VEBM230102

# SHOP MANUAL

KOMATSU

# WA250-5H
# WA250PT-5H

| MACHINE MODEL | SERIAL NUMBER |
|---|---|
| **WA250-5H** | **WA250H50051 and up** |
| **WA250PT-5H** | **WA250H60051 and up** |

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require.
  Materials and specifications are subject to change without notice.
- WA250-5H, WA250PT-5H mounts the SAA6D102E-2-A engine.
  For details of the engine, see the 102 Series Engine Shop Manual.

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# CONTENTS

No. of page

**01 GENERAL** ..... 01-1

**10 STRUCTURE, FUNCTION AND MAINTENANCE STANDARD** ..... 10-1

**20 TESTING AND ADJUSTMENT**.....20-1

**30 DISASSEMBLY AND ASSEMBLY** .....30-1

**90 OTHERS** ..... 90-1

The affected pages are indicated by the use of the following marks. It is requested that necessary actions must be taken to these pages according to the list below.

| Mark | Indication | Action required |
|---|---|---|
| ○ | Page to be newly added | Add |
| ● | Page to be replaced | Replace |
| ( ) | Page to be deleted | Discard |

Pages having no marks are not revised at this time.

**LIST OF REVISED PAGES**

| Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ● | 00- 1 | (2) | | 10- 6 | | | 10- 51 | | | 10- 96 | | | 10-141 | |
| ● | 00- 2 | (2) | | 10- 7 | | | 10- 52 | | | 10- 98 | | | 10-142 | |
| ● | 00- 2-1 | (2) | | 10- 8 | | | 10- 53 | | | 10- 99 | | | 10-143 | |
| ● | 00- 2-2 | (2) | | 10- 9 | | | 10- 54 | | | 10-100 | | | 10-144 | |
| ● | 00- 2-3 | (2) | | 10- 10 | | | 10- 55 | | | 10-101 | | | 10-145 | |
| ○ | 00- 2-4 | (2) | | 10- 11 | | | 10- 56 | | | 10-102 | | | 10-146 | |
| | 00- 3 | | | 10- 12 | | | 10- 58 | | | 10-103 | | | 10-147 | |
| | 00- 4 | | | 10- 13 | | | 10- 59 | | | 10-104 | (1) | | 10-148 | |
| | 00- 5 | | | 10- 14 | | | 10- 60 | | | 10-106 | | | 10-149 | |
| | 00- 6 | | | 10- 15 | | | 10- 61 | | | 10-107 | | | 10-150 | |
| | 00- 7 | | | 10- 16 | | | 10- 62 | | | 10-108 | | | 10-151 | |
| | 00- 8 | | | 10- 17 | | | 10- 63 | | | 10-109 | | | 10-152 | |
| | 00- 9 | | | 10- 18 | | | 10- 64 | | | 10-110 | | | 10-153 | |
| | 00- 10 | | | 10- 19 | | | 10- 65 | | | 10-111 | | | 10-154 | |
| | 00- 11 | | | 10- 20 | | | 10- 66 | | | 10-112 | | | 10-155 | |
| | 00- 12 | | | 10- 21 | | | 10- 67 | | | 10-113 | | | 10-156 | |
| | 00- 13 | | | 10- 22 | | | 10- 68 | | | 10-114 | | | 10-157 | |
| | 00- 14 | | | 10- 23 | | | 10- 69 | | | 10-115 | | | 10-158 | |
| | 00- 15 | | | 10- 24 | | | 10- 70 | | | 10-116 | | | 10-159 | |
| | 00- 16 | | | 10- 25 | | | 10- 71 | | | 10-117 | | | 10-160 | |
| | 00- 17 | | | 10- 26 | | | 10- 72 | | | 10-118 | | | 10-161 | |
| | 00- 18 | | | 10- 27 | | | 10- 73 | | | 10-119 | | | 10-162 | |
| | 00- 19 | | | 10- 28 | | | 10- 74 | | | 10-120 | | | 10-163 | |
| | 00- 20 | | | 10- 29 | | | 10- 75 | | | 10-121 | | | 10-164 | |
| | 00- 21 | | | 10- 30 | | | 10- 76 | | | 10-122 | | | 10-165 | |
| | 00- 22 | | | 10- 31 | | | 10- 77 | | | 10-123 | | | 10-166 | |
| | | | | 10- 32 | | | 10- 78 | | | 10-124 | | | 10-167 | |
| | 01- 1 | | | 10- 33 | | | 10- 79 | | | 10-125 | | | 10-168 | |
| | 01- 2 | | | 10- 34 | | | 10- 80 | | | 10-126 | | | 10-169 | |
| | 01- 3 | | | 10- 35 | | | 10- 81 | | | 10-127 | | | 10-170 | |
| | 01- 4 | | | 10- 36 | | | 10- 82 | | | 10-128 | | | 10-171 | |
| | 01- 5 | | | 10- 37 | | | 10- 83 | | | 10-129 | | | 10-172 | |
| | 01- 6 | | | 10- 38 | | | 10- 84 | | | 10-130 | | | 10-173 | |
| | 01- 7 | | | 10- 40 | | | 10- 85 | | | 10-131 | | | 10-174 | |
| | 01- 8 | | | 10- 41 | | | 10- 86 | | | 10-132 | | | 10-175 | |
| | 01- 9 | | | 10- 42 | | | 10- 87 | | | 10-133 | | | 10-176 | |
| | 01- 10 | | | 10- 43 | | | 10- 88 | | | 10-134 | | | 10-177 | |
| | | | | 10- 44 | | | 10- 90 | | | 10-135 | | | 10-178 | |
| | 10- 1 | | | 10- 46 | | | 10- 91 | | | 10-136 | | | 10-179 | |
| | 10- 2 | | | 10- 47 | | | 10- 92 | | | 10-137 | | | 10-180 | |
| | 10- 3 | | | 10- 48 | | | 10- 93 | | | 10-138 | | | 10-181 | |
| | 10- 4 | | | 10- 49 | | | 10- 94 | | | 10-139 | | | 10-182 | |
| | 10- 5 | | | 10- 50 | | | 10- 95 | | | 10-140 | | | 10-184 | |

| Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 10-185 | | | | | | 20-153 | (1) | | 20-244 | (1) | | 20-422 | (1) |
| | 10-186 | | | 20- 1 | (1) | | 20-154 | (1) | | 20-245 | (1) | | 20-423 | (1) |
| | 10-187 | | | 20- 2 | (1) | | 20-155 | (1) | | 20-246 | (1) | | 20-424 | (1) |
| | 10-188 | | | 20- 3 | (1) | | 20-156 | (1) | | 20-247 | (1) | | 20-426 | (1) |
| | 10-190 | | | 20- 4 | (1) | | 20-157 | (1) | | 20-248 | (1) | | 20-427 | (1) |
| | 10-191 | | | 20- 5 | (1) | | 20-158 | (1) | | 20-250 | (1) | | 20-428 | (1) |
| | 10-192 | | | 20- 6 | (1) | | 20-159 | (1) | | 20-251 | (1) | | 20-429 | (1) |
| | 10-193 | (1) | | 20-101 | (1) | | 20-160 | (1) | | 20-252 | (1) | | 20-430 | (1) |
| | 10-194 | | | 20-102 | (1) | | 20-161 | (1) | | 20-253 | (1) | | 20-431 | (1) |
| | 10-195 | | | 20-103 | (1) | | 20-162 | (1) | | 20-254 | (1) | | 20-432 | (1) |
| | 10-196 | | | 20-104 | (1) | | 20-163 | (1) | | 20-301 | (1) | | 20-433 | (1) |
| | 10-197 | | | 20-105 | (1) | | 20-164 | (1) | | 20-302 | (1) | | 20-434 | (1) |
| | 10-198 | | | 20-106 | (1) | | 20-165 | (1) | | 20-303 | (1) | | 20-435 | (1) |
| | 10-199 | | | 20-107 | (1) | | 20-166 | (1) | | 20-304 | (1) | | 20-436 | (1) |
| | 10-200 | | | 20-108 | (1) | | 20-167 | (1) | | 20-305 | (1) | | 20-437 | (1) |
| | 10-201 | | | 20-109 | (1) | | 20-168 | (1) | | 20-306 | (1) | | 20-438 | (1) |
| | 10-202 | | | 20-110 | (1) | | 20-169 | (1) | | 20-307 | (1) | | 20-439 | (1) |
| | 10-203 | | | 20-111 | (1) | | 20-170 | (1) | | 20-308 | (1) | | 20-440 | (1) |
| | 10-204 | | | 20-112 | (1) | | 20-201 | (1) | | 20-309 | (1) | | 20-441 | (1) |
| | 10-205 | | | 20-113 | (1) | | 20-202 | (1) | | 20-310 | (1) | | 20-442 | (1) |
| | 10-206 | | | 20-114 | (1) | | 20-203 | (1) | | 20-311 | (1) | | 20-443 | (1) |
| | 10-207 | | | 20-115 | (1) | | 20-204 | (1) | | 20-312 | (1) | | 20-444 | (1) |
| | 10-208 | | | 20-116 | (1) | | 20-205 | (1) | | 20-313 | (1) | | 20-445 | (1) |
| | 10-209 | | | 20-117 | (1) | | 20-206 | (1) | | 20-314 | (1) | | 20-446 | (1) |
| | 10-210 | | | 20-118 | (1) | | 20-207 | (1) | | 20-316 | (1) | | 20-447 | (1) |
| | 10-211 | | | 20-119 | (1) | | 20-208 | (1) | | 20-317 | (1) | | 20-448 | (1) |
| | 10-212 | | | 20-120 | (1) | | 20-209 | (1) | | 20-318 | (1) | | 20-449 | (1) |
| | 10-213 | | | 20-121 | (1) | | 20-210 | (1) | | 20-319 | (1) | | 20-450 | (1) |
| | 10-214 | | | 20-122 | (1) | | 20-211 | (1) | | 20-320 | (1) | | 20-451 | (1) |
| | 10-215 | | | 20-123 | (1) | | 20-212 | (1) | | 20-321 | (1) | | 20-452 | (1) |
| | 10-216 | | | 20-124 | (1) | | 20-213 | (1) | | 20-322 | (1) | | 20-453 | (1) |
| | 10-217 | | | 20-125 | (1) | | 20-214 | (1) | | 20-323 | (1) | | 20-454 | (1) |
| | 10-218 | | | 20-126 | (1) | | 20-215 | (1) | | 20-324 | (1) | | 20-455 | (1) |
| | 10-219 | | | 20-127 | (1) | | 20-216 | (1) | | 20-326 | (1) | | 20-456 | (1) |
| | 10-220 | | | 20-128 | (1) | | 20-218 | (1) | | 20-327 | (1) | | 20-501 | (1) |
| | 10-221 | | | 20-129 | (1) | | 20-219 | (1) | | 20-328 | (1) | | 20-502 | (1) |
| | 10-222 | | | 20-130 | (1) | | 20-220 | (1) | | 20-329 | (1) | | 20-503 | (1) |
| | 10-223 | | | 20-131 | (1) | | 20-221 | (1) | | 20-330 | (1) | | 20-504 | (1) |
| | 10-224 | | | 20-132 | (1) | | 20-222 | (1) | | 20-331 | (1) | | 20-506 | (1) |
| | 10-225 | | | 20-133 | (1) | | 20-223 | (1) | | 20-401 | (1) | | 20-507 | (1) |
| | 10-226 | | | 20-134 | (1) | | 20-224 | (1) | | 20-402 | (1) | | 20-508 | (1) |
| | 10-227 | | | 20-135 | (1) | | 20-225 | (1) | | 20-403 | (1) | | 20-510 | (1) |
| | 10-228 | | | 20-136 | (1) | | 20-226 | (1) | | 20-404 | (1) | | 20-511 | (1) |
| | 10-229 | | | 20-137 | (1) | | 20-227 | (1) | | 20-405 | (1) | | 20-512 | (1) |
| | 10-230 | | | 20-138 | (1) | | 20-228 | (1) | | 20-406 | (1) | | 20-513 | (1) |
| | 10-231 | | | 20-139 | (1) | | 20-229 | (1) | | 20-407 | (1) | | 20-514 | (1) |
| | 10-232 | | | 20-140 | (1) | | 20-230 | (1) | | 20-408 | (1) | | 20-515 | (1) |
| | 10-233 | | | 20-141 | (1) | | 20-231 | (1) | | 20-409 | (1) | | 20-516 | (1) |
| | 10-234 | | | 20-142 | (1) | | 20-232 | (1) | | 20-410 | (1) | | 20-517 | (1) |
| | 10-235 | | | 20-143 | (1) | | 20-233 | (1) | | 20-411 | (1) | | 20-518 | (1) |
| | 10-236 | | | 20-144 | (1) | | 20-234 | (1) | | 20-412 | (1) | | 20-519 | (1) |
| | 10-237 | | | 20-145 | (1) | | 20-235 | (1) | | 20-413 | (1) | | 20-520 | (1) |
| | 10-238 | | | 20-146 | (1) | | 20-236 | (1) | | 20-414 | (1) | | 20-521 | (1) |
| | 10-239 | | | 20-147 | (1) | | 20-237 | (1) | | 20-415 | (1) | | 20-522 | (1) |
| | 10-240 | | | 20-148 | (1) | | 20-238 | (1) | | 20-416 | (1) | | 20-523 | (1) |
| | 10-241 | | | 20-149 | (1) | | 20-239 | (1) | | 20-417 | (1) | | 20-524 | (1) |
| | 10-242 | | | 20-150 | (1) | | 20-240 | (1) | | 20-418 | (1) | | 20-526 | (1) |
| | 10-243 | | | 20-151 | (1) | | 20-241 | (1) | | 20-419 | (1) | | 20-527 | (1) |
| | 10-244 | | | 20-152 | (1) | | 20-243 | (1) | | 20-420 | (1) | | 20-528 | (1) |

| Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20-529 | (1) | | 20-623 | (1) | ○ | 30- 33 | (2) | ○ | 30- 92 | (2) | ○ | 30-151 | (2) |
| | 20-530 | (1) | | 20-624 | (1) | ○ | 30- 34 | (2) | ○ | 30- 93 | (2) | ○ | 30-152 | (2) |
| | 20-531 | (1) | | 20-701 | (1) | ○ | 30- 35 | (2) | ○ | 30- 94 | (2) | ○ | 30-153 | (2) |
| | 20-532 | (1) | | 20-702 | (1) | ○ | 30- 36 | (2) | ○ | 30- 95 | (2) | ○ | 30-154 | (2) |
| | 20-533 | (1) | | 20-703 | (1) | ○ | 30- 37 | (2) | ○ | 30- 96 | (2) | ○ | 30-155 | (2) |
| | 20-534 | (1) | | 20-704 | (1) | ○ | 30- 38 | (2) | ○ | 30- 97 | (2) | ○ | 30-156 | (2) |
| | 20-535 | (1) | | 20-705 | (1) | ○ | 30- 39 | (2) | ○ | 30- 98 | (2) | ○ | 30-157 | (2) |
| | 20-536 | (1) | | 20-706 | (1) | ○ | 30- 40 | (2) | ○ | 30- 99 | (2) | ○ | 30-158 | (2) |
| | 20-537 | (1) | | 20-707 | (1) | ○ | 30- 41 | (2) | ○ | 30-100 | (2) | ○ | 30-159 | (2) |
| | 20-538 | (1) | | 20-708 | (1) | ○ | 30- 42 | (2) | ○ | 30-101 | (2) | ○ | 30-160 | (2) |
| | 20-540 | (1) | | 20-709 | (1) | ○ | 30- 43 | (2) | ○ | 30-102 | (2) | ○ | 30-161 | (2) |
| | 20-541 | (1) | | 20-710 | (1) | ○ | 30- 44 | (2) | ○ | 30-103 | (2) | ○ | 30-162 | (2) |
| | 20-542 | (1) | | 20-711 | (1) | ○ | 30- 45 | (2) | ○ | 30-104 | (2) | ○ | 30-163 | (2) |
| | 20-543 | (1) | | 20-712 | (1) | ○ | 30- 46 | (2) | ○ | 30-105 | (2) | ○ | 30-164 | (2) |
| | 20-544 | (1) | | 20-713 | (1) | ○ | 30- 47 | (2) | ○ | 30-106 | (2) | ○ | 30-165 | (2) |
| | 20-545 | (1) | | 20-714 | (1) | ○ | 30- 48 | (2) | ○ | 30-107 | (2) | ○ | 30-166 | (2) |
| | 20-546 | (1) | | 20-715 | (1) | ○ | 30- 49 | (2) | ○ | 30-108 | (2) | ○ | 30-167 | (2) |
| | 20-547 | (1) | | 20-716 | (1) | ○ | 30- 50 | (2) | ○ | 30-109 | (2) | ○ | 30-168 | (2) |
| | 20-548 | (1) | | 20-717 | (1) | ○ | 30- 51 | (2) | ○ | 30-110 | (2) | ○ | 30-169 | (2) |
| | 20-549 | (1) | | 20-718 | (1) | ○ | 30- 52 | (2) | ○ | 30-111 | (2) | ○ | 30-170 | (2) |
| | 20-550 | (1) | | 20-719 | (1) | ○ | 30- 53 | (2) | ○ | 30-112 | (2) | ○ | 30-171 | (2) |
| | 20-551 | (1) | | 20-720 | (1) | ○ | 30- 54 | (2) | ○ | 30-113 | (2) | ○ | 30-172 | (2) |
| | 20-552 | (1) | | 20-721 | (1) | ○ | 30- 55 | (2) | ○ | 30-114 | (2) | ○ | 30-173 | (2) |
| | 20-553 | (1) | | 20-722 | (1) | ○ | 30- 56 | (2) | ○ | 30-115 | (2) | ○ | 30-174 | (2) |
| | 20-554 | (1) | | 20-723 | (1) | ○ | 30- 57 | (2) | ○ | 30-116 | (2) | ○ | 30-175 | (2) |
| | 20-555 | (1) | | 20-724 | (1) | ○ | 30- 58 | (2) | ○ | 30-117 | (2) | ○ | 30-176 | (2) |
| | 20-556 | (1) | | | | ○ | 30- 59 | (2) | ○ | 30-118 | (2) | ○ | 30-177 | (2) |
| | 20-557 | (1) | ○ | 30- 1 | (2) | ○ | 30- 60 | (2) | ○ | 30-119 | (2) | ○ | 30-178 | (2) |
| | 20-558 | (1) | ○ | 30- 2 | (2) | ○ | 30- 61 | (2) | ○ | 30-120 | (2) | ○ | 30-179 | (2) |
| | 20-559 | (1) | ○ | 30- 3 | (2) | ○ | 30- 62 | (2) | ○ | 30-121 | (2) | ○ | 30-180 | (2) |
| | 20-560 | (1) | ○ | 30- 4 | (2) | ○ | 30- 63 | (2) | ○ | 30-122 | (2) | ○ | 30-181 | (2) |
| | 20-561 | (1) | ○ | 30- 5 | (2) | ○ | 30- 64 | (2) | ○ | 30-123 | (2) | ○ | 30-182 | (2) |
| | 20-562 | (1) | ○ | 30- 6 | (2) | ○ | 30- 65 | (2) | ○ | 30-124 | (2) | ○ | 30-183 | (2) |
| | 20-563 | (1) | ○ | 30- 7 | (2) | ○ | 30- 66 | (2) | ○ | 30-125 | (2) | ○ | 30-184 | (2) |
| | 20-564 | (1) | ○ | 30- 8 | (2) | ○ | 30- 67 | (2) | ○ | 30-126 | (2) | ○ | 30-185 | (2) |
| | 20-565 | (1) | ○ | 30- 9 | (2) | ○ | 30- 68 | (2) | ○ | 30-127 | (2) | ○ | 30-186 | (2) |
| | 20-566 | (1) | ○ | 30- 10 | (2) | ○ | 30- 69 | (2) | ○ | 30-128 | (2) | ○ | 30-187 | (2) |
| | 20-601 | (1) | ○ | 30- 11 | (2) | ○ | 30- 70 | (2) | ○ | 30-129 | (2) | ○ | 30-188 | (2) |
| | 20-602 | (1) | ○ | 30- 12 | (2) | ○ | 30- 71 | (2) | ○ | 30-130 | (2) | ○ | 30-189 | (2) |
| | 20-603 | (1) | ○ | 30- 13 | (2) | ○ | 30- 72 | (2) | ○ | 30-131 | (2) | ○ | 30-190 | (2) |
| | 20-604 | (1) | ○ | 30- 14 | (2) | ○ | 30- 73 | (2) | ○ | 30-132 | (2) | ○ | 30-191 | (2) |
| | 20-605 | (1) | ○ | 30- 15 | (2) | ○ | 30- 74 | (2) | ○ | 30-133 | (2) | ○ | 30-192 | (2) |
| | 20-606 | (1) | ○ | 30- 16 | (2) | ○ | 30- 75 | (2) | ○ | 30-134 | (2) | ○ | 30-193 | (2) |
| | 20-607 | (1) | ○ | 30- 17 | (2) | ○ | 30- 76 | (2) | ○ | 30-135 | (2) | ○ | 30-194 | (2) |
| | 20-608 | (1) | ○ | 30- 18 | (2) | ○ | 30- 77 | (2) | ○ | 30-136 | (2) | ○ | 30-195 | (2) |
| | 20-609 | (1) | ○ | 30- 19 | (2) | ○ | 30- 78 | (2) | ○ | 30-137 | (2) | ○ | 30-196 | (2) |
| | 20-610 | (1) | ○ | 30- 20 | (2) | ○ | 30- 79 | (2) | ○ | 30-138 | (2) | ○ | 30-197 | (2) |
| | 20-611 | (1) | ○ | 30- 21 | (2) | ○ | 30- 80 | (2) | ○ | 30-139 | (2) | ○ | 30-198 | (2) |
| | 20-612 | (1) | ○ | 30- 22 | (2) | ○ | 30- 81 | (2) | ○ | 30-140 | (2) | ○ | 30-199 | (2) |
| | 20-613 | (1) | ○ | 30- 23 | (2) | ○ | 30- 82 | (2) | ○ | 30-141 | (2) | ○ | 30-200 | (2) |
| | 20-614 | (1) | ○ | 30- 24 | (2) | ○ | 30- 83 | (2) | ○ | 30-142 | (2) | ○ | 30-201 | (2) |
| | 20-615 | (1) | ○ | 30- 25 | (2) | ○ | 30- 84 | (2) | ○ | 30-143 | (2) | ○ | 30-202 | (2) |
| | 20-616 | (1) | ○ | 30- 26 | (2) | ○ | 30- 85 | (2) | ○ | 30-144 | (2) | ○ | 30-203 | (2) |
| | 20-617 | (1) | ○ | 30- 27 | (2) | ○ | 30- 86 | (2) | ○ | 30-145 | (2) | ○ | 30-204 | (2) |
| | 20-618 | (1) | ○ | 30- 28 | (2) | ○ | 30- 87 | (2) | ○ | 30-146 | (2) | ○ | 30-205 | (2) |
| | 20-619 | (1) | ○ | 30- 29 | (2) | ○ | 30- 88 | (2) | ○ | 30-147 | (2) | ○ | 30-206 | (2) |
| | 20-620 | (1) | ○ | 30- 30 | (2) | ○ | 30- 89 | (2) | ○ | 30-148 | (2) | ○ | 30-207 | (2) |
| | 20-621 | (1) | ○ | 30- 31 | (2) | ○ | 30- 90 | (2) | ○ | 30-149 | (2) | ○ | 30-208 | (2) |
| | 20-622 | (1) | ○ | 30- 32 | (2) | ○ | 30- 91 | (2) | ○ | 30-150 | (2) | ○ | 30-209 | (2) |

| Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number | Mark | Pages | Revision number |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ○ | 30-210 | (2) | | | | | | | | | | | | |
| ○ | 30-211 | (2) | | | | | | | | | | | | |
| ○ | 30-212 | (2) | | | | | | | | | | | | |
| ○ | 30-213 | (2) | | | | | | | | | | | | |
| | 90- 1 | | | | | | | | | | | | | |
| | 90- 3 | (1) | | | | | | | | | | | | |
| | 90- 5 | (1) | | | | | | | | | | | | |
| | 90- 7 | | | | | | | | | | | | | |
| | 90- 9 | | | | | | | | | | | | | |
| | 90- 11 | | | | | | | | | | | | | |
| | 90- 13 | | | | | | | | | | | | | |
| | 90- 15 | | | | | | | | | | | | | |
| | 90- 17 | | | | | | | | | | | | | |
| | 90- 19 | (1) | | | | | | | | | | | | |

# SAFETY

## SAFETY NOTICE

### IMPORTANT SAFETY NOTICE

Proper service and repair is extremely important for safe machine operation. The service and repair techniques recommended by Komatsu and described in this manual are both effective and safe. Some of these techniques require the use of tools specially designed by Komatsu for the specific purpose.

To prevent injury to workers, the symbol ⚠ is used to mark safety precautions in this manual. The cautions accompanying these symbols should always be followed carefully. If any dangerous situation arises or may possibly arise, first consider safety, and take the necessary actions to deal with the situation.

#### GENERAL PRECAUTIONS

Mistakes in operation are extremely dangerous. Read the Operation and Maintenance Manual carefully BEFORE operating the machine.

1. Before carrying out any greasing or repairs, read all the precautions given on the decals which are fixed to the machine.
2. When carrying out any operation, always wear safety shoes and helmet. Do not wear loose work clothes, or clothes with buttons missing.
   - Always wear safety glasses when hitting parts with a hammer.
   - Always wear safety glasses when grinding parts with a grinder, etc.
3. If welding repairs are needed, always have a trained, experienced welder carry out the work. When carrying out welding work, always wear welding gloves, apron, hand shield, cap and other clothes suited for welding work.
4. When carrying out any operation with two or more workers, always agree on the operating procedure before starting. Always inform your fellow workers before starting any step of the operation. Before starting work, hang UNDER REPAIR signs on the controls in the operator's compartment.
5. Keep all tools in good condition and learn the correct way to use them.
6. Decide a place in the repair workshop to keep tools and removed parts. Always keep the tools and parts in their correct places. Always keep the work area clean and make sure that there is no dirt or oil on the floor. Smoke only in the areas provided for smoking. Never smoke while working.

#### PREPARATIONS FOR WORK

7. Before adding oil or making any repairs, park the machine on hard, level ground, and block the wheels or tracks to prevent the machine from moving.
8. Before starting work, lower blade, ripper, bucket or any other work equipment to the ground. If this is not possible, insert the safety pin or use blocks to prevent the work equipment from falling. In addition, be sure to lock all the control levers and hang warning signs on them.
9. When disassembling or assembling, support the machine with blocks, jacks or stands before starting work.
10. Remove all mud and oil from the steps or other places used to get on and off the machine. Always use the handrails, ladders or steps when getting on or off the machine. Never jump on or off the machine. If it is impossible to use the handrails, ladders or steps, use a stand to provide safe footing.

**PRECAUTIONS DURING WORK**

11. When removing the oil filler cap, drain plug or hydraulic pressure measuring plugs, loosen them slowly to prevent the oil from spurting out.
    Before disconnecting or removing components of the oil, water or air circuits, first remove the pressure completely from the circuit.
12. The water and oil in the circuits are hot when the engine is stopped, so be careful not to get burned.
    Wait for the oil and water to cool before carrying out any work on the oil or water circuits.
13. Before starting work, remove the leads from the battery. Always remove the lead from the negative (–) terminal first.
14. When raising heavy components, use a hoist or crane.
    Check that the wire rope, chains and hooks are free from damage.
    Always use lifting equipment which has ample capacity.
    Install the lifting equipment at the correct places.
    Use a hoist or crane and operate slowly to prevent the component from hitting any other part.
    Do not work with any part still raised by the hoist or crane.
15. When removing covers which are under internal pressure or under pressure from a spring, always leave two bolts in position on opposite sides. Slowly release the pressure, then slowly loosen the bolts to remove.
16. When removing components, be careful not to break or damage the wiring. Damaged wiring may cause electrical fires.
17. When removing piping, stop the fuel or oil from spilling out. If any fuel or oil drips onto the floor, wipe it up immediately. Fuel or oil on the floor can cause you to slip, or can even start fires.
18. As a general rule, do not use gasoline to wash parts. In particular, use only the minimum of gasoline when washing electrical parts.
19. Be sure to assemble all parts again in their original places.
    Replace any damaged parts with new parts.
    - When installing hoses and wires, be sure that they will not be damaged by contact with other parts when the machine is being operated.
20. When installing high pressure hoses, make sure that they are not twisted. Damaged tubes are dangerous, so be extremely careful when installing tubes for high pressure circuits. Also, check that connecting parts are correctly installed.
21. When assembling or installing parts, always use the specified tightening torques. When installing protective parts such as guards, or parts which vibrate violently or rotate at high speed, be particularly careful to check that they are installed correctly.
22. When aligning two holes, never insert your fingers or hand. Be careful not to get your fingers caught in a hole.
23. When measuring hydraulic pressure, check that the measuring tool is correctly assembled before taking any measurements.
24. Take care when removing or installing the tracks of track-type machines.
    When removing the track, the track separates suddenly, so never let anyone stand at either end of the track.

# FOREWORD
## GENERAL

This shop manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This shop manual mainly contains the necessary technical information for operations performed in a service workshop. For ease of understanding, the manual is divided into the following chapters; these chapters are further divided into the each main group of components.

**STRUCTURE AND FUNCTION**

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.
In addition, this section may contain hydraulic circuit diagrams, electric circuit diagrams, and maintenance standards.

**TESTING AND ADJUSTING**

This section explains checks to be made before and after performing repairs, as well as adjustments to be made at completion of the checks and repairs.
Troubleshooting charts correlating "Problems" with "Causes" are also included in this section.

**DISASSEMBLY AND ASSEMBLY**

This section explains the procedures for removing, installing, disassembling and assembling each component, as well as precautions for them.

**MAINTENANCE STANDARD**

This section gives the judgment standards for inspection of disassembled parts.
The contents of this section may be described in STRUCTURE AND FUNCTION.

**OTHERS**

This section mainly gives hydraulic circuit diagrams and electric circuit diagrams.
In addition, this section may give the specifications of attachments and options together.

**NOTICE**

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Use the specifications given in the book with the latest date.

## HOW TO READ THE SHOP MANUAL

### VOLUMES

Shop manuals are issued as a guide to carrying out repairs. They are divided as follows:

**Chassis volume:** Issued for every machine model
**Engine volume:** Issued for each engine series
**Electrical volume:**
**Attachments volume:** } Each issued as one volume to cover all models

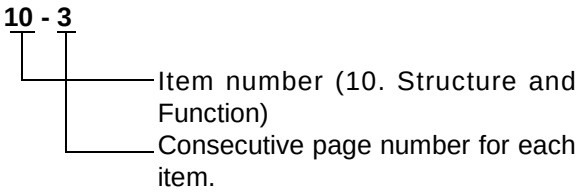
These various volumes are designed to avoid duplicating the same information. Therefore, to deal with all repairs for any model , it is necessary that chassis, engine, electrical and attachment volumes be available.

### DISTRIBUTION AND UPDATING

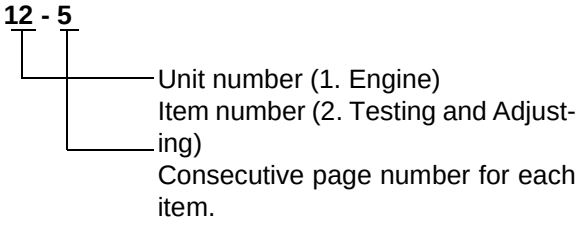
Any additions, amendments or other changes will be sent to KOMATSU distributors. Get the most up-to-date information before you start any work.

### FILING METHOD

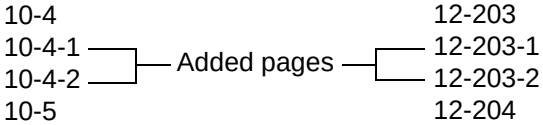
1. See the page number on the bottom of the page. File the pages in correct order.
2. Following examples show how to read the page number.
   Example 1 (Chassis volume):




   Example 2 (Engine volume):




3. Additional pages: Additional pages are indicated by a hyphen (-) and number after the page number. File as in the example.
   Example:




### REVISED EDITION MARK

When a manual is revised, an edition mark ((1)(2)(3)....) is recorded on the bottom of the pages.

### REVISIONS

Revised pages are shown in the LIST OF REVISED PAGES next to the CONTENTS page.

### SYMBOLS

So that the shop manual can be of ample practical use, important safety and quality portions are marked with the following symbols.

| Symbol | Item | Remarks |
|---|---|---|
|  | Safety | Special safety precautions are necessary when performing the work. |
| ★ | Caution | Special technical precautions or other precautions for preserving standards are necessary when performing the work. |
|  | Weight | Weight of parts of systems. Caution necessary when selecting hoisting wire, or when working posture is important, etc. |
|  | Tightening torque | Places that require special attention for the tightening torque during assembly. |
|  | Coat | Places to be coated with adhesives and lubricants, etc. |
|  | Oil, water | Places where oil, water or fuel must be added, and the capacity. |
|  | Drain | Places where oil or water must be drained, and quantity to be drained. |

# HOISTING INSTRUCTIONS

## HOISTING

> ⚠ Heavy parts (25 kg or more) must be lifted with a hoist, etc. In the **DISASSEMBLY AND ASSEMBLY** section, every part weighing 25 kg or more is indicated clearly with the symbol

- If a part cannot be smoothly removed from the machine by hoisting, the following checks should be made:
  1) Check for removal of all bolts fastening the part to the relative parts.
  2) Check for existence of another part causing interference with the part to be removed.

### WIRE ROPES

1) Use adequate ropes depending on the weight of parts to be hoisted, referring to the table below:

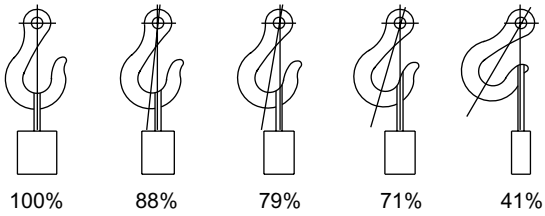
Wire ropes
(Standard "Z" or "S" twist ropes
without galvanizing)

| Rope diameter | Allowable load | |
|---|---|---|
| mm | kN | tons |
| 10 | 9.8 | 1.0 |
| 11.5 | 13.7 | 1.4 |
| 12.5 | 15.7 | 1.6 |
| 14 | 21.6 | 2.2 |
| 16 | 27.5 | 2.8 |
| 18 | 35.3 | 3.6 |
| 20 | 43.1 | 4.4 |
| 22.4 | 54.9 | 5.6 |
| 30 | 98.1 | 10.0 |
| 40 | 176.5 | 18.0 |
| 50 | 274.6 | 28.0 |
| 60 | 392.2 | 40.0 |

★ The allowable load value is estimated to be one-sixth or one-seventh of the breaking strength of the rope used.

2) Sling wire ropes from the middle portion of the hook.

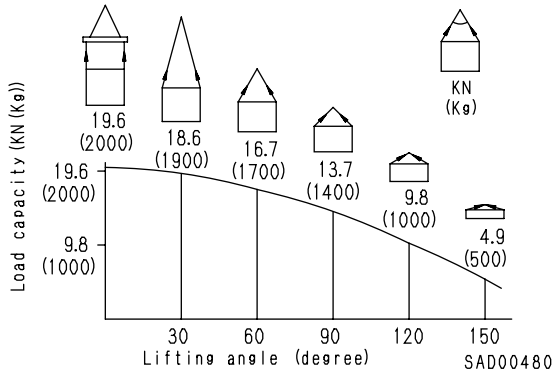
Slinging near the edge of the hook may cause the rope to slip off the hook during hoisting, and a serious accident can result. Hooks have maximum strength at the middle portion.




3) Do not sling a heavy load with one rope alone, but sling with two or more ropes symmetrically wound onto the load.

> ⚠ Slinging with one rope may cause turning of the load during hoisting, untwisting of the rope, or slipping of the rope from its original winding position on the load, which can result in a dangerous accident.

4) Do not sling a heavy load with ropes forming a wide hanging angle from the hook.
When hoisting a load with two or more ropes, the force subjected to each rope will increase with the hanging angles. The table below shows the variation of allowable load kN {kg} when hoisting is made with two ropes, each of which is allowed to sling up to 9.8 kN {1000 kg} vertically, at various hanging angles.
When two ropes sling a load vertically, up to 19.6 kN {2000 kg} of total weight can be suspended. This weight becomes 9.8 kN {1000 kg} when two ropes make a 120° hanging angle. On the other hand, two ropes are subjected to an excessive force as large as 39.2 kN {4000 kg} if they sling a 19.6 kN {2000 kg} load at a lifting angle of 150°.



## METHOD OF DISASSEMBLING, CONNECTING PUSH-PULL TYPE COUPLER

⚠ Before carrying out the following work, release the residual pressure from the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing residual pressure from hydraulic tank.

⚠ Even if the residual pressure is released from the hydraulic tank, some hydraulic oil flows out when the hose is disconnected. Accordingly, prepare an oil receiving container.

**Disconnection**

1) Release the residual pressure from the hydraulic tank. For details, see TESTING AND ADJUSTING, Releasing residual pressure from hydraulic tank.

2) Hold adapter (1) and push hose joint (2) into mating adapter (3). (See Fig. 1)
   - ★ The adapter can be pushed in about 3.5 mm.
   - ★ Do not hold rubber cap portion (4).

3) After hose joint (2) is pushed into adapter (3), press rubber cap portion (4) against (3) until it clicks. (See Fig. 2)

4) Hold hose adapter (1) or hose (5) and pull it out. (See Fig. 3)
   - ★ Since some hydraulic oil flows out, prepare an oil receiving container.

**Connection**

1) Hold hose adapter (1) or hose (5) and insert it in mating adapter (3), aligning them with each other. (See Fig. 4)
   - ★ Do not hold rubber cap portion (4).

2) After inserting the hose in the mating adapter perfectly, pull it back to check its connecting condition. (See Fig. 5)
   - ★ When the hose is pulled back, the rubber cap portion moves toward the hose about 3.5 mm. This does not indicate abnormality, however.

Type 1

Fig. 1

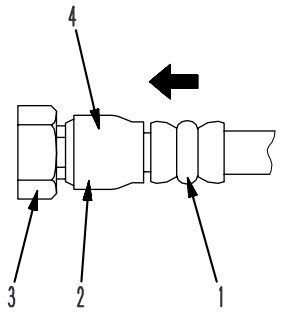



Fig. 2

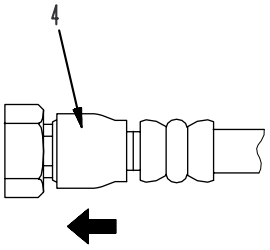



Fig. 3

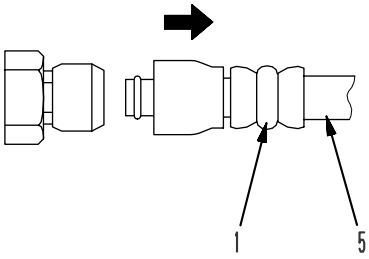



Fig. 4

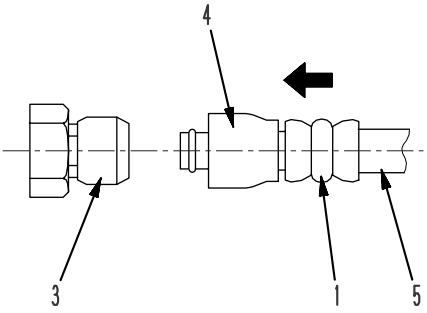
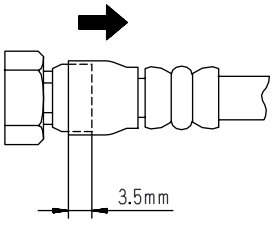
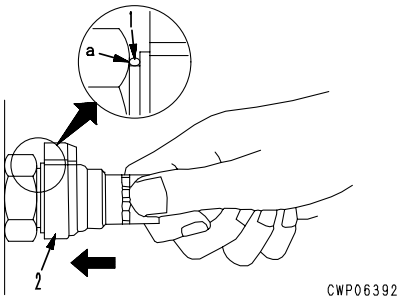
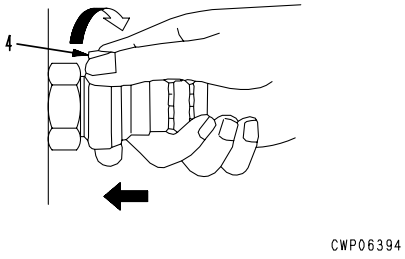
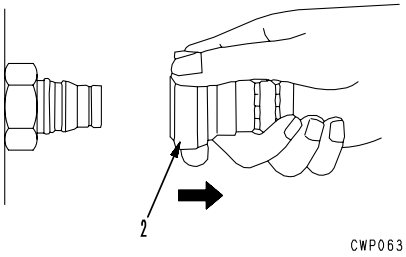
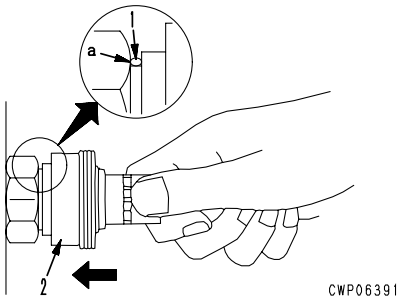
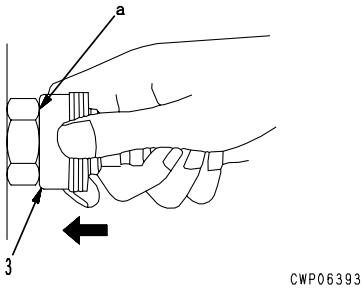
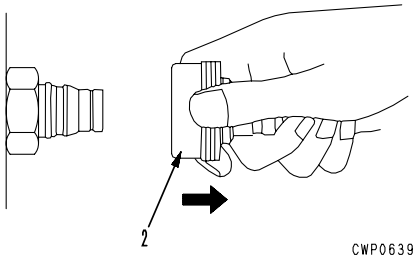
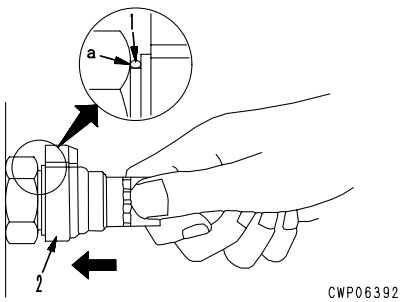
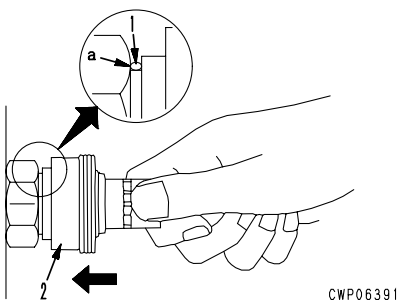



Fig. 5




CWP10701

<table>
<tr><th></th><th>Type 2</th><th>Type 3</th></tr>
<tr><td>Disassembly</td><td>1) Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end.<br> 
<br>2) Hold in the condition in Step 1), and turn lever (4) to the right (clockwise).<br> 
<br>3) Hold in the condition in Steps 1) and 2), and pull out whole body (2) to disconnect it.<br> 
</td><td>1) Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end.<br> 
<br>2) Hold in the condition in Step 1), and push until cover (3) contacts contact surface a of the hexagonal portion at the male end.<br> 
<br>3) Hold in the condition in Steps 1) and 2), and pull out whole body (2) to disconnect it.<br> 
</td></tr>
<tr><td>Connection</td><td>• Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end to connect it.<br> 
</td><td>• Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end to connect it.<br> 
</td></tr>
</table>

## COATING MATERIALS

★ The recommended coating materials such as adhesives, gasket sealants and greases used for disassembly and assembly are listed below.
★ For coating materials not listed below, use the equivalent of products shown in this list.

| Category | Komatsu code | Part No. | Q'ty | Container | Main applications, featuresr |
|---|---|---|---|---|---|
| Adhesives | LT-1A | 790-129-9030 | 150 g | Tube | • Used to prevent rubber gaskets, rubber cushions, and cock plug from coming out. |
| | LT-1B | 790-129-9050 | 20 g (2 pcs.) | Polyethylene container | • Used in places requiring an immediately effective, strong adhesive. Used for plastics (except polyethylene, polyprophylene, tetrafluoroethlene and vinyl chloride), rubber, metal and non-metal. |
| | LT-2 | 09940-00030 | 50 g | Polyethylene container | • Features: Resistance to heat and chemicals<br>• Used for anti-loosening and sealant purpose for bolts and plugs. |
| | LT-3 | 790-129-9060 (Set of adhesive and hardening agent) | Adhesive: 1 kg Hardening agent: 500 g | Can | • Used as adhesive or sealant for metal, glass and plastic. |
| | LT-4 | 790-129-9040 | 250 g | Polyethylene container | • Used as sealant for machined holes. |
| | Holtz MH 705 | 790-126-9120 | 75 g | Tube | • Used as heat-resisting sealant for repairing engine. |
| | Three bond 1735 | 790-129-9140 | 50 g | Polyethylene container | • Quick hardening type adhesive<br>• Cure time: within 5 sec. to 3 min.<br>• Used mainly for adhesion of metals, rubbers, plastics and woods. |
| | Aron-alpha 201 | 790-129-9130 | 2 g | Polyethylene container | • Quick hardening type adhesive<br>• Quick cure type (max. strength after 30 minutes)<br>• Used mainly for adhesion of rubbers, plastics and metals. |
| | Loctite 648-50 | 79A-129-9110 | 50 cc | Polyethylene container | • Resistance to heat, chemicals<br>• Used at joint portions subject to high temperatures. |
| Gasket sealant | LG-1 | 790-129-9010 | 200 g | Tube | • Used as adhesive or sealant for gaskets and packing of power train case, etc. |
| | LG-5 | 790-129-9070 | 1 kg | Can | • Used as sealant for various threads, pipe joints, flanges.<br>• Used as sealant for tapered plugs, elbows, nipples of hydraulic piping. |
| | LG-6 | 790-129-9020 | 200 g | Tube | • Features: Silicon based, resistance to heat, cold<br>• Used as sealant for flange surface, tread.<br>• mab Used as sealant for oil pan, final drive case, etc. |

| Category | Komatsu code | Part No. | Q'ty | Container | Main applications, featuresr |
|---|---|---|---|---|---|
| Adhesives | LG-7 | 790-129-9070 | 1 g | Tube | • Ftures: Silicon based, quick hardening type<br>• Used as sealant for flywheel housing, intake manifold, oil an, thermostat housing, etc. |
| | Three bond 1211 | 790-129-9090 | 100 g | Tube | • Used as heat-resisting sealant for repairing engine. |
| Molybdenum disulphide lubricant | LM-G | 09940-00051 | 60 g | Can | • Used as lubricant for sliding portion (to prevent from squeaking). |
| | LM-P | 09940-00040 | 200 g | Tube | • Used to prevent seizure or scuffling of the thread when press fitting or shrink fitting.<br>• Used as lubricant for linkage, bearings, etc. |
| Grease | G2-LI | SYG2-400LI<br>SYG2-350LI<br>SYG2-400LI-A<br>SYG2-160LI<br>SYGA-160CNLI | Various | Various | • General purpose type |
| | G2-CA | SYG2-400CA<br>SYG2-350CA<br>SYG2-400CA-A<br>SYG2-160CA<br>SYGA-160CNCA | Various | Various | • Used for normal temperature, light load bearing at places in contact with water or steam. |
| | Molybdenum disulphide lubricant | SYG2-400M | 400 g (10 per case) | Belows type | • Used for places with heavy load |

# STANDARD TIGHTENING TORQUE

### STANDARD TIGHTENING TORQUE TABLE (WHEN USING TORQUE WRENCH)

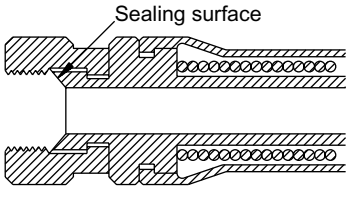
★ In the case of metric nuts and bolts for which there is no special instruction, tighten to the torque given in the table below.

| Thread diameter of bolt | Width across flats |  CDL00372 | |
|---|---|---|---|
| mm | mm | Nm | kgm |
| 6 | 10 | 13.2 ± 1.4 | 1.35 ± 0.15 |
| 8 | 13 | 31 ± 3 | 3.2 ± 0.3 |
| 10 | 17 | 66 ± 7 | 6.7 ± 0.7 |
| 12 | 19 | 113 ± 10 | 11.5 ± 1 |
| 14 | 22 | 177 ± 19 | 18 ± 2 |
| 16 | 24 | 279 ± 30 | 28.5 ± 3 |
| 18 | 27 | 382 ± 39 | 39 ± 4 |
| 20 | 30 | 549 ± 59 | 56 ± 6 |
| 22 | 32 | 745 ± 83 | 76 ± 8.5 |
| 24 | 36 | 927 ± 103 | 94.5 ± 10.5 |
| 27 | 41 | 1320 ± 140 | 135 ± 15 |
| 30 | 46 | 1720 ± 190 | 175 ± 20 |
| 33 | 50 | 2210 ± 240 | 225 ± 25 |
| 36 | 55 | 2750 ± 290 | 280 ± 30 |
| 39 | 60 | 3290 ± 340 | 335 ± 35 |

| Thread diameter of bolt | Width across flats |  CDL00373 | |
|---|---|---|---|
| mm | mm | Nm | kgm |
| 6 | 10 | 7.85 ± 1.95 | 0.8 ± 0.2 |
| 8 | 13 | 18.6 ± 4.9 | 1.9 ± 0.5 |
| 10 | 14 | 40.2 ± 5.9 | 4.1 ± 0.6 |
| 12 | 27 | 82.35 ± 7.85 | 8.4 ± 0.8 |

### TABLE OF TIGHTENING TORQUES FOR FLARED NUTS

★ In the case of flared nuts for which there is no special instruction, tighten to the torque given in the table below.



SAD00483

| Thread diameter | Width across flat | Tightening torque | |
|---|---|---|---|
| mm | mm | Nm | kgm |
| 14 | 19 | 24.5 ± 4.9 | 2.5 ± 0.5 |
| 18 | 24 | 49 ± 19.6 | 5 ± 2 |
| 22 | 27 | 78.5 ± 19.6 | 8 ± 2 |
| 24 | 32 | 137.3 ± 29.4 | 14 ± 3 |
| 30 | 36 | 176.5 ± 29.4 | 18 ± 3 |
| 33 | 41 | 196.1 ± 49 | 20 ± 5 |
| 36 | 46 | 245.2 ± 49 | 25 ± 5 |
| 42 | 55 | 294.2 ± 49 | 30 ± 5 |

**TABLE OF TIGHTENING TORQUES FOR SPLIT FLANGE BOLTS**

★ In the case of split flange bolts for which there is no special instruction, tighten to the torque given in the table below.

| Thread diameter | Width across flat | Tightening torque | |
|---|---|---|---|
| mm | mm | Nm | kgm |
| 10<br>12<br>16 | 14<br>17<br>22 | 65.7 ± 6.8<br>112 ± 9.8<br>279 ± 29 | 6.7 ± 0.7<br>11.5 ± 1<br>28.5 ± 3 |

**TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PIPING JOINTS**

★ Unless there are special instructions, tighten the O-ring boss piping joints to the torque below.

| Norminal No. | Thread diameter | Width across flat | Tightening torque | |
|---|---|---|---|---|
| | mm | mm | Nm | kgm |
| 02<br>03, 04<br>05, 06<br>10, 12<br>14 | 14<br>20<br>24<br>33<br>42 | Varies depending on type of connector. | 34.3 ± 4.9<br>93.1 ± 9.8<br>142.1 ± 19.6<br>421.4 ± 58.8<br>877.1 ± 132.3 | 3.5 ± 0.5<br>9.5 ± 1<br>14.5 ± 2<br>43 ± 6<br>89.5 ± 13.5 |

**TABLE OF TIGHTENING TORQUES FOR O-RING BOSS PLUGS**

★ Unless there are special instructions, tighten the O-ring boss plugs to the torque below.

| Norminal No. | Thread diameter | Width across flat | Tightening torque | |
|---|---|---|---|---|
| | mm | mm | Nm | kgm |
| 08 | 08 | 14 | 7.35 ± 1.47 | 0.75 ± 0.15 |
| 10 | 10 | 17 | 11.27 ± 1.47 | 1.15 ± 0.15 |
| 12 | 12 | 19 | 17.64 ± 1.96 | 1.8 ± 0.2 |
| 14 | 14 | 22 | 22.54 ± 1.96 | 2.3 ± 0.2 |
| 16 | 16 | 24 | 29.4 ± 4.9 | 3 ± 0.5 |
| 18 | 18 | 27 | 39.2 ± 4.9 | 4 ± 0.5 |
| 20 | 20 | 30 | 49 ± 4.9 | 5 ± 0.5 |
| 24 | 24 | 32 | 68.6 ± 9.8 | 7 ± 1 |
| 30 | 30 | 32 | 107.8 ± 14.7 | 11 ± 1.5 |
| 33 | 33 | n | 127.4 ± 19.6 | 13 ± 2 |
| 36 | 36 | 36 | 151.9 ± 24.5 | 15.5 ± 2.5 |
| 42 | 42 | n | 210.7 ± 29.4 | 21.5 ± 3 |
| 52 | 52 | n | 323.4 ± 44.1 | 33 ± 4.5 |

## TIGHTENING TORQUE FOR 102 ENGINE SERIES

1) BOLT AND NUTS

Use these torques for bolts and nuts (unit: mm) of Cummins Engine.

| Thread diameter | Tightening torque | |
|---|---|---|
| mm | Nm | kgm |
| 6 | 10 ± 2 | 1.02 ± 0.20 |
| 8 | 24 ± 4 | 2.45 ± 0.41 |
| 10 | 43 ± 6 | 4.38 ± 0.61 |
| 12 | 77 ± 12 | 7.85 ± 1.22 |

2) EYE JOINTS

Use these torques for eye joints (unit: mm) of Cummins Engine.

| Thread diameter | Tightening torque | |
|---|---|---|
| mm | Nm | kgm |
| 6 | 8 ± 2 | 0.81 ± 0.20 |
| 8 | 10 ± 2 | 1.02 ± 0.20 |
| 10 | 12 ± 2 | 1.22 ± 0.20 |
| 12 | 24 ± 4 | 2.45 ± 0.41 |
| 14 | 36 ± 5 | 3.67 ± 0.51 |

3) TAPERED SCREWS

Use these torques for tapered screws (unit: inch) of Cummins Engine.

| Thread diameter | Tightening torque | |
|---|---|---|
| inch | Nm | kgm |
| 1 / 16 | 3 ± 1 | 0.31 ± 0.10 |
| 1 / 8 | 8 ± 2 | 0.81 ± 0.20 |
| 1 / 4 | 12 ± 2 | 1.22 ± 0.20 |
| 3 / 8 | 15 ± 2 | 1.53 ± 0.41 |
| 1 / 2 | 24 ± 4 | 2.45 ± 0.41 |
| 3 / 4 | 36 ± 5 | 3.67 ± 0.51 |
| 1 | 60 ± 9 | 6.12 ± 0.92 |

## TIGHTENING TORQUE TABLE FOR HOSES (TAPER SEAL TYPE AND FACE SEAL TYPE)

★ Tighten the hoses (taper seal type and face seal type) to the following torque, unless otherwise specified.

★ Apply the following torque when the threads are coated (wet) with engine oil.

| Nominal size of hose | Width across flats | Tightening torque (Nm {kgm}) | | Taper seal type | Face seal type | |
|---|---|---|---|---|---|---|
| | | Range | Target | Thread size (mm) | Nominal thread size - Threads per inch, Thread series | Root diameter (mm) (Reference) |
| 02 | 19 | 35 - 63 {3.5 - 6.5} | 44 {4.5} | 14 | $\frac{9}{16}$ - 18UNF | 14.3 |
| 03 | 22 | 54 - 93 {5.5 - 9.5} | 74 {4.5} | – | $\frac{11}{16}$ - 16UN | 17.5 |
| | 24 | 59 - 98 {6.0 - 10.0} | 78 {8.0} | 18 | – | – |
| 04 | 27 | 84 - 132 {8.5 - 13.5} | 103 {10.5} | 22 | $\frac{13}{16}$ - 16UN | 20.7 |
| 05 | 32 | 128 - 186 {13.0 - 19.0} | 157 {16.0} | 24 | 1 - 14UNS | 25.4 |
| 06 | 36 | 177 - 245 {18.0 - 25.0} | 216 {22.0} | 30 | $1\frac{3}{16}$ - 12UNF | 30.3 |
| (10) | 41 | 177 - 245 {18.0 - 25.0} | 216 {22.0} | 33 | – | – |
| (12) | 46 | 197 - 294 {20.0 - 30.0} | 245 {25.0} | 36 | – | – |
| (14) | 55 | 246 - 343 {25.0 - 35.0} | 294 {30.0} | 42 | – | – |

## ELECTRIC WIRE CODE

In the wiring diagrams, various colors and symbols are employed to indicate the thickness of wires.
This wire code table will help you understand WIRING DIAGRAMS.
Example: 5WB indicates a cable having a nominal number 5 and white coating with black stripe.

### CLASSIFICATION BY THICKNESS

| Norminal number | Copper wire | | | Cable O.D. (mm) | Current rating (A) | Applicable circuit |
|---|---|---|---|---|---|---|
| | Number of strands | Dia. of strands ($mm^2$) | Cross section ($mm^2$) | | | |
| 0.85 | 11 | 0.32 | 0.88 | 2.4 | 12 | Starting, lighting, signal etc. |
| 2 | 26 | 0.32 | 2.09 | 3.1 | 20 | Lighting, signal etc. |
| 5 | 65 | 0.32 | 5.23 | 4.6 | 37 | Charging and signal |
| 15 | 84 | 0.45 | 13.36 | 7.0 | 59 | Starting (Glow plug) |
| 40 | 85 | 0.80 | 42.73 | 11.4 | 135 | Starting |
| 60 | 127 | 0.80 | 63.84 | 13.6 | 178 | Starting |
| 100 | 217 | 0.80 | 109.1 | 17.6 | 230 | Starting |

### CLASSIFICATION BY COLOR AND CODE

| Priority | Classification \ Circuits | | Charging | Ground | Starting | Lighting | Instrument | Signal | Other |
|---|---|---|---|---|---|---|---|---|---|
| 1 | Primary | Code | W | B | B | R | Y | G | L |
| | | Color | White | Black | Black | Red | Yellow | Green | Blue |
| 2 | Auxiliary | Code | WR | — | BW | RW | YR | GW | LW |
| | | Color | White & Red | — | White & Black | Red & White | Rellow & Red | Green & White | Blue & White |
| 3 | | Code | WB | — | BY | RB | YB | GR | LR |
| | | Color | White & Black | — | Black & Yellow | Red & Black | Yellow & Black | Green & Red | Blue & Yellow |
| 4 | | Code | WL | — | BR | RY | YG | GY | LY |
| | | Color | White & Blue | — | Black & Red | Red & Yellow | Yellow & Green | Green & Yellow | Blue & Yellow |
| 5 | | Code | WG | — | — | RG | YL | GB | LB |
| | | Color | White & Green | — | — | Red & Green | Yellow & Blue | Green & Black | Blue & Black |
| 6 | | Code | — | — | — | RL | YW | GL | — |
| | | Color | — | — | — | Red & Blue | Yellow & White | Green & Blue | — |

# CONVERSION TABLE

**METHOD OF USING THE CONVERSION TABLE**

The Conversion Table in this section is provided to enable simple conversion of figures. For details of the method of using the Conversion Table, see the example given below.

**EXAMPLE**

- Method of using the Conversion Table to convert from millimeters to inches

1. Convert 55 mm into inches.
   (1) Locate the number 50 in the vertical column at the left side, take this as (A), then draw a horizontal line from (A).
   (2) Locate the number 5 in the row across the top, take this as (B), then draw a perpendicular line down from (B).
   (3) Take the point where the two lines cross as (C). This point (C) gives the value when converting from millimeters to inches. Therefore, 55 mm = 2.165 inches.
2. Convert 550 mm into inches.
   (1) The number 550 does not appear in the table, so divide by 10 (move the decimal point one place to the left) to convert it to 55 mm.
   (2) Carry out the same procedure as above to convert 55 mm to 2.165 inches.
   (3) The original value (550 mm) was divided by 10, so multiply 2.165 inches by 10 (move the decimal point one place to the right) to return to the original value. This gives 550 mm = 21.65 inches.

**Millimeters to inches**

(B)

1 mm = 0.03937 in

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.039 | 0.079 | 0.118 | 0.157 | 0.197 | 0.236 | 0.276 | 0.315 | 0.354 |
| 10 | 0.394 | 0.433 | 0.472 | 0.512 | 0.551 | 0.591 | 0.630 | 0.669 | 0.709 | 0.748 |
| 20 | 0.787 | 0.827 | 0.866 | 0.906 | 0.945 | 0.984 | 1.024 | 1.063 | 1.102 | 1.142 |
| 30 | 1.181 | 1.220 | 1.260 | 1.299 | 1.339 | 1.378 | 1.417 | 1.457 | 1.496 | 1.536 |
| 40 | 1.575 | 1.614 | 1.654 | 1.693 | 1.732 | 1.772 | 1.811 | 1.850 | 1.890 | 1.929 |
| (A) 50 | 1.969 | 2.008 | 2.047 | 2.087 | 2.126 | (C) 2.165 | 2.205 | 2.244 | 2.283 | 2.323 |
| 60 | 2.362 | 2.402 | 2.441 | 2.480 | 2.520 | 2.559 | 2.598 | 2.638 | 2.677 | 2.717 |
| 70 | 2.756 | 2.795 | 2.835 | 2.874 | 2.913 | 2.953 | 2.992 | 3.032 | 3.071 | 3.110 |
| 80 | 3.150 | 3.189 | 3.228 | 3.268 | 3.307 | 3.346 | 3.386 | 3.425 | 3.465 | 3.504 |
| 90 | 3.543 | 3.583 | 3.622 | 3.661 | 3.701 | 3.740 | 3.780 | 3.819 | 3.858 | 3.898 |

**Millimeters to Inches**

1 mm = 0.03937 in

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.039 | 0.079 | 0.118 | 0.157 | 0.197 | 0.236 | 0.276 | 0.315 | 0.354 |
| 10 | 0.394 | 0.433 | 0.472 | 0.512 | 0.551 | 0.591 | 0.630 | 0.669 | 0.709 | 0.748 |
| 20 | 0.787 | 0.827 | 0.866 | 0.906 | 0.945 | 0.984 | 1.024 | 1.063 | 1.102 | 1.142 |
| 30 | 1.181 | 1.220 | 1.260 | 1.299 | 1.339 | 1.378 | 1.417 | 1.457 | 1.496 | 1.536 |
| 40 | 1.575 | 1.614 | 1.654 | 1.693 | 1.732 | 1.772 | 1.811 | 1.850 | 1.890 | 1.929 |
| 50 | 1.969 | 2.008 | 2.047 | 2.087 | 2.126 | 2.165 | 2.205 | 2.244 | 2.283 | 2.323 |
| 60 | 2.362 | 2.402 | 2.441 | 2.480 | 2.520 | 2.559 | 2.598 | 2.638 | 2.677 | 2.717 |
| 70 | 2.756 | 2.795 | 2.835 | 2.874 | 2.913 | 2.953 | 2.992 | 3.032 | 3.071 | 3.110 |
| 80 | 3.150 | 3.189 | 3.228 | 3.268 | 3.307 | 3.346 | 3.386 | 3.425 | 3.465 | 3.504 |
| 90 | 3.543 | 3.583 | 3.622 | 3.661 | 3.701 | 3.740 | 3.780 | 3.819 | 3.858 | 3.898 |

**Kilogram to Pound**

1 kg = 2.2046 lb

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 2.20 | 4.41 | 6.61 | 8.82 | 11.02 | 13.23 | 15.43 | 17.64 | 19.84 |
| 10 | 22.05 | 24.25 | 26.46 | 28.66 | 30.86 | 33.07 | 35.27 | 37.48 | 39.68 | 41.89 |
| 20 | 44.09 | 46.30 | 48.50 | 50.71 | 51.91 | 55.12 | 57.32 | 59.53 | 61.73 | 63.93 |
| 30 | 66.14 | 68.34 | 70.55 | 72.75 | 74.96 | 77.16 | 79.37 | 81.57 | 83.78 | 85.98 |
| 40 | 88.18 | 90.39 | 92.59 | 94.80 | 97.00 | 99.21 | 101.41 | 103.62 | 105.82 | 108.03 |
| 50 | 110.23 | 112.44 | 114.64 | 116.85 | 119.05 | 121.25 | 123.46 | 125.66 | 127.87 | 130.07 |
| 60 | 132.28 | 134.48 | 136.69 | 138.89 | 141.10 | 143.30 | 145.51 | 147.71 | 149.91 | 152.12 |
| 70 | 154.32 | 156.53 | 158.73 | 160.94 | 163.14 | 165.35 | 167.55 | 169.76 | 171.96 | 174.17 |
| 80 | 176.37 | 178.57 | 180.78 | 182.98 | 185.19 | 187.39 | 189.60 | 191.80 | 194.01 | 196.21 |
| 90 | 198.42 | 200.62 | 202.83 | 205.03 | 207.24 | 209.44 | 211.64 | 213.85 | 216.05 | 218.26 |

**Liter to U.S. Gallon**

1ℓ = 0.2642 U.S. Gal

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.264 | 0.528 | 0.793 | 1.057 | 1.321 | 1.585 | 1.849 | 2.113 | 2.378 |
| 10 | 2.642 | 2.906 | 3.170 | 3.434 | 3.698 | 3.963 | 4.227 | 4.491 | 4.755 | 5.019 |
| 20 | 5.283 | 5.548 | 5.812 | 6.076 | 6.340 | 6.604 | 6.869 | 7.133 | 7.397 | 7.661 |
| 30 | 7.925 | 8.189 | 8.454 | 8.718 | 8.982 | 9.246 | 9.510 | 9.774 | 10.039 | 10.303 |
| 40 | 10.567 | 10.831 | 11.095 | 11.359 | 11.624 | 11.888 | 12.152 | 12.416 | 12.680 | 12.944 |
| 50 | 13.209 | 13.473 | 13.737 | 14.001 | 14.265 | 14.529 | 14.795 | 15.058 | 15.322 | 15.586 |
| 60 | 15.850 | 16.115 | 16.379 | 16.643 | 16.907 | 17.171 | 17.435 | 17.700 | 17.964 | 18.228 |
| 70 | 18.492 | 18.756 | 19.020 | 19.285 | 19.549 | 19.813 | 20.077 | 20.341 | 20.605 | 20.870 |
| 80 | 21.134 | 21.398 | 21.662 | 21.926 | 22.190 | 22.455 | 22.719 | 22.983 | 23.247 | 23.511 |
| 90 | 23.775 | 24.040 | 24.304 | 24.568 | 24.832 | 25.096 | 25.361 | 25.625 | 25.889 | 26.153 |

**Liter to U.K. Gallon**

1ℓ = 0.21997 U.K. Gal

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 0.220 | 0.440 | 0.660 | 0.880 | 1.100 | 1.320 | 1.540 | 1.760 | 1.980 |
| 10 | 2.200 | 2.420 | 2.640 | 2.860 | 3.080 | 3.300 | 3.520 | 3.740 | 3.950 | 4.179 |
| 20 | 4.399 | 4.619 | 4.839 | 5.059 | 5.279 | 5.499 | 5.719 | 5.939 | 6.159 | 6.379 |
| 30 | 6.599 | 6.819 | 7.039 | 7.259 | 7.479 | 7.969 | 7.919 | 8.139 | 8.359 | 8.579 |
| 40 | 8.799 | 9.019 | 9.239 | 9.459 | 9.679 | 9.899 | 10.119 | 10.339 | 10.559 | 10.778 |
| 50 | 10.998 | 11.281 | 11.438 | 11.658 | 11.878 | 12.098 | 12.318 | 12.528 | 12.758 | 12.978 |
| 60 | 13.198 | 13.418 | 13.638 | 13.858 | 14.078 | 14.298 | 14.518 | 14.738 | 14.958 | 15.178 |
| 70 | 15.398 | 15.618 | 15.838 | 16.058 | 16.278 | 16.498 | 16.718 | 16.938 | 17.158 | 17.378 |
| 80 | 17.598 | 17.818 | 18.037 | 18.257 | 18.477 | 18.697 | 18.917 | 19.137 | 19.357 | 19.577 |
| 90 | 19.797 | 20.017 | 20.237 | 20.457 | 20.677 | 20.897 | 21.117 | 21.337 | 21.557 | 21.777 |

**kgm to ft. lb**

1 kgm = 7.233 ft. lb

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 7.2 | 14.5 | 21.7 | 28.9 | 36.2 | 43.4 | 50.6 | 57.9 | 65.1 |
| 10 | 72.3 | 79.6 | 86.8 | 94.0 | 101.3 | 108.5 | 115.7 | 123.0 | 130.2 | 137.4 |
| 20 | 144.7 | 151.9 | 159.1 | 166.4 | 173.6 | 180.8 | 188.1 | 195.3 | 202.5 | 209.8 |
| 30 | 217.0 | 224.2 | 231.5 | 238.7 | 245.9 | 253.2 | 260.4 | 267.6 | 274.9 | 282.1 |
| 40 | 289.3 | 296.6 | 303.8 | 311.0 | 318.3 | 325.5 | 332.7 | 340.0 | 347.2 | 354.4 |
| 50 | 361.7 | 368.9 | 376.1 | 383.4 | 390.6 | 397.8 | 405.1 | 412.3 | 419.5 | 426.8 |
| 60 | 434.0 | 441.2 | 448.5 | 455.7 | 462.9 | 470.2 | 477.4 | 484.6 | 491.8 | 499.1 |
| 70 | 506.3 | 513.5 | 520.8 | 528.0 | 535.2 | 542.5 | 549.7 | 556.9 | 564.2 | 571.4 |
| 80 | 578.6 | 585.9 | 593.1 | 600.3 | 607.6 | 614.8 | 622.0 | 629.3 | 636.5 | 643.7 |
| 90 | 651.0 | 658.2 | 665.4 | 672.7 | 679.9 | 687.1 | 694.4 | 701.6 | 708.8 | 716.1 |
| 100 | 723.3 | 730.5 | 737.8 | 745.0 | 752.2 | 759.5 | 766.7 | 773.9 | 781.2 | 788.4 |
| 110 | 795.6 | 802.9 | 810.1 | 817.3 | 824.6 | 831.8 | 839.0 | 846.3 | 853.5 | 860.7 |
| 120 | 868.0 | 875.2 | 882.4 | 889.7 | 896.9 | 904.1 | 911.4 | 918.6 | 925.8 | 933.1 |
| 130 | 940.3 | 947.5 | 954.8 | 962.0 | 969.2 | 976.5 | 983.7 | 990.9 | 998.2 | 1005.4 |
| 140 | 1012.6 | 1019.9 | 1027.1 | 1034.3 | 1041.5 | 1048.8 | 1056.0 | 1063.2 | 1070.5 | 1077.7 |
| 150 | 1084.9 | 1092.2 | 1099.4 | 1106.6 | 1113.9 | 1121.1 | 1128.3 | 1135.6 | 1142.8 | 1150.0 |
| 160 | 1157.3 | 1164.5 | 1171.7 | 1179.0 | 1186.2 | 1193.4 | 1200.7 | 1207.9 | 1215.1 | 1222.4 |
| 170 | 1129.6 | 1236.8 | 1244.1 | 1251.3 | 1258.5 | 1265.8 | 1273.0 | 1280.1 | 1287.5 | 1294.7 |
| 180 | 1301.9 | 1309.2 | 1316.4 | 1323.6 | 1330.9 | 1338.1 | 1345.3 | 1352.6 | 1359.8 | 1367.0 |
| 190 | 1374.3 | 1381.5 | 1388.7 | 1396.0 | 1403.2 | 1410.4 | 1417.7 | 1424.9 | 1432.1 | 1439.4 |

**kg/cm² to lb/in²**

1kg/cm² = 14.2233 lb/in²

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 14.2 | 28.4 | 42.7 | 56.9 | 71.1 | 85.3 | 99.6 | 113.8 | 128.0 |
| 10 | 142.2 | 156.5 | 170.7 | 184.9 | 199.1 | 213.4 | 227.6 | 241.8 | 256.0 | 270.2 |
| 20 | 284.5 | 298.7 | 312.9 | 327.1 | 341.4 | 355.6 | 369.8 | 384.0 | 398.3 | 412.5 |
| 30 | 426.7 | 440.9 | 455.1 | 469.4 | 483.6 | 497.8 | 512.0 | 526.3 | 540.5 | 554.7 |
| 40 | 568.9 | 583.2 | 597.4 | 611.6 | 625.8 | 640.1 | 654.3 | 668.5 | 682.7 | 696.9 |
| 50 | 711.2 | 725.4 | 739.6 | 753.8 | 768.1 | 782.3 | 796.5 | 810.7 | 825.0 | 839.2 |
| 60 | 853.4 | 867.6 | 881.8 | 896.1 | 910.3 | 924.5 | 938.7 | 953.0 | 967.2 | 981.4 |
| 70 | 995.6 | 1010 | 1024 | 1038 | 1053 | 1067 | 1081 | 1095 | 1109 | 1124 |
| 80 | 1138 | 1152 | 1166 | 1181 | 1195 | 1209 | 1223 | 1237 | 1252 | 1266 |
| 90 | 1280 | 1294 | 1309 | 1323 | 1337 | 1351 | 1365 | 1380 | 1394 | 1408 |
| 100 | 1422 | 1437 | 1451 | 1465 | 1479 | 1493 | 1508 | 1522 | 1536 | 1550 |
| 110 | 1565 | 1579 | 1593 | 1607 | 1621 | 1636 | 1650 | 1664 | 1678 | 1693 |
| 120 | 1707 | 1721 | 1735 | 1749 | 1764 | 1778 | 1792 | 1806 | 1821 | 1835 |
| 130 | 1849 | 1863 | 1877 | 1892 | 1906 | 1920 | 1934 | 1949 | 1963 | 1977 |
| 140 | 1991 | 2005 | 2020 | 2034 | 2048 | 2062 | 2077 | 2091 | 2105 | 2119 |
| 150 | 2134 | 2148 | 2162 | 2176 | 2190 | 2205 | 2219 | 2233 | 2247 | 2262 |
| 160 | 2276 | 2290 | 2304 | 2318 | 2333 | 2347 | 2361 | 2375 | 2389 | 2404 |
| 170 | 2418 | 2432 | 2446 | 2460 | 2475 | 2489 | 2503 | 2518 | 2532 | 2546 |
| 180 | 2560 | 2574 | 2589 | 2603 | 2617 | 2631 | 2646 | 2660 | 2674 | 2688 |
| 190 | 2702 | 2717 | 2731 | 2745 | 2759 | 2773 | 2788 | 2802 | 2816 | 2830 |
| 200 | 2845 | 2859 | 2873 | 2887 | 2901 | 2916 | 2930 | 2944 | 2958 | 2973 |
| 210 | 2987 | 3001 | 3015 | 3030 | 3044 | 3058 | 3072 | 3086 | 3101 | 3115 |
| 220 | 3129 | 3143 | 3158 | 3172 | 3186 | 3200 | 3214 | 3229 | 3243 | 3257 |
| 230 | 3271 | 3286 | 3300 | 3314 | 3328 | 3343 | 3357 | 3371 | 3385 | 3399 |
| 240 | 3414 | 3428 | 3442 | 3456 | 3470 | 3485 | 3499 | 3513 | 3527 | 3542 |

**Temperature**

Fahrenheit-Centigrade Conversion ; a simple way to convert a Fahrenheit temperature reading into a Centigrade temperature reading or vice versa is to enter the accompanying table in the center or boldface column of figures.

These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right. 1°C = 33.8°F

| °C | | °F | °C | | °F | °C | | °F | °C | | °F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| –40.4 | **–40** | –40.0 | –11.7 | **11** | 51.8 | 7.8 | **46** | 114.8 | 27.2 | **81** | 117.8 |
| –37.2 | **–35** | –31.0 | –11.1 | **12** | 53.6 | 8.3 | **47** | 116.6 | 27.8 | **82** | 179.6 |
| –34.4 | **–30** | –22.0 | –10.6 | **13** | 55.4 | 8.9 | **48** | 118.4 | 28.3 | **83** | 181.4 |
| –31.7 | **–25** | –13.0 | –10.0 | **14** | 57.2 | 9.4 | **49** | 120.2 | 28.9 | **84** | 183.2 |
| –28.9 | **–20** | –4.0 | –9.4 | **15** | 59.0 | 10.0 | **50** | 122.0 | 29.4 | **85** | 185.0 |
| –28.3 | **–19** | –2.2 | –8.9 | **16** | 60.8 | 10.6 | **51** | 123.8 | 30.0 | **86** | 186.8 |
| –27.8 | **–18** | –0.4 | –8.3 | **17** | 62.6 | 11.1 | **52** | 125.6 | 30.6 | **87** | 188.6 |
| –27.2 | **–17** | 1.4 | –7.8 | **18** | 64.4 | 11.7 | **53** | 127.4 | 31.1 | **88** | 190.4 |
| –26.7 | **–16** | 3.2 | –7.2 | **19** | 66.2 | 12.2 | **54** | 129.2 | 31.7 | **89** | 192.2 |
| –26.1 | **–15** | 5.0 | –6.7 | **20** | 68.0 | 12.8 | **55** | 131.0 | 32.2 | **90** | 194.0 |
| –25.6 | **–14** | 6.8 | –6.1 | **21** | 69.8 | 13.3 | **56** | 132.8 | 32.8 | **91** | 195.8 |
| –25.0 | **–13** | 8.6 | –5.6 | **22** | 71.6 | 13.9 | **57** | 134.6 | 33.3 | **92** | 197.6 |
| –24.4 | **–12** | 10.4 | –5.0 | **23** | 73.4 | 14.4 | **58** | 136.4 | 33.9 | **93** | 199.4 |
| –23.9 | **–11** | 12.2 | –4.4 | **24** | 75.2 | 15.0 | **59** | 138.2 | 34.4 | **94** | 201.2 |
| –23.3 | **–10** | 14.0 | –3.9 | **25** | 77.0 | 15.6 | **0** | 140.0 | 35.0 | **95** | 203.0 |
| –22.8 | **–9** | 15.8 | –3.3 | **26** | 78.8 | 16.1 | **61** | 141.8 | 35.6 | **96** | 204.8 |
| –22.2 | **–8** | 17.6 | –2.8 | **27** | 80.6 | 16.7 | **62** | 143.6 | 36.1 | **97** | 206.6 |
| –21.7 | **–7** | 19.4 | –2.2 | **28** | 82.4 | 17.2 | **63** | 145.4 | 36.7 | **98** | 208.4 |
| –21.1 | **–6** | 21.2 | –1.7 | **29** | 84.2 | 17.8 | **64** | 147.2 | 37.2 | **99** | 210.2 |
| –20.6 | **–5** | 23.0 | –1.1 | **30** | 86.0 | 18.3 | **65** | 149.0 | 37.8 | **100** | 212.0 |
| –20.0 | **–4** | 24.8 | –0.6 | **31** | 87.8 | 18.9 | **66** | 150.8 | 40.6 | **105** | 221.0 |
| –19.4 | **–3** | 26.6 | 0 | **32** | 89.6 | 19.4 | **67** | 152.6 | 43.3 | **110** | 230.0 |
| –18.9 | **–2** | 28.4 | 0.6 | **33** | 91.4 | 20.0 | **68** | 154.4 | 46.1 | **115** | 239.0 |
| –18.3 | **–1** | 30.2 | 1.1 | **34** | 93.2 | 20.6 | **69** | 156.2 | 48.9 | **120** | 248.0 |
| –17.8 | **0** | 32.0 | 1.7 | **35** | 95.0 | 21.1 | **70** | 158.0 | 51.7 | **125** | 257.0 |
| –17.2 | **1** | 33.8 | 2.2 | **36** | 96.8 | 21.7 | **71** | 159.8 | 54.4 | **130** | 266.0 |
| –16.7 | **2** | 35.6 | 2.8 | **37** | 98.6 | 22.2 | **72** | 161.6 | 57.2 | **135** | 275.0 |
| –16.1 | **3** | 37.4 | 3.3 | **38** | 100.4 | 22.8 | **73** | 163.4 | 60.0 | **140** | 284.0 |
| –15.6 | **4** | 39.2 | 3.9 | **39** | 102.2 | 23.3 | **74** | 165.2 | 62.7 | **145** | 293.0 |
| –15.0 | **5** | 41.0 | 4.4 | **40** | 104.0 | 23.9 | **75** | 167.0 | 65.6 | **150** | 302.0 |
| –14.4 | **6** | 42.8 | 5.0 | **41** | 105.8 | 24.4 | **76** | 168.8 | 68.3 | **155** | 311.0 |
| –13.9 | **7** | 44.6 | 5.6 | **42** | 107.6 | 25.0 | **77** | 170.6 | 71.1 | **160** | 320.0 |
| –13.3 | **8** | 46.4 | 6.1 | **43** | 109.4 | 25.6 | **78** | 172.4 | 73.9 | **165** | 329.0 |
| –12.8 | **9** | 48.2 | 6.7 | **44** | 111.2 | 26.1 | **79** | 174.2 | 76.7 | **170** | 338.0 |
| –12.2 | **10** | 50.0 | 7.2 | **45** | 113.0 | 26.7 | **80** | 176.0 | 79.4 | **175** | 347.0 |

## UNITS

In this manual, the measuring units are indicated with Internatinal System of units (SI).
As for reference, conventionally used Gravitational System of units are indicated in parentheses { }.

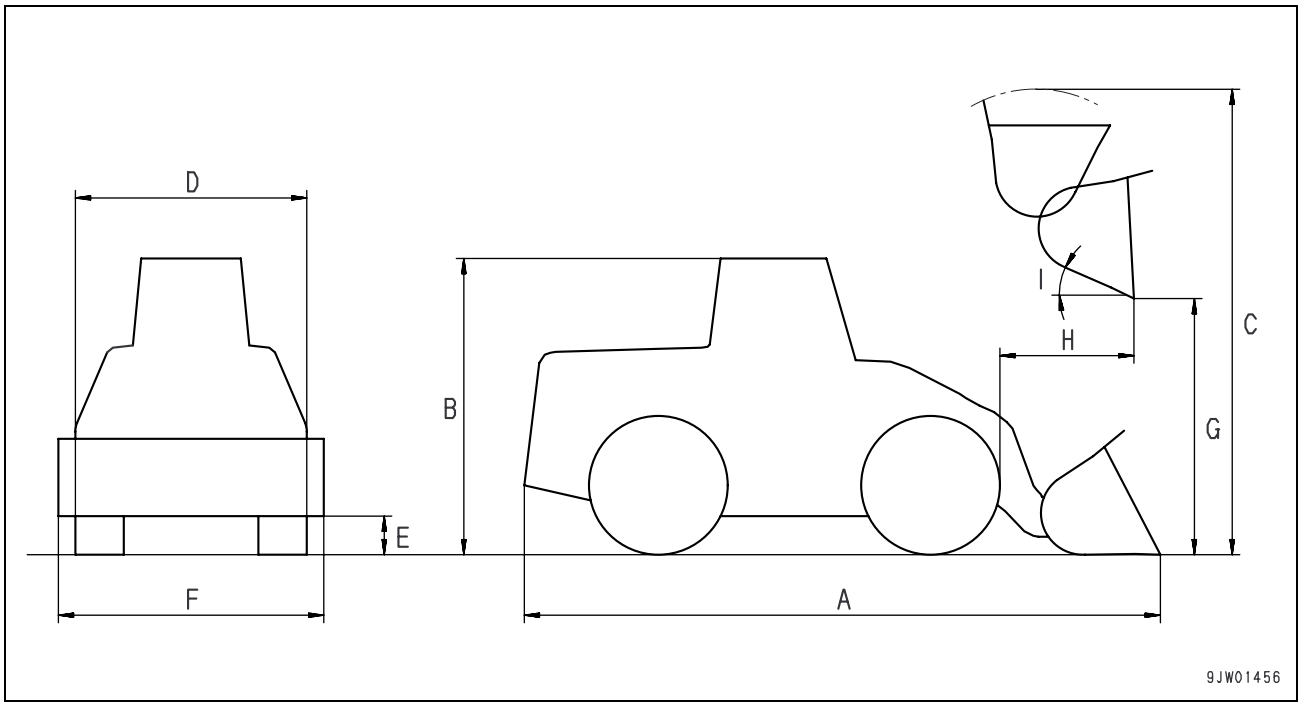
**Example:**

N {kg}
Nm {kgm}
MPa {kg/cm$^2$}
kPa {mm$H_2O$}
kPa {mmHg}
kW/rpm {HP/rpm}
g/kWh {g/HPh}

# 01 GENERAL

General assembly drawings ..... 01-2
Specifications ..... 01-3
Weight table ..... 01-7
List of lubricant and coolant ..... 01-9

# GENERAL ASSEMBLY DRAWINGS




| | Item | | Unit | WA250-5H | WA250PT-5H |
|---|---|---|---|---|---|
| | Operating weight | | kg | 10,950 | 12,450 |
| | Rated load | | kg | 3,680 | 3,540 |
| | Bucket capacity (piled) | | $m^3$ | 2.1 | 2.0 |
| | Engine model | | — | KOMATSU SAA6D102E-2-A Diesel engine | |
| | Flywheel horse power | | kW {HP} / rpm | 101{135} / 2,000 | |
| A | Overall length | | mm | 6,905 | 7,575 |
| B | Overall height | | mm | 3,200 | 3,200 |
| C | Overall height when bucket is raised | | mm | 5,040 | 5,400 |
| D | Overall width | | mm | 2,470 | 2,470 |
| E | Min. ground clearance | | mm | 465 | 465 |
| F | Bucket width | | mm | 2,685 | 2,560 |
| G | Dumping clearance | Tip of cutting edge/Tip of tooth | mm | 2,910 | 2,840 / 2,730 |
| H | Dumping reach | Tip of cutting edge/Tip of tooth | mm | 920 | 1,075 / 1,230 |
| I | Bucket dump angle | | deg. | 45 | 45 |
| | Min. turning radius | Tip of cutting edge/Tip of tooth | mm | 5,775 | 5,840 / 5,920 |
| | | Center of outside wheel | mm | 4,950 | 4,950 |
| | Travel speed | F1 | km / h | 4.0 – 13.0 | 4.0 – 13.0 |
| | | F2 | km / h | 13.0 | 13.0 |
| | | F3 | km / h | 18.0 | 18.0 |
| | | F4 | km / h | 38.0 | 38.0 |
| | | R1 | km / h | 4.0 – 13.0 | 4.0 – 13.0 |
| | | R2 | km / h | 13.0 | 13.0 |
| | | R3 | km / h | 18.0 | 18.0 |
| | | R4 | km / h | 38.0 | 38.0 |

# SPECIFICATIONS

| Machine model | | | | WA250-5H | WA250PT-5H |
|---|---|---|---|---|---|
| Serial No. | | | | WA250H50051 and up | WA250H60051 and up |
| Weight | Operating weight | | kg | 10,950 | 12,450 |
| | Distribution (front) SAE travel posture | | kg | 4,330 | 5,270 |
| | Distribution (rear) SAE travel posture | | kg | 6,620 | 7,180 |
| Performance | Bucket capacity (piled) | | $m^3$ | 2.1 | 2.0 |
| | Rated load | | kg | 3,680 | 3,540 |
| | Travel speed | FORWARD 1st | km / h | 4.0 – 13.0 | 4.0 – 13.0 |
| | | FORWARD 2nd | km / h | 13.0 | 13.0 |
| | | FORWARD 3rd | km / h | 18.0 | 18.0 |
| | | FORWARD 4th | km / h | 38.0 | 38.0 |
| | | REVERSE 1st | km / h | 4.0 – 13.0 | 4.0 – 13.0 |
| | | REVERSE 2nd | km / h | 13.0 | 13.0 |
| | | REVERSE 3rd | km / h | 18.0 | 18.0 |
| | | REVERSE 4th | km / h | 38.0 | 38.0 |
| | Max. rimpull | FORWARD | kN {kg} | 98 {10,000} | 96 {9,800} |
| | | REVERSE | kN {kg} | 98 {10,000} | 96 {9,800} |
| | Gradeability | | deg. | 25 | 25 |
| | Min. turning radius | (Center of outside wheel) | mm | 4,950 | 4,950 |
| | Min. turning radius (Tip of cutting edge/Tip of tooth) | [SAE travel posture] | mm | 5,775 | 5,840 / 5,920 |
| Dimensions | Overall length (Tip of cutting edge/Tip of tooth) | | mm | 6,905 | 7,575 |
| | Overall width (chassis) | | mm | 2,470 | 2,470 |
| | Bucket width (Without tooth/With tooth) | | mm | 2,685 | 2,560 |
| | Overall height (top of cab) | | mm | 3,200 | 3,200 |
| | Overall height (Bucket approx. raised to max.) | | mm | 5,040 | 5,400 |
| | Wheel base | | mm | 2,900 | 2,900 |
| | Tread | | mm | 1,930 | 1,930 |
| | Min. ground clearance | | mm | 465 | 465 |
| | Max. height of bucket hinge pin | | mm | 3,795 | 3,965 |
| | Dumping clearance (Tip of cutting edge/ Tip of tooth) | | mm | 2,910 | 2,840 / 2,730 |
| | Dumping reach (Tip of cutting edge/Tip of tooth) | | mm | 920 | 1,075 / 1,230 |
| | Steering angle | | deg. | 40 | 40 |
| | Bucket tilt angle (travel posture) | | deg. | 50 | 44 |
| | Bucket tilt angle (max. height) | | deg. | 66 | 55 |
| | Bucket dump angle (max. height) | | deg. | 45 | 50 |
| | Digging depth (10° dump) (Tip of cutting edge/Tip of tooth) | | mm | 245 | 305 / 385 |

| Machine model | | | | WA250-5H | WA250PT-5H |
|---|---|---|---|---|---|
| Serial No. | | | | WA250H50051 and up | WA250H60051 and up |
| Engine | Model | | | SAA6D102E-2-A | |
| | Type | | | 4-cycle, water-cooled, in-line, 6-cylinder, direct injection with turbocharger, aftercooler | |
| | No. of cylinders - bore x stroke | | mm | 6 – 102 x 120 | |
| | Piston displacement | | ℓ {cc} | 5.88 {5,880} | |
| | Flywheel horsepower | | kW / rpm | 101 / 2,000 | |
| | | | {HP / rpm} | {135 / 2,000} | |
| | Maximum torque | | Nm / rpm | 618 / 1,400 | |
| | | | {kgm / rpm} | {63 / 1,400} | |
| | Min. fuel consumption ratio | | g / kWh {g / HPh} | 224 {167} | |
| | High idling speed | | rpm | 2,225 | |
| | Low idling speed | | rpm | 825 | |
| | Starting motor | | | 24 V 4.5 kW | |
| | Alternator | | | 24 V 60 A | |
| | Battery | | | 24 V 110 Ah x 2 pcs. | |
| Power train | HST pump | | | Variable displacement swash plate-type piston pump | |
| | HST motor 1 | | | Variable displacement swash plate-type piston motor | |
| | HST motor 2 | | | Variable displacement swash plate-type piston motor | |
| | Transfer | | | Multiple shaft planetary compound-type, spur gear constant mesh-type, 2 alternative power systems | |
| | Reduction gear | | | Spiral bevel gear, splash lubrication type | |
| | Differential | | | Straight bevel gear type, torque portioning | |
| | Final drive | | | Planetary gear 1-stage, splash lubrication type | |
| Axle | Drive type | | | Front and rear wheel drive | |
| | Front axle | | | Fixed to frame, semi-floating type | |
| | Rear axle | | | Center pin support, semi-floating type | |
| Tire | Tire size | | | 20.5–25–12PR | |
| | Rim size | | | 25x17.00–1.7 | |
| | Inflation pressure | Front tire | kPa {kg / cm²} | 274 {2.8} | |
| | | Rear tire | kPa {kg / cm²} | 274 {2.8} | |
| Brakes | Main brake | Braking system | | 4 wheel braking, Front and rear wheel independent system control | |
| | | Brake type | | Enclosed wet multiple disc type | |
| | | Operation method | | Hydraulically controlled | |
| | | Control method | | Hydraulic power servo assisted brake | |
| | Parking brake | Braking system | | Speed change gear output shaft braking | |
| | | Brake type | | Wet multiple disc type | |
| | | Operation method | | Mechanical type | |
| | | Control method | | Hand lever type | |

| Machine model | | | | WA250-5H | WA250PT-5H |
|---|---|---|---|---|---|
| Serial No. | | | | WA250H50051 and up | WA250H60051 and up |
| Steering control | Type | | | Articulated steering | |
| | Control | | | Hydraulic control | |
| Hydraulic system | Hydraulic pump | Steering pump | | | |
| | | | • Type | | Gear type |
| | | | • Delivery | ℓ / min | 110 |
| | | Work equipment pump | | | |
| | | | • Type | | Gear type |
| | | | • Delivery | ℓ / min | 78 |
| | | Brake and cooling fan pump | | | |
| | | | • Type | | Gear type |
| | | | • Delivery | ℓ / min | 19 |
| | | Transfer lubrication pump | | | |
| | | | • Type | | Gear type |
| | | | • Delivery | ℓ / min | 22 |
| | Cylinder | Steering cylinder | Type | | Reciprocating piston type |
| | | | Cylinder inner diameter | mm | 70 |
| | | | Piston rod diameter | mm | 40 |
| | | | Stroke | mm | 453 |
| | | | Max. length between pins | mm | 1,271 |
| | | | Min. length between pins | mm | 818 |
| | | Lift cylinder | Type | | Reciprocating piston type |
| | | | Cylinder inner diameter | mm | 130 |
| | | | Piston rod diameter | mm | 70 |
| | | | Stroke | mm | 717 |
| | | | Max. length between pins | mm | 1,950.5 |
| | | | Min. length between pins | mm | 1,233.5 |
| | | Bucket cylinder | Type | | Reciprocating piston type / Reciprocating piston type |
| | | | Cylinder inner diameter | mm | 150 / 180 |
| | | | Piston rod diameter | mm | 75 / 90 |
| | | | Stroke | mm | 491 / 600 |
| | | | Max. length between pins | mm | 1,545 / 2,380 |
| | | | Min. length between pins | mm | 1,054 / 1,780 |
| | | Coupler plunger | Type | | — / Reciprocating piston type |
| | | | Cylinder inner diameter | mm | — |
| | | | Piston rod diameter | mm | — |
| | | | Stroke | mm | — |
| | | | Max. length between pins | mm | — |
| | | | Min. length between pins | mm | — |

| Machine model | | | | WA250-5H | WA250PT-5H |
|---|---|---|---|---|---|
| Serial No. | | | | WA250H50051 and up | WA250H60051 and up |
| Hydraulic system | Control valve | Work equipment control valve<br>• Type | | 2-spool type | 3-spool type |
| | | • Set pressure | MPa {kg / cm²} | 20.6 {210} | 20.6 {210} |
| | | Steering valve<br>• Type | | Orbit-roll type | |
| | | • Set pressure | MPa {kg / cm²} | 18.6 {190} | |
| | Motor | Cooling fan motor<br>• Type | | Fixed displacement piston type | |
| Work equipment | Link type | | | Single link | Parallel link |
| | Bucket edge type | | | Flat blade with top BOC | Flat blade with top BOC |

# WEIGHT TABLE

★ This weight table is a guide for use when transporting or handling components.

Unit: kg

| Machine model | WA250-5H | WA250PT-5H |
|---|---|---|
| Serial Numbers | WA250H50051 and up | WA250H60051 and up |
| Engine (without coolant and oil) | 608 | 608 |
| Cooling assembly (without coolant) | 54 | 54 |
| Cooling fan motor | 6 | 6 |
| Damper | 3 | 3 |
| HST pump | 60 | 60 |
| HST motor 1 | 59 | 59 |
| HST motor 2 | 59 | 59 |
| Transfer | 211 | 211 |
| Front drive shaft | 18 | 18 |
| Rear drive shaft | 4 | 4 |
| Front axle | 555 | 555 |
| Rear axle | 492 | 492 |
| Axle pivot (rear axle) | 79 | 79 |
| Wheel (each) | 130 | 130 |
| Tire (each) | 147 | 147 |
| Orbit-roll valve | 7 | 7 |
| Priority valve | 6 | 6 |
| Steering cylinder assembly (each) | 18 | 18 |
| Brake valve | 10 | 10 |
| Hydraulic tank (without hydraulic oil) | 59 | 59 |
| 4-gear pump unit | 40 | 40 |
| Work equipment PPC valve | 3 | 3 |
| Attachment PPC valve | — | 1 |
| Work equipment control valve | 19 | 26 |
| Lift cylinder assembly (each) | 104 | 104 |
| Bucket cylinder assembly | 104 | 208 |
| Engine hood (with side panel) | 164 | 164 |
| Front frame | 840 | 1,104 |
| Rear frame | 700 | 704 |

Unit: kg

| Machine model | WA250-5H | WA250PT-5H |
|---|---|---|
| Serial Numbers | WA250H50051 and up | WA250H60051 and up |
| Lift arm (including bushing) | 715 | 612 |
| Bucket (2.1$m^2$, excluding BOC) | 763 | — |
| Bucket (2.0$m^2$, including tooth) | — | 980 |
| Tilt lever | 166 | 101 |
| Quick coupler | — | 308 |
| Coupler plunger Ass'y | — | 4 |
| Bucket link | 28 | 68 |
| Counterweight | 1,435 | 1,770 |
| Additional counterweight (1 piece) | 153 (If equipped) | 153 |
| Fuel tank (without fuel) | 79 | 79 |
| Battery (each) | 33 | 33 |
| Operator's Cab (including air conditioner and interior parts) | 755 | 755 |
| Operator's seat | 41 | 41 |

# LIST OF LUBRICANT AND COOLANT

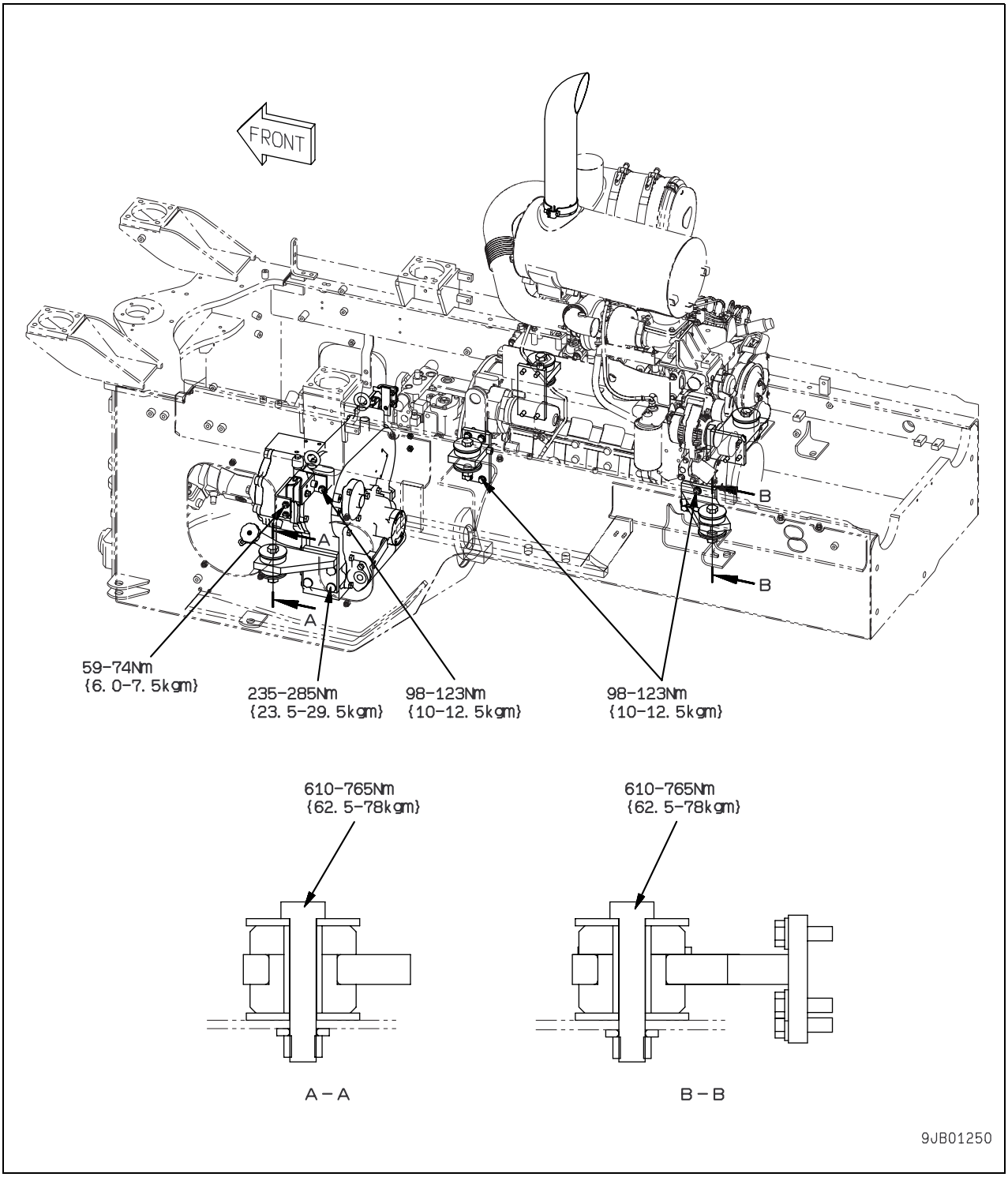
| WA250-5H WA250PT-5H | LUBRICANTS, FUELS AND FILLING CAPACITIES | | | | | |
|---|---|---|---|---|---|---|
| | **Lubricant and operating medium** | **Short code / cask lettering** | **Quality grade** | **Temperature range** | **Viscosity range** | **Filling capacitiy in litres** |
| Engine | Engine oil | EO 0030A<br>EO 0540A<br>EO 10<br>EO 30<br>EO 1030A<br>EO 1540A | CCMC D4<br>or, if not available:<br>API CD or<br>API CE or<br>API CF -4 | -30° up to 40° C<br>-25° up to 40° C<br>-20° up to 10° C<br>0° up to 40° C<br>-20° up to 40° C<br>- 15° up to 50° C | SAE 0W-30<br>SAE 5W-40<br>SAE 10<br>SAE 30<br>SAE 10W-30<br>SAE 15W-40 *) | 20<br>(19,5 **) |
| Transfer case | Engine oil | EO 10 | CCMC D4<br>or, if not available:<br>API CD or API CE or<br>API CF -4 | -30° up to 40° C | SAE 10W *) | 7,7<br>(6,9 **) |
| Hydraulic system | Hydraulic oil | HYD 0530 | HVLP, HVLP D | -30° up to 40° C | ISO VG46*)<br>(SAE 5W-30) | 135<br>(67**) |
| | or Engine oil | EO 1030A | CCMC D4<br>or, if not available:<br>API CD or API CE or<br>API CF -4 | -30° up to 40° C | SAE 10W-30 | |
| Axle with standard differential | Axle oil | AXO 80<br>AXO | Fuchs: RENOGEAR HYDRA ZF 20W-40 | -30° up to 40°C<br>-10° up to 45° C | 80W<br>SAE20W-40 *) | each 18<br>(each 18**) |
| | or Engine oil | EO 30 | CCMC D4<br>or, if not available:<br>API CD or API CE or<br>API CF -4 | 0° up to 40° C | SAE 30 | |
| Axle with limited-slip differential (*4) | Axle oil | AXO | Shell: DONAX TD 5W-30***<br>Esso: TORQUE FLUID 424****<br>Mobil: MOBILFLUID 424<br>Fuchs: RENOGEAR HYDRA ZF 20W-40 | | SAE5W-30<br><br>SAE20W-40 *) | |
| Fuel tank | Diesel fuel | ASTM D975<br>Nr 1<br>ASTM D975<br>Nr. 2<br>According<br>DIN-EN 590 | CFPP class B<br>CFPP class D<br>CFPP class F | -30° up to -10° C<br>-10° up to 40° C<br>0° up to 40° C<br>-10° up to 40° C<br>-20° up to 40° C | ----- | 184 |
| Grease nippels | Multi purpose grease on a lithium base | MPG-A | KP2N-20 | -30° up to 40° C | NLGI-No. 2 | --- |
| Grease box of central lubrication unit | Multi purpose grease on a lithium base | MPG-A | KP2N-20 | -30° up to 40° C | NLGI-No. 2 | --- |
| Cooling system | Water and coolant | SP-C | Add antifreeze with corrosion resistor | | | 17,5 |
| Air conditioner | Coolant | NRS | R134a (CFC-free) | | | 860 g |

* Work filling
** Top-up quantity
*** North American manufacted DONAX TD 20W-40 must not be used.
**** North American manufacted TORQUE FLUID 56 must not be used.

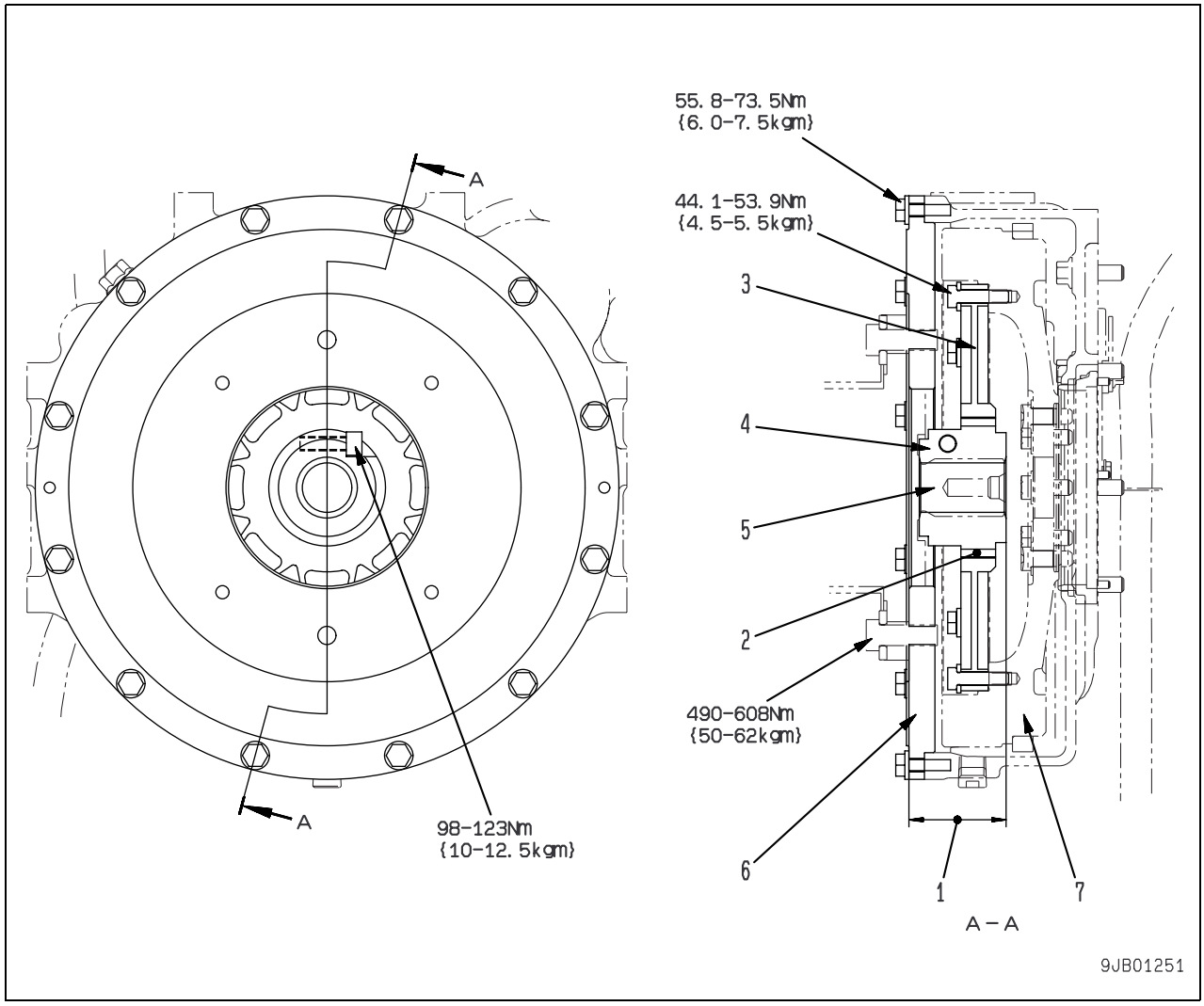
# 10 STRUCTURE, FUNCTION AND MAINTENANCE STANDARD


Engine mount and transfer mount ..... 10-2
Damper ..... 10-3
Cooling system ..... 10-4
Power train ..... 10-5
Power train system diagram ..... 10-6
Drive shaft (propeller shaft) ..... 10-8
HST hydraulic piping diagram ..... 10-9
HST pump ..... 10-10
High-pressure relief valve ..... 10-12
Low-pressure relief valve ..... 10-14
HST charge pump ..... 10-15
Speed-related valve (DA valve) ..... 10-16
High-pressure cut-off valve ..... 10-17
HST motor ..... 10-18
EP servo valve ..... 10-21
HA servo valve ..... 10-22
Forward-reverse shuttle valve ..... 10-23
Transfer ..... 10-24
Transfer oil cooler ..... 10-35
Clutch solenoid valve ..... 10-36
Axle ..... 10-37
Differential ..... 10-40
Limited-slip differential ..... 10-46
Final drive ..... 10-52
Axle mounting and center hinge pin ..... 10-58
Steering piping ..... 10-63
Steering column ..... 10-64
Priority valve ..... 10-65
Orbit-roll valve ..... 10-68
2-way restrictor valve ..... 10-76
Steering cylinder ..... 10-77
Emergency steering piping ..... 10-79
Emergency steering valve ..... 10-80
Brake piping ..... 10-83
Brake valve ..... 10-84
Inching valve ..... 10-88
Charge valve ..... 10-90
Accumulator (for brake) ..... 10-94
Slack adjuster ..... 10-95
Brake ..... 10-98
Parking brake control ..... 10-103
Parking brake ..... 10-104
Hydraulic piping ..... 10-106
Work equipment lever linkage ..... 10-110
Hydraulic tank ..... 10-114
4-gear pump unit ..... 10-116
Accumulator (for ppc circuit) ..... 10-118
Lock valve ..... 10-119
Bypass valve ..... 10-120
Quick coupler valve ..... 10-126
E.C.S.S. valve ..... 10-127
Accumulator (for E.C.S.S.) ..... 10-129
Hydraulic piping of cooling system ..... 10-130
Cooling fan motor ..... 10-131
Work equipment control valve ..... 10-133
Work equipment PPC valve ..... 10-146
Attachment PPC valve ..... 10-158
Work equipment linkage ..... 10-162
Bucket ..... 10-166
Control of bucket positioner, boom kick-out, and dump speed ..... 10-168
Work equipment cylinder ..... 10-182
Air conditioner ..... 10-186
Machine monitoring system ..... 10-187
Machine monitor ..... 10-197
List of items displayed on monitor ..... 10-198
Electrical system (HST controller system) ..... 10-224
HST controller ..... 10-228
Function of selecting forward-reverse selector switch ..... 10-229
Engine start circuit ..... 10-231
Engine stop circuit ..... 10-233
Preheating circuit (automatic preheating system) ..... 10-234
Parking brake circuit ..... 10-235
Electronically controlled suspension system ..... 10-238
Sensors ..... 10-239

# ENGINE MOUNT AND TRANSFER MOUNT



# DAMPER




Unit: mm

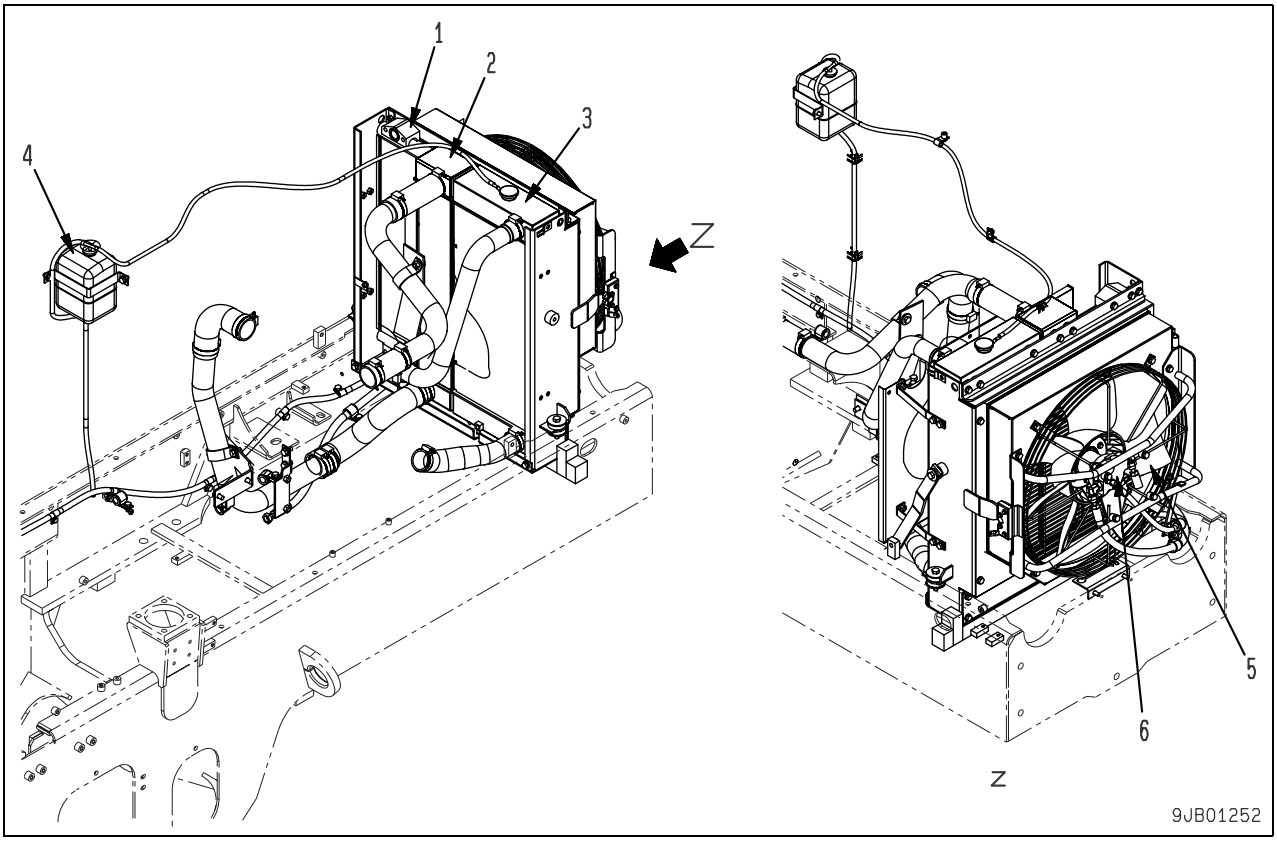
| No. | Check item | Criteria | | Remedy |
|---|---|---|---|---|
| 1 | Distance between HST pump mounting face and tip of boss | Standard size | Repair limit | Adjust |
| | | 75.1 | ± 0.8 | |
| 2 | Wear of internal teeth of coupling (plastic) | Repair limit: 1.0 | | Replace |

3. Coupling
4. Boss
5. HST pump input shaft
6. Cover
7. Flywheel

**Outline**

- The damper reduces the torsional vibration caused by fluctuation of the engine torque to protect the drive system after the engine from the torsional vibration.
- The power from the engine is transmitted through flywheel (7) to coupling (3), which absorbs the torsional vibration, and then transmitted through boss (4) to the HST pump.

# COOLING SYSTEM

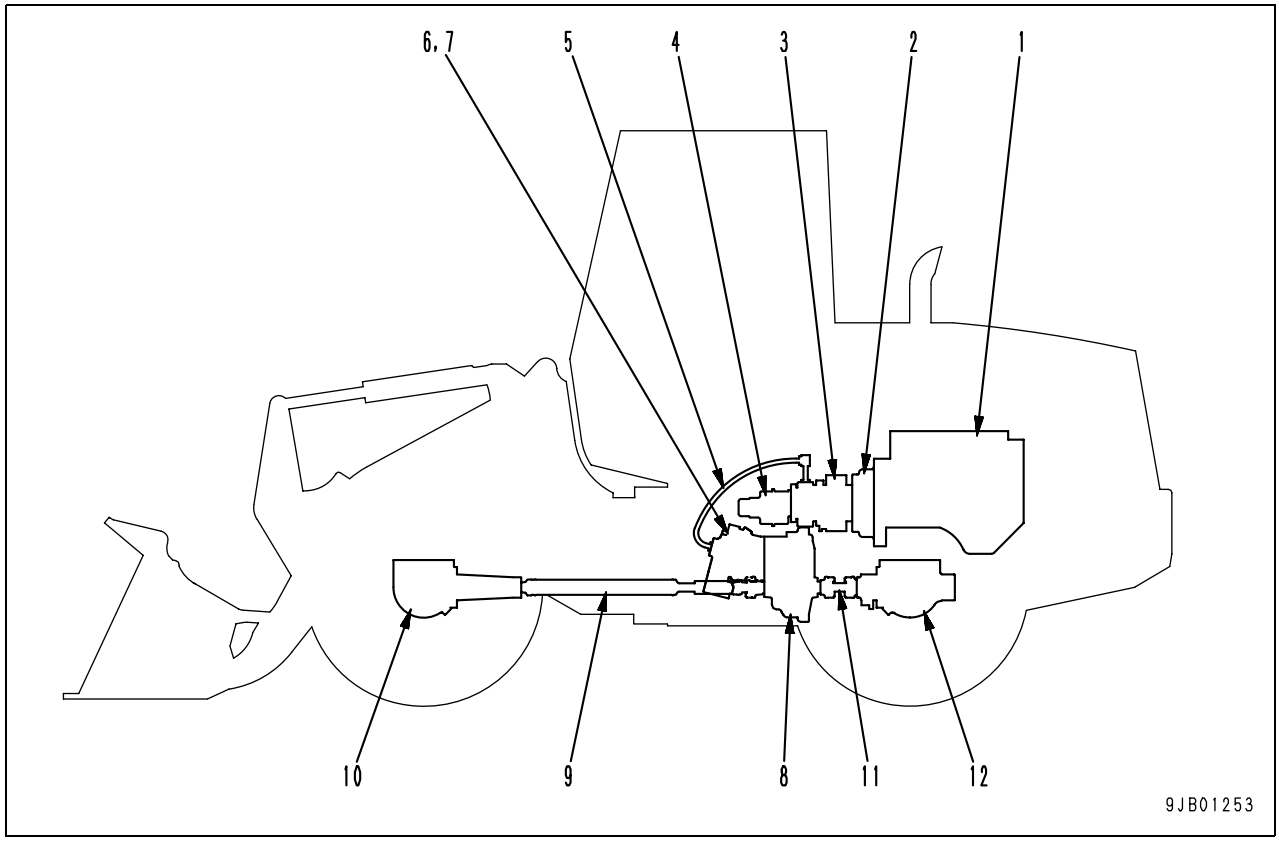



1. Oil cooler
2. Charge air cooler
3. Radiator
4. Reservoir tank
5. Cooling fan
6. Cooling fan motor

**Specification**

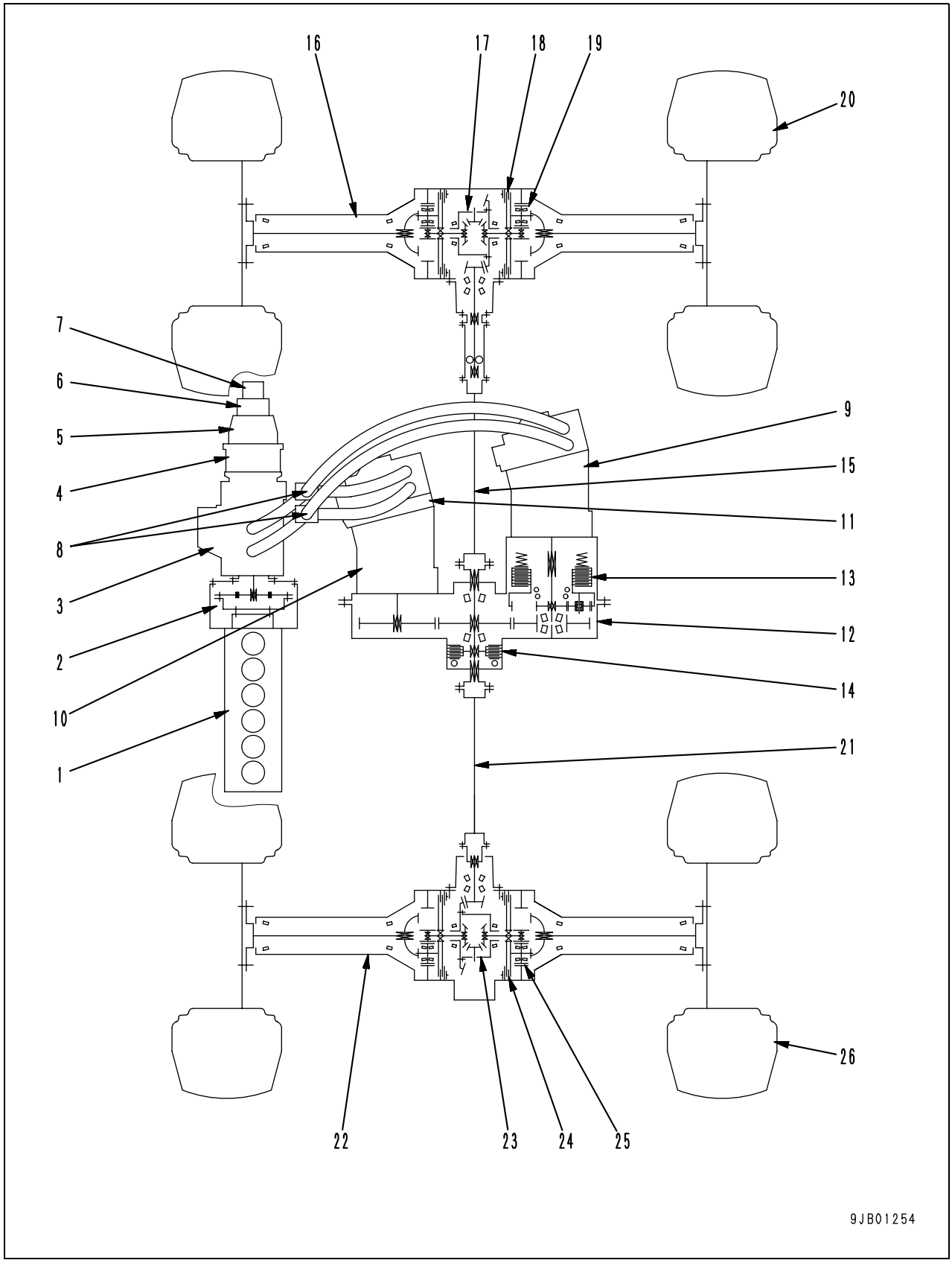
| | Radiator | Oil cooler | Charge air cooler |
|---|---|---|---|
| Core type | AL WAVE–4 | CF40–1 | |
| Fin pitch (mm) | 3.5 / 2 | 3.5 / 2 | 4.0 / 2 |
| Total heat radiating area ($m^2$) | 27.9 | 4.67 | 7.23 |
| Pressure valve opening pressure (kPa {$kg/cm^2$}) | 68.6 {0.7} | — | — |
| Vacuum valve opening pressure (kPa {$kg/cm^2$}) | 0 – 4.9 {0 – 0.05} | — | — |

# POWER TRAIN




1. Engine
2. Damper
3. HST pump
4. 4-gear pump unit
5. High-pressure hose
6. HST motor 1
7. HST motor 2
8. Transfer
9. Front drive shaft
10. Front axle
11. Rear drive shaft
12. Rear axle

# POWER TRAIN SYSTEM DIAGRAM

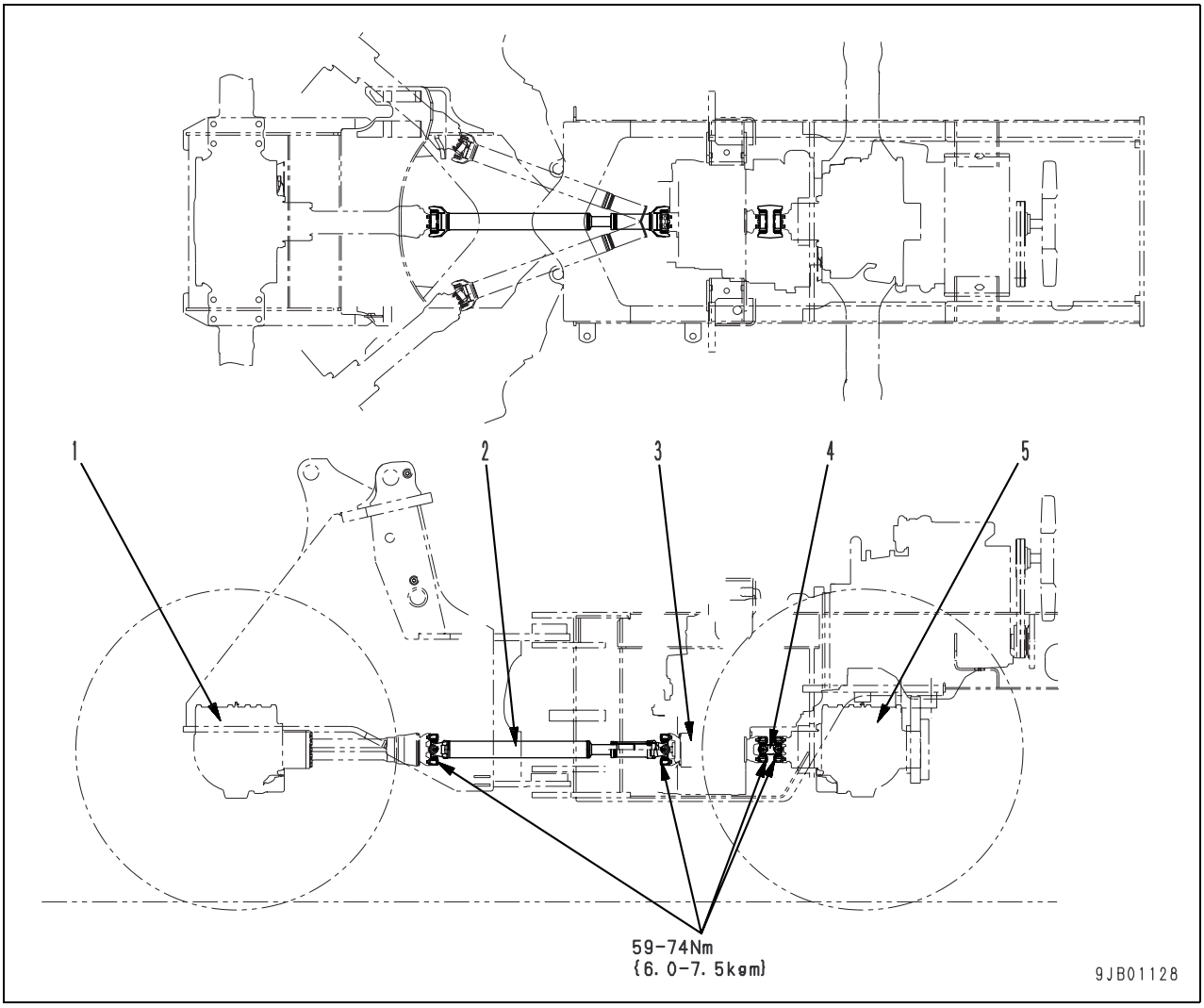


1. Engine
2. Damper
3. HST pump
4. Steering pump
5. Work equipment pump
6. Brake and cooling fan pump
7. Transfer lubricating oil pump
8. High-pressure hose
9. HST motor 1
10. HST motor 2
11. Emergency steering valve
12. Transfer
13. Transfer clutch
14. Parking brake
15. Front drive shaft
16. Front axle
17. Differential
18. Wet multiple disc brake
19. Final drive
20. Front tire
21. Rear drive shaft
22. Rear axle
23. Differential
24. Wet multiple disc brake
25. Final drive
26. Rear tire

**Outline**

- The power of engine (1) is transmitted to HST pump (3) through damper (2) which is installed to the flywheel and which absorbs the torsional vibration of the power,
- The power of engine (1) is also transmitted to HST pump (3), HST charge pump built in HST pump (3), steering pump (4) connected to HST pump (3), work equipment pump (5), brake and cooling fan pump (6), and transfer lubricating oil pump (7).
- HST pump (3) is equipped with the forward-reverse shifting valve and servo piston, which changes the discharge direction and discharge rate of HST pump (3) continuously by changing the swash plate angle.
- HST motors (9) and (10) are installed to transfer (12) and connected to HST pump (3) by high-pressure hose (8).
- The turning direction and speed of HST motors (9) and (10) are changed by the hydraulic power of HST pump (3) to control the travel direction and travel speed of the machine.
- The power of HST motor 1 (9) is transmitted through transfer clutch (13) in transfer (12) to the output shaft.
  The power of HST motor 2 (10) is transmitted through the gear in transfer (12) to the output shaft.
- Parking brake (14) is installed on the rear side in transfer (12). It operates the wet multiple disc brake to stop the machine according to the operation of the parking brake lever.
- The power for the front side is transmitted through front drive shaft (15) to front axle (16).
  The power for the rear side is transmitted through rear drive shaft (21) to rear axle (22).
- The power transmitted to axles (16) and (22) is reduced in speed by the pinion gears of differentials (17) and (23), and then transmitted through the sun gear shaft to the sun gear.
- The power of the sun gear is reduced in speed by the planetary mechanisms of final drives (19) and (25), and then transmitted through the axle shaft and wheels to tires (20) and (26).

# DRIVE SHAFT (PROPELLER SHAFT)

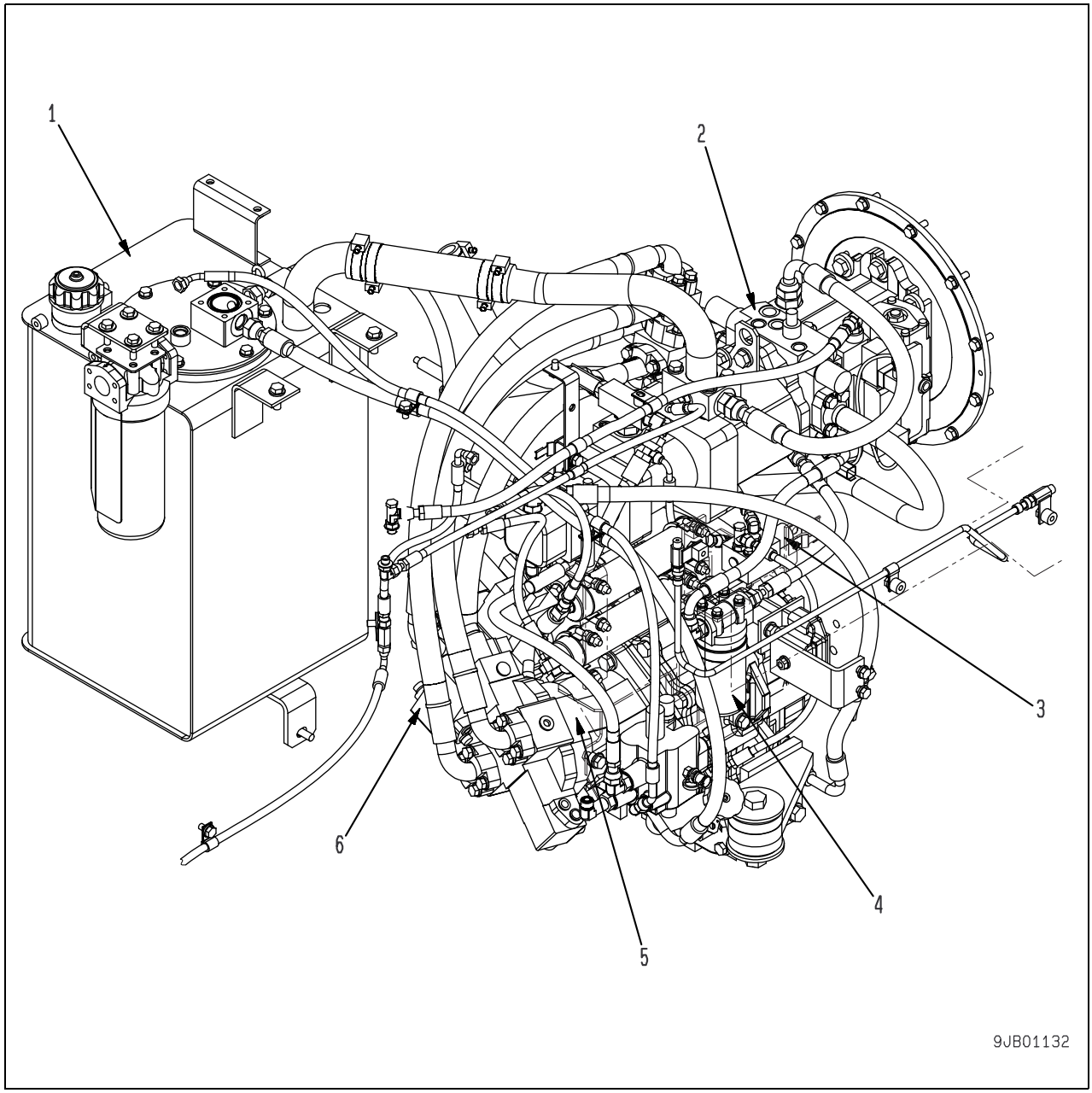



1. Front axle
2. Front drive shaft
3. Transfer
4. Rear drive shaft
5. Rear axle

**Outline**

- The power from the output shaft of the transfer is transmitted through front drive shaft (2) and rear drive shaft (4) to front axle (1) and rear axle (5).
- When the machine is articulated or it receives an impact from the road during travel or a working impact, the positions of the transfer and front and rear axles change. The drive shafts can change their angles and lengths by means of the universal joints and sliding joints so that the power will be transmitted without damaging any part even when the positions of the components change because of the impacts.

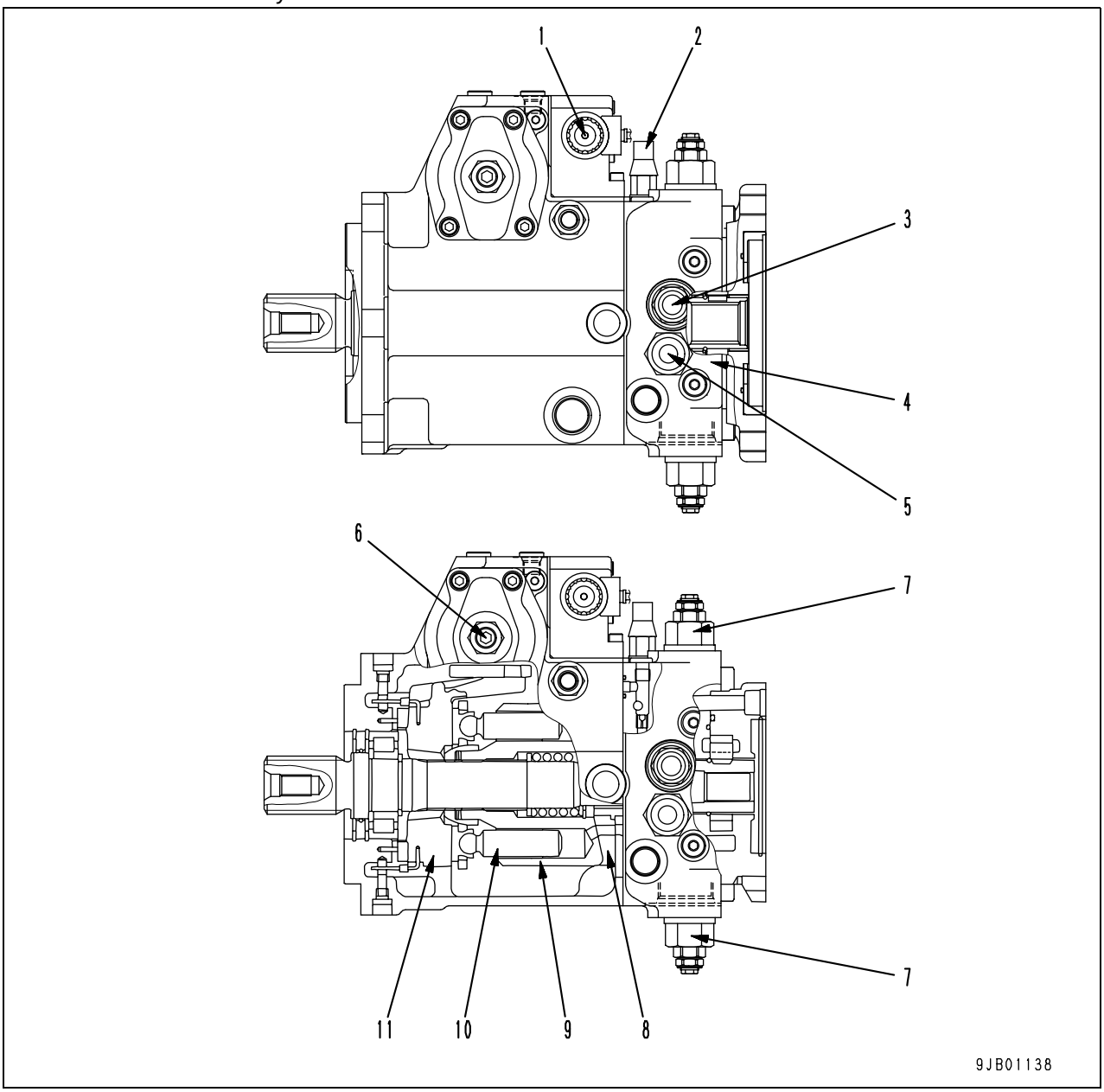
# HST HYDRAULIC PIPING DIAGRAM




1. Hydraulic tank
2. HST pump
3. Clutch solenoid valve
4. HST oil filter
5. HST motor 1
6. HST motor 2

# HST PUMP

★ HST: Abbreviation for Hydro Static Transmission




1. Forward-reverse shifting solenoid valve
2. High-pressure cut-off valve
3. Speed-related valve (DA valve)
4. Charge pump
5. Low-pressure relief valve
6. Servo cylinder
7. High-pressure relief valve
8. Control plate
9. Cylinder block
10. Piston
11. Swash plate

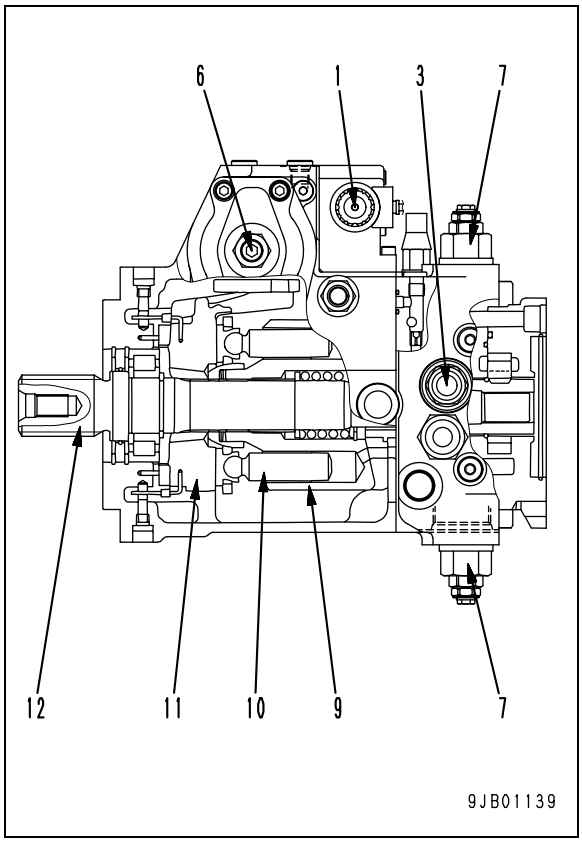
**Specifications**

| Model | A4VG90DA |
|---|---|
| Type | Variable displacement swash plate-type piston pump |
| Theoretical capacity (cc / rev) | 0 – 90 |
| Set pressure of high-pressure relief valve (MPa {kg/cm$^2$}) | 44.1 {450} |
| Set pressure of high-pressure cut-off valve (MPa {kg/cm$^2$}) | Effective differential pressure 41.2 {420} |
| Set pressure of low-pressure relief valve (MPa {kg/cm$^2$}) | 2.45 {25} |

## Operation

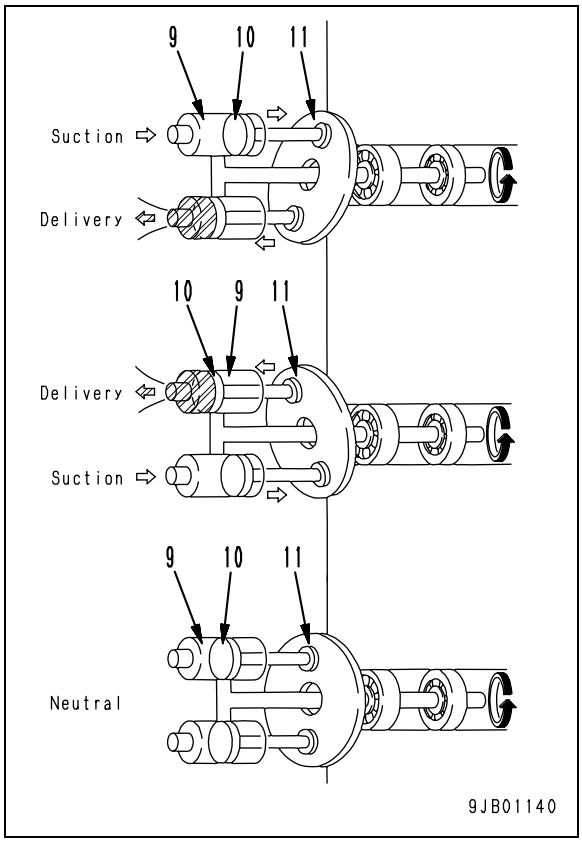
### Flow of power

- The HST pump is installed to the coupling which is installed to the engine flywheel.
- The power of the engine is transmitted from the flywheel through the coupling to the HST pump.
- The HST pump is equipped with forward-reverse shifting solenoid valve (1) and servo cylinder (6). If the operator operates for forward or reverse travel, forward-reverse shifting solenoid valve (1) operates and swash plate (11) in the HST pump slants to reverse the oil flow.
- Cylinder block (9) and pistons (10) in it rotate together with drive shaft (12) and the tips of pistons (10) slide on swash plate (11) which does not rotate. The pump has 9 pistons (10) in it.

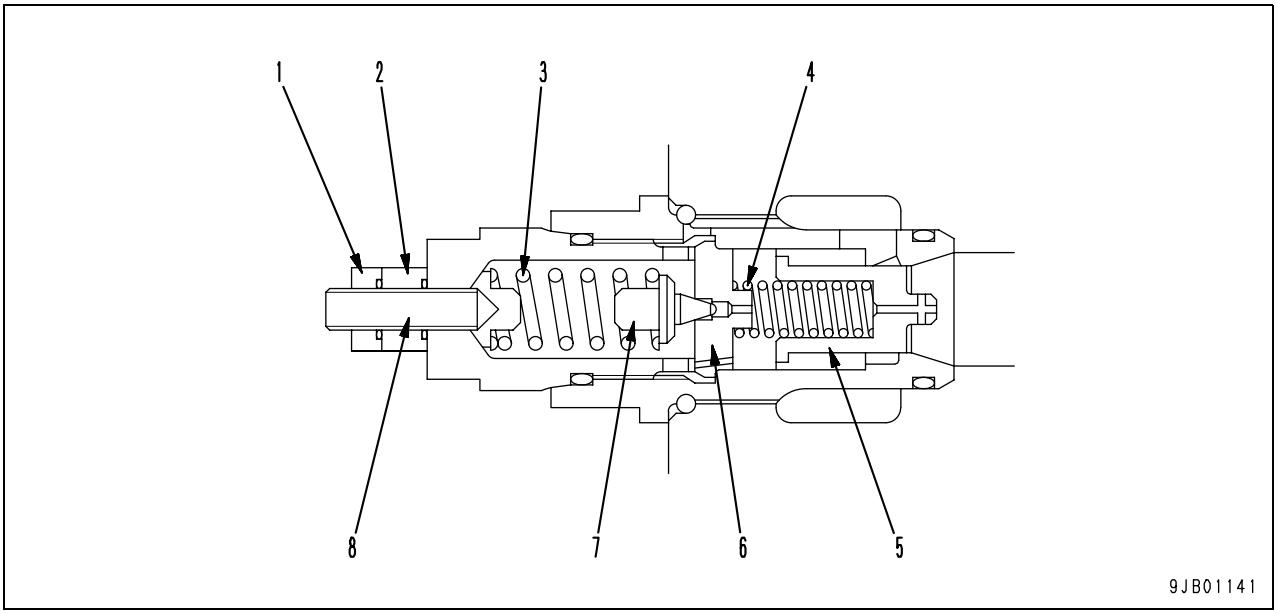



### Flow of oil

- As swash plate (11) of the HST pump slants, pistons (10) in contact with its surface reciprocate and work as pumps to suck and discharge the oil in cylinder block (9).
- As a result, high-pressure oil flows in a constant direction into the HST motor.
- If swash plate (11) slants in the opposite direction, the sucking and discharging directions of the oil are reversed, that is, the oil flows in the opposite direction. While swash plate (11) is in neutral, pistons (10) do not reciprocate, thus they do not discharge any oil.
- The strokes of pistons (10) are changed to control the travel speed by increasing or decreasing inclination (angle) of swash plate (11).
- If the quantity of the oil in the low-pressure circuit (the return circuit from the motor to the pump) becomes insufficient because of leakage from the HST pump, HST motor, and control valve, the charge pump adds oil through speed-related valve (3) and check valve of high-pressure relief valve (7).



# HIGH-PRESSURE RELIEF VALVE



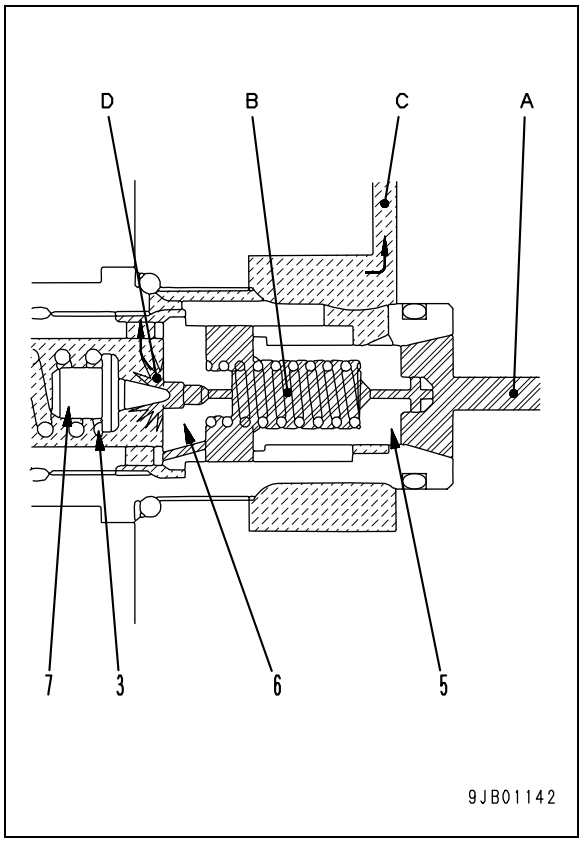

1. Nut
2. Locknut
3. Poppet spring
4. Check spring
5. Main piston
6. Valve seat
7. Pilot poppet
8. Adjustment screw

**Function**

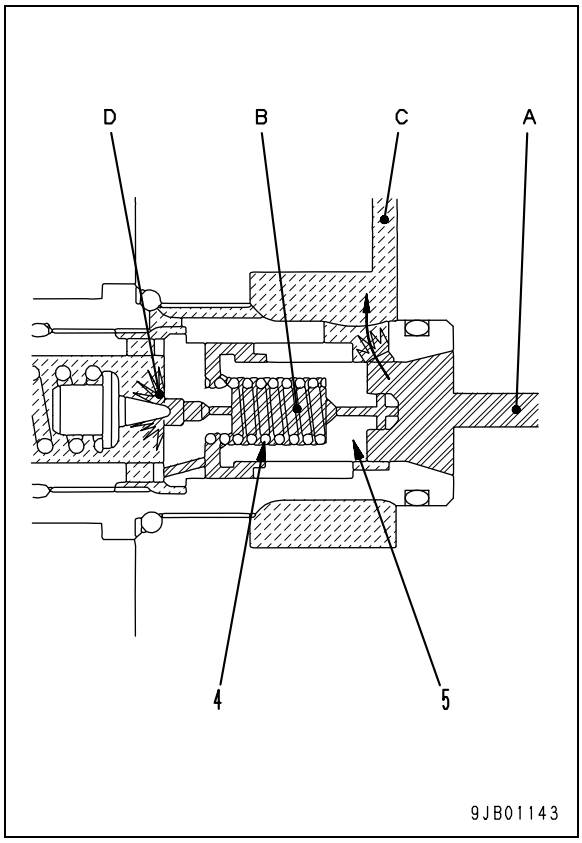
- The high-pressure relief valve is installed to the HST pump. If the oil pressure in the high-pressure circuit between the HST pump and HST motor rises higher than the set pressure, the high-pressure relief valve drains the oil into the low-pressure circuit.
  The high-pressure relief valve controls the maximum pressure in the circuit to protect the circuit with this function.
- If the quantity of the oil in the circuit becomes insufficient, the high-pressure valve leads oil in from the HST charge pump to prevent cavitation.

**Operation**

- Port **A** is connected to the high-pressure circuit of the HST pump and ports **C** and **D** are connected to the low-pressure circuit of the HST pump.
  The oil fills chamber **B** through the orifice of main piston (5).
  Pilot poppet (7) is seated on valve seat (6).

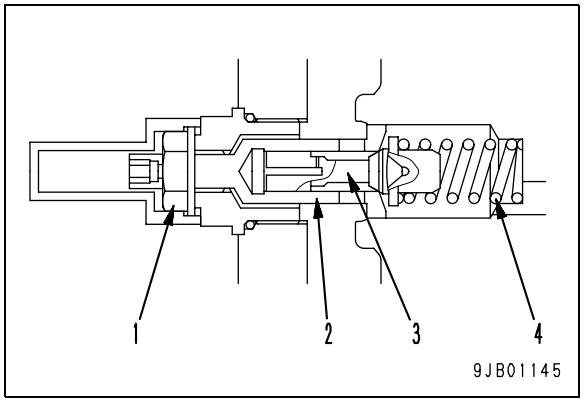


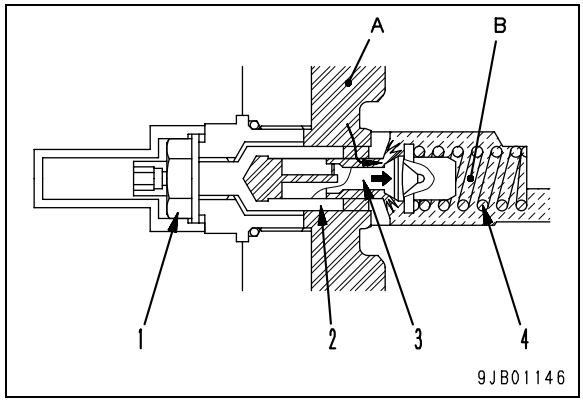

- If the oil pressure in port **A** and chamber **B** reaches the set pressure of poppet spring (3), pilot poppet (7) opens and the oil in chamber **B** flows through chamber **D** to port **C**, and the oil pressure in chamber **B** lowers consequently.
  If the oil pressure in chamber **B** lowers, a pressure difference is made between port **A** and chamber **B** by the orifice of main piston (5). As a result, main piston (5) is pushed open and the oil in port **A** flows into port **C** to relieve the abnormal pressure.




- The set pressure can be adjusted by increasing or decreasing the tension of poppet spring (3).
  To adjust the set pressure, remove the nut and loosen the locknut. If the adjustment screw is tightened, the set pressure is heightened. If the former is loosened, the latter is lowered.
- If the oil pressure in port **A** lowers below that in port **C**, check spring (4) pushes back main piston (5) and the oil in port **C** flows through chamber **D** into port **A** so that the quantity of the oil in port **A** will not become insufficient.

# LOW-PRESSURE RELIEF VALVE




1. Locknut
2. Adjustment screw
3. Piston
4. Spring

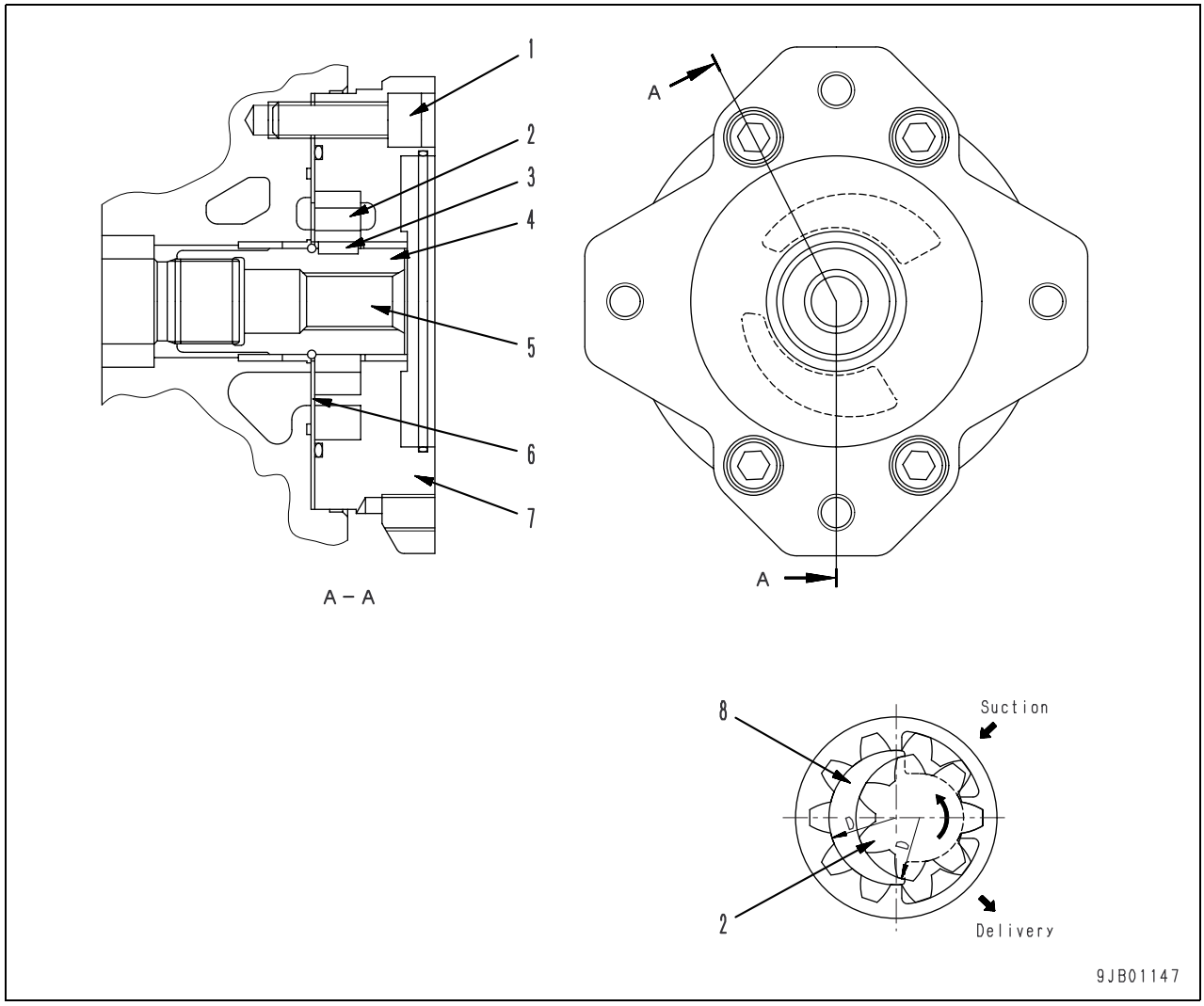
**Function**

- The low-pressure relief valve is installed to the HST pump. If the oil pressure in the low-pressure circuit between the HST pump and HST motor rises higher than the set pressure, the low-pressure relief valve drains the oil into the hydraulic tank.
  The low-pressure relief valve controls the pressure in the HST pump charge circuit to protect the circuit with this function.

**Operation**

- Port **A** is connected to the HST pump charge circuit and port **B** is connected to the drain circuit. If the oil pressure is below the set pressure, the oil does not flow into port **B**.
- If the pressure in port **A** reaches the set pressure for some reason, piston (3) opens and the oil in port **A** flows into port **B**, and the oil pressure in port **A** lowers consequently.
- The set pressure can be adjusted by increasing or decreasing the tension of spring (4).
  To adjust the set pressure, loosen locknut (1) and turn adjustment screw (2). If the adjustment screw is tightened, the set pressure is heightened. If the former is loosened, the latter is lowered.

# HST CHARGE PUMP




1. Cover bolt
2. Pump gear
3. Key
4. Coupling
5. Drive shaft
6. Plate
7. Charge pump cover
8. Crescent divider board

**Outline**

- The HST charge pump is built in the HST pump and driven together with the HST pump to supply oil to the HST speed-related valve and low-pressure relief valve of the HST pump.
- The HST charge pump sucks in oil from the hydraulic tank.

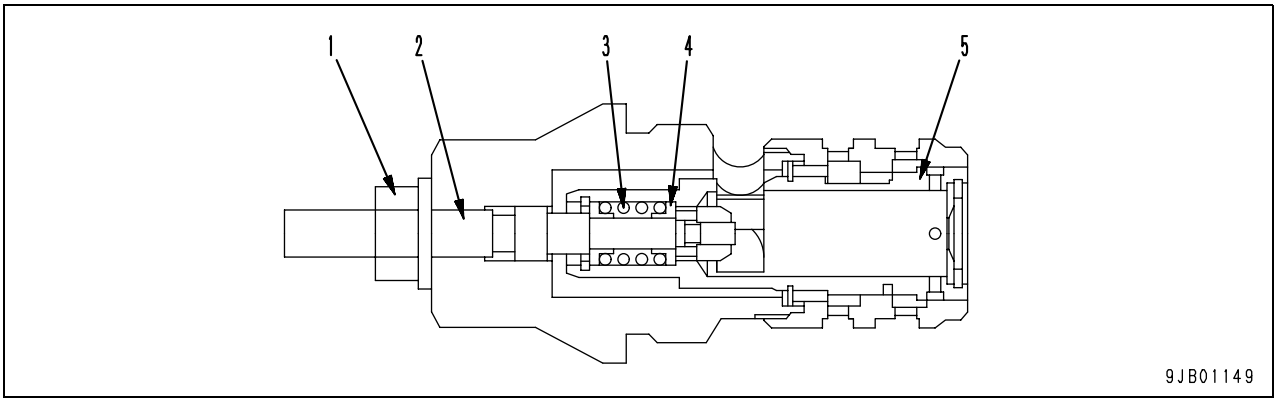
**Specifications**

| | |
|---|---|
| Type | Gear pump (Inscribed type) |
| Theoretical capacity (cc/rev) | 19.6 |

**Function**

- The HST charge pump is connected to drive shaft (5) of the HST pump and rotated by coupling (4).
- The HST charge pump has pump gear (2) and crescent divider board (8) in it and sucks and discharges the oil in the direction shown in the above figure.

# SPEED-RELATED VALVE (DA VALVE)



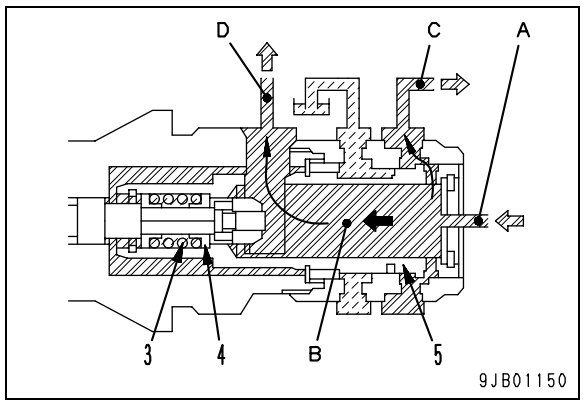

1. Locknut
2. Adjustment screw
3. Poppet spring
4. Spring seat
5. Pilot poppet

**Function**

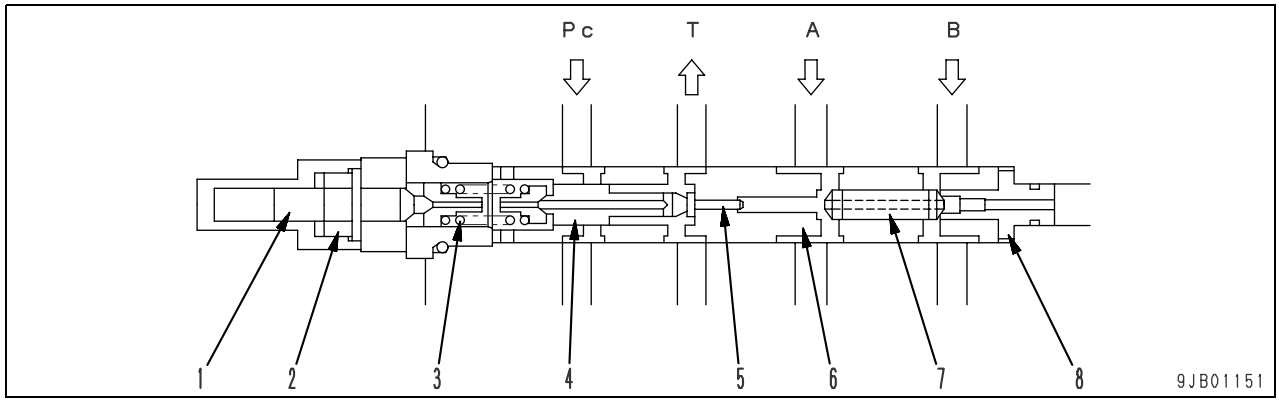
- The speed-related valve is installed to the HST pump and used to divide the oil from the HST charge pump into two parts. One part flows through a throttle valve to the forward-reverse shifting solenoid valve of the HST pump and the other part flows to the low-pressure relief valve of the HST pump.

**Operation**

- Port **A** is connected to the HST pump charge circuit. Port **D** is connected to the low-pressure relief valve circuit. Port **C** is connected to the forward-reverse shifting solenoid valve circuit.
- The oil from the HST charge pump always flow through the throttle valve of pilot poppet (5), chamber **B**, and port **D** to the low-pressure relief valve.
  As the hydraulic pressure from the HST charge pump is applied a differential pressure is generated between port **A** and chamber **B** because of the throttle valve of pilot poppet (5). Since this differential pressure moves pilot poppet (5), the oil flows from chamber **B** through port **C** to the forward-reverse shifting solenoid valve.
- Pilot poppet (5), poppet spring (3), and spring seat (4) are used as a set. To change the set pressure, loosen locknut (1) and turn the adjustment screw (2). If the adjustment screw is tightened, the set pressure is lowered. If the former is loosened, the latter is heightened.



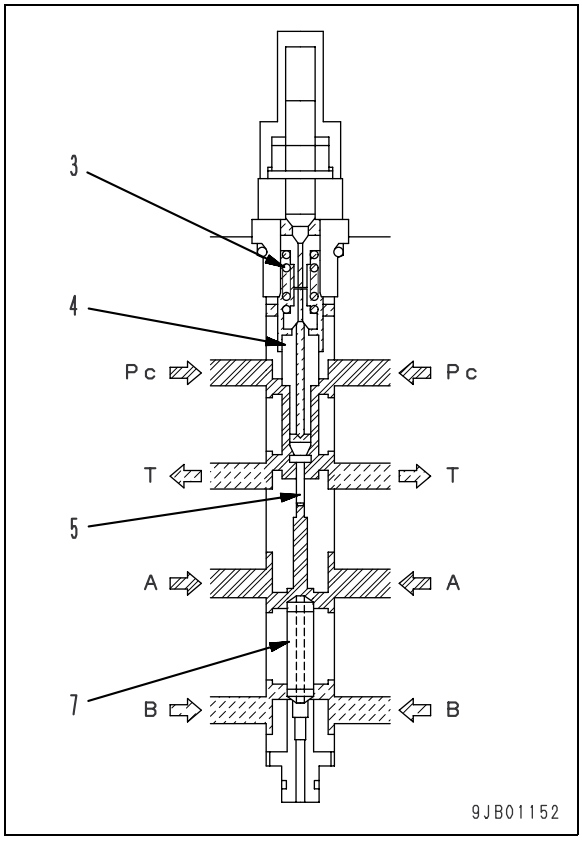
# HIGH-PRESSURE CUT-OFF VALVE




1. Adjustment screw
2. Locknut
3. Spring
4. Spool
5. Piston
6. Barrel
7. Shuttle spool
8. Valve seat

**Function**

- The high-pressure cut-off valve is installed to the HST pump. If the oil pressure in the high-pressure circuit between the HST pump and HST motor rises higher than the set pressure, the high-pressure cut-off valve drains the oil from the servo cylinder circuit into the hydraulic tank to control the maximum pressure in the HST pump circuit.



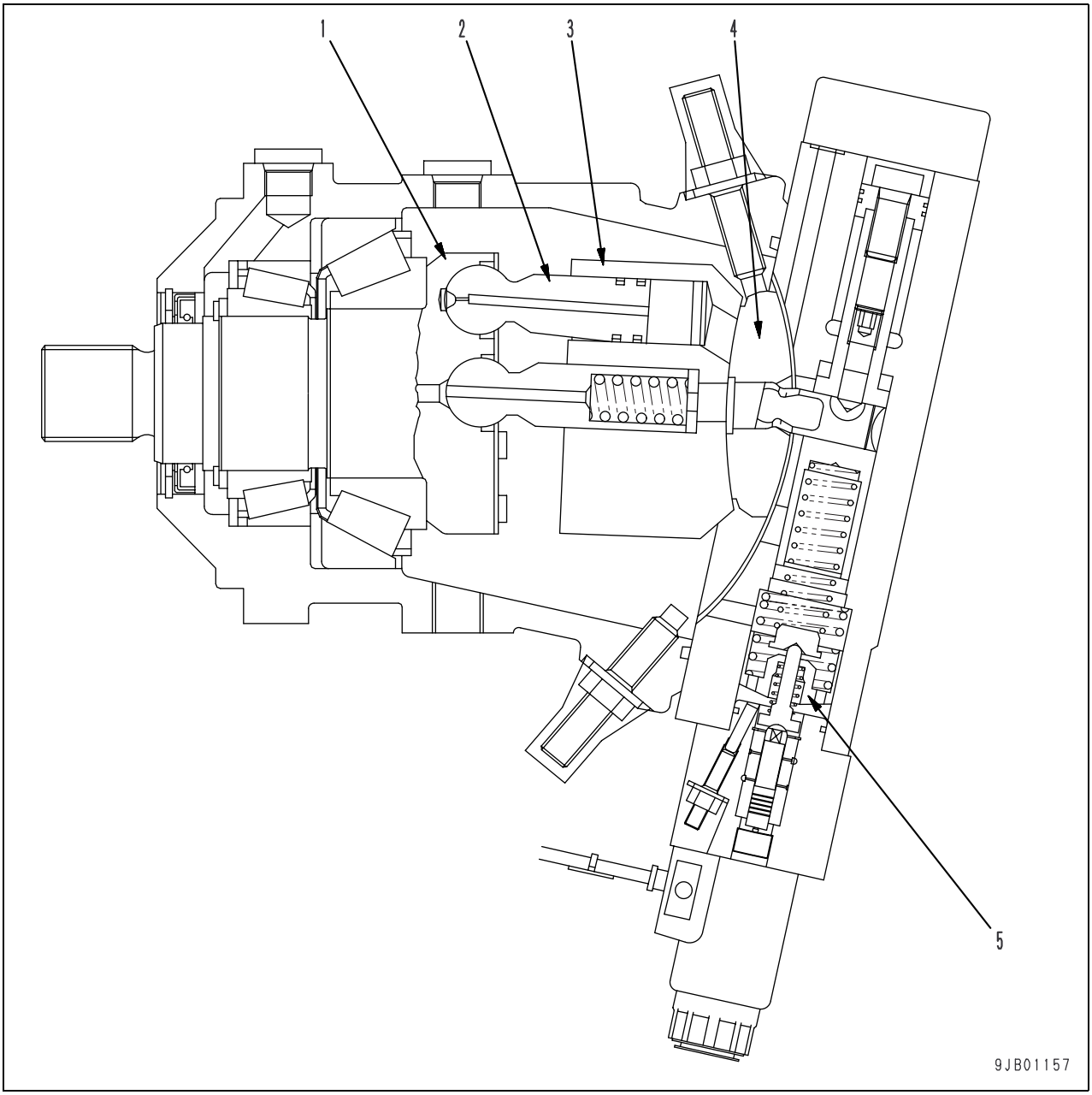

**Operation**

- Port **A** is connected to the high-pressure circuit during reverse travel. Port **B** is connected to the high-pressure circuit during forward travel. Port **Pc** is connected to the speed-related valve, and port **T** is connected to the drain circuit.
- If the pressure on the port **A** side rises high for some reason, shuttle spool (7) is pushed down and the circuit on port **B** side is closed. At the same time, piston (5) is pushed up by the hydraulic pressure on port **A** side and spring (3) is compressed and spool (4) is also pushed up. Then, ports **Pc** and **T** are opened and the hydraulic oil in the speed-related valve circuit flows into the drain port.
  As a result, the oil pressure in port **Pc** lowers and the swash plate angle of the HST pump reduces, and consequently the discharge reduces and the abnormal pressure in the HST pump circuit lowers.

# HST MOTOR

★ HST: Abbreviation for Hydro Static Transmission

**HST motor 1**

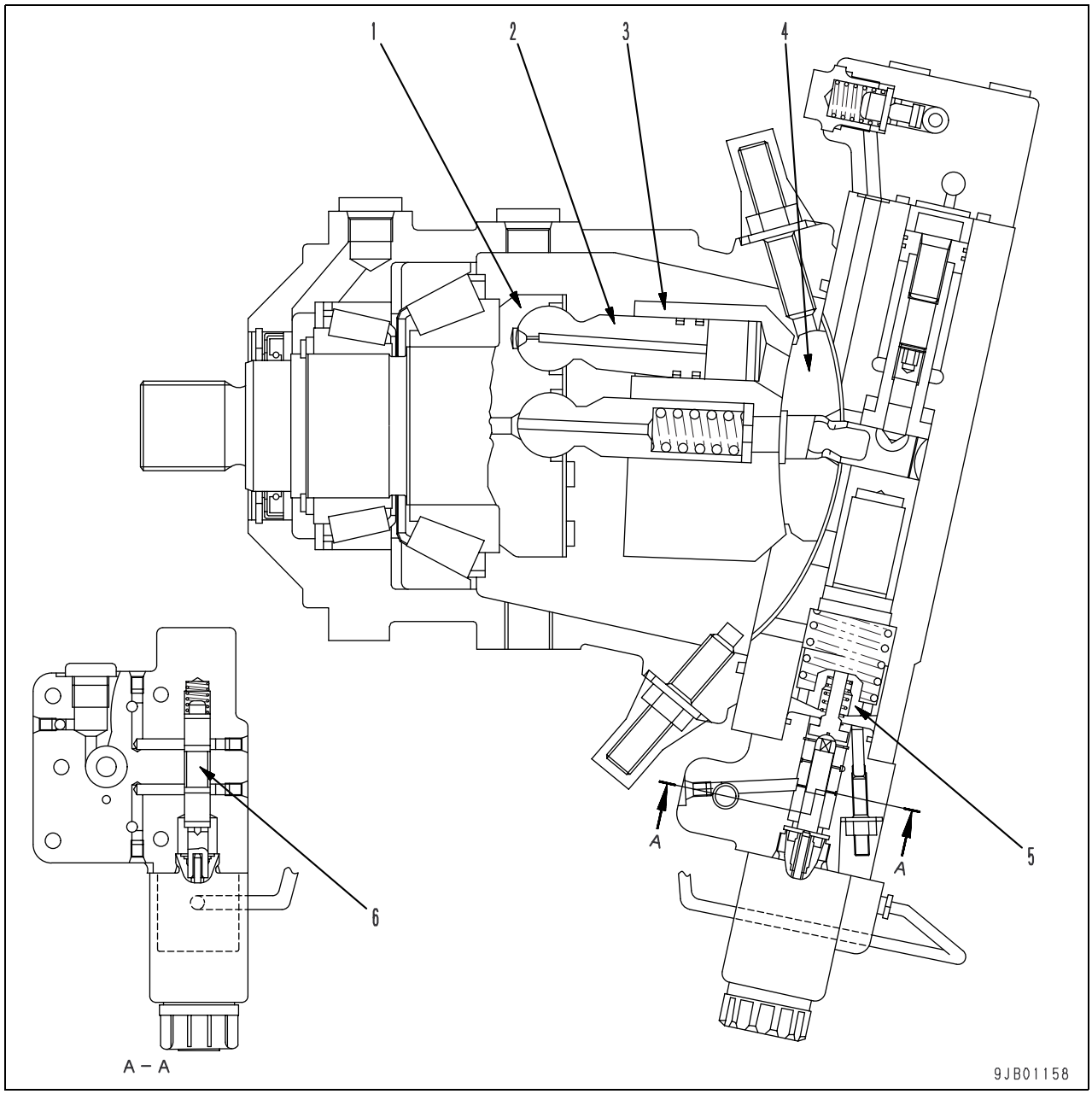



1. Drive shaft
2. Piston
3. Cylinder block
4. Port plate
5. EP servo valve

**Specifications**

| Model | A6VM107EP |
|---|---|
| Type | Variable displacement swash plate-type piston motor |
| Theoretical capacity (cc/rev) | 0 – 107 |
| Set pressure of high-pressure relief valve (MPa {kg/cm$^2$}) | 44.1 {450} |
| Set pressure of high-pressure cut-off valve (MPa {kg/cm$^2$}) | Effective differential pressure 41.2 {420} |
| Set pressure of low-pressure relief valve (MPa {kg/cm$^2$}) | 2.45 {25} |

**HST motor 2**



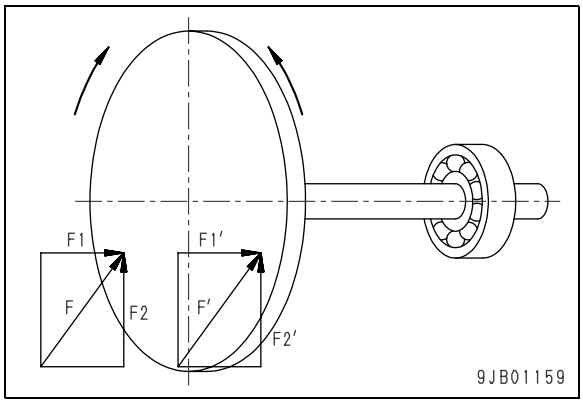

1. Drive shaft
2. Piston
3. Cylinder block
4. Port plate
5. HA servo valve
6. Forward-reverse shuttle valve

**Specifications**

| Model | A6VM107EP |
|---|---|
| Type | Variable displacement swash plate-type piston motor |
| Theoretical capacity (cc/rev) | 48 – 107 |
| Set pressure of high-pressure relief valve (MPa {kg/cm$^2$}) | 44.1 {450} |
| Set pressure of high-pressure cut-off valve (MPa {kg/cm$^2$}) | Effective differential pressure 41.2 {420} |
| Set pressure of low-pressure relief valve (MPa {kg/cm$^2$}) | 2.45 {25} |

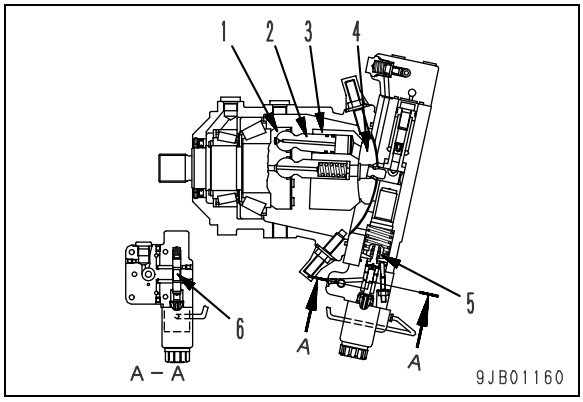
**Principle**

- Let's assume that a shaft of a disc is supported and the disc can rotate freely. If force F is applied bias to this disc, it is divided into component force F1 at right angles to the disc and component force F2 in the peripheral direction of the disc. Component force F2 rotates the disc to the right.
- If force F', not force F, is applied to the disc, it is divided into component forces F1' and F2' similarly to the above and force F2' rotates the disc to the left



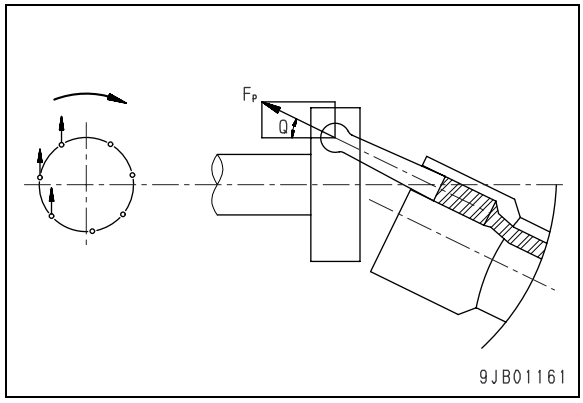

**Structure**

- There are 7 pistons (2) installed to the disc portion of the drive shaft (1) as if they are spherical joints. They are set in cylinder block (3) at a certain angle to drive shaft (1).
- As the external load on the HST motor is increased by servo valve (5) and forward-reverse shuttle valve (6), inclination of pistons (2) is increased. As a result, the revolving speed is lowered but the torque is increased.

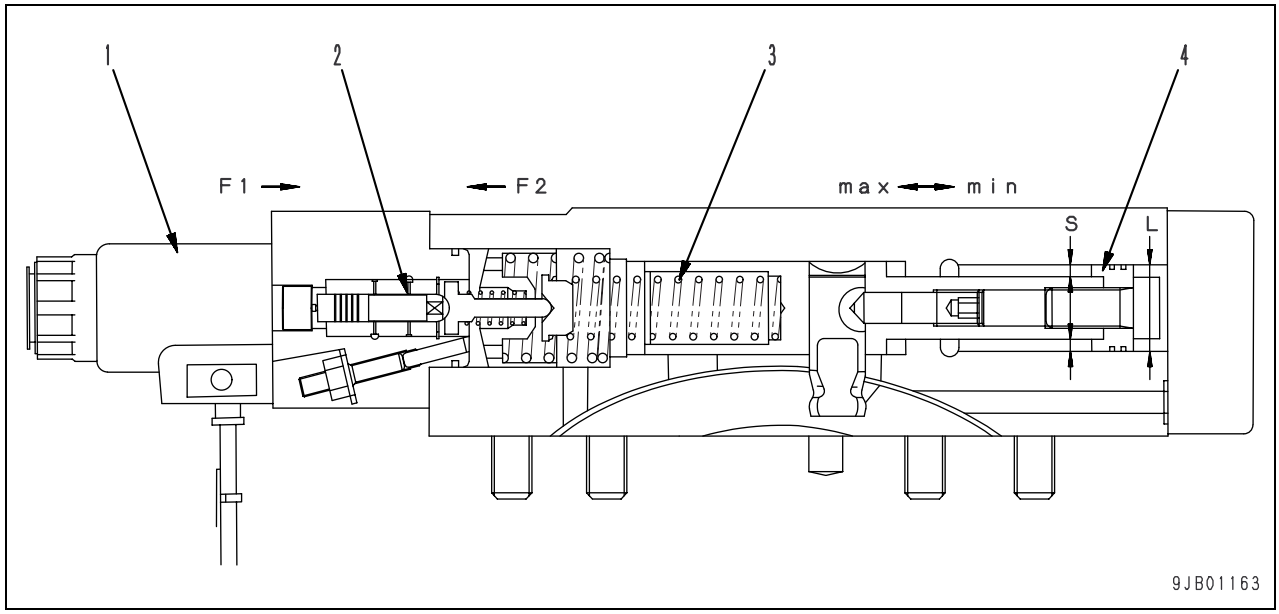



**Operation**

- The hydraulic oil sent from the HST pump flows in the inlet port of the HST motor and gives hydraulic pressure to the back side of pistons (2). Accordingly, drive shaft (1) rotates because of inclination of pistons (2) and cylinder block (3).
- The oil from the HST pump flows between the forward-reverse shifting solenoid valve and servo cylinder into forward-reverse shuttle valve (6) of the HST motor. The oil from the forward or reverse high-pressure discharge side of the HST motor flows into forward-reverse shuttle valve (6). If a load is applied to the motor connected to servo valve (5) in the HST motor, the oil flows into the servo cylinder of the HST motor because of the pressure difference from forward-reverse shuttle valve (6) side, thus cylinder block (3) is inclined more.



# EP SERVO VALVE




1. Motor 1 solenoid valve
2. EP servo valve
3. Spring
4. Servo cylinder

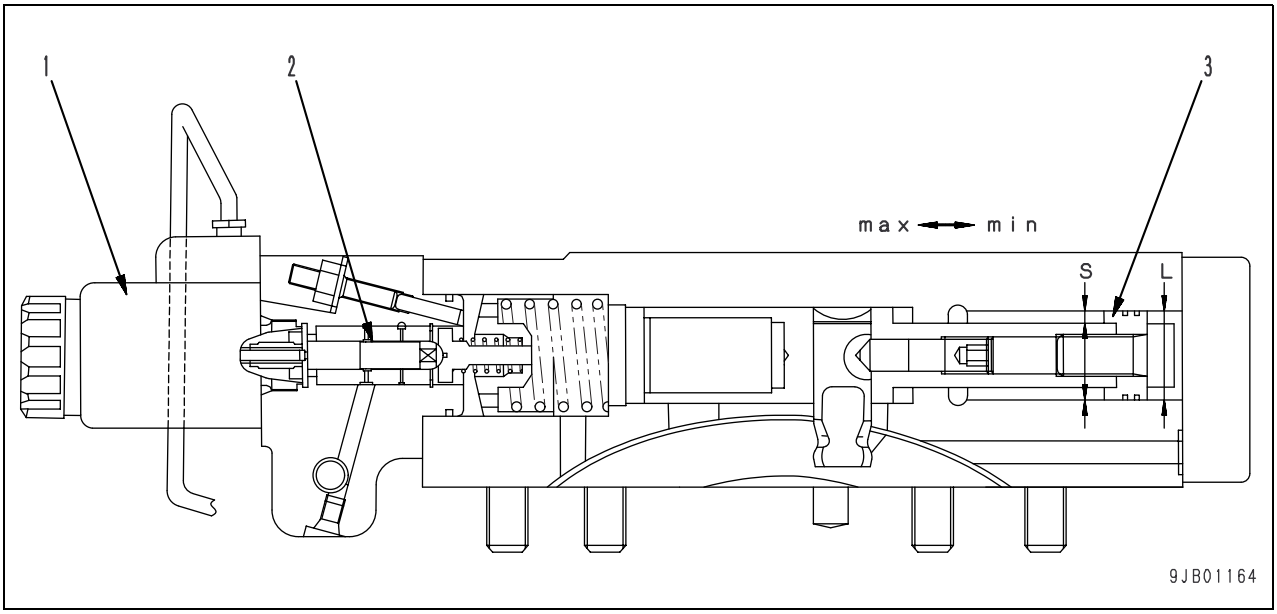
**Function**

- The EP servo valve is installed to the rear part of HST motor 1 and used to change the displacement of the motor according to the current given to motor 1 solenoid valve (1).

**Operation**

- Suction force F1 of motor 1 solenoid valve (1) and force F2 of spring (3) are applied to EP servo valve (2).
- If the current given to motor 1 solenoid valve (1) is little (F1 < F2), EP servo valve (2) leads the hydraulic pressure of the motor high-pressure circuit to the small diameter (S) side of servo cylinder (4) and releases the hydraulic pressure on the large diameter (L) side into the tank (motor housing). As a result, servo cylinder (4) moves toward the min side.
- If the current given to motor 1 solenoid valve (1) is large (F1 > F2), EP servo valve (2) leads the hydraulic pressure to the large diameter (L) side. As a result, servo cylinder (4) moves toward the max side because of the area difference between the small diameter (S) side and large diameter (L) side.
- The force of spring (3) changes according to the position of servo cylinder (4) (the displacement of the motor).
  Accordingly, the displacement of the motor is controlled by the current given to motor 1 solenoid valve (1) so that suction force F1 will be balanced with spring force F2.

# HA SERVO VALVE




1. Motor 2 solenoid valve
2. HA servo valve
3. Servo cylinder

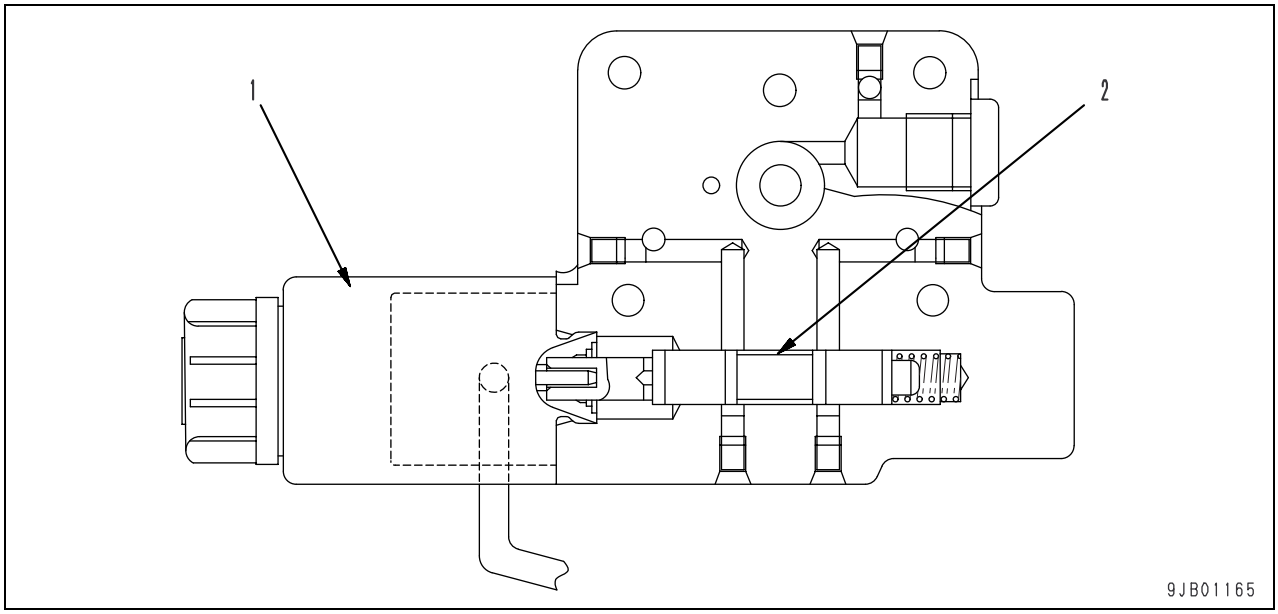
**Function**

- The HA servo valve is installed to the rear part of HST motor 2 and used to control the position of servo cylinder (3) (the displacement of the motor) to meet the motor output to the external load on the motor. The displacement is controlled with the hydraulic pressure in the circuit selected by the forward-reverse shuttle valve.

**Operation**

- When the load on the machine is small, HA servo valve (2) leads the hydraulic pressure on the side selected by the forward-reverse shuttle valve to the small diameter (S) side of servo cylinder (3) and releases the hydraulic pressure on the large diameter (L) side into the tank (motor housing) to minimize the displacement of the motor.
- When a large load is applied to the machine on a uphill, etc., HA servo valve (2) leads the hydraulic pressure to the large diameter (L) side. As a result, servo cylinder (3) moves toward the max side because of the area difference between the small diameter (S) side and large diameter (L) side. At this time, the displacement of the motor becomes largest and the motor generates large torque.
- If motor 2 solenoid valve (1) is energized, HA servo valve (2) leads the hydraulic pressure to the large diameter (L) side and the displacement of the motor becomes largest, regardless of the load on the machine.

# FORWARD-REVERSE SHUTTLE VALVE




1. Forward-reverse shifting solenoid valve
2. Forward-reverse shuttle valve

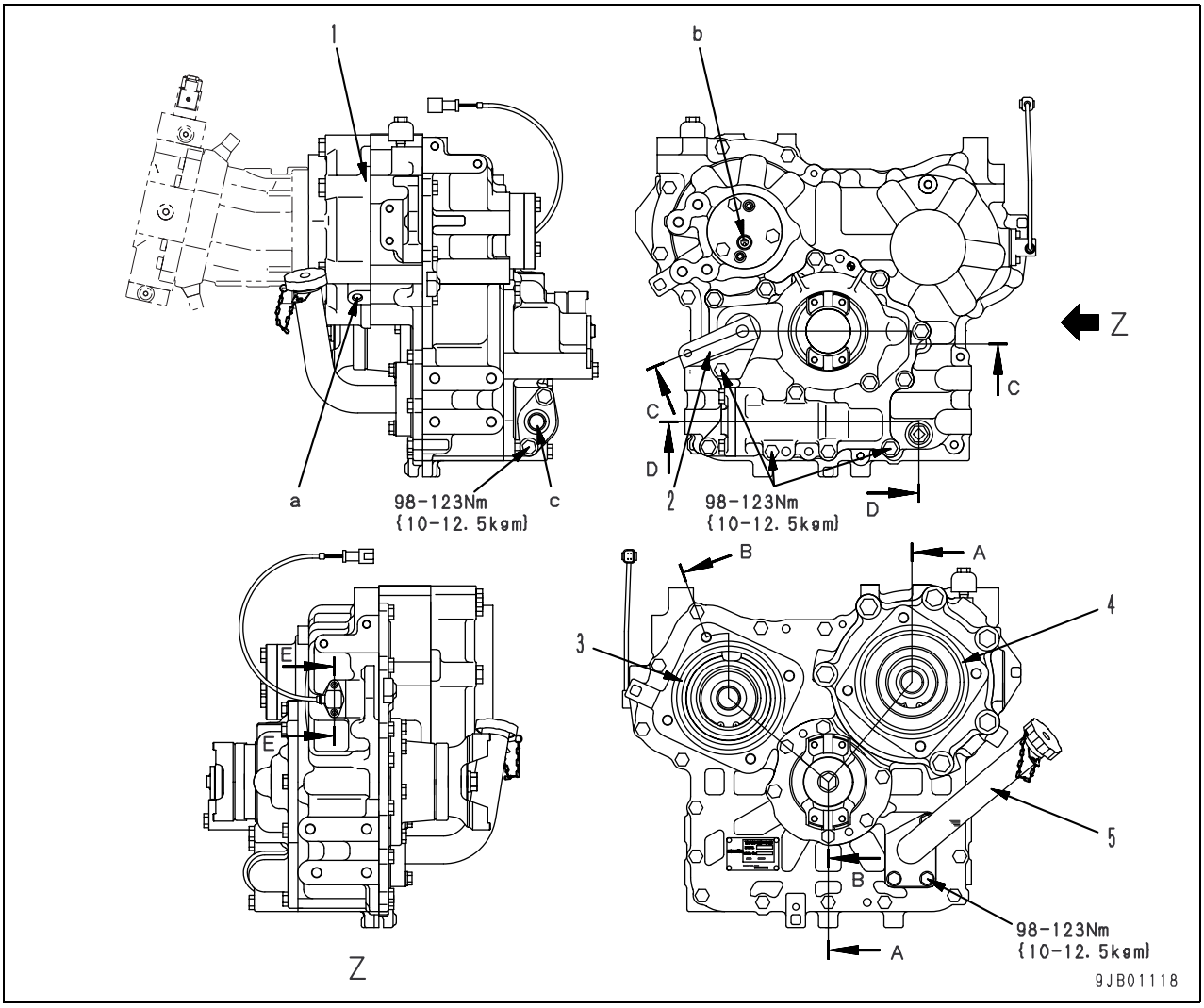
**Function**

- The forward-reverse shuttle valve is installed to the rear part of HST motor 2 and used to grasp and change the position of the forward-reverse shifting solenoid valve to control where to lead the hydraulic pressure for the HA servo valve.

**Operation**

- The electric signals given to the forward-reverse shifting solenoid valve of the HST pump are used for forward-reverse shifting solenoid valve (1) and linked to the forward-reverse shifting mechanism.
- Forward-reverse shuttle valve (2) changes the hydraulic pressure applied to the HA servo valve according to the forward-reverse shifting command.

# TRANSFER




a. Clutch port
b. Lubricating oil inlet port
c. Lubricating oil suction port

1. Transfer
2. Parking brake lever
3. HST motor 2 mount
4. HST motor 1 mount
5. Oil filler pipe

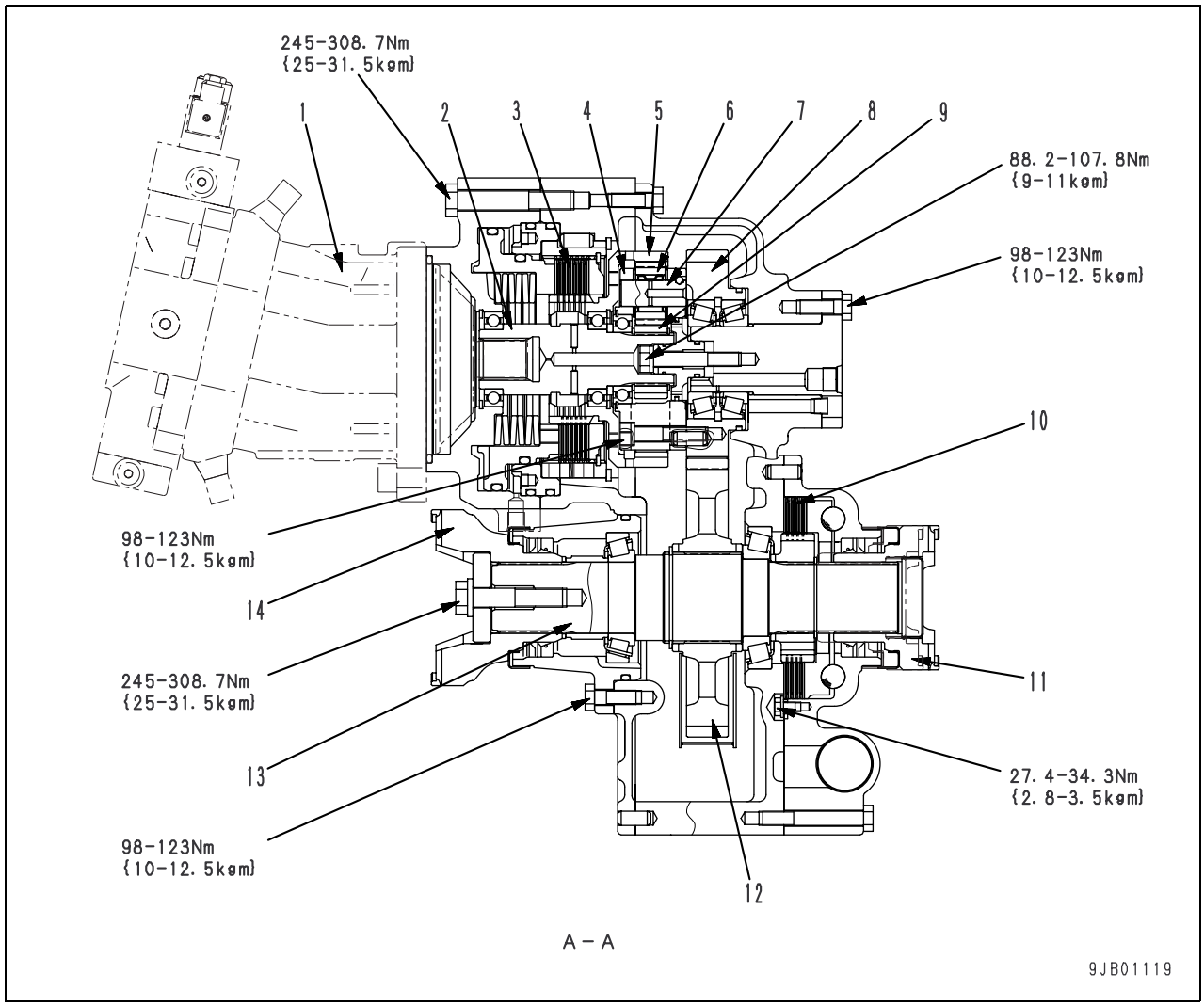
**Outline**

- The transfer is equipped with 2 HST motors. The engine speed is changed to the forward 1st – 4th and rear 1st – 4th gear speeds by combining the output and revolving direction of the HST motor and the transfer clutch.

**Relationship between transfer clutch and transfer clutch pressure at each gear speed**

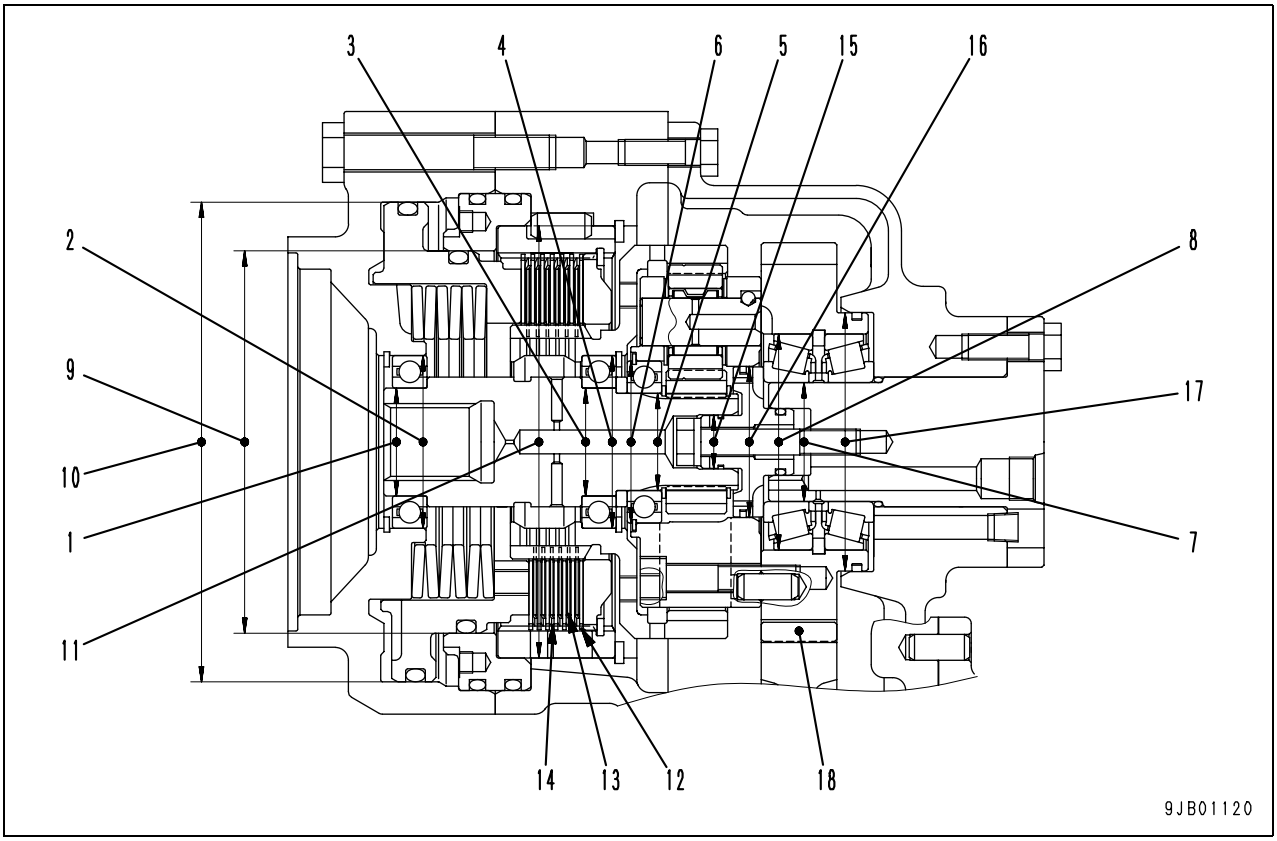
| Gear speed | Transfer clutch | | Transfer clutch pressure | |
|---|---|---|---|---|
| 1st | Engaged | | OFF | |
| 2nd | Engaged | | OFF | |
| 3rd | Travel speed 0 – 10km/h | Travel speed 10 – 18km/h | Travel speed 0 – 10km/h | Travel speed 10 – 18km/h |
| | Engaged | Disengaged | OFF | ON |
| 4th | Travel speed 0 – 10km/h | Travel speed 10 – 18km/h | Travel speed 0 – 10km/h | Travel speed 10 – 18km/h |
| | Engaged | Disengaged | OFF | ON |

Note: The travel speed when tires of 20.5 – 25 size are used is shown in the table.




1. HST motor 1
2. Input shaft
3. Transfer clutch
4. Carrier
5. Ring gear (Number of teeth: 80)
6. Planetary gear (Number of teeth: 24)
7. Planetary shaft
8. Motor 1 gear (Number of teeth: 44)
9. Sun gear (Number of teeth: 28)
10. Parking brake
11. Rear coupling
12. Output gear (Number of teeth: 57)
13. Output shaft
14. Front coupling

**Input shaft portion**

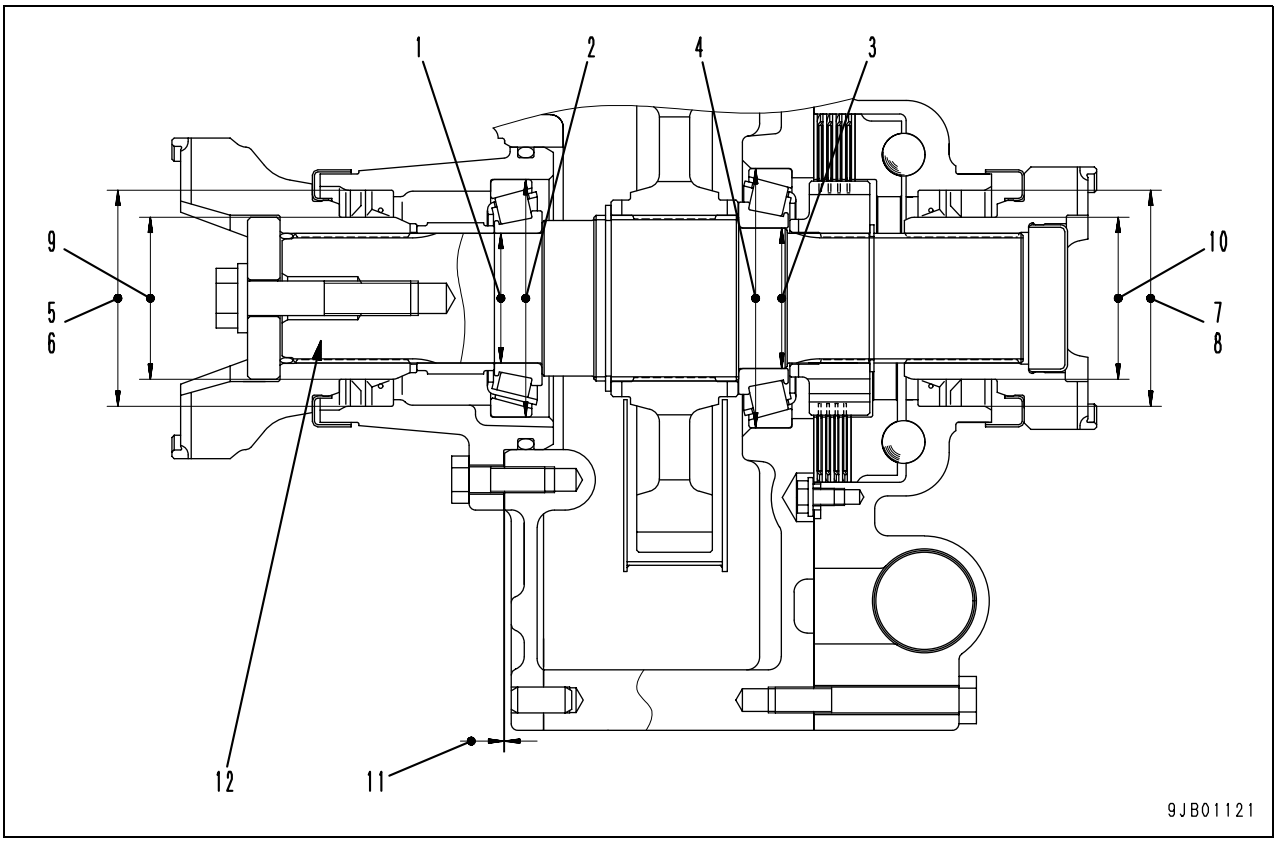



Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | Tolerance | | Standard clearance | Clearance limit | |
| | | | Shaft | Hole | | | |
| 1 | Clearance between input shaft and bearing (F) | ø50 | +0.011<br>-0.005 | 0<br>-0.012 | -0.023 – 0.005 | – | Replace |
| 2 | Clearance between input shaft bearing and cage (F) | ø80 | 0<br>-0.013 | +0.013<br>-0.006 | -0.006 – 0.026 | – | |
| 3 | Clearance between input shaft and bearing (M) | ø50 | +0.011<br>-0.005 | 0<br>-0.012 | -0.023 – 0.005 | – | |
| 4 | Clearance between input shaft bearing and ring gear (M) | ø80 | 0<br>-0.013 | +0.013<br>-0.006 | -0.006 – 0.026 | – | |
| 5 | Clearance between input shaft and bearing (R) | ø45 | +0.011<br>-0.005 | 0<br>-0.012 | -0.023 – 0.005 | – | |
| 6 | Clearance between input shaft bearing and carrier (R) | ø75 | 0<br>-0.013 | +0.013<br>-0.006 | -0.006 – 0.026 | – | |

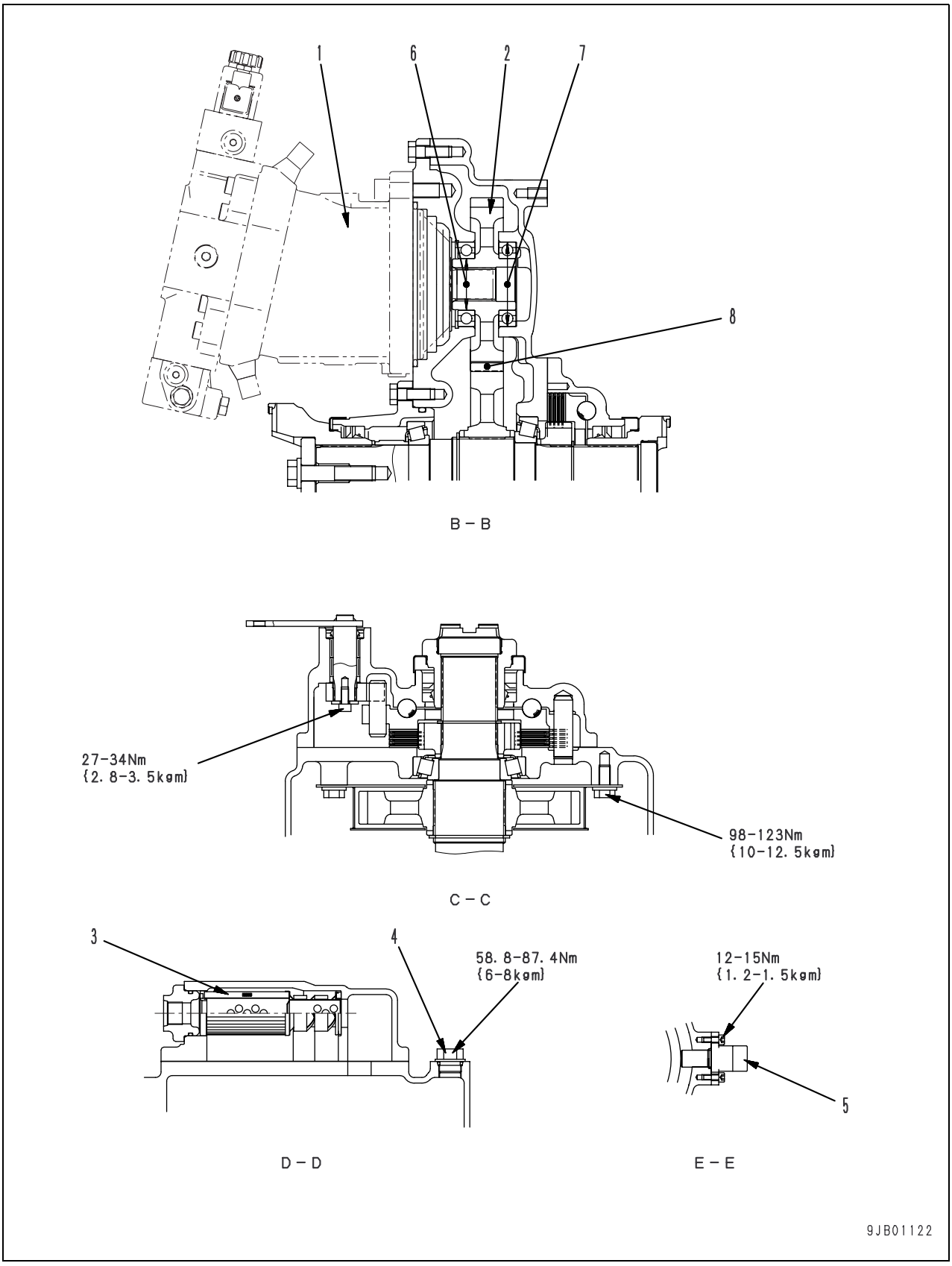
| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 7 | Clearance between press-fit shaft and bearing | ø55 | +0.039<br>+0.020 | 0<br>-0.015 | -0.054 –<br>-0.020 | – | Replace |
| 8 | Clearance between press-fit shaft bearing and motor 1 gear | ø100 | 0<br>-0.018 | -0.016<br>-0.038 | -0.038 –<br>0.002 | – | |
| 9 | Clearance between piston and spacer | ø177 | -0.085<br>-0.125 | +0.040<br>0 | 0.085 –<br>0.165 | – | |
| 10 | Clearance between piston and cage | ø222 | -0.550<br>-0.650 | +0.046<br>0 | 0.550 –<br>0.696 | – | |
| 11 | Clearance between clutch housing and front case | ø200 | +0.061<br>+0.015 | +0.046<br>0 | -0.061 –<br>0.031 | – | |
| 12 | Thickness of separator plate | Standard size | | Tolerance | | Repair limit | |
| | | 1.7 | | ±0.05 | | 1.6 | |
| | Distortion of separator plate | – | | 0.05 | | 0.15 | |
| 13 | Thickness of friction plate | 2.2 | | ±0.08 | | 1.8 | |
| | Distortion of friction plate | – | | 0.02 | | 0.25 | |
| 14 | Load on wave spring (Height: 2.2 mm) | 1,010 N<br>{103 kg} | | ±101 N<br>{±10.3 kg} | | 804 N<br>{82 kg} | |
| 15 | Inside diameter of contact face of seal ring | ø25 | | +0.021<br>0 | | ø25.1 | |
| | Width of groove of seal ring | 2.5 | | +0.15<br>+0.10 | | 2.7 | |
| | Width of seal ring | 2.5 | | -0.01<br>-0.03 | | 2.3 | |
| | Thickness of seal ring | 1.2 | | ±0.1 | | 1.05 | |
| 16 | Inside diameter of contact face of seal ring | ø70 | | +0.030<br>0 | | ø70.1 | |
| | Width of groove of seal ring | 3 | | +0.15<br>+0.10 | | 3.3 | |
| | Width of seal ring | 3 | | -0.01<br>-0.03 | | 2.7 | |
| | Thickness of seal ring | 2.9 | | ±0.1 | | 2.75 | |
| 17 | Inside diameter of contact face of seal ring | ø120 | | +0.022<br>0 | | ø120.5 | |
| | Width of groove of seal ring | 4.5 | | +0.1<br>0 | | 5.0 | |
| | Width of seal ring | 4.36 | | 0<br>-0.1 | | 3.9 | |
| | Thickness of seal ring | 3 | | ±0.1 | | 2.7 | |
| 18 | Backlash between motor 1 gear and output gear | 0.170 – 0.453 | | | | | |
| — | Side clearance of planetary gear (on both sides) | 0.35 – 0.80 | | | | | |

**Output shaft portion**



Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 1 | Clearance between output shaft and bearing (F) | Standard size | Tolerance | | Standard clearance | Clearance limit | Replace |
| | | | Shaft | Hole | | | |
| | | ø 60 | +0.030<br>+0.011 | 0<br>-0.015 | -0.045 –<br>-0.011 | – | |
| 2 | Clearance between output shaft bearing and cage (F) | ø 110 | 0<br>-0.018 | -0.015<br>-0.040 | -0.040 –<br>0.003 | – | |
| 3 | Clearance between output shaft and bearing (R) | ø 65 | +0.030<br>+0.011 | 0<br>-0.015 | -0.045 –<br>-0.011 | – | |
| 4 | Clearance between output shaft bearing and rear case (R) | ø 120 | 0<br>-0.018 | -0.015<br>-0.040 | -0.040 –<br>0.003 | – | |
| 5 | Clearance between oil seal and cage (F) | ø 100 | +0.170<br>+0.080 | +0.054<br>0 | -0.170 –<br>-0.026 | – | |
| 6 | Clearance between dust seal and cage (F) | ø 100 | +0.400<br>+0.200 | +0.054<br>0 | -0.400 –<br>-0.146 | – | |
| 7 | Clearance between oil seal and cage (R) | ø 100 | +0.170<br>+0.080 | +0.054<br>0 | -0.170 –<br>-0.026 | – | |
| 8 | Clearance between dust seal and cage (R) | ø 100 | +0.400<br>+0.200 | +0.054<br>0 | -0.400 –<br>-0.146 | – | |
| 9 | Inside diameter of sliding surface of coupling oil seal (F) | Standard size | | Tolerance | | Repair limit | |
| | | ø 75 | | 0<br>-0.074 | | 74.8 | |
| 10 | Inside diameter of sliding surface of coupling oil seal (R) | ø 75 | | 0<br>-0.074 | | 74.8 | |
| 11 | Clearance between cage and front case | Standard size | | Standard clearance | | Clearance limit | Adjust shim |
| | | 0.7 | | 0.1 – 1.3 | | – | |
| 12 | Free rotation torque of output shaft | 3.9 – 5.9 Nm {0.4 – 0.6 kgm} | | | | | |


1
6
2
7
8
B – B
27–34Nm
{2. 8–3. 5kgm}
98–123Nm
{10–12. 5kgm}
C – C
3
4
58. 8–87. 4Nm
{6–8kgm}
D – D
12–15Nm
{1. 2–1. 5kgm}
5
E – E
9JB01122

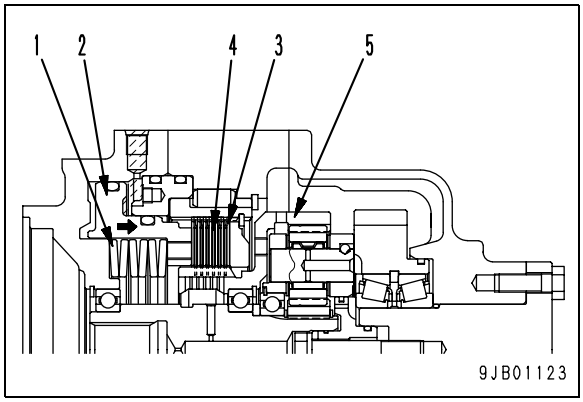
1. HST motor 2
2. Motor 2 gear (Number of teeth: 44)
3. Strainer
4. Drain plug
5. Speed sensor

Unit: mm

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Check item</th><th colspan="5">Criteria</th><th rowspan="2">Remedy</th></tr>
<tr><th rowspan="2">Standard size</th><th colspan="2">Tolerance</th><th rowspan="2">Standard clearance</th><th rowspan="2">Clearance limit</th></tr>
<tr><th>Shaft</th><th>Hole</th></tr>
<tr><td rowspan="2">6</td><td rowspan="2">Clearance between input shaft and bearing (F)</td><td>ø 55</td><td>+0.030<br>+0.011</td><td>0<br>-0.015</td><td>-0.045 –<br>-0.011</td><td>–</td><td rowspan="3">Replace</td></tr>
<tr><td>7</td><td>Clearance between input shaft bearing and cage (F)</td><td>ø 90</td><td>0<br>-0.015</td><td>+0.022<br>-0.013</td><td>-0.013 –<br>0.037</td><td>–</td></tr>
<tr><td>8</td><td>Backlash between motor 2 gear and output gear</td><td colspan="5">0.170 – 0.453</td></tr>
</table>

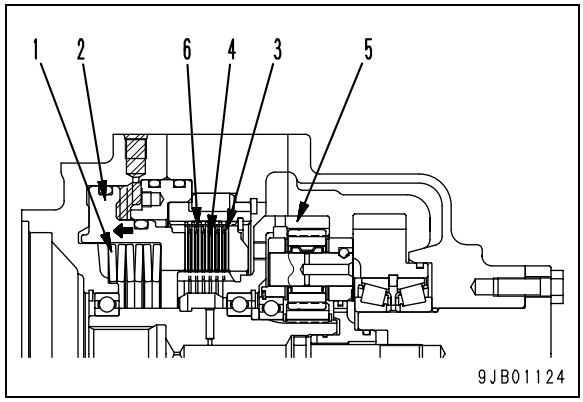
**Operation of clutch**

**When clutch is ON (fixed)**



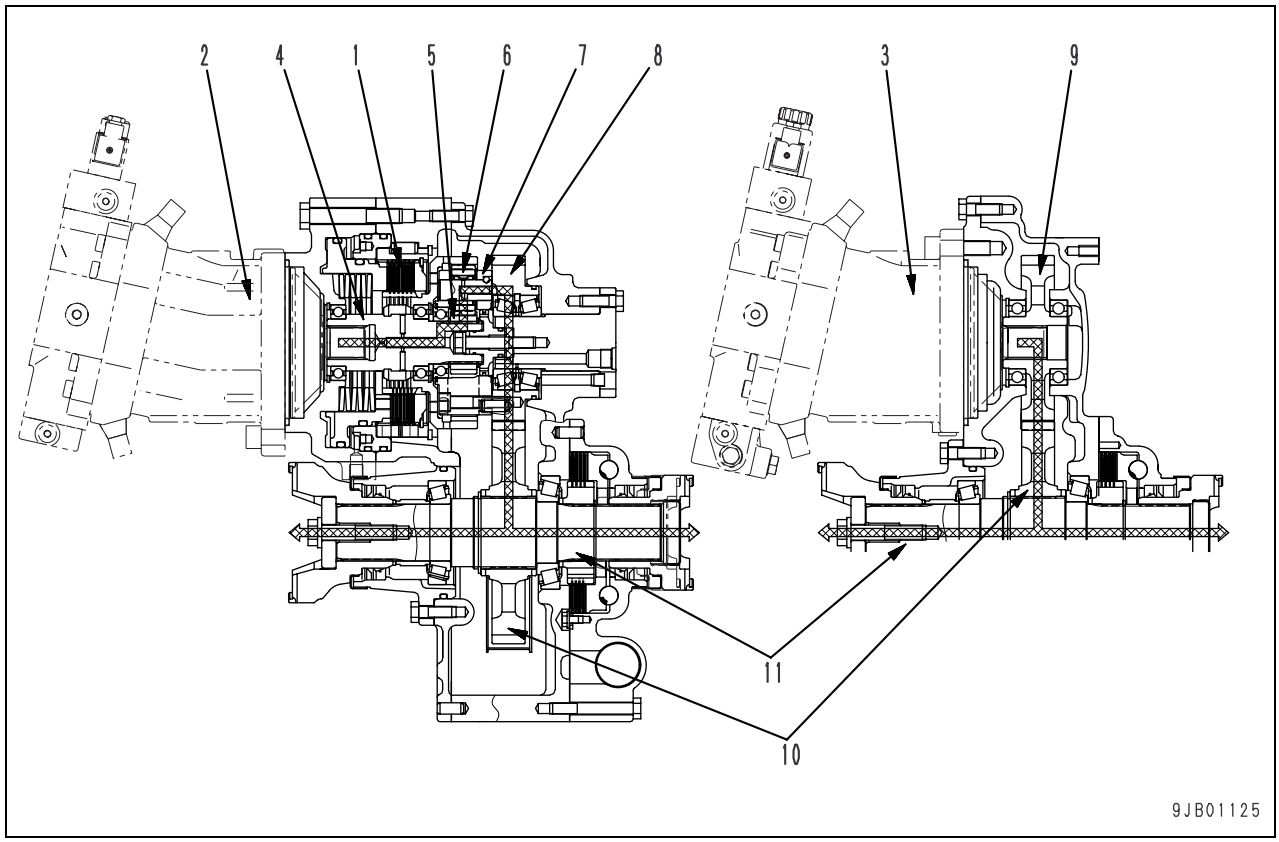

- If the oil from the clutch solenoid valve is shut off, piston (2) is moved to the right by the tension of spring (1).
  Plates (3) and discs (4) are fixed to each other and rotation of discs (4) is stopped by their friction force and ring gear (5) meshed with the internal teeth is fixed.

**When clutch is OFF (released)**




- The oil sent from the clutch solenoid valve is sent by pressure to the back side of piston (2) and it pushes back spring (1) and piston (2) moves to the left. The friction force of plates (3) and discs (4) is lost and ring gear (5) is set in neutral.
- Wave springs (6) installed between plates (3) return piston (2) quickly and separate plates (3) and discs (4) to prevent increase of slip loss when the clutch is disengaged.

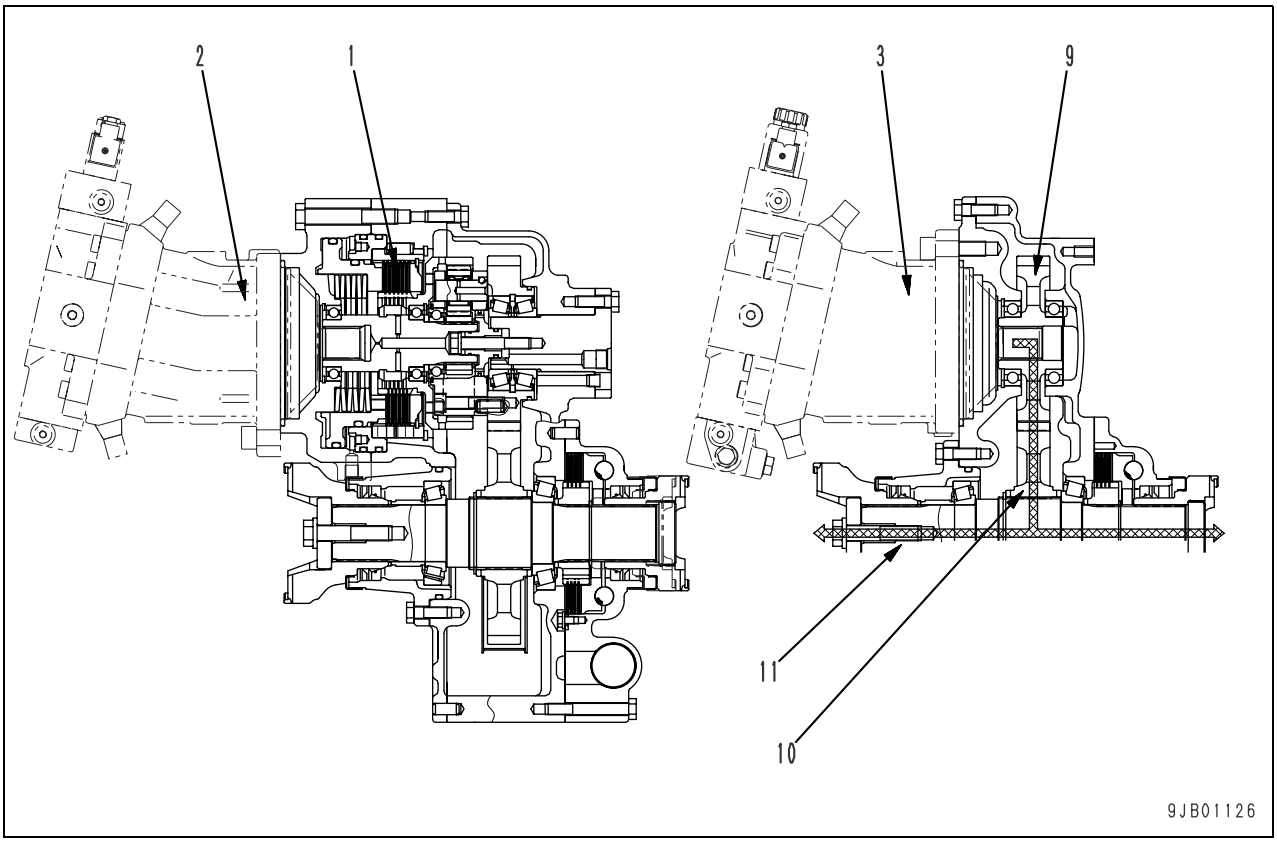
**Low-speed mode**




**Operation**

- In the low-speed mode, transfer clutch (1) is fixed and the power of both HST motor 1 (2) and HST motor 2 (3) is transmitted to output shaft (11).
- The power of HST motor 1 (2) is transmitted through input shaft (4), sun gear (5), planetary gear (6), carrier (7), motor 1 gear (8), and output gear (10) to output shaft (11).
- The power of HST motor 2 (3) is transmitted through motor 2 gear (9) and output gear (10) to output shaft (11).

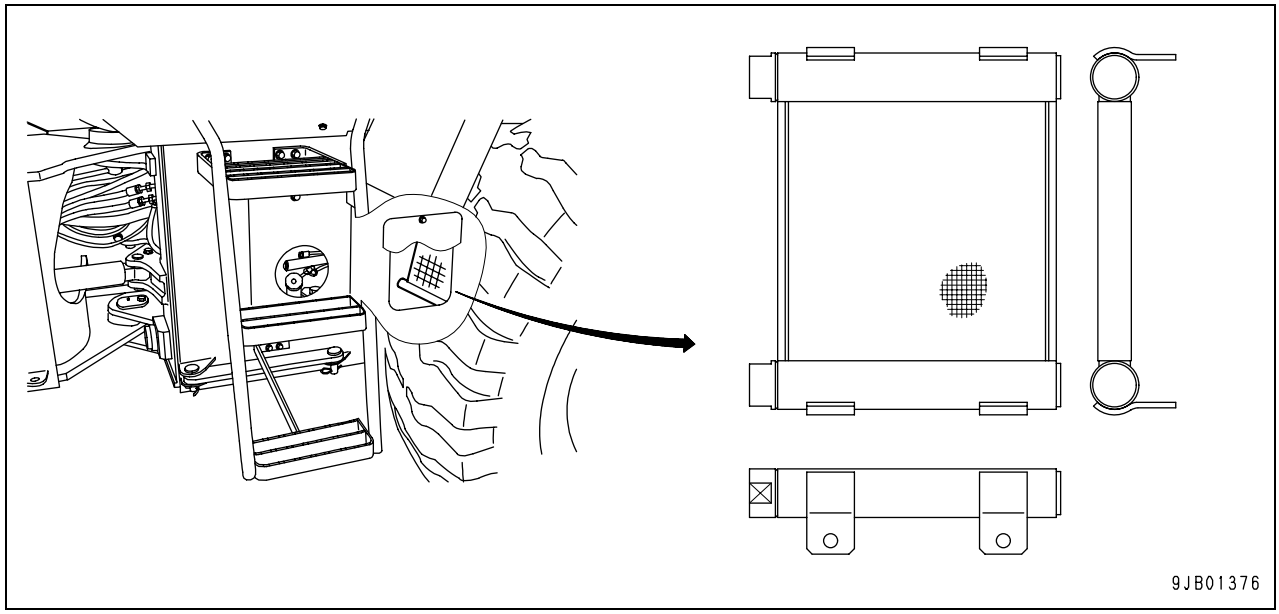
**High-speed mode**




**Operation**

- In the high-speed mode, transfer clutch (1) is released and HST motor 1 (2) stops. Accordingly, the power of only HST motor 2 (3) is transmitted to output shaft (11).
- The power of HST motor 2 (3) is transmitted through motor 2 gear (9) and output gear (10) to output shaft (11).

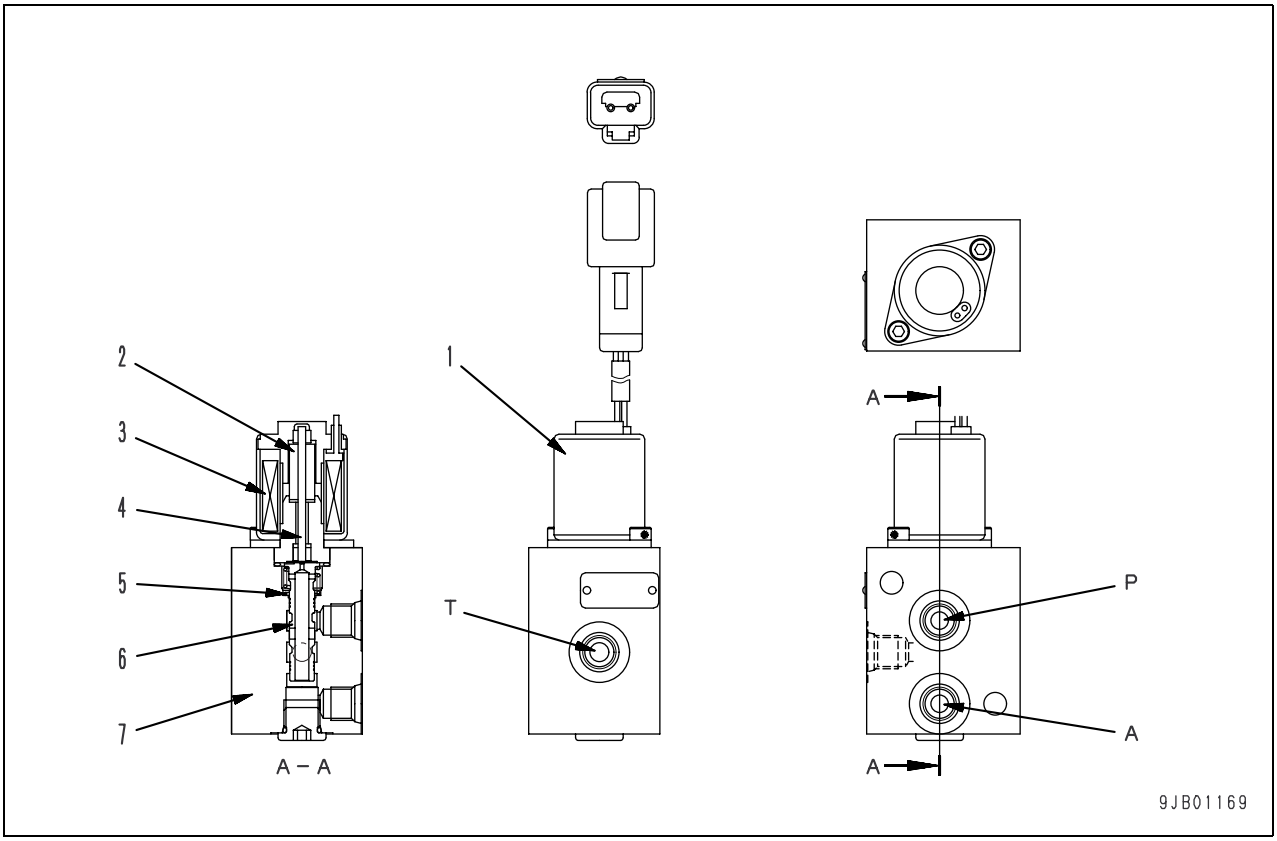
# TRANSFER OIL COOLER




**Specification**

| | Transfer oil cooler |
|---|---|
| Core type | CF40–1 |
| Fin pitch (mm) | 4.5 / 2 |
| Total heat radiating area ($m^2$) | 1.42 |

# CLUTCH SOLENOID VALVE




P: From HST charge pump
A: To transfer clutch
T: To drain port

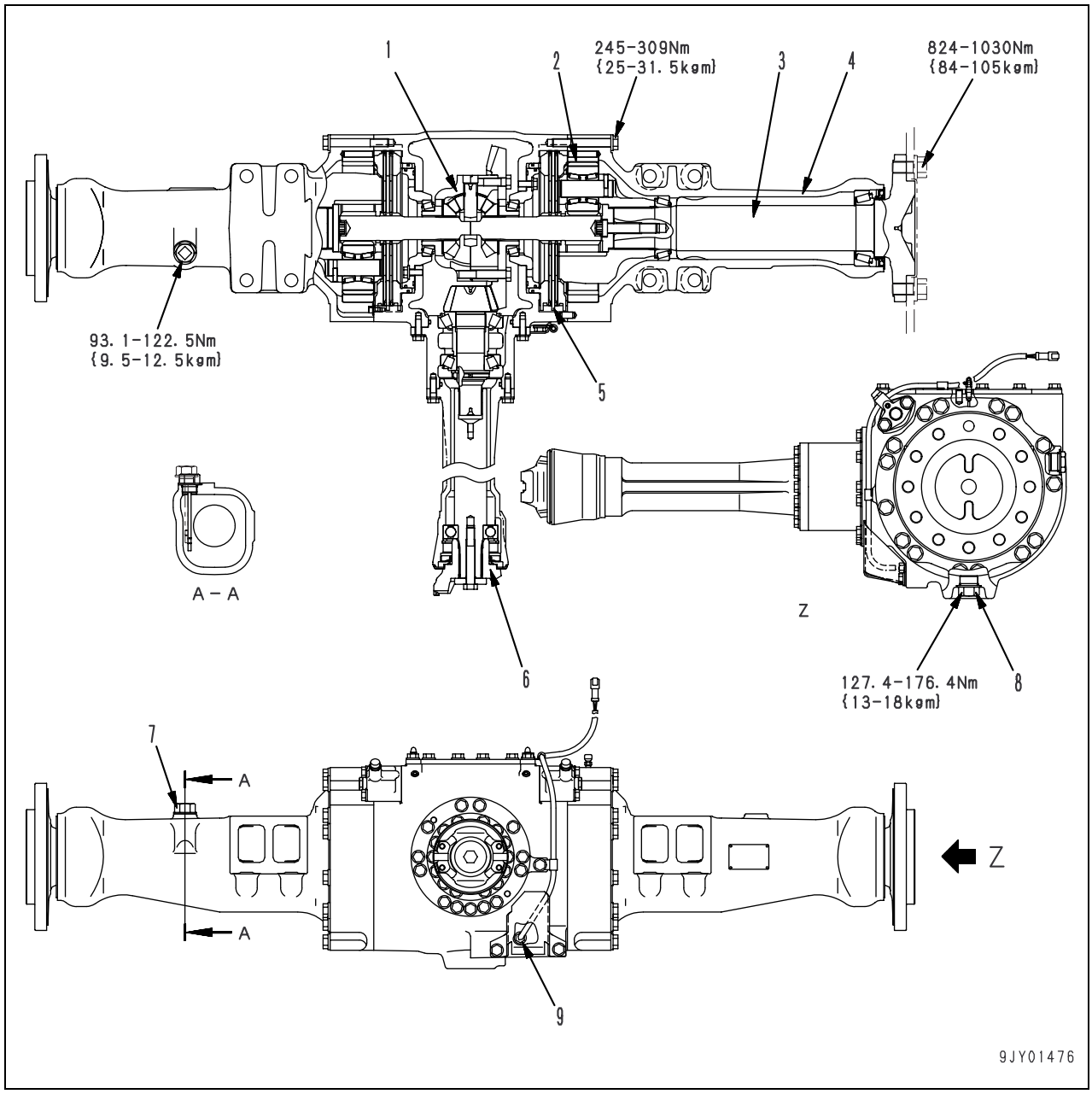
1. Clutch solenoid valve
2. Plunger
3. Coil
4. Push pin
5. Spring
6. Spool
7. Body

**Operation**

- When the current of the input signal is large, the hydraulic oil of the transfer clutch is drained.
- As the current of the input signal is reduced, the hydraulic pressure of the transfer clutch is heightened.
- After the current of the input signal is reduced until the hydraulic pressure of the transfer clutch reaches the hydraulic pressure sent from the HST charge pump, the hydraulic pressure of the transfer clutch is kept at the hydraulic pressure sent from the HST charge pump even if the current of the input signal is reduced further.

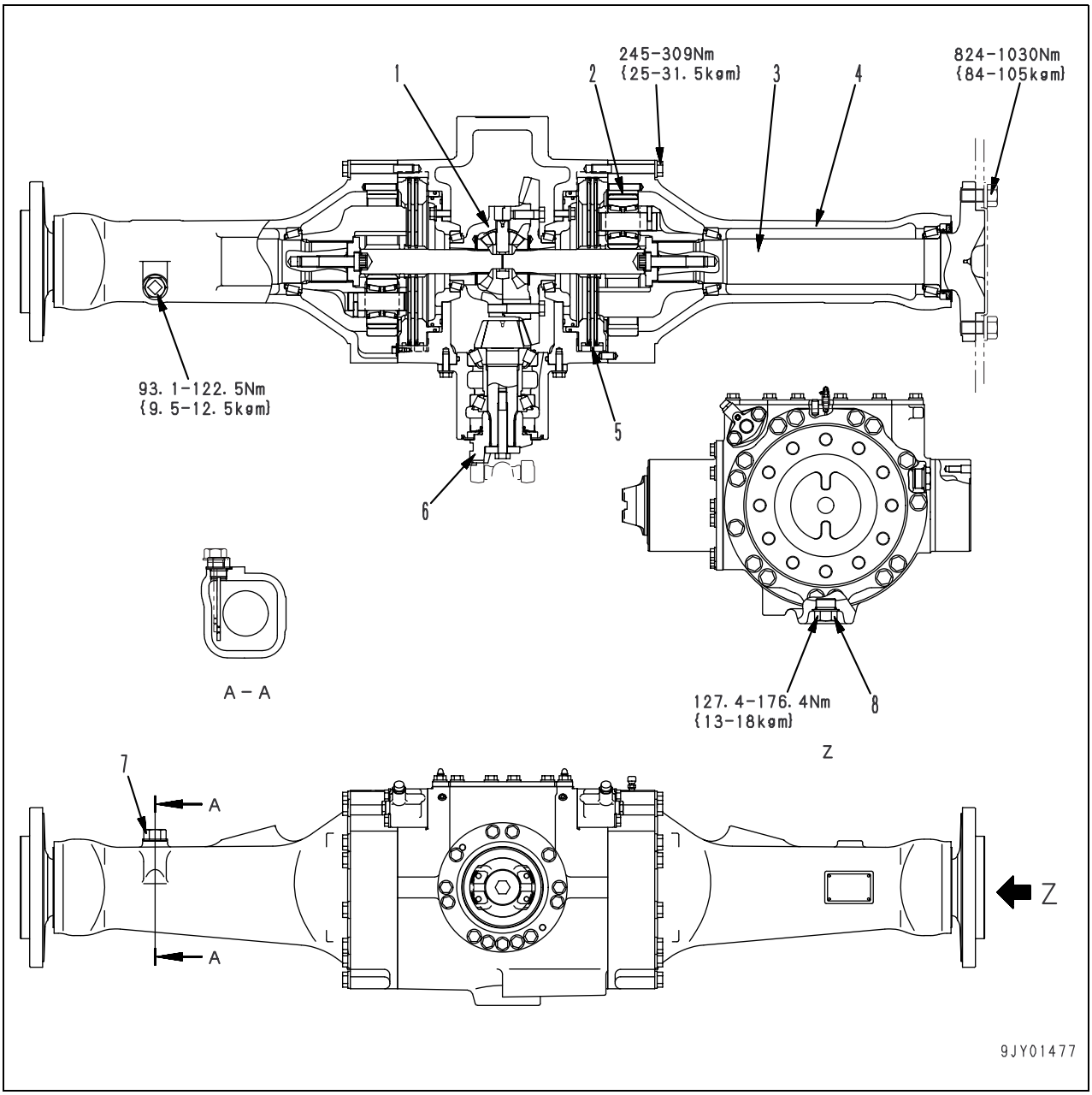
# AXLE

## FRONT AXLE




1. Differential
2. Final drive
3. Axle shaft
4. Axle housing
5. Wet-type multiple-disc brake
6. Coupling
7. Oil filler port / level plug
8. Draing plug
9. Oil temperature sensor

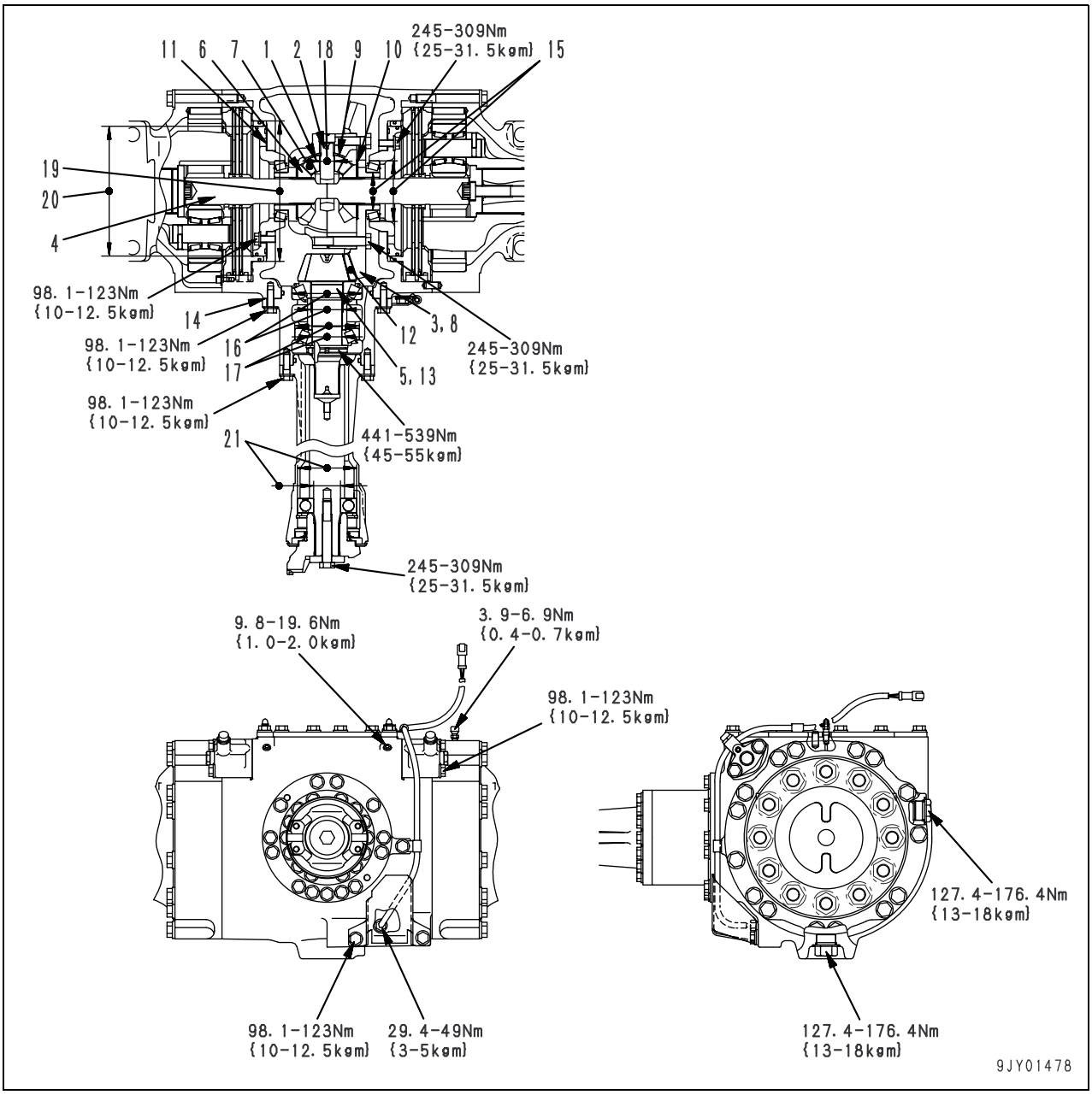
**REAR AXLE**




1. Differential
2. Final drive
3. Axle shaft
4. Axle housing
5. Wet-type multiple-disc brake
6. Coupling
7. Oil filler port / level plug
8. Draing plug

# DIFFERENTIAL

## FRONT DIFFERENTIAL

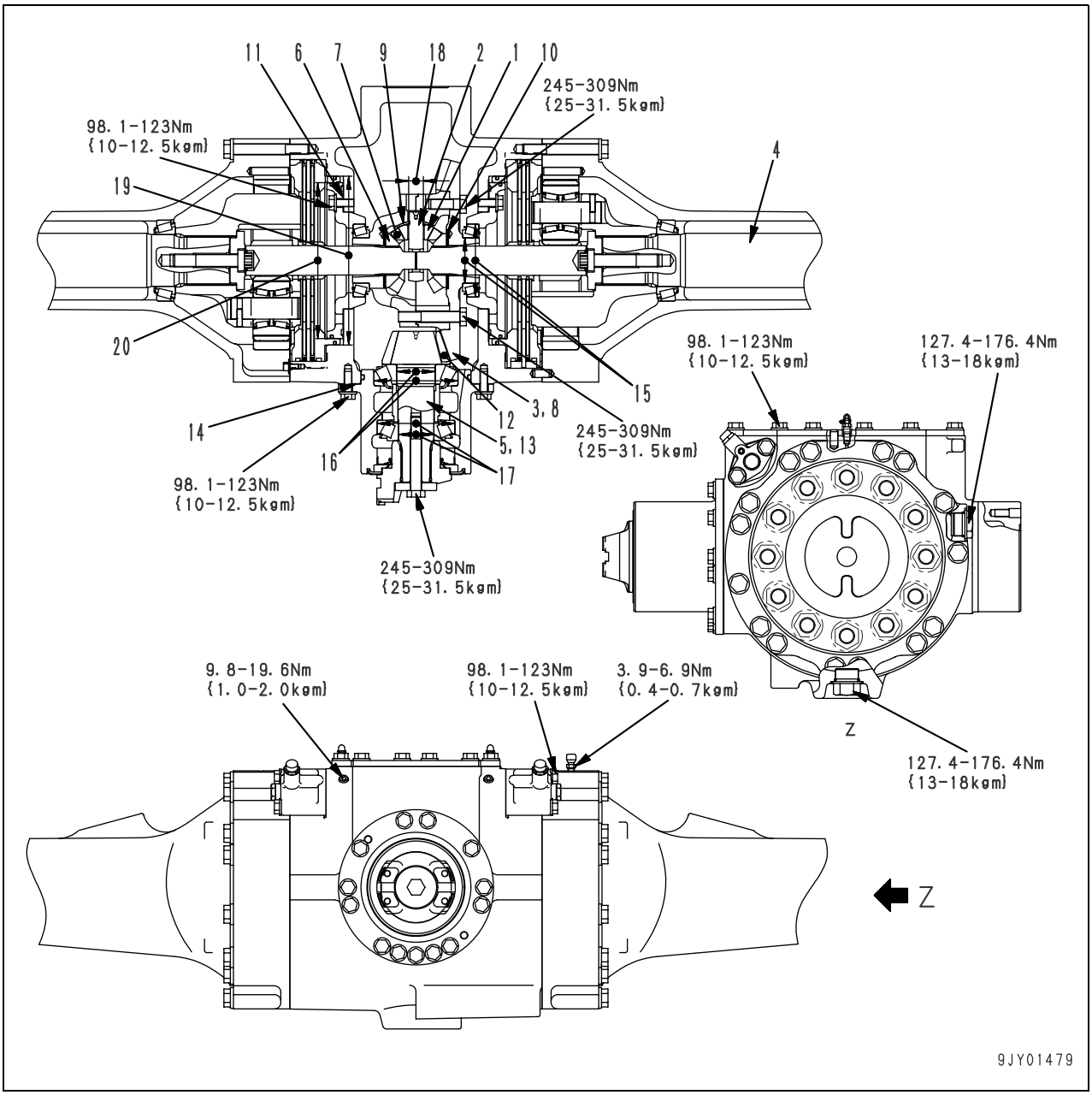



1. Pinion gear (Number of teeth: 9)
2. Shaft
3. Bevel gear (Number of teeth: 43)
4. Sun gear shaft
5. Bevel pinion (Number of teeth: 12)
6. Side gear (Number of teeth: 12)

Unit: mm

| No. | Check item | | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|---|
| 7 | Backlash of differential gear | | 0.1 – 0.25 | | | | | Adjust |
| 8 | Starting torque of bevel gear | | 88.2 – 205.8 Nm {0.9 – 2.1 kgm} (At outside surface of bevel gear) | | | | | |
| 9 | Pinion gear washer thickness | | Standard size: 3 | Tolerance: ± 0.08 | Repair limit: 2.8 | | | Replace |
| 10 | Side gear washer thickness | | 2 | ± 0.05 | 1.8 | | | |
| 11 | Thickness of shim at differential side bearing carrier (Each side) | | 0.50 – 1.35 | | | | | Adjust |
| 12 | Backlash of bevel gear | | 0.20 – 0.33 | | | | | |
| 13 | End play of bevel pinion | | 0 – 0.162 | | | | | Replace |
| 14 | Thickness of shim at differential housing and gauge assembly | | 0.50 – 1.23 | | | | | Adjust |
| 15 | Clearance of differential side bearing | Outer race | ø 112.713 | +0.025<br>0 | -0.004<br>-0.029 | -0.054 –<br>-0.004 | — | Replace |
| | | Inner race | ø 69.85 | +0.066<br>+0.045 | +0.013<br>0 | -0.066 –<br>-0.032 | — | |
| 16 | Clearance of bearing on gear side of pinion shaft | Outer race | ø 130 | 0<br>-0.018 | -0.048<br>-0.088 | -0.088 –<br>-0.030 | — | |
| | | Inner race | ø 60 | +0.039<br>+0.020 | 0<br>-0.015 | -0.054 –<br>-0.020 | — | |
| 17 | Clearance of bearing on coupling side of pinion shaft | Outer race | ø 120 | 0<br>-0.015 | -0.041<br>-0.076 | -0.076 –<br>-0.026 | — | |
| | | Inner race | ø 55 | +0.039<br>+0.020 | 0<br>-0.015 | -0.054 –<br>-0.020 | — | |
| 18 | Clearance between pinion gear and spider | | ø 28 | -0.06<br>-0.11 | +0.10<br>+0.05 | 0.11 –<br>0.21 | — | |
| 19 | Clearance of piston fitting portion of differential housing (Housing and piston) | | ø 261 | -0.110<br>-0.191 | +0.81<br>0 | 0.110 –<br>0.272 | — | |
| 20 | Clearance of piston fitting portion of bearing carrier (Piston and carrier) | | ø 241 | -0.100<br>-0.172 | +0.072<br>0 | 0.100 –<br>0.244 | — | |
| 21 | Clearance between drive shaft and bearing of cage | Outer race | ø 110 | 0<br>-0.015 | 0<br>-0.035 | -0.035 –<br>0.015 | — | |
| | | Inner race | ø 50 | +0.025<br>0 | +0.021<br>+0.002 | -0.023 –<br>0 | — | |

**REAR DIFFERENTIAL**



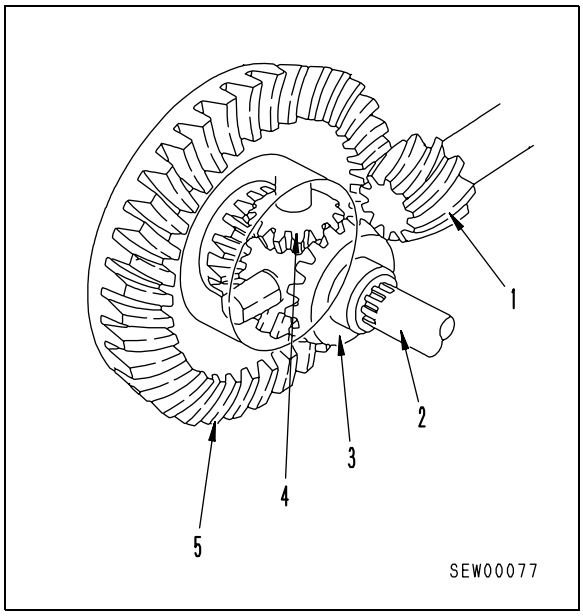

1. Pinion gear (Number of teeth: 9)
2. Shaft
3. Bevel gear (Number of teeth: 43)
4. Sun gear shaft
5. Bevel pinion (Number of teeth: 12)
6. Side gear (Number of teeth: 12)

Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 7 | Backlash of differential gear | 0.15 – 0.35 | | | | | Adjust |
| 8 | Starting torque of bevel gear | 88.2 – 205.8 Nm {0.9 – 2.1 kgm} (At outside surface of bevel gear) | | | | | |
| 9 | Pinion gear washer thickness | Standard size | Tolerance | Repair limit | | | Replace |
| | | 3 | ± 0.08 | 2.8 | | | |
| 10 | Side gear washer thickness | 2 | ± 0.05 | 1.8 | | | |
| 11 | Thickness of shim at differential side bearing carrier (Each side) | 0.50 – 1.35 | | | | | Adjust |
| 12 | Backlash of bevel gear | 0.20 – 0.33 | | | | | |
| 13 | End play of bevel pinion | 0 – 0.162 | | | | | Replace |
| 14 | Thickness of shim at differential housing and gauge assembly | 0.50 – 1.23 | | | | | Adjust |
| 15 | Clearance of differential side bearing | | Standard size | Tolerance | | Standard clearance | Clearance limit | Replace |
| | | | | Shaft | Hole | | |
| | | Outer race | ø 112.713 | +0.025<br>0 | -0.004<br>-0.029 | -0.029 – +0.014 | — |
| | | Inner race | ø 69.85 | +0.066<br>+0.045 | +0.013<br>0 | -0.066 – -0.032 | — |
| 16 | Clearance of bearing on gear side of pinion shaft | Outer race | ø 130 | 0<br>-0.018 | -0.023<br>-0.063 | -0.063 – -0.005 | — |
| | | Inner race | ø 60 | +0.039<br>+0.020 | 0<br>-0.015 | -0.054 – -0.020 | — |
| 17 | Clearance of bearing on coupling side of pinion shaft | Outer race | ø 120 | 0<br>-0.015 | -0.041<br>-0.076 | -0.076 – -0.026 | — |
| | | Inner race | ø 55 | +0.039<br>+0.020 | 0<br>-0.015 | -0.054 – -0.020 | — |
| 18 | Clearance between pinion gear and spider | | ø 28 | -0.06<br>-0.11 | +0.10<br>+0.05 | 0.110 – 0.210 | — |
| 19 | Clearance of piston fitting portion of differential housing (Housing and piston) | | ø 261 | -0.110<br>-0.191 | +0.81<br>0 | 0.110 – 0.272 | — |
| 20 | Clearance of piston fitting portion of bearing carrier (Piston and carrier) | | ø 241 | -0.100<br>-0.172 | +0.072<br>0 | 0.100 – 0.244 | — |

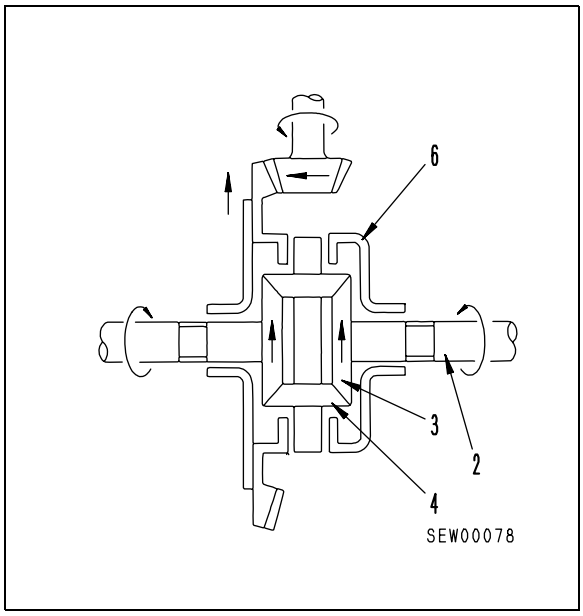
**Outline**

- The power transmitted to the front and rear axles is turned by 90 degrees and reduced in speed, and then transmitted through pinion gear (4) to sun gear shaft (2).
- The power of the sun gear is further reduced by the planetary gear type final drive and is transmitted to the axle shaft and wheels.



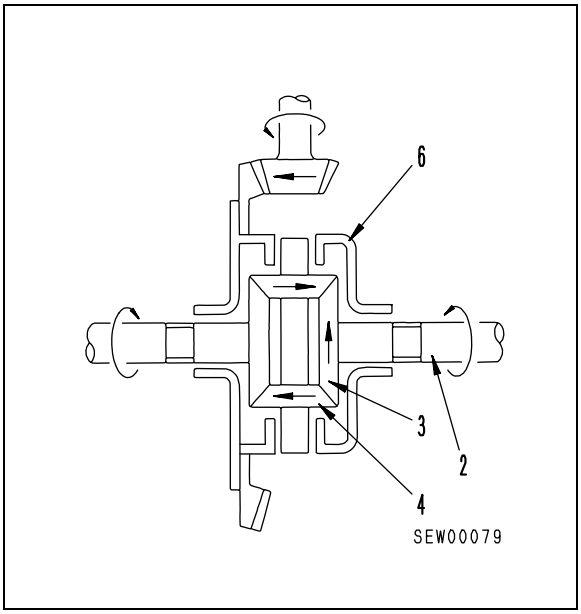

**When traveling in a straight line**

- When traveling in a straight line, the rotating speed of the left and right wheels is the same, so pinion gear (4) inside the differential assembly does not rotate. The power of carrier (6) passes through pinion gear (4) and side gear (3), and is transmitted equally to the left and right sun gear shafts (2).



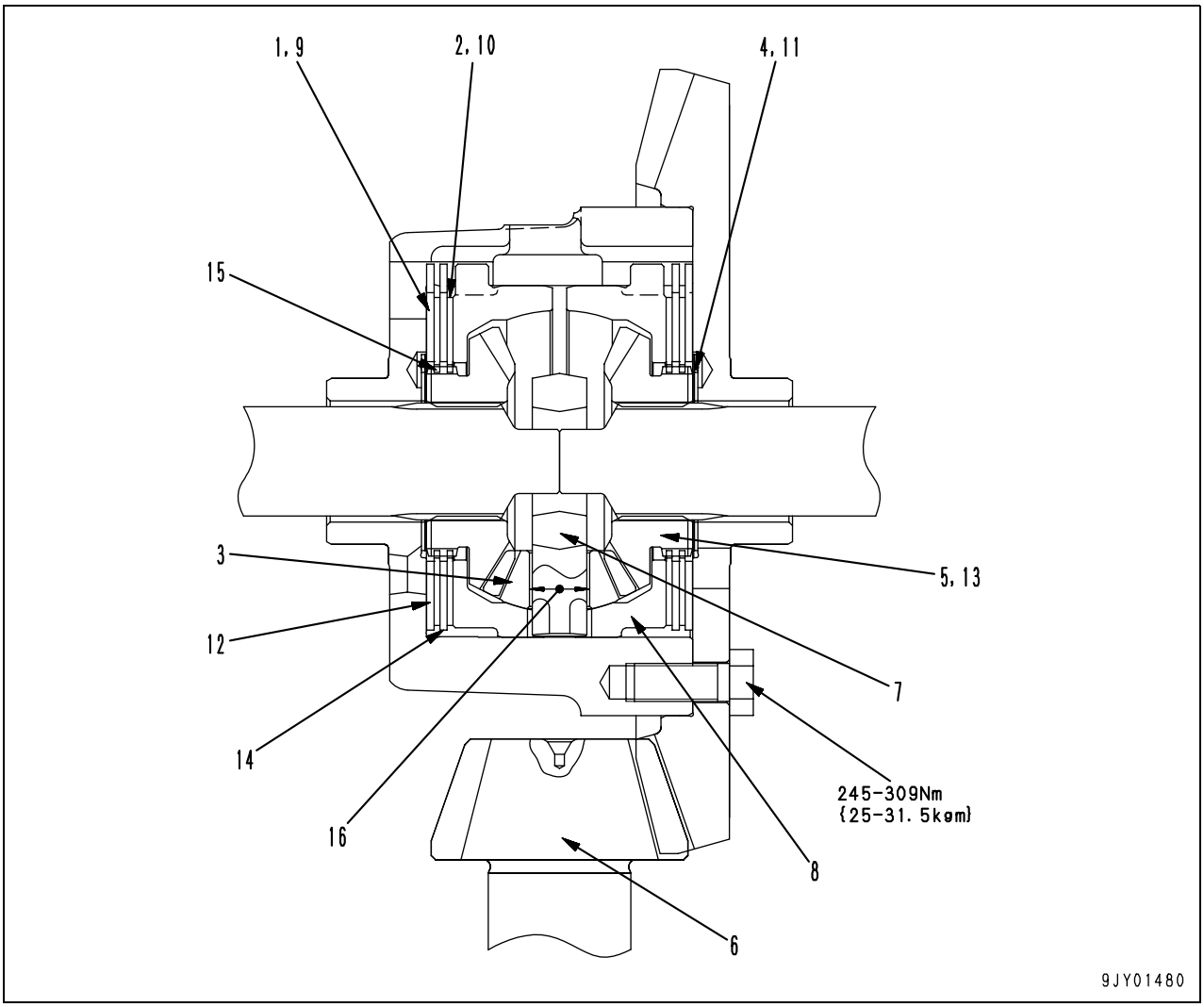

**When turning**

- When turning, the rotating speed of the left and right wheels is different, so pinion gear (4) and side gear (3) inside the differential transmit the power of carrier (6) to sun gear shaft (2) while rotating in accordance with the difference between the left and right rotating speeds.



# LIMITED-SLIP DIFFERENTIAL

**FRONT**

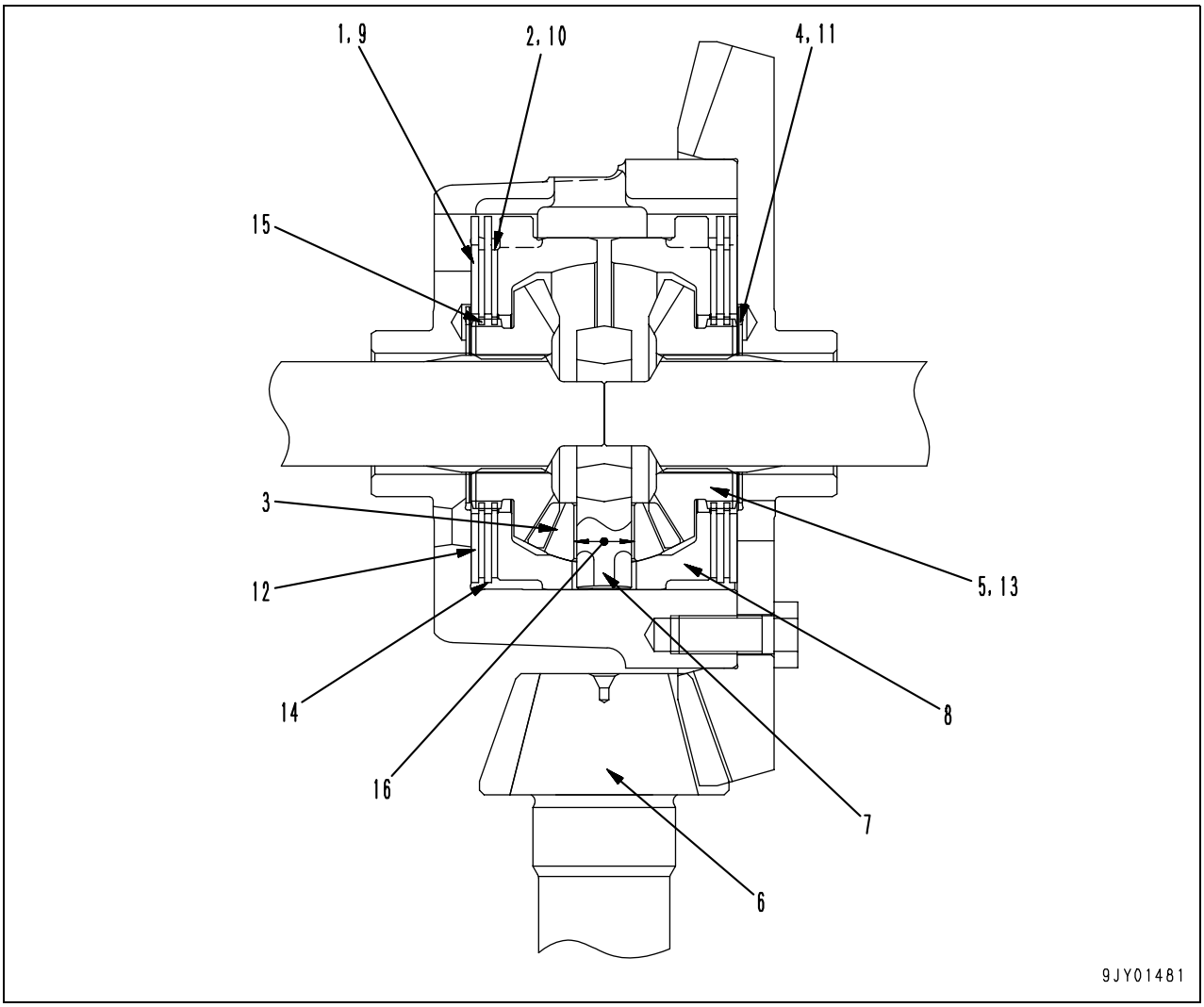



1. Plate
2. Disc
3. Pinion (Number of teeth:12)
4. Washer
5. Side gear(Number of teeth:24)
6. Bevel pinion
7. Shaft
8. Pressure ring

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Plate thickness</td><td colspan="2">Standard size</td><td colspan="2">Tolerance</td><td>Repair limit</td><td rowspan="11">Replace</td></tr>
<tr><td colspan="2">3</td><td colspan="2" rowspan="2">± 0.02</td><td rowspan="2">2.9</td></tr>
<tr><td colspan="2">3.1</td></tr>
<tr><td>10</td><td>Disc thickness</td><td colspan="2">2.5</td><td colspan="2">+0.04<br>-0.03</td><td>2.45</td></tr>
<tr><td>11</td><td>Washer thickness</td><td colspan="2">2</td><td colspan="2">± 0.05</td><td>1.8</td></tr>
<tr><td>12</td><td>Clearance between disc and plate (Total of both sides)</td><td colspan="6">0.20 – 0.6</td></tr>
<tr><td>13</td><td>End play (one end ) of side gear in axial direction</td><td colspan="6">0.13 – 0.36</td></tr>
<tr><td>14</td><td>Backlash between case and plate</td><td colspan="6">0 – 0.5</td></tr>
<tr><td>15</td><td>Backlash between side gear and disc</td><td colspan="6">0.13 – 0.32</td></tr>
<tr><td rowspan="2">16</td><td rowspan="2">Clearance between spider and differential pinion gear</td><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td></tr>
<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>ø 25.4</td><td>-0.110<br>-0.160</td><td>-0.05<br>0</td><td>0.110 –<br>0.210</td><td>—</td></tr>
</table>

**REAR**




1. Plate
2. Disc
3. Pinion (Number of teeth:12)
4. Washer
5. Side gear(Number of teeth:24)
6. Bevel pinion
7. Shaft
8. Pressure ring

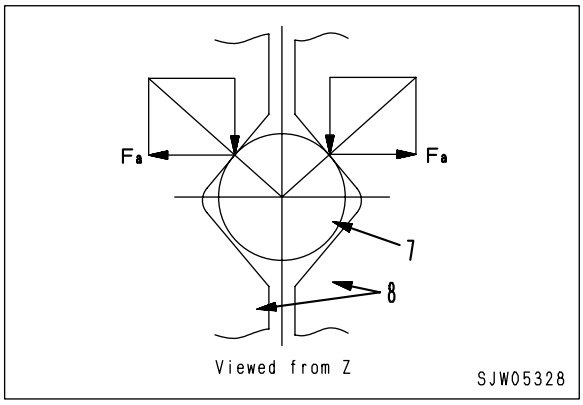
Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="5">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="3">9</td><td rowspan="3">Plate thickness</td><td colspan="2">Standard size</td><td colspan="2">Tolerance</td><td>Repair limit</td><td rowspan="11">Replace</td></tr>
<tr><td colspan="2">3</td><td colspan="2" rowspan="2">± 0.02</td><td rowspan="2">2.9</td></tr>
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<tr><td>11</td><td>Washer thickness</td><td colspan="2">2</td><td colspan="2">± 0.05</td><td>1.8</td></tr>
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<tr><td>Shaft</td><td>Hole</td></tr>
<tr><td>ø 25.4</td><td>-0.110<br>-0.160</td><td>-0.05<br>0</td><td>0.110 –<br>0.210</td><td>—</td></tr>
</table>

## Operation of limited-slip differential

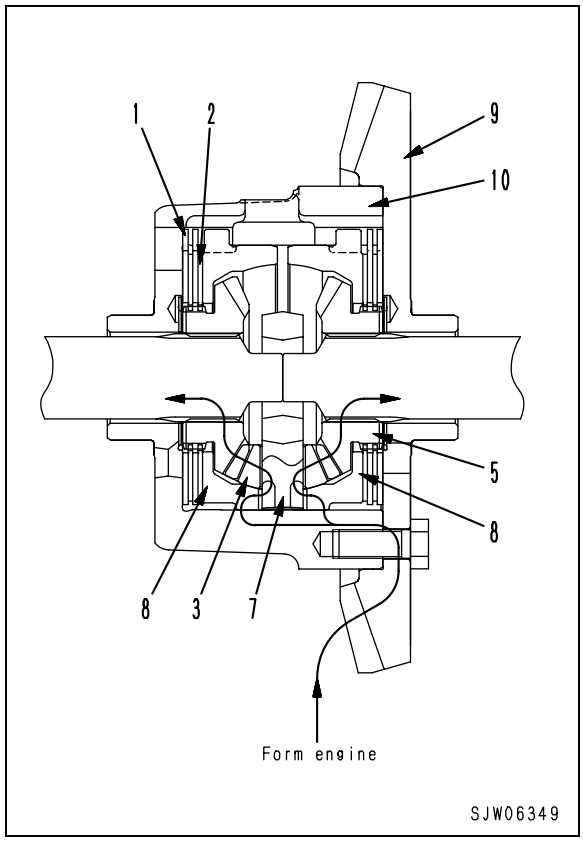
The power is transmitted from bevel gear (9) to case (10), pressure ring (8), shaft (7), pinion (3), and gear (5), and is divided to the left and right shafts.
The brake system, consisting of discs (2) and plates (1) is installed at the rear face of side gear (5). A brake torque is generated that is proportional to the torque transmitted from pressure ring (8) to shaft (7).
This brake torque acts to limit the rotation in relation to side gear (5) and case (10), so it is difficult for left and right side gears (5) to rotate mutually and the operation of the differential is limited.

**Brake torque generation mechanism of left and right side gears (5).**
Shaft (7) is supported at the cam surface cut into the facing surfaces of left and right pressure rings (8).
The power (torque) transmitted from pressure rings (8) to shaft (7) is transmitted at the cam surface, but force **Fa** separating left and right pressure rings (8) is generated in proportion to the torque transmitted according to the angle of this cam surface.
This separation load **Fa** acts on the brake at the rear face of left and right side gears (5) and generates the brake torque.

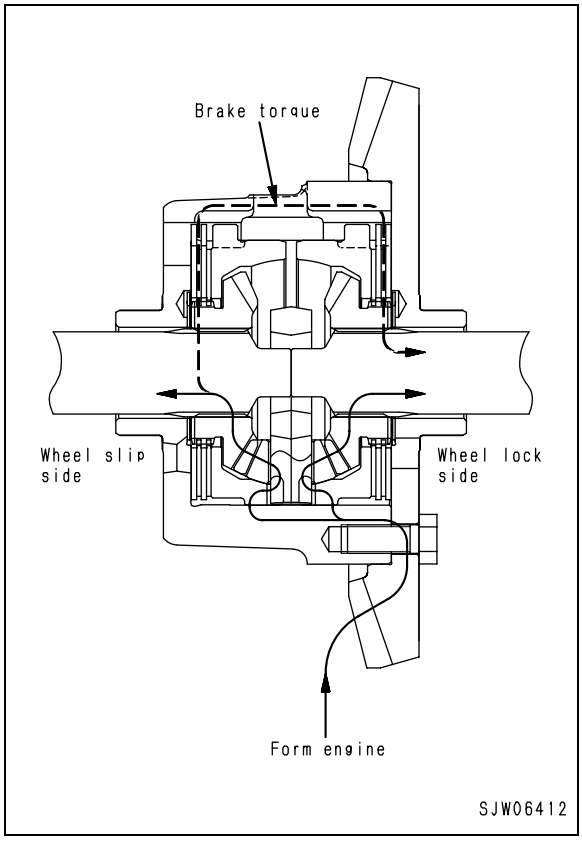



**When traveling in a straight line**

1. **When there is no imbalance between drive force of left and right wheels** [Road surface condition (friction coefficient) and load for left and right wheels are uniform and load on bucket is centered exactly]
   The power is divided equally to the left and right by the differential gear. In this case, the wheel slip limit of the left and right wheels is the same, so even if the power from the engine exceeds the wheel slip limit, both wheels will slip and the differential will not be actuated.
   There is no load on the brake at the rear face of the side gears.



2. **When there is imbalance between drive force of left and right wheels** [Road surface condition (friction coefficient) and load for left and right wheels are not uniform and it is easier for wheel on one side to slip]
   **Example 1.** When digging, and wheel on one side is on soft surface
   **Example 2.** When clearing snow, and wheel on one side is on snow and wheel on other side is on asphalt
   **Example 3.** When traveling on slope, and there is imbalance between load on left and right wheels
   The power is divided equally to the left and right by the differential gear. However, when the drive force exceeds the wheel slip limit on the side where the wheel is slipping, the amount of the force exceeding the wheel slip limit passes through the brake and case at the rear face of the side gear and is transmitted to the brake on the opposite side (locked side) and is sent to the wheel on the locked side.
   If this excess portion of the drive force becomes greater than the braking force, the differential starts to work.

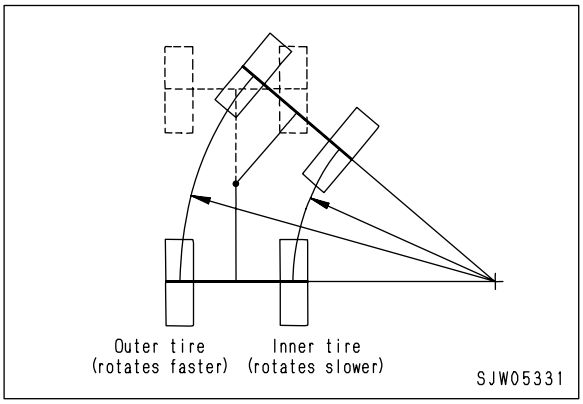



Difference in wheel drive force for each type of differential when wheel on one side slips

| | Wheel drive force (when one wheel is slipping) | | |
|---|---|---|---|
| | Slipping wheel | Locked wheel | Total (ratio) |
| Limited-slip differential | 1 | 2.64 | 3.64 (1.82) |
| Normal differential | 1 | 1 | 2 (1) |

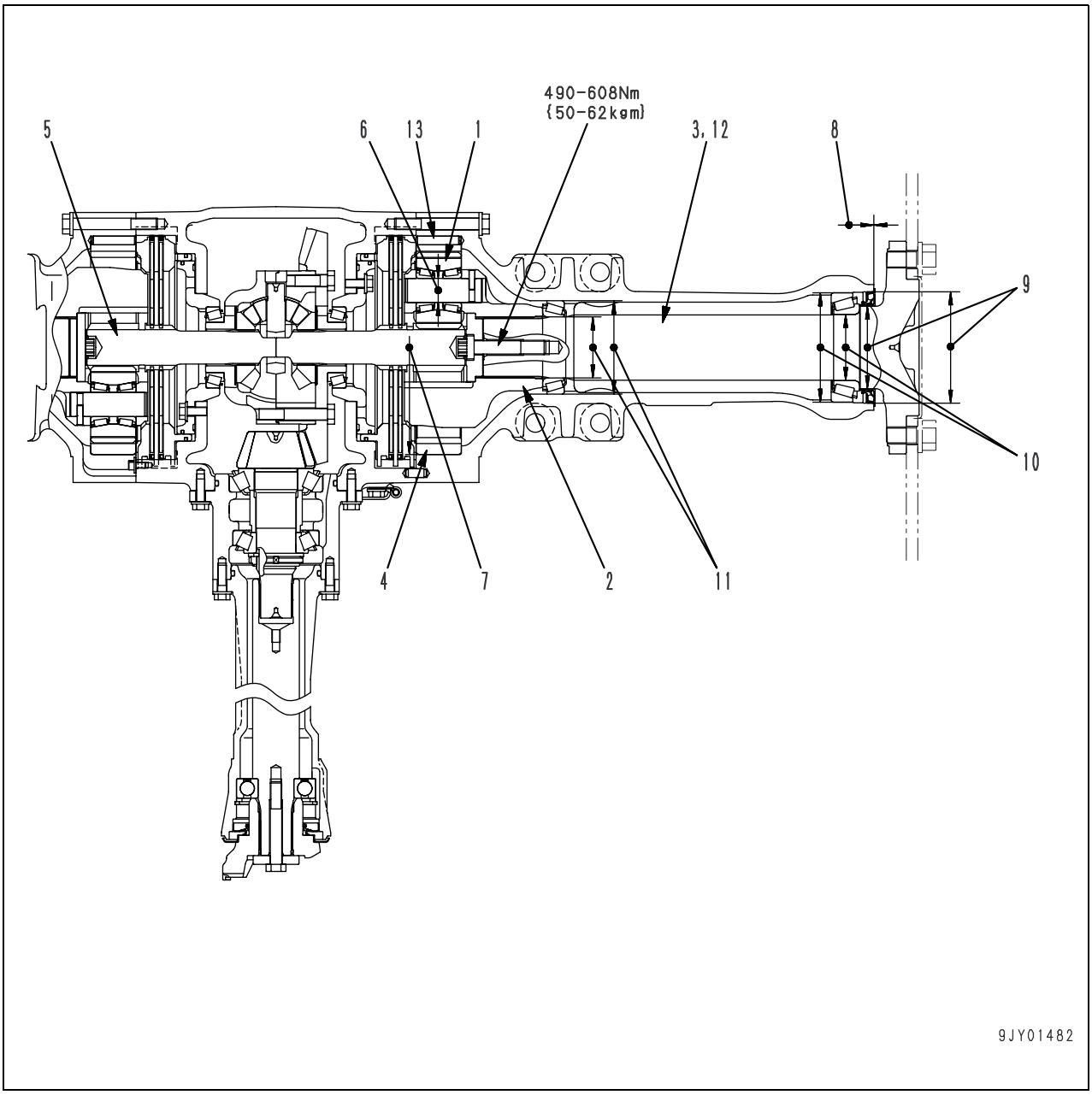
On road surfaces where the wheel on one side is likely to slip, the limited-slip differential increases the drive force by 1.82 times more than the normal differential.

**When turning**
The differential gears built into a limited-slip differential are the same as the gears used in a normal differential, so the difference in rotation between the inside and outside wheels when turning the machine can be generated smoothly.



# FINAL DRIVE

**FRONT**

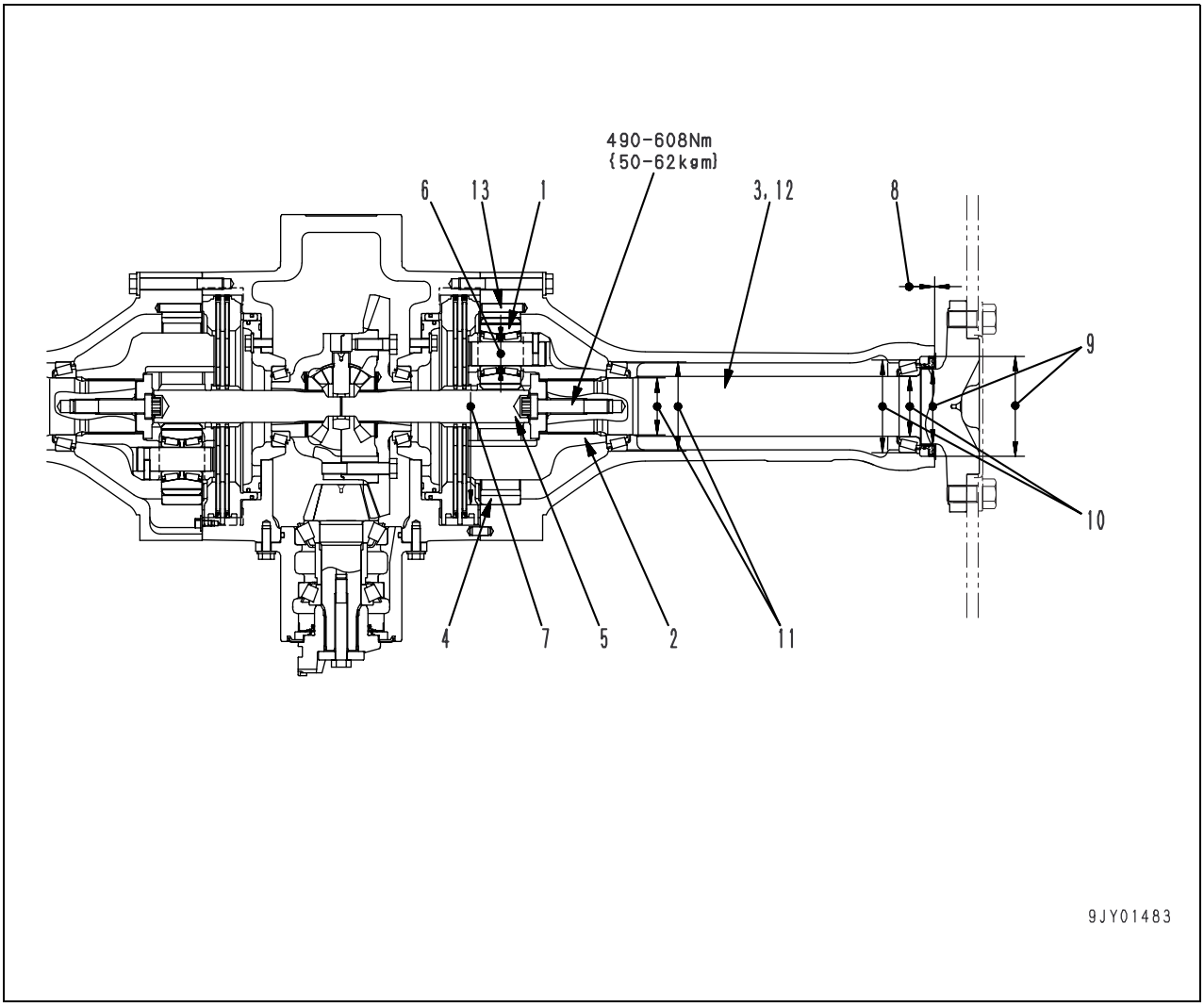



1. Planet gear (No. of teeth: 26)
2. Planetary carrier
3. Axle shaft
4. Ring gear (No. of teeth: 69)
5. Sun gear shaft (No. of teeth: 15)

Unit: mm

| No. | Check item | | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|---|
| | | | Standard size | Tolerance | | Standard Clearance | Clearance limit | |
| | | | | Shaft | Hole | | | |
| 6 | Clearance between pinion gear bearing and shaft | | ø 33.338 | +0.025<br>+0.013 | +0.013<br>0 | -0.025 –<br>0 | — | Replace |
| 7 | Clearance between axle housing and ring gear | | ø 298 | +0.100<br>+0.030 | +0.100<br>0 | -0.100 –<br>+0.070 | — | |
| 8 | Clearance between oil seal and housing | | Max. 0.2 | | | | | Adjust |
| 9 | Press-fitting portion of axle shaft seal | Housing | ø 155 | +0.400<br>+0.200 | +0.063<br>0 | -0.4 –<br>-0.137 | — | Replace |
| | | Shaft | ø 115 | 0<br>-0.054 | -0.200<br>-0.400 | -0.4 –<br>-0.146 | — | |
| 10 | Clearance at press-fitting portion of axle housing bearing | Outer race | ø 152.4 | +0.025<br>0 | -0.012<br>-0.052 | -0.077–<br>-0.012 | — | |
| | | Inner race | ø 92.075 | +0.073<br>+0.051 | +0.025<br>0 | -0.073 –<br>-0.026 | — | |
| 11 | Clearance at press-fitting portion of axle housing bearing | Outer race | ø 130 | 0<br>-0.025 | -0.038<br>-0.078 | -0.078 –<br>-0.013 | — | |
| | | Inner race | ø 85 | +0.035<br>+0.013 | 0<br>-0.020 | -0.055 –<br>-0.013 | — | |
| 12 | End play of axle shaft | | 0 – 0.1 | | | | | Adjust |
| 13 | Clearance of guide pin | | ø 12 | +0.025<br>+0.007 | +0.207<br>+0.145 | 0.120 –<br>0.200 | — | Replace |

**REAR**



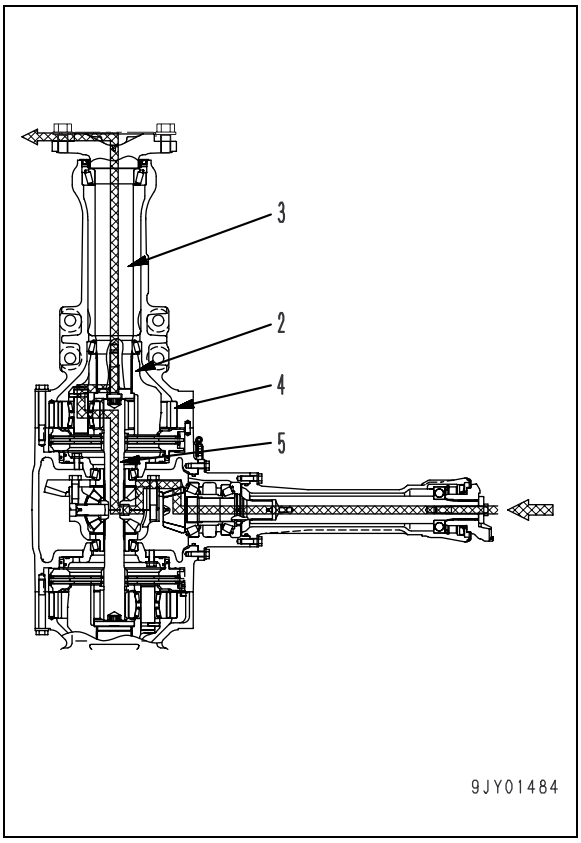

1. Planet gear (No. of teeth: 26)
2. Planetary carrier
3. Axle shaft
4. Ring gear (No. of teeth: 69)
5. Sun gear shaft (No. of teeth: 15)

Unit: mm

| No. | Check item | | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|---|
| | | | Standard size | Tolerance | | Standard Clearance | Clearance limit | |
| | | | | Shaft | Hole | | | |
| 6 | Clearance between pinion gear bearing and shaft | | ø 33.338 | +0.025<br>+0.013 | +0.013<br>0 | -0.025 –<br>0 | — | Replace |
| 7 | Clearance between axle housing and ring gear | | ø 276 | +0.100<br>+0.030 | +0.100<br>0 | -0.100 –<br>+0.070 | — | |
| 8 | Clearance between oil seal and housing | | Max. 0.2 | | | | | Adjust |
| 9 | Press-fitting portion of axle shaft seal | Housing | ø 140 | +0.400<br>+0.200 | +0.063<br>0 | -0.400 –<br>-0.137 | — | Replace |
| | | Shaft | ø 105 | 0<br>-0.054 | -0.200<br>-0.400 | -0.400 –<br>-0.147 | — | |
| 10 | Clearance at press-fitting portion of axle housing bearing | Outer race | ø 130 | 0<br>-0.025 | -0.028<br>-0.068 | -0.068 –<br>-0.003 | — | |
| | | Inner race | ø 85 | +0.045<br>+0.023 | 0<br>-0.020 | -0.065 –<br>-0.023 | — | |
| 11 | Clearance at press-fitting portion of axle housing bearing | Outer race | ø 125 | 0<br>-0.018 | -0.028<br>-0.068 | -0.068 –<br>-0.010 | — | |
| | | Inner race | ø 80 | +0.030<br>+0.011 | 0<br>-0.016 | -0.046 –<br>-0.011 | — | |
| 12 | End play of axle shaft | | 0 – 0.1 | | | | | Adjust |
| 13 | Clearance of guide pin | | ø 12 | +0.025<br>+0.007 | +0.207<br>+0.145 | 0.120 –<br>0.200 | — | Replace |

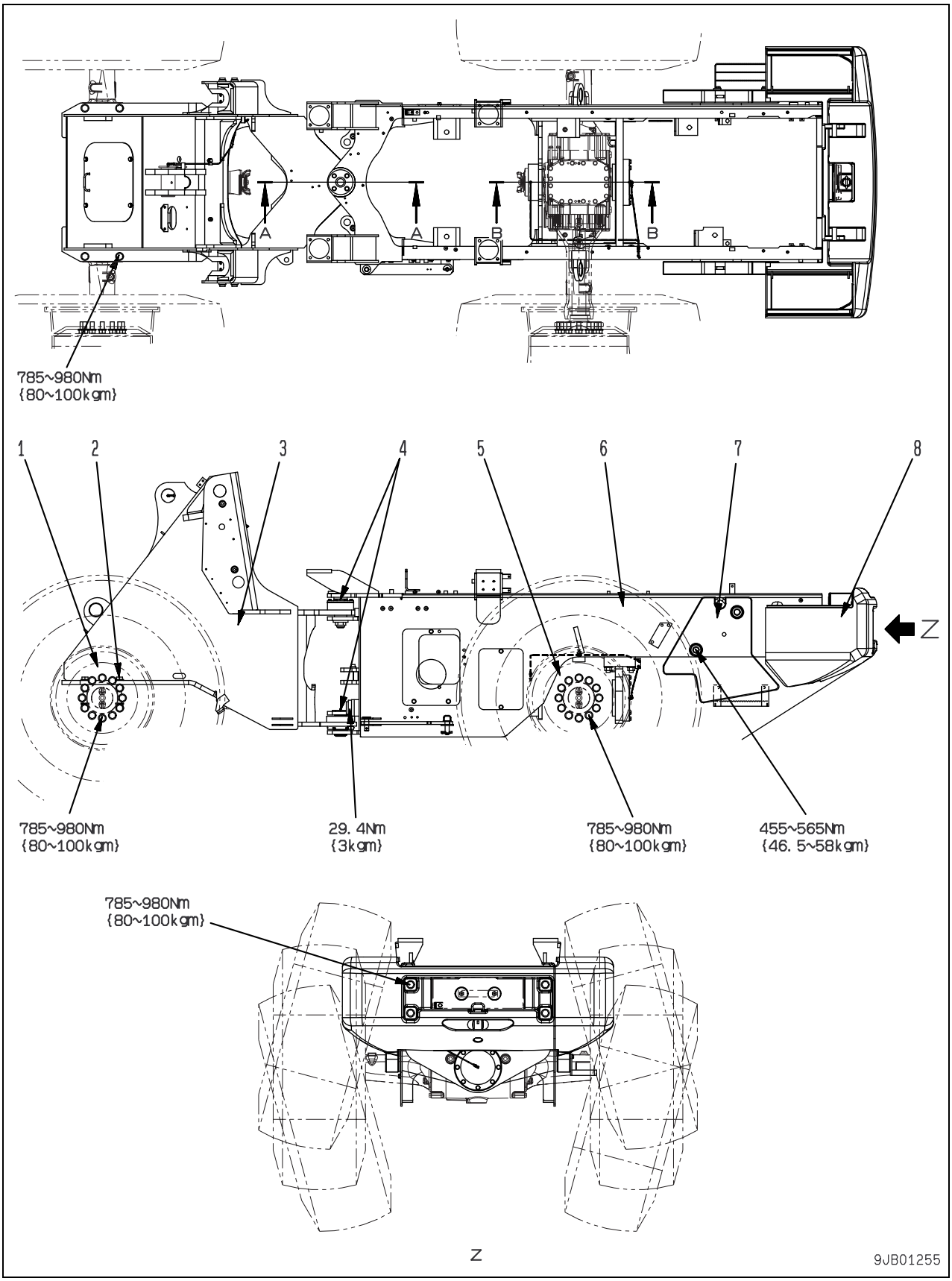
**Outline**

- The final drive reduces the speed of the power from the engine and increases the drive force.
- Ring gear (4) is press fitted to the axle housing and is fixed in position by a pin.
- The power transmitted from the differential and passing through sun gear shaft (5) has its speed reduced by the planetary gear mechanism and the drive force increased.
  The increased drive force passes through planetary carrier (2) and axle shaft (3) and is transmitted to the wheels.



# AXLE MOUNTING AND CENTER HINGE PIN

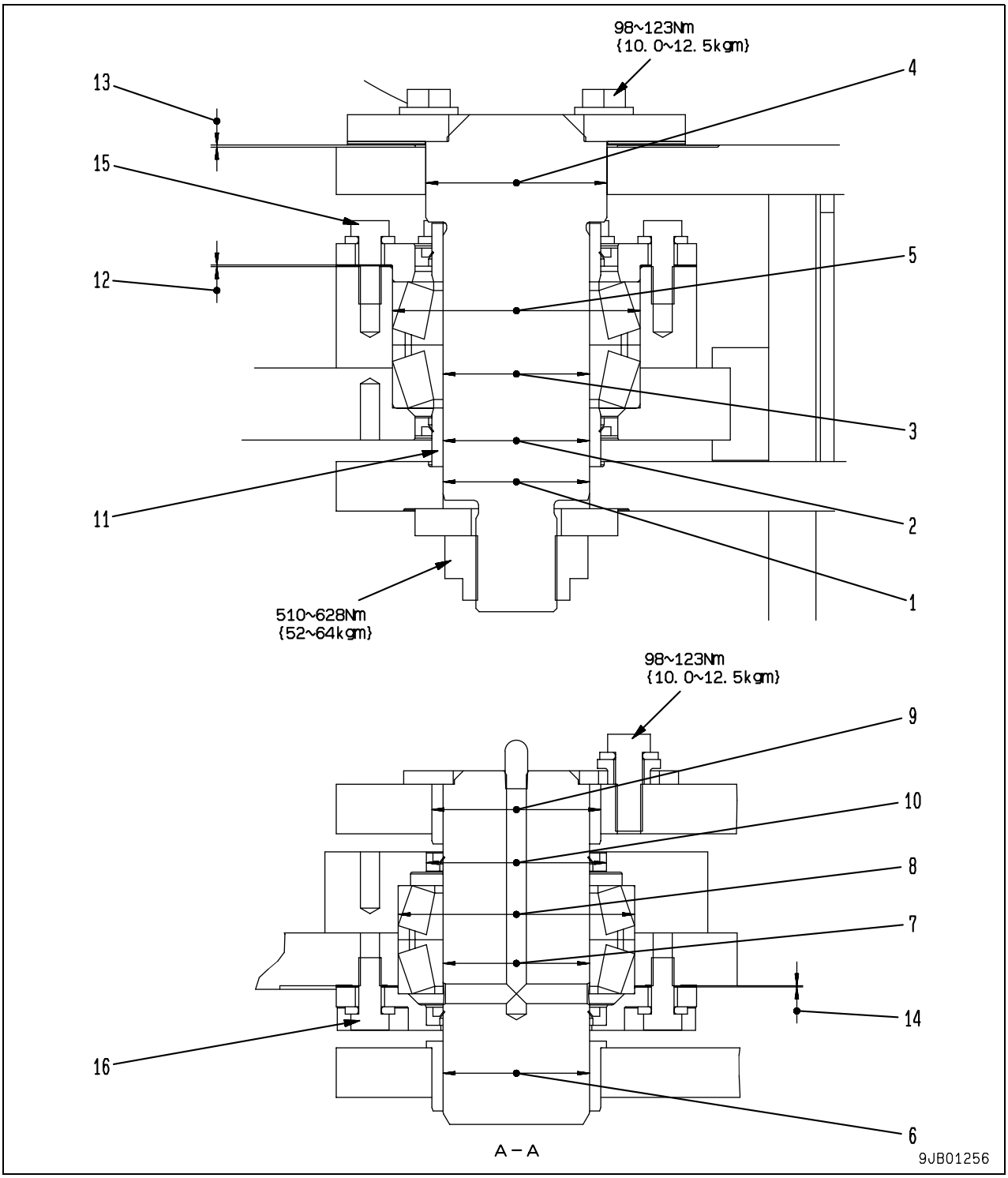
★ The following drawing shows WA250-5



1. Front axle
2. Tension bolt
3. Front frame
4. Center hinge pin
5. Rear axle
6. Rear frame
7. Additional counterweight
8. Counterweight

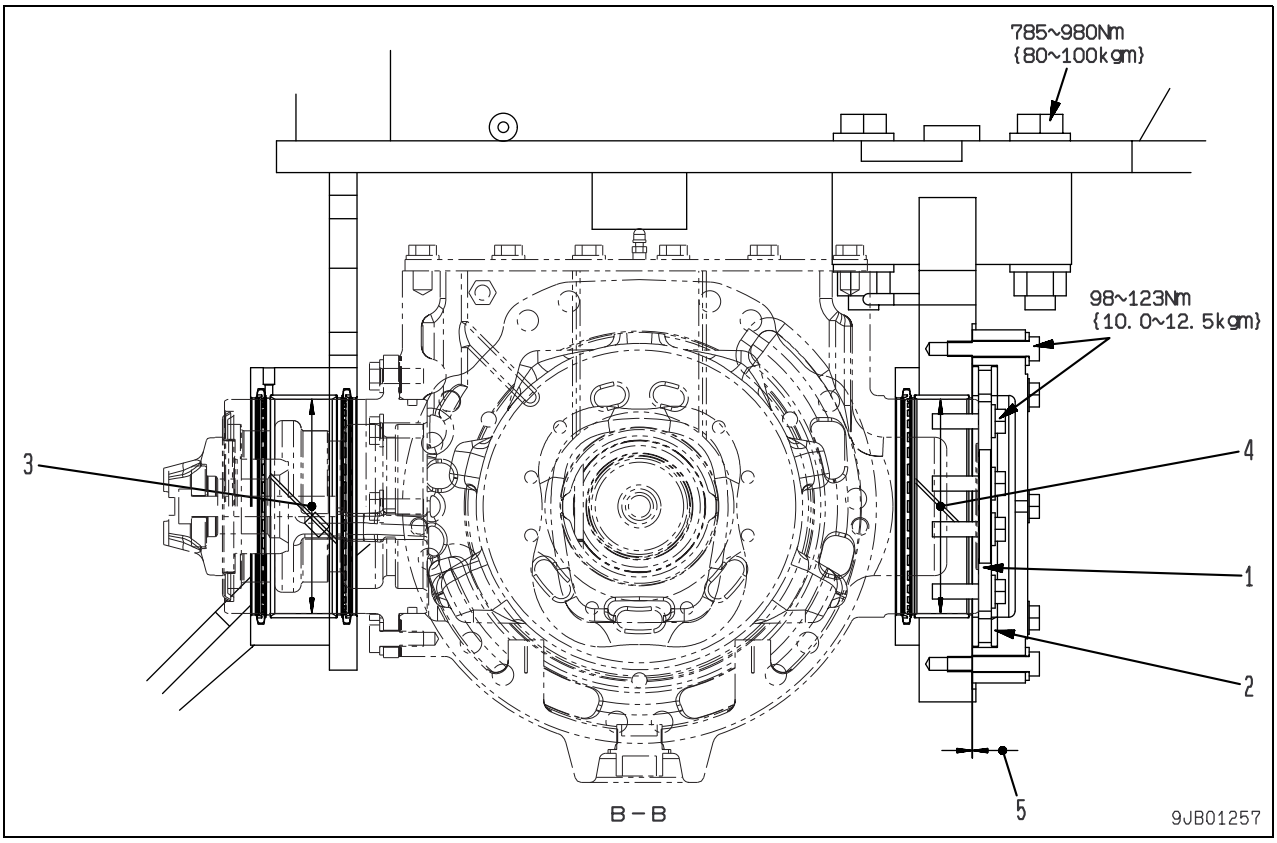
**Outline**

- Since front axle (1) receives forces directly during work, it is fixed to front frame (3) directly with tension bolts (2).
- Rear axle (5) rocks at the center of rear frame (6) so that each tire will keep in contact with ground even when the machine travels on soft ground.
- Front frame (3) and rear frame (6) are connected by center hinge pin (4) with the bearing between them. The steering cylinders on both sides connect front frame (3) and rear frame (6) and move to adjust the bending angle, or the turning radius.


98~123Nm
{10. 0~12. 5kgm}
13
15
12
11
510~628Nm
{52~64kgm}
4
5
3
2
1
98~123Nm
{10. 0~12. 5kgm}
9
10
8
7
14
16
6
A – A
9JB01256

Unit: mm

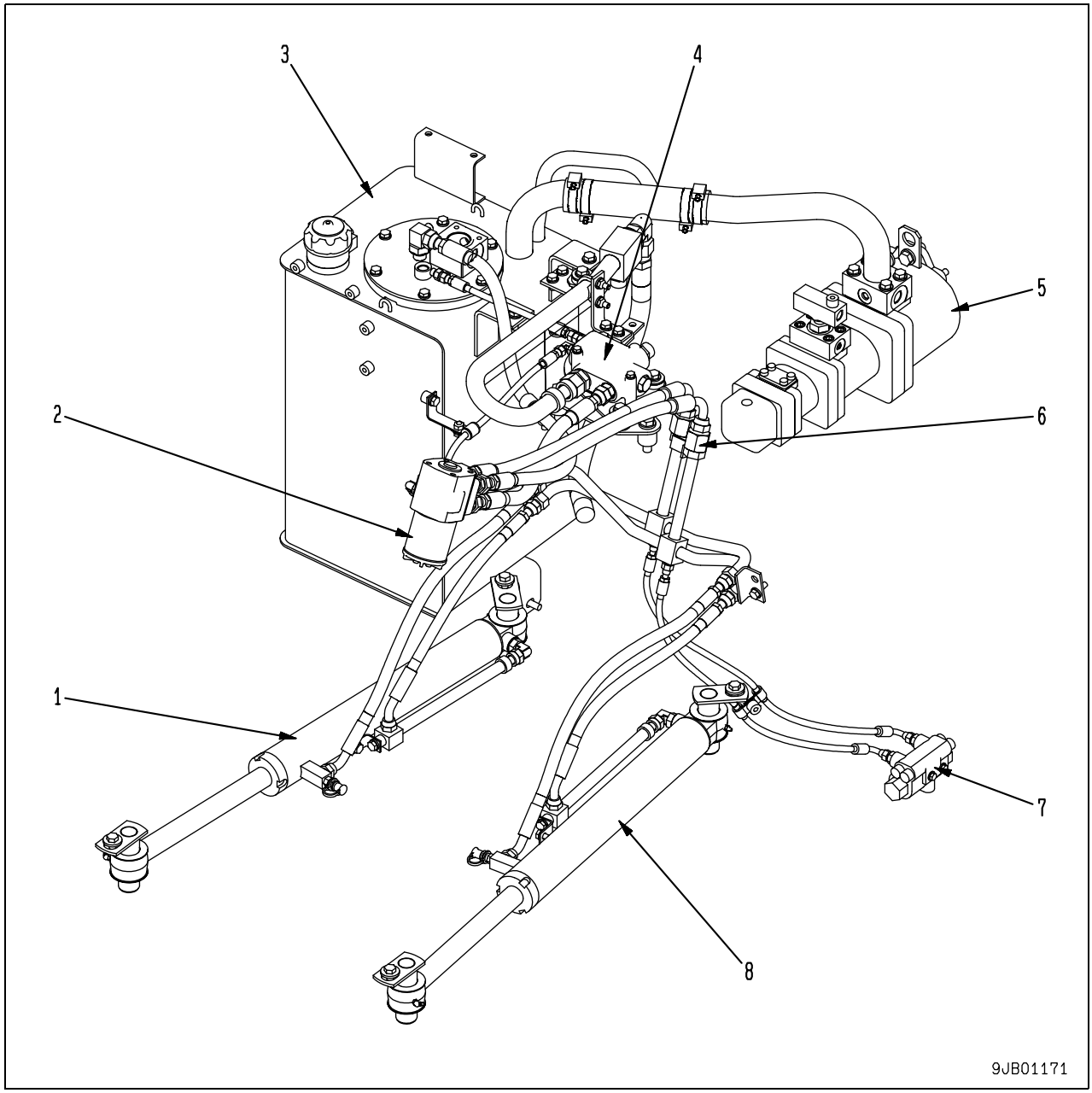
| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 1 | Clearance between upper hinge pin and rear frame | Standard size | Tolerance | | Standard clearance | Clearance limit | Replace |
| | | | Shaft | Hole | | | |
| | | ø 65 | -0.030<br>-0.049 | +0.100<br>0 | 0.030 –<br>0.149 | – | |
| 2 | Clearance between upper hinge pin and spacer (small) | ø 65 | -0.030<br>-0.049 | +0.240<br>0 | 0.030 –<br>0.289 | – | |
| 3 | Clearance between upper hinge pin and bearing | ø 65 | -0.030<br>-0.049 | 0<br>-0.015 | 0.015 –<br>0.049 | – | |
| 4 | Clearance between rear frame and spacer (large) | ø 80.5 | -0.080<br>-0.180 | ±0.050 | 0.030 –<br>0.230 | – | |
| 5 | Clearance between front frame and upper hinge bearing | ø 110 | 0<br>-0.020 | -0.041<br>-0.076 | -0.076 –<br>-0.021 | – | |
| 6 | Clearance between lower hinge pin and rear frame bushing | ø 65 | -0.030<br>-0.076 | +0.067<br>+0.027 | 0.057 –<br>0.143 | – | |
| 7 | Clearance between lower hinge pin and bearing | ø 65 | -0.030<br>-0.076 | 0<br>-0.015 | 0.015 –<br>0.076 | – | |
| 8 | Clearance between front frame and lower hinge bearing | ø 105 | 0<br>-0.020 | -0.041<br>-0.076 | -0.076 –<br>-0.021 | – | |
| 9 | Clearance between rear frame and bushing | ø 75 | +0.084<br>+0.059 | +0.046<br>0 | -0.084 –<br>-0.013 | – | |
| 10 | Clearance at seal press-fitting portion of lower hinge pin | ø 80 | +0.260<br>+0.160 | +0.046<br>0 | -0.260 –<br>-0.114 | – | |
| 11 | Height of upper hinge spacer (small) | Standard size | | Tolerance | | Repair limit | |
| | | 26 | | 0<br>-0.25 | | – | |
| 12 | Standard shim thickness of upper hinge and retainer | Standard size | | | | | Adjust |
| | | 0.92 | | | | | |
| 13 | Standard shim thickness of upper hinge and retainer | 1.45 | | | | | |
| 14 | Standard shim thickness of lower hinge and retainer | 0.85 | | | | | |
| 15 | Tightening torque for upper hinge retainer mounting bolt | 14.7 ± 1.5 Nm {1.5 ± 0.15 kgm} (When adjusting shim) | | | | | |
| | | 59 – 74 Nm {6.0 – 7.5 kgm} (Final value) | | | | | |
| 16 | Tightening torque for lower hinge retainer mounting bolt | 14.7 ± 1.5 Nm {1.5 ± 0.15 kgm} (When adjusting shim) | | | | | |
| | | 59 – 74 Nm {6.0 – 7.5 kgm} (Final value) | | | | | |




Unit: mm

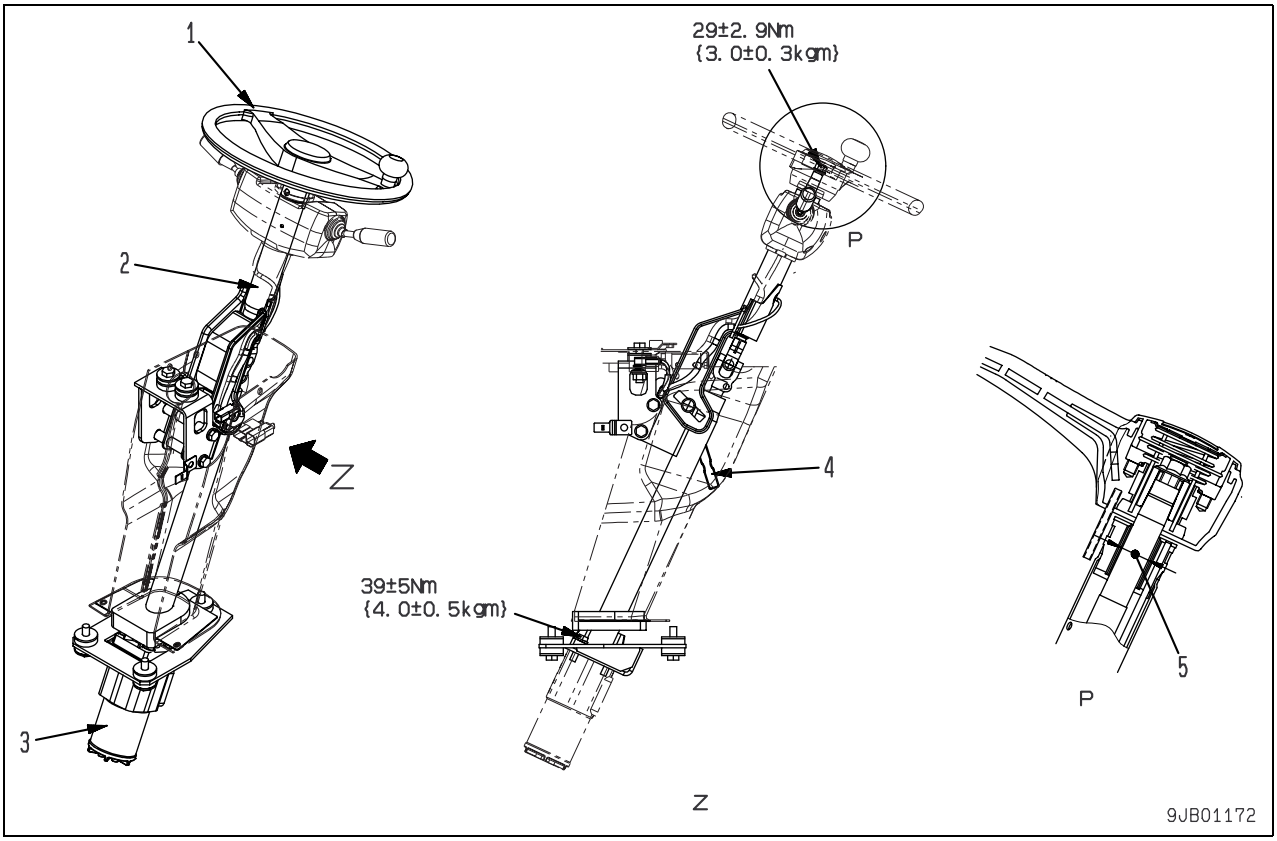
| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 1 | Thickness of thrust plate | Standard size | Tolerance | | Repair limit | | Replace |
| | | 10 | 0<br>-0.15 | | – | | |
| 2 | Thickness of thrust washer | 5 | +0.3<br>-0.1 | | – | | |
| 3 | Clearance between hole and shaft at front support end | Standard size | Tolerance | | Standard clearance | Clearance limit | |
| | | | Shaft | Hole | | | |
| | | ø 170 | -0.043<br>-0.106 | +0.550<br>+0.050 | 0.093 –<br>0.656 | – | |
| 4 | Clearance between hole and shaft at rear support end | ø 170 | -0.043<br>-0.106 | +0.550<br>+0.050 | 0.093 –<br>0.656 | – | |
| 5 | Standard shim thickness of thrust cap | 0.2 | | | | | – |

# STEERING PIPING




1. Steering cylinder (right)
2. Orbit-roll valve
3. Hydraulic oil tank
4. Priority valve
5. Steering pump
6. 2-way restrictor valve
7. Cushion valve
8. Steering cylinder (left)

# STEERING COLUMN

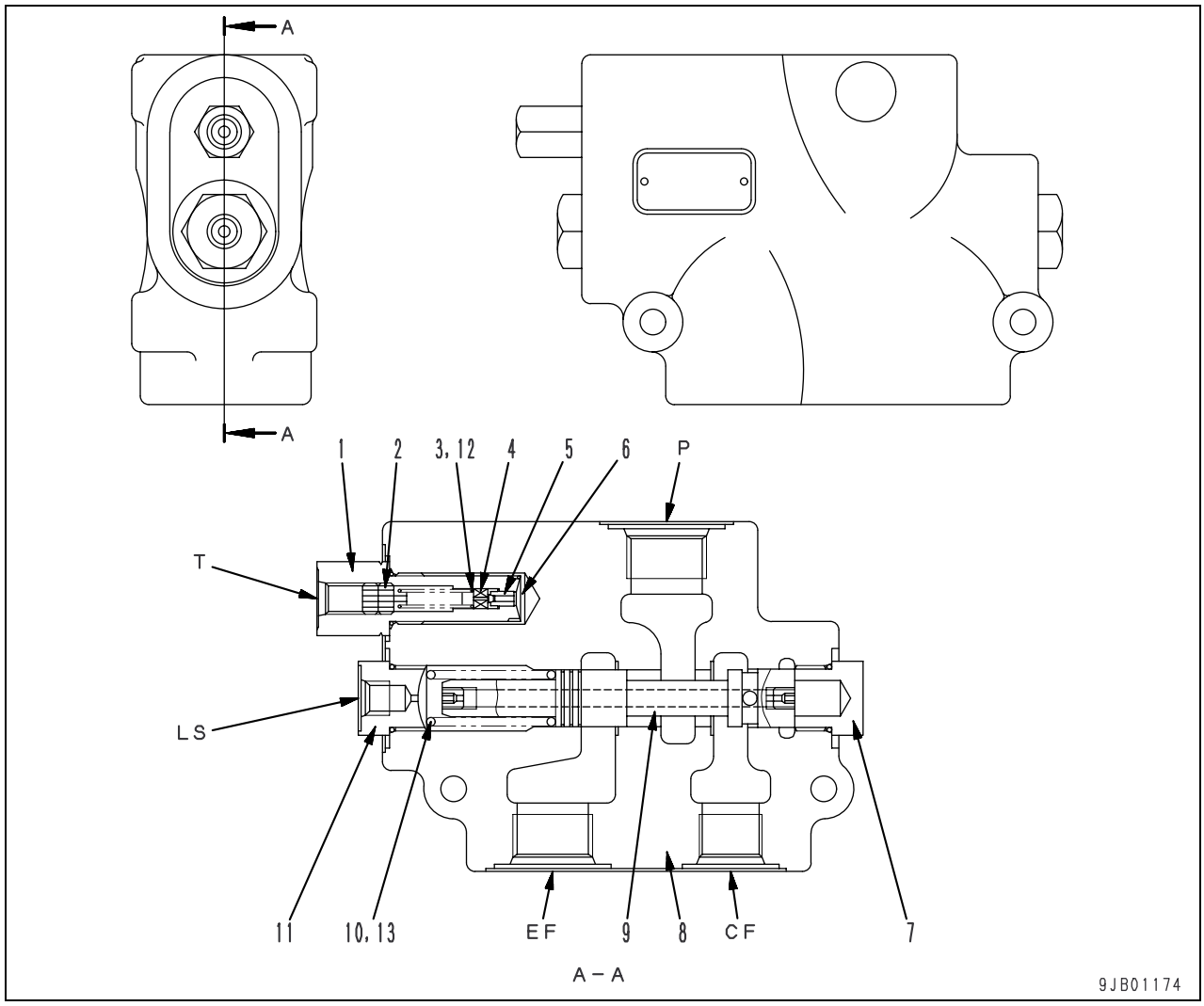



1. Steering wheel
2. Steering column
3. Orbit-roll valve
4. Tilt lever

Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | Tolerance | | Standard clearance | Clearance limit | |
| | | | Shaft | Hole | | | |
| 5 | Clearance between steering shaft and column bushing | ø 19 | 0<br>-0.08 | +0.15<br>+0.05 | 0.05 – 0.23 | 0.4 | Replace |

# PRIORITY VALVE




P: From steering pump
CF: To orbit-roll valve
EF: To work equipment control valve
LS: From orbit-roll valve
T: To hydraulic tank

1. Relief valve body
2. Spring seat
3. Spring
4. Poppet
5. Seat
6. Screen
7. Plug
8. Valve body
9. Spool
10. Spring
11. Plug

Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | | | Repair limit | | |
| 12 | Control spring | Free length | Installed length | Installed load | Free length | Installed load | Replace |
| | | 63.4 | 47.6 | 187 N {19.1 kg} | 63.4 ± 1 | 187 ± 14.7 N {19.1 ± 1.5 kg} | |
| 13 | Relief spring | 31 | 26.9 | 146 N {14.9 kg} | – | 146 ± 14.7 N {14.9 ± 1.5 kg} | |

**Outline**

- The priority valve is in the circuit between the steering pump and the orbit-roll valve. It acts to divide the flow of oil from the steering pump and send it to the orbit-roll valve or oil cooler circuit. It also sets the oil pressure in the circuit from the priority valve to the orbit-roll valve to 20.6 MPa {210 kg/cm$^2$} to protect the circuit.

**Operation**

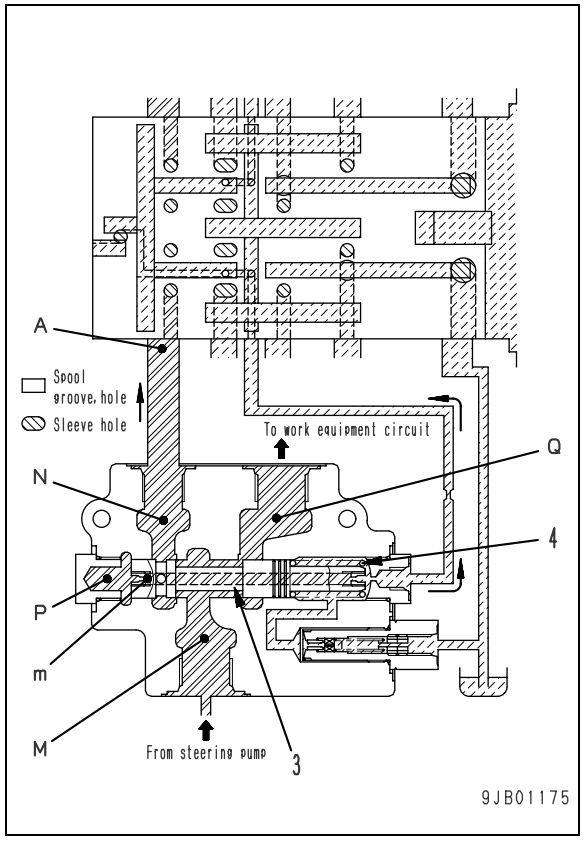
**1. Steering wheel at neutral**

When the engine is stopped, spool (3) is pushed fully to the left by the tension of spring (4). The circuit between ports **M** and **N** is fully open, while the circuit between ports **M** and **Q** is fully closed.

In this condition, is the engine is started and the steering pump is rotated, the oil from the pump goes from the port **M** to port **N**, and then enters port **A** to the orbit-roll valve.

When this happens, the oil passing through orifice **m** in spool (3) enters port **P**. It then compresses spring (4), and moves spool (3) to the right in the direction of the arrow.

This stabilizes the condition so that the circuit between ports **M** and **Q** is almost fully open and the circuit between ports **M** and **N** is almost fully closed. Therefore, the oil from the pump almost all flows to the work equipment circuit.



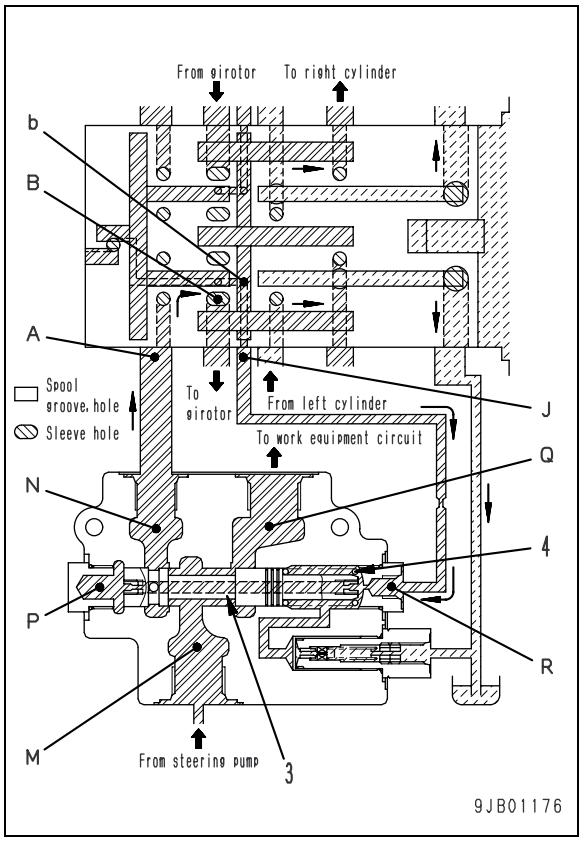
**2. Steering wheel turned to left**

When the steering wheel is turned to the left, an angle variation is generated between the spool and sleeve of the orbit-roll valve, and the oil flow is switched. (For details, see ORBIT-ROLL VALVE.)

The oil from the pump flows from port **M** to port **N**, and enters port **A**. The degree of opening of the sleeve (port **A**) and spool (port **B**) creates a difference between the pressure up to port **A** and the pressure beyond port **B**. Some of the oil from port **B** flows to the Girotor, and then goes to the front right cylinder. The remaining oil passes through orifice **b**, flows to port **J**, and then enters port **R**.

When this happens, spool (3) stabilizes at a position where the differential pressure between the circuit up to port **A** and circuit beyond port **B** (pressure of port **P** - pressure of port **R**) and the load of the spring (4) are balanced. It adjusts the degree of opening from port **M** to ports **N** and **Q**, and distributes the flow to both circuits.

The ratio of this distributed flow is determined by the degree of opening of port **A** and port **B**, in other words, the angle variation between the sleeve and spool of the orbit-roll valve. This degree the opening is adjusted steplessly by the amount the steering is turned.

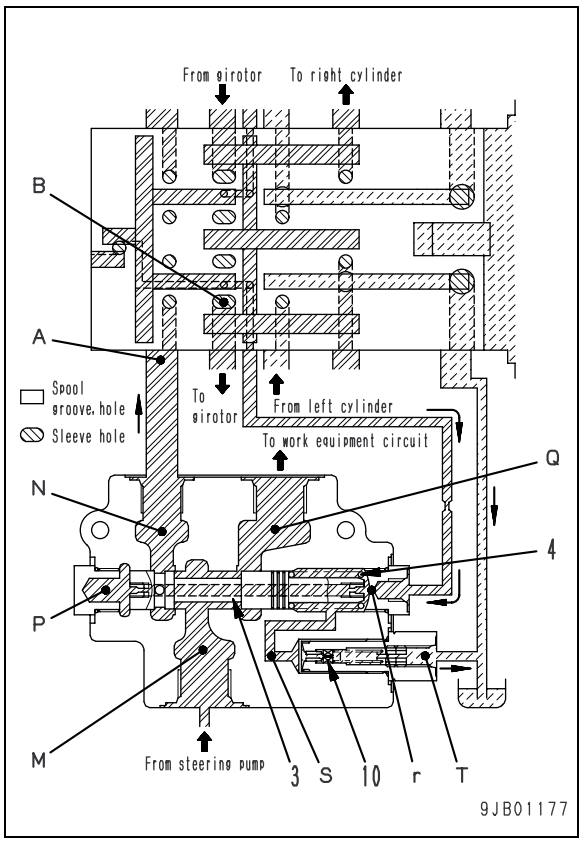



**3. Steering cylinder at end of stroke**

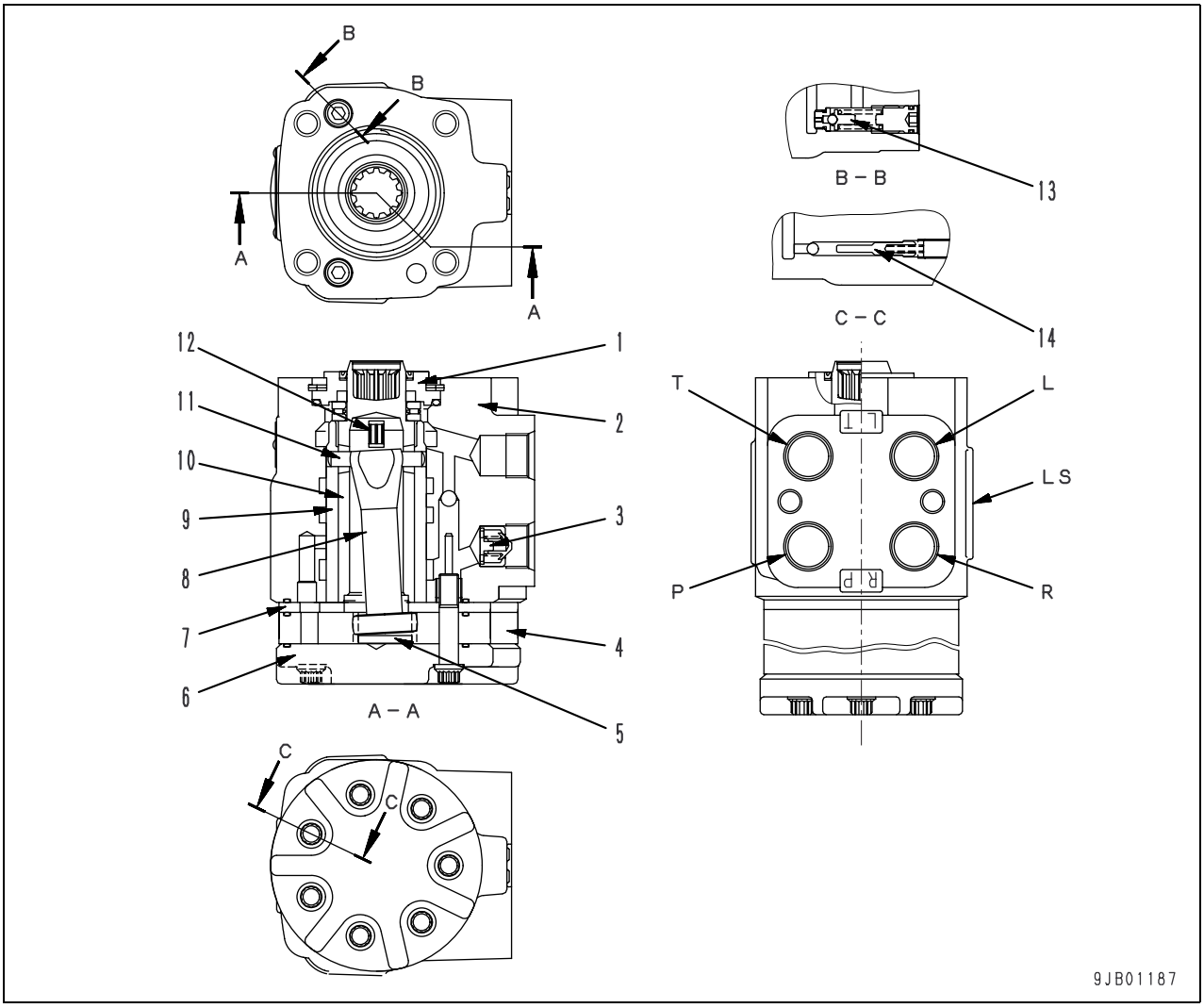
If the operator tries to turn the steering wheel further when the steering cylinder has reached the end of its stroke, the circuit from port **M** through port **N** to port **S** is kept open and the pressure rises.

When this pressure rises above requirement pressure relief valve (10) opens and the oil is relieved to the hydraulic tank. Because of this flow of oil, a differential pressure is created on both sides of orifice **r**. Therefore, the balance is lost between the load of spring (4) and the pressure up to port **A** and the pressure beyond port **B**. As a result, the pressure up tp the port **A** becomes relatively higher.

For this reason, the pressure at port **P** moves spool (3) even further to the right from the condition in Item 2. It stabilizes the condition at a position where the circuit between ports **M** and **N** is almost fully closed, and the circuit between ports **M** and **Q** is almost fully open.



# ORBIT-ROLL VALVE

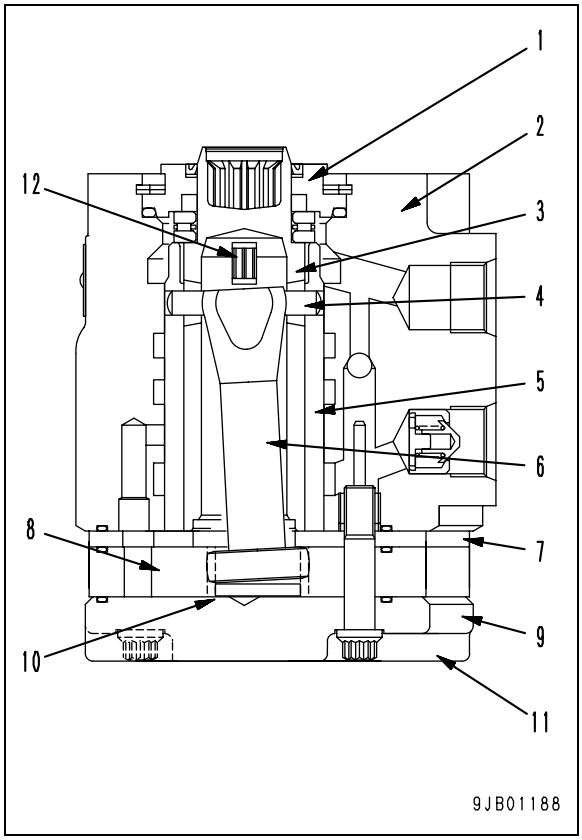



P: From steering pump
L: To steering cylinder
R: To steering cylinder
LS: To priority valve
T: To hydraulic tank

1. Ground
2. Valve body
3. Check valve
4. Gerotor
5. Spacer
6. Cover
7. Spacer
8. Drive shaft
9. Sleeve
10. Spool
11. Center pin
12. Centering spring
13. Anti-cavitation valve
14. Over-load relief valve

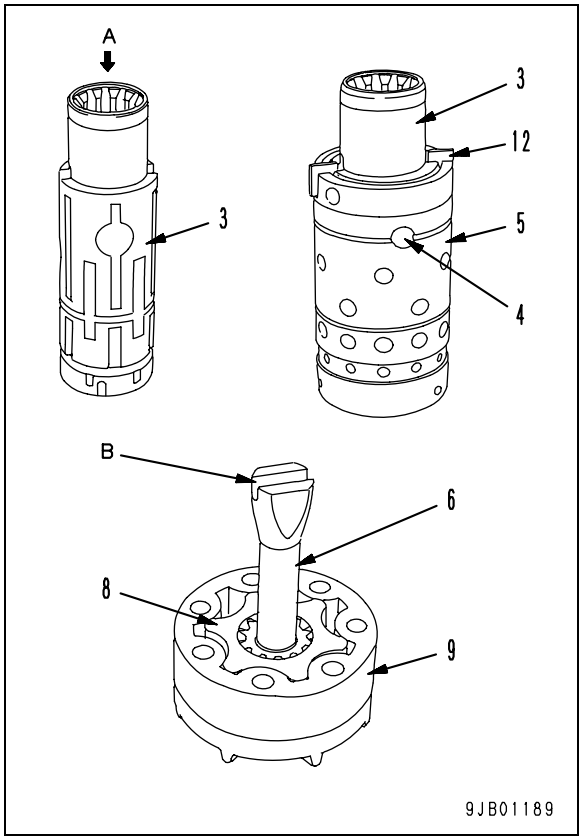
**Outline**

- The orbit-roll valve is connected directly to the shaft of the steering wheel. It switches the flow of oil from the steering pump to the left and right steering cylinders to determine the direction of travel of the machine.
- The orbit-roll valve, broadly speaking, consists of the following components: rotary type spool (3) and sleeve (5), which have the function of selecting the direction, and the Girotor set (a combination of rotor (8) and stator (9)), which acts as a hydraulic motor during normal steering operations, and as a hand pump (in fact, the operating force of the steering wheel is too high, so it cannot be operated) when the steering pump or engine have failed and the supply of oil has stopped.



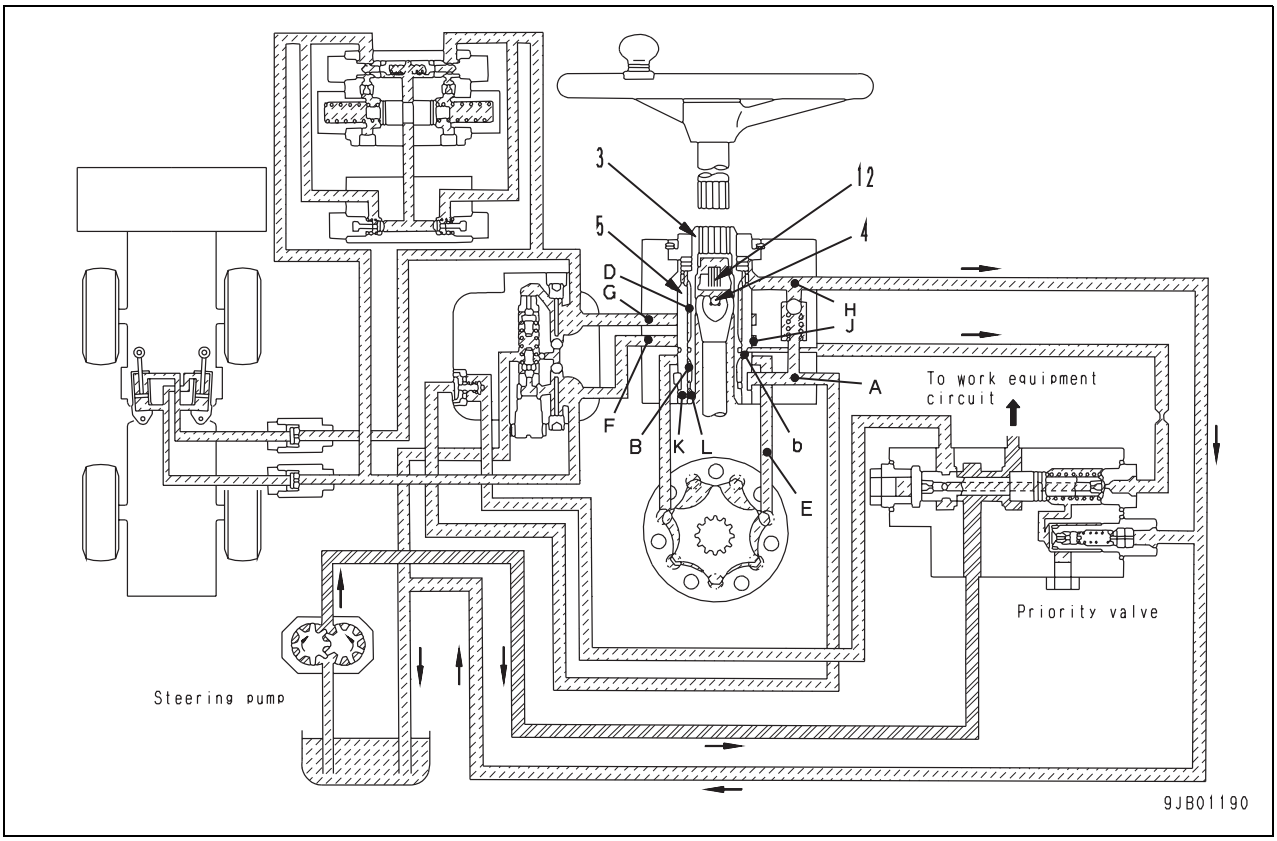

**Structure**

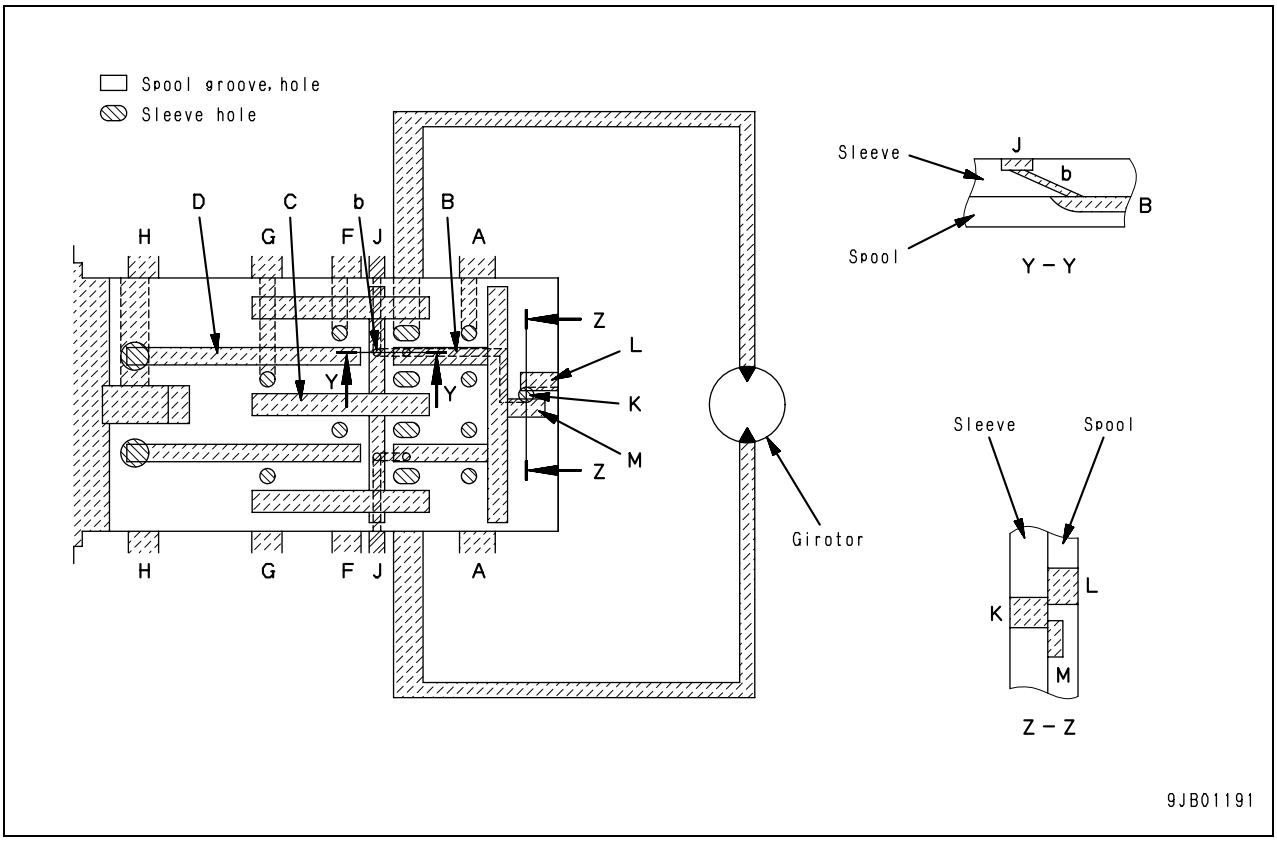
- Top (A) of spool (3) is connected to the drive shaft of the steering column and further connected to sleeve (5) through center pin (4) (which is not in contact with the spool while the steering wheel is in neutral) and centering spring (12).
- Top (B) of drive shaft (6) is engaged with center pin (4) and combined with sleeve (5) in one body, and the bottom is engaged with the spline of rotor (8) of the gerotor set.
- Valve body (2) has 5 ports, which are connected to the pump circuit, tank circuit, left steering circuit, right steering circuit, and LS circuit respectively. The ports on the pump side and tank side are connected by the check valve in the body. If the pump or engine fails, the oil can be sucked through this check valve directly from the tank side.



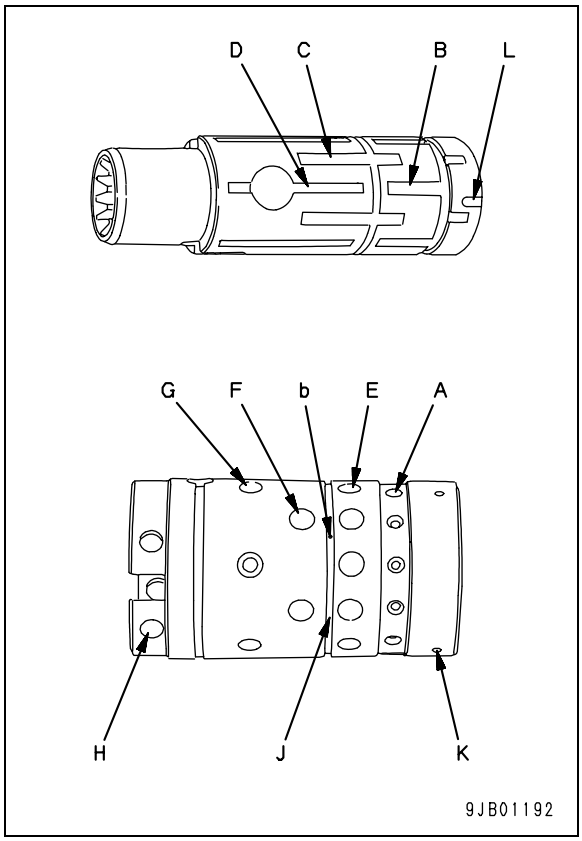
## Operation

### 1. Steering wheel at neutral

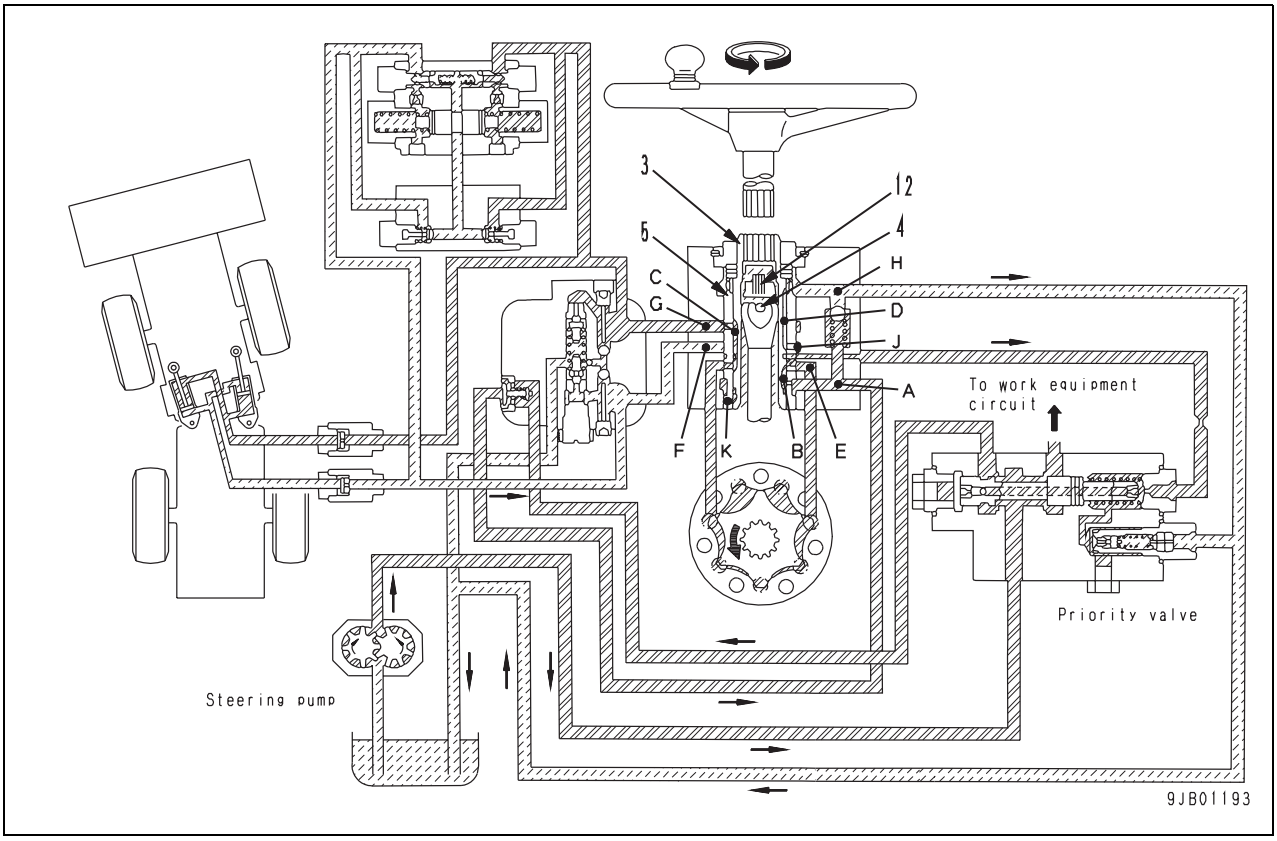


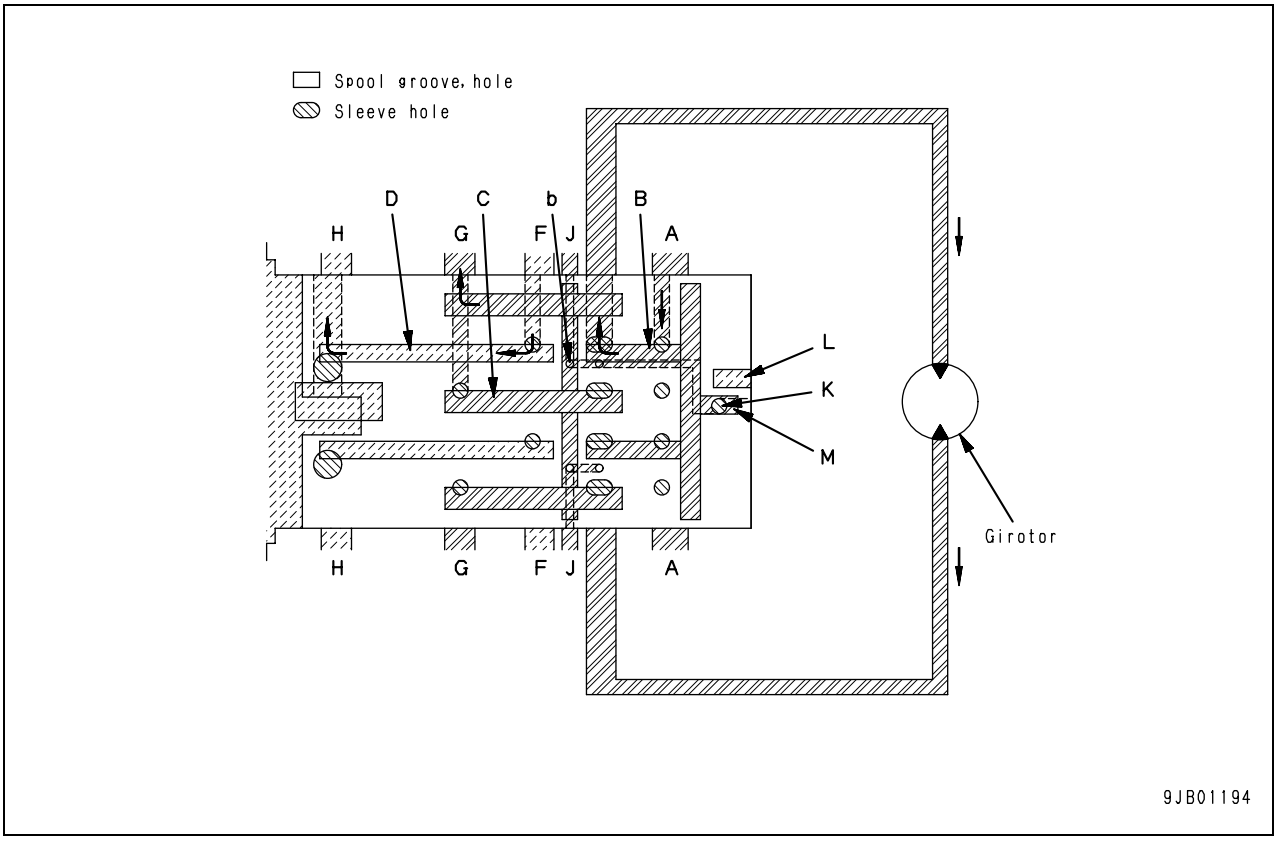



- While the steering wheel is in neutral, spool (3) and sleeve (5) are fixed at a place where center pin (4) is set to the center of the oblong hole of spool (3) by centering spring (12).
  At this time, port **A** of sleeve (5) from the pump, port **E** to gerotor, port **F** of the right steering circuit, port **G** of the left steering circuit, and vertical grooves **B**, **C**, and **D** of spool (3) are shut off.
  Orifice **b** of port **J** to the priority valve is connected to vertical groove **B** of spool (3).
  Port **K** of sleeve (5) connects port **L** of spool (3) to vertical groove **M**.
- As a result of above connection and disconnection of the ports and vertical grooves, the oil which has been set to the pilot pressure of the priority valve is drained through port **J**, orifice **b**, vertical grooves **M** and **K**, and port **L** into the hydraulic tank.



**2. Steering wheel turned (turning left)**



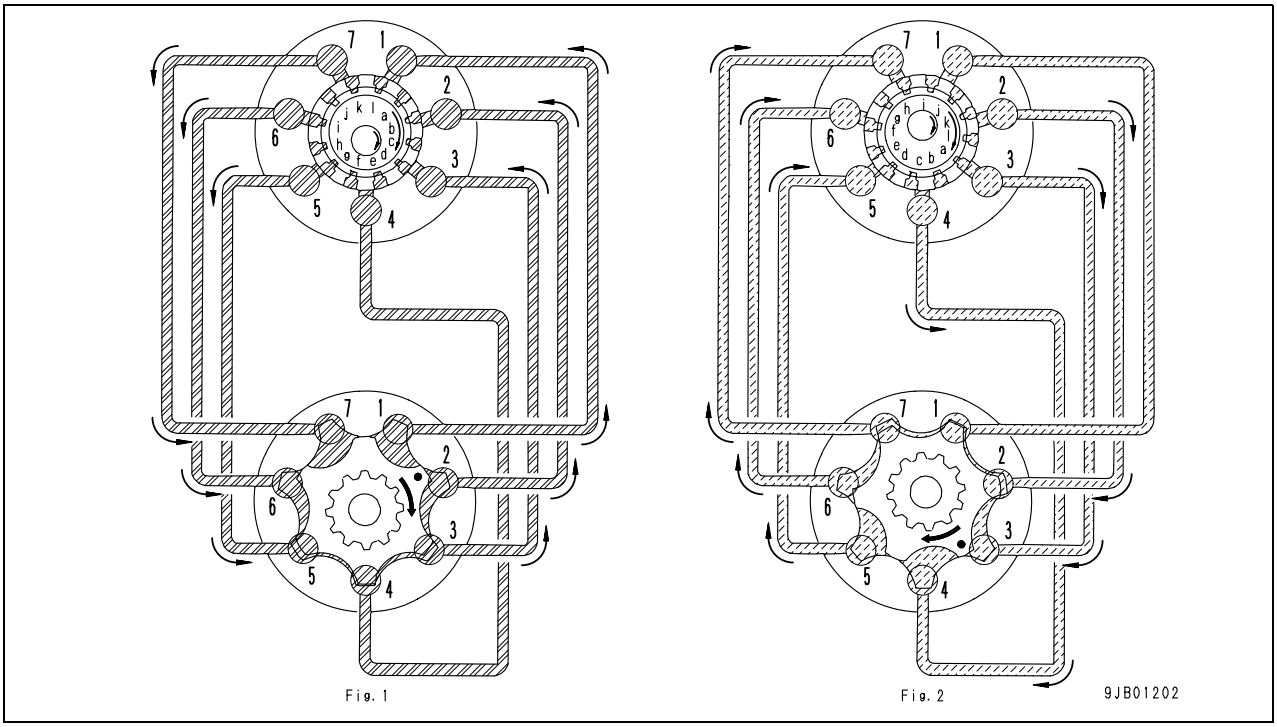



- If the steering wheel is turned to the left, spool (3) connected by the drive shaft of the steering column turns to the left.
  At this time, since spool (3) and sleeve (5) are connected by centering spring (12), spool (3) compresses centering spring.
  Accordingly, an angular displacement is made between spool (3) and sleeve (5) by the compression of centering spring (12).
  Then, port **A** is connected to vertical groove **B** first. Next, vertical groove **B** is connected to port **E**, and then port **E** is connected to vertical groove **C**, and vertical groove **C** is connected to port **G** of the left steering circuit at last.
  Orifice **b** of port **J** to vertical **B** and priority valve is kept connected, but port **K** of sleeve (5) disconnects vertical groove **M** and port **L** gradually.
  When port **A** is connected to vertical groove **B**, port **F** of the right steering circuit is connected to vertical groove **D**.
- As a result of above connection and disconnection of the ports and vertical grooves, the oil from the pump flows through port **A** to the vertical groove **B**, and then flows to port **E** to rotate the gerotor. The oil discharged from the gerotor flows through port **E**, vertical groove **C**, and port **G** to the head side of the left steering cylinder.
  The hydraulic pressure in vertical groove **M** is transmitted through orifice **b** to port **J** and used as the pilot pressure of the priority valve.
  The oil from the head side of the right steering cylinder is drained through port **F**, vertical groove **D**, and port **H** into the hydraulic tank.

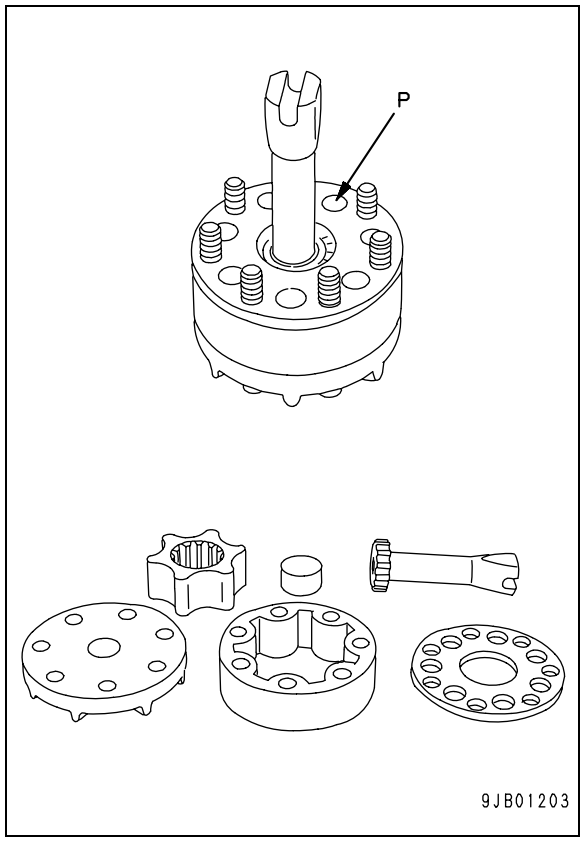
**3. Steering wheel stopped**

When the operation of steering wheel is stopped, the difference in rotation between the spool (3) and sleeve (5) is returned to the neutral condition by the reaction of centering spring (12).

**CONNECTION BETWEEN HAND PUMP AND SLEEVE**

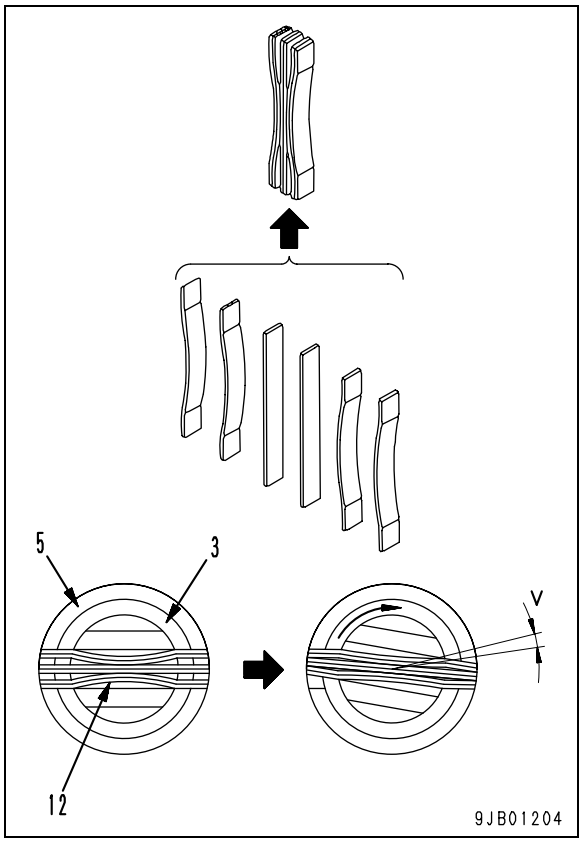



- The diagrams above show the connections with the sleeve ports used to connect the suction and discharge ports **P** of the Girotor.
- If the steering wheel has been turned to the right, ports **a**, **c**, **e**, **g**, **i**, and **k** are connected by the vertical grooves in the spool to the pump side. At the same time, ports **b**, **d**, **f**, **h**, **j**, and **l** are connected to the head end of the right steering cylinder in the same way.
  In the condition in Fig. 1, ports **1**, **2**, and **3** are the discharge ports of the Girotor set.
  They are connected to port **l**, **b**, and **d**, so the oil is sent to the steering cylinder.
  Ports **5**, **6**, and **7** are connected and the oil flows in from the pump.
  If the steering wheel is turned 90°, the condition changes to the condition shown in Fig. 2. In this case, ports **2**, **3**, and **4**, are the suction ports, and are connected to ports **k**, **a**, and **c**. Ports **5**, **6**, and **7** are the discharge ports, and are connected to ports **d**, **f**, and **h**.
- In this way, the ports acting as the discharge ports of the Girotor are connected to the ports going to the steering cylinder, while the ports acting as the suction ports are connected to the pump circuit.
- Adjustment of discharge according to amount steering wheel is turned.
  For each 1/7 turn of the steering wheel, the inside teeth of the Girotor advance one tooth, and the oil from the pump is discharged in an amount that matches this movement.
  Therefore, the amount of oil discharged is directly proportional to the amount the steering wheel is turned.

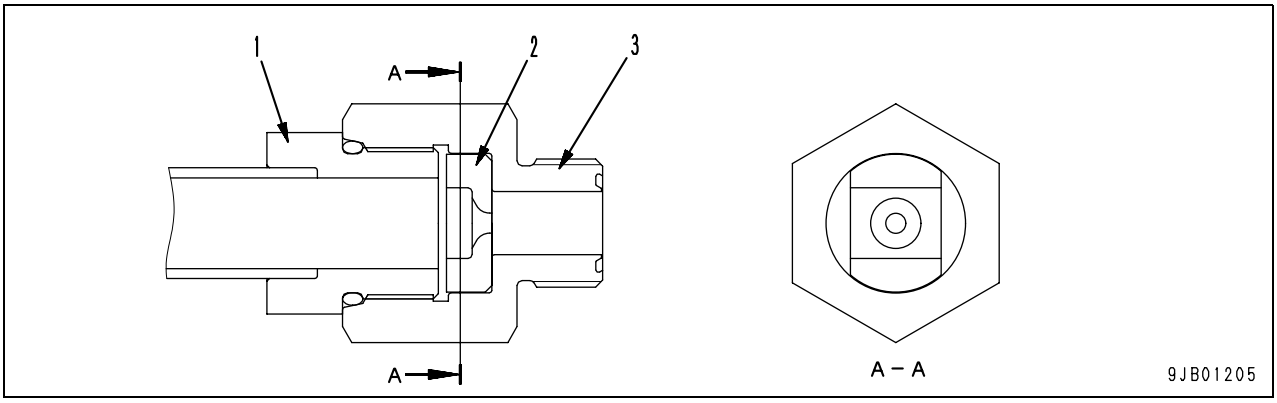


**Role of centering spring**

- Center spring (12) is composed of 4 X-shaped leaf springs and 2 flat leaf springs and installed between spool (3) and sleeve (5) as shown in the figure.
- If the steering wheel is turned, spool (3) compresses centering spring (12) and an angular displacement is made between spool (3) and sleeve (5).
  As a result, the ports of spool (3) and sleeve (5) are connected and the oil is sent to the steering cylinder. When the steering wheel stops turning, the gerotor also stops turning. Then, the oil is not sent to the steering cylinder and its pressure rises. To prevent this, when the steering wheel stops turning, it is returned by the reaction force of centering spring (12) toward the neutral position by the angular displacement of spool (3) and sleeve (5).



# 2-WAY RESTRICTOR VALVE



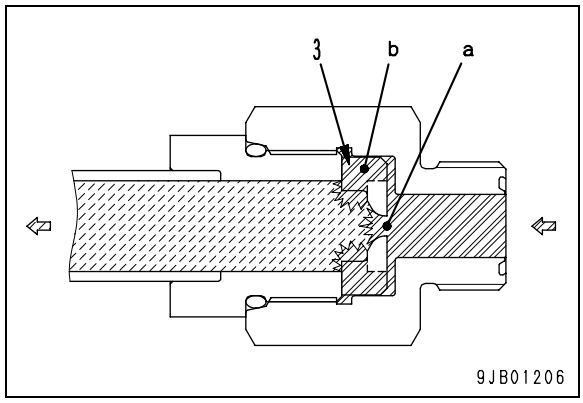

1. Tube
2. Poppet
3. Body

**Function**

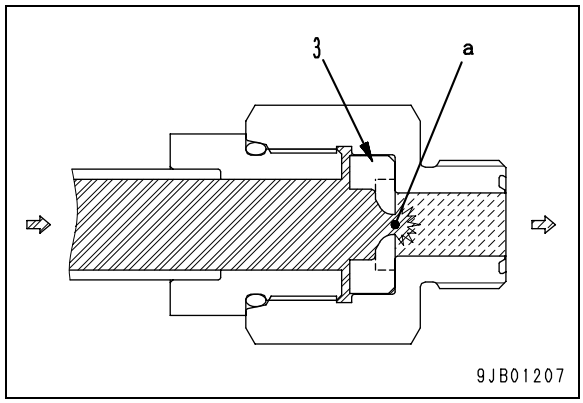
- An orifice is installed to the return circuit on the cylinder side to give pressure to the return oil and control the movement of the cylinder piston for reduction of shocks caused by inertia of the machine body when the machine is steered.

**Operation**

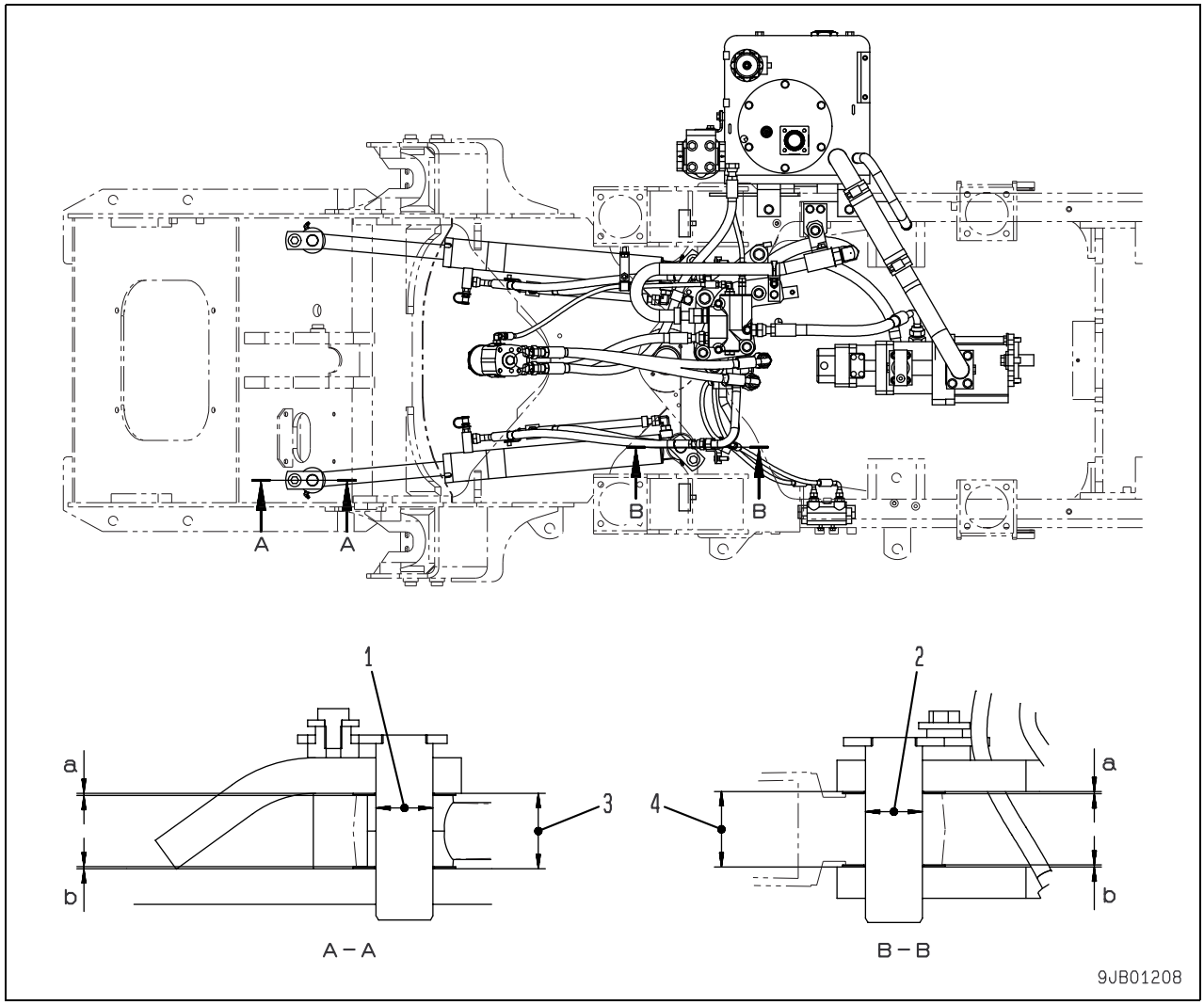
- When the oil flows to the left (to move the cylinder forward), it pushes poppet (3) open and flows through orifice (a) of poppet (3) and notch (b).




- When the oil flows to the right (to move the cylinder backward), it flows through only orifice (a) of poppet (3). Accordingly, the oil flow rate is restricted.

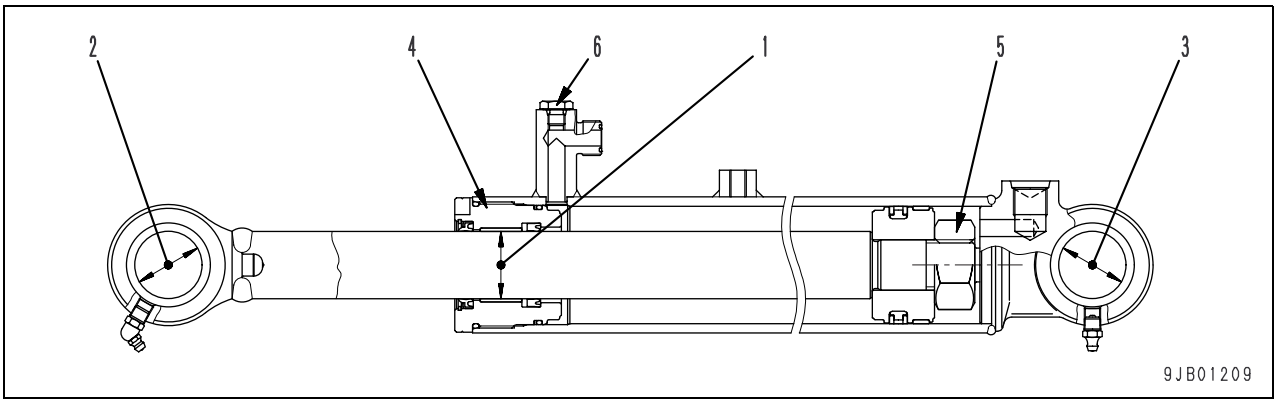


# STEERING CYLINDER




Unit: mm

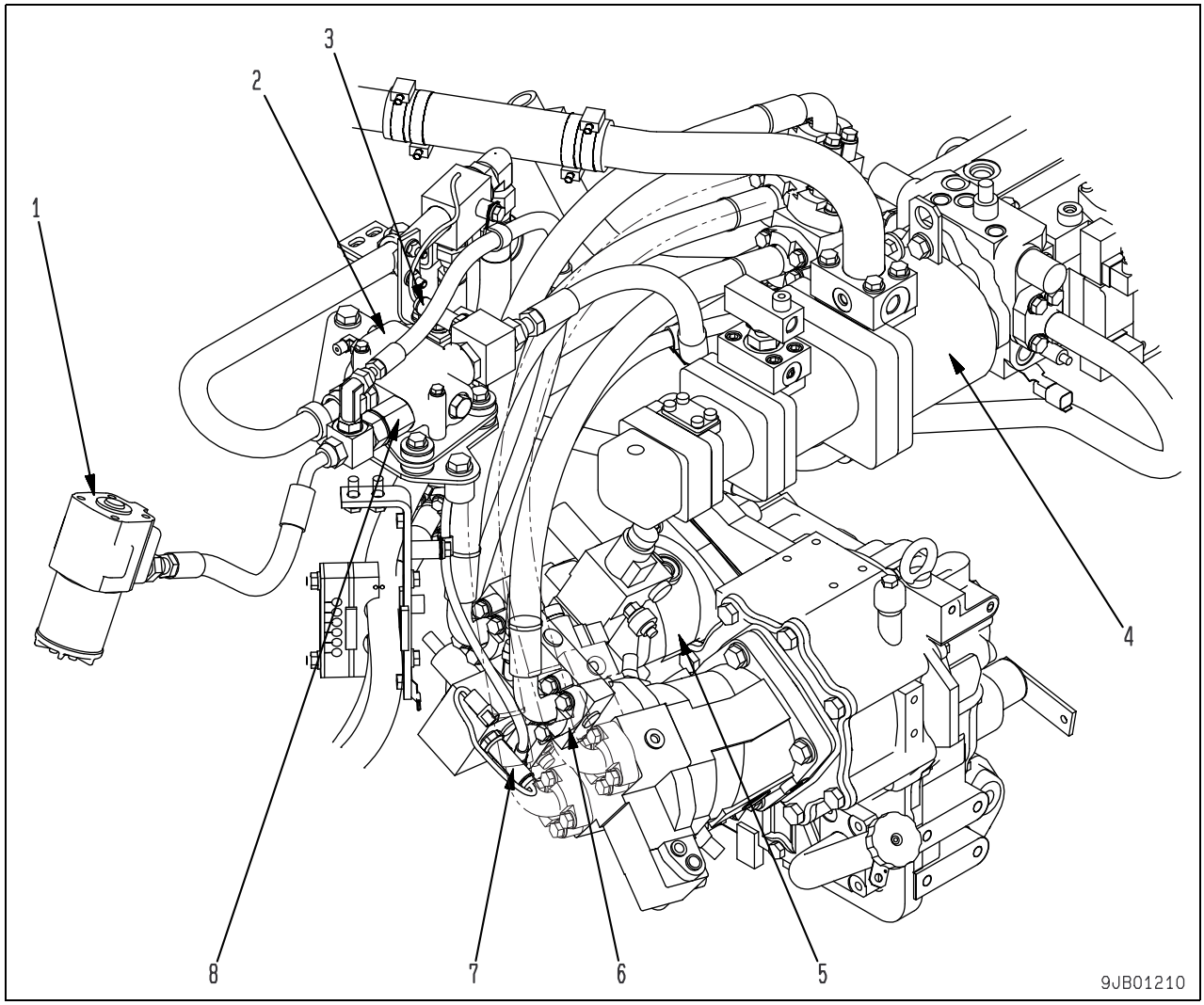
| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 1 | Clearance between mounting pin and bushing at connection of frame and cylinder rod | Standard size | Tolerance | | Standard Clearance | Clearance limit | Replace |
| | | | Shaft | Hole | | | |
| | | ø 40 | 0<br>-0.025 | +0.180<br>+0.042 | 0.042 – 0.205 | — | |
| 2 | Clearance between mounting pin and bushing at connection of frame and cylinder bottom | ø 40 | 0<br>-0.025 | +0.180<br>+0.042 | 0.042 – 0.205 | — | |
| 3 | Connection of steering cylinder and front frame | Width of boss | Width of hinge | | Standard clearance (a + b) | | |
| | | 50 | 53 | | Max. 0.5 (after adjusting shim) | | |
| 4 | Connection of steering cylinder and rear frame | 50 | 53 | | Max. 0.5 (after adjusting shim) | | |




Unit: mm

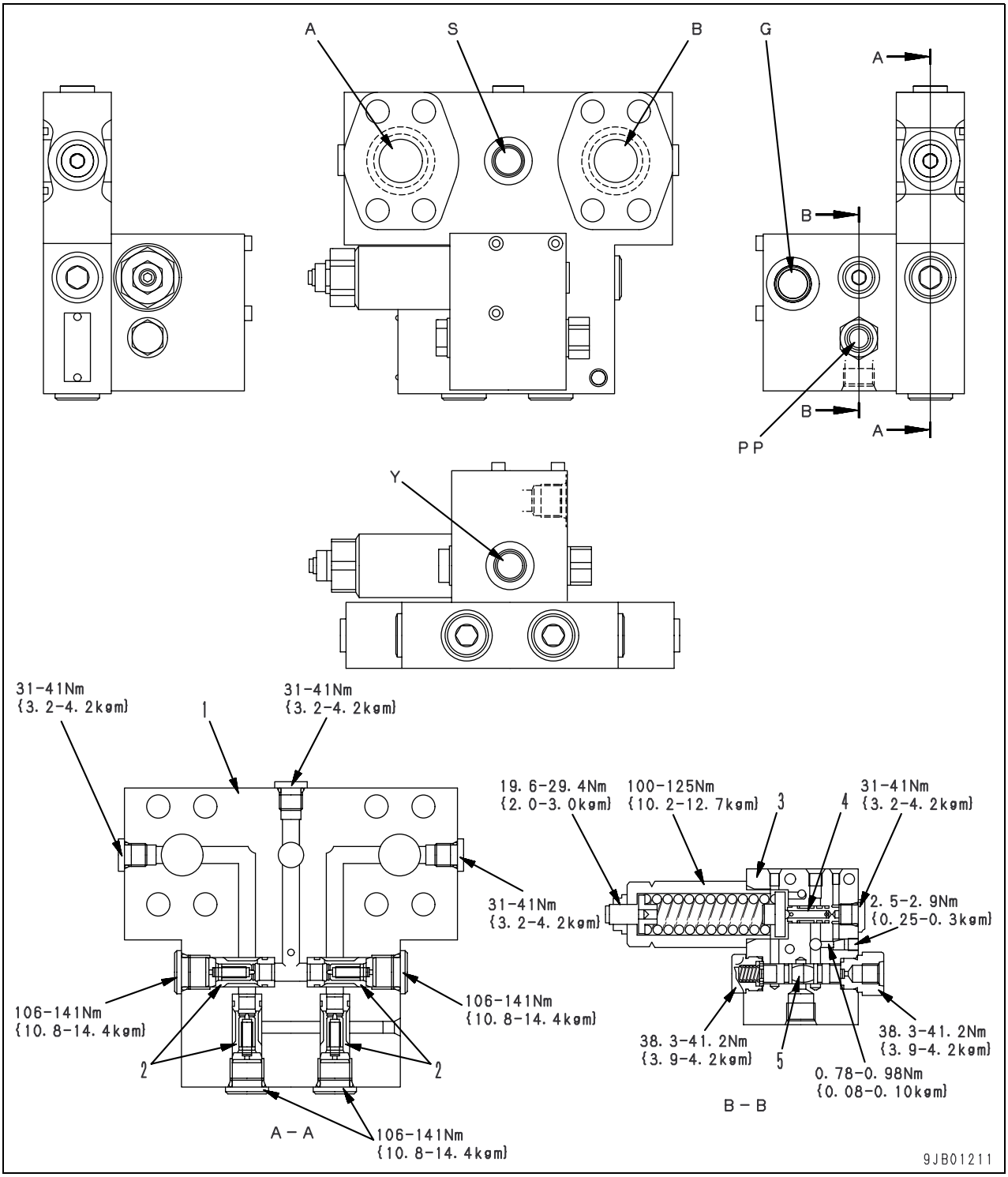
| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 1 | Clearance between piston rod and bushing | Standard size | Tolerance | | Standard Clearance | Clearance limit | Replace pin, bushing |
| | | | Shaft | Hole | | | |
| | | ø 40 | -0.025<br>-0.087 | +0.132<br>+0.006 | 0.031 – 0.219 | 0.519 | |
| 2 | Clearance between piston rod support shaft and bushing | ø 40 | 0<br>-0.025 | +0.180<br>+0.042 | 0.042 – 0.205 | 1.0 | |
| 3 | Clearance between cylinder bottom support shaft and bushing | ø 40 | 0<br>-0.025 | +0.180<br>+0.042 | 0.042 – 0.205 | 1.0 | |
| 4 | Tightening torque of cylinder head | 539 ± 53.9 Nm {55 ± 5.5 kgm} | | | | | Tighten |
| 5 | Tightening torque of cylinder piston | 785 ± 78.5 kNm {80 ± 8.0 kgm} (Width across flats: 46 mm) | | | | | |
| 6 | Tightening torque of nipple plug on cylinder head side | 9.8 – 12.74 Nm {1.0 – 1.3 kgm} | | | | | |

# EMERGENCY STEERING PIPING




1. Orbit-roll valve
2. Priority valve
3. Pressure switch (for detecting drop of steering oil pressure)
4. Steering pump
5. HST motor 2
6. Emergency steering valve
7. Pressure switch (For detecting operation of emergency steering)
8. Check valve

# EMERGENCY STEERING VALVE

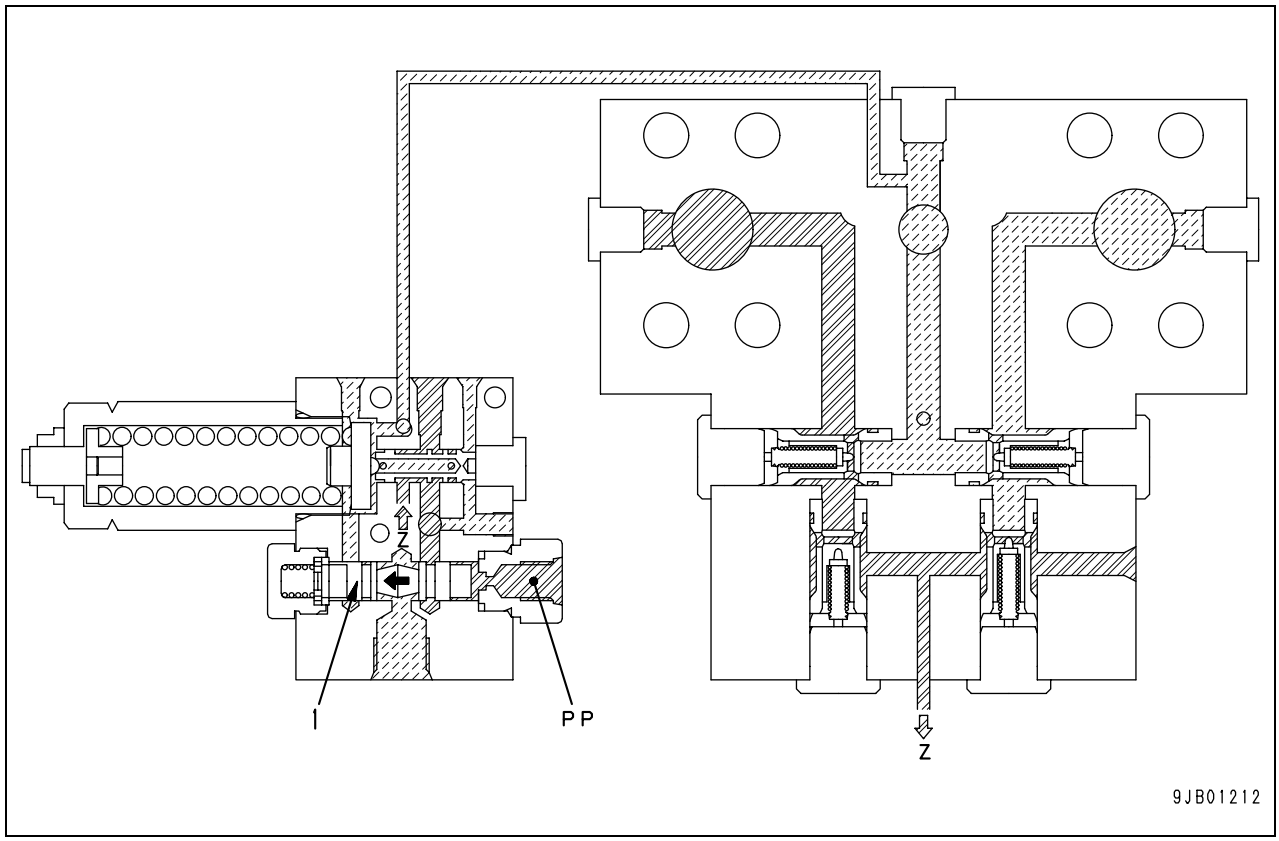



PP: From steering pump
A: To port A of HST motor 2
B: To port B of HST motor 2
Y: To orbit-roll valve
S: To hydraulic tank
G: To pressure switch

1. Check valve body
2. Check valve
3. Valve body
4. Pressure reducing valve
5. Selector valve

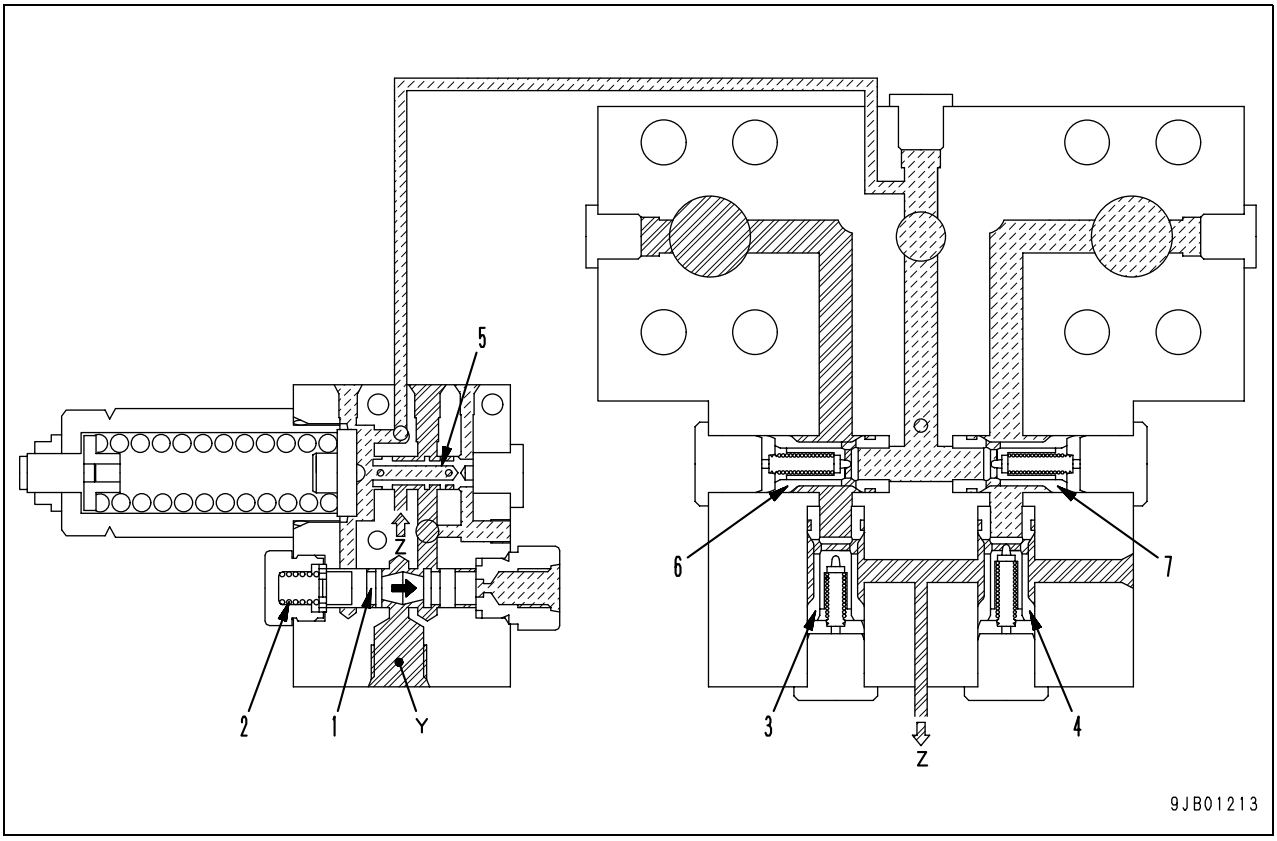
**Operation**

**When engine and steering pump are normal**




- While the engine and steering pump are operating normally, the oil sent from the steering pump flows into the orbit-roll valve to steer the machine.
- At this time, the oil from the steering pump flows in port **PP** and pushes spool (1) to the left to shut off the circuit from the HST motor to the orbit-roll valve.

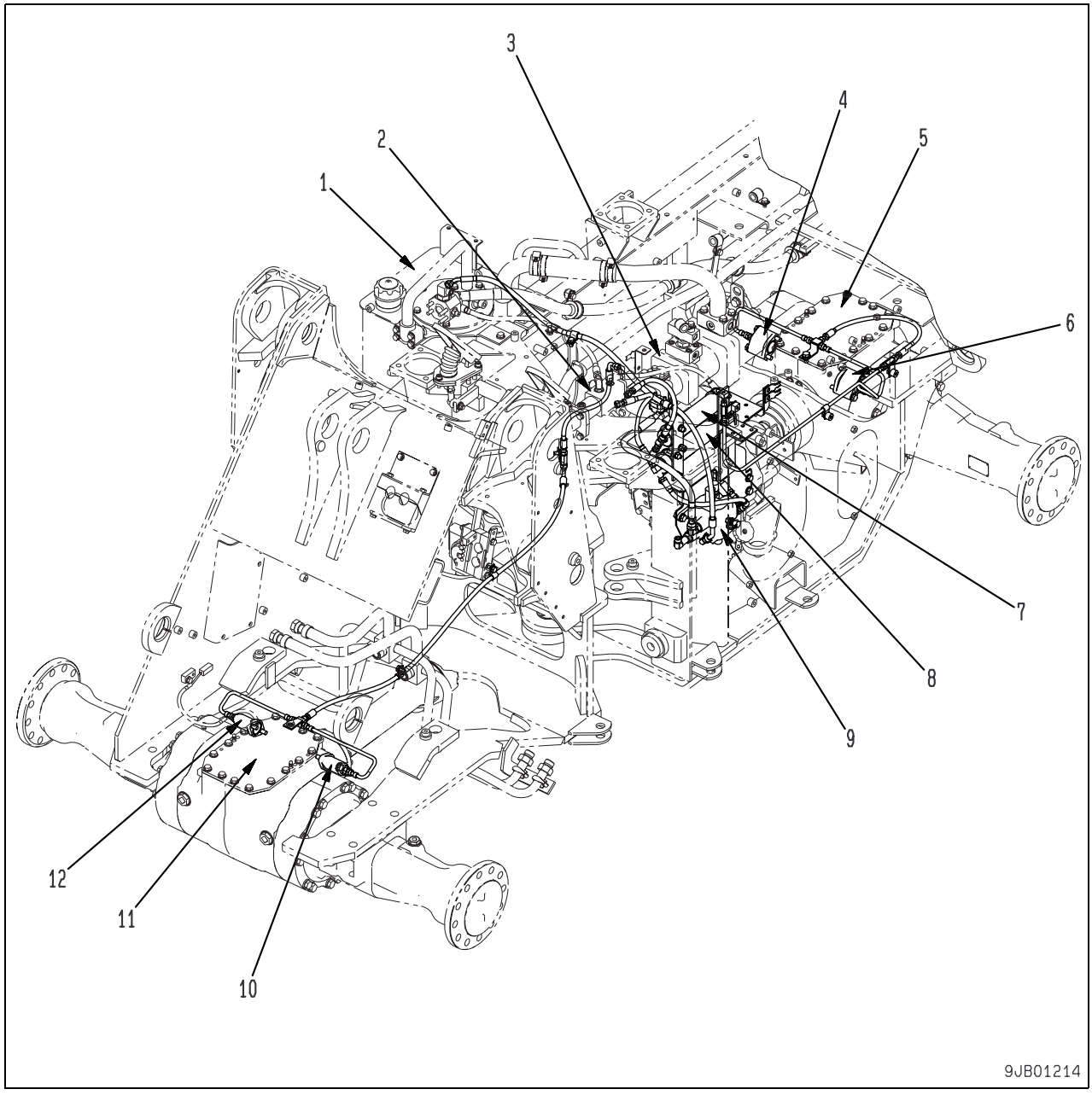
**When engine or steering pump is abnormal**




- If the engine or steering pump has a trouble and the steering pump does not supply oil sufficiently to the orbit-roll valve during travel, the discharge pressure of the steering pump lowers and spool (1) is pushed back to the right by the reaction force of spring (2).
- At this time, the oil from the HST motor is set high by check valves (3) and (4). Then, the oil is reduced in pressure by pressure reducing valve (5) to a proper level for the steering circuit and it flows through spool (1) and port **Y** to the orbit-roll valve. As a result, the machine can be steered.
- If the quantity of the oil in the HST circuit becomes insufficient because of oil leakage into the steering circuit, etc., check valves (6) and (7) add oil to the HST circuit.

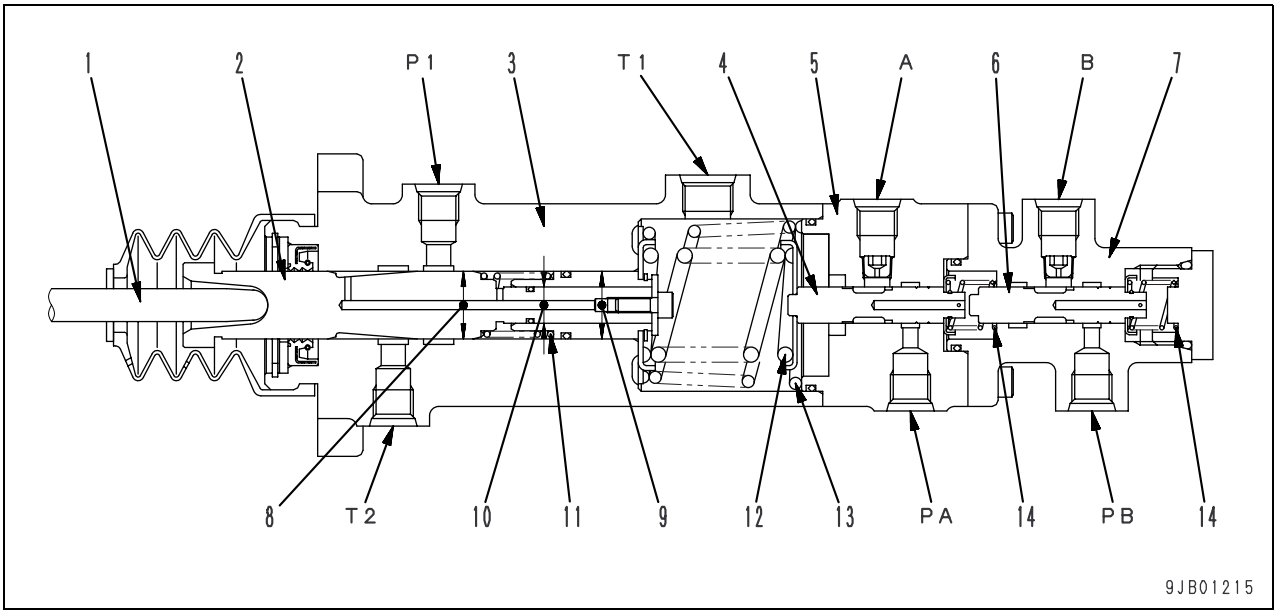
★ Check valves (3) and (4) work so that the emergency steering system will operate regardless of the travel direction.

# BRAKE PIPING




1. Hydraulic tank
2. Brake valve
3. Brake and cooling fan pump
4. Slack adjuster (for right rear)
5. Rear brake
6. Slack adjuster (for left rear)
7. Accumulator (for front)
8. Accumulator (for rear)
9. Charge valve
10. Slack adjuster (for left front)
11. Front brake
12. Slack adjuster (for right front)

# BRAKE VALVE




P1: From HST pump
T1: To hydraulic tank
T2: To steering pump (Suction side)
PA: From accumulator (Rear side)
A: To rear brake
PB: From accumulator (Front side)
B: To front brake

1. Rod
2. Inching valve spool
3. Inching valve body
4. Brake valve spool (for rear)
5. Brake valve body (for rear)
6. Brake valve spool (for front)
7. Brake valve body (for front)

Unit: mm

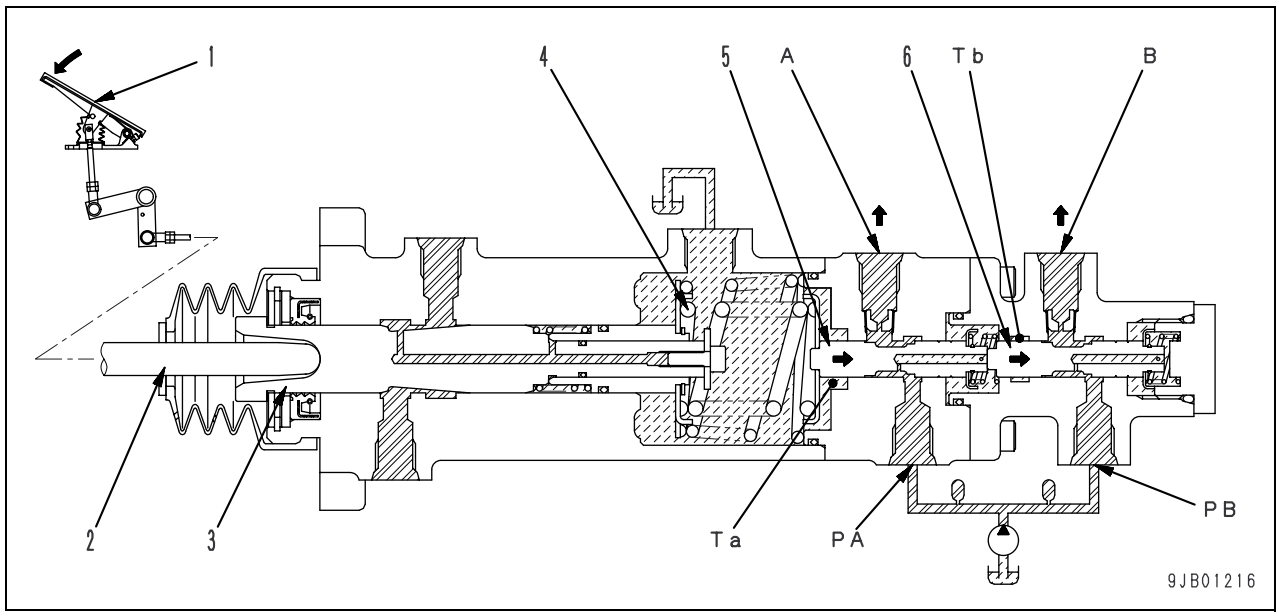
| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 8 | Clearance between inching valve spool and body | Standard size | Tolerance | | Standard clearance | Clearance limit | Replace |
| | | | Shaft | Hole | | | |
| | | ø 22.4 | -0.022<br>-0.053 | +0.033<br>0 | 0.020 –<br>0.086 | 0.096 | |
| 9 | Clearance between inching valve guide and body | ø 22.4 | -0.022<br>-0.053 | +0.033<br>0 | 0.020 –<br>0.086 | 0.096 | |
| 10 | Clearance between inching valve spool and guide | ø 12 | -0.050<br>-0.093 | +0.050<br>0 | 0.050 –<br>0.143 | 0.157 | |
| 11 | Inching valve control spring | Standard size | | | Repair limit | | |
| | | Free length | Installed length | Installed load | Free length | Installed load | |
| | | 34.7 | 16.7 | 24.5 N<br>{2.5 kg} | – | 20.8 N<br>{2.1 kg} | |
| 12 | Brake valve control spring | 35.6 | 24.0 | 113 N<br>{11.5 kg} | – | 96 N<br>{9.8 kg} | |
| 13 | Inching valve return spring | 50.0 | 49.5 | 19.6 N<br>{2.0 kg} | – | 16.7 N<br>{1.7 kg} | |
| 14 | Brake valve return spring | 114.9 | 52.4 | 147 N<br>{15.0 kg} | – | 125 N<br>{12.7 kg} | |

**Outline**

- The brake valve is installed under the front of the operator's seat. If either brake pedal is pressed, oil flows to the brake piston to operate the brake.
- Both brake pedals are connected mechanically to each other. If either of them is pressed, the other moves, too.
- The brake valve has an inching valve in it to control the control pressure of the HST pump.

**Operation**

**1. When brake pedal is pressed**

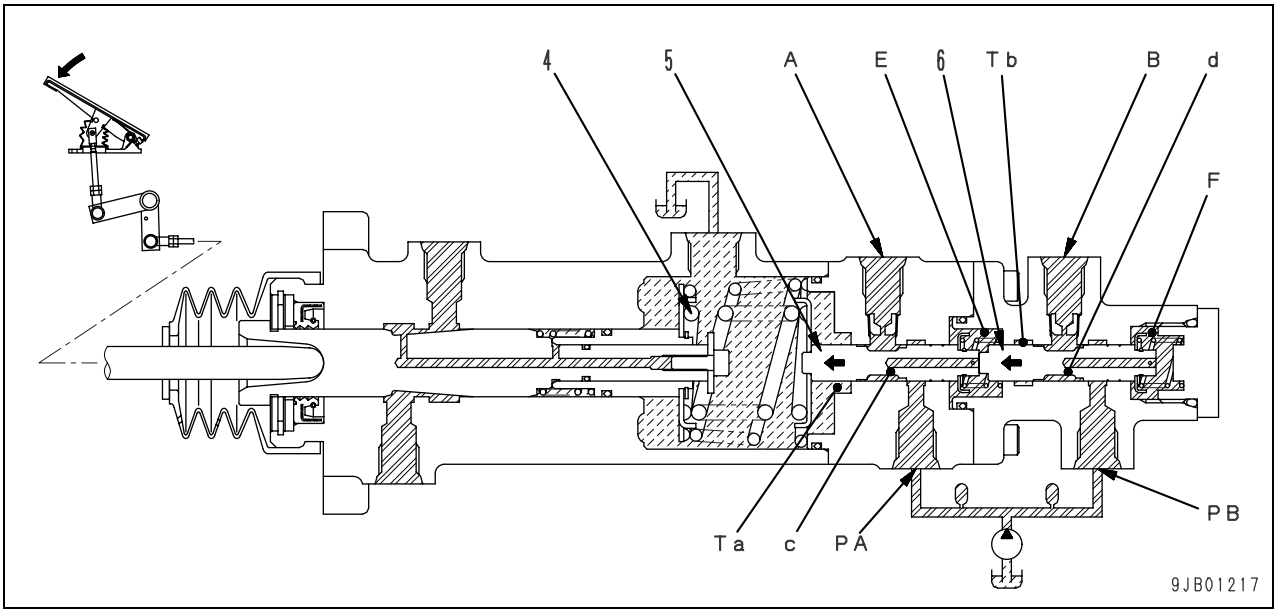



- If brake pedal (1) is pressed, the pressing force is transmitted through rod (2), spool (3), and spring (4) to spool (5).
- If spool (5) is pushed to the right, port **Ta** is closed and the oil from the pump flows through the accumulator, port **PA**, and port **A** to the rear brake piston to operate the rear brake.
- At the time when spool (5) is pushed to the right, spool (6) is also pushed to the right to close port **Pb**. As a result, the oil from the pump flows through the accumulator, port **PB**, and port **B** to the front brake piston to operate the front brake.

**When only either brake operates (When either brake fails)**

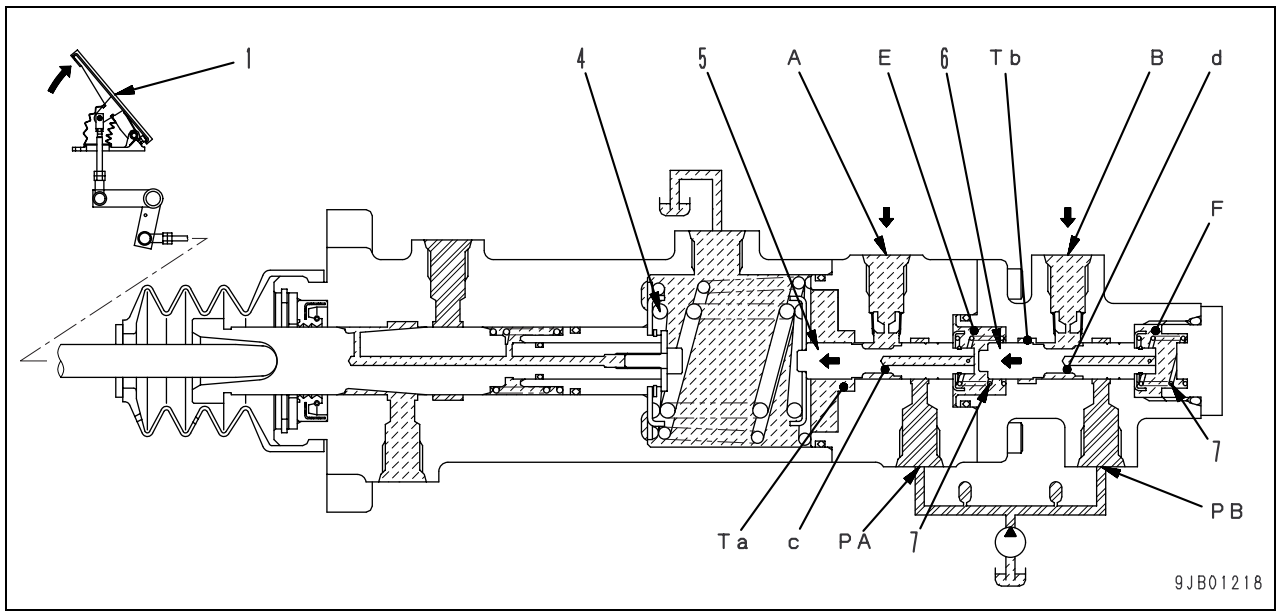
- Even if only either brake operates because of oil leakage, etc. in the front or rear brake system, the pressing force of brake pedal (1) moves spools (5) and (6) mechanically to the right. Accordingly, the oil from the pump flows normally to the brake piston of the normal system to operate the brake and stop the machine. With this mechanism, safety is heightened.

**2. When balanced**



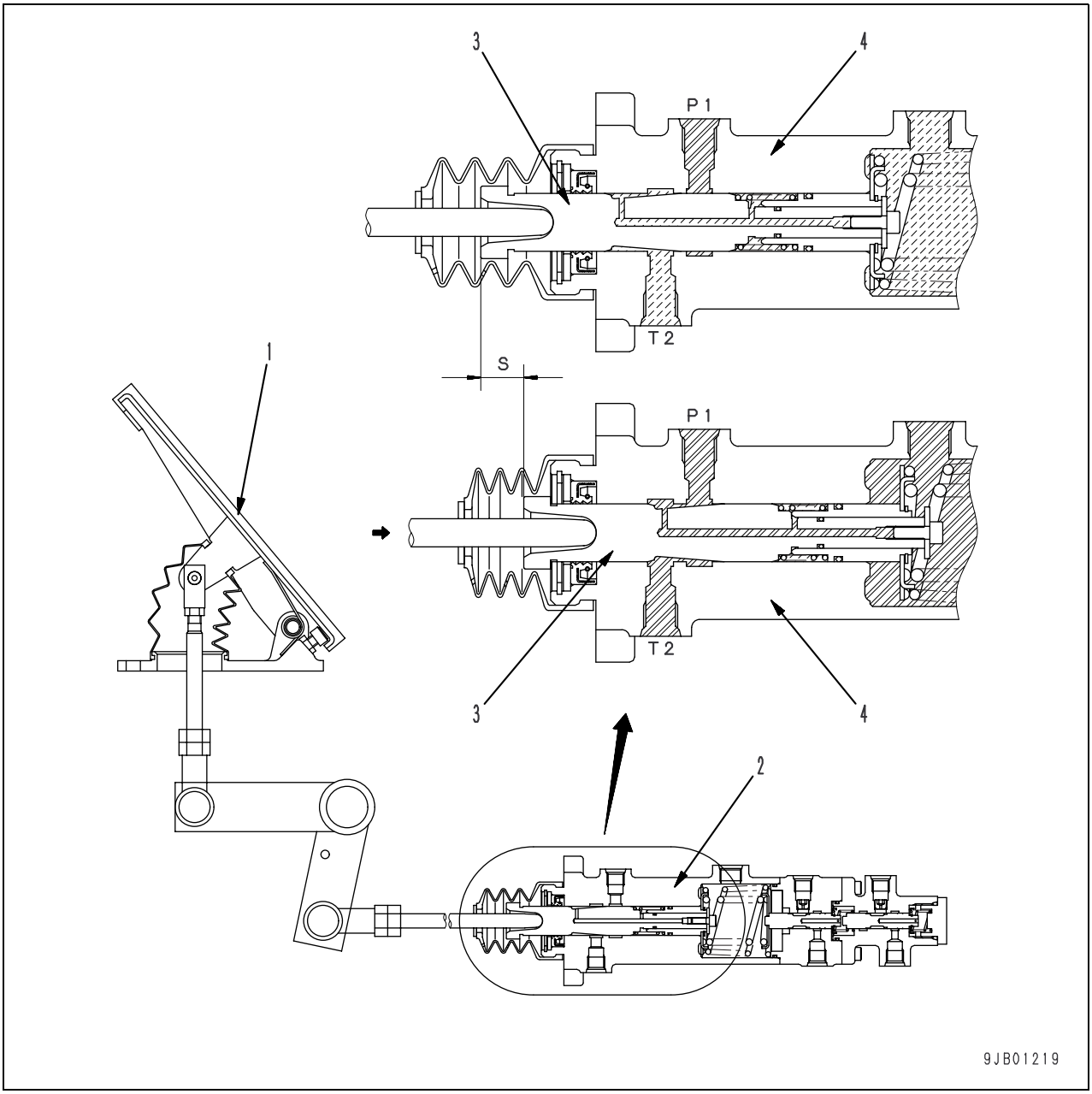

- If the rear brake piston is filled with oil and the oil pressure between ports **PA** and **A** rises, the oil flowing through orifice **c** of spool (5) into chamber **E** pushes back spool (5) to the left against spring (4) and close ports **PA** and **A** from. Since port **Ta** is kept closed at this time, the oil which flowed into the brake piston is held and the brake is kept operated.
- At the time when spool (5) is pushed to the left, the front brake piston is filled with oil and the pressure between ports **PB** and **B** rises. As a result, the oil which flowed through orifice **d** of spool (6) into chamber **F** pushes back spool (6) to the left by the moving distance of spool (5) to close ports **PB** and **B**. Since port **Tb** is kept closed, the oil which flowed into the brake piston is held and the brake is kept operated.
- The oil pressure in the rear brake circuit (on port **A** side) is balanced with the pressing force of the brake pedal. The oil pressure in the front brake circuit (on port **B** side) is balanced with the oil pressure in the rear brake circuit (on port **A** side).
  If spools (5) and (6) move to the right stroke end, the passes between ports **PA** and **A** and between ports **PB** and **B** are fully open and the oil pressure in the rear and front brake circuits is equal to the oil pressure from the pump. Accordingly, the operator can adjust the braking force with the brake pedal until spool (5) and (6) move to the right stroke end.

### 3. When brake pedal is released




- If brake pedal (1) is released, the pedal pressing force applied to spool (5) is lost.
- Spool (5) is pushed back to the left by the back pressure of the rear brake piston and reaction force of spring (7). Consequently, port **PA** is closed and the oil in the rear brake piston flows through ports **A** and port **Ta** into the hydraulic tank and the rear brake is released.
- At the time when spool (5) moves to the left, spool (6) is also pushed back to the left by the back pressure of the front brake piston and reaction force of spring (7). Consequently, port **PB** is closed and the oil in the front brake piston flows through ports **B** and **Tb** into the hydraulic tank and the front brake is released.

# INCHING VALVE



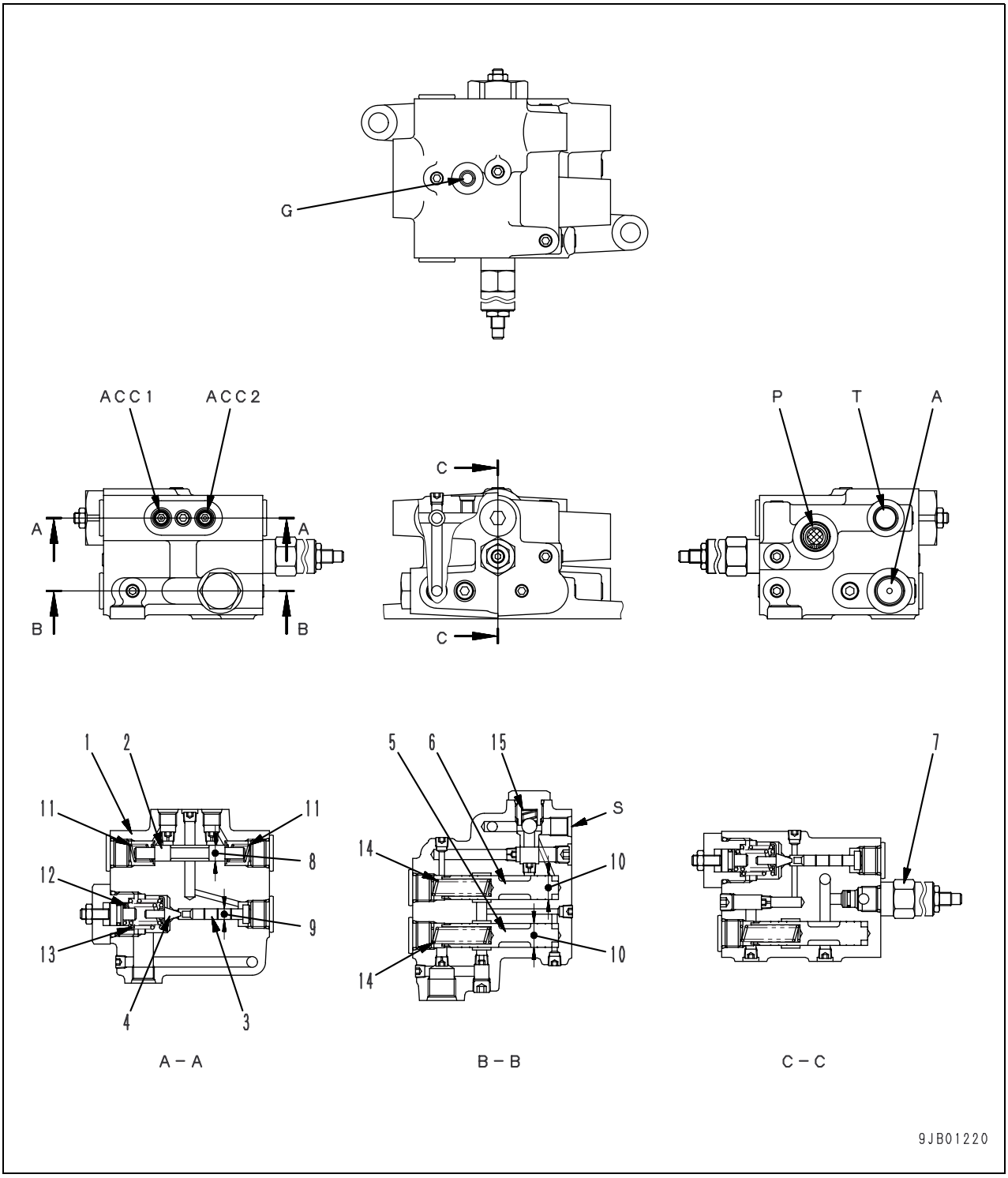

P1: From port Y of HST pump
T2: To steering pump (Suction side)

1. Brake pedal
2. Brake valve
3. Spool
4. Body

**Outline**

- The inching valve is built in brake valve (2). It reduces the control oil pressure of the HST circuit to reduce the capacity of the HST pump according to stroke (S) of spool (3).

# CHARGE VALVE



P: From brake and cooling fan pump
T: To hydraulic tank
A: To cooling fan motor
ACC1: To accumulator (Rear side)
ACC2: To accumulator (Front side)
S: Brake operation sensor port
G: Gauge port

1. Valve body
2. Inverse shuttle valve
3. Plunger
4. Unload relief valve
5. Flow control valve
6. Unload valve
7. Relief valve

Unit: mm

<table>
<tr><th rowspan="2">No.</th><th rowspan="2">Check item</th><th colspan="5">Criteria</th><th rowspan="2">Remedy</th></tr>
<tr><td rowspan="2">Standard size</td><td colspan="2">Tolerance</td><td rowspan="2">Standard clearance</td><td rowspan="2">Clearance limit</td></tr>
<tr><td rowspan="2">8</td><td rowspan="2">Clearance between inverse shuttle valve spool and body</td><td>Shaft</td><td>Hole</td></tr>
<tr><td>ø 12</td><td>-0.006<br>-0.014</td><td>+0.011<br>0</td><td>0.006 – 0.025</td><td>0.029</td><td rowspan="9">Replace</td></tr>
<tr><td>9</td><td>Clearance between plunger and body</td><td>ø 8</td><td>-0.005<br>-0.012</td><td>+0.009<br>0</td><td>0.005 – 0.021</td><td>0.024</td></tr>
<tr><td>10</td><td>Clearance between flow control valve, unload valve spool and body</td><td>ø 18</td><td>-0.006<br>-0.017</td><td>+0.011<br>0</td><td>0.006 – 0.028</td><td>0.032</td></tr>
<tr><td rowspan="3">11</td><td rowspan="3">Inverse shuttle valve return spring</td><td colspan="3">Standard size</td><td colspan="2">Repair limit</td></tr>
<tr><td>Free length</td><td>Installed length</td><td>Installed load</td><td>Free length</td><td>Installed load</td></tr>
<tr><td>21.6</td><td>18.3</td><td>9.8 N<br>{1.0 kg}</td><td>–</td><td>8.3 N<br>{0.85 kg}</td></tr>
<tr><td>12</td><td>Unload relief valve return spring (inside)</td><td>35.9</td><td>30.0</td><td>188 N<br>{19.2 kg}</td><td>–</td><td>160 N<br>{16.3 kg}</td></tr>
<tr><td>13</td><td>Unload relief valve return spring (outside)</td><td>39.8</td><td>27.5</td><td>137 N<br>{14.0 kg}</td><td>–</td><td>116 N<br>{11.8 kg}</td></tr>
<tr><td>14</td><td>Flow control valve, unload valve spool return spring</td><td>51.6</td><td>45.0</td><td>49 N<br>{5.0 kg}</td><td>–</td><td>42 N<br>{4.3 kg}</td></tr>
<tr><td>15</td><td>Check valve return spring</td><td>11.5</td><td>9.0</td><td>4.9 N<br>{0.5 kg}</td><td>–</td><td>4.2 N<br>{0.43 kg}</td></tr>
</table>

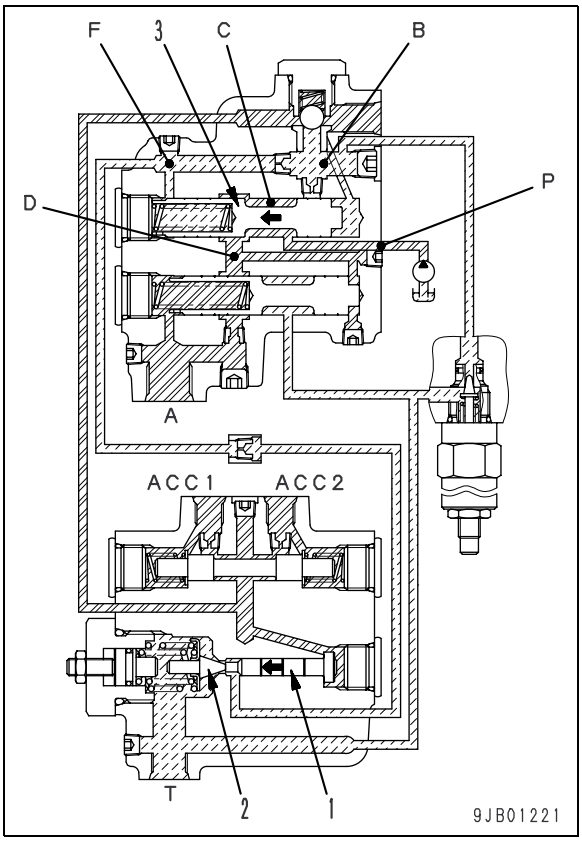
**Function**

- The charge valve keeps the oil pressure from the pump to the set pressure and stores it in the accumulator.
- If the oil pressure rises above the set pressure, the oil from the pump is led to the drain circuit to reduce the load on the pump.

**Operation**

**1. When oil is not supplied to accumulator (Cut-out state)**

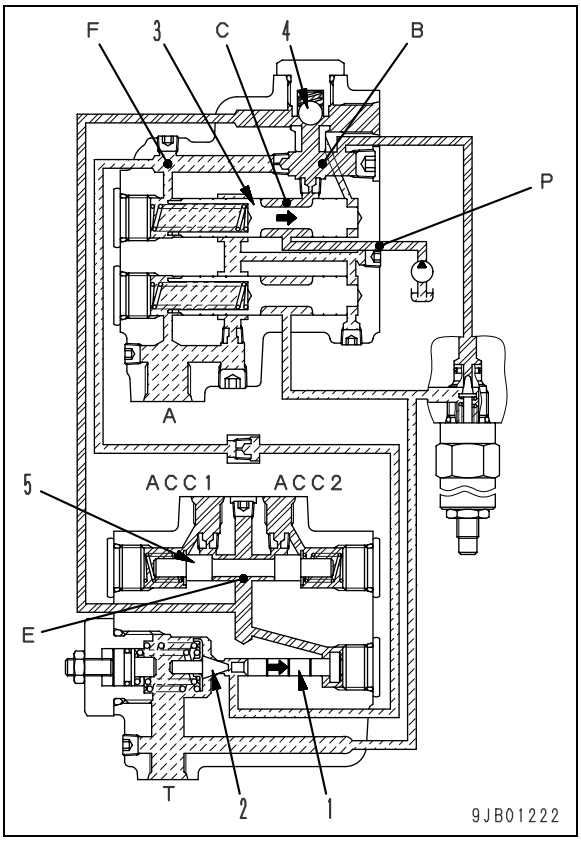
- Plunger (1) is moved by the pressure of the accumulator to the left to keep unload relief valve (2) pushed open.
- The oil in the spring chamber of unload valve (3) flows through port **F**, unload relief valve (2), and port **T** into the hydraulic tank.
- Since the oil pressure in port **F** lowers, unload valve (3) is moved by the oil pressure in chamber **B** to the left.
- Accordingly, ports **C** and **D** are connected to each other and almost all the oil from the pump flows through ports **P**, **C**, **D** and **A** to the cooling fan motor.



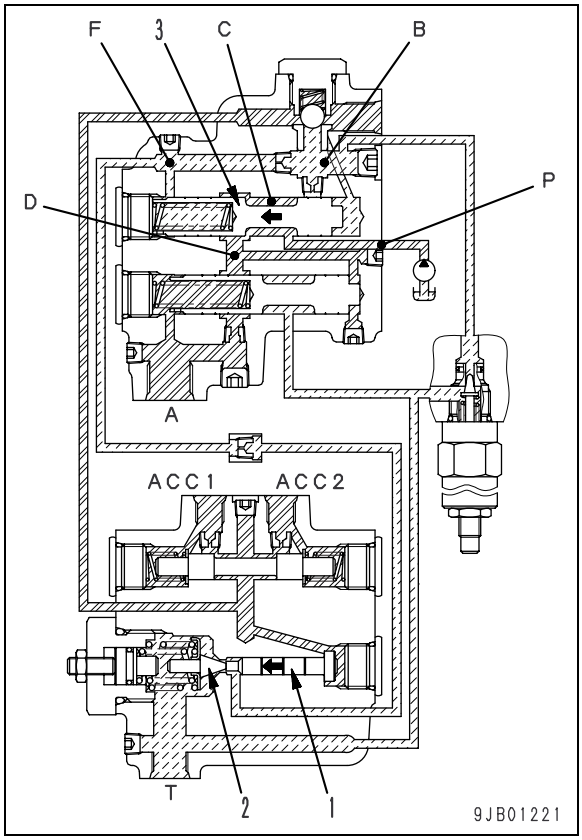

**2. When oil is supplied to accumulator**

1) Cut-in state

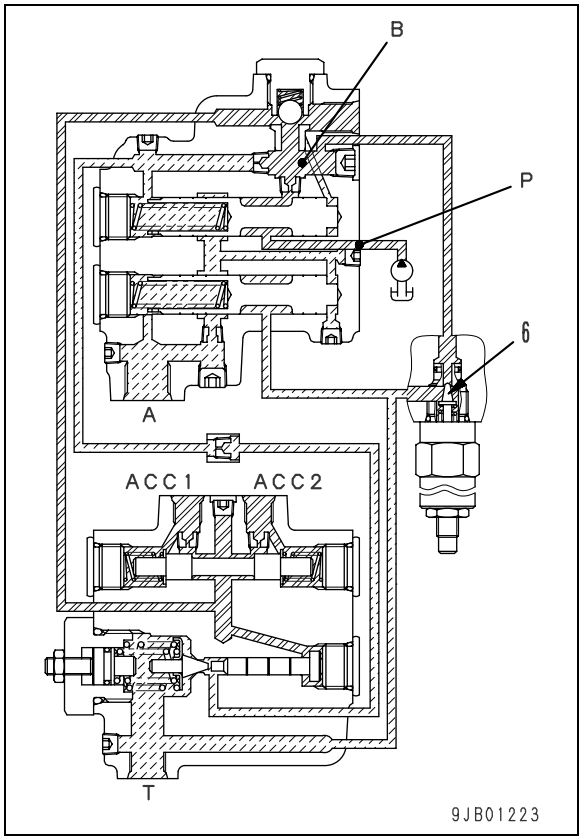
- If the accumulator pressure lowers, the pressure in port **E** lowers and plunger (1) moves to the right and unload relief valve (2) closes the drain circuit.
- Accordingly, the oil pressure in port **F** and the spring chamber of unload relief valve (3) rises and unload relief valve (3) moves to the right.
- As a result, ports **C** and **B** are connected to each other and the oil from the pump flows to port **B**.
- If the oil pressure in port **B** exceeds the set pressure of check valve (4), it pushes check valve (4) open and flows to port **E** to start heightening the pressure in the accumulator. The supply pressure for the accumulator is decided by the set pressure of check valve (4).
- A set quantity of oil is supplied to the accumulator, regardless of the engine speed, and the excessive oil flows through port **A** to the cooling fan motor.
- The oil flowing to port **E** is supplied first to the accumulator having the lowest pressure by inverse shuttle valve (5).



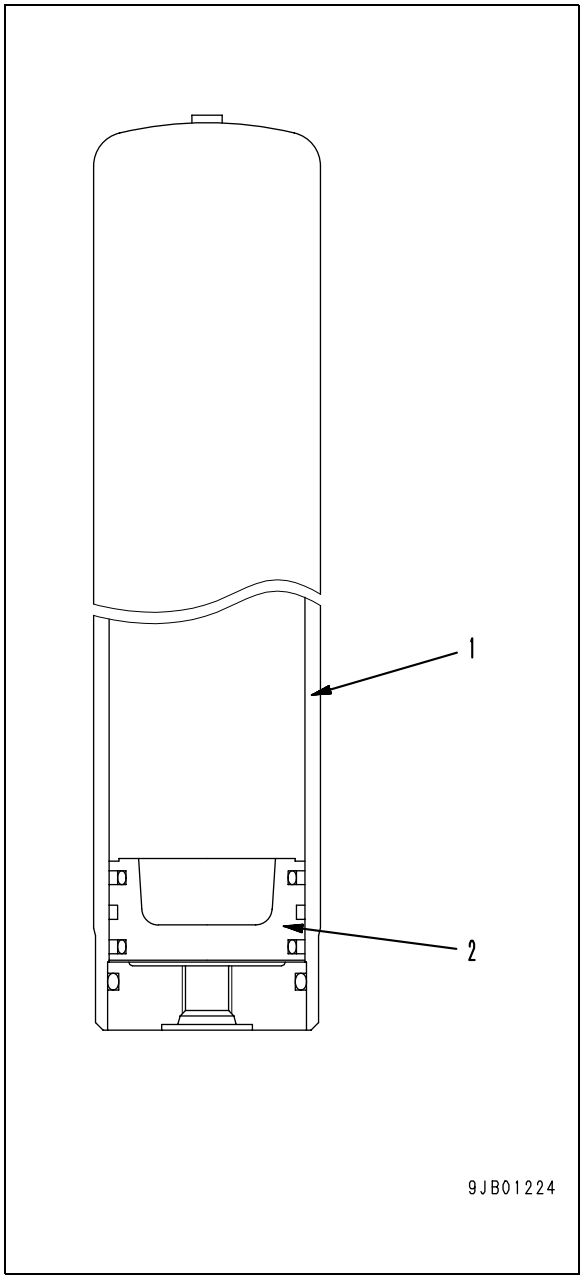
2) Cut-out state
   - If the pressure in port **F** reaches the set pressure (cut-out pressure) of unload relief valve (2), the oil in the spring chamber of unload valve (3) flows through port **F**, unload relief valve (2), and port **T** to the hydraulic tank.
   - Plunger (1) is moved to the left by the pressure of the accumulator to keep unload relief valve (2) pushed open.
   - Since the oil pressure in port **F** lowers, unload valve (3) is moved by the oil pressure in chamber **B** to the left.
   - Accordingly, ports **C** and **D** are connected to each other and almost all the oil from the pump flows through ports **P**, **C**, **D** and **A** to the cooling fan motor.




**3. When input pressure to valve rises above set pressure**
   - If the oil pressure in chamber **B** reaches the set pressure of relief valve (6), the oil flowing from the pump through port **P** to chamber **B** pushes relief valve (6) open and flows through port **T** into the hydraulic tank.
     As a result, the maximum pressure in the brake circuit is limited to protect the circuit.



# ACCUMULATOR (FOR BRAKE)



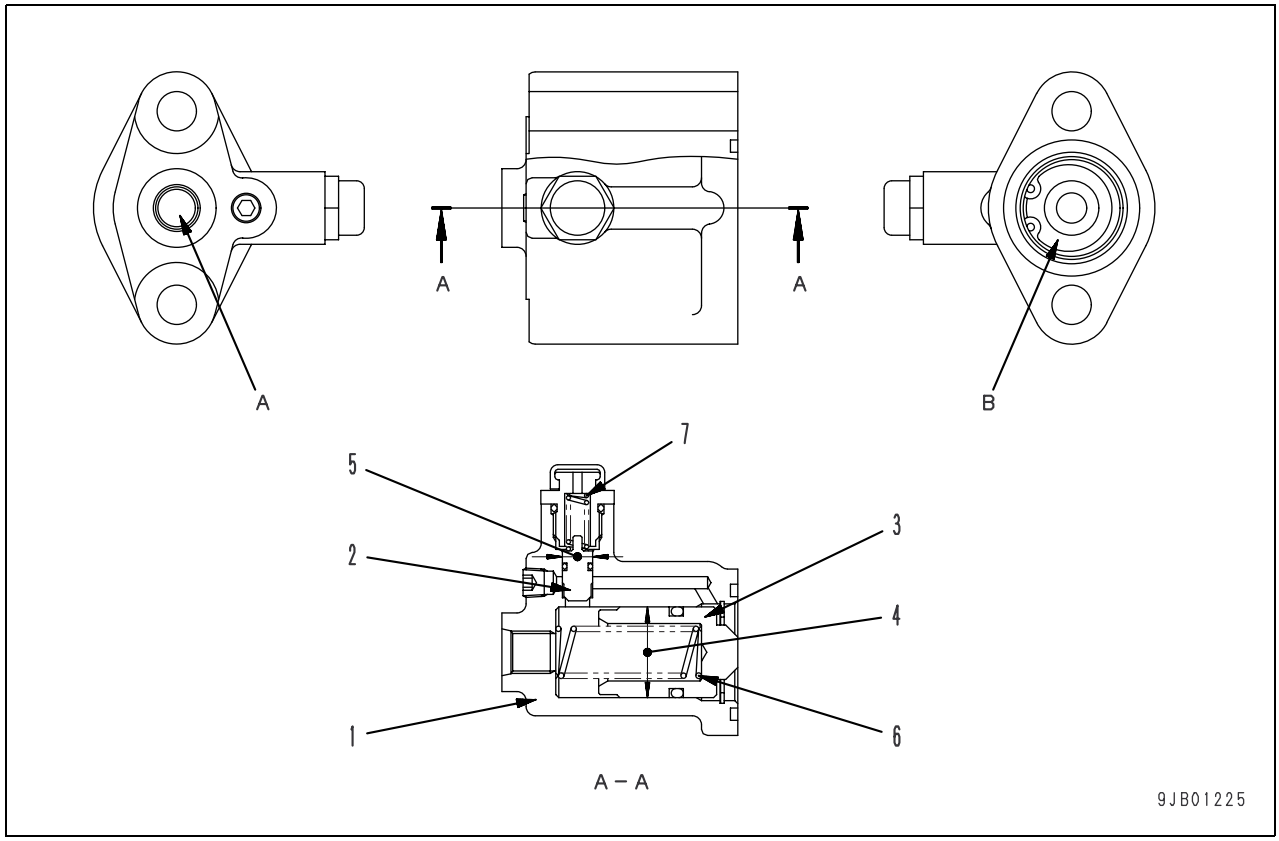

1. Cylinder
2. Piston

**Function**

- The accumulator is installed between the charge valve and brake valve. The space between its cylinder (1) and free piston (2) is filled with nitrogen gas. The brake oil pressure is stored in this space by utilizing the compressibility of the nitrogen gas and used as the pressure source to drive the brake.

Specifications
Gas used: Nitrogen gas
Amount of gas: 500cc
Charge pressure: 3.43 ± 0.1 MPa {35 ± 1.0 kg/cm$^2$}
(at 20°C)

# SLACK ADJUSTER




A: From brake valve
B: To brake piston

1. Body
2. Check valve
3. Piston

Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 4 | Clearance between piston and body | Standard size | Tolerance | | Standard clearance | Clearance limit | Replace |
| | | | Shaft | Hole | | | |
| | | ø 30 | -0.065<br>-0.098 | +0.052<br>0 | 0.065 – 0.150 | 0.163 | |
| 5 | Clearance between check valve and body | ø 10 | -0.013<br>-0.028 | +0.015<br>0 | 0.013 – 0.043 | 0.048 | |
| 6 | Piston return spring | Standard size | | | Repair limit | | |
| | | Free length | Installed length | Installed load | Free length | Installed load | |
| | | 87.5 | 48.2 | 11.8 N {1.2 kg} | – | 9.8 N {1.0 kg} | |
| 7 | Check valve return spring | 21.7 | 19.25 | 53.9 N {5.5 kg} | – | 46.1 N {4.7 kg} | |

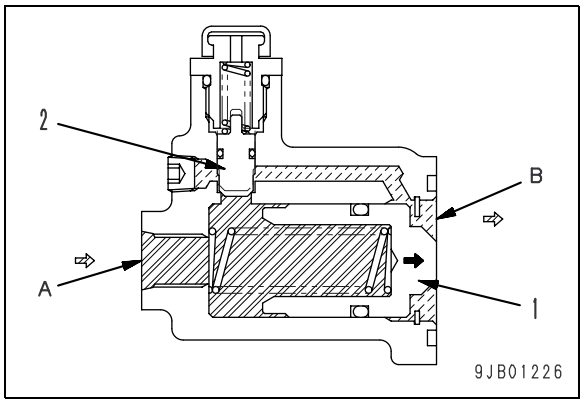
**Function**

- The slack adjuster is installed to the brake oil line from the brake valve to the brake piston and used to fix the time lag of operation of the brake.

**Operation**

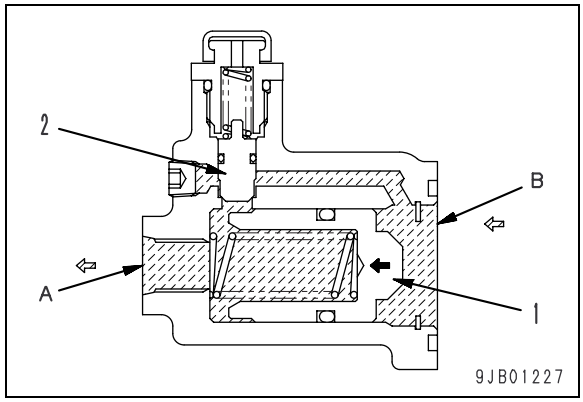
**When brake is applied**

- The oil from the brake valve flows to port **A** and moves piston (1) to the right. The oil kept between piston (1) and brake piston drives the brake.
- Since the oil kept between piston (1) and brake piston drives the brake, the brake piston stroke is fixed and the time lag of operation of the brake is reduced.
- If the quantity of the oil between piston (1) and brake piston becomes insufficient because of wear of the brake disc, etc., check valve (2) is pushed open and oil is added.



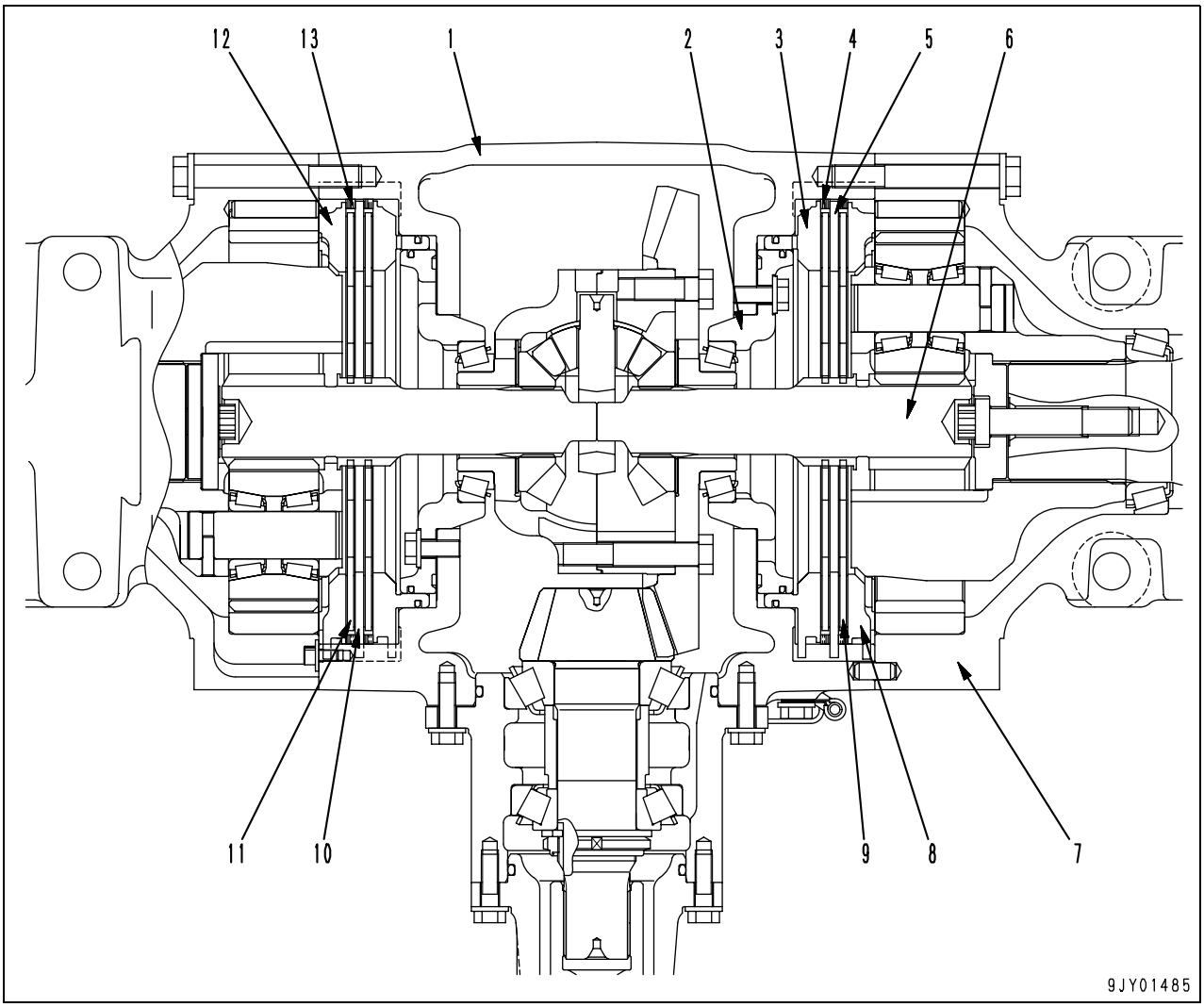

**When brake is released**

- The oil kept between piston (1) and brake piston pushes back piston (1) to the left. Oil of quantity equivalent to the moving distance of piston (1) is returned through port **A** to the brake valve and drained into the hydraulic tank.



# BRAKE

**FRONT**




1. Differential housing
2. Bearing carrier
3. Piston
4. Spring
5. Inner ring
6. Sun gear shaft
7. Axle housing
8. Outer ring
9. Discs (x2)

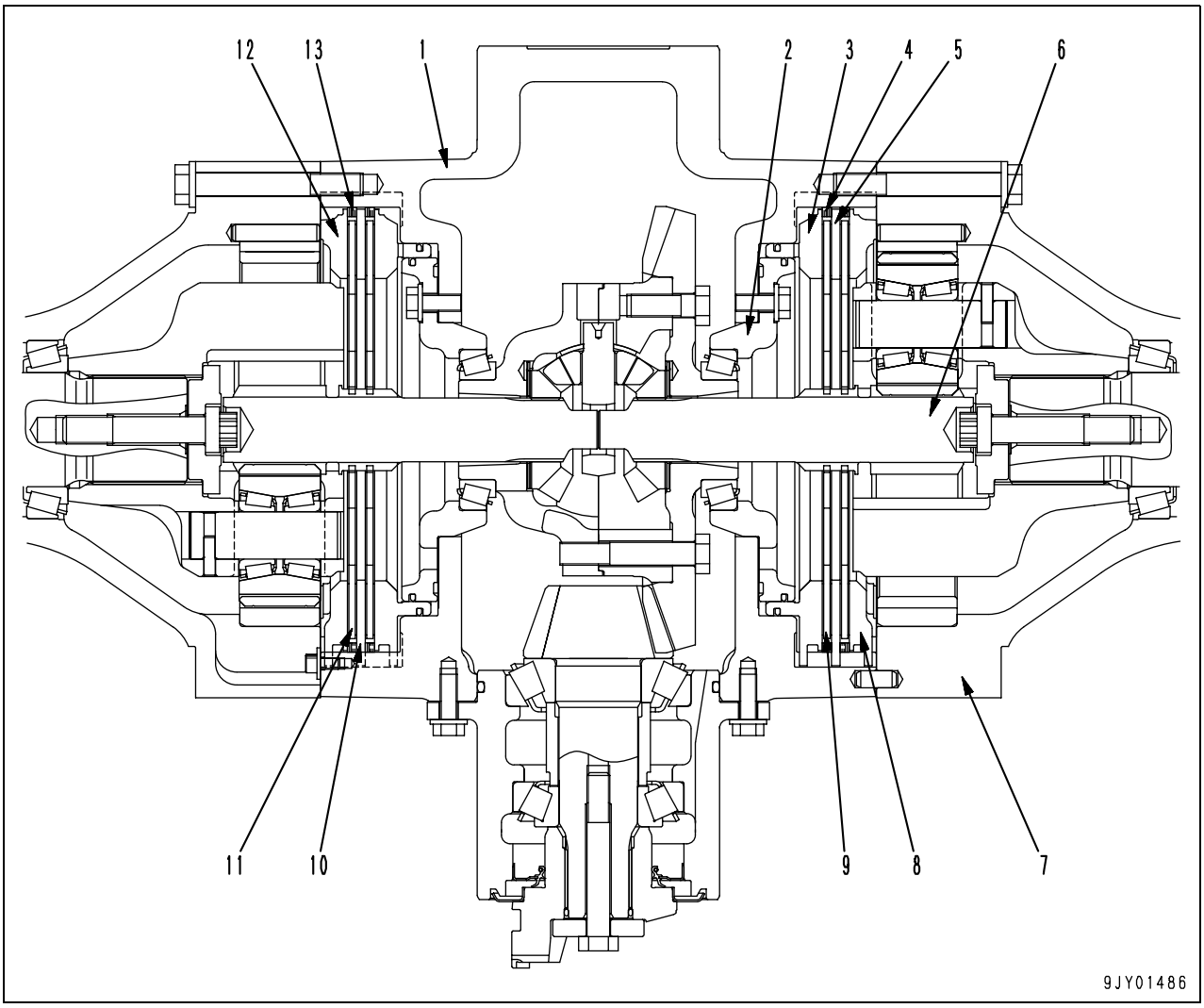
Unit: mm

| No. | Check item | Criteria | | | Remedy |
|---|---|---|---|---|---|
| 10 | Thickness of inner ring | Standard size | Tolerance | Repair limit | Replace |
| | | 6 | ± 0.1 | 5.5 | |
| 11 | Thickness of brake disc | 6.5 | ± 0.15 | 5.7 | |
| | Depth of lining groove | 0.8 (Min.) | — | 0.4 | |
| | Thickness of lining | 1.0 | 0.8 (Min.) | — | |
| 12 | Wear of brake outer ring disc contact surface | Standard size | Tolerance | Wear limit | |
| | | 19.0 | ± 0.1 | 0.3 | |
| 13 | Spring load | Standard size | | Repair limit | |
| | | Installed height | Installed load | Installed load | |
| | | 6.5 | 2,253 N {230 kg} | 1,800 N {184 kg} | |

**Outline**

- The front brake has a wet-type multiple-disc structure, and consists of piston (3), inner ring (5), discs (9), outer ring (8), and spring (4).
- The brake cylinder consists of differential housing (1) and bearing carrier (2), and piston (3) is assembled in it.
  Inner ring (5) and outer ring (8) are joined to the spline portion of differential housing (1).
- Discs (9) have a lining adhered to both sides. They are assembled between inner ring (5) and outer ring (8), and are joined by the spline of sun gear shaft (6).

**REAR**




1. Differential housing
2. Bearing carrier
3. Piston
4. Spring
5. Inner ring
6. Sun gear shaft
7. Axle housing
8. Outer ring
9. Discs (x2)

Unit: mm

| No. | Check item | Criteria | | | Remedy |
|---|---|---|---|---|---|
| 10 | Thickness of inner ring | Standard size | Tolerance | Repair limit | Replace |
| | | 6 | ± 0.1 | 5.5 | |
| 11 | Thickness of brake disc | 6.5 | ± 0.15 | 5.7 | |
| | Depth of lining groove | 0.8 (Min.) | — | 0.4 | |
| | Thickness of lining | 1.0 | 0.8 (Min.) | — | |
| 12 | Wear of brake outer ring disc contact surface | Standard size | Tolerance | Wear limit | |
| | | 19.0 | ± 0.1 | 0.3 | |
| 13 | Spring load | Standard size | | Repair limit | |
| | | Installed height | Installed load | Installed load | |
| | | 6.5 | 2,253 N {230 kg} | 1,800 N {184 kg} | |

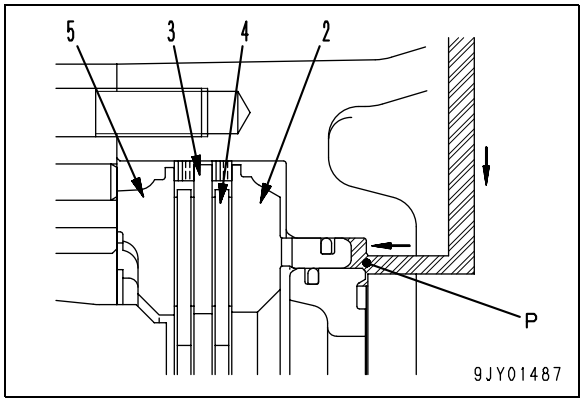
**Outline**

- The rear brake has a wet-type multiple-disc structure, and consists of piston (3), inner ring (5), disc (9), outer ring (8), and spring (4).
- The brake cylinder consists of differential housing (1) and bearing carrier (2), and piston (3) is assembled in it.
  Inner ring (5) and outer ring (8) are joined to the spline portion of differential housing (1).
- Disc (9) has a lining stuck to both sides. It is assembled between inner ring (5) and outer ring (8), and is joined by the spline of sun gear shaft (6).

## Outline

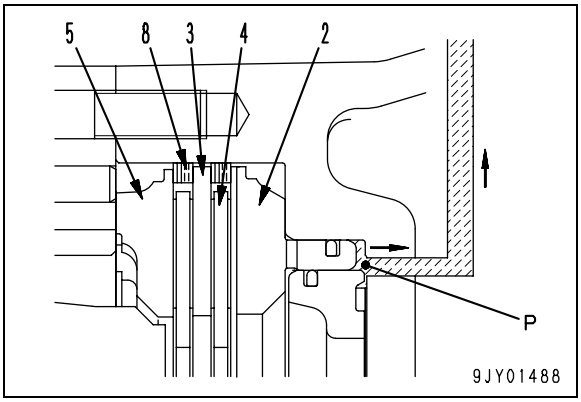
### When brake is applied

- When the brake pedal is depressed, pressure oil **P** goes from the hydraulic tank through the pump and brake charge valve. It acts on the piston inside the brake cylinder and the piston (2) slides.
  Therefore, piston (2) stops the rotation of discs (4) fitted between inner ring (3) and outer ring (5), and applies the brake to the machine.

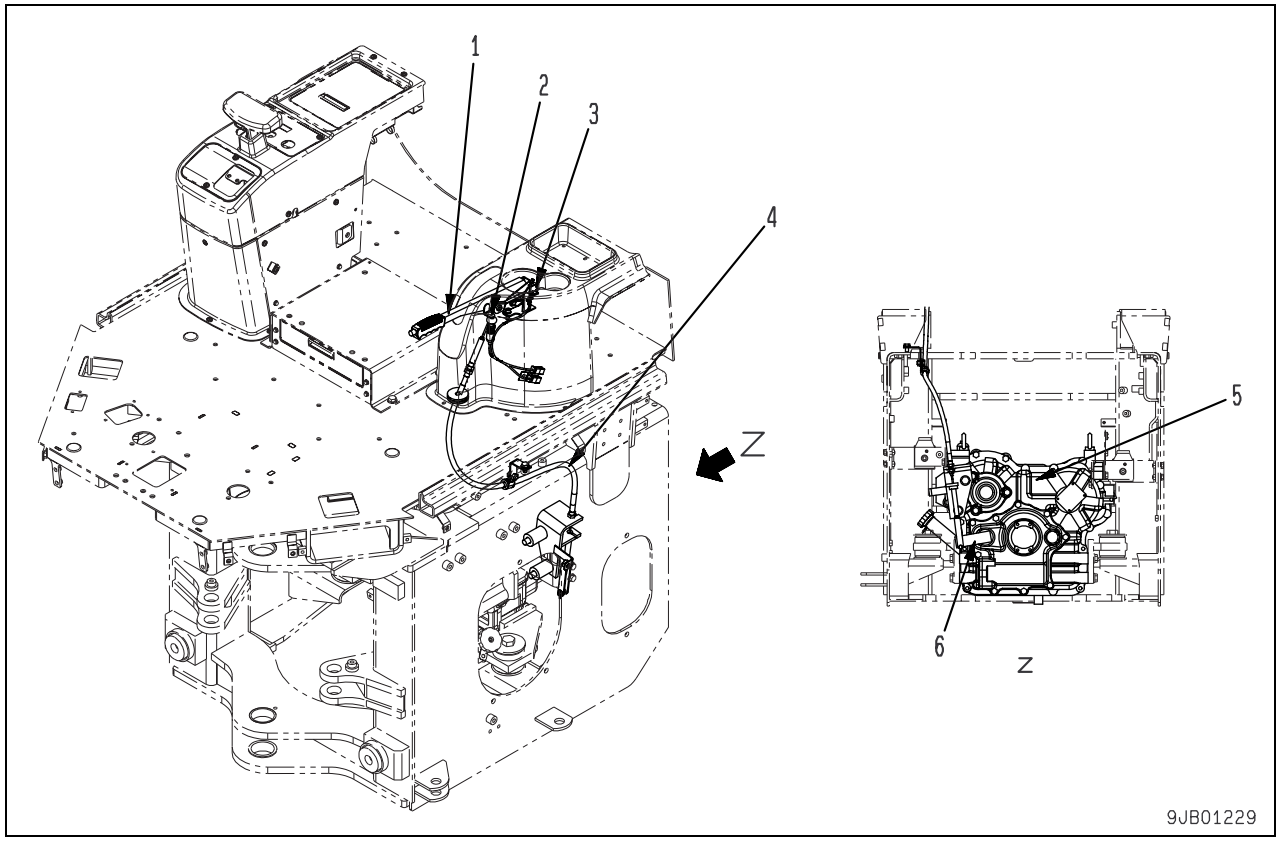



### When brake is released

- When the oil pressure is released, piston (2) is returned to its original position by the force of spring (8), a gap is formed between inner ring (3) and outer ring (5), and discs (4) become free. Lattice shape grooves are cut into the lining stuck to disc (4), and when disc (4) is rotating, oil flows in the grooves and carries out cooling of the lining.



# PARKING BRAKE CONTROL

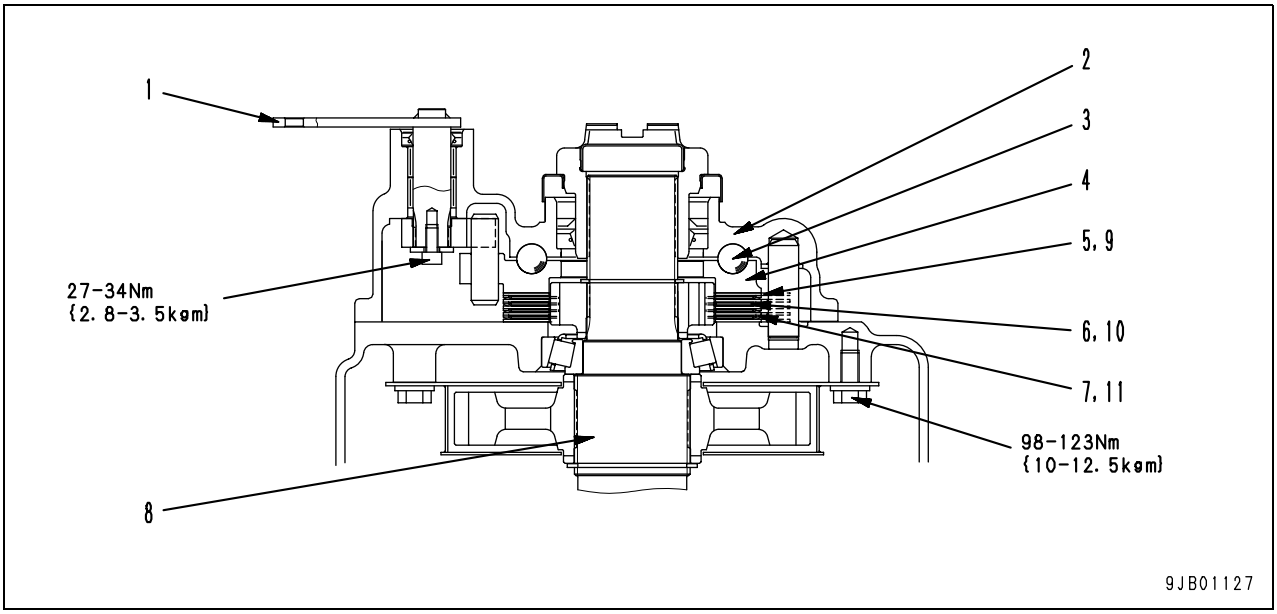



1. Parking brake lever
2. Lowest switch of parking brake lever
3. Intermediate switch of parking brake lever
4. Control cable
5. Transfer
6. Multiple-disc brake lever

**Outline**

- The mechanical parking brake is built in transfer (5). If parking brake lever (1) is operated, multiple-disc brake lever (6) is operated to "apply" or "release" the parking brake.
- If parking brake lever (1) installed on the operator's seat is pulled, multiple-disc brake lever (6) connected by control cable (4) is pulled up and the parking brake is "applied".
- If parking brake lever (1) is returned, multiple-disc brake lever (6) connected by control cable (4) is pushed down and the parking brake is "released"
- While the parking brake is "applied", the current to the forward-reverse solenoid valve of the HST pump is shut off and the swash plate of the HST pump is kept in neutral.

# PARKING BRAKE




1. Lever
2. Housing
3. Ball
4. Piston
5. Plate
6. Disc
7. Wave spring
8. Output shaft

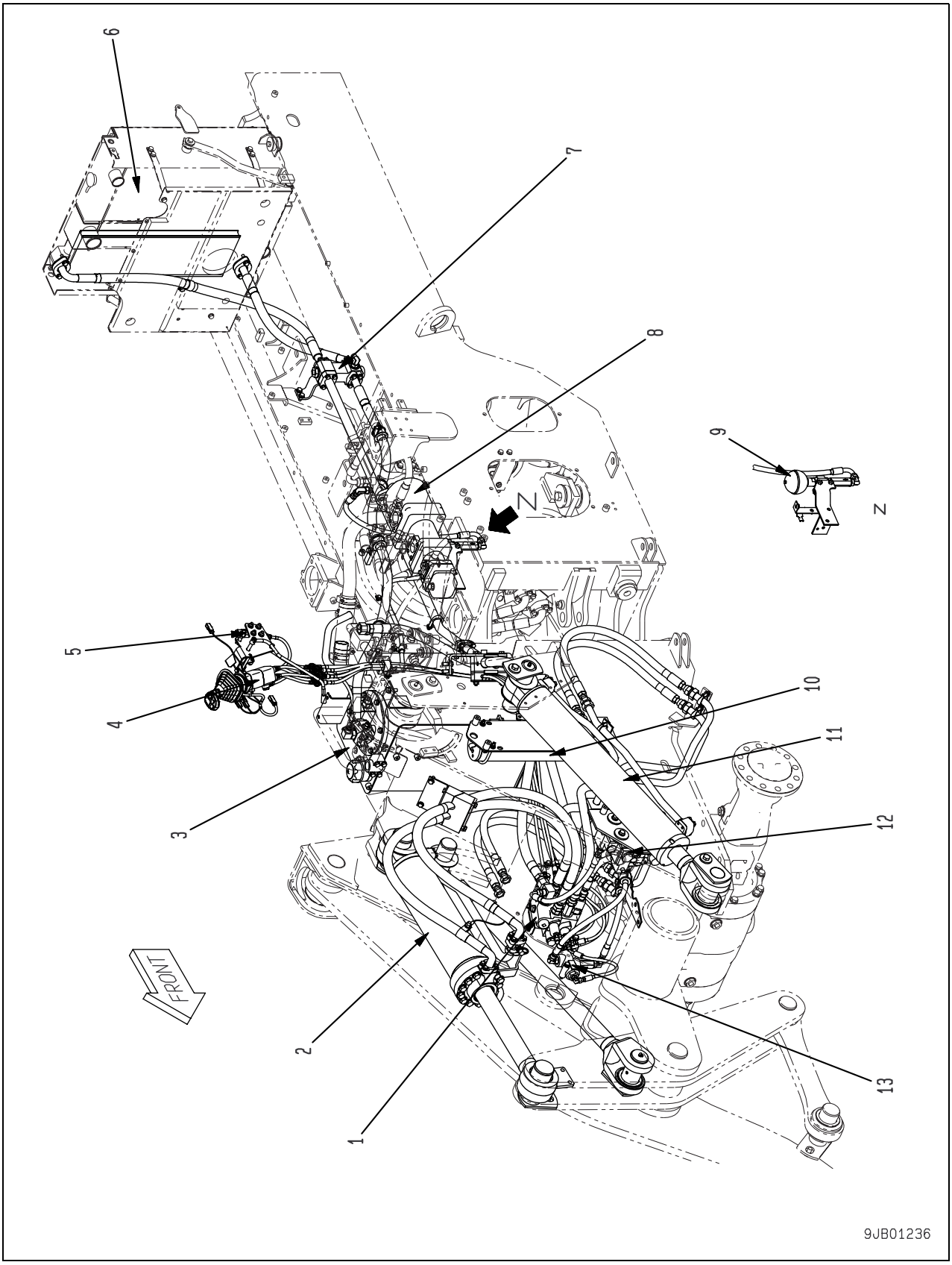
Unit: mm

| No. | Check item | Criteria | | | Remedy |
|---|---|---|---|---|---|
| 9 | Thickness of plate | Standard size | Tolerance | Repair limit | Replace |
| | | 2.6 | ± 0.06 | 2.5 | |
| | Distortion of plate | — | 0.05 | 0.1 | |
| 10 | Thickness of brake disc | 2.2 | ± 0.08 | 2.05 | |
| | Distortion of brake disc | — | 0.02 | 0.25 | |
| 11 | Load on wave spring (Height: 2.2 mm) | 1,010 N {103 kg} | ± 101N {± 10.3 kg} | 858 N {87.6 kg} | |

**Outline**

- The parking brake is a wet multiple-disc brake which mechanically brakes transmission output shaft (8).
- Lever (1) is connected to the control cable. If the parking brake lever is pulled, ball (3) between piston (4) connected to lever (1) and housing (2) moves on the inclined surface of the piston groove. As a result, piston (4) presses plates (5) and discs (6) to brake output shaft (8).

# HYDRAULIC PIPING



1. Work equipment control valve
2. Bucket cylinder
3. Hydraulic tank
4. Work equipment PPC valve
5. Lock valve
6. Oil cooler
7. Check valve
8. 4-gear pump unit
   - Steering pump
   - Work equipment pump
   - Brake and cooling fan pump
   - Transfer lubricating oil pump
9. Accumulator (for PPC circuit)
10. Accumulator (for E.C.S.S.) (If equipped)
11. Lift cylinder
12. E.C.S.S. valve (If equipped)
13. Bypass valve (for lift arm)

(E.C.S.S.: Electronically Controlled Suspension System)

**Outline**

- The hydraulic system consists of the HST, steering, work equipment, brake, cooling fan, and transfer lubricating circuit. Work equipment circuit controls the operation of the lift arm and bucket.
- The oil in hydraulic tank (3) is sent by the work equipment pump of 4-gear pump unit (8) to work equipment control valve (1). If both spools of the lift arm and bucket of work equipment control valve (1) are held, the oil flows through the drain circuit of work equipment control valve (1) and is filtrated by the return filter installed to hydraulic tank (3) and returns to hydraulic tank (3).
- If the work equipment control lever is operated, the spool of the lift arm or bucket of work equipment PPC valve (4) operates.
- The oil from the work equipment PPC valve (4) hydraulically operates each spool of work equipment control valve (1) and flows to lift cylinder (11) or bucket cylinder (2) to move the lift arm or bucket.
- The maximum pressure in the hydraulic circuit is controlled by the relief valve in work equipment control valve (1). The bucket cylinder circuit has a safety valve (safety-suction valve) to protect itself.
- Accumulator (for PPC circuit) (9) is installed to the PPC pilot circuit so that the work equipment can be lowered to the ground even if the engine stops.
- Hydraulic tank (3) is pressurized, enclosed, and equipped with a breather which has a relief valve and which is also used as an oil filler cap. The breather pressurizes the tank and prevents generation of negative pressure and cavitation.

**WA250PT-5**



1. Work equipment control valve
2. Quick coupler solenoid valve
3. Lift cylinder
4. Coupler plunger
5. Bucket cylinder
6. Hydraulic tank
7. Attachment PPC valve
8. Work equipment PPC valve
9. Lock valve
10. Oil cooler
11. Check valve
12. 4-gear pump unit
    - Steering pump
    - Work equipment pump
    - Brake and cooling fan pump
    - Transfer lubricating oil pump
13. Accumulator (for PPC circuit)
14. Accumulator (for E.C.S.S.) (If equipped)
15. Bypass valve (for bucket circuit)
16. E.C.S.S. valve (If equipped)

(E.C.S.S.: Electronically Controlled Suspension System)

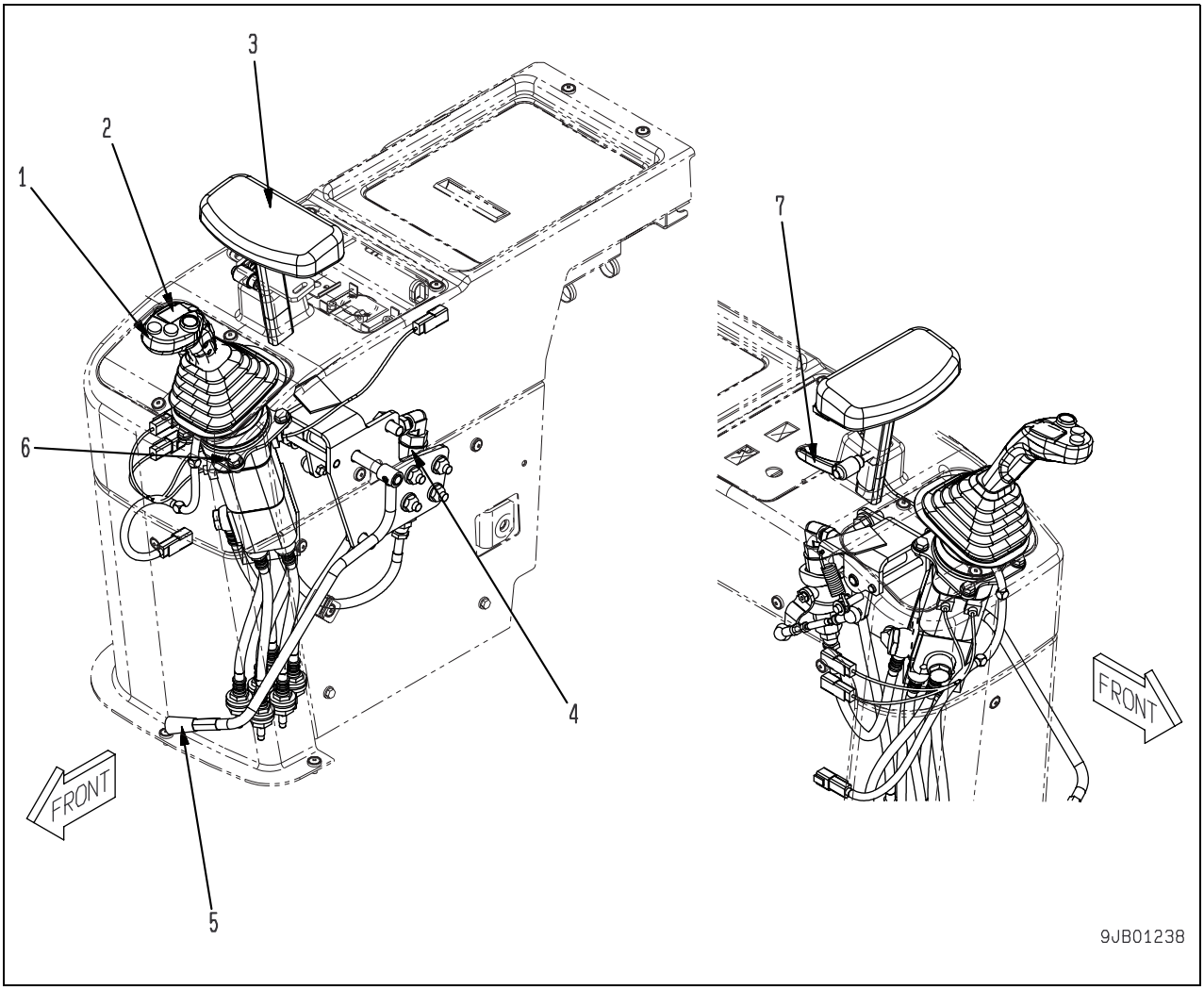
**Outline**

- The hydraulic system consists of the HST, steering, work equipment, brake, cooling fan, and transfer lubricating circuit. Work equipment circuit controls the operation of the lift arm, bucket, and attachment.
- The oil in hydraulic tank (6) is sent by the work equipment pump of 4-gear pump unit (12) to work equipment control valve (1). If the all spools of the lift arm, bucket, and attachment of work equipment control valve (1) are held, the oil flows through the drain circuit of work equipment control valve (1) and is filtrated by the return filter installed to hydraulic tank (6) and returns to hydraulic tank (6).
- If the work equipment control lever is operated, the spool of the lift arm or bucket of work equipment PPC valve (8) operates. If the auxiliary lever is operated, the spool of attachment PPC valve (7) operates.
- The oil from the work equipment PPC valve (8) or attachment PPC valve (7) hydraulically operates each spool of work equipment control valve (1) and flows to lift cylinder (3), bucket cylinder (5), or coupler plunger (4) to move the lift arm, bucket, or attachment.
- The maximum pressure in the hydraulic circuit is controlled by the relief valve in work equipment control valve (1). The bucket cylinder circuit has a safety valve (safety-suction valve) to protect itself.
- Accumulator (for PPC circuit) (13) is installed to the PPC pilot circuit so that the work equipment can be lowered to the ground even if the engine stops.
- Hydraulic tank (6) is pressurized, enclosed, and equipped with a breather which has a relief valve and which is also used as an oil filler cap. The breather pressurizes the tank and prevents generation of negative pressure and cavitation.

# WORK EQUIPMENT LEVER LINKAGE

**WA250-5**

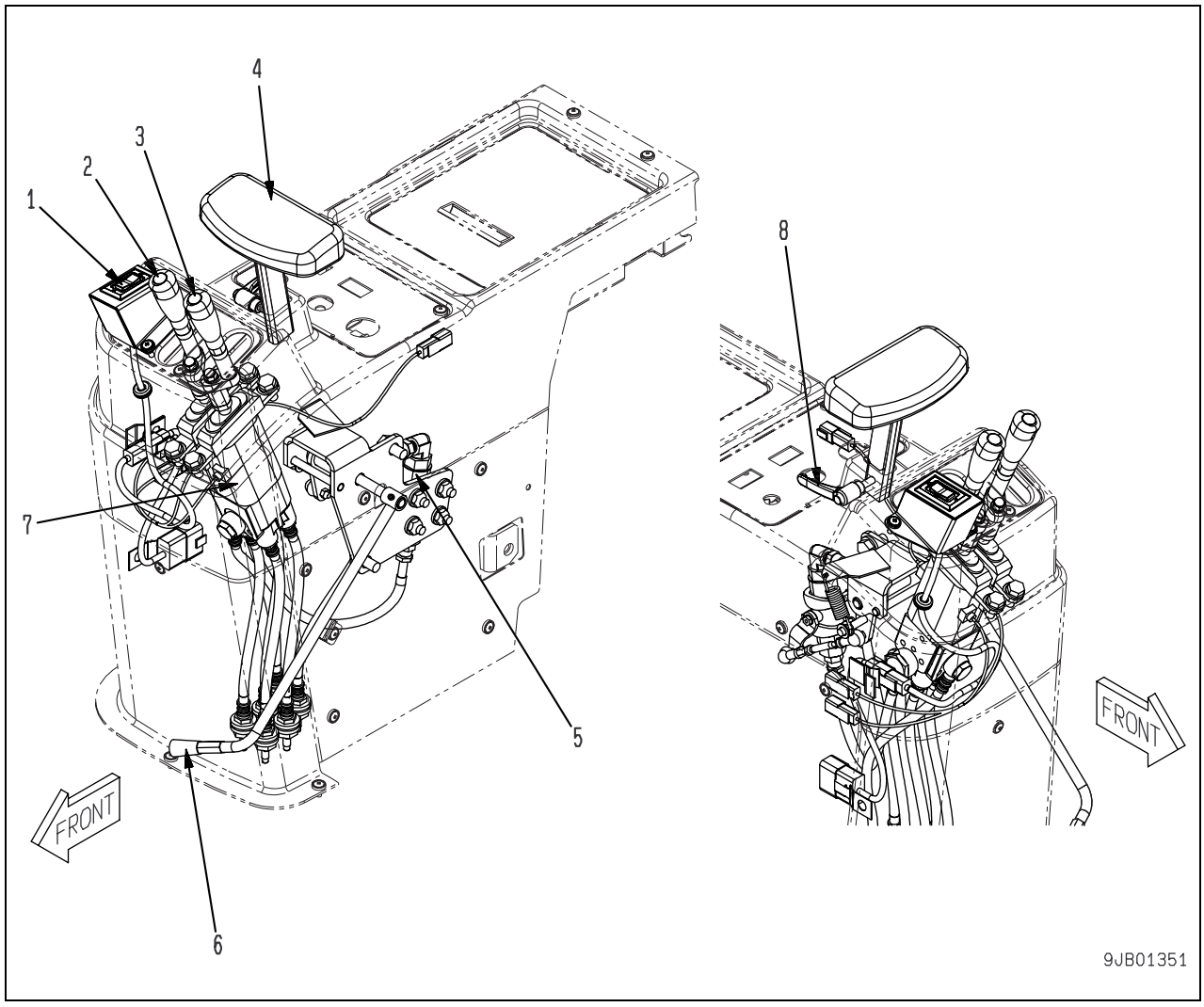
**Multi-function joystick type**




1. Work equipment control lever
2. Forward-reverse shifting switch
3. Wrist rest
4. Lock valve
5. Safety lock lever
6. Work equipment PPC valve
7. Wrist rest height adjustment lever

**WA250-5**

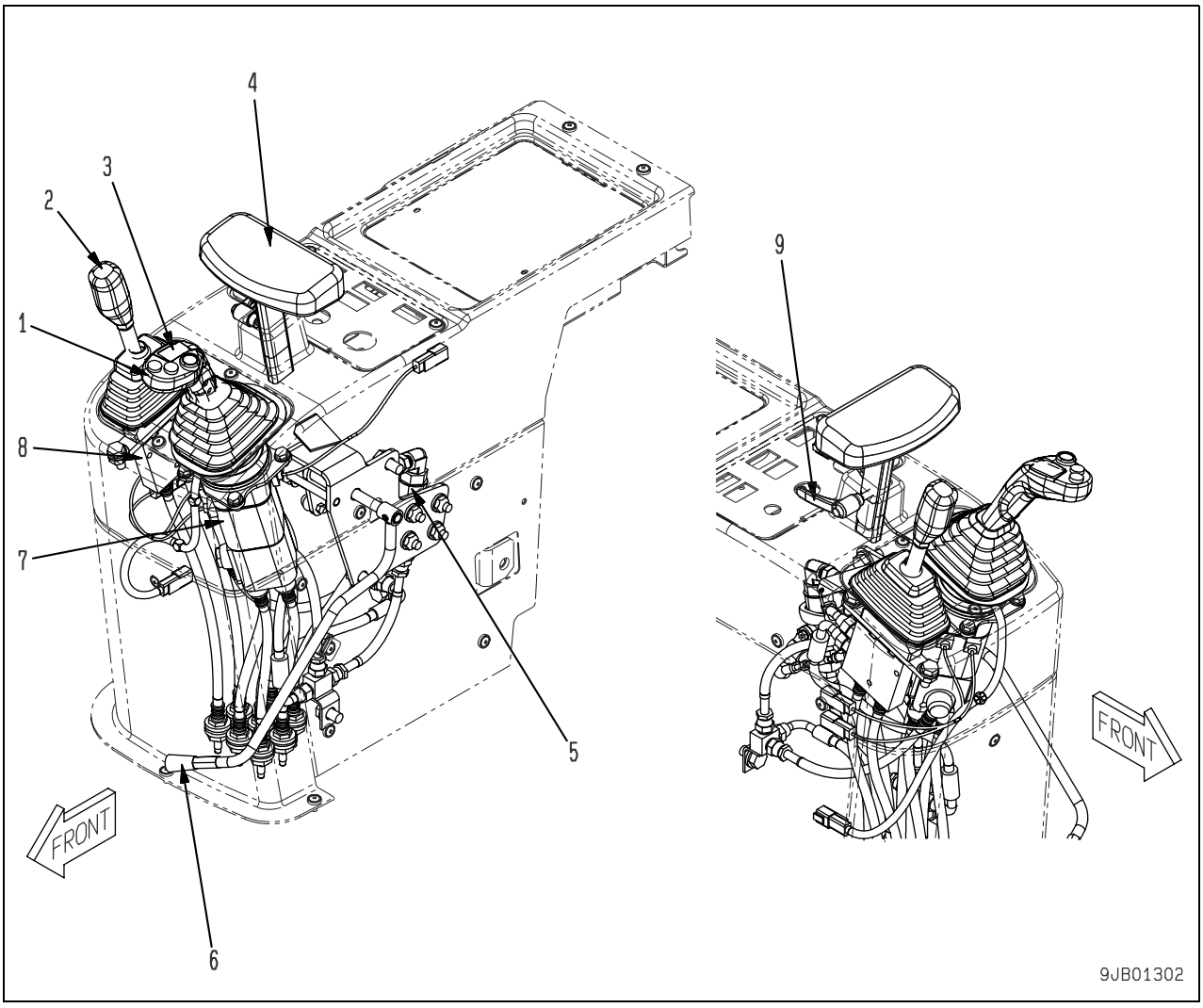
**2-lever type**
**(If equipped)**




1. Forward-reverse shifting switch
2. Lift arm control lever
3. Bucket control lever
4. Wrist rest
5. Lock valve
6. Safety lock lever
7. Work equipment PPC valve
8. Wrist rest height control lever

**WA250PT-5**

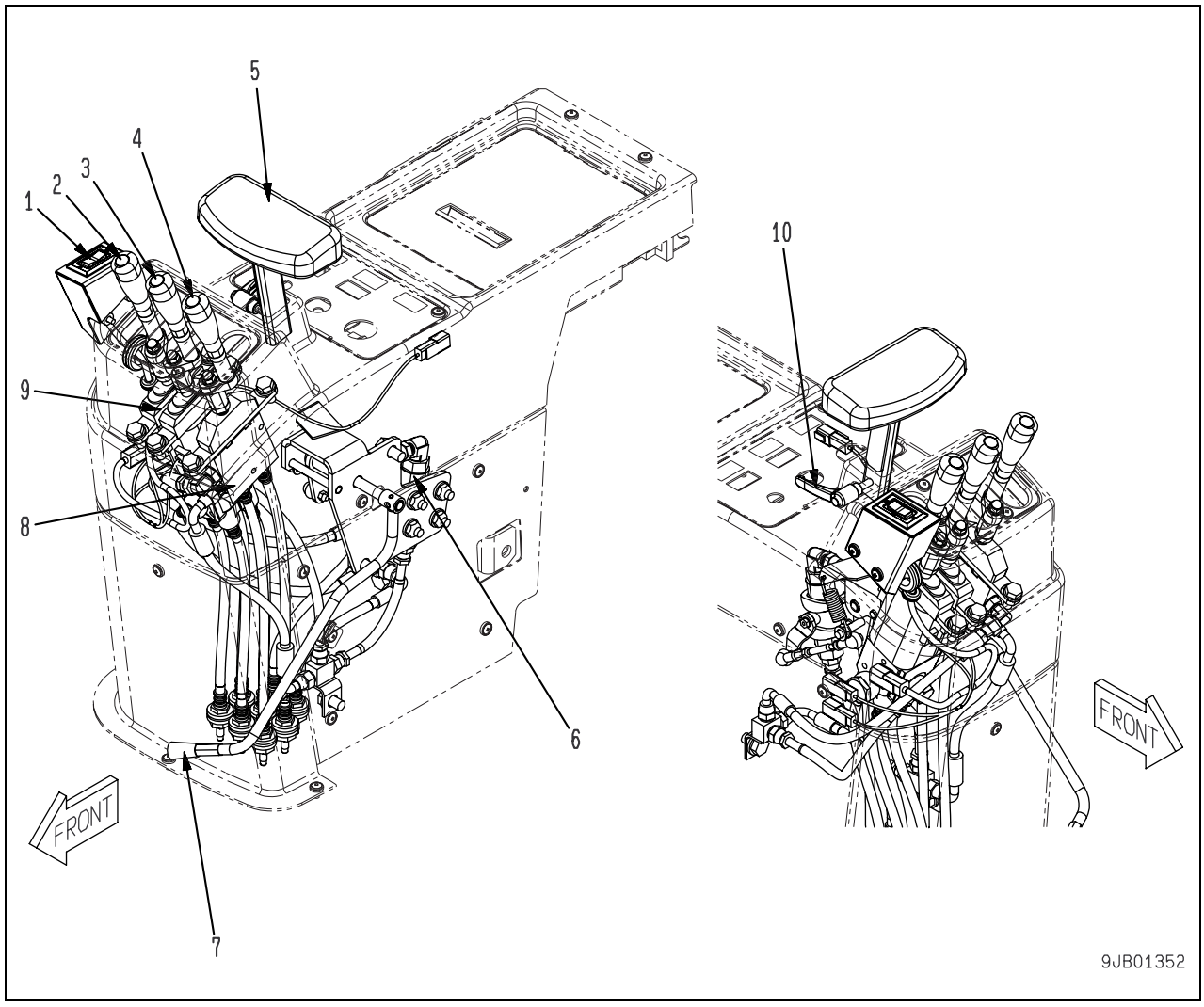
**Multi-function joystick type**




1. Work equipment control lever
2. Auxiliary control lever
3. Forward-reverse shifting switch
4. Wrist rest
5. Lock valve
6. Safety lock lever
7. Work equipment PPC valve
8. Attachment PPC valve
9. Wrist rest height adjustment lever

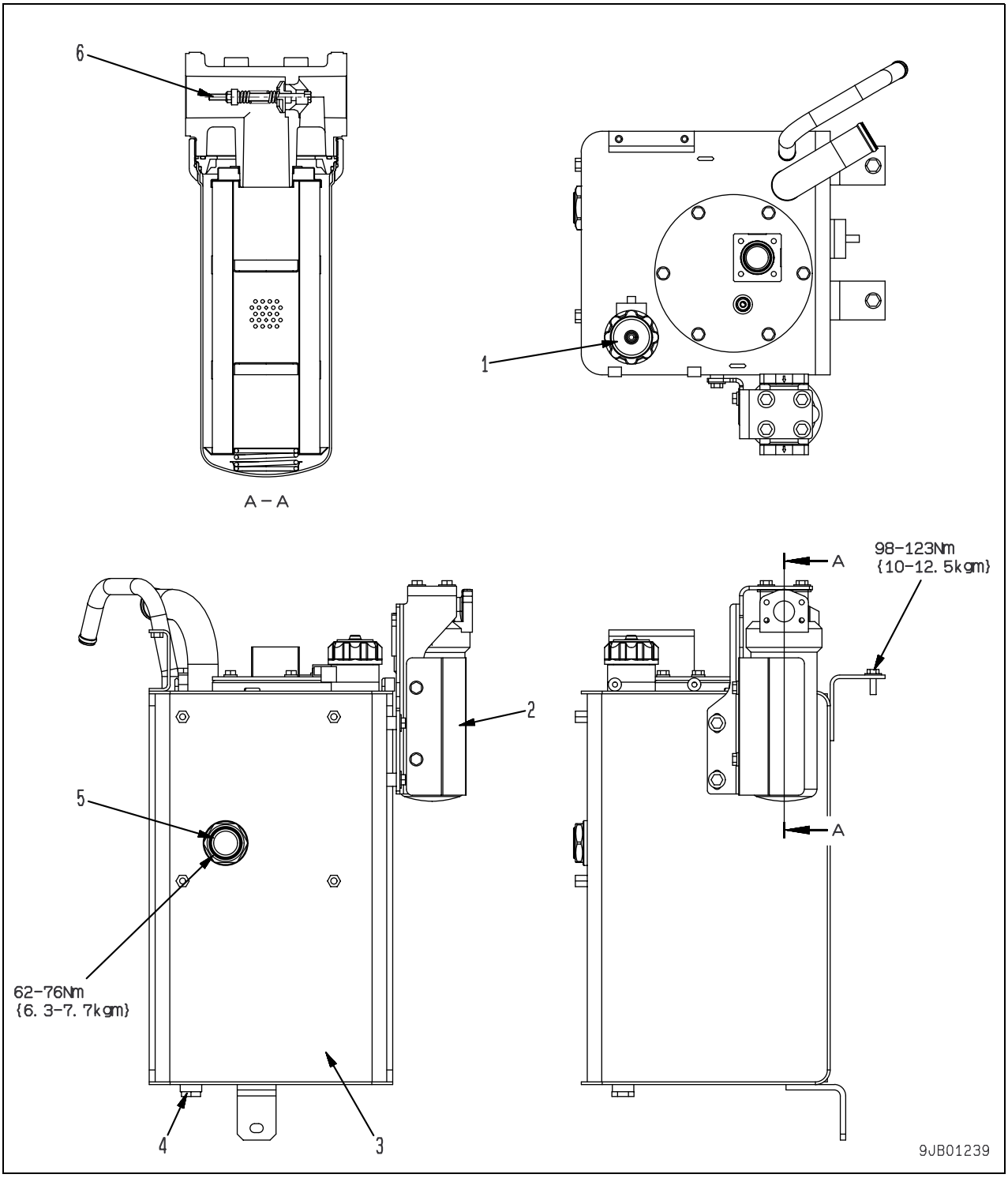
**WA250PT-5**

**2-lever type**
**(If equipped)**




1. Forward-reverse shifting switch
2. Lift arm control lever
3. Bucket control lever
4. Auxiliary control lever
5. Wrist rest
6. Lock valve
7. Safety lock lever
8. Attachment PPC valve
9. Work equipment PPC valve
10. Wrist rest height control lever

# HYDRAULIC TANK

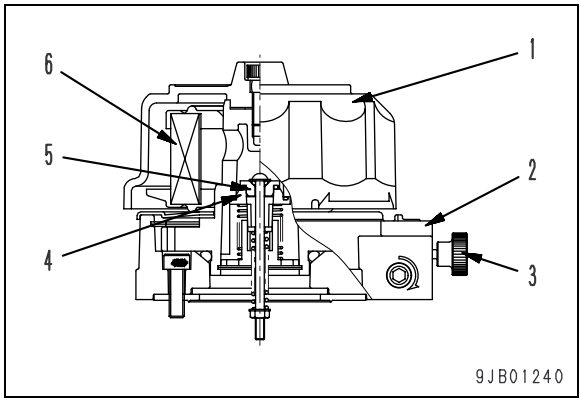



1. Oil filler cap / Breather
2. Return filter
3. Hydraulic tank
4. Drain plug
5. Sight gauge
6. Return filter bypass valve

**Specifications**

| | |
|---|---|
| Tank capacity (ℓ) | 96 |
| Oil quantity inside the tank (ℓ) | 67 |
| Bypass valve setting pressure (MPa{kg/cm$^2$}) | 0.2 {2.04} |

**Breather**




1. Oil filler cap
2. Case
3. Unlocking knob
4. Sleeve
5. Poppet
6. Filter element

**Prevention of negative pressure in tank**

- Since the hydraulic tank is pressurized and enclosed, negative pressure can be generated when the oil level in the tank lowers. At this time, sleeve (4) is opened by the pressure difference from the atmospheric pressure and the atmosphere flows in the tank to prevent generation of negative pressure.
  (Set pressure of air intake valve:
  3.0 ± 0.3 kPa {0.03 ± 0.003 kg/cm$^2$})

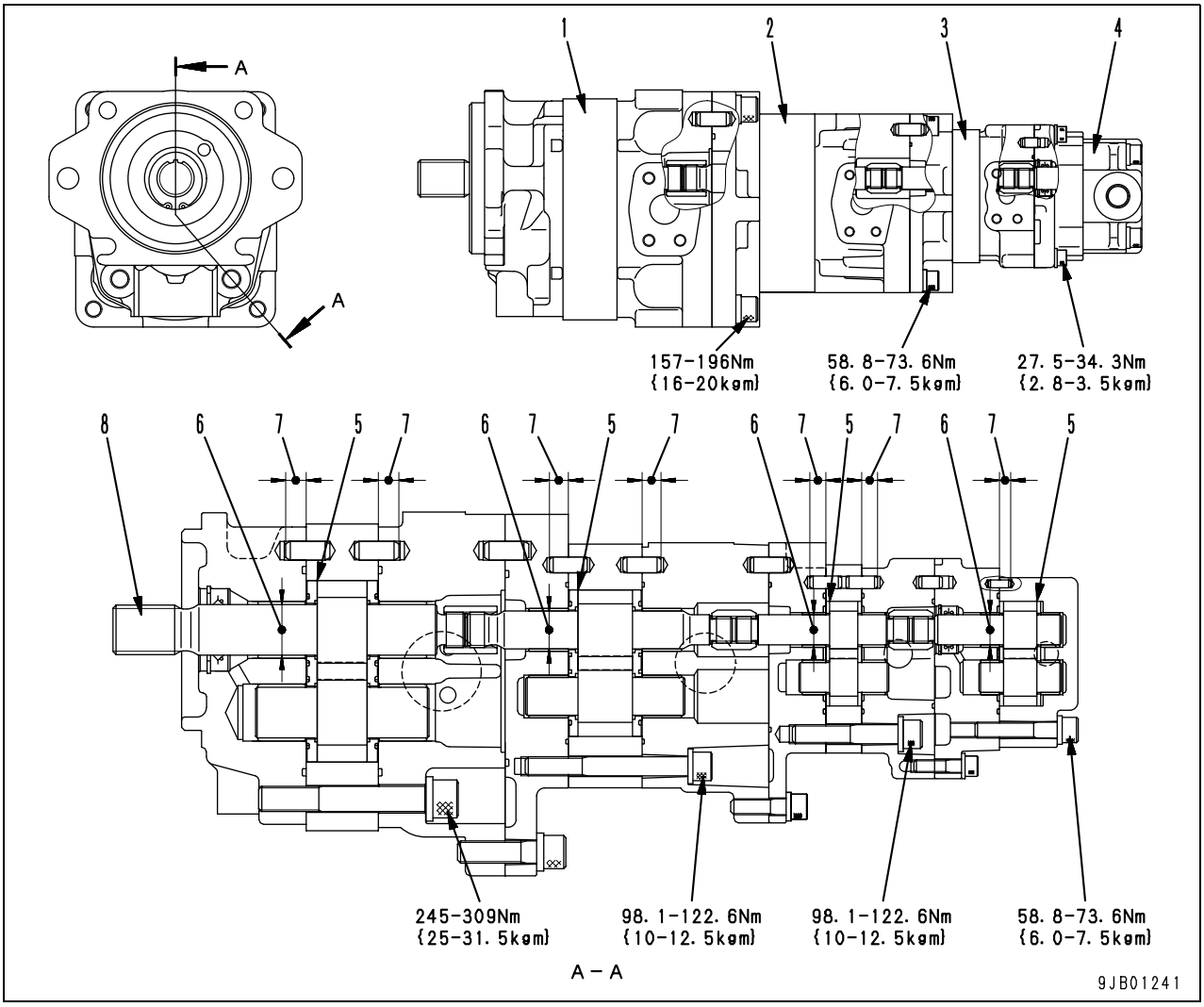
**Prevention of rise of pressure in tank**

- While the hydraulic circuit is in operation, the pressure in the hydraulic tank rises when the oil level in the hydraulic tank rises according to the operation of the hydraulic cylinders and when the temperature rises. If the pressure in the tank rises above the set pressure, poppet (5) operates to release the pressure from the tank.
  (Set pressure of exhaust valve:
  0.1 ± 0.015 MPa {1.0 ± 0.15 kg/cm$^2$})

# 4-GEAR PUMP UNIT

(Steering / Work equipment / Brake and cooling fan / Transfer lubricating oil)

**SAR(3)56 + (2)40 + SBR(1)10 + 12**




1. Steering pump
2. Work equipment pump
3. Brake and cooling fan pump
4. Transfer lubricating oil pump

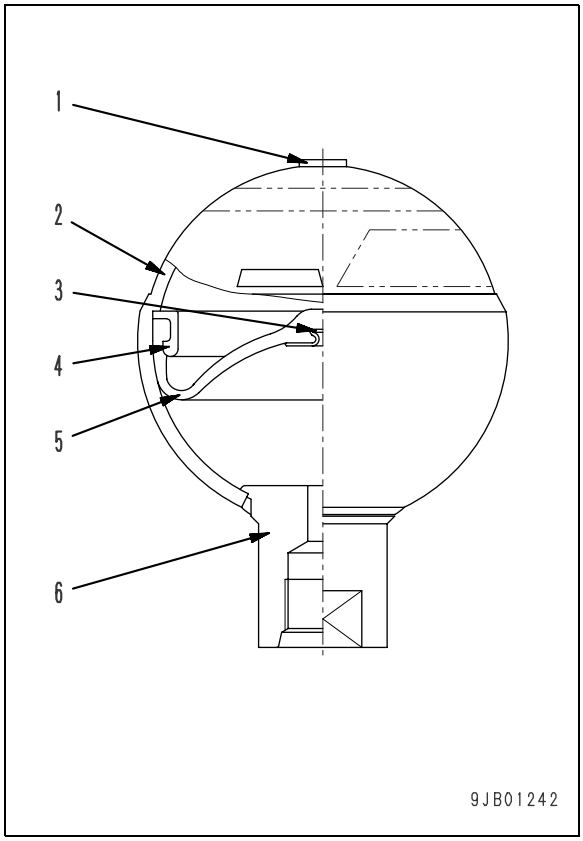
**Outline**

- The 4-gear pump unit is installed to the HST pump and driven through its shaft to supply hydraulic oil to the steering, work equipment, brake, cooling fan, and transfer.

Unit: mm

<table>
<tr><th>No.</th><th>Check item</th><th colspan="6">Criteria</th><th>Remedy</th></tr>
<tr><td rowspan="5">5</td><td rowspan="5">Side clearance</td><td>Model</td><td colspan="2">Standard clearance</td><td colspan="2">Clearance limit</td><td rowspan="13">Replace</td></tr>
<tr><td>SAR(3)56</td><td colspan="2" rowspan="4">0.10 – 0.15</td><td colspan="2" rowspan="4">0.19</td></tr>
<tr><td>SAR(2)40</td></tr>
<tr><td>SBR(1)10</td></tr>
<tr><td>SBR(1)12</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Clearance between inside diameter of plain bearing and outside diameter of gear shaft</td><td>SAR(3)56</td><td colspan="2">0.083 – 0.144</td><td colspan="2" rowspan="4">0.20</td></tr>
<tr><td>SAR(2)40</td><td colspan="2">0.071 – 0.121</td></tr>
<tr><td>SBR(1)10</td><td colspan="2" rowspan="2">0.068 – 0.115</td></tr>
<tr><td>SBR(1)12</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Diving depth of pin</td><td>Model</td><td>Standard size</td><td colspan="2">Tolerance</td><td>Repair limit</td></tr>
<tr><td>SAR(3)56</td><td>13</td><td colspan="2" rowspan="3">0<br>-0.5</td><td rowspan="4">–</td></tr>
<tr><td>SAR(2)40</td><td>12</td></tr>
<tr><td>SBR(1)10</td><td>10</td></tr>
<tr><td>SBR(1)12</td><td>7</td><td colspan="2">+0.5<br>0</td></tr>
<tr><td>8</td><td>Spline rotating torque</td><td colspan="6">13.8 – 28.5 Nm {1.4 – 2.9 kgm}</td><td rowspan="6">–</td></tr>
<tr><td rowspan="5">–</td><td rowspan="5">Discharge amount<br>Oil: SAE10W<br>Oil temperature: 45 - 55°C</td><td>Model</td><td>Speed (rpm)</td><td>Discharge pressure (MPa {kg/cm$^2$})</td><td>Standard discharge amount (ℓ/min)</td><td>Discharge amount limit (ℓ/min.)</td></tr>
<tr><td>SAR(3)56</td><td rowspan="4">2,500</td><td rowspan="3">20.6 {210}</td><td>129</td><td>119</td></tr>
<tr><td>SAR(2)40</td><td>91</td><td>82</td></tr>
<tr><td>SBR(1)10</td><td>23</td><td>21</td></tr>
<tr><td>SBR(1)12</td><td>2.9 {30}</td><td>27</td><td>24</td></tr>
</table>

# ACCUMULATOR (FOR PPC CIRCUIT)




1. Gas plug
2. Shell
3. Poppet
4. Holder
5. Bladder
6. Oil port

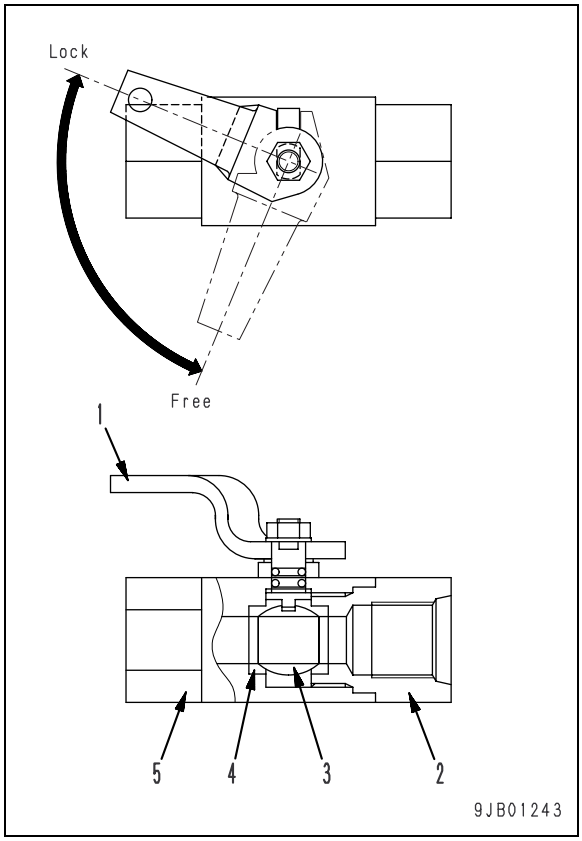
**Outline**

- The accumulator is installed between the HST charge pump and work equipment PPC valve. Even if the engine stops with the work equipment raised, the pressure of the compressed nitrogen gas in the accumulator sends the pilot oil pressure to the work equipment control valve to operate the valve so that the work equipment will lower by its weight.

**Specifications**

Gas used: Nitrogen gas
Amount of gas: 300 cc
Charge pressure: 1.18 MPa {12 kg/cm$^2$}) (at 80°C)
Max. using pressure: 6.86 MPa {70 kg/cm$^2$}

# LOCK VALVE



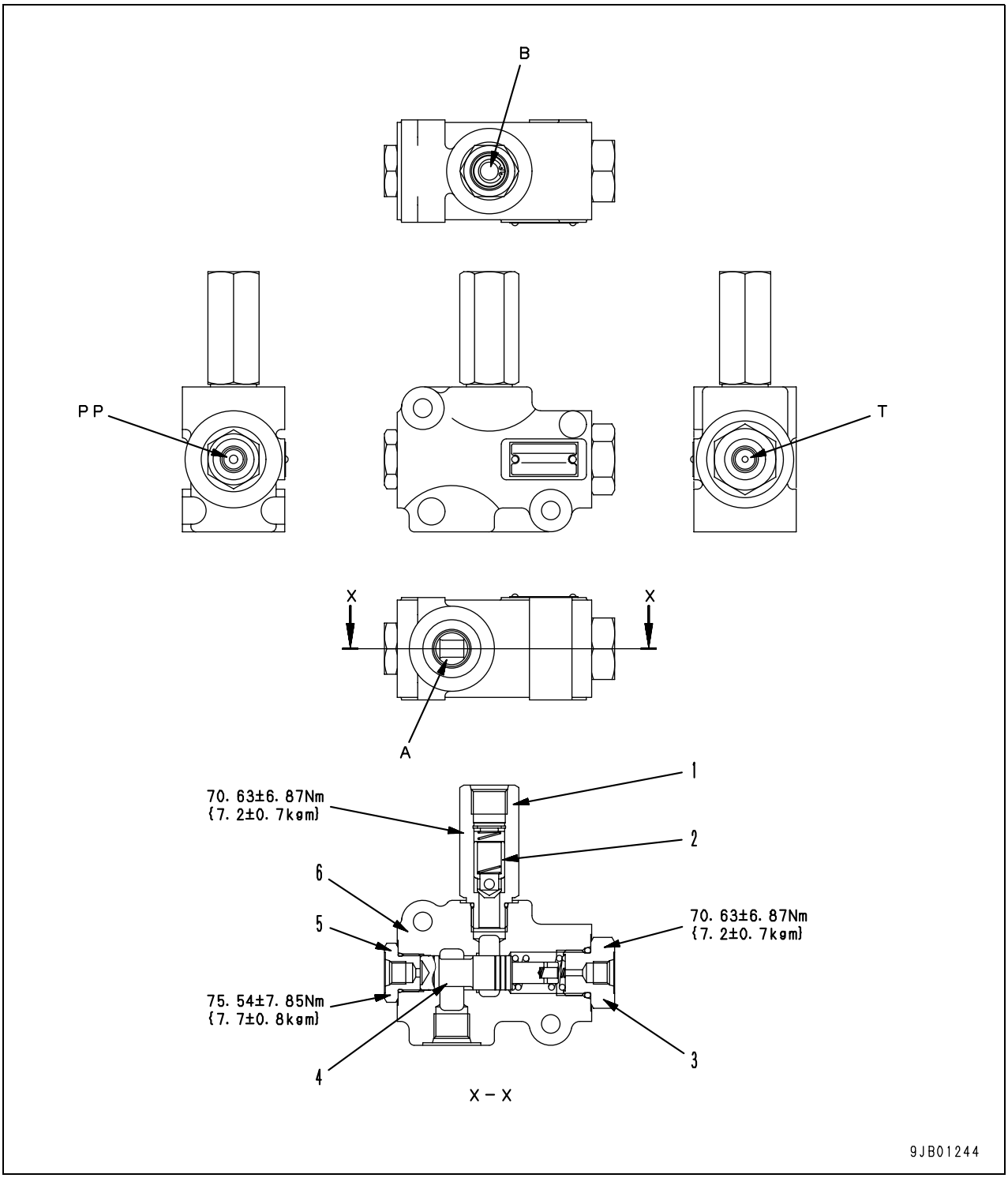

1. Lever
2. End cap
3. Ball
4. Seat
5. Body

**Outline**

- The lock valve is installed between the HST charge pump and work equipment PPC valve. If the safety lock lever is set in the LOCK position, the lock valve operates to shut off the oil in the PPC circuit so that the work equipment cannot be operated.

# BYPASS VALVE

**WA250-5**

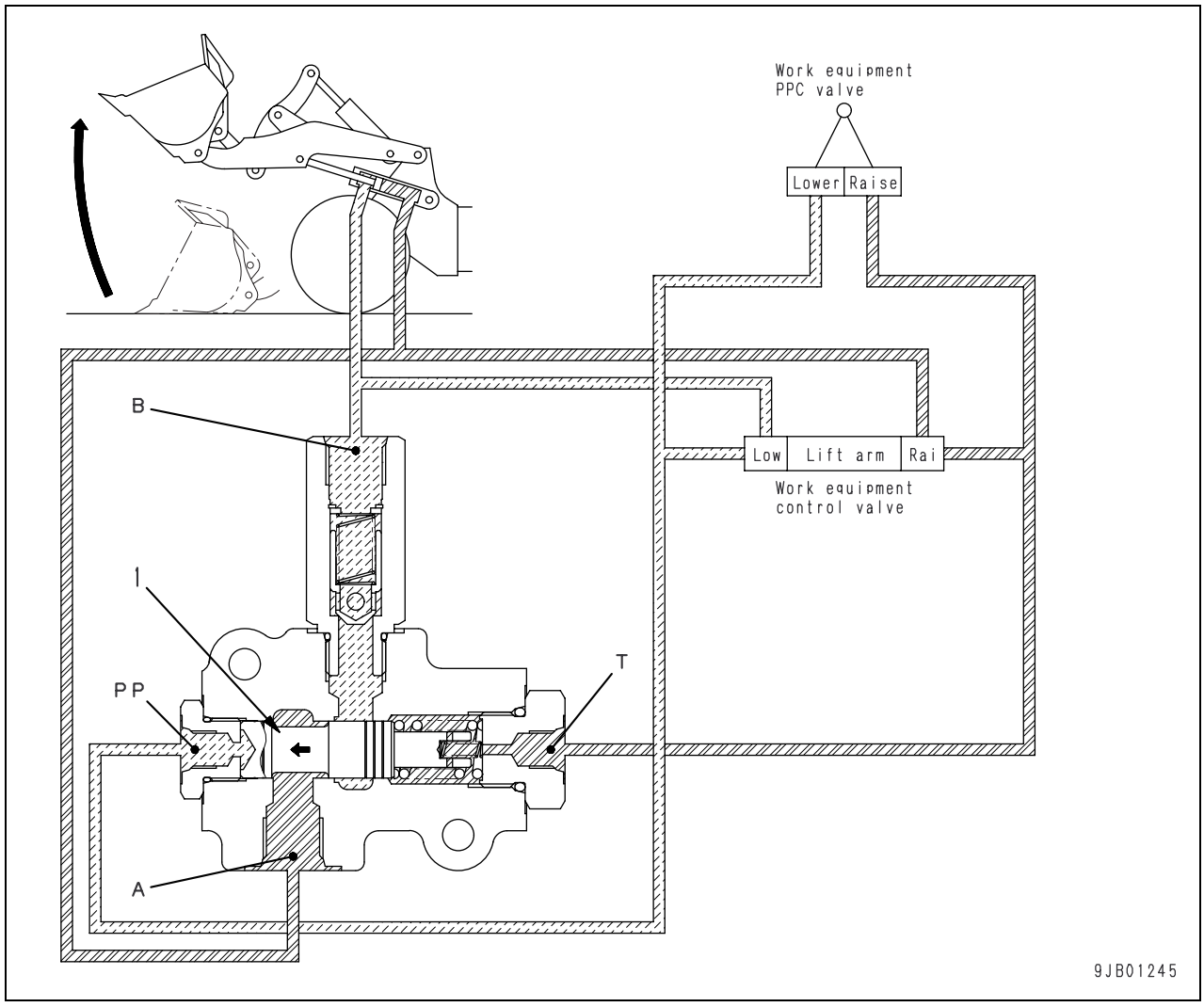



PP: From port **P4** of work equipment PPC valve (Multi-function joystick type)
From port **P2** of work equipment PPC valve (2-lever type)
T: From port **P3** of work equipment PPC valve
A: To lift cylinder bottom side
B: To lift cylinder head side

1. Body
2. Plunger
3. Plug
4. Spool
5. Plug
6. Body

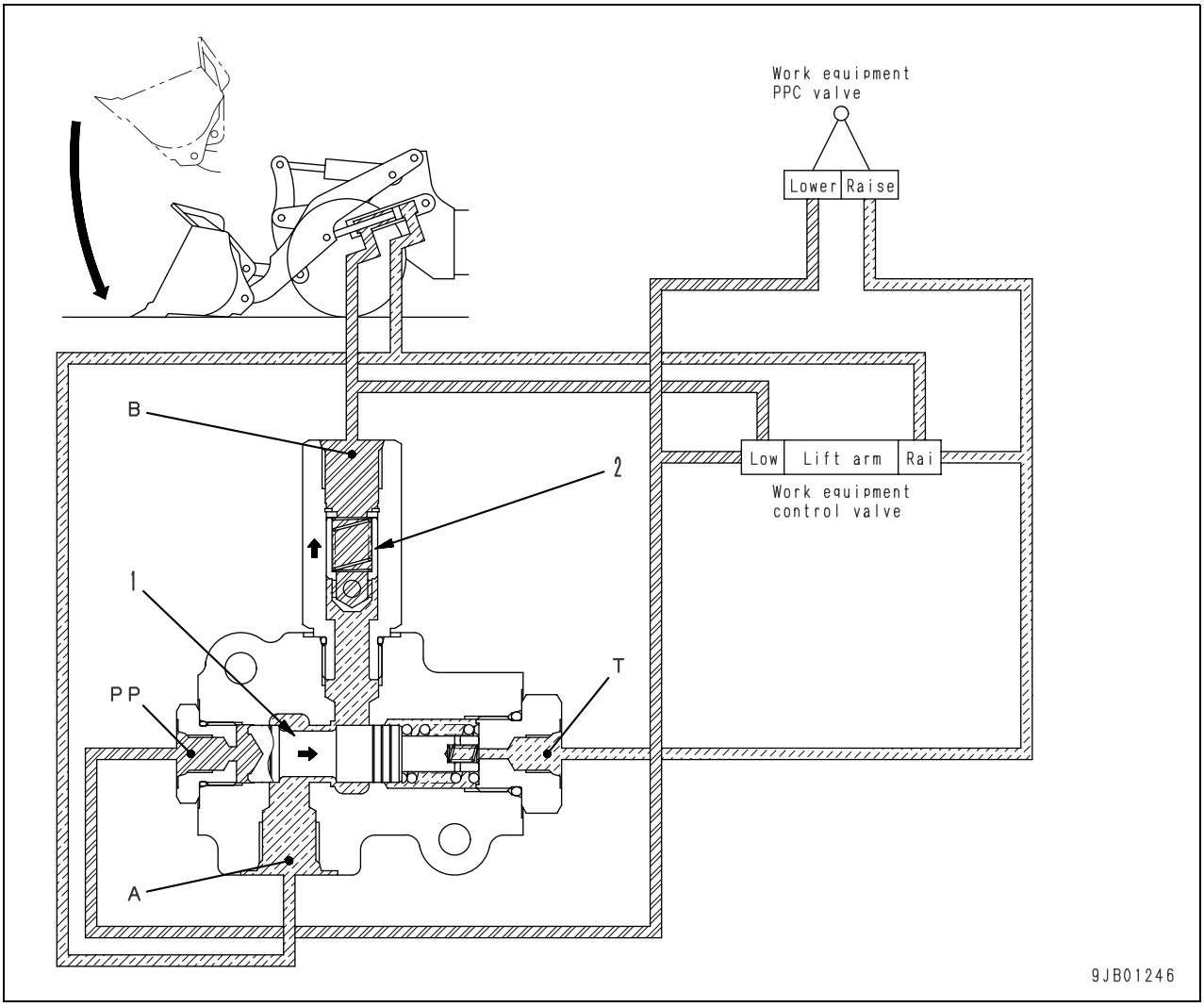
**Operation**

**When lift arm is "RAISE"**



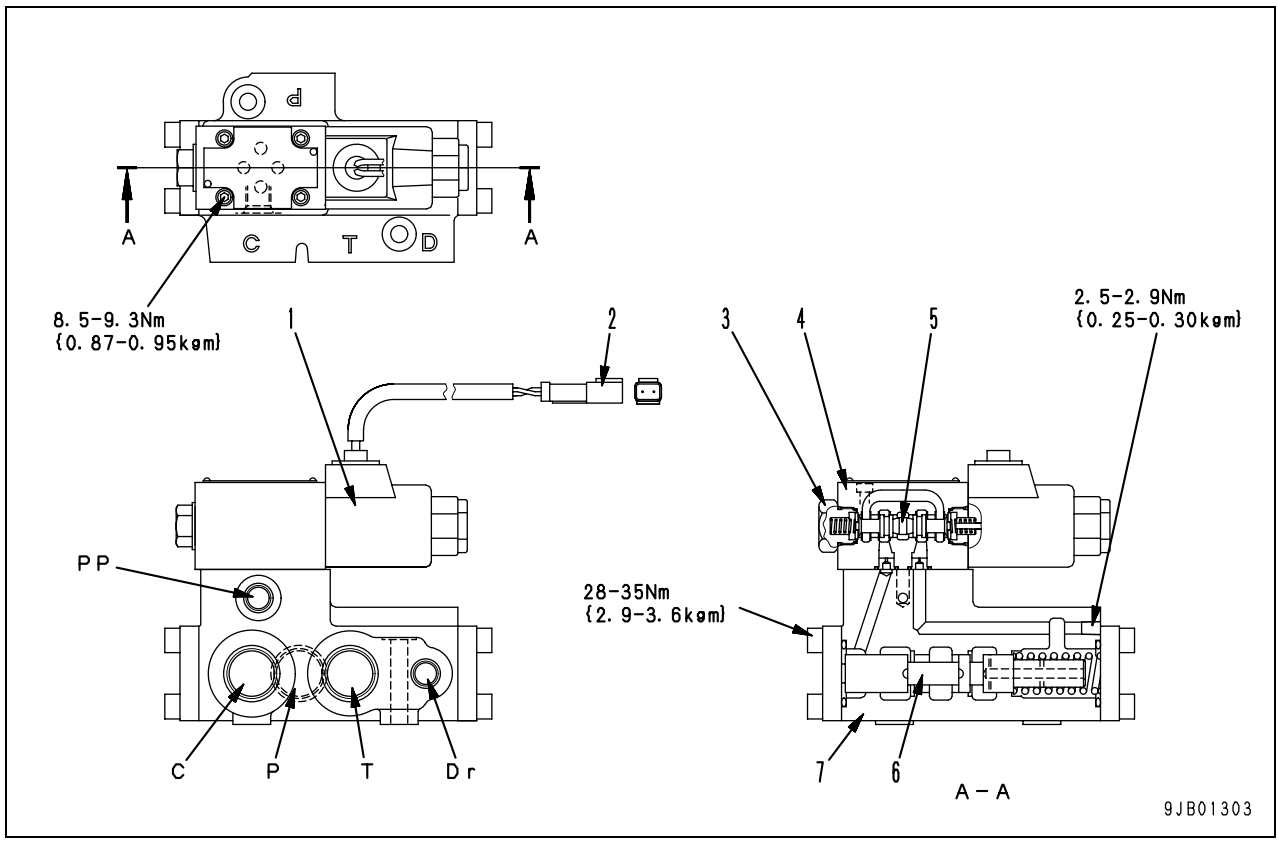

- If the lift arm is "RAISE", the oil of the work equipment PPC valve operates the work equipment control valve and the oil from the work equipment pump flows to the lift cylinder bottom side.
- At this time, the oil of the work equipment PPC valve flows to port T to push spool (1) to the left and close ports **A** and **B**.
- The oil on the lift cylinder head side flows through the work equipment control valve into the hydraulic tank, thus the lift arm rises.

**When lift arm is "LOWER"**




- If the lift arm is "LOWER", the oil of the work equipment PPC valve operates the work equipment control valve and the oil from the work equipment pump flows to the lift cylinder head side.
- At this time, the oil of the work equipment PPC valve flows to port **PP** to push spool (1) to the right and open ports **A** and **B**.
- When the lift arm is lowered, a part of the oil on the lift cylinder bottom side flows through the work equipment control valve into the hydraulic tank. A pressure higher than the pressure on the cylinder head side is generated on the cylinder bottom side by the weight of the work equipment, however.
- The hydraulic pressure generated on the lift cylinder bottom side pushes up and opens check valve plunger (2) and flows through port **B** to the cylinder head side, thus the lift arm lowers smoothly.

**WA250PT-5**

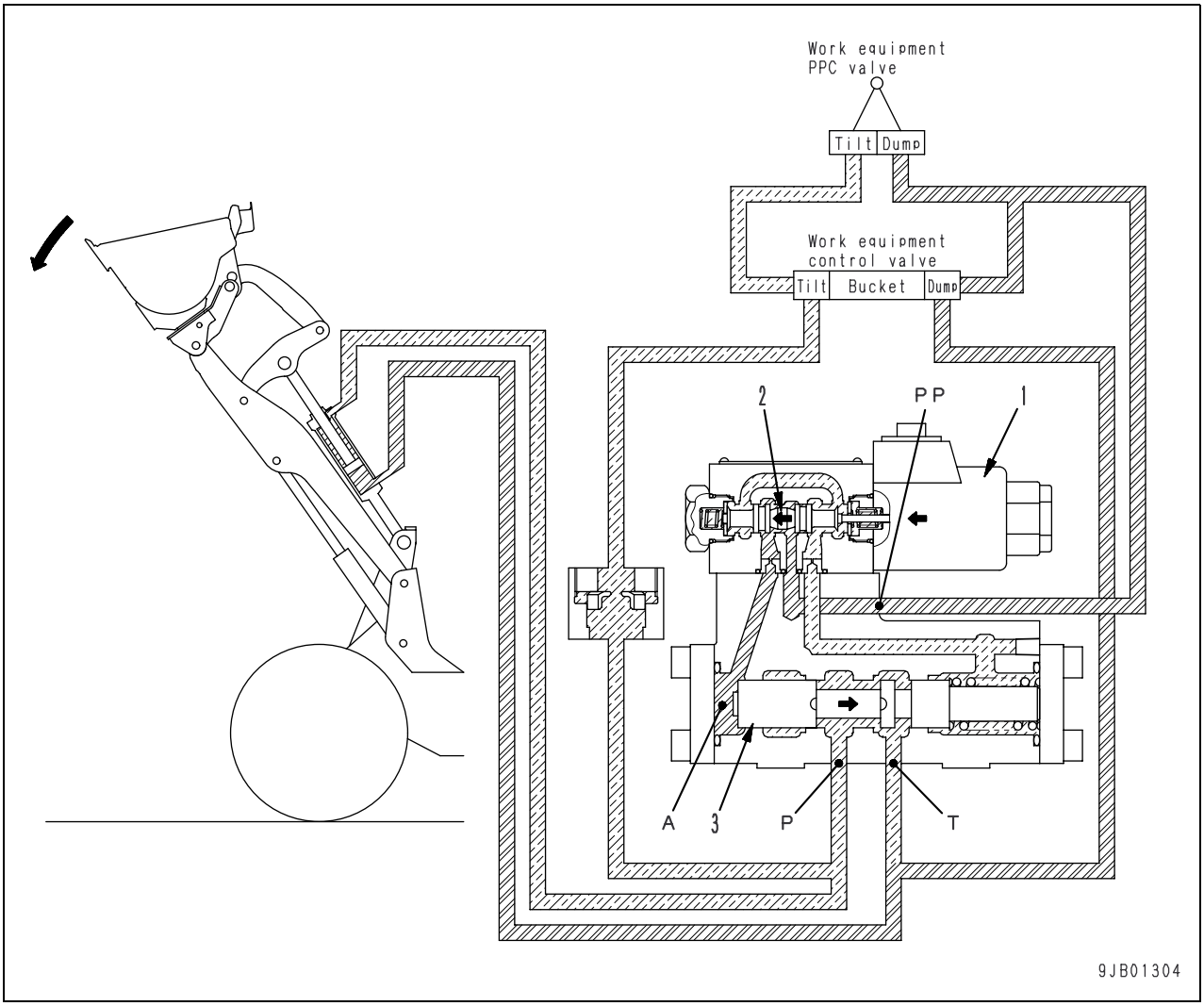



PP: From port **P2** of work equipment PPC valve (Multi-function joystick type)
From port **P4** of work equipment PPC valve (2-lever type)
P: From bucket cylinder head side
T: To bucket cylinder bottom side
C: Plug
Dr: To hydraulic tank

1. Bypass solenoid valve
2. Connector
3. Plug
4. Body
5. Spool
6. Spool
7. Body

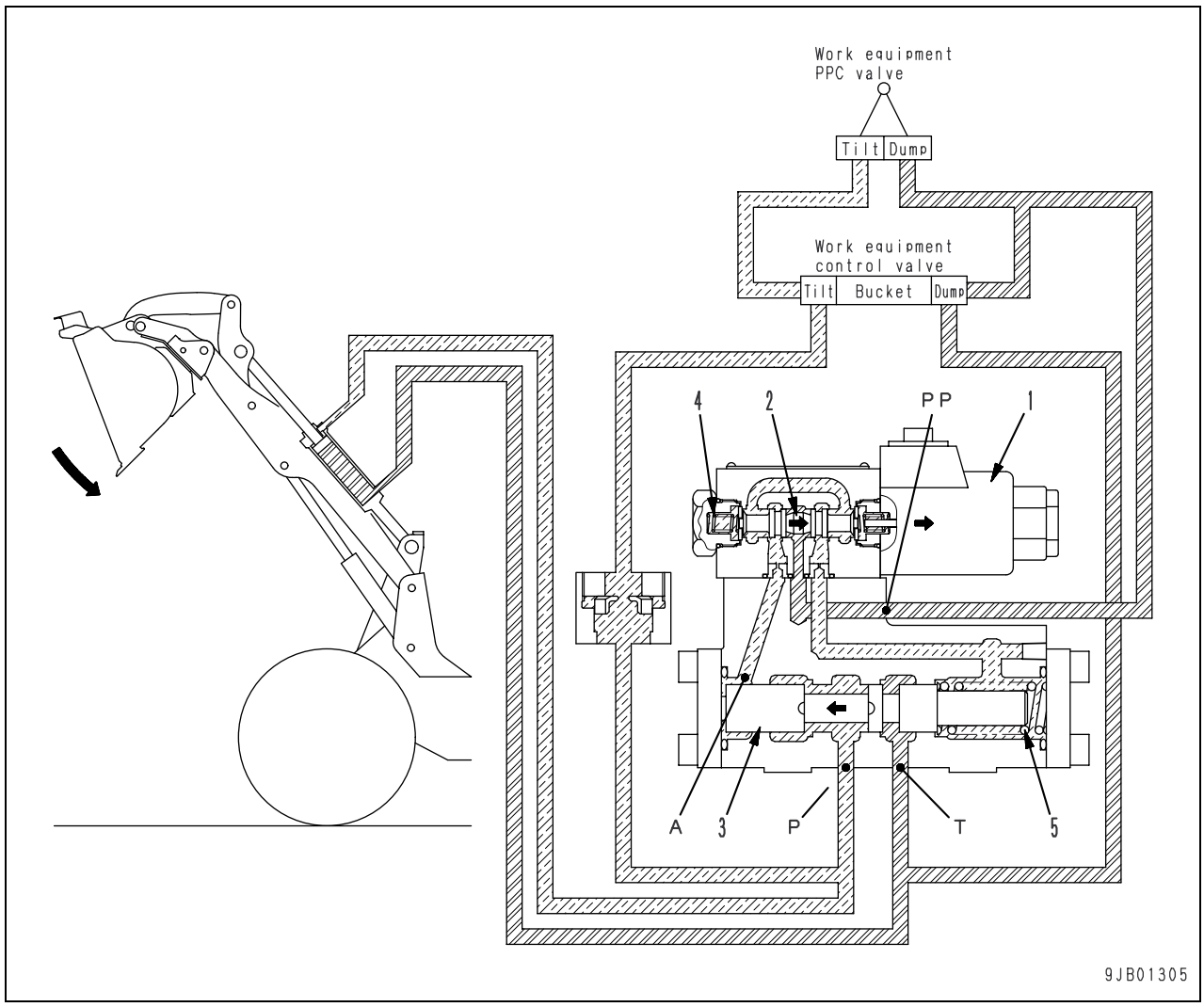
**Operation**

When bucket is "DUMP" in FAST mode (from tilt-back position to just before dump end)




- If the bucket is "DUMP" with the dump speed switch in the FAST mode position, the oil of the work equipment PPC valve operates the work equipment control valve and the oil from the work equipment pump flows to the bucket cylinder bottom side.
- Since the tilt lever angle proximity switch does not operate, bypass solenoid valve (1) is turned ON and spool (2) moves to the left.
- At this time, the oil from the work equipment PPC valve flows through port **PP** into chamber **A** and pushes spool (3) to the right and opens ports **P** and **T**.
- A part of the oil on the bucket cylinder head side flows through the work equipment control valve into the hydraulic tank, but most of the oil flows through ports **P** and **T** to the bucket cylinder bottom side.
- The oil from the work equipment control valve and the oil from the bucket cylinder head side merge together and flow to the bucket cylinder bottom side, thus the bucket dump speed is heightened.

When bucket is "DUMP" in FAST mode (from just before dump end to dump end)




- If the bucket is "DUMP" continuously to just before the dump end with the dump speed switch in the FAST mode position, the tilt lever angle proximity switch operates.
- Bypass solenoid valve (1) is turned OFF and spool (2) is moved to the right and held in the neutral position by the reaction force of spring (4).
- At this time, port **PP** and chamber **A** are closed and spool (3) is pushed back to the left by the reaction force of spring (5) to close ports **P** and **T**.
- The oil on the bucket cylinder head side does not flow through the bypass valve but all of it flows through the work equipment control valve into the hydraulic tank.
- Since only the oil from the work equipment control valve flows to the bucket cylinder bottom side, the bucket dump speed is lowered.

★ When the dump speed switch is set in the SLOW mode position, the bucket is operated as explained on this page regardless of the tilt lever angle.

# QUICK COUPLER VALVE

**WA250PT-5**

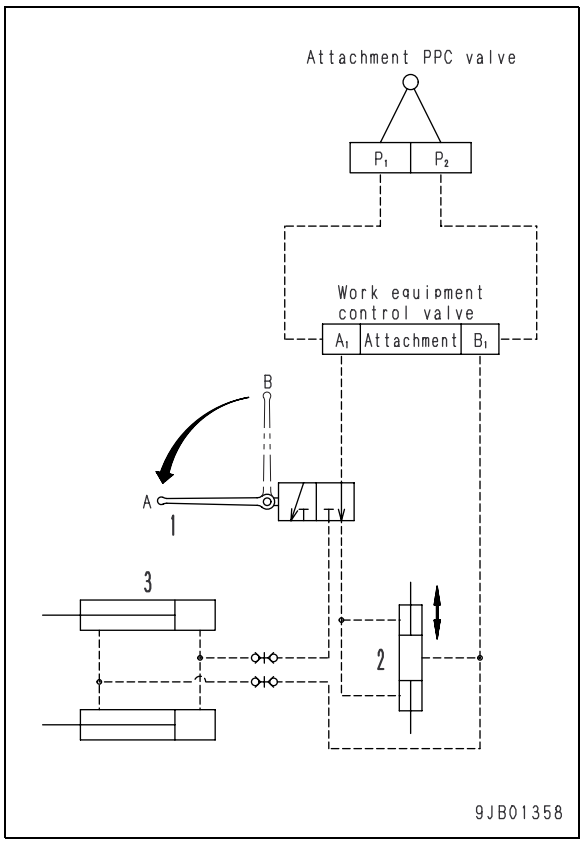
**Outline**

- The coupler plunger is extracted or retracted by operating the quick coupler valve lever to couple and uncouple each attachment and the coupler.

**Operation**

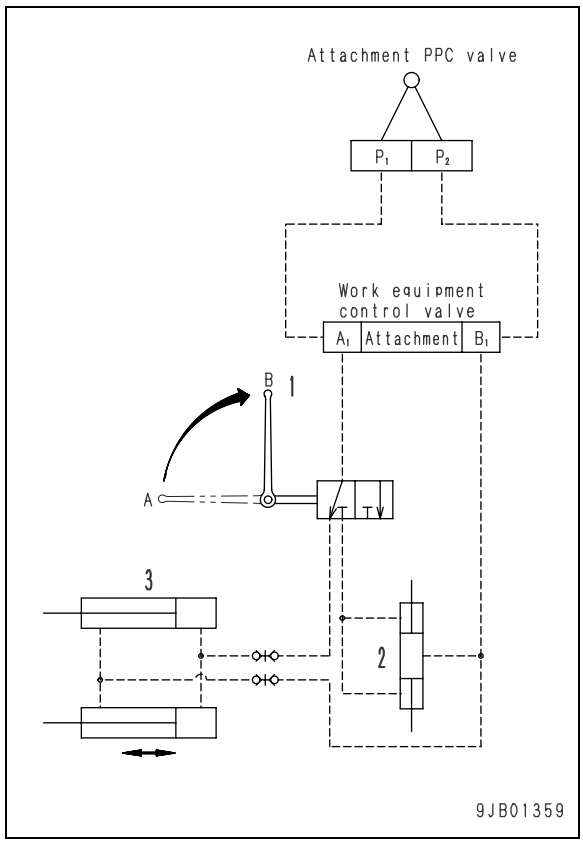
**When quick coupler valve lever is in position "A"**

- If the auxiliary control lever is operated with quick coupler valve lever (1) in position "A", oil flows in coupler plunger (2) to extract or retract coupler plunger (2) and couple or uncouple the attachment and coupler.




**When quick coupler valve lever is in position "B"**

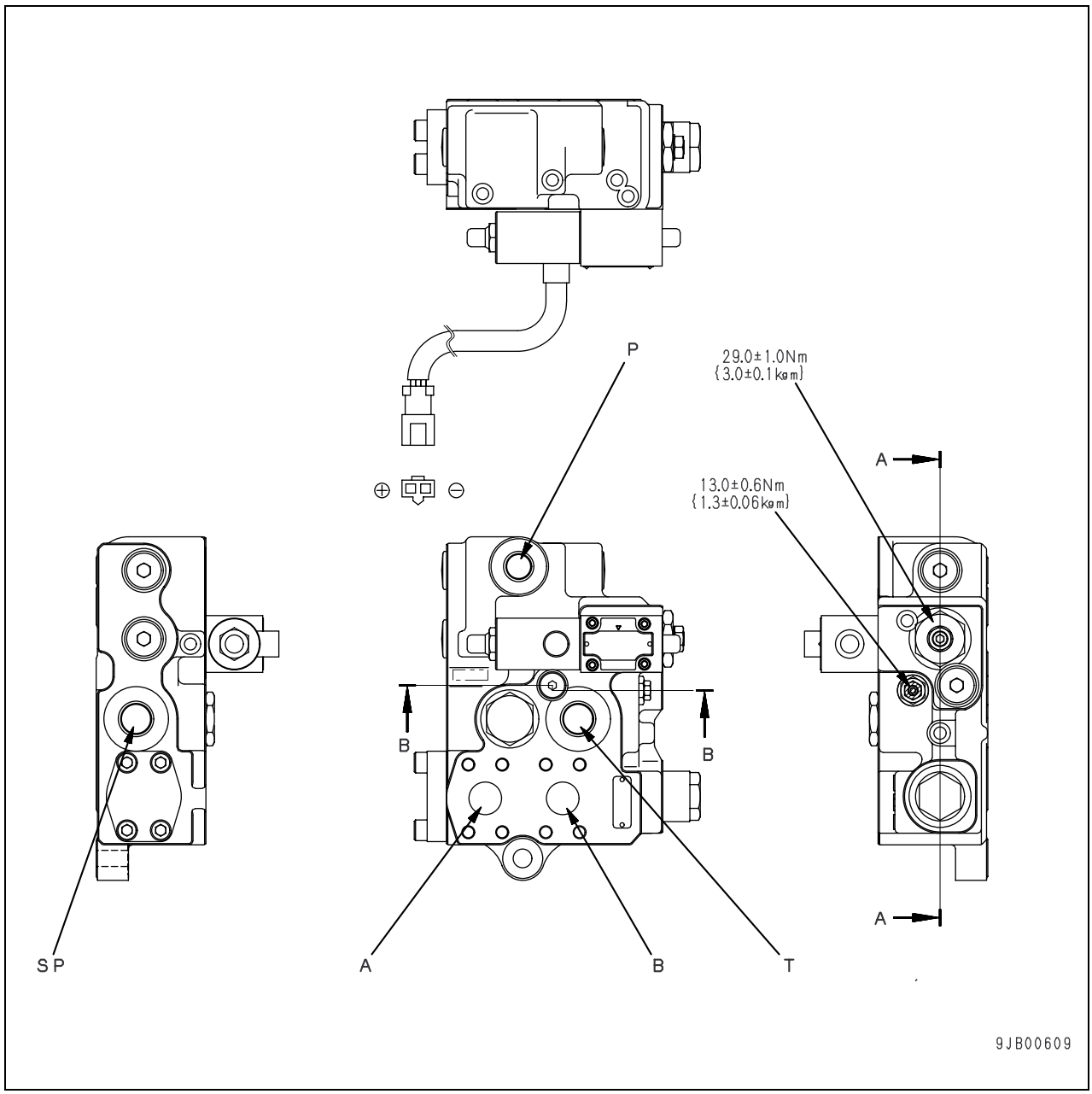
- If the auxiliary control lever is operated with quick coupler valve lever (1) in position "B", oil flows in attachment cylinder (3) to extract or retract attachment cylinder (3) and operate the attachment.



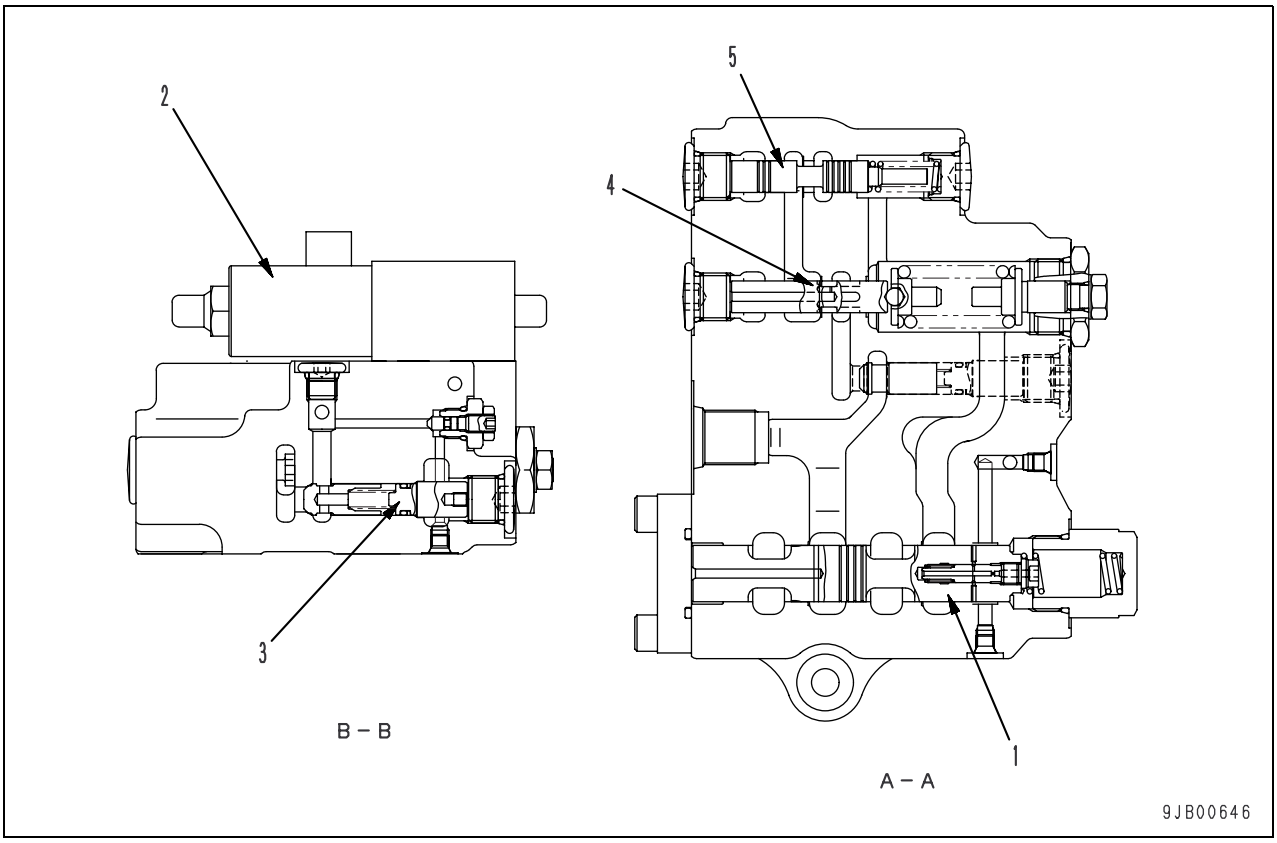
# E.C.S.S. VALVE

**(If equipped)**

**(E.C.S.S.: Electronically Controlled Suspension System)**



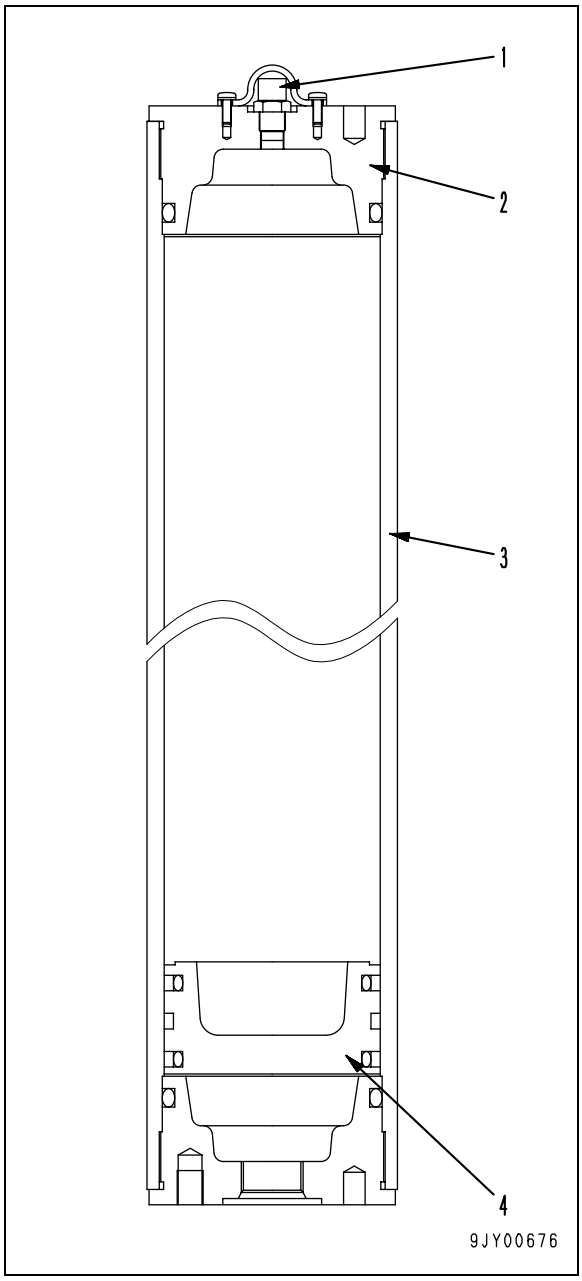

P: From work equipment hydraulic pump
T: To hydraulic tank
A: From lift cylinder bottom side
B: From lift cylinder head side
SP: To accumulator (for E.C.S.S.)




1. Main spool
2. Solenoid valve
3. Flow control valve
4. Shuttle valve
5. Charge valve

# ACCUMULATOR (FOR E.C.S.S.)

**(If equipped)**




1. Valve
2. Top cover
3. Cylinder
4. Free piston

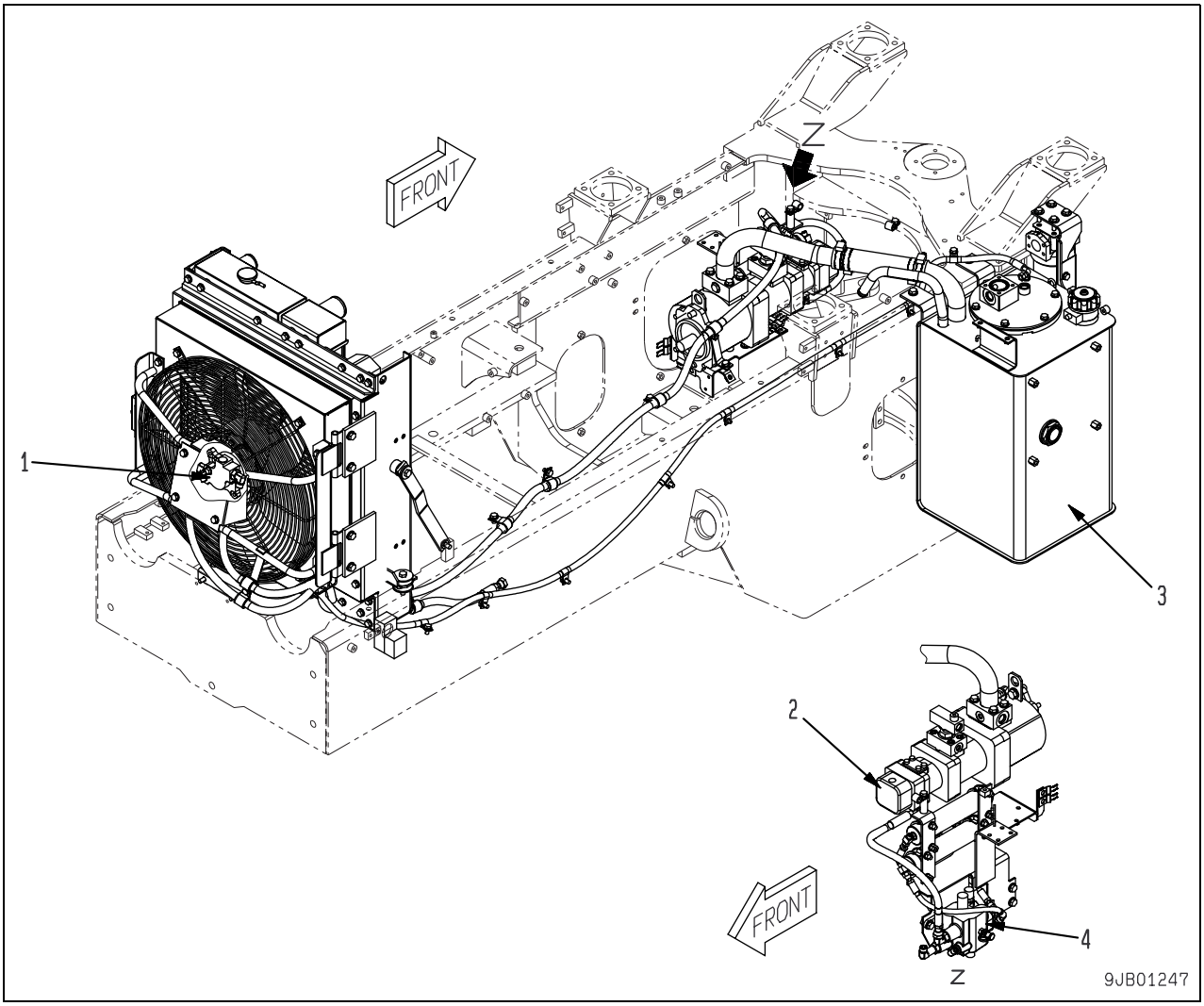
**Function**

- The accumulator is installed to the lift cylinder bottom circuit. The space between its cylinder (3) and free piston (4) is filled with nitrogen gas. The nitrogen gas absorbs the oil pressure pulses generated on the lift cylinder bottom side during travel for higher travel performance and operating performance by utilizing its compressibility.

**Specifications**

Gas used: Nitrogen gas
Amount of gas: 3,000 cc
Charge pressure: 2.0 ± 0.1 MPa {20 ± 1.0 kg/cm$^2$})
(at 20°C)

# HYDRAULIC PIPING OF COOLING SYSTEM

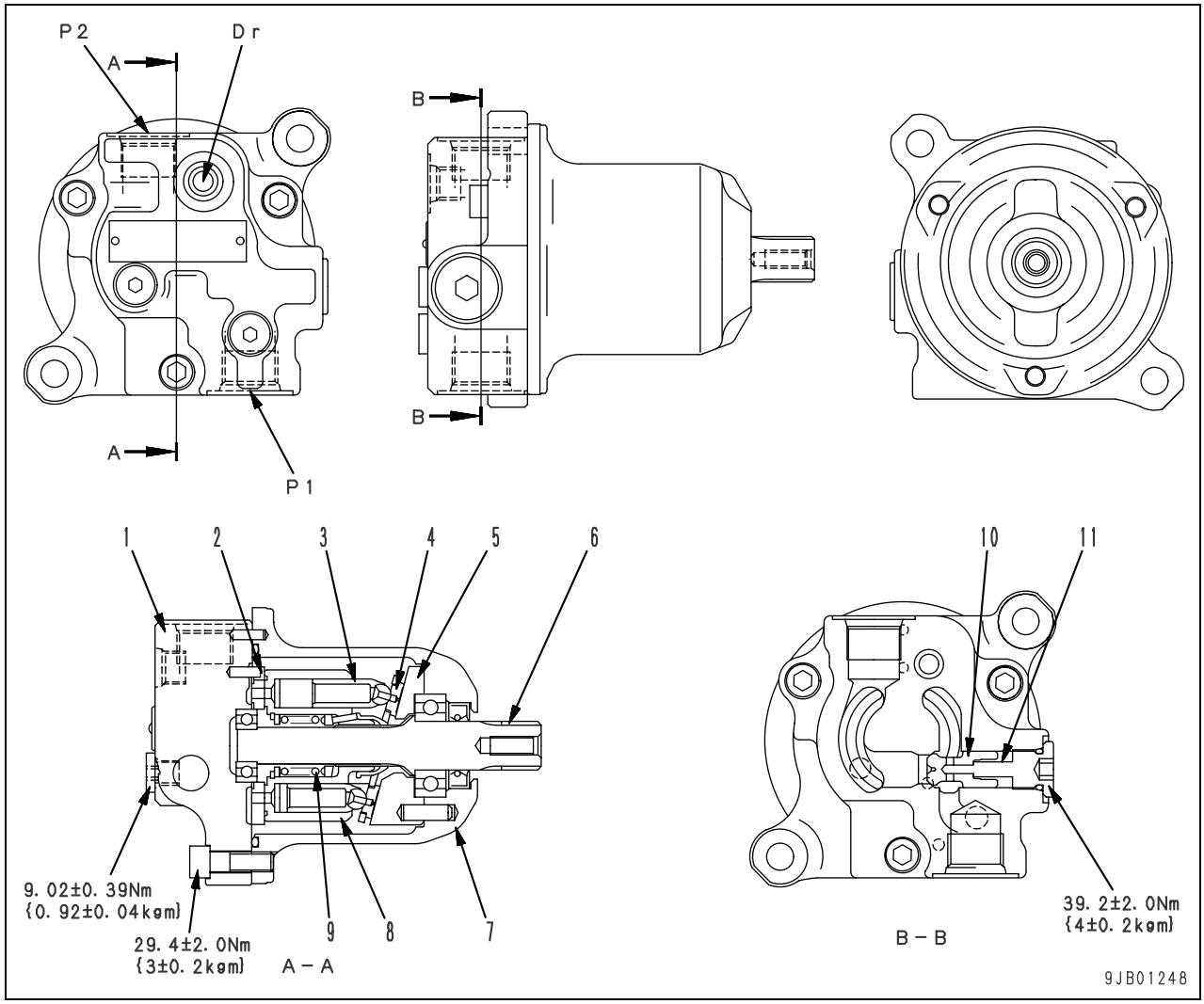



1. Cooling fan motor
2. Brake and cooling fan pump
3. Hydraulic tank
4. Charge valve

**Outline**

- Cooing fan motor (1) installed to the radiator is driven hydraulically by brake and cooling fan pump (2).

# COOLING FAN MOTOR




P1: From charge valve
P2: To hydraulic tank
Dr: To hydraulic tank

1. Port block
2. Valve plate
3. Piston
4. Shoe
5. Thrust plate
6. Output shaft
7. Case
8. Cylinder block
9. Center spring
10. Check valve
11. Check valve spring

**Specifications**

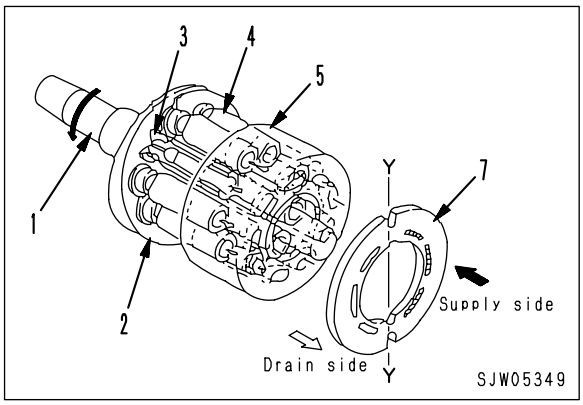
| Model | MSF-12-10 |
|---|---|
| Type | Fixed displacement swash plate-type piston motor |
| Theoretical capacity (cc/rev) | 9.9 |
| Rated speed (rpm) | 1,450 |
| Rated capacity (ℓ/min) | 14.4 |

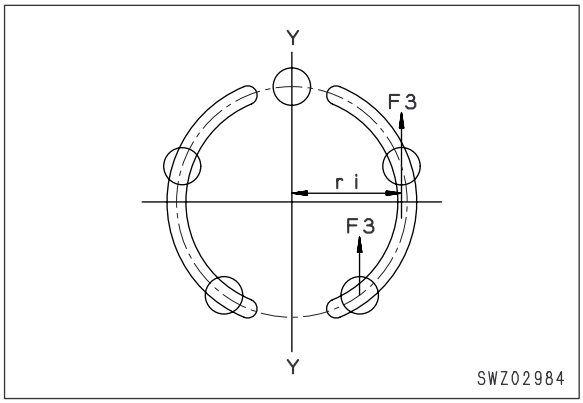
**Function**

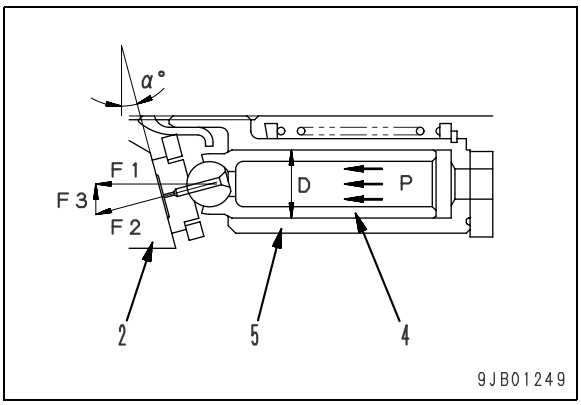
- This hydraulic motor is a swash plate-type axial piston motor, which converts the pressure of the hydraulic oil sent from the hydraulic pump into revolution.

**Principle of operation**

- The oil sent from the hydraulic port flows through valve plate (7) into cylinder block (5).
  This oil can flow on only one side of the Y-Y line connecting the top dead center and bottom dead center of the stroke of piston (4).
- The oil sent to one side of cylinder block (5) pressed pistons (4) (2 or 3 pieces) and generates force F1 (F1 kg=P kg/cm$^2$ x ✕/4 D2 cm$^2$).
- This force is applied to thrust plate (2). Since thrust plate (2) is fixed to the angle of Eo degrees to the output shaft (1), the force is divided into components F2 and F3.
- The radial components F3 generates torque against the Y-Y line connecting the top dead center and bottom dead center (T = F3 x ri).
- The resultant of this torque [T = Σ (F3 x ri)] rotates the cylinder block (5) throught the piston.
- Since the cylinder block (5) is coupled with the output shaft by means of spline, the output shaft (1) revolves to transmit the torque.

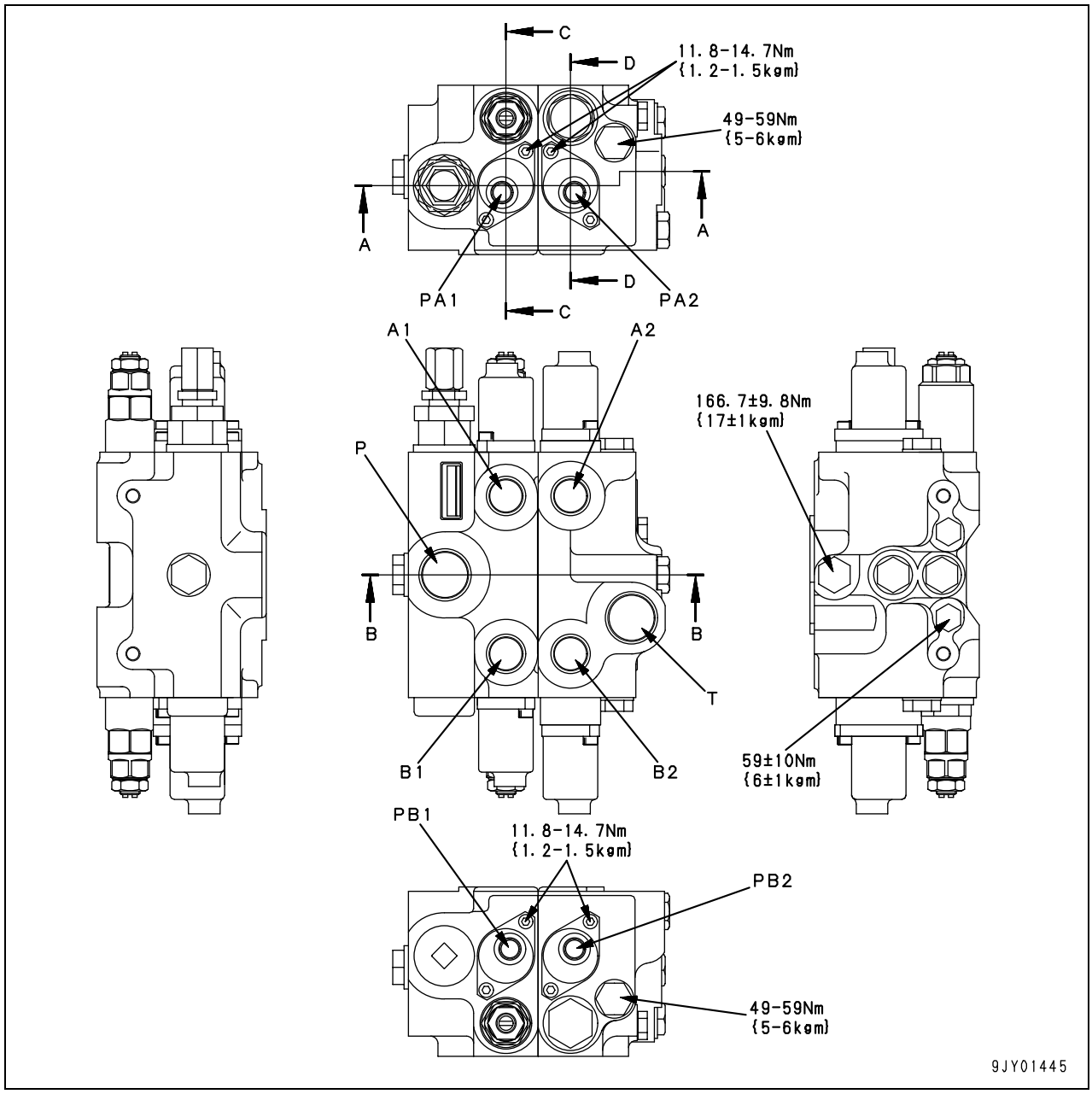


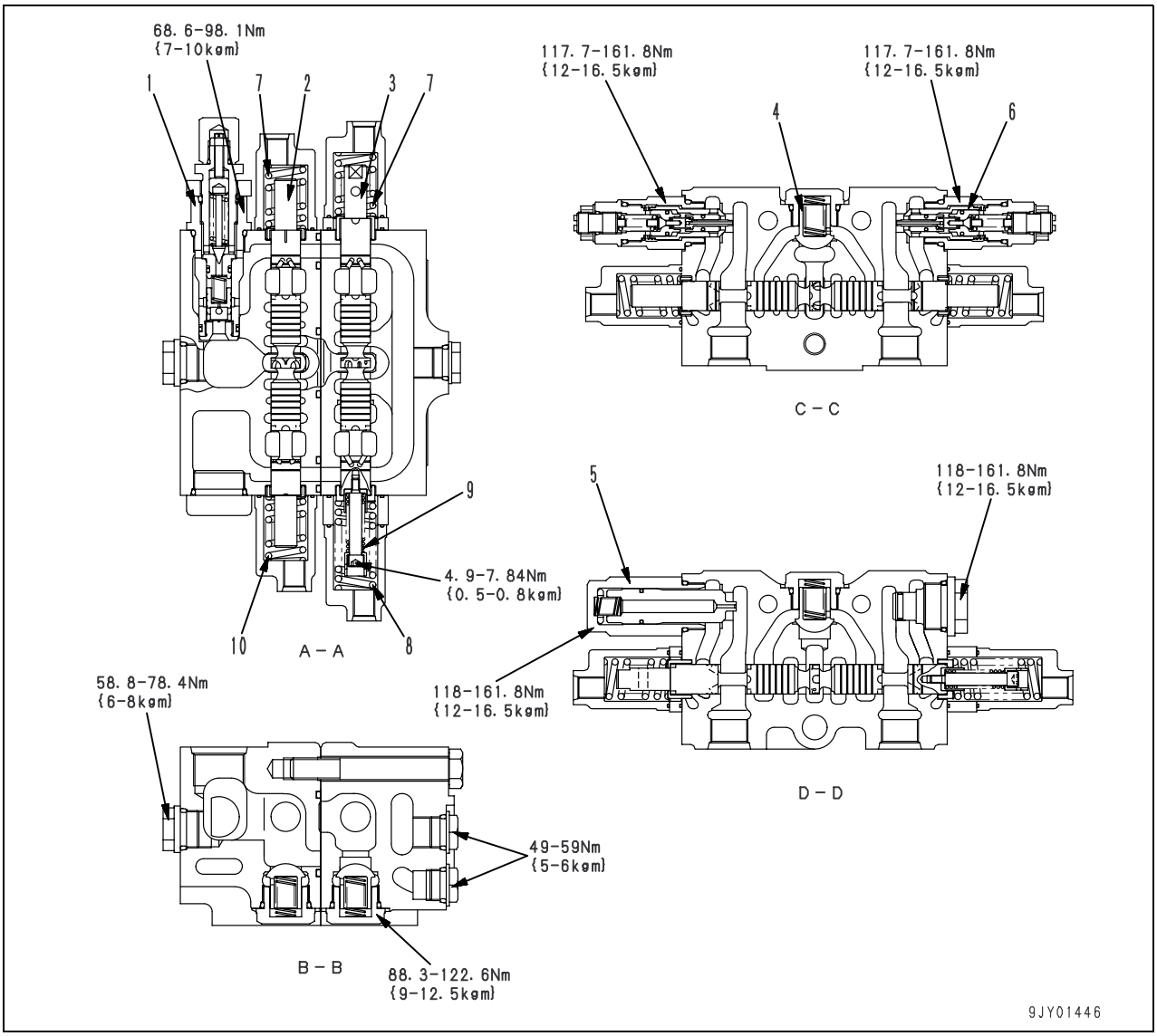



# WORK EQUIPMENT CONTROL VALVE

**1. 2-Spool valve**




P: Pump
T: Drain
A1: To bucket cylinder head
A2: To lift cylinder head
B1: To bucket cylinder bottom
B2: To lift cylinder bottom
PA1: To work equipment PPC valve P2
PA2: To work equipment PPC valve P4
PB1: To work equipment PPC valve P1
PB2: To work equipment PPC valve P3

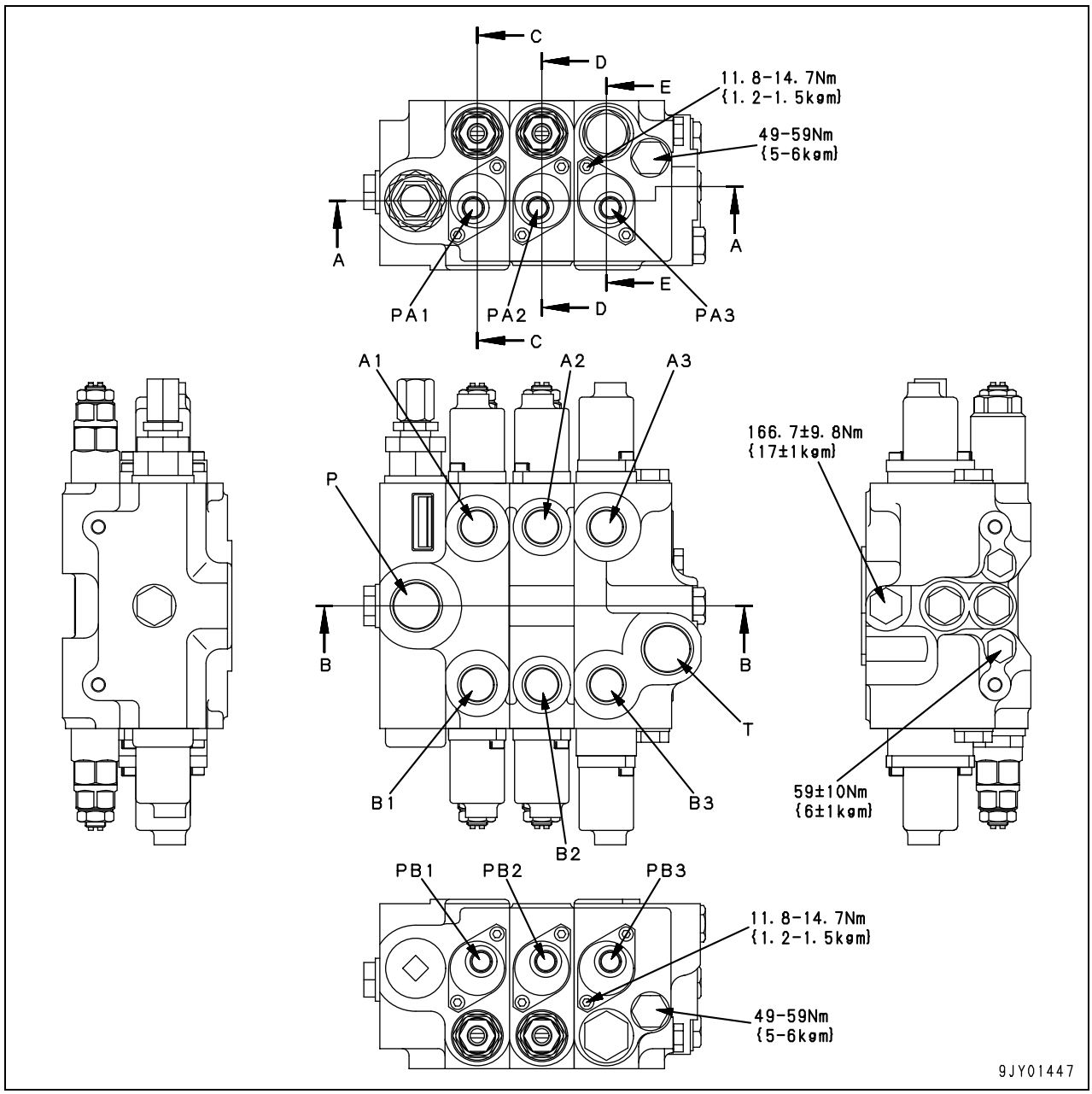



1. Main relief valve
2. Bucket spool
3. Lift arm spool
4. Check valve
5. Suction valve
6. Safety-suction valve

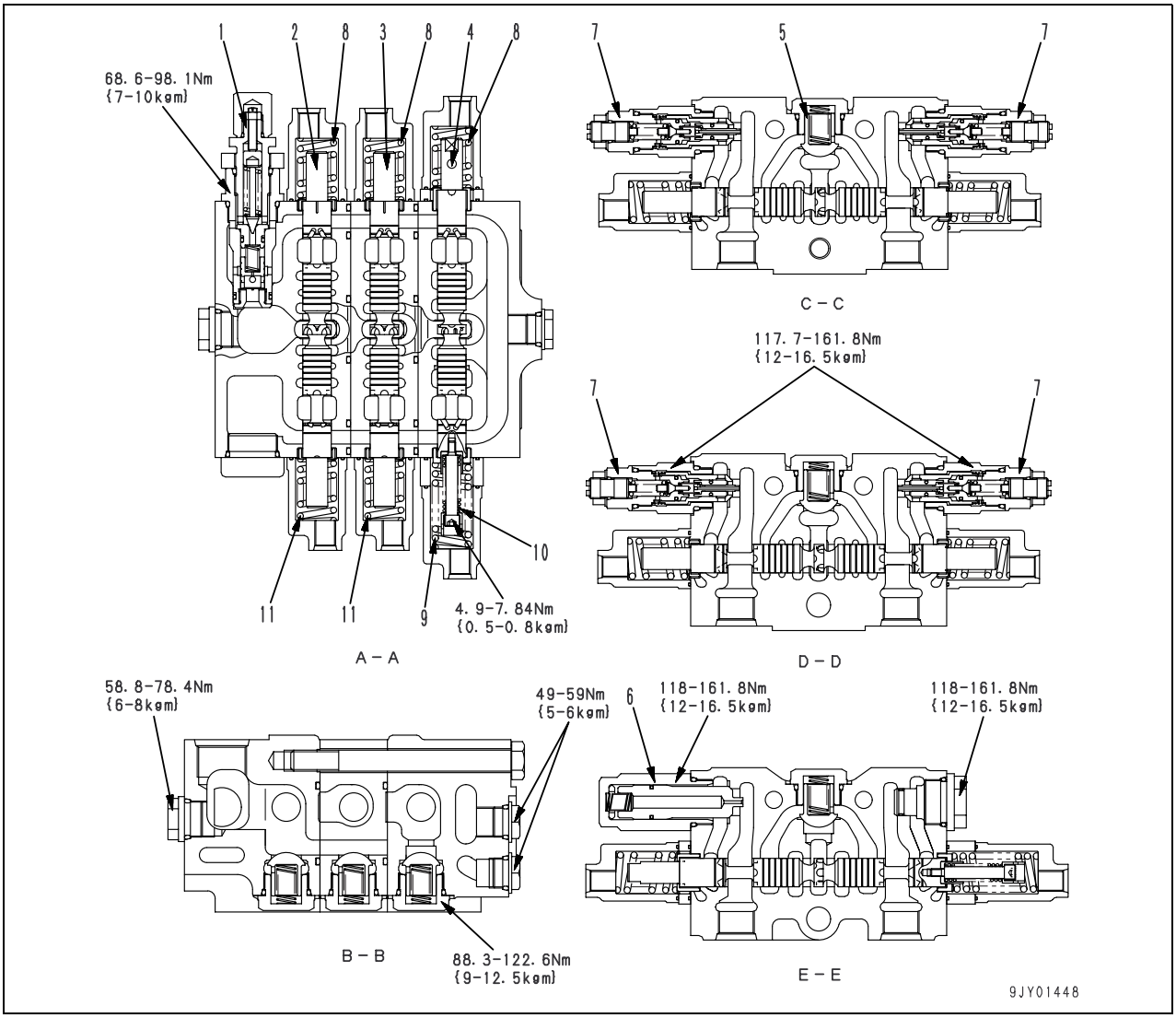
Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | | | Repair limit | | |
| 7 | Lift arm raise and bucket tilt spool return spring | Free length x Outside diameter | Installed length | Installed load | Free length | Installed load | Replace spring if damaged or replaced |
| | | 42.5 x 27.5 | 41 | 92.2 N {9.4 kg} | 40.4 | 87.3 N {8.9 kg} | |
| 8 | Lift arm lower spool return spring | 58.9 x 26.3 | 57.3 | 55.9 N {5.7 kg} | 56 | 53 N {5.4 kg} | |
| 9 | Lift arm float spool return spring | 53.4 x 12 | 38.5 | 110.8 N {11.3 kg} | 50.7 | 105 N {10.7 kg} | |
| 10 | Bucket dump spool return spring | 42 x 27.5 | 41 | 72.5 N {7.4 kg} | 39.9 | 68.6 N {7 kg} | |

**2. 3-Spool valve**




P: To pump
T: To drain
A1: To service cylinder
A2: To bucket cylinder head
A3: To lift cylinder head
B1: To service cylinder
B2: To bucket cylinder bottom
B3: To lift cylinder bottom
PA1: To service PPC valve P1
PA2: To work equipment PPC valve P2
PA3: To work equipment PPC valve P4
PB1: To service PPC valve P2
PB2: To work equipment PPC valve P1
PB3: To work equipment PPC valve P3

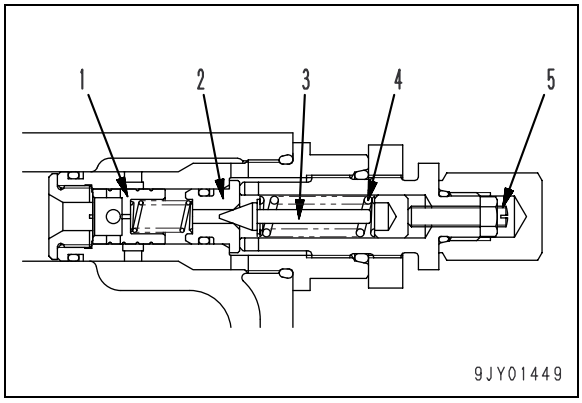



1. Main relief valve
2. Service spool
3. Bucket spool
4. Lift arm spool
5. Check valve
6. Suction valve
7. Safety-suction valve

Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | | | Repair limit | | |
| 8 | Lift arm raise and bucket tilt spool return spring | Free length x Outside diameter | Installed length | Installed load | Free length | Installed load | Replace spring if damaged or replaced |
| | | 42.5 x 27.5 | 41 | 92.2 N {9.4 kg} | 40.4 | 87.3 N {8.9 kg} | |
| 9 | Lift arm lower spool return spring | 58.9 x 26.3 | 57.3 | 55.9 N {5.7 kg} | 56 | 53 N {5.4 kg} | |
| 10 | Lift arm float spool return spring | 53.4 x 12 | 38.5 | 110.8 N {11.3 kg} | 50.7 | 105 N {10.7 kg} | |
| 11 | Bucket dump spool return spring | 42 x 27.5 | 41 | 72.5 N {7.4 kg} | 39.9 | 68.6 N {7 kg} | |

### 3. Relief valve



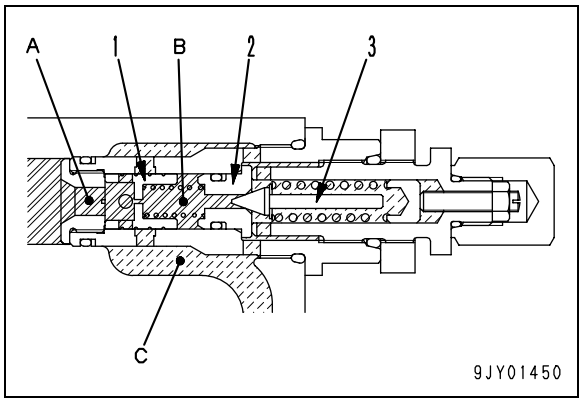

1. Main valve
2. Valve seat
3. Pilot poppet
4. Spring
5. Adjusting screw

**Function**

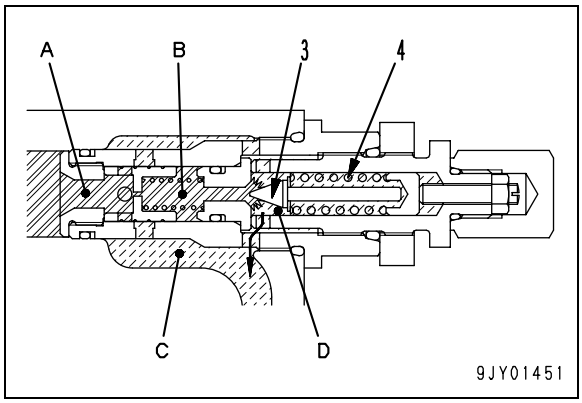
- The relief valve is installed to the inlet of the work equipment valve. When the oil pressure rises above the specified level, this valve drains the oil into the hydraulic tank to limit the maximum pressure of the work equipment circuit and protect the circuit.

**Operation**

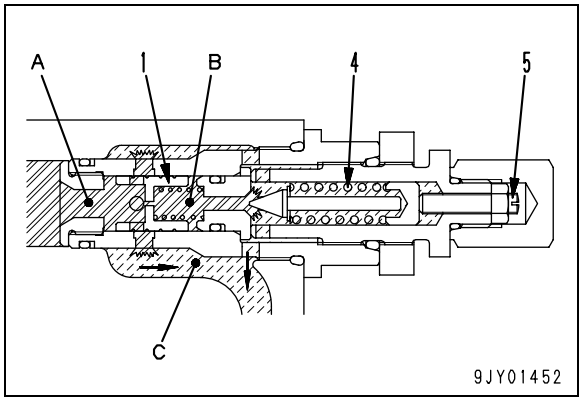
- The port **A** is connected to the pump circuit and the port **C** is connected to the drain circuit. The oil passes through the orifice of the main valve (1) to fill the port **B**. The pilot poppet (3) is contacting (seated) to the valve seat (2).



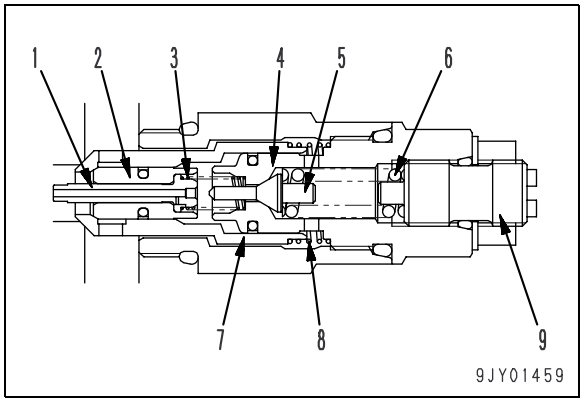

- When the hydraulic pressure inside the port **A** and the port **B** reaches the set pressure of the pilot poppet spring (4), the pilot poppet (3) opens to let the hydraulic pressure of the port **B** flow from the port **D** to the port **C** and the pressure of the port **B** drops.

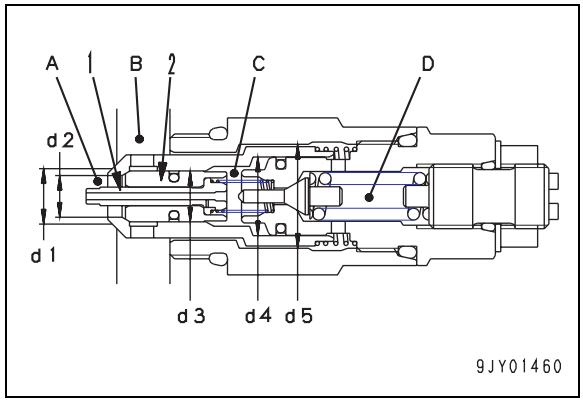



- When the pressure at the port **B** drops, pressure difference occurs between the port **A** and the port **B** by the orifice of the main valve (1) and the main valve shall be pushed open to let the oil of the port **A** to pass through the port **C** to flow into the drain circuit, to release the abnormal pressure.
- The preset pressure can be changed by increasing or decreasing the tension of the pilot poppet spring (4).
- To change the preset pressure, remove the cap nut to loosen the lock nut. After that, screw-in the adjust screw (5) to raise the preset pressure and loosen the adjust screw to lower the preset pressure.



### 4. Safety-suction valve




1. Piston
2. Main valve
3. Piston spring
4. Valve seat
5. Poppet
6. Poppet spring
7. Suction valve
8. Suction valve spring
9. Adjustment screw

**Function**

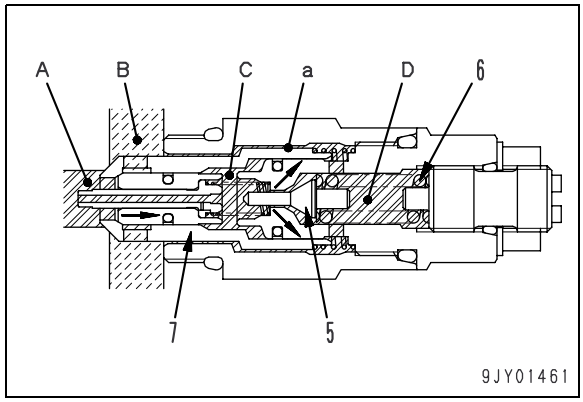
- The safety-suction valve is in the bucket cylinder circuit in the work equipment valve. When the work equipment valve is in neutral, if any impact is applied to the cylinder and abnormal pressure is generated, that pressure is released through this valve to protect the cylinder.
- If negative pressure is generated in the cylinder circuit, this valve works as a suction valve.

**Operation**

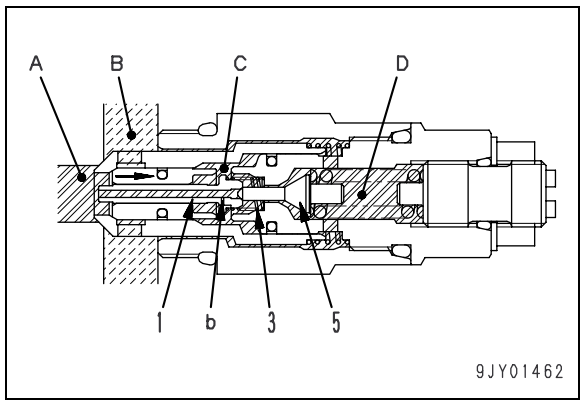
**(1) Operation as safety valve**

- Ports **A** and **B** are connected to the cylinder circuit and drain circuit respectively.
- The hydraulic oil in port **A** flows through the hole of piston (1) to port **C**. Since **d2** < **d3**, main valve (2) is seated on the left side.
- The order of the diameters (areas) of the sections is **d5** > **d4** > **d1** > **d3** > **d2**.

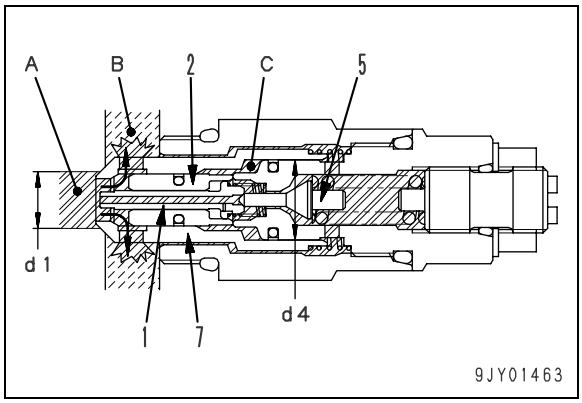
- If abnormal pressure generated in port **A** reaches the set pressure of spring (6), poppet (5) opens and the hydraulic oil in port **C** is drained through port **D** and periphery **a** of suction valve (7).




- If poppet (5) opens, the pressure in port **C** lowers and piston (1) moves to the right. Piston (1) comes in contact with the tip of poppet (5) and the hydraulic oil is drained through throttle **b** and port **D**.

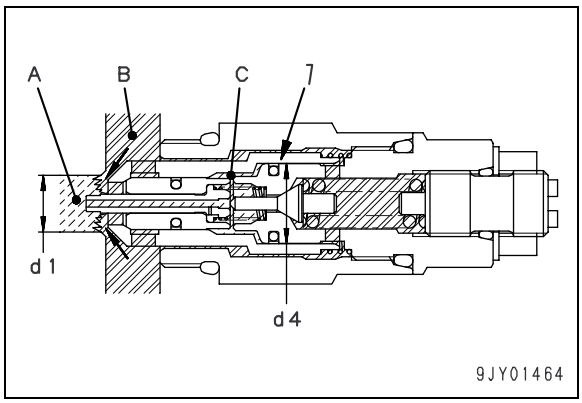


- Since the pressure in port **C** is lower than that in port **A**, main valve (2) moves to the right and the hydraulic oil flows through port **A** to port **B**, thus generation of abnormal pressure is prevented.
- Even if abnormal pressure is generated, suction valve (7) having a large section diameter does not operate since **d1** < **d4**.

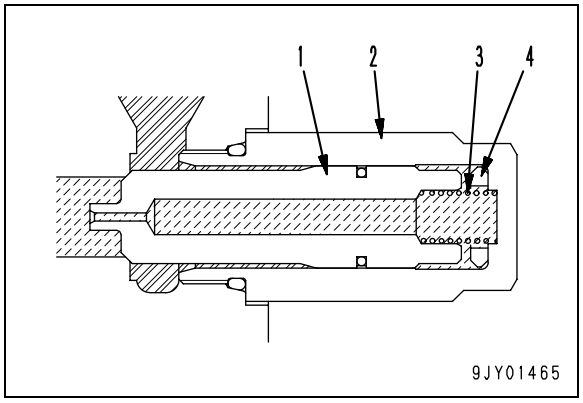



**(2) Operation as suction valve**

- If negative pressure is generated in the cylinder circuit, the pressure in ports **A** and **C** becomes negative since those ports are connected. The hydraulic pressure equivalent to the area difference between **d4** and **d1** is applied to suction valve (7).
- If the pressure difference between ports **B** and **A** increases above the set pressure, it moves suction valve (7) to the right. Accordingly, hydraulic oil flows from port **B** to port **A** to prevent generation of negative pressure in port **A**.




**5. Suction valve**



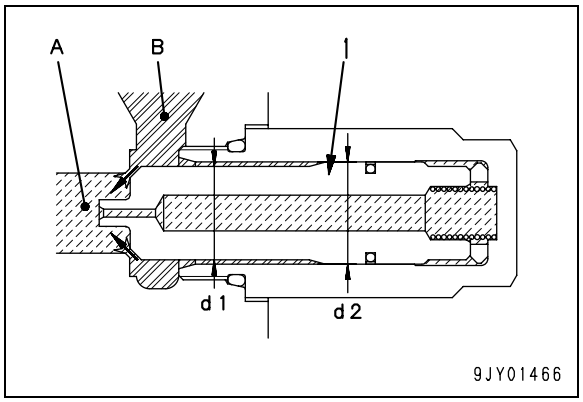

1. Main poppet
2. Sleeve
3. Spring
4. Spacer

**Function**

- The suction valve prevents generation of negative pressure in the circuit.

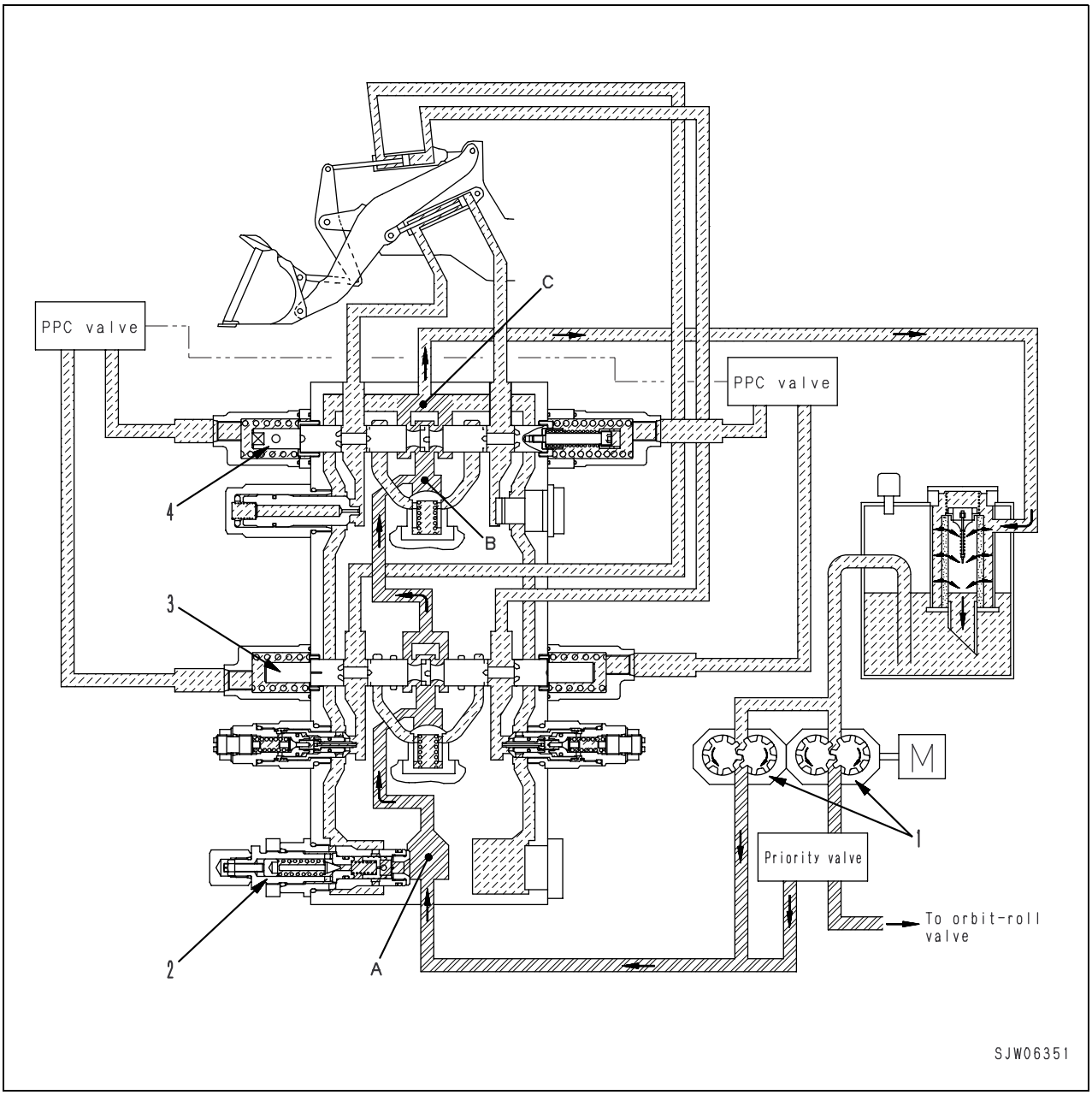
**Operation**

- If negative pressure is generated in port **A** (lift cylinder head) (If the pressure in port **A** is lower than the pressure in the tank circuit port **B**), main poppet (1) opens because of the area difference between **d1** and **d2** and the oil flows from tank port **B** into cylinder port **A**.



## 6. Operation of the work equipment control valve

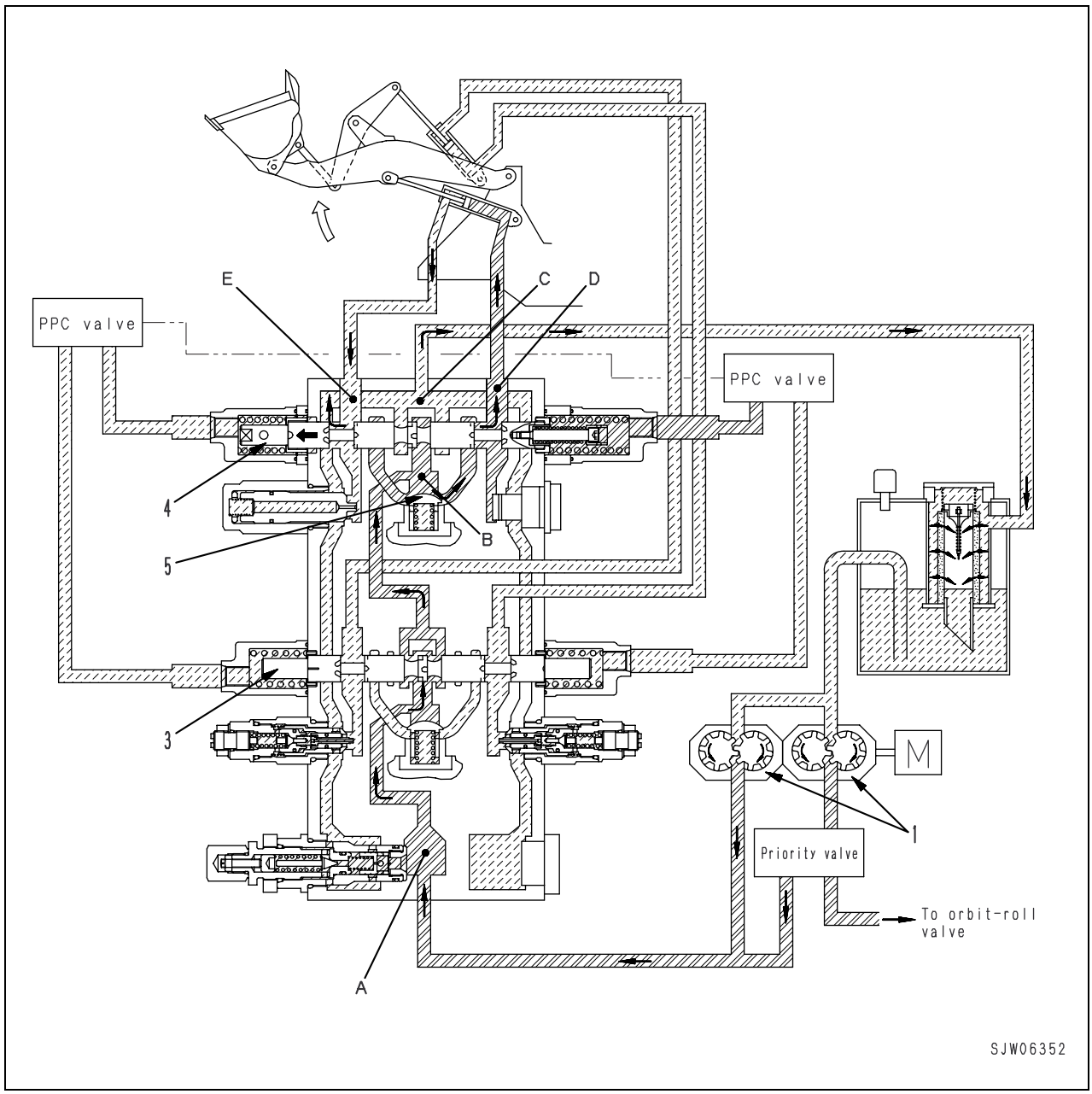
### (1) Neutral position of the lift arm and bucket spools




**Operation**

- The hydraulic oil flows through pump (1) and priority valve to port **A** and its maximum pressure is controlled by relief valve (2).
- The holding bypass circuit of bucket spool (3) is open and the hydraulic oil in port **A** flows through the periphery of the spool to port **B**.
- Since lift arm spool (4) is in neutral, its bypass circuit is open. Accordingly, the hydraulic oil in port **B** returns through the periphery of the spool, port **C** of the drain circuit, and filter into the tank.

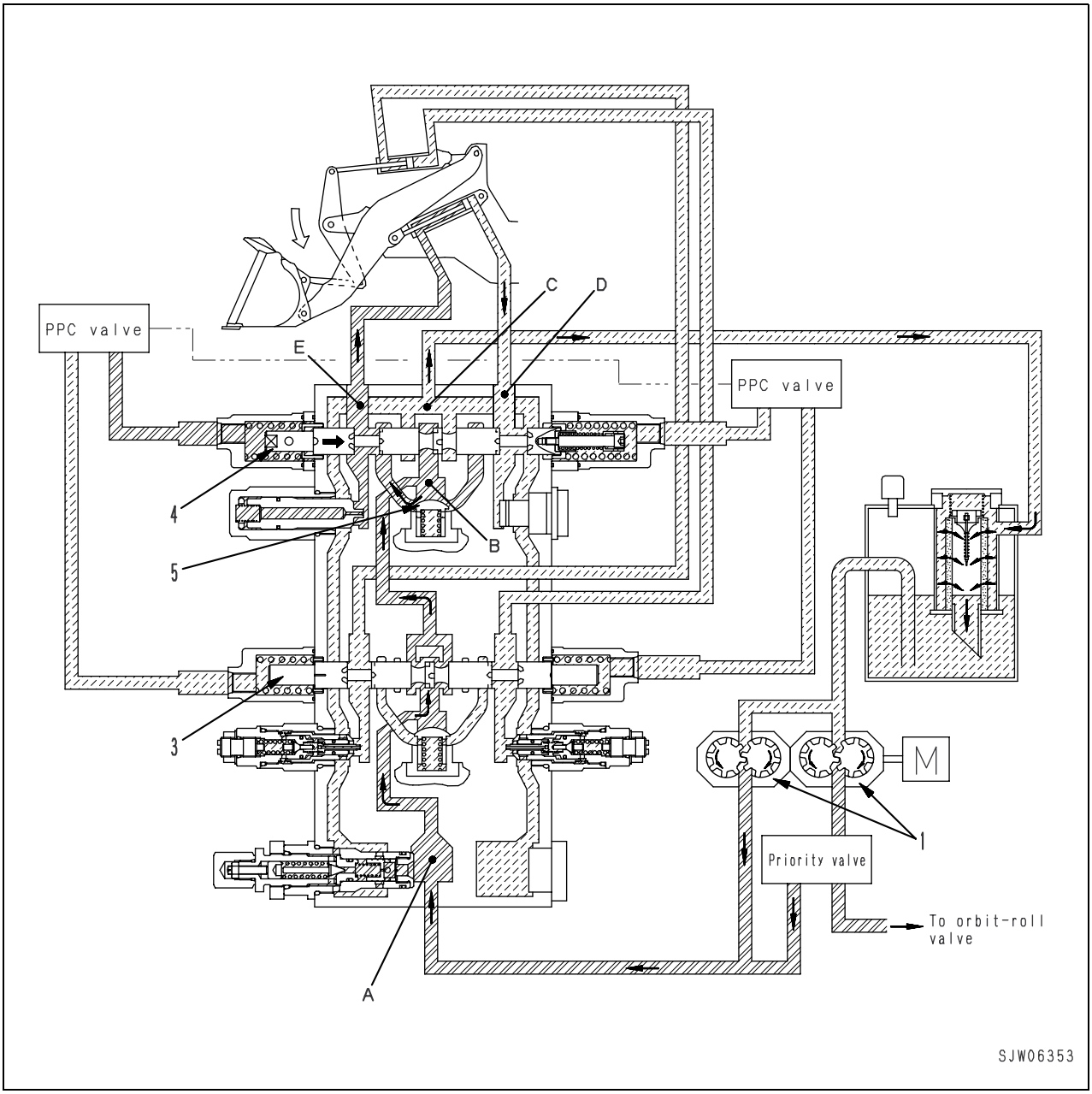
**(2) RAISE position of the lift arm spool**




**Operation**

- If the work equipment control lever is pulled, lift arm spool (4) is pulled out to the RAISE position.
- The hydraulic oil flows through pump (1) and bypass circuit of bucket spool (3) to the bypass circuit of lift arm spool (4).
- Since the bypass circuit is closed by the spool, the hydraulic oil from port **B** pushes check valve (5) open.
- The hydraulic oil from port **B** flows through port **D** to the cylinder bottom side.
- On the other hand, the hydraulic oil on the cylinder head side returns through port **E** and drain port **C** into the tank. Accordingly, the lift arm rises.

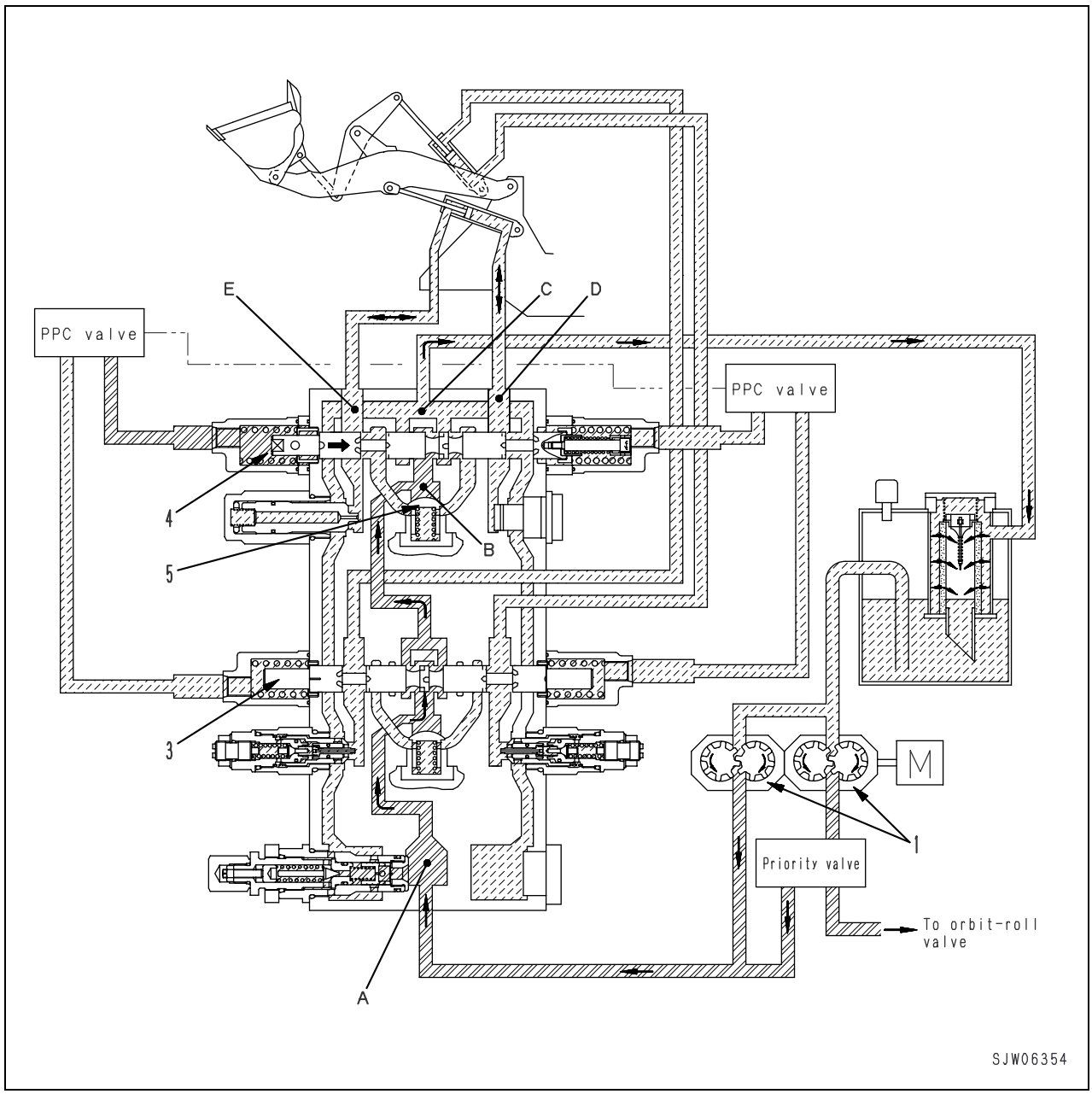
### (3) LOWER position of the lift arm spool




**Operation**

- If the work equipment control lever is pushed, lift arm spool (4) is pushed in to the LOWER position.
- The hydraulic oil flows through pump (1) and bypass circuit of bucket spool (3) to the bypass circuit of lift arm spool (4).
- Since the bypass circuit is closed by the spool, the hydraulic oil from port **B** pushes check valve (5) open.
- The hydraulic oil from port **B** flows through port **E** to the cylinder rod side.
- On the other hand, the hydraulic oil on the cylinder bottom side returns through port **D** and drain port **C** into the tank. Accordingly, the lift arm lowers.

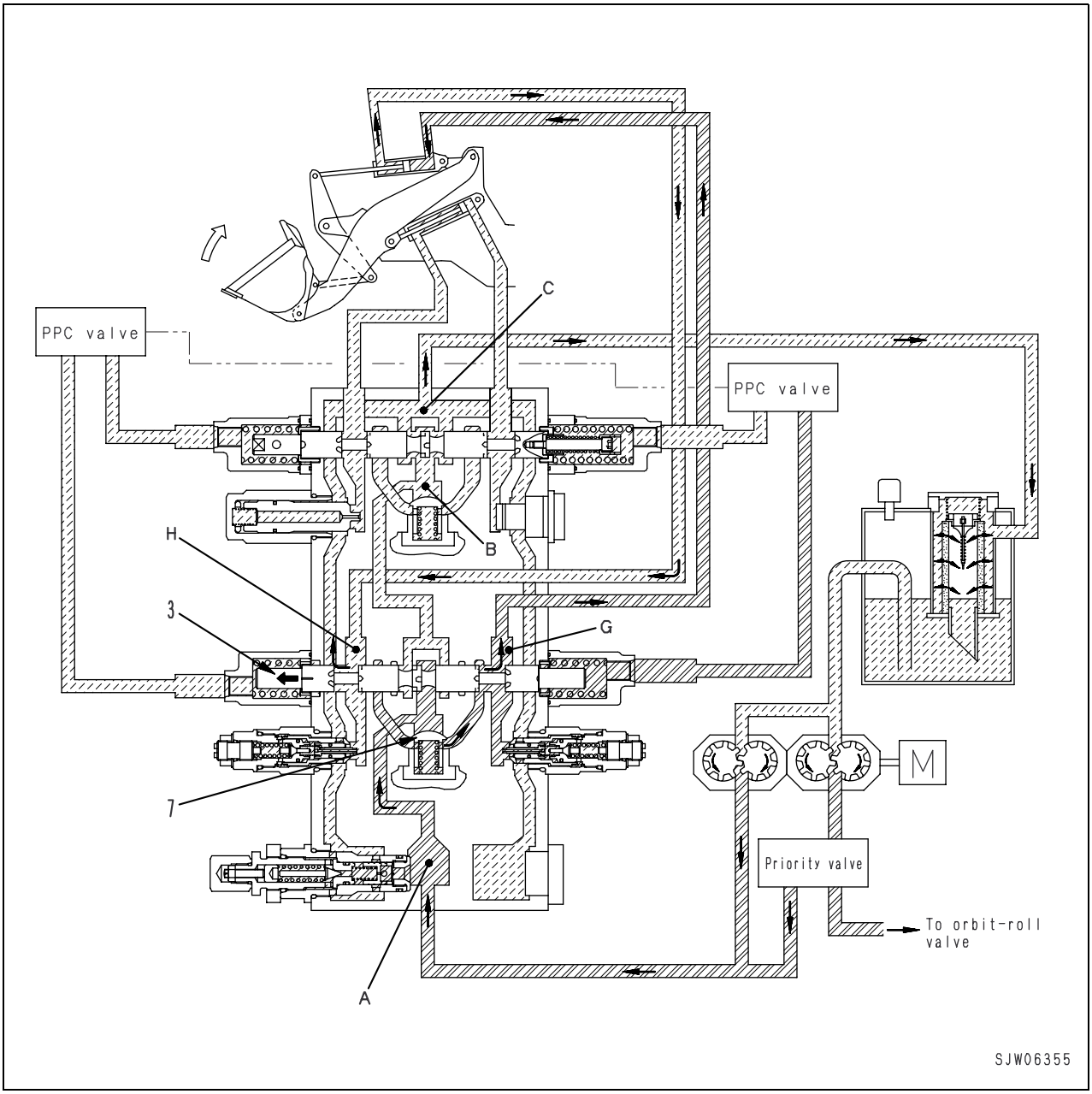
### (4) FLOAT position of the lift arm spool




**Operation**

- If the work equipment control lever is pushed further from the LOWER position, lift arm spool (4) is pushed in to the FLOAT position.
- The hydraulic oil flows through pump (1) and bypass circuit of bucket spool (3) to the bypass circuit of lift arm spool (4).
- The hydraulic oil in the bypass circuit flows into the drain circuit because of the spool and cannot push check valve (5) open.
- Since both of RAISE circuit **D** and LOWER circuit **E** of the lift cylinder are connected to the drain circuit, the lift arm is lowered by its weight.
- While the bucket is in contact with the ground, it can move up and down according to the unevenness of the ground.

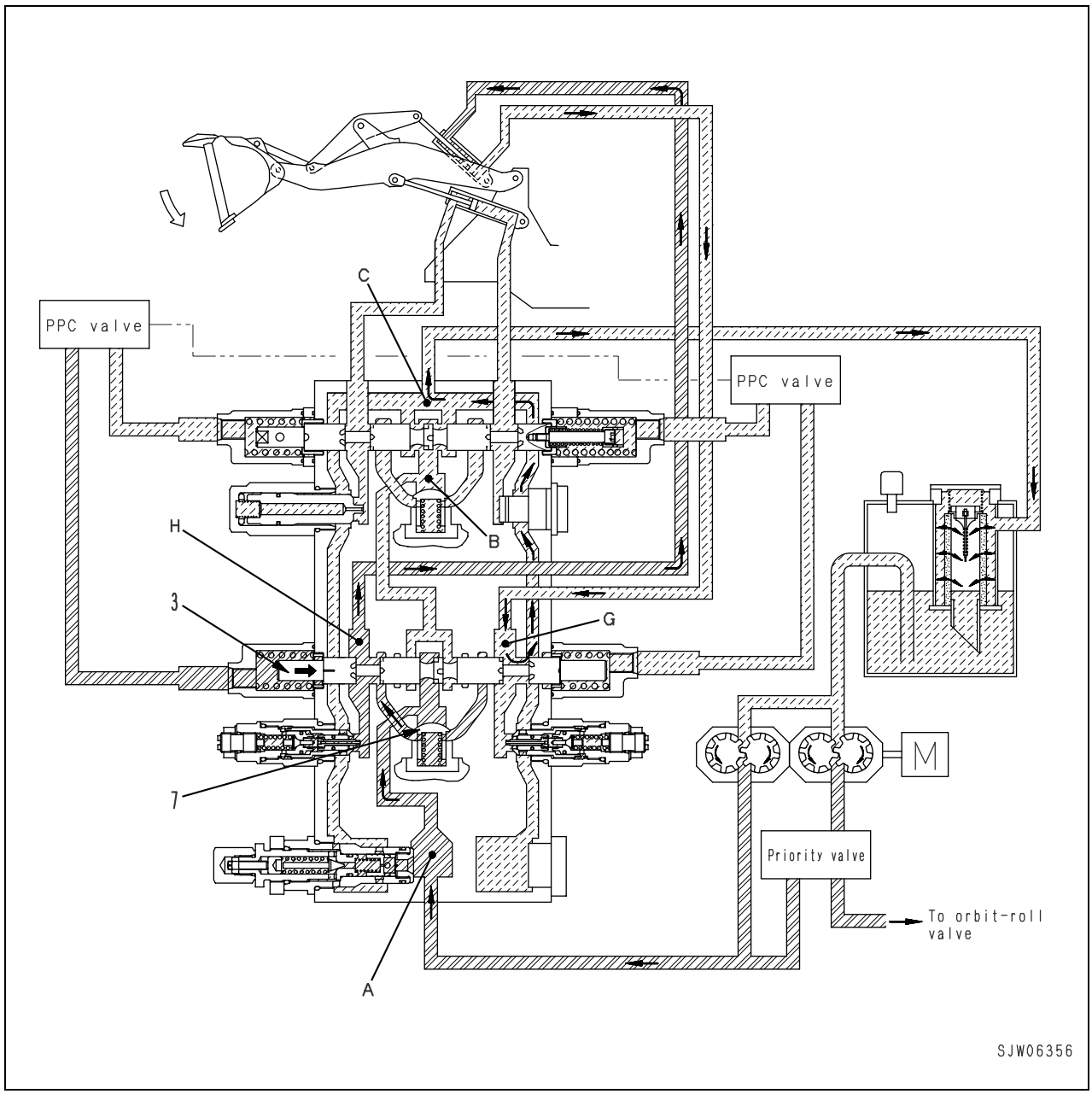
**(5) TILT position of the bucket spool**




**Operation**

- If the work equipment control lever is pulled, bucket arm spool (3) is pulled out to the TILT position.
- Since the bypass circuit is closed by the spool, the hydraulic oil from port **A** pushes check valve (7) open.
- The hydraulic oil from port **G** flows to the cylinder bottom side.
- On the other hand, the hydraulic oil on the cylinder rod side returns through port **H** and drain port **C** into the tank. Accordingly, the bucket tilts.

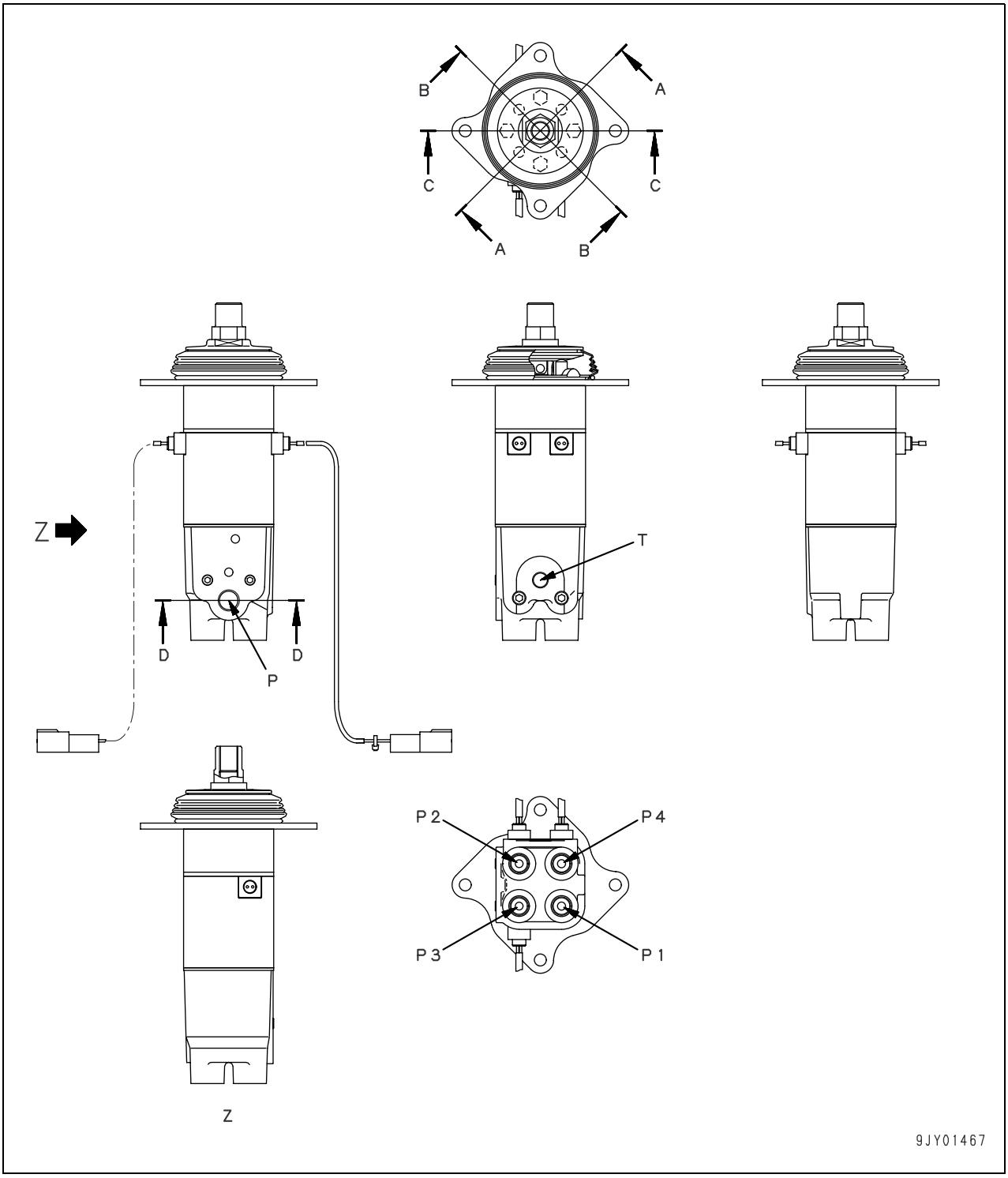
### (6) DUMP position of the bucket spool



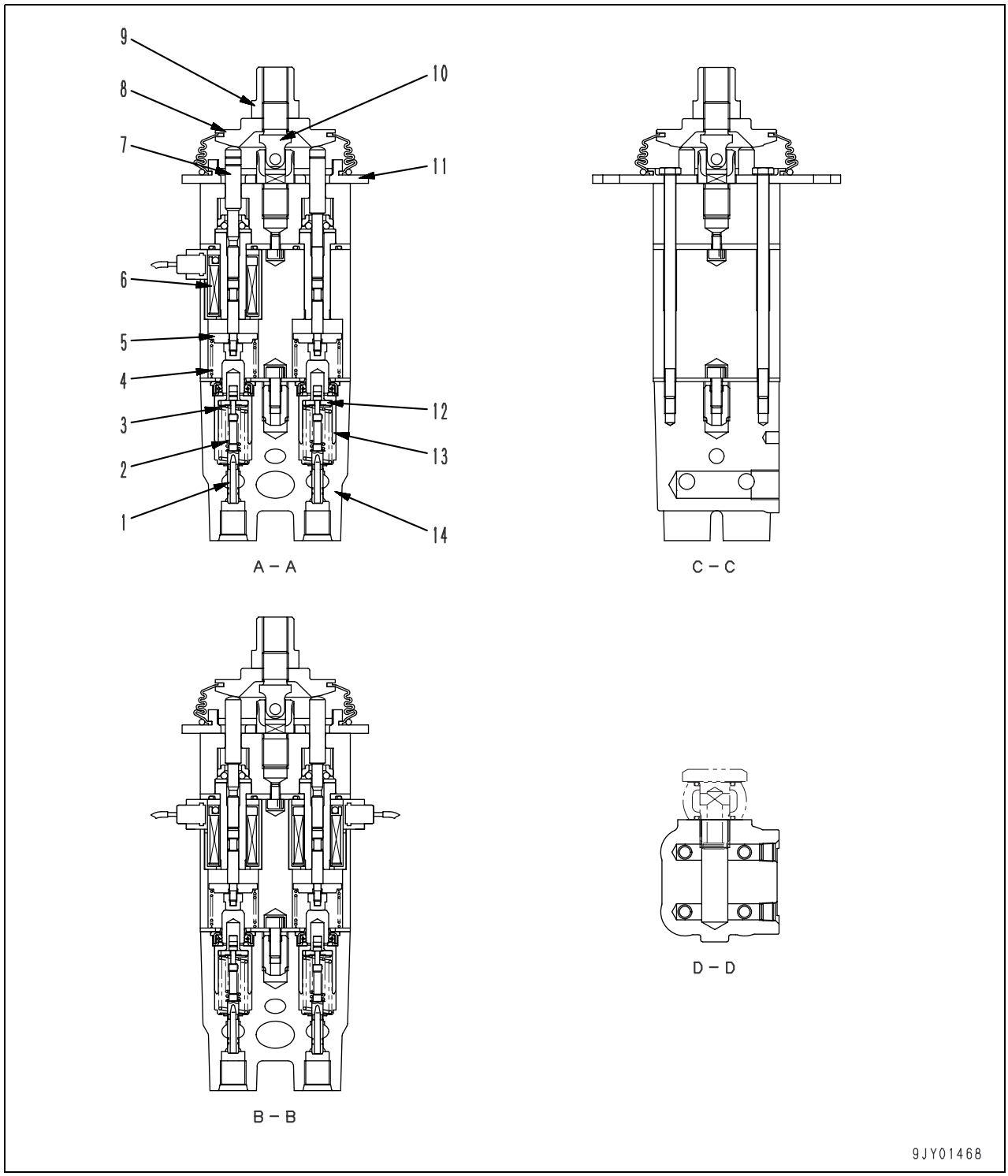

**Operation**

- If the work equipment control lever is pushed, bucket arm spool (3) is pushed in to the DUMP position.
- Since the bypass circuit is closed by the spool, the hydraulic oil from port **A** pushes check valve (7) open.
- The hydraulic oil from port **H** flows to the cylinder rod side.
- On the other hand, the hydraulic oil on the cylinder bottom side returns through port **G** and drain port **C** into the tank. Accordingly, the bucket dumps.

# WORK EQUIPMENT PPC VALVE




P: From HST charging pump
T: To hydraulic tank
P1: To bucket TILT valve
P2: To bucket DUMP valve
P3: To lift arm RAISE valve
P4: To lift arm LOWER (FLOAT) valve



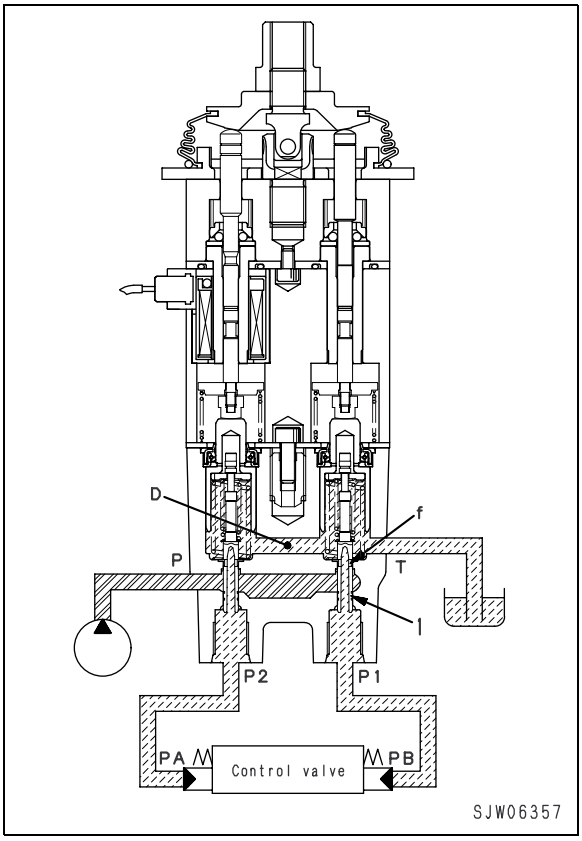

1. Spool
2. Metering spring
3. Centering spring
4. Spring
5. Retainer
6. Solenoid
7. Rod
8. Disc
9. Nut (for connecting lever)
10. Joint
11. Plate
12. Retainer
13. Piston
14. Body

**Operation**

**1. When in NEUTRAL**

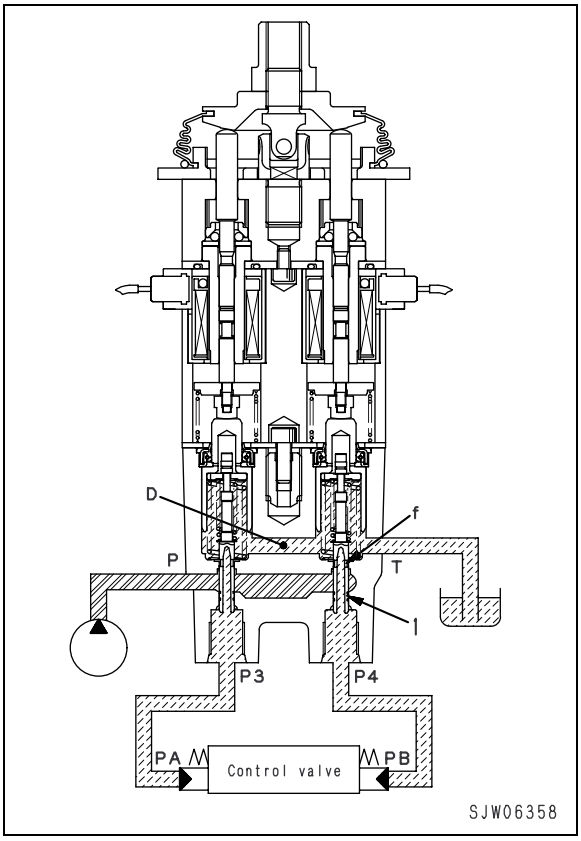
**(1) PPC valve for bucket**

- Ports **PA** and **PB** of the bucket control valve and ports **P1** and **P2** of the PPC valve are connected through fine control hole **f** of spool (1) to the drain chamber **D**.



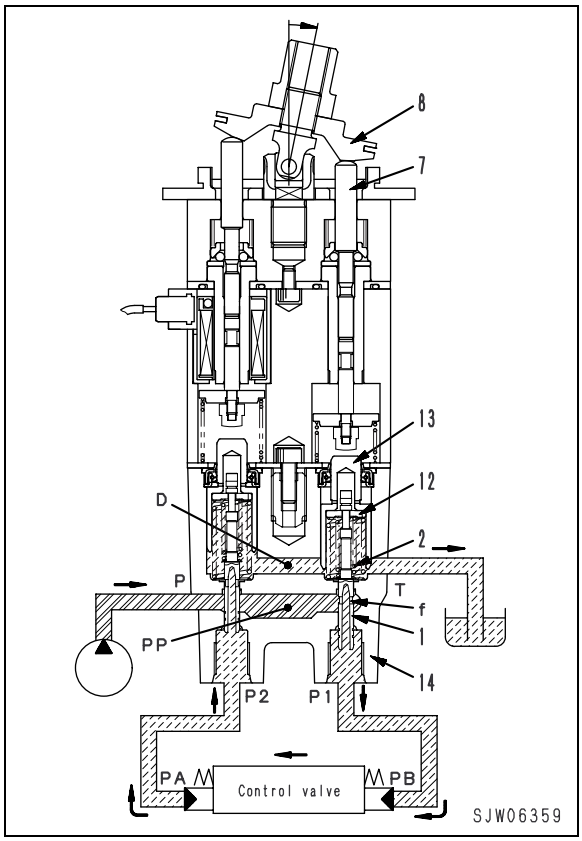

**(2) PPC valve for lift arm**

- Ports **PA** and **PB** of the lift arm control valve and ports **P3** and **P4** of the PPC valve are connected through fine control hole **f** of spool (1) to the drain chamber **D**.



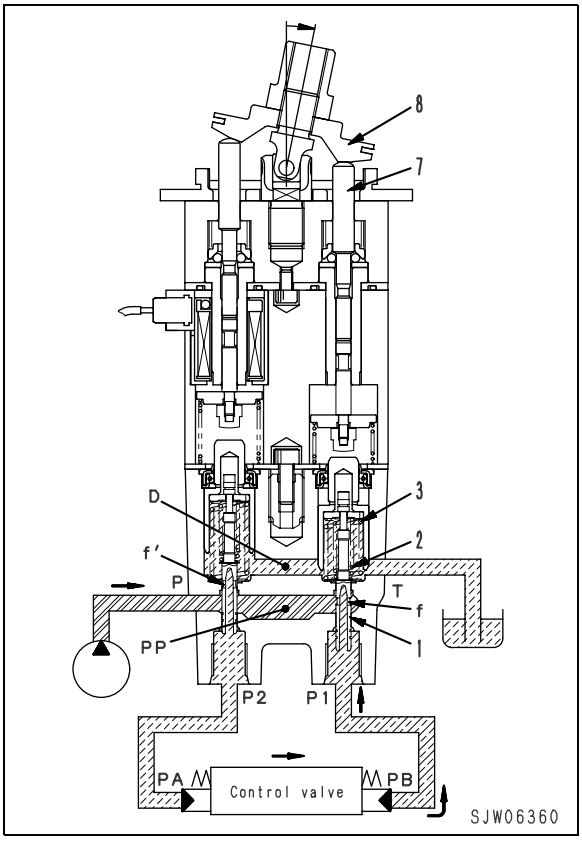
**2. When in fine control**
**NEUTRAL ✕ Fine control)**

- If rod (7) and piston (13) are pushed by disc (8), retainer (12) is pushed and spool (1) is also pushed down through metering spring (2).
- Accordingly, fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP** almost simultaneously, and then the pilot oil of the main pump flows from port **P1** to port **PB**.
- If the pressure in port **P1** rises, spool (1) is pushed back and fine control hole **f** is disconnected from pump pressure chamber **PP** and connected to drain chamber **D** almost simultaneously to release the pressure in port **P1**.
- As a result, spool (1) moves up and down to balance the force of metering spring (2) with the pressure in port **P1**.
  The positional relationship between spool (1) and body (14) (where fine control hole **f** is between drain chamber **D** and pump pressure chamber **PP**) does not change until retainer (12) comes in contact with spool (1).
- Since metering spring (2) is compressed in proportion to the stroke of the control lever, the pressure in port **P1** rises in proportion to the stroke of the control lever.
- Accordingly, the control valve spool moves to a position at which the pressure in the chamber **PB** (equal to the pressure in port **P1**) is balanced with the force of the control valve spool return spring.



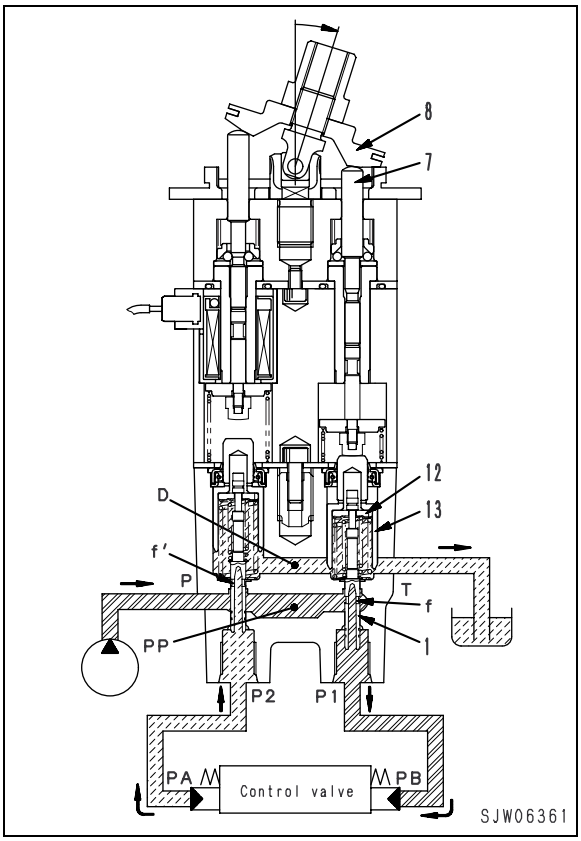
**3. When in fine control (When control lever is returned)**

- If disc (8) begins to return, the force of centering spring (3) and the pressure in port **P1** push up spool (1).
- As a result, fine control hole **f** is connected to drain chamber **D** and the oil in port **P1** is released.
- If the pressure in port **P1** lowers too much, spool (1) is pushed down by metering spring (2) and fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP** almost simultaneously. Then, the pump pressure is applied until the pressure in port **P1** is restored to the level corresponding to the position of the lever.
- When the control valve spool returns, the oil in drain chamber **D** flows in through fine control hole **f'** of the valve which is not in operation and then flows through port **P2** into chamber **PA**.



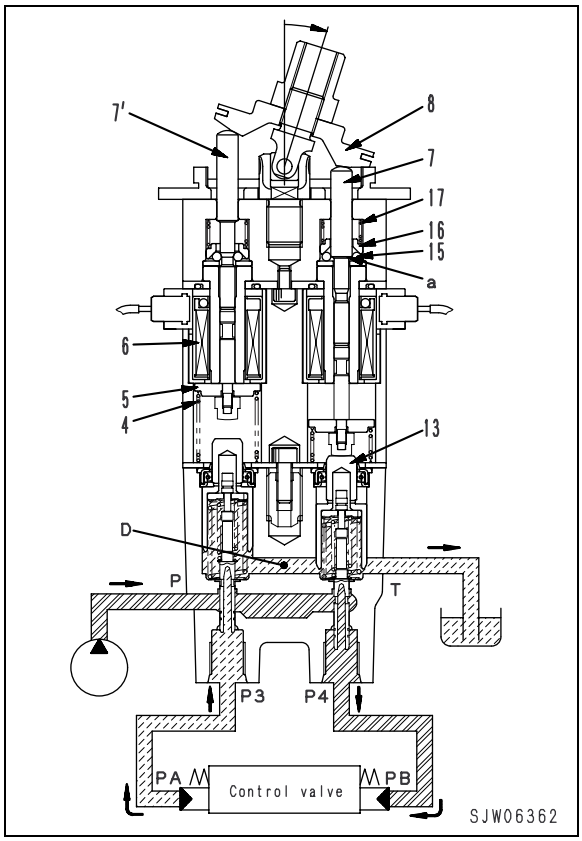

**4. When lever is operated to stroke end**

- If disc (8) and rod (7) push down piston (13) and retainer (12) pushes down spool (1), fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP**.
- Accordingly, the pilot oil from the main pump flows through fine control hole **f** and port **P1** into chamber **PB** and pushes the control valve spool.
- The oil returning from chamber **PA** flows through port **P2** and fine control **f'** into drain chamber **D**.



### 5. When lift arm is FLOATED

- If rod (7) and piston (13) on the LOWER side of port P3 are pushed down by disc (8), ball (15) touches projection **a** of rod (7) in the middle of the stroke (The detent starts to operate).
- If rod (7) is pushed in further, ball (15) pushes up collar (16) supported on detent spring (17) and escapes out to go over projection **a** of the piston.
- At this time, rod (7') on the opposite side is pushed up by spring (4) through retainer (5).
- If rod (7') is pushed up and the current is flowing in solenoid (6), retainer (5) is attracted by solenoid (6).
- Accordingly, rod (7') is kept pushed up and the FLOAT state is kept even if the lever is released.
- At the same time, the control valve is also moved to the FLOAT position and kept at that position.

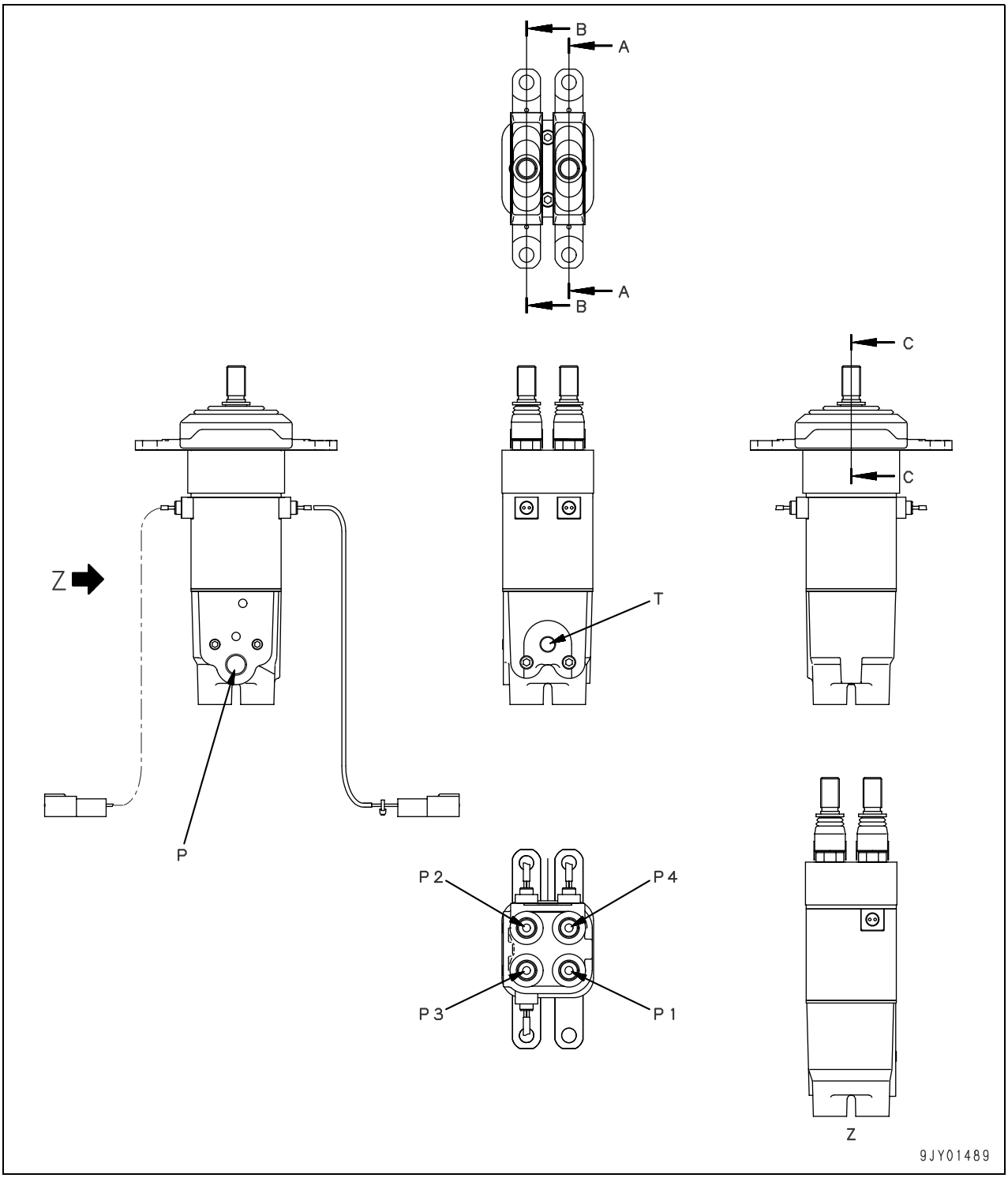



### 6. When FLOAT state of lift arm is reset

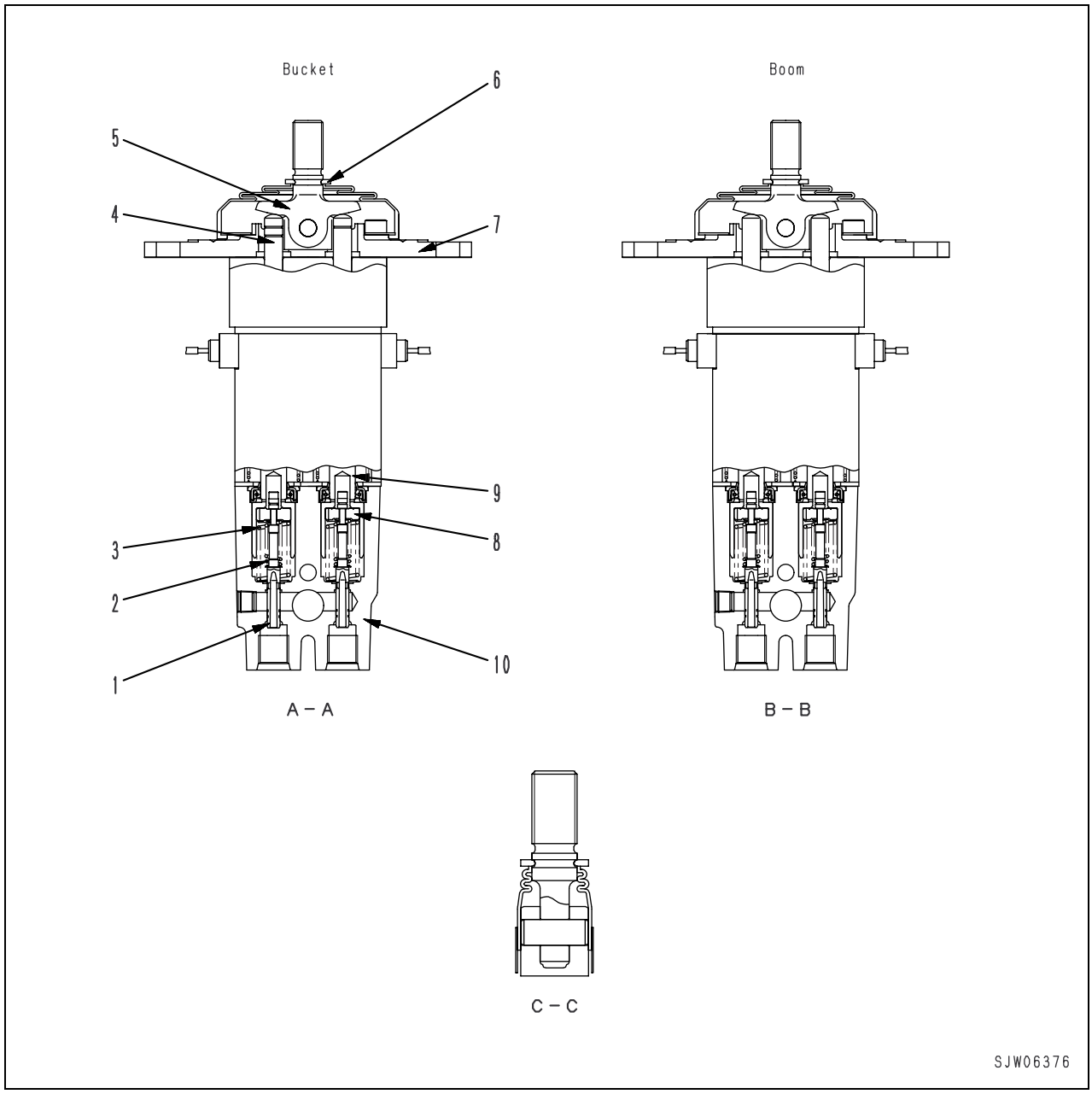
- Disc (8) is returned from the FLOAT position by pushing it down with a force greater than the attractive force of solenoid (6) and retainer (5).
- The FLOAT state also can be reset and the lever can be returned to the neutral position by turning off the current in solenoid (6) (demagnetizing the solenoid).
- The lift arm RAISE and bucket TILT operations are carried out similarly to the above.

**2-lever type**

**(If equipped)**




P: From HST charge pump
T: To hydraulic tank
P1: To bucket tilt valve
P2: To lift arm LOWER (FLOAT) valve
P3: To lift arm RAISE valve
P4: To bucket DUMP valve



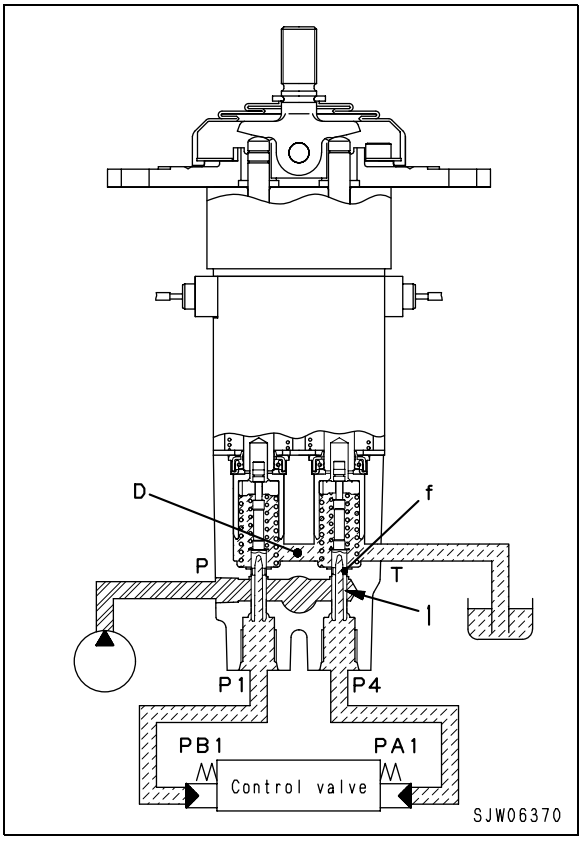

1. Spool
2. Metering spring
3. Centering spring
4. Rod
5. Lever
6. Ring
7. Plate
8. Retainer
9. Piston
10. Body

**Operation**

**1. When in neutral**

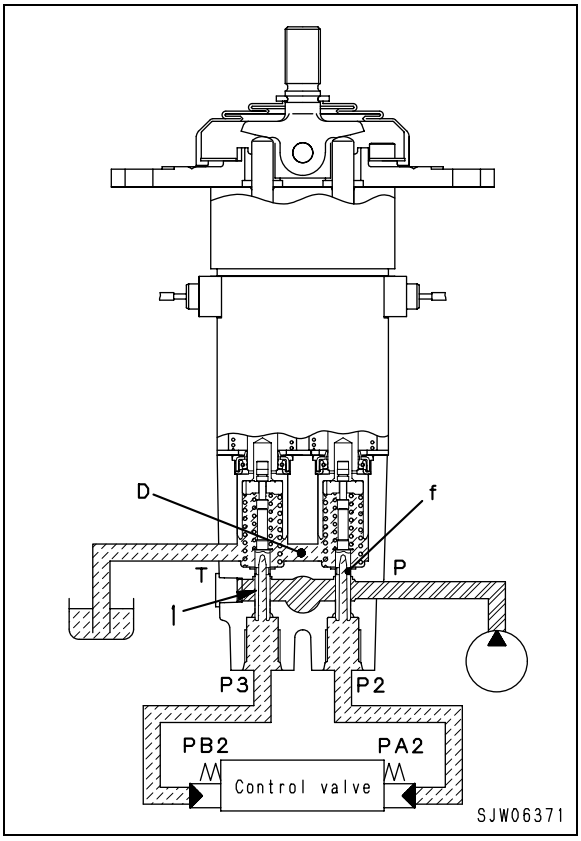
**(1) Bucket PPC valve**

- Ports **PA1** and **PB1** of the bucket control valve and ports **P1** and **P4** of the PPC valve are connected through fine control hole **f** of spool (1) to drain chamber **D**.



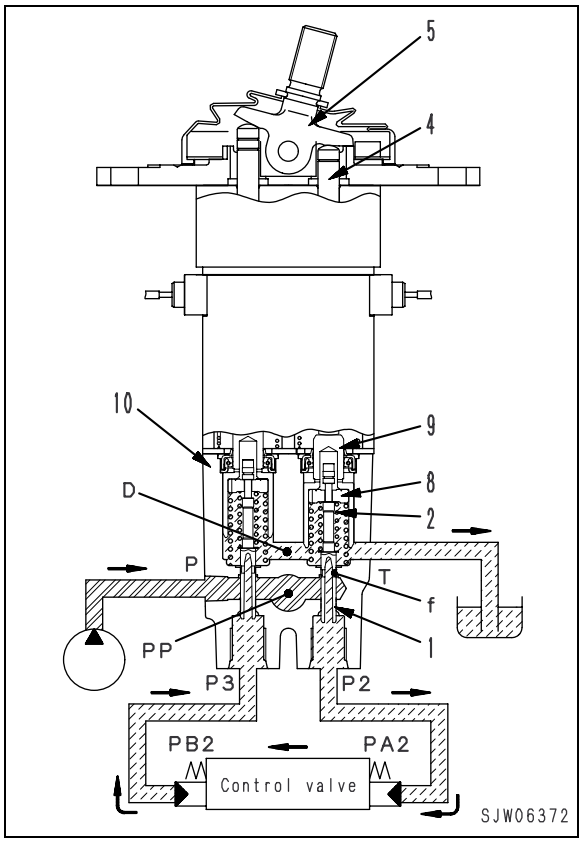

**(2) Lift arm PPC valve**

- Ports **PA2** and **PB2** of the lift arm control valve and ports **P2** and **P3** of the PPC valve are connected through fine control hole **f** of spool (1) to drain chamber **D**.



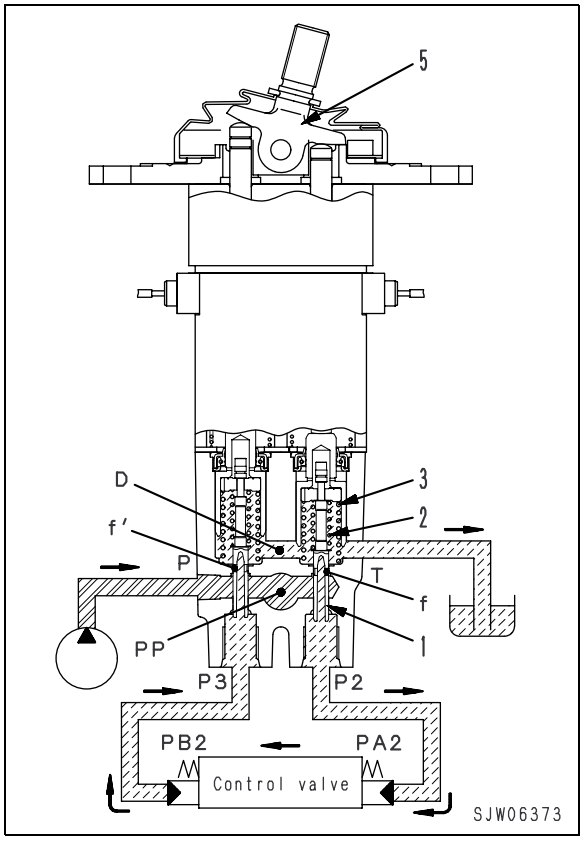
**2. When in fine control mode (Neutral ✕ Fine control)**

- If rod (4) and piston (9) are pushed by lever (5), retainer (8) is pushed and spool (1) is also pushed down through metering spring (2).
- Accordingly, the fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP** almost simultaneously. Then, the pilot hydraulic oil of the main pump flows through fine control hole **f** and port **P2** to port **PA2**.
- If the pressure in port **P2** rises, spool (1) is pushed back and fine control hole **f** is disconnected from pump pressure chamber **PP** and connected to drain chamber **D** almost simultaneously to release the pressure in port **P2**.
- Accordingly, spool (1) moves up and down so that the force of metering spring (2) will be balanced with the pressure in port **P2**.
- The positional relationship between spool (1) and body (10) (that fine control hole **f** is between drain chamber **D** and pump pressure chamber **PP**) does not change until retainer (8) reaches spool (1).
- Since metering spring (2) is compressed in proportion to the control lever stroke, the pressure in port **P2** rises in proportion to the control lever stroke, too.
- Accordingly, the control valve spool moves to a point at which the pressure in chamber **PA2** (that is the same as the pressure in port **P2**) is balanced with the force of the control valve spool return spring.



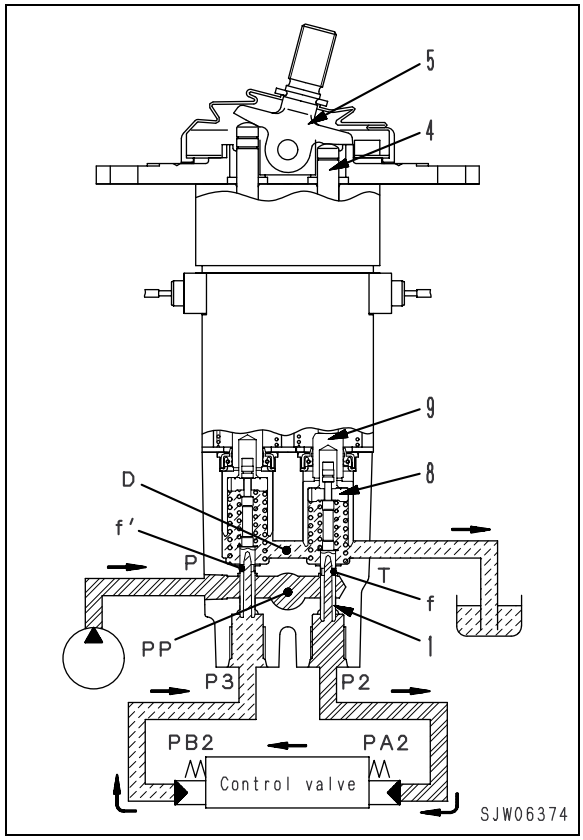
**3. When in fine control mode (When control lever is returned)**

- If lever (5) is returned a little, spool (1) is pushed up by the force of centering spring (3) and the pressure in port **P2**.
- Accordingly, fine control hole **f** is connected to drain chamber **D** to release the hydraulic oil through port **P2**.
- If the pressure in port **P2** lowers too much, spool (1) is pushed down by metering spring (2) and fine control hole **f** is disconnected from drain chamber **D** and connected to pump pressure chamber **PP** almost simultaneously to supply the pump pressure until the pressure in port **P2** rises again to the level equivalent to the lever position.
- When the control valve spool returns, the oil in drain chamber **D** flows in chamber **PB2** through fine control hole **f'** of the valve which is not moving and port **P3**.



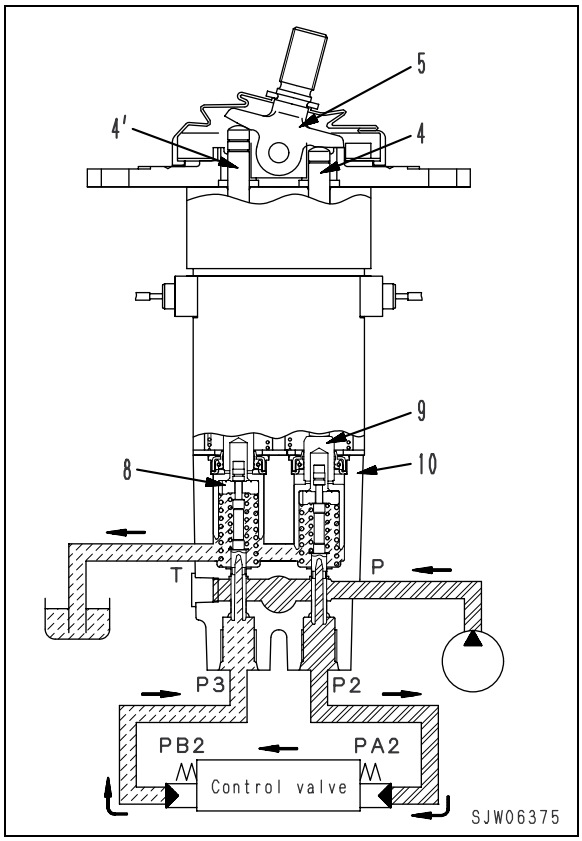

**4. When lever is moved to stroke end**

- Lever (5) and rod (4) push down piston (9) and retainer (8) pushes down spool (1) to disconnect fine control hole **f** from drain chamber **D** and connect it to pump pressure chamber **PP**.
- Accordingly, the pilot hydraulic pressure from the main pump flows through fine control hole **f** and port **P2** into chamber **PA2** to push the control valve spool.
- The oil returning from chamber **PB2** flows through port **P3** and fine control hole **f'** into drain chamber **D**.



**5. When lift arm is "floated"**

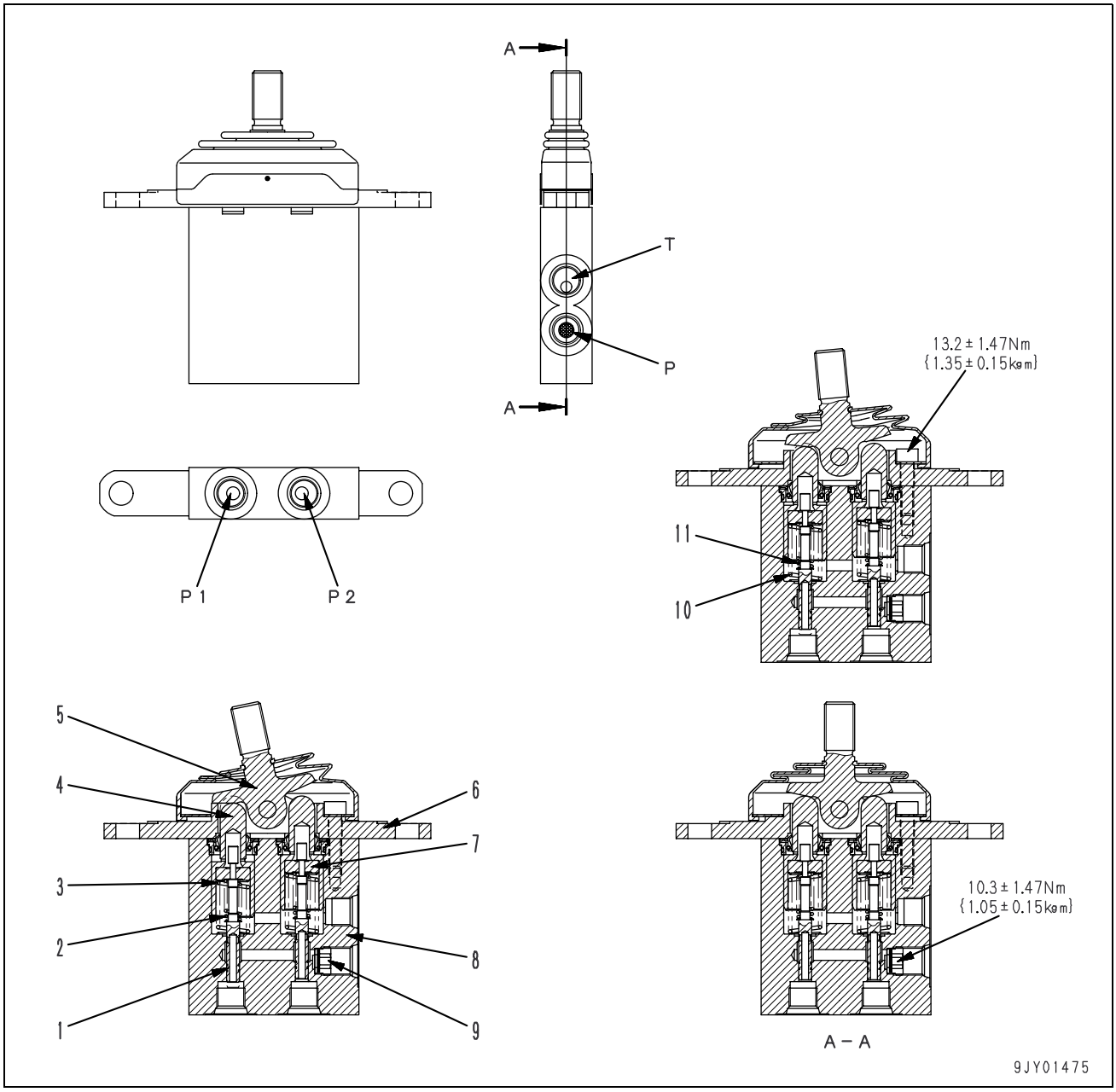
- If rod (4) and piston (9) of port **P2** are pushed down further from the LOWER position with lever (5), they are moved to the FLOAT position.
- Rod (4') on the opposite side is pushed up and a current flows in the solenoid in body (10), and then rod (4') is kept pushed up and the lever (5) is kept at the FLOAT position even if it is released.
- At this time, the control valve is also moved to the "float" position and kept in that position.




**6. When "floating" of lift arm is reset**

- If lever (5) is released at the FLOAT position, lever (4') is pushed down to turn the solenoid current OFF. Accordingly, the force to keep lever (5) in the FLOAT position is canceled and lever (5) returns to the neutral position.
- When the lift arm is raised or the bucket is tilted, the PPC valve operates similarly to the above.

# ATTACHMENT PPC VALVE (IF EQUIPPED)




T: To the tank
P: From the main pump

P1: To the service valve
P2: To the service valve

1. Spool
2. Metering spring
3. Centering spring
4. Piston
5. Lever
6. Plate
7. Retainer
8. Body
9. Filter

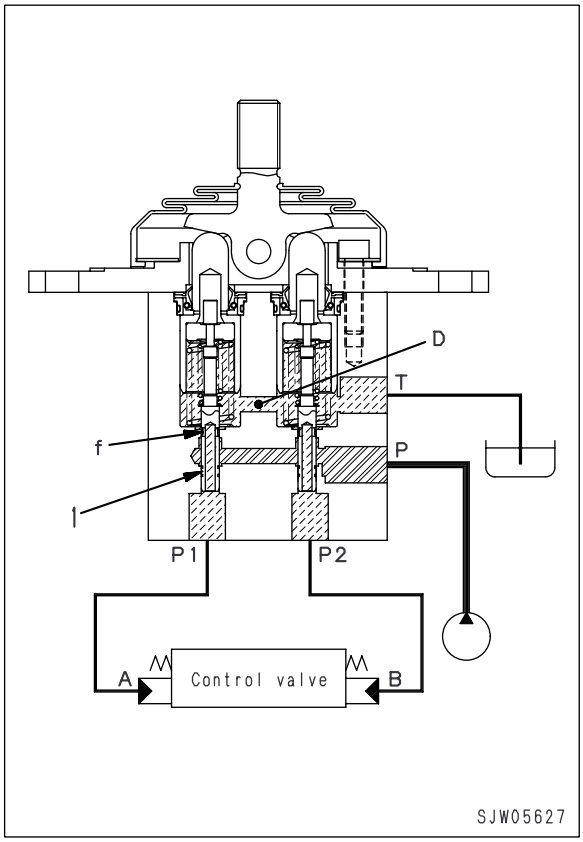
Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | | | Repair limit | | |
| 10 | Center ring spring | Free length x Outside diameter | Installed length | Installed load | Free length | Installed load | If spring is damaged or deformed, replace it |
| | | 41.1 X 15.5 | 29.0 | 36.3 N {3.70 kg} | — | 30.4 N {3.1 kg} | |
| 11 | Metering spring | 22.7 X 8.10 | 22.0 | 16.7 N {1.70 kg} | — | 13.3 N {1.36 kg} | |

**Operation**

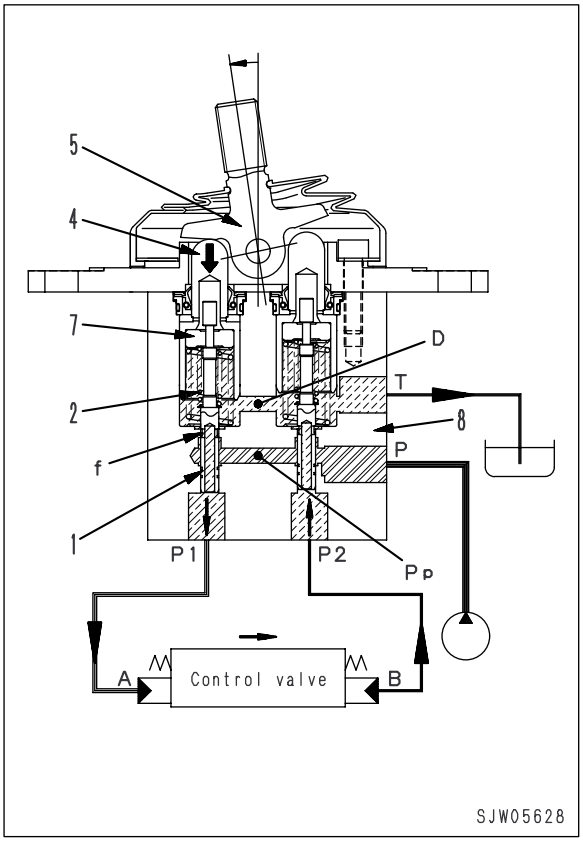
**1. At the neutral position**

- The ports **A** and **B** of the control valve and the ports **P1** and **P2** of the PPC valve are being connected to the drain chamber **D** through the fine control hole of the spool (1).



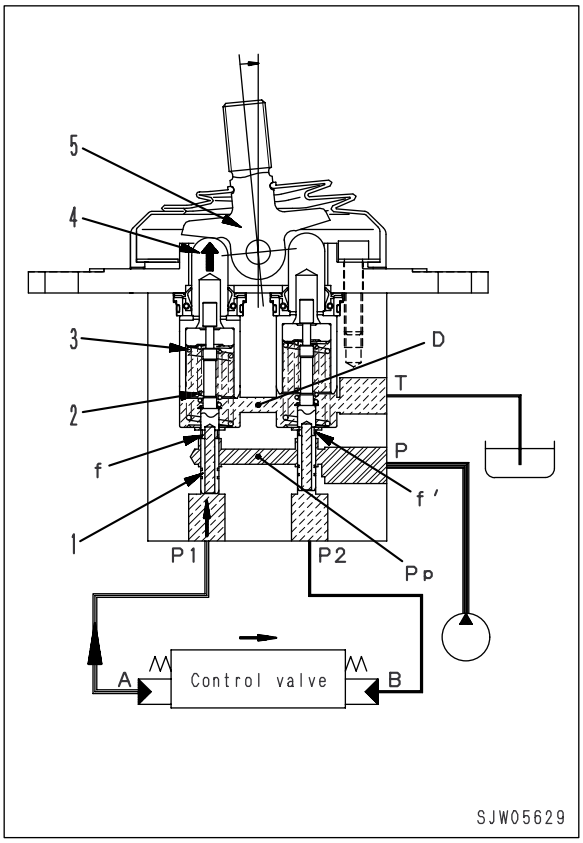

**2. At the fine control position (Neutral ✕ fine control)**

- When the piston (4) is pushed by the lever (5), the retainer (7) is pushed and the spool (1) also is pushed trough the metering spring (2) to move to the lower side.
- When the fine control hole **f** is shut off from the drain chamber **D** by the above, it connects to the pressure chamber **PP** of the pump almost simultaneously and the pilot pressure oil of the main pump is led from the **P1** port to the **A** port through the fine control hole **f**.
- When the pressure at the **P1** port goes up, the spool (1) is pushed back and, when the fine control hole **f** is shut off from the pressure chamber **PP** of the pump, it connects to the drain chamber **D** almost simultaneously to release the pressure at the **P1** port.
- By the above structure, the spool (1) moves up and down so that the power of the metering spring (2) and the **P1** port pressure may balance.
- Until the retainer (7) hits the spool (1), the positional relation between the spool (1) and the body (8) (the fine control hole comes to the intermediate potion between the drain chamber **D** and the pressure chamber of the pump) does not change.
- Therefore, since the metering spring (2) is compressed in proportion to the control lever stroke, the pressure at the **P1** port also rises in proportion to the control lever stroke.
- By the above, control valve spool moves to the position where pressure of the chamber **A** (same pressure to **P1** port) balances to the force of control valve spool return spring.



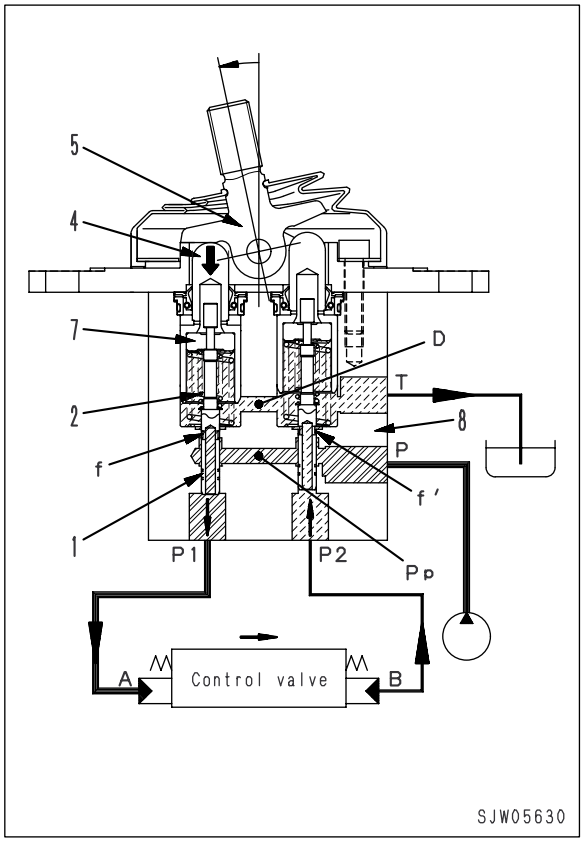
**3. At the fine control position (When the control lever is returned)**

- When the lever (5) is started to be returned, by the power of the centering spring (3) and by the pressure of the **P1** port, the spool (1) is pushed up. By the above, the fine control hole **f** connects to the drain chamber **D** to release the pressurized oil from the **P1** port.
- In case the pressure of the **P1** port drops excessively, the spool (1) is pushed down by the metering spring (2) and the fine control hole **f** is shut off from the drain chamber **D**, connecting to the drain chamber **D** almost simultaneously to supply the pump pressure **PP** until the pressure of the **P1** port returns to the pressure corresponding to the lever position.
- When the control valve spool returns, the oil in the drain chamber **D** flows through the fine control hole **f'** of the valve which is not moving to be led to the **B** chamber through the **P2** port to refill the oil.



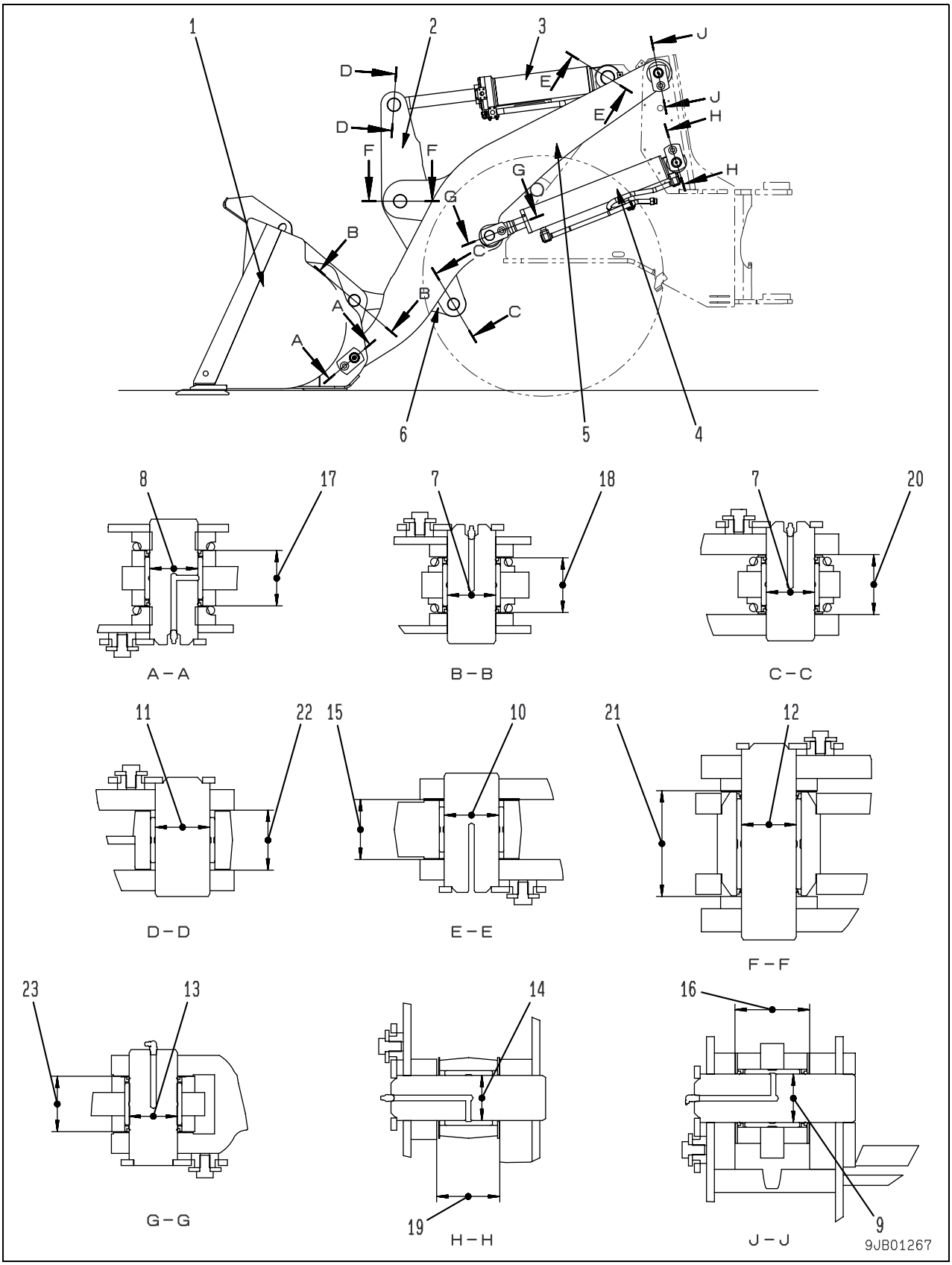

**4. At full stroke**

- When the lever (5) pushes down the piston (4) and when the retainer pushes down the spool (1), the fine control hole **f** is shut off from the drain chamber **D** and, then, it connects to the pressure chamber **PP** of the pump.
- Therefore, the pilot pressure oil coming from the main pump passes through the fine control hole **f** to be led to the **A** chamber through the **P1** port to push the control valve spool.
- The return oil from the **B** chamber passes through the **P2** port and the fine control hole **f'** to flow into the drain chamber **D**.



# WORK EQUIPMENT LINKAGE

**WA250-5**

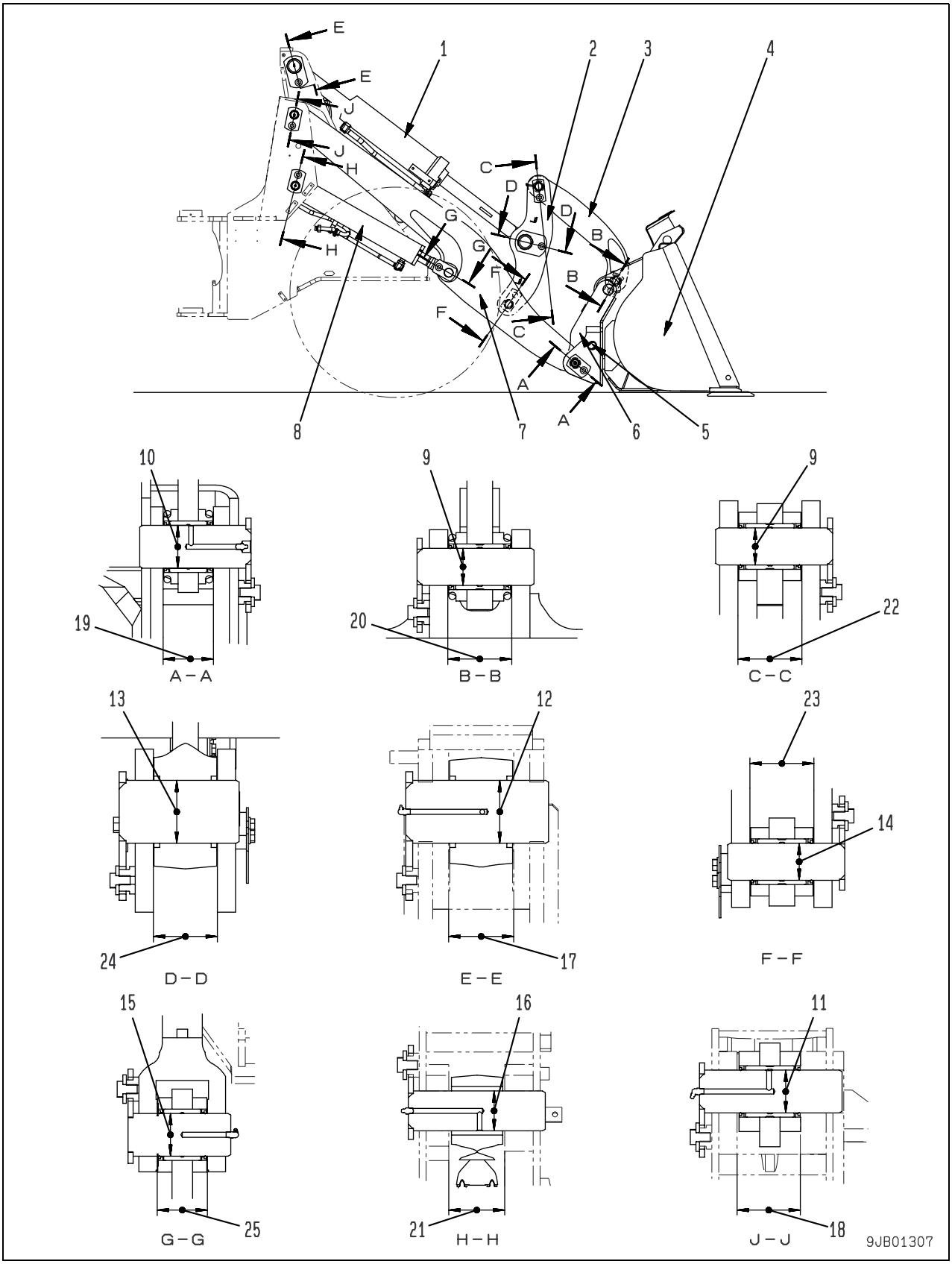


1. Bucket
2. Tilt lever
3. Bucket cylinder
4. Lift cylinder
5. Lift arm
6. Bucket link

Unit: mm

| No. | Check item | | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|---|
| 7 | Clearance between bushing and pin at each end of bucket link | | Standard size | Tolerance | | Standard clearance | Clearance limit | Replace (Replace if pin has scuff mark) |
| | | | | Shaft | Hole | | | |
| | | | ø 75 | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130 – 0.250 | 1.0 | |
| 8 | Clearance between bushing and pin of joint of lift arm and bucket | | ø 75 | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130 – 0.250 | 1.0 | |
| 9 | Clearance between bushing and pin of joint of lift arm and frame | | ø 75 | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130 – 0.250 | 1.0 | |
| 10 | Clearance between bushing and pin of joint of bucket cylinder bottom and frame | | ø 85 | -0.036<br>-0.090 | +0.207<br>+0.120 | 0.156 – 0.297 | 1.0 | |
| 11 | Clearance between bushing and pin of joint of bucket cylinder rod and tilt lever | | ø 85 | -0.036<br>-0.090 | +0.207<br>+0.120 | 0.156 – 0.297 | 1.0 | |
| 12 | Clearance between bushing and pin of joint of tilt lever and lift arm | | ø 85 | -0.036<br>-0.090 | +0.207<br>+0.120 | 0.156 – 0.297 | 1.0 | |
| 13 | Clearance between bushing and pin of joint of lift cylinder rod and lift arm | | ø 75 | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130 – 0.250 | 1.0 | |
| 14 | Clearance between bushing and pin of joint of lift cylinder bottom and frame | | ø 70 | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130 – 0.250 | 1.0 | |
| 15 | Joint of bucket cylinder and frame | | Width of boss | | Width of hinge | | Standard clearance | Replace (Insert shims on both sides so that clearance will be 1.5 mm or less on each side) |
| | | | Standard size | Tolerance | Standard size | Tolerance | | |
| | | | 90 | +0.8<br>0 | 93 | ± 1.5 | 0.7 – 4.5 | |
| 16 | Joint of lift arm and frame | Left side | 108 | — | 116 | ± 1.5 | 6.5 – 9.5 | |
| | | Right side | 108 | — | 111 | ± 1.5 | 1.5 – 4.5 | Adjust clearance on left side of bushing to 1.5 mm or less |
| 17 | Joint of lift arm and bucket | | 86 | — | 88 | +3.0<br>0 | 2.0 – 5.0 | Replace (Insert shims on both sides so that clearance will be 1.5 mm or less on each side) |
| 18 | Joint of bucket link and bucket | | 85 | ± 1.0 | 88 | +3.0<br>0 | 2.0 – 7.0 | |
| 19 | Joint of lift cylinder and frame | | 94 | 0<br>-0.5 | 98 | ± 1.5 | 2.5 – 6.0 | |
| 20 | Joint of tilt lever and bucket link | | 85 | ± 1.0 | 93 | ± 1.5 | 5.5 – 10.5 | |
| 21 | Joint of tilt lever and lift arm | | 161 | ± 1.5 | 164 | ± 1.5 | 0 – 6.0 | |
| 22 | Joint of bucket cylinder and tilt lever | | 90 | +0.8<br>0 | 93 | ± 1.5 | 0.7 – 4.5 | Replace |
| 23 | Joint of lift arm and lift cylinder | | 86 | — | 88 | ± 1.5 | 0.5 – 3.5 | Adjust clearance on each side to 1.5 mm or less |

**WA250PT-5**


E
E
J
J
H
H
1
2
3
4
C
D
D
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G
F
F
B
B
C
A
A
8
7
6
5
10
19
A – A
9
20
B – B
9
22
C – C
13
24
D – D
12
17
E – E
23
14
F – F
15
25
G – G
16
21
H – H
11
18
J – J
9JB01307

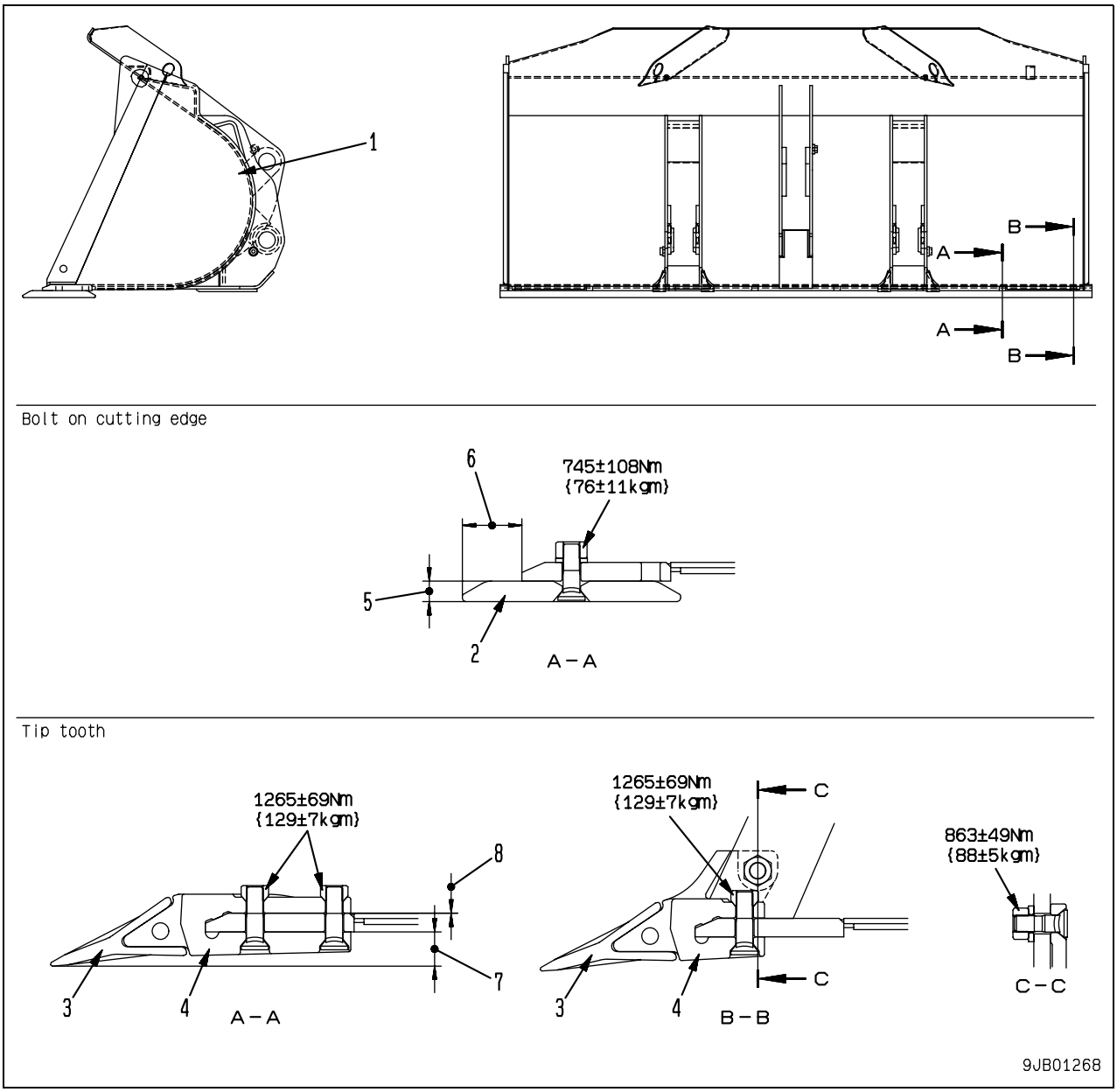
1. Bucket cylinder
2. Tilt lever
3. Bucket link
4. Bucket
5. Coupler plunger
6. Quick coupler
7. Lift arm
8. Lift cylinder

Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| 9 | Clearance between bushing and pin at each end of bucket link | Standard size | Tolerance | | Standard clearance | Clearance limit | Replace (Replace if pin has scuff mark) |
| | | | Shaft | Hole | | | |
| | | ø 65 | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130 – 0.250 | 1.0 | |
| 10 | Clearance between bushing and pin of joint of lift arm and quick coupler | ø 75 | -0.030<br>-0.076 | +0.231<br>+0.181 | 0.211 – 0.307 | 1.0 | |
| 11 | Clearance between bushing and pin of joint of lift arm and frame | ø 75 | -0.030<br>-0.076 | +0.231<br>+0.181 | 0.211 – 0.307 | 1.0 | |
| 12 | Clearance between bushing and pin of joint of bucket cylinder bottom and frame | ø 110 | -0.036<br>-0.090 | +0.207<br>+0.120 | 0.156 – 0.297 | 1.0 | |
| 13 | Clearance between bushing and pin of joint of bucket cylinder rod and tilt lever | ø 110 | -0.036<br>-0.090 | +0.207<br>+0.120 | 0.156 – 0.297 | 1.0 | |
| 14 | Clearance between bushing and pin of joint of tilt lever and lift arm | ø 65 | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130 – 0.250 | 1.0 | |
| 15 | Clearance between bushing and pin of joint of lift cylinder rod and lift arm | ø 75 | -0.030<br>-0.076 | +0.231<br>+0.181 | 0.211 – 0.307 | 1.0 | |
| 16 | Clearance between bushing and pin of joint of lift cylinder bottom and frame | ø 70 | -0.030<br>-0.076 | +0.174<br>+0.100 | 0.130 – 0.250 | 1.0 | |
| 17 | Joint of bucket cylinder and frame | Width of boss | | Width of hinge | | Standard clearance | Replace (Insert shims on both sides so that clearance will be 1.5 mm or less on each side) |
| | | Standard size | Tolerance | Standard size | Tolerance | | |
| | | 110 | 0<br>-0.5 | 114 | ± 1.5 | 2.5 – 6.0 | |
| 18 | Joint of lift arm and frame | 108 | — | 116 | ± 1.5 | 6.5 – 9.5 | |
| 19 | Joint of lift arm and quick coupler | 86 | — | 88 | +1.5<br>0 | 2.0 – 3.5 | |
| 20 | Joint of bucket link and quick coupler | 109 | ± 1.0 | 112 | ± 1.5 | 0.5 – 5.5 | |
| 21 | Joint of lift cylinder and frame | 94 | 0<br>-0.5 | 98 | ± 1.5 | 2.5 – 6.0 | |
| 22 | Joint of tilt lever and bucket link | 109 | ± 1.0 | 112 | ± 1.5 | 0.5 – 5.5 | Replace |
| 23 | Joint of tilt lever and lift arm | 109 | — | 112 | ± 1.5 | 1.5 – 4.5 | Adjust clearance on each side to 1.5 mm or less |
| 24 | Joint of bucket cylinder and tilt lever | 110 | 0<br>-0.5 | 112 | ± 1.5 | 0.5 – 4.0 | Replace |
| 25 | Joint of lift arm and lift cylinder | 86 | — | 88 | ± 1.5 | 0.5 – 3.5 | Adjust clearance on each side to 1.5 mm or less |

# BUCKET

**WA250-5**

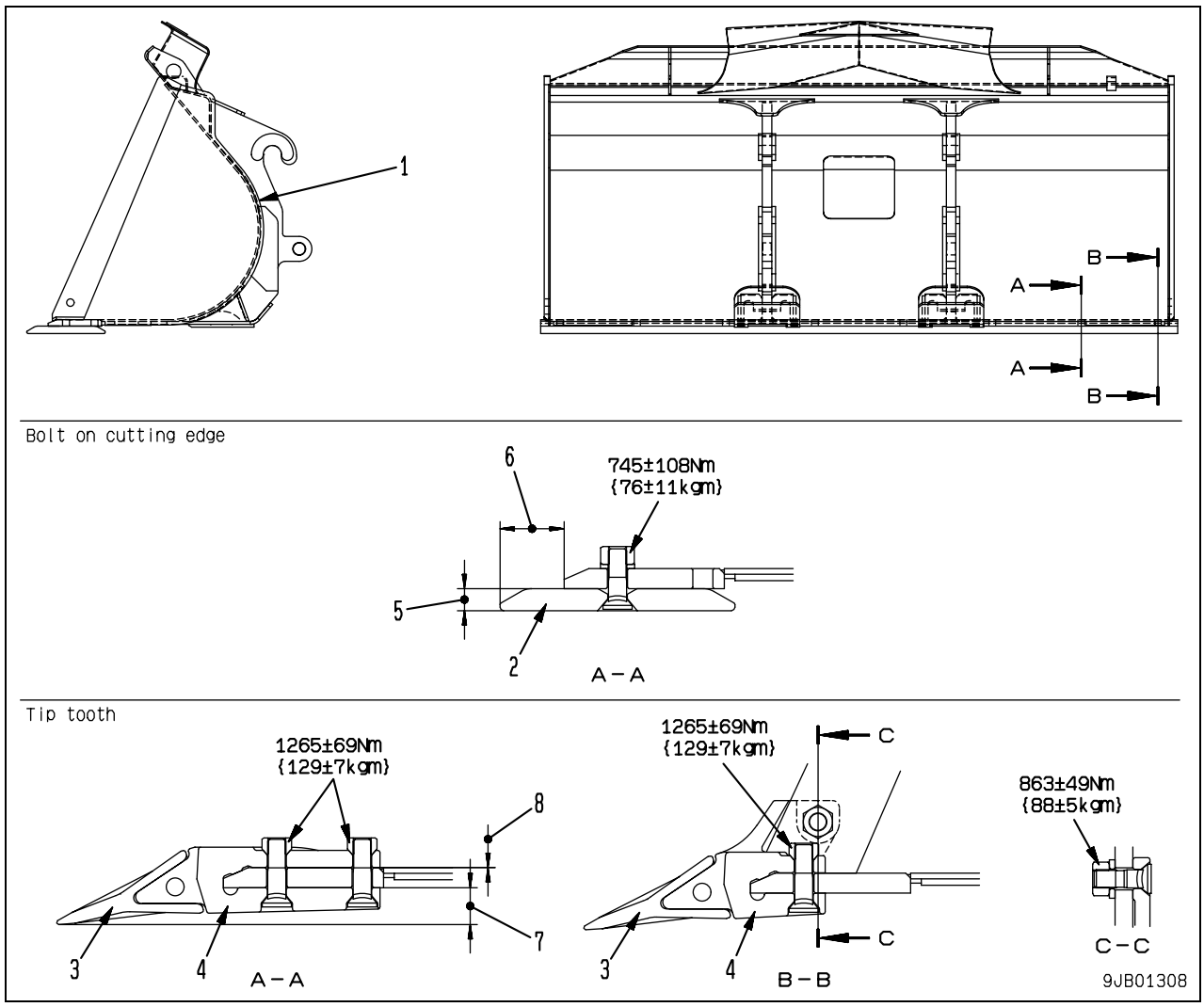



1. Bucket
2. Bolt-on cutting edge
3. Bucket tooth
4. Adapter

Unit: mm

| No. | Check item | Criteria | | Remedy |
|---|---|---|---|---|
| 5 | Wear of cutting edge (Thickness) | Standard size | Repair limit | Turn over or replace |
| | | 31.8 | 19 | |
| 6 | Wear of cutting edge (Length) | 90 | 5 | |
| 7 | Wear of bucket tooth | 51 | 21 | Replace |
| 8 | Clearance of adapter mount | Max. 0.5 | — | Adjust or replace |

**WA250PT-5**




1. Bucket
2. Bolt-on cutting edge
3. Bucket tooth
4. Adapter

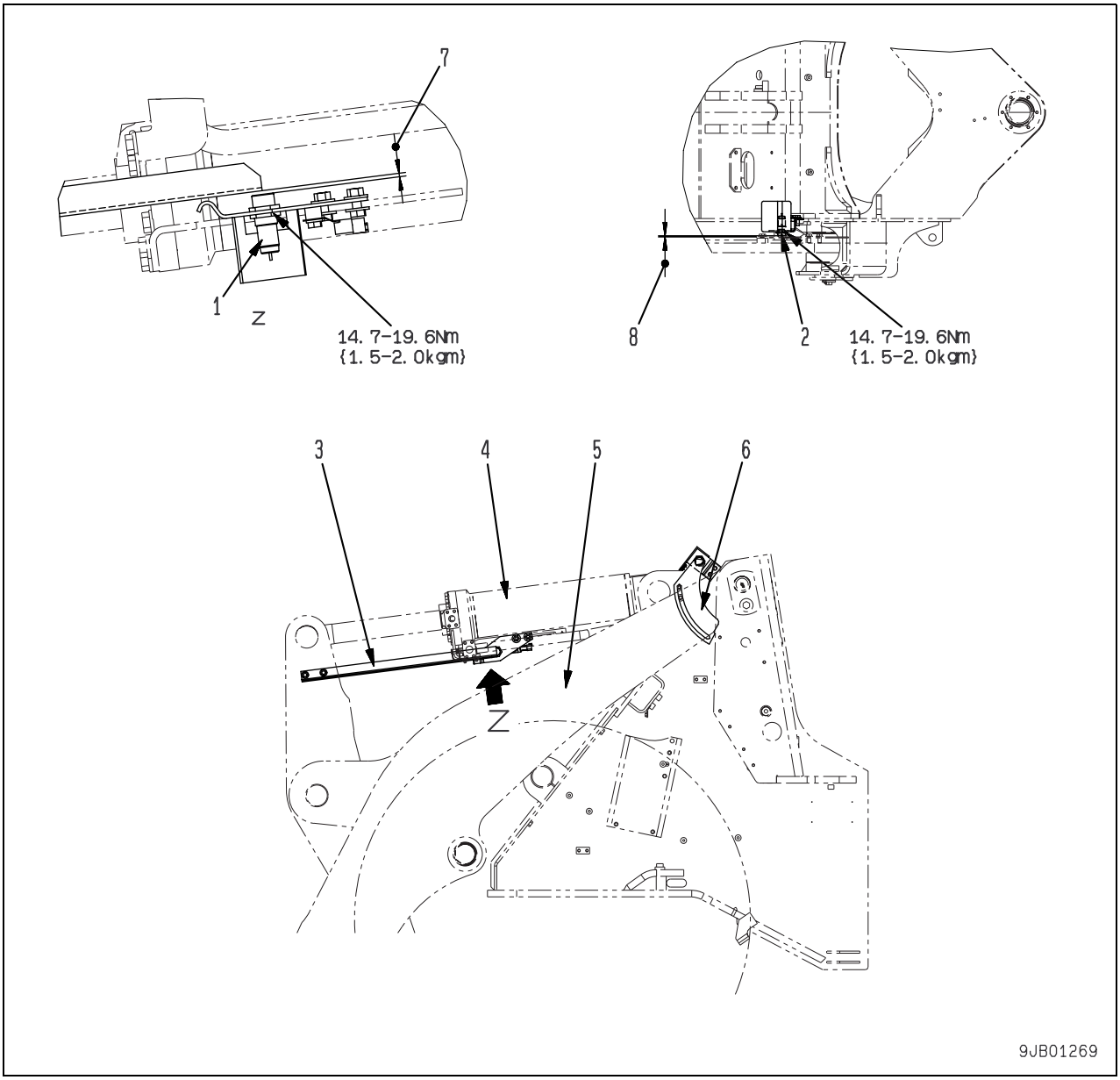
Unit: mm

| No. | Check item | Criteria | | Remedy |
|---|---|---|---|---|
| 5 | Wear of cutting edge (Thickness) | Standard size | Repair limit | Turn over or replace |
| | | 31.8 | 19 | |
| 6 | Wear of cutting edge (Length) | 90 | 5 | |
| 7 | Wear of bucket tooth | 51 | 21 | Replace |
| 8 | Clearance of adapter mount | Max. 0.5 | — | Adjust or replace |

# CONTROL OF BUCKET POSITIONER, BOOM KICK-OUT, AND DUMP SPEED

★ The dump speed control is installed to only WA250PT-5.

**WA250-5**




1. Bucket positioner proximity switch
2. Boom kick-out proximity switch
3. Plate
4. Bucket cylinder
5. Boom
6. Plate

Unit: mm

| No. | Check item | Criteria | Remedy |
|---|---|---|---|
| 7 | Clearance of bucket positioner proximity switch | 3 – 5 | Adjust |
| 8 | Clearance of boom kick-out proximity switch | 3 – 5 | |

## OUTLINE

### Bucket positioner

- The bucket positioner is driven electrically. When the bucket is returned to an angle from the DUMP position toward the TILT position, the bucket positioner returns the work equipment (bucket) control lever from the TILT position to the HOLD position to automatically stop the bucket at a proper digging angle.
- Plate (3) is bolted to the rod of bucket cylinder (4). Proximity switch (1) is bolted to the cylinder.
- If the work equipment (bucket) control lever is moved from the DUMP position to the TILT position, the rod of bucket cylinder (4) moves toward the front of the machine. When plate (3) parts from proximity switch (1) at a point, proximity switch (1) operates to return the work equipment (bucket) control lever to the HOLD position.

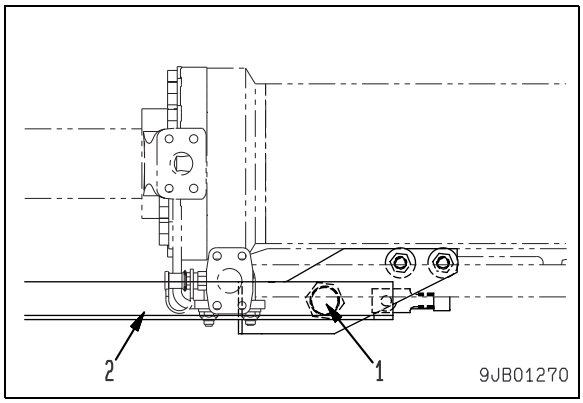
### Boom kick-out

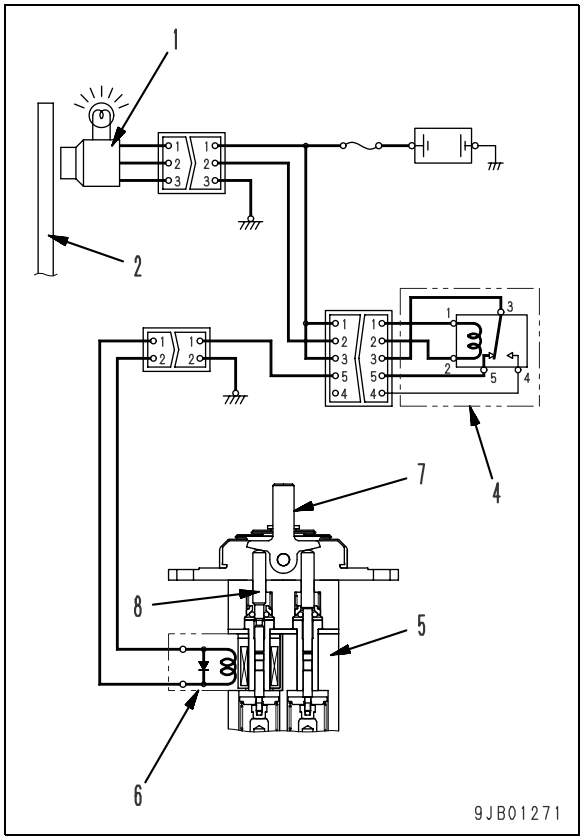
- The boom kick-out is driven electrically. When the lift arm is raised to an angle before the maximum position, the boom kick-out returns the work equipment (lift arm) control lever from the RAISE position to the HOLD position to automatically stop the lift arm at the current position.
- Plate (6) is fixed to lift arm (5). Proximity switch (2) is fixed to the front frame.
- If the work equipment (lift arm) control lever is moved from the LOWER position to the RAISE position, lift arm (5) rises. When plate (6) parts from proximity switch (2), proximity switch (2) operates to return the work equipment (lift arm) control lever to the HOLD position.

## OPERATION OF PROXIMITY SWITCH

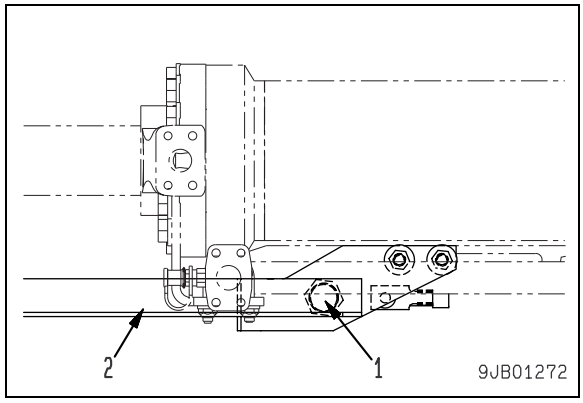
### When bucket is tilted

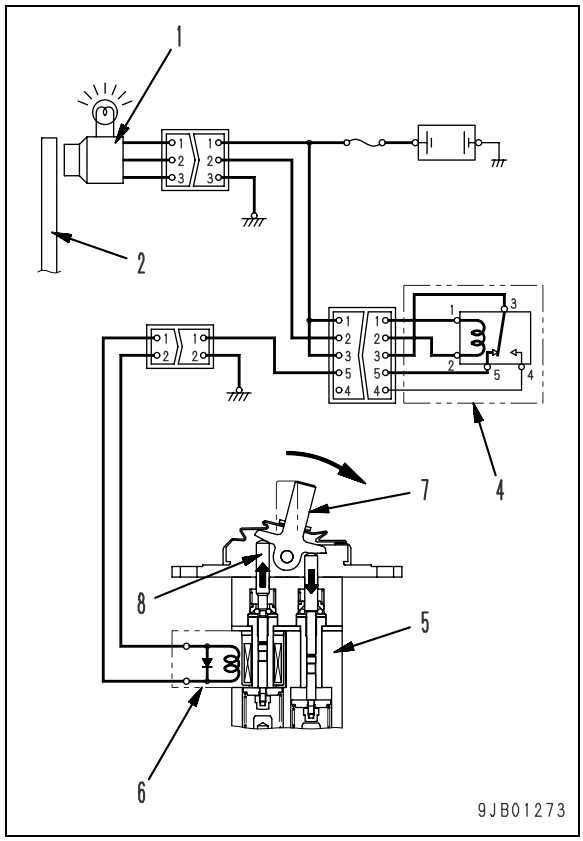
- While the bucket is dumping more than the set position of the bucket positioner, plate (2) is over the sensing face of proximity switch (1), the lamp of which is lighting up.
  At this time, bucket positioner relay (4) is turned on and a current flows in detent solenoid (6) of work equipment PPC valve (5) to magnetize the coil.



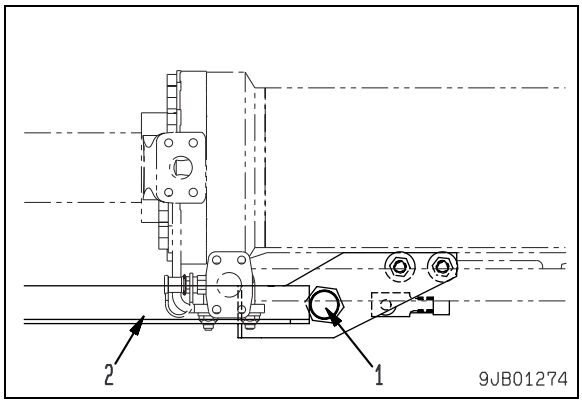



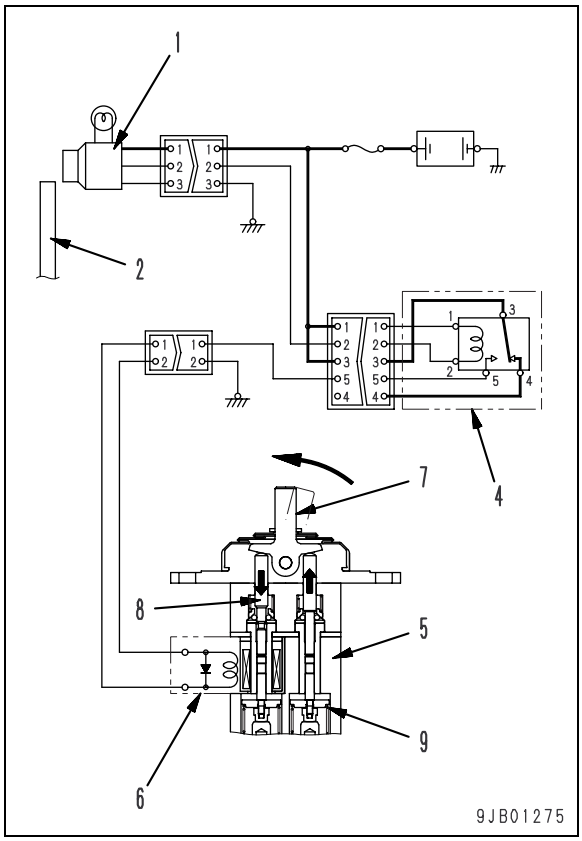

- If the work equipment (bucket) control lever (7) is moved to the TILT position, bucket dump spool (8) moves up and is held at that position by the coil magnetized by detent solenoid (6). As a result, work equipment (bucket) control lever (7) is held at TILT position and the bucket tilts.



- If the bucket tilts and parts from the set position of the bucket positioner, or if plate (2) parts from over the sensing face of proximity switch (1), the lamp of proximity switch (1) goes off and bucket positioner relay (4) is turned off. Accordingly, the circuit of detent solenoid (6) of work equipment PPC valve (5) is turned off to demagnetize the coil.
  Bucket dump spool (8) held at the TILT position receives the reaction force of spring (9) and returns work equipment (bucket) control lever (7) to the HOLD position.




**FUNCTION OF PROXIMITY SWITCH**

**When object of sensing is over sensing face of proximity switch**

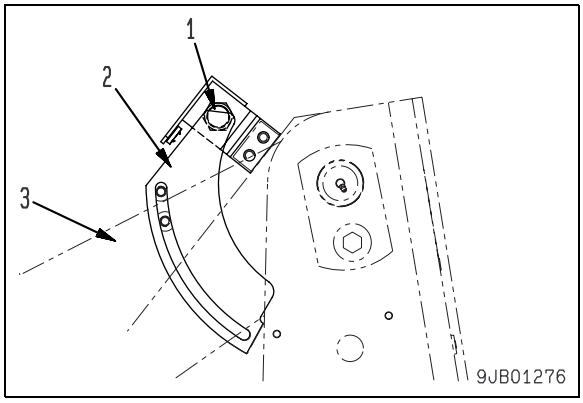
| | |
|---|---|
| Lamp of proximity switch | ON |
| Bucket positioner relay switch circuit | Made |
| Work equipment PPC valve detent solenoid circuit | Made |
| Work equipment PPC valve detent solenoid | Magnetized |

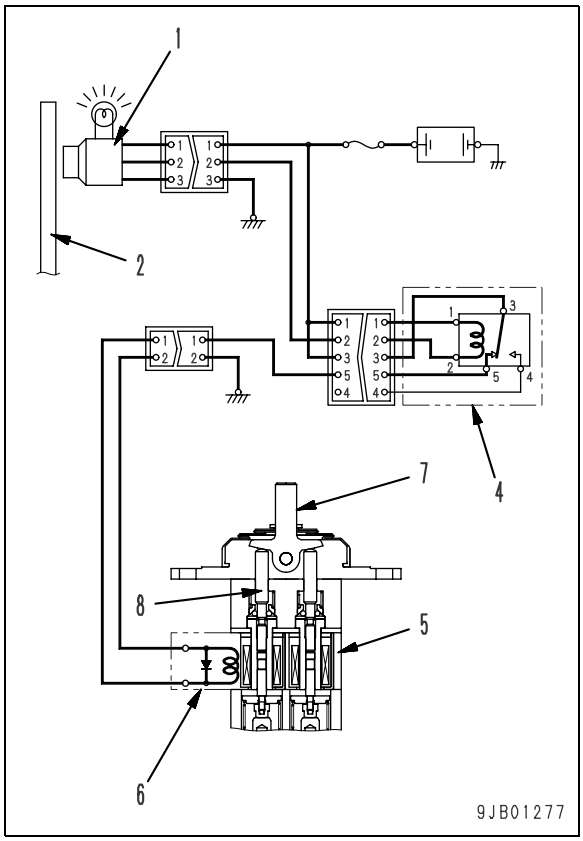
**When object of sensing is apart from over sensing face of proximity switch**

| | |
|---|---|
| Lamp of proximity switch | OFF |
| Bucket positioner relay switch circuit | Broken |
| Work equipment PPC valve detent solenoid circuit | Broken |
| Work equipment PPC valve detent solenoid | Demagnetized |

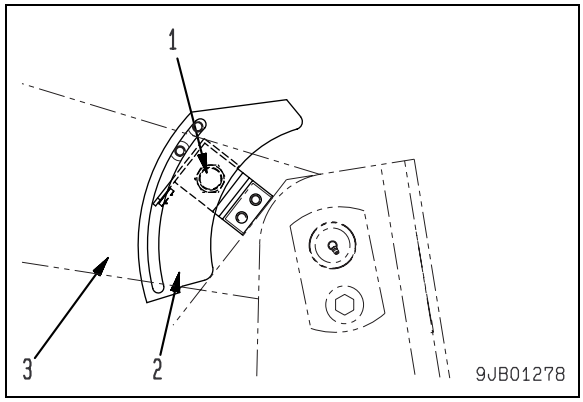
**When lift arm is raised**

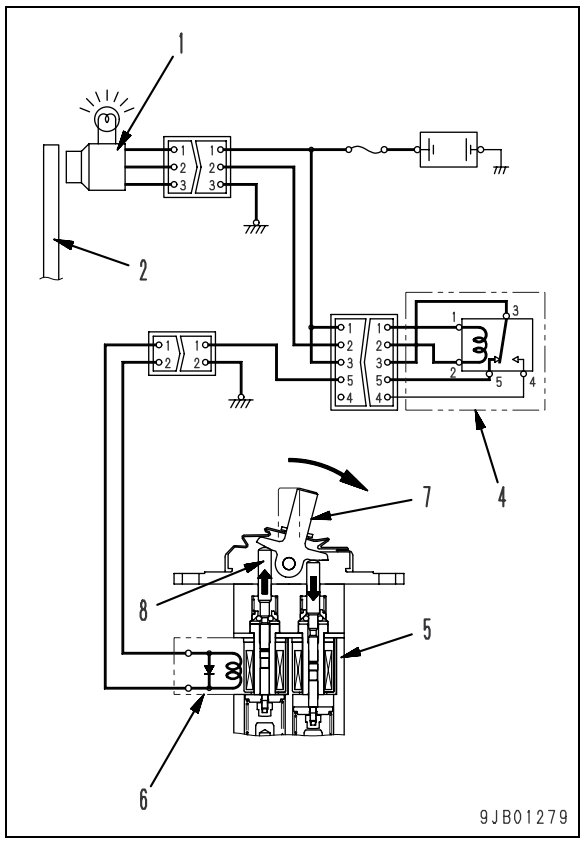
- While the lift arm (3) is lower than the set position of the boom kick-out, plate (2) is over the sensing face of proximity switch (1), the lamp of which is lighting up.
  At this time, boom kick-out relay (4) is turned on and a current flows in detent solenoid (6) of work equipment PPC valve (5) to magnetize the coil.



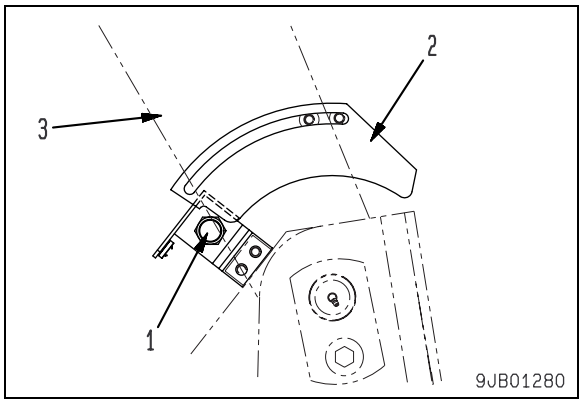



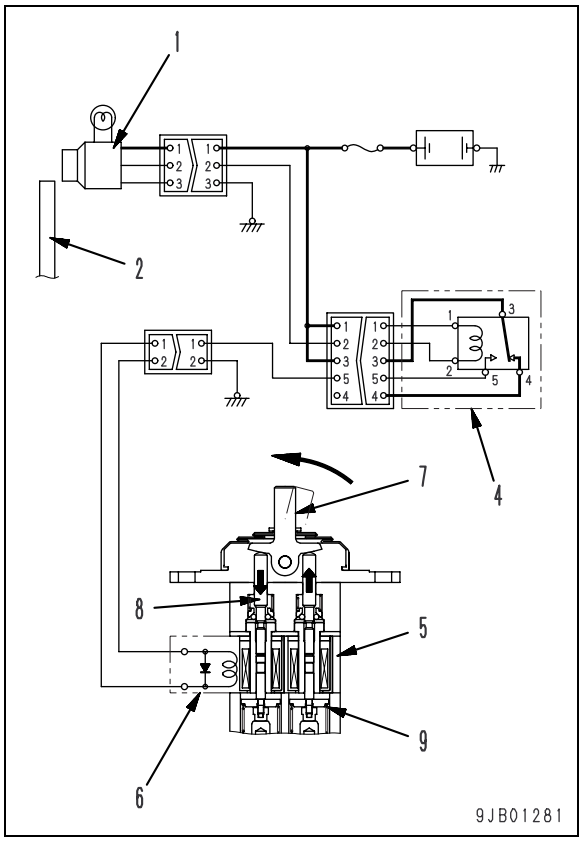

- If the work equipment (lift arm) control lever (7) is moved to the RAISE position, boom lower spool (8) moves up and is held at that position by the coil magnetized by detent solenoid (6). As a result, work equipment (lift arm) control lever (7) is held at RAISE position and the lift arm rises.



- If the lift arm (3) rises and parts from the set position of the kick-out, or if plate (2) parts from over the sensing face of proximity switch (1), the lamp of proximity switch (1) goes off and boom kick-out relay (4) is turned off. Accordingly, the circuit of detent solenoid (6) of work equipment PPC valve (5) is turned off to demagnetize the coil.
  Lift arm raise spool (8) held at the RAISE position receives the reaction force of spring (9) and returns work equipment (lift arm) control lever (7) to the HOLD position.




**FUNCTION OF PROXIMITY SWITCH**

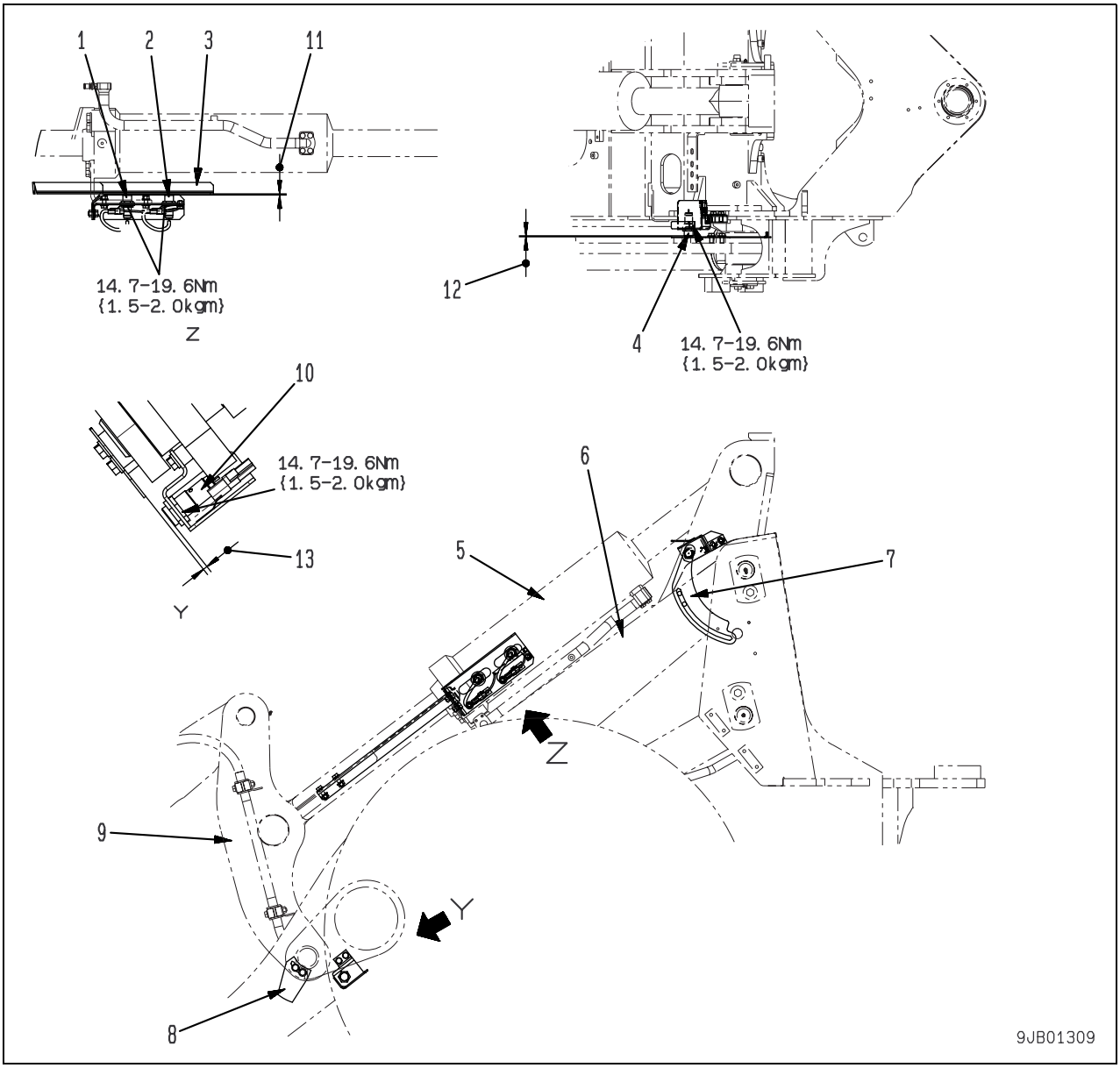
**When object of sensing is over sensing face of proximity switch**

| | |
|---|---|
| Lamp of proximity switch | ON |
| Boom kick-out relay switch circuit | Made |
| Work equipment PPC valve detent solenoid circuit | Made |
| Work equipment PPC valve detent solenoid | Magnetized |

**When object of sensing is apart from over sensing face of proximity switch**

| | |
|---|---|
| Lamp of proximity switch | OFF |
| Boom kick-out relay switch circuit | Broken |
| Work equipment PPC valve detent solenoid circuit | Broken |
| Work equipment PPC valve detent solenoid | Demagnetized |

**WA250PT-5**




1. Fork positioner proximity switch
2. Bucket positioner proximity switch
3. Plate
4. Boom kick-out proximity switch
5. Bucket cylinder
6. Lift arm
7. Plate
8. Plate
9. Tilt lever
10. Dump speed control proximity switch

Unit: mm

| No. | Check item | Criteria | Remedy |
|---|---|---|---|
| 11 | Clearance of bucket positioner proximity switch | 3 – 5 | Adjust |
| 12 | Clearance of boom kick-out proximity switch | 3 – 5 | |
| 13 | Clearance of dump speed control proximity switch | 3 – 5 | |

## OUTLINE

**Bucket positioner or fork positioner**

- The bucket positioner is driven electrically. When the bucket or fork is returned to an angle from the DUMP position toward the TILT position, the bucket positioner returns the work equipment (bucket or fork) control lever from the TILT position to the HOLD position to automatically stop the bucket or fork at a proper digging angle or lift angle.
- Plate (3) is bolted to the rod of bucket cylinder (5). Proximity switches (1) and (2) are bolted to the cylinder.
- If the work equipment (bucket or fork) control lever is moved from the DUMP position to the TILT position, the rod of bucket cylinder (5) moves toward the rear of the machine. When plate (3) approaches proximity switches (1) and (2) at a point, proximity switch (1) or (2) operates to return the work equipment (bucket or fork) control lever to the HOLD position.
- While the attachment selector switch of the right-hand console is in the BUCKET position, proximity switch (2) operates. While the former is in the FORK position, proximity switch (1) operates.

**Boom kick-out**

- The lift arm kick-out is driven electrically. When the lift arm is raised to an angle before the maximum position, the lift arm kick-out returns the work equipment (lift arm) control lever from the RAISE position to the HOLD position to automatically stop the lift arm at the current position.
- Plate (7) is fixed to lift arm (6). Proximity switch (4) is fixed to the front frame.
- If the work equipment (lift arm) control lever is moved from the LOWER position to the RAISE position, lift arm (6) rises. When plate (7) parts from proximity switch (4), proximity switch (4) operates to return the work equipment (lift arm) control lever to the HOLD position.

**The dump speed control**

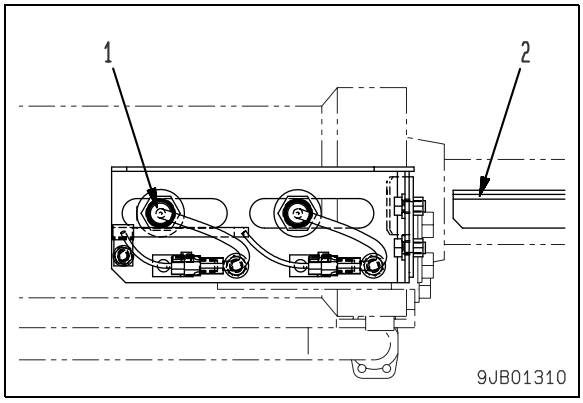
- The dump speed control is driven electrically. When the bucket or fork approaches the dump end, the dump speed controller lowers the dump speed to reduce the shock made at the dump end.
- Plate (8) is fixed to tilt lever (9). Proximity switch (10) is fixed to lift arm (6).
- While the dump speed switch of the right-hand console is in the FAST position, if the work equipment (bucket or fork) control lever is moved to the DUMP position, tilt lever (9) moves toward the front of the machine. When plate (8) approaches proximity switch (10) at a point, proximity switch (10) operates to lower the dump speed.

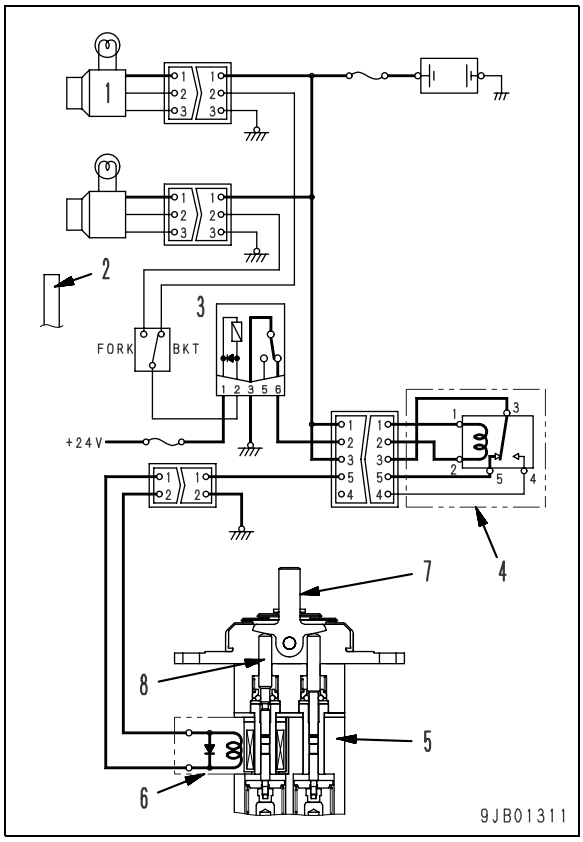
## OPERATION OF PROXIMITY SWITCH

### When bucket is tilted

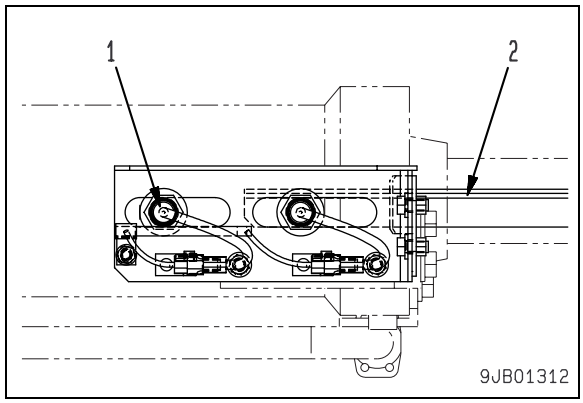
★ The case when the attachment selector switch is in the BUCKET position is shown below.

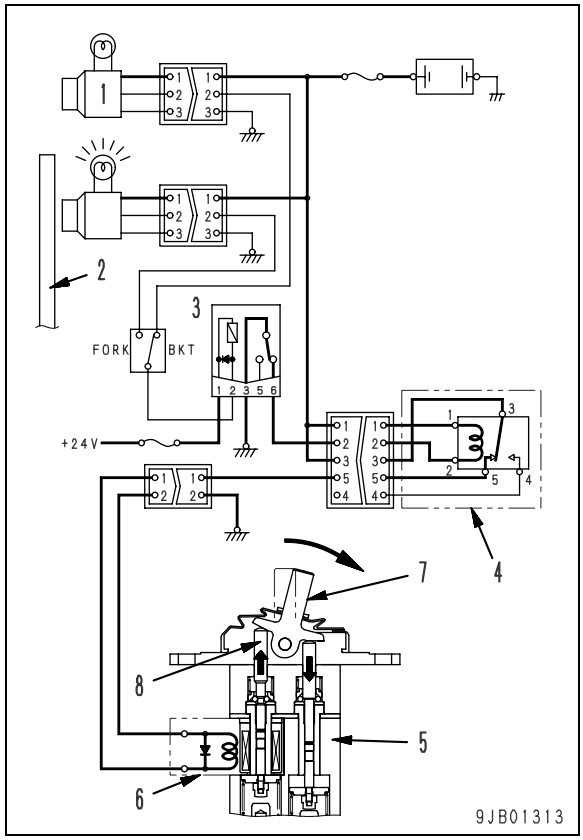
- While the bucket is dumping more than the set position of the bucket positioner, plate (2) is not over the sensing face of proximity switch (1), the lamp of which is turned off.
  At this time, since relay (3) does not operate, bucket positioner relay (4) is turned on and a current flows in detent solenoid (6) of work equipment PPC valve (5) to magnetize the coil.



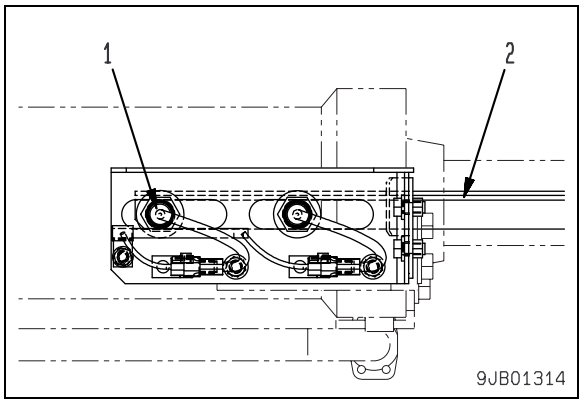



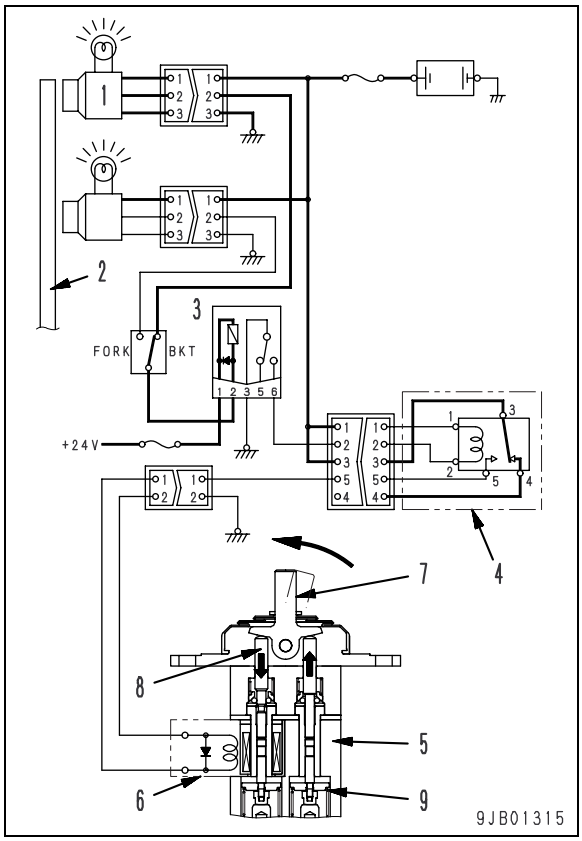

- If the work equipment (bucket) control lever (7) is moved to the TILT position, bucket dump spool (8) moves up and is held at that position by the coil magnetized by detent solenoid (6). As a result, work equipment (bucket) control lever (7) is held at TILT position and the bucket tilts.



- If the bucket tilts to the set position of the bucket positioner, or if plate (2) comes over the sensing face of proximity switch (1), the lamp of proximity switch (1) lights up and relay (3) operates to turn bucket positioner relay (4) off. Accordingly, the circuit of detent solenoid (6) of work equipment PPC valve (5) is turned off to demagnetize the coil.
  Bucket dump spool (8) held at the TILT position receives the reaction force of spring (9) and returns work equipment (bucket) control lever (7) to the HOLD position.




**FUNCTION OF PROXIMITY SWITCH**

**When object of sensing is over sensing face of proximity switch**

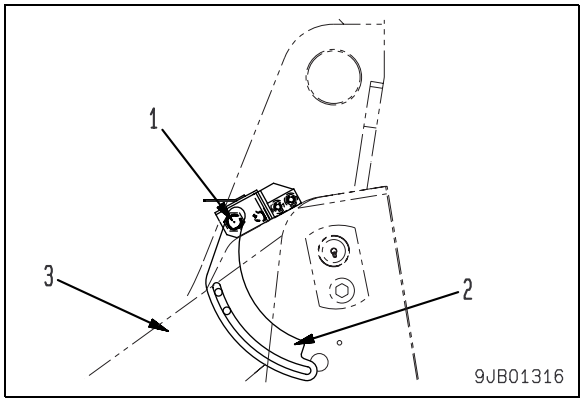
| | |
|---|---|
| Lamp of proximity switch | ON |
| Attachment selector switch relay | ON |
| Bucket positioner relay switch circuit | Broken |
| Work equipment PPC valve detent solenoid circuit | Broken |
| Work equipment PPC valve detent solenoid | Demagnetized |

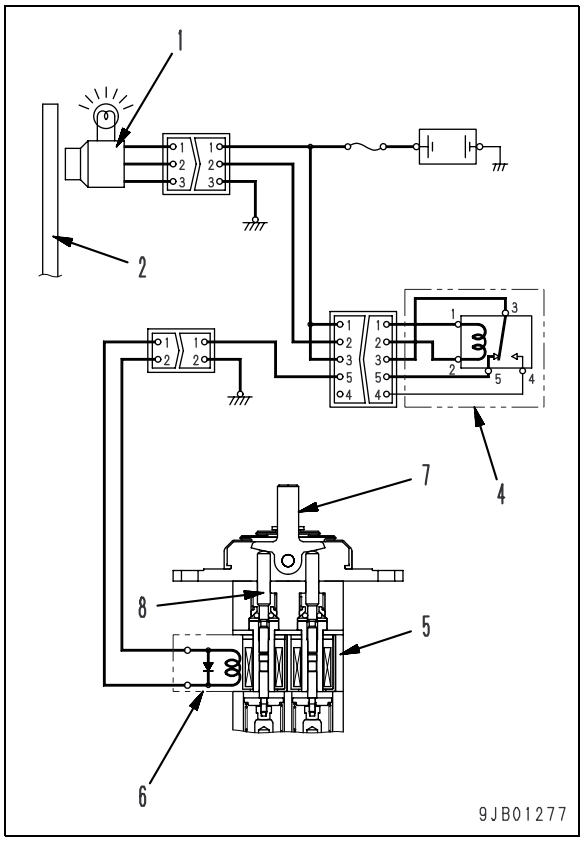
**When object of sensing is apart from over sensing face of proximity switch**

| | |
|---|---|
| Lamp of proximity switch | OFF |
| Attachment selector switch relay | OFF |
| Bucket positioner relay switch circuit | Made |
| Work equipment PPC valve detent solenoid circuit | Made |
| Work equipment PPC valve detent solenoid | Magnetized |

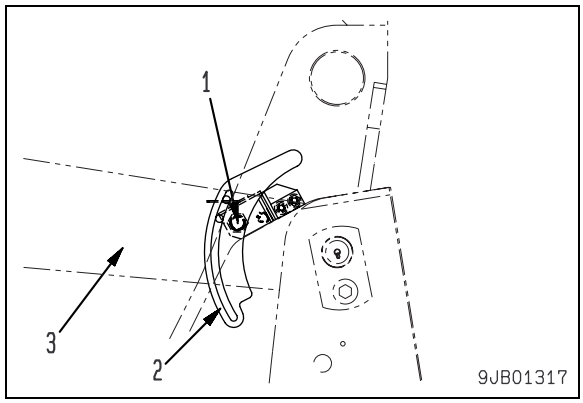
**When lift arm is raised**

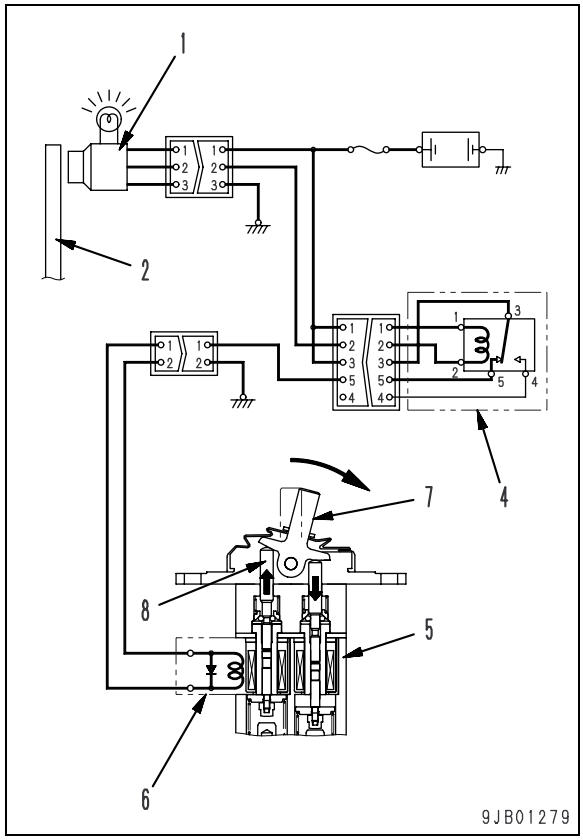
- While the lift arm (3) is lower than the set position of the boom kick-out, plate (2) is over the sensing face of proximity switch (1), the lamp of which is lighting up.
  At this time, boom kick-out relay (4) is turned on and a current flows in detent solenoid (6) of work equipment PPC valve (5) to magnetize the coil.



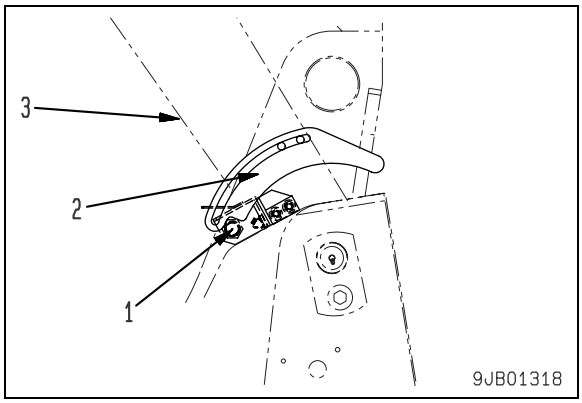



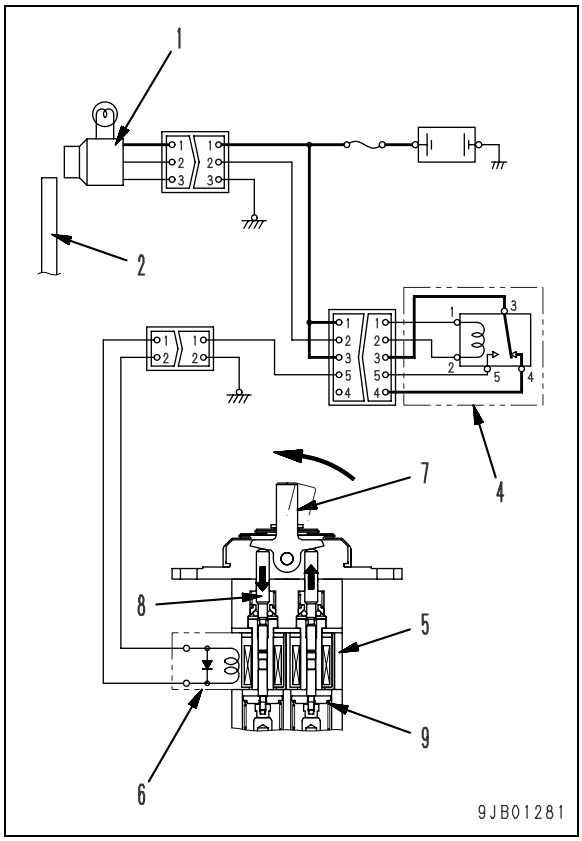

- If the work equipment (lift arm) control lever (7) is moved to the RAISE position, lift arm lower spool (8) moves up and is held at that position by the coil magnetized by detent solenoid (6). As a result, work equipment (lift arm) control lever (7) is held at RAISE position and the lift arm rises.



- If the lift arm (3) rises and parts from the set position of the kick-out, or if plate (2) parts from over the sensing face of proximity switch (1), the lamp of proximity switch (1) goes off and boom kick-out relay (4) is turned off. Accordingly, the circuit of detent solenoid (6) of work equipment PPC valve (5) is turned off to demagnetize the coil.
  Lift arm raise spool (8) held at the RAISE position receives the reaction force of spring (9) and returns work equipment (lift arm) control lever (7) to the HOLD position.




**FUNCTION OF PROXIMITY SWITCH**

**When object of sensing is over sensing face of proximity switch**

| | |
|---|---|
| Lamp of proximity switch | ON |
| Boom kick-out relay switch circuit | Made |
| Work equipment PPC valve detent solenoid circuit | Made |
| Work equipment PPC valve detent solenoid | Magnetized |

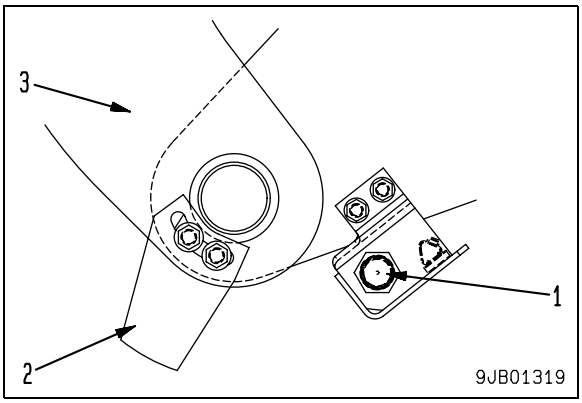
**When object of sensing is apart from over sensing face of proximity switch**

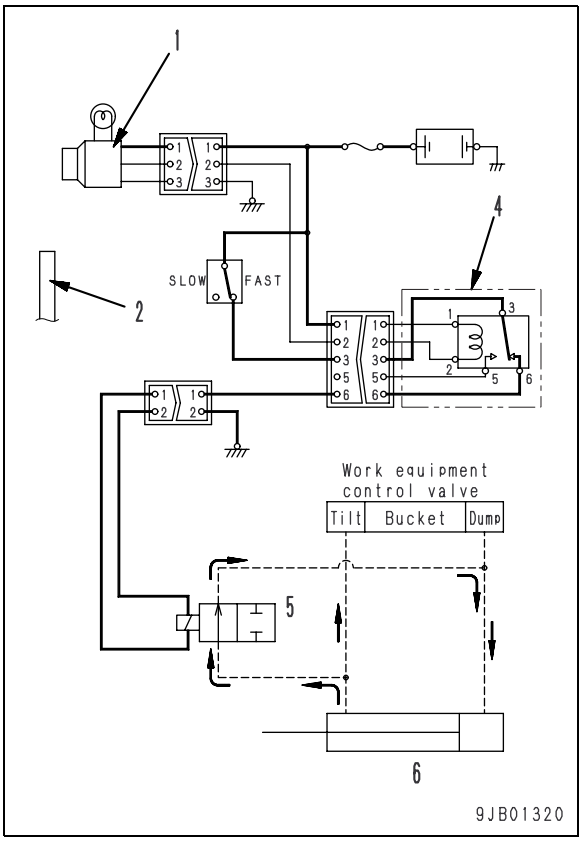
| | |
|---|---|
| Lamp of proximity switch | OFF |
| Boom kick-out relay switch circuit | Broken |
| Work equipment PPC valve detent solenoid circuit | Broken |
| Work equipment PPC valve detent solenoid | Demagnetized |

**When bucket is dumped**

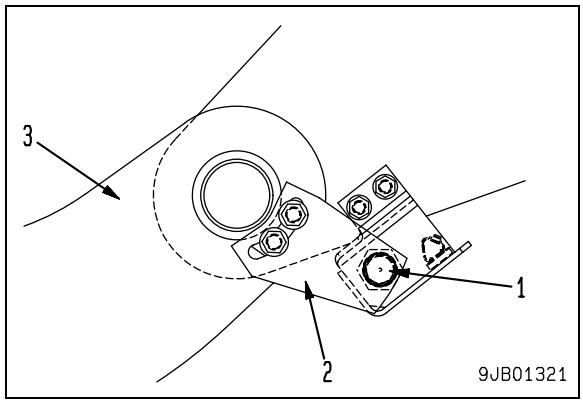
★ The case when the dump speed switch is in the FAST position is shown below.

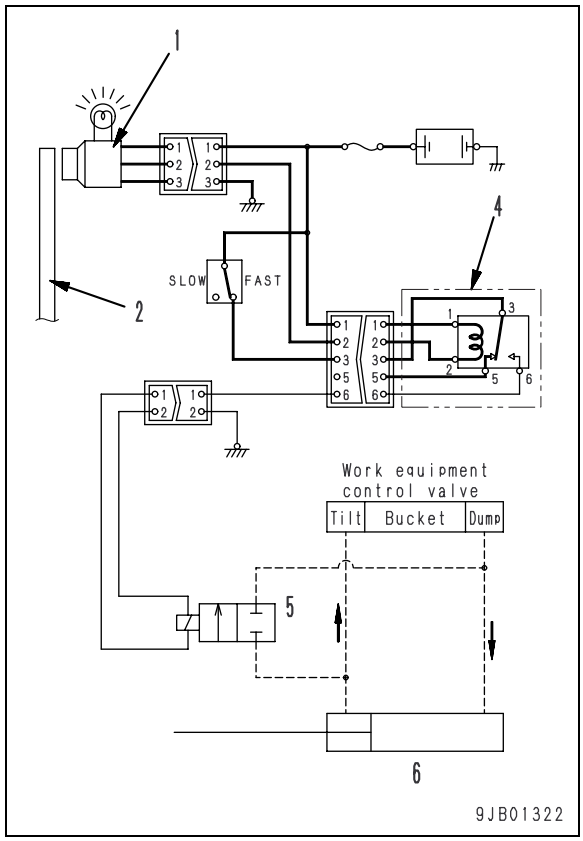
• While the tilt lever (3) is tilted more than the set position of the bell crank angle sensor, plate (2) is not over the sensing face of proximity switch (1), the lamp of which is turned off.
At this time, dump speed relay (4) is turned ON and a current flows in the coil of bypass solenoid valve (5) to merge the oils on the head side and bottom side of bucket cylinder (6) together, thus the bucket dump speed is heightened.




• When the bucket approaches the dump end and plate (2) comes over the sensing face of proximity switch (1), the lamp of which lights up and dump speed relay (4) is turned on. As a result, the circuit of bypass solenoid valve (5) is broken and the coil is demagnetized.
The oil on the head side of bucket dump cylinder (6) does not flow to the bottom side and the bucket dump speed is lowered.



★ While the dump speed switch is in the SLOW mode position, the dump speed is kept low regardless of the bell crank angle.

**FUNCTION OF PROXIMITY SWITCH**

**When object of sensing is over sensing face of proximity switch**

| | |
|---|---|
| Lamp of proximity switch | ON |
| Dump speed relay switch circuit | Made |
| Bypass solenoid valve circuit | Broken |
| Bypass solenoid | Demagnetized |

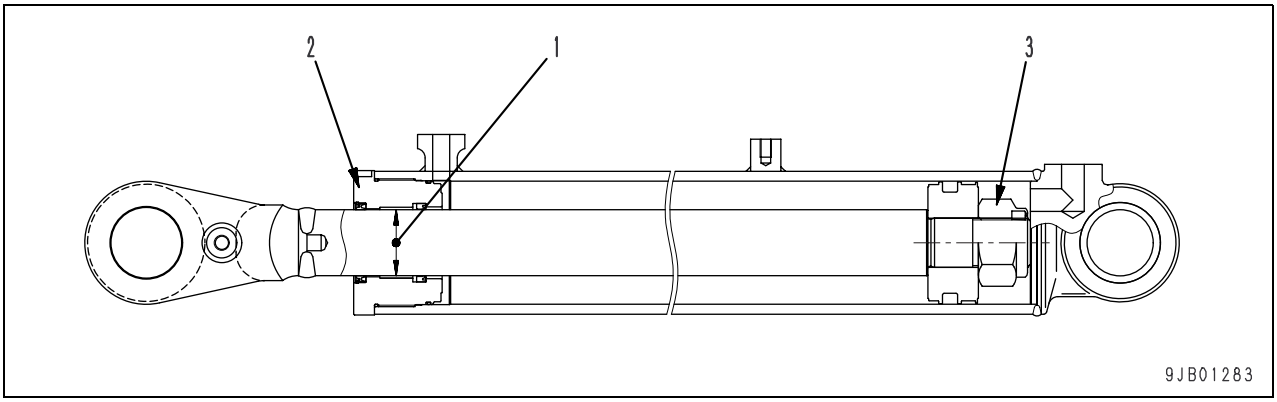
**When object of sensing is apart from over sensing face of proximity switch**

| | |
|---|---|
| Lamp of proximity switch | ON |
| Dump speed relay switch circuit | Broken |
| Bypass solenoid valve circuit | Made |
| Bypass solenoid | Magnetized |

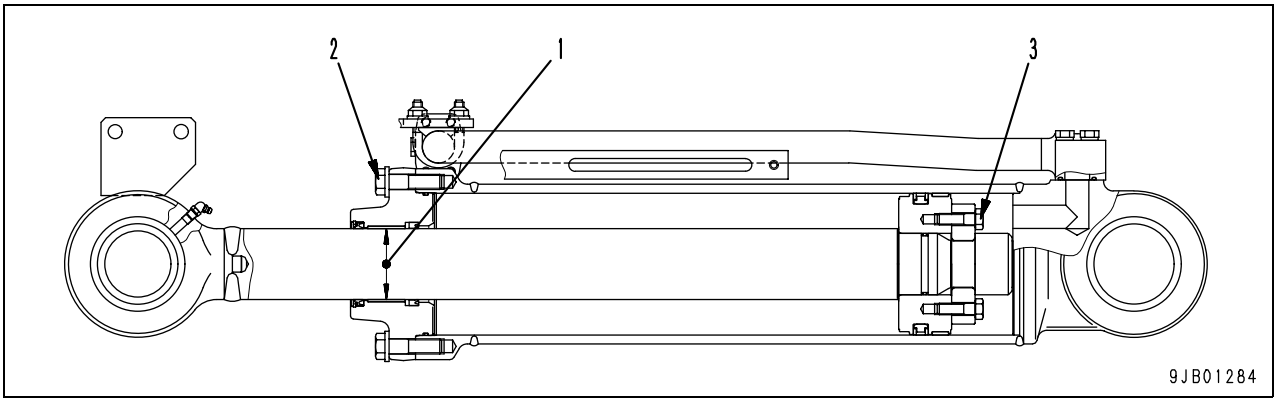
# WORK EQUIPMENT CYLINDER

**WA250-5**

**LIFT CYLINDER**




**BUCKET CYLINDER**

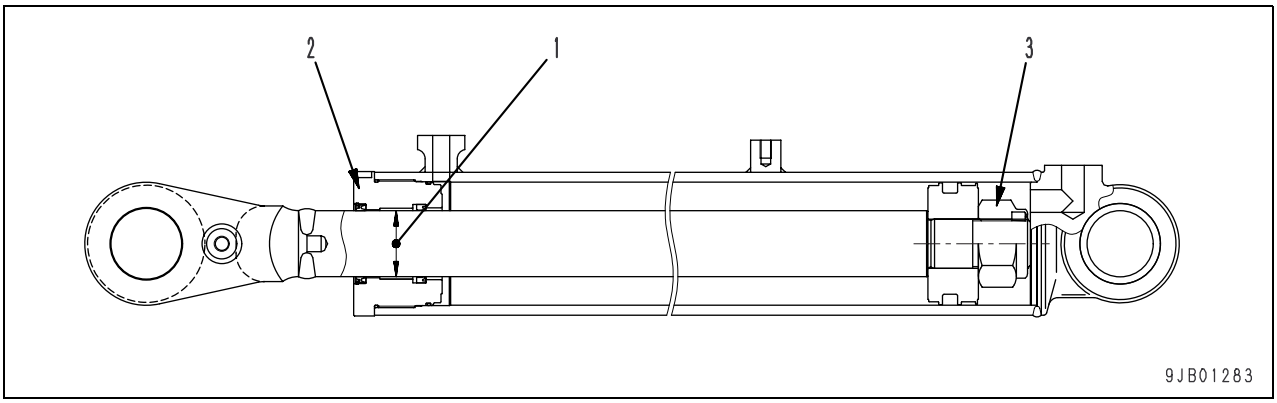



Unit: mm

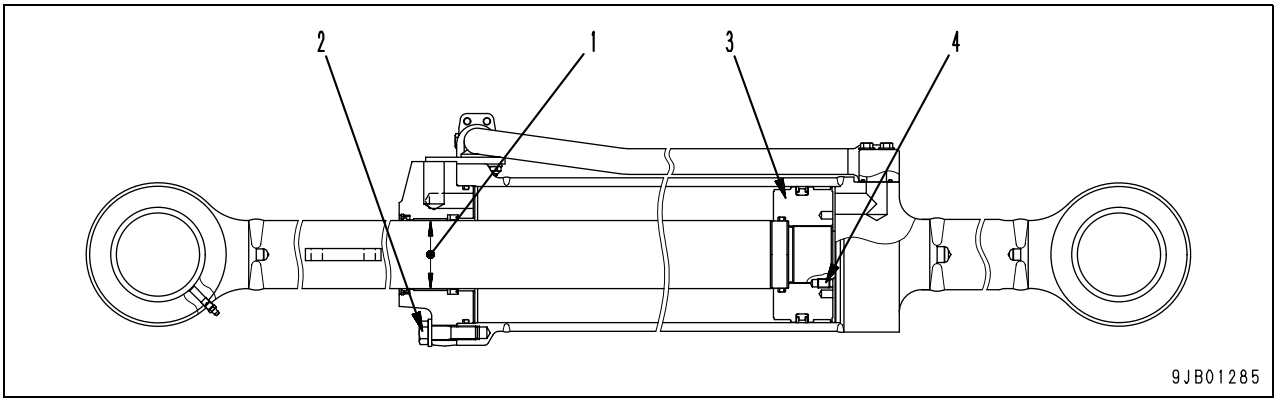
| No. | Check item | | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|---|
| | | Name of cylinder | Standard size | Tolerance | | Standard clearance | Clearance limit | |
| | | | | Shaft | Hole | | | |
| 1 | Clearance between piston rod and bushing | Lift | ø 70 | -0.030<br>-0.104 | +0.271<br>+0.075 | 0.105 – 0.375 | 0.675 | Replace bushing |
| | | Bucket | ø 75 | -0.030<br>-0.104 | +0.291<br>+0.077 | 0.107 – 0.395 | 0.695 | |
| 2 | Tightening torque of cylinder head | Lift | 1,030 ± 103 Nm {105 ± 10.5 kgm} | | | | | Retighten |
| | Tightening torque of cylinder head bolt | Bucket | 250 ± 24.5 Nm {25.5 ± 2.5 kgm} | | | | | |
| 3 | Tightening torque of cylinder piston nut | Lift | 3,970 ± 397 Nm {405 ± 40.5 kgm}<br>(Width across flats:80 mm) | | | | | |
| | Tightening torque of cylinder piston bolt | Bucket | 98 – 123 Nm {10 – 12.5 kgm} | | | | | |

**WA250PT-5**

**LIFT CYLINDER**




**BUCKET CYLINDER**

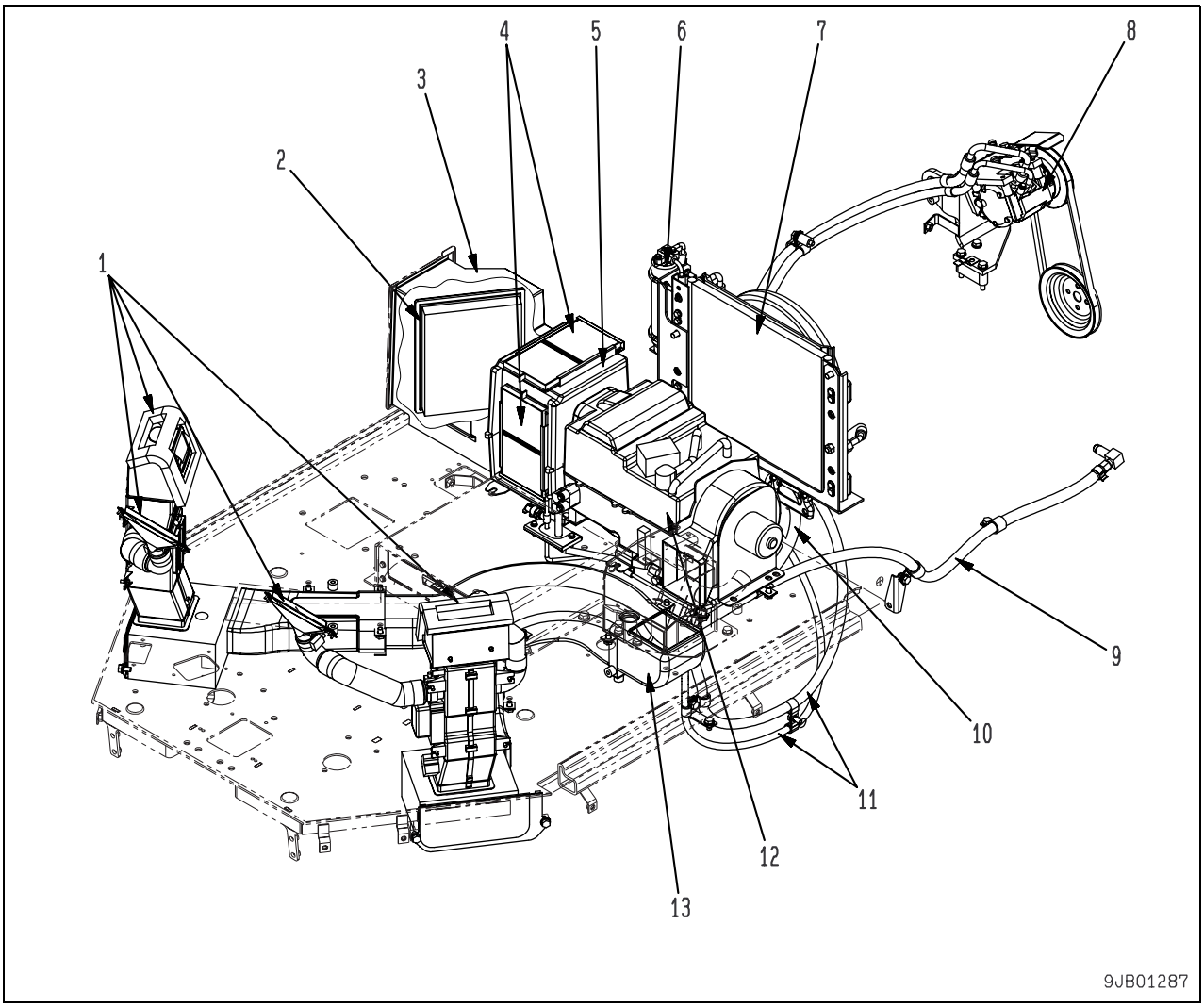


Unit: mm

| No. | Check item | | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|---|
| | | Name of cylinder | Standard size | Tolerance | | Standard clearance | Clearance limit | |
| | | | | Shaft | Hole | | | |
| 1 | Clearance between piston rod and bushing | Lift | ø 70 | -0.030<br>-0.104 | +0.271<br>+0.075 | 0.105 – 0.375 | 0.675 | Replace bushing |
| | | Bucket | ø 90 | -0.036<br>-0.090 | +0.257<br>+0.048 | 0.084 – 0.347 | 0.647 | |
| | | Coupler plunger | | | | – | | |
| 2 | Tightening torque of cylinder head | Lift | 1,030 ± 103 Nm {105 ± 10.5 kgm} | | | | | Retighten |
| | Tightening torque of cylinder head bolt | Bucket | 343 ± 34.3 Nm {35 ± 3.5 kgm} | | | | | |
| | Tightening torque of cylinder head | Coupler plunger | ± Nm { ± kgm} | | | | | |
| 3 | Tightening torque of cylinder piston nut | Lift | 3,970 ± 397 Nm {405 ± 40.5 kgm}<br>(Width across flats: 80 mm) | | | | | |
| | Tightening torque of cylinder piston | Bucket | 294 ± 29.4 Nm {30 ± 3.0 kgm} | | | | | |
| | Tightening torque of cylinder piston nut | Coupler plunger | ± Nm { ± kgm}<br>(Width across flats: mm) | | | | | |
| 4 | Tightening torque of cylinder piston screw | Bucket | 58.9 – 73.6 Nm {6 – 7.5 kgm} | | | | | |

# AIR CONDITIONER

### AIR CONDITIONER PIPING




1. Air outlet duct
2. Fresh air inlet filter
3. Fresh air inlet duct
4. Recirculating air filter
5. Recirculating / Fresh air selector damper
6. Receiver tank
7. Condenser
8. Compressor
9. Hot water return piping
10. Hot water take-out piping
11. Refrigerant piping
12. Air conditioner unit
13. Floor duct

# MACHINE MONITORING SYSTEM

**Outline**

- The machine monitor system uses the sensors and other devices installed to various parts of the machine to observe the condition of the machine. It processes this information swiftly and displays it on the monitor panel to inform the operator of the condition of the machine.
- The indications of the machine monitor will be made under the normal mode and under the service mode.
- The machine monitor has ON/OFF output function of automatic preheating which assists with the starting of the engine.
- The machine monitor has the relay ON/OFF output function to cut the output to the HST solenoid when the HST controller has a trouble.

- Normal mode indications are those which are usually being made for ordinary use by the machine operators. The description below applies to the contents of the main indications.

1. Items which are always indicated
   - Meters (Travel speedometer or engine tachometer)
   - Gauges (Engine cooling water temperature gauge, HST oil temperature gauge and fuel level gauge)
   - Pilot indications
   - Service meter

2. Items which will be indicated only when some abnormality occurs
   - Cautions
   - Action code indications (When the machine monitor mode changeover switch (>) is depressed and released while the action code is being indicated, the failure code (6 digits) will be indicated.)

3. When the time comes to change the filter or oil, necessary items for the filter change or oil change will be indicated on the character display. (Maintenance monitoring functions)

4. In addition to the above, this system is equipped with the functions to indicate the travel distance integrating meter (odometer), to reset the filter/oil changing time, and to select the language by use of the character display and the machine monitor mode selector switch which is the operation switch of the character display.

- This machine monitoring system is equipped with the service mode function to facilitate the troubleshooting work for respective controllers (including the machine monitor itself) on the network. The description below applies to the contents of the main functions.

1. Electric fault history
   This function will indicate the electric fault history data of respective controllers being memorized by the machine monitor. Also, it can be used to delete the aforementioned data.

2. Machine fault history
   This function will indicate the machine fault history and machine fault history data of respective controllers being memorized by the machine monitor.

3. Real time monitor
   This function will make real time indications of the inputting data and outputting data being recognized by respective controllers on the network.

4. Maintenance monitor
   This function is to be used for revisions of the preset filter and oil changing time. (Revision of the time for the maintenance monitor operation)

5. Selection of optional items
   This function is used to set the machine model, tier size, and optional equipment.

6. Controller initializing function
   This function is being used to effect the settings of this machine monitor before shipment from our factory.

- Also, the service mode is equipped with the following functions necessary when replacing the machine monitor.

1. Service meter setting
   This function is to be used to make setting of the service meter value being memorized by the machine monitor. However, this setting is valid only toward the direction to increase the current value.

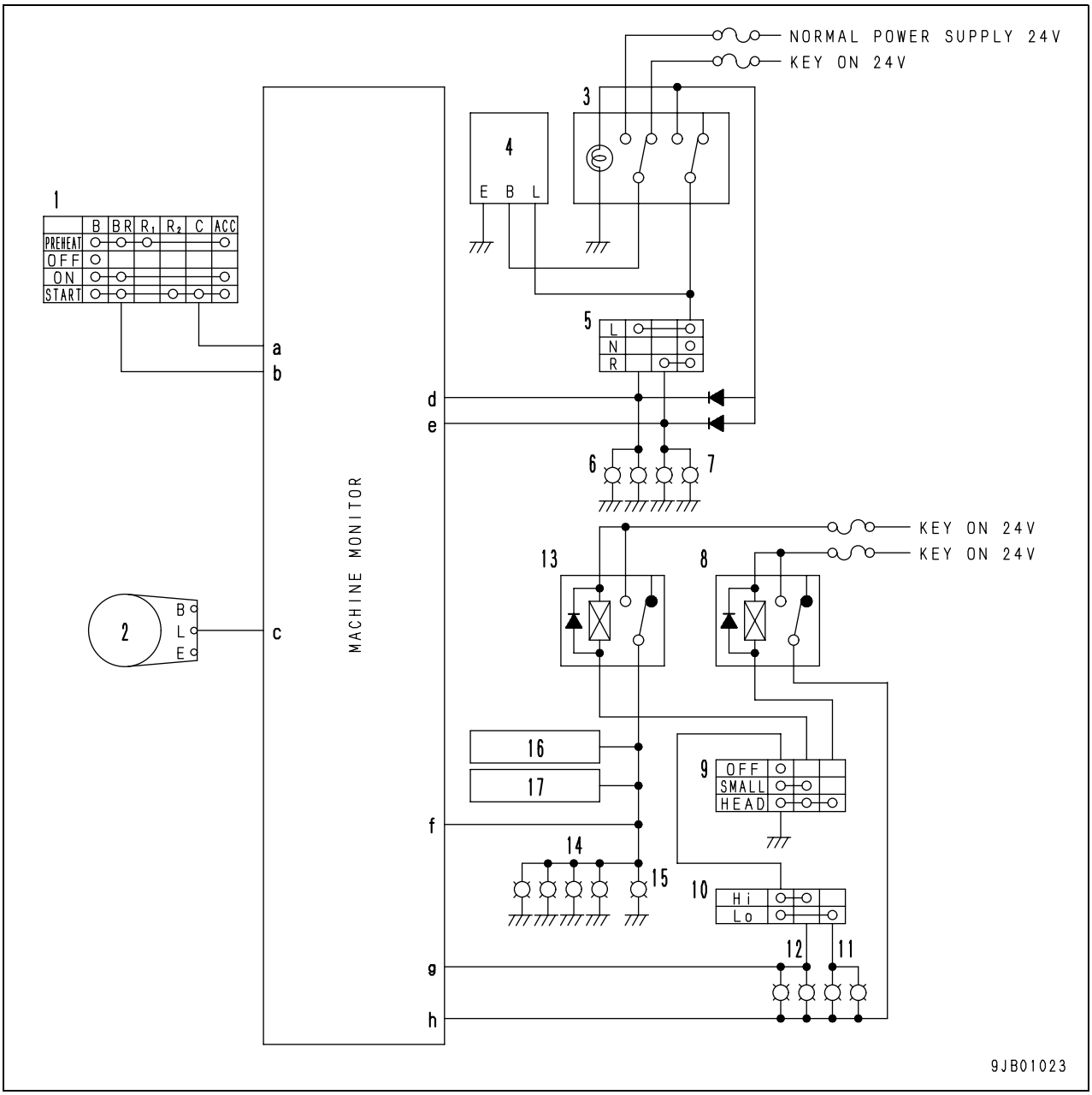
2. Travel distance integrating meter value setting
   This function is to be used to set the travel distance integrating meter value being memorized by the machine monitor. However, this setting is valid only toward the direction to increase the current value.

★ For "Setting service meter" and "Setting integrated travel distance", ask the manufacturer since they are carried out with the initializing function.

- The machine monitoring system consists of the machine monitor proper, buzzer, and switches that are used for inputting data to the machine monitor proper, sensors, respective controller on the network, and relevant switches and sensors.

**Individual circuit diagrams of the machine monitor**

**Starting and lighting**

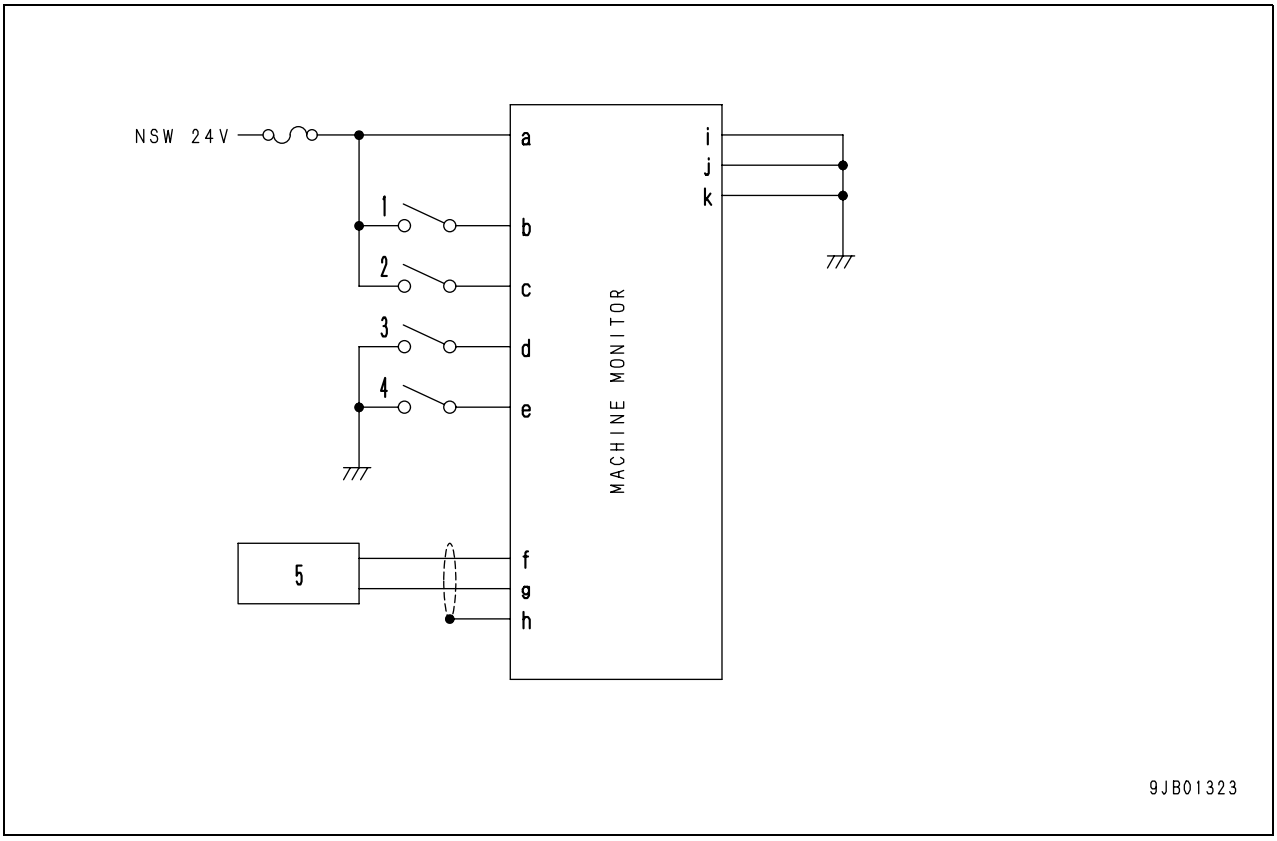


1. Starting switch
2. Alternator
3. Emergency flasher switch
4. Flasher unit
5. Turn signal lever
6. Turn signal lamp (Left)
7. Turn signal lamp (Right)
8. Head lamp relay
9. Lamp switch
10. Dimmer switch
11. Head lamp (Lo)
12. Head lamp (Hi)
13. Clearance lamp, tail lamp relay
14. Clearance lamp, tail lamp
15. License plate lamp
16. Working lamp relay
17. Tachograph lamp (If equipped)

Connection table of connector pins of machine monitor

| Symbol | Connector pin No. |
|---|---|
| a | CNL23-3 |
| b | CNL23-1 |
| c | CNL23-12 |
| d | CNL22-11 |
| e | CNL23-17 |
| f | CNL21-12 |
| g | CNL22-12 |
| h | CNL23-9 |

**Power supply and network**

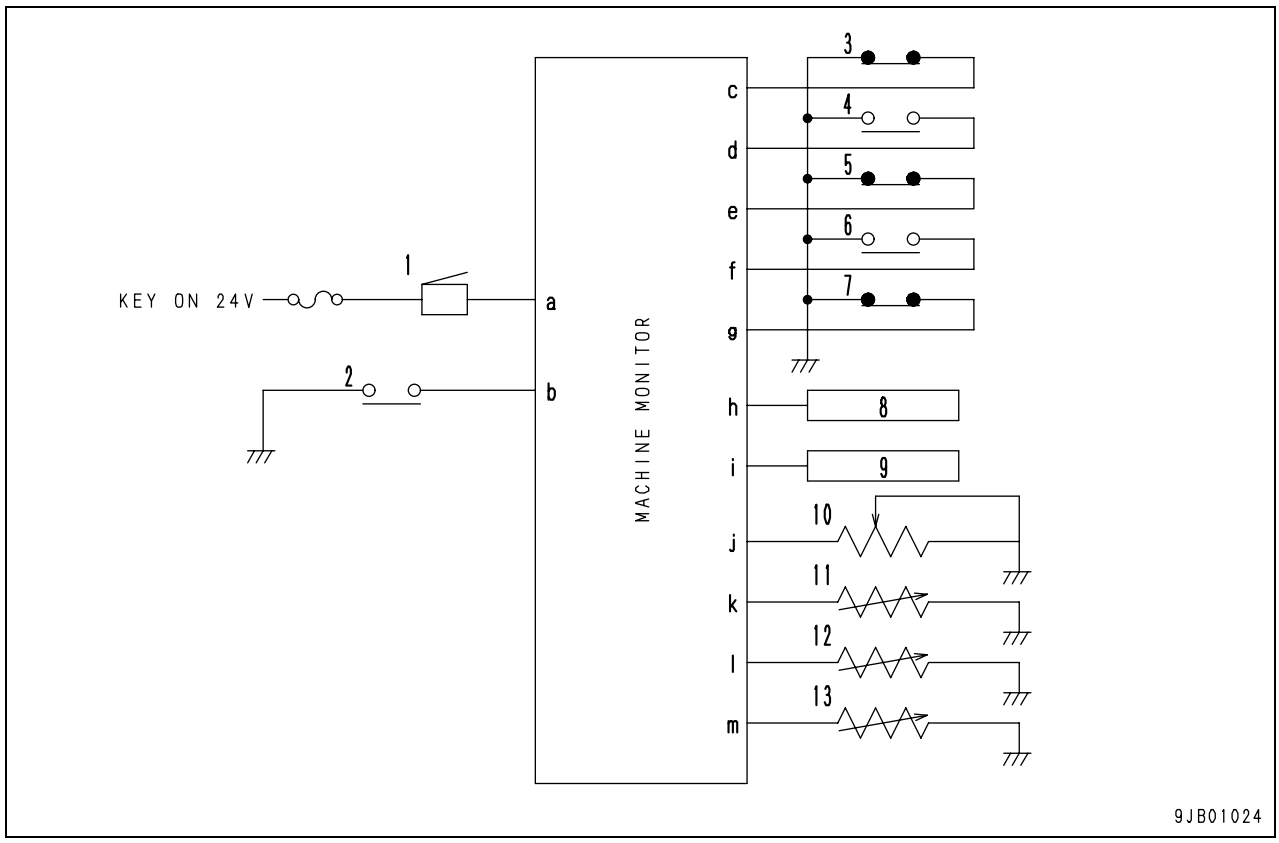



1. Monitor panel mode selector switch 1 "◇"
2. Monitor panel mode selector switch 1 "◆"
3. Monitor panel mode selector switch 2 "<"
4. Monitor panel mode selector switch 2 ">"
5. HST controller

Connection table of connector pins of machine monitor

| Symbol | Connector pin No. |
|---|---|
| a | CNL23-11 |
| b | CNL21-2 |
| c | CNL21-1 |
| d | CNL21-4 |
| e | CNL21-5 |
| f | CNL22-6 |
| g | CNL22-2 |
| h | CNL21-3 |
| i | CNL21-7 |
| j | CNL21-15 |
| k | CNL23-14 |

**Sensing**

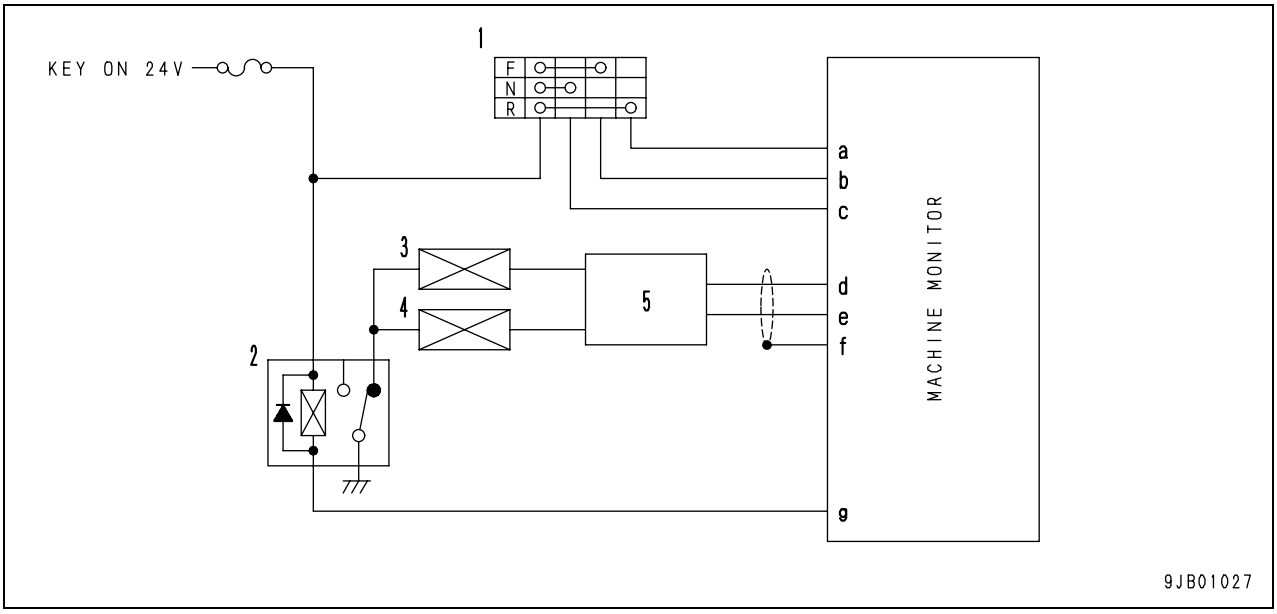



1. Alarm buzzer
2. HST filter clogging sensor
3. Steering oil pressure sensor
4. Emergency steering oil pressure sensor
5. Coolant level sensor
6. Brake oil pressure sensor
7. Engine oil pressure sensor
8. Parking brake not applied signal
9. Parking brake indicator signal
10. Fuel level sensor
11. HST oil temperature sensor
12. Coolant temperature sensor (for monitor)
13. Axle oil temperature sensor

Connection table of connector pins of machine monitor

| Symbol | Connector pin No. |
|---|---|
| a | CNL21-11 |
| b | CNL23-6 |
| c | CNL22-3 |
| d | CNL22-5 |
| e | CNL23-8 |
| f | CNL23-19 |
| g | CNL23-10 |
| h | CNL21-13 |
| i | CNL23-18 |
| j | CNL23-13 |
| k | CNL21-14 |
| l | CNL21-16 |
| m | CNL21-8 |

**HST safety control**

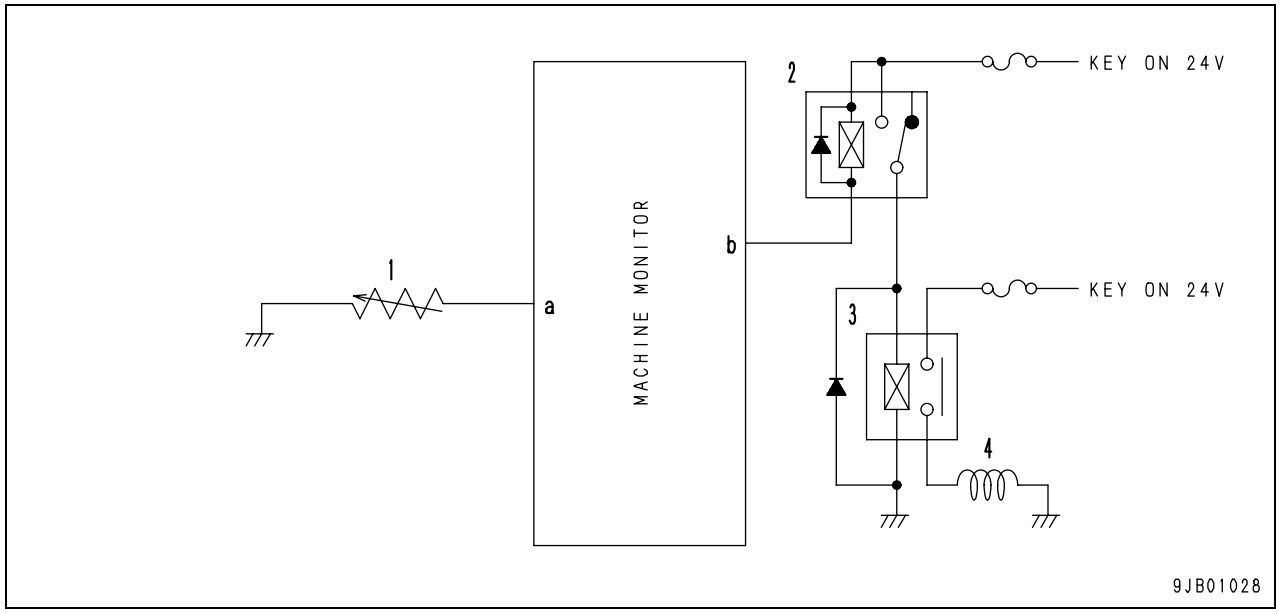



1. Forward-reverse lever
2. HST safety relay
3. Motor 1 solenoid valve
4. Clutch solenoid valve
5. HST controller

Connection table of connector pins of machine monitor

| Symbol | Connector pin No. |
|---|---|
| a | CNL22-8 |
| b | CNL22-9 |
| c | CNL22-10 |
| d | CNL22-6 |
| e | CNL22-2 |
| f | CNL21-3 |
| g | CNL23-15 |

**Autmatic preheating**




1. Coolant temperature sensor (for preheating)
2. Automatic preheater relay
3. Engine heater relay
4. Ribbon heater

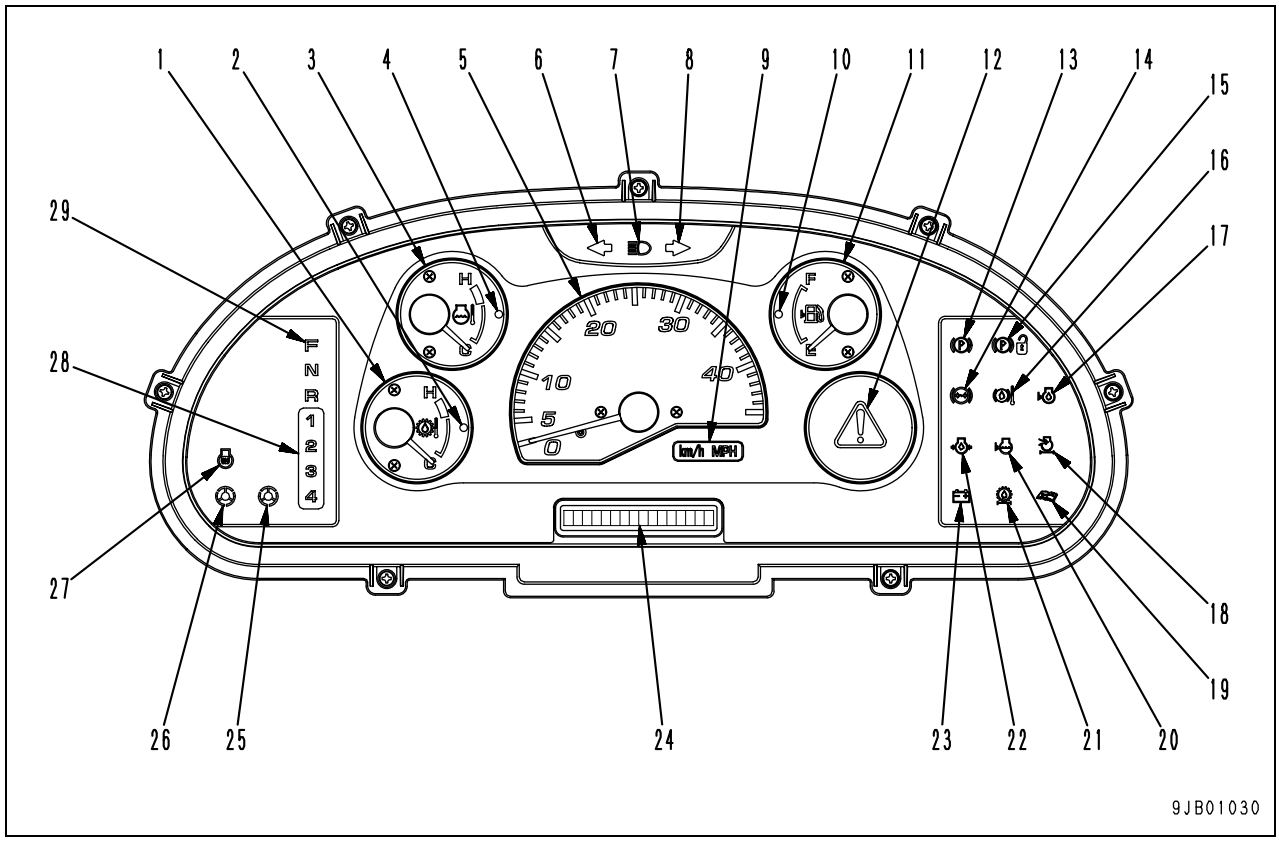
Connection table of connector pins of machine monitor

| Symbol | Connector pin No. |
|---|---|
| a | CNL21-6 |
| b | CNL22-4 |

| CAN output \ CAN input | | Machine monitor | HST controller |
|---|---|---|---|
| Machine monitor | Forward-reverse lever signal | | HST control |
| | Model selection | | Model selection |
| | HST function selection | | HST control |
| HST controller | Travel speed pulse | Travel speedometer | |
| | Gear speed signal | Indication of 1, 2, 3, or 4 | |
| | Error | Indication of characters | |
| | Input/Output state signal | Real-time monitor | |

# MACHINE MONITOR

★ Monitor lamps 17 and 18 do not operate on this machine.




1. HST oil temperature gauge
2. HST oil temperature caution lamp
3. Engine water temperature gauge
4. Engine water temperature caution lamp
5. Speedometer
6. Turn signal pilot lamp (Left)
7. Head lamp beam pilot lamp
8. Turn signal pilot lamp (Right)
9. Meter indication pilot lamp
10. Fuel level caution lamp
11. Fuel level gauge
12. Centralized warning lamp
13. Parking brake pilot lamp
14. Brake oil pressure caution lamp
15. Parking brake not applied caution lamp
16. Axle oil temperature caution lamp
17. Engine oil level caution lamp
18. Air cleaner clogging caution lamp
19. Maintenance caution lamp
20. Radiator water level caution lamp
21. HST oil filter clogging caution lamp
22. Engine oil pressure caution lamp
23. Battery charge circuit caution lamp
24. Character display
25. Steering oil pressure pilot lamp
26. Emergency steering pilot lamp
27. Preheater pilot lamp
28. Gear speed selector switch position pilot lamp
29. Forward-reverse lever position pilot lamp

# LIST OF ITEMS DISPLAYED ON MONITOR

Condition for judging running of engine: When running judgment A or B is satisfied, it is judged that the engine is running.

1. Input is given to alternator terminal R (24 V).
2. Engine oil pressure is normal (Open).
3. Signal of terminal C has been input at least once after IGN_BR, and then it has been turned OFF at least once.

Judgment of operation

A: After 1 and 2 are established simultaneously, it is judged that the engine is running until IGN_BR is turned OFF.

B: If 1 and 3 are established simultaneously or 2 and 3 are established simultaneously, it is judged that the engine is running. If both signals of 1 and 2 are lost, however, it is judged that the engine is stopped even if IGN_BR is turned ON.

| Lamp | Period of lamp |
|---|---|
| ○: ON | – |
| ◎: Flash | Period: 1,600 msec<br>ON: 800 msec<br>OFF: 800 msec<br>(DUTY 50%) |
| ☆: Intermittent | Period: 240 msec<br>ON 1: 80 msec<br>OFF: 160 msec |
| △: Condition is set separately | – |

| Buzzer | Condition for operation | Period of buzzer | Priority |
|---|---|---|---|
| ◎: ON and OFF continuously | Warning for dangerous condition<br>(When error indication or caution is turned on) | Period: 1,600 msec<br>ON: 800 msec<br>OFF: 800 msec<br>(DUTY 50%) | 1 |
| ☆: Intermittent | Caution for wrong operation, etc. (When abnormal operation is performed) | Period: 240 msec<br>ON 1: 80 msec<br>OFF: 160 msec | 2 |
| △: Cancellation sound | Cancellation of calibration, etc. (When operation is not accepted) | ON: 1,000 msec (Once) | 3 |
| ▲: Completion sound | Completion of calibration, etc. (When completed normally) | ON: 1,000 msec.<br>OFF: 160 msec.<br>ON: 1,000 msec (Once) | 4 |

| Division | No. | Item | Device | Condition for operation | Operation | | | | | | | | Indication color | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Engine is stopped | | | | Engine is running | | | | | |
| | | | | | Warning buzzer | Individual indication | Centralized warning | Indication of error code message | Warning buzzer | Individual indication | Centralized warning | Indication of error code message | | |
| Backup lamp | – | Backup lamp | Bulb for night light | When clearance lamp is ON | – | – | – | – | – | – | – | – | Orange | |
| Unit | 9 | Indication of meter | LED | | – | ○ | – | – | – | ○ | – | – | Green | km/h or MPH (Selected by setting monitor) |
| Gauge/ Meter | 5 | Travel speed | Pointer: Movement | Conversion of travel speed pulse into travel speed | – | – | – | – | – | – | – | – | – | If there is error in communication, condition is held until key is turned OFF. |
| | 1 2 | HST oil temperature/HST oil temperature caution | Pointer: Movement Indicator: LED | Other than below | – | – | – | – | – | – | – | – | – | White range: 50 - 110°C Red range: 110 - 135°C |
| | | | | Alarm: Above 110°C | ◎ | ○ | ○ | B@CRNS | ◎ | ○ | ○ | B@CRNS | Red | |
| | | | | HST oil temperature: Above 150°C | – | – | – | DGH1KX | – | – | – | DGH1KX | – | |
| | 3 4 | Engine water temperature/ Engine water temperature caution | Pointer: Movement Indicator: LED | Other than below | – | – | – | – | – | – | – | – | – | White range: 50 - 102°C Red range: 102 - 135°C |
| | | | | Alarm: Above 102°C | – | ○ | – | – | – | ○ | – | – | Red | |
| | | | | Alarm: Above 105°C | ◎ | ○ | ○ | B@BCNS | ◎ | ○ | ○ | B@BCNS | Red | |
| | | | | Engine water temperature: Above 150°C | – | – | – | DGE2KX | – | – | – | DGE2KX | – | |
| | 10 11 | Fuel level / Fuel level caution | Pointer: Movement Indicator: LED | Other than below | – | – | – | – | – | – | – | – | – | |
| | | | | Above 110✗ (Below 5%) | – | ○ | – | – | – | ○ | – | – | Red | |
| | 24 | Odometer | LCD | Conversion of travel speed pulse into travel distance | – | – | – | – | – | – | – | – | – | |
| | | Service meter | | Operates when charge is normal. Corresponds to clock time in 1:1. | – | – | – | – | – | – | – | – | – | |
| Caution lamp | 12 | Centralized warning lamp | Bulb | Other than below | – | – | – | – | – | – | – | – | – | Lamp is turned ON by each controller and message is indicated on character display. Lamp is turned ON by caution. |
| | | | | When error is made | △ | △ | △ | △ | △ | △ | △ | △ | Red | |
| | 14 | Brake oil pressure (Accumulator oil pressure) | Bulb | Oil pressure is normal (GND) | – | – | – | – | – | – | – | – | – | *1: For 30 sec just after key is turned ON and engine is started *2: 30 sec after engine is started (after *1) |
| | | | | Oil pressure is abnormal (OPEN) (*1) | – | ○ | – | – | ◎ | ○ | ○ | – | Red | |
| | | | | Oil pressure is abnormal (OPEN) (*2) | – | – | – | – | ◎ | ○ | ○ | 2G42ZG | Red | |
| | 15 | Prevention of omitting to apply parking brake | Bulb | Other than below | – | – | – | – | – | – | – | – | – | Lamp lights up and warning buzzer sounds when engine is stopped and parking brake is released (or when key is turned OFF). |
| | | | | When application of parking brake is omitted (24 V) | ☆ | ○ | ○ | – | – | – | – | – | Red | |
| | 16 | Axle oil temperature | Bulb | Oil temperature is normal | – | – | – | – | – | – | – | – | – | |
| | | | | Oil temperature is abnormal | ◎ | ○ | ○ | B@C7NS | ◎ | ○ | ○ | B@C7NS | Red | |
| | | | | Brake oil temperature: Above 150°C | – | – | – | DGR1KX | – | – | – | DGR1KX | – | |
| | | | | Detection of error | – | – | – | DGR1KB | – | – | – | DGR1KB | – | |

| Division | No. | Item | Device | Condition for operation | Operation | | | | | | | | Indication color | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Engine is stopped | | | | Engine is running | | | | | |
| | | | | | Warning buzzer | Individual indication | Centralized warning | Indication of error code message | Warning buzzer | Individual indication | Centralized warning | Indication of error code message | | |
| Caution lamp | 17 | Engine oil temperature | Bulb | Oil level is normal (GND) | – | – | – | – | – | – | – | – | – | If error is detected when IGN_C signal is turned ON. Error is not detected while engine is running. (If abnormality is detected when key is turned ON, alarm is kept turned ON until normal oil level is detected.) |
| | | | | Oil level is low (OPEN) | – | ○ | – | B@BAZK | – | – | – | – | Red | |
| | 18 | Clogging of air cleaner | Bulb | Normal (OPEN) | – | – | – | – | – | – | – | – | – | Error is detected only while engine is running. |
| | | | | Clogging (GND) | – | ○ | – | – | – | ○ | – | AA1ANX | Red | |
| | 19 | Maintenance | Bulb | Normal | – | – | – | – | – | – | – | – | – | |
| | | | | 30 h before maintenance | – | ○ | – | △ | – | ○ | – | △ | Red | |
| | 20 | Radiator water level | Bulb | Water level is normal (GND) | – | – | – | – | – | – | – | – | – | Error is judged when it is detected for 30 sec. |
| | | | | Water level is low (OPEN) | – | ○ | – | B@BCZK | – | ○ | – | B@BCZK | Red | |
| | 21 | Clogging of HST oil filter | Bulb | Normal (OPEN) | – | – | – | – | – | – | – | – | – | Error is judged when HST oil temperature is above 50°C. |
| | | | | Clogging (GND) | – | ○ | – | 15BONX | – | ○ | – | 15BONX | Red | |
| | 22 | Engine oil pressure | Bulb | Oil pressure is normal (OPEN) | – | – | – | – | – | – | – | – | – | Error is detected 15 sec after engine is started. |
| | | | | Oil pressure is low (GND) | – | ○ | – | – | ◎ | ○ | ○ | B@BAZG | Red | |
| | | | | When abnormality is detected (OPEN) | – | – | – | DHE4L6 | – | – | – | – | Red | |
| | 23 | Battery charge circuit | Bulb | Normal voltage (24 V) | ◎ | – | ○ | AB00L6 | – | – | – | – | Red | |
| | | | | Defective charge (0 V) | – | ○ | – | – | ◎ | ○ | ○ | AB00MA | Red | |
| Pilot lamp | 6 8 | Turn signal lamp | Bulb | When turn signal lever is turned ON (while key is turned OFF, too) | – | ○ | – | – | – | ○ | – | – | Green | Interlocked with turn signal lever. Operates when hazard lamp switch is turned ON. |
| | 7 | Beam of head lamp | Bulb | When beam of head lamp is turned ON (When both head lamp and beam are turned ON) | – | ○ | – | – | – | ○ | – | – | Blue | Interlocked with lamp switch and dimmer switch. |
| | 13 | Parking brake | Bulb | Parking brake is released (OPEN) | – | – | – | – | – | – | – | – | – | Lamp lights up when parking brake is applied. Operation of forward-reverse (F-R) lever is prohibited and warning buzzer is turned ON while parking brake is applied. |
| | | | | Parking brake is applied (GND) | – | ○ | – | – | – | ○ | – | – | Red | |
| | | | | Prevention of dragging of parking brake | ☆ | ○ | ○ | – | ☆ | ○ | ○ | – | Red | |
| | 25 | Steering oil pressure | Bulb | Oil pressure is normal (OPEN) | – | – | – | – | – | – | – | – | – | |
| | | | | Oil pressure is low (GND) | – | ○ | – | – | ◎ | ○ | ○ | DDS5L6 | Red | |
| | 26 | Emergency steering | Bulb | Oil pressure is lost (GND) | – | – | – | – | – | – | – | – | – | |
| | | | | Oil pressure is normal (OPEN) | – | ○ | – | – | – | ○ | – | – | Green | |

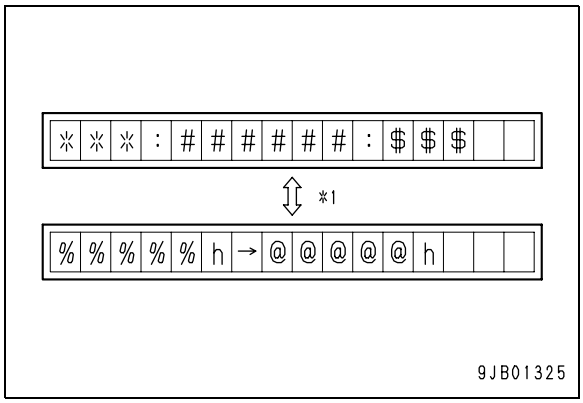
★ Monitor lamps 17 and 18 do not operate on this machine.

| Division | No. | Item | | Device | Condition for operation | Operation | | | | | | | | Indication color | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Engine is stopped | | | | Engine is running | | | | | |
| | | | | | | Warning buzzer | Individual indication | Centralized warning | Indication of error code message | Warning buzzer | Individual indication | Centralized warning | Indication of error code message | | |
| Pilot lamp | 27 | Automatic preheating | | Bulb | Other than below | – | – | – | – | – | – | – | – | – | Lamp lights up when automatic preheater is turned ON. Output is turned OFF when IGN_C signal is turned ON. Postheater is turned ON after IGN_C signal is turned OFF. |
| | | | | | When engine is preheated (postheated) | – | ○ | – | – | – | ○ | – | – | Orange | |
| | 29 | Forward-reverse lever position | F | LED | When F is selected | – | ○ | – | – | – | ○ | – | – | Green | |
| | | | N | | When N is selected | – | ○ | – | – | – | ○ | – | – | Orange | |
| | | | R | | When R is selected | – | ○ | – | – | – | ○ | – | – | Green | |
| | 28 | Gear speed selector switch position | 1 | LED | When 1st gear speed is received | – | ○ | – | – | – | ○ | – | – | Green | Indicator lamp lights up when CAN signal is received from HST controller. Indicator lamp does not light up when CAN communication is defective (All lamps go off). |
| | | | 2 | | When 2nd gear speed is received | – | ○ | – | – | – | ○ | – | – | Green | |
| | | | 3 | | When 3rd gear speed is received | – | ○ | – | – | – | ○ | – | – | Green | |
| | | | 4 | | When 4th gear speed is received | – | ○ | – | – | – | ○ | – | – | Green | |

**Service mode functions**

**1. Outline**

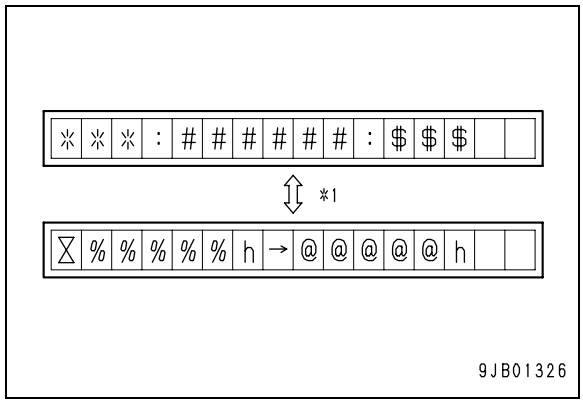
1) Electrical equipment system failure history
This function is used to check the electrical equipment system failure history of each controller saved in the machine monitor. For the failure codes displayed in the electrical equipment system failure history, see TROUBLESHOOTING. After each failure is repaired and the normal operation is confirmed, delete the failure history.
The contents of the electrical equipment system failure history displayed on the character display are as follows.




*1: Displayed alternately every 3 seconds

***: The order in which the subject failure occurred
######: Failure code
$$$: Frequency of occurrence of the subject failure
%%%%%: The time elapsed since the subject failure occurrence for the first time (it is determined by subtracting the service meter value of the first occurrence from the current service meter value)
@@@@@: The time elapsed since occurrence of the latest failure (it is determined by subtracting the service meter value at the latest occurrence from the current service meter value)
The failure code failure of a currently detected failure flashes. Up to 20 failure codes are saved.

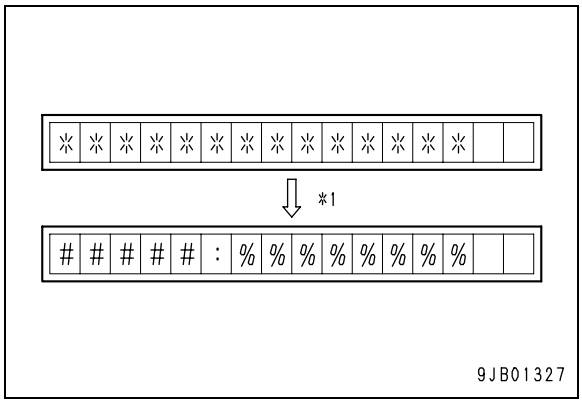
2) Machine system failure history
This function is used to check the machine system failure history of each controller saved in the machine monitor. For the failure codes displayed in the machine system failure history, see TROUBLESHOOTING.
The contents of the machine system failure history displayed on the character display are as follows.




*1: Displayed alternately every 3 seconds

***: The order in which the subject failure occurred
######: Failure code
$$$: Frequency of occurrence of the subject failure
%%%%%: The service meter value of the first occurrence of the subject failure
@@@@@: The service meter value at the occurrence of the latest failure
The failure code failure of a currently detected failure flashes. Up to several machine system failure codes are saved.

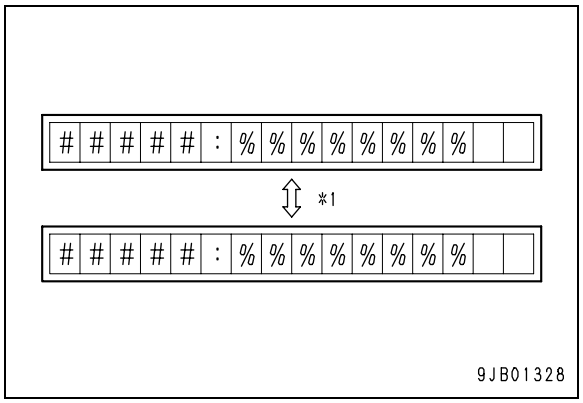
3) Real-time monitor
This function is used to check the input and output signals, etc. recognized by each controller on the network.
The contents of the real-time monitor displayed on the character display are as follows.




*1: Changed after 3 seconds

***: Item name
######: ID No. given to each item
%%%: Data. If a unit is used, it is displayed on the right of the data.

Any 2 items can be displayed simultaneously by specifying their ID Nos. In this case, they are displayed on the character display as shown below.




*1: Displayed alternately every 3 seconds

#####: Specified ID Nos.
%%%: Data. If a unit is used, it is displayed on the right of the data.

4) Maintenance monitor
   This function is explained in "Operation manual, Operation, Character display, Display of replacement periods of filters and oils". It is used to change the replacement periods of the filters and oils.

5) Selection of options
   With this function, you can display installation of an optional device and change the setting of that device. Use this function after any optional device is installed or removed.

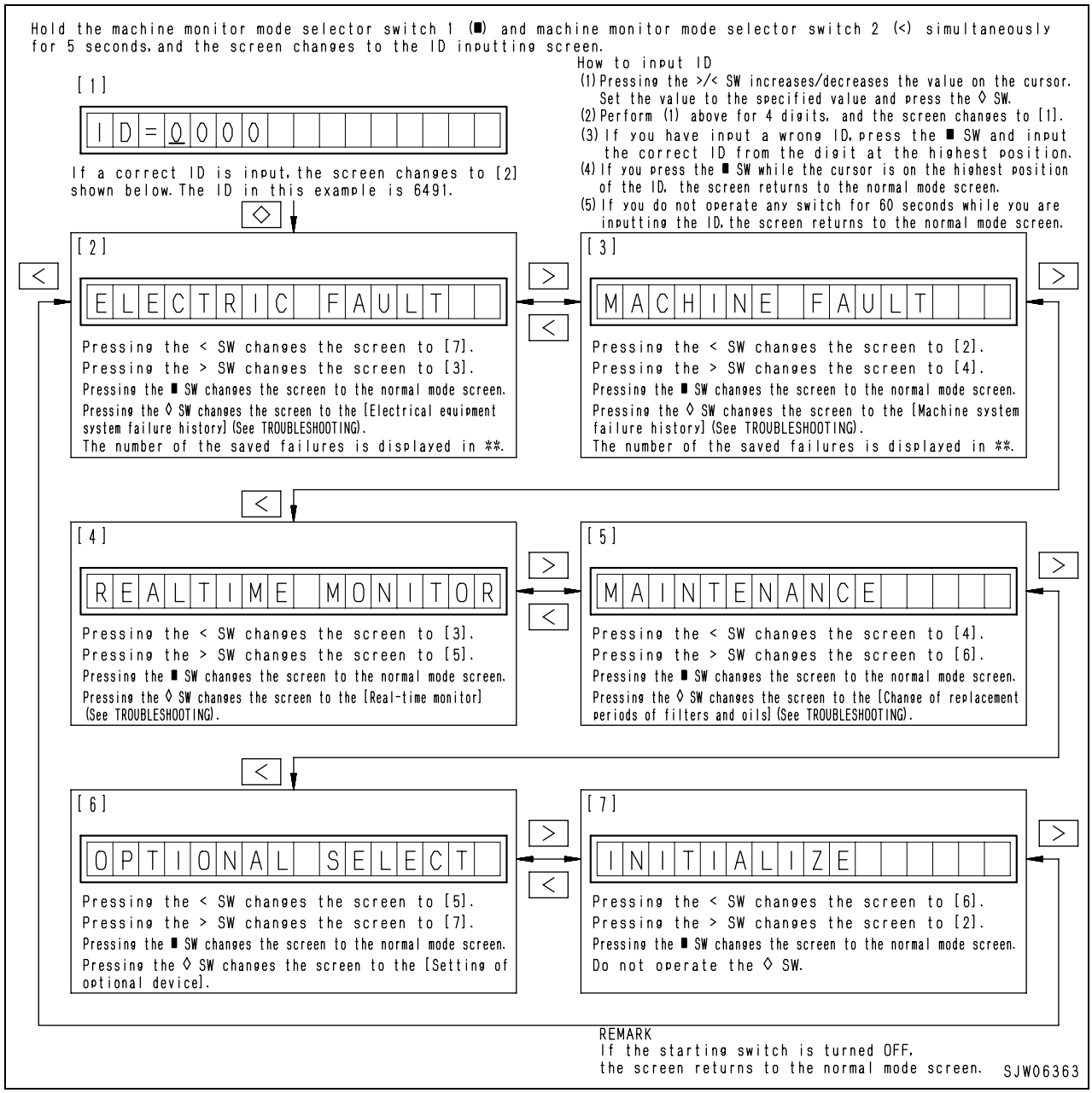
6) Initialize
   This function is used only in the factory. Do not use it.

7) Setting of service meter
   This function is used to set the service meter value of a machine when the machine monitor on that machine is replaced.

8) Setting of odometer
   This function is used to set the odometer value of a machine when the machine monitor on that machine is replaced.

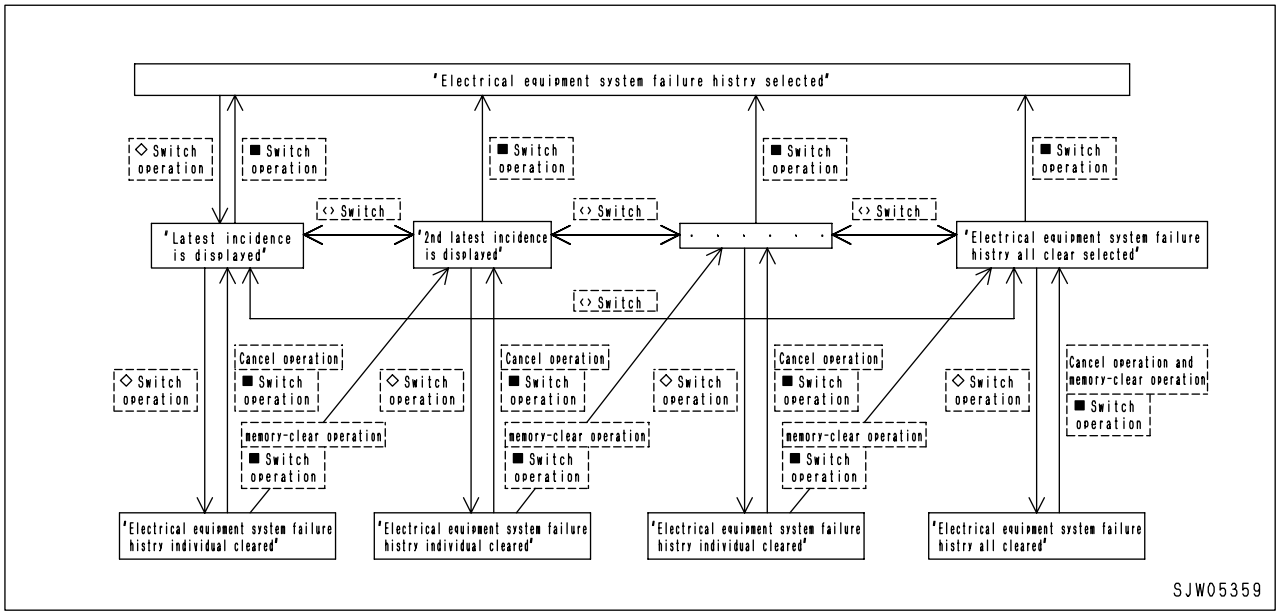
★ Since "Setting of service meter" and "Setting of odometer" are executed with the Initialize function, ask the manufacturer about them.

## 2. Operating method

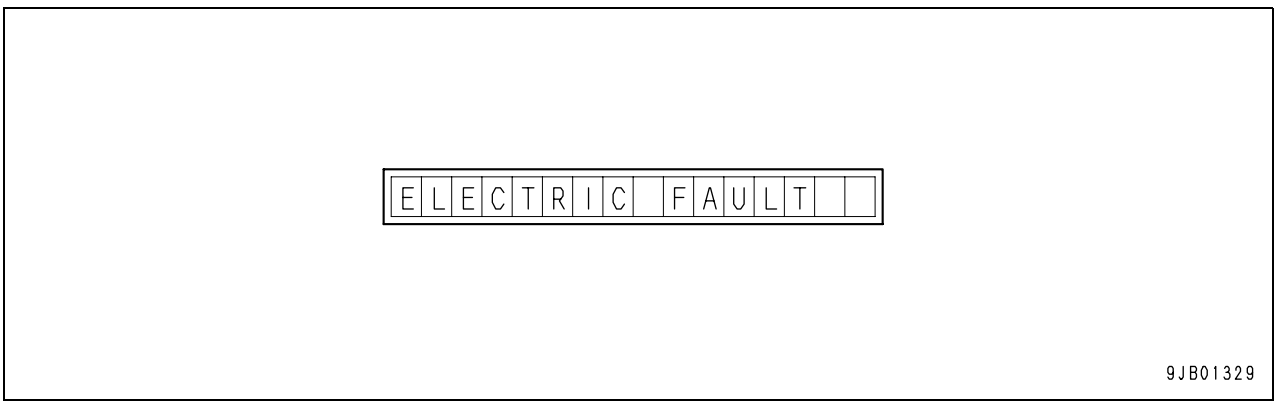


**Items Related to the Fault History of Electric System**

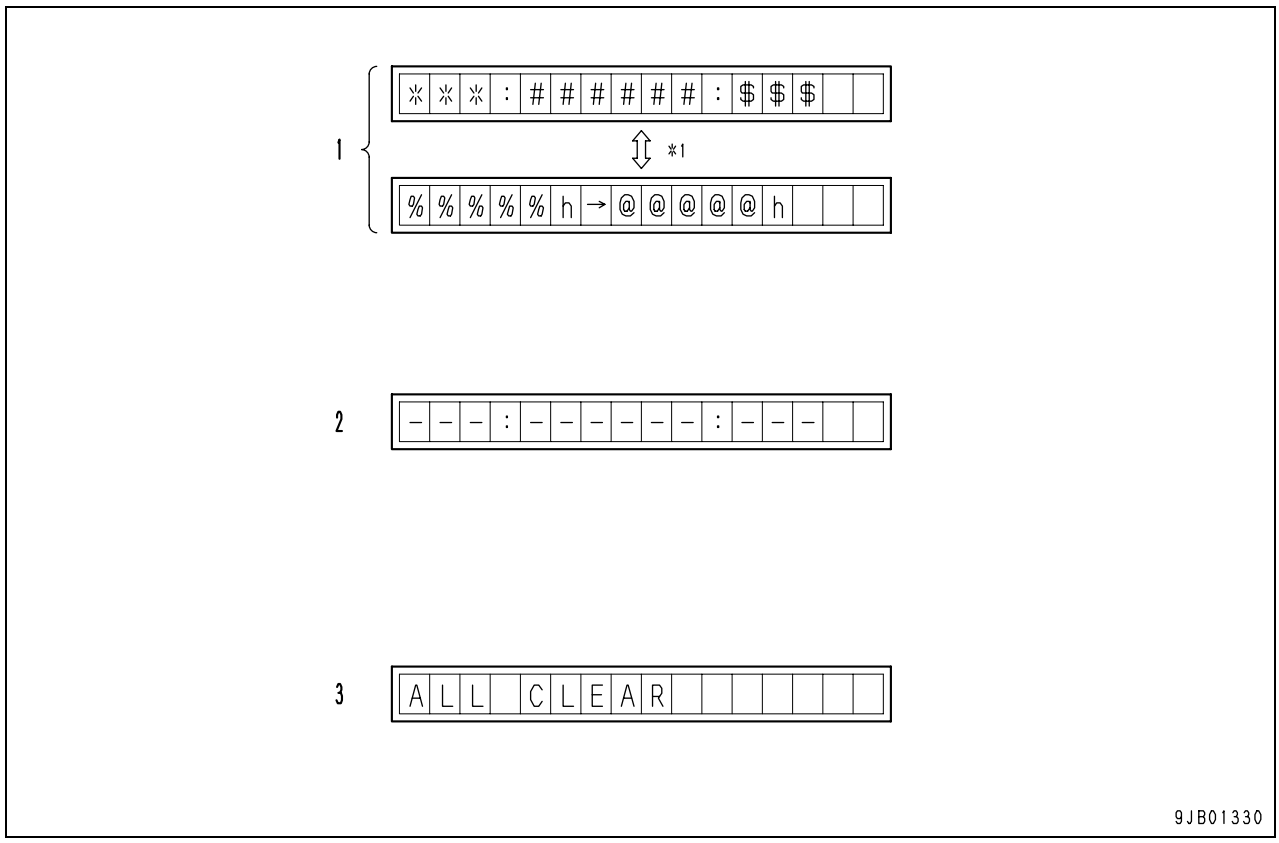
1) Selection of displaying and clearing the fault history of electric system
   The fault history is displayed in the order of occurrence with the new fault first.
   A current fault is displayed prior to the restored ones.
   Pressing the > SW displays the next older fault.
   Pressing the < SW displays the next newer fault.
   After the oldest fault in memory was displayed, a screen is displayed allowing to select clearing the entire fault history of electric system of the relevant controller.
   Pressing the ■SW changes the screen to the [Select displaying abnormalities in electric system] screen on the first layer.
   Pressing the ◇SW changes the screen to the [Clear individually the fault history of electric system] or [Clear the fault history of electric system] screen.




2) Selection of displaying the fault history of electric system (first layer)
   Pressing the > SW changes the screen to the [Select the initializing function] screen.
   Pressing the < SW changes the screen to the [Select displaying the fault history of vehicle system] screen.
   Pressing the ■SW changes the screen to the ordinary or alert screen.
   Pressing the ◇SW changes the screen to the [Display abnormalities in electric system] screen.



3) Selection of displaying the fault history of electric system and clearing the entire fault history of electric system (second layer)
A current fault is displayed piror to the restored ones.
Pressing the > SW displays the next older fault.
Pressing the < SW displays the next newer fault.
After the oldest fault in memory was displayed, a screen is displayed allowing to select clearing the entire fault history of electric system of the relevant controller.
Pressing the ■SW changes the screen to the [Select displaying abnormalities in electric system] screen on the first layer.
Pressing the ◇SW changes the screen to the [Clear individually the fault history of electric system] or [Clear the fault history of electric system]screen.
* If the history consisted of one fault, pressing the switch does not change the screen to that for all-out clearing (but change the screen to that for individual clearing).



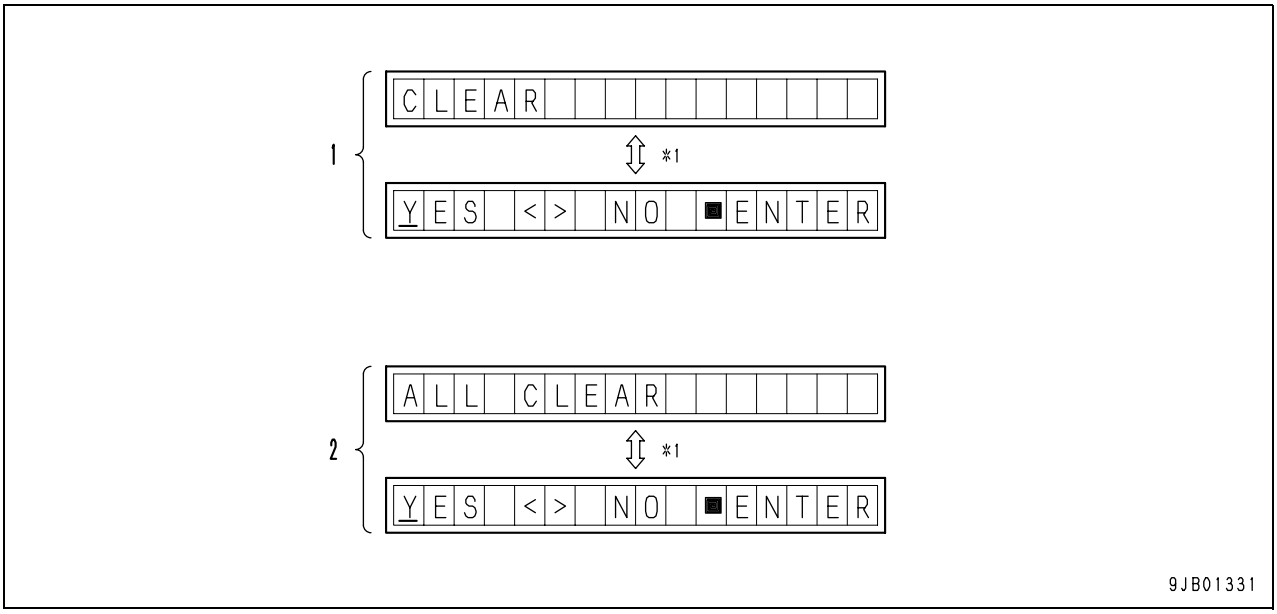

*1: Displayed alternately every 3 seconds

1. [Display the electrical equipment system failure history] screen
2. [Display the electrical equipment system failure history] screen (When there is not history)
3. [Select clearing entirely the electrical equipment system failure history] screen

***: The order in which the subject failure occurred
######: Unified failure code (6 digits)
$$$: Frequency of occurrence of the subject failure
%%%%%: The time elapsed since the subject failure occurrence for the first time (it is determined by subtracting the service meter value of the first occurrence from the current service meter value)
@@@@@: The time elapsed since occurrence of the latest failure (it is determined by subtracting the service meter value at the latest occurrence from the current service meter value)

4) Clearing individually the fault history of electric system, and clearing the entire fault history of electric system (the third layer)
Select YES or NO with the < or > SW.
Cursor (_) blinks on the selected item. Pressing the ■SW changes the display as follows, with the history reset if YES was selected, or not if NO was selected:
   a. If No (cancel) was selected, the display returns to the [Display the fault history of electric system] screen of the relevant fault (i.e., the screen before entering the [Clearing individually (entirely) the fault history of electric system] screen).
   b. If YES (clear ) was selected, the display returns to the [Display the fault history of electric system] screen of a fault next to the relevant fault. If the fault history to be shown exhausts, the screen returns to the [Select displaying the fault history of electric system] screen.

   By default, the cursor is on NO (no reset) to prevent resetting by error.
   A current fault cannot be cleared. If it was selected, a peep sounds for one second to notify that the operation is cancelled.
   If a fault was cleared, peeps sound (on for 0.1 sec. - off for 0.1 sec. - on for0.1 sec.) to notify that the operation has been accepted.
   If the entire history was cleared, it is considered to have been cleared even if it consisted of only one fault .

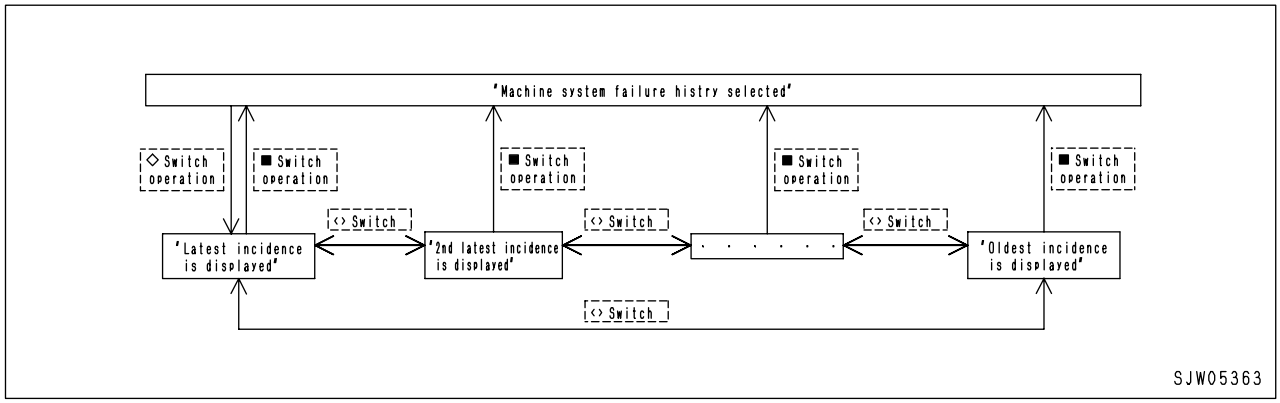



*1: Displayed alternately every 3 seconds

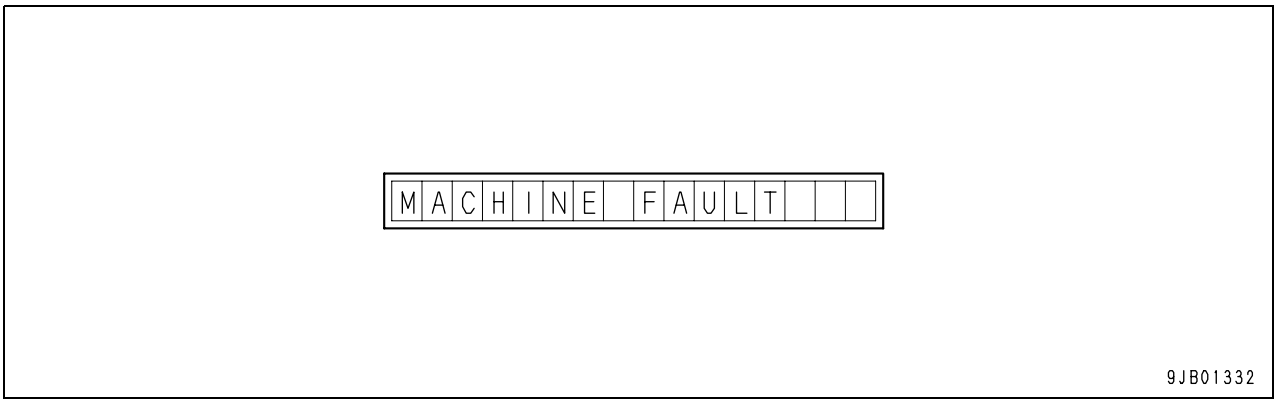
1. [Clear individually the electrical equipment system failure history] screen
2. [Clear entirely the electrical equipment system failure history] screen

**Items Related to the Fault History of Machine System**

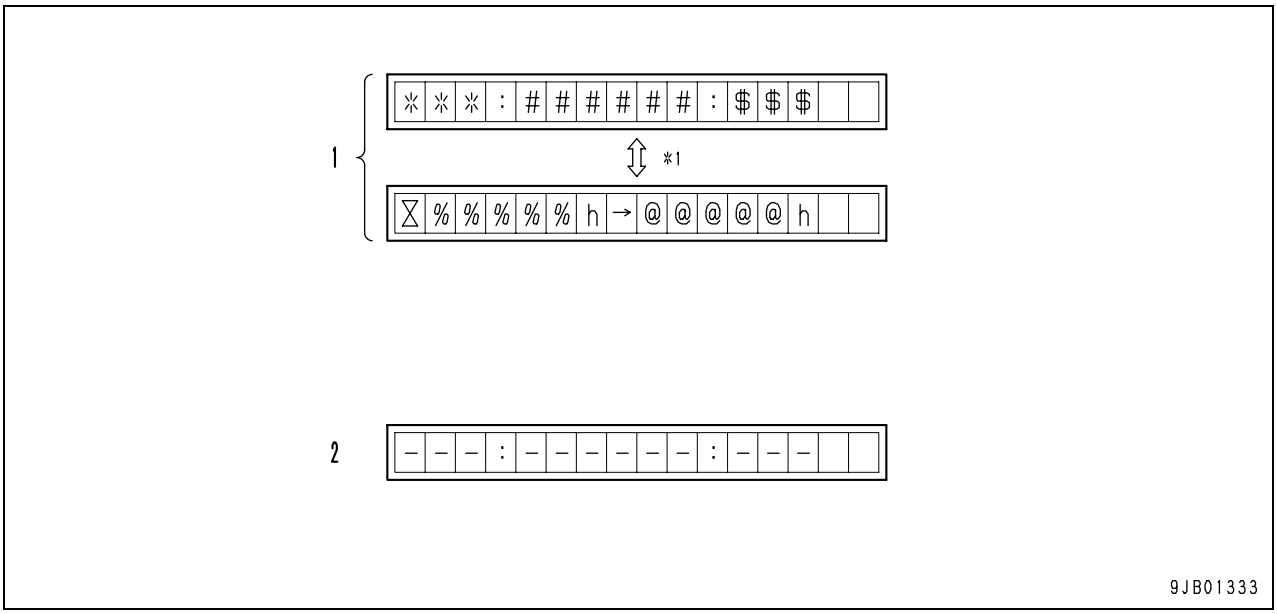
1) Display of the fault history of vehicle system
   A current fault is displayed prior to the restored ones.
   Pressing the > SW displays the next older fault.
   Pressing the < SW displays the next newer fault.
   After the oldest fault in memory was displayed, a screen is displayed allowing to select clearing the entire fault history of electric system of the relevant controller.
   Pressing the ■SW changes the screen to the [Select displaying abnormalities in machine system] screen on the first layer.




2) Selection of displaying the fault history of machine system (first layer)
   Pressing the > SW changes the screen to the [Select the real-time monitor functions] screen.
   Pressing the < SW changes the screen to the [Select displaying the fault history of machine system] screen.
   Pressing the ■SW changes the screen to the ordinary or alert screen.
   Pressing the ◇SW changes the screen to the [Display abnormalities in electric system] screen.



3) Display of the fault history of vehicle system (second layer)
The fault history is displayed in the order of occurrence with the newest fault first.
A current fault is displayed prior to the restored ones.
The fault history is displayed in the order of occurrence with the newest fault first.
Pressing the > SW displays the next newer fault.
Pressing the < SW displays the next older fault.
Pressing the ■SW changes the screen to the [Select displaying abnormalities in vehicle system] screen.




*1: Displayed alternately every 3 seconds

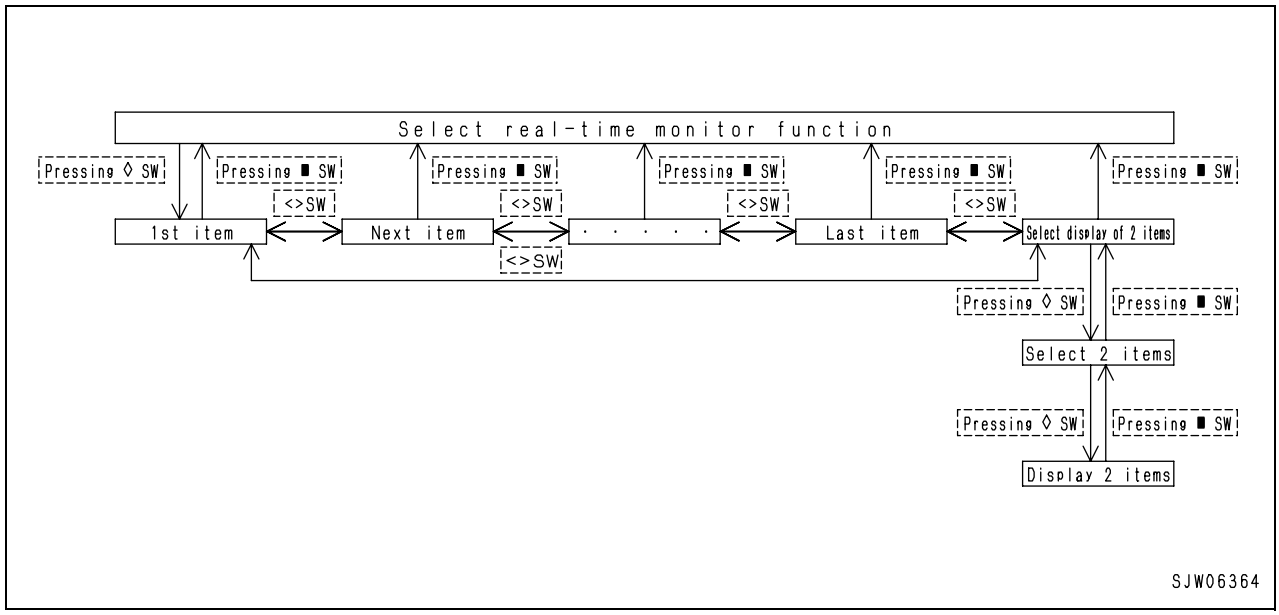
1. [Display the machine system failure history] screen
2. [Display the machine system failure history] screen (When there is not history)

***: The order in which the subject failure occurred
######: Unified failure code (6 digits)
$$$: Frequency of occurrence of the subject failure
%%%%%: The service meter value of the first occurrence of the subject failure
@@@@@: The service meter value at the occurrence of the latest failure

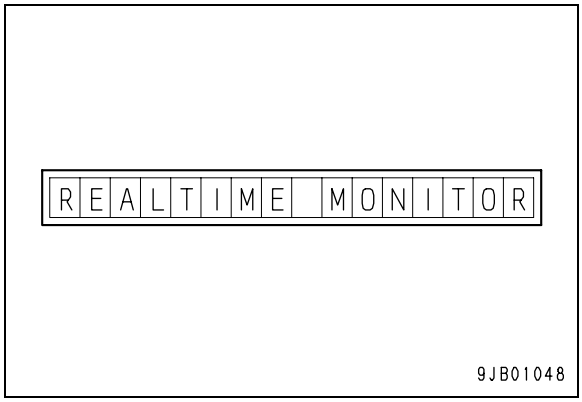
**Real-time monitor function**

The real-time monitor function displays the information saved in the HST controller and machine monitor mounted on the machine in real time.
This function is used for testing, adjusting, and troubleshooting in the normal display mode or 2-item display mode for displaying 2 data simultaneously.

1) Selection/Display of real-time monitor item
   Pressing the > SW changes the screen in the order of No. 1, No. 2, No. 3 --- Select display of 2 items.
   Pressing the < SW changes the screen in the order of Select of display of 2 items, No. 13, No. 12, No. 11 ---.
   Pressing the ■SW changes the screen to the [Select real-time monitor function] screen.
   In [Display of real-time monitor]: Pressing the ◇SW holds the displayed data. Pressing it again returns the displayed data into the active state.
   In [Select display of 2 items]: Pressing the ◇SW changes the screen to the [Select 2 items] screen.

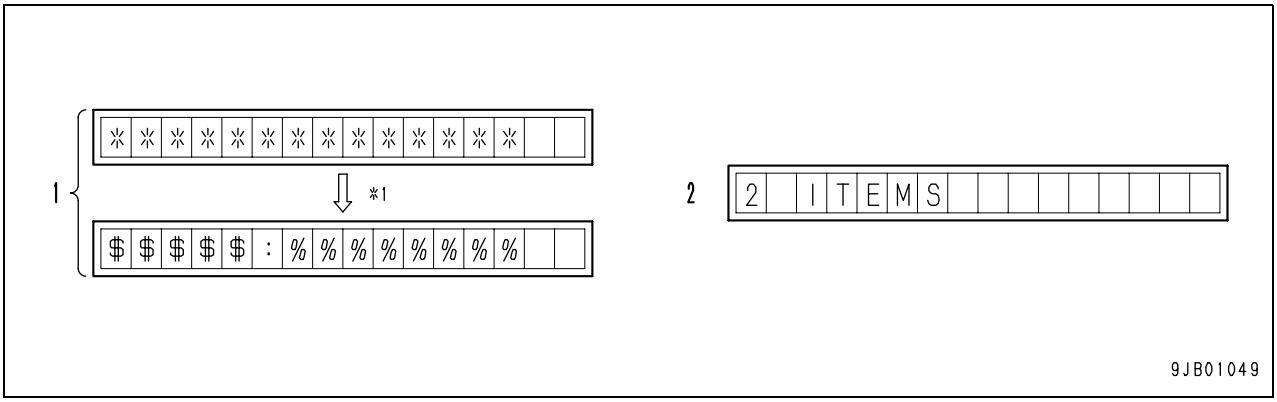



2) Selection of real-time monitor function (first layer)
   Pressing the > SW changes the screen to the [Select maintenance monitor function] screen.
   Pressing the < SW changes the screen to the [Select display of machine system failure history] screen.
   Pressing the ■SW change the screen to the normal screen or alarm screen.
   Pressing the ◇SW change the screen to the [Display of real-time monitor] screen.



3) Display of real-time monitor and selection of display of 2 items (second layer)
Pressing the > SW displays the next data.
Pressing the < SW displays the previous data.
Pressing the ■SW changes the screen to the [Select real-time monitor function] screen.

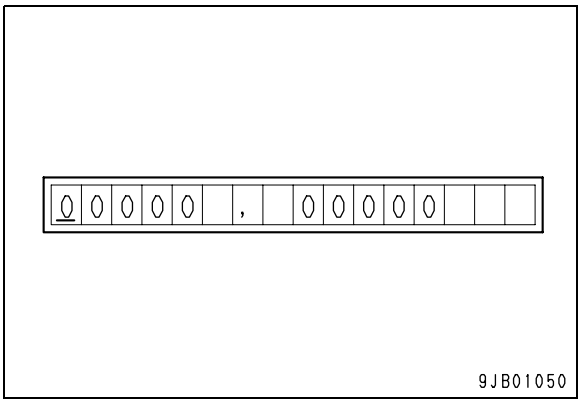
In [Display of real-time monitor]: Pressing the ◇SW holds the displayed data. Pressing it again returns the displayed data into the active state.
In [Select display of 2 items]: Pressing the ◇SW changes the screen to the [Select 2 items] screen.




*1: Changed after 3 seconds

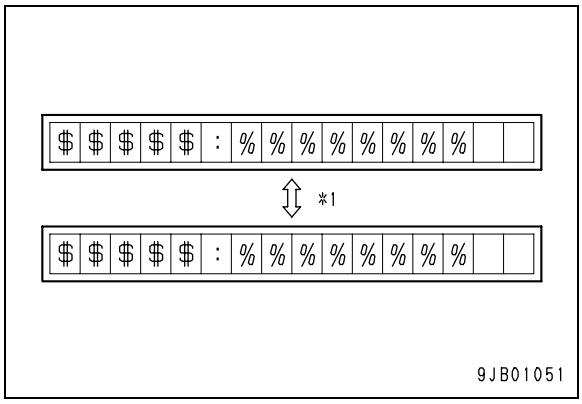
1. [Display of real-time monitor] screen
2. [Select display of 2 items] screen

***: Real-time monitor item name
$$$$$: ID of item
%%%: Data and unit (SI unit)




4) Selection of 2 items (third layer)
How to input ID
a. When the screen appears, the cursor (_) is blinking at the highest position of "00000".
b. Each time the > SW or the < SW is pressed, the digit changes by 1 between 0 and 9.
c. Select a necessary digit and press the ◇SW.
d. The cursor moves to the 2nd position. Select the digits for the all positions by performing steps b. and c. above.
e. After selecting the digit for the lowest position, press the ◇SW.
f. If the ID is entered, the screen changes to the [Display 2 items] screen.
g-1. If you press the ■SW before finishing entering the ID, the cursor moves to the highest position.
g-2. If you press the ■SW while the cursor is at the highest position, the screen returns to the [Select display of 2 items] screen.

5) Display of 2 items (fourth layer)
Pressing the ■SW changes the screen to the [Select 2 items] screen.
Pressing the ◇SW holds the displayed data. Pressing it again returns the displayed data into the active state.




*1: Displayed alternately every 3 seconds

$$$$$: ID of item
%%%%: Data and unit (SI unit)

★ The first item and second item are displayed alternately every 3 seconds
★ If an item ID that cannot be displayed is selected on the [Select 2 items] screen, the data & unit display box (%%%) is left blank.

**Real-time Monitoring Items**

| Item ID | Real-time monitoring item | Item displayed | Display unit | Displayed range | Component detected | Terminal No. | Remarks |
|---|---|---|---|---|---|---|---|
| | All the items are shown even if some of them are not equipped depending on models and options. | Abridged due to limitation of number of letters. | SI unit system so long as the values have units | A value out of the range displayed is shown as the lowest (highest) value in the range. | | | |
| 20200 | Monitor ROM No. | MONITOR ROM | --- | --- | Monitor | --- | |
| 40000 | Travel speed | SPEED | 1 km/h | 0 – 50 | HST | L41-13 | |
| 04202 | Fuel level | FUEL SENSOR | 1% | 0 – 100 | Monitor | L23-13 | |
| 04101 | Engine water temperature | COOLANT TEMP | 1 °C | 24 – 131 | Monitor | L21-16 | |
| 04103 | Engine water temperature low | COOLANT Lo | 1 °C | -31 – 91 | Monitor | L21-6 | |
| 30100 | HST oil temperature | HST TEMP | 1 °C | 24 – 131 | Monitor | L21-14 | |
| 30202 | Axle oil temperature | BRAKE TEMP | 1 °C | 24 – 131 | Monitor | L21-8 | |
| 01005 | Engine speed | ENG SPEED | 1 rpm | 0 – 3000 | HST | L42-4 | HST controller CAN |
| 32600 | HST oil pressure | HST PRESS | 0.1 MPa | 0.0 – 100.0 | HST | L41-3 | HST controller CAN |
| 80000 | Motor 1 solenoid feedback current | MOTOR SOL | 1 mA | 0 – 1000 | HST | L41-6 | HST controller CAN |
| 80100 | Clutch solenoid feedback current | CLUTCH SOL | 1 mA | 0 – 1000 | HST | L41-14 | HST controller CAN |
| 50302 | Potentiometer voltage | SPEED POT | 1 % | 0 – 100 | HST | L41-1 | HST controller CAN |
| 80200 | HST traction force | TRACTION | --- | STD/LIMIT | HST | L42-3 | HST controller CAN |

**(Reference) Inspection with real-time monitor**

Example) Measurement of engine speed
Measure the engine speed under the following condition.
Cooling water temperature: Within operating range
HST oil temperature: 45 - 55°C
First, check this condition with the real-time monitor.

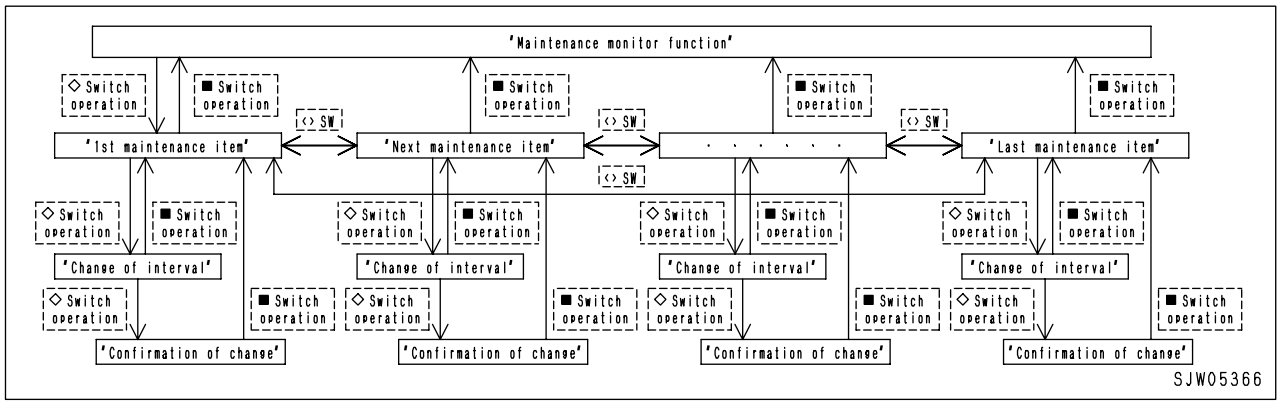
| Condition | Real-time monitor item | Component | ID |
|---|---|---|---|
| Cooling water temperature | COOLANT TEMP | Machine monitor | 04101 |
| HST oil temperature | HST TEMP | Machine monitor | 30100 |

After checking the above items with the real-time monitor, check the engine speed.

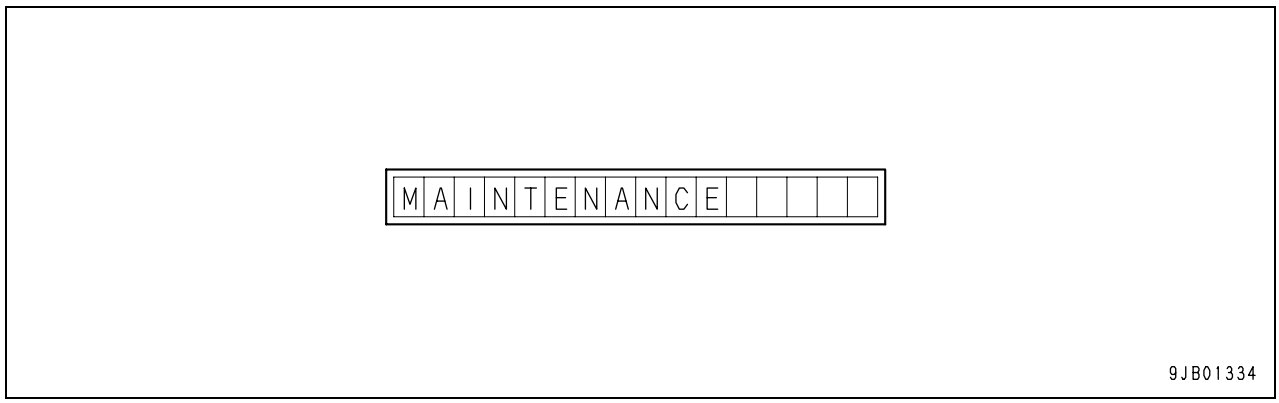
| Condition | Real-time monitor item | Component | ID |
|---|---|---|---|
| Engine speed | ENG SPEED | HST controller | 01005 |

**Maintenance functions**

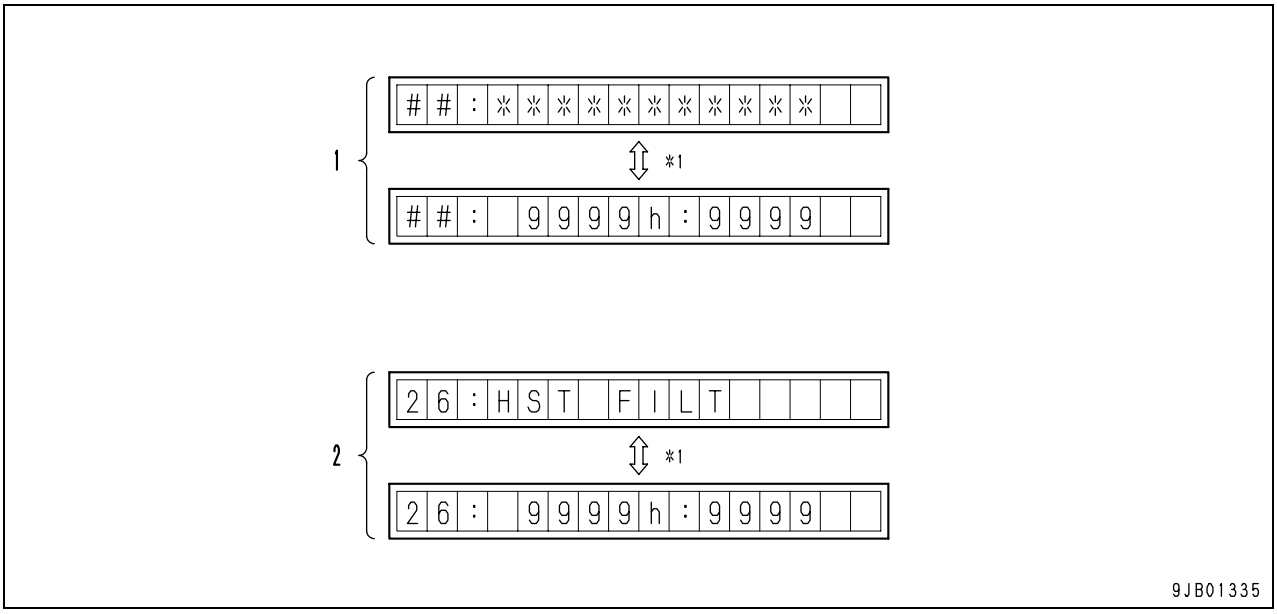
1) Selection/Display of maintenance monitor item
   Pressing the > SW changes the screen in the order of No. 1, No. 2, No. 3 ---.
   Pressing the < SW changes the screen in the order of No. 13, No. 12, No. 11 ---.
   Pressing the ■SW changes the screen to the [Select maintenance monitor function] screen.
   Pressing the ◇SW changes the screen to the [Change maintenance interval time].




2) Selection of display of maintenance monitor function (first layer)
   Pressing the > SW changes the screen to the [Select OPT function] screen.
   Pressing the < SW changes the screen to the [Select real-time monitor function] screen.
   Pressing the ■SW change the screen to the normal screen or alarm screen.
   Pressing the ◇SW change the screen to the [Select maintenance monitor item] screen.



3) Selection of maintenance monitor (second layer)
The contents of this display are the same as those of the maintenance monitor of the function opened to the operator. Maintenance caution lamp does not light up, however.
Pressing the ■SW change the screen to the [Select maintenance monitor function] screen.
Pressing the ◇SW change the screen to the [Change maintenance monitor interval time] screen.




*1: Displayed alternately every 3 seconds

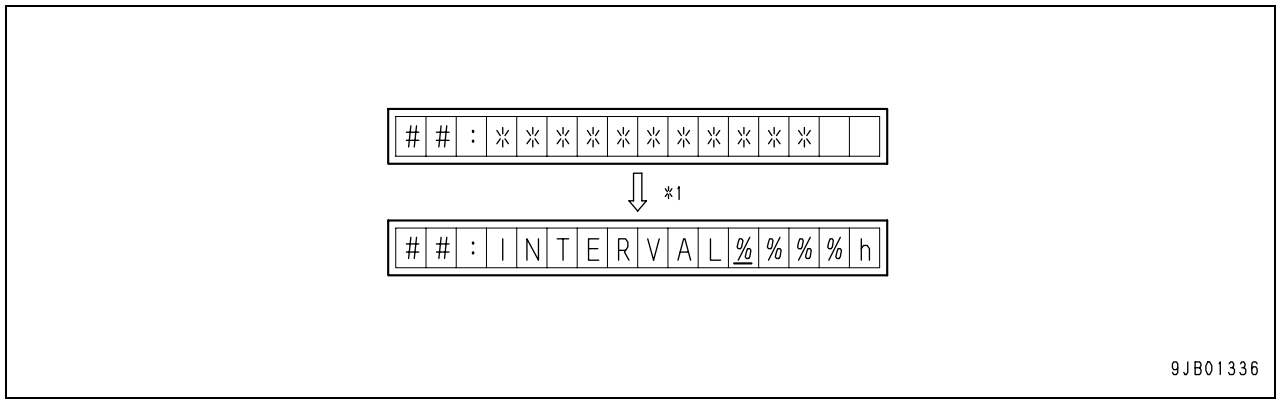
1. [Select maintenance item] screen
2. Example) When the data is HST oil filter

##: ID No. of each maintenance item
***: Each maintenance item

4) Change of maintenance interval time (third layer)
The maintenance interval time can be set freely to 0 - 9999 h.
If you press the ■SW, the time is not changed but the screen changes to the [Select maintenance item] screen.
At this time, the operation cancel sound (1-second peep) is heard.

**How to input interval**

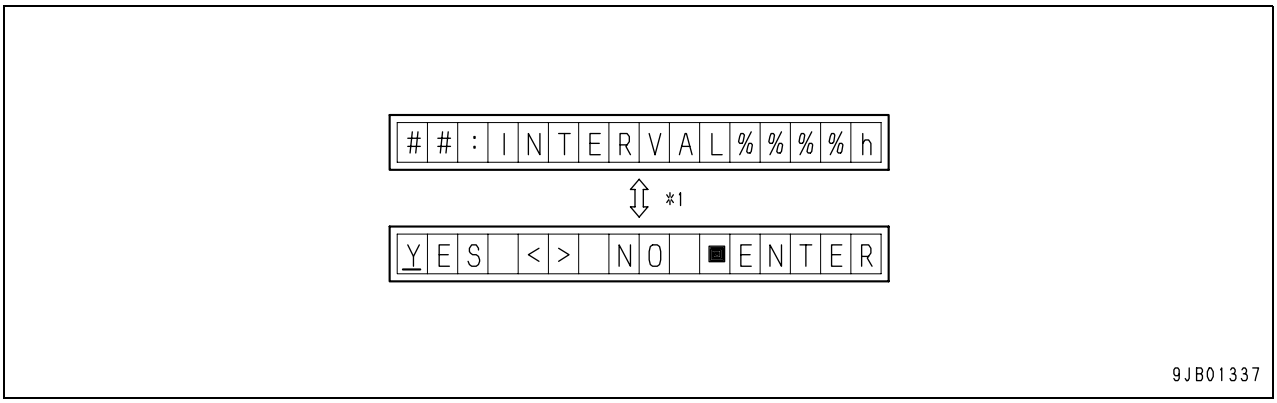
a. When the screen appears, the cursor (_) is blinking at the highest position.
b. Each time the > SW or the < SW is pressed, the digit changes by 1 between 0 and 9.
c. Select a necessary digit and press the ◇SW.
d. The cursor moves to the 2nd position. Select the digits for the all positions by performing steps (b.) and (c.) above.
e. After selecting the digit for the lowest position, press the ◇SW.
f-1. If the input interval time is acceptable, the screen changes to the check screen.
f-2. If the input interval time is not acceptable, the time does not change but the screen changes to the [Select maintenance item] screen. At this time, the operation cancel sound (1-second peep) is heard.
g. If you have input a wrong value, press the ■SW to return to the [Select maintenance item] screen and repeat the above steps from the first.




*1: Changed after 6 seconds

##: ID No. of each maintenance item
***: Each maintenance item
%%%%: Current interval time (4 digits)
If there is not a digit in a position of the interval time, input "0". Example: "0012"

5) Check of change of maintenance interval time (fourth layer)
Select YES or NO with the < or > SW. The cursor (_) blinks on the selected item. Pressing the ■SW returns the screen to the [Select maintenance item] screen with the change done if YES was selected, or not if NO was selected.
By default, the cursor is on NO (the change not done) to prevent resetting by error.
When the change of the set time is finished, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard.




*1: Displayed alternately every 3 seconds

##: ID No. of each maintenance item
%%%%: Interval time (4 digits) to be changed

The maintenance interval time is set as shown in the following table, when shipped.

| Item | Replacement interval time (h) | Displayed item name | ID No. |
|---|---|---|---|
| Engine oil | 500 | ENG OIL | 01 |
| Engine oil filter | 500 | ENG FILT | 02 |
| Fuel filter | 500 | FUEL FILT | 03 |
| Transfer oil | 1,000 | TRANSF OIL | 25 |
| HST oil filter | 1,000 | HST FILT | 26 |
| Hydraulic oil filter | 2,000 | HYD FILT | 04 |
| Hydraulic oil | 2,000 | HYD OIL | 10 |
| Axle oil | 2,000 | AXLE OIL | 15 |

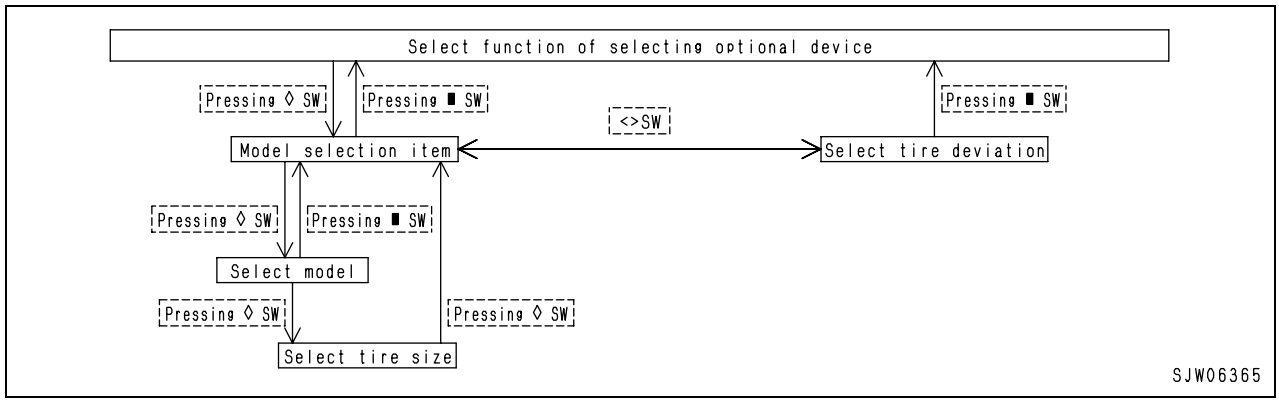
**Setting required when optional device is installed**

When any of the following optional devices is added or replaced, adjust the sensors, etc. to the initial values with the machine monitor.

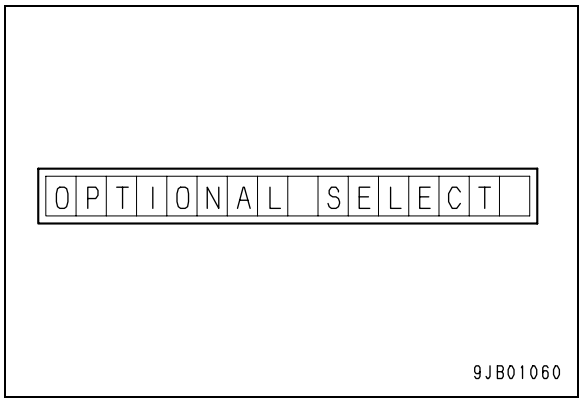
| Added or replaced optional device | Adjustment item |
|---|---|
| Tire size, machine monitor | Model selection, tire size selection, tire deviation selection |

**Function of selecting optional device**

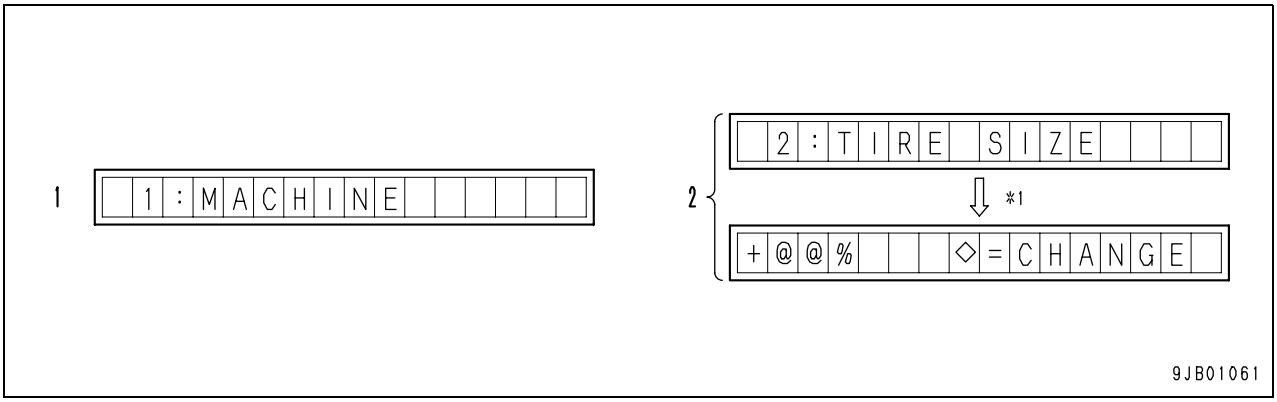
1) Selection and display of optional item
   Pressing the > SW or < SW changes the selected optional items in order.
   Pressing the ■SW changes the screen to the [Select function of selecting optional device]
   In [Model selection item]: Pressing the ◇SW changes the screen to the [Select model] screen.
   In [Select each optional device]: Pressing the ◇SW updates the items of each optional device.




2) Selection of function of selecting optional device (fourth layer)
   Pressing the > SW changes the screen to the [Select initializing function] screen.
   Pressing the < SW changes the screen to the [Select maintenance monitor function] screen
   Pressing the ■SW changes the screen to the normal screen or alarm screen.
   Pressing the ◇SW changes the screen to the [Model selection item] screen.



3) Model selection item and selection of optional device (second layer)
Pressing the > SW or < SW changes the selected optional items in order.
Pressing the ■SW changes the screen to the [Select function of selecting optional device]
In [Model selection item]: Pressing the ◇SW changes the screen to the [Select model] screen.
In [Select each optional device]: Pressing the ◇SW updates the items of each optional device.



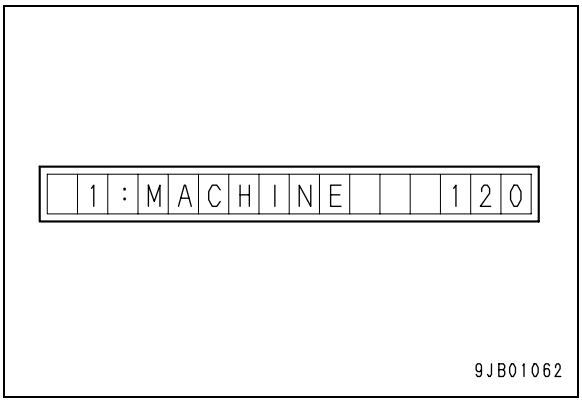

*1: Changed after 3 seconds

1. [Model selection item] screen
2. [Select tire deviation] screen

**Selection of tire deviation**
Pressing the ◇SW selects deviation from the standard tire between -12% and +12% (at intervals of 2%). (@@ is the deviation selected when shipped.)
(+00/+02/+04/+06/+08/+10/+12/-02/-04/-06/-08/-10/-12)
When selection is finished, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard.
Pressing the ■SW changes the screen to the [Select function of selecting optional device]

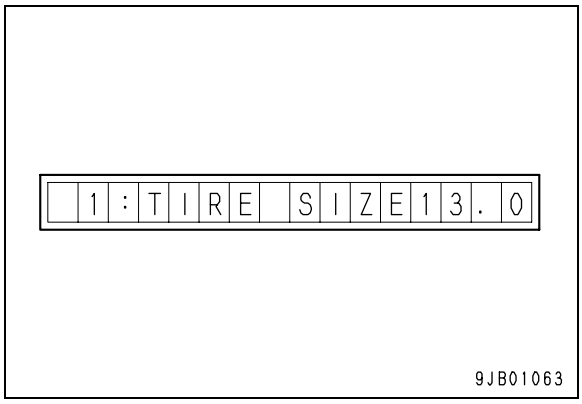
4) Selection of model (third layer)
Pressing the >SW or <SW selects a model.
(120/150/200/250/320)
Pressing the ■SW changes the screen to the [Model selection item] screen.
If you press the ◇SW to finish selection, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard and the screen changes to the [Select tire size] screen.

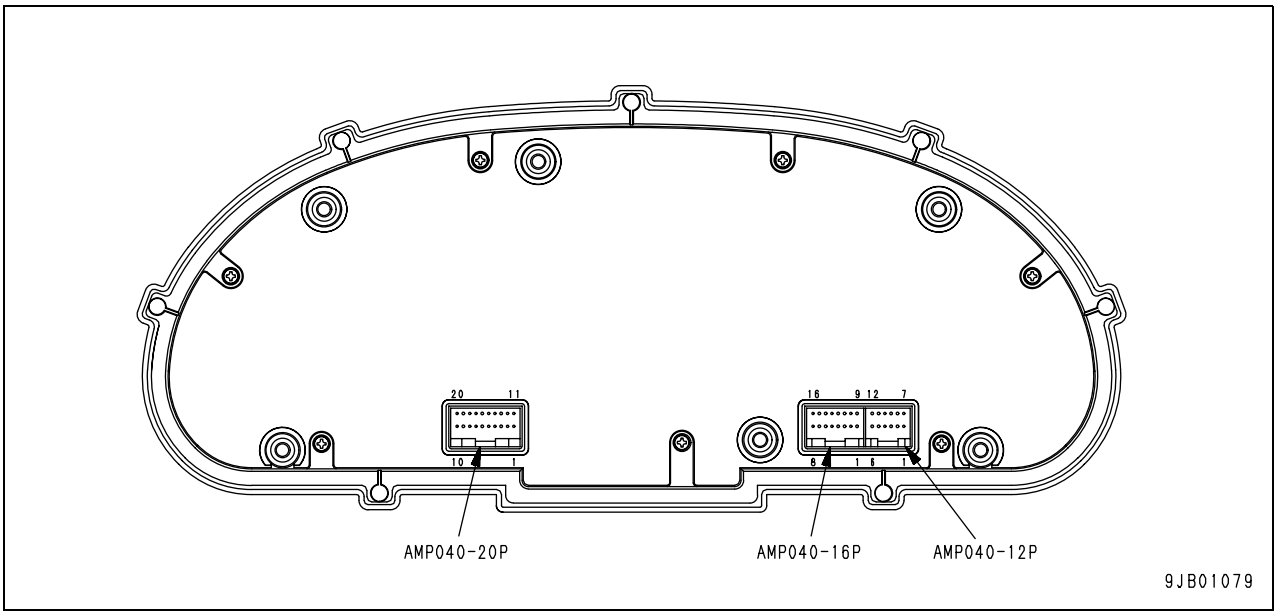
★ Select "250" for this machine.



5) Selection of tire size (fourth layer)
Pressing the > SW or < SW selects a tire size.
(13.0/15.5/16.9/17.5/18.4/20.5)
If you press the ◇SW to finish selection, the operation acceptance peeps (on for 0.1 sec ✕ off for 0.1 sec ✕ on for 0.1 sec) are heard and the screen changes to the [Model selection item] screen.

★ Since "250" was selected on the "Select model" screen, "17.5" or "20.5" can be selected. (Other tire sizes are not displayed.)






AMP040-16P [CN-L21]

| Pin No. | Specification | I/O | Type of use | Signal name | WA250/250PT-5 | Remarks |
|---|---|---|---|---|---|---|
| 1 | D_IN (NSW +24V) | I | D/I+24V | Service SW | ■ SW input | SW for operating machine monitor |
| 2 | D_IN (+24V) | I | D/I+24V | Service SW | ◇ SW input | SW for operating machine monitor |
| 3 | GND | I | GND | CAN shield | GND | |
| 4 | D_IN (GND) | I | D/IGND | Increment SW | < SW input | SW for operating machine monitor |
| 5 | D_IN (GND) | I | D/IGND | Decrement SW | > SW input | SW for operating machine monitor |
| 6 | A_IN | I | A/I | Engine water temperature sensor (For automatic preheating) | Engine water temperature sensor (For automatic preheating) | |
| 7 | GND | I | GND | Sensor GND | GND | |
| 8 | A_IN | I | A/I | Brake oil temperature sensor | Brake oil temperature sensor | |
| 9 | N.C. | – | – | --- | --- | |
| 10 | N.C. | – | – | --- | --- | |
| 11 | D_OUT (+24 V, sink: 200 mA) | O | D/O sink | Buzzer (Machine monitor) | Buzzer (Machine monitor) | |
| 12 | D_IN (+24V) | I | D/I+24V | Lamp switch (Clearance lamp) | Lamp switch (Clearance lamp) | |
| 13 | D_IN (NSW +24V) | I | D/I+24V | Parking brake omission prevention | Parking brake omission prevention | |
| 14 | A_IN | I | A/I | HST oil temperature sensor | HST oil temperature sensor | |
| 15 | GND | I | GND | GND | GND | |
| 16 | A_IN | I | A/I | Engine water temperature sensor | Engine water temperature sensor | |

AMP040-12P [CN-L22]

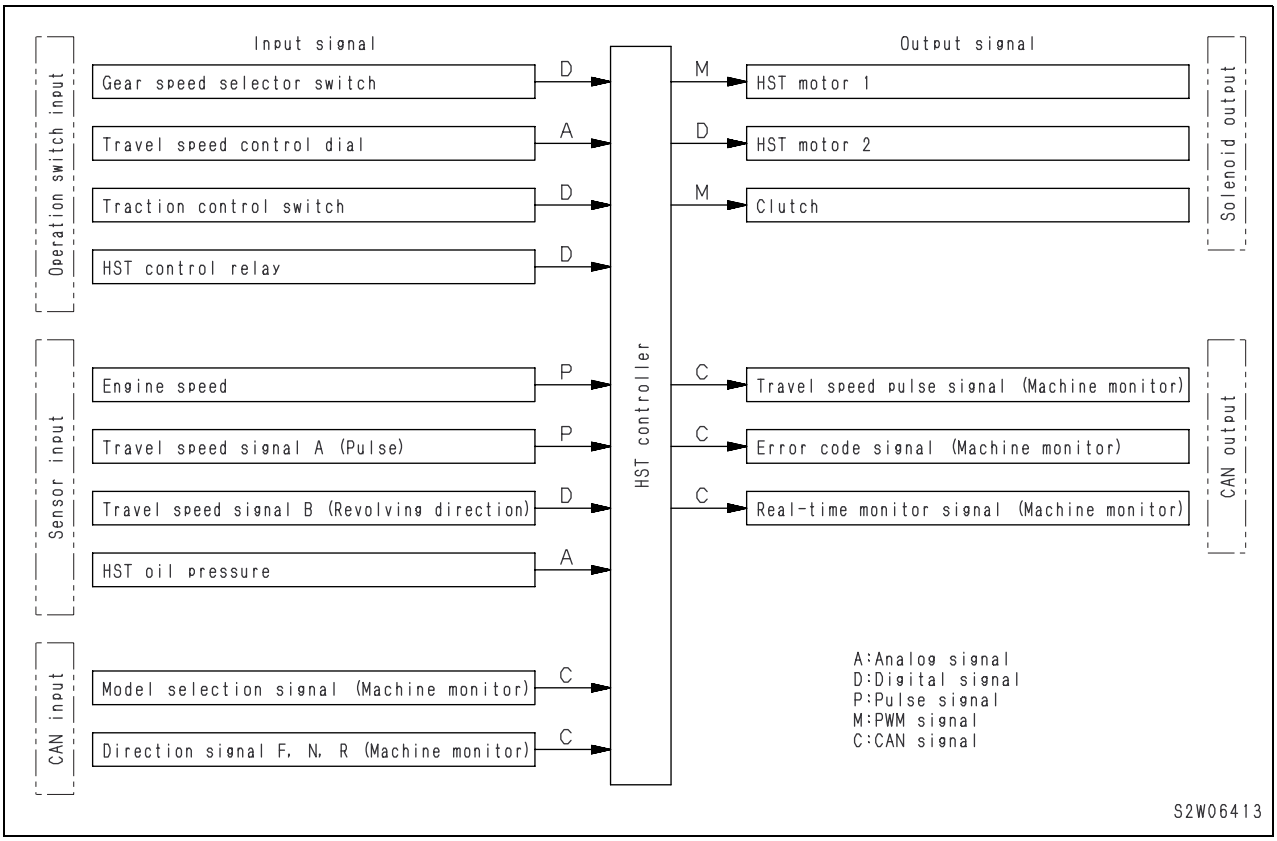
| Pin No. | Specification | I/O | Type of use | Signal name | WA250/250PT-5 | Remarks |
|---|---|---|---|---|---|---|
| 1 | N.C. | – | – | --- | --- | |
| 2 | CAN- | I/O | CAN | Machine monitor – HST controller | CAN- | |
| 3 | D_IN (GND) | I | D/IGND | Emergency steering operation | Emergency steering operation | (If equipped) |
| 4 | D_OUT (+24 V, sink: 200 mA) | O | D/O sink | Automatic preheater relay | Automatic preheater relay | |
| 5 | D_IN (GND) | I | D/IGND | Emergency steering normal | Emergency steering normal | (If equipped) |
| 6 | CAN+ | I/O | CAN | Machine monitor – HST controller | CAN+ | |
| 7 | N.C. | – | – | --- | --- | |
| 8 | D_IN (+24V) | I | D/I+24V | Direction R | Direction R | |
| 9 | D_IN (+24V) | I | D/I+24V | Direction N | Direction N | |
| 10 | D_IN (+24V) | I | D/I+24V | Direction F | Direction F | |
| 11 | D_IN (+24V) | I | D/I+24V | Turn signal lamp left | Turn signal lamp left | |
| 12 | D_IN (GND) | I | D/IGND | Dimmer switch | Dimmer switch | |

AMP040-20P [CN-L23]

| Pin No. | Specification | I/O | Type of use | Signal name | WA250/250PT-5 | Remarks |
|---|---|---|---|---|---|---|
| 1 | D_IN (NSW+24V) | I | D/I+24V | IGN BR | IGN BR | |
| 2 | N.C. | – | – | --- | --- | |
| 3 | D_IN (+24V) | I | D/I+24V | IGN C | IGN C | |
| 4 | N.C. | – | – | --- | --- | |
| 5 | N.C. | – | – | --- | --- | |
| 6 | D_IN (GND) | I | D/IGND | HST filter clogging | HST filter clogging | |
| 7 | D_IN (GND) | I | D/IGND | (Air cleaner clogging) | --- | |
| 8 | D_IN (GND) | I | D/IGND | Engine water level | Engine water level | |
| 9 | D_IN (+24V) | I | D/I+24V | Lamp switch (Head lamp) | Lamp switch (Head lamp) | |
| 10 | D_IN (GND) | I | D/IGND | Engine oil pressure | Engine oil pressure | |
| 11 | NSW power supply (+24 V) | I | Power supply +24 V | NSW power supply (+24 V) | NSW power supply (+24 V) | |
| 12 | D_IN (GND) | I | D/IGND | Alternator R | Alternator R | |
| 13 | A_IN | I | A_I | Fuel level sensor | Fuel level sensor | |
| 14 | GND | I | GND | GND | GND | |
| 15 | D_OUT (+24 V, sink: 200 mA) | O | D/O sink | HST solenoid cut-out relay | HST solenoid cut-out relay | |
| 16 | N.C. | – | – | --- | --- | |
| 17 | D_IN (+24V) | I | D/I+24V | Turn signal lamp right | Turn signal lamp right | |
| 18 | D_IN (+24V) | I | D/I+24V | Parking brake | Parking brake | |
| 19 | D_IN (GND) | I | D/IGND | Brake oil pressure | Brake oil pressure | |
| 20 | D_IN (GND) | I | D/IGND | (Engine oil level) | --- | |

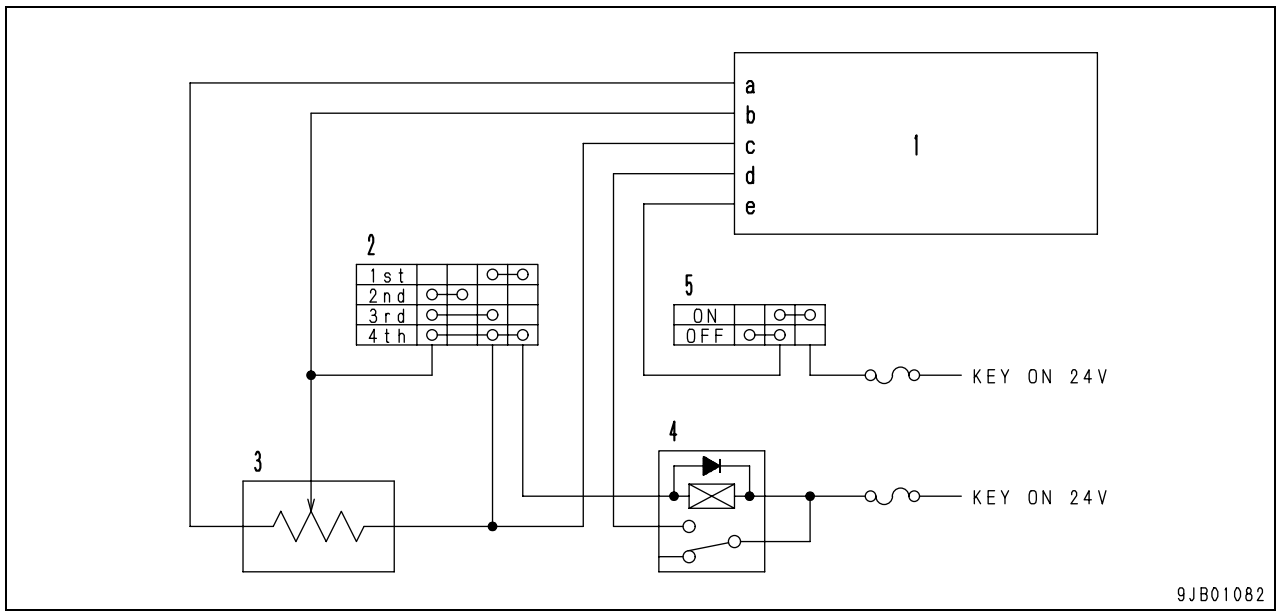
# ELECTRICAL SYSTEM (HST CONTROLLER SYSTEM)

**System diagram**



**Control function**

1. Speed changing function
   The HST controller calculates the maximum speed matched to the selected gear speed and controls the HST according to the gear speed signal and travel speed adjustment signal.




1. HST controller
2. Gear speed selector switch
3. Travel speed adjustment dial
4. HST control relay
5. Traction control switch

a. CNL41-10: Travel speed adjustment dial power supply (+5 V)
b. CNL41-1: Travel speed adjustment signal
c. CNL41-2: Travel speed adjustment dial GND
d. CNL42-12: Gear speed signal
e. CNL42-3: Traction control signal

| Selected gear speed | Travel speed range (km/h) | Traction control switch signal | Traction control | Clutch solenoid output | Motor 1 solenoid output | Motor 2 solenoid output | Travel speed adjustment signal input voltage (V) |
|---|---|---|---|---|---|---|---|
| 1st | 0 – 13 (Set with travel speed adjustment signal) | – (Normally OFF) | Unlimited | OFF | MAX – MID | MAX. fixed | 1.0 – 4.0 |
| 2nd | 0 – 13 | Standard (OFF) | Unlimited | OFF | MAX – MID | MAX. fixed | Below 1.0 |
| | | Limited (ON) | Limited | | | | |
| 3rd | 0 – 18 | Standard (OFF) | Unlimited | OFF,ON | MAX – 0 | MAX. fixed | 0 |
| | | Limited (ON) | Limited | | | | |
| 4th | 0 – 38 | Standard (OFF) | Unlimited | OFF,ON | MAX – 0 | MAX. fixed - Variable | 0 |
| | | Limited (ON) | Limited | | | | |

Note: The travel speed range shown above is for the tire size of 20.5-25.

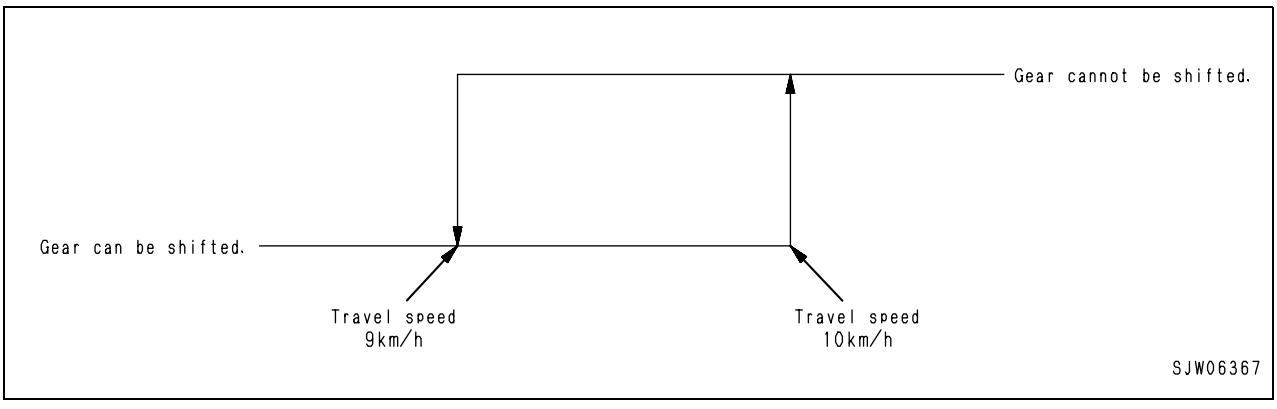
2. Traction control function
   The HST controller can limit the output torque according to the traction control signals when the selected gear speed is 2nd - 4th.

3. Travel speed adjustment function (Variable shift control system)
   If the gear speed selector switch is set to the 1st position, the maximum speed can be limited to 4 - 13 km/h with the travel speed adjustment signal.

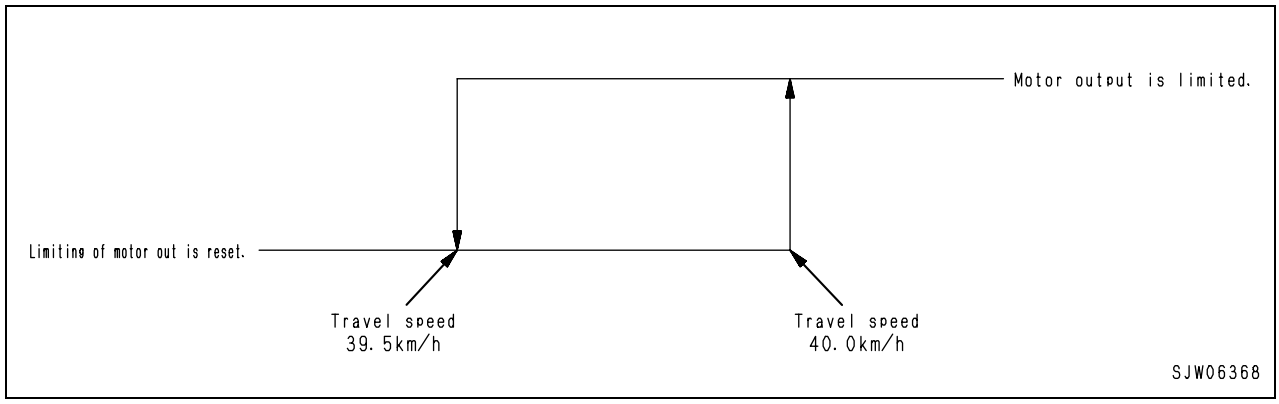
4. Motor 1 overrun prevention function
   While the machine is traveling at high speed (15 km/h or higher) with the gear in the 3rd or 4th position, if the gear is shifted to the 1st or 2nd position, the clutch is engaged at high speed and motor 1 speed exceeds the allowable limit.
   To prevent motor 1 from overrunning in this case, the HST controller prohibits shifting the gear from 3rd or 4th position to the 1st or 2nd position while the travel speed is above 10 km/h.
   If the gear cannot be shifted, the error code (989F00) is displayed on the machine monitor and the alarm buzzer is turned ON.
   The error condition is reset when the travel speed lowers below 9 km/h or the gear speed selector switch is set in a gear speed position at which the gear can be shifted.

| Gear shifting operation | | | Action after gear shifting | | |
|---|---|---|---|---|---|
| Switch position before gear shifting | Travel speed at gear shifting (km/h) | Switch position after gear shifting | Actual gear speed after gear shifting | Display of error code | Remarks |
| 1st | 0 – | 2nd | 2nd | Not displayed | Gear can be shifted regardless of travel speed. |
| | | 3rd | 3rd | | |
| | | 4th | 4th | | |
| 2nd | 0 – | 1st | 1st | Not displayed | Gear can be shifted regardless of travel speed. |
| | | 3rd | 3rd | | |
| | | 4th | 4th | | |
| 3rd | 0 – 10 | 1st | 1st | Not displayed | Gear can be shifted to 1st or 2nd only when travel speed is below 9 km/h. |
| | | 2nd | 2nd | | |
| | | 4th | 4th | | |
| | 10 – | 1st | 3rd | Displayed (989F00) | |
| | | 2nd | 3rd | | |
| | | 4th | 4th | Not displayed | |
| 4th | 0 –10 | 1st | 1st | Not displayed | Gear can be shifted to 1st or 2nd only when travel speed is below 9 km/h. |
| | | 2nd | 2nd | | |
| | | 3rd | 3rd | | |
| | 10 – | 1st | 3rd | Displayed (989F00) | |
| | | 2nd | 3rd | | |
| | | 3rd | 3rd | Not displayed | |

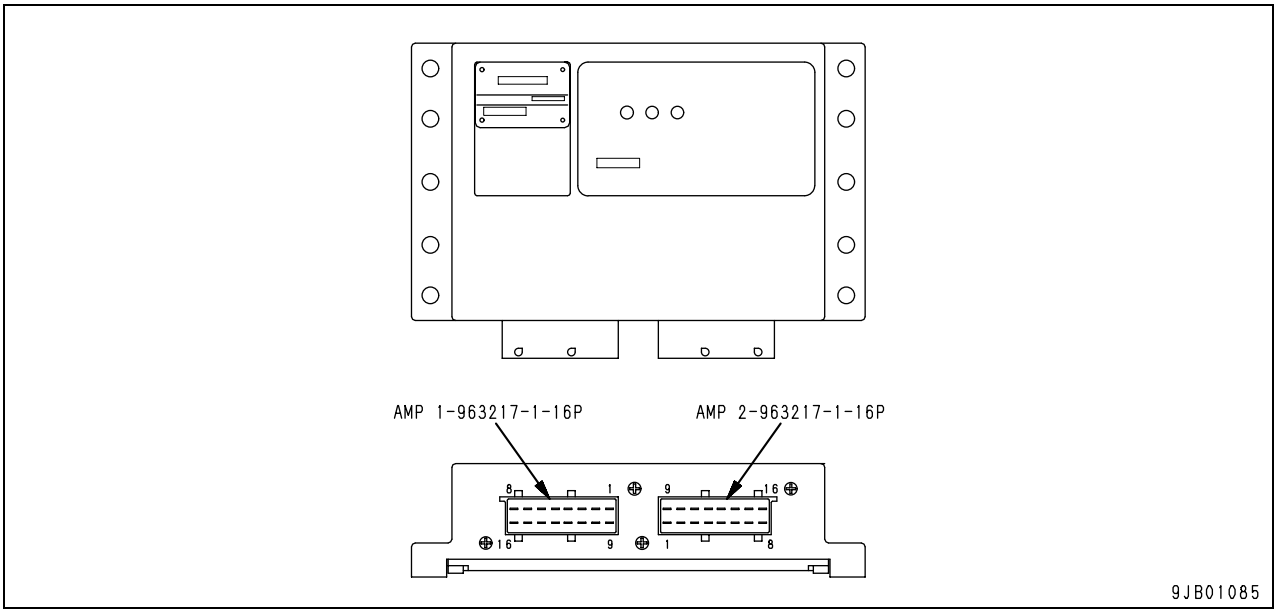
Note: The travel speed range shown above is for the tire size of 20.5-25.



5. Travel speed limiting function
   When the machine travels down a slope at high speed, the axle speed and engine speed exceed the allowable limit, and the travel speed exceeds the allowable limit consequently.
   To limit the travel speed in this case, the HST controller limits the output of motor 2 while the travel speed is above 40 km/h.
   If the travel speed is limited, the error code (989F00) is displayed on the machine monitor and the alarm buzzer is turned ON.
   The error condition is reset when the travel speed lowers below 39.5 km/h.



# HST CONTROLLER




### Input and output signals

AMP 1-963217-1-16P [CN-L41]

| Pin No. | Signal name | Input/Output signal |
|---|---|---|
| 1 | Travel speed adjustment signal | Input |
| 2 | Travel speed adjustment potentiometer GND | – |
| 3 | HST pressure signal | Input |
| 4 | HST pressure sensor GND | – |
| 5 | Motor 2 solenoid | Output |
| 6 | Motor 1 solenoid | Output |
| 7 | Power supply (+24 V) | Input |
| 8 | Power supply (+24 V) | Input |

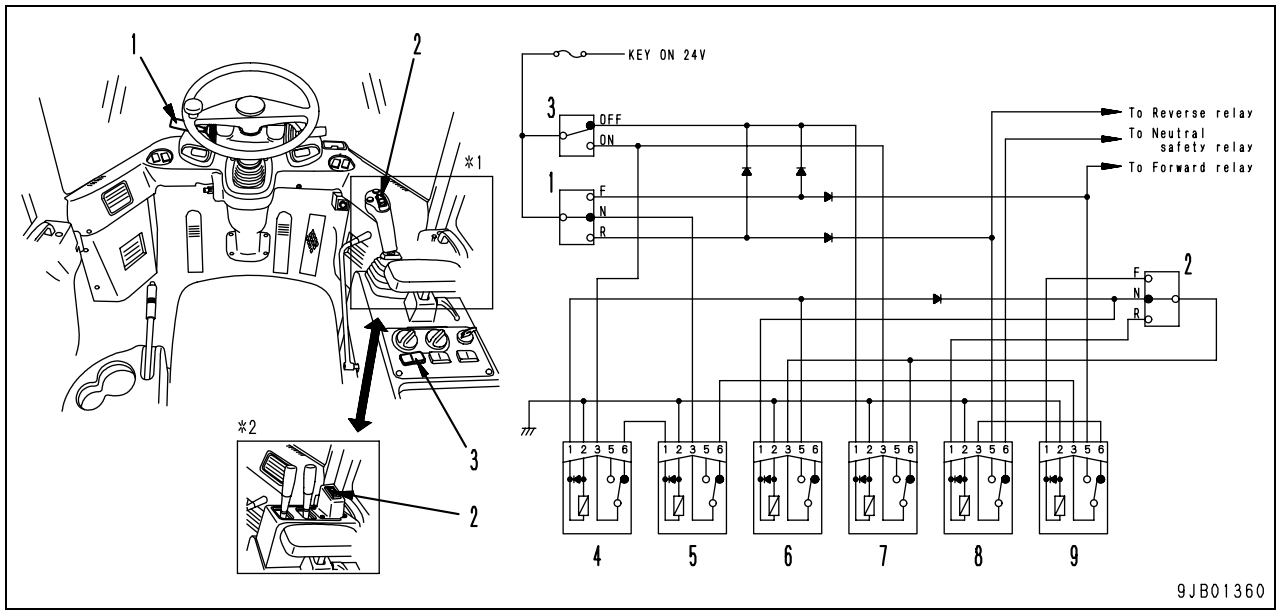
| Pin No. | Signal name | Input/Output signal |
|---|---|---|
| 9 | NC | – |
| 10 | Travel speed adjustment potentiometer GND | Output |
| 11 | NC | – |
| 12 | HST pressure sensor (+5 V) | Output |
| 13 | Travel speed signal A (Pulse) | Input |
| 14 | Clutch solenoid | Output |
| 15 | NC | – |
| 16 | GND | – |

AMP 2-963217-1-16P [CN-L42]

| Pin No. | Signal name | Input/Output signal |
|---|---|---|
| 1 | NC | – |
| 2 | Checker H | Input and output |
| 3 | Traction control signal | Input |
| 4 | Engine speed signal | Input |
| 5 | Travel speed signal B (Revolving direction) | Input |
| 6 | NC | – |
| 7 | Checker C | Input and output |
| 8 | CAN-L | Input and output |

| Pin No. | Signal name | Input/Output signal |
|---|---|---|
| 9 | NC | – |
| 10 | NC | – |
| 11 | Engine speed sensor GND | – |
| 12 | Gear speed signal | Input |
| 13 | NC | – |
| 14 | Checker D | Input and output |
| 15 | Checker B | Input and output |
| 16 | CAN-H | Input and output |

# FUNCTION OF SELECTING FORWARD-REVERSE SELECTOR SWITCH




*1: Multi-function joystick type
*2: 2-lever type

1. Forward-reverse lever
2. Forward-reverse selector switch
3. Forward-reverse selector switch drive switch
4. Multi-relay 1
5. Multi-relay 2
6. Multi-relay 3
7. Multi-relay 4
8. Multi-relay 5
9. Multi-relay 6

**Outline**

- If forward-reverse selector switch drive switch (3) on the switch panel on the right side of the console box is operated, the travel direction can be changed with forward-reverse lever (1) or forward-reverse selector switch (2).

**Function**

1. Change of travel direction with forward-reverse lever
   While forward-reverse selector switch drive switch (3) is turned OFF, the travel direction can be changed with forward-reverse lever (1).
2. Safety function for use of forward-reverse selector switch
   To prevent unexpected start of the machine just after forward-reverse selector switch drive switch (3) is turned ON, the travel direction cannot be changed with forward-reverse selector switch (2) unless both of forward-reverse lever (1) and forward-reverse selector switch (2) are in the N (Neutral) position.
3. Change of travel direction with forward-reverse selector switch
   While forward-reverse lever (1) is in the N (Neutral) position and forward-reverse selector switch drive switch (3) is turned ON, the travel direction can be changed with forward-reverse selector switch (2).
4. Forward-reverse lever priority function
   Forward-reverse lever (1) is kept effective, regardless of the position of forward-reverse selector switch drive switch (3), so that the travel direction can be changed in an emergency.
   After the travel direction is changed with forward-reverse lever (1) while forward-reverse selector switch drive switch (3) is turned ON, it cannot be changed with forward-reverse selector switch (2) unless forward-reverse lever (1) and forward-reverse selector switch (2) are returned to the N (Neutral) position.

**Operation**

**When travel direction is changed with forward-reverse lever**

- Since forward-reverse selector switch drive switch (3) is OFF, the contacts of multi-relay 4 (7) are closed and the current to forward-reverse selector switch (2) and multi-relay 3 (6) is cut out.
- At this time, the F (Forward) signal and R (Reverse) signal of forward-reverse lever (1) flow through the diode to the forward relay or reverse relay.
- The N (Neutral) signal of forward-reverse lever (1) flows through multi-relay 2 (5), multi-relay 6 (9), and multi-relay 5 (8) to the neutral safety relay.

**When forward-reverse selector switch is selected to be used**

- While forward-reverse lever (1) and forward-reverse selector switch (2) are in the N (Neutral) position, if forward-reverse selector switch drive switch (3) is turned ON, the contacts of multi-relay (4) (7) are open and the current flows through the ON terminal of forward-reverse selector switch drive switch (3), multi-relay 4 (7), and N terminal of forward-reverse selector switch (2) to the coil of multi-relay 3 (6), and then the contacts are closed.
- Since the current in multi-relay 4 (7) flows through multi-relay 3 (6) to the coil of multi-relay 1 (4) and the contacts are closed, the current to the coil of multi-relay 2 (5) is cut out and the contacts are opened.
- Since the current at N terminal of forward-reverse lever (1) flows through multi-relay 2 (5) to multi-relay 6 (9), the travel direction can be changed with forward-reverse selector switch (2).
- Once the current flows in the coil of multi-relay 3 (6) to close the contacts, it keeps flowing until forward-reverse selector switch drive switch (3) is turned OFF or forward-reverse lever (1) is set in the FORWARD or REVERSE position.
- While forward-reverse lever (1) is in the N (Neutral) position and forward-reverse selector switch (2) is not in the N (Neutral) position, if forward-reverse selector switch drive switch (3) is turned ON, the current does not flow in multi-relay 3 (6) and the travel direction cannot be changed with forward-reverse selector switch (2).

**When travel direction is changed with forward-reverse selector switch**

1. When forward-reverse selector switch is in N (Neutral)
   Since the current does not flow in the coils of multi-relay 6 (9) and multi-relay 5 (8), the current at N terminal of forward-reverse lever (1) flows through multi-relay 2 (5), multi-relay 6 (9), and multi-relay 5 (8) to the neutral safety relay.

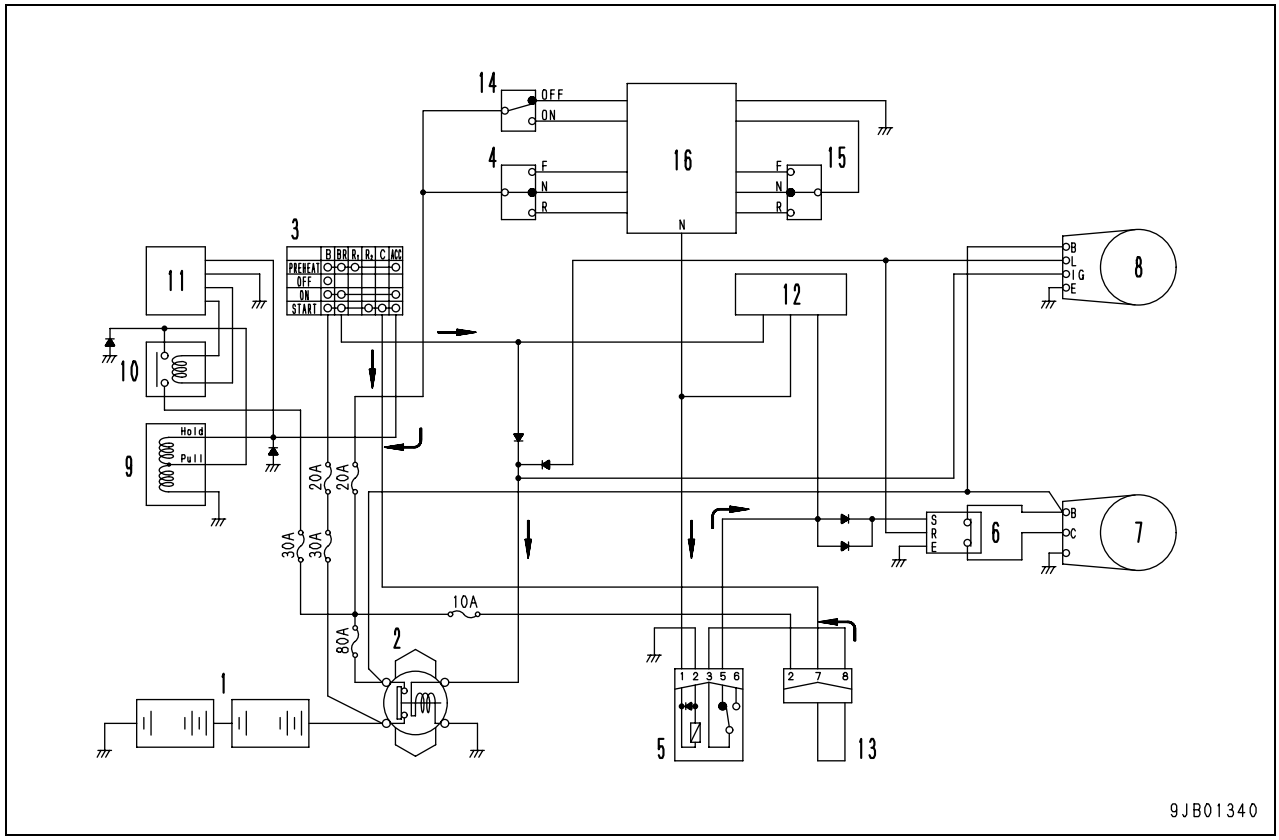
2. When forward-reverse selector switch is in F (Forward)
   Since the current flows in the coil of multi-relay 6 (9) and the contacts are closed, the current at N terminal of forward-reverse lever (1) flows through multi-relay 2 (5) and multi-relay 6 (9) to the forward relay.

3. When forward-reverse selector switch is in R (Reverse)
   Since the current flows in the coil of multi-relay 5 (8) and the contacts are closed, the current at N terminal of forward-reverse lever (1) flows through multi-relay 2 (5), multi-relay 6 (9), and multi-relay 5 (8) to the reverse relay.

**When forward-reverse lever has priority**

- While forward-reverse selector switch (2) is operated, if forward-reverse lever (1) is set in the F (Forward) or R (Reverse) position, the F (Forward) or R (Reverse) signal of forward-reverse lever (1) flows through the diode into the coil of multi-relay 4 (7) and the contacts are closed. Accordingly, the current does not flow into forward-reverse selector switch (2). In this case, the travel direction does not change even if forward-reverse selector switch (2) is operated.
- The F (Forward) or R (Reverse) signal of forward-reverse lever (1) flows through the diode into the forward relay or reverse relay and the travel direction can be changed.
- When forward-reverse lever (1) is returned to the N (Neutral) position, even if forward-reverse selector switch (2) is in the F (Forward) or R (Reverse) position, the travel direction does not change since the coil of multi-relay 3 (6) is not energized. Accordingly, the machine does not start unexpectedly.
- If both forward-reverse lever (1) and forward-reverse selector switch (2) are returned to the N (Neutral) position, the travel direction can be changed again with forward-reverse selector switch (2).

# ENGINE START CIRCUIT




★ For details of the multi-function selector relay circuit, see Function of selecting forward-reverse selector switch.

1. Battery
2. Battery relay
3. Starting switch
4. Forward-reverse lever
5. Neutral safety relay
6. Starting motor safety relay
7. Starting motor
8. Alternator
9. Fuel cut-out solenoid
10. Fuel solenoid pull relay
11. Fuel cut-out solenoid timer
12. Machine monitor
13. Short connector
14. Forward-reverse selector switch drive switch
15. Forward-reverse selector switch
16. Multi-function selector relay circuit

**Function**

1. The neutral safety circuit is employed to secure the safety when the engine is started.
   - While the forward-reverse selector switch drive switch is OFF, the engine does not start if the forward-reverse lever is not in the N (Neutral) position.
   - While the forward-reverse selector switch drive switch is ON, the engine does not start if the forward-reverse selector switch is not in the N (Neutral) position.

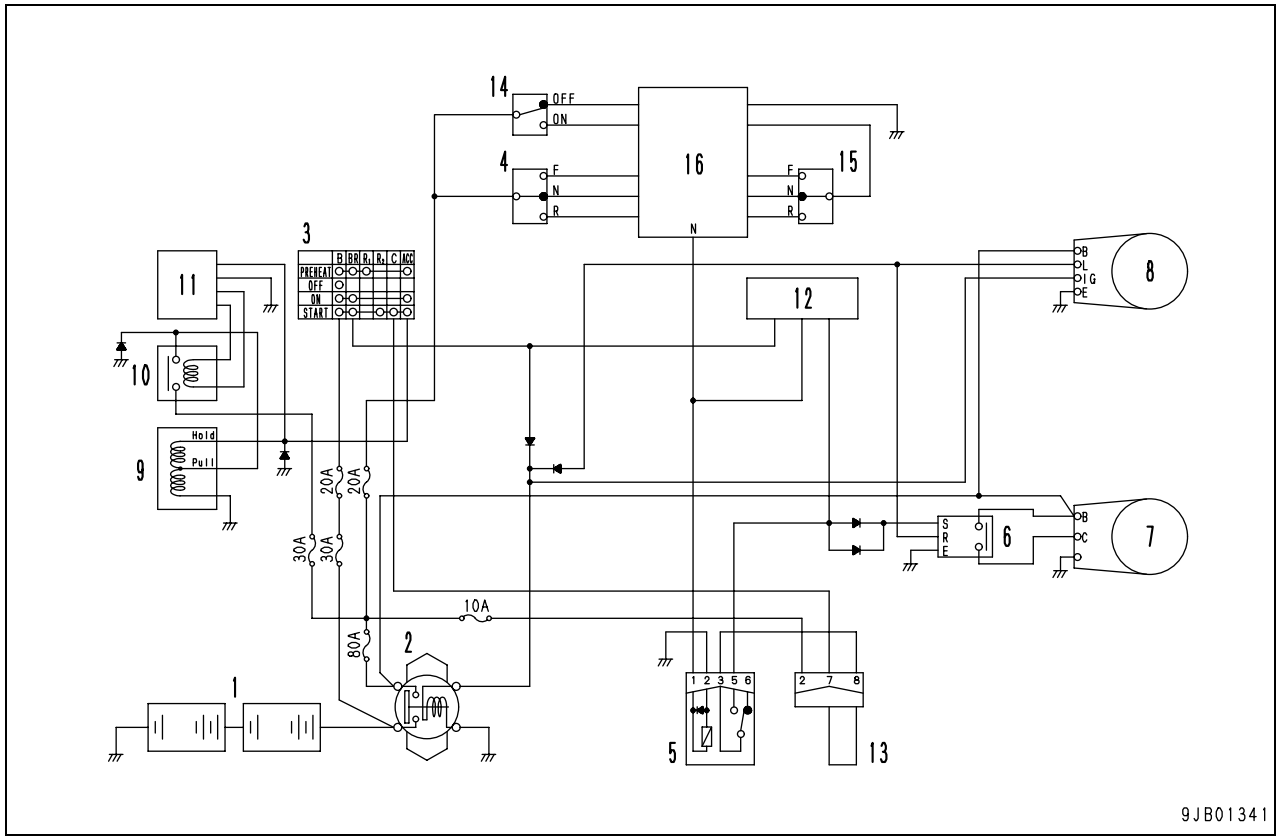
**Operation**

1. When starting switch is ON
   - If the starting switch is turned ON, terminals B and BR of the starting switch are closed and the current flows from the battery through the starting switch and battery relay coil to the ground and the contacts are closed. As a result, the power is supplied to each circuit of the machine.
     At this time, if the signal from terminal ACC of the starting switch flows in the timer relay, the relay contacts are closed for 3 seconds and the current flows into the coil on the pull side of the fuel cut-out solenoid.
     The current from terminal ACC of the starting switch flows into the coil on the hold side of the fuel cut-out solenoid to hold the solenoid so that the fuel will be supplied even after the coil on the pull side is energized. The engine is now ready to start.

2. Neutral safety circuit
   - While the forward-reverse selector switch drive switch is OFF, if the forward-reverse lever is set in the N (Neutral) position, the current flows from contact N of the forward-reverse lever to the multi-function selector relay circuit. At this time, multi-function selector relay circuit supplies a current as the N signal to the neutral safety relay coil to connect neutral safety relay terminals 3 and 5.
   - While the forward-reverse selector switch drive switch is ON, the current flows from its ON contact to the multi-function selector relay circuit.
     Then, the multi-function selector relay circuit supplies a current as the N signal to the neutral safety relay coil to connect neutral safety relay terminals 3 and 5 only when both forward-reverse lever and forward-reverse selector switch are in the N (Neutral) position.

3. When starting switch is turned to START position
   - If the starting switch is turned to the START position, terminals B and C of the starting switch are closed and the current flows from short connector terminal 7 through terminal 8 and neutral safety relay terminals 3 and 5 to starting motor safety relay terminal S, and then the contacts are closed to start the starting motor and engine.
   - While forward-reverse selector switch drive switch is OFF, if the forward-reverse lever is not in the N (Neutral) position, the neutral safety relay does not operate and the engine does not start.
   - While forward-reverse selector switch drive switch is ON, if the forward-reverse lever and forward-reverse selector switch are not in the N (Neutral) position, the neutral safety relay does not operate and the engine does not start.

# ENGINE STOP CIRCUIT



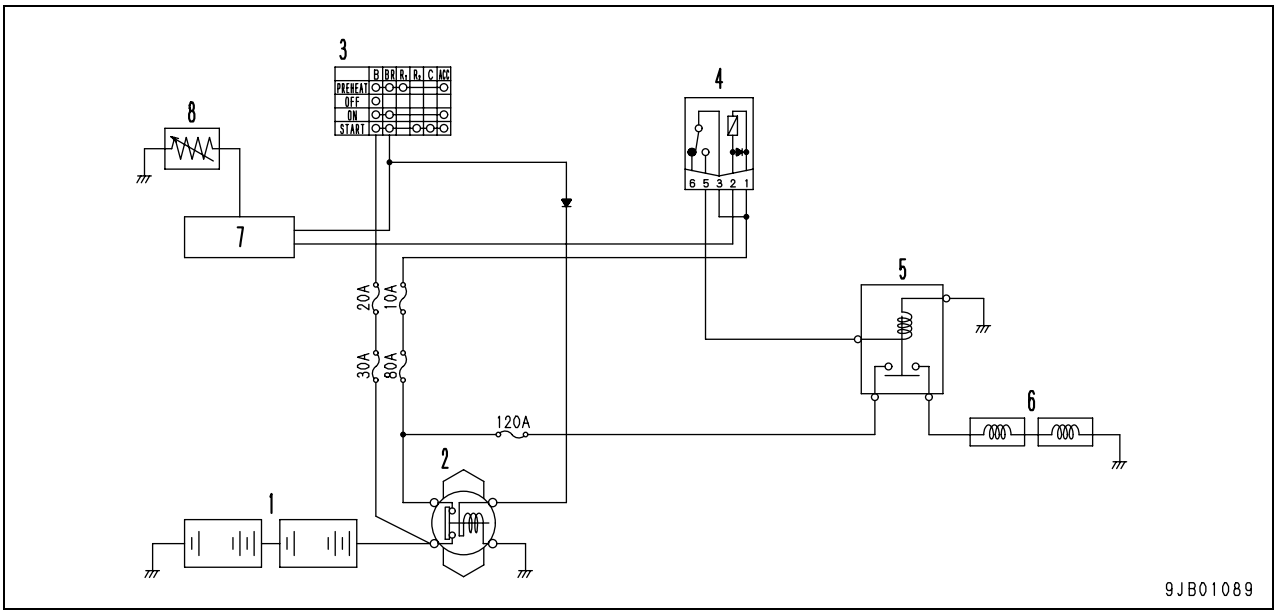

★ For details of the multi-function selector relay circuit, see Function of selecting forward-reverse selector switch.

1. Battery
2. Battery relay
3. Starting switch
4. Forward-reverse lever
5. Neutral safety relay
6. Starting motor safety relay
7. Starting motor
8. Alternator
9. Fuel cut-out solenoid
10. Fuel solenoid pull relay
11. Fuel cut-out solenoid timer
12. Machine monitor
13. Short connector
14. Forward-reverse selector switch drive switch
15. Forward-reverse selector switch
16. Multi-function selector relay circuit

**Operation**

- The current from ACC terminal of starting switch to hold side coil of fuel cut solenoid is cutoff when starting is turned off. Fuel supply to engine is shut off.
  When the fuel supply is stopped, the engine reduces its speed and stops. Then, the power generation of the alternator stops to shut off voltage supply from the terminal L of the alternator. In addition, the current from the terminal BR of starting switch is shut off. Consequently, the battery relay contact opens to shut down the power supplied to every circuit of the machine.

# PREHEATING CIRCUIT
# (AUTOMATIC PREHEATING SYSTEM)



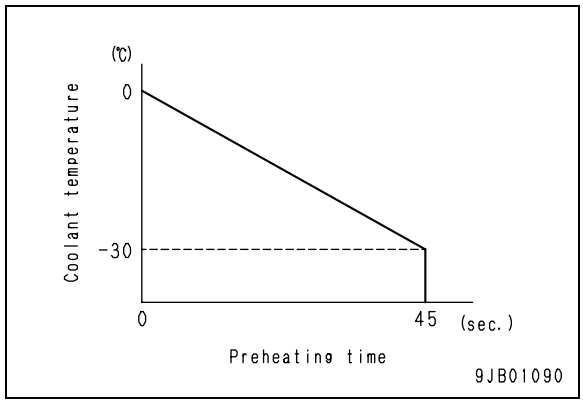

1. Battery
2. Battery relay
3. Starting switch
4. Automatic preheating relay
5. Engine heater relay
6. Ribbon heater
7. Machine monitor
8. Coolant temperature sensor (For preheating)

**Outline**

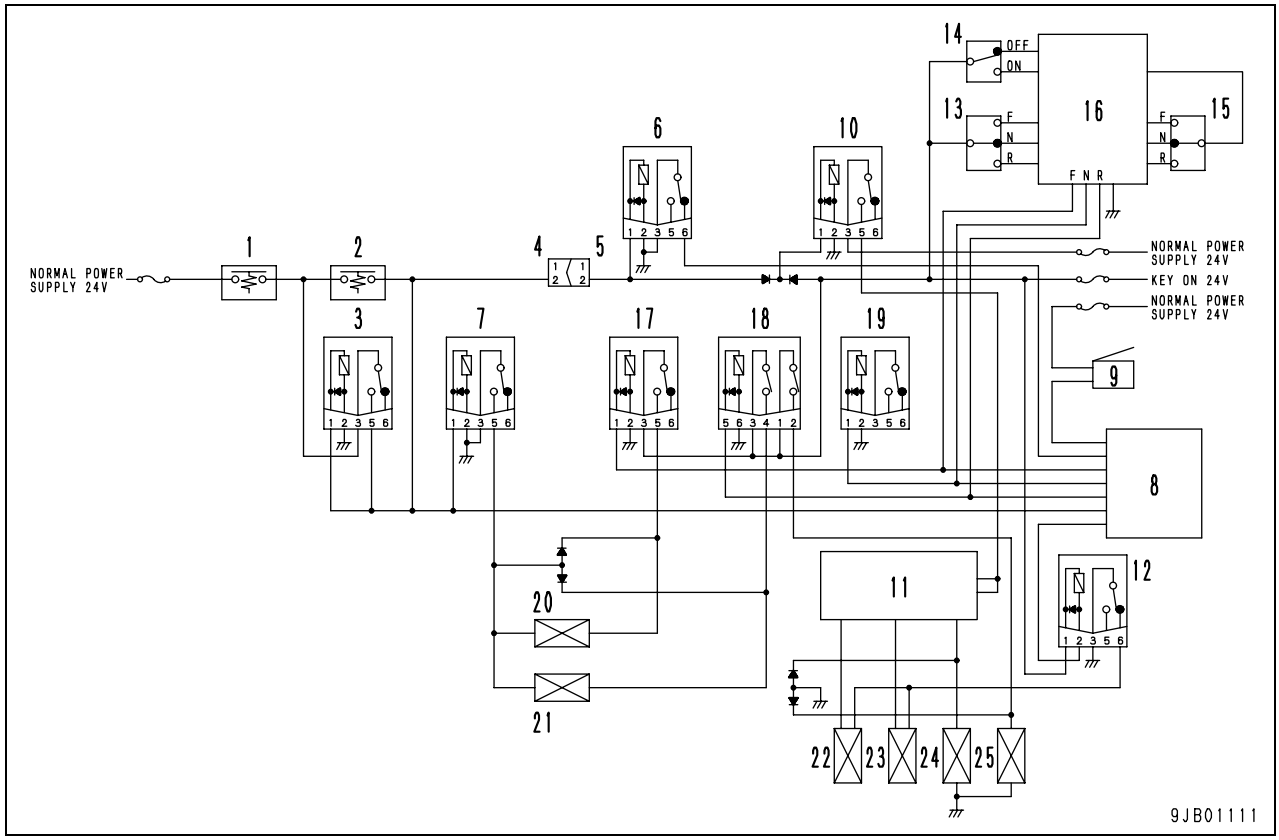
- The automatic preheating system is being installed to improve the engine starting capability in cold weather areas. This system is capable of shortening the preheating time and, at the same time, it is capable of making automatic setting of the preheating time matching the current coolant temperature, by merely turning the starting switch.
- When the starting switch is turned ON, the preheating pilot lamp on the machine monitor lights and the electric intake air heater starts preheating the intake air.
  As for the preheating time, the coolant temperature is detected by the coolant temperature sensor and the controller being built into the machine monitor carries out the preheating time setting.
- While the pilot lamp is lighting, preheating is in progress and keep the starting switch at the ON state. If the starting switch is turned to the START position, the preheating process is cancelled.

**Operation**

- When the starting switch is turned ON, the machine monitor is started up. At this time, if the coolant temperature is 0°C or less, the machine monitor makes to contact the coil of the preheating relay to the earth and the preheating relay operates to let the engine heater relay operate to start preheating by the electric intake air heater.
- The operating time of the preheating process is as shown below



# PARKING BRAKE CIRCUIT




★ For details of the multi-function selector relay circuit, see Function of selecting forward-reverse selector switch.

1. Parking brake lever intermediate switch
2. Parking brake lever bottom switch
3. Parking brake relay
4. Parking brake selector connector (CNL20)
5. Parking brake selector connector (CNL18)
6. Parking brake indicator relay
7. Parking brake drag prevention relay
8. Machine monitor
9. Alarm buzzer
10. HST controller power hold relay
11. HST controller
12. HST safety relay
13. Forward-reverse lever
14. Forward-reverse selector switch drive switch
15. Forward-reverse selector switch
16. Multi-function selector relay circuit
17. Forward relay
18. Reverse relay
19. Neutral safety relay
20. HST pump forward solenoid valve
21. HST pump reverse solenoid valve
22. Motor 1 solenoid valve
23. Clutch solenoid valve
24. Motor 2 solenoid valve
25. HST motor forward-reverse selector solenoid valve

**Operation**

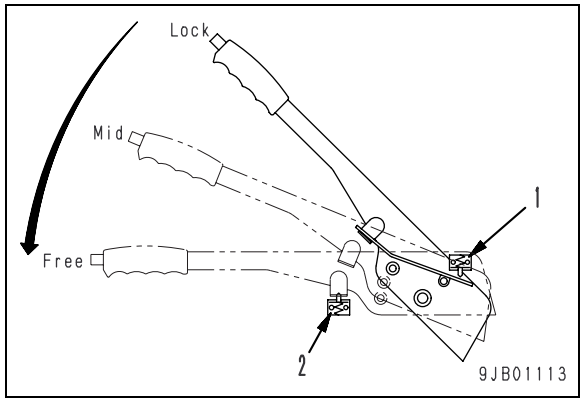
1. When parking brake lever is returned (ON ✕ OFF)

| Position of starting switch | OFF | | | ON | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| State of engine | Stopped | | | | | | Running | | |
| Position of parking brake lever | Lock | Mid-Free | Free | Lock | Mid-Free | Free | Lock | Mid-Free | Free |
| Intermediate switch (1) | Open | Close | | Open | Close | | Open | Close | |
| Bottom switch (2) | Open | | Close | Open | | Close | Open | | Close |
| Parking brake omission prevention indicator (Alarm buzzer) | OFF (Reset) | | ON (Operated) | OFF (Reset) | | ON (Operated) | OFF (Reset) | | |
| Parking brake indicator | OFF | | | ON | | OFF | ON | | OFF |

1) When parking brake lever is in Lock position
   - When the parking brake is applied, both intermediate switch (1) and bottom switch (2) are open.
   - The parking brake indicator lights up only while the starting switch is in the ON position and goes off regardless of the state of the parking brake omission prevention indicator.
   - The parking brake is applied.

2) When parking brake lever is moved from Lock position to Mid position
   - If the parking brake lever is returned a little, intermediate switch (1) is closed but the contacts of the parking brake relay are kept open.
   - The parking brake indicator and parking brake omission prevention indicator operate as in step 1).
   - The parking brake is kept applied.

3) When parking brake is set in Free position
   - If the parking brake lever is returned to the end, bottom switch (2) is closed.
   - At this time, the coil flows in the coil of the parking brake relay to close the contacts, and then the parking brake indicator relay operates.
   - Since the current flows in the coil of the parking brake drag prevention relay, the forward-reverse solenoid circuit is closed and the machine can travel forward or in reverse and the parking brake omission prevention signal is input to the machine monitor.
   - The parking brake indicator goes off regardless of the state of the parking brake. Parking brake omission prevention indicator lights up and the alarm buzzer sounds only when the engine is stopped.
   - Then, the HST controller power hold relay operates and the current flows in the HST controller to hold the operation of the motor solenoid and clutch solenoid and prevent the machine from moving down on a slope, etc.
   - The parking brake is released.



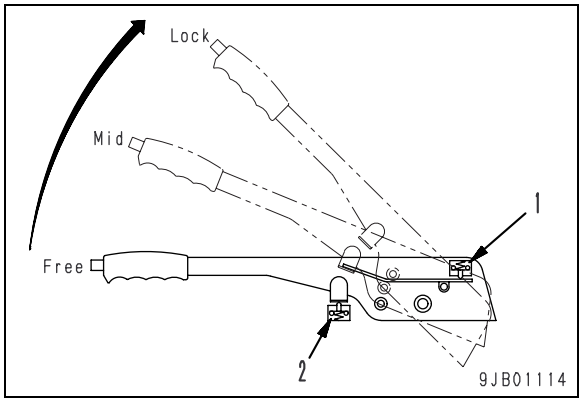
2. When parking brake lever is pulled (OFF ✗ ON))

| Position of starting switch | OFF | | | ON | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| State of engine | Stopped | | | | | | Running | | |
| Position of parking brake lever | Free | Free-Mid | Lock | Free | Free-Mid | Lock | Free | Free-Mid | Lock |
| Intermediate switch (1) | Close | | Open | Close | | Open | Close | | Open |
| Bottom switch (2) | Close | Open | | Close | Open | | Close | Open | |
| Parking brake omission prevention indicator (Alarm buzzer) | ON (Operated) | | OFF (Reset) | ON (Operated) | | OFF (Reset) | OFF (Reset) | | |
| Parking brake indicator | OFF | | | OFF | | ON | OFF | | ON |

1) When parking brake is set in Free position
   - When the parking brake is released, both intermediate switch (1) and bottom switch (2) are closed.
   - The parking brake indicator goes off regardless of the state of the parking brake. Parking brake omission prevention indicator lights up and the alarm buzzer sounds only when the engine is stopped.
   - Then, the HST controller power hold relay operates and the current flows in the HST controller to hold the operation of the motor solenoid and clutch solenoid and prevent the machine from moving down on a slope, etc.
   - The parking brake is released.

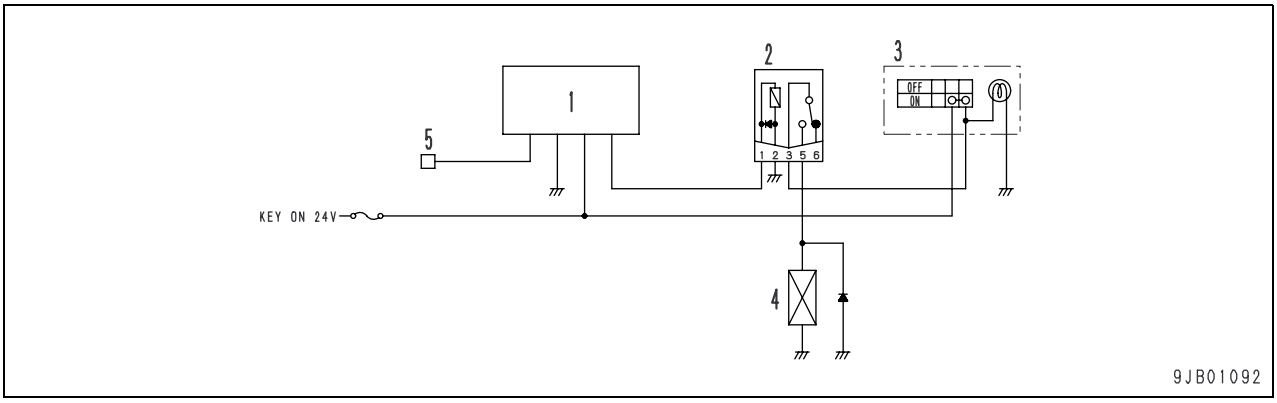
2) When parking brake lever is moved from Free position to Mid position
   - If the parking brake lever is pulled a little, bottom switch (2) is opened but the contacts of the parking brake relay are kept closed.
   - The parking brake indicator and parking brake omission prevention indicator operate as in step 1).
   - The parking brake is kept released.

3) When parking brake lever is in Lock position
   - If the parking brake lever is pulled to the end, intermediate switch (1) is opened.
   - At this time, the current to the coil of the parking brake relay is cut out and the contacts are opened and the parking brake indicator relay is turned OFF.
   - Since the current to the coil of the parking brake drag prevention relay is cut out, the forward-reverse solenoid circuit is opened. Accordingly, the machine does not move forward or in reverse even if the forward-reverse lever or the forward-reverse selector switch is operated.
   - The parking brake indicator lights up only while the starting switch is in the ON position and goes off regardless of the state of the parking brake omission prevention indicator.
   - The parking brake is applied.



# ELECTRONICALLY CONTROLLED SUSPENSION SYSTEM

**Electronically Controlled Suspension System (Abbreviation: ECSS)**
**(If equipped)**




1. ECSS controller
2. ECSS relay
3. ECSS switch
4. ECSS solenoid
5. Speed sensor

**Function**

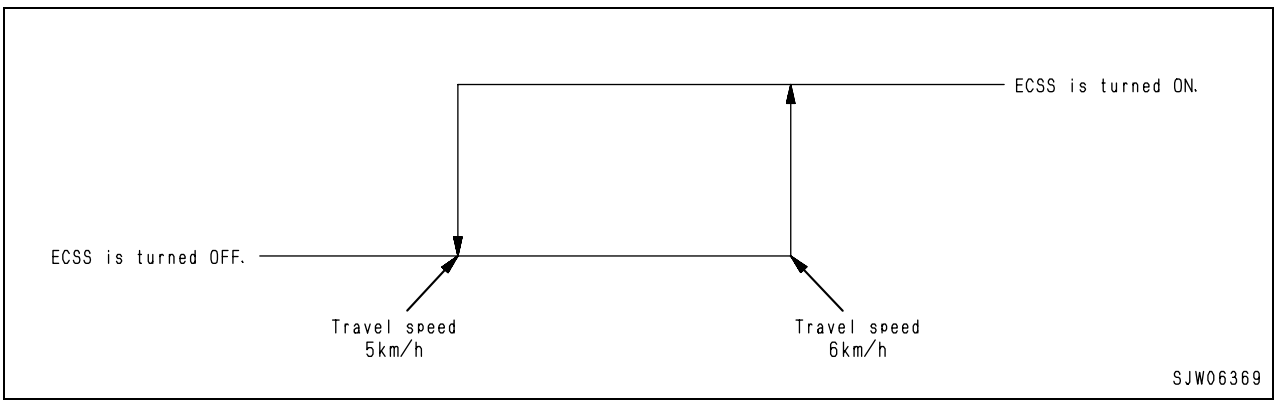
- The controller controls the ECSS solenoid valve automatically to turn the accumulator charged with high-pressure gas ON and OFF to damp the vertical movement of the work equipment and reduce the jolts of the machine during high-speed travel. Consequently, the operator comfort is improved, the material spills less, and the working efficiency is increased.

**System operation table**

| ECSS switch | | Travel speed (km/H) | ECSS solenoid output | State of ECSS |
|---|---|---|---|---|
| OFF | | 0 – MAX | OFF | OFF |
| ON (*1) | Turn system ON | 0 – 6 | OFF | OFF |
| | | 6 – MAX | ON | ON |
| | Turn system OFF | MAX – 5 | ON | ON |
| | | 5 – 0 | OFF | OFF |

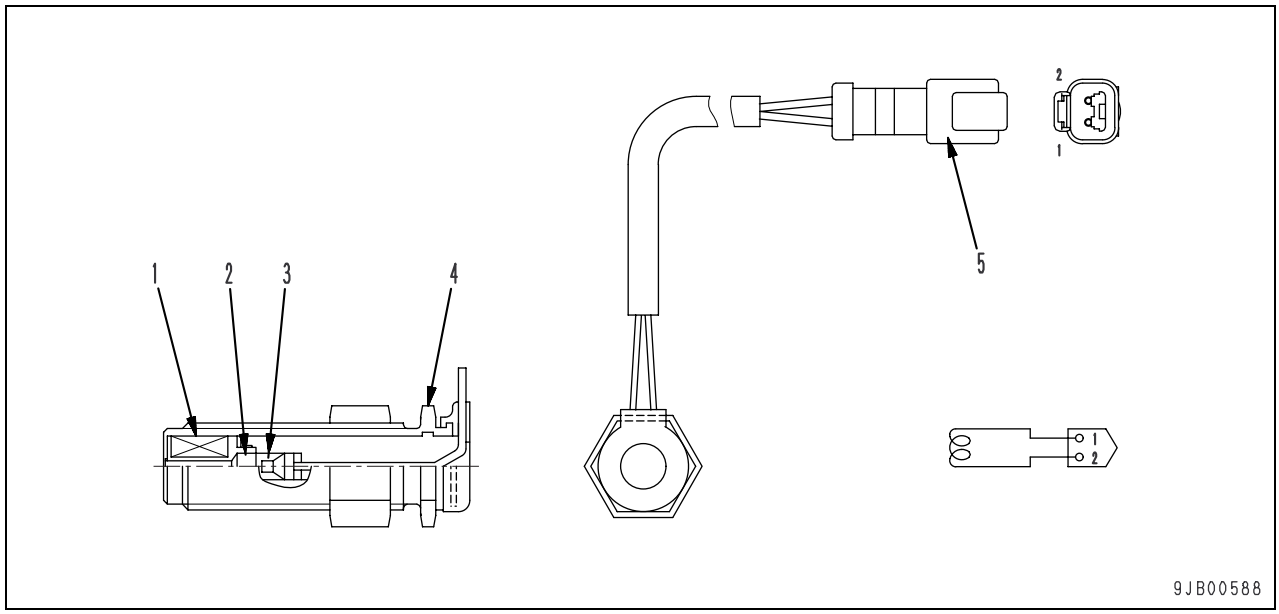
Note: The travel speed range shown above is for the tire size of 20.5-25.

*1: When the bucket of WA250PT-5 is tilted, the ECSS is not turned ON even if the travel speed is increased above 6 km/h.



# SENSORS

**Engine speed sensor**

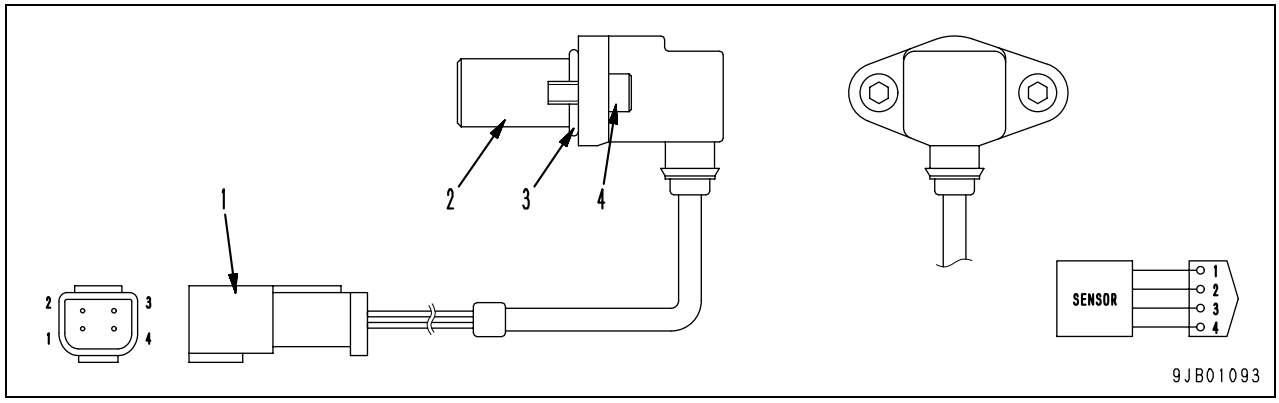



1. Wire
2. Magnet
3. Terminal
4. Housing
5. Connector

**Function**

- The engine speed sensor is installed to the ring gear of the flywheel housing. As the gear revolves, the engine speed sensor generates a pulse voltage.

**Speed sensor**

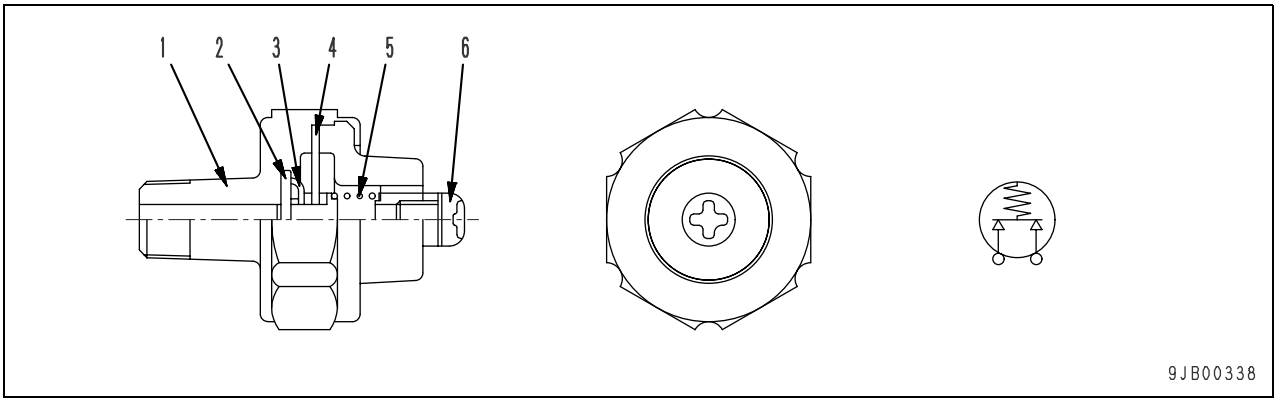



1. Connector
2. Sensor
3. O-ring
4. Bolt

**Function**

- The speed sensor is installed to the transfer case. As the gear revolves, the speed sensor generates a pulse voltage and a revolving direction signal (Counterclockwise: ON).

**Engine oil pressure sensor**

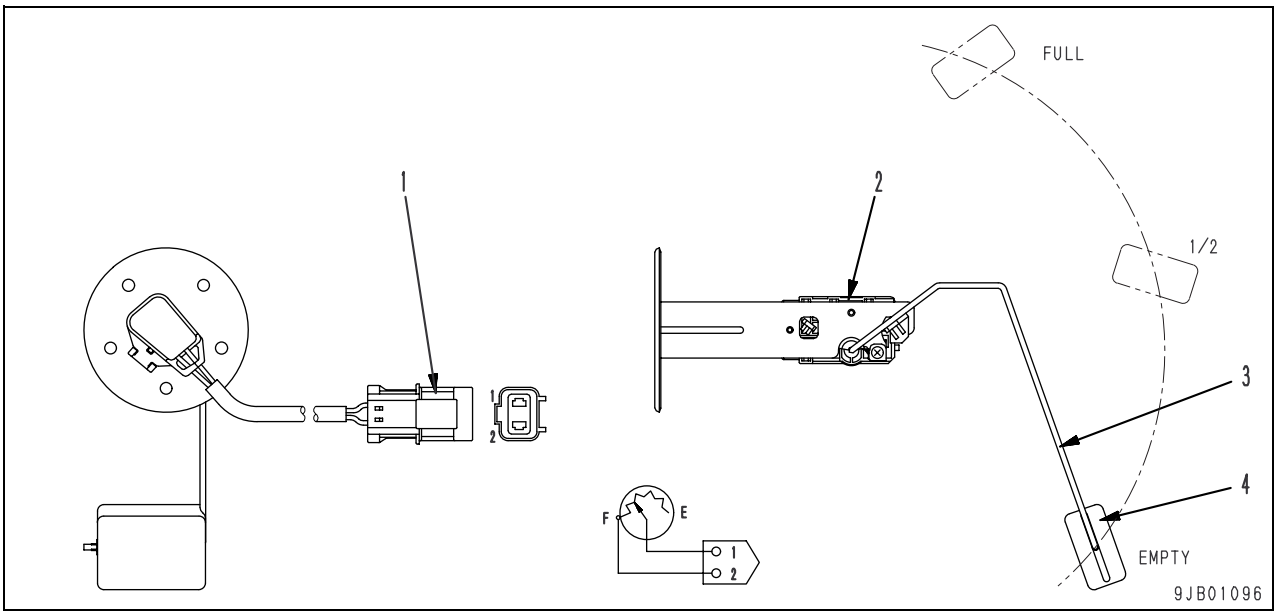



1. Plug
2. Contact ring
3. Contact
4. Diaphragm
5. Spring
6. Terminal

**Function**

- This sensor is mounted to the engine block. The diaphragm detects oil pressure, and when it reaches below the specified value, the switch is turned ON.

**Fuel level sensor**



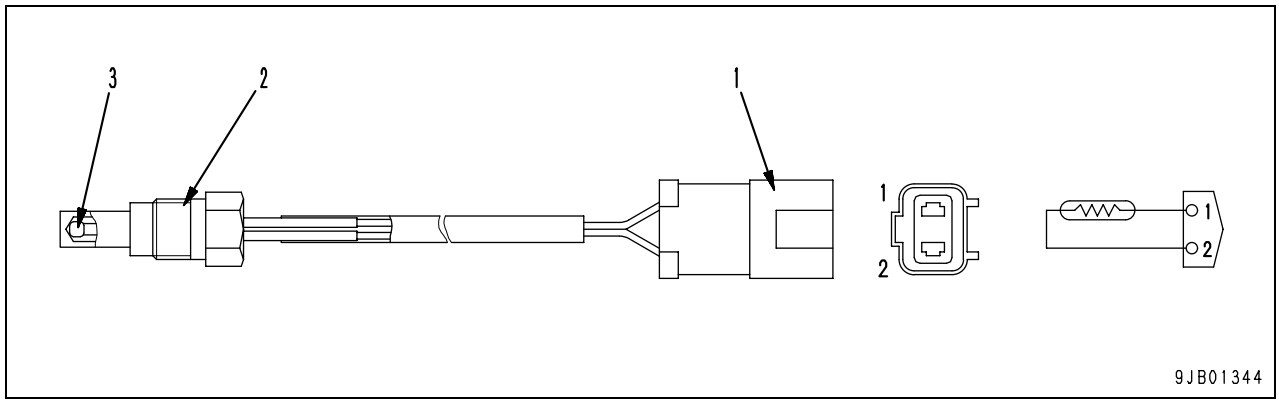

1. Connector
2. Variable resistor
3. Arm
4. Froat

**Function**

- This sensor is mounted to the side surface of the fuel tank. The float moves vertically depending on the remaining quantity of the fuel.
  The movement of the float operates the variable resistor through the arm and sends a signal to the machine monitor to indicate the remaining quantity of the fuel.

**Coolant temperature sensor (Formonitor)**

**HST oil temperature sensor**

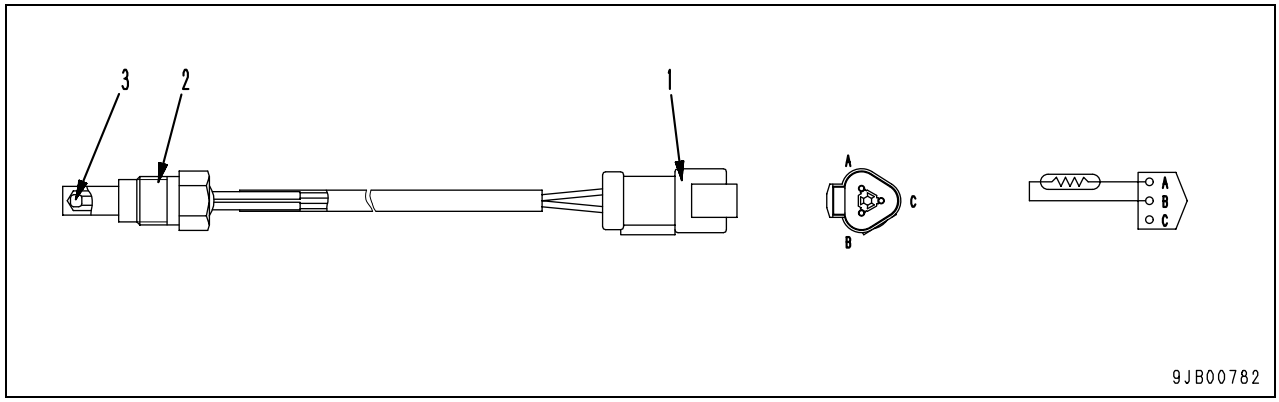



1. Connector
2. Plug
3. Thermistor

**Function**

- The coolant temperature sensor (for monitor) is installed to the engine cylinder block and the HST oil temperature sensor is installed to the hydraulic piping of motor 2. They generate thermistor resistance change signals as temperature change signals.

**Coolant temperature sensor (For preheating)**

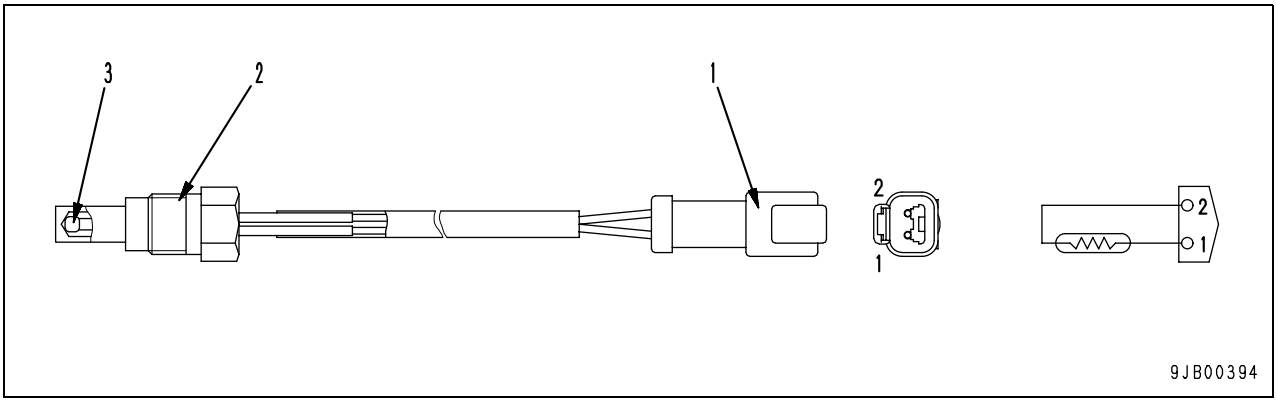



1. Connector
2. Plug
3. Thermistor

**Function**

- The coolant temperature sensor (for preheating) is installed to the engine coolant piping. It generates thermistor resistance change signals as temperature change signals.

**Axle oil temperature sensor**

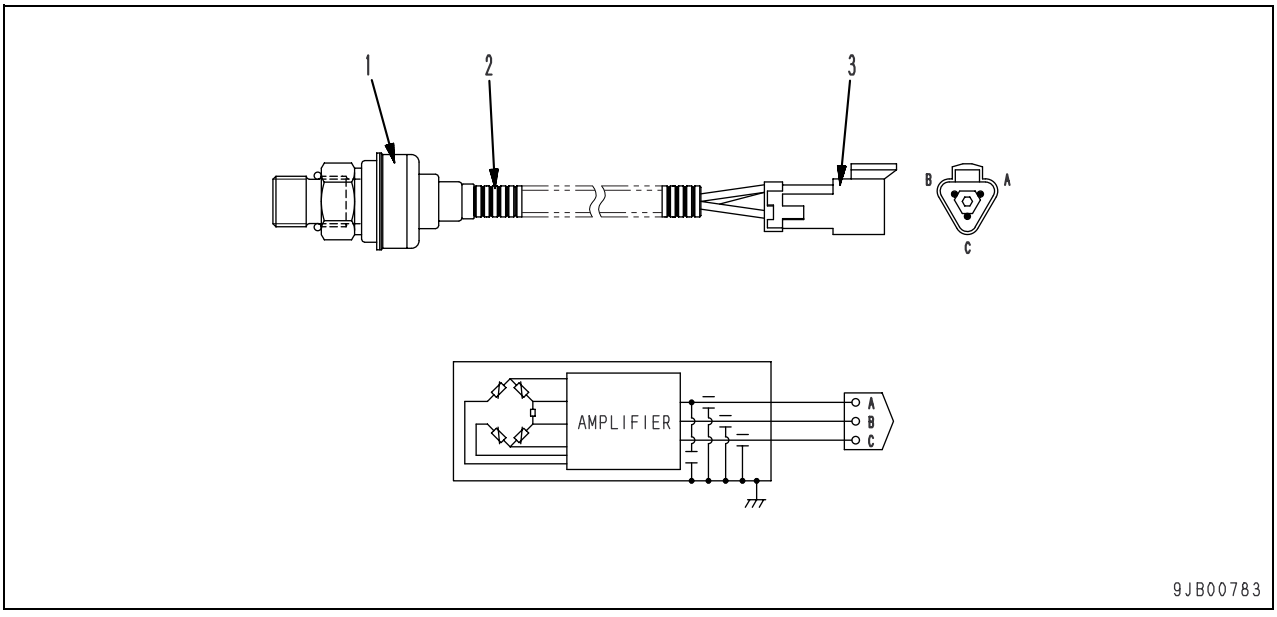



1. Connector
2. Plug
3. Thermistor

**Function**

- The axle oil temperature sensor is installed to the front axle. It generates thermistor resistance change signals as temperature change signals.

**HST oil pressure sensor**



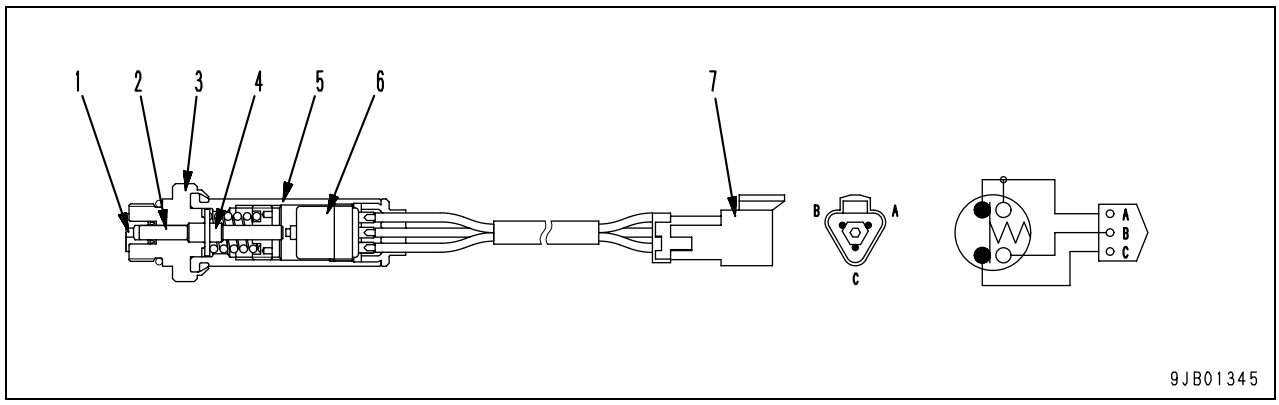

1. Sensor
2. Lead wires
3. Connector

**Function**

- The HST oil pressure sensor is installed to the solenoid block of motor 2. It measures the oil pressure in the HST circuit and generates signals of that pressure.

**Steering oil pressure sensor**

**Emergency steering oil pressure sensor**

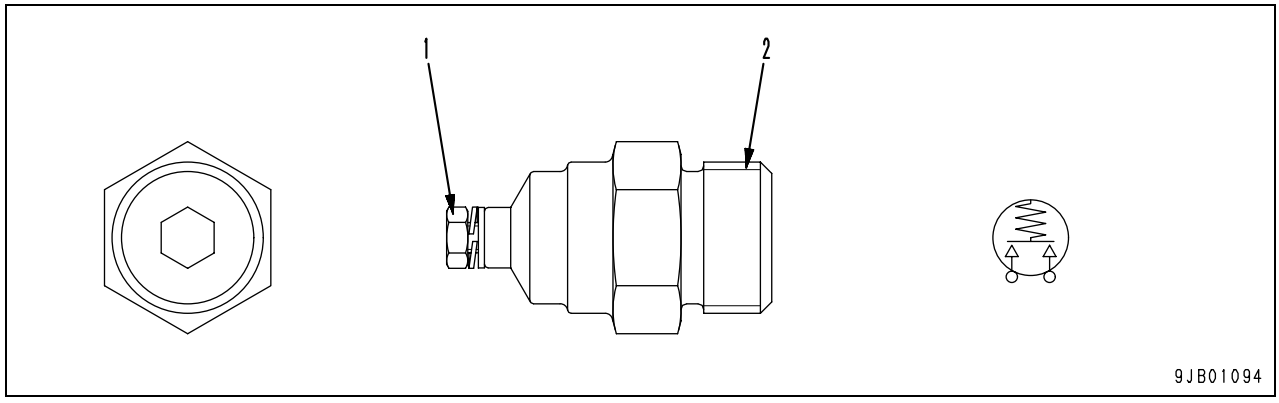



1. Retainer
2. Piston
3. Body
4. Push rod
5. Case
6. Switch
7. Connector

**Function**

- The steering oil pressure sensor is installed to the block of priority valve port P. It measures the oil pressure in the steering circuit and generates signals of that pressure.
- The emergency steering oil pressure sensor is installed to the emergency steering valve. It measures the oil pressure in the emergency steering circuit and generates signals of that pressure.

**HST filter clogging sensor**

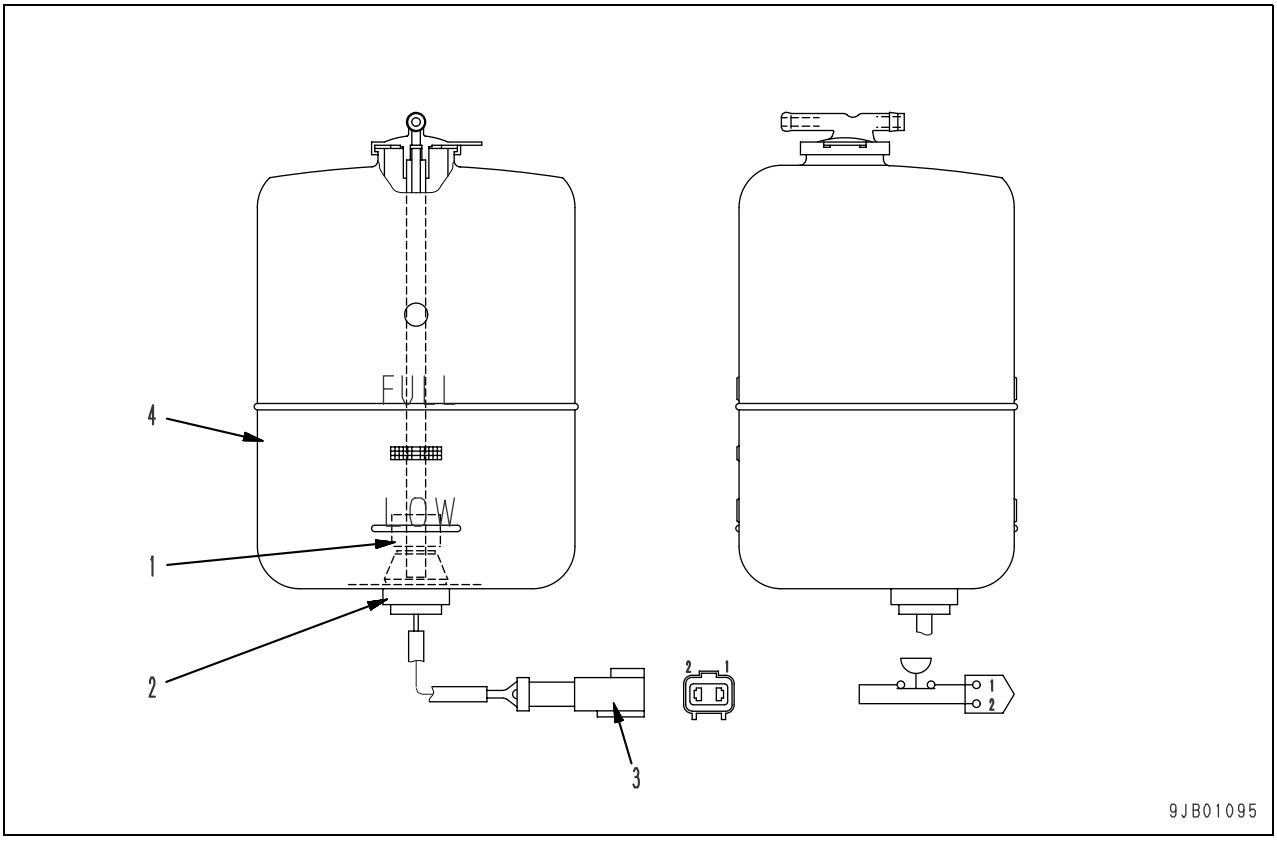



1. Terminal
2. Plug

**Function**

- The HST filter clogging sensor is installed to the HST filter. It senses the oil pressures before and after the filter. If the difference between the measured pressures exceeds the set level, the switch is turned ON.

**Coolant level sensor**




1. Float
2. Sensor
3. Connector
4. Sub-tank

**Function**

- This sensor is mounted to the sub-tank in the bulkhead. The float lowers to turn off the switch when the coolant level reaches below the specified level.

# 20 TESTING AND ADJUSTING

Standard value table
Standard value table for engine. . . . . 20-2
Standard value table for chassis . . . . . 20-3
Testing and adjusting . . . . . 20-101
Troubleshooting . . . . . 20-201

★ Note the following when making judgements using the standard value tables for testing, adjusting, or trouble-shooting.

1. The standard value for a new machine given in the table is the value used when shipping the machine from the factory and is given for reference. It is used as a guideline for judging the progress of wear after the machine has been operated, and as a reference value when carrying out repairs.
2. The service limit value given in the tables is the estimated value for the shipped machine based on the results of various tests. It is used for reference together with the state of repair and the history of operation to judge if there is a failure.
3. These standard values are not the standards used in dealing with claims

**WARNING!** When carrying out testing, adjusting, or troubleshooting, park the machine on level ground, insert the safety pins, and use blocks to prevent the machine from moving.

**WARNING!** When carrying out work together with other workers, always use signals and do not let unauthorized people near the machine.

**WARNING!** When checking the water level, always wait for the water to cool down. If the radiator cap is removed when the water is still hot, the water will spurt out and cause burns.

**WARNING!** Be careful not to get caught in the fan, fan belt or other rotating parts.

# STANDARD VALUE TABLE FOR ENGINE

| Machine Model | | | WA250-5 | |
|---|---|---|---|---|
| Engine | | | SAA6D102E-2 | |
| Item | Measurement Conditions | Unit | Standard Value For New Machine | Service Limit Value |
| Revolving Speed | High idling | rpm | 2,250 ± 50 | - |
| | Low idling | | 825 ± 50 | - |
| | Rated revolving speed | | 2,000 | - |
| Exhaust gas color | At sudden acceleration | Bosch index | Max. 5.0 | Min. 7.0 |
| | At high idling | | Max. 0.5 | Max. 2.0 |
| Valve clearance | Air intake valve | mm | 0.25 | - |
| | Exhaust valve | | 0.51 | - |
| | (Normal temperature) | | | |
| Compression pressure | Oil temperature: 40 - 60°C | MPa {kg/cm$^2$} | Min. 2.4 | 1.69 |
| | (SAE15W-40 oil) | | {Min. 24.6} | {17.2} |
| | (Engine speed) | (rpm) | (250 - 280) | (250 - 280) |
| Blow-by pressure | At high idling<br>(Water temperature: Min. 70°C)<br>(SAE15W-40 oil) | KPa {mmH2O} | Max. 0.49<br>{Max. 50} | Max. 0.98<br>{Max. 100} |
| Oil pressure | (Oil temperature: Min. 80°C) | | | |
| | At high idling (SAE15W-40) | kPa {kg/cm$^2$} | 340 - 640<br>{3.5 - 6.5} | 245<br>{2.5} |
| | At low idling (SAE15W-40) | | Min. 150<br>{Min. 1.5} | 80<br>{0.8} |
| Oil temperature | All revolution range (Inside oil pan) | °C | 90 -110 | Min. 120 |
| Fuel injection timing | Before compression top dead center | °(deg.) | 10 ± 1 | 10 ± 1 |
| Fan belt tension | - | - | Auto-tensioner | - |
| Air conditioner compressor belt tension | Deflection made by finger pressure of about 98.1N {about 10kg} | mm | 10 - 15 | 10 - 15 |

# STANDARD VALUE TABLE FOR CHASSIS

| Machine model | | | | | WA250-5 | |
|---|---|---|---|---|---|---|
| Category | Item | | Measurement Conditions | Unit | Standard Value For New Machine | Service Limit Value |
| Accelerator pedal | Pressing effort | | • Engine running<br>• Measure at 150 mm from fulcrum of pedal | N {kg} | $61.7\ ^{+19.6}_{0}$<br>$\{6.3\ ^{+2}_{0}\}$ | 132.4{13.5} |
| | Pressing angle | α1 | • Engine stopped<br>★ Detail drawing, See TESTING AND ADJUSTING | deg. | 50 | - |
| | | α2 | | | $31.5\ ^{+3}_{-2}$ | - |
| | Height of stopper L1 | | | mm | 52 | - |
| Directional lever | Operating effort | N - FORWARD | • Engine stopped<br>• Measure at 10 mm from top of lever | N {kg} | $5.9\ ^{+5.9}_{0}$<br>$\{0.6\ ^{+0.6}_{0}\}$ | 13.7 {1.4} |
| | | N - REVERSE | | | $5.9\ ^{+5.9}_{0}$<br>$\{0.6\ ^{+0.6}_{0}\}$ | 13.7 {1.4} |
| | Travel | N - FORWARD | | mm | 45 ± 10 | 40 ± 20 |
| | | N - REVERSE | | | 45 ± 10 | 40 ± 20 |
| Speed switch (Dial switch) | Operating effort | F1 - F2 | • Engine stopped<br>• Measure at 10 mm from end of switch knob | N {kg} | 7.8 ± 4.9<br>{0.8 ± 0.5} | 15.7<br>{1.6} |
| | | F2 - F3 | | | 7.8 ± 4.9<br>{0.8 ± 0.5} | 15.7<br>{1.6} |
| | | F3 - F4 | | | 7.8 ± 4.9<br>{0.8 ± 0.5} | 15.7<br>{1.6} |
| | Travel | F1 - F2 | • Engine stopped | deg. | 30 ± 5 | 30 ± 10 |
| | | F2 - F3 | | | 30 ± 5 | 30 ± 10 |
| | | F3 - F4 | | | 30 ± 5 | 30 ± 10 |
| Steering wheel | Operating effort | | • Flat, horizontal, straight, dry paved road surface<br>• Engine speed: Low idling (Bucket empty)<br>• Hydraulic oil temperature: 45 - 55°C<br>• Engine water temperature: Operating range<br>• Tire inflation pressure: Specified pressure | N {kg} | 9.8 ± 2.9<br>{1.0 ± 0.3} | Max. 14.7<br>{Max. 1.5} |
| | Operating time | Low idling | • Flat, horizontal, straight, dry paved road surface<br>• Hydraulic oil temperature: 45 - 55°C<br>• Engine water temperature: Operating range<br>• Tire inflation pressure: Specified pressure<br>• Machine stopped<br>• Steering wheel turning speed: 60rpm | Sec. | 3.7 ± 0.4 | Max. 4.8 |
| | | High idling | | | 3.7 ± 0.3 | 3.7 ± 1 |
| | Play | | • Engine stopped<br>• Machine facing straight to front | mm | 20 ± 20 | Max. 60 |
| Brake pedal | Pressing angle | • α1: Pressing effort at 0N {0kg} | • Engine water temperature: Operating range<br>• Engine speed: Low idling<br>• Detail drawing, See TESTING AND ADJUSTING | deg. | 50 | - |
| | | • α2: Pressing effort at 196N {20kg} | | | 35 ± 2 | 35 ± 4 |

| Machine model | | | | | | WA250-5 | |
|---|---|---|---|---|---|---|---|
| Category | Item | | Measurement Conditions | | Unit | Standard Value For New Machine | Service Limit Value |
| Work equipment control lever | Operating effort | Lift arm | • Engine water temperature: Operating range<br>• Engine speed: Low idling<br>• Hydraulic oil temperature: 60 - 80°C | HOLD→RAISE | N {kg} | $14.7\,^{+4.9}_{0}$ {$1.5\,^{+0.5}_{0}$} | 29.4 {3} |
| | | | | RAISE→HOLD | | $18.6\,^{+4.9}_{0}$ {$1.9\,^{+0.5}_{0}$} | 35.3 {3.6} |
| | | | | HOLD→LOWER | | $12.3\,^{+4.9}_{0}$ {$1.25\,^{+0.5}_{0}$} | 25.7 {2.6} |
| | | | | LOWER→HOLD | | - | - |
| | | | | LOWER→FLOAT | | $18.6\,^{+4.9}_{0}$ {$1.9\,^{+0.5}_{0}$} | 35.3 {3.6} |
| | | | | FLOAT→HOLD | | $21.6\,^{+4.9}_{0}$ {$2.2\,^{+0.5}_{0}$} | 39.7 {4.0} |
| | | Bucket | | HOLD→DUMP | | $16.7\,^{+4.9}_{0}$ {$1.7\,^{+0.5}_{0}$} | 32.3 {3.3} |
| | | | | HOLD→TILT | | $14.7\,^{+4.9}_{0}$ {$1.5\,^{+0.5}_{0}$} | 29.4 {3} |
| | | | | TILT→HOLD | | $18.6\,^{+4.9}_{0}$ {$1.9\,^{+0.5}_{0}$} | 27.9 {2.9} |
| | Travel | Lift arm | | HOLD→RAISE | mm | 46 ± 9 | 46 ± 12 |
| | | | | HOLD→LOWER | | 46 ± 9 | 46 ± 12 |
| | | | | LOWER→FLOAT | | 14 ± 9 | 14 ± 12 |
| | | Bucket | | HOLD→DUMP | | 60 ± 9 | 60 ± 12 |
| | | | | HOLD→TILT | | 46 ± 9 | 46 ± 12 |
| Engine | Engine speed | HST stall | • Engine water temperature: Operating range<br>• HST oil temperature: 60 - 80°C<br>• Hydraulic oil temperature: 45 - 55°C | | rpm | 2,180 ± 100 | 2,180 ± 200 |
| | | Hydraulic stall | | | | 2,070 ± 100 | 2,070 ± 200 |
| | | Full stall (HST stall + Hydraulic stall) | | | | 2,040 ± 200 | 2,040 ± 300 |

| Machine model | | | | | | WA250-5 | |
|---|---|---|---|---|---|---|---|
| Category | Item | | Measurement Conditions | | Unit | Standard Value For New Machine | Service Limit Value |
| Power train (HST) | HST oil pressure | High pressure cut-off pressure | • Engine speed: Full speed<br>• Hydraulic oil temperature: 45 -55°C<br>• Directional lever: FORWARD<br>• Speed switch: 3RD speed | | MPa {kg/cm$^2$} | $44.1^{+1.47}_{0}$ {$450^{+15}_{0}$} | $44.1^{+1.96}_{0}$ {$450^{+20}_{0}$} |
| | | Low pressure relief pressure (Work equipment PPC circuit pressure) | • Engine speed: Full speed<br>• Hydraulic oil temperature: 45 -55°C<br>• Directional lever: N | | | $2.46^{+0.2}_{0}$ {$25^{+2}_{0}$} | $2.46^{+0.2}_{0}$ {$25^{+2}_{0}$} |
| | | Servo piston control oil pressure | • Engine speed: Full speed<br>• Hydraulic oil temperature: 45 - 55°C<br>• Directional lever: N | When brake pedal releasing | | 2.6 ± 0.1 {27 ± 1} | 2.6+0.1/-0.2 {27+1/-2} |
| | | | | When brake pedal depressing | | 0.59 ± 0.1 {6 ± 1} | 0.59+0.1/-0.2 {6+1/-2} |
| | Transfer | Clutch control pressure | • Hydraulic oil temperature: 45 - 55°C<br>• Directional lever: FORWARD<br>• Speed switch: 3RD or 4TH speed<br>• Travel at a speed of at least 10km/h | | | $2.46^{+0.2}_{0}$ {$25^{+2}_{0}$} | $2.46^{+0.2}_{0}$ {$25^{+2}_{0}$} |
| Steering | Steering relief pressure | | • Engine speed: High idling<br>• Hydraulic oil temperature: 45 - 55°C | | | 18.6 ± 0.7 {190 ± 7} | 18.6 ± 2.0 {190 ± 20} |
| Wheel brake | Performance | | • Flat, horizontal, straight, dry paved road surface<br>• Speed when applying brake: 32km/h, braking delay: Within 0.1sec<br>• Brake pedal operating effort: 313.8N{32kg}<br>• Tire inflation pressure: Specified pressure<br>• Measure braking distance | | m | Max.14 | Max.14 |
| | Disc wear | | • Thickness of lining | | mm | 1 ± 0.1 | Max.0.6 |
| Parking brake | Performance | | • Tire inflation pressure: Specified pressure<br>• Flat paved road with 1/5 (11°20') grade<br>• Machine at operating condition | | - | Holds position | Holds position |
| Work equipment control valve | Relief pressure | | • Engine speed: High idling<br>• Hydraulic oil temperature: 45 - 55°C | | MPa {kg/cm$^2$} | 20.6 ± 0.4 {210 ± 4} | 20.6 ± 2.0 {210 ± 20} |

| Machine model | | | | | | WA250-5 | |
|---|---|---|---|---|---|---|---|
| Category | Item | | Measurement Conditions | | Unit | Standard Value For New Machine | Service Limit Value |
| Work equipment | Speed | Lift arm | • Engine speed: High idling<br>• Hydraulic oil temperature: 45 - 55°C<br>• Steering valve: Neutral<br>• Apply no load<br>• Time taken for work equipment to rise from position with bucket in contact with ground (bottom of bucket horizontal) to max. height of lift arm | RAISE | Sec. | 5.9 ± 0.5 | Max. 8.2 |
| | | | | LOWER | | 3.4 ± 0.5 | Max. 4.7 |
| | | Bucket | • Engine speed: High idling<br>• Hydraulic oil temperature: 45 - 55°C<br>• Steering valve: Neutral<br>• Apply no load<br>• Time taken for bucket to move from max. tilt to max. dump | TILT | | 2.3 ± 0.3 | Max. 3.8 |
| | | | | DUMP | | 1.7 ± 0.3 | Max. 2.5 |
| | | | • Engine speed: High idling<br>• Hydraulic oil temperature: 45 - 55°C<br>• Steering valve: Neutral<br>• Apply no load<br>• Time taken for bucket to move from horizontal position to max. tilt | TILT | | 1.4 ± 0.3 | Max. 2 |
| | Hydraulic drift | Lift arm cylinder | • Bucket no load<br>• Position of work equipment: Lift arm and bucket in level position<br>• Engine stopped<br>• Hydraulic oil temperature: 45 -55°C<br>• Stop engine and leave for 5 minutes, then measure for 15 minutes. | | mm | Max. 20 | Max. 20 |
| | | Bucket cylinder | | | | Max. 17 | Max. 20 |
| Proximity switch | Clearance between bucket positioner switch | | • Hydraulic oil temperature: 45 -55°C | | | 3 - 5 | - |
| | Clearance between lift arm positioner switch | | | | | 3 - 5 | - |
| Oil pressure drive fan | Max. fan speed | | • Engine speed: High idling<br>• Hydraulic oil temperature: 45 -55°C | | rpm | 1,440 ± 40 | - |
| | Fan driving pressure | | • Hydraulic oil temperature: 45 -55°C | | MPa {kg/cm$^2$} | 15.7 ± 1.6 {160 ± 16} | 15.7 ± 2.5 {160 ± 25} |

# TESTING AND ADJUSTING


Tools for testing, adjusting, and troubleshooting . . . . . 20-102
Measuring engine speed . . . . . 20-104
Measuring exhaust gas color . . . . . 20-105
Adjusting valve clearance . . . . . 20-106
Measuring compression pressure . . . . . 20-108
Measuring blow-by pressure . . . . . 20-109
Testing and adjusting fuel injection timing . . . . . 20-110
Measuring engine oil pressure . . . . . 20-111
Measuring, testing operating force of accelerator pedal . . . . . 20-112
Adjusting engine stop solenoid . . . . . 20-114
Adjusting engine speed sensor . . . . . 20-115
Testing and adjusting air conditioner compressor belt tension . . . . . 20-115
Measuring directional lever . . . . . 20-116
Testing and adjusting HST oil pressure . . . . . 20-117
Measuring clutch control pressurer . . . . . 20-122
Testing and adjusting steering wheel . . . . . 20-123
Testing and adjusting steering oil pressure . . . . . 20-125
Bleeding air from steering circuit . . . . . 20-126
Testing hydraulic fan . . . . . 20-127
Measuring brake pedal . . . . . 20-128
Testing and adjusting brake pedal linkage . . . . . 20-129
Measuring brake performance . . . . . 20-130
Testing and adjusting accumulator charge pressure . . . . . 20-131
Measuring brake oil pressurer . . . . . 20-132
Measuring wear of brake disc . . . . . 20-134
Bleeding air from brake circuit . . . . . 20-135
Measuring parking brake performance . . . . . 20-136
Testing and adjusting parking brake linkage . . . . . 20-137
Measuring parking brake release pressure . . . . . 20-138
Measuring and adjusting work equipment control lever . . . . . 20-139
Testing and adjusting work equipment hydraulic pressure . . . . . 20-140
Testing and adjusting work equipment PPC oil pressure . . . . . 20-141
Bleeding air . . . . . 20-143
Releasing remaining pressure in hydraulic circuit . . . . . 20-144
Testing and adjusting bucket positioner . . . . . 20-145
Testing and adjusting of boom kick-out . . . . . 20-146
Checking proximity switch actuation display lamp . . . . . 20-147
Procedure for checking diode . . . . . 20-148
Special functions of machine monitor . . . . . 20-149
Flow of modes and functions . . . . . 20-150
Pm clinic inspection chart . . . . . 20-168


When carrying out testing, adjusting, or troubleshooting, park the machine on level ground, inset the safety pins, and use blocks to prevent the machine from moving.

When carrying out work together with other workers, always use signals and do not let unauthorized people near the machine.

When checking the water level, always wait for the water to cool down. If the radiator cap is removed when the water is still hot, the water will spurt out and cause burns.

Be careful not to get caught in the fan, fan belt or other rotating parts.

# TOOLS FOR TESTING, ADJUSTING, AND TROUBLESHOOTING

| Check or measurement item | Symbol | | Part No. | Part Name | Q'ty | Remarks |
|---|---|---|---|---|---|---|
| Engine speed | A | 1 | 799-203-8001 | Multi-tachometer | 1 | Digital indication L: 60 – 2,000rpm H: 60 – 19,999rpm |
| | | 2 | 795-790-2500 | Adapter | 1 | For 102 engine series |
| Exhaust gas color | B | 1 | 799-201-9000 | Handy smoke checker | 1 | Discoloration 0- 70% (With standard color) (Discoloration x 1/10 ✕ Bosch index) |
| | | 2 | Commercially available | Smoke meter | 1 | |
| Valve clearance | Q | 1 | 795-799-1131 | Gear | 1 | For 102 engine series |
| | | 2 | Commercially available | Filler gauge | 1 | (Intake: 0.25mm, Exhaust: 0.51mm) |
| Compression pressure | D | 1 | 795-502-1205 | Compression gauge | 1 | 0 – 6.9MPa {0 – 70kg/cm$^2$} |
| | | 2 | 795-502-1700 | Adapter | 1 | For 102 engine series |
| Blow-by pressure | E | 1 | 799-201-1504 | Blow-by kit | 1 | 0 – 4.9MPa {0 – 500mmH2O} |
| | | 2 | 795-790-1950 | Tool (Nozzle) | 1 | |
| Fuel injection timing | Q | 1 | 795-799-1131 | Gear | 1 | |
| | | 2 | 795-799-1900 | Pin assembly | 1 | |
| | | 3 | 795-799-1950 | Lock pin | 1 | |
| Engine oil pressure | C | 1 | 799-101-5002 | Hydraulic tester | 1 | Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm$^2$} |
| | | | 790-261-1203 | Digital hydraulic tester | 1 | Pressure gauge: 58.8MPa {600kg/cm$^2$} |
| | | 2 | 799-401-2320 | Hydraulic tester | 1 | Pressure gauge:0.98MPa {10kg/cm$^2$} |
| Clearance of swing circle bearing | H | | Commercially available | Dial gauge | 1 | |
| Work equipment, swing or travel circuits oil pressure | J | 1 | 799-101-5002 | Hydraulic tester | 1 | Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm$^2$} |
| | | | 790-261-1203 | Digital hydraulic tester | 1 | Pressure gauge: 58.8MPa {600kg/cm$^2$} |
| | | 2 | 799-101-5220 | Nipple | 2 | Size: 10 x 1.25mm |
| | | | 07002-11023 | O-ring | 2 | |
| Control circuit oil pressure | K | 1 | 799-101-5002 | Hydraulic tester | 1 | Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm$^2$} |
| | | | 790-261-1203 | Digital hydraulic tester | 1 | Pressure gauge: 58.8MPa {600kg/cm$^2$} |
| | | 2 | 799-101-5220 | Nipple | 1 | Size: 10 x 1.25mm |
| | | | 07002-11023 | O-ring | 1 | |
| Pump PC control circuit oil pressure | L | 1 | 799-101-5002 | Hydraulic tester | 1 | Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm$^2$} |
| | | | 790-261-1203 | Digital hydraulic tester | 1 | Pressure gauge: 58.8MPa {600kg/cm$^2$} |
| | | 2 | 799-101-5220 | Nipple | 3 | Size: 10 x 1.25mm |
| | | | 07002-11023 | O-ring | 3 | |
| Pump LS control circuit oil pressure | M | 1 | 799-101-5002 | Hydraulic tester | 1 | Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm$^2$} |
| | | | 790-261-1203 | Digital hydraulic tester | 1 | Pressure gauge: 58.8MPa {600kg/cm$^2$} |
| | | 2 | 799-101-5220 | Nipple | 3 | Size: 10 x 1.25mm |
| | | | 07002-11023 | O-ring | 3 | |
| | | 3 | 799-401-1340 | Differential pressure gauge | 1 | |
| Solenoid valve output oil pressure | N | 1 | 799-101-5002 | Hydraulic tester | 1 | Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm$^2$} |
| | | | 790-261-1203 | Digital hydraulic tester | 1 | Pressure gauge: 58.8MPa {600kg/cm$^2$} |
| | | 2 | 799-401-3100 | Nipple | 1 | Size: 02 |
| | | | 02896-11008 | O-ring | 1 | |
| PPC valve output oil pressure | P | | 799-101-5002 | Hydraulic tester | 1 | Pressure gauge:2.5, 5.9, 39.2, 58.8MPa {25, 60, 400, 600kg/cm$^2$} |
| | | | 790-261-1203 | Digital hydraulic tester | 1 | Pressure gauge: 58.8MPa {600kg/cm$^2$} |

| Check or measurement item | Symbol | | Part No. | Part Name | Q'ty | Remarks |
|---|---|---|---|---|---|---|
| Oil leakage inside hydraulic cylinder | N | | Commercially available | Cylinder | 1 | |
| Water temperature, oil temperature | P | | 799-101-1502 | Digital thermometer | 1 | -99.9 – 1,299°C |
| Operating effort | Q | | 79A-264-0021 | Push-pull scale | 1 | 0 – 294N {0 – 30kg} |
| | | | 79A-264-0091 | Push-pull scale | 1 | 0 – 490N {0 – 50kg} |
| Stroke, hydraulic drift | R | | Commercially available | Scale | 1 | |
| Work equipment speed | S | | Commercially available | Stopwatch | 1 | |
| Voltage, resistance | T | | Commercially available | Tester | 1 | |
| Troubleshooting of sensor and wiring harness | U | 1 | 799-601-7400 | T-adapter assembly | 1 | |
| | | | 799-60-7310 | Adapter | 1 | For SWP-12 |
| | | | 799-60-7320 | Adapter | 1 | For SWP-16 |
| | | | 799-60-7330 | Adapter | 1 | For S-16 (White) |
| | | | 799-60-7340 | Adapter | 1 | For M-8 |
| | | | 799-60-7350 | Adapter | 1 | For S-12 (White) |
| | | | 799-60-7360 | Adapter | 1 | For Relay (5 pin) |
| | | | 799-60-7520 | Adapter | 1 | For AMP070-12 |
| | | 2 | 799-601-9000 | T-adapter assembly | 1 | For DT type connector |
| | | 3 | 799-601-9300 | T-adapter assembly | 1 | For DT type connector (For 24, 40 pin) |

# MEASURING ENGINE SPEED

**Special tools required**

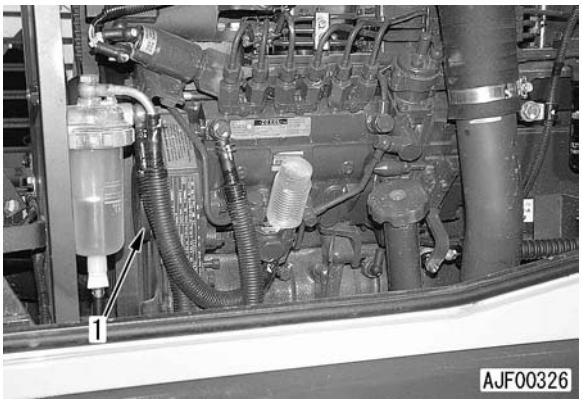
| Symbol | | Part No. | Part Name |
|---|---|---|---|
| A | 1 | 799-203-8001 | Multi-tachometer |
| | 2 | 795-790-2500 | Adapter assembly |

**WARNING!** When installing or removing the measuring equipment, be careful not to touch any hot parts.

**MEASURING HIGH-IDLING AND LOW-IDLING SPEEDS**

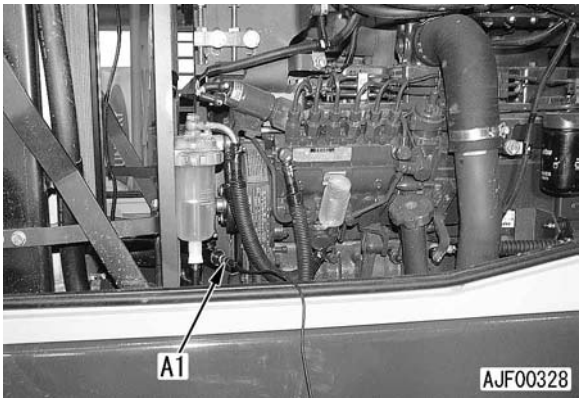
★ Measure the engine speed under the following conditions.
- Coolant temperature: Within operating range.
- Hydraulic temperature: 45 - 55°C
- HST oil temperature: 60 - 80°C

1. Remove cap (1) of speed pick-up port.




2. Install adapter **A2** and connect multi-tachometer **A1**.

**WARNING!** When measuring the engine speed, be careful not to touch any rotating parts or hot parts.




3. Start engine, and then measure the engine speeds at high-idling and low-idling.

**MEASURING HST STALL SPEED**

**WARNING!** Dig the bucket into the stockpile to prevent the machine from moving forward.

★ Check that the low idling and high idling speeds are the standard value.
★ Check that the engine speed is within the standard value. If it is not within the standard value, loosen the linkage and check that there is no play.
1. Measure the engine speed when the HST is stalled.

**MEASURING HYDRAULIC SPEED**

★ Check that the low idling and high idling speeds are the standard value.
★ Check that the engine speed is within the standard value. If it is not within the standard value, loosen the linkage and check that there is no play.
1. Start the engine and run at low idling.
2. Operate the work equipment control lever and operate the cylinder to the end of its stroke.
3. Relieve the cylinder at the end of its stroke and measure the engine speed at this point.

**MEASURING FULL STALL SPEED**

- Measure the engine speed when the HST stall and hydraulic stall (bucket dump end relief) are carried out at the same time.

★ Measure the full stall if the HST stall speed and hydraulic stall speed are normal.
If either of them shows any abnormality, remove the problem and carry out the measurement again.

# MEASURING EXHAUST GAS COLOR

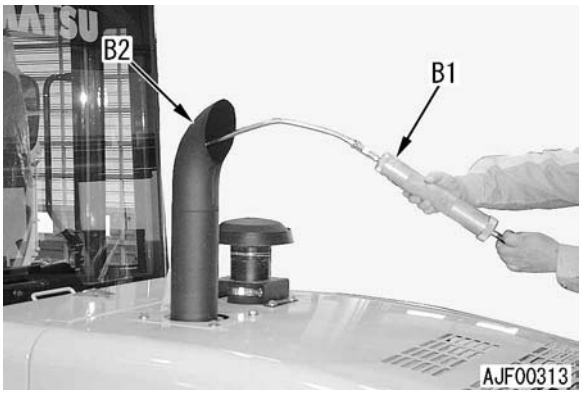
**Special tools required**

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| B | 1 | 799-201-9000 | Handy Smoke Checker |
| | 2 | Commercially available | Smoke meter |

**WARNING!** When installing or removing the measuring equipment, be careful not to touch any hot parts.

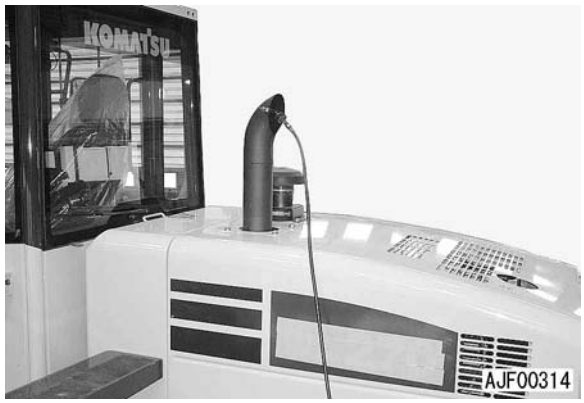
★ When measuring in the field where there is no air or power supply, use Handy Smoke Checker **B1**; when recording official data, use Smoke meter **B2**.

1. Measuring with Handy Smoke Checker **B1**
   1) Fit filter paper in tool **B1**.
   2) Insert the exhaust gas intake port into the exhaust pipe.
   3) Start the engine and raise the engine water temperature to the operating range.
   4) Accelerate the engine suddenly run it at high idling, and at the same time operate the handle of Handy Smoke Checker **B1** to catch the exhaust gas on the filter paper.

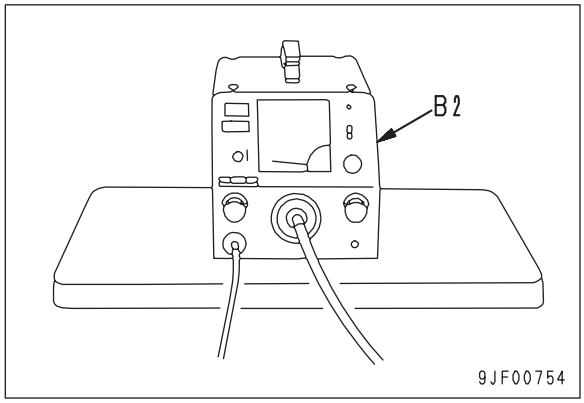



   5) Remove the filter paper and compare it with the scale provided to judge the condition.
   6) After completing the measurement, remove the measuring equipment and return to the original condition.

2. Measuring with Smoke Meter **B2**
   1) Insert probe of smoke meter **B2** into the outlet port of the exhaust pipe, then secure it to the exhaust pipe with the clip.




   2) Connect the probe hose, accelerator switch plug, and air hose to smoke meter **B2**.
      ★ The pressure of the air supply should be less than 1.5 MPa {15 kg/cm$^2$}.
   3) Connect the power cord to the AC 100 V outlet.
      ★ Before connecting the cord, check that the power switch of the smoke meter is OFF.
   4) Loosen the cap nut of the suction pump, then fit the filter paper.
      ★ Fit the filter paper securely so that the exhaust gas does not leak.
   5) Turn the power switch of smoke meter **B2** ON.



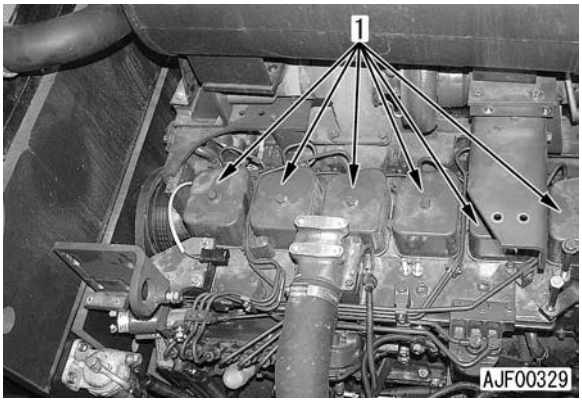

   6) Start the engine and raise the engine water temperature to the operating range.
   7) Accelerate the engine suddenly, and at the same time, depress the accelerator pedal to catch the exhaust gas color on the filter paper.
   8) Lay the filter paper used to catch the exhaust gas color on top of unused filter papers (10 sheets or more) inside the filter paper holder, and read the indicated value.
   9) After completing the measurement, remove the measuring equipment and return to the original condition.

# ADJUSTING VALVE CLEARANCE

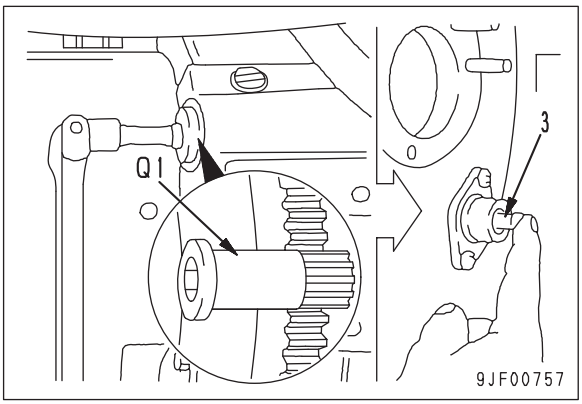
**Special tools required**

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| Q | 1 | 795-799-1131 | Gear (Cranking tool) |
| | 2 | Commercially available | Filler gauge |

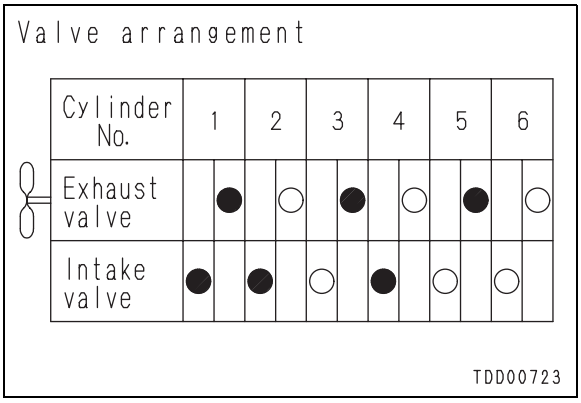
1. Remove the air cleaner, then remove all cylinder head covers (1).




2. Remove cap (2), then use gear **Q1** to rotate the crankshaft in the normal direction until timing pin (3) enters the hole in the gear.
   - ★ Push pin (3) lightly while cranking.
   - ★ The position where the pin enters is the top dead center for No. 1 cylinder.
   - ★ At compression top dead center, the rocker arm of the No. 1 cylinder moves by hand an amount equal to the valve clearance.



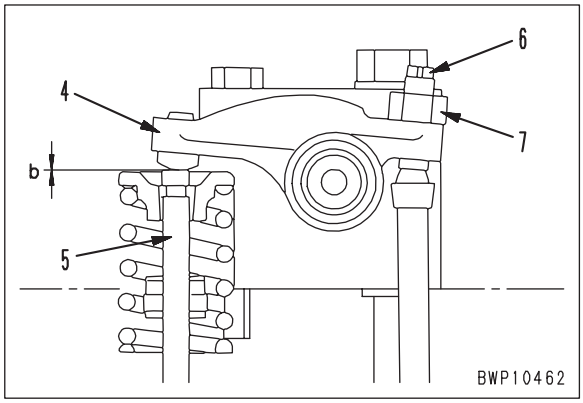

3. In this position, adjust the valve clearance of the valves marked ● in the valve arrangement chart. At the same time, make counter marks on the crankshaft pulley and timing gear case, then remove timing pin (3).

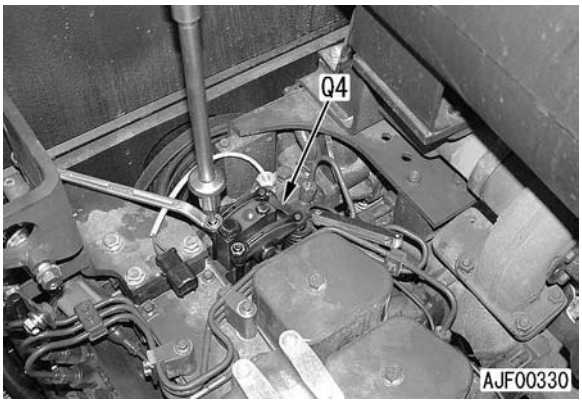



4. Rotate the crankshaft one more turn in the normal direction, align the counter marks made in Step 3, then adjust the valve clearance of the remaining valves marked ○.
   - ★ When adjusting the valve clearance, loosen locknut (7) of adjustment screw (6), insert filler gauge **Q4** between the valve stem (5) and rocker arm (4), and adjust the clearance so that it is a sliding fit. Then tighten the locknut to hold the adjustment screw in position.

**Locknut: 24± 4 Nm {2.45± 0.41 kgm}**

   - ★ After tightening the locknut, check the valve clearance again.
   - ★ Firing order: 1 - 5 - 3 - 6 - 2 - 4 Valve clearance
     Intake: 0.25 mm
     Exhaust: 0.51 mm




Q4
AJF00330

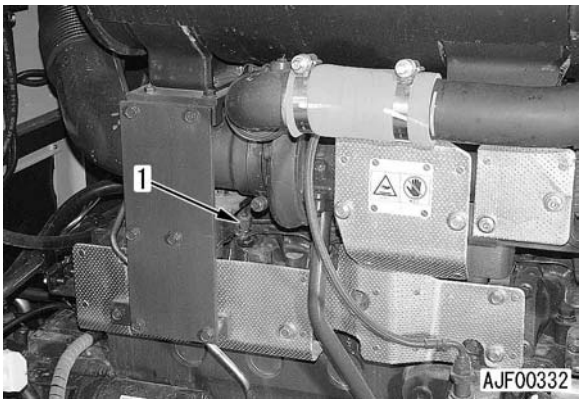
# MEASURING COMPRESSION PRESSURE

**Special tools required**

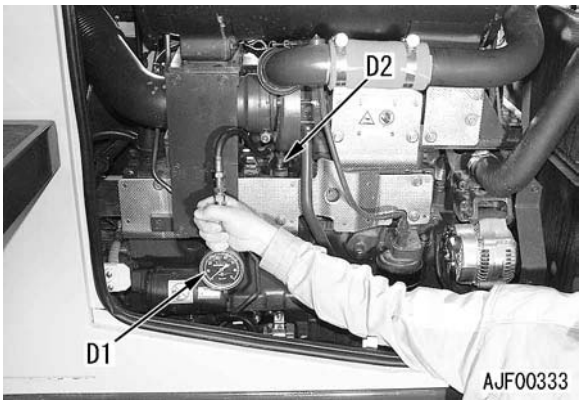
| Symbol | | Part No. | Part Name |
|---|---|---|---|
| D | | 795-502-1205 | Compression gauge |
| D | 1 | 795-502-1590 | Gauge assembly |
| | 2 | 795-502-1700 | Adapter |
| A | 1 | 799-201-8001 | Multi-tachometer |

**WARNING!** When measuring the compression pressure, be careful not to burn yourself on the exhaust manifold or muffler, or to get your clothes caught in the fan, fan belt or other rotating parts.

1. Adjust the valve clearance.
   For details, see ADJUSTING VALVE CLEARANCE.
2. Warm up the engine to make the oil temperature 40 - 60°C.
3. Remove nozzle holder assembly (1) from the cylinder to be measured.




4. Install adapter **D2** in the mount of the nozzle holder, then connect compression gauge D1.



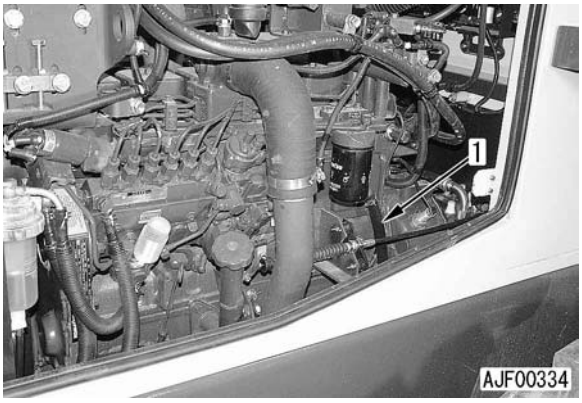

5. Set multi-tachometer **A1** in position.
   ★ For details, see MEASUREMENT OF ENGINE SPEED.
6. Disconnect fuel cut solenoid connectors (CN-E23, E03, E24).
7. Disconnect the fuel control linkage, secure the governor lever of the fuel pump at the NO INJECTION position, then crank the engine with the starting motor and measure the compression pressure.
   ★ Measure the compression pressure at the point where the pressure gauge indicator remains steady.
   ★ When measuring the compression pressure, measure the engine speed to confirm that it is within the specified range.
   ★ After measuring the compression pressure, install the nozzle holder assembly.

# MEASURING BLOW-BY PRESSURE

**Special tools required**

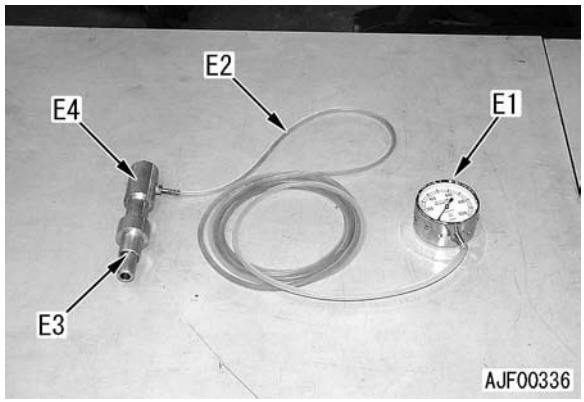
| Symbol | | Part No. | Part Name |
|---|---|---|---|
| E | | 799-201-1504 | Blow-by KIT |
| E | 1 | • 799-201-1541 | Gauge |
| | 2 | • 795-201-1571 | Tube |
| | 3 | • 799-201-1450 | Adapter |
| | 4 | • 795-790-1950 | Nozzle |

1. When measuring the blow-by, warm up the engine thoroughly so that the water temperature is at least 70°C.
2. Stop the engine, then install blow-by checker E to breather hose (1).









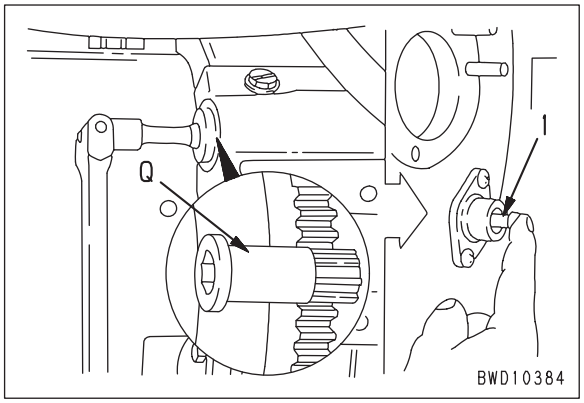

3. Run the engine at the rated output, and measure the blow-by pressure.
   - ★ The blow-by should be measured with the engine running at rated output.
   - • When measuring in the field, a similar value can be obtained at stall speed. In this case, the blow-by value will be about 80% of the value at rated output.
   - ★ Blow-by varies greatly according to the condition of the engine. Therefore, if the blow-by value is considered abnormal, check for problems connected with defective blow-by, such as excessive oil consumption, defective exhaust gas color, and prematurely dirty or deteriorated oil.

# TESTING AND ADJUSTING FUEL INJECTION TIMING

**Special tools required**

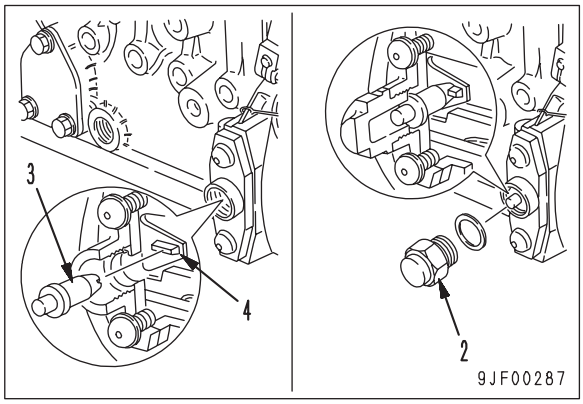
| Symbol | | Part No. | Part Name |
|---|---|---|---|
| Q | 1 | 795-799-1131 | Gear (Cranking tool) |
| | 2 | 795-799-1900 | Pin assembly |
| | 3 | 795-799-1950 | Lock pin |

1. Testing
   1) Using cranking tool **Q1**, rotate the crankshaft in the normal direction until timing pin (1) enters the hole in the gear.
      ★ Highly precise adjustment of the fuel injection timing is needed, so always lock the drive gear with the pin when adjusting the injection timing.
      ★ If it is difficult to check with the pin installed to the flywheel housing, it is possible to use metal pin assembly **Q2**.




   2) Remove plug (2), then reverse timing pin (3) and check that pin (3) meshes with timing pointer (4) on the fuel injection pump.
      ★ If it is possible to insert the timing pin smoothly, the injection timing is correct.
      ★ If it is impossible to insert the timing pin, the injection timing is not correct, so adjust it.
      ★ If it is difficult to check with the pin installed to the fuel injection pump, it is possible to use metal pin assembly **Q3**.
      ★ After completing the inspection, remove the inspection equipment and return to the original condition.

**WARNING!** Be careful not to forget to return timing pin (3) of the drive gear and the timing pin of the fuel injection pump to the original condition.




2. Adjusting
   • If the timing pin does not mesh, adjust as follows.
   1) Remove the fuel injection pump assembly. For details, see REMOVAL OF FUEL INJECTION PUMP ASSEMBLY.
   2) Rotate the camshaft of the fuel injection pump, push timing pin (3) and mesh with timing pin pointer (4).
   3) Install the fuel injection pump assembly.
      ★ For details, see INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY.
      ★ After completing the inspection, remove the inspection equipment and return to the original condition.
      ★ After completing the adjustment, remove the adjustment equipment and return to the original condition.

**WARNING!** Before starting the engine, check again that you have not forgotten to return timing pin (3) of the drive gear and the timing pin of the fuel injection pump to the original condition.

# MEASURING ENGINE OIL PRESSURE

**Special tools required**

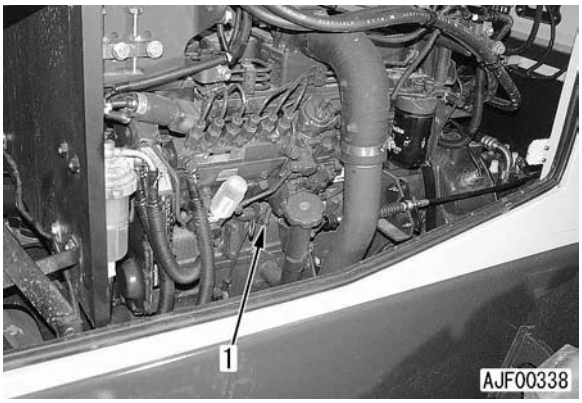
| Symbol | | Part No. | Part Name |
|---|---|---|---|
| C | 1 | 799-101-5002 | Analog type hydraulic tester |
| | | 790-261-1203 | Digital type hydraulic tester |
| K | 4 | 793-463-1100 | Stopper |

**WARNING!** When measuring, be careful not to let your clothes get caught in any rotating part.

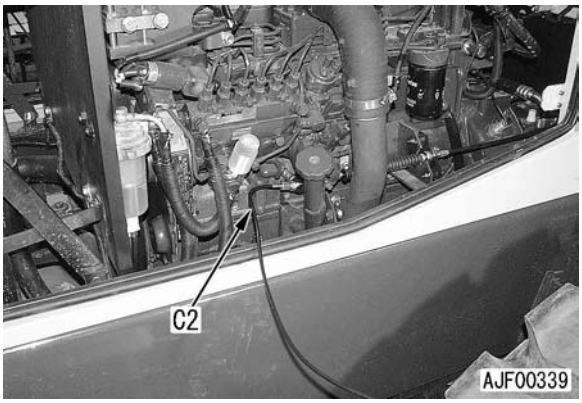
**WARNING!** Always stop the engine before removing or installing any oil pressure sensor or oil pressure gauge.

★ When measuring the oil pressure, always measure at the specified oil temperature.

1. Remove engine oil pressure sensor (1).




2. Install tool **C2** (Gauge: 1MPa {10kg/cm$^2$}).




3. Start the engine, and measure the engine oil pressure.

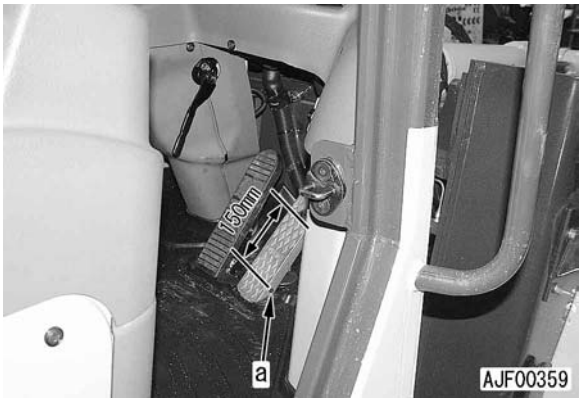
# MEASURING, TESTING OPERATING FORCE OF ACCELERATOR PEDAL

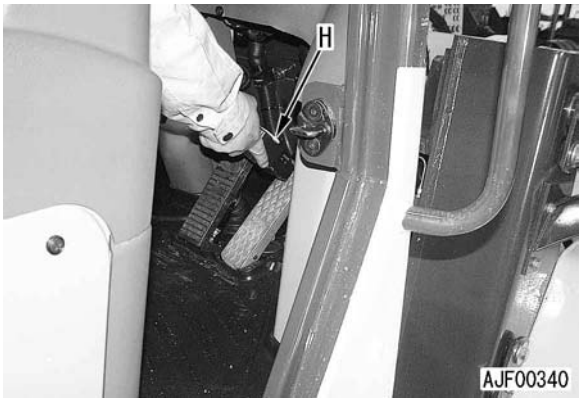
**Special tools required**

| Symbol | Part No. | Part Name |
|---|---|---|
| H | 79A-264-0021 | Push-pull scale |

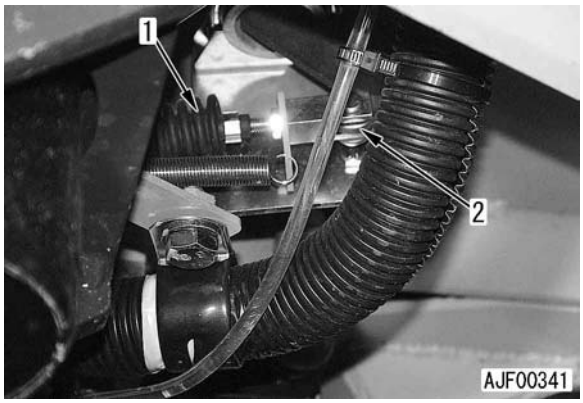
### MEASURING, TESTING OPERATING FORCE OF ACCELERATOR PEDAL

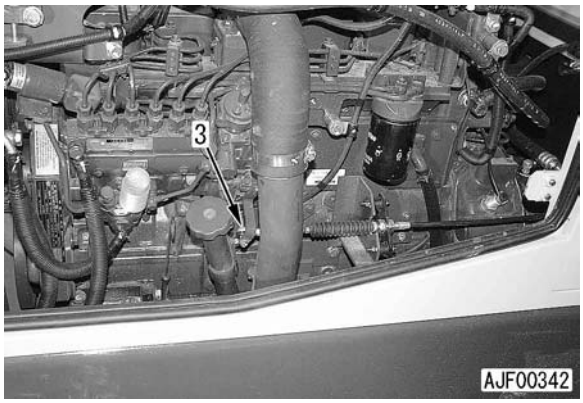
1. Set tool **H** at a position 150 mm from pedal fulcrum a.
   ★ Put the center of tool **H** in contact with a point 150 mm from the pedal fulcrum.




2. Start the engine, then measure the maximum value when the pedal is pushed in from the low idling position to the end of its travel (high idling).
3. Stop the engine.
4. Disconnect cable (1) at the bottom of the accelerator pedal, and check that there is no stiffness in plate (2) or ball joint (3) at the engine end.



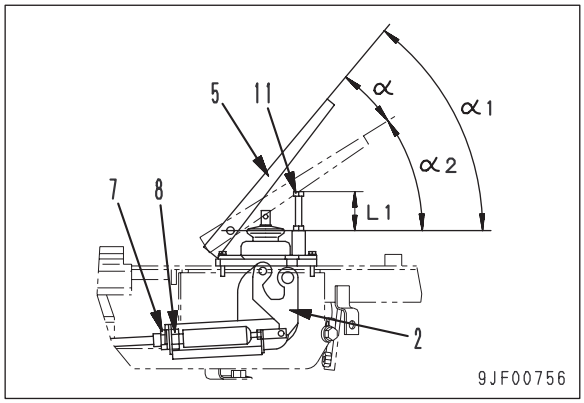



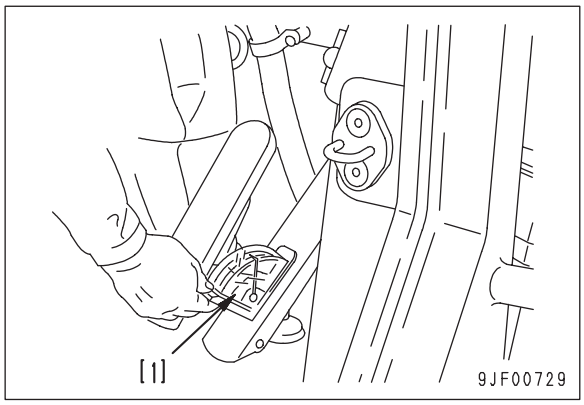

★ Carry out the above inspection, and adjust or replace parts if necessary. Then carry out the measurement of the operating effort again to check that it is within the standard value.

## OPERATING ANGLE OF ACCELERATOR PEDAL

### Measuring

1. Stop the engine.
2. Measure operating angle a when the pedal is operated from the low idling position to the high idling position.
   Put angle gauge (1) in contact with the accelerator pedal, and measure operating angle $\alpha$ ($\alpha$ = $\alpha$1 - $\alpha$2) when the pedal is operated from low idling position $\alpha$1 to high idling position $\alpha$2.




### Adjusting

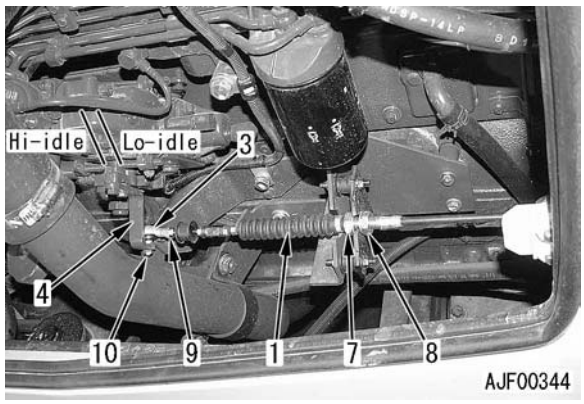
1. Open the inspection cover of the engine hood.
2. Set accelerator pedal (5) at the FREE position (lever (2) is in contact with U-bolt (6)), adjust cable (1) so that governor lever (4) is in the idling position, then tighten nuts (7) and (8).

Locknut (7), (8):
44 - 59 Nm {4.5 - 6.0 kgm}

Locknut (9):
2.9 - 4.9 Nm {0.3 - 0.5 kgm}

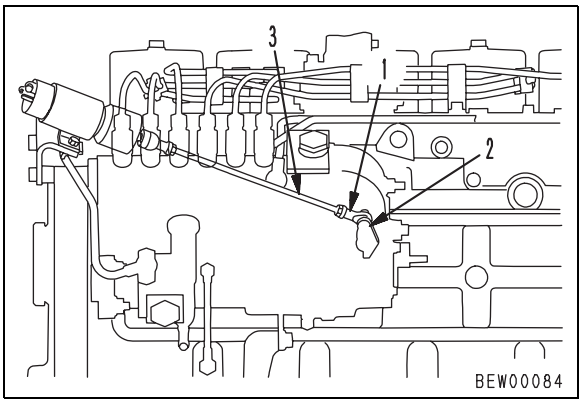
Mounting nut (19):
11.8 - 14.7 Nm {1.2 - 1.5 kgm}

3. Adjust stopper bolt (11) so that governor lever (4) is at the high idling position when accelerator pedal (5) is depressed.
   ★ Screw in ball joint (3) at least 8 mm.



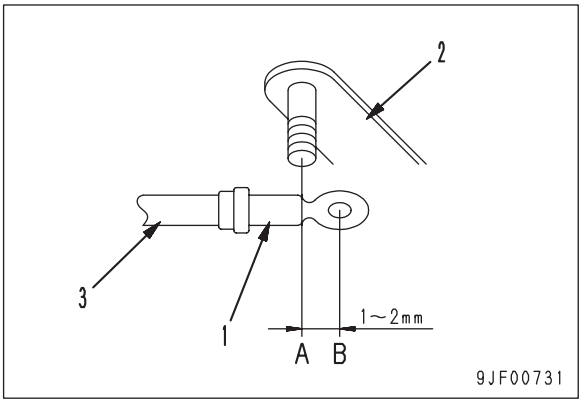
# ADJUSTING ENGINE STOP SOLENOID

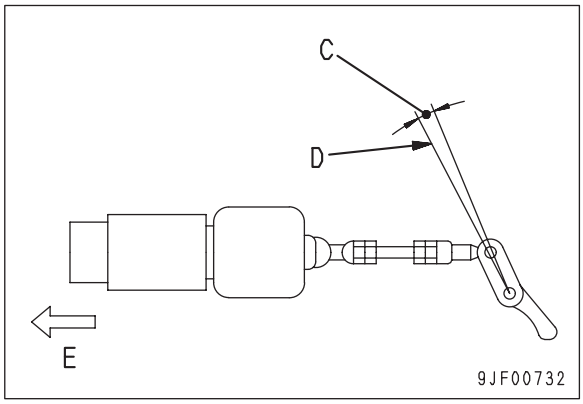
1. Disconnect joint (1) of stop rod (3) from fuel injection pump stop lever (2).
   ★ Always turn the starting switch OFF before doing this.




2. Turn the starting switch ON and actuate the solenoid.
3. Check that the relationship between the position of the pin and pin hole is as follows when fuel injection pump stop lever (2) is operated fully by hand to the OPERATING position.
   • Check that the center (portion A) of the pin hole of stop rod joint (1) is 1 - 2 mm to the right of the center (portion B) of the pin of stop lever (2).
   ★ If it is not within the above measurement, adjust with rod (3).
   C: Play from operating end
   D: Stop lever operating end
   E: Solenoid at hold position

   **WARNING!** If the above dimension is the opposite, there is a possibility that the engine stop solenoid has seized.

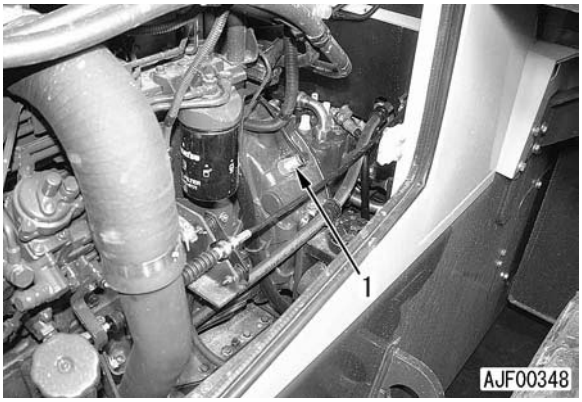



4. If the position of the pin hole is within the standard value, connect rod (3) and lever (2).
5. Start the engine, then turn the starting switch OFF and check that the engine stops.

# ADJUSTING ENGINE SPEED SENSOR

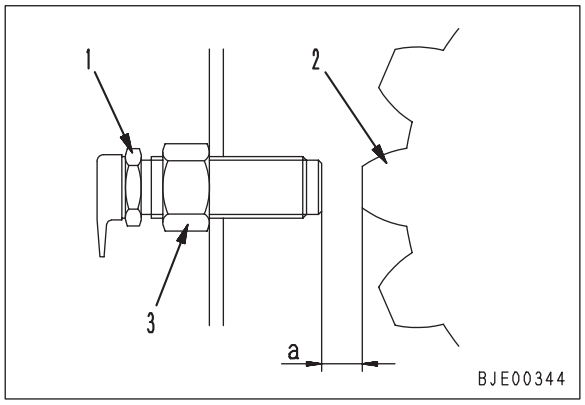
★ If engine speed sensor (1) (CN-E12) or the flywheel have been removed and installed, adjust as follows.




1. Open the engine right side cover.
2. Screw in until the tip of engine speed sensor (1) contacts the tip of the teeth of flywheel ring gear (2) lightly.
   ★ Check that there are no metal particles or scratches on the tip of the sensor before installing.

   Thread: Loctite hydraulic sealant (No. 21028)

3. Turn engine speed sensor (1) back 1/2 - 2/3 turns from that point.
   ★ Adjust clearance a between the tip of the sensor and the tip of the gear teeth to 0.75 - 1.00 mm.
4. Hold engine speed sensor (1) in position and tighten locknut (2).

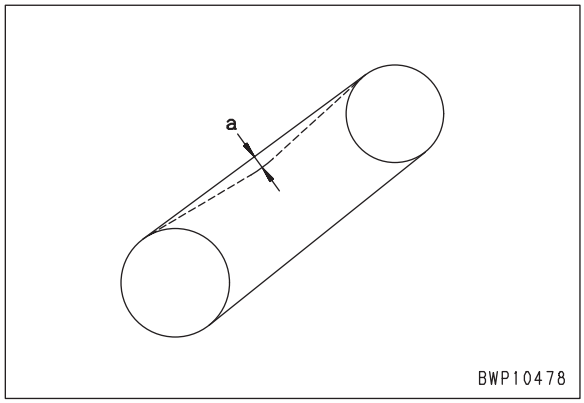



# TESTING AND ADJUSTING AIR CONDITIONER COMPRESSOR BELT TENSION

**Testing**

Press a point midway between the fan pulley and the compressor pulley with a thumb and, and check belt deflection (a).

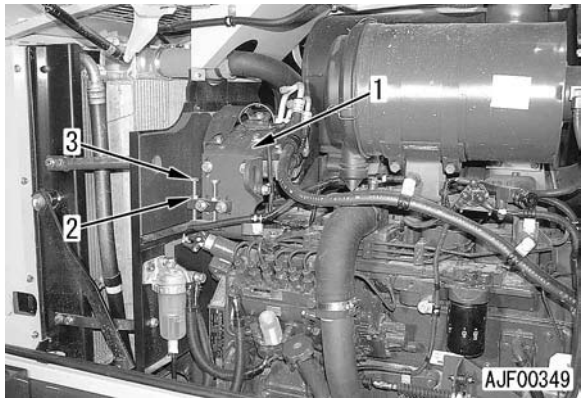
- Belt pressing force: 98.0 N {10 kg} or equivalent




**Adjusting**

★ If the deflection is not correct, adjust as follows.

1. Loosen the mounting bolts (top and bottom: 2 each) of compressor bracket (1).
2. Loosen locknut (2), and use adjustment bolt (3) to move compressor bracket (1) and adjust the belt tension.
3. Tighten locknut (2).
4. Tighten the mounting bolts (top and bottom: 2 each) of compressor bracket (1).




5. After adjusting the belt tension, check the belt tension again.

# MEASURING DIRECTIONAL LEVER

**WARNING!** Apply the parking brake and put blocks under the tires.

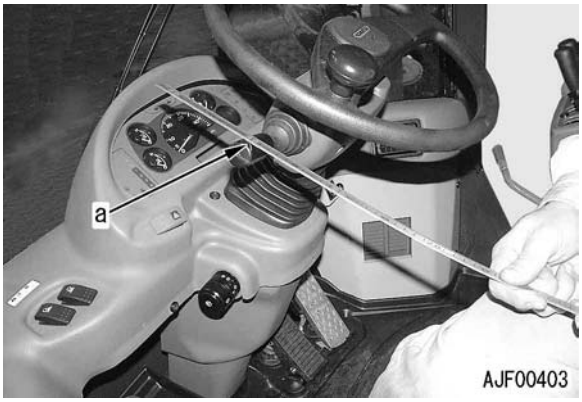
**Operating effort of directional lever**

1. Stop the engine.
2. Install push-pull scale H or a spring balance to a point 10mm from the tip of the control lever, then measure the operating effort when the lever is pulled in the direction of actuation.
   ★ Carry out the measurement in each speed range.




**Travel of directional lever**

1. Stop the engine.
2. Make mark a on the center of the knob of the control lever, then measure the travel when the lever is operated in the direction of actuation.



# TESTING AND ADJUSTING HST OIL PRESSURE

**Special tools required**

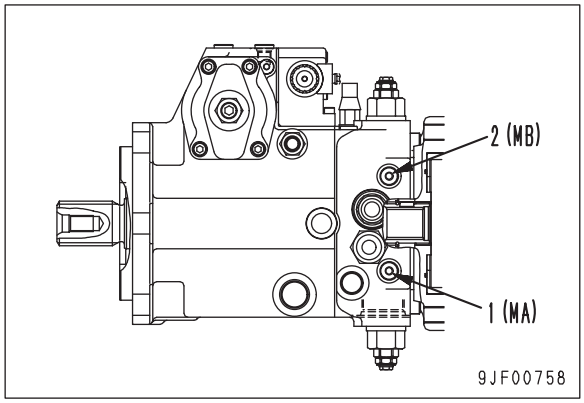
| Symbol | | Part No. | Part Name |
|---|---|---|---|
| C | 1 | 799-101-5002 | Analog type hydraulic tester |
| | | 790-261-1203 | Digital type hydraulic tester |

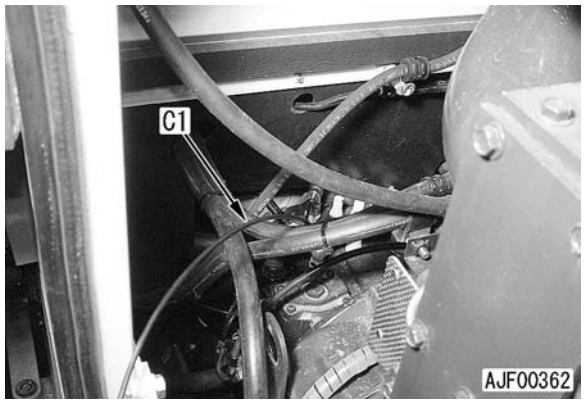
**WARNING!** Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

★ HST oil temperature when measuring: Within operating range

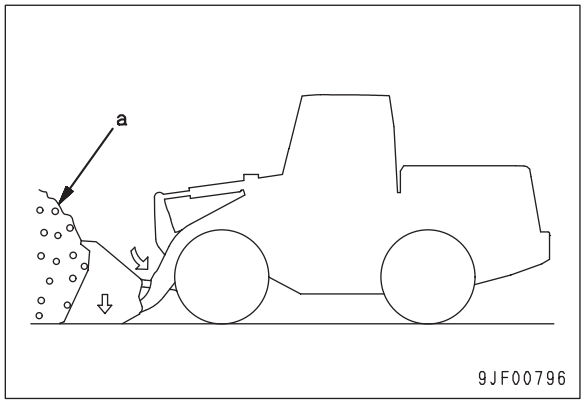
★ The high-pressure relief pressure is the same as the safety pressure of the main circuit, so it cannot be measured. (Normally, the cut-off valve is actuated first, so it does not rise to the safety valve set pressure)

1. Measuring high-pressure cut-off oil pressure
   1) Open the engine hood side cover.
   2) Install oil pressure gauge C1 (58.8 MPa {600 kg/cm$^2$}) to pressure measurement nipple (1) or (2).
      - Nipple (1): For FORWARD circuit (port: MA)
      - Nipple (2): For REVERSE circuit (port: MB)




   3) Measure the high-pressure cut-off oil pressure under the following conditions.
      i) Lower the bucket to near the ground, then drive the machine forward and thrust the bucket into the stockpile of soil or rock (portion a).
         ★ Set the directional lever to FORWARD and the speed selector switch to 3rd.

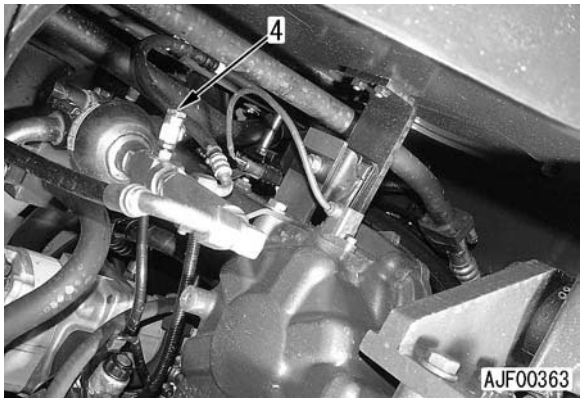



      ii) Run the engine at full throttle and push in until the machine stops moving forward.

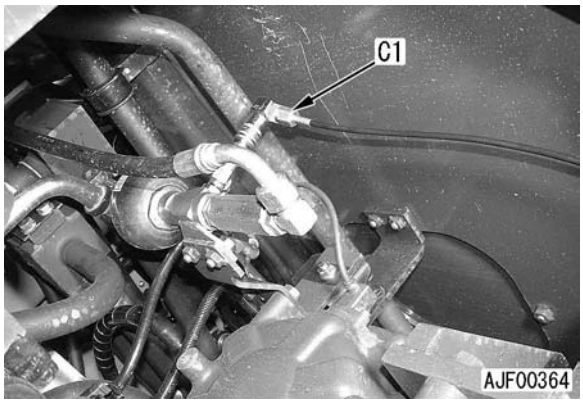
**WARNING!** Carry out the measurement on hard ground where it is difficult for the tires to slip.

      iii) Keep the engine running at full throttle, check that the tires are not turning, then measure the oil pressure.

2. Measuring low-pressure relief pressure (basic pressure of work equipment EPC circuit)
   1) Remove low-pressure relief pressure measurement plug (4) (10mm, P=1.25mm) from under the machine.
      ★ The oil pressure measurement plug is installed near the bottom right of the transfer on the right side of the rear frame.

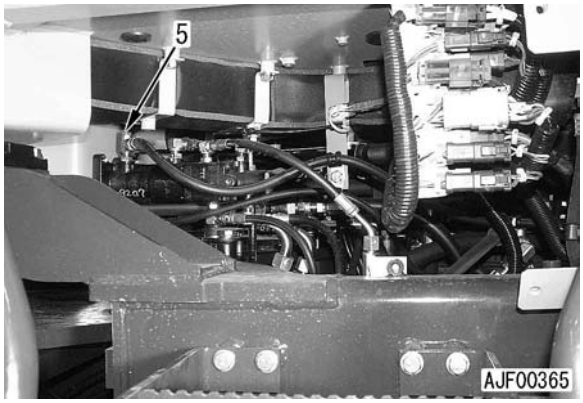



   2) Install a nipple, then connect oil pressure gauge C1 (5.9 MPa {60 kg/cm$^2$}).

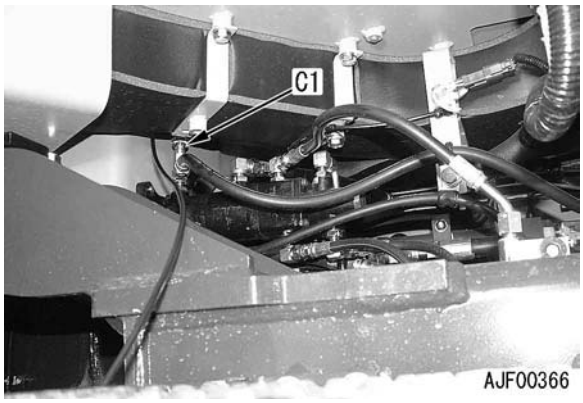



   3) Place the directional lever at N, run the engine at high idling, and measure the low-pressure relief pressure.

3. Measuring servo piston control pressure (DA pressure)
   1) Remove the floor frame cover (bottom left of operator's cab).
   2) Remove servo piston control pressure measurement plug (DA pressure) (10mm, P=1.25mm).

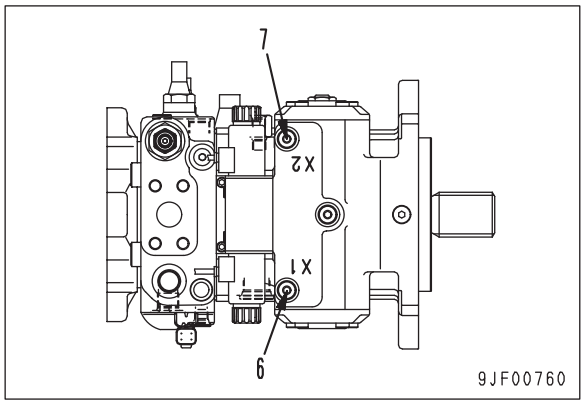



   3) Install a nipple, then connect oil pressure gauge C1 (5.9 MPa {60 kg/cm$^2$}).

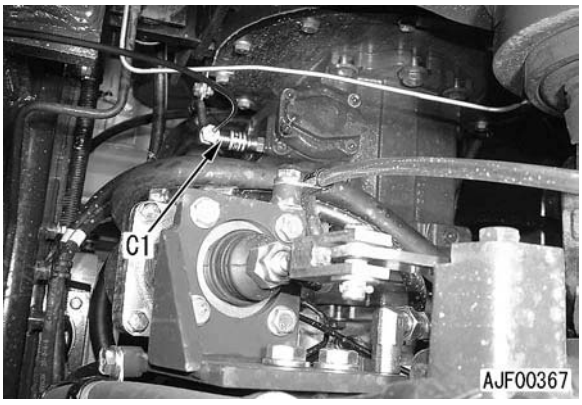



   4) Place the directional lever at N, run the engine at high idling, and measure the control pressure when the wheel brake pedal is depressed and when it is released.
      ★ The brake pedal is connected to the inching valve and controls the control pressure.

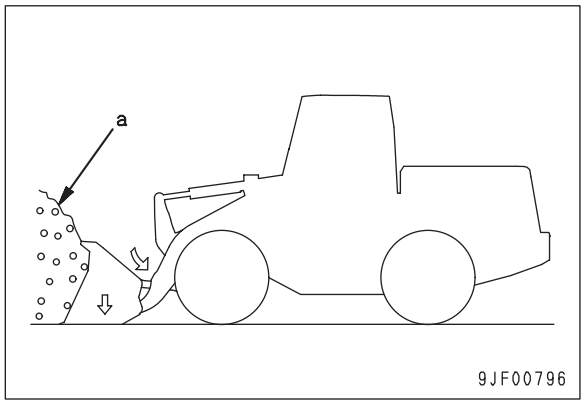
4. Measuring servo piston actuating pressure
   1) Remove servo piston actuation pressure measurement plug (6) or (7) (G 1/4) (width across flats for hexagonal head wrench: 8 mm).
      - Plug (6): For FORWARD circuit (port: X1)
      - Plug (7): For REVERSE circuit (port: X2)




   2) Install a nipple, then connect oil pressure gauge C1 (5.9 MPa {60 kg/cm2}).




   3) Measure the servo piston actuating pressure under the following conditions.
      i) Lower the bucket to near the ground, then drive the machine forward and thrust the bucket into the stockpile of soil or rock (portion a).
         ★ Set the directional lever to FORWARD and the speed selector switch to 3rd.




      ii) Run the engine at full throttle and push in until the machine stops moving forward.



**WARNING!** Carry out the measurement on hard ground where it is difficult for the tires to slip.

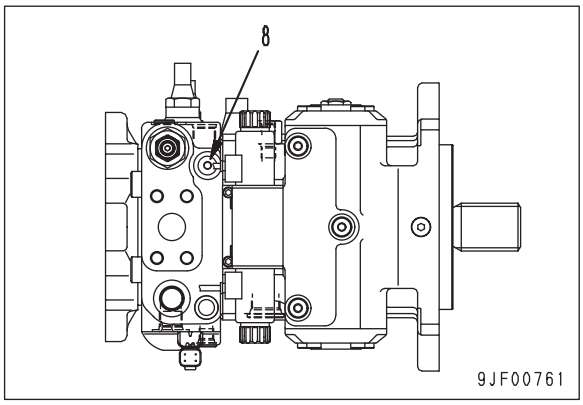
      iii) Keep the engine running at full throttle, check that the tires are not turning, then measure the oil pressure.

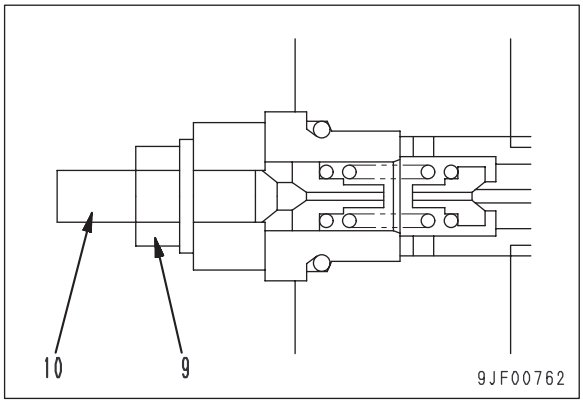
**Adjusting**

★ The high-pressure relief pressure is also the safety pressure of the main circuit, so it cannot be measured. (Normally, the cut-off valve is actuated first, so it does not rise to the safety valve set pressure)

1. Adjusting high-pressure cut-off valve
   ★ If the high-pressure cut-off pressure is not correct, adjust high-pressure cut-off valve (8) as follows.
   1) Remove the engine hood.
   2) Loosen locknut (9) of high-pressure cut-off valve (8), then turn adjustment screw (10) to adjust.
      ★ Turn the adjustment screw to adjust as follows.
         • To INCREASE pressure, turn CLOCKWISE.
         • To DECREASE pressure, turn COUNTERCLOCKWISE.
      ★ Amount of adjustment for one turn of adjustment screw: 9.1 MPa {93 kg/cm$^2$}
   3) After adjusting, tighten locknut (9).

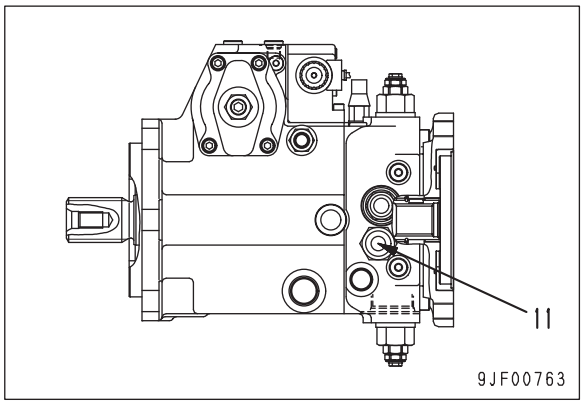
      Locknut: 37.2 Nm {3.8 kgm}

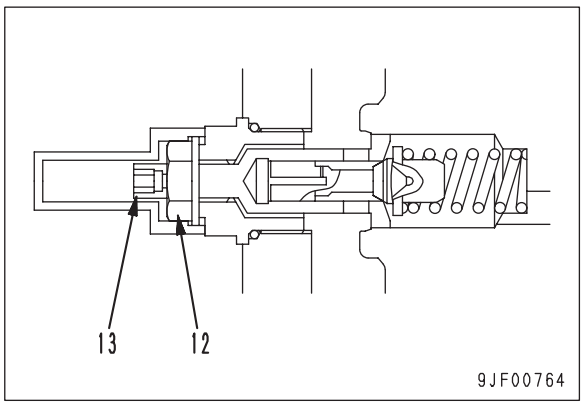



2. Adjusting low-pressure relief valve
   ★ If the low-pressure relief pressure is not correct, adjust the low-pressure relief valve as follows.
   1) Remove the engine hood.
   2) Loosen locknut (12) of low-pressure relief valve (11), then turn adjustment screw (13) to adjust.
      ★ Turn the adjustment screw to adjust as follows.
         • To INCREASE pressure, turn CLOCKWISE.
         • To DECREASE pressure, turn COUNTERCLOCKWISE
      ★ Amount of adjustment for one turn of adjustment screw: 0.38 MPa {3.9 kg/cm$^2$}
   3) After adjusting, tighten locknut (12).

      Locknut: 69.6 Nm {7.1 kgm}



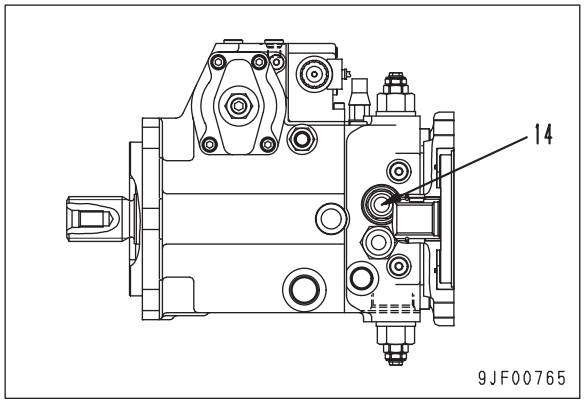

★ After completion of adjustment, repeat the measurement procedure to check the low-pressure relief pressure again.

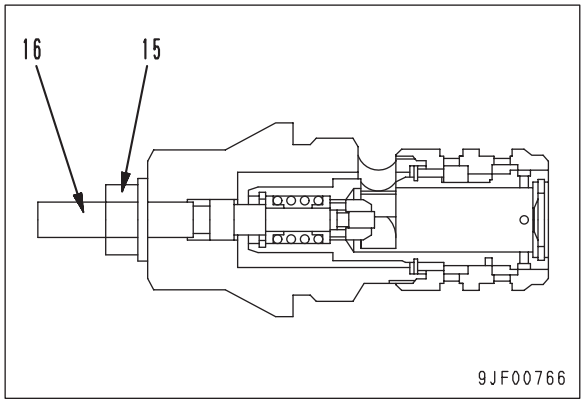
3. Adjusting DA valve

★ If the servo piston control pressure is not correct, adjust the DA valve as follows.

1) Remove the engine hood.
2) Loosen locknut (15) of DA valve (14), then turn adjustment screw (16) to adjust.
   ★ Turn the adjustment screw to adjust as follows.
      • To DECREASE pressure, turn CLOCKWISE.
      • To INCREASE pressure, turn COUNTERCLOCKWISE
   ★ Amount of adjustment for one turn of adjustment screw: 0.34 MPa {3.5 kg/cm$^2$}
3) After adjusting, tighten locknut (12).

Locknut: 64.7 Nm {6.6 kgm}




★ After completion of adjustment, repeat the measurement procedure to check the control pressure again.

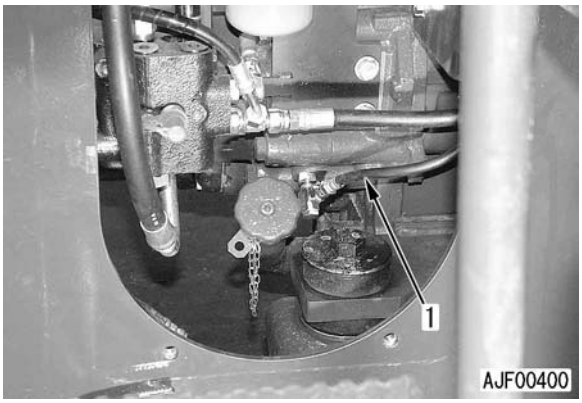
# MEASURING CLUTCH CONTROL PRESSURER

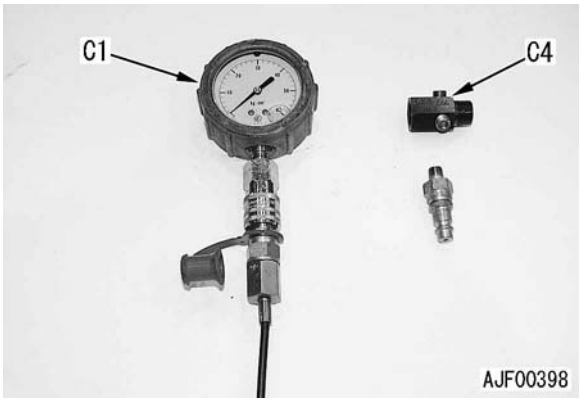
**Special tools required**

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| C | 1 | 799-101-5002 | Analog type hydraulic tester |
| | | 790-261-1203 | Digital type hydraulic tester |
| | 4 | 799-401-3100 | Adapter |

**WARNING!** When removing the measurement plug and disconnecting the hose, loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

1. Remove the rear frame left side cover.
2. Disconnect clutch solenoid valve output pressure (clutch inlet pressure) hose (1), then connect tool **C1** (5.9 MPa {60 kg/cm$^2$}) and **C4** (hose size: for # 02).
3. Disconnect hose (1), then connect tool **C1** (5.9 MPa {60 kg/cm$^2$}) and **C4** (hose size: for # 04).



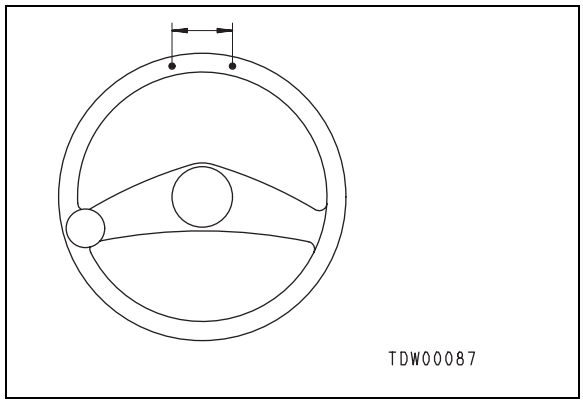




4. Set the speed selector switch to 3rd or 4th, travel at a speed of at least 10 km/h, and measure the clutch inlet pressure (clutch solenoid valve output pressure).

# TESTING AND ADJUSTING STEERING WHEEL

### Special tools required

| Symbol | Part No. | Part Name |
|---|---|---|
| H | 79A-264-0021 | Push-pull scale |

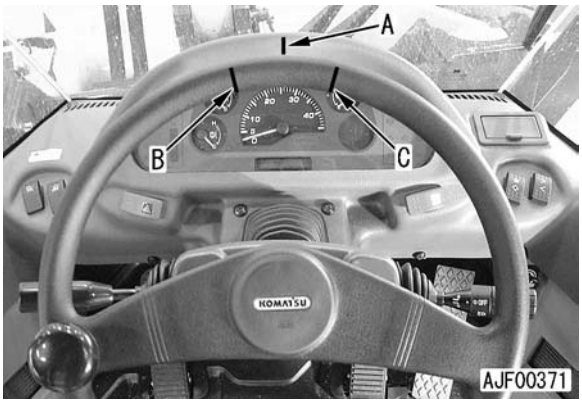



### MEASURING PLAY OF STEERING WHEEL

★ Measurement conditions
- Engine speed: Stopped
- Machine posture: Facing straight forward

### Method of measurement

1. Move the steering wheel 2 or 3 times lightly to the left and right, check that the steering mechanism is at the neutral position, then make mark (A) on the outside frame of the machine monitor.
2. Turn the steering wheel to the right, and make mark (B) at the position where the operating effort starts to become heavy.



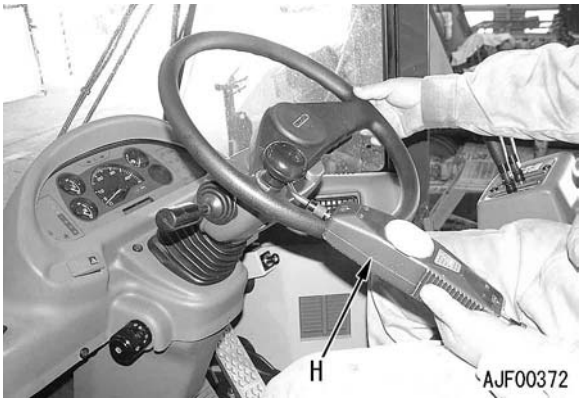

3. Turn the steering wheel to the left in the opposite direction from Step 2, and make a mark at the point where the operating effort becomes heavy (when the steering valve lever starts to move). Then measure the distance in a straight line between marks (B) and (C).

## MEASURING OPERATING FORCE OF STEERING WHEEL

★ Measurement conditions
- Road surface : Flat, horizontal, dry paved surface
- Engine water temperature : Within green range on engine water temperature gauge
- Hydraulic oil temperature : 45 - 55°C
- Tire inflation pressure : Specified pressure
- Engine speed : Low idling (bucket empty)

### Measurement method

1. Install push-pull scale **H** to the steering wheel knob.
   ★ Install push-port scale **H** to the center.
2. Start the engine.
   ★ After starting the engine, raise the bucket approx. 400 mm and remove the safety bar.
3. Pull push-pull scale **H** in the tangential direction and measure the value when the steering wheel moves smoothly.
   ★ Stop measuring when the steering wheel starts to move.




## MEASURING OPERATING TIME FOR STEERING WHEEL

★ Measurement conditions
- Road surface : Flat, horizontal, dry paved surface
- Engine water temperature : Within green range on engine water temperature gauge
- Hydraulic oil temperature : 45 - 55°C
- Tire inflation pressure : Specified pressure
- Engine speed : Low idling and high idling

### Measurement method

1. Start the engine.
   ★ After starting the engine, raise the bucket approx. 400 mm and remove the safety bar.
2. Operate the steering wheel to the end of its stroke to turn the machine to the left or right.
3. Measure the time taken to operate the steering wheel to the end of the stroke to the right or left.
   ★ Operate the steering wheel at about 60 turns per minute without using force.
   ★ Carry out the measurements both at low idling and high idling, and to both the left and right.



# TESTING AND ADJUSTING STEERING OIL PRESSURE

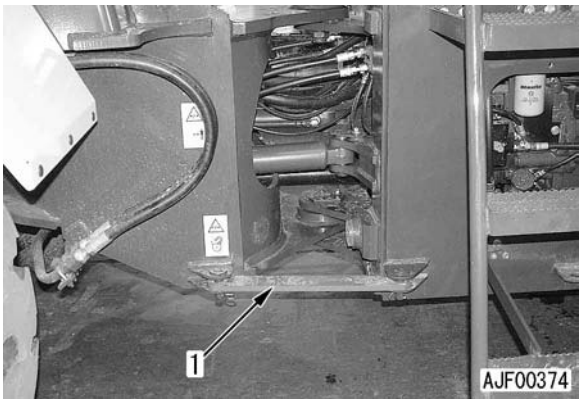
### Special tools required

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| C | 1 | 799-101-5002 | Analog type hydraulic tester |
| | | 790-261-1203 | Digital type hydraulic tester |

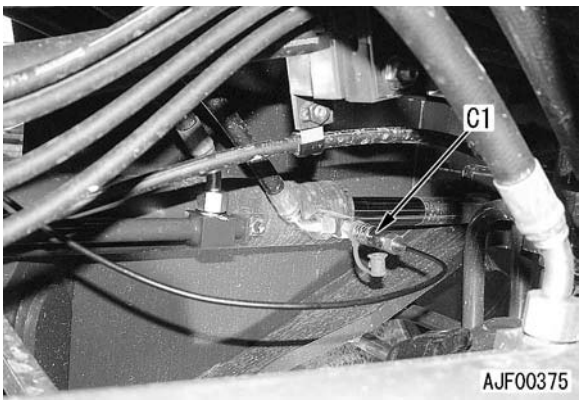
★ Measuring condition
- Hydraulic oil temperature:45 - 55°C
- Engine speed: High idling

### Method of measuring main relief pressure

1. Fit safety bar (1) to the frame.



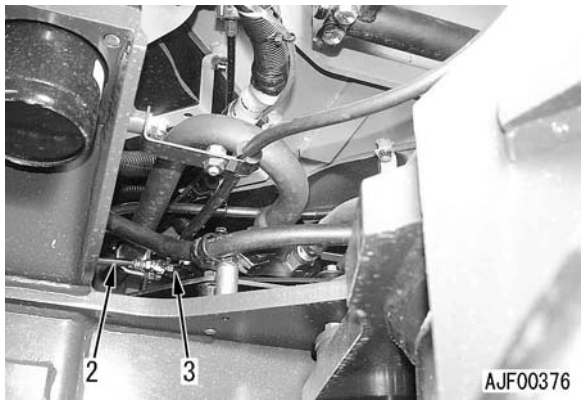

2. Fit a nipple to the steering circuit pressure measurement plug, then install oil pressure gauge **C1** (39.2 MPa {400 kg/cm$^2$}).




3. Start the engine, run the engine at high idling, then turn the steering wheel to the left or right and measure the pressure when the relief valve is actuated.

### Method of adjusting main relief pressure

1. Stop the engine.
2. Disconnect hose (2) and fitting (3) connected to port T of the priority valve.

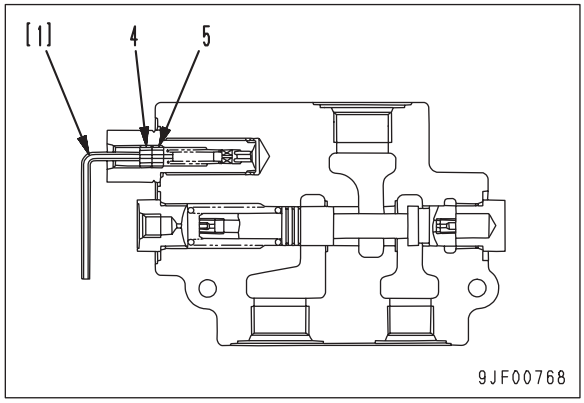



3. Loosen lock screw (4), and then turn adjustment screw (5) to adjust.
   ★ Turn the adjustment screw to adjust as follows.
   - To INCREASE pressure, turn CLOCKWISE.
   - To DECREASE pressure, turn COUNTERCLOCKWISE.

   ★ Pressure adjustment for one turn of adjustment screw: Approx. 6.9 MPa (70 kg/cm$^2$)
   ★ Tool (1) for adjusting adjustment screw: Size 7/32 inch, hexagonal
   ★ Do not carry out any adjustment if the relief pressure cannot be measured accurately.

   Lock screw (6):
   14.7 ± 2 Nm (1.5 ± 0.2 kgm)

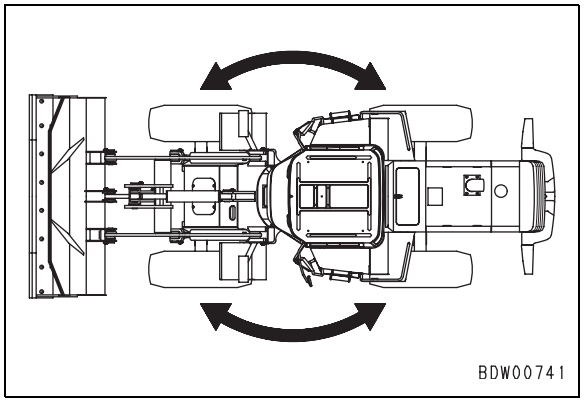
   Adjustment screw:
   2.3 ± 6.8 Nm (0.23 ± 0.69 kgm)



# BLEEDING AIR FROM STEERING CIRCUIT

★ Bleed the air from the circuit as follows if the steering valve or steering cylinder have been removed and installed again.

1. Start the engine and run at idling for approx. 5 minutes.
2. Run the engine at low idling and turn 4 - 5 times to the left and right.
   ★ Operate the piston rod to approx. 100 mm before the end of its stroke. Be careful not to relieve the circuit.
3. Repeat Step 2 with the engine at full throttle.
4. Run the engine at low idling and operate the piston to the end of its stroke to relieve the circuit.



# TESTING HYDRAULIC FAN

### Special tools required

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| A | 1 | 799-203-8001 | Multi-tachometer |
| C | 1 | 799-101-5002 | Analog type hydraulic tester |
| | | 790-261-1203 | Digital type hydraulic tester |
| | 6 | 799-401-3300 | Adapter |

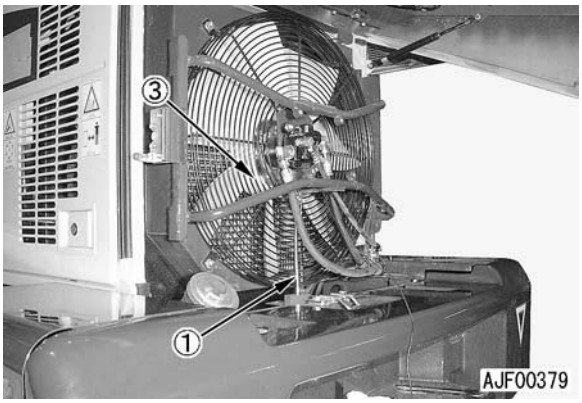
**WARNING!** Set the bottom face of the bucket horizontal, lower the bucket completely to the ground, and put blocks under the tires.

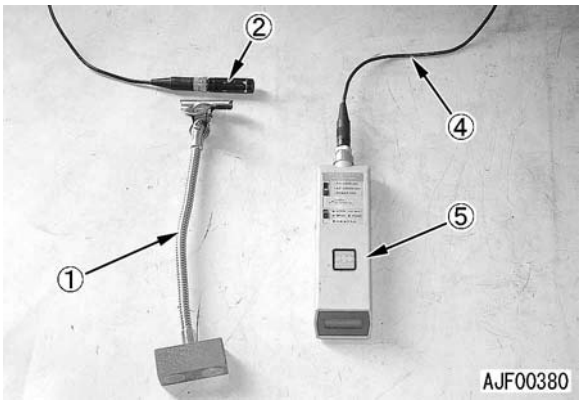
**WARNING!** When removing the measurement plug and disconnecting the hose, loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

★ Measurement conditions
- Hydraulic oil temperature: 45 - 55°C

### Measuring fan speed

1. Open the radiator grill.
2. Install stand [1], probe [2], and reflecting tape [3] in the multi-tachometer **A1** kit, then connect the meter itself.

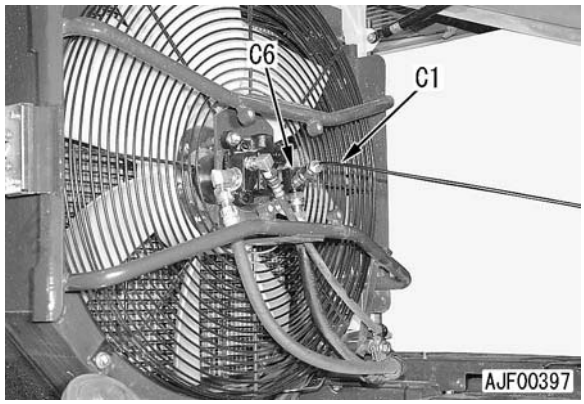


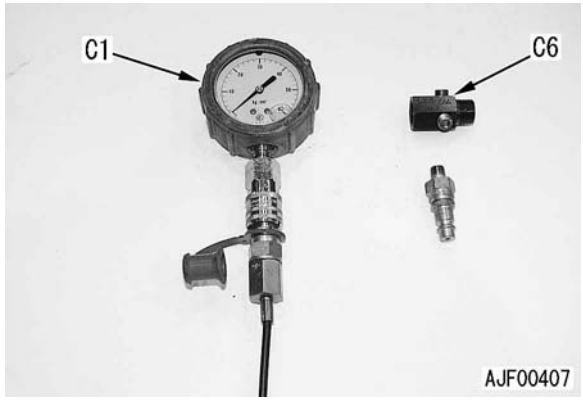




3. Start the engine, run at high idling, and measure the fan speed.

### Measuring oil pressure

1. Open the radiator grill.
2. Disconnect hose (1), then connect tool **C1** (5.9 MPa {60 kg/cm$^2$}) and **C6** (hose size: for # 04).

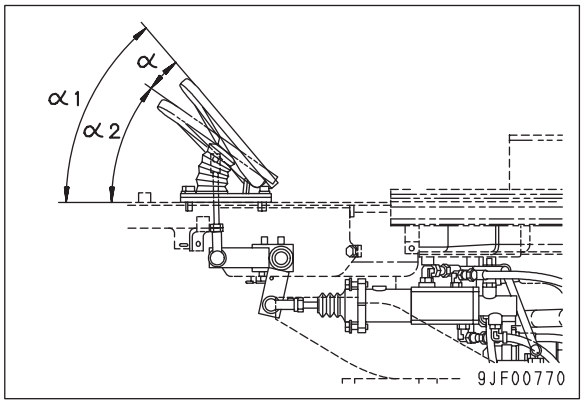



3. Start the engine and measure the fan drive oil pressure.

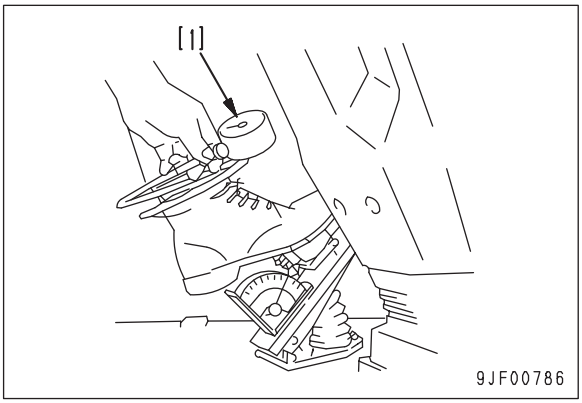
# MEASURING BRAKE PEDAL

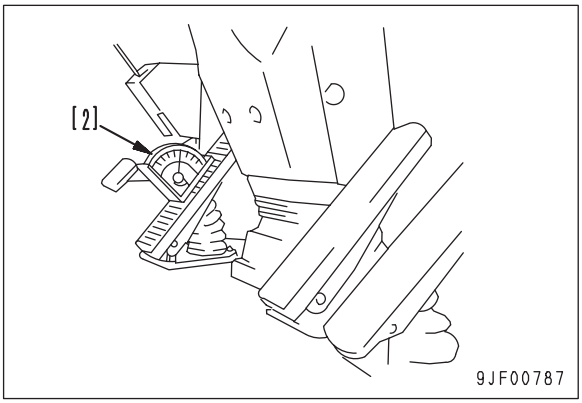
★ Measurement conditions
- Engine water temperature: Within green range on engine water temperature gauge
- Engine speed: Low idling




**Operating effort of pedal**

1. Install push gauge (1) to the operator's foot.
   ★ Set the push gauge at a point 150 mm from the fulcrum of the pedal.
2. Start the engine, and measure pedal angle a1 when running at low idling.
3. Next, put angle meter (2) in contact with the brake pedal and measure operating angle a from position α1 to position α2 (α = α1 - α2) when the pedal is depressed.
   - Operating force at α2: 196 N (20 kg).



# TESTING AND ADJUSTING BRAKE PEDAL LINKAGE

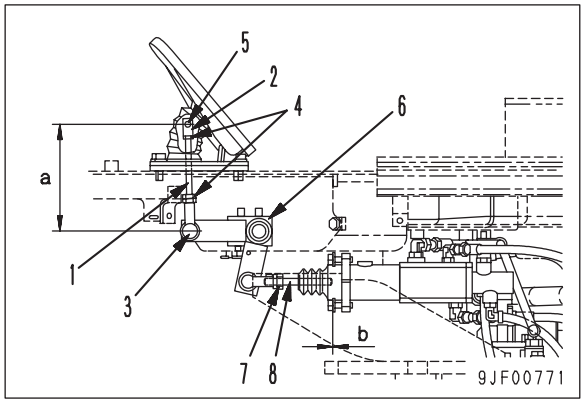
### Testing

1. Check for play in linkage mounting pin (7), pin-hole of lever (6), and lever bushing.
2. Measure length of link (a = 184 mm), and check that it is within the standard value.
   ★ Measure the length from the center of pin (1) to the center of ball joint (3).
3. Measure the distance of movement of rod (8) and check that clearance b is within the standard value.
   ★ When doing this, check that the brake pedal is in contact with the stopper.

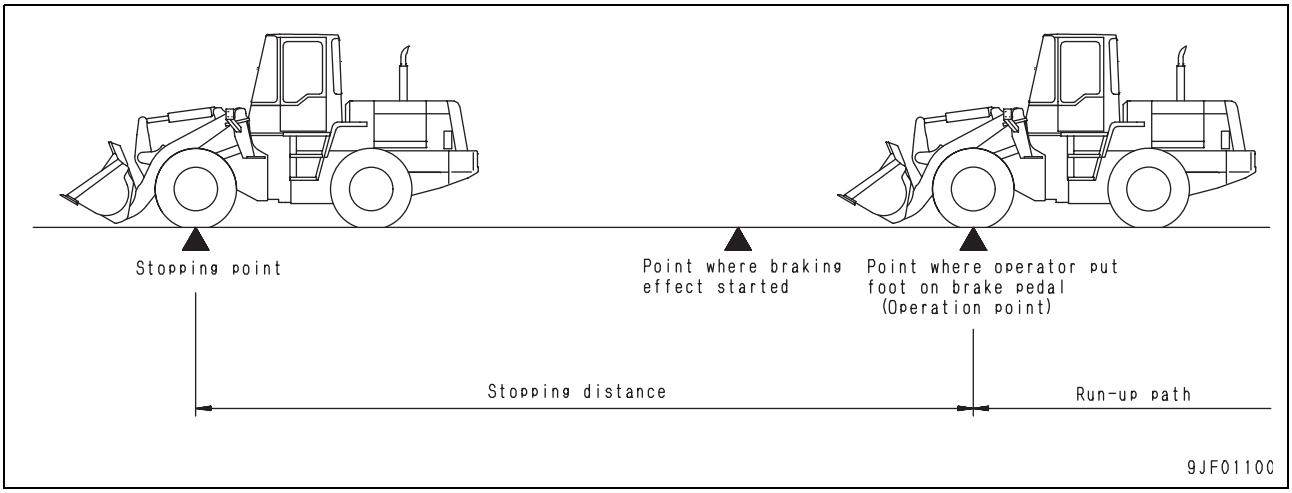
### Adjusting

1. Adjusting link length (a)
   1) Remove pin (5) and ball joint (3), then remove rod (1).
   2) Loosen locknut (4), then turn yoke (2) and ball joint (3) to adjust the length.
   3) After adjusting the length of link (a), connect it to the brake pedal.
      ★ Standard values
      a = 184 mm
      b = 0 - 0.3 mm

2. Adjusting rod length (b)
   1) Loosen locknut (7), turn rod (8) so that the tip of the rod contacts the booster cylinder piston, then turn rod (8) back 1/4 turn.
      ★ Movement for 1/2 turn of rod: 0.75 mm
   2) Tighten locknut (7) to hold in position.
      ★ Standard values
      a = 184 mm
      b = 0 - 0.3 mm



# MEASURING BRAKE PERFORMANCE




★ Measurement conditions
- Road surface : Flat, horizontal, dry paved surface
- Travel speed : 32 km/h when brakes are applied
- Tire inflation pressure : Specified pressure
- Delay in applying brakes : 0.1 sec

**Measurement method**

1. Start the engine and drive the machine.
2. Set the speed selector switch to 4th and drive the machine.
3. When the travel speed reaches 32 km/h, depress the left brake pedal with the specified operating force.
   ★ Before carrying out this operation, determine the run-up path and the point for applying the brakes, then apply the brakes when the machine reaches that point.
4. Measure the distance from the point where the brakes were applied to the point where the machine stopped.
   ★ Repeat this measurement three times and take the average.

# TESTING AND ADJUSTING ACCUMULATOR CHARGE PRESSURE

### Special tools required

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| C | 1 | 799-101-5002 | Analog type hydraulic tester |
| | | 790-261-1203 | Digital type hydraulic tester |

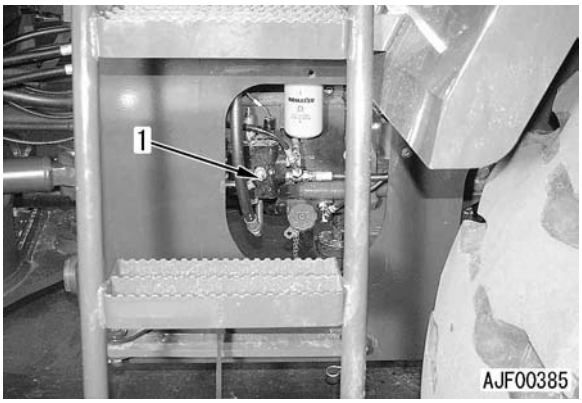
### Measuring

- Hydraulic oil temperature:45 - 55°C

**WARNING!** Put blocks under the tires.

**WARNING!** Stop the engine, then depress the brake pedal at least 100 times to release the pressure inside the accumulator circuit.

1. Remove the rear frame left side cover.
2. Install oil pressure gauge **C1** (39.2 MPa {400 kg/cm$^2$}) to adapter **C3**.




3. Measure the accumulator charge cut-in pressure. Start the engine, run the engine at low idling, and measure the oil pressure when the brake pressure caution lamp on the monitor panel goes out.
4. Measure the accumulator charge cut-out pressure. After the accumulator charge cut-in is actuated, measure the oil pressure when the indicator of the oil pressure gauge has risen and suddenly starts to drop.

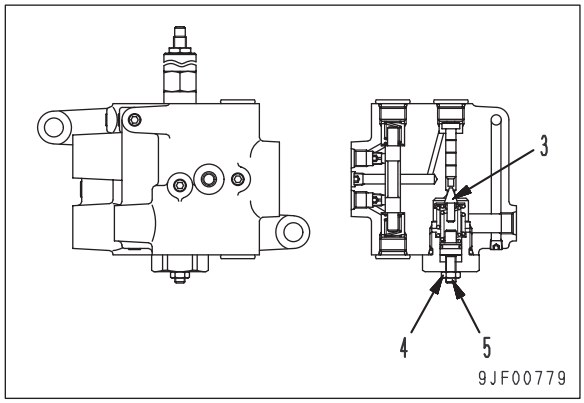
### Adjusting

★ When the accumulator charge cut-out pressure is adjusted, the cut-in pressure also changes in proportion to the ratio of the valve area.

1. Loosen locknut (4) of unload relief valve (accumulator charge cut-out valve) (3), then turn adjustment screw (5) to adjust.
   ★ Turn the adjustment screw to adjust as follows.
   - To RAISE pressure, turn CLOCKWISE
   - To LOWER pressure, turn COUNTER-CLOCKWISE

   ★ Pressure adjustment for one turn of adjustment screw: 1.45 MPa {14.8 kg/cm$^2$}

   Locknut : 16.7 Nm {1.7 kgm}
2. After adjusting, tighten locknut (4).




★ After completion of adjustment, repeat the measurement procedure given above to check the accumulator cut-in pressure and cutout pressure again.

# MEASURING BRAKE OIL PRESSURER

**Special tools required**

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| K | 1 | 793-605-1001 | Brake test KIT |
| | 2 | 790-101-1430 | Coupler |
| | 3 | 790-101-1102 | Pump |
| | 4 | 793-463-1100 | Stopper |

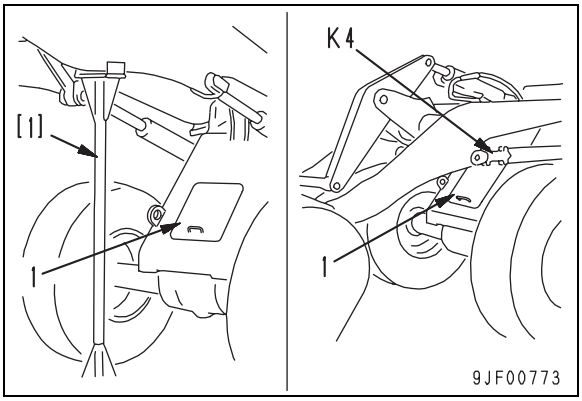
★ Measurement conditions
- Engine water temperature: Within green range on engine water temperature gauge
- Brake pressure: 4.1 MPa (42 kg/cm$^2$)

**WARNING!** Apply the parking brake and put blocks under the tires.

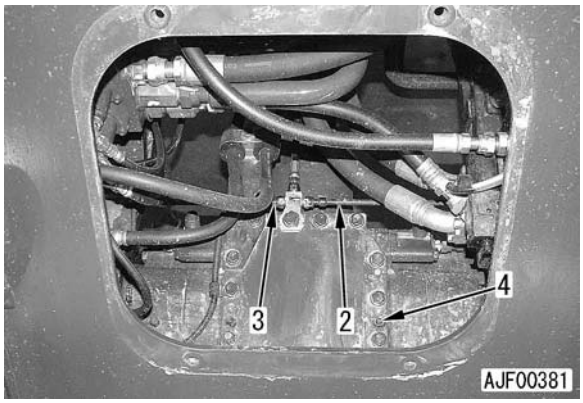
**Measuring**

1. Raise the boom, set support (1) or boom drop prevention stopper **K4** in position, then remove front cover (1).

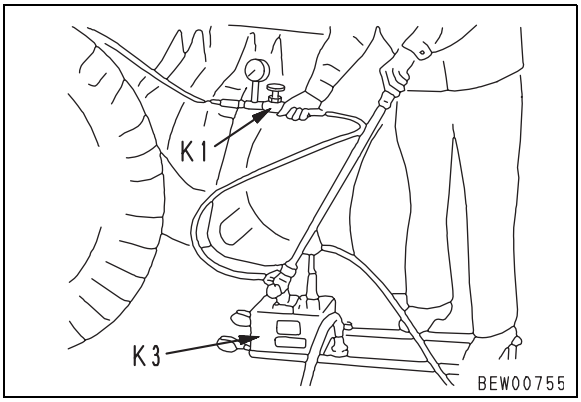
**WARNING!** When leaving the operator's seat, apply the safety lock lever to the work equipment control levers securely.




2. Stop the engine.
3. Remove brake tube (2) on the side to be measured, then remove nipple (3).
4. Set brake test kit **K1** in position, then connect pump **K3** with coupler **K2**.
5. Loosen bleeder screw (4) and bleed the air.
   ★ Operate pump **K3** to bleed the air.

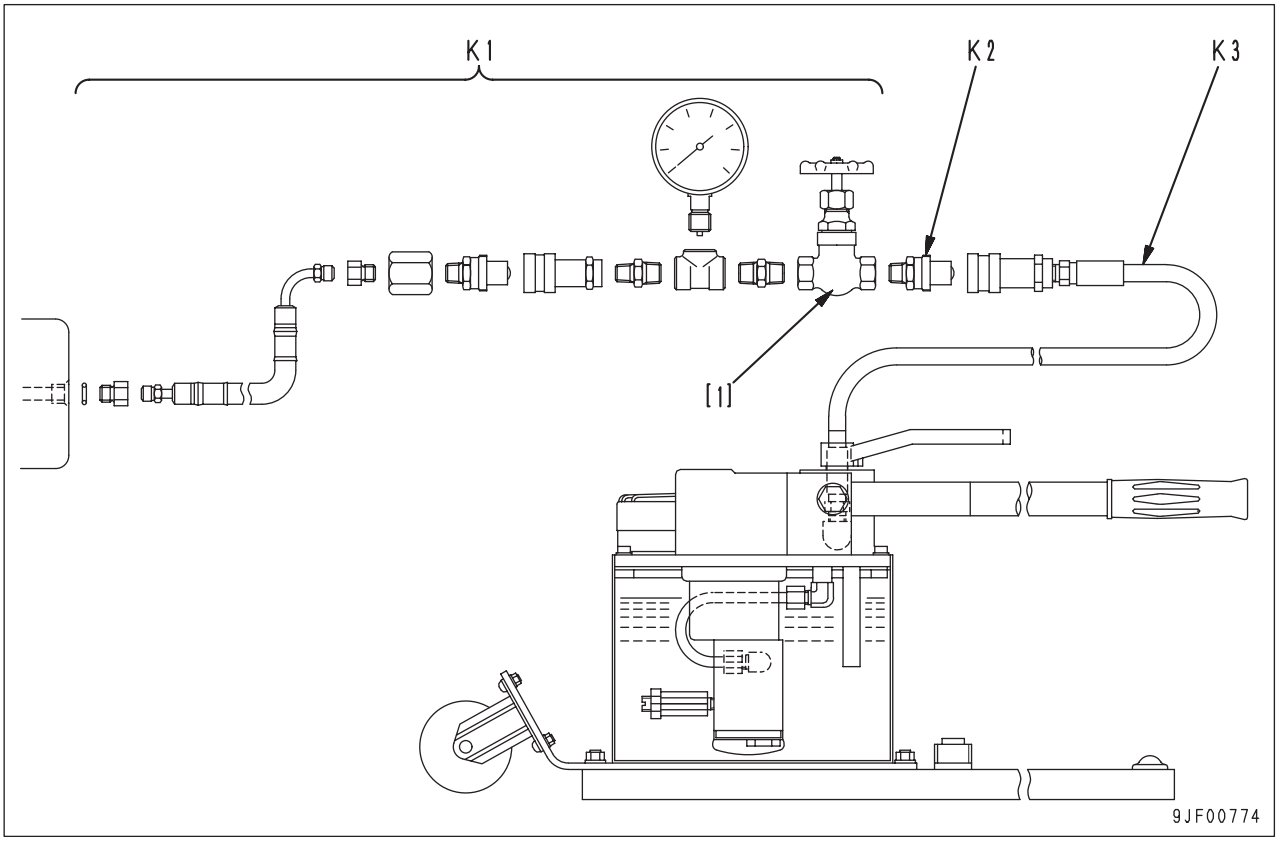



6. Tighten the bleeder screw, operate pump **K3**, raise the pressure to 4.1 MPa (42 kg/cm$^2$), then close stop valve (1).




7. After applying the pressure, leave for 5 minutes and measure the drop in the pressure.
   ★ If the hose is moved while measuring the pressure, the pressure will change, so do not move the hose.
   ★ After testing, operate pump **K3** to lower the pressure of the brake circuit, then remove brake test kit **K1**.
   ★ After completing the inspection, install the brake tube, then bleed the air from the brake circuit.

**Brake test tool**



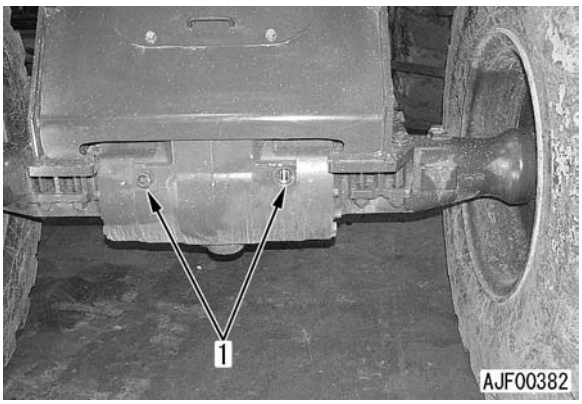
# MEASURING WEAR OF BRAKE DISC

**Special tools required**

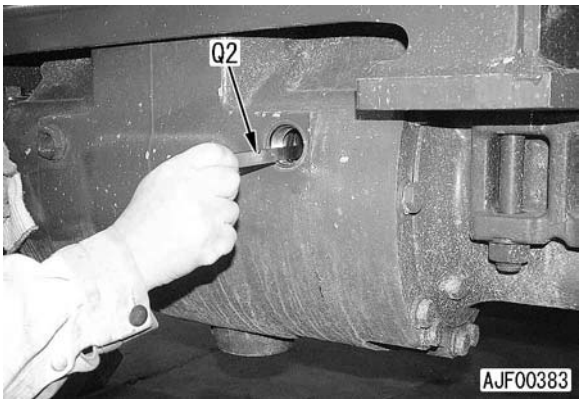
| Symbol | | Part No. | Part Name |
|---|---|---|---|
| Q | 2 | Commercially available | Filler gauge |

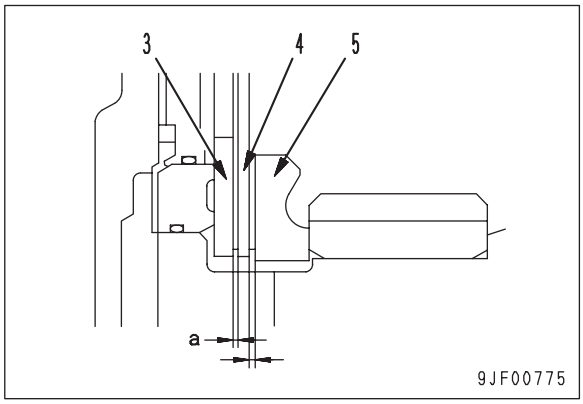
**WARNING!** Stop the machine on horizontal ground and put blocks under the tires.

1. Loosen drain plug and drain axle oil.
   Axle oil: 1.8ℓ
2. Remove measuring plug (1).




3. Depress the brake pedal lightly to the end of its travel.
   ★ Check that plate (4) and plate (5) are pressed tightly against the disc.
4. Insert tool **F2** between disc (4) and plates (3) and (5), and measure the clearance.




5. Tighten the drain plug and add axle oil through the oil filler to the specified level.
   Axle oil: 1.8ℓ

# BLEEDING AIR FROM BRAKE CIRCUIT

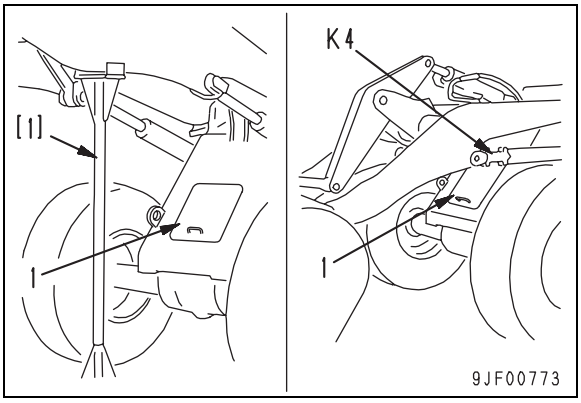
**Special tools required**

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| K | 4 | 793-463-1100 | Stopper |

**WARNING!** Stop the machine on horizontal ground and put blocks under the tires.

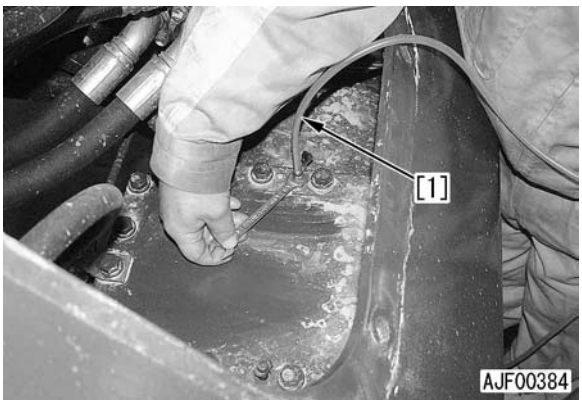
★ If equipment in the brake circuit has been removed and installed, bleed the air from the brake circuit as follows.
★ Use the same procedure for both the front brake circuit and rear brake circuit (2 places each).

1. Raise the boom, set support (1) or boom drop prevention stopper **K4** in position, then remove front cover (1).




**WARNING!** Always be sure to apply the safety lock to the work equipment control lever.

2. Remove the cap, insert vinyl hose (1) into bleeder screw (2), and insert the other end in a container.



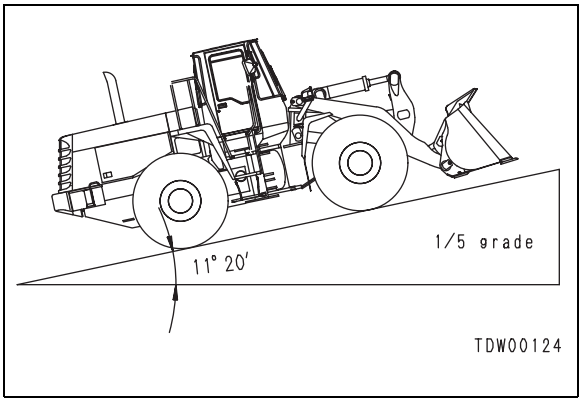

3. Depress the brake pedal, then loosen the bleeder screw and bleed the air.
   ★ Tighten the bleeder screw, then release the brake pedal slowly.
   ★ Add brake oil when necessary during the operation to keep the brake oil tank full.
4. Repeat this operation, and when no more bubbles come out with the fluid from the hose, depress the pedal fully and tighten the bleeder screw while the oil is still flowing.
   ★ Repeat the operation to bleed the air from the other cylinders, and after completing the operation, check the level in the oil tank and add more oil if necessary.
   ★ To bleed the air completely, bleed the air first from the cylinder, which is farthest from the brake pedal.
   ★ After bleeding the air, carry out a brake performance test, then bleed the air again and check that there is no air in the circuit.

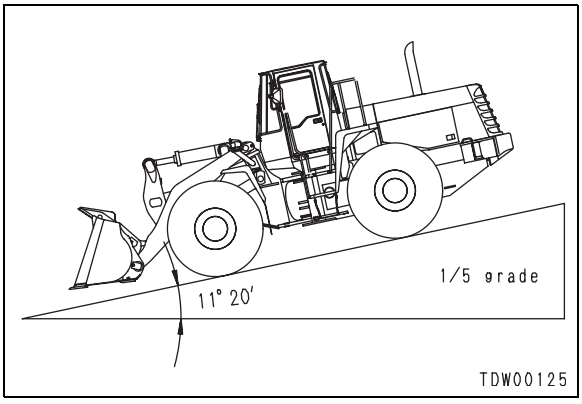
# MEASURING PARKING BRAKE PERFORMANCE

★ Measurement conditions
- Tire inflation pressure : Specified pressure
- Road surface : Flat, dry paved road surface with slope of 1/5 grade (11°20').
- Machine : Operating condition
- Operating effort : Max. 40 kg

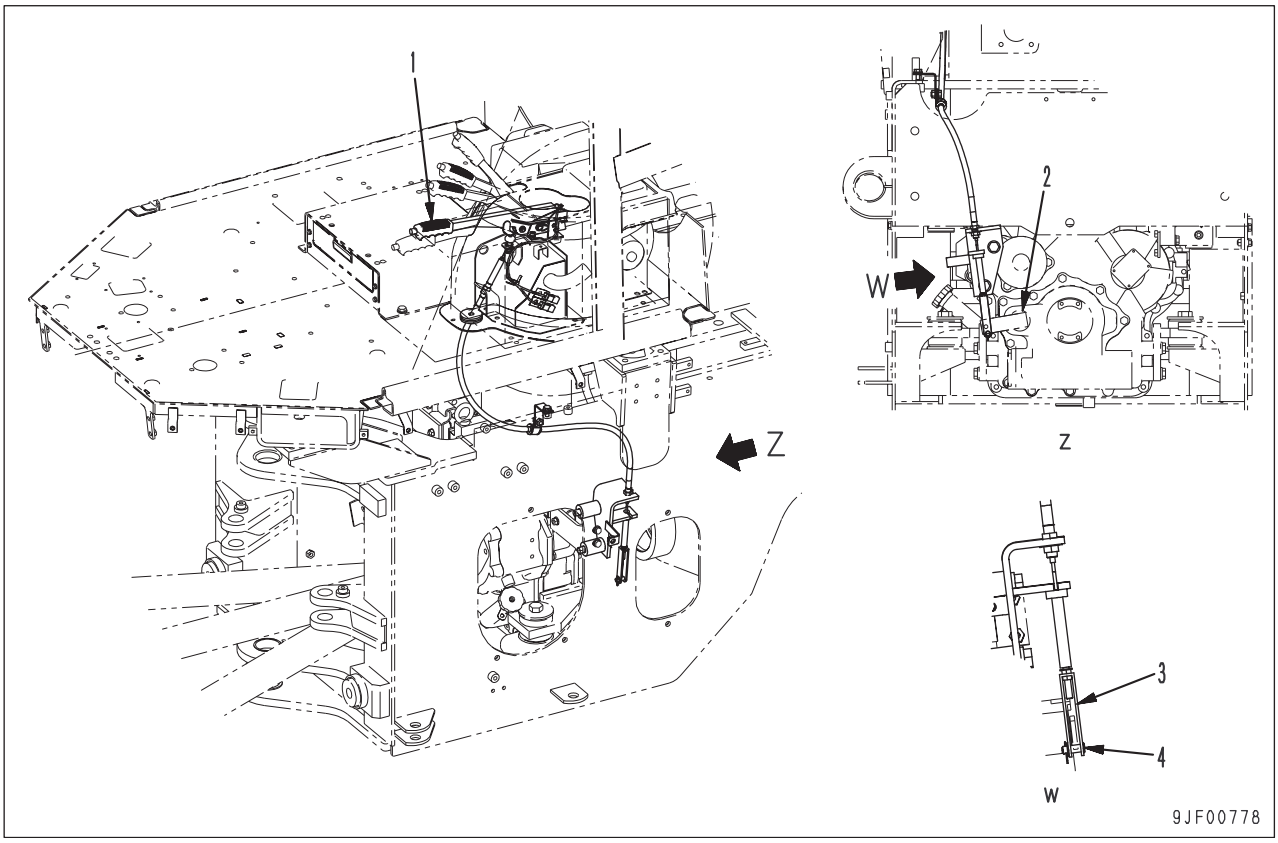
**Measurement method**

1. Start the engine, set the machine facing in a straight line, then drive the machine up a 1/5 grade slope with the bucket empty.
2. Depress the brake, stop the machine, set the directional lever to the neutral position, then stop the engine.
3. Set the parking brake lever to PARKING, then gradually release the brake pedal and check that the machine is held in position. (Overseas specification)
   Turn the parking brake switch to PARKING, then gradually release the brake pedal and check that the machine is held in position. (Domestic specification)
   ★ Carry out the measurement in two ways: Once with the machine facing uphill, and once more with the machine facing downhill.



# TESTING AND ADJUSTING PARKING BRAKE LINKAGE




1. Set parking lever (1) in the FREE (released) position.
2. Pull up lever (2) and the transfer end so that there is no play at the pin portion, and in this condition, adjust at the yoke portion so that the hole in lever (2) and yoke (3) are aligned.
   ★ If it is difficult to align the hole, shorten by one pitch of the yoke thread and install pin (4) so that the play is completely removed.

# MEASURING PARKING BRAKE RELEASE PRESSURE

**Special tools required**

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| C | 1 | 799-101-5002 | Analog type hydraulic tester |
| | | 790-261-1203 | Digital type hydraulic tester |
| | 4 | 799-401-3200 | Adapter |

**WARNING!** Set the bottom face of the bucket horizontal, lower the bucket completely to the ground, and put blocks under the tires.

**WARNING!** When removing the measurement plug and disconnecting the hose, loosen the oil filler cap slowly to release the pressure inside the hydraulic tank.

1. Turn the parking brake switch to the PARKING position.
2. Disconnect parking brake solenoid valve output pressure hose (1) from under the machine, then connect tool **C1** (5.9 MPa {60 kg/cm$^2$}) and **C4** (hose size: for # 03).
3. Disconnect hose (1), then connect tool **C1** (5.9 MPa {60 kg/cm$^2$}) and **C4** (hose size: for # 04).
4. Start the engine, raise the oil pressure in the brake circuit, then measure the parking brake release pressure (parking brake solenoid valve output pressure).

# MEASURING AND ADJUSTING WORK EQUIPMENT CONTROL LEVER

★ Measuring condition

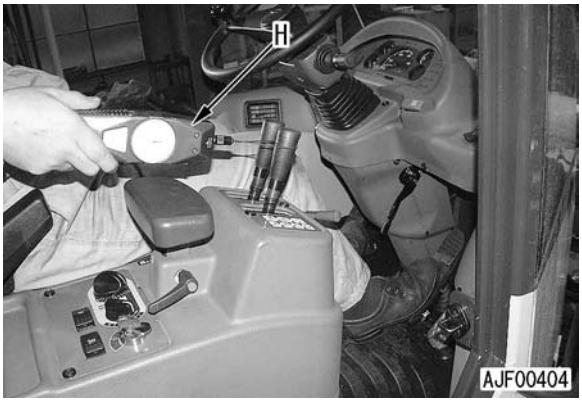
- Engine coolant temperature: Operating range of engine coolant thermometer
- Hydraulic oil temperature:60 - 80°C
- Engine speed: Low idling

**WARNING!** Install the safety bar to the frame.




**Measurement**

1. Operating effort of work equipment control lever
   1) Install tool **H** to the work equipment control lever and secure it in position.
      ★ Install tool **H** to the center of the knob.
      ★ Operate the control lever at the same speed as for normal operations, and measure the minimum value for the effort needed to operate the knob.




2. Travel of work equipment control lever
   1) Measure the travel at each position when operating the work equipment control lever.
      ★ Mark the lever knob and use a scale to measure.
      ★ If the stroke is not within the standard value, check for play in the linkage and wear of the bushing.

# TESTING AND ADJUSTING WORK EQUIPMENT HYDRAULIC PRESSURE

### Special tools required

| Symbol | | Part No. | Part Name |
|---|---|---|---|
| C | 1 | 799-101-5002 | Analog type hydraulic tester |
| | | 790-261-1203 | Digital type hydraulic tester |
| K | 4 | 793-463-1100 | Stopper |

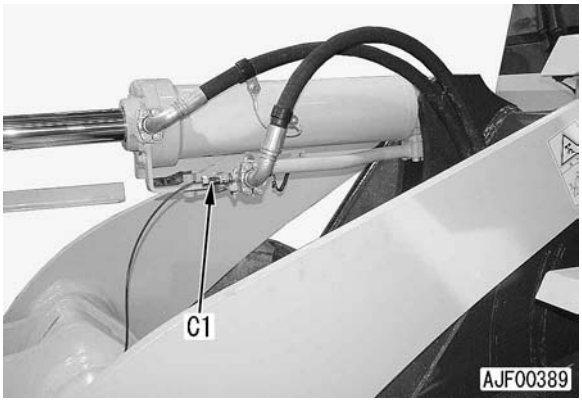
### Measuring condition

- Hydraulic oil temperature:45 - 55°C

**WARNING!** Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank, then operate the control levers several times to release the remaining pressure in the hydraulic piping.

### Measuring

1. Install tool **C1** (39.2 MPa {400 kg/cm$^2$}) to the oil pressure measurement nipple.



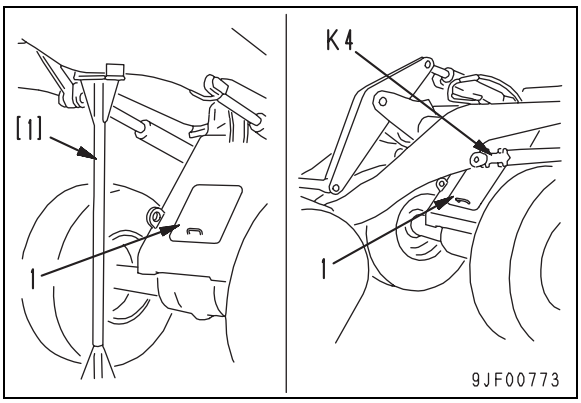

2. Start the engine, raise the lift arm approx. 400 mm, run the engine at high idling, then operate the control lever to tilt back the bucket, and measure the pressure when the relief valve is actuated.

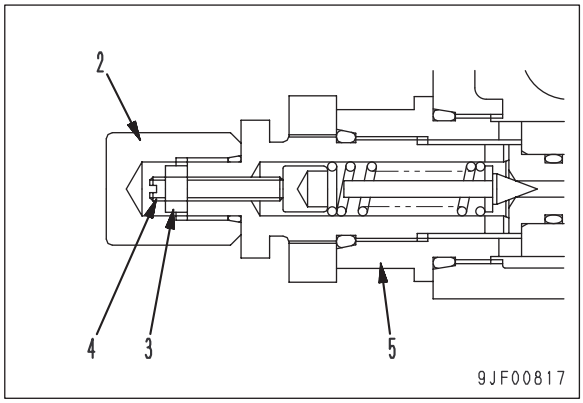
### Adjusting

★ Always stop the engine before adjusting the oil pressure.

**WARNING!** When carrying out the operation with the boom raised, set support (1) or boom drop prevention stopper **K4** in position before starting the operation.

1. Remove cap nut (3) of relief valve (5).
2. Loosen locknut (3) of relief valve (5), then turn adjustment screw (4) to adjust.
   - ★ Turn the adjustment screw to adjust the set pressure as follows.
     - TIGHTEN to INCREASE pressure
     - LOOSEN to DECREASE pressure
   - ★ Pressure adjustment for one turn of adjustment screw: Approx. 0.38 MPa (Approx. 3.9 kg/cm$^2$)
   - ★ Do not carry out any adjustment if the relief pressure cannot be measured accurately.



# TESTING AND ADJUSTING WORK EQUIPMENT PPC OIL PRESSURE

### Special tools required

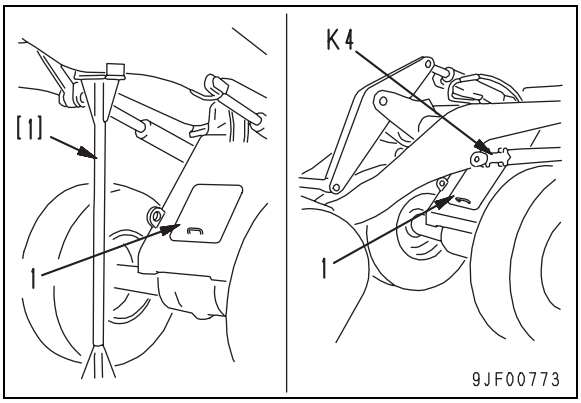
| Symbol | | Part No. | Part Name |
|---|---|---|---|
| C | 1 | 799-101-5002 | Analog type hydraulic tester |
| | | 790-261-1203 | Digital type hydraulic tester |
| K | 4 | 793-463-1100 | Stopper |

### Measuring condition

- Hydraulic oil temperature:45 - 55°C

**WARNING!** Loosen the oil filler cap slowly to release the pressure inside the hydraulic tank. Then operate the control levers several times to release the pressure in the piping.

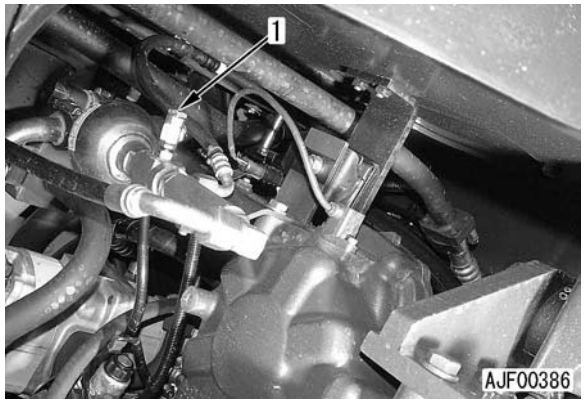
**WARNING!** Except for measuring the oil pressure, when carrying out preparatory operations with the boom raised, set support (1) or boom drop prevention stopper **K4** in position before starting the operation.



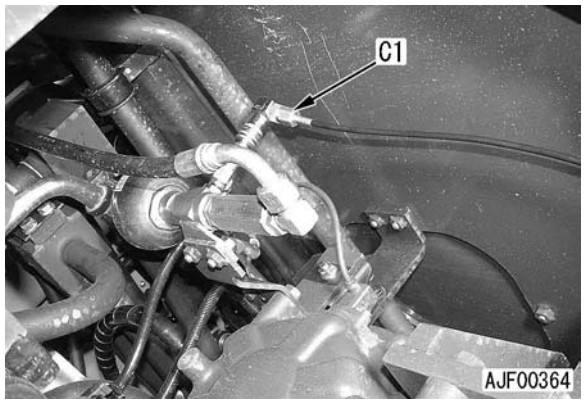

**WARNING!** When leaving the operator's seat, apply the safety lock lever to the work equipment control levers securely.

### Measuring

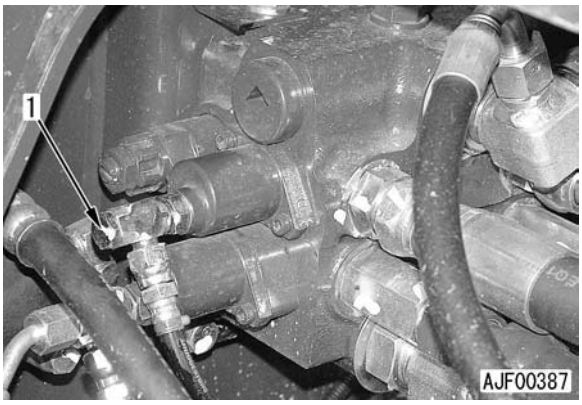
1. Measuring PPC valve basic pressure
   1) Remove plug (4) (10 mm, P = 1.25 mm) for measuring the work equipment EPC valve basic pressure (same as low-pressure relief pressure) from under the machine.

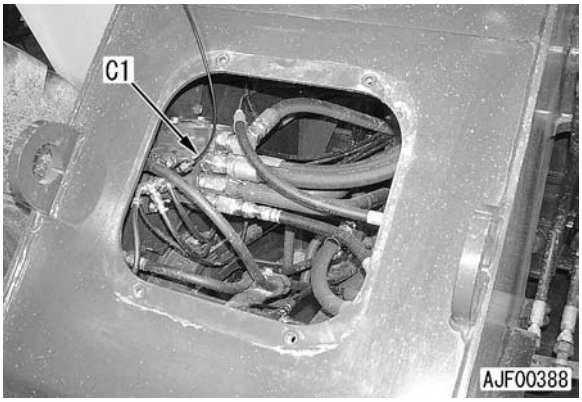



   2) Fit a nipple, then install oil pressure gauge **C1** (5.9 MPa {60 kg/cm$^2$}).
   3) Start the engine, then remove support (1) or boom drop prevention stopper **K4**.
   4) Run the engine at high idling, then operate the work equipment control lever and measure the oil pressure.

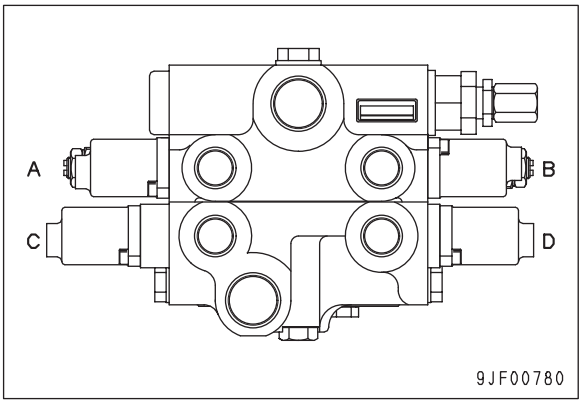


2. Measuring PPC valve output pressure
   1) Remove the inspection cover of the front frame.
   2) Remove EPC output pressure measurement plug (1) of the circuit to be measured, then install oil pressure gauge **C1** (39.8 MPa {400 kg/cm$^2$}).




★ A: Bucket TILT
B: Bucket DUMP
C: Boom RAISE
D: Boom LOWER

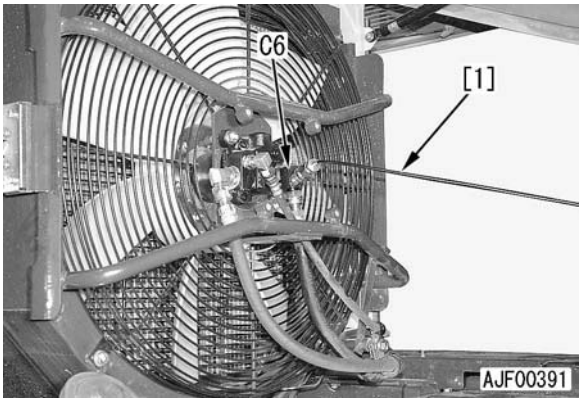


# BLEEDING AIR

1. Bleeding air from fan motor circuit
   1) Open the radiator grill, then remove cover (1).




   2) Disconnect hose (2) at the inlet port of the motor, then fit tool **C6** and connect air bleed hose [1].




   3) Start the engine, and when oil comes out from air bleed hose, stop the engine and remove the air bleed hose.
2. Bleeding air from work equipment PPC circuit
   1) Operate each work equipment lever fully and hold it in position to relieve the circuit for approx. 1 minute. Carry out this operation once for each work equipment lever stroke end.
3. Bleeding air from cylinders
   1) Start the engine and run at idling for approx. 5 minutes.
   2) Run the engine at low idling, then raise and lower the lift arm 4 - 5 times in succession.
      ★ Operate the piston rod to a point approx. 100 mm before the end of its stroke. Do not relieve the circuit under any circumstances.
   3) Run the engine at full throttle and repeat Step 2). After that, run the engine at low idling, and operate the piston rod to the end of its stroke to relieve the circuit.
   4) Repeat Steps 2) and 3) to bleed the air from the bucket and steering cylinders.
      ★ When the cylinder has been replaced, bleed the air before connecting the piston rod.

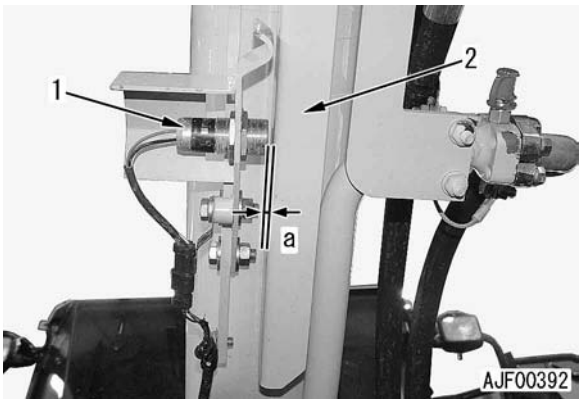
# RELEASING REMAINING PRESSURE IN HYDRAULIC CIRCUIT

1) Releasing remaining pressure between each hydraulic cylinder and control valve.
   - ★ If the piping between the hydraulic cylinder and the control valve is to be disconnected, release the remaining pressure from the circuit as follows.
   1) Stop the engine.
   2) Loosen the oil filler cap slowly to release the pressure inside the tank.
   3) Operate the control levers.
      - ★ When the levers are operated 2 - 3 times, the pressure stored in the PPC accumulator is removed. Start the engine, run at low idling for approx. 5 seconds to charge the accumulator, then stop the engine and operate the control levers.
      - ★ Repeat the above operation 2 - 3 times to release all the remaining pressure.
2) Releasing remaining pressure in brake accumulator circuit
   - ★ If the piping between the ACC charge valve and brake accumulator, between the ACC charge valve and parking brake valve, and between the accumulator and brake valve is to be disconnected, release the remaining pressure from the circuit as follows.
   1) Stop the engine.
   2) Depress the brake pedal at least 100 times to release the pressure inside the brake accumulator circuit.
3) Releasing remaining pressure in PPC accumulator circuit
   - ★ If the piping between the PPC accumulator and PPC valve is to be disconnected, release the remaining pressure from the circuit as follows.
   1) Operate the control lever 2 - 3 times to release all the remaining pressure from the circuit.

# TESTING AND ADJUSTING BUCKET POSITIONER

★ Engine coolant temperature: Operating range of engine coolant thermometer
★ Hydraulic oil temperature: 45 - 55 °C

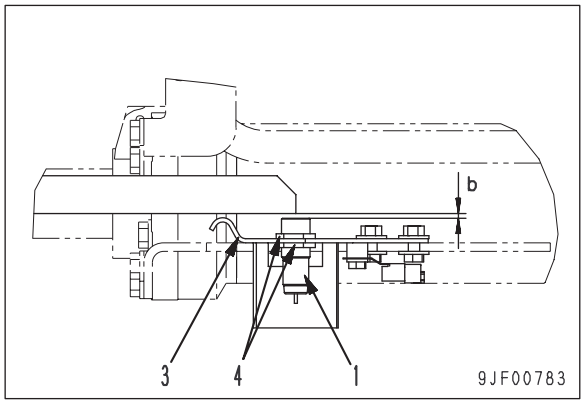
**Testing**
1. Stop the engine and check that clearance **a** between proximity switch (1) and sensing bar (2) is in the standard range.
   ★ Clearance **a**: 3 - 5 mm




2. Run the engine at low idling and check the operating point. (Measure 3 times and obtain the average.)

**Adjusting**
1. Adjusting clearance.
   1) Adjust and secure clearance **b** between the tip of switch protector (3) and the sensitive surface of the switch to the standard range with switch nuts (4).
   ★ Standard clearance **b**: 0.5 - 1.0 mm

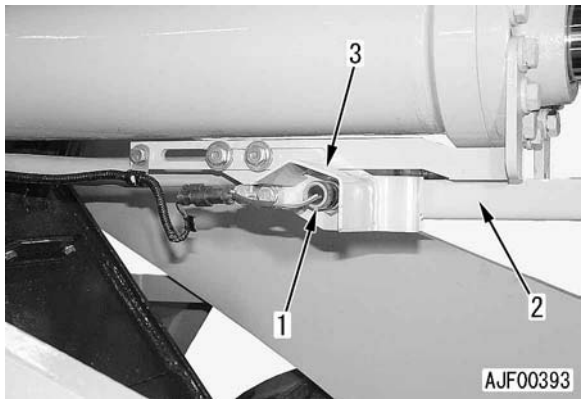
Mounting nut:
14.7 - 19.6 Nm {1.5 - 2.0 kgm}




   2) Adjust and secure clearance **a** between the sensitive surface of proximity switch (1) and sensing bar (2) to the standard range with the shim and mounting bolt of the proximity switch bracket.
   ★ Clearance **a**: 3 - 5 mm
   ★ Adjust sensing bar (2) with the shim so that clearance **a** will be in the standard range through the stroke of the sensing bar.
2. Adjusting installing position (stopping position).
   1) Lower the bucket to the ground and set it to a desired digging angle, then return the lever to the holding position and stop the engine.
   2) Adjust with switch mounting nut (4) so that clearance b of the detection lever (2) of proximity switch (1) is within the standard value, then secure in position.

Switch mounting nut:
14.7 - 19.6 Nm {1.5 - 2.0 kgm}

- The installing position may be checked by checking the operation of the pilot lamp of the proximity switch with the starting switch at the ON position. (When the pilot lamp goes off, the bucket stops.)

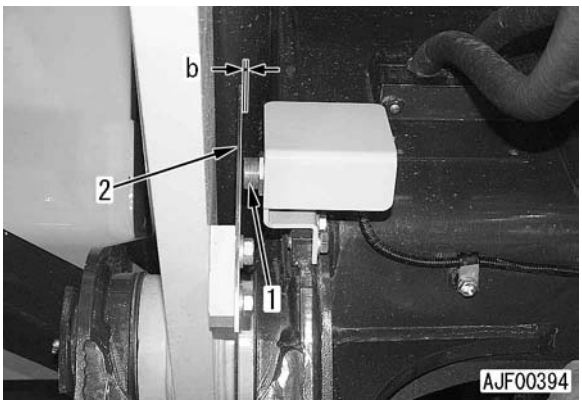



★ After adjusting, start the engine and operate the bucket control lever to check that the bucket positioner operates at the desired position.

# TESTING AND ADJUSTING OF BOOM KICK-OUT

**Testing**

1. With the engine stopped, check that clearance **b** between switch (1) and plate (2) is the standard value.
   ★ Clearance **b**: 3 - 5 mm



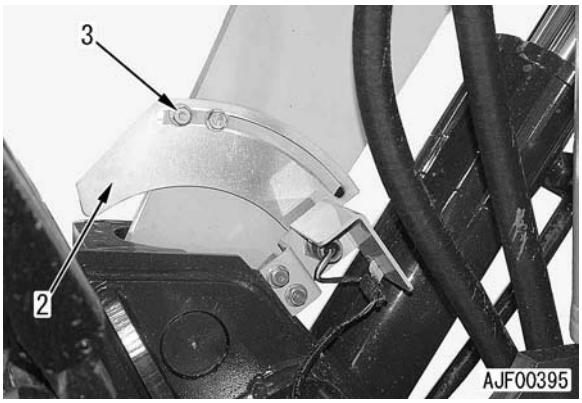

2. Start the engine, run at high idling, and check the actuation point.
   (Check three times and take the average.)

**Adjusting**

1. Raise the boom to the desired height, then mark the boom to show the position where the center of the switch is aligned with the bottom of the plate.

   **WARNING!** Always be sure to apply the safety lock to the work equipment control lever.

2. Lower the boom and stop the engine.
3. Align the marks and adjust the position of the plate so that the center of switch (1) is at the bottom of plate (2), then secure in position with bolt (3).




4. Adjust the switch so that clearance **b** between the sensing surface of the switch and plate (2) is the standard value, then secure in position.

   Switch mounting nut:
   14.7 - 19.6 Nm {1.5 - 2.0 kgm}

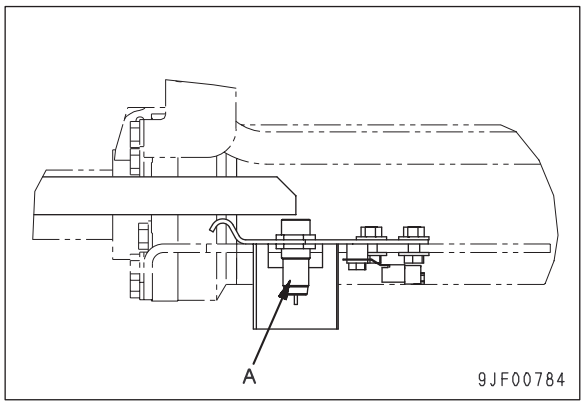
   ★ After adjusting, operate the work equipment and check that the boom kickout is actuated at the desired position.
   ★ Standard clearance **b**: 3 - 5 mm

# CHECKING PROXIMITY SWITCH ACTUATION DISPLAY LAMP

**Proximity switch actuation display lamp (red)**

A display lamp is installed to the proximity switch to show the actuation status, and so use this when adjusting.

- A: Actuation display lamp (red)

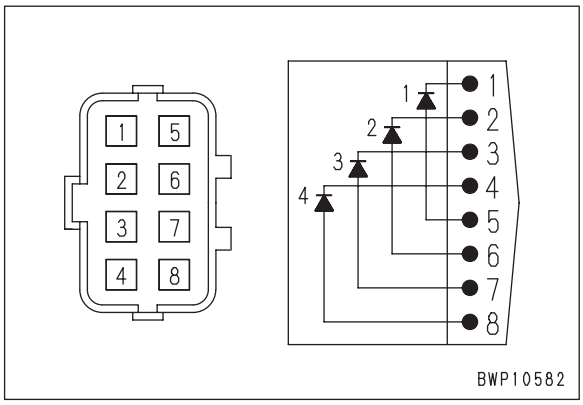


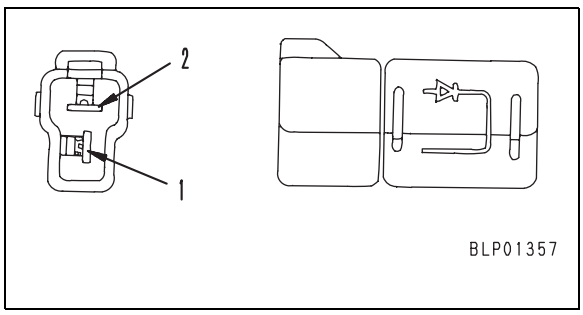

| Proximity switch | Relative position of detector and detection surface of proximity switch | Actuation display lamp | Remarks |
|---|---|---|---|
| Bucket positioner | In contact | ON | Actuated when center of switch approaches |
| | Separated | OFF | |
| Boom kick-out | In contact | ON | Actuated when center of switch separates |
| | Separated | OFF | |

# PROCEDURE FOR CHECKING DIODE

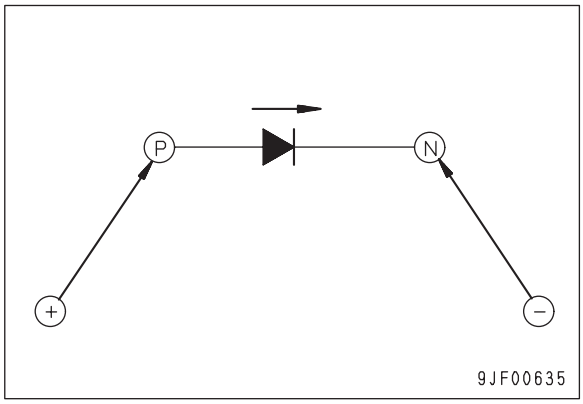
★ Use the following procedure to check the centralized diode (8-pin) and theindividual diode (2-pin).

★ The direction of continuity of the individual diode is marked on the surface of the diode as shown in the diagram below.




1. When using digital tester
   1) Switch to the diode range and check the display value.
      ★ With a normal tester, the internal battery voltage is displayed.
   2) Put the red (+) end of the test pin in contact with the anode (P) of the diode, and the black (-) end in contact with the cathode (N), and check the display.
   3) Judge the condition of the diode from the display value.
      - Display value does not change: No continuity (defective)
      - Display value of changes: There is continuity (normal) (see ★)
      ★ In the case of silicon diodes, a value between 460 and 600 is displayed.




2. When using analog tester
   1) Set to the resistance range.
   2) When doing the following, check the deflection of the indicator.
      i) Put the red (+) end of the test pin in contact with the anode (P) of the diode, and the black (-) end in contact with the cathode (N).
      ii) Put the red (+) end in contact with the cathode (N) and the black (-) end of the test pin in contact with the anode (P) of the diode.
   3) Judge the condition of the diode from the deflection of the indicator.
      - If the indicator does not deflect in Step i), but it deflects in Step ii): Normal (note that the amount of the deflection (resistance value) differs according to the type of tester and the selection of the measurement range.)
      - If the indicator deflects in both Step i) and Step ii): Defective (internal short circuit)
      - If the indicator does not deflect in either Step i) or Step ii): Defective (internal disconnection)

# SPECIAL FUNCTIONS OF MACHINE MONITOR

**Normal functions and special functions of machine monitor**

The machine monitor is equipped with normal functions and special functions.

Various items of data are displayed on the character display in the middle of the machine monitor. Depending on the internal setting of the machine monitor, the display items are divided into automatic display items and items displayed when the machine monitor switches are operated.

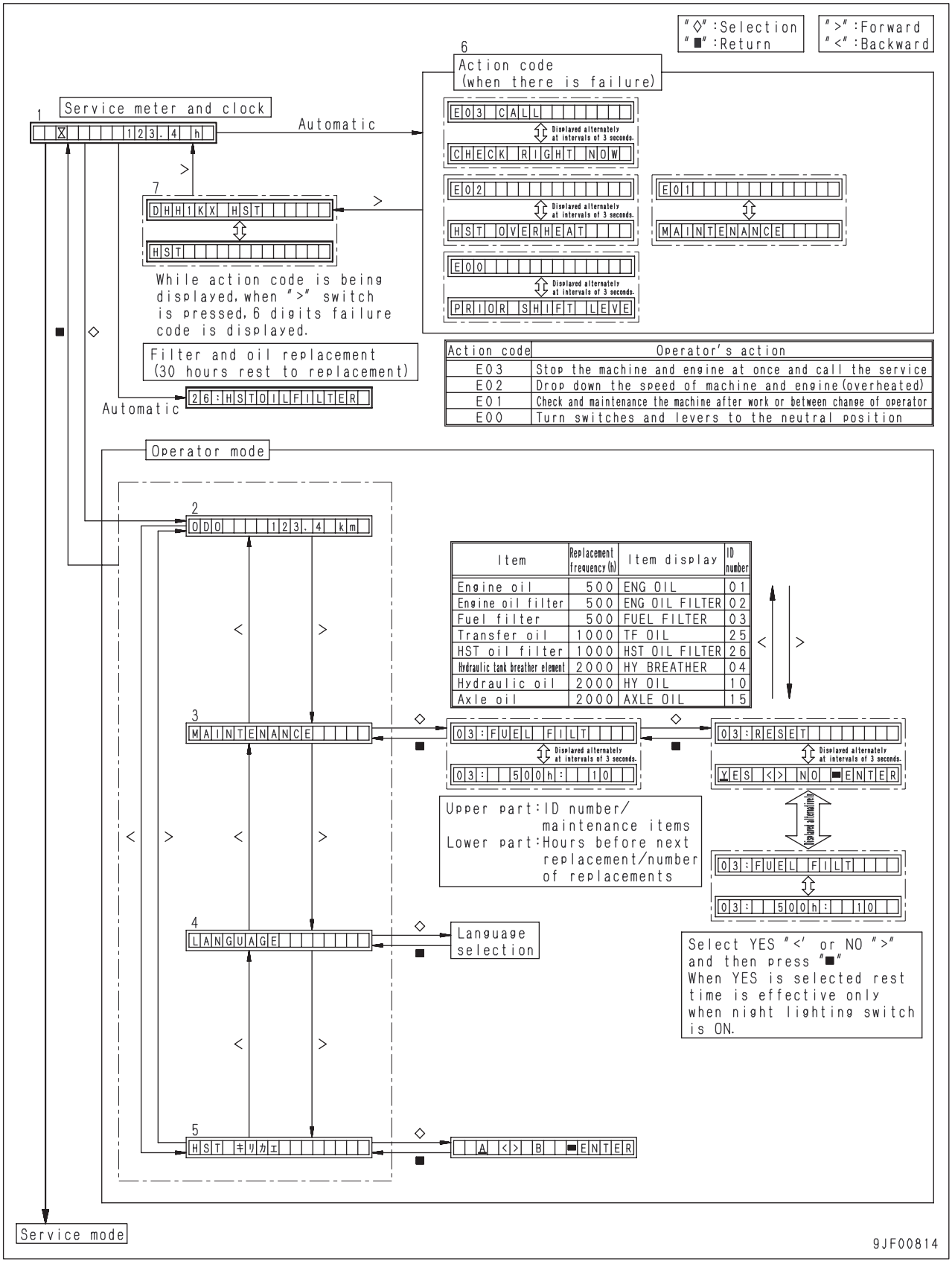
1. Normal functions: Operator mode
   Functions for which the content is normally displayed or which can be used displayed and operated by the operator operating the switches.
2. Special functions 1: Service Mode 1
   Functions which the serviceman can display and operate with the special switches to carry out inspection, maintenance, and troubleshooting.
3. Special functions 2: Service Mode 2
   Special operations performed by the serviceman or at the factory.

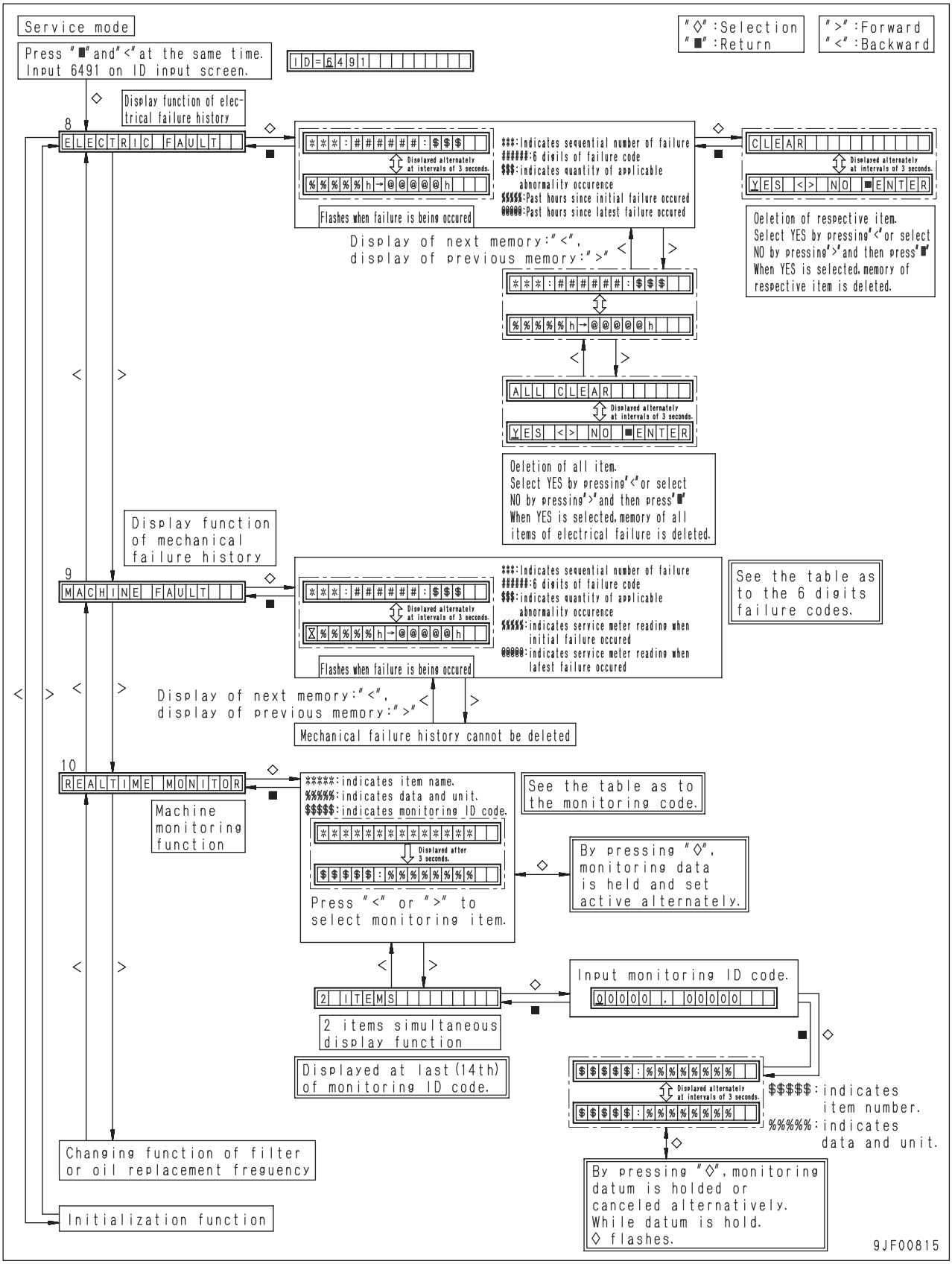
| Operator mode | |
|---|---|
| 1 | Service meter, time display (Load meter specification) |
| 2 | Odometer display function |
| 3 | Filter, oil replacement interval display function |
| 4 | Language selection function |
| 5 | HST selection function |
| 6 | Action code display function |
| 7 | Error code display function |

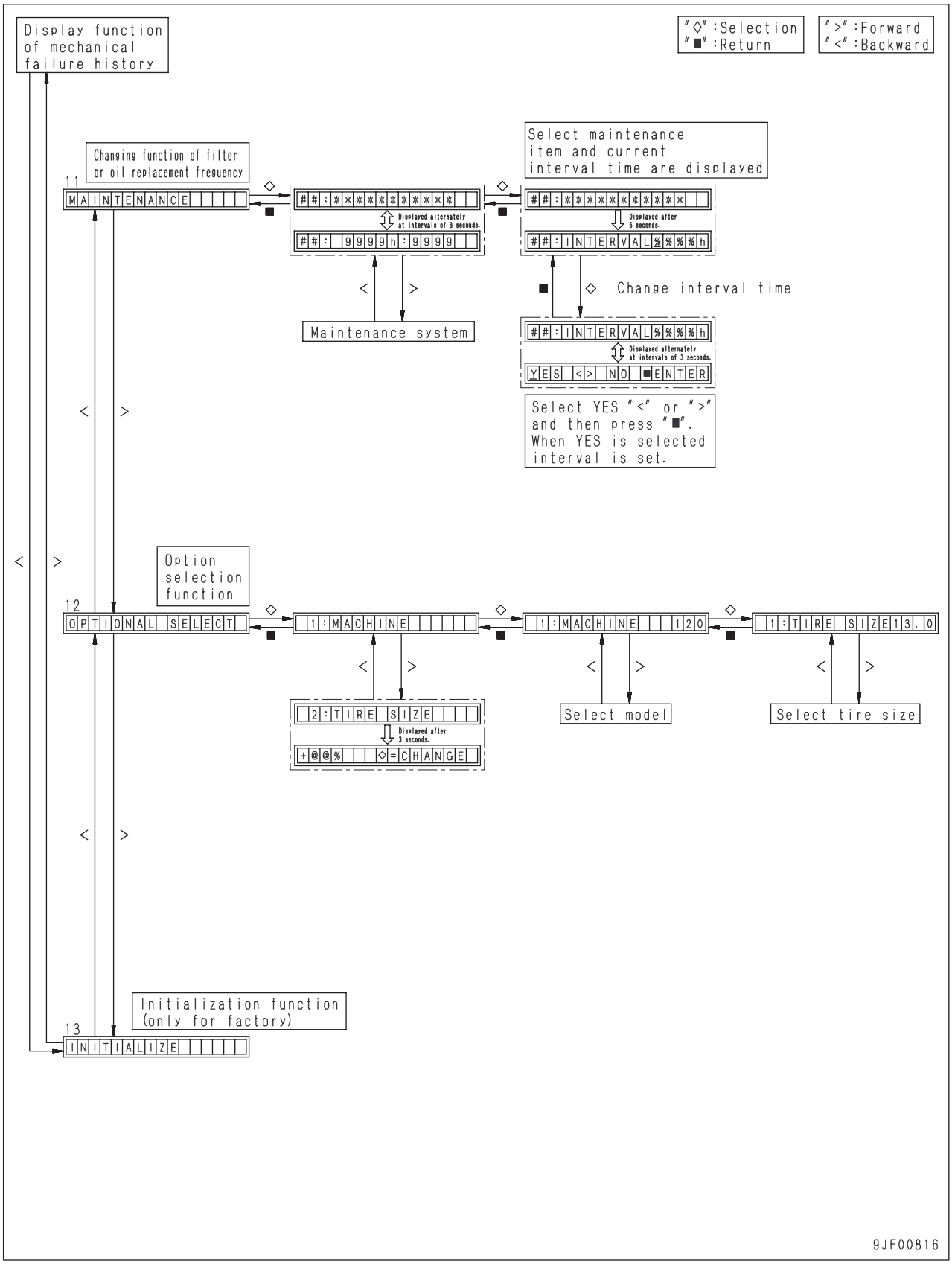
| Service mode 1 | |
|---|---|
| 8 | Electrical system trouble data display function |
| 9 | Mechanical system trouble data display function |
| 10 | Machine data monitoring function |
| 11 | Filter, oil replacement time setting function |
| 12 | Option selection function |
| 13 | Initialize function |

| Service mode 2 | |
|---|---|
| 14 | Service meter setting function |
| 15 | Odometer setting function |

# FLOW OF MODES AND FUNCTIONS




Service mode
Press "■" and "<" at the same time. Input 6491 on ID input screen.
ID=6491
"◇":Selection
"■":Return
">":Forward
"<":Backward
Display function of electrical failure history
8
ELECTRIC FAULT
***:#####:$$$
%%%%%h→@@@@@h
Displayed alternately at intervals of 3 seconds.
***:Indicates sequential number of failure
######:6 digits of failure code
$$$:indicates quantity of applicable abnormality occurence
%%%%%:Past hours since initial failure occured
@@@@@:Past hours since latest failure occured
Flashes when failure is being occured
Display of next memory:"<", display of previous memory:">"
CLEAR
YES <> NO ■ENTER
Oeletion of respective item. Select YES by pressing "<" or select NO by pressing ">" and then press "■" When YES is selected, memory of respective item is deleted.
ALL CLEAR
Oeletion of all item. Select YES by pressing "<" or select NO by pressing ">" and then press "■" When YES is selected, memory of all items of electrical failure is deleted.
Display function of mechanical failure history
9
MACHINE FAULT
%%%%%h→@@@@@h
%:indicates service meter reading when initial failure occured
@@@@@:indicates service meter reading when lafest failure occured
See the table as to the 6 digits failure codes.
Mechanical failure history cannot be deleted
10
REALTIME MONITOR
Machine monitoring function
*****:indicates item name.
%%%%%:indicates data and unit.
$$$$$:indicates monitoring ID code.
Displayed after 3 seconds.
Press "<" or ">" to select monitoring item.
See the table as to the monitoring code.
By pressing "◇", monitoring data is held and set active alternately.
2 ITEMS
2 items simultaneous display function
Displayed at last (14th) of monitoring ID code.
Input monitoring ID code.
Q0000.00000
$$$$$:indicates item number.
%%%%%:indicates data and unit.
By pressing "◇", monitoring datum is holded or canceled alternatively. While datum is hold. ◇ flashes.
Changing function of filter or oil replacement freguency
Initialization function
9JF00815


Display function of mechanical failure history
"◇":Selection
"■":Return
">":Forward
"<":Backward
Changing function of filter or oil replacement frequency
Select maintenance item and current interval time are displayed
11
MAINTENANCE
##:**********
Displayed alternately at intervals of 3 seconds.
##: 9999h:9999
Displayed after 5 seconds.
##:INTERVAL%%%%h
Maintenance system
Change interval time
##:INTERVAL%%%%h
Displayed alternately at intervals of 3 seconds.
YES <> NO ■ENTER
Select YES "<" or ">" and then press "■". When YES is selected interval is set.
Option selection function
12
OPTIONAL SELECT
1:MACHINE
1:MACHINE 120
1:TIRE SIZE 13.0
2:TIRE SIZE
Displayed after 3 seconds.
+@@% ◇=CHANGE
Select model
Select tire size
Initialization function (only for factory)
13
INITIALIZE
9JF00816

**Operator mode**

★ The display is given endlessly when the [>], [<], [◇], or [■] switches are operated.

★ If a failure occurs, the screen switches automatically to the [Action code display function], regardless of the screen being displayed.

★ If the switches are not operated for more than 30 seconds, the screen switches automatically as follows regardless of the screen being displayed.
- If there is no failure, the display switches to the [Service meter (time display) function].
- If there is a failure, the display switches to the [Action code display function].

**Service mode 1**

★ The switching of each function occurs endlessly when the [>], [<], [◇], or [■] switches are operated.

★ Once the ID is input, it remains effective until the starting switch is turned OFF.

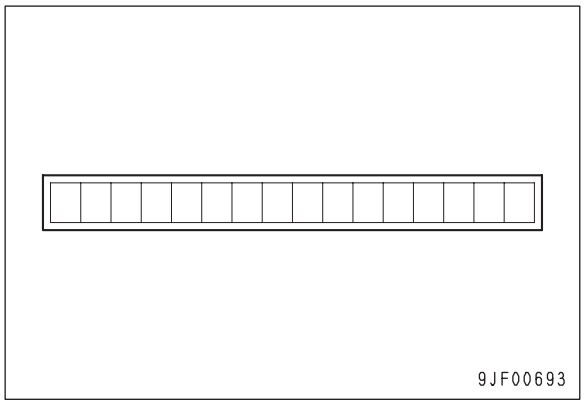
**Service mode 2**

★ The switching of each function occurs endlessly when the [>], [<], [◇], or [■] switches are operated.

**Character display**

Sixteen characters can be displayed on the character display. A combination of numerals, letters, and symbols can be used for the display.

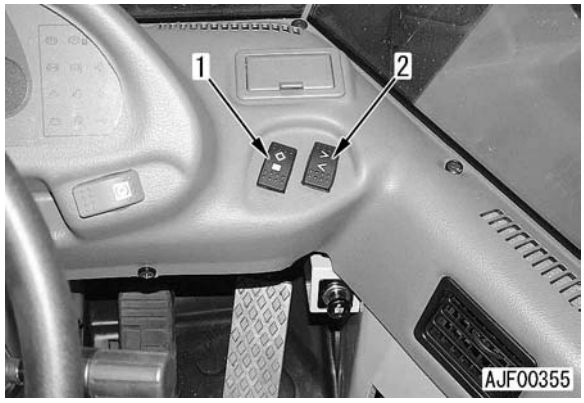
1. Numerals: 1, 2, 3, . . .
2. Lower case letters: a, b, c, . . .
3. Upper case letters: A, B, C, . . .
4. Japanese katakana:
5. Symbols: @, Y, $, . . .
6. Special characters




**Operating switches**

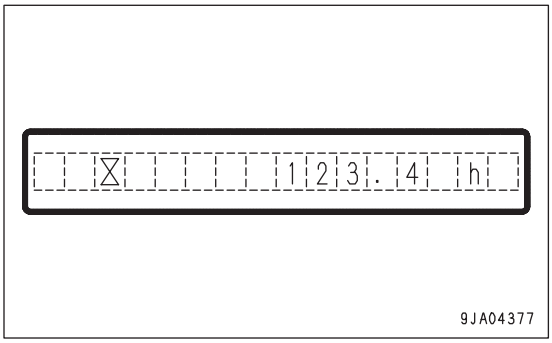
The display operations on the machine monitor are all carried out with machine monitor mode selector switches (1) and (2).
The following functions are set for the button for each switch.

1. [◇]: Execute, select
2. [■]: Cancel, enter (YES/NO screen only)
3. [>]: Right, next
4. [<]: Left, back

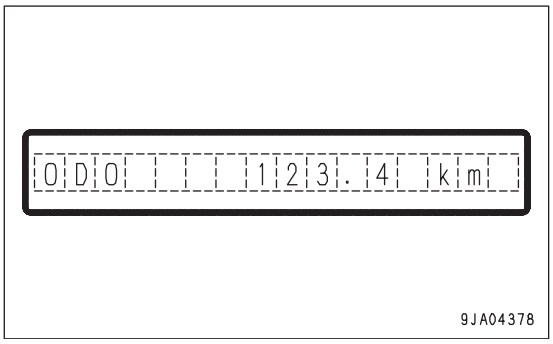



**Operator mode operation and displays**

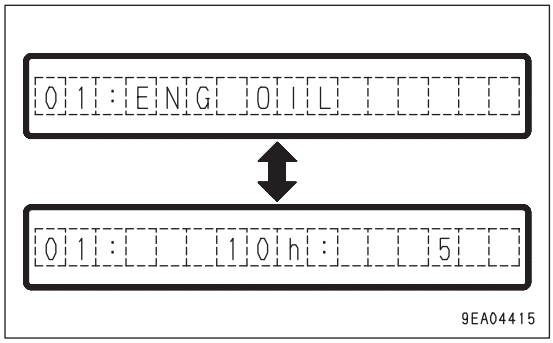
1. Service meter, time display function
   When the starting switch is turned ON, the display shows the service meter.



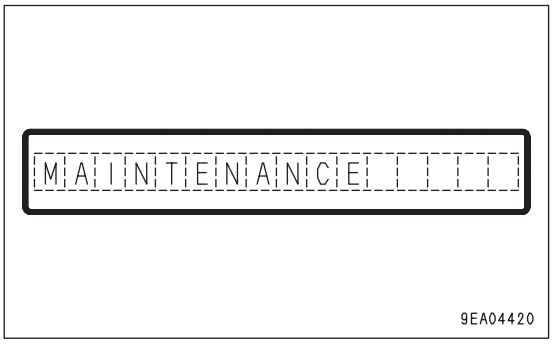
2. Odometer display function
From the normal service meter display screen or action code display, press the [◇] switch to display the odometer.



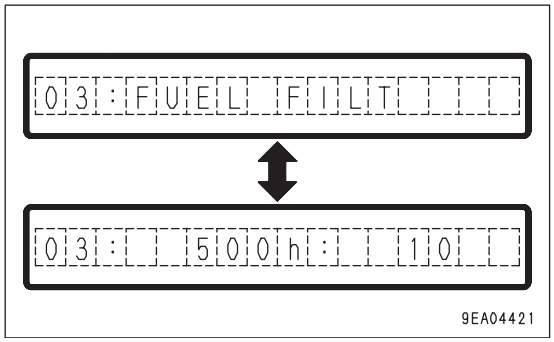

3. Filter/oil change time display function
1) Filter/oil change time display (automatic display)
When the starting switch is turned ON (after completion of the system check), but display is given for approx. 30 seconds for the filters and oil that are near the time for replacement or change. At the same time, the maintenance caution lamp also flashes or lights up to advise the operator to carry out maintenance.



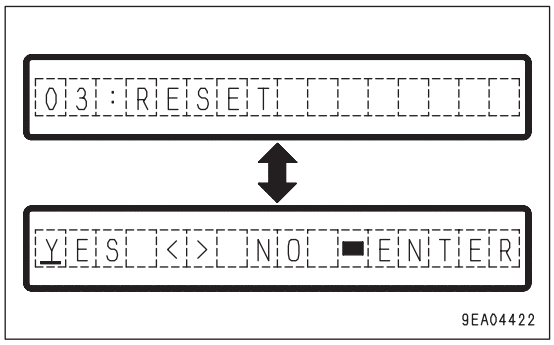

2) Resetting change time
If the maintenance for each filter or oil has been completed, operate the switch to reset the time.
i) Press the [◇] switch to display the odometer, then press the [>] or [<] switch to display [Maintenance monitor].




ii) When the [◇] switch is pressed, each item is displayed, then the change time is displayed in the center and the related number of times of replacement is displayed in turn on the right side.
iii) Use the [>] or [<] switch to select the item to be reset.

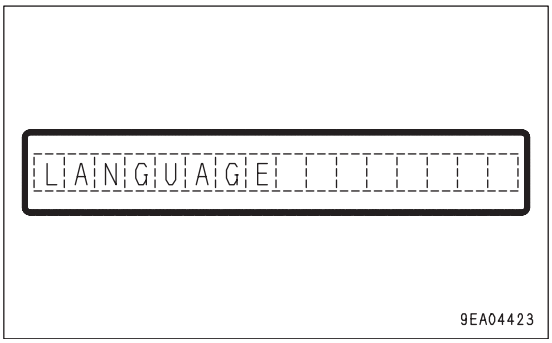



iv) When the [◇] switch is pressed, the reset item and item to be reset are displayed.
★ When resetting the replacement time, use the [>] or [<] switch to select YES, then press the [■] switch. The item is reset and the screen returns to the previous screen. (If the item is not to be reset, select NO, then press the [■] switch. The screen returns to the previous screen. )



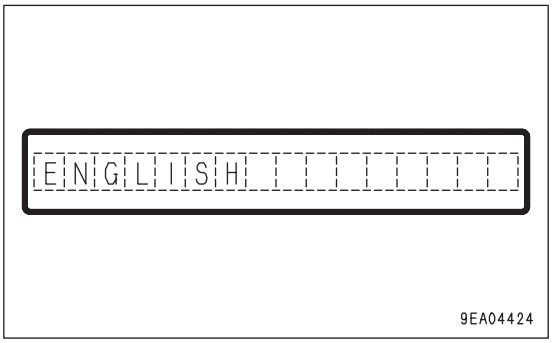

v) When the resetting the time for other items, repeat the procedure from Step ii).
★ To complete the operation, press the [■] switch twice or turn the starting switch OFF.

4. Language selection function
   1) Press the [< >] switch to display the odometer, then press the [>] or [<] switch to display [Language selection].



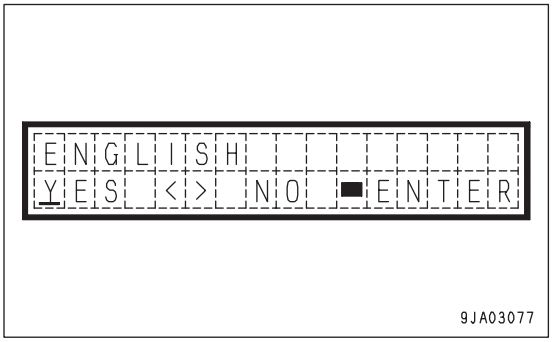

**(The following explanation is for when the display is in Japanese)**
**(For European languages, the language table is deleted: see separate explanation)**

   2) When the [◇] switch is pressed, the present language is displayed.
   3) Use the [>] or [<] switch to select the language.



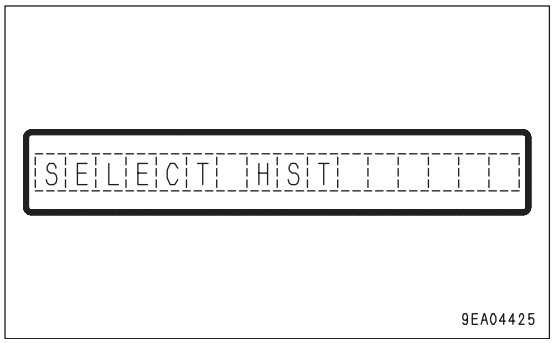

- The available languages are English, and Japanese, German, French, Italian, Spanish, and Swedish.

   4) After selecting the language, press the [◇] switch.
      ★ When selecting the language, use the [>] or [<] switch to select YES, then press the [■] switch. The language is set and the screen returns to the previous screen. (To abort the language selection, select NO, then press the [■] switch. The screen returns to the previous screen. )

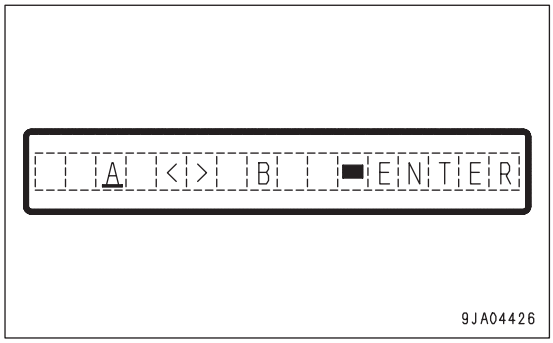



      ★ To complete the operation, press the [■] switch twice or turn the starting switch OFF.

5. HST selector function
   1) Press the [◇] switch to display the odometer, then press the [>] or [<] switch to display [HST selection].

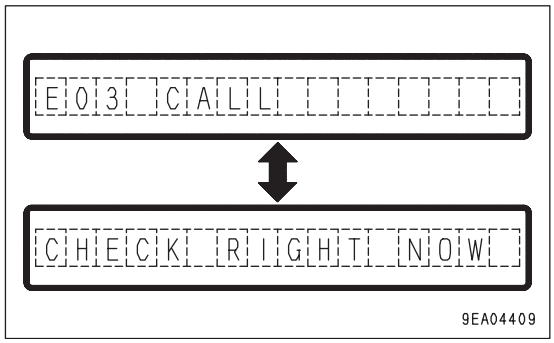



   2) When the [◇] switch is pressed, the present HST selection is displayed.
   3) Use the [>] or [<] switch to select either A or B.
   4) After selecting, press the [■] switch.
      The HST selection is set and the screen returns to the previous screen.




   ★ To complete the operation, press the [■] switch twice or turn the starting switch OFF.

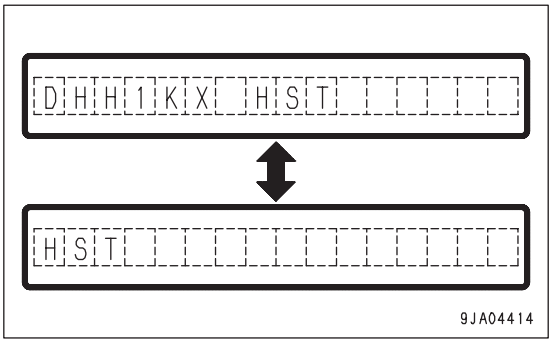
6. Action display function
   If an abnormality occurs on the machine, the action code is displayed automatically depending on the level of the abnormality to advise the operator to carry out the applicable action.
   ★ The sketch below shows an example of action code [E03 CALL] and [Perform maintenance immediately] shown in turn.




★ Action codes and remedy recommended to operator

| Action code | CALL | Content of advice to operator |
|---|---|---|
| E00 | No | • Return switches and levers for control switch to normal condition |
| E01 | No | • Carry out maintenance after completion of operation or when operators change shift |
| E02 | No | • When overrun related display is given, reduce engine speed and machine speed and continue operation |
| | | • When overheat related display is given, stop machine and run engine at a mid-range speed under no load |
| E03 | Yes | • Start engine and machine immediately and contact serviceman |

7. Failure code display function
   If an action code is being displayed, press the [>] switch to display the failure code for the existing failure.
   - ★ The failure codes detected in the past are divided into failures of the electrical system and the mechanical system, and are recorded as trouble data. (For details, see Service mode 1)
   - ★ With the service code display function, the following information is displayed.
     [Failure code + controller detecting failure code (left side)] and [Location of failure (right side)] are displayed in turn.
     Code on right side:
     MON ✕ Machine monitor
     HST ✕ HST controller




   - ★ When there are multiple failures, press the [>] switch to display the other failure codes.
   - ★ After pressing the [>] switch to display or the failure codes for existing failures, press the [>] switch to return to the service meter display screen.
   - ★ For details of of the failure code is displayed, see [Failure code list].

### Failure code table

| Failure Code | Location of Failure (Location, component with failure) | Nature of Failure (Problem, nature of failure) | Controller | Action code |
|---|---|---|---|---|
| (HST controller related) | | | | |
| 989F00 | Transmission protection caution | Actuated (00) | HST | E00 |
| DGH1KX | HST oil pressure sensor | Input signal outside range (KX) | HST | E03 |
| DLE2LC | Engine revolution sensor (Speed signal mismatch) (LC) | *See separate table (LC) | HST | E03 |
| DW25KZ | HA solenoid system | Disconnection or short circuit (KZ) | HST | E03 |
| DX19KZ | EP solenoid system | Disconnection or short circuit (KZ) | HST | E03 |
| DX20KZ | Clutch solenoid system | Disconnection or short circuit (KZ) | HST | E03 |
| (Monitor related) | | | | |
| 15B0NX | HST oil filter | Clogging (NX) | MON | E01 |
| 2G42ZG | Accumulator | Drop in oil pressure (ZG) | MON | E03 |
| 989F00 | Transmission protection caution | Actuated (00) | MON | E00 |
| 989FN1 | HST overrun | Overrun (N1) | MON | E02 |
| AA1ANX | Air cleaner | Clogging (NX) | MON | E01 |
| AB00L6 | Battery charging circuit (Alternator terminal R signal detected when engine stopped) | *See separate table (L6) | MON | E03 |
| AB00MA | Battery charging circuit (No signal from alternator terminal R, Abnormal detection) | Function impossible (MA) | MON | E03 |
| B@BAZG | Engine oil pressure | Drop in oil pressure ((ZG) | MON | E01 |
| B@BAZK | Engine oil | Drop in level (ZK) | MON | E01 |
| B@BCNS | Engine coolant temperature | Overheat (NS) | MON | E02 |
| B@BCZK | Radiator coolant level | Drop in level (ZK) | MON | E01 |
| B@C7NS | Brake oil temperature | Overheat (NS) | MON | E02 |
| B@CRNS | HST oil temperature | Overheat (NS) | MON | E02 |
| D5ZHL6 | Starting switch "C" (IGN "C" abnormal input signal) | *See separate table (L6) | MON | E01 |
| DAF0KT | Controller | Abnormally inside controller (KT) | MON | E03 |
| DAJ0KR | HST controller (Communication shut-down) | Defective communication (Abnormally in applicable component system) (KR) | MON | E03 |
| DD15LD | Monitor panel mode selector switch 1 [■] (Panel switch 1) input error | *See separate table (LD) | MON | E01 |
| DD16LD | Monitor panel mode selector switch 1 [□] (Panel switch 2) input error | *See separate table (LD) | MON | E01 |
| DD17LD | Monitor panel mode selector switch 2 [<] (Panel switch 3) input error | *See separate table (LD) | MON | E01 |
| DD18LD | Monitor panel mode selector switch 2 [>] (Panel switch 4) input error | *See separate table (LD) | MON | E01 |
| DD1CLD | Sub-total switch failure | *See separate table (LD) | MON | E01 |
| DDK3KB | Shift lever F and R signals same time input | Short circuit (KB) | MON | E03 |
| DDS5L6 | Steering oil pressure drop | *See separate table (L6) | MON | E03 |
| DDY0LD | Cancel switch abnormal | *See separate table (LD) | MON | E01 |
| DGE2KX | Engine water temperature sensor (High temperature) system abnormal | Input signal outside range (KX) | MON | E01 |
| DGE3L6 | Engine water temperature sensor (Low temperature) system abnormal | *See separate table (L6) | MON | E01 |
| DGH1KX | HST oil temperature sensor system abnormal | Input signal outside range (KX) | MON | E01 |

| Failure Code | Location of Failure (Location, component with failure) | Nature of Failure (Problem, nature of failure) | Controller | Action code |
|---|---|---|---|---|
| DGR1KA | Brake oil temperature sensor system abnormal | Disconnection (KA) | MON | E01 |
| DGR1KX | Brake oil temperature sensor system abnormal | Short circuit (KB) | MON | E01 |
| DHE4L6 | Engine oil pressure sensor disconnect | *See separate table (L6) | MON | E01 |

*Separate table: Detailed phenomena of problem code (L*)

| Problem code | Nature |
|---|---|
| L0 | Fill signal ON 2 or more channels for clutches not forming a set are input at same time |
| L1 | Fill signal is ON when command current to ECMV is OFF |
| L2 | Fuel pressure is greater than maximum specified value |
| L3 | Corresponding component cannot be controlled |
| L4 | ON/OFF signals for 2 systems do not match |
| L5 | Potentiometer signal and switch signal do not match |
| L6 | Engine speed signal, terminal C signal, signals for oil pressure switch, water temperature, etc. do not match operating condition or stopped condition of machine |
| L8 | Analog signals for 2 systems do not match |
| LC | Speed signals for 2 systems do not match |
| LD | Switch has been kept pressed for abnormally long time |
| LH | Fill signal is OFF when command current to ECMV is ON |

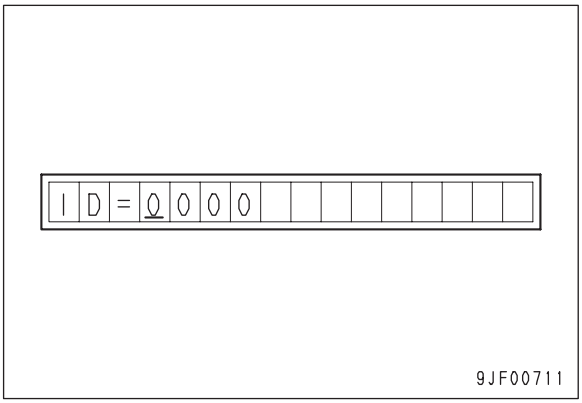
**Procedure for switching to Service Mode 1 and screen display**

★ When using Service Mode 1, carry out the following special operation to switch the screen display.

1) Checking screen display
With the machine monitor in the operator mode, check that the screen is one of the following displays: Service meter, action code, or failure code.

2) Initial screen display for ID input
Press the following 2 buttons at the same time for at least 5 seconds to display the initial screen display for the ID input.
- [■] button and [<] button

★ If the buttons are held pressed for at least 5 seconds, the whole screen will give no display, so check that the screen gives no display, then release the buttons.

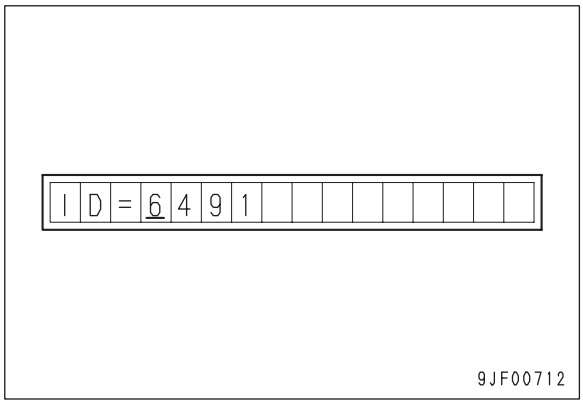



3) Inputting, confirming ID
Operate the buttons to input the ID.

★ ID: 6491
- [>] button: Number at cursor goes up.
- [<] button: Number at cursor goes down.
- [◇] button: Number at cursor is confirmed.
- [■] button: Returns to initial screen (see Note).

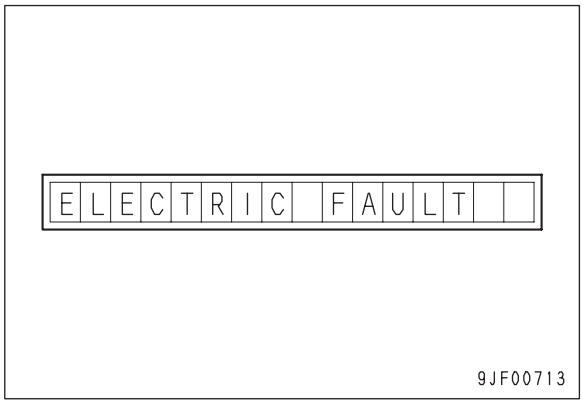
Note: When the cursor is at the left edge, the screen returns to the normal screen (operator mode).
If the cursor is not at the left edge, the cursor returns to the left edge.

★ If more than 60 seconds passes before the switch on the ID input screen is operated, the screen returns automatically to the normal screen.

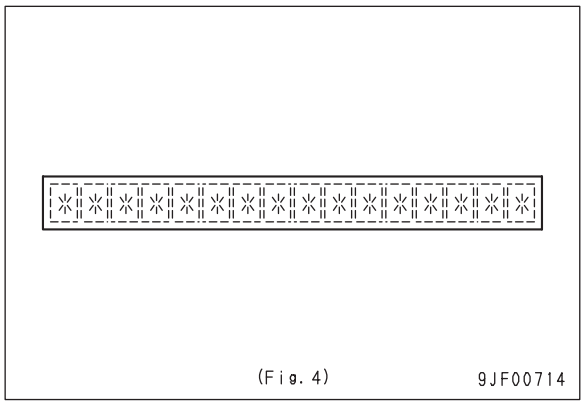



4) Displaying menu initial screen
After all four digits of the ID are confirmed, the menu initial screen of Service Mode 1 is displayed.

★ Once the ID has been input and confirmed, it remains effective until the starting switch is turned OFF.

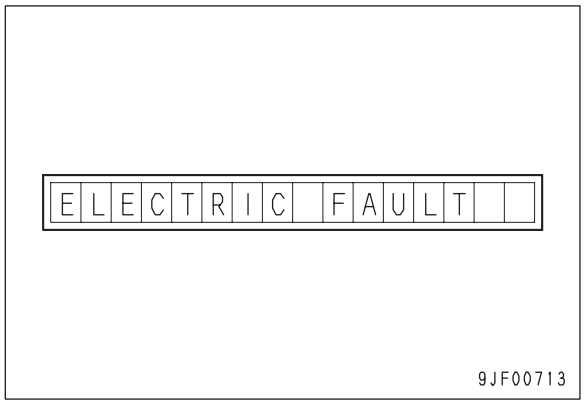


5) Menu selection in Service Mode 1
Press the [>] or [<] buttons on the menu screen and the menus of Service Mode 1 are displayed endlessly in the following order.
★ The menu is displayed in the places marked with [*].
• [>] button: Go on to the next menu
• [<] button: Go back to previous menu
(1) ELECTRICAL FAULT: Trouble data display function for electrical system
(2) MACHINE FAULT: Trouble data display function for mechanical system
(3) REAL-TIME MONITOR: Machine data monitoring function
(4) MAINTENANCE MONITOR: Filter, oil replacement interval setting function
(5) OPTION SELECT: Option installation selection function
(6) INITIALIZE: Initialize function (exclusive function for factory)


(Fig. 4) 9JF00714

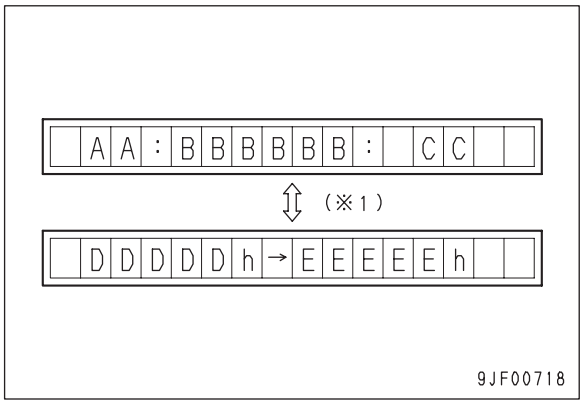
6) Completion of mode, function
When operating at any point in any function, it is possible to finish the mode or function by using any of the following methods.
(1) When continuing operations in another mode or function: Press the [■] button and return to the mode screen to be used or menu screen to be used.
★ Note that if the [■] button is pressed on the YES/NO screen, the function will be executed.
★ If you return to the normal screen (operator mode) by mistake, repeat the procedure from Step 1) above (there is no need to input the ID again).
(2) When completing all operations:
Turn the starting switch OFF.

8. Electrical system trouble data display function (ELECTRIC FAULT)
The monitor retains the data for problems that occurred in the electrical system in the past as failure codes. They can be displayed as follows.
1) Menu selection
Select the display function for ELECTRIC FAULT trouble data on the menu screen of Service Mode 1.



9JF00713

2) Trouble data display
With the menu selected, press the [◇] button and display the trouble data recorded in memory.
3) Displayed trouble data
A. Record number
B. Failure code (4-digit location code + 2 digit problem code
C. Number of occurrences (number of occurrences of same code in past)
D. Elapsed time 1 (time elapsed on service meter since first occurrence)
E. Elapsed time 2 (time elapsed on service meter since last occurrence)
★ Failure codes for problems that are still existing are shown on a flashing display.
★ For details of the failure codes displayed, see FAILURE CODE TABLE in the explanation for the failure code display function.
★ Note that with the trouble data display function and failure code display function for the electrical system, the displayed data are partially different.
★ If no trouble data are recorded, [-] is displayed on the display portion.

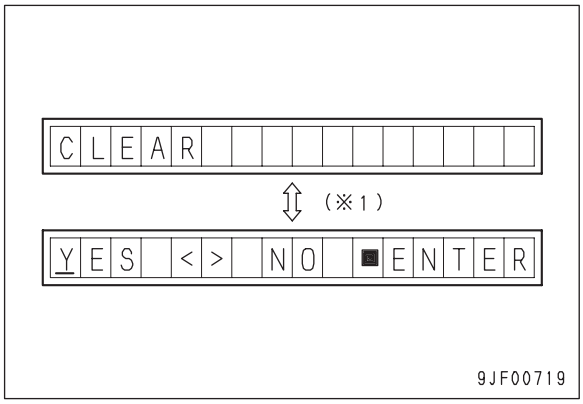



(*1): Displayed alternately at intervals of 3 seconds.

4) Switching trouble data display
If the [>] button or [<] button is pressed during the display of trouble data, the display switches to the other recorded trouble data.
   - [>] button: Go on to data for next record number.
   - [<] button: Go back to data for last record number.

5) Deleting individual trouble data
   (1) Display the trouble data to be deleted, then press the [◇] button once to display the individual item CLEAR screen (Fig. 4).
      - [◇] button: Display CLEAR screen
   (2) Operate the buttons according to the explanation on the screen (Fig. 4).
      - [<] button: Select YES
      - [>] button: Select NO
      - [■] button: Run

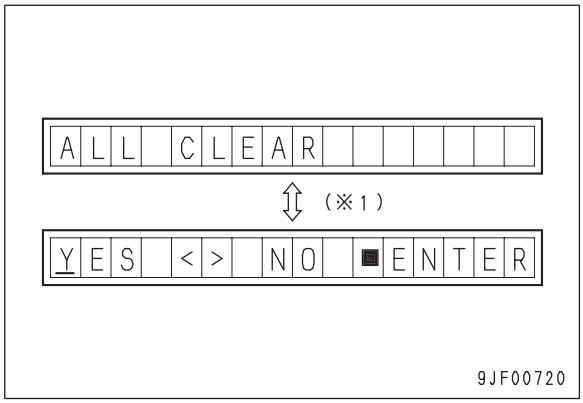
   ★ The data for an existing problem (flashing display) cannot be deleted.




(*1): Displayed alternately at intervals of 3 seconds.

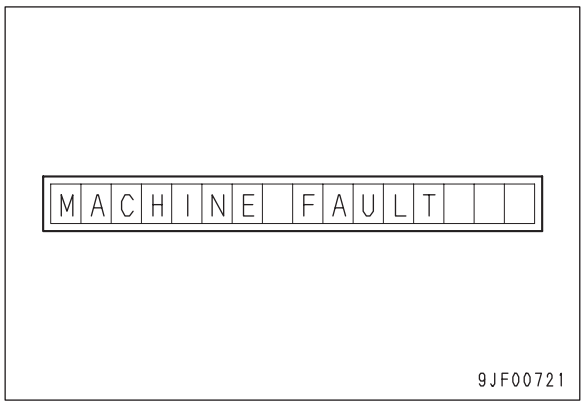
6) Deleting all trouble data
   (1) Display the trouble data, then press the [>] button or [<] button to display the ALL CLEAR menu (Fig. 5).
   (2) Press the [◇] button once to display the ALL CLEAR screen (Fig. 6).
      - [◇] button: Run ALL CLEAR menu
   (3) Operate the buttons according to the explanation on the screen (Fig. 6).
      - [<] button: Select YES
      - [>] button: Select NO
      - [■] button: Run

   ★ The data for an existing problem (flashing display) cannot be deleted.

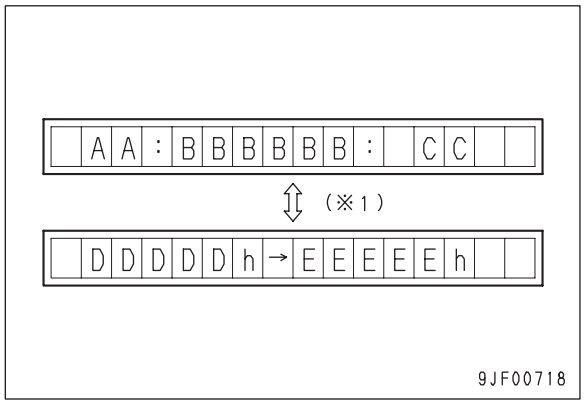



(*1): Displayed alternately at intervals of 3 seconds.

9. Mechanical system trouble data display function (MACHINE FAULT)
   The machine monitor retains the data for problems that occurred in the mechanical system in the past as failure codes. They can be displayed as follows.
   1) Menu selection
      Select the display function for MACHINE FAULT trouble data on the menu screen of Service Mode 1.




   2) Trouble data display
      With the menu selected, press the [◇] button and display the trouble data recorded in memory.
   3) Display trouble data
      A. Record number
      B. Failure code (4-digit location code + 2-digit problem code)
      C. Number of occurrences (number of occurrences of same code in past)
      D. Elapsed time 1 (time elapsed on service meter since first occurrence)
      E. Elapsed time 2 (time elapsed on service meter since last occurrence)
      ★ Failure codes for problems that are still existing are shown on a flashing display.
      ★ For details of the failure code displayed, see FAILURE CODE TALBLE in the explanation for the failure code display function.
      ★ Note that with the trouble data display function and failure code display function for the mechanical system, the displayed data are partially different.
      ★ If no trouble data are recorded, [-] is displayed on the display portion.

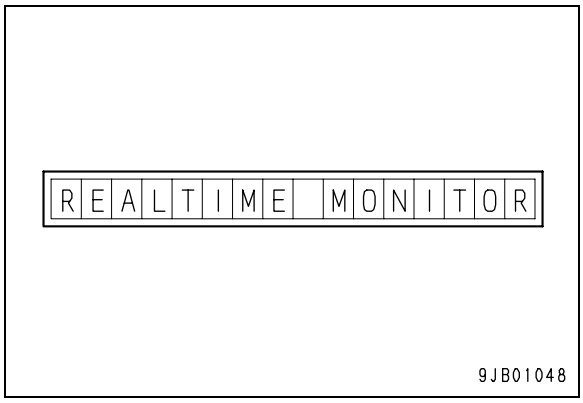



(*1): Displayed alternately at intervals of 3 seconds.

   4) Switching trouble data display
      If the [>] button or [<] button is pressed during the display of trouble data, the display switches to the other recorded trouble data.
      - [>] button: Go on to data for the next record number
      - [<] button: Go back to data for last record number
   5) Deleting trouble data (not permitted)
      ★ The trouble data for the mechanical system cannot be deleted.

10. Machine data monitoring function (REAL-TIME MONITOR)
The machine monitor can monitor the condition of the machine in real time through the signals from the sensors installed to various parts of the machine.
In the machine data monitoring function, the following 2 types of display can be shown.
- 1st item independent display (for each controller)
- 2nd item simultaneous display (code input)

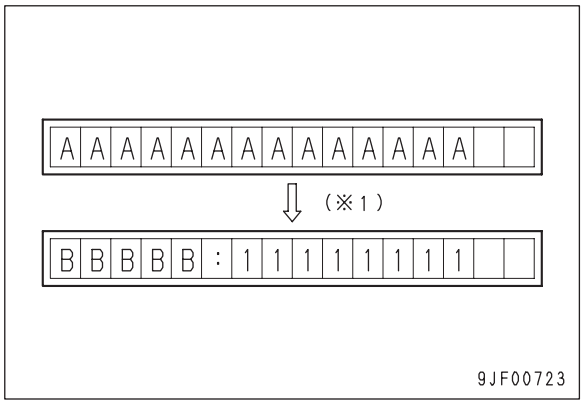
1) Menu selection
Select the machine data monitoring function (REAL TIME MONITOR) on the menu screen of the Service Mode 1.




2) Setting 1st item individual monitoring
(1) Press the [◇] button and display the REAL TIME MONITOR screen.
- [◇] button: Run sub menu

(2) Press the [>] button or [<] button to select the item for monitoring.
- [>] button: Go on to next item
- [<] button: Go back to last item
- ★ Scroll the monitoring items to display in the internally set order.
- ★ If the button is kept pressed, the items will scroll at high speed.
- ★ To hold or cancel monitoring data:
If the [◇] button is pressed during monitoring, the monitor data is held. If the [◇] button is pressed again, it becomes active again.

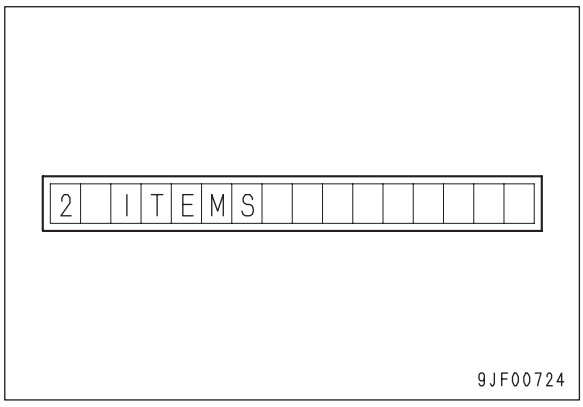
3) Display data for 1st item individual monitoring
★ On the 1st item individual monitoring screen, the following data are displayed (Fig. 6).
A. Item display
B. Monitoring data (5-digit)
1. Monitoring data (including unit)
★ For details, see MONITORING CODE TABLE.




(*1): Displayed after 3 seconds.

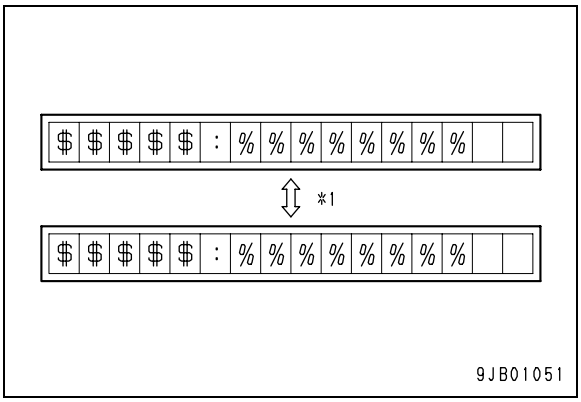
4) Setting 2nd item simultaneous monitoring
(1) Press the [◇] button and display the REAL TIME MONITOR screen.
(2) Press the [>] button or [<] button to select the 2nd item select screen (The 14th of last).
- [>] button: Number at cursor goes up
- [<] button: Number at cursor goes down

(3) Press the [◇] button and display the monitoring code input screen.
(4) Operate each button and input the monitoring code for the 2nd monitoring item directly.
- [>] button: Number at cursor goes up
- [<] button: Number at cursor goes down
- [◇] button: Number at cursor is confirmed
- [■] button: Returns to code input screen




(5) When both of the monitoring codes have been confirmed, the screen switches to the 2nd item display screen.

★ To hold or cancel monitoring data:
If the [◇] button is pressed during monitoring, the monitor data are held and the [◇] mark flashes. If the [◇] button is pressed again, it becomes active again.
★ Display data for 2nd item simultaneous monitoring
On the 2nd item simultaneous monitoring screen, the following data are displayed.
A. Monitoring code 1
1. Monitoring data 1 (including unit)
B. Monitoring code 2
2. Monitoring data 2 (including unit)
★ For details, see MONITORING CODE TABLE.




(*1): Displayed alternately at intervals of 3 seconds.

**Real-time monitoring items**

| Item ID | Real-time monitoring item | Item display | Display unit | Display range | Detection component | Terminal No. | Remarks |
|---|---|---|---|---|---|---|---|
| | Items for sensors not installed depending on the model and option are all displayed | Abbreviated due to limit on number of characters | Items with units all use SI units | Values outside display range are displayed with fixed display in display range | | | |
| 20200 | Monitor ROM part No. | MONITOR ROOM | - | - | Monitor | - | |
| 40000 | Travel speed | SPEED | 1 km/h | 0 - 50 | HST | L41-13 | |
| 04202 | Fuel level | FUEL SENSOR | 1 % | 0 - 100 | Monitor | L23-13 | |
| 04101 | Engine water temperature | COOLANT TEMP | 1 °C | 24 - 131 | Monitor | L21-16 | |
| 04103 | Engine water temperature (Low temperature) | COOLANT Lo | 1 °C | -31 - 91 | Monitor | L21-6 | |
| 30100 | HST oil temperature | HST TEMP | 1 °C | 24 - 131 | Monitor | L21-14 | |
| 30202 | Axle oil temperature | BRAKE TEMP | 1 °C | 24 - 131 | Monitor | L21-8 | |
| 01005 | Engine speed | ENG SPEED | 1 rpm | 0 - 3000 | HST | L42-4 | HST Controller CAN |
| 32600 | HST oil pressure | HST PRESS | 0.1 MPa | 0.0 - 100.0 | HST | L41-3 | HST Controller CAN |
| 80000 | Motor 1 solenoid feed-back current | MOTOR SOL | 1 mA | 0 - 1000 | HST | L41-6 | HST Controller CAN |
| 80100 | Clutch solenoid feed-back current | CLUTCH SOL | 1 mA | 0 - 1000 | HST | L41-14 | HST Controller CAN |
| 50302 | Potential voltage | SPEED POT | 1 % | 0 - 100 | HST | L41-1 | HST Controller CAN |
| 80200 | HST traction force | TRACTION | - | STD/LIMIT | HST | L42-3 | HST Controller CAN |

11. Maintenance monitor
The machine monitor can set the maintenance interval for filters and oil. This forms the base for the filter and oil replacement interval and display.
★ For details, see STRUCTURE AND FUNCTION, Maintenance monitor function.

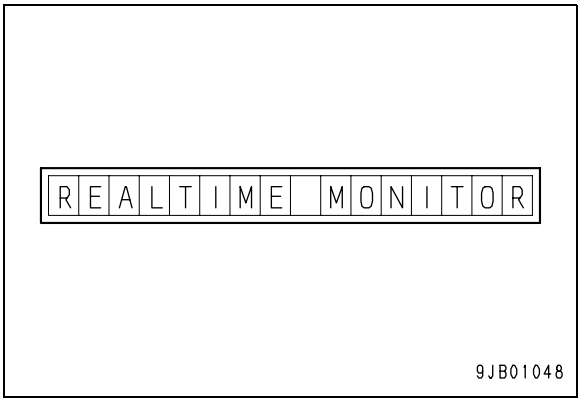



**Table of filter and oil replacement interval set items (when sipping)**

| Item ID | Real-time monitoring item | Item display | Display unit | Display range | Detection component | Terminal No. | Remarks |
|---|---|---|---|---|---|---|---|
| | Items for sensors not installed depending on the model and option are all displayed | Abbreviated due to limit on number of characters | Items with units all use SI units | Values outside display range are displayed with fixed display in display range | | | |
| Monitor Panel Controller | | | | | | | |
| 20200 | Monitor ROM part No. | MONITOR ROOM | - | - | Monitor | - | |
| 40000 | Travel speed | SPEED | 1 km/h | 0 - 50 | HST | L41-13 | |
| 04202 | Fuel level | FUEL SENSOR | 1 % | 0 - 100 | Monitor | L28-1 | |
| 04101 | Engine water temperature | COOLANT TEMP | 1 °C | 24 - 131 | Monitor | L28-8 | |
| 04103 | Engine water temperature (Low temperature) | COOLANT Lo | 1 °C | -31 - 91 | Monitor | L28-3 | |
| 30100 | HST oil temperature | HST TEMP | 1 °C | 24 - 131 | Monitor | L28-2 | |
| 30202 | Axle oil temperature | BRAKE TEMP | 1 °C | 24 - 131 | Monitor | L28-7 | |
| 06001 | Lift arm angle | BOOM ANG | 1 ° | -41 - 46 | Monitor | L28-10 | |
| 40400 | Lift cylinder bottom pressure | BTM PRESS | 0.01 MPa | 0.00 - 50.00 | Monitor | L28-9 | Only load-meter specification |
| 40500 | Lift cylinder rod pressure | ROD PRESS | 0.01 MPa | 0.00 - 50.00 | Monitor | L28-4 | Only load-meter specification |
| 40600 | Calibration pressure | CAL PRESS | 0.01 MPa | 0.00 - 50.00 | Monitor | Calculation value | Only load-meter specification |
| 40700 | Calculation pressure | MES PRESS | 0.01 MPa | 0.00 - 50.00 | Monitor | Calculation value | Only load-meter specification |
| 40800 | Calculation load | MES LOAD | 0.01 t | 0.00 - 50.00 | Monitor | Calculation value | Only load-meter specification |
| 40900 | Input signal D_IN_0-7 | D-IN-0------7 | - | 01010101 | Monitor | See separate table | Only load-meter specification |
| 40901 | Input signal D_IN_8-15 | D-IN-8------15 | - | 01010101 | Monitor | See separate table | Only load-meter specification |
| 40902 | Input signal D_IN_16-23 | D-IN-16------23 | - | 01010101 | Monitor | See separate table | Only load-meter specification |
| 40903 | Input signal D_IN_24-31 | D-IN-24------31 | - | 01010101 | Monitor | See separate table | Only load-meter specification |
| 40904 | Input signal D_IN_32-39 | D-IN-32------39 | - | 01010101 | Monitor | See separate table | Only load-meter specification |
| HST Controller | | | | | | | |
| 01005 | Engine speed | ENG SPEED | 1 rpm | 0 - 3000 | HST | L42-4 | HST Controller CAN |
| 32600 | HST oil pressure | HST PRESS | 0.1 MPa | 0.0 - 100.0 | HST | L41-3 | HST Controller CAN |
| 80000 | Motor 1 solenoid feed-back current | MOTOR SOL | 1 mA | 0 - 1000 | HST | L41-6 | HST Controller CAN |
| 80100 | Clutch solenoid feed-back current | CLUTCH SOL | 1 mA | 0 - 1000 | HST | L41-14 | HST Controller CAN |
| 50302 | Potential voltage | SPEED POT | 1 % | 0 - 100 | HST | L41-1 | HST Controller CAN |
| 80200 | HST traction force | TRACTION | - | STD/LIMIT | HST | L42-3 | HST Controller CAN |

12. Option selection function
    Select the display function for option selection function on the menu screen of Service Mode 1.
    - When adding or removing optional equipment, change the setting on the machine monitor.
    - When the machine monitor has been replaced, set the status of optional equipment installed on the machine.

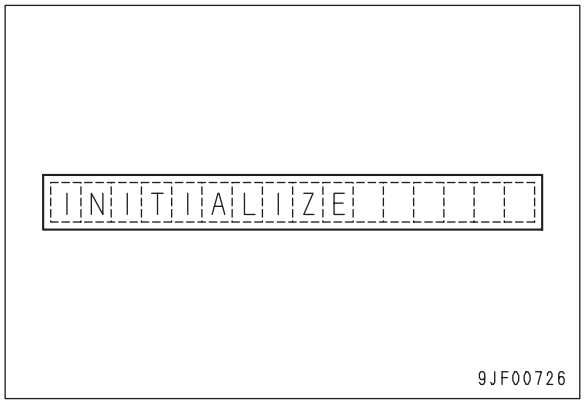
★ For details, see STRUCTURE AND FUNCTION, Option selection function.

**Option set items**

| Adding and changing option | Adjustment item |
|---|---|
| Tire size, Machine monitor | Model selection, Tire size selection, Tire deflection selection |

13. Initialize function

★ This function is a special function used only at the factory, so it cannot be used when servicing the machine.




**Service mode 2**

This has the following functions to allow settings to be made when the machine monitor is replaced.

1. Setting service monitor
   This sets the values for the service meter recorded in the machine monitor.
   ★ It is only possible to set to a higher value than the present value.
2. Setting odometer reading
   This sets the value for the odometer reading recorded in the machine monitor.
   ★ It is only possible to set to a higher value than the present value.
   ★ For details, see STRUCTURE AND FUNCTION, Necessary settings for machine.

# PM CLINIC INSPECTION CHART

**WA250-5 #70001--**

| | |
|---|---|
| Machine serial No. | |
| Engine serial No. | SAA6D102E-2# |

| | Hours inspection |
|---|---|

| Work order No. | Rotate | Service Meter | Serviceman |
|---|---|---|---|
| | | h | |

Questions asked to operator, walk around nspection

| Was there any abnormality before inspection tarted? | Ambient temperature Max. °C |
|---|---|
| | Min. °C |
| | Altitude m |
| | |

| Max. coolant temp. (During operation) | | Max. HST oil temp. (During operation) | |
|---|---|---|---|
| Segment color | W G G G G R R<br>1 2 3 4 5 6 7 | Segment color | G G G G G R R<br>1 2 3 4 5 6 7 |

★ If the machine is cold, warm it up fully. <>: Reference value

| | Item | Conditions | | Unit | Standard value for new machine | Service limit value | Measure-ment results | Pass | Fail |
|---|---|---|---|---|---|---|---|---|---|
| Engine | Engine speed | Low idling | | rpm | 775 - 875 | - | | | |
| | | High idling | | | 2,200 - 2,300 | - | | | |
| | | HST stall | | | 2,080 - 2,280 | 1,980 - 2,380 | | | |
| | | Hydraulic stall | | | 1,970 - 2,170 | 1,870 - 2,270 | | | |
| | | Full stall (HST stall + hydraulic stall) | | | 1,840 - 2,240 | 1,740 - 2,340 | | | |
| | Blow-by pressure | High idling | | kPa {mmH2O} | Max. 0.49 {Max. 50} | 0.98 {100} | | | |
| | Oil pressure | SAE15W-40 | High idling | kPa {kg/cm$^2$} | 340 - 640 {3.5 - 6.5} | 245 {2.5} | | | |
| | | | Low idling | | Min. 150 {Min. 1.5} | 80 {0.8} | | | |

★ Before starting the inspection, check that the machine does not move when the directional lever is placed in position.

★ When measuring the transfer clutch control pressure, carry out the measurement at a place where the machine can travel safety at a speed of more than 10 km/h.

| | Item | Conditions | | Unit | Standard value for new machine | Service limit value | Measure-ment results | Pass | Fail |
|---|---|---|---|---|---|---|---|---|---|
| HST | High-pressure cut-off pressure | • Engine: Full throttle<br>• Hydraulic oil temp.: 45 - 55°C | Directional lever: F<br>Speed selector switch: 3rd | MPa {kg/cm$^2$} | 44.1 - 45.57 {450 - 465} | 44.1 - 46.06 {450 - 470} | | | |
| | Low-pressure relief pressure (work equip-ment PPC cir-cuit basic pressure) | | Directional lever: N | | 2.46 - 2.66 {25 - 27} | 2.46 - 2.66 {25 - 27} | | | |
| | Servo piston control pressure | | Directional lever: N<br>Brake: released | | 2.5 - 2.7 {26 - 28} | 2.4 - 2.7 {25 - 28} | | | |
| | | | Directional lever: N<br>Brake: depressed | | 0.49 - 0.69 {5 - 7} | 0.39 - 0.69 {4 - 7} | | | |
| | Servo piston actuation pres-sure | | Directional lever: F<br>Speed selector switch: 3rd | | 2.5 - 2.7 {26 - 28} | 2.4 - 2.7 {25 - 28} | | | |
| | Transfer clutch control pressure | Hydraulic oil temp.: 45 - 55°C | Directional lever: F<br>Speed selector switch: 3rd | | 2.46 - 2.66 {25 - 27} | 2.46 - 2.66 {25 - 27} | | | |

<>: Reference value

| Item | | Conditions | | Unit | Standard value for new machine | Service limit value | Measure-ment results | Pass | Fail |
|---|---|---|---|---|---|---|---|---|---|
| Steering | Steering wheel operating time | Engine low idling | | sec | 3.3 - 4.1 | Max. 4.8 | | | |
| | | Engine high idling | | | 3.4 - 4.0 | 2.7 - 4.7 | | | |
| | Lock frame with safety bar | | | | | | | | |
| | Steering relief pressure | Engine high idling | | MPa {kg/cm$^2$} | 17.9 - 19.3 {183 - 197} | 16.6 - 20.6 {170 - 210} | | | |
| Brake | Service brake | Lining thickness | Front right | mm | 0.9 - 1.1 | Max. 0.6 | | | |
| | | | Front left | | 0.9 - 1.1 | Max. 0.6 | | | |
| | | | Rear right | | 0.9 - 1.1 | Max. 0.6 | | | |
| | | | Rear left | | 0.9 - 1.1 | Max. 0.6 | | | |
| Work equipment | Relief pressure | Engine high idling | Bucket relief | MPa {kg/cm$^2$} | 20.2 - 21.0 {206 - 214} | 18.6 - 22.6 {190 - 230} | | | |
| | Lift arm speed | | Raising time | sec | 5.4 - 6.4 | Max. 8.2 | | | |
| | | | Lowering time | | 2.9 - 3.9 | Max. 4.7 | | | |
| | Bucket speed | | Dumping time | | 1.4 - 2.0 | Max. 2.5 | | | |
| | | | Tilting-back time | | 2.0 - 2.6 | Max. 3.8 | | | |
| | Hydraulic drift | Engine stopped | Bucket cylinder | mm/15 min | Max. 17 | Max. 20 | | | |
| | | | Lift cylinder | | Max. 20 | Max. 20 | | | |
| Axle | Check differential drain plug visually | | Front axle | - | Must be no excessive metal particles | | | | |
| | | | Rear axle | | | | | | |

| MEMO |
|---|
| |

white 20-170

# TROUBLESHOOTING

Points to remember when troubleshooting . . . . . 20-202
Sequence of events in troubleshooting . . . . . 20-203
Precautions when carrying out maintenance . . . . . 20-204
Check before troubleshooting . . . . . 20-212
Categories, procedure, and method of using troubleshooting charts . . . . . 20-213
Phenomena considered to be failures and troubleshooting no. . . . . 20-214
Connection table for connector pin numbers . . . . . 20-218
T-adapter table . . . . . 20-239
Connector types and mounting locations . . . . . 20-243
Connector layout drawing . . . . . 20-250

# POINTS TO REMEMBER WHEN TROUBLESHOOTING

**WARNING!** Stop the machine in a level place, and check that the safety pin, blocks, and parking brake are securely fitted.

**WARNING!** When carrying out the operation with two or more workers, keep strictly to the agreed signals, and do not allow any unauthorized person to come near.

**WARNING!** If the radiator cap is removed when the engine is hot, hot coolant may spurt out and cause burns, so wait for the engine to cool down before starting troubleshooting.

**WARNING!** Be extremely careful not to touch any hot parts or to get caught in any rotating parts.

**WARNING!** When disconnecting wiring, always disconnect the negative (-) terminal of the battery first.

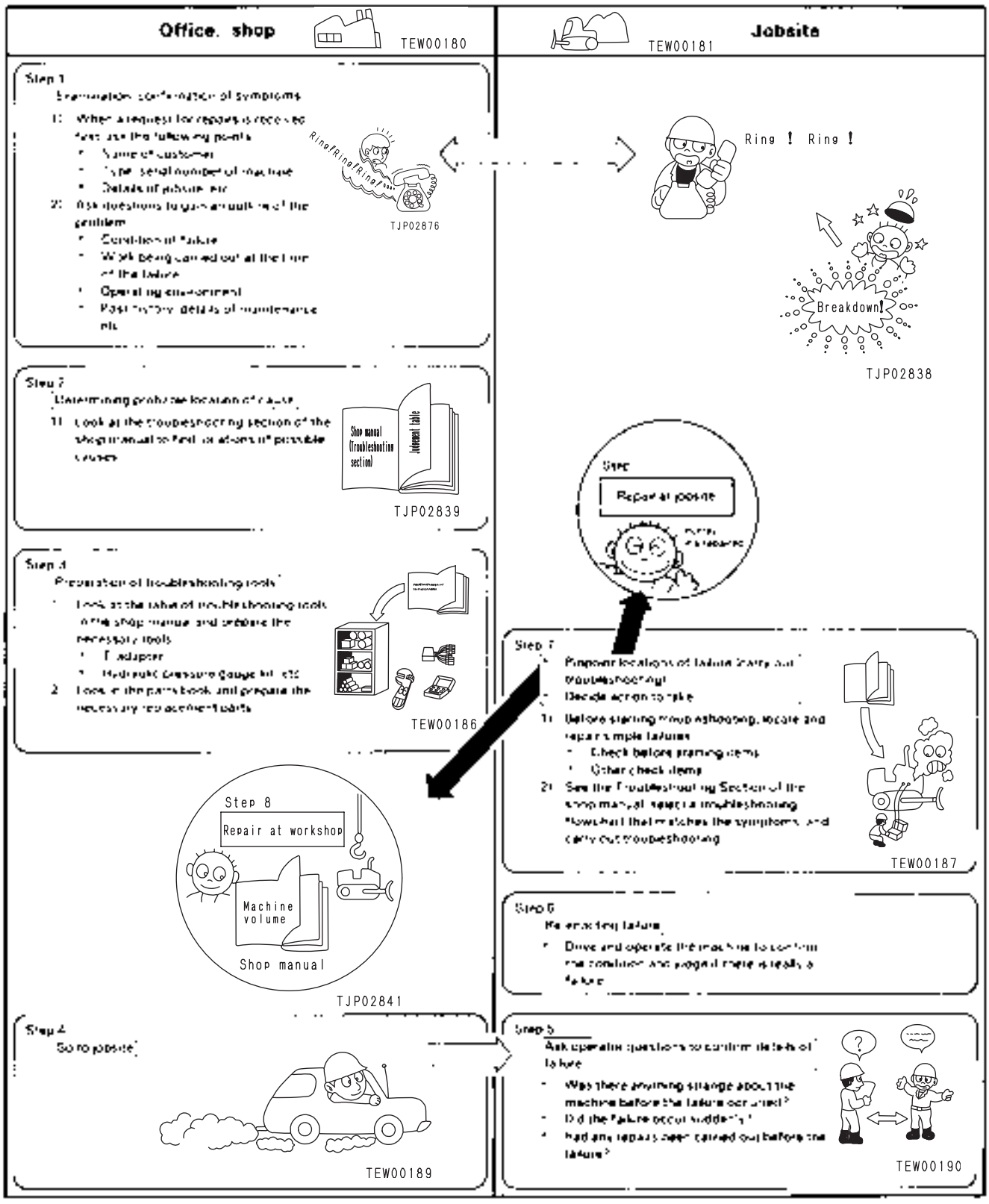
**WARNING!** When removing the plug or cap from a location which is under pressure from oil, water or air, always release the internal pressure first. When installing measuring equipment, be sure to connect it properly.

The aim of troubleshooting is to pinpoint the basic cause of the failure, to carry out repairs swiftly, and to prevent reoccurrence of the failure.
When carrying out troubleshooting, an important point is to understand the structure and function of the machine. However, a short cut to effective troubleshooting is to ask the operator various questions to form some idea of possible causes of the failure that would produce the reported symptoms.

1. When carrying out troubleshooting, do not hurry to disassemble the components. If components are disassembled immediately after a failure occurs:
   - Parts that have no connection with the failure or other unnecessary parts will be disassembled.
   - It will become impossible to find the cause of the failure.

   It will also cause a waste of man hours, parts, or oil and grease. At the same time, it will also lose the confidence of the user or operator. For this reason, when carrying out troubleshooting, it is necessary to carry out thorough prior investigation and to carry out troubleshooting in accordance with the fixed procedure.
2. Points to ask the user or operator.
   1) Have any other problems occurred apart from the problem that has been reported?
   2) Was there anything strange about the machine before the failure occurred?
   3) Did the failure occur suddenly, or were there problems with the machine condition before this?
   4) Under what conditions did the failure occur?
   5) Had any repairs been carried out before the failure? When were these repairs carried out?
   6) Has the same kind of failure occurred before?
3. Check before troubleshooting.
   1) Check the oil level.
   2) Check for any external leakage of oil from the piping or hydraulic equipment.
   3) Check the travel of the control levers.
   4) Check the stroke of the control valve spool.
   5) Other maintenance items can be checked externally, so check any item that is considered to be necessary.
4. Confirming the failure.
   Confirm the extent of the failure yourself, and judge whether to handle it as a real failure or as a problem with the method of operation, etc.
   ★ When operating the machine to re-enact the troubleshooting symptoms, do not carry out any investigation or measurement that may make the problem worse.
5. Troubleshooting
   Use the results of the investigation and inspection in Steps 2 - 4 to narrow down the causes of the failure, then use the troubleshooting flowchart to locate the position of the failure exactly.
   ★ The basic procedure for troubleshooting is as follows.
      1) Start from the simple points.
      2) Start from the most likely points.
      3) Investigate other related parts or information.
6. Measures to remove root cause of failure.
   Even if the failure is repaired, if the root cause of the failure is not repaired, the same failure will occur again.
   To prevent this, always investigate why the problem occurred. Then, remove the root cause.

# SEQUENCE OF EVENTS IN TROUBLESHOOTING

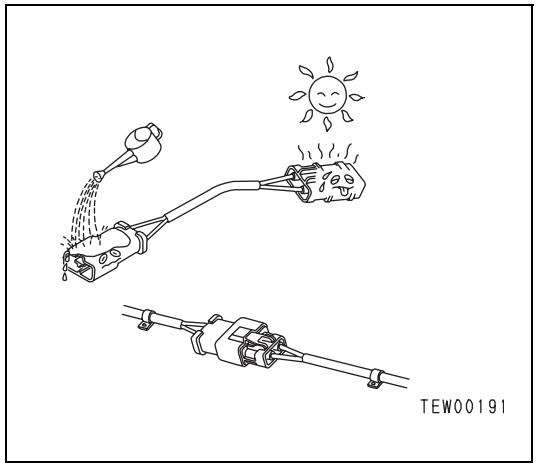


# PRECAUTIONS WHEN CARRYING OUT MAINTENANCE

To maintain the performance of the machine over a long period, and to prevent failures or other troubles before they occur, correct operation, maintenance and inspection, troubleshooting, and repairs must be carried out. This section deals particularly with correct repair procedures for mechatronics and is aimed at improving the quality of repairs. For this purpose, it gives sections on 'Handling electric equipment' and 'Handling hydraulic equipment' (particularly hydraulic oil).

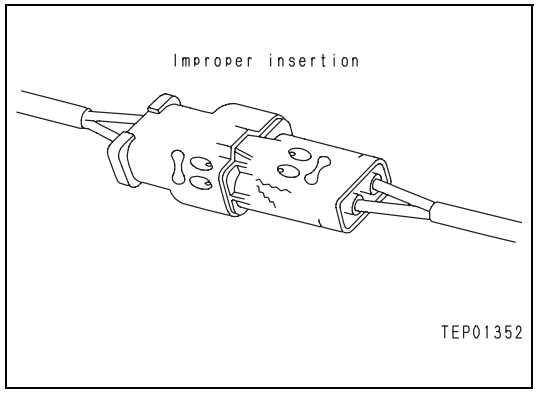
1. PRECAUTIONS WHEN HANDLING ELECTRIC EQUIPMENT

1) Handling wiring harnesses and connectors
Wiring harnesses consist of wiring connecting one component to another component, connectors used for connecting and disconnecting one wire from another wire, and protector or tubes used for protecting the wiring.
Compared with other electrical components fitted in boxes or cases, wiring harnesses are more likely to be affected by the direct effects of rain, water, heat, or vibration. Furthermore, during inspection and repair operations they are frequently removed and installed again, so they are likely to suffer deformation or damage. For this reason, it is necessary to be extremely careful when handling wiring harnesses.

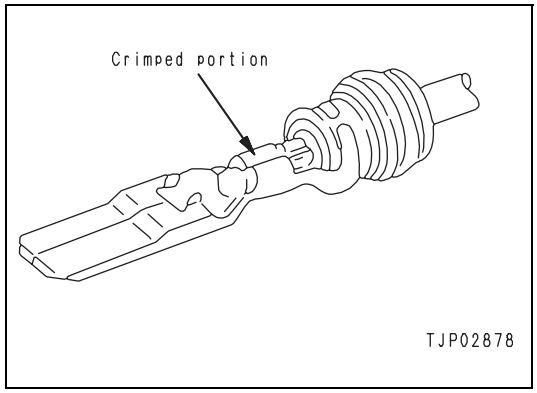



Main failures occurring in wiring harness

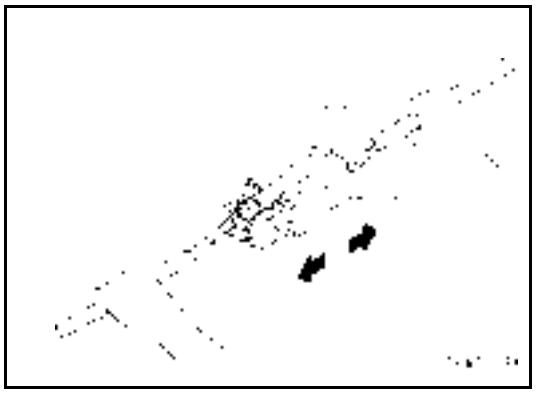
(1) Faulty contact of connectors
(faulty contact between male and female).
Problems with faulty contact are likely to occur because the male connector is not properly inserted into the female connector, or because one or both of the connectors is deformed or the position is not correctly aligned, or because there is corrosion or oxidation of the contact surfaces.



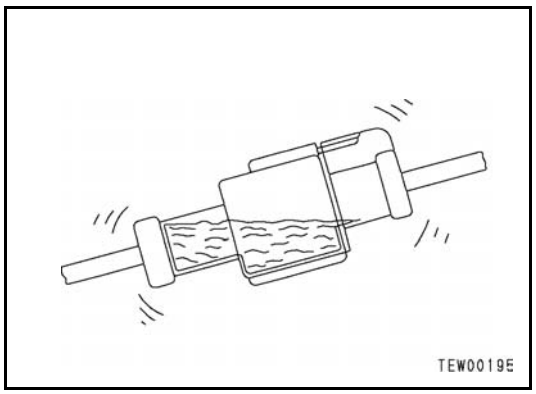

(2) Defective compression or soldering of connectors
The pins of the male and female connectors are in contact at the compressed terminal or soldered portion, but there is excessive force on the wiring, and the plating peels to cause improper connection or breakage.



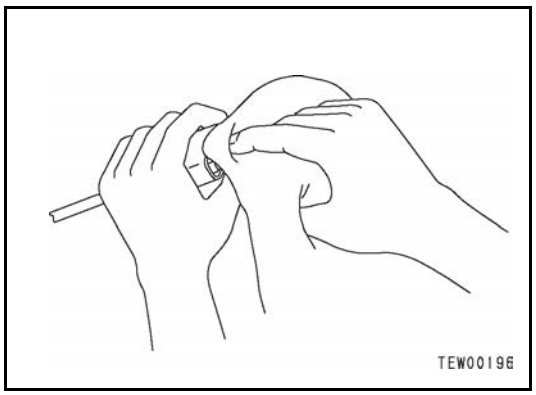
(3) Disconnections in wiring
If the wiring is held and tugged and the connectors are pulled apart, or components are lifted with a crane with the wiring still connected, or a heavy object hits the wiring, the crimping compression of the connectors to the wire may be loosened, or the soldering may be damaged, or the wiring may be broken.



(4) High pressure water entering a connector
The connector is designed to make it difficult for water to enter (drip-proof structure), but if high-pressure water is sprayed directly on the connector, water may enter the connector depending on the direction of the water jet. The connector is designed to prevent water from entering, but if water does enter, it is difficult for it to be drained. Therefore, if water should get into the connector, the pins will be short-circuited by the water, so if any water gets in, immediately dry the connector or take other appropriate action before passing electricity through it.



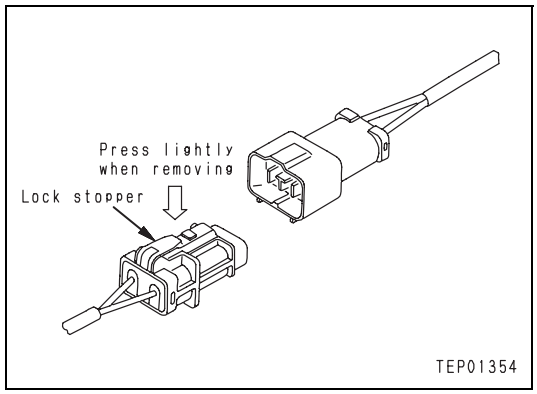

(5) Oil, grease or dirt stuck to connector
If oil or grease are stuck to the connector and an oil film is formed on the mating surface between the male and female pins, the oil will not let the electricity pass, and this will cause a defective contact. If there is oil or grease or dirt stuck to the connector, wipe it off with a dry cloth or blow dry with air, and spray it with a contact restorer.
- ★ When wiping the mating portion of the connector, be careful not to use excessive force or deform the pins.
- ★ If there is water or oil present, it will increase the contamination of the points, so clean with air until all water and oil has been removed.



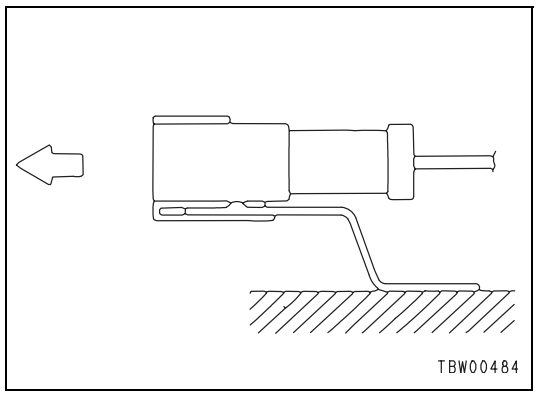
2) Removing, installing, and drying connectors and wiring harnesses

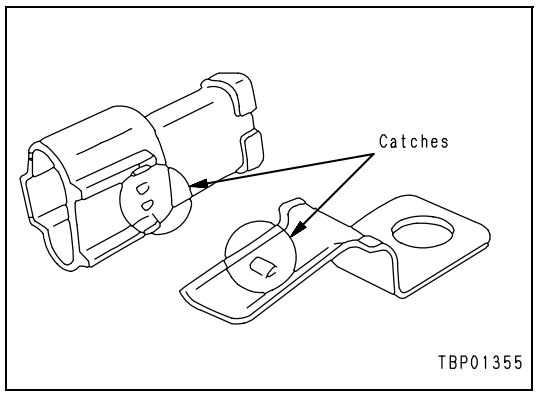
- Disconnecting connectors

(1) Hold the connectors when disconnecting. When disconnecting the connectors, hold the connectors and not the wires. For connectors held by a screw, loosen the screw fully, then hold the male and female connectors in each hand and pull apart. For connectors which have a lock stopper, press down the stopper with your thumb and pull the connectors apart.
★ Never try to pull apart with one hand.

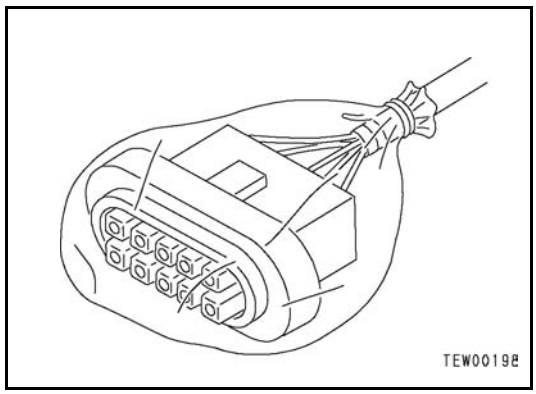



(2) When removing the connectors from the clips, pull the connector in a parallel direction to the clip.
★ If the connector is twisted to the left and right or up and down, the housing may break.

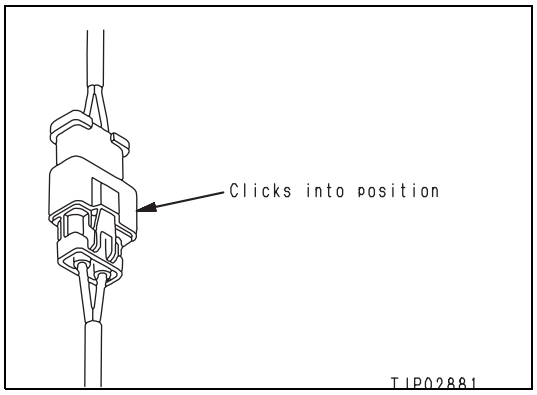


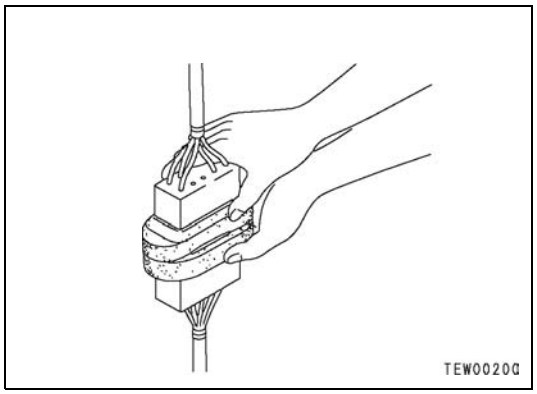

(3) Action to take after removing connectors. After removing any connector, cover it with a vinyl bag to prevent any dust, dirt, oil, or water from getting in the connector portion.
★ If the machine is left for a long time, it is particularly easy for improper contact to occur, so always cover the connector.



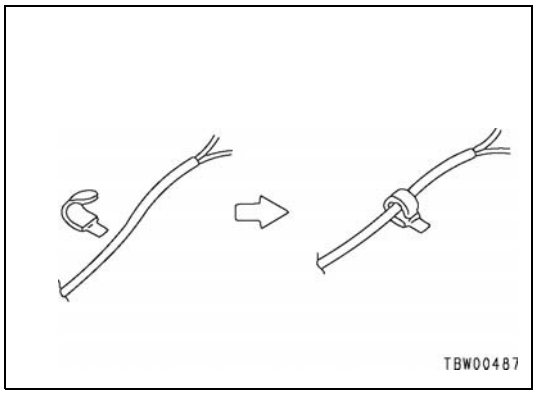
- Connecting connectors
  (1) Check the connector visually.
    1) Check that there is no oil, dirt, or water stuck to the connector pins (mating portion).
    2) Check that there is no deformation, faulty contact, corrosion, or damage to the connector pins.
    3) Check that there is no damage or breakage to the outside of the connector.
    ★ If there is any oil, water, or dirt stuck to the connector, wipe it off with a dry cloth. If any water has gotten inside the connector, warm the inside of the wiring with a dryer, but be careful not to make it too hot as this will cause short circuits.
    ★ If there is any damage or breakage, replace the connector.




  (2) Assemble the connector securely.
  Align the position of the connector correctly, then insert it securely.
  For connectors with a lock stopper:
  Push in the connector until the stopper clicks into position.

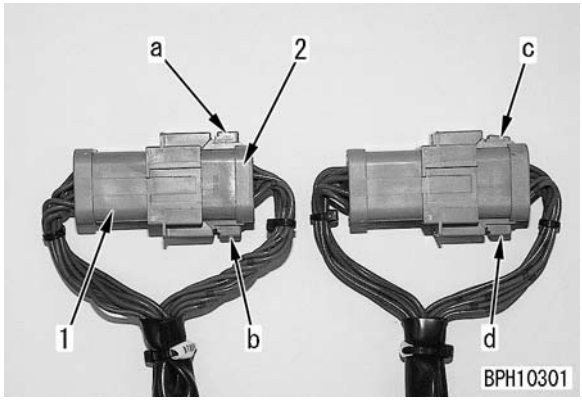



  (3) Correct any protrusion of the boot and any misalignment of the wiring harness.
  For connectors fitted with boots, correct any protrusion or the boot. In addition, if the wiring harness is misaligned, or the clamp is out of position, adjust it to its correct position.
    ★ When blowing with dry air, there is danger that the oil in the air may cause improper contact, so clean with properly filtered air.



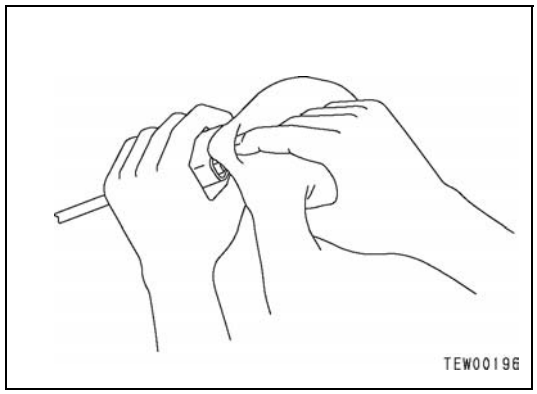

  (4) When the wiring harness clamp of the connector has been removed, always return it to its original condition and check that there is no looseness of the clamp.

- Connecting connectors (DT type connector)
  Since the DT 8-pole and 12-pole DT type connectors have 2 latches respectively, push them in until they click 2 times.
  1. Male connector, 2. Female connector
  - Normal locking state (Horizontal) : **a**, **b**, **d**
  - Incomplete locking state (Diagonal) : **c**

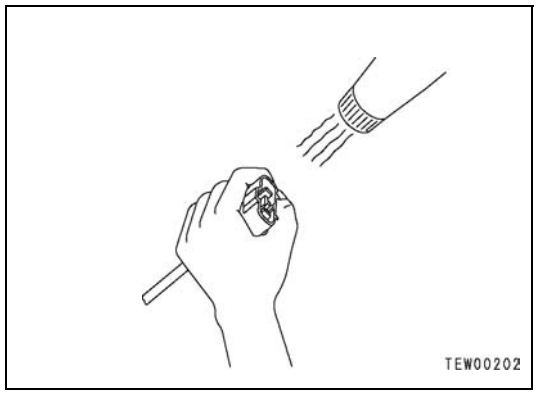


- Drying wiring harness
  If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high pressure water or steam directly on the wiring harness.

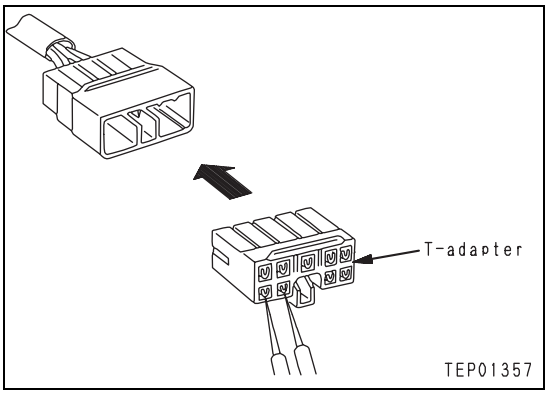
  If water gets directly on the connector, do as follows:
  (1) Disconnect the connector and wipe off the water with a dry cloth.
      ★ If the connector is blown dry with air, there is the risk that oil in the air may cause a faulty contact, so avoid blowing with air.



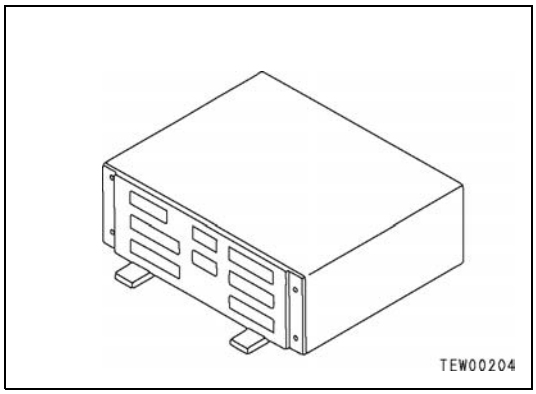

  (2) Dry the inside of the connector with a dryer.
  If water gets inside the connector, use a dryer to dry the connector.
      ★ Hot air from the dryer can be used, but be careful not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.



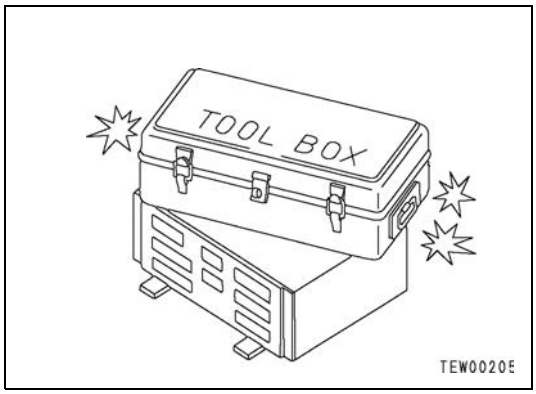

  (3) Carry out a continuity test on the connector.
  After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.
      ★ After completely drying the connector, spray it with contact restorer and reassemble.



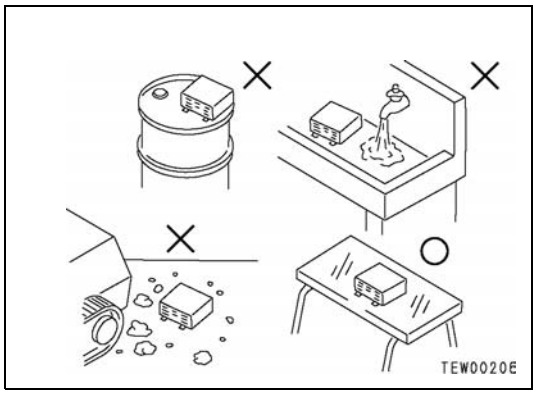
3) Handling control box
   (1) The control box contains a microcomputer and electronic control circuits.
   This controls all of the electronic circuits on the machine, so be extremely careful when handling the control box.
   (2) Do not open the cover of the control box unless necessary.




   (3) Do not place objects on top of the control box.
   (4) Cover the control connectors with tape or a vinyl bag.
   Never touch the connector contacts with your hand.
   (5) Do not leave the control box in a place where it is exposed to rain.




   (6) Do not place the control box on oil, water, or soil, or in any hot place, even for a short time. (Place it on a suitable dry stand)
   (7) Precautions when carrying out arc welding
   When carrying out arc welding on the body, disconnect all wiring harness connectors connected to the control box. Fit an arc welding ground close to the welding point.



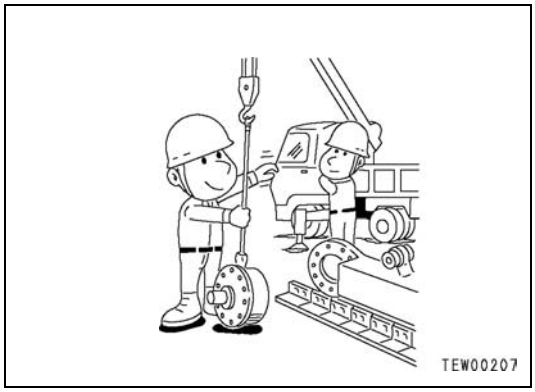

2. Points to remember when troubleshooting electric circuits
   1) Always turn the power OFF before disconnecting or connecting connectors.
   2) Before carrying out troubleshooting, check that all the related connectors are properly inserted.
      ★ Disconnect and connect the related connectors several times to check.
   3) Always connect any disconnected connectors before going on to the next step.
      ★ If the power is turned ON with the connectors still disconnected, unnecessary abnormality displays will be generated.
   4) When carrying out troubleshooting of circuits (measuring the voltage, resistance, continuity, or current), move the related wiring and connectors several times and check that there is no change in the reading of the tester.
      ★ If there is any change, there is probably defective contact in the circuit.

3. Points to remember when handling hydraulic equipment

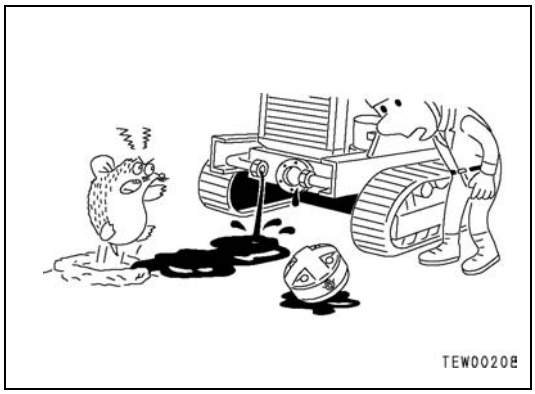
With the increase in pressure and precision of hydraulic equipment, the most common cause of failure is dirt (foreign material) in the hydraulic circuit. When adding hydraulic oil, or when disassembling or assembling hydraulic equipment, it is necessary to be particularly careful.

1) Be careful of the operating environment
Avoid adding hydraulic oil, replacing filters, or repairing the machine in rain or high winds, or places where there is a lot of dust.

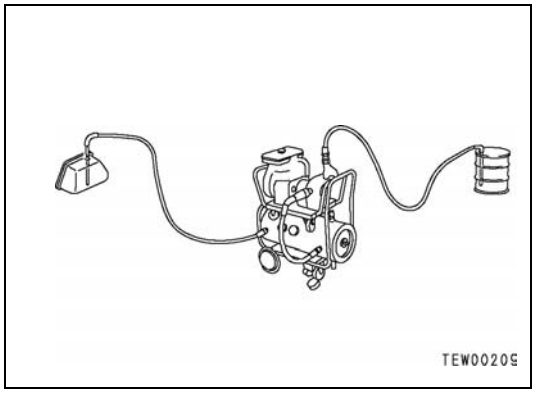
2) Disassembly and maintenance work in the field
If disassembly or maintenance work is carried out on hydraulic equipment in the field, there is danger of dust entering the equipment. It is also difficult to confirm the performance after repairs, so it is desirable to use unit exchange. Disassembly and maintenance of hydraulic equipment should be carried out in a specially prepared dust proof workshop, and the performance should be confirmed with special test equipment.




3) Sealing openings
After any piping or equipment is removed, the openings should be sealed with caps, tape, or vinyl bags to prevent any dirt or dust from entering. Never leave any openings opened or blocked with a rag, this could cause particles or dirt to get into the system.
Drain all oil into a container and not unto the ground and be sure to follow the proper environmental regulation for any disposal of oil.

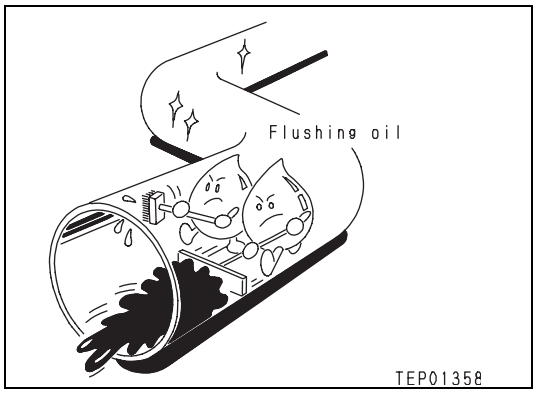



4) Do not let any dirt, or dust get in during refilling operations.
Be careful not to let any dirt or dust get in when refilling with hydraulic oil. Always keep the oil filler and the area around it clean, and also use clean pumps and oil containers. If an oil cleaning device is used, it is possible to filter out the dirt that has collected during storage, so this is an even more effective method.

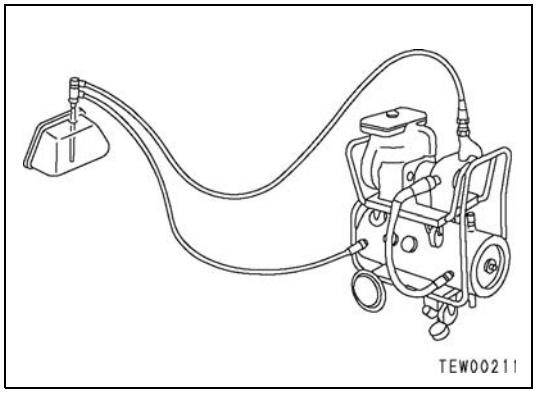


5) Change hydraulic oil when the temperature is high.
When hydraulic oil or other oil is warm, it flows easily. In addition, the sludge can also be drained out easily from the circuit together with the oil, so it is best to change the oil when it is still warm.
When changing the oil, as much as possible of the old hydraulic oil must be drained out. (Do not drain the oil from the hydraulic tank; but drain the oil from the filter and from the drain plug in the circuit.) If any old oil is left, the contaminants and sludge in it will mix with the new oil and will shorten the life of the hydraulic oil.

6) Flushing operations
After disassembling and assembling the equipment, or changing the oil, use flushing oil to remove the contaminants, sludge, and old oil from the hydraulic circuit.
Normally, flushing is carried out twice: primary flushing is carried out with flushing oil, and secondary flushing is carried out with the specified hydraulic oil.




7) Cleaning operations
After repairing the hydraulic equipment (pump, control valve, etc.) or when running the machine, carry out oil cleaning to remove the sludge or contaminants in the hydraulic oil circuit.
The oil cleaning equipment is used to remove the ultra fine (about 3µ) particles that the filter built into the hydraulic equipment cannot remove, so it is an extremely effective device.



# CHECK BEFORE TROUBLESHOOTING

| | | Item | Judgement Value | Action |
|---|---|---|---|---|
| Before Starting Checking Item | Lubricating oil, coolant | 1. Check fuel level | - | Add fuel |
| | | 2. Check for impurities in fuel | - | Drain |
| | | 3. Check oil level in hydraulic oil tank | - | Add oil |
| | | 4. Check oil filter (Hydraulic, HST) | - | Replace |
| | | 5. Check brake oil level | - | Add oil |
| | | 6. Check engine oil level inside oil pan | - | Add oil |
| | | 7. Check coolant level | - | Add coolant |
| | | 8. Check dust indicator for clogging | - | Clean or replace |
| | Air, Hydraulic, Mechanical equipment | 9. Check play of steering wheel | **mm or below | Adjust |
| | | 10. Check emergency steering | - | Repair |
| | | 11. Check tire inflation pressure and damage | - | Air charge or replace |
| | | 12. Check loosen of hub nut | Tightening torque (See DISASSEMBLY AND ASSEMBLY) | Tighten |
| | | 13. Check effect of foot brake | - | Adjust |
| | | 14. Check effect of parking brake | - | Adjust or repair |
| | | 15. Check effect of emergency brake | - | Adjust or repair |
| | | 16. Check operation of steering | - | Adjust or repair |
| | | 17. Check direction of rear view mirror and under mirror | - | Adjust |
| | | 18. Check effect of exhaust gas color and sound | - | Adjust or repair |
| | | 19. Check effect retarder brake | - | Adjust or repair |
| | | 20. Check effect body mounting rubber | - | Replace |
| | Electrical equipment | 21. Check sound of horn | - | Repair |
| | | 22. Check flashing of lamps | - | Repair or replace |
| | | 23. Check operation of gauge when during operation | - | Adjust or repair |
| | | 24. Check operation of monitor panel | - | Adjust or repair |
| | | 25. Check operation of machine monitor system | - | Adjust or repair |
| | | 26. Check for missing central warning lamps | - | Repair or replace |
| | | 27. Check for looseness, corrosion of battery terminal, wiring | - | Tighten or clean |
| | | 28. Check for looseness, corrosion of alternator terminal, wiring | - | Tighten or clean |
| | | 29. Check for looseness, corrosion of starting motor terminal, wiring | - | Tighten or clean |
| Others Checking Item | | 30. Check for abnormal noise, smell | - | Repair |
| | | 31. Check for oil leakage | - | Repair |
| | | 32. Carry out air bleeding | - | Bleed air |
| | | 33. Check battery voltage (Engine stopped) | 24 V | Charge or replace |
| | | 34. Check battery electrolyte level | - | Add |
| | | 35. Check for discolored, burnt, exposed wiring | - | Replace |
| | | 36. Check for missing wiring clamps, hanging wire | - | Repair |
| | | 37. Check for water leakage on wiring (Pay particular attention to water leaking on connectors or terminals) | - | Dry |
| | | 38. Check for blown, corroded fuses | - | Replace |
| | | 39. Check alternator voltage (Engine running at 1/2 throttle of above) | After running for several minutes: 28.5 - 29.5V | Replace |
| | | 40. Check sound of actuation of battery relay (When starting switch is turned ON, OFF) | - | Replace |

# CATEGORIES, PROCEDURE, AND METHOD OF USING TROUBLESHOOTING CHARTS

1. Categories of troubleshooting codes
   - ★ If the machine monitor displays a failure code, the name of the controller is also displayed at the same time, so the troubleshooting codes are categorized according to the name of each controller. (This may also includes some failure codes for the electrical system that are not displayed)
   - ★ Failures of the hydraulic and mechanical system that the machine monitor cannot display are categorized as H mode.

| Failure code | System for troubleshooting |
|---|---|
| HST | Troubleshooting of HST controller system |
| MON | Troubleshooting of machine monitor system |
| E | Troubleshooting of electrical system |
| H | Troubleshooting of hydraulic, mechanical system |
| Engine | Troubleshooting of engine (see 102 Series engine shop manual) |

2. Procedure for troubleshooting
   - ★ If a problem occurs on the machine, or if any problem is felt, carry out troubleshooting as follows.

   1) When failure code is displayed on machine monitor
      If a failure code is displayed on the machine monitor at the same time as the problem occurs, check the content of the display, then go to the applicable troubleshooting for the failure code.
   2) If no failure code is displayed on the machine monitor but the failure is recorded in memory
      If it is impossible to check the failure code display on the machine monitor when a problem occurs, use the troubleshooting history display function in the service mode of the machine monitor to check if there is a failure code.
      If a failure code is recorded, it is probable that it is the cause, so go to the applicable troubleshooting for the failure code.
   3) If no failure code is displayed and no failure history is recorded
      If it is impossible to check the failure display on the machine monitor when a problem occurs, and there is also no failure code recorded in the troubleshooting history display function in the service mode of the machine monitor, it is probable that are problem has occurred in the hydraulic or mechanical system or in the electrical system that the controller cannot detect.
      In such a case, check the condition of the failure carefully, then go to the applicable troubleshooting for the failure.

# PHENOMENA CONSIDERED TO BE FAILURES AND TROUBLESHOOTING NO.

★With mark ● go to troubleshooting No. on failure code display.

| No. | Phenomena considered to be failures | | Troubleshooting | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Failure code | HST code | MON code | E mode | H mode | S mode (Engine) |
| Failures related to failure code | | | | | | | | |
| 1 | Failure code is displayed on failure code display unit (LED display unit) | | ● | | | | | |
| Failures related to engine (S mode) | | | | | | | | |
| 2 | Starting performance is poor (starting always takes time) | | | | | | | S-1 |
| 3 | Engine does not start | Engine does not rotate | | | | | | S-2a) |
| 4 | | Engine rotates but no exhaust smoke comes out | | | | | | S-2b) |
| 5 | | Exhaust smoke comes out but engine does not start | | | | | | S-2c) |
| 6 | Engine does not pick up smoothly (follow-up is poor) | | | | | | | S-3 |
| 7 | Engine stops during operations | | | | | | | S-4 |
| 8 | Engine does not rotate smoothly (hunting) | | | | | | | S-5 |
| 9 | Engine lacks output (or lacks power) | | | | | | | S-6 |
| 10 | Exhaust smoke is black (incomplete combustion) | | | | | | | S-7 |
| 11 | Oil consumption is excessive (or exhaust smoke is blue) | | | | | | | S-8 |
| 12 | Oil becomes contaminated quickly | | | | | | | S-9 |
| 13 | Fuel consumption is excessive | | | | | | | S-10 |
| 14 | Oil in cooling water (or water spurts back, or water level goes down) | | | | | | | S-11 |
| 15 | Oil pressure caution lamp light ON (drop in oil pressure) | | | | | | | S-12 |
| 16 | Oil level rises (water, fuel in oil) | | | | | | | S-13 |
| 17 | Water temperature becomes too high (overheating) | | | | | | | S-14 |
| 18 | Abnormal noise is made | | | | | | | S-15 |
| 19 | Vibration is excessive | | | | | | | S-16 |
| Failures related to HST (HST mode) | | | | | | | | |
| 20 | Defective HST controller power source (HST controller does not function) | | | HST-1 | | | | |
| 21 | Travel speed does not shifted | | | HST-2 | | | | |
| 22 | Travel speed does not excessive (defective speed sensor system) | | | HST-3 | | | | |
| 23 | When speed selector switch is at 1st, travel speed cannot be controlled | | | HST-4 | | | | |
| 24 | HST output cannot be controlled (traction control) | | | HST-5 | | | | |
| Failures related to monitor (MON mode) | | | | | | | | |
| 25 | The parking brake indicator lamp does not light ON | | | | MON-1 | | | |
| 26 | The brake oil pressure caution lamp does not light ON | | | | MON-2 | | | |
| 27 | The engine water temperature caution lamp does not light ON or the engine water temperature gauge does not rises when engine is started | | | | MON-3 | | | |
| 28 | The HST oil temperature caution lamp does not light ON or the HST oil temperature gauge does not rises when engine is started | | | | MON-4 | | | |
| 29 | The fuel level gauge does not rises or goes down | | | | MON-5 | | | |
| 30 | The radiator water temperature caution lamp does not light | | | | MON-6 | | | |

| No. | Phenomena considered to be failures | Troubleshooting | | | | | |
|---|---|---|---|---|---|---|---|
| | | Failure code | HST code | MON code | E mode | H mode | S mode (Engine) |
| Failures related to monitor (MON mode) | | | | | | | |
| 31 | The steering oil pressure caution lamp does not light ON | | | MON-7 | | | |
| 32 | The emergency steering oil pressure indicator lamp does not light ON | | | MON-8 | | | |
| 33 | Input fault in monitor panel mode switch 1 [■] (panel switch 1) | | | MON-9 | | | |
| 34 | Input fault in monitor panel mode switch 1 [◇] (panel switch 2) | | | MON-10 | | | |
| 35 | Input fault in monitor panel mode switch 2 [<] (panel switch 3) | | | MON-11 | | | |
| 36 | Input fault in monitor panel mode switch 2 [>] (panel switch 4) | | | MON-12 | | | |
| 37 | The alarm buzzer does not sound or stop | | | MON-13 | | | |
| 38 | The wiper does not function | | | MON-14 | | | |
| 39 | The each lamps do not light ON | | | MON-15 | | | |
| Failures related to electrical system (E mode) | | | | | | | |
| 40 | The engine does not start | | | | E-1 | | |
| 41 | The engine does not stop | | | | E-2 | | |
| 42 | Preheating is impossible or constant | | | | E-3 | | |
| 43 | Defective parking brake system | | | | E-4 | | |
| 44 | Defective emergency brake (electric type) | | | | E-5 | | |
| 45 | Defective lift arm kick-out function and cancellation | | | | E-6 | | |
| 46 | Defective bucket leveler function and cancellation | | | | E-7 | | |
| 47 | Defective lift arm FLOATING holding and cancellation | | | | E-8 | | |
| 48 | The wiper does not function | | | | E-9 | | |
| 49 | The window washer does not function | | | | E-10 | | |
| 50 | The each lamps do not light ON | | | | E-11 | | |
| 51 | The horn does not sound | | | | E-12 | | |
| 52 | The air conditioner does not work | | | | E-13 | | |
| Failures related to hydraulic and mechanical system (H mode) | | | | | | | |
| 53 | The machine does not start | | | | | H-1 | |
| 54 | The travel speed is slow | | | | | H-2 | |
| 55 | The thrusting force is weak | | | | | H-3 | |
| 56 | Engine stalls when traveling or engine speed drops excessively | | | | | H-4 | |
| 57 | Travel speed (gear) does not shifted | | | | | H-5 | |
| 58 | The steering wheel dose not turn | | | | | H-6 | |
| 59 | Steering is heavy | | | | | H-7 | |
| 60 | The steering wheel shakes or jerks | | | | | H-8 | |

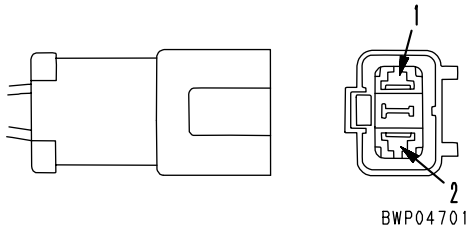
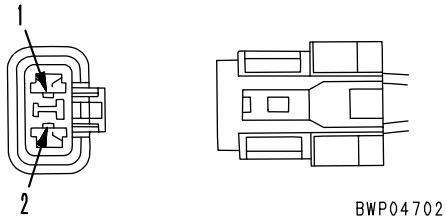
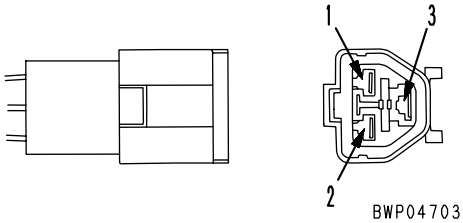
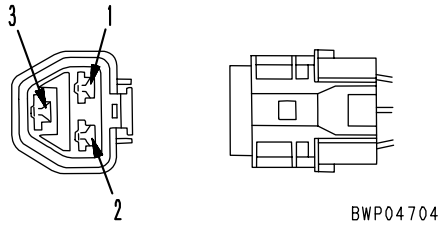
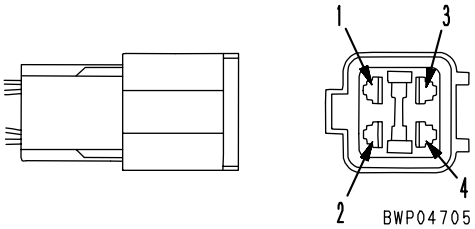
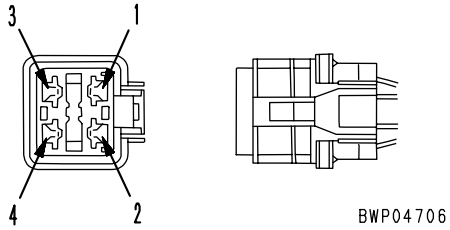
| No. | Phenomena considered to be failures | Troubleshooting | | | | | |
|---|---|---|---|---|---|---|---|
| | | Failure code | HST code | MON code | E mode | H mode | S mode (Engine) |
| Failures related to hydraulic and mechanical system (H mode) | | | | | | | |
| 61 | The brake does not work or does not work well | | | | | H-9 | |
| 62 | The brake is not released or is dragged | | | | | H-10 | |
| 63 | The parking brake does not work or is not released or is dragged | | | | | H-11 | |
| 64 | The lift arm does not rise | | | | | H-12 | |
| 65 | The lift arm moves slowly or the lift arm rising force is insufficient | | | | | H-13 | |
| 66 | When rising, the lift arm comes to move slowly at specific height | | | | | H-14 | |
| 67 | The lift arm cylinder cannot hold down the bucket (The bucket rises in the air) | | | | | H-15 | |
| 68 | Hydraulic drifts of the lift arm occur often | | | | | H-16 | |
| 69 | The lift arm wobbles during operation | | | | | H-17 | |
| 70 | When the control lever is switched from "HOLD" to "RAISE", the lift arm falls temporarily | | | | | H-18 | |
| 71 | The bucket does not tilt back | | | | | H-19 | |
| 72 | The bucket moves slowly or the tilting-back force is insufficient | | | | | H-20 | |
| 73 | The bucket comes to operate slowly in the midst of tilting-back | | | | | H-21 | |
| 74 | The bucket cylinder cannot hold down the bucket | | | | | H-22 | |
| 75 | Hydraulic drifts of the bucket occur often | | | | | H-23 | |
| 76 | The bucket wobbles during travel with cargo (The work equipment valve is set to "HOLD") | | | | | H-24 | |
| 77 | When the control lever is switched from "HOLD" to "TILT", the bucket falls temporarily | | | | | H-25 | |
| 78 | The control levers of lift arm and bucket do not move smoothly and heavy | | | | | H-26 | |

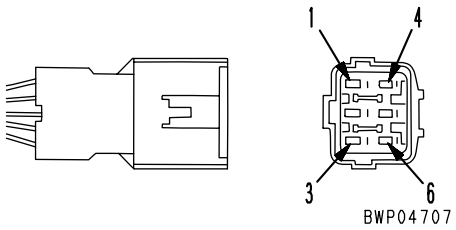
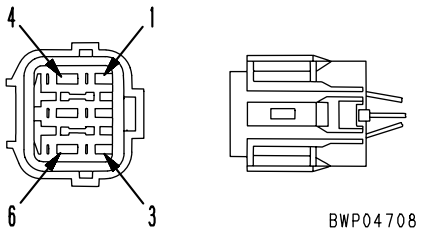
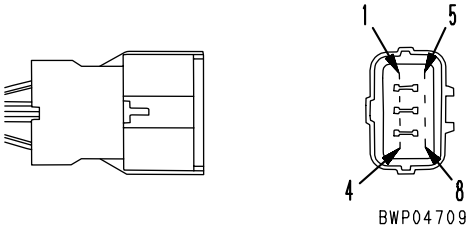
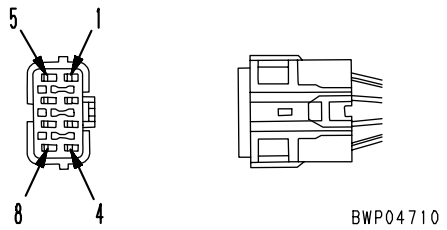
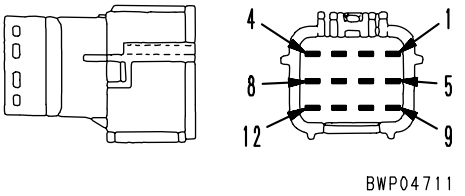
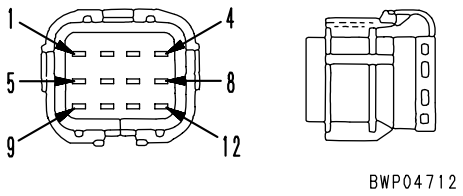
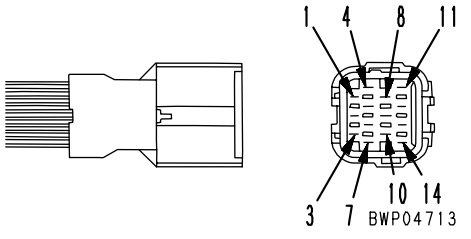
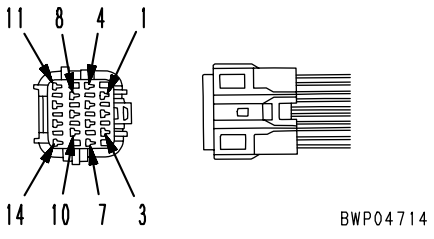
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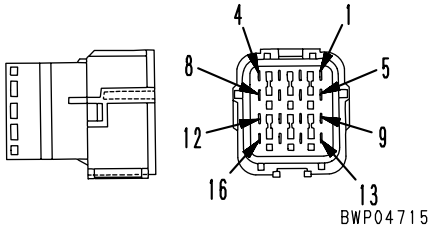
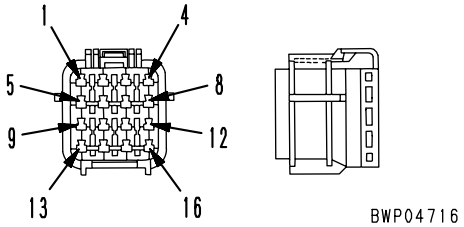
# CONNECTION TABLE FOR CONNECTOR PIN NUMBERS

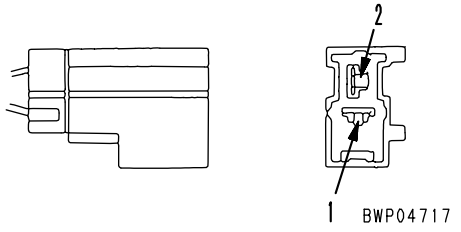
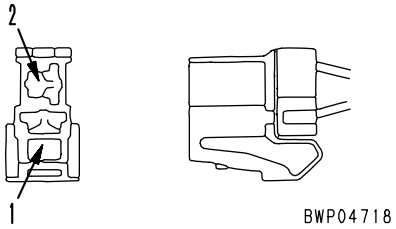
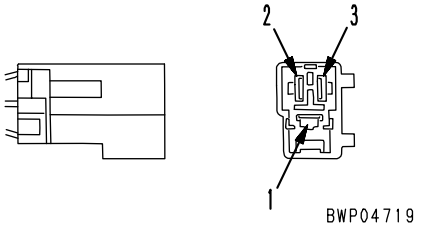
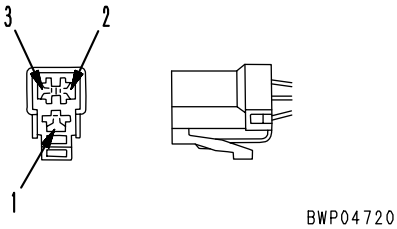
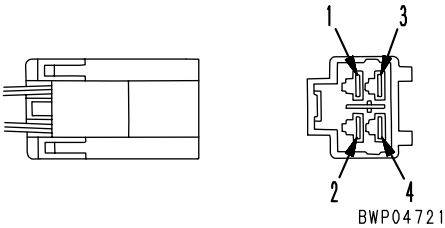
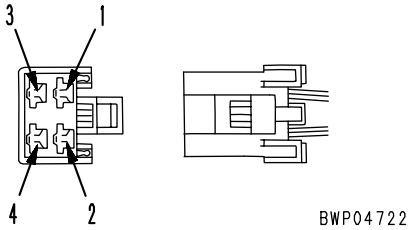
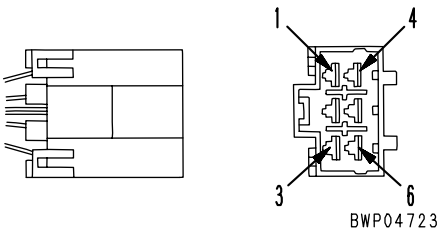
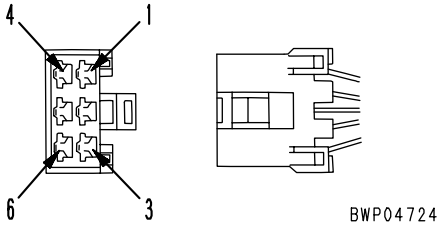
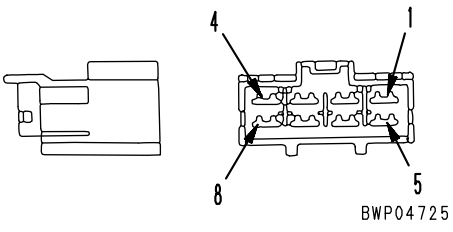
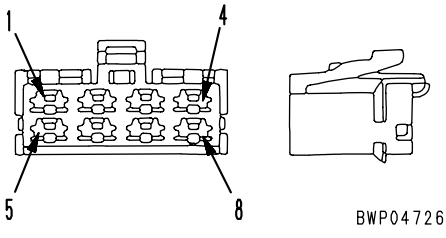
★ The terms male and female refer to the pins, while the terms male housing and female housing refer to the mating portion of the housing.

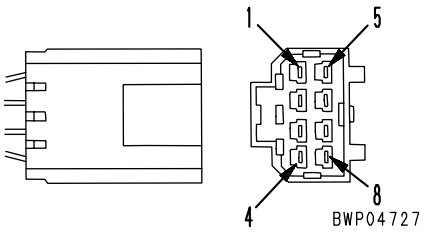
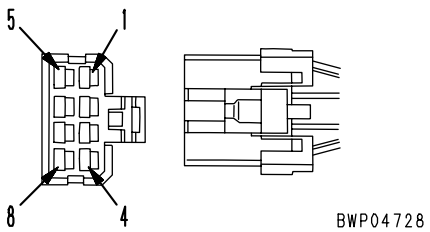
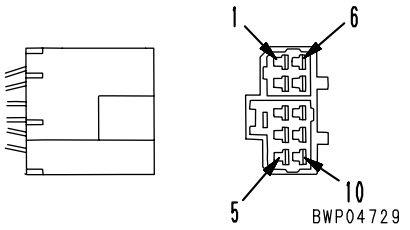
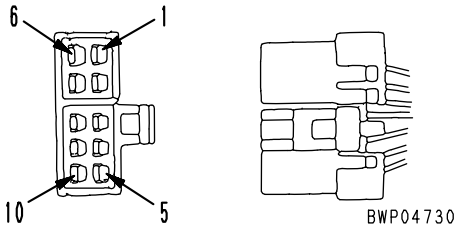
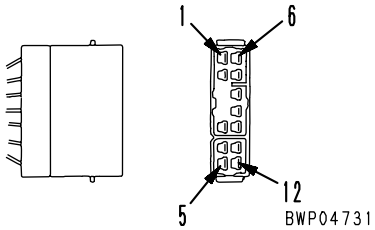
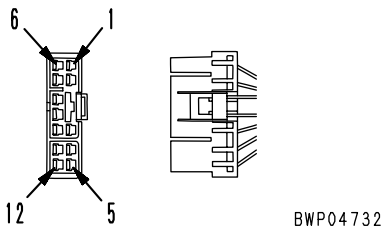
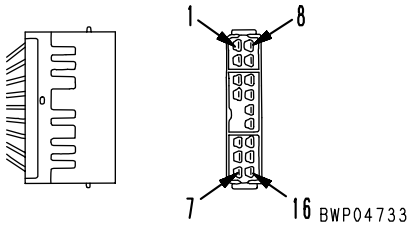
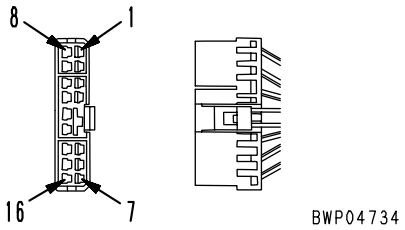
★ Deuscht connector has marks of pin numbers on the wiring harness side.

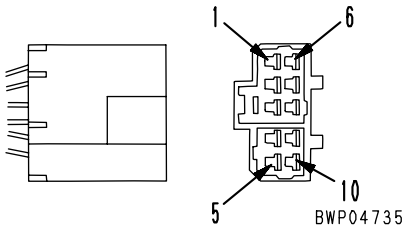
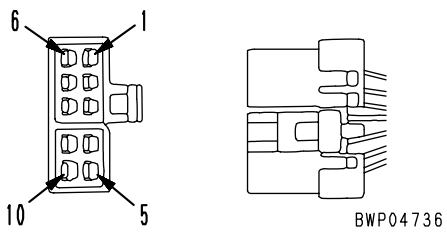
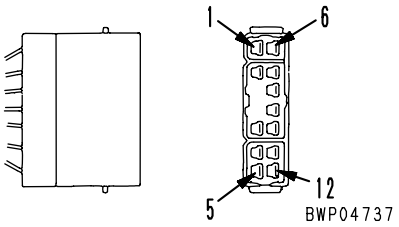
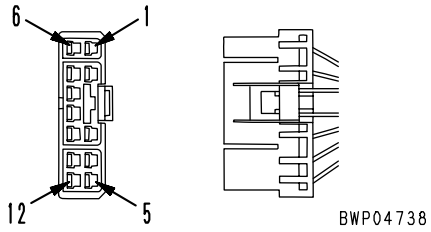
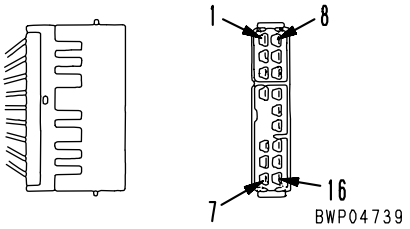
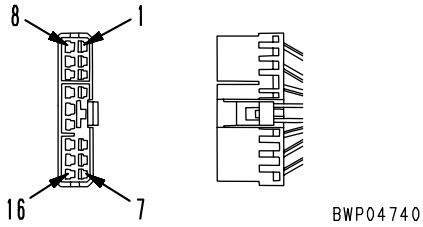
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<tr><td>Male (Female housing)</td><td>Female (Male housing)</td><td>T-adapter Part Number</td></tr>
<tr><td>1</td><td>Part number: 08055-00181</td><td>Part number: 08055-00191</td><td>799-601-7010</td></tr>
<tr><td rowspan="2">2</td><td> 
</td><td> 
</td><td rowspan="2">799-601-7020</td></tr>
<tr><td>Part number: 08055-00282</td><td>Part number: 08055-00292</td></tr>
<tr><td rowspan="2">3</td><td> 
</td><td> 
</td><td rowspan="2">799-601-7030</td></tr>
<tr><td>Part number: 08055-00381</td><td>Part number: 08055-00391</td></tr>
<tr><td rowspan="2">4</td><td> 
</td><td> 
</td><td rowspan="2">799-601-7040</td></tr>
<tr><td>Part number: 08055-00481</td><td>Part number: 08055-00491</td></tr>
<tr><td>—</td><td>Terminal part number: 79A-222-3370<br>• Wire size: 0.85<br>• Quantity: 20 pieces<br>• Grommet: black</td><td>Terminal part number: 79A-222-3390<br>• Wire size: 0.85<br>• Quantity: 20 pieces<br>• Grommet: black</td><td>—</td></tr>
<tr><td>—</td><td>Terminal part number: 79A-222-3380<br>• Wire size: 2.0<br>• Quantity: 20 pieces<br>• Grommet: red</td><td>Terminal part number: 79A-222-3410<br>• Wire size: 2.0<br>• Quantity: 20 pieces<br>• Grommet: red</td><td>—</td></tr>
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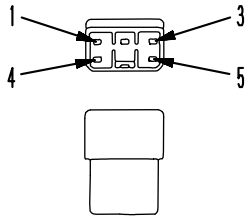
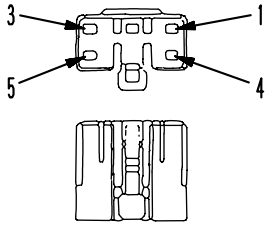
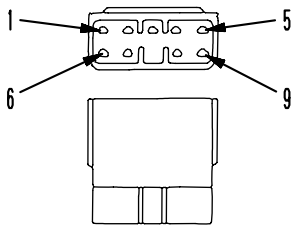
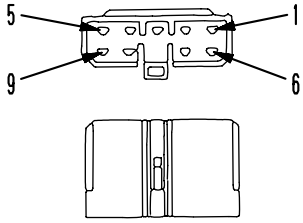
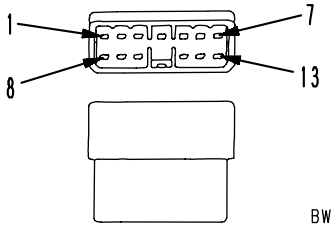
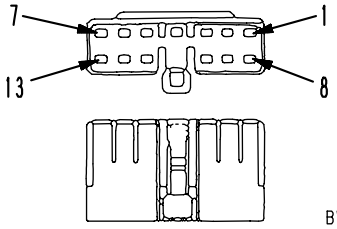
| Number of Pins | SWP Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 6 |  |  | 799-601-7050 |
| | Part number: 08055-10681 | Part number: 08055-10691 | |
| 8 |  |  | 799-601-7060 |
| | Part number: 08055-10881 | Part number: 08055-10891 | |
| 12 |  |  | 799-601-7310 |
| | Part number: 08055-11281 | Part number: 08055-11291 | |
| 14 |  |  | 799-601-7070 |
| | Part number: 08055-11481 | Part number: 08055-11491 | |

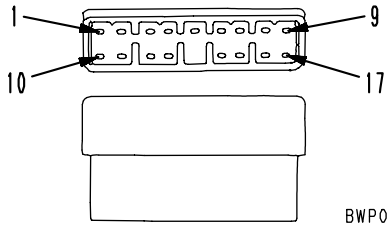
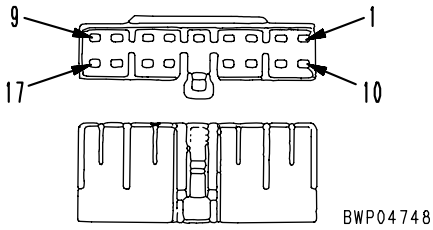
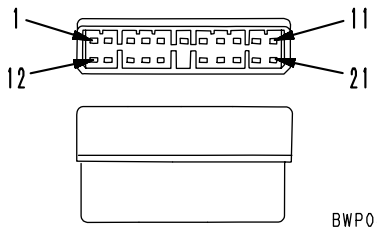
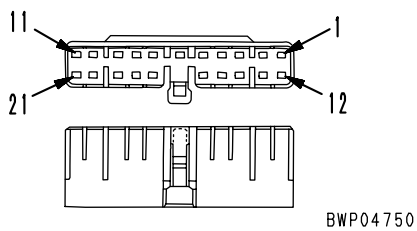
| Number of Pins | SWP Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 16 |  |  | 799-601-7320 |
| | Part number: 08055-11681 | Part number: 08055-11691 | |
| — | Terminal part number:<br>• Wire size: 0.85<br>• Quantity: 20 pieces<br>• Grommet: black | Terminal part number:<br>• Wire size: 0.85<br>• Quantity: 20 pieces<br>• Grommet: black | — |
| — | Terminal part number:<br>• Wire size: 1.25<br>• Quantity: 20 pieces<br>• Grommet: red | Terminal part number:<br>• Wire size: 1.25<br>• Quantity: 20 pieces<br>• Grommet: red | — |

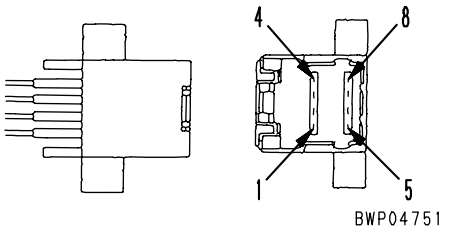
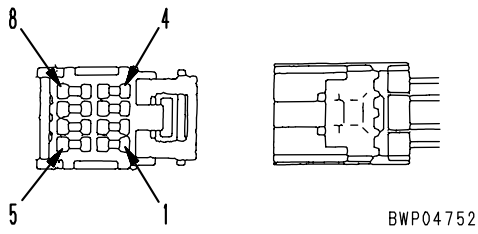
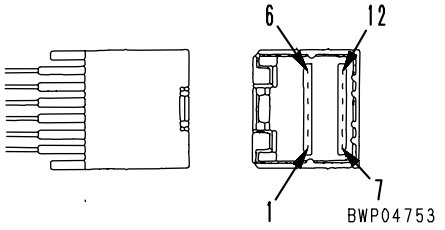
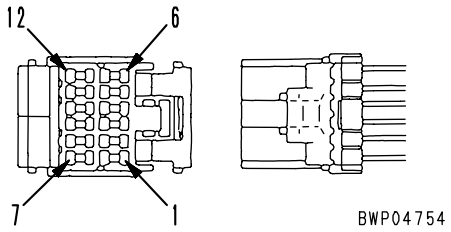
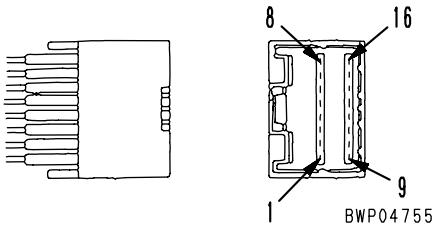
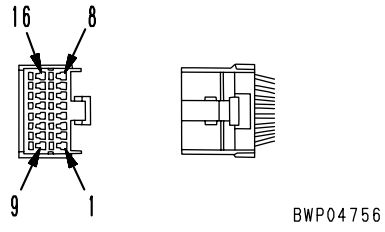
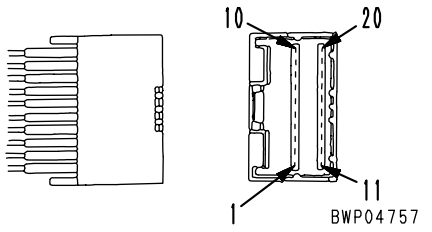
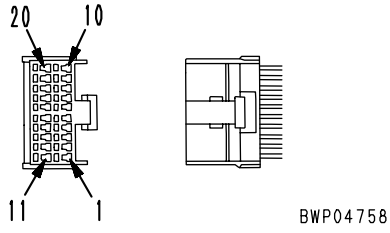
| Number of Pins | M Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 1 | Part number: 08056-00171 | Part number: 08056-00181 | 799-601-7080 |
| 2 |  |  | 799-601-7090 |
| | Part number: 08056-00271 | Part number: 08056-00281 | |
| 3 |  |  | 799-601-7110 |
| | Part number: 08056-00371 | Part number: 08056-00381 | |
| 4 |  |  | 799-601-7120 |
| | Part number: 08056-00471 | Part number: 08056-00481 | |
| 6 |  |  | 799-601-7130 |
| | Part number: 08056-00671 | Part number: 08056-00681 | |
| 8 |  |  | 799-601-7340 |
| | Part number: 08056-00871 | Part number: 08056-00881 | |

| Number of Pins | S Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 8 |  |  | 799-601-7140 |
| | Part number: 08056-10871 | Part number: 08056-10881 | |
| 10 (white) |  |  | 799-601-7150 |
| | Part number: 08056-11071 | Part number: 08056-11081 | |
| 12 (white) |  |  | 799-601-7350 |
| | Part number: 08056-11271 | Part number: 08056-11281 | |
| 16 (white) |  |  | 799-601-7330 |
| | Part number: 08056-11671 | Part number: 08056-11681 | |

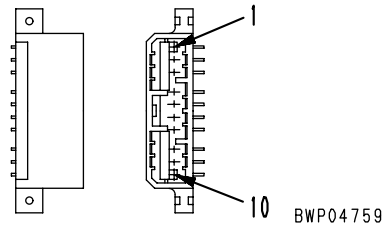
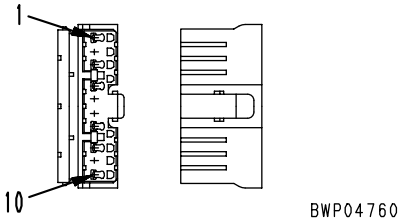
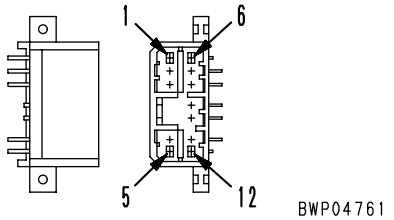
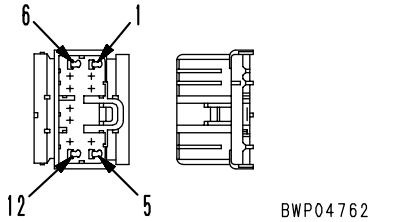
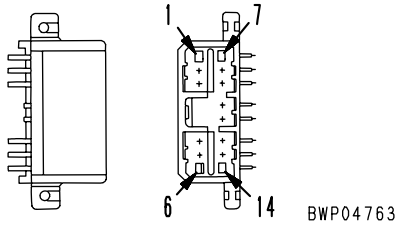
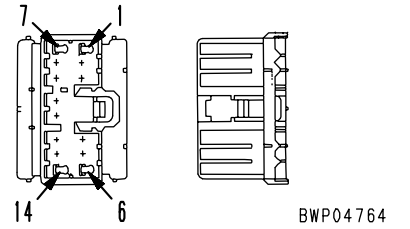
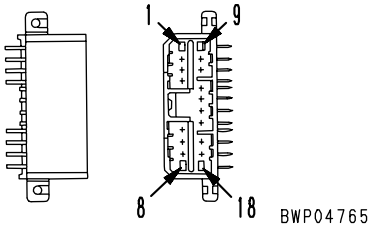
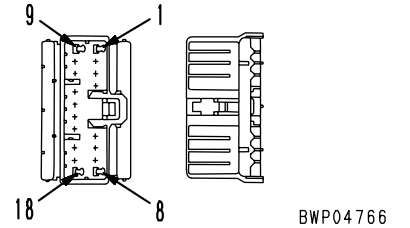
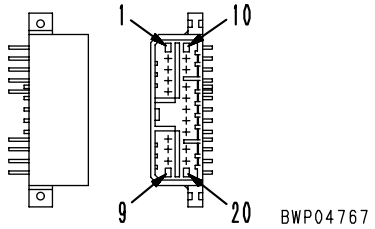
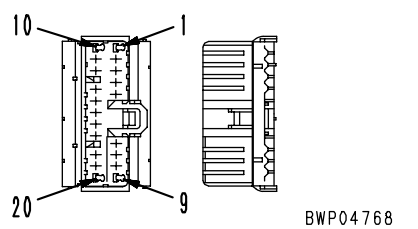
| Number of Pins | S Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 10 (blue) |  |  | — |
| | — | — | |
| 12 (blue) |  |  | 799-601-7160 |
| | Part number: 08056-11272 | Part number: 08056-11282 | |
| 16 (blue) |  |  | 799-601-7170 |
| | Part number: 08056-11672 | Part number: 08056-11682 | |

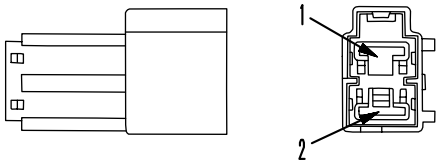
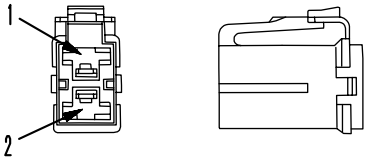
| Number of Pins | MIC Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 7 | Body part number: 79A-222-2640<br>(Quantity: 5 pieces) | Body part number: 79A-222-2630<br>(Quantity: 5 pieces) | — |
| 11 | Body part number: 79A-222-2680<br>(Quantity: 5 pieces) | Body part number: 79A-222-2670<br>(Quantity: 5 pieces) | — |
| 5 |  <br>BWP04741 |  <br>BWP04742 | 799-601-2710 |
| | Body part number: 79A-222-2620<br>(Quantity: 5 pieces) | Body part number: 79A-222-2610<br>(Quantity: 5 pieces) | |
| 9 |  <br>BWP04743 |  <br>BWP04744 | 799-601-2950 |
| | Body part number: 79A-222-2660<br>(Quantity: 5 pieces) | Body part number: 79A-222-2650<br>(Quantity: 5 pieces) | |
| 13 |  <br>BWP04745 |  <br>BWP04746 | 799-601-2720 |
| | Body part number: 79A-222-2710<br>(Quantity: 2 pieces) | Body part number: 79A-222-2690<br>(Quantity: 2 pieces) | |

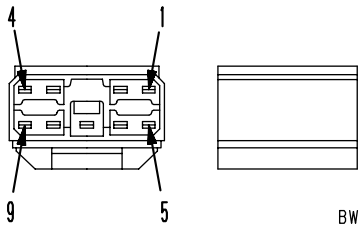
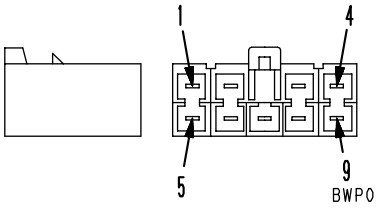
| Number of Pins | MIC Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 17 |  |  | 799-601-2730 |
| | Body part number: 79A-222-2730<br>(Quantity: 2 pieces) | Body part number: 79A-222-2720<br>(Quantity: 2 pieces) | |
| 21 |  |  | 799-601-2740 |
| | Body part number: 79A-222-2750<br>(Quantity: 2 pieces) | Body part number: 79A-222-2740<br>(Quantity: 2 pieces) | |
| — | Body part number: 79A-222-2770<br>(Quantity: 50 pieces) | Body part number: 79A-222-2760<br>(Quantity: 50 pieces) | — |

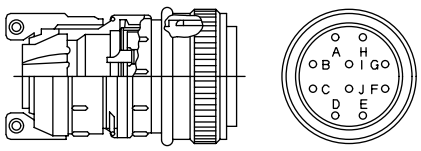
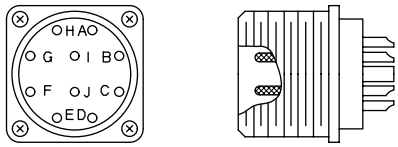
| Number of Pins | AMP040 Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 8 |  |  | 799-601-7180 |
| | — | Housing part number: 79A-222-3430<br>(Quantity: 5 pieces) | |
| 12 |  |  | 799-601-7190 |
| | — | Housing part number: 79A-222-3440<br>(Quantity: 5 pieces) | |
| 16 |  |  | 799-601-7210 |
| | — | Housing part number: 79A-222-3450<br>(Quantity: 5 pieces) | |
| 20 |  |  | 799-601-7220 |
| | — | Housing part number: 79A-222-3460<br>(Quantity: 5 pieces) | |

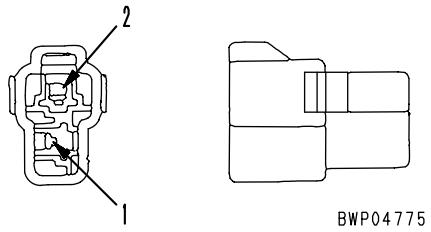
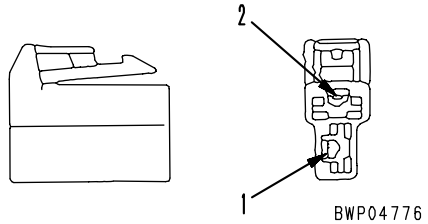
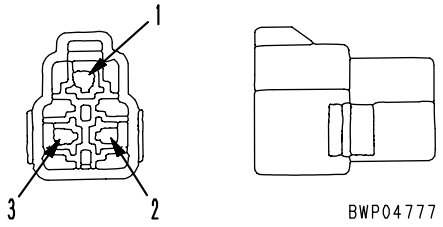
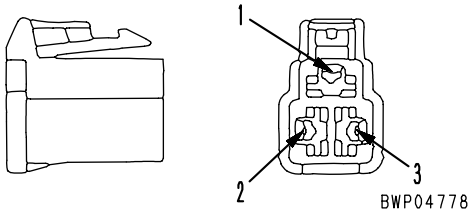
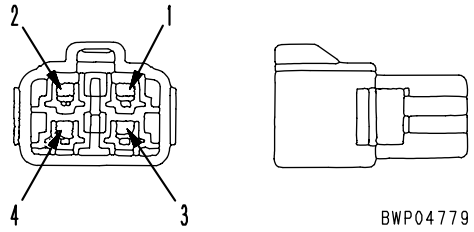
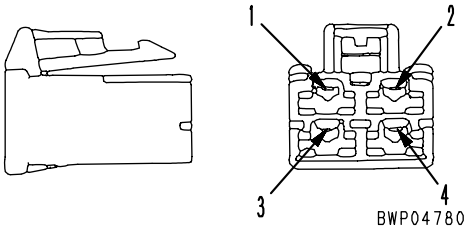
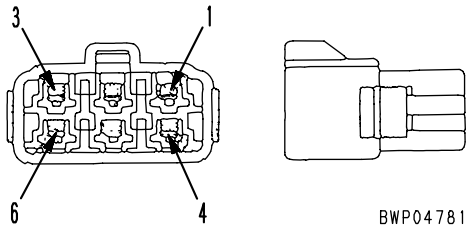
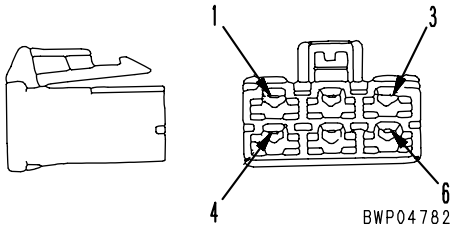
★ Terminal part number: 79A-222-3470 (for all numbers of pins).

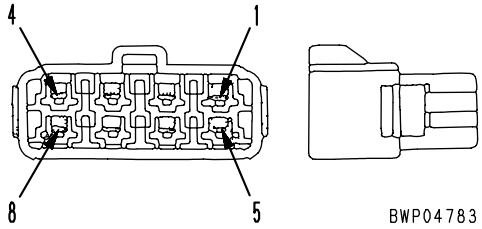
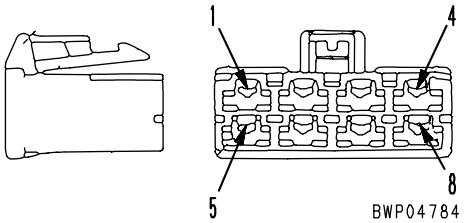
| Number of Pins | AMP070 Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 10 |  |  | 799-601-7510 |
| | — | Part number: 08195-10210 | |
| 12 |  |  | 799-601-7520 |
| | — | Part number: 08195-12210 | |
| 14 |  |  | 799-601-7530 |
| | — | Part number: 08195-14210 | |
| 18 |  |  | 799-601-7540 |
| | — | Part number: 08195-18210 | |
| 20 |  |  | 799-601-7550 |
| | — | Part number: 08195-20210 | |

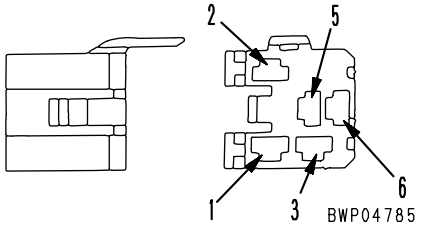
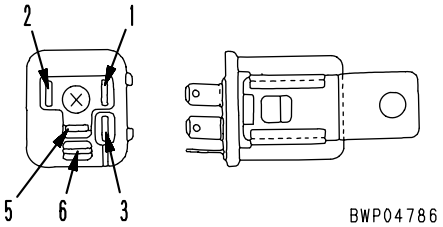
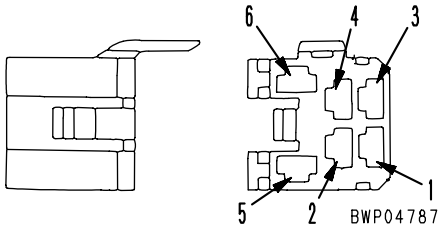
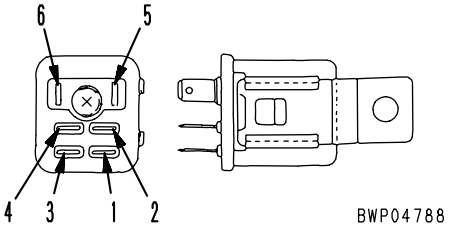
| Number of Pins | L Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 2 |  BWP04769 |  BWP04770 | — |
| | — | — | |

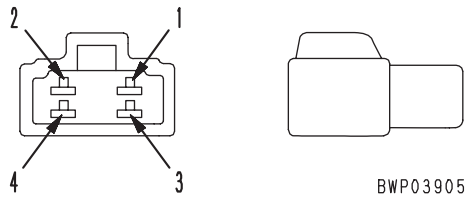
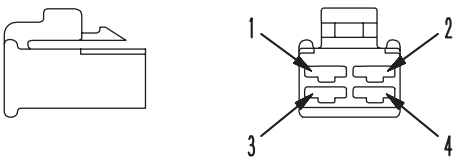
| Number of Pins | PA Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 9 |  BWP04771 |  BWP04772 | — |
| | — | — | |

| Number of Pins | BENDIX (MS) Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 10 |  BWP04773 |  BWP04774 | 799-601-3460 |
| | — | — | |

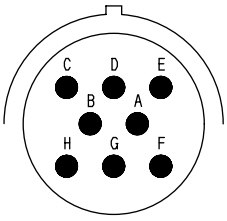
| Number of Pins | KES1 Automobile Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 2 |  |  | — |
| | Part number: 08027-10210 (Natural color)<br>08027-10220 (Black) | Part number: 08027-10260 (Natural color)<br>08027-10270 (Black) | |
| 3 |  |  | — |
| | Part number: 08027-10310 | Part number: 08027-10360 | |
| 4 |  |  | — |
| | Part number: 08027-10410 (Natural color)<br>08027-10420 (Black) | Part number: 08027-10460 (Natural color)<br>08027-10470 (Black) | |
| 6 |  |  | — |
| | Part number: 08027-10610 (Natural color)<br>08027-10620 (Black) | Part number: 08027-10660 (Natural color)<br>08027-10670 (Black) | |

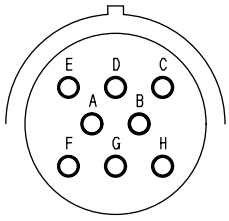
| Number of Pins | KES1 Automobile Type Connector | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 8 |  |  | — |
| | Part number: 08027-10810 (Natural color)<br>08027-10820 (Black) | Part number: 08027-10860 (Natural color)<br>08027-10870 (Black) | |

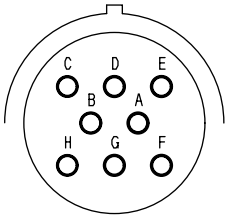
| Number of Pins | Connector for relay (Socket) | | |
|---|---|---|---|
| | Male (Female housing) | Female (Male housing) | T-adapter Part Number |
| 5 |  |  | 799-601-7360 |
| | — | — | |
| 6 |  |  | 799-601-7370 |
| | — | — | |

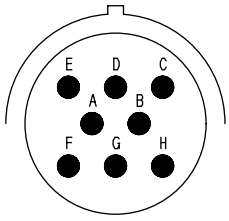
| Type (shell size code) | F Type Connector | | |
|---|---|---|---|
| | Pin (Male terminal) | Body (Female terminal) | T-adapter Part Number |
| 4 |  |  | — |
| | — | — | |

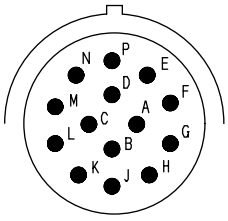
[The pin No. is also marked on the connector (electric wire insertion end)]

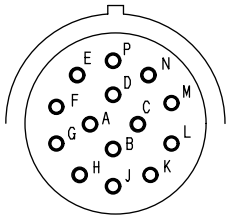
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<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part Number</td></tr>
<tr><td rowspan="4">18-8 (1)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9210</td></tr>
<tr><td> 

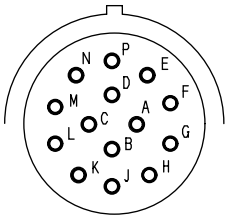
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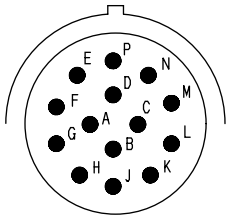
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<tr><td>Pin (female terminal)</td><td>Pin (male terminal)</td><td rowspan="2">799-601-9210</td></tr>
<tr><td> 

BWP05003</td><td> 

BWP05004</td></tr>
<tr><td>Part number: 08191-11201, 08191-12202<br>08191-11205, 08191-12206</td><td>Part number: 08191-13101, 08191-13102<br>08191-13105, 08191-13106</td></tr>
<tr><td rowspan="4">18-14 (2)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9220</td></tr>
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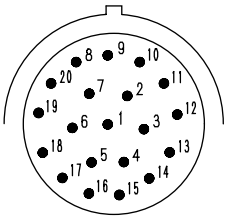
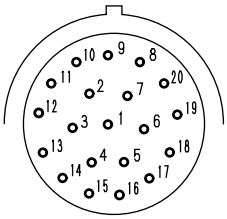
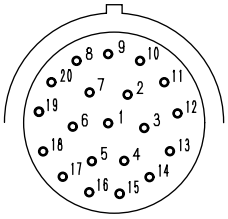
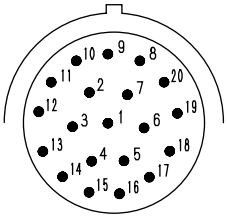
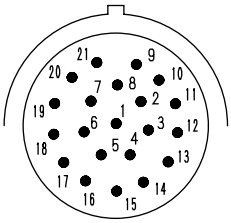
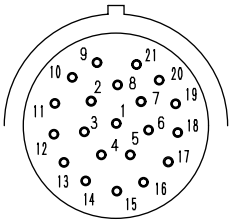
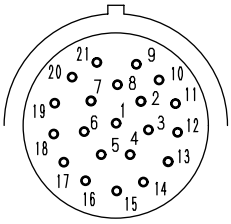
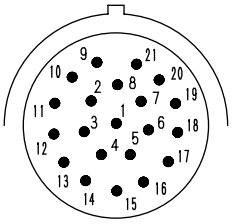
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BWP05006</td></tr>
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<tr><td>Pin (female terminal)</td><td>Pin (male terminal)</td><td rowspan="2">799-601-9220</td></tr>
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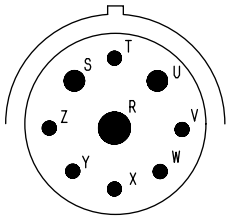
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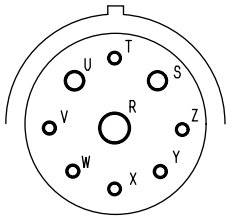
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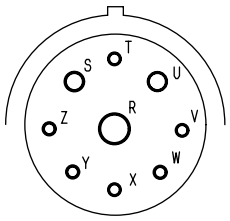
[The pin No. is also marked on the connector (electric wire insertion end)]

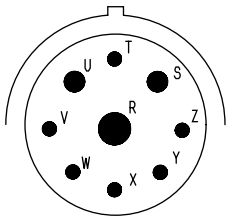
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<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part Number</td></tr>
<tr><td rowspan="6">18-20 (3)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9230</td></tr>
<tr><td>  <br>BWP05009</td><td>  <br>BWP05010</td></tr>
<tr><td>Part number: 08191-31201, 08191-31202</td><td>Part number: 08191-34101, 08191-34102</td></tr>
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<tr><td>  <br>BWP05011</td><td>  <br>BWP05012</td></tr>
<tr><td>Part number: 08191-32201, 08191-32202</td><td>Part number: 08191-33101, 08191-33102</td></tr>
<tr><td rowspan="6">18-21 (4)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9240</td></tr>
<tr><td>  <br>BWP05013</td><td>  <br>BWP05014</td></tr>
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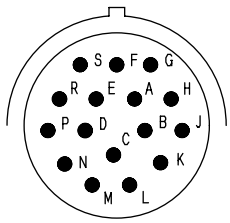
[The pin No. is also marked on the connector (electric wire insertion end)]

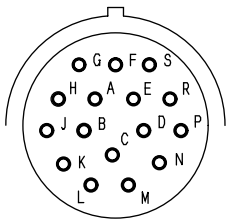
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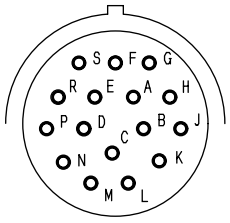
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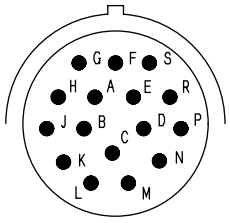
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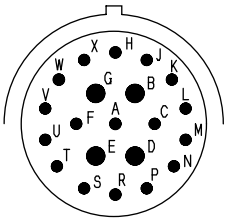
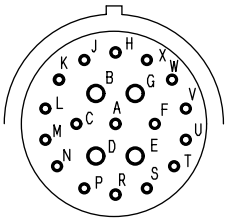
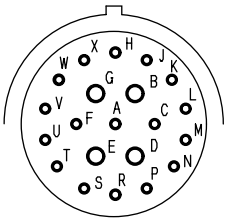
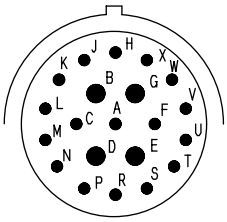
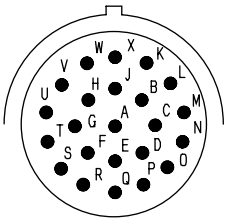
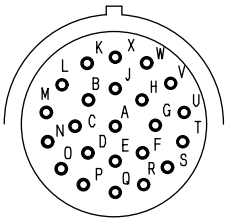
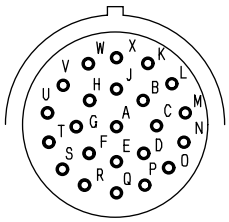
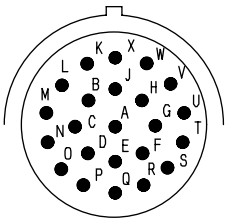
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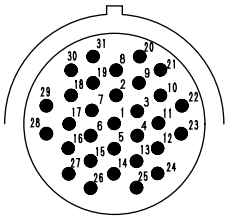
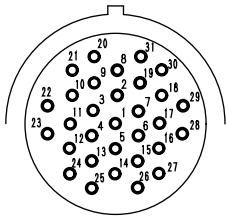
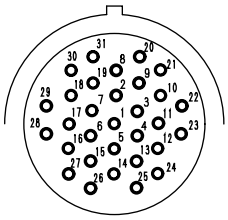
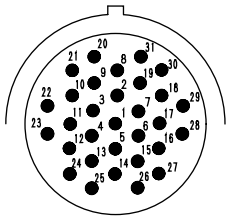
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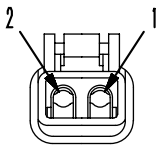
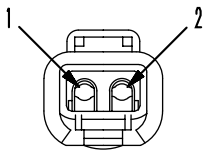
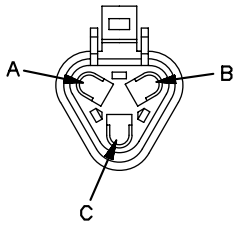
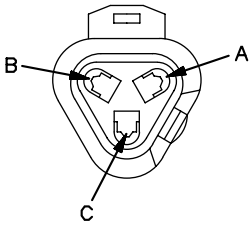
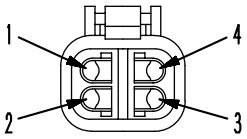
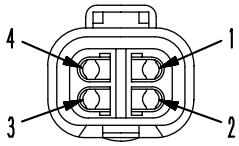
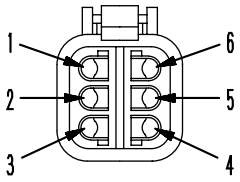
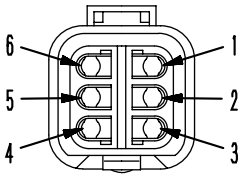
[The pin No. is also marked on the connector (electric wire insertion end)]

<table>
<tr><td rowspan="2">Type (shell size code)</td><td colspan="3">HD30 Series connector</td></tr>
<tr><td>Body (plug)</td><td>Body (receptacle)</td><td>T-adapter Part Number</td></tr>
<tr><td rowspan="4">24-21 (7)</td><td>Pin (male terminal)</td><td>Pin (female terminal)</td><td rowspan="2">799-601-9270</td></tr>
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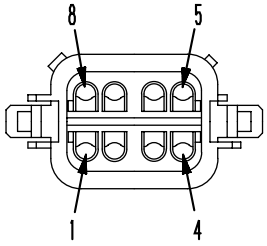
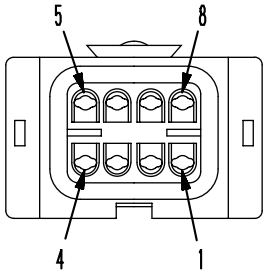
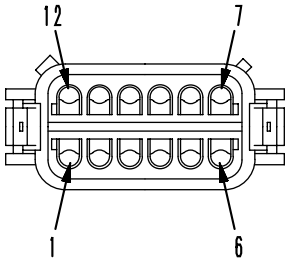
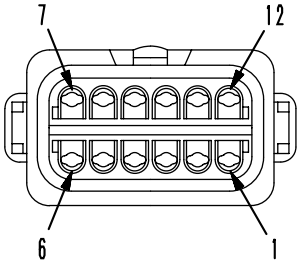
[The pin No. is also marked on the connector (electric wire insertion end)]

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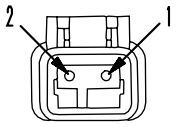
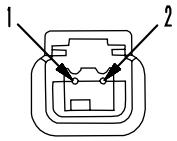
[The pin No. is also marked on the connector (electric wire insertion end)]

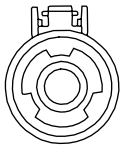
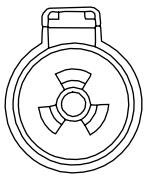
| Number of Pins | DT Series connector | | |
|---|---|---|---|
| | Body (plug) | Body (receptacle) | T-adapter Part Number |
| 2 |  BWP05037 |  BWP05038 | 799-601-9020 |
| | Part number: 08192-12200 (normal type)<br>08192-22200 (fine wire type) | Part number: 08192-12100 (normal type)<br>08192-22100 (fine wire type) | |
| 3 |  BWP05039 |  BWP05040 | 799-601-9030 |
| | Part number: 08192-13200 (normal type)<br>08192-23200 (fine wire type) | Part number: 08192-13100 (normal type)<br>08192-23100 (fine wire type) | |
| 4 |  BWP05041 |  BWP05042 | 799-601-9040 |
| | Part number: 08192-14200 (normal type)<br>08192-24200 (fine wire type) | Part number: 08192-14100 (normal type)<br>08192-24100 (fine wire type) | |
| 6 |  BWP05043 |  BWP05044 | 799-601-9050 |
| | Part number: 08192-16200 (normal type)<br>08192-26200 (fine wire type) | Part number: 08192-16100 (normal type)<br>08192-26100 (fine wire type) | |

[The pin No. is also marked on the connector (electric wire insertion end)]

| Number of Pins | DT Series connector | | |
|---|---|---|---|
| | Body (plug) | Body (receptacle) | T-adapter Part Number |
| 8 |  BWP05045 |  BWP05046 | 8GR: 799-601-9060<br>8B: 799-601-9070<br>8G: 799-601-9080<br>8BR: 799-601-9080 |
| | Part number: 08192-1820 □ (normal type)<br>08192-2820 □ (fine wire type) | Part number: 08192-1810 □ (normal type)<br>08192-2810 □ (fine wire type) | |
| 10 |  BWP05047 |  BWP05048 | 12GR: 799-601-9110<br>12B: 799-601-9120<br>12G: 799-601-9130<br>12BR: 799-601-9140 |
| | Part number: 08192-1920 □ (normal type)<br>08192-2920 □ (fine wire type) | Part number: 08192-1910 □ (normal type)<br>08192-2910 □ (fine wire type) | |
| | | | |
| | | | |

[The pin No. is also marked on the connector (electric wire insertion end)]

| Number of Pins | DTM Series connector | | |
|---|---|---|---|
| | Body (plug) | Body (receptacle) | T-adapter Part Number |
| 2 |  BWP05049 |  BWP05050 | 799-601-9010 |
| | Part number: 08192-02200 | Part number: 08192-02100 | |

| Number of Pins | DTHD Series connector | | |
|---|---|---|---|
| | Body (plug) | Body (receptacle) | T-adapter Part Number |
| 1 |  BWP05051 |  BWP05052 | — |
| | Part number: 08192-31200 (Contact size #12)<br>08192-41200 (Contact size #8)<br>08192-51200 (Contact size #4) | Part number: 08192-31100 (Contact size #12)<br>08192-41100 (Contact size #8)<br>08192-51100 (Contact size #4) | |

# T-ADAPTER TABLE

★ The part Nos. of the T-adapter boxes and T-adapters are shown in the columns and those of the wiring harness checker assemblies are shown in the lines.

| | | | KIT No. | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Port No. | Connector type | Pin No. | 799-601-2500 | 799-601-2700 | 799-601-2800 | 799-601-2900 | 799-601-3000 | 799-601-5500 | 799-601-6000 | 799-601-6500 | 799-601-7000 | 799-601-7100 | 799-601-7400 | 799-601-7500 | 799-601-8000 | 799-601-9000 | 799-601-9100 | 799-601-9200 | 799-601-9300 | \| |
| 799-601-2600 | For measuring box | Econo-21P | ○ | | ○ | ○ | | | | | | ○ | ○ | | ○ | | | | | |
| 799-601-3100 | For measuring box | MS-37P | | | | | ○ | | | | | | | | | | | | | |
| 799-601-3200 | For measuring box | MS-37P | | | | | ○ | | | | | | | | | | | | | |
| 799-601-3300 | For measuring box | Econo-24P | | | | | | | ○ | | | | | | | | | | | |
| 799-601-3360 | Plate | For MS box | | | | | | | | | | | | | | | | | | |
| 799-601-3370 | Plate | For MS box | | | | | | | | | | | | | | | | | | |
| 799-601-3380 | Plate | For MS box | | | | | | | | | | | | | | | | | | |
| 799-601-3410 | BENDIX(MS) | 24P | | | | | | | ○ | ○ | | | | | | | | | | |
| 799-601-3420 | BENDIX(MS) | 24P | | | | | | | ○ | ○ | | | | | | | | | | |
| 799-601-3430 | BENDIX(MS) | 17P | | | | | | | ○ | ○ | | | | | | | | | | |
| 799-601-3440 | BENDIX(MS) | 17P | | | | | | | ○ | ○ | | | | | | | | | | |
| 799-601-3450 | BENDIX(MS) | 5P | | | | | | ○ | ○ | | | | | | | | | | | |
| 799-601-3460 | BENDIX(MS) | 10P | | | | | | | ○ | ○ | | | | | | | | | | |
| 799-601-3510 | BENDIX(MS) | 5P | | | | | | ○ | ○ | | | | | | | | | | | |
| 799-601-3520 | BENDIX(MS) | 14P | | | | | | ○ | ○ | | | | | | | | | | | |
| 799-601-3530 | BENDIX(MS) | 19P | | | | | | | ○ | ○ | | | | | | | | | | |
| 799-601-2910 | BENDIX(MS) | 14P | | | | | | ○ | ○ | | | | | | | | | | | |
| 799-601-3470 | CASE | | | | | | | | ○ | | | | | | | | | | | |
| 799-601-2710 | MIC | 5P | ○ | ○ | | ○ | | | | | | | ○ | | | | | | | |
| 799-601-2720 | MIC | 13P | ○ | ○ | | ○ | | | | | | | ○ | | | | | | | |
| 799-601-2730 | MIC | 17P | ○ | ○ | ○ | ○ | | | | | | ○ | ○ | | ○ | | | | | |
| 799-601-2740 | MIC | 21P | ○ | ○ | ○ | ○ | | | | | | ○ | ○ | | ○ | | | | | |
| 799-601-2950 | MIC | 9P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-2750 | ECONO | 2P | ○ | ○ | | | | | | | | | | | | | | | | |
| 799-601-2760 | ECONO | 3P | ○ | ○ | | | | | | | | | | | | | | | | |
| 799-601-2770 | ECONO | 4P | ○ | ○ | | | | | | | | | | | | | | | | |
| 799-601-2780 | ECONO | 8P | ○ | ○ | | | | | | | | | | | | | | | | |
| 799-601-2790 | ECONO | 12P | ○ | ○ | | | | | | | | | | | | | | | | |
| 799-601-2810 | DLI | 8P | ○ | ○ | | | | | | | | | | | | | | | | |
| 799-601-2820 | DLI | 12P | ○ | ○ | | | | | | | | | | | | | | | | |
| 799-601-2830 | DLI | 16P | ○ | ○ | | | | | | | | | | | | | | | | |
| 799-601-2840 | Extension cable | | ○ | ○ | | | | | | | | | ○ | | | | | | | |
| 799-601-2850 | CASE | | ○ | | | | | | | | | | | | | | | | | |
| 799-601-7010 | X | 1P | | | | | | | | | | | ○ | | ○ | | | | | |
| 799-601-7020 | X | 2P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7030 | X | 3P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7040 | X | 4P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7050 | SWP | 6P | | | | | | | | | ○ | ○ | ○ | | | | | | | |
| 799-601-7060 | SWP | 8P | | | | | | | | | ○ | ○ | ○ | | | | | | | |
| 799-601-7310 | SWP | 12P | | | | | | | | | | | | | | | | | | ○ |
| 799-601-7070 | SWP | 14P | | | | | | | | | | | ○ | | ○ | | | | | |

| Port No. | Connector type | Pin No. | KIT No. 799-601-2500 | 799-601-2700 | 799-601-2800 | 799-601-2900 | 799-601-3000 | 799-601-5500 | 799-601-6000 | 799-601-6500 | 799-601-7000 | 799-601-7100 | 799-601-7400 | 799-601-7500 | 799-601-8000 | 799-601-9000 | 799-601-9100 | 799-601-9200 | 799-601-9300 | — |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 799-601-7320 | SWP | 16P | | | | | | | | | | | | | | | | | | ○ |
| 799-601-7080 | M | 1P | | | | | | | | | | | ○ | | ○ | | | | | |
| 799-601-7090 | M | 2P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7110 | M | 3P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7120 | M | 4P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7130 | M | 6P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7340 | M | 8P | | | | | | | | | | | | | | | | | | ○ |
| 799-601-7140 | S | 8P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7150 | S | 10P-White | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7160 | S | 12P-Blue | | | | | | | | | ○ | ○ | ○ | | | | | | | |
| 799-601-7170 | S | 16P-Blue | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7330 | S | 16P-White | | | | | | | | | | | | | ○ | | | | | |
| 799-601-7350 | S | 12P-White | | | | | | | | | | | | | | | | | | ○ |
| 799-601-7180 | AMP040 | 8P | | | | | | | | | | | ○ | | | | | | | |
| 799-601-7190 | AMP040 | 12P | | | | | | | | | | | ○ | | ○ | | | | | |
| 799-601-7210 | AMP040 | 16P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7220 | AMP040 | 20P | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7230 | Short connector | X-2 | | | | | | | | | ○ | ○ | ○ | | ○ | | | | | |
| 799-601-7240 | Case | | | | | | | | | | ○ | ○ | | | | | | | | |
| 799-601-7270 | Cace | | | | | | | | | | | | ○ | | | | | | | |
| 799-601-7510 | 070 | 10P | | | | | | | | | | | | ○ | | | | | | |
| 799-601-7520 | 070 | 12P | | | | | | | | | | | | ○ | | | | | | |
| 799-601-7530 | 070 | 14P | | | | | | | | | | | | ○ | | | | | | |
| 799-601-7540 | 070 | 18P | | | | | | | | | | | | ○ | | | | | | |
| 799-601-7550 | 070 | 20P | | | | | | | | | | | | ○ | | | | | | |
| 799-601-7360 | Relay connector | 5P | | | | | | | | | | | | | | | | | | ○ |
| 799-601-7370 | Relay connector | 6P | | | | | | | | | | | | | | | | | | ○ |
| 799-601-7380 | JFC connector | 2P | | | | | | | | | | | | | | | | | | ○ |
| 799-601-9010 | DTM | 2P | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9020 | DT | 2P | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9030 | DT | 3P | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9040 | DT | 4P | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9050 | DT | 6P | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9060 | DT | 8P-Gray | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9070 | DT | 8P-Black | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9080 | DT | 8P-Green | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9090 | DT | 8P-Blown | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9110 | DT | 12P-Gray | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9120 | DT | 12P-Black | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9130 | DT | 12P-Green | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9140 | DT | 12P-Blown | | | | | | | | | | | | | | ○ | | ○ | | |
| 799-601-9210 | HD30 | 18-8 | | | | | | | | | | | | | | ○ | ○ | | | |
| 799-601-9220 | HD30 | 18-14 | | | | | | | | | | | | | | ○ | ○ | | | |

| Port No. | Connector type | Pin No. | KIT No. 799-601-2500 | 799-601-2700 | 799-601-2800 | 799-601-2900 | 799-601-3000 | 799-601-5500 | 799-601-6000 | 799-601-6500 | 799-601-7000 | 799-601-7100 | 799-601-7400 | 799-601-7500 | 799-601-8000 | 799-601-9000 | 799-601-9100 | 799-601-9200 | 799-601-9300 | — |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 799-601-9230 | HD30 | 18-20 | | | | | | | | | | | | | | ○ | ○ | | | |
| 799-601-9240 | HD30 | 18-21 | | | | | | | | | | | | | | ○ | ○ | | | |
| 799-601-9250 | HD24 | 24-9 | | | | | | | | | | | | | | ○ | ○ | | | |
| 799-601-9260 | HD30 | 2-16 | | | | | | | | | | | | | | ○ | ○ | | | |
| 799-601-9270 | HD30 | 24-21 | | | | | | | | | | | | | | ○ | ○ | | | |
| 799-601-9280 | HD30 | 24-23 | | | | | | | | | | | | | | ○ | ○ | | | |
| 799-601-9290 | HD30 | 24-31 | | | | | | | | | | | | | | ○ | ○ | | | |
| 799-601-9310 | Plate | For HD30 | | | | | | | | | | | | | | ○ | ○ | | ○ | |
| 799-601-9320 | For measuring box | For DT, HD | | | | | | | | | | | | | | ○ | ○ | | ○ | |
| 799-601-9330 | Case | | | | | | | | | | | | | | | ○ | | | | |
| 799-601-9340 | Case | | | | | | | | | | | | | | | | ○ | | | |
| 799-601-9350 | DEUTSCH | 40P | | | | | | | | | | | | | | | | | ○ | |
| 799-601-9360 | DEUTSCH | 24P | | | | | | | | | | | | | | | | | ○ | |
| 799-601-9410 | For NE, G sensor | 2P | | | | | | | | | | | | | | | | | | ○ |
| 799-601-9420 | For boost pressure, fuel | 3P | | | | | | | | | | | | | | | | | | ○ |
| 799-601-9430 | PVC socket | 2P | | | | | | | | | | | | | | | | | | ○ |

white 20-242

# CONNECTOR TYPES AND MOUNTING LOCATIONS

★ The address column of the table indicates each address of a connector placement diagram (diagram in three dimensions) and an electrical circuit system diagram.

★ Symbols of the circuit diagram address column of the table:
HST: HST System, MON: Monitoring system, E: Electrical system.

★ The item enclosed by parentheses in the connector type column indicates the color of the connector body. (B: Black, Br: Brown, G: Green, Gr: Gray, W: White)

| Connector No. | Connector Type | Number of pins | Installation Name | Address | | | |
|---|---|---|---|---|---|---|---|
| | | | | Layout Drawing | System Drawing | | |
| | | | | | HST | MON | E |
| A01 | M | 6 | Blower motor, resister | V-7 | | | F-8 |
| A02 | SWP | 6 | Air mixing servomotor | V-6 | | | F-8 |
| A03 | M | 2 | Thermistor | V-7 | | | F-8 |
| A05 | Sumitomo | 4 | Air conditioner pressure switch | V-8 | | | E-8 |
| A07 | SWP | 8 | L.H. side blower servomotor | R-1 | | | D-8 |
| A08 | SWP | 8 | R.H. side blower servomotor | N-4 | | | D-8 |
| A09 | Sumitomo | 5 | Blower relay (Main) | U-8 | | | B-1 |
| A10 | Sumitomo | 5 | Blower relay (HI) | U-8 | | | B-1 |
| A11 | Sumitomo | 5 | Blower relay (M2) | T-9 | | | B-1 |
| A12 | Sumitomo | 5 | COND relay | T-9 | | | A-1 |
| A13 | Sumitomo | 5 | Blower relay (M1) | S-9 | | | A-1 |
| A15 | Sumitomo | 5 | Magnet clutch relay | T-9 | | | A-1 |
| AL1 | S | 16 | Intermediate connector (Air conditioner relay harness) | T-9 | | | C-3 |
| B01 | M | 2 | Rear working lamp (Right side) | I-9 | | | Q-1 |
| B02 | M | 2 | Rear working lamp (Left side) | J-8 | | | Q-1 |
| B03-1 | Terminal | 1 | Back-up alarm | L-7 | | R-1 | |
| B03-2 | Terminal | 1 | Back-up alarm | L-7 | | R-1 | |
| B04 | DT-T | 3 | Condenser | H-9 | | | N-3 |
| B05 | X | 2 | Coolant level sensor | G-9 | | N-2 | R-2 |
| B06 | KES1 | 2 | Rear window shield washer | G-9 | | | Q-3 |
| B07 | KES1 | 2 | Front window shield washer | G-9 | | | Q-3 |
| BL1 | DT-T | 6 | Intermediate connector (Bulkhead harness) | H-2, W-1 | | M-3 | M-4 |
| BR1 | DT-T | 4 | Intermediate connector (Grill harness) | J-8 | | Q-3 | P-1 |
| C03 | AMP040 | 16 | Air conditioner controller | E-9 | | | B-9 |
| C04 | AMP040 | 12 | Air conditioner controller | E-9 | | | C-9 |
| C05 | M | 2 | Front working lamp (Right side) | D-8 | | | C-9 |
| C06 | M | 2 | Front working lamp (Left side) | E-9 | | | C-9 |
| C07 | KES1 | 2 | Room lamp | F-9 | | | |
| C08 | M | 1 | Door switch (Left side) (Room lamp) | F-9 | | | |
| C09 | M | 1 | Door switch (Right side) (Room lamp) | D-8 | | | |
| C10 | Terminal | 1 | Ground | D-9 | | | |
| C11 | PA | 9 | AM/FM radio | D-9 | | | |
| C12 | M | 2 | Speaker (Left side) | G-9 | | | |
| C13 | M | 2 | Speaker (Right side) | F-9 | | | |
| C14 | VHC | 8 | Warning lamp (beacon) switch | E-9 | | | |
| C15 | M | 1 | Warning lamp connector | E-9 | | | |
| C16 | Plug | 1 | Warning lamp (beacon) | C-8 | | | |
| C17 | Terminal | 1 | Ground | | | | D-8 |
| C18 | Terminal | 1 | Ground | E-9 | | | C-8 |
| C19 | VCH | 8 | Defroster switch | E-9 | | | |

| Connector No. | Connector Type | Number of pins | Installation Name | Address | | | |
|---|---|---|---|---|---|---|---|
| | | | | Layout Drawing | System Drawing | | |
| | | | | | HST | MON | E |
| C20 | Sumitomo | 5 | Defroster | F-9 | | | |
| C21 | Yazaki | 1 | Rear glass (Defroster) | F-9 | | | |
| C22 | Yazaki | 1 | Rear glass (Defroster) | H-9 | | | |
| C23 | Terminal | 1 | Ground | C-8 | | | |
| CAN1 | DT-T | 3 | CAN connector | O-7 | F-1 | K-2 | |
| CAN2 | DT-T | 3 | CAN connector | N-3 | F-1 | K-2 | |
| CL1 | S | 16 | Intermediate connector (Cab harness) | A-6, N-3 | | | B-8 |
| CL2 | S | 12 | Intermediate connector (Cab harness) | A-6, N-3 | | | C-8 |
| D01 | Yazaki | 3 | Diode (Forward and reverse solenoid) | X-9 | A-4 | H-1 | |
| D03 | Yazaki | 2 | Diode (Fuel-cut solenoid) | X-9 | | | M-9 |
| D04 | Yazaki | 2 | Diode (Fuel-cut solenoid) | X-9 | | | |
| D05 | Yazaki | 3 | Diode (ECSS solenoid, heater relay) | X-7 | | J-1 | M-9 |
| D06 | Yazaki | 2 | Diode (Magnet clutch) | W-9 | | | N-9 |
| D07 | Yazaki | 3 | Diode (Engine started) | W-9 | A-3 | H-1 | N-9 |
| D08 | Yazaki | 2 | Diode (Engine started) | W-7 | | | N-9 |
| D09 | Yazaki | 4 | Diode (Parking brake, HST motor 2 solenoid) | X-8 | A-3 | | |
| D10 | Yazaki | 2 | Diode (Washer motor [F]) | W-8 | | | O-9 |
| D11 | Yazaki | 2 | Diode (Hazard) | O-1 | | | O-9 |
| D12 | Yazaki | 3 | Diode (HST controller power source) | W-9 | A-3 | I-1 | |
| D13 | Yazaki | 2 | Diode (Washer motor [R]) | W-8 | | | O-9 |
| D14 | Yazaki | 2 | Diode (Hazard) | P-1 | | | P-9 |
| D15 | Yazaki | 2 | Diode (Engine started) | W-8 | | | P-9 |
| D16 | Yazaki | 2 | Diode (Forward) | X-3 | H-9 | J-9 | A-4 |
| D17 | Yazaki | 2 | Diode (Reverse) | X-3 | G-9 | I-9 | A-4 |
| D18 | Yazaki | 2 | Diode (Neutral) | X-3 | | | A-4 |
| E01 | DT-T | 2 | Safety relay | AD-2 | | W-4 | Q-6 |
| E02 | Sumitomo | 3 | Alternator | K-8 | | Q-2 | Q-6 |
| E03 | Terminal | 1 | Fuel-cut solenoid | Z-5 | | | R-5 |
| E06 | Terminal | 1 | Heater relay | AB-8 | | T-1 | R-5 |
| E07 | Terminal | 1 | Heater relay | AB-7 | | T-1 | R-5 |
| E08 | Terminal | 1 | Heater relay | AB-7 | | T-1 | R-5 |
| E09 | Terminal | 1 | Ribbon heater | AB-6 | | T-2 | R-4 |
| E10 | Terminal | 1 | Starting motor B terminal | AC-1 | | X-4 | R-6 |
| E11 | Terminal | 1 | Alternator B terminal | L-8 | | | |
| E12 | DT-T | 2 | Engine speed sensor | AA-3 | K-1 | | |
| E13 | DT-T | 3 | Engine water temperature sensor (Preheating) | L-7 | | Q-1 | |
| E14 | X | 2 | Engine water temperature sensor (Monitor) | AA-5 | | W-3 | |
| E15 | Terminal | 1 | Engine oil pressure switch | AA-5 | | | |
| E16 | DT-T | 2 | FREON compressor magnet clutch | Y-7 | | | |
| E19 | Terminal | 1 | Safety relay | Z-3 | | W-4 | R-6 |
| E20 | Terminal | 1 | Safety relay | Z-3 | | W-4 | R-6 |
| E21 | Terminal | 1 | Starting motor C terminal | Y-3 | | X-4 | R-6 |
| E22 | Terminal | 1 | Ground | Y-7 | | | |
| E23 | Terminal | 1 | Fuel-cut solenoid (HOLD) | Z-5 | | | R-5 |

| Connector No. | Connector Type | Number of pins | Installation Name | Address | | | |
|---|---|---|---|---|---|---|---|
| | | | | Layout Drawing | System Drawing | | |
| | | | | | HST | MON | E |
| E24 | Terminal | 1 | Fuel-cut solenoid (GND) | Z-5 | | | R-5 |
| E25 | Terminal | 1 | Ground | AA-3 | | | |
| ER03 | L | 2 | Intermediate connector (Engine harness) | K-2, AC-2 | | U-2 | Q-5 |
| ER1 | DT | 6 | Intermediate connector (Engine harness) | L-4, AD-2 | | Q-4 | Q-5 |
| ER2 | DT-T | 12 | Intermediate connector (Engine harness) | L-3, AC-2 | I-1 | Q-4 | P-5 |
| F03 | DT-T | 3 | Bucket positioner proximity switch | A-4 | | | N-3 |
| F04 | DT-T | 3 | Lift arm kick-out proximity switch | A-5 | | | N-2 |
| F07 | DT-T | 2 | ECSS solenoid | D-1 | | | Q-4 |
| F10 | Terminal | 1 | Ground | E-1 | | P-7 | O-1 |
| F11 | DT-T | 3 | Steering pump pressure switch (Low pressure) | G-1 | | O-8 | |
| F12 | DT-T | 3 | Emergency steering pressure switch | B-7 | | | |
| F14 | DT-T | 2 | Axle oil temperature sensor | A-2 | | Q-8 | |
| F16 | DT-T | 2 | Bypass solenoid valve (PT specification) | | | | |
| F18 | DT-T | 2 | PPC pressure switch (PT specification) | | | | |
| F19 | DT-T | 3 | Fork positioner proximity switch (PT specification) | | | | |
| F20 | DT-T | 3 | Bucket positioner proximity switch (PT specification) | | | | |
| F21 | DT-T | 3 | Bell-crank angle detection switch (PT specification) | | | | |
| FL1 | S | 10 | Intermediate connector (Front harness) | B-7, P-1 | | M-6 | M-5 |
| FL2 | DT-T | 6 | Intermediate connector (Front harness) | C-8, P-1 | | M-6 | M-4 |
| FL3 | DT-T | 4 | Intermediate connector (Emergency steering harness) | C-8, Q-1 | | M-7 | |
| FL5 | DT-T | 4 | Intermediate connector (PT specification) | | | | |
| FL6 | DT-T | 4 | Intermediate connector (PT specification) | | | | |
| FS1 | - | - | Fuse box | S-9 | A-2 | K-9 | L-3 |
| FS2 | - | - | Fuse box | S-9 | | L-9 | L-2 |
| HEAD L | SWP | 8 | Front combination lamp (Left side) | F-1 | | P-8 | N-1 |
| HEAD R | SWP | 8 | Front combination lamp (Right side) | A-5 | | P-8 | N-1 |
| J01 | J | 20 | Junction connector (Orange) | Q-1 | | A-1 | D-1 |
| J02 | J | 20 | Junction connector (Blue) | N-4 | B-1 | B-1 | E-1 |
| J03 | J | 20 | Junction connector (Blue) | N-4 | B-1 | B-1 | E-1 |
| J04 | J | 20 | Junction connector (Gray) | S-9 | B-1 | C-1 | F-1 |
| J05 | J | 20 | Junction connector (Brown) | X-7 | | D-1 | G-1 |
| J06 | J | 20 | Junction connector (Brown) | W-6 | C-1 | D-1 | G-1 |
| J07 | J | 20 | Junction connector (Green) | P-8 | D-1 | | H-1 |
| J08 | J | 20 | Junction connector (Orange) | X-7 | D-1 | E-1 | H-1 |
| J09 | J | 20 | Junction connector (Pink) | X-6 | E-1 | E-1 | I-1 |
| J10 | J | 20 | Junction connector (Blue) | W-7 | | F-1 | I-1 |
| J11 | J | 20 | Junction connector (Brown) | P-8 | E-1 | G-1 | J-1 |
| J12 | J | 20 | Junction connector (Orange) | W-7 | F-1 | G-1 | J-1 |
| L02 | DT | 4 | Starting switch | P-8 | A-8 | K-2 | A-6 |
| L03 | DT-T | 4 | Speed selector switch | O-7 | E-8 | | |
| L04 | X | 8 | Light combination switch | N-2 | | E-8 | A-8 |

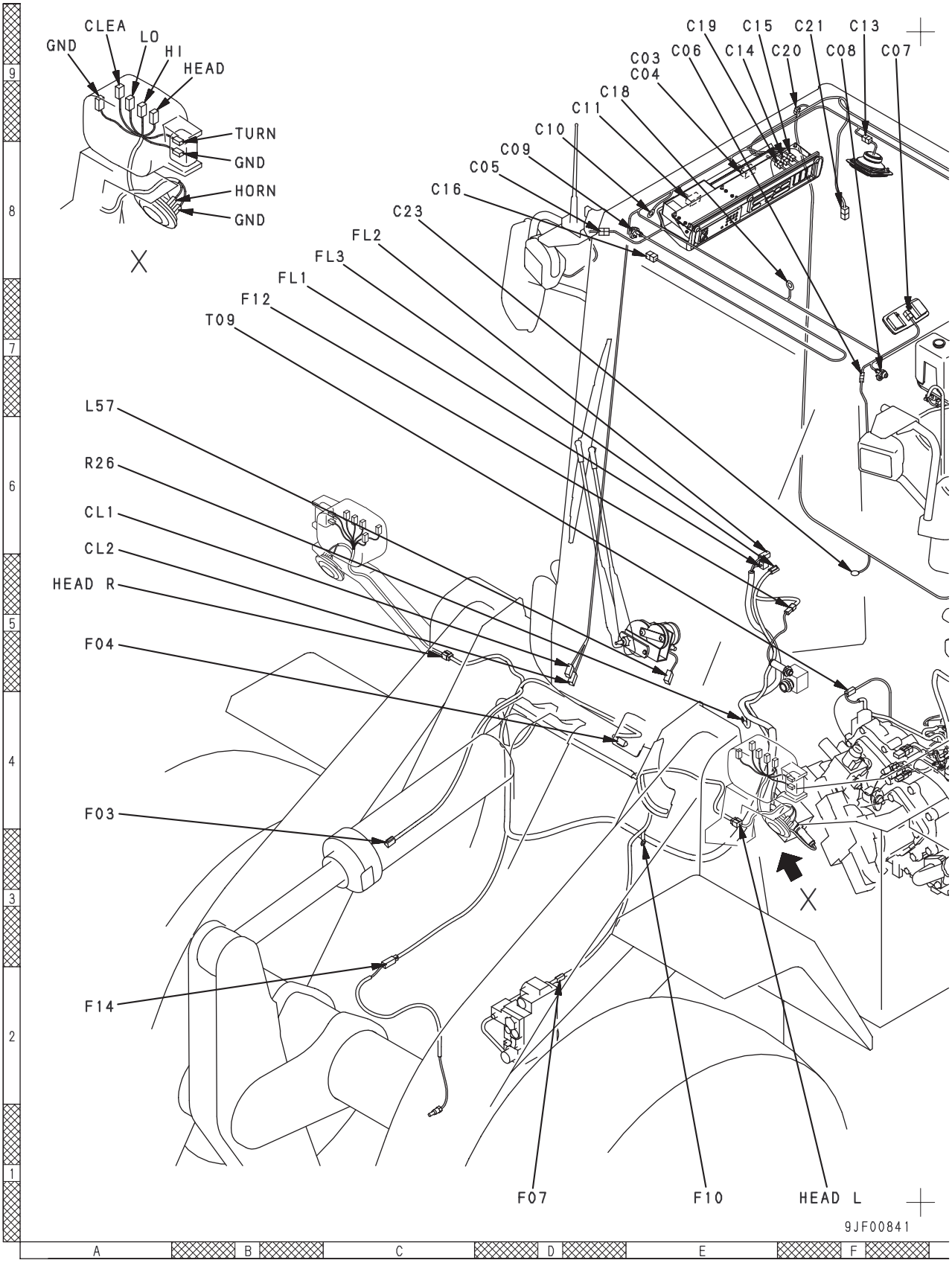
| Connector No. | Connector Type | Number of pins | Installation Name | Address | | | |
|---|---|---|---|---|---|---|---|
| | | | | Layout Drawing | System Drawing | | |
| | | | | | HST | MON | E |
| L05 | S | 10 | Wiper switch (Front, rear) | O-2 | | | A-5 |
| L06 | VCH | 8 | Hazard switch | O-1 | | I-8 | L-1 |
| L07 | VCH | 8 | Front working lamp switch | Q-1 | | | K-1 |
| L08 | VCH | 8 | Rear working lamp switch | Q-1 | | | K-1 |
| L09 | VCH | 8 | ECSS switch | Q-8 | | | L-9 |
| L10 | VCH | 8 | Monitor mode switch 1 | N-5 | | A-8 | |
| L11 | VCH | 8 | Monitor mode switch 2 | N-5 | | A-8 | |
| L12 | Yazaki | 2 | Cigar lighter | N-4 | | | |
| L13 | DT-T | 2 | Steering horn switch | O-1 | | | A-5 |
| L14 | DT-T | 4 | Intermediate connector (ECSS controller) | N-2 | | | M-3 |
| L15 | DT-T | 4 | FNR switch | O-1 | F-8 | D-8 | A-8 |
| L16 | DT-T | 2 | Option connector | N-6 | | | D-1 |
| L17 | DT-T | 2 | Parking brake selection connector (Electrical type) | V-5 | | G-8 | |
| L18 | DT-T | 2 | Parking brake selection connector (Mechanical type) | V-6 | | G-8 | |
| L19 | VCH | 8 | Parking brake switch | N-5 | | | |
| L20 | DT-T | 2 | Parking brake selection connector (Selection) | V-5 | | G-8 | |
| L21 | AMP040 | 16 | Monitor panel controller | N-3 | | B-8 | C-1 |
| L22 | AMP040 | 12 | Monitor panel controller | N-2 | G-7 | C-8 | C-1 |
| L23 | AMP040 | 20 | Monitor panel controller | N-5 | G-7 | C-8 | D-1 |
| L34 | DT-T | 2 | Stop lamp switch | V-3 | | | L-1 |
| L35 | DT-T | 2 | PPC valve, electrical detent (Liftarm float) | Q-8 | | | C-1 |
| L36 | DT-T | 2 | PPC valve, electrical detent (Liftarm raise) | N-7 | | | C-1 |
| L37 | DT-T | 2 | PPC valve, electrical detent (Bucket tilt) | N-6 | | | C-1 |
| L38 | M | 2 | Power supply (Battery) | V-5 | | | |
| L39 | M | 2 | Power supply (Key-ON) | L-6, V-5 | | | |
| L40 | Terminal | 1 | Ground (HST controller) | O-7 | H-1 | | |
| L41 | AMP 1-963217-1 | 16 | HST controller | N-7 | B-8 | J-1 | |
| L42 | AMP 2-963217-1 | 16 | HST controller | O-7 | C-8 | J-1 | |
| L43 | DT-T | 4 | Checker | N-6 | D-8 | | |
| L44 | M | 4 | For steering controller | R-1 | | | |
| L45 | SWP | 6 | Auto-grease | N-5 | | | |
| L46 | M | 2 | Caution buzzer | N-7 | | F-8 | |
| L47 | DT-T | 2 | Parking brake switch (Intermediate) | V-4 | | H-8 | |
| L48 | M | 6 | Interval wiper timer | P-8 | | | G-8 |
| L49 | KES1 | 4 | Flasher unit | R-1 | | F-8 | L-8 |
| L50 | M | 4 | Power supply | V-4 | | | |
| L51 | X | 2 | Air servomotor | S-9 | | | D-8 |
| L52 | M | 4 | Rear wiper motor | G-9, U-8 | | | H-8 |
| L53 | DT-T | 2 | Parking brake switch | V-4 | | H-8 | |
| L54 | M | 3 | Travel speed control dial | P-8 | E-8 | | |
| L55 | DT-T | 2 | Air suspension seat | V-8 | | | |
| L56 | VCH | 8 | Traction control switch | Q-8 | F-8 | | |
| L57 | M | 6 | Front wiper motor | A-7, N-2 | | | G-8 |
| L58 | M | 2 | DC converter | V-4 | | | |
| L70 | M | 2 | Power supply (PT specification) | | | | |
| L71 | VCH | 8 | Dump speed select switch (PT specification) | | | | |

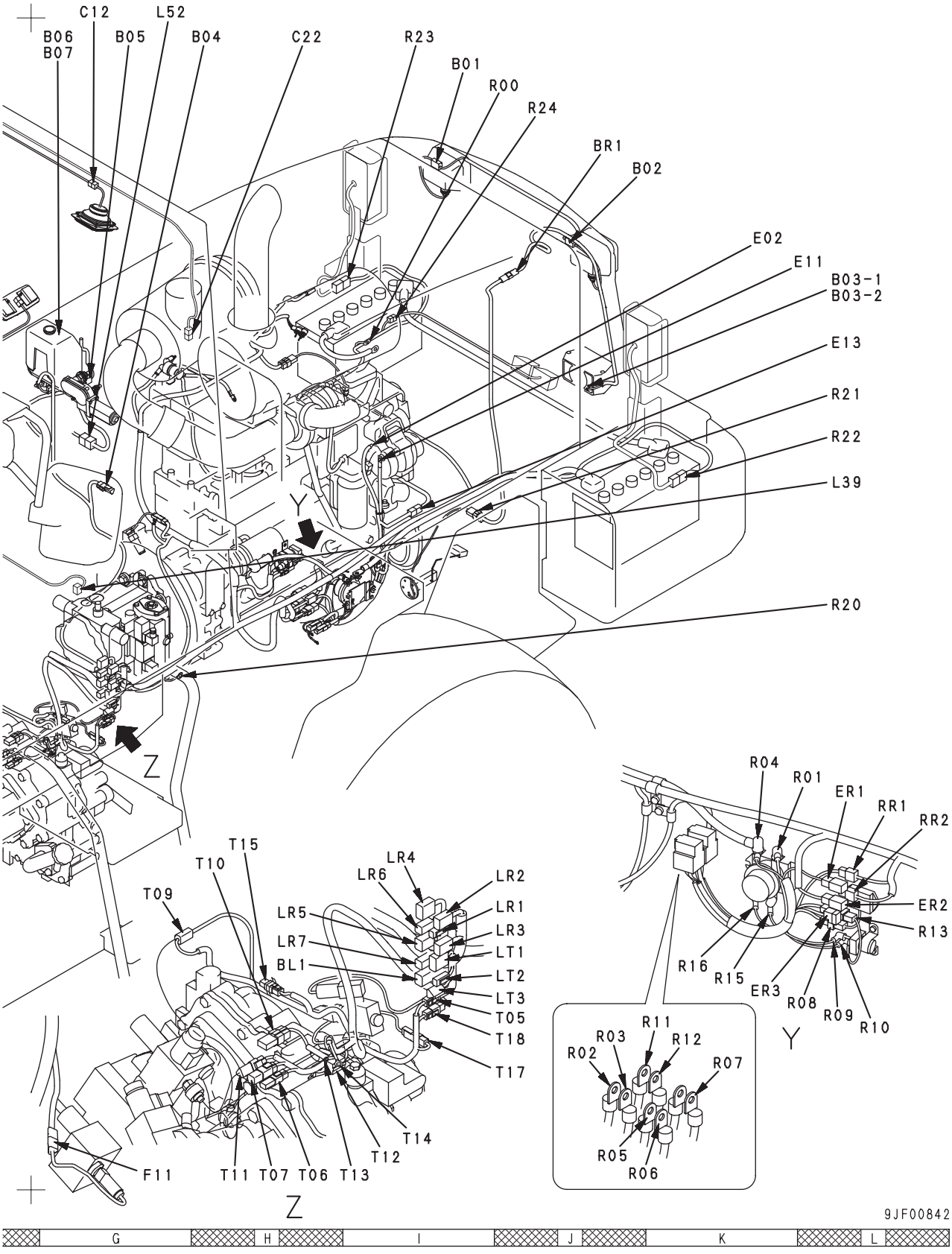
| Connector No. | Connector Type | Number of pins | Installation Name | Address | | | |
|---|---|---|---|---|---|---|---|
| | | | | Layout Drawing | System Drawing | | |
| | | | | | HST | MON | E |
| L73 | VCH | 8 | Attachment selection switch (PT specification) | | | | |
| L74 | M | 2 | Intermediate connector (PT specification) *Connect to L58 connector. | | | | |
| L75 | R | 5 | Bell-crank angle detection relay (PT specification) | | | | |
| L76 | R | 5 | Attachment selection relay (PT specification) | | | | |
| L77 | DT-T | 4 | ECSS controller (PT specification) | | | | |
| L78 | DT-T | 4 | Intermediate connector (PT specification) *Connect to L14 connector. | | | | |
| L100 | Terminal | 1 | Ground | V-7 | G-1 | L-1 | C-3 |
| L101 | R | 5 | Mechanical parking brake relay | N-9 | | A-7 | |
| L102 | R | 5 | HST controller power hold relay | M-8 | A-6 | A-7 | |
| L103 | R | 5 | Shift control relay | N-8 | A-6 | | |
| L104 | R | 5 | Parking brake indicator relay (Electrical type) | N-9 | | A-6 | |
| L105 | R | 5 | Parking brake safety relay | N-8 | | | |
| L106 | R | 5 | Neutral safety relay | M-8 | | A-4 | I-9 |
| L107 | R | 6 | Reverse relay | M-8 | A-5 | A-4 | K-9 |
| L108 | R | 5 | Forward relay | N-7 | A-5 | A-4 | |
| L109 | R | 5 | Back buzzer relay | M-9 | | | I-9 |
| L110 | R | 5 | ECSS relay | N-9 | | | L-9 |
| L111 | R | 5 | HST solenoid safety relay | M-9 | A-4 | | |
| L112 | R | 5 | Parking brake neutral safety relay | M-9 | | A-3 | |
| L113 | R | 5 | Boom kick-out relay | N-9 | | | H-9 |
| L114 | R | 5 | Bucket positioner relay | N-8 | | | H-9 |
| L115 | R | 5 | Auto preheating relay | M-9 | | A-3 | I-9 |
| L116 | R | 5 | Horn relay | N-9 | | | I-9 |
| L117 | R | 5 | Small lamp relay (Left side) | U-9 | | A-6 | J-9 |
| L118 | R | 5 | Small lamp relay (Right side) | X-5 | | A-6 | J-9 |
| L119 | R | 5 | Head lamp relay (Right side) | W-4 | | A-5 | K-9 |
| L120 | R | 5 | Head lamp relay (Left side) | T-9 | | A-5 | K-9 |
| L121 | R | 5 | Stop lamp relay | U-8 | | | K-9 |
| L122 | R | 6 | Working lamp relay | U-8 | | | J-9 |
| L132 | R | 5 | Multi relay 1 (M/T lever relay) | W-4 | | | A-3 |
| L133 | R | 5 | Multi relay 2 (FNR lever select relay) | W-4 | H-9 | J-9 | A-3 |
| L134 | R | 5 | Multi relay 3 (FNR lever select relay) | W-4 | | | B-3 |
| L135 | R | 5 | Multi relay 4 (FNR lever select relay) | W-5 | | | A-3 |
| L136 | R | 5 | Multi relay 5 (Reverse relay) | X-5 | I-9 | J-9 | B-3 |
| L137 | R | 5 | Multi relay 6 (Forward relay) | X-5 | I-9 | K-9 | B-3 |
| LR1 | DT | 2 | Intermediate connector (Rear harness) | J-3, X-2 | H-4 | M-5 | M-6 |
| LR2 | L | 2 | Intermediate connector (Rear harness) | J-3, X-3 | H-4 | M-5 | M-6 |
| LR3 | L | 2 | Intermediate connector (Rear harness) | J-3, X-2 | H-4 | M-5 | M-6 |
| LR4 | DT-T | 12 | Intermediate connector (Rear harness) | I-3, W-3 | H-3 | M-4 | M-6 |
| LR5 | DT-T | 6 | Intermediate connector (Rear harness) | H-3, W-2 | H-3 | M-4 | M-5 |
| LR6 | DT-T | 6 | Intermediate connector (Rear harness) | I-3, W-2 | | M-4 | M-5 |
| LR7 | DT-T | 2 | Intermediate connector (Rear harness) | H-3, W-2 | | M-3 | M-4 |
| LT1 | DT-T | 12 | Intermediate connector (HST harness) | J-2, X-2 | G-6 | M-6 | M-3 |
| LT2 | DT-T | 4 | Intermediate connector (HST harness) | J-2, X-1 | H-5 | M-6 | M-3 |

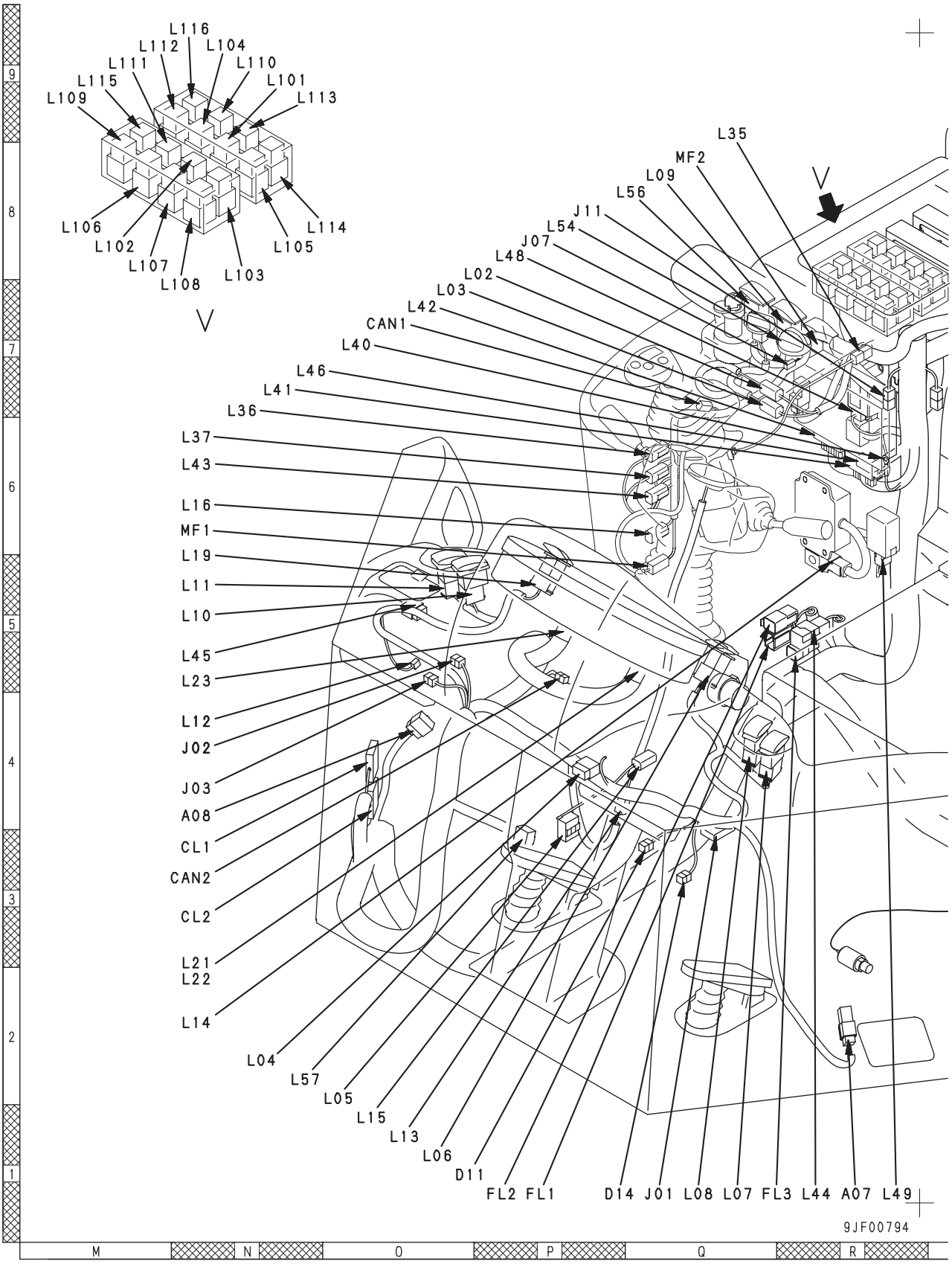
| Connector No. | Connector Type | Number of pins | Installation Name | Address | | | |
|---|---|---|---|---|---|---|---|
| | | | | Layout Drawing | System Drawing | | |
| | | | | | HST | MON | E |
| LT3 | DT-T | 4 | Intermediate connector (HST harness) | J-2, X-1 | | M-5 | |
| MF1 | DT | 12 | Direction select switch | N-6 | | | D-8 |
| MF2 | VCH | 8 | Direction select switch function | Q-8 | | | E-8 |
| MF3 | DT-T | 12 | Intermediate connector (Multi-function harness) | X-4 | H-6 | I-5 | B-4 |
| MF4 | DT-T | 2 | Intermediate connector (Multi-function harness) | X-4 | | | |
| R00 | Terminal | 1 | Ground (Battery) | J-9 | | X-5 | |
| R01 | Terminal | 1 | Battery relay | L-4, AD-2 | L-2 | X-6 | R-7 |
| R02 | Terminal | 1 | Slow blow fuse (30A) | J-2 | L-4 | X-7 | R-8 |
| R03 | Terminal | 1 | Slow blow fuse (30A) | J-2 | L-4 | X-7 | R-8 |
| R04 | Terminal | 1 | Battery relay | K-4 | L-2 | X-6 | R-7 |
| R05 | Terminal | 1 | Slow blow fuse (120A) | J-1 | L-3 | X-7 | R-8 |
| R06 | Terminal | 1 | Slow blow fuse (80A) | J-1 | L-3 | X-7 | R-7 |
| R07 | Terminal | 1 | Slow blow fuse (120A) | K-2 | | X-7 | R-7 |
| R08 | DT-T | 4 | Fuel solenoid cut timer | L-2 | | | P-8 |
| R09 | Terminal | 1 | Fuel solenoid pull relay | L-2 | | | Q-9 |
| R10 | Terminal | 1 | Fuel solenoid pull relay | L-2 | | | Q-9 |
| R11 | Terminal | 1 | Slow blow fuse (30A) | K-2 | | | R-8 |
| R12 | Terminal | 1 | Slow blow fuse (30A) | K-2 | | | R-8 |
| R13 | DT-T | 2 | Fuel solenoid pull relay | L-3 | | | Q-8 |
| R15 | Terminal | 1 | Battery relay (+) | K-2 | L-3 | X-6 | R-7 |
| R16 | Terminal | 1 | Battery relay (-) | K-2 | L-3 | X-6 | R-7 |
| R20 | Terminal | 1 | Ground | L-5 | H-1 | O-1 | P-1 |
| R21 | X | 2 | Fuel level sensor | L-7 | | U-8 | P-1 |
| R22 | SWP | 6 | Rear combination lamp (Left side) | L-6 | | P-2 | Q-1 |
| R23 | SWP | 6 | Rear combination lamp (Right side) | I-9 | | P-2 | Q-2 |
| R24 | DT-T | 2 | License lamp | J-9 | | O-1 | Q-2 |
| R26 | Terminal | 1 | Ground | A-6 | | | P-1 |
| RR1 | L | 2 | Intermediate connector (power supply harness) | L-4 | J-4 | Q-5 | O-6 |
| RR2 | DT-T | 6 | Intermediate connector (power supply harness) | L-3 | J-4 | Q-5 | O-6 |
| T01 | DT-T | 4 | F-R solenoid | AA-1 | K-2 | W-1 | |
| T05 | DT-T | 2 | Clutch control EPC solenoid | J-2 | K-7 | | |
| T06 | DT-T | 2 | HST motor 1 EPC solenoid | H-1 | K-8 | | |
| T07 | DT-T | 4 | HST motor 2 EPC solenoid and motor 2 overrun solenoid | H-1 | K-8 | R-8 | Q-3 |
| T09 | DT-T | 4 | Speedometer sensor | B-7, G-3 | K-9 | | Q-4 |
| T10 | X | 2 | HST oil temperature sensor | H-3 | | R-8 | |
| T11 | DT-T | 3 | HST oil pressure sensor | H-1 | K-5 | | |
| T12 | X | 2 | Brake oil pressure sensor | I-1 | | S-8 | |
| T13 | Terminal | 1 | HST filter clogging sensor | I-1 | | T-6 | |
| T14 | Terminal | 1 | Ground | I-1 | J-5 | U-6 | Q-3 |
| T15 | DT-T | 2 | OPT (Parking brake solenoid) | H-3 | | | |
| T17 | DT-T | 2 | OPT (Emergency brake pressure solenoid) | J-2 | | | |
| T18 | DT-T | 2 | OPT (Parking brake indicator pressure switch) | J-2 | | T-8 | |
| TEL | DT-T | 12 | Short connector | | H-6 | M-7 | G-8 |

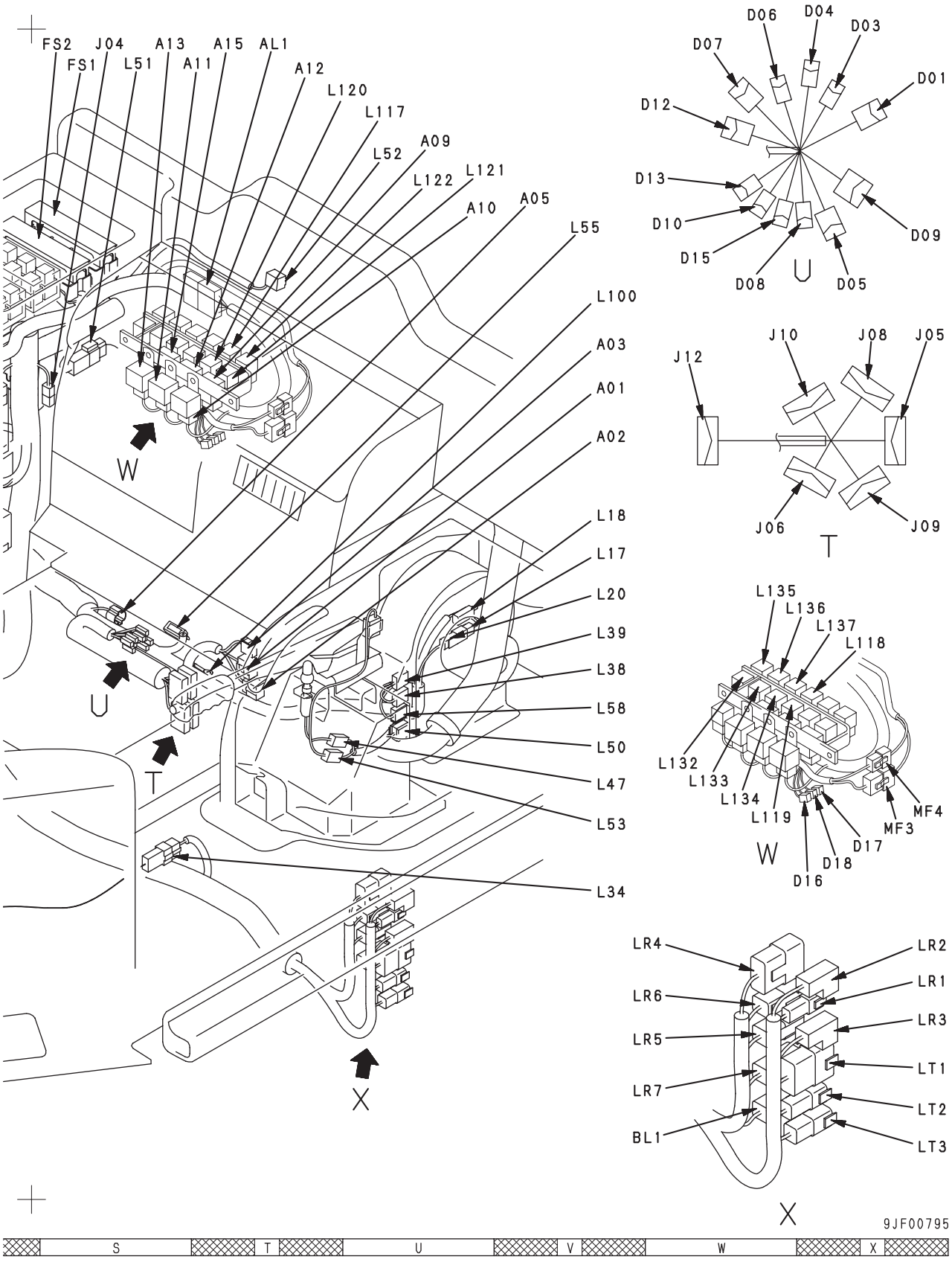
white 20-249

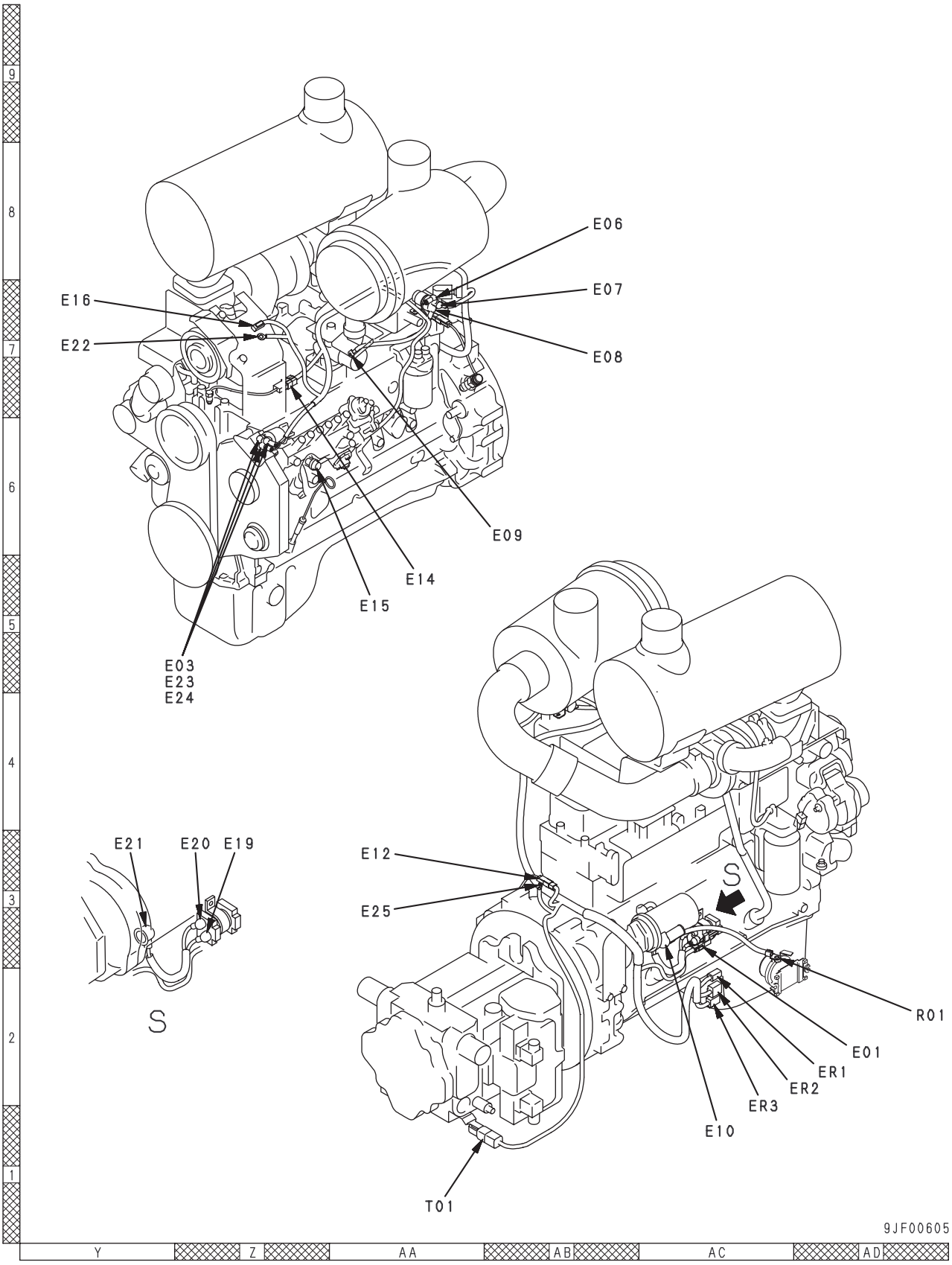
# CONNECTOR LAYOUT DRAWING




C12
L52
B06
B07
B05
B04
C22
R23
B01
R00
R24
BR1
B02
E02
E11
B03-1
B03-2
E13
R21
R22
L39
R20
Y
Z
T15
T10
T09
LR4
LR6
LR2
LR5
LR1
LR3
LR7
LT1
BL1
LT2
LT3
T05
T18
T17
T14
T12
F11
T11
T07
T06
T13
R04
R01
ER1
RR1
RR2
ER2
R13
R16
R15
ER3
R08
R09
R10
R11
R03
R12
R02
R07
R05
R06
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L116
L112
L104
L111
L110
L115
L101
L109
L113
L106
L102
L107
L108
L103
L105
L114
V
L35
MF2
L09
L56
J11
L54
J07
L48
L02
L03
L42
CAN1
L40
L46
L41
L36
L37
L43
L16
MF1
L19
L11
L10
L45
L23
L12
J02
J03
A08
CL1
CAN2
CL2
L21
L22
L14
L04
L57
L05
L15
L13
L06
D11
FL2 FL1
D14 J01 L08 L07 FL3 L44 A07 L49
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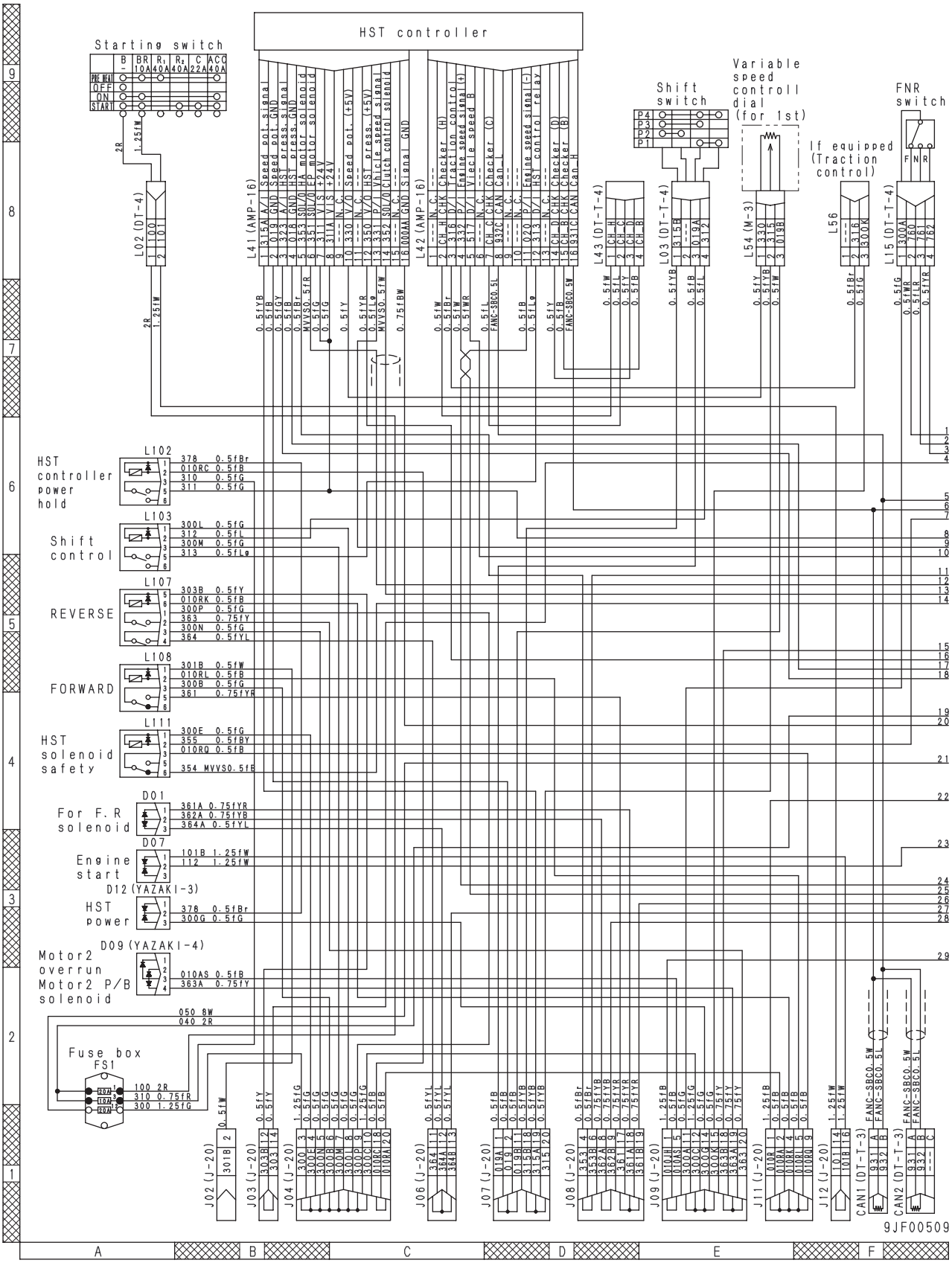

FS2
FS1
J04
L51
A13
A11
A15
AL1
A12
L120
L117
A09
L52
L122
L121
A10
A05
L55
L100
A03
A01
A02
L18
L17
L20
L39
L38
L58
L50
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L34
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L133
L134
L119
MF4
MF3
D17
D18
D16
W
LR4
LR2
LR6
LR1
LR3
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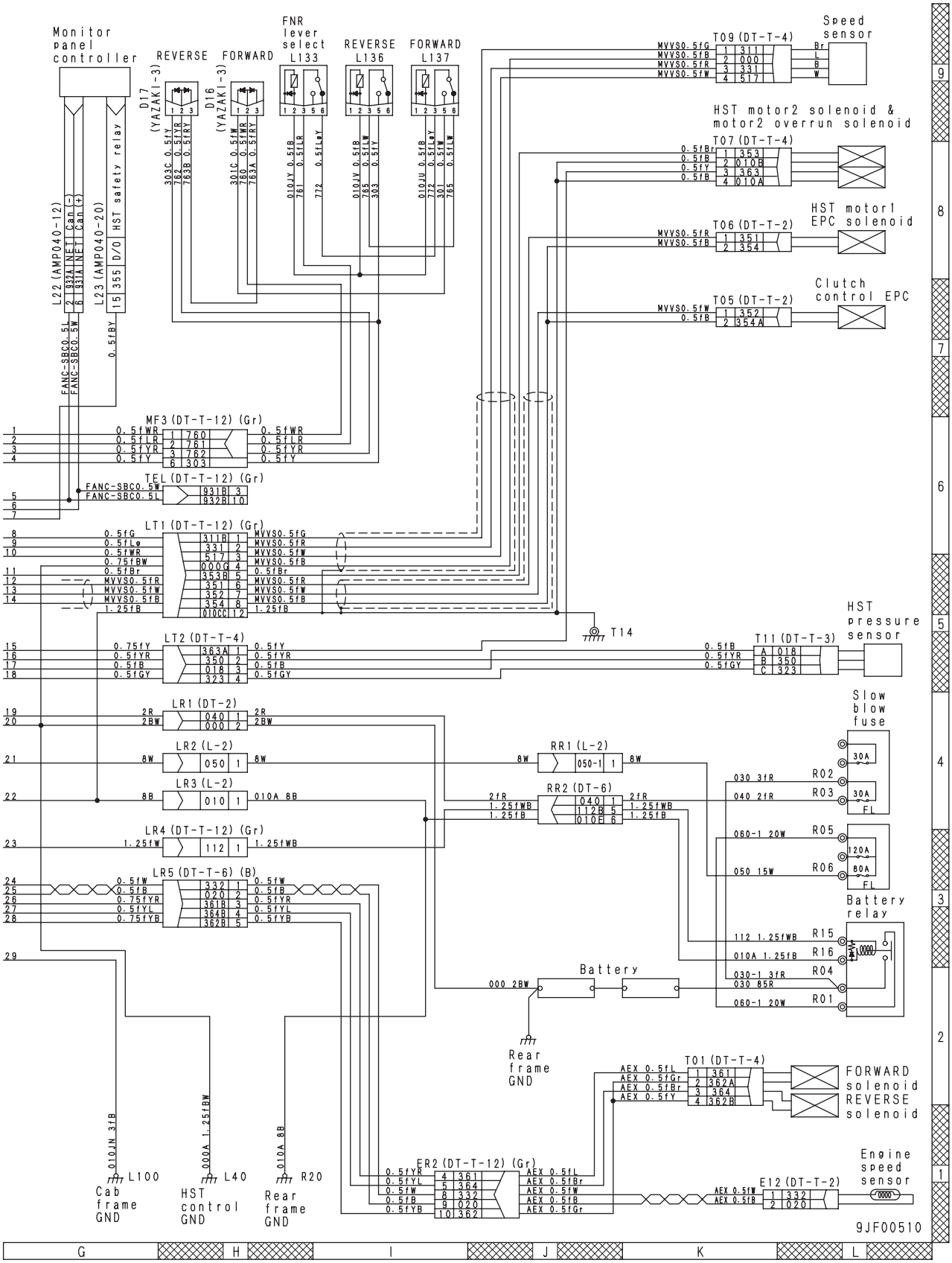

E06
E07
E08
E16
E22
E09
E14
E15
E03
E23
E24
E21
E20
E19
S
E12
E25
S
R01
E01
ER1
ER2
ER3
E10
T01
9JF00605

# TROUBLESHOOTING OF HST CONTROLLER SYSTEM (HST MODE)


HST controller system diagram . . . . . 20-302
Before troubleshooting code display . . . . . 20-304
Before troubleshooting electrical system . . . . . 20-305
Information contained in troubuleshooting table . . . . . 20-306
Error Code [989F00] (Transmission protection caution (00)) is displayed . . . . . 20-308
Error Code [DHH1KX] (HST oil pressure sensor input signal outside range (KX)) is displayed . . . . . 20-309
Error Code [DLE2LC] (Engine revolution sensor revolution speed signal mismatch (LC)) is displayed . . . 20-311
Error Code [DW26KZ] (Motor 2 solenoid system discontinuity or short-circuiting (KZ)) is displayed . . . . . 20-312
Error Code [DX19KZ] (Motor 1 solenoid system discontinuity or short-circuiting (KZ)) is displayed . . . . . 20-316
Error Code [DX20KZ] (Clutch solenoid system discontinuity or short-circuiting (KZ)) is displayed . . . . . 20-318
Troubleshooting Code [HST-1] Defective HST controller power source (HST controller does not function) . 20-320
Troubleshooting Code [HST-2] Travel speed does not shifted . . . . . 20-322
Troubleshooting Code [HST-3] Travel speed does not excessive (defective speed sensor system) . . . . . 20-326
Troubleshooting Code [HST-4] Travel speed cannot be controlled when the travel speed selector switch is at 1st . . . . . 20-328
Troubleshooting Code [HST-5] HST output control (Traction control) cannot be controlled . . . . . 20-330

# HST CONTROLLER SYSTEM DIAGRAM




Monitor panel controller
REVERSE
FORWARD
FNR lever select L133
REVERSE L136
FORWARD L137
D17 (YAZAKI-3)
D16 (YAZAKI-3)
L22 (AMP040-12)
L23 (AMP040-20)
HST safety relay
T09 (DT-T-4)
Speed sensor
HST motor2 solenoid & motor2 overrun solenoid
T07 (DT-T-4)
HST motor1 EPC solenoid
T06 (DT-T-2)
Clutch control EPC
T05 (DT-T-2)
MF3 (DT-T-12) (Gr)
TEL (DT-T-12) (Gr)
LT1 (DT-T-12) (Gr)
LT2 (DT-T-4)
T14
T11 (DT-T-3)
HST pressure sensor
LR1 (DT-2)
LR2 (L-2)
LR3 (L-2)
LR4 (DT-T-12) (Gr)
LR5 (DT-T-6) (B)
RR1 (L-2)
RR2 (DT-6)
Slow blow fuse
Battery relay
Battery
Rear frame GND
T01 (DT-T-4)
FORWARD solenoid
REVERSE solenoid
ER2 (DT-T-12) (Gr)
E12 (DT-T-2)
Engine speed sensor
L100
Cab frame GND
L40
HST control GND
R20
Rear frame GND
9JF00510

# BEFORE TROUBLESHOOTING CODE DISPLAY

## ERROR CODE AND POSSIBLE CAUSES TABLE

| Error Code | Action Code | Possible Causes: Defective machine monitor | Defective HST controller | Defective starting switch | Defective monitor panel mode switch 1 [■] | Defective monitor panel mode switch 1 [◇] | Defective monitor panel mode switch 2 [<] | Defective monitor panel mode switch 2 [>] | Defective FNR switch | Battery is deteriorated | Defective battery relay | Defective fuse, fusible link | Defective alternator | Defective engine revolution sensor | Defective HST motor 2 solenoid | Defective HST motor 1 solenoid | Defective clutch solenoid | Engine oil pressure drops | Defective engine oil pressure sensor | Engine water temperature overheating | Defective engine water temperature sensor (high temperature) | Defective engine water temperature sensor (low temperature) | Engine cooling water level lacks | Defective coolant level sensor | Defective HST oil pressure sensor | HST oil filter clogging | Defective HST oil filter sensor | HST oil temperature overheating | Defective HST oil temperature sensor | Accumulator oil pressure drops | Defective accumulator oil pressure sensor | Brake cooling oil temperature overheating | Defective brake cooling oil temperature sensor | Steering oil temperature overheating | Defective steering oil temperature sensor | Defective relay | Wiring harness discontinuity | Wiring harness ground fault | Wiring harness hot short-circuiting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Failures related to HST controller | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 989F00 | E00 | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DHH1KX | E03 | | ● | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | ● | ● | ● |
| DLE2LC | E03 | | ● | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | ● | | ● |
| DW26KZ | E03 | | ● | | | | | | ● | | | | | | ● | | | | | | | | | | | | | | | | | | | | | ● | ● | |
| DX19KZ | E03 | | ● | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | ● | ● | |
| DX20KZ | E03 | ● | ● | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | ● | ● | |
| Failures related to monitor | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15B0NX | E01 | ● | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | ● | |
| 2G42ZG | E03 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | ● | ● | |
| 989F00 | E00 | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 989FN1 | E02 | ● | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | ● | ● | ● | |
| AB00L6 | E03 | ● | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| AB00MA | E03 | ● | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● |
| B@BAZG | E01 | ● | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | ● | |
| B@BCNS | E02 | ● | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | ● | |
| B@BCZK | E01 | ● | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | ● | |
| B@C7NS | E02 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | |
| B@CRNS | E02 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | |
| D5ZHL6 | E01 | ● | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | ● | ● |
| DAF0KT | E03 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DAJ0KR | E03 | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | ● |
| DD15LD | E01 | ● | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| DD16LD | E01 | ● | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| DD17LD | E01 | ● | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| DD18LD | E01 | ● | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| DDK3KB | E03 | ● | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| DDS5L6 | E03 | ● | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | |
| DGE2KX | E01 | ● | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | ● | |
| DGE3L6 | E01 | ● | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | ● | |
| DGH1KX | E01 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | ● | |
| DGR1KX | E01 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | ● | |
| DGR4KA | E01 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | ● | |
| DHE4L6 | E01 | ● | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | ● | |

# BEFORE TROUBLESHOOTING ELECTRICAL SYSTEM

## FUSE BOX CONNECTION TABLE

★ This connection chart shows the equipment that each fuse box power source supplies power directly to ("switch power source" means the power supplied when the starting switch is ON; "permanent power source" means the power supplied when the starting switch is OFF).

| Category | Fuse No. | Fuse capacity | Power supply destination |
|---|---|---|---|
| Permanent power source (Fuse box 1) | 1 | 20A | Starting switch |
| | 2 | 10A | Hazard lamp |
| | 3 | 10A | HST control A |
| | 4 | 10A | Parking brake 1 |
| | 5 | 10A | Meter, panel |
| | 6 | 10A | Car radio A |
| | 7 | 10A | Option (24V-1) |
| Switch power source (Fuse box 1) | 8 | 10A | Head lamp (left side) |
| | 9 | 10A | Head lamp (right side) |
| | 10 | 10A | Turn signal lamp |
| | 11 | 10A | Back lamp, stop lamp |
| | 12 | 20A | HST control B |
| | 13 | 10A | Work equipment positioner |
| | 14 | 10A | Wiper |
| | 15 | 10A | Car radio B |
| Switch power source (Fuse box 2) | 1 | 20A | Air conditioner A |
| | 2 | 20A | Air conditioner B |
| | 3 | 10A | Beacon lamp |
| | 4 | 10A | - |
| | 5 | 10A | Load-meter |
| | 6 | 20A | DC converter |
| | 7 | 10A | Option (24V-2) |
| | 8 | 10A | Parking brake 2 |
| | 9 | 10A | Horn |
| | 10 | 10A | Side marker lamp (left side) |
| | 11 | 10A | Side marker lamp (right side) |
| | 12 | 20A | Front working lamp |
| | 13 | 20A | Rear working lamp |
| | 14 | 10A | (Spare 1) |
| | 15 | 10A | (Spare 2) |

# INFORMATION CONTAINED IN TROUBULESHOOTING TABLE

★ The troubleshooting table and the related circuit diagrams contain the following information. Grasp their contents fully before proceeding to actual troubleshooting work.

| Action Code | Error Code | Controller Code | Trouble | Trouble displayed in trouble data |
|---|---|---|---|---|
| Panel display | Panel display | Panel display | | |
| Description of Trouble | • Condition when machine monitor or controller detected trouble. | | | |
| Machine monitor or controller Reaction | • Action to take to protect system or equipment when machine monitor or controller detected trouble. | | | |
| Effect on Machine | • Condition that appeared as problem on machine when action (given above) was taken by machine monitor or controller. | | | |
| Related Information | • Information related to troubleshooting or error that occurred. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting |
|---|---|---|---|
| Possible Causes and Standard Values | 1 | Probable cause when trouble occurred (the numbers are index numbers and do not indicate the order of priority) | <Data to fill in><br>• Normal standard values used to judge probable cause<br>• Remarks regarding decision-making<br><br><Condition when wiring harness is defective><br>• Disconnection<br>There is defective connection of connector or disconnection in wiring harness<br>• Short circuit with ground<br>Wiring harness not wired to ground (GND) circuit is in contact with ground (GND) circuit<br>• Short circuit with power source<br>Wiring harness not wired to power supply (24 V) circuit is in contact with power supply (24 V) circuit<br><br><Points to remember when troubleshooting><br>1) Method of displaying connector No. and handling T-adapter<br>Unless there is special instruction, insert or connect the T-adapter as follows<br>• If there is no indication for the male or female terminal of the connector No., disconnect the connector and insert the T-adapter in both the male and female terminals<br>• If there is indication for the male or female terminal of the connector No., disconnect the connector and connect the T-adapter to only the terminal indicated (either the male terminal or female terminal)<br><Points to remember when troubleshooting><br>2) Given order for pin numbers and handling tester lead<br>Unless there is a special instruction, connect tester (+) lead and (-) lead as follows to carry out troubleshooting<br>• Connect the (+) lead to the wiring harness for the pin No. given first<br>• Connect the (-) lead to the wiring harness for the pin No. given last |
| | 2 | | |
| | 3 | | |
| | 4 | | |
| | 5 | | |

**Related circuit diagram**

This is part of electrical circuit diagram which shows the portion where the failure occurred.

- Connector No.: Indicates (Type - numbers of a pin) (color)
- Arrow: Roughly indicates the location in the machine where it is installed.

**Phenomena code table**

★ For problem codes marked "See list", see the list below.

| Phenomena code | Details | Disconnection | Details |
|---|---|---|---|
| KA | Disconnection | L0 | Fill signal ON 2 or more channels |
| KB | Short circuit | L1 | Fill signal is ON when command current is OFF |
| KK | Drop in power source voltage, input | L2 | Fuel pressure is higher than maximum set value |
| KQ | Non match in model selection signal | L3 | Corresponding component cannot be controlled |
| KR | Defective communication | L4 | ON/OFF signals for 2 systems do not match |
| KT | Abnormality inside controller | L6 | Engine signals do not match operating condition or stopped condition of machine |
| KX | Input signal outside range | L8 | Analog signals for 2 systems do not match |
| KY | Short circuit in power supply line | LC | Speed signals for 2 systems do not match |
| KZ | Disconnection or short circuit | LD | Switch has been kept pressed for abnormally long time |
| MA | Function impossible | LH | Fill signal is OFF when command current is ON |
| NS | Overheat | | |
| ZG | Drop in oil pressure | | |
| ZK | Drop in level | | |

# Error Code [989F00] (Transmission protection caution (00))

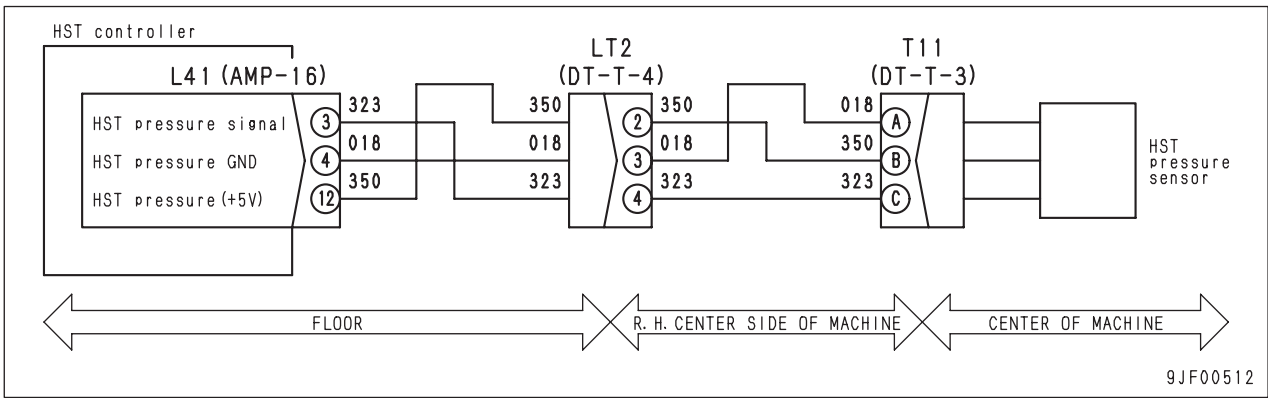
| Action Code | Error Code | Controller Code | Trouble | Transmission protection caution (00) |
|---|---|---|---|---|
| E00 | 989F00 | HST | | |
| Description of Trouble | • Not considered to be a failure.<br>• The travel speed exceeds the allowable speed the HST on down shifting.<br>• The travel speed exceeds 40km/h. | | | |
| Machine monitor or controller Reaction | • Do not shift down in the above condition.<br>• Reduce speed so that travel speed is less than 40 km/h. | | | |
| Effect on Machine | • If travel speed exceeds 40 km/h, speed is automatically reduced.<br>• May not shift down even when shift down is operated. | | | |
| Related Information | | | | |

# Error Code [DHH1KX] (HST oil pressure sensor input signal outside range (KX))

| Action Code | Error Code | Controller Code | Trouble | HST oil pressure sensor input signal outside range (KX) |
|---|---|---|---|---|
| E03 | DHH1KX | HST | | |
| Description of Trouble | • There is disconnection, short circuit with ground, short circuit with power source in HST oil pressure sensor system, so HST oil pressure sensor signal is not input. | | | |
| Machine monitor or controller Reaction | • Error is sent to machine monitor through CAN communications, and machine monitor turns HST safety relay ON (cuts motor 1, clutch solenoid circuit). | | | |
| Effect on Machine | • Travels but drive power is low | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective HST oil pressure sensor | 1) Turn starting switch OFF. 2) Disconnect connector T11. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON | | |
| | | | Between T11 (A) and (C) | Voltage | 0.5 - 4.5 V |
| | | | Between T11 (A) and (B) | Voltage | 4 - 6 V |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connectors L41 and T11. 3) Connect T-adapter | | |
| | | | Wiring harness between L41 (Female) (3) and T11 (Female) (C) | Resistance | 1Ω and below |
| | | | Wiring harness between L41 (Female) (4) and T11 (Female) (A) | Resistance | 1Ω and below |
| | | | Wiring harness between L41 (Female) (12) and T11 (Female) (B) | Resistance | 1Ω and below |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connectors L41 and T11. 3) Connect T-adapter | | |
| | | | Wiring harness between L41 (Female) (3) and T11 (Female) (C) | Resistance between L41 (Female) (3), T11 (Female) (C) and chassis ground | 1MΩ and above |
| | | | Wiring harness between L41 (Female) (4) and T11 (Female) (A) | Resistance between L41 (Female) (4), T11 (Female) (A) and chassis ground | 1MΩ and above |
| | | | Wiring harness between L41 (Female) (12) and T11 (Female) (B) | Resistance between L41 (Female) (12), T11 (Female) (B) and chassis ground | 1MΩ and above |
| | 4 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect connectors L41 and T11. 3) Connect T-adapter. 4) Turn starting switch ON | | |
| | | | Wiring harness between L41 (Female) (3) and T11 (Female) (C) | Voltage between L41 (Female) (3), T11 (Female) (C) and chassis ground | 1V and below |
| | | | Wiring harness between L41 (Female) (4) and T11 (Female) (A) | Voltage between L41 (Female) (4), T11 (Female) (A) and chassis ground | 1V and below |
| | | | Wiring harness between L41 (Female) (12) and T11 (Female) (B) | Voltage between L41 (Female) (12), T11 (Female) (B) and chassis ground | 1V and below |
| | 5 | Defective HST controller | 1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON | | |
| | | | Between L41 (3) and (4) | Voltage | 0.5 - 4.5 V |
| | | | Between L41 (12) and (4) | Voltage | 4 - 6 V |

**Related circuit diagram**

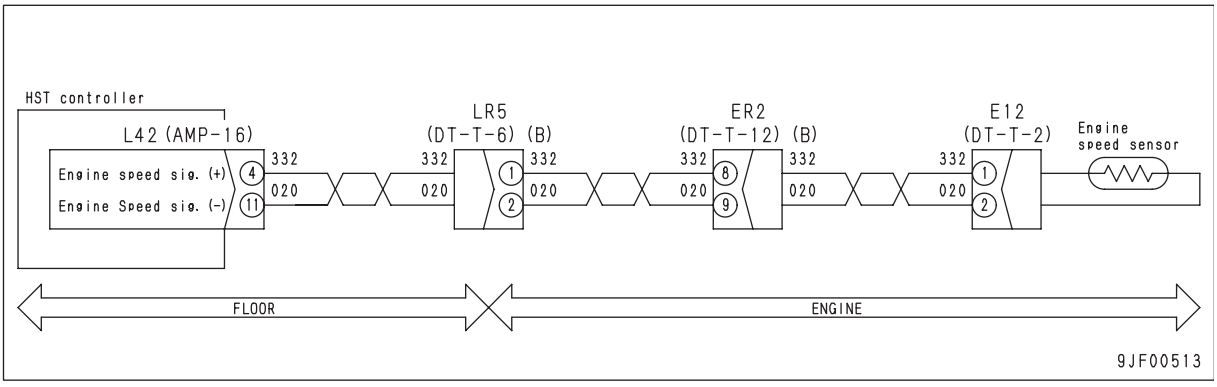


# Error Code [DLE2LC] (Engine revolution sensor revolution speed signal mismatch (LC))

| Action Code | Error Code | Controller Code | Trouble | Engine revolution sensor revolution speed signal mismatch (LC) |
|---|---|---|---|---|
| E03 | DLE2LC | HST | | |
| Description of Trouble | • There is an abnormality in the speed calculated from the speed sensor signal and signal speed from the engine revolution signal. | | | |
| Machine monitor or controller Reaction | • Error is sent to machine monitor through CAN communications, and machine monitor turns HST safety relay ON (cuts motor 1, clutch solenoid circuit). | | | |
| Effect on Machine | • Travels but drive power is low | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective engine revolution sensor | 1) Turn starting switch OFF. 2) Disconnect connector E12. 3) Connect T-adapter | | |
| | | | Between E12 (Male) (1) and (2) | Resistance | 500 - 1,000Ω |
| | | | Between E12 (Male) (1), (2) and chassis ground | Resistance | 1MΩ and above |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L42, E12. 3) Connect T-adapter | | |
| | | | Wiring harness between L42 (Female) (4) and E12 (Female) (1) | Resistance between L42 (Female) (4), E12 (Female) (1) and chassis ground | 1MΩ and above |
| | 3 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect Connectors L42, E12. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON | | |
| | | | Wiring harness between L42 (Female) (4) and E12 (Female) (1) | Voltage between L42 (Female) (4), E12 (Female) (1) and chassis ground | 1V and below |
| | 4 | Defective HST controller | 1) Turn starting switch OFF. 2) Disconnect connector L42. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON | | |
| | | | Between L42 (Female) (4) and (11) | Voltage (AC range) | 0.5V and above |

### Related circuit diagram



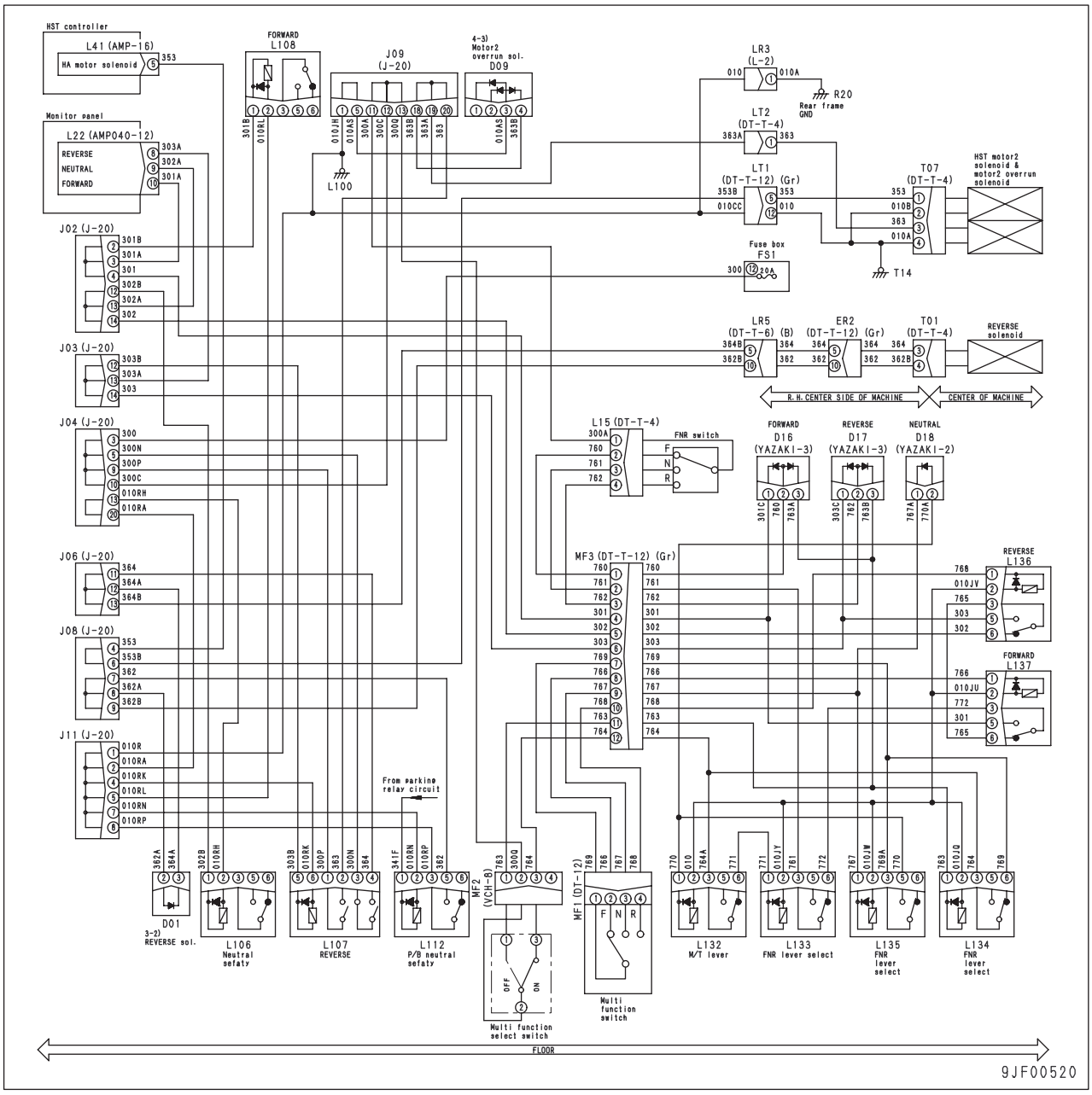
# Error Code [DW26KZ] (Motor 2 solenoid system discontinuity or short-circuiting (KZ))

| Action Code | Error Code | Controller Code | Trouble | Motor 2 solenoid system discontinuity or short-circuiting (KZ) |
|---|---|---|---|---|
| E03 | DW26KZ | HST | | |
| Description of Trouble | • Excessive electricity flows when output to motor 2 solenoid circuit is ON; no electricity flows when output is ON or electricity flows when output is ON. | | | |
| Machine monitor or controller Reaction | • No action. | | | |
| Effect on Machine | • Travel speed does not increase.<br>• Travel speed indicator on machine monitor stays at 0 km/h and does not move | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective motor 2 solenoid | 1) Turn starting switch OFF. 2) Disconnect connector T07. 3) Connect T-adapter | | | |
| | | | Between T07 (Female) (1) and (2) | | Resistance | 10 - 30Ω |
| | | | Between T07 (Female) (3) and (4) | | Resistance | 10 - 30Ω |
| | | | Between T07 (Female) (1), (2) and chassis ground | | Resistance | 1MΩ and above |
| | 2 | Defective reverse relay (L107) | 1) Turn starting switch OFF. 2) Interchange relay (L107) with normal relay, 3) Turn starting switch ON. 4) Operate FNR switch | | | |
| | | | Does condition become normal when reverse relay (L107) is interchanged with normal relay? | The condition is abnormal | | Relay (L107) is normal |
| | | | | The condition is normal | | Defective relay (L107) |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L107. 3) Solid part check | | | |
| | | | Between L107 (Male) (5) and (6) | | Resistance | 200 - 40Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L107. 3) Check as individual part. 4) Apply impressed voltage between L107 (Male) (5) - (6) | | | |
| | | | Between L107 (Male) (1) and (2) | Applies 24V impressed voltage between L107 (Male) (5) - (6) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L107 (Male) (5) - (6) | Resistance | 1MΩ and above |
| | 3 | Defective FNR switch | 1) Turn starting switch OFF. 2) Disconnect connector L15. 3) Connect T-adapter | | | |
| | | | Between L15 (Male) (1) and (4) | Operate FNR lever F | Resistance | 1MΩ and above |
| | | | | Operate FNR lever N | Resistance | 1MΩ and above |
| | | | | Operate FNR lever R | Resistance | 1Ω and below |
| | 4 | Defective diode (D09) | 1) Turn starting switch OFF. 2) Interchange diode (D09) with normal diode. 3) Turn starting switch ON. 4) Operate FNR switch | | | |
| | | | Does condition become normal when diode (D09) is interchanged with normal diode? | The condition is abnormal | | Diode (D09) is normal |
| | | | | The condition is normal | | Defective diode (D09) |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 5 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L15, L41, L107, T07 and fuse FS1 terminal. 3) Connect T-adapter | | | |
| | | | Wiring harness between T07 (Female) (1) and L41 (Female) (5) | | Resistance | 1Ω and below |
| | | | Wiring harness between T07 (Female) (2), (4) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between T07 (Female) (3) and L107 (Female) (2) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 (12) and L107 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between L107 (Female) (6) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between L15 (Female) (4) and D17 (2), between D17 (1) and L107 (Female) (5) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 (12) and L15 (Female) (1) | | Resistance | 1Ω and below |
| | 6 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L15, L41, L136, L107, D17 and fuse FS1 (4). 3) Connect T-adapter | | | |
| | | | Wiring harness between T07 (Female) (1) and L41 (Female) (5) | Resistance between T07 (Female) (1), L41 (Female) (5) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between T07 (Female) (3) and L107 (Female) (2) * | Resistance between T07 (Female) (3), L107 (Female) (2) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (12) and L107 (Female) (1) * | Resistance between fuse FS1 (12), L107 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L15 (Female) (4) and D17 (Female) (2), between D17 (Female) (1) and L107 (Female) (5) | Resistance between L107 (Female) (5), L15 (Female) (4) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (12) and L15 (Female) (1) * | Resistance between fuse FS1 (12), L15 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between J09 (Female) (17) and D09 (Female) (4) | Resistance between J09 (Female) (17), D09 (Female) (4) and chassis ground | | 1MΩ and above |
| | | | In the above case of marked mark (*), the fuse is blown. | | | |
| | 7 | Defective HST controller | 1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON | | | |
| | | | Between L41 (5) and chassis ground | Turn travel speed selector switch 1st | Voltage | 20 - 30 V |
| | | | | Turn travel speed selector switch 2nd | Voltage | 20 - 30 V |
| | | | | Turn travel speed selector switch 3rd | Voltage | 20 - 30 V |
| | | | | Turn travel speed selector switch 4th (10km/h and below) | Voltage | 20 - 30 V |
| | | | | Turn travel speed selector switch 4th (10 - 38km/h) | Voltage | 2V and below |

## Related circuit diagram



white 20-315

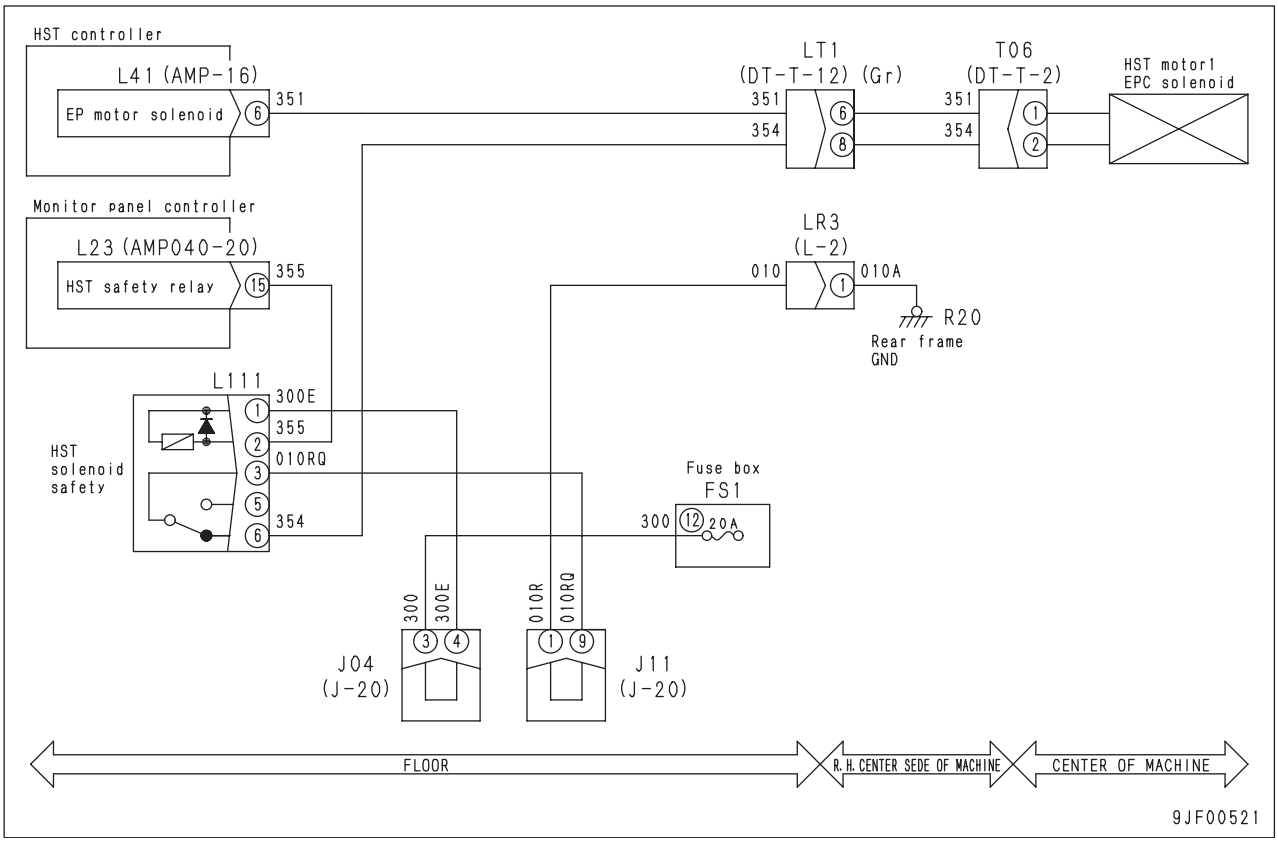
# Error Code [DX19KZ] (Motor 1 solenoid system discontinuity or short-circuiting (KZ))

| Action Code | Error Code | Controller Code | Trouble | Motor 1 solenoid system discontinuity or short-circuiting (KZ) |
|---|---|---|---|---|
| E03 | DX19KZ | HST | | |
| Description of Trouble | • Excessive electricity flows when output to motor 1 solenoid circuit is ON; no electricity flows when output is ON or electricity flows when output is ON. | | | |
| Machine monitor or controller Reaction | • No action. | | | |
| Effect on Machine | • Travels but drive power is low | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective motor 1 solenoid | 1) Turn starting switch OFF. 2) Disconnect connector T06. 3) Connect T-adapter | | | |
| | | | Between T06 (Female) (1) and (2) | | Resistance | 15 - 35Ω |
| | | | Between T06 (Female) (1), (2) and chassis ground | | Resistance | 1MΩ and above |
| | 2 | Defective HST safety relay (L111) | 1) Turn starting switch OFF. 2) Interchange relay (L111) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch | | | |
| | | | Does condition become normal when HST safety relay (L111) is interchanged with normal relay? | | The condition is abnormal | Relay (L111) is normal |
| | | | | | The condition is normal | Defective relay (L111) |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check | | | |
| | | | Between L111 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check. 4) Applies impressed voltage between L111 (Male) (1) - (2) | | | |
| | | | Between L111 (Male) (3) and (5) | Applies 24V impressed voltage between L111 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L111 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, L41, L111, T06 and fuse FS1 (12). 3) Connect T-adapter | | | |
| | | | Wiring harness between T06 (Female) (1) and L41 (Female) (6) | | Resistance | 1Ω and below |
| | | | Wiring harness between T06 (Female) (2) and L111 (Female) (5) | | Resistance | 1Ω and below |
| | | | Wiring harness between L111 (Female) (3) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between L111 (Female) (2) and L23 (Female) (15) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 (12) and L111 (Female) (1) | | Resistance | 1Ω and below |
| | 4 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, L41, L111, T06 and fuse FS1 (12). 3) Connect T-adapter | | | |
| | | | Wiring harness between T06 (Female) (1) and L41 (Female) (6) | Resistance between T06 (Female) (1), L41 (Female) (6) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between T06 (Female) (2) and L111 (Female) (5) | Resistance between T06 (Female) (2), L111 (Female) (5) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (12) and L111 (Female) (1) * | Resistance between fuse FS1 (12), L111 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | In the above case of marked mark (*), the fuse is blown. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 5 | Defective HST controller | 1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON | | | |
| | | | Between L41 (6) and chassis ground | Turn travel speed selector switch 1st | Voltage | 2 - 20V |
| | | | | Turn travel speed selector switch 2nd | Voltage | 2 - 20V |
| | | | | Turn travel speed selector switch 3rd and 4th | Voltage | 2 - 20V |
| | | | | Turn travel speed selector switch 3rd and 4th (10km/h and below) | Voltage | 3V and below |

**Related circuit diagram**



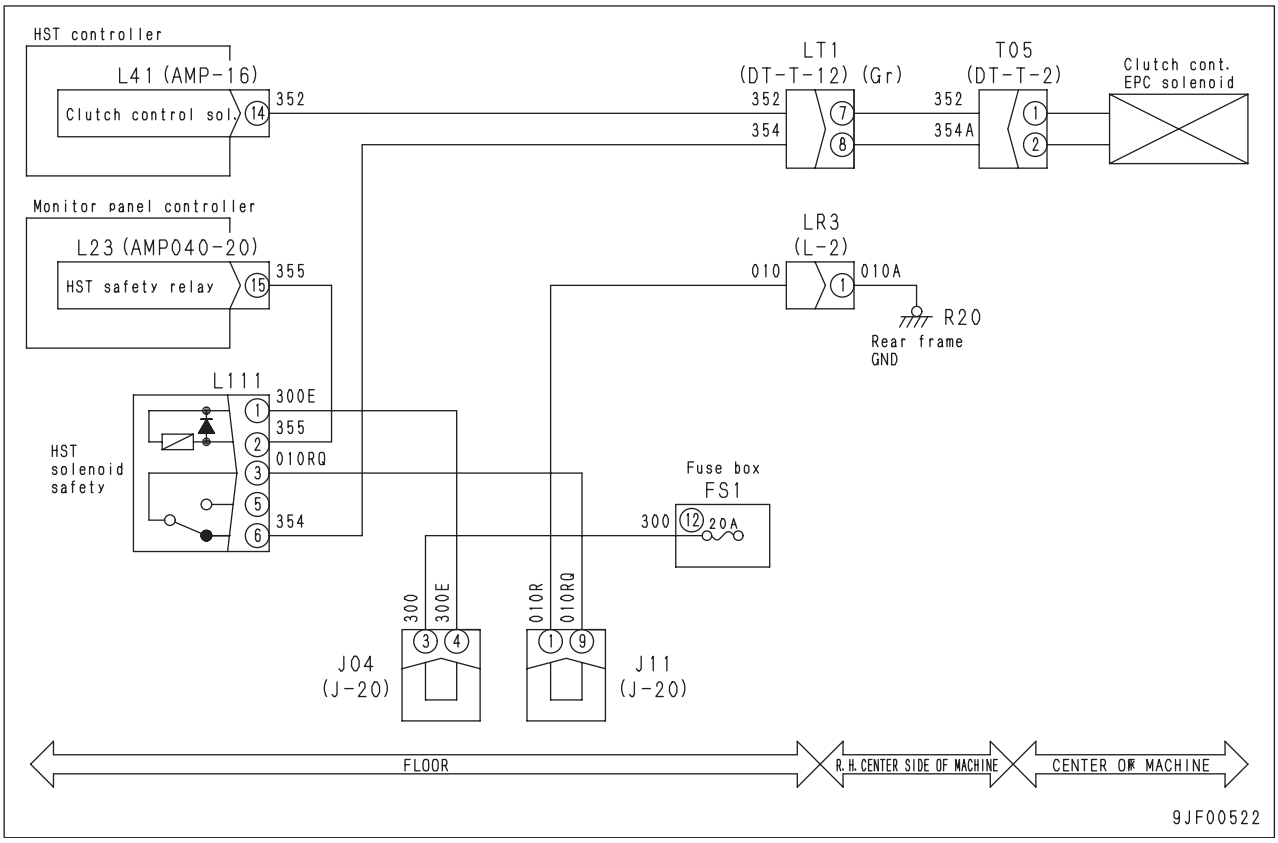
# Error Code [DX20KZ] (Clutch solenoid system discontinuity or short-circuiting (KZ))

| Action Code | Error Code | Controller Code | Trouble | Clutch solenoid system discontinuity or short-circuiting (KZ) |
|---|---|---|---|---|
| E03 | DX20KZ | HST | | |
| Description of Trouble | • Excessive electricity flows when output to clutch solenoid circuit is ON; no electricity flows when output is ON or electricity flows when output is ON. | | | |
| Machine monitor or controller Reaction | • No action. | | | |
| Effect on Machine | • Travel speed does not switch.<br>• Does not control 3rd or 4th, or does not control 1st or 2nd. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective clutch solenoid | 1) Turn starting switch OFF. 2) Disconnect connector T05. 3) Connect T-adapter | | | |
| | | | Between T05 (Female) (1) and (2) | | Resistance | 15 - 35Ω |
| | | | Between T05 (Female) (1), (2) and chassis ground | | Resistance | 1MΩ and above |
| | 2 | Defective HST safety relay (L111) | 1) Turn starting switch OFF. 2) Interchange relay (L111) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch | | | |
| | | | Does condition become normal when HST safety relay (L111) is interchanged with normal relay? | | The condition is abnormal | Relay (L111) is normal |
| | | | | | The condition is normal | Defective relay (L111) |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check | | | |
| | | | Between L111 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L111. 3) Solid part check, 4) Applies impressed voltage between L111 (Male) (1) - (2) | | | |
| | | | Between L111 (Male) (3) and (5) | Applies 24V impressed voltage between L111 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L111 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, L41, L111, T05 and fuse FS1 (12). 3) Connect T-adapter | | | |
| | | | Wiring harness between T05 (Female) (1) and L41 (Female) (14) | | Resistance | 1Ω and below |
| | | | Wiring harness between T05 (Female) (2) and L111 (Female) (5) | | Resistance | 1Ω and below |
| | | | Wiring harness between L111 (Female) (3) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between L111 (Female) (2) and L23 (Female) (15) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 (12) and L111 (Female) (1) | | Resistance | 1Ω and below |
| | 4 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, L41, L111, T05 and fuse FS1 (12). 3) Connect T-adapter | | Resistance | 1Ω and below |
| | | | Wiring harness between T05 (Female) (1) and L41 (Female) (14) | Resistance between T05 (Female) (1), L41 (Female) (14) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between T05 (Female) (2) and L111 (Female) (5) | Resistance between T05 (Female) (2), L111 (Female) (5) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (12) and L111 (Female) (1) * | Resistance between fuse FS1 (12), L111 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | In the above case of marked mark (*), the fuse is blown. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 5 | Defective HST controller | 1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON | | | |
| | | | Between L41 (14) and chassis ground | Turn travel speed selector switch 1st | Voltage | 3 - 15V |
| | | | | Turn travel speed selector switch 2nd | Voltage | 3 - 15V |
| | | | | Turn travel speed selector switch 3rd and 4th | Voltage | 3 - 15V |
| | | | | Turn travel speed selector switch 3rd and 4th (10km/h and below) | Voltage | 4V and below |

**Related circuit diagram**



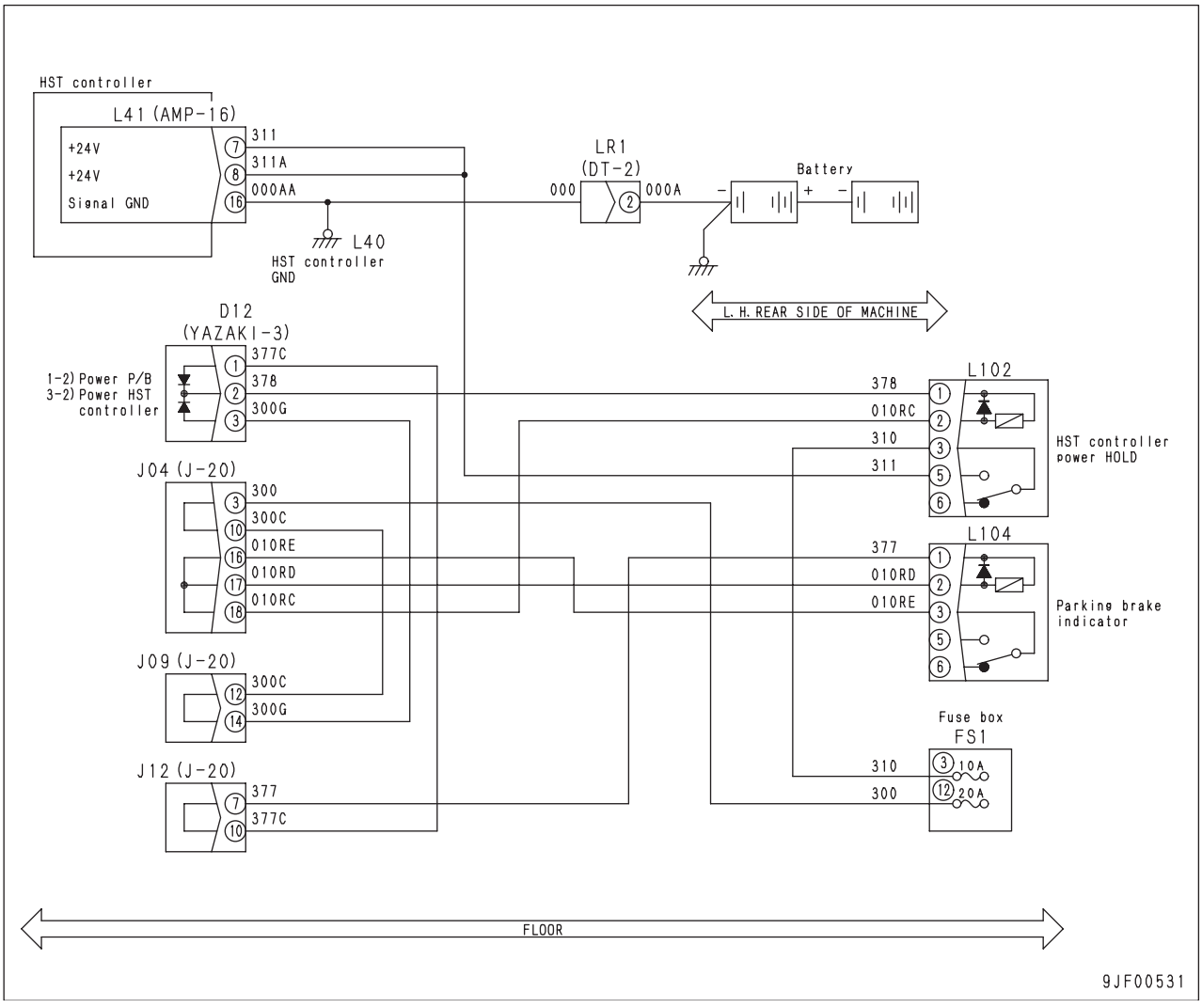
# Troubleshooting Code [HST-1] (Defective HST controller power source (HST controller does not function))

| Action Code | Error Code | Controller Code | Trouble | Defective HST controller power source (HST controller does not function) |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • HST controller power source system is defective, so HST controller does not work. | | | |
| Machine monitor or controller Reaction | • No action. | | | |
| Effect on Machine | • Travels but drive power is low<br>• Machine monitor announces failure code DAJOKR for defective HST controller communications | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L41, L102 and fuse FS1 terminal. 3) Connect T-adapter | | | |
| | | | Wiring harness between L41 (Female) (8) and L102 (Female) (5) | | Resistance | 1✕ and below |
| | | | Wiring harness between fuse FS1 (3) and L102 (Female) (3) | | Resistance | 1✕ and below |
| | | | Wiring harness between fuse FS1 (12) and L102 (Female) (1) | | Resistance | 1✕ and below |
| | | | Wiring harness between L102 (Female) (2) and chassis ground | | Resistance | 1✕ and below |
| | | | Wiring harness between L41 (Female) (16) and chassis ground | | Resistance | 1✕ and below |
| | 2 | Defective HST power source safety relay (L102) | 1) Turn starting switch OFF. 2) Interchange relay (L102) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch | | | |
| | | | Does condition become normal when HST safety relay (L102) is interchanged with normal relay? | The condition is abnormal | Relay (L102) is normal | |
| | | | | The condition is normal | Defective relay (L102) | |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L102. 3) Solid part check | | | |
| | | | Between L102 (Male) (1) and (2) | | Resistance | 200 - 400✕ |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L102. 3) Solid part check. 4) Applies impressed voltage between L102 (Male) (1) - (2) | | | |
| | | | Between L102 (Male) (3) and (5) | Applies 24V impressed voltage between L102 (Male) (1) - (2) | Resistance | 1✕ and below |
| | | | | Does not apply voltage between L102 (Male) (1) - (2) | Resistance | 1M✕ and above |
| | 3 | Defective diode (D12) | 1) Turn starting switch OFF. 2) Replace diode (D12) to correct diode. 3) Turn starting switch START | | | |
| | | | The condition is abnormal | | Diode (D12) is normal | |
| | | | The condition is normal | | Defective diode (D12) | |
| | | | Measure at diode range | | | |
| | | | D12 (Male) (1) ✕ (2) | Continuity | | |
| | | | D12 (Male) (3) ✕ (2) | Continuity | | |
| | | | D12 (Male) (1) ✕ (3) | Discontinuity | | |
| | | | D12 (Male) (2) ✕ (1) | Discontinuity | | |
| | | | D12 (Male) (2) ✕ (3) | Discontinuity | | |
| | | | D12 (Male) (3) ✕ (1) | Discontinuity | | |
| | | | ★ Connect the (+) pole of the tester to the left side of D12 ( ) ✕ ( ). | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 4 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L41, L102 and fuse FS1 terminal. 3) Connect T-adapter | | |
| | | | Wiring harness between L41 (Female) (8) and L102 (Female) (5) | Resistance between L41 (Female) (8), L102 (Female) (5) and chassis ground | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (3) and L102 (Female) (3) | Resistance between fuse FS1 (3), L102 (Female) (3) and chassis ground | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (12) and L102 (Female) (1) | Resistance between fuse FS1 (12), L102 (Female) (1) and chassis ground | 1MΩ and above |
| | | | ★ In the above case, the all fuses are blown. | | |
| | 5 | Defective HST controller | 1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON | | |
| | | | Between L41 (8) and (16) | Voltage | 20 - 30V |

**Related circuit diagram**



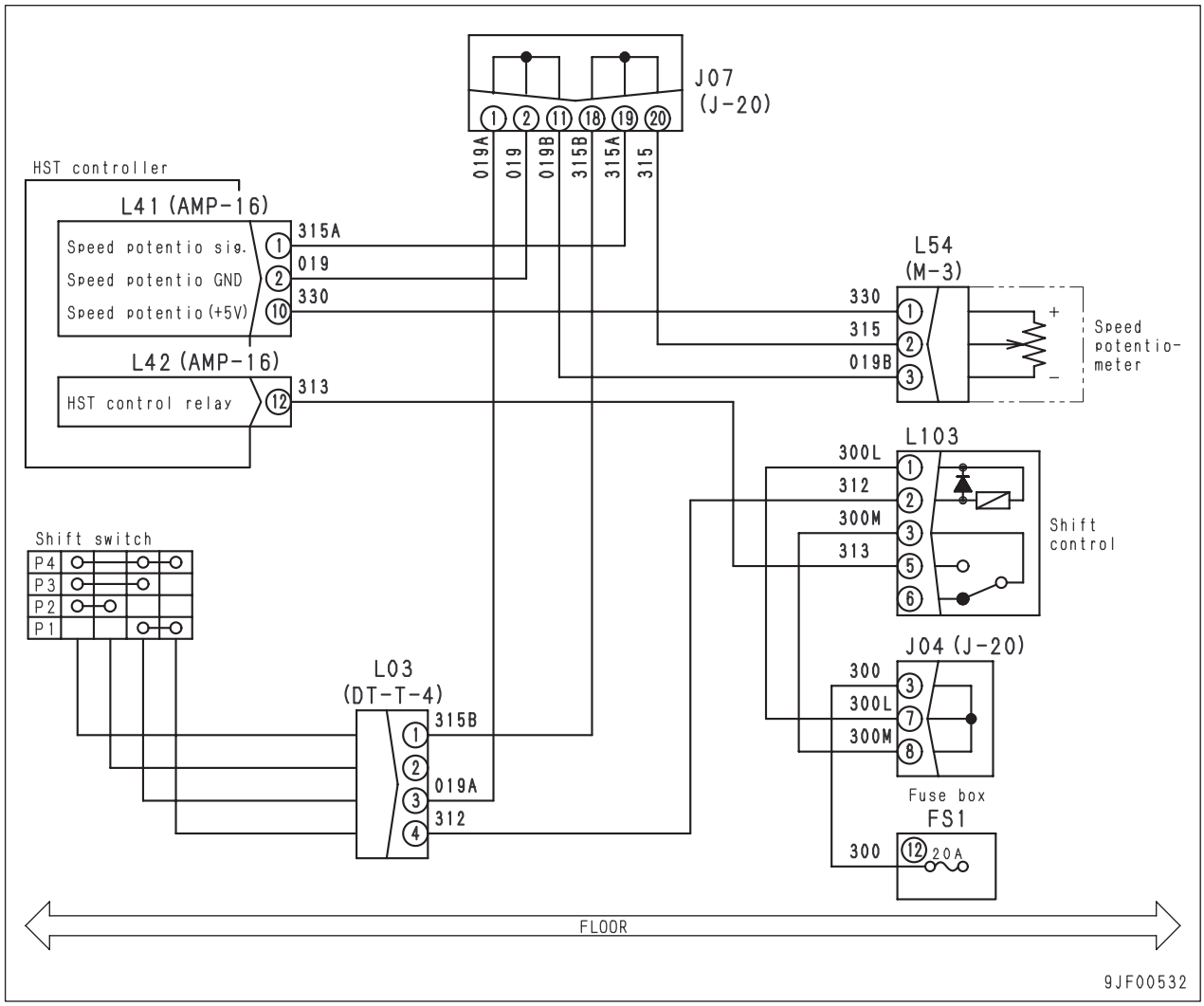
# Troubleshooting Code [HST-2] (Travel speed does not shifted)

| Action Code | Error Code | Controller Code | Trouble | Travel speed does not shifted |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The speed selector switch system is defective, so the travel speed cannot be changed. | | | |
| Machine monitor or controller Reaction | • No action. | | | |
| Effect on Machine | • Travel speed does not shifted | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | 1 | Defective travel speed selector switch | 1) Turn starting switch OFF. 2) Disconnect connector L03. 3) Connect T-adapter | | | |
| | | | Between L03 (Female) (1) and (2) | 2nd | Resistance | 1✕ and below |
| | | | | Other than the above | Resistance | 1M✕ and above |
| | | | Between L03 (Female) (1) and (3) | 1st | Resistance | 1M✕ and above |
| | | | | 2nd | Resistance | 1M✕ and above |
| | | | | 3rd | Resistance | 1✕ and below |
| | | | | 4th | Resistance | 1✕ and below |
| | | | Between L03 (Female) (1) and (4) | 4th | Resistance | 1✕ and below |
| | | | | Other than the above | Resistance | 1M✕ and above |
| | | | Between L03 (Female) (3) and (4) | 1st | Resistance | 1✕ and below |
| | | | | 2nd | Resistance | 1M✕ and above |
| | | | | 3rd | Resistance | 1M✕ and above |
| | | | | 4th | Resistance | 1✕ and below |
| | 2 | Defective HST control relay (L103) | 1) Turn starting switch OFF. 2) Interchange relay (L103) with normal relay. 3) Turn starting switch ON. 4) Operate FNR switch | | | |
| | | | Does condition become normal when HST safety relay (L103) is interchanged with normal relay? | | The condition is abnormal | Relay (L103) is normal |
| | | | | | The condition is normal | Defective relay (L103) |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L103. 3) Solid part check | | | |
| | | | Between L103 (Male) (1) and (2) | | Resistance | 200 - 400✕ |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L103. 3) Solid part check, 4) Applies impressed voltage between L103 (Male) (1) - (2) | | | |
| | | | Between L103 (Male) (3) and (5) | Applies 24V impressed voltage between L103 (Male) (1) - (2) | Resistance | 1✕ and below |
| | | | | Does not apply voltage between L103 (Male) (1) - (2) | Resistance | 1M✕ and above |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | | |
|---|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 3 | Defective travel speed potentiometer | 1) Turn starting switch OFF. 2) Disconnect connector L54. 3) Connect T-adapter | | | | |
| | | | Between L54 (Female) (1) and (3) | | | Resistance | 4 - 6 kΩ |
| | | | Between L54 (Female) (1) and (2) | | | Resistance | 0.25 - 5 kΩ |
| | | | Between L54 (Female) (2) and (3) | | | Resistance | 0.25 - 5 kΩ |
| | 4 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L42, L103, J07 and fuse FS1 terminal. 3) Connect T-adapter | | | | |
| | | | Wiring harness between L42 (Female) (12) and L103 (Female) (5) | | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 (12) and L103 (Female) (3) | | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 (12) and L103 (Female) (1) | | | Resistance | 1Ω and below |
| | | | Wiring harness between L103 (Female) (2) and L03 (Female) (4) | | | Resistance | 1Ω and below |
| | | | Wiring harness between L03 (Female) (3) and J07 (Female) (1) | | | Resistance | 1Ω and below |
| | | | Wiring harness between L03 (Female) (1) and J07 (Female) (18) | | | Resistance | 1Ω and below |
| | 5 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L42, L103 and fuse FS1 terminal. 3) Connect T-adapter | | | | |
| | | | Wiring harness between L42 (Female) (12) and L103 (Female) (5) | | Resistance between L42 (Female) (12), L103 (Female) (5) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (12) and L103 (Female) (3) | | Resistance between fuse FS1 (12), L103 (Female) (3) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (12) and L103 (Female) (1) | | Resistance between fuse FS1 (12), L103 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | ★ In the above case, the all fuses are blown. | | | | |
| | 6 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect Connectors L42, L103. 3) Insert T-adapter.<br>4) Turn starting switch ON | | | | |
| | | | Wiring harness between L42 (Female) (12) and L103 (Female) (5) | | Voltage between L42 (Female) (12), L103 (Female) (5) and chassis ground | | 1V and below |
| | 7 | Defective HST controller | 1) Turn starting switch OFF. 2) Disconnect connector L42. 3) Insert T-adapter.<br>4) Connect connector. 5) Turn starting switch ON | | | | |
| | | | Between L42 (12) and chassis ground | Travel speed selector switch | "1st", "4th" | Voltage | 20 - 30V |
| | | | | | "2nd", "3rd" | Voltage | 1V and below |

**Related circuit diagram**



white 20-325

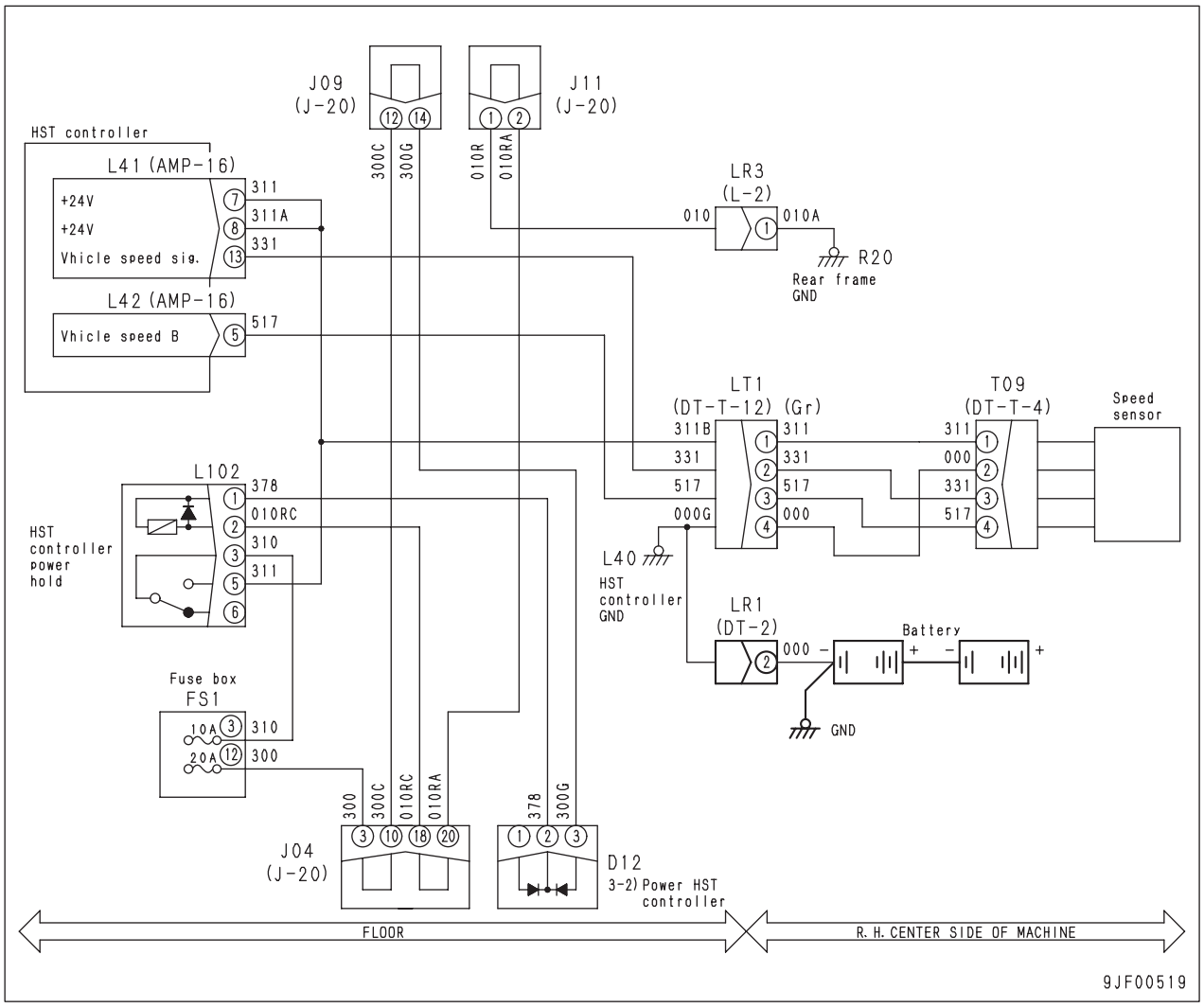
# Troubleshooting Code [HST-3] (Travel speed does not excessive (defective speed sensor system))

| Action Code | Error Code | Controller Code | Trouble | Travel speed does not excessive (defective speed sensor system) |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The travel speed signal does not input due to disconnection or short-circuit with ground in travel speed sensor signal. | | | |
| Machine monitor or controller Reaction | • No action. | | | |
| Effect on Machine | • Travel speed does not increase.<br>• Travel speed indicator on machine monitor stays at 0 km/h and does not move | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L41, L42, L102 and T09. 3) Connect T-adapter | | | |
| | | | Wiring harness between T09 (Female) (4) and L42 (Female) (5) | | Resistance | 1✕ and below |
| | | | Wiring harness between T09 (Female) (3) and L41 (Female) (13) | | Resistance | 1✕ and below |
| | | | Wiring harness between T09 (Female) (2) and chassis ground | | Resistance | 1✕ and below |
| | | | Wiring harness between T09 (Female) (1) and L41 (Female) (7), between L41 (Female) (8) and L102 (Female) (5) | | Resistance | 1✕ and below |
| | | | Wiring harness between L102 (Female) (3) and fuse FS1 (3) | | Resistance | 1✕ and below |
| | | | Wiring harness between L102 (Female) (2) and chassis ground | | Resistance | 1✕ and below |
| | | | Wiring harness between L102 (Female) (1) and D12 (Female) (2) | | Resistance | 1✕ and below |
| | | | Wiring harness between D12 (Female) (3) and fuse FS1 (12) | | Resistance | 1✕ and below |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L41, L42, L102 and T09. 3) Connect T-adapter | | | |
| | | | Wiring harness between T09 (Female) (4) and L42 (Female) (5) | Resistance between T09 (Female) (4), L42 (Female) (5) and chassis ground | | 1M✕ and above |
| | | | Wiring harness between T09 (Female) (3) and L41 (Female) (13) | Resistance between T09 (Female) (3), L41 (Female) (13) and chassis ground | | 1M✕ and above |
| | | | Wiring harness between T09 (Female) (1) and L41 (Female) (7), between L41 (Female) (8) and L102 (Female) (5) * | Resistance between T09 (Female) (1), L41 (Female) (7) and chassis ground, between L41 (Female) (8), L102 (Female) (5) and chassis ground | | 1M✕ and above |
| | | | Wiring harness between L102 (Female) (3) and fuse FS1 (3) * | Resistance between L102 (Female) (3) and fuse FS1 (3) and chassis ground | | 1M✕ and above |
| | | | Wiring harness between L102 (Female) (1) and D12 (Female) (2) * | Resistance between L102 (Female) (1) and D12 (Female) (2) and chassis ground | | 1M✕ and above |
| | | | Wiring harness between D12 (Female) (3) and fuse FS1 (12) * | Resistance between D12 (Female) (3) and fuse FS1 (12) and chassis ground | | 1M✕ and above |
| | | | ★ In the above case of marked mark (*), the fuse is blown. | | | |
| | 3 | Defective travel speed sensor | 1) Turn starting switch OFF. 2) Disconnect connector T09. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. 6) Move machine slightly and repeat following action: stop machine ✕ measure voltage | | | |
| | | | Between T09 (1) and (2) | | Voltage | 20 - 30V |
| | | | Between T09 (3) and (2) | | Voltage | 2V and below |
| | | | ★ Measure the voltages according to the position where the machine is stopped. | | | |
| | | | Between T09 (4) and (2) | Move machine forward in measurement condition | Voltage | 20 - 30V |
| | | | | Move machine in reverse in measurement condition | Voltage | 2V and below |
| | | | **WARNING** When moving the machine forward and in reverse when measuring the voltage, be particularly careful to ensure safety. | | | |

<table>
<tr><td rowspan="9">Possible Causes and Standard Values</td><td colspan="2">Causes</td><td colspan="4">Standard Value in Normal State and Remarks on Troubleshooting</td></tr>
<tr><td rowspan="8">4</td><td rowspan="8">Defective HST controller</td><td colspan="4">1) Turn starting switch OFF. 2) Disconnect connector L42. 3) Insert T-adapter.<br>4) Connect connector. 5) Turn starting switch ON. 6) Move machine slightly and repeat following action: stop machine ✕ measure voltage</td></tr>
<tr><td colspan="2">Between L41 (7), (8) and chassis ground</td><td>Voltage</td><td>20 - 30V</td></tr>
<tr><td colspan="2">Between L41 (13) and chassis ground</td><td>Voltage</td><td>2V and below</td></tr>
<tr><td colspan="4">★ Measure the voltages according to the position where the machine is stopped.</td></tr>
<tr><td rowspan="2">Between L42 (5) and chassis ground</td><td>Move machine forward in measurement condition</td><td>Voltage</td><td>20 - 30V</td></tr>
<tr><td>Move machine in reverse in measurement condition</td><td>Voltage</td><td>2V and below</td></tr>
<tr><td colspan="4">WARNING When moving the machine forward and in reverse when measuring the voltage, be particularly careful to ensure safety.</td></tr>
</table>

## Related circuit diagram



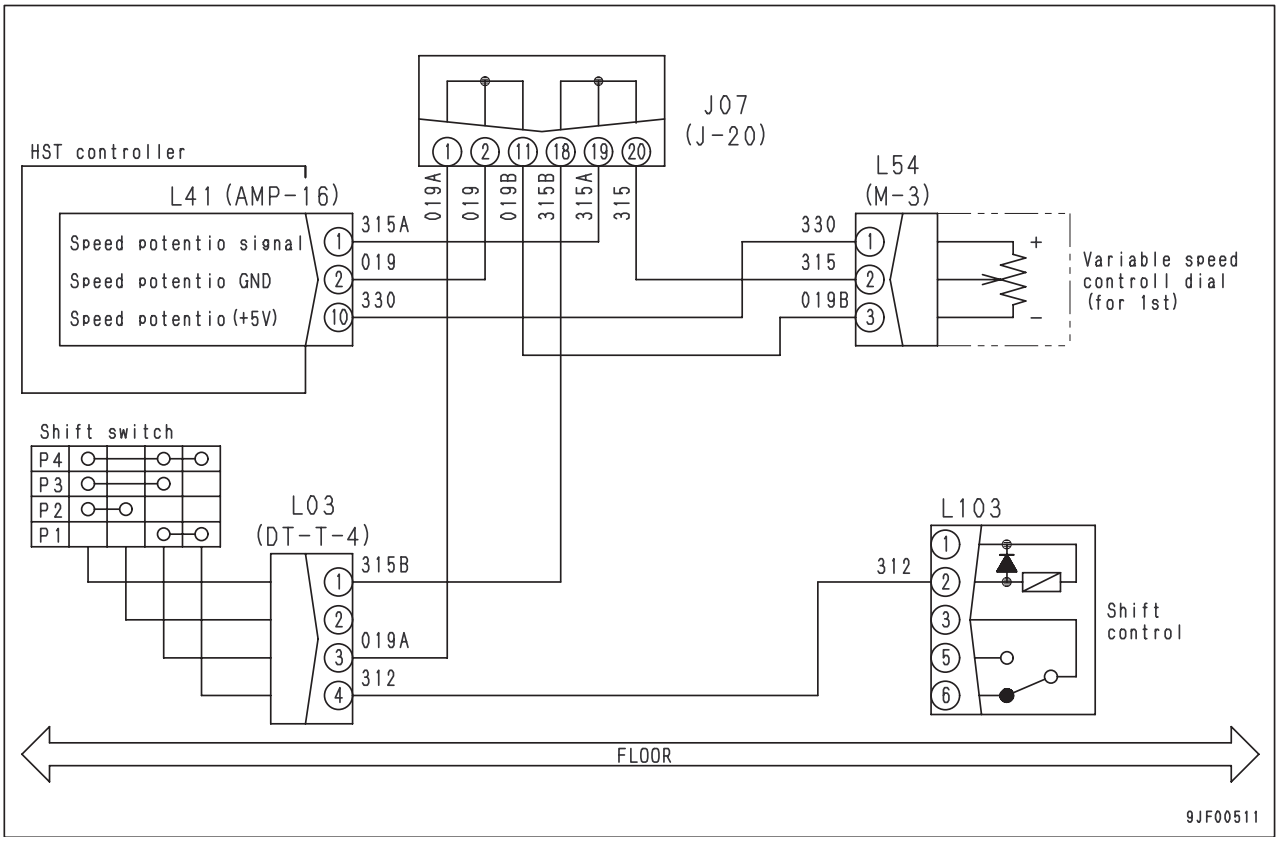
# Troubleshooting Code [HST-4] (Travel speed cannot be controlled when the travel speed selector switch is at 1st)

| Action Code | Error Code | Controller Code | Trouble | Travel speed cannot be controlled when the travel speed selector switch is at 1st |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • There is disconnection, short circuit with ground, short circuit with power source in speed potentiometer system, so speed potentiometer signal is not input. | | | |
| Machine monitor or controller Reaction | • No action | | | |
| Effect on Machine | • Travel speed cannot be controlled when the travel speed selector switch is at 1st.<br>(Speed is fixed at 4 km/h or 13 km/h) | | | |
| Related Information | • The speed potentiometer is displayed by real-time monitoring code 50302 {speed limit is taken as follows: max. (13 km/h = 100%)/min. (4 km/h = 0%) | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective travel speed potentiometer | 1) Turn starting switch OFF. 2) Disconnect connector L54. 3) Connect T-adapter | | | |
| | | | Between L54 (Female) (1) and (3) | | Resistance | 4 - 6kΩ |
| | | | Between L54 (Female) (1) and (2) | | Resistance | 0.25 - 5kΩ |
| | | | Between L54 (Female) (2) and (3) | | Resistance | 0.25 - 5kΩ |
| | 2 | Defective travel speed selector switch | 1) Turn starting switch OFF. 2) Disconnect connector L03. 3) Connect T-adapter | | | |
| | | | Between L03 (Female) (1) and (2) | 2nd | Resistance | 1Ω and below |
| | | | | Other than the above | Resistance | 1MΩ and above |
| | | | Between L03 (Female) (1) and (3) | 1st | Resistance | 1MΩ and above |
| | | | | 2nd | Resistance | 1MΩ and above |
| | | | | 3rd | Resistance | 1Ω and below |
| | | | | 4th | Resistance | 1Ω and below |
| | | | Between L03 (Female) (1) and (4) | 4th | Resistance | 1Ω and below |
| | | | | Other than the above | Resistance | 1MΩ and above |
| | | | Between L03 (Female) (3) and (4) | 1st | Resistance | 1Ω and below |
| | | | | 2nd | Resistance | 1MΩ and above |
| | | | | 3rd | Resistance | 1MΩ and above |
| | | | | 4th | Resistance | 1Ω and below |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L41, L54, L03. 3) Connect T-adapter | | | |
| | | | Wiring harness between L41 (Female) (10) and L54 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between L41 (Female) (1) and L54 (Female) (2) | | Resistance | 1Ω and below |
| | | | Wiring harness between L41 (Female) (2) and L54 (Female) (3) | | Resistance | 1Ω and below |
| | 4 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L41, L54, L03. 3) Connect T-adapter | | | |
| | | | Wiring harness between L41 (Female) (10) and L54 (Female) (1) | Resistance between L41 (Female) (10) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L41 (Female) (1), L54 (Female) (2) and L03 (Female) (1) 30 | Resistance between L41 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L41 (Female) (2), L54 (Female) (3) and L03 (Female) (3) | Resistance between L41 (Female) (2) and chassis ground | | 1MΩ and above |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 5 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect connector L41. 3) Connect T-adapter. 4) Turn starting switch ON | | |
| | | | Wiring harness between L41 (Female) (10) and L54 (Female) (1) | Voltage between L41 (Female) (10) and chassis ground | 1V and below |
| | | | Wiring harness between L41 (Female) (1), L54 (Female) (2) and L03 (Female) (1) | Voltage between L41 (Female) (1) and chassis ground | 1V and below |
| | | | Wiring harness between L41 (Female) (2), L54 (Female) (3) and L03 (Female) (3) | Voltage between L41 (Female) (2) and chassis ground | 1V and below |
| | 6 | Defective HST controller | 1) Turn starting switch OFF. 2) Disconnect Connectors L41, L54, L03. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON 6) Travel speed selector switch 1ST | | |
| | | | Between L41 (10) and (2) | Voltage | 4 - 6V |
| | | | Between L41 (1) and (2) | Voltage | 0.5V - 5V |

**Related circuit diagram**

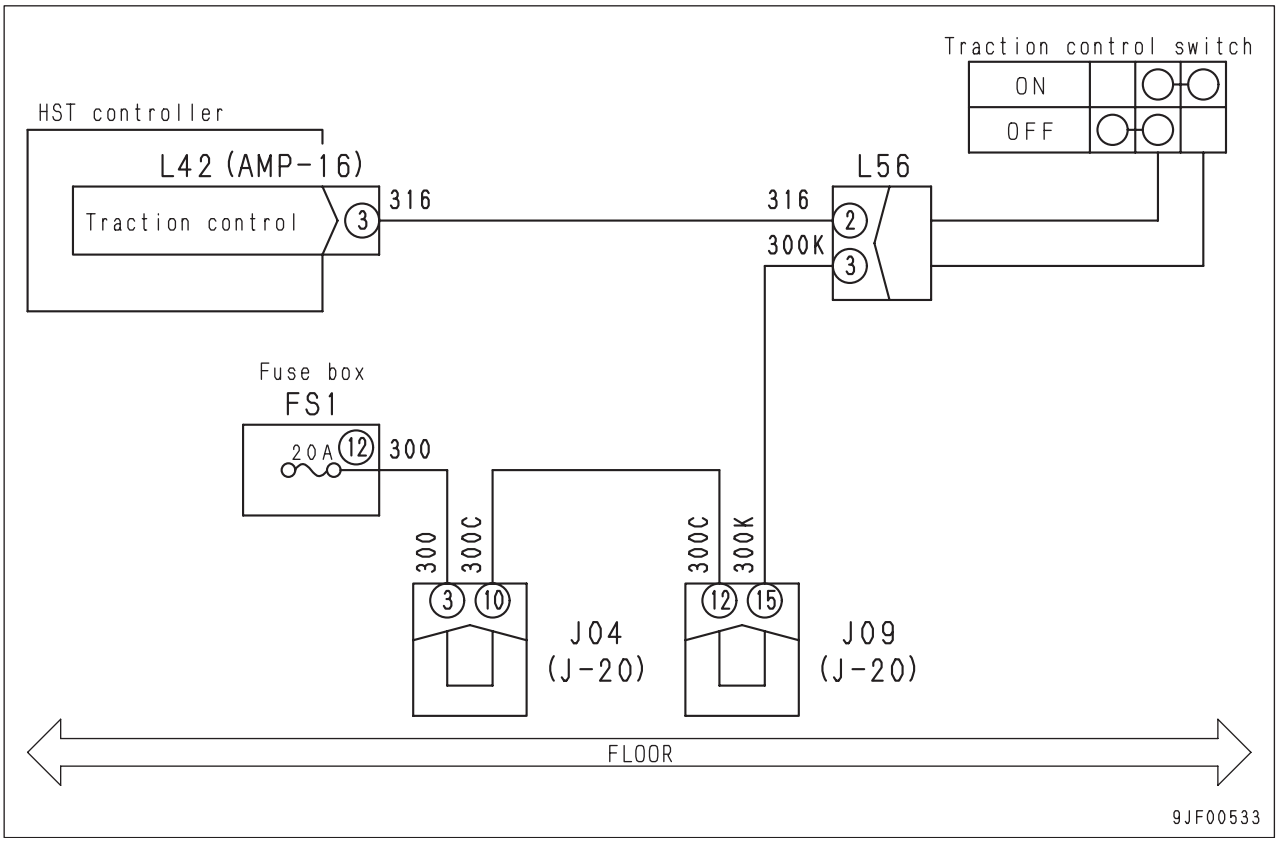


# Troubleshooting Code [HST-5] HST Output Control (Traction control) cannot be controlled

| Action Code | Error Code | Controller Code | Trouble | HST output control (Traction control) cannot be controlled |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The traction control switch system is defective, so the HST output control cannot be controlled. | | | |
| Machine monitor or controller Reaction | • No action. | | | |
| Effect on Machine | • The HST output control (Traction control) cannot be controlled. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective traction control switch | 1) Turn starting switch OFF. 2) Disconnect connector L56. 3) Connect T-adapter. | | | |
| | | | Between L56 (Female) (3) and (2) | Traction control switch ON | Resistance | 1Ω and below |
| | | | | Traction control switch OFF | Resistance | 1MΩ and above |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L42, L56 and fuse FS1 terminal. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L42 (Female) (3) and L56 (Female) (2) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 (12) and L56 (Female) (3) | | Resistance | 1Ω and below |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L42, L56 and fuse FS1 terminal. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L42 (Female) (3) and L56 (Female) (3) | Resistance between L42 (Female) (3), L56 (Female) (2) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (12) and L56 (Female) (3) | Resistance between fuse FS1 (12), L56 (Female) (3) and chassis ground | | 1MΩ and above |
| | | | ★ In the above case, the all fuses are blown. | | | |
| | 4 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect connectors L41 and L56. 3) Connect T-adapter. 4) Turn starting switch ON. | | | |
| | | | Wiring harness between L42 (Female) (3) and L56 (Female) (2) | Voltage between L42 (Female) (3), L56 (Female) (2) and chassis ground | | 1V and below |
| | 5 | Defective HST controller | 1) Turn starting switch OFF. 2) Disconnect Connector L42. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L42 (3) and chassis ground | Traction control switch ON | Voltage | 20 - 30V |
| | | | | Traction control switch OFF | Voltage | 1V and below |

**Related circuit diagram**

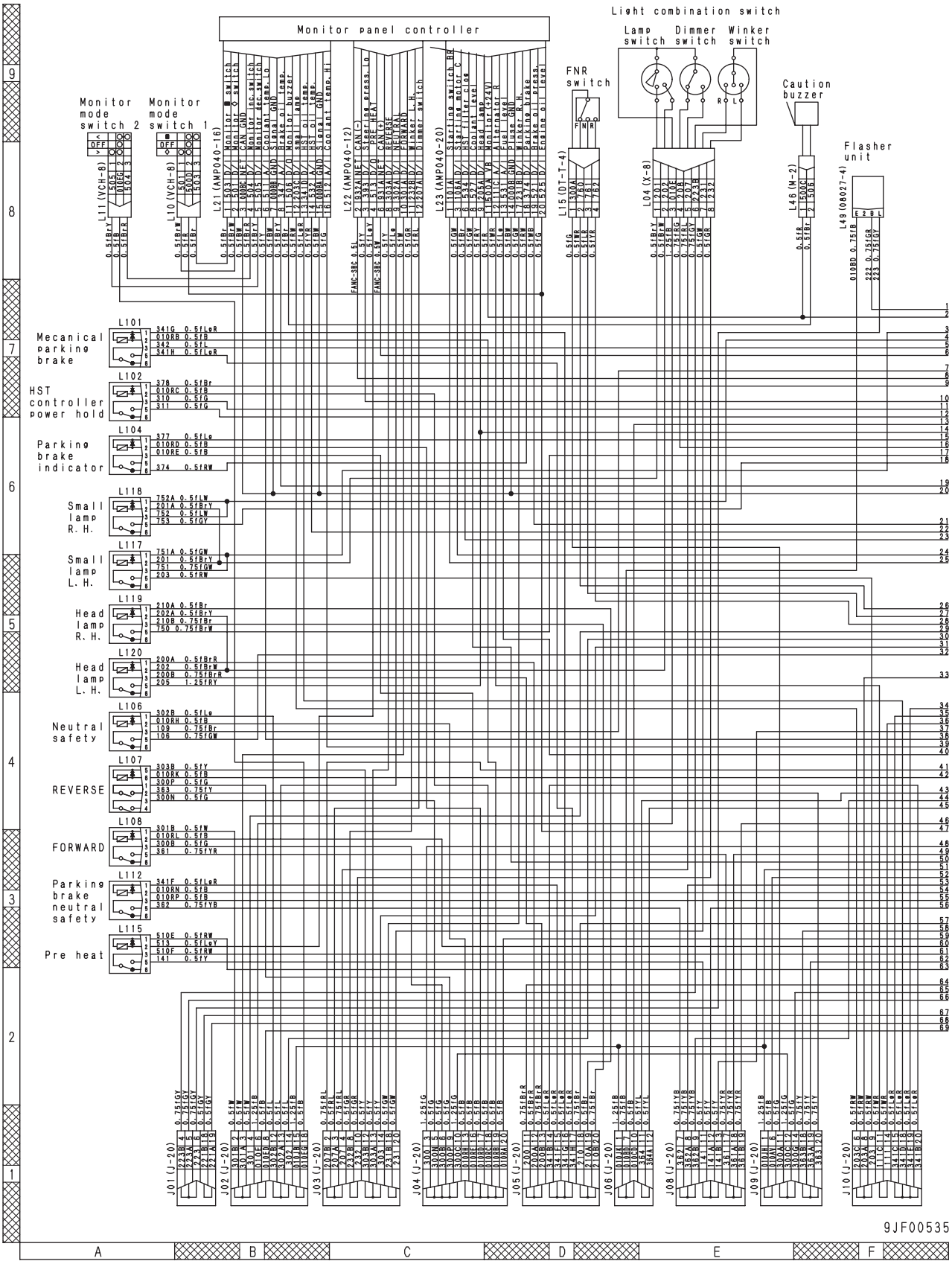


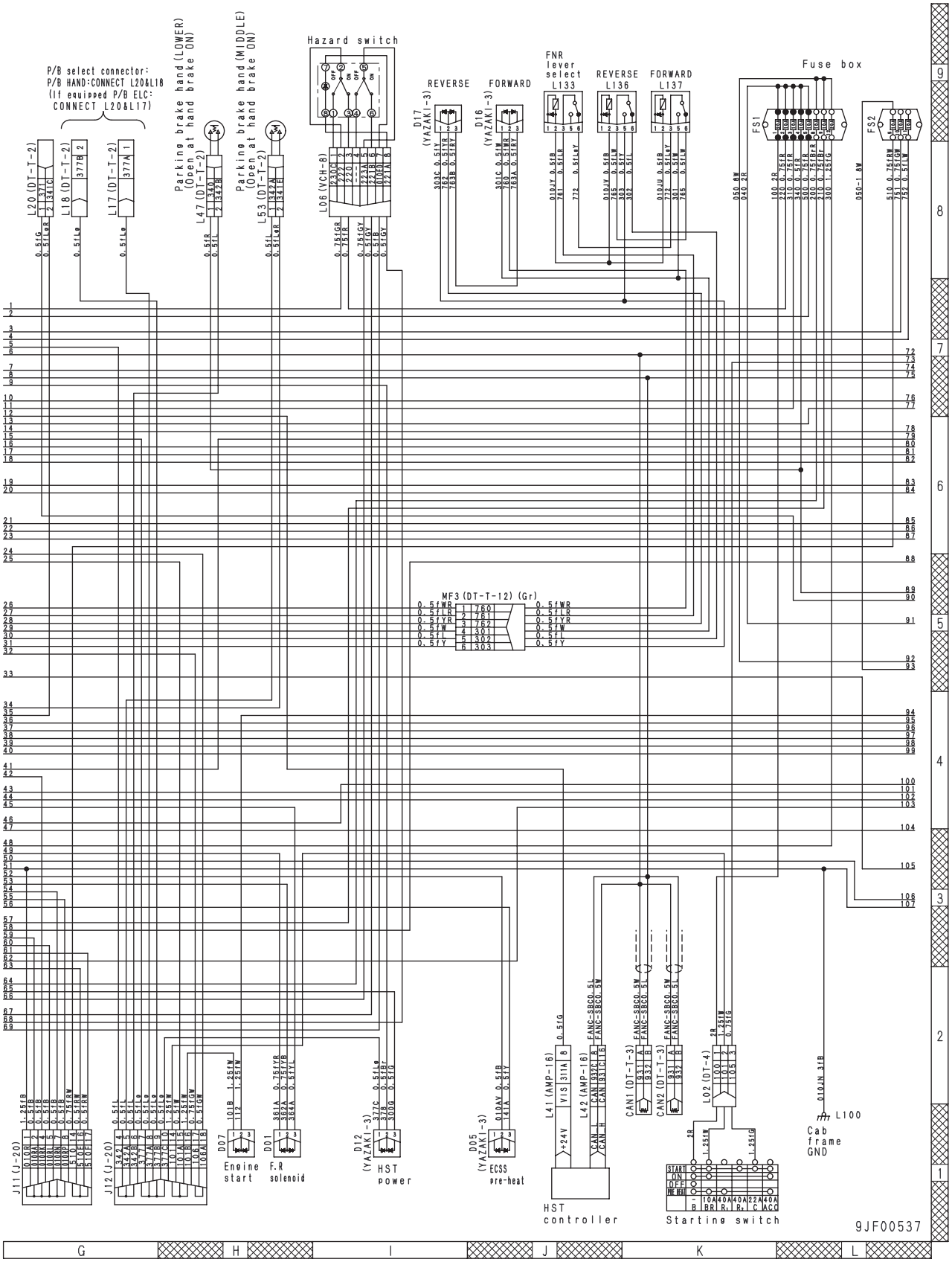
white 20-332

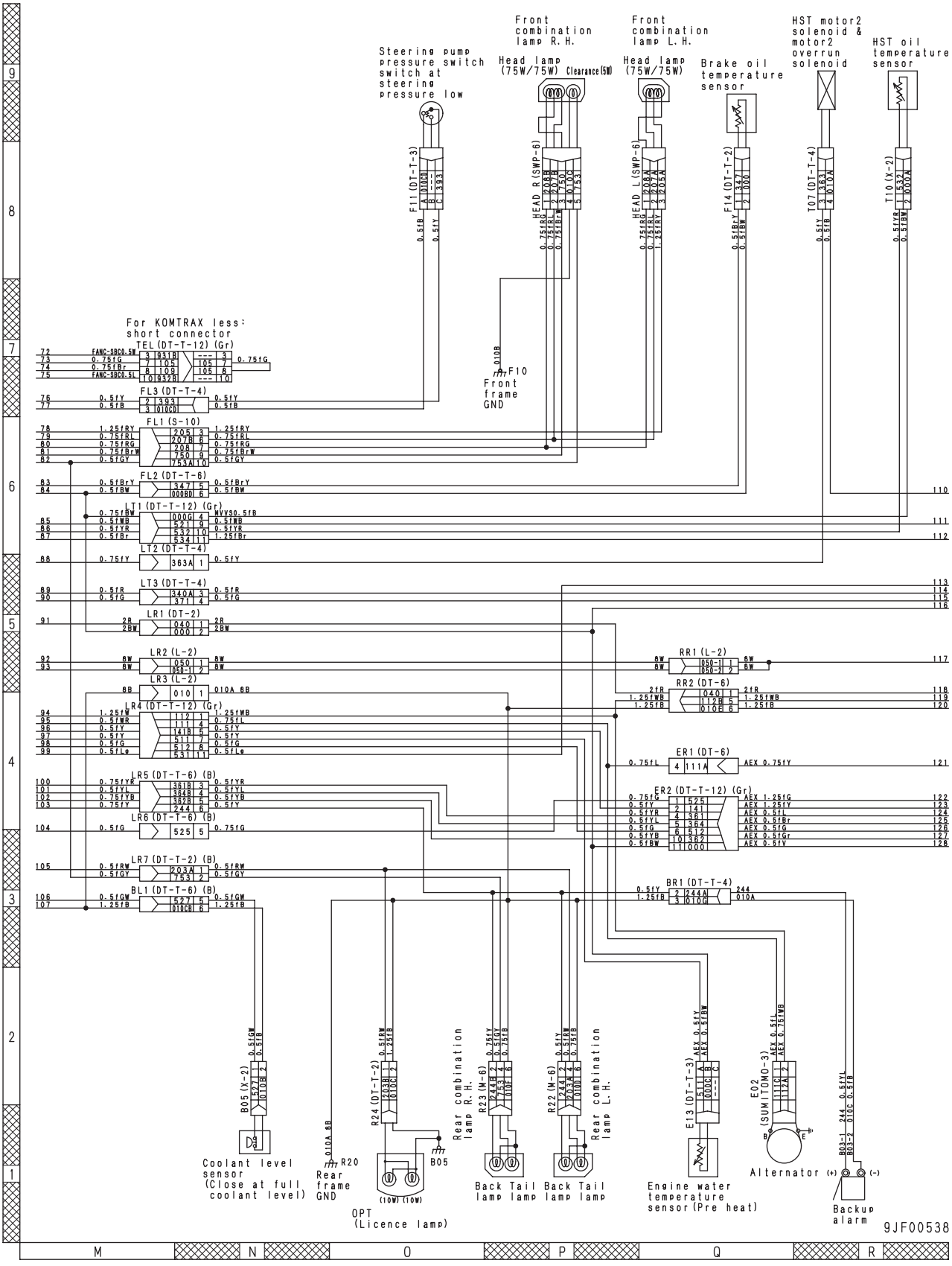
# TROUBLESHOOTING OF HST CONTROLLER SYSTEM (HST MODE)

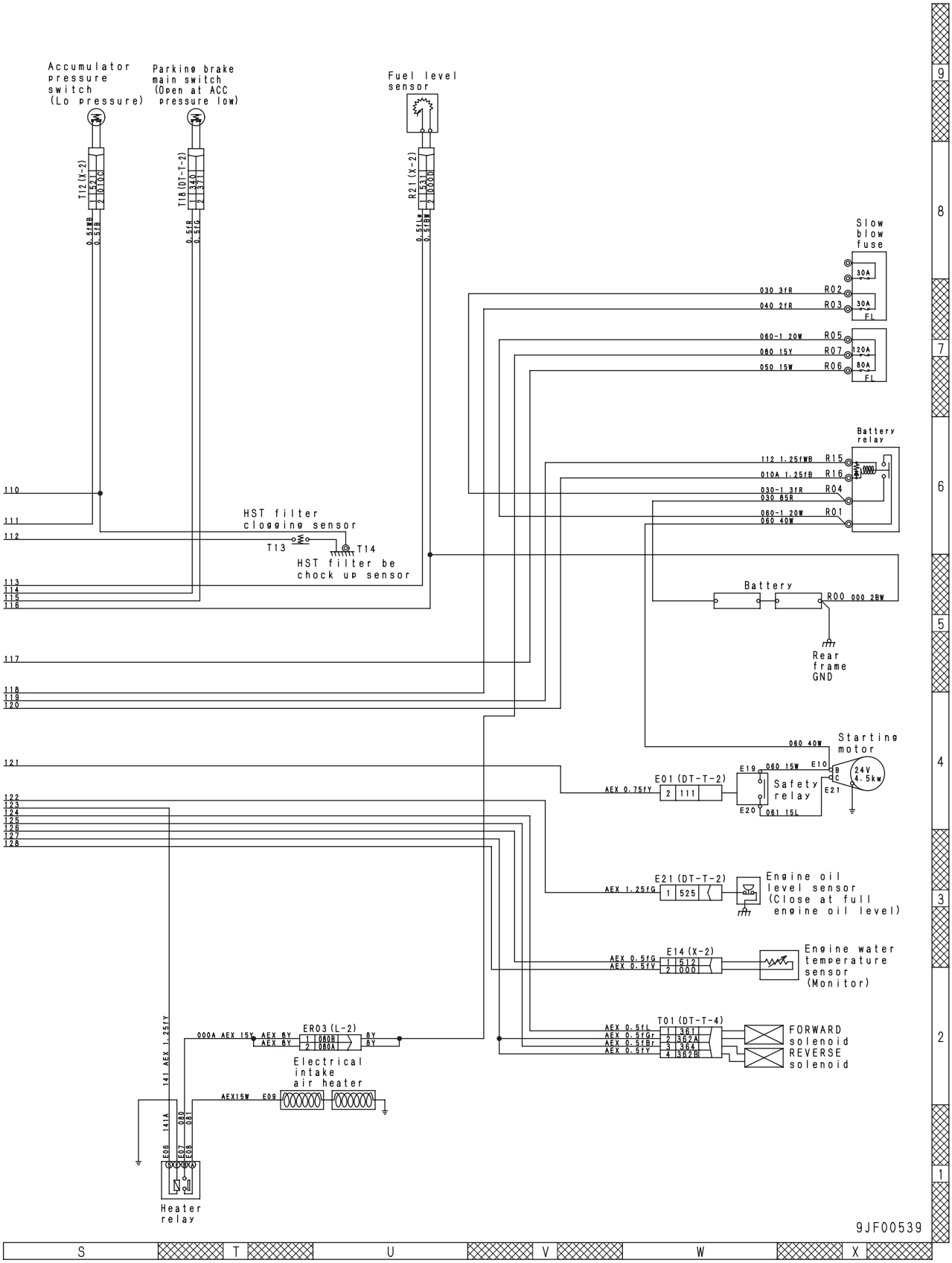

Monitor system circuit diagram . . . . . 20-402
Before troubleshooting code display . . . . . 20-406
Before troubleshooting electrical system . . . . . 20-407
Information contained in troubuleshooting table . . . . . 20-408
Error Code [15B0NX] (HST oil filter clogged (NX)) is displayed. . . . . 20-410
Error Code [2G42ZG] (Decreased accumulator oil pressure (ZG)) is displayed . . . . . 20-411
Error Code [989F00] (Transmission protection caution (00)) is displayed . . . . . 20-412
Error Code [989FN1] (HST overrunning (N1)) is displayed . . . . . 20-413
Error Code [AB00L6] (Defective battery charging circuit (L6)) is displayed. . . . . 20-414
Error Code [AB00MA] (Defective battery charging circuit (MA)) is displayed . . . . . 20-415
Error Code [B@BAZG] (Degreased engine oil pressure (ZG)) is displayed. . . . . 20-416
Error Code [B@BCNS] (Engine water temperature overheating (NS)) is displayed. . . . . 20-417
Error Code [B@BCZK] (Alarm indicating low coolant level (ZK)) is displayed . . . . . 20-418
Error Code [B@C7NS] (Brake cooling oil temperature overheating (NS)) is displayed . . . . . 20-419
Error Code [B@CRNS] (HST oil temperature overheating (NS)) is displayed . . . . . 20-420
Error Code [D5ZHL6] (Starting switch "C" (IGN "C") input failure (L6)) is displayed . . . . . 20-422
Error Code [DAF0KT] (Controller inside failure (KT)) is displayed . . . . . 20-424
Error Code [DAJ0KR] (HST controller communication failure (KR)) is displayed. . . . . 20-426
Error Code [DD15LD] (Monitor panel mode selector switch 1 [■] (Panel switch 1) input error (LD)) is displayed . . . . . 20-428
Error Code [DD16LD] (Monitor panel mode selector switch 1 [◇] (Panel switch 2) input error (LD)) is displayed . . . . . 20-429
Error Code [DD17LD] (Monitor panel mode selector switch 2 [<] (Panel switch 3) input error (LD)) is displayed . . . . . 20-430
Error Code [DD18LD] (Monitor panel mode selector switch 2 [>] (Panel switch 4) input error (LD)) is displayed . . . . . 20-431
Error Code [DDK3KB] (Multiple shift lever FR signal input (KB)) is displayed . . . . . 20-432
Error Code [DDS5L6] (Decreased steering oil pressure (L6)) is displayed . . . . . 20-434
Error Code [DGE2KX] (Engine water temperature (High temperature) sensor system failure (KX)) is displayed . . . . . 20-435
Error Code [DGE3L6] (Engine water temperature (Low temperature) sensor system failure (L6)) is displayed . . . . . 20-436
Error Code [DGH1KX] (HST oil temperature sensor system failure (KX)) is displayed. . . . . 20-437
Error Code [DGR1KX] (Brake oil temperature sensor system short-circuiting (KX)) is displayed. . . . . 20-438
Error Code [DGR4KA] (Brake oil temperature sensor system discontinuity (KA)) is displayed. . . . . 20-439
Error Code [DHE4KA] (Engine oil pressure sensor system discontinuity (KA)) is displayed . . . . . 20-440
Troubleshooting Code [MON-1] The parking brake indicator lamp does not light ON. . . . . 20-441
Troubleshooting Code [MON-2] The brake oil pressure caution lamp does not light ON . . . . . 20-444
Troubleshooting Code [MON-3] The engine water temperature caution lamp does not light ON, or after the engine starts, the engine water temperature gauge does not rise. . . . . 20-445
Troubleshooting Code [MON-4] The HST oil temperature caution lamp does not light ON, or after the engine starts, the HST oil temperature gauge does not rise. . . . . 20-446
Troubleshooting Code [MON-5] The fuel level gauge does not rise or decrease. . . . . 20-447
Troubleshooting Code [MON-6] The radiator coolant level caution lamp does not light ON . . . . . 20-448
Troubleshooting Code [MON-7] The steering oil pressure caution lamp does not light ON . . . . . 20-449
Troubleshooting Code [MON-8] The emergency steering oil pressure indicator lamp does not light ON . . . . 20-450
Troubleshooting Code [MON-9] Input failure in monitor panel mode selector switch 1 [■] (Panel switch 1). . 20-451
Troubleshooting Code [MON-10]Input failure in monitor panel mode selector switch 1 [◇] (Panel switch 2). 20-452
Troubleshooting Code [MON-11]Input failure in monitor panel mode selector switch 2 [<] (Panel switch 3) . 20-453
Troubleshooting Code [MON-12]Input failure in monitor panel mode selector switch 2 [>] (Panel switch 4) . 20-454
Troubleshooting Code [MON-13]The alarm buzzer does not sound or stop . . . . . 20-455
Troubleshooting Code [MON-14]The wiper does not function. . . . . 20-456
Troubleshooting Code [MON-15]The lamps do not work properly. . . . . 20-456

# MONITOR SYSTEM CIRCUIT DIAGRAM




P/B select connector:
P/B HAND:CONNECT L20&L18
(If equipped P/B ELC:
CONNECT L20&L17)
Parking brake hand (LOWER)
(Open at hand brake ON)
Parking brake hand (MIDDLE)
(Open at hand brake ON)
Hazard switch
REVERSE
FORWARD
FNR lever select L133
REVERSE L136
FORWARD L137
Fuse box
MF3 (DT-T-12) (Gr)
Engine start
F.R solenoid
HST power
ECSS pre-heat
HST controller
Starting switch
Cab frame GND
9JF00537


Steering pump pressure switch switch at steering pressure low
Front combination lamp R.H.
Head lamp (75W/75W)
Clearance (5W)
Front combination lamp L.H.
Head lamp (75W/75W)
Brake oil temperature sensor
HST motor2 solenoid & motor2 overrun solenoid
HST oil temperature sensor
F11 (DT-T-3)
HEAD R (SWP-6)
HEAD L (SWP-6)
F14 (DT-T-2)
T07 (DT-T-4)
T10 (X-2)
For KOMTRAX less: short connector
TEL (DT-T-12) (Gr)
FL3 (DT-T-4)
FL1 (S-10)
FL2 (DT-T-6)
LT1 (DT-T-12) (Gr)
LT2 (DT-T-4)
LT3 (DT-T-4)
LR1 (DT-2)
LR2 (L-2)
LR3 (L-2)
LR4 (DT-T-12) (Gr)
LR5 (DT-T-6) (B)
LR6 (DT-T-6) (B)
LR7 (DT-T-2) (B)
BL1 (DT-T-6) (B)
F10
Front frame GND
RR1 (L-2)
RR2 (DT-6)
ER1 (DT-6)
ER2 (DT-T-12) (Gr)
BR1 (DT-T-4)
B05 (X-2)
R24 (DT-T-2)
R23 (M-6)
R22 (M-6)
E13 (DT-T-3)
E02 (SUMITOMO-3)
B03-1
B03-2
Coolant level sensor (Close at full coolant level)
R20
Rear frame GND
OPT (Licence lamp)
Rear combination lamp R.H.
Rear combination lamp L.H.
Back Tail lamp
Back Tail lamp
Engine water temperature sensor (Pre heat)
Alternator
Backup alarm
9JF00538


Accumulator pressure switch (Lo pressure)
Parking brake main switch (Open at ACC pressure low)
Fuel level sensor
T12 (X-2)
T18 (DT-T-2)
R21 (X-2)
Slow blow fuse
30A
30A FL
120A FL
80A FL
030 3fR R02
040 2fR R03
060-1 20W R05
080 15Y R07
050 15W R06
Battery relay
112 1.25fWB R15
010A 1.25fB R16
030-1 3fR R04
030 85R
060-1 20W R01
080 40W
HST filter clogging sensor
T13
T14
HST filter be chock up sensor
Battery
R00 000 2BW
Rear frame GND
Starting motor
24V 4.5kw
E01 (DT-T-2)
Safety relay
E19 060 15W E10
E20 061 15L
E21
E21 (DT-T-2)
Engine oil level sensor (Close at full engine oil level)
E14 (X-2)
Engine water temperature sensor (Monitor)
ER03 (L-2)
Electrical intake air heater
T01 (DT-T-4)
FORWARD solenoid
REVERSE solenoid
Heater relay
9JF00539

# BEFORE TROUBLESHOOTING CODE DISPLAY

## ERROR CODE AND POSSIBLE CAUSES TABLE

| Error Code | Action Code | Possible Causes: Defective machine monitor | Defective HST controller | Defective starting switch | Defective monitor panel mode switch 1 [■] | Defective monitor panel mode switch 1 [◇] | Defective monitor panel mode switch 2 [<] | Defective monitor panel mode switch 2 [>] | Defective FNR switch | Battery is deteriorated | Defective battery relay | Defective fuse, fusible link | Defective alternator | Defective engine revolution sensor | Defective HST motor 2 solenoid | Defective HST motor 1 solenoid | Defective clutch solenoid | Engine oil pressure drops | Defective engine oil pressure sensor | Engine water temperature overheating | Defective engine water temperature sensor (high temperature) | Defective engine water temperature sensor (low temperature) | Engine cooling water level lacks | Defective coolant level sensor | Defective HST oil pressure sensor | HST oil filter clogging | Defective HST oil filter sensor | HST oil temperature overheating | Defective HST oil temperature sensor | Accumulator oil pressure drops | Defective accumulator oil pressure sensor | Brake cooling oil temperature overheating | Defective brake cooling oil temperature sensor | Steering oil temperature overheating | Defective steering oil temperature sensor | Defective relay | Wiring harness discontinuity | Wiring harness ground fault | Wiring harness hot short-circuiting |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Failures related to HST controller | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 989F00 | E00 | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DHH1KX | E03 | | ● | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | ● | ● | ● |
| DLE2LC | E03 | | ● | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | ● | | ● |
| DW26KZ | E03 | | ● | | | | | | ● | | | | | | ● | | | | | | | | | | | | | | | | | | | | | ● | ● | ● | |
| DX19KZ | E03 | | ● | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | ● | ● | ● | |
| DX20KZ | E03 | ● | ● | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | ● | ● | ● | |
| Failures related to monitor | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 15B0NX | E01 | ● | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | ● | |
| 2G42ZG | E03 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | ● | ● | |
| 989F00 | E00 | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| 989FN1 | E02 | ● | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | ● | ● | ● | |
| AB00L6 | E03 | ● | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| AB00MA | E03 | ● | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | |
| B@BAZG | E01 | ● | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | | | ● | |
| B@BCNS | E02 | ● | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | | | | ● | |
| B@BCZK | E01 | ● | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | | | | | ● | |
| B@C7NS | E02 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | |
| B@CRNS | E02 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | | | | | | | | |
| D5ZHL6 | E01 | ● | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | ● | ● |
| DAF0KT | E03 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| DAJ0KR | E03 | ● | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | ● |
| DD15LD | E01 | ● | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| DD16LD | E01 | ● | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| DD17LD | E01 | ● | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| DD18LD | E01 | ● | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | |
| DDK3KB | E03 | ● | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● |
| DDS5L6 | E03 | ● | | | | | | | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | ● | | ● | |
| DGE2KX | E01 | ● | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | ● | |
| DGE3L6 | E01 | ● | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | ● | | |
| DGH1KX | E01 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | | | | | ● | |
| DGR1KX | E01 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | ● | | |
| DGR4KA | E01 | ● | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | ● | | | | | ● | |
| DHE4L6 | E01 | ● | | | | | | | | | | | | | | | | | ● | | | | | | | | | | | | | | | | | | ● | | |

# BEFORE TROUBLESHOOTING ELECTRICAL SYSTEM

## FUSE BOX CONNECTION TABLE

★ This connection chart shows the equipment that each fuse box power source supplies power directly to ("switch power source" means the power supplied when the starting switch is ON; "permanent power source" means the power supplied when the starting switch is OFF).

| Category | Fuse No. | Fuse capacity | Power supply destination |
|---|---|---|---|
| Permanent power source (Fuse box 1) | 1 | 20A | Starting switch |
| | 2 | 10A | Hazard lamp |
| | 3 | 10A | HST control A |
| | 4 | 10A | Parking brake 1 |
| | 5 | 10A | Meter, panel |
| | 6 | 10A | Car radio A |
| | 7 | 10A | Option (24V-1) |
| Switch power source (Fuse box 1) | 8 | 10A | Head lamp (left side) |
| | 9 | 10A | Head lamp (right side) |
| | 10 | 10A | Turn signal lamp |
| | 11 | 10A | Back lamp, stop lamp |
| | 12 | 20A | HST control B |
| | 13 | 10A | Work equipment positioner |
| | 14 | 10A | Wiper |
| | 15 | 10A | Car radio B |
| Switch power source (Fuse box 2) | 1 | 20A | Air conditioner A |
| | 2 | 20A | Air conditioner B |
| | 3 | 10A | Beacon lamp |
| | 4 | 10A | - |
| | 5 | 10A | Load-meter |
| | 6 | 20A | DC converter |
| | 7 | 10A | Option (24V-2) |
| | 8 | 10A | Parking brake 2 |
| | 9 | 10A | Horn |
| | 10 | 10A | Side marker lamp (left side) |
| | 11 | 10A | Side marker lamp (right side) |
| | 12 | 20A | Front working lamp |
| | 13 | 20A | Rear working lamp |
| | 14 | 10A | (Spare 1) |
| | 15 | 10A | (Spare 2) |

# INFORMATION CONTAINED IN TROUBULESHOOTING TABLE

★ The troubleshooting table and the related circuit diagrams contain the following information. Grasp their contents fully before proceeding to actual troubleshooting work.

| Action Code | Error Code | Controller Code | Trouble | Trouble displayed in trouble data |
|---|---|---|---|---|
| Panel display | Panel display | Panel display | | |
| Description of Trouble | • Condition when machine monitor or controller detected trouble. | | | |
| Machine monitor or controller Reaction | • Action to take to protect system or equipment when machine monitor or controller detected trouble. | | | |
| Effect on Machine | • Condition that appeared as problem on machine when action (given above) was taken by machine monitor or controller. | | | |
| Related Information | • Information related to troubleshooting or error that occurred. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting |
|---|---|---|---|
| Possible Causes and Standard Values | 1 | Probable cause when trouble occurred (the numbers are index numbers and do not indicate the order of priority) | <Data to fill in><br>• Normal standard values used to judge probable cause<br>• Remarks regarding decision-making<br><br><Condition when wiring harness is defective><br>• Disconnection<br>There is defective connection of connector or disconnection in wiring harness<br>• Short circuit with ground<br>Wiring harness not wired to ground (GND) circuit is in contact with ground (GND) circuit<br>• Short circuit with power source<br>Wiring harness not wired to power supply (24 V) circuit is in contact with power supply (24 V) circuit<br><br><Points to remember when troubleshooting><br>1) Method of displaying connector No. and handling T-adapter<br>Unless there is special instruction, insert or connect the T-adapter as follows<br>• If there is no indication for the male or female terminal of the connector No., disconnect the connector and insert the T-adapter in both the male and female terminals<br>• If there is indication for the male or female terminal of the connector No., disconnect the connector and connect the T-adapter to only the terminal indicated (either the male terminal or female terminal)<br><Points to remember when troubleshooting><br>2) Given order for pin numbers and handling tester lead<br>Unless there is a special instruction, connect tester (+) lead and (-) lead as follows to carry out troubleshooting<br>• Connect the (+) lead to the wiring harness for the pin No. given first<br>• Connect the (-) lead to the wiring harness for the pin No. given last |
| | 2 | | |
| | 3 | | |
| | 4 | | |
| | 5 | | |

**Related circuit diagram**

This is part of electrical circuit diagram which shows the portion where the failure occurred.

- Connector No.: Indicates (Type - numbers of a pin) (color)
- Arrow: Roughly indicates the location in the machine where it is installed.

**Phenomena code table**

★ For problem codes marked "See list", see the list below.

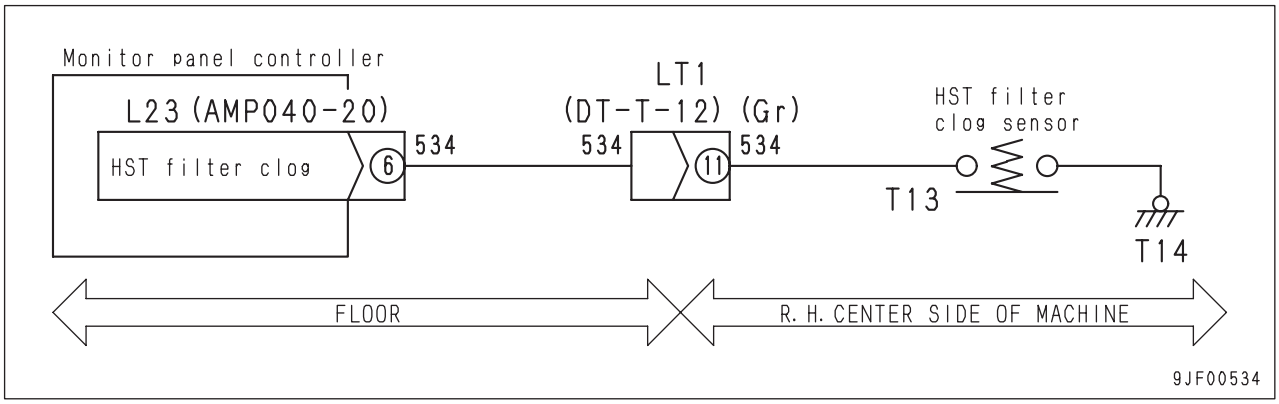
| Phenomena code | Details | Disconnection | Details |
|---|---|---|---|
| KA | Disconnection | L0 | Fill signal ON 2 or more channels |
| KB | Short circuit | L1 | Fill signal is ON when command current is OFF |
| KK | Drop in power source voltage, input | L2 | Fuel pressure is higher than maximum set value |
| KQ | Non match in model selection signal | L3 | Corresponding component cannot be controlled |
| KR | Defective communication | L4 | ON/OFF signals for 2 systems do not match |
| KT | Abnormality inside controller | L6 | Engine signals do not match operating condition or stopped condition of machine |
| KX | Input signal outside range | L8 | Analog signals for 2 systems do not match |
| KY | Short circuit in power supply line | LC | Speed signals for 2 systems do not match |
| KZ | Disconnection or short circuit | LD | Switch has been kept pressed for abnormally long time |
| MA | Function impossible | LH | Fill signal is OFF when command current is ON |
| NS | Overheat | | |
| ZG | Drop in oil pressure | | |
| ZK | Drop in level | | |

# Error Code [15B0NX] (HST oil filter clogged (NX))

| Action Code | Error Code | Controller Code | Trouble | HST oil filter clogged (NX) |
|---|---|---|---|---|
| E01 | 15B0NX | MON | | |
| Description of Trouble | • When HST oil temperature went above 50oC: signal circuit of HST oil filter clogging sensor changed to CLOSE (connected to GND) | | | |
| Machine monitor or controller Reaction | • Trigger an alarm. | | | |
| Effect on Machine | • If it is used as it is, there is danger that dirt will circulated in the HST circuit | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | HST oil filter clogged | • Clean or replace | | | |
| | 2 | Defective HST oil filter clogging sensor | 1) Turn starting switch OFF. 2) Disconnect connector T13. | | | |
| | | | Between T13 and chassis ground | Filter is normal | Resistance | 1MΩ and above |
| | | | | Filter clogged | Resistance | 1Ω and below |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector T13. | | | |
| | | | Wiring harness between L23 (Female) (6) and T13 | Resistance between L23 (Female) (6), T13 and chassis ground | | 1MΩ and above |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L23 (Female) (6) and chassis ground | Filter is normal | Voltage | 20 - 30V |
| | | | | Filter clogged | Voltage | 1V and below |

**Related circuit diagram**

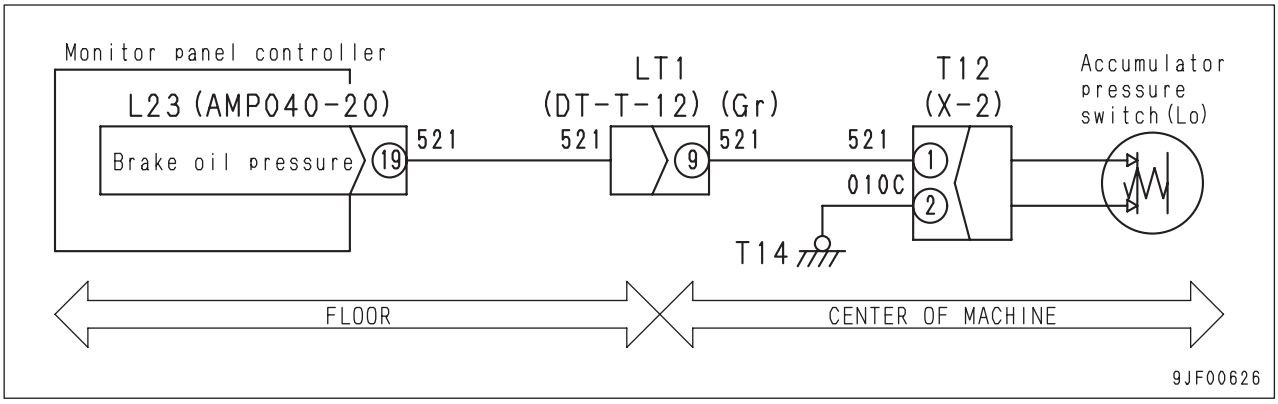


# Error Code [2G42ZG] (Decreased accumulator oil pressure (ZG))

| Action Code | Error Code | Controller Code | Trouble | Decreased accumulator oil pressure (ZG) |
|---|---|---|---|---|
| E03 | 2G42ZG | MON | | |
| Description of Trouble | • When engine was running (continuously for more than 30 seconds), signal from accumulator oil pressure sensor went below 4.6 MPa {45 kg/cm$^2$}. | | | |
| Machine monitor or controller Reaction | • Trigger an alarm. | | | |
| Effect on Machine | • If it is used as it is, there is danger that the brake will have no effect. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Decrease accumulator oil pressure | Accumulator (Brake) oil pressure is normal<br>★ If the oil pressure is not normal, carry out troubleshooting for the hydraulic, mechanical system. | | | |
| | 2 | Defective accumulator oil pressure sensor | 1) Turn starting switch OFF. 2) Disconnect connector T12. 3) Connect T-adapter. | | | |
| | | | Between T12 (Male) (1) and (2) | Oil pressure is normal (6MPa {61.2kg/cm$^2$}) | Resistance | 1Ω and below |
| | | | | Oil pressure is low (4MPa {40.8kg/cm$^2$}) | Resistance | 1MΩ and above |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | Turn starting switch OFF. 2) Disconnect Connectors T12, T23. 3) Connect T-adapter. | | | |
| | | | Wiring harness between T12 (Female) (1) and L23 (Female) (19) | | Resistance | 1Ω and below |
| | | | Wiring harness between T12 (Female) (2) and chassis ground | | Resistance | 1Ω and below |
| | 4 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors T12, L23. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (19) and T12 (Female) (1) | Resistance between L23 (Female) (19), T12 (Female) (1) and chassis ground | | 1MΩ and above |
| | 5 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L23 (Female) (19) and chassis ground | Oil pressure is normal (5.88MPa {60kg/cm$^2$}) | Voltage | 1V and below |
| | | | | Oil pressure is low (3.92MPa {40kg/cm$^2$}) | Voltage | 20 - 30V |

**Related circuit diagram**



# Error Code [989F00] (Transmission protection caution (00))

| Action Code | Error Code | Controller Code | Trouble | Transmission protection caution (00) |
|---|---|---|---|---|
| E00 | 989F00 | MON | | |
| Description of Trouble | • Not considered to be a failure.<br>• The travel speed exceeds the allowable speed the HST on down shifting.<br>• The travel speed exceeds 40km/h. | | | |
| Machine monitor or controller Reaction | • Do not shift down in the above condition. | | | |
| Effect on Machine | • If travel speed exceeds 40 km/h, speed is automatically reduced.<br>• May not shift down even when shift down is operated. | | | |
| Related Information | | | | |

# Error Code [989FN1] (HST overrunning (N1))

| Action Code | Error Code | Controller Code | Trouble | HST overrunning (N1) |
|---|---|---|---|---|
| E02 | 989FN1 | MON | | |
| Description of Trouble | • Travel speed exceeds 45 km/h.<br>• Automatic speed reduction when travel speed exceeds 40 km/h does not work. | | | |
| Machine monitor or controller Reaction | • Failure code is transmitted to HST controller, and when travel speed exceeds 40 km/h, HST controller automatically reduces speed | | | |
| Effect on Machine | • HST overrun alarm is given.<br>• Automatically reduces speed. | | | |
| Related Information | | | | |

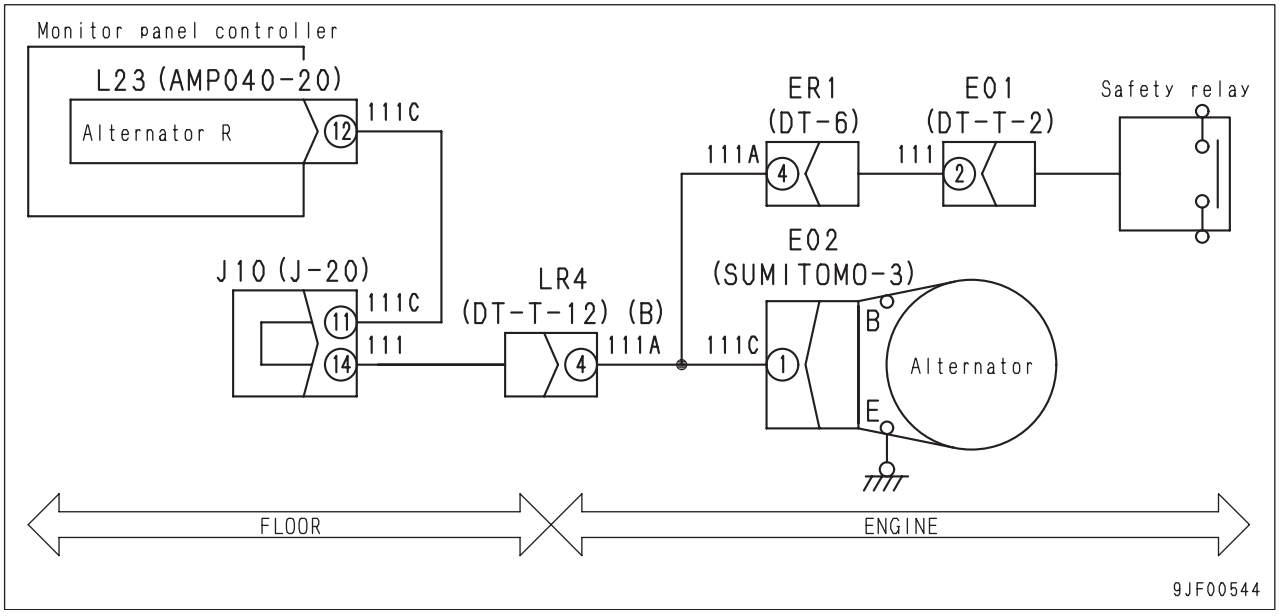
| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | |
|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | - - - | 1) Turn starting switch ON.<br>2) Operate machine monitor | |
| | | | Other code is displayed at same time | Carry out troubleshooting for applicable code displayed |
| | 2 | Overrunning HST | When machine was used in way that would cause HST to overrun | Inspect and repair cause of problem and damage to HST. |
| | 3 | Defective machine monitor | 1) Start engine.<br>2) Operate machine monitor<br>3) Travel on flat ground. | |
| | | | Travel speed goes above 40 km/h. | Carry out troubleshooting for HST controller system failure codes DW26KZ and DX19KZ. |
| | | | Travel speed does not go above 40 km/h. (Less than 40 km/h) | Inspect and repair cause of problem and damage to HST. |

# Error Code [AB00L6] (Defective battery charging circuit (L6))

| Action Code | Error Code | Controller Code | Trouble | Defective battery charging circuit (L6)<br>(Alternator terminal R signal detected when engine stopped) |
|---|---|---|---|---|
| E03 | AB00L6 | MON | | |
| Description of Trouble | • The alternator terminal R signal input voltage is 12V or higher before the engine started. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The engine cannot be started.<br>• The service meter increases simply by starting switch ON. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective alternator | Between alternator terminal R [E02 (1)] and chassis ground | Engine started (Throttle 1/2 or more). | Voltage | 27.5 - 29.5V |
| | | | | Engine stopped. | Voltage | 1V and below |
| | 2 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, E02. 3) Connect T-adapter. 4) Turn starting switch ON. | | | |
| | | | Wiring harness between L23 (Female) (12) and E02 (Female) (1) | Voltage between L23 (Female) (12), E02 (Female) (1) and chassis ground | | 1V and below |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L23 (Female) (12) and chassis ground | Engine started (Throttle 1/2 or more). | Voltage | 27.5 - 29.5V |
| | | | | Engine stopped. | Voltage | 1V and below |

**Related circuit diagram**

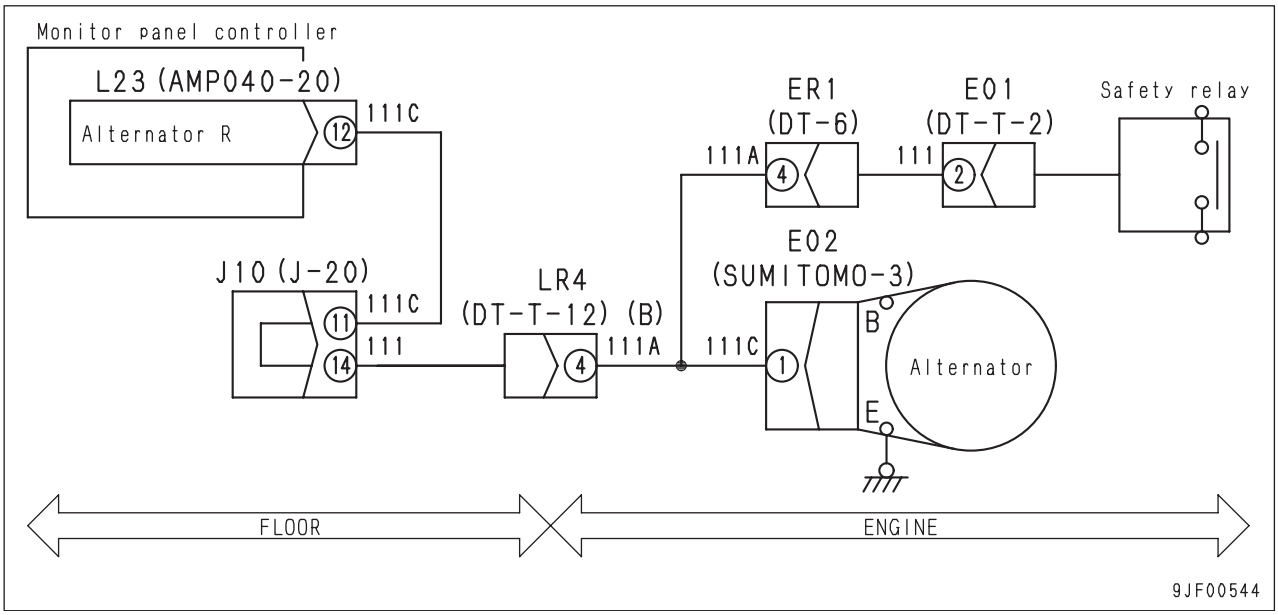


# Error Code [AB00MA] (Defective battery charging circuit (MA))

| Action Code | Error Code | Controller Code | Trouble | Defective battery charging circuit (MA)<br>(No signal from alternator terminal R when engine stopped, Abnormal detection) |
|---|---|---|---|---|
| E03 | AB00MA | MON | | |
| Description of Trouble | • During engine operation, the input voltage to the alternator terminal R signal is below 5V. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The battery is deteriorated.<br>• The engine cannot be started.<br>• The service meter does not work. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Battery is deteriorated. | - - - | | | |
| | 2 | Defective alternator | Between alternator terminal R [E02 (1)] and chassis ground | Engine started (Throttle 1/2 or more). | Voltage | 27.5 - 29.5V |
| | | | | Engine stopped. | Voltage | 1V and below |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, E02. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (12) and E02 (Female) (1) | | Resistance | 1Ω and below |
| | 4 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, E02. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (12) and E02 (Female) (1) | Resistance between L23 (Female) (12), E02 (Female) (1) and chassis ground | | 1MΩ and above |
| | 5 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L23 (Female) (12) and chassis ground | Engine started (Throttle 1/2 or more). | Voltage | 27.5 - 29.5V |
| | | | | Engine stopped. | Voltage | 1V and below |

**Related circuit diagram**

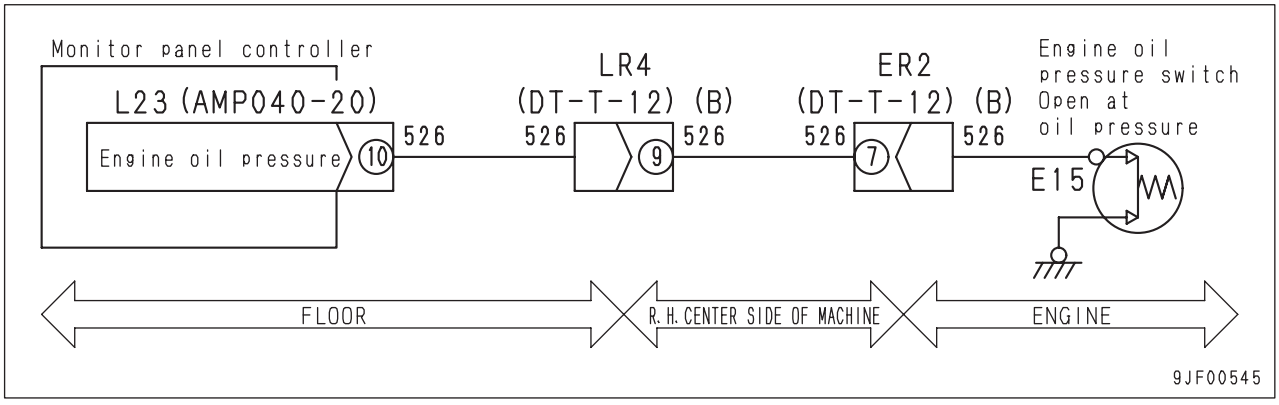


# Error Code [B@BAZG] (Degreased engine oil pressure (ZG))

| Action Code | Error Code | Controller Code | Trouble | Degreased engine oil pressure (ZG) |
|---|---|---|---|---|
| E01 | B@BAZG | MON | | |
| Description of Trouble | • The engine oil pressure sensor circuit is always in the CLOSE state 15 minutes after the engine started. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The engine oil pressure is low (The engine may be damaged). | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Degrease engine oil pressure | - - - | | | |
| | 2 | Defective engine oil pressure sensor (switch) | 1) Turn starting switch OFF. 2) Disconnect connector E15. 3) Connect T-adapter. | | | |
| | | | Between engine oil pressure sensor terminal (E15) and chassis ground | Engine stopped. | Resistance | 1✕ and below |
| | | | | Engine rotating. | Resistance | 1M✕ and above |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, E15. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (10) and E15 | Resistance between L23 (Female) (10), E15 and chassis ground | | 1M✕ and above |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L23 (Female) (10) and chassis ground | Engine stopped. | Voltage | 1V and below |
| | | | | Engine rotating. | Voltage | 20 - 30V |

**Related circuit diagram**

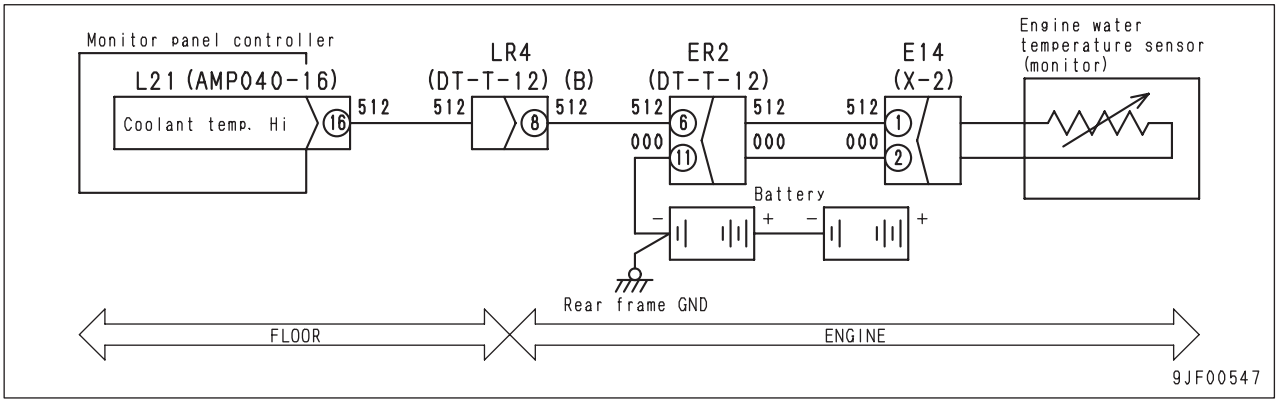


# Error Code [B@BCNS] (Engine water temperature overheating (NS))

| Action Code | Error Code | Controller Code | Trouble | Engine water temperature overheating (NS) |
|---|---|---|---|---|
| E02 | B@BCNS | MON | | |
| Description of Trouble | • The engine water temperature is above 105°C | | | |
| Machine monitor or controller Reaction | • Activates an alarm (Turns the engine water temperature caution lamp ON at 102°C or above and issues this error code at 105°C or above). | | | |
| Effect on Machine | • The engine water temperature overheat alarm is issued (The engine may be damaged if operation continues). | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Overheating engine water temperature | - - - | | | |
| | 2 | Defective engine water temperature sensor (high temperature) | 1) Turn starting switch OFF. 2) Disconnect connector E14. 3) Connect T-adapter. | | | |
| | | | Between E14 (Male) (1) and (2) | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, E14. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (16) and E14 (Female) (1) | Resistance between L21 (Female) (16), E14 (Female) (1) and chassis ground | | 1MΩ and above |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (16) and chassis ground | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |

**Related circuit diagram**

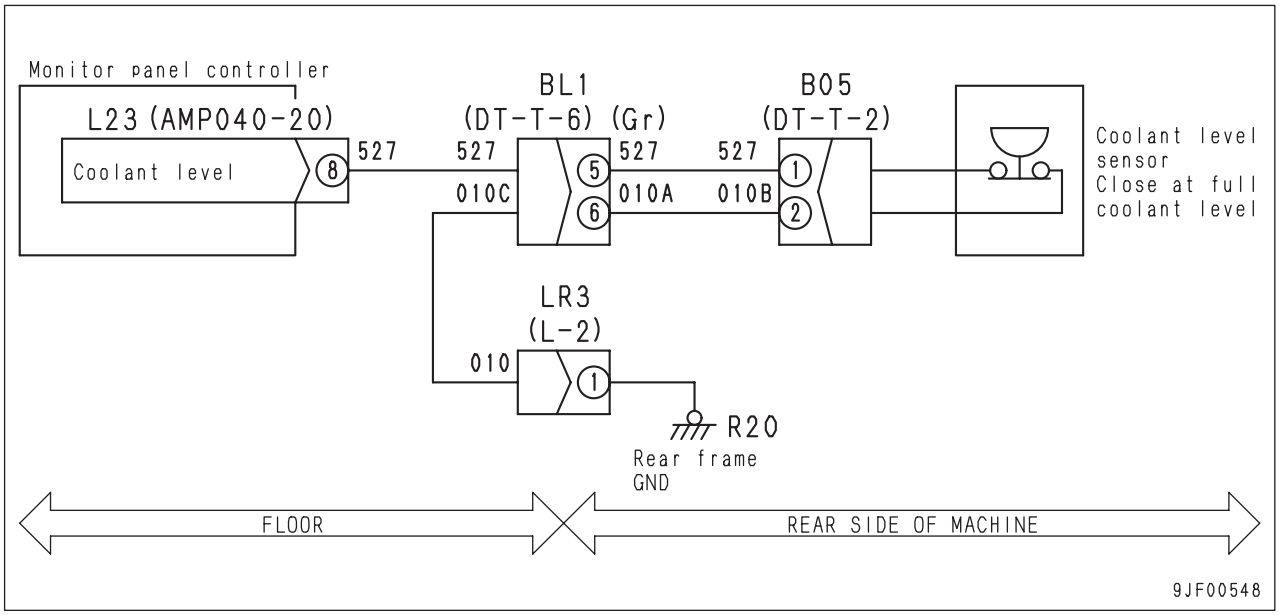


# Error Code [B@BCZK] (Alarm indicating low coolant level (ZK))

| Action Code | Error Code | Controller Code | Trouble | Alarm indicating low coolant level (ZK) |
|---|---|---|---|---|
| E01 | B@BCZK | MON | | |
| Description of Trouble | • The coolant level sensor circuit is opened. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The coolant level is low (The engine may be damaged). | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Decrease coolant level. | - - - | | | |
| | 2 | Defective coolant level sensor | 1) Turn starting switch OFF. 2) Disconnect connector B05. 3) Connect T-adapter. | | | |
| | | | Between B (Male) (1) and (2) | Reserve tank low level and above (normal). | Resistance | 1Ω and below |
| | | | | Reserve tank low level and below (abnormal). | Resistance | 1MΩ and above |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, B05. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (8) and B05 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between B05 (Female) (2) and Chassis ground | | Resistance | 1Ω and below |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L23 (Female) (8) and chassis ground | Reserve tank low level and above (normal). | Voltage | 1V and below |
| | | | | Reserve tank low level and below (abnormal). | Voltage | 20 - 30V |

**Related circuit diagram**

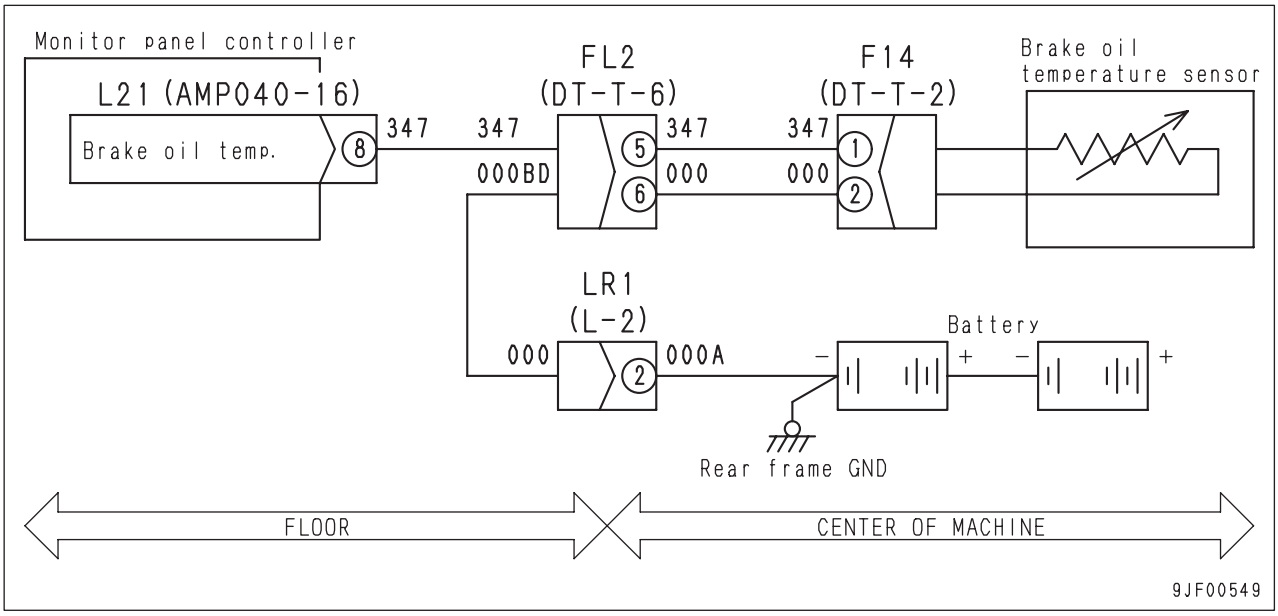


# Error Code [B@C7NS] (Brake cooling oil temperature overheating (NS))

| Action Code | Error Code | Controller Code | Trouble | Brake cooling oil temperature overheating (NS) |
|---|---|---|---|---|
| E02 | B@C7NS | MON | | |
| Description of Trouble | • The brake cooling oil temperature is overheating. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The brake may be damaged if operation continues. | | | |
| Related Information | • This failure code is displayed if the probability of a failure in the electrical system is low.<br>• The brake cooling temperature is displayed by monitoring code 30202. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Overheating brake cooling oil temperature. | - - - | | | |
| | 2 | Defective brake cooling oil temperature sensor | 1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter. | | | |
| | | | Between F14 (Male) (1) and (2) | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (8) and chassis ground | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |

**Related circuit diagram**

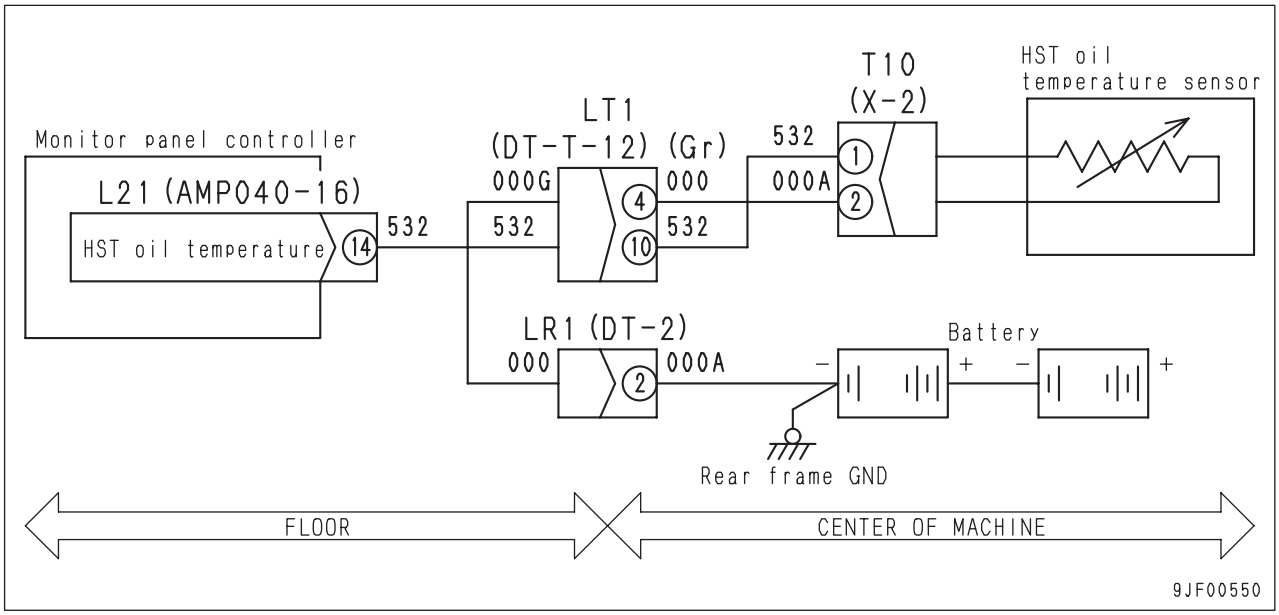


# Error Code [B@CRNS] (HST oil temperature overheating (NS))

| Action Code | Error Code | Controller Code | Trouble | HST oil temperature overheating (NS) |
|---|---|---|---|---|
| E02 | B@CRNS | MON | | |
| Description of Trouble | • The HST oil temperature is above 110°C. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The HST may be damaged if operation continues. | | | |
| Related Information | • This failure code is displayed if the probability of a failure in the electrical system is low. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Overheating HST oil temperature. | - - - | | | |
| | 2 | Defective HST oil temperature sensor | 1) Turn starting switch OFF. 2) Disconnect connector T10. 3) Connect T-adapter. | | | |
| | | | Between T10 (Male) (1) and (2) | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (14) and chassis ground | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |

**Related circuit diagram**



white 20-421

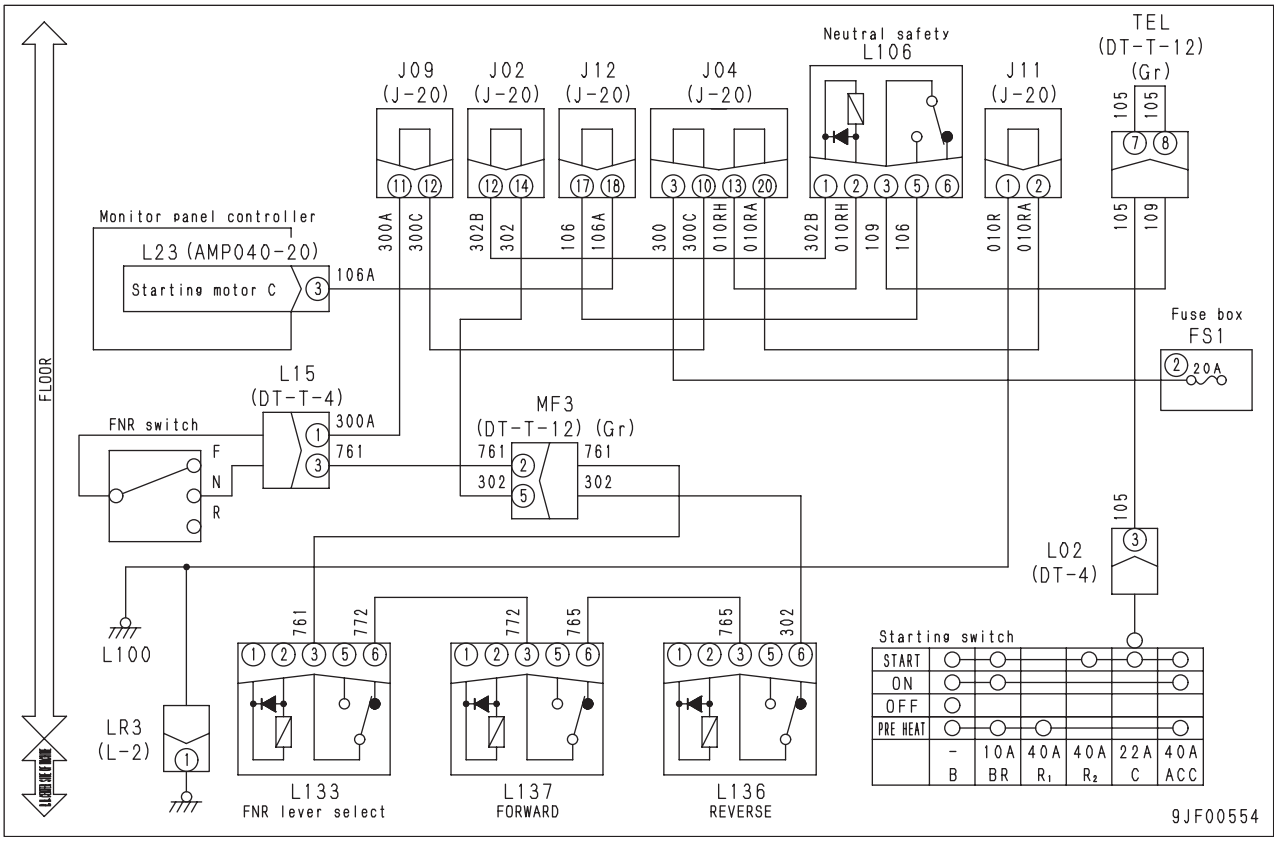
# Error Code [D5ZHL6] (Starting switch "C" (IGN "C") input failure (L6))

| Action Code | Error Code | Controller Code | Trouble | Starting switch "C" (IGN "C") input failure (L6) |
|---|---|---|---|---|
| E01 | D5ZHL6 | MON | | |
| Description of Trouble | • When engine was running, starting switch C (IGN C) terminal signal turned ON, or did not turn ON when starting switch was at START | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • No reaction. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective starting switch | 1) Turn starting switch OFF. 2) Disconnect starting switch terminals. 3) Connect T-adapter. | | | |
| | | | Between starting switch terminal B and C | Starting switch START. | Resistance | 1Ω and below |
| | | | | Other than the above. | Resistance | 1MΩ and above |
| | 2 | Defective neutral safety relay (L106) | 1) Turn starting switch OFF.<br>2) Interchange relay (L106) with normal relay | | | |
| | | | Does condition become normal when neutral safety relay (L106) is interchanged with normal relay? | | The condition is abnormal. | Relay (L106) is normal. |
| | | | | | The condition is normal. | Defective relay (L106) |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check. | | | |
| | | | Between L106 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check.<br>4) Applies impressed voltage between L106 (Male) (1) - (2) | | | |
| | | | Between L106 (Male) (3) and (5) | Applies 24V impressed voltage between L106 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L106 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L02, L15, L23 and fuse L106. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L02 (Female) (3) and L106 (Female) (3) | | Resistance | 1Ω and below |
| | | | Wiring harness between L23 (Female) (3) and L106 (Female) (5) | | Resistance | 1Ω and below |
| | | | Wiring harness between L106 (Female) (2) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between L106 (Female) (1) and L15 (Female) (3) | | Resistance | 1Ω and below |
| | 4 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L02, L15, L23 and L106. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L02 (Female) (3) and L106 (Female) (3) | Resistance between L02 (Female) (3), L106 (Female) (3) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L23 (Female) (3) and L106 (Female) (5) | Resistance between L23 (Female) (3), L106 (Female) (5) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L106 (Female) (1) and L15 (Female) (3) | Resistance between L106 (Female) (1), L15 (Female) (3) and chassis ground | | 1MΩ and above |
| | | | ★ In the above case, the fuse is blown. | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
| | 5 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, L106. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (3) and L106 (Female) (5) | Voltage between L23 (Female) (3), L106 (Female) (5) and chassis ground | | 1V and below |
| | 6 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L23 (Female) (3) and Chassis ground | Starting switch START. | Voltage | 20 - 30V |
| | | | | Other than the above. | Voltage | 1V and below |

**Related circuit diagram**



# Error Code [DAF0KT] (Controller inside failure (KT))

| Action Code | Error Code | Controller Code | Trouble | Controller inside failure (KT) |
|---|---|---|---|---|
| E03 | DAF0KT | MON | | |
| Description of Trouble | • Abnormality has occurred inside controller. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • Abnormality in data recorded inside monitor, monitor operation possible | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting |
|---|---|---|---|
| | 1 | Defective machine monitor | Abnormality inside machine monitor, so troubleshooting cannot be carried out. |

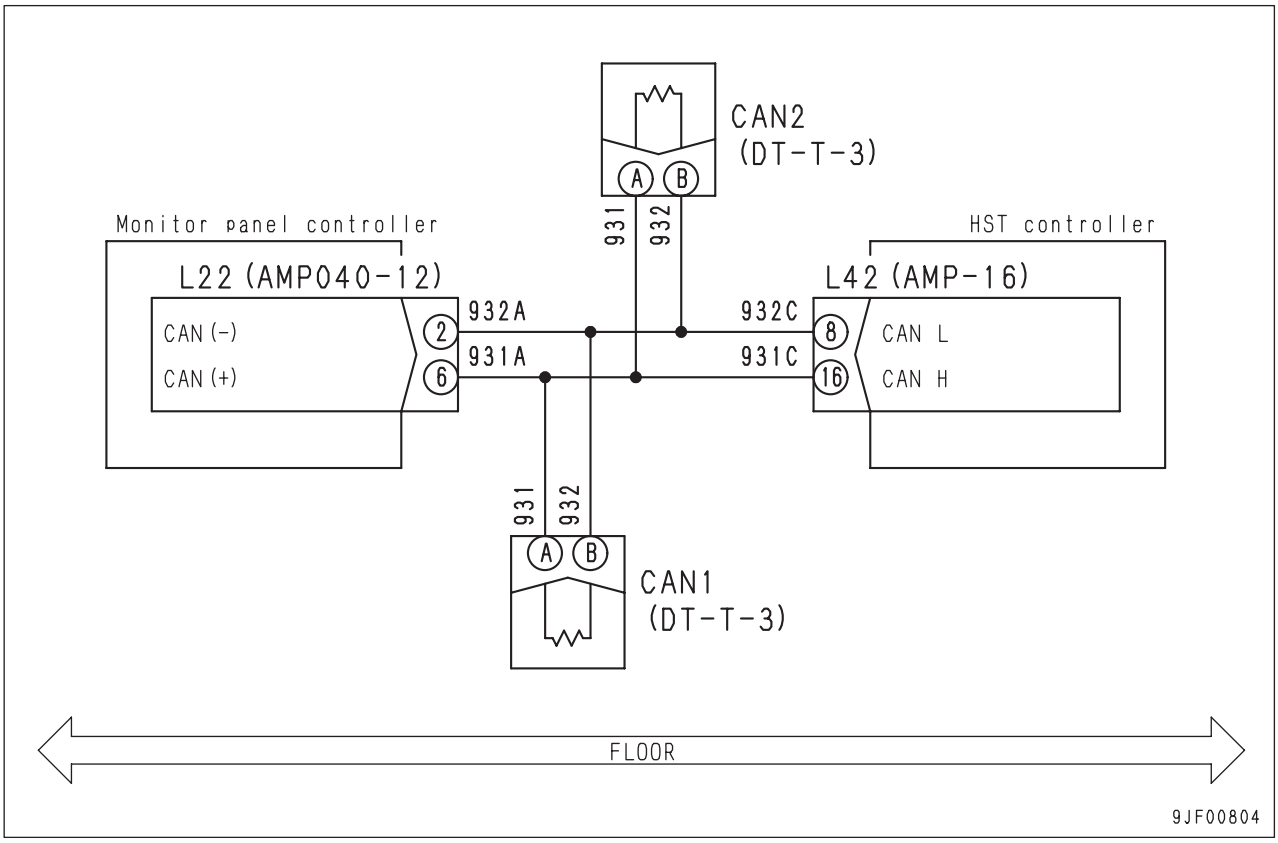
white 20-425

# Error Code [DAJ0KR] (HST controller communication failure (KR))

| Action Code | Error Code | Controller Code | Trouble | HST controller communication failure (KR) |
|---|---|---|---|---|
| E03 | DAJ0KR | MON | | |
| Description of Trouble | • Communications (CAN) data cannot be received from HST controller. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • HST controller holds at condition before abnormality occurred.<br>• HST controller actuates with mode that ignores CAN communications. | | | |
| Related Information | • Movement of machine becomes abnormal.<br>• Speed range display does not switch.<br>• Speedometer always displays 0 km/h. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective wiring harness | 1) Turn starting switch OFF. 2) Disconnect Connectors L22, L42, TEL. 3) Connect T-adapter. | | |
| | | | Wiring harness between L22 (Female) (6), L42 (Female) (16) and TEL (Female) (3) | Resistance between L22 (Female) (2) and (6) | 40 - 80Ω |
| | | | Wiring harness between L22 (Female) (2), L42 (Female) (8) and TEL (Female) (10) | Resistance between L22 (Female) (2) and (6) | 40 - 80Ω |
| | | | Wiring harness between L22 (Female) (6), L42 (Female) (16) and TEL (Female) (3) | Resistance between L22 (Female) (2) and chassis ground | 1MΩ and above |
| | | | Wiring harness between L22 (Female) (2), L42 (Female) (8) and TEL (Female) (10) | Resistance between L22 (Female) (2) and chassis ground | 1MΩ and above |
| | | | ★ Check that terminal resistances CAN1, CAN 2 are connected.<br>★ Resistance value of terminal resistances CAN1, CAN 2: 120Ω | | |
| | 2 | Defective HST controller | 1) Turn starting switch OFF. 2) Replace HST controller. 3) Turn starting switch ON. | | |
| | | | When HST controller is replaced, do communications become normal? | Communication is abnormal. | HST controller is normal. |
| | | | | Communication is normal. | Defective HST controller |
| | 3 | Defective terminal resistance | 1) Turn starting switch OFF. 2) Disconnect Connectors CAN1, CAN2. 3) Connect T-adapter. | | |
| | | | Wiring harness between CAN1 (A) and (B) (3) | Resistance | 100 - 130Ω |
| | | | Wiring harness between CAN2 (A) and (B) (3) | Resistance | 100 - 130Ω |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Replace machine monitor. 3) Turn starting switch ON. | | |
| | | | When machine monitor is replaced, do communications become normal? | Communication is abnormal. | Machine monitor is normal. |
| | | | | Communication is normal. | Defective Machine monitor |
| | | | ★ When replacing the machine monitor, carry out adjustments.<br>For details, see TESTING AND ADJUSTING, Adjusting machine monitor. | | |

**Related circuit diagram**

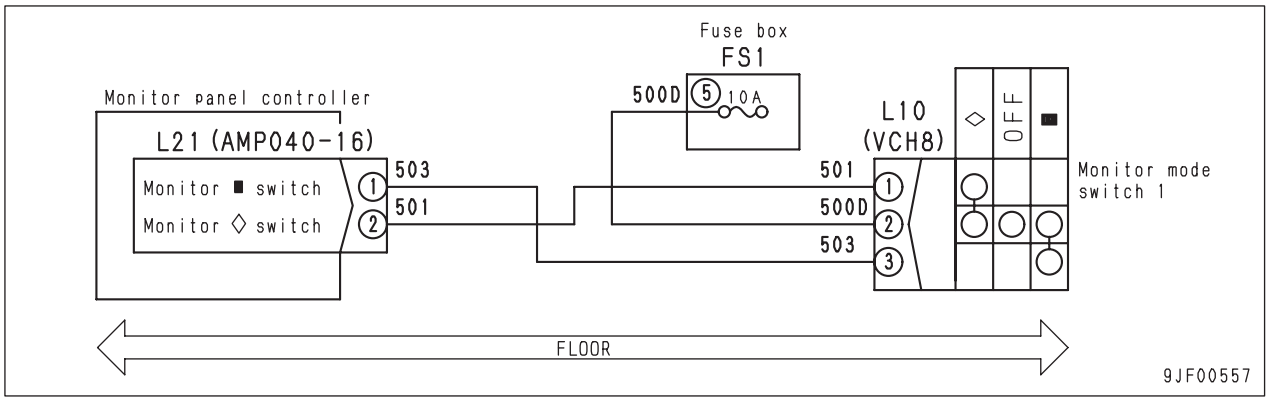


# Error Code [DD15LD] (Monitor panel mode selector switch 1 [■] (Panel switch 1) input error (LD))

| Action Code | Error Code | Controller Code | Trouble | Monitor panel mode selector switch 1 [■] (Panel switch 1) input error (LD) |
|---|---|---|---|---|
| E01 | DD15LD | MON | | |
| Description of Trouble | • The monitor panel mode selector switch 1 [■] (Panel switch 1) input circuit is always in the CLOSE state for more one minute. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The monitor does not work. | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | 1 | Defective monitor panel mode selector switch 1 [■] | 1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter. | | | |
| | | | Between L10 (Female) (2) and (3) | When monitor panel mode selector switch 1 [■] is turned ON. | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |
| | 2 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10. 3) Connect T-adapter. 4) Turn starting switch ON. | | | |
| | | | Wiring harness between L21 (Female) (1) and L10 (Female) (3) | Voltage between L21 (Female) (1), L10 (Female) (3) and chassis ground | | 1V and below |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (1) and chassis ground | When monitor panel mode selector switch 1 [■] is turned ON. | Voltage | 20 - 30V |
| | | | | Other than above. | Voltage | 1V and below |

**Related circuit diagram**

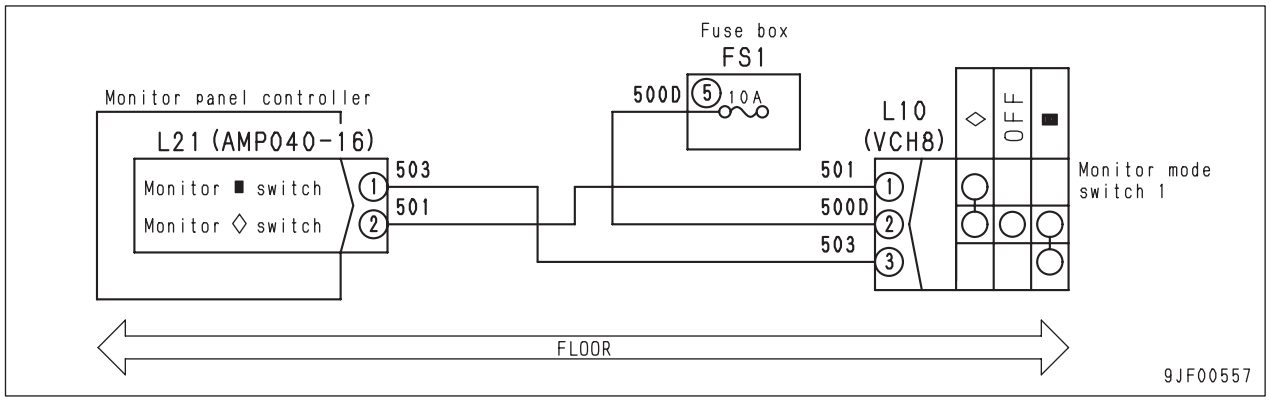


# Error Code [DD16LD] (Monitor panel mode selector switch 1 [◇] (Panel switch 2) input error (LD))

| Action Code | Error Code | Controller Code | Trouble | Monitor panel mode selector switch 1 [◇] (Panel switch 2) input error (LD) |
|---|---|---|---|---|
| E01 | DD16LD | MON | | |
| Description of Trouble | • The monitor panel mode selector switch 1 [◇] (Panel switch 2) input circuit is always in the CLOSE state for more one minute. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The monitor does not work. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective monitor panel mode selector switch 1 [◇] | 1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter. | | | |
| | | | Between L10 (Female) (2) and (1) | When monitor panel mode selector switch 1 [◇] is turned ON. | Resistance | 1Ω and below |
| | | | | Other than above. | Resistance | 1MΩ and above |
| | 2 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10. 3) Connect T-adapter. 4) Turn starting switch ON. | | | |
| | | | Wiring harness between L21 (Female) (2) and L10 (Female) (1) | Voltage between L21 (Female) (2), L10 (Female) (1) and chassis ground | | 1V and below |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (2) and chassis ground | When monitor panel mode selector switch 1 [◇] is turned ON. | Voltage | 20 - 30V |
| | | | | Other than above. | Voltage | 1V and below |

**Related circuit diagram**

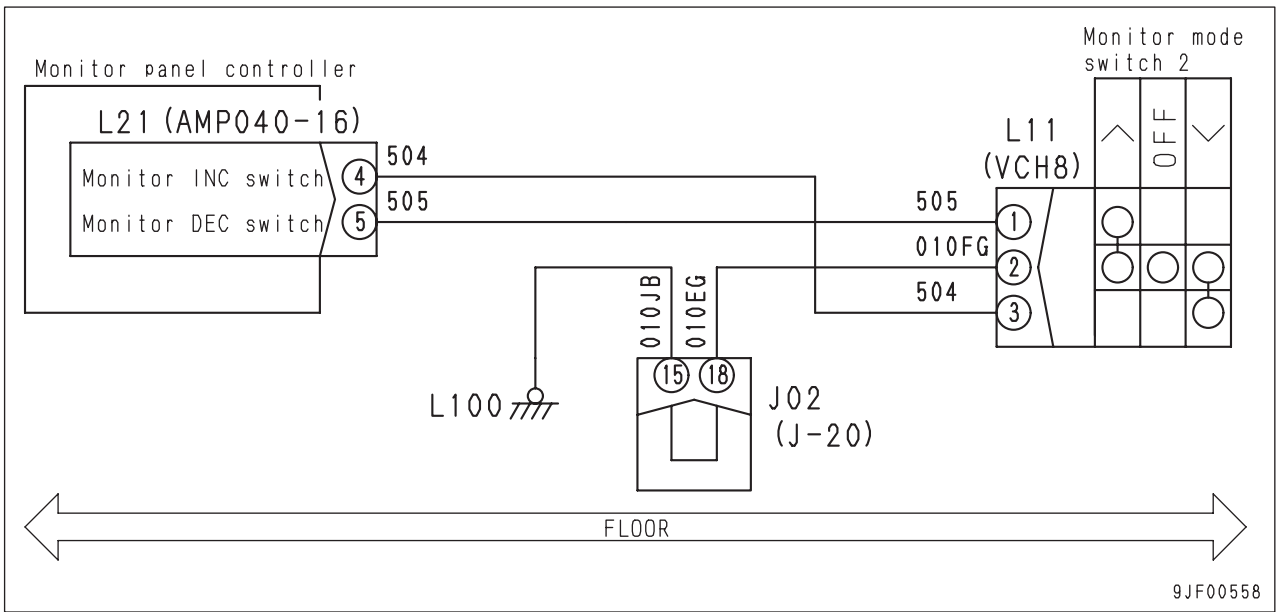


# Error Code [DD17LD] (Monitor panel mode selector switch 2 [<] (Panel switch 3) input error (LD))

| Action Code | Error Code | Controller Code | Trouble | Monitor panel mode selector switch 2 [<] (Panel switch 3) input error (LD) |
|---|---|---|---|---|
| E01 | DD17LD | MON | | |
| Description of Trouble | • The monitor panel mode selector switch 2 [<] (Panel switch 3) input circuit is always in the CLOSE state for more one minute. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The monitor does not work. | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | 1 | Defective monitor panel mode selector switch 2 [<] | 1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter. | | | |
| | | | Between L11 (Female) (2) and (3) | When monitor panel mode selector switch 2 [<] is turned ON. | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. 4) Turn starting switch ON. | | | |
| | | | Wiring harness between L21 (Female) (4) and L11 (Female) (3) | Resistance between L21 (Female) (4), L11 (Female) (3) and chassis ground | | 1M✕ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (4) and chassis ground | When monitor panel mode selector switch 2 [<] is turned ON. | Voltage | 1V and below |
| | | | | Other than above. | Voltage | 20 - 30V |

**Related circuit diagram**

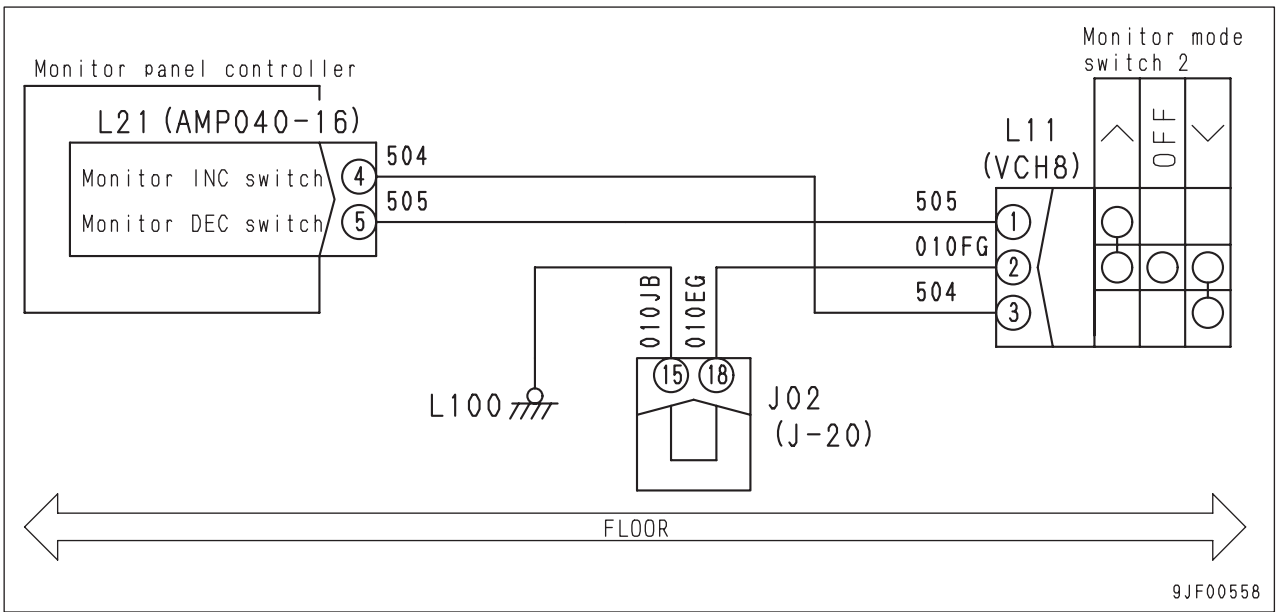


# Error Code [DD18LD] (Monitor panel mode selector switch 2 [>] (Panel switch 4) input error (LD))

| Action Code | Error Code | Controller Code | Trouble | Monitor panel mode selector switch 2 [>] (Panel switch 4) input error (LD) |
|---|---|---|---|---|
| E01 | DD18LD | MON | | |
| Description of Trouble | • The monitor panel mode selector switch 2 [>] (Panel switch 4) input circuit is always in the CLOSE state for more one minute. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The monitor does not work. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective monitor panel mode selector switch 2 [>]. | 1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter. | | | |
| | | | Between L11 (Female) (2) and (1) | When monitor panel mode selector switch 2 [>] is turned ON. | Resistance | 1Ω and below |
| | | | | Other than above. | Resistance | 1MΩ and above |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. 4) Turn starting switch ON. | | | |
| | | | Wiring harness between L21 (Female) (5) and L11 (Female) (1) | Resistance between L21 (Female) (5), L11 (Female) (1) and chassis ground | | 1MΩ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (5) and chassis ground | When monitor panel mode selector switch 2 [>] is turned ON. | Voltage | 1V and below |
| | | | | Other than above. | Voltage | 20 - 30V |

**Related circuit diagram**

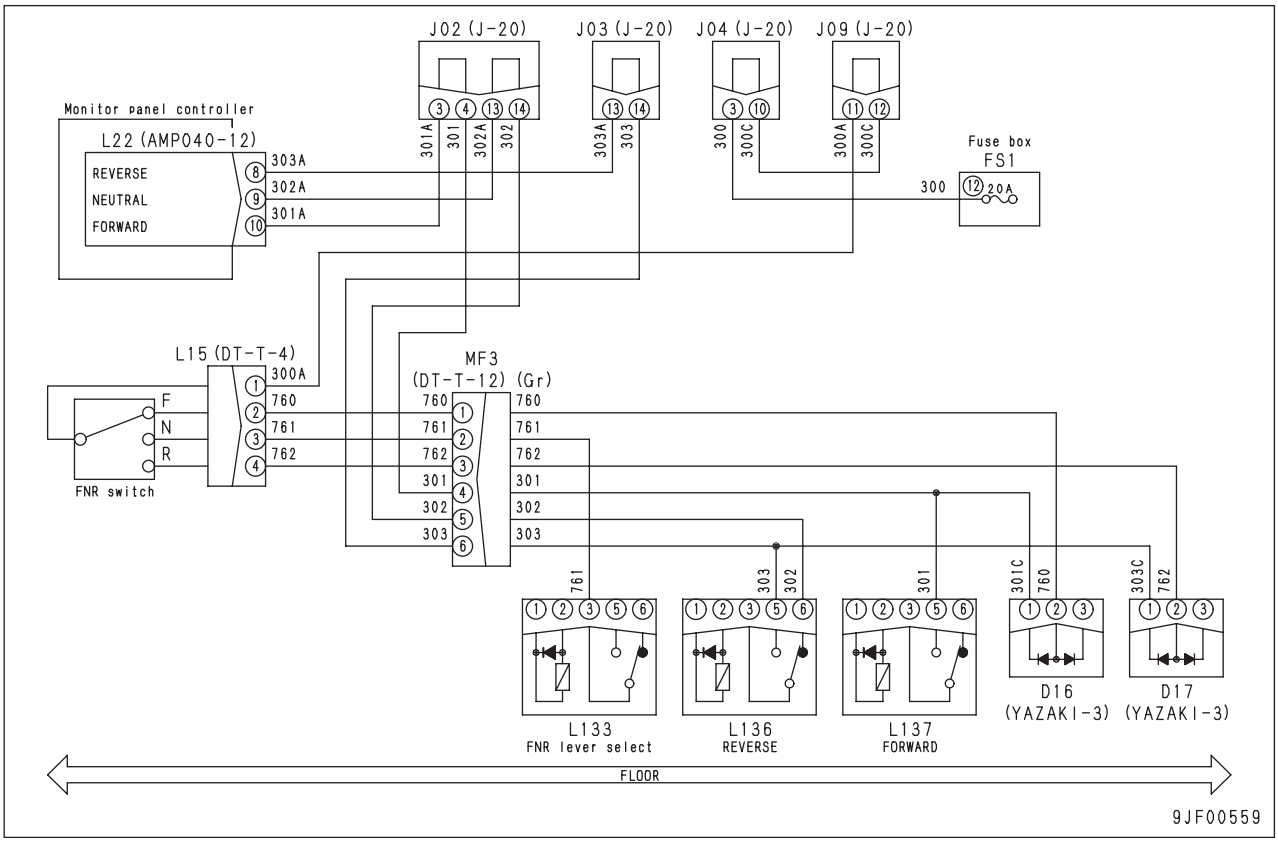


# Error Code [DDK3KB] (Multiple shift lever FR signal input (KB))

| Action Code | Error Code | Controller Code | Trouble | Multiple shift lever FR signal input (KB) |
|---|---|---|---|---|
| E03 | DDK3KB | MON | | |
| Description of Trouble | • Multiple signals (F and R signal) are input due to short-circuited FNR switch | | | |
| Machine monitor or controller Reaction | • Input signal is displayed as it is (F and R light up at same time).<br>• When engine is started, machine moves even when directional switch is at N position.<br>• Activates an alarm. | | | |
| Effect on Machine | • Does not travel.<br>• The power train may be damaged. | | | |
| Related Information | | | | |

| Causes | | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect Connectors L22, L15. 3) Connect T-adapter. 4) Turn starting switch ON. | | | |
| | | | Wiring harness between L22 (Female) (10) and L15 (Female) (2) | Voltage between L22 (Female) (10), L15 (Female) (2) and chassis ground | | 1V and below |
| | | | Wiring harness between L22 (Female) (8) and L15 (Female) (4) | Voltage between L22 (Female) (8), L15 (Female) (4) and chassis ground | | 1V and below |
| | 2 | Defective FNR switch | 1) Turn starting switch OFF. 2) Disconnect connector L15. 3) Connect T-adapter. | | | |
| | | | Between L15 (Female) (1) and (2) | When FNR switch is turned F. | Resistance | 1Ω and below |
| | | | | Other than above. | Resistance | 1MΩ and above |
| | | | Between L15 (Female) (1) and (4) | When FNR switch is turned R. | Resistance | 1Ω and below |
| | | | | Other than above. | Resistance | 1MΩ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L22. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L15 (Female) (1) and (2) | When FNR switch is turned F. | Voltage | 20 - 30V |
| | | | | Other than above. | Voltage | 1V and below |
| | | | Between L15 (Female) (1) and (4) | When FNR switch is turned R. | Voltage | 20 - 30V |
| | | | | Other than above. | Voltage | 1V and below |

**Related circuit diagram**

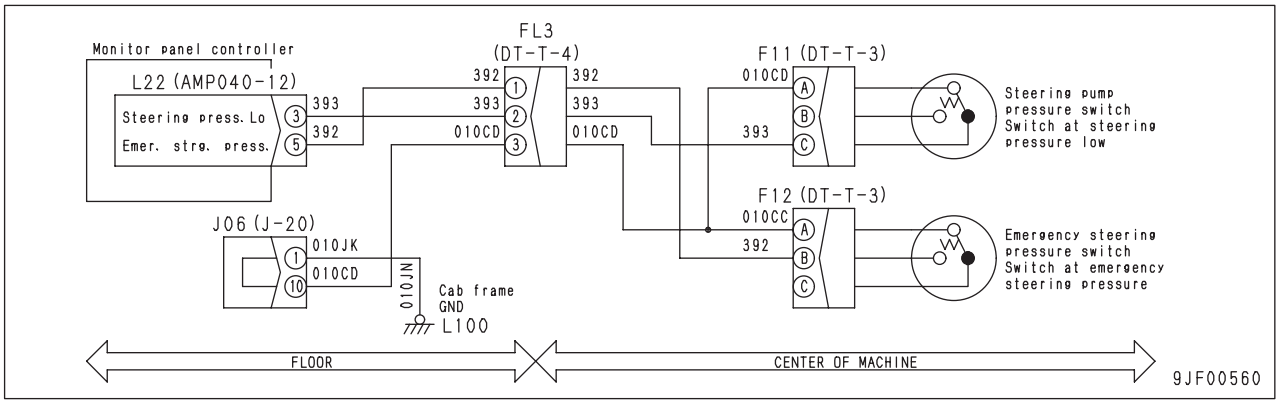


# Error Code [DDS5L6] (Decreased steering oil pressure (L6))

| Action Code | Error Code | Controller Code | Trouble | Decreased steering oil pressure (L6) |
|---|---|---|---|---|
| E03 | DDS5L6 | MON | | |
| Description of Trouble | • The steering oil pressure sensor signal circuit is always in the CLOSE state during the engine is revolved. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The steering may be not worked if operation continues. | | | |
| Related Information | • This warning is given when the emergency steering (option) is installed. | | | |

| Possible Causes and Standard Values | | Causes | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | 1 | Decrease steering oil pressure | • Steering oil pressure is normal.<br>★ If the oil pressure is not normal, carry out troubleshooting for the hydraulic, mechanical system. | | | |
| | 2 | Defective steering oil pressure sensor (switch) | 1) Turn starting switch OFF. 2) Disconnect connector F11. 3) Connect T-adapter. | | | |
| | | | Between F11 (Male) (A) and (C) | Steering oil pressure is low (Engine stopped). | Resistance | 1✕ and below |
| | | | | Steering oil pressure is normal (Engine started). | Resistance | 1M✕ and above |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L22, F11. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L22 (Female) (3) and F11 (Female) (C) | Resistance between L22 (Female) (3), F11 (Female) (C) and chassis ground | | 1M✕ and above |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L22. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L22 (Female) (3) and Chassis ground | Steering oil pressure is normal. | Voltage | 20 - 30V |
| | | | | Steering oil pressure is abnormal (low). | Voltage | 1V and below |

**Related circuit diagram**

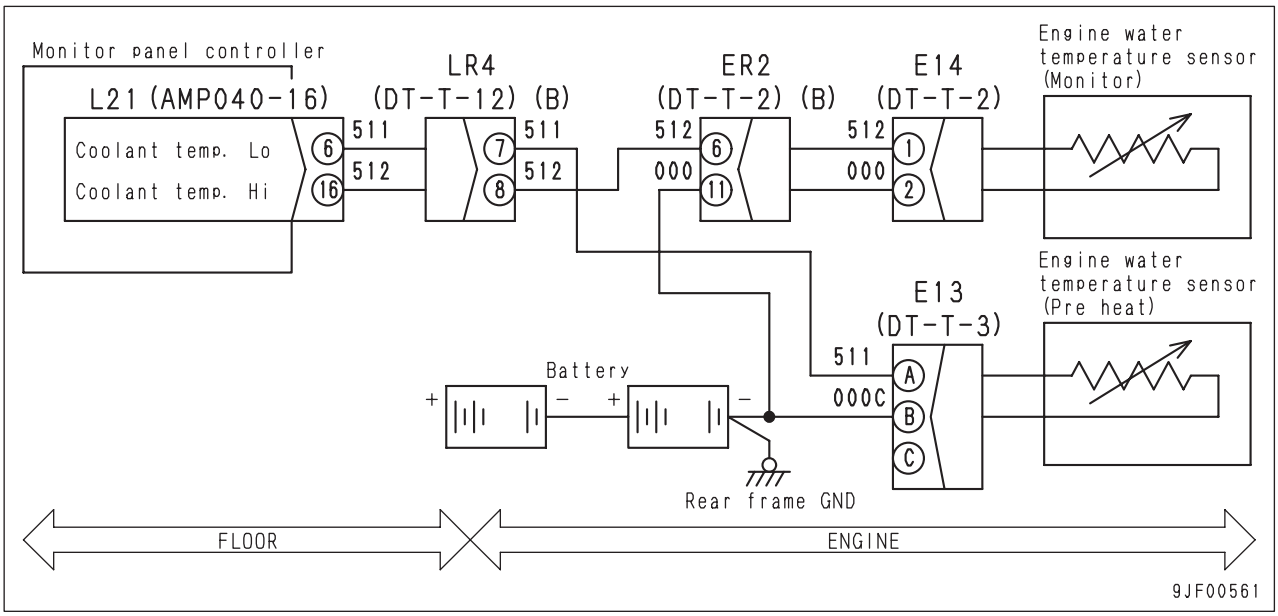


# Error Code [DGE2KX] (Engine water temperature (High temperature) sensor system failure (KX))

| Action Code | Error Code | Controller Code | Trouble | Engine water temperature (High temperature) sensor system failure (KX) |
|---|---|---|---|---|
| E01 | DGE2KX | MON | | |
| Description of Trouble | • The engine water temperature is more than 150°C (The engine water temperature sensor input voltage is less 0.98V) | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The engine water temperature gauge is in the MAX position. | | | |
| Related Information | • The engine water temperature is displayed by real-time monitoring code 04101. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective engine water temperature (High temperature) sensor | 1) Turn starting switch OFF. 2) Disconnect connector E14. 3) Connect T-adapter. | | | |
| | | | Between E14 (Male) (1) and (2) | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, E14. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (16) and E14 (Female) (1) | Resistance between L21 (Female) (16), E14 (Female) (1) and chassis ground | | 1MΩ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (16) and chassis ground | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |

### Related circuit diagram

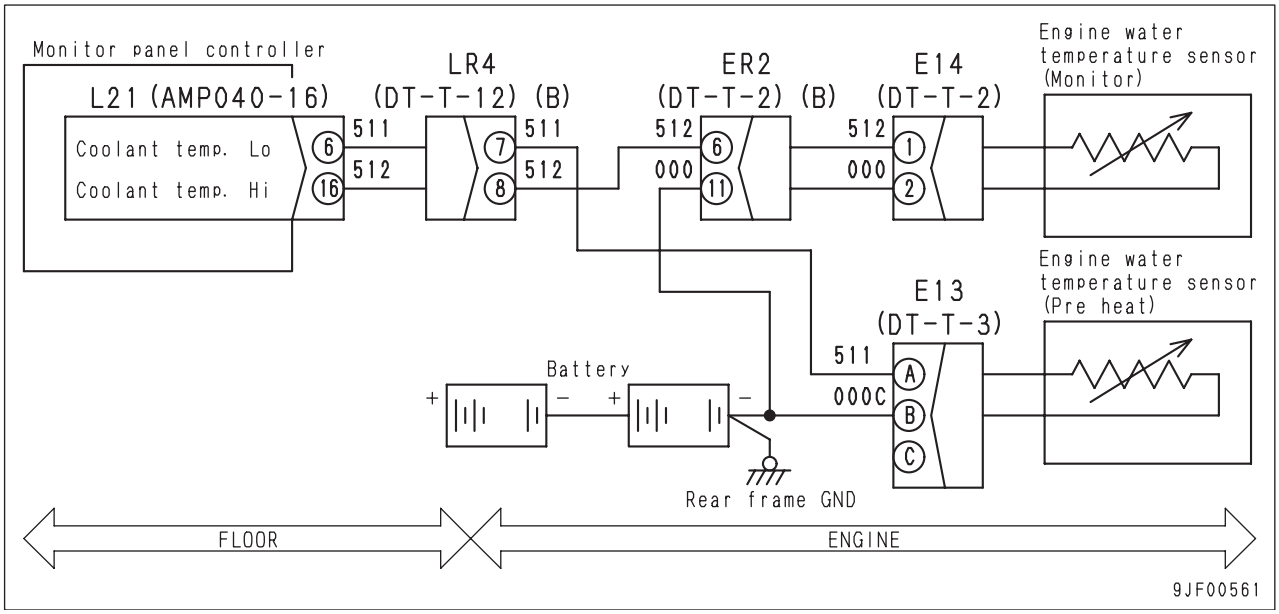


# Error Code [DGE3L6] (Engine water temperature (Low temperature) sensor system failure (L6))

| Action Code | Error Code | Controller Code | Trouble | Engine water temperature (Low temperature) sensor system failure (L6) |
|---|---|---|---|---|
| E01 | DGE3L6 | MON | | |
| Description of Trouble | • After starting the engine, and running it for more than 30 minutes, engine water temperature (low temperature) sensor signal becomes abnormal 4.5V | | | |
| Machine monitor or controller Reaction | • The Activates an alarm. | | | |
| Effect on Machine | • After starting switch is turned ON, system always carries out automatic preheating/post heating. | | | |
| Related Information | • The engine water temperature (low temperature) is displayed by real-time monitoring code 04101. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective engine water temperature (Low temperature) sensor | 1) Turn starting switch OFF. 2) Disconnect connector E13. 3) Connect T-adapter. | | | |
| | | | Between E13 (Male) (A) and (B) | Normal temperature (25°C). | Resistance | 3.1 - 5.7kΩ |
| | | | | When 100°C | Resistance | 0.2 - 0.7kΩ |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, E13. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (6) and E13 (Female) (A) | | Resistance | 1MΩ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (6) and chassis ground | Normal temperature (25°C). | Resistance | 3.1 - 5.7kΩ |
| | | | | When 100°C | Resistance | 0.2 - 0.7kΩ |

**Related circuit diagram**

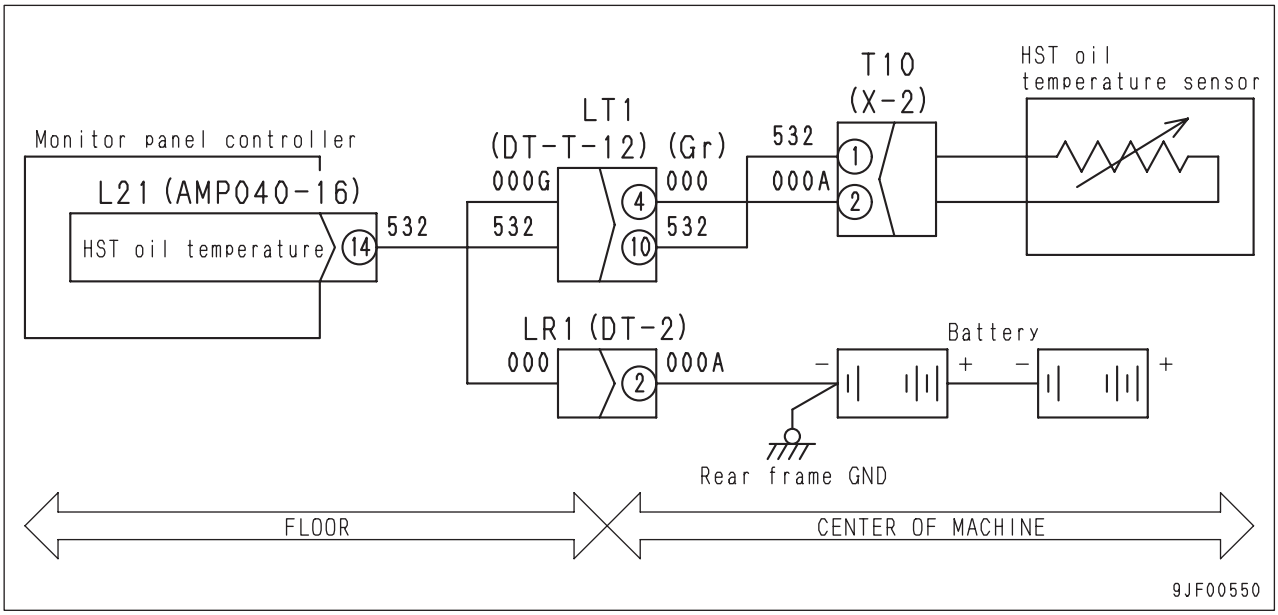


# Error Code [DGH1KX] (HST oil temperature sensor system failure (KX))

| Action Code | Error Code | Controller Code | Trouble | HST oil temperature sensor system failure (KX) |
|---|---|---|---|---|
| E01 | DGH1KX | MON | | |
| Description of Trouble | • The HST oil temperature is more than 150°C (The HST oil temperature sensor input voltage is less 0.98V) | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The HST oil temperature gauge is in the MAX position. | | | |
| Related Information | • The HST oil temperature is displayed by real-time monitoring code 30100. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective HST oil temperature sensor | 1) Turn starting switch OFF. 2) Disconnect connector T10. 3) Connect T-adapter. | | | |
| | | | Between T10 (Male) (1) and (2) | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, T10. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (14) and T10 (Female) (1) | Resistance between L21 (Female) (14), T10 (Female) (1) and chassis ground | | 1MΩ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (14) and chassis ground | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |

**Related circuit diagram**

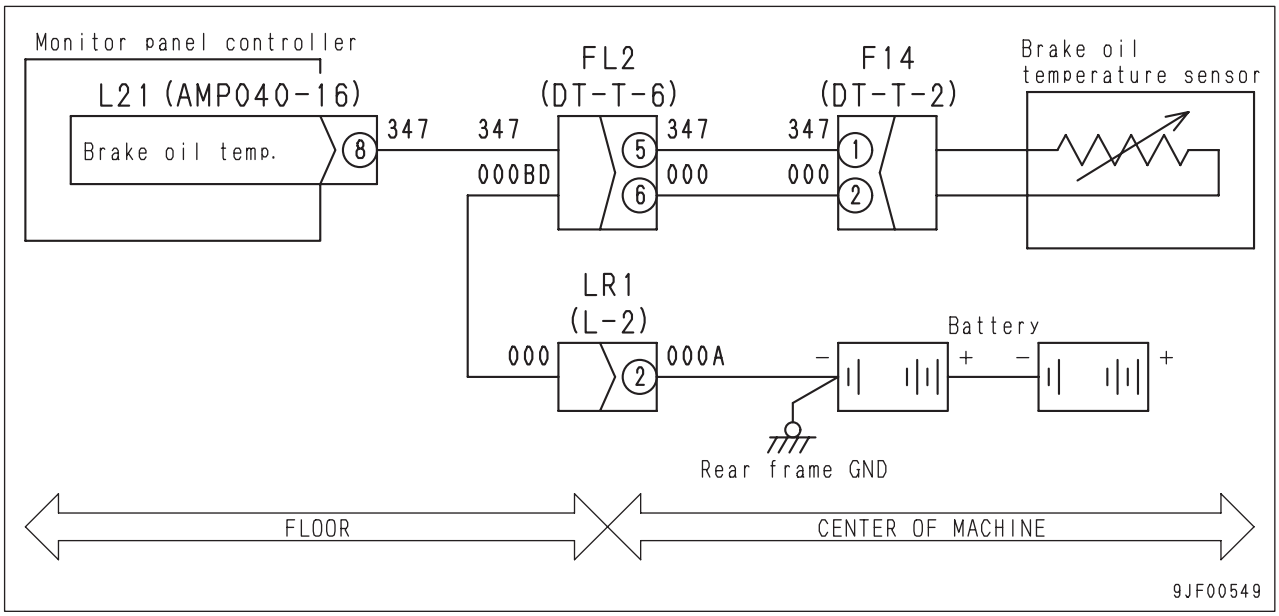


# Error Code [DGR1KX] (Brake oil temperature sensor system short-circuiting (KX))

| Action Code | Error Code | Controller Code | Trouble | Brake oil temperature sensor system short-circuiting (KX) |
|---|---|---|---|---|
| E01 | DGR1KX | MON | | |
| Description of Trouble | • The brake oil temperature is more than 150°C (The brake oil temperature sensor input voltage is less 0.98V) | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The brake cooling oil temperature is displayed by real-time monitoring code 30202. | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | 1 | Defective brake oil temperature sensor | 1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter. | | | |
| | | | Between F14 (Male) (1) and (2) | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, F14. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (8) and F14 (Female) (1) | Resistance between L21 (Female) (8), F14 (Female) (1) and chassis ground | | 1MΩ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (8) and chassis ground | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |

**Related circuit diagram**

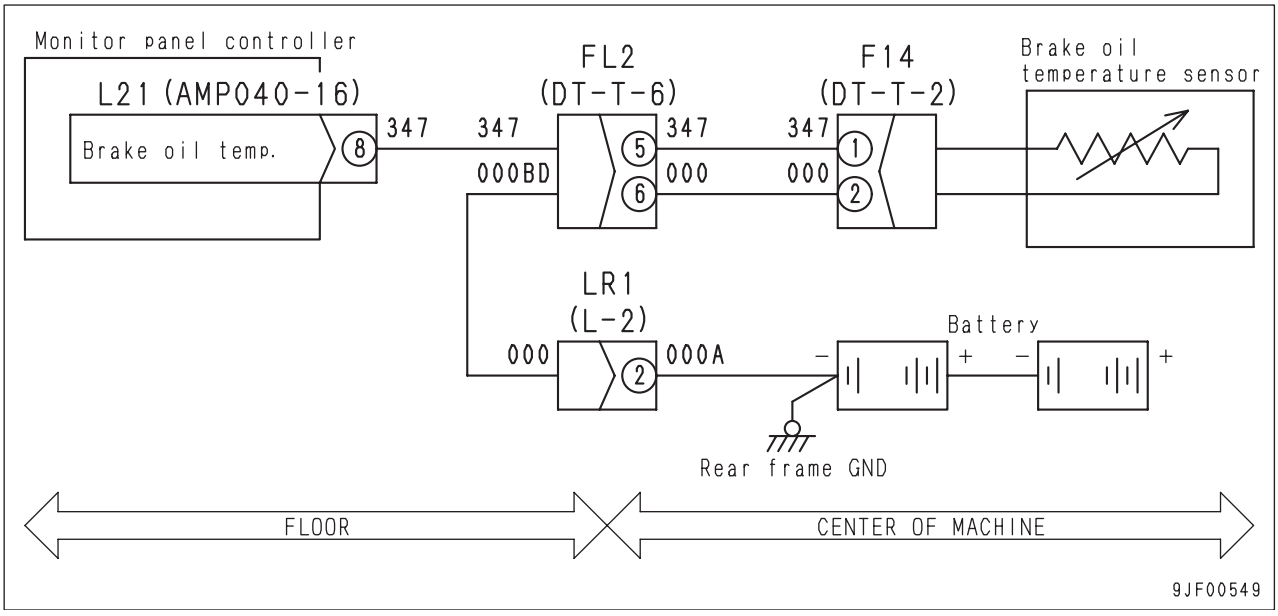


# Error Code [DGR4KA] (Brake oil temperature sensor system discontinuity (KA))

| Action Code | Error Code | Controller Code | Trouble | Brake oil temperature sensor system discontinuity (KA) |
|---|---|---|---|---|
| E01 | DGR4KA | MON | | |
| Description of Trouble | • The brake oil temperature is less than 30°C. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The brake cooling oil temperature is displayed by real-time monitoring code 30202. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective brake oil temperature sensor | 1) Turn starting switch OFF. 2) Disconnect connector F14. 3) Connect T-adapter. | | | |
| | | | Between F14 (Male) (1) and (2) | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, F14. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (8) and F14 (Female) (1) | | Resistance | 1Ω and below |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (8) and chassis ground | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |

**Related circuit diagram**

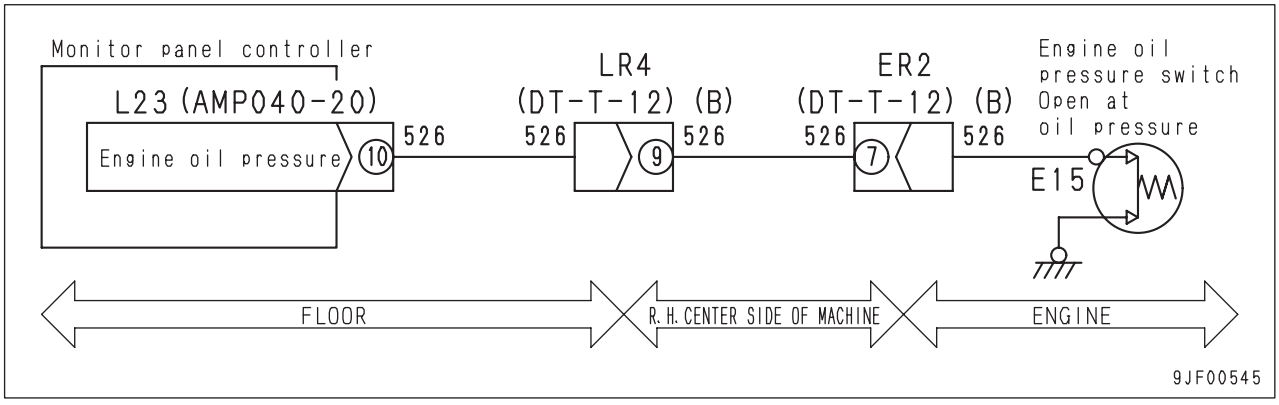


# Error Code [DHE4KA] (Engine oil pressure sensor system discontinuity (KA))

| Action Code | Error Code | Controller Code | Trouble | Engine oil pressure sensor system discontinuity (KA) |
|---|---|---|---|---|
| E01 | DHE4KA | MON | | |
| Description of Trouble | • The engine oil pressure sensor circuit is always in the CLOSE state when the engine is stopped. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective engine oil pressure sensor (switch) | 1) Turn starting switch OFF. 2) Disconnect connector E15. 3) Connect T-adapter. | | | |
| | | | Between engine oil pressure sensor terminal E15 and chassis ground | Engine stopped. | Resistance | 1Ω and below |
| | | | | Engine rotating. | Resistance | 1MΩ and above |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L22, E15. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (10) and E15 (Female) (C) | | Resistance | 1Ω and below |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L23 (Female) (10) and Chassis ground | Engine stopped. | Voltage | 1V and below |
| | | | | Engine rotating. | Voltage | 20 - 30V |

**Related circuit diagram**



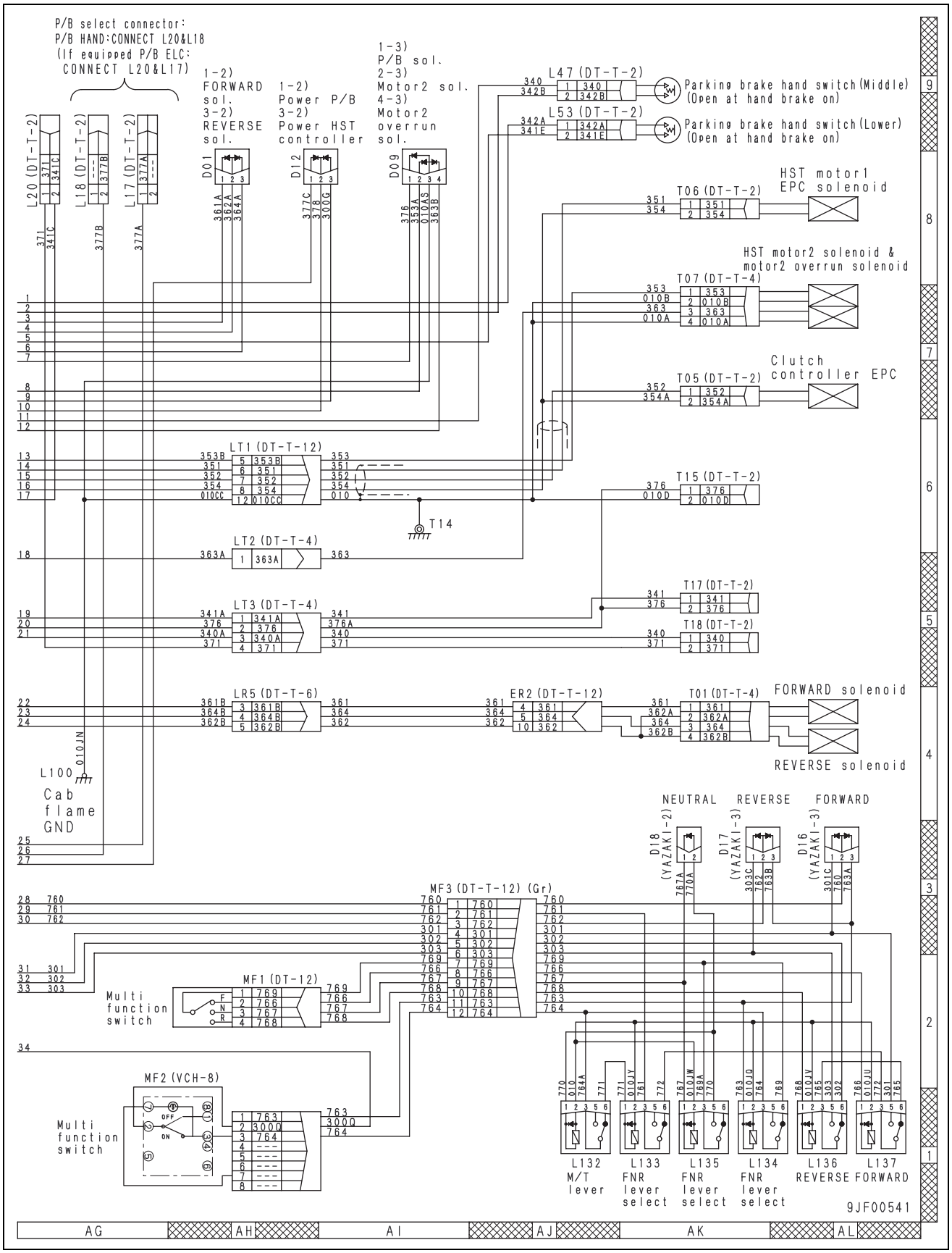
# Troubleshooting Code [MON-1] (The parking brake indicator lamp does not light ON)

| Action Code | Error Code | Controller Code | Trouble | The parking brake indicator lamp does not light ON |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The parking brake indicator lamp does not light ON when the parking brake switch is turned ON. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The parking brake indicator lamp does not light ON when the parking brake switch is turned ON. | | | |
| Related Information | • If the parking brake does not work normally, carry out troubleshooting after carrying out the applicable troubleshooting. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective parking brake indicator lamp relay (L104) | 1) Turn starting switch OFF. 2) Interchange relay (L104) with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch. | | | |
| | | | Does condition become normal when parking brake indicator lamp relay (L104) is interchanged with normal relay? | The condition is abnormal. | | Relay (L104) is normal. |
| | | | | The condition is normal. | | Defective relay (L104) |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check. | | | |
| | | | Between L104 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check. 4) Applies impressed voltage between L104 (Male) (1) - (2) | | | |
| | | | Between L104 (Male) (3) and (5) | Applies 24V impressed voltage between L104 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L104 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 2 | Defective parking brake lever middle position detection switch (Mechanical type) | 1) Turn starting switch OFF. 2) Disconnect connector L47. 3) Connect T-adapter. | | | |
| | | | Between L47 (Male) (1) and (2) | Parking brake lever is placed LOCK to MIDDLE. | Resistance | 1Ω and below |
| | | | | Parking brake lever is placed MIDDLE to FREE. | Resistance | 1MΩ and above |
| | 3 | Defective parking brake lever lowest position detection switch (Mechanical type) | 1) Turn starting switch OFF. 2) Disconnect connector L53. 3) Connect T-adapter. | | | |
| | | | Between L53 (Male) (1) and (2) | Set parking brake lever to bottom position. | Resistance | 1Ω and below |
| | | | | Set parking brake lever to any position other than bottom position. | Resistance | 1MΩ and above |
| | 4 | Defective parking brake indicator lamp switch (Electrical type) | 1) Turn starting switch OFF. 2) Disconnect connector T18. 3) Connect T-adapter. | | | |
| | | | Between T18 (Male) (1) and (2) | Brake air pressure: 5.88MPa {60kg/cm$^2$} and above | Resistance | 1Ω and below |
| | | | | Brake air pressure: 3.92MPa {40kg/cm$^2$} and below | Resistance | 1MΩ and above |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 5 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, L53, L104 and fuse T18. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (18) and L104 (Female) (6) | | Resistance | 1Ω and below |
| | | | Wiring harness between L104 (Female) (3) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between L104 (Female) (2) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between L104 (Female) (1) and J12 (Female) (7) | | Resistance | 1Ω and below |
| | | | Wiring harness between J12 (Female) (9) and J10 (Female) (15) | | Resistance | 1Ω and below |
| | | | Wiring harness between J10 (Female) (19) and L53 (Female) (2) | | Resistance | 1Ω and below |
| | | | Wiring harness between L53 (Female) (1) and J12 (Female) (5) | | Resistance | 1Ω and below |
| | 6 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector T13. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (18) and L104 (Female) (5) * | Resistance between L23 (Female) (18), L104 (Female) (5) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L104 (Female) (1) and J12 (Female) (7) | Resistance between L104 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between T18 (Female) (1) and fuse FS1 (4) | Resistance between T18 (Female) (1), fuse FS1 (4) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between J12 (Female) (9) and J10 (Female) (15) | Resistance between J10 (Female) (15) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between J10 (Female) (19) and L53 (Female) (2) | Resistance between L53 (Female) (2) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L53 (Female) (1) and J12 (Female) (5), (6) and L47 (Female) (2) | Resistance between L53 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L47 (Female) (1) and fuse FS1 (4) | Resistance between L47 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | ★ In the above case (Other than marked mark (*)), the fuse is blown. | | | |
| | 7 | Defective junction connector (J10) and (J12) | Carry out inspection, and if any abnormality is found, repair or replace. | | | |
| | 8 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L23 (Female) (18) and chassis ground | Parking brake lever is placed PARKING. | Voltage | 1V and below |
| | | | | Parking brake lever is placed other than FREE. | Voltage | 20 - 30V |

**Related circuit diagram**

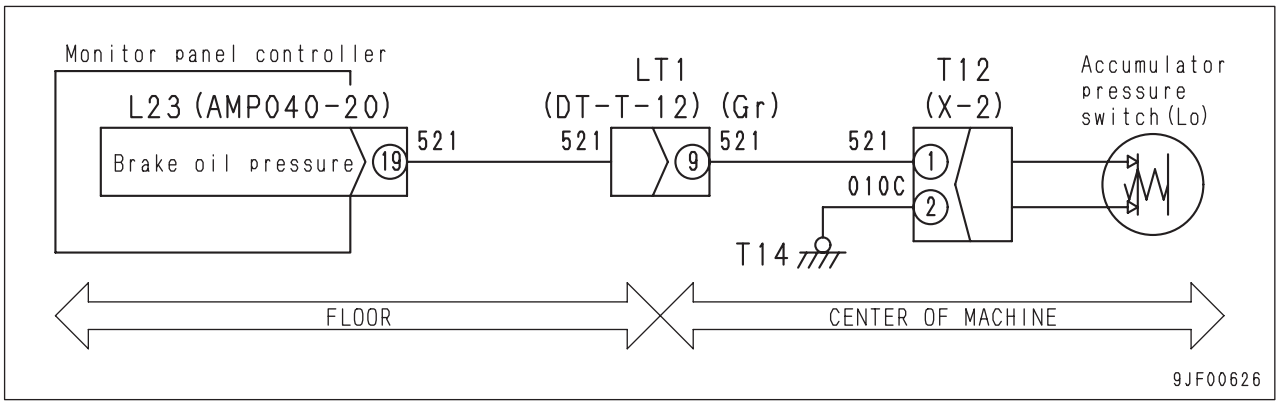


# Troubleshooting Code [MON-2] (The brake oil pressure caution lamp does not light ON)

| Action Code | Error Code | Controller Code | Trouble | The brake oil pressure caution lamp does not light ON |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The brake oil pressure sensor signal circuit is always in the CLOSE state. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The brake oil pressure caution lamp does not light ON when accumulator oil pressure is decreased. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective accumulator oil pressure sensor | 1) Turn starting switch OFF. 2) Disconnect connector T12. 3) Connect T-adapter. | | | |
| | | | Between T12 (Male) (1) and (2) | Brake oil pressure is normal (When 5.88MPa {60kg/cm$^2$} and above). | Resistance | 1Ω and below |
| | | | | Steering oil pressure is abnormal (When 3.92MPa {40kg/cm$^2$} and below). | Resistance | 1MΩ and above |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, T12. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (19) and T12 (Female) (1) | Resistance between L23 (Female) (19), T12 (Female) (1) and chassis ground | | 1MΩ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Insert T-adapter. 4) Connect connector. 5) Start engine. | | | |
| | | | Between L23 (Female) (19) and Chassis ground | Brake oil pressure is normal (When 5.88MPa {60kg/cm$^2$} and above). | Voltage | 1V and below |
| | | | | Steering oil pressure is abnormal (When 3.92MPa {40kg/cm$^2$} and below). | Voltage | 20 - 30V |

**Related circuit diagram**

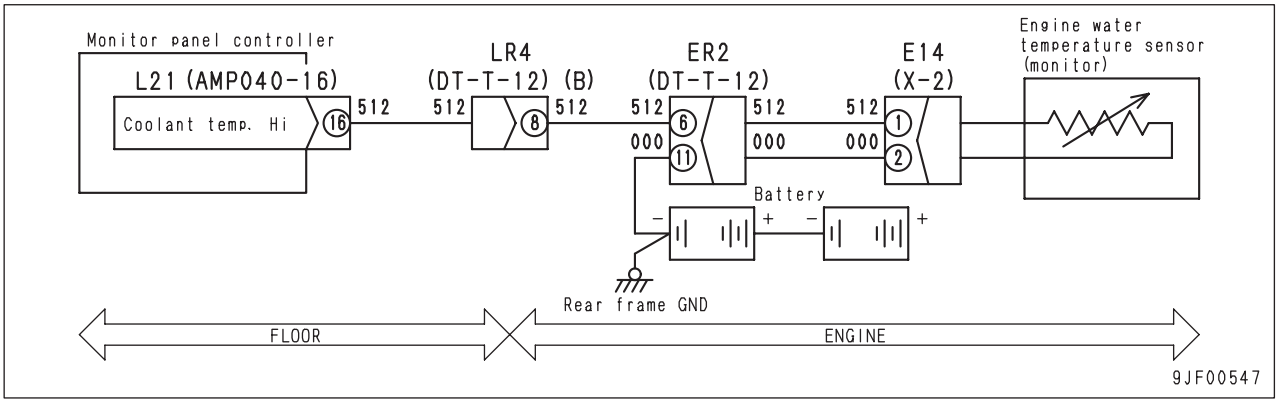


# Troubleshooting Code [MON-3] (The engine water temperature caution lamp does not light ON, or after the engine starts, the engine water temperature gauge does not rise. )

| Action Code | Error Code | Controller Code | Trouble | The engine water temperature caution lamp does not light ON, or after the engine starts, the engine water temperature gauge does not rise. |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The engine water temperature sensor circuit is always in the OPEN state. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The engine water temperature caution lamp does not light ON.<br>• After the engine starts, the engine water temperature gauge does not rise. | | | |
| Related Information | • The engine water temperature is displayed by real-time monitoring code 04101. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective engine water temperature sensor | 1) Turn starting switch OFF. 2) Disconnect connector E14. 3) Connect T-adapter. | | | |
| | | | Between E14 (Male) (1) and (2) | Normal temperature (25°C) | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, E14. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (16) and E14 (Female) (1) | | Resistance | 1MΩ and above |
| | | | Wiring harness between E14 (Female) (2) and chassis ground | | Resistance | 1MΩ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Connect T-adapter. | | | |
| | | | Between L21 (Female) (16) and Chassis ground | Normal temperature (25°C) | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |

**Related circuit diagram**

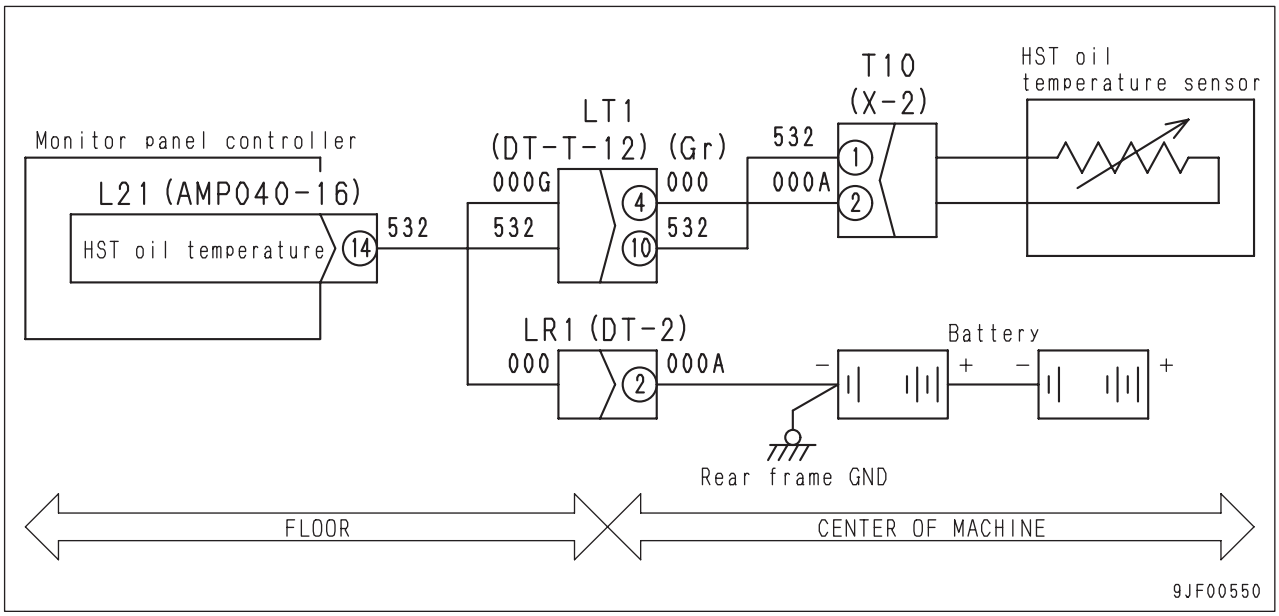


# Troubleshooting Code [MON-4] (The HST oil temperature caution lamp does not light ON, or after the engine starts, the HST oil temperature gauge does not rise. )

| Action Code | Error Code | Controller Code | Trouble | The HST oil temperature caution lamp does not light ON, or after the engine starts, the HST oil temperature gauge does not rise. |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The HST oil temperature sensor circuit is always in the OPEN state. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The HST oil temperature caution lamp does not light ON.<br>• After the engine starts, the HST oil temperature gauge does not rise. | | | |
| Related Information | • The HST oil temperature is displayed by real-time monitoring code 30100. | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | 1 | Defective HST oil temperature sensor | 1) Turn starting switch OFF. 2) Disconnect connector T10. 3) Connect T-adapter. | | | |
| | | | Between T10 (Male) (1) and (2) | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, T10. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (14) and T10 (Female) (1) | | Resistance | 1MΩ and above |
| | | | Wiring harness between T10 (Female) (2) and chassis ground | | Resistance | 1MΩ and above |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Connect T-adapter. | | | |
| | | | Between L21 (Female) (14) and Chassis ground | Normal temperature (25°C). | Resistance | 35 - 50kΩ |
| | | | | When 100°C | Resistance | 3.1 - 4.5kΩ |

**Related circuit diagram**

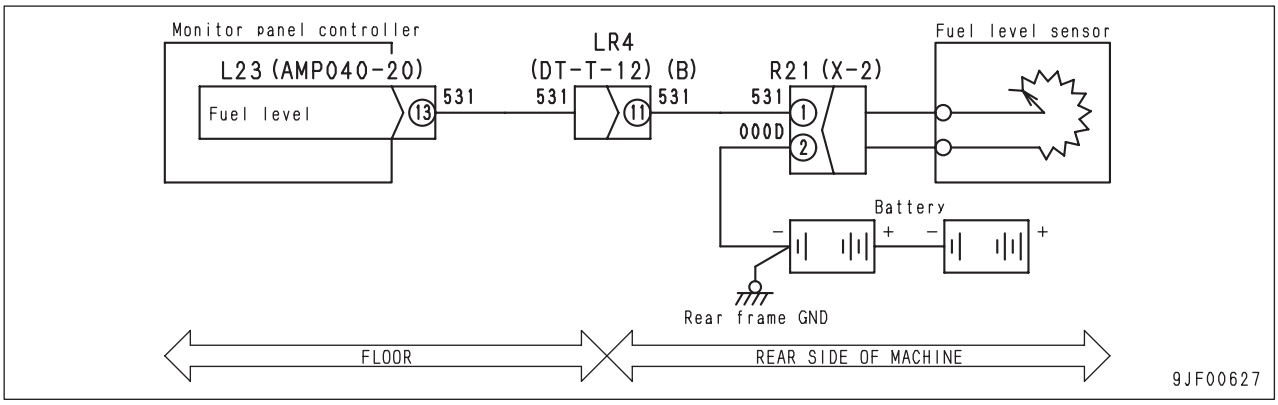


# Troubleshooting Code [MON-5] (The fuel level gauge does not rise or decrease. )

| Action Code | Error Code | Controller Code | Trouble | The fuel level gauge does not rise or decrease. |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • An abnormality has occurred in the fuel level sensor circuit. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The fuel level gauge does not rise or decrease. | | | |
| Related Information | • The fuel level is displayed by real-time monitoring code 04202. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective fuel level sensor | 1) Turn starting switch OFF. 2) Disconnect connector R21. 3) Connect T-adapter. | | | |
| | | | Between R21 (Male) (1) and (2) | FULL | Resistance | 9 - 11Ω |
| | | | | 1/2 LEVEL | Resistance | 29 - 35Ω |
| | | | | EMPTY | Resistance | 78 - 92Ω |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, R21. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (13) and R21 (Female) (1) | | Resistance | 1MΩ and above |
| | | | Wiring harness between R21 (Female) (2) and chassis ground | | Resistance | 1MΩ and above |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, R21. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (13) and R21 (Female) (1) | Resistance between L23 (Female) (13), R21 (Female) (1) and chassis ground | | 1Ω and below |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Connect T-adapter. | | | |
| | | | Between L23 (Female) (13) and Chassis ground | FULL | Resistance | 9 - 11Ω |
| | | | | 1/2 LEVEL | Resistance | 29 - 35Ω |
| | | | | EMPTY | Resistance | 78 - 92Ω |

### Related circuit diagram

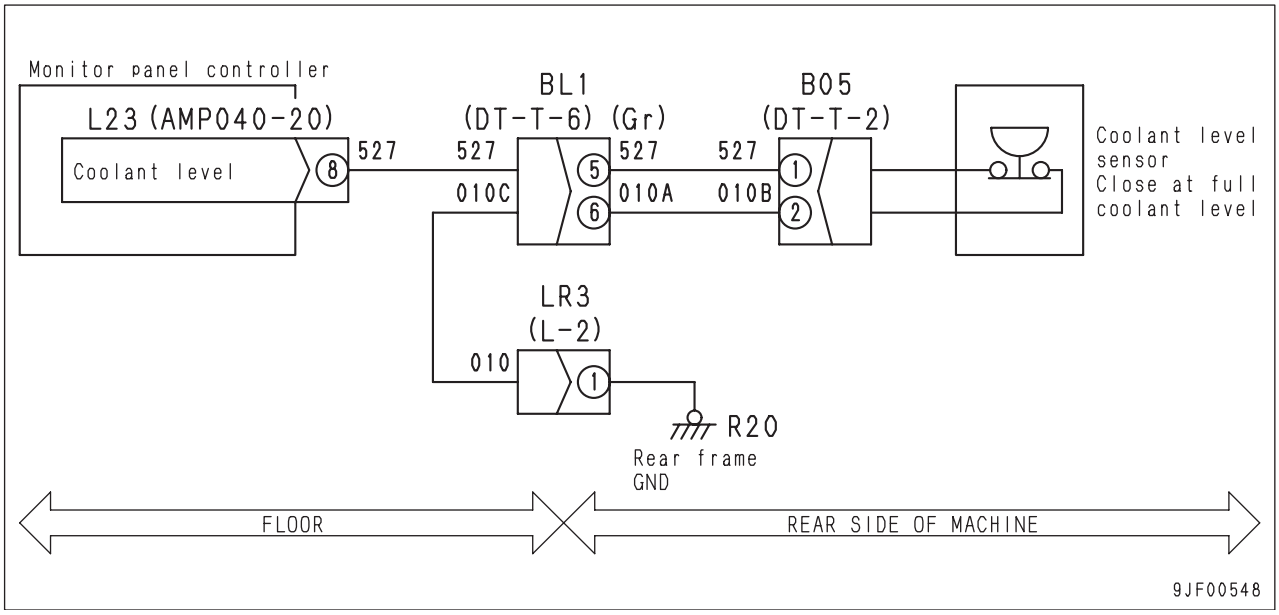


# Troubleshooting Code [MON-6] (The radiator coolant level caution lamp does not light ON)

| Action Code | Error Code | Controller Code | Trouble | The radiator coolant level caution lamp does not light ON |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The radiator coolant level sensor signal circuit is always in the CLOSE state. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The radiator coolant level caution lamp does not light ON, when the radiator coolant level (Coolant water volume) is insufficient. | | | |
| Related Information | • The engine water temperature is displayed by real-time monitoring code 04101. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective radiator coolant level sensor | 1) Turn starting switch OFF. 2) Disconnect connector B05. 3) Connect T-adapter. | | | |
| | | | Between B05 (Male) (1) and chassis ground | Reserve tank low level or more (Normal). | Resistance | 1✕ and below |
| | | | | Reserve tank low level or less (Abnormal). | Resistance | 1M✕ and above |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L23, B05. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L23 (Female) (8) and B05 (Female) (1) | Resistance between L23 (Female) (8), B05 (Female) (1) and chassis ground | Resistance | 1✕ and below |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L23. 3) Connect T-adapter. | | | |
| | | | Between L23 (Female) (8) and Chassis ground | Reserve tank low level or more (Normal). | Resistance | 1✕ and below |
| | | | | Reserve tank low level or less (Abnormal). | Resistance | 1M✕ and above |

**Related circuit diagram**

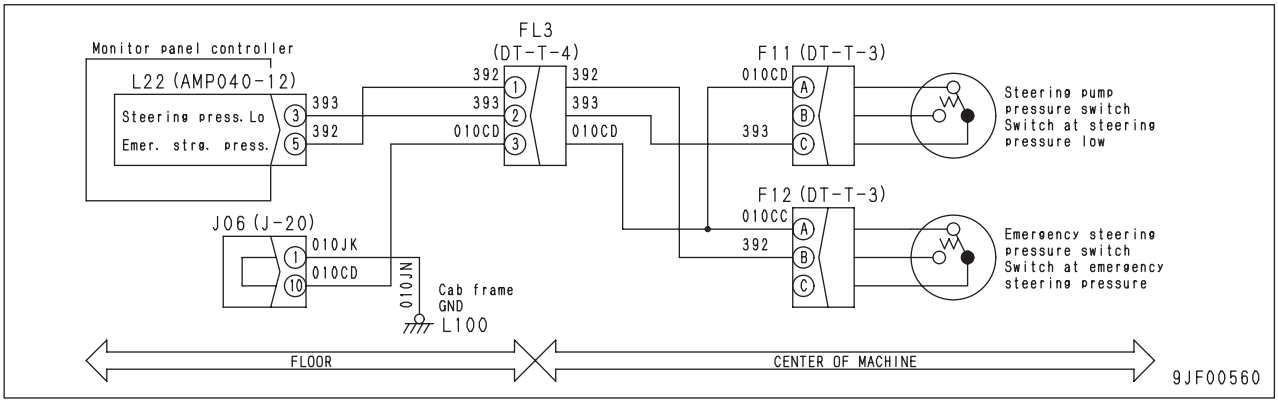


# Troubleshooting Code [MON-7] (The steering oil pressure caution lamp does not light ON)

| Action Code | Error Code | Controller Code | Trouble | The steering oil pressure caution lamp does not light ON |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The steering oil pressure sensor signal circuit is always in the CLOSE state during the engine is revolved. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The steering may be not worked if operation continues. | | | |
| Related Information | • This warning is given when the emergency steering (option) is installed. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective steering oil pressure sensor (switch) | 1) Turn starting switch OFF. 2) Disconnect Connectors L22, F11. 3) Connect T-adapter. | | | |
| | | | Between F11 (Male) (A) and (C) | Steering oil pressure is low (Engine stopped). | Resistance | 1Ω and below |
| | | | | Steering oil pressure is normal (Engine started). | Resistance | 1MΩ and above |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L22, F11. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L22 (Female) (3) and F11 (Female) (C) | | Resistance | 1Ω and below |
| | | | Wiring harness between F11 (Female) (A) and chassis ground | | Resistance | 1Ω and below |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L22. 3) Insert T-adapter. 4) Connect connector. 5) Start engine. | | | |
| | | | Between L22 (Female) (3) and Chassis ground | Steering oil pressure is low (Engine stopped). | Voltage | 1V and below |
| | | | | Steering oil pressure is normal (Engine started). | Voltage | 20 - 30V |

### Related circuit diagram

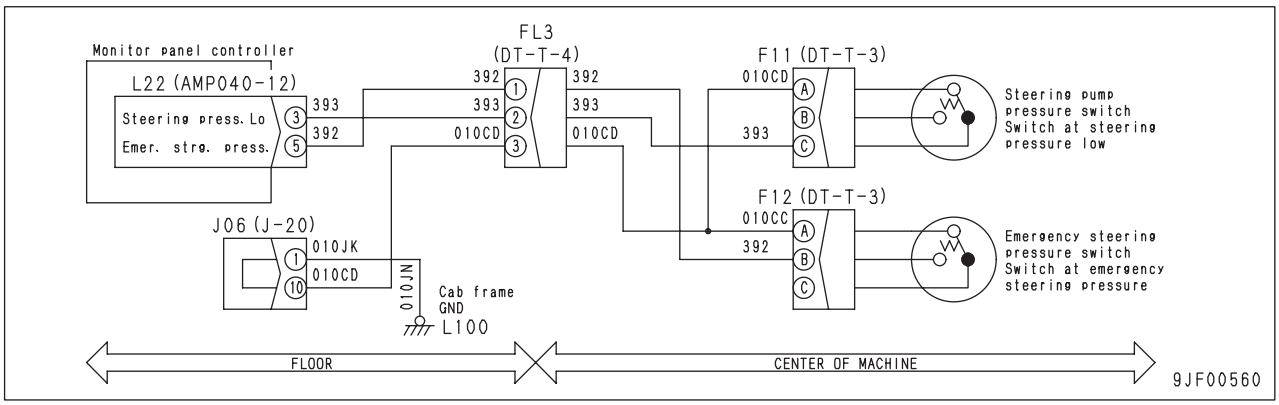


# Troubleshooting Code [MON-8] (The emergency steering oil pressure indicator lamp does not light ON)

| Action Code | Error Code | Controller Code | Trouble | The emergency steering oil pressure indicator lamp does not light ON |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The emergency steering oil pressure sensor circuit is always in the OPEN state during the engine is revolved. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The emergency steering does not work, so if the machine continues to be used, there is danger that the steering itself will stop working. | | | |
| Related Information | • This indicator lights up only when the emergency steering (option) is installed. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective steering oil pressure sensor (switch) | 1) Turn starting switch OFF. 2) Disconnect Connectors L22, F12. 3) Connect T-adapter. | | | |
| | | | Between F12 (Male) (A) and (B) | Steering oil pressure is low. | Resistance | 1✕ and below |
| | | | | Steering oil pressure is normal. | Resistance | 1M✕ and above |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L22, F12. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L22 (Female) (5) and F12 (Female) (B) | | Resistance | 1✕ and below |
| | | | Wiring harness between F12 (Female) (A) and chassis ground | | Resistance | 1✕ and below |
| | 3 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L22. 3) Insert T-adapter. 4) Connect connector. 5) Start engine. | | | |
| | | | Between L22 (Female) (5) and Chassis ground | Steering oil pressure is low. | Voltage | 1V and below |
| | | | | Steering oil pressure is normal. | Voltage | 20 - 30V |

**Related circuit diagram**

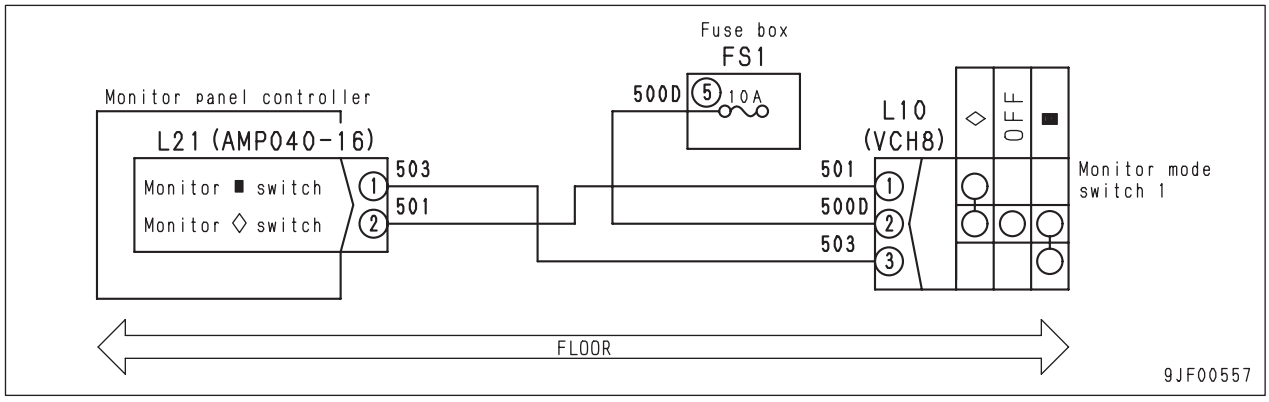


# Troubleshooting Code [MON-9] (Input failure in monitor panel mode selector switch 1 [■] (Panel switch 1))

| Action Code | Error Code | Controller Code | Trouble | Input failure in monitor panel mode selector switch 1 [■] (Panel switch 1) |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The monitor panel mode selector switch 1 [■] (Panel switch 1) input circuit is always in the OPEN state. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The monitor does not work. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective monitor panel mode selector switch 1 [■] | 1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter. | | | |
| | | | Between L10 (Female) (2) and (3) | When monitor panel mode selector switch 1 [■] is turned ON. | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10, fuse FS1 (5). 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (1) and L10 (Female) (3) | | Resistance | 1✕ and below |
| | | | Wiring harness between L10 (Female) (2) and fuse FS1 (5) | | Resistance | 1✕ and below |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10, fuse FS1 (5). 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (1) and L10 (Female) (3) | Resistance between L21 (Female) (1), L10 (Female) (3) and chassis ground | | 1M✕ and above |
| | | | Wiring harness between L10 (Female) (2) and fuse FS1 (5) | Resistance between L10 (Female) (2), fuse FS1 (5) and chassis ground | | 1M✕ and above |
| | | | ★ In the above case, the fuse is blown. | | | |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (1) and chassis ground | When monitor panel mode selector switch 1 [■] is turned ON. | Voltage | 20 - 30V |
| | | | | Other than above. | Voltage | 1V and below |

**Related circuit diagram**

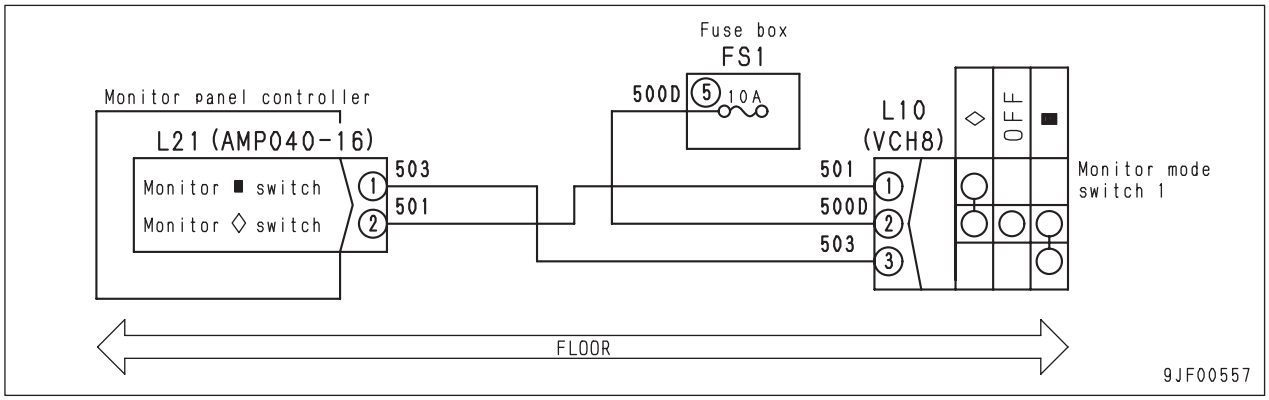


# Troubleshooting Code [MON-10] (Input failure in monitor panel mode selector switch 1 [◇] (Panel switch 2))

| Action Code | Error Code | Controller Code | Trouble | Input failure in monitor panel mode selector switch 1 [◇] (Panel switch 2) |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The monitor panel mode selector switch 1 [◇] (Panel switch 2) input circuit is always in the OPEN state. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The monitor does not work. | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | | Causes | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | 1 | Defective monitor panel mode selector switch 1 [◇] | 1) Turn starting switch OFF. 2) Disconnect connector L10. 3) Connect T-adapter. | | | |
| | | | Between L10 (Female) (2) and (1) | When monitor panel mode selector switch 1 [◇] is turned ON. | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10, fuse FS1 (5). 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (2) and L10 (Female) (1) | | Resistance | 1✕ and below |
| | | | Wiring harness between L10 (Female) (2) and fuse FS1 (5) | | Resistance | 1✕ and below |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L10, fuse FS1 (5). 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (2) and L10 (Female) (1) | Resistance between L21 (Female) (2), L10 (Female) (1) and chassis ground | | 1M✕ and above |
| | | | Wiring harness between L10 (Female) (2) and fuse FS1 (5) | Resistance between L10 (Female) (2), fuse FS1 (5) and chassis ground | | 1M✕ and above |
| | | | ★ In the above case, the fuse is blown. | | | |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (2) and chassis ground | When monitor panel mode selector switch 1 [◇] is turned ON. | Voltage | 20 - 30V |
| | | | | Other than above. | Voltage | 1V and below |

**Related circuit diagram**

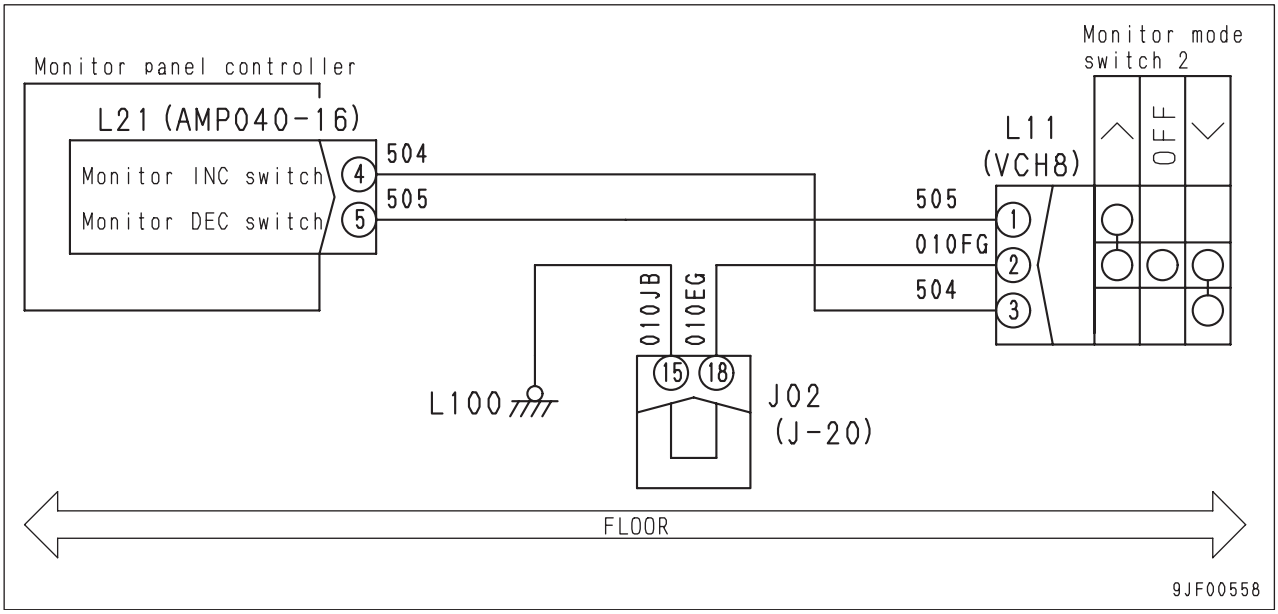


# Troubleshooting Code [MON-11] (Input failure in monitor panel mode selector switch 2 [<] (Panel switch 3))

| Action Code | Error Code | Controller Code | Trouble | Input failure in monitor panel mode selector switch 2 [<] (Panel switch 3) |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The monitor panel mode selector switch 2 [<] (Panel switch 3) input circuit is always in the OPEN state. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The monitor does not work. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective monitor panel mode selector switch 2 [<] | 1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter. | | | |
| | | | Between L11 (Female) (2) and (3) | When monitor panel mode selector switch 2 [<] is turned ON. | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (4) and L11 (Female) (3) | | Resistance | 1✕ and below |
| | | | Wiring harness between L11 (Female) (2) and chassis ground | | Resistance | 1✕ and below |
| | 3 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. 4) Turn starting switch ON. | | | |
| | | | Wiring harness between L21 (Female) (4) and L11 (Female) (3) | Voltage between L21 (Female) (4), L11 (Female) (3) and chassis ground | | 1V and below |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (4) and chassis ground | When monitor panel mode selector switch 2 [<] is turned ON. | Voltage | 1V and below |
| | | | | Other than above. | Voltage | 20 - 30V |

**Related circuit diagram**

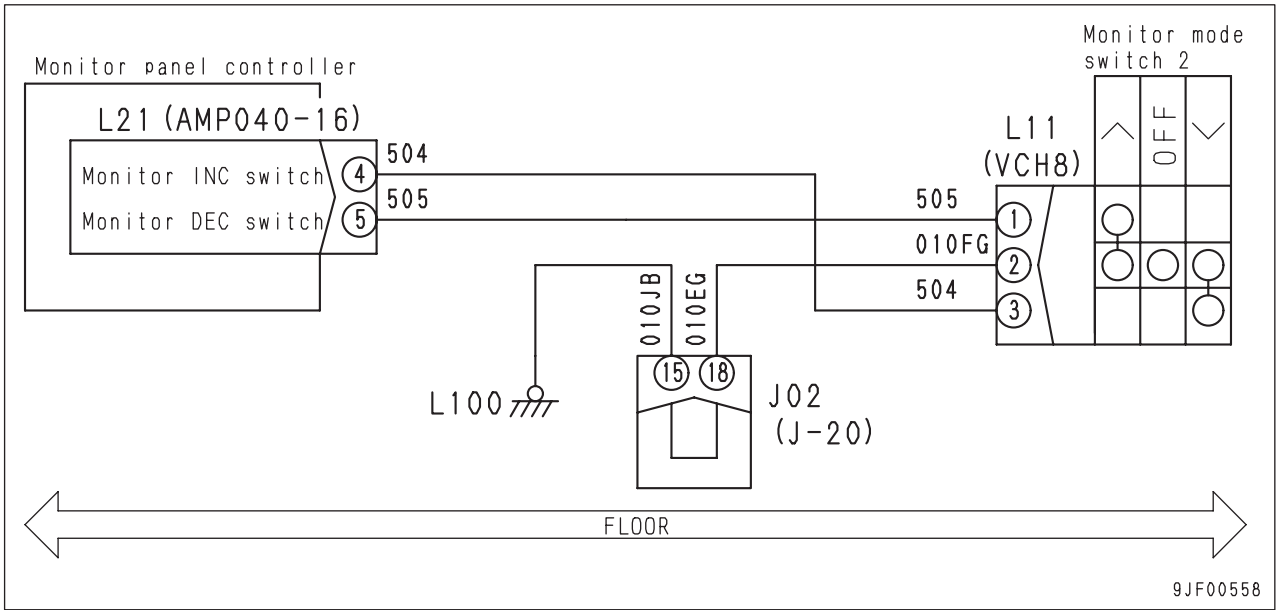


# Troubleshooting Code [MON-12] (Input failure in monitor panel mode selector switch 2 [>] (Panel switch 4))

| Action Code | Error Code | Controller Code | Trouble | Input failure in monitor panel mode selector switch 2 [>] (Panel switch 4) |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The monitor panel mode selector switch 2 [>] (Panel switch 4) input circuit is always in the OPEN state. | | | |
| Machine monitor or controller Reaction | • Activates an alarm. | | | |
| Effect on Machine | • The monitor does not work. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective monitor panel mode selector switch 2 [>] | 1) Turn starting switch OFF. 2) Disconnect connector L11. 3) Connect T-adapter. | | | |
| | | | Between L11 (Female) (2) and (1) | When monitor panel mode selector switch 2 [>] is turned ON. | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (5) and L11 (Female) (1) | | Resistance | 1✕ and below |
| | | | Wiring harness between L11 (Female) (2) and chassis ground | | Resistance | 1✕ and below |
| | 3 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L11. 3) Connect T-adapter. 4) Turn starting switch ON. | | | |
| | | | Wiring harness between L21 (Female) (5) and L11 (Female) (1) | Voltage between L21 (Female) (5), L11 (Female) (1) and chassis ground | | 1V and below |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (5) and chassis ground | When monitor panel mode selector switch 2 [>] is turned ON. | Voltage | 1V and below |
| | | | | Other than above. | Voltage | 20 - 30V |

**Related circuit diagram**

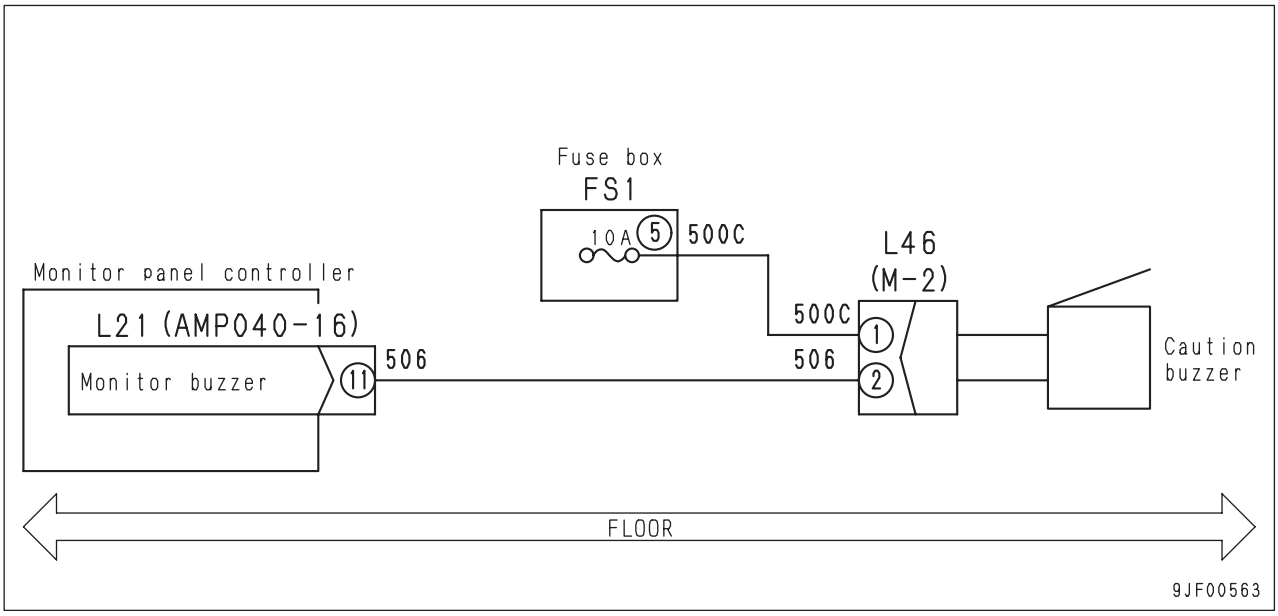


# Troubleshooting Code [MON-13] (The alarm buzzer does not sound or stop)

| Action Code | Error Code | Controller Code | Trouble | The alarm buzzer does not sound or stop |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The alarm buzzer does not sound or stop. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The alarm buzzer does not sound or stop. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L46. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (11) and L46 (Female) (2) | | Resistance | 1✕ and below |
| | | | Wiring harness between L46 (Female) (1) and fuse FS1 (5) | | Resistance | 1✕ and below |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect Connectors L21, L46. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L21 (Female) (11) and L46 (Female) (2) | Resistance between L21 (Female) (11), L46 (Female) (2) and chassis ground | | 1✕ and below |
| | | | ★ In the above case, the fuse is blown. | | | |
| | 3 | Defective alarm buzzer | 1) Turn starting switch OFF. 2) Disconnect connector L46. 3) Insert T-adapter. 4) Connect connector. 5) 5 seconds lapsed after the starting switch was turned ON. | | | |
| | | | Between L46 (Female) (2) and chassis ground | The alarm buzzer sounds. | | Alarm buzzer is normal. |
| | | | | The alarm buzzer does not sound. | | Defective alarm buzzer. |
| | 4 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L21 (Female) (11) and chassis ground | Turn starting switch ON. | Voltage | 20 - 30V |
| | | | | For 2 seconds after the starting switch was turned ON. (The alarm buzzer sounds.) | Voltage | 20 - 30V |
| | | | | For 1 second after 2 seconds lapsed after the starting switch was turned ON. (The alarm buzzer does not sound.) | Voltage | 1V and below |

**Related circuit diagram**



## Troubleshooting Code [MON-14] The wiper does not function

★ Defects in the wiper system is given in the TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE), so see the section for TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE).

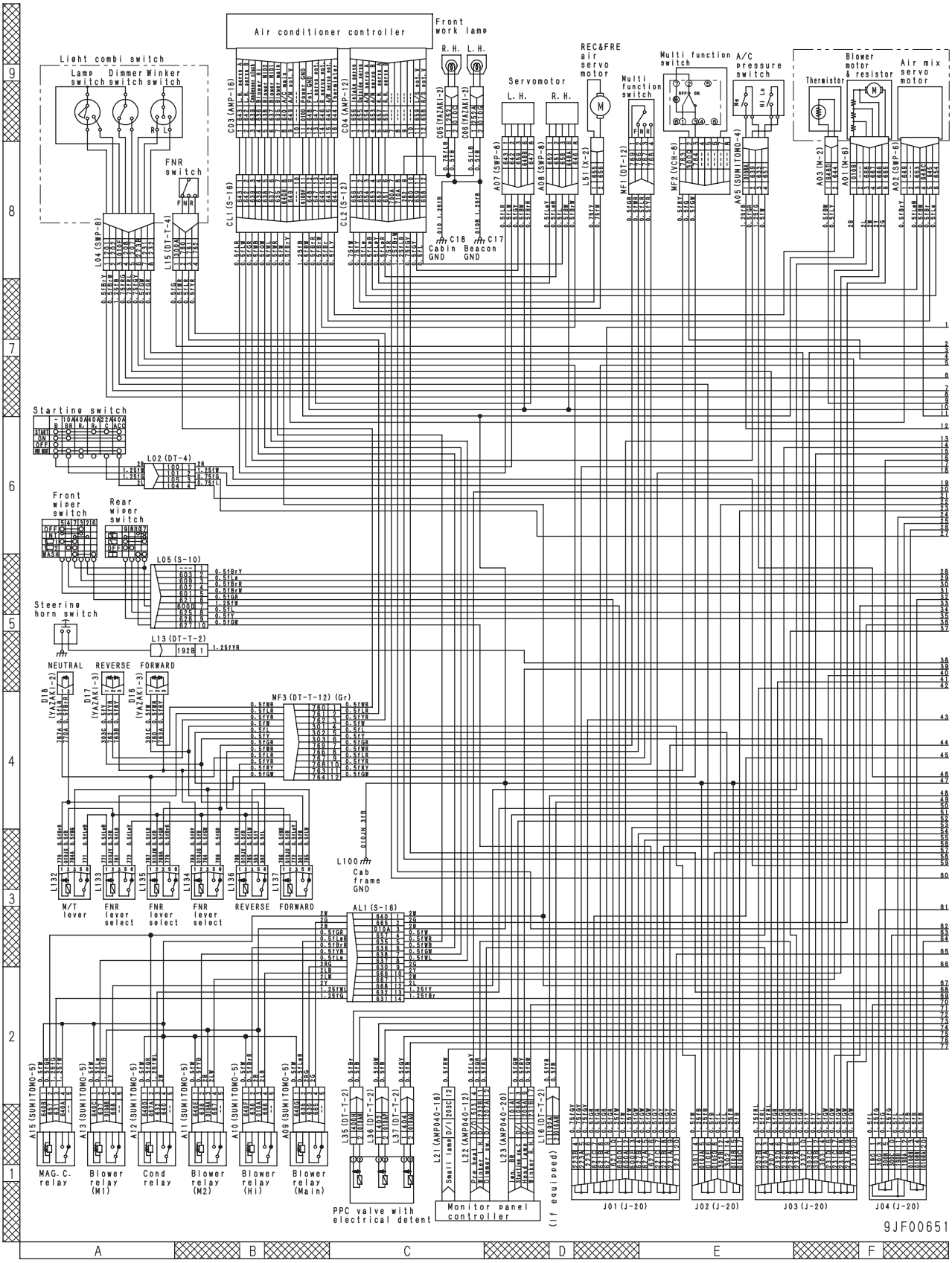
## Troubleshooting Code [MON-15] The lamps do not work properly

★ Defects in the lamp system (lamps do not work properly) is given in the TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE), so see the section for TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE).

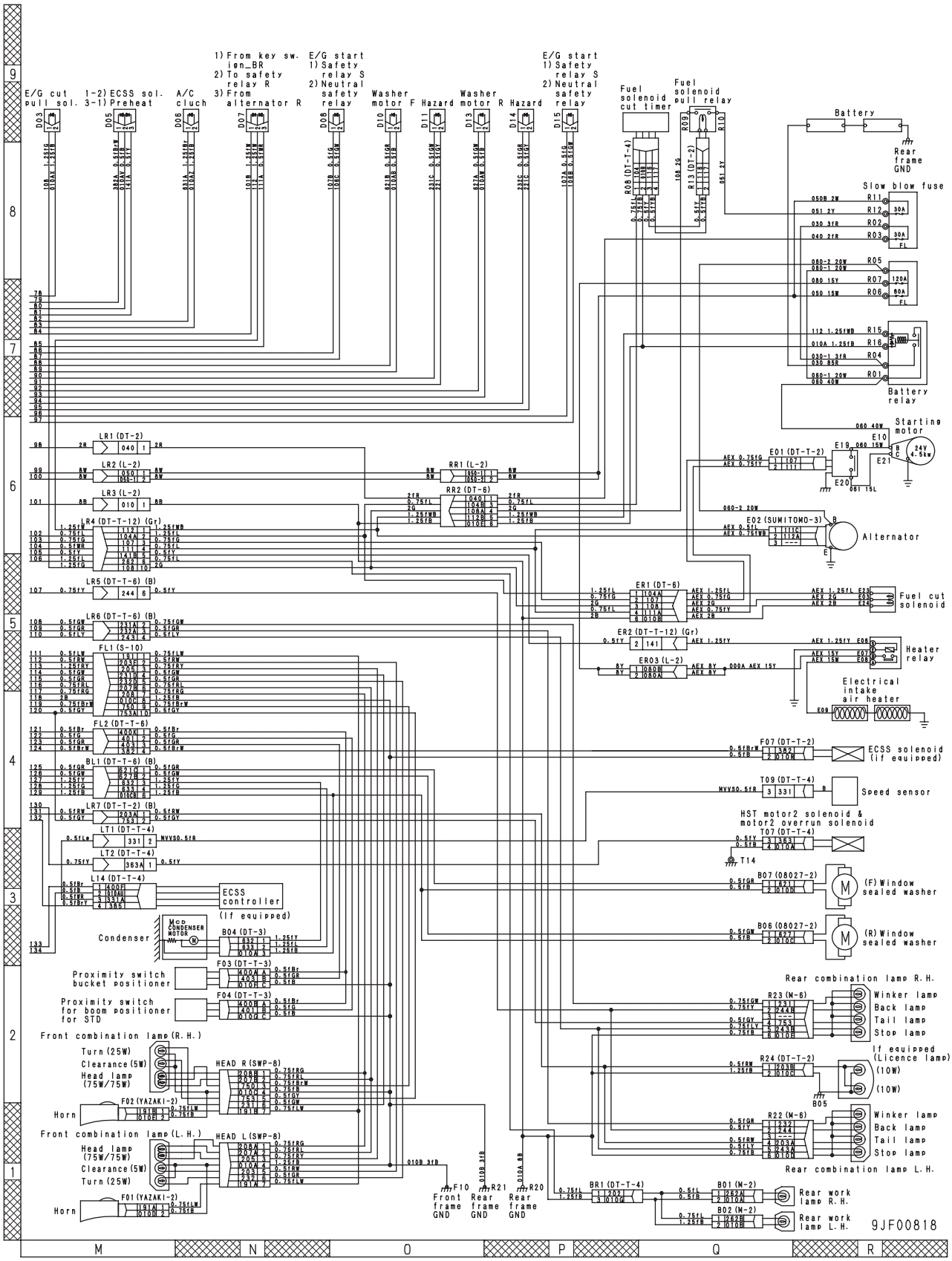
# TROUBLESHOOTING OF ELECTRICAL SYSTEM (E MODE)


Electrical system diagram . . . . . 20-502
Parking brake related diagram . . . . . 20-506
Before troubleshooting electrical system . . . . . 20-508
INFORMATION CONTAINED IN TROUBULESHOOTING TABLE . . . . . 20-510
Troubleshooting Code [E-1] The engine does not start . . . . . 20-512
Troubleshooting Code [E-2] The engine does not stop . . . . . 20-516
Troubleshooting Code [E-3] Preheating is impossible or constant . . . . . 20-518
Troubleshooting Code [E-4] The parking brake (Mechanical type) does not function . . . . . 20-522
Troubleshooting Code [E-5] The emergency brake system (Electrical type) does not function. . . . . 20-528
Troubleshooting Code [E-6] Defective boom kick-out function and cancellation . . . . . 20-529
Troubleshooting Code [E-7] Defective bucket leveler function and cancellation . . . . . 20-532
Troubleshooting Code [E-8] Defective lift arm FLOATING holding function and cancellation . . . . . 20-535
Troubleshooting Code [E-9] The wiper does not function . . . . . 20-536
Troubleshooting Code [E-10] The window washer does not function . . . . . 20-542
Troubleshooting Code [E-11] Lamps do not work properly . . . . . 20-545
Troubleshooting Code [E-12] The horn does not sound . . . . . 20-556
Troubleshooting Code [E-13] Defective the air conditioner . . . . . 20-558

# ELECTRICAL SYSTEM DIAGRAM

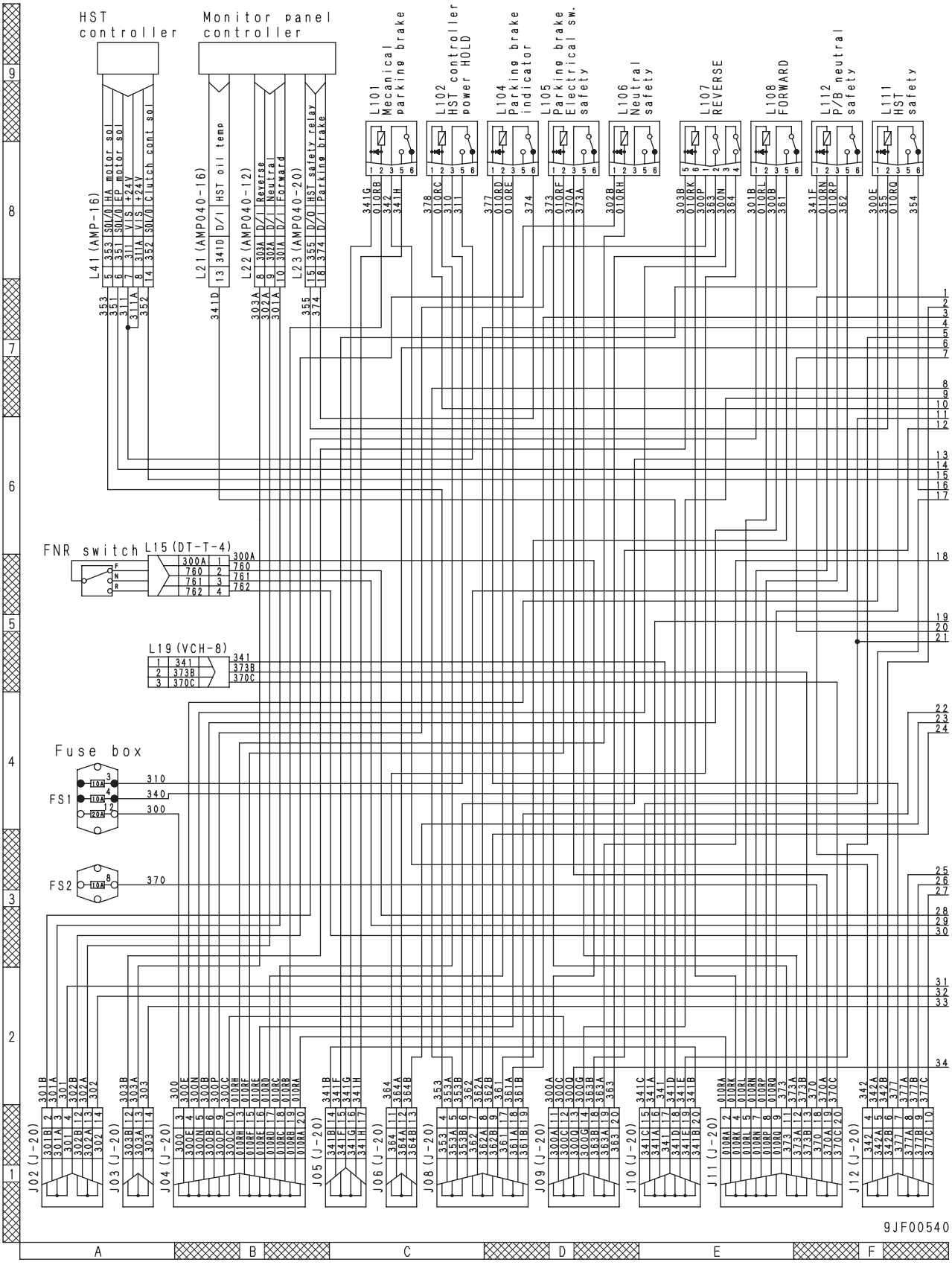


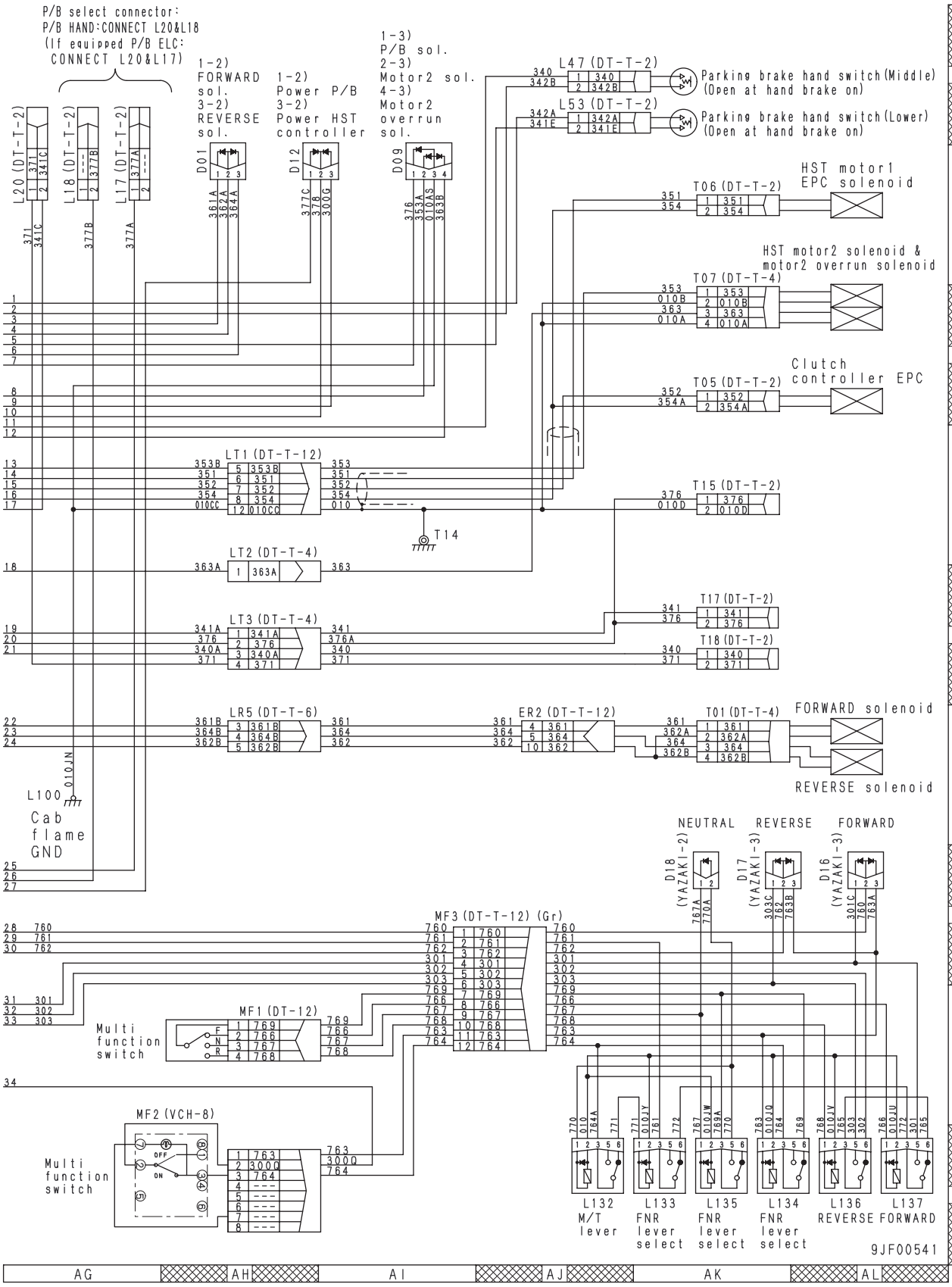

Front wiper motor
Rear wiper motor
Interval wiper timer
Boom kick out
Bucket leveler
Pre heat
Horn
Back buzzer
Neutral safety
Work lamp
Small lamp R.H.
Small lamp L.H.
Head lamp R.H.
Head lamp L.H.
Stop lamp
Reverse
ECSS (If equipped)
ECSS switch (if equipped)
Flasher unit
Fuse box
FS1
FS2
J05 (J-20)
J06 (J-20)
J07 (J-20)
J08 (J-20)
J09 (J-20)
J10 (J-20)
J11 (J-20)
J12 (J-20)
Rear work lamp switch
Front work lamp switch
Hazard switch
Stop lamp switch (Close at brake pedal step (R OR L))
9JF00652


E/G cut
pull sol. 1-2)
3-1)
ECSS sol.
Preheat
A/C
cluch
1) From key sw. ign_BR
2) To safety relay R
3) From alternator R
E/G start
1) Safety relay S
2) Neutral safety relay
Washer motor F
Hazard
Washer motor R
Hazard
E/G start
1) Safety relay S
2) Neutral safety relay
Fuel solenoid cut timer
Fuel solenoid pull relay
Battery
Rear frame GND
Slow blow fuse
Battery relay
Starting motor
Alternator
Fuel cut solenoid
Heater relay
Electrical intake air heater
ECSS solenoid (if equipped)
Speed sensor
HST motor2 solenoid & motor2 overrun solenoid
(F) Window sealed washer
(R) Window sealed washer
Rear combination lamp R.H.
Winker lamp
Back lamp
Tail lamp
Stop lamp
If equipped (Licence lamp)
(10W)
(10W)
Rear combination lamp L.H.
Rear work lamp R.H.
Rear work lamp L.H.
ECSS controller
(If equipped)
Condenser
Proximity switch bucket positioner
Proximity switch for boom positioner for STD
Front combination lamp (R.H.)
Front combination lamp (L.H.)
Turn (25W)
Clearance (5W)
Head lamp (75W/75W)
Horn
Front frame GND
Rear frame GND
Rear frame GND
9JF00818

white 20-505

# PARKING BRAKE RELATED DIAGRAM




P/B select connector:
P/B HAND:CONNECT L20&L18
(If equipped P/B ELC:
CONNECT L20&L17)
1-2) FORWARD sol.
3-2) REVERSE sol.
1-2) Power P/B
3-2) Power HST controller
1-3) P/B sol.
2-3) Motor2 sol.
4-3) Motor2 overrun sol.
L47 (DT-T-2)
Parking brake hand switch(Middle)
(Open at hand brake on)
L53 (DT-T-2)
Parking brake hand switch(Lower)
(Open at hand brake on)
HST motor1 EPC solenoid
T06 (DT-T-2)
HST motor2 solenoid & motor2 overrun solenoid
T07 (DT-T-4)
Clutch controller EPC
T05 (DT-T-2)
LT1 (DT-T-12)
T15 (DT-T-2)
T14
LT2 (DT-T-4)
T17 (DT-T-2)
LT3 (DT-T-4)
T18 (DT-T-2)
LR5 (DT-T-6)
ER2 (DT-T-12)
T01 (DT-T-4)
FORWARD solenoid
REVERSE solenoid
L100
Cab flame GND
NEUTRAL
REVERSE
FORWARD
D18 (YAZAKI-2)
D17 (YAZAKI-3)
D16 (YAZAKI-3)
MF3 (DT-T-12) (Gr)
MF1 (DT-T-12)
Multi function switch
MF2 (VCH-8)
Multi function switch
L132 M/T lever
L133 FNR lever select
L135 FNR lever select
L134 FNR lever select
L136 REVERSE
L137 FORWARD
9JF00541
AG
AH
AI
AJ
AK
AL

# BEFORE TROUBLESHOOTING ELECTRICAL SYSTEM

## FUSE BOX CONNECTION TABLE

★ This connection chart shows the equipment that each fuse box power source supplies power directly to ("switch power source" means the power supplied when the starting switch is ON; "permanent power source" means the power supplied when the starting switch is OFF).

| Category | Fuse No. | Fuse capacity | Power supply destination |
|---|---|---|---|
| Permanent power source (Fuse box 1) | 1 | 20A | Starting switch |
| | 2 | 10A | Hazard lamp |
| | 3 | 10A | HST control A |
| | 4 | 10A | Parking brake 1 |
| | 5 | 10A | Meter, panel |
| | 6 | 10A | Car radio A |
| | 7 | 10A | Option (24V-1) |
| Switch power source (Fuse box 1) | 8 | 10A | Head lamp (left side) |
| | 9 | 10A | Head lamp (right side) |
| | 10 | 10A | Turn signal lamp |
| | 11 | 10A | Back lamp, stop lamp |
| | 12 | 20A | HST control B |
| | 13 | 10A | Work equipment positioner |
| | 14 | 10A | Wiper |
| | 15 | 10A | Car radio B |
| Switch power source (Fuse box 2) | 1 | 20A | Air conditioner A |
| | 2 | 20A | Air conditioner B |
| | 3 | 10A | Beacon lamp |
| | 4 | 10A | - |
| | 5 | 10A | Load-meter |
| | 6 | 20A | DC converter |
| | 7 | 10A | Option (24V-2) |
| | 8 | 10A | Parking brake 2 |
| | 9 | 10A | Horn |
| | 10 | 10A | Side marker lamp (left side) |
| | 11 | 10A | Side marker lamp (right side) |
| | 12 | 20A | Front working lamp |
| | 13 | 20A | Rear working lamp |
| | 14 | 10A | (Spare 1) |
| | 15 | 10A | (Spare 2) |

white 20-509

# INFORMATION CONTAINED IN TROUBULESHOOTING TABLE

★ The troubleshooting table and the related circuit diagrams contain the following information. Grasp their contents fully before proceeding to actual troubleshooting work.

| Action Code | Error Code | Controller Code | Trouble | Trouble displayed in trouble data |
|---|---|---|---|---|
| Panel display | Panel display | Panel display | | |
| Description of Trouble | • Condition when machine monitor or controller detected trouble. | | | |
| Machine monitor or controller Reaction | • Action to take to protect system or equipment when machine monitor or controller detected trouble. | | | |
| Effect on Machine | • Condition that appeared as problem on machine when action (given above) was taken by machine monitor or controller. | | | |
| Related Information | • Information related to troubleshooting or error that occurred. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting |
|---|---|---|---|
| Possible Causes and Standard Values | 1 | Probable cause when trouble occurred (the numbers are index numbers and do not indicate the order of priority) | <Data to fill in><br>• Normal standard values used to judge probable cause<br>• Remarks regarding decision-making<br><br><Condition when wiring harness is defective><br>• Disconnection<br>There is defective connection of connector or disconnection in wiring harness<br>• Short circuit with ground<br>Wiring harness not wired to ground (GND) circuit is in contact with ground (GND) circuit<br>• Short circuit with power source<br>Wiring harness not wired to power supply (24 V) circuit is in contact with power supply (24 V) circuit<br><br><Points to remember when troubleshooting><br>1) Method of displaying connector No. and handling T-adapter<br>Unless there is special instruction, insert or connect the T-adapter as follows<br>• If there is no indication for the male or female terminal of the connector No., disconnect the connector and insert the T-adapter in both the male and female terminals<br>• If there is indication for the male or female terminal of the connector No., disconnect the connector and connect the T-adapter to only the terminal indicated (either the male terminal or female terminal)<br><Points to remember when troubleshooting><br>2) Given order for pin numbers and handling tester lead<br>Unless there is a special instruction, connect tester (+) lead and (-) lead as follows to carry out troubleshooting<br>• Connect the (+) lead to the wiring harness for the pin No. given first<br>• Connect the (-) lead to the wiring harness for the pin No. given last |
| | 2 | | |
| | 3 | | |
| | 4 | | |
| | 5 | | |

**Related circuit diagram**

This is part of electrical circuit diagram which shows the portion where the failure occurred.

- Connector No.: Indicates (Type - numbers of a pin) (color)
- Arrow: Roughly indicates the location in the machine where it is installed.

# Troubleshooting Code [E-1] (The engine does not start)

## a) Defective starting motor system

| Action Code | Error Code | Controller Code | Trouble | The engine does not start<br>a) Defective starting motor system |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The engine does not start due to defective starting motor system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The engine does not start. | | | |
| Related Information | • If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code.<br>• If the fuses are blown, check the wiring harness is short-circuited with the ground. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective battery | Specific gravity | | 1.26V and above | |
| | | | Voltage | | 25V and above | |
| | 2 | Defective neutral safety relay (L106) | 1) Turn starting switch OFF. 2) Interchange relay (L106) with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when neutral safety relay (L106) is interchanged with normal relay? | The condition is abnormal. | | Relay (L106) is normal. |
| | | | | The condition is normal. | | Defective relay (L106) |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check. | | | |
| | | | Between L106 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L106. 3) Solid part check. 4) Applies impressed voltage between L106 (Male) (1) - (2) | | | |
| | | | Between L106 (Male) (3) and (5) | Applies 24V impressed voltage between L106 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L106 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 3 | Defective FNR switch | 1) Turn starting switch OFF. 2) Disconnect connector L15. 3) Connect T-adapter. | | | |
| | | | Between L15 (Female) (1) and (3) | When FNR switch is turned N. | Resistance | 1Ω and below |
| | | | | Other than above. | Resistance | 1MΩ and above |
| | 4 | Defective multi-function related relay (L133, L136, L137) | 1) Turn starting switch OFF. 2) Interchange relay (one of L133, L136, or L137) with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when neutral safety relay (one of L133, L136, or L137) is interchanged with normal relay? | The condition is abnormal. | | Relay (L133, L136, L137) is normal. |
| | | | | The condition is normal. | | Defective relay (L133, L136, L137) |
| | | | 1) Turn starting switch OFF. 2) Disconnect one of connectors L133, L136, or L137. 3) Solid part check. | | | |
| | | | Between (Male) (1) - (2) of one of L133, L136, or L137 | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect one of connectors L133, L136, or L137. 3) Solid part check. 4) Applies impressed voltage between (Male) (1) - (2) of one of L133, L136, or L137 | | | |
| | | | Between (Male) (3) - (5) of one of L133, L136, or L137 | Applies 24V impressed voltage between L106 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L106 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 5 | Defective diode (D08, D15)<br>★ Only when defect occurs in both at the same time | 1) Turn starting switch OFF. 2) Replace both diodes (D08, D15) with normal diodes. 3) Turn starting switch START. | | | |
| | | | The condition is abnormal. | | Diode (D08, D15) is normal. | |
| | | | The condition is normal. | | Defective diode (D08, D15) | |
| | | | Measure from (2) end with diode range | | Continuity | |
| | | | Measure from (1) end with diode range | | Discontinuity | |

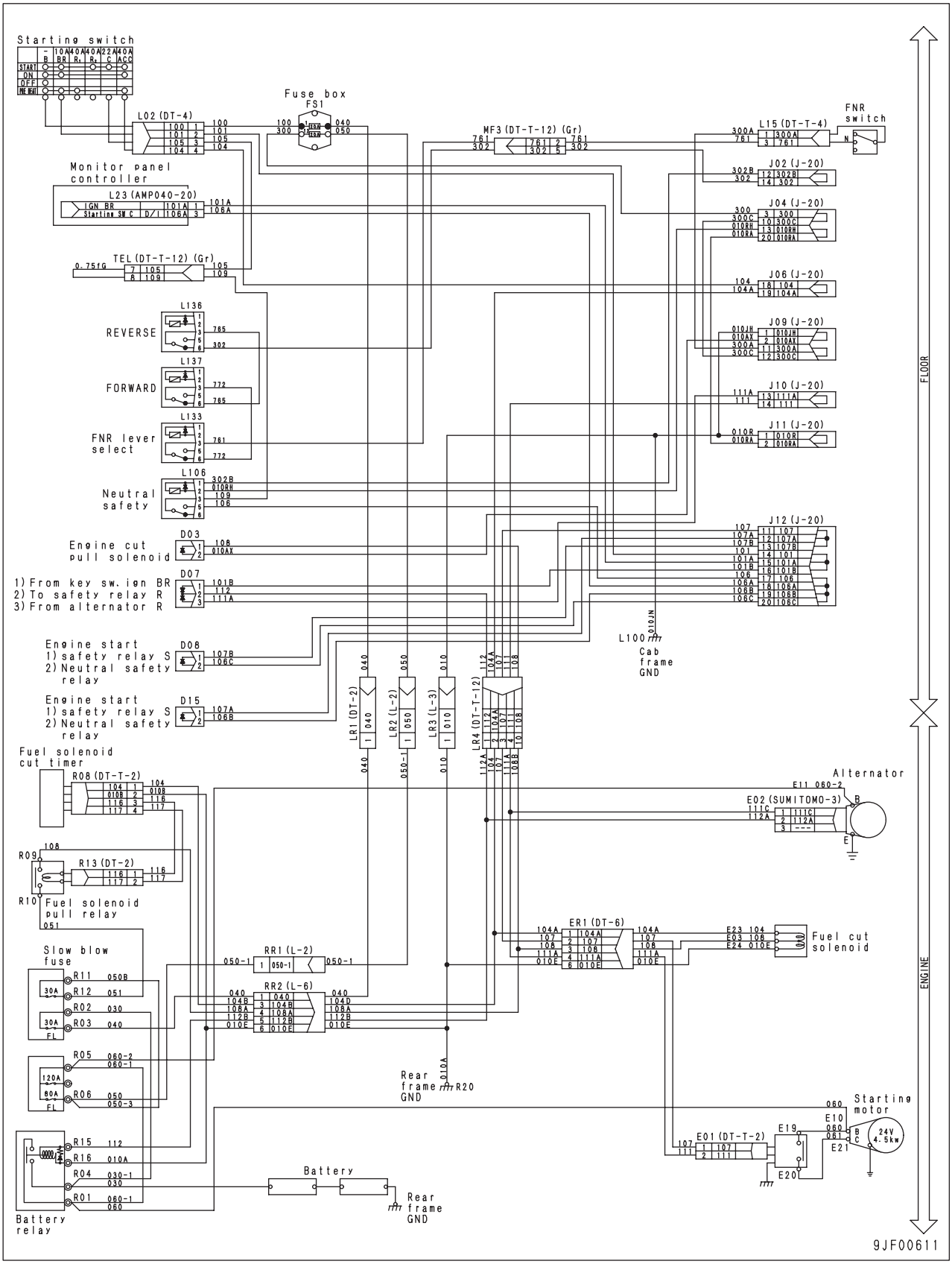
| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| | 6 | Defective diode (D07) | 1) Turn starting switch OFF. 2) Replace diode (D07) with normal diode. 3) Turn starting switch START. | | |
| | | | The condition is abnormal. | Diode (D07) is normal. | |
| | | | The condition is normal. | Defective diode (D07) | |
| | | | Measure between (1) ✕ (2) with diode range | Continuity | |
| | | | Measure between (3) ✕ (2) with diode range | Continuity | |
| | | | Measure between (2) ✕ (3) with diode range | Discontinuity | |
| | | | Measure between (2) ✕ (1) with diode range | Discontinuity | |
| | | | Measure between (1) ✕ (3) with diode range | Discontinuity | |
| | | | Measure between (3) ✕ (1) with diode range | Discontinuity | |
| | | | ★ Put (+) pole of tester in contact with left side. | | |
| | 7 | Wiring harness discontinuity (Disconnection or defective contact)<br>★ Starting motor related harness | 1) Turn starting switch OFF. 2) Disconnect connector L106, D08, D15, terminal E01, R05 and E11. 3) Connect T-adapter. | | |
| | | | Wiring harness between L106 (Female) (5) and D08 (Female) (2) | Resistance | 1✕ and below |
| | | | Wiring harness between L106 (Female) (5) and D15 (Female) (2) | Resistance | 1✕ and below |
| | | | Wiring harness between D08 (Female) (1) and E01 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between D15 (Female) (1) and E01 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between R05 and starting motor terminal B (E11) | Resistance | 1✕ and below |
| | 8 | Wiring harness discontinuity (Disconnection or defective contact)<br>★ Battery relay related harness | 1) Turn starting switch OFF. 2) Disconnect connector D07, E02, terminal R16, R15, R07, R04, R02 and R05. 3) Connect T-adapter. | | |
| | | | Wiring harness between R16 and chassis ground | Resistance | 1✕ and below |
| | | | Wiring harness between R15 and D07 (Female) (2) | Resistance | 1✕ and below |
| | | | Wiring harness between E02 (Female) (2) and R15 | Resistance | 1✕ and below |
| | | | Wiring harness between R04 and R02 | Resistance | 1✕ and below |
| | | | Wiring harness between R01 and R05 | Resistance | 1✕ and below |
| | | | Wiring harness between battery and R04 | Resistance | 1✕ and below |
| | 9 | Wiring harness discontinuity (Disconnection or defective contact)<br>★ Starting switch related harness | 1) Turn starting switch OFF. 2) Disconnect connector L02, D07, terminal R03, R04, R02, R01, R05 and fuse FS1. 3) Connect T-adapter. | | |
| | | | Wiring harness between L02 (Female) (1), FS1 (1) and R03 | Resistance | 1✕ and below |
| | | | Wiring harness between L02 (Female) (2) and D07 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between L02 (Female) (2) and L23 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between R04 and R02 | Resistance | 1✕ and below |
| | | | Wiring harness between R01 and R05 | Resistance | 1✕ and below |
| | 10 | Wiring harness discontinuity (Disconnection or defective contact)<br>★ FNR switch related harness | 1) Turn starting switch OFF. 2) Disconnect connector L15, terminal R06 and fuse FS1. 3) Connect T-adapter. | | |
| | | | Wiring harness between L15 (Female) (1), FS1 (2) and R06 | Resistance | 1✕ and below |
| | | | Wiring harness between L15 (Female) (3) and L106 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between L106 (Female) (2) and chassis ground | Resistance | 1✕ and below |
| | 11 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect connector E01, E02, D07. 3) Connect T-adapter. 4) Turn starting switch ON. | | |
| | | | Wiring harness between E01 (Female) (2), E02 (Female) (1) and D07 (Female) (3) | Voltage between E01 (Female) (2), E02 (Female) (1) and chassis ground | 1V and below |
| | 12 | Defective starting switch | 1) Disconnect starting switch terminal. 2) Solid part check. | | |
| | | | Turn starting switch START. | Between terminal B and C | 1✕ and below |
| | 13 | Defective starting motor | 1) Solid part check. | | |
| | | | • If the check of the individual part shows that it is normal, the starting motor is normal. | | |

### b) Defective fuel cut solenoid system

| Action Code | Error Code | Controller Code | Trouble | The engine does not start<br>b) Defective fuel cut solenoid system |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The fuel cut solenoid system is defective, so the engine does not start. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The engine does not start. | | | |
| Related Information | • If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code.<br>• If the fuses are blown, check the wiring harness is short-circuited with the ground. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective fuel cut solenoid pull relay (R13) | 1) Turn starting switch OFF. 2) Interchange relay (R13) with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when pull relay (R13) is interchanged with normal relay? | The condition is abnormal. | | Relay (R13) is normal. |
| | | | | The condition is normal. | | Defective relay (R13) |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L104. 3) Solid part check. | | | |
| | | | Between R13 (Male) (1) and (2) | | Resistance | 50 - 90Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector R13. 3) Solid part check. 4) Applies impressed voltage between R13 (Male) (1) - (2) | | | |
| | | | Between R13 (Male) (3) and (5) | Applies 24V impressed voltage between R13 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between R13 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 2 | Defective fuel cut solenoid | 1) Turn starting switch OFF. 2) Disconnect terminal E03, E23, E24. 3) Connect T-adapter. 4) Solid part check. | | | |
| | | | Between E23 and E24 | | Resistance | 37 - 46Ω |
| | | | Between E03 and E24 | | Resistance | 0.6 - 1.0Ω |
| | 3 | Defective fuel cut solenoid timer | 1) Turn starting switch OFF. 2) Disconnect connector R08. 3) Insert T-adapter. 4) Connect connector. | | | |
| | | | Between R08 (1) and (2) | Turn starting switch ON. | Voltage | 20 - 30V |
| | | | | Turn starting switch OFF. | Voltage | 1V and below |
| | | | Between R08 (3) and (4) | 2 - 4 sec after turning starting switch ON | Voltage | 16V and above |
| | | | | Other than above. | Voltage | 1V and below |
| | 4 | Defective diode (D03 or D04) | 1) Turn starting switch OFF. 2) Replace diode (D03 or D04) with a normal diode. 3) Turn starting switch START. | | | |
| | | | The condition is abnormal. | Diode (D03 or D04) is normal. | | |
| | | | The condition is normal. | Defective diode (D03 or D04) | | |
| | 5 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L02, D03, D04, D08, D15, terminal E01, E03, E11, E23, E24, R05, R08, R09, R10, R12 and R13. 3) Connect T-adapter. | | | |
| | | | Wiring harness between E24 and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between D03 (Female) (2) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between E03 and R09 | | Resistance | 1Ω and below |
| | | | Wiring harness between D04 (Female) (2) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between E23 and L02 (Female) (4) | | Resistance | 1Ω and below |
| | | | Wiring harness between E23 and R08 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between R08 (Female) (2) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between R08 (Female) (3) and R13 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between R08 (Female) (4) and R13 (Female) (2) | | Resistance | 1Ω and below |
| | | | Wiring harness between R10 and R12 | | Resistance | 1Ω and below |
| | | | Wiring harness between R11 and R06 | | Resistance | 1Ω and below |
| | 6 | Defective starting switch | 1) Disconnect starting switch terminal. 2) Solid part check. | | | |
| | | | Turn starting switch START. | Between terminal B and ACC | | 1Ω and below |

**Related circuit diagram**

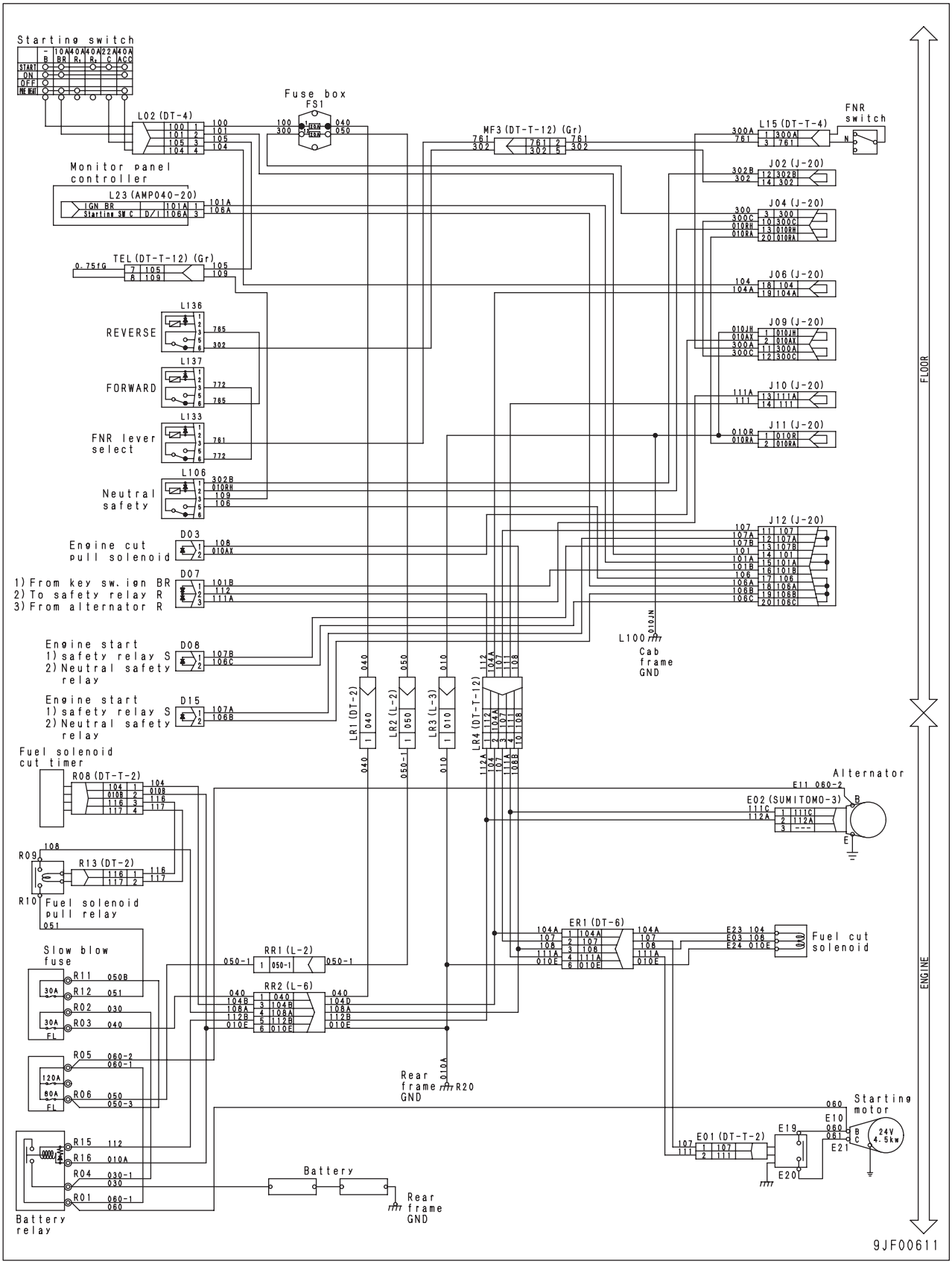


# Troubleshooting Code [E-2] (The engine does not stop)

| Action Code | Error Code | Controller Code | Trouble | The engine does not stop |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The engine does not stop. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The engine does not stop. | | | |
| Related Information | • If the failure code D5ZHL6 for abnormality in starting switch C input is given, carry out troubleshooting first for the applicable code. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective fuel cut solenoid | 1) Turn starting switch OFF. 2) Disconnect terminal E03, E23, E24. 3) Connect T-adapter. 4) Solid part check. | | | |
| | | | Between E23 and E24 | | Resistance | 37 - 46Ω |
| | | | Between E03 and E24 | | Resistance | 0.8 - 1.0Ω |
| | 2 | Defective fuel cut solenoid timer | 1) Turn starting switch OFF. 2) Disconnect connector R08. 3) Insert T-adapter. 4) Connect connector. | | | |
| | | | Between R08 (1) and (2) | Turn starting switch ON. | Voltage | 20 - 30V |
| | | | | Turn starting switch OFF. | Voltage | 1V and below |
| | 3 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect connector L02, D03, D08, terminal E03, E23 and R09. 3) Connect T-adapter. 4) Turn starting switch OFF. | | | |
| | | | Wiring harness between E03, R09 and D03 (Female) (1) | Voltage between E03 (Harness side) and chassis ground | | 1V and below |
| | | | Wiring harness between E23, L02 (Female) (4) and R08 (Female) (1) | Voltage between E23 (Harness side) and chassis ground | | 1V and below |

**Related circuit diagram**



# Troubleshooting Code [E-3] (Preheating is impossible or constant)

**a) Preheating is impossible**

| Action Code | Error Code | Controller Code | Trouble | Preheating is impossible or constant<br>a) Preheating is impossible |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Preheating is impossible. (The engine water temperature at 0? and below.) | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Preheating is impossible. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective intake air heater relay | 1) Turn starting switch OFF. 2) Disconnect heater relay terminal E06, E07, E08. 3) Solid part check. | | | |
| | | | Between E06 and chassis ground | | Resistance | 19 - 25Ω |
| | | | Between E07 and E08 | When relay is ON (impressed voltage 24V between E08 - chassis ground). | Resistance | 1Ω and below |
| | | | | When the relay OFF (Other than above). | Resistance | 1MΩ and above |
| | 2 | Defective intake air heater (Ribbon heater) | 1) Turn starting switch OFF. 2) Disconnect heater terminal E09. 3) Solid part check. | | | |
| | | | Between heater terminal E09 and chassis ground | | Resistance | 0.17 - 0.27Ω |
| | 3 | Defective auto-preheating relay (L115) | 1) Turn starting switch OFF. 2)Replace relay L115 with normal relay 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when automatic preheating relay L115 is replaced with normal relay? | | Condition is abnormal. | Relay L115 is normal. |
| | | | | | Condition is normal. | Defective relay L115. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check. | | | |
| | | | Between L115 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check. 4) Applies impressed voltage between L115 (Male) (1) - (2) | | | |
| | | | Between L115 (Male) (3) and (5) | Applies 24V impressed voltage between L115 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L115 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 4 | Defective diode (D05) | 1) Turn starting switch OFF. 2) Replace diode (D05) with normal diode. 3) Turn starting switch ON. | | | |
| | | | Condition is abnormal. | | Diode (D05) is normal. | |
| | | | Condition is normal. | | Defective diode (D05) | |
| | | | Measure between (2) Ω (1) with diode range | | Resistance | 1Ω and below |
| | | | Measure between (2) Ω (3) with diode range | | Resistance | 1Ω and below |
| | | | Measure between (1) Ω (2) with diode range | | Resistance | 1Ω and below |
| | | | Measure between (1) Ω (3) with diode range | | Resistance | 1Ω and below |
| | | | Measure between (3) Ω (2) with diode range | | Resistance | 1Ω and below |
| | | | Measure between (3) Ω (1) with diode range | | Resistance | 1Ω and below |
| | | | ★ Put (+) pole of tester in contact with left side. | | | |

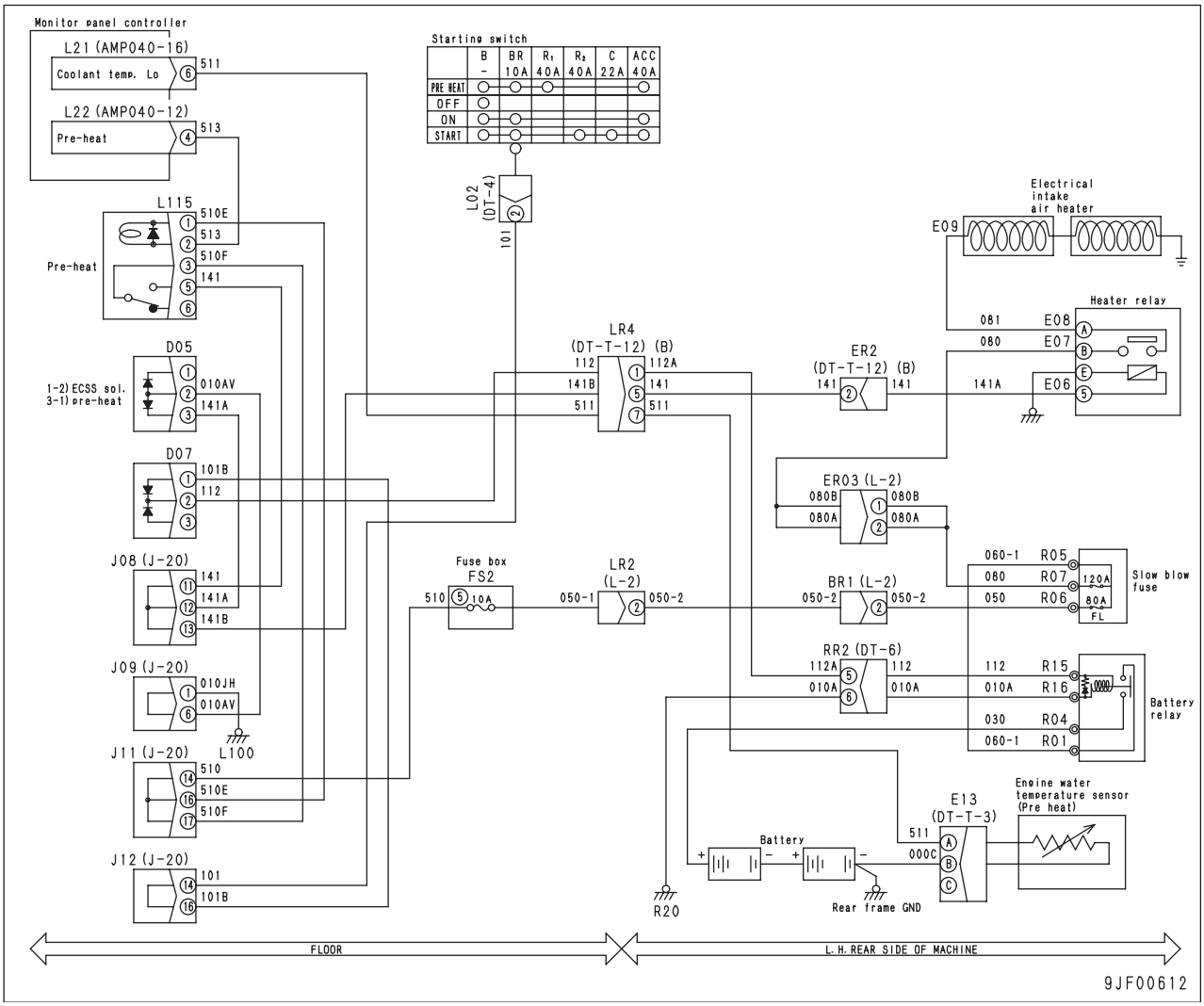
<table>
<tr><td rowspan="15">Possible Causes and Standard Values</td><td colspan="2">Causes</td><td colspan="5">Standard Value in Normal State and Remarks on Troubleshooting</td></tr>
<tr><td rowspan="6">5</td><td rowspan="6">Wiring harness discontinuity (Disconnection or defective contact)</td><td colspan="5">1) Turn starting switch OFF. 2) Disconnect connector L115, L22, fuse FS2 (5), E06, E07 and E08. 3) Connect T-adapter.</td></tr>
<tr><td colspan="3">Wiring harness between E08 and E09</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between R07 and E07</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between E06, J06 and L115 (Female) (5)</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between fuse FS2 (5) and L115 (Female) (3)</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td colspan="3">Wiring harness between fuse FS2 (5) and L115 (Female) (1)</td><td>Resistance</td><td>1✕ and below</td></tr>
<tr><td rowspan="9">6</td><td rowspan="9">Wiring harness ground fault</td><td colspan="5">1) Turn starting switch OFF. 2) Disconnect connector D05, L115, L22, fuse FS2 (5), E06, E07 E08, E09 and R07. 3) Connect T-adapter.</td></tr>
<tr><td colspan="2">Wiring harness between E08 and E09 *</td><td colspan="2">Resistance between E08, E09 and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="2">Wiring harness between R07 and E07 *</td><td colspan="2">Resistance between R07, E07 and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="2">Wiring harness between E06, J08 and L115 (Female) (5) *</td><td colspan="2">Resistance between E06, J08, L115 (Female) (5) and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="2">Wiring harness between fuse FS2 (5) and L115 (Female) (3) *</td><td colspan="2">Resistance between fuse FS2 (5), L115 (Female) (3) and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="2">Wiring harness between fuse FS2 (5) and L115 (Female) (1) *</td><td colspan="2">Resistance between fuse FS2 (5), L115 (Female) (1) and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="2">Wiring harness between J06 (Female) (12) and D05 (Female) (3) *</td><td colspan="2">Resistance between J06 (Female) (12), D05 (Female) (3) and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="5">★ Item 6 above is wiring harness related to intake air heater (ribbon heater)<br>★ If it is marked * , the fuse is blown</td></tr>
<tr><td colspan="2">Wiring harness between L21 (Female) (6) and E13 (A)</td><td colspan="2">Resistance between L21 (Female) (6), E13 (A) and chassis ground</td><td>1M✕ and above</td></tr>
<tr><td colspan="5">★ The above is wiring harness related to the engine water temperature (low temperature) sensor</td></tr>
<tr><td rowspan="3">7</td><td rowspan="3">Defective engine water temperature (Low temperature) sensor</td><td colspan="5">1) Turn starting switch OFF. 2) Disconnect connector E13. 3) Connect T-adapter.</td></tr>
<tr><td rowspan="2">Between E13 (Male) (A) and (B)</td><td>Normal temperature (25°C).</td><td>Resistance</td><td>3.1 - 5.7k✕</td></tr>
<tr><td>When 100°C</td><td>Resistance</td><td>0.2 - 1.0k✕</td></tr>
<tr><td rowspan="3">8</td><td rowspan="3">Defective junction connector (J09)</td><td colspan="5">1) Turn starting switch OFF. 2) Replace junction connector (J09) with normal junction connector</td></tr>
<tr><td colspan="3">Condition is abnormal.</td><td colspan="2">Junction connector (J09) is normal.</td></tr>
<tr><td colspan="3">Condition is normal.</td><td colspan="2">Defective junction connector (J09).</td></tr>
</table>

### b) Preheating is constant

| Action Code | Error Code | Controller Code | Trouble | Preheating is impossible or constant<br>b) Preheating is constant |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Preheating is constant. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Preheating is constant. | | | |
| Related Information | • If the failure code DGE3L6 for abnormality in engine water temperature (low temperature) sensor related is given, carry out troubleshooting first for the applicable code.<br>• The engine water temperature (low temperature) is displayed by real-time monitoring code 04103. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective intake air heater relay | 1) Turn starting switch OFF. 2) Disconnect heater relay terminal E06, E07, E08. 3) Solid part check. | | | |
| | | | Between E06 and chassis ground | | Resistance | 19 - 25Ω |
| | | | Between E07 and E08 | When relay is ON (impressed voltage 24V between E08 - chassis ground). | Resistance | 1Ω and below |
| | | | | When the relay OFF (Other than above). | Resistance | 1MΩ and above |
| | 2 | Defective auto-preheating relay (L115) | 1) Turn starting switch OFF. 2) Replace relay L115 with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when automatic preheating relay L115 is replaced with normal relay? | | Condition is abnormal. | Relay L115 is normal. |
| | | | | | Condition is normal. | Defective relay L115. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check. | | | |
| | | | Between L115 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L115. 3) Solid part check. 4) Applies impressed voltage between L115 (Male) (1) - (2) | | | |
| | | | Between L115 (Male) (3) and (5) | Applies 24V impressed voltage between L115 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L115 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 3 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect connector L115, L22, fuse FS2 (5), E06, E07 and E08. 3) Connect T-adapter. | | | |
| | | | Wiring harness between E08 and E09 | Resistance between E08, E09 and chassis ground | | 1MΩ and above |
| | | | Wiring harness between E06, J06 and L115 (Female) (5) | Resistance between E06, J08, L115 (Female) (5) and chassis ground | | 1MΩ and above |

**Related circuit diagram**



# Troubleshooting Code [E-4] (The parking brake (Mechanical type) does not function)

### a) Parking brake dragging prevention does not function (mechanical type)

| Action Code | Error Code | Controller Code | Trouble | The parking brake (Mechanical type) does not function<br>a) Parking brake dragging prevention does not function (mechanical type) |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Parking brake dragging prevention does not function | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Parking brake dragging prevention does not function | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective parking brake neutral safety relay (L112) | 1) Turn starting switch OFF. 2) Replace relay L112 with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch. | | | |
| | | | Does condition become normal when parking brake neutral safety relay L112 is replaced with normal relay? | | Condition is abnormal. | Relay L112 is normal. |
| | | | | | Condition is normal. | Defective relay L112. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L112. 3) Solid part check. | | | |
| | | | Between L112 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L112. 3) Solid part check. 4) Applies impressed voltage between L112 (Male) (1) - (2) | | | |
| | | | Between L112 (Male) (3) and (5) | Applies 24V impressed voltage between L112 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L112 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector D01, L19, L112, T01. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L112 (Female) (5) and J08 (7), (9) and T01 (Female) (2), (4) | Resistance between L112 (Female) (5), T01 (Female) (4) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L112 (Female) (5) and J08 (7), (8) and T01 (Female) (2) | Resistance between L112 (Female) (5), T01 (Female) (2) and chassis ground | | 1MΩ and above |
| | 3 | Defective diode (D01) | 1) Turn starting switch OFF. 2) Replace diode D01 with normal diode. 3) Turn starting switch ON. | | | |
| | | | Condition is abnormal. | | Diode (D05) is normal. | |
| | | | Condition is normal. | | Defective diode (D01) | |
| | | | Measure between (2) ⇔ (1) with diode range | | Continuity | |
| | | | Measure between (2) ⇔ (3) with diode range | | Continuity | |
| | | | Measure between (1) ⇔ (2) with diode range | | Discontinuity | |
| | | | Measure between (1) ⇔ (3) with diode range | | Discontinuity | |
| | | | Measure between (3) ⇔ (2) with diode range | | Discontinuity | |
| | | | Measure between (3) ⇔ (1) with diode range | | Discontinuity | |

## b) Parking brake "non-applied" indicator does not light up (mechanical type)

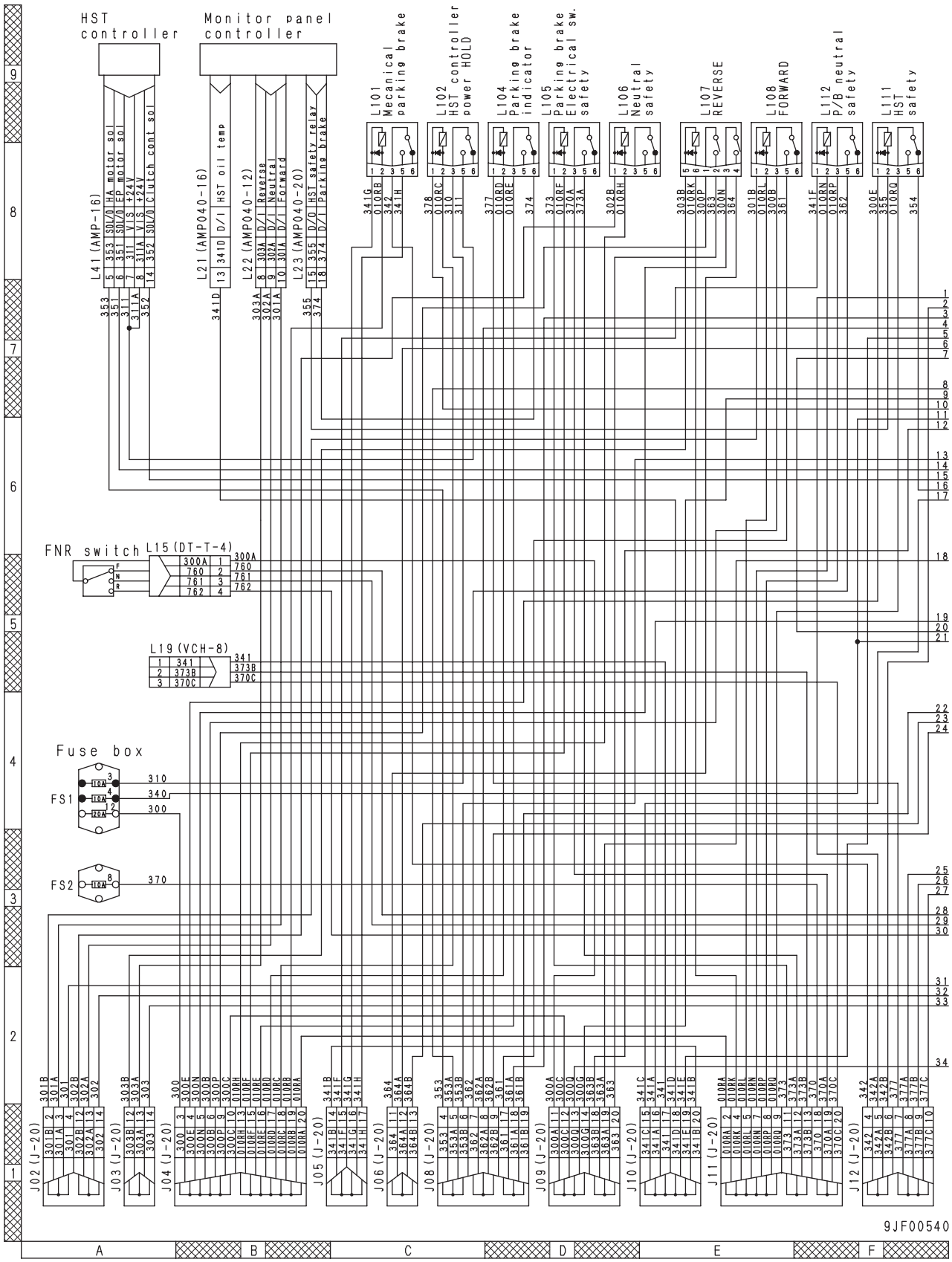
| Action Code | Error Code | Controller Code | Trouble | The parking brake (Mechanical type) does not function<br>b) Parking brake "non-applied" indicator does not light up (mechanical type) |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Parking brake "non-applied" indicator does not light up | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Parking brake "non-applied" indicator does not light up | | | |
| Related Information | | | | |

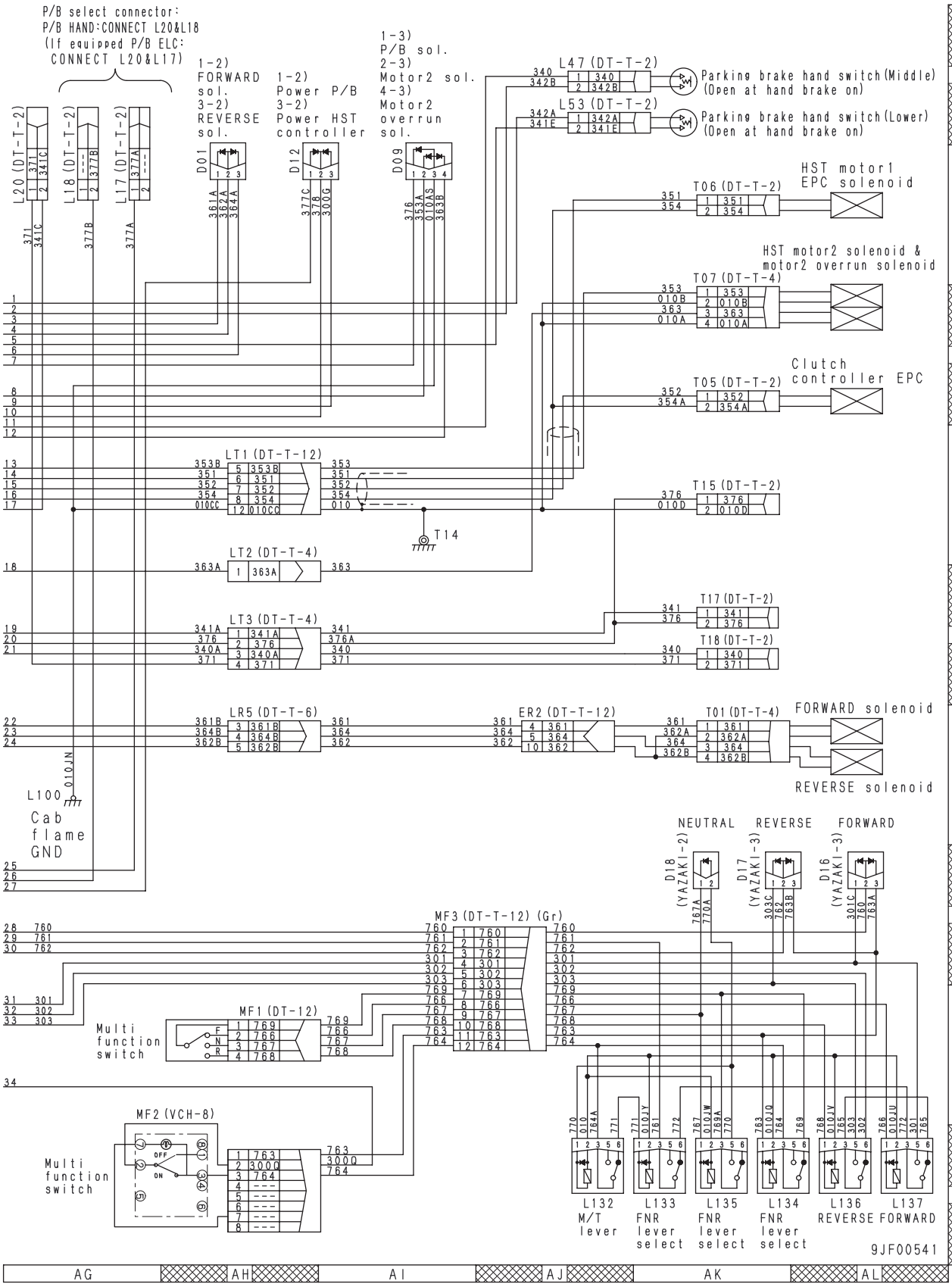
| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective parking brake lowest switch | 1) Turn starting switch OFF. 2) Disconnect connector L53. 3) Connect T-adapter. | | | |
| | | | Between L53 (Male) (3) and (2) | Place parking brake lever LOCK. | Resistance | 1MΩ and above |
| | | | | Place parking brake lever FREE. | Resistance | 1Ω and below |
| | 2 | Defective parking brake middle switch | 1) Turn starting switch OFF. 2) Disconnect connector L47. 3) Connect T-adapter. | | | |
| | | | Between L47 (Male) (3) and (1) | Place parking brake lever LOCK to MIDDLE. | Resistance | 1MΩ and above |
| | | | | Place parking brake lever MIDDLE to FREE. | Resistance | 1Ω and below |
| | 3 | Defective parking brake relay (L101) | 1) Turn starting switch OFF. 2) Replace relay L101 with normal relay. 3) Turn starting switch ON. 4) Operate parking brake switch. | | | |
| | | | Does condition become normal when parking brake relay L101 is replaced with normal relay? | Condition is abnormal. | | Relay L101 is normal. |
| | | | | Condition is normal. | | Defective relay L101. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Solid part check. | | | |
| | | | Between L101 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L101. 3) Solid part check.<br>4) Applies impressed voltage between L101 (Male) (1) - (2) | | | |
| | | | Between L101 (Male) (3) and (5) | Applies 24V impressed voltage between L101 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L101 (Male) (1) - (2) | Resistance | 1MΩ and above |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 4 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L47, L53, fuse FS1 terminal. 3) Connect T-adapter. | | | |
| | | | Wiring harness between fuse FS1 (4) and L47 (Female) (1) | | Resistance | 1✕ and below |
| | | | Wiring harness between L47 (Female) (2) and J12 (6), (7) and L53 (Female) (1) | | Resistance | 1✕ and below |
| | | | Wiring harness between L53 (Female) (2) and J10 (19), (18) and L21 (Female) (13) | | Resistance | 1✕ and below |
| | | | Wiring harness between L53 (Female) (2) and J10 (Female) (19), (20) and J05 (14), (16) and L101 (Female) (1) | | Resistance | 1✕ and below |
| | | | Wiring harness between L53 (Female) (2) and J10 (Female) (19), (20) and J05 (14), (17) and L101 (Female) (5) | | Resistance | 1✕ and below |
| | | | Wiring harness between L101 (Female) (2) and chassis ground | | Resistance | 1✕ and below |
| | | | Wiring harness between L47 (Female) (2) and J12 (Female) (6), (4) and L101 (Female) (3) | | Resistance | 1✕ and below |
| | 5 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector L105, L19, T17, T15, both ends of No.341, No.373, No.377 line and fuse FS1 terminal. 3) Connect T-adapter. | | | |
| | | | Wiring harness between fuse FS1 (4) and L47 (Female) (1) | Resistance between L47 (Female) (1) and chassis ground | | 1M✕ and above |
| | | | Wiring harness between L47 (Female) (2) and J12 (6), (5) and L53 (Female) (1) | Resistance between L47 (Female) (2), L53 (Female) (1) and chassis ground | | 1M✕ and above |
| | | | Wiring harness between L47 (Female) (2) and J12 (6), (4) and L101 (Female) (3) | Resistance between L47 (Female) (2), L101 (Female) (3) and chassis ground | | 1M✕ and above |
| | | | ★ In the above case, the fuse is blown. | | | |
| | 6 | Defective junction connector (J05), (J10) and (J11) | • Carry out inspection, and if any abnormality is found, repair or replace. | | | |
| | 7 | Defective machine monitor | 1) Turn starting switch OFF. 2) Disconnect connector L21. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch | | | |
| | | | Between L21 (13) and chassis ground | Place parking brake lever LOCK to MIDDLE. | Voltage | 20 - 30V |
| | | | | Place parking brake lever MIDDLE to FREE. | Voltage | 1V and below |

white 20-525

**Related circuit diagram**




P/B select connector:
P/B HAND:CONNECT L20&L18
(If equipped P/B ELC:
CONNECT L20&L17)
1-2) FORWARD sol.
3-2) REVERSE sol.
1-2) Power P/B
3-2) Power HST controller
1-3) P/B sol.
2-3) Motor2 sol.
4-3) Motor2 overrun sol.
L20 (DT-T-2)
L18 (DT-T-2)
L17 (DT-T-2)
D01
D12
D09
L47 (DT-T-2)
Parking brake hand switch(Middle)
(Open at hand brake on)
L53 (DT-T-2)
Parking brake hand switch(Lower)
(Open at hand brake on)
HST motor1 EPC solenoid
T06 (DT-T-2)
HST motor2 solenoid & motor2 overrun solenoid
T07 (DT-T-4)
Clutch controller EPC
T05 (DT-T-2)
LT1 (DT-T-12)
T15 (DT-T-2)
T14
LT2 (DT-T-4)
T17 (DT-T-2)
LT3 (DT-T-4)
T18 (DT-T-2)
LR5 (DT-T-6)
ER2 (DT-T-12)
T01 (DT-T-4)
FORWARD solenoid
REVERSE solenoid
L100
Cab flame GND
NEUTRAL
REVERSE
FORWARD
D18 (YAZAKI-2)
D17 (YAZAKI-3)
D16 (YAZAKI-3)
MF3 (DT-T-12) (Gr)
MF1 (DT-T-12)
Multi function switch
MF2 (VCH-8)
Multi function switch
L132 M/T lever
L133 FNR lever select
L135 FNR lever select
L134 FNR lever select
L136 REVERSE
L137 FORWARD
9JF00541
AG
AH
AI
AJ
AK
AL

# Troubleshooting Code [E-5] (The emergency brake system (Electrical type) does not function)

| Action Code | Error Code | Controller Code | Trouble | The emergency brake system (Electrical type) does not function |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The emergency brake system (Electrical type) does not function. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The emergency brake system (Electrical type) does not function. | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | | | 1) Turn starting switch OFF. 2) Disconnect connector T17. 3) Connect T-adapter. | | | |
| | 1 | Defective emergency brake pressure switch | Between T17 (Male) (1) and (2) | Brake accumulator pressure: 4.90MPa {50kg/cm$^2$} | Resistance | 1Ω and below |
| | | | | Brake accumulator pressure: 2.94MPa {30kg/cm$^2$} | Resistance | 1MΩ and above |

**Related circuit diagram**

- See "TROUBLESHOOTING CODE [E-4]".

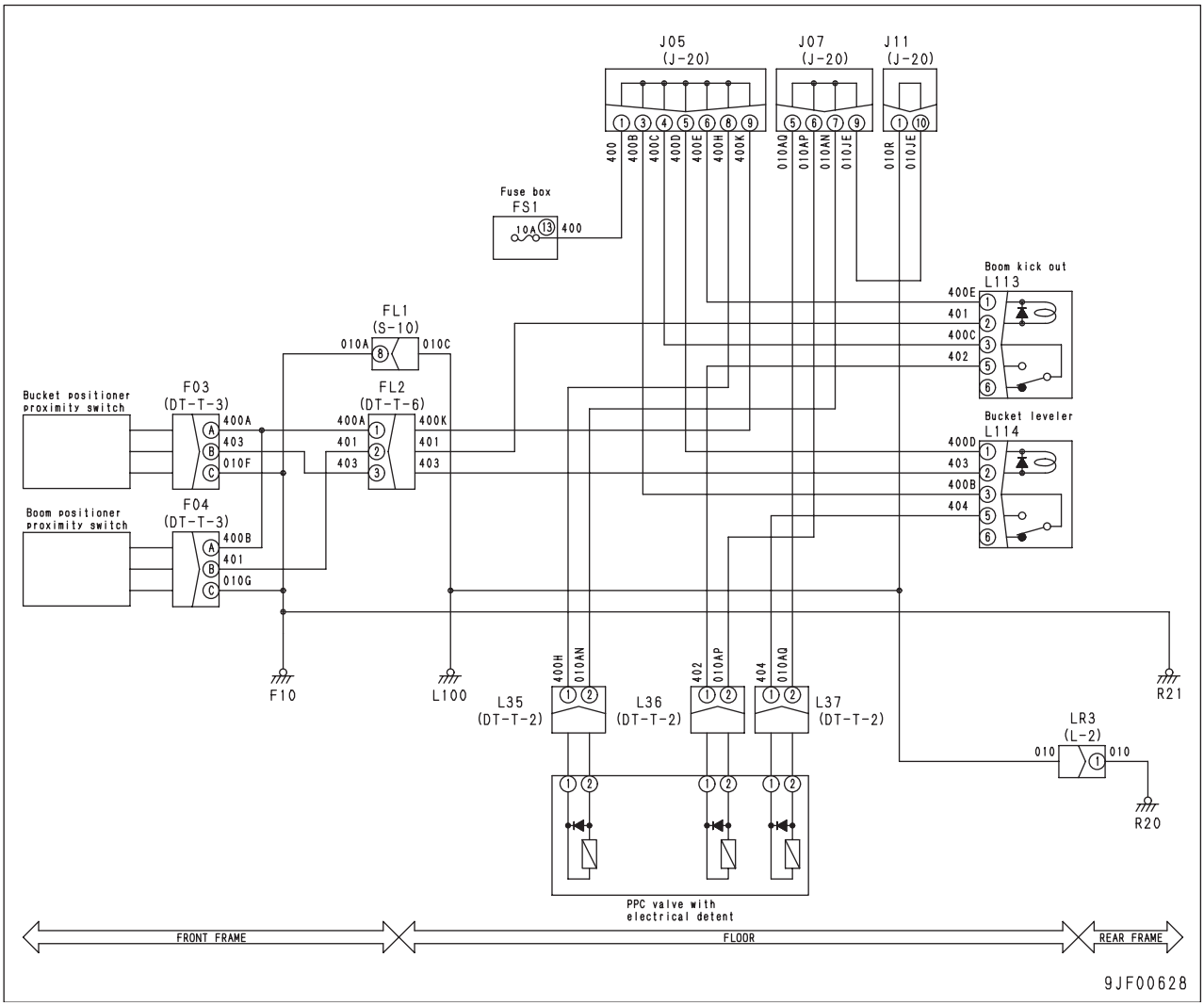
# Troubleshooting Code [E-6] (Defective boom kick-out function and cancellation)

| Action Code | Error Code | Controller Code | Trouble | Defective boom kick-out function and cancellation |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Boom kick-out does not function or cannot be cancelled due to defective boom kick-out proximity switch system, lift arm PPC detent system and lift arm detent relay system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Boom kick-out does not function or cannot be cancelled. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective lift arm detent relay (L113) | 1) Turn starting switch OFF. 2) Disconnect connector L113. 3) Replace lift arm detent relay (L113) with normal relay. 4) Operate boom kick-out. | | | |
| | | | Boom kick-out function is normal. | | Defective relay L113. | |
| | | | Boom kick-out does not function. | | Relay L113 is normal. | |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L113. 3) Connect T-adapter. | | | |
| | | | Between L113 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L113. 3) Solid part check. 4) Applies impressed voltage between L113 (Male) (1) - (2) | | | |
| | | | Between L113 (Male) (3) and (5) | Applies 24V impressed voltage between L113 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L113 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 2 | Defective lift arm PPC detent | 1) Turn starting switch OFF. 2) Disconnect connector L37. 3) Connect T-adapter. | | | |
| | | | Between L37 (Male) (1) and (2) | | Resistance | 30 - 50Ω |
| | 3 | Defective lift arm positioner proximity switch | 1) Turn starting switch OFF. 2) Disconnect connector F04. 3) Interchange lift arm positioner proximity switch (F04) with bucket leveler proximity switch (F03). 4) Operate boom kick-out. | | | |
| | | | Boom kick-out function is normal. | | Defective boom kick-out proximity switch F04 | |
| | | | Boom kick-out does not function. | | Boom kick-out proximity switch F04 is normal. | |
| | 4 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector F04, L113, L36 and fuse FS1 terminal. 3) Connect T-adapter. | | | |
| | | | Wiring harness between F04 (Female) (A) and fuse FS1 (13) | | Resistance | 1Ω and below |
| | | | Wiring harness between F04 (Female) (B) and L113 (Female) (2) | | Resistance | 1Ω and below |
| | | | Wiring harness between F04 (Female) (C) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between L113 (Female) (1) and fuse FS1 (13) | | Resistance | 1Ω and below |
| | | | Wiring harness between L113 (Female) (3) and fuse FS1 (13) | | Resistance | 1Ω and below |
| | | | Wiring harness between L113 (Female) (5) and L36 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between L36 (Female) (2) and chassis ground | | Resistance | 1Ω and below |
| | | | ★ With all the above items, the boom kick-out does not function | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 5 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector F04, L113, L36 and fuse FS1 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between F04 (Female) (B) and L113 (Female) (2) | Resistance between F04 (Female) (B), L113 (Female) (2) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L113 (Female) (5) and L36 (Female) (1) | Resistance between L113 (Female) (5), L36 (Female) (1) and chassis ground | 1M✕ and above |
| | | | ★ In this case, the boom kick-out detent does not function (lever returns to neutral) | | |
| | | | Wiring harness between F04 (Female) (A) and fuse FS1 (13) | Resistance between F04 (Female) (A), FS1 (13) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L113 (Female) (1) and fuse FS1 (13) | Resistance between L113 (Female) (1), fuse FS1 (13) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L113 (Female) (3) and fuse FS1 (13) | Resistance between L113 (Female) (3), fuse FS1 (13) and chassis ground | 1M✕ and above |
| | | | ★ In this case, the fuse is blown and no detents function (lever returns to neutral) | | |
| | 6 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect connector L113, L36. 3) Connect T-adapter. 4) Turn starting switch ON. | | |
| | | | Wiring harness between L113 (Female) (5) and L36 (Female) (1) | Voltage between L113 (Female) (5), L36 (Female) (1) and chassis ground | 1V and below |
| | | | ★ In this case, the boom kick-out does not function (lever does not return to neutral) | | |

**Related circuit diagram**



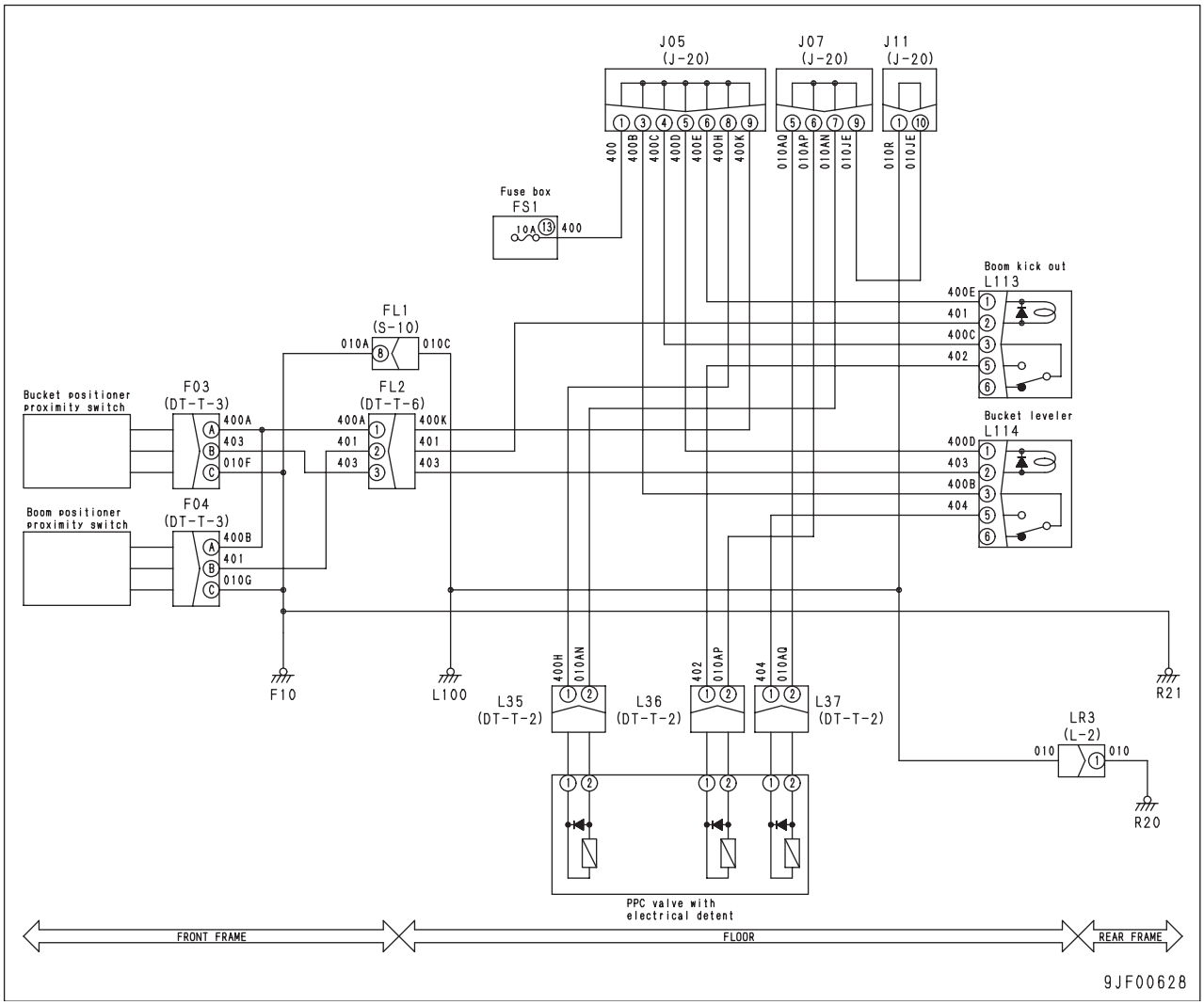
# Troubleshooting Code [E-7] (Defective bucket leveler function and cancellation)

| Action Code | Error Code | Controller Code | Trouble | Defective bucket leveler function and cancellation |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Bucket leveler does not function or cannot be cancelled due to defective bucket leveler proximity switch system, bucket PPC detent system and bucket detent relay system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Bucket leveler does not function or cannot be cancelled. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective bucket detent relay (L114) | 1) Turn starting switch OFF. 2) Disconnect connector L114. 3) Replace bucket detent relay (L114) with normal relay. 4) Operate bucket leveler. | | | |
| | | | Bucket leveler function is normal. | | Defective relay L114. | |
| | | | Bucket leveler does not function. | | Relay L114 is normal. | |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L114. 3) Connect T-adapter. | | | |
| | | | Between L114 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L114. 3) Solid part check. 4) Applies impressed voltage between L114 (Male) (1) - (2) | | | |
| | | | Between L114 (Male) (3) and (5) | Applies 24V impressed voltage between L114 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L114 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 2 | Defective bucket PPC detent | 1) Turn starting switch OFF. 2) Disconnect connector L37. 3) Connect T-adapter. | | | |
| | | | Between L37 (Male) (1) and (2) | | Resistance | 30 - 50Ω |
| | 3 | Defective bucket leveler proximity switch | 1) Turn starting switch OFF. 2) Disconnect connector F03. 3) Interchange bucket leveler proximity switch (F03) with lift arm positioner proximity switch (F04). 4) Operate bucket leveler. | | | |
| | | | Bucket leveler function is normal. | | Defective bucket leveler proximity switch F03 | |
| | | | Bucket leveler does not function. | | Bucket leveler proximity switch F03 is normal. | |
| | 4 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector F03, L114, L37 and fuse FS1 terminal. 3) Connect T-adapter. | | | |
| | | | Wiring harness between F03 (Female) (A) and fuse FS1 (13) | | Resistance | 1Ω and below |
| | | | Wiring harness between F03 (Female) (B) and L114 (Female) (2) | | Resistance | 1Ω and below |
| | | | Wiring harness between F03 (Female) (C) and chassis ground | | Resistance | 1Ω and below |
| | | | Wiring harness between L114 (Female) (1) and fuse FS1 (13) | | Resistance | 1Ω and below |
| | | | Wiring harness between L114 (Female) (3) and fuse FS1 (13) | | Resistance | 1Ω and below |
| | | | Wiring harness between L114 (Female) (5) and L37 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between L37 (Female) (2) and chassis ground | | Resistance | 1Ω and below |
| | | | ★ With all the above items, the bucket leveler does not function | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 5 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector F03, L114, L37 and fuse FS1 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between F03 (Female) (B) and L114 (Female) (2) | Resistance between F03 (Female) (B), L114 (Female) (2) and chassis ground | 1M✕ and above |
| | | | ★ In this case, the bucket leveler detent does not function (lever does not return to neutral) | | |
| | | | Wiring harness between L114 (Female) (5) and L37 (Female) (1) | Resistance between L114 (Female) (5), L37 (Female) (1) and chassis ground | 1M✕ and above |
| | | | ★ In this case, the bucket leveler does not function (lever returns to neutral) | | |
| | | | Wiring harness between F03 (Female) (A) and fuse FS1 (13) | Resistance between F03 (Female) (A), FS1 (13) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L114 (Female) (1) and fuse FS1 (13) | Resistance between L114 (Female) (1), fuse FS1 (13) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L114 (Female) (3) and fuse FS1 (13) | Resistance between L114 (Female) (3), fuse FS1 (13) and chassis ground | 1M✕ and above |
| | | | ★ In this case, the fuse is blown and no detents function (lever returns to neutral) | | |
| | 6 | Hot short-circuiting between harnesses | 1) Turn starting switch OFF. 2) Disconnect connector L114, L37. 3) Connect T-adapter. 4) Turn starting switch ON. | | |
| | | | Wiring harness between L114 (Female) (5) and L37 (Female) (1) | Voltage between L114 (Female) (5), L37 (Female) (1) and chassis ground | 1V and below |
| | | | ★ In this case, the bucket leveler does not function (lever does not return to neutral) | | |

**Related circuit diagram**

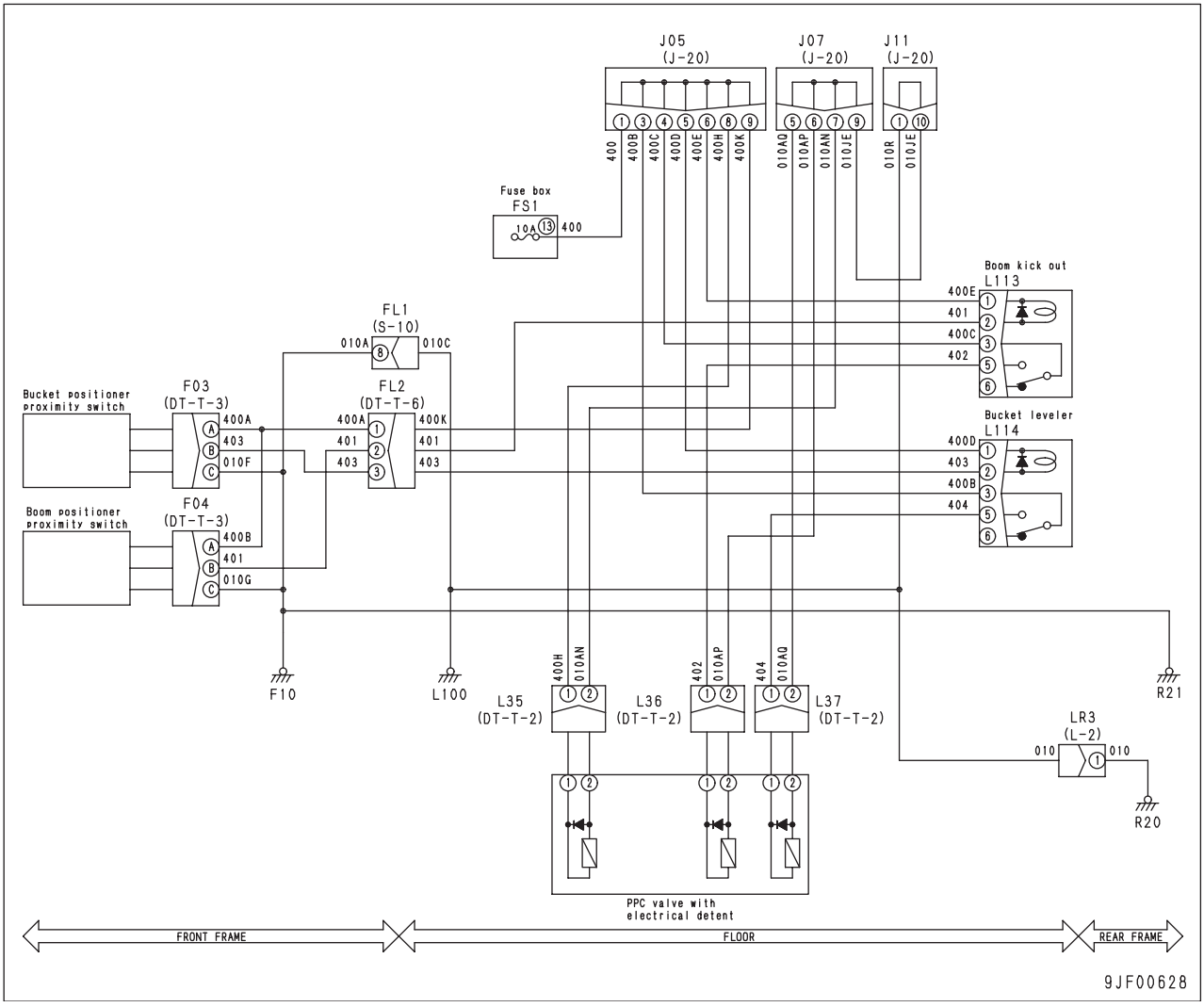


# Troubleshooting Code [E-8] (Defective lift arm FLOATING holding function and cancellation)

| Action Code | Error Code | Controller Code | Trouble | Defective lift arm FLOATING holding function and cancellation |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Lift arm FLOATING holding does not function or cannot be cancelled due to defective lift arm FLOATING PPC detent system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Lift arm FLOATING holding does not function or cannot be cancelled. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective lift arm FLOATING PPC detent | 1) Turn starting switch OFF. 2) Disconnect connector L35. 3) Connect T-adapter. | | |
| | | | Between L35 (Male) (1) and (2) | Resistance | 30 - 50Ω |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector F03, L113, L37 and fuse FS1 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between fuse FS1 (13) and L35 (Female) (1) | Resistance | 1Ω and below |
| | | | Wiring harness between L35 (Female) (2) and chassis ground | Resistance | 1Ω and below |

**Related circuit diagram**



# Troubleshooting Code [E-9] (The wiper does not function)

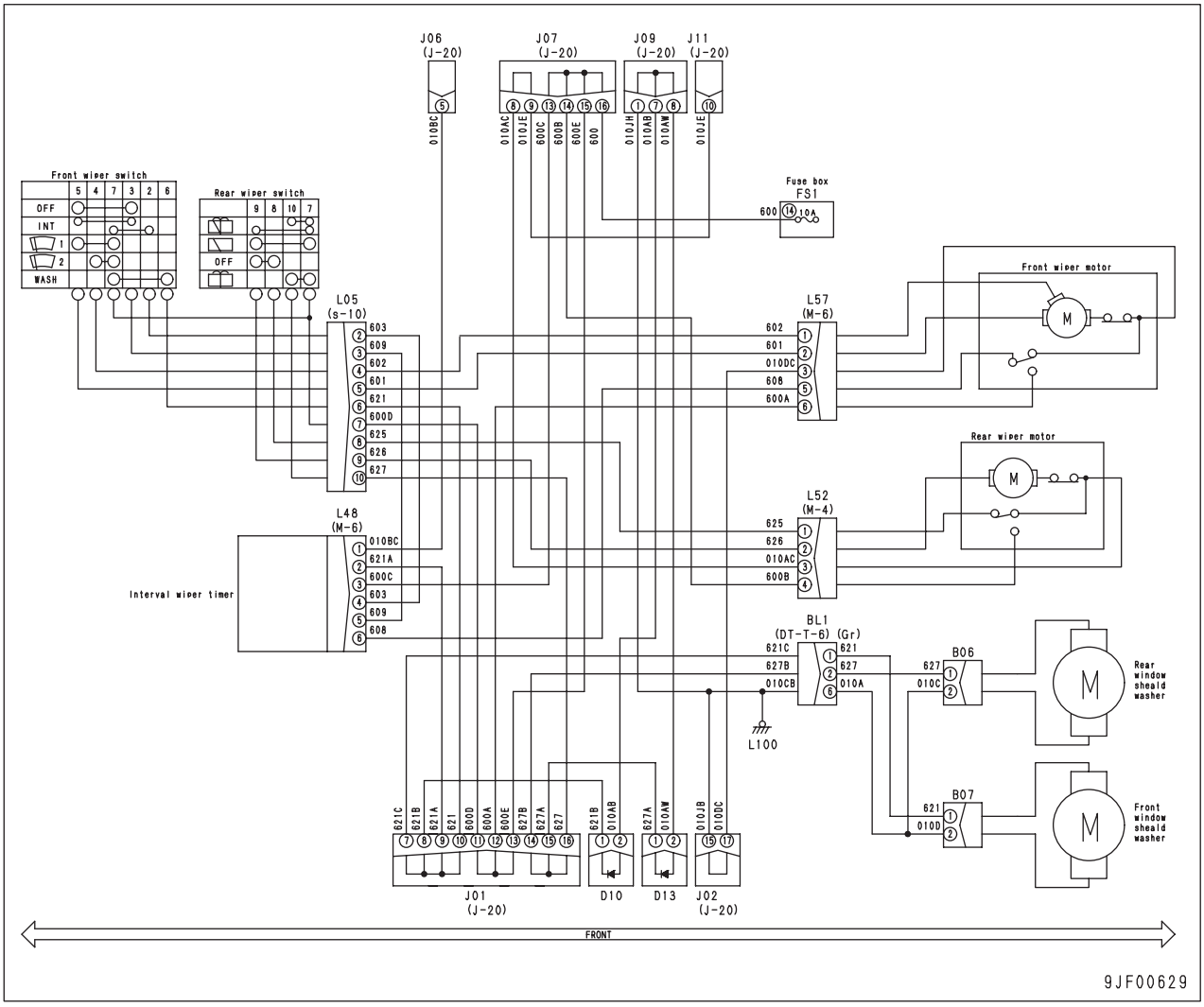
**a) The rear wiper does not function**

| Action Code | Error Code | Controller Code | Trouble | The wiper does not function<br>a) The rear wiper does not function |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The rear wiper does not function due defective rear wiper, switch, timer or wiring harness. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The rear wiper does not function. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective rear wiper motor | 1) Turn starting switch OFF. 2) Disconnect connector L57. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L57 (6) and chassis ground | | Voltage | 20 - 30V |
| | | | Between L57 (2) and chassis ground | Turn wiper switch Lo. | Voltage | 20 - 30V |
| | | | Between L57 (1) and chassis ground | Turn wiper switch Hi. | Voltage | 20 - 30V |
| | | | • When the wiper switch is turned OFF during running of the wiper, the voltage is applied between the L57 (Female) (5) and chassis ground until the wiper motor stops. | | | |
| | 2 | Defective wiper timer | 1) Turn starting switch OFF. 2) Disconnect connector L48. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L48 (3) and chassis ground | | Voltage | 20 - 30V |
| | | | Between L48 (4) and chassis ground | Turn wiper switch INT | Voltage | 20 - 30V |
| | | | Between L48 (2) and chassis ground | Turn wiper switch WASHER | Voltage | 20 - 30V |
| | | | Between L48 (5) and chassis ground (The voltage is output intermittently by wiper switch INT) | | Voltage | 20 - 30V ✕ 0V OV ✕ 20 - 30V (Repeated) |
| | 3 | Defective rear wiper switch | 1) Turn starting switch OFF. 2) Disconnect connector L05. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L05 (Male) (7) and (5) | Turn wiper switch Lo. | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |
| | | | Between L05 (Male) (7) and (4) | Turn wiper switch Hi. | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |
| | | | Between L05 (Male) (7) and (2) | Turn wiper switch INT | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |
| | | | Between L05 (Male) (3) and (5) | Turn wiper switch INT | Resistance | 1✕ and below |
| | | | | Other than above. | Resistance | 1M✕ and above |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 4 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L05, L48, L57 and fuse FS1 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between L05 (Female) (2) and L48 (Female) (4) | Resistance | 1V and below |
| | | | Wiring harness between L05 (Female) (3) and L48 (Female) (5) | Resistance | 1V and below |
| | | | Wiring harness between L05 (Female) (5) and L57 (Female) (2) | Resistance | 1V and below |
| | | | Wiring harness between L05 (Female) (4) and L57 (Female) (1) | Resistance | 1V and below |
| | | | Wiring harness between L48 (Female) (6) and L57 (Female) (5) | Resistance | 1V and below |
| | | | Wiring harness between fuse FS1 (14) and L05 (Female) (7) | Resistance | 1V and below |
| | | | Wiring harness between fuse FS1 (14) and L48 (Female) (3) | Resistance | 1V and below |
| | | | Wiring harness between fuse FS1 (14) and L57 (Female) (6) | Resistance | 1V and below |
| | 5 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector L05, L48, L52, L57 and fuse FS1 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between L05 (Female) (2) and L48 (Female) (4) | Resistance between L05 (Female) (2), L48 (Female) (4) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L05 (Female) (3) and L48 (Female) (5) | Resistance between L05 (Female) (3), L48 (Female) (5) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L05 (Female) (5) and L57 (Female) (2) | Resistance between L05 (Female) (5), L57 (Female) (2) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L05 (Female) (4) and L57 (Female) (1) | Resistance between L05 (Female) (4), L57 (Female) (1) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L48 (Female) (6) and L57 (Female) (5) | Resistance between L48 (Female) (6), L57 (Female) (5) and chassis ground | 1M✕ and above |
| | | | Wiring harness between fuse FS1 (14) and L05 (Female) (7) | Resistance between L05 (Female) (7) and chassis ground | 1M✕ and above |
| | | | Wiring harness between fuse FS1 (14) and L48 (Female) (3) | Resistance between L48 (Female) (3) and chassis ground | 1M✕ and above |
| | | | Wiring harness between fuse FS1 (14) and L57 (Female) (6) | Resistance between L57 (Female) (6) and chassis ground | 1M✕ and above |

**Related circuit diagram**



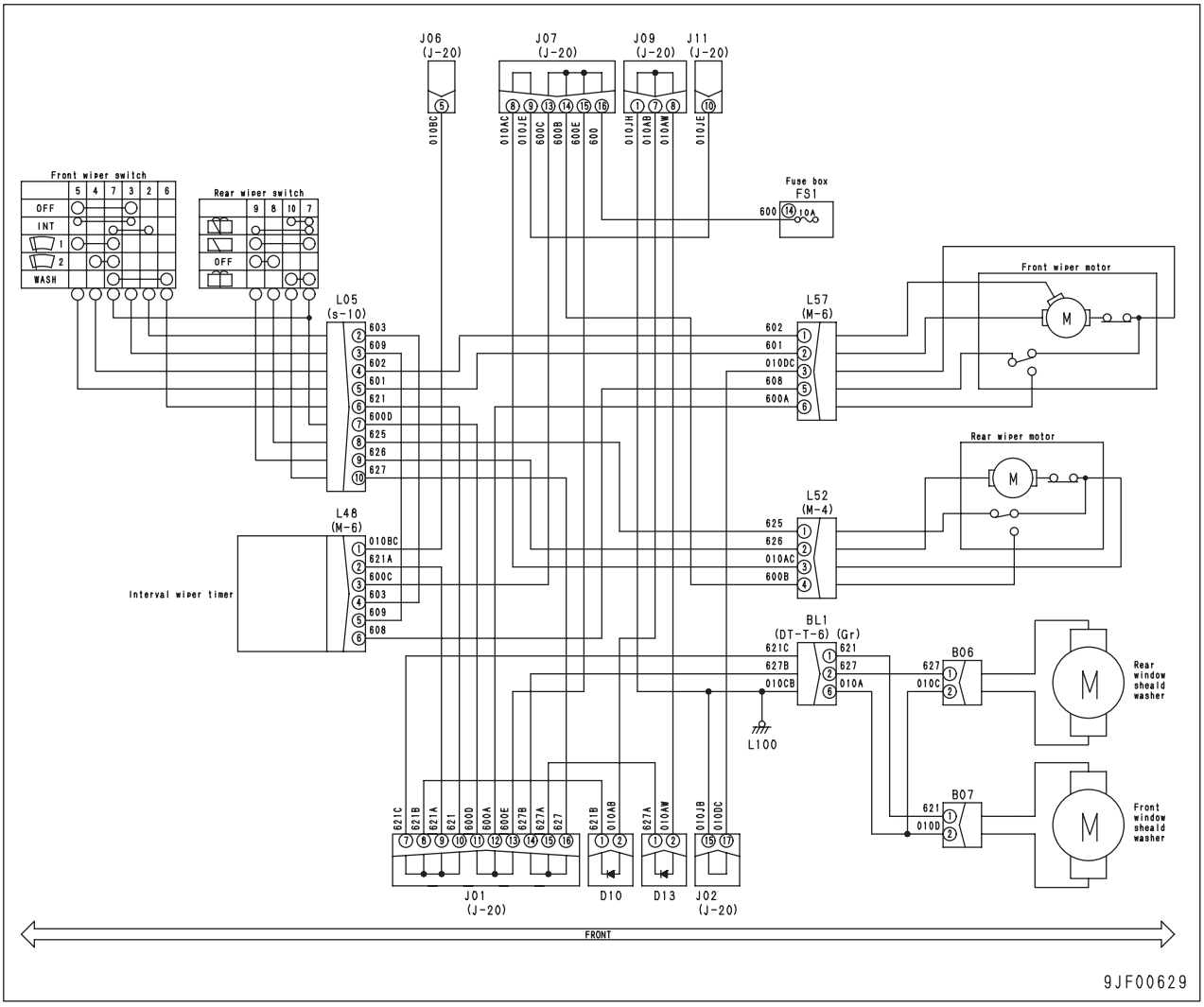
white 20-539

### b) The rear wiper does not function

| Action Code | Error Code | Controller Code | Trouble | The wiper does not function<br>b) The rear wiper does not function |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The rear wiper does not function due defective rear wiper, switch, timer or wiring harness. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The rear wiper does not function. | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | | Causes | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | 1 | Defective rear wiper motor | 1) Turn starting switch OFF. 2) Disconnect connector L52. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L52 (4) and chassis ground | | Voltage | 20 - 30V |
| | | | Between L52 (2) and chassis ground | Turn wiper switch Lo. | Voltage | 20 - 30V |
| | | | • When the wiper switch is turned OFF during running of the wiper, the voltage is applied between the L52 (Female) (1) and chassis ground until the wiper motor stops. | | | |
| | 2 | Defective rear wiper switch | 1) Turn starting switch OFF. 2) Disconnect connector L05. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L05 (Male) (7) and (9) | Turn wiper switch Lo. | Resistance | 1Ω and below |
| | | | | Other than above. | Resistance | 1MΩ and above |
| | | | Between L05 (Male) (8) and (9) | Turn wiper switch OFF. | Resistance | 1Ω and below |
| | | | | Other than above. | Resistance | 1MΩ and above |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L05, L52 and fuse FS1 terminal. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L05 (Female) (8) and L52 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between L05 (Female) (9) and L52 (Female) (2) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 (14) and L05 (Female) (7) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 (14) and L57 (Female) (6) | | Resistance | 1Ω and below |
| | 4 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector L05, L48, L52, L57 and fuse FS1 terminal. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L05 (Female) (8) and L52 (Female) (1) | Resistance between L05 (Female) (8), L52 (Female) (1) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between L05 (Female) (9) and L52 (Female) (2) | Resistance between L05 (Female) (9), L52 (Female) (2) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (14) and L05 (Female) (7) | Resistance between L05 (Female) (7) and chassis ground | | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (14) and L52 (Female) (4) | Resistance between L52 (Female) (6) and chassis ground | | 1MΩ and above |
| | | | ★ In the all above cases, the fuse is blown. | | | |

**Related circuit diagram**



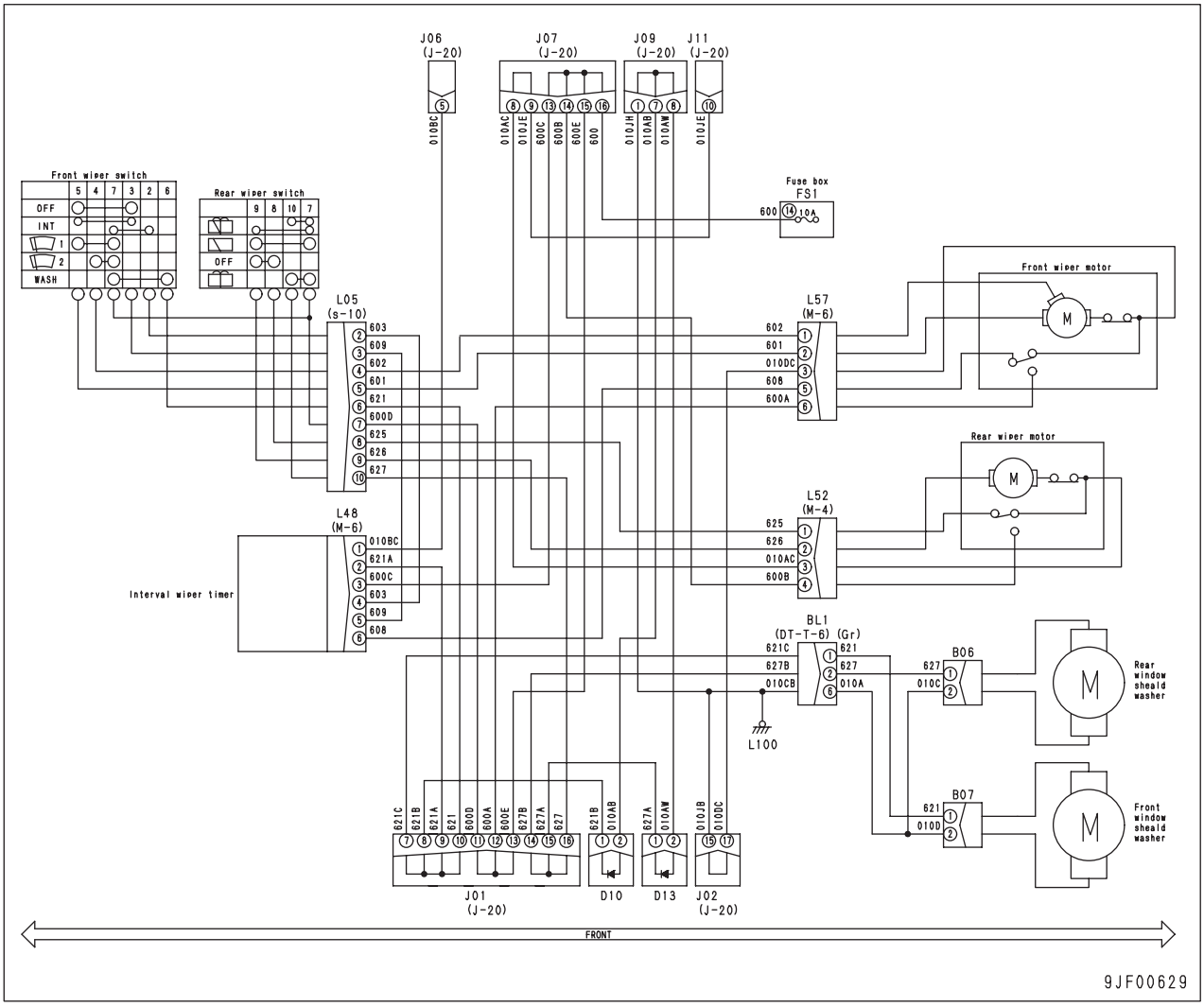
# Troubleshooting Code [E-10] (The window washer does not function)

| Action Code | Error Code | Controller Code | Trouble | The window washer does not function |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The window washer does not function due defective window washer motor, switch, timer (Front only) or wiring harness. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The window washer does not function. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective window washer motor | 1) Turn starting switch OFF. 2) Disconnect connector B07, B06. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | • Front washer motor | | | |
| | | | Between B07 (1) and chassis ground | | Voltage | 20 - 30V |
| | | | • Rear washer motor | | | |
| | | | Between B06 (1) and chassis ground | | Voltage | 20 - 30V |
| | 2 | Defective wiper switch | 1) Turn starting switch OFF. 2) Disconnect connector L05. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | • Common to front switch and rear switch. | | | |
| | | | Between L05 (Male) (7) and chassis ground | | Voltage | 20 - 30V |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L05. 3) Connect T-adapter. | | | |
| | | | • Front switch | | | |
| | | | Between L05 (Male) (7) and (6) | Turn washer switch ON. | Resistance | 1Ω and below |
| | | | | Turn washer switch OFF. | Resistance | 1MΩ and above |
| | | | • Rear switch | | | |
| | | | Between L05 (Male) (7) and (10) | Turn washer switch ON. | Resistance | 1Ω and below |
| | | | | Turn washer switch OFF. | Resistance | 1MΩ and above |
| | | | Between L05 (Male) (7) and (9), (10) | Turn washer and wiper low switch ON. | Resistance | 1Ω and below |
| | 3 | Defective wiper timer (Relay) | 1) Turn starting switch OFF. 2) Disconnect connector L48. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Wiring harness between L48 (3) and chassis ground | | Voltage | 20 - 30V |
| | | | Wiring harness between L48 (2) and chassis ground | Turn washer switch ON. | Voltage | 20 - 30V |
| | | | Wiring harness between L48 (5) and chassis ground (0.2 to 0.8 sec. after the washer switch was turned ON) | | Voltage | 20 - 30V |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 4 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L05, L48, B06, B07 and fuse FS1 terminal. 3) Connect T-adapter. | | |
| | | | • Front side | | |
| | | | Wiring harness between L05 (Female) (6) and B07 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between L05 (Female) (6) and L48 (Female) (2) | Resistance | 1✕ and below |
| | | | Wiring harness between L05 (Female) (3) and L48 (Female) (3) | Resistance | 1✕ and below |
| | | | • Rear side | | |
| | | | Wiring harness between L05 (Female) (10) and B06 (Female) (1) | Resistance | 1✕ and below |
| | | | • Common to front and rear side. | | |
| | | | Wiring harness between fuse FS1 (14) and L05 (Female) (7) | Resistance | 1✕ and below |
| | 5 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector L05, L48, L52, L57, D10, D13 and fuse FS1 terminal. 3) Connect T-adapter. | | |
| | | | • Front side | | |
| | | | Wiring harness between L05 (Female) (6) and B07 (Female) (1) | Resistance between L05 (Female) (6), B07 (Female) (1) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L05 (Female) (6) and L48 (Female) (2) | Resistance between L05 (Female) (6), L48 (Female) (2) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L05 (Female) (3) and L48 (Female) (3) | Resistance between L05 (Female) (7), L48 (Female) (3) and chassis ground | 1M✕ and above |
| | | | • Rear side | | |
| | | | Wiring harness between L05 (Female) (10) and B06 (Female) (1) | Resistance between L05 (Female) (10), B06 (Female) (1) and chassis ground | 1M✕ and above |
| | | | • Common to front and rear side. | | |
| | | | Wiring harness between fuse FS1 (14) and L05 (Female) (7) | Resistance between L52 (Female) (7) and chassis ground | 1M✕ and above |
| | | | ★ In the all above cases, the fuse is blown. | | |

**Related circuit diagram**



# Troubleshooting Code [E-11] (Lamps do not work properly)

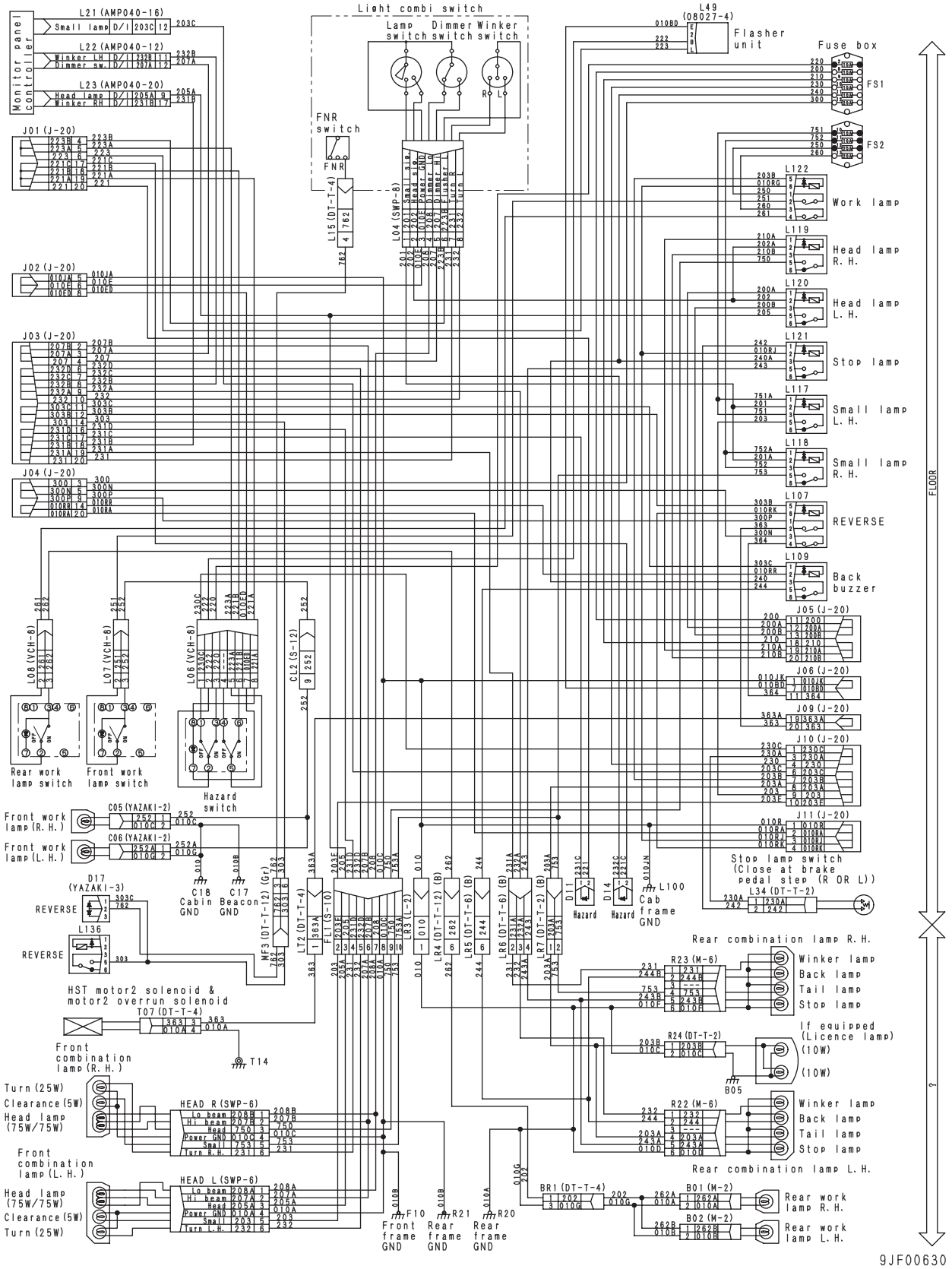
**a) Neither high beam nor low beam of headlamp light up**

| Action Code | Error Code | Controller Code | Trouble | Lamps do not work properly<br>a) Neither high beam nor low beam of headlamp light up |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Head lamp (Hi beam and Lo beam) does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the head lamp system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Head lamp (Hi beam and Lo beam) does not light ON when the lamp switch is turned STEP 2. | | | |
| Related Information | • If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and relay, between fuse and lamp)<br>• When circuits for other lamp systems are normal | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective head lamp | 1) Turn starting switch OFF. 2) Disconnect connector HEAD L, HEAD R. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between HEAD L (3) and chassis ground | Turn lamp switch STEP 2 and dimmer switch Lo. | Voltage | 20 - 30V |
| | | | Between HEAD L (3) and chassis ground | Turn lamp switch STEP 2 and dimmer switch Hi. | Voltage | 20 - 30V |
| | | | Between HEAD R (3) and chassis ground | Turn lamp switch STEP 2 and dimmer switch Lo. | Voltage | 20 - 30V |
| | | | Between HEAD R (3) and chassis ground | Turn lamp switch STEP 2 and dimmer switch Hi. | Voltage | 20 - 30V |
| | 2 | Defective lamp switch and dimmer switch | 1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L04 (Male) (2) and (3) | Turn lamp switch OFF. | Resistance | 1MΩ and above |
| | | | | Turn lamp switch 1 STEP. | Resistance | 1MΩ and above |
| | | | | Turn lamp switch STEP 2. | Resistance | 1Ω and below |
| | | | Between L04 (Male) (4) and (3) | Turn dimmer switch Lo. | Resistance | 1Ω and below |
| | | | | Turn dimmer switch Hi. | Resistance | 1MΩ and above |
| | | | Between L04 (Male) (5) and (3) | Turn dimmer switch Lo. | Resistance | 1MΩ and above |
| | | | | Turn dimmer switch Hi. | Resistance | 1Ω and below |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 3 | Defective head lamp relay (Left side) (L120) | 1) Turn starting switch OFF. 2) Replace relay L120 with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when the headlamp relay (left) L120 is replaced with normal relay? | Condition is abnormal. | | Relay L120 is normal. |
| | | | | Condition is normal. | | Defective relay L120. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L120. 3) Solid part check. 4) Applies impressed voltage between L120 (Male) (1) - (2) | | | |
| | | | Between L120 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L120. 3) Solid part check. | | | |
| | | | Between L120 (Male) (3) and (5) | Applies 24V impressed voltage between L120 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L120 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 4 | Defective head lamp relay (Right side) (L119) | 1) Turn starting switch OFF. 2) Replace relay L119 with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when headlamp relay (right) L119 is replaced with normal relay? | Condition is abnormal. | | Relay L119 is normal. |
| | | | | Condition is normal. | | Defective relay L119. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L119. 3) Solid part check. | | | |
| | | | Between L119 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L119. 3) Solid part check. 4) Applies impressed voltage between L119 (Male) (1) - (2) | | | |
| | | | Between L119 (Male) (3) and (5) | Applies 24V impressed voltage between L119 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L119 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 5 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L04, L120, L119, HEAD L, HEAD R and fuse FS1 terminal (8), (9). 3) Connect T-adapter. | | | |
| | | | ★ When both sides are defective (in this case, clearance lamp also does not light up) | | | |
| | | | Wiring harness between L04 (Female) (3) and chassis ground | | Resistance | 1Ω and below |
| | | | ★ When left side is defective | | | |
| | | | Wiring harness between L120 (Female) (5) and HEAD L (Female) (3) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 terminal (8) and L120 (Female) (1), (3) | | Resistance | 1Ω and below |
| | | | Wiring harness between L120 (Female) (2) and L04 (Female) (2) | | Resistance | 1Ω and below |
| | | | ★ When right side is defective | | | |
| | | | Wiring harness between L119 (Female) (5) and HEAD R (Female) (3) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS1 terminal (9) and L119 (Female) (1), (3) | | Resistance | 1Ω and below |
| | | | Wiring harness between L119 (Female) (2) and L04 (Female) (2) | | Resistance | 1Ω and below |

## Related circuit diagram



### b) Head lamp (Lo beam) does not light ON

| Action Code | Error Code | Controller Code | Trouble | Each lamps does not function<br>b) Head lamp (Lo beam) does not light ON |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Head lamp (Lo beam) does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the head lamp system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Head lamp (Lo beam) does not light ON when the lamp switch is turned STEP 2. | | | |
| Related Information | • If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp)<br>• When circuits for other lamp systems are normal | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| | 1 | Defective head lamp | 1) Turn starting switch OFF. 2) Disconnect connector HEAD L, HEAD R. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between HEAD L (3) and chassis ground | Turn lamp switch STEP 2 and dimmer switch Lo. | Voltage | 20 - 30V |
| | | | Between HEAD R (3) and chassis ground | Turn lamp switch STEP 2 and dimmer switch Lo. | Voltage | 20 - 30V |
| | 2 | Defective lamp switch and dimmer switch | 1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L04 (Male) (2) and (3) | Turn lamp switch OFF. | Resistance | 1M✕ and above |
| | | | | Turn lamp switch 1 STEP. | Resistance | 1M✕ and above |
| | | | | Turn lamp switch STEP 2. | Resistance | 1✕ and below |
| | | | Between L04 (Male) (4) and (3) | Turn dimmer switch Lo. | Resistance | 1✕ and below |
| | | | | Turn dimmer switch Hi. | Resistance | 1M✕ and above |
| | | | Between L04 (Male) (5) and (3) | Turn dimmer switch Lo. | Resistance | 1M✕ and above |
| | | | | Turn dimmer switch Hi. | Resistance | 1✕ and below |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L04, HEAD L, HEAD R. 3) Connect T-adapter. | | | |
| | | | Wiring harness between L04 (Female) (4) and HEAD L (Female) (1) | | Resistance | 1✕ and below |
| | | | Wiring harness between L04 (Female) (4) and HEAD R (Female) (1) | | Resistance | 1✕ and below |

**Related circuit diagram**

★ See "TROUBLESHOOTING CODE [E-11.(a)]".

### c) Head lamp (Hi beam) does not light ON

| Action Code | Error Code | Controller Code | Trouble | Each lamps does not function<br>c) Head lamp (Hi beam) does not light ON |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Head lamp (Hi beam) does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the head lamp system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Head lamp (Hi beam) does not light ON when the lamp switch is turned STEP 2. | | | |
| Related Information | • If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp)<br>• When circuits for other lamp systems are normal | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective head lamp | 1) Turn starting switch OFF. 2) Disconnect connector HEAD L, HEAD R. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between HEAD L (3) and chassis ground | Turn lamp switch STEP 2 and dimmer switch Hi. | Voltage | 20 - 30V |
| | | | Between HEAD R (3) and chassis ground | Turn lamp switch STEP 2 and dimmer switch Hi. | Voltage | 20 - 30V |
| | 2 | Defective lamp switch and dimmer switch | 1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L04 (Male) (2) and (3) | Turn lamp switch OFF. | Resistance | 1MΩ and above |
| | | | | Turn lamp switch 1 STEP. | Resistance | 1MΩ and above |
| | | | | Turn lamp switch STEP 2. | Resistance | 1Ω and below |
| | | | Between L04 (Male) (4) and (3) | Turn dimmer switch Lo. | Resistance | 1Ω and below |
| | | | | Turn dimmer switch Hi. | Resistance | 1MΩ and above |
| | | | Between L04 (Male) (5) and (3) | Turn dimmer switch Lo. | Resistance | 1MΩ and above |
| | | | | Turn dimmer switch Hi. | Resistance | 1Ω and below |
| | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L04, HEAD L, HEAD R. 3) Connect T-adapter. | | | |
| | | | ★ When left side is defective | | | |
| | | | Wiring harness between L04 (Female) (5) and J03 (4), (2) and HEAD L (Female) (2) | | Resistance | 1Ω and below |
| | | | ★ When right side is defective | | | |
| | | | Wiring harness between L04 (Female) (5) and J03 (4), (2) and HEAD R (Female) (2) | | Resistance | 1Ω and below |

**Related circuit diagram**

★ See "TROUBLESHOOTING CODE [E-11.(a)]".

### d) Clearance lamp (Small lamp) does not light ON

| Action Code | Error Code | Controller Code | Trouble | Each lamps does not function<br>d) Clearance lamp (Small lamp) does not light ON |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Clearance lamp (Small lamp) does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the clearance lamp system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Clearance lamp (Small lamp) does not light ON when the lamp switch is turned STEP 1. | | | |
| Related Information | • If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp)<br>• When circuits for other lamp systems are normal | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective clearance lamp | 1) Turn starting switch OFF. 2) Disconnect connector HEAD L, HEAD R. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between HEAD L (5) and chassis ground | Turn lamp switch STEP 1. | Voltage | 20 - 30V |
| | | | Between HEAD R (5) and chassis ground | Turn lamp switch STEP 1. | Voltage | 20 - 30V |
| | 2 | Defective lamp switch | 1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L04 (Male) (2) and (3) | Turn lamp switch OFF. | Resistance | 1MΩ and above |
| | | | | Turn lamp switch STEP 1. | Resistance | 1Ω and below |
| | 3 | Defective small lamp relay (Left side) (L117)<br>★ When left side is defective | 1) Turn starting switch OFF. 2) Replace relay L117 with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when small lamp relay (left) L117 is replaced with normal relay? | Condition is abnormal. | | Relay L117 is normal. |
| | | | | Condition is normal. | | Defective relay L117. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L117. 3) Solid part check. | | | |
| | | | Between L117 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L117. 3) Solid part check. 4) Applies impressed voltage between L117 (Male) (1) - (2) | | | |
| | | | Between L117 (Male) (3) and (5) | Applies 24V impressed voltage between L117 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L117 (Male) (1) - (2) | Resistance | 1MΩ and above |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 4 | Defective small lamp relay (Right side) (L118)<br>★ When right side is defective | 1) Turn starting switch OFF. 2) Replace relay L118 with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when small lamp relay (right) L118 is replaced with normal relay? | Condition is abnormal. | | Relay L118 is normal. |
| | | | | Condition is normal. | | Defective relay L118. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L118. 3) Solid part check. | | | |
| | | | Between L118 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L118. 3) Solid part check.<br>4) Applies impressed voltage between L118 (Male) (1) - (2) | | | |
| | | | Between L118 (Male) (3) and (5) | Applies 24V impressed voltage between L118 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L118 (Male) (1) - (2) | Resistance | 1MΩ and above |
| | 5 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L04, L117, L118, HEAD L, HEAD R and fuse FS2 terminal (10), (11). 3) Connect T-adapter. | | | |
| | | | ★ When both sides are defective (in this case, headlamp also does not light up) | | | |
| | | | Wiring harness between L04 (Female) (3) and chassis ground | | Resistance | 1Ω and below |
| | | | ★ When left side is defective | | | |
| | | | Wiring harness between L117 (Female) (5) and J10 (9), (10) and HEAD L (Female) (5) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS2 (10) and L117 (Female) (1), (3) | | Resistance | 1Ω and below |
| | | | Wiring harness between L117 (Female) (2) and L04 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between HEAD L (Female) (4) and chassis ground | | Resistance | 1Ω and below |
| | | | ★ When right side is defective | | | |
| | | | Wiring harness between L118 (Female) (5) and HEAD R (Female) (5) | | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS2 (11) and L118 (Female) (1), (3) | | Resistance | 1Ω and below |
| | | | Wiring harness between L118 (Female) (2) and L04 (Female) (1) | | Resistance | 1Ω and below |
| | | | Wiring harness between HEAD R (Female) (4) and chassis ground | | Resistance | 1Ω and below |

**Related circuit diagram**

★ See "TROUBLESHOOTING CODE [E-11.(a)]".

### e) Turn signal lamp does not blink

| Action Code | Error Code | Controller Code | Trouble | Each lamps does not function<br>e) Turn signal lamp does not blink |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Turn signal lamp does not blink due to defective switch, lamp or wiring harness (Ground fault) in the turn signal lamp system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Turn signal lamp does not blink | | | |
| Related Information | • If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp)<br>• When circuits for other lamp systems are normal | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective turn-signal switch | 1) Turn starting switch OFF. 2) Disconnect connector L04. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L04 (Male) (6) and (7) | Turn turn-signal switch RIGHT. | Resistance | 1Ω and below |
| | | | | Turn turn-signal switch LEFT. | Resistance | 1MΩ and above |
| | | | Between L04 (Male) (6) and (8) | Turn turn-signal switch RIGHT. | Resistance | 1Ω and below |
| | | | | Turn turn-signal switch LEFT. | Resistance | 1MΩ and above |
| | 2 | Defective hazard switch | 1) Turn starting switch OFF. 2) Disconnect connector L06. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L06 (Male) (1) and (2) | Turn hazard switch OFF. | Resistance | 1Ω and below |
| | | | | Turn hazard switch ON. | Resistance | 1MΩ and above |
| | | | Between L06 (Male) (3) and (2) | Turn hazard switch OFF. | Resistance | 1Ω and below |
| | | | | Turn hazard switch ON. | Resistance | 1MΩ and above |
| | | | ★ When hazard switch does not function | | | |
| | | | Between L06 (Male) (5) and (6) | Wiring harness discontinuity (Disconnection or defective contact) | Resistance | 1MΩ and above |
| | | | | 1) Turn starting switch OFF. 2) Disconnect connector L04, L119, L120, HEAD L, HEAD R and fuse FS1 terminal (8), (9). 3) Connect T-adapter. | Resistance | 1Ω and below |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 3 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L04, L119, L120, HEAD L, HEAD R and fuse FS1 terminal (8), (9). 3) Connect T-adapter. | | |
| | | | ★ When both sides are defective (in this case, headlamp also does not light up) | | |
| | | | Wiring harness between L04 (Female) (3) and chassis ground | Resistance | 1✕ and below |
| | | | ★ When left side is defective | | |
| | | | Wiring harness between L04 (Female) (8) and J03 (10), (6) and HEAD L (Female) (6) | Resistance | 1✕ and below |
| | | | Wiring harness between HEAD L (Female) (4) and chassis ground | Resistance | 1✕ and below |
| | | | Wiring harness between L04 (Female) (8) and J03 (10), (9) and R22 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between R22 (Female) (6) and chassis ground | Resistance | 1✕ and below |
| | | | Wiring harness between J01 (Female) (17) and D12 (2), (1) and J03 (7) | Resistance | 1✕ and below |
| | | | ★ When right side is defective | | |
| | | | Wiring harness between L04 (Female) (7) and J03 (20), (16) and HEAD R (Female) (6) | Resistance | 1✕ and below |
| | | | Wiring harness between HEAD R (Female) (4) and chassis ground | Resistance | 1✕ and below |
| | | | Wiring harness between L04 (Female) (7) and J03 (20), (19) and R23 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between R23 (Female) (6) and chassis ground | Resistance | 1✕ and below |
| | | | Wiring harness between J01 (Female) (20) and D11 (2), (1) and J03 (17) | Resistance | 1✕ and below |
| | | | ★ When both sides are defective | | |
| | | | Wiring harness between fuse FS1 (10) and J10 (4), (1) and L06 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between fuse FS1 (2) and L06 (Female) (3) | Resistance | 1✕ and below |
| | | | Wiring harness between L06 (Female) (2) and L49 (Female) (B) | Resistance | 1✕ and below |
| | | | Wiring harness between L49 (Female) (E) and chassis ground | Resistance | 1✕ and below |
| | | | Wiring harness between L49 (Female) (L) and J01 (Female) (6) | Resistance | 1✕ and below |
| | | | Wiring harness between L04 (Female) (6) and J01 (Female) (4) | Resistance | 1✕ and below |
| | | | ★ When hazard switch does not function | | |
| | | | Wiring harness between L06 (Female) (5) and J01 (Female) (4) | Resistance | 1✕ and below |
| | | | Wiring harness between L06 (Female) (6) and J01 (Female) (18) | Resistance | 1✕ and below |

**Related circuit diagram**

★ See "TROUBLESHOOTING CODE [E-11.(a)]".

### f) Working lamp does not light ON

| Action Code | Error Code | Controller Code | Trouble | Each lamps does not function<br>f) Working lamp does not light ON |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Working lamp does not light ON due to defective switch, lamp or wiring harness (Ground fault) in the clearance lamp system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Working lamp does not light ON. | | | |
| Related Information | • If fuse is blown, there is short circuit with ground, so inspect applicable wiring harness (between fuse and lamp)<br>• When circuits for other lamp systems are normal<br>• When side lamps do not light up, carry out troubleshooting first for side lamp system. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective working lamp | 1) Turn starting switch OFF. 2) Disconnect connector C05, C06, B01 or B02. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between C05 (1) and chassis ground | Turn front working lamp switch ON. | Voltage | 20 - 30V |
| | | | | Turn front working lamp switch OFF. | Voltage | 1V and below |
| | | | Between C06 (1) and chassis ground | Turn front working lamp switch ON. | Voltage | 20 - 30V |
| | | | | Turn front working lamp switch OFF. | Voltage | 1V and below |
| | | | Between B01 (1) and chassis ground | Turn rear working lamp switch ON. | Voltage | 20 - 30V |
| | | | | Turn rear working lamp switch OFF. | Voltage | 1V and below |
| | | | Between B02 (1) and chassis ground | Turn rear working lamp switch ON. | Voltage | 20 - 30V |
| | | | | Turn rear working lamp switch OFF. | Voltage | 1V and below |
| | 2 | Defective working lamp switch | 1) Turn starting switch OFF. 2) Disconnect connector C05, C06, B01 or B02. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L07 (Male) (2) and (3) | Turn front working lamp switch ON. | Resistance | 1Ω and below |
| | | | | Turn front working lamp switch OFF. | Resistance | 1MΩ and above |
| | | | Between L08 (Male) (2) and (3) | Turn rear working lamp switch ON. | Resistance | 1Ω and below |
| | | | | Turn rear working lamp switch OFF. | Resistance | 1MΩ and above |
| | 3 | Defective working lamp relay (L122) | 1) Turn starting switch OFF.2) Replace relay L122 with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when working lamp relay L122 is replaced with normal relay? | Condition is abnormal. | | Relay L122 is normal. |
| | | | | Condition is normal. | | Defective relay L122. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L122. 3) Solid part check. | | | |
| | | | Between L122 (Male) (1) and (2) | | Resistance | 200 - 400Ω |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L122. 3) Solid part check. 4) Applies impressed voltage between L122 (Male) (1) - (2) | | | |
| | | | Between L122 (Male) (3) and (5) | Applies 24V impressed voltage between L122 (Male) (1) - (2) | Resistance | 1Ω and below |
| | | | | Does not apply voltage between L122 (Male) (1) - (2) | Resistance | 1MΩ and above |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 4 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L04, L119, L120, HEAD L, HEAD R and fuse FS1 terminal (8), (9). 3) Connect T-adapter. | | |
| | | | ★ When all lamps are defective | | |
| | | | Wiring harness between L117 (Female) (5) and L122 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between L122 (Female) (2) and chassis ground | Resistance | 1✕ and below |
| | | | ★ When front lamps are defective | | |
| | | | Wiring harness between L122 (Female) (2) and L07 (Female) (2) | Resistance | 1✕ and below |
| | | | Wiring harness between fuse FS2 (12) and L122 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between L07 (Female) (3) and C05 (Female) (1), C06 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between C05 (Female) (2), C06 (Female) (2) and chassis ground | Resistance | 1✕ and below |
| | | | ★ When rear lamps are defective | | |
| | | | Wiring harness between L122 (Female) (4) and L08 (Female) (2) | Resistance | 1✕ and below |
| | | | Wiring harness between fuse FS2 (13) and L122 (Female) (3) | Resistance | 1✕ and below |
| | | | Wiring harness between L08 (Female) (3) and B01 (Female) (1), B02 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between B01 (Female) (2), B02 (Female) (2) and chassis ground | Resistance | 1✕ and below |

**Related circuit diagram**

★ See "TROUBLESHOOTING CODE [E-11.(a)]".

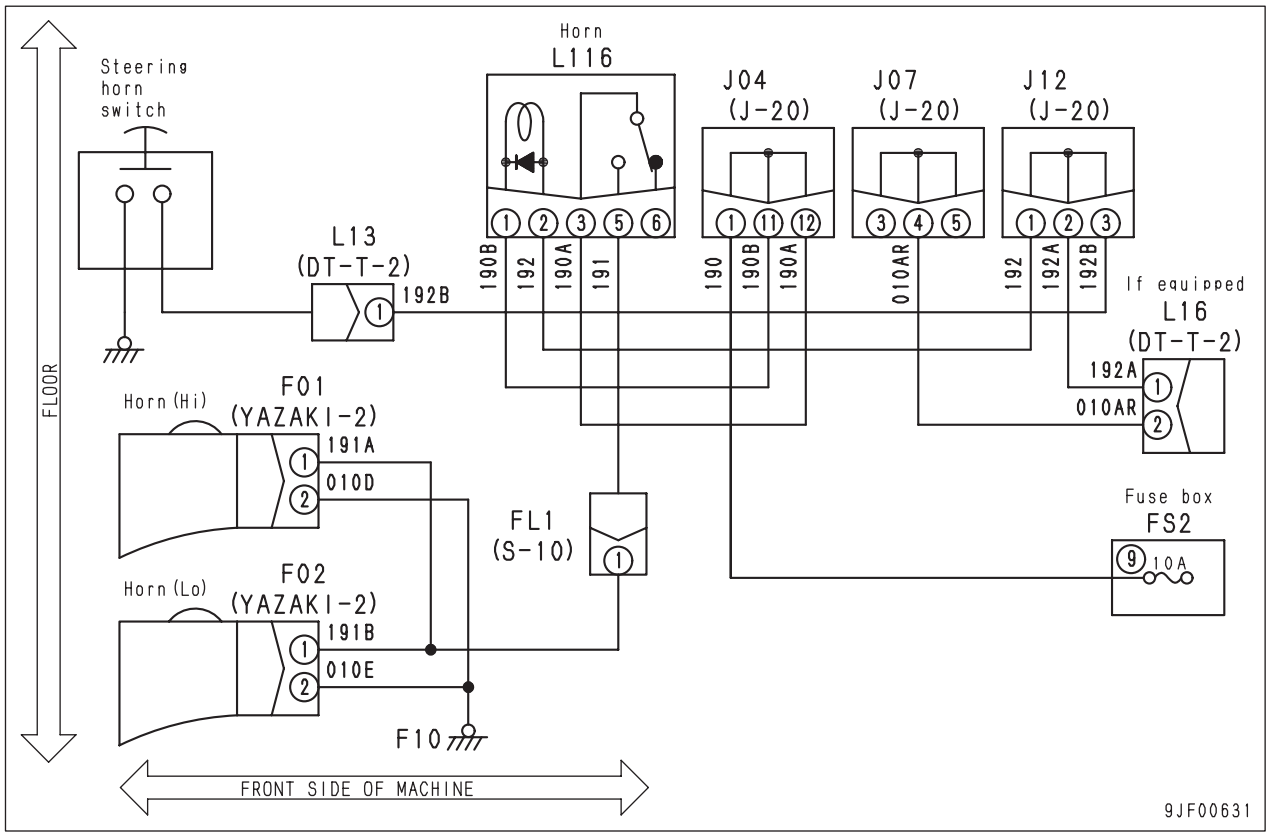
# Troubleshooting Code [E-12] (The horn does not sound)

| Action Code | Error Code | Controller Code | Trouble | The horn does not sound |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Horn does not sound due to defective switch, relay, horn or wiring harness in the horn system. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The horn does not sound. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | | |
|---|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Defective horn switch | 1) Turn starting switch OFF. 2) Disconnect connector L13. 3) Connect connector. | | | |
| | | | Between L13 (Male) (1) and chassis ground | Push horn switch ON | Resistance | 1✕ and below |
| | | | | Horn switch OFF | Resistance | 1M✕ and above |
| | 2 | Defective horn relay (L116) | 1) Turn starting switch OFF. 2) Disconnect connector L116. 3) Insert T-adapter. 4) Connect connector. 5) Turn starting switch ON. | | | |
| | | | Between L116 (1), (3) and chassis ground | | Voltage | 20 - 30V |
| | | | Between L116 (2) and chassis ground | | Voltage | 20 - 30V |
| | | | Between L116 (2) and chassis ground | | Voltage | 1V and below |
| | | | Between L116 (5) and chassis ground | | Voltage | 20 - 30V |
| | | | 1) Turn starting switch OFF. 2) Replace relay L116 with normal relay. 3) Turn starting switch ON. | | | |
| | | | Does condition become normal when horn and lamp relay L116 is replaced with normal relay? | Condition is abnormal. | | Relay L116 is normal. |
| | | | | Condition is normal. | | Defective relay L116. |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L116. 3) Solid part check. | | | |
| | | | Between L116 (Male) (1) and (2) | | Resistance | 200 - 400✕ |
| | | | 1) Turn starting switch OFF. 2) Disconnect connector L116. 3) Solid part check. 4) Applies impressed voltage between L116 (Male) (1) - (2) | | | |
| | | | Between L116 (Male) (3) and (5) | Applies 24V impressed voltage between L116 (Male) (1) - (2) | Resistance | 1✕ and below |
| | | | | Does not apply voltage between L116 (Male) (1) - (2) | Resistance | 1M✕ and above |
| | 3 | Defective horn | 1) Turn starting switch OFF. 2) Disconnect connector F01, F02. 3) Insert T-adapter. 4) Connect T-adapter. 5) Turn starting switch ON. | | | |
| | | | Between F01 (Male) (1) and (2) | Push horn switch ON | Voltage | 20 - 30V |
| | | | | Horn switch OFF | Voltage | 1V and below |
| | | | Between F02 (Male) (1) and (2) | Push horn switch ON | Voltage | 20 - 30V |
| | | | | Horn switch OFF | Voltage | 1V and below |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 4 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector L05, L152 and fuse FS1 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between fuse FS2 (8) and L116 (Female) (1), (3) | Resistance | 1✕ and below |
| | | | Wiring harness between L116 (Female) (2) and L13 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between L116 (Female) (5) and F02 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between F01 (Female) (2), F02 (Female) (2) and chassis ground | Resistance | 1✕ and below |
| | 5 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector L05, L48, L52, L157 and fuse FS1 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between fuse FS2 (8) and L116 (Female) (1), (3) *1 | Resistance between fuse FS2 (8), L116 (Female) (1), (3) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L116 (Female) (2) and L13 (Female) (1) *2 | Resistance between L116 (Female) (2), L13 (Female) (1) and chassis ground | 1M✕ and above |
| | | | Wiring harness between L116 (Female) (5) and F01 (Female) (1), F02 (Female) (1) | Resistance between L116 (Female) (4), F01 (Female) (1), F02 (Female) (1) and chassis ground | 1M✕ and above |
| | | | ★ In case of *1 above, fuse is blown<br>★ In case of *2 above, horn does not stop sounding | | |

**Related circuit diagram**



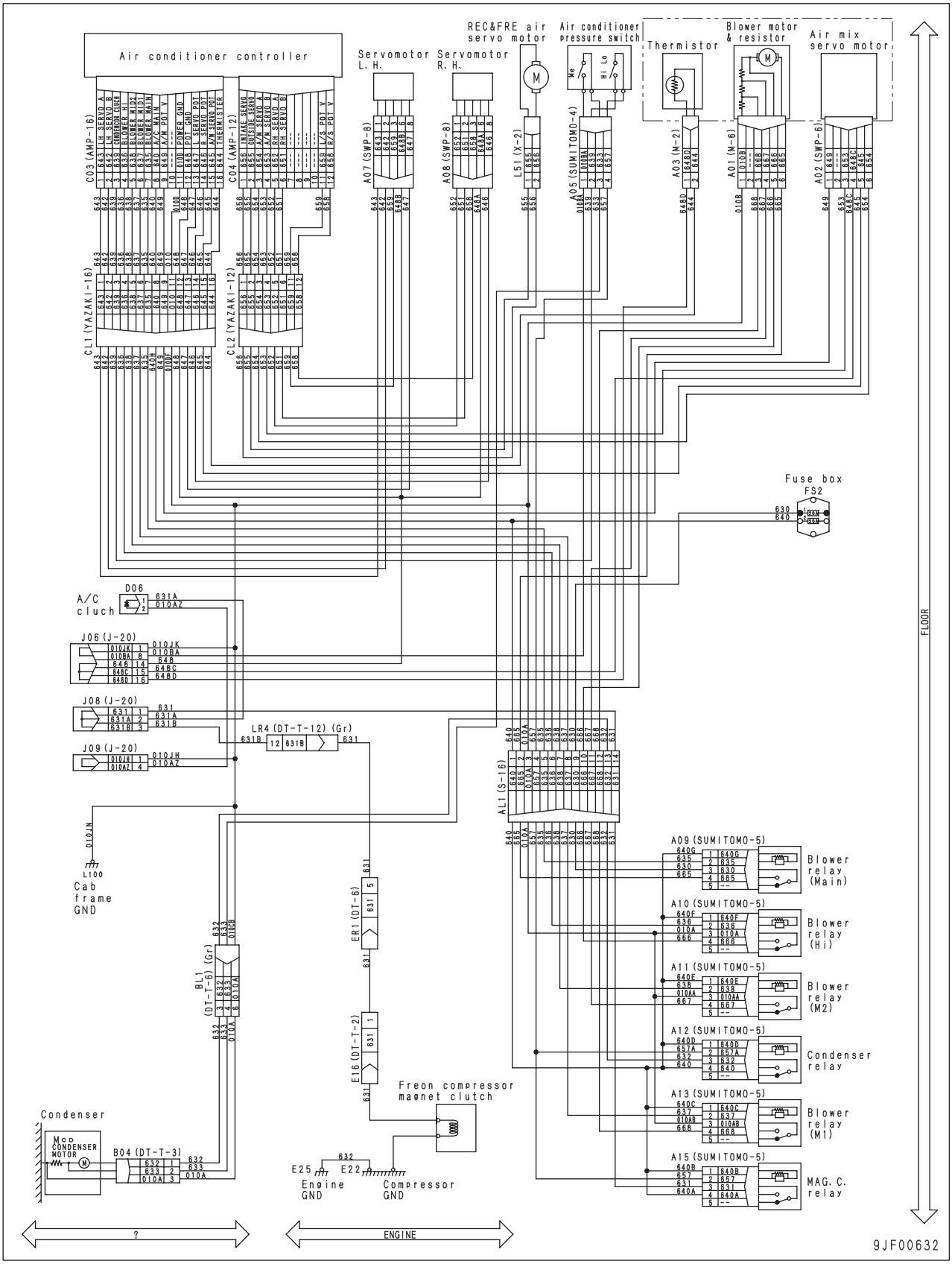
# Troubleshooting Code [E-13] (Defective the air conditioner)

**a) The air conditioner does not work**

| Action Code | Error Code | Controller Code | Trouble | Defective the air conditioner<br>a) The air conditioner does not work |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • The air conditioner does not work. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • The air conditioner does not work. | | | |
| Related Information | • If fuse FS2 (2) is blown, check wiring harness between fuse FS2 (2) - C03 (Female) (8) for short circuit with ground. | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector C03, fuse FS2 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between fuse FS2 (2) and C03 (Female) (8) | Resistance | 1✕ and below |
| | | | Wiring harness between C03 (Female) (11) and chassis ground | Resistance | 1✕ and below |
| | 2 | Defective air conditioner control panel | ★ Check the control panel, and if any abnormality is found, repair or replace. | | |

**Related circuit diagram**



### b) Air does not flow out or amount of air cannot be adjusted.

| Action Code | Error Code | Controller Code | Trouble | Defective air conditioner<br>b) Air does not flow out or amount of air cannot be adjusted. |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Air does not flow out or amount of air cannot be adjusted. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Air does not flow out or amount of air cannot be adjusted. | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| | 1 | Power supply wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector A09, A10, A11, A13 and fuse FS2 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between fuse FS2 (2) and A09 (Female) (1) | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS2 (2) and A10 (Female) (1) | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS2 (2) and A11 (Female) (1) | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS2 (2) and A13 (Female) (1) | Resistance | 1Ω and below |
| | | | Wiring harness between fuse FS2 (1) and A09 (Female) (3) | Resistance | 1Ω and below |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector C03, A09, A10, A11, A12 and fuse FS2 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between C03 (Female) (7) and A09 (Female) (2) | Resistance | 1Ω and below |
| | | | Wiring harness between C03 (Female) (4) and A10 (Female) (2) | Resistance | 1Ω and below |
| | | | Wiring harness between C03 (Female) (5) and A11 (Female) (2) | Resistance | 1Ω and below |
| | | | Wiring harness between C03 (Female) (6) and A13 (Female) (2) | Resistance | 1Ω and below |
| | | | Wiring harness between A09 (Female) (4) and A01 (Female) (6) | Resistance | 1Ω and below |
| | | | Wiring harness between A10 (Female) (4) and A01 (Female) (5) | Resistance | 1Ω and below |
| | | | Wiring harness between A11 (Female) (4) and A01 (Female) (4) | Resistance | 1Ω and below |
| | | | Wiring harness between A13 (Female) (4) and A01 (Female) (3) | Resistance | 1Ω and below |
| | | | Wiring harness between A10 (Female) (3) and chassis ground | Resistance | 1Ω and below |
| | | | Wiring harness between A11 (Female) (3) and chassis ground | Resistance | 1Ω and below |
| | | | Wiring harness between A13 (Female) (3) and chassis ground | Resistance | 1Ω and below |
| | | | Wiring harness between A01 (Female) (1) and chassis ground | Resistance | 1Ω and below |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector A01, A05, A09, A10, A11, A13 and fuse FS2 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between fuse FS1 (2) and A09 (Female) (1) * | Resistance between fuse FS1 (2), A09 (Female) (1) and chassis ground | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (2) and A10 (Female) (1) * | Resistance between fuse FS1 (2), A10 (Female) (1) and chassis ground | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (2) and A11 (Female) (1) * | Resistance between fuse FS1 (2) and A11 (Female) (1) and chassis ground | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (2) and A13 (Female) (1) * | Resistance between fuse FS1 (2), A13 (Female) (1) and chassis ground | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (2) and A12 (Female) (1) * | Resistance between fuse FS1 (2), A12 (Female) (1) and chassis ground | 1MΩ and above |
| | | | Wiring harness between fuse FS1 (2) and A15 (Female) (1) * | Resistance between fuse FS1 (2), A15 (Female) (1) and chassis ground | 1MΩ and above |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 3 | Wiring harness ground fault | Wiring harness between fuse FS1 (2) and A09 (Female) (3) * | Resistance between fuse FS1 (2), A09 (Female) (3) and chassis ground | 1MΩ and above |
| | | | Wiring harness between C03 (Female) (7) and A09 (Female) (2) | Resistance between C03 (Female) (7), A09 (Female) (2) and chassis ground | 1MΩ and above |
| | | | Wiring harness between C03 (Female) (4) and A10 (Female) (2) | Resistance between C03 (Female) (4), A10 (Female) (2) and chassis ground | 1MΩ and above |
| | | | Wiring harness between C03 (Female) (5) and A11 (Female) (2) | Resistance between C03 (Female) (5), A11 (Female) (2) and chassis ground | 1MΩ and above |
| | | | Wiring harness between C03 (Female) (6) and A13 (Female) (2) | Resistance between C03 (Female) (6), A13 (Female) (2) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A09 (Female) (4) and A01 (Female) (6) | Resistance between A09 (Female) (4), A01 (Female) (6) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A10 (Female) (4) and A01 (Female) (5) | Resistance between A10 (Female) (4), A01 (Female) (5) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A11 (Female) (4) and A01 (Female) (4) | Resistance between A11 (Female) (4), A01 (Female) (4) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A13 (Female) (4) and A01 (Female) (3) | Resistance between A13 (Female) (4), A01 (Female) (3) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A05 (Female) (2) and C03 (Female) (3) | Resistance between A05 (Female) (2), C03 (Female) (3) and chassis ground | 1MΩ and above |
| | | | ★ If marked * above, fuse is blown | | |
| | 4 | Defective blower main relay | 1) Turn starting switch OFF. 2) Replace relay with normal relay. 3) Turn starting switch ON. 4) Start air conditioner | | |
| | | | Does condition become normal when relay is replaced with normal relay? | Condition is normal. | Defective relay. |
| | | | | Condition is abnormal. | Relay is normal. |
| | 5 | Defective blower Hi relay | 1) Turn starting switch OFF. 2) Replace relay with normal relay. 3) Turn starting switch ON. 4) Start air conditioner | | |
| | | | Does condition become normal when relay is replaced with normal relay? | Condition is normal. | Defective relay. |
| | | | | Condition is abnormal. | Relay is normal. |
| | 6 | Defective blower M2 relay | 1) Turn starting switch OFF. 2) Replace relay with normal relay. 3) Turn starting switch ON. 4) Start air conditioner | | |
| | | | Does condition become normal when relay is replaced with normal relay? | Condition is normal. | Defective relay. |
| | | | | Condition is abnormal. | Relay is normal. |
| | 7 | Defective blower M1 relay | 1) Turn starting switch OFF. 2) Replace relay with normal relay. 3) Turn starting switch ON. 4) Start air conditioner | | |
| | | | Does condition become normal when relay is replaced with normal relay? | Condition is normal. | Defective relay. |
| | | | | Condition is abnormal. | Relay is normal. |
| | 8 | Defective blower motor | 1) Turn starting switch OFF. 2) Replace motor with normal motor. 3) Turn starting switch ON. 4) Start air conditioner | | |
| | | | Does condition become normal when motor is replaced with normal motor? | Condition is normal. | Defective motor. |
| | | | | Condition is abnormal. | Relay is motor. |
| | 9 | Defective blower resister | 1) Turn starting switch OFF. 2) Disconnect connector A01. 3) Solid part check. | | |
| | | | Between A01 (Female) (1) and (2) | Resistance | 2.8Ω |
| | | | Between A01 (Female) (1) and (3) | Resistance | 4.8Ω |
| | | | Between A01 (Female) (1) and (4) | Resistance | 4.0Ω |
| | 10 | Defective air conditioner control panel | ★ Check the control panel, and if any abnormality is found, repair or replace. | | |

**Related circuit diagram**

★ See "TROUBLESHOOTING CODE [E-13.(a)]".

### c) Does not cool or temperature cannot be adjusted.

| Action Code | Error Code | Controller Code | Trouble | Defective air conditioner<br>c) Does not cool or temperature cannot be adjusted. |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Does not cool or temperature cannot be adjusted. | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Does not cool or temperature cannot be adjusted. | | | |
| Related Information | | | | |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 1 | Power supply wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector A12, A15 and fuse FS2 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between fuse FS2 (2) and A12 (Female) (1), (4) | Resistance | 1✕ and below |
| | | | Wiring harness between fuse FS2 (2) and A15 (Female) (1), (4) | Resistance | 1✕ and below |
| | 2 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector A02, A03, A05, A07, A08, A12, A15, B04, C03, C04 and J06. 3) Connect T-adapter. | | |
| | | | Wiring harness between A05 (Female) (1) and chassis ground | Resistance | 1✕ and below |
| | | | Wiring harness between A05 (Female) (2) and C03 (Female) (4) | Resistance | 1✕ and below |
| | | | Wiring harness between A05 (Female) (3) and B04 (Female) (2) | Resistance | 1✕ and below |
| | | | Wiring harness between A05 (Female) (4) and A12 (Female) (2), A15 (Female) (2) | Resistance | 1✕ and below |
| | | | Wiring harness between A12 (Female) (3) and B04 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between A15 (Female) (3) and E16 (Female) (1) | Resistance | 1✕ and below |
| | | | Wiring harness between B04 (Female) (3) and chassis ground | Resistance | 1✕ and below |
| | | | Wiring harness between compressor magnet clutch (-) terminal and chassis ground | Resistance | 1✕ and below |
| | | | Wiring harness between C03 (Female) (16) and A03 (Female) (2) | Resistance | 1✕ and below |
| | | | Wiring harness between A03 (Female) (1) and J06 (16), (15) and C03 (Female) (12) | Resistance | 1✕ and below |
| | | | Wiring harness between A03 (Female) (1) and J06 (16), (15) and A02 (Female) (4) | Resistance | 1✕ and below |
| | | | Wiring harness between A02 (Female) (1) and C03 (Female) (9) | Resistance | 1✕ and below |
| | | | Wiring harness between A02 (Female) (3) and C04 (Female) (4) | Resistance | 1✕ and below |
| | | | Wiring harness between A02 (Female) (5) and C03 (Female) (15) | Resistance | 1✕ and below |
| | | | Wiring harness between A02 (Female) (6) and C04 (Female) (3) | Resistance | 1✕ and below |
| | 3 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector A02, A03, A05, A12, A15, B04, C03, C04 and fuse FS2 terminal. 3) Connect T-adapter. | | |
| | | | Wiring harness between fuse FS1 (2) and A12 (Female) (1), (4) * | Resistance between fuse FS1 (2), A12 (Female) (1), (4) and chassis ground | 1M✕ and above |
| | | | Wiring harness between fuse FS1 (2) and A15 (Female) (1), (4) * | Resistance between fuse FS1 (2), A15 (Female) (1), (4) and chassis ground | 1M✕ and above |
| | | | Wiring harness between A05 (Female) (3) and B04 (Female) (2) * | Resistance between A05 (Female) (3), B04 (Female) (2) and chassis ground | 1M✕ and above |
| | | | Wiring harness between A05 (Female) (4) and A12 (Female) (2), A15 (Female) (2) | Resistance between A05 (Female) (4), A12 (Female) (2), A15 (Female) (2) and chassis ground | 1M✕ and above |

| | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| Possible Causes and Standard Values | 3 | Wiring harness ground fault | Wiring harness between A12 (Female) (3) and B04 (Female) (1) | Resistance between A12 (Female) (3), B04 (Female) (1) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A15 (Female) (3) and E16 (Female) (1) | Resistance between A15 (Female) (3), E16 (Female) (1) and chassis ground | 1MΩ and above |
| | | | Wiring harness between C03 (Female) (16) and A03 (Female) (2) | Resistance between C03 (Female) (16), A03 (Female) (2) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A03 (Female) (1) and J06 (16), (15) and C03 (Female) (12) | Resistance between A03 (Female) (1), C03 (Female) (12) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A03 (Female) (1) and J06 (16), (15) and A02 (Female) (4) | Resistance between A03 (Female) (1), A02 (Female) (4) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A02 (Female) (1) and C03 (Female) (9) | Resistance between A02 (Female) (1), C03 (Female) (9) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A02 (Female) (3) and C04 (Female) (4) | Resistance between A02 (Female) (3), C04 (Female) (4) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A02 (Female) (5) and C03 (Female) (15) | Resistance between A02 (Female) (5), C03 (Female) (15) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A02 (Female) (6) and C04 (Female) (3) | Resistance between A02 (Female) (6), C04 (Female) (3) and chassis ground | 1MΩ and above |
| | | | ★ If marked * above, fuse is blown | | |
| | 4 | Defective compressor clutch relay | 1) Turn starting switch OFF. 2) Replace relay with normal relay. 3) Turn starting switch ON. 4) Start air conditioner | | |
| | | | Does condition become normal when relay is interchanged with normal relay? | Condition is normal. | Defective relay. |
| | | | | Condition is abnormal. | Relay is normal. |
| | 5 | Defective pressure switch | 1) Turn starting switch OFF. 2) Disconnect connector A05. 3) Connect T-adapter. 4) Turn starting switch ON. | | |
| | | | Between A05 (Male) (1) and (2) | Turn air conditioner switch OFF. | Resistance: 1MΩ and above |
| | | | | When air conditioner switch is ON and cooling is in operation | Resistance: 1Ω and below |
| | 6 | Defective thermister | 1) Turn starting switch OFF. 2) Disconnect connector ACTH. 3) Turn starting switch ON. 4) Start air conditioner. | | |
| | | | Between A03 (Male) (1) and (2) | Temperature: 25°C | 37 - 50kΩ |
| | | | | Temperature: 100°C | 3.5 - 4.0kΩ |
| | 7 | Defective temperature control servo motor | 1) Turn starting switch OFF. 2) Replace motor with normal motor. 3) Turn starting switch ON. 4) Start air conditioner | | |
| | | | Does condition become normal when servo motor is interchanged with normal motor? | Condition is normal. | Defective motor. |
| | | | | Condition is abnormal. | Motor is normal. |
| | 8 | Defective air conditioner compressor | 1) Turn starting switch OFF. 2) Replace compressor with normal compressor. 3) Turn starting switch ON. 4) Start air conditioner | | |
| | | | Does condition become normal when air conditioner compressor is replaced with normal compressor? | Condition is normal. | Defective air conditioner compressor. |
| | | | | Condition is abnormal. | Air conditioner compressor is normal. |
| | 9 | Defective diode (D06) | Turn starting switch OFF. 2) Replace diode D06 with normal diode. | | |
| | | | Replace diode D06 with normal diode | Condition is normal. | Defective diode D06. |
| | | | | Condition is abnormal. | Diode D06 is normal. |
| | 10 | Defective air conditioner control panel | ★ Check the control panel, and if any abnormality is found, repair or replace. | | |

**Related circuit diagram**

★ See "TROUBLESHOOTING CODE [E-13.(a)]".

### d) Impossible to switch between recirculated air and fresh air

| Action Code | Error Code | Controller Code | Trouble | Defective air conditioner<br>d) Impossible to switch between recirculated air and fresh air |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Air conditioner system is defective, so it is impossible to switch between recirculated air and fresh air | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Impossible to switch between recirculated air and fresh air | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| | 1 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector C04, L51. 3) Connect T-adapter. | | |
| | | | Wiring harness between C04 (Female) (1) and L51 (Female) (2) | Resistance | 1Ω and below |
| | | | Wiring harness between C04 (Female) (2) and L51 (Female) (1) | Resistance | 1Ω and below |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector C04, L51. 3) Connect T-adapter. | | |
| | | | Wiring harness between C04 (Female) (1) and L51 (Female) (2) | Resistance between C04 (Female) (1), L51 (Female) (2) and chassis ground | 1MΩ and above |
| | | | Wiring harness between C04 (Female) (2) and L51 (Female) (1) | Resistance between C04 (Female) (2), L51 (Female) (1) and chassis ground | 1MΩ and above |
| | 3 | Defective air conditioner control panel | ★ Check the control panel, and if any abnormality is found, repair or replace. | | |

**Related circuit diagram**

★ See "TROUBLESHOOTING CODE [E-13.(a)]".

### e) Impossible to switch vents

| Action Code | Error Code | Controller Code | Trouble | Defective air conditioner<br>e) Impossible to switch vents |
|---|---|---|---|---|
| - | - | - | | |
| Description of Trouble | • Impossible to switch vents | | | |
| Machine monitor or controller Reaction | • No reaction. | | | |
| Effect on Machine | • Impossible to switch vents | | | |
| Related Information | | | | |

| Possible Causes and Standard Values | Causes | | Standard Value in Normal State and Remarks on Troubleshooting | | |
|---|---|---|---|---|---|
| | 1 | Wiring harness discontinuity (Disconnection or defective contact) | 1) Turn starting switch OFF. 2) Disconnect connector A03, A07, A08, C03, C04, J06. 3) Connect T-adapter. | | |
| | | | Wiring harness between A07 (Female) (1) and C03 (Female) (1) | Resistance | 1Ω and below |
| | | | Wiring harness between A07 (Female) (2) and C03 (Female) (2) | Resistance | 1Ω and below |
| | | | Wiring harness between A07 (Female) (3) and C04 (Female) (11) | Resistance | 1Ω and below |
| | | | Wiring harness between A07 (Female) (8) and C03 (Female) (13) | Resistance | 1Ω and below |
| | | | Wiring harness between A08 (Female) (1) and C04 (Female) (5) | Resistance | 1Ω and below |
| | | | Wiring harness between A08 (Female) (2) and C04 (Female) (6) | Resistance | 1Ω and below |
| | | | Wiring harness between A08 (Female) (3) and C04 (Female) (12) | Resistance | 1Ω and below |
| | | | Wiring harness between A08 (Female) (8) and C03 (Female) (14) | Resistance | 1Ω and below |
| | | | Wiring harness between A03 (Female) (1) and J06 (16), (14) and A07 (Female) (6) | Resistance | 1Ω and below |
| | | | Wiring harness between A03 (Female) (1) and J06 (16), (14) and A08 (Female) (6) | Resistance | 1Ω and below |
| | 2 | Wiring harness ground fault | 1) Turn starting switch OFF. 2) Disconnect connector ACP1, ACP2, ACM2. 3) Connect T-adapter. | | |
| | | | Wiring harness between A07 (Female) (1) and C03 (Female) (1) | Resistance between A07 (Female) (1), C03 (Female) (1) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A07 (Female) (2) and C03 (Female) (2) | Resistance between A07 (Female) (2), C03 (Female) (2) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A07 (Female) (3) and C03 (Female) (11) | Resistance between A07 (Female) (3), C03 (Female) (11) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A07 (Female) (8) and C03 (Female) (13) | Resistance between A07 (Female) (8), C03 (Female) (13) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A08 (Female) (1) and C04 (Female) (5) | Resistance between A08 (Female) (1), C04 (Female) (5) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A08 (Female) (2) and C04 (Female) (6) | Resistance between A08 (Female) (2), C04 (Female) (6) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A08 (Female) (3) and C04 (Female) (12) | Resistance between A08 (Female) (3), C04 (Female) (12) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A08 (Female) (8) and C03 (Female) (14) | Resistance between A08 (Female) (8), C03 (Female) (14) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A03 (Female) (1) and J06 (16), (14) and A07 (Female) (6) | Resistance between A03 (Female) (1), J06 (16), (14), A07 (Female) (6) and chassis ground | 1MΩ and above |
| | | | Wiring harness between A03 (Female) (1) and J06 (16), (14) and A08 (Female) (6) | Resistance between A03 (Female) (1), J06 (16), (14), A08 (Female) (6) and chassis ground | 1MΩ and above |
| | 3 | Defective air conditioner control panel | ★ Check the control panel, and if any abnormality is found, repair or replace. | | |

**Related circuit diagram**

★ See "TROUBLESHOOTING CODE [E-13.(a)]".

white 20-566

# TROUBLESHOOTING OF HYDRAULIC, MECHANICAL SYSTEM (H MODE)


Method of using troubleshooting chart . . . . . 20-602
Failure code and cause table . . . . . 20-604
H-1 The machine does not start . . . . . 20-606
H-2 The travel speed is slow . . . . . 20-607
H-3 The thrusting force is weak . . . . . 20-608
H-4 Engine stalls when traveling or engine speed drops excessively . . . . . 20-609
H-5 The gear is not shifted . . . . . 20-610
H-6 The steering wheel does not turn . . . . . 20-611
H-7 The steering wheel is heavy . . . . . 20-612
H-8 Steering wheel shakes or jerks . . . . . 20-613
H-9 The brake does not work or does not work well . . . . . 20-614
H-10 The brake is not released or is dragged . . . . . 20-615
H-11 The parking brake is not work, released or is dragged . . . . . 20-616
H-12 The lift arm does not rise or lower . . . . . 20-617
H-13 The lift arm moves slowly or the lift arm rising force is insufficient . . . . . 20-618
H-14 When rising, the lift arm comes to move slowly at specific height . . . . . 20-619
H-15 The lift arm cylinder cannot hold down the bucket (The bucket rises in the air) . . . . . 20-619
H-16 Hydraulic drifts of the lift arm occur often . . . . . 20-619
H-17 The lift arm wobbles during operation . . . . . 20-619
H-18 When the control lever is switched from "HOLD" to "RAISE," the lift arm falls temporarily . . . . . 20-620
H-19 The bucket does not tilt back . . . . . 20-621
H-20 The bucket moves slowly or the tilting-back force is insufficient . . . . . 20-622
H-21 The bucket comes to operate slowly in he midst of tilting-back . . . . . 20-623
H-22 The bucket cylinder cannot hold down the bucket . . . . . 20-623
H-23 Hydraulic drifts of the bucket occur often . . . . . 20-623
H-24 The bucket wobbles during travel with cargo (The work equipment valve is set to "HOLD") . . . . . 20-624
H-25 When the control lever is switched from "HOLD" to "TILT," the bucket falls temporarily . . . . . 20-624
H-26 The control levers of the lift arm and bucket do not move smoothly and heavy . . . . . 20-624

# METHOD OF USING TROUBLESHOOTING CHART

This troubleshooting chart, like the other troubleshooting charts (YES/NO type), determines the location from the problem of occurring on the machine and categorizes the problem under one of the main components, such as the steering system or work equipment hydraulic system. Use the following procedure to carry out accurate troubleshooting swiftly.

Step 1. Ask operator questions

The questions to ask the operator are given under the problem. If the answer to the question matches the content given, the cause given after the arrow is the probable cause.
Keeping the content of the questions in mind, read the matrix and proceed with Step 2 and Step 3 to pinpoint the correct cause.

Example: Steering wheel will not turn
Ask the operator and check the following points.

- Did the problem suddenly start?

✗ Broken part in steering equipment

- Was the steering wheel heavy before?

✗ Internal wear, defective seal in steering related equipment

Step 2. Checks before troubleshooting

Before measuring the oil pressure or starting the troubleshooting, confirm the checks before starting items, check for leakage of oil, or for loose bolts.
This will prevent wasting time when troubleshooting.
The items given under Checks before troubleshooting are checks that are particularly important to make about the condition of the machine before starting the actual troubleshooting.

Example: Checks before starting troubleshooting

- Is oil level and type of oil in hydraulic tank correct?
- Is there any oil leakage from steering valve or demand valve?
- Is steering linkage adjusted properly?

Step 3. Method of reading matrix

1) Operate the machine when carrying out troubleshooting of the items in the Troubleshooting column. If any problems occur as the result of the troubleshooting, put a check against the item.
   ★ When carrying out the troubleshooting, check the easier items first. It is not necessary to follow the number order.
2) Find the matching cause in the Causes column.
   If a problem is found, the ○ marks on the same line as the troubleshooting are the causes. (In Troubleshooting item 2 in the same diagram on the right the cause is c or e.)
   When there is one ○ mark
   Carry out troubleshooting for the other items marked with ○ in the same Causes column to check if the problem occurs, then make repairs.
   When there are two ○ marks
   Go to Step 3) to narrow down the cause.

1. Steering wheel does not turn ✗ Problem (example)

| |
|---|
| Ask the operator the following questions.<br>• Did the problem suddenly start?<br>Yes = Equipment related to steering broken<br>• Was there previously any symptom, such as heaviness of the steering wheel?<br>Yes = Wear of equipment related to steering, defective seal |

Checks before troubleshooting (example)

| |
|---|
| • Is the oil level in the hydraulic tank correct? Is the type of oil correct?<br>• Is there any leakage of oil from the steering valve or Orbitroll?<br>• Has the safety bar been removed from the frame? |

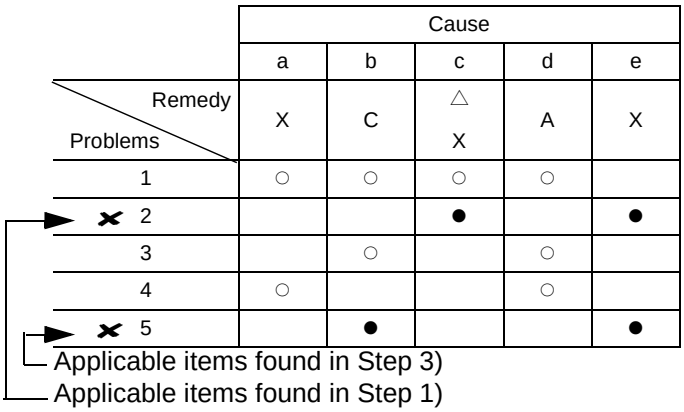
<Example 1>

| No. | Remedy / Problems |
|---|---|
| 1 | Steering wheel does not turn in either direction (left and right) |
| 2 | In Item 1, movement of work equipment is abnormal |
| 3 | Steering wheel turns only in one direction (left or right) |
| 4 | Steering wheel is heavy and does not turn |

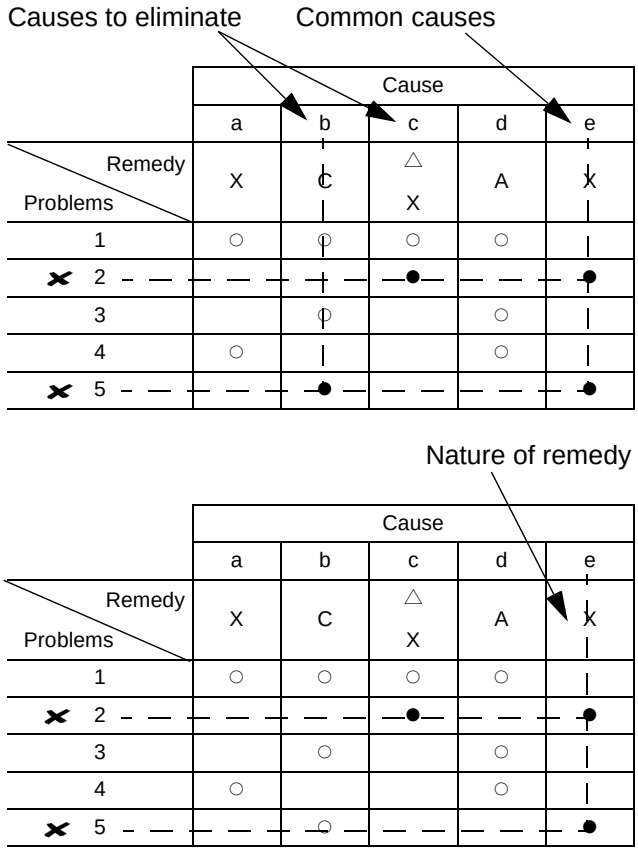
<Example 2>

| | Cause | | | | |
|---|---|---|---|---|---|
| Remedy / Problems | a | b | c | d | e |
| | X | C | △ X | A | X |
| 1 | ○ | ○ | ○ | ○ | |
| 2 | — | — | ● | — | ● |
| 3 | | ○ | | ○ | |
| 4 | ○ | | | ○ | |
| 5 | | ○ | | | ○ |

3) Operate the machine and carry out troubleshooting of the items not checked in Step 1). Operate the machine in the same way as in Step 1), and if any problem occurs, put a check against the item. (In Troubleshooting item 5 in the diagram on the right, the problem was re-enacted.)
4) Find the matching cause in the cause column.
In the same way as in Step 2), if a problem is found, the ○ marks on the same line for the troubleshooting item are the causes. (In Troubleshooting item 5 in the diagram on the right, the cause is b or e.)




5) Narrow down the causes.
Of the causes found in Step 2) and Step 4), there are common items (○ marks on the line for each troubleshooting item and in the same Cause column as each other) that have causes common with the problem items found in the troubleshooting in Step 1) and Step 3).
★ The items that are not common (items that do not have ○ marks in the same cause common as each other) are probably not the cause, so they can be eliminated.
(The causes for Troubleshooting item 2 in the diagram on the right are c or e, and the causes in Troubleshooting item 5 are b or e, so Cause e is the common cause.)
6) Repeat the operation in Steps 3), 4), and 5) until the cause is narrowed down to 1 item (1 common item).
★ If cause items are 2 or more, continue until number of items becomes minimum.







7) Remedy
After narrowing down the common causes, taken the action given in the remedy line.
X: Replace △: Repair A: Adjust C: Clean

# FAILURE CODE AND CAUSE TABLE

| Failure Code | Part causing problem | Damper | HST pump | | | | | | | HST motor 2 | | | HST motor 1 | | Inching valve | Inching valve linkage |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pump body (Piston pump end) | Pump body (Charge pump end) | High pressure relief valve | High pressure cut-off valve | Low pressure relief valve (Charge relief valve) | DA valve | forward and reverse solenoid valve | Motor body | Mode selector solenoid valve (SOL a) | Angle stopper solenoid valve (SOL b) | Motor body | Angle stopper control solenoid valve | | |
| HST related | Does not travel forward or in reverse | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | ○ | | | ○ | | ○ | ○ |
| | Does not travel forward (reverse is normal) | | | | ○ | | | | ○ | | | | | | | |
| | The machine does not start at reverse (Forward is normal) | | | | ○ | | | | ○ | | | | | | | |
| | Speed is slow in both forward and reverse | | ○ | ○ | | | ○ | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| | The travel speed is slow at forward (Reverse is normal) | | | | ○ | | | | ○ | | | | | | | |
| | The travel speed is slow at reverse (Forward is normal) | | | | ○ | | | | ○ | | | | | | | |
| | Rimpull is weak in both forward and reverse | | | | | ○ | | | | ○ | | | ○ | ○ | ○ | ○ |
| | The thrusting force is weak at forward (Reverse is normal) | | | | ○ | | | | | | | | | | | |
| | The thrusting force is weak at reverse (Forward is normal) | | | | ○ | | | | | | | | | | | |
| | Engine stalls when traveling or engine speed drops excessively | | | | | | | ○ | | | | ○ | | ○ | | |
| | The gear is not shifted | | | | | | | | | | | ○ | | ○ | | |
| Steering wheel | The steering wheel does not turn | | | | | | | | | | | | | | | |
| | The steering wheel is heavy | | | | | | | | | | | | | | | |
| | There is play in steering wheel or excessive shock | | | | | | | | | | | | | | | |
| Brake | The brake does not work or does not work well | | | | | | | | | | | | | | | |
| | The brake is not released or is dragged | | | | | | | | | | | | | | | |
| | The parking brake is not work, released or is dragged | | | | | | | | | | | | | | | |
| Work equipment system | The lift arm does not rise or lower | | | ○ | | | | | | | | | | | | |
| | The lift arm moves slowly or the lift arm rising force is insufficient | | | | | | | | | | | | | | | |
| | When the lift arm rising, the lift arm comes to move slowly at specific height | | | | | | | | | | | | | | | |
| | The lift arm cylinder cannot be hold down the bucket (The bucket rises in the air) | | | | | | | | | | | | | | | |
| | Hydraulic drift of the lift arm occur often | | | | | | | | | | | | | | | |
| | The lift arm wobbles during operation | | | | | | | | | | | | | | | |
| | When the control lever is switched from "HOLD" to "RAISE", the lift arm falls temporarily | | | | | | | | | | | | | | | |
| | The bucket does not tilt back | | | | | | | | | | | | | | | |
| | The bucket moves slowly or the tilting-back force is insufficient | | | | | | | | | | | | | | | |
| | The bucket comes to operate slowly in he midst of tilting-back | | | | | | | | | | | | | | | |
| | The bucket cylinder cannot be hold down to bucket | | | | | | | | | | | | | | | |
| | Hydraulic drift of the bucket occur often | | | | | | | | | | | | | | | |
| | The bucket wobbles during travel with cargo (The work equipment valve is set to "HOLD") | | | | | | | | | | | | | | | |
| | When the control lever is switched from "HOLD" to "TILT", the bucket falls temporarily | | | | | | | | | | | | | | | |
| | The control levers of the lift arm and bucket do not move smoothly and heavy | | | | | | | | | | | | | | | |

| Clutch solenoid | Clutch | Transfer | Work equipment and steering pump | Brake pump | Steering valve: Orbit-roll | Steering valve: Priority valve | Steering valve: Relief valve | Steering cylinder | Accumulator charge valve | Brake valve | Slack adjuster | Axle: Brake disc and plate | Axle: Brake piston | Wheel brake linkage | Parking brake solenoid valve | Parking brake disc | Parking brake switch | Parking brake cylinder | Work equipment control valve: Main relief valve | Work equipment control valve: Lift arm spool | Work equipment control valve: Bucket spool | Work equipment control valve: Suction and safety valve | Work equipment control valve: Suction valve | Lift arm cylinder | Bucket cylinder | Lift arm PPC valve | Bucket PPC valve | Bypass valve | 2-way restrictor valve | Cushion valve | Departer valve | Troubleshooting No. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | H-1 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | H-2 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | H-3 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | H-4 |
| ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | H-5 |
| | | | ○ | | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | H-6 |
| | | | ○ | | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | | | | | | H-7 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | H-8 |
| | | | | ○ | | | | | ○ | ○ | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | H-9 |
| | | | | | | | | | | | ○ | ○ | ○ | | | | | | | | | | | | | | | | | | | H-10 |
| | | | | | | | | | ○ | | | | | | ○ | ○ | ○ | ○ | | | | | | | | | | | | | | H-11 |
| | | | ○ | | | ○ | | | | | | | | | | | | | ○ | ○ | | | | ○ | | ○ | | ○ | | | | H-12 |
| | | | ○ | | | ○ | | | | | | | | | | | | | ○ | ○ | | | | ○ | | ○ | | | | | | H-13 |
| | | | | | | | | | | | | | | | | | | | | | | | | ○ | | | | | | | | H-14 |
| | | | ○ | | | ○ | | | | | | | | | | | | | ○ | ○ | | | | ○ | | ○ | | | | | | H-15 |
| | | | | | | | | | | | | | | | | | | | | | | | | ○ | | | | | | | | H-16 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | H-17 |
| | | | | | | | | | | | | | | | | | | | | ○ | | | | | | | | | | | | H-18 |
| | | | ○ | | | ○ | | | | | | | | | | | | | ○ | | ○ | | | | ○ | | ○ | | | | | H-19 |
| | | | ○ | | | ○ | | | | | | | | | | | | | ○ | | ○ | ○ | | | ○ | | ○ | | | | | H-20 |
| | | | | | | | | | | | | | | | | | | | | | | | | | ○ | | | | | | | H-21 |
| | | | ○ | | | ○ | | | | | | | | | | | | | ○ | | ○ | ○ | | | ○ | | ○ | | | | | H-22 |
| | | | | | | | | | | | | | | | | | | | | | ○ | ○ | | | ○ | | | | | | | H-23 |
| | | | | | | | | | | | | | | | | | | | | | | ○ | | | | | | | | | | H-24 |
| | | | | | | | | | | | | | | | | | | | | | ○ | | | | | | | | | | | H-25 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | ○ | ○ | | | | | H-26 |

# H-1 The machine does not start

Ask the operator about the following:
- Has the machine come not start suddenly?
  - ✔ Breakage of HST pump and motor related equipment
- Was there any problem of not traveling before?
  - ✔ Internal wear of HST pump and motor related equipment, defective seal

Inspection before diagnosis
- Are the oil level in the hydraulic tank and the oil type appropriate?
- Is inching valve linkage properly adjusted?
- Is the any external oil leak found around the hydraulic piping, pump and motor?

| | | Cause | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | HST pump | | | | | | | HST motor 2 | HST motor 1 | Others | | | | |
| | | a | b | c | d | e | f | g | h | i | j | k | l | m | n | o |
| | | Damper | Pump body (Piston pump end) | Pump body (Charge pump end) | High pressure relief valve | High pressure cut-off valve | Low pressure relief valve (Charge relief valve) | DA valve | forward and reverse solenoid valve | Motor body | Motor body | Inching valve | Inching valve linkage | Clutch solenoid | Clutch | Transfer |
| No. | Diagnosis \ Remedy | △ X | △ X | △ X | △ X | △ X | △ X | △ X | △ X | △ X | △ X | △ X | △ X A | △ X | △ X | △ X |
| 1 | Does not travel forward or in reverse | ○ | ○ | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 2 | Does not travel forward (reverse is normal) | | | | ○ | | | | ○ | | | | | | | |
| 3 | The machine does not start at reverse (Forward is normal) | | | | ○ | | | | ○ | | | | | | | |
| 4 | Does not travel forward or in reverse, motor makes sound of rotation | | | | | | | | | | | | | ○ | ○ | ○ |

## H-2 The travel speed is slow

Ask the operator about the following:
- Did the travel speed suddenly becomes slower?
  - ✔ Breakage of HST pump and motor related equipment
- Was there any problem of travel speed becoming slower before?
  - ✔ Internal wear of HST pump and motor related equipment, defective seal

Inspection before diagnosis
- Are the oil level in the hydraulic tank and the oil type appropriate?
- Is the inching valve linkage adjusting appropriate?
- Is inching valve linkage properly adjusted?
- Is the any external oil leak found around the hydraulic piping, pump and motor?

| No. | Diagnosis \ Remedy | Cause: HST pump a: Pump body (Piston pump end) △ X | b: Pump body (Charge pump end) △ X | c: High pressure relief valve △ X | d: Low pressure relief valve (Charge relief valve) △ X | e: DA valve △ X | f: forward and reverse solenoid valve △ X | HST motor 2 g: Motor body △ X | h: Mode selector solenoid valve (SOL a) △ X | i: Angle stopper solenoid valve (SOL b) △ X | HST motor 1 j: Motor body △ X | k: Angle stopper control solenoid valve △ X | Others l: Inching valve △ X | m: Inching valve linkage △ X A | n: Clutch solenoid △ X | o: Clutch △ X |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Travel speed is slow in both forward and reverse | ○ | ○ | | ○ | ○ | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 2 | The travel speed is slow at forward (Reverse is normal) | | | ○ | | | ○ | | | | | | | | | |
| 3 | The travel speed is slow at reverse (Forward is normal) | | | ○ | | | ○ | | | | | | | | | |
| 4 | Maximum travel speed in both forward and reverse is approx. 4 km/h | | | | | | | | | | | ○ | | | | |
| 5 | Maximum travel speed in both forward and reverse is approx. 18 km/h | | | | | | | | | ○ | | | | | | |
| 6 | Abnormal sound comes from motor in both forward and reverse when travel speed is 10 km/h or more | | | | | | | | | | | | | | ○ | ○ |

## H-3 The thrusting force is weak

★ When the travel speed is slow, carry out troubleshooting for H-2 first.

| No. | Diagnosis \ Remedy | Cause | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HST pump | | HST motor 2 | HST motor 1 | | Others | | | | |
| | | a | b | c | d | e | f | g | h | i | j |
| | | High pressure relief valve | High pressure cut-off valve | Motor body | Motor body | Inclination control solenoid valve | Inching valve | Inching valve linkage | Clutch solenoid | Clutch | Transfer |
| | | △ X | △ X | △ X | △ X | △ X | △ X | △ X A | △ X | △ X | △ X |
| 1 | Rimpull is weak in both forward and reverse | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ |
| 2 | The thrusting force is weak at forward (Reverse is normal) | ○ | | | | | | | | | |
| 3 | The thrusting force is weak at reverse (Forward is normal) | ○ | | | | | | | | | |
| 4 | Rimpull is weak in both forward and reverse, but maximum travel speed is reached the linee. | | | | | ○ | | | ○ | ○ | |

## H-4 Engine stalls when traveling or engine speed drops excessively

Ask the operator about the following:
- Was there any problem before?
  - ✔ Dirt in HST pump, motor related equipment

Inspection before diagnosis
- Is the any external oil leak found around the hydraulic piping, pump and motor?

| No. | Diagnosis / Remedy | Cause: HST pump (a) | HST motor 2 (b) | Others (c) |
|---|---|---|---|---|
| | | DA valve | Inclination stopper solenoid valve (SOLb) | Inclination control solenoid valve |
| | | △ X | △ X | △ X |
| 1 | Engine stalls when traveling or engine speed drops excessively | ○ | ○ | ○ |
| 2 | Machine moves when the direction the lever is at F or R and engine is at Li | ○ | | |

## H-5 The gear is not shifted

★ If the speed range switch and the monitor display do not match, check the electrical wiring.
★ When the travel speed is slow, carry out troubleshooting for H-2 first.

| No. | Diagnosis \ Remedy | Cause: HST motor 2 a — Inclination stopper solenoid valve (SOLb) | Cause: HST motor 1 b — Inclination control solenoid valve | Cause: Others c — Clutch solenoid | Cause: Others d — Clutch |
|---|---|---|---|---|---|
| | | △ X | △ X | △ X | △ X |
| 1 | The gear is not shifted | ○ | ○ | ○ | ○ |

## H-6 The steering wheel does not turn

Ask the operator about the following:
- Did the problem suddenly start?
  - ✗ Breakage of steering related equipment
- Was there previously any symptom, such as heavy steering?
  - ✗ Internal wear of steering related equipment, defective seal

Inspection before diagnosis
- Are the oil level in the hydraulic tank and the oil type appropriate?
- Has the safety bar been removed from frame?

| No. | Diagnosis \ Remedy | △ X | Cause: Hydraulic pump a: Defective hydraulic pump or PTO Steering pump and switch pump | Others b: Priority valve: Steering | Others b: Priority valve: Spool | Others b: Priority valve: Relief valve | Others c: Obit-roll | Others d: Internal defective steering cylinder (Defective piston seal) | Others e: 2-way restrictor valve | Others f: Departer valve |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Steering wheel does not turn in both directions (left and right) | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | |
| 2 | In condition in Item 1, movement of work equipment is abnormal | ○ | | | | | | | | |
| 3 | In condition in Item 1, movement of work equipment is normal | | ○ | | | | | | | |
| 4 | Steering wheel turns only in one direction (left or right) | | | | ○ | ○ | ○ | ○ | ○ | |
| 5 | Steering wheel is heavy and does not turn | ○ | ○ | ○ | ○ | | | | | |
| 6 | Oil pressure of steering circuit is low or there is no pressure | | | | ○ | | | | | |
| 7 | Emergency steering does not function in both directions (left and right) | | | | | | | | | ○ |

★ There is a close connection between the steering circuit and work equipment circuit, so if any abnormality is felt in the steering, check the operation of the work equipment also.

★ If the steering pump is abnormal (broken), check the priority valve at the same time.

# H-7 The steering wheel is heavy

Ask the operator about the following:
- Did the problem suddenly start?
  - ✗ Breakage of steering related equipment
- Was there previously any symptom, such as heavy steering?
  - ✗ Internal wear of steering related equipment, defective seal

Inspection before diagnosis
- Are the oil level in the hydraulic tank and the oil type appropriate?
- Is there any abnormality in steering gear box,column, linkage?
- Is steering valve control lever stopper adjusted properly?
- Is the any external oil leak found around the hydraulic piping, valve and cylinder?
- Is there any gouging of center hinge pin bearing and steering cylinder pin, bushing?
- Is the tire inflation pressure correct?

Check for abnormalities
- Measure operating effort of steering wheel and time taken to turn steering, and check standard judgment value table to see if there is any abnormality.

| No. | Diagnosis \ Remedy | Cause: Hydraulic pump a: The steering pump and switch pump is defective △ X | Valve b: Internal defective steering cylinder (Defective piston seal) △ X | Others c: Priority valve, Spool △ X A | Others c: Priority valve, Relief valve △ X | Others d: Obit-roll | Others e: Clogging of hydraulic oil return filter, defective bypass valve △ X C | Others f: Clogging of oil cooler △ X C |
|---|---|---|---|---|---|---|---|---|
| 1 | Steering wheel is heavy when turned in both directions (left and right) | ○ | ○ | ○ | ○ | ○ | | |
| 2 | Steering wheel is heavy when turned in one direction (left and right) | | ○ | | | ○ | | |
| 3 | Steering wheel is heavy particularly when engine is running at low speed | ○ | ○ | ○ | ○ | | | |
| 4 | Lift arm lifting speed is slow when engine is running at full speed | ○ | | ○ | | | | |
| 5 | Steering wheel is heavy and there is jerking | ○ | | | | ○ | | |
| 6 | Hydraulic oil overheats | | | ○ | ○ | | | ○ |
| 7 | Oil pressure of steering circuit is low or there is no pressure | | ○ | | ○ | | | |
| 8 | Pressure rises in return piping of steering cylinder | | | | | | ○ | |

## H-8 Steering wheel shakes or jerks

Inspection before diagnosis
- Are the oil level in the hydraulic tank and the oil type appropriate?
- Is there any abnormality in steering gear box,column, linkage?
- Is steering valve control lever stopper adjusted properly?
- Is the any external oil leak found around the hydraulic piping, valve and cylinder?
- Is there any gouging of center hinge pin bearing and steering cylinder pin, bushing?
- Is the tire inflation pressure correct?

Check for abnormalities
- Drive to a safe place and check how steering wheel shakes and under what conditions.

★ If the steering wheel is heavy or there is any other problem in addition to the steering wheel shaking, see troubleshooting "H-7 Steering wheel is heavy".

| No. | Diagnosis \ Remedy | Cause a: △ X 2-way restrictor valve | Cause b: △ X Cushion valve |
|---|---|---|---|
| 1 | Steering wheel jerks in one direction (left or right) | ○ | |
| 2 | Steering wheel shakes in one direction (left or right) | | ○ |

## H-9 The brake does not work or does not work well

Ask the operator about the following:
- Has the brake come not to work suddenly?
  - ✔ Breakage of brake equipment
- Has the brake come not to work gradually?
  - ✔ Wear of lining and disc, defective seal

Inspection before diagnosis
- Is the oil level in the hydraulic tank appropriate?
- Is the play of brake pedal appropriate?
- Oil leak from brake tube and connector, deformation of tube.
- Tire air pressure and state of tire tread.

Check abnormality
- Measure the braking force and check referring to the standard value table if the brake does not work practically.

| | | Cause | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | a | b | c | d | e | f | g | h | i | j | k |
| | | Defective brake piston seal in axle | Defective operation of brake piston in axle | Defective slack adjuster | Wear or abnormality of brake lining in axle | Metal contact due to complete wear of brake lining in axle | Mixing of air in brake circuit | Defect inside brake valve | Defective seal of accumulator piston, insufficient gas pressure | Defective operation of accumulator charge valve | Defective brake pump (For charge) | Brake linkage |
| No. | Diagnosis \ Remedy | △ X | △ X | X | △ X | △ X | △ | X | △ X | X | △ X | |
| 1 | When the brake pedal is stepped on, only a little resistance is felt | ○ | | | | | ○ | ○ | | ○ | | ○ |
| 2 | When the brake pedal is stepped on, a strong resistance is felt | | | | | | | ○ | | | | ○ |
| 3 | When the brake works, an abnormal noise occurs from the axle brake | | | | ○ | ○ | | | | | | |
| 4 | When the four wheels are jacked up, the axle is placed on a table and the brake is applied at the first forward speed, only a specific wheel rotates | ○ | ○ | | ○ | ○ | | | | | | |
| 5 | An airflow is observed in bleeding air from brake circuit, and the brake returns to normal after the bleeding | | | | | | ○ | | | | | |
| 6 | Brake oil leaks abnormally from the axle during inspection | ○ | | | | | | | | | | |
| 7 | Much metal powders are mixed in the axle oil | | | | | ○ | | | | | | |
| 8 | The brake pedal leg-power and stroke are normal, but the brake does not work well | | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | ○ | |
| 9 | The brake does not work often when the engine is stopped | ○ | | ○ | | | ○ | ○ | ○ | ○ | | |
| 10 | The accumulator is not charged, and a buzzer sounds | | | | | | | | ○ | ○ | ○ | |
| 11 | The brake works after some time lag | | | ○ | | | ○ | ○ | | | | |

## H-10 The brake is not released or is dragged

Ask the operator about the following:
- Has the brake pedal returned completely?
- Is the parking brake released completely?

Check abnormality
- Abnormal heat of brake.
- Does the machine travel smoothly inertia on a level ground?

| No. | Diagnosis \ Remedy | Cause a: Defective brake piston seal in axle △ X | Cause b: Defective operation of brake piston in axle △ X | Cause c: Defective slack adjuster △ X | Cause d: Wear or abnormality of brake lining in axle △ X |
|---|---|---|---|---|---|
| 1 | The brake pedal is released, but the brake is still applied | ○ | ○ | ○ | ○ |
| 2 | When the brake pedal is released, oil is drained from the air bleeder, the circuit oil pressure drops and the brake is released | ○ | | | ○ |
| 3 | When the four wheels are jacked up, the axle is placed on a table, the engine is stopped, the parking brake is released and the tires are rotated by hand but a specific tire hardly rotates | | ○ | ○ | ○ |

## H-11 The parking brake is not work, released or is dragged

Inspection before diagnosis
- Check if the parking brake is automatically applied when the engine stops.

| No. | Diagnosis \ Remedy | Cause a: Defective inside parking brake solenoid valve (X) | Cause b: Insufficient oil pressure due to defect of accumulator charge valve (△ X) | Cause c: Being pinched due to peeling of parking brake disc lining (X) | Cause d: Broken harness of parking brake switch line (△) | Cause e: Defective operation of parking brake cylinder piston and linkage (△ X) |
|---|---|---|---|---|---|---|
| 1 | When the parking brake switch is OFF, the parking brake is not released | ○ | ○ | ○ | ○ | ○ |
| 2 | When the parking brake switch is OFF, the brake is not applied even if the engine stops | ○ | | | | ○ |
| 3 | When the parking brake switch is ON, the brake is does not work well | ○ | | ○ | | ○ |

## H-12 The lift arm does not rise or lower

Ask the operator about the following:
- Has the lift arm come not to work suddenly?
  - ✔ Seizure or breakage of each equipment

  Did any abnormal noise occur at the time (And where)?
- Was there the phenomenon that the lift arm worked slowly?
  - ✔ Wear of parts or deformation of spring

Inspection before diagnosis
- Is the oil level in the hydraulic tank appropriate?
- Is the stroke of the lift arm control lever appropriate?

| | | Cause | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Tank to Pump | | | | Priority valve | PPC valve | | Work equipment valve | | Cylinder | |
| | | a | b | c | d | e | f | g | h | i | j | k |
| | | Clogging of pump suction port or mixing of much air in oil | The pump PTO does not drive, defective steering pump | Defective work equipment pump | Defective HST charge pump | Defective operation of spool | Defective relief valve | Defective operation of spool | Defective operation of main relief valve | Breakage inside valve body (Lift arm spool) | Damage of lift arm cylinder piston seal | Defective bypass valve |
| No. | Remedy / Diagnosis | C<br>△ | △<br>X | △<br>X | △<br>X | X | △<br>X | △<br>X | △<br>X | X | X | ?<br>?<br>? |
| 1 | The bucket cannot operate and the lift arm cannot rise | ○ | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | | |
| 2 | The bucket operates but the lift arm cannot rise | | | | | | | ○ | | ○ | | ○ |
| 3 | The lift arm can rise without load but cannot rise when loaded | ○ | ○ | ○ | | | | | ○ | | | ○ |
| 4 | The hydraulic pump causes an abnormal noise | ○ | ○ | ○ | ○ | | | | | | | |
| 5 | Large hydraulic drift of lift arm cylinder | | | | | | | | | ○ | ○ | ○ |
| 6 | When the engine is at full throttle, the steering operation is heavy and slow | ○ | ○ | | | | | | | | | |

# H-13 The lift arm moves slowly or the lift arm rising force is insufficient

Inspection before diagnosis
- Is the stroke of the lift arm control lever appropriate?

Check of Abnormality
- Rising force and speed problem are closely related, and this problem occurs as insufficient rising speed at first. Measure the lift arm rising speed when the lift arm is loaded and make sure referring to the criterion table that the speed is abnormal.

| No. | Diagnosis \ Remedy | Cause | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Tank to Pump | | Priority valve | PPC valve | | Work equipment valve | | Cylinder |
| | | a | b | c | d | e | f | g | h |
| | | Clogging of pump suction port or mixing of much air in oil | Defective work equipment pump and steering pump | Defective operation of spool | Defective relief valve | Defective operation of spool | Defective operation or improper adjustment of main relief valve | Wear or breakage inside valve body (Lift arm spool) | Damage of lift arm cylinder piston seal |
| | | C △ | △ X | △ X | △ X | △ X | A X | X | △ X |
| 1 | The bucket tilting force and speed are abnormal, and the lift arm rising speed is slow | ○ | ○ | ○ | ○ | | ○ | | |
| 2 | The bucket tilting force and speed are normal, and the lift arm rising speed is slow | | | | | ○ | | ○ | ○ |
| 3 | When the oil temperature rises in No. 1, the lift arm speed becomes very slow | | ○ | | | | | ○ | |
| 4 | The hydraulic pump causes an abnormal noise | ○ | ○ | | | | | | |
| 5 | Large hydraulic drift of lift arm cylinder | | | | | | | ○ | ○ |
| 6 | The relief oil pressure from the relief valve of the work equipment valves is low | | ○ | | | | ○ | | |
| 7 | The relief oil pressure from the relief valve of the work equipment valves is too high | | | | | | ○ | | |

## H-14 When rising, the lift arm comes to move slowly at specific height

Inspection before diagnosis

- Deformation of lift arm cylinder in appearance

Cause

- Expansion of lift arm cylinder tube or damage inside

★ For other abnormal phenomena during lift arm rise, see "H-13. The lift arm moves slowly or the lift arm rising force is insufficient."

## H-15 The lift arm cylinder cannot hold down the bucket (The bucket rises in the air)

See "H-13. The lift arm moves slowly or the lift arm rising force is insufficient."

Inspection before diagnosis

- Is the stroke of the lift arm control lever appropriate?

Cause

- Defective seat of suction valve on the lift arm cylinder rod side of work equipment valve
- Oil leak from lift arm cylinder piston seal

## H-16 Hydraulic drifts of the lift arm occur often

Ask the operator about the following:

- Have hydraulic drifts come to occur often suddenly? ✕ Wastes pinched in valve or damage of parts
- Have hydraulic drifts come to occur often gradually? ✕ Wear of parts

Inspection before diagnosis

- Is the lift arm spool at the neutral position? ✕ The spool detent is defective

Diagnosis and Cause

- Does any leaking noise occur inside the lift arm cylinder when hydraulic drift is measured? ✕ The cylinder packing is defective

## H-17 The lift arm wobbles during operation

The bucket and the lift arm moves up and down as the topography goes in digging or leveling with the lift arm control lever in the "HOLD" position.

Diagnosis and Cause

Check at first the hydraulic drift and if the lift arm cylinder can lift the machine

1. When the hydraulic drift is more than the standard value, see "H-15. Hydraulic drifts of the lift arm occur often."
2. When the lift arm cylinder cannot lift the machine, see "H-15. The lift arm cylinder cannot hold down the bucket."
3. When the lift arm cylinder comes to enable to lift the machine after the lift arm is operated several times with the normal hydraulic drift and after the lift arm cylinder operates to full stroke ✕ The cause is vacuum generated inside the cylinder

★ Frequent hydraulic drifts ✕ The suction valve on the lift arm cylinder rod side is defective

## H-18 When the control lever is switched from "HOLD" to "RAISE," the lift arm falls temporarily

Check of Phenomenon

- When the control lever is switched from "HOLD" to "RAISE" gradually at low idling of the engine, the lift arm falls temporarily due to its own weight. When the control lever is completely set to "RAISE," the lift arm returns to normal.

Cause

- Improper adhesion of lift arm spool check valve of the work equipment valve

# H-19 The bucket does not tilt back

Ask the operator about the following:
- Has the bucket come not to work suddenly o Seizure or breakage of each equipment
- Did any abnormal noise occur at the time (And where)?
- Was there the phenomenon that the bucket worked slowly?
  - ✗ Wear of parts or deformation of spring

Inspection before diagnosis
- Is the stroke of the bucket control lever appropriate?

| No. | Diagnosis \ Remedy | Cause: Tank to Pump a: Clogging of pump suction port or mixing of much air in oil | Tank to Pump b: The steering pump is defective | Tank to Pump c: The pump PTO does not drive | Tank to Pump d: The hydraulic pump and the switch pump are defective | Tank to Pump e: The PPC pump is defective | Priority Valve f: Defective operation of spool | PPC Valve g: The relief valve is defective | PPC Valve h: The spool is defective | Work Equipment Valve i: Defective operation of main relief valve | Work Equipment Valve j: Breakage inside valve body (Bucket spool) | Cylinder k: Damage of bucket cylinder piston seal |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | a | b | c | d | e | f | g | h | i | j | k |
| | | C △ | | △ X | △ X | △ X | X | △ X | △ X | A X | X | X |
| 1 | The lift arm cannot operate and the bucket cannot tilt back | ○ | | ○ | ○ | ○ | ○ | ○ | | ○ | ○ | |
| 2 | The bucket can lift the machine but cannot tilt back, or the lift arm operates but the lift arm cannot tilt back | | | | | | | | ○ | | ○ | ○ |
| 3 | The bucket can tilt back without load but cannot in digging or scooping up | ○ | | | ○ | | | | | ○ | | |
| 4 | The hydraulic pump causes an abnormal noise | ○ | | | ○ | ○ | | | | | | |
| 5 | Large hydraulic drift of bucket cylinder | | | | | | | | | | ○ | ○ |
| 6 | When the engine is at full throttle, the steering operation is heavy and slow | ○ | ○ | ○ | | | | | | | | |

# H-20 The bucket moves slowly or the tilting-back force is insufficient

Inspection before diagnosis
- Is the stroke of the bucket control lever appropriate?
- Seizure of work equipment linkage bushing (Does any abnormal noise occur?)

Check of Abnormality
- Make sure in an actual operation that the tilting-back force is insufficient.
- Measure the operating speed of the bucket, and make sure referring to the criterion value table that the speed is abnormal

| No. | Diagnosis \ Remedy | Cause: Tank to Pump a: Clogging of pump suction port or mixing of much air in oil | Tank to Pump b: The hydraulic pump and the switch pump are defective | Priority valve c: Defective operation of spool | PPC valve d: Defective operation of relief valve | PPC valve e: Defective operation of spool | Work equipment valve f: Defective operation or improper adjustment of main relief valve | Work equipment valve g: Defective operation of safety valve (With suction valve) on bucket cylinder bottom side | Work equipment valve h: Wear or breakage inside valve body (Bucket spool) | Cylinder i: Damage of bucket cylinder piston seal |
|---|---|---|---|---|---|---|---|---|---|---|
| | | a | b | c | d | e | f | g | h | i |
| | | C △ | △ X | △ X | △ X | △ X | A X | △ X | X | X |
| 1 | The lift arm rising force and speed are abnormal, and the bucket tilting force and speed are abnormal | ○ | ○ | ○ | ○ | | ○ | | | |
| 2 | The lift arm rising force and speed are normal, and the bucket tilting force and speed are abnormal | | | | | ○ | | ○ | ○ | ○ |
| 3 | When the oil temperature rises in No. 1, the bucket speed becomes worse | | ○ | | | | | | ○ | |
| 4 | The hydraulic pump is causing an abnormal noise | ○ | ○ | | | | | | | |
| 5 | Large hydraulic drift of bucket cylinder | | | | | | | ○ | ○ | ○ |
| 6 | The relief oil pressure from the relief valve of the work equipment valves is low | | ○ | | | | ○ | ○ | | |
| 7 | The relief oil pressure from the relief valve of the work equipment valves is too high | | | | | | ○ | | | |

## H-21 The bucket comes to operate slowly in he midst of tilting-back

Inspection before diagnosis
- Deformation of bucket cylinder in appearance

Cause
- Expansion of bucket cylinder tube or damage inside
  For other abnormal phenomena during bucket operation, see "H-20. The bucket moves slowly or the tilting-back force is insufficient."

## H-22 The bucket cylinder cannot hold down the bucket

See "H-20. The bucket moves slowly or the tilting-back force is insufficient."

Inspection before diagnosis
- Is the stroke of the bucket control lever appropriate?

Cause
- Defective seat of suction valve on the bucket cylinder rod side of work equipment valve
- Oil leak from bucket cylinder piston seal

## H-23 Hydraulic drifts of the bucket occur often

Ask the operator about the following:
- Have hydraulic drifts come to occur often suddenly? ✗ Wastes pinched in valve or damage of parts
- Have hydraulic drifts come to occur often gradually? ✗ Wear of parts

Inspection before diagnosis
- Is the bucket lever (PPC valve) at the neutral position? ✗ Seizure of link bushing or the spool detent is defective

Check of Abnormality
- Refer to the criterion value table and check if the hydraulic drift of the bucket occurs often practically

Cause
- Oil leak in bucket cylinder
- Improper adhesion of safety valve (With suction valve) on the bottom side
- Improper oil tight of bucket spool

## H-24 The bucket wobbles during travel with cargo (The work equipment valve is set to "HOLD")

Inspection before diagnosis

- Pin of work equipment linkage and "play of bushing" (Is any abnormal noise heard?)

Cause

- Defective seal of bucket cylinder piston
- Defective operation of safety valve (With suction valve) on bucket cylinder rod side. For other abnormal phenomena, refer to diagnoses for relevant abnormal phenomena.

## H-25 When the control lever is switched from "HOLD" to "TILT," the bucket falls temporarily

Check of Phenomenon

- When the control lever is switched from "HOLD" to "RAISE" gradually at low idling of the engine, the bucket falls temporarily due to its own weight. When the control lever is completely set to "TILT," the bucket returns to normal.

Cause

- Improper adhesion of bucket spool check valve of the work equipment valve

## H-26 The control levers of the lift arm and bucket do not move smoothly and heavy

Check of Abnormality

- Refer to the criterion value table and check if the lever operating efforts are large practically.

| | | Cause |
|---|---|---|
| | | PPC valve |
| | | a |
| | | Defective operation of relief valve |
| No. | Remedy / Diagnosis | C △ |
| 1 | Becomes heavy in some places during operation regardless of oil pressure and oil temperature | ○ |
| 2 | Becomes heavy overall during operation regardless of oil pressure and oil temperature | ○ |

# TROUBLESHOOTING OF ENGINE (S MODE)


Method of using troubleshooting charts . . . . . 20-702
S-1 Starting performance is poor (Starting always takes time) . . . . . 20-706
S-2 Engine does not start . . . . . 20-708
(1) Engine does not turn . . . . . 20-708
(2) Engine turns but no exhaust smoke comes out (Fuel is not being injected) . . . . . 20-709
(3) Exhaust smoke comes out but engine does not start(Fuel is being injected) . . . . . 20-710
S-3 Engine does not pick up smoothly (Follow-up is poor) . . . . . 20-711
S-4 Engine stops during operations . . . . . 20-712
S-5 Engine does not rotate smoothly (Hunting) . . . . . 20-713
S-6 Engine lacks output (or lacks power) . . . . . 20-714
S-7 Exhaust smoke is black (Incomplete combustion) . . . . . 20-715
S-8 Oil consumption is excessive (or exhaust smoke is blue) . . . . . 20-716
S-9 Oil becomes contaminated quickly . . . . . 20-717
S-10 Fuel consumption is excessive . . . . . 20-718
S-11 Oil is in cooling water, or water spurts back, or water level goes down . . . . . 20-719
S-12 Oil pressure caution lamp lights up (Drop in oil pressure) . . . . . 20-720
S-13 Oil level rises (Water, fuel in oil) . . . . . 20-721
S-14 Water temperature becomes too high (Overheating) . . . . . 20-722
S-15 Abnormal noise is made . . . . . 20-723
S-16 Vibration is excessive . . . . . 20-724

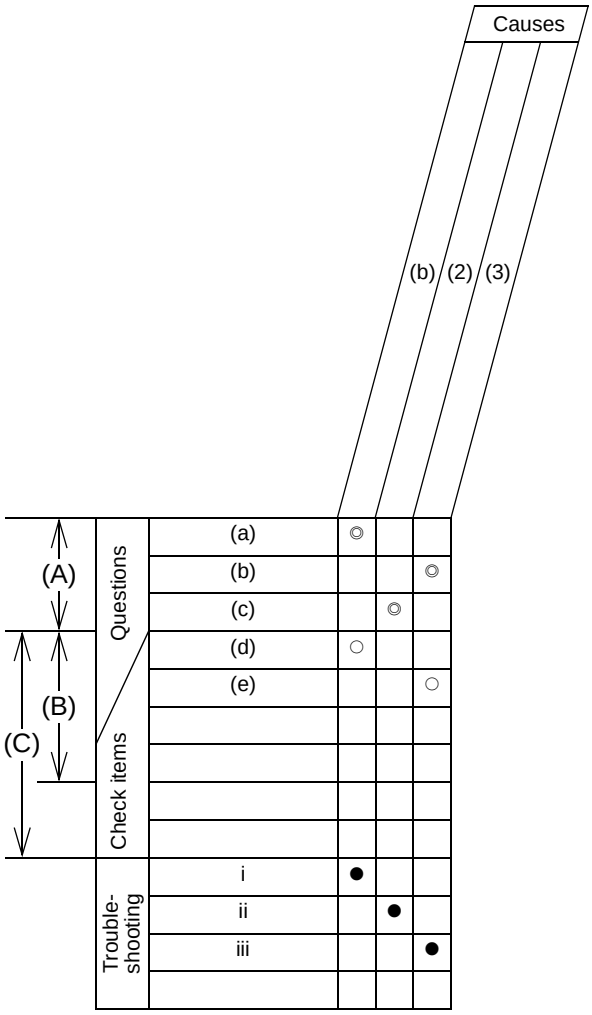
# METHOD OF USING TROUBLESHOOTING CHARTS

This troubleshooting chart is divided into three sections: **questions**, **check items**, and **troubleshooting**. The questions and check items are used to pinpoint high probability causes that can be located from the failure symptoms or simple inspection without using troubleshooting tools.
Next, troubleshooting tools or direct inspection are used to check the high probability causes to make final confirmation.

**[Questions]**
Sections (A) + (B) in the chart on the right corresponds to the items where answers can be obtained from the user. The items in B are items that can be obtained from the user, depending on the user's level.

**[Check items]**
The serviceman carries out simple inspection to narrow down the causes. The items under (C) in the chart on the right correspond to this.
The serviceman narrows down the causes from information (A) that he has obtained from the user and the results of (C) that he has obtained from his own inspection.

**[Troubleshooting]**
Troubleshooting is carried out in the order of probability, starting with the causes that have been marked as having the highest probability from information gained from **[Questions]** and **[Check items]**.



The basic method of using the troubleshooting chart is as follows.
Items listed for **[Questions]** and **[Check items]** that have a relationship with the Cause items are marked with !, and these, causes that have a high probability are marked with T.
Check each of **[Questions]** and **[Check items]** in turn, and marked the ! or T in the chart for items where the problem appeared. The vertical column (Causes) that has the highest number of points is the most probable cause, so start troubleshooting for that item to make final confirmation of the causes.

*1. For [Confirm recent repair history] in the [Questions] Section, ask the user, and mark the Cause column with # to use as reference for locating the cause of the failure. However, do not use this when making calculations to narrow down the causes.
*2. Use the # in the Cause column as reference for [Degree of use (Operated for long period)] in the **[Questions]** section as reference. As a rule, do not use it when calculating the points for locating the causes, but it can be included if necessary to determine the order for troubleshooting.

| | | | Causes | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Seized turbocharger, interference | Clogged air cleaner element | Worn piston ring, cylinder | Clogged, seized injection nozzle | Improper injection timing | Defective injection pump (excessive injection) | |
| *1 | Confirm recent repair history | | | | | | | | |
| *2 | Degree of use of machine | Operated for long period | | △ | △ | △ | | | |
| | | | ◎ | | | | | | |
| | | | | | | | | | |

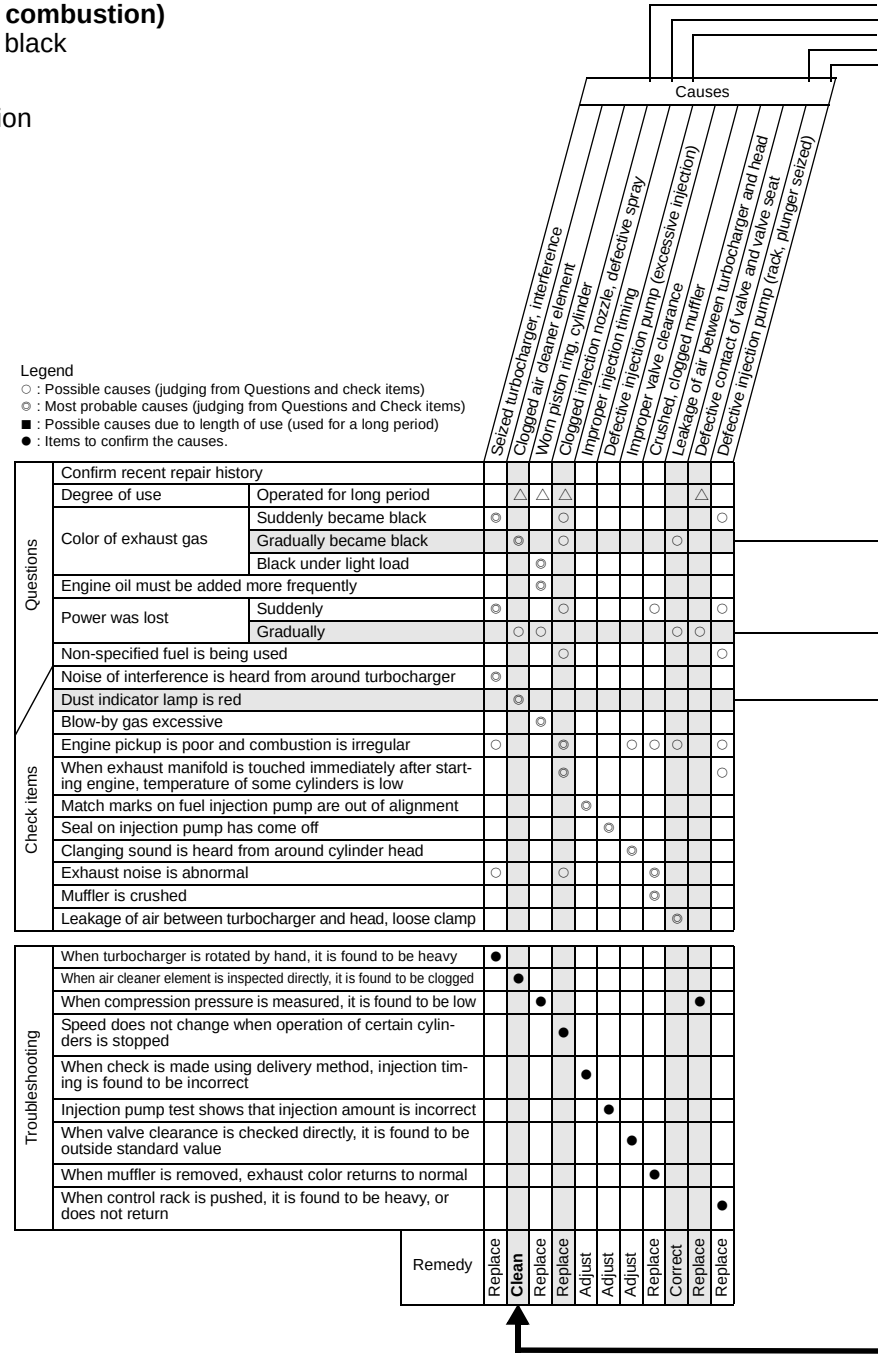
- **Example of troubleshooting when exhaust gas is black**

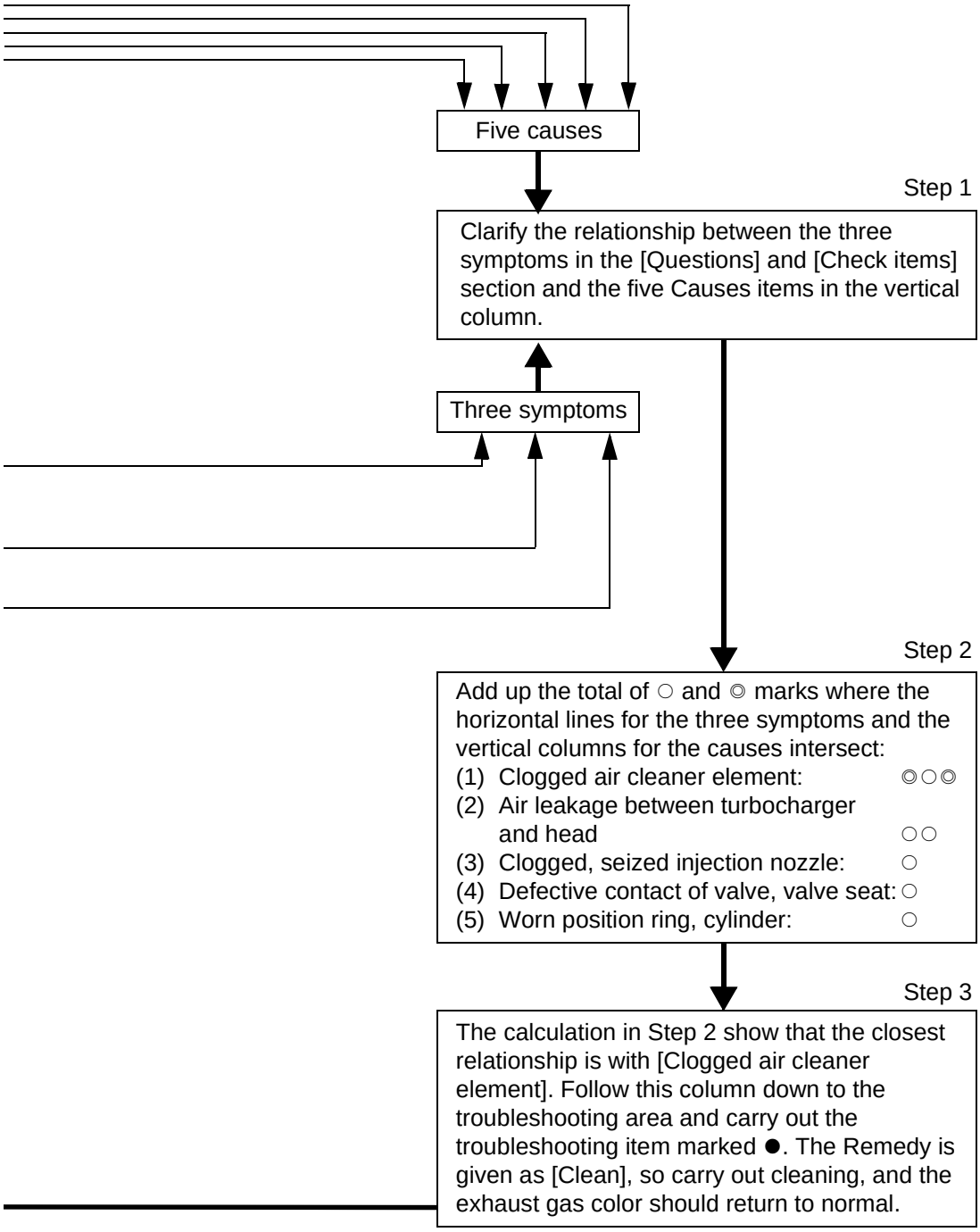
  Let us assume that [Clogged air cleaner] is taken to be the cause of black exhaust gas. Three symptoms have causal relationship with this problem: [Exhaust gas slowly became black], [Power slowly became weaker], and [Dust indicator is red].
  If we look from these three symptoms to find the causes, we find that there is a relationship with five causes.
  Let us explain here the method of using this causal relationship to pinpoint the most probable cause.

**S-7 Exhaust gas is black (incomplete combustion)**

General causes why exhaust gas is black

- Insufficient intake of air
- Improper condition of fuel injection
- Excessive injection fuel




Five causes
Step 1
Clarify the relationship between the three symptoms in the [Questions] and [Check items] section and the five Causes items in the vertical column.
Three symptoms
Step 2
Add up the total of ○ and ◎ marks where the horizontal lines for the three symptoms and the vertical columns for the causes intersect:
(1) Clogged air cleaner element: ◎○◎
(2) Air leakage between turbocharger and head ○○
(3) Clogged, seized injection nozzle: ○
(4) Defective contact of valve, valve seat: ○
(5) Worn position ring, cylinder: ○
Step 3
The calculation in Step 2 show that the closest relationship is with [Clogged air cleaner element]. Follow this column down to the troubleshooting area and carry out the troubleshooting item marked ●. The Remedy is given as [Clean], so carry out cleaning, and the exhaust gas color should return to normal.

# S-1 Starting performance is poor (Starting always takes time)

General causes why exhaust smoke comes out but engine takes time to start

- Defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel
  (At ambient temperature of -10°C or below, ASTM D975 No. 2 diesel fuel is used)

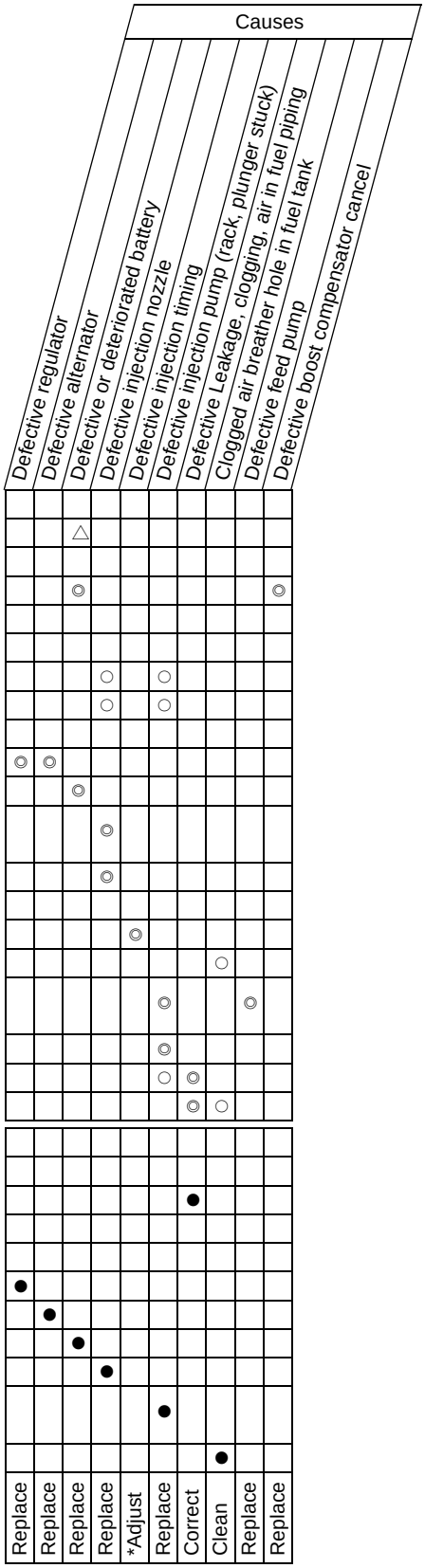
★ Battery charging rate

| Ambient temperature \ Charging rate | 100% | 90% | 80% | 75% | 70% |
|---|---|---|---|---|---|
| 20°C | 1.28 | 1.26 | 1.24 | 1.23 | 1.22 |
| 0°C | 1.29 | 1.27 | 1.25 | 1.24 | 1.23 |
| -10°C | 1.30 | 1.28 | 1.26 | 1.25 | 1.24 |

- The specific gravity should exceed the valve for the charging rate of 70% in the above table.
- In cold areas the specific gravity must exceed the value for the charging rate of 75% in the above table.

| | | | Causes: Worn piston ring, cylinder | Defective contact of valve, valve seat | Clogged air cleaner element | Clogged fuel filter, strainer | Clogged feed pump gauze filter | Electrical intake air heater |
|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | |
| | Degree of use of machine | Operated for long period | | | △ | △ | △ | |
| | Ease of starting | Gradually became worse | ◎ | ◎ | ○ | ○ | ○ | |
| | | Starts when warm | | | | | | ◎ |
| | Indicator lamp does not light up | | | | | | | ◎ |
| | Engine oil must be added more frequently | | ◎ | | | | | |
| | Replacement of filters has not been carried out according to operation Manual | | | | ◎ | ◎ | ◎ | |
| | Non-specified fuel has being used | | | | | ○ | ○ | |
| Check items | Dust indicator lamp is red | | | | ◎ | | | |
| | Battery charge lamp is ON | | | | | | | |
| | Starting motor cranks engine slowly | | | | | | | |
| | When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low | | | | | | | |
| | Engine does not pick up smoothly, and combustion is irregular | | ○ | ○ | | | | |
| | Blow-by gas is excessive | | ◎ | | | | | |
| | Timing lock on fuel injection pump does not match | | | | | | | |
| | Mud is stuck to fuel tank cap | | | | | | | |
| | When Engine is cranked with starting motor, 1) Little fuel comes out even when injection pump piping sleeve nut is loosened | | | | | ◎ | ◎ | |
| | 2) Little fuel comes out even when fuel filter air bleed plug is loosened | | | | | | | |
| | Leakage from fuel piping | | | | | | | |
| | There is hunting from engine (rotation is irregular) | | | | | ○ | ○ | |
| Troubleshooting | When compression pressure is measured, it is found to be low | | ● | ● | | | | |
| | When air cleaner element is inspected directly, it is found to be clogged | | | | ● | | | |
| | When fuel filter, strainer are inspected directly, they are found to be clogged | | | | | ● | | |
| | When feed pump strainer is inspected directly, it is found to be clogged | | | | | | ● | |
| | Heater mount does not become warm | | | | | | | ● |
| | Is voltage 26 - 30V between alternator terminal B and terminal E with engine at low idling? | Yes | | | | | | |
| | | No | | | | | | |
| | Either specific gravity of electrolyte or voltage of battery is low | | | | | | | |
| | Speed does not change when operation of certain cylinders is stopped | | | | | | | |
| | When control rack is pushed, it is found to be heavy or does not return (check after removing fuel injection pump) | | | | | | | |
| | When fuel tank cap is inspected directly, it is found to be clogged | | | | | | | |
| | Remedy | | Replace | Correct | Clean | Clean | Clean | Replace |

* Use a test stand


Causes
Defective regulator
Defective alternator
Defective or deteriorated battery
Defective injection nozzle
Defective injection timing
Defective injection pump (rack, plunger stuck)
Clogged Leakage, clogging, air in fuel piping
Defective air breather hole in fuel tank
Defective feed pump
Defective boost compensator cancel
Replace
Replace
Replace
Replace
*Adjust
Replace
Correct
Clean
Replace
Replace

# S-2 Engine does not start

### (1) Engine does not turn

General causes why engine does not turn

- Internal parts of engine seized
  - ★ If internal parts of the engine are seized, carry out troubleshooting for "Engine stops during operations".
- Defective electrical system
- Failure in power train

| | | | Causes: Defective wiring of starting circuit | Defective or deteriorated battery | Defective starting motor | Broken ring gear | Defective safety relay or safety switch | Defective battery relay | Defective battery terminal connection | Defective fuel cut solenoid | Defective starting switch |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions / Check items | Confirm recent repair history | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | | △ | | △ | | | | | |
| | Condition of horn when starting switch is turned ON | Horn sounds | ◎ | | | | | | ○ | | ○ |
| | | Horn volume is low | | ◎ | | | | | | | |
| | When starting switch is turned to START, pinion moves out, but | Speed of rotation is low | | ◎ | | | | | | | |
| | | Makes grating noise | | | ◎ | ◎ | | | | | |
| | | Soon disengages pinion again | | | | | ◎ | | | | |
| | | Makes rattling noise and does not turn | | ○ | ○ | | ○ | | | | |
| | When starting switch is turned to START, pinion does not move out | | ◎ | ○ | | | | | | | ○ |
| | When starting switch is turned to ON, there is no clicking sound | | Troubleshooting of defective wiring in starting circuit | ○ | | | | ◎ | | | |
| | Battery terminal is loose | | | | | | | | ◎ | | |
| | When starting switch is turned ON, linkage is not actuated | | | | | | | | | ◎ | |
| | When battery is checked, battery electrolyte is found to be low | | | ◎ | | | | | | | |
| Troubleshooting | Specific gravity of electrolyte, voltage of battery is low | | | ● | | | | | | | |
| | For the following conditions 1) - 5), turn the starting switch OFF, connect the cord, and carry out troubleshooting | | | | | | | | | | |
| | | 1) When terminal B and terminal C of starting switch are connected, engine starts | | | | | | | | | ● |
| | | 2) When terminal B and terminal C of starting motor are connected, engine starts | | | ● | | | | | | |
| | | 3) When terminal B and terminal C of starting safety relay are connected, engine starts | | | | | ● | | | | |
| | | 4) When terminal of safety switch and terminal B of starting motor are connected, engine starts | | | | | ● | | | | |
| | | 5) There is no 24V between battery relay terminal b and terminal E | | | | | | ● | | | |
| | When ring gear is inspected directly, tooth surface is found to be chipped | | | | ● | | | | | | |
| | Cannot be moved by hand even when linkage of fuel cut solenoid is disconnected | | | | | | | | | ● | |
| | | Remedy | - | Replace | Replace | Replace | Replace | Replace | Replace | Replace | Replace |

### (2) Engine turns but no exhaust smoke comes out (Fuel is not being injected)

General causes why engine turns but no exhaust smoke comes out

- Supply of fuel impossible
- Supply of fuel is extremely small
- Improper selection of fuel (particularly in winter)

★ Standards for use of fuel

| KIND OF FLUID | AMBIENT TEMPERATURE -4 -20 | 14 -10 | 32 0 | 50 10 | 68°C 20°F |
|---|---|---|---|---|---|
| Diesel fuel | ASTM D975 No. 1 | | ASTM D975 No. 2 | | |

| | | Causes: Broken, injection pump drive shaft, key | Defective injection pump (rack, plunger seized) | Seized broken feed pump piston | Clogged fuel filter, strainer | Clogged feed pump strainer | Insufficient fuel in tank | Clogged leaking fuel piping | Clogged air breather hole in fuel tank | Defective fuel cut solenoid | Improper fuel used |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | | |
| | Degree of use of machine — Operated for long period | | | | △ | △ | | | △ | | |
| | Exhaust smoke suddenly stops coming out (when starting again) | ◎ | ◎ | ◎ | | | | | | | |
| | Replacement of filters has not been carried out according to Operation Manual | | | | ◎ | ◎ | | | | | |
| | Fuel tank is found to be empty | | | | | | ◎ | | | | |
| | There is leakage from fuel piping | | | | | | | ◎ | | | |
| | Mud is stuck to fuel tank cap | | | | | | | | ◎ | | |
| | When starting switch is turned ON, linkage is not actuated | | | | | | | | | ◎ | |
| | When fuel filter is drained, fuel does not come out | | | | | | | | | | ◎ |
| Check items | When engine is cranked with starting motor, 1) No fuel comes out even when fuel filter air bleed plug is loosened | ◎ | | | ○ | ○ | | | | | ○ |
| | 2) No fuel spurts out even when injection pump piping sleeve nut is loosened | ◎ | ◎ | ◎ | | | | | | | |
| | Rust and water are found when fuel tank is drained | | | | ○ | ○ | | | | | ○ |
| Troubleshooting | Inspect injection pump directly | ● | | | | | | | | | |
| | When control rack is pushed, it is found to be heavy, or does not return | | ● | | | | | | | | |
| | Inspect feed pump directly | | | ● | | | | | | | |
| | When fuel filter, strainer are inspected directly, they are found to be clogged | | | | ● | | | | | | ● |
| | When feed pump strainer is inspected directly, it is found to be clogged | | | | | ● | | | | | |
| | When fuel cap is inspected directly, it is found to be clogged | | | | | | | | ● | | |
| | Cannot be moved by hand even when linkage of fuel cut solenoid is disconnected | | | | | | | | | ● | |
| | Remedy | Replace | Replace | Replace | Replace | Replace | Replace | Replace | Replace | Replace | Replace |

### (3) Exhaust smoke comes out but engine does not start (Fuel is being injected)

General causes why exhaust smoke comes out but engine not start

- lack of rotating force due to defective electrical system
- Insufficient supply of fuel
- Insufficient intake of air
- Improper selection of fuel and oil

| | | Causes: Defective, broken valve system (valve, rocker lever etc.) | Defective injection pump (rack, plunger stuck) | Worn piston ring, cylinder liner | Clogged fuel filter, strainer | Clogged feed pump strainer | Clogged air cleaner element | Defective electrical intake air heater | Defective or deteriorated battery | Leakage, clogging, air in fuel system | Clogged injection nozzle, defective spray | Clogged air breather hole in fuel tank cap | Improper fuel used |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | | | | |
| | Degree of use of machine / Operated for long period | | | △ | △ | △ | | | | △ | | | |
| | Suddenly failed to start | ◎ | ◎ | | | | | | | | | | |
| | When engine is cranked, abnormal noise is heard from around cylinder head | ◎ | | | | | | | | | | | |
| | Engine oil must be added more frequently | | | ◎ | | | | | | | | | |
| | Non-specified fuel is being used | | ○ | | | | | | | ○ | | | |
| | Replacement of filters has not been carried out according to Operation Manual | | | | ◎ | ◎ | ◎ | | | | | | |
| Check items | Rust and water are found when fuel tank is drained | | | | ◎ | ◎ | | | | | | | |
| | Dust indicator lamp is red | | | | | | ◎ | | | | | | |
| | Indicator lamp does not light up | | | | | | | ◎ | | | | | |
| | Starting motor cranks engine slowly | | | | | | | | ◎ | | | | |
| | Mud is stuck to fuel tank cap | | | | | | | | | | ○ | | |
| | When fuel lever is placed at FULL position, it does not contact stopper | | ○ | | | | | | | | | | |
| | When engine is cranked with starting motor, 1) Little fuel comes out even when fuel filter air bleed plug is loosened | | ◎ | | | | | | | | | | |
| | 2) No fuel comes out even when fuel filter air bleed plug is loosened | | | | ◎ | ◎ | | | | | | | ○ |
| | There is leakage from fuel piping | | | | | | | | ◎ | | | | |
| | When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low | | | | | | | | | ◎ | | | |
| | When fuel filter is drained, no fuel comes out | | | | | | | | | | | | ◎ |
| Troubleshooting | Remove head cover and check directly | ● | | | | | | | | | | | |
| | When control rack is pushed, it is found to be heavy, or does not return | | ● | | | | | | | | | | |
| | When compression pressure is measured, it is found to be low | | | ● | | | | | | | | | |
| | When fuel filter, strainer are inspected directly, they are found to be clogged | | | | ● | | | | | | | | ● |
| | When feed pump strainer is inspected directly, it is found to be clogged | | | | | ● | | | | | | | |
| | When air cleaner element is inspected directly, it is found to be clogged | | | | | | ● | | | | | | |
| | Heater mount does not become warm | | | | | | | ● | | | | | |
| | Either specific gravity of electrolyte or voltage of battery is low | | | | | | | | ● | | | | |
| | When feed pump is operated, there is no response, or operation is too heavy | | | | | | | | | ● | | | |
| | Speed does not change when operation of certain cylinders is stopped | | | | | | | | | | ● | | |
| | When fuel tank cap is inspected directly, it is found to be clogged | | | | | | | | | | | ● | |
| | Remedy | Replace | Replace | Replace | Clean | Clean | Clean | Correct | Replace | Correct | Clean | Clean | |

# S-3 Engine does not pick up smoothly (Follow-up is poor)

General causes why engine does not pick up smoothly

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used

| | | | Causes: Clogged air cleaner element | Clogged fuel filter, strainer | Clogged feed pump strainer | Clogged injection nozzle, defective spray | Seized injection pump plunger | Worn piston ring, cylinder liner | Seized turbocharger, interface | Improper valve clearance | Clogged air breather hole in fuel tank cap | Clogged, leaking fuel piping | Defective contact of valve and valve seat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions / Check items | Confirm recent repair history | | | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | △ | △ | △ | | | △ | | | | | △ |
| | Replacement of filters has not been carried out according to Operation Manual | | ◎ | ◎ | ◎ | | | | | | | | |
| | Non-specified fuel is being used | | | ◎ | ◎ | ◎ | ◎ | | | | | | |
| | Engine oil must be added more frequently | | | | | | ◎ | | | | | | |
| | Engine pick-up suddenly became poor | | | | | ○ | | | ◎ | | ○ | ○ | |
| | Rust and water are found when oil is drained | | | ◎ | ◎ | | | | | | | | |
| | Dust indicator lamp is red | | ◎ | | | | | | | | | | |
| | Noise of interference is heard from around turbocharger | | | | | | | | ◎ | | | | |
| | Color of exhaust gas | Blue under light load | | | | ○ | | ◎ | | | | | |
| | | Black | ◎ | | | ◎ | | | ◎ | | | | ○ |
| | Clanging sound is heard from around cylinder head | | | | | | | | | ◎ | | | |
| | Mud is stuck to fuel tank cap | | | | | | | | | | ◎ | | |
| | There is leakage from fuel piping | | | | | | | | | | | ◎ | |
| | High idling speed under no load is normal, but speed suddenly drops when load is applied | | | ◎ | ◎ | | | | | ○ | | | |
| | There is hunting from engine (rotation is irregular) | | | ○ | ◎ | ○ | | | | ○ | | | |
| | When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low | | | | | ◎ | ○ | | | | | | |
| | Blow-by gas excessive | | | | | | | ◎ | | | | | |
| Troubleshooting | When air cleaner element is inspected directly, it is found to be clogged | | ● | | | | | | | | | | |
| | When fuel filter, strainer are inspected directly, they are found to be clogged | | | ● | | | | | | | | | |
| | When feed pump strainer is inspected directly, it is found to be clogged | | | | ● | | | | | | | | |
| | Speed does not change when operation of certain cylinders is stopped | | | | | ● | | | | | | | |
| | When control rack is pushed, it is found to be heavy, or does not return | | | | | | ● | | | | | | |
| | When compression pressure is measured, it is found to be low | | | | | | | ● | | | | | ● |
| | When turbocharger is rotated by hand, it is found to be heavy | | | | | | | | ● | | | | |
| | When valve clearance is checked directly, it is found to be outside standard value | | | | | | | | | ● | | | |
| | When fuel tank cap is inspected directly, it is found to be clogged | | | | | | | | | | ● | | |
| | When feed pump is operated, operation is too light or too heavy | | | | | | | | | | | ● | |
| | | Remedy | Clean | Clean | Clean | Correct | Replace | Replace | Replace | Adjust | Clean | Correct | Replace |

# S-4 Engine stops during operations

General causes why engine stop during operations

- Seized parts inside engine
- Insufficient supply of fuel
- Overheating
  - ★ If there is overheating and the engine stops, carry out troubleshooting for overheating.
- Failure in power train
  - ★ If the engine stops because of a failure in the power train, carry out troubleshooting for the chassis.

| | | | Causes: Broken, seized piston, connecting rod | Broken, seized crankshaft bearing | Broken dynamic valve system (valve, rocker lever, etc.) | Broken, seized gear train | Broken pump auxiliary equipment | Broken fuel pump drive shaft, key | Insufficient fuel in tank | Clogged fuel filter, strainer | Clogged feed pump strainer | Broken, seized feed pump piston | Clogged, leaking fuel piping | Clogged air breather hole in fuel tank | Defective injection pump (rack, plunger stuck) | Failure in power train |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | | | | | | | △ | △ | | | | | | |
| | Condition when engine stopped | Abnormal noise was heard and engine stopped suddenly | ◎ | ◎ | ◎ | ◎ | ◎ | ◎ | | | | ○ | | | ○ | ◎ |
| | | Engine overheated and stopped | ◎ | ○ | | | ○ | | | | | | | | | |
| | | Engine stopped slowly | | | | | | | ◎ | ○ | ○ | | | | | |
| | | There was hunting and engine stopped | | | | | | | ◎ | ○ | ○ | | | ○ | | |
| | Replacement of filters has not been carried out according to Operation Manual | | | | | | | | | ◎ | ◎ | | | | | |
| Check items | Non-specified fuel is being used | | | | | | | | | ○ | ○ | ○ | | | ○ | |
| | Fuel level lamp lights up | | | | | | | | ◎ | | | | | | | |
| | Fuel tank is found to be empty | | | | | | | | ◎ | | | | | | | |
| | When feed pump is operated, operation is too light or too heavy | | | | | | | | | ○ | ○ | | ◎ | | | |
| | Mud is stuck to fuel tank cap | | | | | | | | | | | | | ◎ | | |
| | Engine rotates, but stops when power train is operated | | | | | | | | | | | | | | | ◎ |
| | When it is attempted to turn by hand using barring tool | Does not turn at all | ◎ | ◎ | | | | | | | | | | | | |
| | | Turns in opposite direction | | | ◎ | | | | | | | | | | | |
| | | Moves amount of backlash | | | | ◎ | ◎ | | | | | | | | | |
| | | Shaft does not turn | | | | | | ◎ | | | | | | | | |
| | Rust and water are found when tank is drained | | | | | | | | ◎ | ◎ | | | | | | |
| | Metal particles are found when oil is drained | | ◎ | ◎ | | | | | ○ | ○ | | | | | | |
| Troubleshooting | Remove oil pan and inspect directly | | ● | ● | | | | | | | | | | | | |
| | Remove head cover and inspect directly | | | | ● | | | | | | | | | | | |
| | When gear train is inspected, it does not turn | | | | | ● | | | | | | | | | | |
| | Rotates when pump auxiliary equipment is removed | | | | | | ● | | | | | | | | | |
| | When fuel filter, strainer are inspected directly, they are found to be clogged | | | | | | | | ● | | | | | | | |
| | When feed pump strainer is inspected directly, it is found to be clogged | | | | | | | | | ● | | | | | | |
| | Inspect feed pump directly | | | | | | | | | | ● | | | | | |
| | When control rack is pushed, it is found to be heavy, or does not return | | | | | | | | | | | | | | ● | |
| | | Remedy | Replace | Replace | Replace | Replace | Replace | Add | Clean | Clean | Replace | Replace | Correct | Clean | Replace | - |
| | | | | | | | | | | | | | | | | Troubleshooting of chassis |

# S-5 Engine does not rotate smoothly (Hunting)

General causes why engine does not rotate smoothly

- Air in fuel system
- Defective governor mechanism
- Defective electric governor mechanism (engine with electric governor)
  - ★ If hunting stops when electric governor rod is disconnected, carry out troubleshooting for the chassis.

| | | | Causes: Defective operation of governor | Defective adjustment of governor | Defective operation of control rack | Low idling speed is too low | Insufficient fuel in tank | Clogged feed pump strainer | Clogged fuel filter, strainer | Clogged air in circuit between fuel tank and feed pump | Clogged air in circuit between feed pump and nozzle | Clogged air breather hole in fuel tank |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | | | | | △ | △ | | | | |
| | Condition of hunting | Occurs at a certain speed range | ◎ | ◎ | ◎ | ○ | | | | | | |
| | | Occurs at low idling | ○ | | | ◎ | | ○ | ○ | ○ | ○ | |
| | | Occurs even when speed is raised | ○ | ○ | ○ | | | | | | | ○ |
| | | Occurs on slopes | | | | | ◎ | | | | | |
| | Replacement of filters has not been carried out according to Operation Manual | | | | | | | ◎ | ◎ | | | |
| Check items | Fuel tank is found to be empty | | | | | | ◎ | | | | | |
| | Rust and water are found when tank is drained | | | | | | | ○ | ○ | | | |
| | Leakage from fuel piping | | | | | | | | | ◎ | ◎ | |
| | When feed pump is operated, 1) No response, light, return is quick | | | | | | | | | ◎ | | |
| | 2) No response, light, return is normal | | | | | | | | | ◎ | | |
| | Engine speed sometimes rises too far | | ◎ | ◎ | | | | | | | | |
| | Engine is sometimes difficult to stop | | ◎ | | ◎ | | | | | | | |
| | Seal on injection pump has come off | | | ◎ | | ◎ | | | | | | |
| Troubleshooting | When governor level is moved it is found to be stiff | | ● | | ● | | | | | | | |
| | When injection pump is tested, governor is found to be improperly adjusted | | | ● | | | | | | | | |
| | When control rack is pushed, it is found to be heavy, or does not return | | | | ● | | | | | | | |
| | When fuel tank cap is inspected directly, it is found to be clogged | | | | | ● | | | | | | ● |
| | When feed pump strainer is inspected directly, it is found to be clogged | | | | | | | ● | | | | |
| | When fuel filter, strainer are inspected directly, they are found to be clogged | | | | | | | | ● | | | |
| | | Remedy | Adjust | Adjust | Adjust | Adjust | Add | Clean | Clean | Correct | Correct | Clean |

# S-6 Engine lacks output (or lacks power)

General causes why engine lacks output

- Insufficient intake of air
- Insufficient supply of fuel
- Improper condition of fuel injection
- Improper fuel used
  (if non-specified fuel is used, output drops)
- Lack of output due to overtaking
  - ★ If there is overheating and lack of output, carry out troubleshooting for overheating.

| | | | Causes: Clogged air cleaner element | Seized turbocharger, interference | Worn piston ring, cylinder | Clogged fuel filter, strainer | Clogged feed pump strainer | Clogged injection nozzle, defective spray | Seized injection pump plunger | Improper valve clearance | Defective contact of valve and valve seat | Bent fuel lever linkage, defective adjustment | Clogged, leaking fuel piping | Clogged air breather hole in fuel tank | Defective boost compensator diaphragm | Defective westgate diaphragm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | △ | | △ | △ | △ | | | | △ | | | | | |
| | Power was lost | Suddenly | | ◎ | | | | | | | | | | | ◎ | ◎ |
| | | Gradually | ○ | | ○ | ○ | ○ | ○ | | | ○ | | | | | |
| | Engine oil must be added more frequently | | | | ◎ | | | | | | | | | | | |
| | Replacement of filters has not been carried out according to Operation Manual | | ◎ | | | ◎ | ◎ | | | | | | | | | |
| | Non-specified fuel is being used | | | | | ◎ | ◎ | ◎ | ◎ | | | | | | | |
| Check items | Dust indicator lamp is red | | ◎ | | | | | | | | | | | | | |
| | Color of exhaust gas | Black | ◎ | ◎ | | | | | | | | | | | | |
| | | Black under light load | | | ◎ | | | | | | | | | | | |
| | Noise of interference is heard from around turbocharger | | | ◎ | | | | | | | | | | | | |
| | Blow-by gas excessive | | | | ◎ | | | | | | | | | | ○ | |
| | Engine pickup is poor and combustion is irregular | | | ◎ | | | | ○ | | | | | ○ | ○ | | |
| | High idling speed under no load is normal, but speed suddenly drops when load is applied | | | | | ◎ | ◎ | | | | | | | ○ | | |
| | When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low | | | | | | | ◎ | ○ | | | | | | | |
| | There is hunting from engines (rotation is irregular) | | | | | ○ | ○ | | | | | | ○ | ○ | | |
| | Clanging sound is heard from around cylinder head | | | | | | | | ◎ | | | | | | | |
| | High idling speed of engine is low | | | | | | | | ○ | | ◎ | | | | | |
| | Leakage from fuel piping | | | | | | | | | | | ◎ | | | | |
| Troubleshooting | When air cleaner element is inspected directly, it is found to be clogged | | ● | | | | | | | | | | | | | |
| | When turbocharger is rotated by hand, it is found to be heavy | | | ● | | | | | | | | | | | | |
| | When compression pressure is measured, it is found to be low | | | | ● | | | | | | ● | | | | | |
| | When fuel filter, strainer are inspected directly, they are found to be clogged | | | | | ● | | | | | | | | | | |
| | When feed pump strainer is inspected directly, it is found to be clogged | | | | | | ● | | | | | | | | | |
| | Speed does not change when operation of certain cylinders is stopped | | | | | | | ● | | | | | | | | |
| | When control rack is pushed, it is found to be heavy, or does not return | | | | | | | | ● | | | | | | | |
| | When valve clearance is checked directly, it is found to be outside standard value | | | | | | | | | ● | | | | | | |
| | When level is placed at FULL position, it does not contact stopper | | | | | | | | | | | ● | | | | |
| | When feed pump is operated, operation is too light or too heavy | | | | | | | | | | | | ● | | | |
| | When fuel tank cap is inspected directly, it is found to be clogged | | | | | | | | | | | | | ● | | |
| | | Remedy | Clean | Replace | Replace | Clean | Clean | Correct | Replace | Adjust | Replace | Adjust | Correct | Clean | Replace | Replace |

# S-7 Exhaust smoke is black (Incomplete combustion)

General causes why exhaust smoke is black

- Insufficient intake of air
- Improper condition of fuel injection
- Excessive injection of fuel

| | | | Causes: Seized turbocharger, interference | Clogged air cleaner element | Worn piston ring, cylinder | Clogged injection nozzle, defective spray | Improper injection timing | Defective injection timing | Improper valve clearance | Crushed, clogged muffler | Leakage of air between turbocharger and head | Defective contact of valve and valve seat | Defective injection pump (rack, plunger seized) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | | △ | △ | △ | | | | | | △ | |
| | Color of exhaust gas | Suddenly became black | ◎ | | | ○ | | | | | | | ○ |
| | | Gradually became black | | ◎ | | ○ | | | | | ○ | | |
| | | Black under light load | | | ◎ | | | | | | | | |
| | Engine oil must be added more frequently | | | | ◎ | | | | | | | | |
| | Power was lost | Suddenly | ◎ | | | ○ | | | | ○ | | | ○ |
| | | Gradually | | ○ | ○ | | | | | | ○ | ○ | |
| | Non-specified fuel is being used | | | | | ○ | | | | | | | ○ |
| Check items | Noise of interference is heard from around turbocharger | | ◎ | | | | | | | | | | |
| | Dust indicator lamp is red | | | ◎ | | | | | | | | | |
| | Blow-by gas excessive | | | | ◎ | | | | | | | | |
| | Engine pickup is poor and combustion is irregular | | ○ | | | ◎ | | | ○ | ○ | ○ | | ○ |
| | When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low | | | | | ◎ | | | | | | | ○ |
| | Timing lock on fuel injection pump does not match | | | | | | ◎ | | | | | | |
| | Seal on injection pump has come off | | | | | | | ◎ | | | | | |
| | Clanging sound is heard from around cylinder head | | | | | | | | ◎ | | | | |
| | Exhaust noise is abnormal | | ○ | | | ○ | | | | ◎ | | | |
| | Muffler is crushed | | | | | | | | | ◎ | | | |
| | Leakage of air between turbocharger and head, loose clamp | | | | | | | | | | ◎ | | |
| Troubleshooting | When turbocharger is rotated by hand, it is found to be heavy | | ● | | | | | | | | | | |
| | When air cleaner element is inspected directly, it is found to be clogged | | | ● | | | | | | | | | |
| | When compression pressure is measured, it is found to be low | | | | ● | | | | | | | ● | |
| | Speed does not change when operation of certain cylinders is stopped | | | | | ● | | | | | | | |
| | When check is made using delivery method, injection timing is found to be incorrect | | | | | | ● | | | | | | |
| | Injection pump test shows that injection amount is incorrect | | | | | | | ● | | | | | |
| | When valve clearance is checked directly, it is found to be outside standard value | | | | | | | | ● | | | | |
| | When muffler is removed, exhaust color returns to normal | | | | | | | | | ● | | | |
| | When control rack is pushed, it is found to be heavy, or does not return | | | | | | | | | | | | ● |
| | | Remedy | Replace | Clean | Replace | Replace | Adjust | Adjust | Adjust | Replace | Correct | Replace | Replace |

# S-8 Oil consumption is excessive (or exhaust smoke is blue)

★ Do not run the engine at idling for more than 20 minutes continuously. (Both low and high idling)

General causes why oil consumption is excessive

- Abnormal combustion of oil
- External leakage of oil
- Wear of lubrication system

| | | | Causes | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Turbocharger | | | | |
| | | | Broken piston ring | Worn piston ring, cylinder (liner less engine) | Clogged breather or breather hose | Leakage from oil filter or oil cooler | Leakage from oil piping | Leakage from oil drain plug | Broken oil pan or cylinder head | Broken oil cooler | Worn seal at turbine end | Worn seal at blower end | Worn, broken rear seal, seal surface | Dust sucked in from intake system | Worn valve (stem, guide), broken seal |
| Questions / Check items | Confirm recent repair history | | | | | | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | | △ | | | | | | △ | △ | | | | △ |
| | Oil consumption suddenly increased | | ◎ | | | | | | ○ | | | | | | |
| | Engine oil must be added more frequently | | | ◎ | | | | | ○ | | | | | | |
| | Engine oil becomes contaminated quickly | | ○ | ◎ | ○ | | | | | | | | | | |
| | Exhaust smoke is blue under light load | | ◎ | ◎ | | | | | | | | | | | |
| | Amount of blow-by gas | Excessive | ◎ | ◎ | | | | | | | ○ | | | | ○ |
| | | None | | | ◎ | | | | | | | | | | |
| | Area around engine is dirty with oil | | | | | ◎ | ◎ | ◎ | ◎ | | | | | | |
| | There is oil in engine cooling water | | | | | | | | ◎ | | | | | | |
| | When exhaust pipe is removed, inside is found to be dirty with oil | | | | | | | | | ◎ | | | | | ○ |
| | When turbocharger air supply pipe is removed, inside is found to be dirty with oil | | | | | | | | | | ◎ | | | | |
| | Oil level in clutch or TOROFLOW transmission damper chamber rises | | | | | | | | | | | ◎ | | | |
| | Clamps for intake system are loose | | | | | | | | | | | | ◎ | | |
| Troubleshooting | When compression pressure is measured, it is found to be low | | ● | ● | | | | | | | | | | | |
| | When breather element is inspected, it is found to be clogged with dirty oil | | | | ● | | | | | | | | | | |
| | There is external leakage of oil from engine | | | | | ● | ● | ● | ● | | | | | | |
| | Pressure-tightness test of oil cooler shows there is leakage | | | | | | | | ● | | | | | | |
| | Excessive play of turbocharger shaft | | | | | | | | | ● | ● | | | | |
| | Inspect rear seal directly | | | | | | | | | | | ● | | | |
| | When intake manifold is removed, dust is found inside | | | | | | | | | | | | ● | | |
| | When intake manifold is removed, inside is found to be dirty with oil | | | | | | | | | | | | | | ● |
| | Remedy | | Replace | Replace | Clean | Correct | Correct | Correct | Correct | Replace | Replace | Replace | Correct | Correct | Correct |

# S-9 Oil becomes contaminated quickly

General causes why oil becomes contaminated quickly

- Entry of exhaust gas due to internal wear
- Clogging of lubrication passage
- Improper fuel
- Improper oil used
- Operation under excessive load

| | | | Causes: Worn piston ring, cylinder liner | Clogged breather, breather hose | Clogged oil filter | Worn valve, valve guide | Clogged oil cooler | Clogged turbocharger oil drain tube | Defective seal at turbocharger turbine end | Exhaust smoke is black |
|---|---|---|---|---|---|---|---|---|---|---|
| Questions / Check items | Confirm recent repair history | | | | | | | | | |
| | Degree of use of machine | Operated for long period | △ | | | △ | | | △ | |
| | Engine oil must be added more frequently | | ◎ | | | | | | | |
| | Non-specified fuel is being used | | | | ○ | | | | | |
| | Color of exhaust gas | Black under light load | ◎ | | | | | | | |
| | | Black | | | | | | | | ◎ |
| | Amount of blow-by gas | Excessive | ◎ | | | ○ | | ○ | ○ | |
| | | None | | ◎ | | | | | | |
| | When oil filter is inspected, metal particles are found | | ○ | | ◎ | ○ | | | | |
| | When exhaust pipe is removed, inside is found to be dirty with oil | | | | | ◎ | | | | |
| | Engine oil temperature rises quickly | | | | | | ◎ | | | |
| Troubleshooting | When compression pressure is measured, it is found to be low | | ● | | | ● | | | | |
| | When breather element is inspected directly, hose is broken or is found to be clogged with dirty oil | | | ● | | | | | | |
| | When oil filter is inspected directly, it is found to be clogged | | | | ● | | | | | |
| | When oil cooler is inspected directly, it is found to be clogged | | | | | | ● | | | |
| | Turbocharger oil drain tube is clogged | | | | | | | ● | | |
| | Excessive play of turbocharger shaft | | | | | | | | ● | |
| | When safety valve is directly inspected, spring is found to be catching or broken | | | | | | | | | |
| | | Remedy | Replace | Clean | Replace | Replace | Clean | Clean | Replace | - |

Carry out troubleshooting for "Exhaust smoke is black".

# S-10 Fuel consumption is excessive

General causes why fuel consumption is excessive
- Leakage of fuel
- Improper condition of fuel injection
- Excessive injection of fuel

| | | | Causes: Defective injection pump (excessive injection) | Defective nozzle holder spray | Defective injection pump plunger | Defective fuel injection timing | External leakage from fuel piping, fuel filter | Leakage of fuel inside head cover | Defective oil seal inside feed pump (piston) | Defective adjustment of fuel control linkage |
|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | |
| | Degree of use of machine | Operated for long period | | △ | △ | | | | △ | |
| | Condition of fuel consumption | More than for other machines of same model | ◎ | | | ○ | | | | |
| | | Gradually increased | | ○ | ○ | | | | | |
| | | Suddenly increased | | | | | ○ | ○ | | |
| | Exhaust smoke color | Black | ◎ | ○ | | ○ | | | | ○ |
| | | White | | | | | | ○ | | |
| Check items | Seal on injection pump has come off | | ◎ | | | | | | | |
| | There is irregular combustion | | | ◎ | | | | | | |
| | When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low | | | ◎ | ○ | | | | | |
| | Match mark on injection pump is misaligned | | | | | ◎ | | | | |
| | There is external leakage of fuel from engine | | | | | | ◎ | | | |
| | Engine oil level rises and smells of diesel fuel | | ○ | | | | | ◎ | ◎ | |
| | Engine low idling and high idling speeds are high | | ○ | | | | | | | ◎ |
| Troubleshooting | Injection pump measurement shows that injection amount is excessive | | ● | | | | | | | |
| | Speed does not change when operation of certain cylinders is stopped | | | ● | | | | | | |
| | When control rack is pushed, it is found to be heavy, or does not return | | | | ● | | | | | |
| | When check is made using delivery method, injection timing is found to be incorrect | | | | | ● | | | | |
| | Remove head cover and inspect directly | | | | | | | ● | | |
| | Remove feed cover and inspect directly | | | | | | | | ● | |
| | When engine speed is measured, low and high idling speeds are found to be high | | | | | | | | | ● |
| | | Remedy | Adjust | Replace | Replace | Adjust | Correct | Correct | Correct | Adjust |

# S-11 Oil is in cooling water, or water spurts back, or water level goes down

General causes why oil is in cooling water
- Internal leakage in lubrication system
- Internal leakage in cooling system

| | | | Causes: Broken oil cooler core, O-ring | Broken cylinder head, head gasket | Broken power train oil cooler | Holes caused by pitting | Internal cracks in cylinder block |
|---|---|---|---|---|---|---|---|
| Questions / Check items | Confirm recent repair history | | | | | | |
| | Degree of use of machine | Operated for long period | △ | | | △ | |
| | Oil level | Suddenly increased | ○ | ○ | ○ | | |
| | | Gradually increased | | | | ○ | ○ |
| | Hard water is being used as cooling water | | ○ | | | ○ | |
| | Engine oil level has risen, oil is cloudy white | | ◎ | | | ○ | ○ |
| | Excessive air bubbles inside radiator spurts back | | | ◎ | | | |
| | Hydraulic oil, transmission oil is cloudy white | | | | ◎ | | |
| | When hydraulic oil transmission oil is drained, water is found | | | | ◎ | | |
| Trouble-shooting | Pressure-tightness test of oil cooler shows there is leakage | | ● | | ● | | |
| | Pressure-tightness test of cylinder head shows there is leakage | | | ● | | | |
| | Remove oil pan and inspect directly | | | | | ● | ● |
| | | Remedy | Replace | Replace | Replace | Replace | Replace |

# S-12 Oil pressure caution lamp lights up (Drop in oil pressure)

General causes why oil pressure lamp lights up

- Leakage, clogging, wear of lubricating system
- Defective oil pressure control
- Improper oil used (improper viscosity)
- Deterioration of oil due to overheating

★ Standards for engine oil selection

| Type of oil | Selection of SAE No. according to ambient temperature |
|---|---|
| | -30 -20 -10 0 10 20 30 40℃ |
| Engine oil | SAE30CD |
| | SAE10WCD |
| | SAE10W-30CD |
| | SAE15W-40CD |

| | | | Causes: Clogged oil filter | Worn bearing, journal | Clogged strainer inside oil pan | Clogged oil pipe inside oil pan | Broken suction pipe brazing | Defective oil pump | Lack of oil in oil pan | Defective regulator valve | Defective relief valve | Leaking, crushed hydraulic piping | Defective oil pressure sensor | Defective oil level sensor | Water, fuel in oil | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | △ | △ | | | | △ | | | | | | | | |
| | Replacement of filters has not been carried out according to Operation Manual | | ◎ | | | | | | | | | | | | | |
| | Non-specified fuel is being used | | ○ | ○ | | | | | | | | | | | | |
| | Caution lamp lights up | | ◎ | | | | | | | ○ | | | | | | |
| Check items | Condition when oil pressure lamp lights up | Lights up at low idling | | ◎ | | | | | | ○ | | | | | | |
| | | Lights up at low, high idling | | | ◎ | ◎ | ◎ | ◎ | ○ | ○ | ○ | | | | | |
| | | Lights up on slopes | | | | | | ◎ | | | | | | | | |
| | | Sometimes lights up | | | | | | | ◎ | ◎ | | ○ | ○ | | | |
| | There is crushing, leakage from hydraulic piping (external) | | | | | | | | | | ◎ | | | | | |
| | Oil level sensor lamp lights up | | | | | | | ◎ | | | | ◎ | | | | |
| | When oil level in oil pan is inspected, it is found to be low | | | | | | | ◎ | | | | | | | | |
| | Metal particles are found when oil is drained | | | ◎ | | | | | | | | | | | | |
| | Metal particles are stuck to oil filter element | | | ◎ | | | | ○ | | | | | | | | |
| | Oil is cloudy white or smells of diesel oil | | | | | | | | | | | | | | | ◎ |
| Troubleshooting | When oil filter is inspected, it is found to be clogged | | ● | ● | | | | | | | | | | | | Carry out troubleshooting for "Oil level rises". |
| | Remove oil pan and inspect directly | | | | ● | ● | ● | | | | | | | | | |
| | Oil pump rotation is heavy, there is play | | | | | | | ● | | | | | | | | |
| | There is catching of relief valve or regulator valve, spring or valve guide is broken | | | | | | | | ● | ● | | | | | | |
| | When oil level sensor is replaced, oil level sensor lamp goes out | | | | | | | | | | | | ● | | | |
| | When oil pressure is measured, it is found to be within standard valve | | | | | | | | | | | | | ● | | |
| | | Remedy | Clean | Clean | Clean | Clean | Correct | Replace | Add | Adjust | Adjust | Correct | Replace | Replace | - | |

# S-13 Oil level rises (Water, fuel in oil)

★ If there is oil in the cooling water, carry out trouble-shooting for "Oil is in cooling water".

General causes why oil level rises

- Water in oil (milky white)
- Fuel in oil (diluted, and smells of diesel fuel)
- Entry of oil from other component

| | | Causes: Broken oil cooler core, O-ring | Defective nozzle holder sleeve | Broken cylinder head, head gasket | Worn, damaged rear seal surface | Defective pump auxiliary equipment seal | Leakage of fuel from piping inside head cover | Defective part inside injection pump | Defective thermostat | Holes made by pitting | Cracks inside cylinder block |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Check items: Questions | Confirm recent repair history | | | | | | | | | | |
| | Degree of use of machine: Operated for long period | | △ | | △ | △ | | | | △ | |
| | There is oil in radiator cooling water | ◎ | ○ | ○ | | | | | | ○ | ○ |
| | Fuel must be added more frequently | | | | | | ◎ | ◎ | ◎ | | |
| | Exhaust smoke is white | | ◎ | | | | ○ | | ○ | | |
| | When engine is first started, drops of water come from muffler | | ◎ | | | | | | | | |
| | Leave radiator cap open. When engine is run at idling, an abnormal number of bubbles appear, or water spurts back | | | ◎ | | | | | | ○ | |
| | Oil level goes down in clutch, TORQFLOW transmission, or damper chamber | | | | ◎ | | | | | | |
| | Oil level goes down in hydraulic tank | | | | | ◎ | | | | | |
| | Engine oil smells of diesel fuel | | | | | | ◎ | ◎ | ◎ | | |
| | Water temperature is low | | | | | | | | ◎ | | |
| Troubleshooting | Pressure-tightness test of oil cooler shows there is leakage | ● | | | | | | | | | |
| | Pressure-tightness test of cylinder head shows there is leakage | | ● | | | | | | | | |
| | When compression pressure is measured, it is found to be low | | | ● | | | | | | | |
| | Inspect rear seal directly | | | | ● | | | | | | |
| | When pump auxiliary equipment is removed, seal is found to be damaged | | | | | ● | | | | | |
| | Remove head cover and inspect directly | | | | | | ● | | | | |
| | Remove injection pump and inspect directly | | | | | | | ● | | | |
| | Defective contact with thermostat seal valve | | | | | | | | ● | | |
| | Remove oil pan and check directly | | | | | | | | | ● | ● |
| | Remedy | Replace | Replace | Replace | Correct | Replace | Correct | Replace | Correct | Replace | Replace |

# S-14 Water temperature becomes too high (Overheating)

General causes why water temperature becomes too high

- Lack of cooling air (deformation, damage of fan)
- Drop in heat dissipation efficiency
- Defective cooling circulation system
- Rise in oil temperature in power train

★ Carry out troubleshooting for chassis.

| | | | Causes: Broken water pump | Clogged, crushed radiator fins | Clogged radiator core | Defective thermostat (does not open) | Defective water temperature gauge | Lack of cooling water | Fan belt slipping, worn fan pulley | Clogged, broken oil cooler | Defective pressure valve | Broken cylinder head, head gasket | Holes made by pitting | Rise in torque converter oil temperature |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | | △ | △ | | | | | | △ | △ | | |
| | Condition of overheating | Suddenly overheated | ◎ | | | | | ○ | ○ | | | | | |
| | | Always tends to overheat | | ◎ | ◎ | ○ | | | ○ | | | | | |
| | Water temperature gauge | Rise quickly | | | | ◎ | | ○ | | | | | | |
| | | Does not go down from red range | | | | | ◎ | | | | | | | |
| Check items | Radiator water level sensor lights up | | | | | | | ◎ | | | | | | |
| | Fan belt whines under sudden load | | | | | | | | ◎ | | | | | |
| | Cloudy white oil is floating on cooling water | | | | | | | | | ◎ | | | | |
| | Cooling water flows out from overflow hose | | | | | | | | | | ◎ | | | |
| | Excessive air bubbles inside radiator, water spurts back | | | | | | | | | | | ◎ | | |
| | Engine oil level has risen, oil is cloudy white | | | | | | | | ○ | | | | ◎ | |
| | There is play when fan pulley is rotated | | ◎ | | | | | | | | | | | |
| | Radiator shroud, inside of underguard are clogged with dirt or mud | | | ◎ | | | | | ◎ | | | | | |
| | When light bulb is held behind radiator, no light passes through | | | ◎ | | | | | | | | | | |
| | Water is leaking because of cracks in hose or loose clamps | | | | | | | ◎ | | | | | | |
| | When belt tension is inspected, it is found to be loose | | | | | | | | ◎ | | | | | |
| | Power train oil temperature enters red range faster than engine water temperature | | | | | | | | | | | | | ◎ |
| Troubleshooting | Temperature difference between top and bottom radiator tanks is excessive | | ● | | | | | | | | | | | Carry out troubleshooting for chassis. |
| | Temperature difference between top and bottom radiator tanks is slight | | | ● | | | | | | | | | | |
| | When water filler port is inspected, core is found to be clogged | | | | ● | | | | | | | | | |
| | When function test is carried out on thermostat, it does not open | | | | | ● | | | | | | | | |
| | When water temperature is measured, it is found to be normal | | | | | | ● | | | | | | | |
| | When oil cooler is inspected directly, it is found to be clogged | | | | | | | | ● | | | | | |
| | When measurement is made with radiator cap tester, set pressure is found to be low | | | | | | | | | ● | | | | |
| | When compression pressure is measured, it is found to be low | | | | | | | | | | ● | | | |
| | Remove oil pan and inspect directly | | | | | | | | | | | ● | | |
| | | Remedy | Replace | Correct | Correct | Replace | Replace | Add | Correct | Replace | Replace | Replace | Replace | - |

# S-15 Abnormal noise is made

★ Judge if the noise is an internal noise or an external noise.

General causes why abnormal noise is made

- Abnormality due to defective parts
- Abnormal combustion
- Air sucked in from intake system

| | | | Causes: Excessive wear of piston ring, cylinder (liner less engine) | Seized turbocharger, interference | Missing, seized bushing | Clogged, seized injection nozzle | Defective injection pump (rack, plunger seized) | Defective injection pump (excessive injection) | Deformed fan, fan belt interference | Defective adjustment of valve clearance | Broken dynamic valve system (valve, rocker lever, etc.) | Improper gear train backlash | Leakage of air between turbocharger and cylinder head | Defect inside muffler (dividing board out of position) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | | | | | |
| | Degree of use of machine | Operated for long period | △ | | | | | | | | | | | |
| | Condition of abnormal noise | Gradually occurred | ○ | | | | | ○ | | | | | | |
| | | Suddenly occurred | | ○ | ○ | | | | | ○ | | | | |
| | Non-specified fuel is being used | | | | | ○ | ○ | | | | | | | |
| | Engine oil must be added more frequently | | ◎ | | | | | | | | | | | |
| Check items | Color of exhaust gas | Black under light load | ◎ | | | | | | | | | | | |
| | | Black | | ◎ | | | | | ○ | | | | ○ | |
| | Metal particles found in oil filter | | ◎ | | ◎ | | | | | | | | | |
| | Blow-by gas excessive | | ◎ | | | | | | | | | | | |
| | Noise of interference is heard from around turbocharger | | | ◎ | | | | | | | | | | |
| | Engine pickup is poor and combustion is abnormal | | | | | ◎ | | | | | | | | |
| | When exhaust manifold is touched immediately after starting engine, temperature of some cylinders is low | | | | | ◎ | ○ | | | | | | | |
| | Seal on injection pump has come off | | | | | | | ◎ | | | | | | |
| | Abnormal noise is loud when accelerating engine | | | | | ○ | ○ | ○ | ○ | ○ | | ○ | | |
| | Clanging sound is heard from around cylinder head | | | | | | | | | ◎ | ◎ | | | |
| | Leakage of air between turbocharger and cylinder head, loose clamp | | | | | | | | | | | | ◎ | |
| | Vibrating noise is heard from around muffler | | | | | | | | | | | | | ◎ |
| Troubleshooting | When compression pressure is measured, it is found to be low | | ● | | | | | | | | | | | |
| | When turbocharger is rotated by hand, it is found to be heavy | | | ● | | | | | | | | | | |
| | Remove gear cover and inspect directly | | | | ● | | | | | | | ● | | |
| | Speed does not change when operation of certain cylinders is stopped | | | | | ● | | | | | | | | |
| | When control rack is pushed, it is found to be heavy, or does not return | | | | | | ● | | | | | | | |
| | Injection pump test shows that injection amount is incorrect | | | | | | | ● | | | | | | |
| | Fan is deformed, belt is loose | | | | | | | | ● | | | | | |
| | When valve clearance is checked, it is found to be outside standard value | | | | | | | | | ● | | | | |
| | Remove cylinder head cover and inspect directly | | | | | | | | | | ● | | | |
| | When muffler is removed, abnormal noise disappears | | | | | | | | | | | | | ● |
| | Remedy | | Replace | Replace | Replace | Replace | Correct | Replace | Correct | Replace | Correct | Replace | Replace | Replace |

# S-16 Vibration is excessive

★ If there are abnormal noise together with the vibration, carry out troubleshooting also for "Abnormal noise is made".

General causes why vibration is excessive

- Defective parts (abnormal wear, breakage)
- Improper combustion
- Abnormal combustion

| | | | Causes: Worn connecting rod, main bearing | Worn cam bushing | Loose engine mounting bolts, broken cushion | Broken part inside output shaft (damper) | Center of engine and power train misaligned | Improper gear train backlash | Defective dynamic valve system (valve, rocker lever, etc. stuck) | Defective injection pump (excessive fuel injection) |
|---|---|---|---|---|---|---|---|---|---|---|
| Questions | Confirm recent repair history | | | | | | | | | |
| | Degree of use of machine | Operated for long period | △ | △ | △ | | | | | |
| | Condition of vibration | Suddenly increased | | | | ○ | | | ○ | |
| | | Gradually increased | ○ | ○ | ○ | | | | | |
| | Non-specified fuel is being used | | ○ | ○ | | | | | | |
| Check items | Metal particles are found in oil filter | | ◎ | ◎ | | | | | | |
| | Metal particles are found when oil is drained | | ◎ | ◎ | | | | | | |
| | Oil pressure is low at low idling | | ○ | ○ | | | | | | |
| | Vibration occurs at mid-range speed | | | | ○ | ○ | | | | |
| | Vibration follows engine speed | | | | ○ | ○ | ○ | ○ | | |
| | Exhaust smoke is black | | | | | | | | ◎ | ○ |
| | Seal on injection pump has come off | | | | | | | | | ◎ |
| Troubleshooting | Remove oil pan and inspect directly | | ● | | | | | | | |
| | Remove side cover and inspect directly | | | ● | | | | | | |
| | Inspect directly for loose engine mounting bolts, broken cushion | | | | ● | | | | | |
| | Inspect inside of output shaft (damper) directly | | | | | ● | | | | |
| | When face runout and radial runout are inspected, they are found to be incorrect | | | | | | ● | | | |
| | Remove front cover and inspect directly | | | | | | | ● | | |
| | Remove head cover and inspect directly | | | | | | | | ● | |
| | Injection pump test shows that injection amount is incorrect | | | | | | | | | ● |
| | | Remedy | Replace | Replace | Replace | Replace | Correct | Correct | Replace | Adjust |

# 30 DISASSEMBLY AND ASSEMBLY


How to read this manual . . . . . 30 - 3
Removal and installation of assemblies . . . 30 - 3
Disassembly and assembly of assemblies . 30 - 4
Precautions when performing operation . . . . . 30 - 5
Special tool list . . . . . 30 - 7
Sketches of special tools . . . . . 30 - 10
Removal, installation of fuel injection pump assembly . . . . . 30 - 16
Special tools . . . . . 30 - 16
Removal . . . . . 30 - 16
Installation . . . . . 30 - 18
Removal, installation of nozzle holder assembly . . . . . 30 - 20
Special tools . . . . . 30 - 20
Removal . . . . . 30 - 20
Installation . . . . . 30 - 21
Removal, installation of cylinder head assembly . . . . . 30 - 22
Special tools . . . . . 30 - 22
Removal . . . . . 30 - 22
Installation . . . . . 30 - 27
Removal, installation of engine assembly . . . 30 - 30
Removal . . . . . 30 - 30
Installation . . . . . 30 - 35
Removal, installation of radiator assembly . . 30 - 37
Removal . . . . . 30 - 37
Installation . . . . . 30 - 38
Removal, installation of air aftercooler . . . . . 30 - 39
Removal . . . . . 30 - 39
Installation . . . . . 30 - 40
Removal, installation of hydraulic oil cooler assembly . . . . . 30 - 41
Removal . . . . . 30 - 41
Installation . . . . . 30 - 42
Removal, installation of cooling fan and fan motor assembly . . . . . 30 - 43
Removal . . . . . 30 - 43
Installation . . . . . 30 - 44
Removal, installation of fuel tank assembly . . 30 - 45
Removal . . . . . 30 - 45
Installation . . . . . 30 - 46
Removal, installation of transfer . . . . . 30 - 47
Removal . . . . . 30 - 47
Installation . . . . . 30 - 49
Disassembly, assembly of transfer assembly 30 - 50
Special tools . . . . . 30 - 50
Disassembly . . . . . 30 - 50
Assembly . . . . . 30 - 58
Removal, installation of parking brake assembly . . . . . 30 - 70
Removal . . . . . 30 - 70
Installation . . . . . 30 - 71
Disassembly, assembly of parking brake assembly . . . . . 30 - 72
Special tools . . . . . 30 - 72
Disassembly . . . . . 30 - 72
Assembly . . . . . 30 - 74
Removal, installation of front axle assembly . . 30 - 77
Removal . . . . . 30 - 77
Installation . . . . . 30 - 78
Removal, installation of rear axle assembly . . 30 - 79
Removal . . . . . 30 - 79
Installation . . . . . 30 - 81
Disassembly, assembly of axle housing assembly . . . . . 30 - 82
Special tools . . . . . 30 - 82
Disassembly . . . . . 30 - 82
Assembly . . . . . 30 - 85
Disassembly, assembly of differential assembly . . . . . 30 - 91
Special tools . . . . . 30 - 91
Disassembly . . . . . 30 - 91
Assembly . . . . . 30 - 100
Removal, installation of HST pump and 4-gear pump assembly . . . . . 30 - 117
Removal . . . . . 30 - 117
Installation . . . . . 30 - 119
Disassembly and assembly of HST pump assembly . . . . . 30 - 120
Disassembly . . . . . 30 - 120
Assembly . . . . . 30 - 129
Removal, installation of HST motor 1 assembly . . . . . 30 - 146
Removal . . . . . 30 - 146
Installation . . . . . 30 - 146
Removal, installation of HST motor 2 assembly . . . . . 30 - 147
Removal . . . . . 30 - 147
Installation . . . . . 30 - 147
Disassembly and assembly of HST motor assembly . . . . . 30 - 148
Disassembly . . . . . 30 - 148
Assembly . . . . . 30 - 156
Removal, installation of work equipment control valve assembly . . . . . 30 - 164
Removal . . . . . 30 - 164
Installation . . . . . 30 - 165

Removal, installation of travel damper valve assembly. . . . . 30 - 166
Removal . . . . . 30 - 166
Installation. . . . . 30 - 167
Removal, installation of hydraulic tank assembly. . . . . 30 - 168
Removal . . . . . 30 - 168
Installation. . . . . 30 - 169
Removal, installation of work equipment assembly. . . . . 30 - 170
Removal . . . . . 30 - 170
Installation. . . . . 30 - 173
Disassembly, assembly of hydraulic cylinder assembly. . . . . 30 - 177
Special tools . . . . . 30 - 177
Disassembly . . . . . 30 - 178
Assembly . . . . . 30 - 181
Removal, installation of operator's cab assembly. . . . . 30 - 185
Removal . . . . . 30 - 185
Installation. . . . . 30 - 188
Removal, installation of operator's cab glass (Stuck glass). . . . . 30 - 189
Special tools . . . . . 30 - 189
Removal . . . . . 30 - 189
Installation. . . . . 30 - 190
Coating materials . . . . . 30 - 196
Removal, installation of center hinge pin . . . 30 - 197
Removal . . . . . 30 - 197
Installation. . . . . 30 - 201
Removal, installation of counterweight. . . . . 30 - 206
Removal . . . . . 30 - 206
Installation. . . . . 30 - 207
Removal, installation of air conditioner unit assembly. . . . . 30 - 208
Special tools . . . . . 30 - 208
Removal . . . . . 30 - 208
Installation. . . . . 30 - 209
Removal, installation of air conditioner compressor assembly. . . . . 30 - 210
Special tools . . . . . 30 - 210
Removal . . . . . 30 - 210
Installation. . . . . 30 - 210
Removal, installation of monitor panel . . . . . 30 - 211
Removal . . . . . 30 - 211
Installation. . . . . 30 - 213

# HOW TO READ THIS MANUAL

## REMOVAL AND INSTALLATION OF ASSEMBLIES

### SPECIAL TOOLS

- Special tools that are deemed necessary for removal or installation of parts are listed.
- List of the special tools contains the following kind of information.
  1) Necessity
     ■: Special tools which cannot be substituted, should always be used.
     ●: Special tools which are very useful if available, can be substituted with commercially available tools.
  2) Distinction of new and existing special tools
     N: Tools with new part numbers, newly developed for this mode.
     R: Tools with upgraded part numbers, remodeled from already available tools for other models.
     Blank: Tools already available for other models, used without any modification.
  3) Circle mark (○) in sketch column:
     A circle mark means that a sketch of the special tool is presented in the section of Sketches for Special Tools.

★ Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan e.g. 79*T--- xxx --- xxxx.

### REMOVAL OF PARTS

- The REMOVAL Section contains procedures, precautions and the amount of oil or water to be drained.
- Various symbols used in the REMOVAL Section are explained and listed below.


This mark indicates safety-related precautions which must be followed when doing the work.

★ This mark gives guidance or precautions when doing the procedure.

[*1] This mark shows that there are instructions or precautions for installing parts.


This mark shows oil or water to be drained


This mark shows the weight of a part or a device.

### INSTALLATION OF PARTS

- Except where otherwise instructed, install parts is the reverse order of removal.
- Instructions and precautions for installing parts are shown with [*1] mark in the INSTALLATION Section, identifying which step the instructions are intended for.
- Marks shown in the INSTALLATION Section stand for the following.


This mark indicates safety-related precautions which must be followed when doing the work.

★ This mark gives guidance or precautions when doing the procedure.


This mark stands for a specific coating agent to be used.


This mark indicates the specified torque.


This mark indicates an amount of oil or water to be added.

### SKETCHES OF SPECIAL TOOLS

- Various special tools are illustrated for the convenience of local manufacture.

## DISASSEMBLY AND ASSEMBLY OF ASSEMBLIES

### SPECIAL TOOLS

- Special tools which are deemed necessary for disassembly and assembly of parts are listed.
- List of the special tools contains the following kind of information.
  1) Necessity
     ■: Special tools which cannot be substituted, should always be used.
     ●: Special tools which are very useful if available, can be substituted with commercially available tools.
  2) Distinction of new and existing special tools
     N: Tools with new part numbers, newly developed for this mode.
     R: Tools with upgraded part numbers, remodeled from already available tools for other models.
     Blank: Tools already available for other models, used without any modification.
  3) Circle mark (○) in sketch column:
     A circle mark means that a sketch of the special tool is presented in the section of Sketches for Special Tools.

★ Part No. of special tools starting with 79*T means that they are locally made parts and as such not interchangeable with those made by Komatsu in Japan e.g. 79*T--- xxx --- xxxx.

### DISASSEMBLY

- The DISASSEMBLY Section contains procedures, precautions and the amount of oil or water to be drained.
- Various symbols used in the DISASSEMBLY Section are explained and listed below.


This mark indicates safety-related precautions which must be followed when doing the work.

★ This mark gives guidance or precautions when doing the procedure.

[*1] This mark shows that there are instructions or precautions for installing parts.


This mark shows oil or water to be drained

### ASSEMBLY

- Section titled ASSEMBLY contain procedures, precautions and the know-how for the work, as well as the amount of oil or water to be added.
- Various symbols used in ASSEMBLY Section are explained and listed below.
- Marks shown in the INSTALLATION Section stand for the following.


This mark indicates safety-related precautions which must be followed when doing the work.

★ This mark gives guidance or precautions when doing the procedure.


This mark stands for a specific coating agent to be used.


This mark indicates the specified torque.


This mark indicates an amount of oil or water to be added.

### SKETCHES OF SPECIAL TOOLS

1) Various special tools are illustrated for the convenience of local manufacture.

# PRECAUTIONS WHEN PERFORMING OPERATION

Be sure to follow the general precautions given below when performing removal or installation (disassembly or assembly) of units.

**1. Precautions when performing removal work**

- If the engine coolant water contains antifreeze, dispose of it properly.
- After disconnecting hoses or tubes, cover them or install blind plugs to prevent dirt or dust from entering.
- When draining oil, prepare a container of adequate size to catch the oil.
- Confirm the match marks showing the installation position, and make match marks in the necessary places before removal to prevent any mistake during assembly.
- To avoid loosening any wire contacts, do not pull on the wires. In-order to prevent excessive force to the wiring, hold onto the connectors when disconnecting them.
- Fasten tags to wires and hoses to identify them and show their installation position. This helps prevent any mistakes when re-installing.
- Count and check the number and thickness of the shims and keep them in a safe place.
- When raising or lifting components, be sure to use proper lifting equipment of ample strength and safety.
- When using forcing screws to remove any components, tighten the forcing screws uniformly in turn.
- Before removing any unit, clean the surrounding area and install a cover to prevent any dust or dirt from entering after removal.

★ **Precautions when handling piping during disassembly**

Install the following blind plugs into the piping after disconnecting it during disassembly operations.

A. Face seal type hoses and tubes

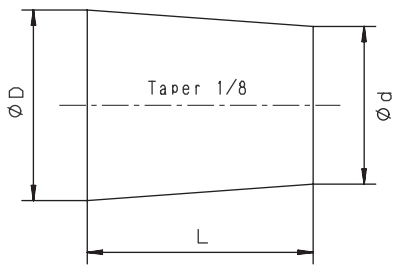
| Nominal Number | Plug (nut end) | Nut (elbow end) |
|---|---|---|
| 02 | 07376-70210 | 02789-00210 |
| 03 | 07376-70315 | 02789-00315 |
| 04 | 07376-70422 | 02789-00422 |
| 05 | 07376-70522 | 02789-00522 |
| 06 | 07376-70628 | 02789-00628 |

B. Split flange type hoses and tubes

| Nominal Number | Flange (hose end) | Sleeve head (tube end) | Split flange |
|---|---|---|---|
| 04 | 07379-00400 | 07378-10400 | 07371-30400 |
| 05 | 07379-00500 | 07378-10500 | 07371-30500 |

C. If the part is not under hydraulic pressure, the following corks can be used:

| Nominal Number | Part Number | Dimensions | | |
|---|---|---|---|---|
| | | D | d | L |
| 06 | 07049-00608 | 6 | 5 | 8 |
| 08 | 07049-00811 | 8 | 6.5 | 11 |
| 10 | 07049-01012 | 10 | 8.5 | 12 |
| 12 | 07049-01215 | 12 | 10 | 15 |
| 14 | 07049-01418 | 14 | 11.5 | 18 |
| 16 | 07049-01620 | 16 | 13.5 | 20 |
| 18 | 07049-01822 | 18 | 15 | 22 |
| 20 | 07049-02025 | 20 | 17 | 25 |
| 22 | 07049-02228 | 22 | 18.5 | 28 |
| 24 | 07049-02430 | 24 | 20 | 30 |
| 27 | 07049-02734 | 27 | 22.5 | 34 |




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**2. Precautions when carrying out installation work**

- Tighten all bolts and nuts (sleeve nuts) to the specified (KES) torque.
- Install the hoses without twisting or interference.
- Replace all gaskets, O-rings, cotter pins, and lock plates with new parts.
- Bend the cotter pin or lock plate securely.
- When coating with adhesive, clean the part and remove all oil and grease, then coat the threaded portion with two or three drops of adhesive.
- When coating with gasket sealant, clean the surface and remove all oil and grease, check that there is no dirt or damage, then coat uniformly with gasket sealant.
- Clean all parts, and correct any damage, dents, burrs, or rust.
- Coat rotating parts and sliding parts with engine oil.
- When press-fitting parts, coat the surface with anti-friction compound (LM-P).
- After installing snap rings, check that the snap ring is installed securely in the ring groove.
- When connecting wiring connectors, clean the connector to remove all oil dirt, or water, then connect it securely.
- When using eye bolts, check that there is no deformation or deterioration. Screw them in fully, and align the direction of the hook.
- When tightening split flanges, tighten uniformly in turn to prevent excessive tightening on one side.

★ When operating the hydraulic cylinders for the first time after reassembling the cylinders, pumps and other hydraulic equipment removed for repair, bleed the air as follows:

1. Start the engine and run it at low idle.
2. Operate the work equipment control lever to operate the hydraulic cylinders, 4 - 5 times, stopping the cylinders 100 mm from the end of their stroke.
3. Next, operate the hydraulic cylinder 3 - 4 times to the end of its stroke.
4. After doing this run the engine at normal speed.

★ When using the machine for the first time after repair or long storage, follow the same procedure.

**3. Precautions when completing the operations**

- If the engine coolant water has been drained, tighten the drain valve, and add coolant water to the specified level. Run the engine to circulate the coolant water through the system. Then check the coolant water level again.
- If the hydraulic equipment has been removed and installed again, add engine oil to the specified level. Run the engine to circulate the oil through the system. Then check the oil level again.
- If the piping or hydraulic equipment have been removed for repair, bleed the air from the system after reassembling the parts.

★ For details, see TESTING AND ADJUSTING, Bleeding air.

- Add the specified amount of grease (molybdenum disulphide grease) to the work equipment related parts.

# SPECIAL TOOL LIST

★ Tools with part number 79○T-○○○-○○○○ can not be supplied (they are items to be locally manufactured).

★ Necessity: ■ .....Cannot be substituted, should always be installed (used)
● .....Extremely useful if available or can be substituted with commercially available part

★ New/remodel: :N.....Tools with new part numbers, newly developed for this model
:R.....Tools with upgraded part numbers, remodeled from items already available for other models
:Blank ..Tools already available for other models, can be used without any modification

★ Tools marked ○ in the Sketch column are tools introduced in the sketches of the special tools (See SKETCHES OF SPECIAL TOOLS).

| Component | Symbol | | Part No. | Part Name | Necessity | Q'ty | New/remodel | Sketch | Nature of work, remarks |
|---|---|---|---|---|---|---|---|---|---|
| Fuel injection pump assembly | A | 1 | 795-799-1131 | Gear | ■ | 1 | | | Removal, installation of fuel injection pump assembly |
| | | 2 | 795-799-1390 | Remover | ■ | 1 | | | |
| Nozzle holder assembly | | 3 | 795-799-1171 | Puller | ● | 1 | | | Removal of nozzle holder assembly |
| Cylinder head assembly | | 4 | 790-331-1110 | Wrench | ■ | 1 | | | Tightening of cylinder head bolt |
| Transfer assembly and parking brake assembly | D | 1 | 790-201-2840 | Spacer | ■ | 1 | | | Press fitting of output shaft bearing |
| | | 2 | 793T-417-1110 | Push tool | ■ | 1 | N | ○ | |
| | | 3 | 790-101-5201 | Push tool kit | ■ | 1 | | | Press fitting of oil seal of parking brake case |
| | | | • 790-101-5311 | • Plate | | 1 | | | |
| | | | • 790-101-5221 | • Grip | | 1 | | | |
| | | | • 01010-51225 | • Bolt | | 1 | | | |
| | | 4 | 793T-417-1120 | Push tool | ■ | 1 | N | ○ | Press fitting of dust seal of parking brake case |
| | | | 790-101-5221 | Grip | ■ | 1 | | | |
| | | | 01010-81225 | Bolt | ■ | 1 | | | |
| | | | 799-301-1500 | Oil leak tester | ■ | 1 | | | |
| Axle housing assembly | H | 1 | 793T-623-1170 | Push tool | ■ | 1 | | ○ | Press fitting of inner race of axle shaft bearing |
| | | | 793T-422-1230 | Push tool | ■ | 1 | N | ○ | |
| | | | 793T-423-1110 | Push tool | ■ | 1 | N | ○ | |
| | | 2 | 793T-422-1240 | Seal support | ■ | 2 | N | ○ | Supporting of axle shaft oil seal |
| | | | 01010-80860 | Bolt | ■ | 6 | | | |
| | | | 793T-423-1120 | Seal support | ■ | 2 | N | ○ | |
| | | | 01010-80860 | Bolt | ■ | 6 | | | |
| | | 3 | 793T-659-1110 | Push tool | ■ | 1 | | ○ | Press fitting of inner race of axle shaft bearing |
| | | | 790-201-2750 | Spacer | ■ | 1 | | | |
| | | 4 | 793T-423-1150 | Holder | ■ | 1 | N | ○ | Adjustment of shim of axle shaft bearing |

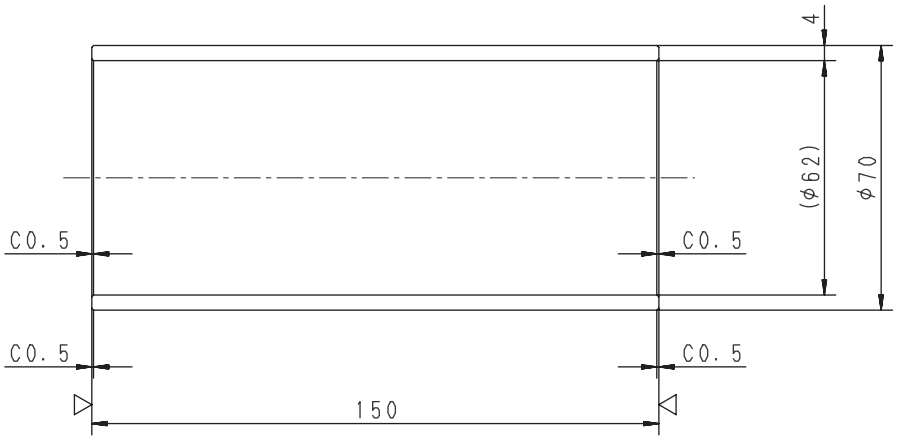
| Component | Symbol | | Part No. | Part Name | Necessity | Q'ty | New/remodel | Sketch | Nature of work, remarks |
|---|---|---|---|---|---|---|---|---|---|
| Differential assembly | H | 5 | 799-301-1500 | Oil leak tester | ■ | 1 | | | Operation check of clutch piston |
| | | 6 | 797-101-1211 | Wrench | ■ | 1 | | | Removal, installation of pinion shaft nut |
| | | 7 | 793-615-1100 | Wrench | ■ | 1 | | | No-load operating torque of limited-slip differential |
| | | 8 | 793T-422-1220 | Push tool | ■ | 1 | N | ○ | Press fitting of pinion shaft bearing |
| | | 9 | 797T-423-1320 | Push tool | ■ | 1 | | ○ | |
| | | 10 | 792T-413-1130 | Push tool | ■ | 1 | | ○ | Press fitting of oil seal of pinion shaft cage |
| | | 11 | 793-520-2202 | Installer | ● | 3 | | | Installation of brake piston<br>Check for brake oil leakage |
| | | 12 | 799-101-5210 | Nipple | ■ | 1 | | | Check for brake oil leakage |
| | | 13 | 790-190-1500 | Pump assembly | ■ | 1 | | | |
| Hydraulic cylinder assembly | U | 1 | 790-502-1003 | Repair stand | ■ | 1 | | | Disassembly, assembly of hydraulic cylinder |
| | | | 790-101-1102 | Hydraulic pump | ■ | 1 | | | |
| | | 2 | 790-102-2303<br>or<br>790-102-3802 | Wrench assembly (for lift and bucket) | ■ | 1 | | | Removal, installation of cylinder head |
| | | 3 | 790-302-1340 | Socket (for lift) | ■ | 1 | | | Removal, installation of piston nut |
| | | 4 | 790-201-1702 | Push tool kit | | 1 | | | Press fitting of cylinder head bushing |
| | | | 790-101-5021 | • Grip | | 1 | | | |
| | | | 01010-50816 | • Bolt | | 1 | | | |
| | | | 790-201-1811 | • Push tool (Lift) | | 1 | | | |
| | | | 790-201-1821 | • Push tool (Bucket) | | 1 | | | |
| | | | 790-201-1841 | • Push tool (WA250PT-5 bucket) | | 1 | | | |
| | | | 790-201-1741 | • Push tool (Steering) | | 1 | | | |
| | | 5 | 790-201-1500 | Push tool kit | ■ | 1 | | | Installation of dust seal |
| | | | 790-101-5021 | • Grip | | 1 | | | |
| | | | 01010-50816 | • Bolt | | 1 | | | |
| | | | 790-210-1620 | • Plate (Lift) | | 1 | | | |
| | | | 790-201-1630 | • Plate (Bucket) | | 1 | | | |
| | | | 790-201-1841 | • Push tool (WA250PT-5 bucket) | | | | | |
| | | | 790-201-1741 | • Push tool (Steering) | | 1 | | | |

| Component | Symbol | | Part No. | Part Name | Necessity | Q'ty | New/remodel | Sketch | Nature of work, remarks |
|---|---|---|---|---|---|---|---|---|---|
| Hydraulic cylinder assembly | U | 6 | 790-720-1000 | Expander | ○ | 1 | | | Installation of piston ring |
| | | 7 | 796-720-1670 | Ring (Lift) | ○ | 1 | | | |
| | | | 07281-01279 | Ring (Lift) | ○ | 1 | | | |
| | | | 796-720-1680 | Ring (Bucket) | ○ | 1 | | | |
| | | | 07281-01589 | Ring (Bucket) | ○ | 1 | | | |
| | | | 796-720-1690 | Ring (WA250PT-5 bucket) | ○ | 1 | | | |
| | | | 07281-01919 | Ring (WA250PT-5 bucket) | ○ | 1 | | | |
| | | | 796-720-1740 | Ring (Steering) | ○ | 1 | | | |
| | | | 07281-00809 | Ring (Steering) | ○ | 1 | | | |
| | | 8 | 790-102-4300 | Wrench assembly (WA250PT-5 bucket) | ■ | 1 | | | Removal, installation of piston |
| | | | 790-102-4310 | Pin (WA250PT-5 bucket) | ■ | 2 | | | |
| Operator's cab glass | X | 1 | 799-703-1200 | Service tool kit | ■ | 2 | | | Collection and supply of refrigerant |
| | | | 799-703-1100 | Vacuum pump (100 V) | ■ | 1 | | | |
| | | | 799-703-1110 | Vacuum pump (220 V) | ■ | 1 | | | |
| | | | 799-703-1120 | Vacuum pump (240 V) | ■ | 1 | | | |
| | | | 799-703-1400 | Gas leak tester | ■ | 1 | | | |
| | | 2-1 | 793-498-1120 | Clear plate | ■ | 2 | | | Adjustment of clearance of window glass |
| | | 2-2 | 793-498-1130 | Plate | ■ | 2 | | | |
| | | 2-3 | 793-498-1110 | Magnet | ■ | 2 | | | |
| | | 3 | 793-498-1210 | Lifter (Suction cup) | ■ | 2 | | | Removal, installation of window glass |

# SKETCHES OF SPECIAL TOOLS

Note: Komatsu cannot accept any responsibility for special tools manufactured according to these skeches.

**D2 PUSH TOOL**

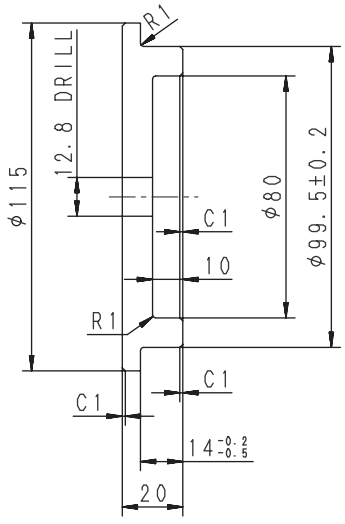



9JF00891

| HEAT TREATMENT | MATERIAL |
|---|---|
| ---- | STKM13A |
| PART NAME | Q'TY |
| PUSH TOOL | 1 |
| 793T-417-1110 △ | |

Numerical values and units within curly brackets are for reference

**D4 PUSH TOOL**

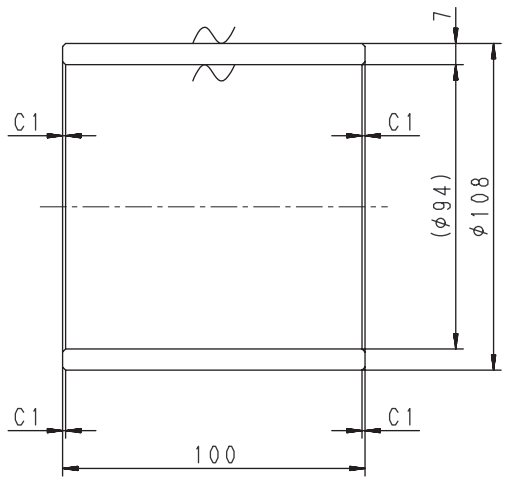



9JF00892

| HEAT TREATMENT | MATERIAL |
|---|---|
| ---- | SS400 |
| PART NAME | Q'TY |
| PUSH TOOL | 1 |
| 793T-417-1120 △ | |

Numerical values and units within curly brackets are for reference ▽

**H1 PUSH TOOL**

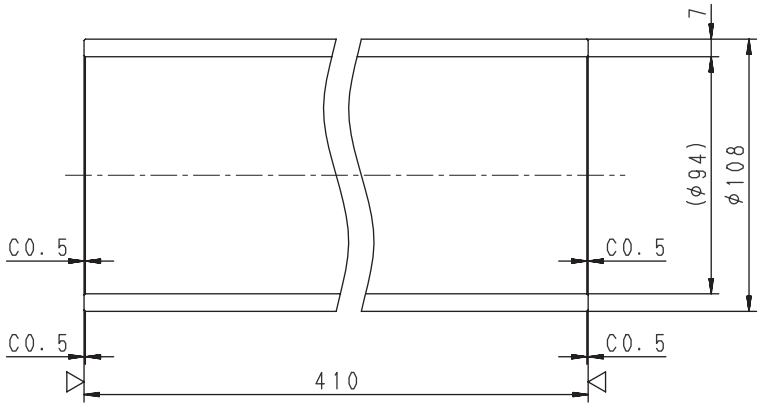



9JF00902

| HEAT TREATMENT | MATERIAL |
|---|---|
| ---- | STKM13A |
| PART NAME | Q'TY |
| PUSH TOOL | 1 |
| 793T-623-1170 △ | |

▽

**H1 PUSH TOOL**

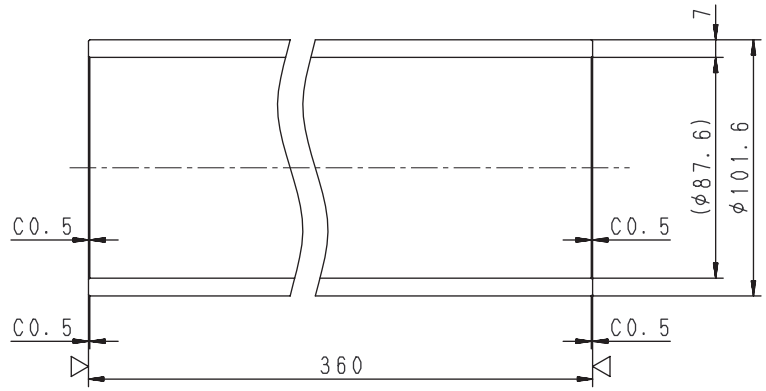



9JF00893

| HEAT TREATMENT | MATERIAL |
|---|---|
| ---- | STKM13A |
| PART NAME | Q'TY |
| PUSH TOOL | 1 |
| 793T-422-1230 △ | |

Numerical values and units within curly brackets are for reference

## H1 PUSH TOOL

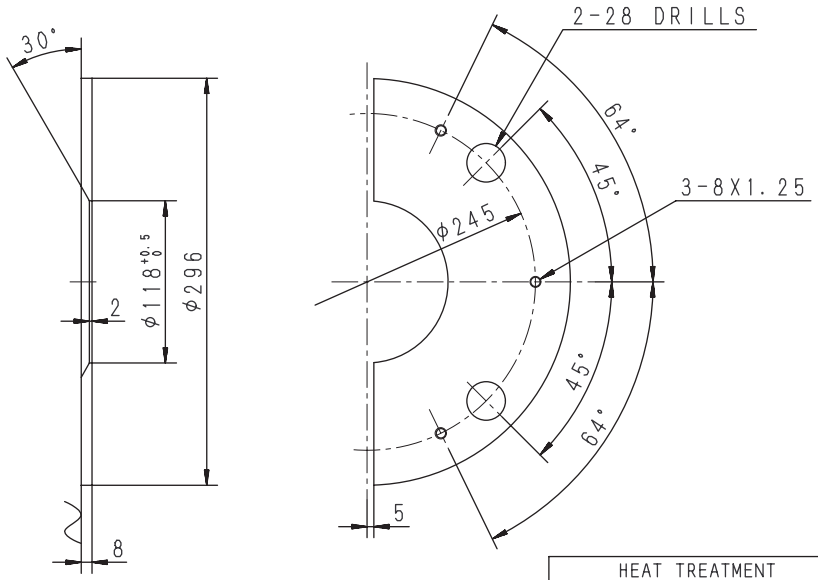



9JF00894

| HEAT TREATMENT | MATERIAL |
|---|---|
| ---- | STKM13A |
| PART NAME | Q'TY |
| PUSH TOOL | 1 |
| 793T-423-1110 △ | |

Numerical values and units within curly brackets are for reference

## H2 SEAL SUPPORT



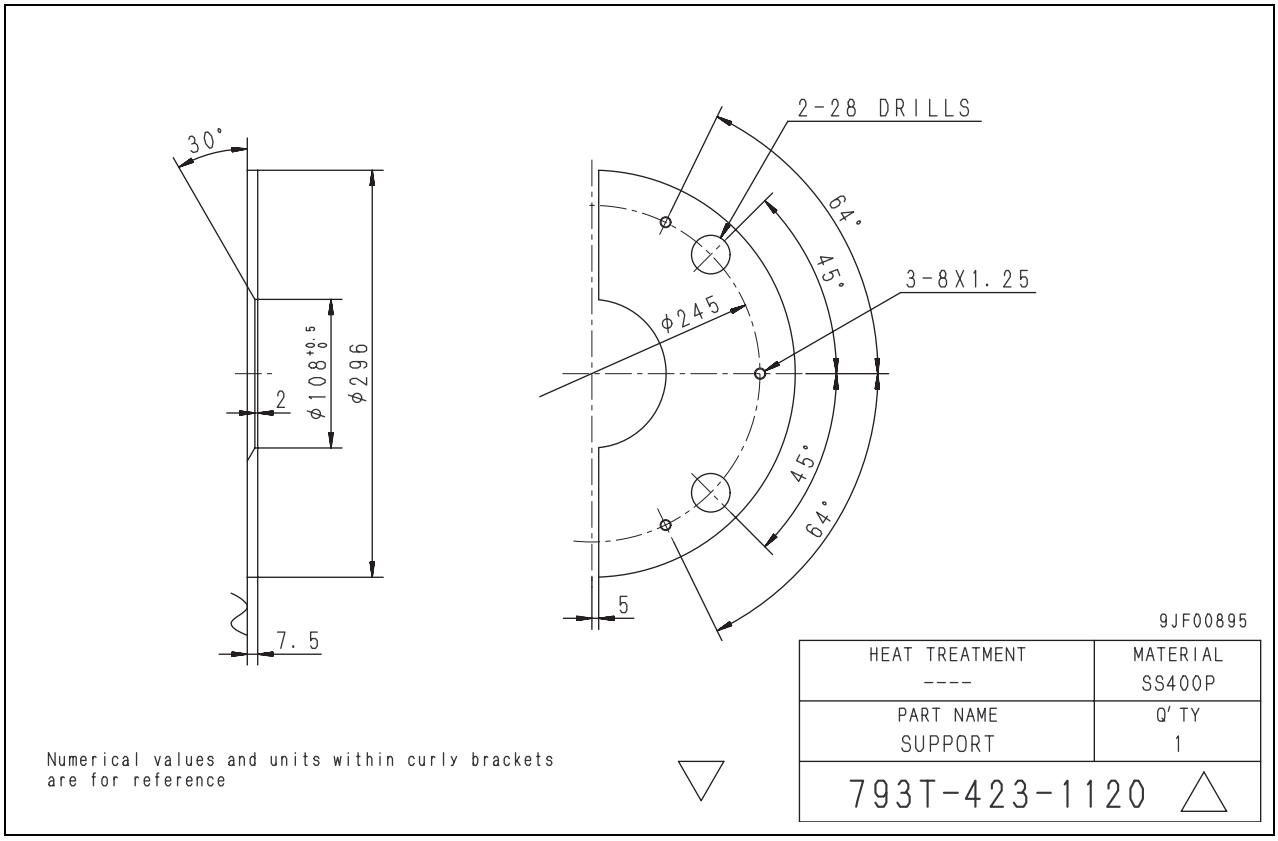

9JF00896

| HEAT TREATMENT | MATERIAL |
|---|---|
| ---- | SS400P |
| PART NAME | Q'TY |
| SUPPORT | 1 |
| 793T-422-1240 △ | |

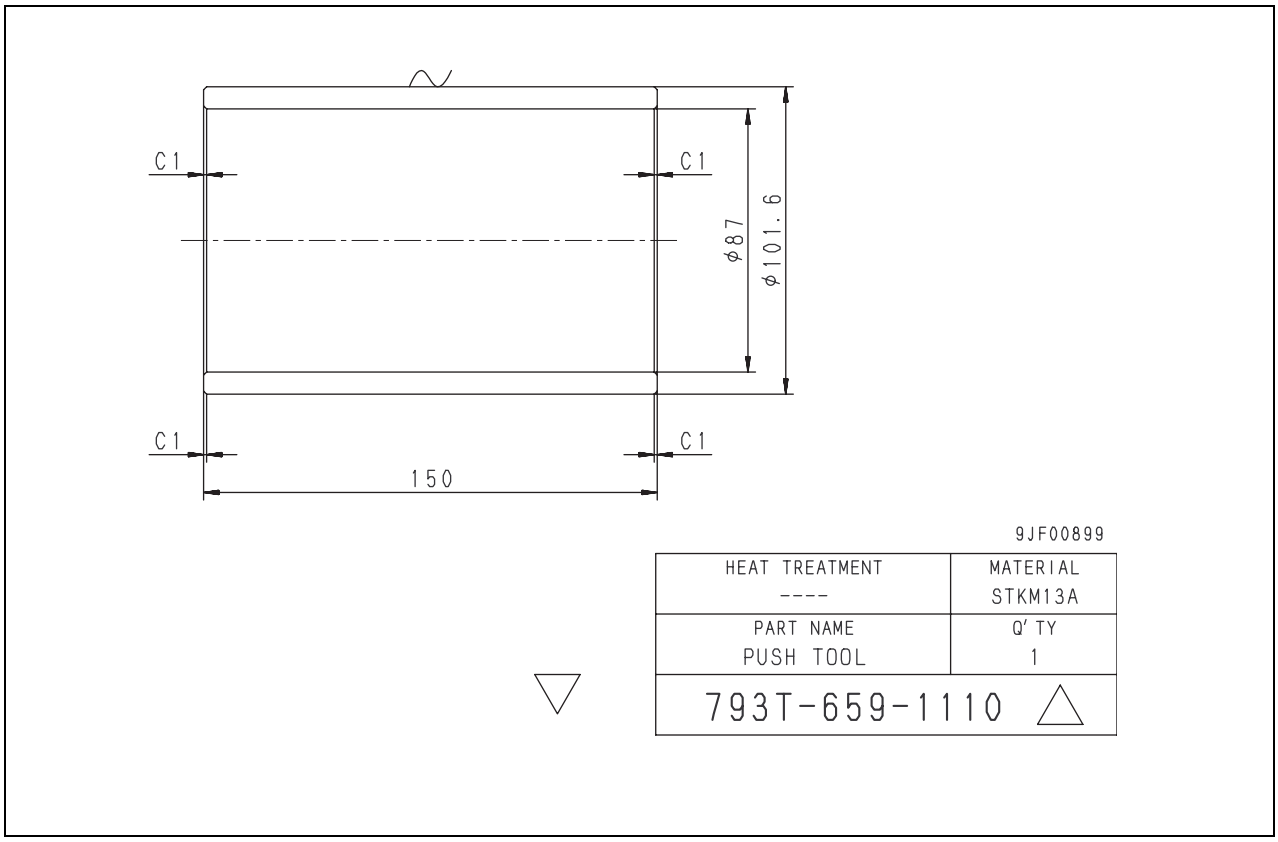
Numerical values and units within curly brackets are for reference

▽

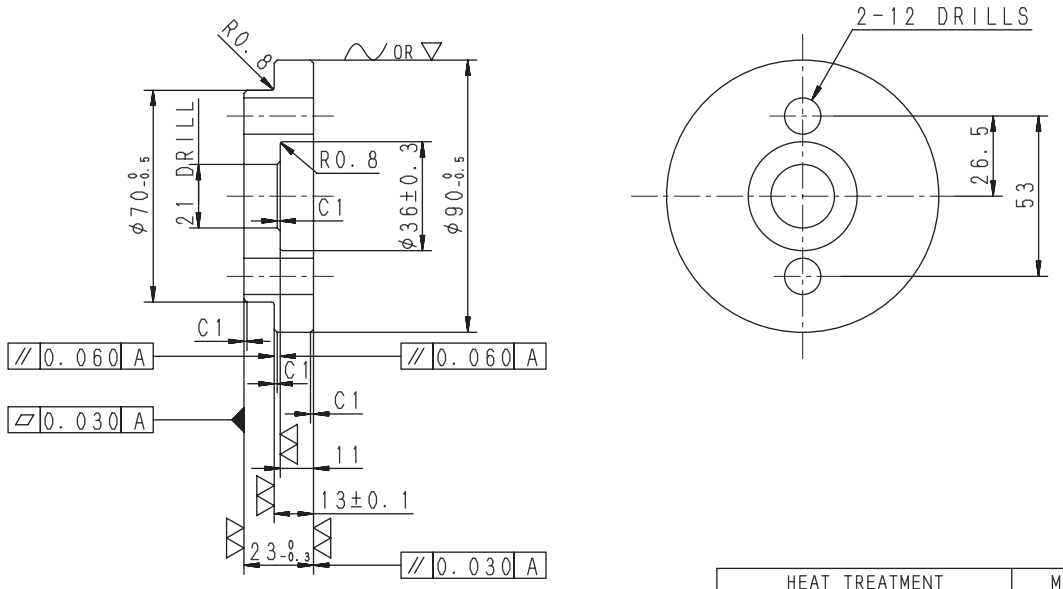
## H2 SEAL SUPPORT




## H3 PUSH TOOL



## H4 HOLDER

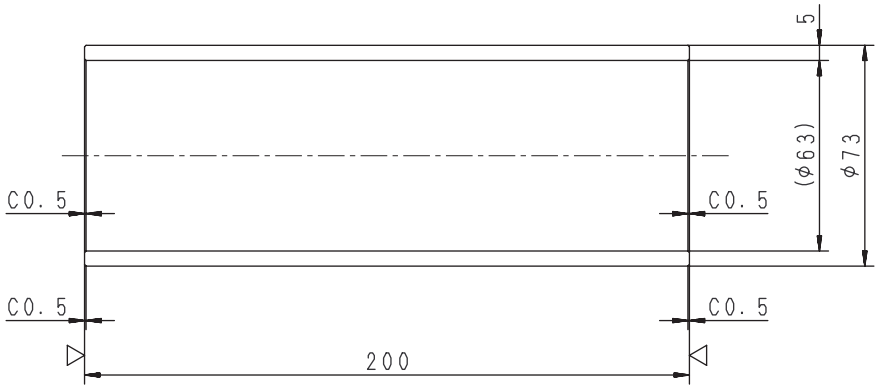



9JF00897

| HEAT TREATMENT | MATERIAL |
|---|---|
| ---- | SS400 |
| PART NAME | Q'TY |
| HOLDER | 1 |
| 793T-423-1150 △ | |

Numerical values and units within curly brackets are for reference

## H8 PUSH TOOL

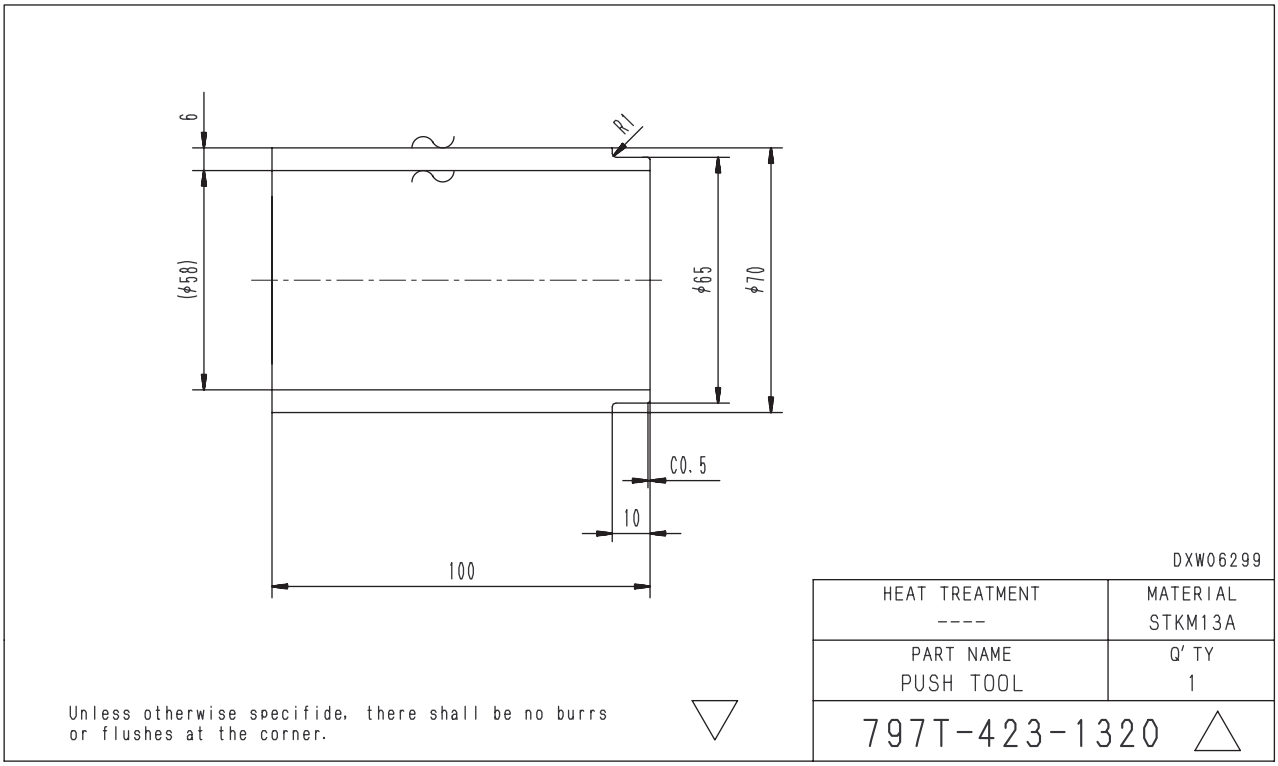



9JF00898

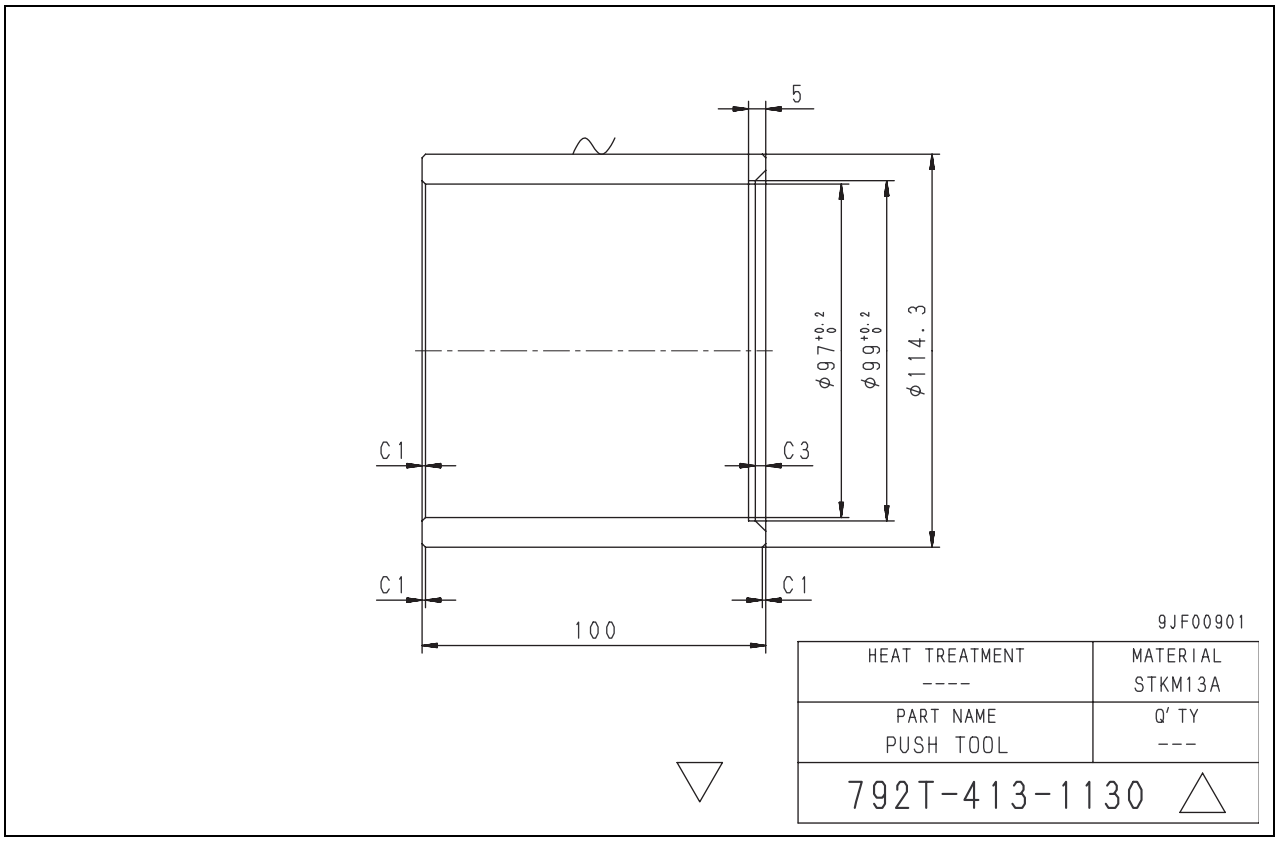
| HEAT TREATMENT | MATERIAL |
|---|---|
| ---- | STKM13A |
| PART NAME | Q'TY |
| PUSH TOOL | 1 |
| 793T-422-1220 △ | |

Numerical values and units within curly brackets are for reference

## H9 PUSH TOOL




## H10 PUSH TOOL



# REMOVAL, INSTALLATION OF FUEL INJECTION PUMP ASSEMBLY

## SPECIAL TOOLS

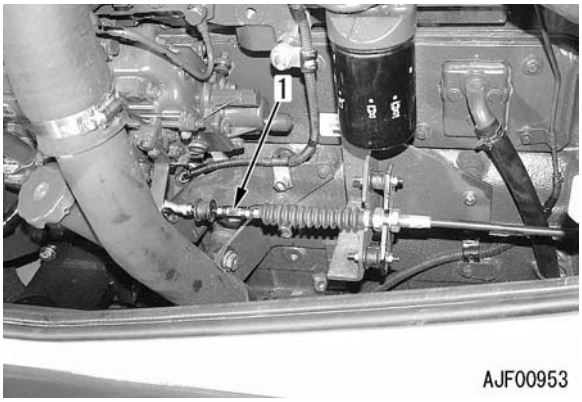
| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| A | 1 | 795-799-1131 | Gear | ■ | 1 | | |

## REMOVAL

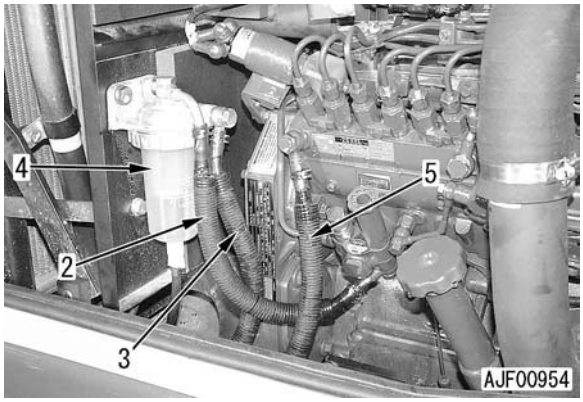
Lower the work equipment to the ground and stop the engine.

Disconnect the cable from the negative (-) terminal of the battery.

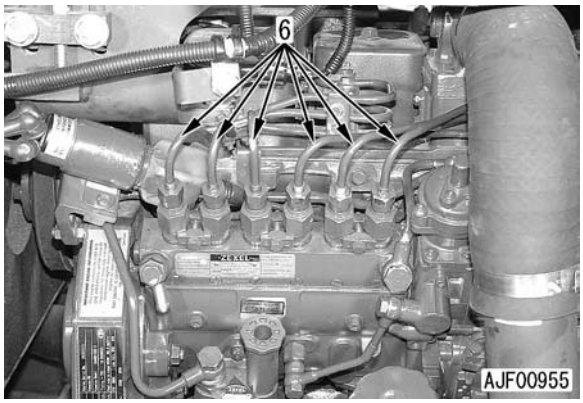
1. Open the engine right side cover.
2. Disconnect fuel control cable (1) from the fuel injection pump. [*1]



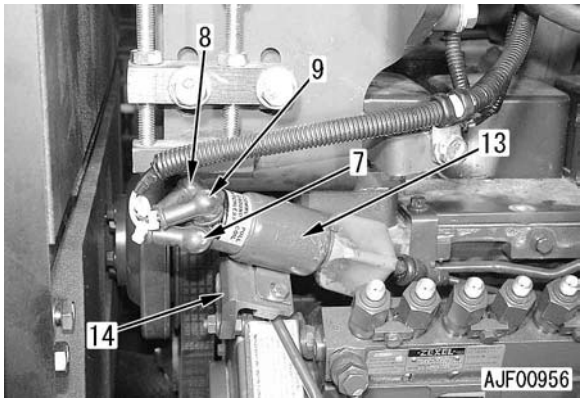

3. Disconnect fuel supply hoses (2) and (3).
4. Disconnect fuel filter (4).
5. Disconnect fuel return hose (5).

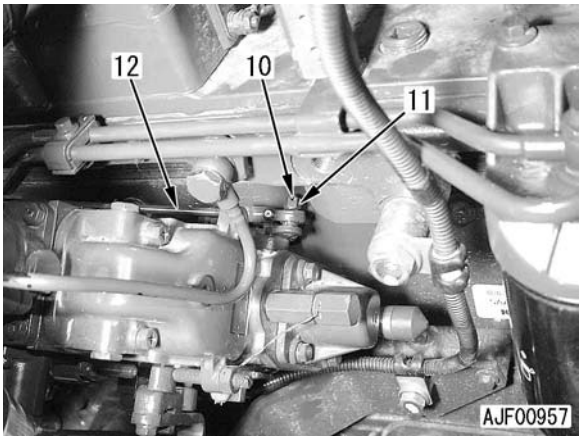



6. Remove 6 fuel injection tubes (6). [*2]



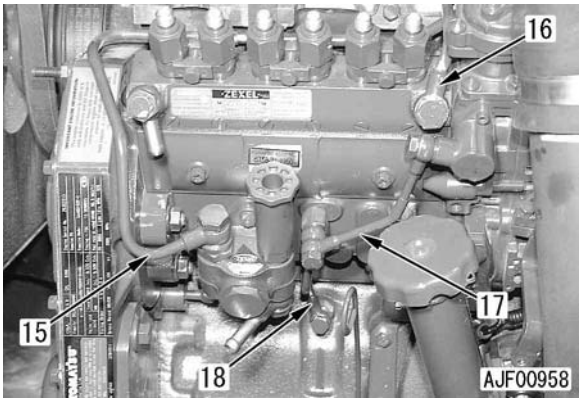

7. Disconnect engine stop solenoid terminals PULL (7), HOLD (8), and GND (9).
8. Remove cotter pin (10) and nut (11), and then remove engine stop solenoid rod (12) from the fuel injection pump.
9. Remove engine stop solenoid (13) and bracket (14) together. [*3]



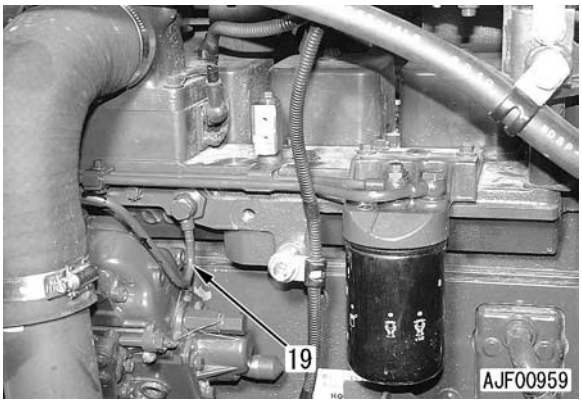



10. Remove fuel tubes (15) and (16). [*4]

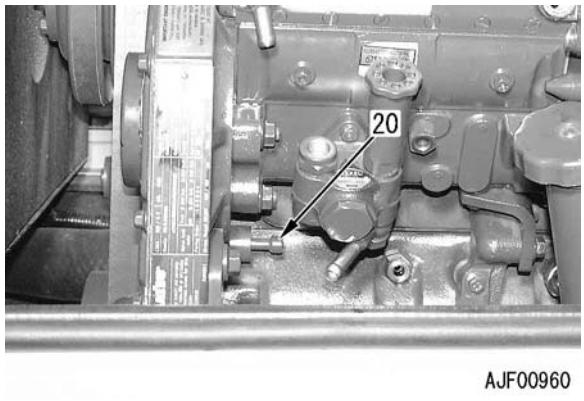
11. Remove lubrication tubes (17) and (18).



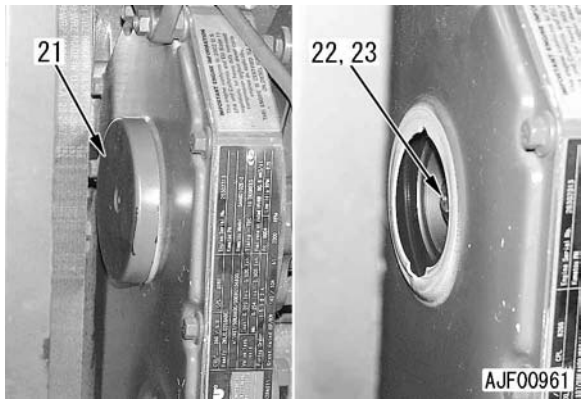

12. Remove boost compensator tube (19).



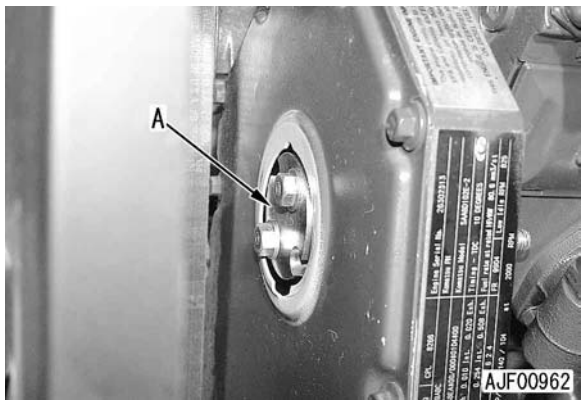

13. Using timing pin (20), match the timing gear to the fuel injection timing.
    ★ For details, see TESTING AND ADJUSTING, Testing and adjusting fuel injection timing.



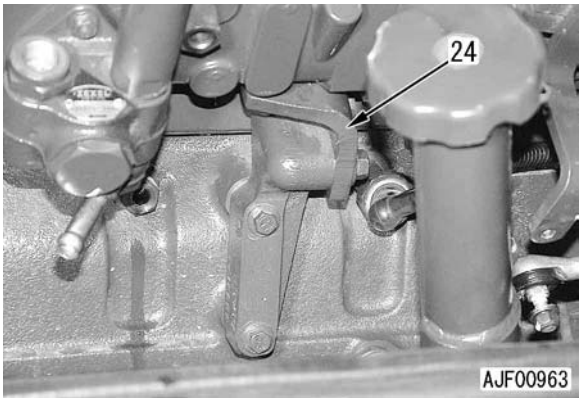

14. Remove cap (21).
    ★ Use a filter wrench, etc. to remove the cap.
15. Remove fuel injection pump nut (22) and washer (23).
    ★ Take care not to drop the nut and washer into the case.



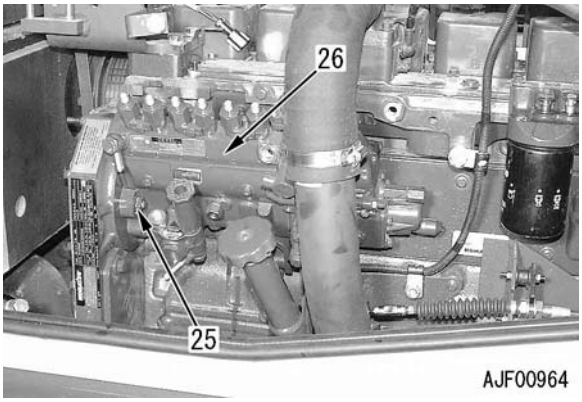

16. Using tool **A1**, disconnect the fuel injection pump shaft and pump drive gear.



17. Remove fuel injection pump bracket (24).




18. Remove 4 fuel injection pump mounting nuts (25) and fuel injection pump assembly (26). [*5]




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

★ Adjust the fuel control cable. For details, see TESTING AND ADJUSTING, Measuring, testing operating force of accelerator pedal.

[*2]

Fuel injection tube nut (on injection pump side): **24 ± 4 Nm {2.45 ± 0.41 kgm}**
Fuel injection tube nut (on nozzle holder side): **30 ± 5 Nm {3.06 ± 0.51 kgm}**

[*3]

Engine stop solenoid bracket mounting nut: **14 - 21 Nm {1.4 - 2.1 kgm}**

★ Adjust the engine stop solenoid. For details, see TESTING AND ADJUSTING, Adjusting engine stop solenoid.

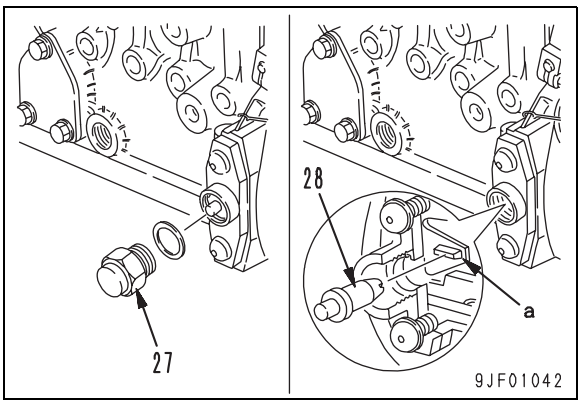
[*4]

Fuel tube joint bolt (on fuel filter side): **19.6 - 29.4 Nm {2.0 - 3.0 kgm}**

[*5]

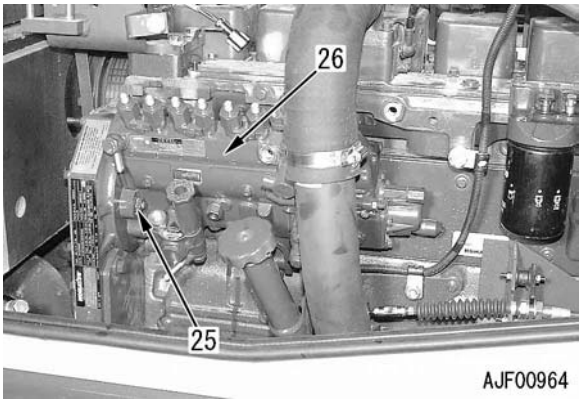
★ Install the fuel injection pump assembly according to the following procedure.

1. Check that the timing pin is matched to the injection timing.
   ★ For details, see TESTING AND ADJUSTING, Testing and adjusting fuel injection timing.
   ★ See step 13 of the removal procedure.
2. Remove plug (27) and turn over timing pin (28) of the fuel injection pump, and then install them to the fuel injection pump again.
   ★ Check that the cut of the pin is meshed with projection (a) in the pump.



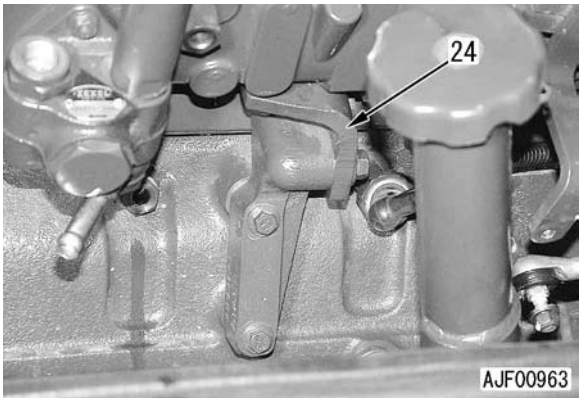
3. Install fuel injection pump assembly (26) and tighten 4 nuts (25).

   Fuel injection pump mounting nut:
   **9.8 ± 2 Nm {1.0 ± 0.2 kgm}**




4. Install fuel injection pump bracket (24).

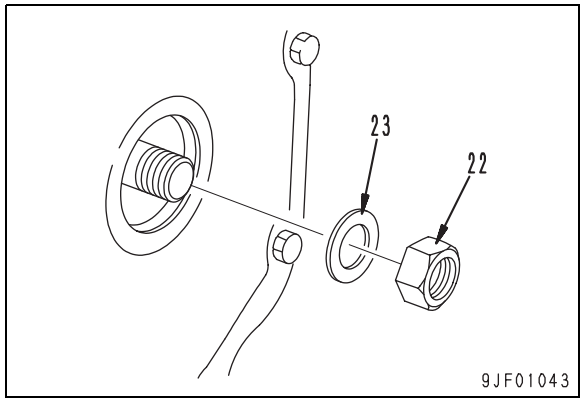
   Fuel injection pump bracket mounting bolt (on injection pump side): **22 ± 2 Nm {2.2 ± 0.2 kgm}**




5. Install washer (23) and tighten fuel injection pump nut (22) temporarily.
   ★ Take care not to drop the nut and washer into the case.

   Tighten the nut to the following torque temporarily so that it will not damage the timing pin.

   Temporary tightening torque of fuel injection pump nut:
   **12.5 ± 2.5 Nm {1.27 ± 0.25 kgm}**




6. Disengage the timing pin of the fuel injection pump on the timing gear side from projection (a) and return it to the original position.
7. Tighten fuel injection pump nut (22) permanently.

   Permanent tightening torque of fuel injection pump nut:
   **95 ± 10 Nm {9.7 ± 1.01 kgm}**

- **Bleeding air**
  Bleed air from the fuel system.

# REMOVAL, INSTALLATION OF NOZZLE HOLDER ASSEMBLY

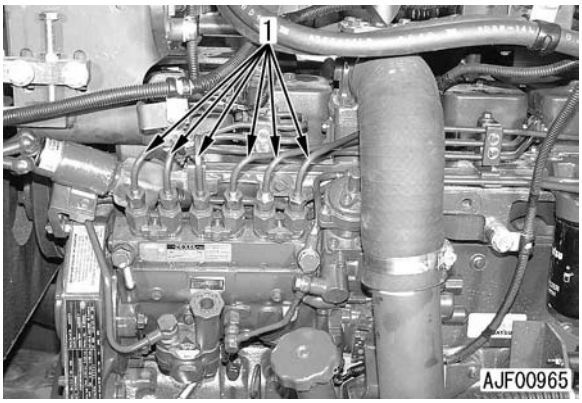
## SPECIAL TOOLS

| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| A | 3 | 795-799-1171 | Puller | ■ | 1 | | |

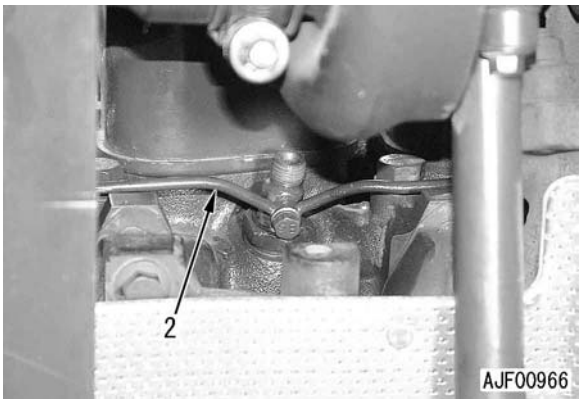
## REMOVAL

Lower the work equipment to the ground and stop the engine.

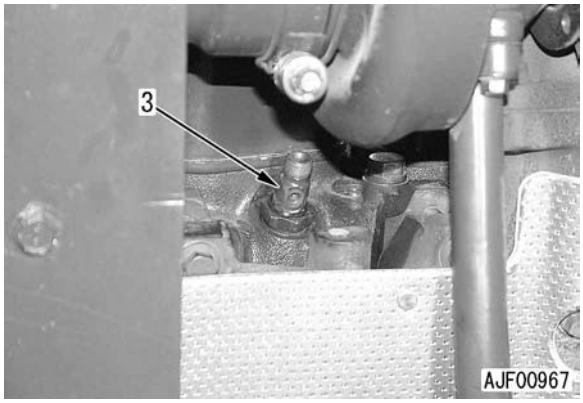
1. Open the engine right and left side covers.
2. Remove fuel injection tubes (1). [*1]



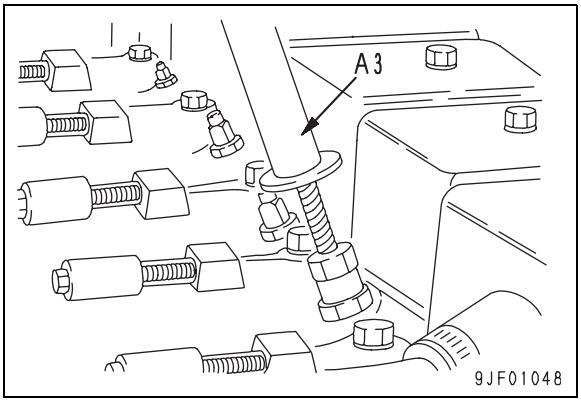

3. Remove spill tube (2). [*2]




4. Loosen and remove nozzle holder assembly (3). [*3]
   ★ Take care that dirt and foreign matter will not enter the mounting part of the nozzle holder assembly




   ★ If the nozzle holder is difficult to remove, use tool **A3**.



## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Fuel injection tube nut (on injection pump side): **24 ± 4 Nm {2.45 ± 0.41 kgm}**
Fuel injection tube nut (on nozzle holder side): **30 ± 5 Nm {3.06 ± 0.51 kgm}**

[*2]

Spill tube joint bolt: **9 Nm {0.9 kgm}**

[*3]

Nozzle holder: **60 Nm {6.1 kgm}**

- **Bleeding air**
  Bleed air from the fuel system.

# REMOVAL, INSTALLATION OF CYLINDER HEAD ASSEMBLY

## SPECIAL TOOLS

| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| A | 3 | 795-799-1171 | Puller | ■ | 1 | | |
| | 4 | 790-331-1110 | Wrench | ■ | 1 | | |

## REMOVAL

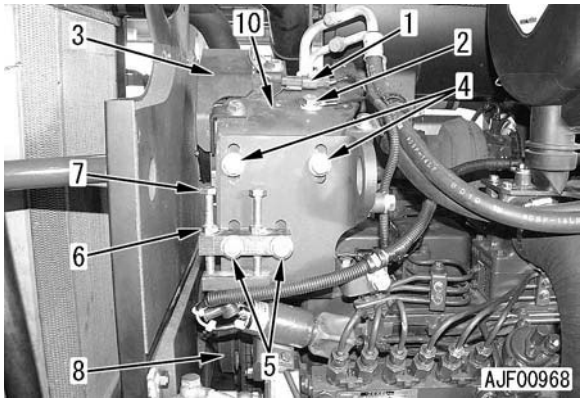
Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

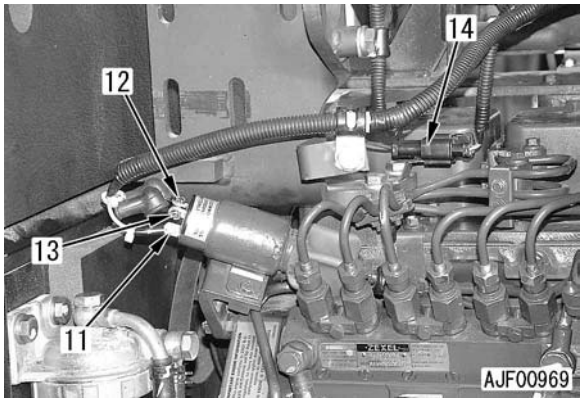
Disconnect the cable from the negative (-) terminal of the battery.

1. Remove engine assembly. For details, see Removal, Installation of engine assembly.
2. Drain the coolant.

   Coolant: **17 ℓ**
3. Remove the air conditioner compressor according to the following procedure.
   1) Disconnect wiring connector E16 (1) and ground terminal E22 (2).
   2) Remove cover (3).
   3) Loosen 2 mounting bolts (4) and 2 mounting bolts (5).
   4) Loosen 2 locknuts (6) and 2 adjustment bolts (7).
   5) Remove air conditioner compressor belt (8). [*1]
   6) Remove 2 mounting bolts (4), 2 mounting bolts (5), and air conditioner compressor and bracket assembly (10).
      ★ Place the air conditioner piping by the side of the engine without disconnecting it.

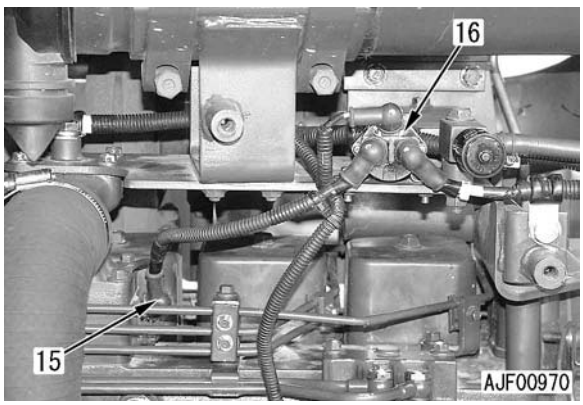



4. Disconnect the following wiring connectors and terminals.
   ★ Disconnect the wiring harness clamps, too.
   - (11): PULL
   - (12): HOLD
   - (13): GND
   - (14): E14

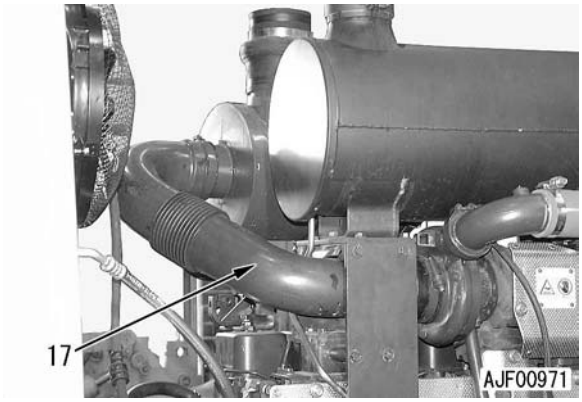



   - (15): E09

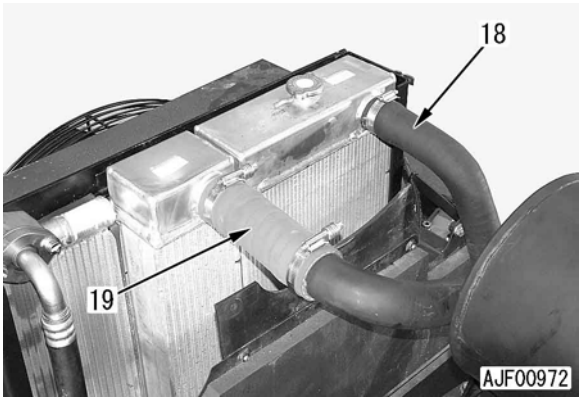
5. Remove the mounting bolts of heater relay (16).



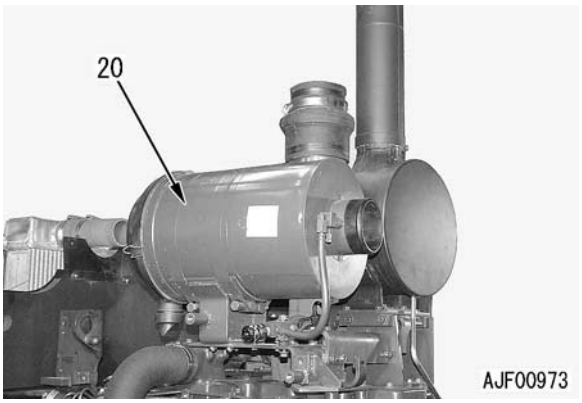
6. Remove air hose (17) between the air cleaner and turbocharger. [*2]



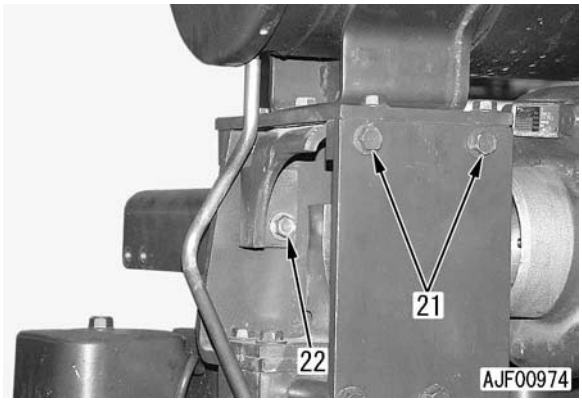

7. Disconnect radiator inlet hose (18). [*3]
8. Disconnect aftercooler upper hose (19). [*4]



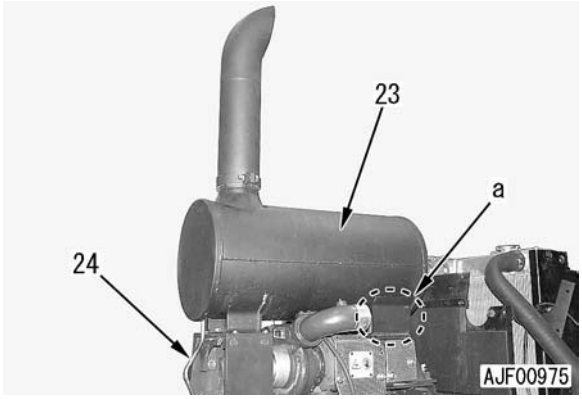

9. Remove air cleaner and bracket assembly (20).



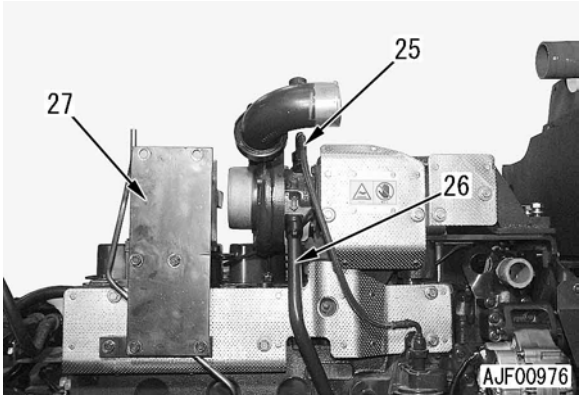

10. Remove the muffler according to the following procedure.
    1) Remove mounting bolts (21), 2 pieces on each side.
    2) Remove 1 mounting bolt (22).



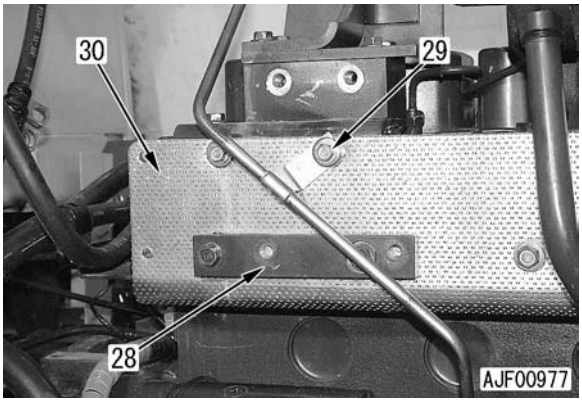

    3) Remove 4 mounting bolts from the inside of rear side (a).
    4) Raise muffler (23) and disconnect drain tube (24).



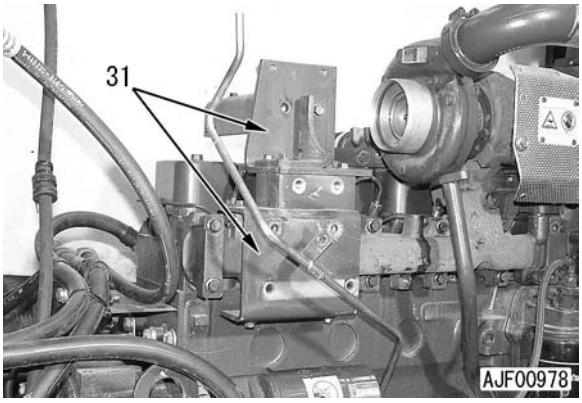
11. Remove the turbocharger and exhaust manifold assembly according to the following procedure.
    1) Disconnect turbocharger lubrication tubes (25) and (26). [*5]
    2) Remove bracket (27).




    3) Remove bracket (28).
    4) Remove muffler drain tube mounting bolt (29).
    5) Remove exhaust manifold heat insulation cover (30).

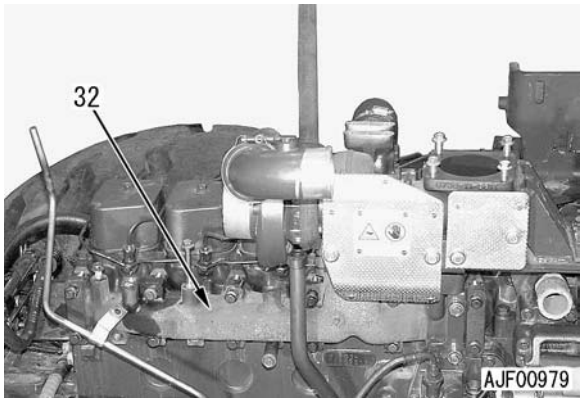



    6) Remove muffler brackets (31).

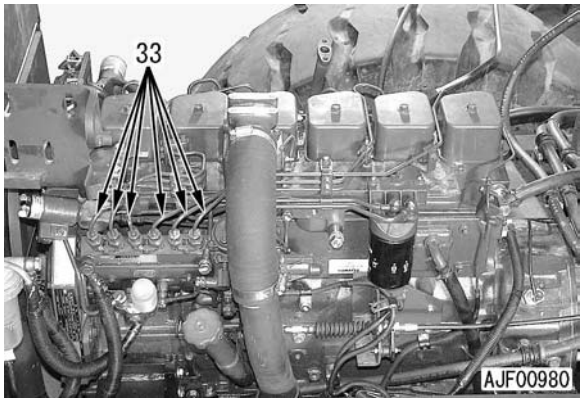



    7) Lift off turbocharger and exhaust manifold assembly (32). [*6]

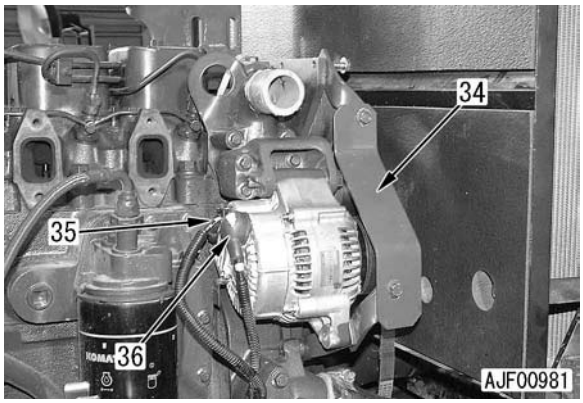
Turbocharger and exhaust manifold assembly: **40 kg**



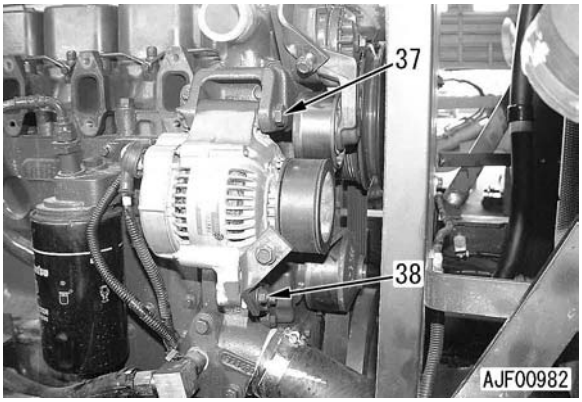

12. Remove 6 fuel injection tubes (33). [*7]



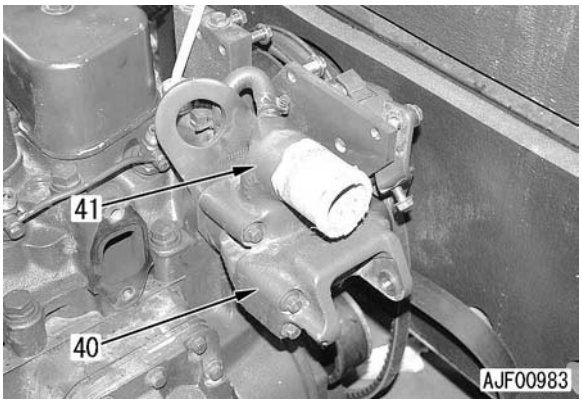

13. Remove alternator belt cover (34).
14. Disconnect wiring connectors E02 (35) and terminal E11 (36).



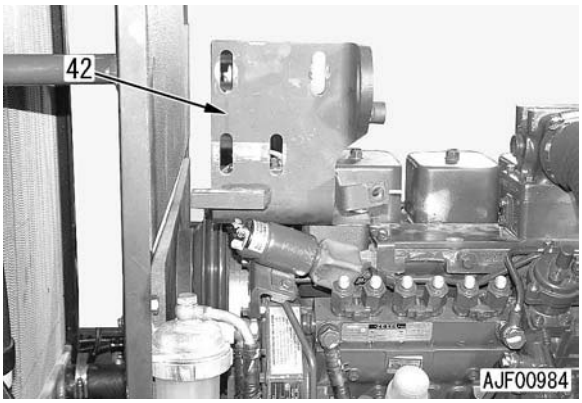
15. Remove mounting bolts (37) and (38) and alternator.



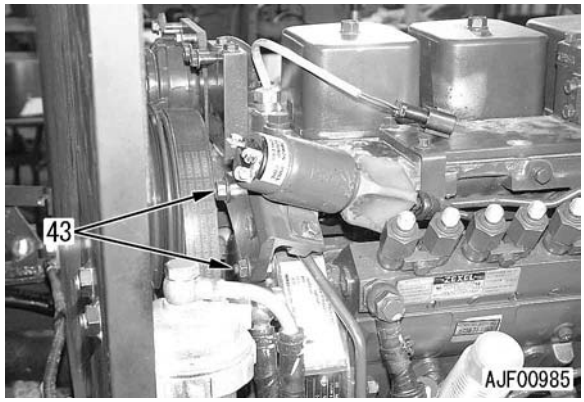

16. Remove alternator bracket (40).
17. Remove engine sling and thermostat housing assembly (41). [*8]



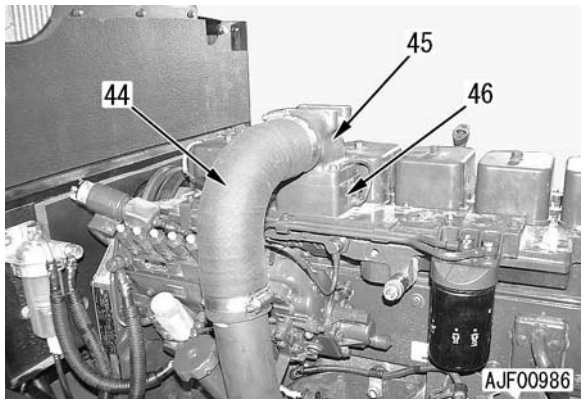

18. Remove air conditioner compressor bracket (42).



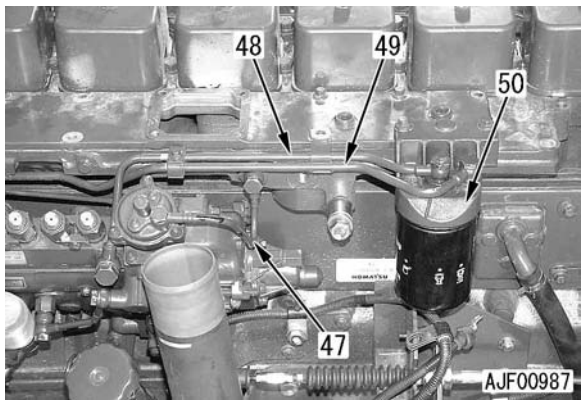

19. Remove engine stop solenoid bracket mounting bolts and nuts (43). [*9]



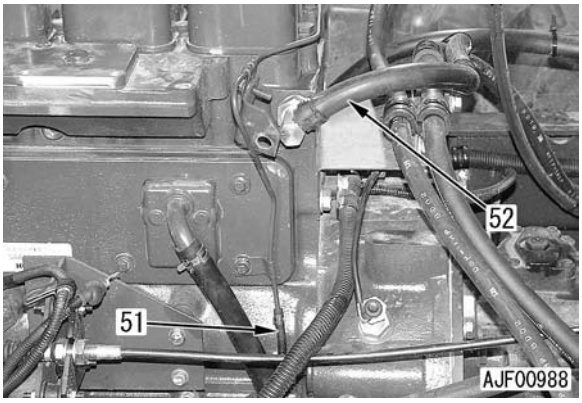

20. Disconnect air hose (44). [*10]
21. Remove air intake connector (45) and heater (46).



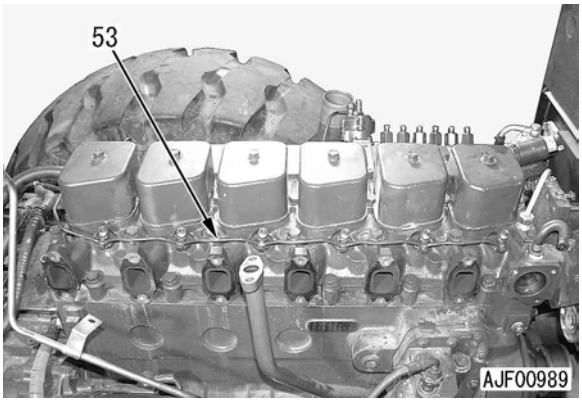

22. Remove boost compensator tube (47).
23. Remove fuel tubes (48) and (49).
24. Remove fuel filter (50).



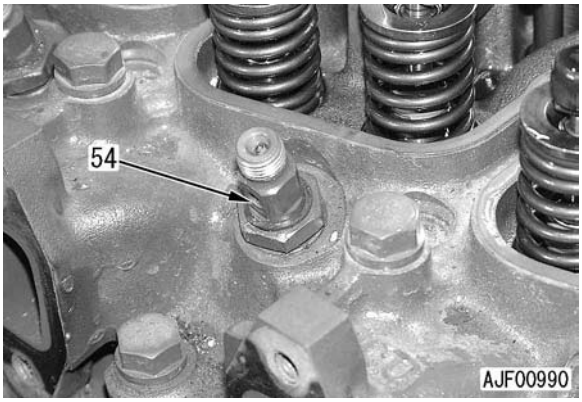
25. Disconnect spill hose (51).
26. Disconnect heater hose (52).



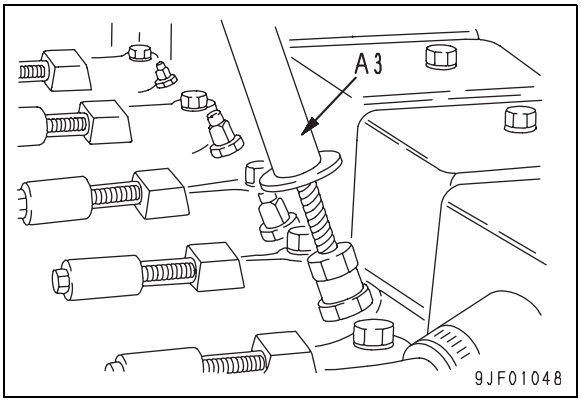

27. Remove spill tube (53).



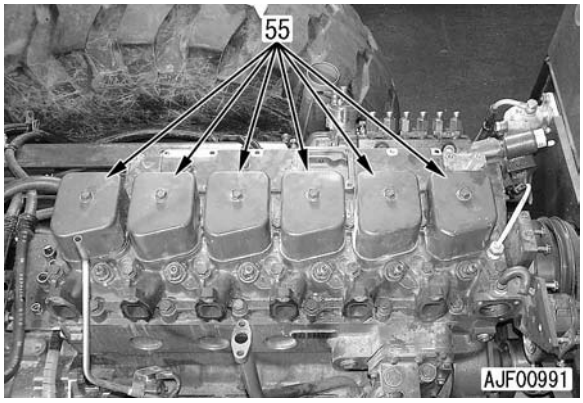

28. Remove 6 nozzle holders (54). [*11]



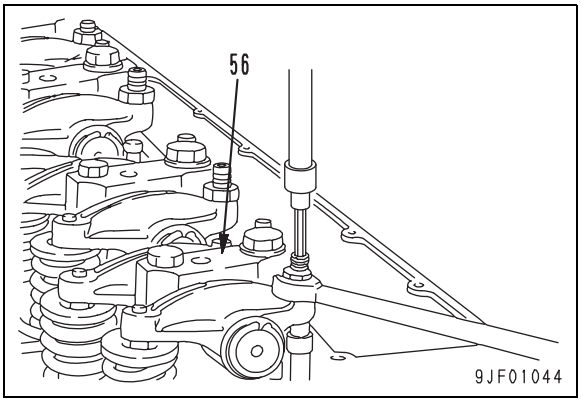

★ If the nozzle holder is difficult to remove, use tool **A3**.



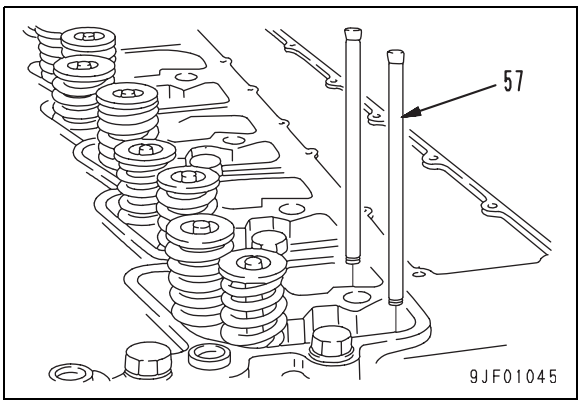

29. Remove 6 cylinder head covers (55). [*12]




30. Remove rocker arm (56). [*13]
★ Loosen the locknut, and then loosen adjustment screw by 2 - 3 turns.



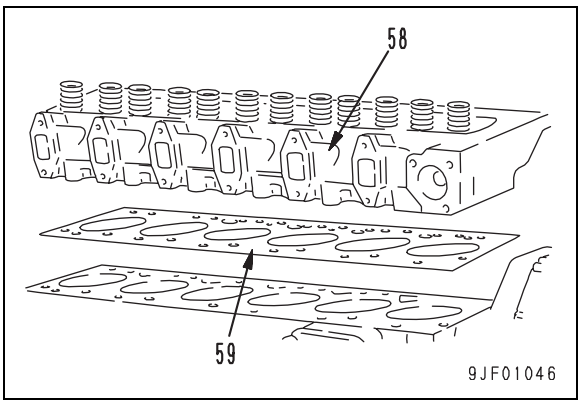
31. Remove push rods (57). [*14]




32. Lift off cylinder head assembly (58). [*15]

Cylinder head assembly: **55 kg**

33. Remove cylinder head gasket (59). [*16]




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

★ Adjust the tension of the air conditioner compressor belt. For details, see TESTING AND ADJUSTING, Testing and adjusting air conditioner compressor belt tension.

[*2]

Air hose clamp:
**9.8 ± 0.5 Nm {1.0 ± 0.05 kgm}**

[*3]

Mating face of hose:
**Gasket sealant (ThreeBond 1208E or equivalent)**

Radiator hose clamp:
**10.5 ± 0.5 Nm {107 ± 5 kgcm}**

[*4]

Aftercooler hose clamp:
**10.5 + 0.5 Nm {107 ± 5 kgcm}**

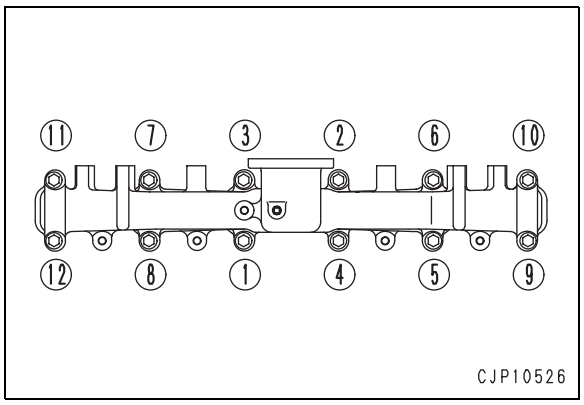
[*5]

Mounting nut of turbocharger lubrication tube (25): **35 ± 5 Nm {3.57 ± 0.51 kgm}**
Mounting bolt of turbocharger lubrication tube (26): **24 ± 4 Nm {2.45 ± 0.41 kgm}**

[*6]

★ Tighten the exhaust manifold mounting bolts in 3 times according to the following procedure.

Exhaust manifold mounting bolt:
1st time: Tighten the bolts to **24 ± 4 Nm {2.45 ± 0.41 kg}** in the order of 1 - 12.
2nd time: Tighten the bolts to **43 ± 6 Nm {4.38 ± 0.61 kg}** in the order of 1 - 12.
3rd time: Tighten the bolts to **43 ± 6 Nm {4.38 ± 0.61 kg}** again in the order of 1 - 4.




[*7]

Fuel injection tube nut (on injection pump side): **24 ± 4 Nm {2.45 ± 0.41 kgm}**
Fuel injection tube nut (on nozzle holder side): **30 ± 5 Nm {3.06 ± 0.51 kgm}**

[*8]

Thermostat housing mounting bolt: **24 ± 4 Nm {2.45 ± 0.41 kgm}**

[*9]

Engine stop solenoid bracket mounting nut: **14 - 21 Nm {1.4 - 2.1 kgm}**

[*10]

Air hose clamp: **8.8 ± 0.5 Nm {90 ± 5 kgcm}**

[*11]

Nozzle holder: **60 Nm {6.1 kgm}**

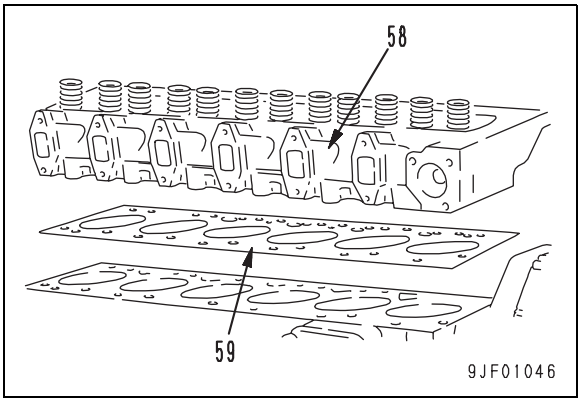
[*12]

Cylinder head cover mounting bolt: **24 ± 4 Nm {2.45 ± 0.41 kgm}**

[*13] [*14] [*15] [*16]

★ Install the rocker arm assembly and cylinder head assembly according to the following procedure.
★ Check that there is not dirt or foreign matter on the mounting face of the cylinder head or in the cylinder.

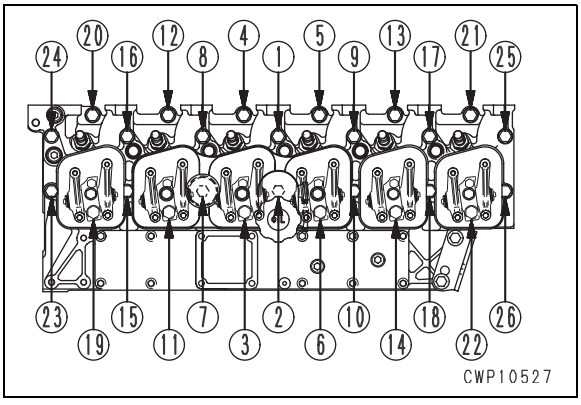
1. Set cylinder head gasket (59) to the cylinder block.
   ★ Check that the gasket is matched to the hole of the block.
2. Sling cylinder head assembly (58) and set it to the cylinder block.

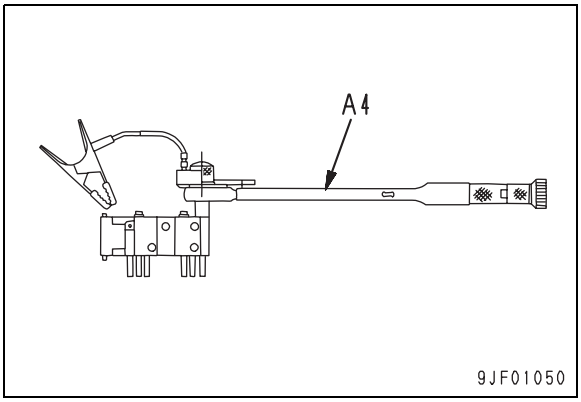



3. Tighten the cylinder head bolts in 3 times in the order shown in the following figure.

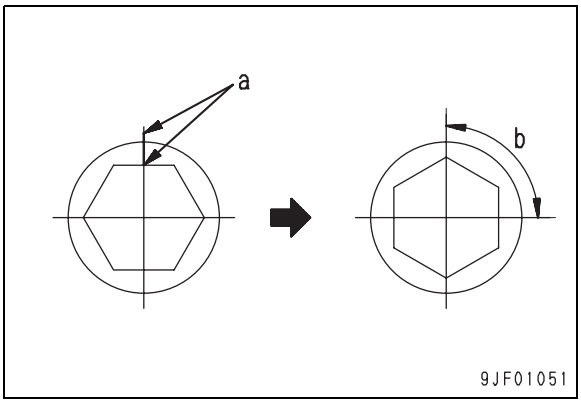
Threads and seat of mounting bolt: Engine oil

Cylinder head bolt:
1st time: Tighten the bolts to **90 ± 5 Nm {9.18 ± 0.51 kgm}** in the order of 1 - 26.
2nd time: Tighten the bolts to **120 ± 5 Nm {12.24 ± 0.51 kgm}** in the order of 3, 6, 11, 14, 19, and 22.
3rd time:
- When using tool **A4**: Using angle tightening wrench **A4**, tighten the bolts by **90° ± 5°** in the order of 1 - 26 (Angle tightening).

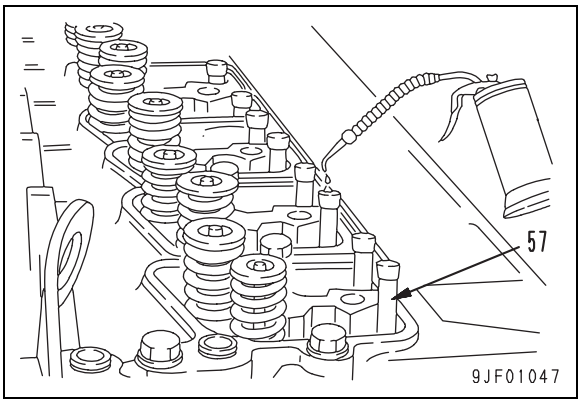




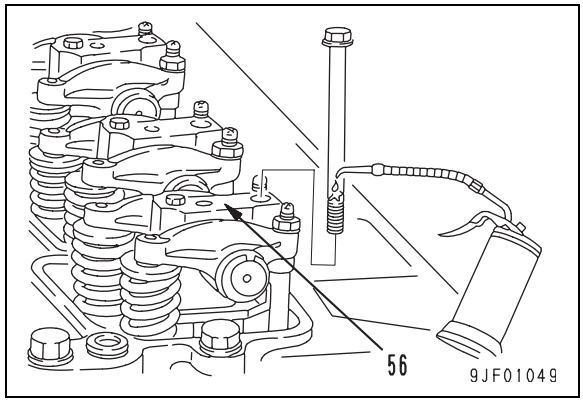

- When not using tool **A4**:
  Make marks on the bolts and cylinder as shown in (a), and then tighten each bolt by the angle of (b) (**90° ± 5°**).




4. Install push rods (57).
   ★ Apply engine oil to the push rod.

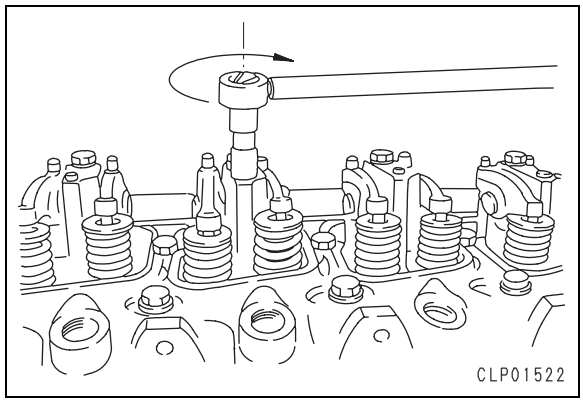



5. Install rocker arm assembly (56) and tighten the mounting bolts with the fingers.
   ★ Check that the ball of the adjustment screw is fitted to the socket of push rod (57).
   ★ Apply engine oil to the threads and seats of the mounting bolts 8 mm and 12 mm in diameter.




6. Tighten the rocker arm assembly mounting bolts (8 mm in diameter).

   Rocker arm mounting bolt:
   **24 ± 4 Nm {2.45 ± 0.41 kgm}**




7. Adjust the valve clearance. For details, see TESTING AND ADJUSTING, Adjusting valve clearance.

- **Refilling with water**
  Add water through the water filler to the specified level. Run the engine to warm the water. Then, check the water level again.

- **Bleeding air**
  Bleed air from the fuel system.

# REMOVAL, INSTALLATION OF ENGINE ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Disconnect the cable from the negative (-) terminal of the battery.

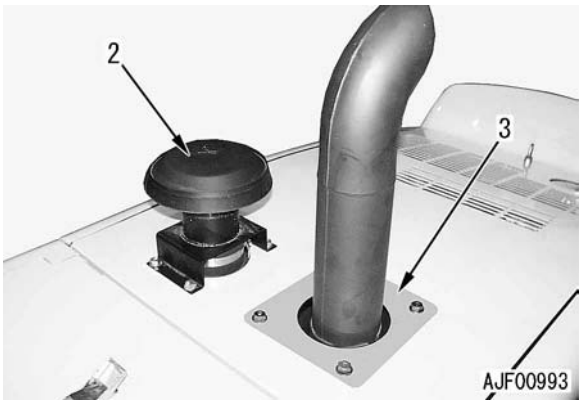
1. Drain the coolant.

   Coolant: **17 ℓ**

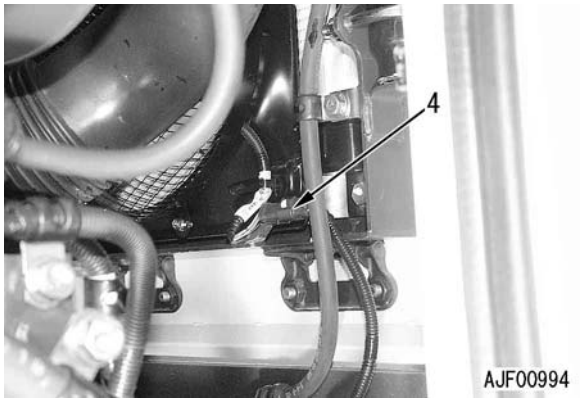
2. Remove the engine hood assembly according to the following procedure.
   1) Remove right and left fenders (1).

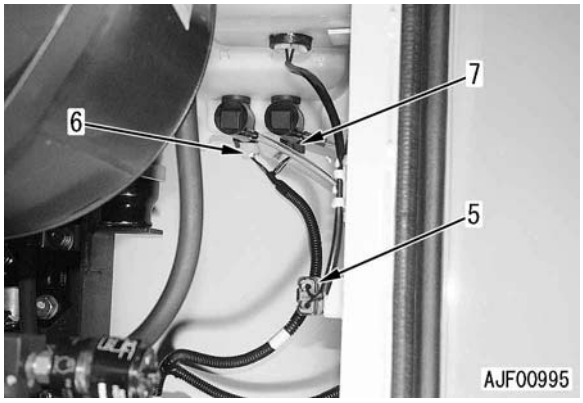



   2) Remove precleaner (2). [*1]
   3) Remove cover (3).

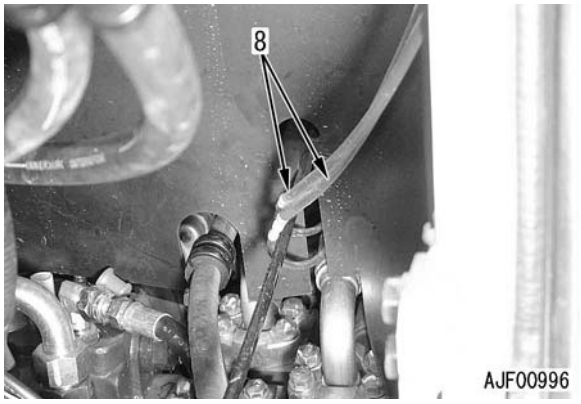



   4) Disconnect wiring connectors B04 (4), B05 (5), B06 (6), and B07 (7) from the front side of the engine hood.

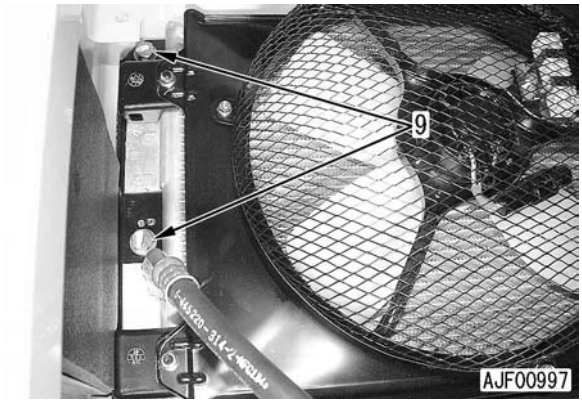


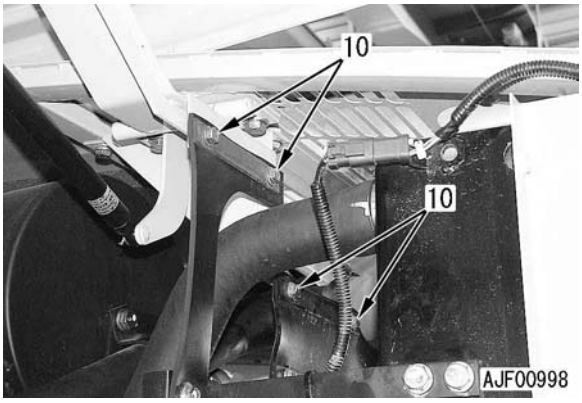

   5) Disconnect 2 windshield washer hoses (8).



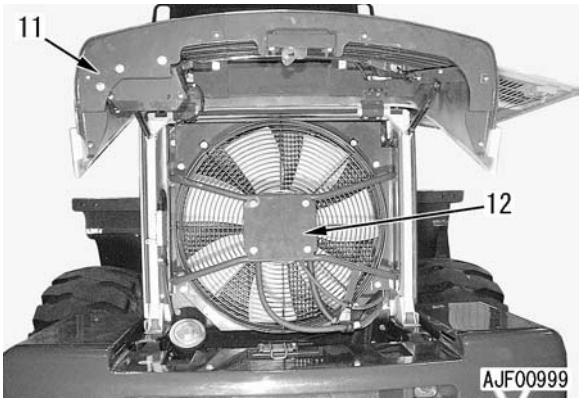
6) Remove 2 condenser mounting bolts (9) from each side.
   ★ Lower the condenser onto the engine without disconnecting the air conditioner piping.



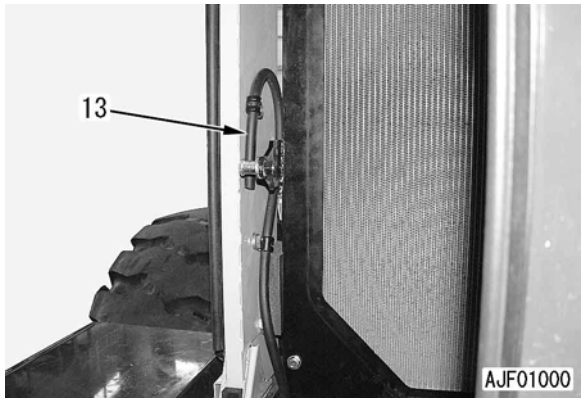

7) Remove 4 rubber mounting bolts (10) from the rear side of the engine.



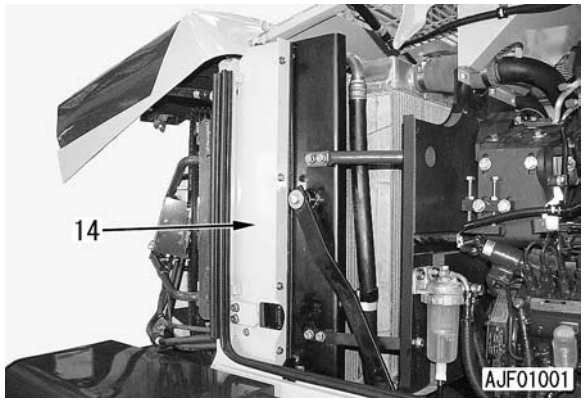

8) Open grille (11) and fan guard (12).



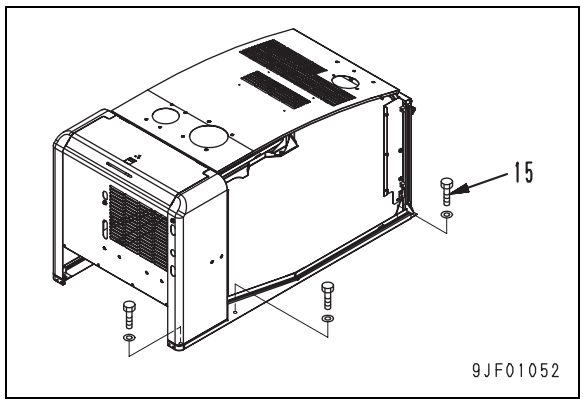

9) Remove fuel tank air bleeding hose (13) from the clamp.



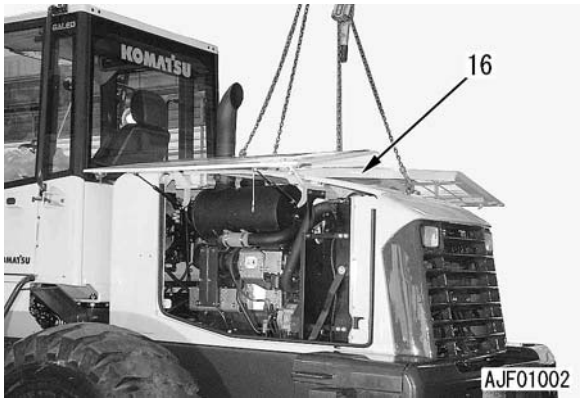

10) Remove right and left covers (14).



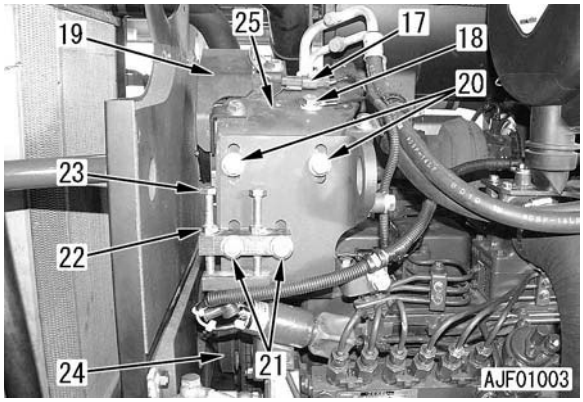

11) Remove 3 engine hood mounting bolts (15) from each side.



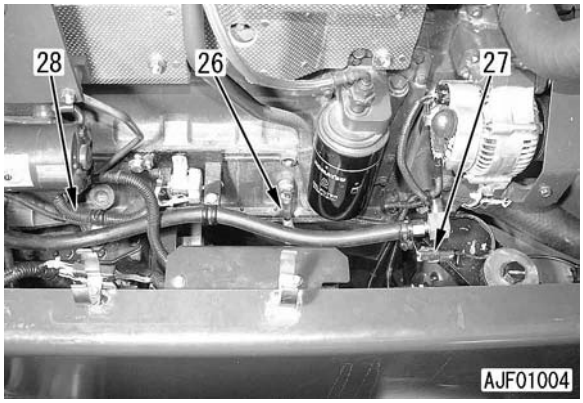
12) Lift off engine hood assembly (16).
★ Take care not to damage the condenser.



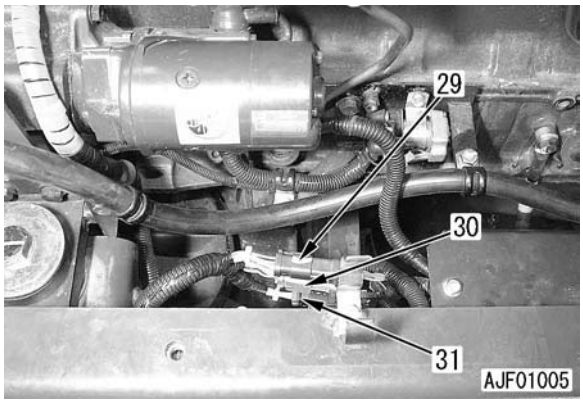

3. Remove the air conditioner compressor according to the following procedure.
1) Disconnect wiring connector E16 (17) and ground terminal E22 (18).
2) Remove cover (19).
3) Loosen 2 mounting bolts (20) and 2 mounting bolts (21).
4) Loosen 2 locknuts (22) and 2 adjustment bolts (23).
5) Remove air conditioner compressor belt (24). [*2]
6) Remove 2 mounting bolts (20), 2 mounting bolts (21), and air conditioner compressor and bracket assembly (25).
★ Place the air conditioner piping by the side of the engine without disconnecting it.



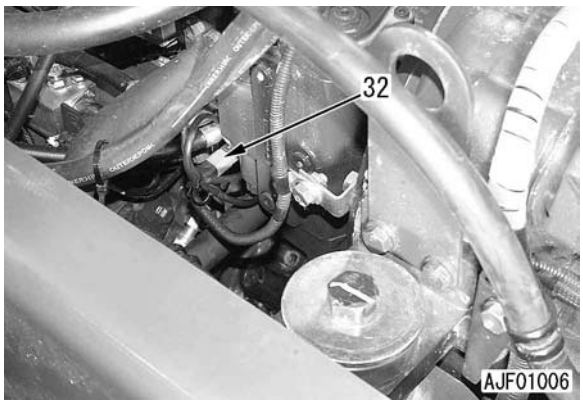

4. Disconnect the following wiring connectors and terminals.
- (26): Engine ground
- (27): E13
- (28): E10



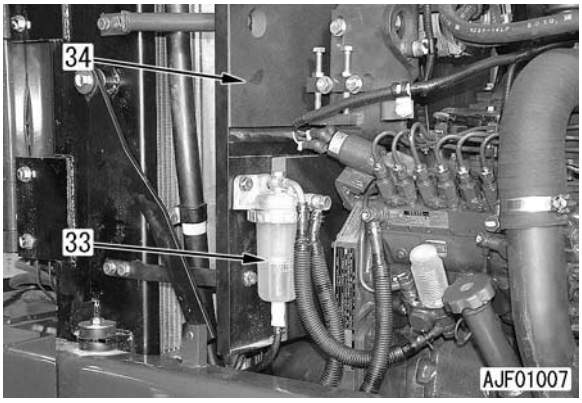

- (29): ER1
- (30): ER2
- (31): ER3



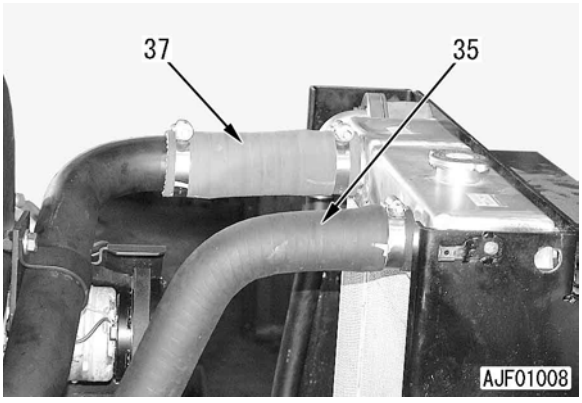

- (32): T01

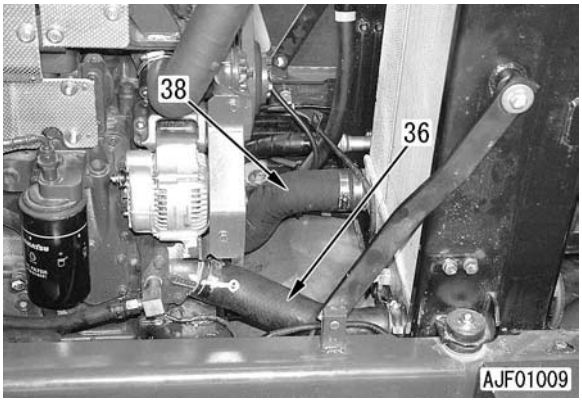


5. Remove the mounting bolts of fuel filter (33).
   ★ Bind the fuel filter to the engine with ropes, etc.
6. Remove cover (34).

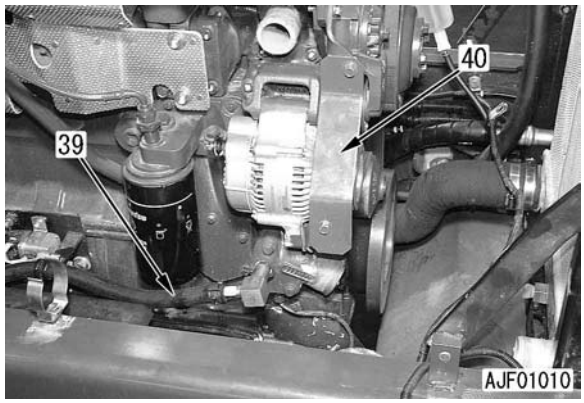



7. Disconnect radiator inlet hose (35) and radiator outlet hose (36). [*3]
8. Disconnect aftercooler upper hose (37) and aftercooler lower hose (38). [*4]



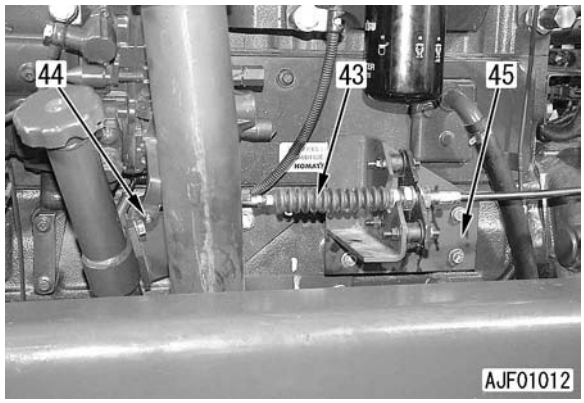

9. Disconnect heater hose (39).
   ★ Disconnect the 3 heater hose clamps.
10. Remove alternator belt cover (40).



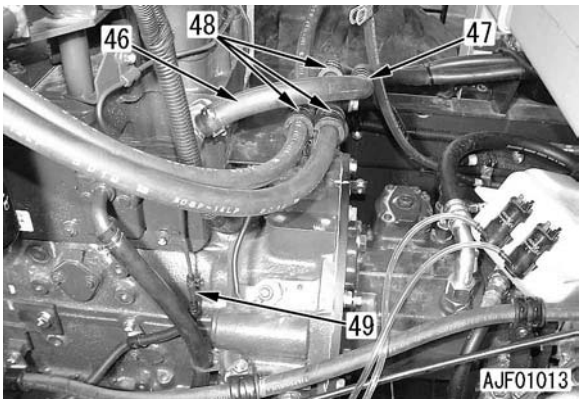

11. Disconnect fuel supply hose (41) and fuel return hose (42).



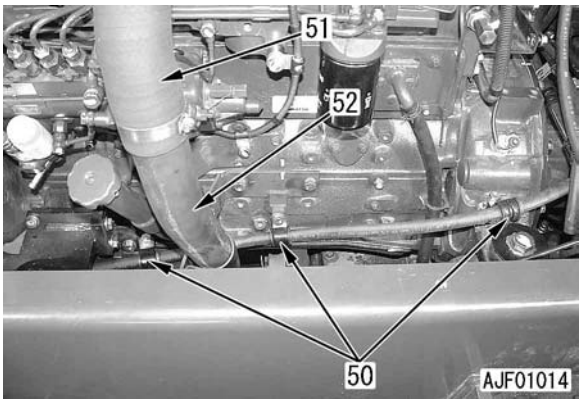

12. Remove mounting nut (44) of fuel control cable (43), and then remove bracket (45) and fuel control cable together. [*5]
    ★ Move the fuel control cable and bracket assembly to the outside of the engine.



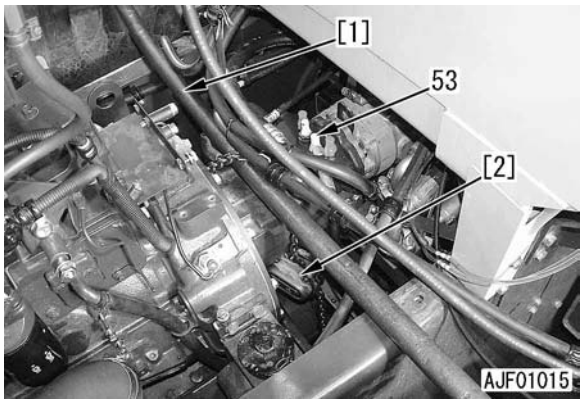
13. Disconnect heater hose (46).
14. Disconnect heater hose clamp (47) and air conditioner hose clamp (48).
15. Disconnect spill hose (49).



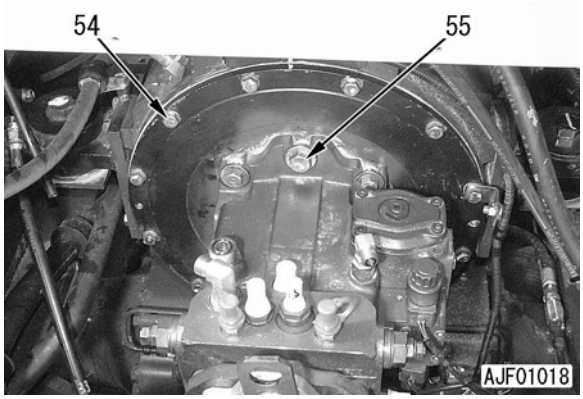

16. Disconnect 4 fan motor hose clamps (50) from the engine block.
    ★ Disconnect 1 of the 4 clamps from the HST pump.
17. Remove air intake hose (51) and air intake tube (52).
    ★ Place the hose and tube under the engine.



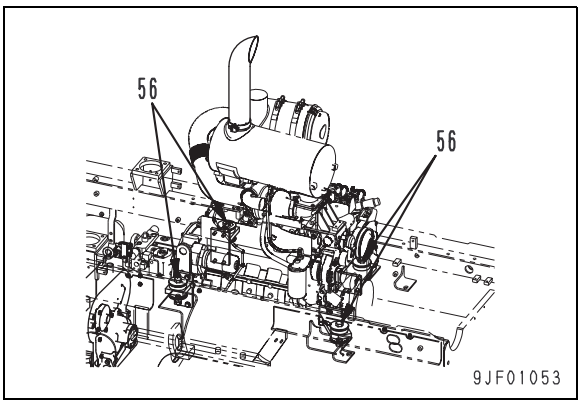

18. Place pipe [1] across the frame, and then secure HST pump assembly (53) and pipe [1] with lever block [2].




19. Remove all damper cover mounting bolts (54). [*6]
    ★ Do not disconnect the engine from the HST pump unit by removing HST pump mounting bolts (55).
    If the engine assembly is disconnected from the HST pump mounting part, meshing of the gear is not seen when the engine assembly is installed again. As a result, the damper may be damaged.

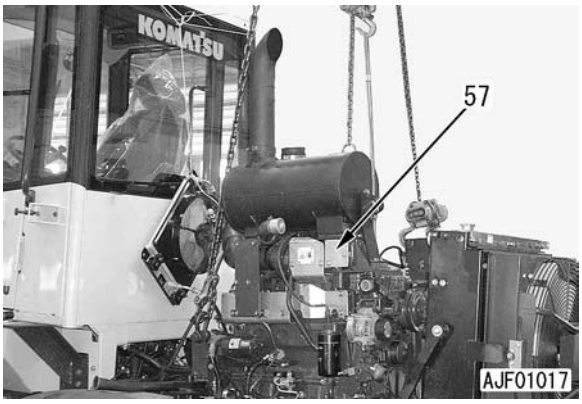



20. Remove 4 engine mounting bolts (56). [*7]



21. Sling engine assembly (57) a little and move it to the rear to disconnect it from the HST pump assembly. [*8]
22. Sling engine assembly (57) slowly to remove it.
    - ★ Check that all the wires and pipes are disconnected.
    - ★ Take care not to damage the radiator, aftercooler, and hydraulic oil cooler.

Engine assembly: **650 kg**




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Precleaner mounting bolt:
**8.8 ± 0.5 Nm {90 ± 5 kgcm}**

[*2]

★ Adjust the tension of the air conditioner compressor belt. For details, see TESTING AND ADJUSTING, Testing and adjusting air conditioner compressor belt tension.

[*3]

Mating face of radiator hose:
**Gasket sealant (ThreeBond 1208E or equivalent)**

Radiator hose clamp:
**10.5 ± 0.5 Nm {107 ± 5 kgcm}**

[*4]

Aftercooler hose clamp:
**10.5 + 0.5 Nm {10 ± 5 kgcm}**

[*5]

★ Adjust the fuel control cable. For details, see TESTING AND ADJUSTING, Measuring, testing operating force of accelerator pedal.

[*6]

Mating face of damper cover:
**Gasket sealant (LG-6)**

Damper cover mounting bolt:
**58.8 - 73.5 Nm {6 -7.5 kgm}**

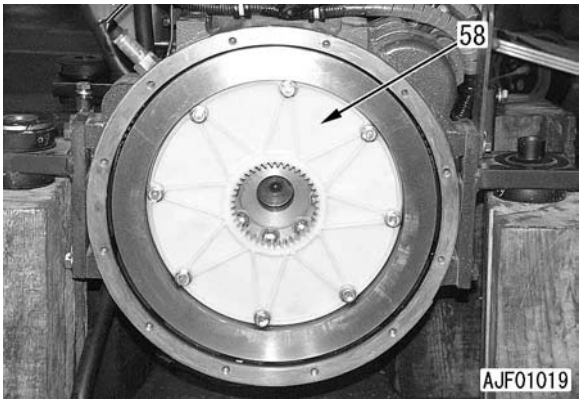
[*7]

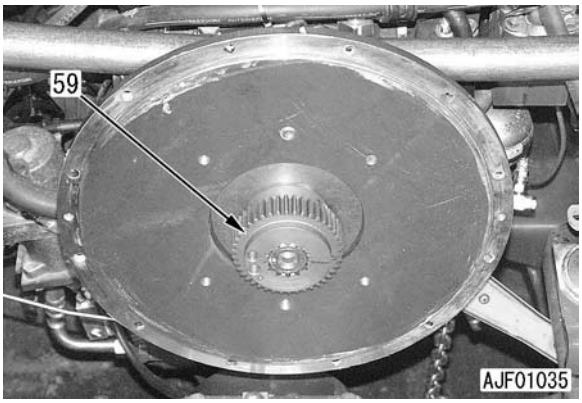
Engine mounting bolt:
**610 - 765 Nm {62.5 - 78 kgm}**

[*8]

★ When installing the engine assembly, position it carefully and mesh the gears of damper flange (58) and HST pump boss (59).

★ Take care not to damage flange (58).




- **Bleeding air**
  Bleed air from the fuel system.

- **Refilling with water**
  Add water through the water filler to the specified level. Run the engine to warm the water. Then, check the water level again.

# REMOVAL, INSTALLATION OF RADIATOR ASSEMBLY

## REMOVAL

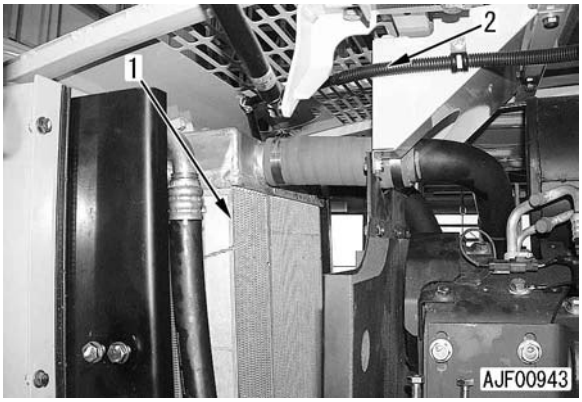
Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

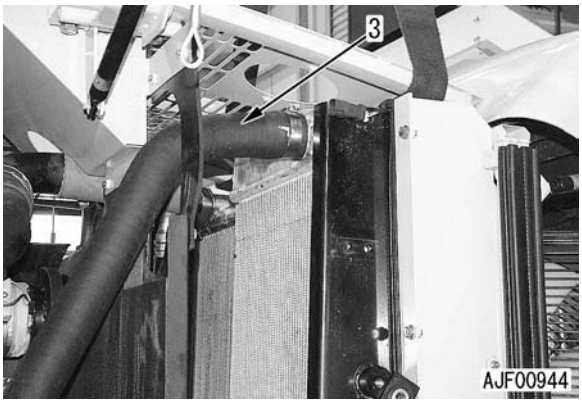
1. Drain the coolant.

   Coolant: **17 ℓ**

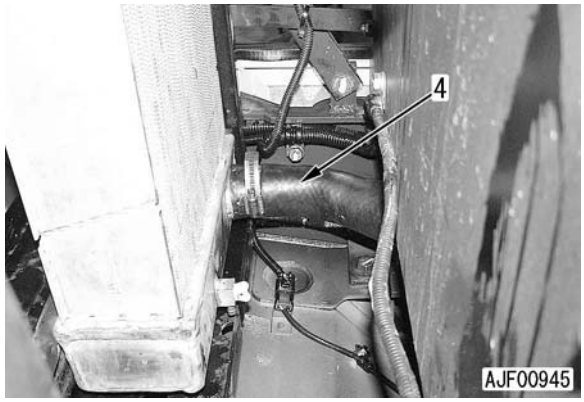
2. Remove air aftercooler (1). For details, see Removal, installation of air aftercooler.
3. Disconnect reservoir tank hose (2).



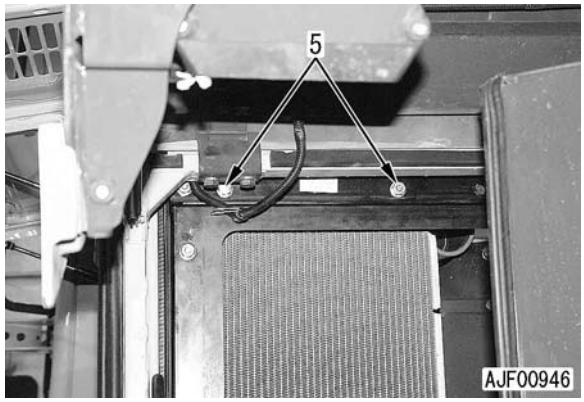

4. Disconnect radiator inlet hose (3). [*1]




5. Disconnect radiator outlet hose (4). [*2]




6. Remove 2 radiator assembly upper mounting bolts (5).




7. Raise radiator assembly (6) and pull it out toward the fan guard.
   ★ Take care not to damage the core.



## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1] [*2]



Mating face of hose: **Gasket sealant (ThreeBond 1208E or equivalent)**



Radiator hose clamp:
**10.5 ± 0.5 Nm {107 ± 5 kgcm}**

- **Refilling with water**
  Add water through the water filler to the specified level. Run the engine to warm the water. Then, check the water level again.

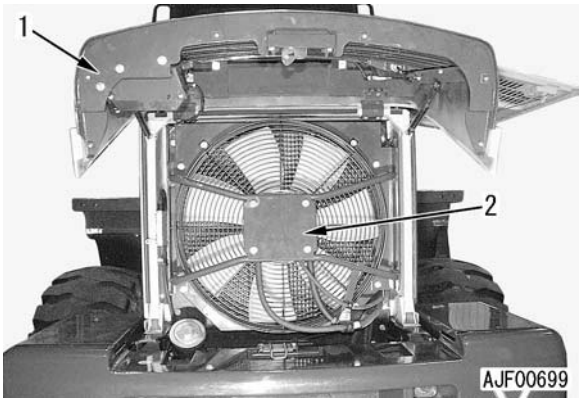
# REMOVAL, INSTALLATION OF AIR AFTERCOOLER

## REMOVAL

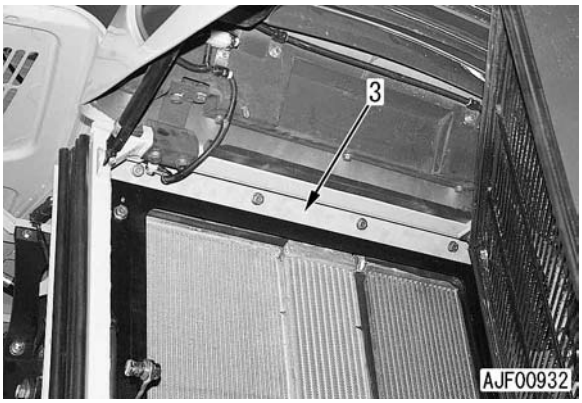
Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

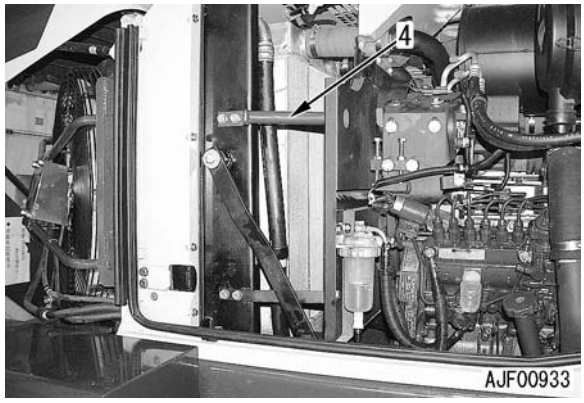
1. Open grille (1) and fan guard (2).



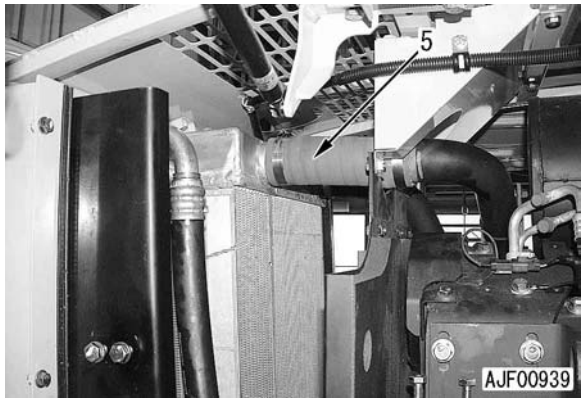

2. Remove cover (3).

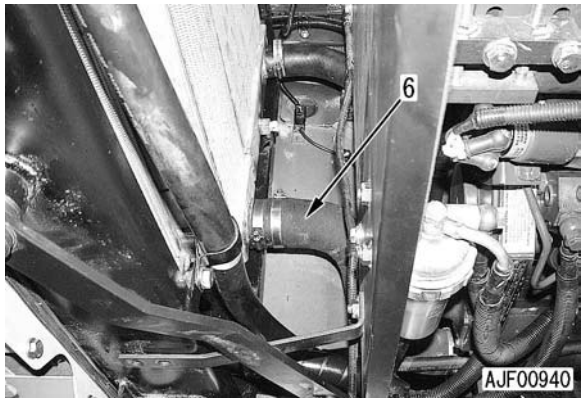



3. Remove right and left stays (4).

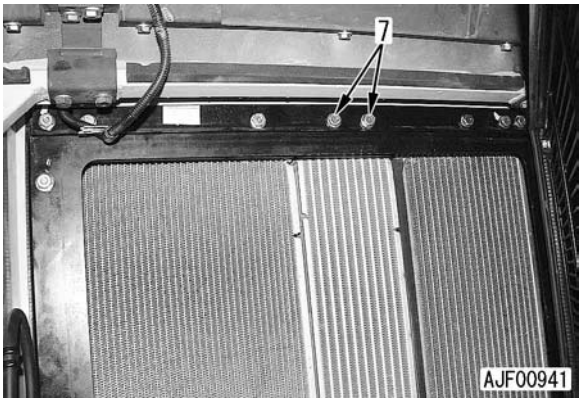



4. Disconnect upper air hose (5) and lower air hose (6). [*1]

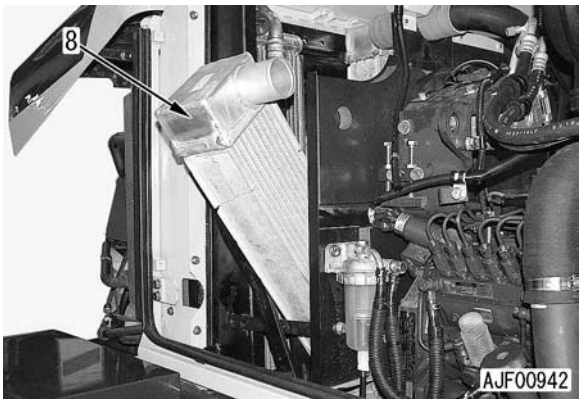


5. Remove 2 air aftercooler upper mounting bolts (7).




6. Raise air aftercooler (8) and pull it out to the right.
   ★ Take care not to damage the core.




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Air hose clamp:
**10.5 ± 0.5 Nm {107 ± 5 kgcm}**

# REMOVAL, INSTALLATION OF HYDRAULIC OIL COOLER ASSEMBLY

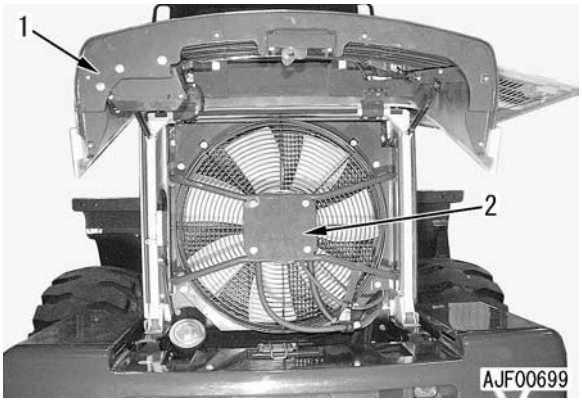
## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

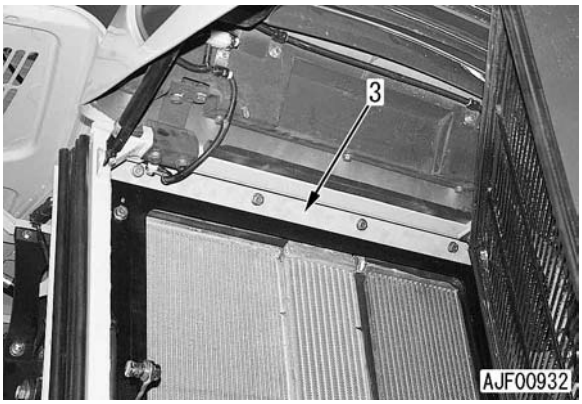
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

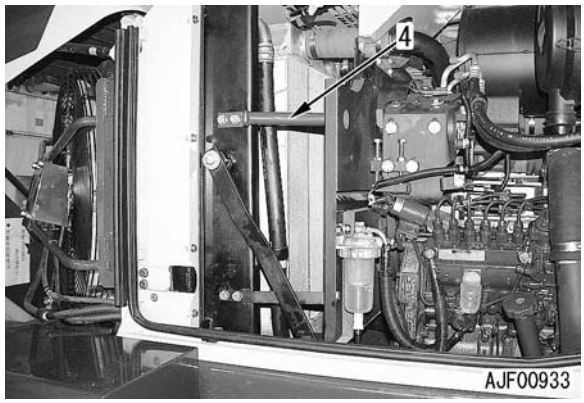
1. Open grille (1) and fan guard (2).




2. Remove cover (3).

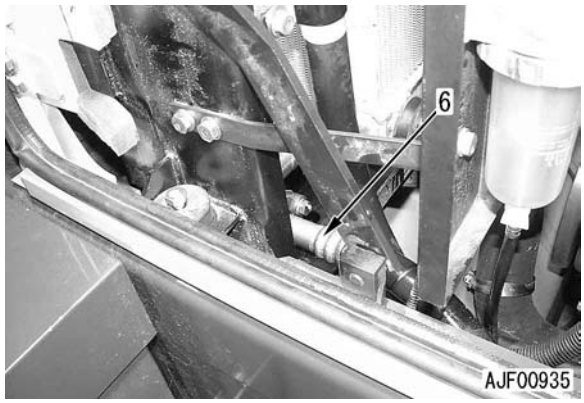



3. Remove stay (4).

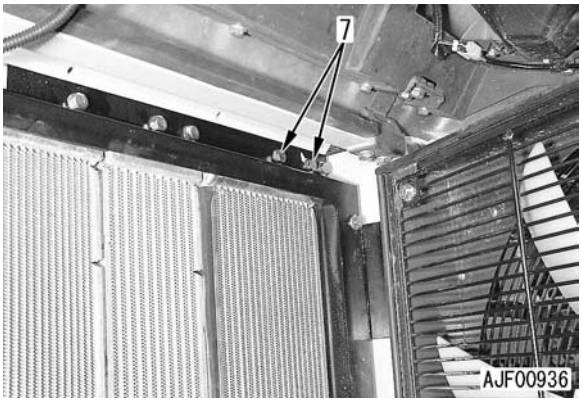


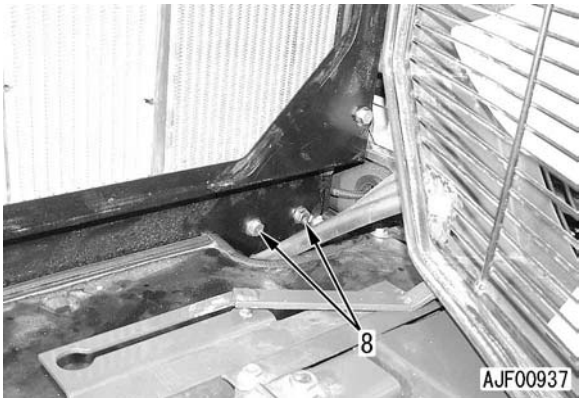

4. Disconnect oil cooler upper hose (5) and lower hose (6).
   ★ Since oil will leak, prepare an oil receiver and an oil stop plug.



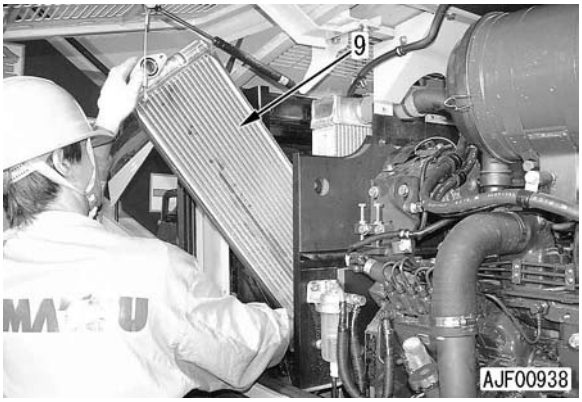



5. Remove 2 oil cooler upper mounting bolts (7) and 2 lower mounting bolts (8).




6. Pull out oil cooler (9) to the right.
   ★ Take care not to damage the core.




## INSTALLATION

- Carry out installation in the reverse order to removal.

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

# REMOVAL, INSTALLATION OF COOLING FAN AND FAN MOTOR ASSEMBLY

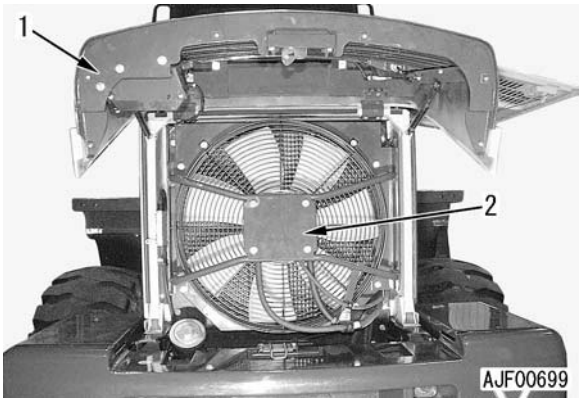
## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

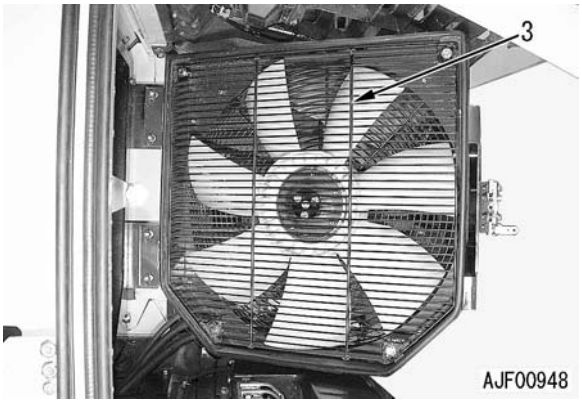
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

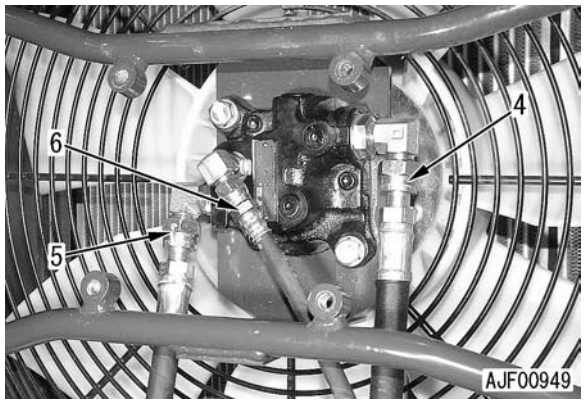
1. Open grille (1) and remove cover (2).



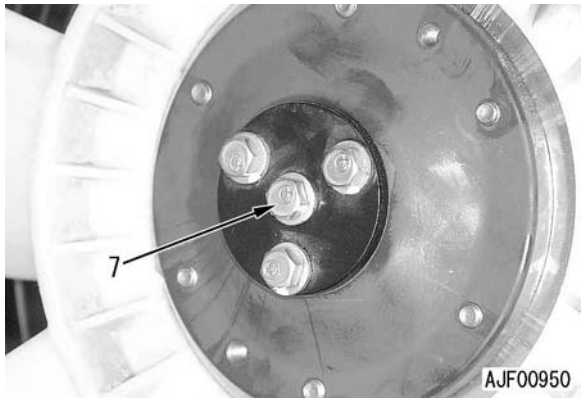

2. Open the fan guard assembly and remove guard (3).

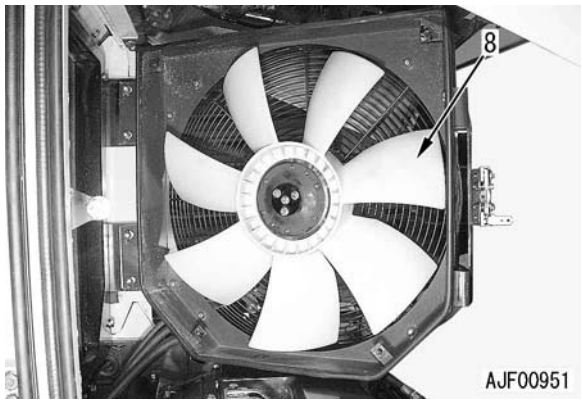



3. Disconnect P1-port hose (4), P2-port hose (5), and Dr-port hose (6).
   ★ Since oil will leak, prepare an oil receiver and an oil stop plug.

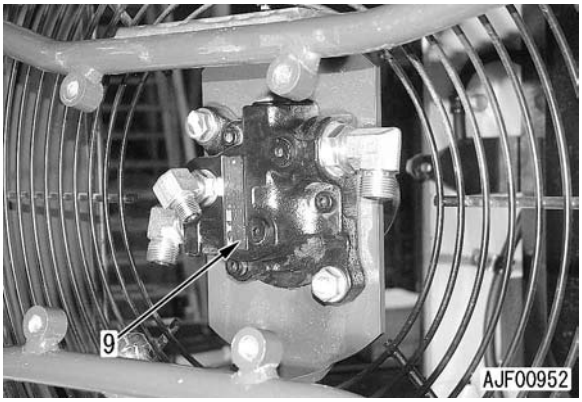



4. Remove 1 fan mounting bolt (7) and cooling fan (8). [*1]



5. Remove the 2 mounting bolts and fan motor assembly (9).




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Mounting bolt:
**27 - 34 Nm {2.8 - 3.5 kgm}**

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

# REMOVAL, INSTALLATION OF FUEL TANK ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

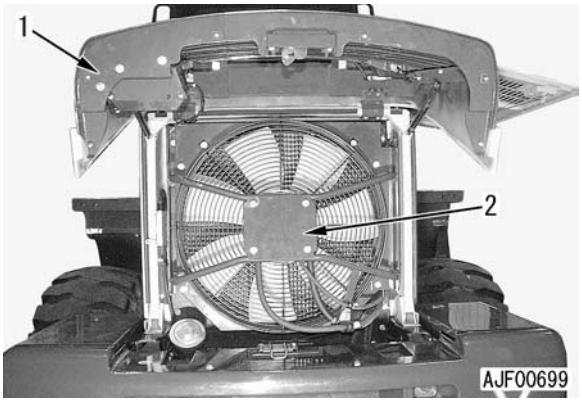
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Disconnect the cable from the negative (-) terminal of the battery.

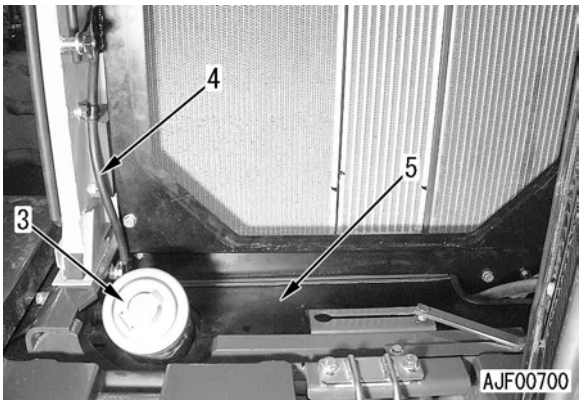
1. Drain the fuel.

   Fuel tank: **184 ℓ** (When full)

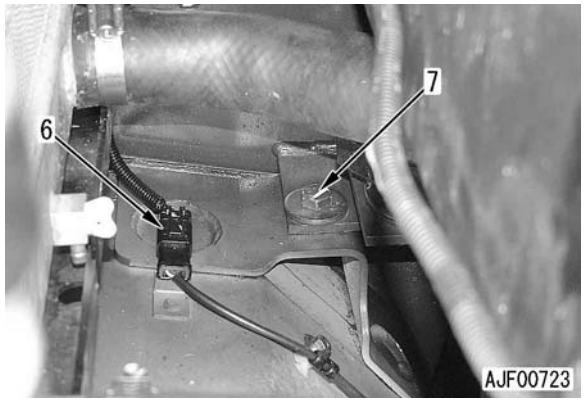
2. Open grille (1) and fan guard (2).

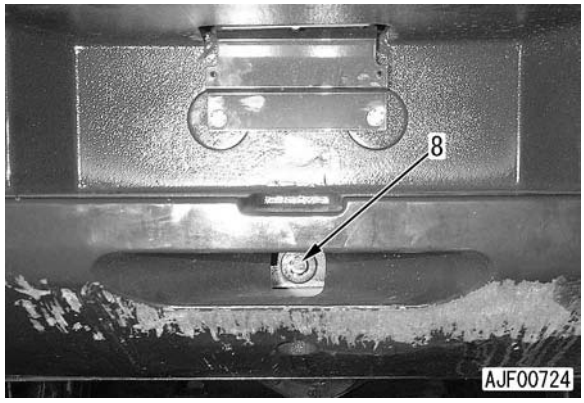



3. Remove oil filler cap (3).
4. Remove the clamp of fuel tank air bleeding hose (4).
5. Remove the mounting bolts of cover (5).

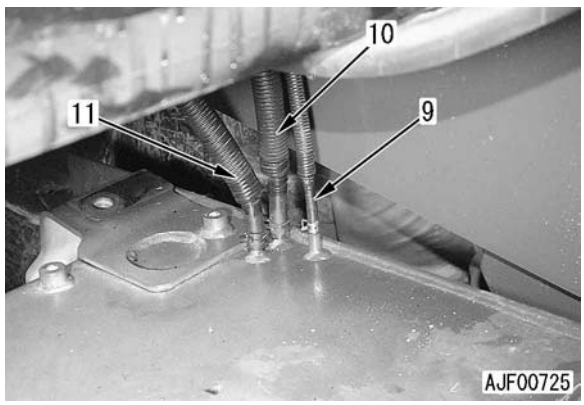



6. Open the engine left side cover and disconnect wiring connector R21 (6) from the fuel tank top.
7. Support the fuel tank bottom with the transmission jack.
8. Remove 2 upper mounting bolts (7) on both sides and rear mounting bolt (8).



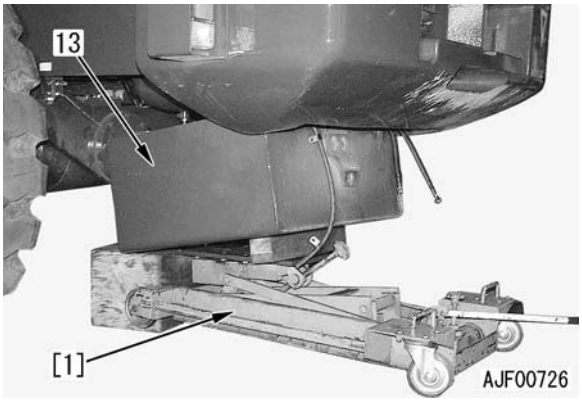




9. Lower the transmission jack slowly and disconnect spill hose (9), fuel supply hose (10), and fuel return hose (11).
   - ★ Mark all the hoses with tags to prevent mistakes in the mounting position when installing.
   - ★ Disconnect the fuel hose clamp from the fuel tank.



10. Lower transmission jack [1] and remove fuel tank (13). [*1]
    ★ Take extreme care that the fuel tank will not come off the transmission jack.

    Fuel tank assembly: **80 kg** (excluding fuel)




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Fuel tank mounting bolt: **245 - 309 Nm {25 - 31.5 kgm}**

- **Refilling with fuel (Fuel tank)**
  Add fuel.

  Fuel tank: **184 ℓ** (When full)

# REMOVAL, INSTALLATION OF TRANSFER

## REMOVAL

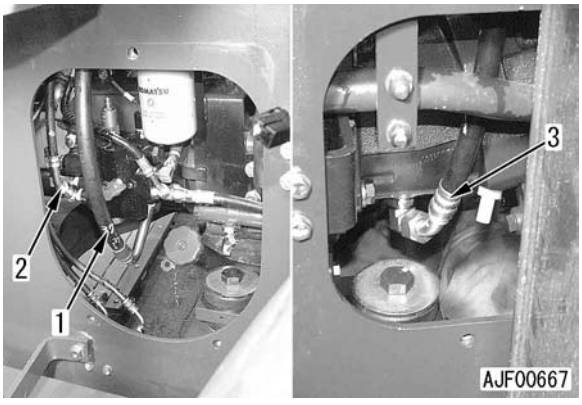
Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

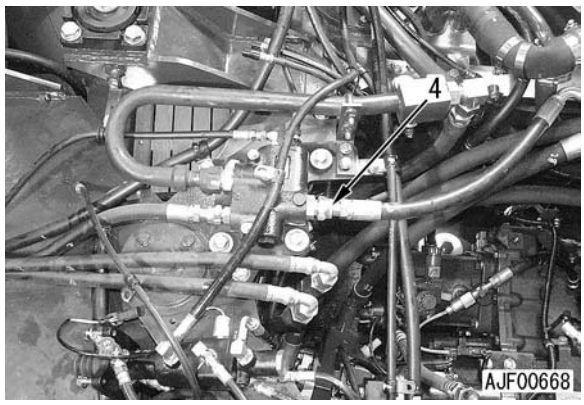
Press the brake pedal at least 100 times to release the residual pressure in the brake accumulator circuit.

Disconnect the cable from the negative (-) terminal of the battery.

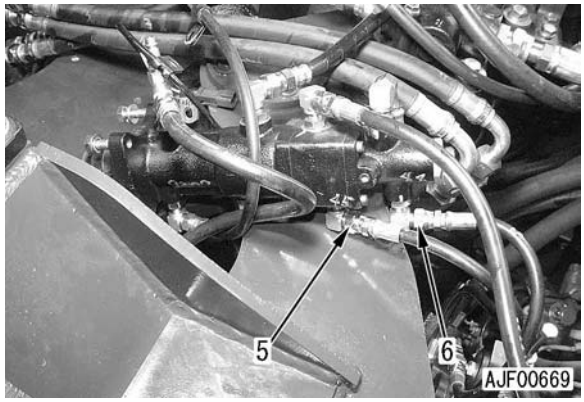
1. Remove the operator's cab assembly. For details, see Removal, installation of operator's cab assembly.
2. Remove the HSS pump and 4-gear pump assembly. For details, see Removal, installation of HSS pump and 4-gear pump assembly.
3. Disconnect motor 1 drain hose (1) and motor 2 drain hose (2).
4. Disconnect accumulator charge valve drain hose (3).



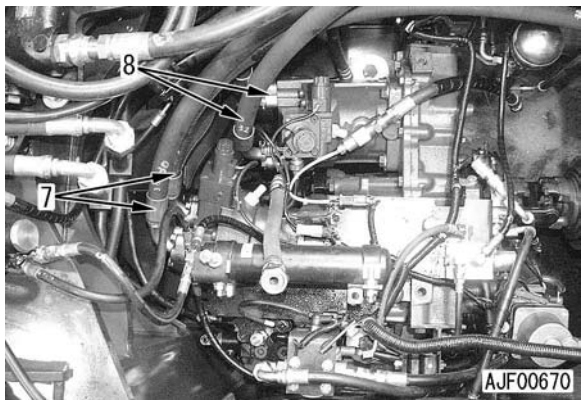

5. Disconnect priority valve port P hose (4).



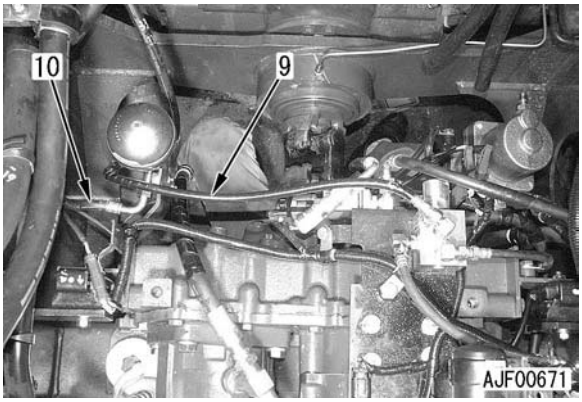

6. Disconnect port PA hose (5) and port PB hose (6) from the brake valve.



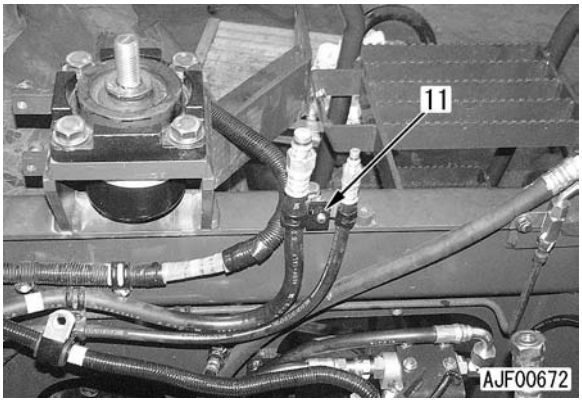

7. Disconnect 2 hoses of ports A and B (7) from HST motor 1 and disconnect 2 hoses of ports A and B (8) from HST motor 2.



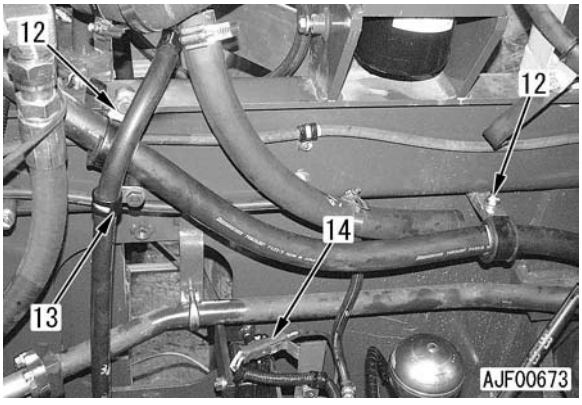
8. Disconnect hoses (9) and (10) from the accumulator for PPC.



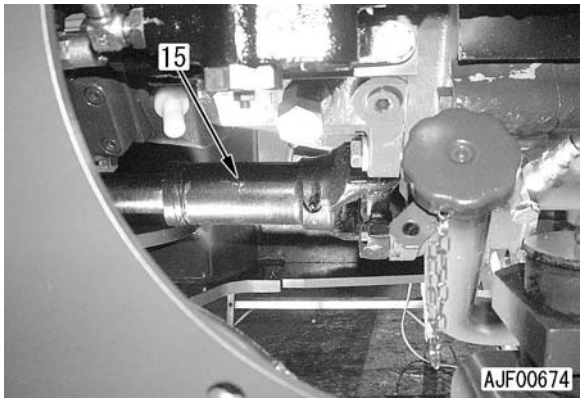

9. Remove air conditioner hose bracket (11).



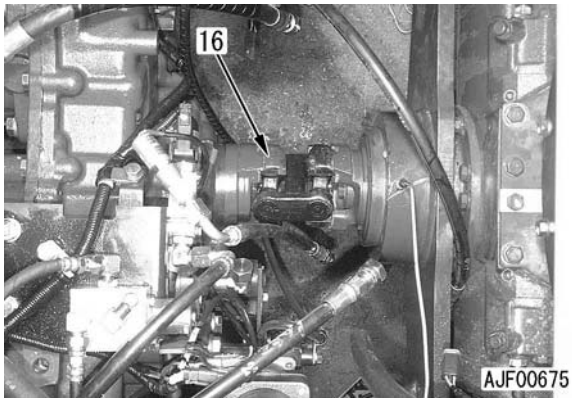

10. Disconnect 2 hydraulic oil cooler hose clamps (12) and motor 2 drain hose clamp (13) from the right inside of the frame.
11. Disconnect wiring connector T09 (14).



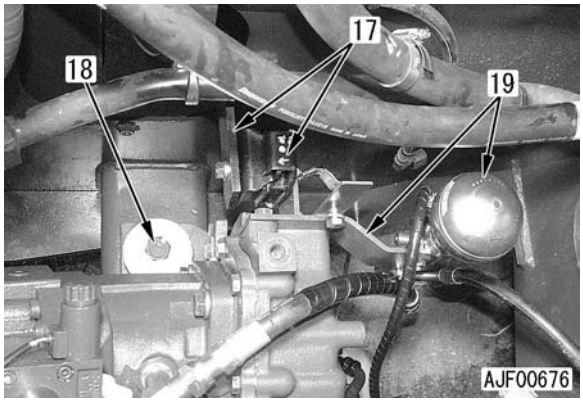

12. Disconnect front drive shaft (15) from the transfer side. [*1]




13. Remove rear drive shaft (16). [*2]

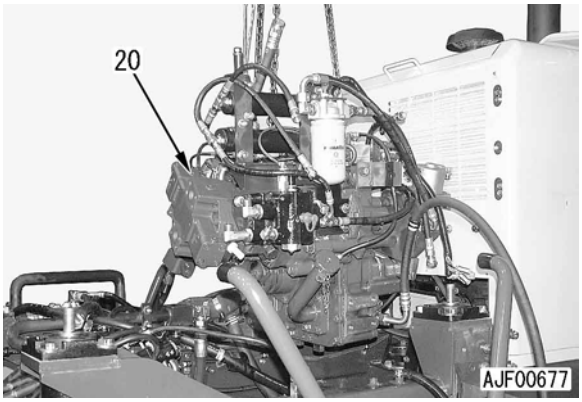



14. Sling the transfer assembly temporarily and remove 2 transfer cushions (17) on both sides, and then remove 2 transfer mounting bolts (18) on both sides. [*3]
    ★ After removing the right cushion, remove accumulator bracket assembly (19).



15. Lift off transfer assembly (20).
    ★ Check that all the wires and pipes are disconnected, and then sling the assembly slowly.

    Transfer and HST motor assembly: **350 kg**




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1] [*2]

Drive shaft mounting bolt:
**59 - 74 Nm {6.0 - 7.5 kgm}**

★ When installing the drive shaft, check that the key way of the spider cap is fitted in the key way of the mating yoke, and then tighten the mounting bolts.
★ When installing the rear drive shaft, check that the lateral runout of the rear axle and transfer from each other is less than 3 mm. If the runout is 3 mm or larger, shift the transfer cushion and transfer mount to reduce the runout.

[*3]

Transfer cushion mounting bolt:
M10 bolt: **59 - 74 Nm {6.0 - 7.5 kgm}**
M12 bolt: **98 - 123 Nm {10 -12.5 kgm}**

Transfer mount mounting bolt:
**610 - 765 Nm {62.5 - 78 kgm}**

# DISASSEMBLY, ASSEMBLY OF TRANSFER ASSEMBLY

## SPECIAL TOOLS

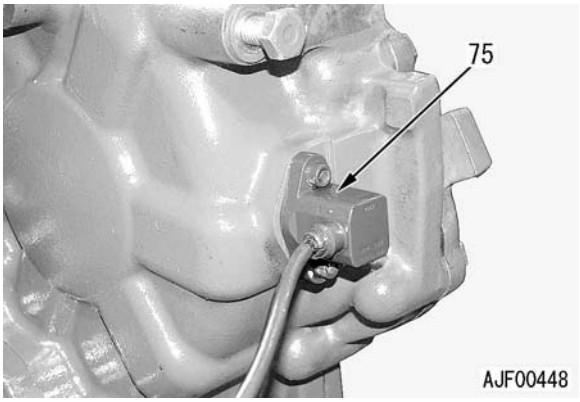
| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| D | 1 | 790-201-2840 | Spacer | ■ | 1 | | |
| | 2 | 793T-417-1110 | Push tool | ■ | 1 | N | ○ |
| | 3 | 790-101-5201 | Push tool kit | ■ | 1 | | |
| | | • 790-101-5301 | Plate | | 1 | | |
| | | • 790-101-5221 | Grip | | 1 | | |
| | | • 01010-51225 | Bolt | | 1 | | |
| | 4 | 793T-417-1120 | Push tool | ■ | 1 | N | ○ |
| | | 790-101-5221 | Grip | ■ | 1 | | |
| | | 01010-81225 | Bolt | ■ | 1 | | |
| | 5 | 799-301-1500 | Oil leak tester | ■ | 1 | | |

## DISASSEMBLY

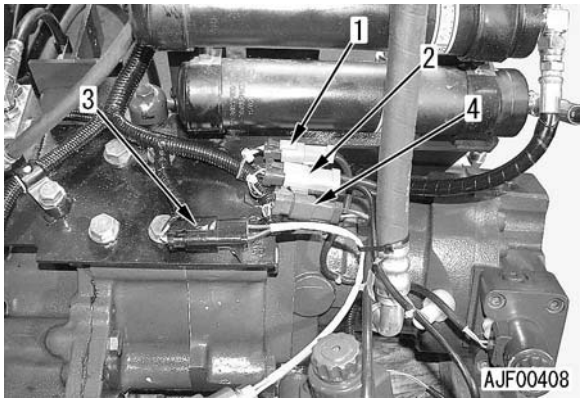
1. Draining transfer oil

   Transfer case: **6.5 ℓ**

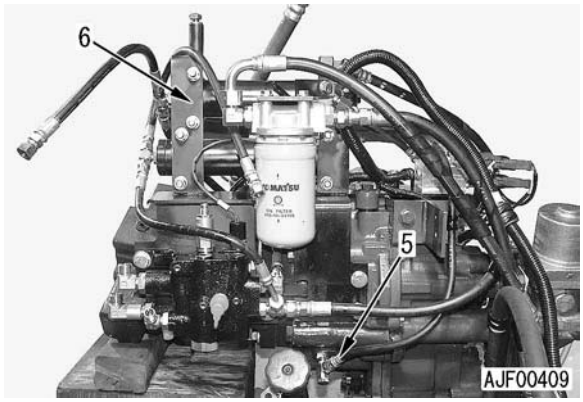
2. Speed sensor
   1) Remove speed sensor (75).



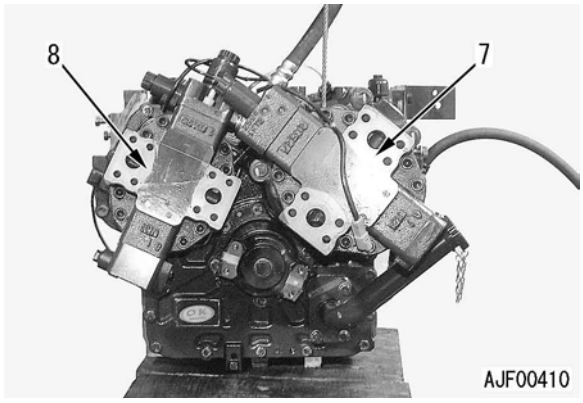

3. Brake accumulator
   1) Disconnect wiring connectors T06 (1), T07 (2), T10 (3), and T11 (4).



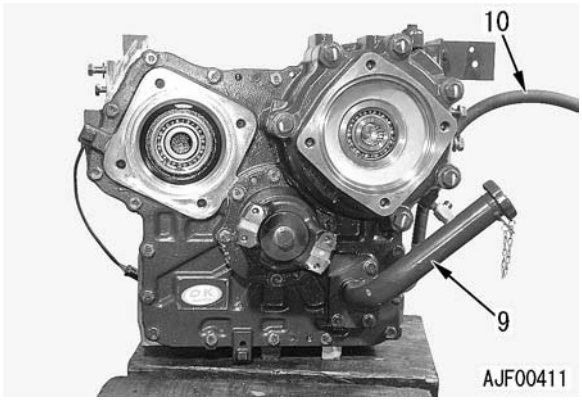

   2) Disconnect clutch port hose (5).
   3) Remove the 6 mounting bolts, and then brake accumulator and transfer oil filter bracket assembly (6).



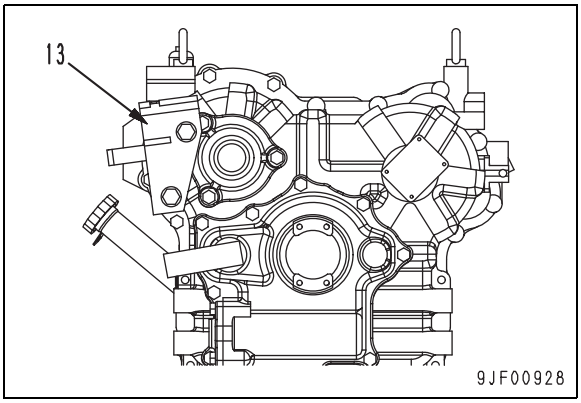

4. HST motor
   1) Remove the 4 mounting bolts and lift off HST motor 1 (7).
   2) Remove the 4 mounting bolts and lift off HST motor 2 (8).



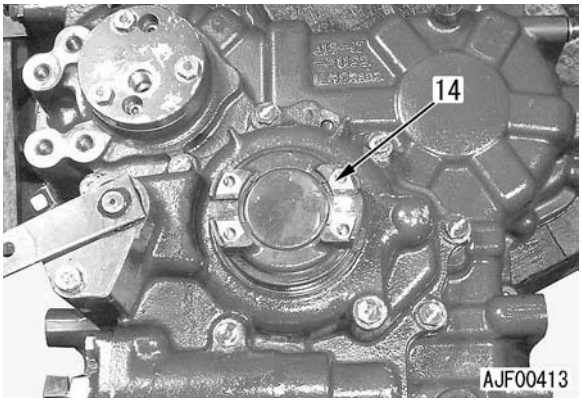
5. Oil supply pipe and hose
   1) Remove oil supply pipe (9).
   2) Remove hose (10) from the transfer case strainer.



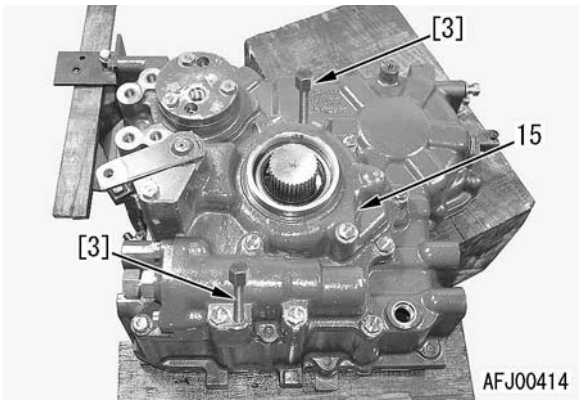

6. Parking brake bracket
   1) Remove parking brake bracket (13).



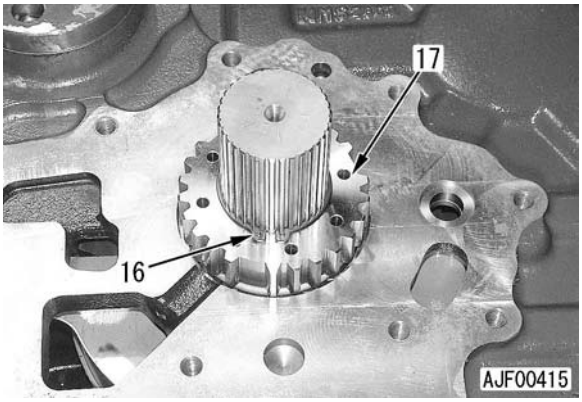

7. Parking brake assembly
   1) Set the transfer assembly to a block with the parking brake side up.
   2) Remove coupling (14) on the parking brake side.



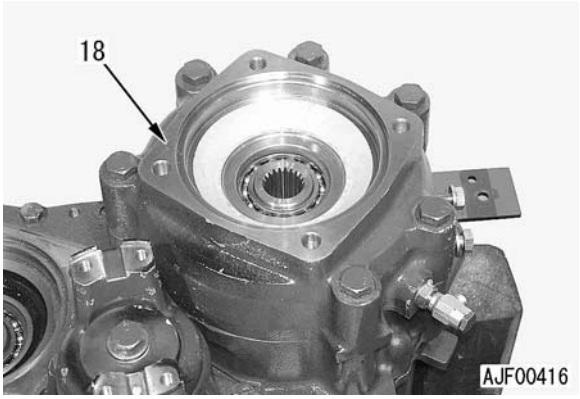

   3) Remove the mounting bolts. Using forcing screws [3], remove parking brake assembly (15).
      ★ For disassembly and assembly of the parking brake assembly, see DISASSEMBLY, ASSEMBLY OF PARKING BRAKE ASSEMBLY.



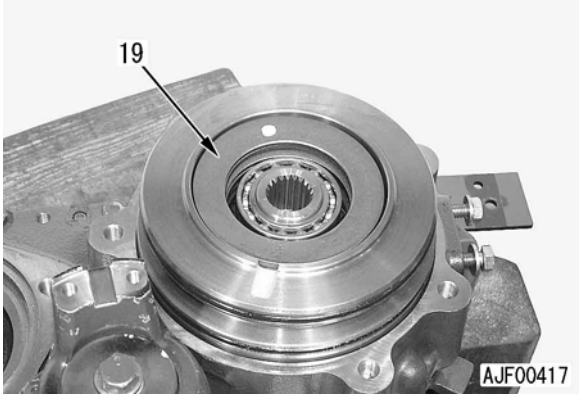

8. Hub
   1) Remove snap ring (16).
   2) Remove hub (17).



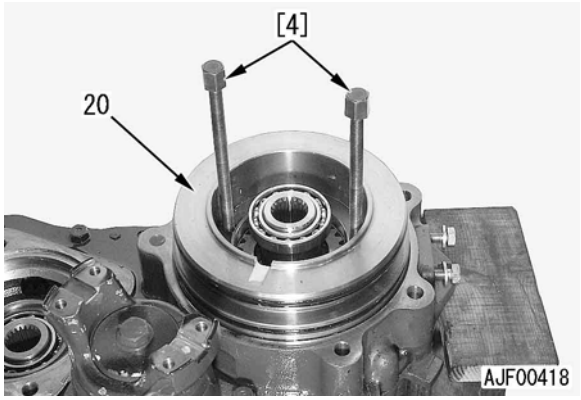
9. Belleville springs
   1) Turn over the case and remove cage (18) from the HST motor mounting section.
      ★ Loosen the mounting bolts evenly and gradually to release the belleville springs, and then remove the cage.
         • Free height of belleville springs (6-piece set): 49.2 mm
         • Installed height of belleville springs (6-piece set): 38.4 mm
         • Installed load of belleville springs (6-piece set): 21,500 N {2,190 kg}



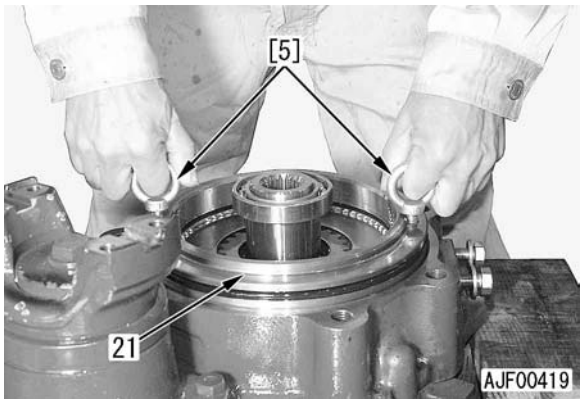

   2) Remove 6 belleville springs (19).
      ★ Check the directions of the belleville springs.
      ★ The 1st and 6th belleville springs has white marks.
      ★ When any belleville spring needs to be replaced, replace all of the 6 springs as a set.



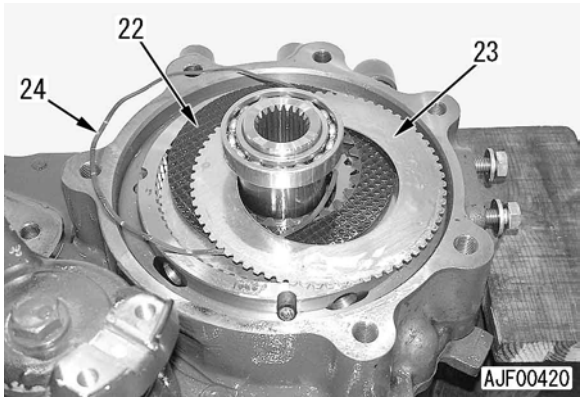

10. Piston and spacer
    1) Using 2 forcing screws [4], remove piston (20).



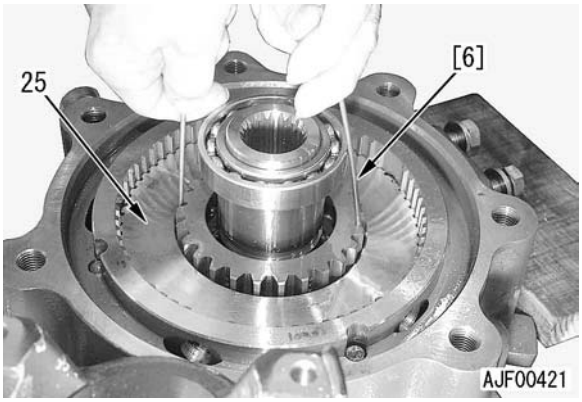

    2) Using 2 eyebolts [5], remove spacer (21).



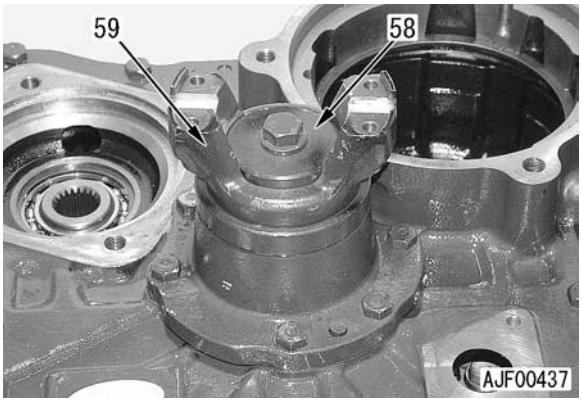

11. Clutch discs, plates, and springs
    1) Remove 6 discs (22), 7 plates (23), and 6 wave springs (24).



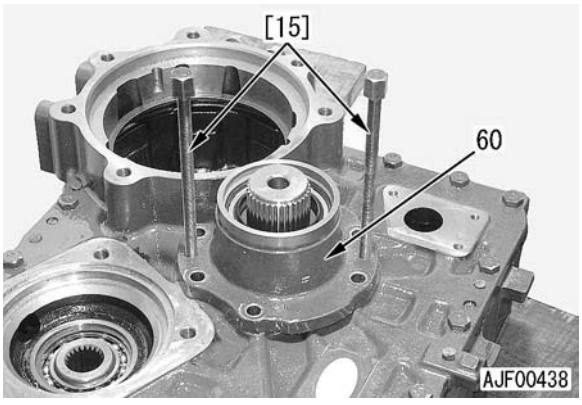
2) Using bar [6], remove end plate (25).



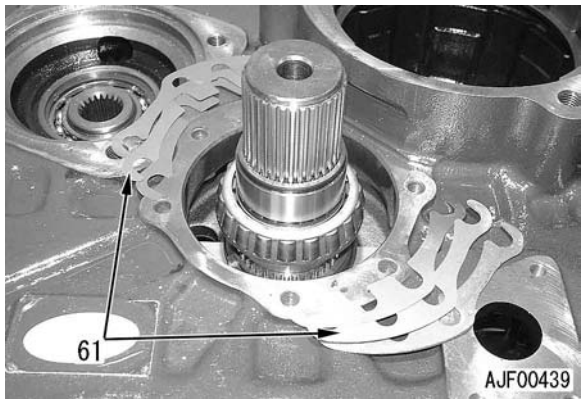

12. Coupling
    1) Remove the mounting bolts and holder (58).
    2) Remove coupling (59).



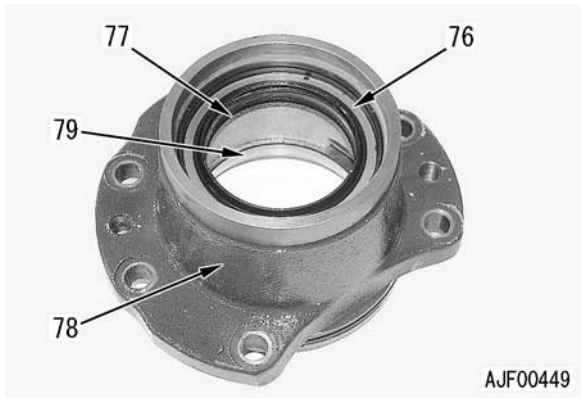

13. Cage assembly
    1) Remove the mounting bolts. Using forcing screws [15], remove cage assembly (60).



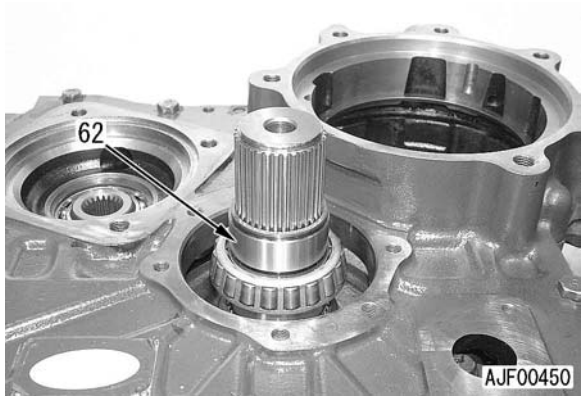

2) Remove shims (61).
   ★ Check the thickness and quantity of the shims.



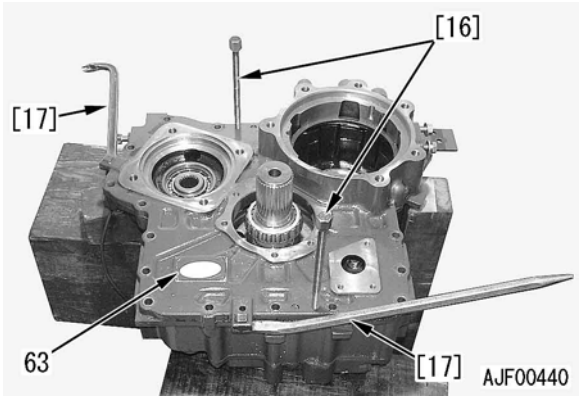

3) Remove dust seal (76) and oil seal (77) from cage (78).
4) Remove outer race (79).



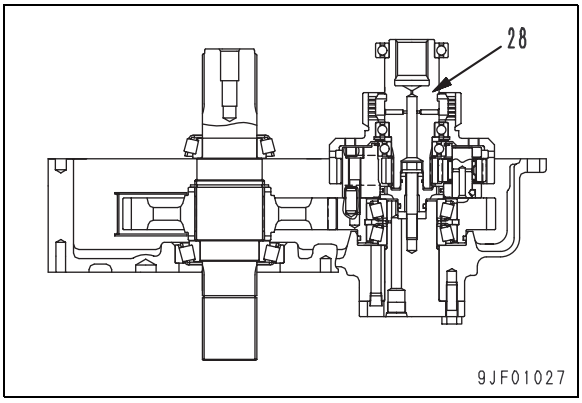

14. Spacer
    1) Remove spacer (62).



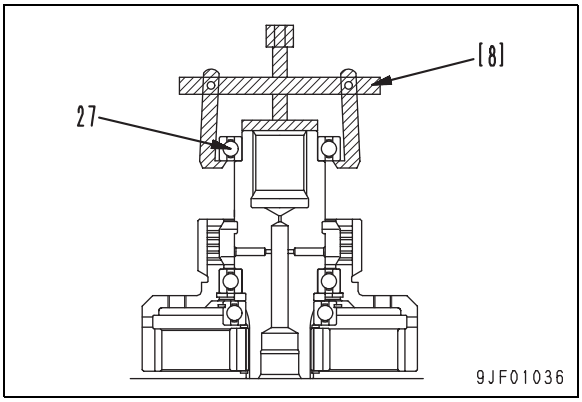
15. Front case
    1) Remove the mounting bolts. Using forcing screws [16] and bars [17], remove front case (63).



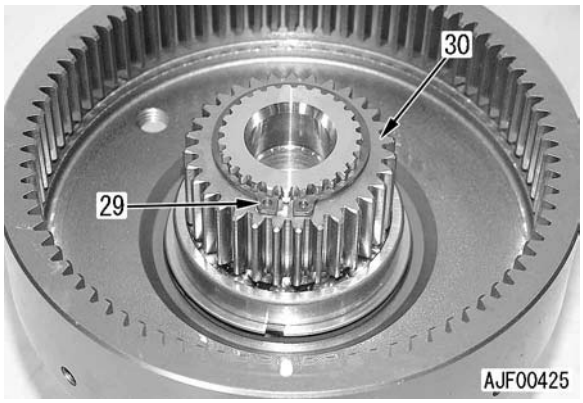

16. Removal of HST motor 1 shaft and ring gear
    1) Remove HST motor 1 shaft and ring gear assembly (28).



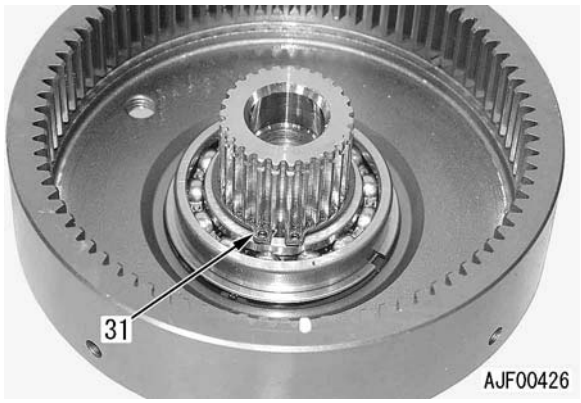

17. Disassembly of HST motor 1 shaft and ring gear assembly
    1) Using puller [8], remove bearing (27).



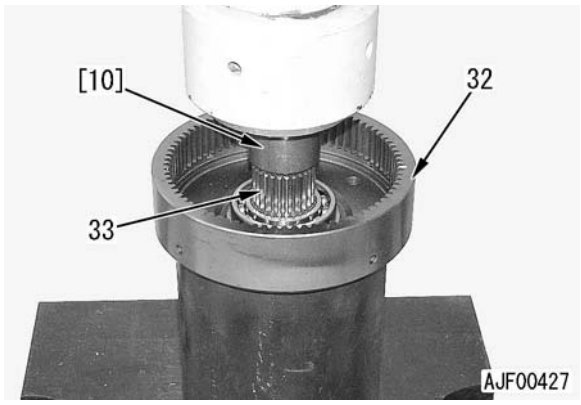

    2) Remove snap ring (29) and sun gear (30).




    3) Remove snap ring (31).

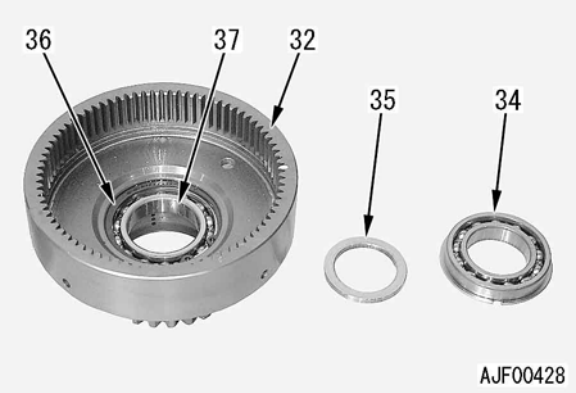



    4) Supporting ring gear (32) and using push tool [10] and a press, push out HSS motor 1 shaft (33).

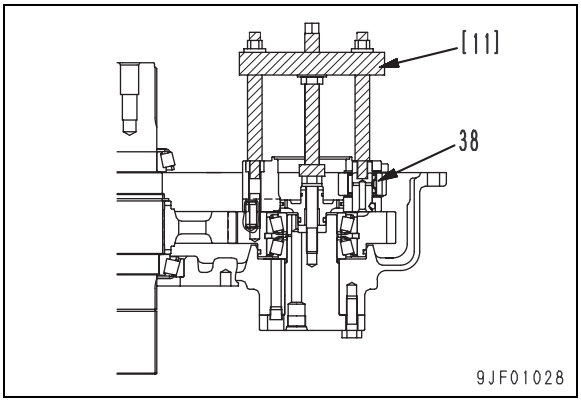


5) Remove bearing (34) and spacer (35) from ring gear (32).

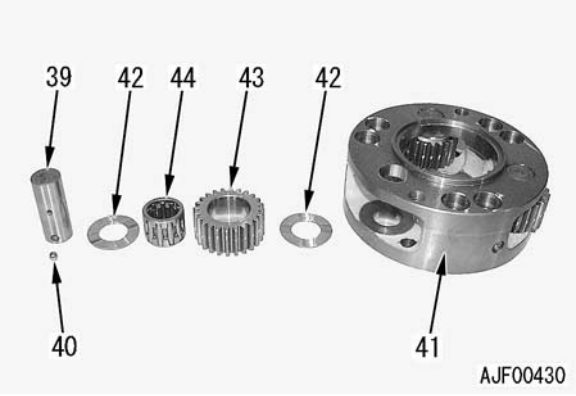
6) Remove snap ring (36) and bearing (37).



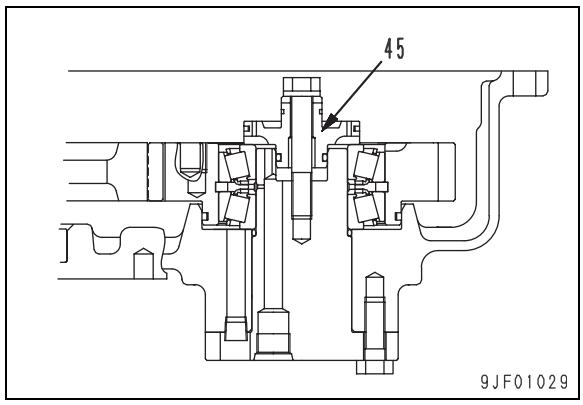

18. Removal of carrier assembly
    1) Using tool [11], remove carrier assembly (38) from the dowel pin of the HST motor 1 gear.



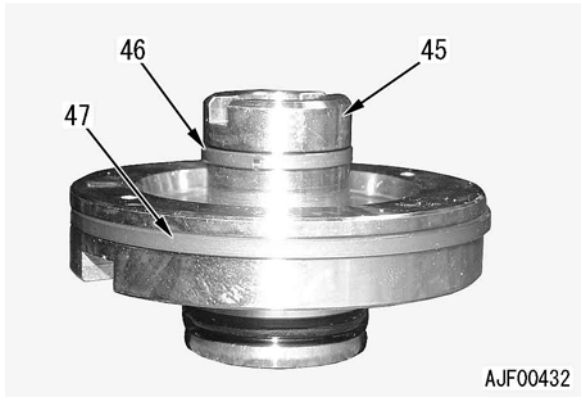

19. Disassembly of carrier assembly
    1) Press shaft (39) and remove ball (40) and pinion shaft (39) from carrier (41).
       ★ Keep the ball carefully.
    2) Remove 2 thrust washers (42), planetary gear (43), and bearing (44) (at 3 places).



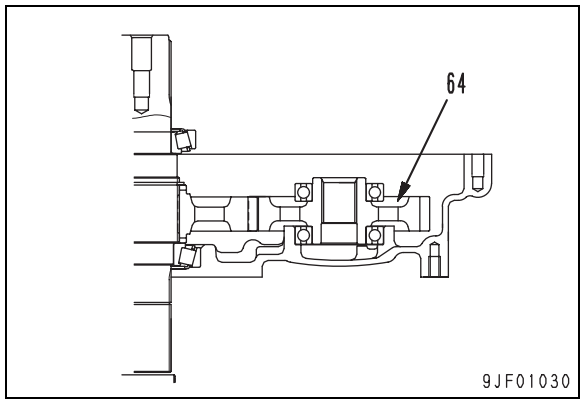

20. Holder
    1) Remove the mounting bolts and holder (45).



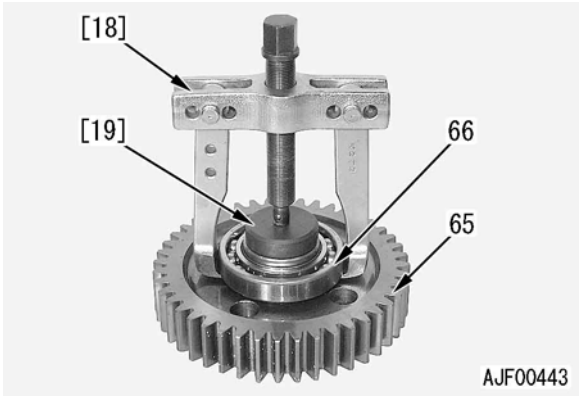

    2) Remove seal rings (46) and (47) from holder (45).



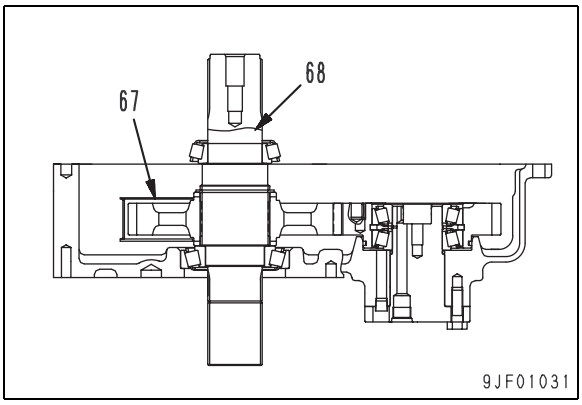

21. Removal of HST motor 2 gear and bearing assembly
    1) Remove HST motor 2 gear and bearing assembly (64).



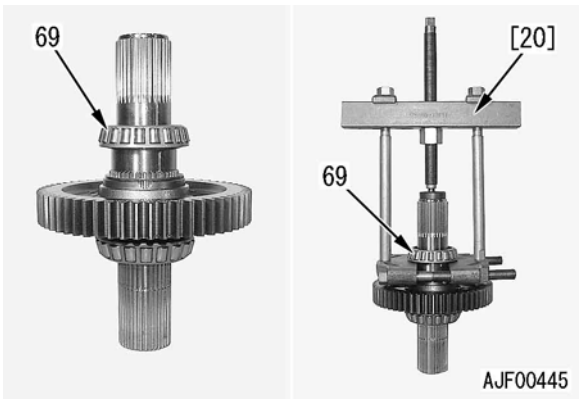
22. Disassembly of HST motor 2 gear and bearing assembly
    1) Using puller [18] and plate [19] remove 2 bearings (66) from HST motor 2 gear (65).



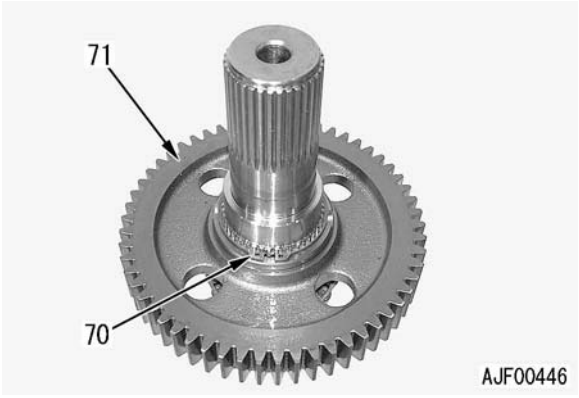

23. Removal of output shaft and gear assembly
    1) Remove 2 mounting bolts of cover (67).
    2) Remove output shaft and gear assembly (68) and cover (67).



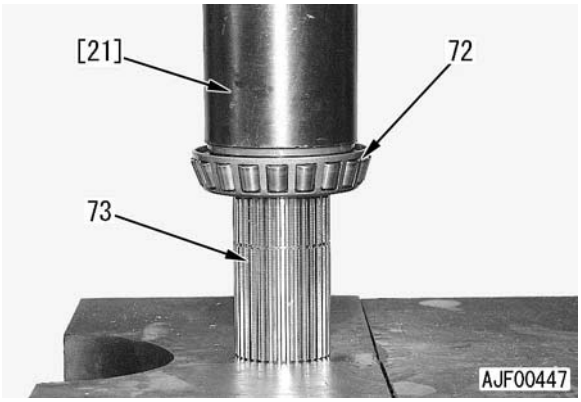

24. Disassembly of output shaft and gear assembly
    1) Using puller [20], remove front bearing (69).



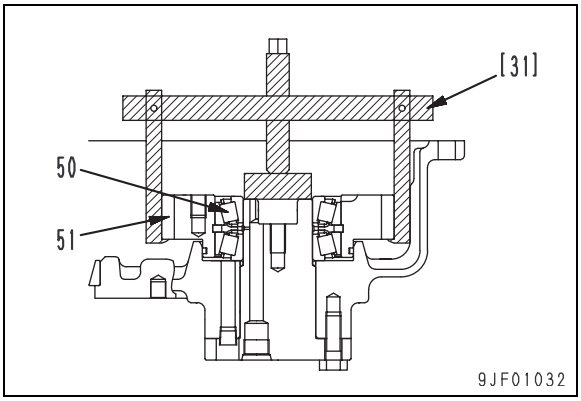

    2) Remove snap ring (70) and output gear (71).



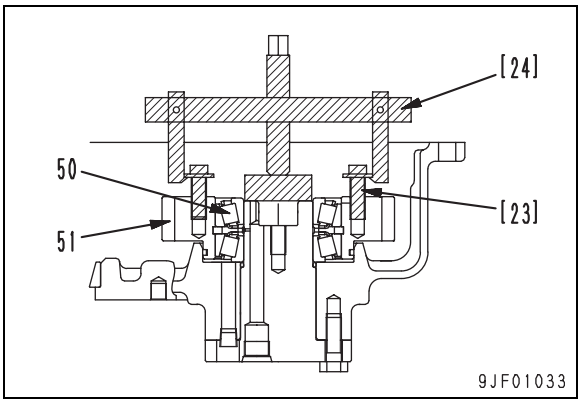

    3) Using push tool [21] and the press, push rear bearing (72) out of output shaft (73).



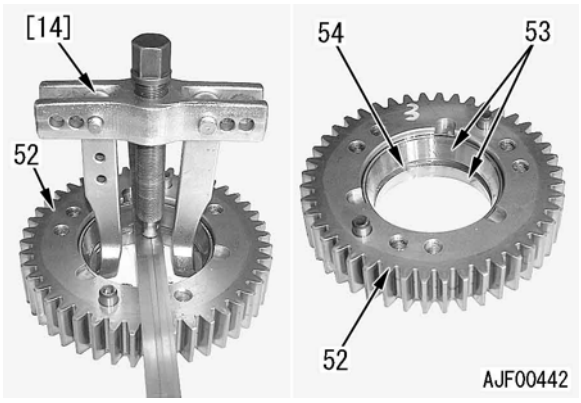

25. Removal of HST motor 1 gear and outer races
    ★ Do not remove the HST motor 1 gear shaft. (If it is removed forcibly and reused, it can cause a trouble.)
    1) Using puller [31], remove bearing (50) and HST motor 1 gear and outer races (51).



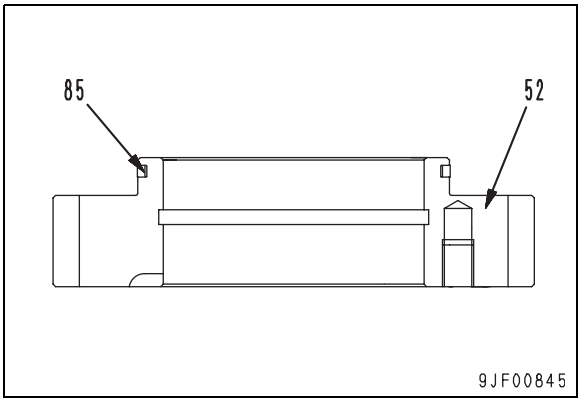
★ If the claws of puller [31] are so thick that they cannot be inserted between the gear and case, screw 3 mounting bolts (M12 x 35 mm) [23] into the carrier mounting holes of HST motor 1 gear (51) by 15 mm. Then, using 3-claw puller [24], remove bearing (50) and HST motor 1 gear and outer races (51).



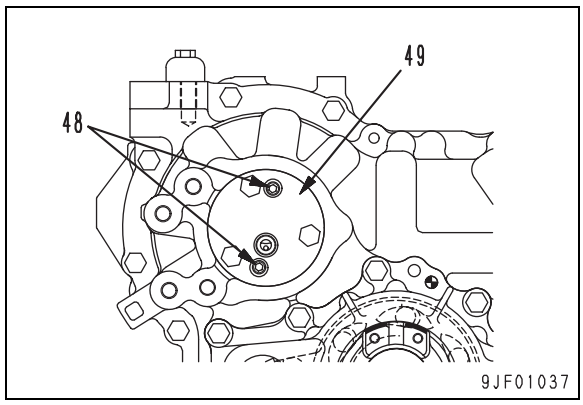

26. Disassembly of HST motor 1 gear and outer races
    1) Using puller [14], remove 2 outer races (53) from HST motor 1 gear (52), and then remove spacer (54).



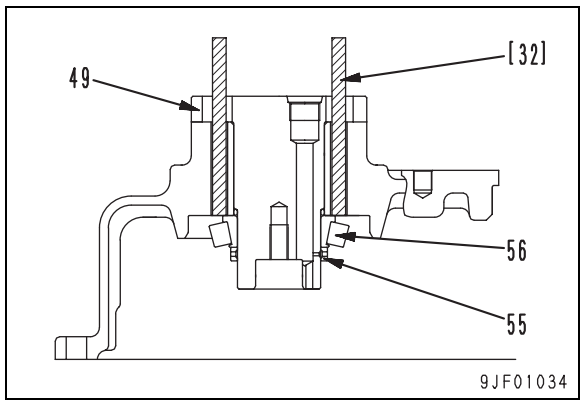

    2) Remove seal ring (85) from HST motor 1 gear (52).



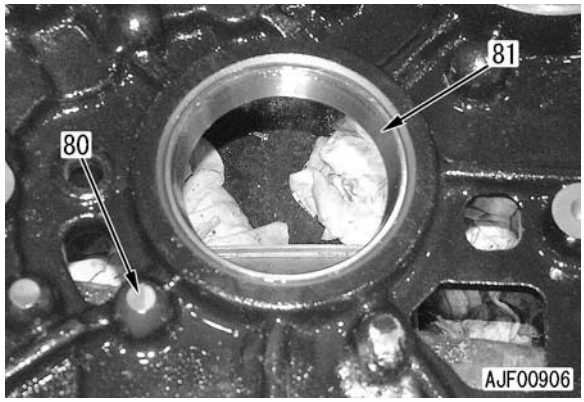

27. Bearing
    1) Remove 2 plugs (48) from shaft (49).



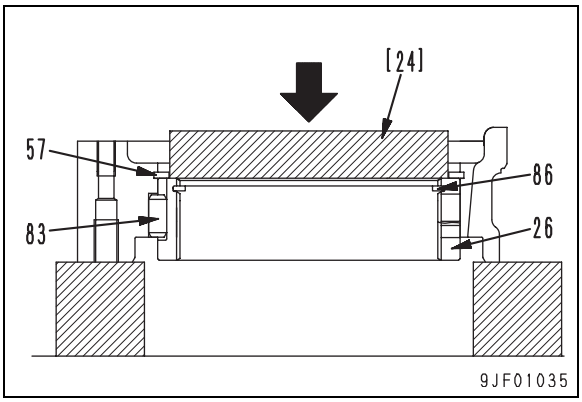

    2) Insert 2 push tools [32] in the plug holes and hit them evenly to remove spacer (55) and bearing (56) from shaft (49).




28. Rear case
    1) Remove outer race (81) from rear case (80).



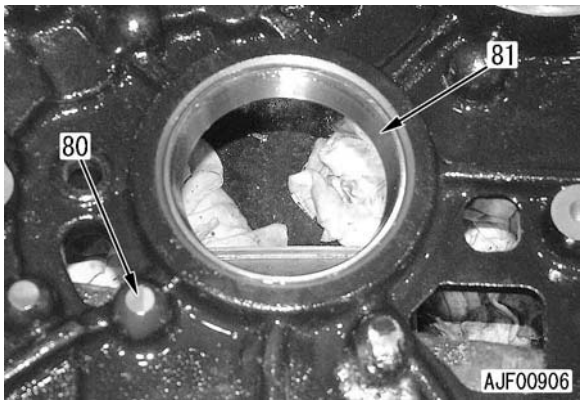
29. Clutch housing
    1) Using push tool [24], remove clutch housing (26) and 3 pins (83).
    2) Remove snap ring (86) from clutch housing (26).
    3) Remove snap ring (57).



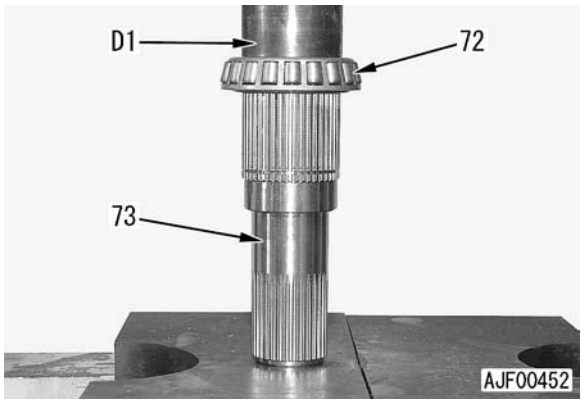

## ASSEMBLY

★ Clean the all parts and check them for dirt or damage. Coat their sliding surfaces with transfer oil T010 (E010-CD) before installing.
★ Before icing a bearing in dry ice for expansion fit, drop about 6 cc of E010-CD or E0-30CD onto it and rotate it 10 turns.

1. Rear case
    1) Press fit outer race (81) to rear case (80).

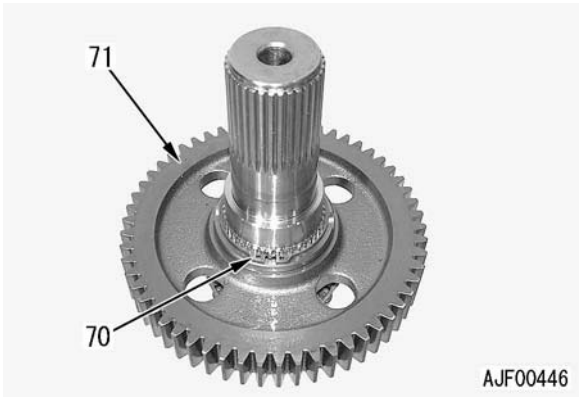



2. Assembly of output shaft and gear assembly
    1) Using tool D1 and the press, press fit rear bearing (72) to output shaft (73) until it stops.
        ★ After press fitting the bearing, apply transfer oil to it and rotate it.

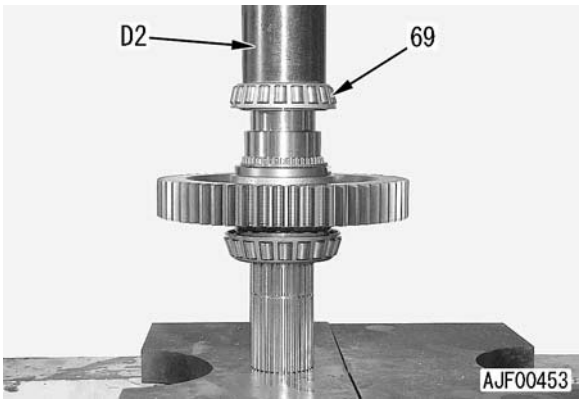


2) Install output gear (71) and snap ring (70).

Spline of gear: **Grease (LM-G)**



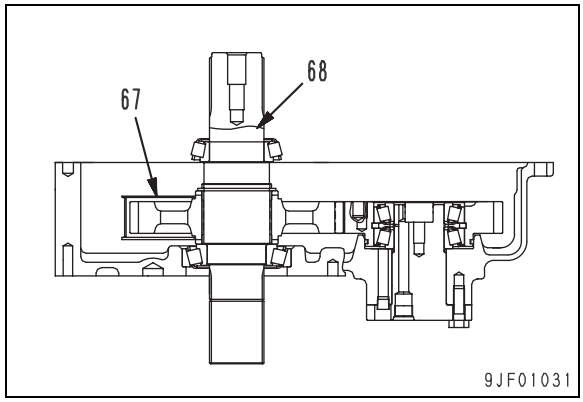

3) Using tool **D2** and the press, press fit front bearing (69).
   ★ After press fitting the bearing, apply transfer oil to it and rotate it.



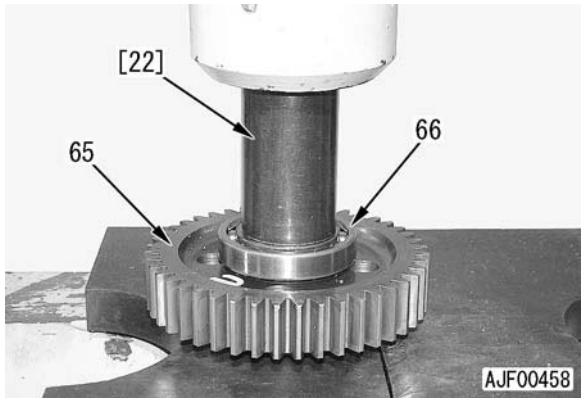

3. Installation of output shaft and gear assembly
   1) Place cover (67) on the gear and install output shaft and gear assembly (68) to the rear case.
   2) Install the mounting bolts of cover (67).
      ★ Check that cover (67) does not interfere with the inside surface of the gear.

Mounting bolt: **Adhesive (LT-2)**

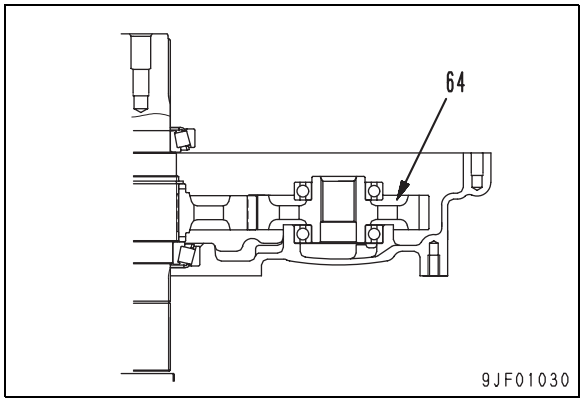
Mounting bolt:
**98 - 123 Nm {10 - 12.5 kgm}**




4. Assembly of HST motor 2 gear and bearing assembly
   1) Using push tool [22], press fit 2 bearings (66) to HST motor 2 gear (65).
      ★ After press fitting the bearings, apply transfer oil to them and rotate them.

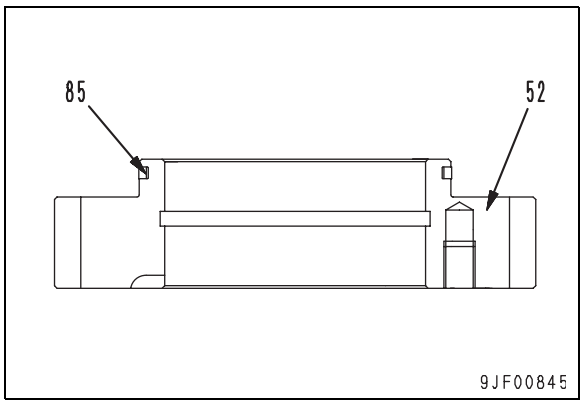


5. Installation of HST motor 2 gear and bearing assembly
   1) Install HST motor 2 gear and bearing assembly (64).

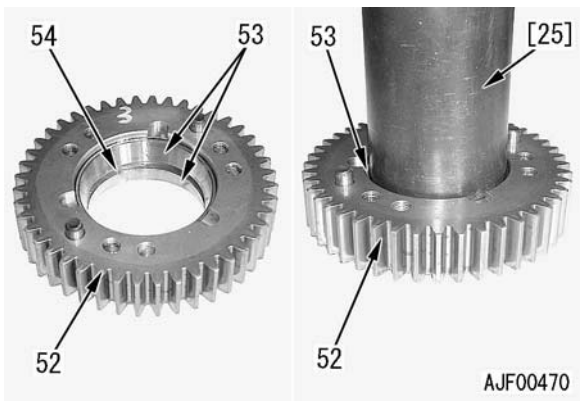



6. Assembly of HST motor 1 gear and outer races
   1) Install seal ring (85) to HST motor 1 gear (52).

Seal ring: **Grease (G2-LI)**

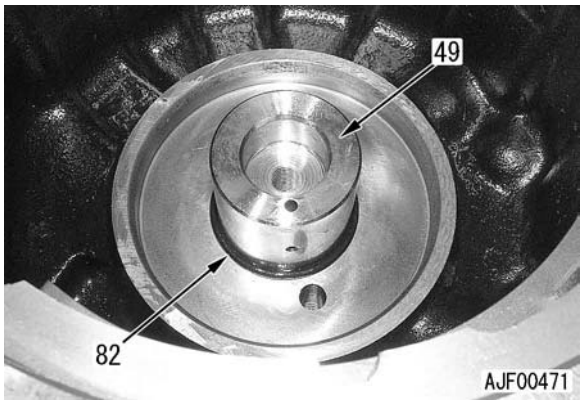



   2) Install spacer (54) to HST motor 1 gear (52).
   3) Using push tool [25], press fit 2 outer races (53) to HST motor 1 gear (52).

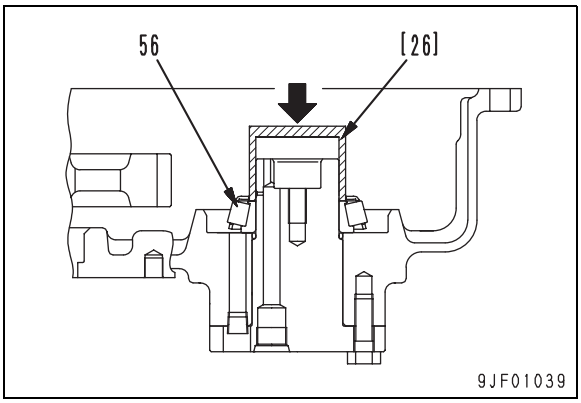



7. Installation of motor 1 gear and outer races
   1) Install O-ring (82) to shaft (49).

O-ring: **Grease (G2-LI)**



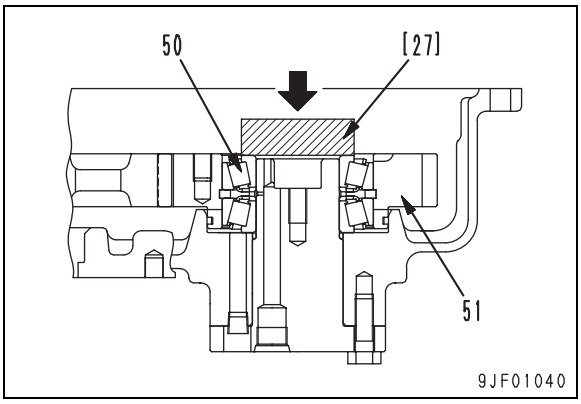

8. Bearing and HST motor 1 gear
   1) Using push tool [26] and the press, press fit bearing (56).




   2) Install spacer (55).

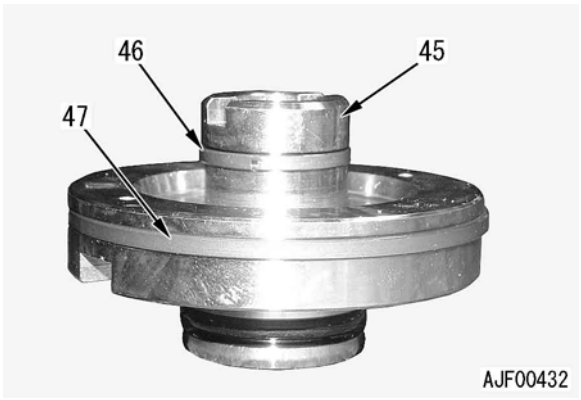


3) Install the HST motor 1 gear and outer races (51).
4) Using push tool [27] and the press, press fit bearing (50).
   - Projection of bearing from shaft: 1.71 - 3.35 mm



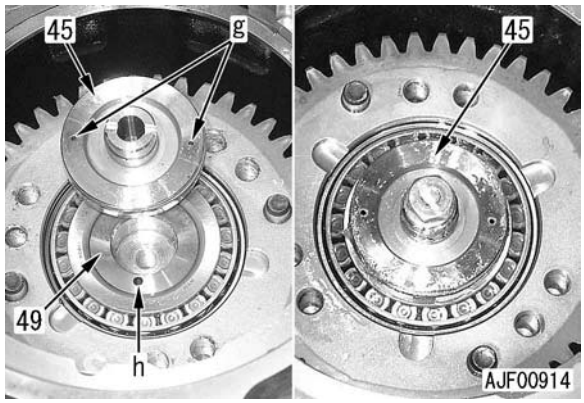

9. Holder
   1) Install seal rings (46) and (47) to holder (45).

      Seal ring and O-ring: Grease (G2-LI)

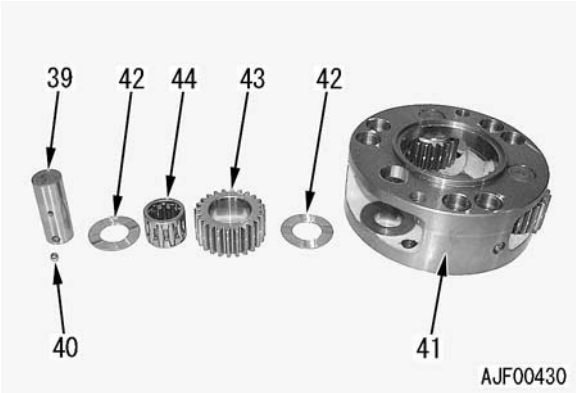



   2) Install holder (45) and tighten the mounting bolts.
      ★ Set the hole 2 mm in diameter (g) on the top of the holder horizontally [Set it at 90 degrees to the hole 4.5 mm in diameter (h) on shaft (49)].

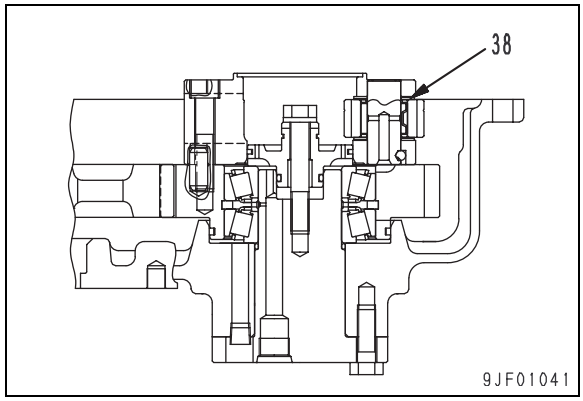
      Mounting bolt: **88.2 - 107.8 Nm {9 - 11 kgm}**



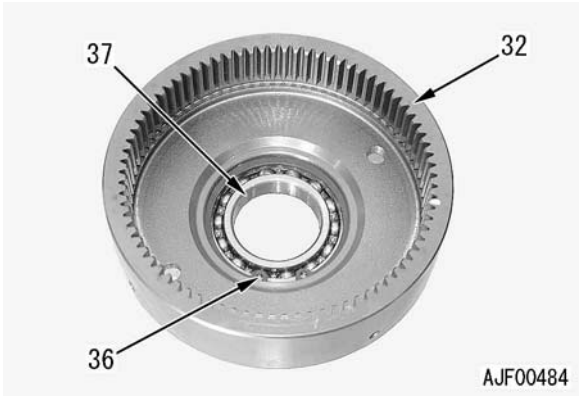

10. Assembly of carrier assembly
    1) Set planetary gear (43), bearing (44), and 2 thrust washers (42) to carrier (41) (at 3 places).
    2) Install pinion shaft (39) to carrier (41), matching their ball holes to each other, and then install ball (40).



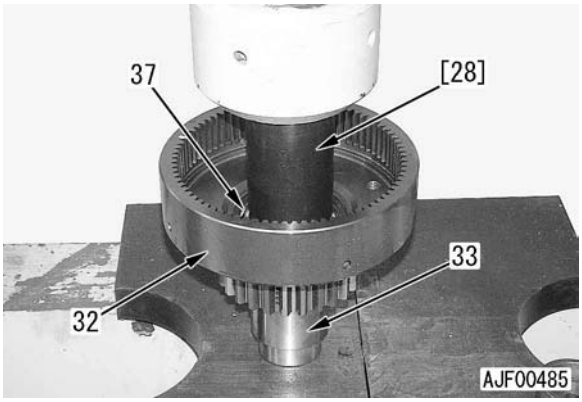

11. Installation of carrier assembly
    1) Install carrier assembly (38), matching it to the dowel pin of the HST motor 1 gear.



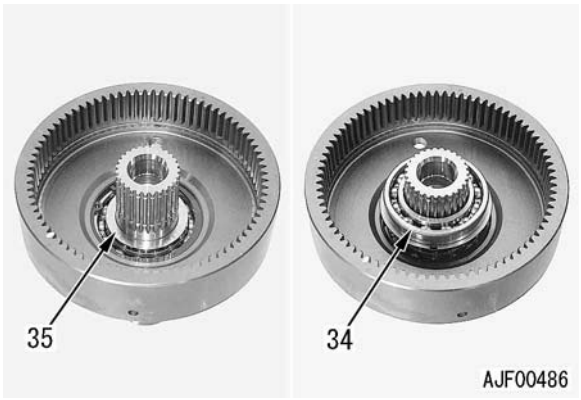
12. Assembly of HST motor 1 shaft and ring gear assembly
    1) Install bearing (37) to ring gear (32), and then install snap ring (36).



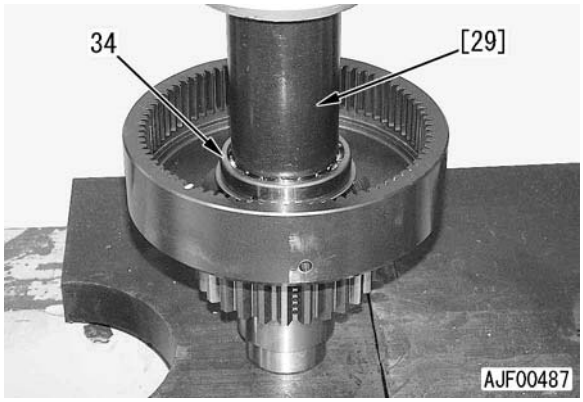

    2) Set ring gear (32) to HST motor 1 shaft (33). Using push tool [28] and the press, press fit bearing (37).



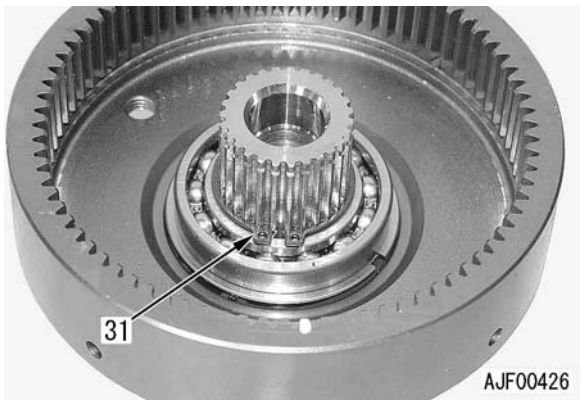

    3) Install spacer (35) and set bearing (34).



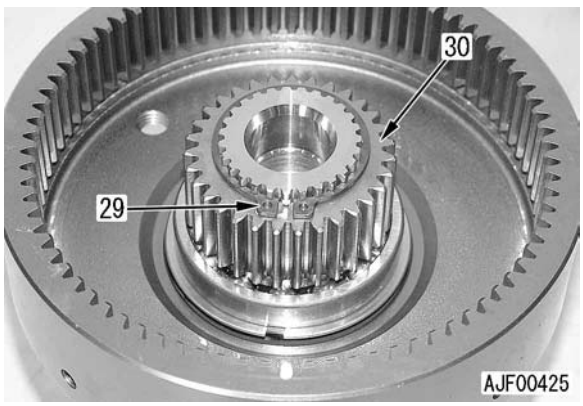

    4) Using push tool [29] and the press, press fit bearing (34).



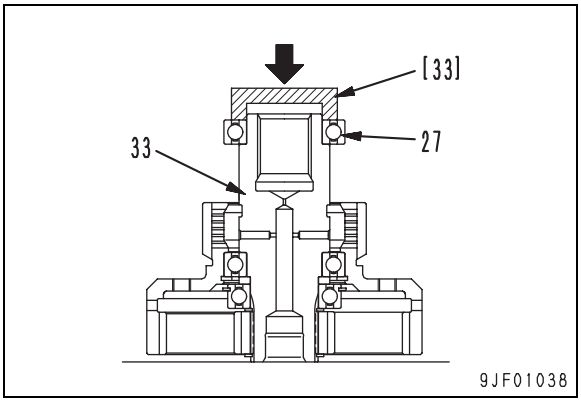

    5) Install snap ring (31).



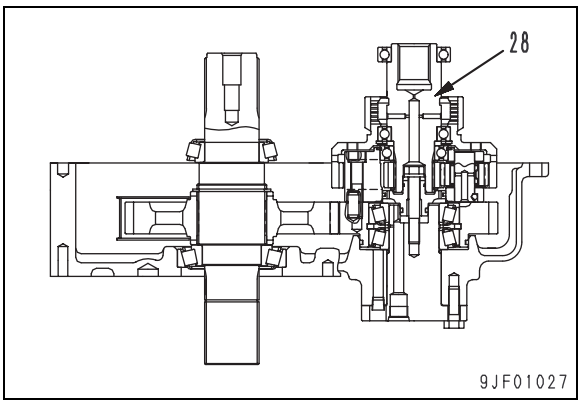

    6) Install sun gear (30) and snap ring (29).



7) Using tool [33], press fit bearing (27) to HST motor 1 shaft (33).

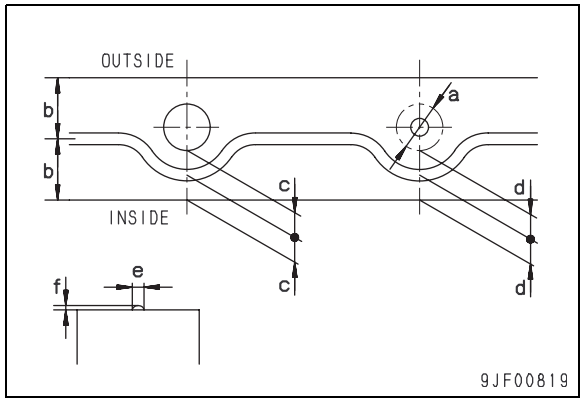



13. Installation of HST motor 1 shaft and ring gear
    1) Install HST motor 1 shaft and ring gear assembly (28).



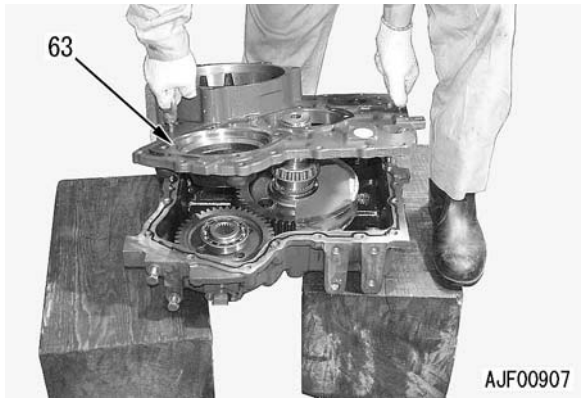

14. Front case
    ★ Use the front case and rear case as an assembly.
    ★ When installing the cases, match the match marks on their tops to each other.
    1) Apply gasket sealant to the rear case according to the following procedure.
       ★ Apply the gasket sealant to forcing screw contact part (a), similarly to the dimensions for a bolt hole.
       ★ Apply the gasket sealant so that dimensions (b) and (c) will be the same respectively.
       ★ Apply the gasket sealant so that dimension (e) x dimension (f) will be 2 - 5 mm.

       Gasket sealant:
       **ThreeBond 1207B or equivalent**

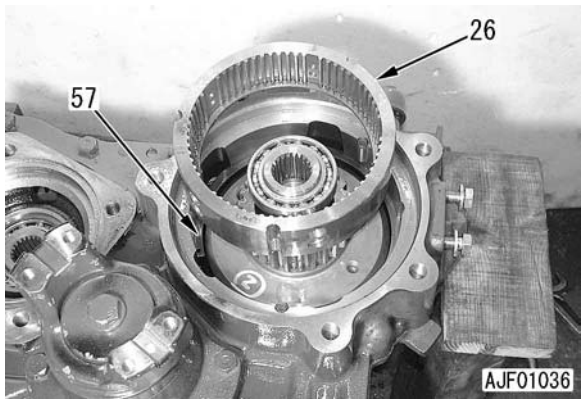



2) Install front case (63).

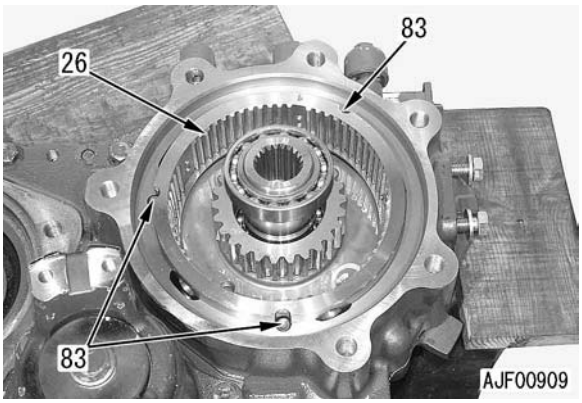
   Mounting bolt:
   **98 - 123 Nm {10 - 12.5 kgm}**



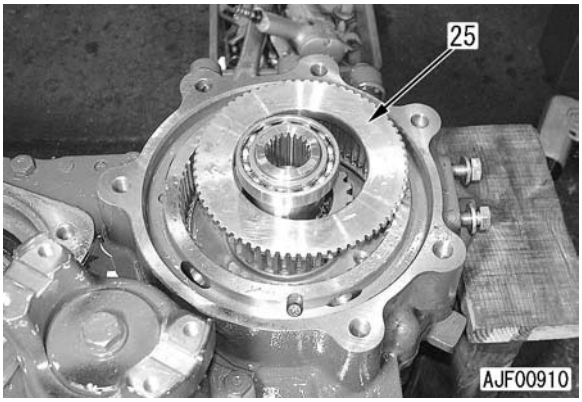

15. Clutch housing
    1) Install snap ring (57) to the front case.



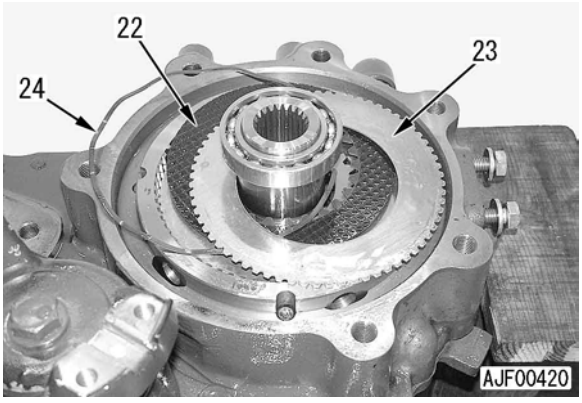
2) Install clutch housing (26) and 3 pins (83).




16. Clutch discs, plates, and springs
    1) Install end plate (25).

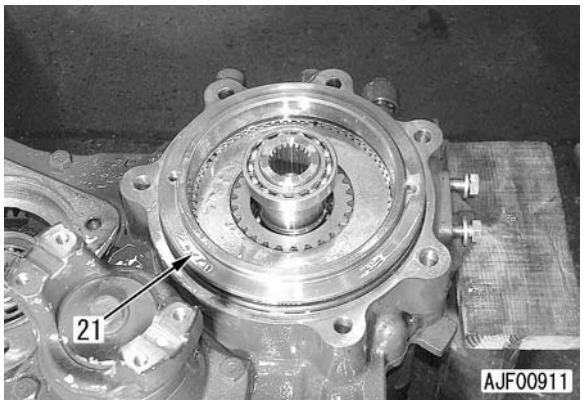



    2) Install 6 discs (22), 6 wave springs (24), and 7 plates (23).
       ★ Soak the discs in clean transfer oil for at least 2 minutes before installing them.



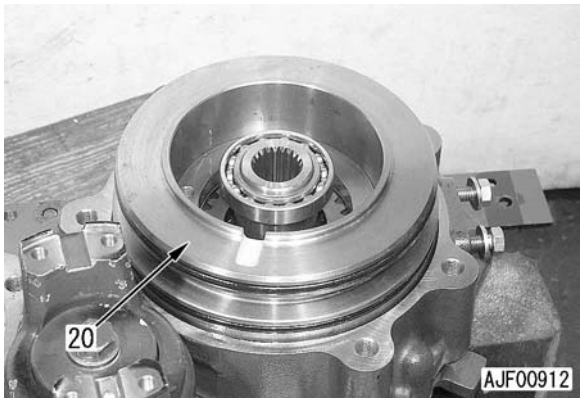

17. Spacer and piston
    1) Install the O-ring and spacer (21).

       O-ring: **Grease (G2-LI)**

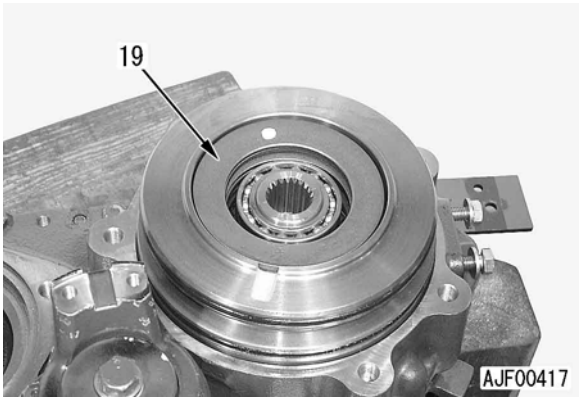



    2) Install the O-ring and piston (20).

       O-ring: **Grease (G2-LI)**

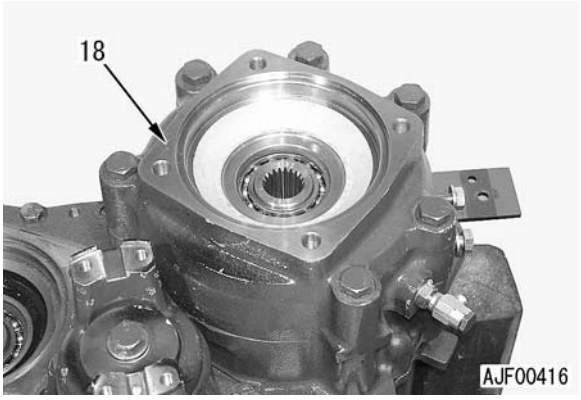


18. Belleville springs
    1) Set the 1st one of the 6 belleville springs (19) with the white mark side down.
    2) Set the 2nd and 5th belleville springs in the opposite direction to the 1st one and set the 2nd and 5th ones in the same direction as the 1st one.
    3) Set the 6th belleville spring with the white mark side up.
       ★ When any belleville spring needs to be replaced, replace all of the 6 springs as a set.




19. Cage
    1) Install cage (18).
       ★ Tighten the mounting bolts evenly and gradually.
       • Installed load of belleville springs (6-piece set): **21.500 N {2,190 kg}**

       Mounting bolt: **245 - 308 Nm {25 - 31.5 kgm}**

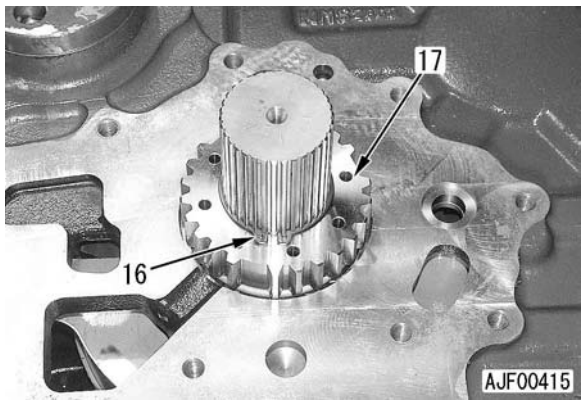



20. Operation test of transfer clutch
    1) Using tool D5, apply air pressure to transfer clutch disengagement port (m).
       ★ When the air pressure is applied, if the transfer clutch is disengaged, it is operating normally.
       • Clutch disengaging air pressure: **1.52 MPa {15.5 kg/cm$^2$}**

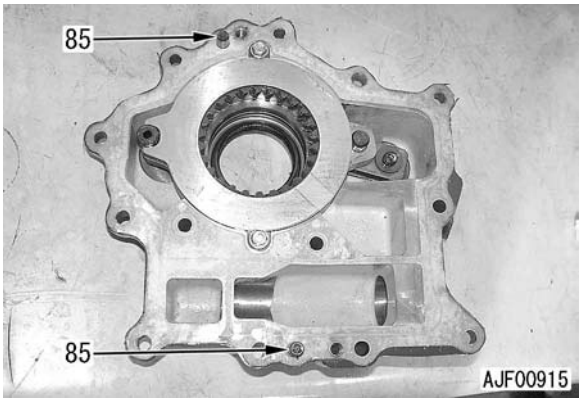



21. Hub
    1) Turn over the transfer assembly, install hub (17).
    2) Install snap ring (16).

       Spline of output shaft: **Lubricant containing molybdenum disulfide (LM-P)**

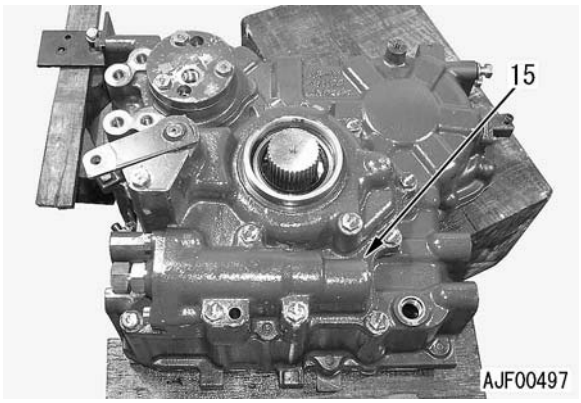


22. Parking brake assembly
    1) Install 2 dowel pins (85) from the parking brake assembly.



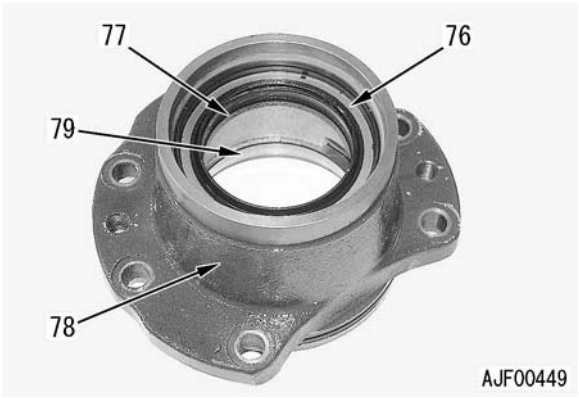

    2) Install parking brake assembly (15).
        ★ After the all internal teeth of the disc are meshed with the spline and the clearance between the parking brake housing and transfer case is eliminated, tighten the mounting bolts.
        ★ If the mounting bolts are tightened while there is clearance between the parking brake housing and transfer case and the internal teeth of the disc are shifted from the spline, the disc will be broken. Accordingly, remove the dowel pins and check securely in advance that there is not clearance.
        ★ Do not reuse the basket but replace it.
        ★ Install the coupling after ADJUSTING PRE-LOAD ON OUTPUT SHAFT TAPER ROLLER BEARING.

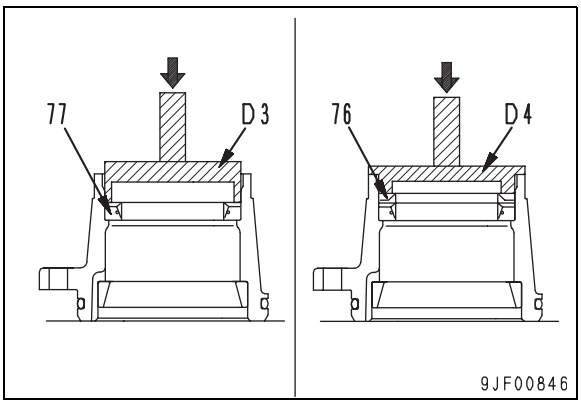
        Mounting bolt:
        **98 - 123 Nm {10 - 12.5 kgm}**




23. Cage assembly
    1) Press fit outer race (79) to cage (78).
    2) Using tools **D3** and **D4**, press fit oil seal (77) and dust seal (76) to cage (78).

        Lips and clearances of oil seal and dust seal: **Silicone grease (ThreeBond 1855 or equivalent)**



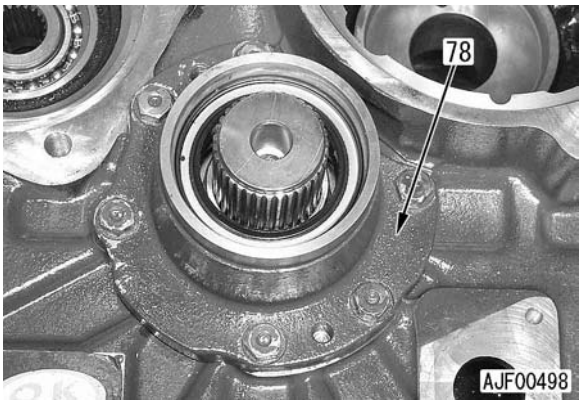



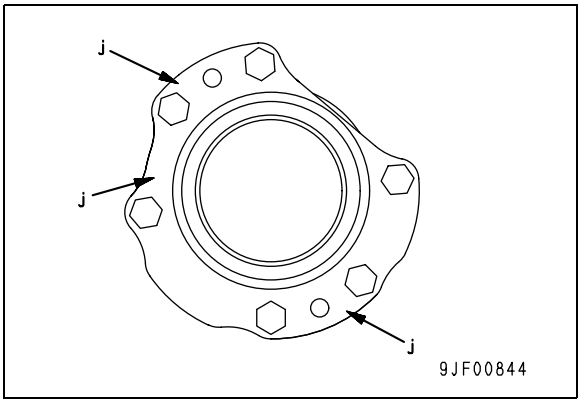

24. Adjusting pre-load on output shaft taper roller bearing
    1) Install cage (78) without inserting any shim.

        Mounting bolt:
        **4.80 ± 0.98 Nm {0.5 ± 0.1 kgm}**

    2) Rotate the output shaft 20 turns and check the tightening torque of the mounting bolts tightened in step 1).
        ★ If the tightening torque has changed, repeat steps 1) and 2), and then check again.

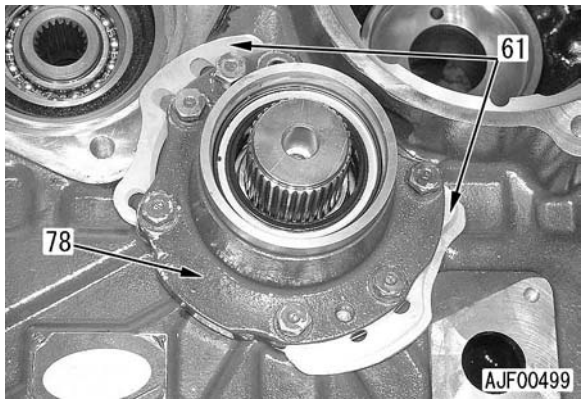
3) If the tightening torque has not changed, measure the clearances at 3 places (j) of cage (78) and obtain average (k).
   ★ To confirm that the bearing is not leaning, check that the dispersion of clearances at 3 places (j) is 0.15 mm or less. If the dispersion is large, the bearing is not installed normally or there is another cause. In this case, eliminate the cause and reduce the dispersion to 0.15 mm or less.



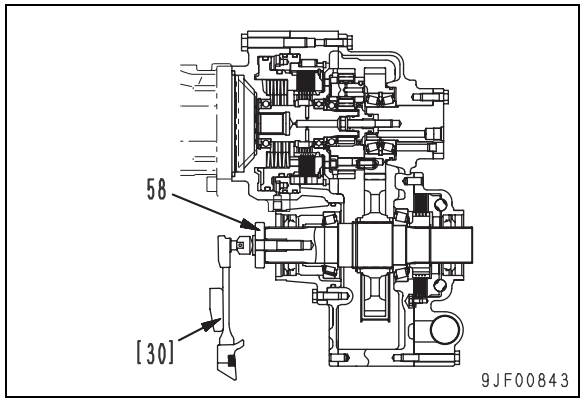




4) Calculate shim thickness (t).
   • Shim thickness (t) = Average of clearance (k) + 0.15 mm - 0.20 mm
5) Insert selected shims (61) between cage (78) and the front case.
6) Tighten the cage mounting bolts.

   Mounting bolt:
   **98 - 122.5 Nm {10 - 12.5 kgm}**



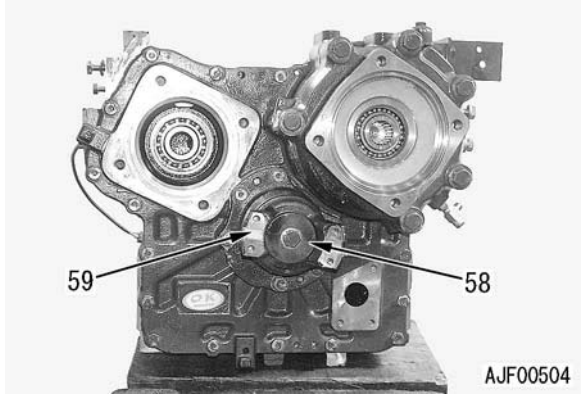

7) Install holder (58) and the holder mounting bolt to the output shaft.
8) Set torque wrench [30] to the holder mounting bolt and measure the rotating torque of the output shaft.
   ★ Measure the rotating torque without installing the front and rear couplings.
   • Rotating torque of output shaft:
   **3.9 - 5.9 Nm {0.4 - 0.6 kgm}**




25. Coupling
1) Install coupling (59) on the cage side.

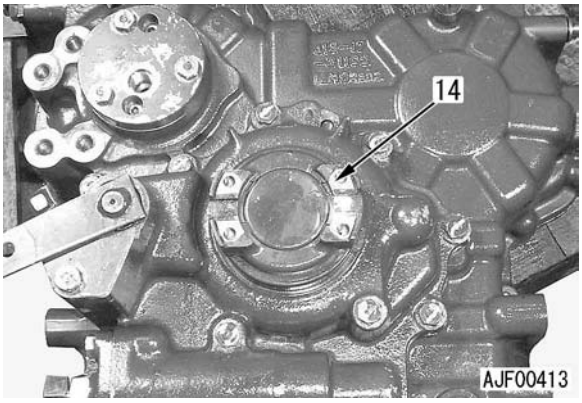
   Spline of coupling: **Lubricant containing molybdenum disulfide (LM-G)**

2) Install holder (58) and tighten the mounting bolt.



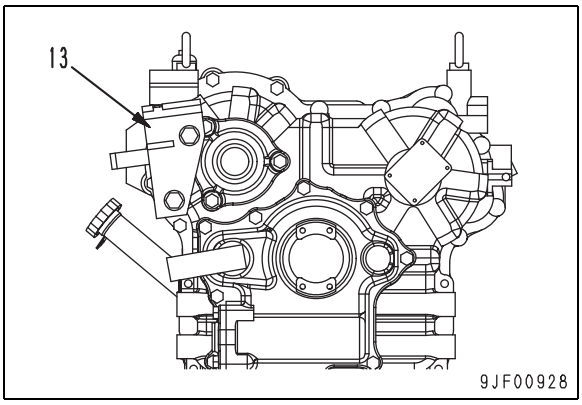
3) Install coupling (14) on the parking brake side.

Spline of coupling: **Lubricant containing molybdenum disulfide (LM-G)**

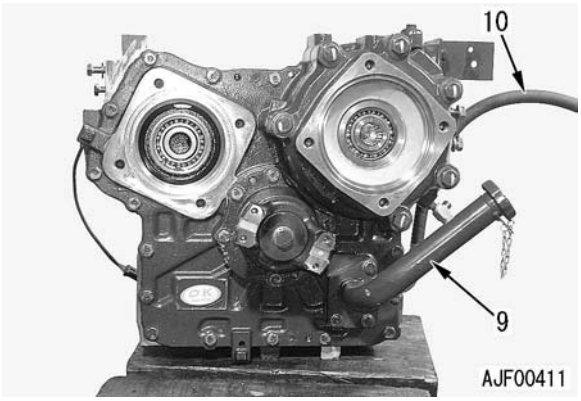



26. Parking brake bracket
    1) Install parking brake bracket (13).

Mounting bolt:
**245 - 309 Nm {25.0 - 31.5 kgm}**




27. Oil supply pipe and hose
    1) Connect hose (10) to the transfer case strainer.
    2) Install oil supply pipe (9).



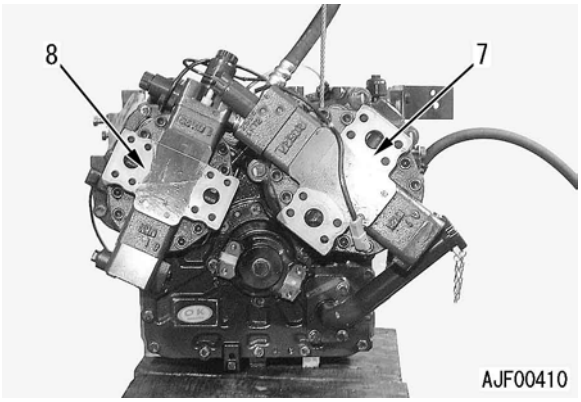

28. HST motor
    1) Sling and install HST motor 2 (8).

Spline of HST motor 2: **Lubricant containing molybdenum disulfide (LM-G)**

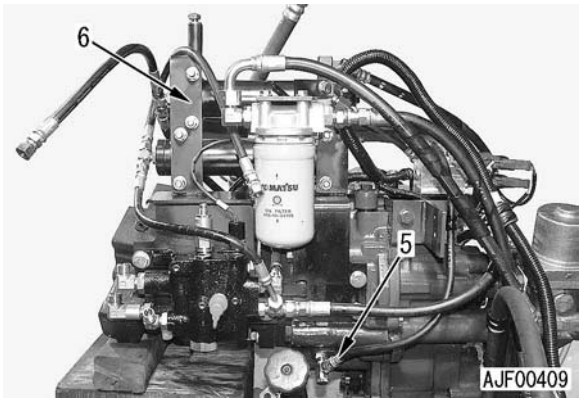
Mounting bolt:
**245 - 309 Nm {25.0 - 31.5 kgm}**

    2) Sling and install HST motor 1 (7).
    ★ Do not apply LM-G to the spline of HST motor (1).

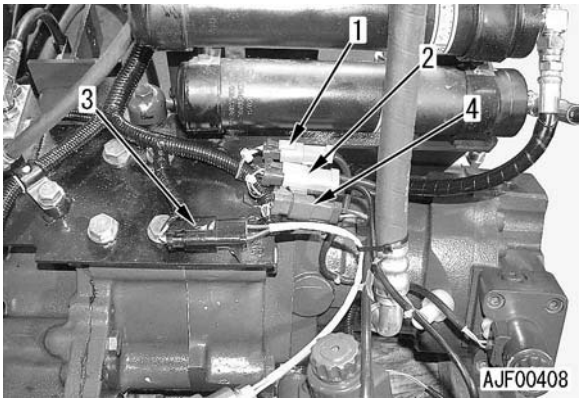
Mounting bolt:
**245 - 309 Nm {25.0 - 31.5 kgm}**



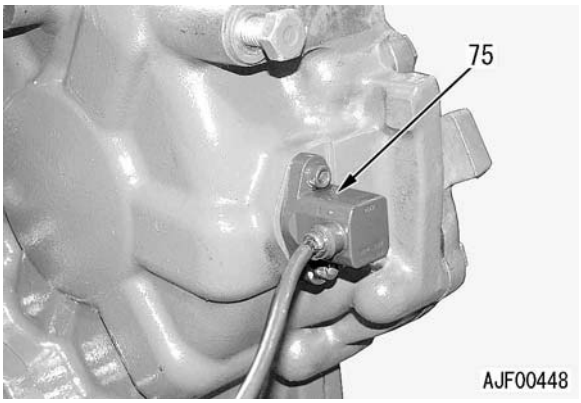
29. Brake accumulator
    1) Install brake accumulator and transfer oil filter bracket assembly (6) with the 6 mounting bolts.
    2) Connect clutch port hose (5).




    3) Connect wiring connectors T06 (1), T07 (2), T10 (3), and T11 (4).




30. Speed sensor
    1) Install speed sensor (75).



# REMOVAL, INSTALLATION OF PARKING BRAKE ASSEMBLY

## REMOVAL

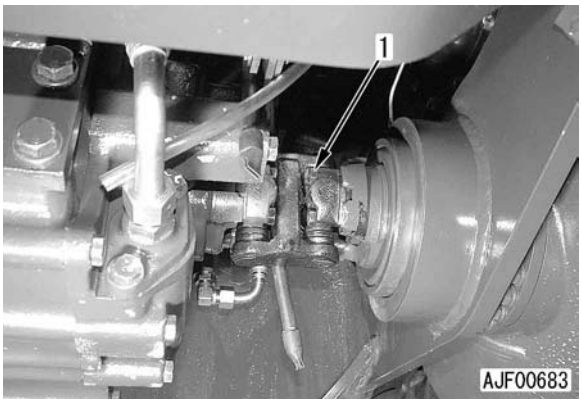
Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

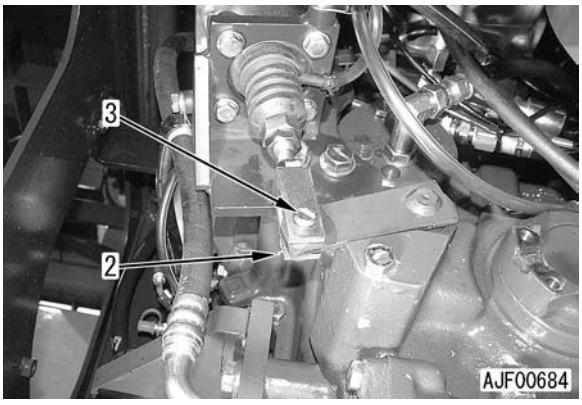
1. Drain the transfer oil.

   Transfer case: **96 ℓ**

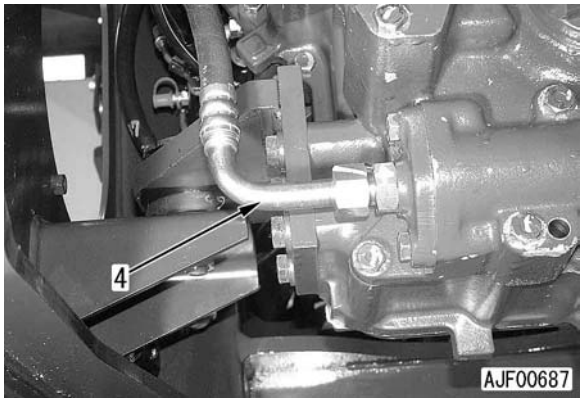
2. Disconnect rear drive shaft (1). [*1]



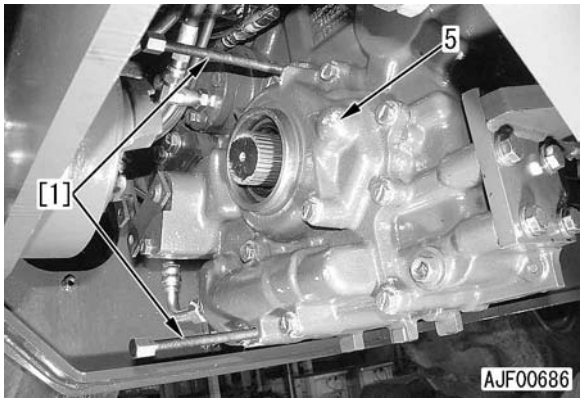

3. Lower (Open) the parking brake lever.
4. Remove cotter pin (2) and pin (3) of the parking brake cylinder. [*2]




5. Turn starting switch off.
6. Disconnect transfer lubricating oil pump suction hose (4) from the parking brake.




7. Remove the parking brake mounting bolts. Using forcing screws [1], remove parking brake assembly (5). [*3]



## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Rear drive shaft mounting bolt:
**59 - 74 Nm {6.0 - 7.5 kgm}**

★ When installing the drive shaft, check that the key way of the spider cap is fitted in the key way of the mating yoke, and then tighten the mounting bolts.

★ When installing the rear drive shaft, check that the lateral runout of the rear axle and transfer from each other is less than 3 mm. If the runout is 3 mm or larger, shift the transfer cushion and transfer mount to reduce the runout.

[*2]

★ Insert cotter pin (2) in pin (3), and then open it to both sides by 180 degrees.

[*3]

★ Using the guide bolt, install the parking brake.

Parking brake mounting bolt:
**235 - 385 Nm {23.5 - 29.5 kgm}**

- Refilling with oil (Transfer case)
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

  Transfer case: **6.9 ℓ**

# DISASSEMBLY, ASSEMBLY OF PARKING BRAKE ASSEMBLY

## SPECIAL TOOLS

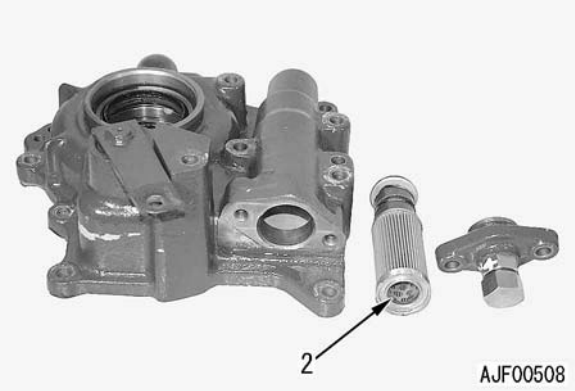
| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| D | 3 | 790-101-5201 | Push tool kit | ■ | 1 | | |
| | | • 790-101-5301 | • Plate | | 1 | | |
| | | • 790-101-5221 | • Grip | | 1 | | |
| | | • 01010-51225 | • Bolt | | 1 | | |
| | 4 | 793T-417-1120 | Push tool | ■ | 1 | N | ○ |
| | | 790-101-5221 | Grip | ■ | 1 | | |
| | | 01010-81225 | Bolt | ■ | 1 | | |

## DISASSEMBLY

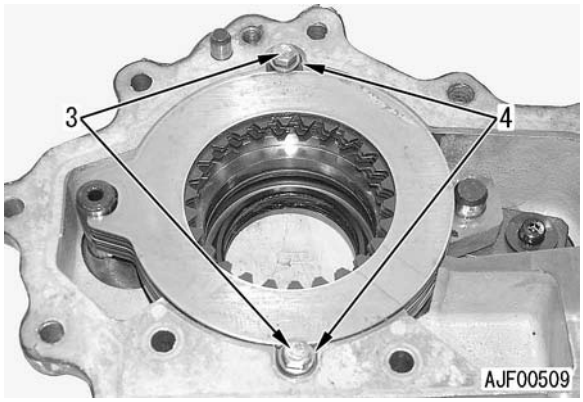
1. Strainer
   1) Remove cover (1).



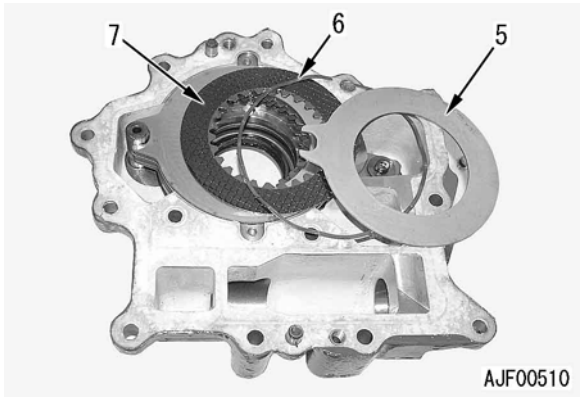

   2) Remove strainer (2).



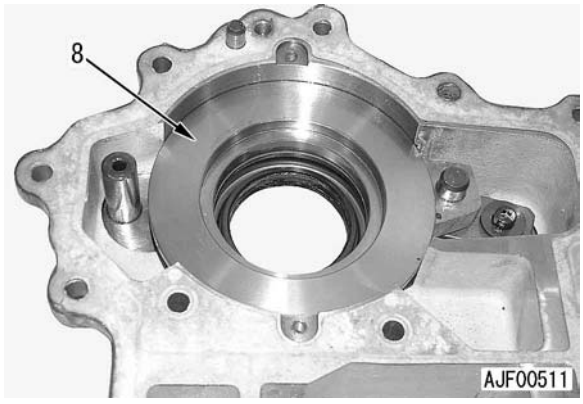

2. Plates, discs, and springs
   1) Remove 2 clamping bolts (3) and 2 spacers (4).
      ★ Since the spring tension is applied, loosen the 2 clamping bolts evenly.



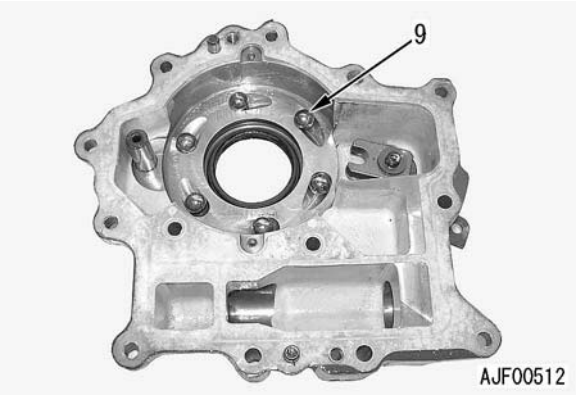

   2) Remove 5 plates (5), 4 wave springs (6), and 4 discs (7).



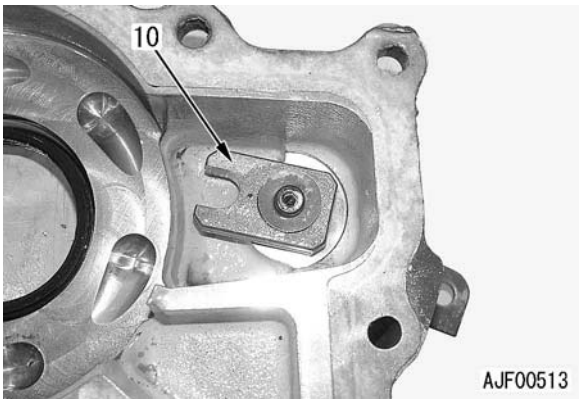

3. Cam plate
   1) Remove cam plate (8).



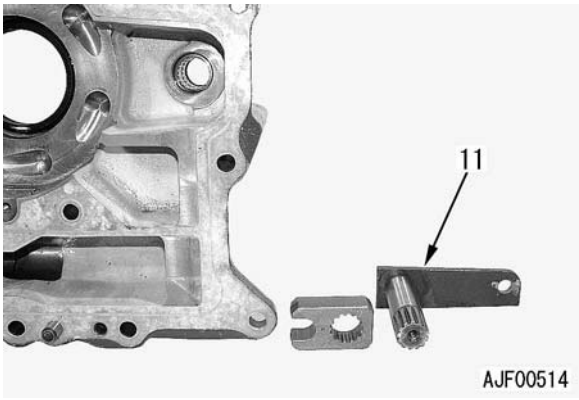
4. Ball
   1) Remove 6 balls (9).



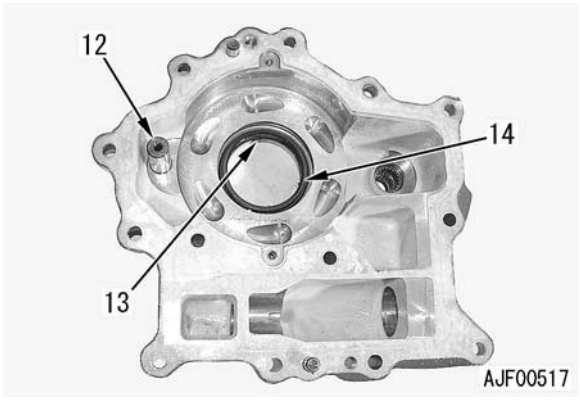

5. Lever
   1) Remove the mounting bolt and lever (10).



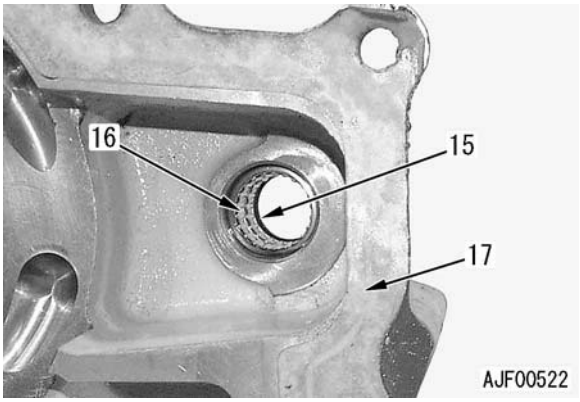

   2) Remove lever (11).




6. Pin
   1) Remove pin (12).
7. Dust seal and oil seal
   1) Remove dust seal (13) and oil seal (14).




8. Oil seal and bearings
   1) Remove oil seal (15).
   2) Remove 2 bearings (16) from parking brake case (17).



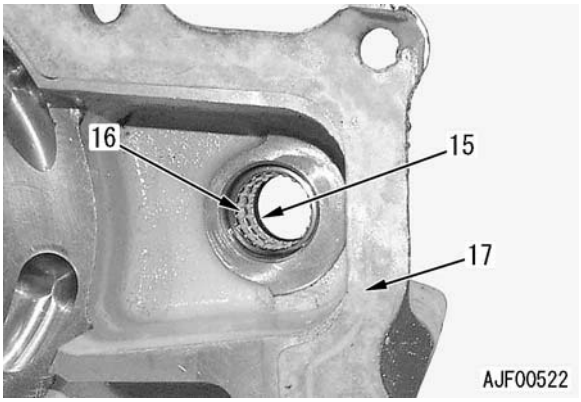
## ASSEMBLY

★ Clean the all parts and check them for dirt or damage. Coat their sliding surfaces with transfer oil (E010-CD) before installing.
★ Do not reuse the gasket but remove it completely.

1. Oil seal and bearings.
   1) Install 2 bearings (16) to parking brake case (17).
   2) Install oil seal (15).

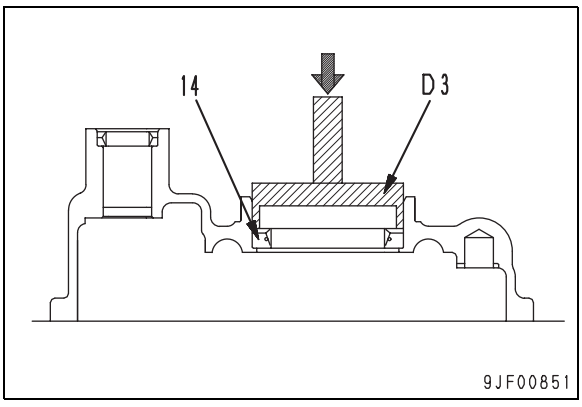
      Oil seal: **Grease (G2-LI)**

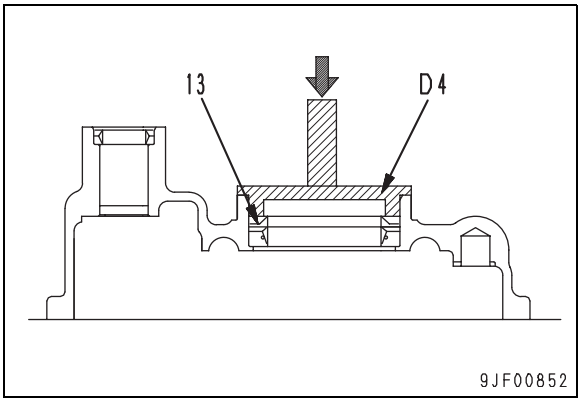
      (Although the gasket is fitted to the parking brake fitting face in the drawing, perform the work without fitting the gasket.)




2. Oil seal and dust seal
   1) Using tools **D3** and **D4**, press fit oil seal (14) and dust seal (13).

      Lips and clearances of oil seal and dust seal: **Silicone grease (ThreeBond 1855 or equivalent)**



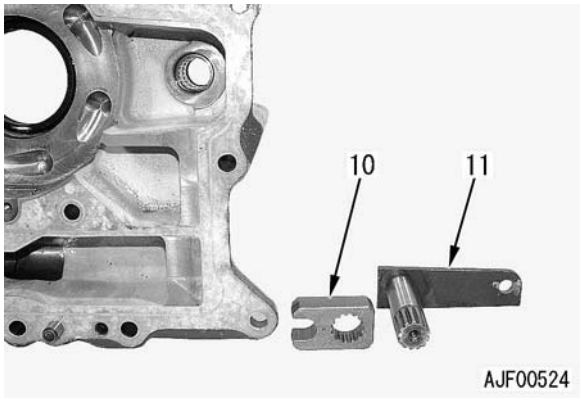

3. Pin
   1) Install pin (12).
      ★ Install the pin with the grooved part outward.
      ★ Check that dirt is not sticking to the ball groove and inside of the housing.

      (Although the gasket is fitted in the drawing, perform the work without fitting the gasket.)




4. Lever
   1) Install levers (11) and (10).

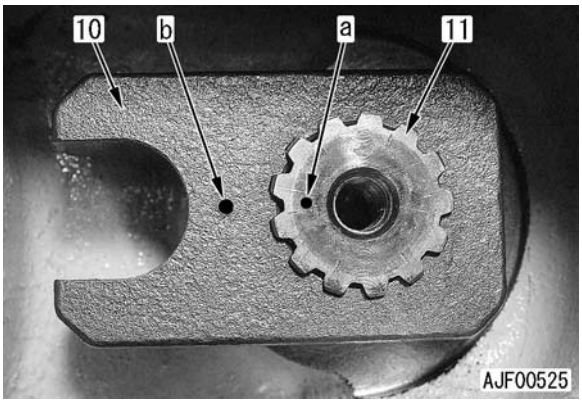
      (Perform the work with the gasket removed.)



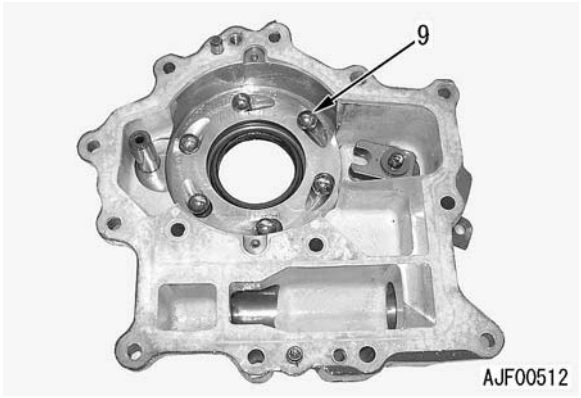
★ When installing the levers (11) and (10), match their match marks (a) and (b).

Mounting bolt: **Adhesive (LT-2)**

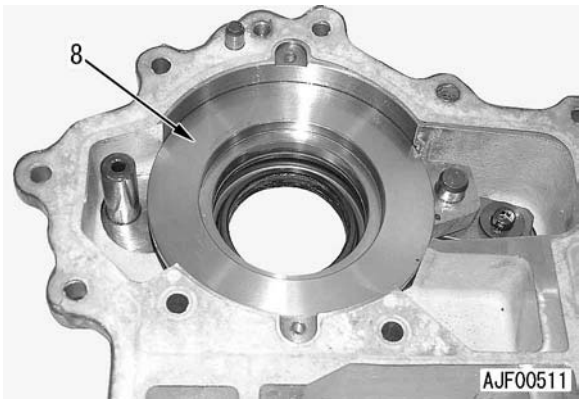
Mounting bolt:
**27 - 34 Nm {2.8 - 3.5 kgm}**



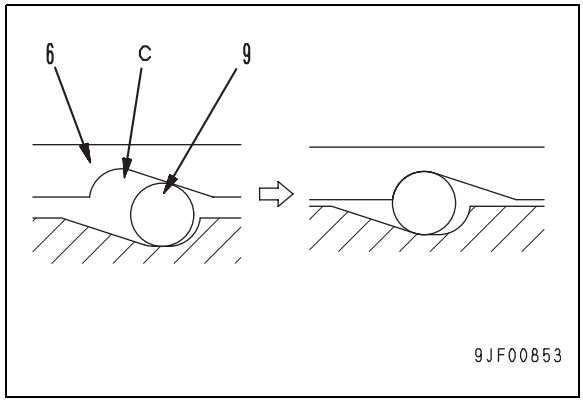

5. Balls
   1) Install 6 balls (9).
      ★ Check that dirt is not sticking to the balls.
      (Perform the work with the gasket removed.)



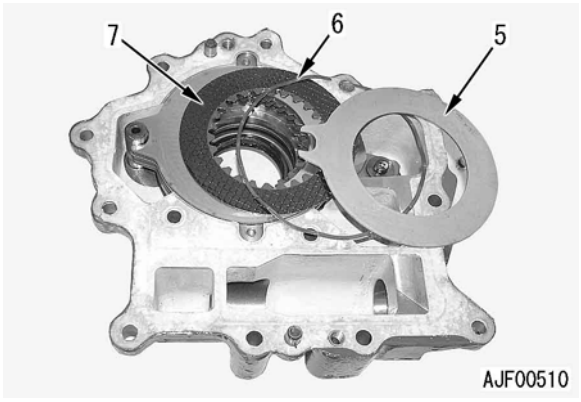

6. Cam plate
   1) Install cam plate (8).
      ★ Check that dirt is not sticking to the ball grooves, inside of parking brake housing, cam plate, discs, and plates.
      (Perform the work with the gasket removed.)




★ Move the cam plate (8) several times so that balls (9) will be fitted to grooves "c" of cam plate (8).
★ Check that the cam plate does not hitch on the housing.




7. Plates, disc, and springs
   1) Install 4 discs (7), 4 wave springs (6), and 5 plates (5).
      ★ Soak the disc in clean transfer oil for at least 2 minutes before installing them.
      ★ Check that dirt is not sticking to the discs and plates.
      (Perform the work with the gasket removed.)

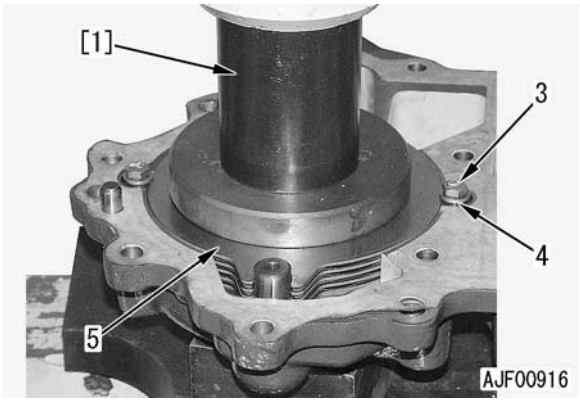


2) Using push tool [1], press plate (5) lightly with a press and install 2 spacers (4) and 2 clamping bolts (3).
   - ★ Take care not to press plate (5) too much and not to damage it.
   - ★ Press plate (5) until it is flush with the parking brake case.
   - ★ Move the lever and check that it returns normally.

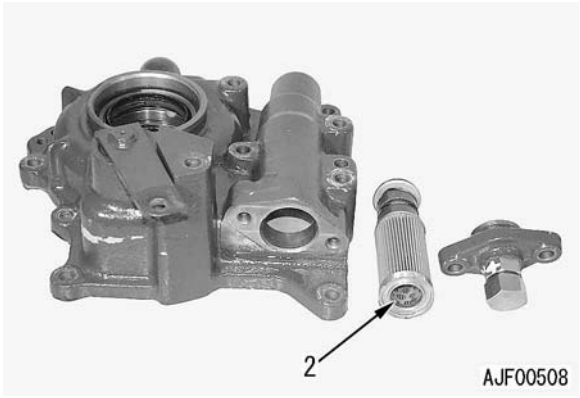
   Clamping bolt: **Adhesive (LT-2)**

   Clamping bolt:
   **19.6 - 27.4 Nm {2.0 - 2.8 kgm}**

   (Perform the work with the gasket removed.)




8. Strainer
   1) Install strainer (2).




2) Install the O-ring and cover (1).

   O-ring: **Grease (G2-LI)**

   Mounting bolt:
   **98 - 122.5 Nm {10 - 12.5 kgm}**



# REMOVAL, INSTALLATION OF FRONT AXLE ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and set chocks under the tires.

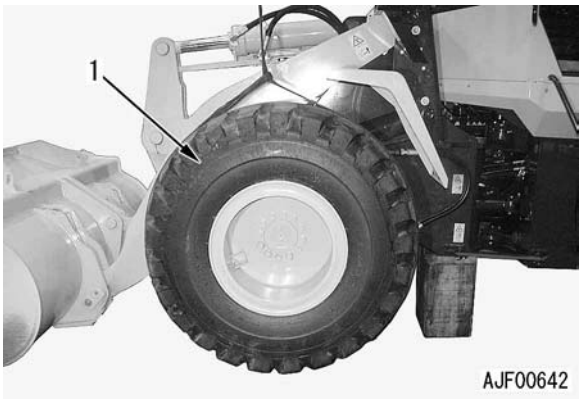
Release the residual pressure in the brake accumulator circuit. For details, see RELEASING REMAINING PRESSURE IN HYDRAULIC CIRCUIT.

1. Raise the chassis with the work equipment and set stands [1] under the frame in front of the front wheels to float the front of the chassis.

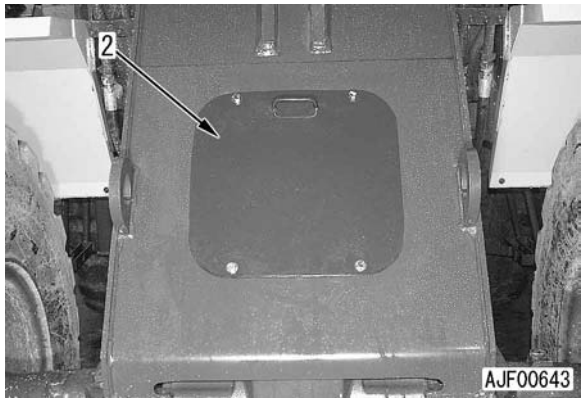



2. Lift off the front wheel (1). [*1]
   ★ Lift off the front wheel on the other side similarly.

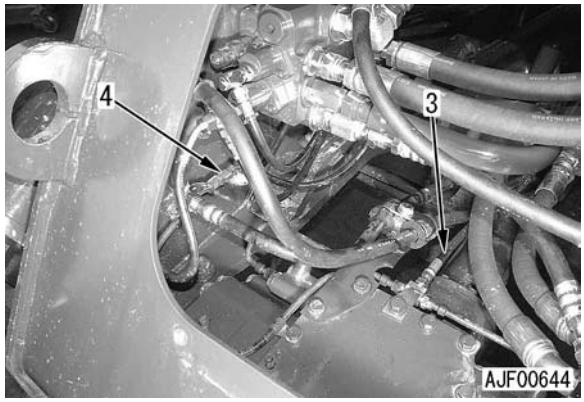
   Front wheel (1 side): **280 kg**



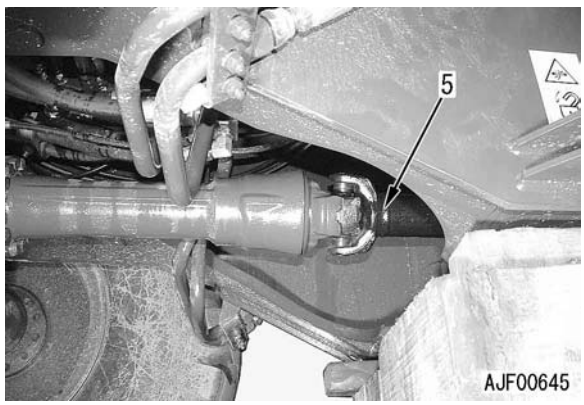

3. Remove work equipment upper cover (2).




4. Disconnect wiring connector F14 (3).
5. Disconnect brake hose (4).

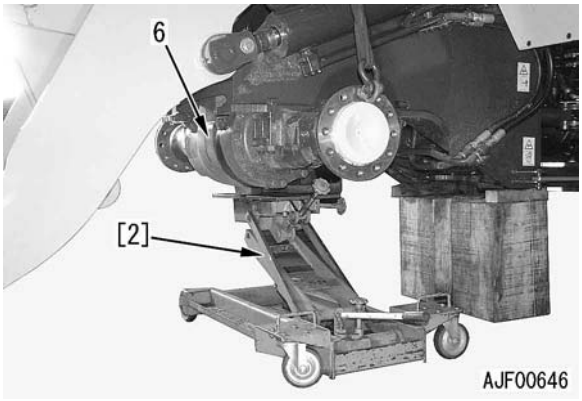



6. Disconnect front drive shaft (5). [*2]



7. Sling front axle assembly (6) temporarily and support it on jack [2]. Remove the 4 mounting bolts on both sides and front axle assembly (6). [*3]

Front axle assembly: **570 kg**




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Front wheel mounting bolt:
**785 - 980 Nm {80 - 100 kgm}**

[*2]

★ When installing the drive shaft, check that the key way of the spider cap is fitted to the key way of the mating yoke, and then tighten the mounting bolts.

Front drive shaft mounting bolt:
**59 - 74 Nm {6.0 - 7.5 kgm}**

[*3]

Front axle mounting bolt:
**785 - 980 Nm {80 - 100 kgm}**

- **Bleeding air**
  Bleed air from the brake system. For details, see TESTING AND ADJUSTING, Bleeding air from brake circuit.

# REMOVAL, INSTALLATION OF REAR AXLE ASSEMBLY

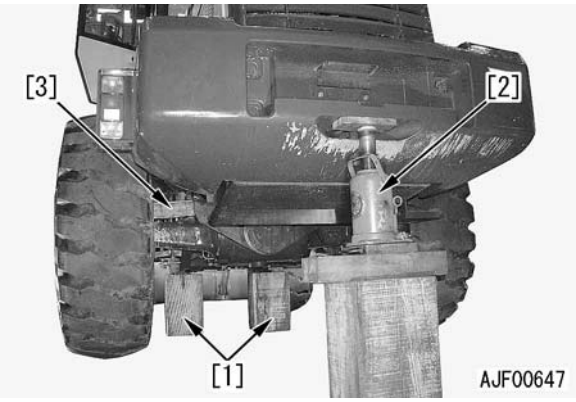
## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and set chocks under the tires.

Release the residual pressure in the brake accumulator circuit. For details, see RELEASING REMAINING PRESSURE IN HYDRAULIC CIRCUIT.

1. Raise the chassis with the work equipment and set stands [1] under the frame in front of the rear wheels to float the rear of the chassis.
2. Support the counterweight on jack [2].
3. Set blocks [3] between top of each side of the rear axle and the rear frame.

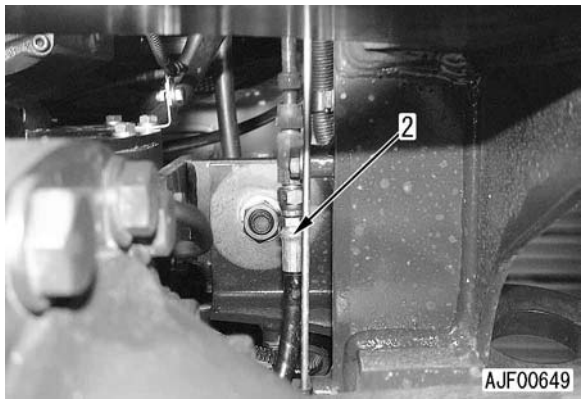



4. Lift off the rear wheel (1). [*1]
   ★ Lift off the rear wheel on the other side similarly.

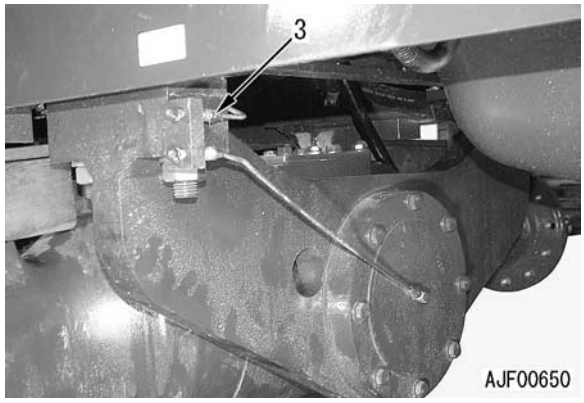
   Rear wheel (1 side): **280 kg**



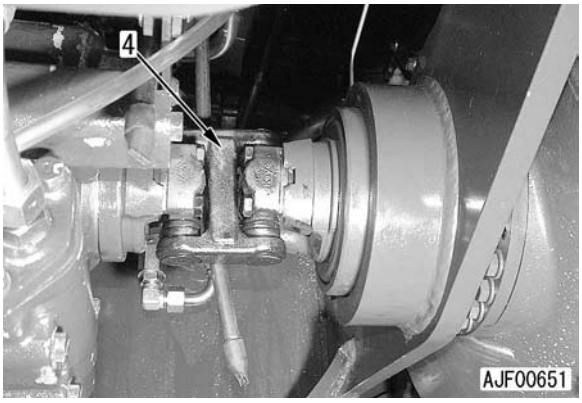

5. Disconnect brake hose (2) from the left inside of the frame.



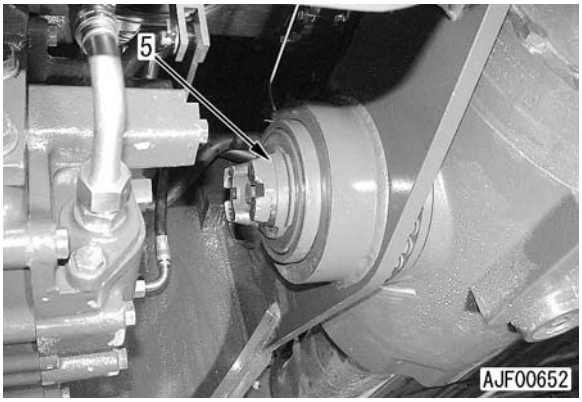

6. Disconnect grease supply tube (3).



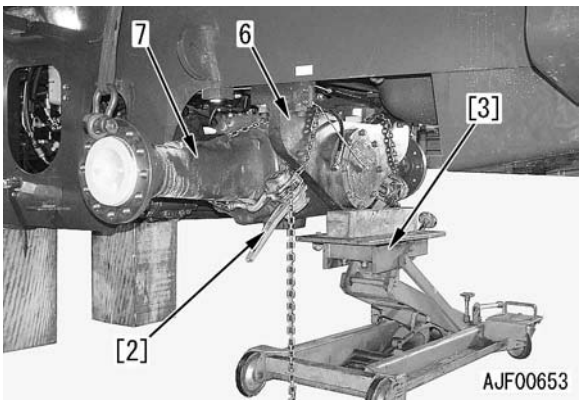
7. Remove rear drive shaft (4). [*2]



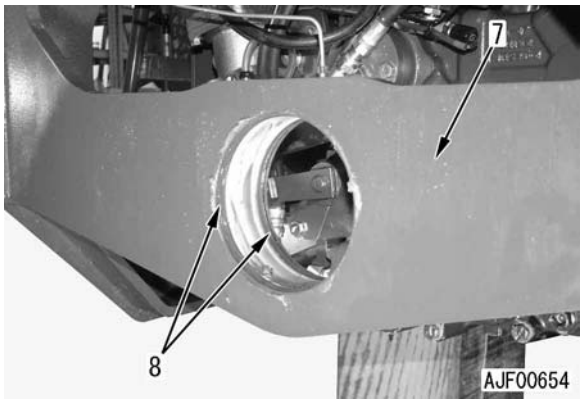

8. Remove the bolts and coupling (5). [*3]
   ★ If the coupling is not removed, dust seal (8) is damaged easily in step 11.




9. Secure support (6) and both sides of the rear axle with lever block [2].
10. Sling rear axle assembly (7) temporarily, support it on jack [3], and remove the mounting bolts of support (6). [*4]

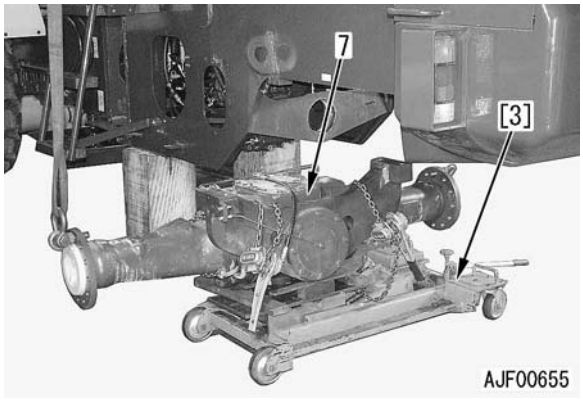



11. Pull out the rear axle assembly toward the rear of the chassis and disconnect it from the rear frame assembly.
   ★ Take care not to damage dust seal (8) of rear frame (7).




12. Lower the crane and jack [3] simultaneously to remove rear axle assembly (7).

   Rear axle assembly: **500 kg**



## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Rear wheel mounting bolt:
**785 - 980 Nm {80 - 100 kgm}**

[*2]

★ Check that the radial runout of the rear axle from the transfer in lateral direction is not larger than 3 mm. If it is larger than 3 mm, reduce it by moving the transfer mount.

★ When installing the drive shaft, check that the key way of the spider cap is fitted to the key way of the mating yoke, and then tighten the mounting bolts.

Rear drive shaft mounting bolt:
**59 - 74 Nm {6.0 - 7.5 kgm}**

[*3]

Coupling mounting bolt: **Adhesive (LT-2)**

Coupling mounting bolt:
**245 - 309 Nm {25 - 31.5 kgm}**

[*4]

Support mounting bolt:
**785 - 980 Nm {80 - 100 kgm}**

- **Bleeding air**
  Bleed air from the brake system. For details, see TESTING AND ADJUSTING, Bleeding air from brake circuit.

# DISASSEMBLY, ASSEMBLY OF AXLE HOUSING ASSEMBLY

## SPECIAL TOOLS

| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| H | 1 | 793T-623-1170 | Push tool | ■ | 1 | | ○ |
| | | 793T-422-1230 | Push tool | ■ | 1 | N | ○ |
| | | 793T-423-1110 | Push tool | ■ | 1 | N | ○ |
| | 2 | 793T-422-1240 | Seal support | ■ | 2 | N | ○ |
| | | 01010-80860 | Bolt | ■ | 6 | | |
| | | 793T-423-1120 | Seal support | ■ | 2 | N | ○ |
| | | 01010-80860 | Bolt | ■ | 6 | | |
| | 3 | 793T-659-1110 | Push tool | ■ | 1 | | ○ |
| | | 790-201-2750 | Spacer | ■ | 1 | | |
| | 4 | 793T-423-1150 | Holder | ■ | 1 | N | ○ |

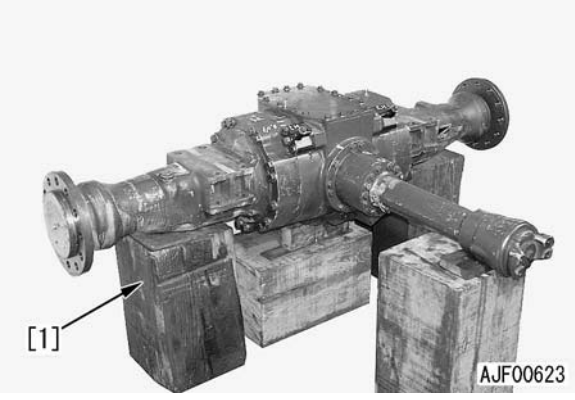
## DISASSEMBLY

★ The following photos and illustrations show the front axle housing as an example.

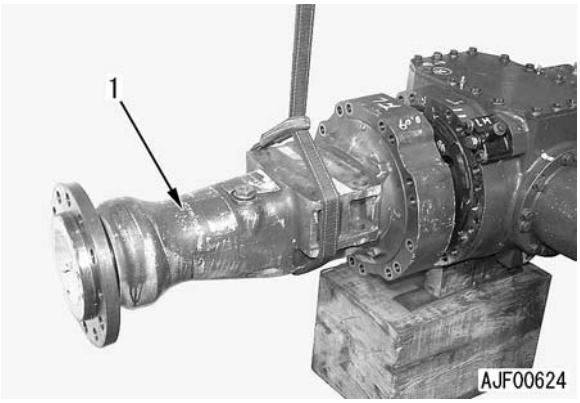
1. Draining oil

   Axle (Each of front and rear axles): **18 ℓ**

2. Axle assembly
   1) Set the axle assembly on block [1].
      ★ Set block [1] so that the axle assembly will not lean when the housing assembly on one side is removed.



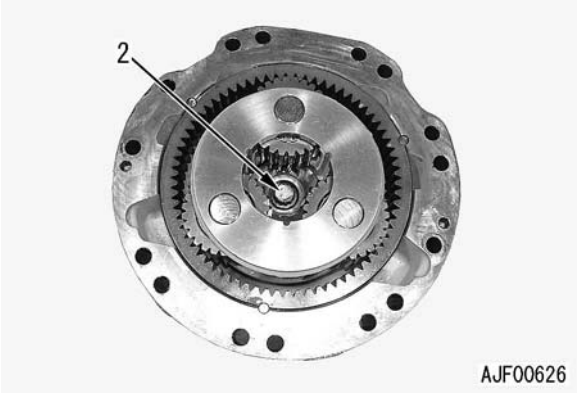

3. Axle housing assembly
   1) Sling axle housing assembly (1) temporarily and remove the housing mounting bolts.
      ★ When removing both axle housing assemblies, make match marks on the housings and differential case so that the housing assemblies will not be mistaken.
   2) Remove axle housing assembly (1).



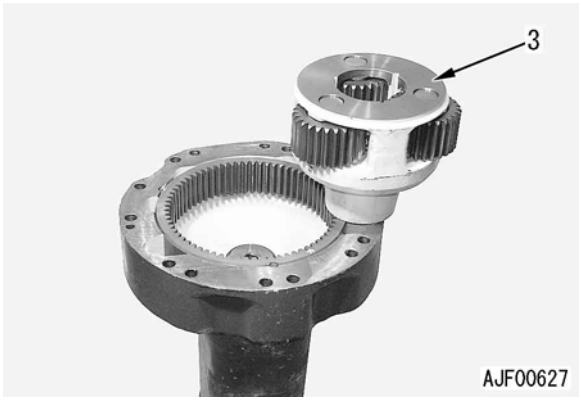

   3) Set axle housing assembly (1) with the planetary carrier side up.



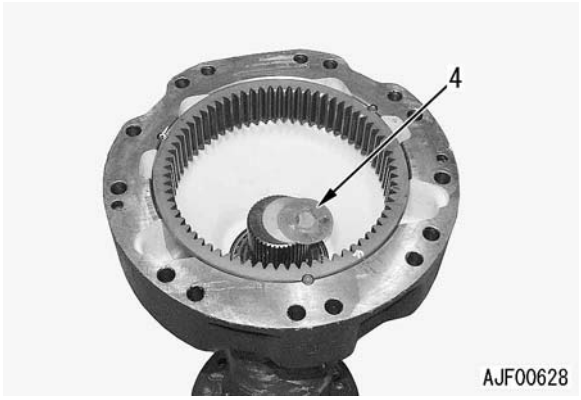

4. Planetary carrier assembly
   1) Remove axle shaft mounting bolt (2).



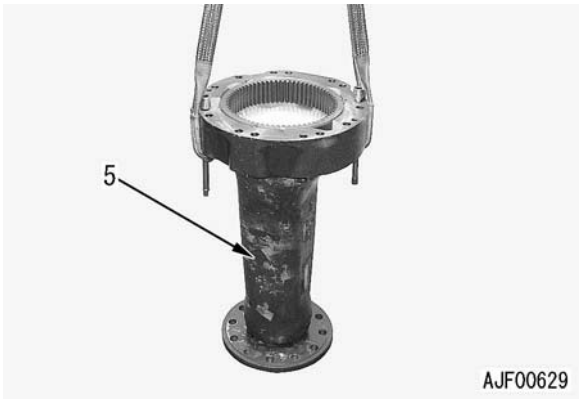
2) Remove planetary carrier assembly (3).



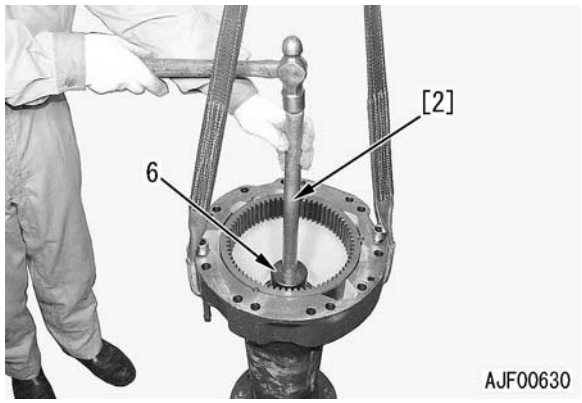

3) Remove shim (4).
★ Check the thickness and quantity of the shims.



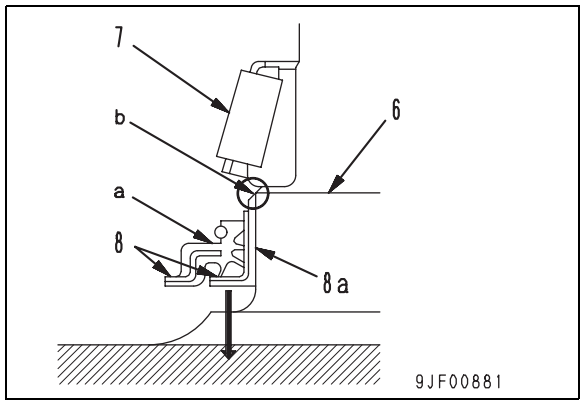

5. Axle shaft
1) Sling axle housing assembly (5) about 20 mm.



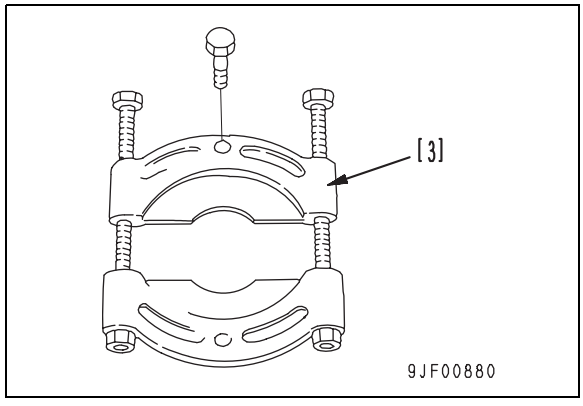

2) Hit the end of axle shaft (6) with copper hammer [2] to drive it out.



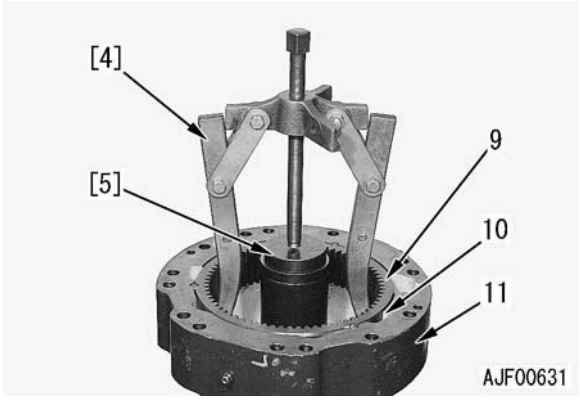

6. Axle shaft bearing
★ Do not heat the bearing to remove it or cut it with gas.
1) When removing bearing (7) from axle shaft (6), evenly push in part (a) around the oil seal and sleeve (8) with a screwdriver toward the flange.
2) Make clearance (b) at the contact part of bearing (7) and sleeve (8a) to hitch the claws of the puller.



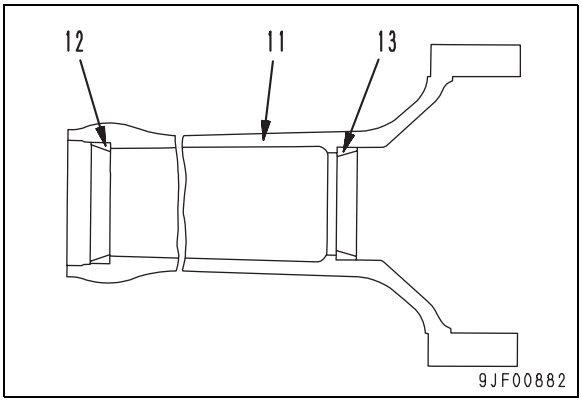

3) Install bearing puller [3] to the bottom of the bearing and it securely.
4) Install bearing puller [3] to clearance (b).
5) Tighten the bolts of bearing puller [3] to remove bearing (7).
6) Remove oil seal (8).



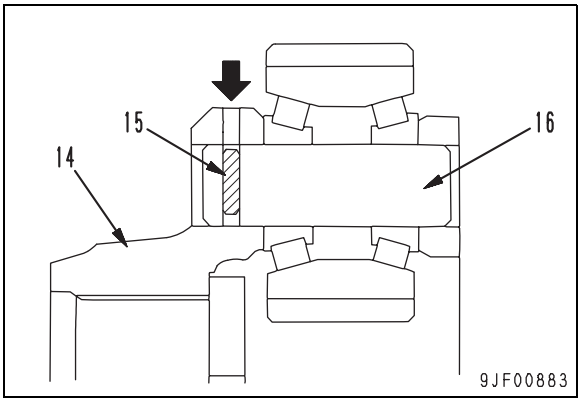
7. Axle housing
   1) Using puller [4], pull up ring gear (9) and 3 pins (10) evenly to remove them from axle housing (11).
      ★ Install spacer [5] to the bolt end of the puller [4] to adjust the height.
      ★ Take care that the claws of the puller will not come off the ring gear.

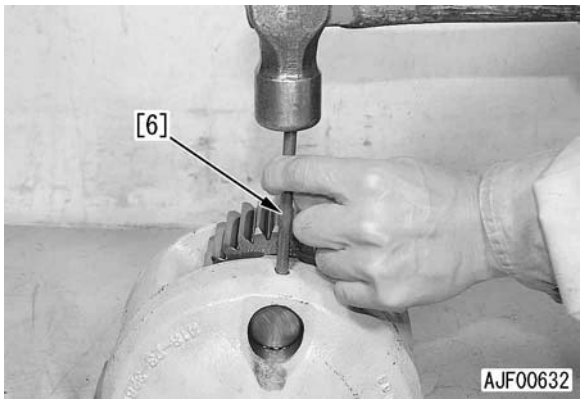



   2) Remove outer races (12) and (13) from axle housing (11).

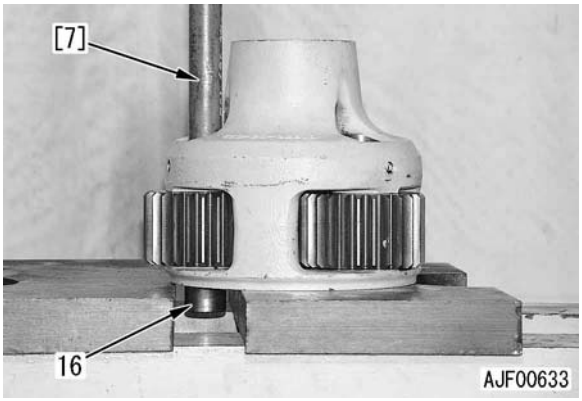


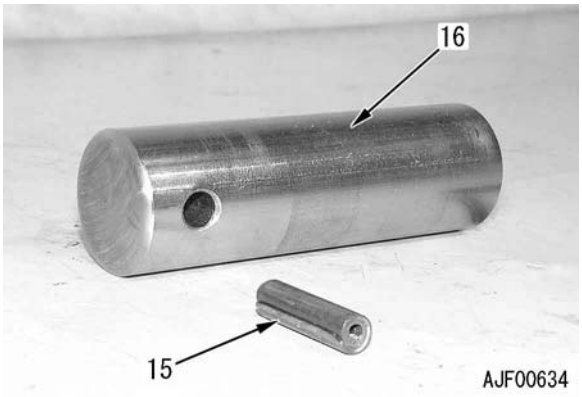

8. Planetary carrier
   1) Using push tool [6], drive in roll pin (15) of planetary carrier (14) until it is in the range of shaft (16).
      ★ Take care not to drive in the roll pin too deep.



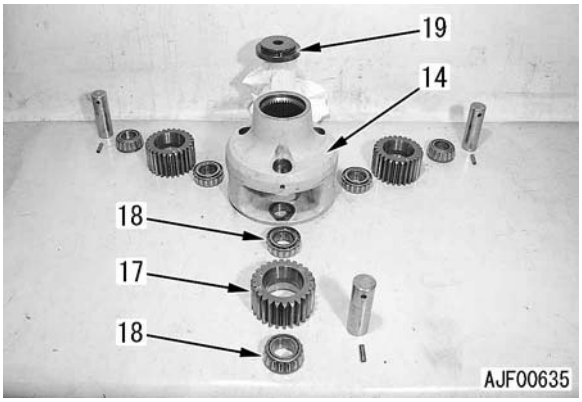



2) Using push tool [7], push out shaft (16) with a press.



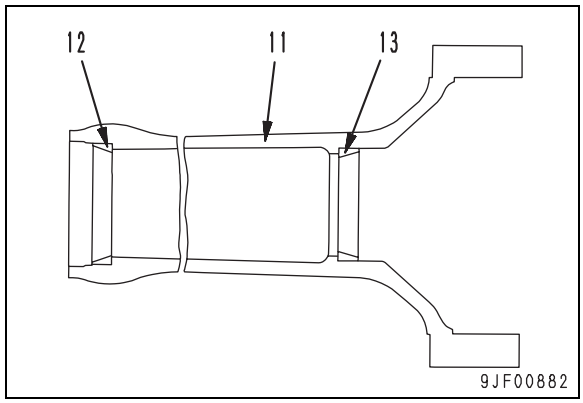




3) Remove pinion gear (17), bearings (18), and spacer (19) from planetary carrier (14).

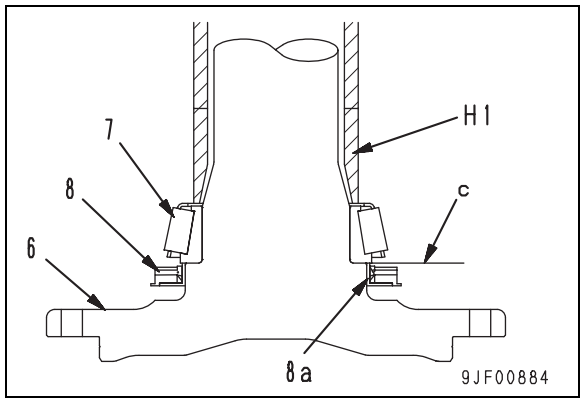



## ASSEMBLY

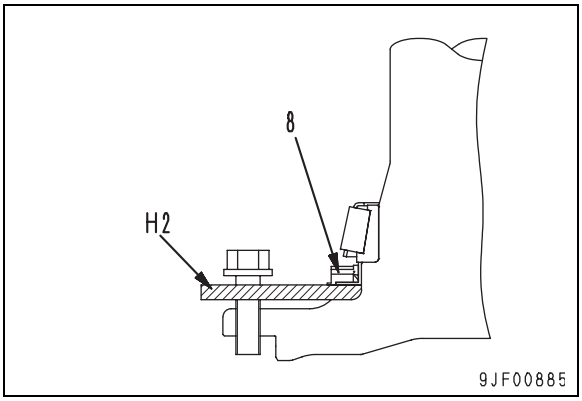
1. Axle housing and axle shaft
   1) Press fit bearing outer races (12) and (13) to axle housing (11).




   2) Using tool **H1**, press fit seal (8) and bearing (7) to axle shaft (6) simultaneously.
      ★ Press fit the seal and bearing until oil seal sleeve (8a) is flush with shaft end (c), and then check that there is not clearance between oil seal sleeve (8a) and bearing (7).



3) Install tool **H2** under oil seal (8).
   ★ Adjust tool **H2** so that its top will lightly touch oil seal (8) and the clearance will be even.



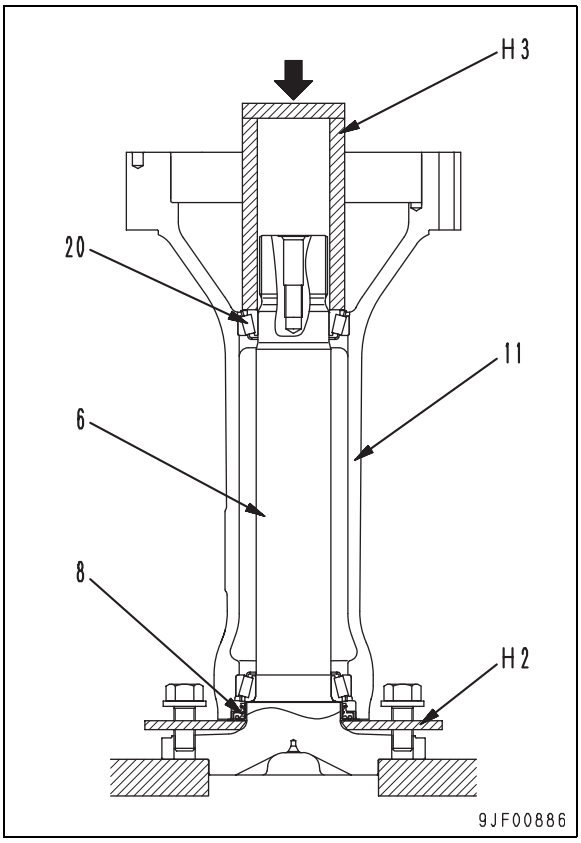

2. Axle shaft bearing
   1) Erect axle shaft (6) on the block and fix it securely.
   2) Sling axle housing (11) vertically, and then lower it slowly.
      ★ Install the front axle, matching it to the oil seal, and insert the axle housing by utilizing its weight.

      Fitting part of oil seal and bearing (front axle): **Axle oil**

      ★ After installing the housing, leave tool **H2** installed until stop 4).
   3) Using tool **H3**, press fit bearing (20) to axle shaft (6).
      ★ Press fit the bearing, turning the axle housing with the hand.

      Outside of bearing: **Axle oil**

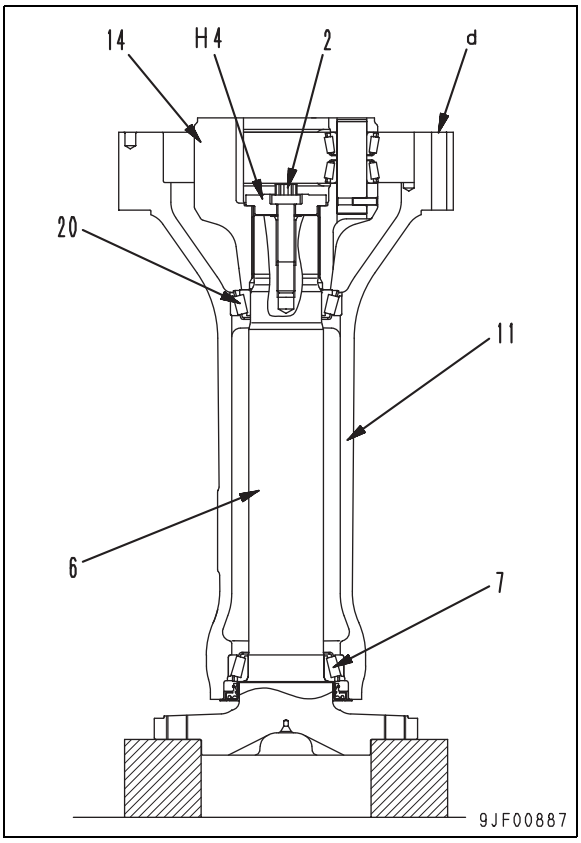
   4) Remove tool **H2** horizontally.
      ★ Check that oil seal (8) does not lean.
      ★ Check that the clearance between axle housing (11) and oil seal (8) is 0.2 mm or less.




3. Adjusting end play
   1) Install planetary carrier (14) to the spline of axle shaft (6) and tighten tool **H4** with mounting bolt (2).
      ★ Install planetary carrier (14) without gear.
      ★ Remove the all adhesive from the bolt hole of the axle shaft and mounting bolt.
   2) Turning axle housing (11), tighten holder mounting bolt (2).

      Mounting bolt: **490 - 608 Nm {50 - 62 kgm}**

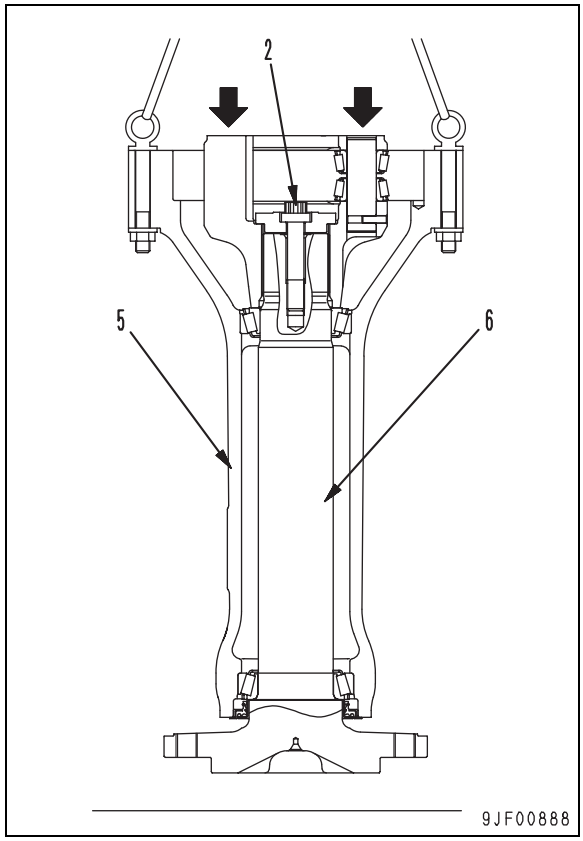
      ★ Fit the bearing sufficiently and check that the end play is 0 - 0.1 mm.
   3) After fitting bearings (7) and (20), measure the starting torque at hole (d) of axle housing (11).
      • Starting torque
        Front axle: **39.2 - 63.7 N {4.0 - 6.5 kg} (Including seal resistance of 17.64 N {1.8 kg})**
        Rear axle: **34.3 - 63.7 N {3.5 - 6.5 kg} (Including seal resistance of 14.7 N {1.5 kg})**




★ If the starting torque is less than the standard value, press fit the bearings again and repeat the work from step 2.

★ If the starting torque exceeds the standard value, adjust it according to the following procedure.

4) Loosen holder mounting bolt (2) 1 - 2 turns.
5) Sling axle shaft and housing assembly (5) 20 - 30 mm by installing wire ropes to 2 parts, similarly to installation of the axle hosing.
6) Turning axle shaft (6), hit the flange with a copper hammer in the direction of the arrow to drive out axle shaft (6).
7) Repeat steps 2) and 3) so that the starting torque will be in the standard value range.

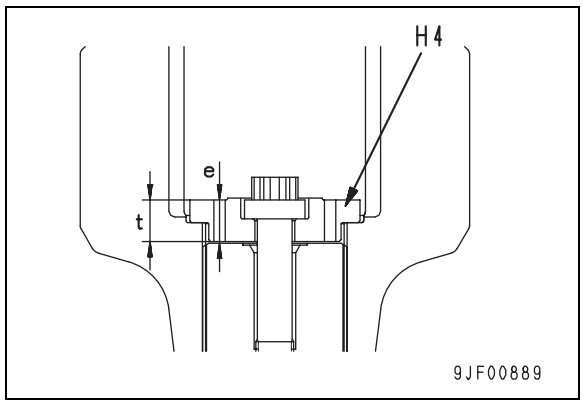



8) Using a depth micrometer, measure distance (e) from the end of tool **H4** to the end of the axle shaft.

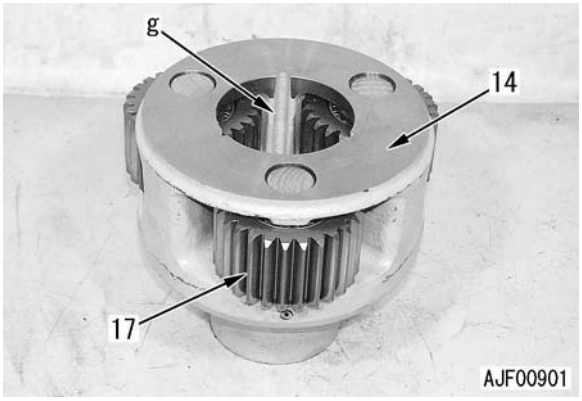
★ Set the value obtained by subtracting thickness (t) of tool **H4** from dimension (e) as (e-t).

• Thickness of shim = (e-t) $^{+0.05}_{0}$

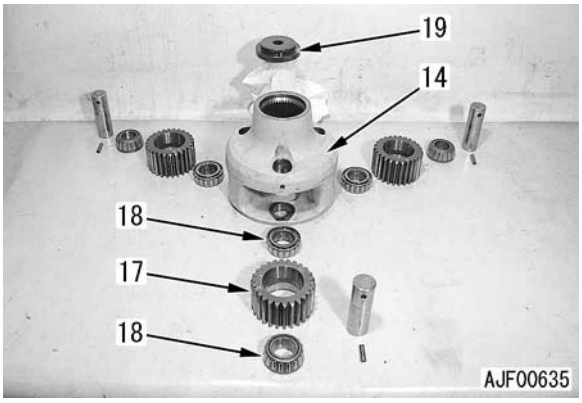
9) After deciding the thickness of the shim, remove planetary carrier (14).



4. Planetary carrier
   1) Install spacer (19) in planetary carrier (14).
      ★ Insert the spacer from (g) side of planetary carrier (14) before installing gear (17).

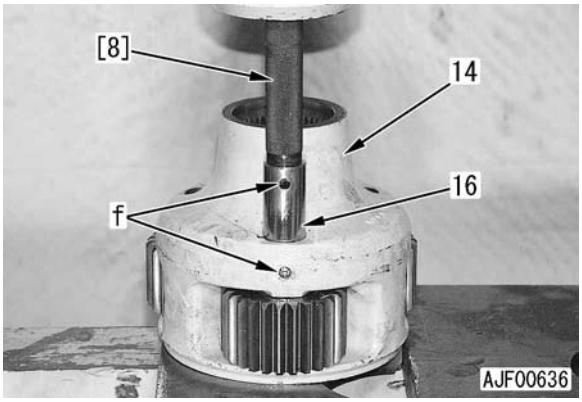



   2) Raise spacer (19), then install gear (17) and bearings (18).

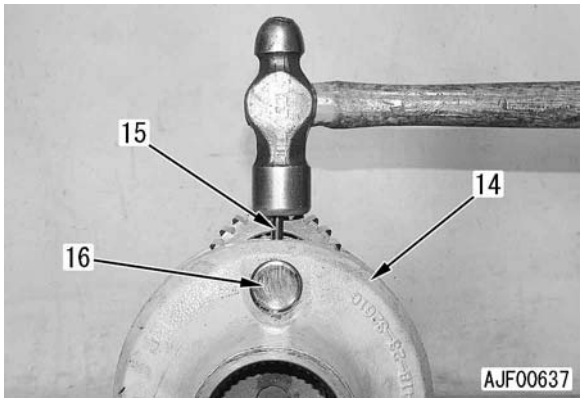



   3) Using push tool [8], press fit shaft (16) to planetary carrier (14).
      ★ When press fitting, match pin holes (f).

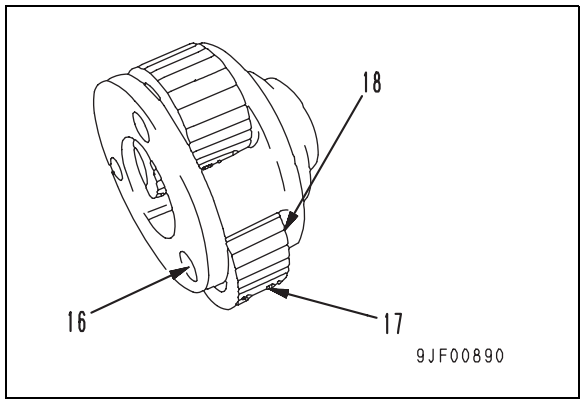
      Shaft: **Axle oil**



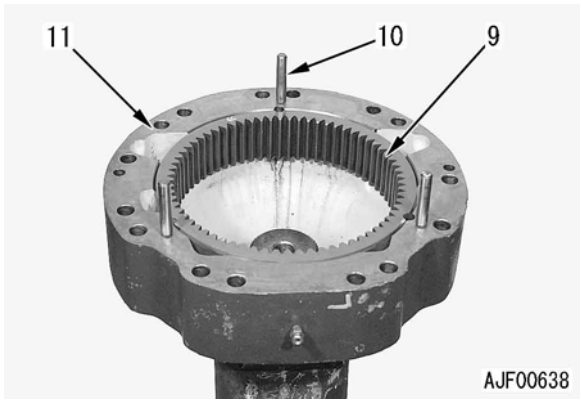

      ★ Matching the holes of shaft (16) and roll pin (15), drive roll pin (15) so that it will be flush with planetary carrier (14).



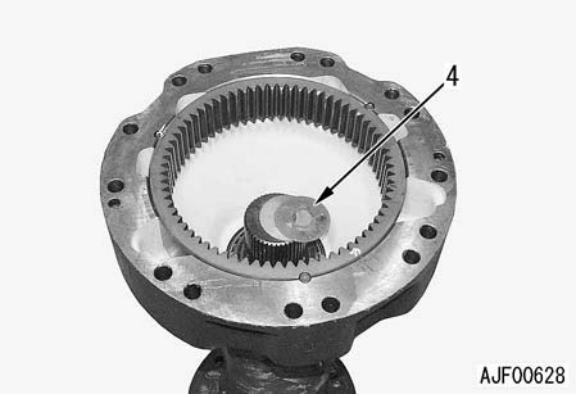

   4) Hit the end of shaft (16) and the differential side of gear (17) lightly to push back the bearing and check that the gear rotates smoothly.




5. Ring gear
   1) Install ring gear (9) to axle housing (11) and insert 3 pins (10).
      ★ Match the pin holes of the housing and ring gear.

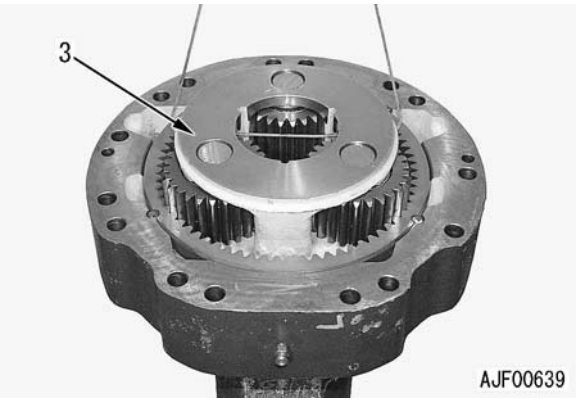


6. Planetary carrier assembly
   1) Install shim (4) selected in steps 3.-8) to the end of the axle shaft.




   2) Sling and install planetary carrier assembly (3).

When installing the planetary carrier, take care not to catch your fingers in the gear.

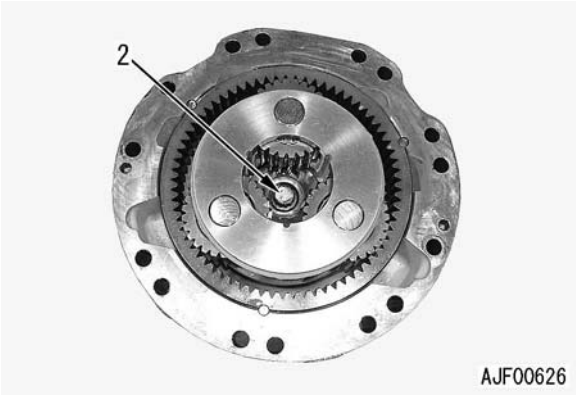



   3) Tighten mounting bolt (2).
      ★ Degrease and clean the bolt hole of the axle shaft and mounting bolt.

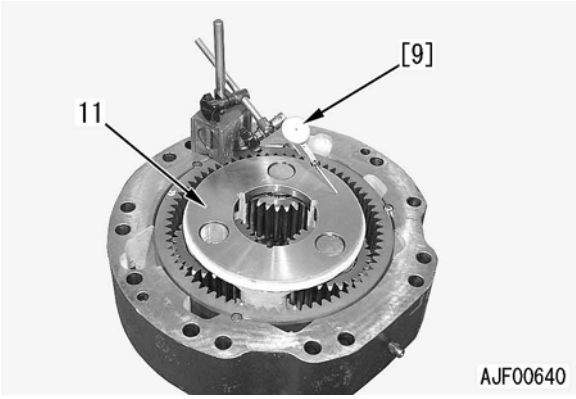
      Mounting bolt: **Adhesive (LT-2)**

      Mounting bolt:
      **490 - 608 Nm {50 - 62 kgm}**

      ★ Clean the shaft end and planetary carrier spline thoroughly before installing.

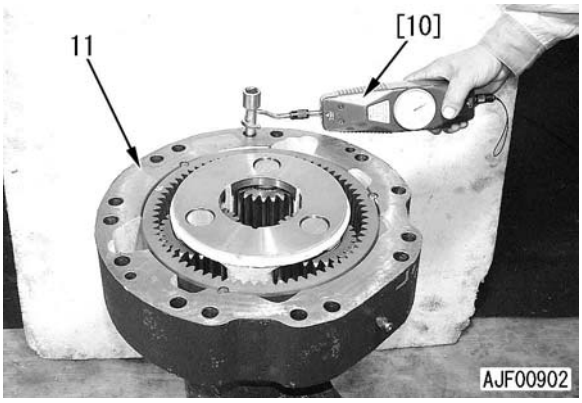



   4) Install dial gauge [9] to axle housing (11) and measure the end play of the planetary carrier.
      • End play of planetary carrier:
      **0 - 0.1 mm**



5) Rotate axle housing (11) 10 or more turns to fit it. Then, using push-pull gauge [10], measure the starting torque at the mounting bolt hole of the axle housing assembly.
   - Starting torque (including seal resistance)
     Front axle: **39.2 - 63.7 N {4.0 - 6.5 kgm}**
     Rear axle: **34.3 - 63.7 N {3.5 - 6.5 kgm}**

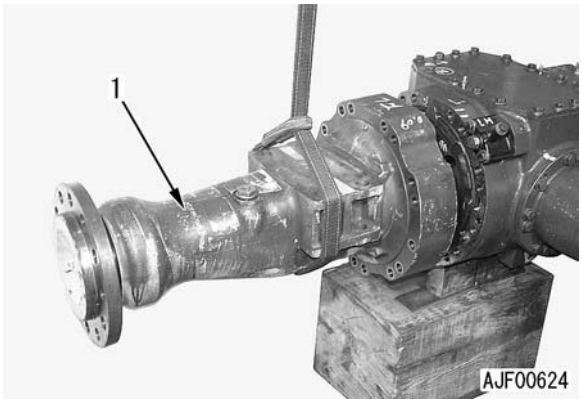
   ★ If the starting torque exceeds the above range, adjust it again, referring to 3 ADJUSTING END PLAY above.




7. Axle housing assembly
   1) Degrease and clean the mating faces of the axle housing and differential housing and apply gasket sealant all over them.

      Mating faces of housings: **Gasket sealant (LOCTITE 515 or equivalent)**

   2) Sling axle housing assembly (1) horizontally and install it carefully, matching it to the spline grooves of the sun gear shaft.




   3) Tighten the axle housing mounting bolts in the diagonal order.

      Mounting bolt: **245 - 309 Nm {25.0 - 31.5 kgm}**

- **Refilling with oil (Axle housing)**
  Tighten the drain plug and add oil through the oil filler to the specified level, and then check the oil level.

  Axle (Each of front and rear): **18 ℓ**

# DISASSEMBLY, ASSEMBLY OF DIFFERENTIAL ASSEMBLY

## SPECIAL TOOLS

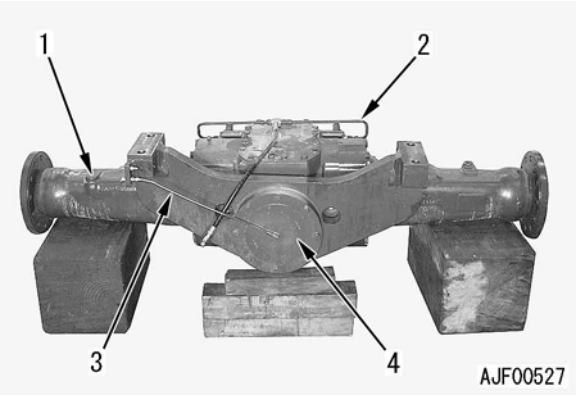
| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| H | 5 | 799-301-1500 | Oil leak tester | ■ | 1 | | |
| | 6 | 797-101-1211 | Wrench | ■ | 1 | | |
| | 7 | 793-615-1100 | Wrench | ■ | 1 | | |
| | 8 | 793T-422-1220 | Push tool | ■ | 1 | N | ○ |
| | 9 | 797T-423-1320 | Push tool | ■ | 1 | | ○ |
| | 10 | 792T-413-1130 | Push tool | ■ | 1 | | ○ |
| | 11 | 793-520-2202 | Installer | ● | 3 | | |
| | 12 | 799-101-5210 | Nipple | ■ | 1 | | |
| | 13 | 790-190-1500 | Pump assembly | ■ | 1 | | |

## DISASSEMBLY

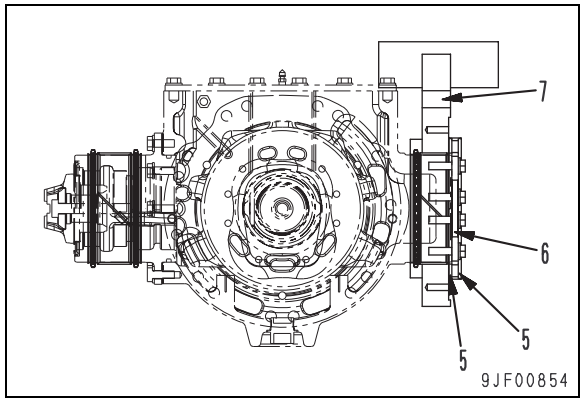
1. Draining oil

   Axle (Each of front and rear axles): **18 ℓ**

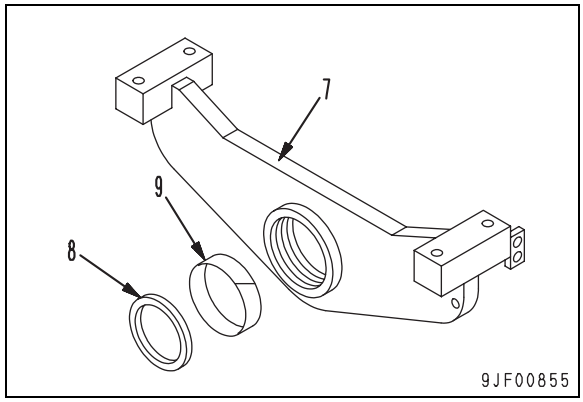
2. Brake piping
   1) Remove brake tube and hose assembly (2).
3. Rear axle support (Only rear axle)
   1) Remove grease tube (3).
   2) Remove cover (4).
      ★ Check the thickness and quantity of the shims.
4. Axle housing
   1) Remove both axle housings (1). For details, see DISASSEMBLY, ASSEMBLY OF AXLE HOUSING.



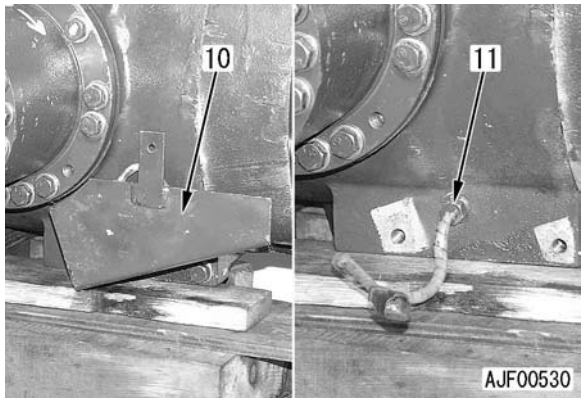

   2) Remove 2 thrust washers (5) and thrust plate (6).
   3) Lift off rear axle support (7).



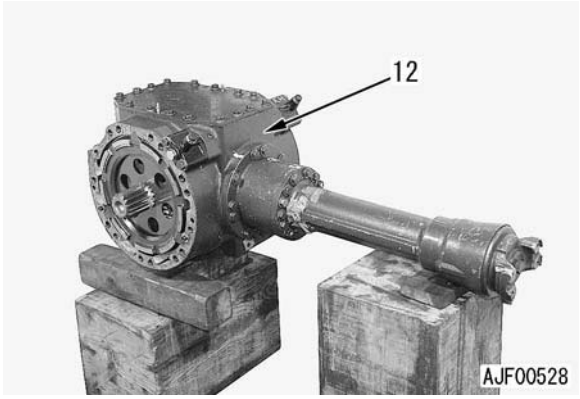

   4) Remove packing (8) and bushing (9) from rear axle support (7).

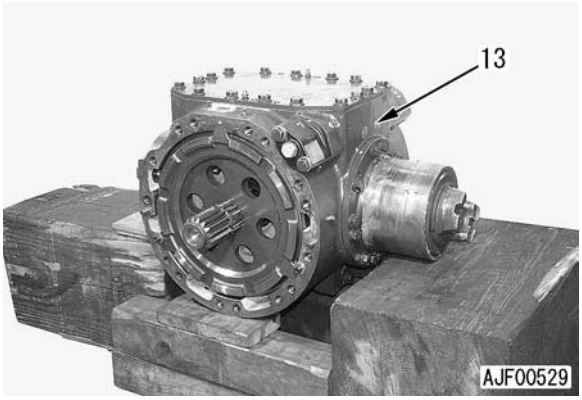



5. Axle oil temperature sensor (Only front axle)
   1) Remove cover (10).
   2) Remove axle oil temperature sensor (11). (The shape of the cover in the figure is different more or less from the shape of the actual cover.)

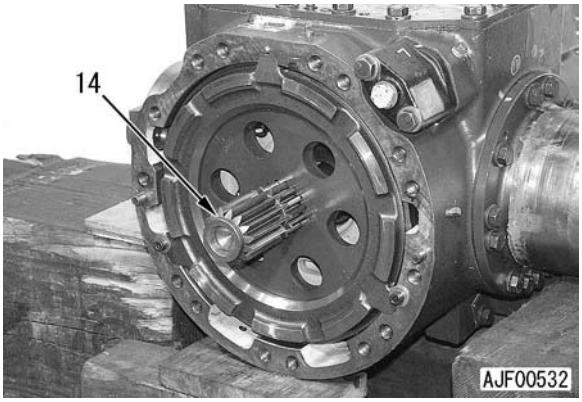


6. Differential assemblies
   1) Place and stabilize differential assemblies (12) and (13) on blocks.
      ★ (12): Front differential
      (13): Rear differential

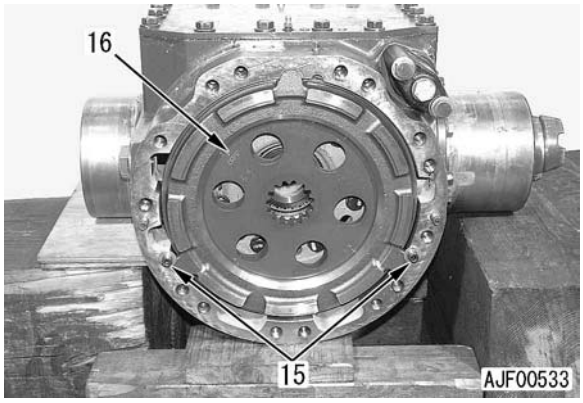


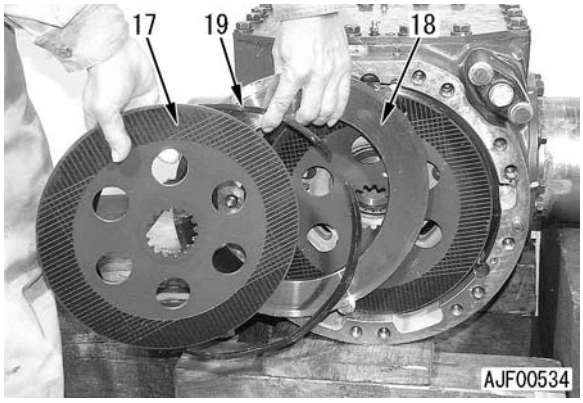

7. Brakes
   ★ Remove both brakes according to the following procedure.
   1) Remove sun gear shafts (14).



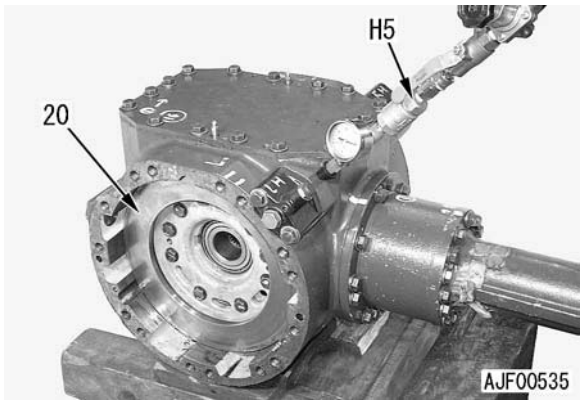

   2) Remove 2 inside hexagon bolts (15) and outer plate (16).



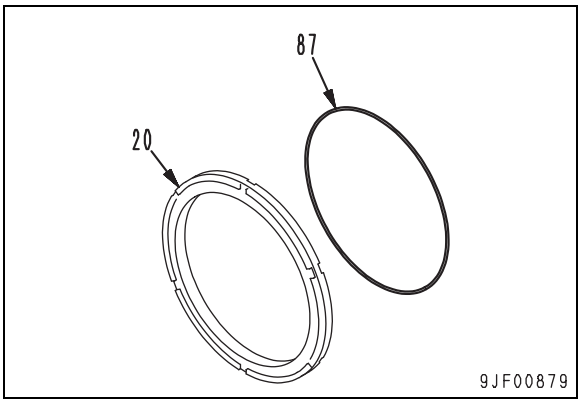

   3) Remove 2 discs (17), 1 plate (18), and 4 wave springs (19).



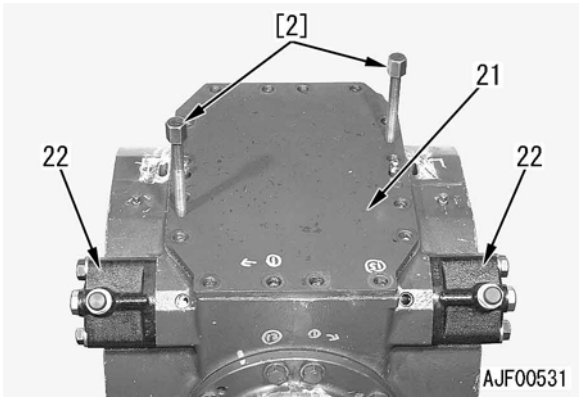

   4) Using tool **H5**, supply air to the brake port to remove piston (20).



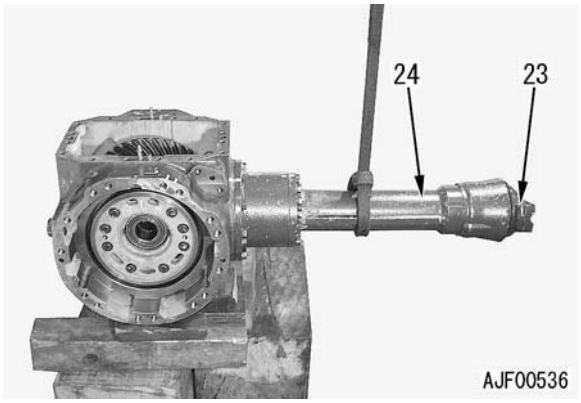
5) Remove seal (87) from piston (20).



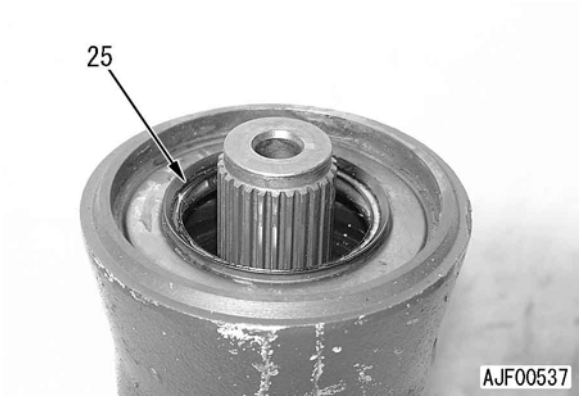

8. Top cover
   1) Remove the mounting bolts, and then remove top cover (21), using forcing screws [2].
9. Slack adjuster
   1) Remove 2 slack adjusters (22).



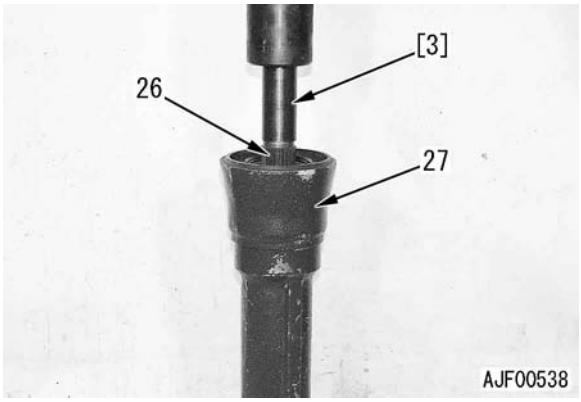

10. Removal of long cage assembly (Only front differential)
    1) Remove coupling (23).
       ★ Remove the coupling protector only when it needs to be removed.
    2) Remove long cage assembly (24).



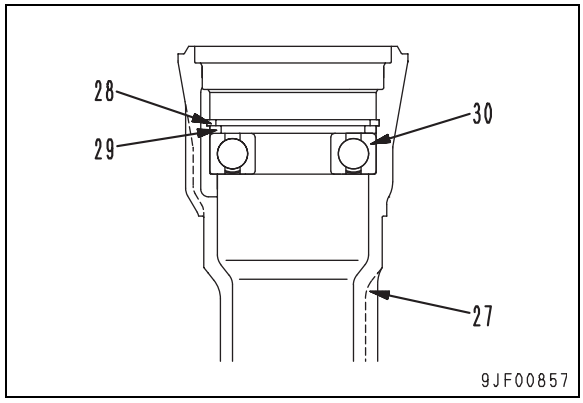

11. Disassembly of long cage assembly (Only front differential)
    1) Remove oil seal (25).



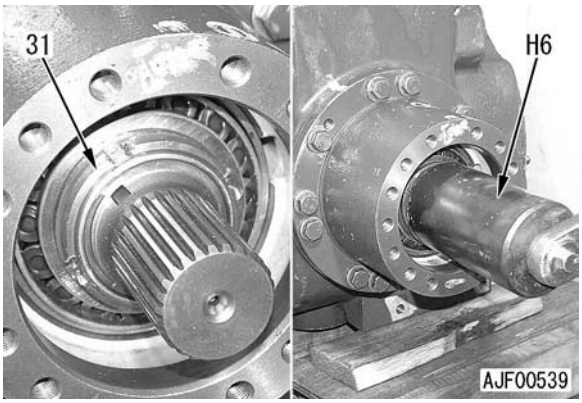

    2) Using push tool [3], push shaft (26) with a press to remove it from long cage (27).



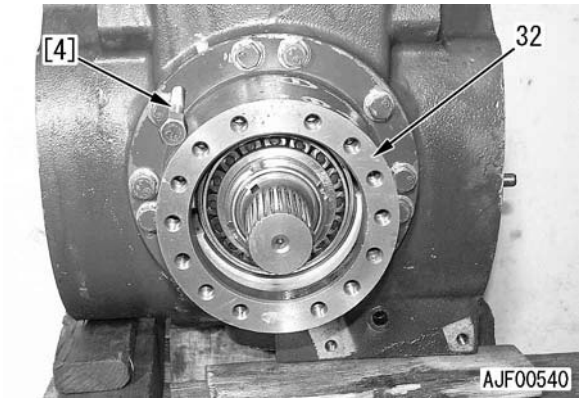

    3) Remove snap ring (28) and ring (29), and then remove bearing (30) from long cage (27).



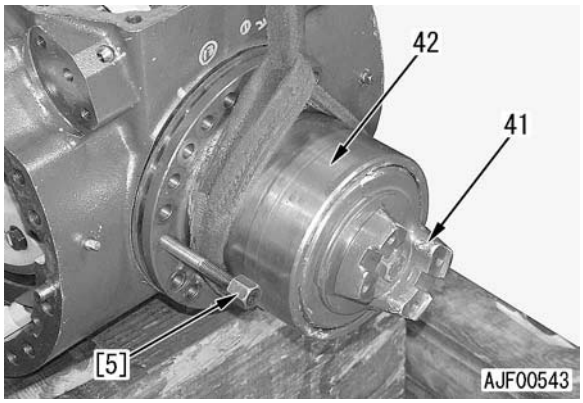
12. Removal of front cage assembly (Front differential)
    1) Using tool **H6**, loosen nut (31) before removing the cage assembly.



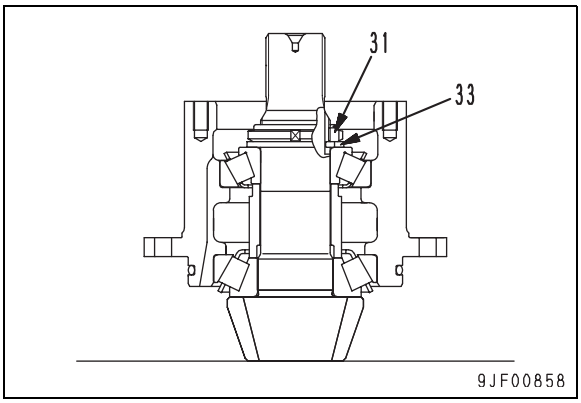

    2) Remove the mounting bolts. Using forcing screw [4], remove front cage assembly (32).
       ★ Check the thickness and quantity of the shims.



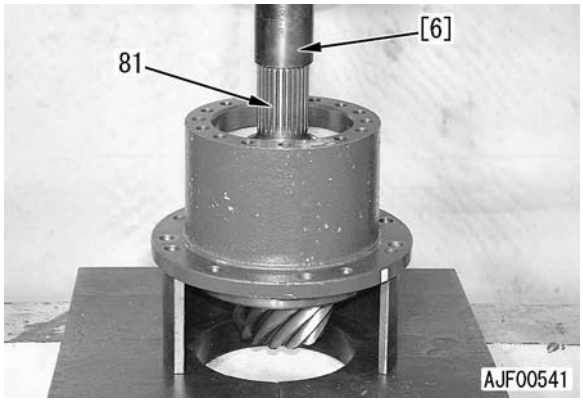

13. Removal of rear cage assembly (For rear differential)
    1) Before removing cage assembly, loosen the mounting bolts of coupling (41).
    2) Remove the mounting bolts. Using forcing screw [5], remove rear cage assembly (42).
       ★ Check the thickness and quantity of the shims.



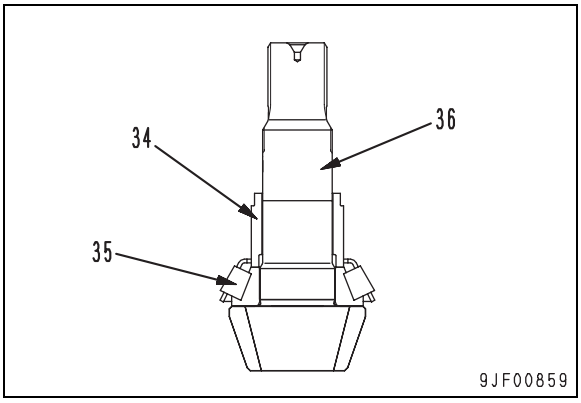

14. Disassembly of front cage assembly (For front differential)
    1) Remove nut (31) and holder (33).



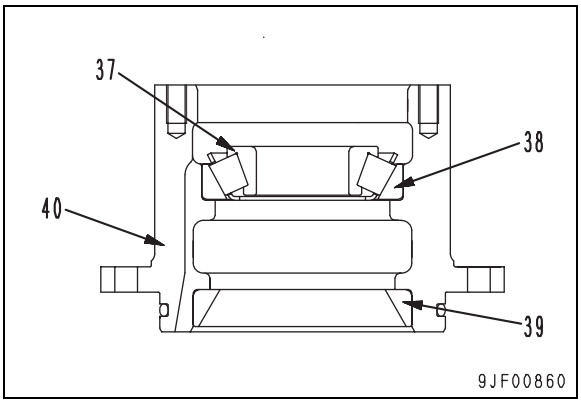

    2) Using push tool [6], push out pinion gear assembly (81) with a press.



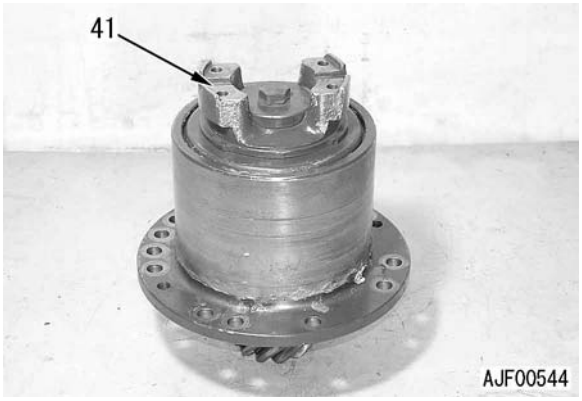
3) Remove spacer (34) and bearing (35) from pinion gear (36).



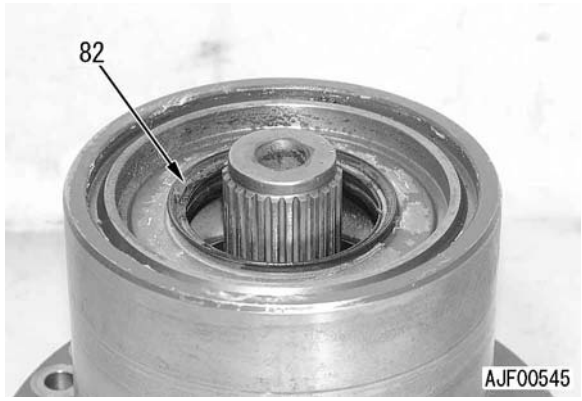

4) Remove bearing (37), outer races (38) and (39) from cage (40).




15. Disassembly of rear cage assembly (For rear differential)
    1) Remove coupling (41).
       ★ Remove the coupling protector only when it needs to be removed.

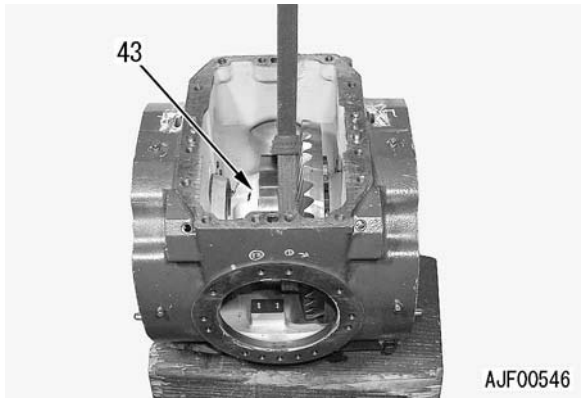



2) Remove oil seal (82).

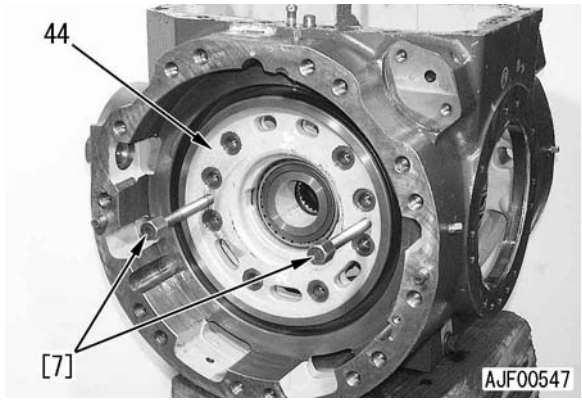



3) For the further disassembly procedure for the rear cage assembly, see steps 2) - 4) in 14 Disassembly of front cage assembly shown above.

16. Bearing carriers
    1) Sling differential carrier assembly (43) temporarily.



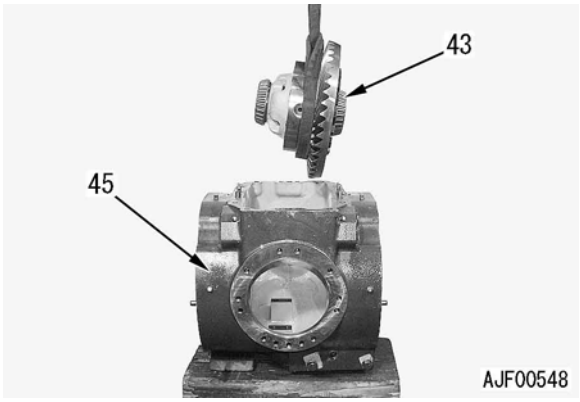

2) Remove the mounting bolts and both bearing carriers (44), using forcing screws [7].
   ★ Make marks on both bearing carriers so that they will not be mistaken.
   ★ Check the thickness and quantity of the shims.



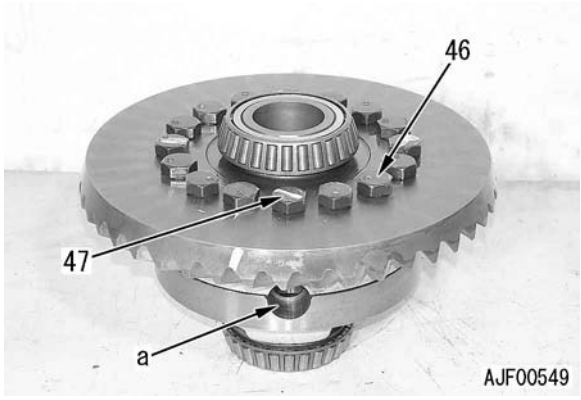
3) Remove seal (84) and ring (85) from each bearing carrier (44).
4) Remove outer race (86).



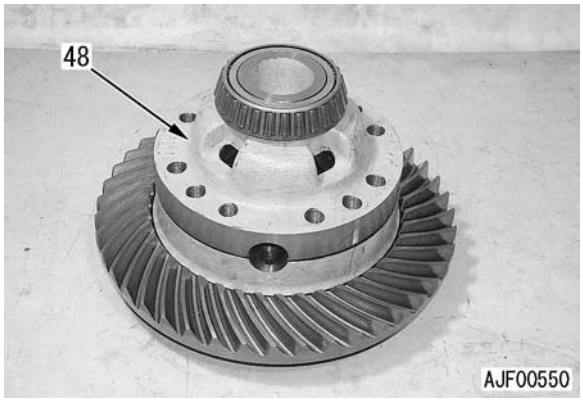

17. Removal of differential carrier assembly
1) Lift off differential carrier assembly (43) from differential housing (45).
★ Take care that the sling will not come off.
★ Do not damage the bearing of the differential carrier assembly by hitting it against the differential case.



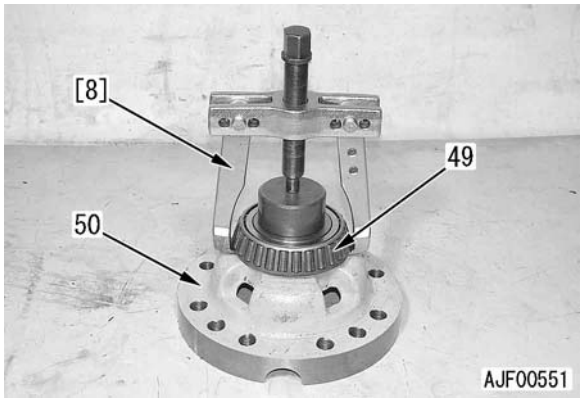

18. Disassembly of standard differential carrier assembly
★ When keeping the parts on both sides, make marks on them so that they will not be mistaken.
1) Remove 12 mounting bolts (46).
★ Do not remove 4 mounting bolts (47) of spider shaft (a).



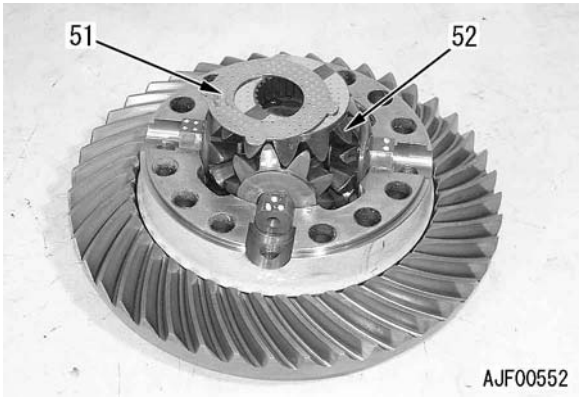

2) Remove case and bearing assembly (48).
★ Before disconnecting the case and bearing assembly, make match marks on it and the case.



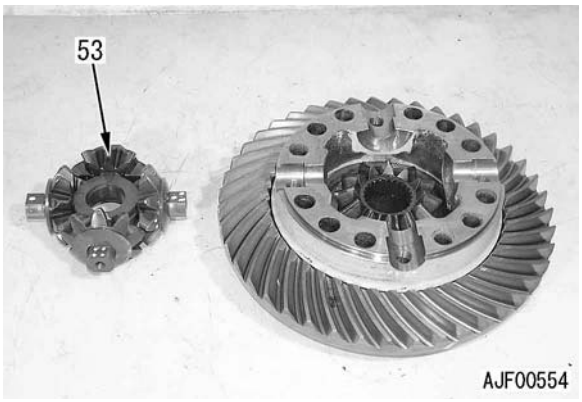

3) Using puller [8], remove bearing (49) from case (50).



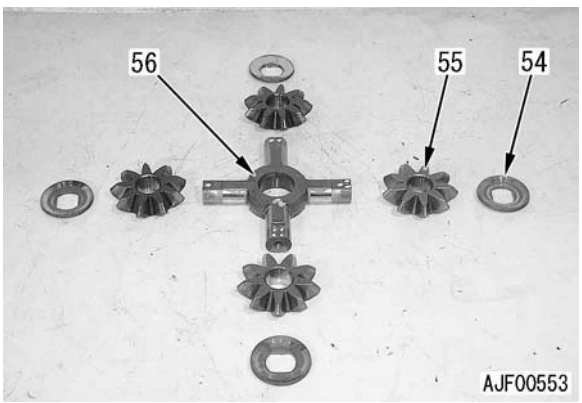
4) Remove washer (51) and side gear (52).



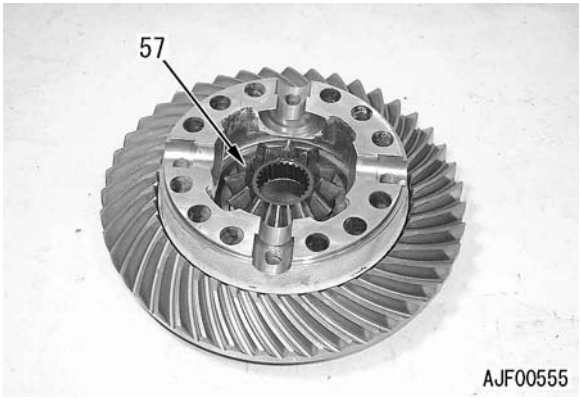

5) Remove pinion gear assembly (53).



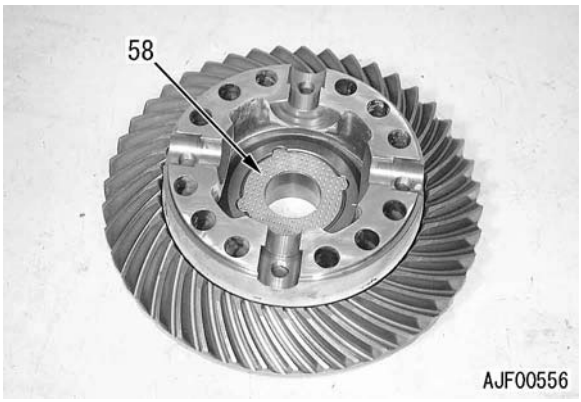

6) Remove 4 spherical washers (54) and 4 pinion gears (55) from spider shaft (56).



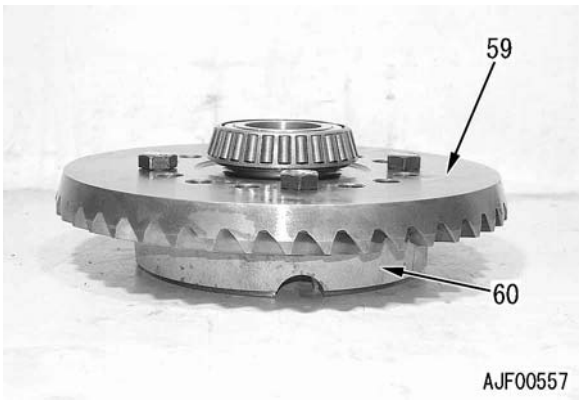

7) Remove side gear (57).



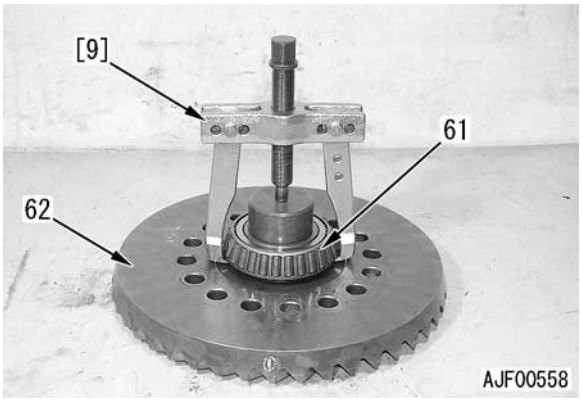

8) Remove washer (58).




9) Remove 4 mounting bolts, and then remove bevel gear and bearing assembly (59) from case (60).

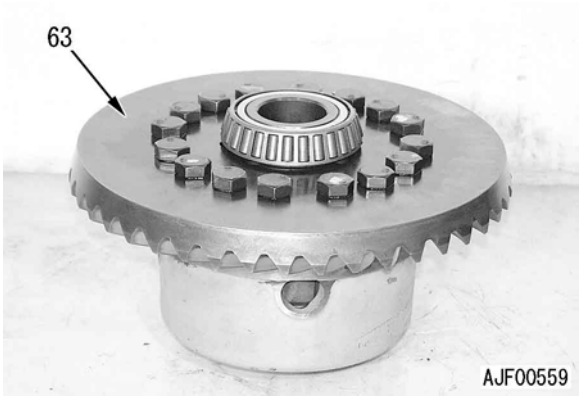


10) Using puller [9], remove bearing (61) from bevel gear (62).

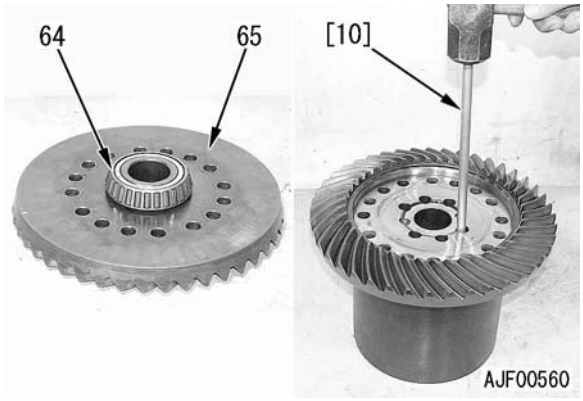



19. Disassembly of limited-slip differential assembly (Optional)
    - ★ If the vehicle is equipped with the limited-slip differential assembly, disassemble it according to the following procedure.
    - ★ When keeping the parts on both sides, make marks on them so that they will not be mistaken.

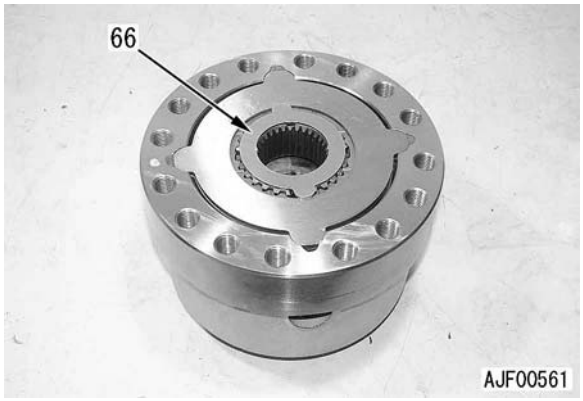
    1) Remove the 16 mounting bolts and bevel gear and bearing assembly (63)
       - ★ Before disconnecting the bevel gear and bearing assembly, make match marks on it and the case.



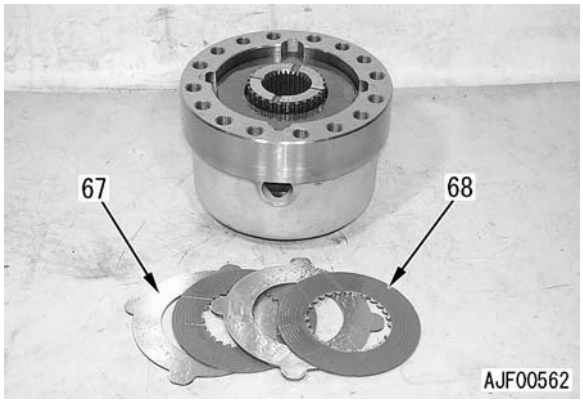

2) Using push tool [10], remove bearing (64) from bevel gear (65).



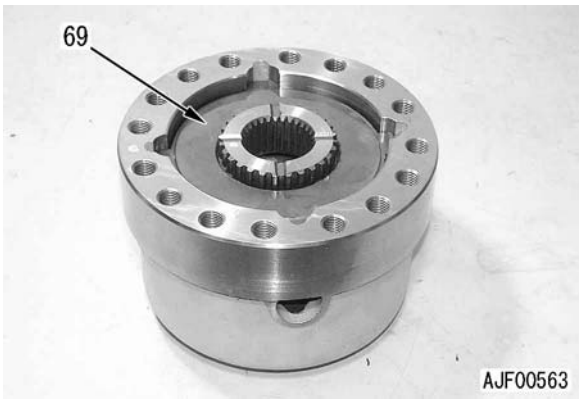

3) Remove washer (66).



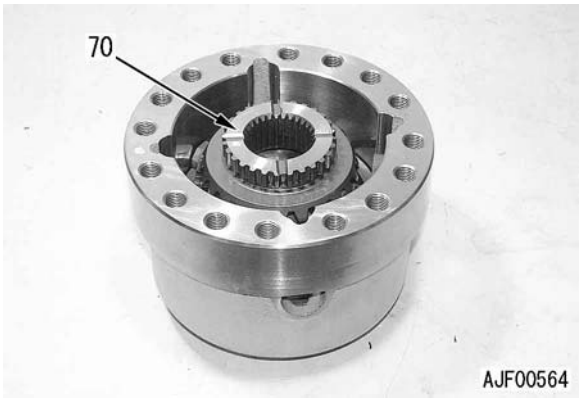

4) Remove 2 plates (67) and 2 discs (68).



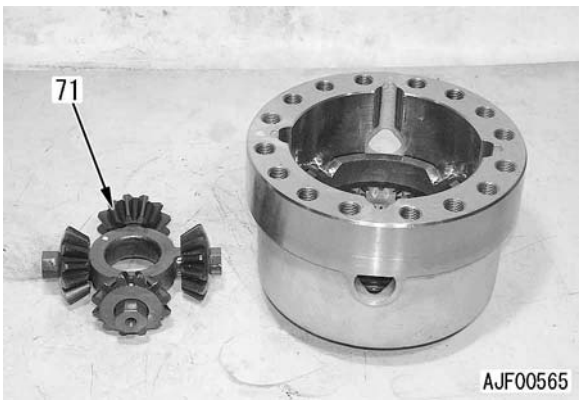
5) Remove pressure ring (69).
   ★ Insert a finger in the hole on the side of the case to raise the pressure ring.



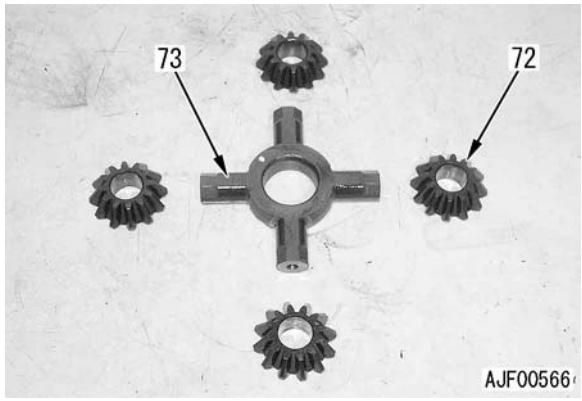

6) Remove side gear (70).



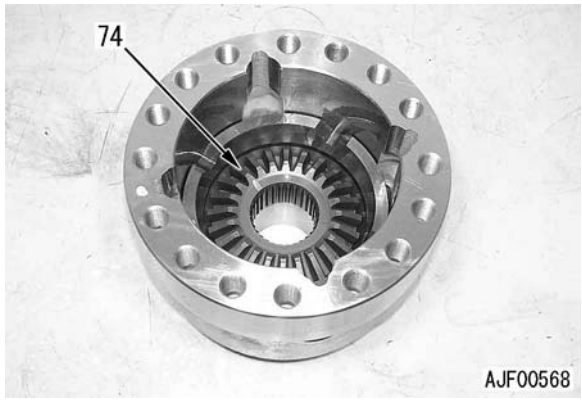

7) Remove pinion gear assembly (71).



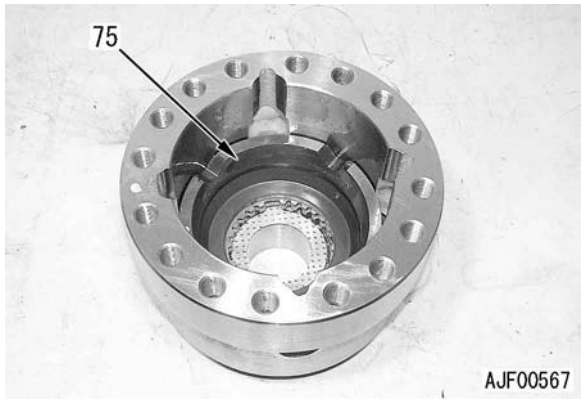

8) Remove 4 pinion gears (72) from spider shaft (73).



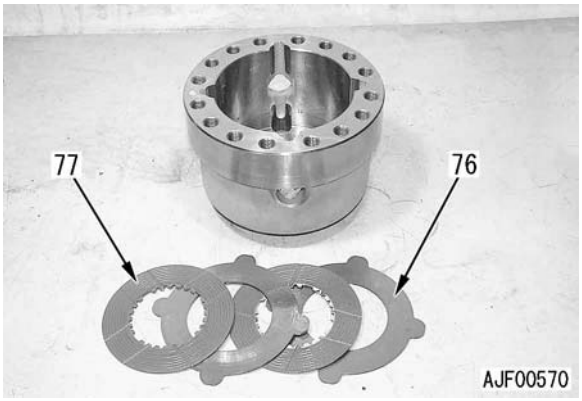

9) Remove side gear (74).



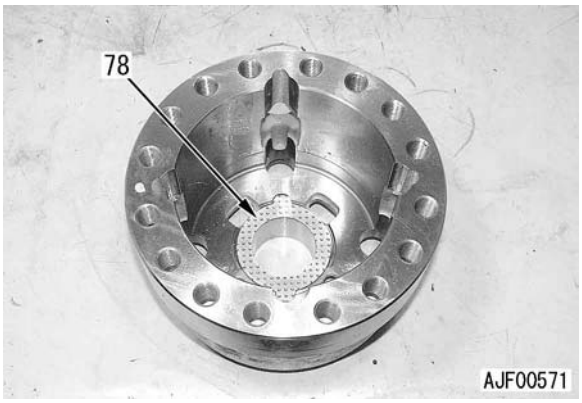

10) Remove pressure ring (75).



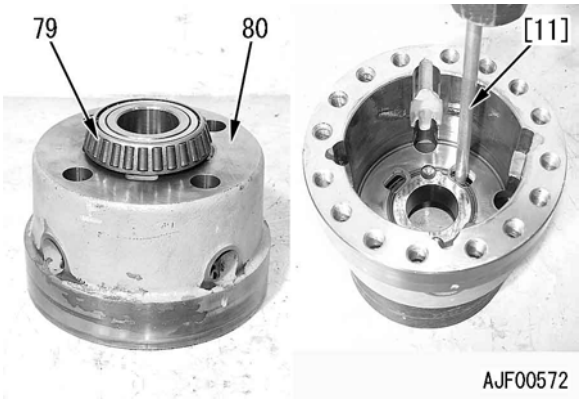
11) Remove 2 plates (76) and 2 discs (77).




12) Remove washer (78).



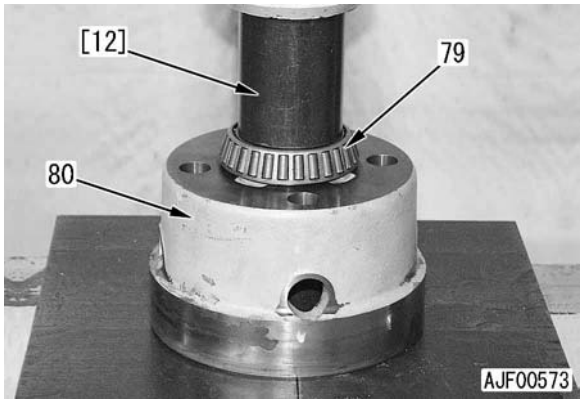

13) Using push tool [11], remove bearing (79) from case (80).



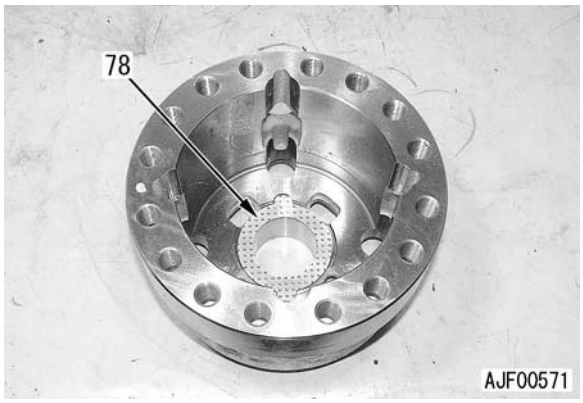

## ASSEMBLY

★ Clean the all parts and check them for dirt or damage. Coat their sliding surfaces with axle oil before installing.

1. Assembly of limited-slip differential assembly (If equipped)
   1) Install bearing (79) to case (80).
      ★ Install the bearing by shrink fit at temperature below 100°C or by using push tool [12] and a press.



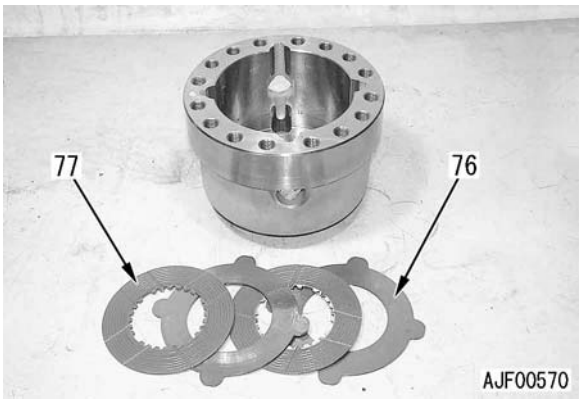

   2) Install washer (78).
      ★ Install the washer with the dimpled side in (up).



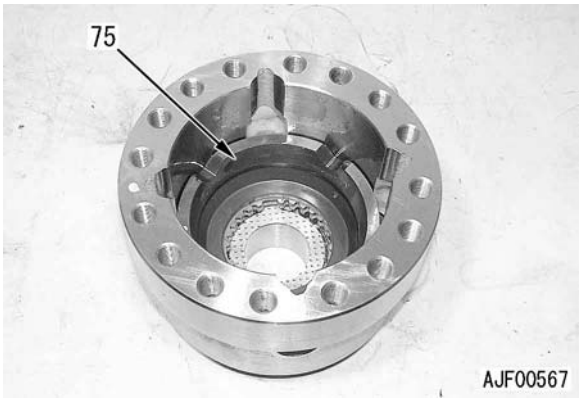
3) Install 2 discs (77) and 2 plates (76).

Before installing the discs and plates, soak them in the following oils.

- Standard differential: AX080
- Limited-slip differential:
  SHELL (DONAX TD 5W-30)
  ESSO (TORQUE FLUID 56)
  MOBIL (MOBILFLUID 424)
  FUCHS (RENOGEAR HYDRA ZF 20W-40)

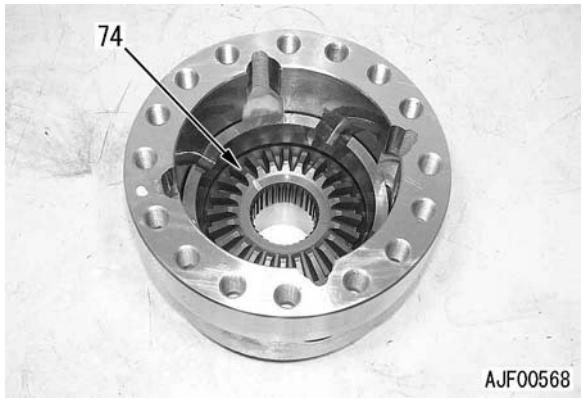



4) Install pressure ring (75).

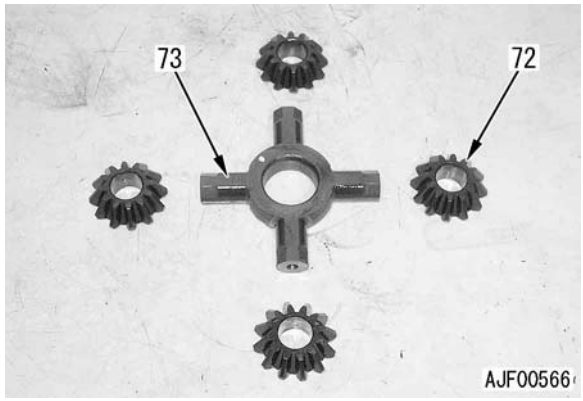



5) Install side gear (74).

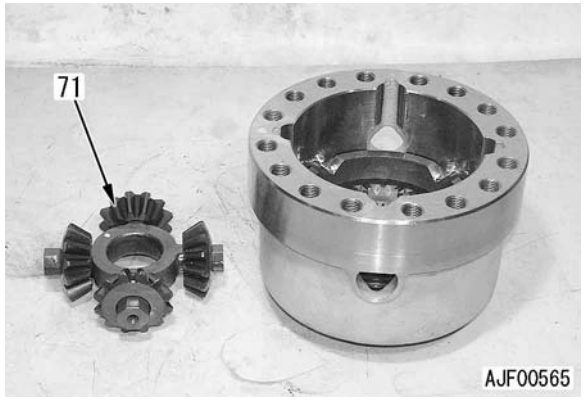
★ Referring to step 10) below, match the cut of the inside of the disc to the oil groove of the side gear.



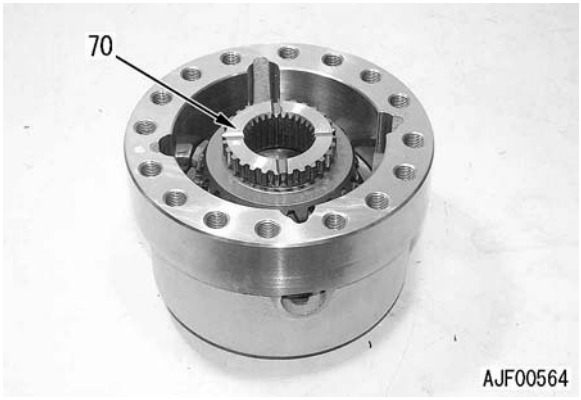

6) Install 4 pinion gears (72) to spider shaft (73).



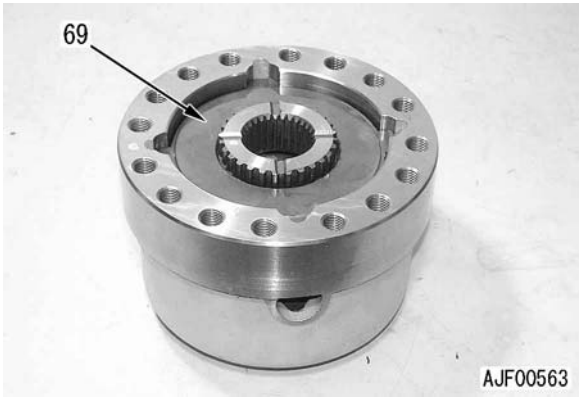

7) Install pinion gear assembly (71).



8) Install side gear (70).



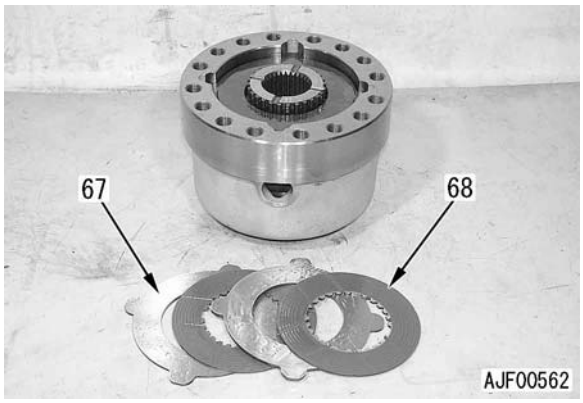

9) Install pressure ring (69).

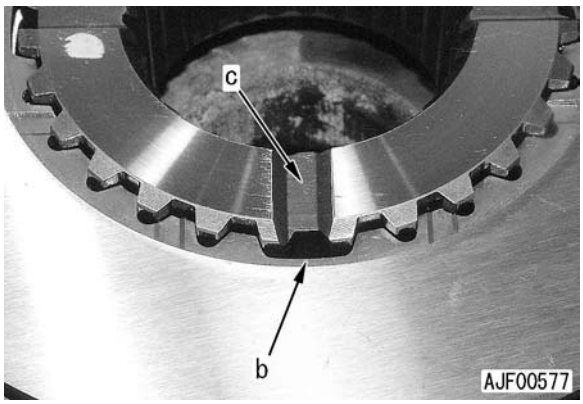



10) Install 2 discs (68) and 2 plates (67).
★ Match cut (b) of the inside of the disc to oil groove (c) of the side gear.

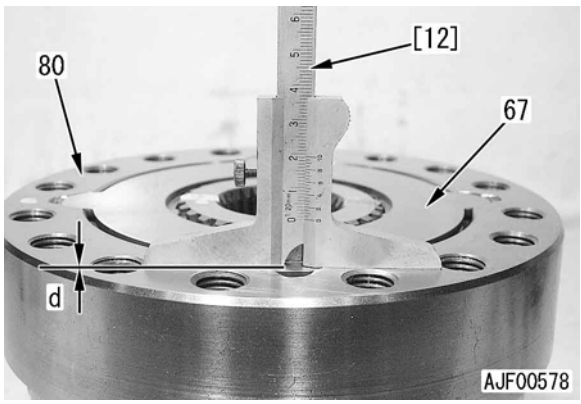
Before installing the discs and plates, soak them in the following oils.

- Standard differential: AX080
- Limited-slip differential:
  SHELL (DONAX TD 5W-30)
  ESSO (TORQUE FLUID 56)
  MOBIL (MOBILFLUID 424)
  FUCHS (RENOGEAR HYDRA ZF 20W-40)

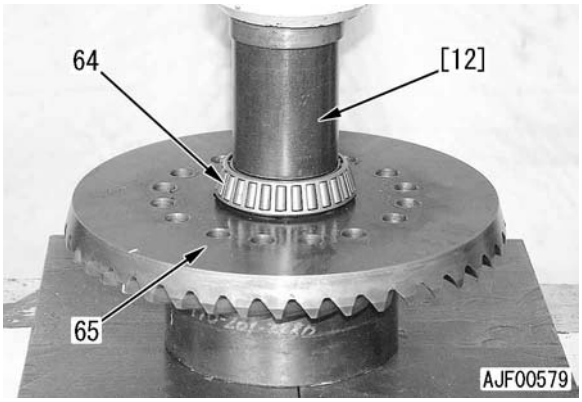


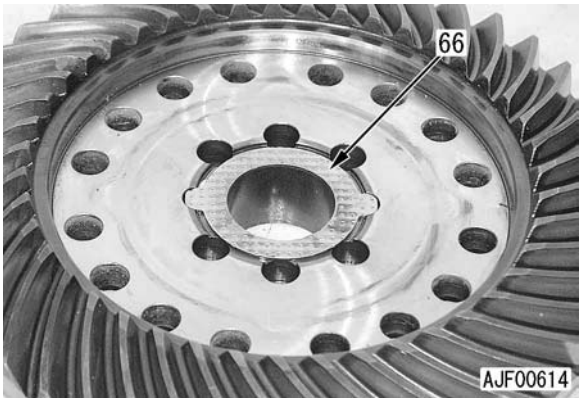

11) Selection of thickness of plate
i) Using depth gauge [12], measure distance (d) between case (80) and plate (67).
★ Distance (d) is the clearance between the case and plate.
ii) Select the thickness of the plate so that distance (d) will be 0.2 - 0.6 mm.
★ Replace the plates on both sides so that their thickness (total of 2 pieces) will be the same and assemble them according to the procedure 3) after shown above.
- Varieties of plate thickness:
  **3.0 mm, 3.1 mm**



12) Install bearing (64) to bevel gear (65).
★ Install the bearing by shrink fit at temperature below 100°C or by using push tool [12] and a press.



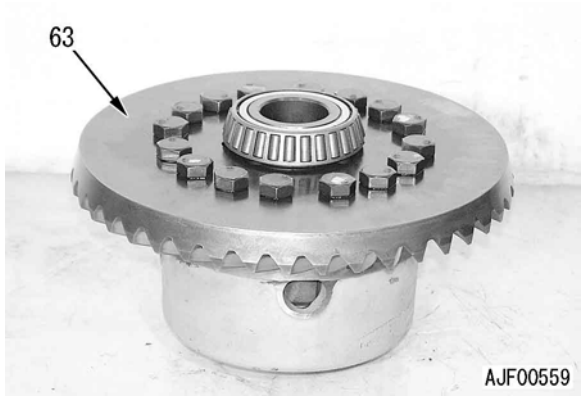

13) Install washer (66) to the back side of the bevel gear.
★ Install the washer with the dimpled side toward the side gear.
★ When installing the washer, apply grease thinly to it so that it will stuck to the bevel gear.



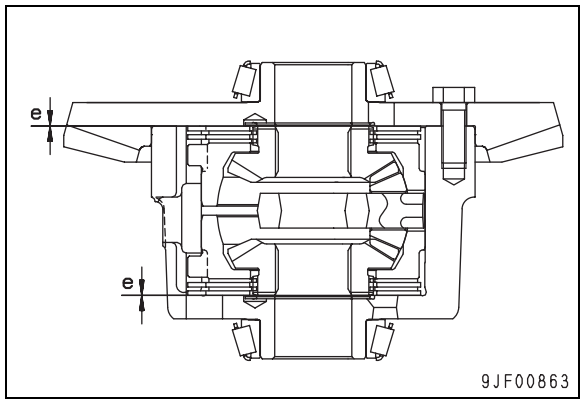

14) Install bevel gear and bearing assembly (63).
★ Match the match marks made when the assembly was removed.

Mounting bolt: **Adhesive (LT-2)**

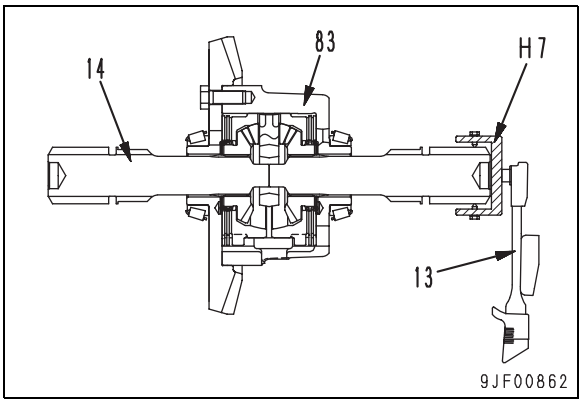
Mounting bolt:
**245 - 309 Nm {25 - 31.5 kgm}**



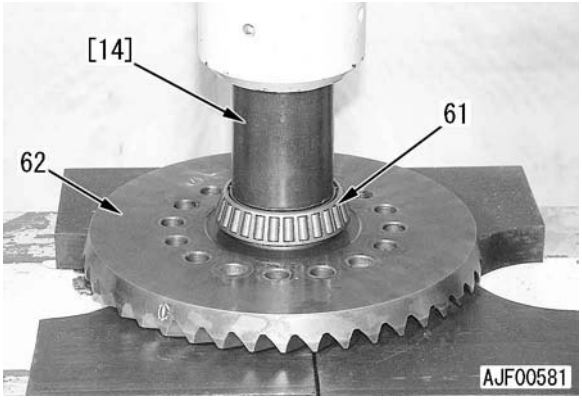

15) Adjust the clearance of the side gear in the axial direction.
i) Measure clearance (e) between the side gear and washer through the shaft holes on both sides of the limited-slip differential.
• Clearance (e):
**0.13 - 0.36 mm (on both sides)**
★ If the clearance is out of the standard range, replace the washer with new one.



16) Measure the no-load operation torque.
   i) Install sun gear shafts (14) to both sides of limited-slip differential assembly (83).
   ii) Fix the sun gear shaft on one side and install tool **H7** to the sun gear shaft on the other side.
   iii) Install torque wrench (13) to tool **H7** and measure the no-load operation torque.
      ★ When measuring, let the case rotate freely.
      • No-load operation torque:
        **Max. 10 Nm {Max. 1.0 kgm}**
      • If the no-load operation torque exceeds the standard value, disassemble the limited-slip differential again and perform 11) Selection of thickness of plate and 15) Adjust the clearance of the side gear in the axial direction.



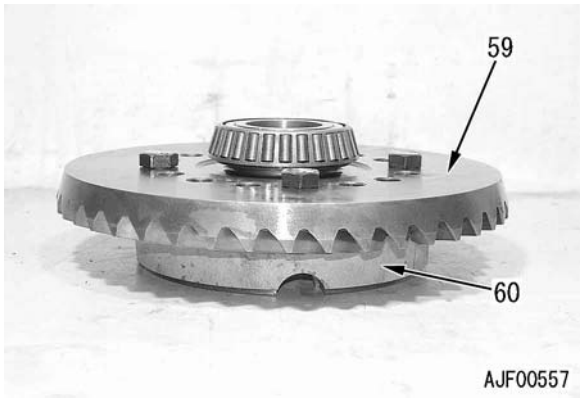

2. Assembly of standard differential carrier assembly
   1) Install bearing (61) to bevel gear (62).
      ★ Install the bearing by shrink fit at temperature below 100°C or by using push tool [14] and a press.



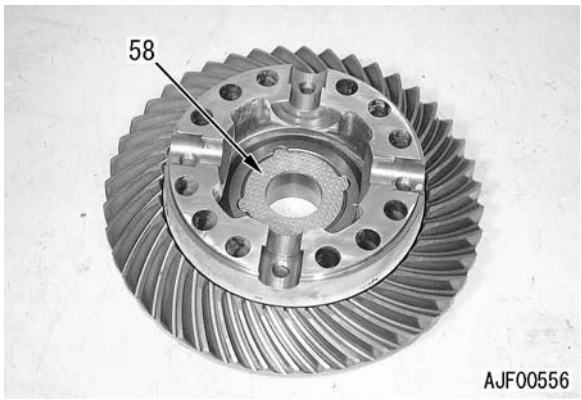

   2) Install bevel gear and bearing assembly (59) to case (60) with the 4 mounting bolts.
      ★ Match the match marks made when the assembly was removed.
      ★ Install the mounting bolts to the 4 places of the spider shaft.

      Mounting bolt: **Adhesive (LT-2)**

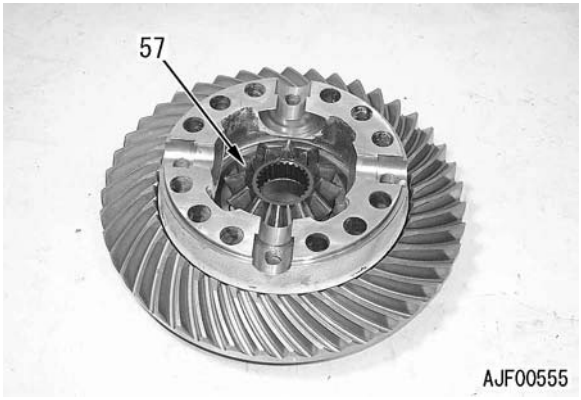
      Mounting bolt:
      **245 - 309 Nm {25 - 31.5 kgm}**



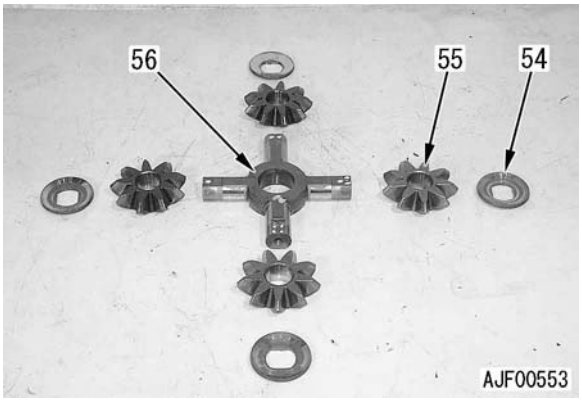

   3) Install washer (58).
      ★ Install the washer with the dimpled side up (toward the side gear).



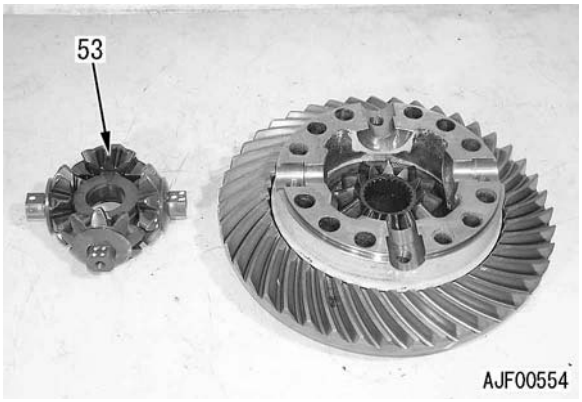
4) Install side gear (57).



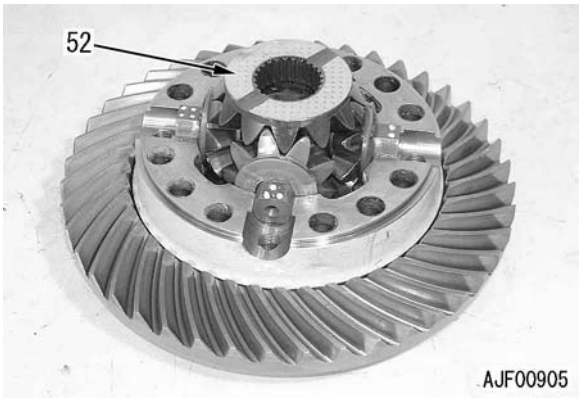

5) Install 4 pinion gears (55) and 4 spherical bushings (54) to spider shaft (56).



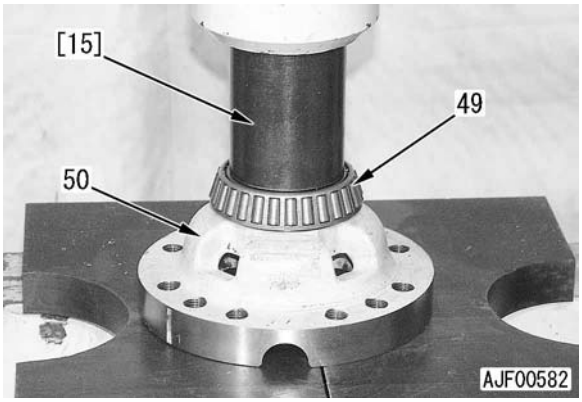

6) Install pinion gear assembly (53).



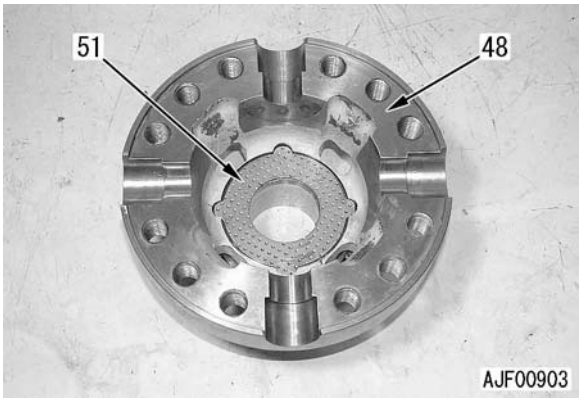

7) Install side gear (52).




8) Install bearing (49) to case (50).
   ★ Install the bearing by shrink fit at temperature below 100°C or by using puller [15] and a press.



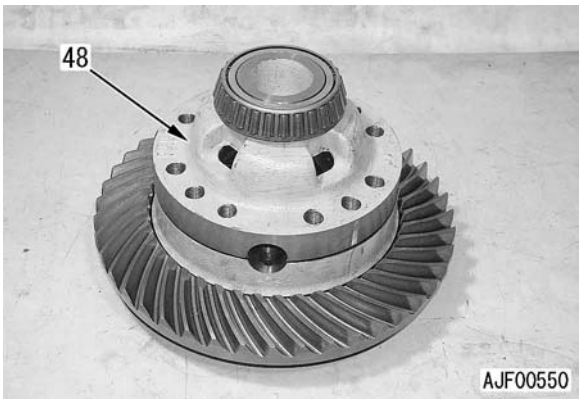

9) Install washer (51) to case and bearing assembly (48).
   ★ Install the washer with the dimpled side up (toward the side gear).
   ★ Apply axle oil or grease thinly to the washer and stick the washer to the case.



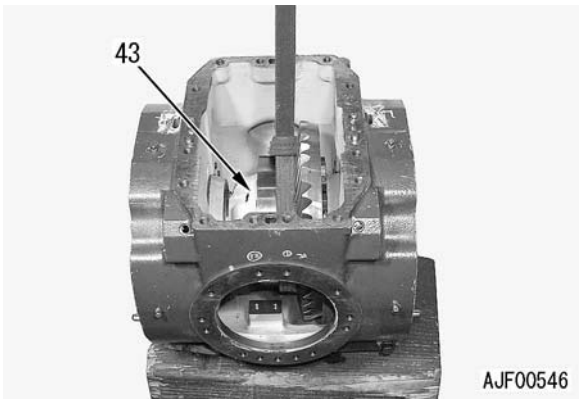
10) Install case and bearing assembly (48).
★ Match the match marks made when the assembly was removed.
★ Turn over the assembly and tighten the mounting bolts.

Mounting bolt: **Adhesive (LT-2)**

Mounting bolt:
**245 - 309 Nm {25 - 31.5 kgm}**




3. Installation of differential assembly
1) Sling differential carrier assembly (43) and set it to the mounting section of differential case.
★ Take care that the sling will not come off.
★ Do not damage the bearing of the differential carrier assembly by hitting it against the differential case.



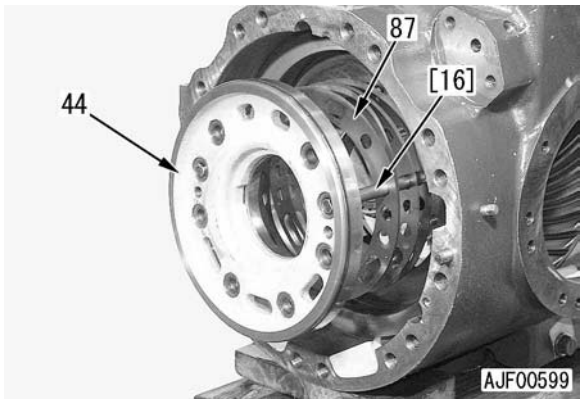

4. Bearing carrier
1) Install outer race (86).
2) Install ring (85) and seal (84) to bearing carrier (44).



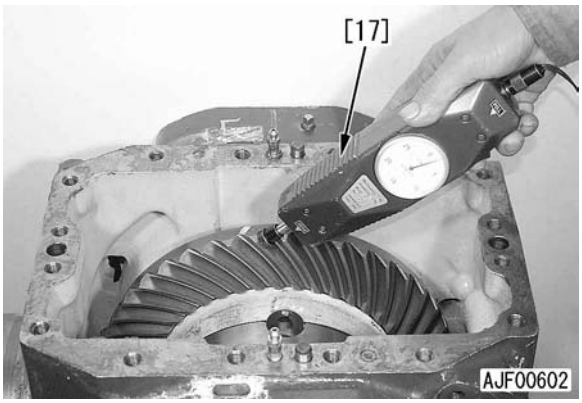

3) Using guide bolt [16], install shim (87) and both bearing carrier (44).
★ Install the shims of the thickness and quantity checked when disassembled to each bearing carrier.
★ Turning the bevel gear, tighten the mounting bolts.

Bearing: **Differential oil**

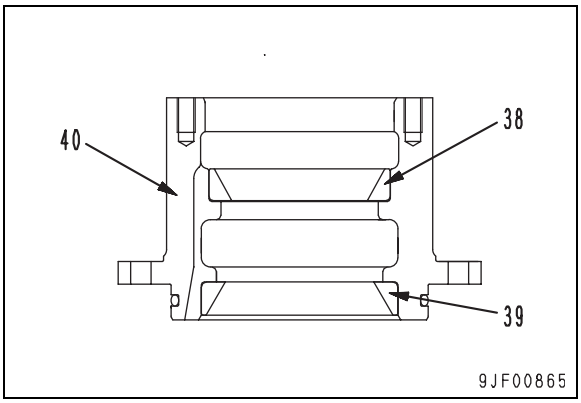
Mounting bolt:
**98 - 122.5 Nm {10- 12.5 kgm}**



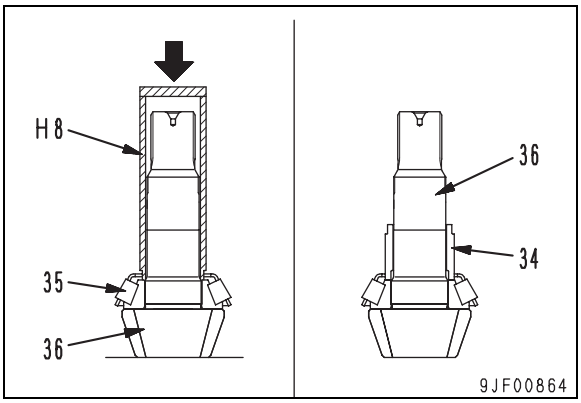

4) Using push-pull gauge [17], measure the starting torque of the bevel gear in the tangential direction.
• Starting torque:
**8.8 - 20.6 N {0.9 - 2.1 kg}**
★ If the starting torque is out of the standard range, adjust it by increasing or decreasing the shim thickness.
• Varieties of shim thickness:
0.05 mm, 0.2 mm, 0.3 mm, 0.8 mm
★ Limit the shim thickness after the adjustment to 0.5 - 1.35 mm on each side.



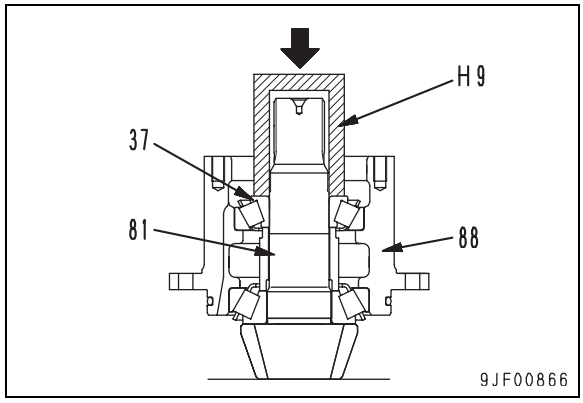

5. Assembly of front cage assembly (For front differential)
   1) Install outer races (39) and (38) to cage (40).



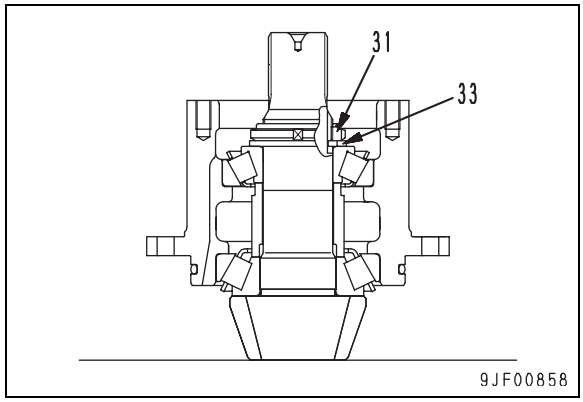

   2) Install bearing (35) to pinion gear (36).
      ★ Install the bearing by shrink fit at temperature below 100°C or by using tool **H8** and a press.
   3) Install spacer (34) to pinion gear (36).




   4) Erect pinion gear assembly (81) and install cage assembly (88).
   5) Install bearing (37) to pinion gear assembly (81).
      ★ Install the bearing by shrink fit at temperature below 100°C or by using tool **H9** and a press.

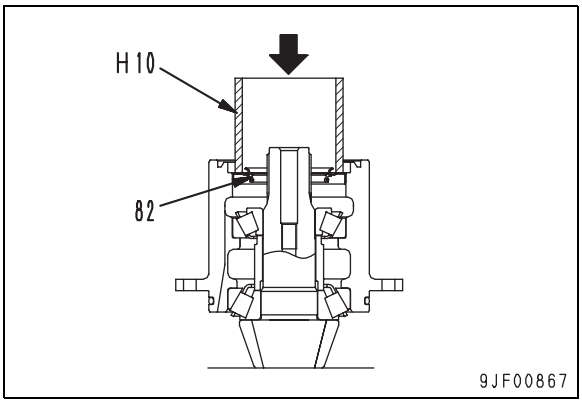



   6) Check that you can rotate the cage with the hand easily since any preload is not applied to the bearing.
      ★ If the cage is heavy to rotate, replace the bearing and spacer, and then check the rotation of the cage again.
   7) Install holder (33) and nut (31).
      ★ Tighten the nut temporarily first. After installing the cage assembly to the differential case assembly, tighten the nut securely.



6. Assembly of rear cage assembly
   1) Referring to 5 Assembly of front cage assembly, steps 1) - 5), assemble the rear cage assembly.
   2) Using tool **H10**, press fit oil seal (82).

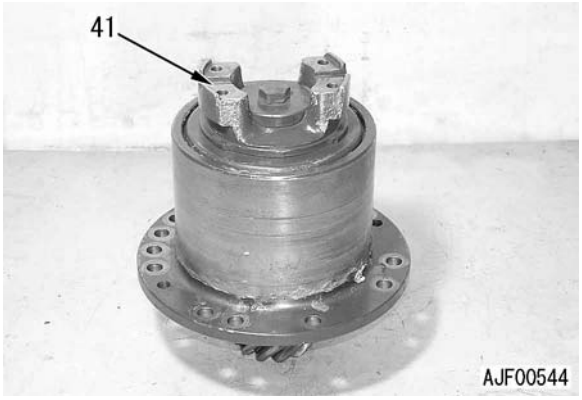
      Oil seal: **Grease (G2-LI)**




   3) Install coupling (41) and the holder.
      ★ Tighten the bolt temporarily first. After installing the cage assembly to the differential case assembly, tighten the bolt securely.

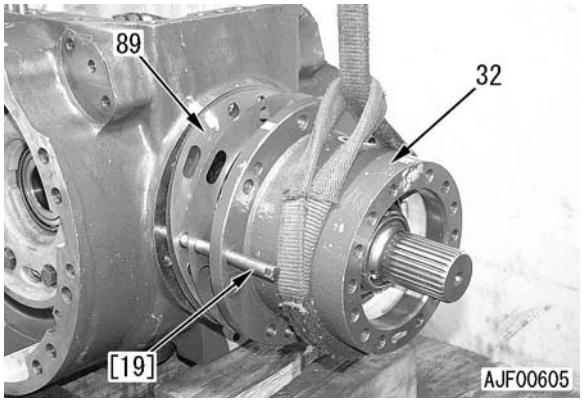
      Contact surfaces of coupling and bearing: **Lubricant containing molybdenum disulfide (LM-G or LM-P)**

   4) Check that you can rotate the cage with the hand easily since any preload is not applied to the bearing.
      ★ If the cage is heavy to rotate, replace the bearing and spacer, and then check the rotation of the cage again.



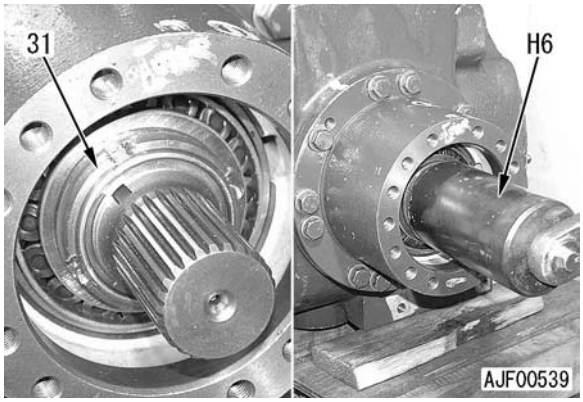

7. Installation of front cage assembly (For front differential)
   1) Install guide bolt [19] to the differential case assembly, and then install shim (89), O-ring, and front cage assembly (32).
      ★ Install the shims of the thickness and quantity checked when disassembled to each bearing carrier.
      ★ Install the shims with the thinnest one on the cage side.
      - Adjustment allowance of shims: **0.50 - 1.25 mm**
      - Varieties of shim thickness: **0.05 mm, 0.2 mm, 0.3 mm, 0.6 mm**

      Mounting bolt: **98 - 122.5 Nm {10 - 12.5 kgm}**




   2) Using tool **H6**, tighten nut (31) securely.

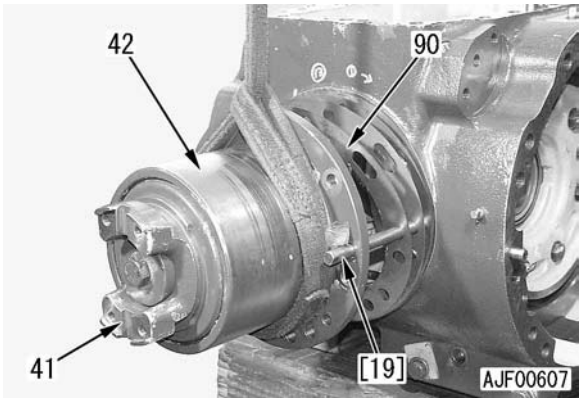
      Mounting bolt: **441 - 539 Nm {45 - 55 kgm}**



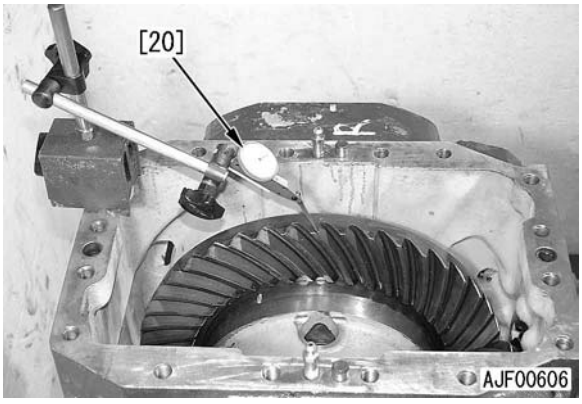
8. Installation of rear cage assembly
   1) Install guide bolt [19] to the differential case assembly, and then install shim (90), O-ring, and rear cage assembly (42).
      ★ For the adjustment of the shims and tightening torque, see 7 Installation of front cage assembly.
   2) Tighten the mounting bolts of coupling (41).

      Mounting bolt: **Adhesive (LT-2)**

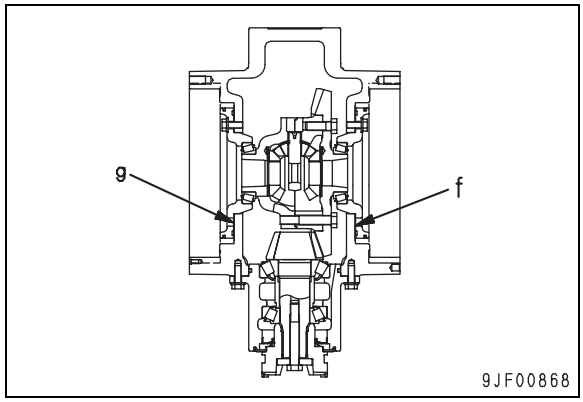
      Mounting bolt:
      **245 - 309 Nm {25.0 - 31.5 kgm}**

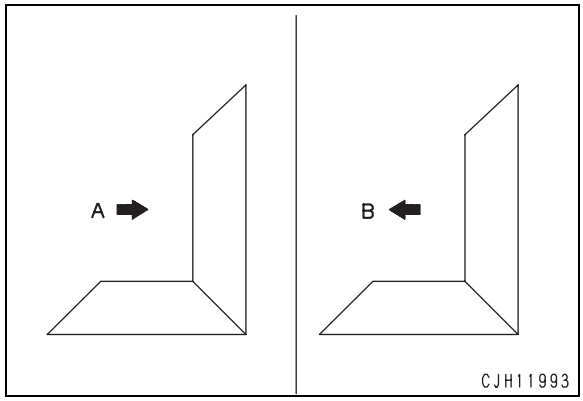



9. Adjusting backlash
   1) Measure the backlash of the bevel gear with dial gauge [20].
      • Standard backlash: **0.20 - 0.33 mm**
      ★ Measure the backlash at 3 places on the periphery of the bevel gear and check that the dispersion of the measured values is 0.1 mm or less.

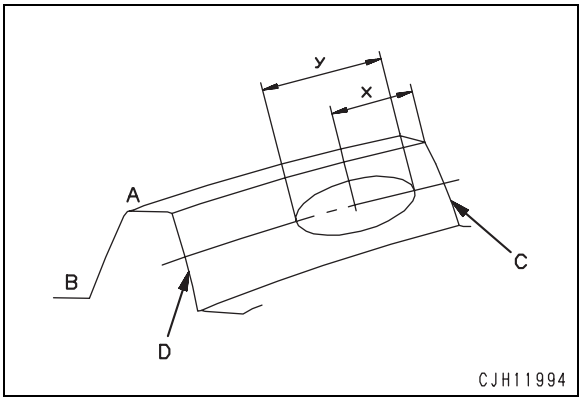



   2) If the measured backlash is out of the standard range, adjust it by moving a part of the shims on either side to the opposite side.
      ★ Do not change the total thickness of the shims on both sides.
      ★ If the backlash is insufficient, move a part of shims (**g**) to the shims (f). (Move the bevel gear in direction A.)
      ★ If the backlash is too large, move a part of shims (**f**) to the shims (**g**). (Move the bevel gear in direction B.)

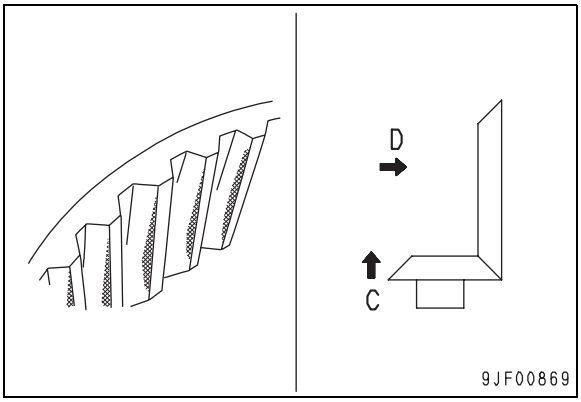


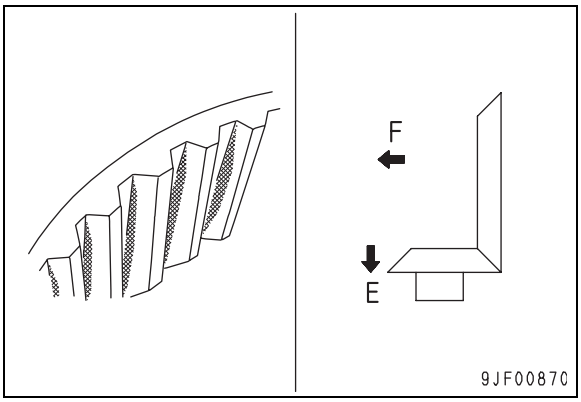
10. Testing tooth contact
    1) Apply red lead thinly to the surfaces of the bevel gear teeth and turn the bevel gear in the forward and reverse directions, then check the tooth contact pattern on the bevel gear.
       ★ The center of the tooth contact must be as follows.
         • Middle of tooth height
         • Point on tooth at which distance of "**x**" from small end "**C**" is 22 ± 3 mm
       ★ Width "y" of the tooth contact must be 28 ± 3 mm.
       ★ Check that there is not a strong contact at tip "**A**", bottom "**B**", small end "**C**", or large end "**D**".




11. Adjusting tooth contact
    1) If the tooth contact pattern is not proper, adjust the tooth contact.
       ★ Adjust the toot contact by increasing or decreasing the shims on both sides of the bearing carrier (to move the bevel gear) and the shims of the cage assembly (to move the bevel pinion).
       ★ After adjusting the tooth contact, check the backlash again.
    2) If the bevel pinion is too far from the bevel gear, the tooth contact pattern is as follows. In this case, adjust the tooth contact according to the following procedure.
       • Decrease the shims of the cage assembly (on the bevel pinion side) to move the cage assembly in the direction (**C**).
       • Adjust the shims on both sides of the bearing carrier to move bevel gear in the direction of (**D**) far from the bevel pinion.
       ★ Do not change the total thickness of the shims on both sides of the bearing carrier.

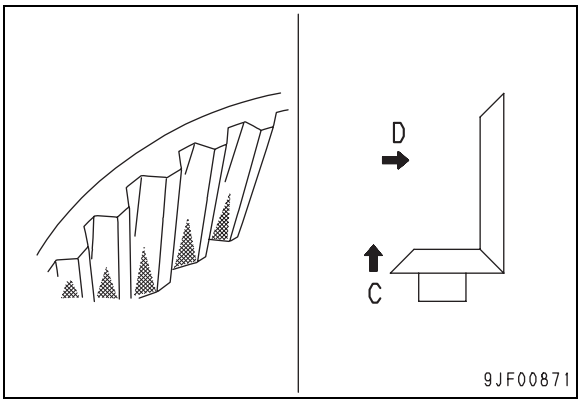



    3) If the bevel pinion is too close to the bevel gear, the tooth contact pattern is as follows. In this case, adjust the tooth contact according to the following procedure.
       • Increase the shims of the cage assembly (on the bevel pinion side) to move the cage assembly in the direction (**E**).
       • Adjust the shims on both sides of the bearing carrier to move bevel gear in the direction of (**F**) close to the bevel pinion.
       ★ Do not change the total thickness of the shims on both sides of the bearing carrier.



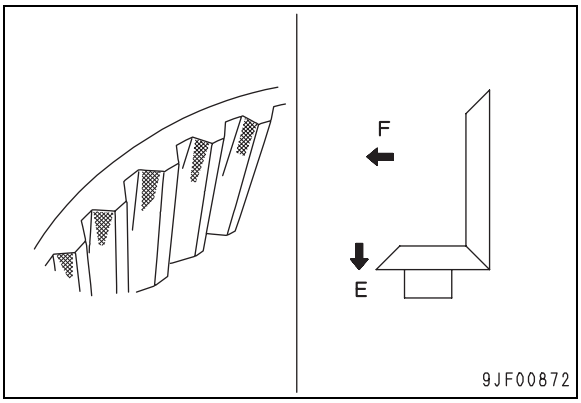
4) If the bevel gear is too close to the bevel pinion, the tooth contact pattern is as follows. In this case, adjust the tooth contact according to the following procedure.
   - Decrease the shims of the cage assembly (on the bevel pinion side) to move the cage assembly in the direction (**C**).
   - Adjust the shims on both sides of the bearing carrier to move bevel gear in the direction of (**D**) far from the bevel pinion.

   ★ Do not change the total thickness of the shims on both sides of the bearing carrier.



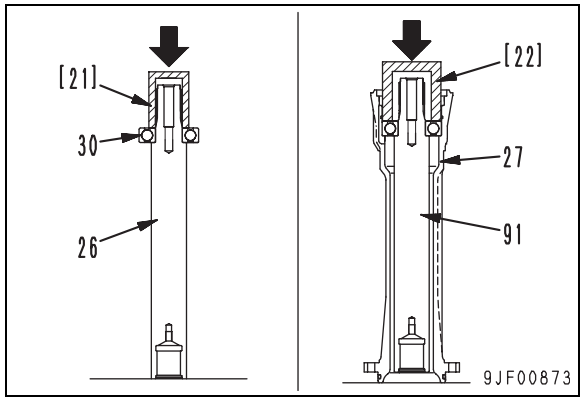

5) If the bevel gear is too far from the bevel pinion, the tooth contact pattern is as follows. In this case, adjust the tooth contact according to the following procedure.
   - Increase the shims of the cage assembly (on the bevel pinion side) to move the cage assembly in the direction (**E**).
   - Adjust the shims on both sides of the bearing carrier to move bevel gear in the direction of (**F**) close to the bevel pinion.

   ★ Do not change the total thickness of the shims on both sides of the bearing carrier.

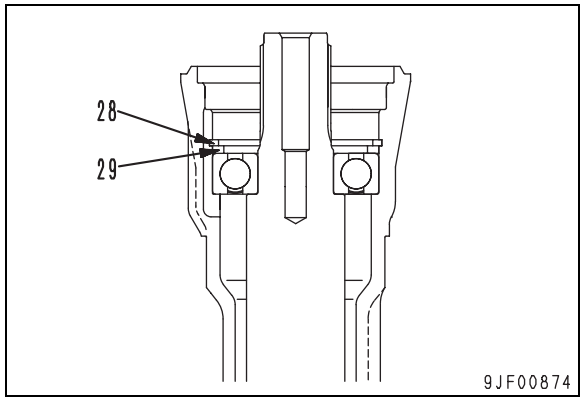



12. Disassembly of long cage assembly (Only front differential)
    1) Using push tool [21], press fit bearing (30) to shaft (26) with a press.

       ★ Direct the shield side of the bearing down.
    2) Using push tool [22], press fit shaft and bearing assembly (91) to long cage (27).

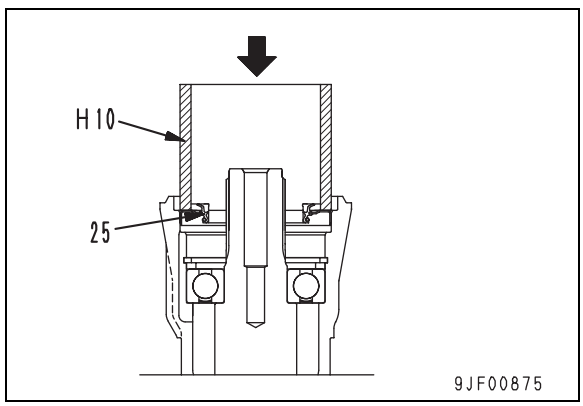



    3) Install ring (29) and snap ring (28).




    4) Using tool **H10**, press fit oil seal (25).

       Oil seal: **Grease (G2-LI)**



13. Installation of long cage assembly
    1) Sling and install long cage assembly (24).

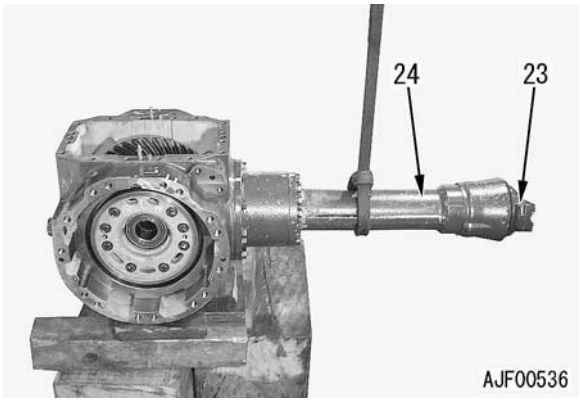
       Mounting bolt:
       **98 - 123 Nm {10 - 12.5 kgm}**

    2) Install coupling (23).

       Contact surfaces of coupling and bearing: **Lubricant containing molybdenum disulfide (LM-G) or (LM-P)**

       Mounting bolt: **Adhesive (LT-2)**

       Mounting bolt:
       **245 - 309 Nm {25.0 - 31.5 kgm}**

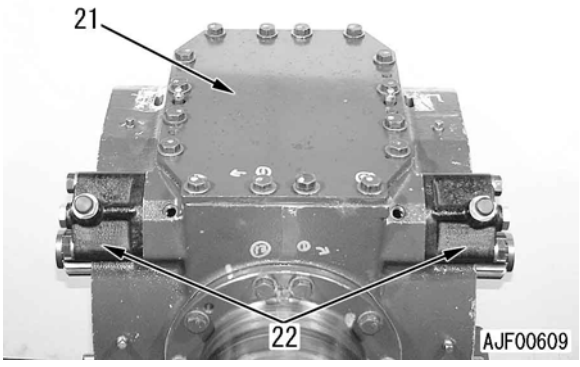



14. Slack adjuster
    1) Install 2 slack adjusters (22).
       ★ Take care that the O-ring will not come off.

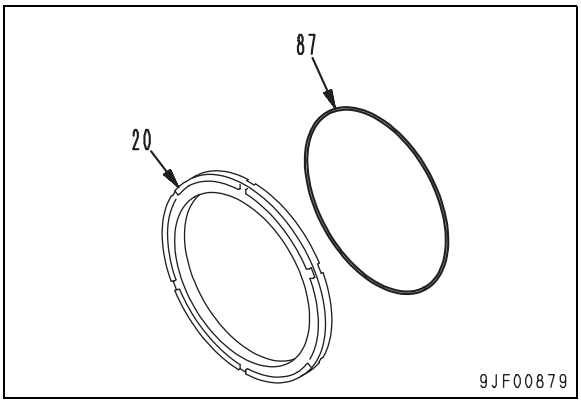
15. Top cover
    1) Install top cover (21).

       Mating face of cover: **Adhesive (LOCTITE 515 or equivalent)**

       Mounting bolt:
       **98 - 122.5 Nm {10 - 12.5 kgm}**

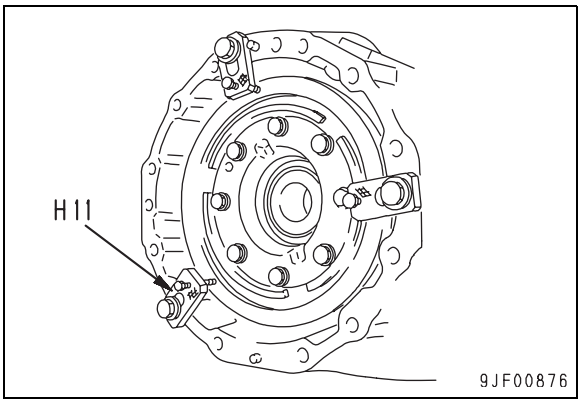



16. Brake
    ★ Install both brakes according to the same procedure.
    1) Install seal (87) to piston (20).

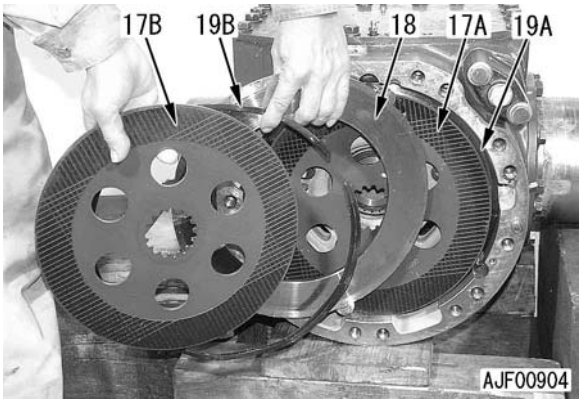



       Thinly apply differential oil to the piston and piston mounting section.

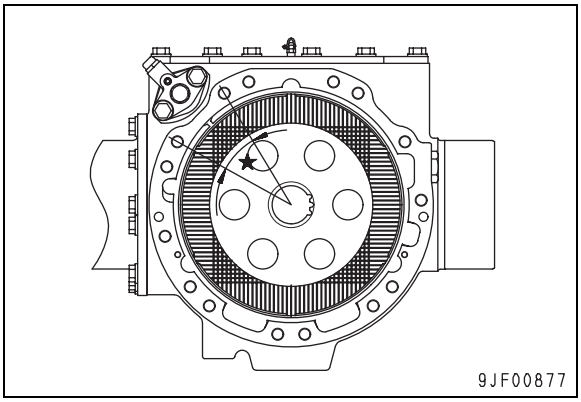
    2) Using tool **H11**, press fit piston (20) evenly.
       ★ Press fit the piston until it touches the housing.
       ★ Do not hit the piston with a plastic hammer, etc. to press fit it. (If it is press fitted so, it and its O-ring will be damaged.)



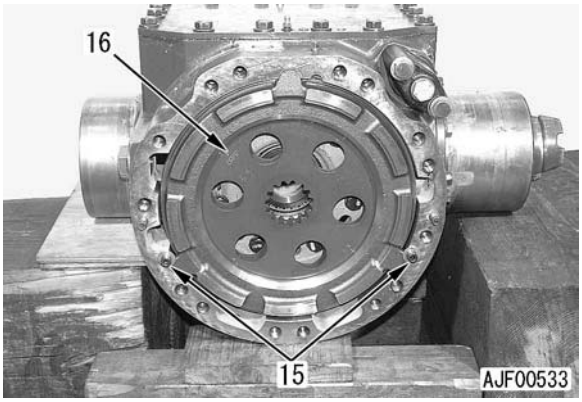
3) Install 1 disc (17A), 1 disc (17B), 1 plate (18), 2 wave springs (19A), and 2 wave springs (19B).
   ★ Install these parts in order of (19A), (17A), (18), (19B), and (17B).



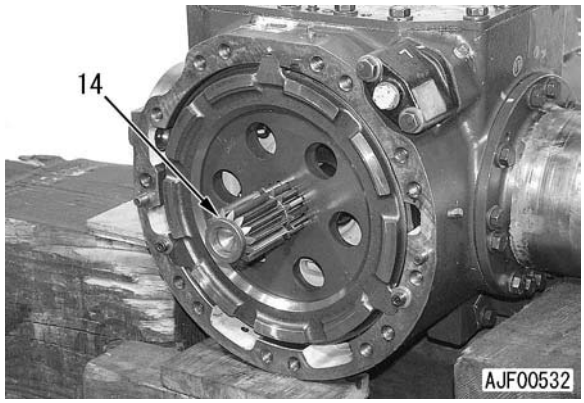

   ★ Pile up the 2 springs and match their cuts to each other, and then install them so that their cuts will be in the range marked with ★ in the brake oil port.



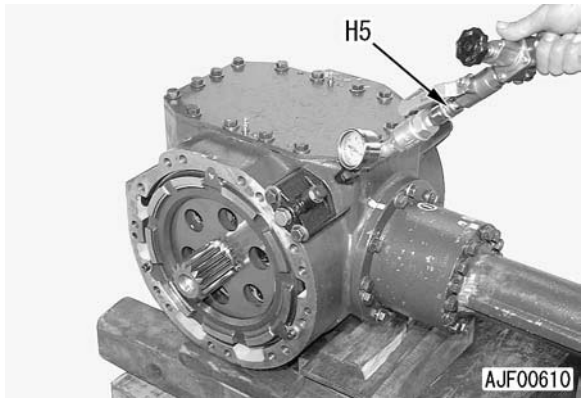

4) Install outer plate (16) and install 2 inside hexagon bolts (15).




5) Install sun gear shaft (14).

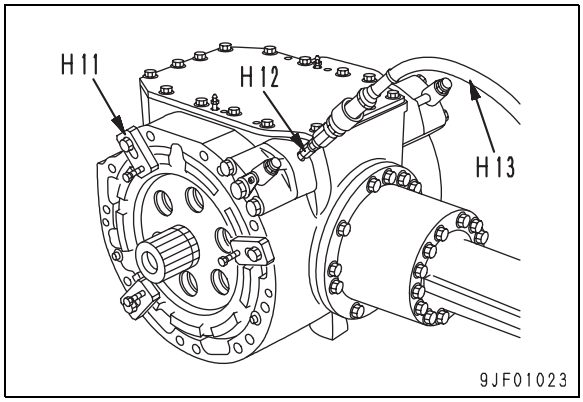



6) Using tool **H15**, supply air into the brake oil port to fit the piston.




17. Brake oil leakage test
   1) Set outer plate fixing tool **H11**.
      ★ If you check for brake oil leakage without setting **H11**, the 2 hexagon socket head bolts for fixing the outer plate will be broken.
   2) Install nipple **H12** and pump **H13** to the brake port and bleed all air through the bleeder.
      ★ Bleed air by operating pump **H13**.
   3) Perform the low-pressure oil leakage test.
      ★ Operate tool **H13** to raise the pressure to 98 kPa {1 kg/cm$^2$}.
      ★ Leave the system for 5 minutes and check that the pressure does not lower at all.

4) Perform the high-pressure oil leakage test.
   - ★ If oil leakage is not detected by the low-pressure brake oil leakage test, operate tool **H13** to raise the pressure to 4,410 kPa {45 kg/cm$^2$}.
   - ★ Leave the system for 5 minutes and check that the pressure does not drop more than 98 kPa {1 kg/cm$^2$}.
   - ★ If the oil leaks (If the pressure drops more than the standard), remove the brake piston and check the seals for damage.
   - ★ If the hose is moved while the pressure is measured, the pressure fluctuates. Accordingly, do not move the hose.



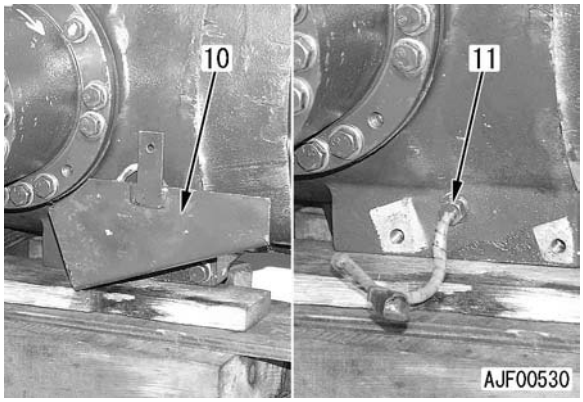

18. Axle oil temperature sensor (Only front axle)
    1) Install axle oil temperature sensor (11).

       Threads: **Gasket sealant (LG-5)**

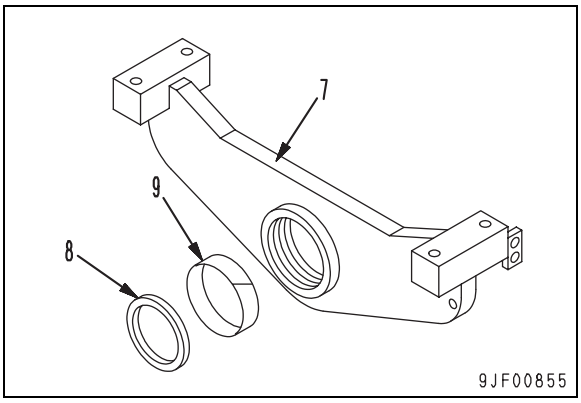
       Axle oil temperature sensor: **29.4 - 49 Nm {3 - 5 kgm}**

    2) Install cover (10).

       Mounting bolt: **98 - 122.5 Nm {10 - 12.5 kgm}**




19. Rear axle support
    1) Install bushing (9) and packing (8) to rear axle support (7).
       - ★ Install the bushing with the chamfered part on the axle side and the slit at the side position.
       - ★ Install the packing with the lip on the outside of the rear axle support (on the axle side).

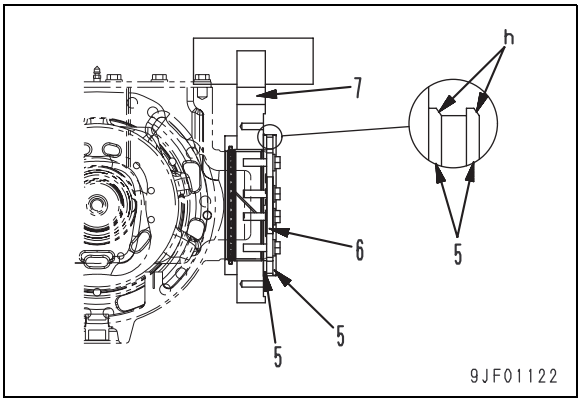



    2) Sling and install rear axle support (7).
    3) Install thrust plate (6) and 2 thrust washers (5).
       - ★ Clean the mating faces of the thrust plate and thrust washer thoroughly.
       - ★ Install thrust washer (5) with chamfered part (h) out.
       - ★ Insert a feeler gauge all round the mating faces of the thrust plate and thrust washer to check that there is not a clearance.

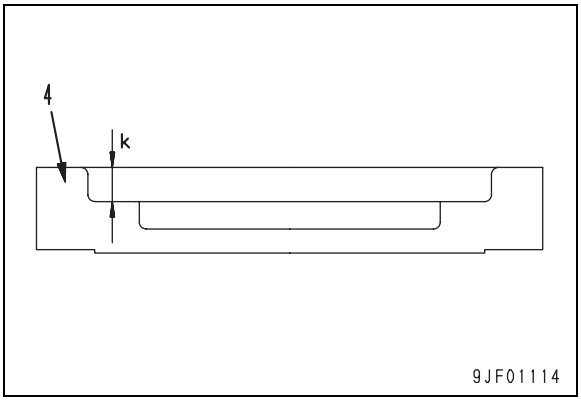
       Periphery of pivot mounting part: **Grease (G2-LI)**

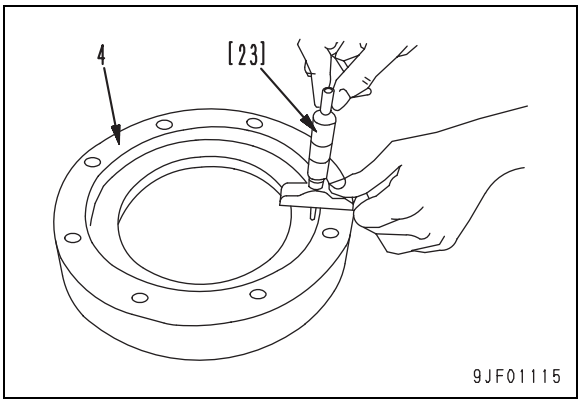
       Mounting bolt: **Adhesive (LOCTITE 262)**

       Mounting bolt: **93.1 - 122.5 Nm {9.5 - 12.5 kgm}**

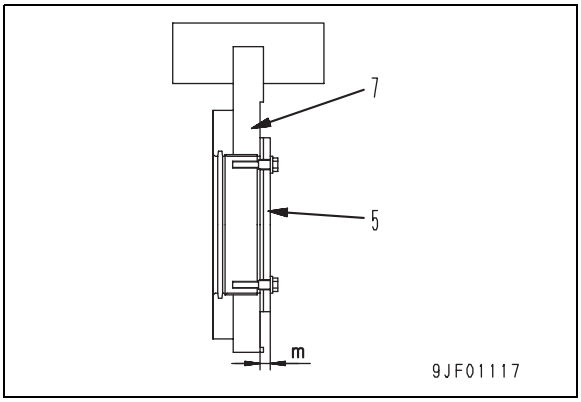


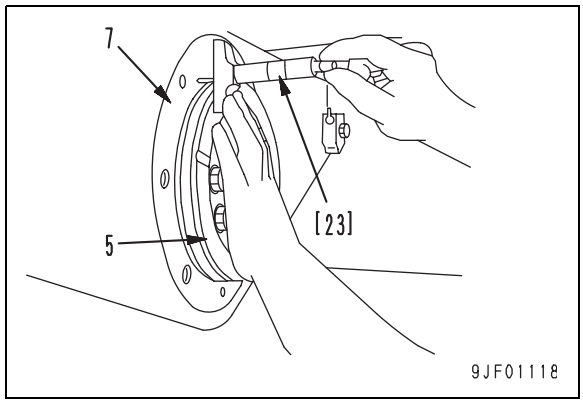
20. Adjust the shim of cover (trunnion cap) (4).
    1) Measure dimension (k) of cover (4) with depth micrometer [23] at 4 places on the diagonal lines and obtain the average.
       ★ Clean the contact face of the depth micrometer thoroughly.
       • Standard average value (k):
         **19.85 - 20.0 mm**




    2) Measure dimension (m) between rear axle support (7) and thrust washer (5) with depth micrometer [23] at 4 places on the diagonal lines and obtain the average.
       ★ Clean the contact face of the depth micrometer thoroughly.
       • Standard average value (m) (Reference): **19.65 - 20.0 mm**



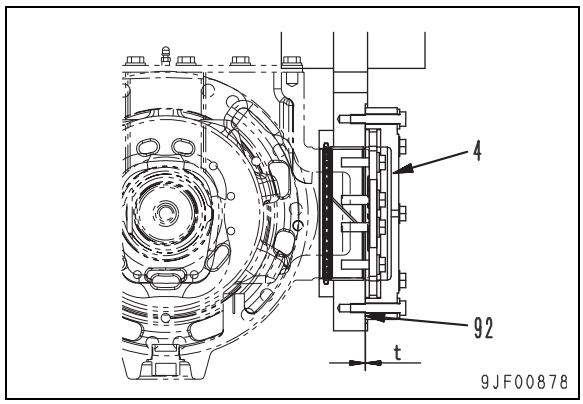

    3) Calculate shim thickness (t).
       • Shim thickness (t) = (h) - (k)
       ★ Decide the number of the shims by the calculated shim thickness and the following table.
       • Shim thickness (1 piece): 0.2 mm

| Shim thickness | Number of shims |
|---|---|
| 0 – 0.07 mm | 1 |
| 0.08 – 0.27 mm | 2 |
| 0.28 – 0.47 mm | 3 |

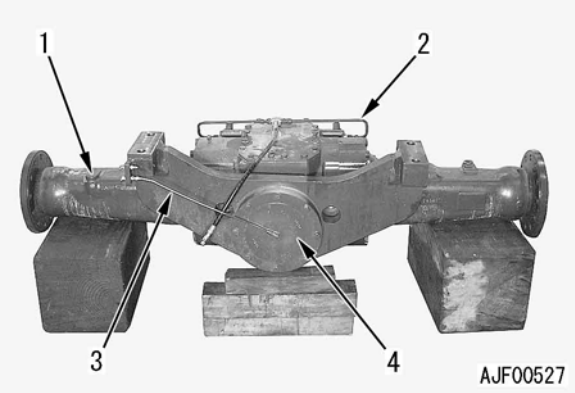
    4) Install selected shim (92), and then install cover (4) again.

       Cover: **Grease (G2-LI)**

       Mounting bolt:
       **93.1 - 122.5 Nm {9.5 - 12.5 kgm}**



21. Grease tube and brake piping
    1) Install grease tube (3).
    2) Install brake tube and hose assembly (2).
22. Axle housing
    1) Install both axle housings (1). For details, see DISASSEMBLY, ASSEMBLY OF AXLE HOUSING ASSEMBLY.




- **Refilling with oil (Axle housing)**
  Tighten the drain plug and add oil through the oil filler to the specified level.

Drain plug:
**127.4 - 176.4 Nm {13 - 18 kgm}**

Oil filler plug:
**93.1 - 122.5 Nm {9.5 - 12.5 kgm}**

Axle (Each of front and rear): **18 ℓ**

# REMOVAL, INSTALLATION OF HST PUMP AND 4-GEAR PUMP ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

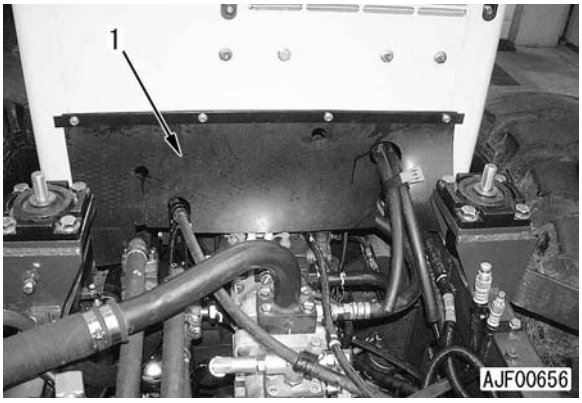
Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

Disconnect the cable from the negative (-) terminal of the battery.

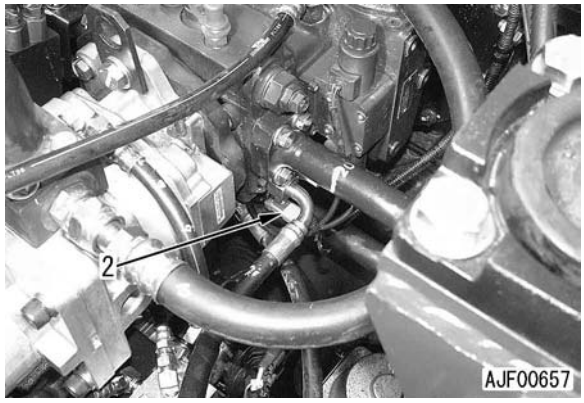
1. Drain the hydraulic oil.

   Hydraulic tank: **96 ℓ**

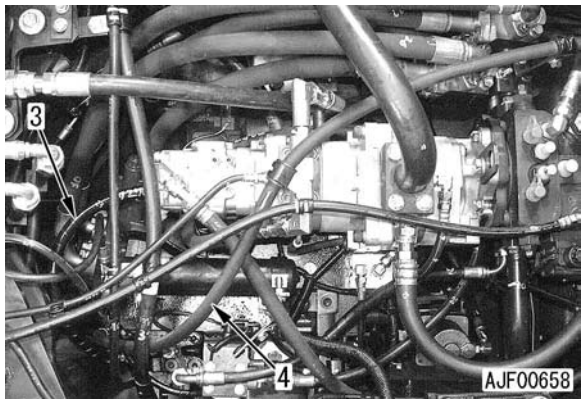
2. Remove the operator's cab assembly. For details, see Removal, installation of operator's cab assembly.
3. Remove rubber (1).



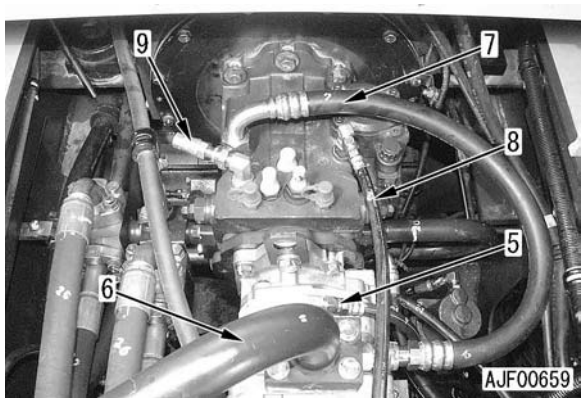

4. Disconnect wiring connectors T01 (2).



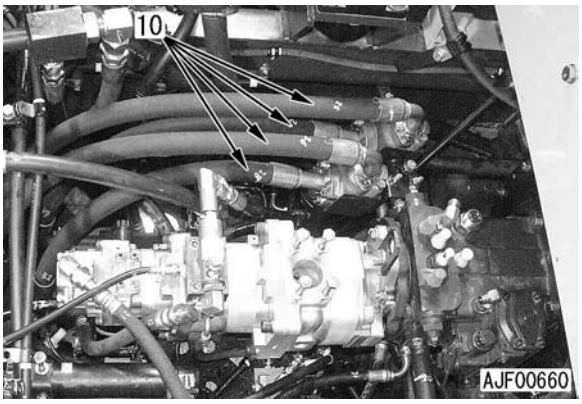

5. Disconnect the following tubes and hoses.
   - (3): Hose between accumulator charge valve port P and brake pump
   - (4): Hose between accumulator charge valve port A and fan motor



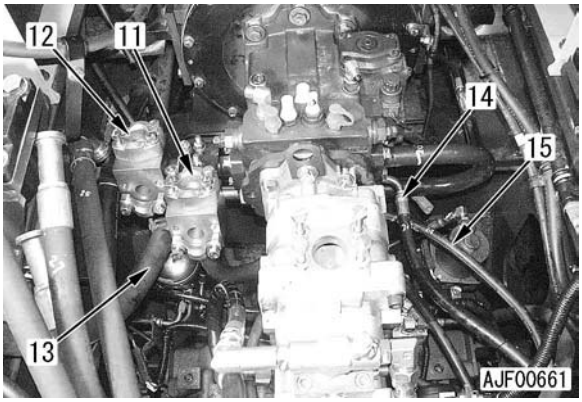

   - (5): P/B solenoid valve return hose
   - (6): Steering pump suction tube
   - (7): Hose between HST pump port Y and steering pump
   - (8): HST pump port T2 hose
   - (9): HST pump port G hose



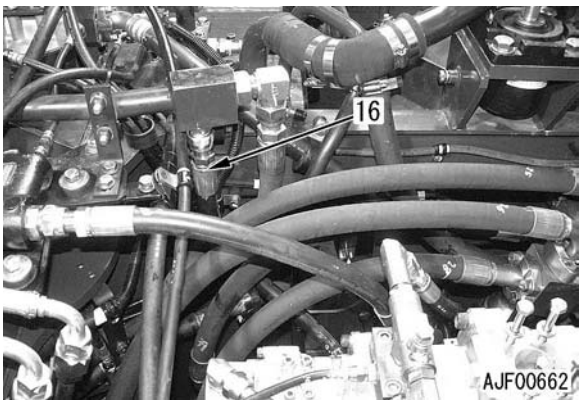
- (10): 4 HST pump discharge hoses



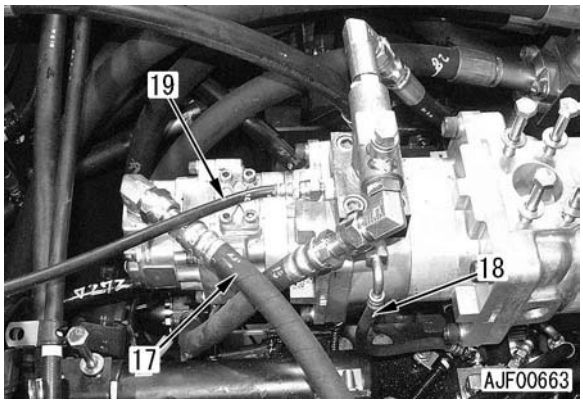

- (11): HST pump port A discharge tube
- (12): HST pump port B discharge tube [*1]
- (13): HST pump suction hose
- (14): HST pump port Fa hose
- (15): HST pump port Fe hose



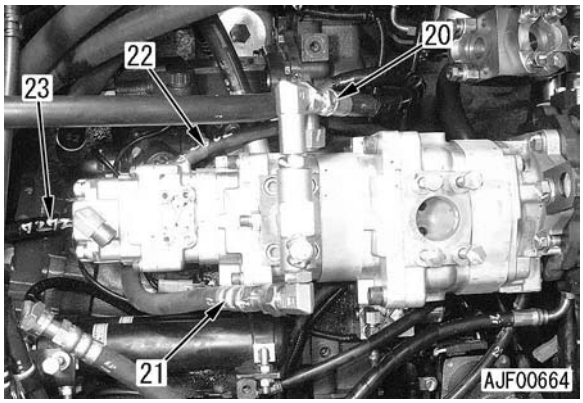

- (16): Work equipment pump discharge hose




- (17): Transfer lubricating oil pump suction hose
- (18): Clutch solenoid valve return hose
- (19): Brake valve return hose




- (20) (21): Work equipment pump suction hoses
- (22): Brake and fan pump discharge hose
- (23): Transfer lubrication hose




6. Sling HST pump and 4-gear pump assembly (24) temporarily, and then remove its 6 mounting bolts and it. [*2]
   Mounting bolt M12: 4
   Mounting bolt M16: 2

   HST pump and 4-gear pump assembly: **120 kg**

## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

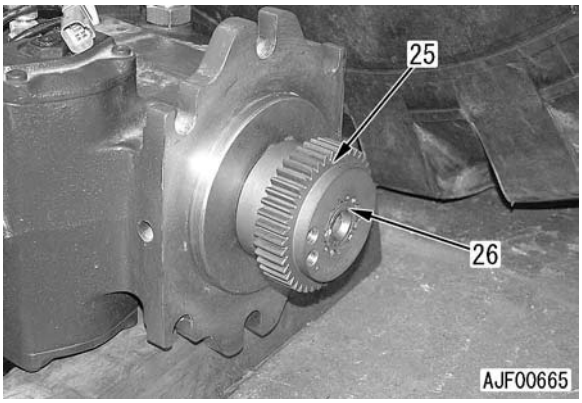
U-clamp of tube (12): **10 - 26 Nm {1.1 - 2.7 kgm}**

[*2]

Mating face of pump: **Gasket sealant (LG-6)**

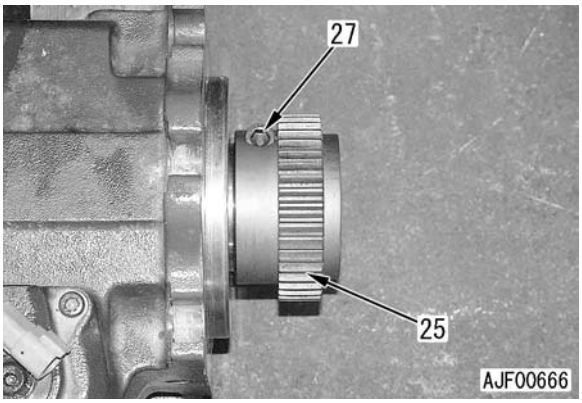
Mounting bolt (M12): **490 - 608 Nm {50 - 62 kgm}**

1. If boss (25) was removed from the HST pump assembly, install it according to the following procedure.
   - ★ Install boss (25) so that it will be flush with the shaft end of pump (26).
   - Level difference between boss and pump shaft end: **Max. 0.5 mm**




2. Tighten mounting bolt (27) of boss (25).

   Mounting bolt: **86 Nm {8.8 kgm}**



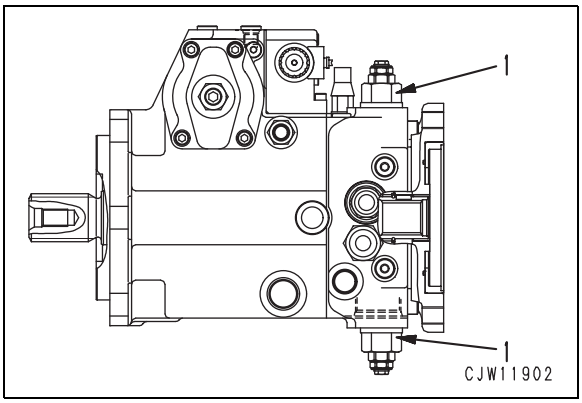

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

  Hydraulic tank: **96 ℓ**

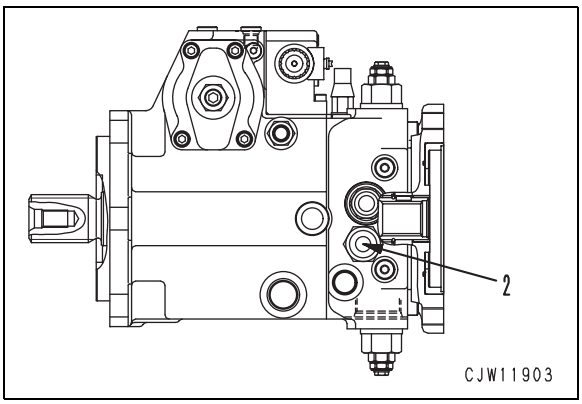
# DISASSEMBLY AND ASSEMBLY OF HST PUMP ASSEMBLY

## DISASSEMBLY

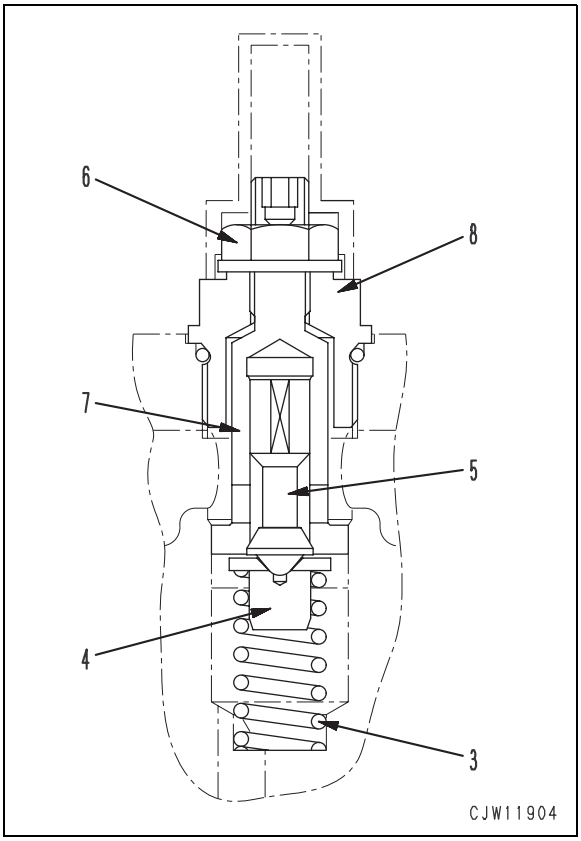
1. High pressure relief valve assembly
   1) Remove 2 high pressure relief valve assemblies (1).
      ★ Do not change adjustment screw.
      ★ Control: O-ring, housing.
      ★ Do not disassemble the high pressure relief valve assemblies, except the O-rings and backup rings.



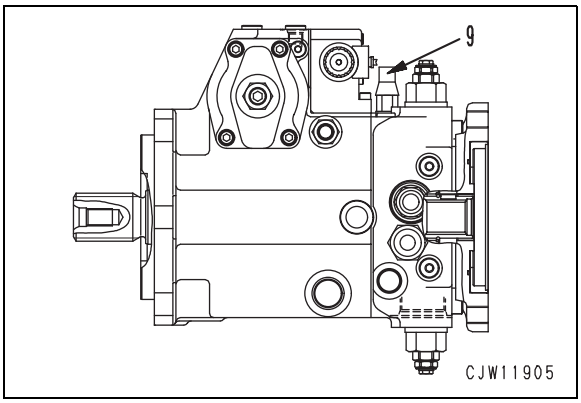

2. Low pressure valve assembly.
   1) Remove low pressure valve assembly (2).
      ★ Do not change adjustment screw.




   2) Disassemble the low pressure relief valve according to the following procedure, if necessary.
      ★ Before loosening the adjustment screw, check the adjustment dimension.
      i) Remove spring (3) and spring seat (4).
      ii) Remove piston (5).
      iii) Remove locknut (6).
      iv) Remove adjustment screw (7) from holder (8).




3. High pressure cut-off valve assembly
   1) Remove high pressure cut-off valve assembly (9)
      ★ Unscrew setting cartridge completely.
      ★ Control: O-ring, housing.

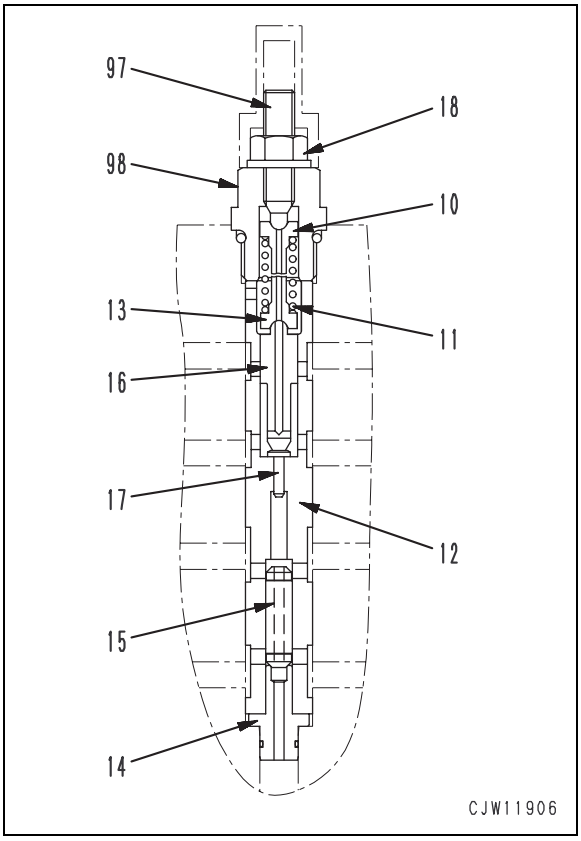



   2) Disassemble the high pressure cut-off valve according to the following procedure, if necessary.
      ★ Before loosening the adjustment screw, check the adjustment dimension.
      i) Remove spring seat (10) and spring (11) from the pump case.
      ii) Remove barrel assembly (12) from the pump case.

iii) Remove spring seat (13), valve seat (14), and shuttle spool (15) from barrel (12).

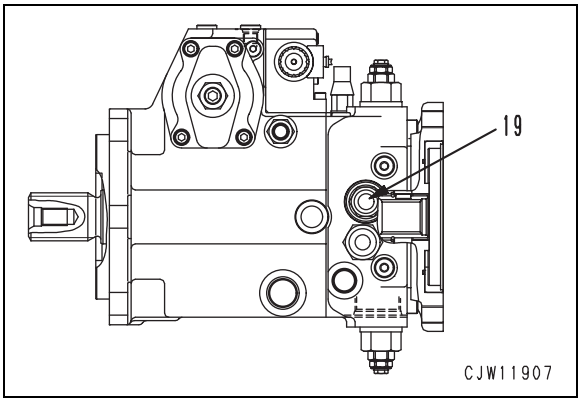
iv) Remove spool (16) and piston (17) from barrel (12).

v) Remove locknut (18), and then remove adjustment screw (97) from holder (98).




4. Remove speed-related valve (DA) valve assembly

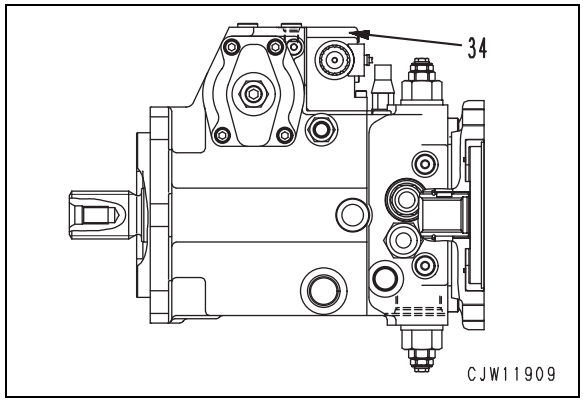
1) Remove speed-related valve assembly (19).




5. Forward-reverse solenoid valve

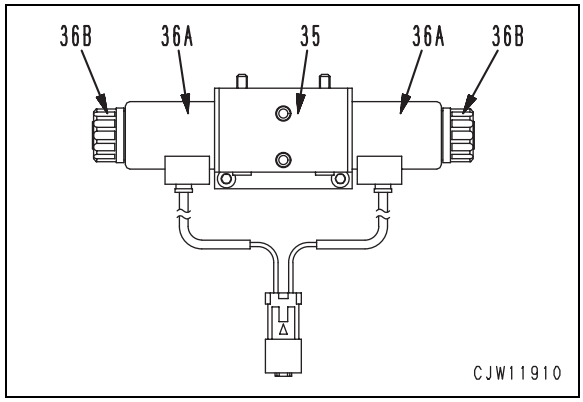
1) Remove forward-reverse solenoid valve assembly (34).

Check correct hydraulic 0-position.

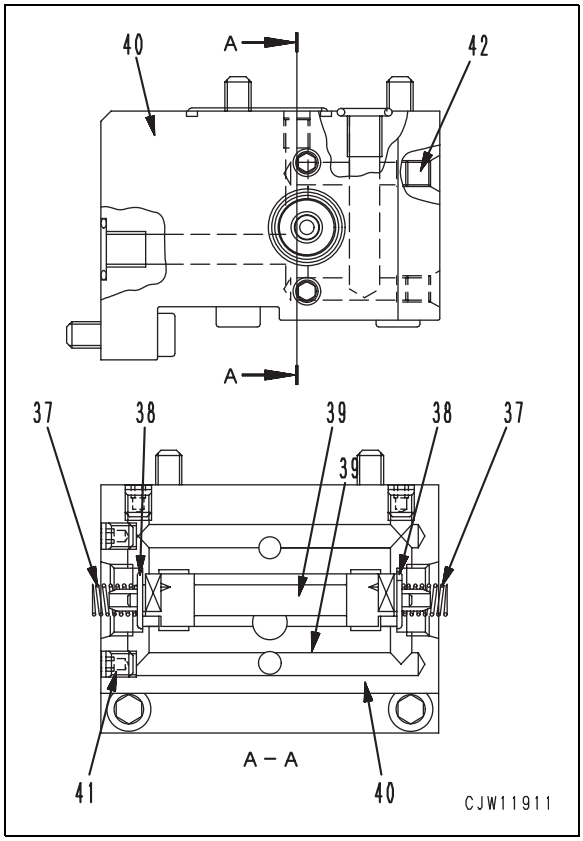



2) Remove 2 solenoid valves (36) from valve housing assembly (35).

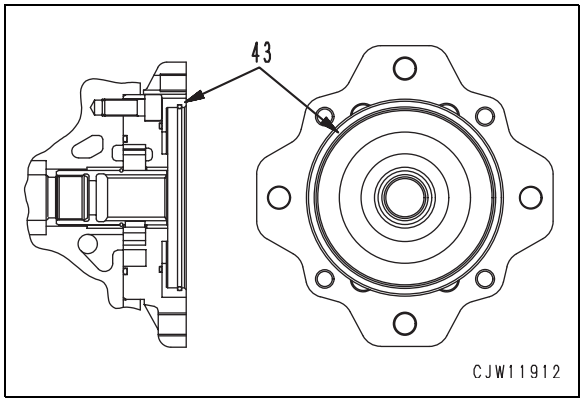
★ Remove cap (36A) and coil (36B) from the solenoid valve, and then remove the tube from the valve housing.



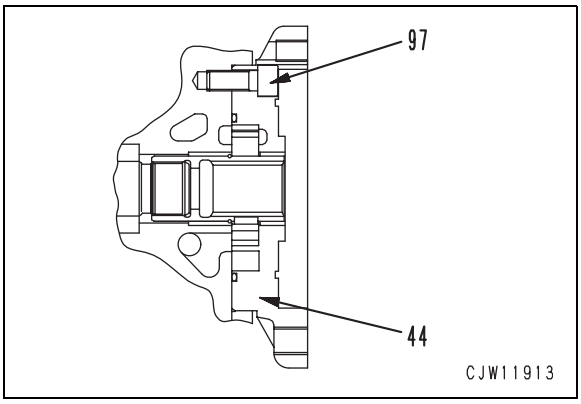
3) Disassemble the valve housing assembly according to the following procedure.
   i) Remove 2 springs (37) and 2 collars (38).
   ii) Remove piston (39).
   iii) Remove 4 plugs (41) and plug (42) from housing (40).



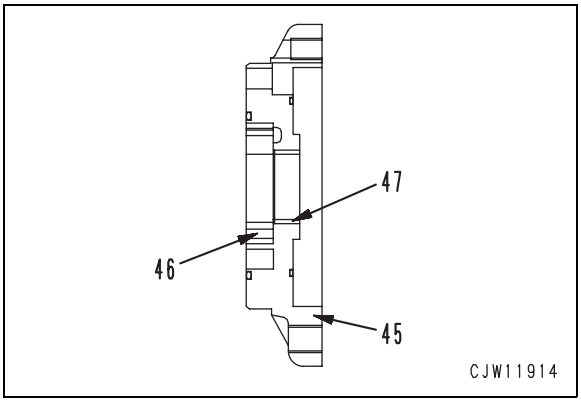

6. Charge pump assebmly
   1) Remove spacer (43).



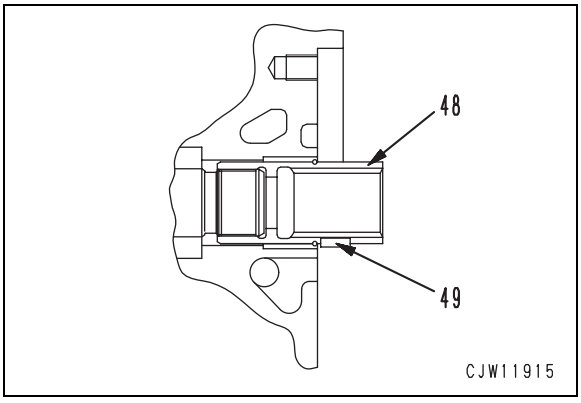

2) Remove the 4 mounting bolts and charge pump assembly (44).



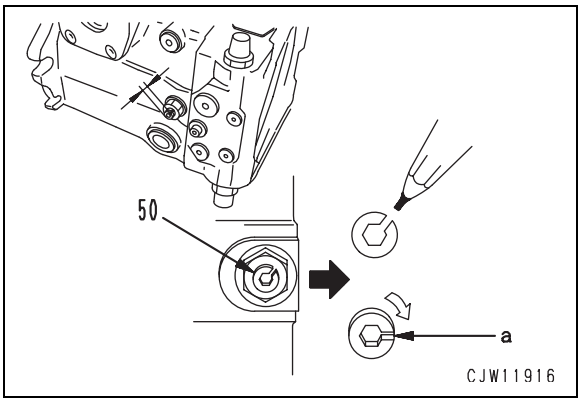

3) Remove gear (46) and bearing metal (47) from flange (45).



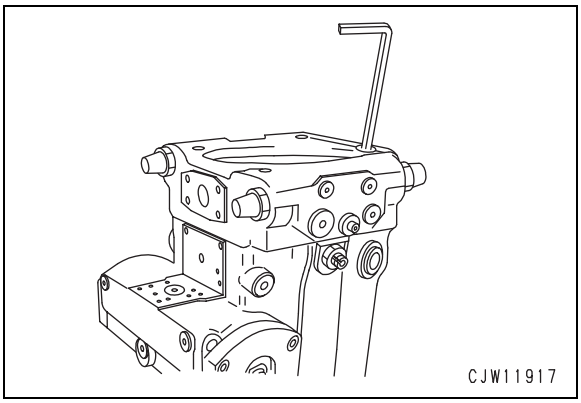

4) Remove coupling (48) and key (49).



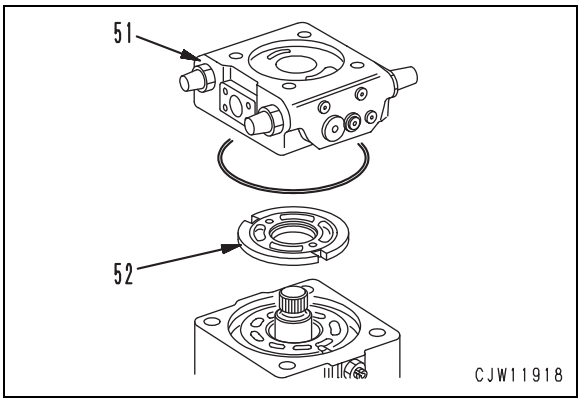
7. Port plate Ass'y
   1) Mark the position of the indexing screw (50).
   ★ Record setting measure.
   2) Set the indexing screw to disassembly position (a).



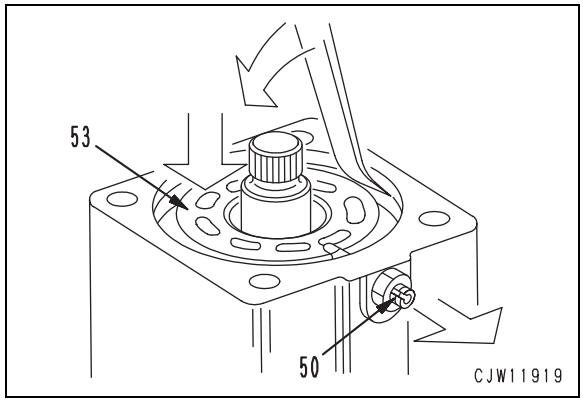

   3) Mark position of the connection plate.
   4) Loosen connection plate fixation.



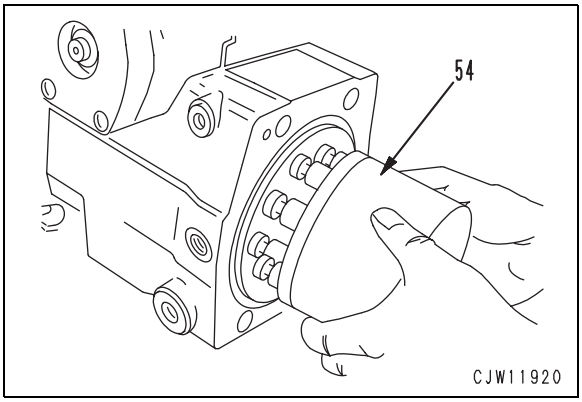

   5) Lift off port plate Assembly (51) and control plate (52).



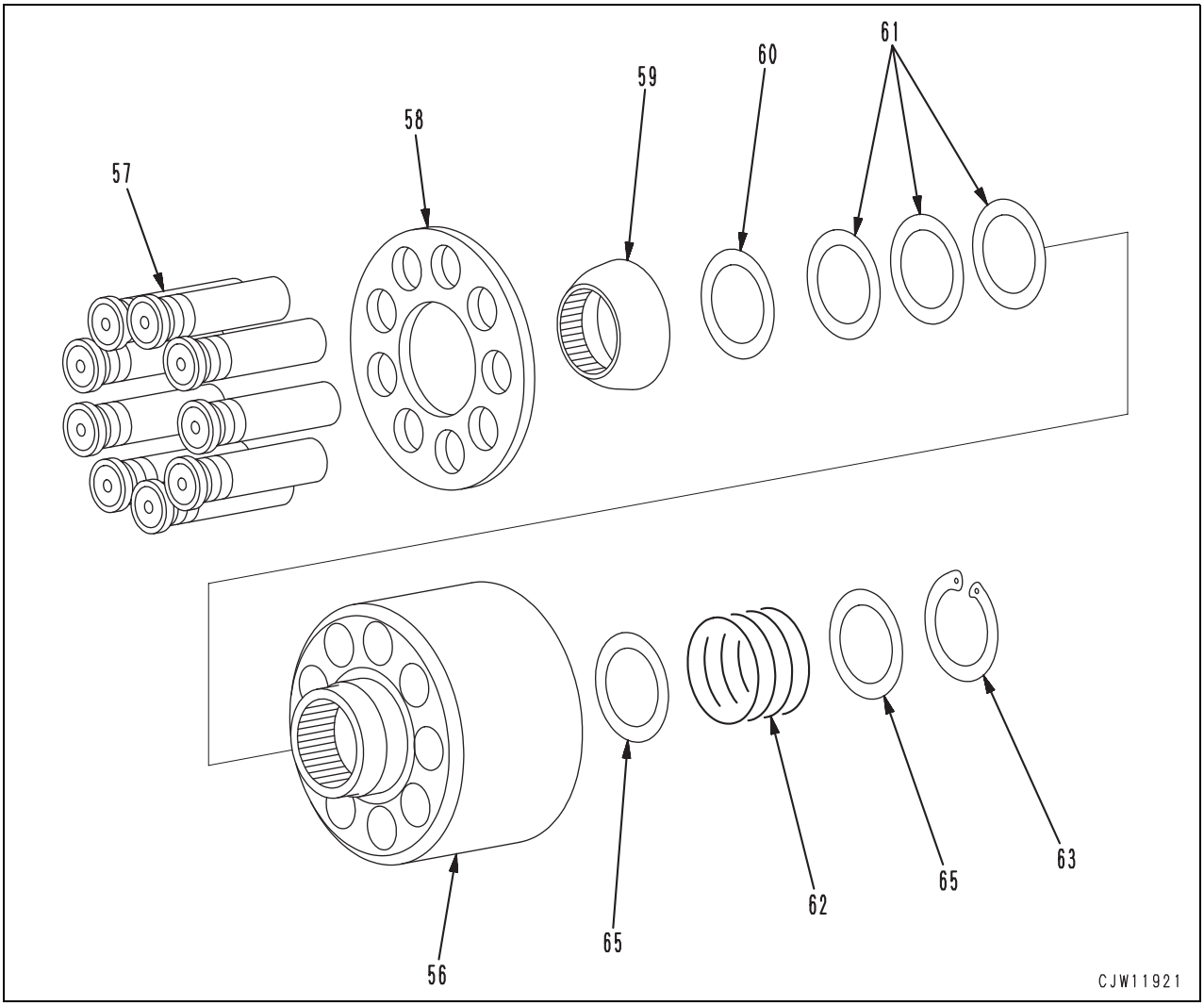

8. Cylinder block, Piston assembly
   1) Press the cylinder (53) to the bottom.
   2) Remove fixing indexing screw (50).



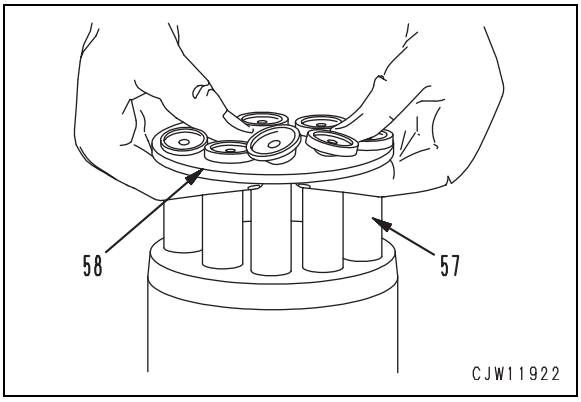

   3) Remove cylinder block and piston assembly (54).



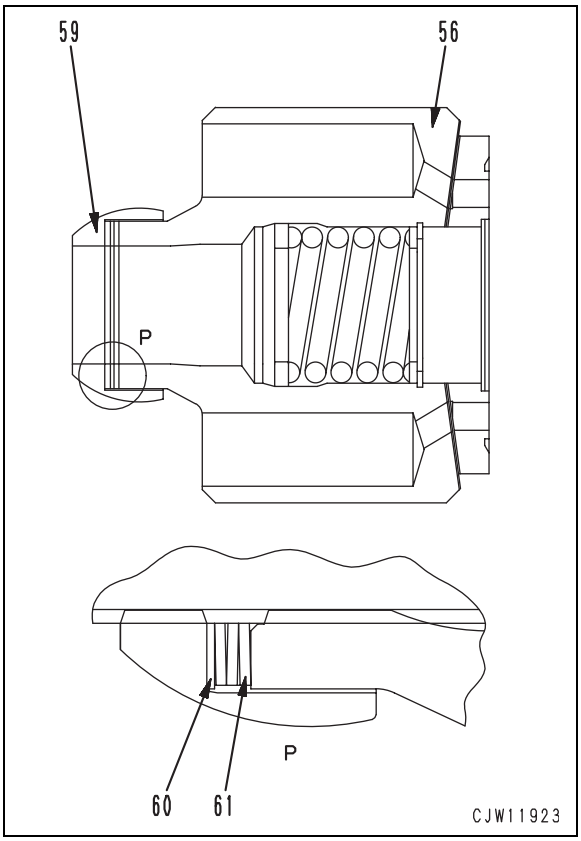
4) Disassemble the cylinder block and piston assembly according to the following procedure.



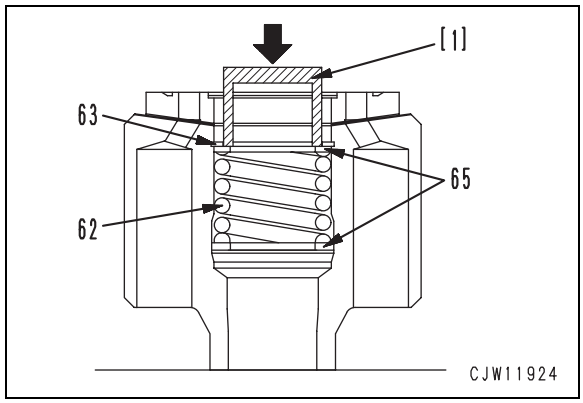
i) Remove the assembly of pistons (57) and retainer (58) from cylinder block (56).
ii) Remove 9 pistons (57) from retainer (58).



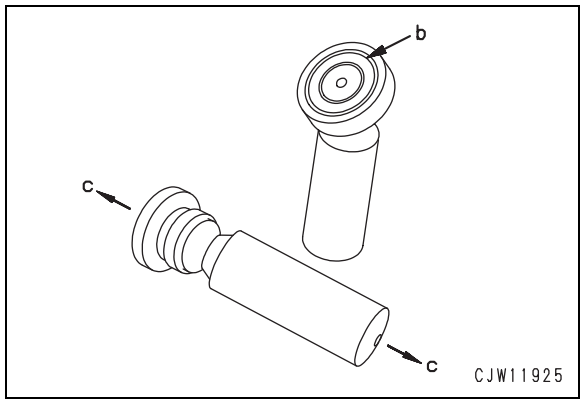

iii) Remove retainer guide (59) from cylinder block (56).
iv) Remove shim (60) and spring (61).



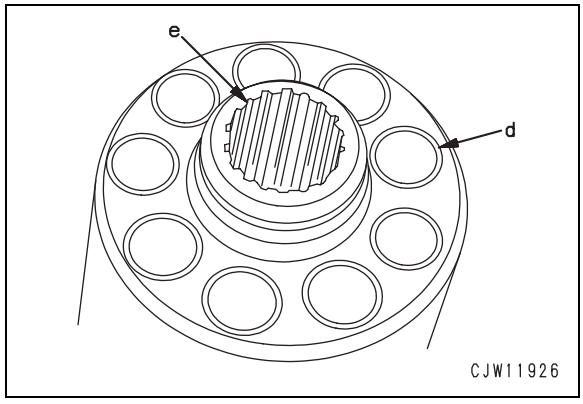

v) Set tool [1] to cylinder block (56) and compress spring (62).
vi) Remove snap ring (63) from the cylinder block.
vii) Remove spring (62) and 2 shims (65).



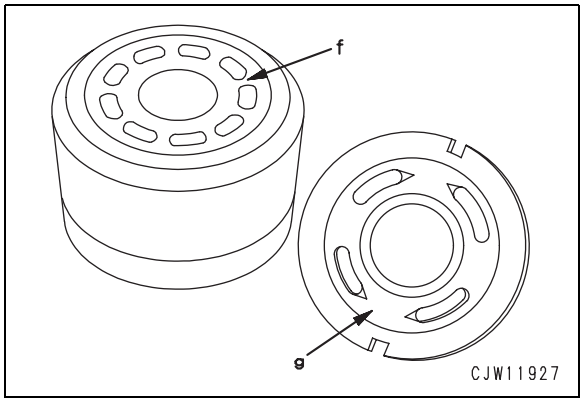

★ Check of pistons
- Check that there are no scratches or metal deposits on sliding surface (b), and there is no axial play (c), (otherwise: pistons must be replaced in sets).



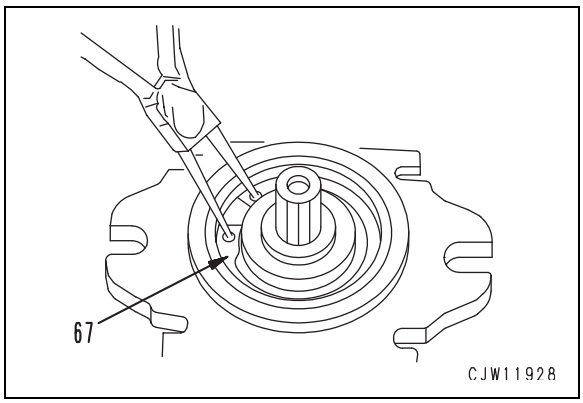

★ Check of cylinder block and control plate.
- Cylinder bores (d), splines (e).



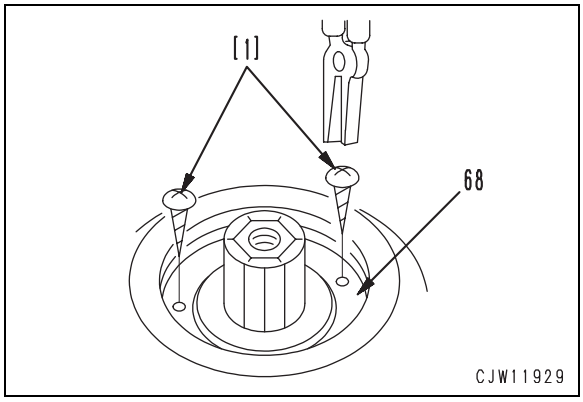
- Cylinder surface (f) free of scoring.
- Control plate (g) without scoring.



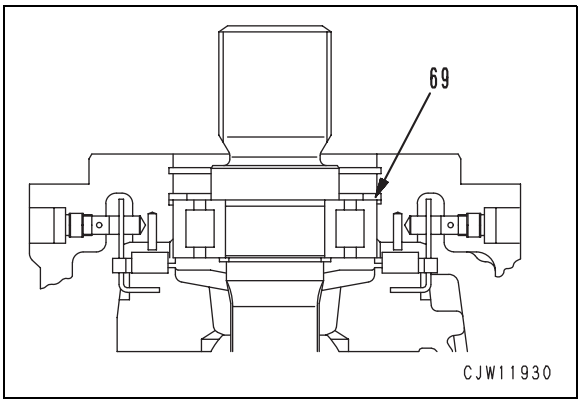

9. Seal
   1) Protecting the drive shaft (66).
   2) Remove snap ring (67).



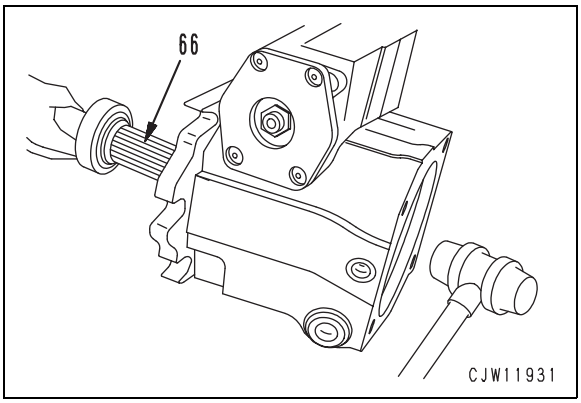

   3) Screw [1] in sheet metal screw into the holes fitted with rubber.
   4) Pull out shaft seal (68) with pliers.




   5) Remove snap ring (69).

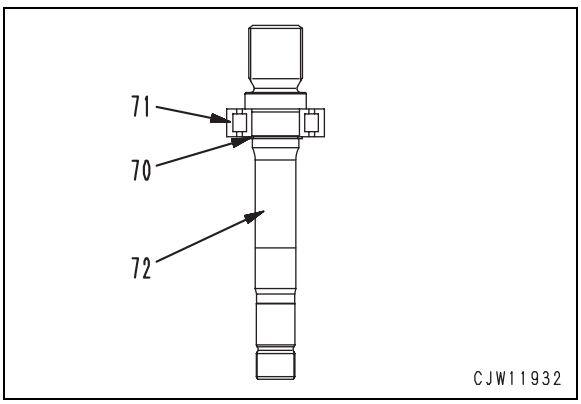



10. Drive shaft assembly
    1) Remove drive shaft assembly (66) with slide hammer strokes.

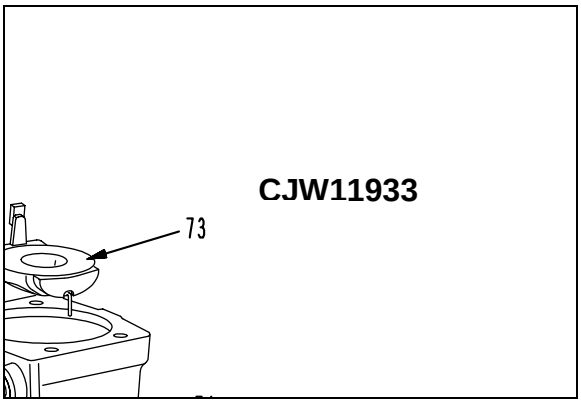



    2) Disassemble the drive shaft assembly according to the following procedure.
       i) Remove snap ring (70).
       ii) Remove bearing (71) from drive shaft (72).

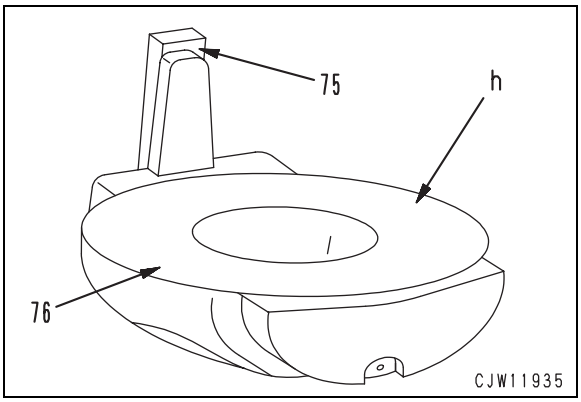
       ★ Check of drive shaft
       - Splines for damage or fretting.
       - Running surfaces.
       - Groove cut by shaft seal.



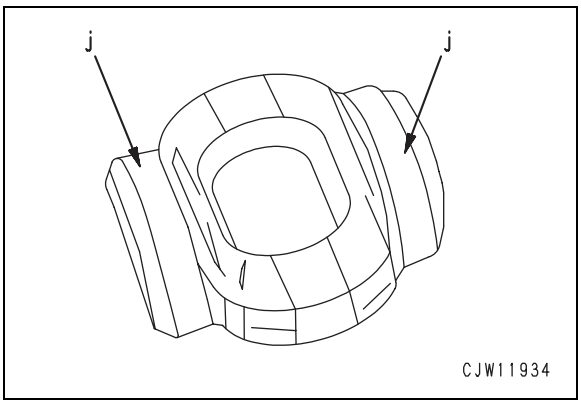
11. Swivel cradle, Bearing cups
    1) Remove swivel cradle (73).
    2) Remove bearing cups (74).
       ★ Check
       • Bearing cups set.



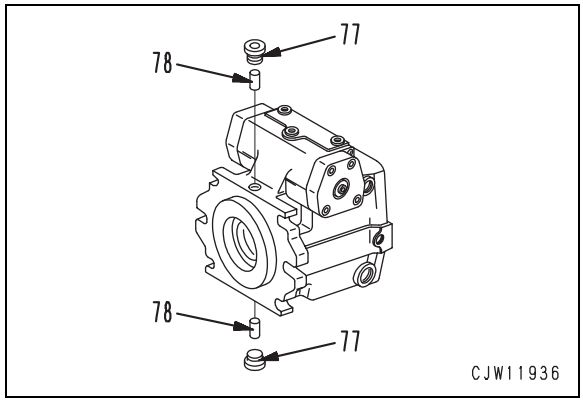

    3) Remove lever (75) from cradle (76).
       ★ Check of cradle
       • Sliding surface (h) free from scoring.



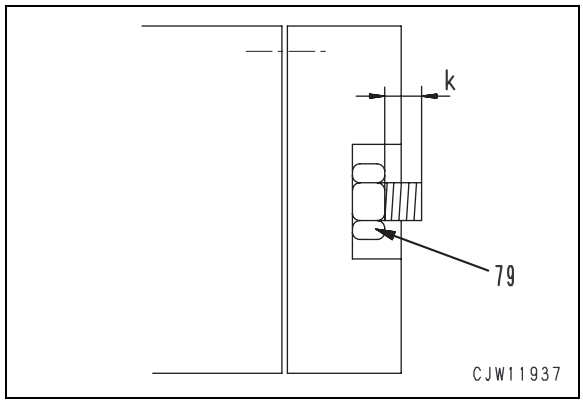

       • Bearing surfaces (j).



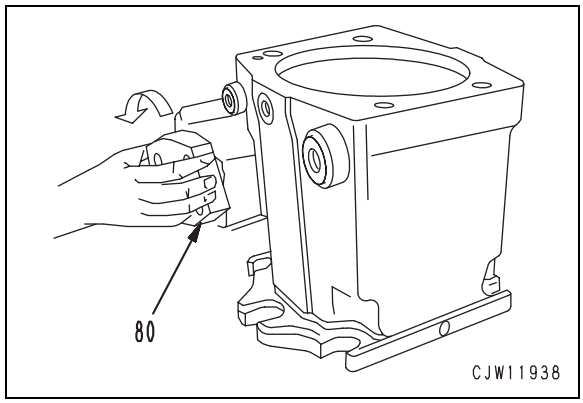

12. Joint pin
    1) Remove plugs (77).
    2) Remove joint pins (78).



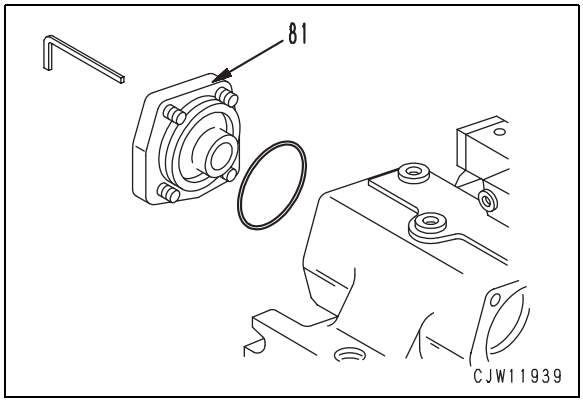

13. Servo cylinder assembly
    1) Mark position of the cover, note measure of "zero position" (k).
    2) Loosen nut (79).



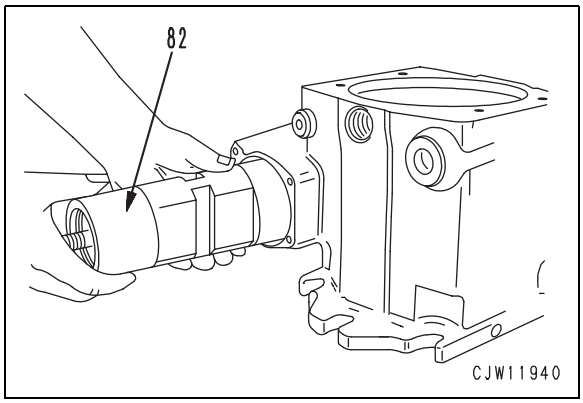

    3) Remove cover (80).



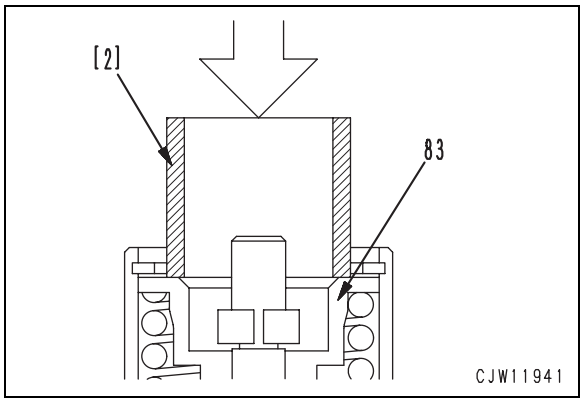
4) Mark position of the cover.
5) Loosen locking screw, remove cover (81).



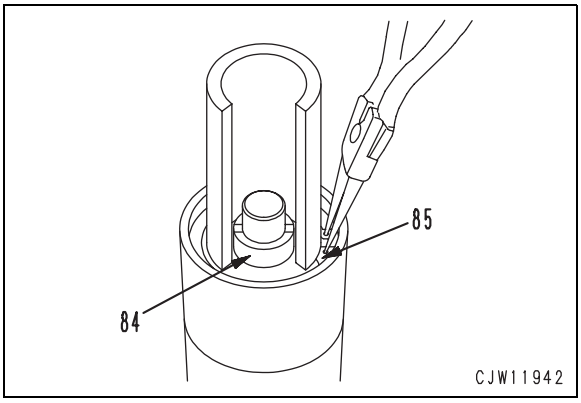

6) Remove servo piston assembly (82).



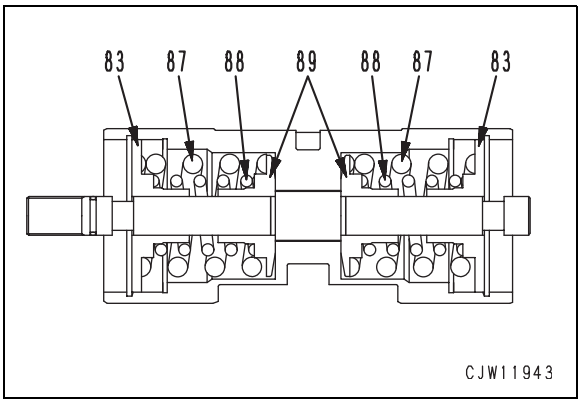

7) Disassemble the servo piston assembly according to the following procedure.
   i) Using tool [2], push collar (83).



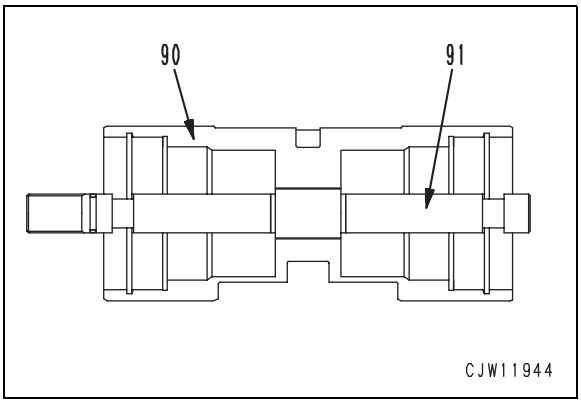

   ii) Remove 2 rings (84).
   iii) Remove snap ring (85).




   iv) Remove collars (83).
   v) Remove large springs (87) and small springs (88).
   vi) Remove collars (89).



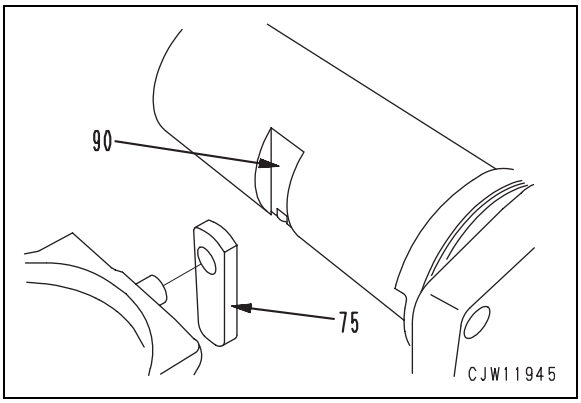

   vii) Disassemble the opposite side similarly.
   viii) Remove rod (91) from piston (90).



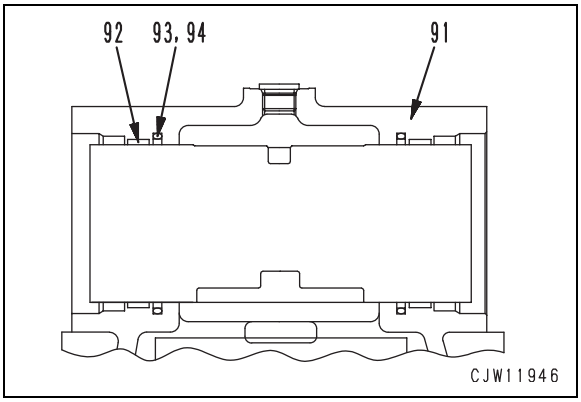
★ Check

Piston - cradle lever.

- Gliding stone (75), groove at the piston (90).
- Positioning piston (90).



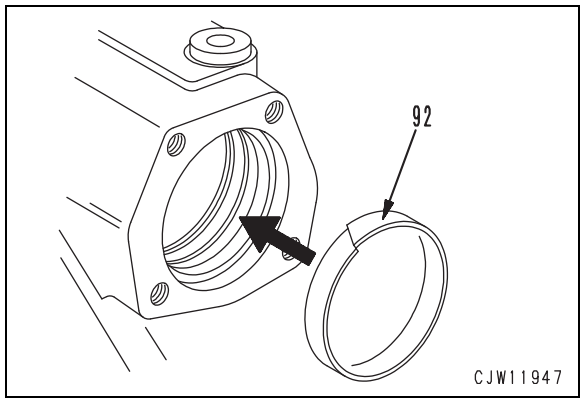

14. Pump case
    1) Remove guide ring (92) from the servo cylinder mounting part of pump case (91).
    2) Remove seal ring (93) and O-ring (94).



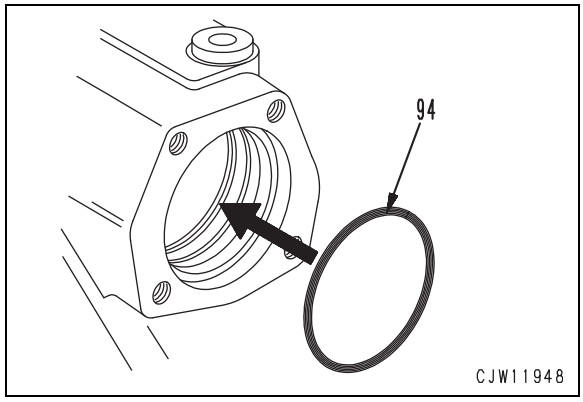

## ASSEMBLY

★ Clean the all parts and remove burrs, etc.
★ Coat the rotary parts and sliding parts with engine oil (EO10-CD) before installing.
★ If the tightening torque of a mounting bolt, nut, or plug is not shown in this manual, see the tightening torque table.

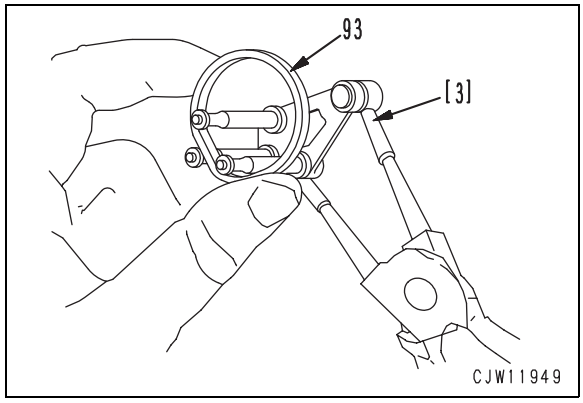
1. Pump case
    1) Install guide ring (92).



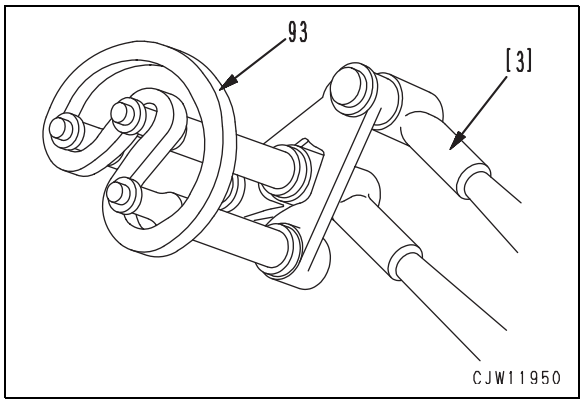

    2) Install ring (94).



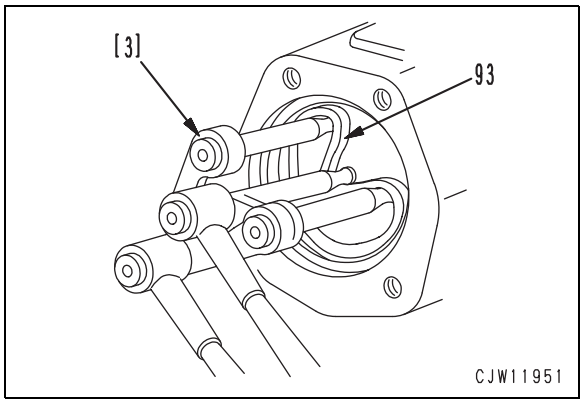

    3) Using tool [3], install the seal ring according to the following procedure.
        i) Fit the seal ring (93) into the assembly tool [3].



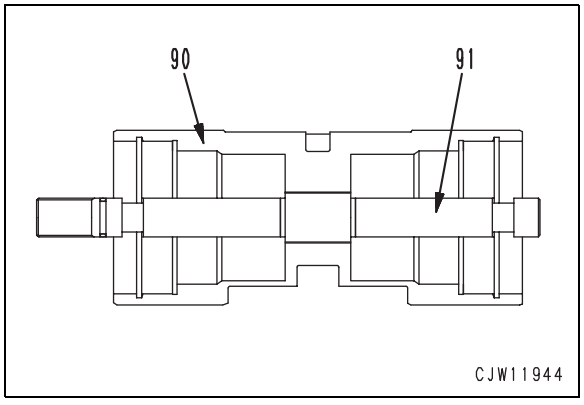
ii) Press the seal ring (93) into the kidney shape using the assembly tool [3].
★ The deformation of the seal has to be done withcare so as not to damage the sealing edges.



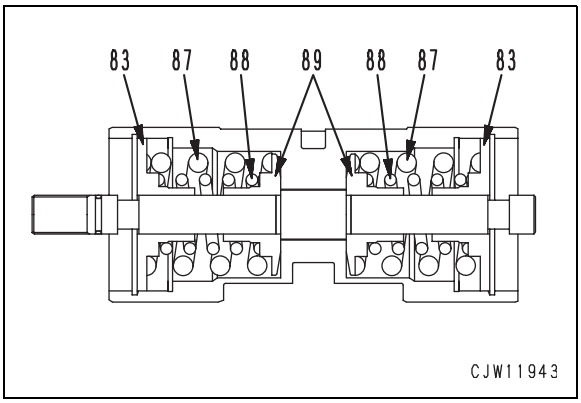

iii) Position the seal ring (93) into the housing and place it into the groove. Release the tension and withdraw the assembly tool [3].
★ Check the position of the seal ring (93) if necessary straighten using a finger.



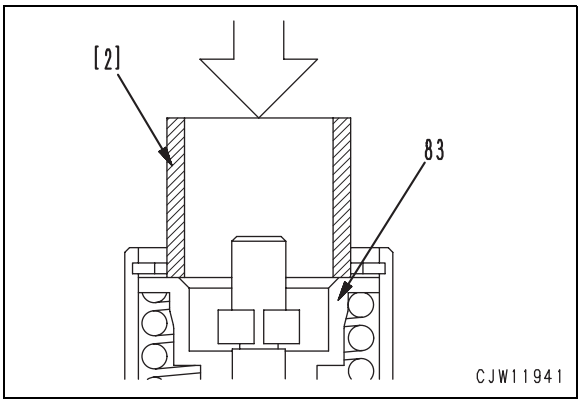

2. Servo piston assembly
1) Assemble the servo piston assembly according to the following procedure.
i) Install rod (91) to piston (90).

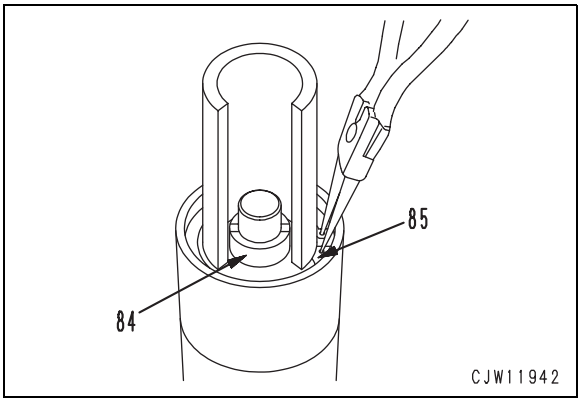



ii) Install collars (89).
iii) Install small springs (88) and large springs (87).
iv) Install collars (83).
v) Assemble the opposite side similarly.

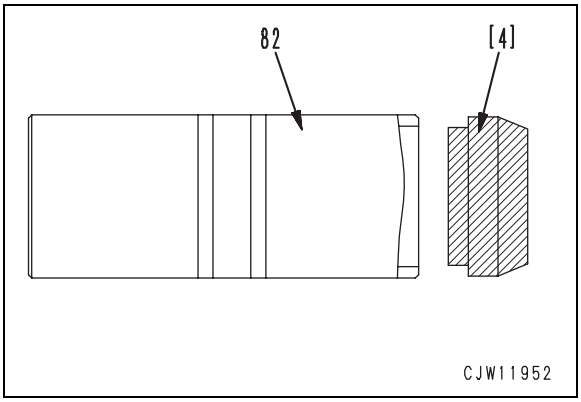



vi) Using tool [2], push collar (83).
vii) Install snap ring (85).
viii) Install 2 rings (84).

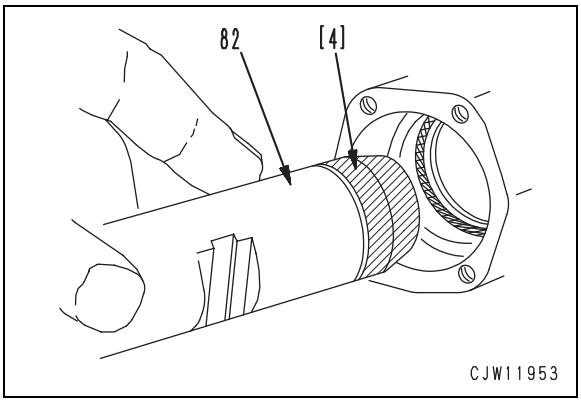


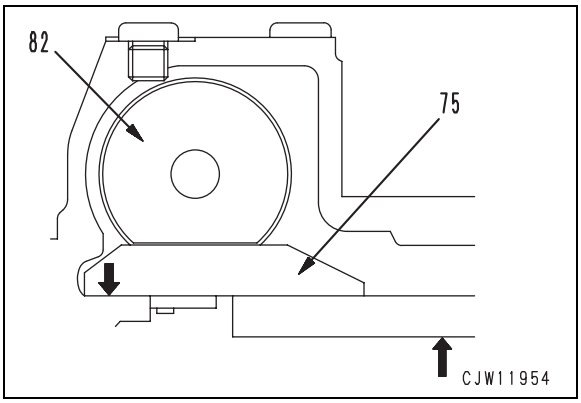
2) Insert guide thorn [4] into the servo piston Assembly (82).



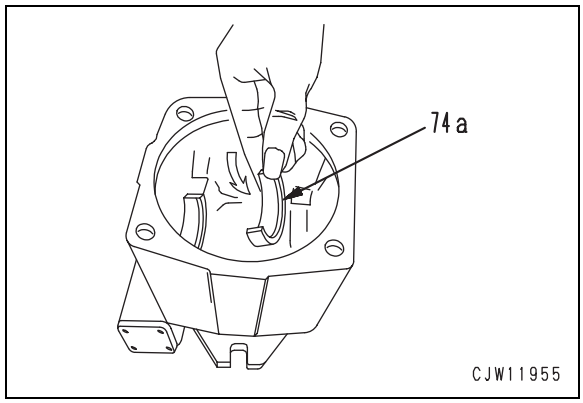

3) Grease slightly guide thorn [4].
4) Install servo piston Assembly (82) with guide thorn [4].



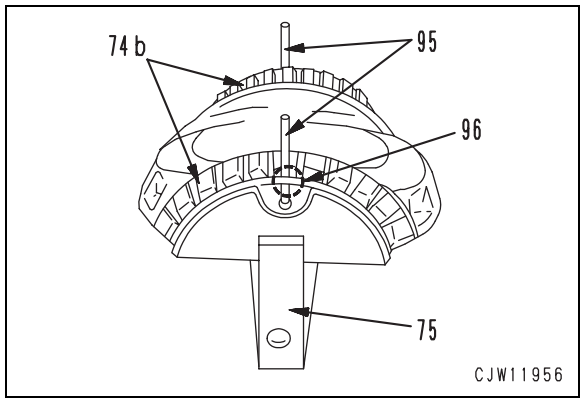

3. Cradle, Bearing cups
   1) Position stroke piston (82) with lever (75).
      ★ Sliding stone guidance in the piston (82).




2) Insert bearing cup set (74a).

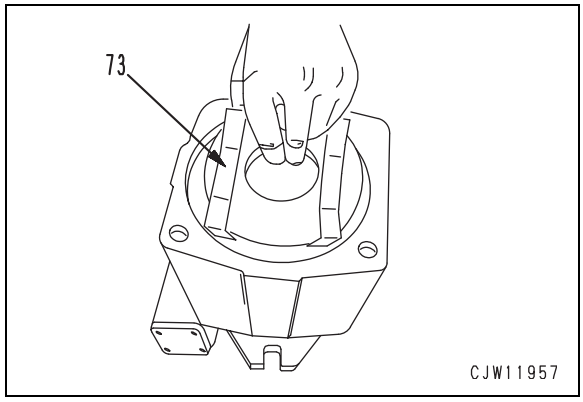



3) Assemble bearing (74b), wire (95), gliding stone (75) and articulating pin (96).
   ★ Assistance: Devices e.g. - Clamp / rubber rings / grease.



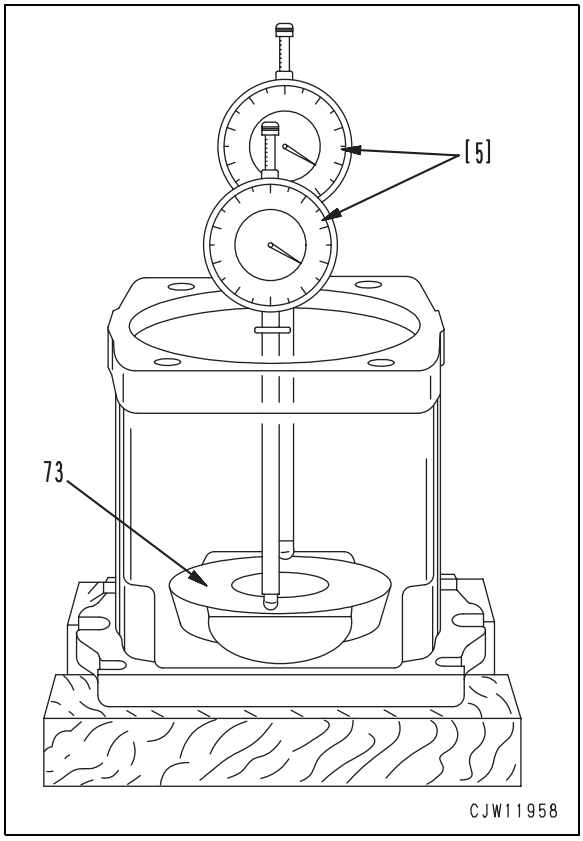

4) Insert completely swivel cradle (73) into housing.
   ★ Pay attention for correct seat of the swivel cradle (73) in the housing.

Remove auxiliary device.

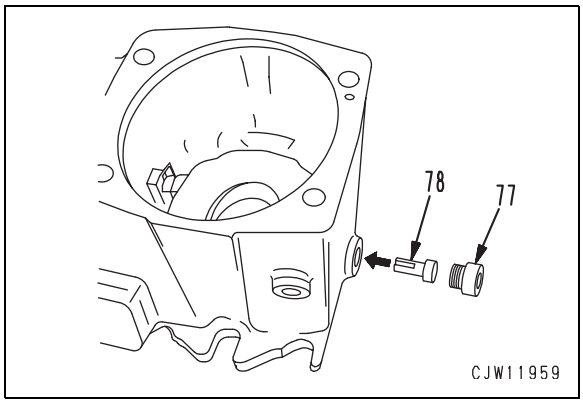


★ Check: Location of the swivel-bearing in the bearing.

- Centralise the swivel (73) by using a measuring device (dial gauge or depth mesurement [5])
- Check points 1 and 2 - they should have the same dimension.

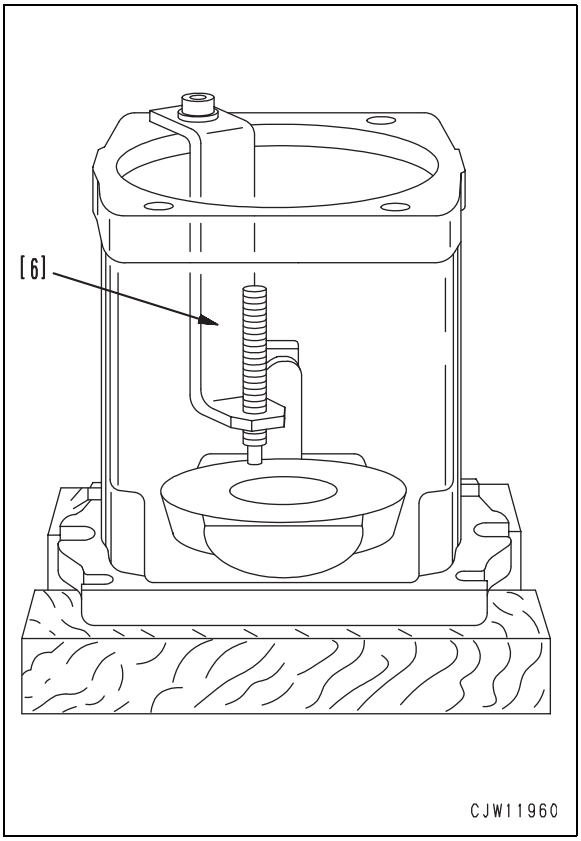



5) Fit joint pin (78) and plug (77).

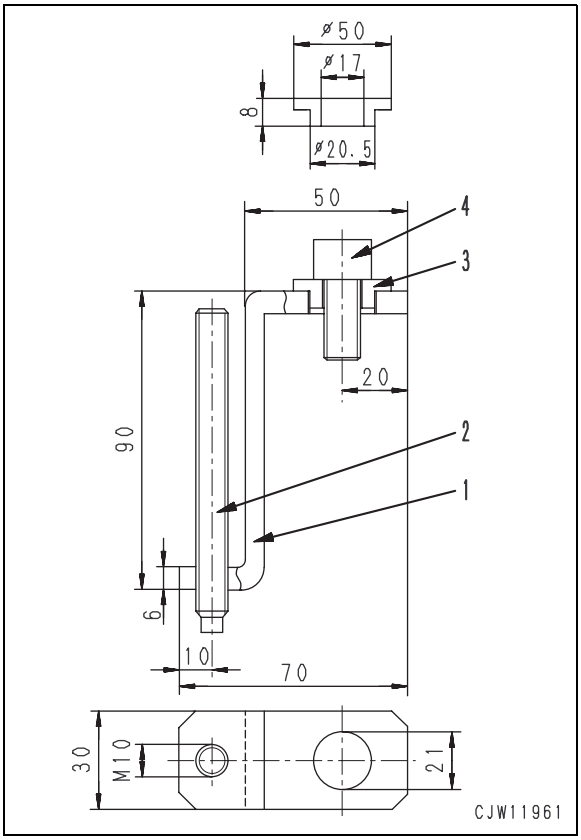



6) Fit holding device [6].
7) Hold swash plate in position utilising the seat screw.

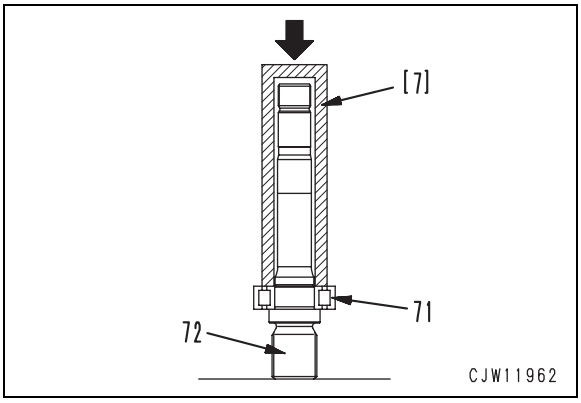
Do not use force.



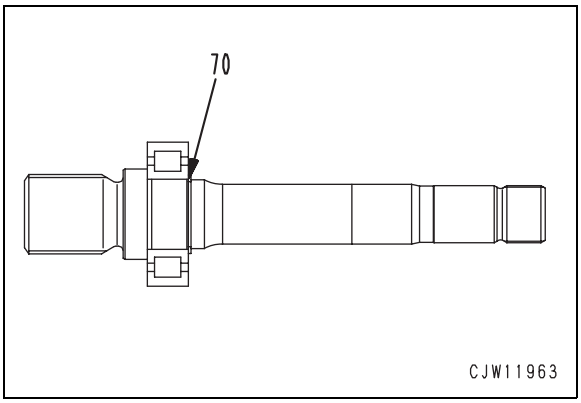

★ Holding device [6] "swivel cradle"



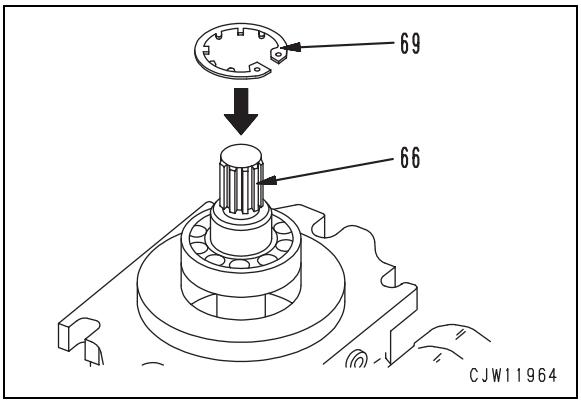
4. Drive shaft assembly
   1) Using tool [7], press fit bearing (71) to drive shaft (72).



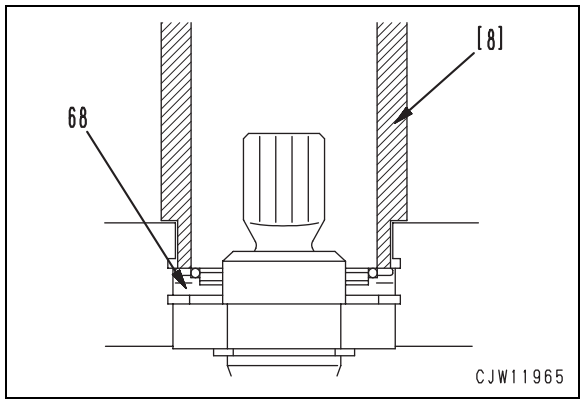

   2) Install snap ring (70).



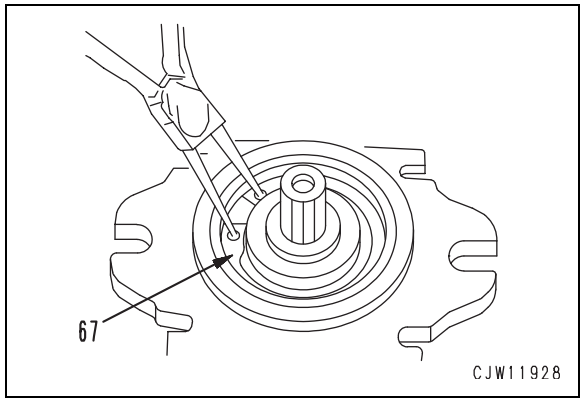

   3) Install drive shaft assembly (66).
   4) Install snap ring (69).



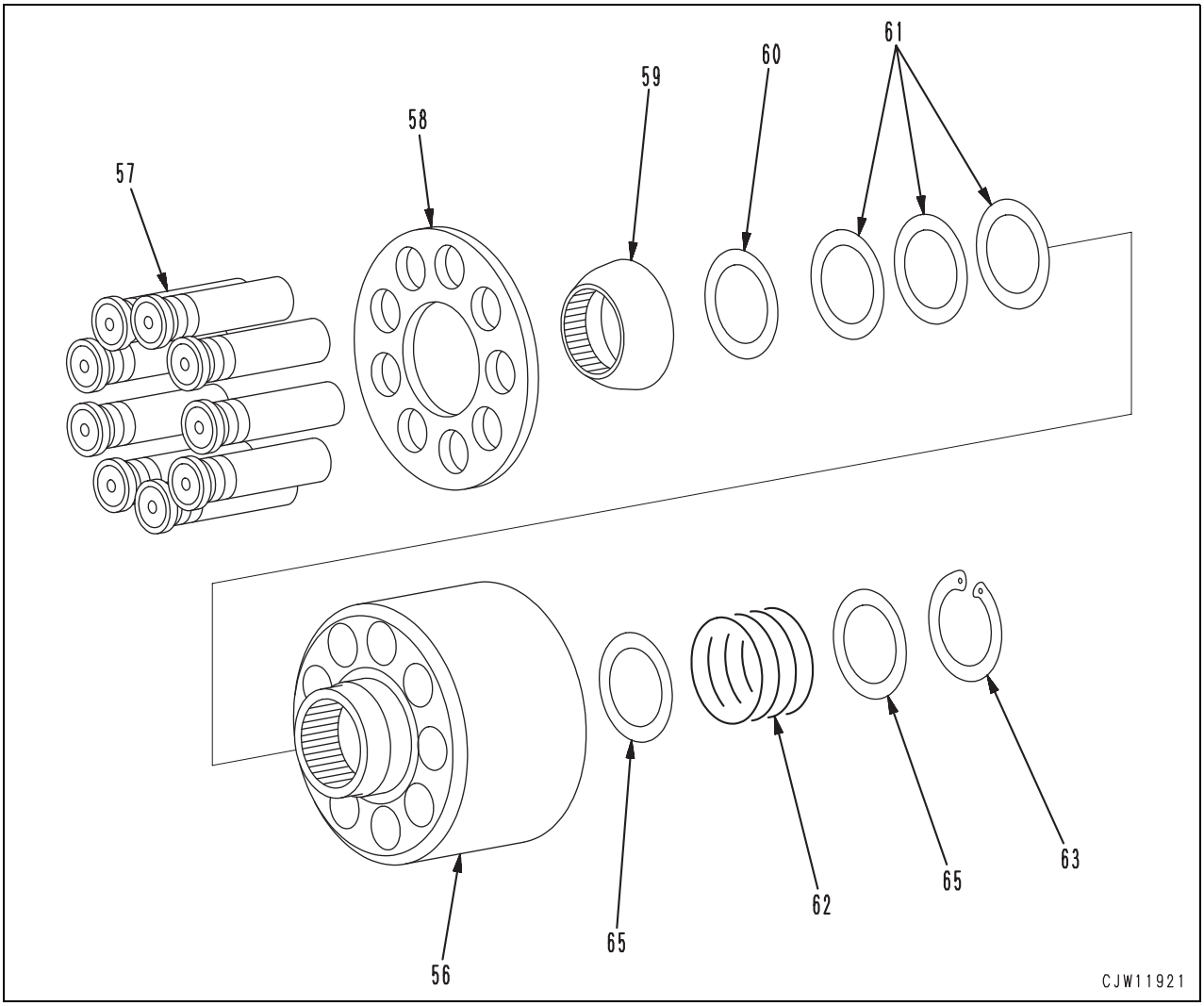

   5) Using tool [8], press fit seal (68).



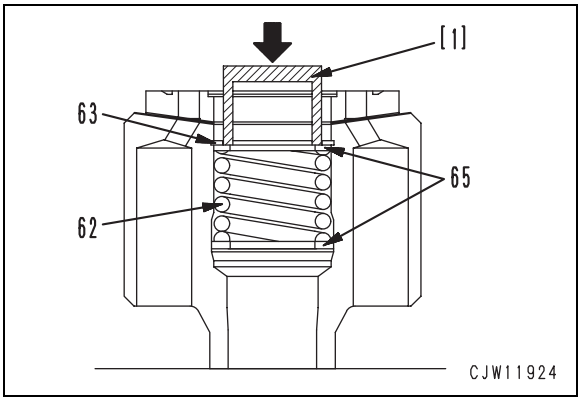

   6) Install snap ring (67).



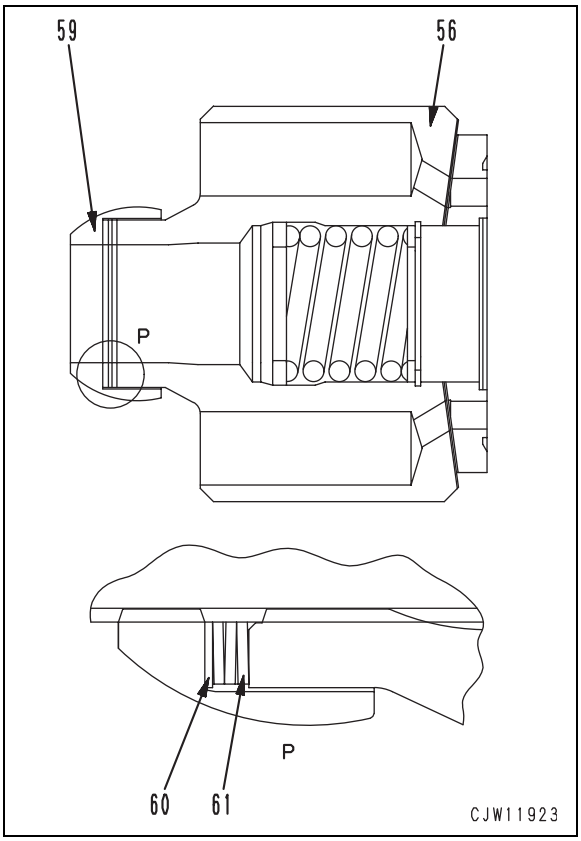
5. Cylinder block, Piston assembly
   1) Assemble the cylinder block and piston assembly according to the following procedure.



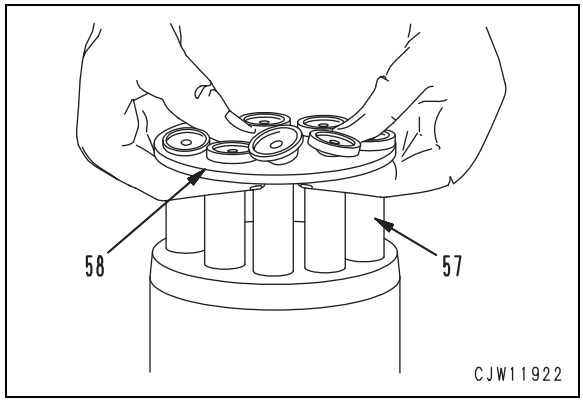
i) Install 2 shims (65) and spring (62) to the cylinder block.
ii) Compress spring (62) with tool [1] and install snap ring (63).



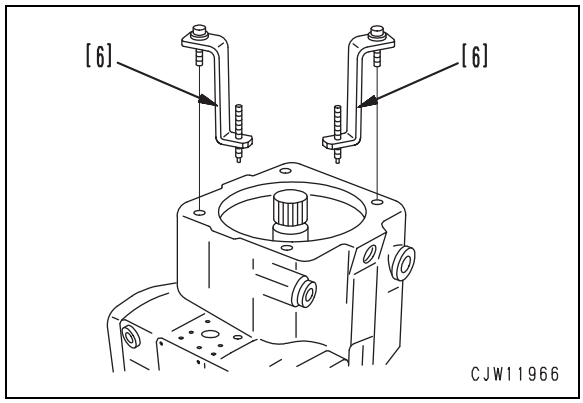

iii) Install spring (61) and shim (60) to cylinder block (56).
iv) Install retainer guide (59).



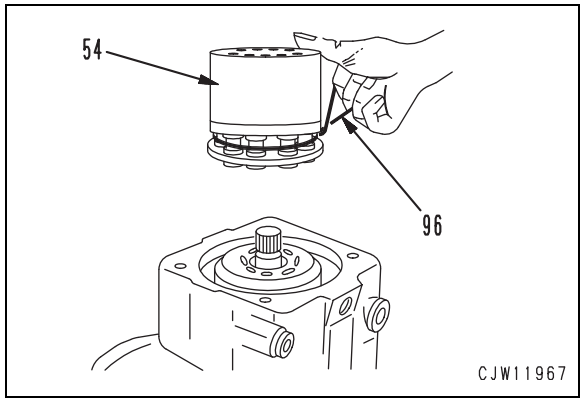

v) Install 9 pistons (57) to retainer (58).
vi) Install piston and retainer assembly (55) to cylinder block assembly (56).
★ Oil piston and piston pad.



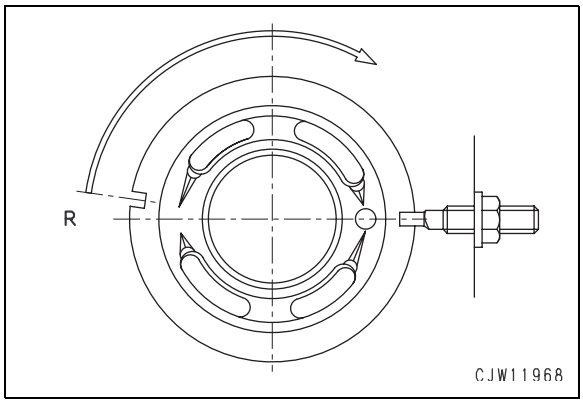

2) Remove holding device [6].
★ Fit cylinder complete with pistons and retaining device.



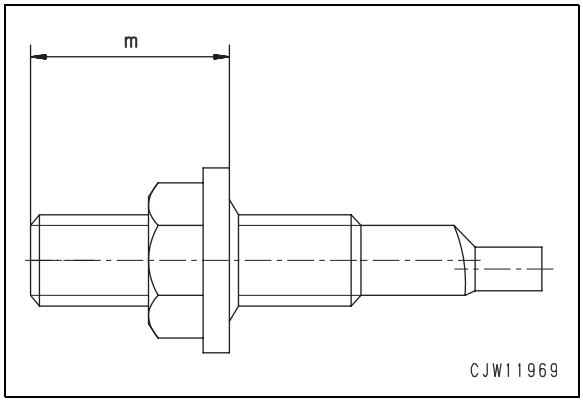

3) Assembly aid:
Hold the cylinder block and piston Assembly (54) by using an O-ring (96).



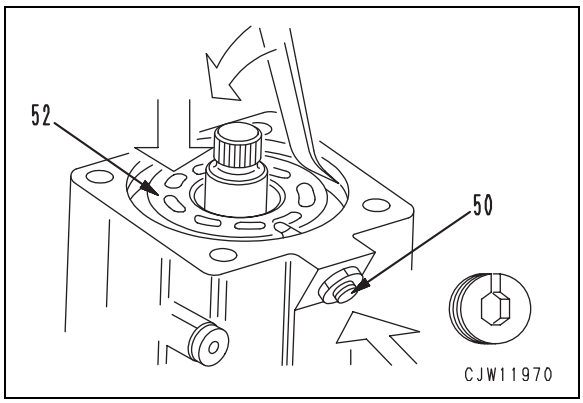
6. Control plate
   - ★ Control plate clockwise rotation - indexed in the direction of rotation.
   - ★ Noise grooves are machined - in based on direction of rotation.



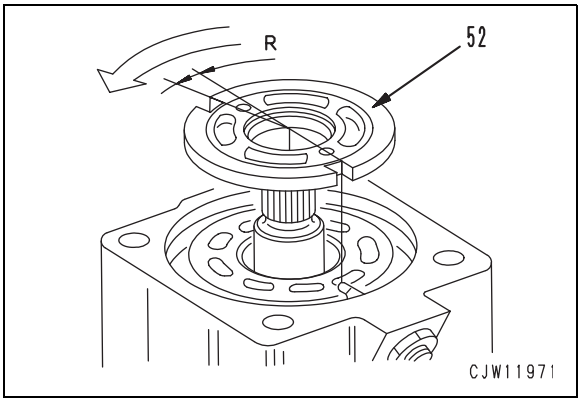

   - ★ indexing screw Basic setting - indexing screw
     Dimension m: 29 ± 0.75 mm

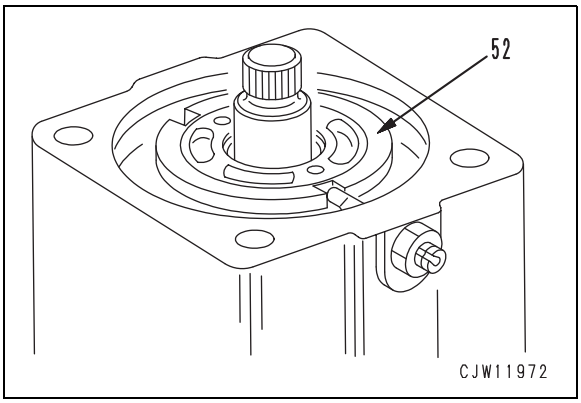



   1) Press the cylinder (52) to the bottom.
   2) Screw in the indexing screw (50).
      - ★ Groove in mounting position.




   3) Insert the control plate (52) - clockwise rotation.

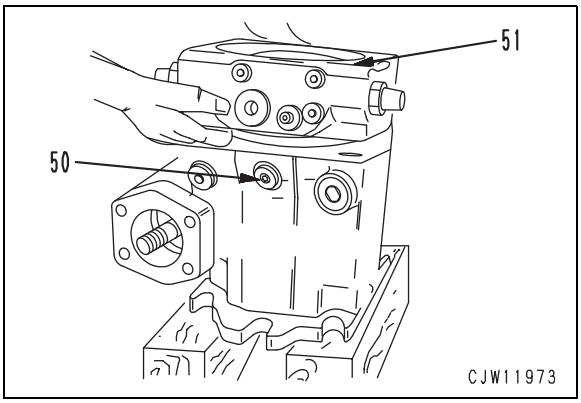


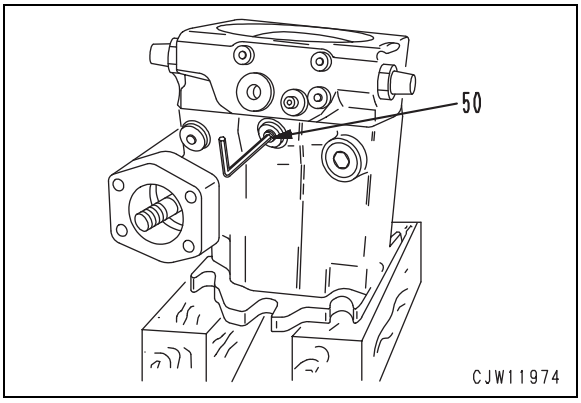

7. Port plate
   1) Assemble port plate (51).

   Spring preloaded!

   - ★ Insert port plate Assembly (51) into housing, guidance with two locking screws (50) crossing over - Finish assembly!

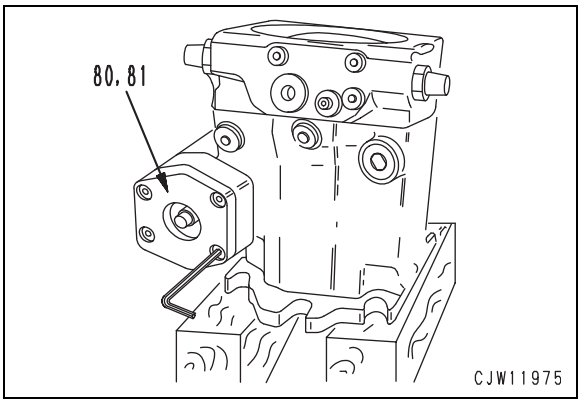


2) Locking screw (50) - Observe adjusting measure.

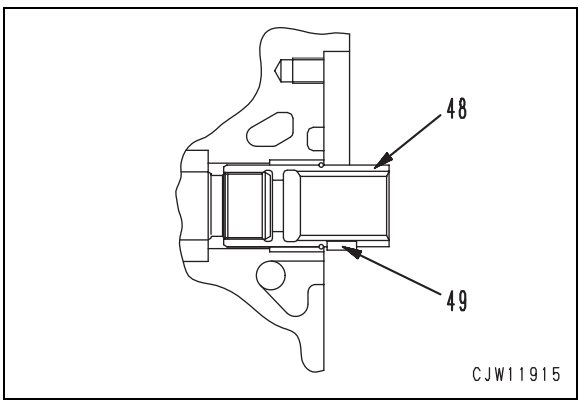



8. Servo piston cover
   1) Install servo piston covers (80) and (81) to both sides.
   2) Adjust zero position according to measure.

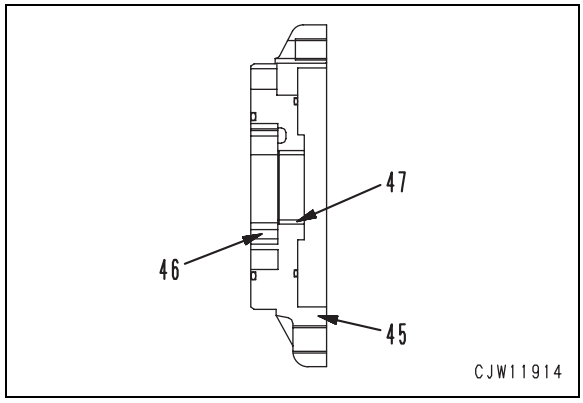
Adjustments of the correct zero position to be carried out after installation into the machine or on the bench test.



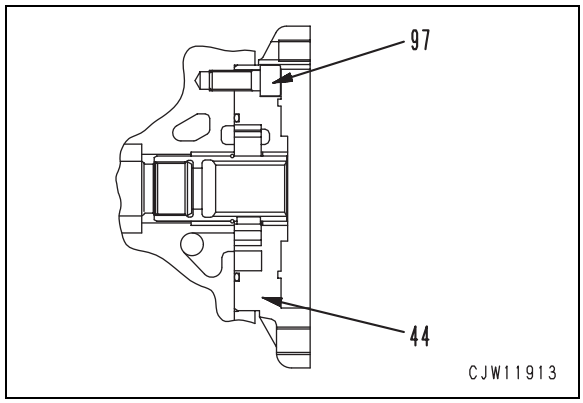

9. Charge pump assembly
   1) Install coupling (48) and key (49).



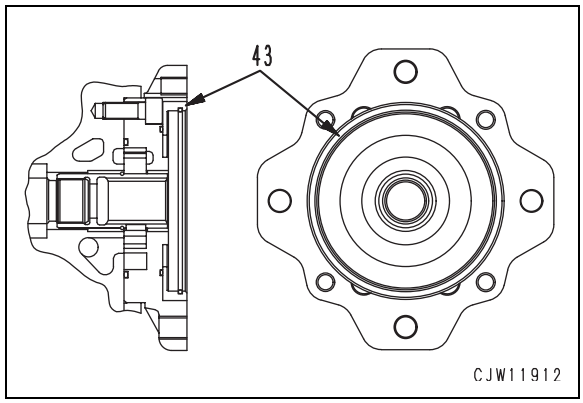

2) Install gear (46) and bearing metal (47) to flange (45).




3) Install charge pump assembly (44) with the 4 mounting bolts (97).




4) Install spacer (43).



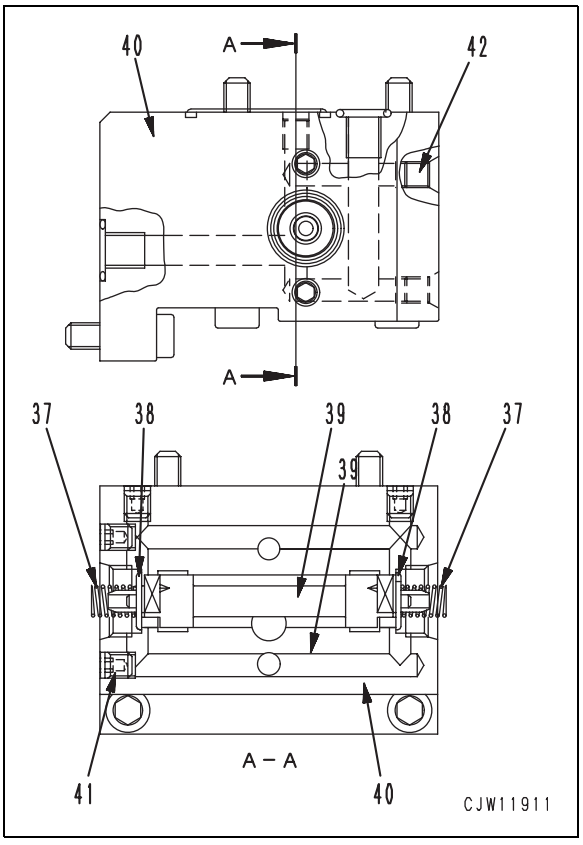
10. Forward-reverse solenoid valve
    1) Assemble the valve housing assembly according to the following procedure.
       i) Install plug (42) to housing (40).

       Threads of plug: **ThreeBond No. 1305**

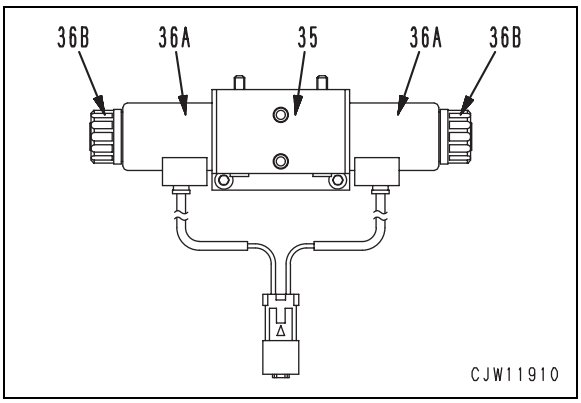
       ii) Install 4 plugs (41).

       Plug: **5.6 Nm {0.57 kgm}**

       iii) Install piston (39).
       iv) Install 2 collars (38) and 2 springs (37).

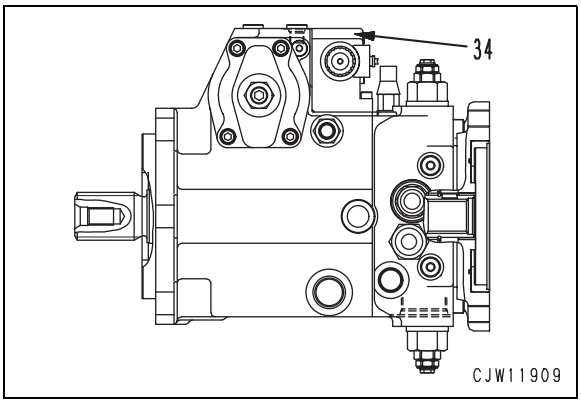



    2) Install 2 solenoid valves (36) to housing assembly (35).
       ★ Fit the tube to the solenoid valve housing and install coil (36B) and cap (36A).

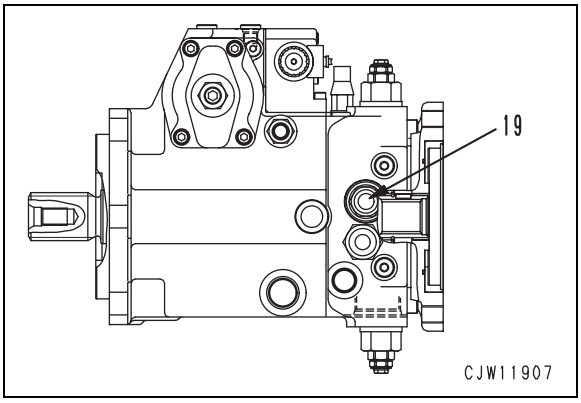



    3) Install forward-reverse solenoid valve assembly (34).

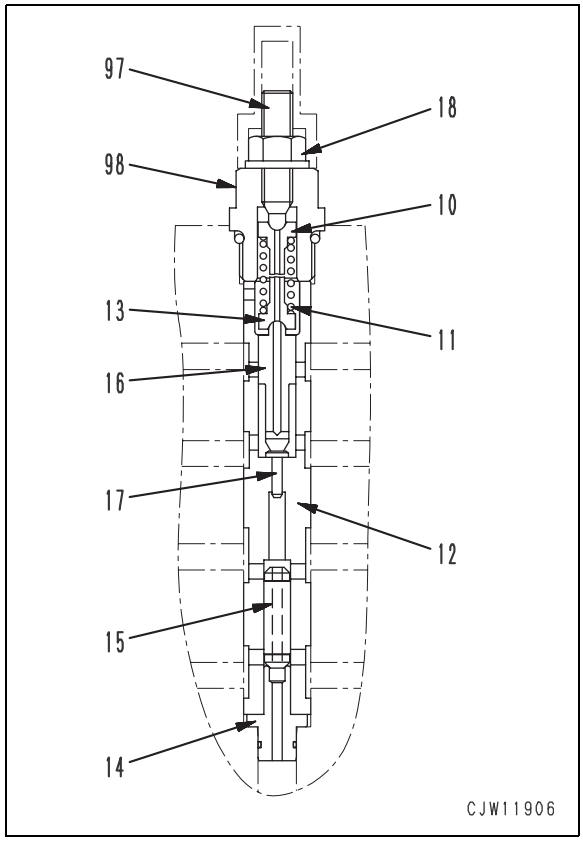
       Mounting bolt: **10.4 Nm {1 kgm}**



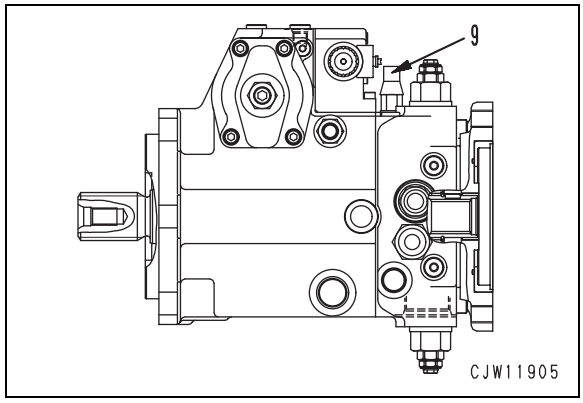
11. Speed-related valve (DA valve)
    1) Fit the O-ring and install speed-related valve assembly (19).



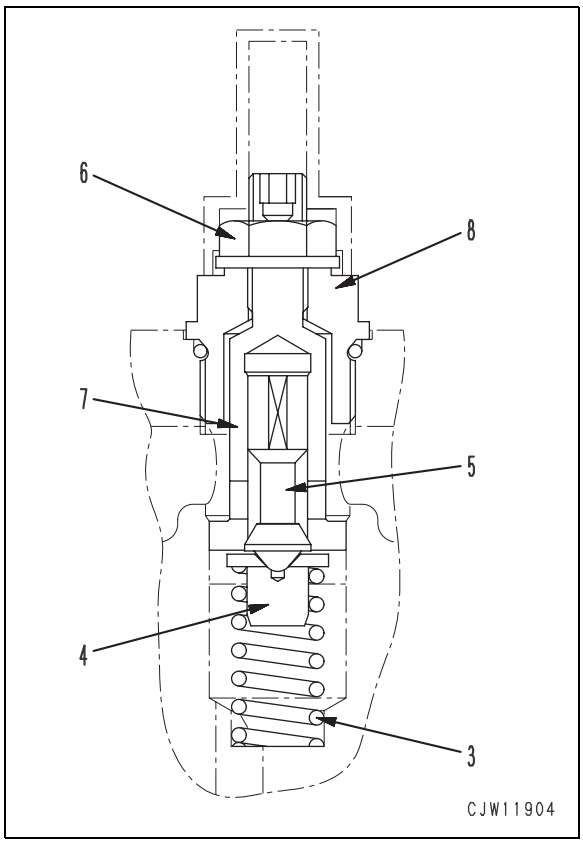

12. High pressure cut-off valve assembly
    1) Assemble the high pressure cut-off valve assembly according to the following procedure.
        i) Install adjustment screw (97) and locknut (18) to holder (98).
        ii) Install piston (17) and spool (16) to barrel (12).
        iii) Install shuttle spool (15), valve seat (14), and spring seat (13) to barrel (12).
        iv) Install barrel assembly (12) to the pump case.
        v) Install spring (11) and spring seat (10) to the pump case.
        ★ Set the spring to the dimension measured before disassembly.




    2) Fit the O-ring and install high pressure cut-off valve assembly (9).
        ★ After installing the pump assembly to the machine, adjust the high pressure cut-off valve assembly. For details, see TESTING AND ADJUSTING, Testing and adjusting HST oil pressure.

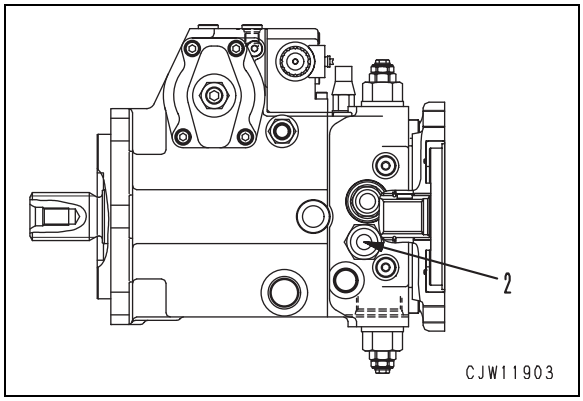


13. Low pressure relief valve assembly
    1) Assemble the low pressure relief valve assembly according to the following procedure.
       i) Install adjustment screw (7) to holder (8).
       ii) Install the locknut (6).
       iii) Install piston (5).
       iv) Install spring seat (4) and spring (3) to the pump case.



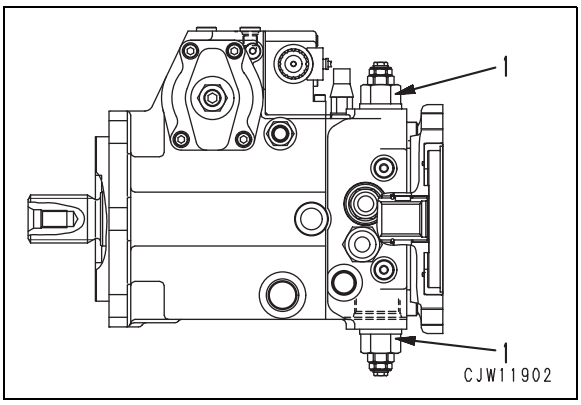

    2) Fit the O-ring and install low pressure relief valve assembly (2).

       Low pressure relief valve assembly: **200 ± 10 Nm {20.39 ± 1.02 kgm}**

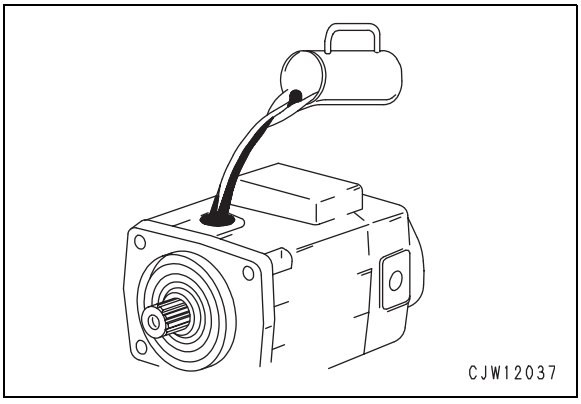



14. High pressure relief valve assembly
    Fit the O-ring and install 2 high pressure relief valve assemblies (1).

    High pressure relief valve assembly: **150 Nm {15.3 kgm}**




15. Filling with oil
    Fill up hydraulic aggregates with medium before start-up.



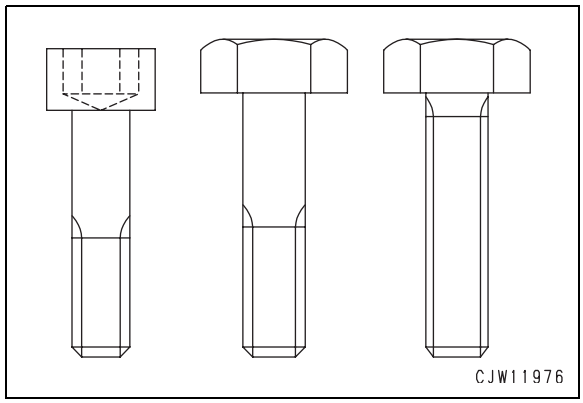

16. Before starting
    - Observe the operating instructions before starting.
    - Check the machine for remarkable faults.
    - Do not operate the machine with defective instruments, warning lights or control elements.
    - All safety devices must be in a secure position.
    - Do not carry with you movable objects or secure them to the machine.
    - Keep oily and inflammable material away from the machine.
    - Before entering the driver's cabin, check if persons or obstacles are beside or beneath the machine.
    - Be careful when entering the driver's cabin, use stairs and handles.
    - Adjust your seat before starting.

17. Tightening torque table

★ If the tightening torque of a mounting bolt, nut, or plug is not shown in this manual, tighten that part according to the following tightening torque table.

1) Bolts

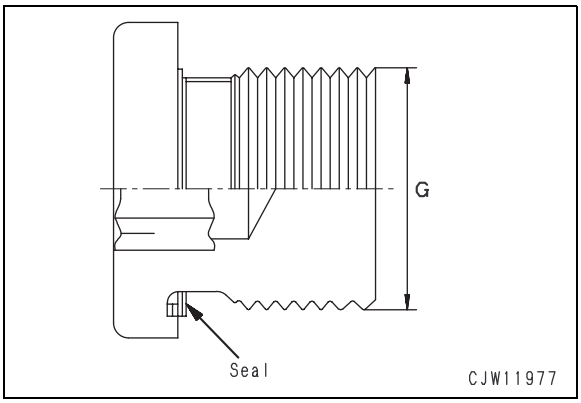
The values stated are vaild for bolts with metric ISO threads to DIN 13 part 13, as well as head areas to DIN 912 socked head cap screws, DIN 913 hexagon bolt or DIN 933 hexagon bolts with threads up to the head.




| Thead | Tensile strength class | | | | | |
|---|---|---|---|---|---|---|
| | 8.8 | | 10.9 | | 12.9 | |
| | Nm | kgm | Nm | kgm | Nm | kgm |
| M3 | 1.1 | 0.11 | 1.6 | 0.16 | 1.9 | 0.19 |
| M4 | 3.1 | 0.32 | 4.5 | 0.46 | 5.3 | 0.54 |
| M5 | 6.1 | 0.62 | 8.9 | 0.91 | 10.4 | 1.06 |
| M6 | 10.4 | 1.06 | 15.5 | 1.58 | 18 | 18.4 |
| M8 | 25 | 2.55 | 37 | 3.77 | 43 | 4.38 |
| M10 | 51 | 5.20 | 75 | 7.65 | 87 | 8.87 |
| M12 | 87 | 8.87 | 130 | 13.26 | 150 | 15.30 |
| M14 | 140 | 14.28 | 205 | 20.90 | 240 | 24.47 |
| M16 | 215 | 21.92 | 310 | 31.61 | 370 | 37.73 |
| M18 | 300 | 30.59 | 430 | 43.85 | 510 | 52.01 |
| M20 | 430 | 43.85 | 620 | 63.22 | 720 | 73.42 |
| M22 | 580 | 59.14 | 830 | 84.64 | 970 | 98.91 |
| M24 | 740 | 75.46 | 1060 | 108.09 | 1240 | 126.44 |

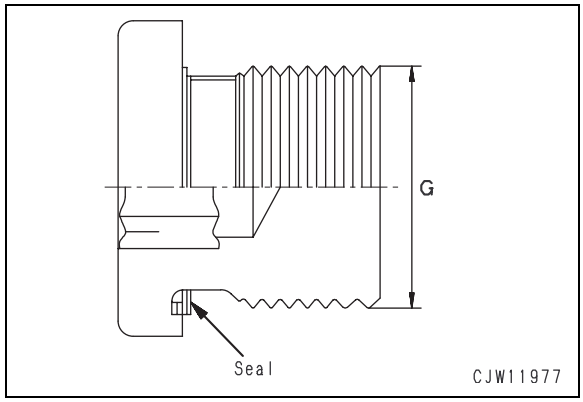
(2) Plugs

i) Plugs with internal hexagon and profile seal ring



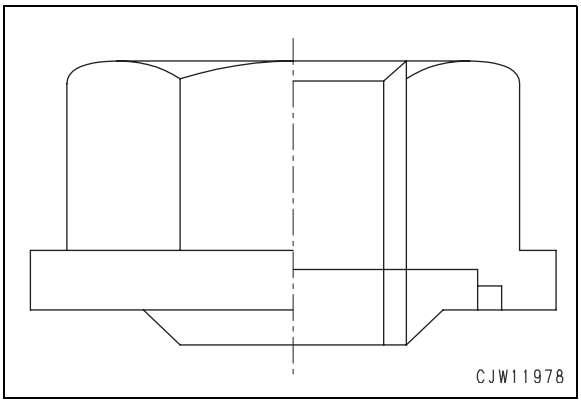

| Thead | Tightening torque | | Thead | Tightening torque | |
|---|---|---|---|---|---|
| | Nm | kgm | | Nm | kgm |
| M8 x 1 | 5 | 0.51 | G 1/8 A | 10 | 1.02 |
| M10 x 1 | 10 | 1.02 | G 1/4 A | 30 | 3.06 |
| M12 x 1.5 | 20 | 2.04 | G 3/8 A | 35 | 3.57 |
| M14 x 1.5 | 30 | 3.06 | G 1/2 A | 60 | 6.12 |
| M16 x 1.5 | 35 | 3.57 | G 3/4 A | 90 | 9.18 |
| M18 x 1.5 | 40 | 4.08 | G 1 A | 140 | 14.28 |
| M20 x 1.5 | 50 | 5.10 | G 11/4 A | 240 | 24.47 |
| M22 x 1.5 | 60 | 6.12 | G 11/2 A | 300 | 30.59 |
| M26 x 1.5 | 70 | 7.14 | | | |
| M27 x 2 | 90 | 9.18 | | | |
| M30 x 1.5 | 100 | 10.20 | | | |
| M33 x 2 | 140 | 14.28 | | | |
| M42 x 2 | 240 | 24.47 | | | |
| M48 x 2 | 300 | 30.59 | | | |

ii) Plugs with internal hexagon, O-ring and UNF-, UN- threads to SAE J 514



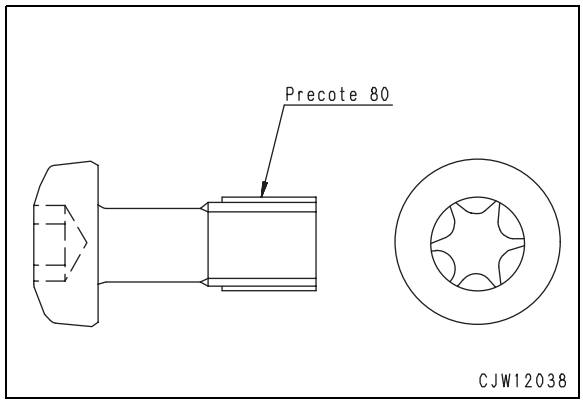

| Thead | Tightening torque | | Thead | Tightening torque | |
|---|---|---|---|---|---|
| | Nm | kgm | | Nm | kgm |
| 7/16-20UNF | 15 | 1.53 | M12 x 1.5 | 20 | 2.04 |
| 1/2-20UNF | 20 | 2.04 | M14 x 1.5 | 30 | 3.06 |
| 9/16-18UNF | 25 | 2.55 | M27 x 1.5 | 90 | 9.18 |
| 3/4-16UNF | 72 | 7.34 | | | |
| 7/8-14UN | 127 | 12.95 | | | |
| 11/16-12UN | 147 | 14.99 | | | |
| 13/16-12UN | 173 | 17.64 | | | |
| 15/16-12UN | 198 | 20.19 | | | |
| 15/8-12UN | 320 | 32.63 | | | |
| 17/8-12UN | 390 | 39.77 | | | |

(3) SEAL-LOCK - sealing nuts




| Thead | Tightening torque | |
|---|---|---|
| | Nm | kgm |
| M6 | 10 | 1.02 |
| M6 x 0.5 | 11 | 1.12 |
| M8 | 22 | 2.24 |
| M8 x 1 | 24 | 2.45 |
| M10 | 40 | 4.08 |
| M10 x 1 | 44 | 4.49 |
| M12 | 69 | 7.04 |
| M12 x 1.5 | 72 | 7.34 |
| M14 | 110 | 11.22 |
| M14 x 1.5 | 120 | 12.24 |
| M16 | 170 | 17.34 |
| M16 x 1.5 | 180 | 18.35 |

(4) Oval head screw
Oval head screw with inner TORX, thread precoated with "procote 80"




| Thead | Tensile strength class | | | |
|---|---|---|---|---|
| | 10.9 | | 11.9 | |
| | Tightening torque | | | |
| | Nm | kgm | Nm | kgm |
| M3 | 2.1 | 0.21 | --- | --- |
| M4 | 4.7 | 0.48 | --- | --- |
| M5 | 9.1 | 0.93 | 9.5 | 0.97 |
| M6 | 15.8 | 1.61 | --- | --- |
| M8 | 37.7 | 3.84 | --- | --- |

# REMOVAL, INSTALLATION OF HST MOTOR 1 ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

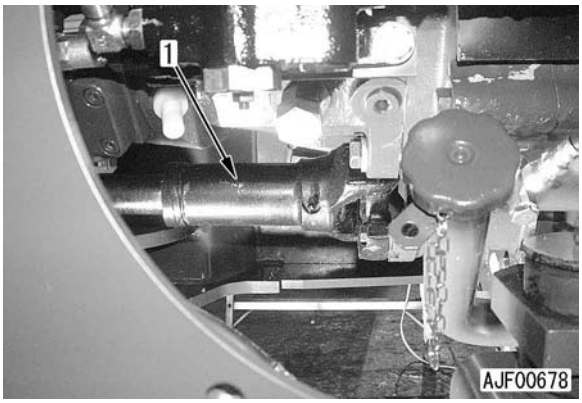
Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

Disconnect the cable from the negative (-) terminal of the battery.

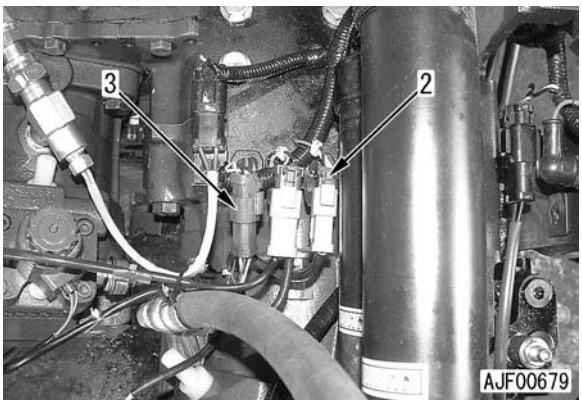
1. Drain the hydraulic oil.

   Hydraulic tank: **96 ℓ**

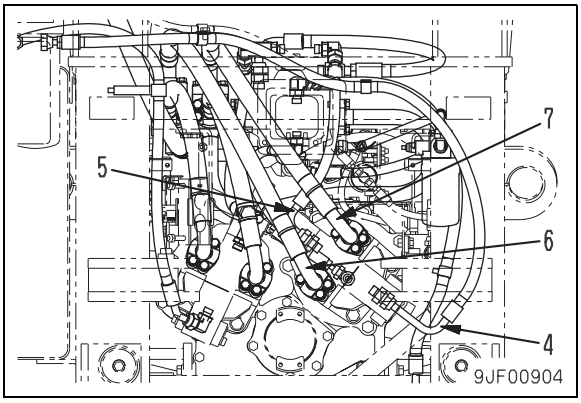
2. Disconnect front drive shaft (1) from the transfer side.




3. Disconnect wiring connectors T06 (2) and T11 (3) from motor 1.

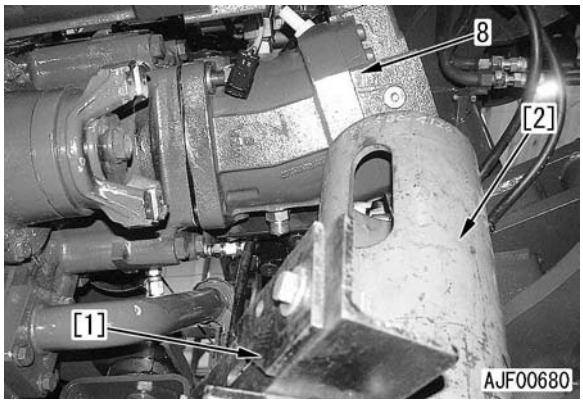



4. Disconnect port T1 hose (4) and port T2 hose (5).
5. Disconnect port A hose (6) and port B hose (7).




6. Support motor 1 assembly (8) with block [2] placed on transmission jack [1] and remove 4 motor 1 mounting bolts. [*1]
7. Supporting motor 1 assembly (8) with the hand, lower transmission jack [1] gradually to remove motor 1 assembly (8).

   Motor 1 assembly: **60 kg**




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Motor 1 assembly mounting bolt:
**245 - 309 Nm {25.0 - 31.5 kgm}**

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

  Hydraulic tank: **96 ℓ**

# REMOVAL, INSTALLATION OF HST MOTOR 2 ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

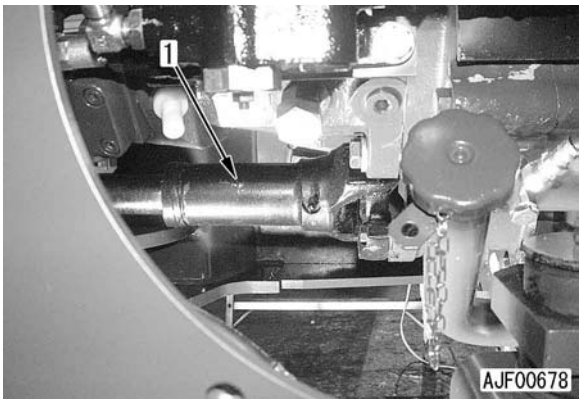
Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

Disconnect the cable from the negative (-) terminal of the battery.

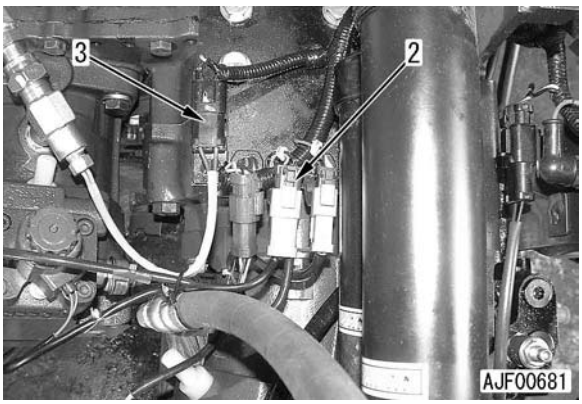
1. Drain the hydraulic oil.

   Hydraulic tank: **96 ℓ**

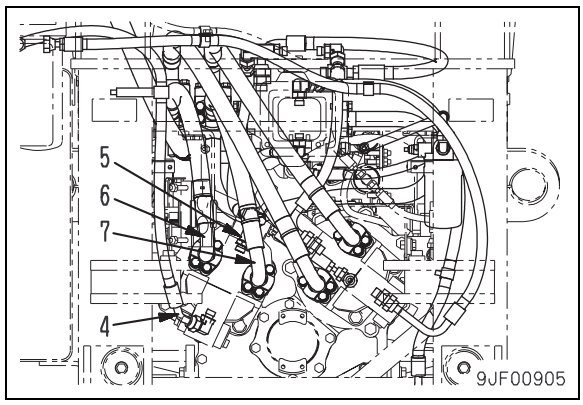
2. Disconnect front drive shaft (1) from the transfer side.




3. Disconnect wiring connectors T07 (2) and T10 (3) from motor 2.

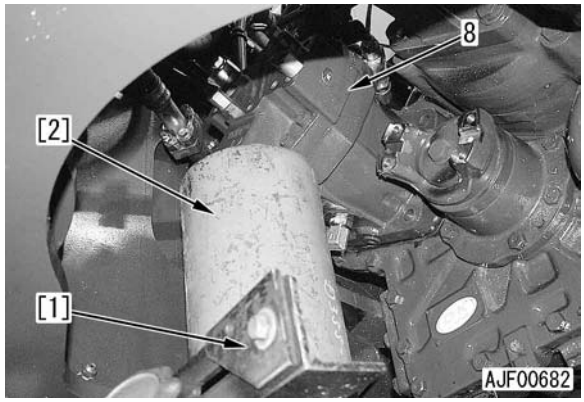



4. Disconnect port T1 hose (4) and port T2 hose (5).
5. Disconnect port A hose (6) and port B hose (7).




6. Support motor 2 assembly (8) with block [2] placed on transmission jack [1] and remove 4 motor 2 mounting bolts. [*1]
7. Supporting motor 2 assembly (8) with the hand, lower transmission jack [1] gradually to remove motor 2 assembly (8).

   Motor 2 assembly: **60 kg**




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Motor 2 assembly mounting bolt:
**245 - 309 Nm {25.0 - 31.5 kgm}**

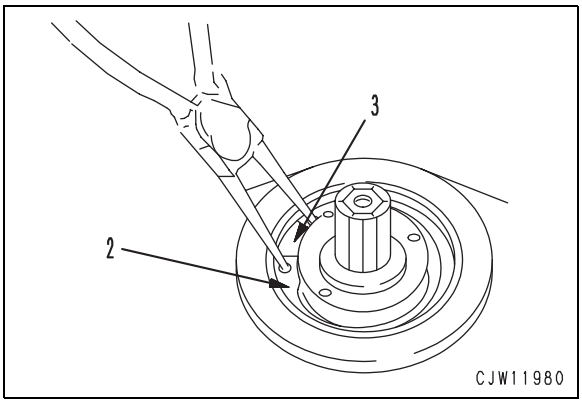
- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

  Hydraulic tank: **96 ℓ**

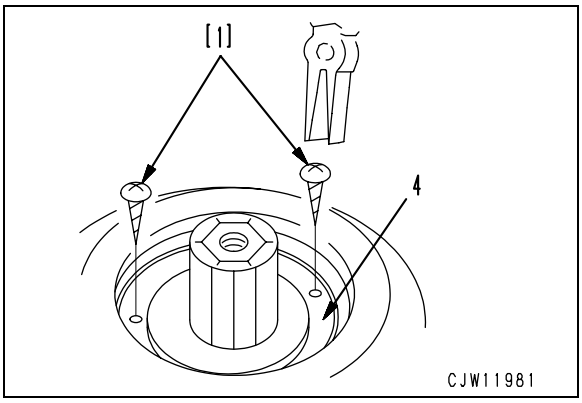
# DISASSEMBLY AND ASSEMBLY OF HST MOTOR ASSEMBLY

## DISASSEMBLY

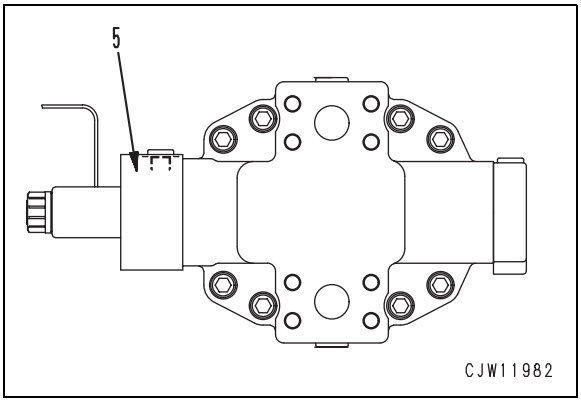
1. Seal
   1) Protecting the driver shaft.
   2) Remove snap ring (2) and shim (3).



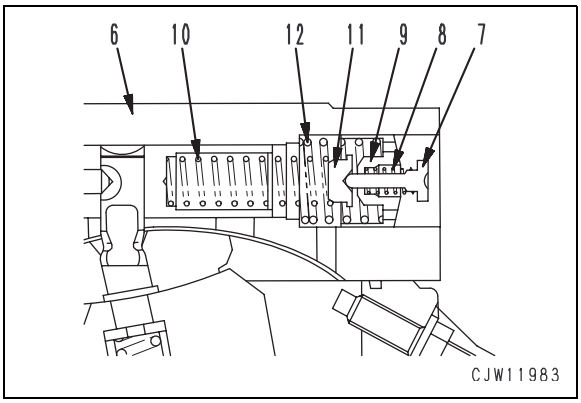

   3) Screw [1] in sheet metal screw into the holes fitted with rubber.
   4) Pull out shaft seal (4) with pliers.



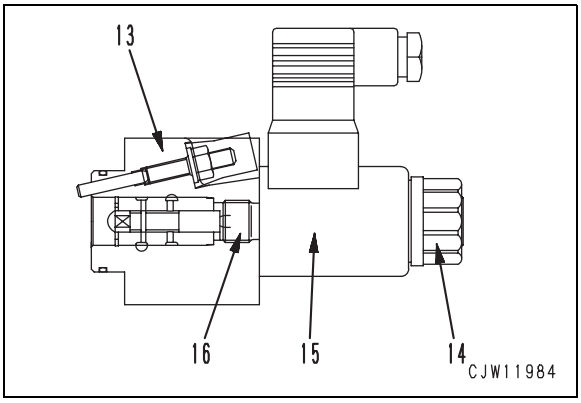

2. EP servo valve assembly and cover (HST motor 1)
   1) Remove 4 mounting bolts and solenoid valve and housing assembly (5).
      ★ Take care of the spring which may jump out.



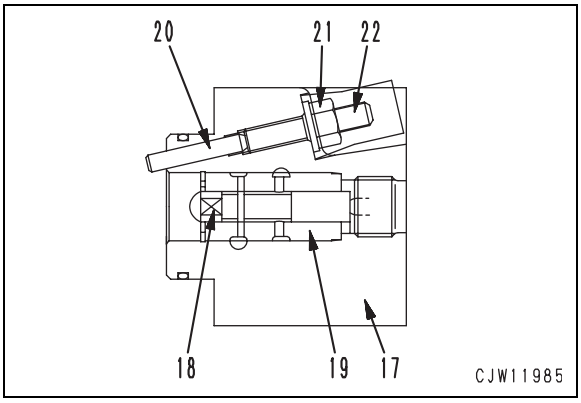

   2) Remove spring seat (7) and spring (8) from port plate assembly (6).
   3) Remove spring seat (9) and spring (10).
   4) Remove spring seat (11) and spring (12).



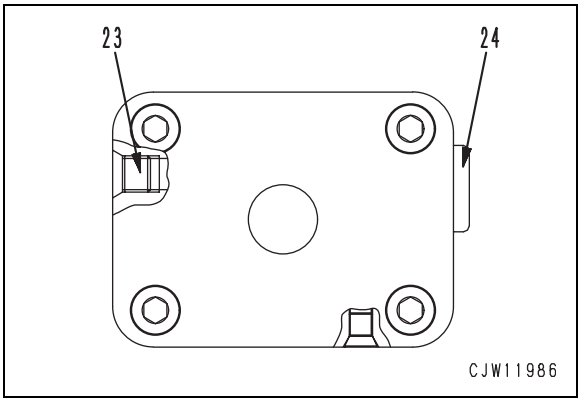

   5) Remove the solenoid from housing assembly (13).
      ★ Remove cap (14), coil (15), and tube (16) of the solenoid in order.



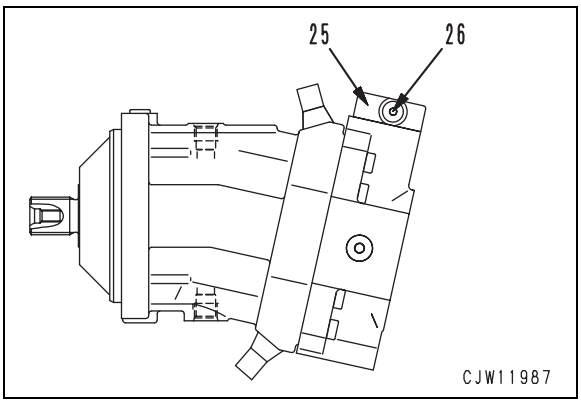
6) Disassemble the housing assembly according to the following procedure.
   i) Remove spool (18) and bushing (19) from housing (17).
   ii) Remove pin (20)
   ★ Do not remove nut (21) and screw 22.



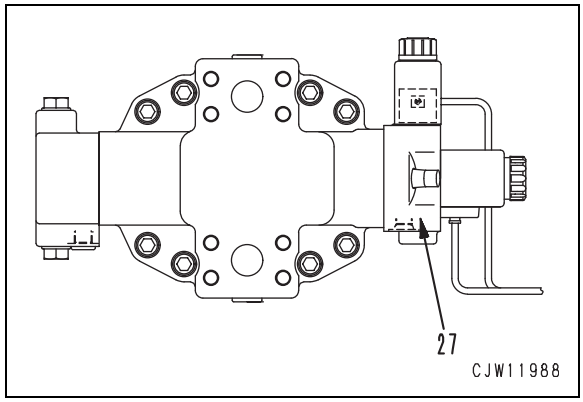

   iii) Remove plugs (23) and (24) from housing (17).



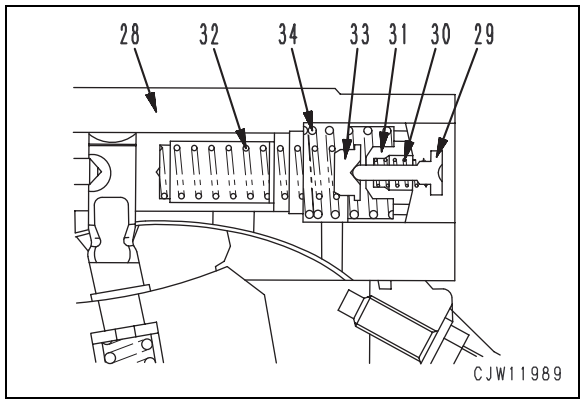

7) Cover
   i) Remove cove (25)
   ii) Remove plug (26) from cover (25).



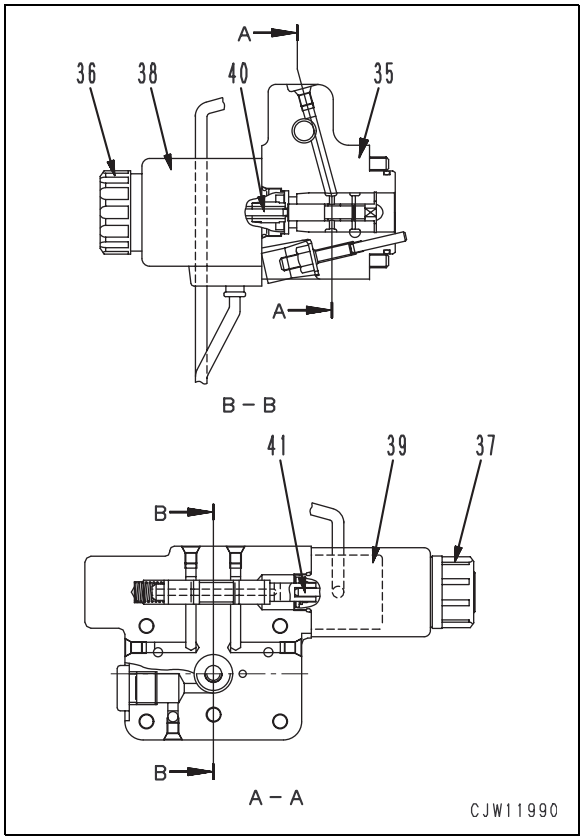

3. HA servo valve and forward-reverse shuttle valve assembly and flushing valve assembly (HST motor 2)
   1) Remove the 4 mounting bolts and solenoid valve and housing assembly (27).
      ★ Take care of the spring which may jump out.



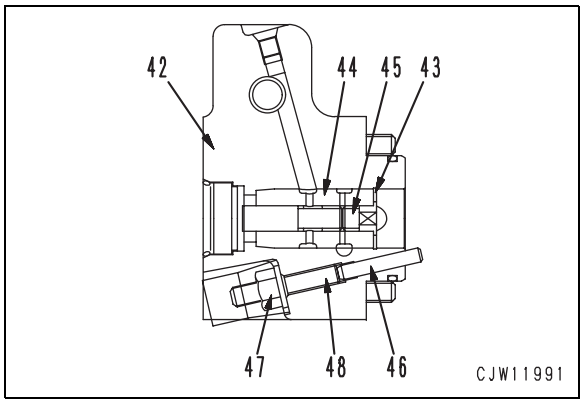

   2) Remove spring seat (29) and spring (30) from port plate (28).
   3) Remove spring seat (31) and spring (32).
   4) Remove spring seat (33) and spring (34).



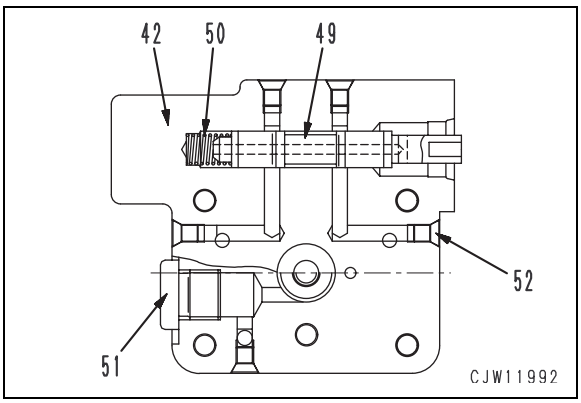
5) Remove 2 solenoids from housing assembly (35).
   ★ Remove caps (36) and (37), coils (38) and (39), and tubes (40) and (41) of the solenoid in order.



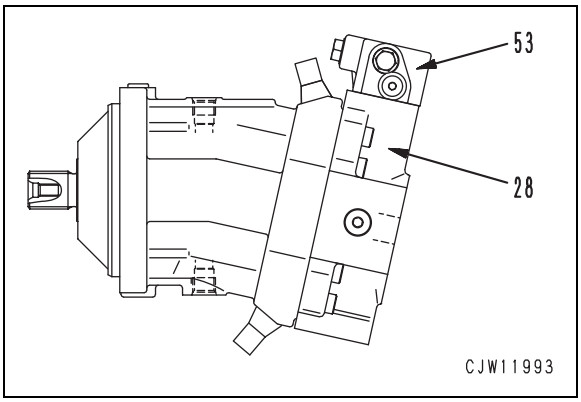

6) Disassemble the housing assembly according to the following procedure.
   i) Remove snap ring (43), control bushing (44), and control piston (45) from housing (42).
   ii) Remove pin (46).
   ★ Do not remove nut (47) and screw (48).



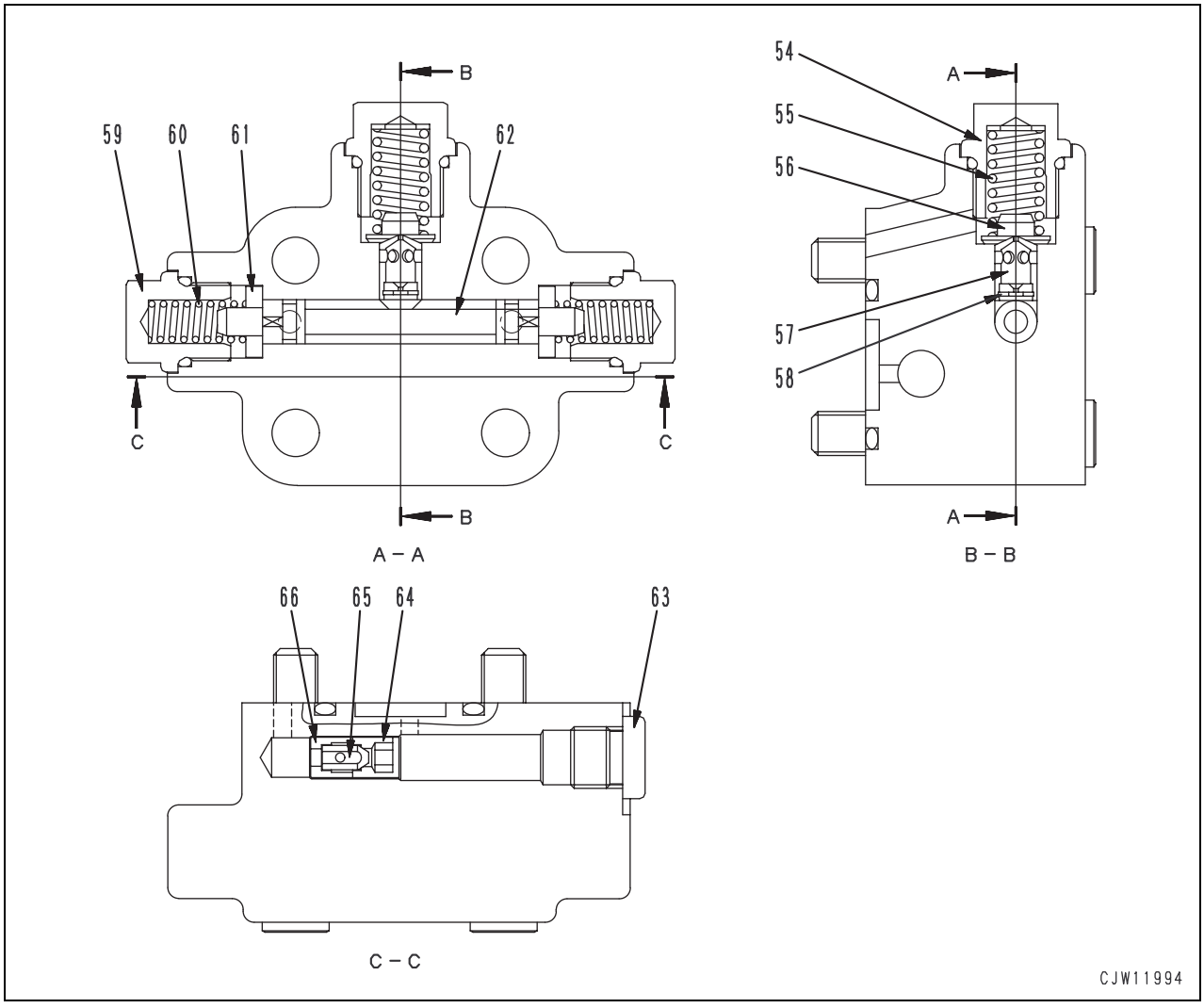

   iii) Remove control piston (49) and spring (50) from housing (42).
   iv) Remove plug (51) and 5 plugs (52).



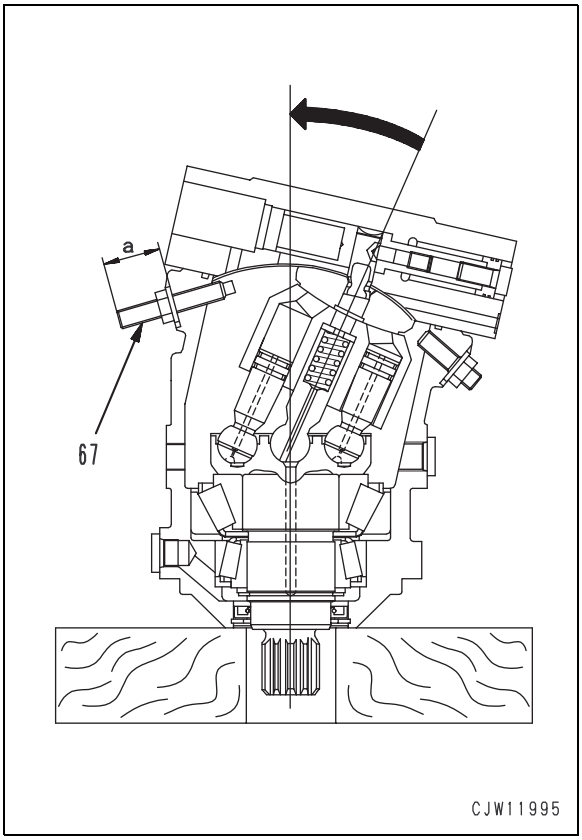

7) Remove flushing valve assembly (53) from port plate (28).



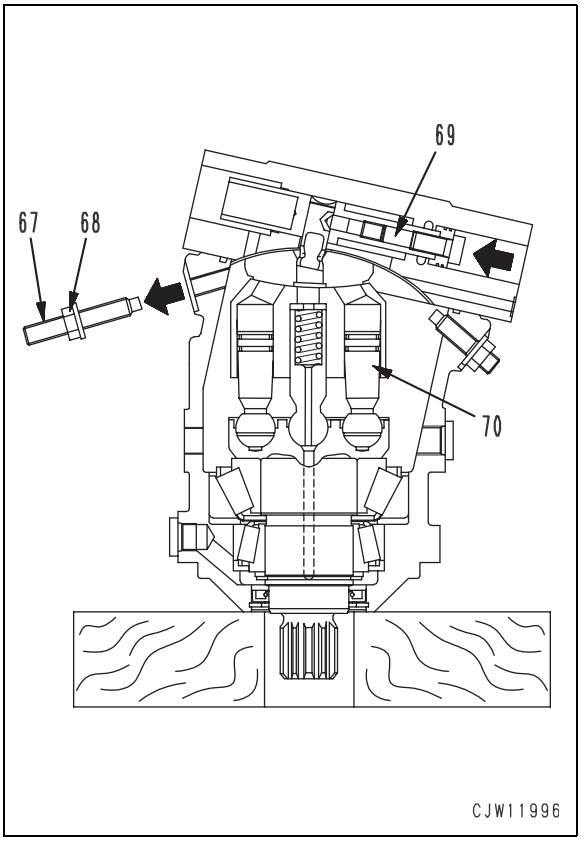
8) Disassemble the flushing valve assembly according to the following procedure.
   i) Remove plug (54).
   ii) Remove spring (55), plunger (56), orifice (57), and washer (58).
   iii) Remove 2 plugs (59).
   iv) Remove spring (60), spring seat (61), and spool (62).
   v) Remove plug (63).
   vi) Remove guide (64), orifice (65), and guide (66).



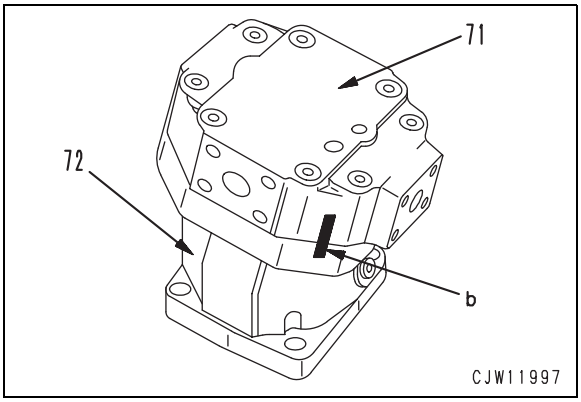
4. Port plate assembly
   1) Check installed dimension (a) of Qmin-screw (67).



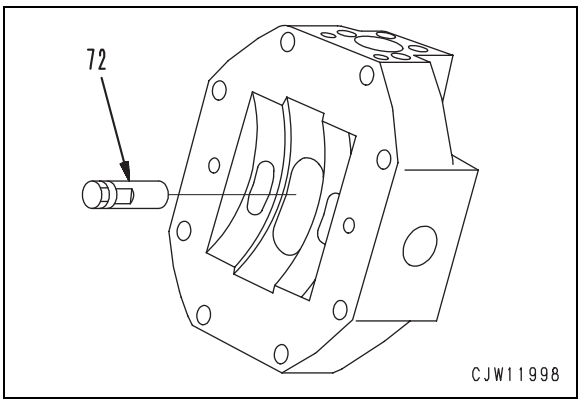

   2) Loosen locknut (68) and remove Qmin-screw (67).
   3) Push piston (69) to set the angle of rotary group (70) to 0 degree.



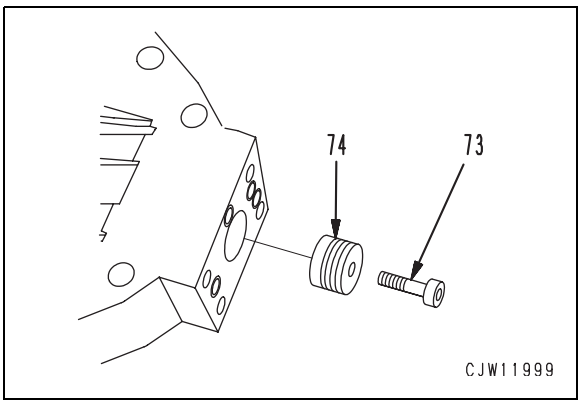

   4) Make match marks (b) between port plate (71) and housing (72).
   5) Remove port plate assembly (71).



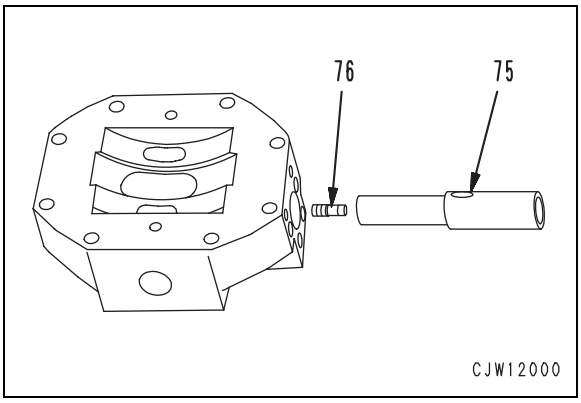
6) Disassemble the port plate assembly according to the following procedure.
   i) Remove rod (72).



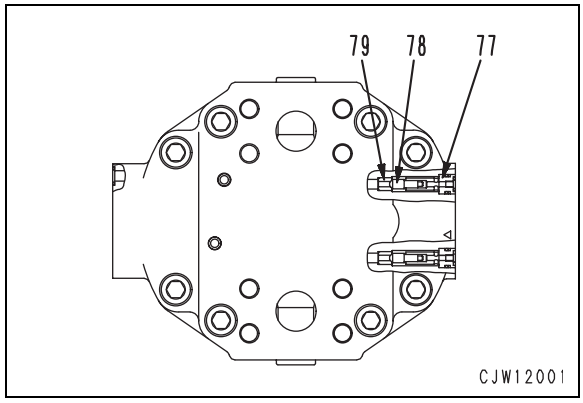

   ii) Remove bolt (73) and barrel (74).



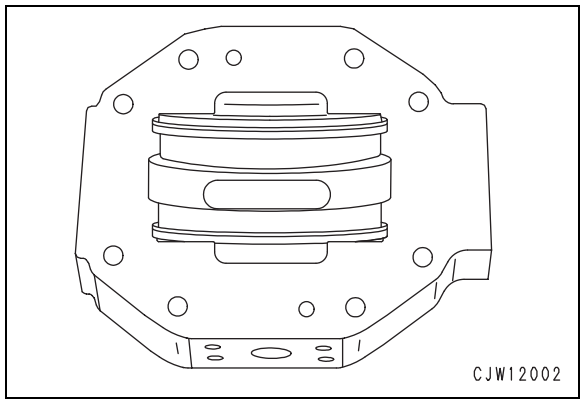

   iii) Remove piston (75).
   iv) Remove screw (76) from piston (75).



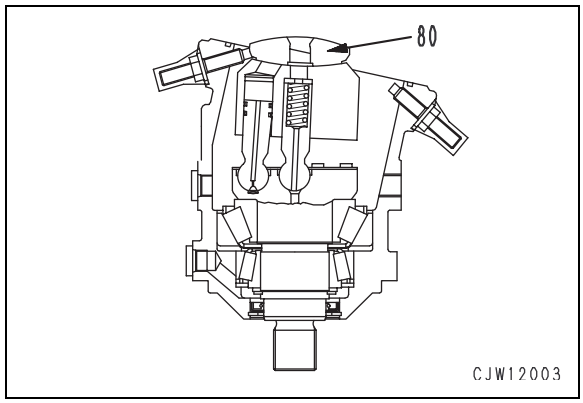

   v) Remove valve guide (77).
   vi) Remove poppet (78).
   vii) Remove valve seat (79).



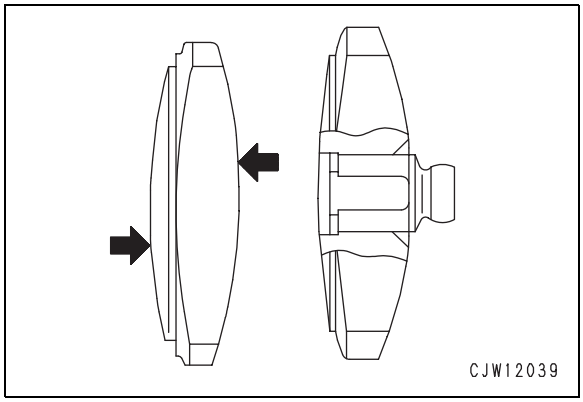

★ Check of port plate
- Sliding surface and side guides free of scoring and no wear.



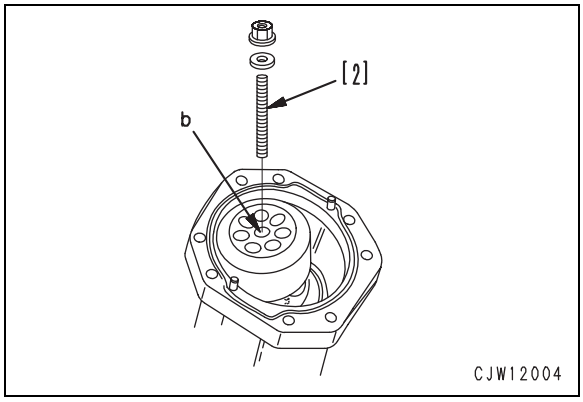

5. Control plate
   Remove control plate (80).



★ Check of control plate
Faces smooth and even, free of cracks and scoring.

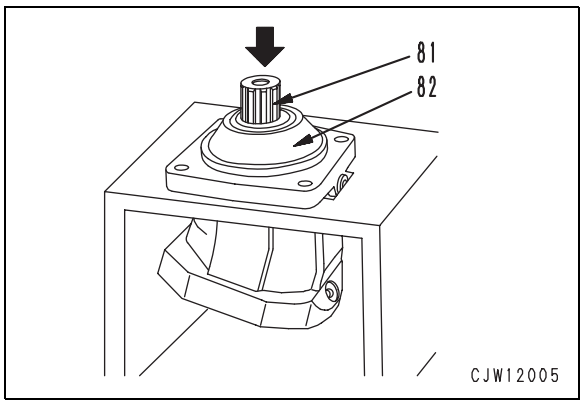



6. Removal of rotary group assembly
   1) Screw [2] in threaded pin into center pin (b)
      ★ Fix the cylinder with disc and locknut.
      • Screw size: M6 x 92 mm

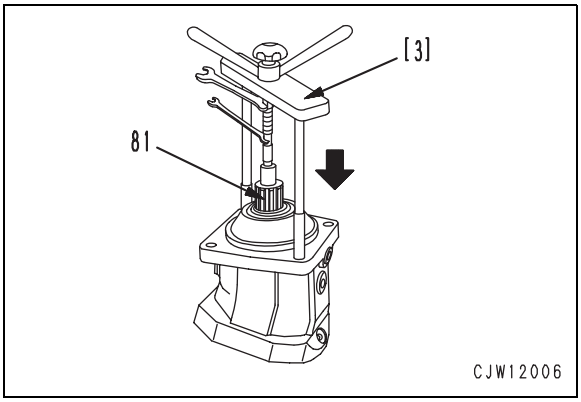


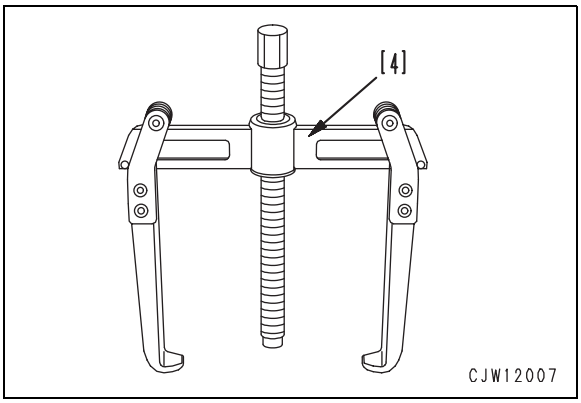

   2) Push the shaft end with a press to remove rotary group assembly (81) from housing (82).

      If the bearings are used again do not hit on the drive shaft.

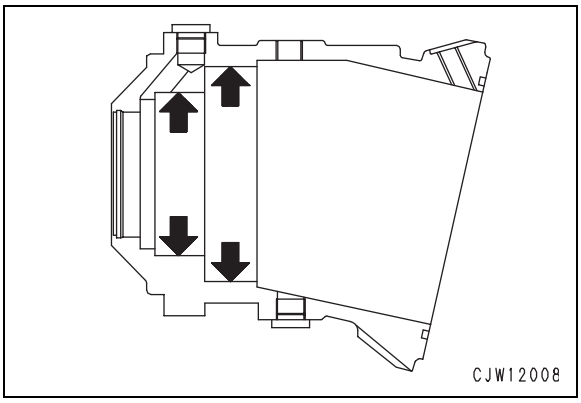



   3) If a press is not available, push the shaft end with tool [3] or [4] to remove rotary group assembly (81).

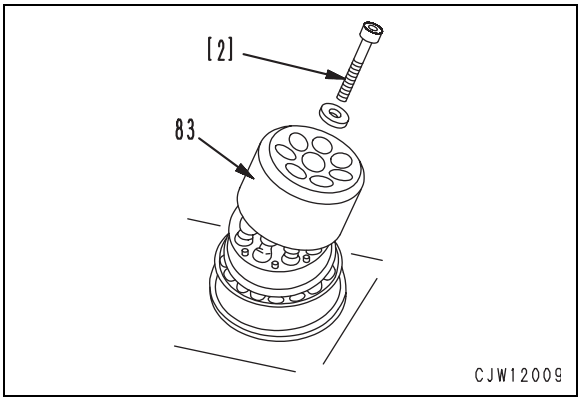


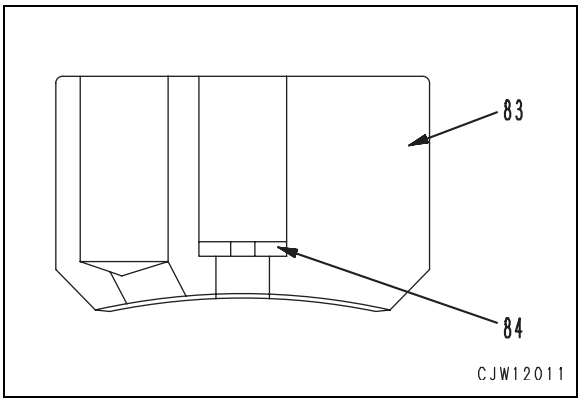

★ Check of housing
• Sliding surface and slide guides free of scoring and no wear.



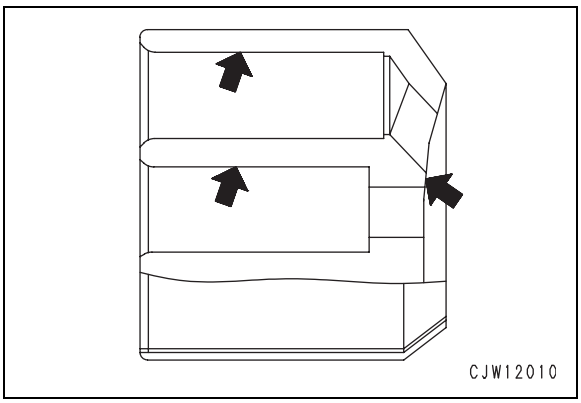
7. Disassembly of rotary group assembly
   ★ Do not disassembly the drive shaft and bearing assembly in the rotary group. (If the drive shaft and bearing assembly is defective, replace it.)
   1) Remove screw [2].
   2) Remove cylinder block (83).



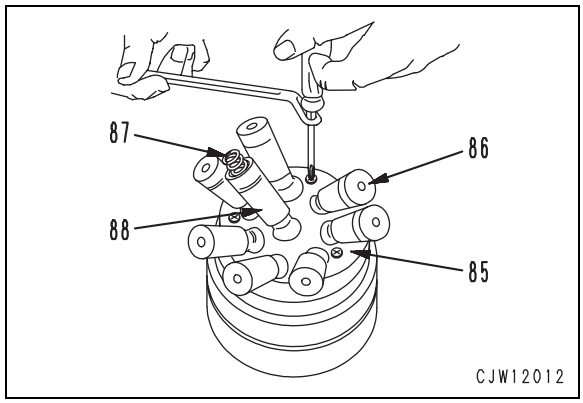

   3) Remove shim (84) from cylinder block (83).



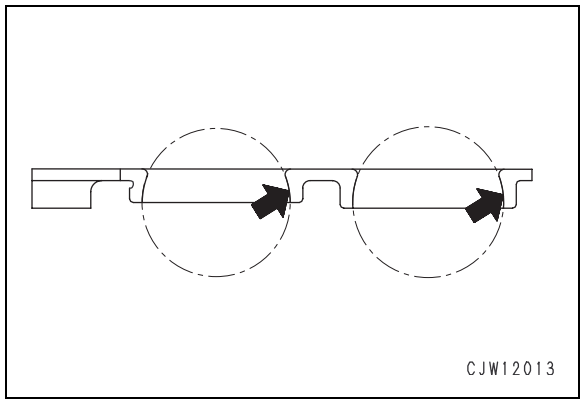

   ★ Check of cylinder block
   • Bores free of scoring, no evidence of wear.



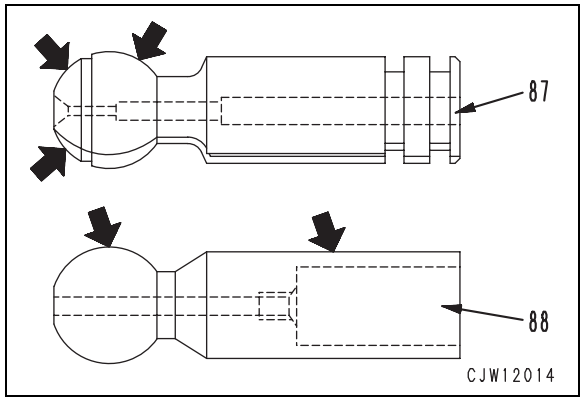

   4) Remove retaining ring assembly (85).
      ★ Screws are glued. Warm it up to max. 120°C and remove with Torx-tools.
   5) Remove 7 pistons (86), spring (87), and center pin (88) from retaining ring (85).




   ★ Check of retaining ring
   • No scoring and no evidence of wear.



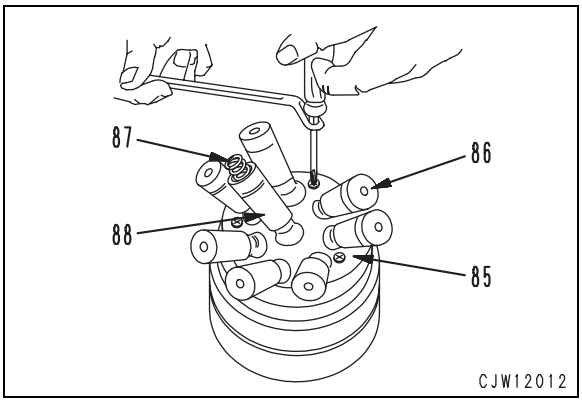

   ★ Check of piston and center pin
   • No scoring and no pittings.



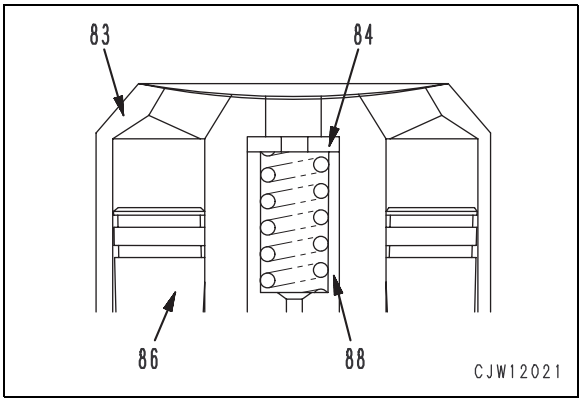
## ASSEMBLY

★ Clean the all parts and remove burrs, etc.
★ Coat the rotary parts and sliding parts with engine oil (EO10-CD) before installing.
★ If the tightening torque of a mounting bolt, nut, or plug is not shown in this manual, see the tightening torque table.

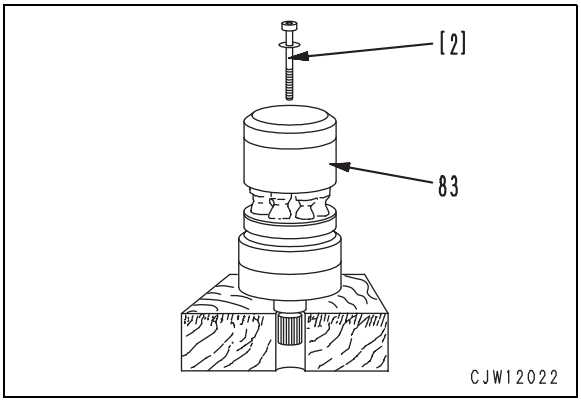
1. Assembly of rotary group assembly
   ★ If the drive shaft and bearing assembley is defective, replace it. (The parts of this assembly cannot be supplied loose.)
   1) Install 7 pistons (86), center pin (88), and spring (87) to retaining ring (85).
   2) Install retaining ring assembly (85) with the screw.
      ★ For the tightening torque of the screw, see TIGHTENING TORQUE TABLE.



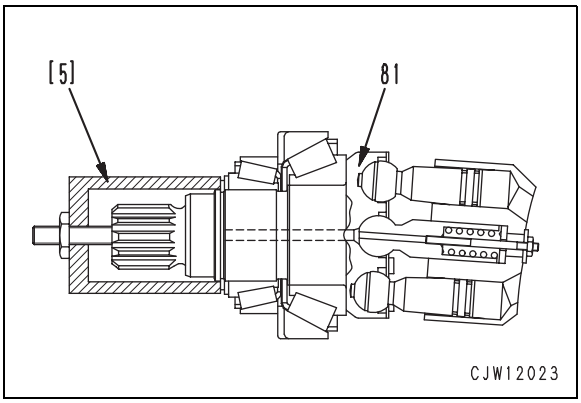

   3) Insert shim (84), center pin (88), and piston (86) in cylinder block (83).
      ★ Make sure all parts are fitted in correctly.



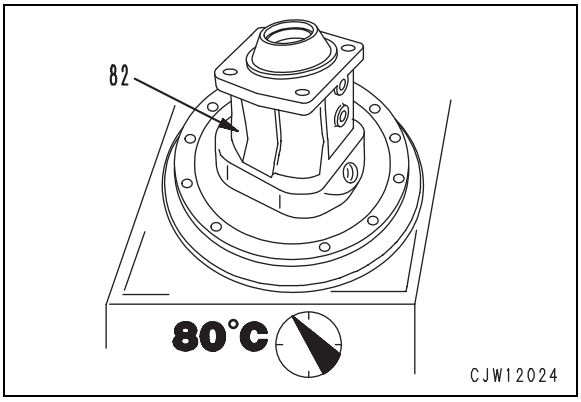

   4) Insert the piston to the end of cylinder block (83) and secure it with screw [2].



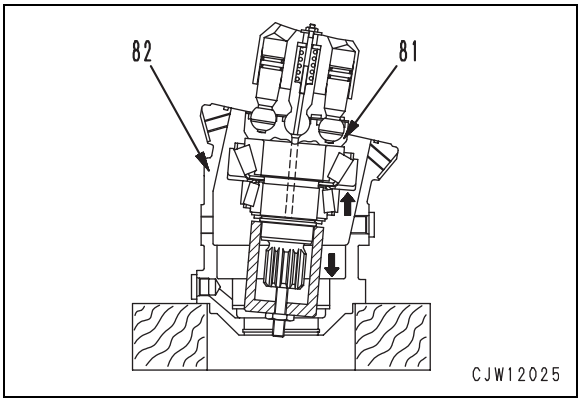

   5) Set tool [5] to rotary group assembly (81).



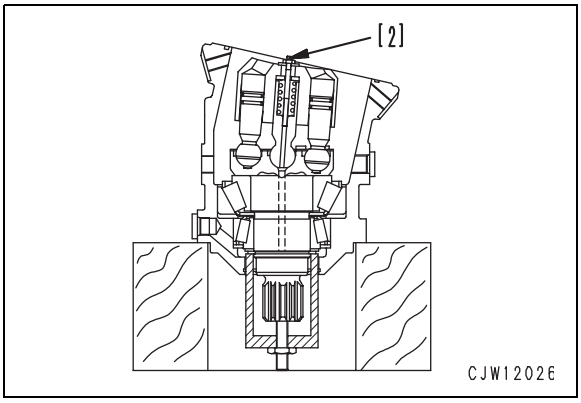

2. Installation of rotary group assembly
   1) Heat housing (82) to 80°C.



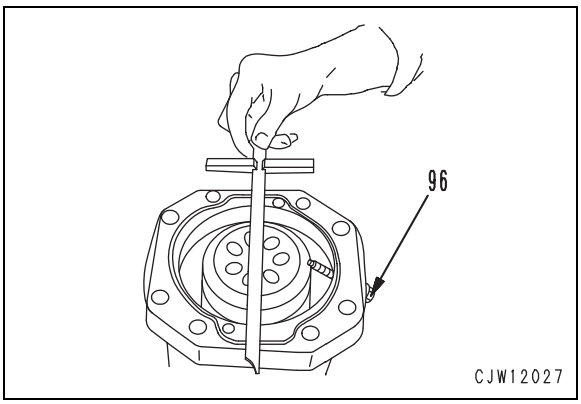
2) Insert rotary group (81) into housing (82) to seat position.

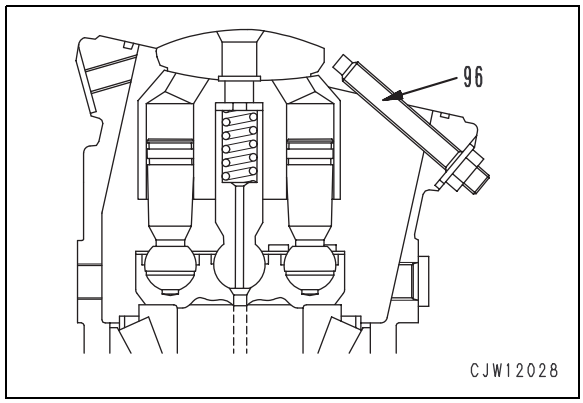



3) Remove screw [2].
4) Install the O-ring to the housing.

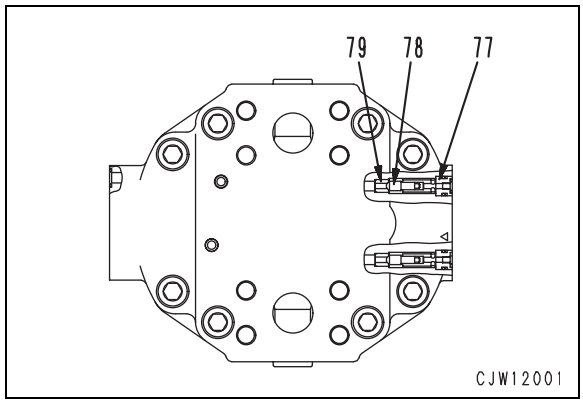



5) Determine cylinder swivel range to max, angle with Qmax-screw (96).

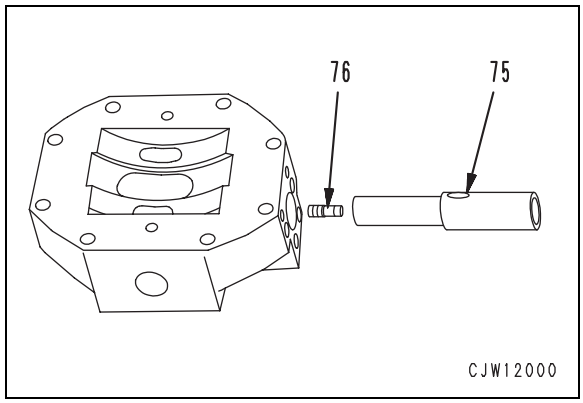


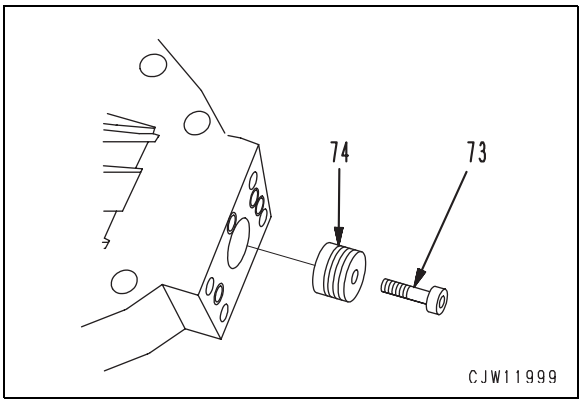

3. Port plate assembly
   1) Assemble the port plate assembly according to the following procedure.
      i) Install valve seat (79).
      ii) Install poppet (78).
      iii) Install valve guide (77).



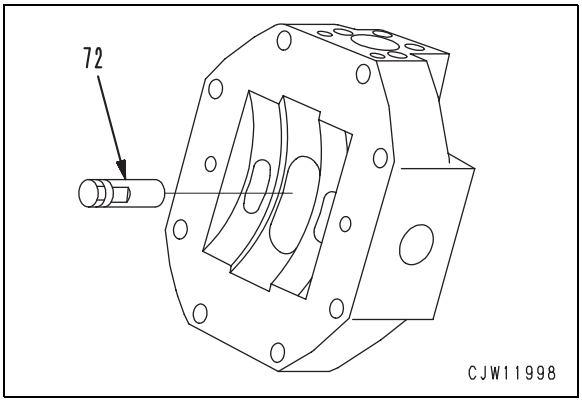

      iv) Install screw (76) to piston (75).
      v) Install piston (75).



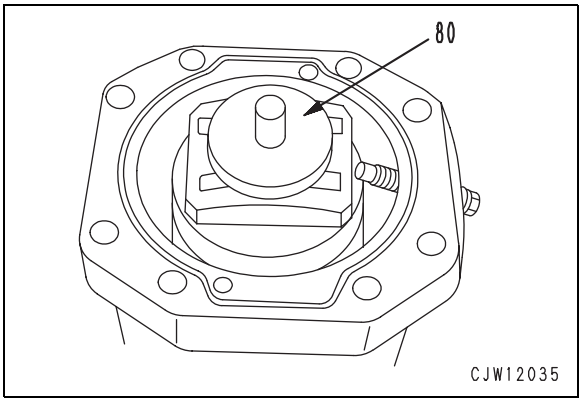
vi) Install barrel (74) and bolt (73).



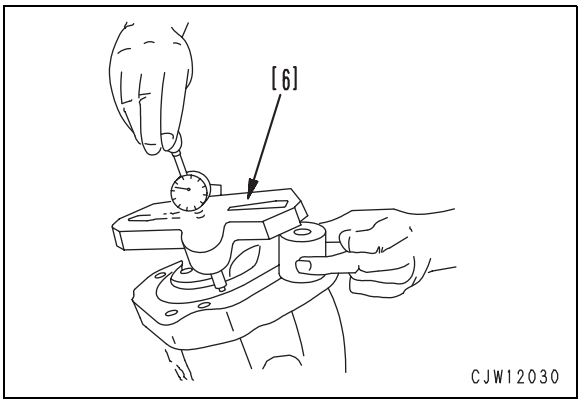

vii) Install rod (72).



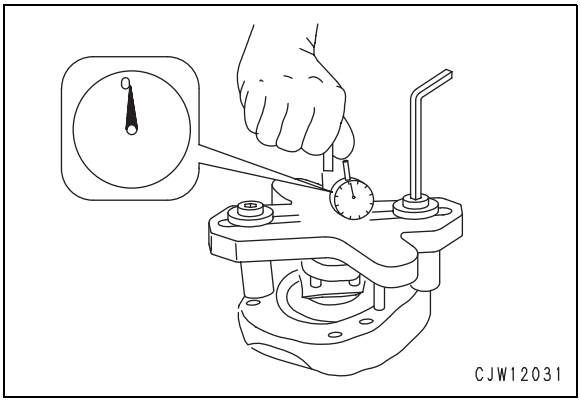

2) Install control plate (80).



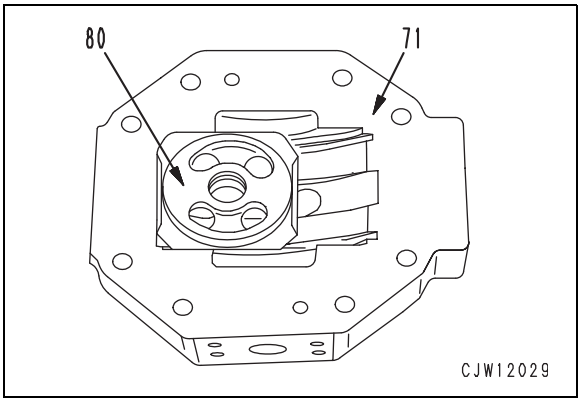

3) Mount measuring device [6].



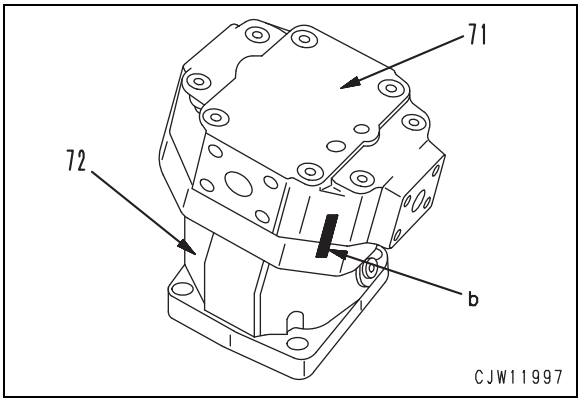

4) Check dimension X.




5) Remove control plate (80) from the top of the cylinder block and thinly apply grease to it, and then install it to the sliding surface of the port plate assembly.



6) Install port plate assembly (71) to housing (72), matching match marks (b) made when it was removed.




7) Assemble port plate (71) with differential piston.

★ Take care of assembly design!

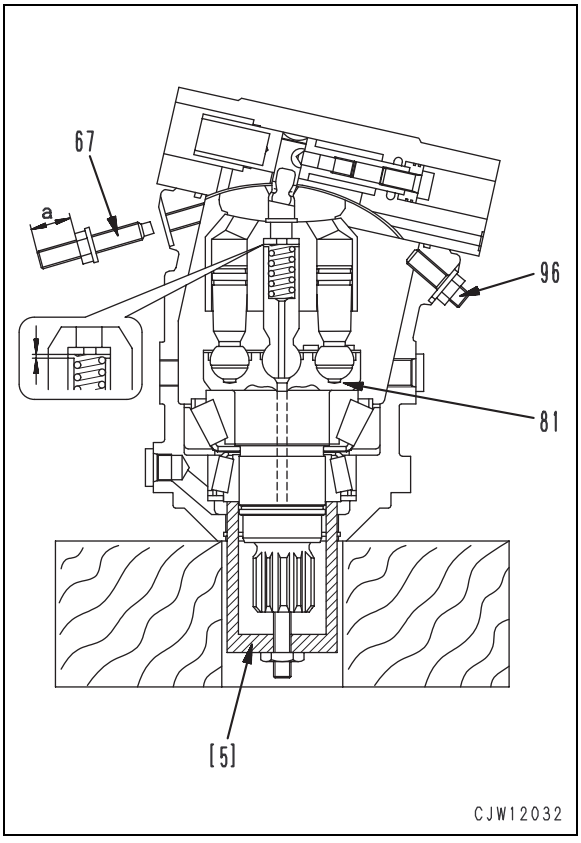
★ Tighten fixing screws (67), (96) with torque.

8) Swivel rotary group (81) to "starting position".

9) Set Qmin - screw (67) to dimension (**a**).

10) Assemble plug.

11) Remove tool [5].



4. HA servo valve and forward-reverse shuttle valve assembly and flushing valve assembly (HST motor 2)
   1) Assemble the flushing valve assembly according to the following procedure.
      i) Install guide (66), orifice (65), and guide (64).

      Guide (66): **3 Nm {0.31 kgm}**

      Guide (64): **8 Nm {0.81 kgm}**

      ii) Install plug (64).

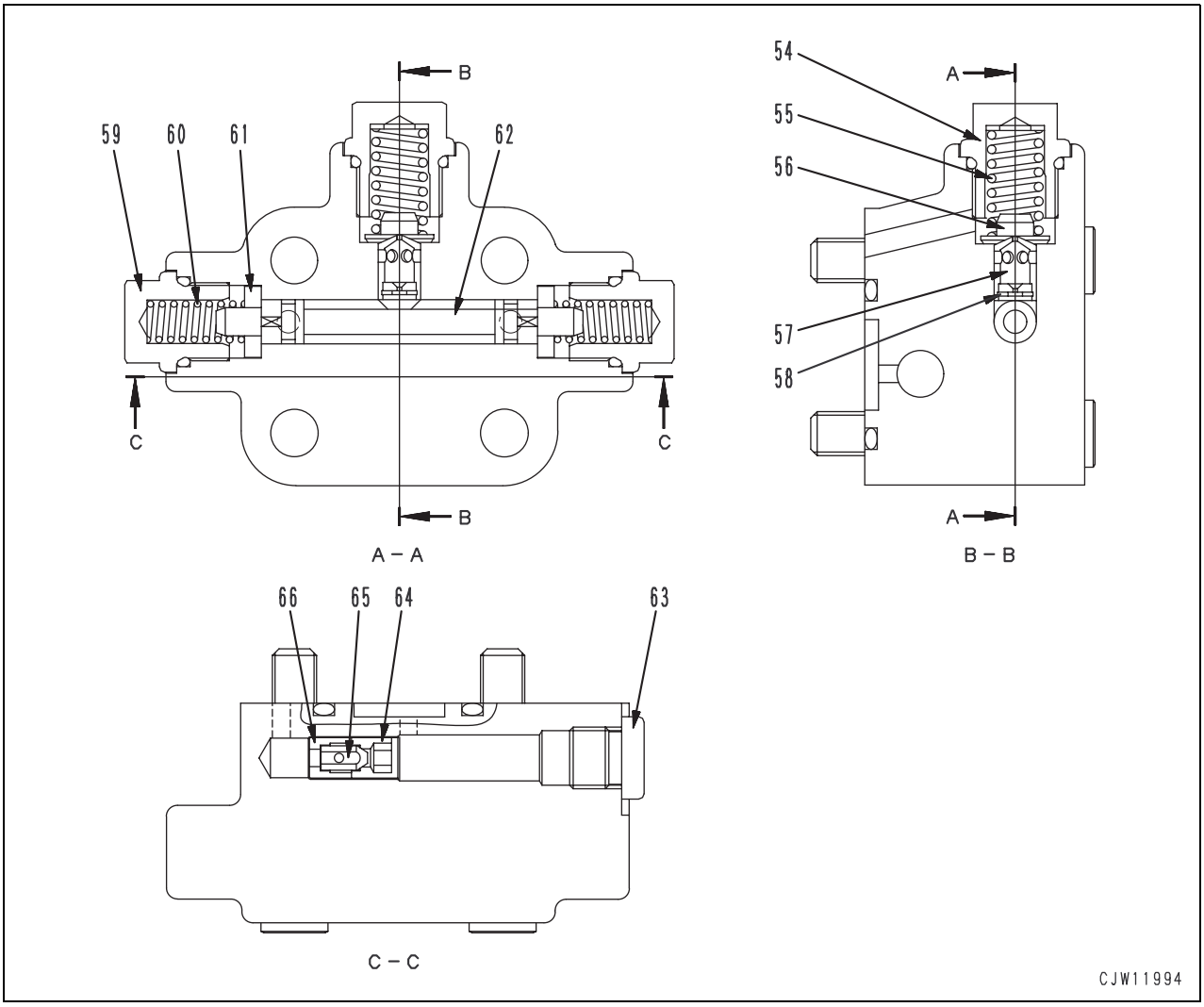
      Plug: **29 - 38 Nm {2.96 - 3.89 kgm}**

      iii) Install spool (62), spring seat (61), and spring (60).
      iv) Install 2 plugs (59).

      Plug: **60 Nm {6.1 kgm}**

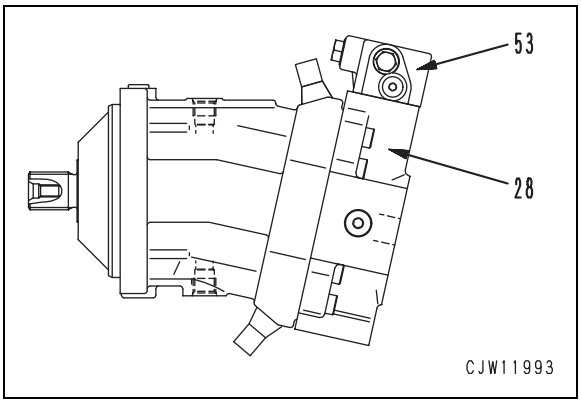
      v) Install washer (58), orifice (57), plunger (56), and spring (55).
      vi) Install plug (54).

      Plug: **60 Nm {6.1 kgm}**

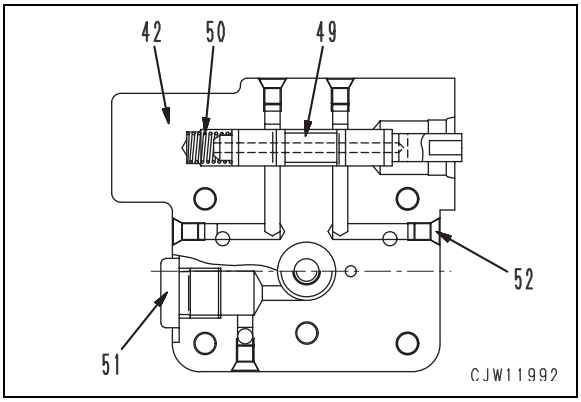


2) Install flushing valve assembly (53) to port plate (28).

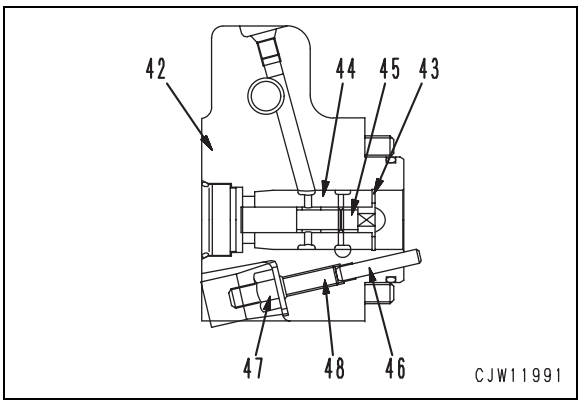
Plug:
**55 - 60 Nm {5.61 - 6.12 kgm}**



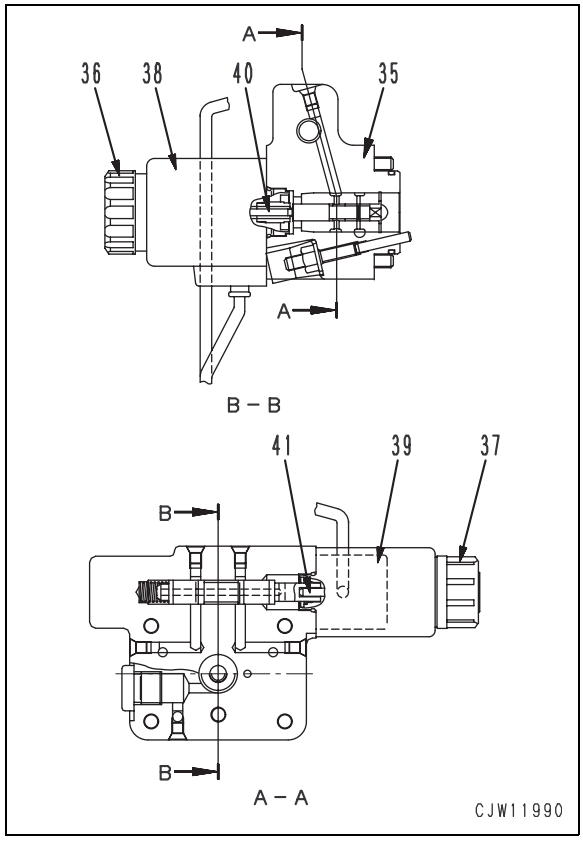

3) Assemble the housing assembly according to the following procedure.
   i) Install 5 plugs (52) and plug (51).
   ii) Install spring (50) and control piston (49) to housing (42).



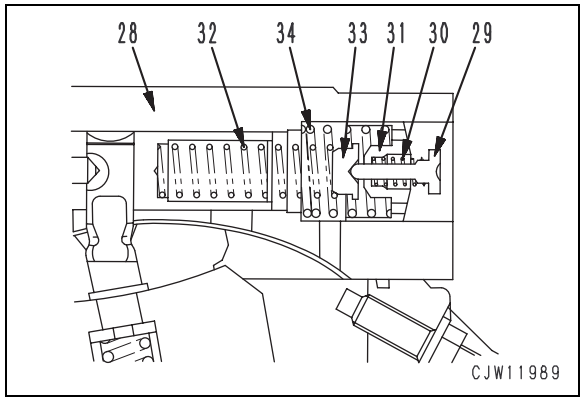

   iii) Install pin (46).
   iv) Install control piston (45) and control bushing (44).
   v) Install snap ring (43).



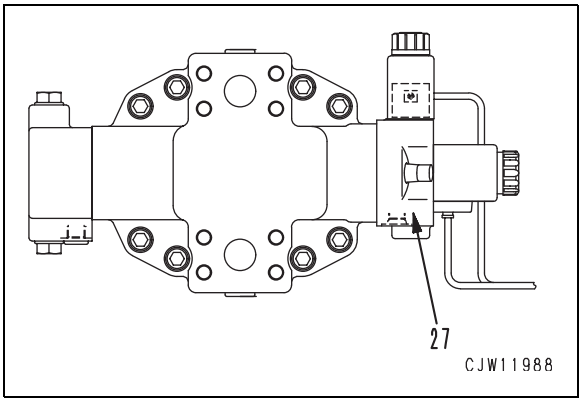

4) Install 2 solenoids to housing assembly (35).
   ★ Install tubes (41) and (40), coils (39) and (38), and caps (37) and (36) of the solenoid in order.




5) Install spring (34) and spring seat (33) to the port plate.
6) Install spring (32) and spring seat (31).
7) Install spring (30) and spring seat (29).



8) Install solenoid valve and housing assembly (27) with the 4 mounting bolts.

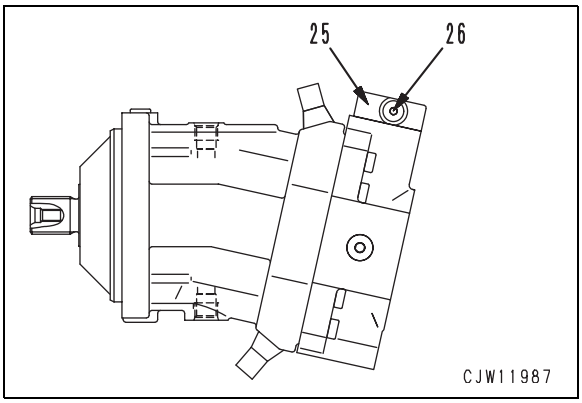



5. EP servo valve assembly and cover
   1) Cover
      i) Install plug (26) to cover (25).

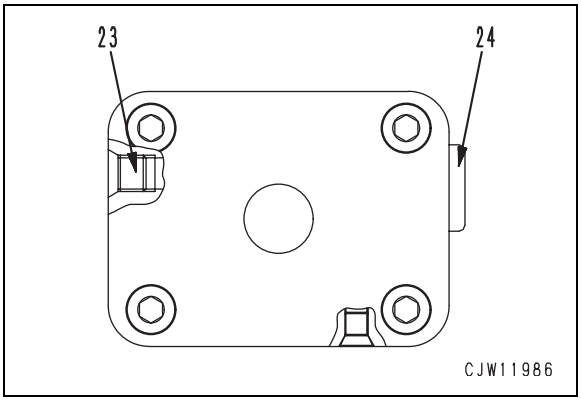
      Plug: **28 - 38 Nm {3.0 - 3.9 kgm}**

      ii) Install cover (25).

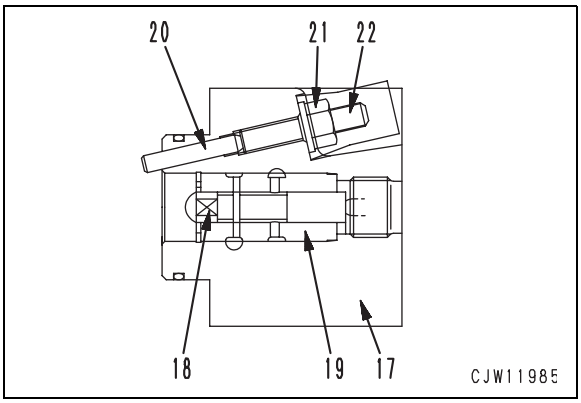
      Mounting bolt:
      **39 - 49 Nm {4.0 - 5.0 kgm}**



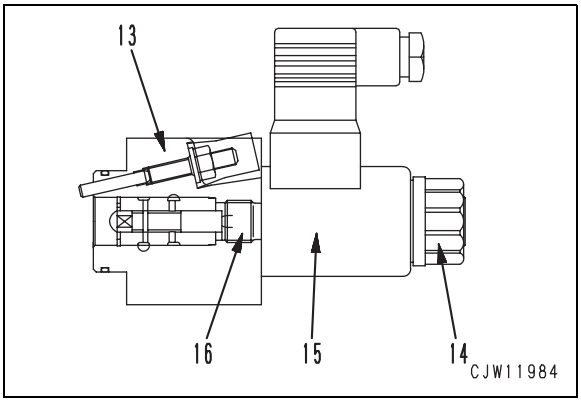

2) Assemble the housing assembly according to the following procedure.
   i) Install plugs (23) and (24) to housing (17).



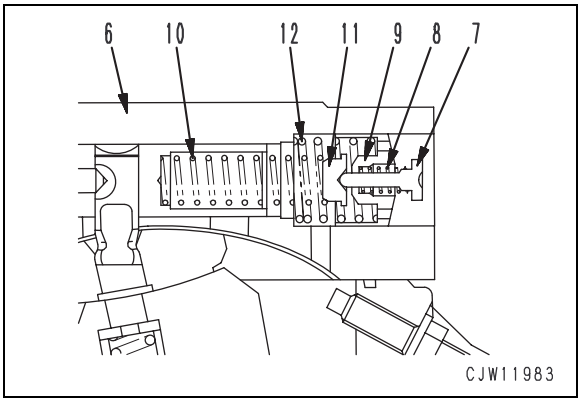

   ii) Install pin (20).
   iii) Install bushing (19) and spool (18) to housing (17).



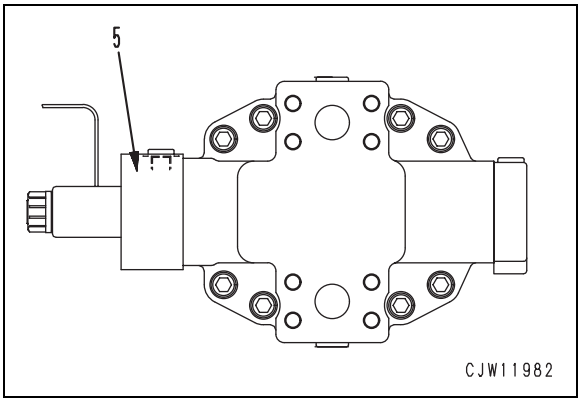

3) Install the solenoid to housing assembly (13).
   ★ Install tube (16), coil (15), and cap (14) in order.



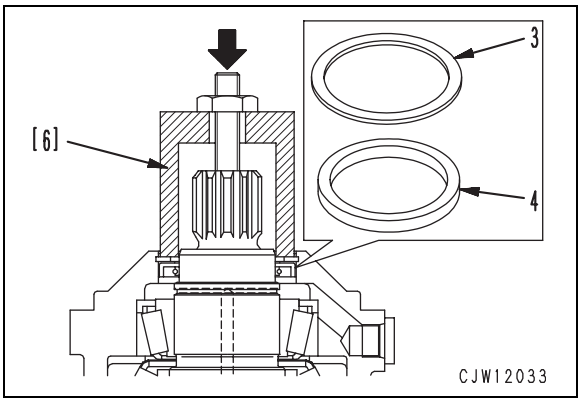
4) Install spring (12) and spring seat (11) to port plate assembly (6).
5) Install spring (10) and spring seat (9).
6) Install spring (8) and spring seat (7).



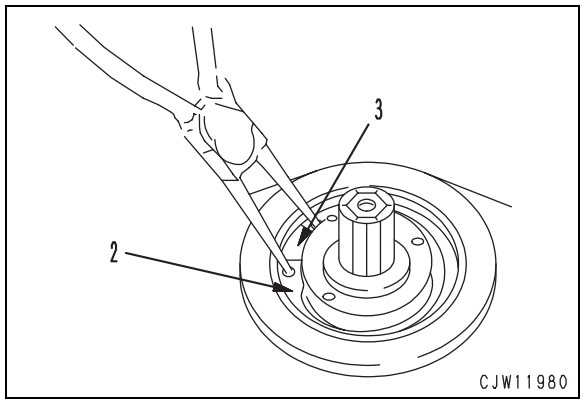

7) Install solenoid valve and housing assembly (5) with the 4 mounting bolts.



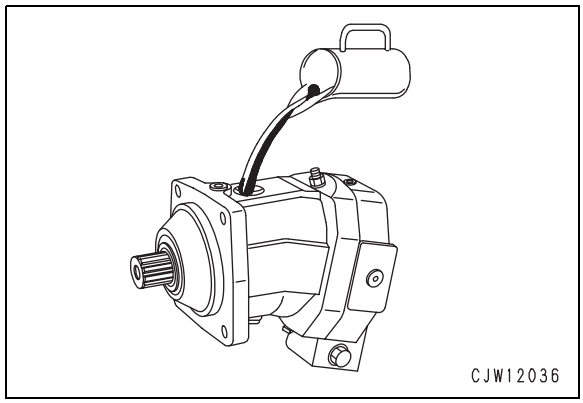

6. Seal
1) Using push tool [6], press fit seal (4).
2) Install shim (3).




3) Install snap ring (2).




7. Filling with oil
Fill up hydraulic aggregates with medium before start-up.




8. Tightening torque table
★ If the tightening torque of a mounting bolt, nut, or plug is not shown in this manual, see DISASSEMBLY, ASSEMBLY OF HST PUMP ASSEMBLY, Tightening torque table.

9. Before starting
- Observe the operating instructions before starting.
- Check the machine for remarkable faults.
- Do not operate the machine with defective instruments, warning lights or control elements.
- All safety devices must be in a secure position.
- Do not carry with you movable objects or secure them to the machine.
- Keep oily and inflammable material away from the machine.
- Before entering the driver's cabin, check if persons or obstacles are beside or beneath the machine.
- Be careful when entering the driver's cabin, use stairs and handles.
- Adjust your seat before starting.

# REMOVAL, INSTALLATION OF WORK EQUIPMENT CONTROL VALVE ASSEMBLY

## REMOVAL

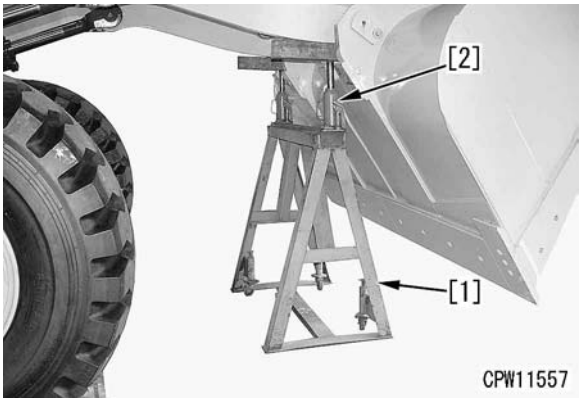
Stop the vehicle on a level place and, apply the parking brake, and put chocks under the tires.

1. Bend the chassis to the left and raise the boom and dump the bucket. Then, support the boom with block [1] and hydraulic jack [2], setting them flush with each other.

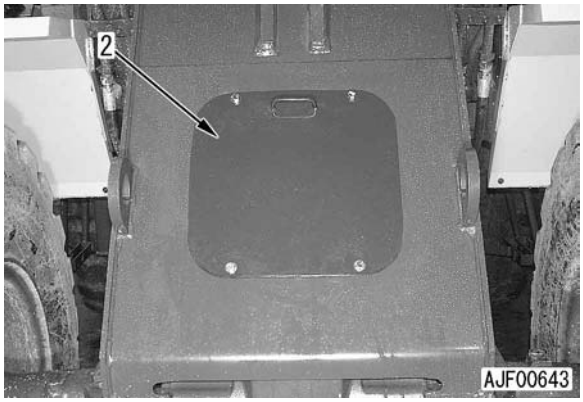
   Support the boom securely.

   Stop the engine, and then slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

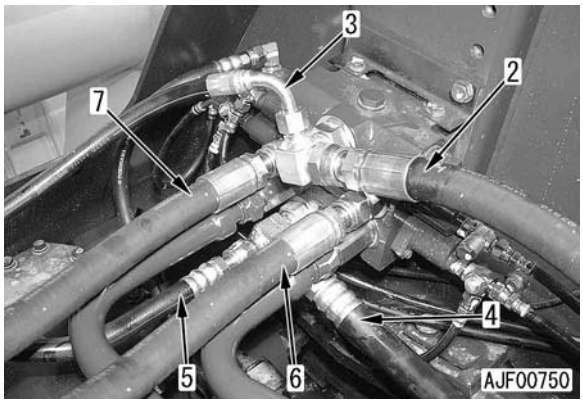
   Operate the work equipment control lever 2 - 3 times to release the residual pressure in the work equipment circuit.



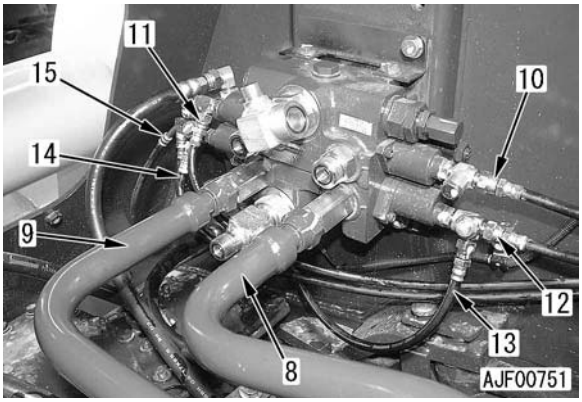

2. Remove the work equipment valve upper cover (2).

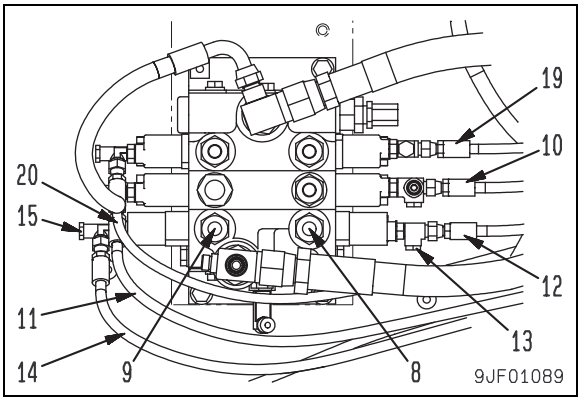



3. Disconnect the following hoses and tubes. [*1]
   - ★ Mark all the hoses and tubes with tags to prevent mistakes in the mounting position when installing.
   - ★ Since oil will leak through the disconnected hoses and tubes, prepare oil receivers.
   - (2) (3): Port P hose
   - (4) (5): Port T hose
   - (6): Port A1 hose
   - (7): Port B1 hose

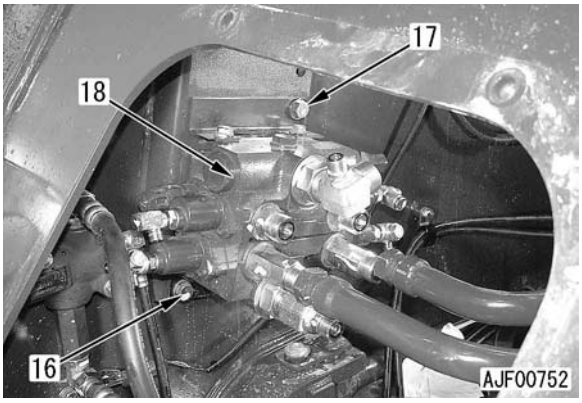


- (8): Port A2 tube
- (9): Port B2 tube
- (10): Bucket DUMP PPC hose
- (11): Bucket TILT PPC hose
- (12): Boom LOWER PPC hose
- (13): Bypass valve port PP hose
- (14): Boom RAISE PPC hose
- (15): Bypass valve port T hose
- (19): PULL PPC hose (WA250PT-5)
- (20): PUSH PPC hose (WA250PT-5)




4. Loosen 2 lower bracket mounting bolts (16) and remove 1 upper bracket mounting bolt (17).
   ★ Just loosen 2 lower bracket mounting bolts (16). Do not remove them.
5. Remove work equipment control valve assembly (18).




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

★ Connect PPC hoses (10), (11), (12), (14), (19), and (20) according to their band colors shown below.

- PPC hose band colors of WA250-5

| No. | Connecting point | Band color |
|---|---|---|
| (10) | Bucket DUMP | Orange |
| (11) | Bucket TILT | Red |
| (12) | Boom LOWER | Blue |
| (14) | Boom RAISE | Yellow |

- PPC hose band colors of WA250PT-5

| No. | Connecting point | Band color |
|---|---|---|
| (10) | Bucket DUMP | Orange |
| (11) | Bucket TILT | Red |
| (12) | Boom LOWER | Blue |
| (14) | Boom RAISE | Yellow |
| (19) | PULL | Green |
| (20) | PUSH | White/Red |

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

# REMOVAL, INSTALLATION OF TRAVEL DAMPER VALVE ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and, apply the parking brake, and put chocks under the tires.

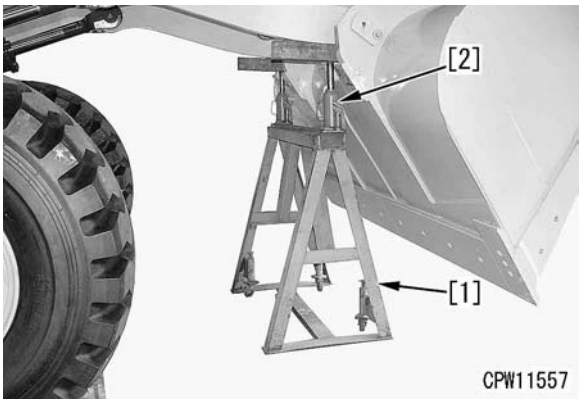
Disconnect the cable from the negative (-) terminal of the battery.

1. Bend the chassis to the right and raise the boom and dump the bucket. Then, support the boom with block [1] and hydraulic jack [2], setting them flush with each other.

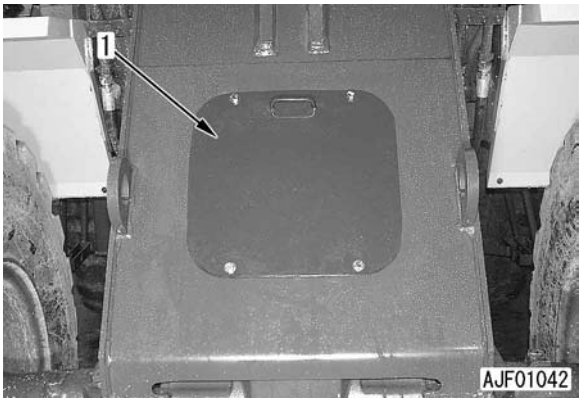
   Support the boom securely.

   Stop the engine, and then slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

   Operate the work equipment control lever 2 - 3 times to release the residual pressure in the work equipment circuit.

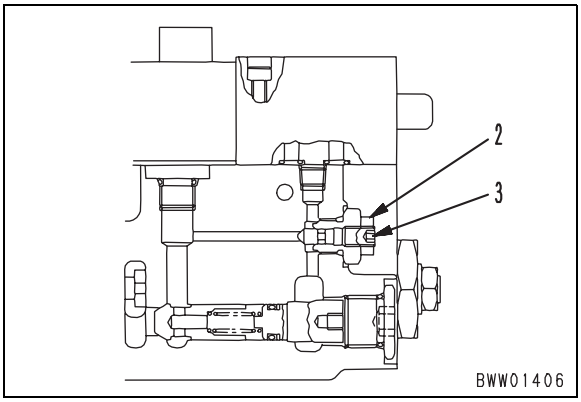



2. Remove the work equipment valve upper cover (1).

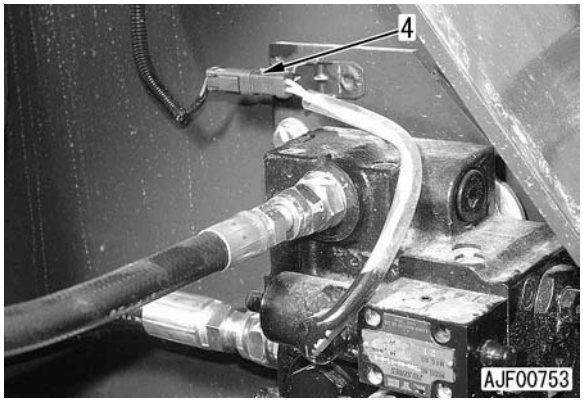



3. Release the residual pressure in the travel damper circuit.
   1) Loosen locknut (2).
   2) Loosen adjustment screw (3) by 1/2 - 1 turn to release the pressure in the accumulator circuit for the travel damper.
      ★ Locknut (2) and adjustment screw (3) are painted red.
   3) After releasing the residual pressure, return adjustment screw (3) and tighten locknut (2) securely.

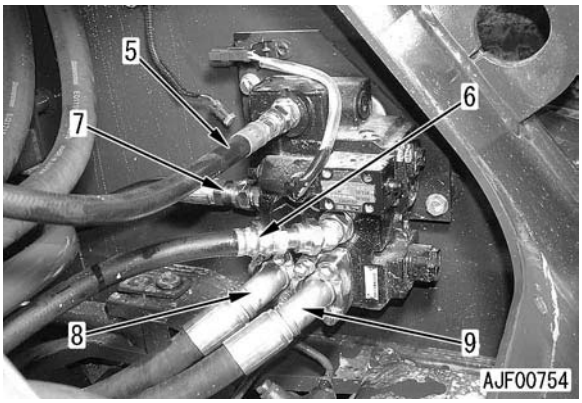
      Mounting bolt:
      **12.7 ± 0.6 Nm {1.3 ± 0.06 kgm}**



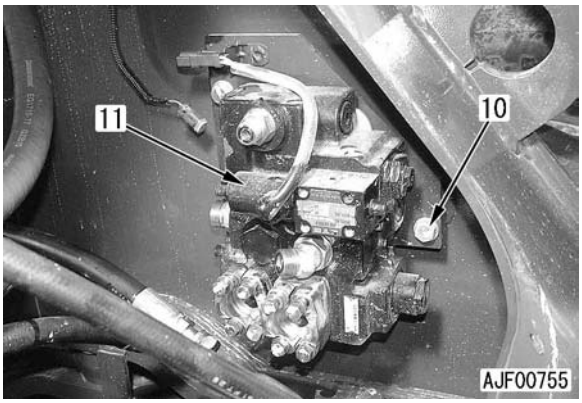

4. Disconnect wiring connector F07 (4).



5. Disconnect the following hoses and tubes.
   - ★ Mark all the hoses and tubes with tags to prevent mistakes in the mounting position when installing.
   - ★ Since oil will leak through the disconnected hoses and tubes, prepare oil receivers.
   - (5): Port P hose
   - (6): Port T hose
   - (7): Port SP hose
   - (8): Port A hose
   - (9): Port B hose




6. Remove 3 bracket mounting bolts (10) and travel damper valve assembly (11).




## INSTALLATION

- Carry out installation in the reverse order to removal.

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

# REMOVAL, INSTALLATION OF HYDRAULIC TANK ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

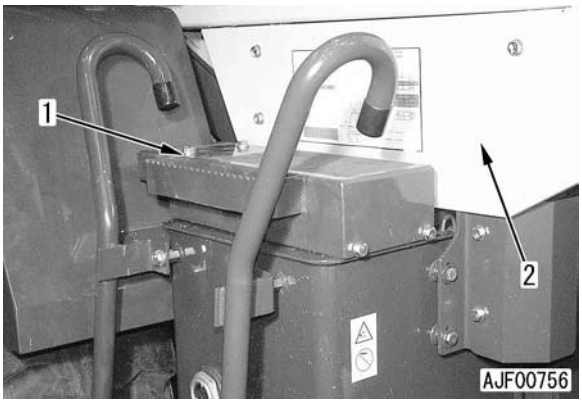
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Operate the work equipment control lever 2 - 3 times to release the residual pressure in the work equipment circuit.

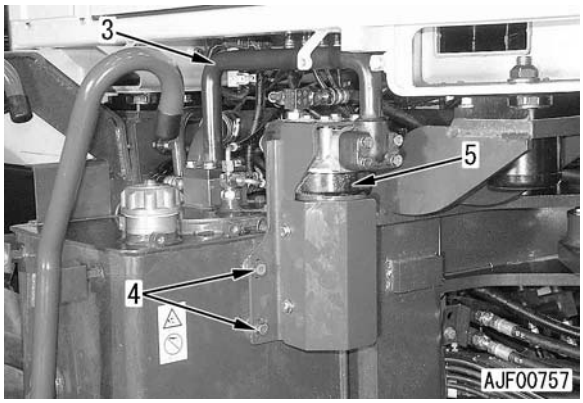
1. Remove hydraulic tank upper cover (1).

   Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

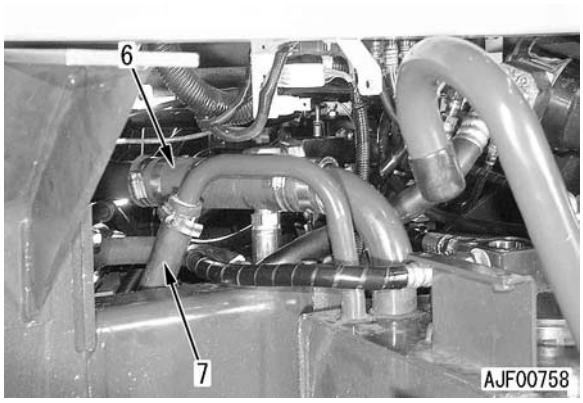
2. Remove cab right undercover (2).

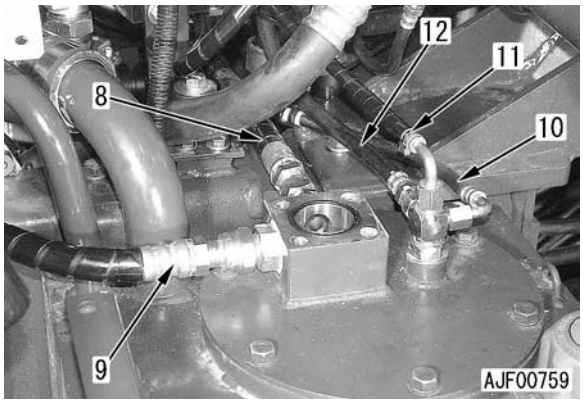



3. Remove tube (3) from the hydraulic oil filter.
4. Remove hydraulic oil filter cover mounting bolts (4) and move hydraulic oil filter cover assembly (5) and its hoses to under the operator's cab.

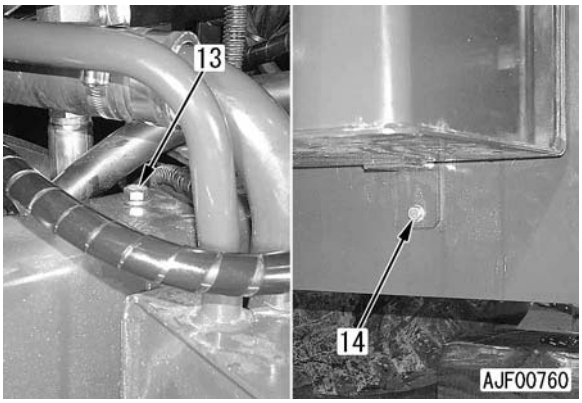



5. Disconnect 7 hoses (6), (7), (8), (9), (10), (11), and (12) from the hydraulic tank. [*1]



6. Sling the hydraulic tank assembly temporarily and remove 2 upper mounting bolts (13) and 1 lower mounting bolt (14). [*2]




7. Lift off hydraulic tank (15) and ladder together.

Hydraulic tank and ladder assembly: **160 kg (including hydraulic oil)**




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Inserting parts of hoses (6) and (7): **Gasket sealant (ThreeBond 1208D or equivalent)**

Hose clamp: **8.8 ± 0.5 Nm {90 ± 5 kgcm}**

[*2]

Hydraulic tank mounting bolt: **98 - 123 Nm {10 - 12.5 kgm}**

- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

# REMOVAL, INSTALLATION OF WORK EQUIPMENT ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

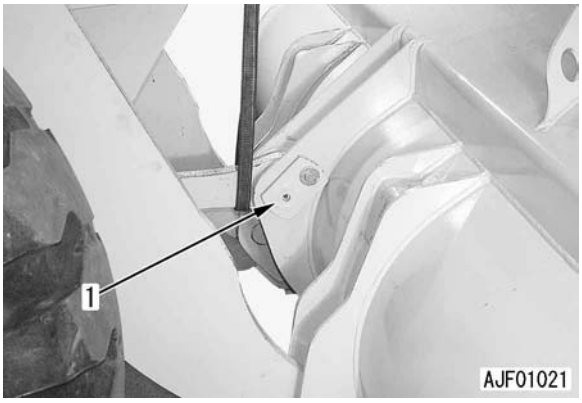
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Disconnect the cable from the negative (-) terminal of the battery.

1. Sling the bucket link temporarily and remove bucket link pin (1). [*1]

   Bucket link: **55 kg**

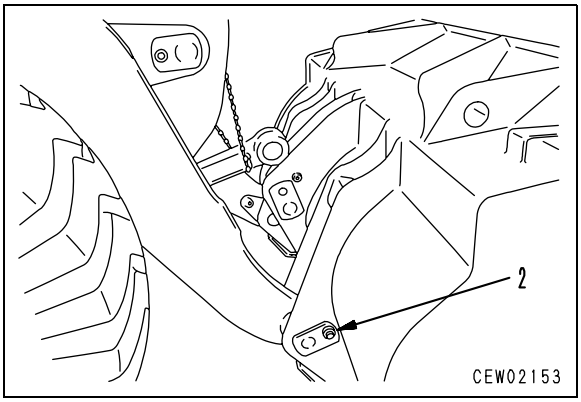
   ★ Secure the bucket link to the tilt lever with wires, etc.
   ★ Check the thickness and quantity of the shims.




2. Remove bucket hinge mounting pin (2). [*2]

   Never insert your fingers in the pin holes.

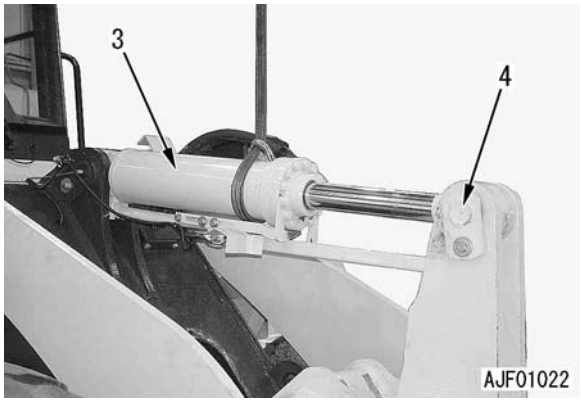
   ★ Check the thickness and quantity of the shims.

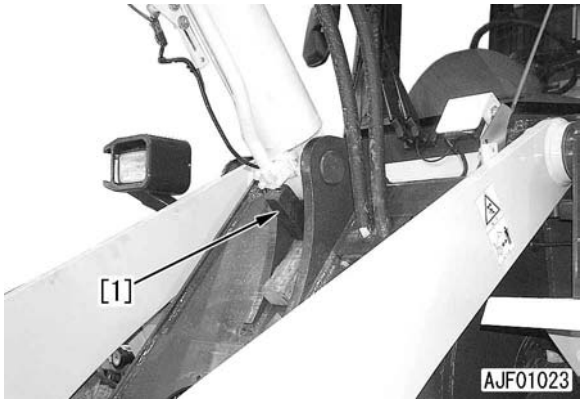



3. Move the machine to the rear and disconnect the bucket.
4. Sling bucket cylinder assembly (3) temporarily and pull out rod-side pin (4) to disconnect the cylinder rod and tilt lever. [*3]

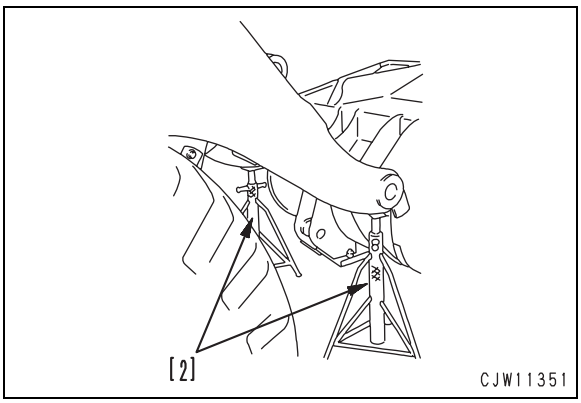
   ★ Install block [1] between the cylinder bottom and frame.
   ★ Check the thickness and quantity of the shims.

   Bucket cylinder assembly: **110 kg**



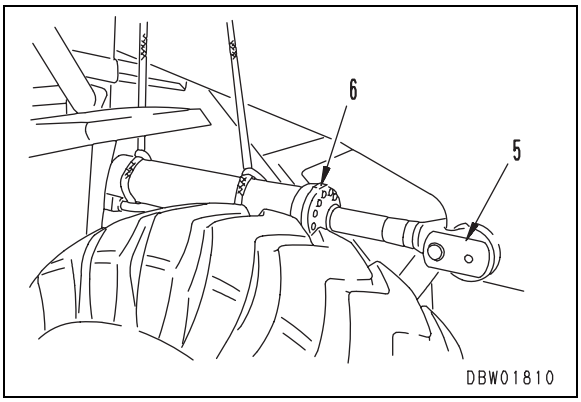



5. Set supports [2] under the end of the lift arm and release the residual pressure in the hydraulic piping.

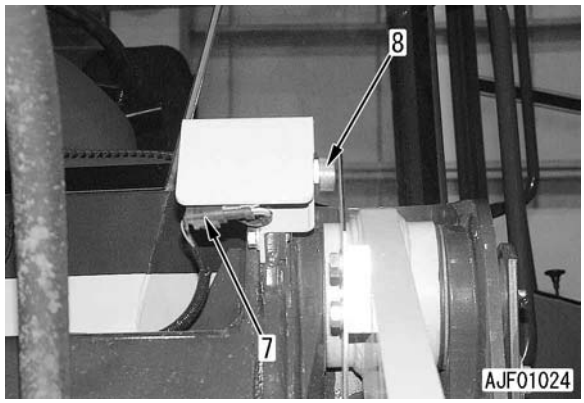



6. Sling lift cylinder assembly (6) temporarily and remove mounting pin (5). [*4]
   - ★ Check the thickness and quantity of the shims.
   - ★ When lowering the lift cylinder assembly, put a block on the axle.

   Lift cylinder assembly (1 pieces): **110 kg**

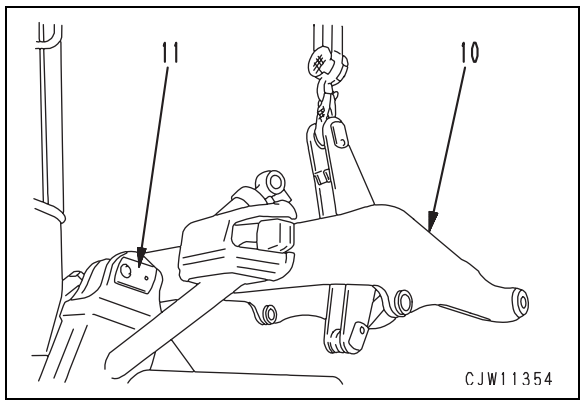



7. Disconnect boom positioner proximity switch connector F04 (7).
8. Remove boom kick-out switch (8). [*5]



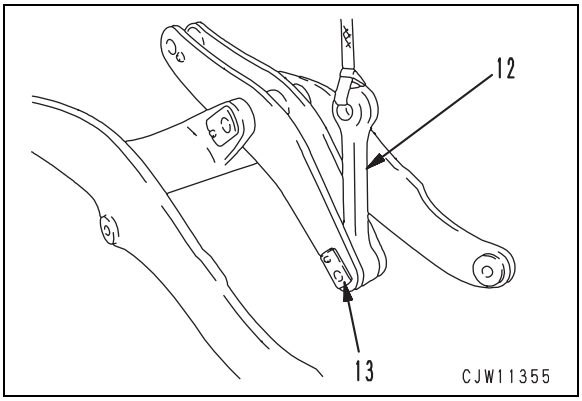

9. Sling lift arm and tilt lever and bucket link assembly (10) temporarily and pull out mounting pin (11). [*6]
   - ★ Check the thickness and quantity of the shims.
10. Lift off lift arm and tilt lever and bucket link assembly (10).

    Lift arm and tilt lever and bucket link assembly: **950 kg**



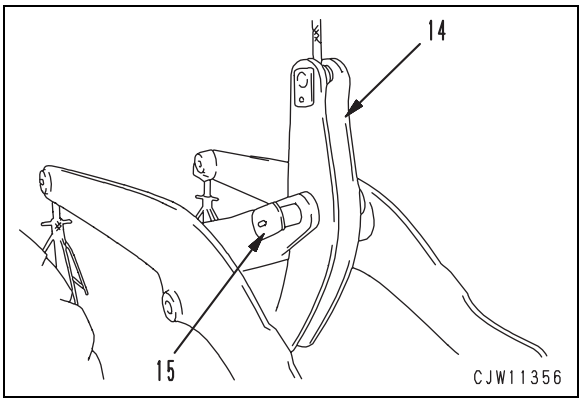
11. Sling bucket link assembly (12) temporarily, pull out mounting pin (13), and remove the bucket link assembly from the tilt lever assembly. [*7]

Bucket link assembly: **30 kg**

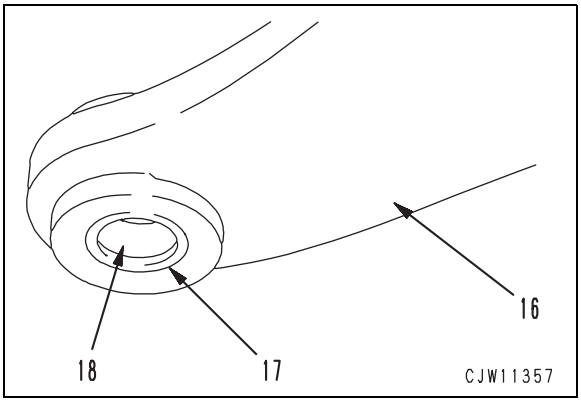



12. Sling tilt lever assembly (14) temporarily and pull out mounting pin (15).
13. Lift off tilt lever assembly (14).

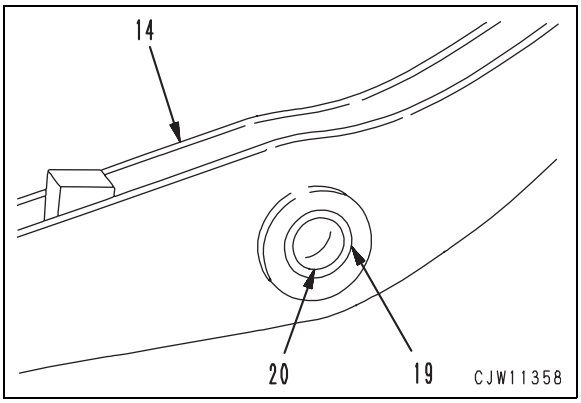
Tilt lever assembly: **170 kg**



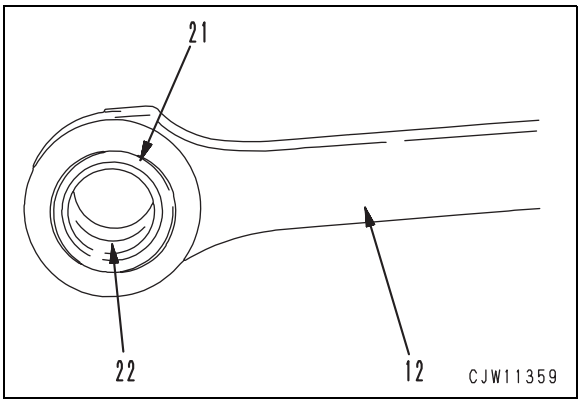

14. Pull dust seal (17) and bushing (18) out of lift arm (16). [*8]




15. Pull dust seal (19) and bushing (20) out of tilt lever (14). [*8]




16. Pull dust seal (21) and bushing (22) out of bucket link (12). [*8]



## INSTALLATION

- Carry out installation in the reverse order to removal.

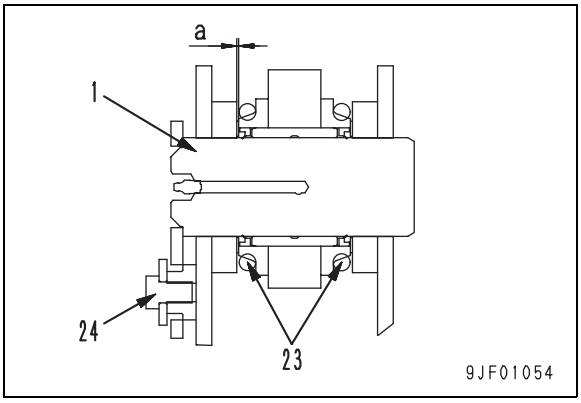
When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.

[*1]
**Procedure for installing bucket link pin**

1. Sling the bucket link and install cord ring (23), aligning the holes for mounting pin (1).
2. Insert shims on both sides so that clearances (a) on both sides will be the same.
   - Clearance (a) (On each side): **Max. 1.5 mm**
   - Varieties of shim thickness: **Only 1.5 mm**
3. Install mounting pin (1) and lock it with bolt (24).

Never insert your fingers in the pin holes.

★ Take care that the cord ring will not be caught.




[*2]
**Procedure for installing bucket hinge pin**

1. Operate the control lever to align the holes for bucket mounting pin (2) and install cord ring (25).
2. Insert shims in clearance (b).
   - Clearance (b) (On each side): **Max. 1.5 mm**
   - Varieties of shim thickness: **1.5, 3.0 mm**
3. Install mounting pin (1) and lock it with bolt (26).

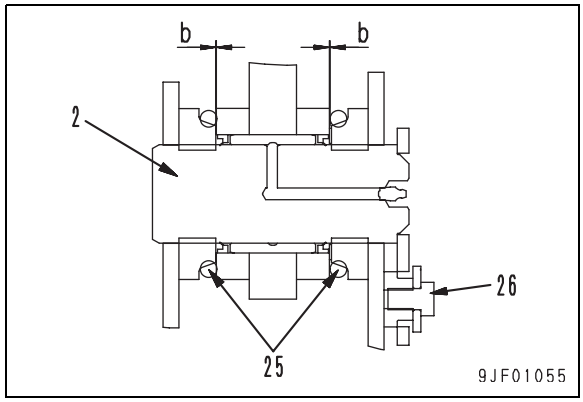
Never insert your fingers in the pin holes.

★ Take care that the cord ring will not be caught.
★ Take care not to damage the pin.
★ Before installing the pin, apply lubricant containing molybdenum disulfide to the inside of the bushing.

Inside of bushing:
**Lubricant containing molybdenum disulfide (LM-P or equivalent)**

★ After installing the pin, supply grease.

Grease:
**Lubricant containing molybdenum disulfide (LM-G or Hyper White G1-T)**



[*3]
**Procedure for installing bucket cylinder pin (on rod side)**

★ It is not necessary to adjust shims for clearance (c).

1. Install mounting pin (4) and lock it with bolt (27).

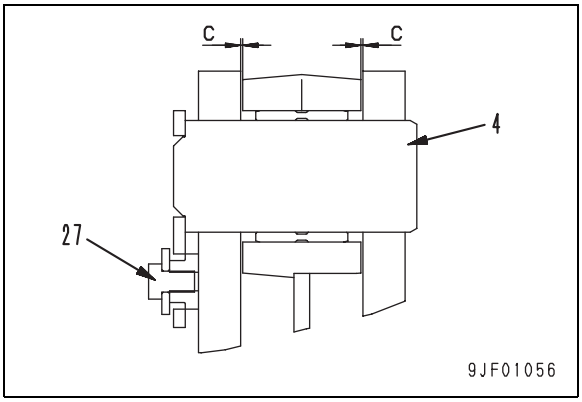
   Never insert your fingers in the pin holes.

   ★ Take care not to damage the pin.
   ★ Before installing the pin, apply lubricant containing molybdenum disulfide to the inside of the bushing.

   Inside of bushing:
   **Lubricant containing molybdenum disulfide (LM-P or equivalent)**

   ★ After installing the pin, supply grease containing molybdenum disulfide.

   Grease:
   **Lubricant containing molybdenum disulfide (LM-G or Hyper White G1-T)**




2. Adjust the bucket positioner. For details, see TESTING AND ADJUSTING, Testing and adjusting bucket positioner.

[*4]
**Procedure for installing lift cylinder pin (on rod side)**

When starting the engine, check that the forward-reverse lever is in neutral and the parking brake is applied.

1. Insert shims in clearance (d).
   - Clearance (d) (On each side): **Max. 1.5 mm**
   - Varieties of shim thickness: **Only 1.5 mm**
2. Install mounting pin (5) and lock it with bolt (28).

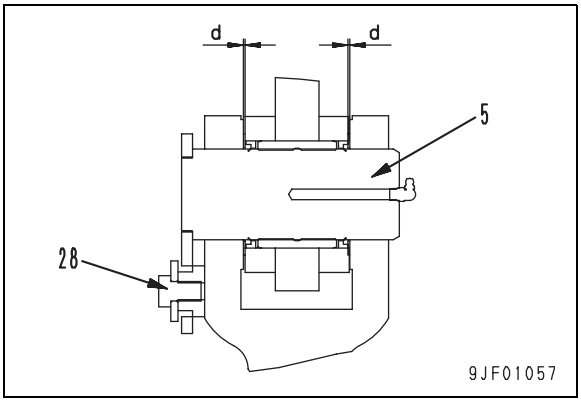
   Never insert your fingers in the pin holes.

   ★ Take care not to damage the pin.
   ★ Before installing the pin, apply lubricant containing molybdenum disulfide to the inside of the bushing.

   Inside of bushing:
   **Lubricant containing molybdenum disulfide (LM-P or equivalent)**

   ★ After installing the pin, supply grease containing molybdenum disulfide.

   Grease:
   **Lubricant containing molybdenum disulfide (LM-G or Hyper White G1-T)**




[*5]

★ Adjust the boom kick-out. For details, see TESTING AND ADJUSTING, Testing and adjusting of boom kick-out.

[*6]

**Procedure for installing lift arm pin (on frame side)**

1. Insert shims in clearance (e).
   - ★ When installing the right-hand lift arm pin, fit the boss on the right inside of the frame to the lift arm boss to eliminate the clearance and insert shims in the clearance on the opposite side.
   - ★ When installing the left-hand lift arm pin, insert shims evenly on both sides.
   - • Clearance (e) (On each side of left-hand boom pin): **Max. 1.5 mm**
   - • Varieties of shim thickness: **1.5 mm, 3.0 mm**
2. Install mounting pin (11) and lock it with bolt (29).

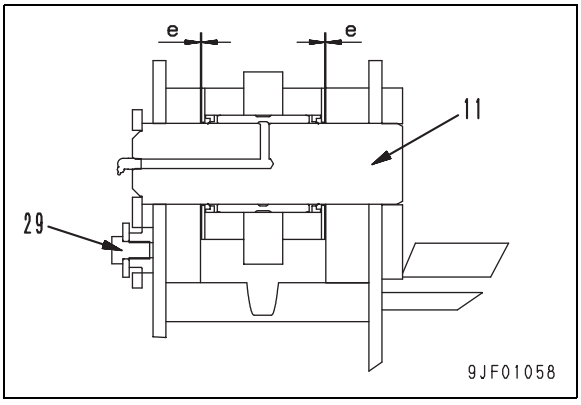
   Never insert your fingers in the pin holes.

   - ★ Take care not to damage the pin.
   - ★ Before installing the pin, apply lubricant containing molybdenum disulfide to the inside of the bushing.

     Inside of bushing:
     **Lubricant containing molybdenum disulfide (LM-P or equivalent)**

   - ★ After installing the pin, supply grease containing molybdenum disulfide.

     Grease:
     **Lubricant containing molybdenum disulfide (LM-G or Hyper White G1-T)**




[*7]

**Procedure for installing bucket link pin**

1. Insert shims so that clearances (f) on both sides will be even.
   - • Clearance (f) (On each side): **Max. 1.5 mm**
   - • Varieties of shim thickness: **Only 3.0 mm**
   - ★ Secure the bucket link to the bell crank with wires, etc.
2. Install cord rings (30), aligning the holes for bucket link mounting pin (13).
3. Install mounting pin (13) and lock it with bolt (31).

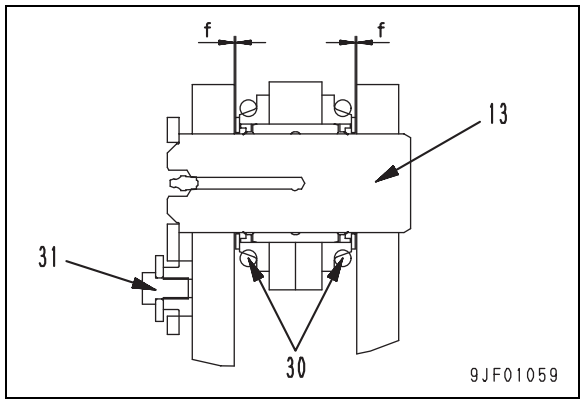
   Never insert your fingers in the pin holes.

   - ★ Take care that the cord ring will not be caught.
   - ★ Take care not to damage the pin.
   - ★ Before installing the pin, apply lubricant containing molybdenum disulfide to the inside of the bushing.

     Inside of bushing:
     **Lubricant containing molybdenum disulfide (LM-P or equivalent)**

   - ★ After installing the pin, supply grease containing molybdenum disulfide.

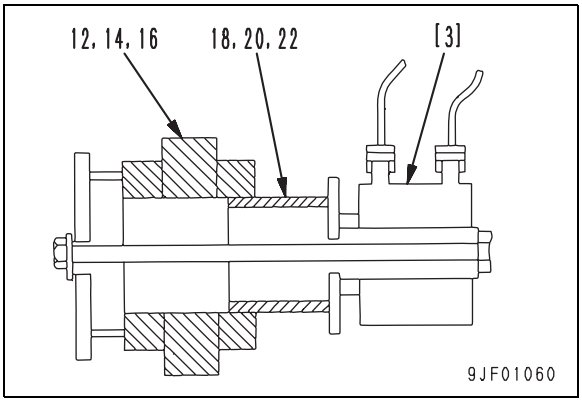
     Grease:
     **Lubricant containing molybdenum disulfide (LM-G or Hyper White G1-T)**



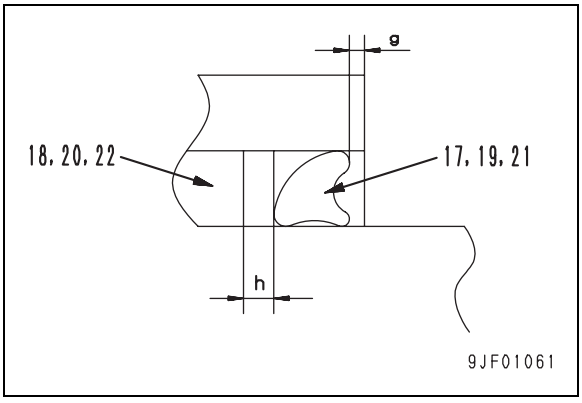
[*8]
Press fit bushings (18), (20), and (22) to lift arm (16), tilt lever (14), and bucket link (12) respectively with hydraulic cylinder [3], etc., and then install the dust seals.

Bushing: **Grease (G2-LI)**

★ Apply grease to the seal so that the seal will not be damaged.




★ Press fit the dust seal with the lip out.
- Installed dimension (g): **0.25 - 0.8 mm**
- Installed dimension (h): **2 - 3 mm**




- **Greasing**
  Supply grease to each pin.

★ Supply grease until it comes out of the joint.

# DISASSEMBLY, ASSEMBLY OF HYDRAULIC CYLINDER ASSEMBLY

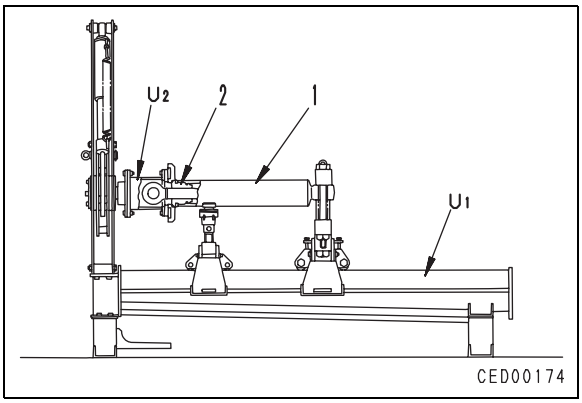
## SPECIAL TOOLS

| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| U | 1 | 790-502-1003 | Repair stand | ■ | 1 | | |
| | | 790-101-1102 | Hydraulic pump | ■ | 1 | | |
| | 2 | 790-102-2303 or 790-102-3802 | Wrench assembly (for lift and bucket) | ■ | 1 | | |
| | 3 | 790-302-1340 | Socket (for lift) | ■ | 1 | | |
| | 4 | 790-201-1702 | Push tool kit | | 1 | | |
| | | 790-101-5021 | • Grip | | 1 | | |
| | | 01010-50816 | • Bolt | | 1 | | |
| | | 790-201-1811 | • Push tool (Lift) | | 1 | | |
| | | 790-201-1821 | • Push tool (Bucket) | | 1 | | |
| | | 790-201-1841 | • Push tool (WA250PT-5 bucket) | | 1 | | |
| | | 790-201-1741 | • Push tool (Steering) | | 1 | | |
| | 5 | 790-201-1500 | Push tool kit | ■ | 1 | | |
| | | 790-101-5021 | • Grip | | 1 | | |
| | | 01010-50816 | • Bolt | | 1 | | |
| | | 790-210-1620 | • Push tool (Lift) | | 1 | | |
| | | 790-201-1630 | • Push tool (Bucket) | | 1 | | |
| | | 790-201-1841 | • Push tool (WA250PT-5 bucket) | | 1 | | |
| | | 790-201-1741 | • Push tool (Steering) | | 1 | | |
| | 6 | 790-720-1000 | Expander | ○ | 1 | | |

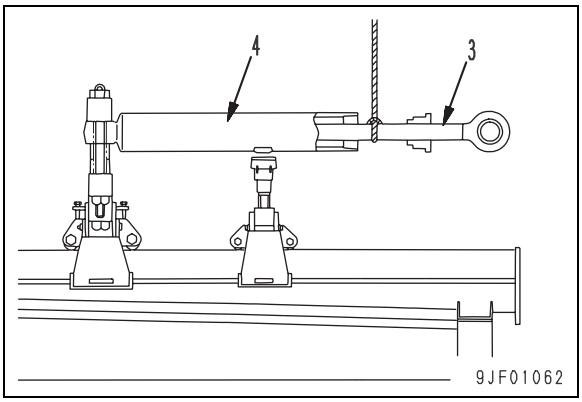
| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| U | 7 | 796-720-1670 | Ring (Lift) | ○ | 1 | | |
| | | 07281-01279 | Ring (Lift) | ○ | 1 | | |
| | | 796-720-1680 | Ring (Bucket) | ○ | 1 | | |
| | | 07281-01589 | Ring (Bucket) | ○ | 1 | | |
| | | 796-720-1690 | Ring (WA250PT-5 bucket) | ○ | 1 | | |
| | | 07281-01919 | Ring (WA250PT-5 bucket) | ○ | 1 | | |
| | | 796-720-1740 | Ring (Steering) | ○ | 1 | | |
| | | 07281-00809 | Ring (Steering) | ○ | 1 | | |
| | 8 | 790-102-4300 | Wrench assembly (for WA250PT-5 bucket) | ■ | 1 | | |
| | | 790-102-4310 | Pin (for WA250PT-5 bucket) | ■ | 2 | | |

## DISASSEMBLY

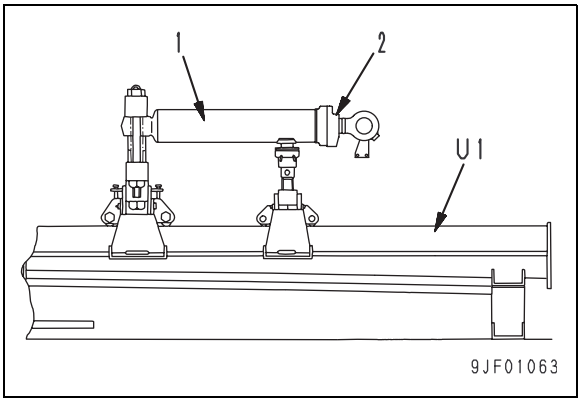
1. Cylinder assembly
   Set cylinder assembly (1) to tool U1.
2. Cylinder head and piston rod assembly (Steering cylinder and lift cylinder)
   1) Using tool **U2**, remove cylinder head (2) from the cylinder.



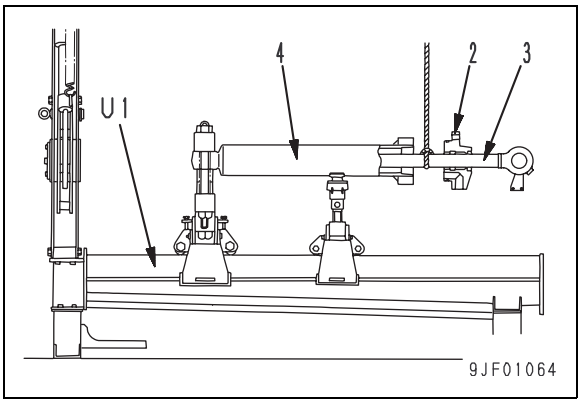

   2) Pull cylinder head and piston rod assembly (3) out of cylinder (4).
      ★ Since oil will flow out when the piston rod assembly is pulled out of the cylinder, prepare an oil receiver.



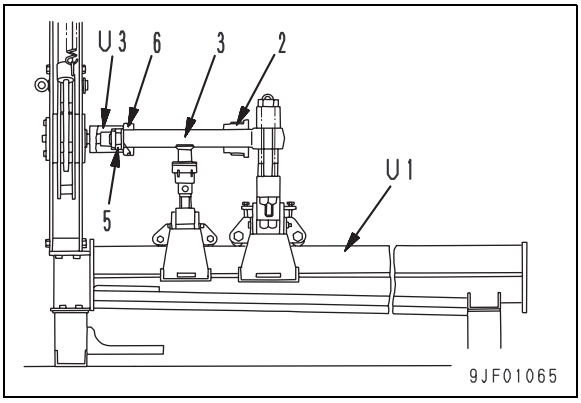

3. Cylinder head and piston rod assembly (Bucket cylinder assembly)
   1) Remove the mounting bolt of cylinder head assembly (2).
      • WA250-5 - Width across flats of bolt: **24 mm**
      • WA250PT-5 - Width across flats of bolt: **27 mm**



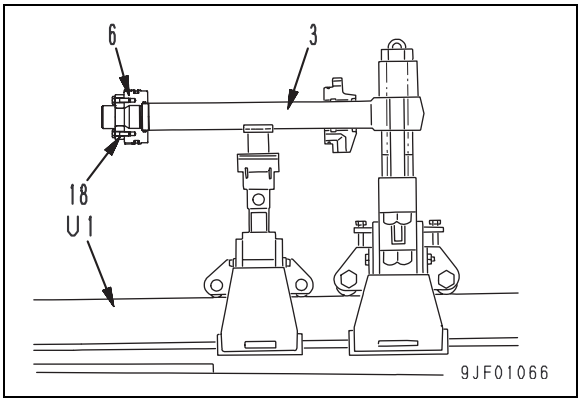

   2) Pull cylinder head and piston rod assembly (3) out of cylinder (4).
      ★ Since oil will flow out when the piston rod assembly is pulled out of the cylinder, prepare an oil receiver.



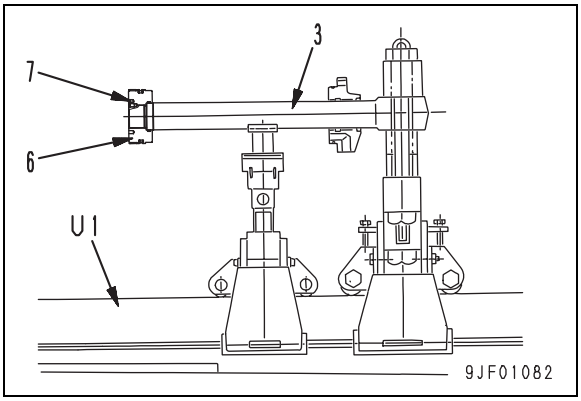

4. Piston and cylinder head (Steering cylinder and lift cylinder)
   1) Set cylinder head and piston rod assembly (3) to tool **U1**.
   2) Using tool **U3**, remove nut (5).
      • Width across flats of nut
      (Steering): **46 mm**
      (Lift): **80 mm**
   3) Remove piston assembly (6) and cylinder head assembly (2).



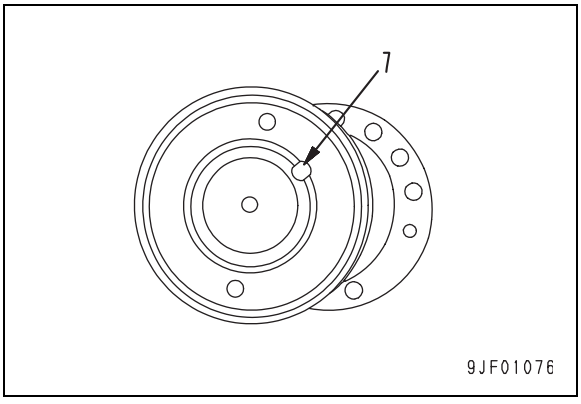
5. Piston and cylinder head (WA250-5 bucket cylinder)
   1) Set cylinder head and piston rod assembly (3) to tool **U1**.
   2) Remove the mounting bolts and 2 spacers (18).
   3) Remove piston assembly (6) and cylinder head assembly (2).



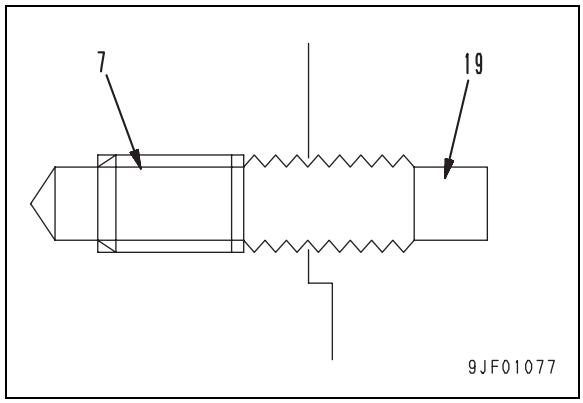

6. Piston and cylinder head (WA250PT-5 bucket cylinder)
   1) Set cylinder head and piston rod assembly (3) to tool **U1**.



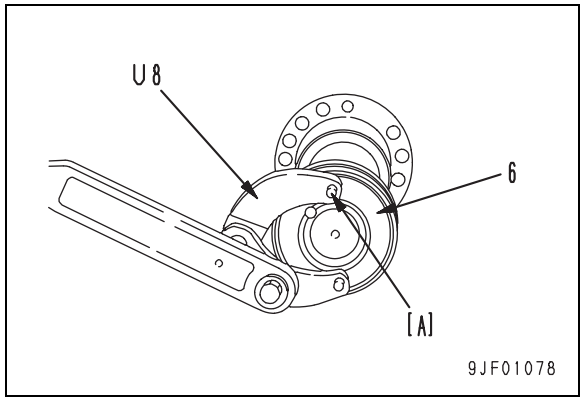

   2) Remove lock screw (7) of the piston assembly.
      ★ Screw size: M12 x 1.75



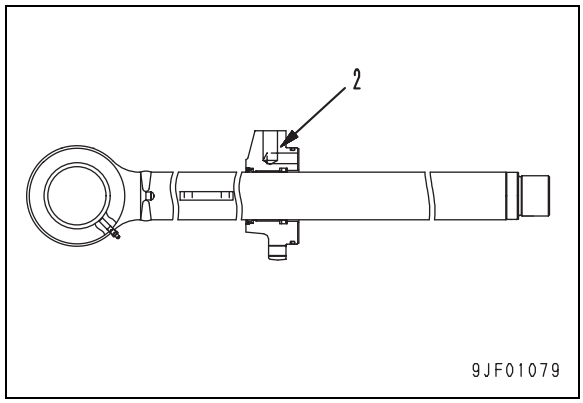

      ★ If screw (7) is so caulked that it cannot be removed, tighten it and apply tap (19) to its threads, and then remove it.



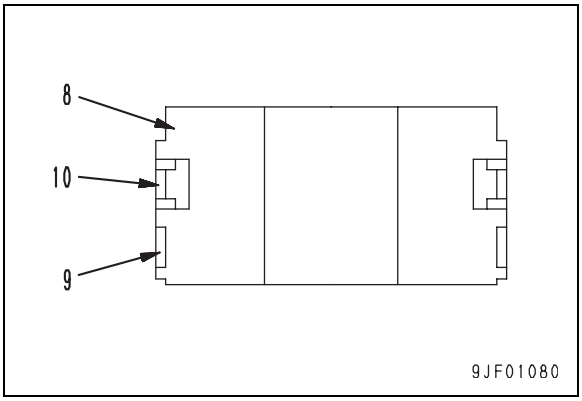

   3) Using tool **U8**, remove piston assembly (6).
      ★ When not using tool **U8**, loosen the piston assembly by using 2 holes [A].
      • Hole [A]: ϕ **10 mm**



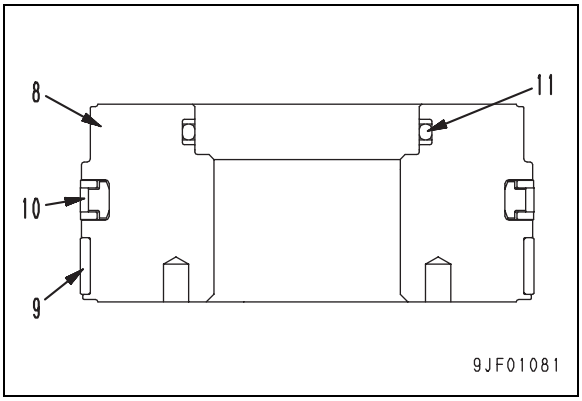

   4) Remove cylinder head assembly (2) from the cylinder.



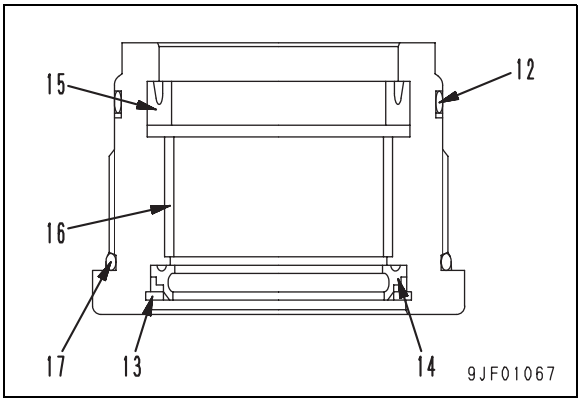
7. Disassembly of piston assembly (Lift cylinder, steering cylinder, and WA250-5 bucket cylinder)
   Remove wear ring (9) and piston ring (10) from piston (8).



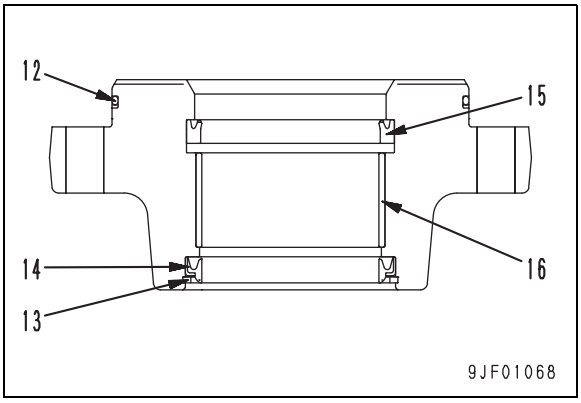

8. Disassembly of piston assembly (WA250PT-5 bucket cylinder)
   1) Remove wear ring (9) and piston ring (10) from piston (8).
   2) Remove O-ring and backup ring (11) from piston (8).




9. Disassembly of cylinder head assembly
   1) Remove O-ring and backup ring (12).
   2) Remove snap ring (13) and dust seal (14).
   3) Remove rod packing (15).
   4) Remove bushing (16).
   5) Remove O-ring (17).



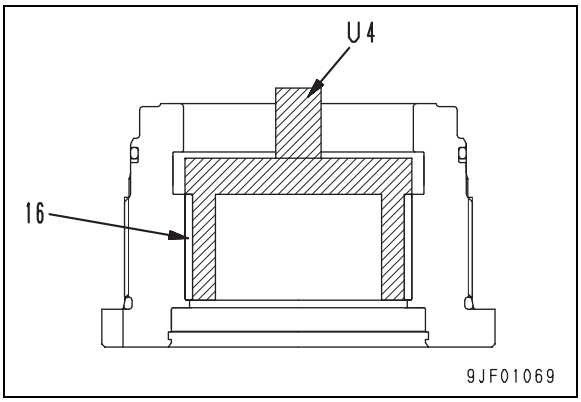

10. Disassembly of cylinder head assembly (Lift and bucket cylinder assembly)
    1) Remove O-ring and backup ring (12).
    2) Remove snap ring (13) and dust seal (14).
    3) Remove rod packing (15).
    4) Remove bushing (16).



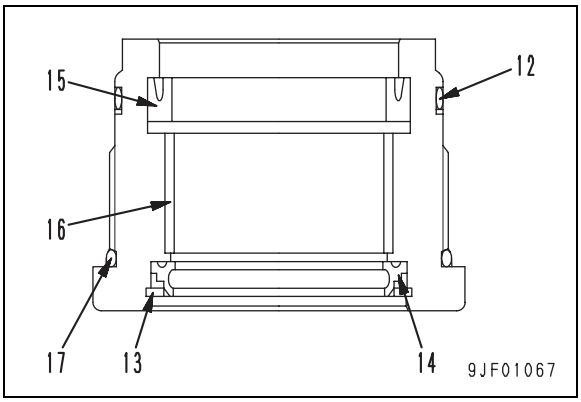
## ASSEMBLY

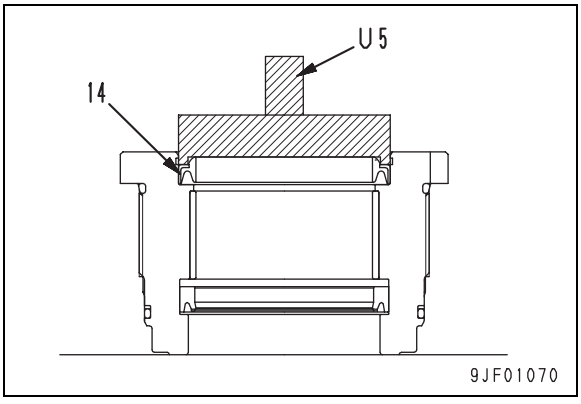
★ Take care not to damage the packings, dust seals, O-rings, etc.
★ Do not insert each backup ring forcibly, but warm it in water at 50 - 60°C and then insert it.

1. Assembly of cylinder head assembly (Steering cylinder assembly)
   1) Using tool **U4**, press fit bushing (16).

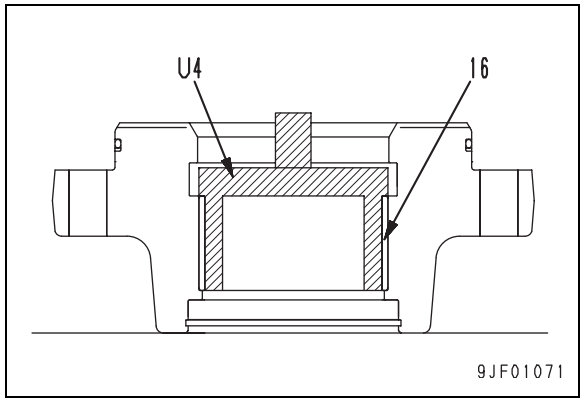



   2) Install rod packing (15).
   3) Using tool **U5**, install dust seal (14) and secure it with snap ring (13).
   4) Install backup ring and O-ring (12).
   5) Install O-ring (17).

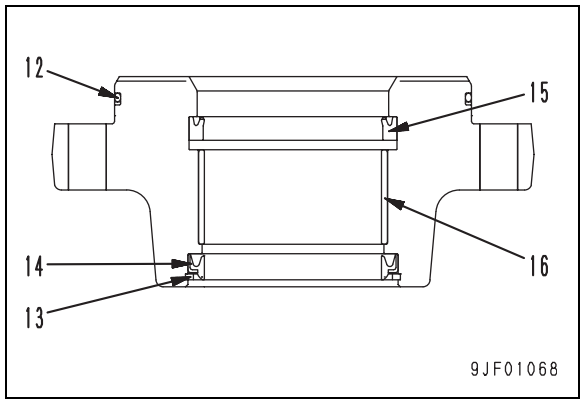


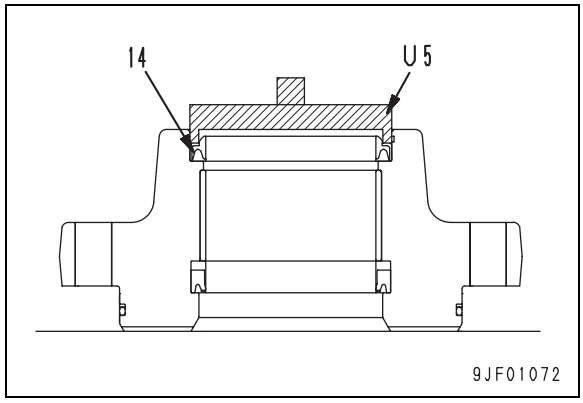




2. Assembly of cylinder head assembly (Lift and bucket cylinder assembly)
   1) Using tool **U4**, press fit bushing (16).

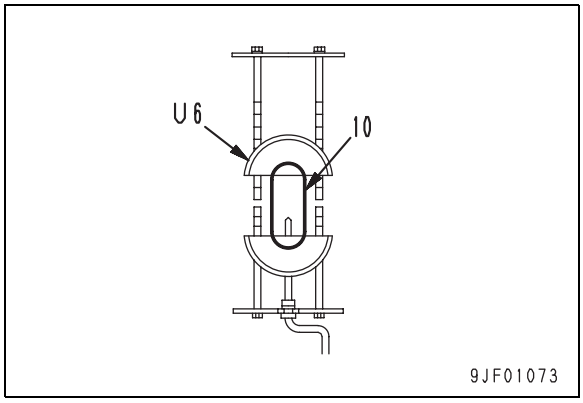



   2) Install rod packing (15).
   3) Using tool **U5**, install dust seal (14) and secure it with snap ring (13).
   4) Install backup ring and O-ring (12).

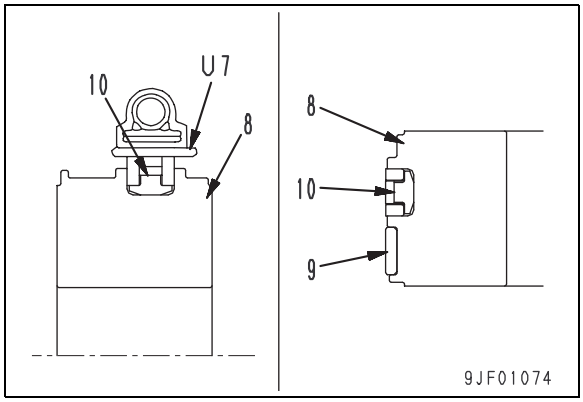


3. Assembly of piston assembly (Steering cylinder assembly)
   1) Using tool **U6**, expand piston ring (10).
      ★ Set the tool to the piston ring and turn its handle by 8 - 10 turns to expand the piston ring.




   2) Remove piston ring (10) from tool **U6** and install it to piston (8).
   3) Using tool **U7**, shrink piston ring (10).
   4) Install wear ring (9).

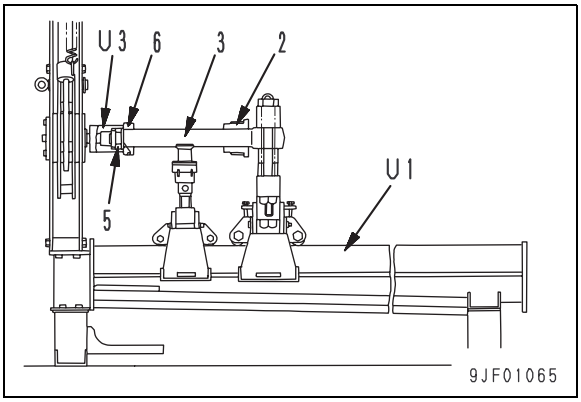



4. Assembly of cylinder head and piston rod assembly (Steering cylinder assembly)
   1) Set cylinder head and piston rod assembly (3) to tool **U1**.
   2) Install cylinder head assembly (2) and piston assembly (6) to the piston rod.
   3) Using tool U3, tighten nut (5) to the specified torque.
      • Width across flats of nut
        (Steering): **46 mm**
        (Lift): **80 mm**

      Threads of piston rod:
      **Liquid adhesive (LOCTITE No. 262 or equivalent)**

      Nut (Steering):
      **785 ± 78.5 Nm {80 ± 8.0 kgm}**

      Nut: (Lift):
      **3,970 ± 397 Nm {405 ± 40.5 kgm}**




5. Assembly of cylinder head and piston rod assembly (WA250-5 bucket cylinder)
   1) Set piston rod (19) to tool **U1**.
   2) Install cylinder head assembly (2).
   3) Install piston assembly (6).
   4) Install spacer (7) with 6 mounting bolts.

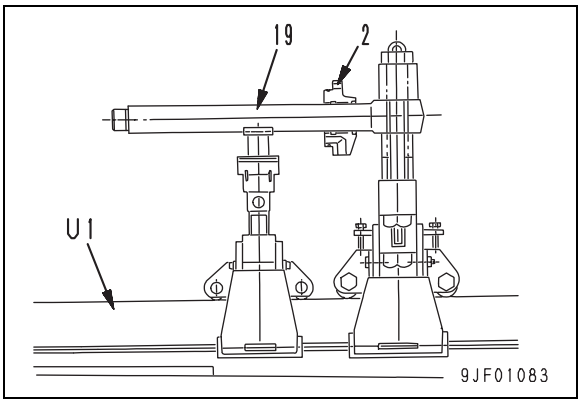
      Bolt mounting part of piston and mounting bolt:
      **Hardening accelerator (NIHON LOCTITE PRIMER T or equivalent)**

      ★ Apply the above primer first, and then apply the following liquid adhesive.

      Bolt mounting part of piston:
      **Liquid adhesive (LOCTITE No. 262 or equivalent)**

      Mounting bolt:
      **98 - 123 Nm {10 - 12.5 kgm}**

6. Assembly of cylinder head and piston rod assembly (WA250PT-5 bucket cylinder)
   1) Set piston rod (19) to tool **U1**.
   2) Install cylinder head assembly (2).

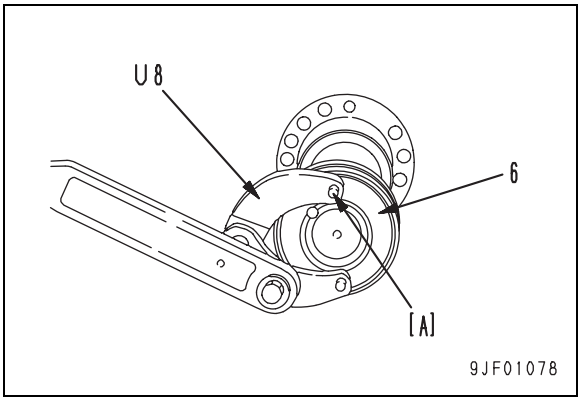



- When reusing the rod and piston assembly, assemble them according to the following procedure.

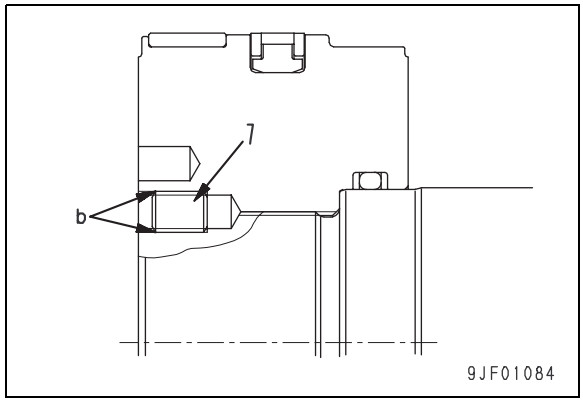
★ Clean the parts thoroughly and remove metal chips and dirt.

   3) Using tightening tool **U8**, tighten piston assembly (6) until the screw holes are aligned.
      ★ Remove burrs and fins from the threads with a file, etc.
   4) Tighten the screw (7).

Screw:
**58.9 - 73.6 Nm {6 - 7.5 kgm}**

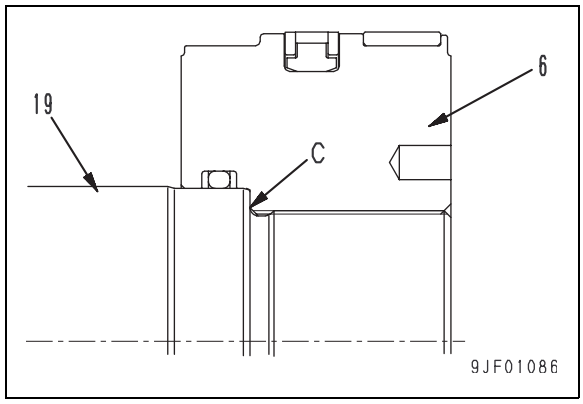



   5) Caulk 4 points of the threaded part (b) with a punch.




- When replacing either or both of the rod and piston, assemble the new parts according to the following procedure.

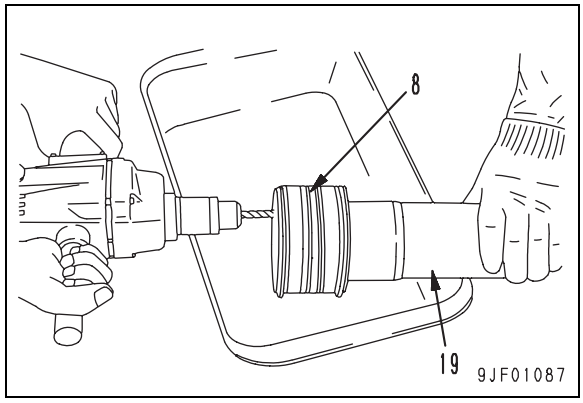
   6) Using tool **U8**, screw in piston assembly (6) until it touches the end [part C] of rod (19), and then tighten it to the specified torque.




   7) Make 1 screw hole to install screw (7).
      ★ Make 1 hole horizontally with a drill at the V-groove of the threaded parts of piston (8) and rod (19).
      - Threading dimensions (mm)

| Diameter of tap drill hole | Depth of tap drill hole | Tap to be used | Tapping depth |
|---|---|---|---|
| 10.3 | 27 | 12 X 1.75 | 20 |

   8) After making the hole, remove the all chips and dirt and clean thoroughly.

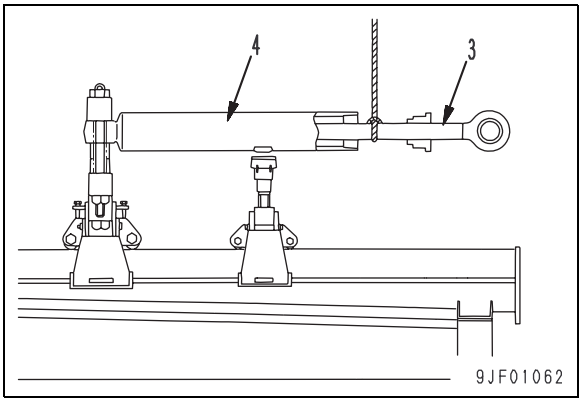


9) Tighten screw (7).

Screw:
**58.9 - 73.6 Nm {6 - 7.5 kgm}**

10) Caulk 4 points of the threaded part with a punch.

7. Cylinder head (Steering cylinder and lift cylinder)
   1) Set cylinder (4) to tool **U1**.
   2) Sling cylinder head and piston rod assembly (3) and install cylinder (4).

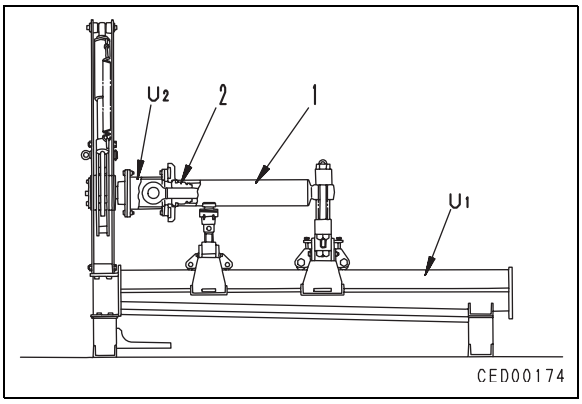



3) Using tool **U2**, install cylinder head assembly (2) to the cylinder.

Cylinder head (Steering):
**539 ± 54.0 Nm {55 ± 5.5 kgm}**

Cylinder head (Lift):
**1.03 ± 0.10 kNm {105 ± 10.5 kgm}**

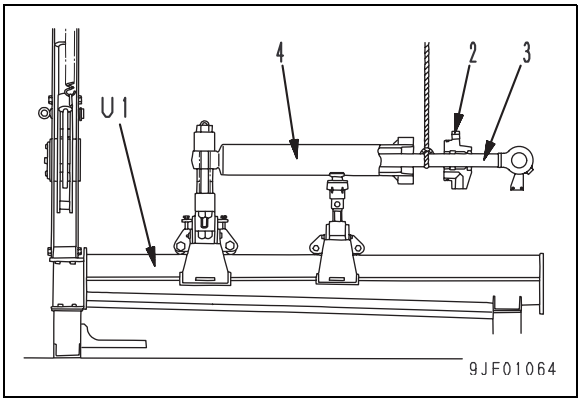
4) Remove cylinder assembly (1) from tool **U1**.



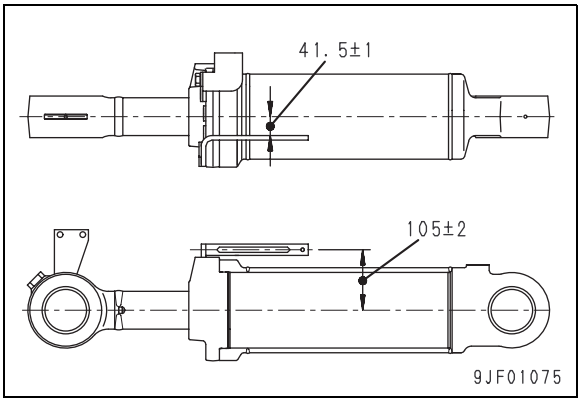

8. Cylinder head (Bucket cylinder)
   1) Set cylinder (4) to tool **U1**.
   2) Sling cylinder head and piston rod assembly (3) and install cylinder (4).
   3) Install cylinder head assembly (2) to the cylinder.

WA250-5 cylinder head mounting bolt:
**250 ± 24.5 Nm {25.5 ± 2.5 kgm}**

WA250PT-5 cylinder head mounting bolt:
**343 ± 34.3 Nm {35 ± 3.5 kgm}**




★ Tighten the bolts of the leveler plate of WA250-5 so that the leveler plate will be installed as shown in the figure.




4) Remove cylinder assembly (1) from tool **U1**.

# REMOVAL, INSTALLATION OF OPERATOR'S CAB ASSEMBLY

## REMOVAL

Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Operate the work equipment control lever 2 - 3 times to release the residual pressure in the work equipment circuit.

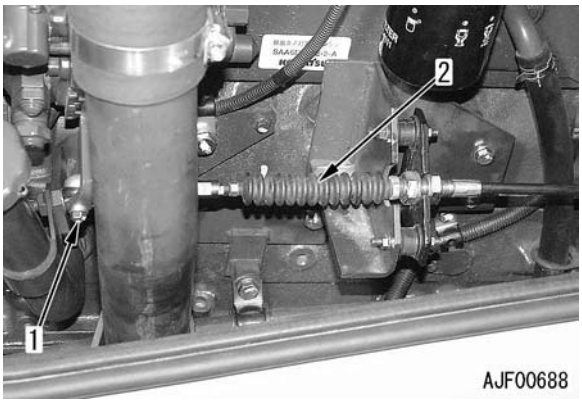
Slowly loosen the oil filler cap of the hydraulic tank to release the residual pressure in the hydraulic tank.

Connect tool X to the air conditioner compressor hose valve and collect the refrigerant (R134a).

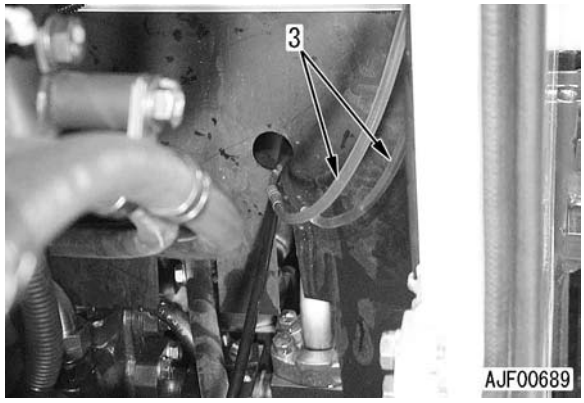
Disconnect the cable from the negative (-) terminal of the battery.

* The operator's cab and the floor frame of this vehicle are made as a unit.

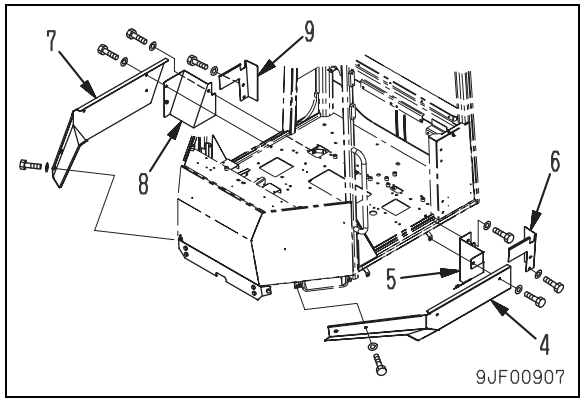
1. Open the engine right cover.
2. Remove mounting nut (1) of the ball joint from the fuel control cable. [*1]
3. Remove the mounting bolt and disconnect fuel control cable (2) from the engine. [*2]



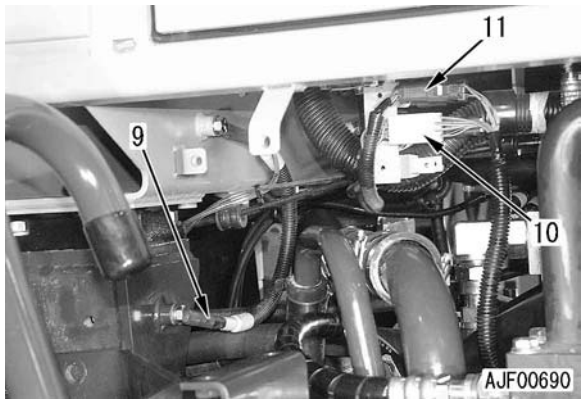

4. Disconnect 2 windshield washer hoses (3).



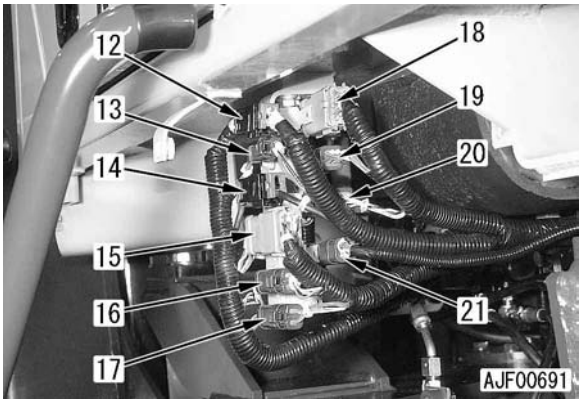

5. Remove covers (4) - (9) from both sides of the operator's cab.




6. Disconnect cab ground (9) from the right side of the operator's cab.
7. Disconnect the following wiring connectors.
   - ★ Right side of operator's cab
   - (10): FL1
   - (11): FL2

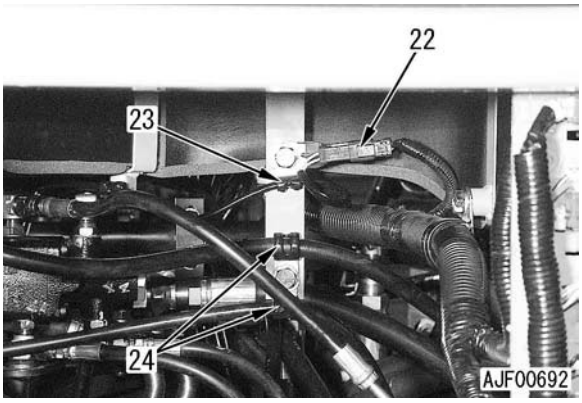


★ Left side of operator's cab
- (12): LR2
- (13): LR1
- (14): LR3
- (15): LT1
- (16): LT2
- (17): LT3
- (18): LR4
- (19): LR6
- (20): LR5
- (21): LB1

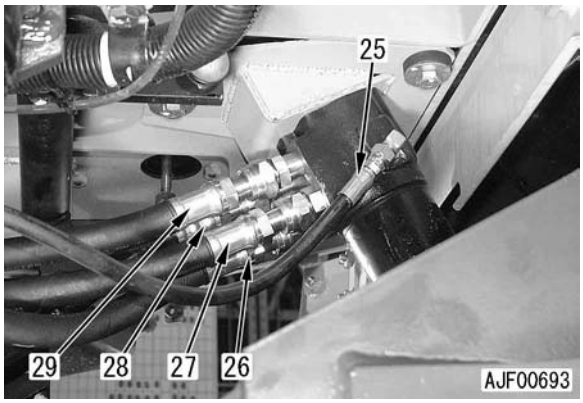



- (22): L34

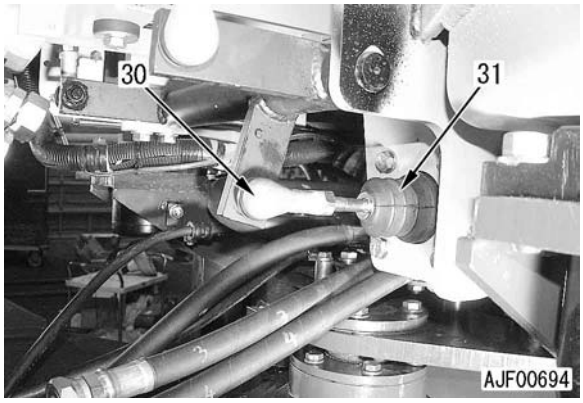
8. Disconnect wire clamp (23) and brake valve hose clamps (24).



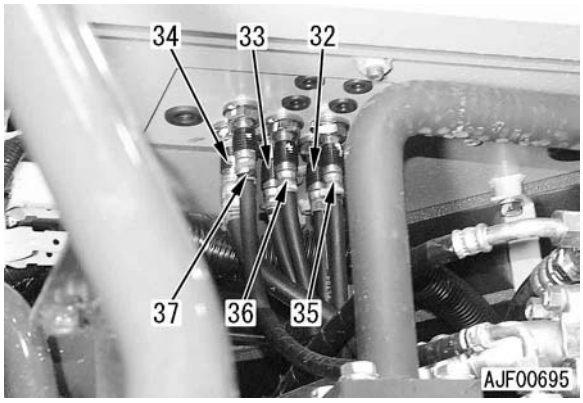

9. Disconnect hoses (25) - (29) from the orbit-roll valve.
   - (25): Port LS hose (Right)
   - (26): Port P hose (Left lower)
   - (27): Port R hose (Right lower)
   - (28): Port T hose (Left upper)
   - (29): Port L hose (Right upper)

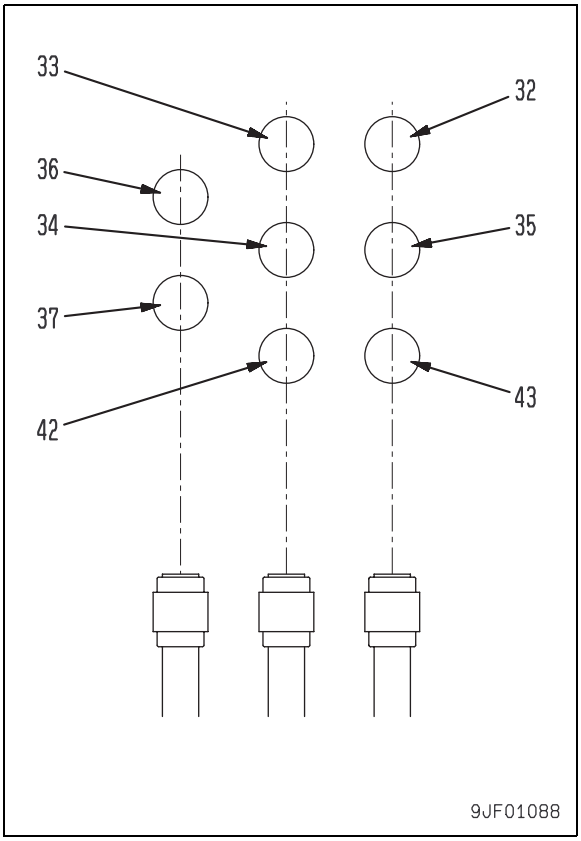



10. Remove the locknut and disconnect brake valve linkage (30). [*3]
11. Remove the mounting bolt and place brake valve (31) on the frame.

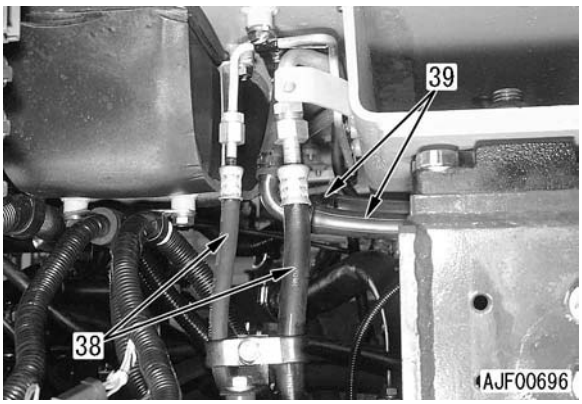



12. Disconnect the PPC hoses.
    ★ Disconnect 6 PPC hoses (32) - (37). (WA250-5)
    ★ Disconnect PPC hoses (32) - (37), (43), and (44) (WA250PT-5) [*4]

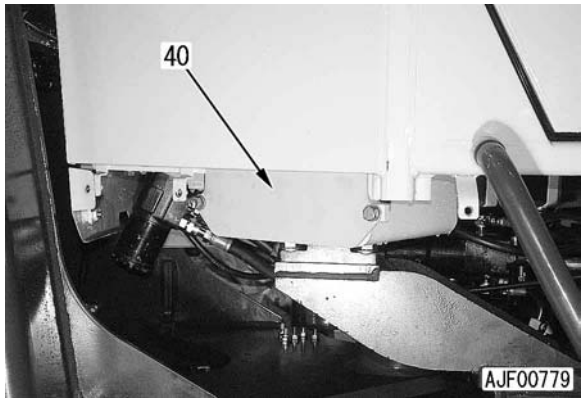





13. Disconnect 2 air conditioner hoses (38).
14. Disconnect 2 heater hoses (39).




15. Remove 2 mount covers (40) on both sides.

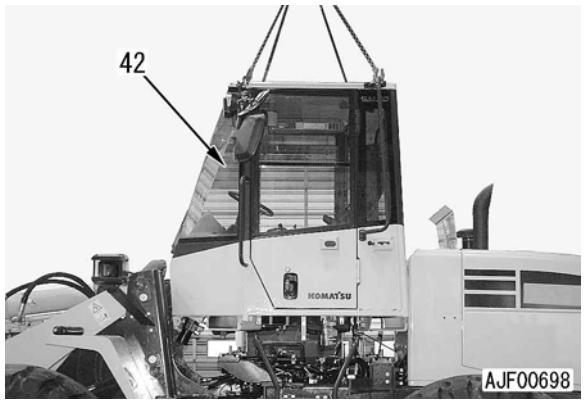



16. Remove 4 operator's cab mounting nuts (41).[*5]




17. Lift off operator's cab assembly (42).
    ★ Check that all the wires and pipes are disconnected.

    Operator's cab: **810 kg**



## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1] [*2]

★ Adjust the fuel control cable. For details, see TESTING AND ADJUSTING, Measuring, testing operating force of accelerator pedal.

Mounting nut of ball joint: **11.8 - 14.7 Nm {1.2 - 1.5 kgm}**

Locknut: **44 - 59 Nm {4.5 - 6.0 kgm}**

[*3]

★ Adjust the brake linkage. For details, see TESTING AND ADJUSTING, Testing and adjusting brake pedal linkage.

[*4]

★ Connect PPC hoses (32) - (37), (43), and (44) according to their band colors shown below.

★ PPC hose band colors of WA250-5

- (Multi-function) joystick type

| No. | Connecting point | Band color |
|---|---|---|
| (32) | Bucket DUMP | Orange |
| (33) | Bucket TILT | Red |
| (34) | Port P | Red/Blue |
| (35) | Boom LOWER | Blue |
| (36) | Boom RAISE | Yellow |
| (37) | Port T | Blue/Black |

- 2-lever type

| No. | Connecting point | Band color |
|---|---|---|
| (32) | Bucket DUMP | Blue |
| (33) | Bucket TILT | Red |
| (34) | Port P | Red/Blue |
| (35) | Boom LOWER | Orange |
| (36) | Boom RAISE | Yellow |
| (37) | Port T | Blue/Black |

★ PPC hose band colors of WA250PT-5

- (Multi-function) joystick type

| No. | Connecting point | Band color |
|---|---|---|
| (32) | Bucket DUMP | Orange |
| (33) | Bucket TILT | Red |
| (34) | Port P | Red/Blue |
| (35) | Boom LOWER | Blue |
| (36) | Boom RAISE | Yellow |
| (37) | Port T | Blue/Black |
| (43) | Port E | Green |
| (44) (37) | Port F | White/Red |

- 3-lever type

| No. | Connecting point | Band color |
|---|---|---|
| (32) | Bucket DUMP | White/Red |
| (33) | Bucket TILT | Green |
| (34) | Port P | Red/Blue |
| (35) | Boom LOWER | Blue |
| (36) | Boom RAISE | Yellow |
| (37) | Port T | Blue/Black |
| (43) | Port E | Orange |
| (44) (37) | Port F | Yellow |

[*5]

Operator's cab mounting nut: **824 - 1030 Nm {84 - 105 kgm}**

- **Refilling with oil (Hydraulic tank)**

  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

  Hydraulic tank: **96 ℓ**

- **Bleeding air from PPC circuit**

  Hold the work equipment control lever to a stroke end to relieve the oil for about 1 minute. Perform this operation once for each stroke end of the work equipment control lever.

- **Refilling with water**

  Add water through the water filler to the specified level. Run the engine to warm the water. Then, check the water level again.

- **Charging air conditioner with refrigerant**

  Using tool X, charge the air conditioner circuit with refrigerant (R134a).

# REMOVAL, INSTALLATION OF OPERATOR'S CAB GLASS (STUCK GLASS)

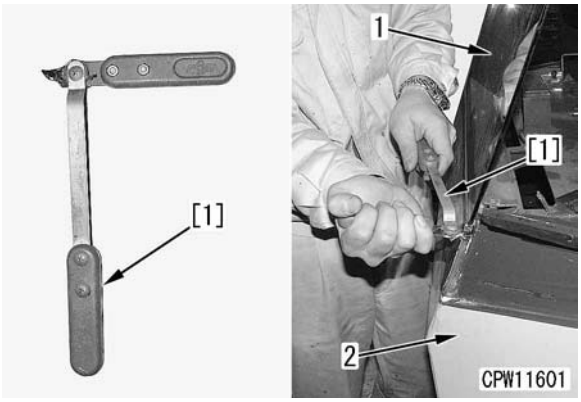
## SPECIAL TOOLS

| Symbol | | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|---|
| X | 2 | 1 | 793-498-1120 | Clear plate | ■ | 2 | | |
| | | 2 | 793-498-1130 | Plate | ■ | 2 | | |
| | | 3 | 793-498-1110 | Magnet | ■ | 2 | | |
| | 3 | | 793-498-1210 | Lifter (Suction cups) | ■ | 2 | | |

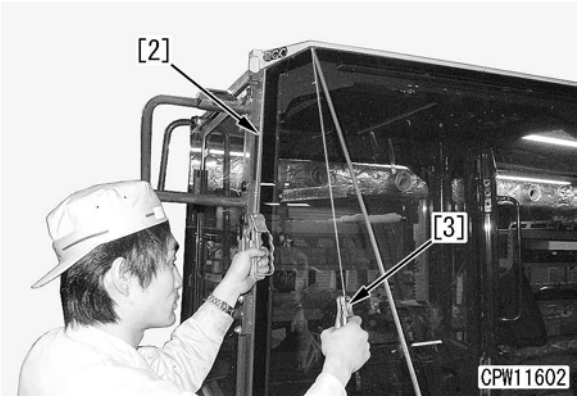
## REMOVAL

★ All sides of each glass of the operator's cab of this vehicle are stuck.
★ Remove the window glass to be replaced according to the following procedure.

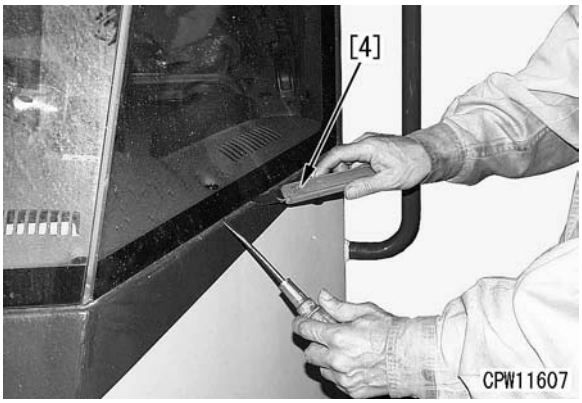
1. Using seal cutter [1], cut the adhesive between broken window glass (1) and operator's cab (2).




★ If the glass is narrow, you may cut the adhesive by the following method. Insert a fine wire [2] (piano wire, etc.) in the adhesive and grip its both ends with priors [3], etc. (or hold them by winding them onto something) and cut the adhesive with the wire.



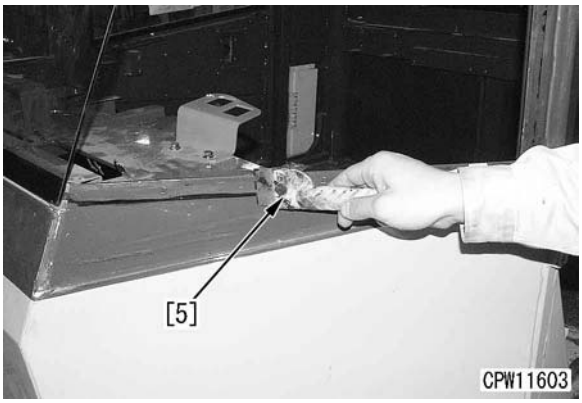

★ The broken window glass may be removed with knife [4] and a screwdriver. (If the screwdriver is applied directly to the normal window glass, the glass will be broken.)
★ When using knife [4], insert a screwdriver in the cut to widen it and move the knife forward.




2. Remove the window glass.

## INSTALLATION

1. Using scraper [5], remove the remaining adhesive.
   ★ Do not scratch the paint.




2. Remove oil, dust, dirt, etc. from the sticking surfaces of cab (2) and window glass (3) with white gasoline.
   ★ If the sticking surfaces are not cleaned well, the glass may not be stuck perfectly.
   ★ Clean the all black part on the back side of the window glass.
   ★ After cleaning the sticking surfaces, leave them for at least 5 minutes to dry.




3. When the adhesive was removed with the scraper, if any paint was flaked off, coat the bare part with paint.
   ★ If the glass is installed without repairing the bare part, that part will be rusted.
   ★ Do not apply paint to a part which will be coated with primer.



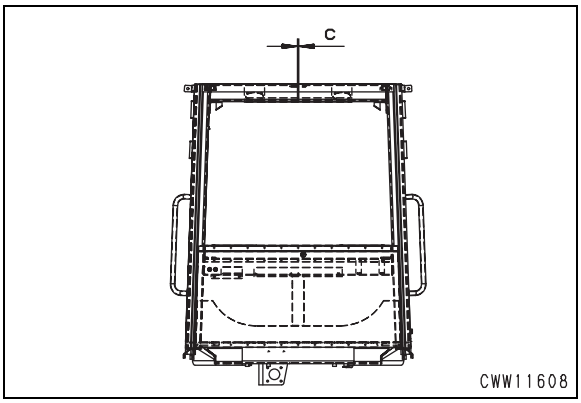

4. Stick both-sided adhesive tape (4) along the inside edge of the glass sticking section.
   • Size of both-sided adhesive tape: 7 x 4.8 mm
   ★ When sticking the both-sided adhesive tape, do not touch the cleaned surface as long as possible.
   ★ Do not remove the release tape of the both-sided adhesive tape on the glass sticking side before sticking the glass.



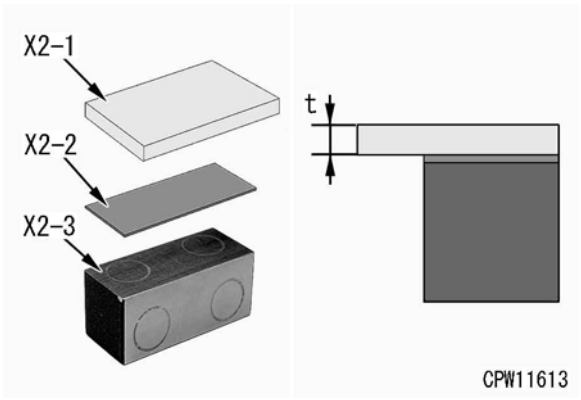

   ★ Take care the corner (part "b") of both-sided adhesive tape will not float.

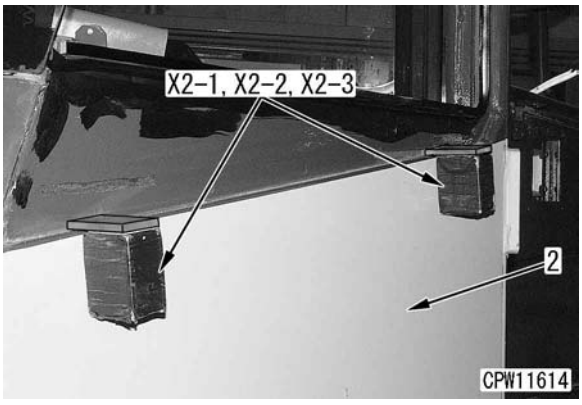


★ When sticking the both-sided adhesive tape around a side or a rear window glass, start at center of the top and make a clearance of about 5 mm at end joint (c).

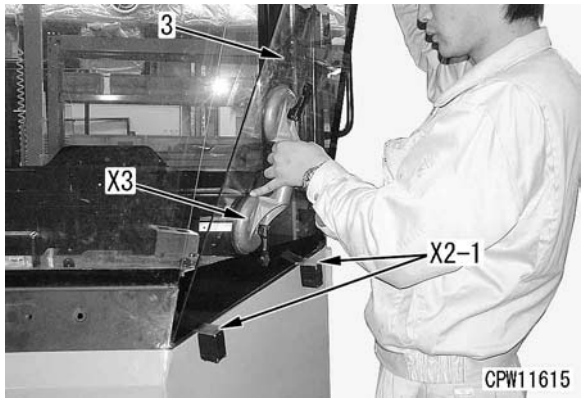



5. Position the replacement glass.
   1) Stick **X2-2** (thin steel sheet) to tool **X2-1** (spacer) with adhesive.
      • Spacer thickness (t): 5 mm
   2) Match tool **X2-3** (magnet) to tools **X2-1** and **X2-2** and set them to the 2 lower places of the window glass sticking part of operator's cab (2).

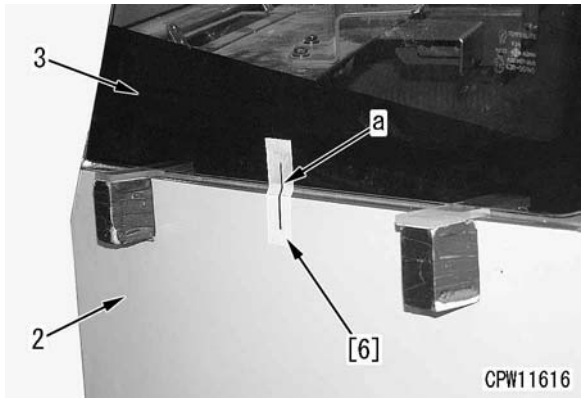



   3) Using tool **X3** (suction cups), place window glass (3) on tool **X2-1** (5 mm spacer) and match it to the operator's cab.

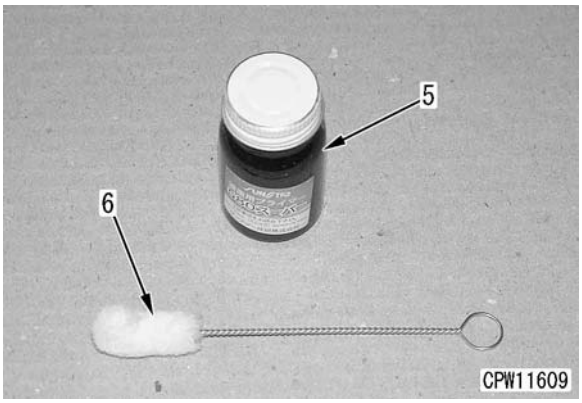



   4) Check the clearance between window glass (3) and operator's cab (2) on both sides and adjust it evenly.
   5) Stick tape [6] between window glass (3) and operator's cab (2) and draw positioning line "a".
   6) Cut the tape between window glass (3) and operator's cab (2) with a knife, and then remove the window glass.
      ★ Do not remove the tapes left on the window glass and operator's cab before installing the window glass.




6. Apply primer.
   ★ The using limit of primer (5) is 4 months after the date of manufacture. Do not use primer (5) after this limit.
   ★ Use the primer within 2 hours after unpacking it.
   ★ Even if the primer is packed again just after it is unpacked, use it within 24 hours after it is unpacked for the first time.
   (Discard the primer 24 hours after it is packed.)

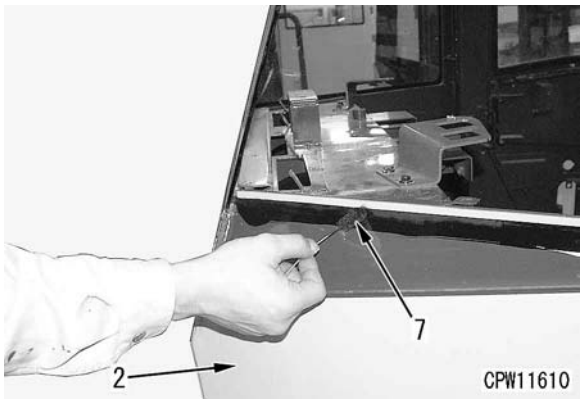
1) Stir the primers for paint and glass sufficiently before using them.
   ★ If the primer has been stored in a refrigerator, leave it at the room temperature for at least half a day before stirring it. (If the primer is unpacked just after taken out of the refrigerator, water will be condensed. Accordingly, leave the primer at the room temperature for a sufficient time.)
2) When reusing primer brush (6), wash it in white gasoline.
   ★ After washing the brush, check it again for dirt and foreign matter.
   ★ Prepare respective brushes for the paint primer glass primer.

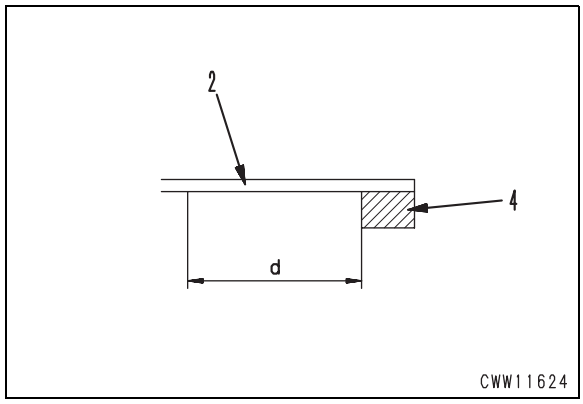



3) Evenly apply paint primer (7) to the parts on the outside of both-sided adhesive tape on operator's cab (2) which will be coated with the adhesive.

   Paint primer: **SUNSTAR PAINT PRIMER 580 SUPRE**

   ★ Do not apply the primer more than 2 times.
   (If it is applied more than 2 times, its performance will be lowered.)
   ★ Parts to be coated with primer: Apply the primer all over dimension (d) on the outside of the both-sided adhesive tape.
      • Dimension to apply primer (d): 23 mm
   ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.
   ★ If the glass primer is applied by mistake, wipe it off with white gasoline.
   (If wrong primer is applied, the glass will not be stuck.)

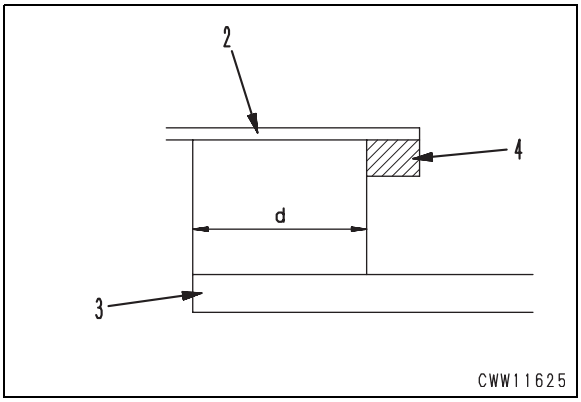


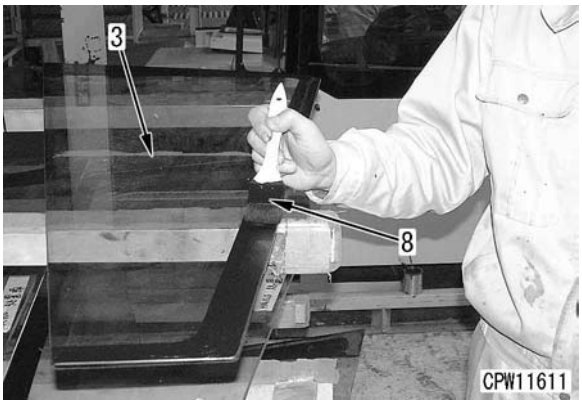




4) Evenly apply glass primer (8) to the black part of window glass (3) to be stuck.

   Glass primer: **SUNSTAR GLASS PRIMER 580 SUPRE**

   ★ Do not apply the primer more than 2 times.
   (If it is applied more than 2 times, its performance will be lowered.)
   ★ Parts to be coated with primer: Apply the primer to the sticking surface of window glass (3) and all over dimension (d) on both-sided adhesive tape (4) and operator's cab (2).
      • Dimension to apply primer (d): 23 mm
   ★ Do not apply the primer to the boarder about 5 mm wide between the black part and transparent part of the glass.
   ★ After applying the primer, leave it for at least 5 minutes (within 8 hours) to dry.
   ★ If the paint primer is applied by mistake, wipe it off with white gasoline.
   (If wrong primer is applied, the glass will not be stuck.)



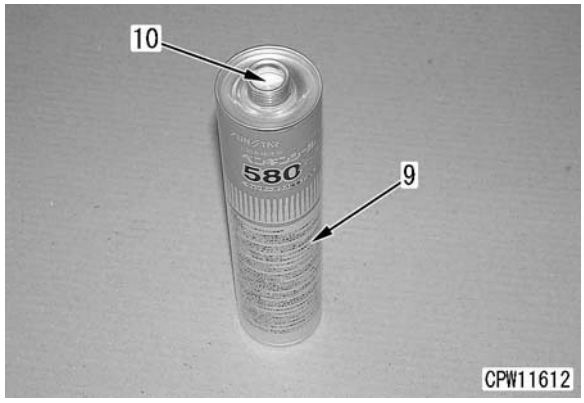

7. Apply adhesive.
   ★ Use either of the 2 types of the adhesive.

   Adhesive (Summer):
   **SUNSTAR PENGUINE SEAL 580 SUPER "S"**

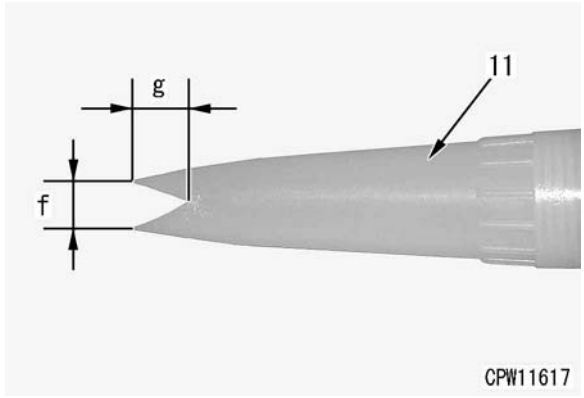
   Adhesive (Winter):
   **SUNSTAR PENGUINE SEAL 580 SUPER "W"**

   ★ The using limit of the adhesive is 4 months after the date of manufacture. Do not use the adhesive after this limit.
   ★ Keep the adhesive in a dark place where the temperature is below 25°C.
   ★ Never heat the adhesive higher than 30°C.
   ★ When reusing the adhesive, remove the all hardened part from the nozzle tip.

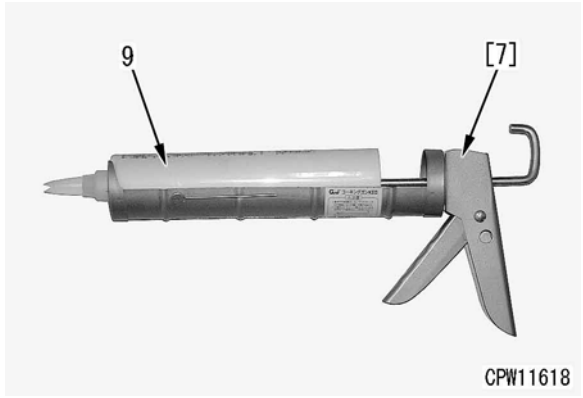
1) Break aluminum seal (10) of the outlet of adhesive cartridge (9) and install the nozzle.




2) Cut the tip of the adhesive nozzle (11) so that dimensions (f) and (g) will be as follows.
   - Dimension (f): 10 mm
   - Dimension (g): 12 mm



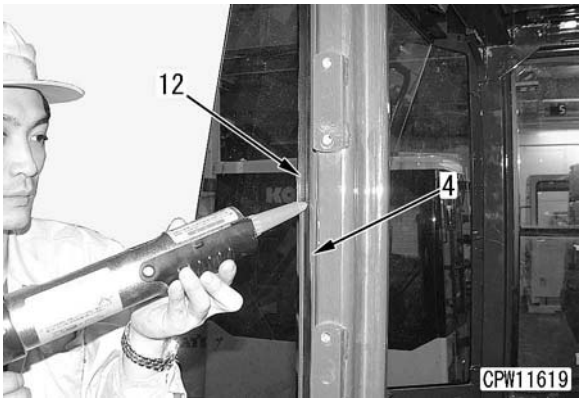

3) Set adhesive cartridge (9) to caulking gun [7].
   ★ An electric caulking gun is more efficient.



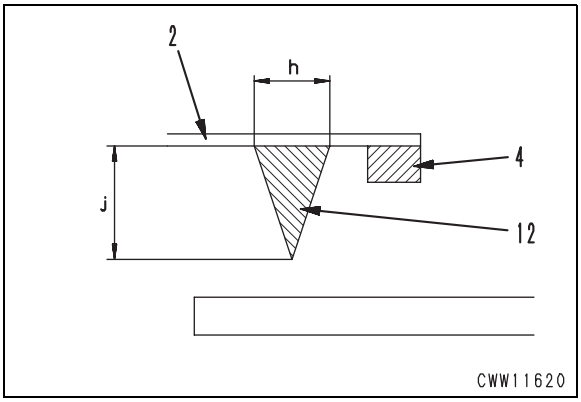
4) Remove release tape (13) of the both-sided adhesive tape on the glass side.



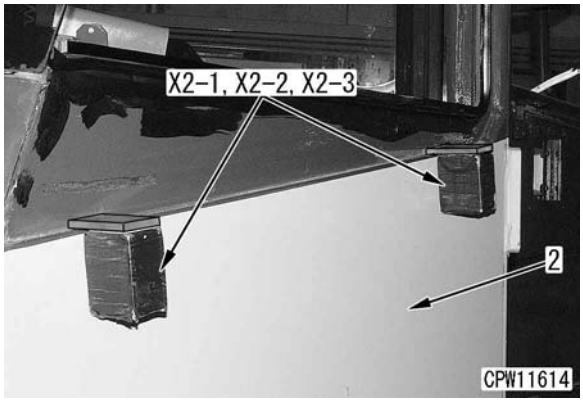

5) Apply adhesive (12) to the outside of both-sided adhesive tape (4) of the operator's cab.
   ★ Before applying the adhesive, check that the primer is applied to the surface to which the adhesive will be applied.



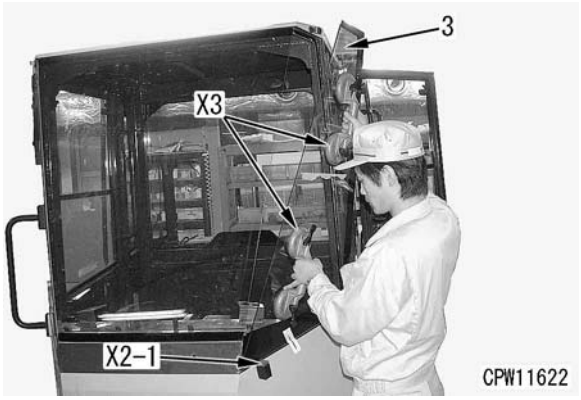

   ★ Apply adhesive (12) to dimensions (h) and (j) of both-sided adhesive tape (4) of operator's cab (2).
      • Dimension (h): 10 mm
      • Dimension (j): 12 mm (Approx. twice as high as adhesive tape)
   ★ Apply adhesive (12) higher than both-sided adhesive tape (4).
   ★ Apply the adhesive evenly.



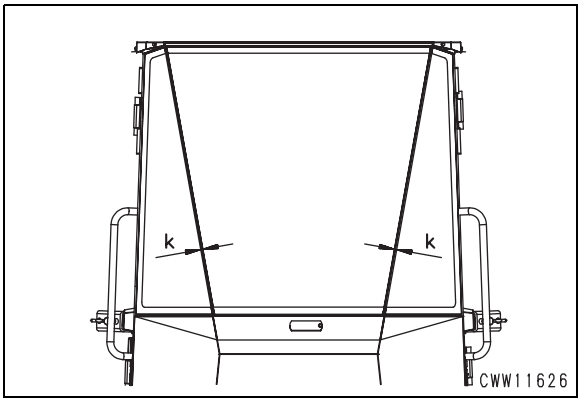

8. Install window glass (3).
   ★ If the glass is positioned wrongly, the adhesive must be removed and cleaned, and then the primer and adhesive must be applied again. Accordingly, position the glass carefully when sticking it.
   1) Similarly to step 1, match tools **X2-1**, **X2-2**, and **X2-3** and set them to the 2 lower places of the window glass sticking part of operator's cab (2).




   2) Using tool **X3**, raise and place window glass (3) on tool **X2-1** (5-mm spacer) and stick it to the operator's cab.
      ★ Match the lines of the match tapes stuck in step 1.
      ★ Stick the glass within 10 minutes after applying the adhesive.
      ★ Before sticking the glass, check that the primer is applied to the surface to which the glass will be stuck.




★ Check clearance (k) between the front side of the front glass and each side and adjust it evenly.
- Clearance (k): 5 mm

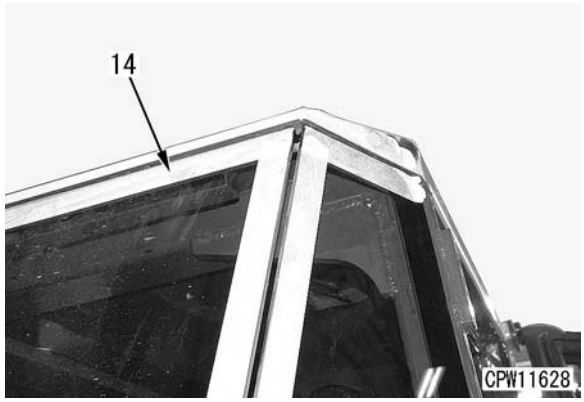


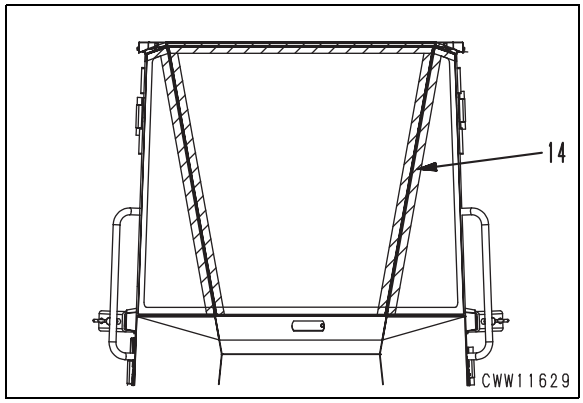

3) After sticking window glass (3), press it evenly.
★ Press all over the window glass to the degree that the window glass will be stuck to the both-sided adhesive tape.
★ Do not press the window glass to strongly.




9. Cure the stuck window glass for a certain time.
★ Curing time before removing tool **X2-1** (5-mm spacer) (at temperature of 20°C and humidity of 60%): **10 hours**
★ Curing time before operating vehicle: **1 day**

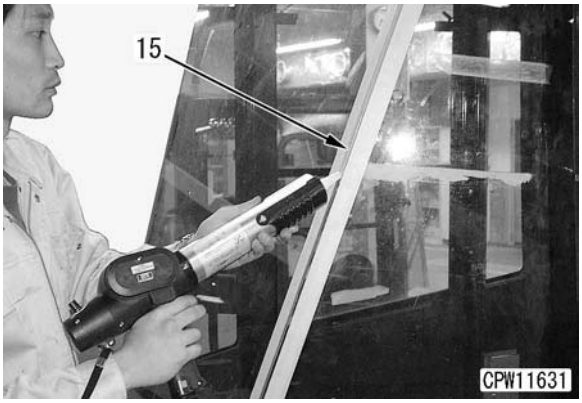
10. If the front glass and both front glasses are replaced, seal them.
1) Stick masking tapes (14) along the parts to be sealed shown in the figure.
★ Stick the masking tapes to both inside and outside of the operator's cab.



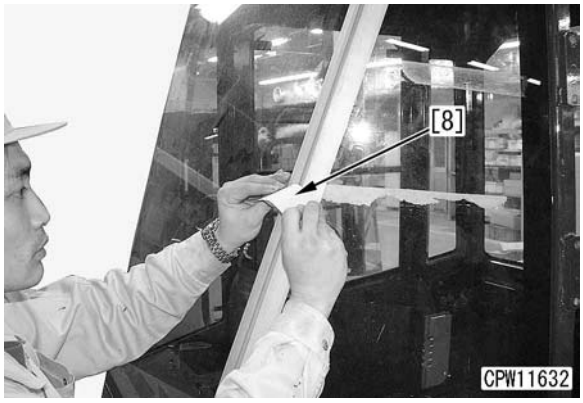



2) Fill the joint of the glasses with caulking material (15).
   ★ The usable period of the following caulking material is 4 months after the date of manufacture. Do not use the caulking material after its usable period.

   Caulking material: **SUNSTAR PENGUINE SEAL NO. 2505**




3) Remove the caulking material projected from the joint with cardboard [8], etc.




4) Remove the masking tapes from the window glass.

11. Remove the primer and adhesive from the operator's cab and window glass.
   ★ Using white gasoline, wipe off the adhesive before it is dried up.
   ★ When cleaning the glass, do not give an impact to it.

## COATING MATERIALS

| Category | Komatsu code | Part No. | Q'ty | Container | Main applications, featuresr | |
|---|---|---|---|---|---|---|
| Primer | SUNSTAR, PAINT PRIMER 580 SUPER | 417-926-3910 | 20 mℓ | Glass container | For sticking cab glass | • Used as primer for cab. (Using limit: 4 months) |
| | SUNSTAR, GLASS PRIMER 580 SUPER | | 20 mℓ | Glass container | | • Used as primer for cab. (Using limit: 4 months) |
| Adhesive | SUNSTAR, PENGUINE SEAL 580 SUPER "S" or "W" | | 320 mℓ | Polyethylene container | | • "S" and "W" are used as adhesive for glass at high temperature (summer) and low temperature (winter) respectively. (Using limit: 4 months) |
| | SIKA JAPAN, SIKAFLEX 256 HV | 20Y-54-39850 | 310 mℓ | Polyethylene container | | • Used as adhesive for glass. (Using limit: 6 months) |
| Caulking material | SUNSTAR, PENGUINE SEAL NO. 2605 | 417-926-3920 | 320 mℓ | Polyethylene container | | • Used to seal joint of glasses (Using limit: 4 months) |
| | SEKISUI SILICONE SEALANT | 20Y-54-55130 | 333 mℓ | Polyethylene container | | • Used to seal front window (Using limit: 6 months) |

# REMOVAL, INSTALLATION OF CENTER HINGE PIN

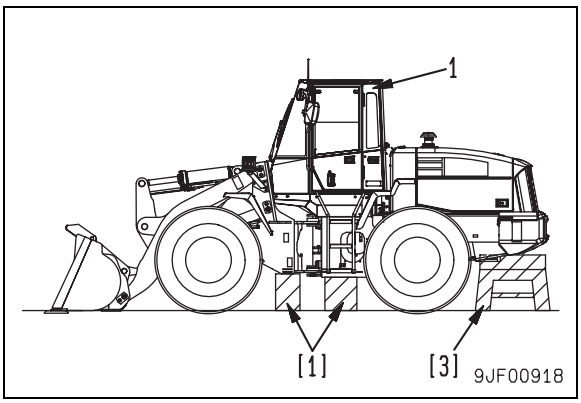
## REMOVAL

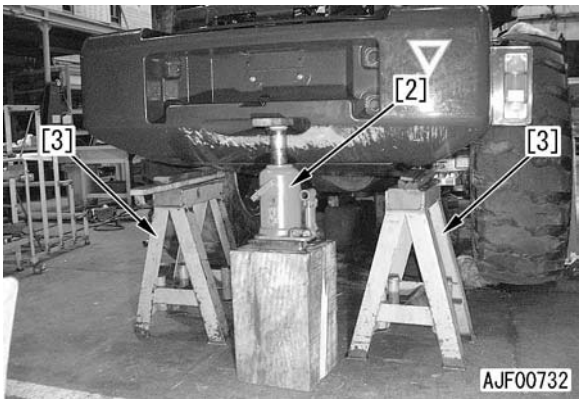
Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

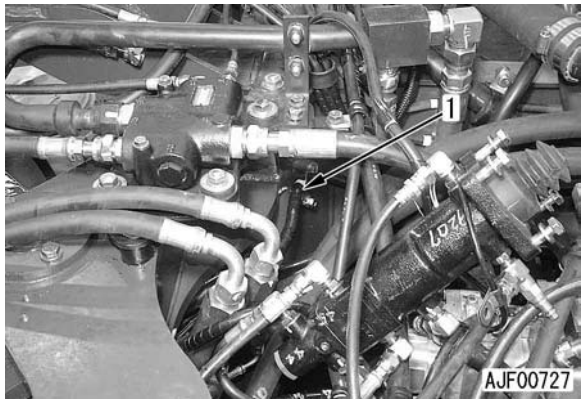
Disconnect the cable from the negative (-) terminal of the battery.

1. Remove operator's cab assembly (1). For details, see Removal, installation of operator's cab assembly.
2. Place blocks [1] under both sides of the front frame and rear frame, raise the counterweight with hydraulic jack [2], and set stands [3].

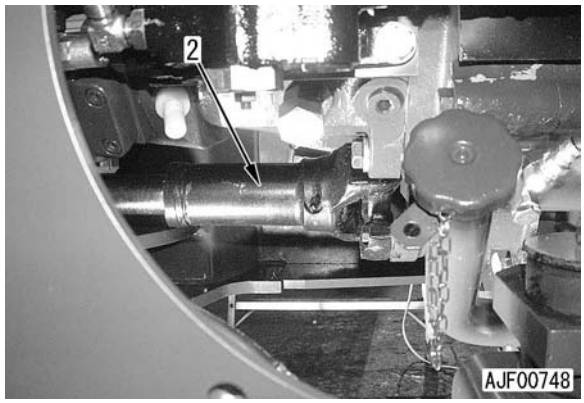


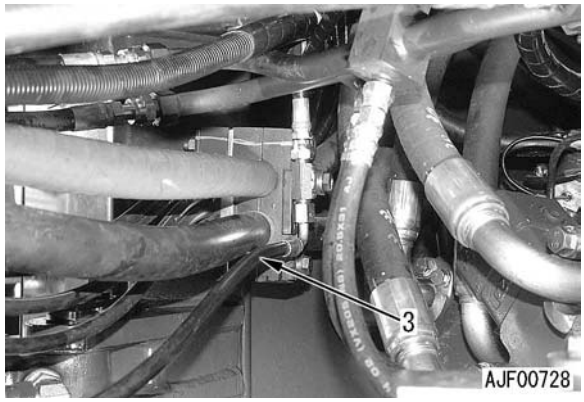

3. Disconnect all wiring harness clamps (1) between the front frame and rear frame from the rear frame.
   ★ Disconnect all wiring harness clamps (1) on the rear frame side.



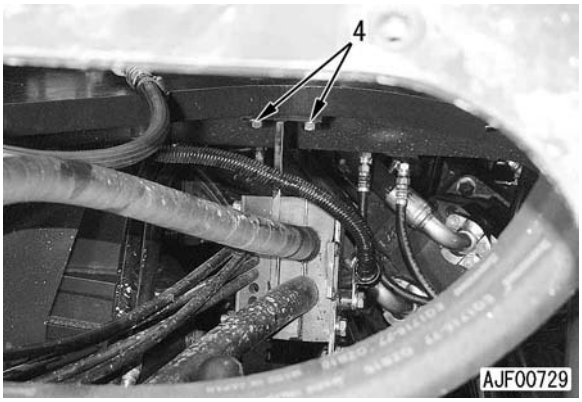

4. Disconnect front drive shaft (2) from the transfer. [*1]



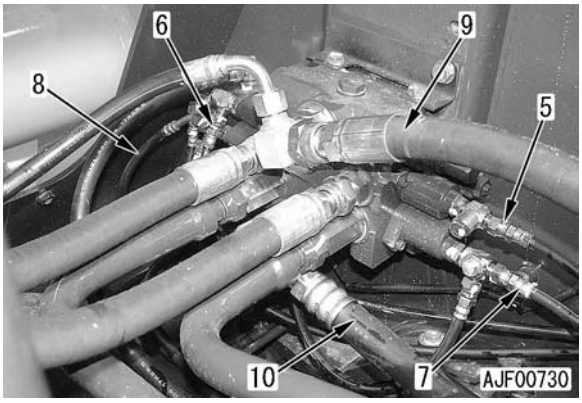

5. Disconnect front brake hose (3) from the hose bracket of the front frame. [*2]

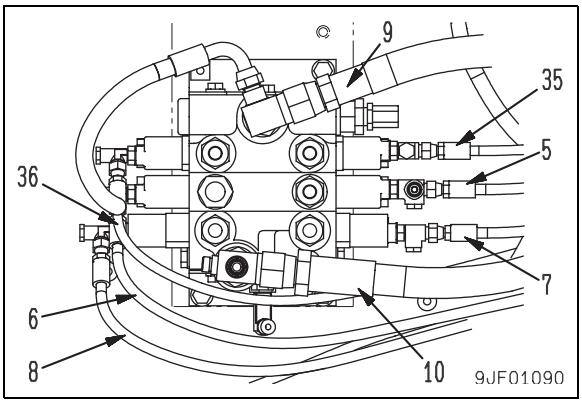


6. Remove 2 hose clamp bracket mounting bolts (4) from the front frame.

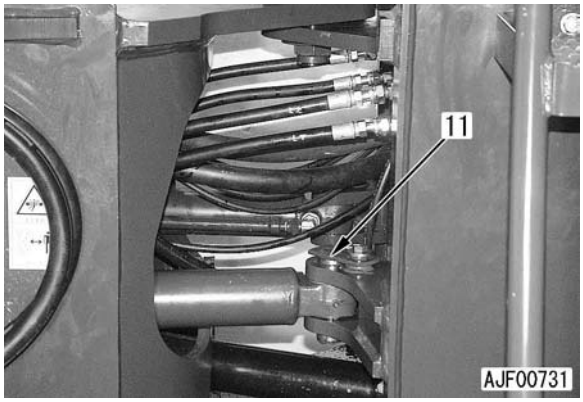



7. Disconnect the PPC hoses from the work equipment valve.
   - ★ Disconnect PPC hoses (5) - (8). (WA250-5)
   - ★ Disconnect PPC hoses (5) - (8), (35), and (36). (WA250PT-5) [*3]
8. Disconnect port P hose (9) and port T hose (10).
   - ★ Since oil will leak through the disconnected hoses and tubes, prepare oil receivers.

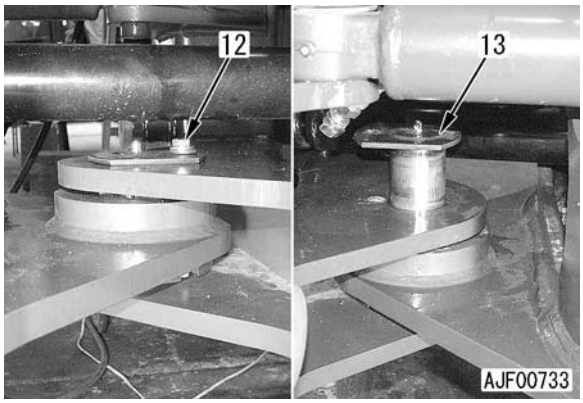


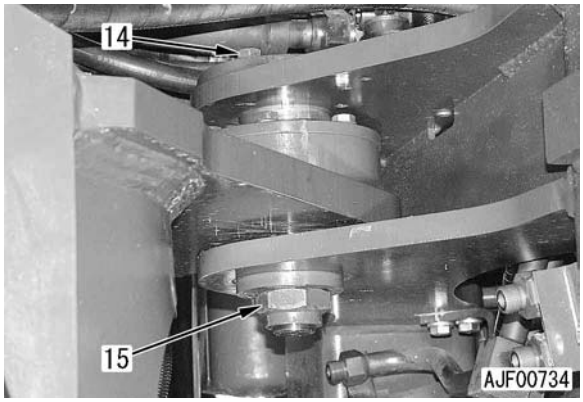

9. Remove pins (11) from the bottom side of both steering cylinders. [*4]



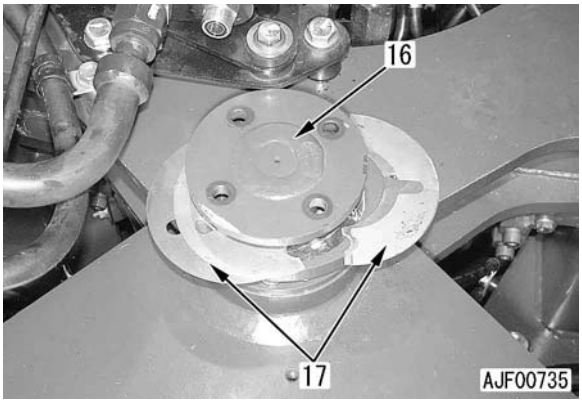

10. Remove the lower hinge pin. [*5]
    1) Remove lock bolt (12).
    2) Remove lower hinge pin (13).



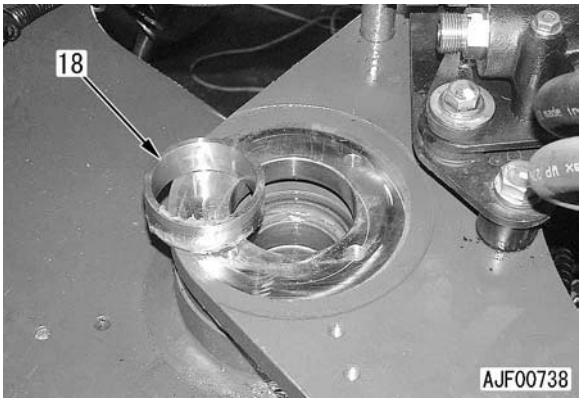

11. Remove the upper hinge pin. [*6]
    1) Remove mounting bolt (14).
    2) Remove mounting nut (15).



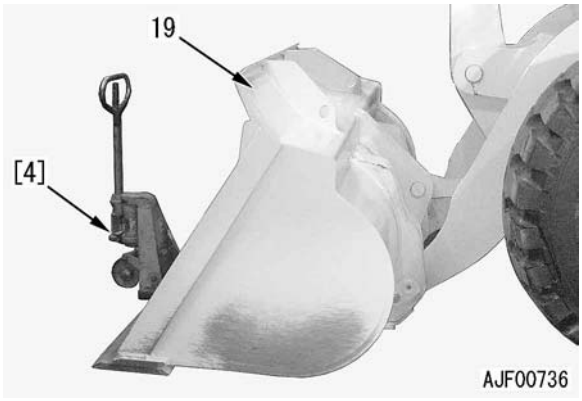
3) Adjust the height of the front frame and rear frame with the hydraulic jack so that you can pull out the pin easily, and then remove upper hinge pin (16) and shim (17). [*7]
   ★ Check the thickness and quantity of the shims.



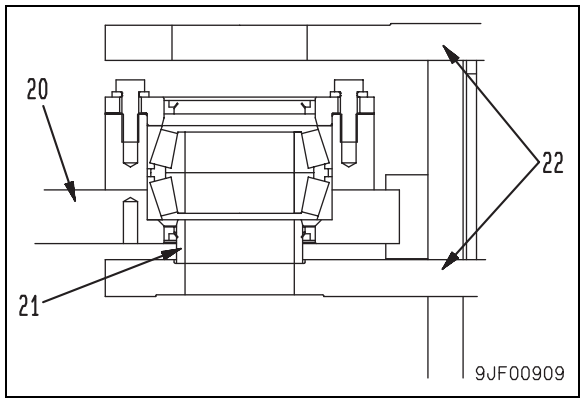

4) Remove upper spacer (18).
   ★ The upper spacer may be removed after the front frame is disconnected.



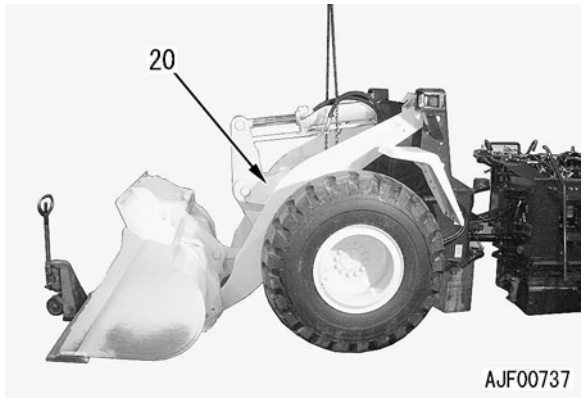

12. Disconnect the front frame and rear frame. [*8]
   1) Set hand lift truck [4] under bucket (19).



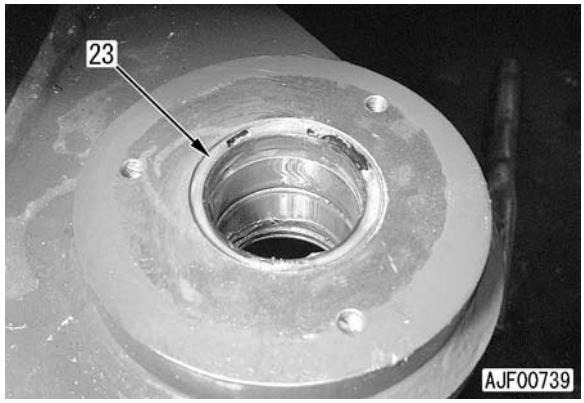

2) Using a bar, etc., raise front frame assembly (20) by 1 - 2 mm to move lower spacer (21) from rear frame assembly (22).
   ★ You may raise the front frame assembly by 1 - 2 mm with a large-sized crane, if available.



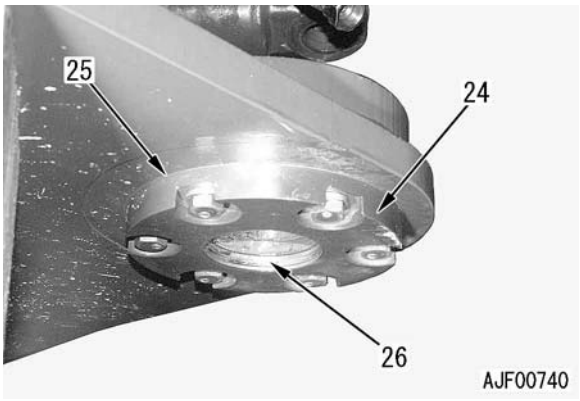

3) Turn the tires to move front frame assembly (20) forward.



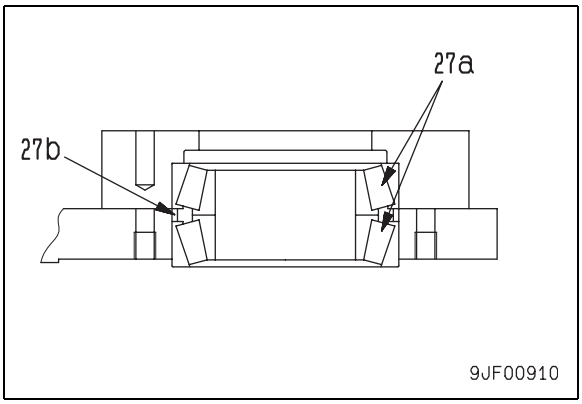

13. Disassemble the lower hinge of the front frame. [*9]
   1) Remove dust seal (23).



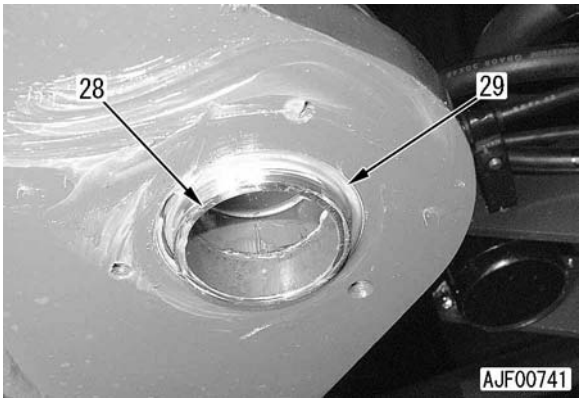
2) Remove retainer (24) and shim (25).
   ★ Check the thickness and quantity of the shims.
3) Remove dust seal (26) from retainer (24).



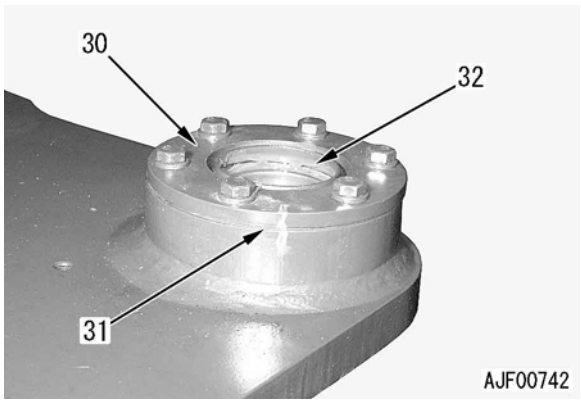

4) Remove bearing (27a) and spacer (27b).



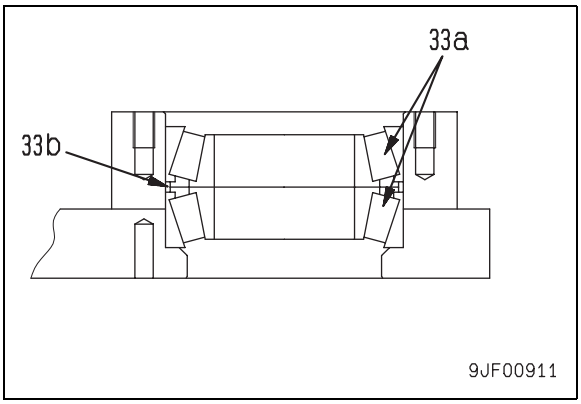

14. Disassemble the upper hinge of the front frame. [*10]
1) Remove lower spacer (28).
2) Remove dust seal (29).



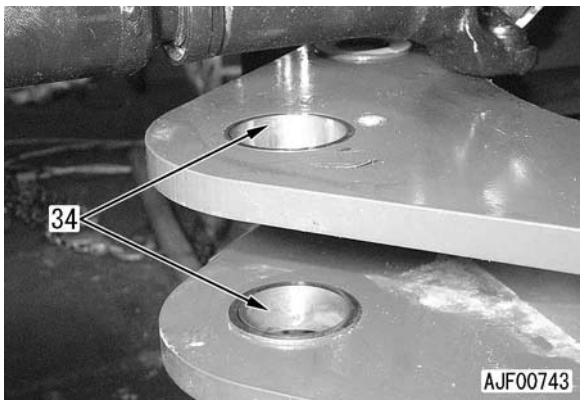

3) Remove retainer (30) and shim (31).
   ★ Check the thickness and quantity of the shims.
4) Remove dust seal (32) from retainer (30).




5) Remove bearing (33a) and spacer (33b).




15. Remove 2 bushings (34) from the lower hinge of the rear frame. [*11]



## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Front drive shaft mounting bolt:
**59 - 74 Nm {6.0 - 7.5 kgm}**

★ When installing the drive shaft, check that the key way of the spider cap is fitted in the key way of the mating yoke, and then tighten the mounting bolts.

[*2]

★ Bleed air from the brake. For details, see TESTING AND ADJUSTING, Bleeding air from brake circuit.

[*3]

★ Connect PPC hoses (5) - (8) according to their band colors shown below.

- PPC hose band colors of WA250-5

| No. | Connecting point | Band color |
|---|---|---|
| (5) | Bucket DUMP | Orange |
| (6) | Bucket TILT | Red |
| (7) | Boom LOWER | Blue |
| (8) | Boom RAISE | Yellow |

- PPC hose band colors of WA250PT-5

| No. | Connecting point | Band color |
|---|---|---|
| (5) | Bucket DUMP | Orange |
| (6) | Bucket TILT | Red |
| (7) | Boom LOWER | Blue |
| (8) | Boom RAISE | Yellow |
| (35) | PULL | Green |
| (36) | PUSH | White/Red |

[*4]

★ Adjust the shim so that the total of the upper and lower clearances between the frame and cylinder will be less than 0.5 mm.

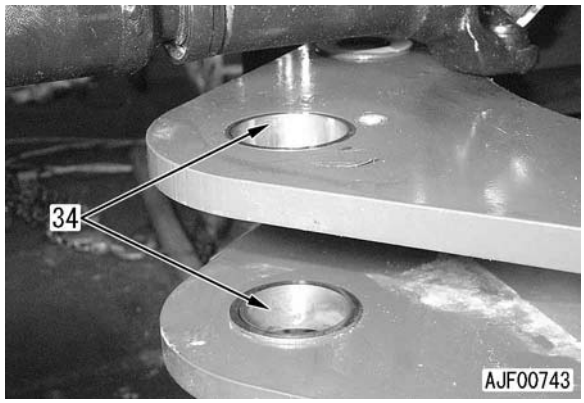
- Varieties of shim thickness: **0.5 mm, 1 mm**

Inside of bushing on cylinder side and dust seal:
**Lubricant containing molybdenum disulfide (LM-P)**

[*9] [*10] [*11]

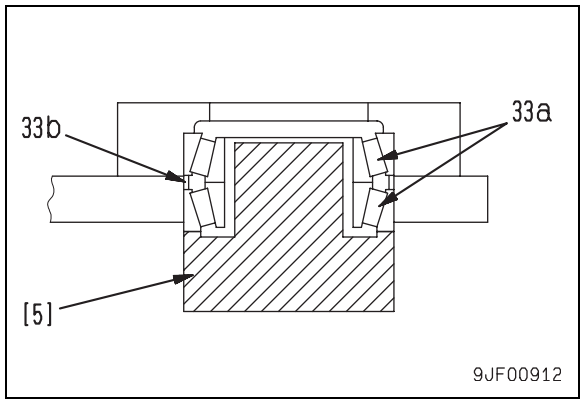
★ Assemble the upper hinge and lower hinge according to the following procedure.

1. Install 2 bushings (34) to the lower hinge of the rear frame.




2. Assemble the upper hinge of the front frame.
   1) Using push tool [5], press fit bearing (33a) and spacer (33b) to the front frame.
      ★ Since the clearance of bearing (33a) and spacer (33b) is adjusted properly, do not change their combination.
      ★ Since bearing (33a) and spacer (33b) are an assembly, always replace them as a set.
      ★ Press fit bearing (33a) and spacer (33b) securely so that a clearance will not be made between the bearing and frame.

Bearing: **Grease (G2-LI)**

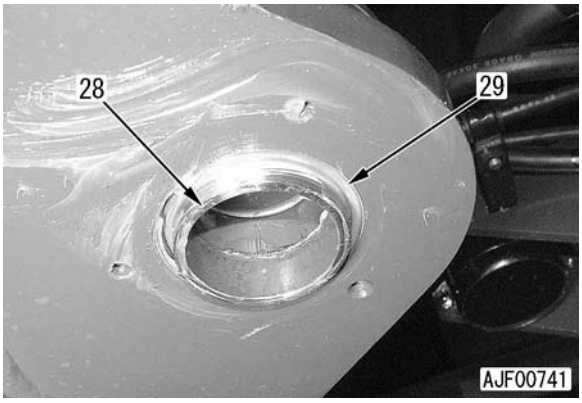


2) Press fit dust seal (29) to the front frame.
   ★ Press fit the dust seal with the lip out.

   Lip of dust seal: **Grease (G2-LI)**

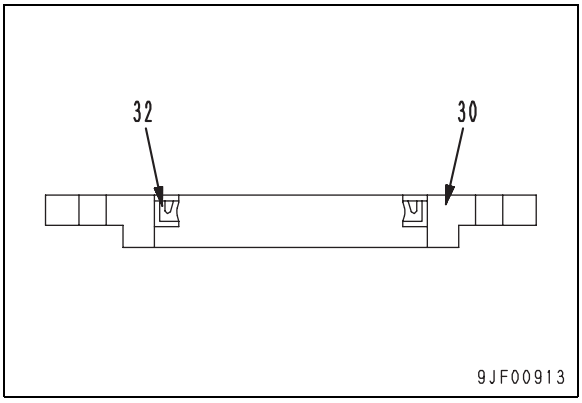
3) Install lower spacer (28).
   ★ Install the spacer with the chamfered part on the bearing side.

   Lower spacer:
   **Lubricant containing molybdenum disulfide (LM-P)**




4) Press fit dust seal (32) to retainer (30).
   ★ Press fit the dust seal with the lip out.

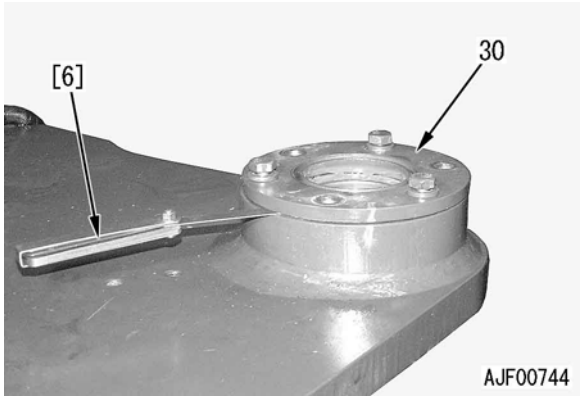
   Lip of dust seal: **Grease (G2-LI)**




5) Tighten the 3 mounting bolts of retainer (30) evenly.

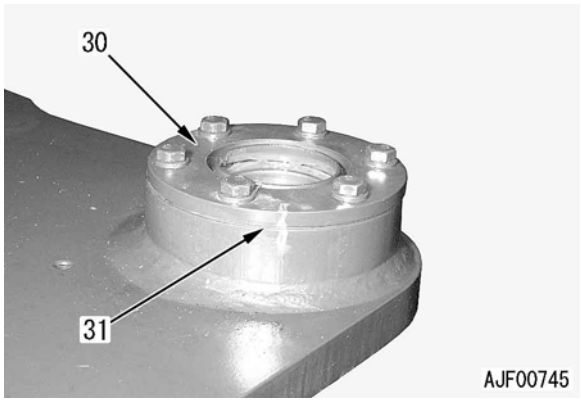
   Retainer mounting bolt:
   **14.7 Nm {1.5 kgm}**

6) Measure the clearance between retainer (30) and front frame with feeler gauge [6], and then select shims so that the maximum clearance will be less than 0.1 mm when the shims are inserted.
   - Standard shim thickness: **0.92 mm**
   - Varieties of shim thickness:
     **0.1 mm, 0.2 mm, 0.5 mm, 1.0 mm**



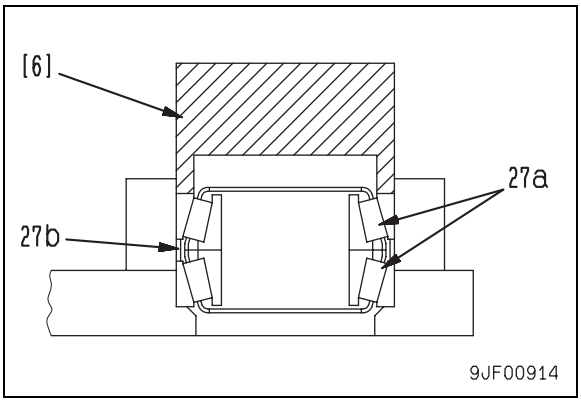

7) Insert selected shim (31) and tighten the 6 mounting bolts.

   Mounting bolt:
   **98 - 123 Nm {10.0 - 12.5 kgm}**



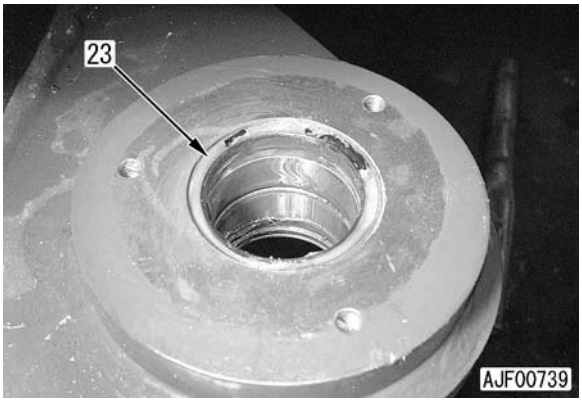
3. Assemble the lower hinge of the front frame.
   1) Using push tool [6], press fit bearing (27a) and spacer (27b) to the front frame.
      ★ Since the clearance of bearing (27a) and spacer (27b) is adjusted properly, do not change their combination.
      ★ Since bearing (27a) and spacer (27b) are an assembly, always replace them as a set.
      ★ Press fit bearing (27a) and spacer (27b) securely so that a clearance will not be made between the bearing and frame.

      Bearing: **Grease (G2-LI)**



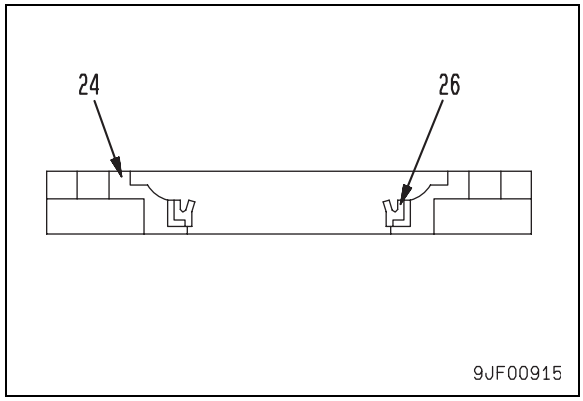

   2) Press fit dust seal (23) to the front frame.
      ★ Press fit the dust seal with the lip out.

      Lip of dust seal: **Grease (G2-LI)**




   3) Press fit dust seal (26) to retainer (24).
      ★ Press fit the dust seal with the lip in.
      ★ Note that only this dust seal must be fitted with the lip in.

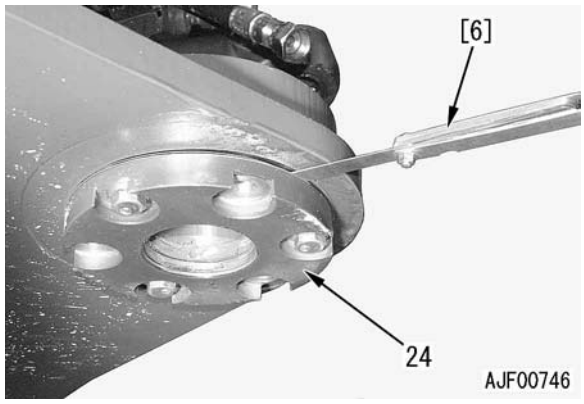
      Lip of dust seal: **Grease (G2-LI)**




   4) Tighten the 3 mounting bolts of retainer (24) evenly.

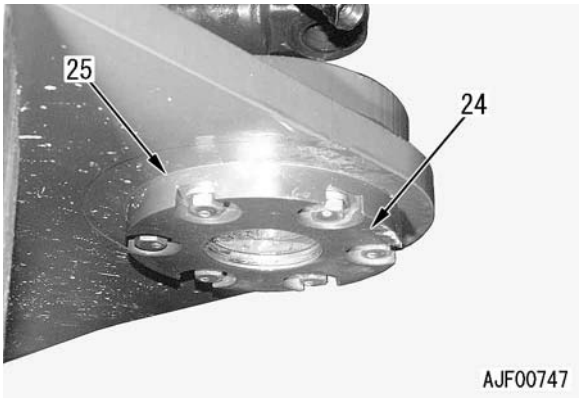
      Retainer mounting bolt: **14.7 Nm {1.5 kgm}**

   5) Measure the clearance between retainer (24) and front frame with feeler gauge [6], and then select shims so that the maximum clearance will be less than 0.1 mm when the shims are inserted.
      - Standard shim thickness: **0.85 mm**
      - Varieties of shim thickness: **0.1 mm, 0.2 mm, 0.5 mm**



6) Insert selected shim (25) and tighten the 6 mounting bolts.

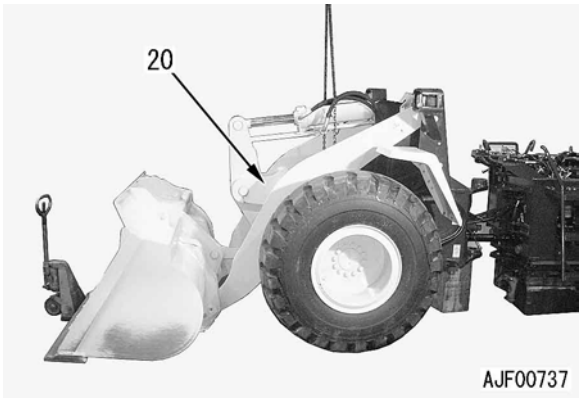
Mounting bolt:
**98 - 123 Nm {10.0 - 12.5 kgm}**



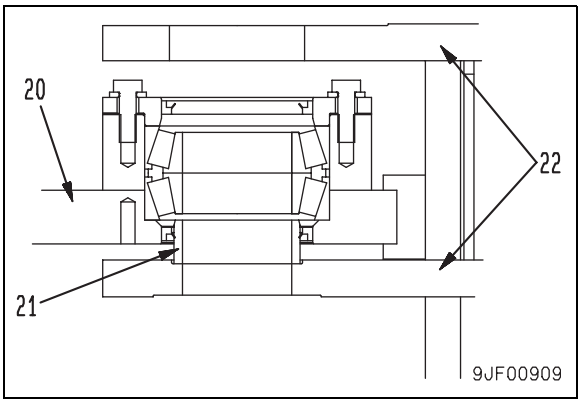

[*5] [*6] [*7] [*8]

★ Install the upper hinge pin and lower hinge pin according to the following procedure.

1. Set hand lift truck under the bucket and turn the tires to move the front frame assembly toward the rear frame.




2. Using a bar, etc., raise front frame assembly (20) by 1 - 2 mm to move spacer (21) to the spacer of rear frame assembly (22).
   ★ You may raise the front frame assembly by 1 - 2 mm with a large-sized crane, if available.

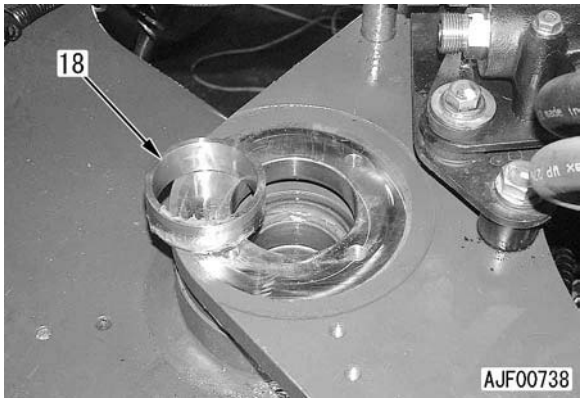



3. Align the upper and lower pin holes.
   ★ Using a hydraulic jack, adjust the height of the front and rear frames and align the pin holes.

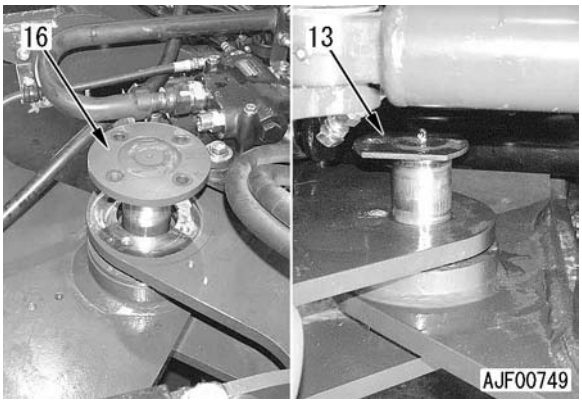
When aligning the pin holes, use a bar. Never insert your fingers in the pin holes.

4. Install upper spacer (18).
   ★ Install the spacer with the chamfered part on the bearing side.

Upper spacer:
**Lubricant containing molybdenum disulfide (LM-P)**



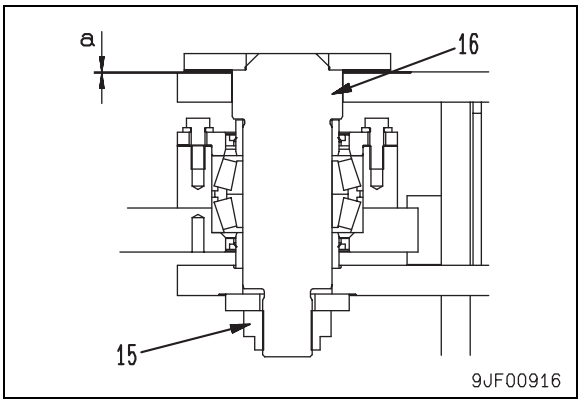
5. Insert upper hinge pin (16) and lower hinge pin (13) to the end.
   ★ Do not insert the shim for the upper hinge pin.




6. Tighten mounting nut (15) of upper hinge pin (16).

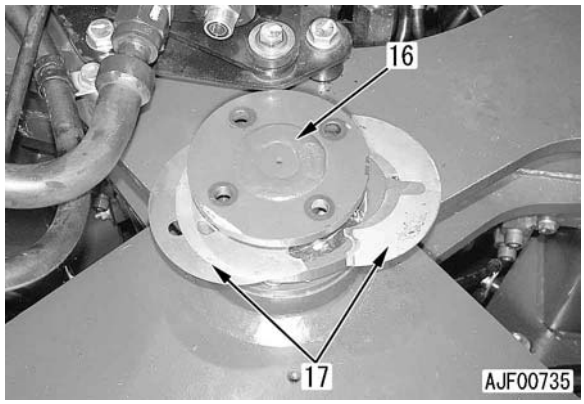
   Mounting nut:
   **510 - 628 Nm {52.0 - 64.0 kgm}**

7. Measure clearance (a) between upper hinge pin (16) and rear frame top with a feeler gauge, and then select shims so that the maximum clearance will be less than 0.1 mm when the shims are inserted.
   - Standard shim thickness: **1.45 mm**
   - Varieties of shim thickness:
     **0.1 mm, 0.2 mm, 0.5 mm, 1.0 mm**

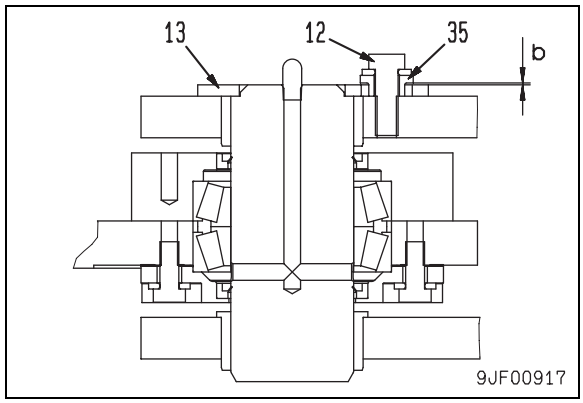



8. Insert selected shim (17) between upper hinge pin (16) and rear frame and tighten the 4 mounting bolts.

   Mounting bolt:
   **98 - 123 Nm {10.0 - 12.5 kgm}**




9. Install lock bolt (12) of lower hinge pin (13).
   ★ A clearance of 1 mm should be made at (b) between bushing (35) and lower hinge pin (13).




- **Refilling with oil (Hydraulic tank)**
  Add oil through the oil filler to the specified level. Run the engine to circulate the oil through the system. Then, check the oil level again.

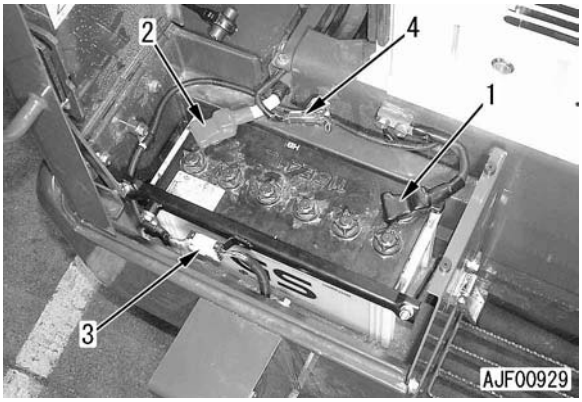
# REMOVAL, INSTALLATION OF COUNTERWEIGHT

## REMOVAL

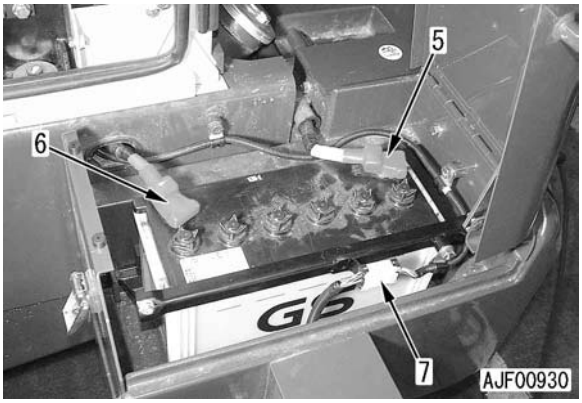
Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

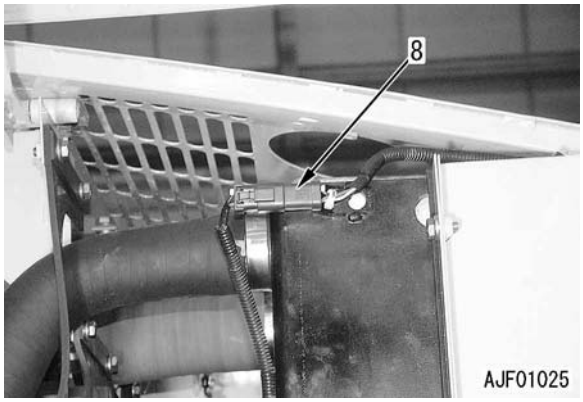
1. Disconnect battery negative (-) terminal (1) from the right side, and then disconnect battery terminal (2).
2. Disconnect wiring connectors R23 (3) and R24 (4).



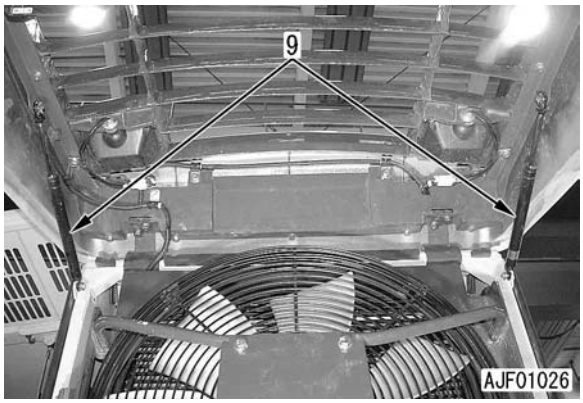

3. Disconnect battery terminals (5) and (6) from the left side.
4. Disconnect wiring connector R22 (7).



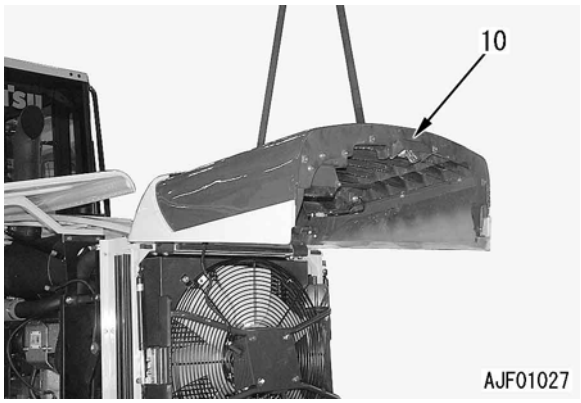

5. Open the grille and sling it temporarily.
6. Open the engine left side cover and disconnect wiring connector BR1 (8).




7. Disconnect both damper gas cylinders (9).

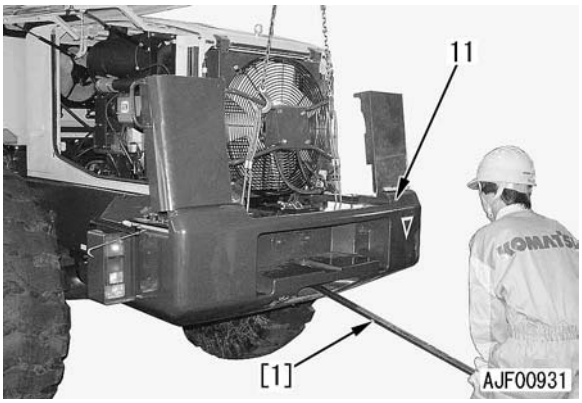



8. Remove the 4 mounting bolts and lift off the grille (10).



9. Sling counterweight (11) temporarily and remove the mounting bolt, and then remove the counterweight. [*1]
   ★ When removing the counterweight, insert bar [1] in its rear part to balance it.

   Counterweight and batteries (both) assembly: **1550 kg**




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Mounting bolt: **785 - 980 Nm {80 - 100 kgm}**

# REMOVAL, INSTALLATION OF AIR CONDITIONER UNIT ASSEMBLY

## SPECIAL TOOLS

| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| X | 1 | 799-703-1200 | Service tool kit | ■ | 2 | | |
| | | 799-703-1100 | Vacuum pump (100 V) | ■ | 1 | | |
| | | 799-703-1110 | Vacuum pump (220 V) | ■ | 1 | | |
| | | 799-703-1120 | Vacuum pump (240 V) | ■ | 1 | | |
| | | 799-703-1400 | Gas leak tester | ■ | 1 | | |

## REMOVAL

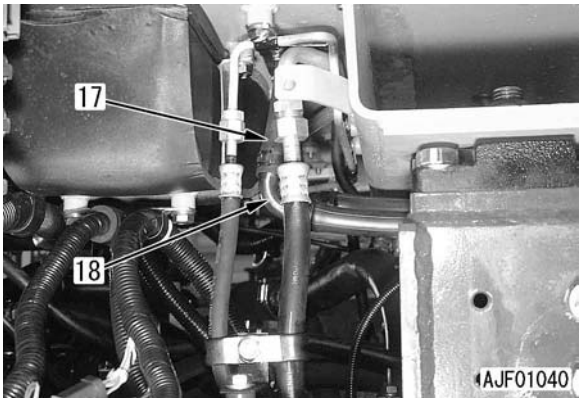
Stop the vehicle on a level place and set the safety bar to the frame.

Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

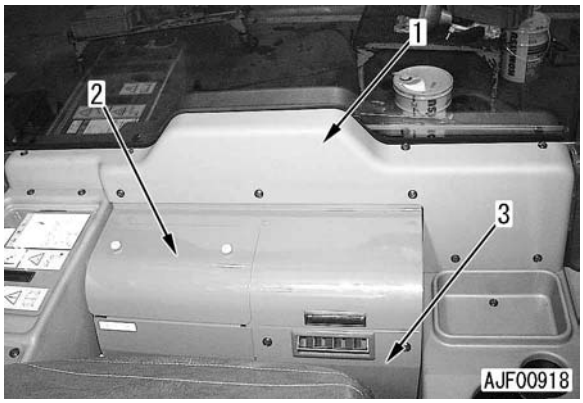
Disconnect the cable from the negative (-) terminal of the battery.

Connect tool X1 to the air conditioner compressor hose valve and collect the refrigerant (R134a).

1. Remove the operator's cab left undercover and disconnect 2 heater hoses (17) from tube (18).
   ★ Disconnect the heater hoses from the air conditioner unit.



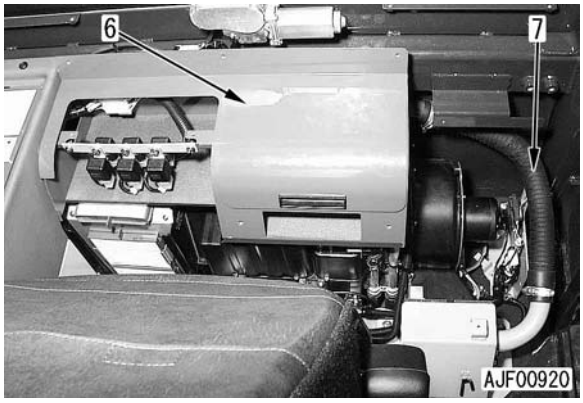

2. Remove covers (1), (2), and (3).



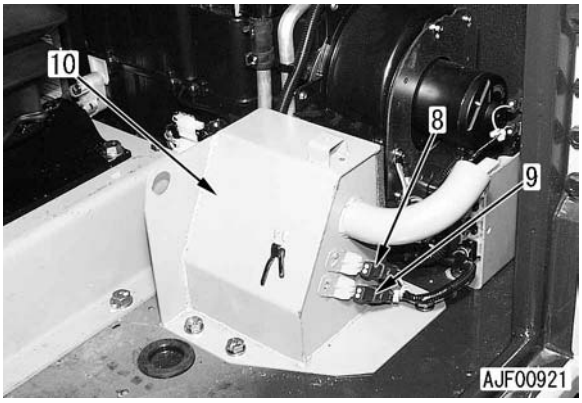

3. Remove cover (4) and bracket (5).



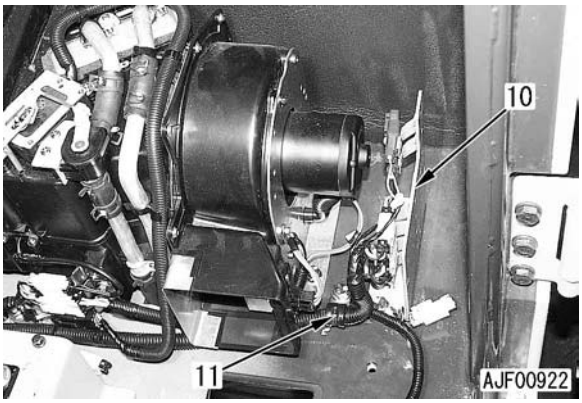

4. Remove console box (6).
5. Remove defroster hose (7).



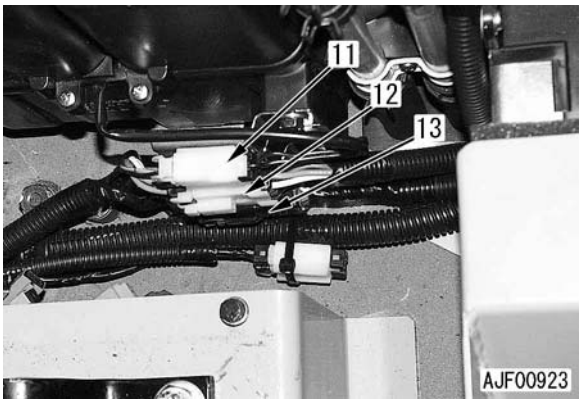
6. Remove wiring connectors L53 (8) and L47 (9).
7. Remove box (10).



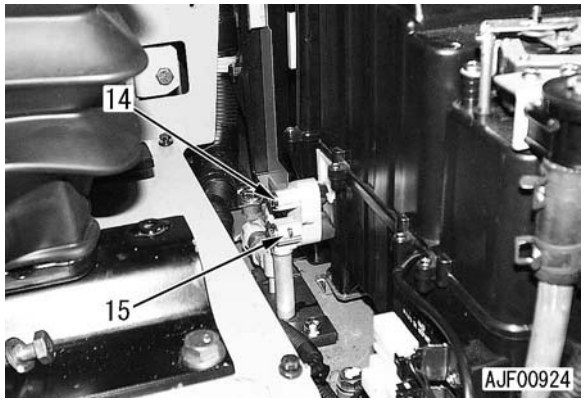

8. Remove wiring connector bracket (10).
9. Disconnect clamp (11).



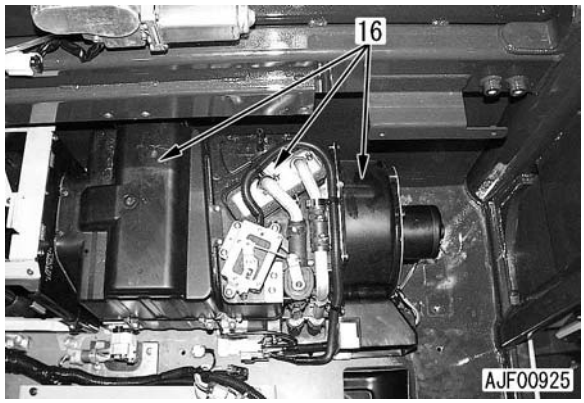

10. Disconnect wiring connectors A03 (11), A01 (12), and A02 (13).




11. Disconnect air conditioner pipes (14) and (15). [*1]




12. Remove the mounting bolts and air conditioner unit assembly (16).




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

O-ring:
**Compressor oil for new refrigerant (NO-OIL8)**

- **Charging air conditioner with refrigerant**
  Using tool **X1**, charge the air conditioner circuit with refrigerant (R134a).

# REMOVAL, INSTALLATION OF AIR CONDITIONER COMPRESSOR ASSEMBLY

## SPECIAL TOOLS

| Symbol | | Part No. | Part Name | Necessity | Q'ty | New/Remodel | Sketch |
|---|---|---|---|---|---|---|---|
| X | 1 | 799-703-1200 | Service tool kit | ■ | 2 | | |
| | | 799-703-1100 | Vacuum pump (100 V) | ■ | 1 | | |
| | | 799-703-1110 | Vacuum pump (220 V) | ■ | 1 | | |
| | | 799-703-1120 | Vacuum pump (240 V) | ■ | 1 | | |
| | | 799-703-1400 | Gas leak tester | ■ | 1 | | |

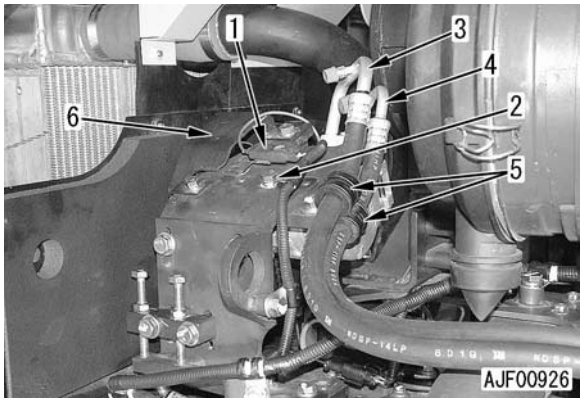
## REMOVAL

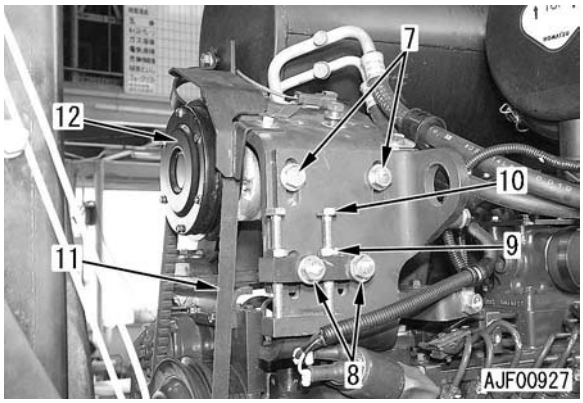
Lower the work equipment to the ground, stop the engine, apply the parking brake, and put chocks under the tires.

Disconnect the cable from the negative (-) terminal of the battery.

Connect tool X to the air conditioner compressor hose valve and collect the refrigerant (R134a).

1. Open the engine left side cover.
2. Disconnect wiring connector E16 (1) and ground terminal E22 (2).
3. Disconnect air conditioner pipes (3) and (4). [*1]
4. Disconnect 2 air conditioner pipe clamps (5).
5. Remove cover (6).
6. Loosen 2 mounting bolts (7) and 2 mounting bolts (8).
7. Loosen 2 locknuts (9) and 2 adjustment bolts (10).
8. Remove air conditioner compressor belt (11). [*2]
9. Remove 2 mounting bolts (7), 2 mounting bolts (8), and air conditioner compressor bracket assembly (12).




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

O-ring:
**Compressor oil for new refrigerant (NO-OIL8)**

[*2]

★ Adjust the tension of the air conditioner compressor belt. For details, see TESTING AND ADJUSTING, Testing and adjusting air conditioner compressor belt tension.

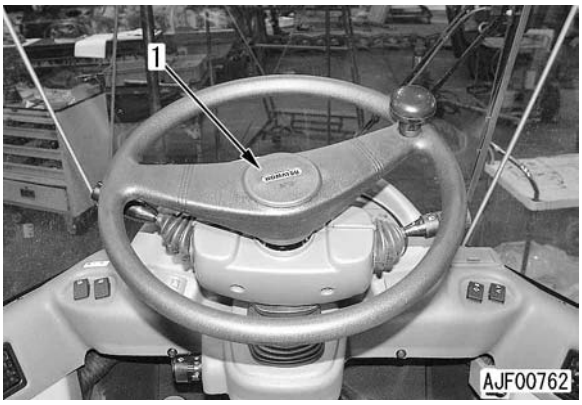
- **Charging air conditioner with refrigerant**
  Using tool **X1**, charge the air conditioner circuit with refrigerant (R134a).

# REMOVAL, INSTALLATION OF MONITOR PANEL

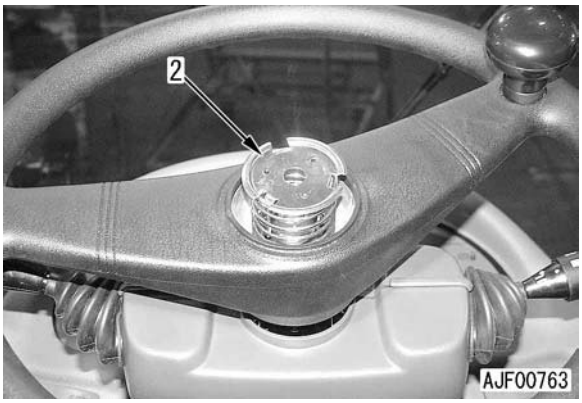
## REMOVAL

Disconnect the cable from the negative (-) terminal of the battery.

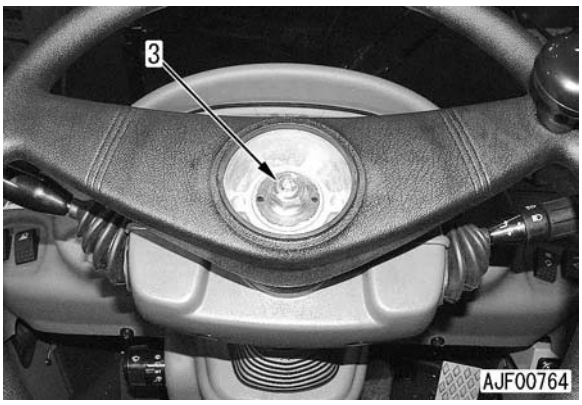
1. Remove pad (1) from the steering wheel.



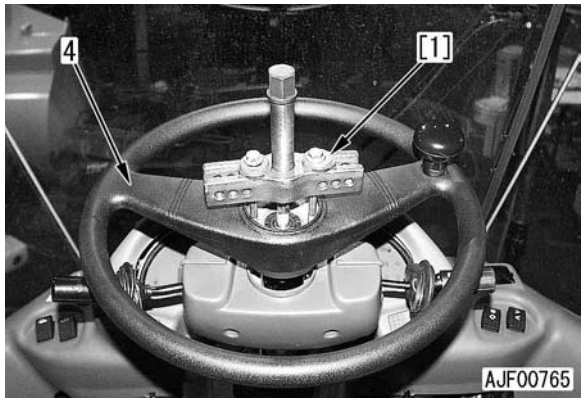

2. Remove contact assembly (2).



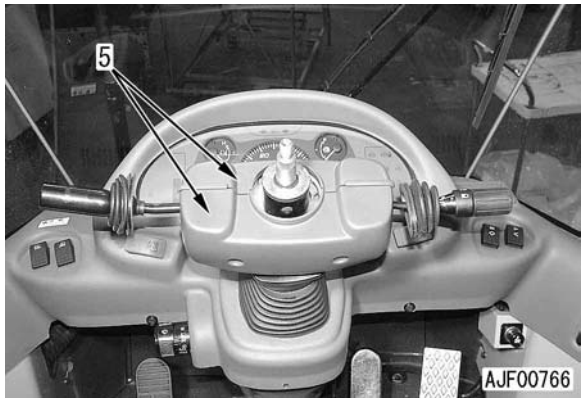

3. Remove steering wheel mounting nut (3). [*1]



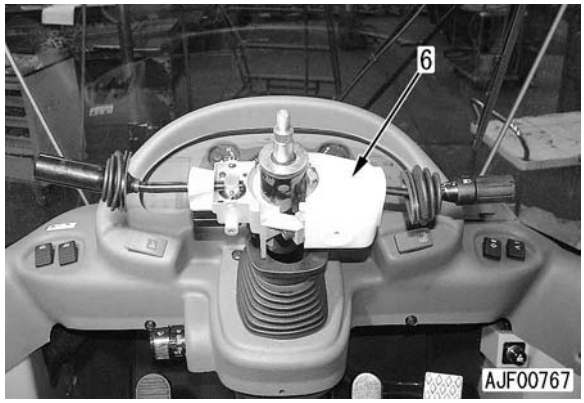

4. Using puller [1], remove steering wheel (4) from the steering column.



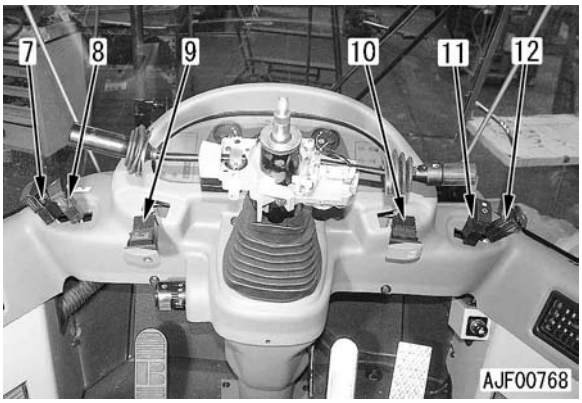

5. Remove cover (5). [*2]

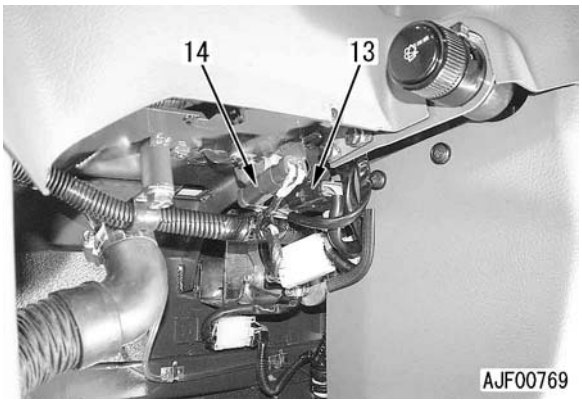



6. Remove cover (6).

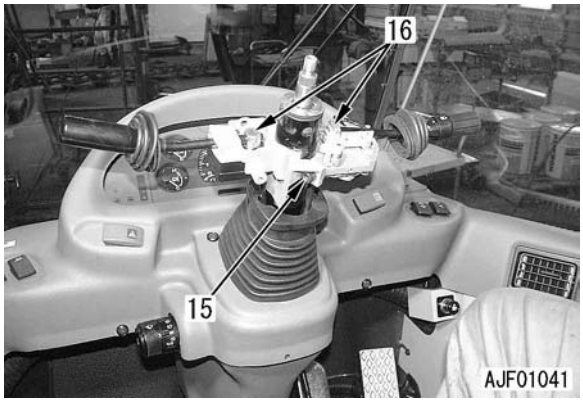


7. Remove the following wiring connectors.
   ★ Before disconnecting switch connectors (7) - (12) above the front panel cover, pull out the switch upward.
   - (7): L07
   - (8): L08
   - (9): L06
   - (10): L19
   - (11): L10
   - (12): L11
   - (13): L04
   - (14): L15

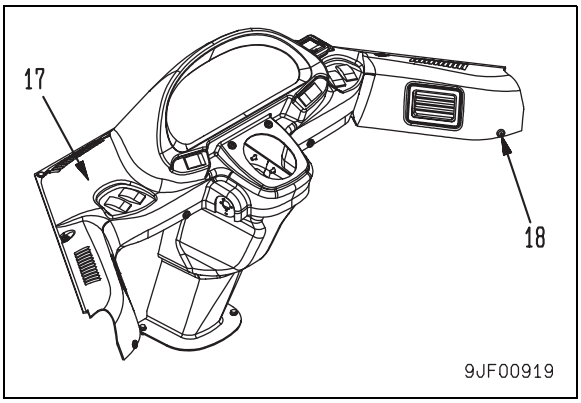


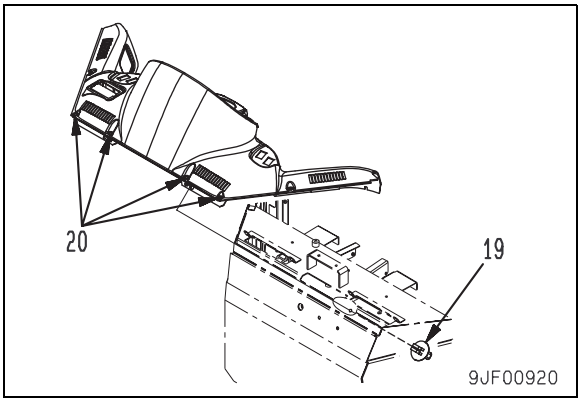

8. Loosen hexagon socket head bolt (15) and remove light and FNR switch assembly (16). [*3]




9. Remove the front panel cover. [*4]
   1) Remove 8 mounting bolts (18) of front panel cover (17).



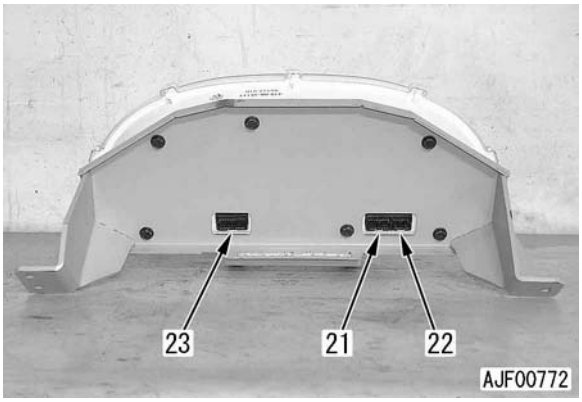

   2) Turn 2 clips (19) by 90 degrees to remove them from the front panel cover.
      ★ Since 4 clips (20) on the operator's cab glass side cannot be removed, disconnect from 2 clips (19).



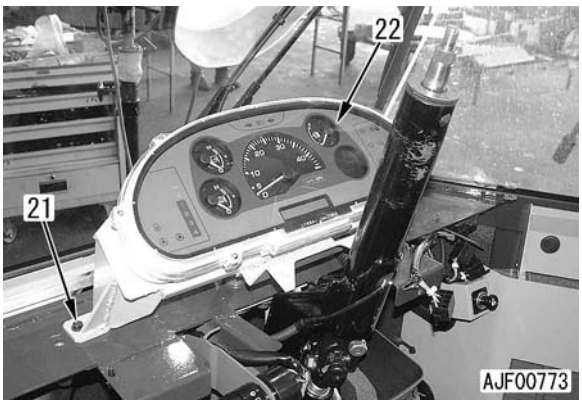
3) Remove front panel cover (17).
   ★ Take care not to damage the painted surface in the operator's cab.



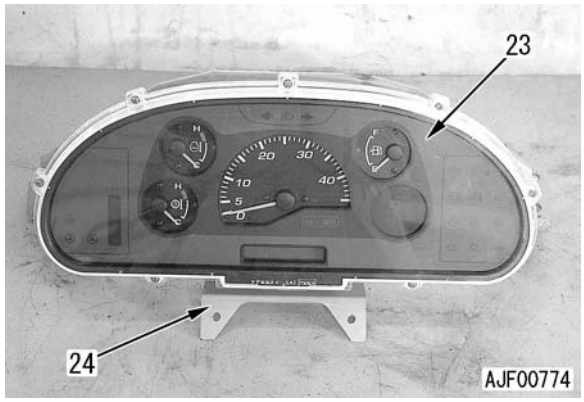

10. Disconnect monitor panel wiring connectors L21 (21), L22 (22), and L23 (23) from the points on the back side of the monitor panel shown in the figure.




11. Remove 4 bracket mounting bolts (21) and monitor panel and bracket assembly (22).




12. Remove monitor panel (23) from bracket (24). [*5]




## INSTALLATION

- Carry out installation in the reverse order to removal.

[*1]

Steering wheel mounting nut:
**29 ± 2.9 Nm {3.0 ± 0.3 kgm}**

[*2]

Cover mounting bolt (Fine thread):
**1.97 - 2.45 Nm {0.2 - 0.25 kgm}**

Cover mounting bolt (Coarse thread):
**5.88 Nm {0.6 kgm}**

[*3]

Hexagon socket head bolt:
**14.7 - 34 Nm {1.5 - 3.5 kgm}**

[*4]

Front panel cover mounting bolt:
**3.44 - 4.4 Nm {0.35 - 0.45 kgm}**

[*5]

Monitor panel mounting bolt:
**2.75 - 3.53 Nm {0.28 - 0.30 kgm}**

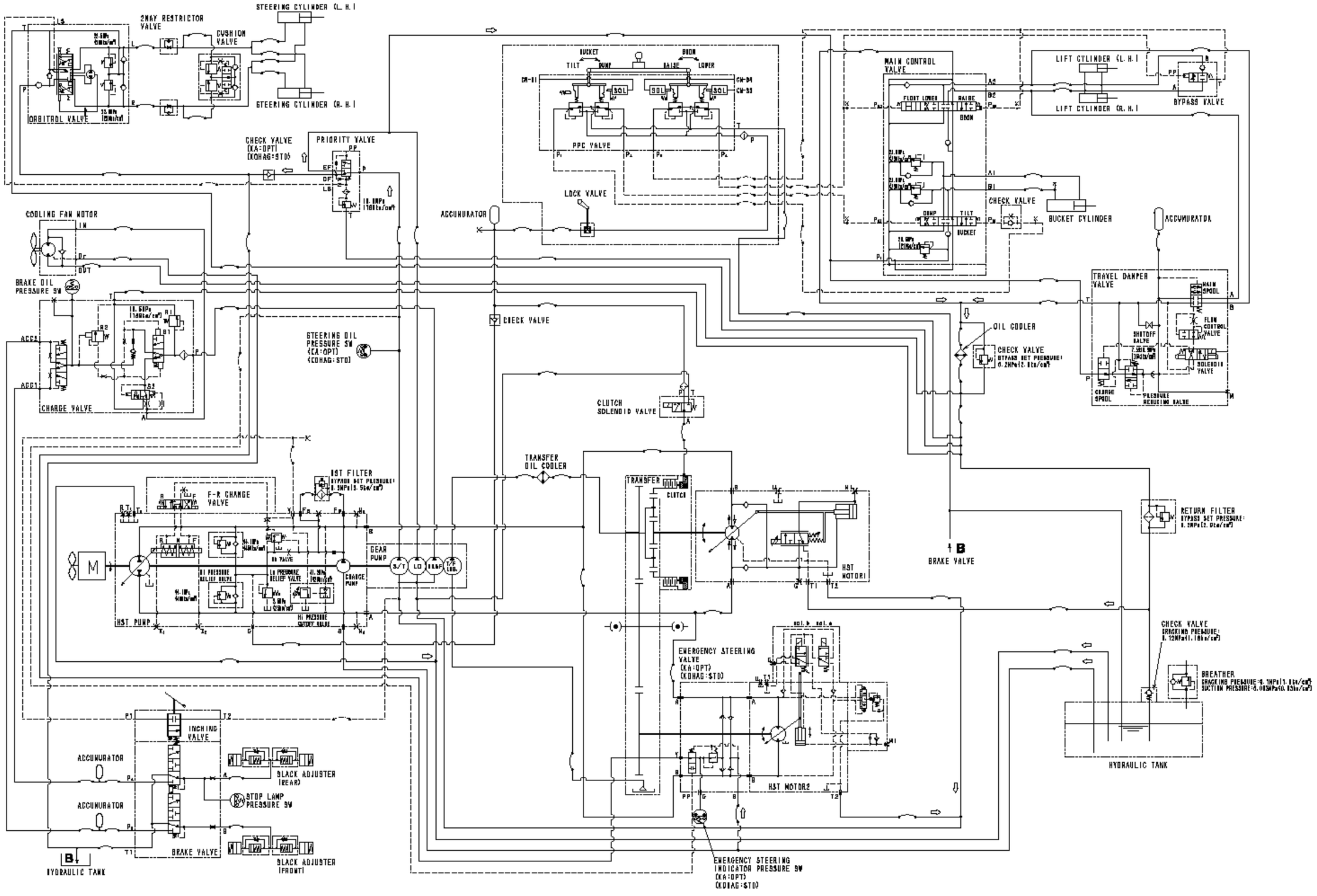
white 30-214

# 90 OTHERS

Hydraulic circuit diagram
WA250-5 ..... 90-3
Hydraulic circuit diagram
WA250PT-5 ..... 90-5
Electrical circuit diagram 1/4 (1/4) ..... 90-7
Electrical circuit diagram 1/4 (2/4) ..... 90-9
Electrical circuit diagram 1/4 (3/4) ..... 90-11
Electrical circuit diagram 1/4 (4/4) ..... 90-13
Electrical circuit diagram 2/4 ..... 90-15
Electrical circuit diagram 3/4 ..... 90-17
Electrical circuit diagram 4/4 ..... 90-19

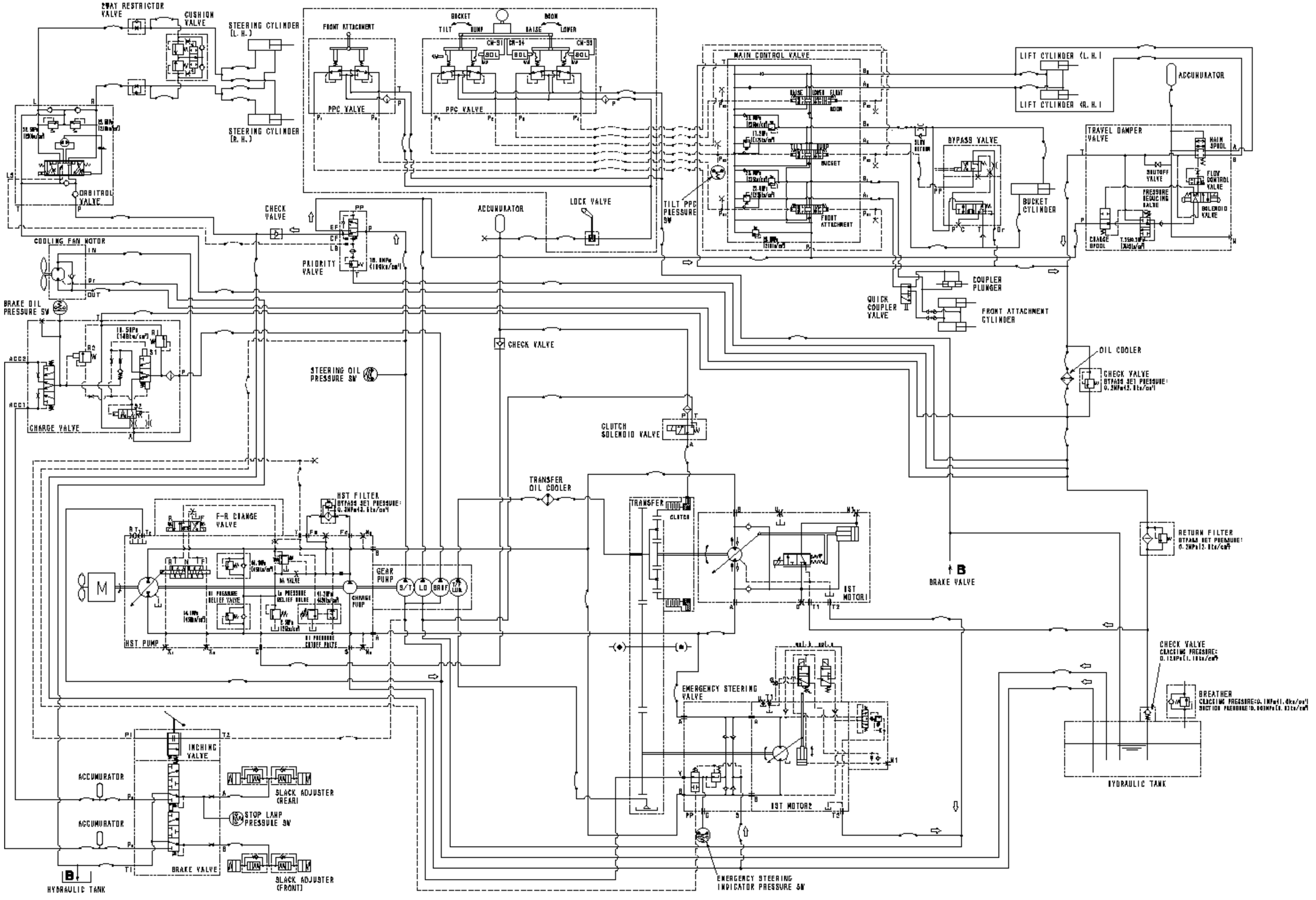
# HYDRAULIC CIRCUIT DIAGRAM

**WA250-5**

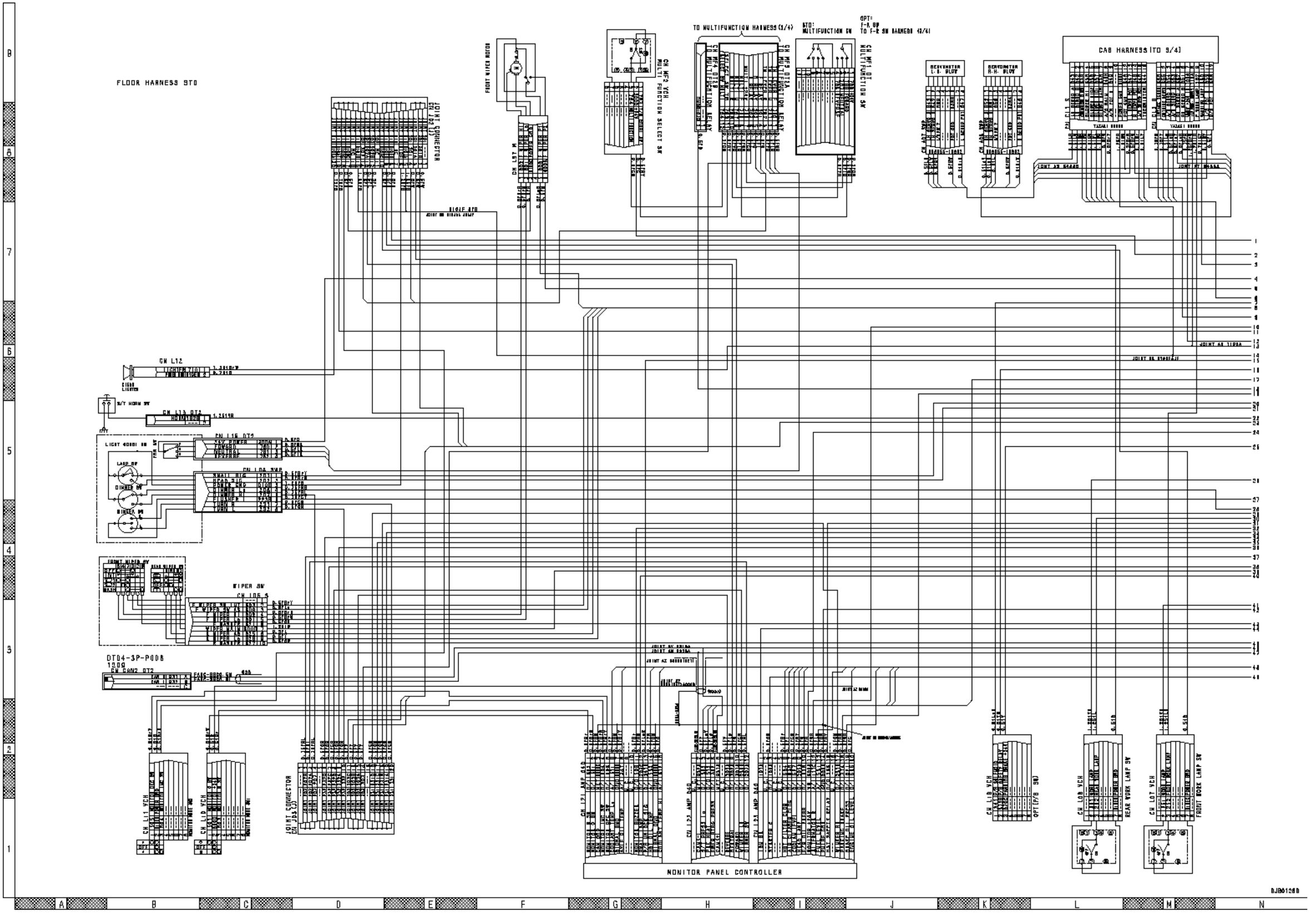


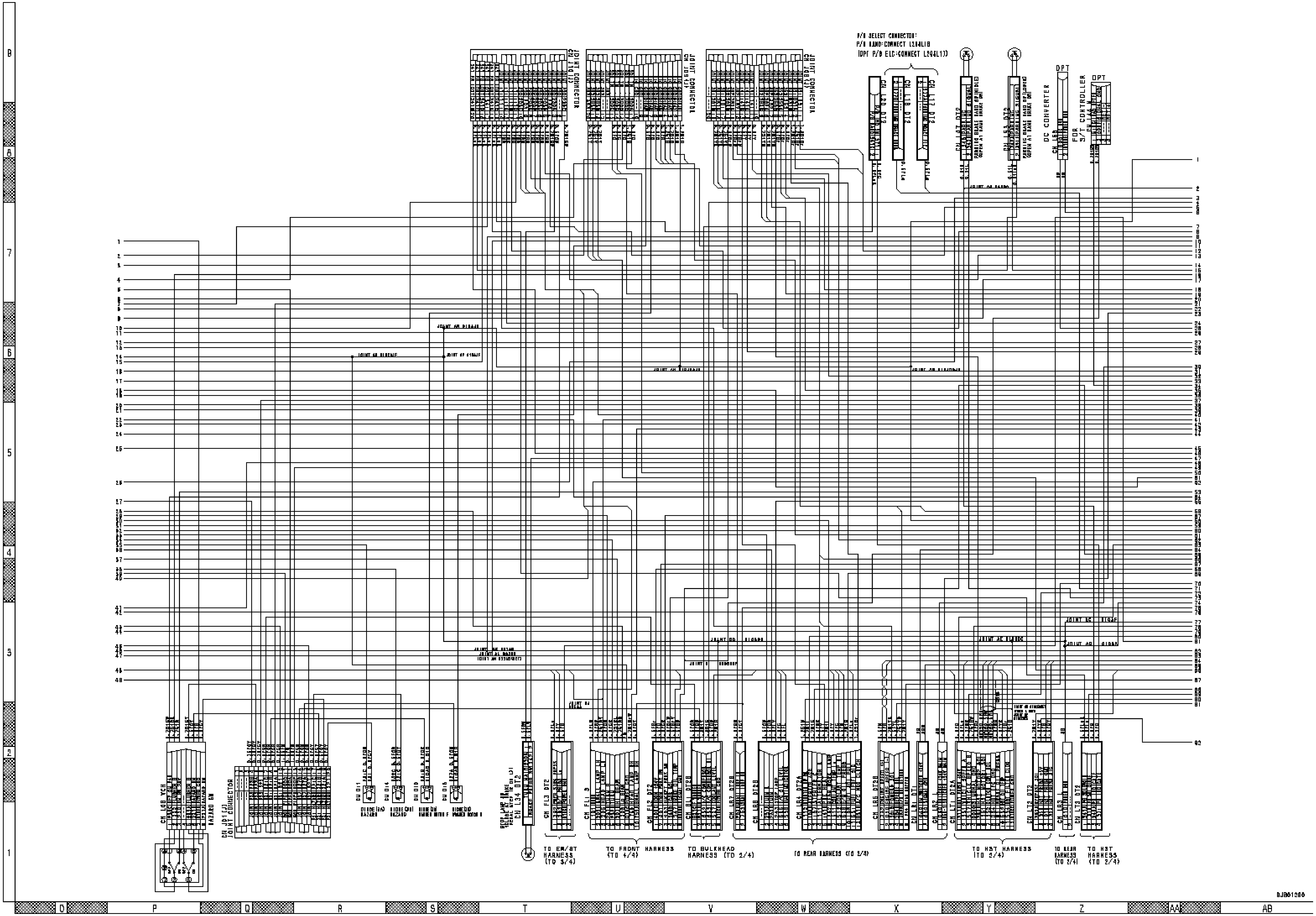
# HYDRAULIC CIRCUIT DIAGRAM

**WA250PT-5**

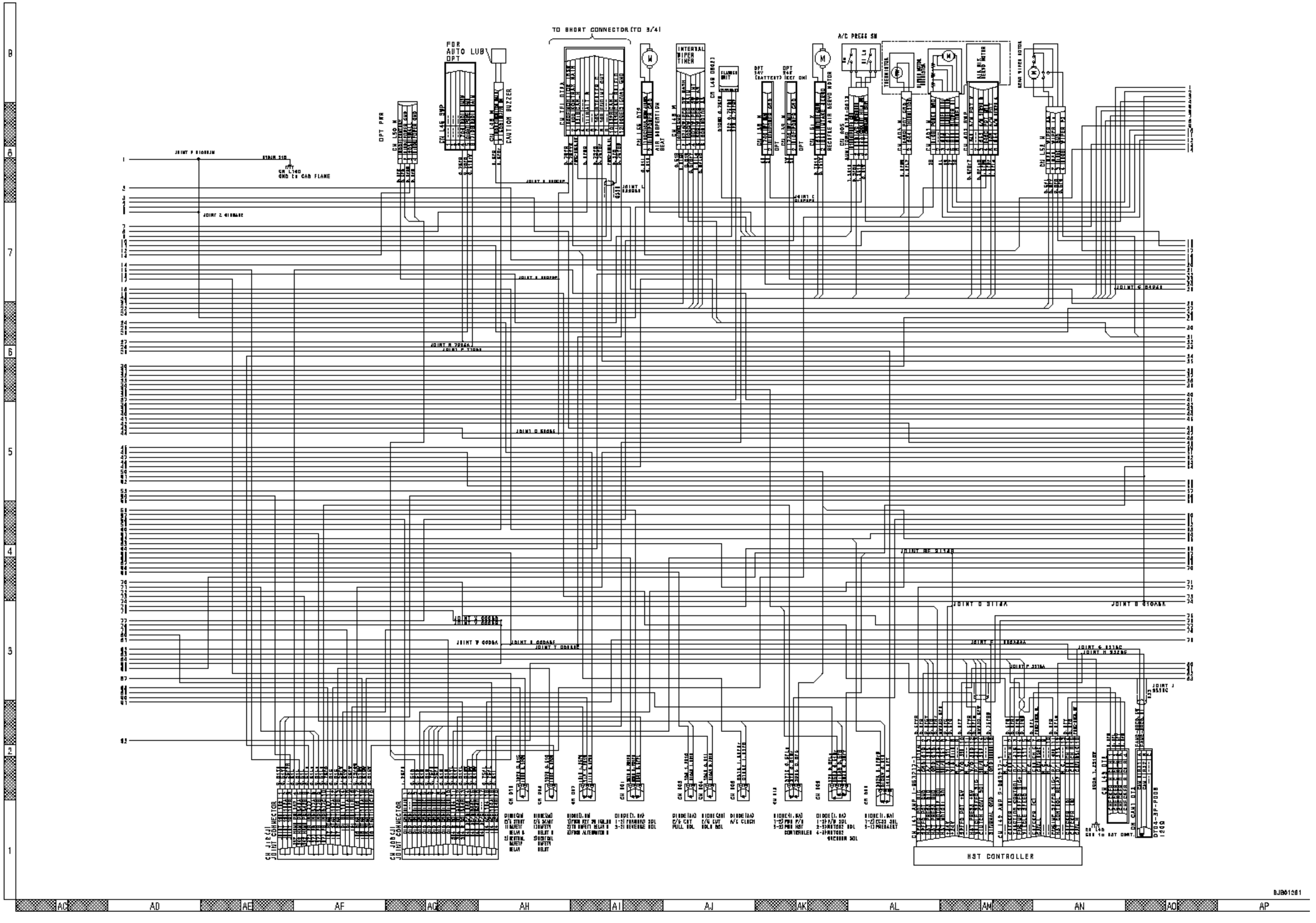


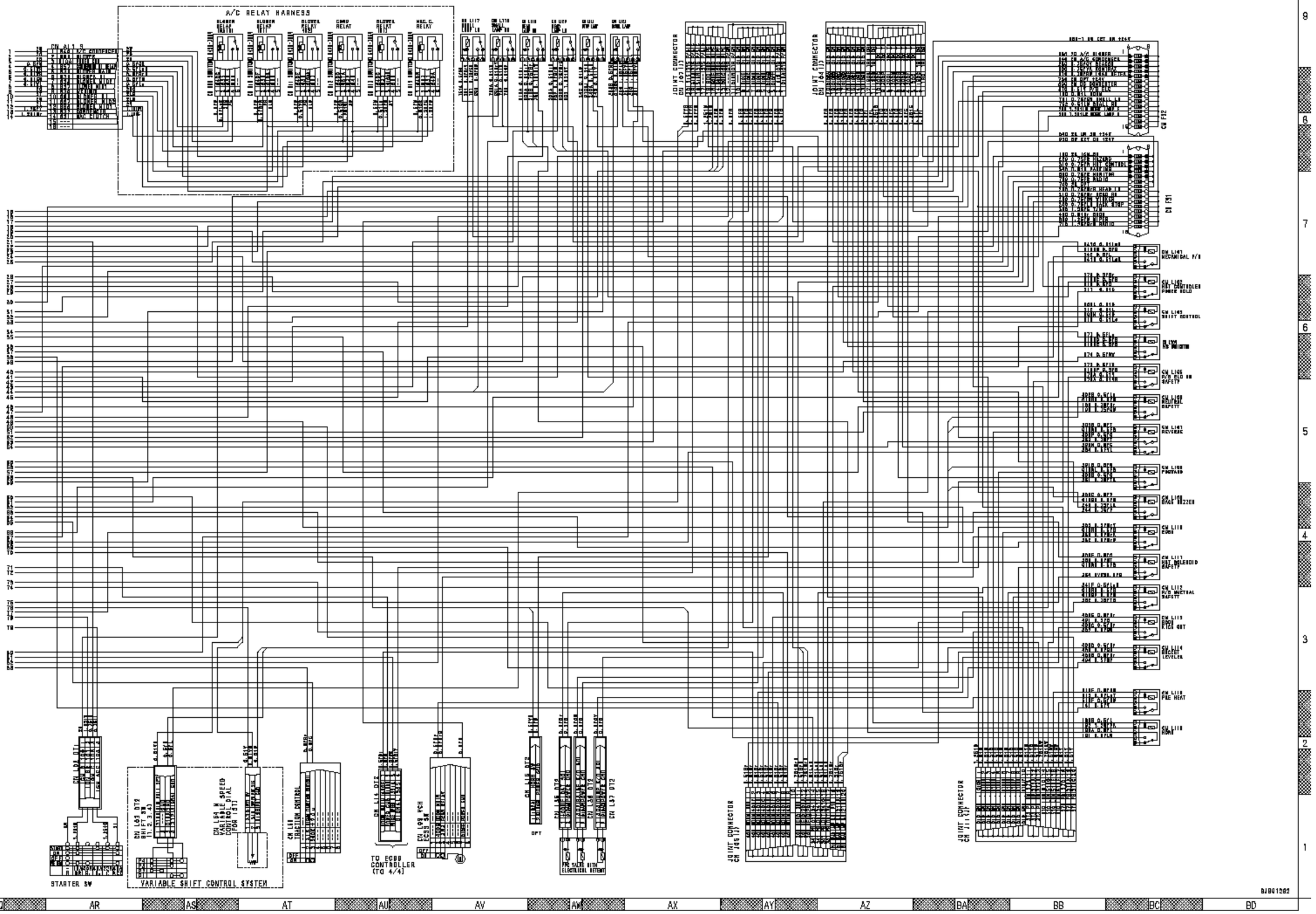
## ELECTRICAL CIRCUIT DIAGRAM 1/4 (1/4)



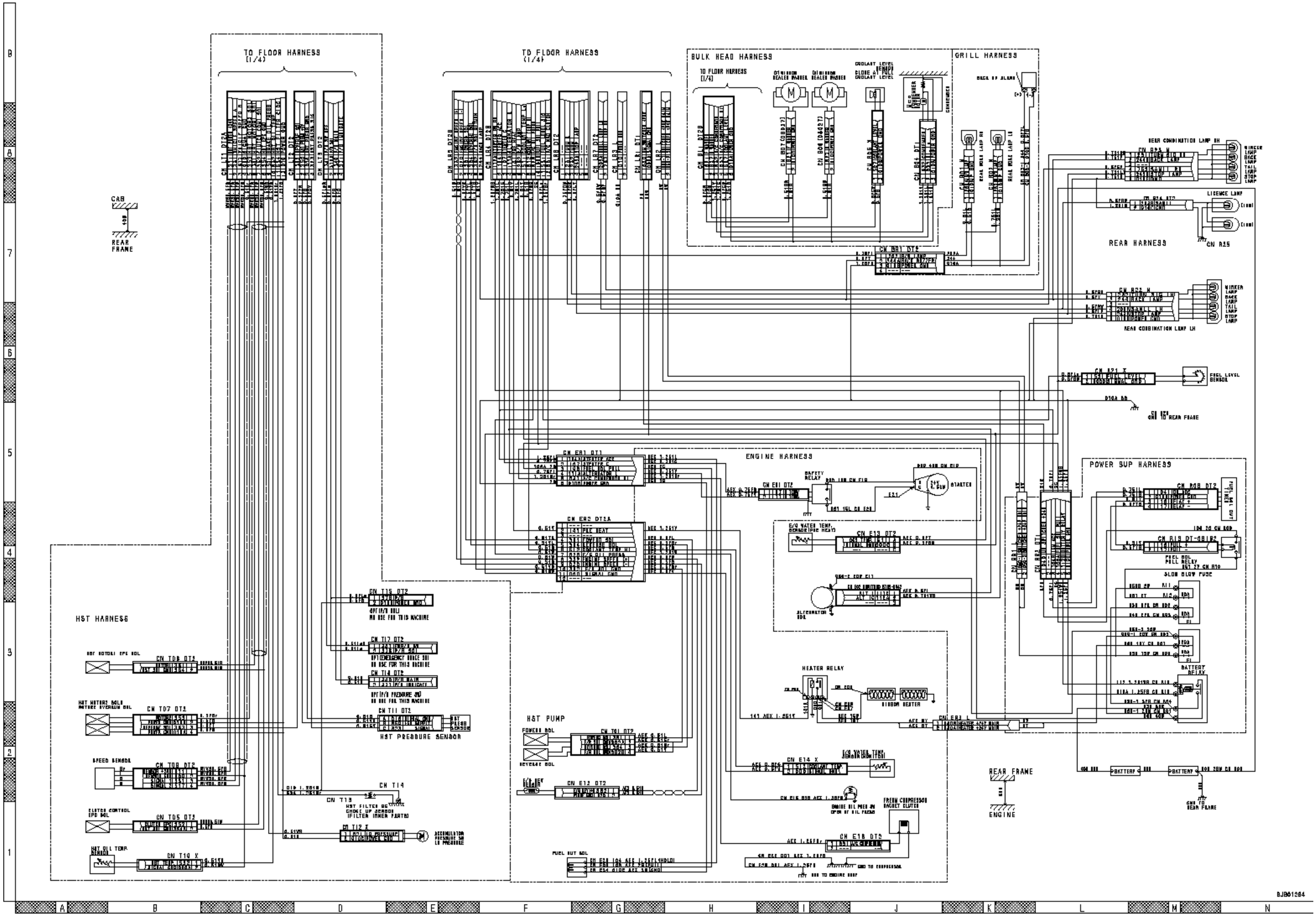

JOINT CONNECTOR CN J10 (J)
JOINT CONNECTOR CN J09 (J)
JOINT CONNECTOR CN J08 (J)
P/B SELECT CONNECTOR:
DC CONVERTER
FOR S/T CONTROLLER
OPT
CN L08 YCH
HAZARD SW
CN JD1 (J) JOINT CONNECTOR
CN L34 DT2
CN FL3 DT2
CN FL1 S
CN FL2 DT2
CN BL1 DT2B
CN LR7 DT2B
CN LR8 DT2B
CN LR4 DT2A
CN LR6 DT2B
CN LR1 DT1
CN LR2 L
CN LT1 DT2A
CN LT2 DT2
CN LR3 L
CN LT3 DT2
TO EM/ST HARNESS (TO 3/4)
TO FRONT HARNESS (TO 4/4)
TO BULKHEAD HARNESS (TO 2/4)
TO REAR HARNESS (TO 2/4)
TO HST HARNESS (TO 2/4)
TO REAR HARNESS (TO 2/4)
TO HST HARNESS (TO 2/4)
BJB01288
O
P
Q
R
S
T
U
V
W
X
Y
Z
AA
AB

## ELECTRICAL CIRCUIT DIAGRAM 1/4 (3/4)

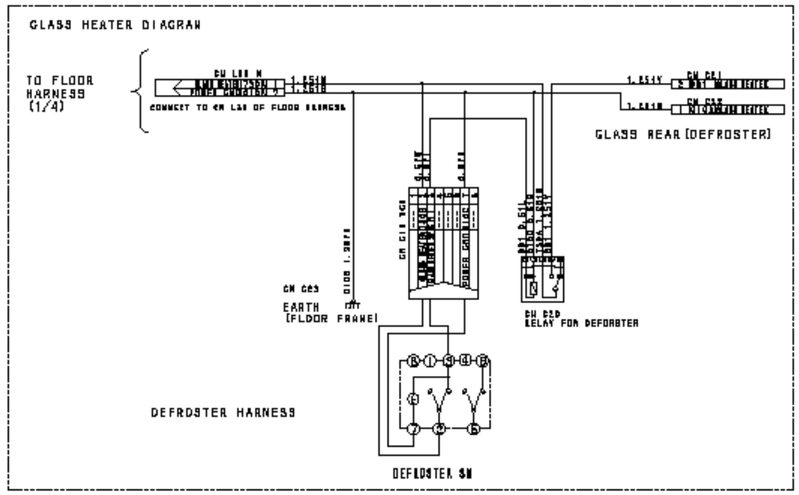


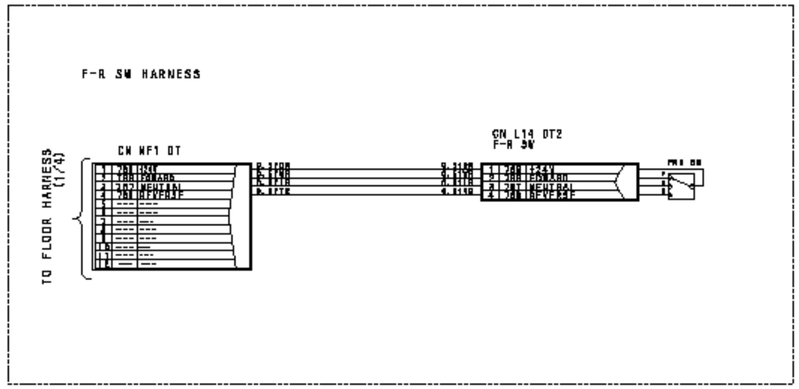

A/C RELAY HARNESS
BLOWER RELAY (NO1)
BLOWER RELAY (NO2)
BLOWER RELAY (NO3)
COMP. RELAY
BLOWER RELAY (NO4)
MAG. C. RELAY
JOINT CONNECTOR CN JG1(1)
JOINT CONNECTOR CN J1(1)
CN L01 9
CN L02 DT2
CN L03 DT2 SHIFT SW (1, 2, 3, 4)
CN L04 N VARIABLE SPEED CONTROL DIAL (FOR 1ST)
CN L05 TRACTION CONTROL
CN L06 DT2
CN L07 DT2
CN L08 DT2
CN L09 YCH ECSS SW
CN L10 DT2
CN L11 DT2
CN L36 DT2
CN L37 DT2
OPT
TO ECSS CONTROLLER (TO 4/4)
PPC VALVE WITH ELECTRICAL DETENT
STARTER SW
VARIABLE SHIFT CONTROL SYSTEM
CN F01
CN F02
SW L101 NEUTRAL P/B
SW L102 KEY CONTROLLER POWER HOLD
SW L103 SHIFT CONTROL
SW L104 P/B BUZZER
SW L105 R/B ELD SW SAFETY
SW L106 HORN SAFETY
SW L107 REVERSE
SW L108 P-NEUTRAL
SW L109 BACK BUZZER
SW L110 CURB
SW L111 HOT SOLENOID SAFETY
SW L112 R/B NEUTRAL SAFETY
SW L113 BODY RISE DET
SW L114 BUCKET LEVELER
SW L115 PRE HEAT
SW L116 HORN
BJBQ1202

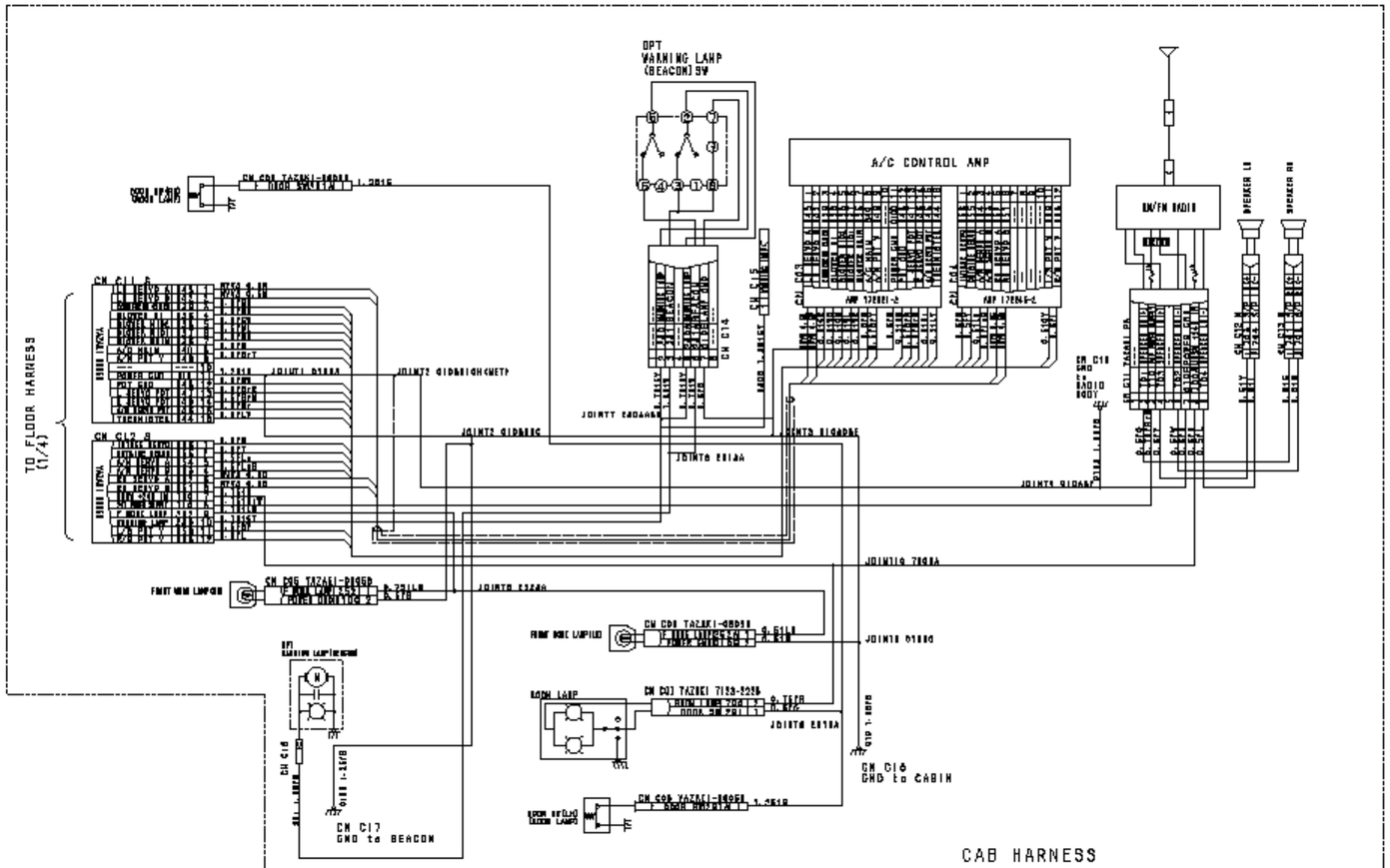
## ELECTRICAL CIRCUIT DIAGRAM 2/4

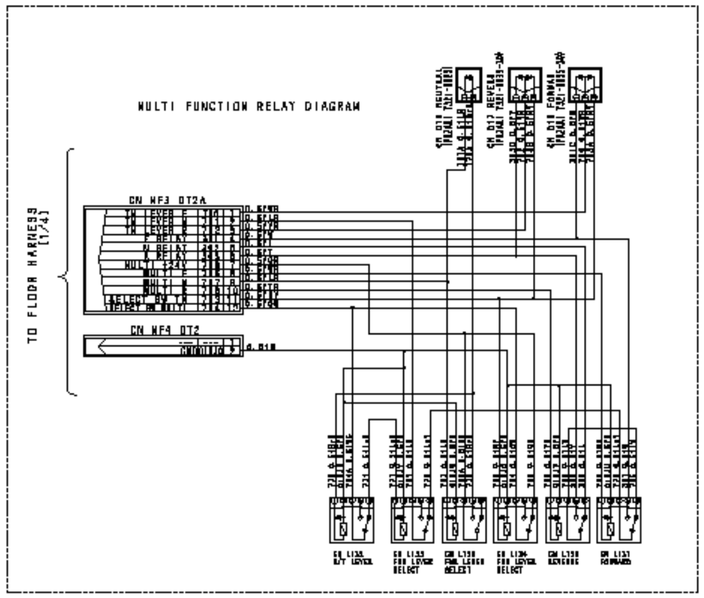


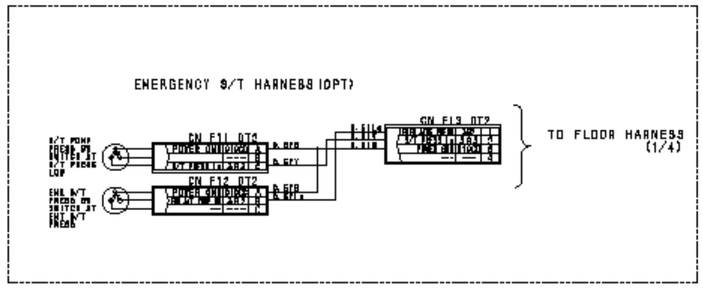
# ELECTRICAL CIRCUIT DIAGRAM 3/4

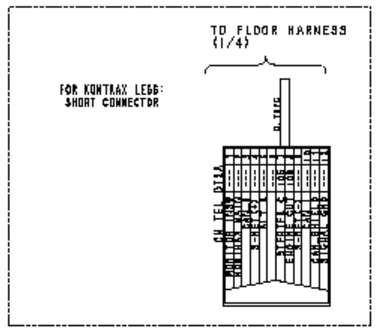


WA250PT-5 WIRING DIAGRAM (FRONT HARNESS, FLOOR HARNESS (ADD ON))

FRONT HARNESS (WA250PT-5)

TO FLOOR HARNESS (1/4)

FRONT COMBINATION LAMP RH

CN HEAD R 3MP

HORN

CN F01

FRONT COMBINATION LAMP LH

CN HEAD L 3MP

HORN

CN F01

PROXIMITY ON BOOM KICKOUT

CN F04 DT2

AXLE OIL TEMP.

CN F14 DT2

OPT(ECSS SOL)

CN F07 DT2

GND TO FRONT FRAME

LINK ANGLE PROXIMITY SW CN F23 DT2

BKT POSITIONER PROXIMITY SWITCH CN F25 DT2

FORK POSITIONER PROXIMITY SWITCH CN F18 DT2

PPC PRESS SW(FOR ECSS) CN F11 DT2

CN F18 DT2

DUMP SPEED SOLENOID VALVE

GND TO REAR FRAME

FLOOR ADD ON HARNESS (WA250PT-5)

TO FLOOR HARNESS (1/4) (CONNECT TO CN L66)

FOR OPT 24V

DUMP SPEED SELECT SWITCH CN L71 YCH

BUCKET FORK SWITCH CN L73 YCH

CN L74 W

CN L70 W

LINK ANGLE CN L76

BUCKET POSI CN L78

CN L78 DT3

TO FLOOR HARNESS (1/4) (FOR OPT 2/4) (CONNECT TO CN L14)

CN L77 DT2

ECSS CONTROLLER (WA250PT-5:OPT)

ECSS CONTROLLER

TO FLOOR HARNESS (1/4) (CONNECT TO CN L14)

CN L14 DT2

ECSS CONTROLLER

ECSS CONTROLLER (WA250-5:OPT)

WA250-5 WIRING DIAGRAM (FRONT HARNESS)

FRONT HARNESS (WA250-5)

TO FLOOR HARNESS (1/4)

GND TO REAR FRAME

FRONT COMBINATION LAMP RH

CN HEAD R 3MP

HORN

CN F01

FRONT COMBINATION LAMP LH

CN HEAD L 3MP

HORN

CN F01

PROXIMITY ON BUCKET POSITIONER

CN F03 DT2

CN F04 DT2

PROXIMITY SW FOR BOOM POSITIONER for 310

CN F14 DT2

AXLE OIL TEMP.

CN F07 DT2

OPT(ECSS SOL)

GND TO FRONT FRAME

BJB5128A