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200E-SM1608-02

SERVICE MANUAL

MINI-CRAWLER CRANE

MK1033C-1

Serial No. MK0003 and up

The parts numbers and lists written in this service manual are the references for the services such as disassembling and assembling.
Be sure to ALWAYS refer to the latest parts catalog (the latest information) before ordering any part, since the parts and the model numbers are subject to change during the endless improvements and changes of our Machine.

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CONTENTS

Item	Page
OVERVIEW	1-1
1. OUTSIDE DRAWING	1-2
1.1 STANDARD SPECIFICATIONS	1-2
1.2 ENGINE AND ELECTRIC MOTOR SPECIFICATIONS	1-3
2. DIMENSIONAL DRAWING OF OUTRIGGER WIDTH	1-4
3. PRINCIPLE SPECIFICATION LIST	1-5
3.1 STANDARD SPECIFICATIONS	1-5
3.2 ENGINE AND ELECTRIC MOTOR SPECIFICATIONS	1-7
4. WORKING RADIUS/LIFTING HEIGHT	1-9
5. RATED TOTAL LOAD CHART	1-18
6. CRANE STANDARD PRESSURE AND OPERATING TIME TABLE	1-19
6.1 OUTRIGGER	1-19
6.2 CRANE	1-19
6.3 TRAVELLING OPERATION	1-19
7. POWER TRANSMISSION SCHEMATIC DIAGRAM	1-20
STRUCTURE AND MAINTENANCE PROCEDURE	2-1
1. HYDRAULIC CIRCUIT DIAGRAM	2-5
2. HYDRAULIC PIPING DIAGRAM	2-7
2.1 CRANE ROTATING PART	2-7
2.1.1 HOSE GUIDE	2-8
2.2 CONTROL LINE A	2-13
2.3 CONTROL LINE B	2-15
2.4 TRAVEL LINE	2-17
2.5 OUTRIGGER LINE	2-19
2.6 PT LINE	2-21
2.7 ELECTRO-HYDRAULIC PIPING ON MACHINE BODY SIDE	2-25
2.8 RETURN MANIFOLD BLOCK	2-27
2.9 OIL COOLER	2-27
2.10 CHECK VALVE	2-28
3. HYDRAULIC TANK	2-29
3.1 AIR BREATHER ASSEMBLY	2-31
3.2 RETURN FILTER	2-32
4. ENGINE ASSEMBLY	2-33
4.1 ENGINE SPECIFICATIONS	2-33
4.2 ENGINE APPEARANCE	2-34
4.3 COMPONENTS OF ENGINE	2-36
4.4 FUEL	2-36
4.4.1 APPROPRIATE USE	2-36
4.4.2 DIESEL FUEL STANDARDS	2-37
4.4.3 BIODIESEL FUEL	2-37
4.4.4 FUEL FEED TO FUEL SYSTEM	2-38
4.5 MAINTENANCE AND INSPECTION	2-39
4.6 TROUBLE SHOOTING	2-40
4.7 FUEL PIPING	2-44
4.7.1 FUEL LINE	2-44
4.7.2 FUEL TANK ASSEMBLY	2-46
4.7.3 FUEL SENDER	2-47
4.8 ENGINE ACCESSORIES	2-48
5. HYDRAULIC PUMP	2-51
5.1 PUMP ASSEMBLY	2-51

https://truckmanualshub.com/

Item	Page
5.2 APPEARANCE AND SPECIFICATIONS (STANDARD PUMP)	2-52
5.3 INTERNAL STRUCTURE	2-53
5.4 OPERATING PRINCIPLES	2-54
5.5 FAILURE CAUSE AND COUNTERMEASURE	2-56
6. TRAVEL CONTROL VALVE	2-57
6.1 APPEARANCE AND SPECIFICATIONS	2-57
6.2 INTERNAL STRUCTURE	2-58
6.3 INSPECTION AND ADJUSTMENT	2-59
6.4 FAILURE CAUSE AND COUNTERMEASURE	2-60
7. TRAVELING MOTOR	2-61
7.1 APPEARANCE AND SPECIFICATIONS	2-61
7.2 INTERNAL STRUCTURE	2-62
7.3 OPERATING PRINCIPLES	2-63
7.4 OPERATING PRINCIPLES	2-64
7.4.1 REDUCER	2-64
7.4.2 HYDRAULIC MOTOR	2-65
7.4.3 HYDRAULIC VALVE (COUNTER-BALANCE VALVE)	2-66
7.4.4 PARKING BRAKE	2-67
7.5 PRECAUTIONS FOR USE	2-68
7.6 FAILURES AND COUNTERMEASURES	2-70
8. CRANE CONTROL VALVE	2-71
8.1 OUTSIDE DRAWING	2-71
8.2 OVERVIEW	2-72
8.3 HYDRAULIC CIRCUIT DIAGRAM	2-73
8.4 ACTIONS OF EACH SECTION	2-74
8.5 FAILURE CAUSE AND COUNTERMEASURE	2-81
9. OUTRIGGER SELECT VALVE	2-82
9.1 APPEARANCE AND SPECIFICATIONS	2-82
9.2 INTERNAL STRUCTURE	2-84
9.3 INSPECTION OF VALVES	2-85
9.4 METHODS FOR OPERATION ADJUSTMENT	2-86
9.5 OUTRIGGER CHANGE-OVER SWITCH	2-87
10. ROTARY JOINT	2-88
10.1 APPEARANCE AND SPECIFICATIONS	2-88
10.2 INTERNAL STRUCTURE	2-90
10.3 ROTARY BRUSH	2-91
11. HOOK	2-97
11.1 INSPECTION OF HOOK	2-97
12. BOOM	2-98
12.1 MAIN BOOM	2-98
12.2 JIB	2-101
12.3 JIB HEAD	2-103
13. TELESCOPIC AND DERRICK CYLINDERS	2-104
13.1 MAIN TELESCOPIC CYLINDER	2-104
13.2 JIB TELESCOPIC CYLINDER	2-106
13.2.1 JIB NO.1 TELESCOPIC CYLINDER	2-108
13.2.2 JIB NO.2 TELESCOPIC CYLINDER	2-110
13.3 JIB TELESCOPIC CYLINDER HYDRAULIC SCHEMATIC DIAGRAM	2-112
13.4 COUNTER BALANCE VALVE (FOR TELESCOPIC AND DERRICK CYLINDERS)	2-113
13.4.1 STRUCTURAL DRAWING	2-113
13.4.2 FAILURE CAUSE AND COUNTERMEASURE	2-113
13.4.3 WORKING DIAGRAM	2-114
13.5 SEQUENCE VALVE (FOR TELESCOPIC CYLINDER)	2-115
13.5.1 STRUCTURAL DRAWING	2-115

https://truckmanualshub.com/

Item	Page
13.5.2 WORKING DIAGRAM	2-115
13.6 MECHANICAL CHECK VALVE (FOR TELESCOPIC CYLINDER)	2-116
13.7 MAIN DERRICK CYLINDER ASSEMBLY	2-117
13.7.1 MAIN LEFT-HAND DERRICK CYLINDER	2-119
13.7.2 MAIN RIGHT-HAND DERRICK CYLINDER	2-121
13.8 JIB DERRICK CYLINDER ASSEMBLY	2-123
13.8.1 JIB DERRICK CYLINDER	2-124
14. SLEWING DEVICE	2-126
14.1 OUTSIDE DRAWING	2-126
14.1.1 TOLERANCE OF LOOSENESS HEIGHT OF SLEWING BEARING	2-127
14.2 INTERNAL STRUCTURE AND SPECIFICATIONS OF REDUCTION GEARS	2-128
14.3 APPEARANCE AND SPECIFICATIONS OF HYDRAULIC MOTOR	2-129
14.4 INTERNAL STRUCTURE OF HYDRAULIC MOTOR	2-130
14.5 FAILURE CAUSE AND COUNTERMEASURE OF SLEWING DEVICE	2-131
15. OUTRIGGER	2-132
15.1 APPEARANCE OF OUTRIGGER ON REAR RIGHT SIDE	2-132
15.2 APPEARANCE OF OUTRIGGER ON FRONT RIGHT SIDE	2-134
15.3 APPEARANCE OF OUTRIGGER ON FRONT LEFT SIDE	2-136
15.4 APPEARANCE OF OUTRIGGER ON REAR LEFT SIDE	2-138
16. OUTRIGGER CYLINDER	2-140
16.1 APPEARANCE AND SPECIFICATIONS	2-140
16.2 INTERNAL STRUCTURAL DRAWING	2-142
16.3 DOUBLE PILOT CHECK VALVE	2-144
17. ELECTRIC CIRCUIT DIAGRAM	2-145
18. ELECTRIC SYSTEM	2-146
18.1.1 WIRE HARNESS OF MACHINE BODY (1)	2-146
18.1.2 WIRE HARNESS OF MACHINE BODY (2)	2-148
18.2 CONTROL UNIT ASSEMBLY	2-149
19. CONTROL ASSEMBLY	2-151
19.1 CONTROLLER	2-151
19.2 MONITOR	2-156
19.2.1 STRUCTURE OF MONITOR SCREEN	2-156
19.2.2 USER MODE	2-169
19.2.3 SERVICE MODE	2-176
19.2.4 LIST OF DATA LOGGER DISPLAY CONTENTS	2-180
19.2.5 LIST OF CONTROLLER INPUT MONITORING	2-181
19.2.6 LIST OF CONTROLLER ANALOG INPUT / OUTPUT MONITORING	2-182
19.2.7 LIST OF ERROR CODES	2-183
20. PROCEDURE FOR DISASSEMBLING AND REASSEMBLING BOOM	2-184
20.1 REMOVING WIRE HARNESS CONNECTORS	2-184
20.2 REMOVING HYDRAULIC HOSES	2-185
20.3 PREPARING HOISTING ACCESSORIES	2-186
20.4 REMOVING THE ROD PIN AND FOOT PIN OF MAIN DERRICKING CYLINDER	2-187
20.5 REMOVING THE LINK ASSEMBLY	2-188
20.6 DISASSEMBLING THE MAIN BOOM	2-189
20.6.1 REMOVING THE MAIN BOOM NO. 1	2-189
20.6.2 REMOVING THE MAIN BOOM NO. 2	2-190
20.6.3 REMOVING THE TELESCOPIC CYLINDER	2-191
20.7 ASSEMBLING PROCEDURE FOR MAIN BOOM	2-192
20.7.1 ADJUSTING THE MAIN BOOM EXTENDING/CONTRACTING WIRE ROPES	2-192
20.8 DISASSEMBLING THE JIB	2-194
20.8.1 REMOVING THE JIB NO. 1	2-194
20.8.2 REMOVING THE JIB NO. 2	2-195
20.8.3 REMOVING THE TELESCOPIC CYLINDER	2-196

Item	Page
20.9 DISASSEMBLING PROCEDURE FOR THE MACHINE WITH OPTIONAL WINCH	2-197
20.9.1 REMOVING THE WINCH WIRE	2-198
20.9.2 REMOVING THE WINCH HYDRAULIC HOSE	2-199
21. PROCEDURE FOR DISASSEMBLING THE VEHICLE BODY	2-200
21.1 PROCEDURE FOR DISASSEMBLING THE OUTRIGGER TOP AND INNER BOXES	2-200
21.2 REMOVAL OF ELECTRIC MOTOR UNIT	2-202
21.3 HOW TO REMOVE AND MOUNT A COUNTERWEIGHT	2-206
21.3.1 REMOVING THE COUNTERWEIGHT	2-206
21.3.2 MOUNTING THE COUNTERWEIGHT	2-208
SAFETY DEVICE	3-1
1. MOMENT LIMITER	3-2
1.1 CONFIGURATION OF MOMENT LIMITER	3-2
1.2 BOOM DISPLACEMENT DETECTION	3-3
1.2.1 TOTAL LENGTH REEL	3-5
1.2.2 ANGLE DETECTOR	3-7
1.2.3 ANGLE METER (360°)	3-9
1.3 LOAD DETECTION	3-11
1.3.1 PRESSURE AND OIL TEMPERATURE SENSOR	3-12
1.4 LEVER DETECTION	3-14
1.5. COMPONENTS OF MONITOR	3-15
1.6 MOMENT LIMITER CALIBRATION PROCEDURE	3-16
1.7 SLEW ANGLE CALIBRATION PROCEDURE	3-22
2. OUTRIGGER SAFETY DEVICE	3-24
2.1 SETTING DETECTION	3-24
2.1.1 SETTING DETECTION ASSEMBLY	3-24
2.1.2 WORKING OF SETTING DETECTION	3-25
2.2 OR STOWAGE DETECTION	3-26
2.2.1 OR STOWAGE DETECTION ASSEMBLY	3-26
2.2.2 WORKING OF OR STOWAGE DETECTION DEVICE	3-27
2.3 OR POSITION DETECTION	3-28
2.3.1 OR POSITION DETECTION ASSEMBLY	3-28
2.3.2 WORKING OF OR POSITION DETECTION DEVICE	3-29
2.4 OR OPEN DETECTION	3-30
2.4.1 OR OPEN DETECTION ASSEMBLY	3-30
2.4.2 WORKING OF OR OPEN DETECTOR	3-31
2.5 OR EXTENSION DETECTION	3-32
2.5.1 OR EXTENSION DETECTION ASSEMBLY	3-32
2.5.2 WORKING OF OR EXTENSION DETECTION DEVICE	3-33
2.6 SLEWING DIRECTION DETECTION	3-34
2.6.1 SLEWING DIRECTION DETECTION ASSEMBLY	3-34
2.6.2 WORKING OF SLEWING DIRECTION DETECTION	3-35
3. TIP-OVER WARNING DEVICE	3-36
3.1 INSTALLATION POSITION	3-36
3.2 APPEARANCE AND SPECIFICATION OF DEVICE	3-37
REMOTE CONTROL	4-1
1. COMPONENTS OF THE TRANSMITTER	4-2
1.1 UPPER PART COMPONENTS OF THE TRANSMITTER	4-2
1.2 LOWER PART COMPONENTS OF THE TRANSMITTER	4-2
1.3 DESCRIPTION OF COMPONENTS OF THE TRANSMITTER	4-3
1.4 DIAGNOSIS OF THE TRANSMITTER STATUS LED (D1)	4-5
2. COMPONENTS OF THE RECEIVER	4-8
2.1 COMPONENTS OF THE RECEIVER	4-8
2.2 INSPECTION AFTER TURNING ON THE TRANSMITTER	4-10
2.3 INSPECTION OF RECEIVER	4-10

https://truckmanualshub.com/

Item	Page
3. SAFETY DEVICE OF REMOTE CONTROLLER	4-11
4. HANDLING BATTERY	4-12
4.1 REPLACEMENT TIMING OF BATTERY	4-12
4.2 REPLACEMENT METHOD OF BATTERY	4-12
4.3 CHARGING METHOD OF BATTERY	4-13
5. TROUBLESHOOTING	4-14
5.1 BEFORE TROUBLESHOOTING	4-14
5.2 ERRORS IN THE REMOTE CONTROLLER	4-15
6. ELECTRICAL WIRING DIAGRAM FOR REMOTE CONTROLLER	4-17
7. PRINCIPLE SPECIFICATION LIST	4-18
8. SERVICE LOCATIONS	4-19
ELECTRIC MOTOR	5-1
1. ELECTRICAL MOTOR UNIT ASSEMBLY	5-2
1.1 POWER UNIT	5-5
1.2 EXTERNAL APPEARANCE / SPECIFICATION OF THE PUMP	5-6
2. CONTROL PANEL ASSEMBLY (CE SPECIFICATION 380V)	5-7
2.1 INVERTER PANEL	5-8
2.2. EXTERNAL APPEARANCE AND NAME OF EACH SECTION	5-9
2.3 NAME AND CONTENT OF THE DIGITAL OPERATOR	5-9
2.4 DETAIL OF INVERTER SET ITEMS	5-10
2.5 ALARM DISPLAY AND COUNTERMEASURE	5-13
2.6 LIST OF ALARM CODES	5-15
2.7 TROUBLESHOOTING	5-19
2.8 MAINTENANCE AND INSPECTION	5-25
2.9 NOTE ABOUT DISPOSAL	5-28
3. POWER SUPPLY BOX	5-29
4. ELECTRIC DIAGRAM	5-31
5. ELECTRIC MOTOR BOX HARNESS	5-33
OPTIONAL WINCH	6-1
1. OPTIONAL WINCH	6-1
1.1 WINCH MACHINE SECTION	6-2
1.2 WINCH ACCESSORIES	6-3
1.3 WINCH UNIT	6-5
1.3.1 APPEARANCE AND SPECIFICATION OF WINCH MOTOR	6-7
1.3.2 INTERNAL STRUCTURE OF WINCH MOTOR	6-8
1.3.3 FAILURE CAUSE AND COUNTERMEASURE	6-10
1.3.4 PRECAUTIONS IN WINCH MOTOR	6-10
1.4 OVER LOWERING DETECTION DEVICE	6-12
1.5 IRREGULAR WINDING PREVENTION ROLLER	6-12
2. OVER-HOISTING PREVENTION DEVICE ASSEMBLY	6-13
2.1 OVER-HOISTING PREVENTION DEVICE	6-14
3. INSTALLATION OF WIRE ROPE	6-15
4. WORKING RADIUS/LIFTING HEIGHT OF ONE FALL WINCH	6-17
5. SPECIFICATIONS OF OPTIONAL WINCH	6-18

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OVERVIEW

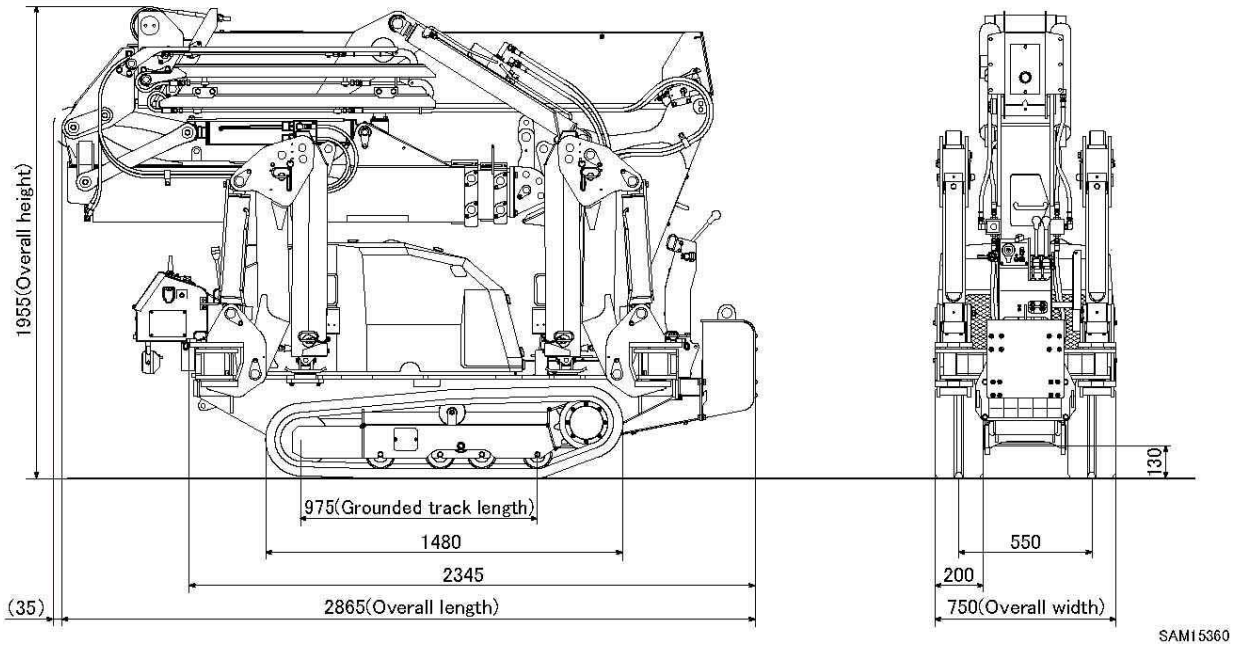
1. OUTSIDE DRAWING	1-2
2. DIMENSIONAL DRAWING OF OUTRIGGER WIDTH	1-4
3. PRINCIPLE SPECIFICATION LIST	1-5
4. WORKING RADIUS/LIFTING HEIGHT	1-9
5. RATED TOTAL LOAD CHART	1-18
6. CRANE STANDARD PRESSURE AND OPERATING TIME TABLE	1-19
7. POWER TRANSMISSION SCHEMATIC DIAGRAM	1-20

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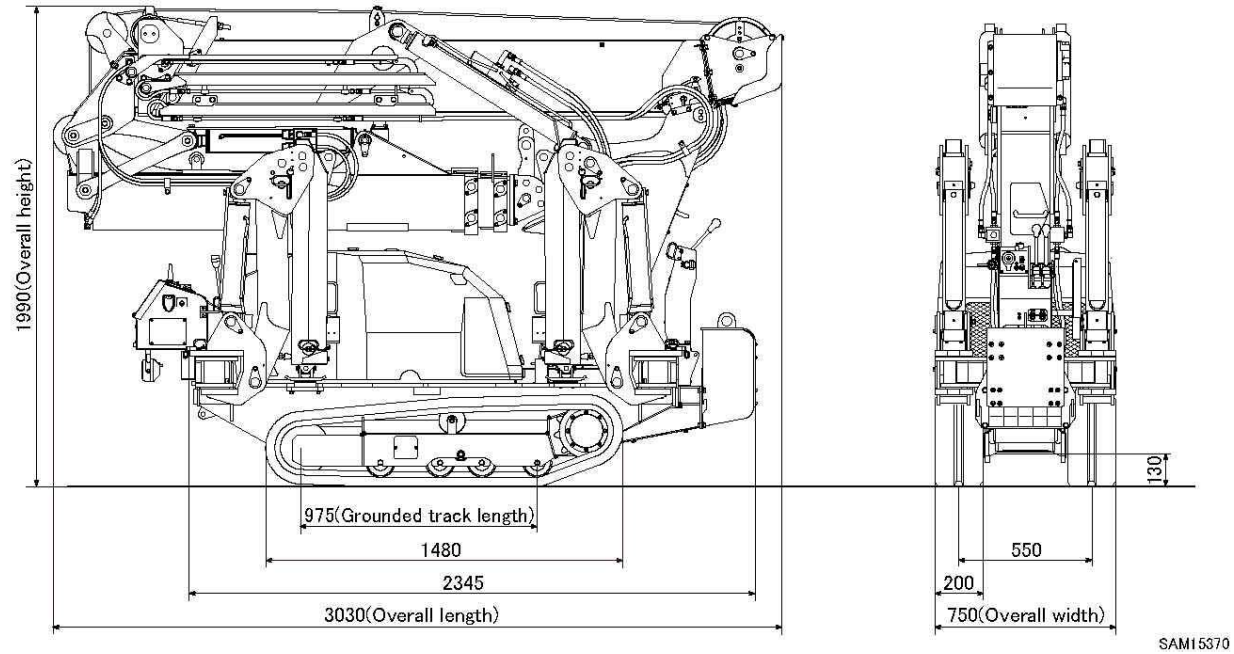
1. OUTSIDE DRAWING

1.1 STANDARD SPECIFICATIONS

Standard specifications



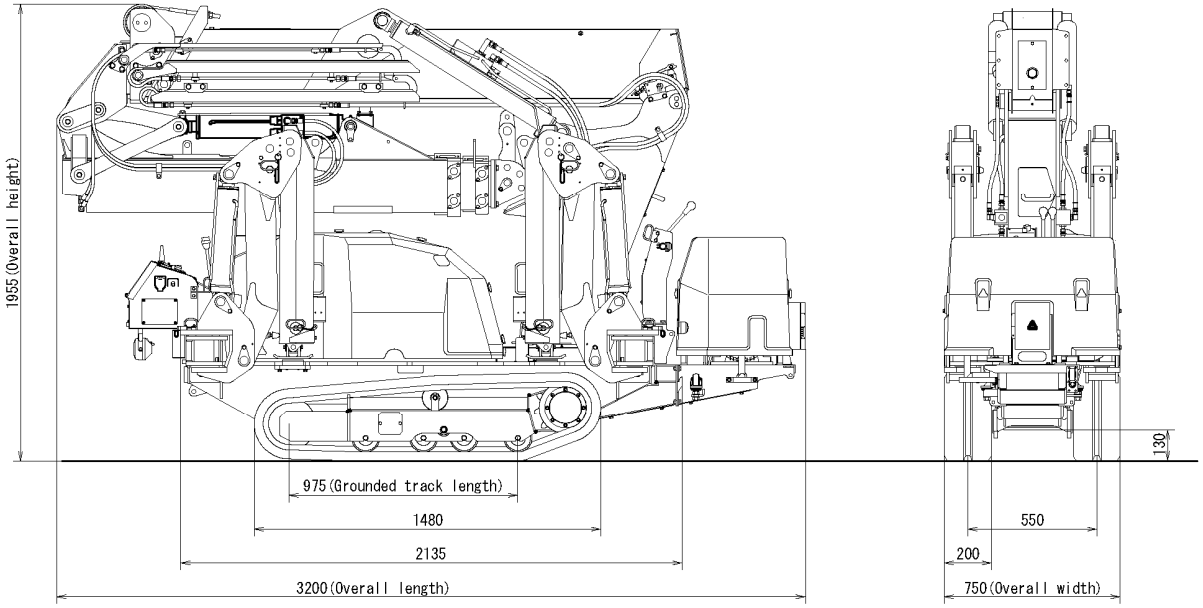
Standard specifications with winch attached



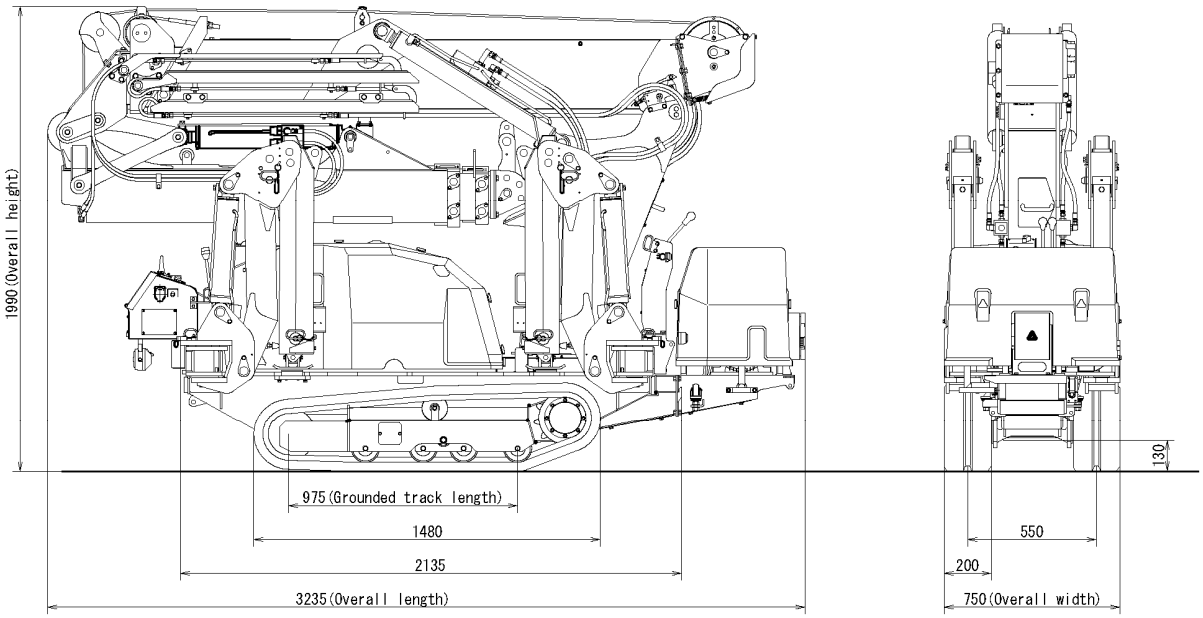
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1.2 ENGINE AND ELECTRIC MOTOR SPECIFICATIONS

Electric Motor Specifications

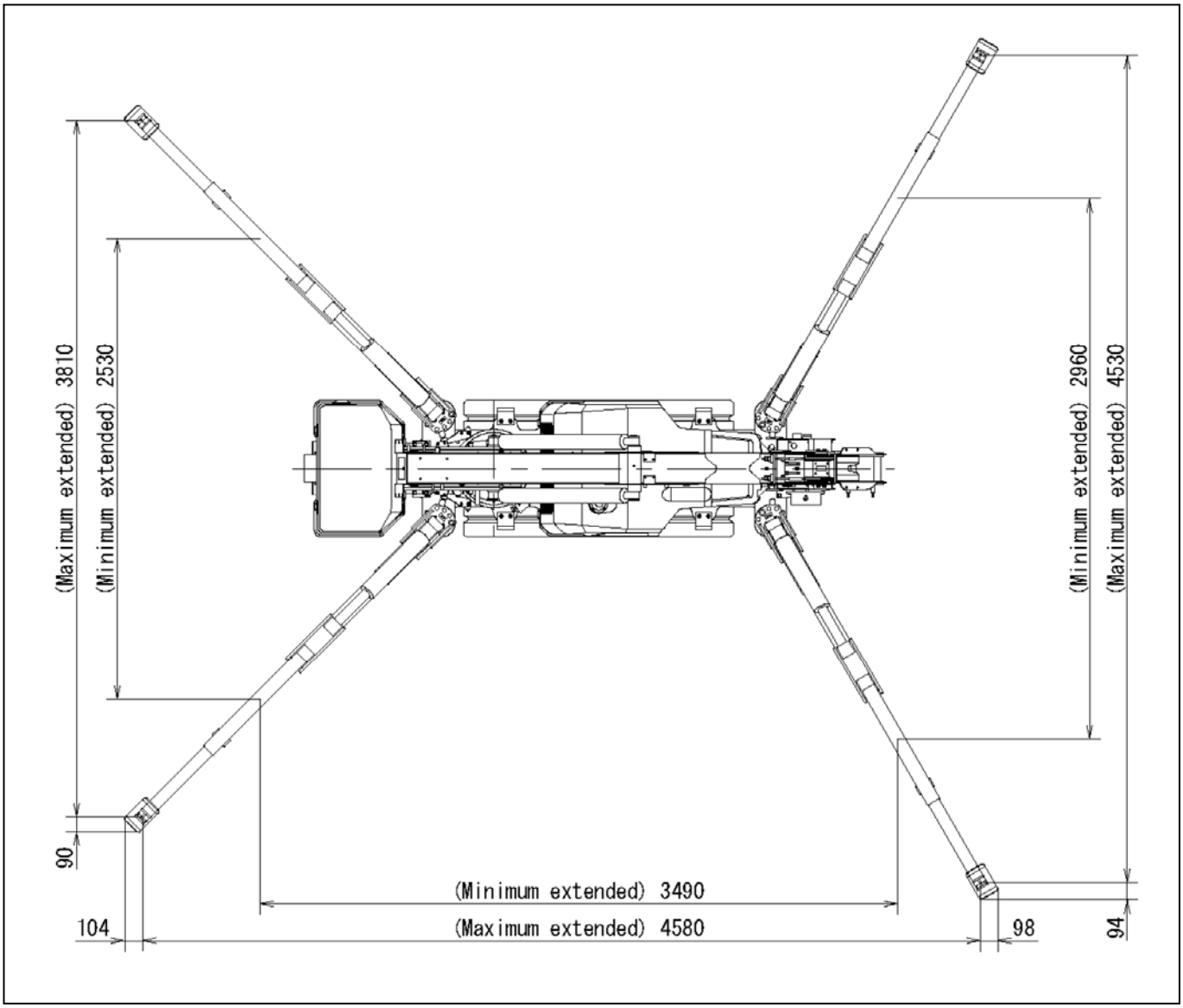


Electric Motor Specifications with winch attached



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2. DIMENSIONAL DRAWING OF OUTRIGGER WIDTH



3. PRINCIPLE SPECIFICATION LIST

3.1 STANDARD SPECIFICATIONS

Equipment/Item			MK1033CW-1
Weight and dimensions		Machine mass	2290 kg [2390 kg]
		Overall length × width × height	2865 mm × 750 mm × 1955 mm [3030 mm × 750 mm × 1990 mm]
		Distance between center idler and sprocket	975 mm
		Track gauge	550 mm
		Width of crawler	200 mm
		Minimum ground height	130 mm
Performance		Maximum rated total load × working radius	0.995 t × 1.3 m (main boom 2 sections 80°/jib 1 section 60°)
		Maximum working radius	9.9 m
		Maximum lifting height above ground	11.3 m
[Winch system]		Type	Swash plate type axial piston motor, epicycle reduction gear, friction disc type brake
		Hook hoist speed	37.8 m/min (5 layers, 1 part of line)
		Hoist wire rope	IWRC 6 × WS (26) 0/0 B type φ8 × 73 m
Main boom	Telescoping system	Type	Telescoping hydraulic cylinder × 1 + wire rope telescoping system × 1
		Type of boom	Automatic hydraulic 3-section pentagonal telescopic 2 to 3 section: simultaneous telescoping
		Boom length 1st section	2590 mm
		Boom length 2nd section	4310 mm
		Boom length 3rd section	6030 mm
		Boom extending speed	3.44 m/15.5 sec
	Derricking system	Derricking type	Hydraulic double acting cylinder, direct acting type × 2
		Boom derricking angle/time	0 to 80°/36.0 sec (main boom 1st section/jib 1st section)
Jib	Telescoping system	Jib type	Telescoping hydraulic cylinder × 2
		Jib type	Automatic hydraulic 3-section pentagonal telescopic
		Jib length 1st section	1876 mm
		Jib length 2nd section	3006 m
		Jib length 3rd section	4111 mm
		Jib extending speed	2.235 m/21.5 sec
	Derricking system	Derricking type	Hydraulic double acting cylinder, direct acting type × 1 + link mechanism
		Jib derricking angle/time	-100 to 80°/26.0 sec (main boom 80°/jib 1st section)
Slewing system		Type	Swing bearing support, trochoid motor driven, worm, spur gear reduction, worm self-lock
		Slewing angle/speed	360° continuous/70 sec
Outrigger system		Type	1st stage with flexible stay damper, 2nd stage manual pullout, hydraulic cylinder direct acting type
		Max extended width	(Right/left) 4580 mm × (Front) 4530 mm × (Rear) 3810 mm
Travelling system		Type	Hydraulic motor driven, Step-less speed changer
		Travel speed	0 to 2.0 km/h
		Grade ability	15°
		Ground pressure	52.6 kPa (0.54 kgf/cm²)

[Winch specification]

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Equipment/Item		MK1033CW-1
Hydraulic system	Hydraulic pump	Variable piston pump (6 cc/rev × 2)
	Rated pressure	20.6 MPa (210 kgf/cm²)
	Hydraulic oil tank capacity	20 L
Engine	Model	Yanmar 2TNV70-NMBA
	Type	4 cycle, vertical type, water cooled in-line 2-cylinder, precombustion chamber type
	Displacement	0.569 L (569 cc)
	Rated output (continuous)	7.4 kW/2500 min^{-1} (10.1 PS/2500 rpm)
	Fuel tank capacity	12 L
Battery	Model	55B24R
Safety device	[Over hoist detector and stop system], [over un-winding detector], overload preventive device and alarm buzzer, hydraulic safety valve, automatic hydraulic lock device, [wire rope latch], levelling instrument, machine body inclination alarm, working status lamp, crane outrigger interlock device, outrigger un-set lamp, slewing direction limiter, main boom and jib retracting and extending interlock	

[Winch specification]

3.2 ENGINE AND ELECTRIC MOTOR SPECIFICATIONS

Equipment/Item			MK1033CE-1 [MK1033CWE-1]
Weight and dimensions		Machine mass	2270 kg [2370 kg]
		Overall length × width × height	3200 mm ×750 mm ×1955 mm [3225 mm × 750 mm × 1990 mm]
		Distance between center idler and sprocket	975 mm
		Track gauge	550 mm
		Width of crawler	200 mm
		Minimum ground height	130 mm
Performance		Maximum rated total load × working radius	0.995 t × 1.3 m (main boom 2nd stage 80°/jib 1st stage 60°)
		Maximum working radius	9.9 m
		Maximum lifting height above ground	11.3 m
[Winch system]		Type	Swash plate axial piston motor, epicycle reduction gear, friction disc type brake
		Hook hoist speed	37.8 m/min (5 layer 1 part of line)
		Hoist wire rope	IWRC 6 × WS (26) 0/0 B type φ8 × 73 m
Main boom	Telescoping system	Type	Telescoping hydraulic cylinder 1 + wire rope telescoping systems 1
		Type of boom	Fully automatic 3-section pentagonal telescope 2 and 3 stages simultaneous telescoping
		Boom length 1st stage	2590 mm
		Boom length 2nd stage	4310 mm
		Boom length 3rd stage	6030 mm
		Boom extending speed	3.44 m/15.5 sec
	Derricking system	Derricking type	Hydraulic double acting cylinder, direct acting type × 2
		Boom derrick angle/time	0° to 80°/36.0 sec (main boom 1st stage/jib 1st stage)
Jib	Telescoping system	Jib type	Telescoping hydraulic cylinder × 2
		Jib type	Automatic hydraulic 3-section pentagonal telescopic
		Jib length 1st stage	1876 mm
		Jib length 2nd stage	3006 mm
		Jib length 3rd stage	4111 mm
		Jib telescoping speed	2.235 m/21.5 sec
	Derricking system	Derricking type	Hydraulic double acting cylinder, direct acting type × 1 + link mechanism
		Jib derrick angle/time	-100 to 80°/26.0 sec (main boom 80°/jib 1st stage)
Slewing system		Type	Swing bearing support, hydraulic motor driven, worm, spur gear reduction, worm self-lock
		Slewing angle/ speed	360° (continuous)/ 70 sec
Outrigger system		Type	1st stage with flexible stay damper, 2nd stage manual pullout, hydraulic cylinder direct acting type
		Max extended width	(Right/left) 4580 mm × (Rear) 4530 mm × (Front) 3810 mm
Travelling system		Type	Hydraulic motor driven, Step-less speed changer
		Travel speed	0 to 2.0 km/h
		Grade ability	15°
		Ground pressure	53.3 kPa (0.537 kgf/cm^2)
Hydraulic system		Hydraulic pump	Variable piston pump (6 cc/rev × 2)
		Rated pressure	20.6 MPa (210 kgf/ cm^2)
		Hydraulic oil tank capacity	20 L

[Winch specification]

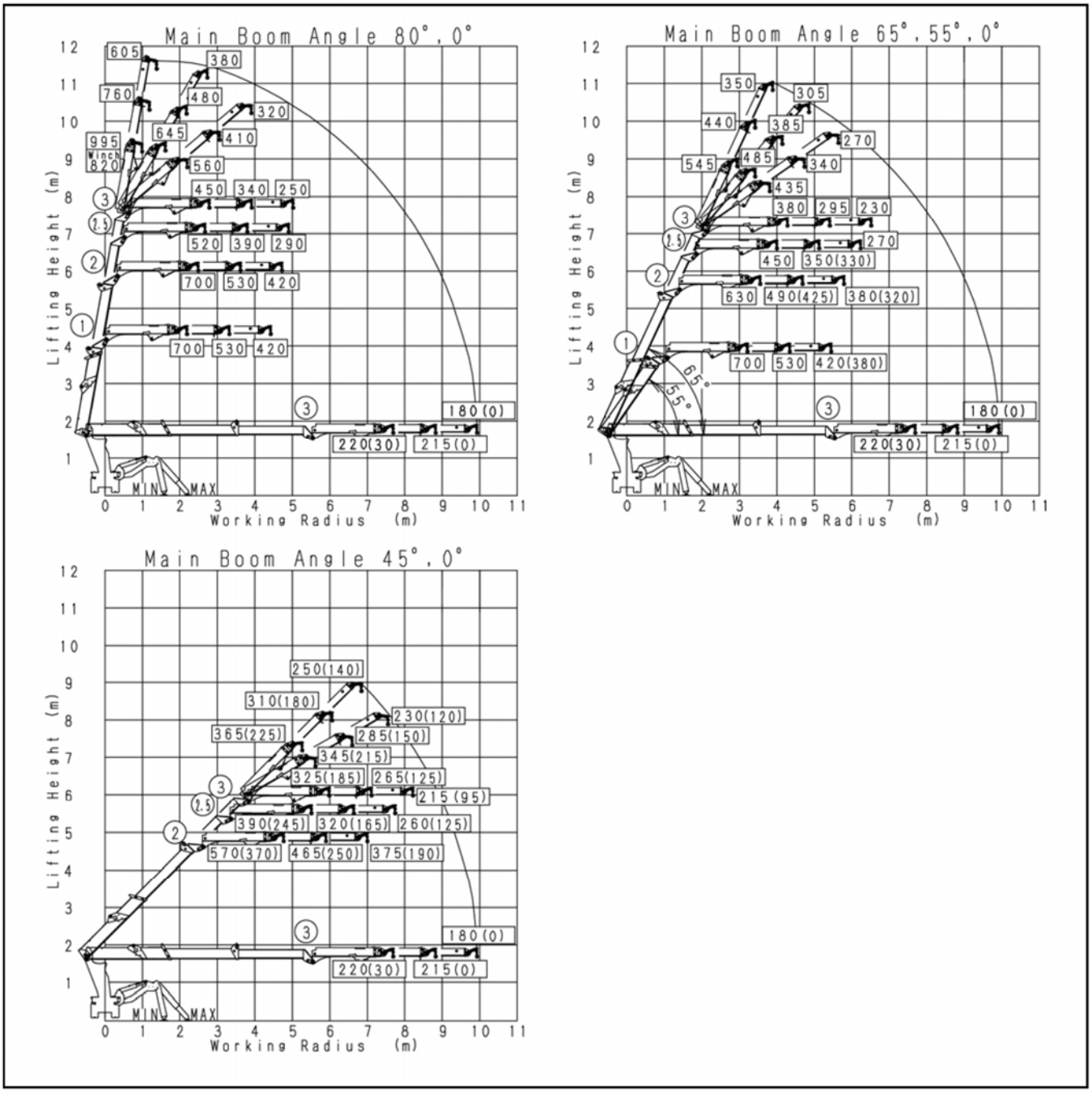
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Equipment/Item		MK1033CE-1 [MK1033CWE-1]
Engine	Model	Yanmar 2TNV70-NMBA
	Type	4 cycle, vertical type, water cooled in-line 2-cylinder, precombustion chamber type
	Displacement	0.569 L (569 cc)
	Rated output (continuous)	7.4 kW/2500 min^{-1} (10.1 PS/2500 rpm)
	Fuel used/fuel tank capacity	12 L
Battery	Model	55B24R
Electric motor	Motor specifications	Three-phase induction motor 5.5 kW 4P 380 V 50 Hz
	Starting method	Inverter-controlled (30 Hz to 60 Hz)
Safety device	[Over hoist detector and stop system], [over un-winding detector], overload preventive device and alarm buzzer, hydraulic safety valve, automatic hydraulic lock device, [wire rope latch], levelling instrument, machine body inclination alarm, working status lamp, crane outrigger interlock device, outrigger un-set lamp, slewing direction limiter, main boom and jib retracting and extending interlock	

[Winch specification]

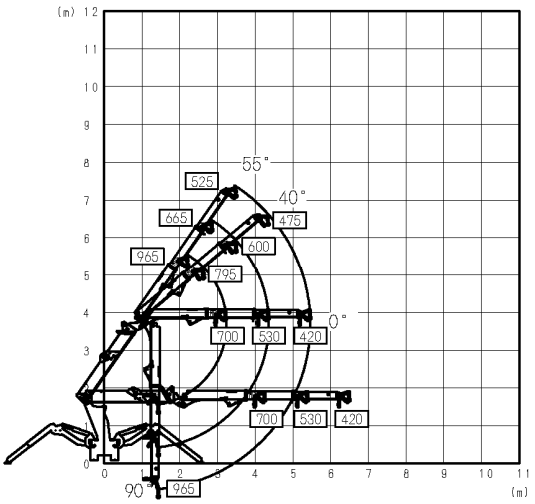
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4. WORKING RADIUS/LIFTING HEIGHT

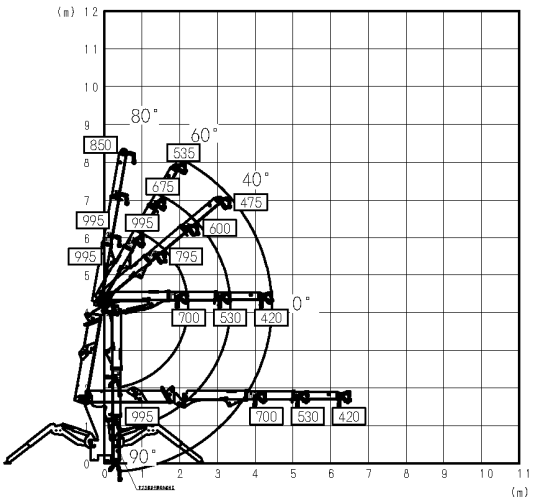


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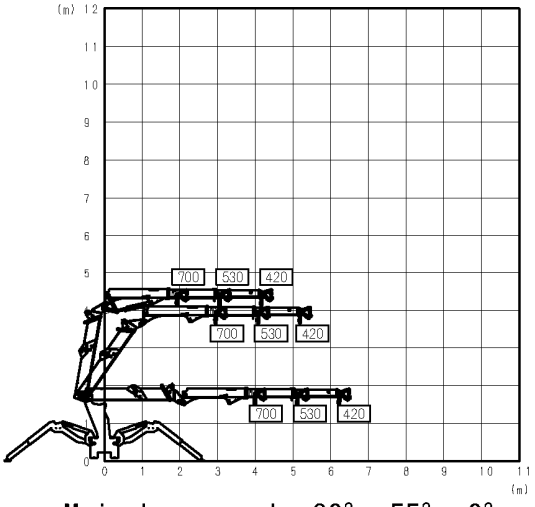
Working range diagram Outrigger extended to maximum Main boom 1 section



Main boom angle 55°



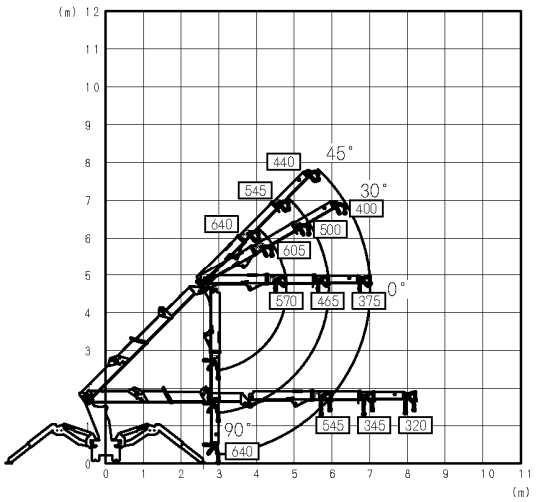
Main boom angle 80°



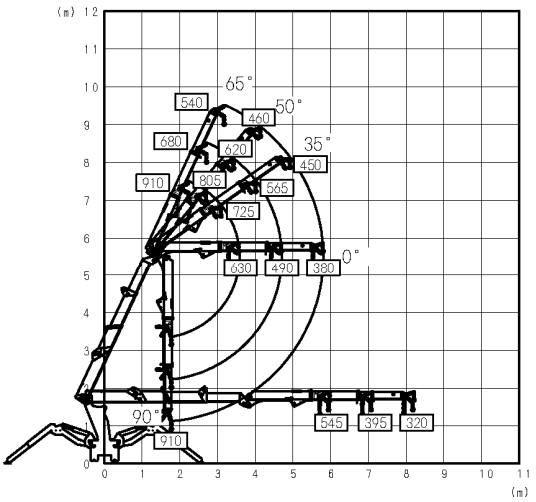
Main boom angle 80° ,55° ,0°

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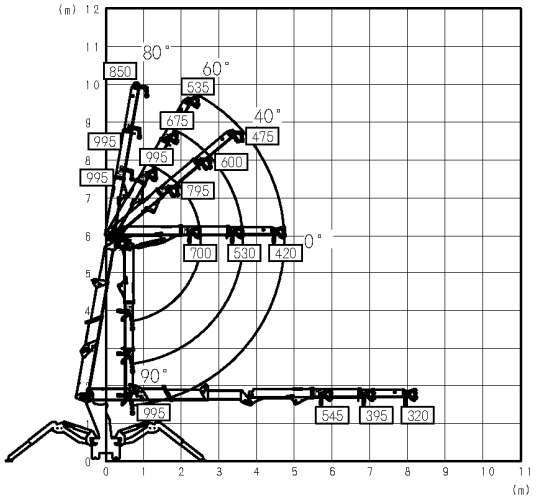
Working range diagram Outrigger extended to maximum Main boom 2 sections



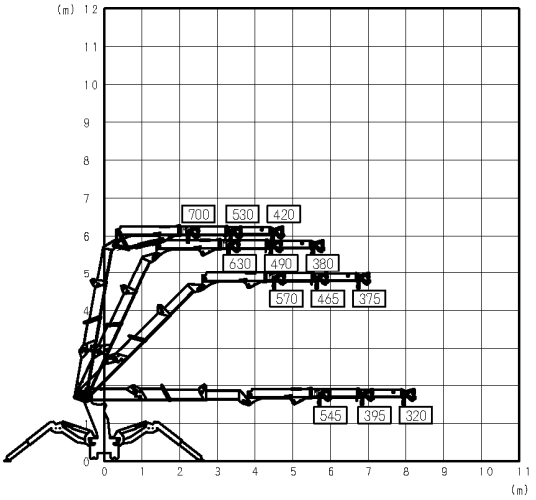
Main boom angle 45°



Main boom angle 65°



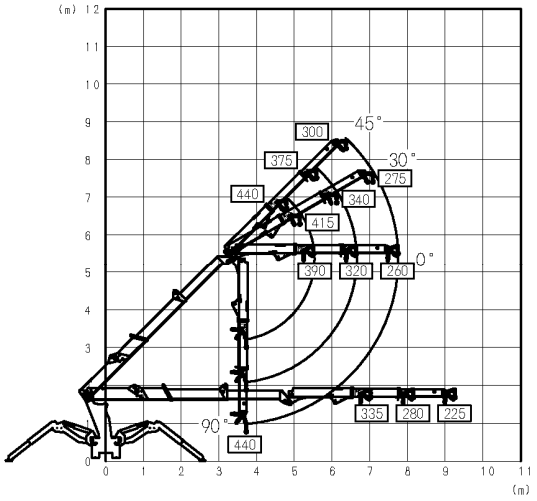
Main boom angle 80°



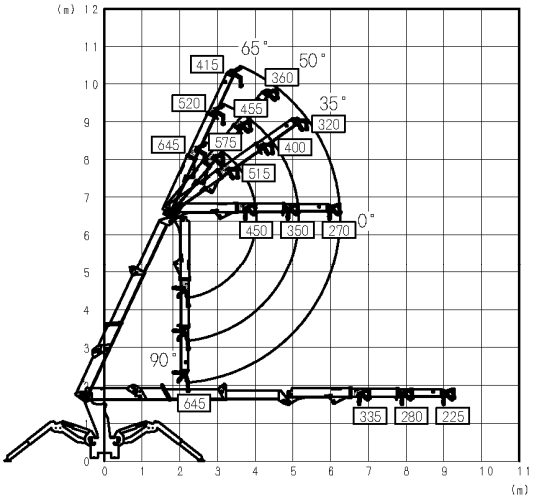
Main boom angle 80° ,65° ,45° ,0°

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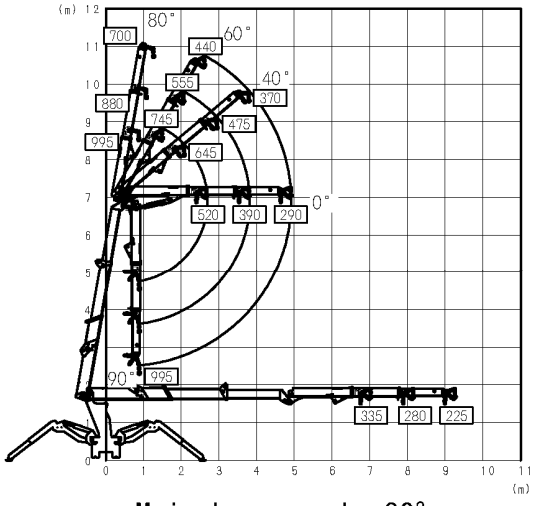
Working range diagram Outrigger extended to maximum Main boom 2.5 sections



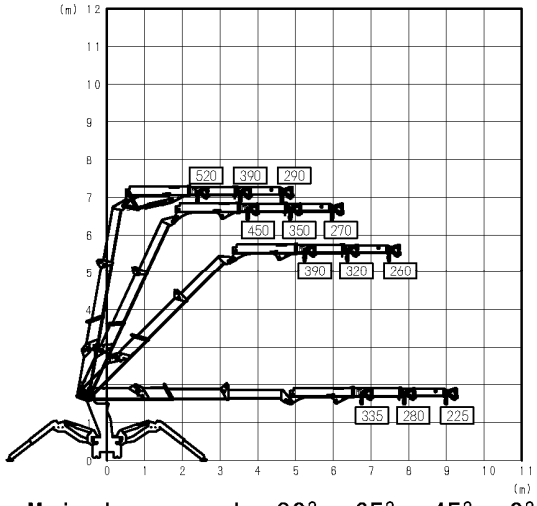
Main boom angle 45°



Main boom angle 65°



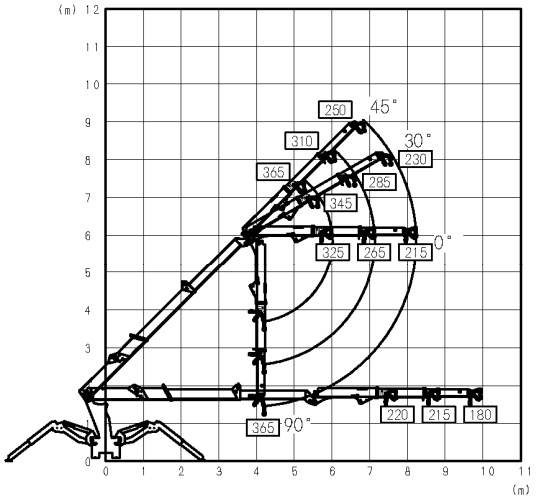
Main boom angle 80°



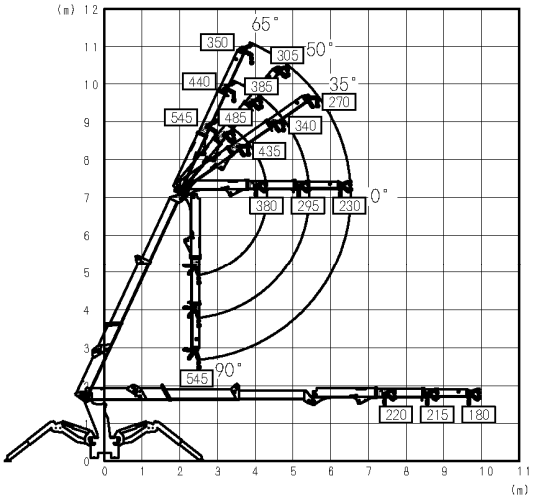
Main boom angle 80° ,65° ,45° ,0°

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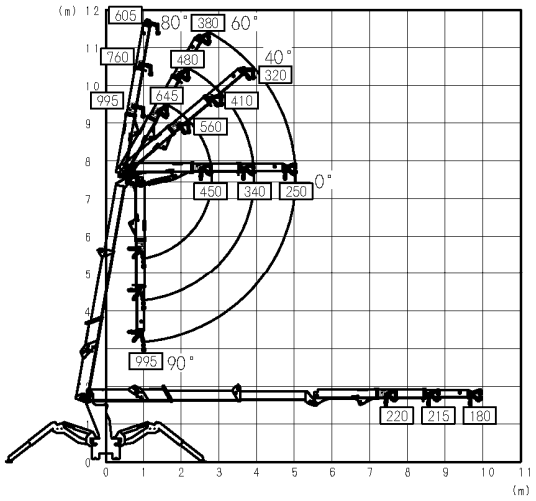
Working range diagram Outrigger extended to maximum Main boom 3 sections



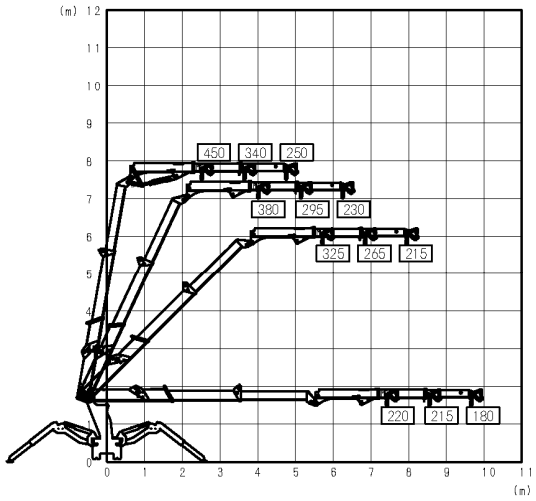
Main boom angle 45°



Main boom angle 65°



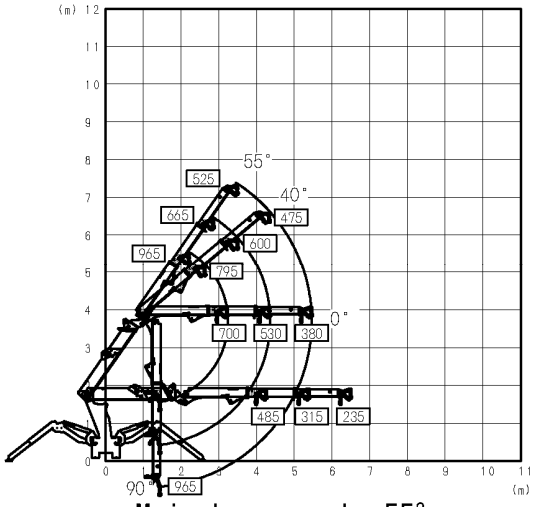
Main boom angle 80°



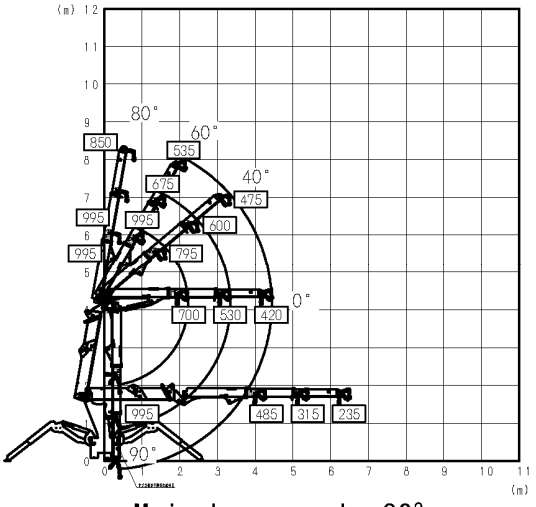
Main boom angle 80° ,65° ,45° ,0°

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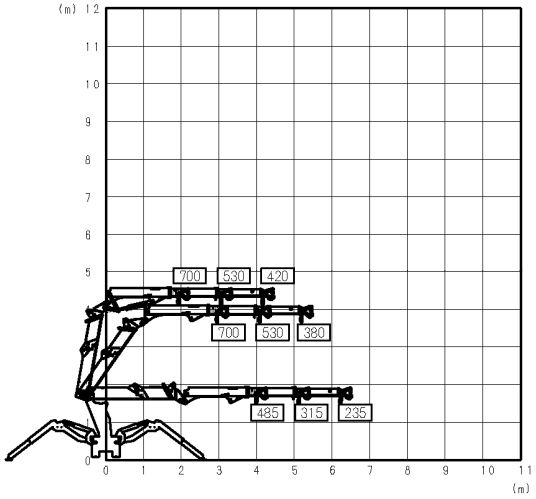
Working range diagram Outrigger extended to minimum Main boom 1 section



Main boom angle 55°



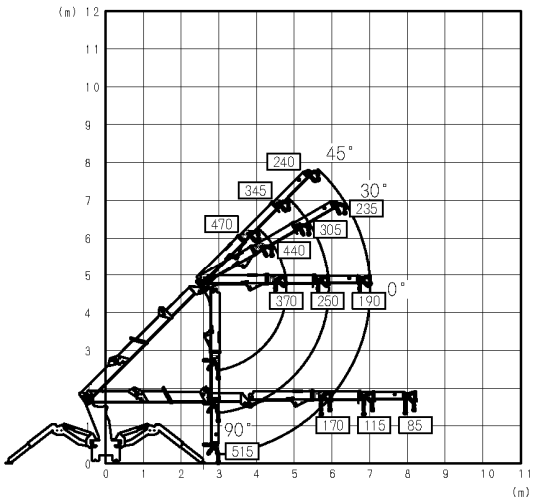
Main boom angle 80°



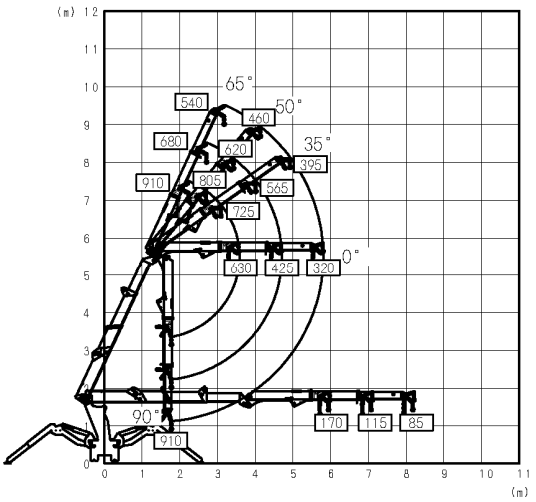
Main boom angle 80° ,55° ,0°

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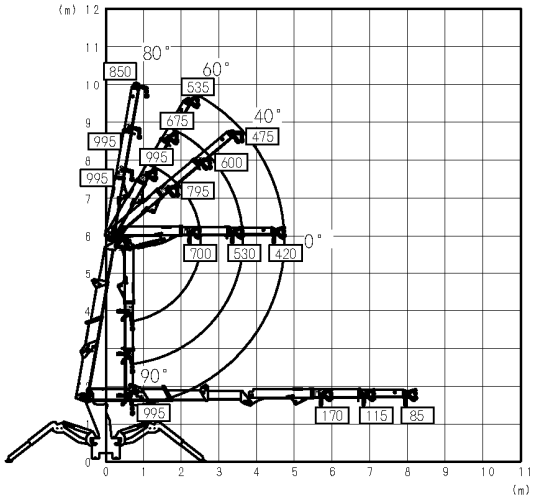
Working range diagram Outrigger extended to minimum Main boom 2 sections



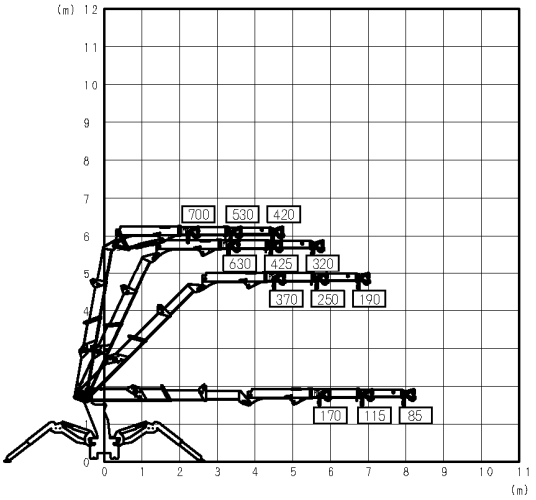
Main boom angle 45°



Main boom angle 65°



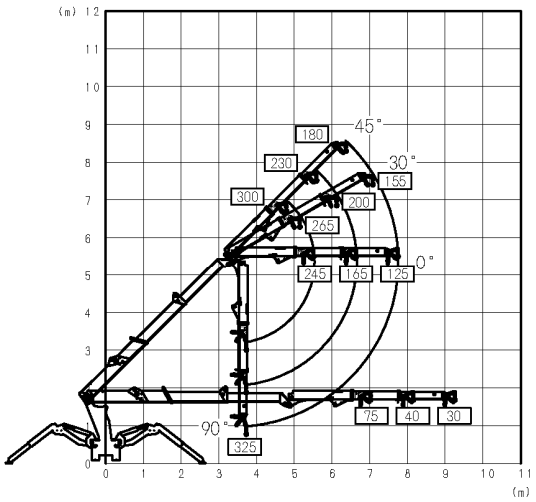
Main boom angle 80°



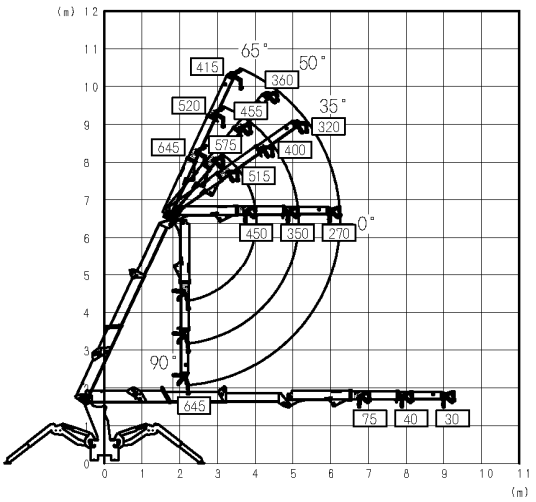
Main boom angle 80° ,65° ,45° ,0°

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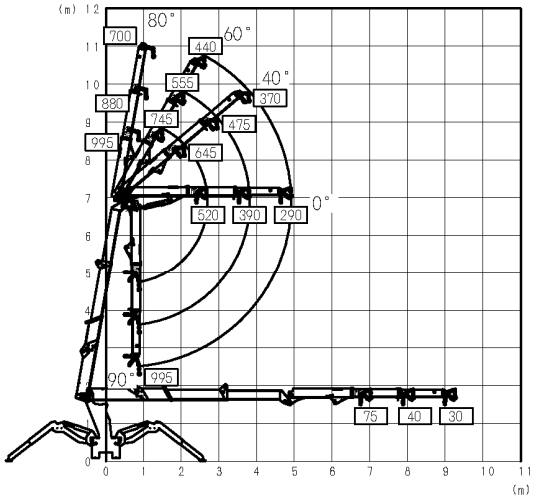
Working range diagram Outrigger extended to minimum Main boom 2.5 sections



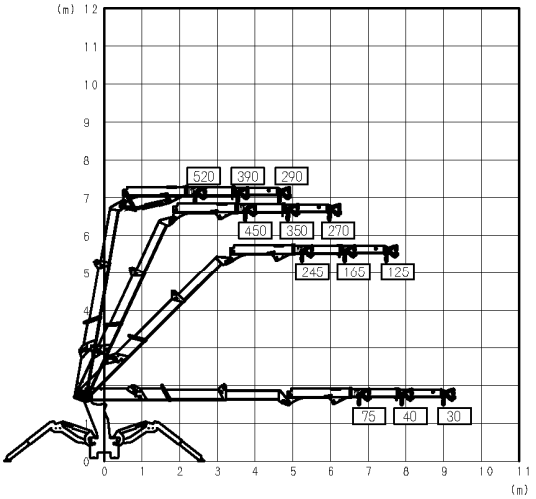
Main boom angle 45°



Main boom angle 65°



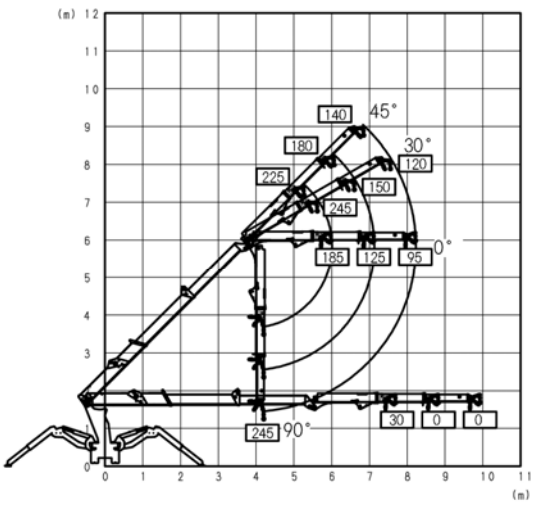
Main boom angle 80°



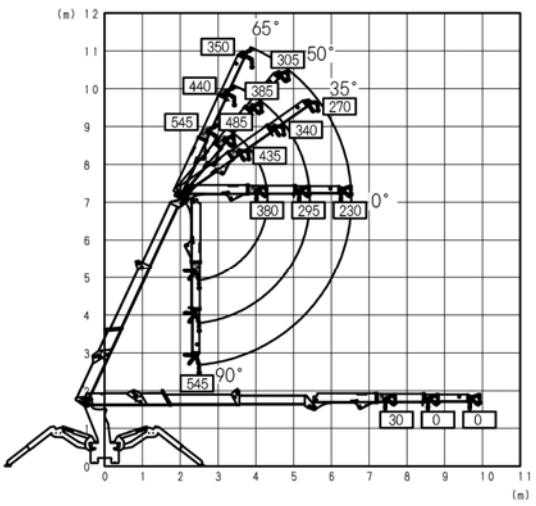
Main boom angle 80° ,65° ,45° ,0°

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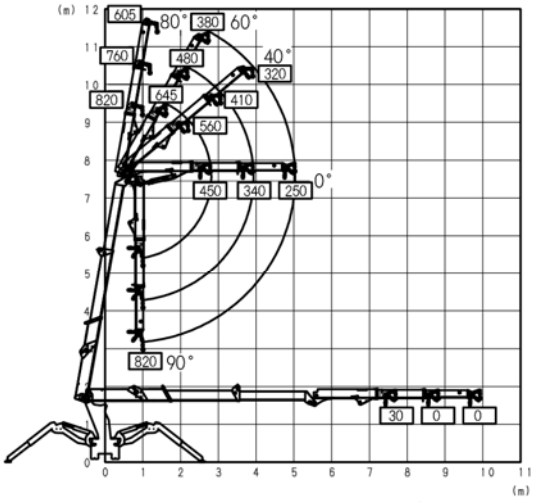
Working range diagram Outrigger extended to minimum Main boom 3 sections



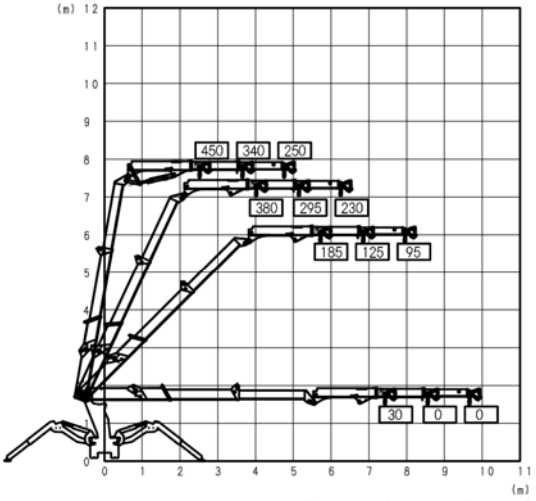
Main boom angle 45°



Main boom angle 65°



Main boom angle 80°



Main boom angle 80° , 65° , 45° , 0°

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5. RATED TOTAL LOAD CHART

Outrigger Position : MAX

Main Boom (1) (kg)

Main Boom Angle	Jib Angle	First	Second	Third
80°	90°		995	
	80°	995	995	850
	60°	995	675	535
	40°	795	600	475
	0°	700	530	420
55°	90°		965	
	55°	965	665	525
	40°	795	600	475
	0°	700	530	420
0°	0°	700	530	420

Main Boom (2) (kg)

Main Boom Angle	Jib Angle	First	Second	Third
80°	90°		995	
	80°	995	995	850
	60°	995	675	535
	40°	795	600	475
	0°	700	530	420
65°	90°		910	
	65°	910	680	540
	50°	805	620	460
	35°	725	565	450
	0°	630	490	380
45°	90°		640	
	45°	640	545	440
	30°	605	500	400
	0°	570	465	375
0°	0°	545	395	320

Main Boom (2.5) (kg)

Main Boom Angle	Jib Angle	First	Second	Third
80°	90°		995	
	80°	995	880	700
	60°	745	555	440
	40°	645	475	370
	0°	520	390	290
65°	90°		645	
	65°	645	520	415
	50°	575	455	360
	35°	515	400	320
	0°	450	350	270
45°	90°		440	
	45°	440	375	300
	30°	415	340	275
	0°	390	320	260
0°	0°	335	280	225

Main Boom (3) (kg)

Main Boom Angle	Jib Angle	First	Second	Third
80°	90°		995	
	80°	995	760	605
	60°	645	480	380
	40°	560	410	320
	0°	450	340	250
65°	90°		545	
	65°	545	440	350
	50°	485	385	305
	35°	435	340	270
	0°	380	295	230
45°	90°		365	
	45°	365	310	250
	30°	345	285	230
	0°	325	265	215
0°	0°	220	215	180

Outrigger Position : MIN

Main Boom (1) (kg)

Main Boom Angle	Jib Angle	First	Second	Third
80°	90°		995	
	80°	995	995	850
	60°	995	675	535
	40°	795	600	475
	0°	700	530	420
55°	90°		965	
	55°	965	665	525
	40°	795	600	475
	0°	700	530	380
0°	0°	485	315	235

Main Boom (2) (kg)

Main Boom Angle	Jib Angle	First	Second	Third
80°	90°		995	
	80°	995	995	850
	60°	995	675	535
	40°	795	600	475
	0°	700	530	420
65°	90°		910	
	65°	910	680	540
	50°	805	620	460
	35°	725	565	395
	0°	630	425	320
45°	90°		515	
	45°	470	345	290
	30°	440	305	235
	0°	370	250	190
0°	0°	170	115	85

Main Boom (2.5) (kg)

Main Boom Angle	Jib Angle	First	Second	Third
80°	90°		995	
	80°	995	880	700
	60°	745	555	440
	40°	645	475	370
	0°	520	390	290
65°	90°		645	
	65°	645	520	415
	50°	575	455	360
	35°	515	400	320
	0°	450	330	270
45°	90°		325	
	45°	300	230	185
	30°	265	200	155
	0°	245	165	125
0°	0°	75	40	30

Main Boom (3) (kg)

Main Boom Angle	Jib Angle	First	Second	Third
80°	90°		995	
	80°	995	760	605
	60°	645	480	380
	40°	560	410	320
	0°	450	340	250
65°	90°		545	
	65°	545	440	350
	50°	485	385	305
	35°	435	340	270
	0°	380	295	230
45°	90°		245	
	45°	225	180	140
	30°	215	150	120
	0°	185	125	95
0°	0°	30	0	0

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6. CRANE STANDARD PRESSURE AND OPERATING TIME TABLE

6.1 OUTRIGGER (OIL TEMPERATURE 45 to 55°C)

			Accelerator full (2600 min^{-1})	
			Operating pressure (MPa) (at travelling valve)	Operating time (sec)
Outrigger front	2 outriggers simultaneously	Contraction		13.0±2
	Full stroke	Extension		13.0±2
Outrigger rear	2 outriggers simultaneously	Contraction		13.0±2
	Full stroke	Extension		13.0±2

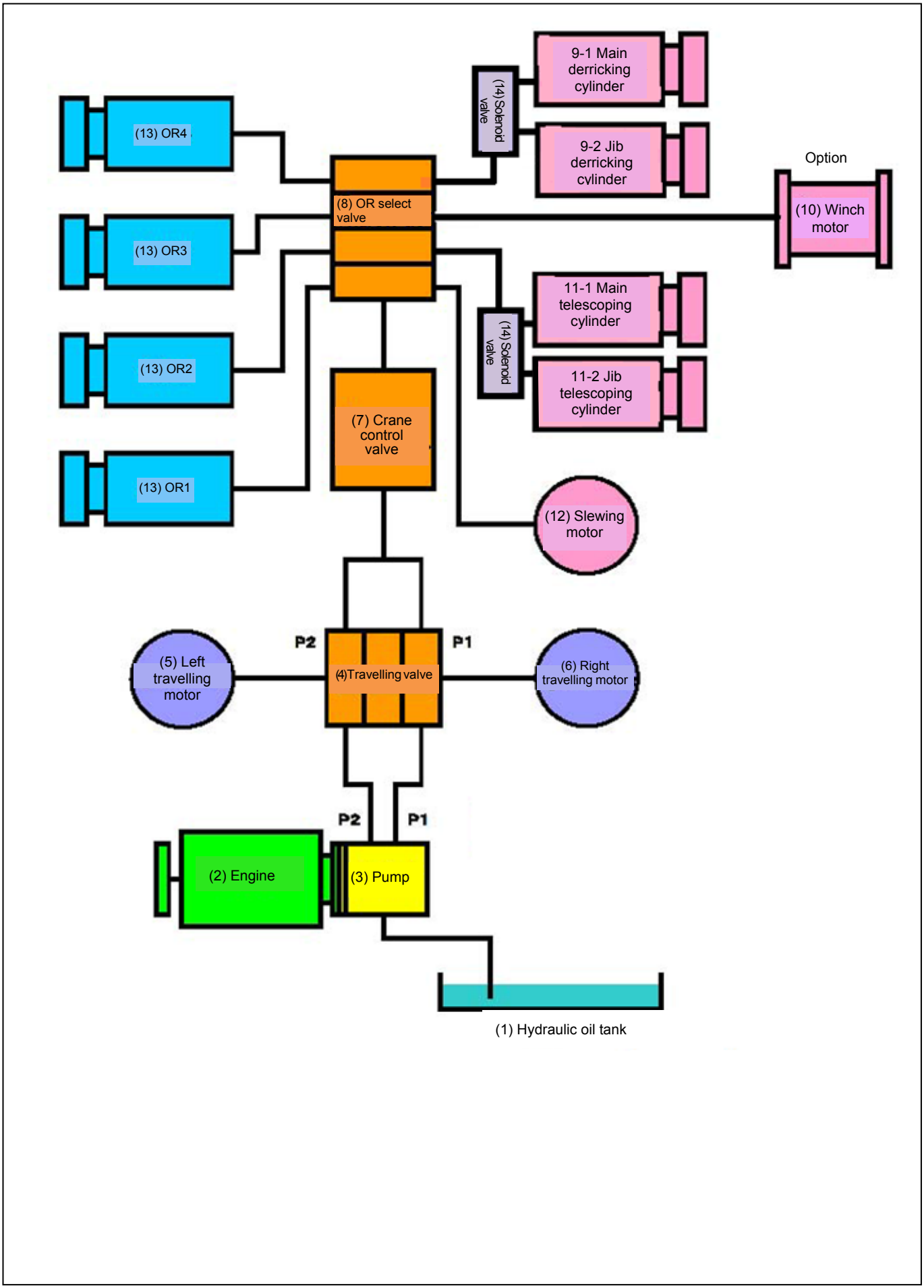
6.2 CRANE (OIL TEMPERATURE 45 to 55°C)

		Accelerator full (2600 min^{-1})	
		Operating pressure (MPa) (at travelling valve)	Operating time (sec)
Main boom derricking (0 to 80°)	Hoist up	12.3±1	36±3
	Hoist down	13.7±1	51±4
Jib derricking (0 to 90°)	Hoist up	4.9±1	26±3
	Hoist down	6.0±1	40±4
Raising (1 fall) (1m, 5th layer, main 2 stages, 50°, jib 2 stages, 50° after run-up of 1m)	Raising	10.7±1	1.8±0.5
	Lowering	10.9±1	2.0±0.5
Main boom telescoping (1 to 3 stages)	Full extension	12.3±1	16±2
	Full contraction	19.6±1	15±1.5
Jib telescoping (1 to 3 stages)	Full extension	12.4±1	21.5±2
	Full contraction	20.3±1	23±2.5
Slewing (360°)	Right		70±7
	Left		70±7

6.3 TRAVELLING OPERATION (OIL TEMPERATURE 45 to 55°C)

		Accelerator full (2600 min^{-1})	
		Operating pressure (MPa) (at travelling valve)	Operating time (sec)
Straight line travelling (20 m)	Forward travelling	6.2±1.0	34.9±2
	Backward travelling	6.8±1.0	36.2±2

7. POWER TRANSMISSION SCHEMATIC DIAGRAM



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STRUCTURE AND MAINTENANCE PROCEDURE

Item	Page
1. HYDRAULIC CIRCUIT DIAGRAM	2-5
2. HYDRAULIC PIPING DIAGRAM	2-7
2.1 CRANE ROTATING PART	2-7
2.1.1 HOSE GUIDE	2-8
2.2 CONTROL LINE A	2-13
2.3 CONTROL LINE B	2-15
2.4 TRAVEL LINE	2-17
2.5 OUTRIGGER LINE	2-19
2.6 PT LINE	2-21
2.7 ELECTRO-HYDRAULIC PIPING ON MACHINE BODY SIDE	2-25
2.8 RETURN MANIFOLD BLOCK	2-27
2.9 OIL COOLER	2-27
2.10 CHECK VALVE	2-28
3. HYDRAULIC TANK	2-29
3.1 AIR BREATHER ASSEMBLY	2-31
3.2 RETURN FILTER	2-32
4. ENGINE ASSEMBLY	2-33
4.1 ENGINE SPECIFICATIONS	2-33
4.2 ENGINE APPEARANCE	2-34
4.3 COMPONENTS OF ENGINE	2-36
4.4 FUEL	2-36
4.4.1 APPROPRIATE USE	2-36
4.4.2 DIESEL FUEL STANDARDS	2-37
4.4.3 BIODIESEL FUEL	2-37
4.4.4 FUEL FEED TO FUEL SYSTEM	2-38
4.5 MAINTENANCE AND INSPECTION	2-39
4.6 TROUBLE SHOOTING	2-40
4.7 FUEL PIPING	2-44
4.7.1 FUEL LINE	2-44
4.7.2 FUEL TANK ASSEMBLY	2-46
4.7.3 FUEL SENDER	2-47
4.8 ENGINE ACCESSORIES	2-48
5. HYDRAULIC PUMP	2-51
5.1 PUMP ASSEMBLY	2-51
5.2 APPEARANCE AND SPECIFICATIONS (STANDARD PUMP)	2-52
5.3 INTERNAL STRUCTURE	2-53
5.4 OPERATING PRINCIPLES	2-54
5.5 FAILURE CAUSE AND COUNTERMEASURE	2-56
6. TRAVEL CONTROL VALVE	2-57
6.1 APPEARANCE AND SPECIFICATIONS	2-57
6.2 INTERNAL STRUCTURE	2-58
6.3 INSPECTION AND ADJUSTMENT	2-59
6.4 FAILURE CAUSE AND COUNTERMEASURE	2-60
7. TRAVELING MOTOR	2-61
7.1 APPEARANCE AND SPECIFICATIONS	2-61
7.2 INTERNAL STRUCTURE	2-62
7.3 OPERATING PRINCIPLES	2-63
7.4 OPERATING PRINCIPLES	2-64
7.4.1 REDUCER	2-64

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Item	Page
7.4.2 HYDRAULIC MOTOR	2-65
7.4.3 HYDRAULIC VALVE (COUNTER-BALANCE VALVE)	2-66
7.4.4 PARKING BRAKE	2-67
7.5 PRECAUTIONS FOR USE	2-68
7.6 FAILURES AND COUNTERMEASURES	2-70
8. CRANE CONTROL VALVE	2-71
8.1 OUTSIDE DRAWING	2-71
8.2 OVERVIEW	2-72
8.3 HYDRAULIC CIRCUIT DIAGRAM	2-73
8.4 ACTIONS OF EACH SECTION	2-74
8.5 FAILURE CAUSE AND COUNTERMEASURE	2-81
9. OUTRIGGER SELECT VALVE	2-82
9.1 APPEARANCE AND SPECIFICATIONS	2-82
9.2 INTERNAL STRUCTURE	2-84
9.3 INSPECTION OF VALVES	2-85
9.4 METHODS FOR OPERATION ADJUSTMENT	2-86
9.5 OUTRIGGER CHANGE-OVER SWITCH	2-87
10. ROTARY JOINT	2-88
10.1 APPEARANCE AND SPECIFICATIONS	2-88
10.2 INTERNAL STRUCTURE	2-90
10.3 ROTARY BRUSH	2-91
11. HOOK	2-97
11.1 INSPECTION OF HOOK	2-97
12. BOOM	2-98
12.1 MAIN BOOM	2-98
12.2 JIB	2-101
12.3 JIB HEAD	2-103
13. TELESCOPIC AND DERRICK CYLINDERS	2-104
13.1 MAIN TELESCOPIC CYLINDER	2-104
13.2 JIB TELESCOPIC CYLINDER	2-106
13.2.1 JIB NO.1 TELESCOPIC CYLINDER	2-108
13.2.2 JIB NO.2 TELESCOPIC CYLINDER	2-110
13.3 JIB TELESCOPIC CYLINDER HYDRAULIC SCHEMATIC DIAGRAM	2-112
13.4 COUNTER BALANCE VALVE (FOR TELESCOPIC AND DERRICK CYLINDERS)	2-113
13.4.1 STRUCTURAL DRAWING	2-113
13.4.2 FAILURE CAUSE AND COUNTERMEASURE	2-113
13.4.3 WORKING DIAGRAM	2-114
13.5 SEQUENCE VALVE (FOR TELESCOPIC CYLINDER)	2-115
13.5.1 STRUCTURAL DRAWING	2-115
13.5.2 WORKING DIAGRAM	2-115
13.6 MECHANICAL CHECK VALVE (FOR TELESCOPIC CYLINDER)	2-116
13.7 MAIN DERRICK CYLINDER ASSEMBLY	2-117
13.7.1 MAIN LEFT-HAND DERRICK CYLINDER	2-119
13.7.2 MAIN RIGHT-HAND DERRICK CYLINDER	2-121
13.8 JIB DERRICK CYLINDER ASSEMBLY	2-123
13.8.1 JIB DERRICK CYLINDER	2-124
14. SLEWING DEVICE	2-126
14.1 OUTSIDE DRAWING	2-126
14.1.1 TOLERANCE OF LOOSENESS HEIGHT OF SLEWING BEARING	2-127
14.2 INTERNAL STRUCTURE AND SPECIFICATIONS OF REDUCTION GEARS	2-128
14.3 APPEARANCE AND SPECIFICATIONS OF HYDRAULIC MOTOR	2-129
14.4 INTERNAL STRUCTURE OF HYDRAULIC MOTOR	2-130
14.5 FAILURE CAUSE AND COUNTERMEASURE OF SLEWING DEVICE	2-131

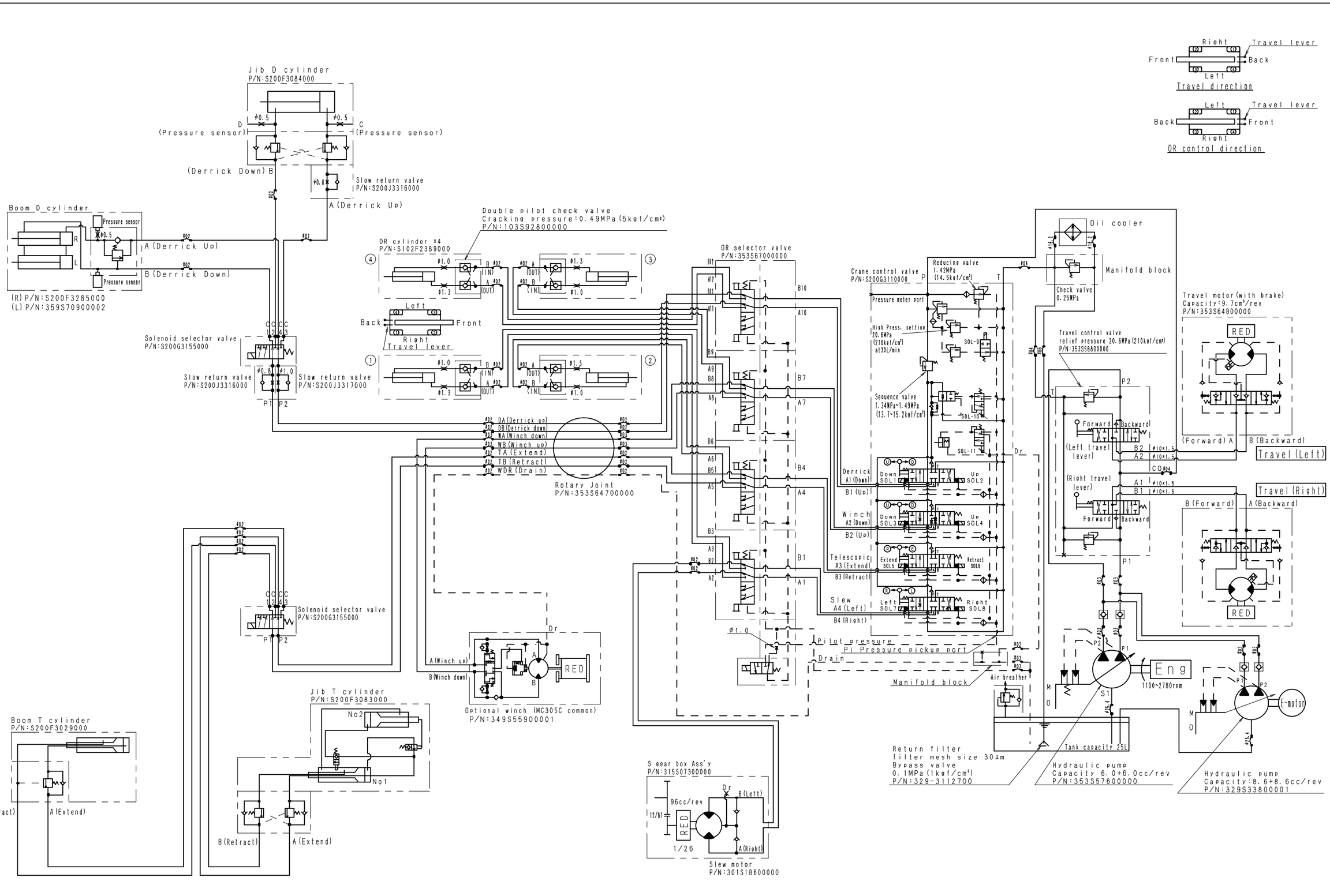
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Item	Page
15. OUTRIGGER	2-132
15.1 APPEARANCE OF OUTRIGGER ON REAR RIGHT SIDE	2-132
15.2 APPEARANCE OF OUTRIGGER ON FRONT RIGHT SIDE	2-134
15.3 APPEARANCE OF OUTRIGGER ON FRONT LEFT SIDE	2-136
15.4 APPEARANCE OF OUTRIGGER ON REAR LEFT SIDE	2-138
16. OUTRIGGER CYLINDER	2-140
16.1 APPEARANCE AND SPECIFICATIONS	2-140
16.2 INTERNAL STRUCTURAL DRAWING	2-142
16.3 DOUBLE PILOT CHECK VALVE	2-144
17. ELECTRIC CIRCUIT DIAGRAM	2-145
18. ELECTRIC SYSTEM	2-146
18.1.1 WIRE HARNESS OF MACHINE BODY (1)	2-146
18.1.2 WIRE HARNESS OF MACHINE BODY (2)	2-148
18.2 CONTROL UNIT ASSEMBLY	2-149
19. CONTROL ASSEMBLY	2-151
19.1 CONTROLLER	2-151
19.2 MONITOR	2-156
19.2.1 STRUCTURE OF MONITOR SCREEN	2-156
19.2.2 USER MODE	2-169
19.2.3 SERVICE MODE	2-176
19.2.4 LIST OF DATA LOGGER DISPLAY CONTENTS	2-180
19.2.5 LIST OF CONTROLLER INPUT MONITORING	2-181
19.2.6 LIST OF CONTROLLER ANALOG INPUT / OUTPUT MONITORING	2-182
19.2.7 LIST OF ERROR CODES	2-183
20. PROCEDURE FOR DISASSEMBLING AND REASSEMBLING BOOM	2-184
20.1 REMOVING WIRE HARNESS CONNECTORS	2-184
20.2 REMOVING HYDRAULIC HOSES	2-185
20.3 PREPARING HOISTING ACCESSORIES	2-186
20.4 REMOVING THE ROD PIN AND FOOT PIN OF MAIN DERRICKING CYLINDER	2-187
20.5 REMOVING THE LINK ASSEMBLY	2-188
20.6 DISASSEMBLING THE MAIN BOOM	2-189
20.6.1 REMOVING THE MAIN BOOM NO. 1	2-189
20.6.2 REMOVING THE MAIN BOOM NO. 2	2-190
20.6.3 REMOVING THE TELESCOPIC CYLINDER	2-191
20.7 ASSEMBLING PROCEDURE FOR MAIN BOOM	2-192
20.7.1 ADJUSTING THE MAIN BOOM EXTENDING/CONTRACTING WIRE ROPES	2-192
20.8 DISASSEMBLING THE JIB	2-194
20.8.1 REMOVING THE JIB NO. 1	2-194
20.8.2 REMOVING THE JIB NO. 2	2-195
20.8.3 REMOVING THE TELESCOPIC CYLINDER	2-196
20.9 DISASSEMBLING PROCEDURE FOR THE MACHINE WITH OPTIONAL WINCH	2-197
20.9.1 REMOVING THE WINCH WIRE	2-198
20.9.2 REMOVING THE WINCH HYDRAULIC HOSE	2-199
21. PROCEDURE FOR DISASSEMBLING THE VEHICLE BODY	2-200
21.1 PROCEDURE FOR DISASSEMBLING THE OUTRIGGER TOP AND INNER BOXES	2-200
21.2 REMOVAL OF ELECTRIC MOTOR UNIT	2-202
21.3 HOW TO REMOVE AND MOUNT A COUNTERWEIGHT	2-206
21.3.1 REMOVING THE COUNTERWEIGHT	2-206
21.3.2 MOUNTING THE COUNTERWEIGHT	2-208

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1. HYDRAULIC CIRCUIT DIAGRAM



200-1176600

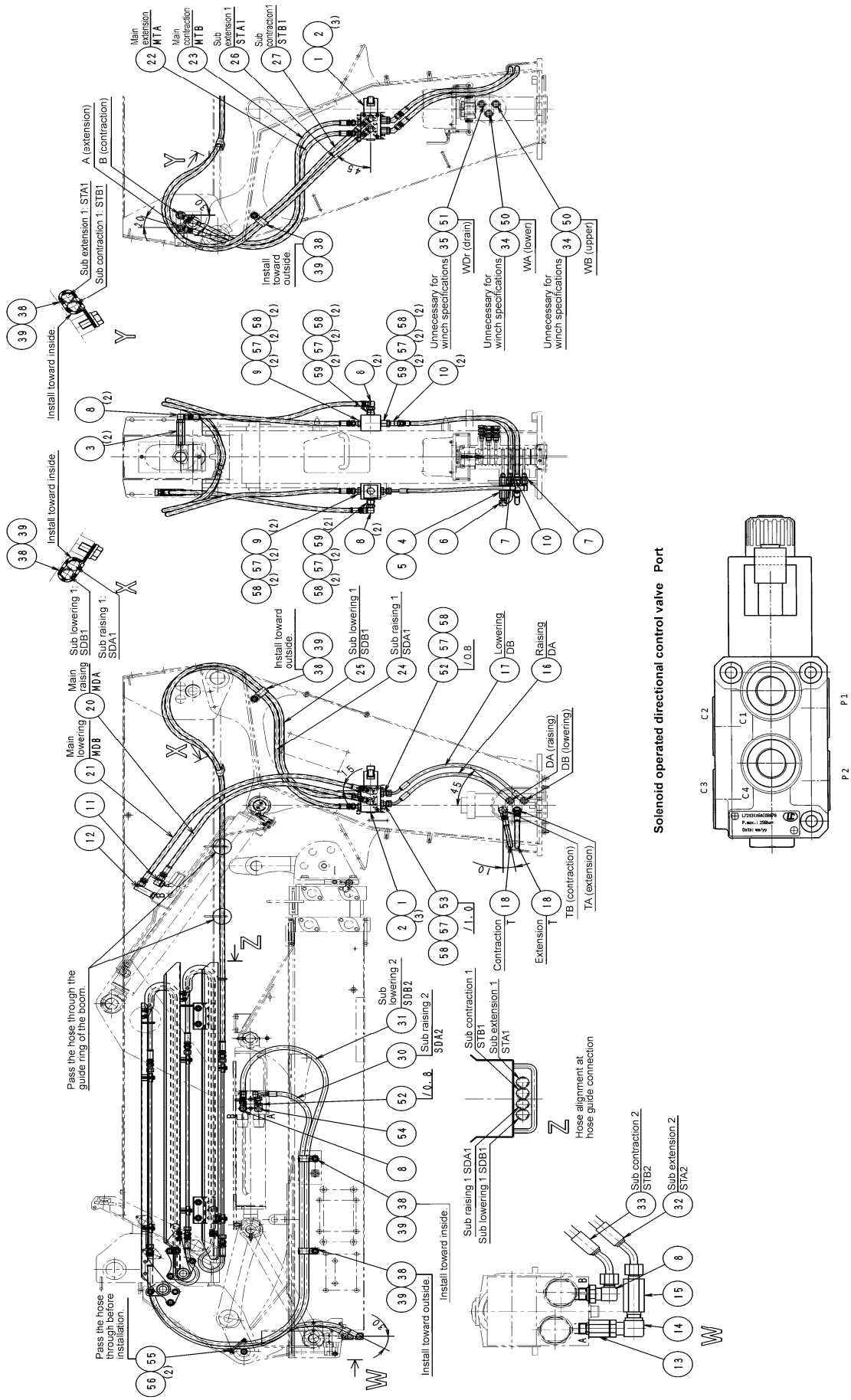
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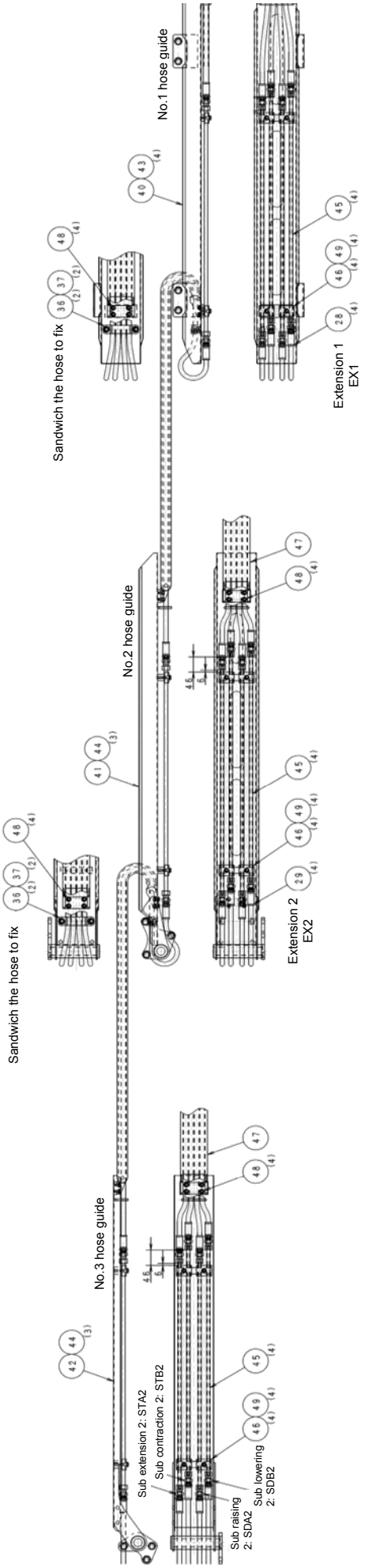
2. HYDRAULIC PIPING DIAGRAM

2.1 CRANE ROTATING PART

200-1171800



2.1.1 HOSE GUIDE



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Connection Table for Rotary Joint										
Port	Joint		Hose/Piping			Joint		Port	Connection destination	Action
	No.	Item number (specifications)	No.	Label	Item number (specifications)	No.	Item number (specifications)			
DA	7	22611-11030 (1067-04)	16	DA	200-4659000 (BS PA2104 R4+CR9 90° 450L)	53	S200J3317000 (Slow return valve (/1.0)	P2	Solenoid valve (left to the post)	Raising
DB	7	22611-11030 (1067-04)	17	DB	200-4659100 (BS PA2104 R4+CR9 90° 500L)	52	S200J3316000 (Slow return valve (/0.8)	P1		Lowering
TA	10	22611-11235 (1072-06-04)	18	T	22779S83085 (NN173-04-850L spiral on entire perimeter 1005 = 1005)	59	22031-45500 (1068-06PF)	P2	Solenoid valve (Right to the post)	Extension
						10	22611-11235 (1072-06-04)			
TB	4	350-4392400 Bushing (PT1/4-PF1/4)	18	T	22779S83085 (NN173-04-850L spiral on entire perimeter 1005 = 1005)	59	22031-45500 (1068-06PF)	P1		Contraction
	6	22611-10430 (1034-04)				10	22611-11235 (1072-06-04)			
WA	50	22611-11050 (1067-06)	-	-	-	*34	22611-12950 (1051-06)	-	-	-
WB	50	22611-11050 (1067-06)	-	-	-	*34	22611-12950 (1051-06)	-	-	-
WDr	51	22611-10130 (1009-04)	-	-	-	*35	22611-12930 (1051-04)	-	-	-

*Unnecessary for optional winch specifications

Connection Table for Solenoid Valve										
Solenoid port	Joint		Hose/Piping			Joint		Port	Connection destination	Action
	No.	Item number (specifications)	No.	Label	Item number (specifications)	No.	Item number (specifications)			
C4	59	22031-45500 (1068-06PF)	20	MDA	22779S83085 (NN173-04-850L spiral on entire perimeter 1005 = 1005)	11	22611-11130 (1071-04)	A	Main D cylinder	Main raising
	8	22611-11135 (1071-06-04)								
C1	59	22031-45500 (1068-06PF)	21	MDB	22779S83090 (NN173-04-900L spiral on entire perimeter 1005 = 1005)	12	22611-14230 (1071-04-62.8A)	B		Main lowering
	8	22611-11135 (1071-06-04)								
C3	9	22611-11035 (1067-06-04)	24	SDA1	22779S83250 (NN173-04-2500L spiral on entire perimeter 1005 = 1005)	45	200-4644200 (G1/4-G1/4-724L)	SDA1	Cableveyor	Jib raising
C2	9	22611-11035 (1067-06-04)	25	SDB1	22779S83245 (NN173-04-2450L spiral on entire perimeter 1005 = 1005)	45	200-4644200 (G1/4-G1/4-724L)	SDB1		Jib lowering
C3	9	22611-11035 (1067-06-04)	22	MTA	22779S83095 (NN173-04-950L spiral on entire perimeter 1005 = 1005)	3	349-4412500 (Long connector PF3/8)	A	Main T cylinder	Main extension
						8	22611-11135 (1071-06-04)			
C2	9	22611-11035 (1067-06-04)	23	MTB	22779S83100 (NN173-04-1000L spiral on entire perimeter 1005 = 1005)	3	349-4412500 (Long connector PF3/8)	B		Main contraction
						8	22611-11135 (1071-06-04)			
C4	59	22031-45500 (1068-06PF)	26	STA1	22779S83245 (NN173-04-2450L spiral on entire perimeter 1005 = 1005)	45	200-4644200 (G1/4-G1/4-724L)	STA1	Cableveyor	Jib extension
	8	22611-11135 (1071-06-04)								
C1	59	22031-45500 (1068-06PF)	27	STB1	22779S83250 (NN173-04-2500L spiral on entire perimeter 1005 = 1005)	45	200-4644200 (G1/4-G1/4-724L)	STB1		Jib contraction
	8	22611-11135 (1071-06-04)								

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Connection Table for Cableveyor										
Action	Hose/Piping			Piping		Hose/Piping			Connection destination	Action
	No.	Label	Item number (specifications)	No.	Item number (specifications)	No.	Label	Item number (specifications)		
Jib raising	28	EX1	22779-83175 (NN173-04-1750L 1005＝1005)	45	200-4644200 (G1/4-G1/4-724L)	29	EX2	22779-83180 (NN173-04-1800L 1005＝1005)	Cableveyor	Jib raising
Jib lowering	28	EX1	22779-83175 (NN173-04-1750L 1005＝1005)	45	200-4644200 (G1/4-G1/4-724L)	29	EX2	22779-83180 (NN173-04-1800L 1005＝1005)		Jib lowering
Jib extension	28	EX1	22779-83175 (NN173-04-1750L 1005＝1005)	45	200-4644200 (G1/4-G1/4-724L)	29	EX2	22779-83180 (NN173-04-1800L 1005＝1005)	Cableveyor	Jib extension
Jib contraction	28	EX1	22779-83175 (NN173-04-1750L 1005＝1005)	45	200-4644200 (G1/4-G1/4-724L)	29	EX2	22779-83180 (NN173-04-1800L 1005＝1005)		Jib contraction

Connection Table for Cableveyor										
Action	Piping		Hose/Piping			Joint		Port	Connection destination	Action
	No.	Item number (specifications)	No.	Label	Item number (specifications)	No.	Item number (specifications)			
Jib raising	45	200-4644200 (G1/4-G1/4-724L)	30	SDA2	22718SA3180 (BS PA2104 C+CR9 spiral on entire perimeter1800L)	52	S200J3316000 (Slow return valve (/0.8)	A	Jib D cylinder	Jib raising
						54	S200J3323000 (Elbow with male/female seats G3/8)			
Jib lowering	45	200-4644200 (G1/4-G1/4-724L)	31	SDB2	22779S83210 (NN173-04-2100L spiral on entire perimeter 1005 = 1005)	8	22611-11135 (1071-06-04)	B		Jib lowering
Jib extension	45	200-4644200 (G1/4-G1/4-724L)	32	STA2	22779SE3110 (NN173-04-1100L spiral on entire perimeter ML 45 = 1005)	13	349-4413000 (Connector PF3/8)	A	Jib T cylinder	Jib extension
						14	22031-40500 (1125-06)			
						15	22611-10253 (9009-06-04)			
Jib contraction	45	200-4644200 (G1/4-G1/4-724L)	33	STB2	22779SE3100 (NN173-04-1000L spiral on entire perimeter ML 45 = 1005)	8	22611-11135 (1071-06-04)	B		Jib contraction

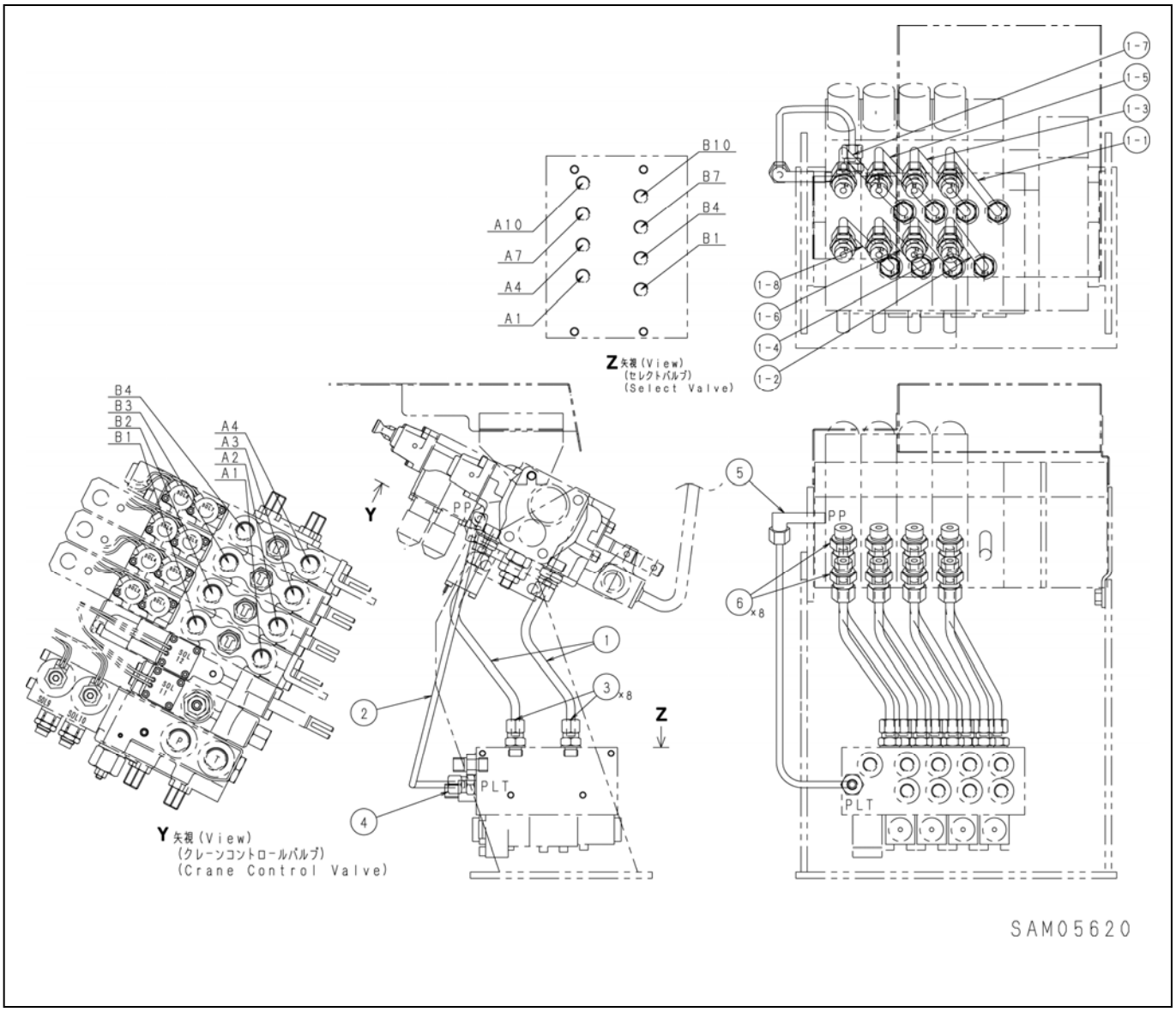
Number	Name	Q'ty	Note
1	Solenoid operated directional control valve	2	Item number: S200G3155000
2	Hexagon socket head screw	6	M6 x 1.0 x 40L (plated)
3	Long connector (3/8)	2	Item number: 349-4412500
4	Bushing (PT1/4-PF1/4)	1	Item number: 350-4392400
5	O-ring	1	P11-1B
6	Hose adapter	1	1034-04
7	Hose adapter	2	1067-04
8	Hose adapter	8	1071-06-04
9	Hose adapter	4	1067-06-04
10	Hose adapter	3	1072-06-04
11	Hose adapter	1	1071-04
12	Hose adapter	1	1071-04-62.8A
13	Connector (3/8)	1	Item number: 349-4413000
14	Adapter	1	1125-06
15	Hose adapter	1	9009-06-04
16	DA hydraulic hose (raised)	1	BS PA2104 CR4+CR9 90° 450L label "DA"
17	DB hydraulic hose (lowered)	1	BS PA2104 CR4+CR9 90° 500L label "DB"
18	T hydraulic hose (telescopic)	2	NN173-04-850L 1005 = 1005 (spiral on entire perimeter) label "T"
19	Missing number		
20	MDA hose (main raising)	1	NN173-04-850L 1005 = 1005 (spiral on entire perimeter) label "MDA"
21	MDB hose (main lowering)	1	NN173-04-900L 1005 = 1005 (spiral on entire perimeter) label "MDB"
22	MTA hose (main extension)	1	NN173-04-950L 1005 = 1005 (spiral on entire perimeter) label "MTA"
23	MTB hose (main contraction)	1	NN173-04-1000L 1005 = 1005 (spiral on entire perimeter) label "MTB"
24	SDA1 hose (sub raising 1)	1	NN173-04-2500L 1005 = 1005 (spiral on entire perimeter) label "SDA1"
25	SDB1 hose (sub lowering 1)	1	NN173-04-2450L 1005 = 1005 (spiral on entire perimeter) label "SDB1"
26	STA1 hose (sub extension 1)	1	NN173-04-2450L 1005 = 1005 (spiral on entire perimeter) label "STA1"
27	STB1 hose (sub contraction 1)	1	NN173-04-2500L 1005 = 1005 (spiral on entire perimeter) label "STB1"
28	EX1 hose (extension hose 1)	4	NN173-04-1750L 1005 = 1005 label "EX1"
29	EX2 hose (extension hose 2)	4	NN173-04-1800L 1005 = 1005 label "EX2"
30	SDA2 hose (sub raising 2)	1	BS PA2104 C+CR9 1800L (spiral on entire perimeter) label "SDA2"
31	SDB2 hose (sub lowering 2)	1	NN173-04-2100L 1005 = 1005 (spiral on entire perimeter) label "SDB2"
32	STA2 hose (sub extension 2)	1	NN173-04-1100L ML45 = 1005 (spiral on entire perimeter) label "STA2"
33	STB2 hose (sub contraction 2)	1	NN173-04-1000L ML45 = 1005 (spiral on entire perimeter) label "STB2"
34	Male plug 1	2	1051-06
35	Male plug 1	1	1051-04
36	Clamp	4	Item number: 200-4646400
37	Sems bolt	4	Komatsu item number: 01024-80816
38	Clip	6	Komatsu item number: 04435-51510
39	Sems bolt	6	Komatsu item number: 01024-81020

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Number	Name	Q'ty	Note
40	Hose guide No.1	1	Item number: 200-3346000
41	Hose guide No.2	1	Item number: 200-3346100
42	Hose guide No.3	1	Item number: 200-3346200
43	Sems bolt	4	Komatsu item number: 01024-81020
44	Sems bolt	6	Komatsu item number: 01024-81025
45	Hose guide piping	12	Item number: 200-4644200
46	Gall	12	Item number: 356-4512300
47	Cableveyor	2	Item number: S200B3173000
48	Sems bolt	16	Komatsu item number: 01024-80612
49	Sems bolt	12	Komatsu item number: 01024-80620
50	Hose adapter	2	1067-06
51	Hose adapter	1	1009-04
52	Slow return valve (/0.8)	2	Item number: S200J3316000
53	Slow return valve (/1.0)	1	Item number: S200J3317000
54	Elbow	1	Item number: S200J3323000
55	Hose guide	1	Item number: 200-4656500
56	Sems bolt	2	Komatsu item number: 01024-80612
57	Retainer ring	12	OR13.94 × 2.62
58	O-ring for retainer ring	12	RRS3/8CF
59	O-ring boss female connector	6	1068-06PF G3/8-G3/8

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2.2 CONTROL LINE A

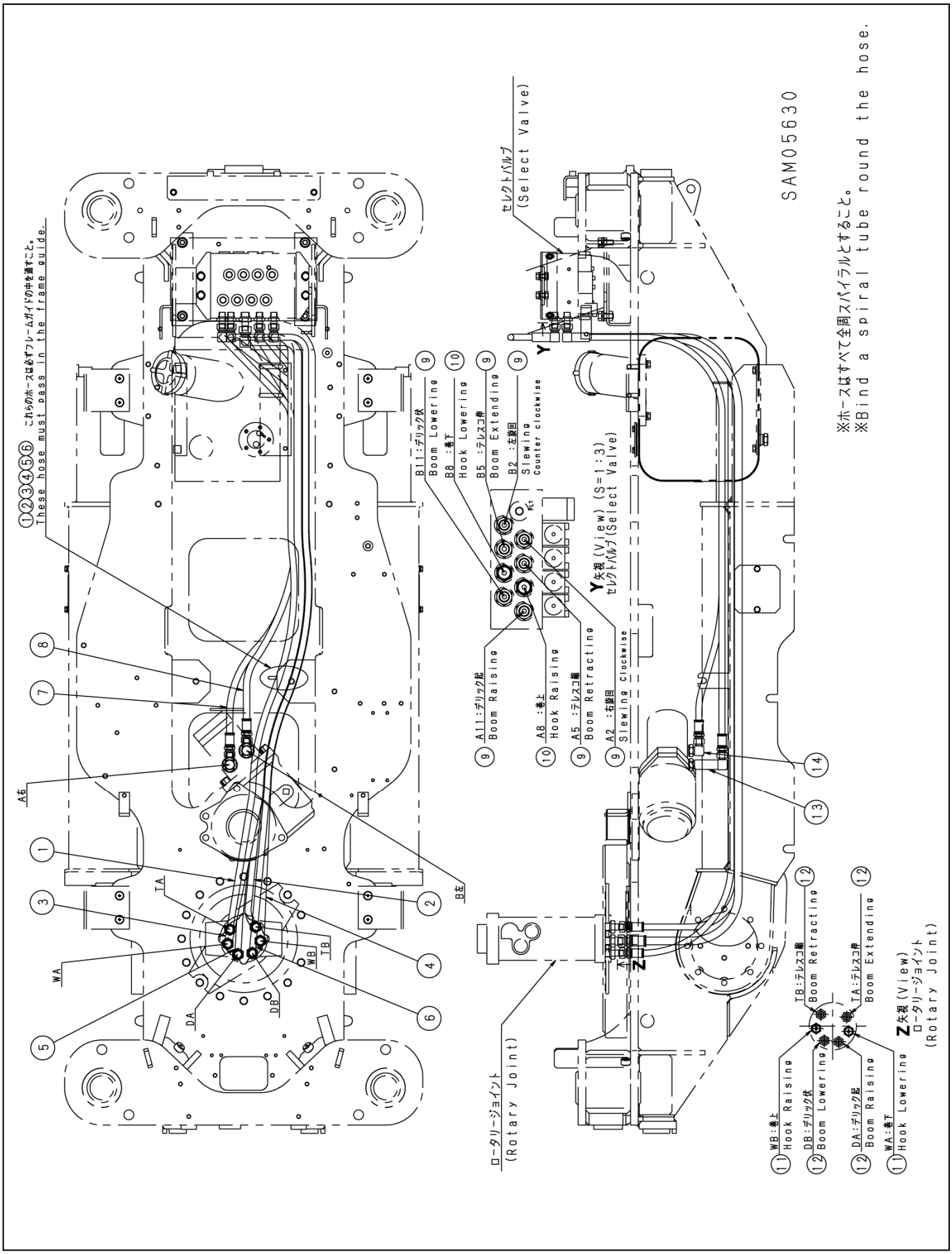


Equipment name	Port	Joint		Hose/Piping		Joint		Port	Connection destination
		No.	Item number	No.	Item number	No.	Item number		
Select valve	A10	3	22511-07330	1-1	350-2047701	6	22511-07350	B1	Crane control valve
	B10	3	22511-07330	1-2	350-2047702	6	22511-07350	A1	
	A7	3	22511-07330	1-3	350-2047703	6	22511-07350	B2	
	B7	3	22511-07330	1-4	350-2047704	6	22511-07350	A2	
	A4	3	22511-07330	1-5	350-2047705	6	22511-07350	B3	
	B4	3	22511-07330	1-6	350-2047706	6	22511-07350	A3	
	A1	3	22511-07330	1-7	350-2047707	6	22511-07350	B4	
	B1	3	22511-07330	1-8	350-2047708	6	22511-07350	A4	
	PLT	4	22511-07230	2	353-4438000-2	5	22511-35210	PP	

Number	Name	Q'ty	Note
1	Main select pipe	1	Item number: 350-2047700
1-1	Main select pipe D1	1	Item number: 350-2047701
1-2	Main select pipe D2	1	Item number: 350-2047702
1-3	Main select pipe W1	1	Item number: 350-2047703
1-4	Main select pipe W2	1	Item number: 350-2047704
1-5	Main select pipe T1	1	Item number: 350-2047705
1-6	Main select pipe T2	1	Item number: 350-2047706
1-7	Main select pipe S1	1	Item number: 350-2047707
1-8	Main select pipe S2	1	Item number: 350-2047708
2	PP pipe	1	Item number: 353-4438000-2
3	Flareless type joint	8	LLM-UR-8 × 1/4
4	Flareless type joint	1	LLM-UR-6 × 1/4
5	Flareless type joint	1	LLM-EPL-6 × 1/8
6	Flareless type joint	8	LLM-UR-8 × 3/8

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2.3CONTROL LINE B



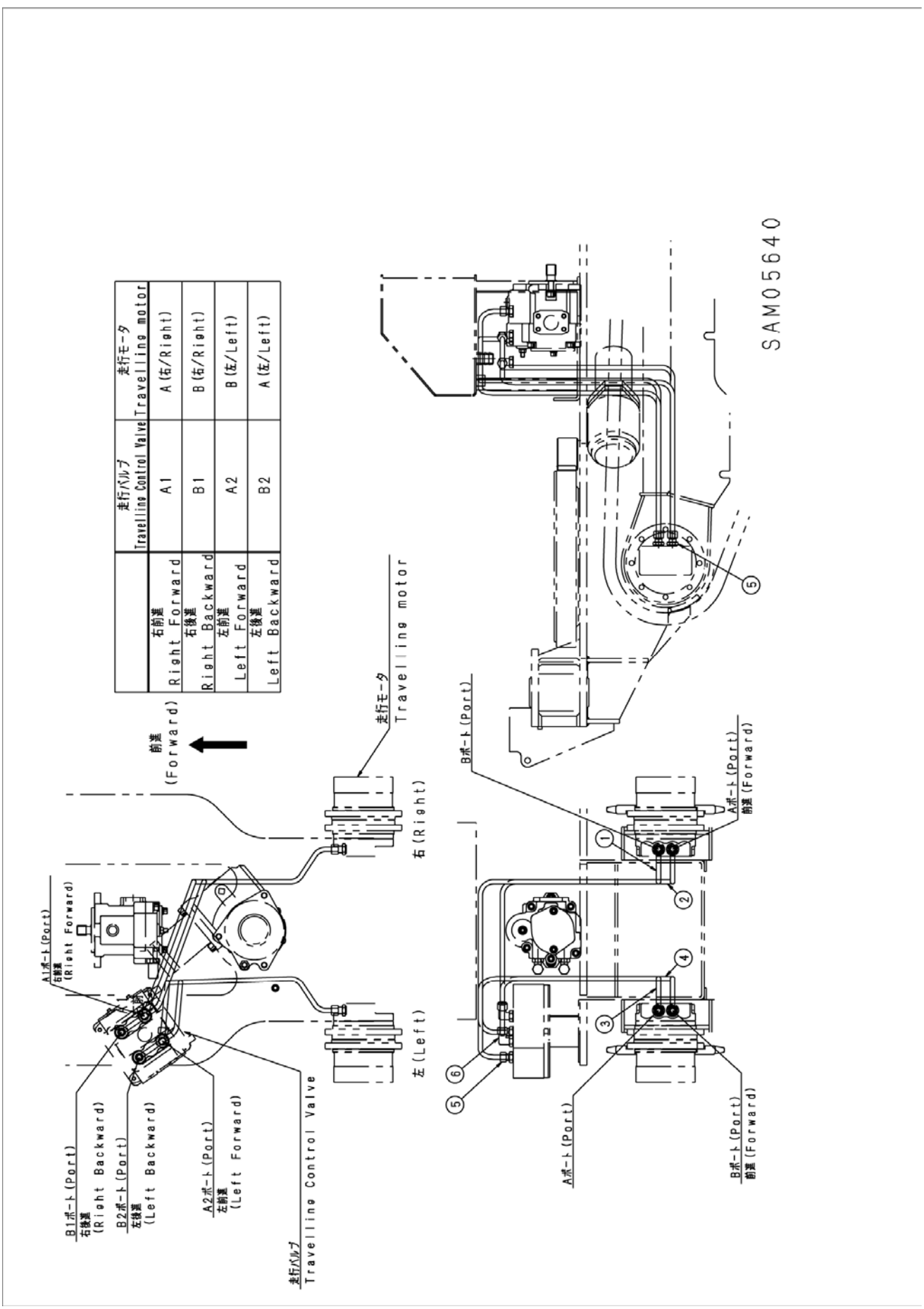
* Perform spiral winding on the entire perimeter of the hose of this part.

Equipment name	Port	Joint		Hose/Piping			Joint		Port	Connection destination	Action
		No.	Item number	No.	Mark	Item number	No.	Item number			
Select valve	A11	9	22611-11030	5	DA	22779SF3180	12	22611-11035	DA	Rotary joint	Raising
	B11	9	22611-11030	6	DB	22779SF3216	12	22611-11035	DB		Lowering
	A5	9	22611-11030	2	TB	22779SF3180	12	22611-11035	TB		Contraction
	B5	9	22611-11030	1	TA	22779SF3216	12	22611-11035	TA		Extension
	A8	10	22611-11053	4	WB	22779SF5180	11	22611-11050	WB		Up
	B8	10	22611-11053	3	WA	22779SF5216	11	22611-11050	WA		Down
	A2	9	22611-11030	7	SA	22779SF3115	13	22611-12436	A	Slewing motor	Right
	B2	9	22611-11030	8	SB	22779SF3151	14	22611-11136	B		Left

Number	Name	Q'ty	Note
1	TA hose (extended)	1	NN173-04-2160L 1005 = 0590 (spiral on entire perimeter) label “TA”
2	TB hose (contracted)	1	NN173-04-1800L 1005 = 0590 (spiral on entire perimeter) label “TB”
3	WA hose (lower)	1	NN173-06-2160L 1005 = 0590 (spiral on entire perimeter) label “WA”
4	WB hose (upper)	1	NN173-06-1800L 1005 = 0590 (spiral on entire perimeter) label “WB”
5	DA hose (raised)	1	NN173-04-1800L 1005 = 0590 (spiral on entire perimeter) label “DA”
6	DB hose (lowered)	1	NN173-04-2160L 1005 = 0590 (spiral on entire perimeter) label “DB”
7	SA hose (right)	1	NN173-04-1150L 1005 = 0590 (spiral on entire perimeter) label “SA”
8	SB hose (left)	1	NN173-04-1510L 1005 = 0590 (spiral on entire perimeter) label “SB”
9	Hose adapter	6	1067-04
10	Hose adapter	2	1067-04—06
11	Hose adapter	2	1067-06
12	Hose adapter	4	1067-06-04
13	Hose adapter	1	1071-08-04-70A
14	Hose adapter	1	1071-08-04

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2.4 TRAVEL LINE



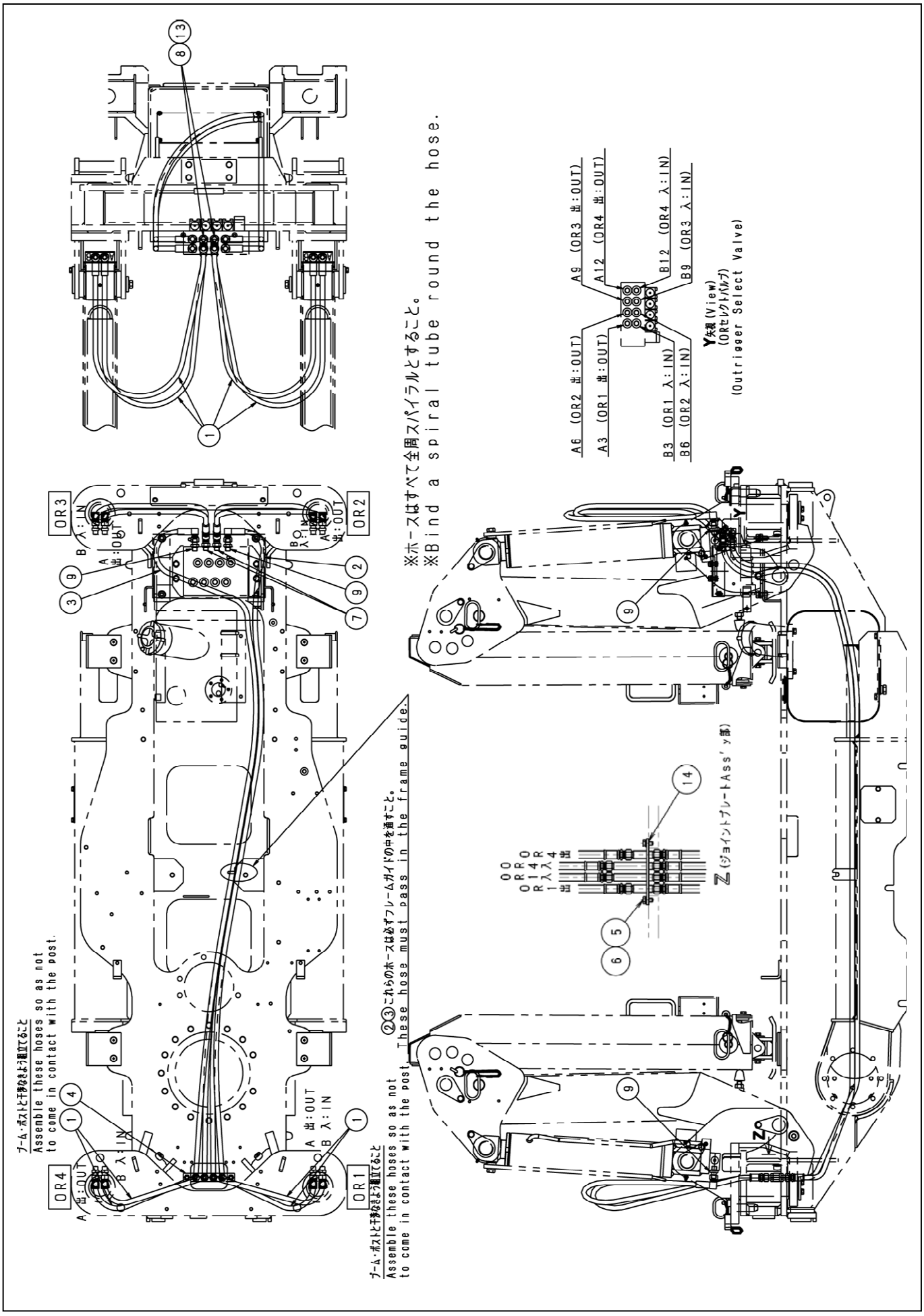
	走行バルブ Travelling Control Valve	走行モータ Travelling motor
右前進 Right Forward	A1	A(右/Right)
右後進 Right Backward	B1	B(右/Right)
左前進 Left Forward	A2	B(左/Left)
左後進 Left Backward	B2	A(左/Left)

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Number	Name	Q'ty	Note
1	Travel pipe R1	1	Item number: 353-3202100-2
2	Travel pipe R2	1	Item number: 353-3202200-2
3	Travel pipe L1	1	Item number: 353-3202300-2
4	Travel pipe L2	1	Item number: 353-3202400-2
5	Flareless type joint	6	LLM-UR-10 × 3/8
6	Flareless type joint	2	LLM-UE-10 × 3/8

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2.5 OUTRIGGER LINE



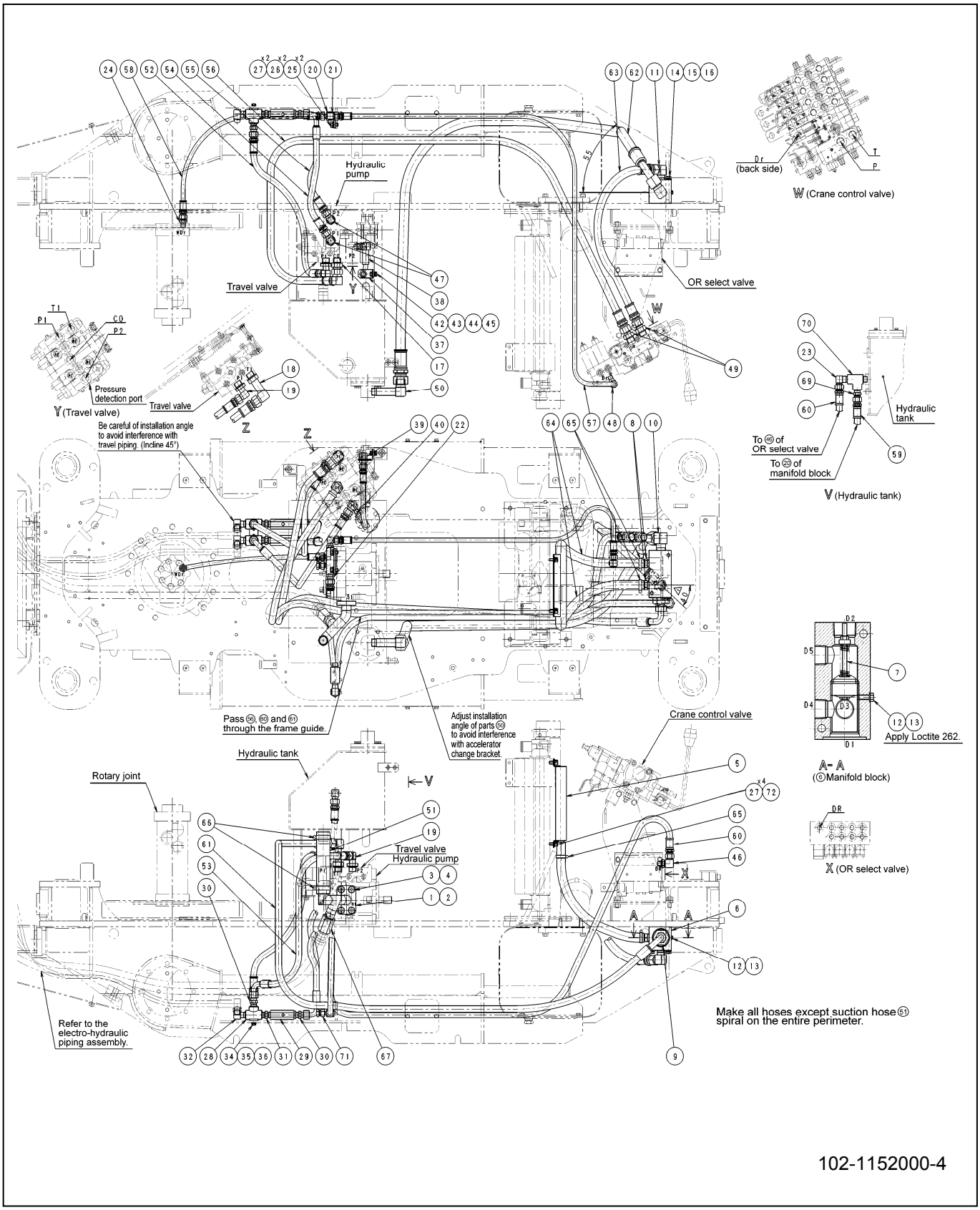
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Select valve port	Joint		Hose			Joint		Hose			Joint		Port	Connection cylinder	Action
	No.	Item number	No.	Label	Item number	No.	Item number	No.	Label	Item number	No.	Item number			
A3	9	22611-11030	2	OR2	22779SF3230	-	-	1	OR1	22779SF3110	9	22611-11030	A	OR1	Out
B3	9	22611-11030	2	OR2	22779SF3230	-	-	1	OR1	22779SF3110	9	22611-11030	B		In
A6	7	22611-11230	1	OR1	22779SF3110	9	22611-11030	-	-	-	-	-	A	OR2	Out
B6	8	22611-10630	1	OR1	22779SF3110	9	22611-11030	-	-	-	-	-	B		In
	13	22031-43300													
A9	7	22611-11230	1	OR1	22779SF3110	9	22611-11030	-	-	-	-	-	A	OR3	Out
B9	8	22611-10630	1	OR1	22779SF3110	9	22611-11030	-	-	-	-	-	B		In
	13	22031-43300													
A12	9	22611-11030	3	OR3	22779SF3245	-	-	1	OR1	22779SF3110	9	22611-11030	A	OR4	Out
B12	9	22611-11030	3	OR3	22779SF3245	-	-	1	OR1	22779SF3110	9	22611-11030	B		In

Number	Name	Q'ty	Note
1	OR hose 1	8	NN173-04-1100L 1005 = 0590 (spiral on entire perimeter) label “OR1”
2	OR hose 2	2	NN173-04-2300L 1005 = 0590 (spiral on entire perimeter) label “OR2”
3	OR hose 3	2	NN173-04-2450L 1005 = 0590 (spiral on entire perimeter) label “OR3”
4	Missing number		
5	Hexagon head bolt	2	M8 × 1.25 × 16L (plated)
6	Spring washer	2	M8 × Type 2 (plated)
7	Hose adapter	2	45 elbow 1072-04
8	Hose adapter	2	45 elbow 1036-04
9	Hose adapter	12	1067-04
10	Missing number		
11	Missing number		
12	Missing number		
13	Bushing	2	1068-04
14	Joint plate assembly	1	Item number: S102J3112000

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2.6 PT LINE



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Connection Table for Pump (P) Line															
Equipment name	Port	Joint		Hose			Joint		Hose			Joint		Port	Connection destination
		No.	Item number	No.	Label	Item number	No.	Item number	No.	Label	Item number	No.	Item number		
Pump	P1	47	22611-11150	54	P3	22750SA5038	30	22611-10150	52	P1	22750S85065	19	22611-11156	P1	Travel valve
							29	349S60200000							
							31	22031-06500							
							28	102-4583500							
							30	22611-10150							
	P2	47	22611-11150	55	P4	22750SA5030	30	22611-10150	53	P2	22750SA5090	19	22611-11156	P2	
							29	349S60200000							
							31	22031-06500							
							28	102-4583500							
							30	22611-10150							
	S1	1	102-3311600	51	-	22813-25019	-	-	-	-	-	-	-	-	(1)
		2	26210-20390												
Travel valve	CO	17	22611-11060	56	CO	22750SF6230	49	22611-11060	-	-	-	-	-	P	(2)
	Pressure detection	40	22611-10130	38	-	22750SF3027	39	22611-10830	-	-	-	-	-	-	(3)

Connection destination (1) = Hydraulic tank

Connection destination (2) = Crane control valve

Connection destination (3) = Travel pressure port bracket

Connection Table for Tank (T) Line										
Equipment name	Port	Joint		Hydraulic hose			Joint		Port	Connection destination
		No.	Item number	No.	Mark	Item number	No.	Item number		
Manifold block (Part No.6)	D1	9	22611-11068	61	T1	22740SA6210	18	22611-12360	T1	Travel valve
	D2	10	22611-10470	62	T2	22748SE7170	50	22611-10576	-	(1)
	D3	11	22611-10460	63	T3	22748S86060	49	22611-11160	T	(2)
	D4	8	22951-06170	64	T4	22813S15040	-	-	-	Oil cooler
	D5	8	22951-06170	64	T4	22813S15043	-	-	-	Oil cooler

Connection destination (1) = Hydraulic tank

Connection destination (2) = Crane control valve

Connection Table for Drain (Dr) Line										
Equipment name	Port	Joint		Hydraulic hose			Joint		Port	Connection destination
		No.	Item number	No.	Mark	Item number	No.	Item number		
Crane control valve	Dr	48	22611-10430	57	ADr	22740S83153	21	22611-11130	-	Manifold block (Part No.20)
Rotary joint	WDr	24	22611-10130	58	WDr	22740S83065	-	-	-	
OR select valve	DR	46	22611-11153	60	SDr	22713S85190	23	22611-10450	-	Hydraulic tank (drain)
Manifold block (Part No.20)	-	22	22611-11053	59	Dr	22740SF5070	69	22611-10150	-	

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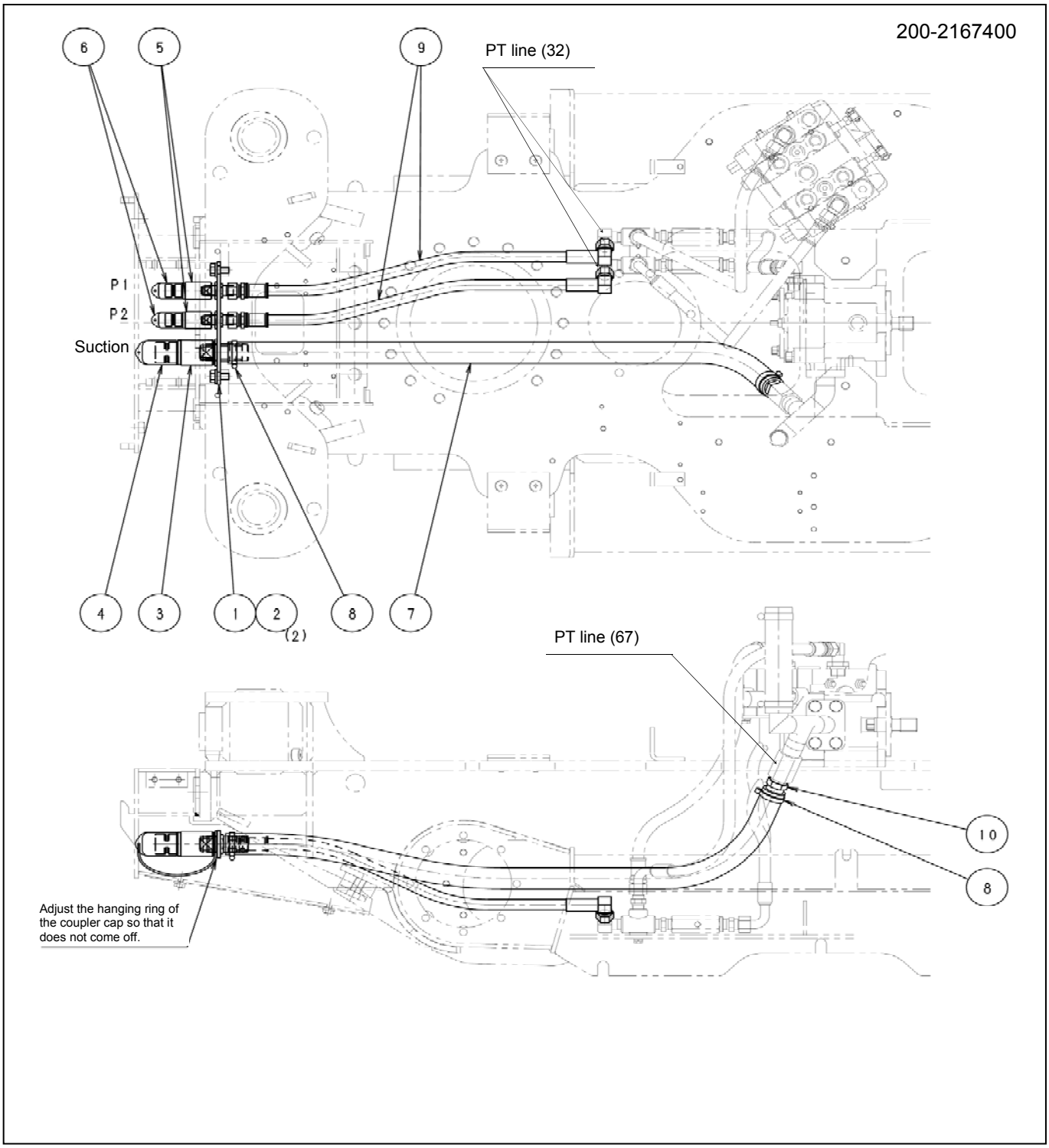
Number	Name	Q'ty	Note
1	Suction block	1	Item number: 102-3311600
2	O-ring	1	P39-1B
3	Hexagon head bolt	4	M10 × 1.5 × 25L (plated)
4	Spring washer	4	M10 × Type 2 (plated)
5	Oil cooler	1	Item number: 353S60700000
6	Manifold block	1	Item number: 353-3200700
7	Check valve	1	Item number: 353S66500000
8	Barb fitting	2	PT1/2 × ϕ17
9	Hose adapter	1	1067-16-08
10	Hose adapter	1	1034-12
11	Hose adapter	1	1034-08
12	Hexagon head bolt	1	M5 × 0.8 × 18L (plated)
13	Seal washer	1	Musashi SW 5 × 9
14	Hexagon head bolt	2	M8 × 1.25 × 80L (plated)
15	Plain washer	2	M8 × Regular circle (plated)
16	Spring washer	2	M8 × Type 2 (plated)
17	Hose adapter	1	1067-08
18	Hose adapter	1	1071-08-78A
19	Hose adapter	2	1071-08-06
20	Manifold block	1	Item number: S101J2063000
21	Hose adapter	1	1071-04
22	Hose adapter	1	1067-04-06
23	Hose adapter	1	1034-06
24	Hose adapter	1	1009-04
25	Hexagon head bolt	2	M8 × 1.25 × 16L (plated)
26	Plain washer	2	M8 × Regular circle (plated)
27	Spring washer	6	M8 × Type 2 (plated)
28	Manifold block 1	1	Item number: 102-4583500
29	Check valve	2	Item number: 349S60200000
30	Hose adapter	4	1009-06
31	Hose adapter	2	2083-06
32	Hose adapter	2	1034-06
33	Missing number		
34	Hexagon head bolt	2	M6 × 1.0 x 16L (plated)
35	Plain washer	2	M6 × Regular circle (plated)
36	Spring washer	2	M6 × Type 2 (plated)
37	Travel pressure port bracket	1	Item number: 102-4583600
38	P hose	1	NWP210-6-270L 1005 = 0590 (spiral on entire perimeter)
39	Hose adapter	1	9007-04
40	Hose adapter	1	1009-04
41	Missing number		
42	Hexagon head bolt	1	M6 × 1.0 × 16L (plated)
43	Hexagon nut	1	M6 × 1.0 Type 1 (plated)
44	Plain washer	2	M6 × Regular circle (plated)
45	Spring washer	1	M6 × Type 2 (plated)
46	Elbow with male 90° seat	1	1071-04-06
47	Hose adapter	2	1071-06
48	Hose adapter	1	1034-04
49	Hose adapter	2	1067-08
50	Hose adapter	1	9034-08-12

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Number	Name	Q'ty	Note
51	Suction hose	1	O.K. Excel hose - 100 25 × 2B 185L
52	P1 hose	1	NWP210-9-650L 1005 = 1005 (spiral on entire perimeter) label "P1"
53	P2 hose	1	NWP210-9-900L 1005 = ML90 (spiral on entire perimeter) label "P2"
54	P3 hose	1	NWP210-9-380L 1005 = ML90 (spiral on entire perimeter) label "P3"
55	P4 hose	1	NWP210-9-300L 1005 = ML90 (spiral on entire perimeter) label "P4"
56	C O hose	1	NWP210-12-2300L 1005 = 0590 (spiral on entire perimeter) label "C O"
57	Accel Dr hose	1	NWP35-6-1530L 1005 = 1005 (spiral on entire perimeter) label "ADr"
58	WDr hose	1	NWP35-6-650L 1005 = 1005 (spiral on entire perimeter) label "WDr"
59	Dr hose	1	NWP35-9-700L 1005 = 0590 (spiral on entire perimeter) label "Dr"
60	SDr hose	1	PA0306 C-C × 1900L (spiral on entire perimeter) label "SDr"
61	T1 hose	1	NWP35-12-2100L 1005 = ML90 (spiral on entire perimeter) label "T1"
62	T2 hose	1	Hi-Mid oil hose nominal size 19-1700L 1005 = ML45 (spiral on entire perimeter) label "T2"
63	T3 hose	1	Hi-Mid oil hose nominal size 12-600L 1005 = 1005 (spiral on entire perimeter) label "T3"
64	T4 hose	2	BS oil proof O.K. Excel-100 15 × 1B 430L (spiral on entire perimeter) label "T4"
65	Hose band	4	0X-25 (ϕ25 - ϕ18)
66	Hose band	2	1X-40 (ϕ40 - ϕ30)
67	Hexagon socket	1	NS-1066
68	Missing number		
69	Male connector	1	1009-06
70	Threaded tee with female plug on one side	1	2092-06
71	Female plug	1	1051-04
72	Hexagon socket head screw	4	M8 × 1.25 × 16L (plated)

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2.7 ELECTRO-HYDRAULIC PIPING ON MACHINE BODY SIDE



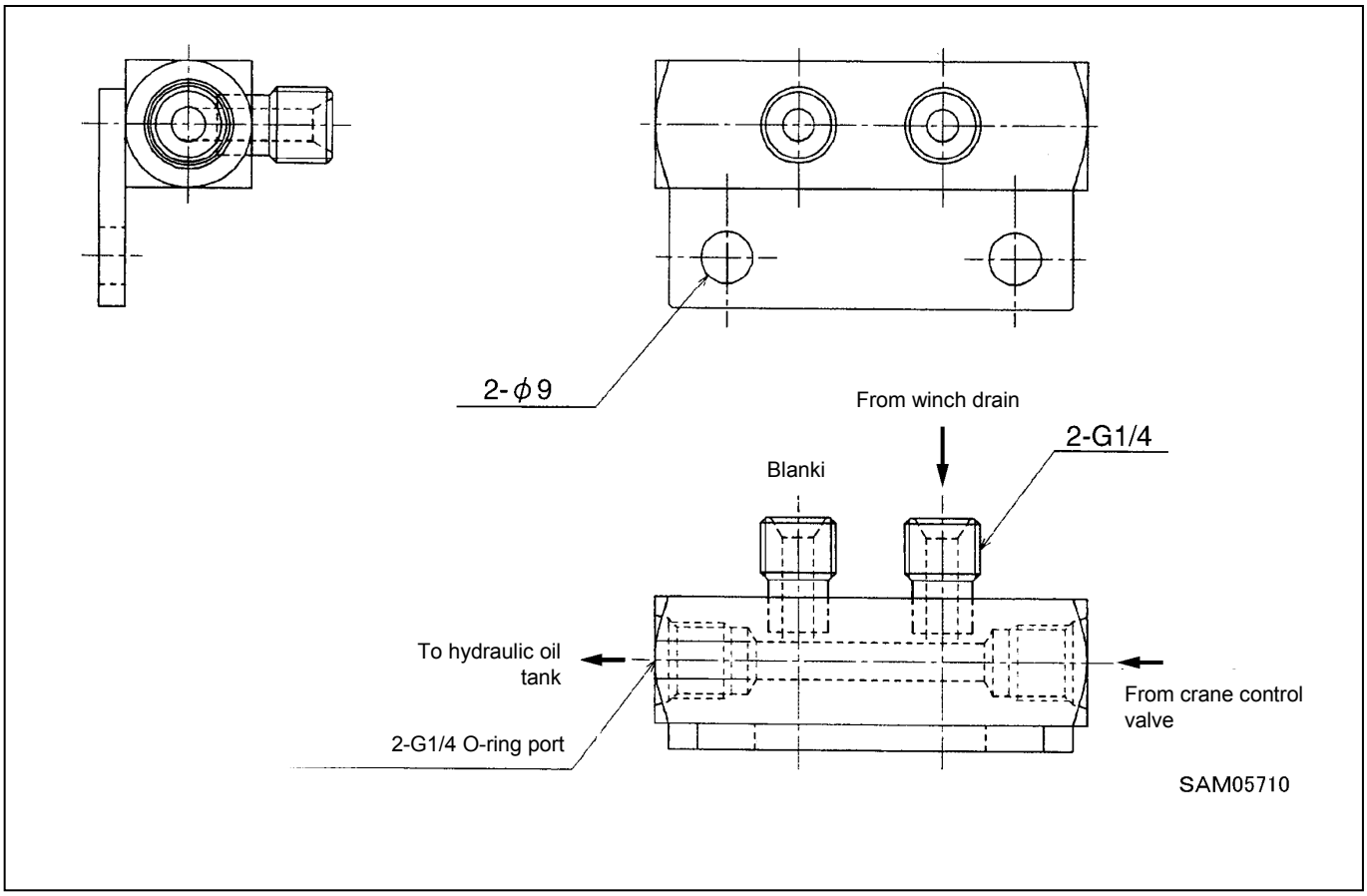
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Connection Table for Electric Powered Line									
Equipment name	Port	Joint		Hydraulic hose		Joint		Port	Connection destination
		No.	Item number	No.	Item number	No.	Item number		
(Manifold block 1) (Part No.28)	P1	(32)	(22611-10450)	9	22744SF5057	1	200-4640200	P1	Coupler F35-3P
	P2	(32)	(22611-10450)	9	22744SF5057	1	200-4640200	P2	Coupler F35-3P
(Suction block) (Part No.1)	—	(67)	(22011-05700)	7	22813S25094	1	200-4640200	Suction	Coupler F35-6P
		10	22951-07270						

*Parts in parentheses are parts of the PT line assembly.

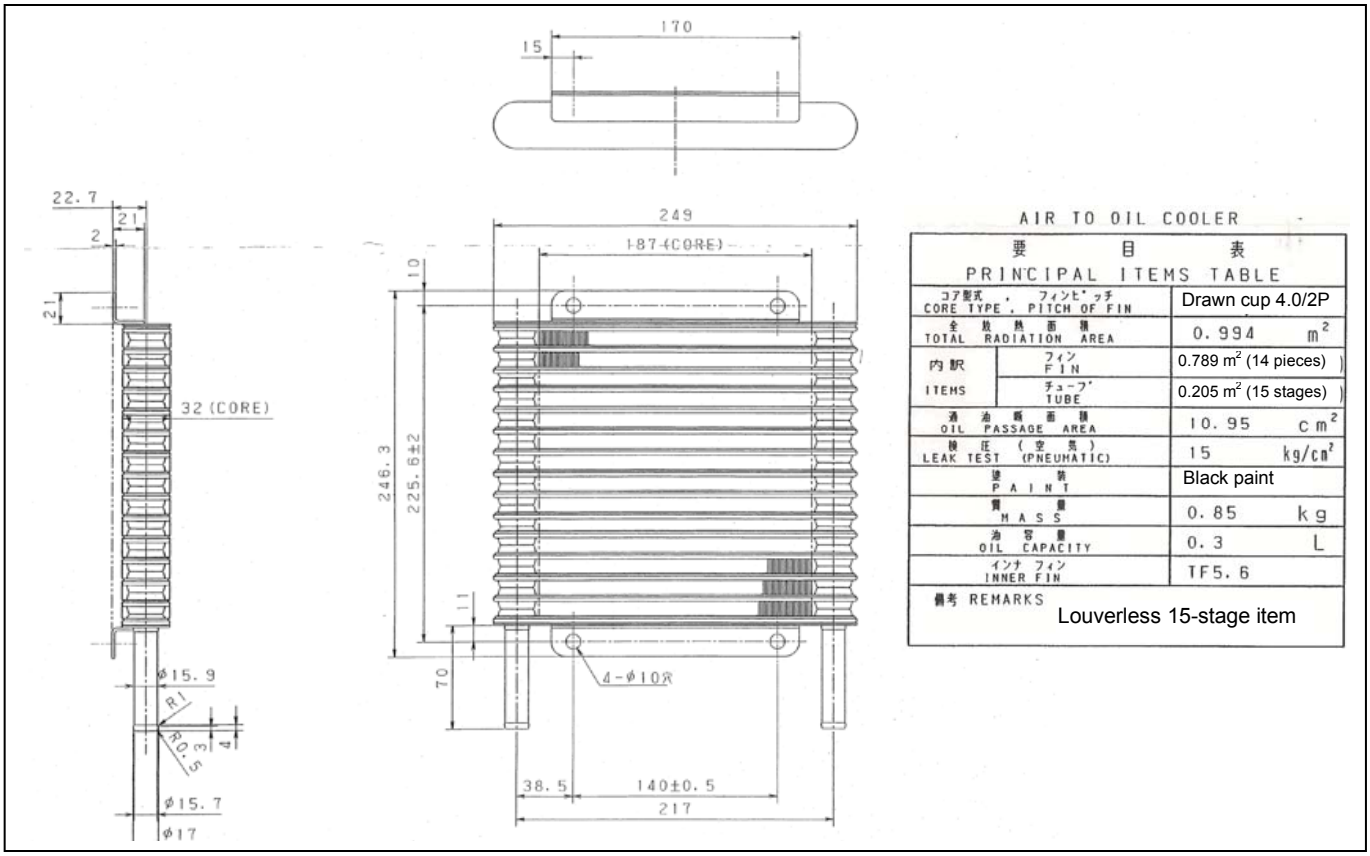
Number	Name	Q'ty	Note
1	Adapter bracket	1	Item number: 200-4640200
2	Sems bolt	2	Komatsu item number: 01024-81020
3	Flat face coupler (male)	1	Item number: 25580-01200 (F35-6P (Nitto))
4	Coupler cap	1	Item number: 25590-03000 (60471 (Nitto))
5	Flat face coupler (male)	2	Item number: 25580-00600 (F35-3P (Nitto))
6	Coupler cap	2	Item number: 25590-01000 (60469 (Nitto))
7	Suction hose	1	Item number: 22813S25094
			BS oil proof O.K. Excel-100 25 x 2B 940L (spiral on entire perimeter)
8	Jubilee band	2	Item number: 22972S04000 (1X-40 (/40 - /30)
9	PE hose	2	Item number: 22744SF5057
			YFH2109 1005 = 0590 570L (spiral on entire perimeter)
10	Barb fitting	1	Item number: 22951-07270 (HN-1627)

2.8 RETURN MANIFOLD BLOCK (P, T LINE PARTS No.20)



Item number: S101J2063000

2.9 OIL COOLER (P,T, Dr LINE)



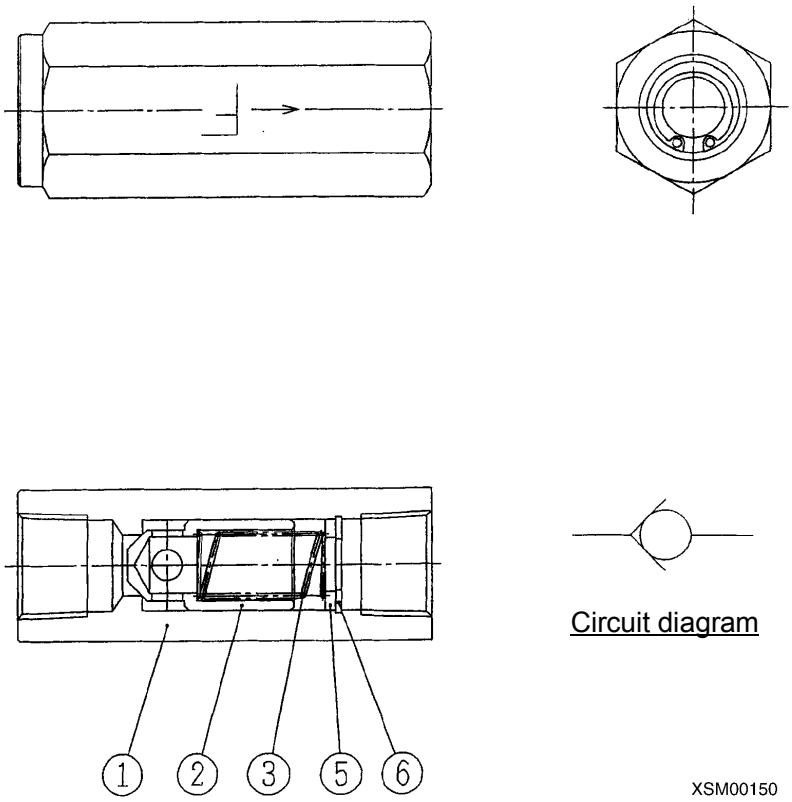
AIR TO OIL COOLER

要目表 PRINCIPAL ITEMS TABLE		
コア型式，フィンピッチ CORE TYPE , PITCH OF FIN		Drawn cup 4.0/2P
全放熱面積 TOTAL RADIATION AREA		0.994 m^2
内訳 ITEMS	フィン FIN	0.789 m^2 (14 pieces)
	チューブ TUBE	0.205 m^2 (15 stages)
通油断面積 OIL PASSAGE AREA		10.95 cm^2
耐圧（空気） LEAK TEST (PNEUMATIC)		15 kg/cm^2
塗装 PAINT		Black paint
質量 MASS		0.85 kg
油容量 OIL CAPACITY		0.3 L
インナフィン INNER FIN		TF5.6
備考 REMARKS		Louverless 15-stage item

Item number: 353S60700000

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2.10 CHECK VALVE (ELECTRIC POWERED LINE)



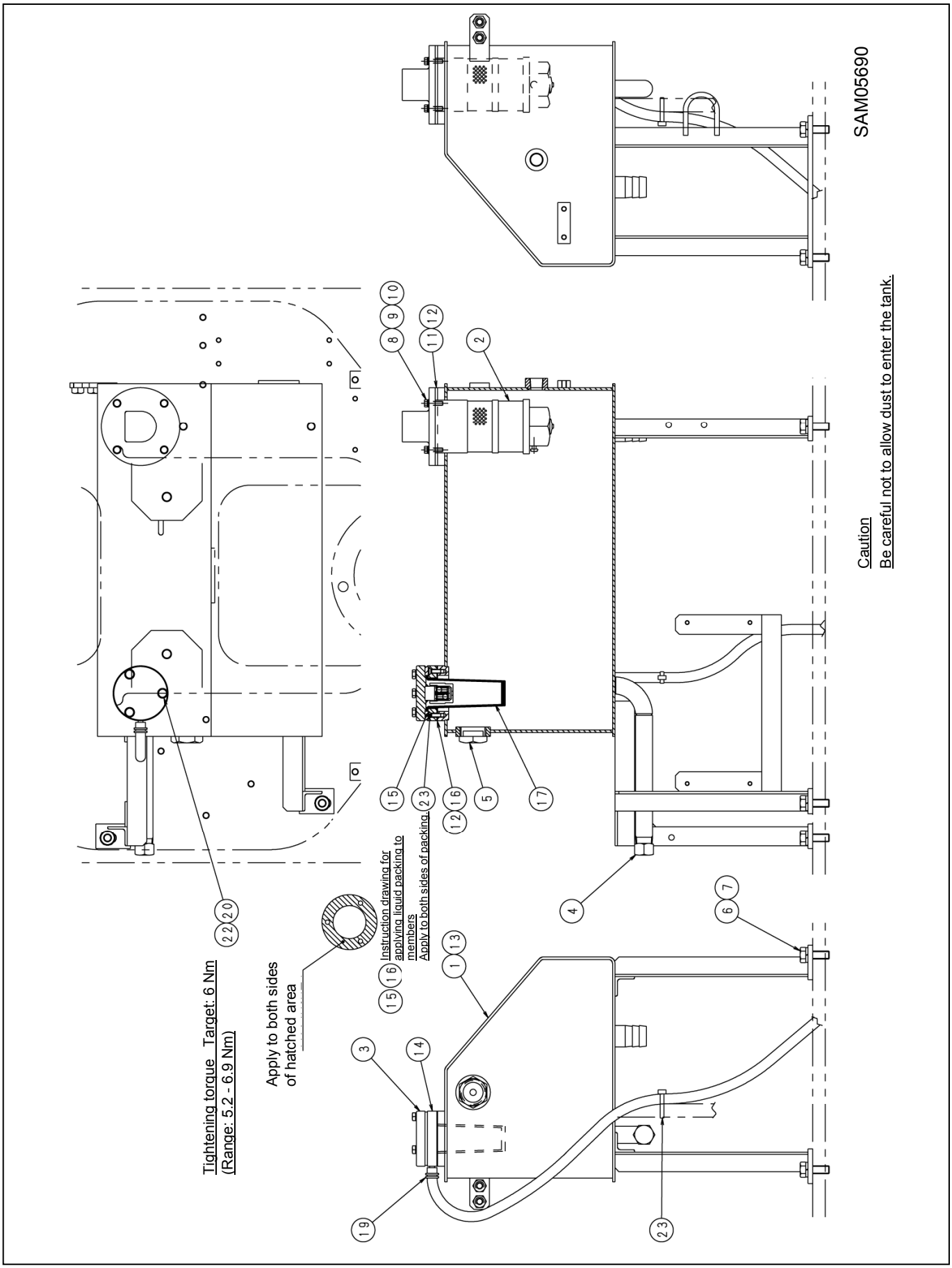
Number	Name	Q'ty	Note
1	Body	1	Manufacturer item number: 1114-1 Port screw size: Rc 3/8
2	Plunger	1	Manufacturer item number: 1114-2
3	Compression spring	1	Manufacturer item number: 1114-3
4	Missing number		
5	Stopper	1	Manufacturer item number: 1114-4
6	Snap ring	1	Manufacturer item number: No.50014

Specifications	
Rated flow rate	64 L/min
Rated pressure	20.59 MPa (210 kgf/cm^2)
Cracking pressure	0.049±0.02 MPa (0.5±0.2 kgf/cm^2)

Item number: 349S60200000

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3. HYDRAULIC TANK

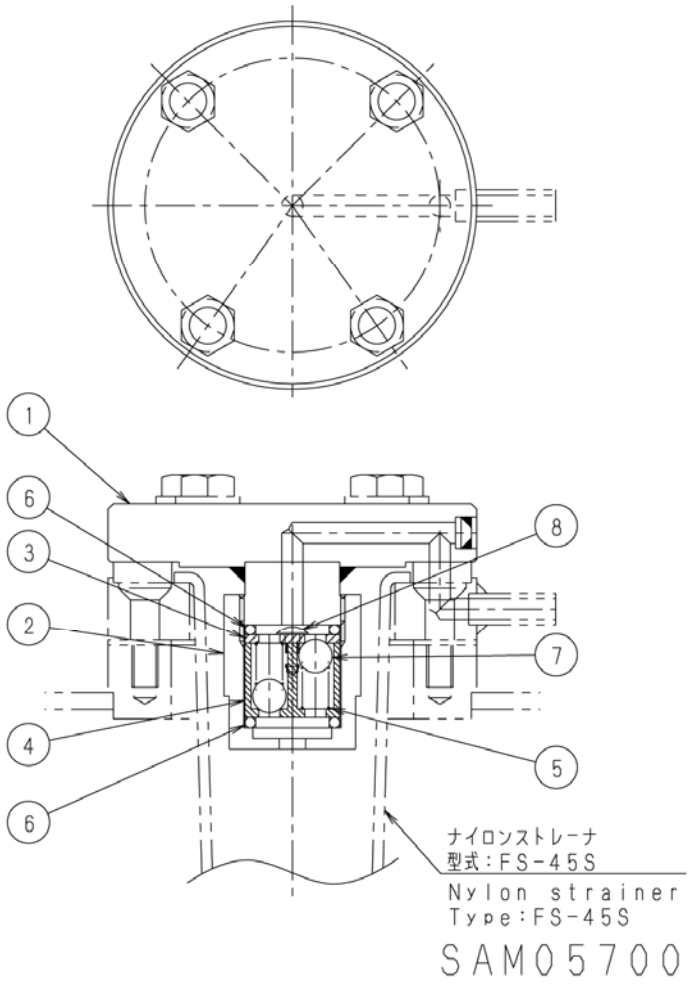


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Number	Name	Q'ty	Note
1	Hydraulic oil tank	1	Item number: 102-2135300
2	Return filter	1	Item number: 329-3112700
3	Air breather assembly	1	Item number: 353-4453000
4	Hexagon cap	1	NC-1004-PT1/2
5	Level gauge	1	Item number: 329-4290000 Model: MN1
6	Hexagon head bolt	4	M10 × 1.5 × 30L (plated)
7	Spring washer	4	M10 × Type 2 (plated)
8	Hexagon head bolt	4	M5 × 0.8 x 20L (plated)
9	Spring washer	4	M5 × Type 2 (plated)
10	Plain washer	4	M5 × Regular circle (plated)
11	Packing RF	1	Item number: 329-4286900-1
12	Liquid packing	-	ThreeBond #1207B
13	Hydraulic oil	25L	VG32 grade
14	Plate	1	Item number: 353-4451100
15	Packing	1	Item number: 101-4605600
16	Packing	1	Item number: 101-4605800
17	Nylon strainer	1	Model: FS-45S
18	Hose	1	OK Excel 6 × 1B ϕ6.6 × ϕ12.7 × 0.9 m
19	Wire band	1	Size 13 13-11
20	Hexagon head bolt	4	M6 × 1.0 × 20L (plated)
21	Cross-recessed head machine screw	3	M5 × 0.8 × 16L (plated)
22	Seal washer	4	SW 6 x 10
23	Cable tie	1	CV-250B

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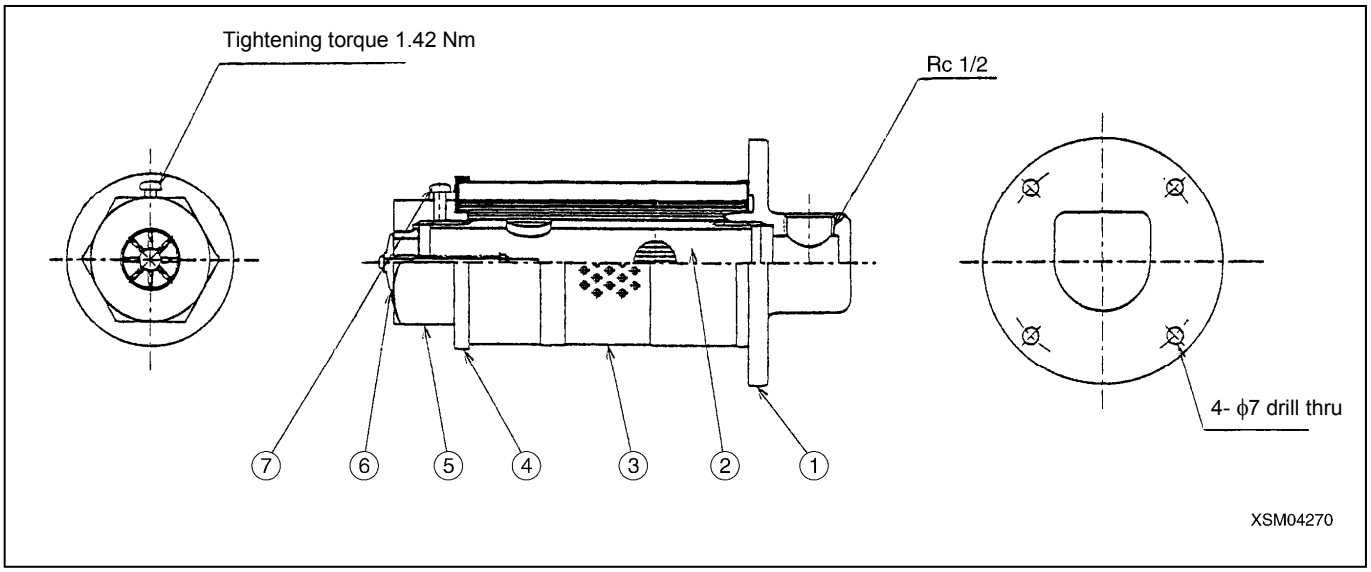
3.1 AIR BREATHER ASSEMBLY



Number	Name	Q'ty	Note
1	Cap	1	Item number: 353-4451000
2	Connector	1	Item number: 353-4450700
3	Plate	1	Item number: 350-4408400
4	Housing	1	Item number: 350-4410900
5	Spring	2	Item number: 350-4408800
6	O-ring	2	P-14, Type 1 A
7	Steel ball	2	Nominal size 1/4
8	Cross-recessed truss head screw	1	M2.6 × 0.45 × 5L

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3.2 RETURN FILTER



Number	Name	Q'ty	Note
1	Cover	1	
2	Inner tube	1	
3	Element	1	30μ
4	Plate	1	0.8t
5	Valve holder	1	
6	Valve assembly	1	
7	Set screw	1	M5 × 12

Specifications	
Oil used	Hydraulic oil ISO VG32, 46
Flow rate	25L/min (Max. 40L/min)
Oil temperature	-20˚C to 120˚C
Filtration accuracy	30μ as per JIS B 8356 (nominal 10μ)
Filtration area	1400 cm^2
Bypass valve set pressure	0.1 MPa

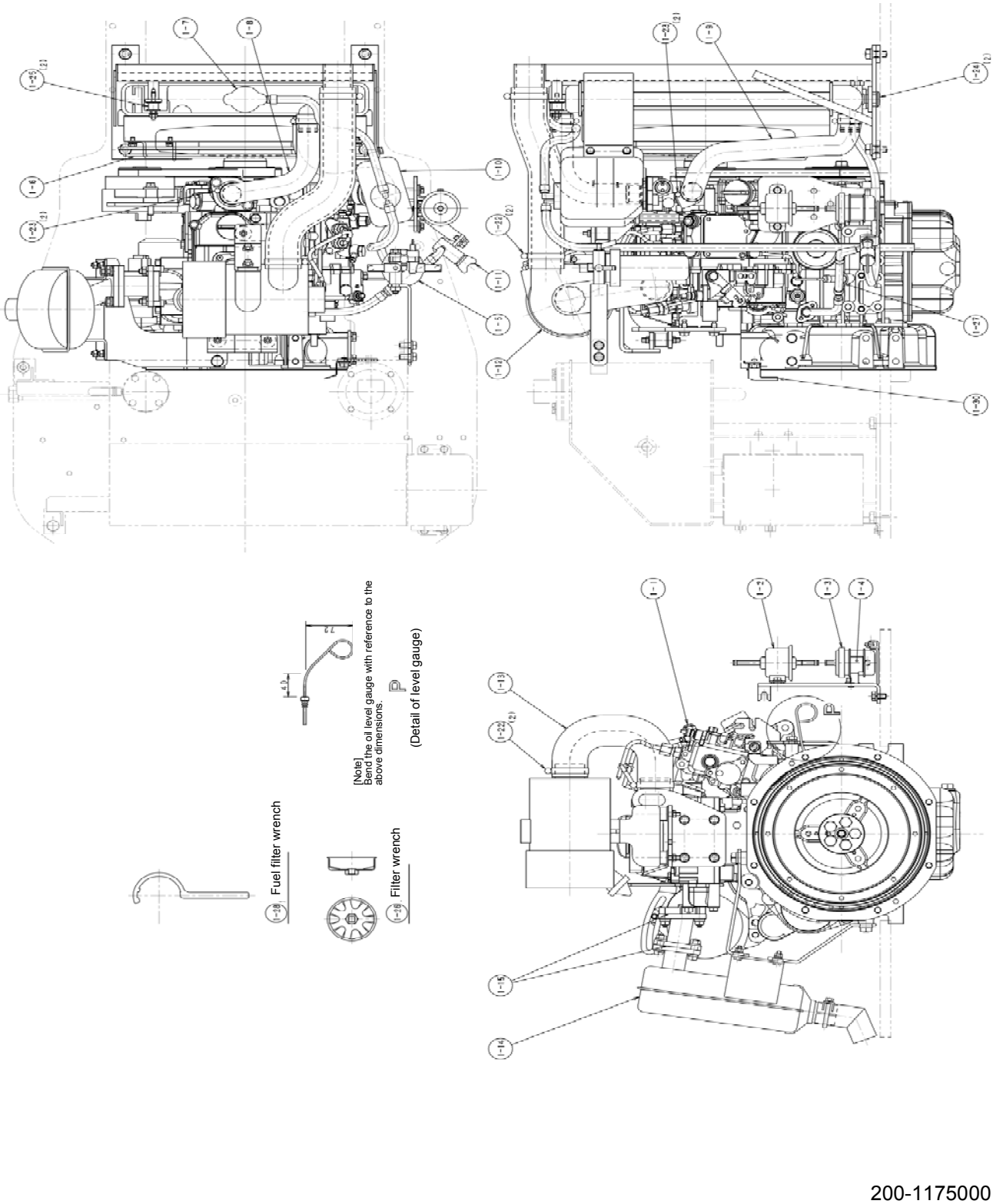
4. ENGINE ASSEMBLY

4.1 ENGINE SPECIFICATIONS

Engine name		2TNV70-NMBA
Applicable emission control		EPA Tier4 voluntary restraint
Engine type		Vertical in-line water-cooled 4 stroke diesel engine (special swirl type)
Number of cylinders - Bore x Stroke		2 - ϕ70 mm × 74 mm
Total stroke volume		569 cm^3
Compression ratio		23
Rated output (Net, output tolerance: ±3%)		7.4 kW/2500 min^{-1} (10.1 PS/2500 min^{-1}) (engine name plate display, no output display)
Maximum torque		31.5 - 34.4 N-m/1800 min^{-1} (3.2 - 3.5 kgf-m/1800 min^{-1})
Rate of fuel consumption		≤288 g/kWh (≤212 g/PSh)
Atmospheric condition		Room temperature 298K (25˚C), Atmospheric pressure 100 kPa (750 mmHg), Relative humidity 30%
Engine speed at no load		Maximum: 2675 (±25) min^{-1}, Minimum: 1250 (±25) min^{-1}
Coefficient of speed fluctuation		Momentary: ≤12%, Steady state: ≤7%
Setting time		≤6s
Rotational fluctuation		≤30 min^{-1}
Allowable inclination angle		Continuous 25 degrees (all sides), momentary 30 degrees (all sides)
Engine rotation direction		Left rotation (viewed from the flywheel side)
Lubricating oil used		Engine oil SD or higher class SAE30 (when cold SAE20)
Dry mass		84 (+0/5) kg
Fuel system	Fuel used	JIS K2204 No.2 light oil
	Fuel injection pump	Bosch integral in-line type (YPES-ML type) integral with speed governor
	Filtration system	Full-flow filtration system (integral with water trap)
	Governor	Centrifugal all-speed type
Lubrication system	Lubricating oil used	CD class of new SAE classification 10W30
	Lubricating oil pump	Trochoid pump
	Filtration system	Forced-feed lubrication
Cooling system	Cooling method	Radiator cooling
	Radiator	Pressurized sealed system, aluminum radiator
	Fan	φ270-5 blade (suction) fan spacer T = 30 Crank pulley/fan pulley = ϕ110/90
Air cleaner		Cyclone type (resin 4 inch)
Start system		Electric type
Starter		12V-1.4kW
Generator		12V-20A
Battery		55B24
Start assist device		Glow plug (Super quick glow plug)
Stop device		Built-in governor made by Stop Solenoid Synchrostart 12V (waterproof)
Coolant capacity		Engine 0.6L (engine only)
Lubricating oil quantity		Total quantity 2.2L, effective quantity 1L (oil pan only)
Engine paint color		Yanmar black

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4.2 ENGINE APPEARANCE

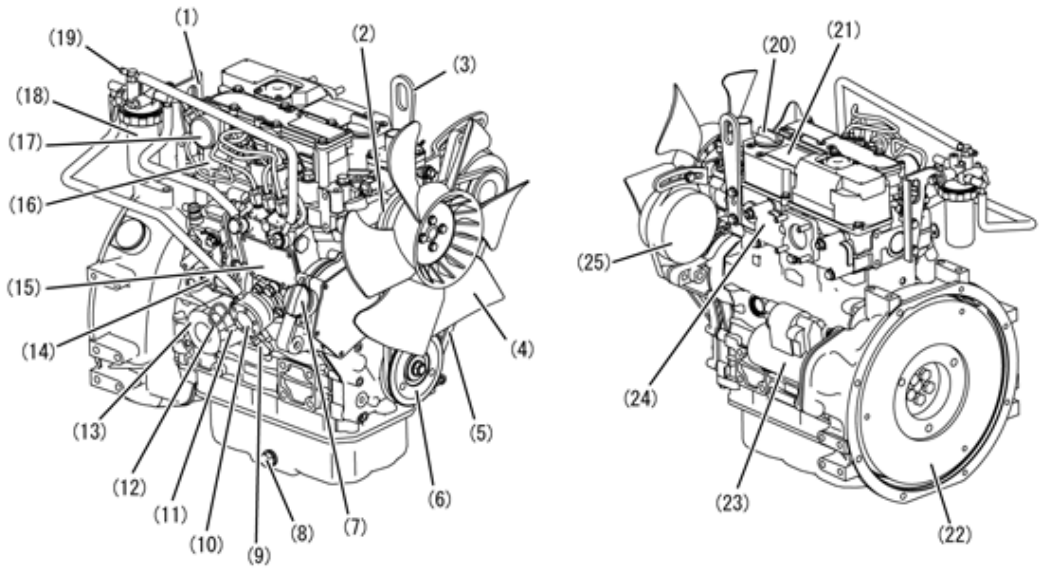


200-1175000

Number	Name	Q'ty	Note
1	Engine assembly	1	Item number: S102A2505001
1-1	Engine	1	Item number: S102A2505011 Model: 2TNV70-NMBA (Yanmar)
1-2	Solenoid feed pump	1	Item number: 119225-52102
1-3	Fuel pre-filter	1	Item number: 129052-55630
1-4	Clamp	1	Item number: 198072-04320
1-5	Fo filter	1	Item number: 129053-55620
1-6	Cooling fin guard	1	Item number: 119802-44570
1-7	Radiator	1	Item number: 119515-44540
1-8	Radiator hose A	1	Item number: 119802-49010
1-9	Radiator hose B	1	Item number: 119940-49020
1-10	Sub tank	1	Item number: 121468-44520
1-11	Three-way cock	1	Item number: 129150-49100
1-12	Air cleaner	1	Item number: 119440-12520
1-13	Intake pipe	1	Item number: 119631-12650
1-14	Silencer	1	Item number: 119325-13500
1-15	Gasket	2	Item number: 121000-13201
1-16	Missing number		
1-17	Missing number		
1-18	Missing number		
1-19	Missing number		
1-20	Missing number		
1-21	Missing number		
1-22	Hose crip 60	4	Item number: 23000-060000
1-23	Hose crip 38	4	Item number: 23010-038000
1-24	Rubber cushion	2	Item number: 119255-44660
1-25	Rubber cushion	2	Item number: 127694-91050
1-26	Filter wrench	1	Item number: 119332-92751
1-27	Vent	1	Item number: 119840-59601
1-28	Fuel filter wrench	1	Item number: 171051-92760
1-29			
1-30	Support	1	Item number: 129136-66852

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4.3 COMPONENTS OF ENGINE



1 - Sling fittings (flywheel side)
2 - Coolant pump
3 - Sling fittings (cooling fan side)
4 - Cooling fan
5 - V-belt
6 - Crankshaft V-pulley
7 - Oil filler port on side (engine oil)
8 - Drain plug (engine oil)*
9 - Fuel inlet
10 - Carburetor type fuel feed pump (if equipped)
11 - Fuel priming lever
12 - Oil level gauge (engine oil)
13 - Lubricating oil filter
14 - Governor lever
15 - Fuel injection pump
16 - Intake manifold
17 - Intake port (from air cleaner)
18 - Fuel filter
19 - Return oil pipe (to fuel tank)
20 - Upper oil filler port (engine oil)
21 - Bonnet
22 - Flywheel
23 - Starter
24 - Exhaust manifold
25 - Alternator

SAM05730

Note: For details of engine maintenance, refer to the separate engine service manual (TNV service manual).

4.4 FUEL

4.4.1 APPROPRIATE USE

The use of fuel oil with poor properties causes the following defects. Provide guidance to users for using appropriate fuel oil.

1. Adhesion of deposit to exhaust valve
   In addition to poor compression, imperfect combustion, excessive fuel consumption, etc., unburned oil mixed in the exhaust gushes out or the exhaust valve seat portion is eroded.
2. Adhesion of deposit to piston ring groove
   Blow-back of burned gas, poor lubrication, imperfect combustion, excessive fuel consumption, or contamination of lubricating oil occurs and cylinder liners and piston rings are worn out prematurely.
3. Blockage or corrosion of nozzle hole of fuel injection valve
   Imperfect combustion causes wear, corrosion of the fuel injection mechanism and closing of the nozzle hole.

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4.4.2 DIESEL FUEL STANDARDS

The diesel fuel needs to conform to the following standards.

The following table shows a part of diesel fuel standards of various countries of the world.

Diesel fuel standards	Region
JIS K2204 No.2 light oil	Japan
No.2-D, No.1-D, ASTM D975-94	USA
EN590: 96	EU (European Union)
ISO 8217 DMX	International standard
BS 2869-A1 (or A2)	UK
KSM-2610	South Korea
GB252	China

[Other technical fuel standards]

- The cetane number of fuel must be “45” or higher.
- The sulfur content must be less than “0.5%” of the total volume. However, the recommended value is less than “0.05%”.
- For biodiesel fuel, refer to “4.4.3 BIODIESEL FUEL”.
- Do not mix kersene, used engine oil or excess fuel with diesel fuel.
- Moisture and deposit in fuel must be less than “0.05%” of the total volume.
- Always clean the fuel tank and equipment which handles fuel.
- Poor quality fuel decreases engine performance. In addition, it causes damage to the engine.
- Refrain from using a fuel additive. A part of fuel additives causes a decrease in engine performance.
- The ash content must be less than “0.01%” of the total volume.
- The residual carbon content must be less than “0.35%” of the total volume. However, the recommended value is less than “0.1%”.
- The aromatic content must be less than “35%” of the total volume. However, the recommended value is less than “30%”.
- PAH (polynuclear aromatic hydrocarbon) must be less than “10%” of the total volume.
- The metal content (sodium, magnesium, silicon, aluminium) must be “1 mass ppm” or less.
  (JPI-5S-44-95test analysis method)
- Lubricity A wear scar of WS1.4 in the HFRR test must be up to “460μm” at the maximum.

4.4.3 BIODIESEL FUEL

In various countries of the world including Europe and the U.S., fuel resources made from non-mineral oil such as RME (rapeseed methyl ester) and SOME (soybean methyl ester) are used as an extending agent of diesel fuel made from mineral oil.

RME and SOME are generically called FAME (fatty acid methyl ester).

In Yanmar engines, the use of biodiesel fuel, which has a mixing ratio of approved diesel fuel made from mineral oil: FAME = “95%” of the total volume: Less than “5%” of the total volume, is approved.

Thus, biodiesel fuel containing “5%” of FAME is called “B5 diesel fuel” in the market.

“B5 diesel fuel” needs to satisfy certain criteria.

1. Biofuel needs to satisfy the minimum criteria in a country where biofuel is used.
   - In Europe, diesel fuel needs to conform to the European standards EN14214.
   - In the U.S., diesel fuel needs to conform to the U.S. standards ASTEM D6751.
2. Be sure to purchase biofuel from an authorized diesel fuel dealer.

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[Precautions in using biofuel]

1. Free methanol in FAME can corrode FIE (fuel injection equipment) part made from aluminum and zinc.
2. Free water in FAME can cause clogging of the fuel filter and increase generation of bacteria.
3. Viscosity can become high when cold, which makes it hard for fuel to flow. Besides, an operation error of the fuel injection pump or faulty atomization of the injection nozzle may be caused.
4. FAME may adversely affect a part of rubber materials (sealing parts, etc.). This causes fuel to leak, which causes lubricating oil to be diluted.
5. Even when biodiesel fuel conforming to appropriate standards is used, attention needs to be paid to maintain fuel quality in the equipment and fuel tank. It is important always to replenish clean and new fuel. It is sometimes necessary to periodically wash away contamination of the fuel system and fuel storage vessel.
6. When biodiesel fuel, which does not conform to the standards specified by a diesel engine manufacturer and diesel fuel injection equipment manufacturer, is used, or deteriorated biodiesel fuel as described in the above precautions is used, this may not be covered by engine manufacturer's warranty.

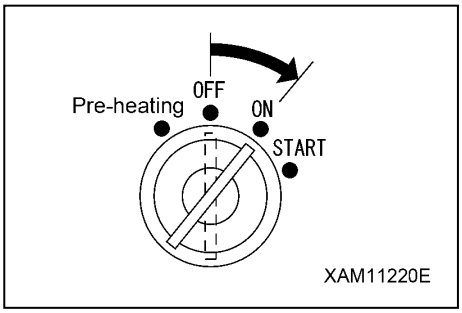
4.4.4 FUEL FEED TO FUEL SYSTEM

In the following cases, it is necessary to feed fuel to the fuel system before starting the engine.

- Before starting the engine for the first time
- After fuel runs out and the fuel tank is replenished with fuel
- After maintenance and inspection of the fuel system is performed such as replacement of the fuel filter, drain of the oil/water separator and replacement of fuel system parts

Feed fuel to the fuel system following the procedure below.

- Turn the main starter switch of the vehicle to the ON position and hold it for 10 - 15 seconds. This enables the solenoid feed pump to feed fuel to the fuel system.



⚠ CAUTION

Never turn the starter switch to feed fuel to the fuel system. Otherwise, the starter may be heated, which may break the coil, pinion gear, ring gear, etc.

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4.5 MAINTENANCE AND INSPECTION

Provide guidance to users for performing maintenance and inspection of the engine according to the following table.

○: Inspection by user ◇: Parts replacement ●: Sales and service shop

System	Inspection and maintenance item	Work Before starting Inspection	Inspection timing					
			50H every	250H every	500H every	1000H every	1500H every	2000H every
Cooling method	Inspection of coolant quantity and replenishment	○						
	Inspection and cleaning of radiator fin			○				
	Inspection of V-belt tension for cooling fan		○ First time	○ Second time onward				
	Drain of coolant, cleaning of cooling system, replenishment of new coolant					◇		
		Or annually (whichever comes first)						
Cylinder head	Gap adjustment of intake and exhaust valve heads					●		
	Lapping of intake and exhaust valve seats							●
Electrical equipment	Inspection of warning lamps	○						
	Inspection of battery fluid amount and auxiliary charge		○					
Lubricating oil	Inspection of engine oil quantity	○						
	Change of engine oil		◇ First time	◇ Second time onward				
	Lubricating oil filter replacement							
Accelerator equipment	Inspection and adjustment of governor lever and accelerator equipment	○		○				
Exhaust gas control system	Inspection and cleaning of fuel injection valve						●	
	Inspection of crankcase breather						●	
Fuel	Inspection of fuel tank oil quantity and replenishment	○						
	Drain of fuel tank			○				
	Drain of oil/water separator		○					
	Inspection of oil/water separator	○						
	Cleaning of oil/water separator				○			
	Replacement of fuel filter				◇◇			
Rubber hose	Replacement of fuel piping and coolant piping						Or every two years	◇
Intake and exhaust system	Cleaning and replacement of air cleaner element			○	◇			
Overall engine	Visual inspection of overall engine	○						

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4.6 TRUOBLE SHOOTING

The table below summarizes general symptoms and causes.If an abnormal symptom appears, take measures before it develops into a big accident.

■ **LIST OF TROUBLE SHOOTING**

Sign of failure / Cause		Starting failure				Insufficient engine output				Exhaust color failure			Knocking sound is high during combustion.	Abnormal noise from engine	There is nonuniformity in combustion sound.	Occurrence of hunting		Engine vibration is large.	Return to low speed is poor.	Fuel consumption is large.	Lubricating oil						There is a lot of blowby.	Coolant		Intake air		Increase in exhaust temperature	Remedy	Reference page
		The engine does not start.	The engine stops after starting.			Exhaust color				During work						At idle	During work				Lubricating oil consumption is large.	Lubricating oil is diluted by fuel.	Water mixes into lubricating oil.	Oil pressure is low.			Overheat	Water temperature is low.	Decrease in pressure	Increase in pressure			
			None	Little	A lot (Exhaust smoke)	Ordinary	White	Black	Black	White	Black																								
Engine system	Improper intake and exhaust valve clearance	O	O			O								O													O					O	Adjustment of valve clearance	Refer to "Measurement and adjustment of valve clearance" (Page 6-29).
	Pressure leak from valve seat part					O				O										O							O					O	Lapping of valve seats	Refer to "Correction of valve seats" (Page 6-24).
	Seizure of intake and exhaust valves	O			O	O				O								O									O						Correction or replacement of intake and exhaust valves	Refer to "Inspection of intake and exhaust valves" (Page 6-23).
	Blowby of cylinder head gasket					O																			O								Replacement of gasket	Refer to "Disassembly of cylinder head" (Page 6-17).
	Sticking or breakage of piston rings	O			O		O			O								O			O						O					O	Replacement of piston rings	Refer to "Installation of cylinder head" (Page 6-25).
	Wear of piston ring, piston or cylinder	O			O		O			O											O						O						Performance of honing and use of over-sized parts	"Honing and Boring" Refer to (Page 6-48).
	Seizure of crank pin metal or bearing	O	O											O				O									O						Repair or replace	Refer to "Inspection of crankshaft and camshaft components" (Page 6-42).
	Closed gap position of piston rings faulty		O				O														O						O						Correction of close gap position	Refer to "Assembly of piston" (Page 6-50).
	Reverse assembly of piston rings							O		O											O						O						Correction of assembly	Refer to "Assembly of piston" (Page 6-50).
	Wear of crank pin metal and journal metal					O								O				O						O									Measurement and replacement	Refer to "Inspection of crankshaft and camshaft components" (Page 6-42).
	Looseness of connecting rod bolt													O																			Tightening to the specified torque	Refer to "Tightening torque of main bolts and nuts" (Page 6-11).
	Mixing of foreign matter in the combustion chamber	O												O								O					O						Disassembly and repair	Refer to "Disassembly of cylinder block components" (Page 6-33).
	Excessive gear backlash													O																			Adjustment of gear engagement	Refer to "Inspection of timing gear backlash" (Page 6-34).
	Wear of intake and exhaust valve guides						O				O											O					O						Measurement and replacement	Refer to "Inspection of valve guides" (Page 6-22).
	Faulty adjustment of governor		O														O	O	O	O													Adjustment	Refer to "Inspection and adjustment of governor lever and accelerator equipment" (Page 5-27).
	Faulty opening/closing timing of intake and exhaust valves	O				O				O				O																			Adjustment of valve clearance	Refer to "Measurement and adjustment of valve clearance" (Page 6-29).

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Sign of failure / Cause	Starting failure: The engine does not start.	Starting failure: The engine stops after starting. Exhaust smoke: None	Starting failure: The engine stops after starting. Exhaust smoke: Little	Starting failure: The engine stops after starting. Exhaust smoke: A lot	Insufficient engine output: Exhaust color: Ordinary	Insufficient engine output: Exhaust color: White	Insufficient engine output: Exhaust color: Black	Exhaust color failure: During work: White	Exhaust color failure: During work: Black	Knocking sound is high during combustion.	Abnormal noise from engine	There is nonuniformity in combustion sound.	Occurrence of hunting: At idle	Occurrence of hunting: During work	Engine vibration is large.	Return to low speed is poor.	Fuel consumption is large.	Lubricating oil: Lubricating oil consumption is large.	Lubricating oil: Lubricating oil is diluted by fuel.	Lubricating oil: Water mixes into lubricating oil.	Lubricating oil: Oil pressure is low.	There is a lot of blowby.	Coolant: Overheat	Coolant: Water temperature is low.	Intake air: Decrease in pressure	Intake air: Increase in pressure	Increase in exhaust temperature	Remedy	Reference page
Coolant system: Supercooling of radiator								○								○								○				Replacement of thermostat	Refer to "Disassembly of coolant pump" (Page 8-8).
Coolant system: Insufficient cooling of radiator							○																○				○	Replace thermostat or inspect fan belt for looseness.	Refer to "Disassembly of coolant pump" (Page 8-8) or "Adjustment of V-belt tension for cooling fan" (Page 5-21).
Coolant system: Lack of coolant							○																○				○	Inspection of water leak of the coolant system	Refer to "Inspection of engine cooling system" (Page 8-7).
Coolant system: Crack of water jacket																				○			○					Repair or replace	Refer to "Disassembly of coolant pump" (Page 8-8).
Coolant system: Elongation of fan belt							○																○				○	Adjustment of belt tension	Refer to "Adjustment of V belt tension for cooling fan" (Page 5-21).
Coolant system: Thermostat failure							○	○															○	○				Inspect or replace	Refer to "Disassembly of coolant pump" (Page 8-8).
Lubricating oil system: Inadequate lubricating oil	○	○			○												○			○	○							Use of adequate lubricating oil	Refer to "Engine oil standards" (Page 4-14).
Lubricating oil system: Leak from lubricating oil system																	○			○								Repair	Refer to "Disassembly of lubricating oil pump" (Page 9-8).
Lubricating oil system: Insufficient discharge amount of trochoid pump																				○								Inspect and repair	Refer to "Disassembly of lubricating oil pump" (Page 9-8).
Lubricating oil system: Clogging of lubricating oil filter																				○		○						Clean or replace	Refer to "Replacement of engine oil and lubricating oil filters" (Page 5-19).
Lubricating oil system: Pressure regulating valve failure																				○								Clean, adjust or replace	Refer to "Disassembly of lubricating oil pump" (Page 9-8).
Lubricating oil system: Lack of lubricating oil quantity		○																		○								Replenishment of adequate lubricating oil	Refer to "Engine oil replenishment" (Page 4-15).
Lubricating oil system: Excessive lubrication to crankcase																				○								Inspection of engine oil	Refer to "Engine oil replenishment" (Page 4-15).

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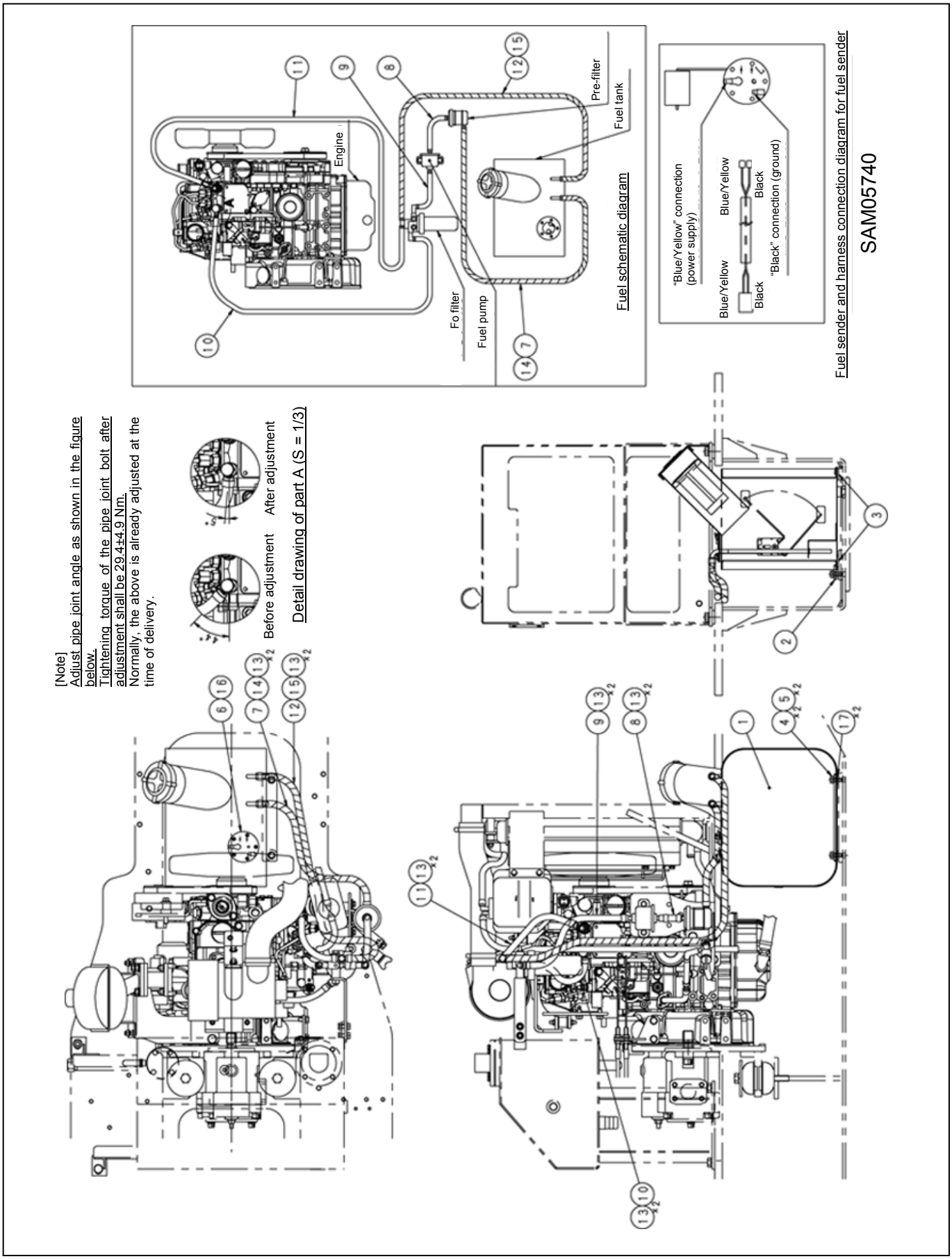
Sign of failure / Cause		Starting failure				Insufficient engine output				Exhaust color failure			Knocking sound is high during combustion.	Abnormal noise from engine	There is nonuniformity in combustion sound.	Occurrence of hunting		Engine vibration is large.	Return to low speed is poor.	Fuel consumption is large.	Lubricating oil						Coolant				Intake air		There is a lot of blowby.	Increase in exhaust temperature	Remedy	Reference page
		The engine does not start.	The engine stops after starting.			Exhaust color				During work						At idle	During work				Lubricating oil is large.	Lubricating oil is diluted by fuel.	Water mixes into lubricating oil.	Oil pressure is low.	Overheat	Water temperature is low.	Decrease in pressure	Increase in pressure					
			Exhaust smoke																																
			None	Little	A lot	Ordinary	White	Black	Black	White	Black																									
Fuel system	Injection timing of the fuel injection pump is too advanced.					○							○					○																Inspect and adjust	Refer to "Inspection and adjustment of fuel injection timing" (Page 7-18).
	Injection timing of the fuel injection pump is too retarded.						○			○										○													○	Inspect and adjust	Refer to "Inspection and adjustment of fuel injection timing" (Page 7-18).
	Inadequate fuel oil					○	○	○		○					○																			Use of adequate fuel	Refer to "Diesel fuel standards" (Page 4-9).
	Mixing of water in the fuel system	○			○		○			○					○	○	○																	Implementation of fuel filter drain	Refer to "Drain of oil/water separator" (Page 5-22).
	Clogging of fuel filter	○		○		○										○	○																	Clean or replace	Refer to "Drain of oil/water separator" (Page 5-22).
	Mixing of air in the fuel system	○		○		○										○	○																	Implementation of air bleeding	Refer to "Oil feed to fuel system" (Page 4-12).
	Clogging or crack of fuel pipe	○		○		○										○	○																	Clean or replace	Refer to "Inspection and replacement of fuel oil pipe and coolant pipe" (Page 5-35).
	Lack of fuel supply to fuel injection pump	○	○			○										○	○																	Inspection of fuel tank cock, fuel filter, fuel pipe and fuel feed pump	Refer to procedures of "Periodic maintenance and inspection" (Page 5-1).
	Ununiformity of injection amount of fuel injection pump						○	○		○					○	○	○																	Inspect and adjust	Refer to "Test of fuel injection valve" (Page 7-22).
	Excessive fuel injection amount										○									○	○				○								○	Inspect and adjust	Refer to "Test of fuel injection valve" (Page 7-22).
	Spray failure of fuel injection nozzle						○	○		○					○	○	○			○														Inspect and adjust	Refer to "Test of fuel injection valve" (Page 7-22).
	Priming cannot be performed.	○																																Dust caught in a valve inside priming pump (disassembly and cleaning)	Refer to "Components of fuel system" (Page 7-10)
	Clogging of strainer of feed pump inlet					○																												Cleaning of strainer	Refer to "Drain of fuel tank" (Page 5-25).

Sign of failure / Cause		Starting failure				Insufficient engine output			Exhaust color failure					Occurrence of hunting					Lubricating oil					Coolant		Intake air			Remedy	Reference page
			The engine stops after starting.			Exhaust color			During work																					
			Exhaust smoke																											
		The engine does not start.	None	Little	A lot	Ordinary	White	Black	White	Black	Knocking sound is high during combustion.	Abnormal noise from engine	There is nonuniformity in combustion sound.	At idle	During work	Engine vibration is large.	Return to low speed is poor.	Fuel consumption is large.	Lubricating oil consumption is large.	Lubricating oil is diluted by fuel.	Water mixes into lubricating oil.	Oil pressure is low.	There is a lot of blowby.	Overheat	Water temperature is low.	Decrease in pressure	Increase in pressure	Increase in exhaust temperature		
Intake and exhaust gas system	Clogging of air filter				O			O		O			O													O			Cleaning of air filter	Refer to “Cleaning of air cleaner element” (Page 5-28).
	Use of engine at high temperature or at high altitude							O		O								O						O		O			Study matching between decrease in output and load	
	Clogging of exhaust pipe							O		O			O															O	Cleaning of exhaust pipe	
Electric system	Starter failure	O																											Repair or replace starter	Refer to “Starter” (Page 10-9).
	Alternator failure	O																											Repair or replace alternator	Refer to “Removal of alternator” (Page 11-12) *or* “Removal of dynamo” (Page 11-21).
	Broken wire	O																											Repair of broken wire part	
	Decrease in battery voltage	O																											Inspection and charging of battery	Refer to “Battery fluid level inspection and auxiliary charge” (Page 5-24).

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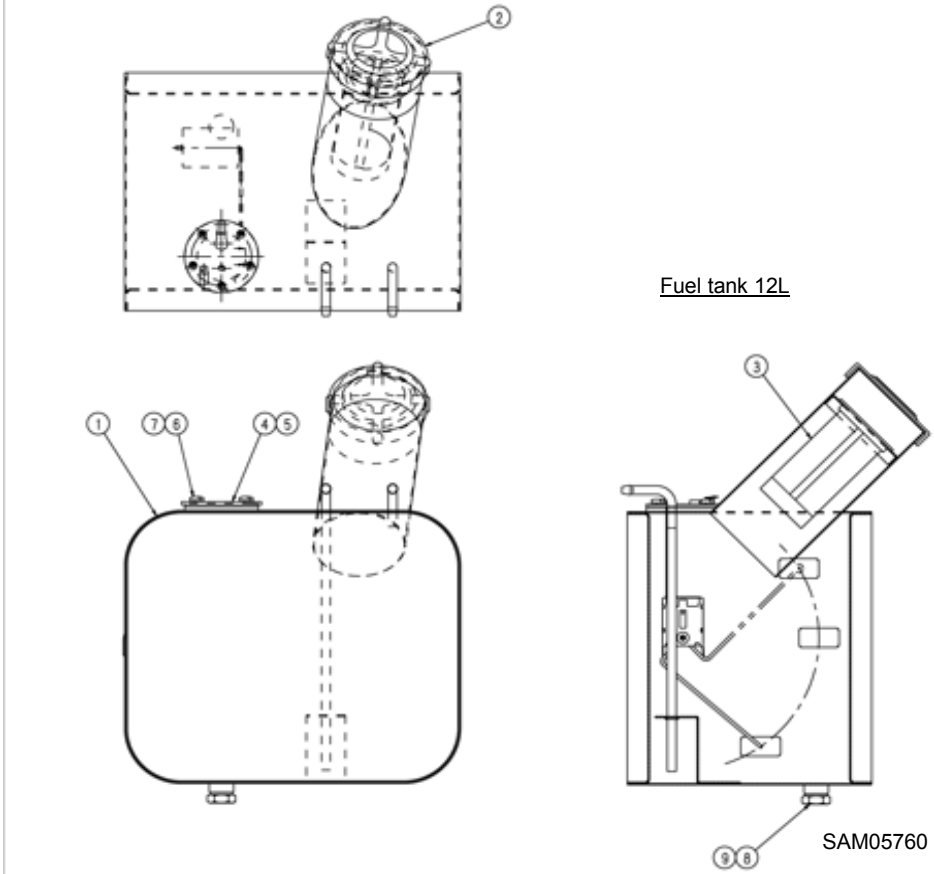
4.7 FUEL PIPING

4.7.1 FUEL LINE



Number	Name	Q'ty	Note
1	Fuel tank assembly	1	Item number: 353-2070400
2	Tank presser	1	Item number: 353-4437500
3	Rubber plate	2	Item number: 353-4437600
4	Hexagon head bolt	2	M8 x 1.25 x 20L (plated)
5	Spring washer	2	M8 x Type 2 (plated)
6	Fuel sender	1	Item number: S353M2324000
7	Fuel hose 1	1	Yokohama fuel hose nominal size 8 410L
8	Fuel hose 2	1	Yokohama fuel hose nominal size 8 60L
9	Fuel hose 3	1	Yokohama fuel hose nominal size 8 300L
10	Fuel hose 4	1	Yokohama fuel hose nominal size 8 190L
11	Fuel hose 5	1	Yokohama fuel hose nominal size 8 260L
12	Fuel hose 6	1	Yokohama fuel hose nominal size 8 950L
13	Crescent clamp	12	RS-8007
14	Spiral tube	1	FP12-B-0.3L = 410 mm
15	Spiral tube	1	FP12-B-0.3L = 950 mm
16	Harness for fuel sender	1	Item number: S102M2542000
17	Shim	2	Item number: 102-4582800

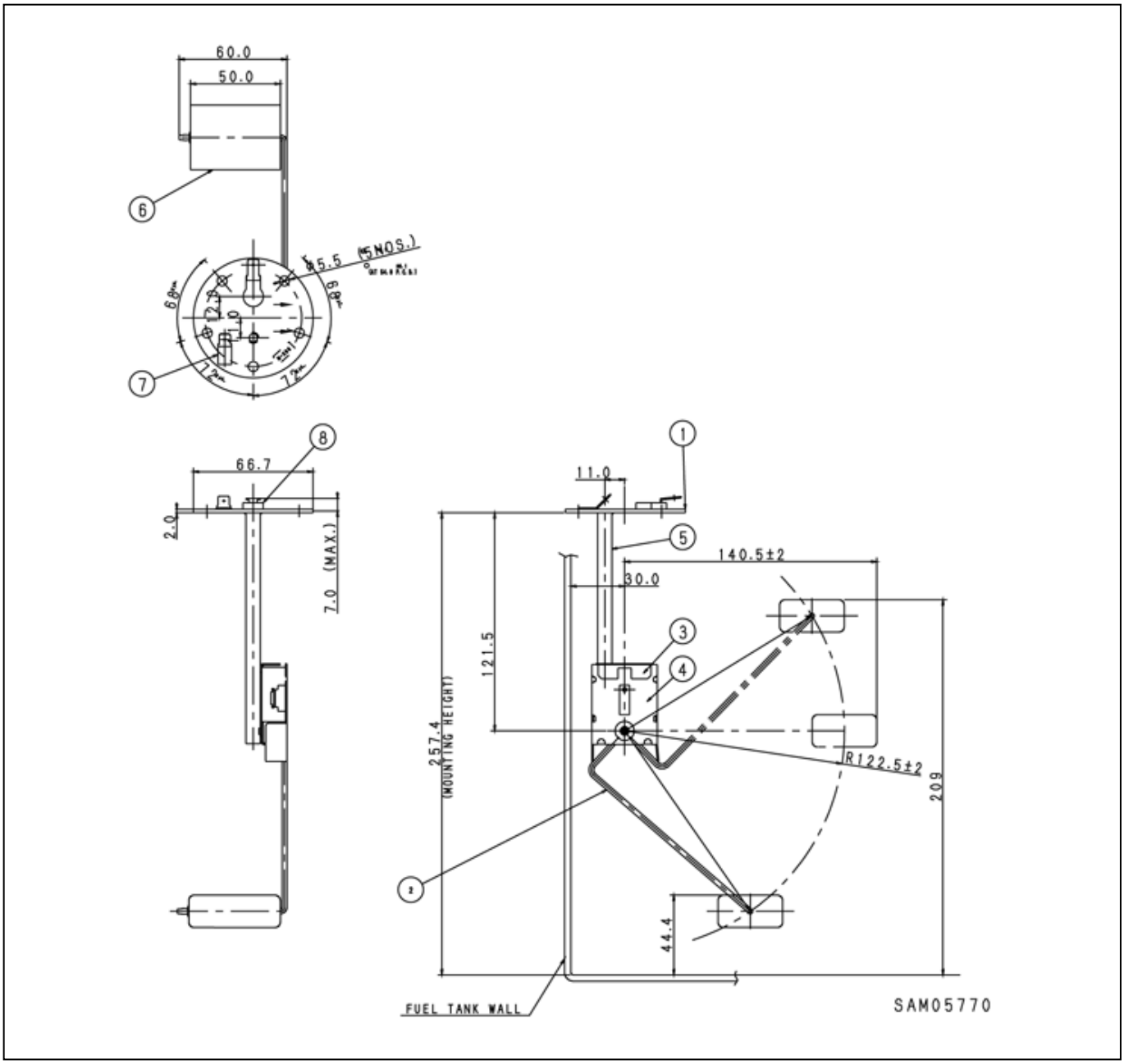
4.7.2 FUEL TANK ASSEMBLY



Number	Name	Q'ty	Note
1	Fuel tank	1	Item number: 353-2064500
2	Cap assembly	1	Item number: 4700-68000-0
3	Strainer	1	Item number: 4700-69000-0
4	Cap	1	Item number: 353-4452100
5	Packing	1	Item number: 353-4438700
6	Cross-recessed round head screw	5	M4 x 0.7 x 10L
7	Spring washer	5	M4 x Type 2
8	Seal washer	1	SW 14 x 23
9	Hexagon head bolt	1	M14 x 1.5 x 10L (fine)

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4.7.3 FUEL SENDER

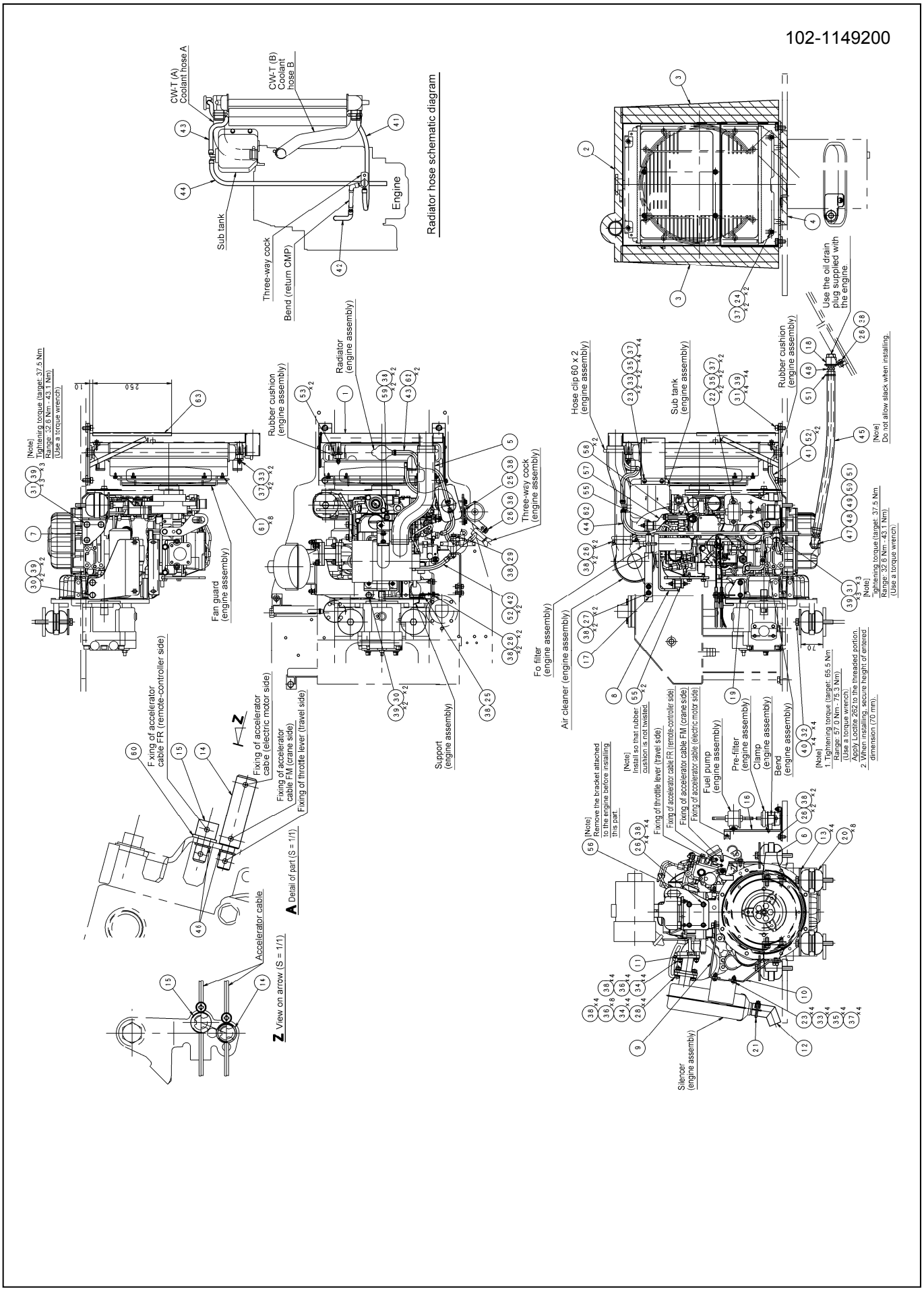


Number	Name	Q'ty
1	Mounting plate	1
2	Tongue wire	1
3	Housing	1
4	Cover	1
5	Tube	1
6	Float (NBR)	1
7	Terminal	2
8	Upper insulator	1

Performance		
Float position	FULL	EMPTY
Value of resistance (Ohm)	5 (+1/-4)	85 (+5/0)

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4.8 ENGINE ACCESSORIES



Number	Name	Q'ty	Note
1	Radiator stand	1	102-2136700
2	Seat	1	353-4438800
3	Seat	2	102-4582000
4	Seat	1	353-4439000
5	Inlet pipe	1	102-3310500
6	Mount BK (L)	1	102-2136800
7	Mount BK (R)	1	102-2136900
8	Air cleaner BK	1	102-3320000
9	Muffler BK (A)	1	102-4582100
10	Muffler BK (B)	1	102-4582200
11	Extension pipe	1	353-3202900
12	Muffler cutter	1	353-4437000
13	Washer	4	710-4057500
14	Wire end	1	102-4599700
15	Double wire end	1	921-4320000-1
16	Pump bracket	1	102-3321400
17	Fo filter bracket	1	102-4582500
18	Drain bracket	1	102-4582600
19	Accelerator change bracket	1	102-3321000
20	Rubber cushion	8	353S66300000 (BS FQ-0677-A)
21	Clamp	1	353-4450100 (WKK 38 mm)
22	Hexagon head bolt	2	21012M06010 (M6 x 1.0 x 10L plated)
23	Hexagon head bolt	6	21012M06020 (M6 x 1.0 x 20L plated)
24	Hexagon head bolt	2	21012M06025 (M6 x 1.0 x 25L plated)
25	Hexagon head bolt	2	21015M08010 (M8 x 1.25 x 10L plated)
26	Hexagon head bolt	12	21015M08016 (M8 x 1.25 x 16L plated)
27	Hexagon head bolt	2	21015M08020 (M8 x 1.25 x 20L plated)
28	Hexagon head bolt	4	21015M08030 (M8 x 1.25 x 30L plated)
29	Hexagon head bolt	1	21015M08070 (M8 x 1.25 x 70L plated)
30	Hexagon head bolt	4	21015M10016 (M10 x 1.5 x 16L plated)
31	Hexagon head bolt	10	21015M10025 (M10 x 1.5 x 25L plated)
32	Hexagon head bolt	4	21015M12110 (M12 x 1.75 x 110L plated)
33	Hexagon nut	8	21211M06210 (M6 x 1.0 x Type 1 plated)
34	Hexagon nut	8	21211M08510 (M8 x 1.25 x Type 1 plated)
35	Plain washer	10	21741M06006 (M6 x Regular circle plated)
36	Plain washer	12	21741M08006 (M8 x Regular circle plated)
37	Spring washer	14	21711M06002 (M6 x Type 2 plated)
38	Spring washer	27	21711M08002 (M8 x Type 2 plated)
39	Spring washer	14	21711M10002 (M10 x Type 2 plated)
40	Spring washer	4	21711M12002 (M12 x Type 2 plated)
41	Radiator hose 1	1	22932-08043 (Toyosilicone hose TSI-8 430L)
42	Radiator hose 2	1	22932-08014 (Toyosilicone hose TSI-8 140L)
43	Radiator hose 3	1	22840-10280 (Toyosilicone hose TSI-8 280L)
44	Radiator hose 4	1	22840-10700 (Yokohama heatproof rubber hose HTW10-04 700L)
45	Drain hose	1	22813-15062 (oil-resistant OK Excel-150 15 x 2BH 550L)
46	E-shaped retaining ring	2	21912-00600 (nominal size 6)
47	Seal washer	1	26991-09135 (Musashi SW 16 x 26)
48	Barb fitting	2	22951-05160 (PT3/8 x ϕ16)
49	Low pressure joint	1	22011-04550 (street elbow PT3/8 x PT3/8)
50	Bushing	1	353-4450200 (Japan A.M.C. 1183468308)

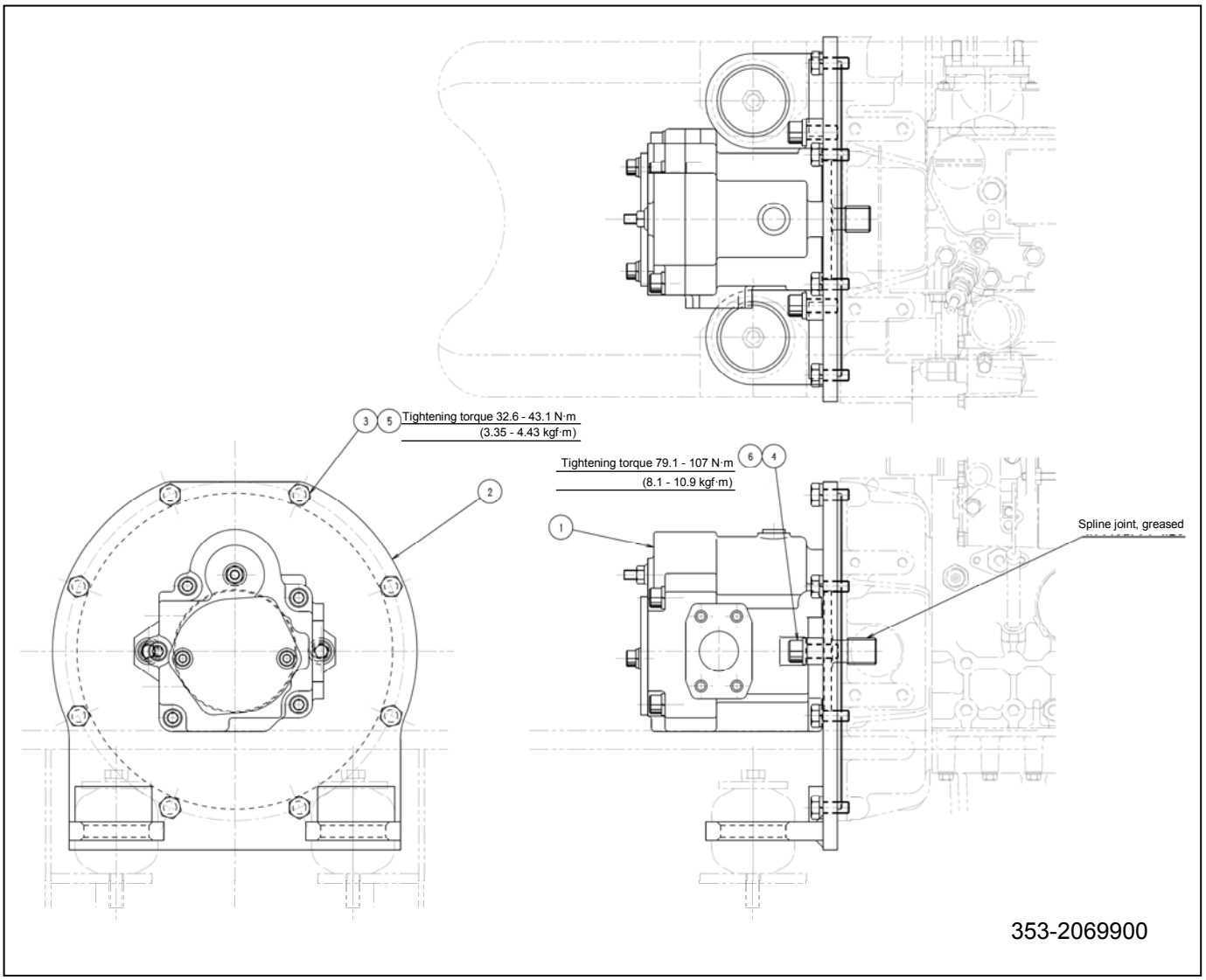
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Number	Name	Q'ty	Note
51	Jubilee band	2	22972S03000 (ϕ22 - ϕ30)
52	Crescent clamp	4	22973-00500 (RS-8005)
53	Collar	2	353-4453800
54	Missing number		
55	Rubber cushion	3	S102E2552000 (Kurashiki Kako QKA020)
56	Bracket for engine sling	1	102-4599900
57	Rubber cushion seat	1	102-4602300
58	Boss	2	102-4602500
59	Hexagon head bolt	2	21015M08075 (M8 x 1.25 x 75 plated)
60	Plain washer	1	21741M08002 (M8 x Small circle plated)
61	Bolt with captive washer	8	21A12M06012 (M6 x 1.0 x 12L)
62	Wire band	3	22971-01300 (size 13)
63	Trim	1	27810-37025 (62-24-8-3 250L Iwata Manufacturing)

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5. HYDRAULIC PUMP

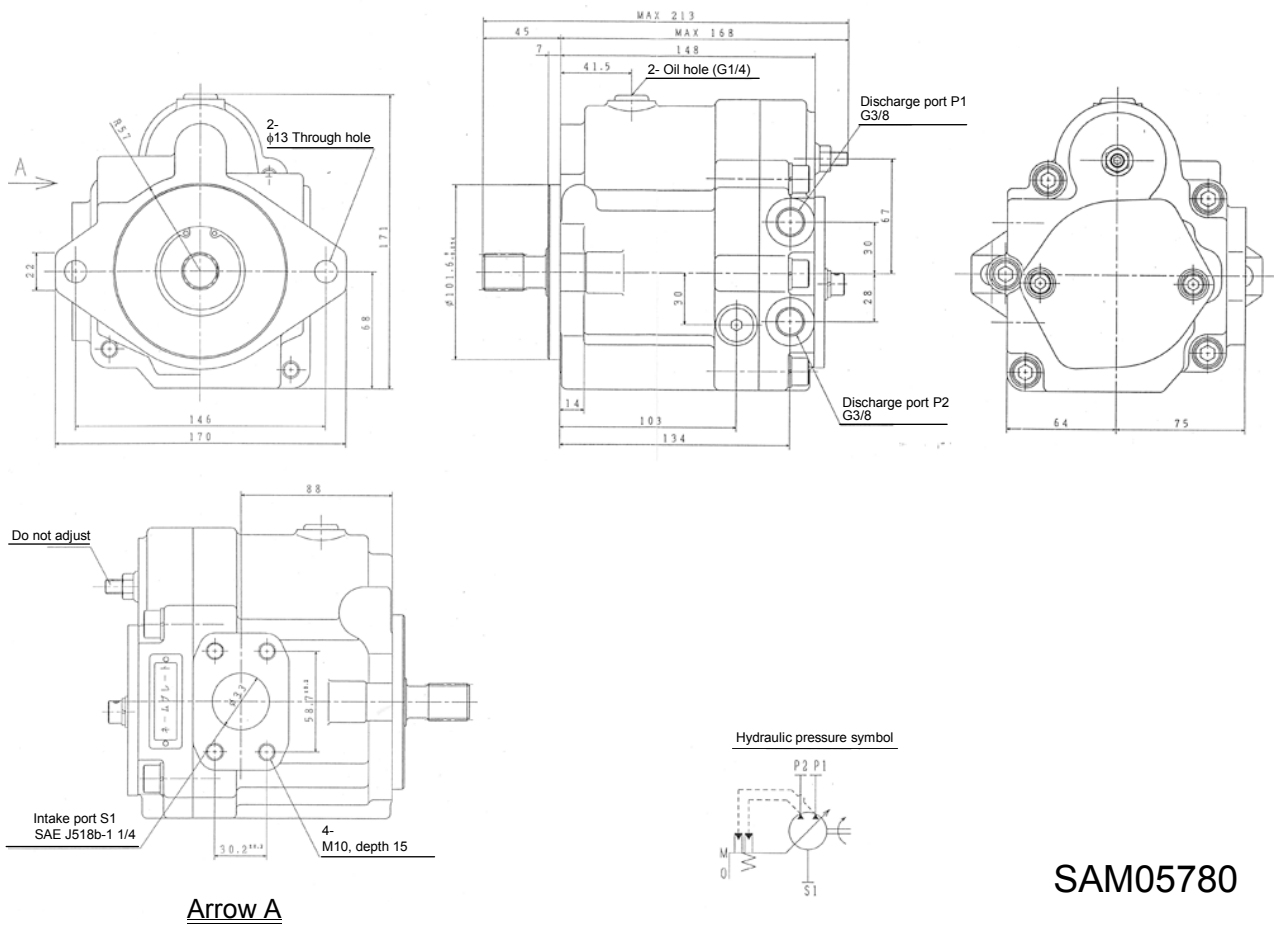
5.1 PUMP ASSEMBLY



No.	Name	Q'ty	Note
1	Pump	1	Item number: 353S57600000
2	Pump bracket	1	Item number: 353-2065100
3	Hexagon head bolt	8	M10 × 1.5 × 25L (Strength grade 8.8, plated)
4	Hexagon socket head cap screw	2	M12 × 1.75 × 30L (Strength grade 12.9)
5	Spring washer	8	M10 × Type-2 (plated)
6	Conical spring washer	2	M12 × 2H

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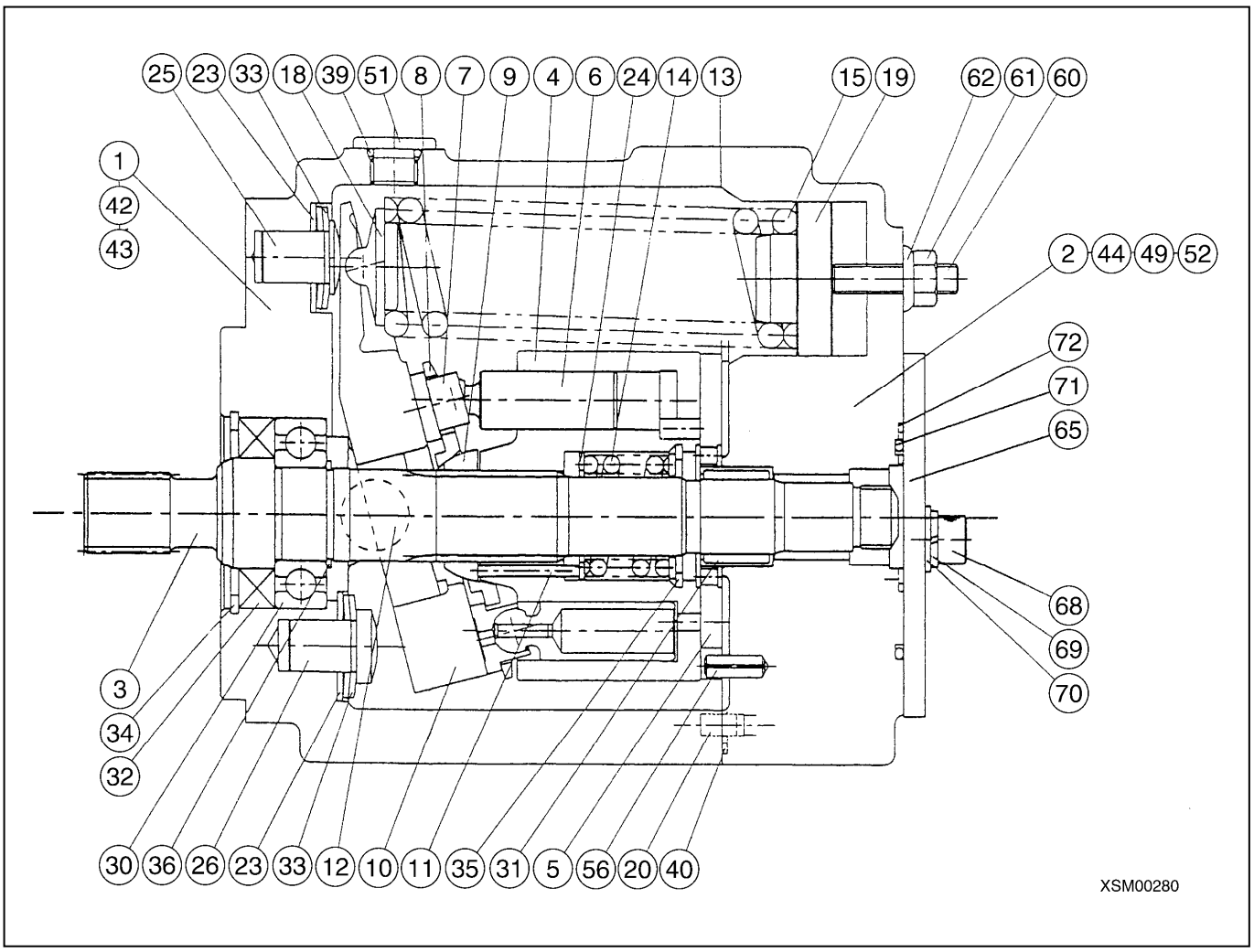
5.2 APPEARANCE AND SPECIFICATIONS (Standard pump, Item number: 353S57600000)



Specifications				
Pump capacity		P1 + P2: 6 + 6 cc/rev	Oil used	ISO VG 32, 46
Maximum pressure		P1: 20.59 MPa P2: 20.59 MPa	Oil temperature range	-20 to 100°C
			Hydraulic fluid pollution level	Within NAS level 11
Rotation	Minimum	1100 min^{-1}	Suction strainer	150 Mesh
	Maximum	2600 min^{-1}	Line filter	10 μm
Variable control mechanism		Fixed horsepower control	Vibration level	Within 10G
Direction of rotation		Right (seen from the spindle side)	Suction pressure	-0.02 to +0.04 MPa
Mass		13 kg		(Suction speed within 2 m/sec)
Paint color		Gray	Oiling	Fill the pump case with clean hydraulic fluid before starting the pump.

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5.3 INTERNAL STRUCTURE



No.	Name	Q'ty	No.	Name	Q'ty	No.	Name	Q'ty
1	Body S	1	25	Stopper pin A	1	49	Hexagon socket head cap plug	5
2	Body H	1	26	Stopper pin B	1	50	Missing number	
3	Shaft	1	27	Missing number		51	Plug	1
4	Cylinder barrel	1	28	Missing number		52	Spring washer	5
5	Valve plate	1	29	Missing number		53	Missing number	
6	Piston	10	30	Ball bearing	1	54	Missing number	
7	Shoe	10	31	Needle bearing	1	55	Missing number	
8	Shoe holder	1	32	Oil seal	1	56	Spring pin	1
9	Barrel holder	1	33	Conical spring	4	57	Missing number	
10	Swash plate	1	34	Snap ring	1	58	Missing number	
11	Needle	3	35	Snap ring	1	59	Missing number	
12	Rocking pin	2	36	Snap ring	1	60	Seal ring with hexagon socket	1
13	Packing	1	37	Missing number		61	Hexagon nut	1
14	Spring C	1	38	Missing number		62	Seal washer	1
15	Spring T1	1	39	O-ring	1	63	Missing number	
16	Missing number		40	O-ring	2	64	Missing number	
17	Missing number		41	Missing number		65	Plate	1
18	Spring holder	1	42	Plug	1	66	Missing number	
19	Spring guide	1	43	O-ring	1	67	O-ring	1
20	Pin	1	44	Hexagon socket head cap screw	5	68	Hexagon socket head cap screw	2
21	Missing number		45	Missing number		69	Spring washer	2
22	Missing number		46	Missing number		70	Plain washer	2
23	Washer	1	47	Missing number		71	O-ring	1
24	Retainer	2	48	Missing number		72	O-ring	1

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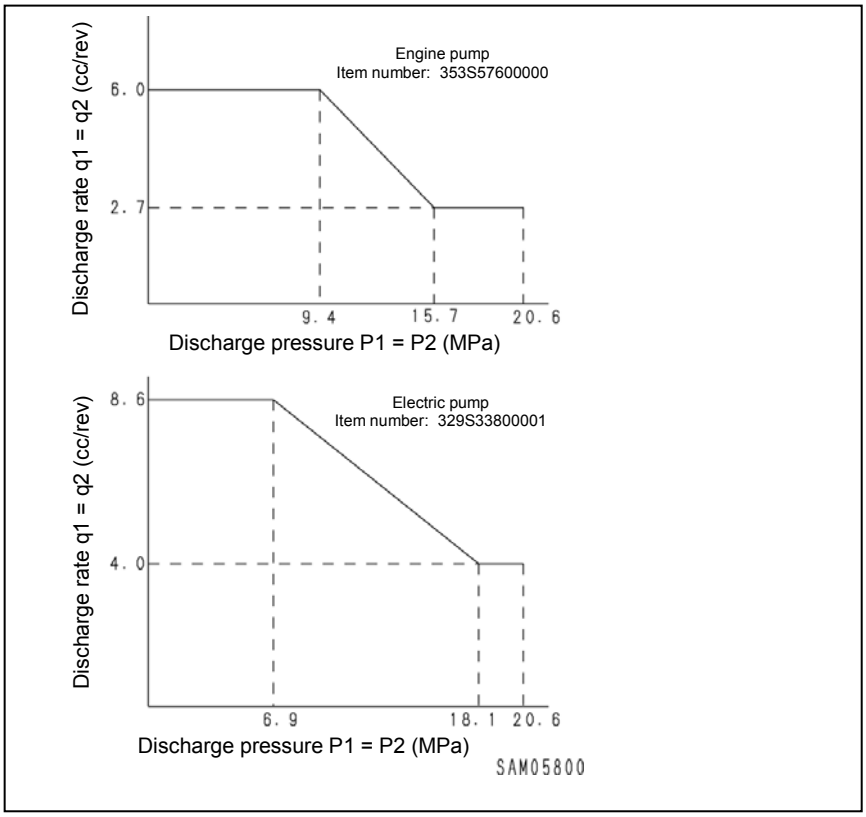
5.4 OPERATING PRINCIPLES

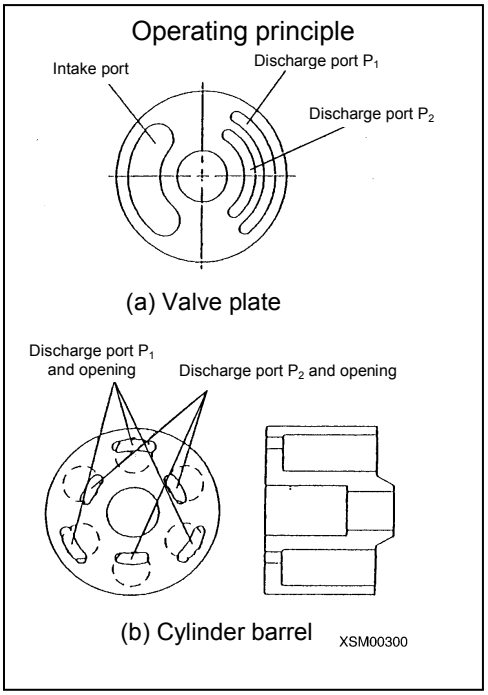
1. Overview

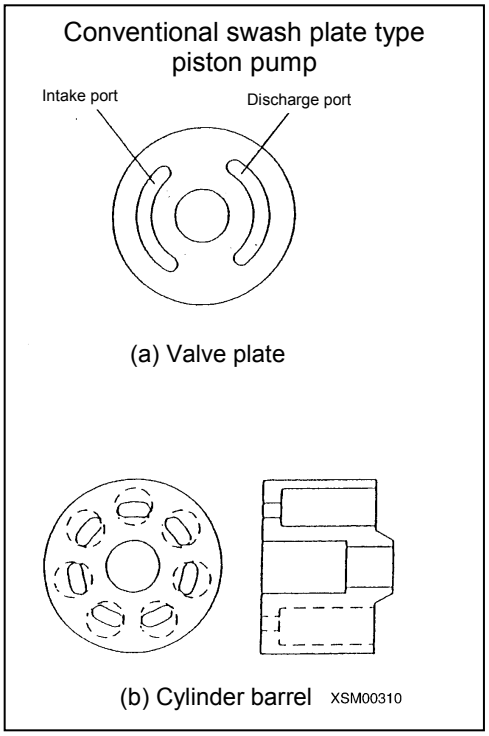
This hydraulic pump consists of such a mechanism that allows this compact and light-weight pump to perform pumping actions equivalent to two pumps while occupying a space required for a single pump only.
To utilize the engine power effectively, this pump has been designed to have a fixed horsepower control characteristic for suppressing the discharge rate in commensurate with the increase of pump load.
Accordingly, this pump is equipped with a mechanism to decrease its discharge rate in such a way that when pump discharge pressures P1 and P2 increase to raise the resultant force in combination with the piston force to allow the swash plate to overcome the spring tension so that it tilts around the rocking center of the rocking pin.

2. Structure and actions

In a swash plate type variable piston pump, in order for the pump to be equipped with the pumping function of two pumps each having an equal capacity that are accommodated in the pump case for a single pump, an even number of pistons are incorporated.
While a conventional valve plate has, as shown in the bottom right figure, a single port each for the intake and discharge is provided, this system comprises a pair of intake port and discharge port each on the outside (P1) and the inside (P2).
Every other pump box in row of the cylinder barrel opens either toward the outside (P1) or inside (P2).
While the intake occurs in similar way for both inside and outside, the discharge of inside and outside performs different delivery actions.
Since this system has an even number of pistons, each having the same diameter, being mounted on the common pitch circle with others, and slides on the common swash plate, the discharge rates from outside (P1) and inside (P2) are equal.
Further, since the sole swash plate allows the discharge rate of both P1 and P2 plates to vary equally with the variation of tilt angle of swash plate in its variable control action, no difference in discharge rate is brought about.



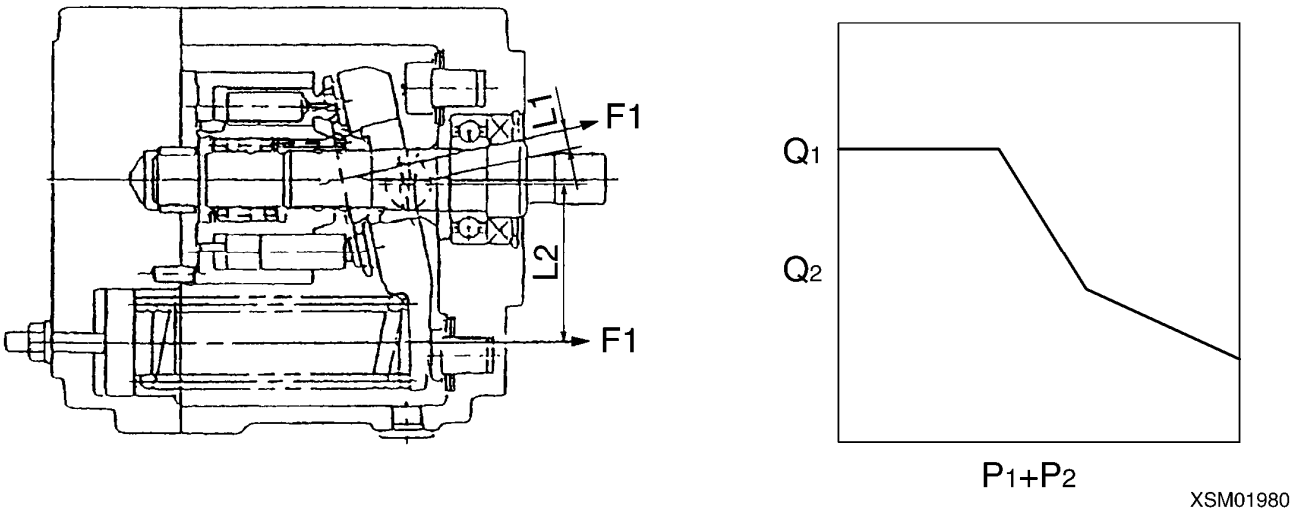




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3. Fixed horse power variable mechanism

The pump capacity can be varied with the variable tilt angle of swash plate, and the fixed horsepower control is effected by the simple, directly responsive tilt angle varying mechanism of the swash plate.
In this pump, the center of rotation of the swash plate is in the ball on the back.
The load F1 from the piston side is located in the direction indicated in the figure below, and generates a rotational moment in the clockwise direction as looked at the swash plate. Against this setup, a spring to set the horsepower to a specific value is installed toward the opposite direction and set to a specified load.
Since the above-mentioned moment increases with the increase of pressure and it deforms the spring to decrease the tilt angle of the place, the discharge rate is resultantly suppressed to maintain a fixed horsepower.



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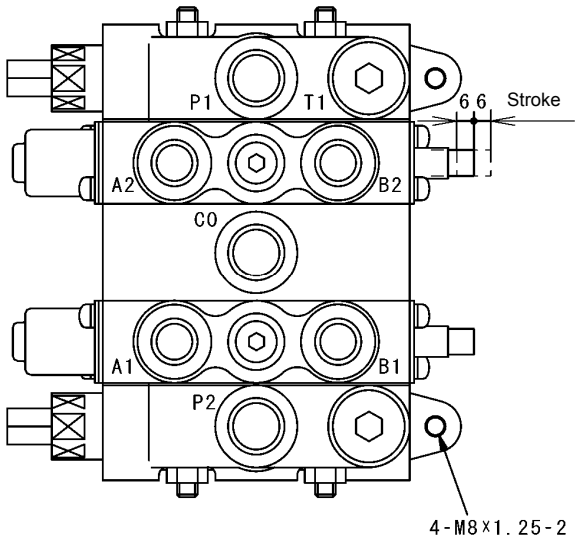
5.5 FAILURE CAUSE AND COUNTERMEASURE

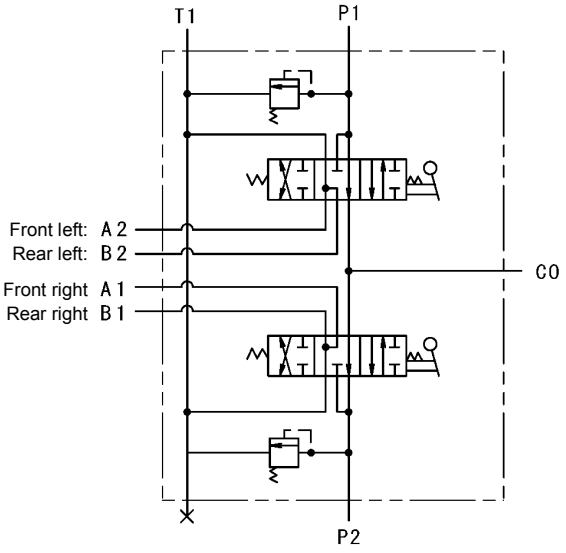
Abnormal Phenomenon	Cause	Remedy
Engine is overloaded.	・Engine speed is higher than specified value. ・Pressure is higher than specified value. ・Seizure or breakage of parts inside the pump.	・Adjust as specified. ・Adjust as specified. ・Repair or replace the pump.
Pump discharge rate drops extremely, or discharge pressure does not rise.	・Drop of engine revolution speed. ・Failure of pump assembly coupling. ・Seizure or breakage of parts inside the pump.	・Adjustment of engine revolution speed. ・Repair or replace the coupling. ・Repair or replace the pump.
Abnormal noise or vibration occurs. (Cavitation phenomenon)	・Air or water inclusion in the hydraulic oil. ・Suction piping is clogged or squeezed. ・Piston shoe swaging is broken. ・Pump mounting is loosened. ・Failure of pump assembly coupling.	・Give an additional tightening to circuits, particularly the suction piping. ・Replace the hydraulic oil with water inclusion. ・Repair or replace the suction pipe. ・Replace the piston assembly. ・Repair the mounting parts. ・Repair or replace the coupling.
Oil leaks.	・Failure of O-ring or gasket. ・Loosening or defective tightening of cap ring. ・Oil leakage from oil seal edge.	・Replace the O-ring or gasket ・Re-tighten it with the specified torque. ・Repair or replace the oil seal or shaft.

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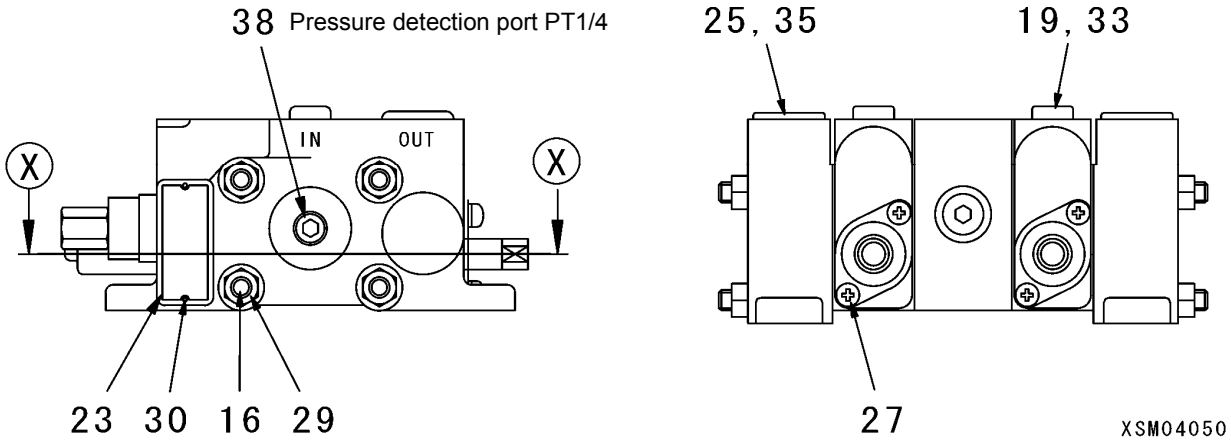
6. TRAVEL CONTROL VALVE

6.1 APPEARANCE AND SPECIFICATIONS





Circuit diagram

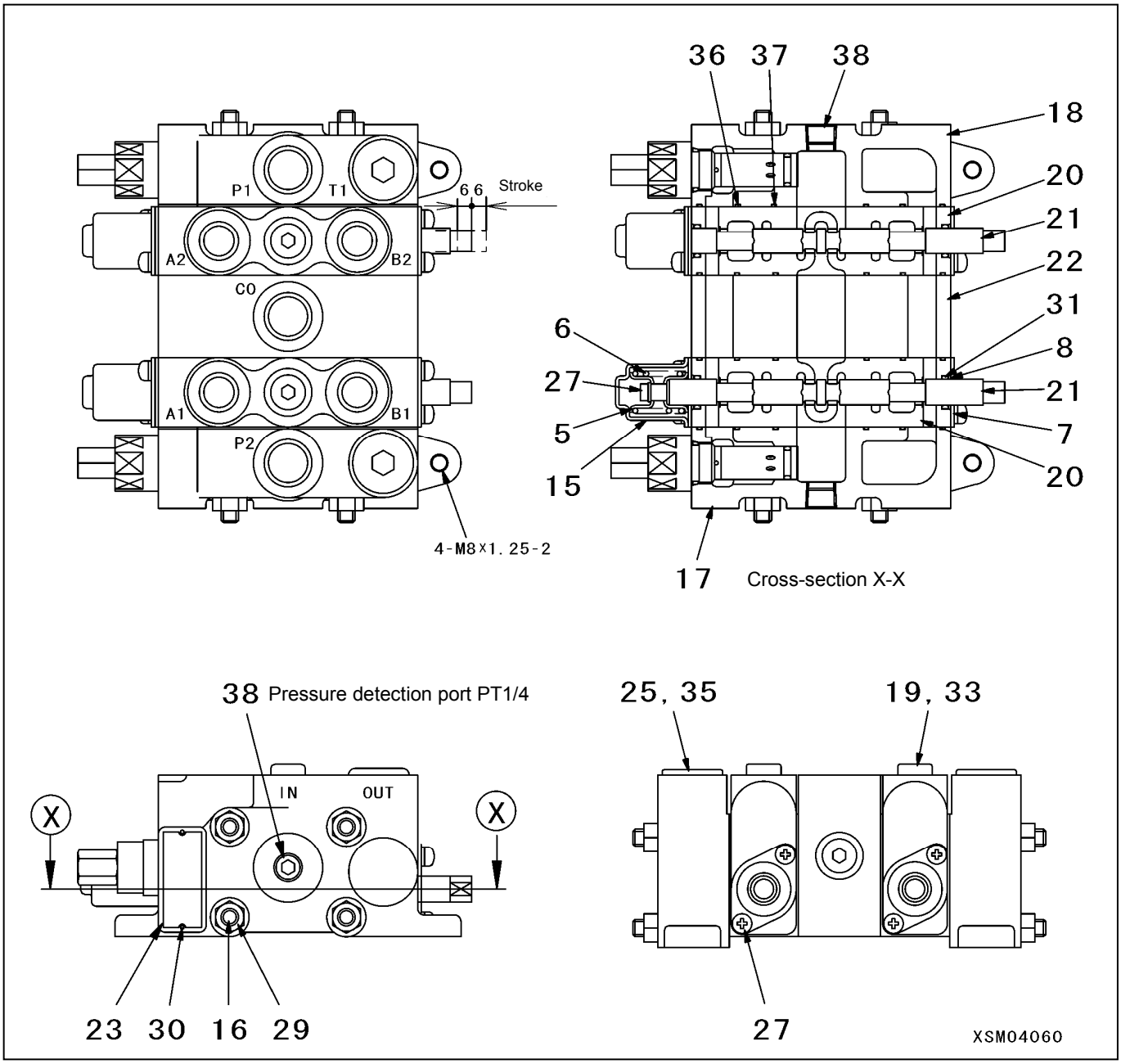


Port destination		Port size	Port destination		Port size
P1	Pump P2 port	G1/2	A1	Right traveling motor port B, forward	G3/8
P2	Pump P1 port	G1/2	B1	Right traveling motor port A, backward	G3/8
T1	Return	G1/2	A2	Left traveling motor port A, forward	G3/8
CO	Crane valve P port	G1/2	B2	Left traveling motor port B, backward	G3/8

Specifications			
Maximum flow rate on board	P1, P2: 15 L/min CO: 30 L/min	Internal leakage at 9.8 MPa, 50 to 55°C	Each spool: 200 mL/min maximum
Main relief valve (both P1 and P2)	20.6 ±0.5 MPa	Spool operating force	In neutral position: approx. 88.2 N In full stroke: approx. 117.6 N
Hydraulic oil	Equivalent to ISO VG 32, 46	Allowable back pressure at port T (normal service back pressure)	1.47 MPa (0.49MPa maximum)
Operating temperature range	-20 to +90°C		

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6.2 INTERNAL STRUCTURE



No.	Name	Q'ty	No.	Name	Q'ty	No.	Name	Q'ty
1	Compression spring	2	14	Wire	2	27	Pan head screw with a set washer (M5 × 12)	8
2	Needle valve	2	15	Spring cover	2	28	Seal ring with hexagon socket (M10 × 14)	2
3	Hexagon cap nut	2	16	Tie rod	4	29	Small hexagon nut (M8)	8
4	Gasket	2	17	Inlet housing	1	30	Rivet	2
5	Spring holder	4	18	Inlet housing	1	31	O-ring (1A-P12)	4
6	Compression spring	2	19	Plug	2	32	O-ring (1B-P9)	2
7	Seal holder	4	20	Plunger housing	2	33	O-ring (1B-P10)	2
8	Backup ring	4	21	Open spool	2	34	O-ring (1B-P12)	2
9	Sleeve	2	22	Body	1	35	O-ring (1B-P18)	3
10	Poppet	2	23	Name plate	1	36	O-ring (1B-AS568-017)	8
11	Compression spring	2	24	Missing number		37	O-ring (1B-AS568-030)	4
12	Housing	2	25	Flange plug (PF1/2)	1	38	Hexagon socket head cap plug (PT1/4)	2
13	Valve seat	2	26	Flange bolt (M5 × 12)	2			

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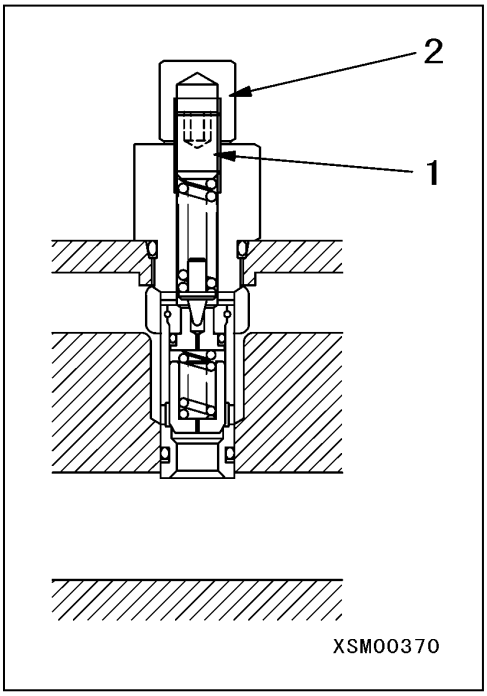
6.3 INSPECTION AND ADJUSTMENT

[1] Parts inspection

Subject area	Judgment criteria	Remedy
・ Housing ・ Block body	・ Scratch and blemish, stain or corrosion of spool sliding area ・ Scratch and blemish, stain or corrosion of the seal pocket of spool insertion area ・ Scratch and blemish, stain or corrosion of the port seal in contact with the O-ring ・ Scratch and blemish, stain or corrosion of the sealing area of relief valve ・ Any other damage that may spoil normal functions	・ Replacement ・ Replacement ・ Replacement ・ Replacement ・ Replacement
・ Spool	・ Scar that catches a finger nail of the circumferential sliding surface when touched ・ Blemishes on the sliding surface mating with an end seal ・ Spool action is not smooth.	・ Replacement ・ Replacement ・ Repair or replace
・ Load check valve	・ Imperfect sealing due to damage of valve or spring ・ When inserted in a block body and allowed to operate, it should move smoothly without being caught.	・ Repair or replace ・ Normal
・ Spring and its periphery	・ Significant damage such as stain, corrosion, deformation or breakage of spring, holder, and cover	・ Replacement
・ Spool sealing area	・ Outward oil leakage ・ Stain, corrosion or deformation of seal holder	・ Repair or replace ・ Repair or replace
・ Main relief valve ・ Port relief valve ・ Anti-cavitation valve	・ Stain or damage in appearance ・ Damage on the valve seat mating surface ・ Damage on the poppet mating surface ・ Fault in spring ・ O-ring, backup ring, and seals	・ Replacement ・ Replacement ・ Replacement ・ Replacement ・ Total replacement is required in principle.

[2] Pressure adjustment of main relief valve

1. Attach a pressure gauge to the pressure detection port.
2. Run the pump at its rated revolution speed.
3. Allow the control valve spool to move to its full stroke and read the pressure gauge value.
4. Loosen the lock nut (2) of main relief valve.
5. While watching the pressure gauge, turn set screw (1) to adjust the pressure.
   - Clockwise direction (turning rightward): To raise the set pressure.
   - Counterclockwise direction (turning leftward): To lower the set pressure.
6. After completing the pressure adjustment, tighten the lock nut (2) while preventing the set screw (1) from turning.
7. Run the pump again at its rated revolution speed to ensure that the pressure is stabilized.



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6.4 FAILURE CAUSE AND COUNTERMEASURE

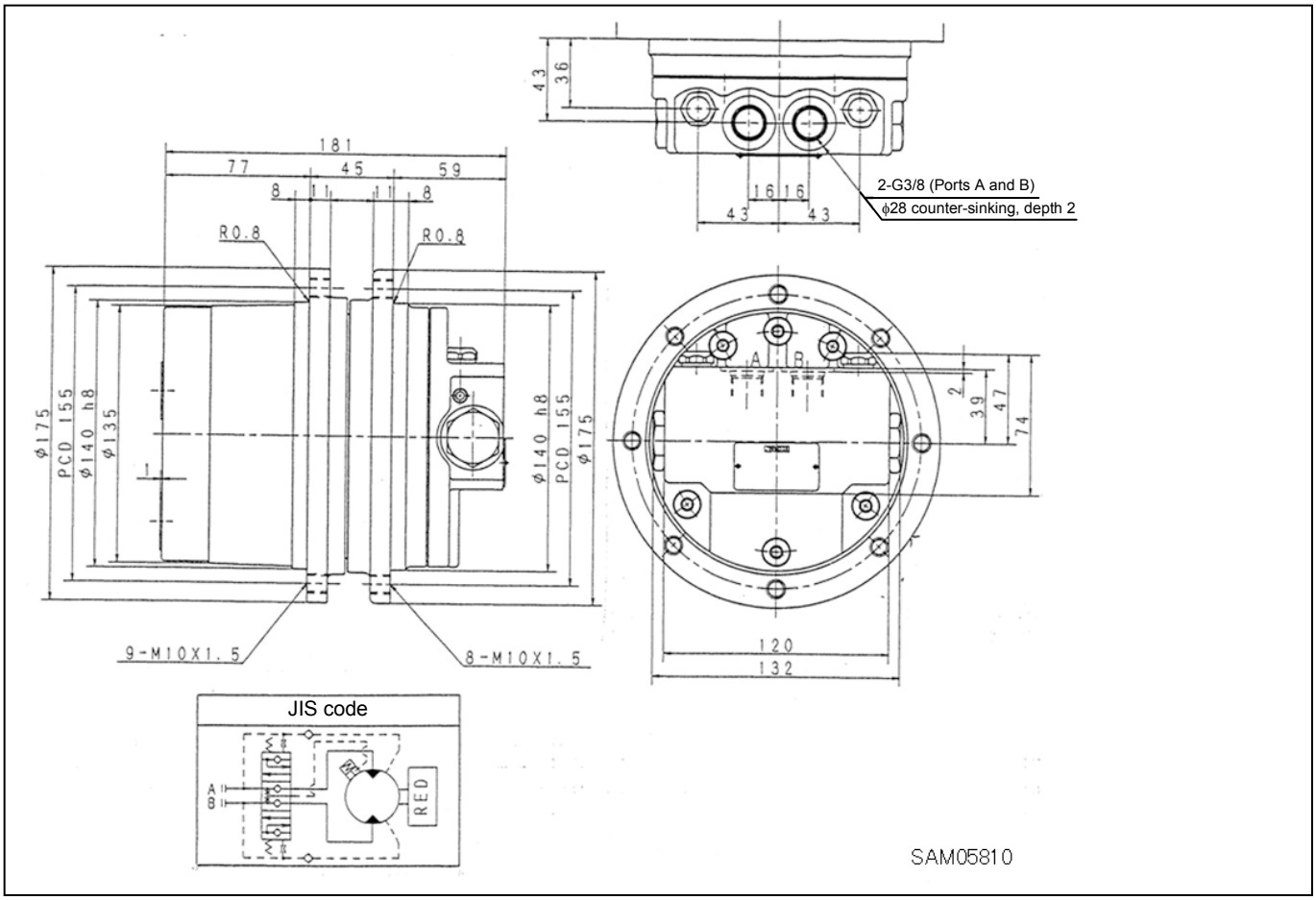
While each of the items indicated in the following table appears to be an independent problem, two or more of them may occur concurrently.
Accordingly, employ such a method that the causes can be removed one by one.

Abnormal Phenomenon	Cause	Remedy
Oil leakage from a spool seal area.	・ Sealing parts are scratched, or the seal lip is worn out after serving for a long period of time.	・ Replace with new ones.
	・ The sliding area of spool seal is scratched from the outside (impact dent, scratch blemish, etc.).	・ Repair or replace the spool.
	・ Mounting of the cover accommodating sealing parts is strained.	・ Correct it to the normal shape, while checking the seal lip for its abrasion state.
	・ The paint applied on the spool seal sliding area is still sticking.	・ Remove it by using diluent, or remove it mechanically. Be cautious of possible damage to the spool surface or seal lip.
	・ The tank circuit pressure has risen to exceed the withstanding performance of the sealing parts.	・ Remove any object that increases the flow resistance.
Spool sliding is not smooth.	・ A foreign object is caught in the spool sliding section.	・ Overhaul the setup and repair or replace.
	・ Loss of oil film between the spool and body due to an abnormal oil temperature rise	・ Take necessary measures to lower the oil temperature. Also, if the relief valve is operating frequently, check for the cause and decrease the frequency.
	・ Failure in lubrication due to degradation of hydraulic oil	・ Not only the oil replacement, but the overhaul of the circuit may be required.
	・ Abrasion of spool caused by a long time use or uneven loading	・ Check the spool diameter and determine if it should be replaced.
	・ The spool is bent by an external force.	・ Check the spool for its straightness and other characteristics, and repair or replace it as required.
	・ Distortion of the whole valve body caused by the stain on the mounting face.	・ Loosen the mounting bolts and check for any cause of strain.
	・ Excessive tightening of valve mounting bolts	・ Re-tighten them with the specified torque.
	・ Oil deposition inside each spring cover on the spool operating side and on the other side.	・ Overhaul the setup and repair or replace the seal.
Fails to travel (but pressure rises).	・ The spool fails to perform the specified stroke (6 mm).	・ Inspect the traveling lever link and repair as required.
	・ The crawlers are overloaded.	・ Check for any obstacle and clean it.
	・ The circuit is clogged with foreign objects or piping is folded and bent.	・ Check the piping for any bent or foreign matter, and repair and clean as required.
The spool cannot be kept at the neutral position.	・ The excessive gap between spool and body causes an excessive leak.	・ Replace the spool, or replace the valve block assembly.
	・ The spool has not returned to the neutral position correctly.	・ Manual operation: Inspect the traveling lever link and repair as required. ・ Hydraulic operation: Check the pilot pressure.
	・ A foreign object is caught in the seat area of port relief valve and anti-cavitation valve, or the seat is damaged.	・ Overhaul the setup and repair or replace.
Fails to travel (and pressure does not rise).	・ A foreign object is caught in the seat area of relief valve, or the seat is damaged.	・ Overhaul the setup, check for foreign matters, repair and clean or replace it.
	・ Loosening of relief valve adjusting screw	・ Give an additional tightening to the adjusting screw.
	・ A foreign object is caught in the seat area of port relief valve and anti-cavitation valve, or the seat is damaged.	・ Overhaul the setup, check for foreign matters, repair and clean or replace it.
	・ The spool fails to perform the specified stroke (6 mm).	・ Manual operation: Inspect the traveling lever link and repair as required. ・ Hydraulic operation: Check the pilot pressure.
	・ Oil flow rate from the pump is insufficient.	・ Check the pump and repair it as required.

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7. TRAVELING MOTOR

7.1 APPEARANCE AND SPECIFICATIONS



Left traveling motor		Right traveling motor	
Port B	Backward travelling	Port A	Backward travelling
Port A	Forward travelling	Port B	Forward travelling

Specifications						
Reducer	Maximum output torque	1000 N·m (102 kgf·m)		Equivalent capacity		358.5cm^3/rev
	Maximum output revolution speed	40.0 min^{-1}		Oil used		Equivalent to ISO VG 32, 46
	Reduction gear ratio	1/36.96		Oil temperature		-20°C to 100°C
Hydraulic motor	Capacity	9.7 cm^3/rev		Filtering		10 μm
	Maximum service pressure	20.6 MPa (210 kgf/cm^2)		Gear oil		SAE-30-CD
	Maximum output revolution speed	1477 min^{-1}				Oil quantity 0.33 ℓ
	Max. flow rate	14.7 L/min		Mass		14 kg
	Parking brake: Static friction torque	17.6 N·m (1.8 kgf·m)		Allowable drain back pressure	Service pressure	0.5MPa (5 kgf/cm^2)
	Parking brake: Opening pressure	1.5MPa (15 kgf/cm^2)			Surge pressure	1.0 MPa (10 kgf/cm^2)

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7.2 INTERNAL STRUCTURE

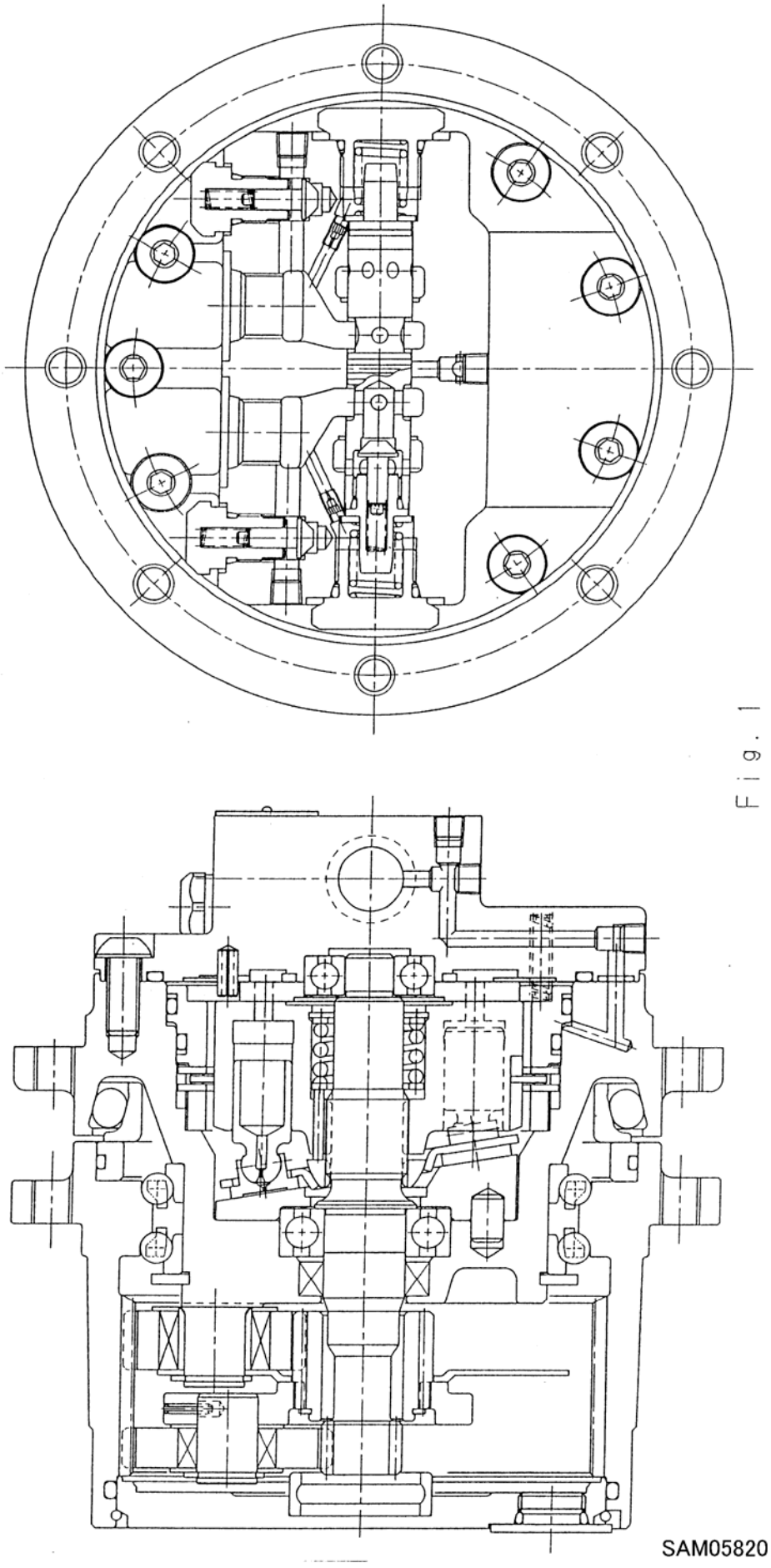


Fig. 1

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7.3 OPERATING PRINCIPLES

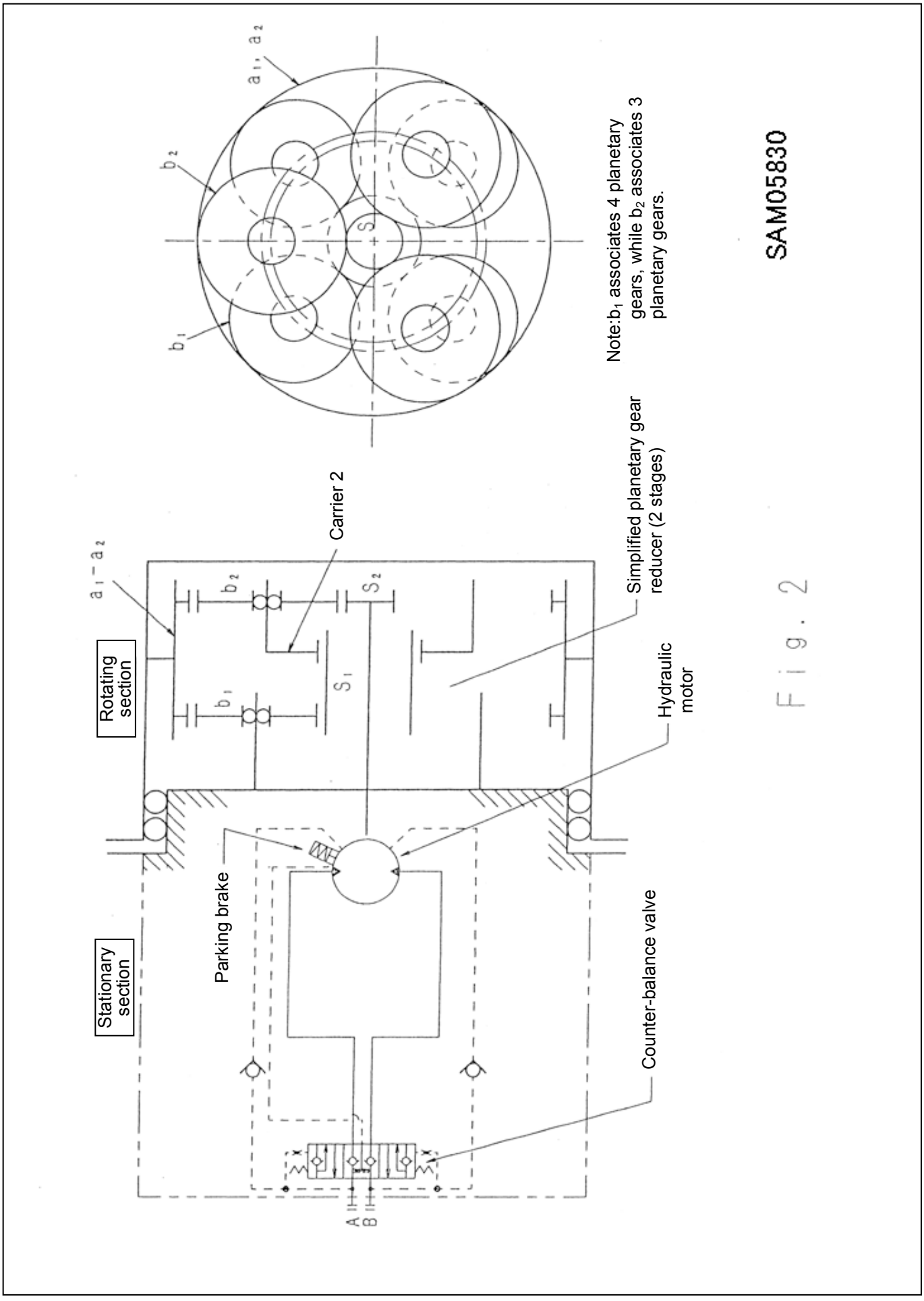


Fig. 2

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7.4 OPERATING PRINCIPLES

Each of the PHK series traveling motor consists of a stationary body composed of a hydraulic motor and hydraulic valves and the rotary body composed of a simplified planetary reducer.

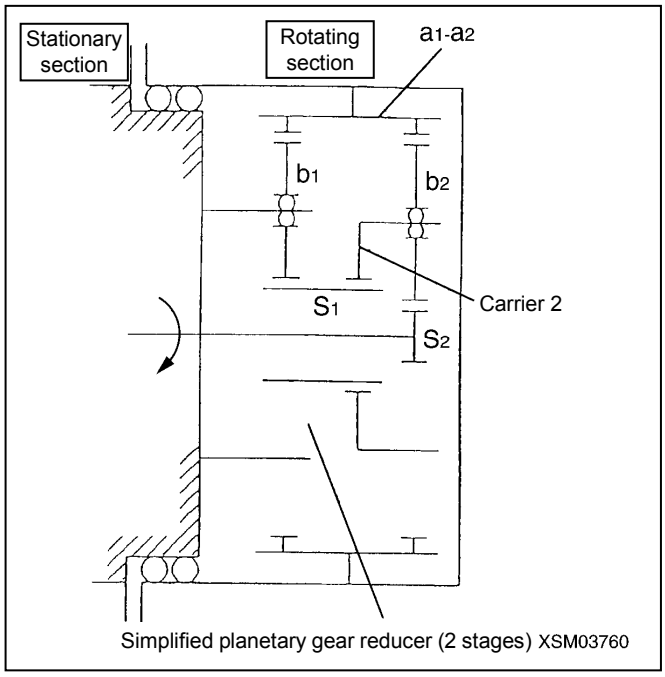
7.4.1 REDUCER

[1] Functions

The traveling motor reducer consists of a 2-stage simplified planetary gear reducer, which reduces and converts the high-speed rotational motion from the hydraulic motor into a low-speed, large torque to obtain a case rotation.

[2] Operating principles

In the figure at the right, the hydraulic pressure motor output shaft is spline-coupled (or integrated with the shaft) with gear S2, and the rotation of gear S2 is single stage-reduced between gears (S2, b2 and a2).
The single stage-reduced revolution is double stage-reduced between the spline-coupled gears (S1, b1 and a1) with carrier 2, and the revolution is transmitted to the rotary body section through the inner a1 and a2 gears to serve as a traveling drive force.



Simplified planetary gear reducer (2 stages) XSM03760

The reduction ratio of a 2-stage simplified planetary gear reducer is generally expressed as follows:

$$R = \frac{Zs1}{Zs1 + Za1} \times \frac{Zs2}{Zs2 + Za2}$$

Where, Zs1, Zs2: Teeth number of s1 and s2
Za1, Za2: Teeth number of a1 and a2

Also, since the traveling motor is of a body rotating type, its reduction ratio is as follows:

$$R' = \frac{1}{1 - 1/R}$$

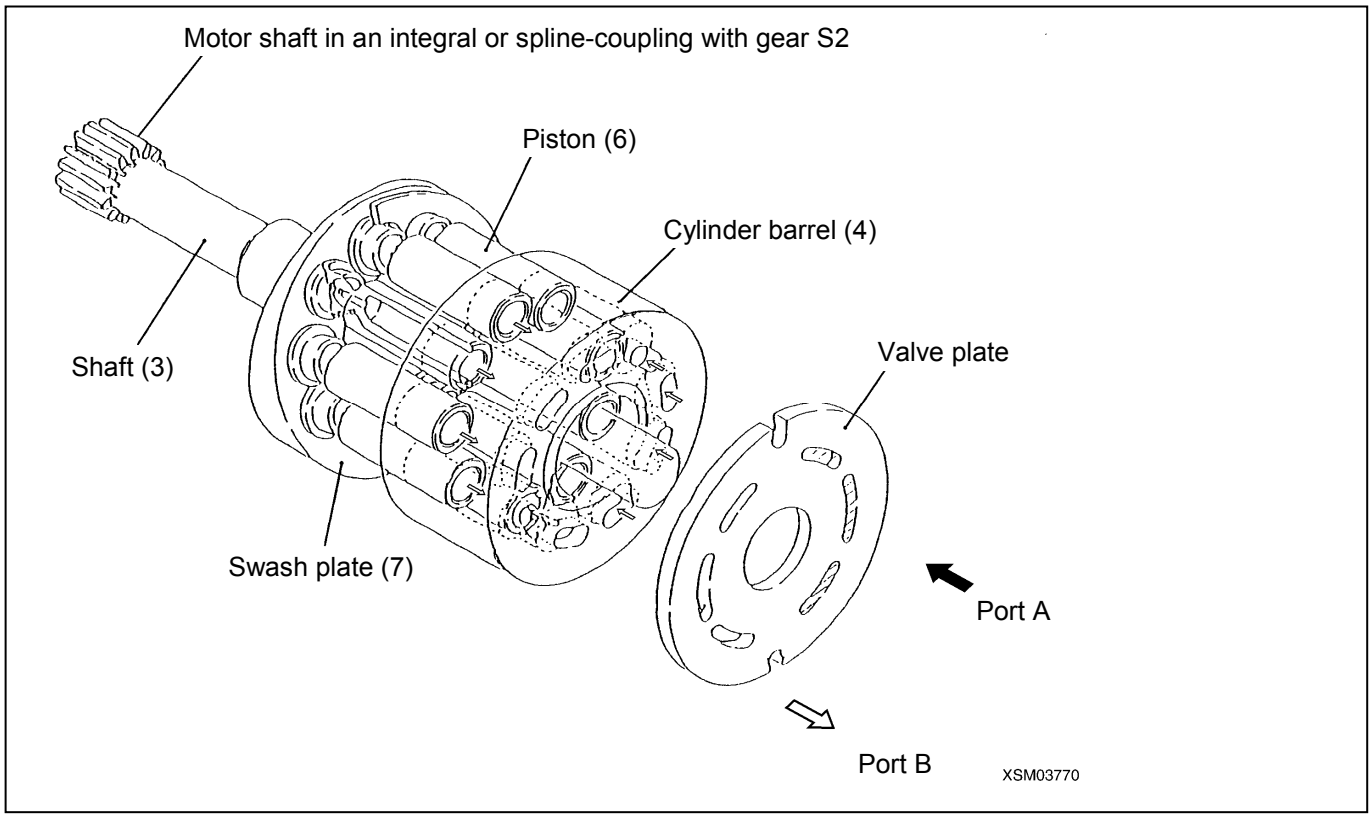
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7.4.2 HYDRAULIC MOTOR

[1] Function of the motor

This motor is of an axial piston motor (rotary cylinder type swash plate system) and has the function to convert the hydraulic energy supplied from the pump to a rotary motion.

[2] Structure and operating principles of the motor (see the figure below)



The hydraulic oil that has flown in through a hydraulic valve is supplied to valve plate (5). When port A is fed with hydraulic oil, the oil flows in the cylinder port in the cylinder barrel (4) corresponding to the port A, and thrusts piston (6). This thrusting force is converted to a rotary force by means of swash plate (7), and yielded from the shaft (3) that is spline-coupled with cylinder barrel (4). The return oil in the cylinder port flows out through port B of valve plate (5). In the case of a reverse run, the hydraulic oil flows in from port B, and the return oil flows out through port A.

7.4.3 HYDRAULIC VALVE (COUNTER-BALANCE VALVE)

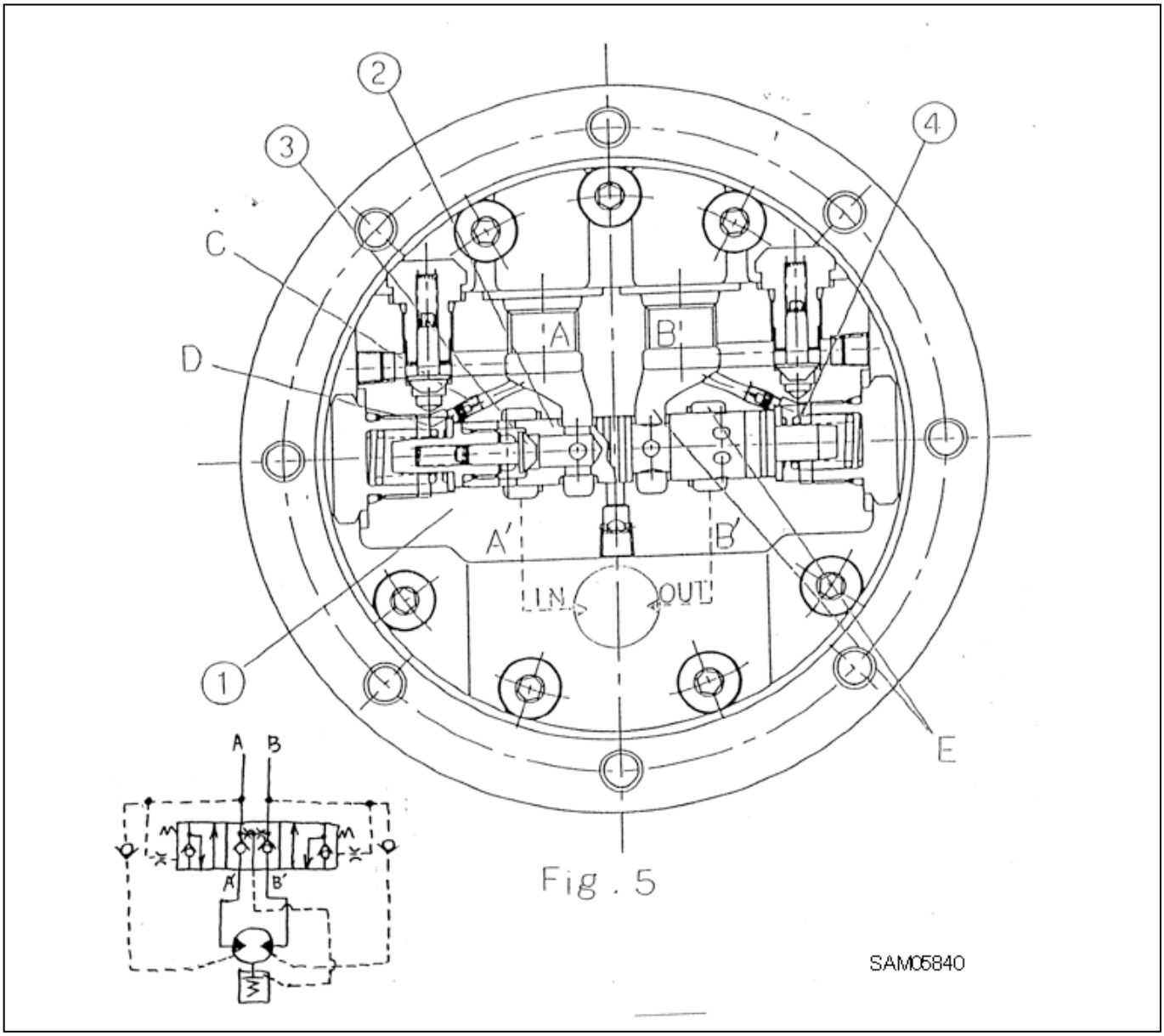


Fig . 5

When supplied through port A, the hydraulic oil pushes check valve (3) to open it, and flows in port A' on the inlet side of the hydraulic motor. On the other hand, the hydraulic oil enters chamber D through choke hole C, and allows the spool valve (2) to slide in the rightward direction by overcoming the force of spring (4). Consequently, the return side oil of hydraulic motor flows in through port B', flows through the body (1) and opening E of spool valve (2), and returns to port B to drive the hydraulic motor.

When the hydraulic oil is supplied through port B, the motion of the above-mentioned parts will be in the reverse direction, and thus the hydraulic runs in reverse.

Subsequently, as the hydraulic oil in port A is shut off from the pressurized state, the spool valve (2) so far sliding rightward will try to return in the rightward direction owing to the force of spring (4). In this stage, because of the squeezing effect of choke hole C, the oil in chamber D controls the leftward returning speed of spool valve (2). Concurrently, the hydraulic motor is forced to rotate by the inertial force, even if the hydraulic oil in port A is shut off. In this process, the spool valve (2) switching speed and the shape of dent, controls the return oil so that the hydraulic motor is smoothly stopped.

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7.4.4 PARKING BRAKE

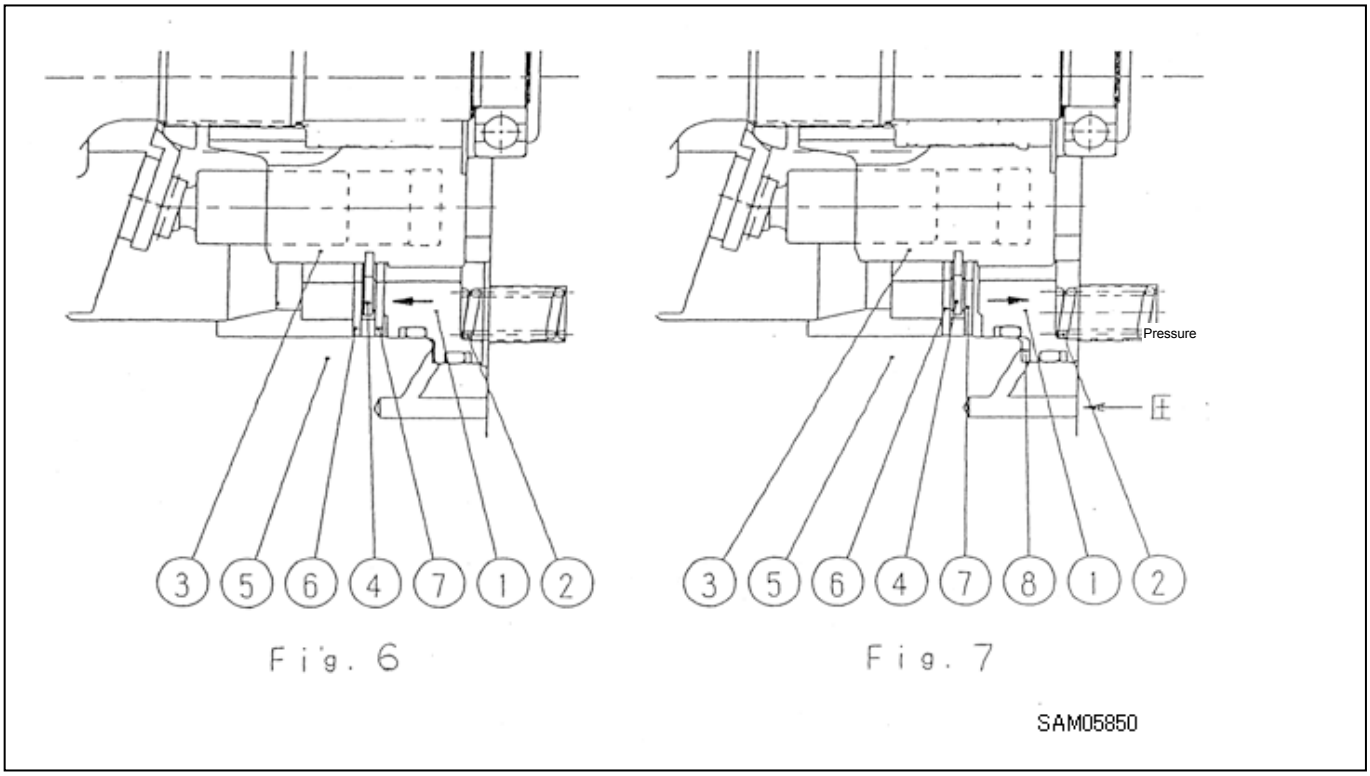


Fig. 6

Fig. 7

The parking brake mechanically immobilizes the hydraulic motor output shaft while the traveling motor is standing still.

[1] Effectiveness of parking brake

When neither port A or B is supplied with hydraulic oil, brake piston (1) is pushed toward the direction of arrow shown in Fig. 6 by the force of spring (2).
In this process, the disk plate (4) fixed to cylinder barrel (3) by means of a half-moon shaped groove is in the pinched position between the steel plates (6) and (7) that are likewise fixed to body 2 (5).
Resultantly, the rotation of cylinder barrel (3) is stopped by the friction force between disk plate (4) and steel plates (6) and (7). (Refer to Fig. 6.)

[2] Release of parking brake

When either port A or B is supplied with hydraulic oil, it will be guided through chamber (8) in Fig. 7.
The hydraulic oil will overcome the spring (2) tension and moves the brake piston (1) to the arrow direction in Fig. 7.
Resultantly, disk plate (4) and steel plates (6) and (7) will be released and the friction force dissipates, making the cylinder barrel (3) rotatable. (Refer to Fig. 7.)

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7.5 PRECAUTIONS FOR USE

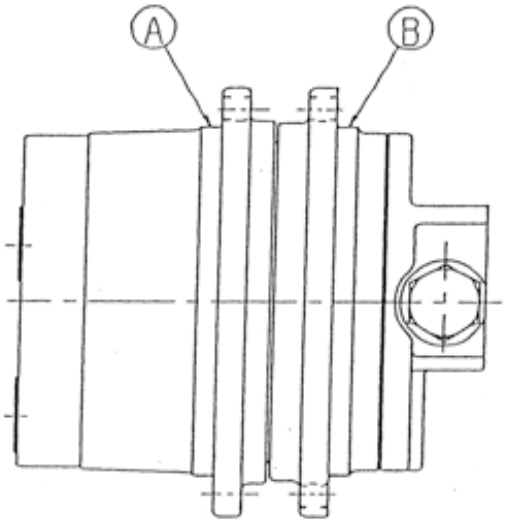
1. Installation

1) Joint of sprocket A

$140h8^{0}_{-0.063}$

Joint of body B

$140h8^{0}_{-0.063}$



2) When installing the motor to the machine and when installing the sprocket to the motor, do not tap with a hammer but use a mounting bolt and push in gently.
3) Use specified bolts (equivalent at least to 11T) when installing the motor and sprocket and tighten by the tightening torque specified below.

Screw size	Tightening torque
M10	49 to 64 N·m {6 to 6.5 kgf·m}

2. Piping

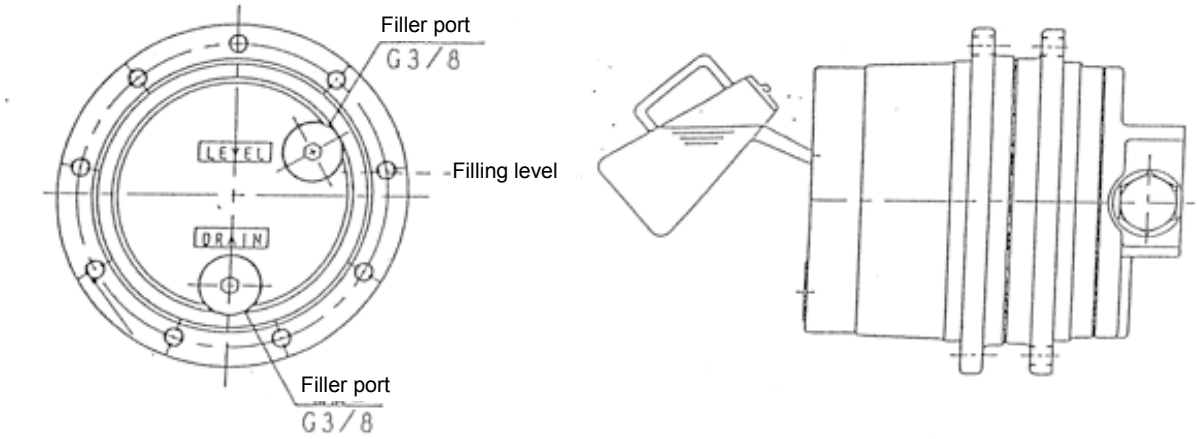
1) Piping of motor is shown in the dimensional drawing. Conduct carefully paying attention to the direction of rotation.
2) Piping port is covered at the time of delivery. When piping, be careful not to let dust from welding scale to go inside.
3) Since this is an inside drain type product, drain pressure (pressure inside the hydraulic motor body) increases up to motor outlet pressure. To protect the interior parts such as an oil seal, pay attention to the dimension of piping and installation method so that the pipings for A and B will not go beyond the allowable pressure of inside of casing.
   Allowable pressure inside the casing must be 5 kgf/cm^2 (0.5 MPa) for common use and 10 kgf/cm^2 (1 MPa) or less for surge.
4) Sufficient filtering will prolong the life of hydraulic systems and increases reliability. For this reason, provide a 10 μm filter inside the circuit.

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3. Gear lubricating oil
   1) Use diesel engine oil SAE-30-CD or equivalent for the lubricating oil.
      (It is filled with Idemitsu Apollo Diesel Motive S-330 at the time of delivery.)

   2) You may use lubricating oil of any recommended brand, but refrain from mixing the oil of different brands.

   3) Lubricating oil is filled at the time of delivery. When refilling, follow the procedure below.
      (All the plugs are O-ring sealed.)
      3-1. Remove the plug of the filler port.
      3-2. Refill the lubricating oil up to “LEVEL”.
      3-3. Close the plug of the filler port.



Note: When removing both plugs at the LEVEL side and DRAIN side of the filler port, remove the LEVEL side plug first (but close from the DRAIN side first).

   4) Lubricating oil quantity 330 cm^3

   5) Replacement timing of lubricating oil

First time	200 hr or at 2 months
Second time and beyond	1000 hr or at 1 year

4. General precautions

Always pay attention to oil leak and looseness of bolts and try to find them at an early stage. It is recommended to prepare a check sheet.

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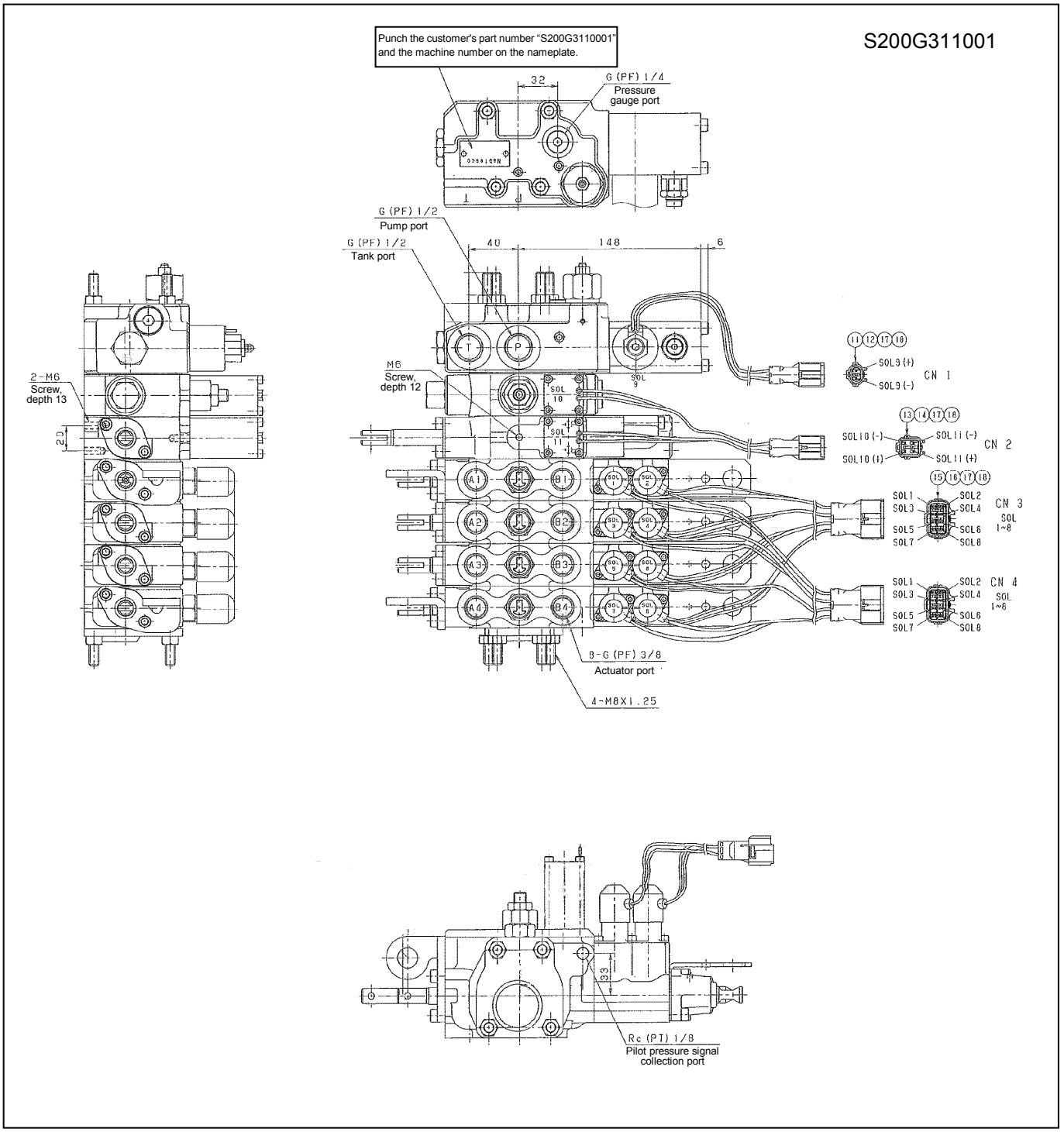
7.6 FAILURES AND COUNTERMEASURES

Details of failure	Major cause(s)	Remedy
Does not start.	Malfunction of hydraulic units other than traveling motor	Check the motor inlet pressure, inspect each unit and repair or replace as required.
	Malfunction of hydraulic motor ・ Breakage of internal parts ・ Leakage of hydraulic oil from check valve for draining	Replacement of broken parts (kit) Removal of foreign matters or replacement of body 1 kit
	Malfunction of counter-balanced valve ・ Spool fails to stroke.	Removal of foreign matters or replacement of body 1 kit
	Malfunction of reducer ・ Breakage of internal parts	Replacement of broken parts (kit)
Vehicle speed cannot be increased.	Malfunction of hydraulic units other than traveling motor	Inspection, repair, or replacement of each unit
	Malfunction of hydraulic motor ・ Drop of volume efficiency caused by abnormal abrasion due to catching foreign matters	Replacement of broken parts (kit)
Does not stop, or delays to stop.	Malfunction of counter-balanced valve ・ Return failure of spool	Removal of foreign matters or replacement of body 1 kit
Brake fails to work or braking force is weak.	・ Abnormal abrasion of steel plate, disk plate or brake piston	Replacement of abraded parts
	・ Breakage of spring	Replacement of spring
	・ Back pressure is so high that the hydraulic oil in the braking line cannot be discharged smoothly.	Review the piping
Oil leakage	Damage of O-ring	Replacement of O-ring
	Breakage of oil seal ・ Outlet pressure of motor is excessively high. ・ Malfunction of check valve for draining internal oil	Replacement of oil seal Review the piping Removal of foreign matters or replacement of body 1 kit
	Abnormal abrasion of mechanical seal	Replacement of floating seat and seal ring

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8. CRANE CONTROL VALVE

8.1 OUTSIDE DRAWING



Port destination		Port size	Port destination		Port size
P	CO port of traveling control valve	G1/2	T	Return	G1/2
A1	Derrick cylinder head, down	G3/8	A3	Telescopic cylinder bottom, extended	G3/8
B1	Derrick cylinder bottom, up	G3/8	B3	Telescopic cylinder head, retracted	G3/8
A2	Winch motor port B, lower	G3/8	A4	Slewing motor port B, left	G3/8
B2	Winch motor port A, upper	G3/8	B4	Slewing motor port A, right	G3/8

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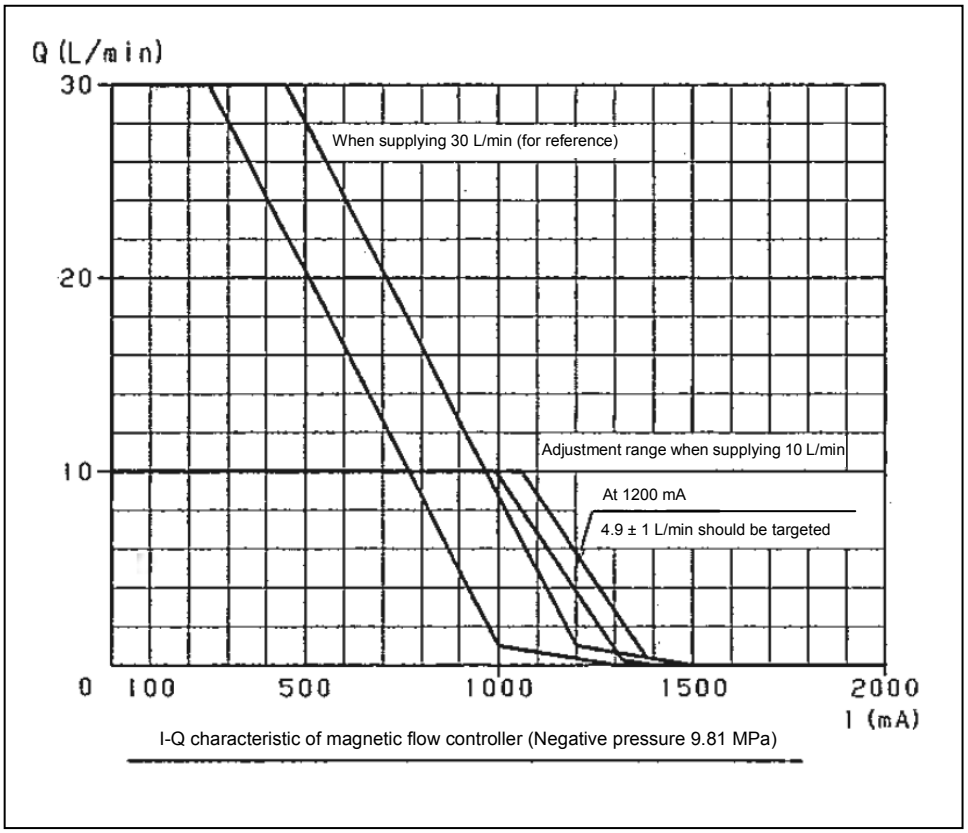
8.2 OVERVIEW

Valve rating specifications	
Maximum service pressure	20.6 $^{0}_{+0.5}$ MPa (210 kgf/cm^2)
Rated flow rate	50 L/min
Back pressure valve set pressure	1.34 to 1.49 MPa (13.7 to 15.2 kgf/cm^2)
Reducing valve set pressure	1.42 to 1.47 MPa (14.5 to 15.0 kgf/cm^2)
Temperature range of oil used	-20 to 80°C
Viscosity range of recommended hydraulic oil	8 to 400 cSt

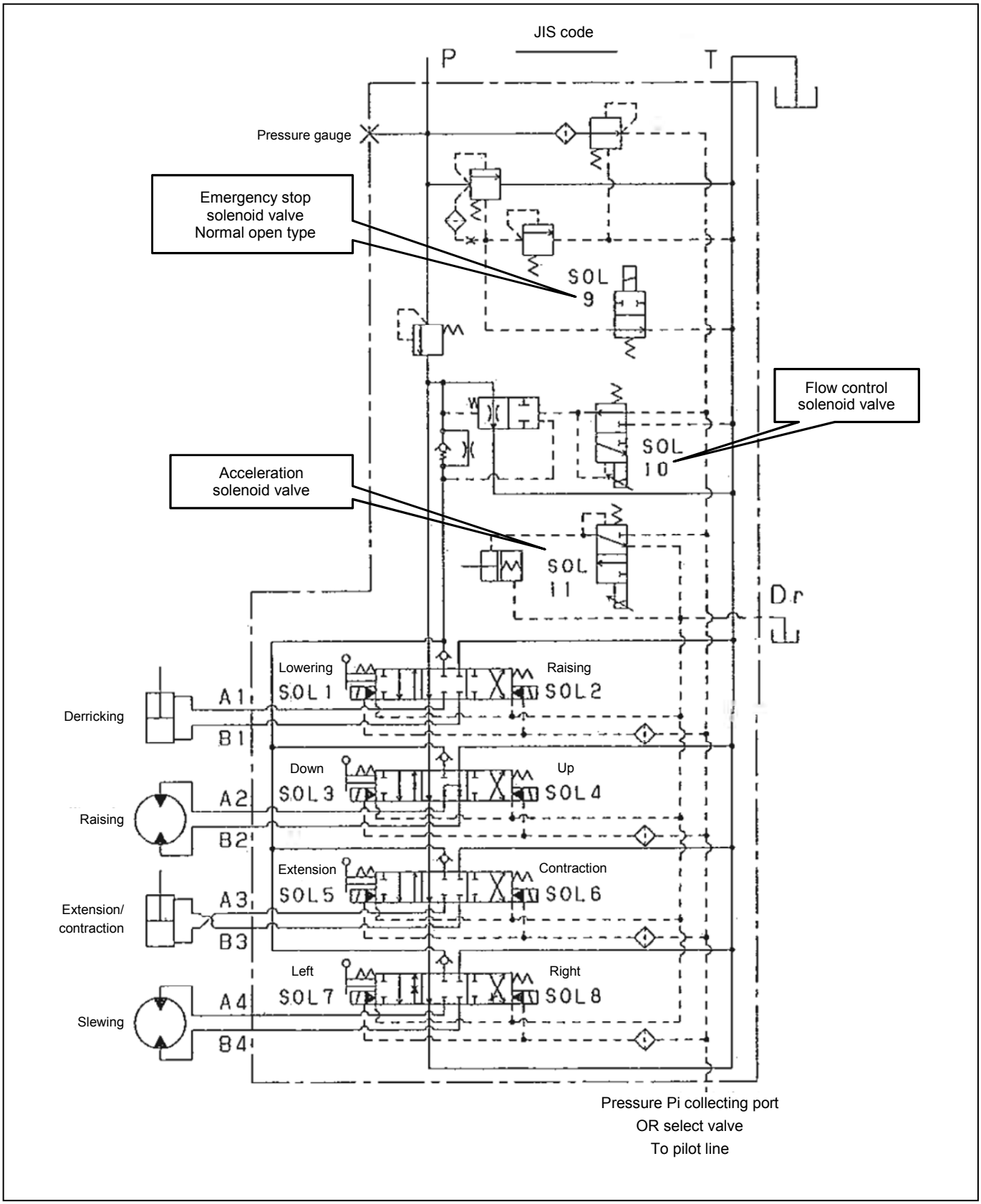
Solenoid rated specifications		
Rated voltage		12 VDC
Voltage fluctuation range		+20 to -10% V
Current and power consumption (at 20°C)	Solenoid Nos. 1 to 8	0.91 A, approx. 11 W (for actuator drive and control)
	Solenoid No. 9	0.98 A, approx. 11.7 W (emergency stop valve)
	Solenoid Nos. 10 and 11	1.7 A (for flow rate control valve and accelerator positioner controlling)
Conducting rating		Continuous (Continuous power ON causes the solenoid to be heated to a high temperature. May cause a burn, if touched inadvertently.)

This is a magnetic control valve comprising a magnetic direction switching function for starting and stopping the load actuator by means of a solenoid valve as well as a function for maintaining the actuator action at a constant speed when discretely by means of a flow rate control valve with pressure compensation.

I-Q characteristic of magnetic flow controller (Negative pressure 9.81 MPa)



8.3 HYDRAULIC CIRCUIT DIAGRAM



[Circuit configuration]

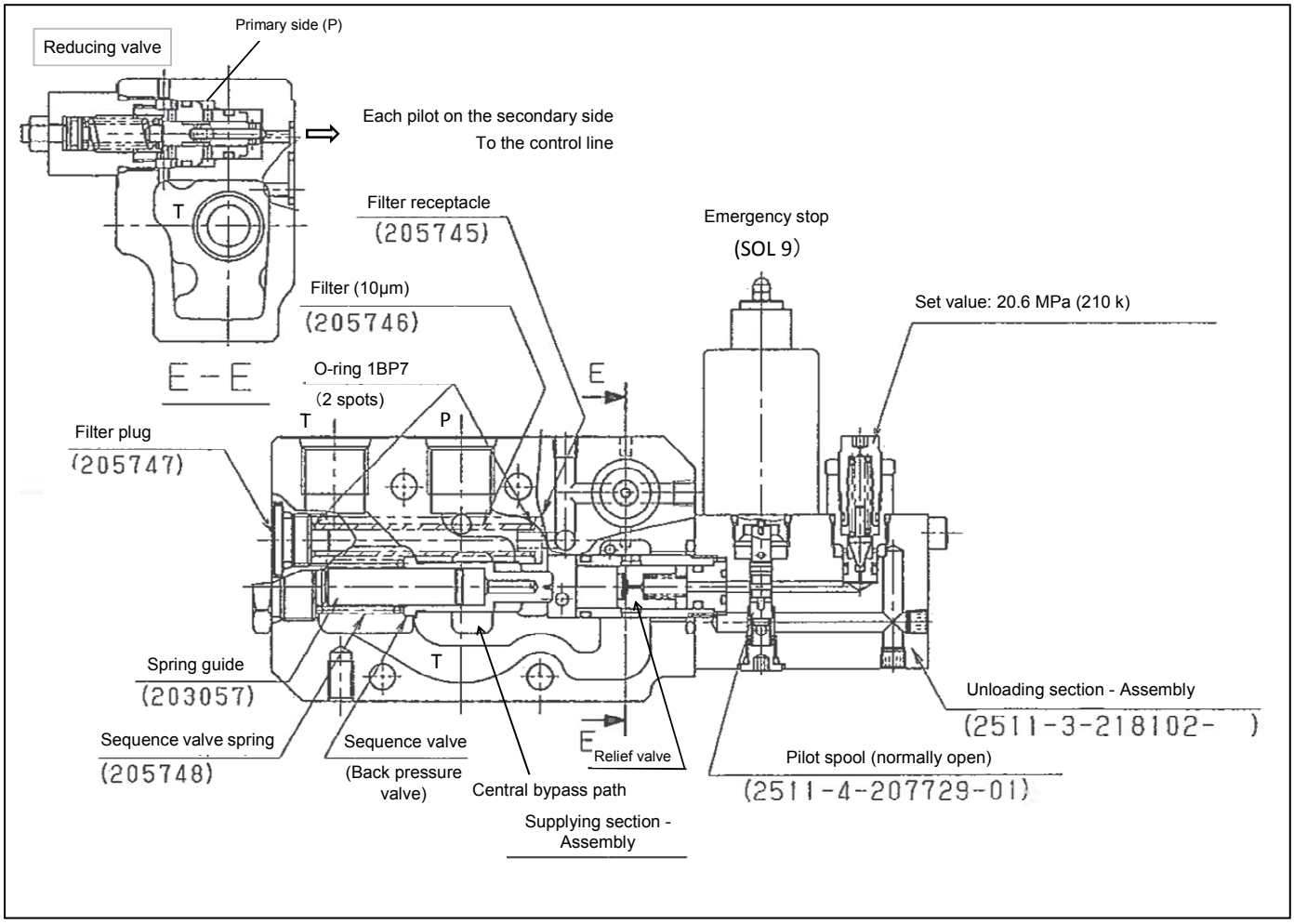
Since the space among the operating elements (derricking, winching, extension/contraction and slewing) of magnetic switching valve is bridged by parallel circuits, the objects of the magnetic switching valve can be simultaneously operated. However, in the case of simultaneous operation, the operation begins with the actuator under the lowest load pressure.

Additionally, this valve has a central bypass path for releasing under no load the oil supplied from the pump while the switching valve is in the neutral position.

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8.4 ACTIONS OF EACH SECTION

[1] Composition and actions of supply section



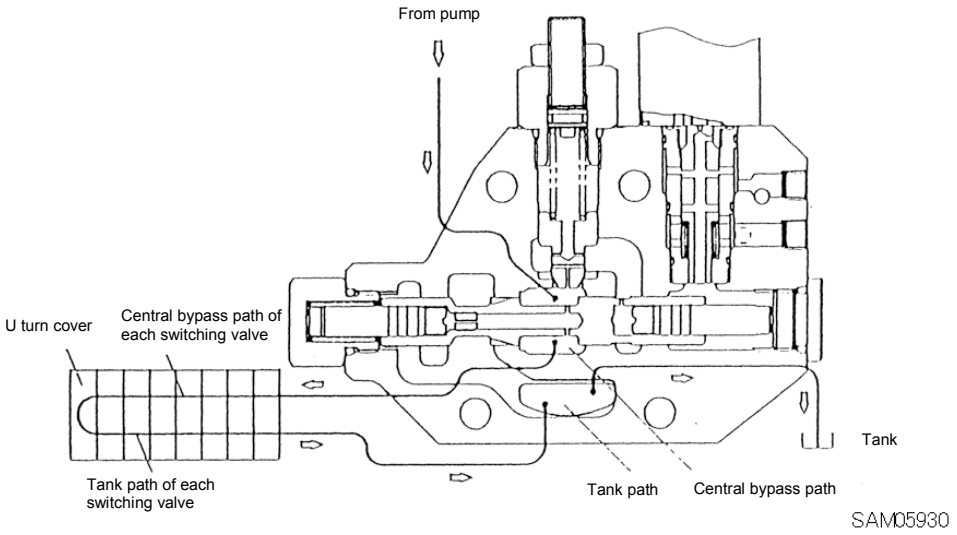
The supply section consists of a supply port (P) for supplying hydraulic oil from pump, oil channel to bring it to operation section (switching section), and the discharge port (T) to discharge the return oil from actuator to tank; and in addition, a back pressure valve (sequence valve), reducing valve, and relief valve.
The sequence valve is provided to secure the minimum operating pressure of pilot when magnetical switching under no load and the reducing valve serves to maintain the pilot pressure at a specified value.
Since the sequence valve, reducing valve and relief valve are not working while no oil is allowed to flow, the paths of pump to tank and pump to central bypass are closed, although the path from pump to the primary side of reducing valve is allowed to flow.
When supplied from pump, the oil pushes the sequence valve to open and flows in the central bypass path. When the switching valve in the downstream is not operated, the pump pressure at supply port (P) serves as the pressure of the sequence valve.
(Cracking pressure: 1.34 to 1.49 MPa)
Concurrently, the reducing valve starts to maintain the pilot pressure at the set pressure of the reducing valve.
(Reducing valve set pressure: 1.42 to 1.47 MPa)
When the downstream switching valve is being operated, the pump pressure works as its load pressure, and as soon as the negative pressure reaches the relief valve set pressure, the relief valve operates to maintain the circuit pressure at the relief valve set pressure.
Also, when the emergency solenoid (SOL.9) is not excited, the circuit pressure can be set to the level of unloaded state.

⚠ CAUTION

・ Limit the set pressure of relief valve within the range not exceeding the rated pressure of the valve.
Using it at a pressure exceeding the rated pressure may invite a performance drop, failure or breakage.

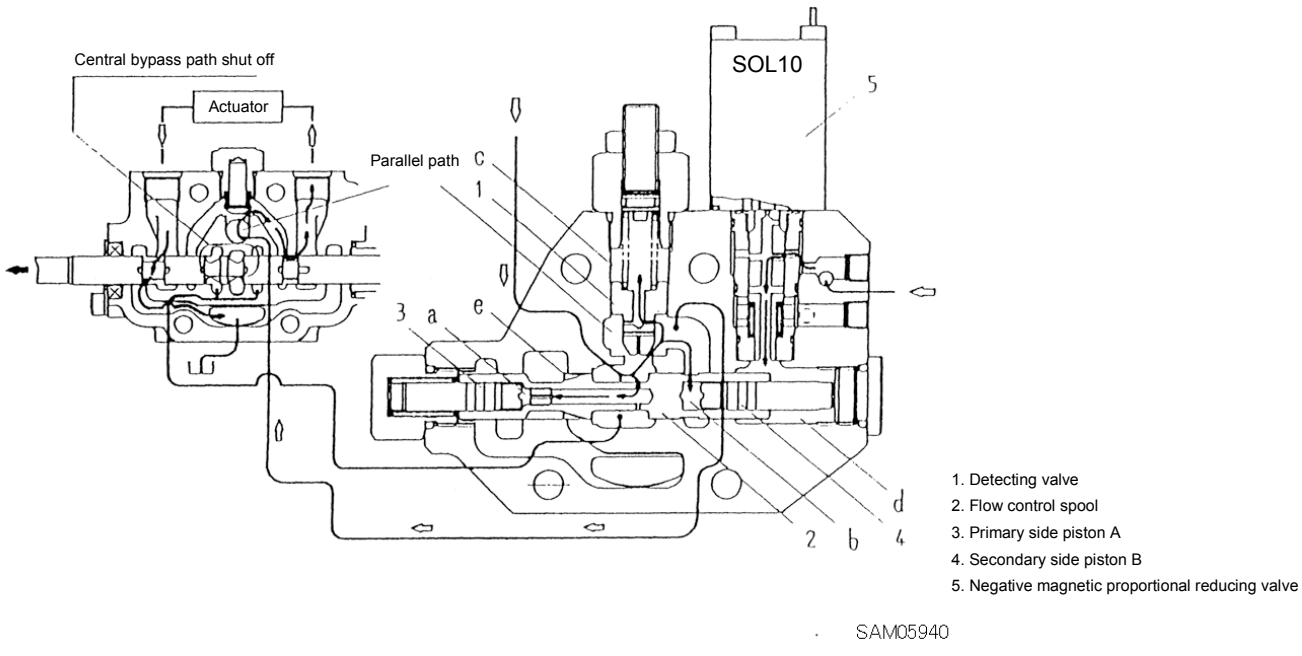
[2] Operation of flow control valve

1. When each switching valve is in its neutral position



When each switching valve is in its neutral position, the hydraulic oil supplied from pump passes through the central bypass path and tank path including this control valve, and returns to the tank through the discharge port of the supply section.

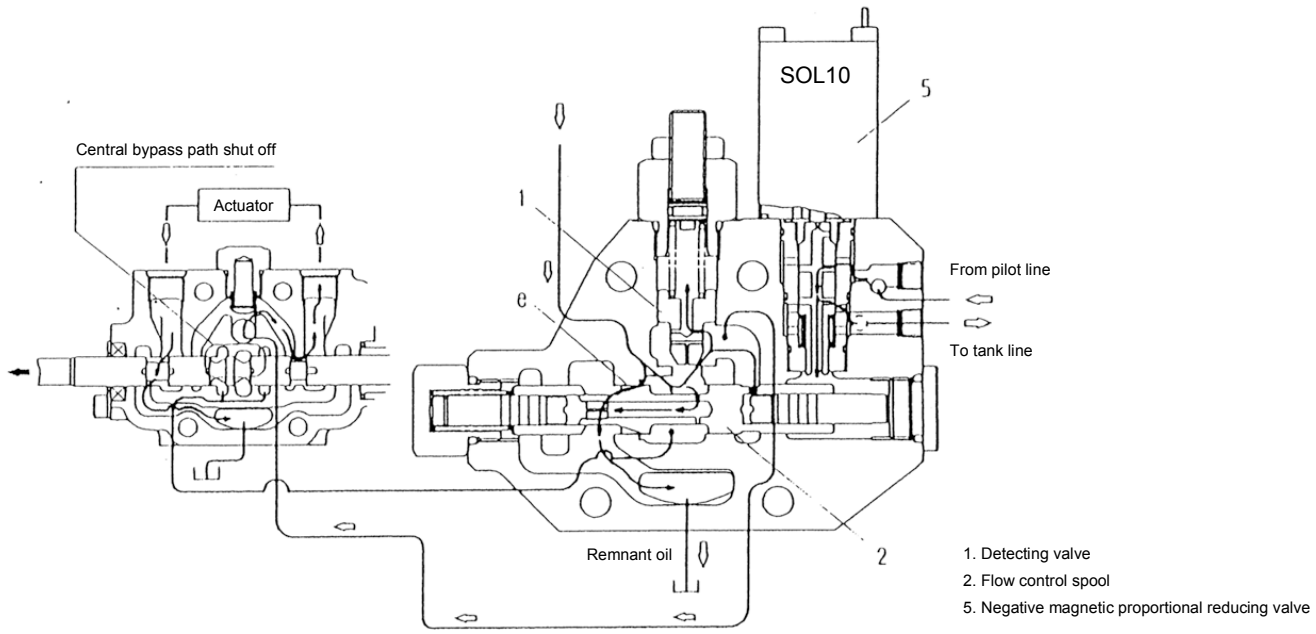
2. When a switching valve is operated (when the solenoid of negative magnetic proportional reducing valve is not excited)

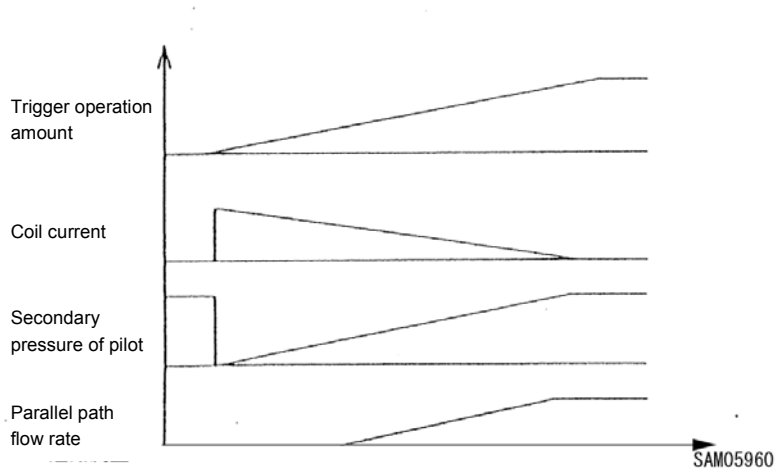


When any of the switching valves is switched, the central bypass path is closed, and the hydraulic oil pushes detecting valve (1) upward to flow the oil into the parallel path. In this stage, pump pressure is applied to the primary side chamber (a) of flow control spool (2), while load pressure (downstream pressure of the detecting valve) is applied to the secondary side chamber (b) and the detecting valve spring chamber (c). Note that since the primary side piston (3) and secondary side piston (4) have the same diameter, the front and rear differential pressure of detecting valve (1) is applied to the rightward of the flow control spool (2).
On the other hand, the secondary pressure of negative magnetic proportional reducing valve (5) is applied to the control valve's spring chamber (d), and works in the leftward direction on the flow control spool (2) by overcoming the spring force.
When the negative magnetic proportional reducing valve solenoid (SOL10) is not excited, the secondary pressure reaches its maximum value, and the leftward force overcomes the rightward force acting on flow control spool (2), and thus the flow control spool (2) is positioned at the extreme left end. Consequently, the control notch (e) remains closed, and thus the hydraulic oil from pump totally passes the parallel path and flows into the switching valve.

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3. When a switching valve is operated (when the solenoid of negative magnetic proportional reducing valve is excited)





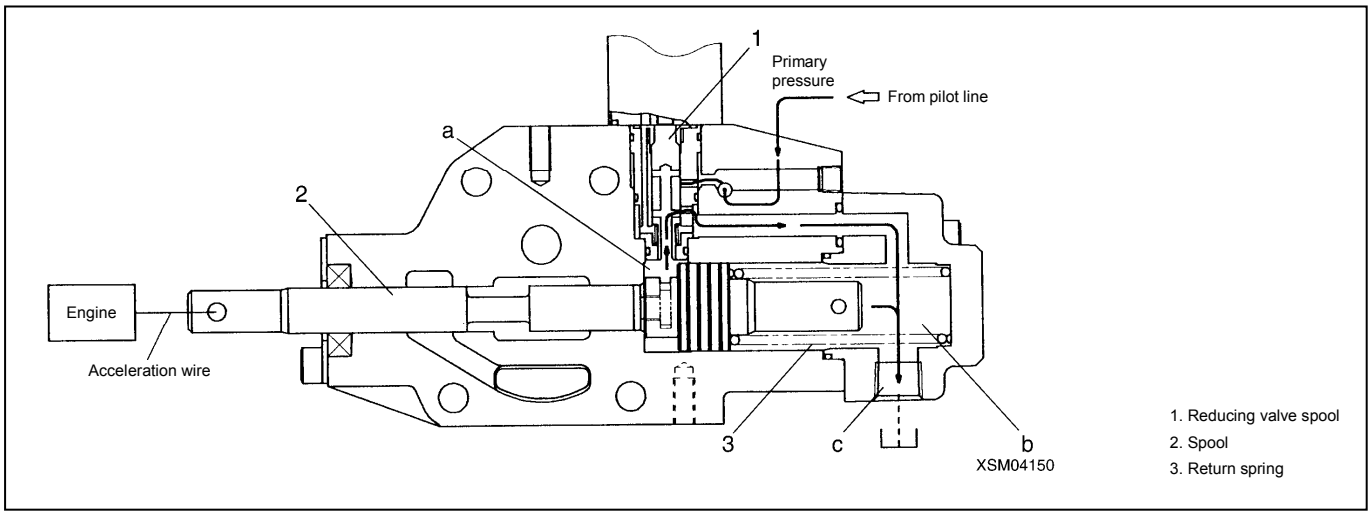
Since applying the maximum current to the solenoid (SOL10) of negative magnetic proportional reducing valve (5) causes the secondary pressure to vary (decrease) in commensurate with its current value, the leftward force acting on flow control spool (2) decreases accordingly.
Consequently, flow control spool (2) moves rightward to open control notch (e) to release the remnant oil to the tank. At this moment, detecting valve (1) remains unlifted, and thus hydraulic oil does not flow into the parallel path. Subsequently decreasing the applied current in commensurate with trigger operation degree causes the secondary pressure to rise, flow control spool (2) to move leftward and control notch (e) to close. As a result, the hydraulic oil pushes detecting valve (1) to open so that it can flow into the parallel path to drive the actuator.
Further, decreasing the applied current allows the control notch (e) to close fully and the total amount of hydraulic oil to flow in.
These actions occur in succession to effect the flow control in commensurate with the applied current value.
When the load pressure varies under this condition, flow control spool (2) allows the opening position of control notch (e) so that the front and rear pressure difference of detecting valve (1) is maintained at a constant level, and thus the flow rate of supply to the actuator is kept constant regardless of the variation of load pressure.

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[3] Actuation of acceleration positioner

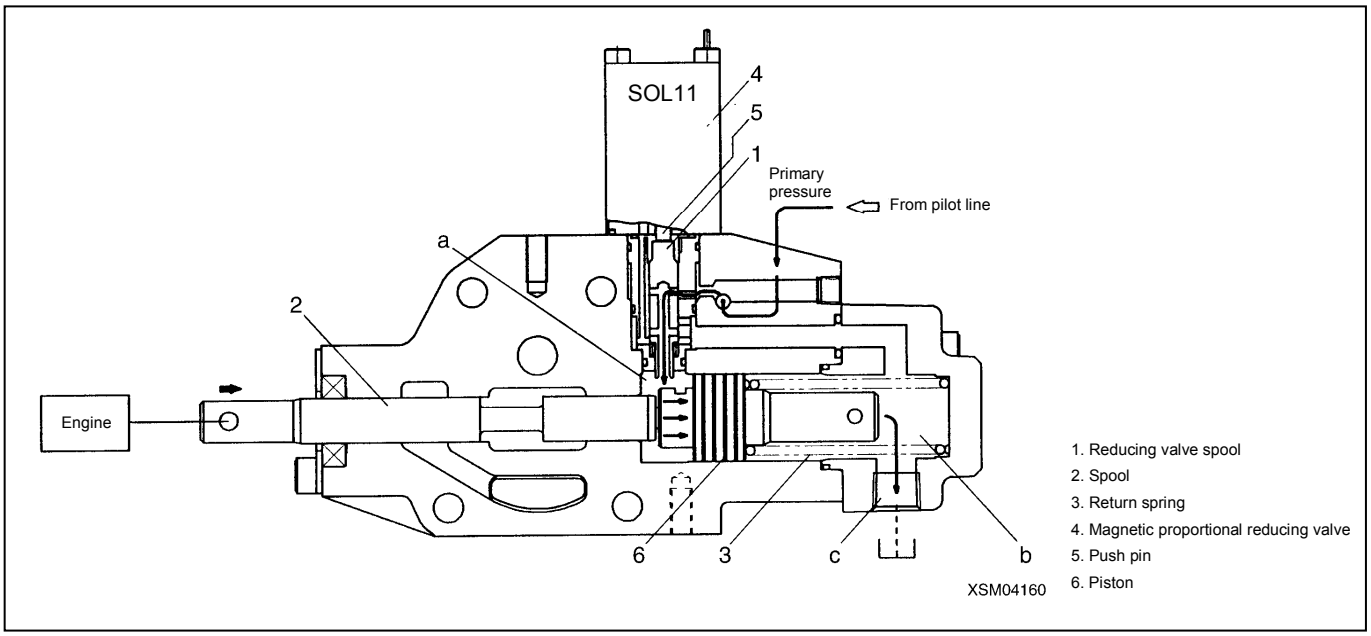
By applying a current to solenoid (SOL11), this operating section moves spool (2) in commensurate with the input current, and by means of the linked acceleration wire, it allows the engine to vary its revolution speed, in order to control the pump discharge rate.

1. When magnetic proportional reducing valve solenoid is not excited



For the pilot pressure (primary pressure) from pilot line, the path to secondary side pilot chamber (a) is closed by reducing valve spool (1). On the other hand, pilot chamber (a) is connected to drain port (c) by way of the internal path of reducing valve spool (1). Consequently, the pressure of pilot chamber (a) becomes equal to that of spring chamber (b) (drain pressure), and thus spool (2) is pushed leftward by return spring (3).

2. When magnetic proportional reducing valve solenoid is excited



Applying a current to solenoid (SOL11) of magnetic proportional reducing valve (4) allows the reducing valve spool (1) to be pushed down by push pin (5) for an amount corresponding to the current value to control the secondary pressure in pilot chamber (a).

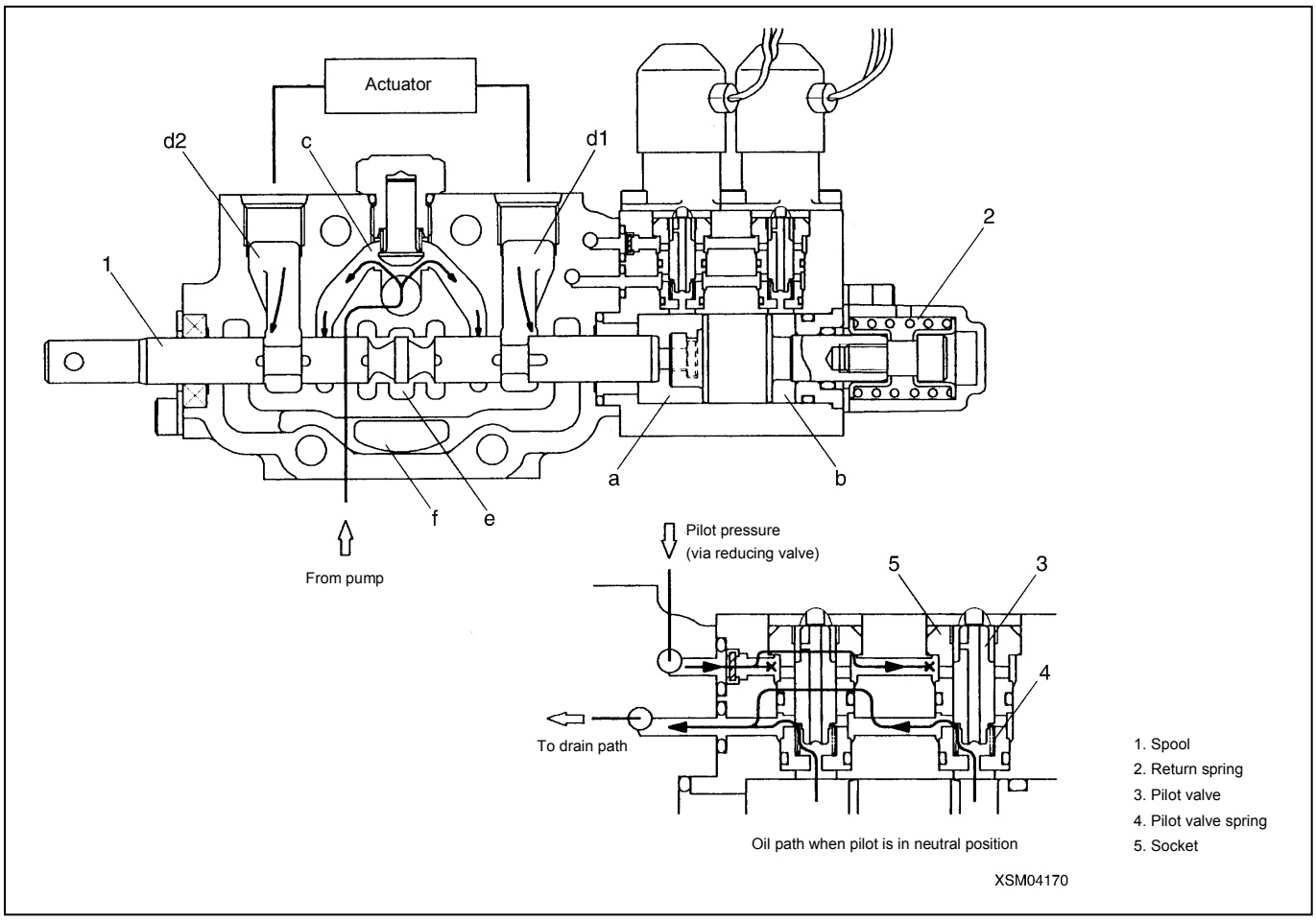
Also, as a result of reducing valve spool (1) being pushed down, the path that has connected the pilot chamber (a) with spring chamber (b) is closed, and consequently the hydraulic oil that has entered pilot chamber (a) acts on piston (6) so that the spool (2) connecting with piston (6) is moved rightward to the location where balanced is established with the force of return spring (3).

Thus, since the input current and the stroke of spool (2) are in a proportional relationship, an engine revolution speed commensurating with the input current can be obtained, and thus the discharge rate of the pump can be controlled.

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[4] Actuation of magnetic switching valve (derricking, winching, extension/contraction and slewing)

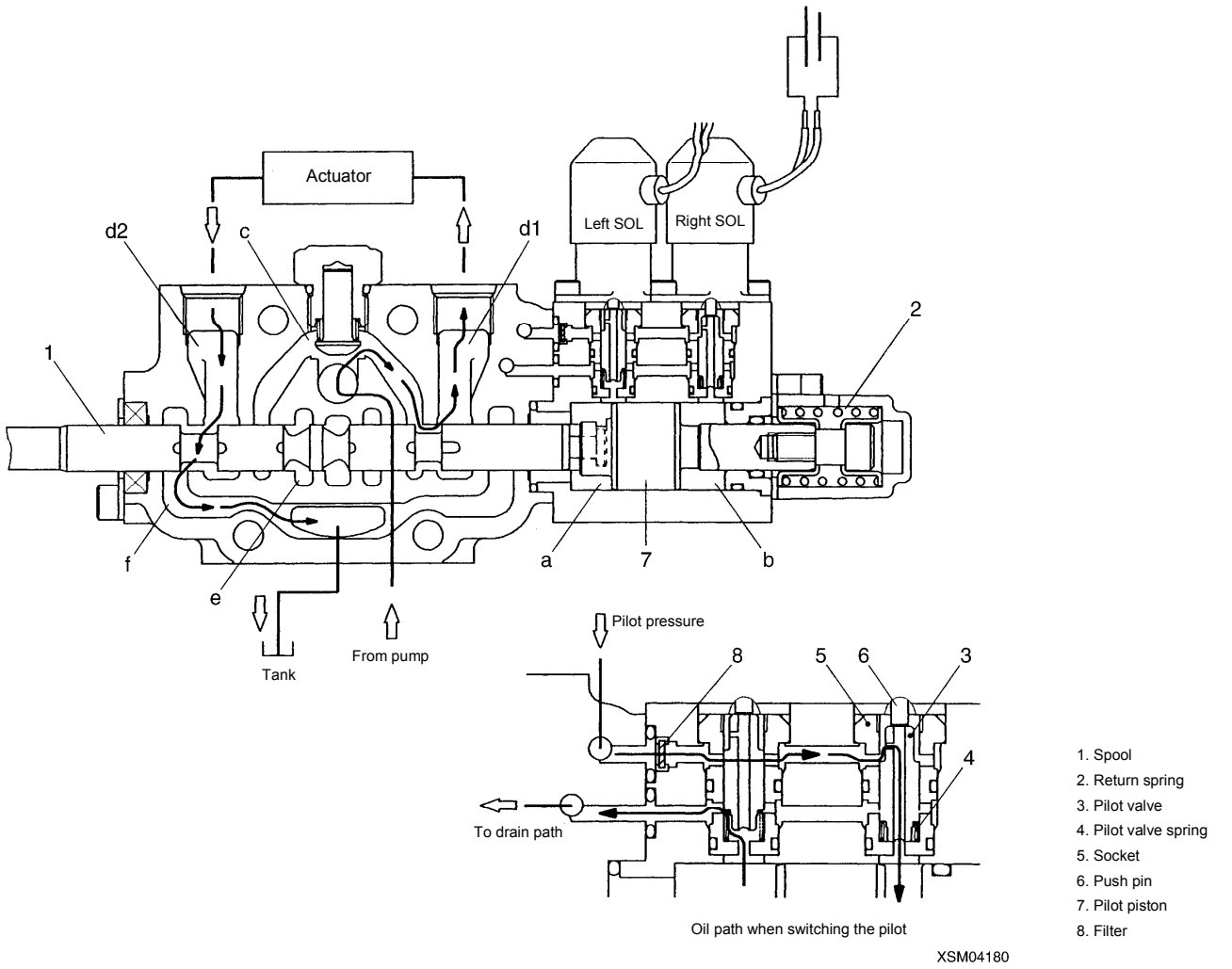
1. When the solenoid is not excited



Spool (1) is maintained in the neutral position by return spring (2).
Pilot valve (3) is pushed up toward the solenoid side by the force of pilot valve spring (4).
In this state, while the pilot path is closed by pilot valve (3), pilot chambers (a) and (b) are connected together by way of the drain path and socket (5). Consequently, the pressure of pilot chamber (a) becomes equal to that of pilot chamber (b) (drain pressure), and no force that can move spool (1) is generated.
Further, since spool (1) employs the all port block type, in the neutral spool position, between parallel path (c), actuator paths (d1) and (d2) as well as between actuator paths (d1) and (d2) and tank path (f) are closed. Accordingly, since every path that leads to actuators is shut off, the actuators are stopped.
On the other hand, when every one of other switching valves is in the neutral position, the oil supplied from pump passes the central bypass path (e) of each switching valve, and returns to the tank after passing the tank path (f) via the U-turn cover.

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2. When solenoids (SOLs 1 to 8) are excited



The following describes the status when right side solenoid is excited:
Pilot valve (3) on the right is pushed down by push pin (6). Consequently, pilot chamber (b) is connected to pilot path via filter (8) to supply the pilot pressure.
In this state, left pilot chamber (a) remains connected to the drain path. Thus, the diffrential pressure between pilot pressure and drain pressure acts on pilot piston (7) to move spool (1) leftward.
With the move of spool (1), central bypass path (e) is closed. On the other hand, pump path (c) and actuator path (d1) on the right side are connected together, and concurrently, actuator path (d2) and tank path (f) are connected together, and thus the actuators begin to move.
When the solenoid on the left is excited, a configuration of paths in reverse to the above-mentioned results, where spool (1) moves rightward, while the actuator moves in the reverse direction.
Demagnetizing the solenoid allows spool (1) to return to the neutral position (the state described under item 1 above) by the force of return spring (2), and the actuator stops when returning to the neutral position.

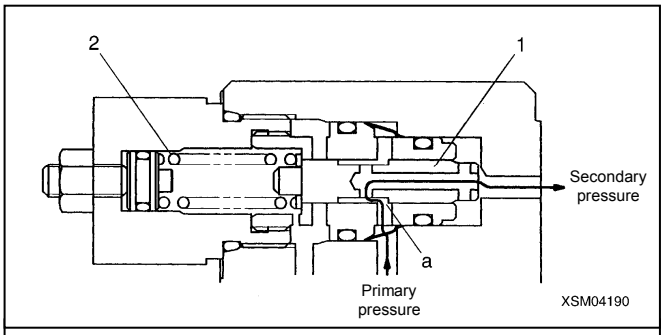
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[5] Actuation of reducing valve

1. When secondary pressure is below a set value

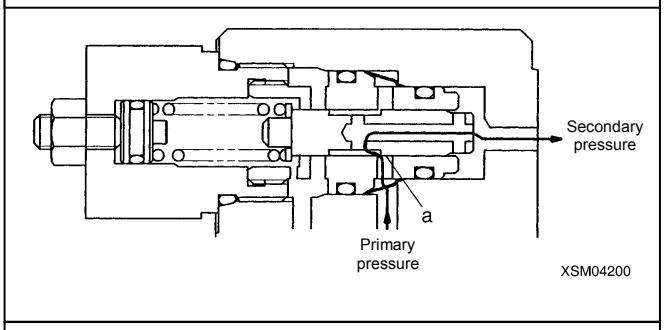
Since reducing valve spool (1) is pushed by reducing valve spring (2), the hydraulic oil of primary pressure flows through the path (a) of reducing valve spool (1) toward the secondary pressure side.

1. Reducing valve spool
2. Reducing valve spring



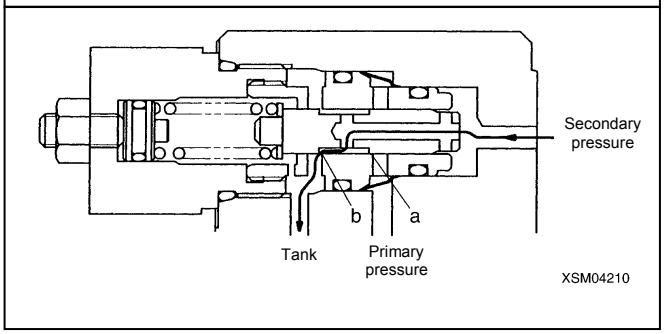
2. When the primary pressure exceeds the set value of secondary pressure

Reducing valve spool (1) moves until reducing valve spring (2) comes to be balanced and squeezes the path (a) of reducing valve spool (1) to maintain the secondary pressure at the set value.



3. When secondary pressure is above a set value

Reducing valve spool (1) moves until the secondary pressure comes to be balanced with reducing valve spring (2), closes path (a), and concurrently opens path (b) to allow the path to communicate with the tank to reduce the secondary pressure to the set value.



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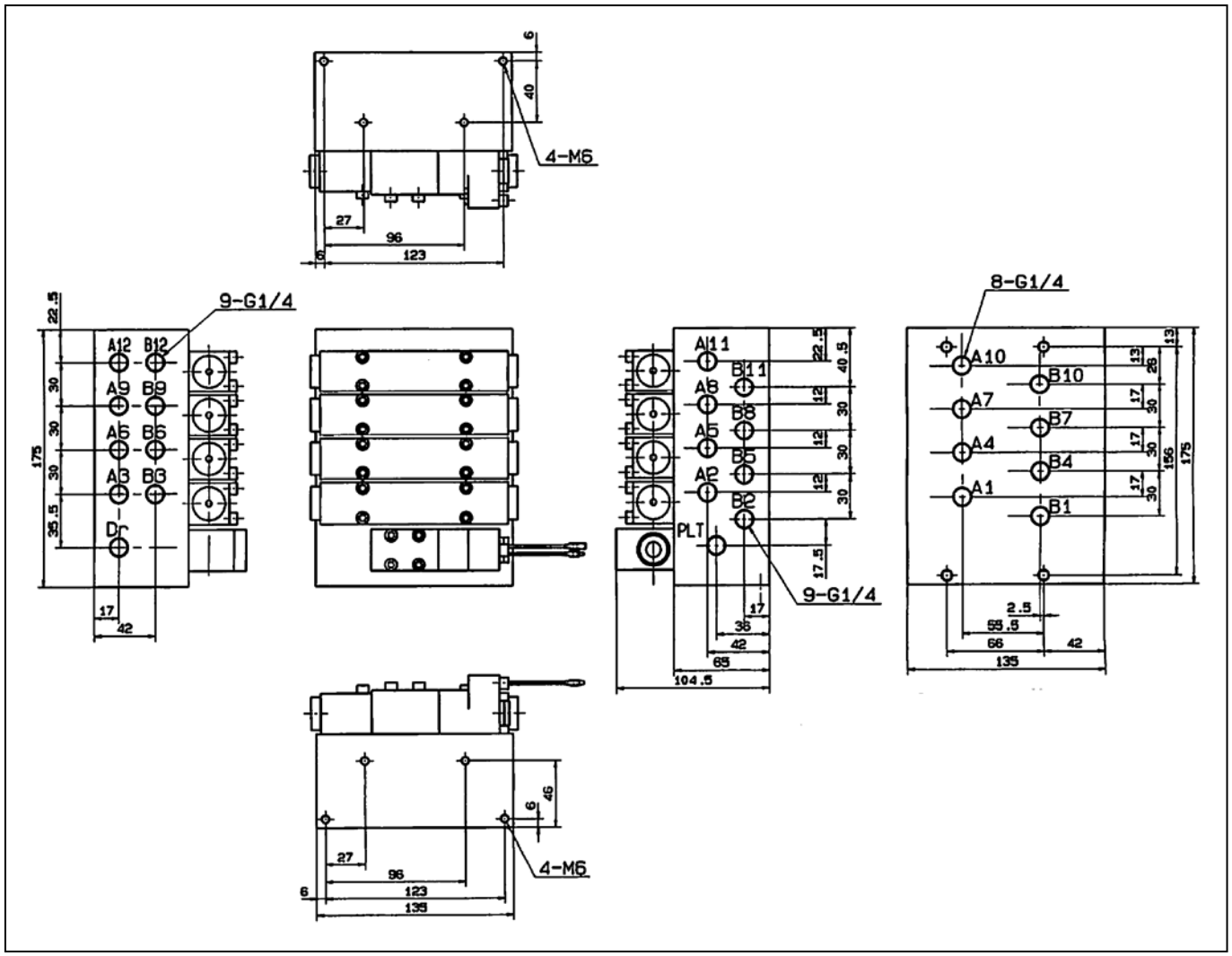
8.5 FAILURE CAUSE AND COUNTERMEASURE

Abnormal Phenomenon	Cause	Remedy
Pressure cannot be raised to the specified pressure.	· Mounting bolts are not tightened with the specified torque. · Unloaded without reaching the full stroke.	· Checking torque value · Refer to the description on “Does not switch the magnetic switching valve when excited”.
Does not switch the magnetic switching valve when excited	· Excitation voltage is excessively low, or the circuit is open. · Pilot valve catches foreign matters. · Spool catches foreign matters. · Reducing valve set value has dropped. · Sequence valve set value has dropped.	· Check the electrical system and repair as required. If the coil is broken, replace it. · Disassemble and repair or replace as required. · Disassemble and repair or replace as required. · Disassemble and repair or replace as required. · Disassemble and repair or replace as required.
Demagnetizing the magnetic switching valve does not return it to neutral.	· Pilot valve catches foreign matters. · Spool catches foreign matters.	· Disassemble and repair or replace as required. · Disassemble and repair or replace as required.
Although the magnetic switching valve is not excited, the valve is switched.	· Failure in seat due to the pilot valve catching foreign matters, or deformation of the seat	· Disassemble and repair or replace as required.
Oil leakage from a spool seal area	· Damage of sealing part, or abrasion of seal lip · Impact dents or scratch blemishes found on the spool seal sliding area · Defective mounting of sealing part fitting lid · The paint applied on the spool seal sliding area is still sticking	· Replacement · Repair or replace spool as required · Correction, or examination of uneven abrasion degree of the seal lip · Remove the paint with a diluent
Spool sliding is not smooth.	· Spool catches foreign matters. · Loss of oil film between the spool and body due to an abnormal oil temperature rise · Spool is unevenly abraded. · Failure in lubrication due to degradation of hydraulic oil · The spool is bent. · Distortion of the entire valve body due to defective mounting face. · Defects in external or operating area · Oil deposition on the lid on the other side of spool	· Disassemble and repair or replace as required. · Lower the oil temperature, or replace it. · Replacement · Oil replacement (overhaul of the circuit) · After examining the straightness of spool, repair or replace it as required. · Loosen the mounting bolts and check and repair as required · Check links and levers followed by repair as required · Leaking oil from spool seal is oozing out from the air vent hole in the lid as the spool is moved. After checking it, replace the seal.
Flow rate cannot be controlled smoothly.	· Spool and piston catch foreign matters. · Orifice in the spool is clogged with foreign matters. · Reducing valve catches foreign matters and the set value has dropped. · The negative proportional reducing valve catches foreign matters and malfunctions. · Orifice in the spool is clogged with foreign matters.	· Disassemble and repair or replace as required. · Disassemble and repair or replace as required. · Disassemble and repair or replace as required. · Disassemble and repair or replace as required. · Disassemble and repair or replace as required.
Acceleration control cannot be performed smoothly.	· Spool and piston catch foreign matters. · The proportional reducing valve catches foreign matters and malfunctions. · Reducing valve catches foreign matters and the set value has dropped. · Defects in external or operating area	· Disassemble and repair or replace as required. · Disassemble and repair or replace as required. · Disassemble and repair or replace as required. · Check links and levers followed by repair as required

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9. OUTRIGGER SELECT VALVE

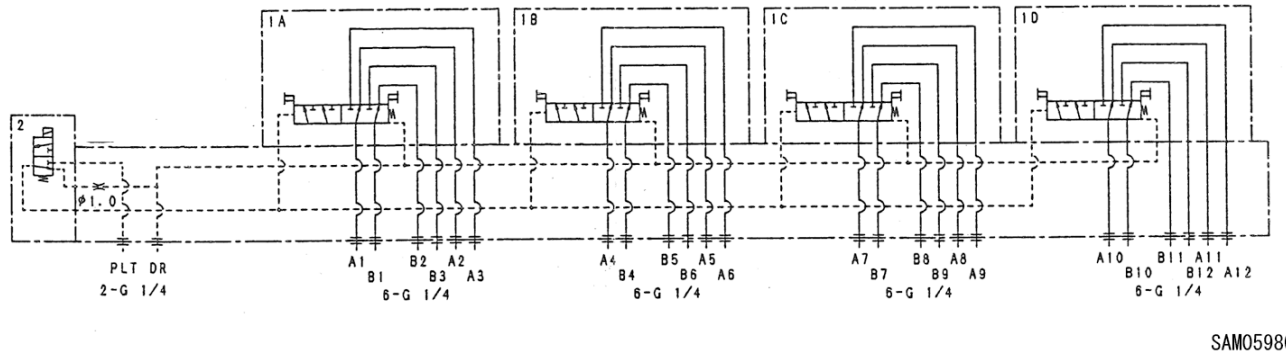
9.1 APPEARANCE AND SPECIFICATIONS



Port destination				Port destination	
A2	Right	A1	Right, OR1 out	A3	OR1 out
B2	Left	B1	Left, OR1 in	B3	OR1 in
A5	Contraction	A4	Contraction, OR2 out	A6	OR2 out
B5	Extension	B4	Extension, OR2 in	B6	OR2 in
A8	Up	A7	Right, OR3 out	A9	OR3 out
B8	Down	B7	Down, OR3 in	B9	OR3 in
A11	Raising	A10	Raising, OR4 out	A12	OR4 out
B11	Lowering	B10	Lowering, OR4 in	B12	OR4 in
PLT	Crane control valve PP port			DR	Hydraulic tank

Note: The size of each port is G1/4.

Circuit diagram



Specifications	
Maximum service pressure	21 MPa (214 kgf/cm^2)
Max. flow rate	30 L/min
Pilot pressure	1.0 to 1.5 MPa (10.2 to 15.3 kgf/cm^2)
DR port allowable back pressure	7 MPa (71.4 kgf/cm^2)
Mass	Approx. 7.5 kg
Material	Aluminum
Allowable range of votage variation	Rated voltage ±10%
Solenoid type	D-SOL-019 (with bullet terminals)
Rated voltage of solenoid	12 VDC
Retention current in solenoid	0.6 A
Power consumption in solenoid	7.2 W

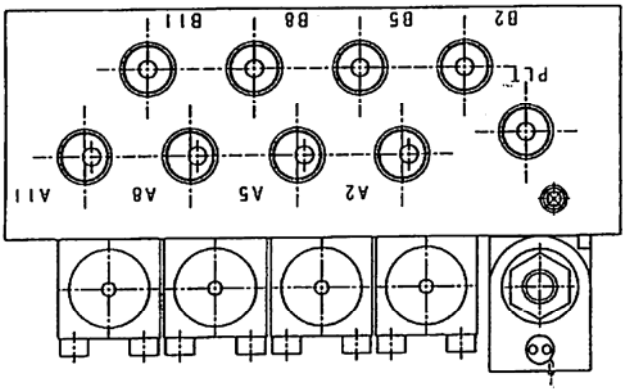
9.2 INTERNAL STRUCTURE

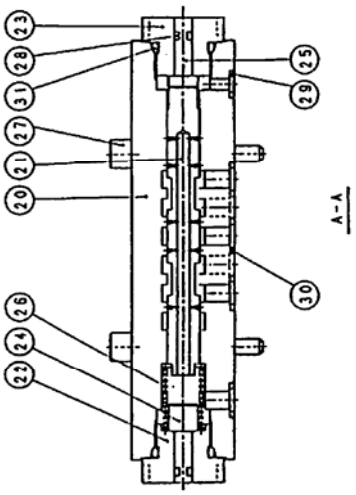
符号 MARK	部品名称 PART NAME	部品形式 PART MODEL NO.	個数 Q'TY	備考 REMARKS
1	マニホールド ブロック MANIFOLD BLOCK	1972-35109-10	1	
2	管栓 PIPE PLUG	GC-C3-1/16	6	
3	管栓 PIPE PLUG	GC-C3-1/8	1	
4	ノズル NOZZLE	S0410	1	
5	ボデー BODY		1	
6	ピストン PISTON		1	
7	スプリング SPRING	D-HP2-W-0101-3	1	
8	Oリング O-RING	PG-CM-12.5	1	JIS B 2401 -1A P12.5
9	Oリング O-RING	PG-CM-5	5	JIS B 2401 -1A P5
10	ソケットボルト SOCKET HEAD BOLT	TA-B2-4X15	4	JIS B 1176 4X15
11	プランジャ ブロック PLUNGER BLOCK		1	
12	コイル ブロック COIL BLOCK		1	
13	プッシュピン PUSH PIN		1	
14	ヘキサゴナットナット HEXAGON NUT		1	
15	Oリング O-RING	S11.2	2	NOK S11.2
16	端子 TERMINAL	1700021-2(ハセプラグ側)	1	AMP
17	スリーブ SLEEVE	1700885-2(配線スリーブ)	1	AMP
18	端子 TERMINAL	1700020-2(プラグ)	1	AMP
19	スリーブ SLEEVE	1700887-3(配線スリーブ)	1	AMP
20	ボデー BODY		4	
21	スプール SPOOL		4	
22	プラグ PLUG	2831-67006-00	4	
23	プラグ PLUG	2831-67002-00	4	
24	ピン PIN	2831-76006-00	4	
25	ピン PIN	2831-76003-10	4	
26	スプリング SPRING	2831-70001-00	4	
27	ソケットボルト SOCKET HEAD BOLT	TA-B2-5X35	16	JIS B 1176 5X35
28	Oリング O-RING	ARP-568-004	8	
29	Oリング O-RING	PG-CM-5	4	JIS B 2401 -1A P5
30	Oリング O-RING	PG-CM-7	32	JIS B 2401 -1A P7
31	Oリング O-RING	PG-CM-14	8	JIS B 2401 -1A P14

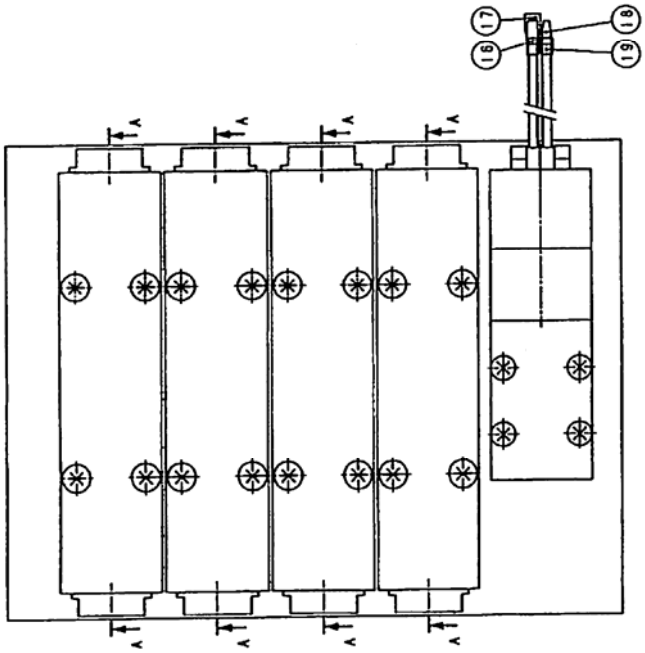
Solenoid block
D-S01-019 (1 set)

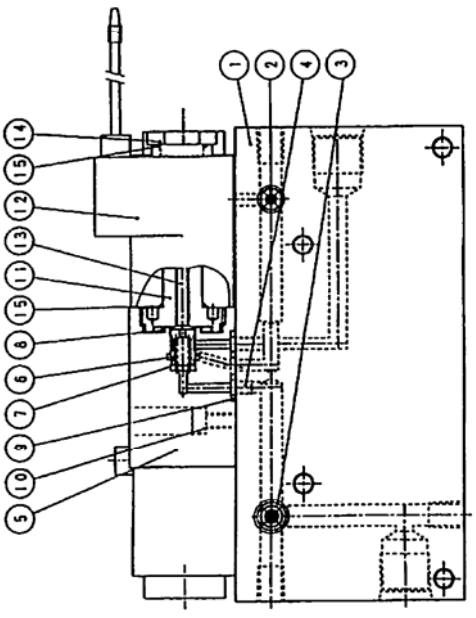
Pilot switching valve
D-HD-01068 (1 unit)

6-port switching valve
D-HD-01081 (4 units)





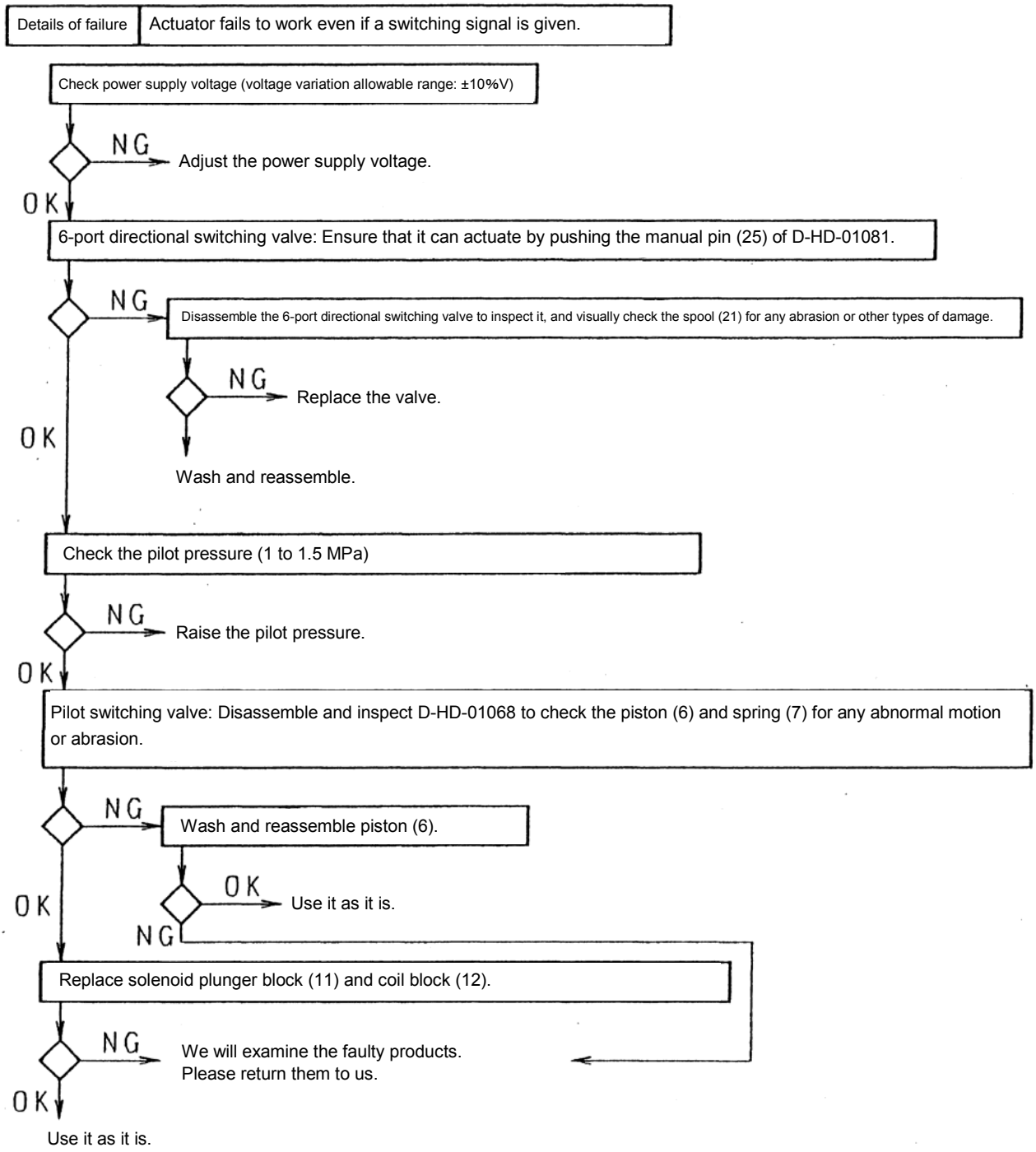




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9.3 INSPECTION OF VALVES

・When a failure occurs in a valve, conduct a troubleshooting by using the following procedure:



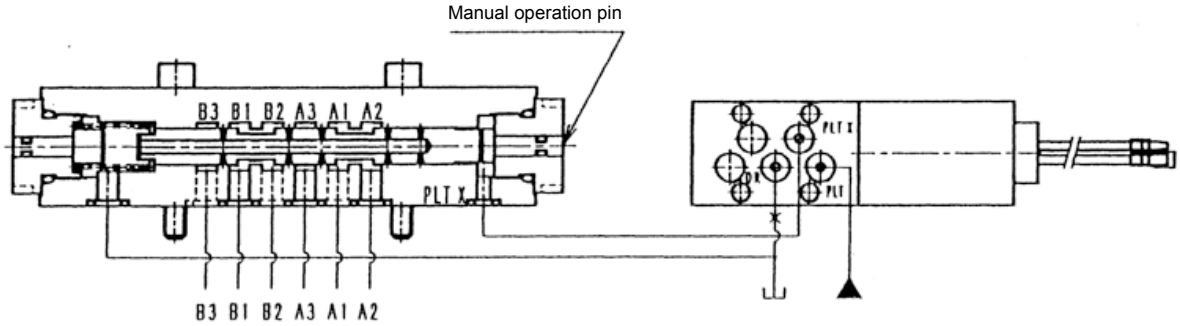
Note 1) Figures in the parentheses ( ) are the check numbers in the assembly drawing of each valve.
Note 2) Dismounting the plunger block (11) requires a special tool. Please place an order for it separately.
Type of the special tool: D-H012

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9.4 METHODS FOR OPERATION ADJUSTMENT

6-port directional switching valve (D-HD-01081)

1) Pilot switching valve: Energizing the solenoid of D-HD-01068 allows the PLT X port of pilot switching valve to generate and apply pressure to the PLT X port of 6-port directional switching valve: D-HD-01081.This pilot pressure pushes the spool of 6-port directional switching valve to generate the flow of A1 to A3, and B1 to B3 in order to allow actuators to work. Turning off the power supply to the solenoid causes the spring to push back the spool of 6-port switching valve to result flows of A1 to A2 and B1 to B2.
2) When electrical checking cannot be exercised, pressing the manual operating pin of 6-port directional switching valve enables the checking of operation.



6-port directional switching valve
D-HD-01081

Pilot switching valve
D-HD-01068

Precautions:

1) If tightened excessively, a mounting bolt may give rise to strain in the body, resulting in malfunctioning. Limit the tightening torque of a mounting bolt within a range of 6 to 8 N·m.
2) When tightening a mounting bolt, pay attention to prevent the O-ring from being squeezed out and the valve from being dropped or mounted in a wrong direction.
3) This valve has been manufactured by high-precision machining. If it is clogged with a foreign matter, even if it is a minute particle, the spool may fail to move and may no longer perform the valve functions. To allow it to work normally, execute a sufficient flushing of piping and use a strainer and filter with pores no larger than 100μ.
4) For the hydraulic oil, we recomment oils conforming to ISO VG32, ISO VG46, or an equivalent one.
5) To maintain the specified viscosity, be cautious of oil temperature. Use hydraulic oils within the temperature range specified below: (Recommended values)

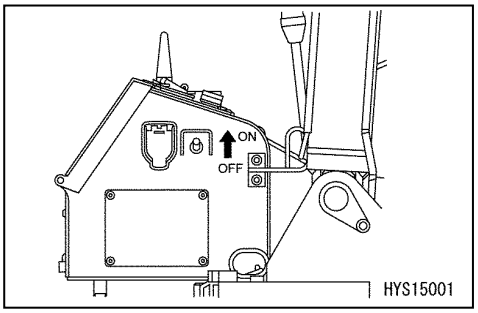
Oil type	Oil temperature	Viscosity
ISO VG32	0 to 60°C	Approx. 15 to 340 mm^2/s
ISO VG46	6 to 65°C	Approx. 18 to 340 mm^2/s

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9.5 OUTRIGGER CHANGE-OVER SWITCH (FOR EMERGENCY AVOIDANCE)

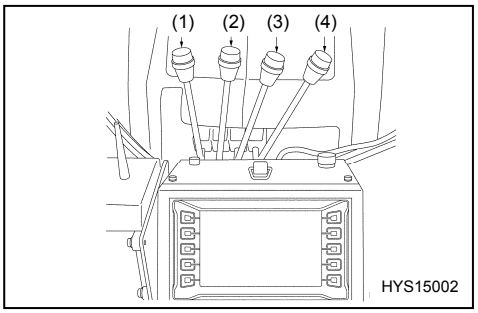
If the monitor is not displayed due to a failure, etc., the outrigger can be operated with the crane lever when “Emergency canceling switch” and “Outrigger change-over switch” are simultaneously used.

The outrigger change-over switch is located to the side of the monitor case.
It is placed side by side to the emergency canceling switch.



The action of each lever, while operation is being changed to outrigger operation, is as follows.

(1) Slewing lever → Outrigger 1
(2) Telescopic lever → Outrigger 2
(3) Hoisting and lowering lever → Outrigger 3
(4) Raising and lowering lever → Outrigger 4

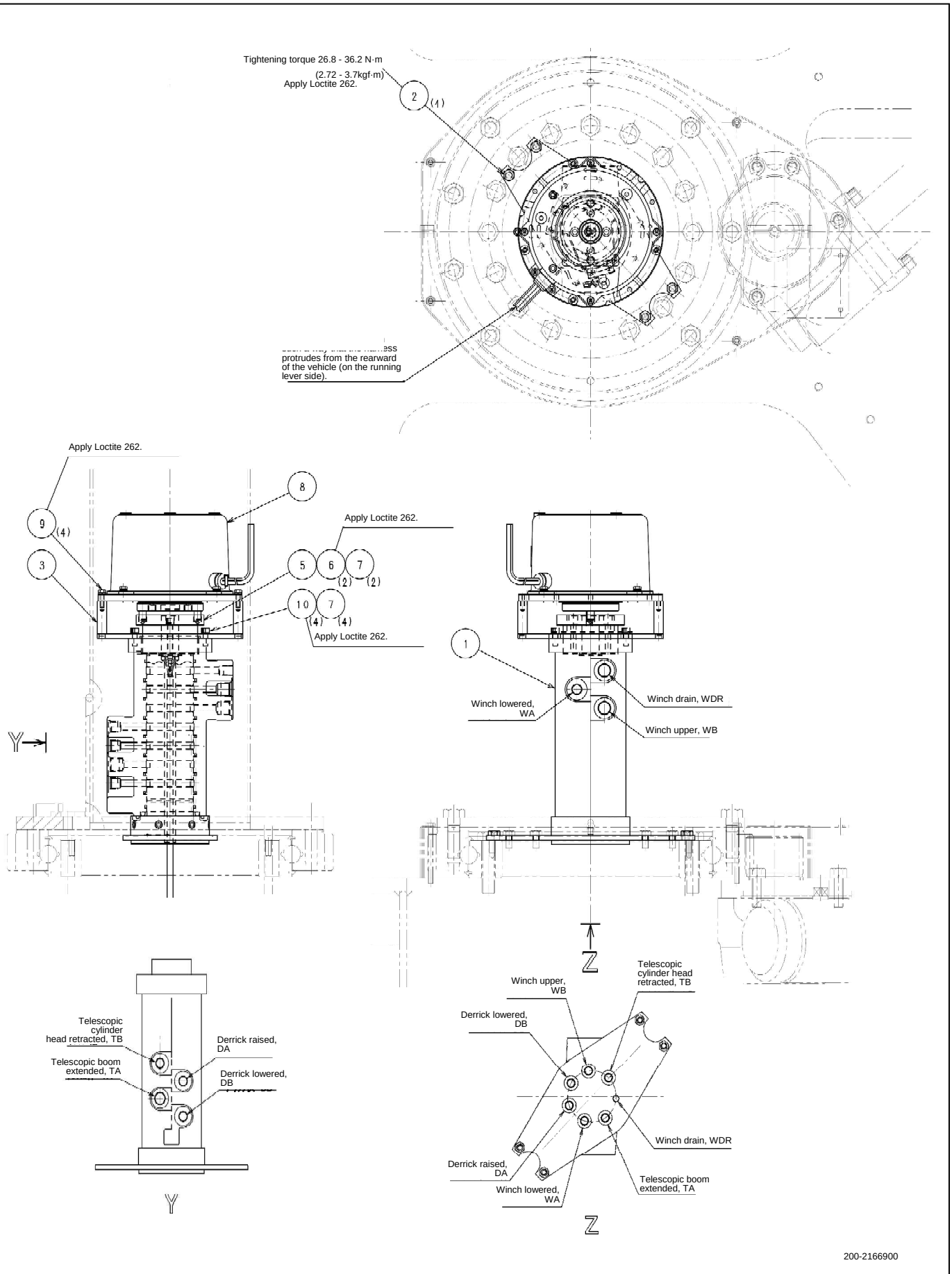


The crane will move when you release the switch while operating the lever. Pay due attention and slowly perform the operation.

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10. ROTARY JOINT

10.1 APPEARANCE AND SPECIFICATIONS



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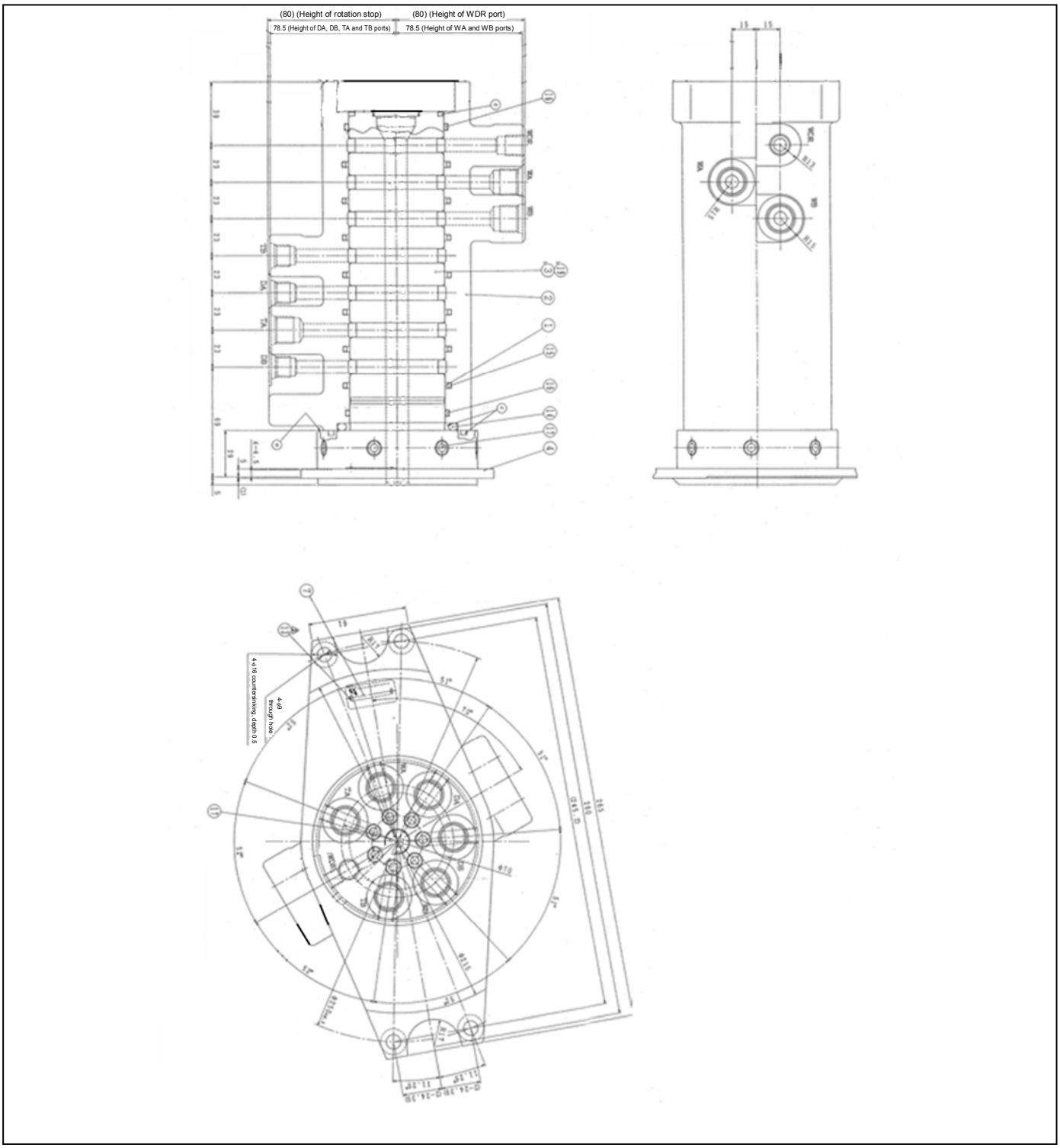
No.	Name	Q'ty	Note
1	Rotary joint	1	Item number: 353S64700000
2	Hexagon head bolt	4	M18 × 1.25 × 16 L (Strength grade 12)
3	Slip ring mounting bracket	1	Item number: 200-4629800
4	Missing number		
5	Joint	1	Item number: 200-4629900
6	Hexagon socket head screw	2	M6 × 1.0 × 45 L
7	Conical spring washer	6	M6 (plated)
8	Rotary brush	1	Item number: S106L3569000
9	Hexagon head bolt with washer	4	M5 × 0.75 × 12 L (plated)
10	Hexagon socket head cap screw	4	M6 × 1.0 × 16 L

Connection Table for Rotary Joint					
Marking stamp	Upper connection hose	Screw size	Marking stamp	Lower connection hose	Screw size
WA	WA hose (Winch motor port A: winding up)	G3/8	WA	WA hose (OR select valve B8 port)	G3/8
WB	WB hose (Winch motor port B: winding down)	G3/8	WB	WB hose (OR select valve A8 port)	G3/8
TA	T hose (Telescopic cylinder bottom port: extended)	G3/8	TA	TA hose (OR select valve B5 port)	G3/8
TB	T hose (Telescopic cylinder head port: retracted)	G3/8	TB	TB hose (OR select valve A5 port)	G3/8
DA	DA hose (Derrick cylinder bottom port: raised)	G3/8	DA	DA hose (OR select valve A11 port)	G3/8
DB	DB hose (Derrick cylinder head port: lowered)	G3/8	DB	DB hose (Crane valve B11 port)	G3/8
WDR	W drain hose (drain)	Rc 1/4	WDR	Drain hose (drain)	Rc 1/4

Specifications	
Maximum rated flow rate	50 L/min
Maximum service pressure	TA, TB, WA, WB, DA, DB: 20.6 MPa (210 kgf/cm^2)
	WDR: 2.9 MPa (30 kgf/cm^2)
Pressure resistance	TA, TB, WA, WB, DA, DB: 30.9 MPa (315 kgf/cm^2)
	WDR: 3.5 MPa (36 kgf/cm^2)
Operating temperature range	-20 to +90°C
Internal leakage	TA, TB, WA, WB, DA, DB: 1 cc/min max. (at 20.6 MPa [210 kgf/cm^2])
	WDR: 1 cc/min max. (at 2.9 MPa [30 kgf/cm^2])
Rotational torque	At start 98.1 N·m [10 kgf·m] max. (DA and TA ports when pressurized to 20.6 MPa [210 kgf/cm^2])
Hydraulic oil	Equivalent to ISO VG 32 and VG 46

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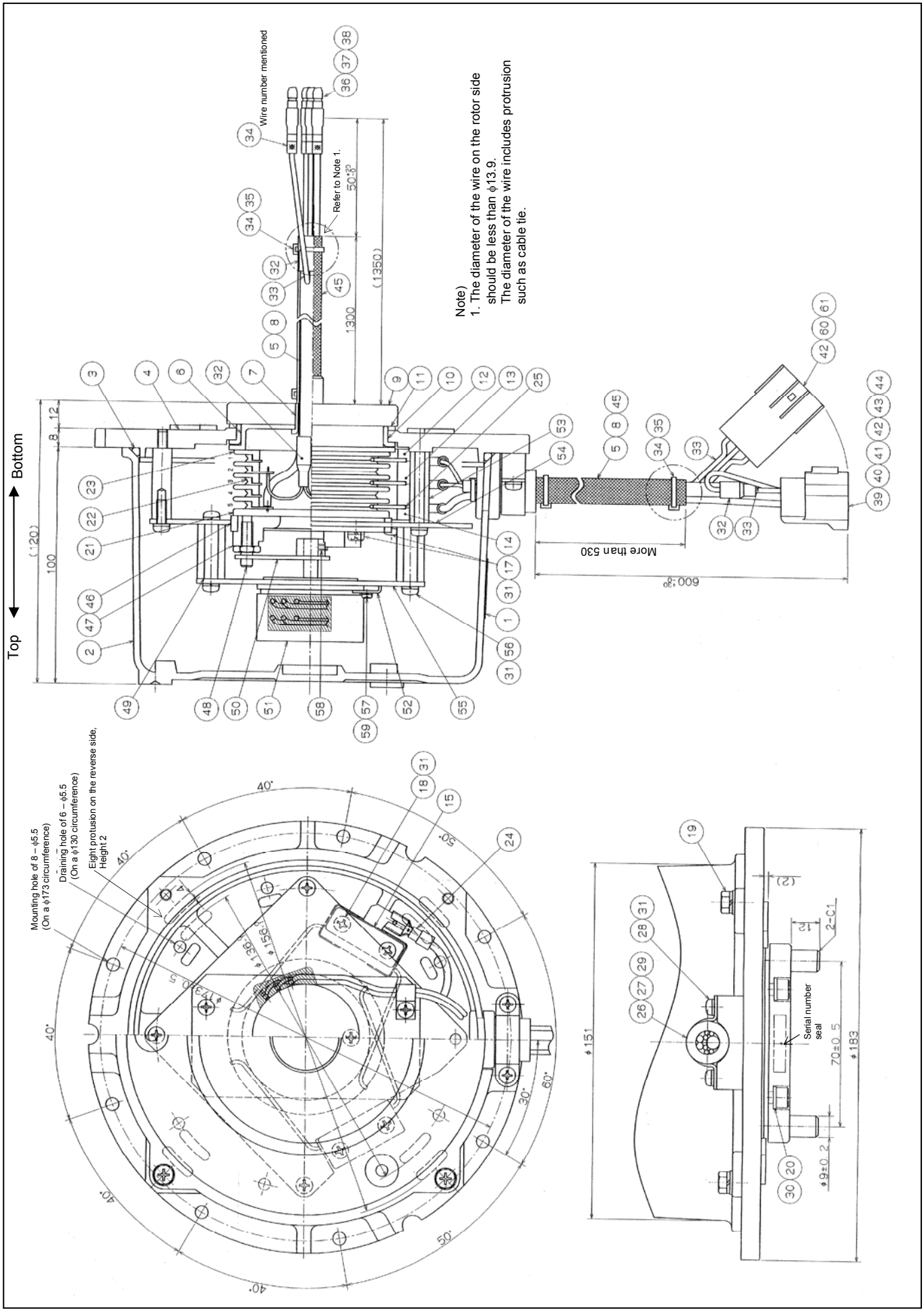
10.2 INTERNAL STRUCTURE



No.	Name	Q'ty	No.	Name	Q'ty	No.	Name	Q'ty
1	Slipper seal	7	8	Missing number		15	O-ring (1B G65 1116-90)	7
2	Hub	1	9	Missing number	2	16	O-ring (1B-AS568-229)	2
3	Shaft	1	10	Missing number	4	17	Hexagon socket head cap plug (R1/8)	14
4	Flange	1	11	Missing number	4	18	Missing number	
5	Missing number		12	Missing number	6	19	Shaft assembly	1
6	Missing number		13	Rivet screw (#2 × 4.8)	2			
7	Name plate	1	14	O-ring (1B-P65)	1			

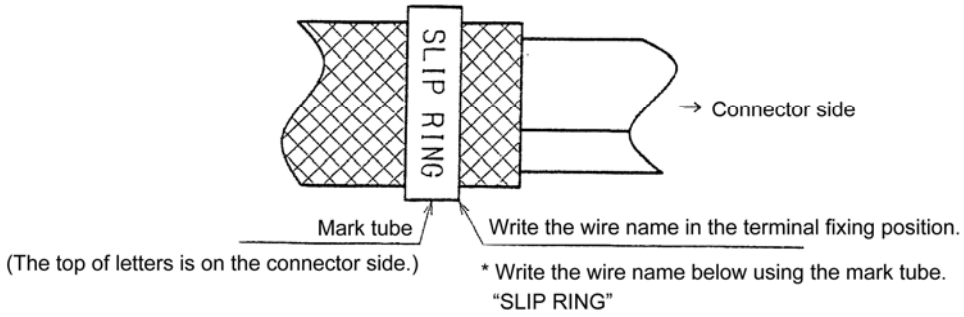
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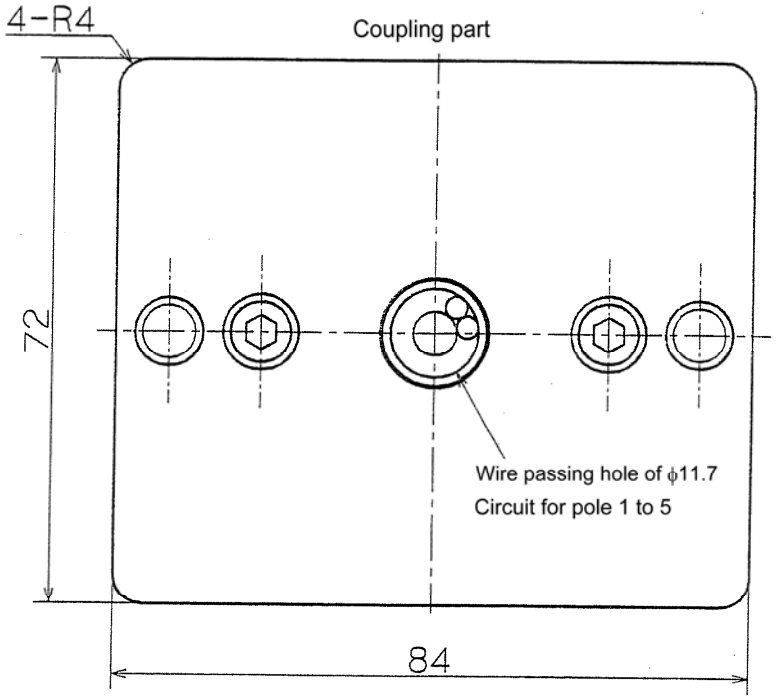
10.3 ROTARY BRUSH



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Part B: Writing method for wire number (Two places)





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● **Bill of materials**

Verification	Part name	Part number	Q'ty	Remarks
1	Meihan	45010226	1	
2	Case	45012725	1	
3	O-ring	008052517	1	
4	Base	45013624	1	Processed product of ϕ183
5	Twisted pair electric wire	– – – – – – –	1 set	See note in Table 1.
6	Axis base	45012689	1	
7	Bushing	VA25358	1	
8	Electric wire (AESSX-2.0 mm^2)	– – – – – – –	4	See note in Table 1.
9	Coupling assembly	45012685	1	
10	Bearing A	VA25328	1	
11	Bearing B	VA25329	1	
12	Brush base (lower)	VA25343	1	
13	Brush base (middle)	VA25342	5	
14	Brush base (upper)	VA25341	2	
15	Washer	VA25412	2	
16	Retainer plate	VA25338	2	
17	Pan head screw	000540459	5	M4 × 45
18	Pan head screw	000540409	2	M4 × 40
19	Hexagon head bolt	45012734	4	M5 × 14 SW with W
20	Spring washer	003850009	2	M5
21	Terminal insulating plate	VA25337	1	
22	Slip link	VA25335	5	
23	Insulating plate	VA25336	5	
24	Plug-in type connection terminal	VA25349	5	
25	Brush assembly	VA10927A	5	
26	Grommet	VA25362	1	
27	Clamp	VA26441	1	
28	Pan head screw	000540209	2	M4 × 20
29	Clamp seat	VA25364	1	
30	Hexagon socket head cap bolt	001950101	2	M5 × 10
31	Spring washer	003840009	9	M4
32	Shrinkable tube	– – – – – – –	4	W3/F2-3/8
33	Electric wire (AEX-0.5 mm^2)	– – – – – – –	2	See note in Table 1.
34	Mark tube	– – – – – – –	7	Wiring name, wiring number
35	Cable tie	– – – – – – –	4	
36	Bullet terminal (male)	CSS43925-M	5	Nichifu/Tin-plated item or equivalent
37	Insulating cap (for male)	43926-M	3	For 0.5 mm^2
38	Insulating cap (for male)	43932-M	2	For 1.25 mm^2
39	Housing (F)	6195-0021	1	Sumitomo Wiring Systems (6P)
40	Terminal (F)	8100-1427	3	For 0.3 – 0.5 mm^2
41	Terminal (F)	8100-1428	2	For 1.25 – 2.0 mm^2
42	Wire seal	7165-0118	3	Hole of ϕ1.5 – 2.0
43	Wire seal	7165-0119	2	Hole of ϕ2.0 – 2.9
44	Dummy plug	7161-9787	1	
45	Braided tube	BTUB6	2	Misumi or equivalent
46	Bushing	VA30296	1	
47	Retainer plate	45010168	1	
48	Pin	45010169	1	
49	Stud	45010170	4	L=23
50	Arm assembly	45018107	1	
51	Potentiometer	VA30090	1	CPP-45SB × 2 (Special)
52	Catch		2	Potentiometer accessories
53	Stud	BSF430E	4	Hirosugi Keiki or equivalent
54	Guide plate	45010167	1	
55	PM posting plate	45010171		
56	Round head screw	000540109	12	M4 × 10
57	Round head screw	000530109	2	M3 × 10

Verification	Part name	Part number	Q'ty	Remarks
58	Hexagon socket setscrew	45011320	2	M3 × 4 (Double points)
59	Spring washer	003840009	2	M3
60	Housing (M)	6195-0024	1	Sumitomo Wiring Systems (6P)
61	Terminal (M)	8230-4472	6	For 0.5 mm^2

Rotary brush TKF-P-02R-2S-21

Product specifications

1. Structure — As per Assembly drawing 45965786-1/2
2. Number of poles — 5 poles
   2-1. Power supply section (pole number: 4 – 5 poles)
   (1) Number of poles — 2 poles
   (2) Rated voltage — DC24V(5 – 32V)
   (3) Rated current — DC 10 mA – 15 A, DC 20A in case of 2 pole parallel connection
   2-2. Multiplex communication section
   (1) Number of poles — 3 poles (for signal: 2 poles, for shield: 1 pole)
   (2) Rated voltage — DC 24 V (5 – 32 V)
   (3) Rated current — DC 10 mA – 1A
   (4) Transmission method standard — CAN
   (5) Baud rate — 500 kbps
   2-3. Common specifications
   (1) Contact resistance — 50 m ohms or less (between brush and slip ring)
   (2) Insulation resistance — 1 M ohm or more (between P-P, between P-E at ordinary temperature and ordinary humidity)
   (3) Dielectric voltage — AC 500 V/1 minute (between P-P, between P-E at ordinary temperature and ordinary humidity)
   (4) temperature increase — 20ºC or less when the maximum current is continuously supplied
   (5) Duty factor — 100%
3. Running torque — 2.0 N·m or less
4. Durability — The specifications above should be met after fifty-thousands round-trip rotations are completed at 10 min^{-1}.
5. Operating temperature range — -20ºC to + 75ºC
6. Humidity — 30% to 95% (no dew condensation)
7. Potentiometer specifications
   (1) Maker, Model — MIDORI PRECISIONS CPP-45SB duplex
   (2) Electrical specifications

	Common to CUP 1 and 2
Effective electrical angle	350º +1º/-2º
Total resistance rate	5 kOhms ±15%
Linearity	±0.1%
Electrical Rating	1W / 70°C

   (3) Water resistance
   (4) Power output — Refer to figure 3
8. Index point
   Assigning the coupling position shown in Figure 1 as an index point, place an alignment mark on the mounting plate (base) and the coupling using a marker.
9. Apply a loosening preventer named three bond 1401C (red) on each clamp screw part. (For application quantity, refer to Figure 2.)
10. Coating color — Munsell 7.5BG4/1.5
11. Apply rust inhibitor on metallic parts inside the case.
12. Vibration resistance — There should be no abnormalities when the vibration frequency is at 33.3 HZ and the vibration acceleration is at 66.8 m/s^2 vertically for 4 hours, and side to side and back and forth each for 2 hours.
13. Shock resistance — There should be no abnormalities when an impact acceleration of 245.2 m/s^2 for 0.01 to 0.02 seconds is applied each vertically, side to side and back and forth three times.
14. Water resistance — Equivalent to JIS D 0203 S1
15. Guaranty — The guaranty (compensation) is limited to this product. (There are no secondary guaranty.)
16. Cautions
    (1) Be sure to hold the case to carry the body. By holding the wire, there is a risk of wire disconnection and/or short circuit.
    (2) When routing the wire of the brush, do it at least once inside the ground. (It is called the draining processing.) By not doing so, water is likely to infiltrate inside the body through the wire.
    (3) Expose the joint between the rotary brush and the swivel joint to the atmosphere so that air can flow. By not doing so, the water removed out of the body is likely to re-enter the body as steam.
    (4) Do not close the draining hole in the base part.

Figure 1 Index point

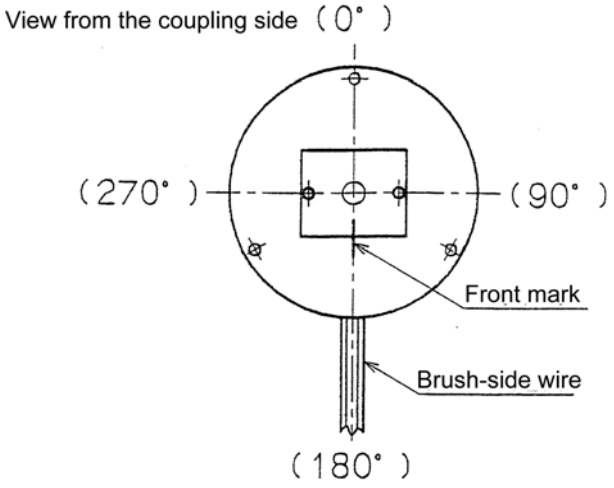
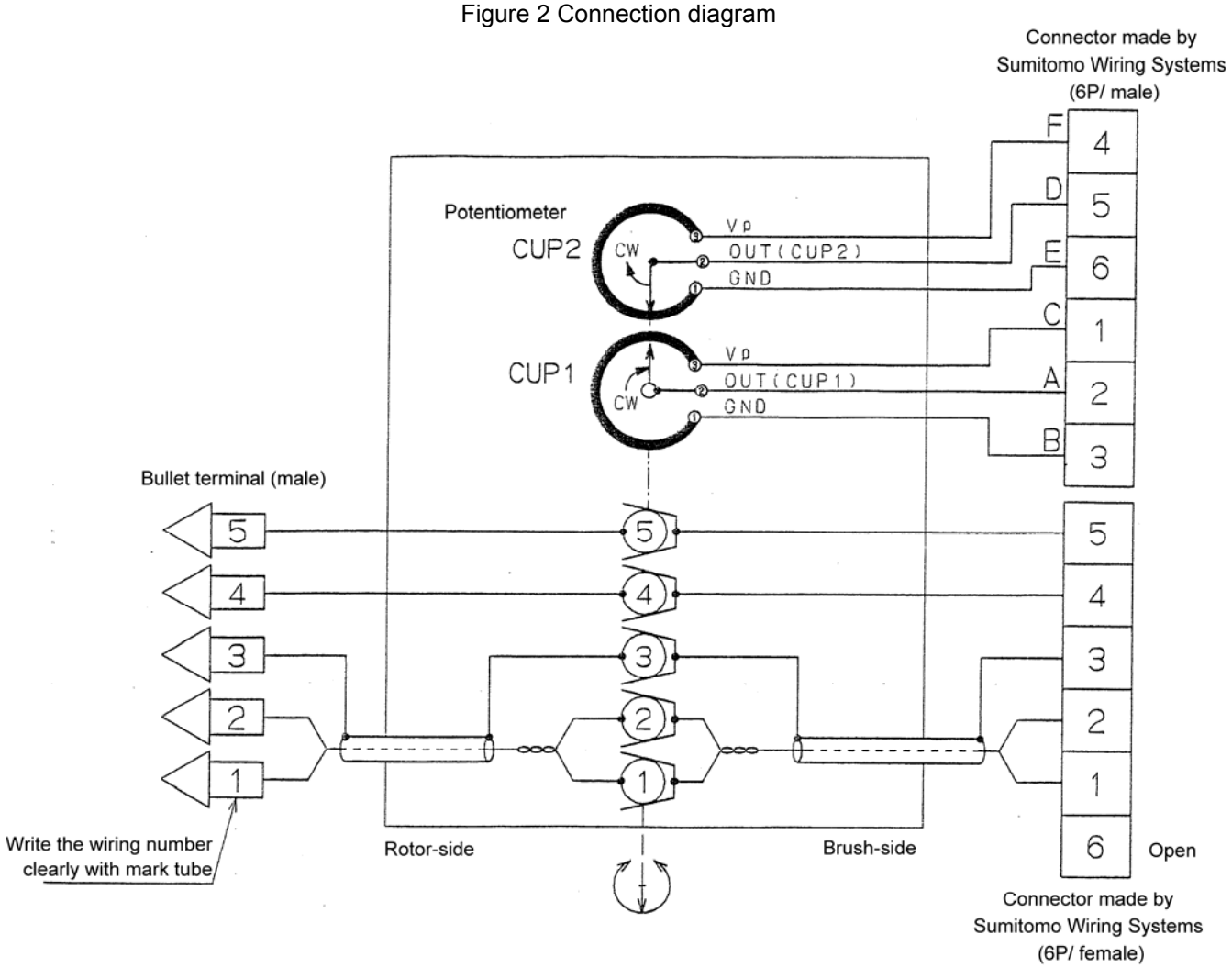


Figure 2 Connection diagram



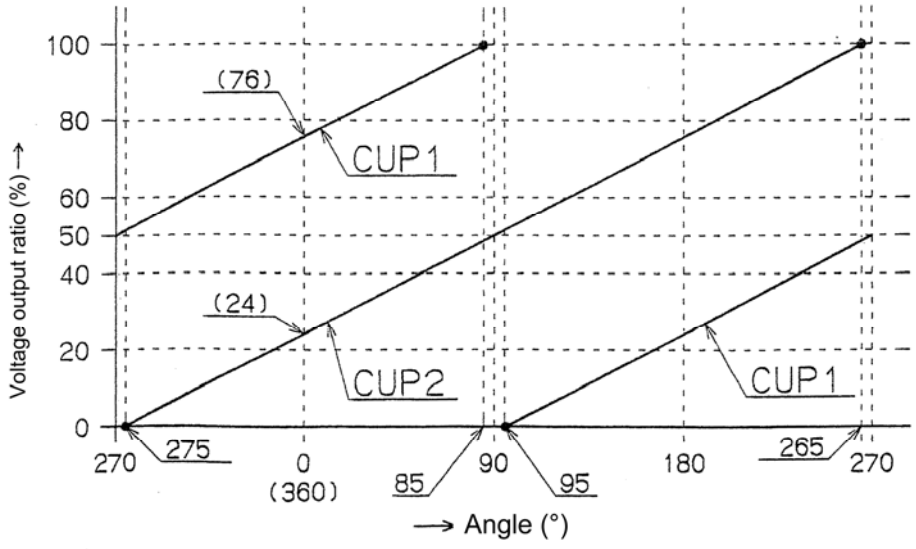
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Table 1 By lead wire type

Pole number	Color	Type
1	Red	Twisted pair electric wire 0.5 mm^2
2	Blue	
3	Green	AEX -0.5 mm^2
4	Red	AESSX -2.0 mm^2
5	Black	
A	Red	AEX -0.5 mm^2
B	Black	
C	Blue	
D	White	
E	Yellow	
F	Brown	

Notes
1. Twisted pair electric wire
   Model CO-FHV-SB 1P × 0.5 SQ R×B (Red–Blue)
   Outer sheath diameter 5.3 mm/max 5.8 mm
   (finished outside diameter)
   Conductor sheath diameter 1.9 mm (1.8 mm – 2.0 mm)
2. AEX wire
   Based on JASO D 608
   AEX-0.5 mm^2 Finished outer diameter
   Standard: 2.0 mm
   Max: 2.2 mm
   AESSX-2.0 mm^2 Finished outer diameter
   Standard: 2.6 mm

Figure 3 Outputting conditions of the rotation angle detector



Note) Figure 2 Outputting conditions due to voltage impression of the potentiometer shown in the connection figure

Figure 4 Screw lock coating

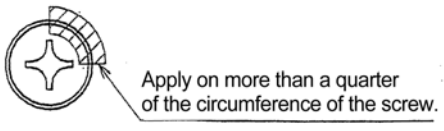
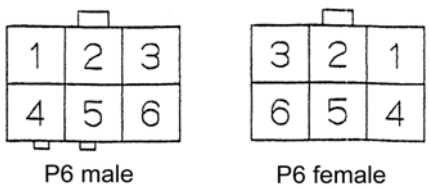
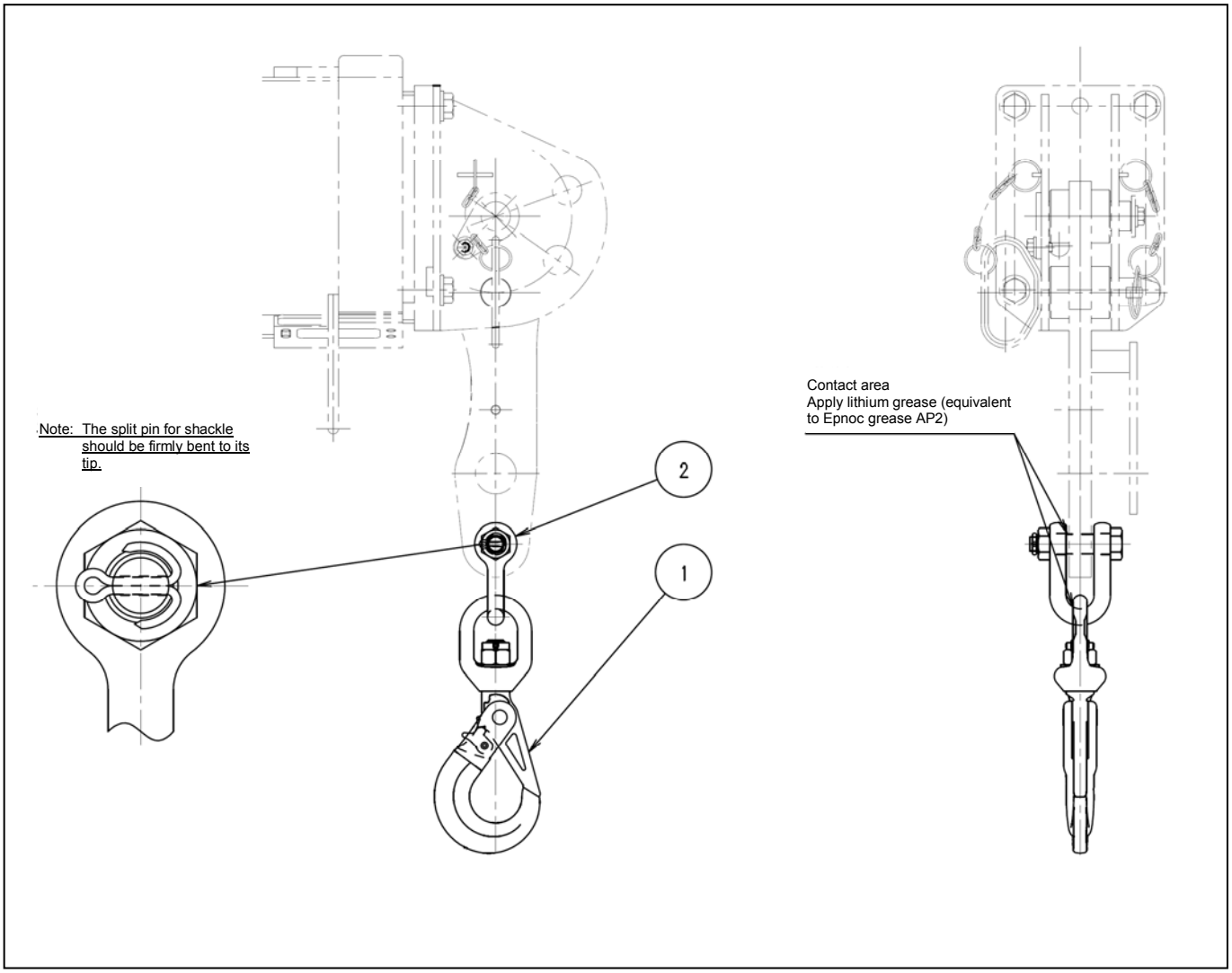


Figure 5 Layout of connector pins (view from the connector's connection side)



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11. HOOK



No.	Name	Q'ty	Note
1	Swivel hook BKL	1	Item number: S200A3229000
2	Shackle	1	Item number: 7076-01400 SB shackle, nominal size 14

11.1 INSPECTION OF HOOK

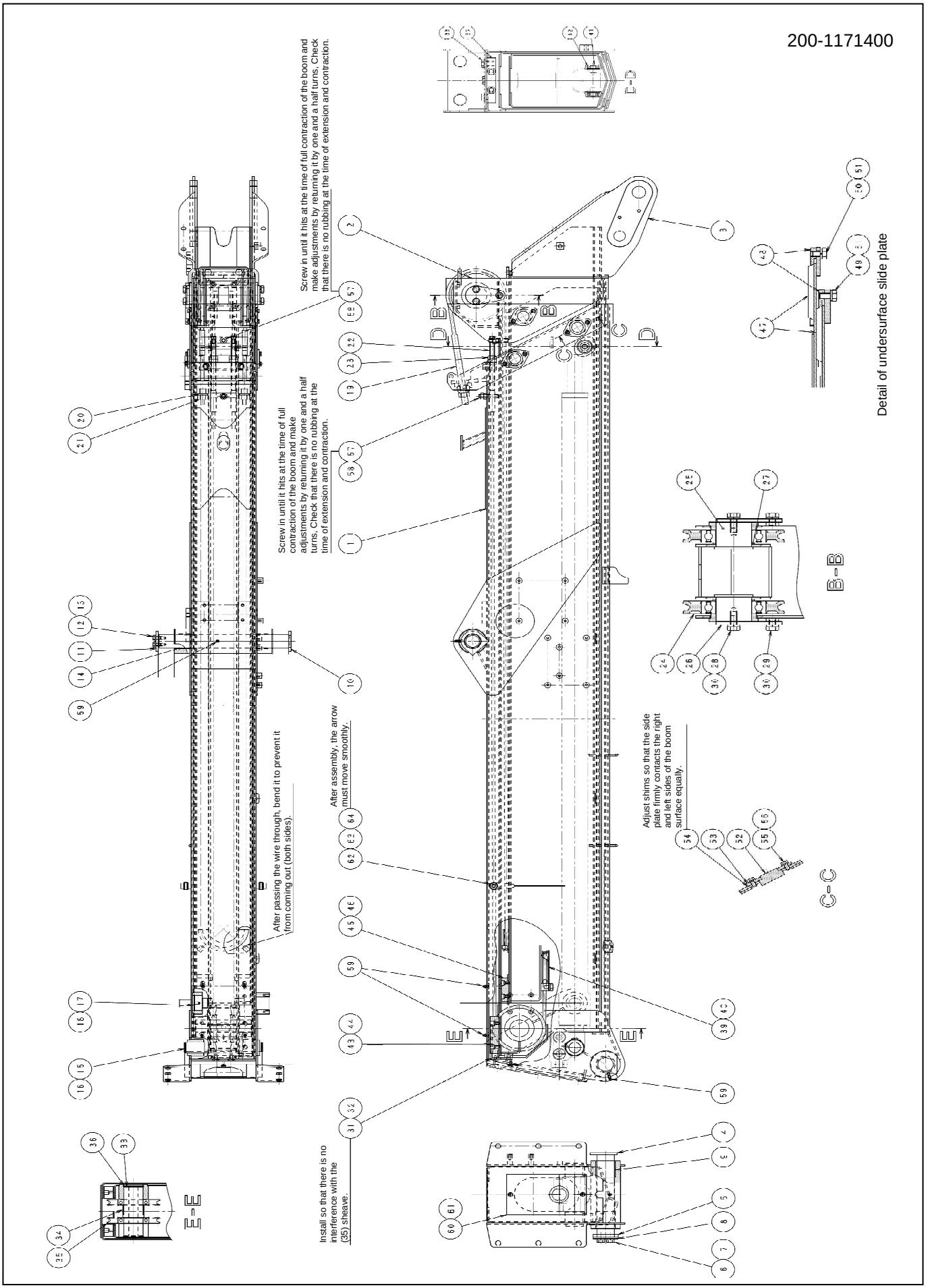
Hook is one of the important security parts. Inspect it by following the procedure below, and always use it in a safe condition.
If any faulty point is found as a result of inspection, repair or replace it promptly.

1. Check to ensure that the hook can be turned smoothly.
   If it fails to turn smoothly, replace it.
2. If any abrasion, crack or damage is found on the hook, replace it promptly.
3. Check the shackle to ensure that it is firmly mounted and that it is not damaged.
   When the shackle is abraded or damaged, replace it.
4. Check the wire rope latch to ensure that it can function normally.
   If it fails to function normally, repair or replace it.

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12. BOOM

12.1 MAIN BOOM



Number	Name	Q'ty	Note
1	No.1 Main boom	1	Item number: 200-1162700
2	No.2 Main boom	1	Item number: 200-1162800
3	No.3 Main boom	1	Item number: 200-1162900
4	Foot pin	1	Item number: 315-4082600
5	Spacer	1	Item number: 101-4616700
6	Hexagon head bolt	2	M10 × 1.5 × 20L (plated) (10.9)
7	Spring washer	2	M10 × Type 2 (plated)
8	End plate	1	Item number: 1825-10003-0 (figure number 4672875)
9	Bushing	2	Item number: 25511-04550 (K5B4550)
10	DC and RH pin	1	Item number: 200-4628600
11	End plate	1	Item number: 724-0211-000 (figure number 4672135)
12	Hexagon head bolt	2	M8 × 1.25 × 15L (plated) (8.8)
13	Spring washer	2	M8 × Type 2 (plated)
14	Bushing	2	Item number: 25511-04040 (K5B4040)
15	TC head pin	1	Item number: 303-4078901
16	Snap ring	2	C type 30 for shaft
17	Trunnion pin	2	Item number: 200-4644100
18	Snap ring	2	C type 45 for hole
19	Extending wire rope	1	Item number: S2003041000
20	Spherical nut B2	2	Item number: 315-4113001
21	Hexagon nut	2	M16 × 2.0 × Type 1 (plated) (4T)
22	Contracting wire rope	1	Item number: S200P3042000
23	Hexagon nut	4	M12 × 1.75 × Type 1 (plated) (4T)
24	Extending sheave B3	2	Item number: 315-3080801
25	Extending sheave pin B3	2	Item number: 315-4111001
26	Stopper B3	2	Item number: 315-4111100
27	Collar B3	2	Item number: 315-4183700
28	Hexagon head bolt	4	M10 × 1.5 × 20L (plated) (10.9)
29	Hexagon head bolt	2	M10 × 1.5 × 15L (plated) (10.9)
30	Spring washer	6	M10 × Type 2 (plated)
31	Contracting wire cover A	1	Item number: 200-4628000
32	Sems bolt	2	Komatsu item number: 01024-80816
33	Contracting sheave pin	1	Item number: 200-4628100
34	Collar	1	Item number: 200-4628200
35	Contracting sheave B3	2	Item number: 315-3035301
36	Snap ring	2	C type 50 for hole
37	Contracting wire fixing seat	1	Item number: 200-4628400
38	Sems bolt	2	Komatsu item number: 01024-81025
39	Contracting wire cover B	1	Item number: 200-4628300
40	Sems bolt	2	Komatsu item number: 01024-81026
41	TD guide roller	2	Item number: 300-4024300
42	Snap ring	2	C type 12 for shaft
43	Slide plate B2U	2	Item number: 200-4627300
44	Hexagon socket countersunk head screw	4	M6 × 1.0 × 15L
45	Slide plate B4U	2	Item number: 315-4184800
46	Hexagon socket countersunk head screw	4	M6 × 1.0 × 15L
47	Slide plate BD	4	Item number: 315-4081600
48	SP stopper plate C	4	Item number: 327-4246000

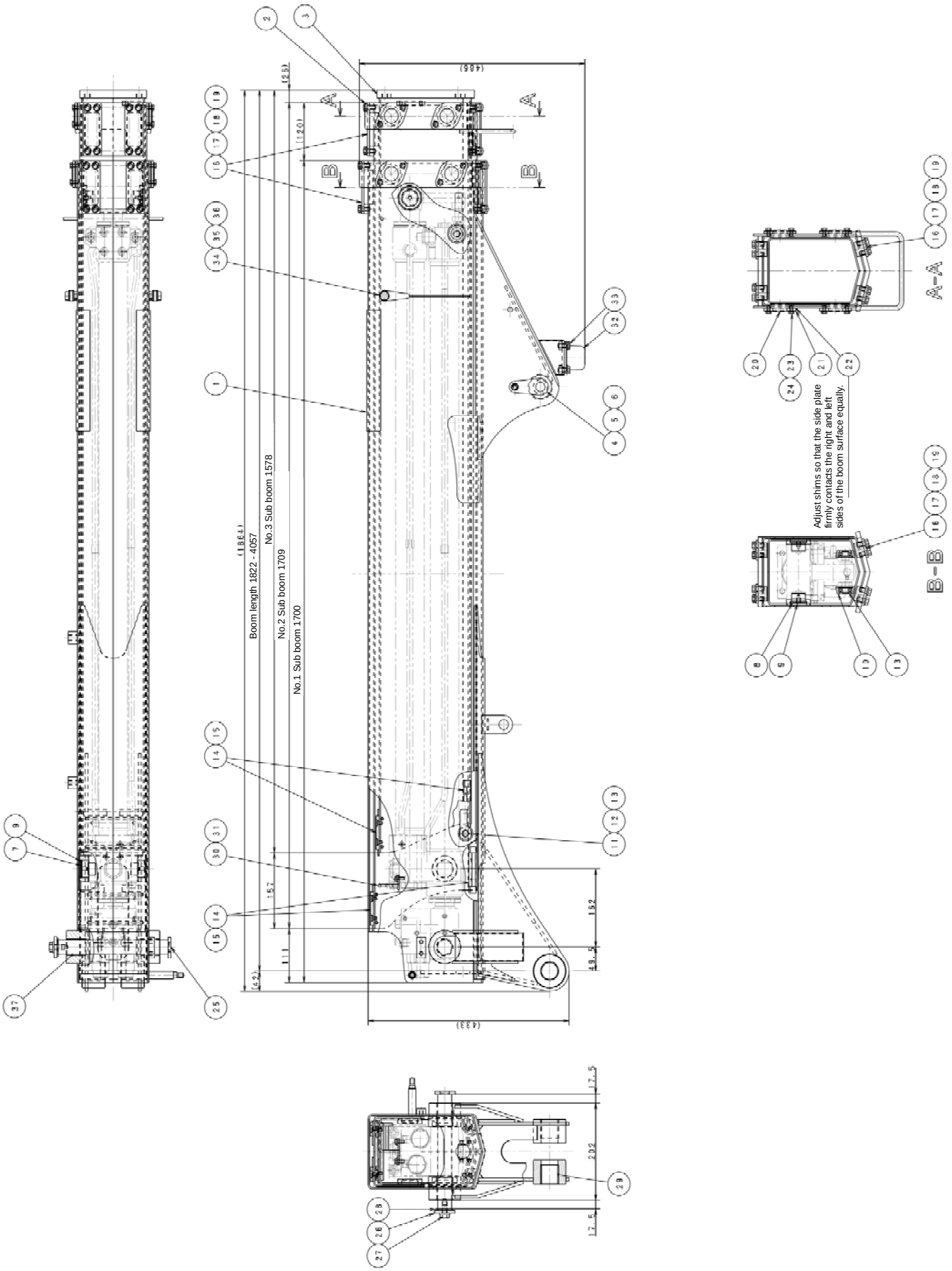
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Number	Name	Q'ty	Note
49	Hexagon head bolt	4	M10 × 1.5 × 20L (plated) (8.8)
50	Hexagon head bolt	4	M10 × 1.5 × 15L (plated) (8.8)
51	Spring washer	8	M10 × Type 2 (plated)
52	Side plate	6	Item number: 315-4176301
53	Side stopper plate	6	Item number: 315-4176200
54	SSP shim	Proper amount	Item number: 737-0225-000 (figure number 4674739)
55	Hexagon head bolt	12	M6 × 1.0 × 12L (plated) (4.6)
56	Spring washer	12	M6 × type 2 (plated)
57	Seal ring with hexagon socket	2	M10 × 1.5 × 50L (flat point)
58	Hexagon nut	2	M10 × 1.5 × Type 1 (plated) (4T)
59	Grease nipple	6	A-M6F
60	Boom tail cover	1	Figure number: 329-4277801
61	Bolt with washer	2	M6 × 1.0 × 12L (with PW and SW)
62	Arrow	2	Item number: 1825-10008-0 (figure number 4672870)
63	Hexagon head bolt	2	M10 × 1.5 × 20L (plated)
64	Plain washer	4	M10 × Regular circle (plated)

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12.2 JIB

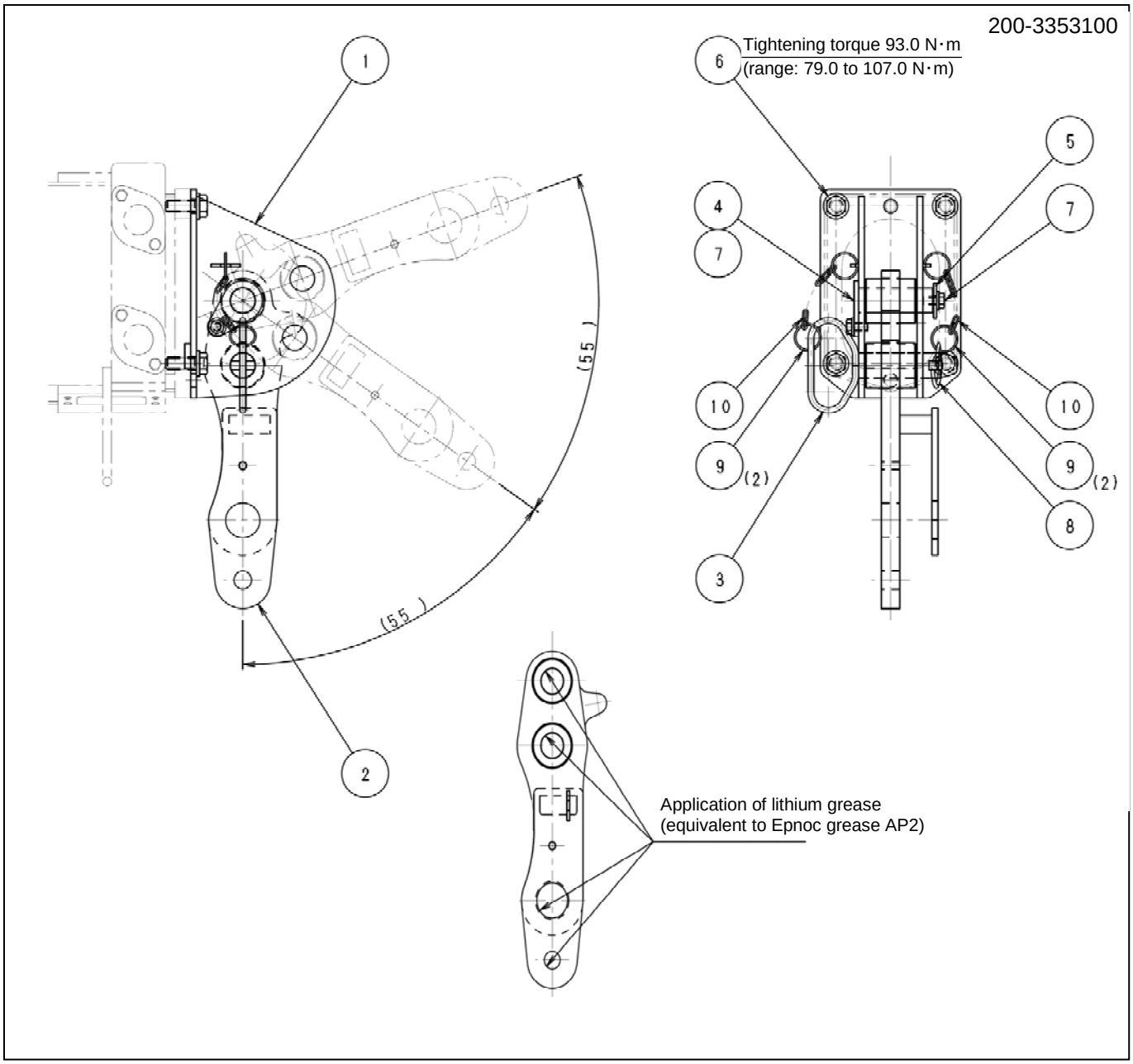
200-1171500



Number	Name	Q'ty	Note
1	No.1 Sub boom	1	Item number: 200-1163300
2	No.2 Sub boom	1	Item number: 200-1163400
3	No.3 Sub boom	1	Item number: 200-1163500
4	DC head pin	1	Item number: 200-4630300
5	Spring washer	1	M8 × Type 2 (plated)
6	Hexagon head bolt	1	M8 × 1.25 × 20L (plated) (12.9)
7	TC trunnion pin	2	Item number: 101-4555900
8	No.3 Trunnion pin	2	Item number: 315-4147500
9	Snap ring	4	C type 35 for hole
10	TD guide roller	2	Item number: 300-4024300
11	T guide roller	1	Figure number 4674141
12	T guide roller pin	1	Figure number 4674128
13	Snap ring	4	C type 12 for shaft
14	Slide plate B3U	8	Item number: 101-4566300
15	Hexagon socket countersunk head screw	16	M6 × 1.0 × 10L
16	Slide plate	8	Item number: 200-4627100
17	Plate	8	Item number: 200-4627200
18	Hexagon head bolt	32	M8 × 1.25 × 20L (plated) (10.9)
19	Spring washer	32	M8 × Type 2 (plated)
20	Side plate	8	Item number: 315-4176301
21	Side stopper plate	8	Item number: 315-4176200
22	SSP shim	Proper amount	Item number: 737-0225-000 (figure number 4674739)
23	Hexagon head bolt	16	M6 × 1.0 × 12L (plated) (4.6)
24	Spring washer	16	M6 × Type 2 (plated)
25	Link pin B	1	Item number: 200-4627800
26	End plate	1	Item number: 200-4627900
27	Sems bolt	1	Komatsu item number: 01024-81020
28	Collar (3L)	1	Item number: 350-4384800
29	Bushing	2	Item number: 25511-03540 (K5B3540)
30	Guide	1	Item number: 200-3352600
31	Sems bolt	2	Komatsu item number: 01024-81016
32	Rubber buffer	1	Item number: 27600-02000 (Kurashiki Kako KJ-50)
33	Sems bolt	4	Komatsu item number: 01024-80820
34	Arrow	2	Item number: 1825-10008-0 (figure number 4672870)
35	Hexagon head bolt	2	M10 × 1.5 × 20L (plated) (4.6)
36	Plain washer	4	M10 × Regular circle (plated)
37	Bushing	2	Item number: 25511-03040 (K5B3040)

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12.3 JIB HEAD



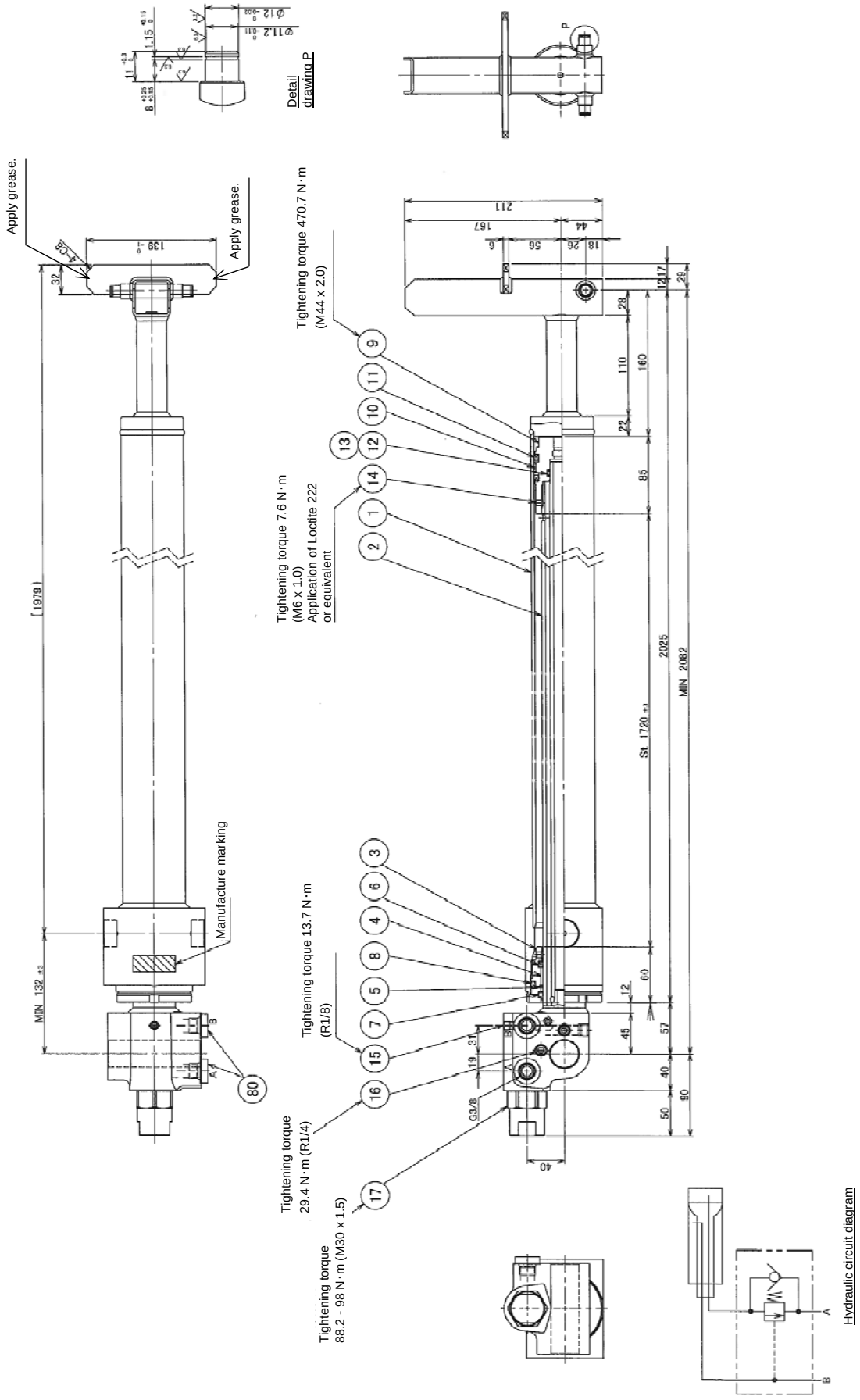
Number	Name	Q'ty	Note
1	Head bracket	1	Item number: 200-2163300
2	Head	1	Item number: 200-2163400
3	Pin	1	Item number: 200-4637500
4	Pin	1	Item number: 349-4510900
5	End plate	1	Item number: 350-4394000
6	Sems bolt	4	Komatsu item number: 01024-81235
7	Sems bolt	2	Komatsu item number: 01024-80816
8	Lynch pin	1	Item number: 21570-08045
9	Ring	4	Item number: 315-4175300
10	Chain	2	Item number: 27931-04010 (SM16L 100L)

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13. TELESCOPIC AND DERRICK CYLINDERS

13.1 MAIN TELESCOPIC CYLINDER

S200F3029000



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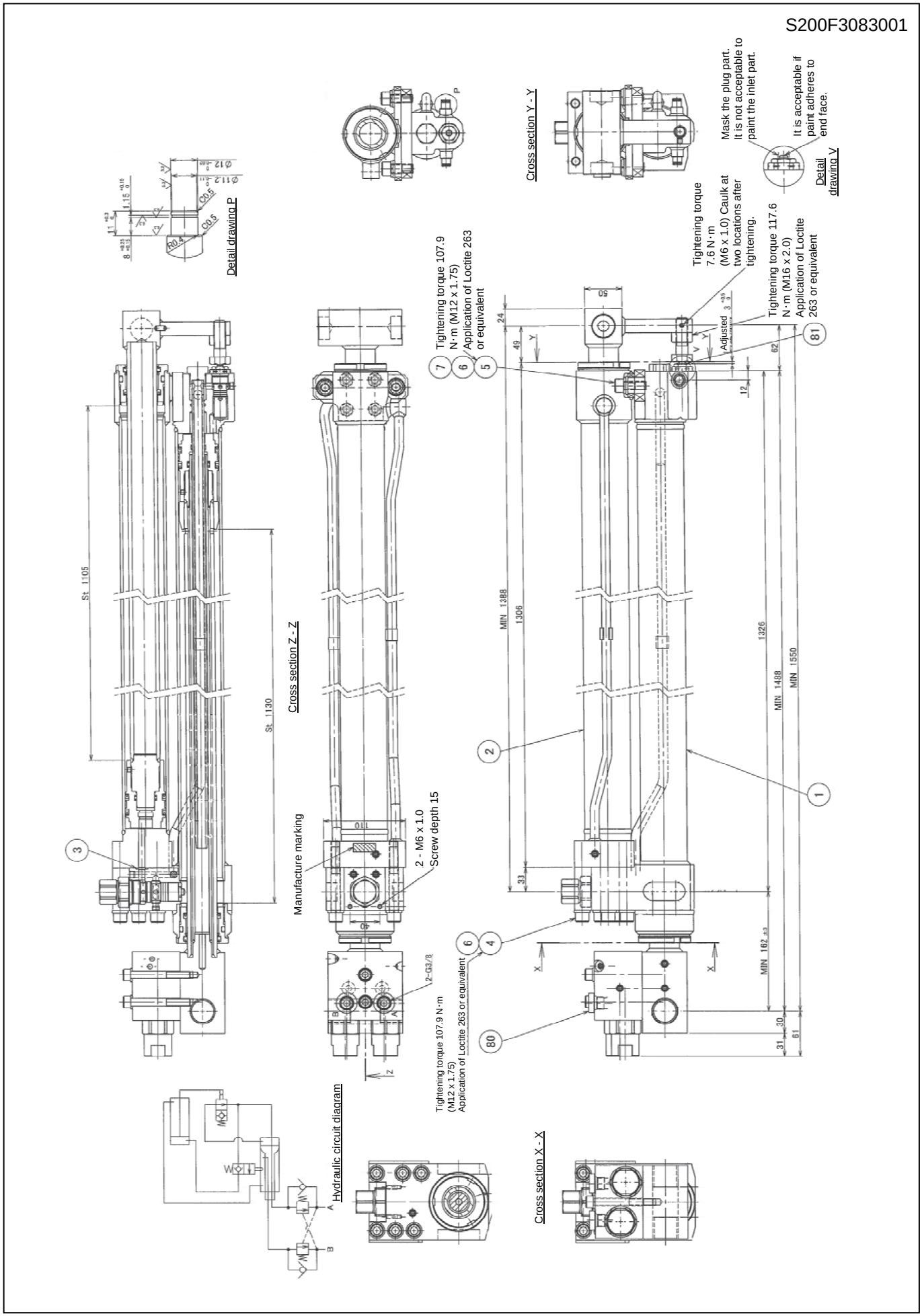
Number	Name	Q'ty	Note
1	Main cylinder tube assembly	1	
2	Main cylinder piston rod assembly	1	
3	Main cylinder head	1	
4	Bushing	1	Oiles Corporation LFB-4520
5	Stopper	1	
6	Rod packing (K1)	1	Kayaba 12 packing 45 × 55 × 6
7	Dust seal (K1)	1	Kayaba 7 wiper 45 × 55 x 6 × 8
8	O-ring (K1)	1	1B-P60
9	Main cylinder piston	1	
10	Wear ring (K1)	1	Sakagami Seisakusho WPB-60A
11	Piston packing (K1)	2	Sakagami Seisakusho RGY-60
12	O-ring (K1)	1	1B-P26
13	Backup ring (K1)	2	T3-P26
14	Set screw	1	Cup point M6X6
15	Plug	2	R1/8
16	Plug	3	R1/4
17	Counter balance valve	1	KYB-YS 65200-00800
80	Plug	2	3/8 Resin plug
K1	Main cylinder seal kit	1	

Main telescopic cylinder specifications			
Cylinder bore x Rod bore - Stroke			ϕ65 x ϕ45 - 1720st
Specification value	Normal load	When extended	58.2 kN (at 20.6 MPa) [5.8t (at 210 kgf/cm^2)]
		When contracted	25.5 kN (at 20.6 MPa) [2.5t (at 210 kgf/cm^2)]
	Hydrostatic test pressure	Extension side	30.9 MPa (315 kgf/cm^2)
		Contraction side	30.9 MPa (315 kgf/cm^2)

Cylinder spontaneous contraction amount (internal leak amount) Note: Keep the temperature constant because a cylinder contraction amount can be affected by thermal expansion due to temperature change.				
Components of cylinder		Max. internal leak amount cc/min	Cylinder bore area cm^2	Cylinder contraction amount cm/day
Main telescopic cylinder (from JIS B8367)		0.16	33.2	6.9
Counter balance valve	Leak amount	0.05	33.2	2.2
			Total	9.1

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13.2 JIB TELESCOPIC CYLINDER



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Number	Name	Q'ty	Note
1	Jib No.1 cylinder assembly	1	
2	Jib No.2 cylinder assembly	1	
3	O-ring	2	1B-P12
4	Hexagon socket head cap screw	6	M12 × 1.75 × 90L
5	Hexagon socket head cap screw	2	M12 × 1.75 × 30L
6	Spring washer	8	M12 × Type 2 (plated)
7	Plain washer	2	M12 × Regular circle
80	Plug	2	3/8 Resin plug
81	Plug	1	1/8

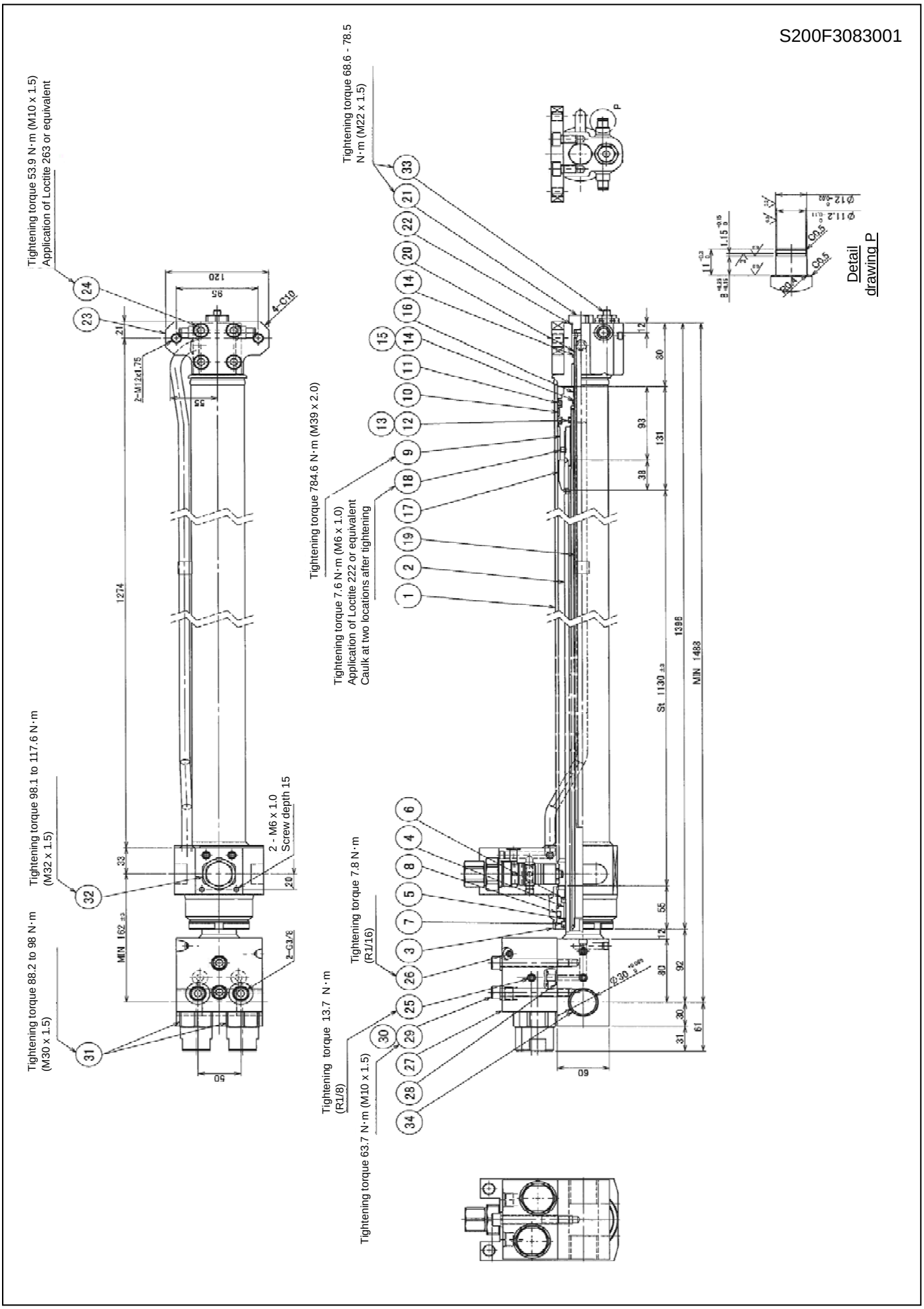
Jib No.1 telescopic cylinder specifications			
Cylinder bore x Rod bore - Stroke			ϕ55 × ϕ40 - 1130st
Specification value	Normal load	When extended	48.9 kN (at 20.6 MPa) [4.9t (at 210 kgf/cm^2)]
		When contracted	23.1 kN (at 20.6 MPa) [2.3t (at 210 kgf/cm^2)]
	Hydrostatic test pressure	Extension side	30.9 MPa (315 kgf/cm^2)
		Contraction side	30.9 MPa (315 kgf/cm^2)
Jib No.2 telescopic cylinder specifications			
Cylinder bore x Rod bore x Stroke			ϕ55 × ϕ40 - 1105st
Specification value	Normal load	When extended	48.9 kN (at 20.6 MPa) [4.9t (at 210 kgf/cm^2)]
		When contracted	23.1 kN (at 20.6 MPa) [2.3t (at 210 kgf/cm^2)]
	Hydrostatic test pressure	Extension side	30.9 MPa (315 kgf/cm^2)
		Contraction side	30.9 MPa (315 kgf/cm^2)

Cylinder spontaneous contraction amount (internal leak amount) Note: Keep the temperature constant because a cylinder contraction amount can be affected by thermal expansion due to temperature change.				
Components of cylinder		Max. internal leak amount cc/min	Cylinder bore area cm^2	Cylinder contraction amount cm/day
Jib No.1 telescopic cylinder (from JIS B8367)		0.14	23.7	8.5
Jib No.2 telescopic cylinder (from JIS B8367)		0.14	23.7	8.5
Counter balance valve	Leak amount of No.1 portion	0.05	23.7	3.0
	Leak amount of No.2 portion		23.7	3.0
			Total	23.0

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13.2.1 JIB NO.1 TELESCOPIC CYLINDER

S200F3083001



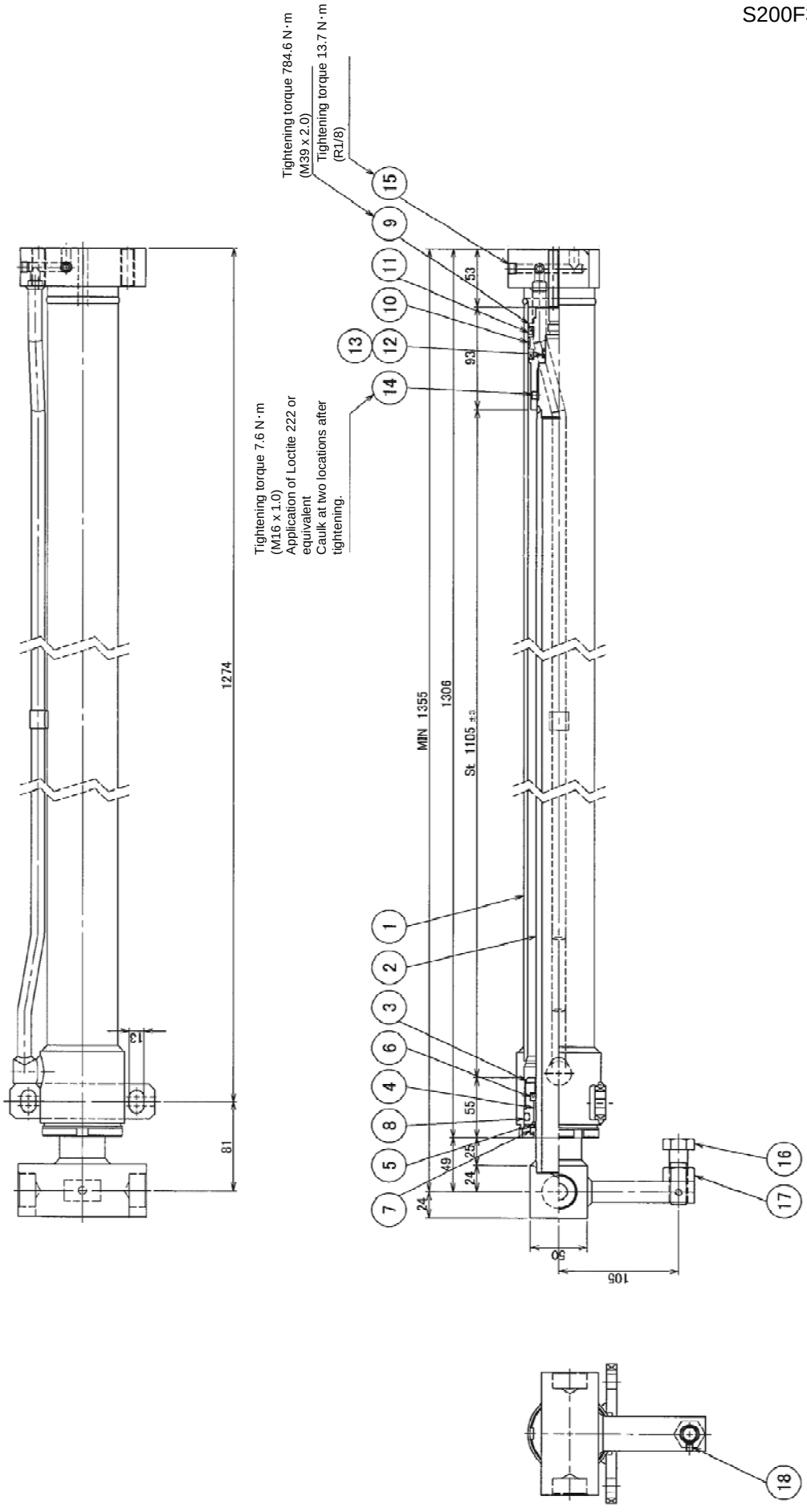
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Number	Name	Q'ty	Note
1	Jib No.1 cylinder tube assembly	1	
2	Jib No.1 cylinder piston rod assembly	1	
3	Jib No.1 cylinder head	1	
4	Bushing	1	Oiles Corporation LFB-4020
5	Stopper	1	
6	Rod packing (K2)	1	Kayaba 12 packing 40 × 50 × 6
7	Dust seal (K2)	1	Kayaba 7 wiper 40 × 50 × 6 × 8
8	O-ring (K2)	1	1B-P50A
9	Jib No.1 cylinder piston	1	
10	Wear ring (K2)	1	Sakagami Seisakusho WPB-55A
11	Piston packing (K2)	2	Sakagami Seisakusho RGY-55
12	O-ring (K2)	1	1B-P24
13	Backup ring (K2)	2	T3-P24
14	O-ring (K2)	2	1B-P16
15	Backup ring (K2)	2	T2-P16
16	Bushing	1	Oiles Corporation LFB-1610
17	Dog	1	
18	Set screw	1	Cup point M6 × 6
19	Pipe	1	
20	Stopper	1	
21	Plug	1	
22	O-ring (K2)	1	1B-P20
23	Plate	1	
24	Hexagon socket head cap screw	4	M10 × 1.5 × 18L
25	Plug	14	R1/8
26	Plug	4	R1/4
27	Valve body	1	
28	O-ring (K2)	2	1B-P14
29	Hexagon socket head cap screw	2	M10 × 1.5 × 80L
30	Spring washer	2	M10 × Type 2
31	Counter balance valve	2	KYB-YS 65200-00800
32	Sequence valve	1	KYB-YS 65100-10300
33	Mechanical check valve	1	KYB-YS 65100-02200
34	Bushing	1	Daido Metal K5B3030
K2	Jib No.1 cylinder seal kit	1	

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13.2.2 JIB NO.2 TELESCOPIC CYLINDER

S200F3083001

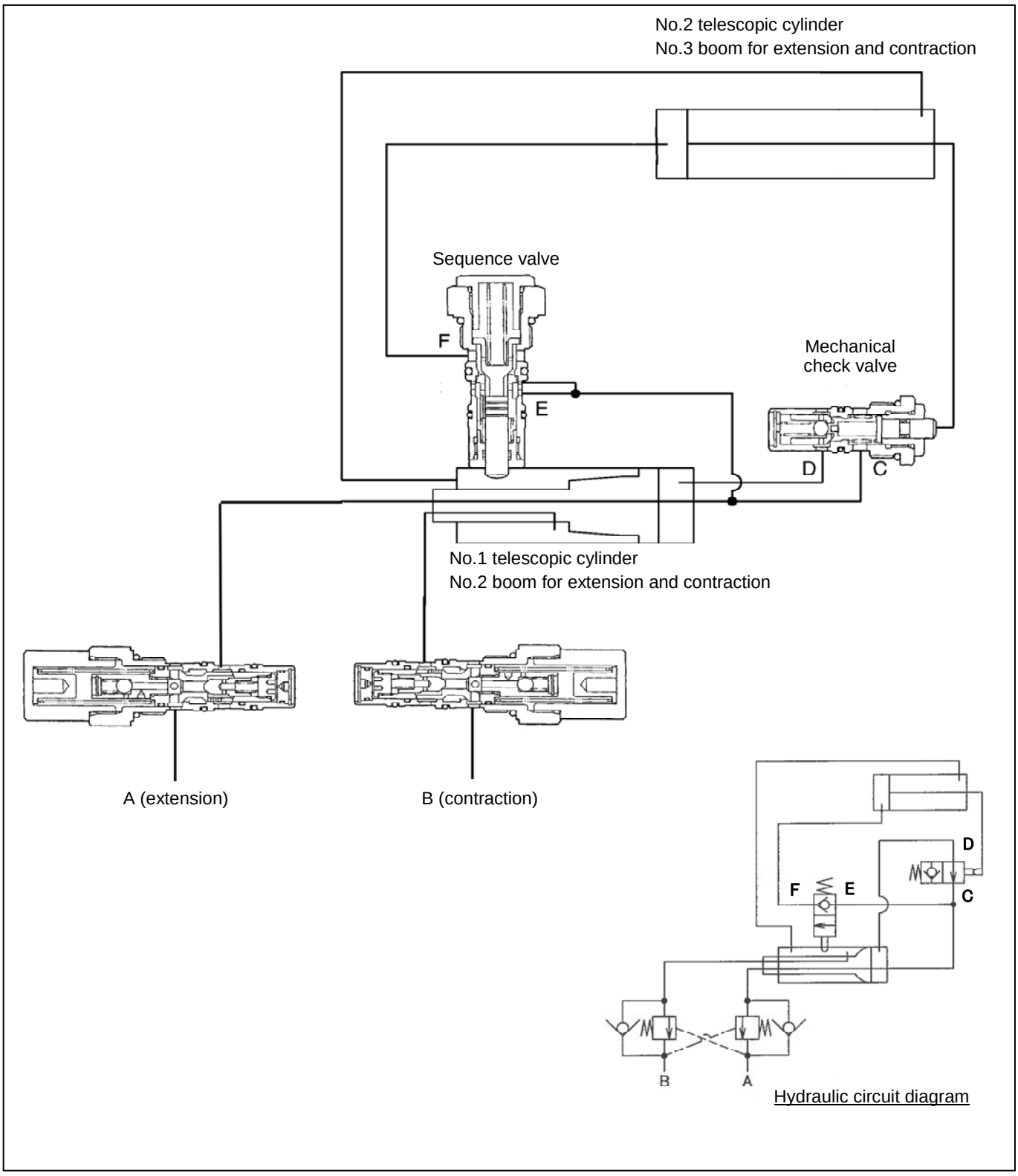


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Number	Name	Q'ty	Note
1	Jib No.2 cylinder tube assembly	1	
2	Jib No.2 cylinder piston rod assembly	1	
3	Jib No.2 cylinder head	1	
4	Bushing	1	Oiles Corporation LFB-4020
5	Stopper	1	
6	Rod packing (K3)	1	Kayaba 12 packing 40 × 50 × 6
7	Dust seal (K3)	1	Kayaba 7 wiper 40 × 50 × 6 × 8
8	O-ring (K3)	1	1B-P50A
9	Jib No.2 cylinder piston	1	
10	Wear ring (K3)	1	Sakagami Seisakusho WPB-55A
11	Piston packing (K3)	2	Sakagami Seisakusho RGY-55
12	O-ring (K3)	1	1B-P24
13	Backup ring (K3)	2	T3-P24
14	Set screw	1	Cup point M6 × 6
15	Plug	2	R1/8
16	Hexagon head bolt	1	M16 × 2.0 × 50L
17	Hexagon nut	1	M16 × 2.0 × Type 1
18	Set screw	1	Cup point M6 × 6
K3	Jib No.2 cylinder seal kit	1	

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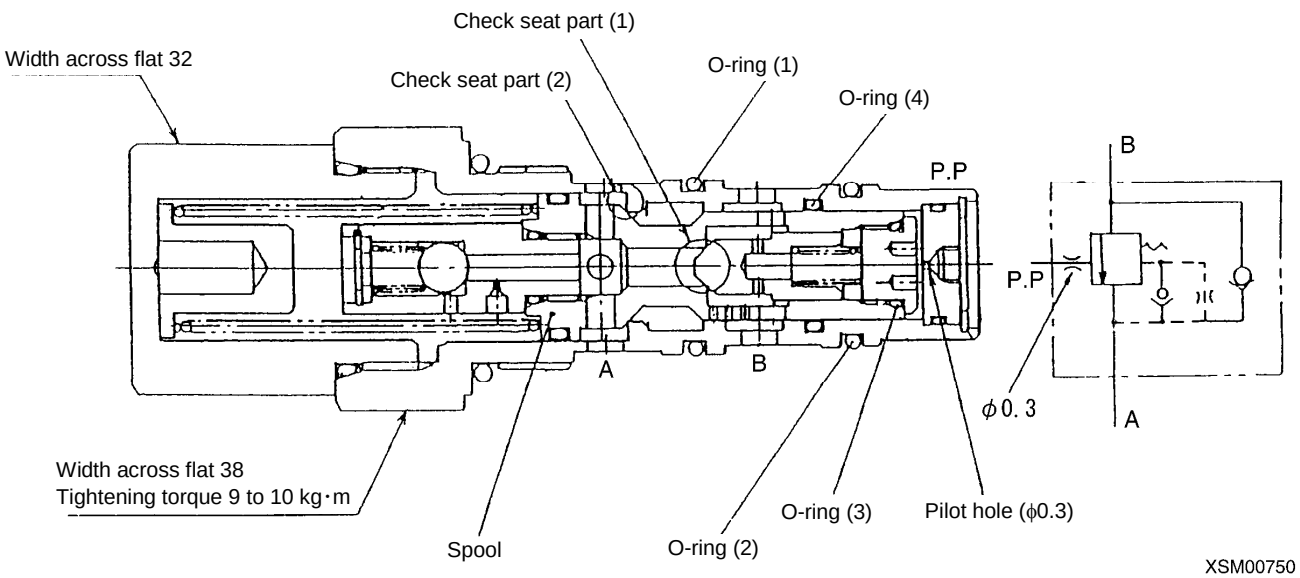
13.3 JIB TELESCOPIC CYLINDER HYDRAULIC SCHEMATIC DIAGRAM



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13.4 COUNTER BALANCE VALVE (FOR TELESCOPIC AND DERRICK CYLINDERS)

13.4.1 STRUCTURAL DRAWING



Specifications	
Max. working pressure	20.6 MPa [210 kgf/cm^2]
Withstand pressure	30.9 MPa [315 kgf/cm^2]
Rated flow rate	50L/min
Allowable leak amount	0.05 cc/min or less (pressurizing 20.6 MPa [210 kgf/cm^2] from B port)
Pilot pressure	$1.18^{+0.3}$MPa [12^{+3}kgf/cm^2] with the valve open
Valve tightening torque	0.9 - 1.0 MPa [9 - 10 kgf-m]
Check cracking pressure	0.098 MPa [1 kgf/cm^2]
Operating temperature range	-10 to +80°C

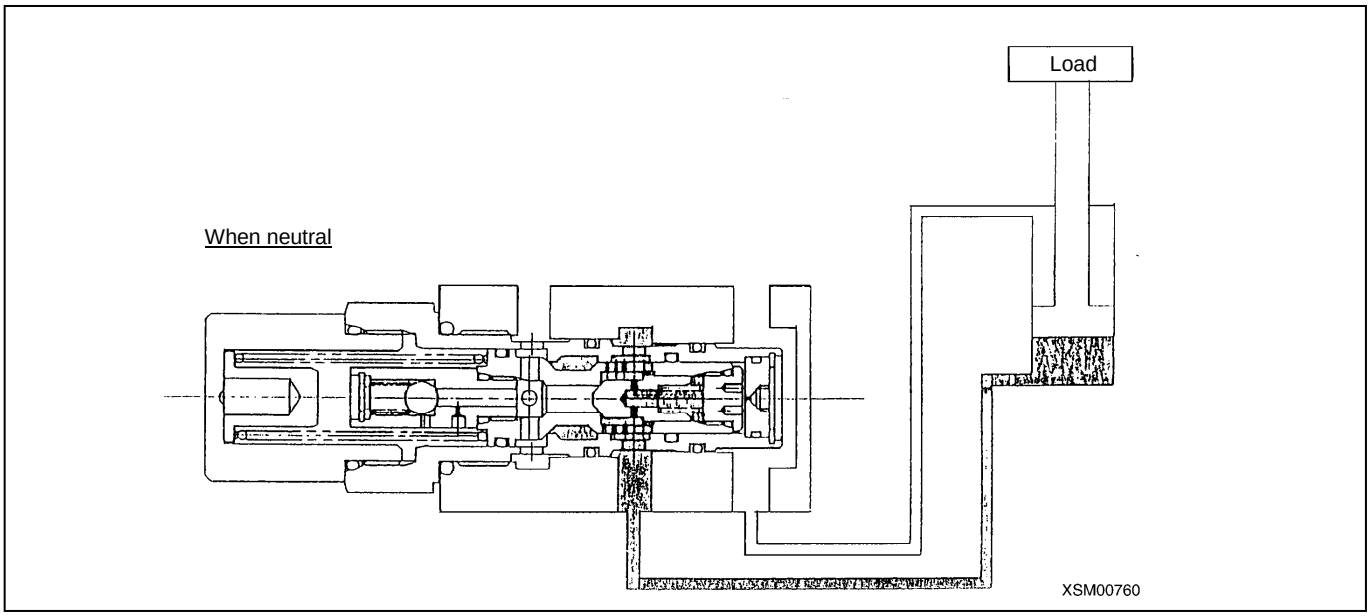
13.4.2 FAILURE CAUSE AND COUNTERMEASURE

Abnormal Phenomenon	Cause	Remedy
The telescopic cylinder and derrick cylinder contract during work. (Boom lowers)	• Failure of check seat part (1) or (2) or biting of foreign matter • Damage to O-ring (1) or (2), (3) and (4) • The pilot hole (ϕ0.3) is clogged with foreign matter and the spool is left moved, resulting in the check seat (2) being left open.	• Removal of foreign matter • Replacement of O-ring • Removal of foreign matter from the pilot hole
The telescopic cylinder and derrick cylinder do not contract (boom does not lower), or speed during contraction is very fast.	• Pilot hole (ϕ0.3) is clogged with foreign matter.	• Removal of foreign matter from the pilot hole

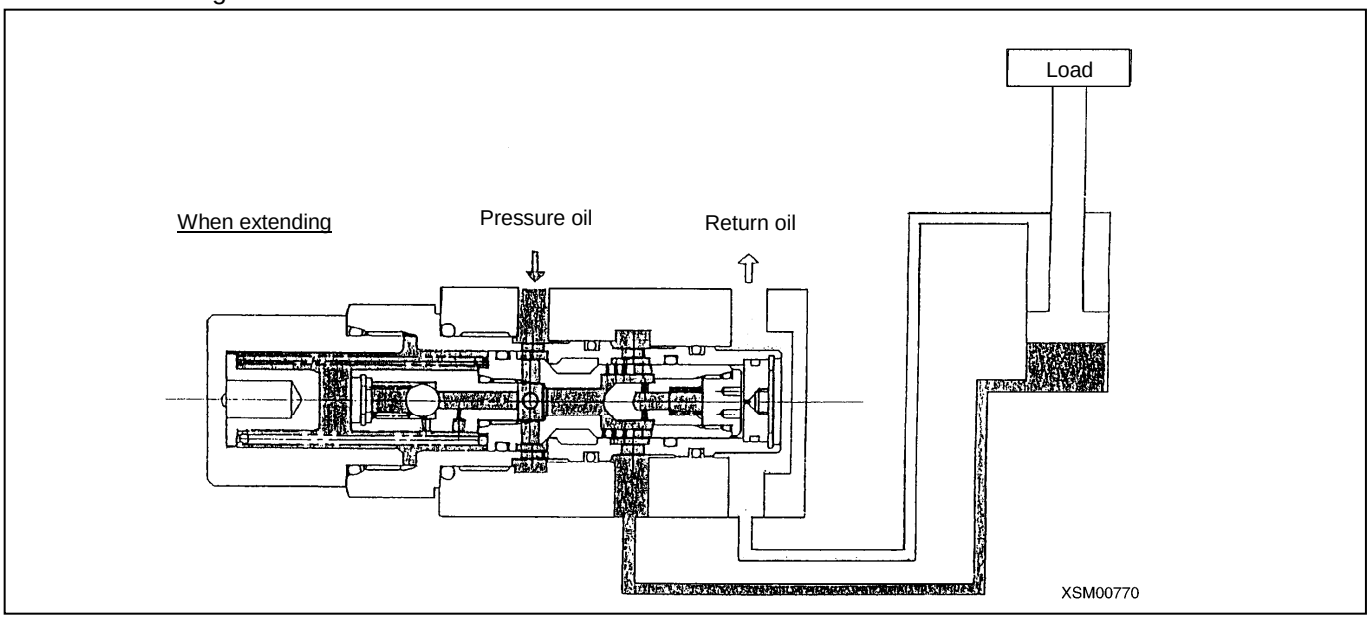
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13.4.3 WORKING DIAGRAM

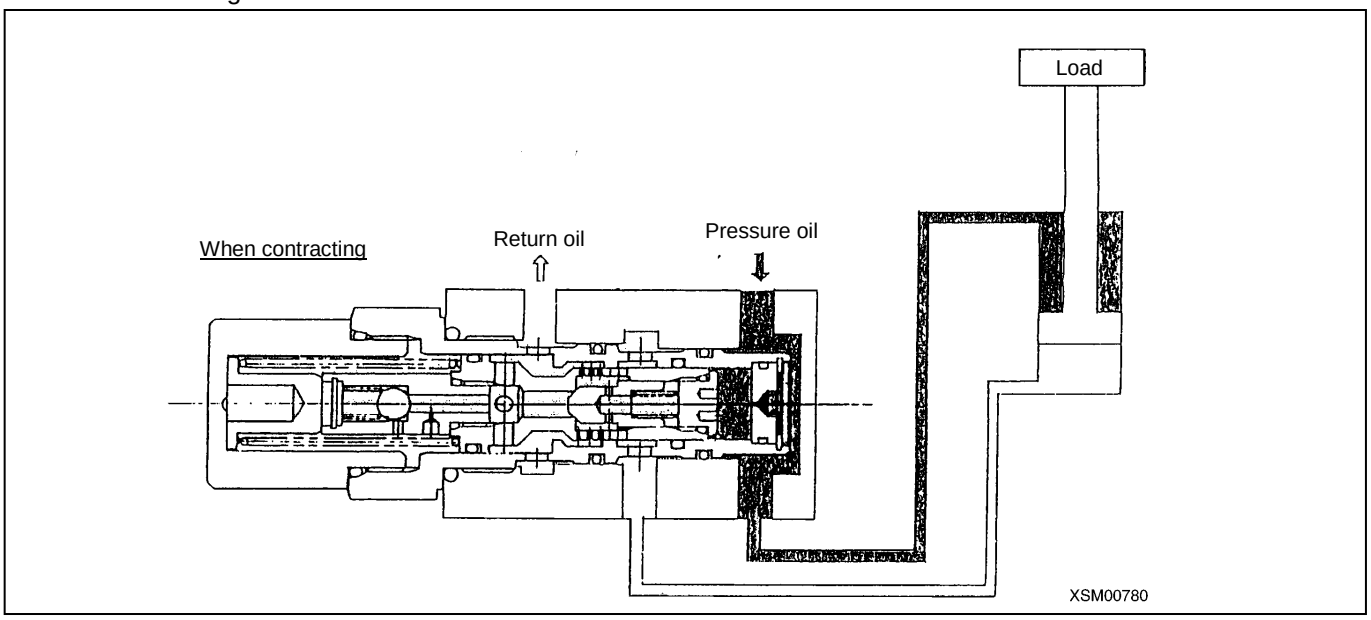
1. When neutral



2. When extending



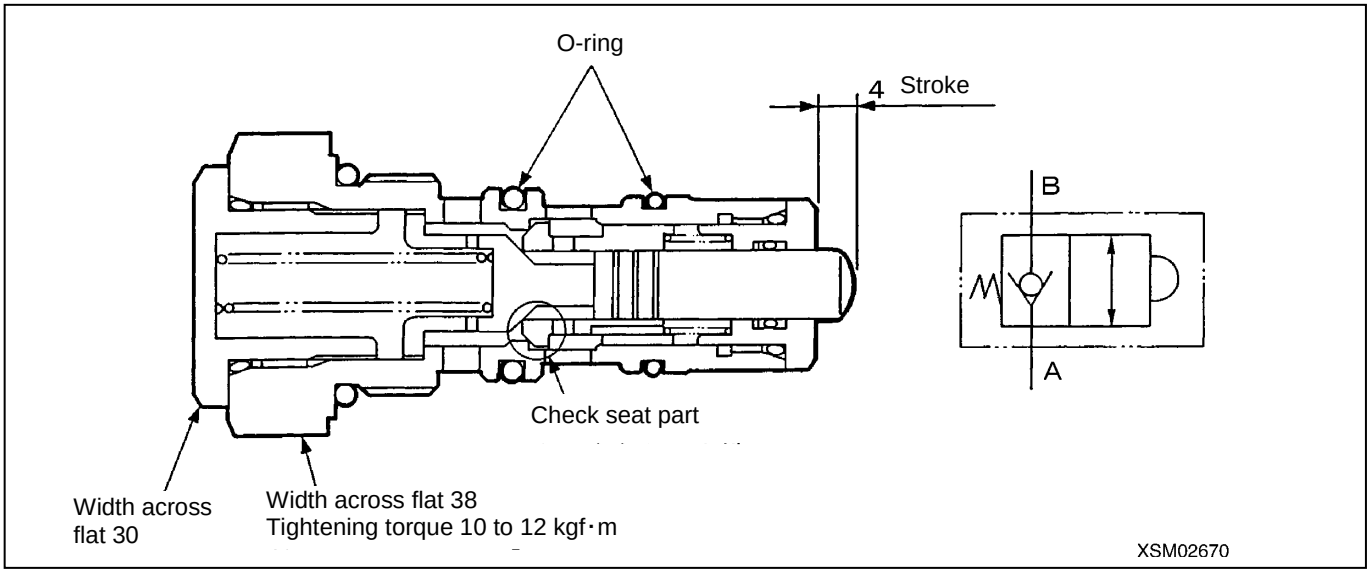
3. When contracting



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13.5 SEQUENCE VALVE (FOR TELESCOPIC CYLINDER)

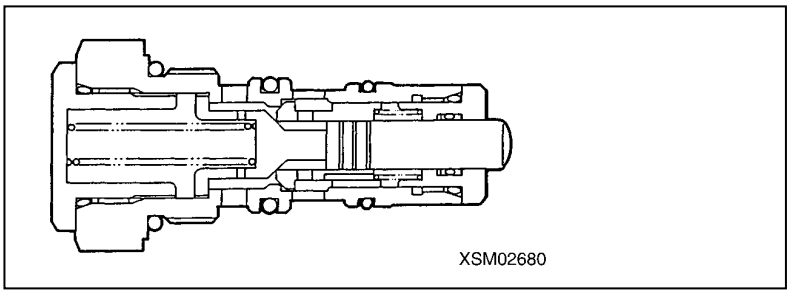
13.5.1 STRUCTURAL DRAWING



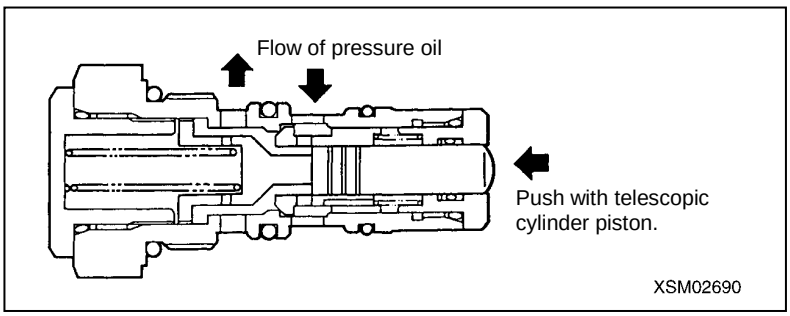
Specifications	
Rated pressure	20.6 MPa [210 kgf/cm^2]
Rated flow rate	50L/min
Allowable leak amount	0.05 cc/min or less (pressurizing 20.6 MPa [210 kgf/cm^2] from B port)
Check valve cracking pressure	0.245 MPa (2.5 kgf/cm^2)
Operating force	0.65 x pressure + 20 kg
Operating temperature range	-10 to +90˚C
Tightening torque during valve assembly	0.98 to 0.18 MPa [10 to 12 kgf·m]

13.5.2 WORKING DIAGRAM

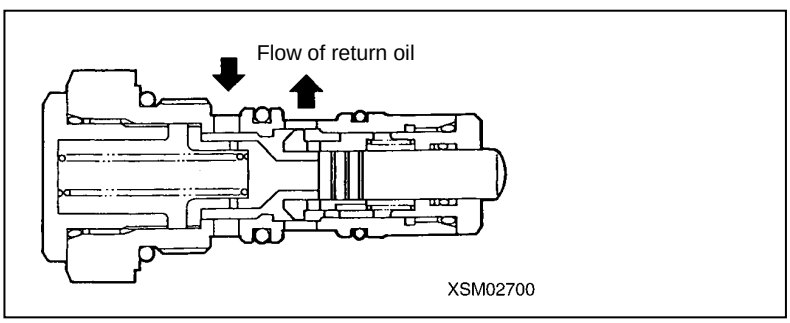
1. When neutral



2. During sequence valve operation

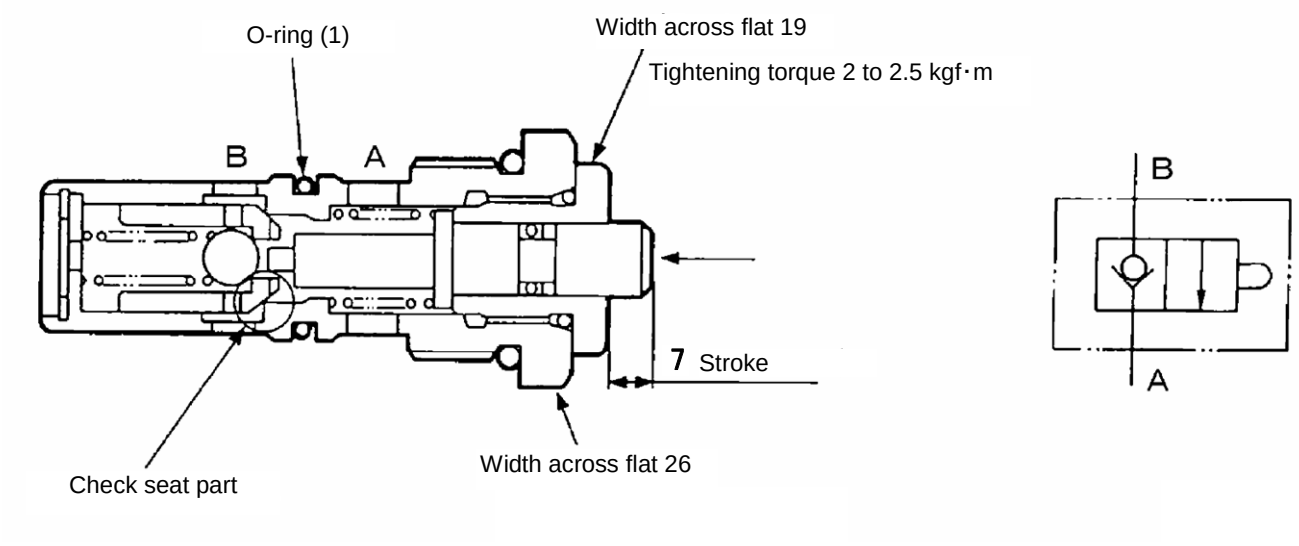


3. During check valve operation



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13.6 MECHANICAL CHECK VALVE (FOR TELESCOPIC CYLINDER)

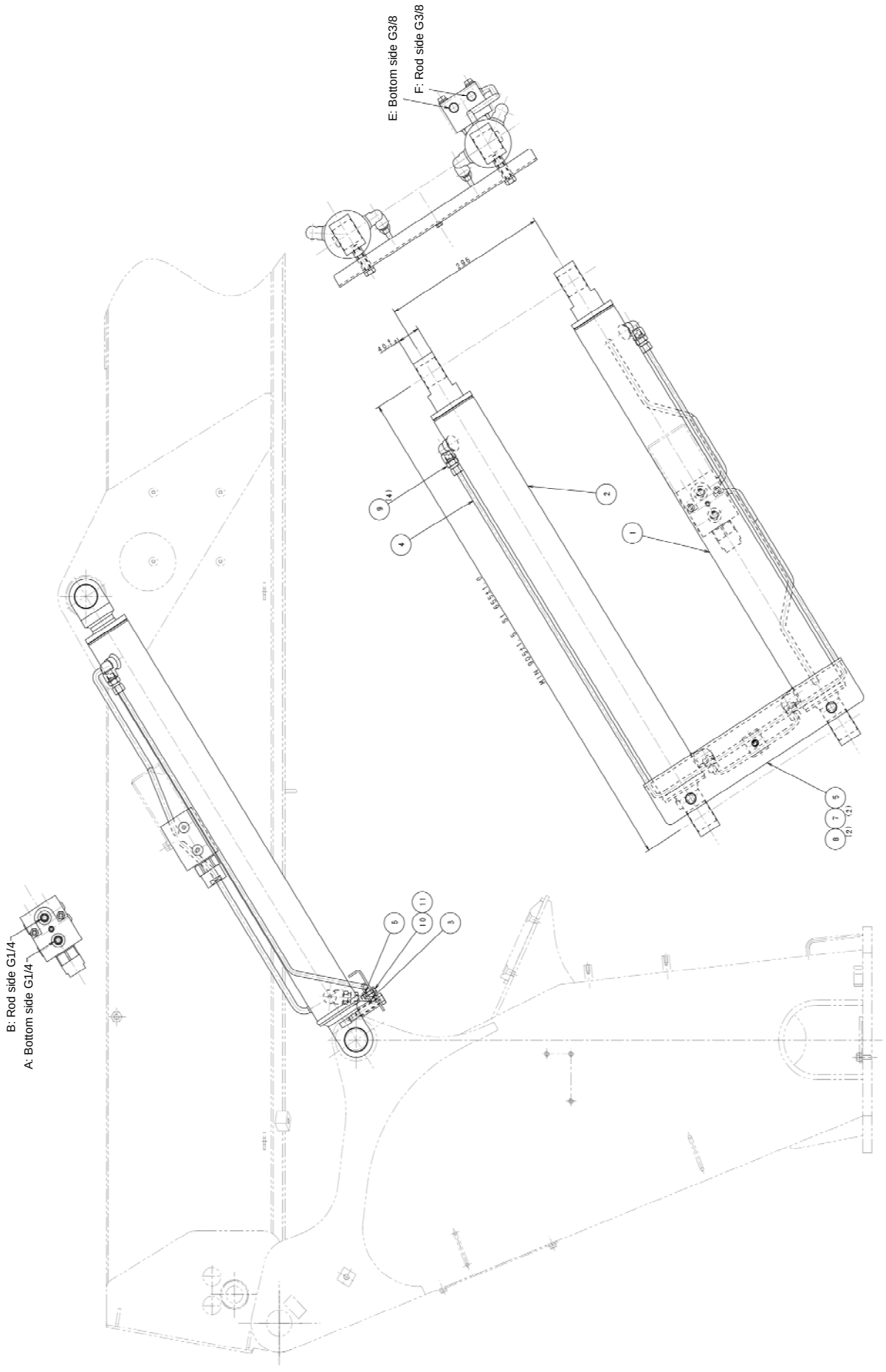


Specifications	
Rated pressure	20.6 MPa [210 kgf/cm^2]
Rated flow rate	40L/min
Allowable leak amount	0.05 cc/min or less (pressurizing 20.6 MPa [210 kgf/cm^2] from B port)
Check cracking pressure	0.196 MPa (2 kgf/cm^2)
Pilot pressure	$1.18^{+0.3}$MPa [12^{+3}kgf/cm^2] with the valve open
Operating force	0.5 x pressure + 3 kg
Operating temperature range	-10 to +80˚C
Cracking pressure	0.098 MPa (1 kgf/cm^2)
Tightening torque during valve assembly	0.8 to 0.9 MPa [8 to 9 kgf·m]

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13.7 MAIN DERRICK CYLINDER ASSEMBLY

200-1171900

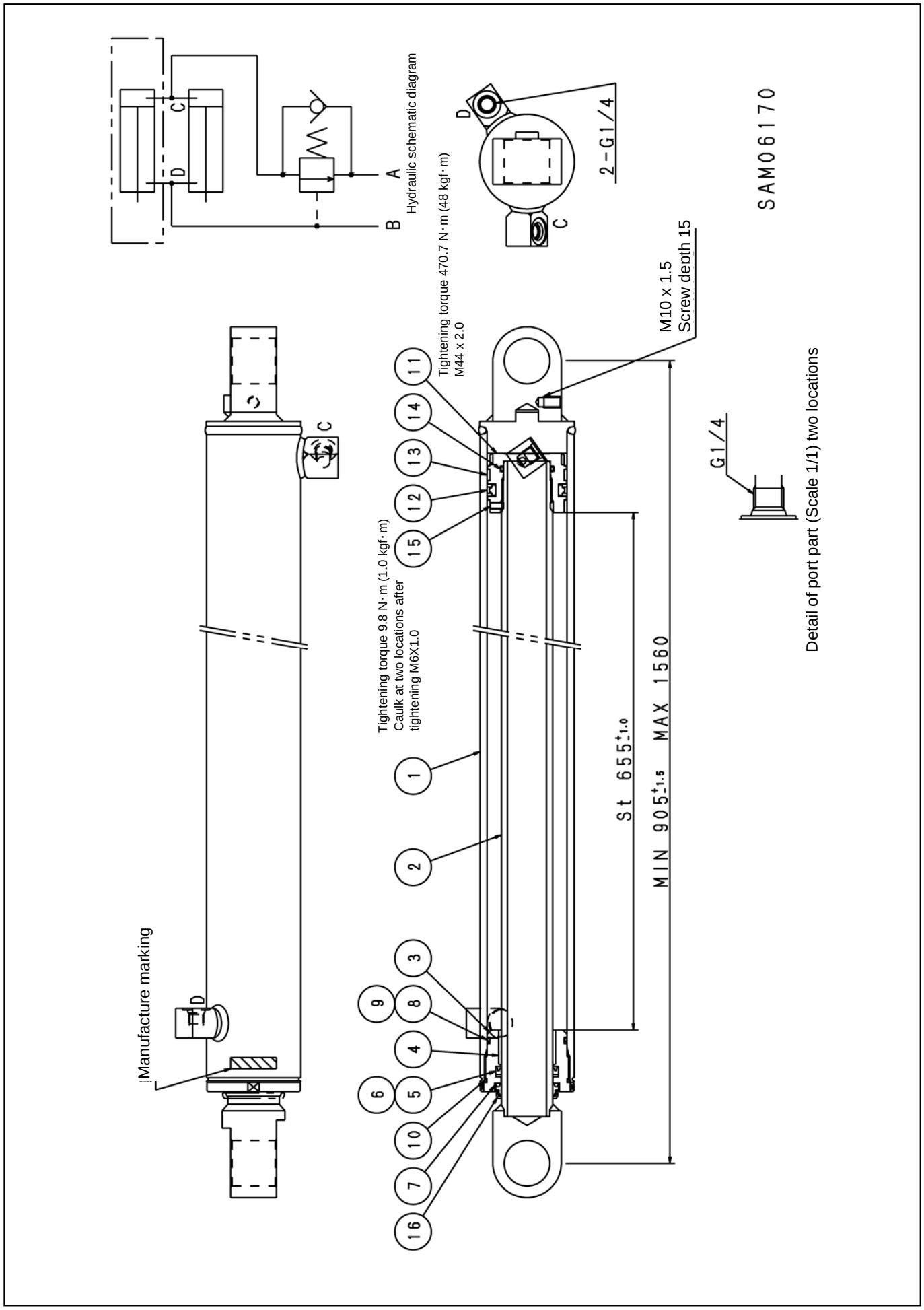


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Number	Name	Q'ty	Note
1	D cylinder (R)	1	Item number: S200F3285000
2	D cylinder (L)	1	Item number: 359S70900002
3	Raising pipe	1	Item number: 200-4629200
4	Lowering pipe	1	Item number: 200-4629300
5	D joint plate	1	Item number: 200-4629400
6	Gall N	1	Item number: 329-4275700
7	Hexagon head bolt	2	M10 × 1.5 × 50L (plated) (4.8)
8	Spring washer	2	M10 × Type 2
9	Joint	4	Item number: 22511-07330 (LLM-UR-8 x 1/4 with O-ring)
10	Hexagon head bolt	1	M6 × 1.0 × 25L (4.8)
11	Spring washer	2	M6 × Type 2

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13.7.1 MAIN LEFT-HAND DERRICK CYLINDER



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Number	Name	Q'ty	Note
1	• Cylinder tube assembly	1	359S70900002
2	• Piston rod assembly	1	359S70901000
3	• Cylinder head	1	359S70902000
4	• Bushing	1	359S70903000 (Oiles Corporation LFB4530)
5	• Rod packing (K1)	1	◆359S70904000 (Kayaba 12 packing 45 × 55 × 6)
6	• Backup ring (K1)	1	◆359S70905000 (45 × 55 × 2.0)
7	• Dust seal (K1)	1	◆359S70906000 (Kayaba 50 wiper 45 × 57 × 7 × 11.5)
8	• O-ring (K1)	1	◆359S70907000 (1B-G65)
9	• Backup ring (K1)	1	◆359S70908000 (T3-G65)
10	• O-ring (K1)	1	◆359S70909000 (1A-G70)
11	• Piston	1	359S70910000
12	• Piston ring (K1)	1	◆359S70911000 (NOK SPGW70)
13	• Wear ring (K1)	1	◆359S70912000 (UNIPLA 70 × 65 × 10)
14	• O-ring (K1)	1	◆359S70913000 (1B-P41)
15	• Set screw	1	359S70914000 (Cup point M6 × 12)
K1	Repair kit (common to right and left)	1	359S70915000

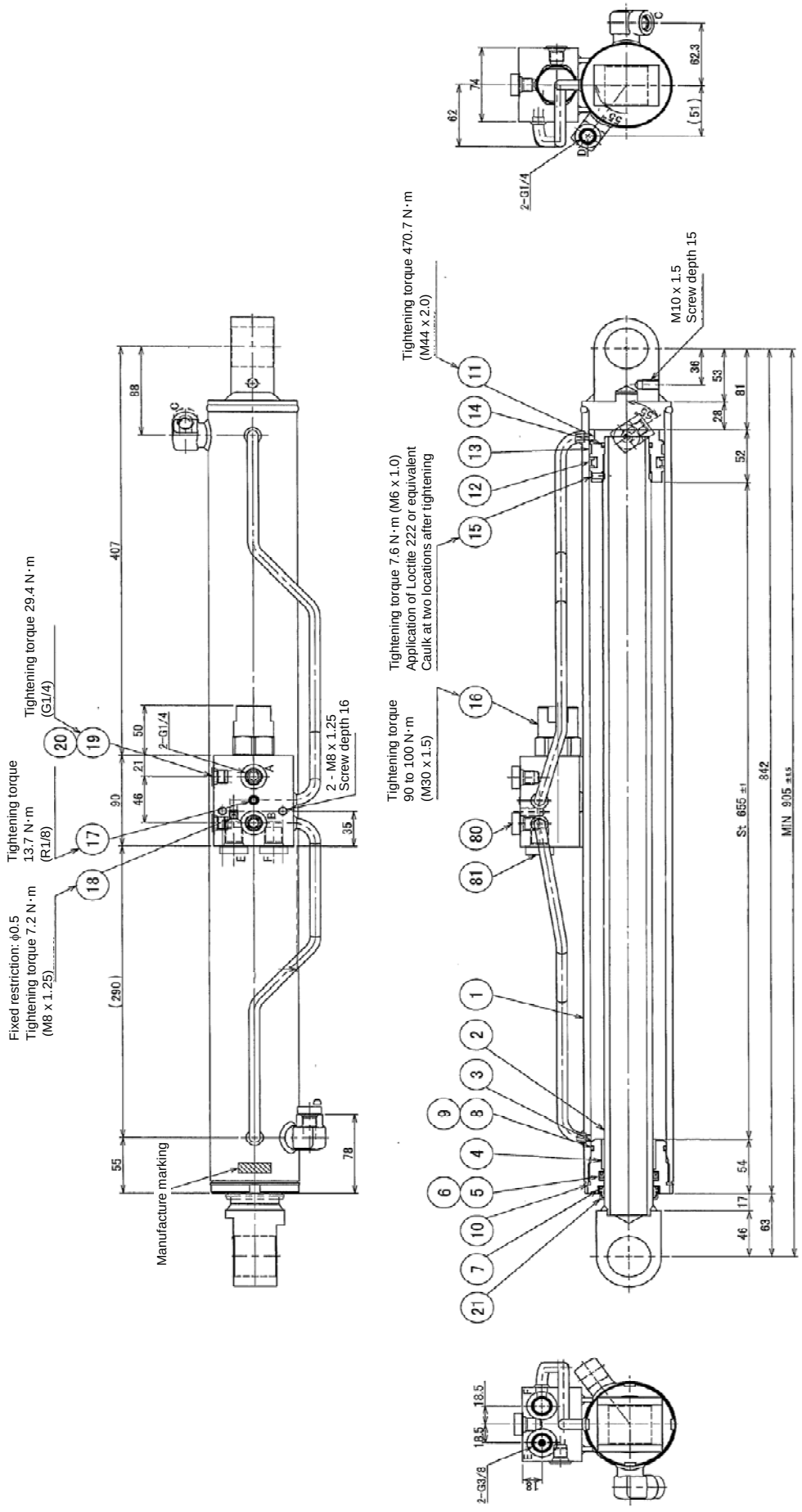
Specifications		
Cylinder bore x Rod bore - Stroke		ϕ70 × ϕ45 - 655st
Normal load	When extended	79.3 kN (at 20.6 MPa) [8.1t (at 210 kgf/cm^2)]
	When contracted	46.5 kN (at 20.6 MPa) [4.7t (at 210 kgf/cm^2)]
Hydrostatic test pressure	Extension side	25.5 MPa (260 kgf/cm^2)
	Contraction side	25.5 MPa (260 kgf/cm^2)

Cylinder spontaneous contraction amount (internal leak amount) Note: Keep the temperature constant because a cylinder contraction amount can be affected by thermal expansion due to temperature change.			
Components of cylinder	Max. internal leak amount cc/min	Cylinder bore area cm^2	Cylinder contraction amount cm/day
Derrick cylinder (from JIS B8367)	0.175	38.5	6.5
Counter balance valve	0.05		1.9
		Total	8.4

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13.7.2 MAIN RIGHT-HAND DERRICK CYLINDER

S200F3285000



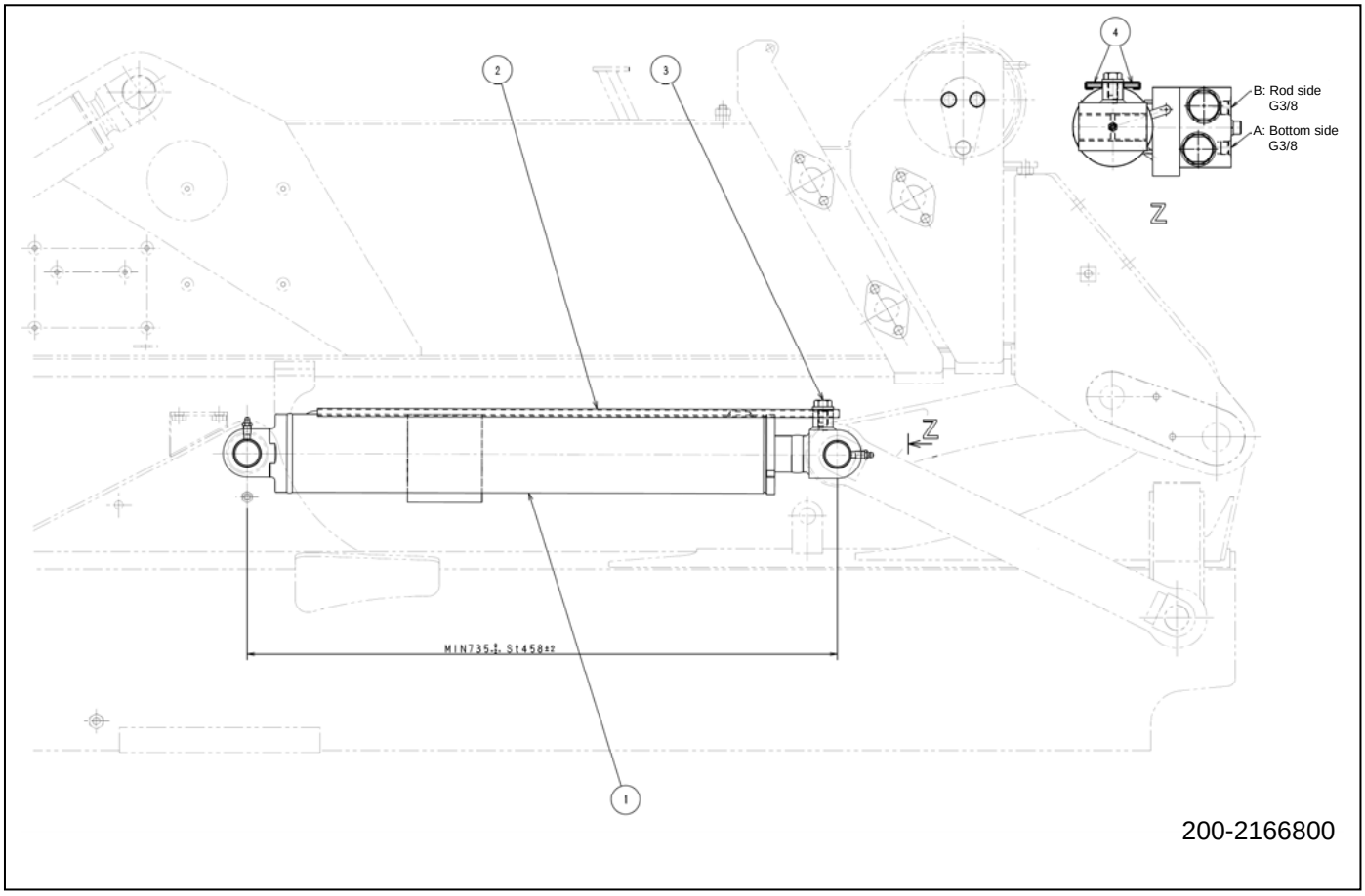
https://truckmanualshub.com/

Number	Name	Q'ty	Note
1	Cylinder tube assembly	1	S200F3285010
2	Piston rod assembly	1	S200F3285020
3	Cylinder head	1	S200F3285030
4	Bushing	1	S200F3285040 (Oiles Corporation LFB4530)
5	Rod packing (K1)	1	◆S200F3285050 (Kayaba 12 packing 45 × 55 × 6)
6	Backup ring (K1)	1	◆S200F3285060 (45 × 55 × 2.0)
7	Dust seal (K1)	1	◆S200F3285070 (Kayaba 50 wiper 45 × 57 × 7 × 11.5)
8	O-ring (K1)	1	◆S200F3285080 (1B-G65)
9	Backup ring (K1)	1	◆S200F3285090 (T3-G65)
10	O-ring (K1)	1	◆S200F3285100 (1A-G70)
11	Piston	1	S200F3285110
12	Piston ring (K1)	1	◆S200F3285120 (NOK SPGW70)
13	Wear ring (K1)	1	◆S200F3285130 (UNIPLA 70 × 65 × 10)
14	O-ring (K1)	1	◆S200F3285140 (1B-P41)
15	Set screw	1	S200F3285150 (Cup point M6 × 12)
16	Counter balance valve	1	(KYB-YS 65200-01000)
17	Plug	1	S200F3285170 (R1/8)
18	Orifice	1	S200F3285180 (S0805)
19	Plug	2	S200F3285190 (GPF1/4)
20	O-ring (K1)	2	◆S200F3285200 (1B-P11)
21	Cap	1	Cap for protecting paint
80	Plug	4	1/4 (Resin plug)
81	Plug	2	3/8 (Resin plug)
K1	Seal kit	1	S200F3285240

Specifications		
Cylinder bore x Rod bore - Stroke		ϕ70 × ϕ45 - 655st
Normal load	When extended	79.3 kN (at 20.6 MPa) [8.1t (at 210 kgf/cm^2)]
	When contracted	46.5 kN (at 20.6 MPa) [4.7t (at 210 kgf/cm^2)]
Hydrostatic test pressure	Extension side	25.5 MPa (260 kgf/cm^2)
	Contraction side	25.5 MPa (260 kgf/cm^2)

Cylinder spontaneous contraction amount (internal leak amount) Note: Keep the temperature constant because a cylinder contraction amount can be affected by thermal expansion due to temperature change.			
Components of cylinder	Max. internal leak amount cc/min	Cylinder bore area cm^2	Cylinder contraction amount cm/day
Derrick cylinder (from JIS B8367)	0.175	38.5	6.5
Counter balance valve	0.05		1.9
		Total	8.4

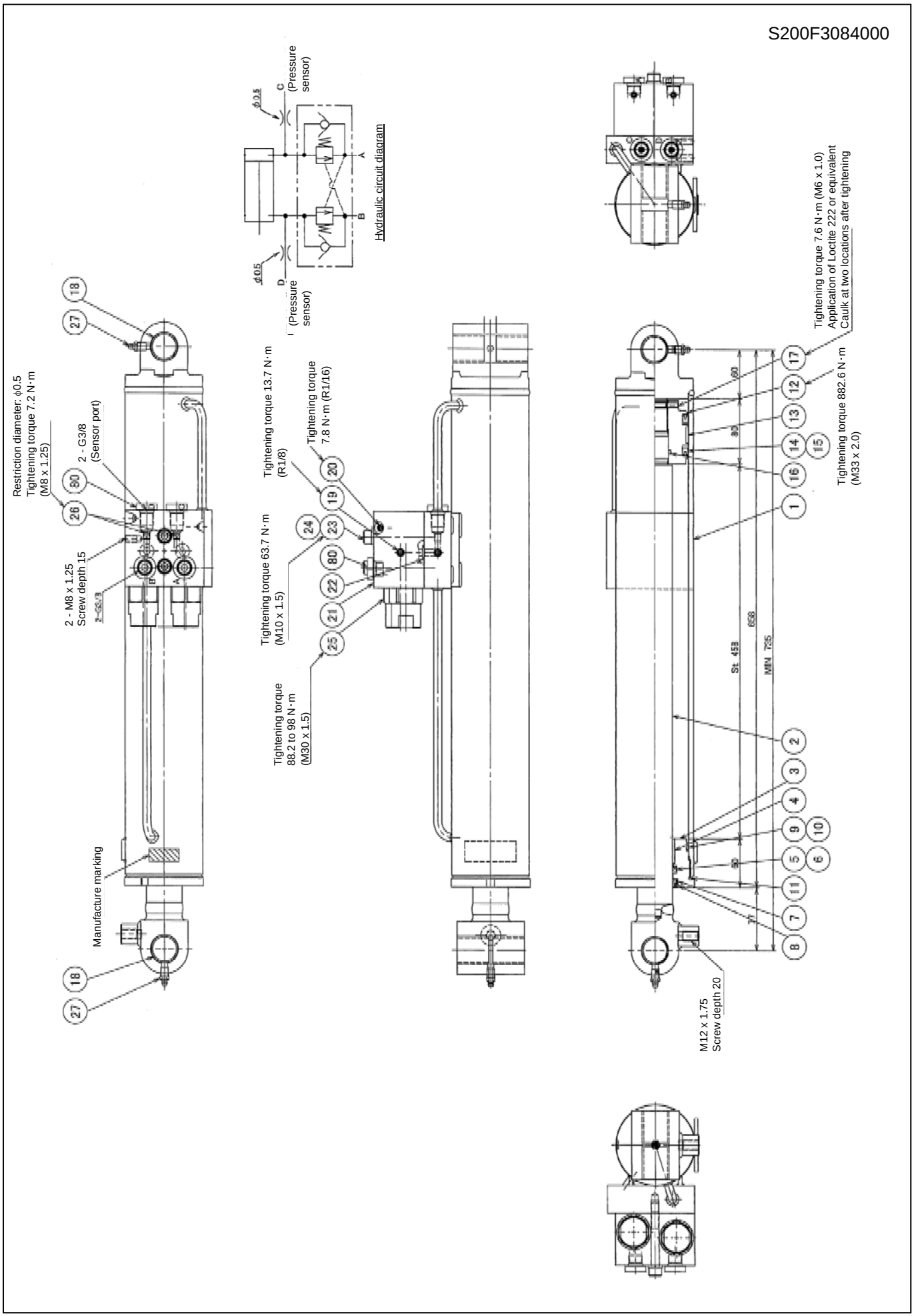
13.8 JIB DERRICK CYLINDER ASSEMBLY



Number	Name	Q'ty	Note
1	Jib D cylinder	1	Item number: S200F3084000
2	Jib D cylinder rod cover	1	Item number: 200-3345700
3	Sems bolt	1	Komatsu item number: 01024-81220
4	Rod guide cover	2	Item number: 101-4570200

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13.8.1 JIB DERRICK CYLINDER



Number	Name	Q'ty	Note
1	Cylinder tube assembly	1	S200F3084010
2	Piston rod assembly	1	S200F3084020
3	Cylinder head	1	S200F3084030
4	Bushing	1	S200F3084040 (YS item number:06009-04530)
5	Rod packing (K1)	1	◆S200F3084050 (YS item number: 05037-04555)
6	Backup ring (K1)	1	◆S200F3084060 (YS item number: 05006-04520)
7	Dust seal (K1)	1	◆S200F3084070 (YS item number: 05055-00045)
8	Snap ring	1	S200F3084080 (YS item number: 02003-02057)
9	O-ring (K1)	1	◆S200F3084090 (YS item number: 05001-18031)
10	Backup ring (K1)	1	◆S200F3084100 (YS item number: 05005-13580)
11	O-ring (K1)	1	◆S200F3084110 (YS item number: 05001-18531)
12	Piston	1	S200F3084120 (YS item number: C320850010)
13	Wear ring (K1)	1	◆S200F3084130 (YS item number: 06001-08520)
14	Piston packing (K1)	2	◆S200F3084140 (YS item number: 05002-00085)
15	Backup ring (K1)	2	◆S200F3084150 (YS item number: 05006-07025)
16	O-ring (K1)	1	◆S200F3084160 (YS item number: 05001-13535)
17	Set screw	1	S200F3084170 (YS item number: 01004-00615)
18	Bushing	4	S200F3084180 (YS item number: 06008-03040)
19	Plug	3	S200F3084190 (YS item number: 01008-00108)
20	Plug	4	S200F3084200 (YS item number: 01008-00008)
21	Body valve	1	S200F3084210 (YS item number: 910-74-03670)
22	O-ring (K1)	2	◆S200F3084220 (YS item number: 05001-11424):
23	Hexagon socket head cap screw	2	S200F3084230 (YS item number: 01002-01080)
24	Spring washer	2	S200F3084240 (YS item number: 02002-01037)
25	Counter balance valve	2	S200F3084250 (YS item number: (KYB-YS 65200-01000V)
26	Orifice	2	S200F3084260 (YS item number: 01016-00805)
27	Grease nipple	2	S200F3084270 (YS item number: 01009-11080)
80	Plug	4	S200F3084280 (YS item number: 01011-00200)
K1	Seal kit	1	S200F3084290

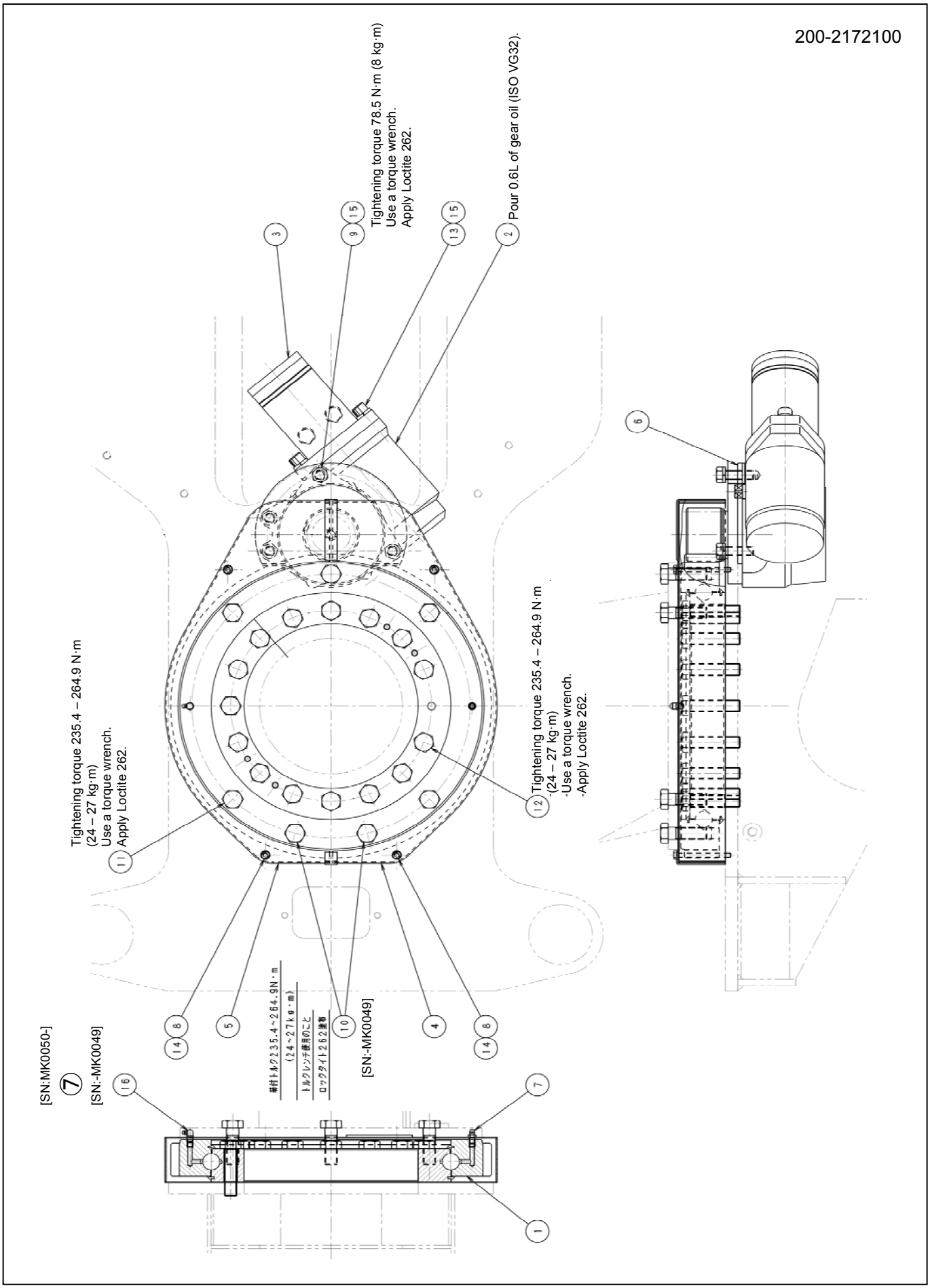
Specifications		
Cylinder bore x Rod bore - Stroke		ϕ85 x ϕ45 - 458st
Normal load	When extended	116.9 kN (at 20.6 MPa) [11.9t (at 210 kgf/cm^2)]
	When contracted	84.1 kN (at 20.6 MPa) [8.5t (at 210 kgf/cm^2)]
Hydrostatic test pressure	Extension side	30.9 MPa (315 kgf/cm^2)
	Contraction side	30.9 MPa (315 kgf/cm^2)

Cylinder spontaneous contraction amount (internal leak amount) Note: Keep the temperature constant because a cylinder contraction amount can be affected by thermal expansion due to temperature change.			
Components of cylinder	Max. internal leak amount cc/min	Cylinder bore area cm^2	Cylinder contraction amount cm/day
Derrick cylinder (from JIS B8367)	0.212	56.7	5.4
Counter balance valve	0.05		1.2
		Total	6.6

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14. SLEWING DEVICE

14.1 OUTSIDE DRAWING



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Number	Name	Q'ty	Item No.
1	Slewing bearing	1	Item number: 301S18500001
2	S gear box	1	Item number: 315S07300000
3	S motor	1	Item number: 301S18600000
4	S gear cover (A)	1	Item number: 353-3200500
5	S gear cover (B)	1	Item number: 353-3200600
6	Spacer	1	Item number: 353-4447100
7	Grease nipple [SN:-MK0049] Grease nipple [SN:MK0050-]	1 2	Item number: 24711-04000 (A-R1/8)
8	Hexagon head bolt	4	Item number: 21012M06070 (M6 × 70 plated 4.6)
9	Hexagon head bolt	4	Item number: 21019-12040 (M12 × 40 12.9)
10	Hexagon head bolt [SN:-MK0049]	2	Item number: 21019-16035 (M16 × 35 12.9)
11	Hexagon head bolt [SN:-MK0049] Hexagon head bolt [SN:MK0050-]	5 7	Item number: 21019-16050 (M16 × 50 12.9)
12	Hexagon head bolt	15	Item number: 21019-16065 (M16 × 65 12.9)
13	Hexagon socket head cap screw	2	Item number: 21079-12030 (M12 × 30 12.9)
14	Spring washer	4	Item number: 21711M06002 (M6 × Type 2 plated)
15	Spring washer	6	Item number: 21711-12003 (M12 × Type 3)
16	Grease nipple [SN:-MK0049]	1	Item number: 24711-2000 (C-R1/8)
	Lubricating oil	0.6	ISO VG320 standard item After assembling the slewing reduction gears and hydraulic motor, feed lubricating oil from the oil filler port to the specified quantity.

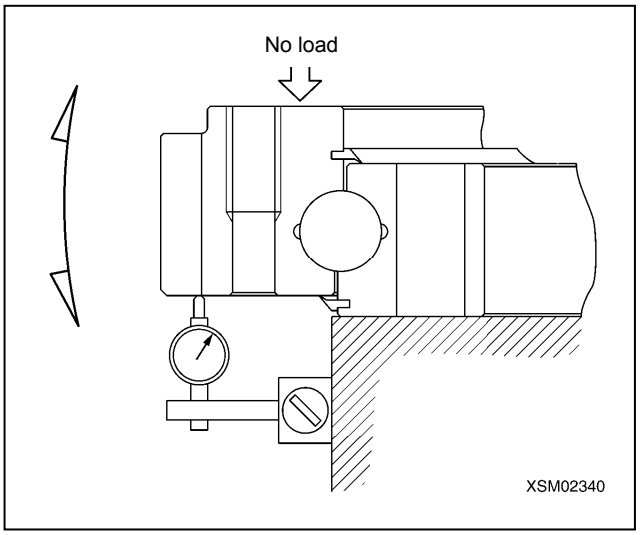
14.1.1 TOLERANCE OF LOOSENESS HEIGHT OF SLEWING BEARING

If a gap increases, a contact ellipse generated at the contact point of the orbit and steel ball approaches the joint of the inner and outer rings when the bearing is subjected to a moment load. A part protrudes from the orbit and depression may be caused at the orbit edge.

As a guide line, a value with reference to the contact angle having this fear is shown below.

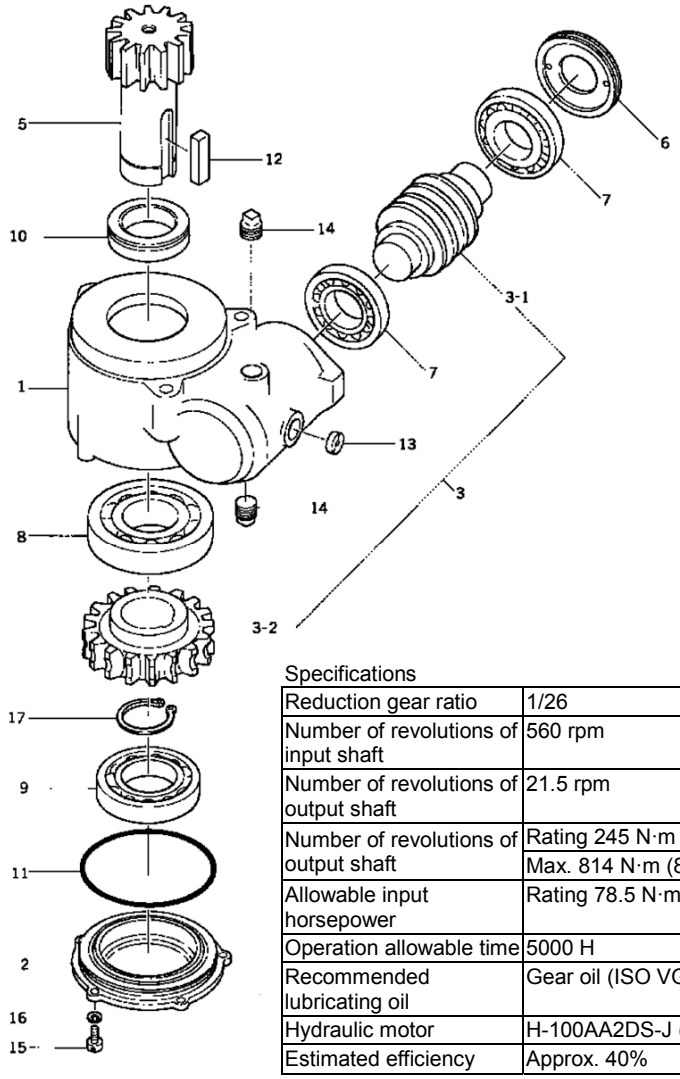
Use this value as a reference of the allowable range of looseness.

1. Fix the inner ring to the rigid body.
2. Set a dial gauge as shown in the illustration.
3. Shake the outer ring. At this time, do not apply a large force. Shake it with man power. (This is to prevent elastic deformation from being caused on the orbit and steel ball.)
   Tolerance of looseness: "2.62 mm" or less based on the reading of the dial gauge



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14.2 INTERNAL STRUCTURE AND SPECIFICATIONS OF REDUCTION GEARS



Specifications

Reduction gear ratio	1/26
Number of revolutions of input shaft	560 rpm
Number of revolutions of output shaft	21.5 rpm
Number of revolutions of output shaft	Rating 245 N·m (25 kgf·m)
	Max. 814 N·m (83 kgf·m: 15 seconds)
Allowable input horsepower	Rating 78.5 N·m (8.0 kgf·m)
Operation allowable time	5000 H
Recommended lubricating oil	Gear oil (ISO VG32): 0.6 L
Hydraulic motor	H-100AA2DS-J (Sumitomo Eaton)
Estimated efficiency	Approx. 40%

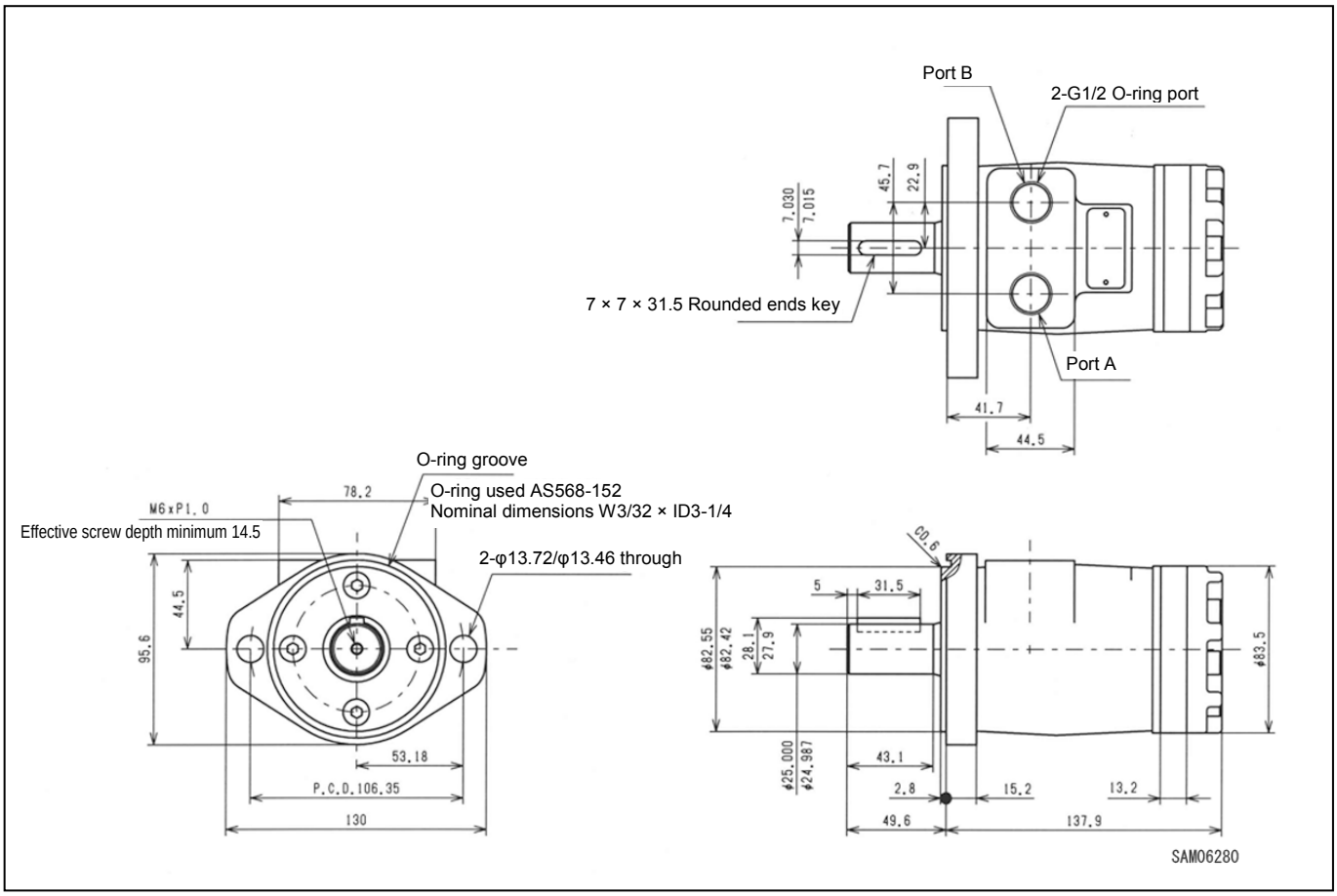
SAM06270

Number	Name	Q'ty	Item No.
	S gear box	1	315S07300000
1	Casing	1	315S07301000
2	LS cover	1	315S07302000
3	Worm assembly	1	315-1032500
3-1	Worm shaft	1	315S07303000
3-2	Worm gear	1	315S07304000
5	Pinion shaft	1	315S07305000
6	Screw ring	1	315S07306000
7	Taper-roller bearing (30208)	2	315S07307000
8	Bearing (6310)	1	315S07308000
9	Bearing (6210)	1	315S07309000
10	Oil seal (OLN50721219)	1	315S07310000
11	O-ring (G115)	1	315S07311000
12	Feather key (15 × 10 × 50 both angles)	1	315S07312000
13	Oil gauge	1	315S07313000
14	Square head plug (R1/2)	2	315S07314000
15	Hexagon socket head cap screw (M6 × 18L)	6	315S07315000
16	Spring washer (M6)	6	315S07316000
17	Snap ring (S-50)	1	315S07317000

- When removing the reduction gears, fix the post and frame with rope to prevent the upper slewing body from spinning before removal.

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14.3 APPEARANCE AND SPECIFICATIONS OF HYDRAULIC MOTOR

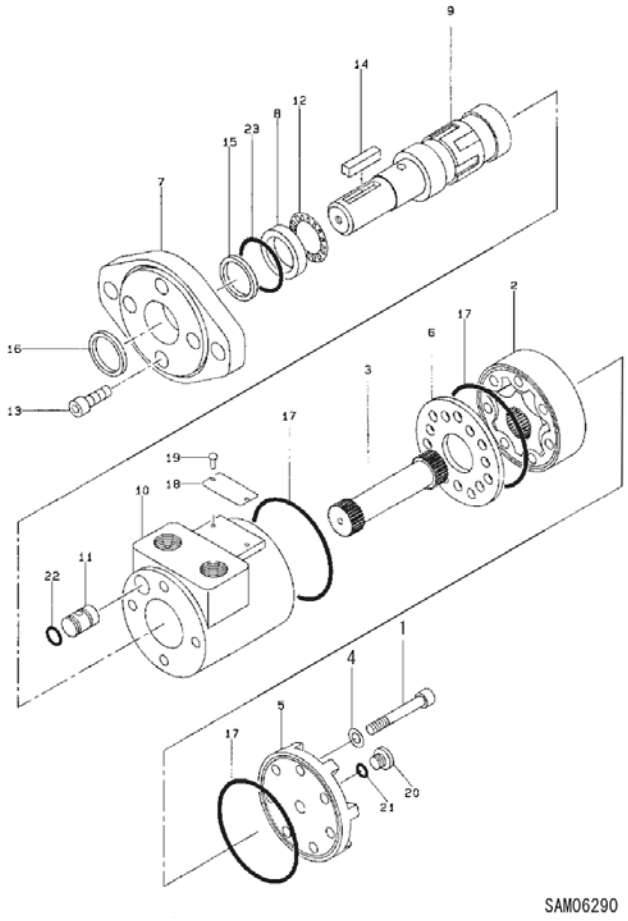


Rotational direction of slewing motor	
Pressure oil	Direction of rotation
Port A	Clockwise slewing
Port B	Counterclockwise slewing

Specifications	
Model	H-100AA2DS-J
Displacement	96 cc/rev
Rated speed	560 min^{-1}
Maximum speed	670 min^{-1}
Rated torque	147 N·m (15 kgf·m)
Maximum torque	206 N·m (21 kgf·m)
Rated pressure	12.3 MPa (125 kgf/cm^2)
Maximum pressure	16.7 MPa (170 kgf/cm^2)
Allowable back pressure	10.2 MPa (105 kgf/cm^2)
Mass	5.6 kgf

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14.4 INTERNAL STRUCTURE OF HYDRAULIC MOTOR



Number	Name	Q'ty	Item No.
	S motor	1	301S18600000
1	Screw	7	4380-80001-0
2	Gerotor	1	4380-80002-0
3	Drive	1	4380-80003-0
4	Seal washer	7	4380-80005-0
5	End cap	1	4380-80006-0
6	Spacer plate	1	4380-80007-0
7	Flange mounting	1	4380-80008-0
8	Thrust bearing race	1	4380-80009-0
9	Shaft output	1	4380-80011-0
10	Housing	1	4380-80012-0
11	Ball check valve assembly	1	4380-80013-0
12	Thrust needle bearing	1	4380-80014-0
13	Screw	4	4380-80015-0
14	Key	1	4380-80017-0
15	Oil seal	1	4380-80018-0
16	Dust seal	1	4380-80019-0
17	O-ring	3	4380-80021-0
18	Name plate	1	4380-80022-0
19	Rivet	2	4380-80023-0
20	End cap plug	1	4380-80024-0
21	O-ring	1	4380-80025-0
22	O-ring	4	4380-80026-0
23	O-ring	1	4380-80027-0

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14.5 FAILURE CAUSE AND COUNTERMEASURE OF SLEWING DEVICE

Abnormal Phenomenon	Cause	Remedy
Motor does not rotate.	• Seizure of shaft and housing due to dust or deterioration of hydraulic oil and excessive radial load	• Slew at no load and check the pressure. When motor does not rotate even if approx. 2.94 MPa (30 kgf/cm^2) is applied, there is a possibility of seizure. Replace the motor.
	• Pressure does not increase.	• Check the entire circuits such as valve and pump.
Abnormal noise is heard.	• Shaft installation failure	• The shaft must be correctly centered.
	• Air remains in the circuit and motor.	• Completely bleed air. Operate at no load until air bubbles in the tank completely come out.
	• Cavitation of pump and motor	• If the motor is rotated at a load of large motor inertia, negative pressure is generated and cavitation is caused, resulting in breakage.
	• Mixing of air into the intake pipe system	• While carefully listening to the sound during operation, apply oil or grease to the joint and retighten the joint where the sound becomes small.

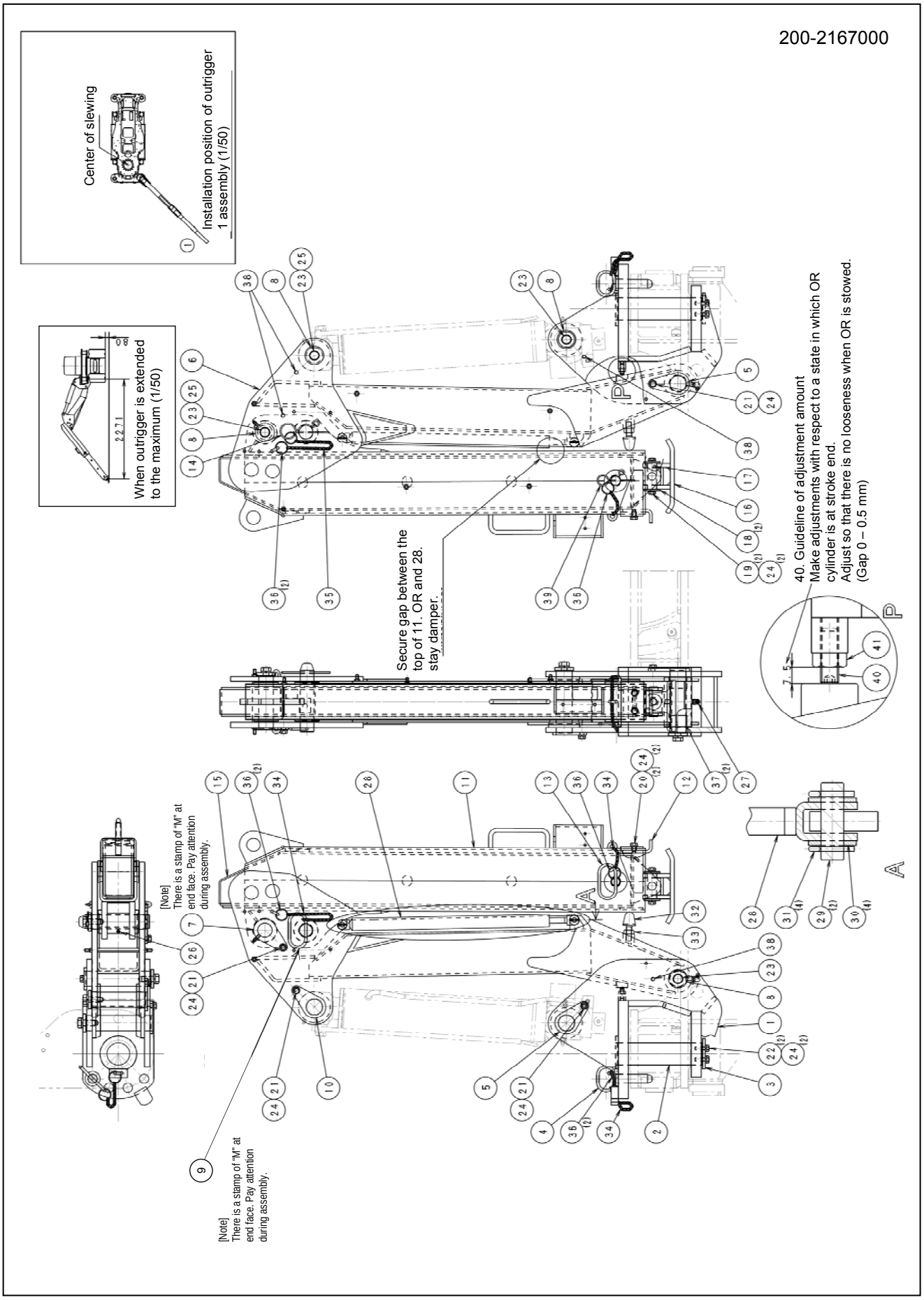
[Operation test]

1. Operate at no load for 15 to 20 minutes at idle and check the following.
   - Whether oil temperature increases excessively
   - Whether abnormal noise is heard
   - Whether there is abnormal vibration
   - Whether there is oil leak
2. If there is no abnormality, gradually apply load, increase the pressure to the maximum and re-check the aforementioned four items.
3. Operate for 1 to 2 minutes at maximum pressure, and if there is no abnormality, move to normal operation.

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15. OUTRIGGER

15.1 APPEARANCE OF OUTRIGGER ON REAR RIGHT SIDE

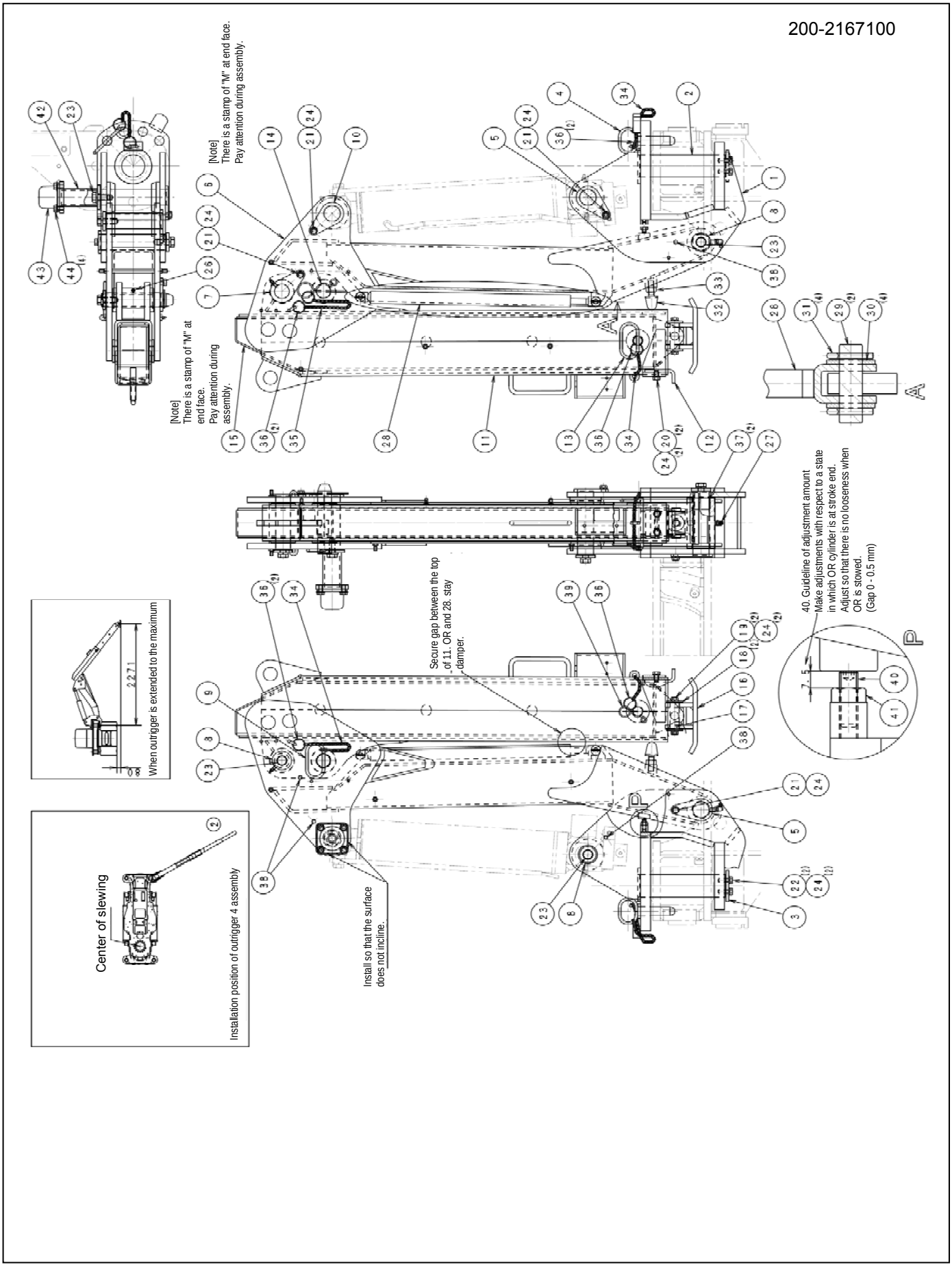


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Number	Name	Q'ty	Item No.
1	Rotary 1	1	200-2165900
2	Rotary shaft	1	329-427800001
3	Stopper plate RS	1	329-427810001
4	Position pin R	1	329-427940002
5	OR cylinder head pin	2	329-427820001
6	OR base 1, 3	1	200-1173000 (up to Unit No. 27) 200-1175400 (Unit No. 28 and up)
7	OR pin A	1	102-460270001
8	Stopper plate BB	4	724-1108-000
9	Position pin	1	102-460280001
10	OR cylinder rod pin	1	329-427860001
11	OR top 1, 3	1	200-1170200
12	Stopper	1	200-4642300
13	Position pin	1	353-443380002
14	Snap pin	1	101-4567800
15	Inner box 1, 3	1	353-208510002
16	Rigger adapter	1	353-4446900
17	Pin	1	353-4447000
18	End plate	2	350-4394000
19	Hexagon head bolt (M8 × 10)	2	21015M08010
20	Hexagon head bolt (M8 × 16)	2	21015M08016
21	Hexagon head bolt (M8 × 20)	4	21017M08020
22	Hexagon head bolt (M8 × 25)	2	21017M08025
23	Sems bolt	4	Komatsu item number: 01024-81225
24	Spring washer (M8)	10	21711M08002
25	Missing number		
26	Grease nipple (A-M6F)	1	24711-01000
27	Grease nipple (C-R1/8)	1	24711-24000
28	Stay damper	1	353S61200000
29	Pin (GS)	2	551-4035400
30	Plain washer (M10)	4	21741M10006
31	Split pin (2.5 × 20)	4	21510-25020
32	Rubber leg	1	353-4451700
33	Hexagon nut (M12)	1	21211M12210
34	Chain (L = 200)	3	27931-04020
35	Chain (L = 130)	1	27931-04013
36	Ring	8	315-4175300
37	Bushing	2	25511-03525
38	Hole plug (CP-30-HP-1)	4	28731-01000
39	Snap pin	1	101-4567900
40	Seal ring with hexagon socket	1	M8 × 1.25 × 25L (Cup point SUS)
41	Hexagon nut	1	M8 × 1.25 × Type 1 (plated 8T)

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15.2 APPEARANCE OF OUTRIGGER ON FRONT RIGHT SIDE

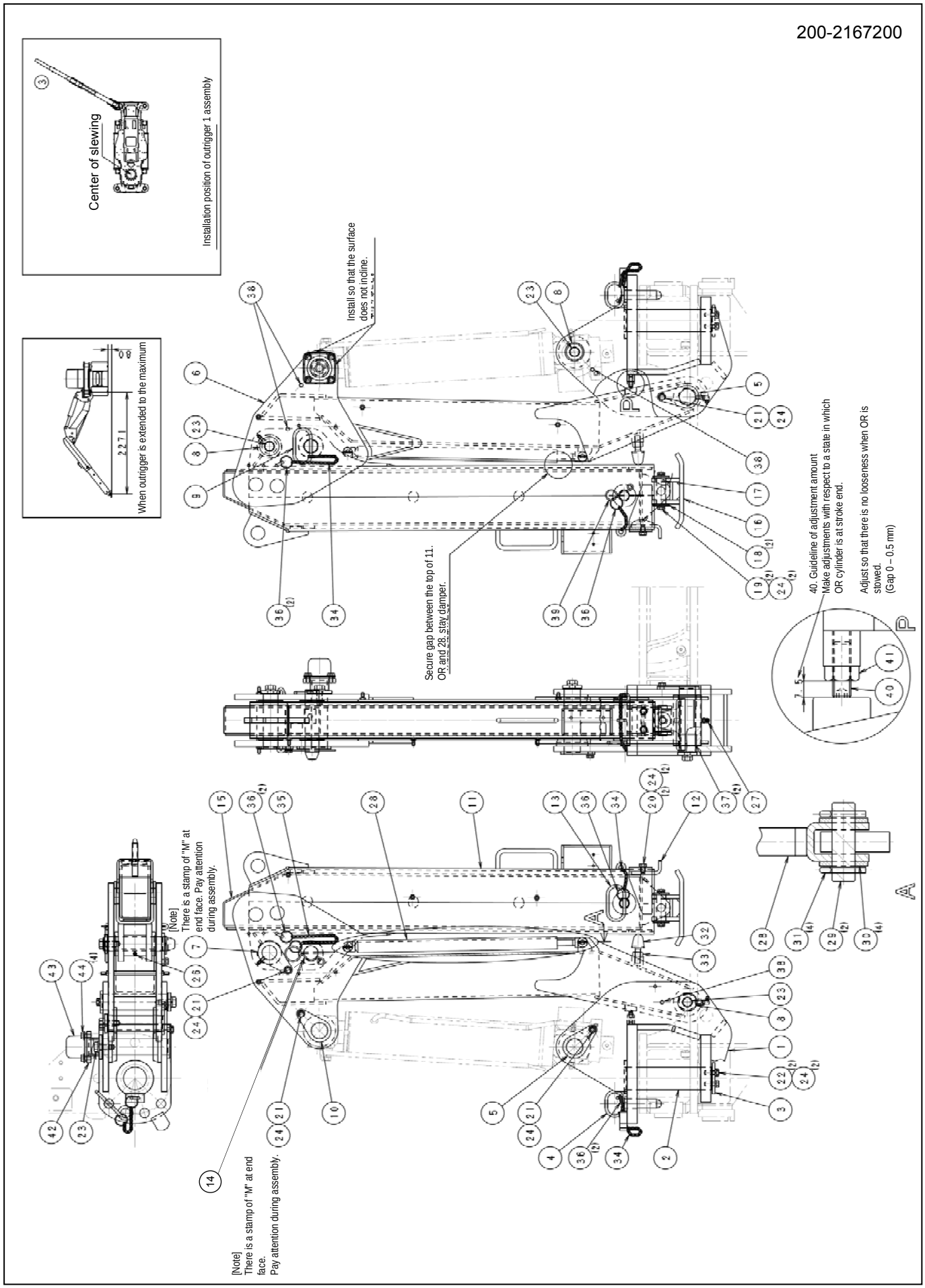


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Number	Name	Q'ty	Item No.
1	Rotary 2	1	200-2166000
2	Rotary shaft	1	329-427800001
3	Stopper plate RS	1	329-427810001
4	Position pin R	1	329-427940002
5	OR cylinder head pin	2	329-427820001
6	OR base 2, 4	1	200-1173100 (up to Unit No. 27) 200-1175500 (Unit No. 28 and up)
7	OR pin A	1	102-460270001
8	Stopper plate BB	3	724-1108-000
9	Position pin	1	102-460280001
10	OR cylinder rod pin	1	329-427860001
11	OR top 1, 3	1	200-1170200
12	Stopper	1	200-4642300
13	Position pin	1	353-443380002
14	Snap pin	1	101-4567800
15	Inner box 1, 3	1	353-2085100
16	Rigger adapter	1	353-4446900
17	Pin	1	353-4447000
18	End plate	2	350-4394000
19	Hexagon head bolt (M8 × 10)	2	21015M08010
20	Hexagon head bolt (M8 × 16)	2	21015M08016
21	Hexagon head bolt (M8 × 20)	4	21017M08020
22	Hexagon head bolt (M8 × 25)	2	21017M08025
23	Sems bolt	4	Komatsu item number: 01024-81225
24	Spring washer (M8)	10	21711M08002
25	Missing number		
26	Grease nipple (A-M6F)	1	24711-01000
27	Grease nipple (C-R1/8)	1	24711-24000
28	Stay damper	1	353S61200000
29	Pin (GS)	2	551-4035400
30	Plain washer (M10)	4	21741M10006
31	Split pin (2.5 × 20)	4	21510-25020
32	Rubber leg	1	353-4451700
33	Hexagon nut (M12)	1	21211M12210
34	Chain (L = 200)	3	27931-04020
35	Chain (L = 130)	1	27931-04013
36	Ring	8	315-4175300
37	Bushing	2	25511-03525
38	Hole plug (CP-30-HP-1)	4	28731-01000
39	Snap pin	1	101-4567900
40	Seal ring with hexagon socket	1	M8 × 1.25 × 25L (Cup point SUS)
41	Hexagon nut	1	M8 × 1.25 × Type 1 (plated 8T)
42	Cushion seat (R)	1	200-4661000
43	Rubber buffer (KJ-50)	1	27600-02000
44	Sems bolt	4	Komatsu item number: 01024-80816

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15.3 APPEARANCE OF OUTRIGGER ON FRONT LEFT SIDE

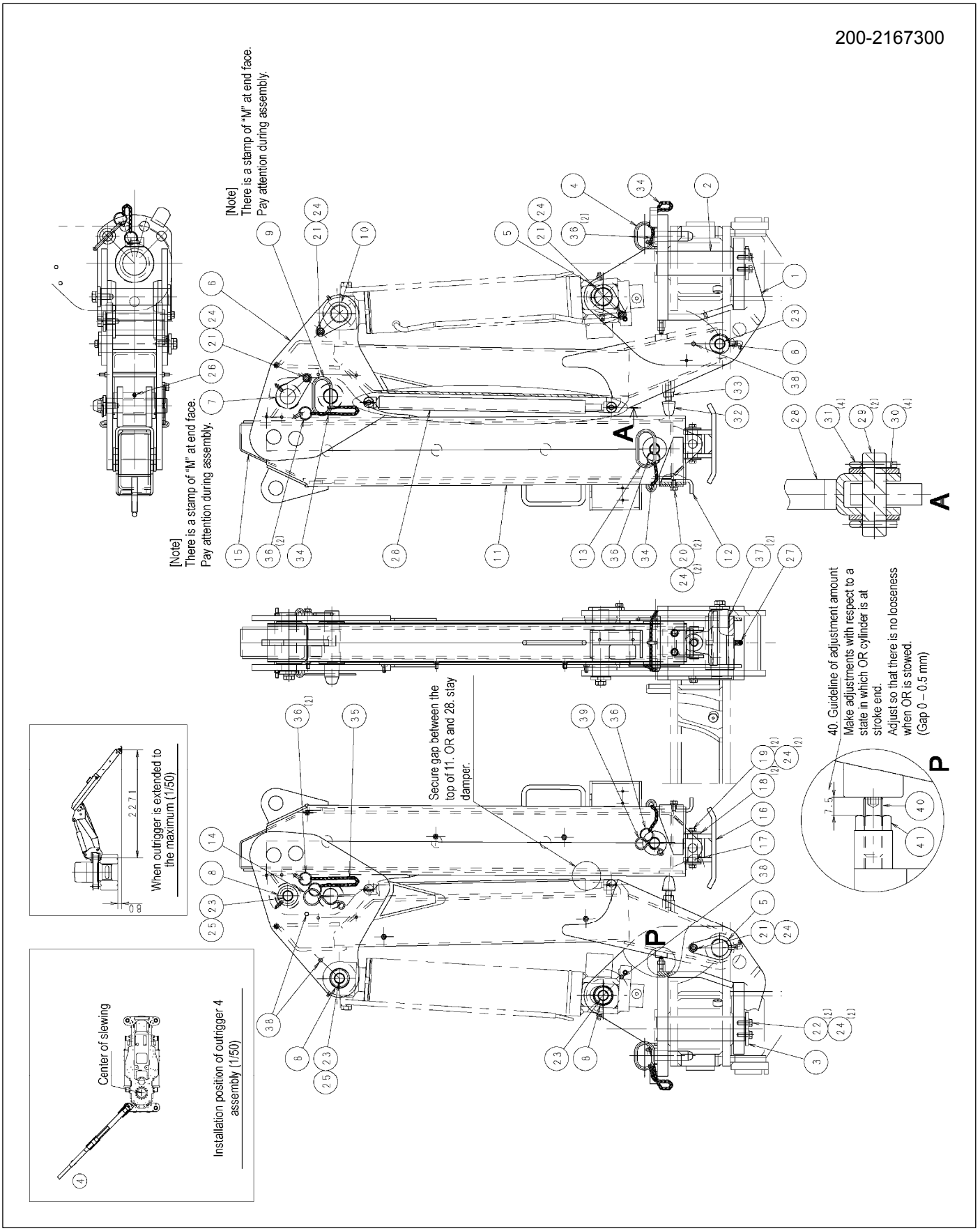


https://truckmanualshub.com/

Number	Name	Q'ty	Item No.
1	Rotary 3	1	200-2166100
2	Rotary shaft	1	329-427800001
3	Stopper plate RS	1	329-427810001
4	Position pin R	1	329-427940002
5	OR cylinder head pin	2	329-427820001
6	OR base 1, 3	1	200-1173000 (up to Unit No. 27) 200-1175400 (Unit No. 28 and up)
7	OR pin A	1	102-460270001
8	Stopper plate BB	3	724-1108-000
9	Position pin	1	102-460280001
10	OR cylinder rod pin	1	329-427860001
11	OR top 2, 4	1	200-1170300
12	Stopper	1	200-4642300
13	Position pin	1	353-443380002
14	Snap pin	1	101-4567800
15	Inner box 2, 4	1	353-20858000
16	Rigger adapter	1	353-4446900
17	Pin	1	353-4447000
18	End plate	2	350-4394000
19	Hexagon head bolt (M8 × 10)	2	21015M08010
20	Hexagon head bolt (M8 × 16)	2	21015M08016
21	Hexagon head bolt (M8 × 20)	4	21017M08020
22	Hexagon head bolt (M8 × 25)	2	21017M08025
23	Sems bolt	4	Komatsu item number: 01024-81225
24	Spring washer (M8)	10	21711M08002
25	Missing number		
26	Grease nipple (A-M6F)	1	24711-01000
27	Grease nipple (C-R1/8)	1	24711-24000
28	Stay damper	1	353S61200000
29	Pin (GS)	2	551-4035400
30	Plain washer (M10)	4	21741M10006
31	Split pin (2.5 × 20)	4	21510-25020
32	Rubber leg	1	353-4451700
33	Hexagon nut (M12)	1	21211M12210
34	Chain (L = 200)	3	27931-04020
35	Chain (L = 130)	1	27931-04013
36	Ring	8	315-4175300
37	Bushing	2	25511-03525
38	Hole plug (CP-30-HP-1)	4	28731-01000
39	Snap pin	1	101-4567900
40	Seal ring with hexagon socket	1	M8 × 1.25 × 25L (Cup point SUS)
41	Hexagon nut	1	M8 × 1.25 × Type 1 (plated 8T)
42	Cushion seat (L)	1	200-4661100
43	Rubber buffer (KJ-50)	1	27600-02000
44	Sems bolt	4	Komatsu item number: 01024-80816

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15.4 APPEARANCE OF OUTRIGGER ON REAR LEFT SIDE



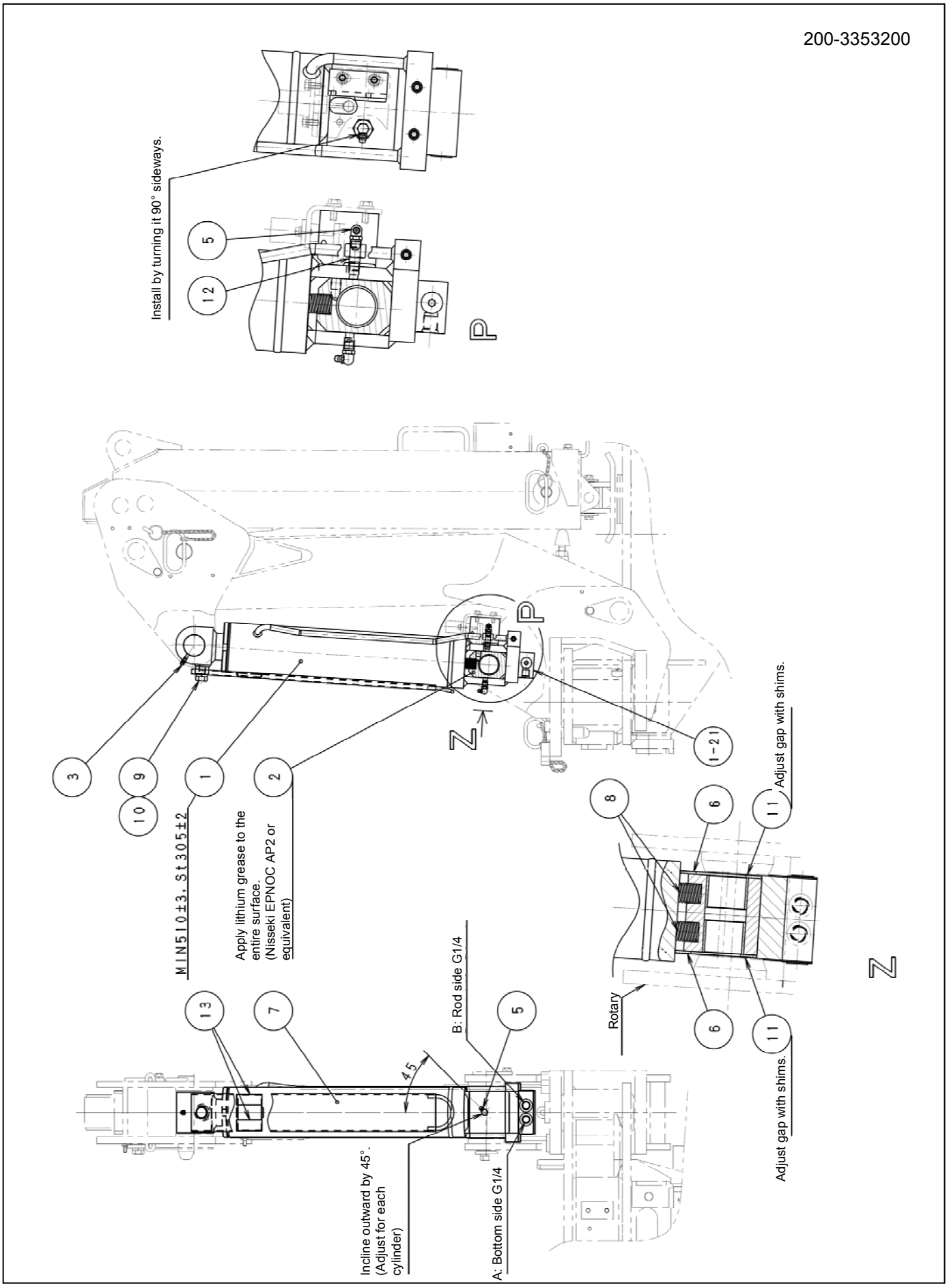
https://truckmanualshub.com/

Number	Name	Q'ty	Item No.
1	Rotary 4	1	200-2166200
2	Rotary shaft	1	329-427800001
3	Stopper plate RS	1	329-427810001
4	Position pin R	1	329-427940002
5	OR cylinder head pin	2	329-427820001
6	OR base 2, 4	1	200-1173100 (up to Unit No. 27) 200-1175500 (Unit No. 28 and up)
7	OR pin A	1	102-460270001
8	Stopper plate BB	4	724-1108-000
9	Position pin	1	102-460280001
10	OR cylinder rod pin	1	329-427860001
11	OR top 2, 4	1	200-1170300
12	Stopper	1	200-4642300
13	Position pin	1	353-443380002
14	Snap pin	1	101-4567800
15	Inner box 2, 4	1	353-208580002
16	Rigger adapter	1	353-4446900
17	Pin	1	353-4447000
18	End plate	2	350-4394000
19	Hexagon head bolt (M8 × 10)	2	21015M08010
20	Hexagon head bolt (M8 × 16)	2	21015M08016
21	Hexagon head bolt (M8 × 20)	4	21017M08020
22	Hexagon head bolt (M8 × 25)	2	21017M08025
23	Sems bolt	4	Komatsu item number: 01024-81225
24	Spring washer (M8)	10	21711M08002
25	Missing number		
26	Grease nipple (A-M6F)	1	24711-01000
27	Grease nipple (C-R1/8)	1	24711-24000
28	Stay damper	1	353S61200000
29	Pin (GS)	2	551-4035400
30	Plain washer (M10)	4	21741M10006
31	Split pin (2.5 × 20)	4	21510-25020
32	Rubber leg	1	353-4451700
33	Hexagon nut (M12)	1	21211M12210
34	Chain (L = 200)	3	27931-04020
35	Chain (L = 130)	1	27931-04013
36	Ring	8	315-4175300
37	Bushing	2	25511-03525
38	Hole plug (CP-30-HP-1)	4	28731-01000
39	Snap pin	1	101-4567900
40	Seal ring with hexagon socket	1	M8 × 1.25 × 25L (Cup point SUS)
41	Hexagon nut	1	M8 × 1.25 × Type 1 (plated 8T)

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16. OUTRIGGER CYLINDER

16.1 APPEARANCE AND SPECIFICATIONS



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Number	Name	Q'ty	Item No.
1	Outrigger cylinder assembly	1	S200F3153000
1-14	• Double pilot check valve assembly	1	103S92800000
2	Dog	1	S200B3154000
3	Grease nipple (A-M6F)	1	24711-01000
4	Missing number		
5	Grease nipple (C-R1/8)	2	24711-20000
6	Dog cover	2	200-4633600
7	OR cylinder cover	1	200-3364200
8	Compression coil spring	2	S200B3159000
9	Hexagon head bolt (M12 × 20)	1	21027M12020
10	Spring washer (M12)	1	21711M12002
11	Shim 0.5	Proper amount	102-4620100
12	Screw-in type adapter (2040-02)	1	22031-35100
13	D rod guide cover	2	347-4388600

Specifications		
Cylinder bore × Rod bore - Stroke		φ80 × φ50 - 305st
Normal load	When extended	103.5 kN (at 20.6 MPa) [10.6t (at 210 kgf/cm^2)]
	When contracted	63.1 kN (at 20.6 MPa) [6.4t (at 210 kgf/cm^2)]
Hydrostatic test pressure	Extension side	30.9 MPa (315 kgf/cm^2)
	Contraction side	30.9 MPa (315 kgf/cm^2)

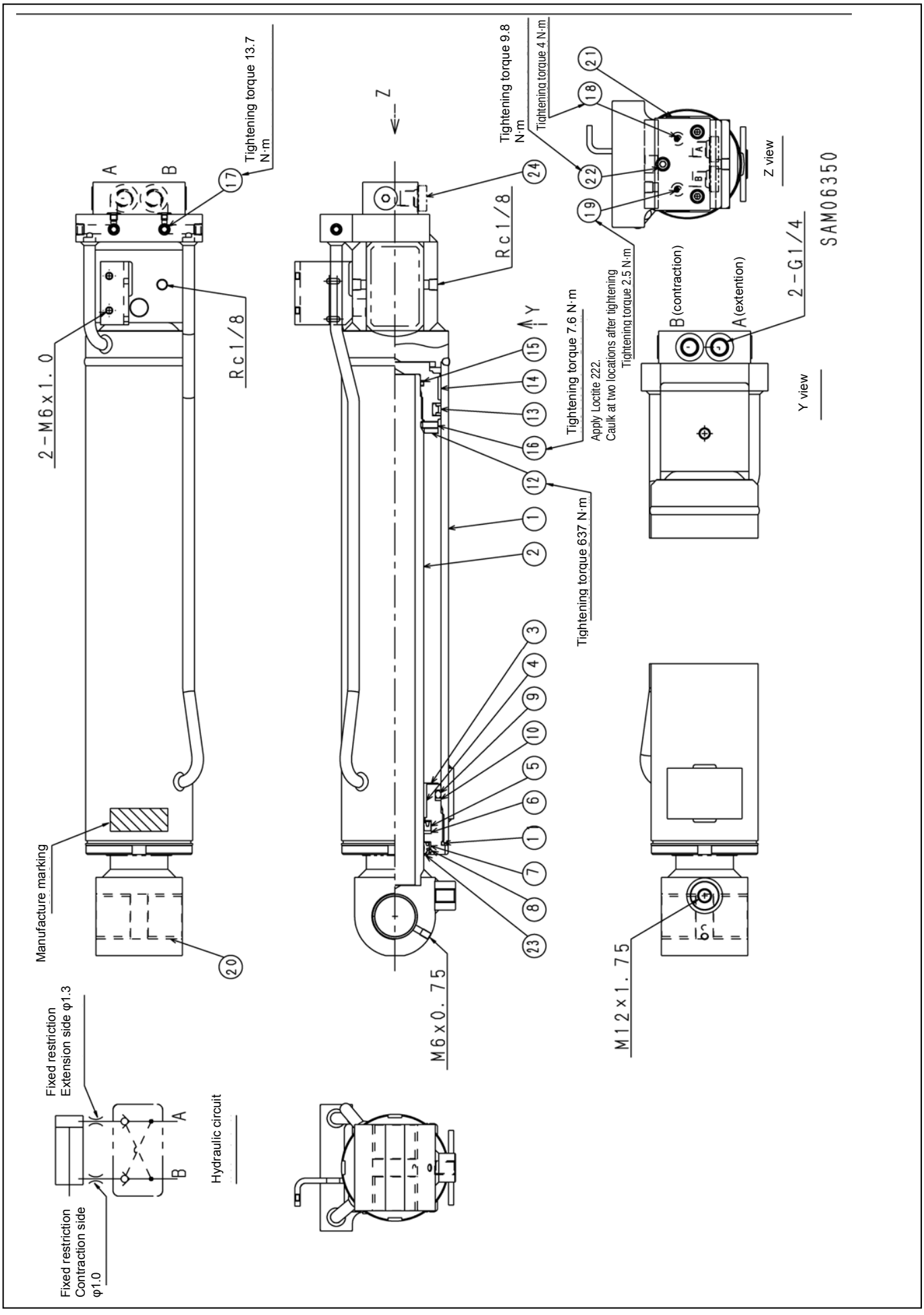
Cylinder spontaneous contraction amount (internal leak amount)

Note: Keep the temperature constant because a cylinder contraction amount can be affected by thermal expansion due to temperature change.

Components of cylinder	Max. internal leak amount cc/min	Cylinder bore area cm^2	Cylinder contraction amount cm/day
Outrigger cylinder	0.20	50.3	5.7
Double pilot check valve	0.05		1.4
		Total	7.1

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16.2 INTERNAL STRUCTURAL DRAWING



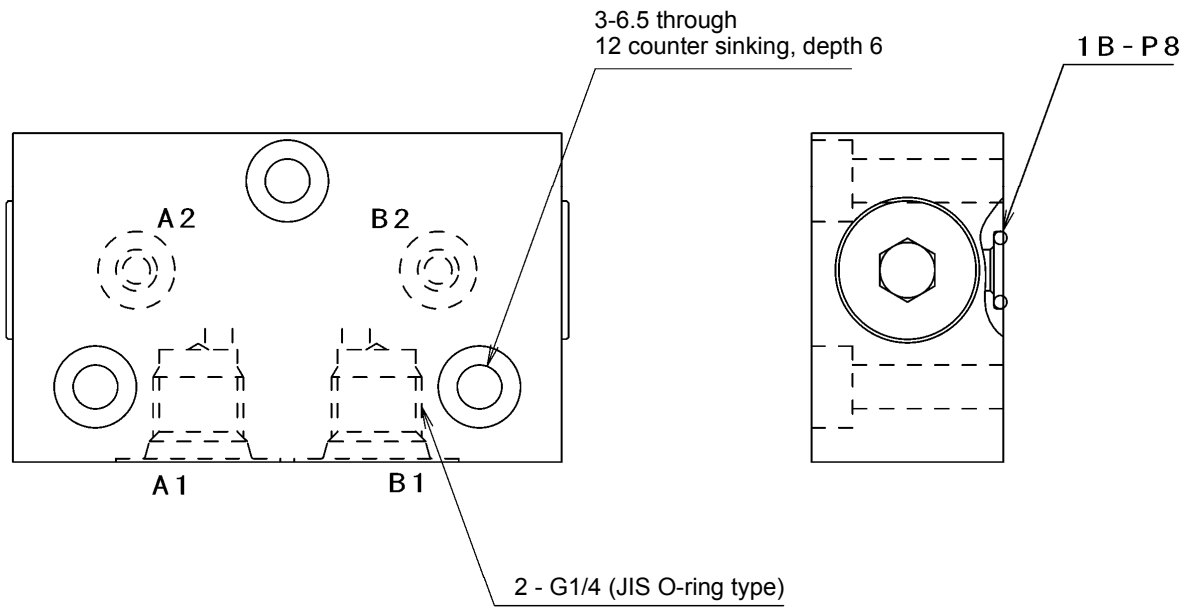
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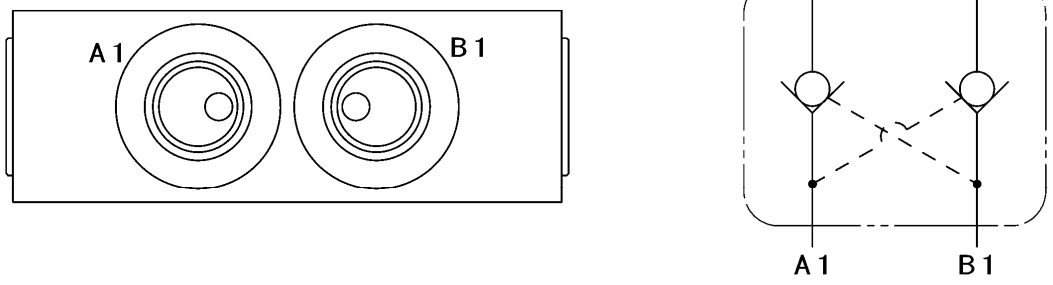
Number	Name	Q'ty	Note
	Outrigger cylinder assembly	4	S200F3153000
1	• Cylinder tube assembly	1	C100800320
2	• Piston rod assembly	1	910-22-50530
3	• Cylinder head	1	930-42-80010
4	• Bushing (LFB-5030)	1	06009-05030
5	• Piston rod packing (GNY-50) (K1)	1	◆05017-00050
6	• Backup ring (TC-GNY-50) (K1)	1	◆05021-05025
7	• Dust seal (DKBI) (K1)	1	◆05020-00050
8	• Snap ring (AR62)	1	02003-02062
9	• O-ring (1B-P70) (K1)	1	◆05001-17057
10	• Backup ring (T3-P70) (K1)	1	◆05005-14070
11	• O-ring (1B-G80) (K1)	1	◆05001-18031
12	• Piston	1	930-32-80030
13	• Piston ring (SPGW-80) (K1)	1	◆05023-00080
14	• Wear ring (K1)	1	◆06001-18020
15	• O-ring (1B-P44) (K1)	1	◆05001-14435
16	• Set screw (Cup point M6 × 15)	1	01004-00615
17	• Sunk head plug (R1/8)	4	01008-00108
18	• Orifice plug (S0613)	1	01016-00613
19	• Orifice plug (S0510)	1	01016-00510
20	• Bushing (K5B3530)	2	06008-03530
21	• Double pilot check valve	1	65000-06400
22	• Hexagon socket head cap bolt	3	01002-00635
23	• Cap	1	940-70-03830
24	• Plug for transportation (1/4)	2	01011-00100
K1	Repair kit	1	930-09-00031

Note: Parts with ◆ in item numbers are repair kit parts.

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16.3 DOUBLE PILOT CHECK VALVE





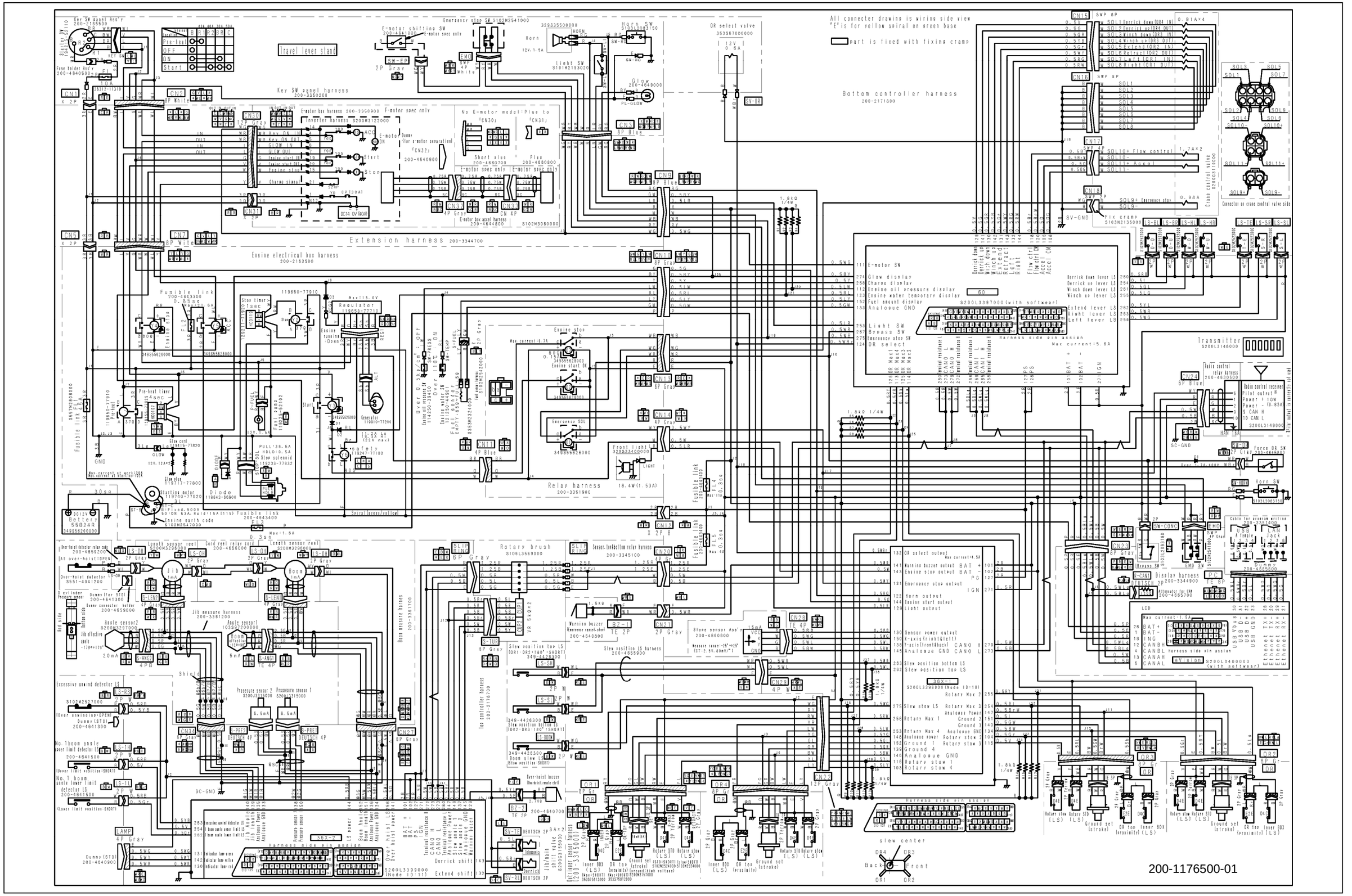
Circuit diagram

XSM00910

Specifications	
Rated pressure	20.6 MPa (210 kgf/cm^2)
Test pressure	41.2 MPa (420 kgf/cm^2)
Max. flow rate	10L/min
Allowable leak amount	0.05 L/min (pressurizing 17.2 MPa [175 kgf/cm^2] from A2 and B2 ports)
Check cracking pressure	0.49 MPa (5 kgf/cm^2)
Pilot area ratio	6.2:1
Test oil temperature range	50 ± 5°C
Operating temperature range	−10 to +80°C

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17. ELECTRIC CIRCUIT DIAGRAM

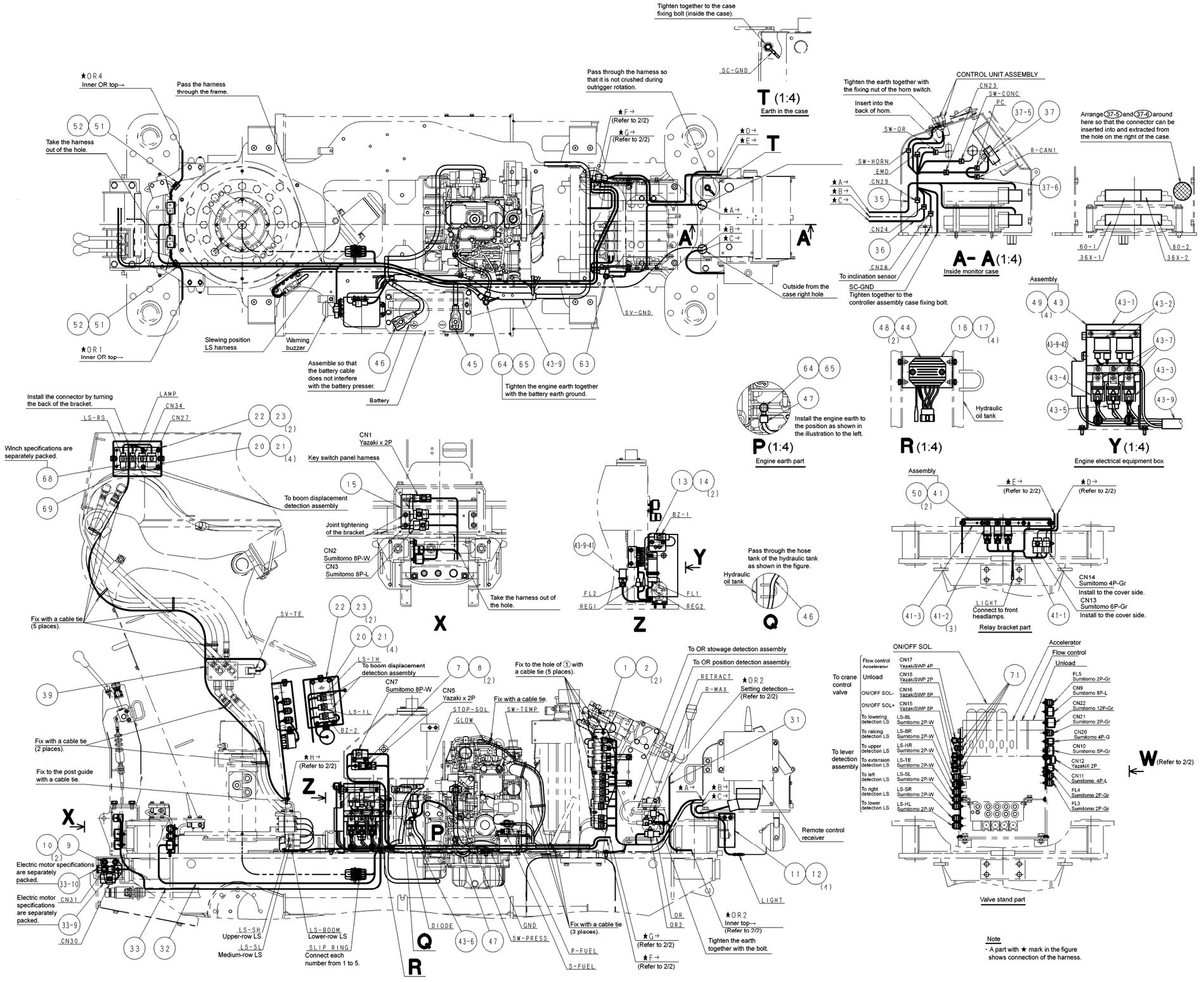


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18. ELECTRIC SYSTEM

18.1.1 WIRE HARNESS OF MACHINE BODY (1)

200-1172200-1



Note

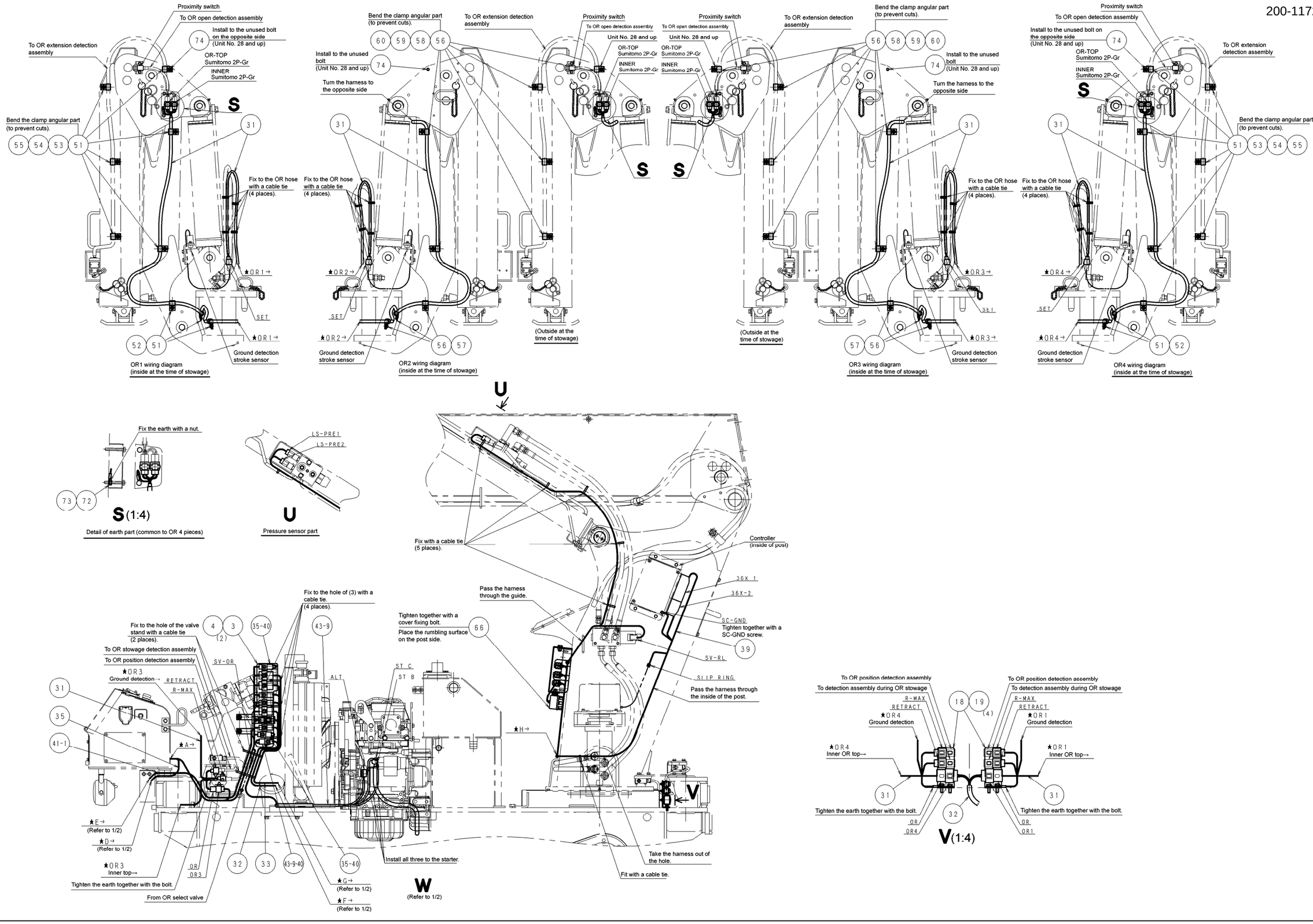
- A part with ★ mark in the figure shows connection of the harness.

Marking	Number	Name	Q'ty For one piece	Note
	74	Screw tip cover	4	27150-06015 (SDC-PLTB-M6-15L) Unit #28 and up
	73	Plain washer	4	M6 x Regular circle (plated)
	72	Hexagon nut	4	M6 x 1.0 x Type 1 (plated)
	71	Fixing clamp	4	S103N2135000
	69	Lamp blind connector	1	200-4640900
	68	Dead turns blind connector	1	200-4641300
	66	Buzzer assembly (TA005)	1	200-4640700
	65	Spring washer	2	M10 x Type-2 (plated)
	64	Hexagon head bolt	2	M10 x 1.5 x 16L (plated)
	63	Sems bolt	1	01024-80816 (Komatsu item number)
	60	Plain washer	12	M6 x Regular circle (plated)
	59	Spring washer	12	M6 x Type-2 (plated)
	58	Hexagon nut	12	M6 x 1.0 x Type 1 (plated)
	57	Sems bolt	6	01024-80612 (Komatsu item number)
	56	Clamp	18	22961-12100 (COT-12)
	55	Plain washer	12	M6 x Regular circle (plated)
	54	Spring washer	12	M6 x Type-2 (plated)
	53	Hexagon nut	12	M6 x 1.0 x Type 1 (plated)
	52	Sems bolt	8	01024-80612 (Komatsu item number)
	51	Clamp	20	22961-12100 (COT-12)
	50	Sems bolt	2	01024-80612 (Komatsu item number)
	49	Sems bolt	4	01024-80616 (Komatsu item number)
	48	Sems bolt	2	01024-80616 (Komatsu item number)
	47	Engine earth cord	1	S102M2547000
	46	Battery earth cord +	1	S102M2546000
	45	Battery earth cord -	1	S102M2545000
	44	Current limiter	1	119653-77710 (Engine accessories)
	43-9-42	Fusible link	1	S557M2806000
	43-9-41	Fusible link 0.85	1	200-4643300
	43-9-40	Fusible link 0.3	1	200-4643400
	43-9	Engine power supply box harness	1	200-2163500
	43-7	Relay	3	349S55626000
	43-6	Diode	1	119643-66900 (Engine accessories)
	43-5	Safety relay	1	119247-77100 (Engine accessories)
	43-4	Timer unit	1	129155-77925 (Engine accessories)
	43-3	Timer	1	129211-77920 (Engine accessories)
	43-2	Relay	2	119650-77910 (Engine accessories)
	43-1	Electrical equipment box	1	102-2138600
	43	Engine electrical equipment box assembly	1	200-2164300
	41-3	Relay bracket	1	102-4584600
	41-2	Relay	3	349S55626000
	41-1	Relay harness	1	200-3351900
	41	Relay harness assembly	1	200-3344600
	39	Controller harness of upper part [SN:-MK0049] Controller harness of upper part [SN:MK0050-]	1 1	200-2171700 200-2178700
	37-6	Attenuator for CAN	1	200-4665700
	37-5	Blanking	1	200-4665600
	37	Display harness	1	200-3344900
	36	Remote controller relay harness	1	200-4630500
	35-40	Fusible link 0.3	2	200-4643400
	35	Lower part controller harness [SN:-MK0049] Lower part controller harness [SN:MK0050-]	1 1	200-2171800 200-2181700
	33-10	Plug	1	200-4660800
	33-9	Short plug	1	200-4660700
	33	Extension harness	1	200-3344700
	32	Sensor and upper and lower relay harness [SN:-MK0049] Sensor and upper and lower relay harness [SN:MK0050-]	1 1	200-3345100 200-3382600
	31	Outrigger sensor harness	4	200-3345000
	23	Sems bolt	4	01024-80616 (Komatsu item number)
	22	Connector bracket cover	2	102-3322300

Marking	Number	Name	Q'ty For one piece	Note
	21	Sems bolt	8	01024-80616 (Komatsu item number)
	20	Connector bracket	2	200-3355200
	19	Sems bolt	4	01024-80616 (Komatsu item number)
	18	Connector bracket	2	200-4638300
	17	Sems bolt	4	0124-80616 (Komatsu item number)
	16	Current limiter bracket	1	102-4584900
	15	Connector bracket I	1	200-4639400
	14	Sems bolt	2	01024-80612 (Komatsu item number)
	13	Connector bracket H	1	102-4597000
	12	Sems bolt	4	01024-80616 (Komatsu item number)
	11	Relay bracket cover	1	102-4584700
	10	Sems bolt	2	01024-80816 (Komatsu item number)
	9	Connector bracket	1	200-4639500
	8	Sems bolt	2	01024-80612 (Komatsu item number)
	7	Connector bracket H	1	200-4639300
	4	Sems bolt	2	01024-80816 (Komatsu item number)
	3	Connector bracket E	1	200-3350500
	2	Sems bolt	2	01024-80816 (Komatsu item number)
	1	Connector bracket D	1	200-4639200

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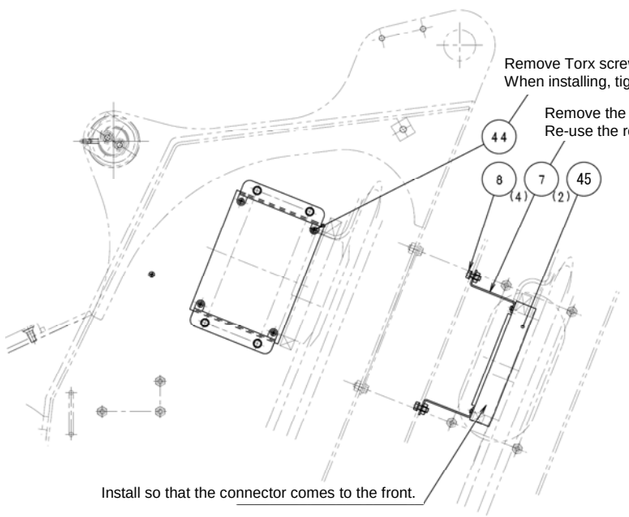
18.1.2 WIRE HARNESS OF MACHINE BODY (2)



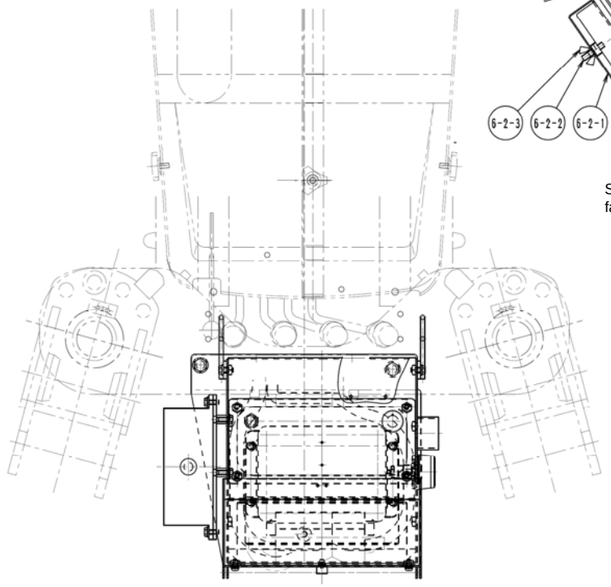
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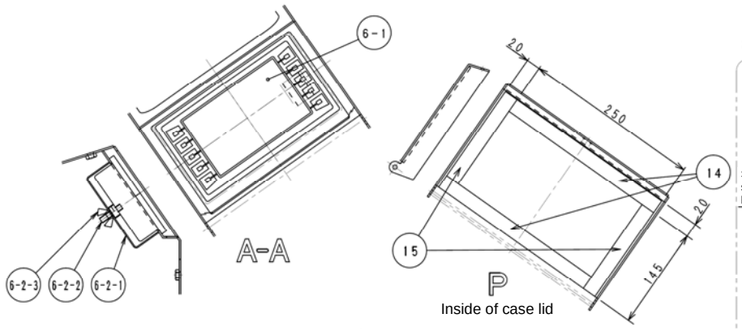
18.2 CONTROL UNIT ASSEMBLY

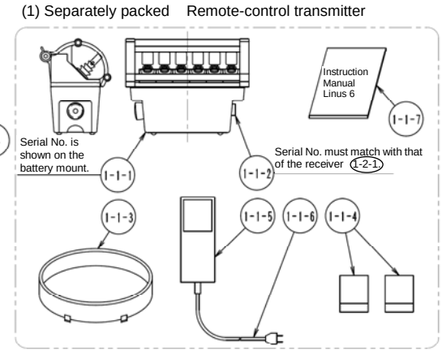
200-1172400

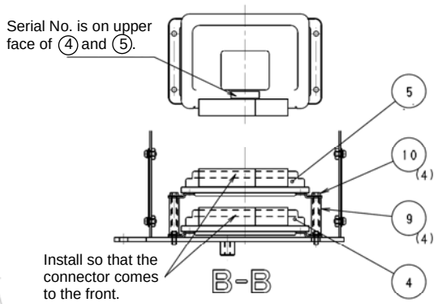


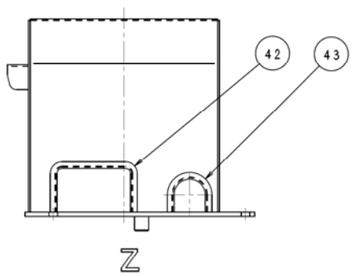
Detail of controller at post part



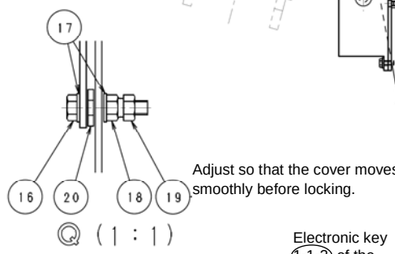




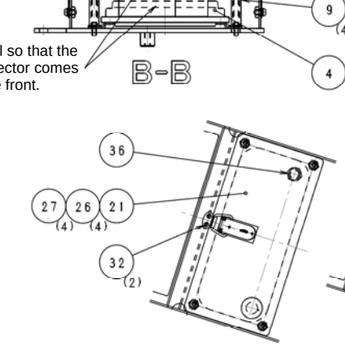


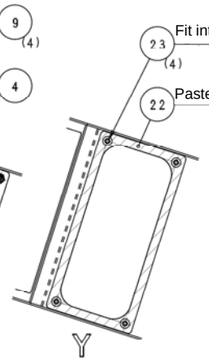


Back of the case

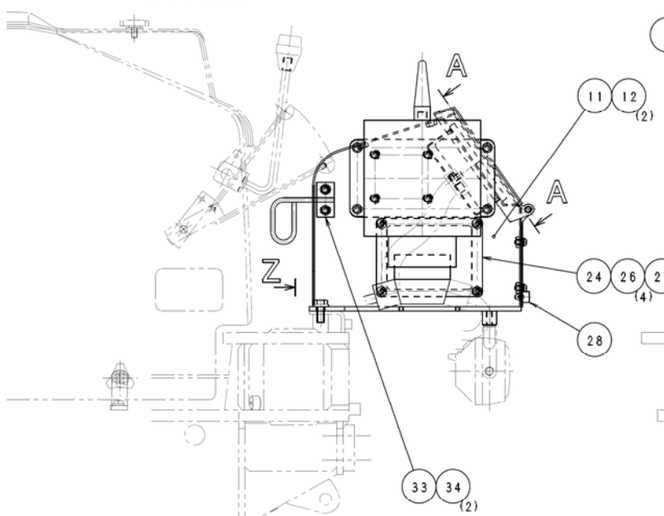


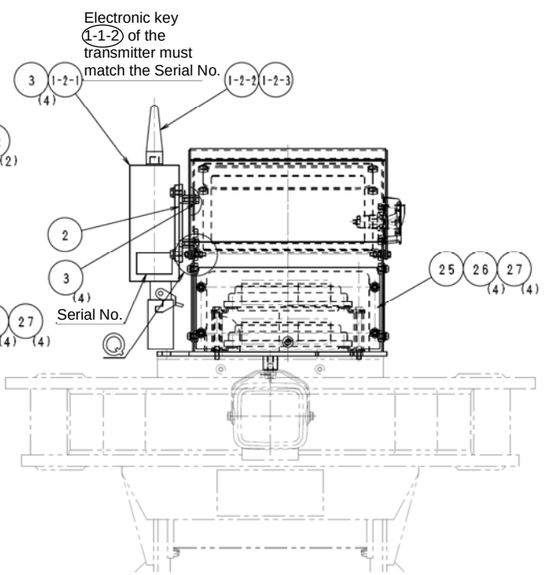
Adjust so that the cover moves smoothly before locking.

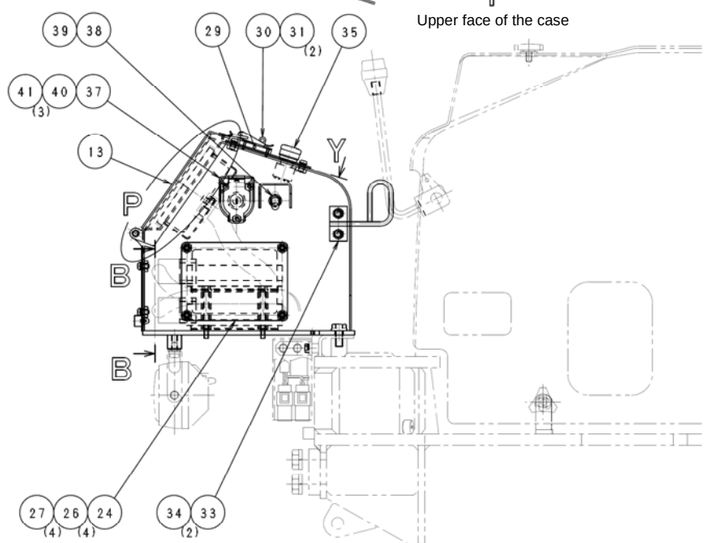




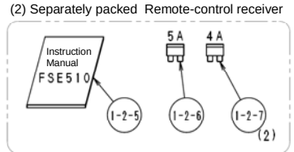
Upper face of the case







(2) Separately packed Remote-control receiver



Number	Name	Q'ty For one piece	Material	Note
45	TTC36X-2	1		
44	Cross recessed pan head tapping screw	1		M3.5 x 0.6 x 20L-C1 type
43	Trim	1		62-24-B-3 120L
42	Trim	1		62-24-B-3 220L
41	Cross-recessed head machine screw	3		M4 x 0.7 x 12L (plated)
40	Cap for cylinder lock	1		103S99000000
39	Waterproof cap (black)	1		S101M2192030
38	Switch assembly (momentary)	1		200-4645800
37	Emergency release switch	1		S103L2083180
36	Horn switch	1		S103L2083150
35	Emergency stop SW	1		S102M2541000
34	Sems bolt	4		01024-80616 (Komatsu item number)
33	Hose guide	2		200-4633300
32	Cross recessed countersunk head screw	2		M3 x 0.5 x 8L (plated)
31	Cross recessed countersunk head screw	2		M3 x 0.5 x 12L (plated)
30	Latch-lock with keyhole	1		353S86900000 (C-1012-1-1)
29	Spacer t6	1		200-4646100
28	Cushion rubber	1		27210-02000 (C-30-CS-2-EP-UL)
27	Plain washer	16		M6 x Regular circle (black plated)
26	Hexagon socket button head screw	16		M6 x 1.0 x 12L (black plated)
25	Front cover	1		200-4633100
24	Side cover	2		200-4633000
23	Plain washer	4		M6 x Regular circle (plated)
22	Sheet	1		200-4646000
21	Upper surface cover	1		200-4637400
20	Duracon washer	2		21697-51300 (CC-0513-20)
19	Hexagon nut	2	4T	M5 x 0.8 x Type 1 (plated)
18	Nylon nut	2		M5 x 0.8 x Type 1 (height 6 mm) (plated)
17	Plain washer	4		M5 x Small circle (plated)
16	Hexagon head bolt	2	4.8	M5 x 0.8 x 25L (plated)
15	Packing 2	2		200-4646300
14	Packing 1	2		200-4646200
13	Case lid	1		200-4637300
12	Sems bolt	2		01024-81025 (Komatsu item number)
11	Case	1		200-1168600
10	Sems bolt	4		01024-80670 (Komatsu item number)
9	Spacer	4		200-4633400
8	Sems bolt	4		01024-80616 (Komatsu item number)
7	Controller bracket	2		200-4628800
6-2-3	Butterfly nut	1		(DIN315-M8)
6-2-2	Headless screw	1		(DIN913-M8 x 35L)
6-2-1	Bracket for panel mount	1		(Stainless made)
6-2	Panel mount set	1		S200L3152020 (10257)
6-1	Monitor 7.0	1		(eVision^2 7.0)
(6)	eVision2-7.0-1	1		
5	TTC36X-1	1		
4	TTC60-1	1		
3	Sems bolt	8		01024-80616 (Komatsu item number)
2	Receiver bracket	1		200-4633200
1-2-7	Flat fuse 4A	2		S200L3149070 (009-03-00075)
1-2-6	Flat fuse 5A	1		S200L3149060 (009-03-00067)
1-2-5	Instruction Manual FSE510	1		S200L3149050 (A0-510)
1-2-4	HAN16 connector for receiver	1		S200L3149040 (AC116043) Supplied to kernel
1-2-3	O-ring	1		S200L3149030 (003-02-00067)
1-2-2	External antenna for receiver	1		S200L3149020 (012-01-00040)
1-2-1	Main body of receiver	1		S200L3149010 (FSE510)
1-2	Receiver	1		S200L3149000
1-1-7	Instruction Manual Linus 6	1		S200L3148070 (A0L6)
1-1-6	Power supply cord for AC charger	1		S200L3148060 (AJST0277)
1-1-5	AC charger	1		S200L3148050 (QA109600)
1-1-4	NiMH battery charger	2		S200L3148040 (BA225030)
1-1-3	Waist belt	1		S200L3148030 (AS000800)
1-1-2	Electronic key	1		S200L3148020 (KSE10001)
1-1-1	Main body of transmitter	1		S200L3148010 (Linus 6)
1-1	Transmitter	1		S200L3148000
(1)	A set of radio control system	1		S200L3147000

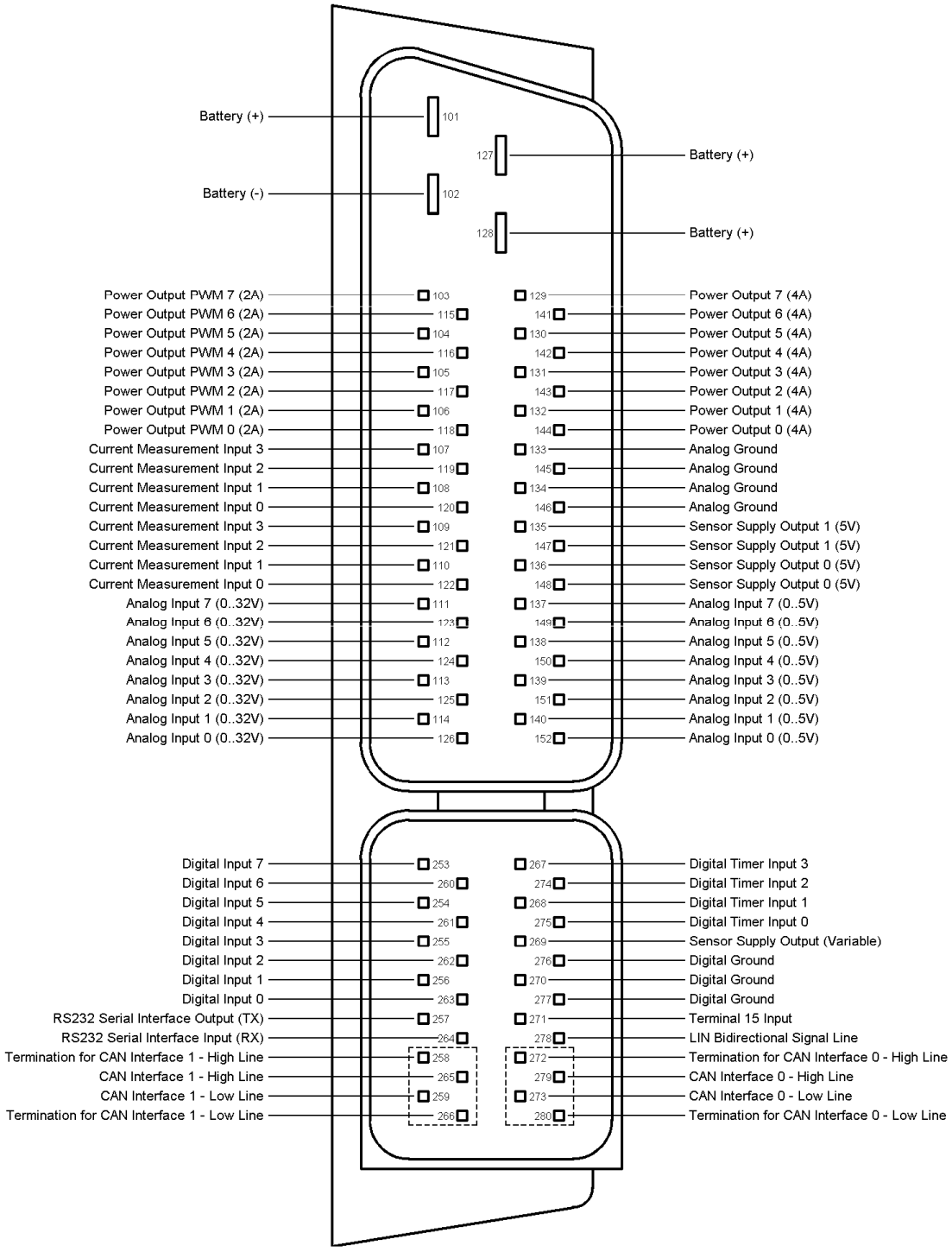
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19. CONTROL ASSEMBLY

19.1 CONTROLLER

[1] TTC60

• Pin arrangement



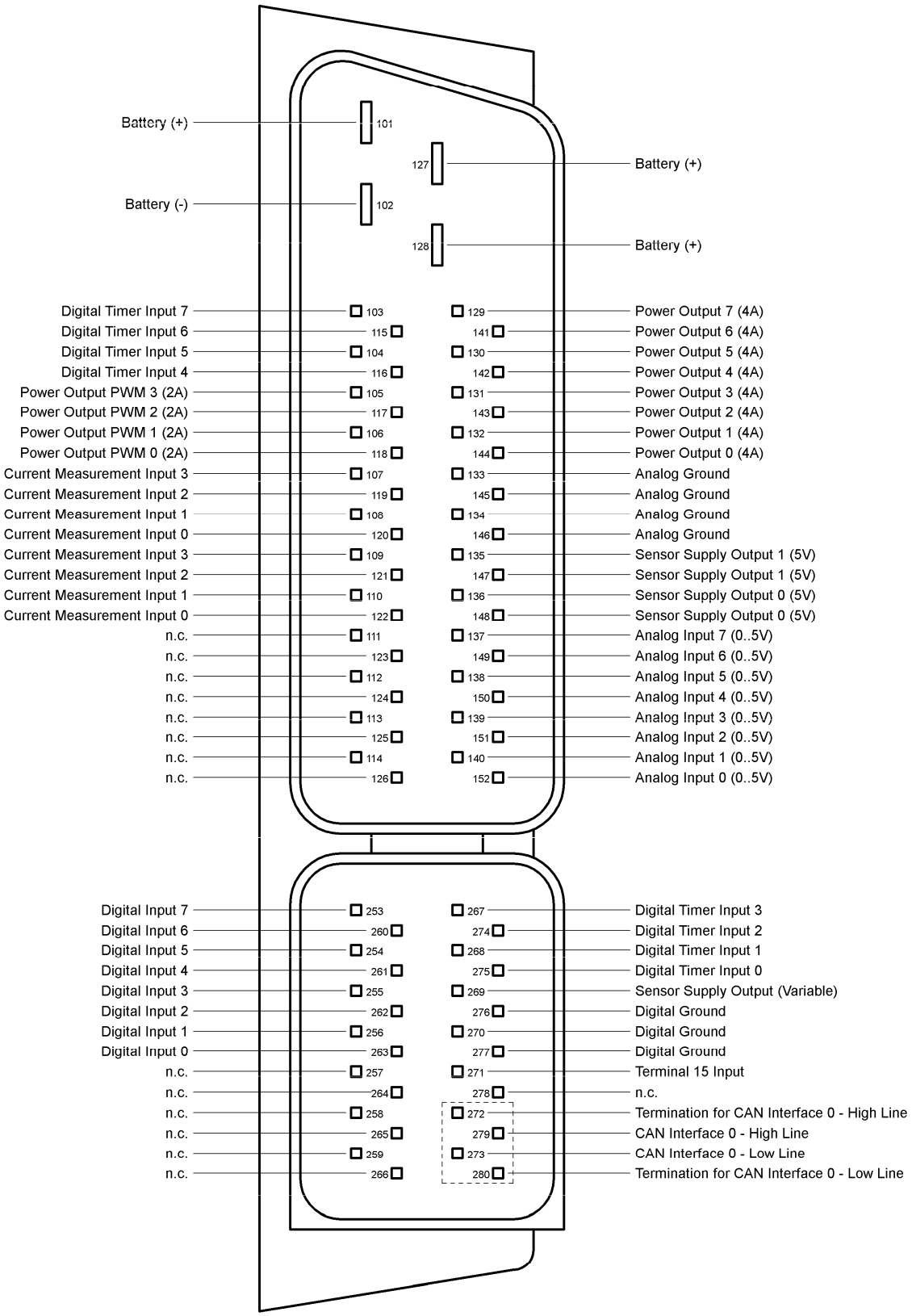
• TTC60 I/O

TTC60								
Input system	No.	Port	Function	Internal setting		Definition	Contact when Hi	Remarks
IN Analog	0	152	Fuel sender	Resistive		FULL: 40mV (9 Ω) or less EMPTY: 310mV (82 Ω) or more		
	1	140						・Rpu : 2020Ω (2.4mA) ・Rpd : 220Ω (4-20mA) ・Rin : 100kΩ (0.05mA)
	2	151						
	3	139						
	4	150						
	5	138						
	6	149						
	7	137						
IN Analog 32V	0	126	OR1 Extension LS	0-15V	Pull down 10k Ohm	During maximum extension: less than 5V	Open	Pull up 1.8k Ω at 12V
	1	114	OR2 Extension LS		Pull down 10k Ohm	During maximum extension: less than 5V	Open	Pull up 1.8k Ω at 12V
	2	125	OR3 Extension LS		Pull down 10k Ohm	During maximum extension: less than 5V	Open	Pull up 1.8k Ω at 12V
	3	113	OR4 Extension LS		Pull down 10k Ohm	During maximum extension: less than 5V	Open	Pull up 1.8k Ω at 12V
	4	124	OR Select	0-15V	Pull up 10k Ohm	During OR select output: Hi During manual OR: Hi	Short	
	5	112	Engine oil pressure		Pull down 10k Ohm	During abnormal case: less than 5V	Open	Pull up 1.8k Ω with two in parallel at 12V
	6	123	Engine coolant temperature		Pull down 10k Ohm	During abnormal case: less than 5V	Open	Pull up 1.8k Ω with two in parallel at 12V
	7	111	Motor-operated		Pull down 10k Ohm	When motor operated: Hi	Short	
IN Digital	0	263	Right lever LS		Pull down 1.8k Ohm	During operation: Hi	Short	・Rpu : 9kΩ (0.5mA) ・Rpd : 9kΩ (1.3mA) ・Rpd : 1.8kΩ (6.6mA)
	1	256	Left lever LS		Pull down 1.8k Ohm	During operation: Hi	Short	
	2	262	Extension lever LS		Pull down 1.8k Ohm	During operation: Hi	Short	
	3	255	Upper lever LS		Pull down 1.8k Ohm	During operation: Hi	Short	
	4	261	Lower lever LS		Pull down 1.8k Ohm	During operation: Hi	Short	
	5	254	Raising lever LS		Pull down 1.8k Ohm	During operation: Hi	Short	
	6	260	Lowering lever LS		Pull down 1.8k Ohm	During operation: Hi	Short	
	7	253	Light SW		Pull down 1.8k Ohm	When light is lit: Hi	Short	
IN Digital Timer	0	275	Emergency stop SW		Pull down 1.8k Ohm	During normal case: Hi	Short	・Rpu : 9kΩ (0.5mA) ・Rpd : 9kΩ (1.3mA) ・Rpd : 1.8kΩ (6.6mA) ・Rpd : 110Ω (7/14mA)
	1	268	Charge		Pull down 1.8k Ohm	During abnormal case: Hi	Short	
	2	274	Glow		Pull down 1.8k Ohm	During glow: Hi	Short	
	3	267	Emergency release SW		Pull down 1.8k Ohm	When released: Hi	Short	

Output system		No.	Port	Function	Internal setting				Remarks
OUT PWM		0	118	Flow control valve	High time variable	PWMCM_0	During stop: 1.35A During manual operation: 0A During RC operation: 1.28 - 0.63A, 0A		
		1	106	Accelerator valve	Low time variable	PWMCM_1	When RC is not operated: 0A When RC is operated: 0.5 - 1.15A		
		2	117						
		3	105						
		4	116						
		5	104						
		6	115						
		7	103						
OUT Low-side	(PWM Current IN)	0	120	Flow control valve					
		1	108	Accelerator valve					
		2	119						
		3	107						
		0	122						
		1	110						
		2	121						
		3	109						
OUT Hi-side		0	144	Right valve					Acceptable to check output abnormality
		1	132	Left valve					Acceptable to check output abnormality
		2	143	Contraction valve					Acceptable to check output abnormality
		3	131	Extension valve					Acceptable to check output abnormality
		4	142	Upper valve					Acceptable to check output abnormality
		5	130	Lower valve					Acceptable to check output abnormality
		6	141	Raising valve					Acceptable to check output abnormality
		7	129	Lowering valve					Acceptable to check output abnormality
Sensor supply (5V)		0	136						
		0	148						
		1	135						
		1	147						

[2] TTC36X

• Pin arrangement



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• TTC36X (lower part)　I/O

TTC36X (lower part)									
Input system	No.	Port	Function	Internal setting		Definition	Contact when Hi		Remarks
IN Analog	0	152	OR1 Reaction force	ratiometric		Voltage high when outriggers are set (Variable range: 0.5 - 4.5V)			・Rpu : 2020Ω (2.4mA) ・Rpd : 220Ω (4-20mA) ・Rin : 100kΩ (0.05mA)
	1	140	OR3 Reaction force	ratiometric		Voltage high when outriggers are set (Variable range: 0.5 - 4.5V)			
	2	151	OR2 Reaction force	ratiometric		Voltage high when outriggers are set (Variable range: 0.5 - 4.5V)			
	3	139	OR4 Reaction force	ratiometric		Voltage high when outriggers are set (Variable range: 0.5 - 4.5V)			
	4	150	Inclination sensor X	ratiometric		When neutral 2.5V When 3°: 2.25V or 2.75V When 15° 1.3V or 3.7V (Variable range: 0.3 - 4.7V)			
	5	138	Inclination sensor Y	ratiometric		When neutral 2.5V When 3°: 2.25V or 2.75V When 15° 1.3V or 3.7V (Variable range: 0.3 - 4.7V)			
	6	149							
	7	137							
IN Digital	0	263	Slewing position lower LS		Pull down 10k Ohm	When OR2 or 3 side: Low	Open	Pull up 1.8k Ω at 12V	・Rpu : 9kΩ (0.5mA) ・Rpd : 9kΩ (1.3mA) ・Rpd : 2kΩ (6.0mA)
	1	256	OR1 R maximum LS		Pull down 10k Ohm	When maximum: Low	Open	Pull up 1.8k Ω at 12V	
	2	262	Slewing position upper LS		Pull down 10k Ohm	When OR1 or 2 side: Low	Open	Pull up 1.8k Ω at 12V	
	3	255	OR2 R maximum LS		Pull down 10k Ohm	When maximum: Low	Open	Pull up 1.8k Ω at 12V	
	4	261							
	5	254	OR3 R maximum LS		Pull down 10k Ohm	When maximum: Low	Open	Pull up 1.8k Ω at 12V	
	6	260							
	7	253	OR4 R maximum LS		Pull down 10k Ohm	When maximum: Low	Open	Pull up 1.8k Ω at 12V	
IN Digital Timer	0	275	Slewing stowage LS		Pull down 10k Ohm	When in stowage position: Low	Open	Pull up 1.8k Ω at 12V	・Rpu : 9kΩ (0.5mA) ・Rpd : 9kΩ (1.3mA) ・Rpd : 1.8kΩ (6.6mA) ・Rpd : 110Ω (7/14mA)
	1	268							
	2	274							
	3	267							
	4	116	OR1 R stowage LS		Pull down 10k Ohm	When in stowage position: Low	Open	Pull up 1.8k Ω at 12V	・Rpu : 9kΩ (0.5mA) ・Rpd : 9kΩ (1.3mA)
	5	104	OR2 R stowage LS		Pull down 10k Ohm	When in stowage position: Low	Open	Pull up 1.8k Ω at 12V	
	6	115	OR3 R stowage LS		Pull down 10k Ohm	When in stowage position: Low	Open	Pull up 1.8k Ω at 12V	
	7	103	OR4 R stowage LS		Pull down 10k Ohm	When in stowage position: Low	Open	Pull up 1.8k Ω at 12V	

Output system		No.	Port	Function	Internal setting					Remarks
OUT PWM		0	118							
		1	106							
		2	117							
		3	105							
OUT Low-side	(PWM Current IN)	0	120							
		1	108							
		2	119							
		3	107							
		0	122	Horn output						
		1	110							
		2	121							
		3	109							
OUT Hi-side		0	144	Engine start RY						
		1	132	OR select valve						
		2	143	Engine stop RY						
		3	131	Emergency stop valve						
		4	142							
		5	130	Inclination sensor power supply						Acceptable to check output abnormality
		6	141	Emergency release/inclination buzzer output						Acceptable to check output abnormality
		7	129	Light						Acceptable to check output abnormality
Sensor supply (5V)		0	136							
		0	148	OR1/4 Reaction force						
		1	135							
		1	147	OR2/3 Reaction force						

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• TTC36X (upper part) I/O

TTC36X (upper part)								
Input system	No.	Port	Function	Internal setting		Definition	Contact when Hi	Remarks
IN Analog	0	152	Main boom angle	ratiometric				・Rpu：2020Ω (2.4mA) ・Rpd：220Ω (4-20mA) ・Rin：100kΩ (0.05mA)
	1	140	Jib angle	ratiometric				
	2	151	Main boom length	ratiometric				
	3	139	Jib length	ratiometric				
	4	150	Pressure sensor 1	ratiometric				
	5	138	Pressure sensor 2	ratiometric				
	6	149	Slewing angle 1	ratiometric				
	7	137	Slewing angle 2	ratiometric				
IN Digital	0	263	Dead turns stop LS		Pull down 1.8k Ohm	During dead turns: Open (Low)	Short	・Rpu：9kΩ (0.5mA) ・Rpd：9kΩ (1.3mA) ・Rpd：2kΩ (6.0mA)
	1	256	Overwinding detection LS		Pull down 1.8k Ohm	During overwinding: Open (Low)	Short	
	2	262	Boom angle lower limit LS		Pull down 1.8k Ohm	When at lower limit: Short (Hi)	Short	
	3	255						
	4	261						
	5	254	Boom angle upper limit LS		Pull down 1.8k Ohm	When at upper limit: Short (Hi)	Short	
	6	260						
	7	253						
IN Digital Timer	0	275						・Rpu：9kΩ (0.5mA) ・Rpd：9kΩ (1.3mA) ・Rpd：1.8kΩ (6.6mA) ・Rpd：110Ω (7/14mA)
	1	268						
	2	274						
	3	267						
	4	116						・Rpu：9kΩ (0.5mA) ・Rpd：9kΩ (1.3mA)
	5	104						
	6	115						
	7	103						

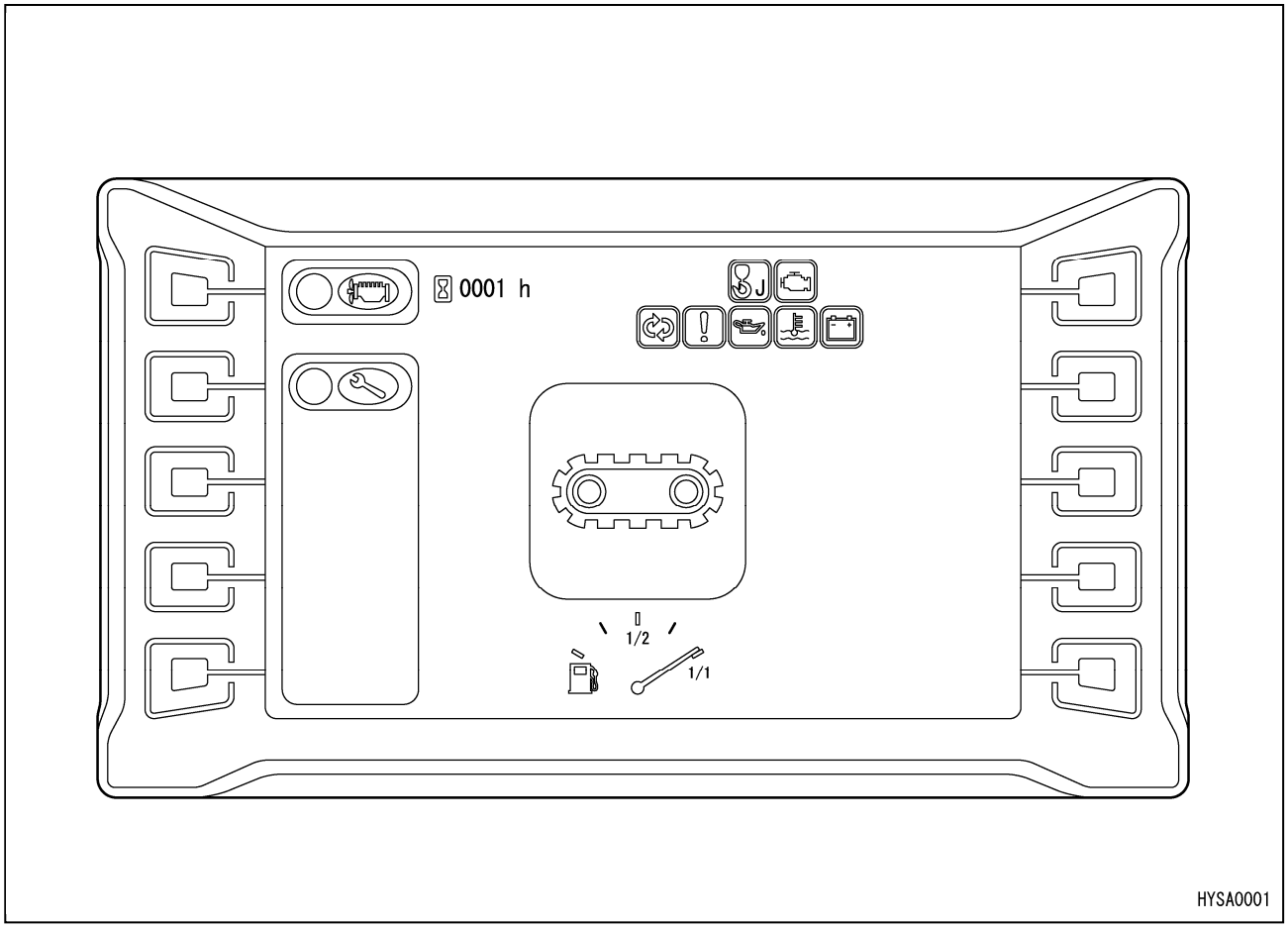
Output system		No.	Port	Function	Internal setting				Remarks
OUT PWM		0	118						
		1	106						
		2	117						
		3	105						
OUT Low-side	(PWM Current IN)	0	120						
		1	108						
		2	119						
		3	107						
		0	122						
		1	110						
		2	121						
		3	109						
OUT Hi-side		0	144						
				LS power supply			Firm output		
		1	132	Extension/contraction switching valve 1					Acceptable to check output abnormality
		2	143	Raising/lowering switching valve 2					Acceptable to check output abnormality
		3	131	Indicator lamp: green					Acceptable to check output abnormality
		4	142	Indicator lamp: yellow					Acceptable to check output abnormality
		5	130	Indicator lamp: red					Acceptable to check output abnormality
		6	141	Overwinding sensor power supply			Firm output		
		7	129	Warning buzzer output					Acceptable to check output abnormality
Sensor supply (5V)		0	136	5V					Main boom length, angle, pressure
		0	148						
		1	135	5V					Jib length, angle
		1	147	5V					Slewing angle

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19.2 MONITOR

19.2.1 STRUCTURE OF MONITOR SCREEN

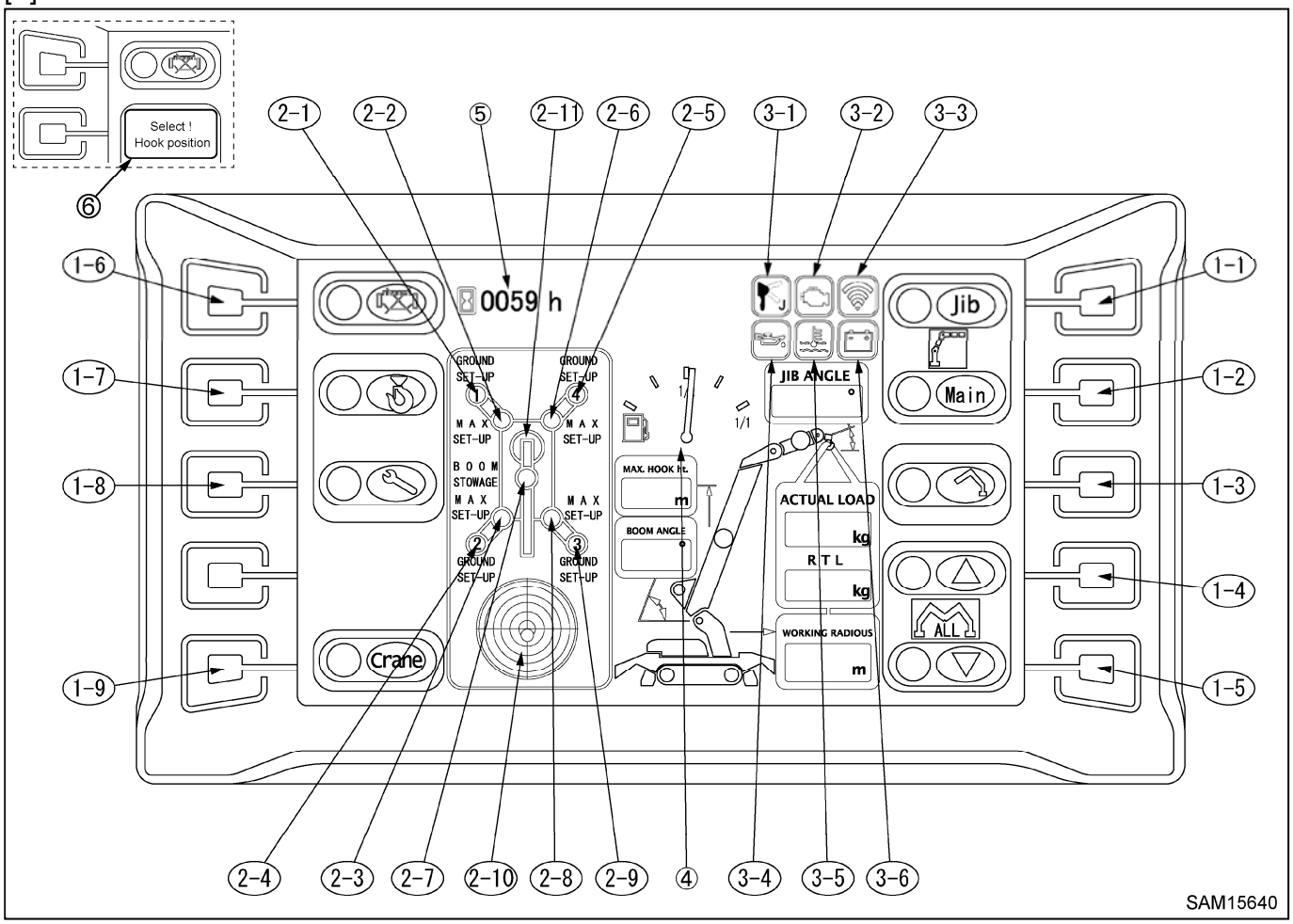
[1] Monitor 1: Travel mode screen



When all of four outriggers are in a stowed state, the travel mode screen is displayed.

When even one outrigger is cancelled from the stowed state, the screen changes to the home screen of the monitor 2.

[2] Monitor 2: Home screen



(1) Selector button
(1-1) Jib selector button
(1-2) Main boom selector button
(1-3) Individual outrigger operation selector button
(1-4) Collective outrigger (ON) button
(1-5) Collective outrigger (OFF) button
(1-6) Auxiliary starter button
(1-7) Winch setting screen selector button
(1-8) Service screen selector button
(1-9) Crane mode button

(2) Outrigger setting/Levelling instrument display
(2-1) No. 1 Outrigger setting lamp
(2-2) No. 1 Outrigger extension lamp (MAX)
(2-3) No. 2 Outrigger extension lamp (MAX)
(2-4) No. 2 Outrigger setting lamp
(2-5) No. 4 Outrigger setting lamp
(2-6) No. 4 Outrigger extension lamp (MAX)
(2-7) Jib and main boom stowage lamp
(2-8) No. 3 Outrigger extension lamp (MAX)
(2-9) No. 3 Outrigger setting lamp
(2-10) Levelling instrument
(2-11) Main boom slewing position lamp

(3) Engine/crane monitor display
(3-1) Hook mode display
(3-2) Engine/electric motor mode display
(3-3) Remote control mode display
(3-4) Engine oil pressure abnormality display
(3-5) Engine water temperature abnormality display
(3-6) Charge abnormality display

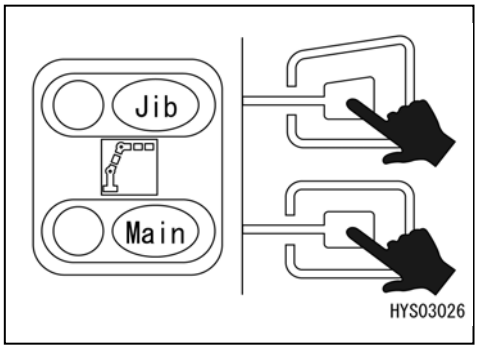
(4) Fuel gauge
(5) Hour meter/clock display
(6) Fixed hook caution display

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(1) Selector button

(1-1) Jib selector button

Use this switch to change between the jib and main boom.
When the jib selector button is pressed, the display on the left turns from blue to green and the jib is selected.

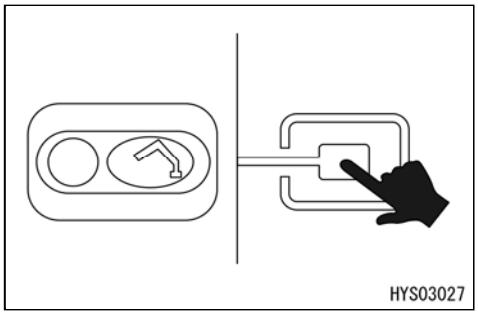


(1-2) Main boom selector button

Use this switch to change between the main boom and jib.
When the main boom selector button is pressed, the display on the left turns from blue to green and the main boom is selected.

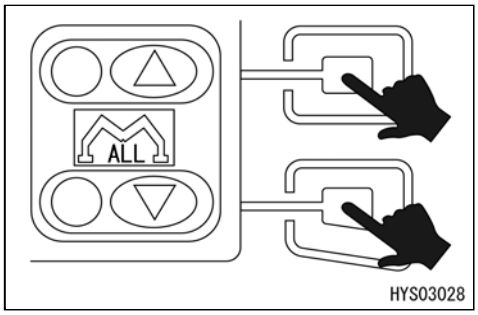
(1-3) Individual outrigger operation selector button

Use this button to change to the outrigger individual operation mode.
When “Individual outrigger operation selector button” is pressed, the screen changes to the outrigger individual operation screen of the monitor 3.



(1-4) Collective outrigger (ON) button

Use this switch to operate the 4 outriggers simultaneously.
When “Collective outrigger (ON) button” is pressed, the four outrigger cylinders contract simultaneously and the outriggers can be stowed.



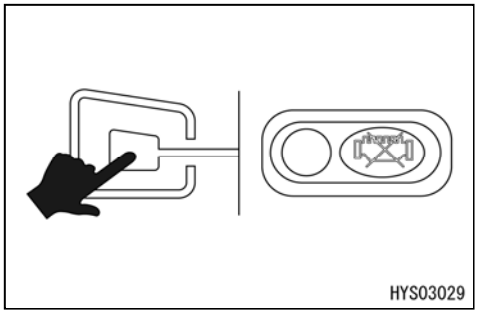
(1-5) Collective outrigger (OUT) button

Use this switch to operate the 4 outriggers simultaneously.
When “Collective outrigger (OUT) button” is pressed, the four outrigger cylinders extend simultaneously and the outriggers can be set.

(1-6) Auxiliary starter button

Use this switch to start and stop the engine.

- Start: When the “auxiliary starter button” is pressed with the engine stopped while the circle on the left is green, the engine starts.
- Stop: When the auxiliary starter switch is pressed during operation of the engine while the circle on the left is red, the engine stops.

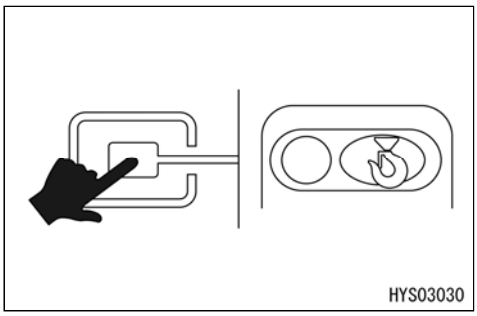


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(1-7) Winch setting screen selector button

Use this button to change the display to the screen with which to set the winch condition (fixed or single fall hook).

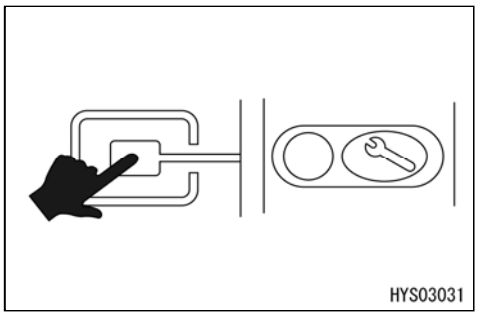
Refer to “ [4] Monitor 4: Hook selector screen ” for setting contents.



(1-8) Service screen selector button

Use this switch to display the service content.

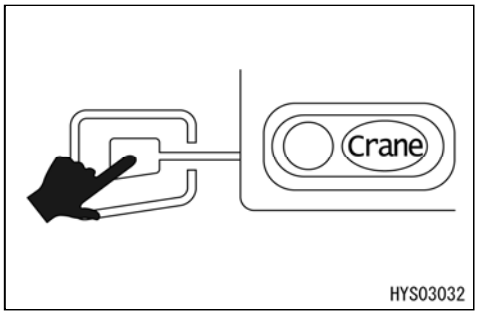
When “Service screen selector button” is pressed, the screen changes to the service screen of the monitor 5.



(1-9) Crane mode button

Use this button to change to the crane mode.

Set up the outrigger securely by referring to “Operation 2.12 Setting Up the Outrigger”. Then, press the “crane mode” button. After the circle on the left turns from red to green and the mode changes to crane, the crane comes ready for operation.



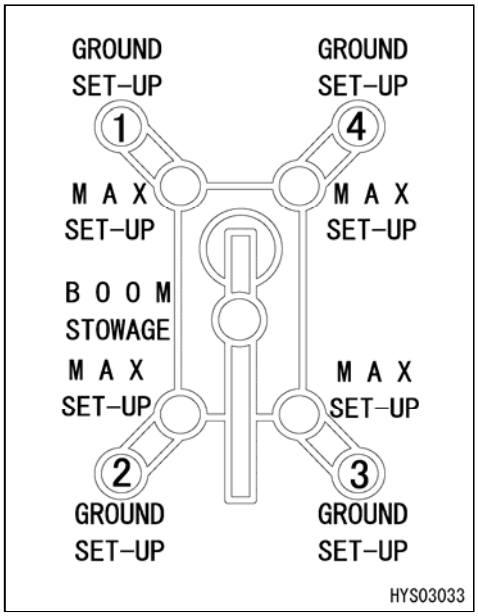
https://truckmanualshub.com/

(2) Outrigger setting/Levelling instrument display

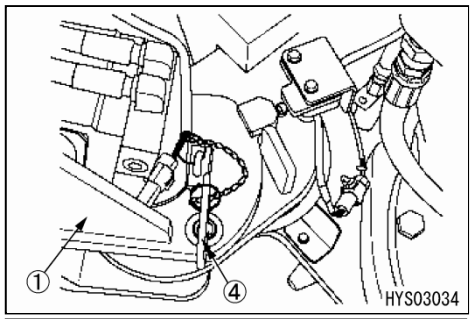
⚠ WARNING

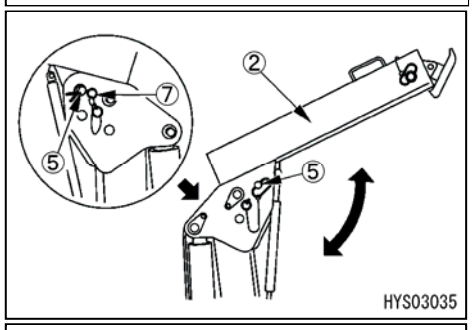
- Do not remove, disassemble, or repair detection switches. Do not move the detection switches from the original location to another.
- If you hit detection switches or find damage to the detection switches, be sure to check the ON/OFF operation of the lamps on the outrigger display and operation of the crane interlock function and outrigger interlock function.
- When setting the outriggers, check that position pins are properly inserted before use.

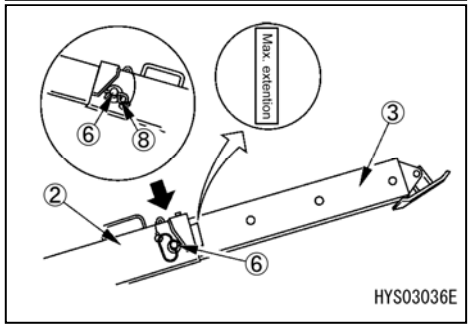
(2-1), (2-4), (2-9), and (2-5) outrigger setting lamps
This lamp turns on and indicates that the outriggers are set.
The lamp lights up in green when the outrigger tray sets, and blinks in red when the tray floats (stowed).
The conditions of the outrigger trays are detected by the detection switch at the base of the outrigger cylinder.



(2-2), (2-3), (2-8), and (2-6) outrigger extension lamps (MAX)
This lamp turns on to indicate that No. 1 outrigger rotary (1), top box (2) and inner box (3) are at the maximum position.
The extension lamp lights up in green when the No. 1 outrigger is set to the maximum and lights up in red when it is set to other position.
The conditions of the outrigger maximum extension are detected by respective detection buttons.
Be sure to insert set position pins (4), (5) and (6) and use snap pins (7) and (8) as a retainer.







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(2-7) Jib and main boom stowing lamp

This lamp turns on to indicate that the jib and main boom are stowed.

The jib and main boom stowing lamp turns on and off in accordance with the following two types of detection switches. (When both of the detection switches detect simultaneously.)

1. [Detection of stowing in the main boom slewing direction]

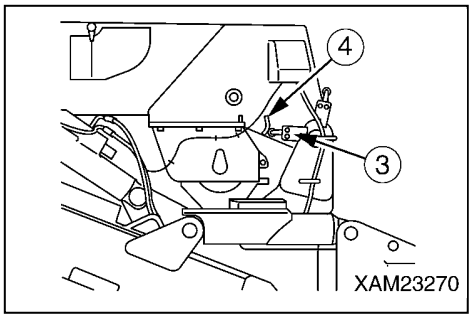
The lamp blinks when the main boom stops at the slew and stowing position and turns off when it leaves there.

Main boom movements are detected by the potentiometer on upper part of rotary joint.

2. [Detection of stowing in the main boom horizontal direction]

The lamp turns on in green when the main boom stops at the horizontal stowing position and blinks in green when it leaves there.

Main boom movements are detected by the projection (4) (movable) at the side of the boom rear edge and the detection switch (3) (fixed) at the boom connection.

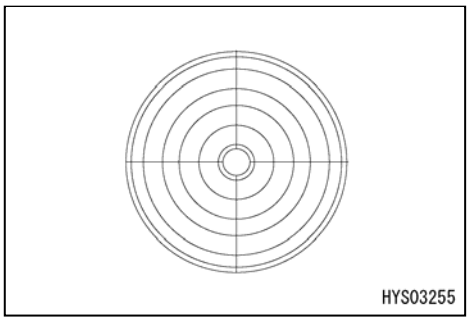


(2-10) Levelling instrument

This displays an inclination status of the machine.

The inclination and direction of the machine can be determined from the position of the yellow circle.

Use this to check whether the machine is in a horizontal condition when setting the outriggers.



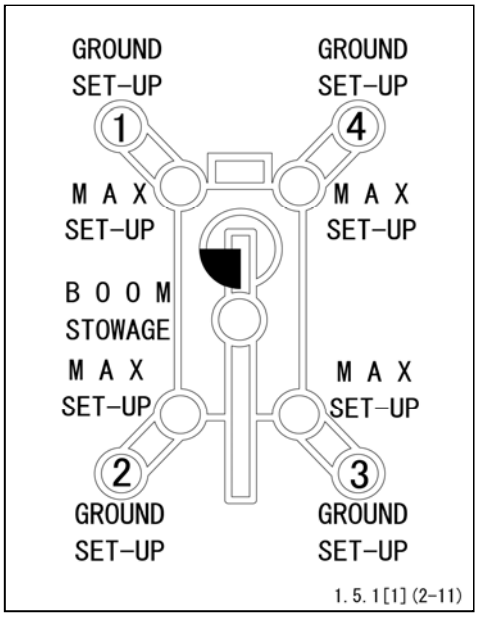
(2-11) Main boom slewing position lamp

This lamp turns on to indicate the position where the main boom is slewing.

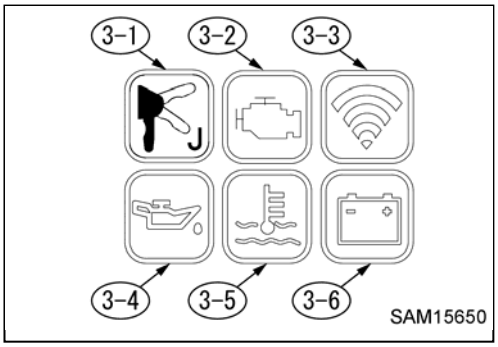
Upon slewing of the main boom, out of the four divided lamps, the one in the slewing direction turns blue.

The main boom slewing position is detected by the potentiometer on upper part of rotary joint.

NOTES
When the main boom is in the stowing direction, the entire main boom slewing position lamp turns off.



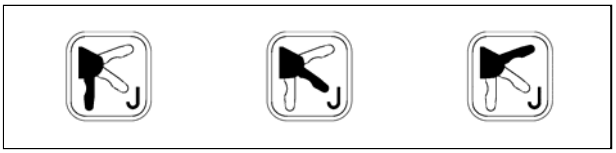
(3) Engine/crane monitor display



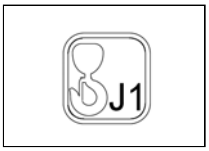
(3-1) Hook mode display

The hook condition (fixed or single fall hook) is displayed.

J: The condition is set to the fixed hook specification.
Display changes in 3 patterns depending on fixed hook position.
To change the setting, use the hook selector button on Monitor 4 hook selector screen.



J1: The condition is set to the wire 1 fall specification.
To change the setting, use the hook selector button on the monitor 4 hook selector screen.



(3-2) Engine/electric motor mode display

Engine symbol: Displayed when the engine is available.

Electric operation symbol: Displayed when electric operation is available.

(3-3) Remote control mode display

The remote control symbol is displayed when remote control operations are enabled.

(3-4) Engine oil pressure abnormality display

Indicates a drop in engine oil pressure.

It is normal if the monitor lights up when the main starter switch is turned “ON” and comes off as engine speed increases after engine start.

If the monitor lights up during operation, engine oil pressure is dropping.

Stop the operation immediately, and check the engine oil filter for clogging and the engine lubricant quantity.

(3-5) Engine water temperature abnormality display

Indicates an abnormality of engine coolant temperature.

It is normal if the monitor remains OFF during operation.

Engine coolant temperature is exceeding the normal value if the monitor lights up during operation.

Set the engine speed to low idle immediately and wait until the monitor goes OFF (engine coolant temperature drops).

Then, stop the operation and check the radiator for water leakage, radiator core for clogging and alternator belt for damage and tension.

(3-6) Charge abnormality display

Indicates an abnormality of the charging system.

It is normal if the monitor lights up when the main starter button is turned “ON” and comes off as engine speed increases after engine start.

The charging system has an error if the monitor lights up during operation.

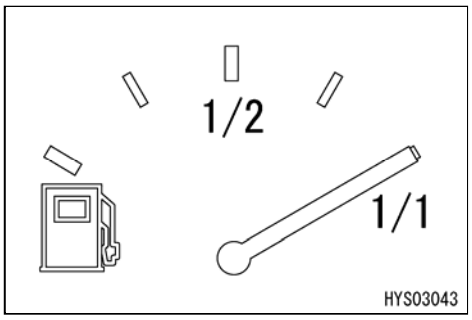
Stop the operation immediately. Then, check the tension of the alternator belt, the battery and alternator output voltages, and others.

(4) Fuel gauge

Displays the remaining amount of fuel in the tank.

The gauge displays the remaining amount of fuel when the main starter switch is turned “ON”.

If the amount of fuel has decreased on the gauge during operation, stop the operation immediately and replenish fuel.



NOTES

- Fill the fuel tank to full at the end of work for the day.
- Even if the starter switch is turned “ON”, a regular remaining amount is not displayed for a while in some cases, but this is not an error.

(5) Hour meter/clock display

Displays total operation hours of the machine.

Use this value as a reference for periodical check intervals.

When the engine is running, the meter indication advances even if the machine is not operated.

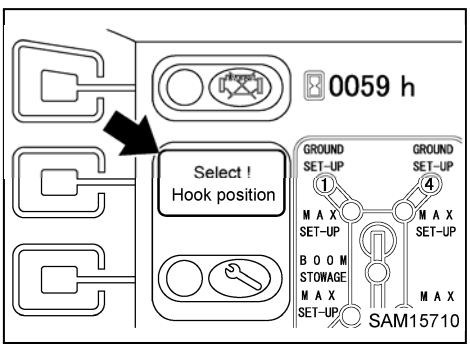
The meter indication advances “1” when the machine has been running for 1 hour regardless of the engine rotation speed.

See “(7) Display setting screen button” of “19.2.2 User mode” for switching between hour meter and clock.



(6) Fixed hook caution display

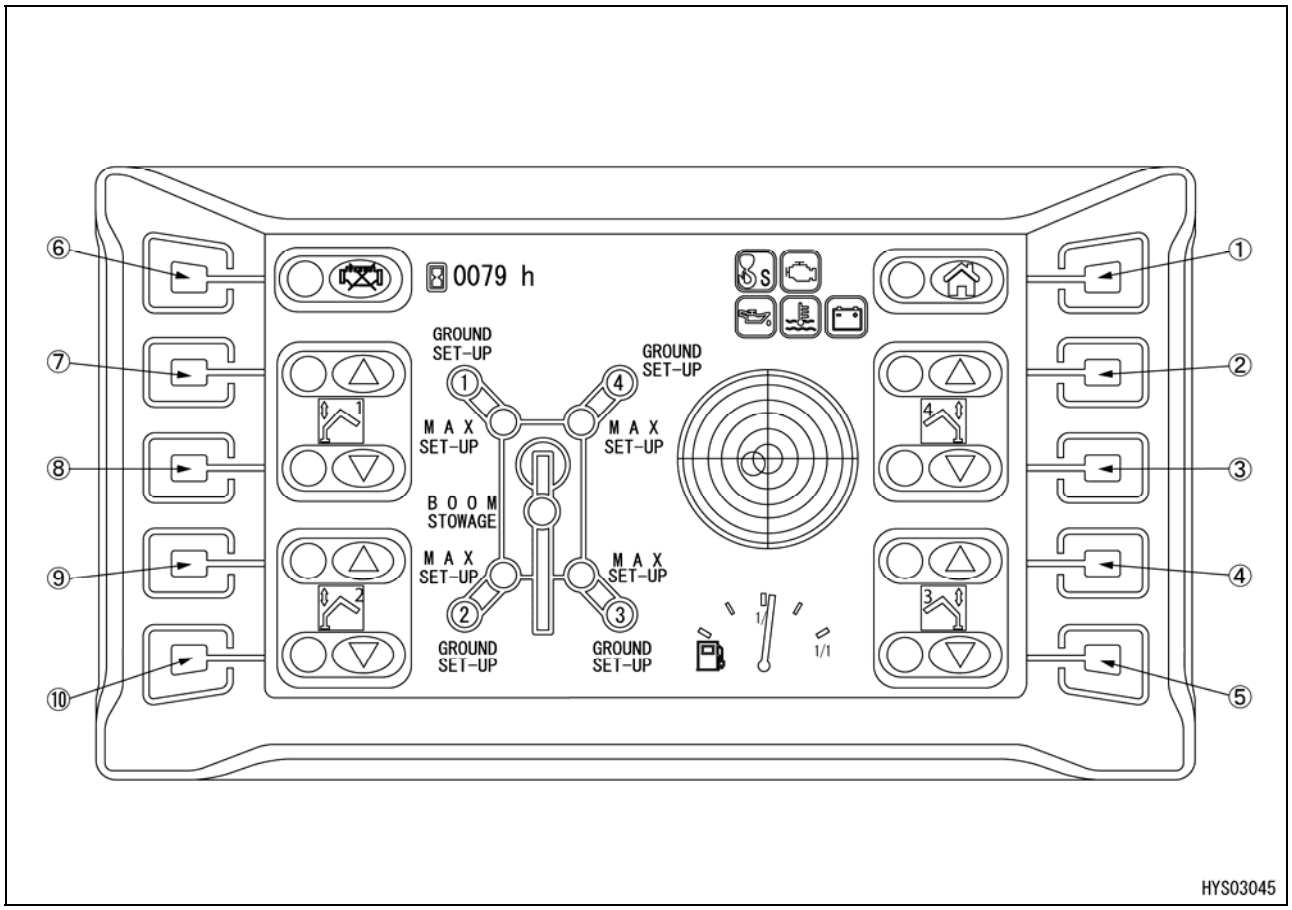
When fixed hook is selected and then return to home, message of “Select! Hook position” appears in blinking all times. If actual position of fixed hook matches, crane can be used safely even the message is shown.



[3] Monitor 3: Outrigger individual operation screen

When “Individual outrigger operation selector switch” on the Monitor 2 screen is pressed, the outrigger individual operation screen (figure below) is displayed.

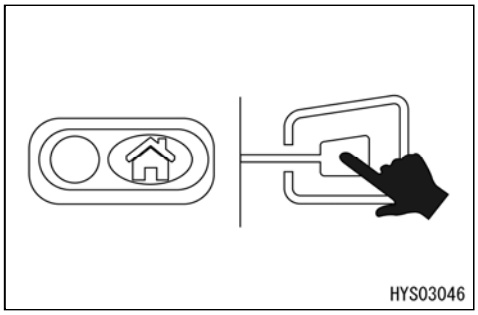
When the home button on the upper right is pressed, the screen returns to the home screen of the monitor 2.



(1) Home button
(2) No. 4 outrigger (IN) button
(3) No. 4 outrigger (OUT) button
(4) No. 3 outrigger (IN) button
(5) No. 3 outrigger (OUT) button
(6) Auxiliary starter button
(7) No. 1 outrigger (IN) button
(8) No. 1 outrigger (OUT) button
(9) No. 2 outrigger (IN) button
(10) No. 2 outrigger (OUT) button

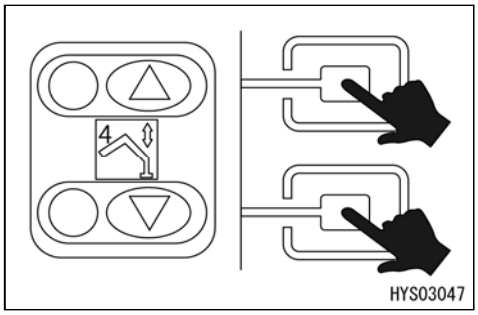
(1) Home button

When the “Home button” is pressed, the screen returns to the home screen of the monitor 2.



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(2), (4), (7), and (9) outrigger (IN) buttons
Use these buttons to stow the outriggers.
When the “Outrigger (IN) button” is pressed, the outrigger cylinders contract and the outriggers can be stowed.
When you release your finger from the button, the outrigger cylinders stop.

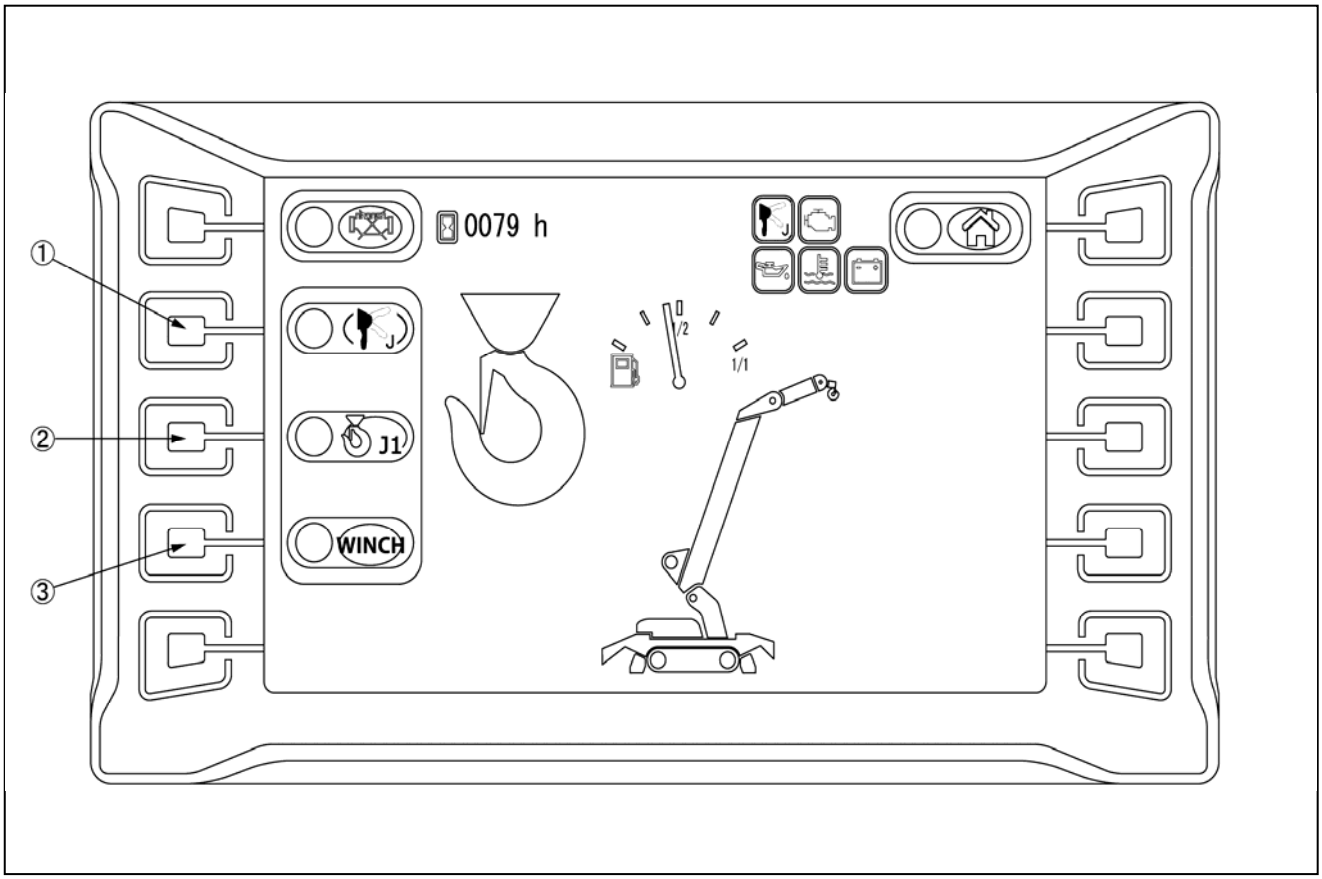


(3), (5), (8), and (10) outrigger (OUT) buttons
Use these buttons to set up the outriggers.
When the “Outrigger (OUT) button” is pressed, the outrigger cylinders extend and the outriggers can be set.
When you release your finger from the button, the outrigger cylinders stop.

[4] Monitor 4: Hook selector screen

When “Winch setting screen selector button” on the monitor 2 screen is pressed, the winch selector screen (the figure below) is displayed.

When the home button on the upper right is pressed, the screen returns to the home screen of the monitor 1.

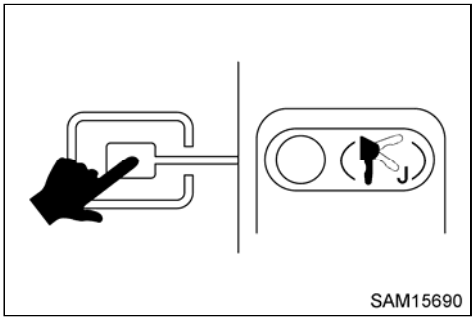


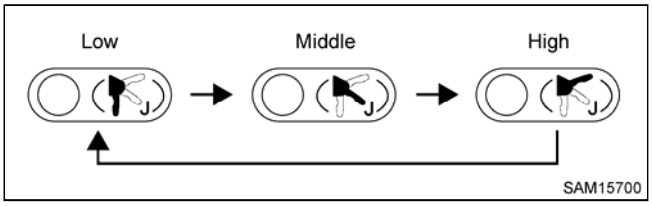
(1) Fixed hook selector button
(2) Wire single fall selector button
(3) Winch installation selector button

(1) Fixed hook selector button

When “Fixed hook selector button” is pressed, the condition is set to the fixed hook specification.

Set position of fixed hook. Display of position changes by pressing select button (1).





No winch operation can be performed.

Even if the condition is set to the fixed hook specification, select “Winch” with the winch installation selector button of (3) when the winch unit is installed on the boom.

When the setting is completed, press the home button to return to the home screen of the monitor 2.

When fixed hook is selected and then return to home, message of “Select! Hook position” appears in blinking all times. If actual position of fixed hook matches, crane can be used safely even the message is shown.

⚠ WARNING

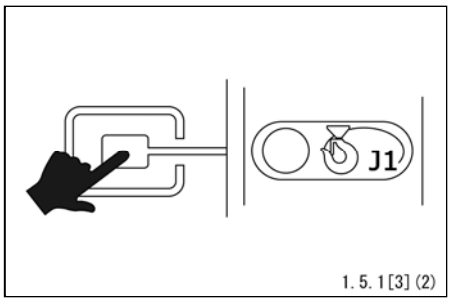
If crane is operated with setting of fixed hook position not matched to actual position, crane may tip.

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(2) Wire single fall selector button

When the “Wire single fall selector button” is pressed, the mode is set to the wire single fall specification.

“Winch installation selector button” is also automatically selected and winch operation becomes possible.



1. 5. 1 [3] (2)

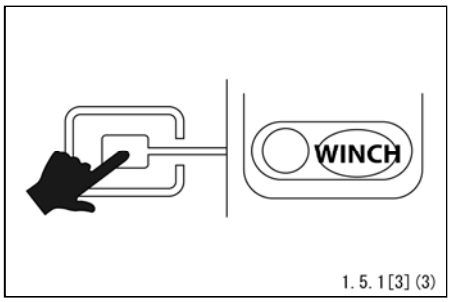
When the setting is completed, press the home button to return to the home screen of the monitor 2.

(3) Winch installation selector button

Pressing the “Winch installation selector button” turns the blue circle on the left to green and the moment limiter considers the weight of the winch unit.

Even if the winch is not used with the fixed hook specification selected, always select this mode when the winch unit is installed on the boom. (Green)

When the winch has not been installed to the boom, be sure to leave this button unselected. (Blue)



1. 5. 1 [3] (3)

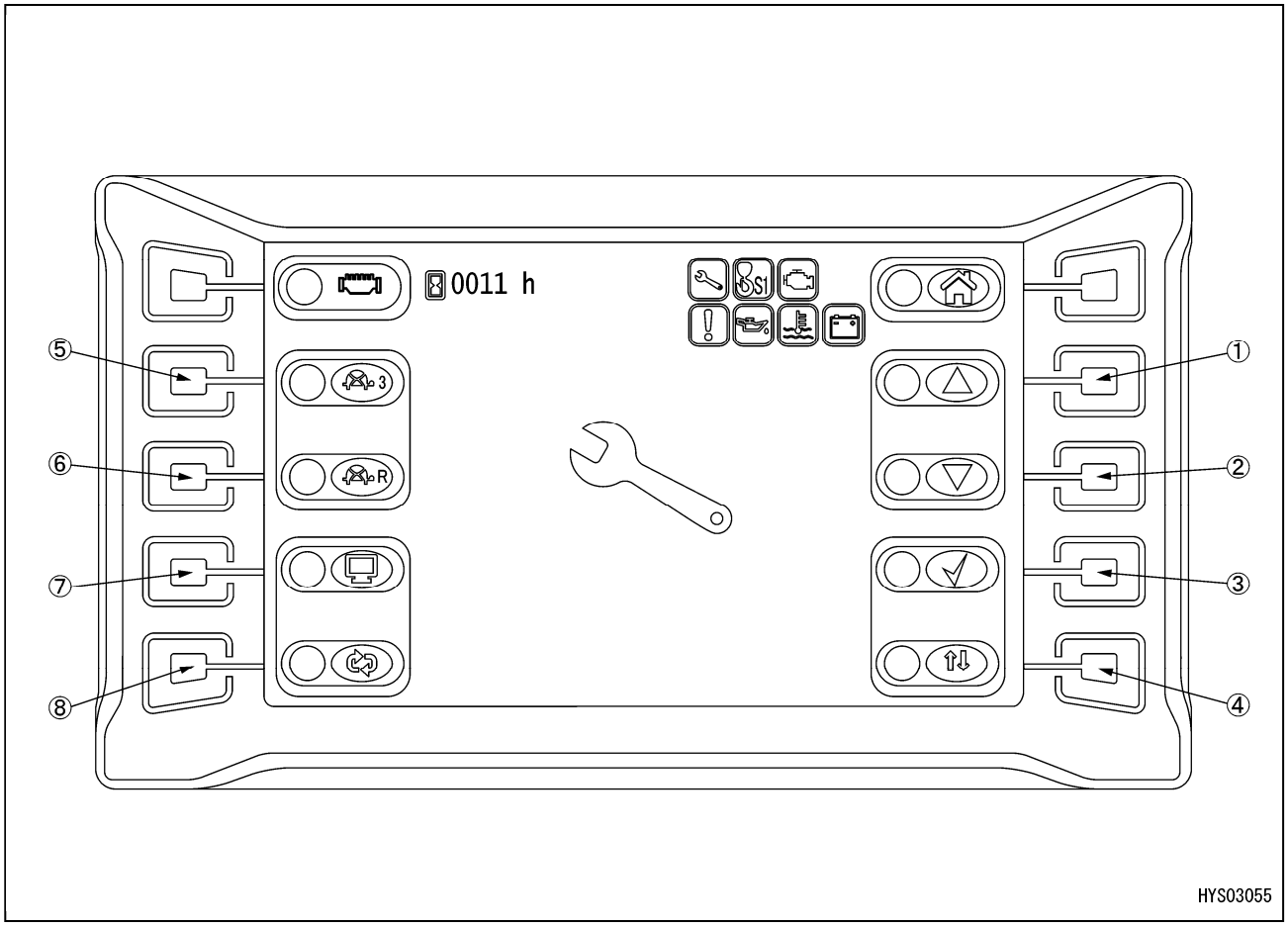
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19.2.2 USER MODE

[5] Monitor 5: User setting screen (service screen)

When “Service screen selector button” on the monitor 2 screen is pressed, the user setting screen (the figure below) is displayed.

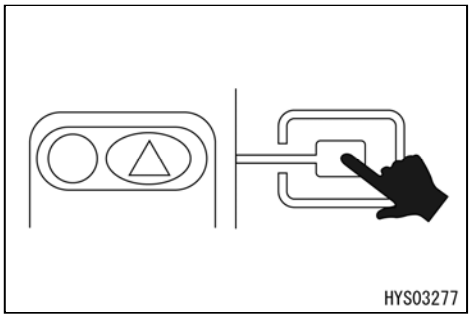
When the home button on the upper right is pressed, the screen returns to the home screen of the monitor 2.



(1) Cursor move button (▲)
(2) Cursor move button (▼)
(3) Set/OK button
(4) Page change button
(5) Micro speed 3 setting button
(6) Micro speed 3 reset button
(7) Display setting screen button
(8) Replacement part confirm button

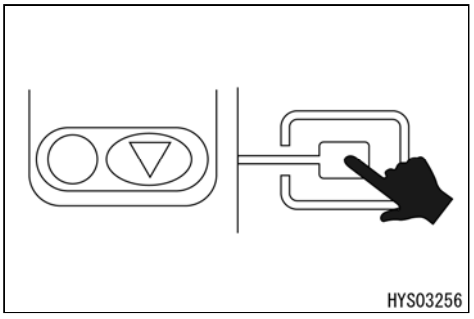
(1) Cursor move button (▲)

When “Cursor move button (▲)” is pressed, the cursor moves one step up or to the left.



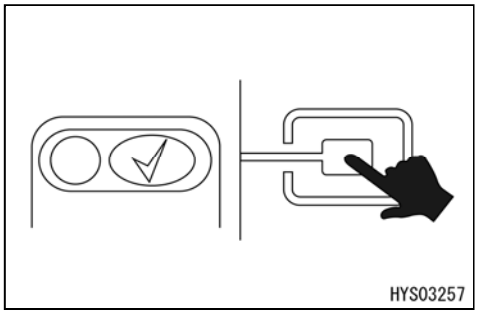
(2) Cursor move button (▼)

When “Cursor move button (▼)” is pressed, the cursor moves one step down or to the right.



(3) Set/OK button

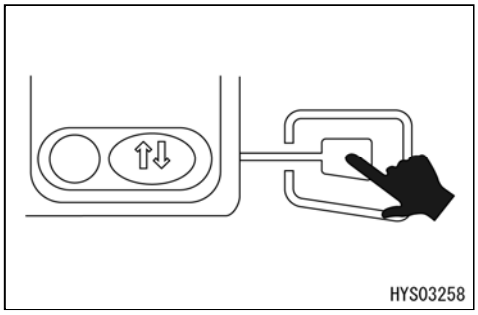
By pressing the “Set/OK button”, the item indicated by the cursor can be set and determined.



(4) Page change button

When the “Page change button” is pressed, the display changes to the next page if any.

When this button is pressed on the last page, the display changes to the first page.

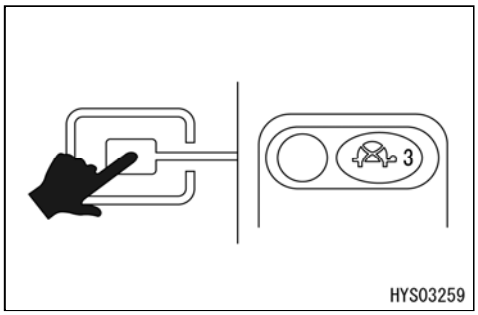


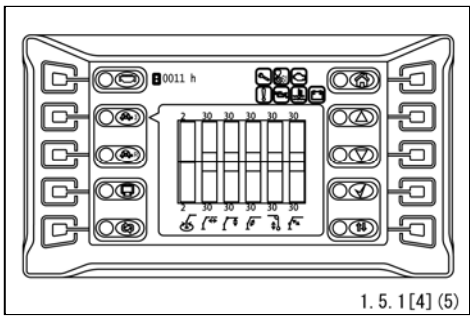
(5) Micro speed 3 setting button

When this button is pressed, the Micro Speed 3 Setting screen is displayed.

Move the cursor (▲ or ▼) to the desired item to set, and press the “Set/OK button”. The speed for that item can be set.

Adjust to arbitrary speed. By pressing the “Set/OK button” again, the adjusted speed can be determined.

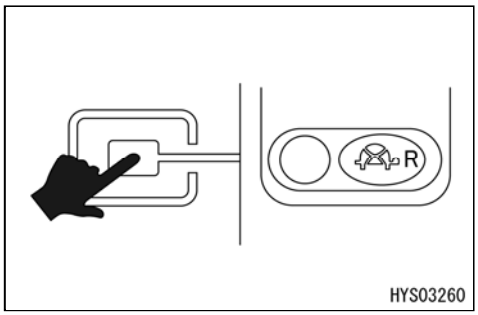




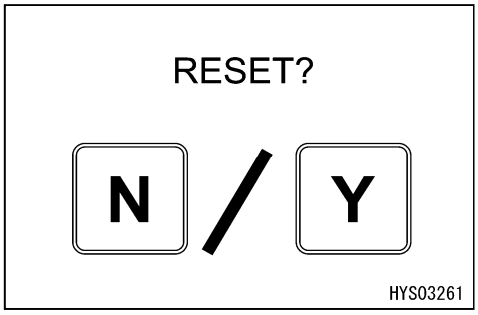
(6) Micro speed 3 seset button

By pressing this button, the setting of “Micro speed 3” can be reset.

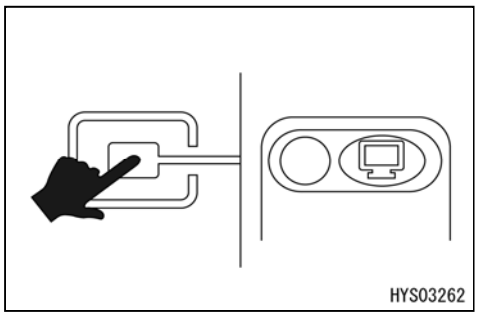
Move the cursor (▲ or ▼) to the desired item to set, and press the “Set/OK button”. That item can be determined.



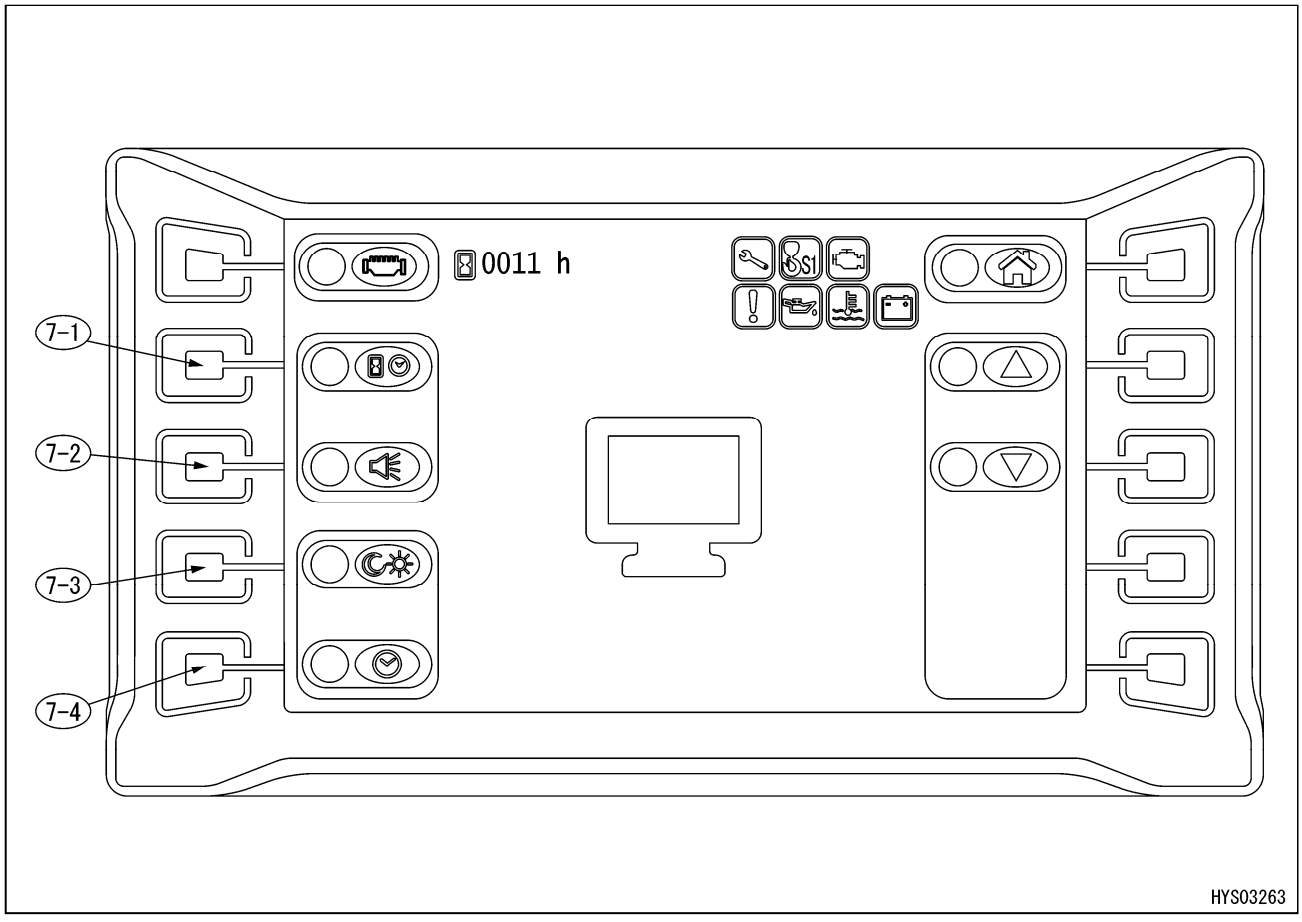
Press the “Micro speed 3 reset button” to access the screen on the right. Using a cursor move button, place the cursor in one of the following:
N: Does not perform the reset.
Y: Performs the reset.
Then, press the “Set/OK button” to determine the selection.



(7) Display setting screen button
When this button is pressed, the display changes to the Display Setting screen.



[Display Setting screen]



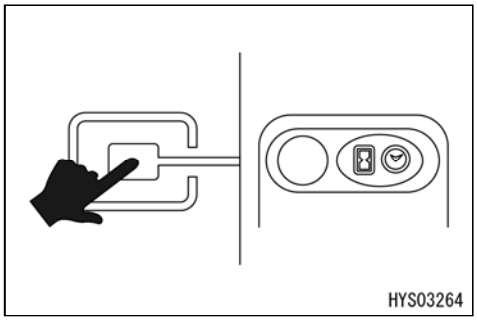
(7-1) Hour meter/clock change button
(7-2) Mute button
(7-3) Screen brightness setting button
(7-4) Clock setting button

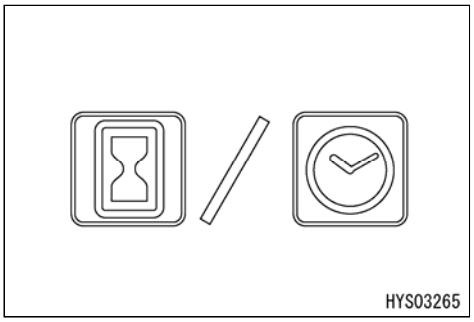
https://truckmanualshub.com/

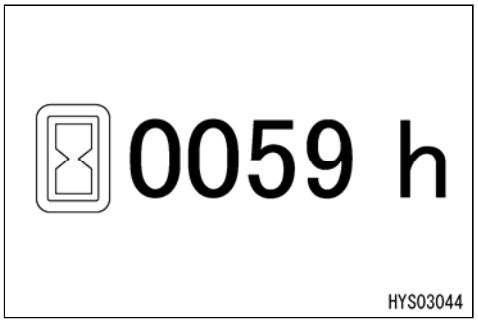
(7-1) Hour Meter/clock change button

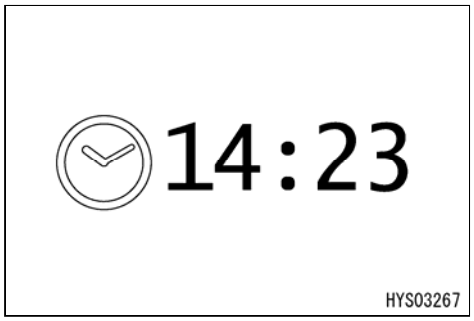
By pressing this button, the hour meter or clock display can be set.

Press the “Hour meter/clock change button”, then move the cursor (▲ or ▼) to the desired item to set. That item can be determined.





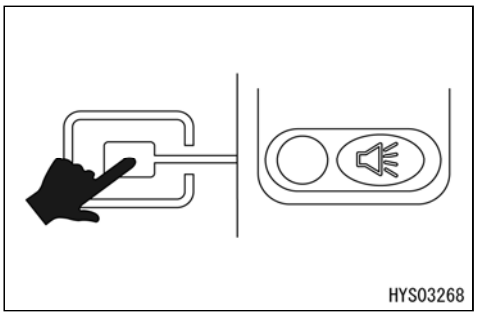




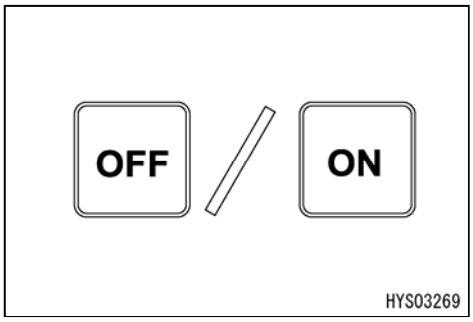
(7-2) Mute button

By pressing this button, the button tone can be set to the mute mode.

Press the “Mute button”, then move the cursor (▲ or ▼) to the desired item to set (ON or OFF). That item can be determined.



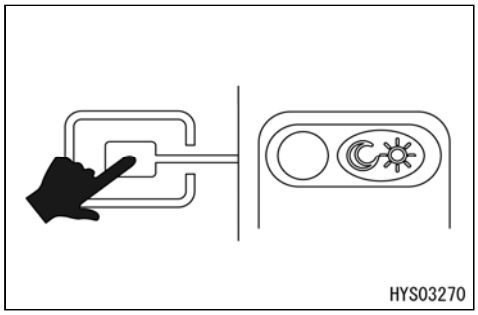
https://truckmanualshub.com/

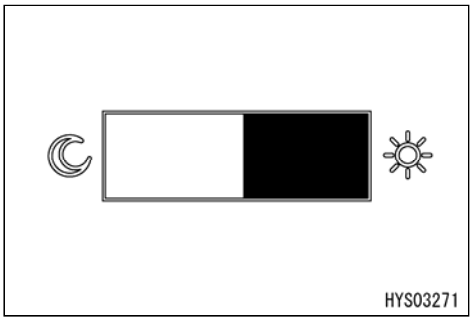


(7-3) Screen brightness setting button

By pressing this button, the screen brightness can be set.

Press the “Screen brightness setting button”, then move the cursor (▲ or ▼). The screen brightness can be adjusted and determined.





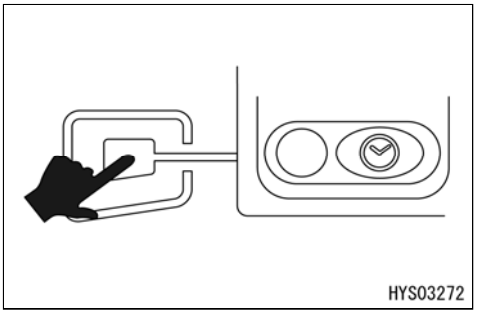
(7-4) Clock setting button

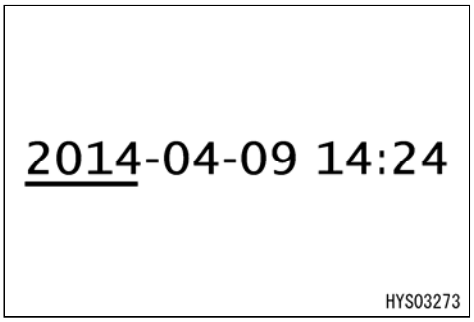
By pressing this button, the clock can be set.

Press the “Clock setting button”, then move the cursor (▲ or ▼) to the desired item to set.

By pressing the “Set/OK button”, the item indicated by the cursor can be set. The time can be adjusted by moving the cursor (▲ or ▼).

By pressing the “Set/OK button” again, the adjusted time can be determined.



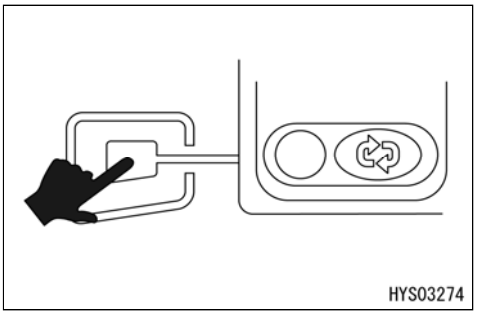


https://truckmanualshub.com/

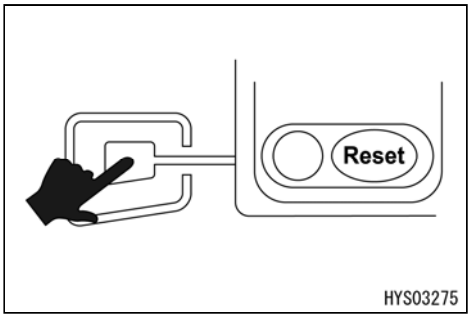
(8) Replacement part confirm button

By pressing this button, the remaining time of life of the replacement part and its expire time can be viewed and set.

Replace the part within the expire time by referring to “Inspection and Maintenance”.



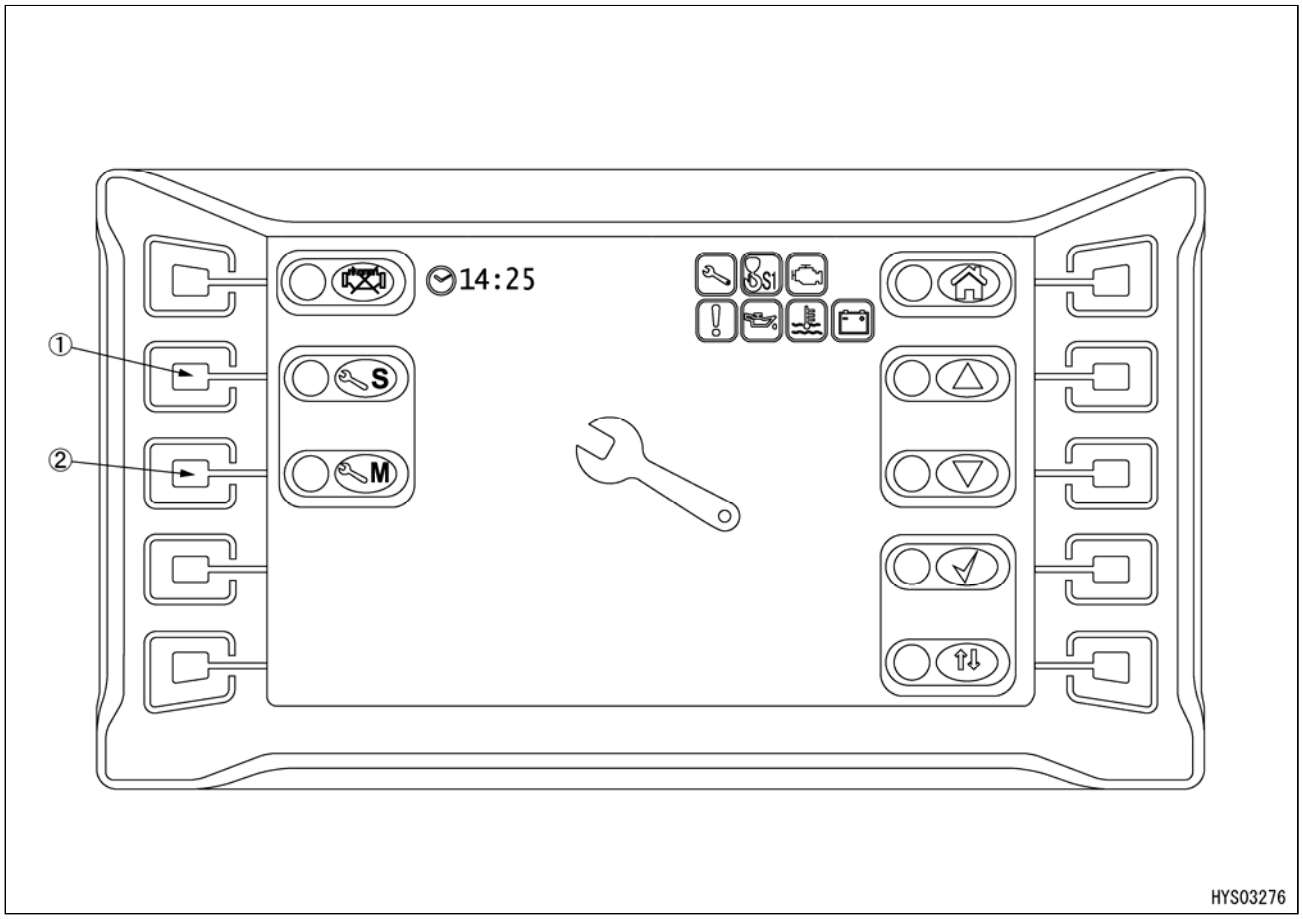
After completion of replacement, select the replaced parts with cursor (▲ or ▼) and press the “Reset button” to reset the remaining time.



[6] MONITOR 6: Service mode screen (service screen)

When “Page switching button” on the monitor 5 screen is pressed, the service mode screen (the figure below) is displayed.

When “Page switching button” is pressed again, the screen returns to the user setting screen.



(1) Service mode button

(2) Manufacturer mode button

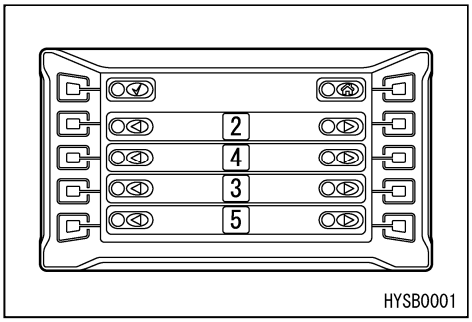
(1) Service mode button

See “19.2.3 Service mode”.

[Password input screen]

The password screen is displayed to enter “(1) Service mode”.

Input the password using the right and left buttons and press the Enter button.



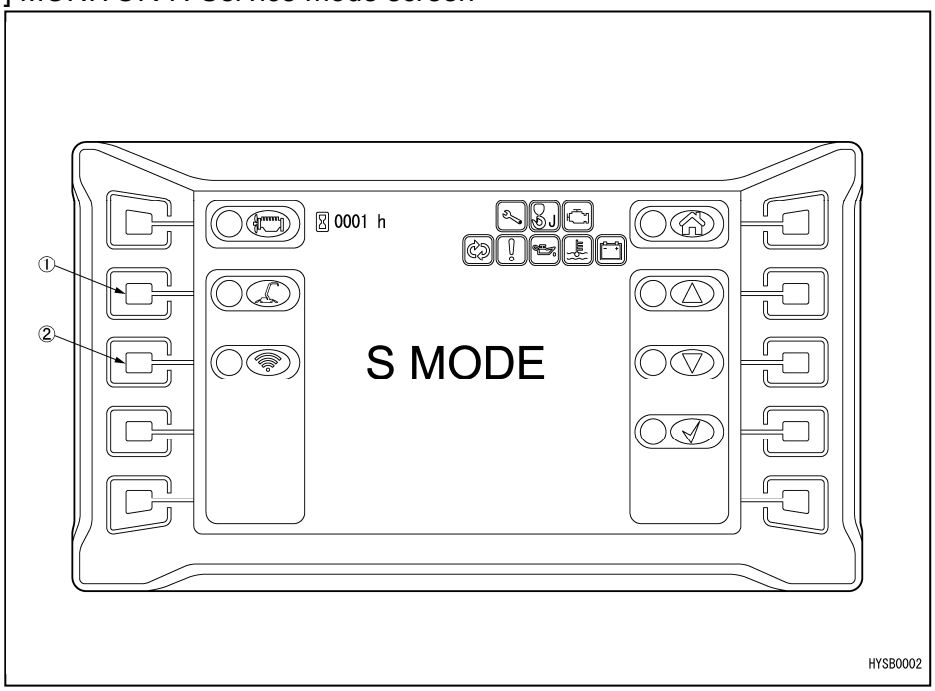
(2) Manufacturer mode button

This button is not used.

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19.2.3 SERVICE MODE

[7] MONITOR 7: Service mode screen

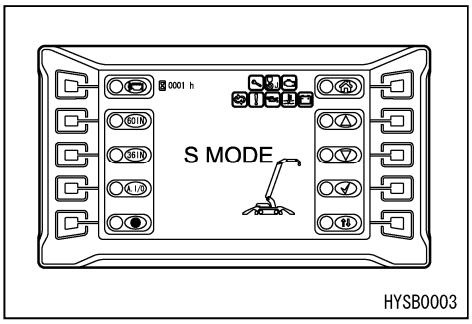


(1) Crane-related screen

(2) Remote control-related screen

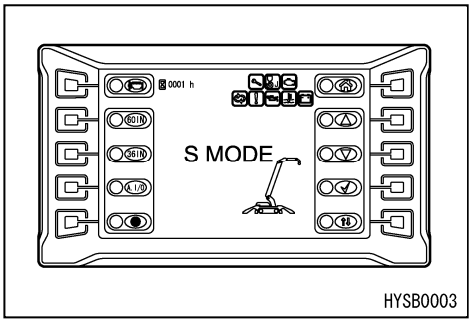
[Crane-related screen 1/2]

The page of “60 IN”, “36X IN”, “Analog I/O” or “Zero adjustment of leveling instrument” is displayed.



[Crane-related screen 2/2]

When the page switching button is pressed, the page is switched and the page of “Data logger monitoring”, “Error record”, “Moment limiter calibration mode” or “Slew angle calibration mode” is displayed.

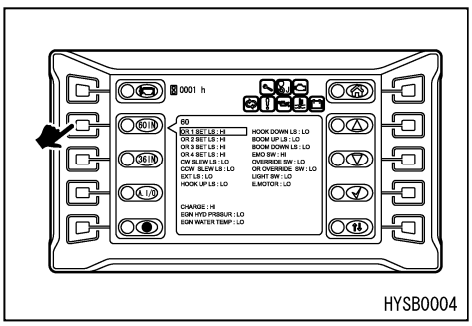


• 60IN

The input information into the controller TTC60 can be checked.

Each limit switch can be selected with ▲ or ▼.

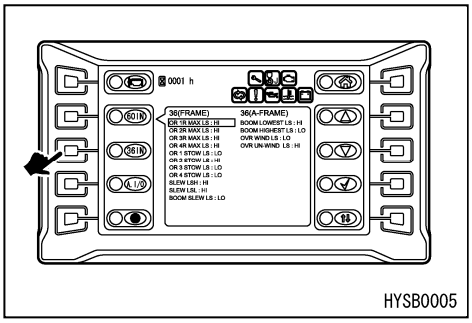
See “19.2.5 List of controller input monitoring” for details of “HI, LO” display.



• 36X IN

The input information into the controller TTC60 can be checked.

See “19.2.5 List of controller input monitoring” for details of “HI, LO” display.



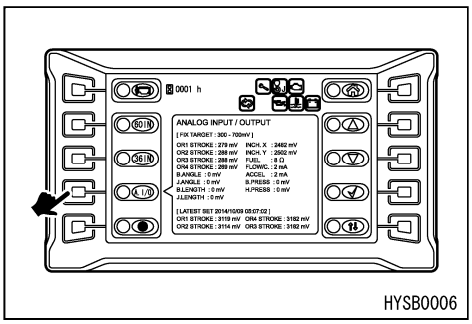
• Analog I/O

The analog input/output information into the controller can be checked.

See “19.2.6 List of controller analog input / output monitoring” for details of “HI, LO” display.

[LATEST SET]

The value and time, when the crane mode is entered last, is displayed.



• Zero adjustment of leveling instrument

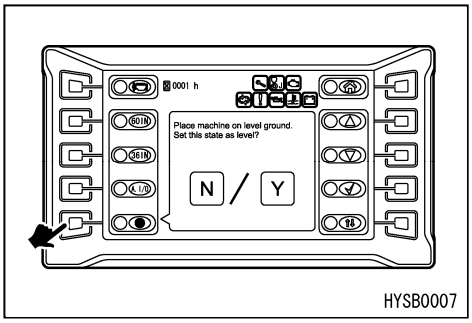
When the following mark is selected, the “N/Y” screen is displayed.

Select using the cursor move button (▲ or ▼) and press the Enter button.

N: No zero adjustment is performed.

Y: Zero adjustment is performed.

When “Y” is pressed, zero adjustment of the levelling instrument is performed in a machine state when the button is pressed.

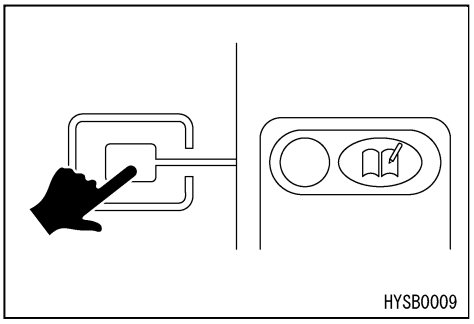


Be sure to keep the machine in a horizontal state before performing zero adjustment.

• Data logger monitoring

The history of the data logger can be monitored.

The displayed page can be switched with the cursor (▲ or ▼).



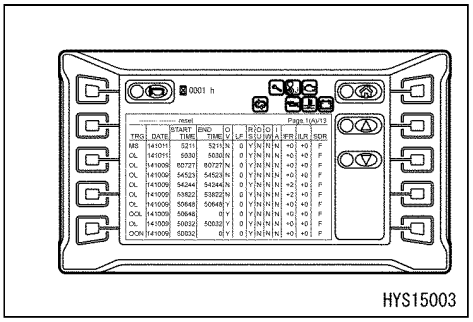
The record capacity is 2,000 lines at the maximum.

If the capacity is exceeded, older data will be overwritten.

A displayed page can be switched with ▲ or ▼.

There are A, B, C and D pages.

For display contents, refer to “19.2.4 List of data logger display contents”.



To return to the previous screen, press the home button.

• Error record

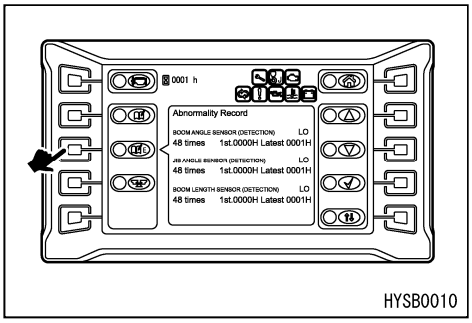
The error record can be checked.

See “19.2.7 List of error codes” for the error content.

XX times: Number of times in which an error was detected

1st: Time when an error was detected

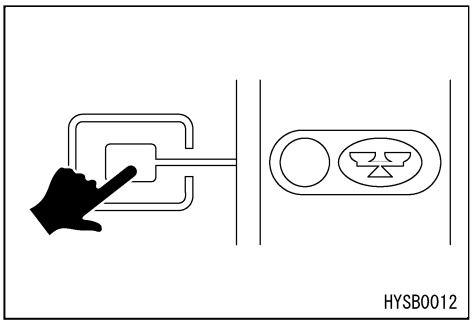
Latest: Time when an error was detected last



HYSB0010

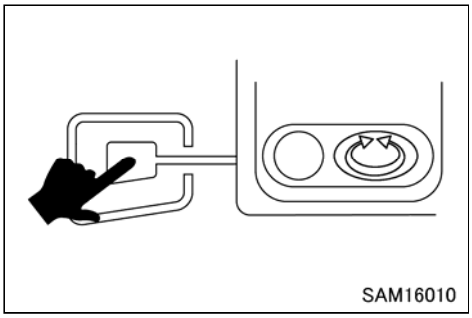
• Moment limiter calibration mode

See “Safety Device 1.6 moment limiter Calibration procedure” for the calibration procedure.


HYSB0012

• Slew angle limiter calibration mode

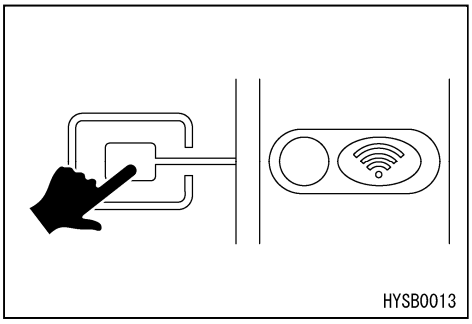
See “Safety Device 1.7 Slew angle Calibration procedure” for the calibration procedure.


SAM16010

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[Remote control-related screen]

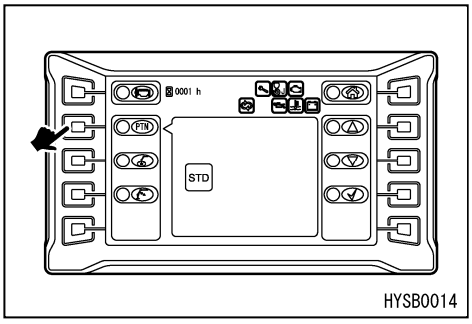
The page of “Operation pattern”, “Slewing gain” or “Raising/lowering gain” is displayed.



• Operation pattern

If there are alternatives of the operation pattern, a change can be made.

Select using the cursor move button (▲ or ▼) and press the Enter button.

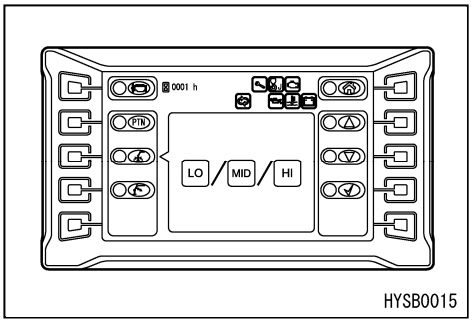


• Slewing gain

The setting of “LO/MID/HI” of slewing gain can be changed.

Select using the cursor move button (▲ or ▼) and press the Enter button.

Default: HI

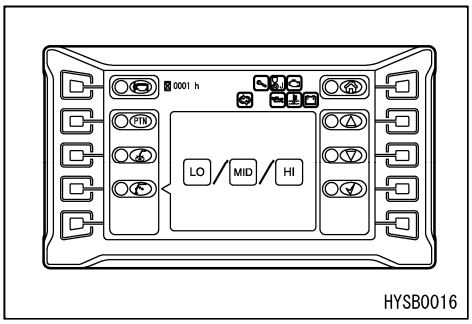


• Raising/lowering gain

The setting of “LO/MID/HI” of raising/lowering gain can be changed.

Select using the cursor move button (▲ or ▼) and press the Enter button.

Default: HI



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19.2.4 LIST OF DATA LOGGER DISPLAY CONTENTS

Trigger: Action which prompted recording

Title: Record item

Trigger

USB ripping , CSV display	Abbreviation on monitor display	Record	Content
Override ON	OON	OON	Emergency canceling ON
Override OFF	OOF	OOF	Emergency canceling OFF
Tipping ON	TON	TON	Two or more adjacent outriggers float without OR operation during the crane mode (falls below the specified value).
Over load	OL	OL	Load factor 100% or more
Mode select	MS	MS	When mode is switched (L/M/H/J1/T/C)

Title (Record Item)

USB ripping , CSV display	Abbreviation on monitor display	Record	Content
Override	OV	Y/N	Y : Emergency canceling ON
Load factor	LF	***	Numerical value [%] used for ML stop judgment When Emergency canceling OFF, record maximum value during Emergency canceling. During outrigger operation record value in that moment.
Slewing resriction	RS	Y/N	Y : ON
Over un-winding	OU	Y/N	Y : Detection of over-lowering LS (During J Mode always set to "N")
Over winding	OW	Y/N	Y : Detection of over-hoisting LS (During J Mode always set to "N")
Inclination alarm	IA	Y/N	Y : Travel mode , 10° or more / crane mode , 3° or more
Inclination front and rear	IFR	±**	Fore-and-side inclination angle [°] (+ : Upper rear) Value when Emergency canceling OFF, write the maximum value (using absolute value) during Emergency canceling using notation ± **. During outrigger operation record value in that moment.
Inclination left and right	ILR	±**	Side-to-side inclination angle [°] (+ : Upper left) When Emergency canceling OFF, record maximum value (using absolute value) during Emergency canceling using notation ± **. During outrigger operation record value in that moment.
Mode	MD	L/M/H/J1/T/C	Low position / Middle position / High position / Jib single fall / Traveling / Caribration
Outrigger 1 setting	O1	SM/SO/OM/OO	Rotary (STD / Other) / Top & Inner (Max / Other)
Outrigger 2 setting	O2	SM/SO/OM/OO	Rotary (STD / Other) / Top & Inner (Max / Other)
Outrigger 3 setting	O3	SM/SO/OM/OO	Rotary (STD / Other) / Top & Inner (Max / Other)
Outrigger 4 setting	O4	SM/SO/OM/OO	Rotary (STD / Other) / Top & Inner (Max / Other)
Jib length	LJ	*.**	Internal calculation value [m]
Jib angle	θJ	***.*	Monitor display value [°]
Boom length	LB	*.**	Internal calculation value [m]
Boom angle	θB	**.*	Monitor display value [°]
Actual load	AL	***	Monitor display value [kg]
Rated total load	RTL	***	Monitor display value [kg]
Working radious	WR	*.*	Monitor display value [m]
Valve outrigger	VO	Y/N	Y : OR
Slew counterclockwise	SL	Y/N	Y : There is operation
Slew clockwise	SR	Y/N	Y : There is operation
Hook lowering	HL	Y/N	Y : There is operation
Hook raising	HR	Y/N	Y : There is operation
Telescopic retraction（boom)	TR	M/2/N	M: Main boom is in operation. J: Jib is in operation. 2: Both main boom and jib (Emergency canceled state). N: Not in operation. When Emergency canceling OFF, record all operations during Emergency canceling. During outrigger operation record value in that moment.
Telescopic retraction（jib)		J/2/N	
Telescopic extention(boom)	TE	M/2/N	
Telescopic extention(jib)		J/2/N	
Derrick lowering(boom)	DL	M/2/N	
Derrick lowering(jib)		J/2/N	
Derrick raising(boom)	DR	M/2/N	
Derrick raising(jib)		J/2/N	
Tipping ON	TO	Y/N	Y : Tow or more adjacent outriggers float . (falls below the specified value)
OR1 Grounding rate	OR1	***	Numerical value [%]
OR2 Grounding rate	OR2	***	Numerical value [%]
OR3 Grounding rate	OR3	***	Numerical value [%]
OR4 Grounding rate	OR4	***	Numerical value [%]
Slew Direction	SDR	1/2/3/4/F	Direction of outriggers 1,2,3,4 including 90 degree arc. F indicates storage direction (Front). (given as ***.* degrees in USB output)

MK1033CW-1 Service Mode
Controller INPUT Monitor Display List

Display	Controller	Item	HI Display		LO Display	
			Condition	Circuit	Condition	Circuit
60IN	60	OR 1 SET LS	OR1 Top & Inner not at MAX	OPEN	OR1 Top & Inner at MAX	SHORT
		OR 2 SET LS	OR2 Top & Inner not at MAX	OPEN	OR2 Top & Inner at MAX	SHORT
		OR 3 SET LS	OR3 Top & Inner not at MAX	OPEN	OR3 Top & Inner at MAX	SHORT
		OR 4 SET LS	OR4 Top & Inner not at MAX	OPEN	OR4 Top & Inner at MAX	SHORT
		CW SLEW LS	In slew lever right operation	SHORT	Not in slew lever right operation	OPEN
		CCW SLEW LS	In slew lever left operation	SHORT	Not in slew lever left operation	OPEN
		EXT LS	In telescopic lever operation	SHORT	Not in telescopic lever operation	OPEN
		HOOK UP LS	In hook up lever operation	SHORT	Not in hook up lever operation	OPEN
		HOOK DOWN LS	In hook down lever operation	SHORT	Not in hook down lever operation	OPEN
		BOOM UP LS	In boom up lever operation	SHORT	Not in boom up lever operation	OPEN
		BOOM DOWN LS	In boom down lever operation	SHORT	Not in boom down lever operation	OPEN
		EMO SW	Emergency stop SW is ON	SHORT	Emergency stop SW is OFF	OPEN
		OVERRIDE SW	Override SW is ON	SHORT	Override SW is OFF	OPEN
		OR OVERRIDE SW	In OR operation, Override SW + OR override SW is ON	SHORT	Not in OR operation, Override SW + OR override SW is OFF	OPEN
		LIGHT SW	Light is ON	SHORT	Light is OFF	OPEN
		E. MOTOR	In electric motor operation	SHORT	Not in electric motor operation	OPEN
		CHARGE	Failure	SHORT	Normal	OPEN
		EGN HYD PRSSUR	More than 0.5kg/cm^2	OPEN	Less than 0.5kg/cm^2	SHORT
		EGN WATER TEMP	Less than 110℃	OPEN	More than 110℃	SHORT
36IN	36 FRAME	OR 1R MAX LS	OR1 rotary not at STD angle	OPEN	OR1 rotary at STD angle	SHORT
		OR 2R MAX LS	OR2 rotary not at STD angle	OPEN	OR2 rotary at STD angle	SHORT
		OR 3R MAX LS	OR3 rotary not at STD angle	OPEN	OR3 rotary at STD angle	SHORT
		OR 4R MAX LS	OR4 rotary not at STD angle	OPEN	OR4 rotary at STD angle	SHORT
		OR 1 STOW LS	OR1 not stowed	OPEN	OR1 stowed	SHORT
		OR 2 STOW LS	OR2 not stowed	OPEN	OR2 stowed	SHORT
		OR 3 STOW LS	OR3 not stowed	OPEN	OR3 stowed	SHORT
		OR 4 STOW LS	OR4 not stowed	OPEN	OR4 stowed	SHORT
	36 A-FRAME	BOOM LOWEST LS	Main boom angle is at lower limit	SHORT	Main boom angle is other than lower limit	OPEN
		BOOM HIGHEST LS	Main boom angle is at upper limit	SHORT	Main boom angle is other than upper limit	OPEN
		OVR WIND LS	Not overwinded	SHORT	Overwinded	OPEN
		OVR UN-WIND LS	Not over un-winded	SHORT	Over un-winded	OPEN

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19.2.6 LIST OF CONTROLLER ANALOG INPUT / OUTPUT MONITORING

MK1033CW-1 Service Mode

Analog INPUT/OUTPUT Monitor Display List

Monitor Display	Items	Unit/Display
OR1 STROKE	OR1 Stroke sensor	mV
OR2 STROKE	OR2 Stroke sensor	mV
OR3 STROKE	OR3 Stroke sensor	mV
OR4 STROKE	OR4 Stroke sensor	mV
B.ANGLE	Boom angle sensor	mV
J.ANGLE	Jib angle sensor	mV
B.LENGTH	Boom length sensor	mV
J.LENGTH	Jib length sensor	mV
INCLI.X	Level sensor X	mV
INCLI.Y	Level sensor Y	mV
FUEL	Fuel sensor	Ω
FLOW/C.	Flow control	mA
ACCEL	Accel	mA
B.PRESS	Derrick pressure sensor (Bottom)	mV
H.PRESS	Derrick pressure sensor (Head)	mV
CUP1	Potentiometer 1	mV
CUP2	Potentiometer 2	mV

MK1033CW-1
Error Code List

No	Display	Contents				
		Detection Result / Threshold		Detection Result / Threshold		Determination Time
1	BOOM ANGLE SENSOR (DETECTION)	LO	＜0.2V	HI	＞4.8V	0.1sec continuous
2	JIB ANGLE SENSOR (DETECTION)	LO	＜0.2V	HI	＞4.8V	0.1sec continuous
3	BOOM LENGTH SENSOR (DETECTION)	LO	＜0.3V	HI	＞3.05V	0.1sec continuous
4	JIB LENGTH SENSOR (DETECTION)	LO	＜0.3V	HI	＞2.4V	0.1sec continuous
5	STROKE SENSOR (DETECTION)	LO	＜0.1V	HI	＞4.7V	0.1sec continuous
6	LEVEL SENSOR POWER			SHORT	≧4V	0.1sec continuous
7	BOOM L/H,OVR UN-WIND LS POWER			SHORT	≧4V	0.1sec continuous
8	SOL/OR SELECT VALVE	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
9	SOL/RIGHT・OR1 OUT	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
10	SOL/LEFT・OR1 IN	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
11	SOL/RETRACT・OR 2 OUT	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
12	SOL/EXTEND・OR 2 IN	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
13	SOL/HOOK RAISE・OR3 OUT	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
14	SOL/HOOK LOWER・OR3 IN	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
15	SOL/BOOM RAISE・OR4 OUT	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
16	SOL/BOOM LOWER・OR4 IN	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
17	SOL/FLOW CONTROL	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
18	SOL/ACCELERATOR	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
19	SOL/UNLOAD	OPEN	≧20kΩ	SHORT	≧4V	0.1sec continuous
20	SOL/MAIN/SUB SWITCH (T)	OPEN	≧20kΩ	SHORT	≧4V	0.5sec continuous
21	SOL/MAIN/SUB SWITCH (D)	OPEN	≧20kΩ	SHORT	≧4V	0.5sec continuous
22	CHARGE	CHARGE ERROR			Detecting condition: *1	6sec continuous
23	ENG OIL PRESS.	ENG OIL PRESS. LOW			Detecting condition: *2	6sec continuous
24	ENG COOLANT	COOLANT TEMP ERROR			Detecting condition: *3	6sec continuous
25	CONTROLLER, RADIO REMOTE	E1, E2, E3, E4, E5, E6, E7 & E8 Refer to the below table for detail				Refer to the below table
26	POTENTIOMETER	ERROR	＜2470mV , ＞2670mV ※4	---	---	0.5sec continuous
27	POTENTIOMETER POWER	ERROR	＜4.8V , ≧5V	---	---	20sec continuous
28	DERRICK PRESSURE SENSOR 1	LO	＜0.3mV	HI	＞4.95V	0.1sec continuous
29	DERRICK PRESSURE SENSOR 2	LO	＜0.3mV	HI	＞4.95V	0.1sec continuous
30	LEVEL SENSOR	ERROR	＜0.03V , ≧4.97V	---	---	0.1sec continuous
31	L.A.P. SENSOR POWER	ERROR	＜4.8V , ≧5V	---	---	20sec continuous
32	STROKE SENSOR 1, 4 POWER	ERROR	＜4.8V , ≧5V	---	---	20sec continuous
33	STROKE SENSOR 2, 3 POWER	ERROR	＜4.8V , ≧5V	---	---	20sec continuous
34	BATTERY VOLTAGE	ERROR	＜11.5V (Engine state (both running and idling))	---	---	60sec continuous

*1 "Engine ON (emergency stop SW_OFF & engine hyd. pressure detect Hi)" + "Engine start SW of transmitter or monitor is not operated" + "Charge detect Hi"
*2 "Engine ON (emergency stop SW_OFF & charge detect Lo)" + "Engine start SW of transmitter or monitor is not operated" + "Engine hyd. pressure Lo" + "Electric motor shift SW_engine side"
*3 "Engine ON (emergency stop SW_OFF & engine hyd. pressure detect Hi or charge detect Lo)" + "Engine start SW of transmitter or monitor is not operated" + "Water temp. detect Lo" + "Electric motor shift SW_engine side"
*4 Error determination is carried out based on the values of [CUP1-CUP2] However, the values of [CUP1] and [CUP2] each should not be 2300 mV - 2700 mV.

＜25 Detail of controller & radio controller error＞

DISPLAY	TTC60	TTC36X1	TTC36X2	HBC	State Recognition			Monitor Display ITEM	Monitor Display ERROR
○	○	○	○	○	Normal				
○	○	○	○	×	HBC Failure			Controller	E-2
○	○	×	○	○	TTC36X1 Failure			Controller	E-3
○	○	○	×	○	TTC36X2 Failure			Controller	E-4
○	○	×	○	×	TTC36X1 Failure	HBC Failure		Controller	E-5
○	○	○	×	×	TTC36X2 Failure	HBC Failure		Controller	E-6
○	○	×	×	○	TTC36X1 Failure	TTC36X2 Failure		Controller	E-7
○	○	×	×	×	TTC36X1 Failure	TTC36X2 Failure	HBC Failure	Controller	E-8
○	×	○	○	○	TTC60 Failure			Controller	E-1
○	×	○	○	×	TTC60 Failure			Controller	E-1
○	×	○	×	○	TTC60 Failure			Controller	E-1
○	×	○	×	×	TTC60 Failure			Controller	E-1
○	×	×	○	○	TTC60 Failure			Controller	E-1
○	×	×	○	×	TTC60 Failure			Controller	E-1
○	×	×	×	○	TTC60 Failure			Controller	E-1

<Controller Error Threshold>

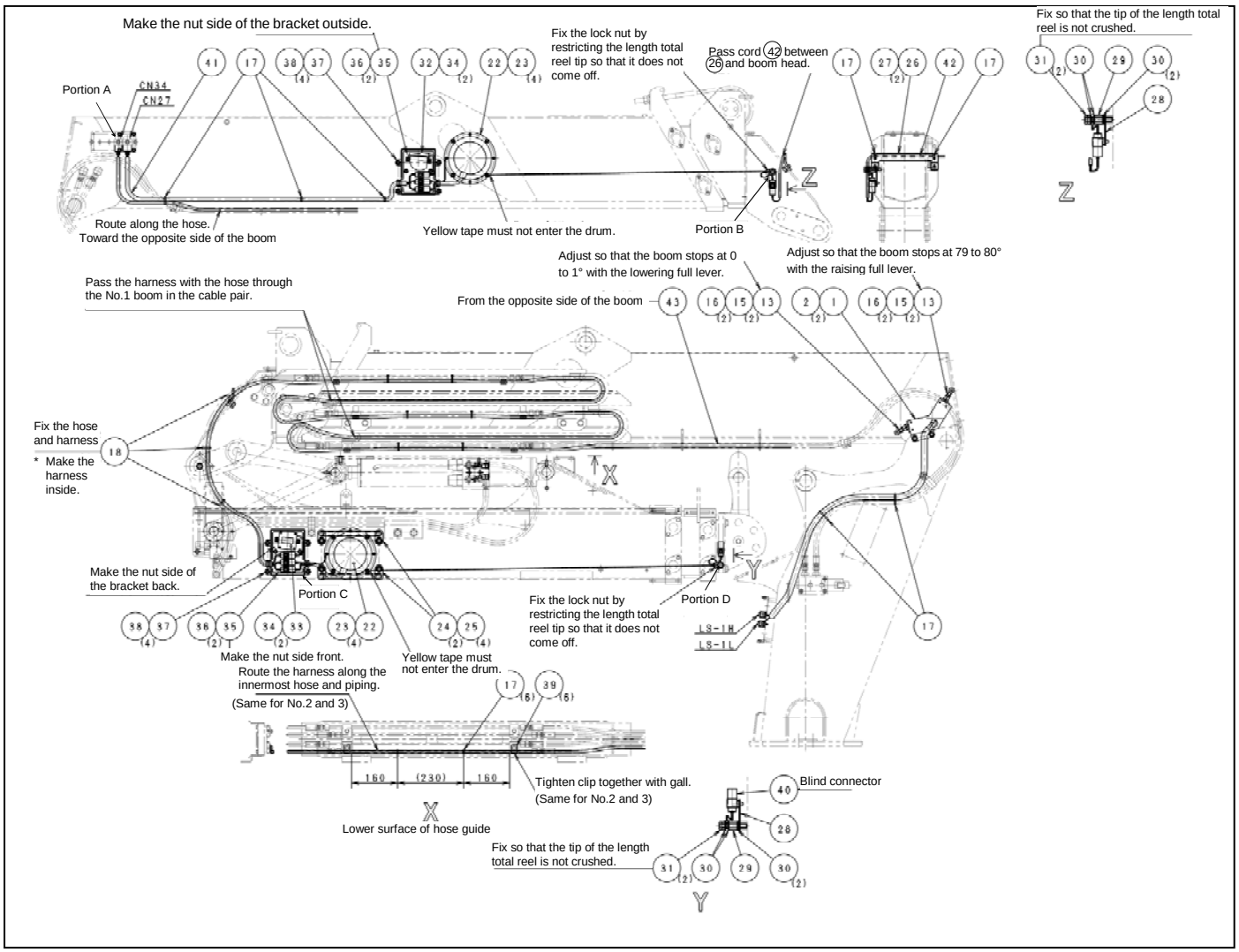
Controller	Error Detecting System	Determination Time
eVision²7.0	Undetectable	
TTC60-1	eVision²7.0 detected that communication data with TTC60-1 is not updated	3sec continuous
TTC36X-1	TTC60-1 detected heartbeat of TTC36X-1 CAN_Open is stopped	0.1sec continuous
TTC36X-2	TTC60-1 detected heartbeat of TTC36X-2 CAN_Open is stopped	0.1sec continuous
FSE510	TTC60-1 detected heartbeat of FSE510 CAN_Open is stopped	0.1sec continuous

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20. PROCEDURE FOR DISASSEMBLING AND REASSEMBLING BOOM

20.1 REMOVING WIRE HARNESS CONNECTORS



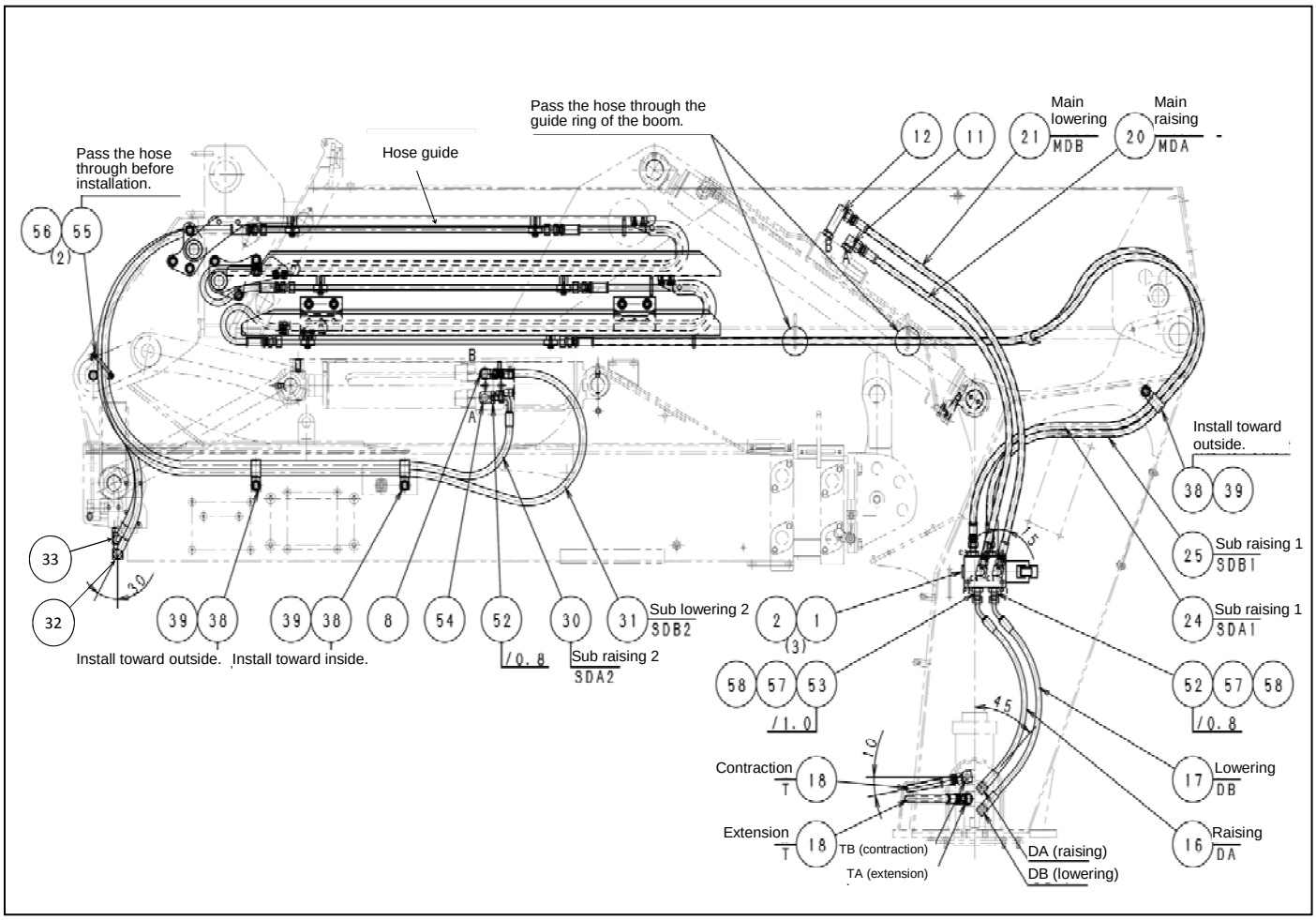
1. Remove the cover for connector bracket of portion A, also disconnect all the connectors on the post side, and disconnect the CN34 for the main boom.

2. Remove the cover for connector bracket of portion C, also disconnect all the connectors from the main boom, and separate them for the main boom and for the jib.

3. Disconnect the connectors for portions B and D, and disengage the terminal of length meter from the boom. In this step, be careful to prevent the wire end portion from being wound up into the length meter.

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20.2 REMOVING HYDRAULIC HOSES

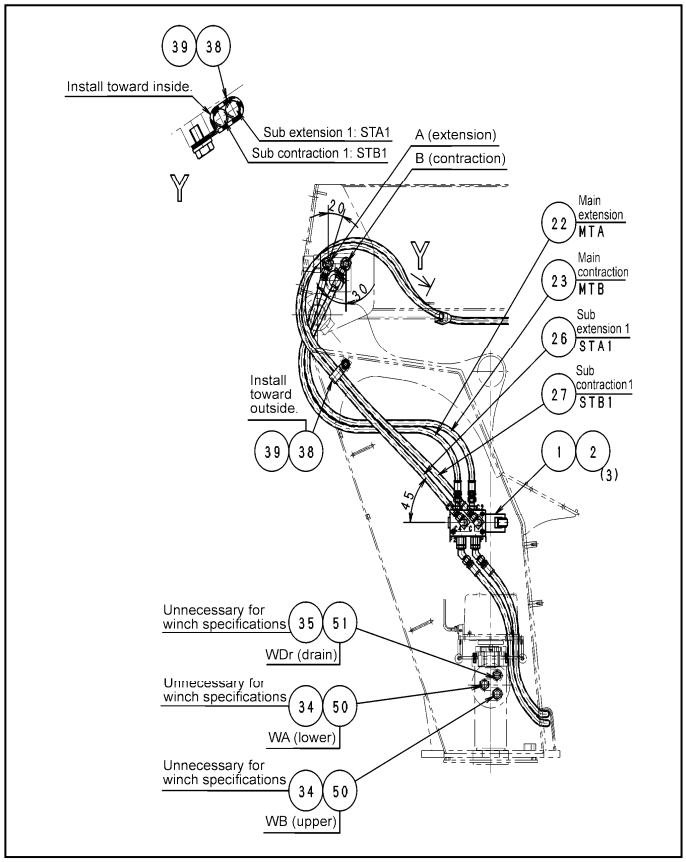


1. Disconnect the hydraulic hose between the JIB RAISING (24) and JIB LOWERING (25) from the solenoid valve (1).
2. Disconnect the hydraulic hose between MAIN EXTENSION (22) and MAIN CONTRACTION (23) and another between JIB EXTENSION (26) and JIB CONTRACTION (27) from the solenoid valve (1).
3. Disconnect the hydraulic hose between the JIB RAISING (30) and JIB LOWERING (31) from the Jib derricking cylinder.
4. Disconnect the hydraulic hose between the JIB EXTENSION (32) and JIB CONTRACTION (33) from the Jib telescoping cylinder.
5. Disconnect the hydraulic hose from clip (38).

   Caution

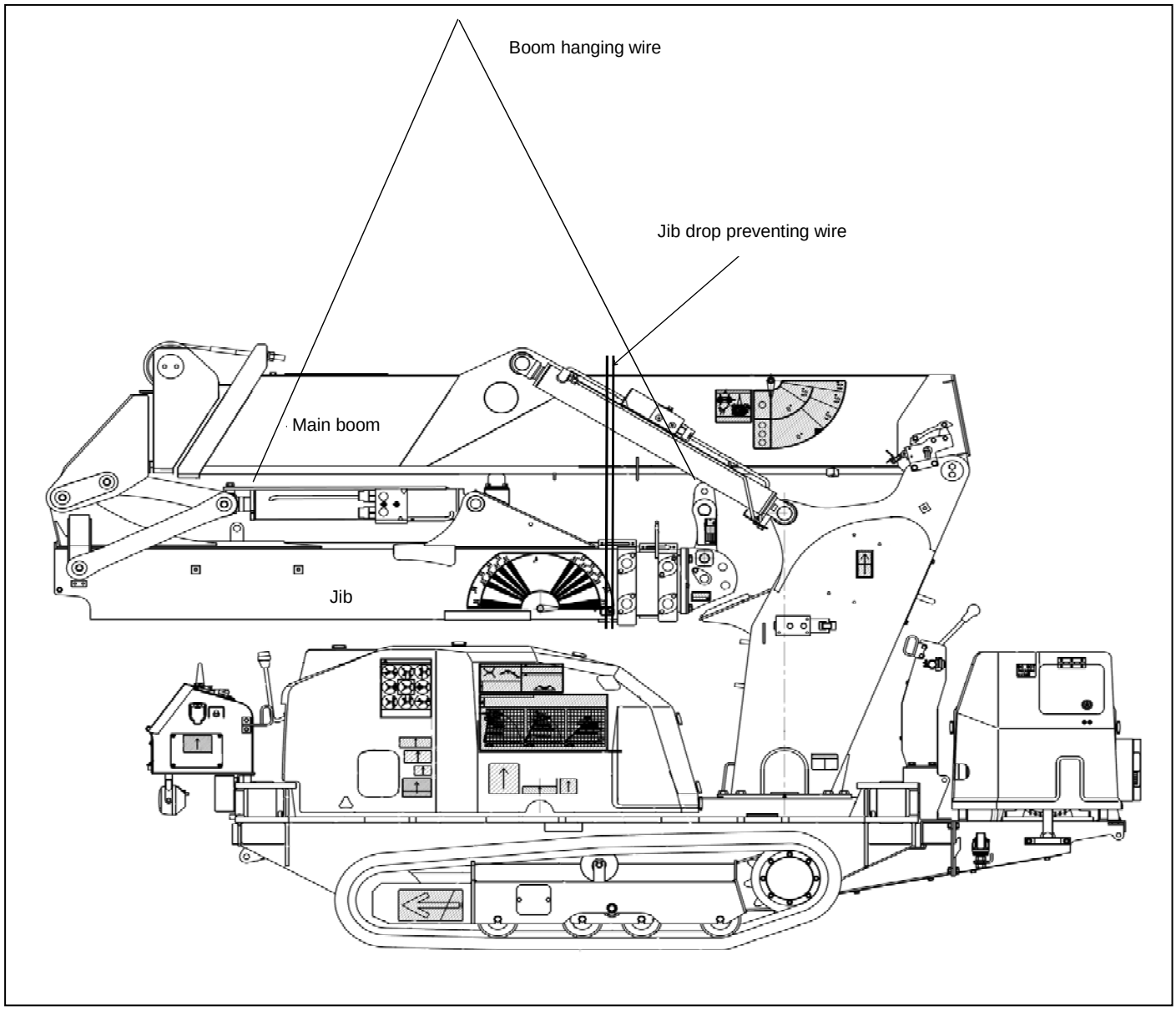
   Apply a blanking plug to the disconnected hose coupling so that no dust will intrude and no leakage will occur.

6. Remove the set of hose guide (hydraulic hose with wire harness) from the main boom.



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20.3 PREPARING HOISTING ACCESSORIES

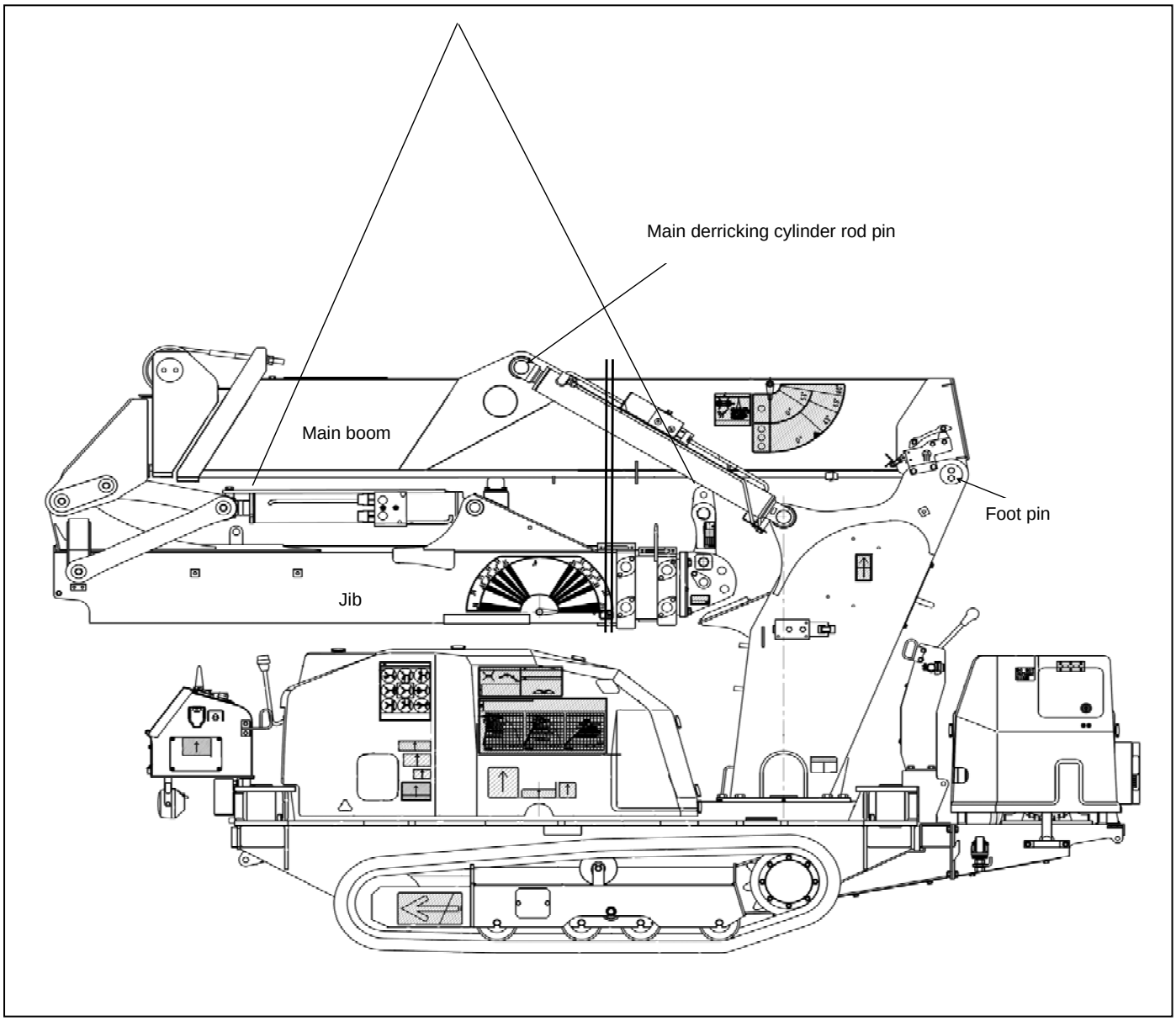


1. Fix the main boom and jib to prevent the jib from dropping.

2. Apply wires to the main boom in 2-fall hanging as shown in the figure. Lift the load up at its center of gravity.

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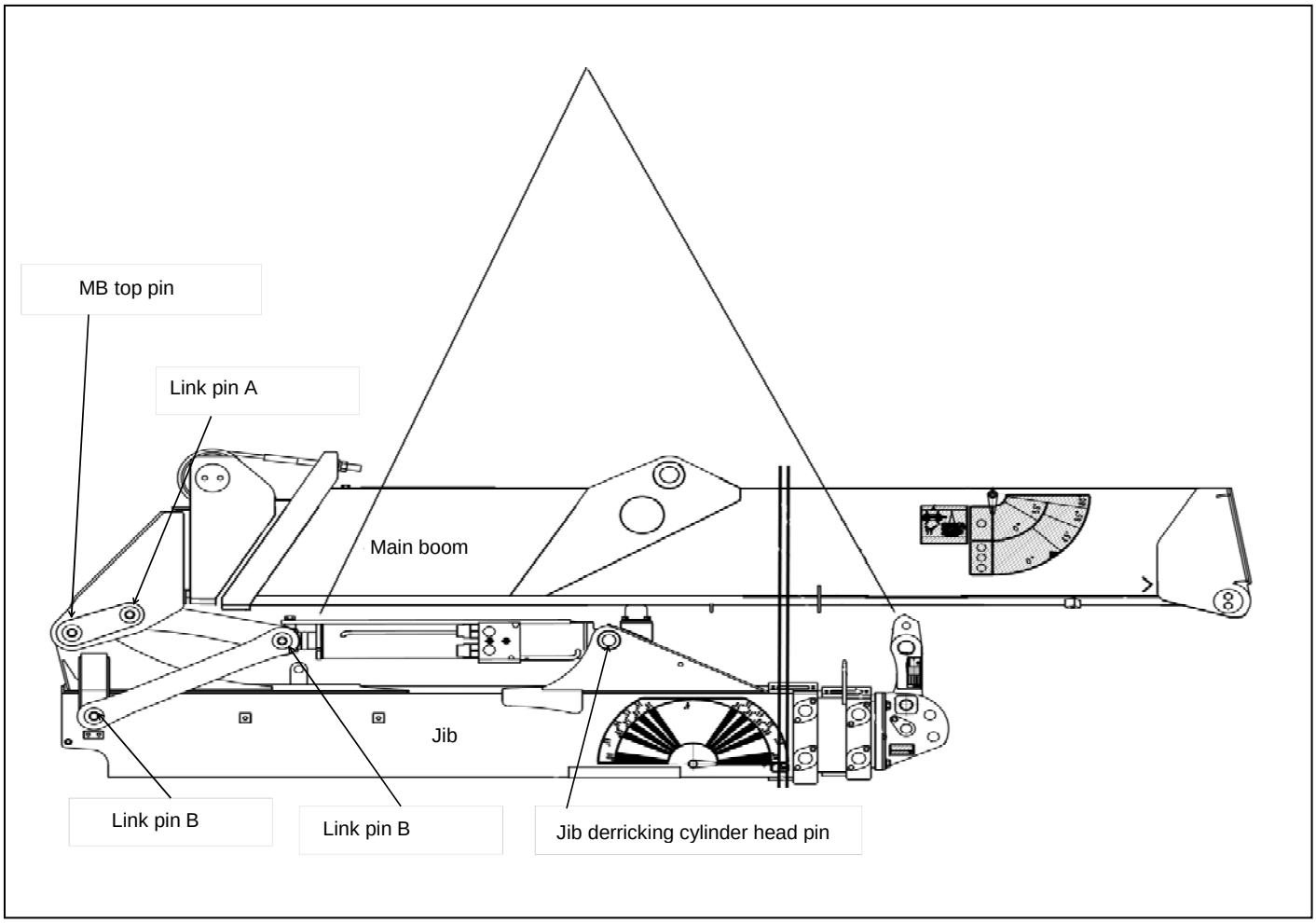
20.4 REMOVING THE ROD PIN AND FOOT PIN OF MAIN DERRICKING CYLINDER



1. Take off the rod pin of main derricking cylinder.
   Apply a steel pipe or other cushioning object to the rod pin, knock it with a hammer to pull it out.
   Watch out for sudden falling of the main derricking cylinder.

2. Take off the foot pin.
   Apply a steel pipe or other cushioning object to the foot pin, knock it with a hammer to pull it out.
   Pay attention to prevent losing the balance.

20.5 REMOVING THE LINK ASSEMBLY



1. Place the boom assembly removed from the main body on one or more woodblocks.

2. Take out the MB top pin and link pin A.
   Apply a steel pipe or other cushioning object to each of the pins, and knock it with a hammer to pull it out.
   Pay attention to prevent losing the balance.

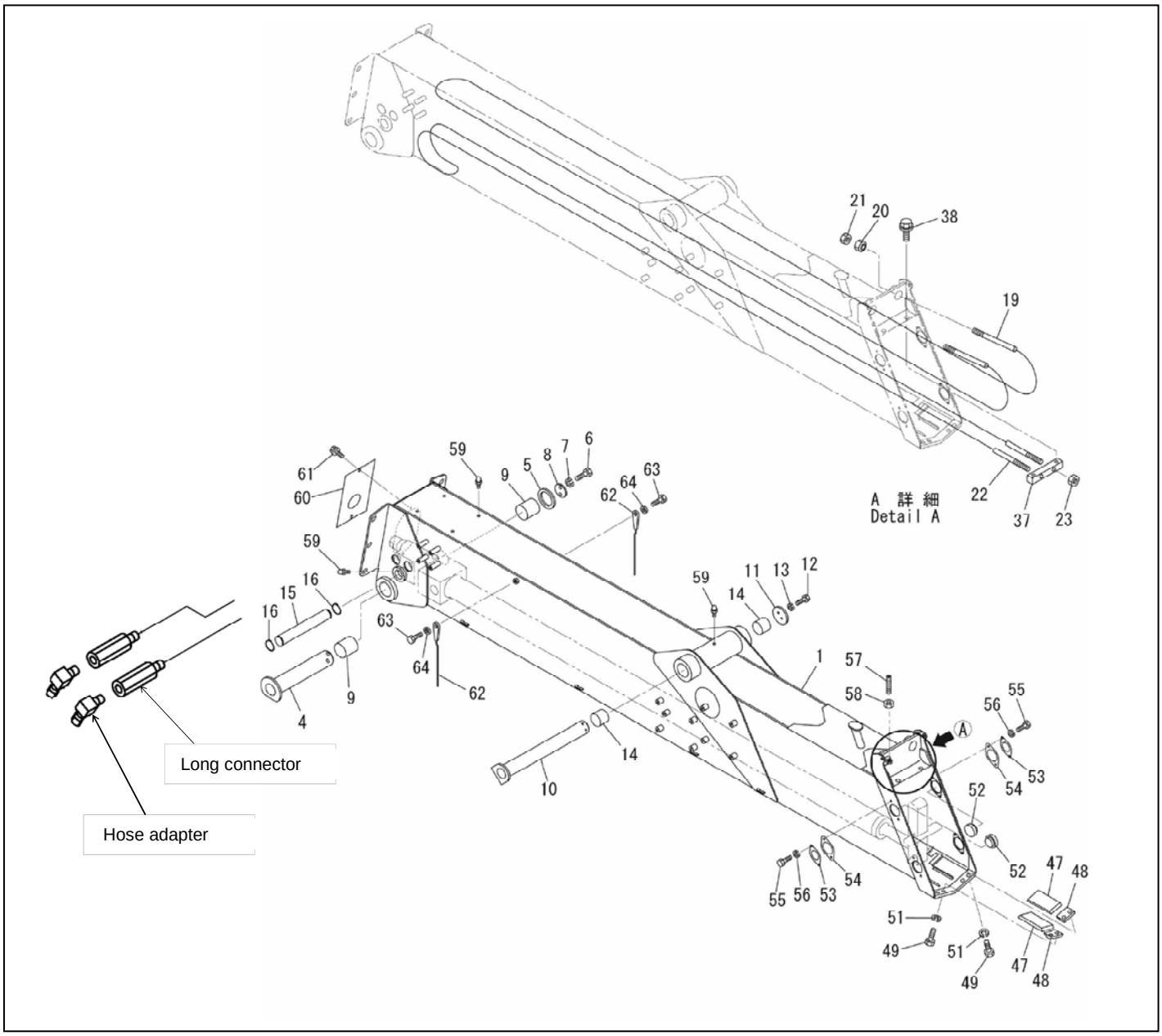
3. Remove the two link pins B and the jib derricking cylinder head pin.

   This completes disassembling the setup into the main boom, jib boom and jib derricking cylinder link assembly.

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20.6 DISASSEMBLING THE MAIN BOOM

20.6.1 REMOVING THE MAIN BOOM NO. 1



1. Take off two each of the hose adapters and long connectors.

2. Remove the two snap rings (16) and take off the telescopic cylinder head pin (15).
   In this stage, apply a steel pipe or other cushioning object to the head pin, and knock it with a hammer to pull it out.

3. Loosen nuts (20 and 21) at the end of extending wire rope (19) and dismount them from boom No. 1.

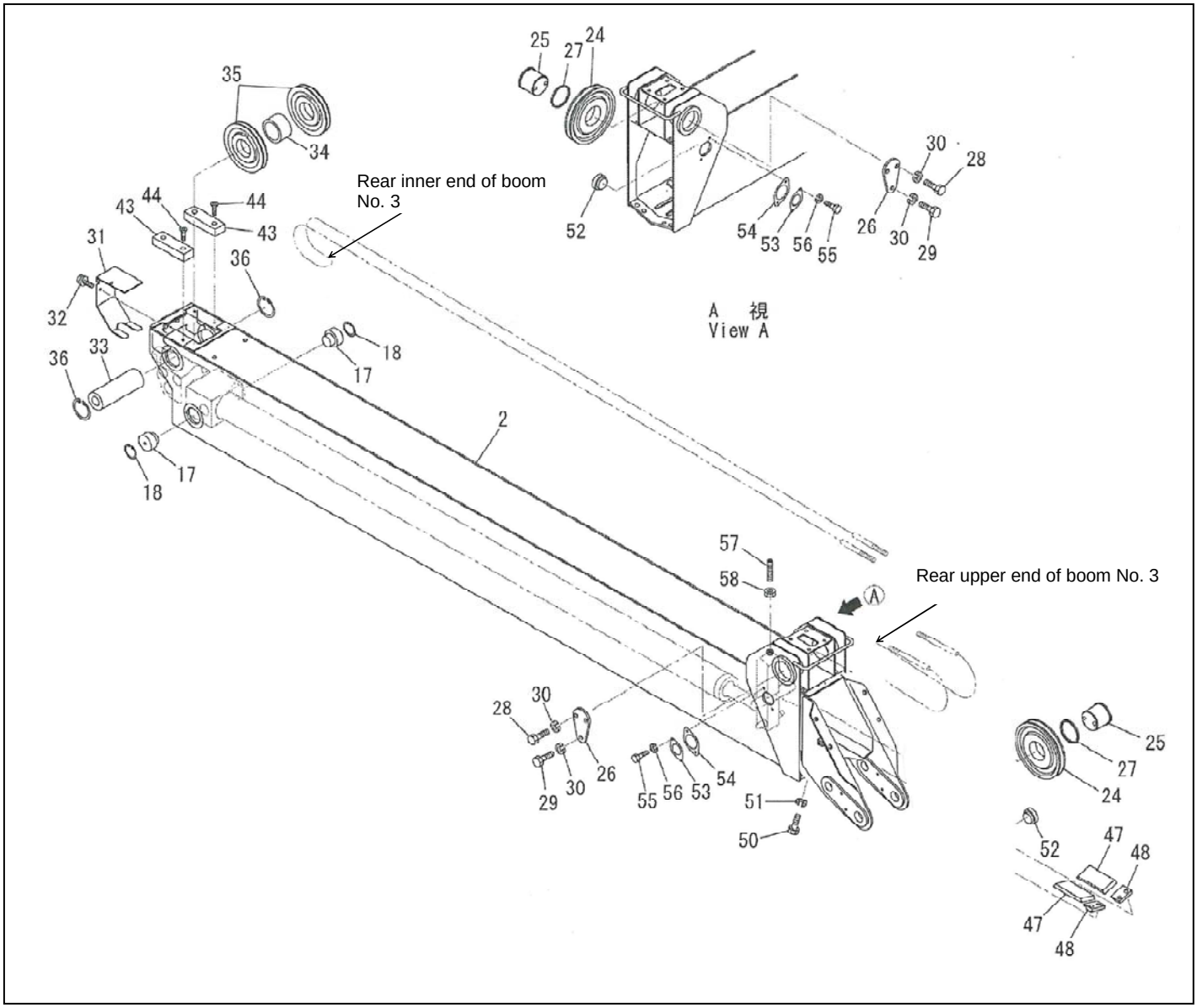
4. Loosen nut (23) at the end of contracting wire rope (22) and dismount them from boom No. 1.

5. Dismount each of contracting wire fixing seat (37), slide plate (47), side stop plate (53), hexagon socket set screw (57) and tail cover (60).

6. From boom No. 1, pull off the setup of boom No. 2, boom No. 3, telescopic cylinder and extending/contracting wire ropes that should be left assembled as such.

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20.6.2 REMOVING THE MAIN BOOM NO. 2



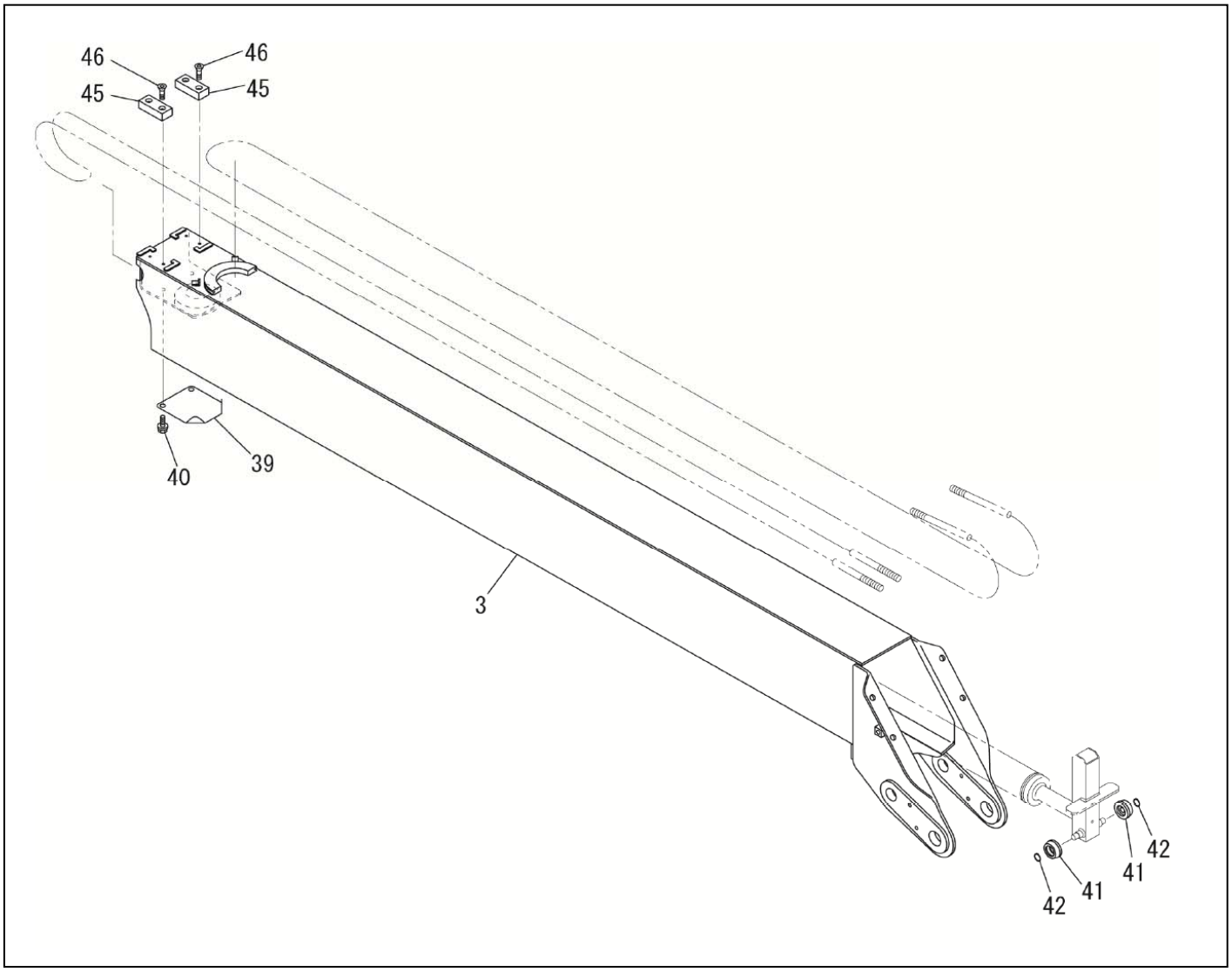
1. Remove the two snap rings (18) and take off the trunnion pin (17).
   In this step, screw in the extracting bolt (M8 X 30 L or thereabouts) into the M8 tap hole for trunnion pin (17), and pull it off by using a plier or the like.

2. Dismount each of sieves (24 and 35), cover (31), slide plates (43 and 47), side stop plate (53) and hexagon socket set screw (57).

3. From boom No. 2, pull off the setup of boom No. 3, telescopic cylinder and extending/contracting wire ropes that should be left assembled as such.

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20.6.3 REMOVING THE TELESCOPIC CYLINDER



1. Pull off the telescopic cylinder from the front end of boom No. 3.

2. Remove the contracting wire cover B (39) and unhook the contracting wire rope (22) from boom No. 3.

3. Unfold the two plates on boom No. 3, and unhook the extending wire rope (19) from boom No. 3.

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20.7 ASSEMBLING PROCEDURE FOR MAIN BOOM

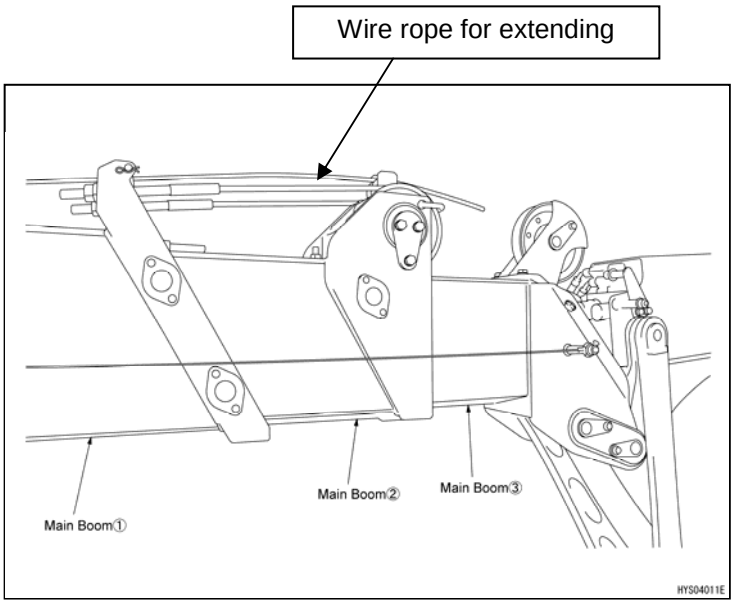
Perform assembling in the reverse order of disassembling.

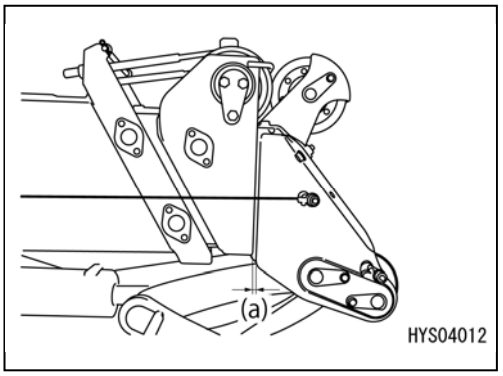
CAUTION: During assembling, exercise care not to allow the extending and contracting wire ropes to cross each other or be damaged in the boom.
Also, after hooking the extending wire rope (19), securely fold the two plates on boom No. 3 and apply the latch.

20.7.1 ADJUSTING THE MAIN BOOM EXTENDING/CONTRACTING WIRE ROPES

1. With the main boom in a horizontal position, reciprocate the boom to extend and retract for two to three times.

2. During the retracting operation, check if the middle portion of the extending wire rope is sagging down, and when it is completely retracted, check to ensure that the clearance between booms No. 2 and No. 3 (clearance (a) in the figure below) is 5 mm or more.
When it is sagging or the clearance is excessively wide, adjust the wire ropes by referring to the section "Adjustment of Wire Rope".





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[ADJUSTING WIRE ROPE]

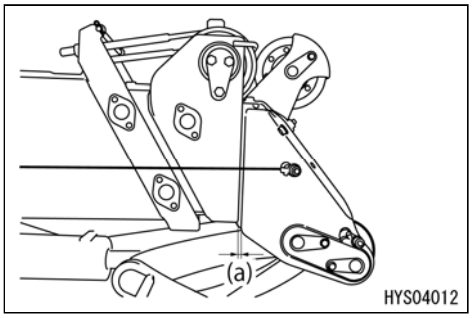
CAUTION

When adjusting each wire rope, be careful of overtension of the wire ropes.

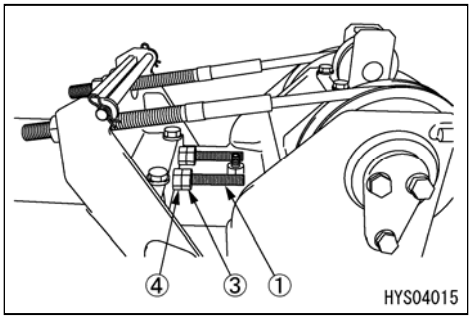
A boom extending wire rope and retracting wire rope (2 pieces each) are used in this machine.
Adjustment of these 2 wire ropes must conform to the specified procedure. Be sure to use the following procedure for wire rope adjustment.

1. With the booms retracted in a horizontal position, extend the telescoping booms by approx. 2 m.

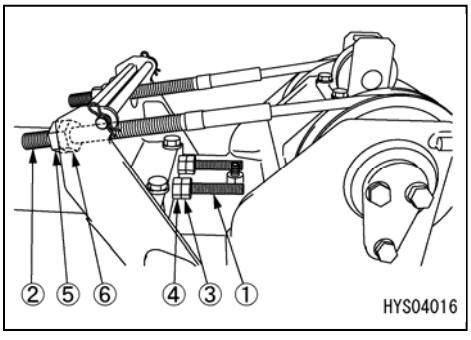
2. Retract the booms completely and at a slow speed.
   Measure clearance (a) in this condition to check the following for proper adjustment.
   - If there is 5 mm or more clearance (a) found, adjust the No. 3 boom retracting wire rope (1).
   - If clearance (a) is “0 (zero)”, adjust the extending wire rope (6) according to step 4 “Adjustment of No. 3 boom extending wire rope (2)”.



3. Adjustment of No. 3 boom retracting wire rope (1)
   (1) With the lock nut (3) loose, tighten the right and left adjusting nut (4) evenly in a direction where the retracting wire rope (1) becomes tight until clearance (a) is closed.
   (2) If clearance (a) is 5 mm or more after performing operation and measurement in steps 1 and 2, readjustment is required.



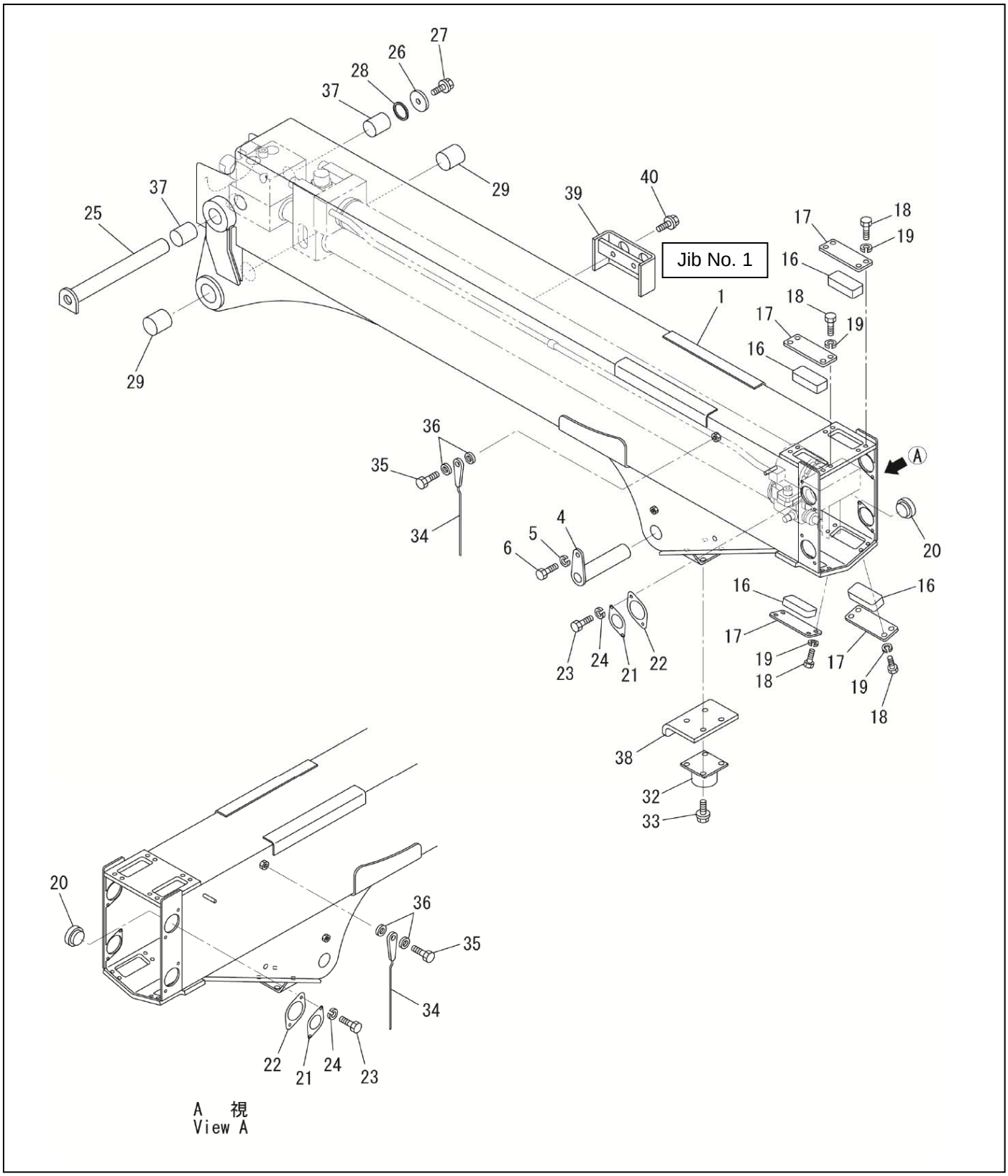
4. Adjustment of No. 3 boom extending wire rope (2)
   (1) With the lock nut (5) loose, tighten the right and left adjusting nut (6) evenly in a direction where the No. 3 boom extending wire rope (2) becomes tight until just before the No. 3 boom begins to extend.
   (2) Retighten both the right and left adjusting nuts (4) of the No. 3 boom retracting wire rope (1).
   (3) Secure the adjusting nut (4) and (6) of the No. 3 boom retracting and extending wire rope (1) and (2) with the respective lock nut (3) and (5).



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20.8 DISASSEMBLING THE JIB

20.8.1 REMOVING THE JIB NO. 1



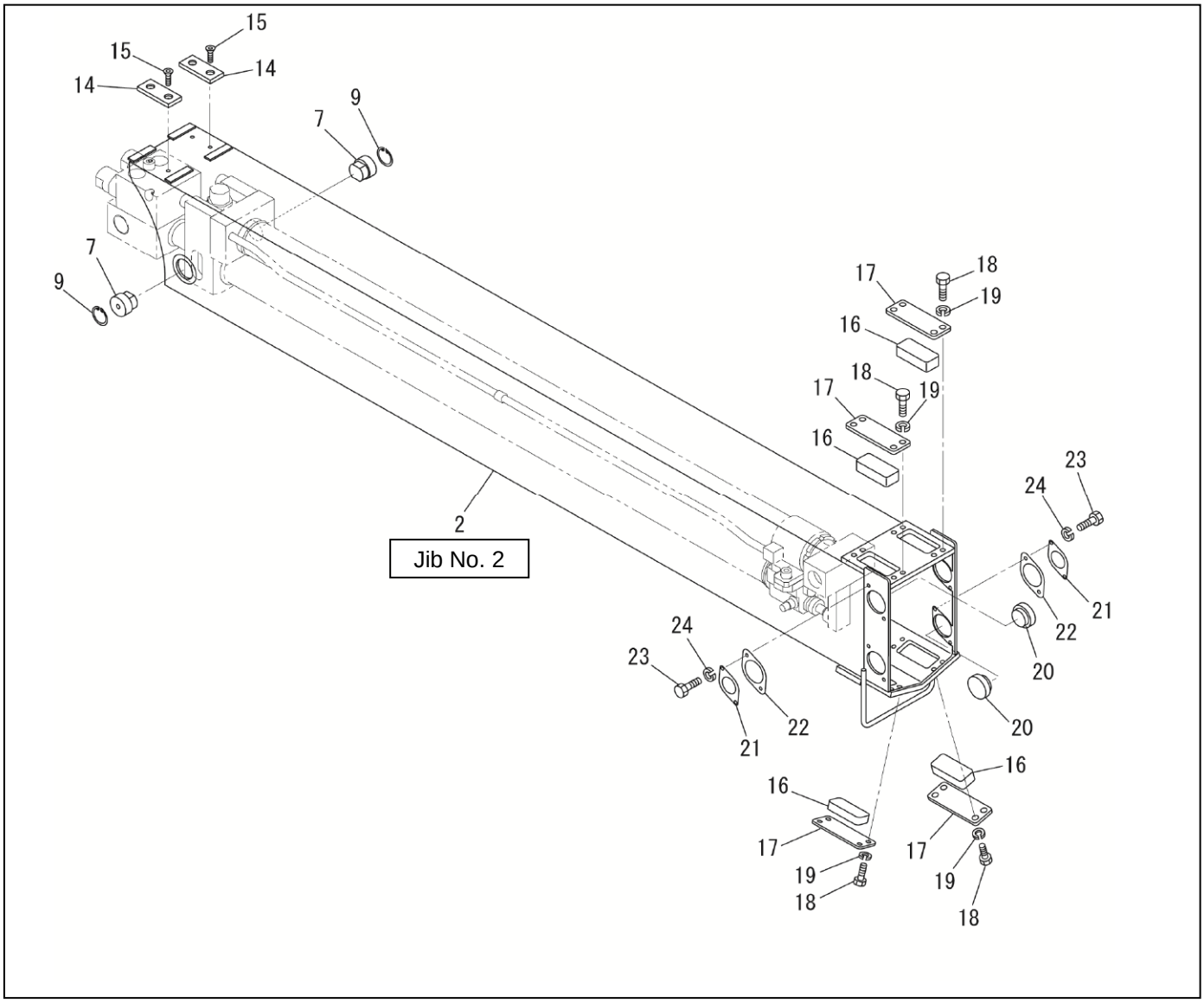
1. Dismount the telescopic cylinder coupling (connector, adapter and hose adapter).

2. Take off the four upper and lower members of slide plate (16) as well as the side stop plate (21) and shim (22).

3. From Jib No.1, pull off the Jibs No. 2 and No. 3 telescopic cylinders remaining assembled as such.

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20.8.2 REMOVING THE JIB NO. 2



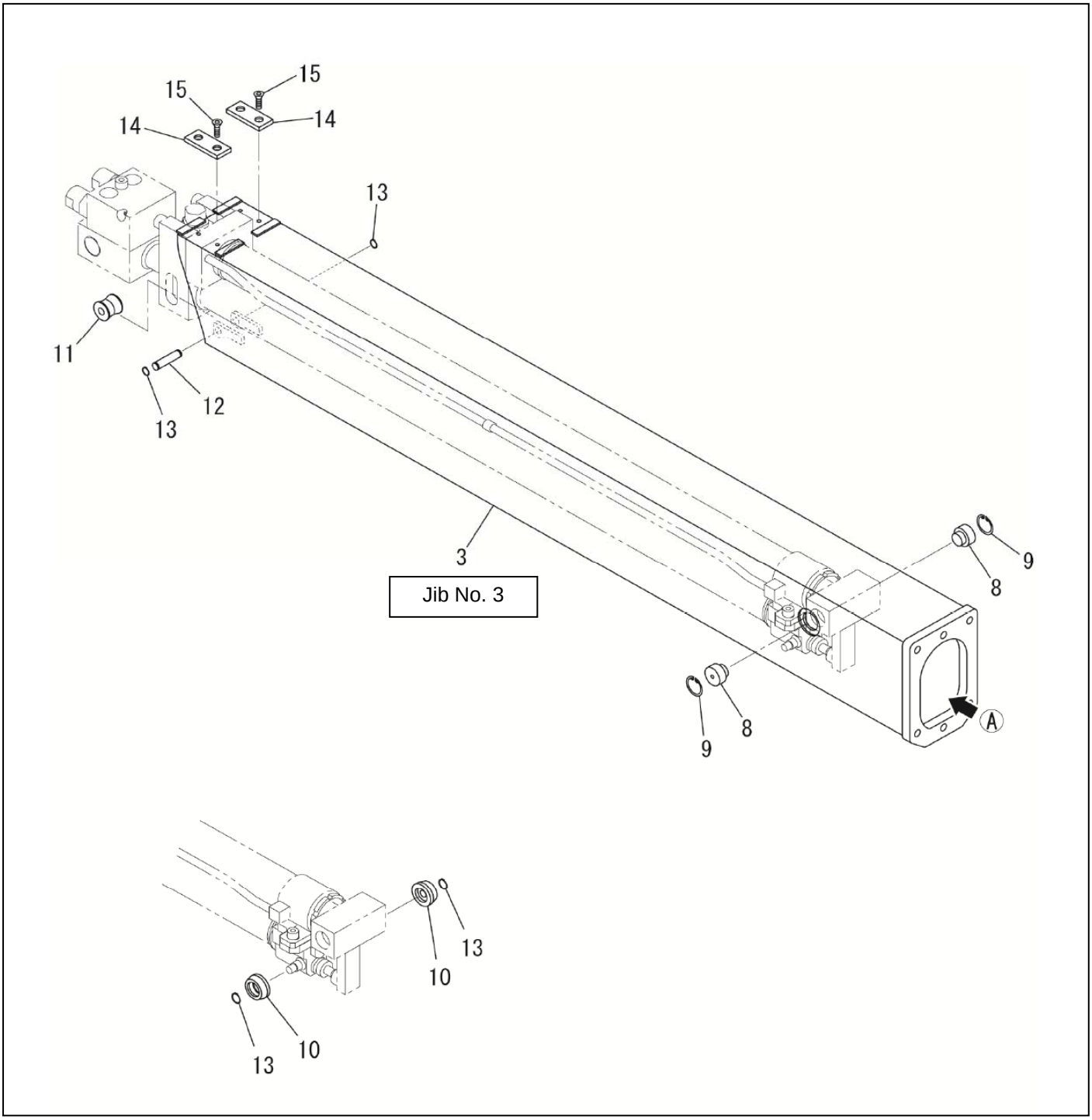
1. Remove the two snap rings (9) at the left and right and take off the trunnion pin (7).
   In this step, screw in the extracting bolt (M8 X 30 L or thereabouts) into the M8 tap hole for trunnion pin (7), and pull it off by using a plier or the like.

2. Take off the four upper and lower members of slide plate (16) as well as the side stop plate (21) and shim (22).

3. From Jib No. 2, pull off the Jib No. 3 telescopic cylinder remaining assembled as such.

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20.8.3 REMOVING THE TELESCOPIC CYLINDER



1. Remove the two snap rings (9) and take off the trunnion pin (8).
   In this step, screw in the extracting bolt (M8 X 30 L or thereabouts) into the M8 tap hole for trunnion pin (8), and pull it off by using a plier or the like.

2. Dismount the T-guide rollers (11).

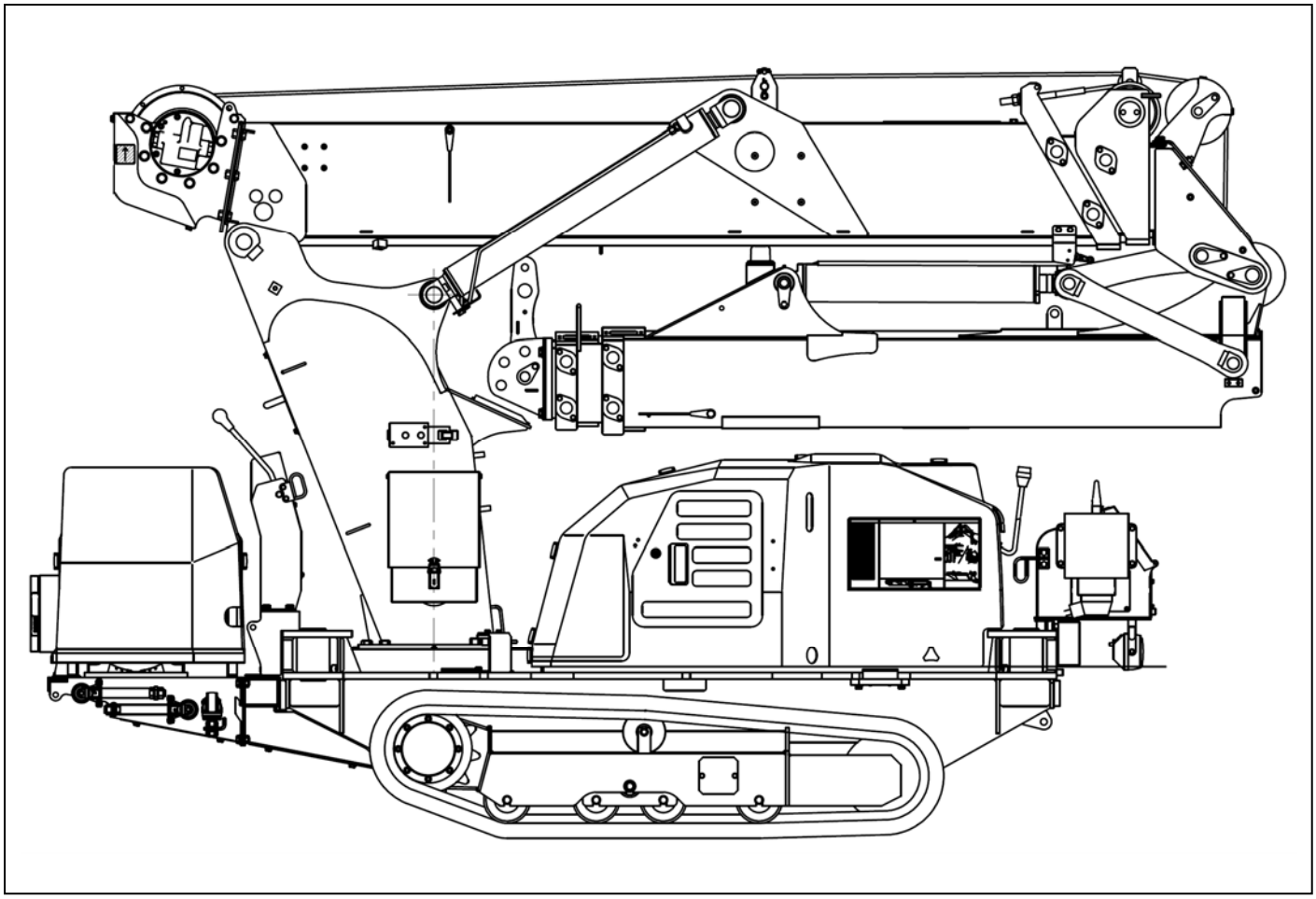
3. Pull out the telescopic cylinder from Jib No. 3.

Assembling procedure

Perform assembling in the reverse order of disassembling.

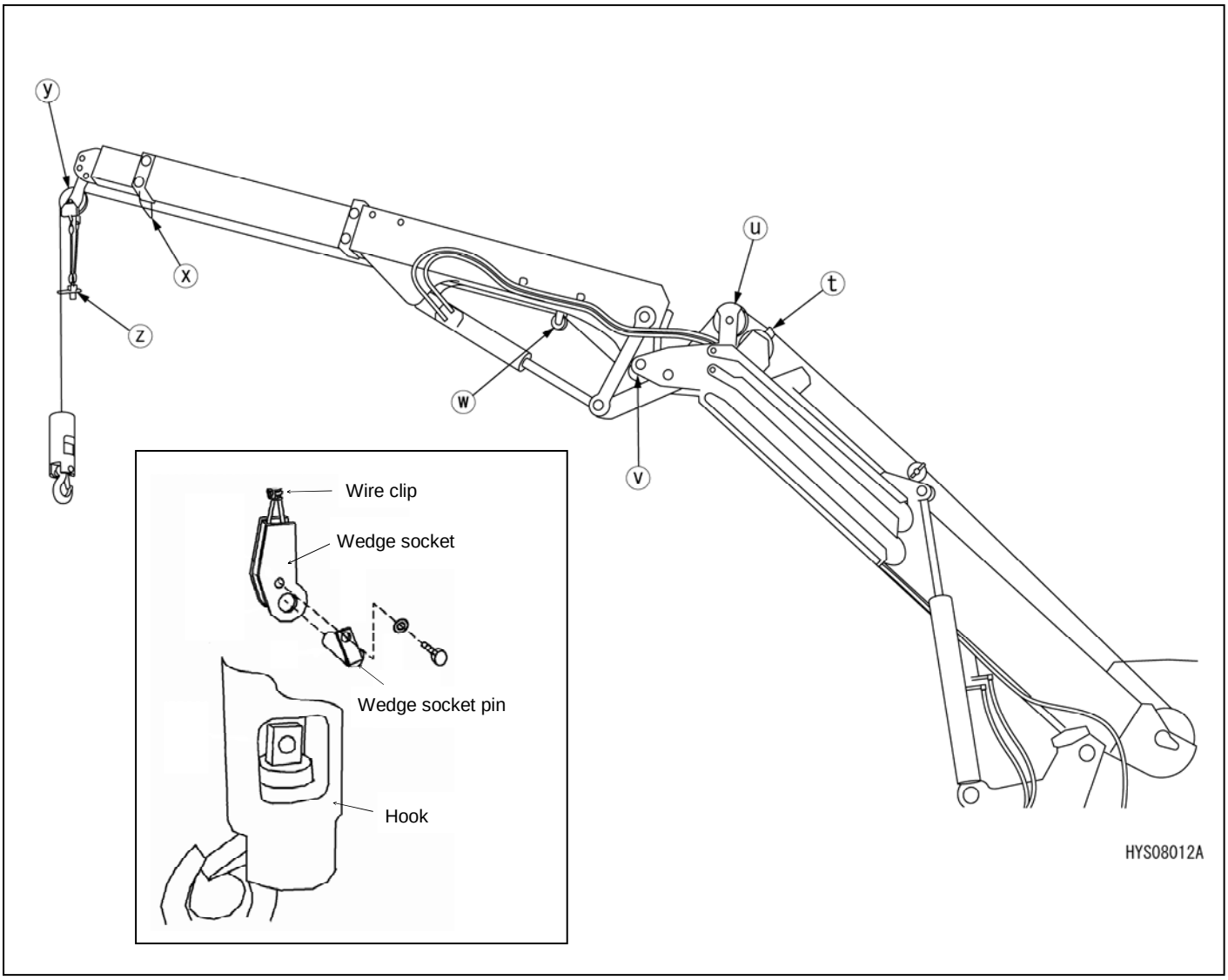
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20.9 DISASSEMBLING PROCEDURE FOR THE MACHINE WITH OPTIONAL WINCH



1. For a machine equipped with an optional winch, first unhook the winch wire and disconnect the hydraulic hose to the winch, and then perform the disassembling operation of the boom by using the procedure described under section 20.1.

20.9.1 REMOVING THE WINCH WIRE



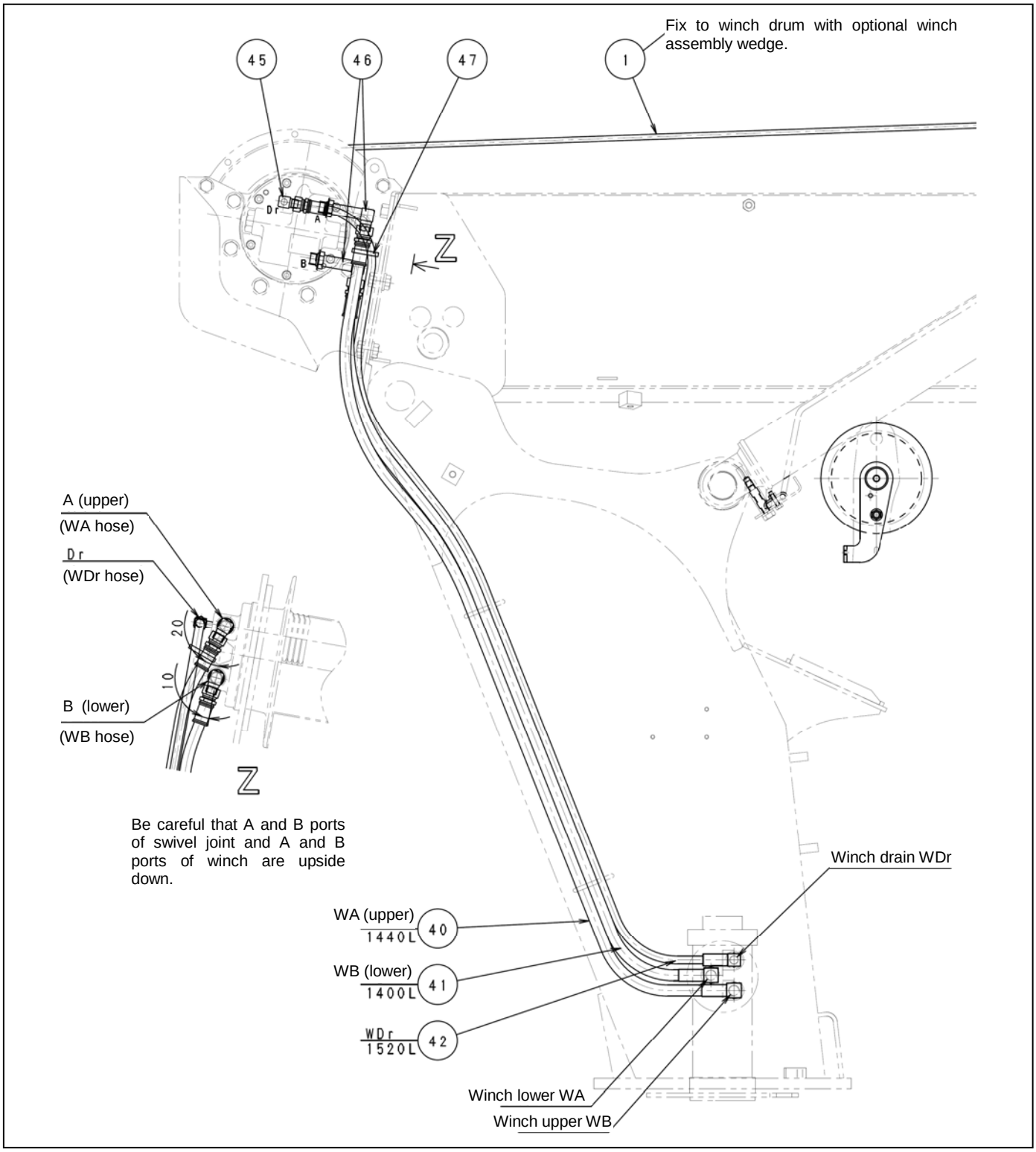
1. Pull the wedge socket pin off the hook, and dismount the wedge socket.

2. Remove the wire clip and unhook the end of wire rope from the wedge socket.

3. Take up the wire rope with the drum by winding up the winch.In this operation, apply a tension to the wire rope to prevent it from irregular winding.

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20.9.2 REMOVING THE WINCH HYDRAULIC HOSE



1. Disconnect the hydraulic hoses for winch upper (40), winch lower (41) and winch drain (42) from the winch motor.

Caution

Apply a blanking plug to the disconnected hose coupling so that no dust will intrude and no leakage will occur.

Be aware that the swivel joint port name and hose label name are contrary to each other.

21. PROCEDURE FOR DISASSEMBLING THE VEHICLE BODY

21.1 PROCEDURE FOR DISASSEMBLING THE OUTRIGGER TOP AND INNER BOXES

Dismounting the top and inner boxes allow the vehicle weight to be split.

Weight of top and inner boxes: 4 units X approx. 34 kg (per unit) = totaling approx. 136 kg



Set the outrigger in the maximum extending position.

Leave the position pin remaining inserted.



Take off one of the split pins on the stay damper bottom side.

Leave the pin removed.



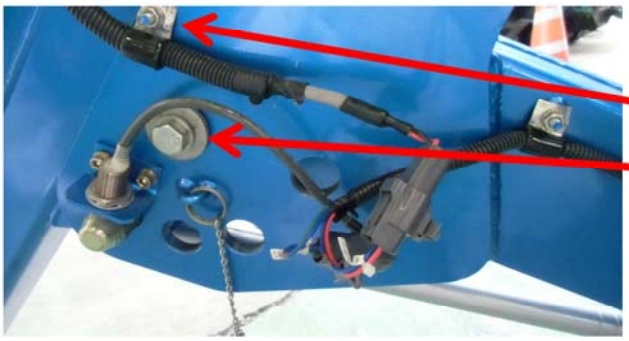
Extend the outrigger.

Allow it to be suspended at 100 mm or thereabouts above ground.

Place a woodblock under the OR top to prevent it from falling.



Take off the connector cover.



Disconnect the connectors “OR top” and “inner”.

Take off the clip for “inner” cable.

Take off the OR pin A stopper plate.



Remove the OR pin check bolt, and while holding the OR top, remove the OR pin A.



Take off the positioning pin.
When the positioning pin is taken off, the OR top and inner boxes are detached.

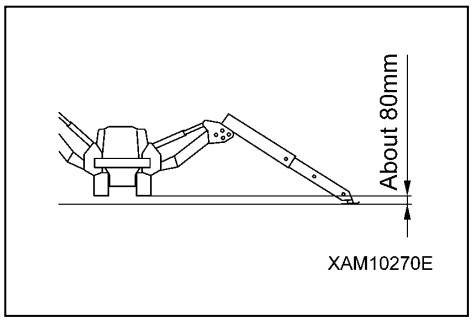
Perform assembling in the reverse order of disassembling.

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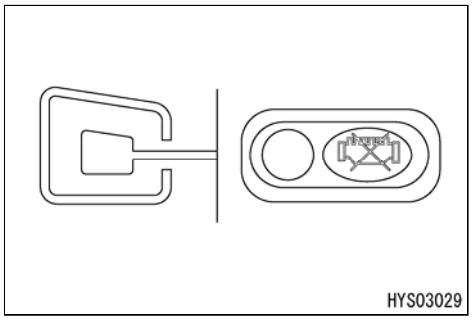
21.2 REMOVAL OF ELECTRIC MOTOR UNIT

Dismounting the power unit allows the vehicle weight to be split.
Weight of power unit: approx. 180 kg

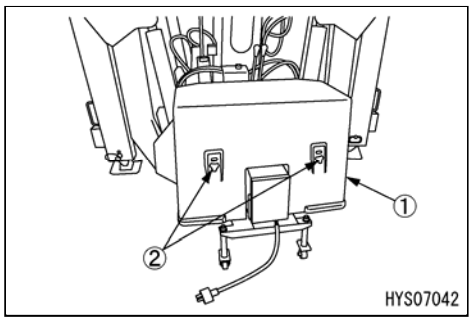
1. Install the outrigger and allow its footage to be suspended at 80 mm or thereabouts above ground.



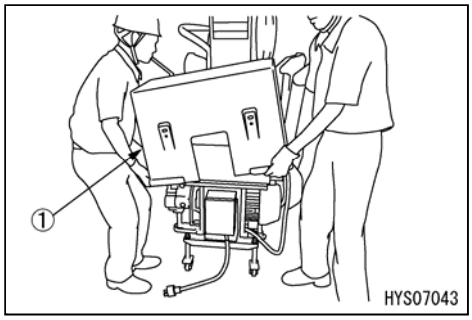
2. Stop the engine.



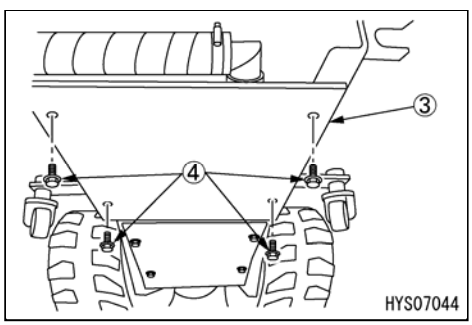
3. Remove 4 fixing bolts (2) of the power unit cover (1).



4. Remove the power unit cover (1).

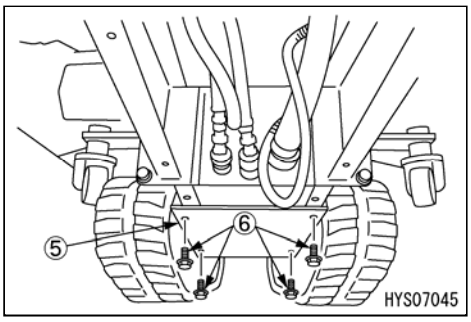


5. Remove the 4 fixing bolts (4) of the cover (3) under the electric motor unit and remove the cover (3).



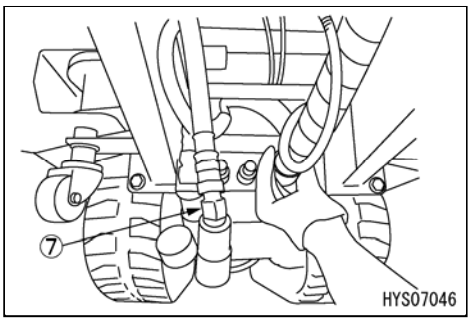
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6. Remove the 4 fixing bolts (6) of the cover (5) under the frame on the main body side and remove the cover (5).



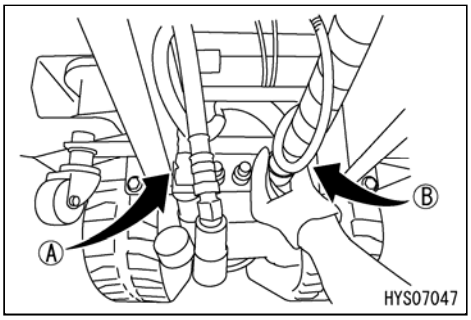
7. Remove 3 hydraulic hoses (7) from the coupler part.

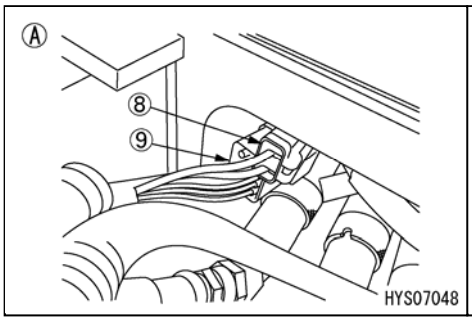
NOTES
The coupler part can be pulled out only when the groove position is aligned with the ball position. Check for their positions. Attach a coupler cap to removed couplers, respectively, so that dust or water droplets are not adhered to the couplers.

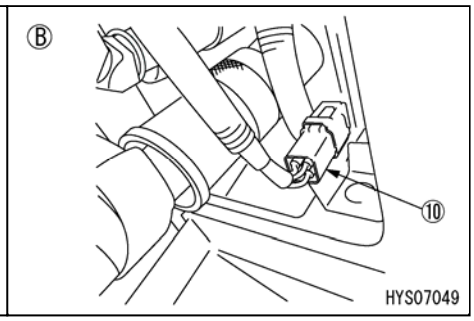


8. Remove connectors (8), (9) and (10).

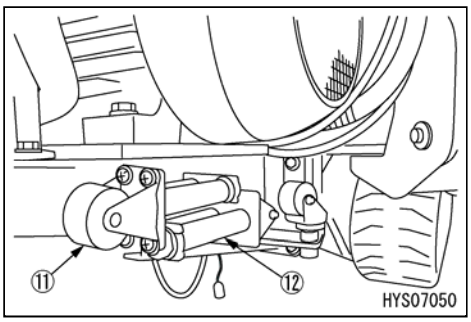
NOTES
Attach a short connector to removed connectors on the machine side. If the short connector is not attached, the engine does not start.





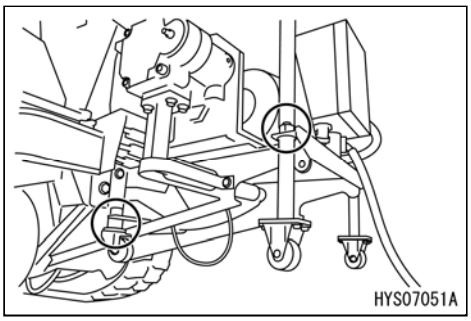


9. Loosen nuts of the casters (11) (12) (2 each) and remove the casters.

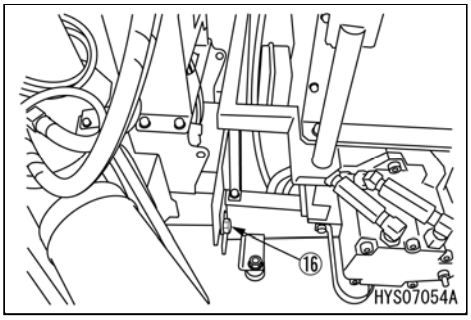


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10. Fit the removed casters into respective locations on the right figure and fix them with nuts.
    Face all the casters downward when fitting them.



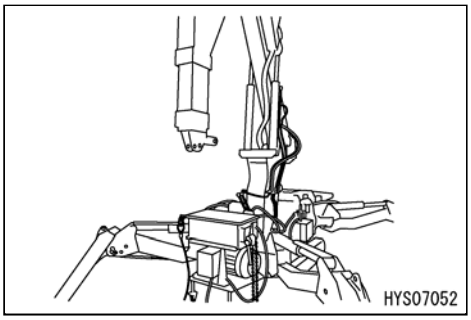
11. Remove 4 bolts (16) which connect the power unit to the machine.



12. To ease lifting up the unit with the machine itself or an overhead crane, allow the hook to stand by right above the power unit.

CAUTION

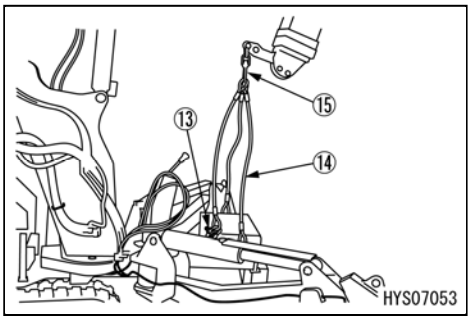
When lifting with the machine itself, avoid allowing the jib to be below -90° while performing the operation. (It stops automatically.)



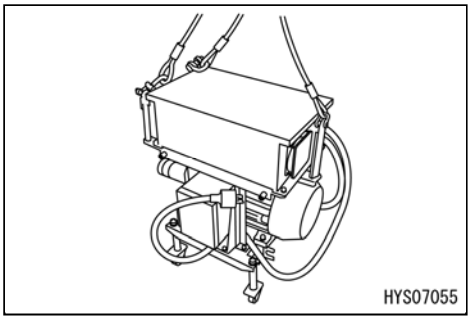
13. Attach the shackle (13) to the hole parts (3 locations) of the lifting brackets, hang a sling (14) on the hook (15) and hoist it up.

NOTES

Use shackles (13) which are attached to both the front and rear ends of the machine.

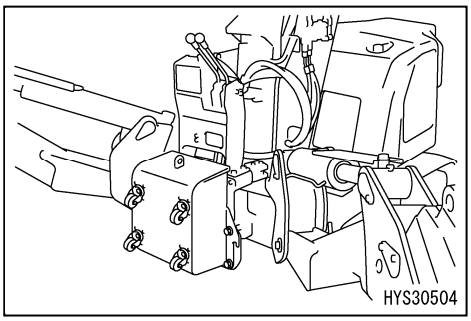


14. Slowly lower the electric motor unit to the ground.



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15. If crane is used without power unit being installed, the counterweight must be mounted instead.
    See “21.3.1 REMOVING THE COUNTERWEIGHT” for how to mount the counterweight.



Perform mounting the power unit in the reverse order of dismounting.

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21.3 HOW TO REMOVE AND MOUNT A COUNTERWEIGHT

Necessary tools

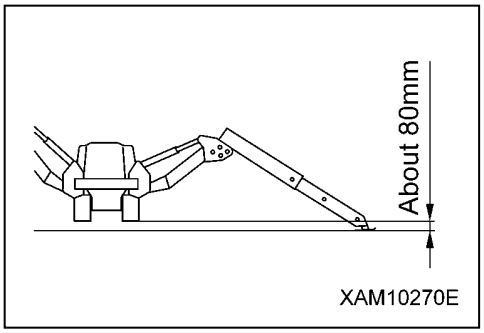
・Width across flat part: 17mm Spanner, socket, or socket wrench (for the counterweight)

・Width across flat part: 5mm Hexagonal wrench (for the castor wheels)

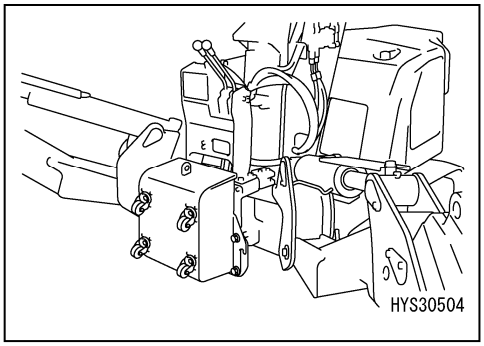
Weight of the counterweight : 200±5kg

21.3.1 REMOVING THE COUNTERWEIGHT

1. Set outriggers and raise machine body to about 80mm from the ground.



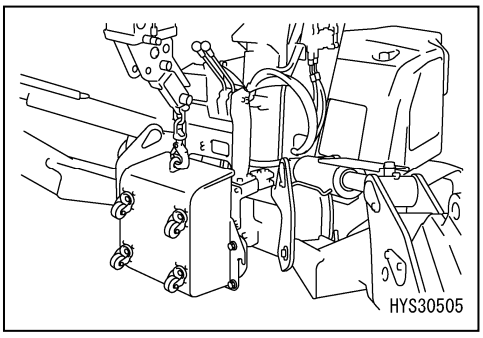
2. If castor wheels are not mounted on the counterweight, mount them. The counterweight can be removed without castor wheels, but transporting the counterweight is easier with castor wheels.



3. Set hook to lifting point of the counterweight, or set hoisting tool to hook.

⚠ CAUTION

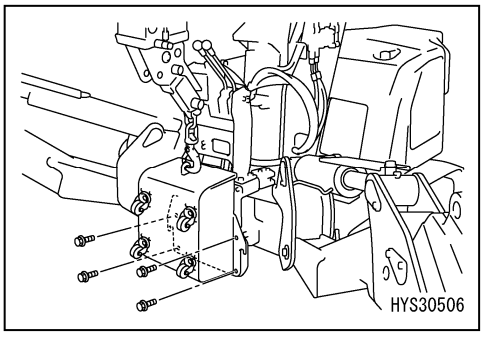
Do not tension or lift the counterweight until fixing bolts of the counterweight are removed. Otherwise it may cause damage to the crane body.



NOTES

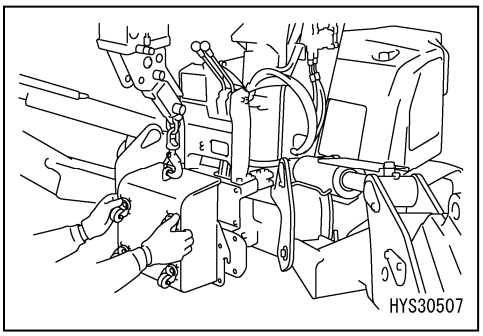
Jib angle must not be less than -90 degrees during the work. Otherwise operation stops automatically.

4. Remove 4 pieces of fixing bolts of the counterweight.



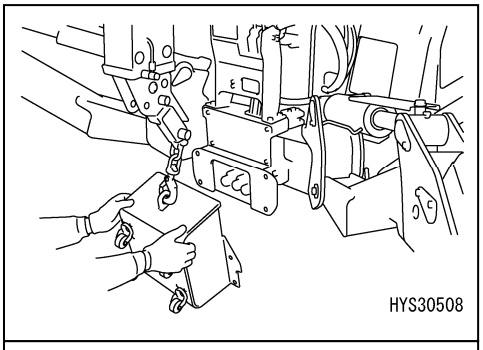
https://truckmanualshub.com/

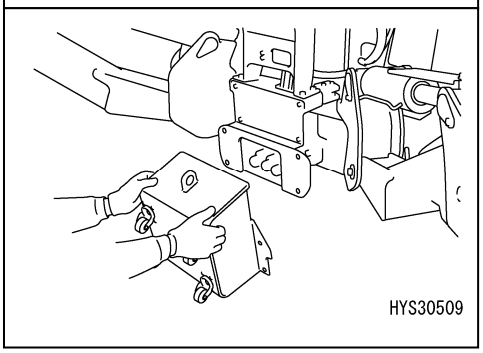
5. Slowly lift the counterweight straight up until the hooking section of the frame (falling prevention) comes off (unlocked).
   - To lift by fixed hook, retract jib for lifting up, and extend jib for lifting down.
   - To lift by winch system, raise hook for lifting up, and lower hook for lowering down.



NOTES
Slowly operate to make sure travelling levers do not hit crane.

6. Slowly lower down the counterweight onto the ground. Take off the hook or hoisting equipment from the counterweight and this work is completed.

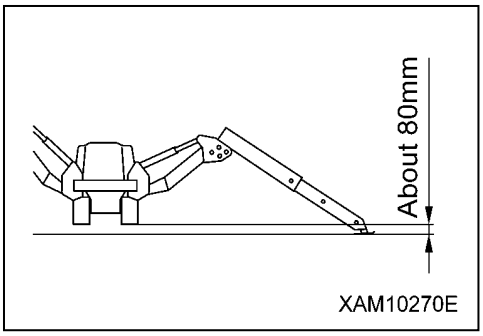




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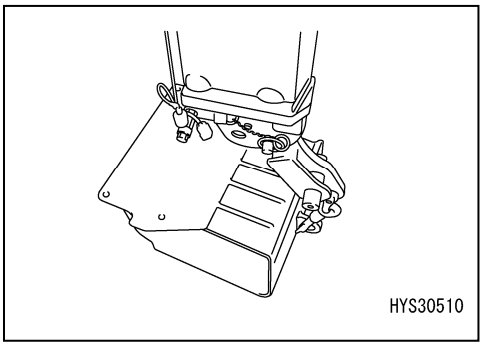
21.3.2 MOUNTING THE COUNTERWEIGHT

1. Set outriggers and raise crane body to about 80mm from the ground.



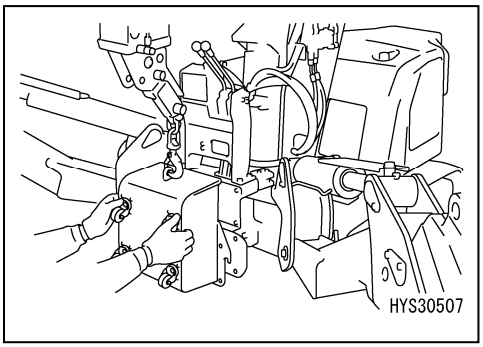
2. Prepare the counterweight near mounting part of the crane, and set hook block to the lifting point of the counterweight or to hoisting equipment.

NOTES
Jib angle must not be less than -90 degrees during the work. Otherwise operation stops automatically..

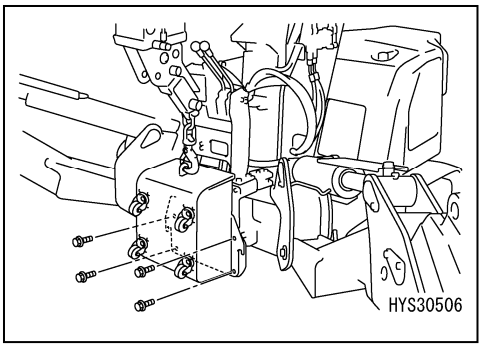


3. After lifting up the counterweight, slowly lower it down to hooking section of the frame (falling prevention) from straight above and lock the hooking section.
   - To lift by fixed hook, retract jib for lifting up, and extend jib for lowering down.
   - To lift by winch system, raise hook for lifting up, and lower hook for lowering down.

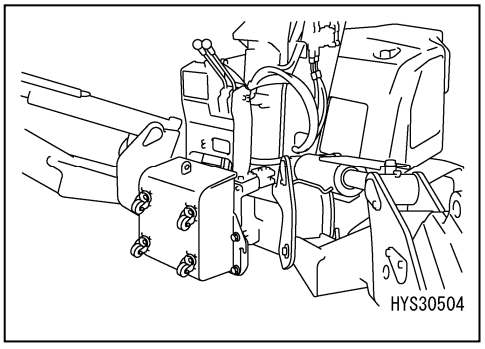
NOTES
Slowly operate to make sure travelling levers do not hit crane.



4. Mount 4 pieces of fixing bolts of the counterweight.



5. Take off hook or hoisting equipment from the counterweight and this work is completed.



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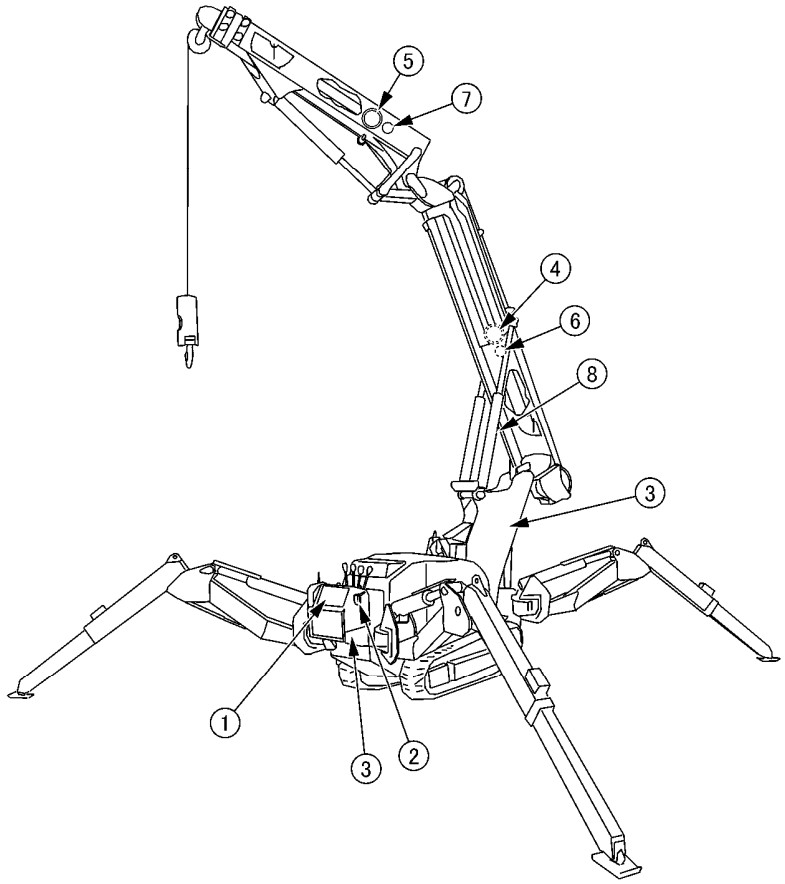
SAFETY DEVICE

1. MOMENT LIMITER	3- 2
1.1 CONFIGURATION OF MOMENT LIMITER	3- 2
1.2 BOOM DISPLACEMENT DETECTION	3- 3
1.2.1 TOTAL LENGTH REEL	3- 5
1.2.2 ANGLE DETECTOR	3- 7
1.2.3 ANGLE METER (360°)	3- 9
1.3 LOAD DETECTION	3- 11
1.3.1 PRESSURE AND OIL TEMPERATURE SENSOR	3- 12
1.4 LEVER DETECTION	3- 14
1.5 COMPONENTS OF MONITOR	3- 15
1.6 MOMENT LIMITER CALIBRATION PROCEDURE	3- 16
1.7 SLEW ANGLE CALIBRATION PROCEDURE	3- 22
2. OUTRIGGER SAFETY DEVICE	3- 24
2.1 SETTING DETECTION	3- 24
2.1.1 SETTING DETECTION ASSEMBLY	3- 24
2.1.2 WORKING OF SETTING DETECTION	3- 25
2.2 OR STOWAGE DETECTION	3- 26
2.2.1 OR STOWAGE DETECTION ASSEMBLY	3- 26
2.2.2 WORKING OF OR STOWAGE DETECTION DEVICE	3- 27
2.3 OR POSITION DETECTION	3- 28
2.3.1 OR POSITION DETECTION ASSEMBLY	3- 28
2.3.2 WORKING OF OR POSITION DETECTION DEVICE	3- 29
2.4 OR OPEN DETECTION	3- 30
2.4.1 OR OPEN DETECTION ASSEMBLY	3- 30
2.4.2 WORKING OF OR OPEN DETECTOR	3- 31
2.5 OR EXTENSION DETECTION	3- 32
2.5.1 OR EXTENSION DETECTION ASSEMBLY	3- 32
2.5.2 WORKING OF OR EXTENSION DETECTION DEVICE	3- 33
2.6 SLEWING DIRECTION DETECTION	3- 34
2.6.1 SLEWING DIRECTION DETECTION ASSEMBLY	3- 34
2.6.2 WORKING OF SLEWING DIRECTION DETECTION	3- 35
3. TIP-OVER WARNING DEVICE	3- 36
3.1 INSTALLATION POSITION	3- 36
3.2 APPEARANCE AND SPECIFICATION OF DEVICE	3- 37

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1. MOMENT LIMITER (OVERLOAD PREVENTIVE DEVICE)

1.1 CONFIGURATION OF MOMENT LIMITER

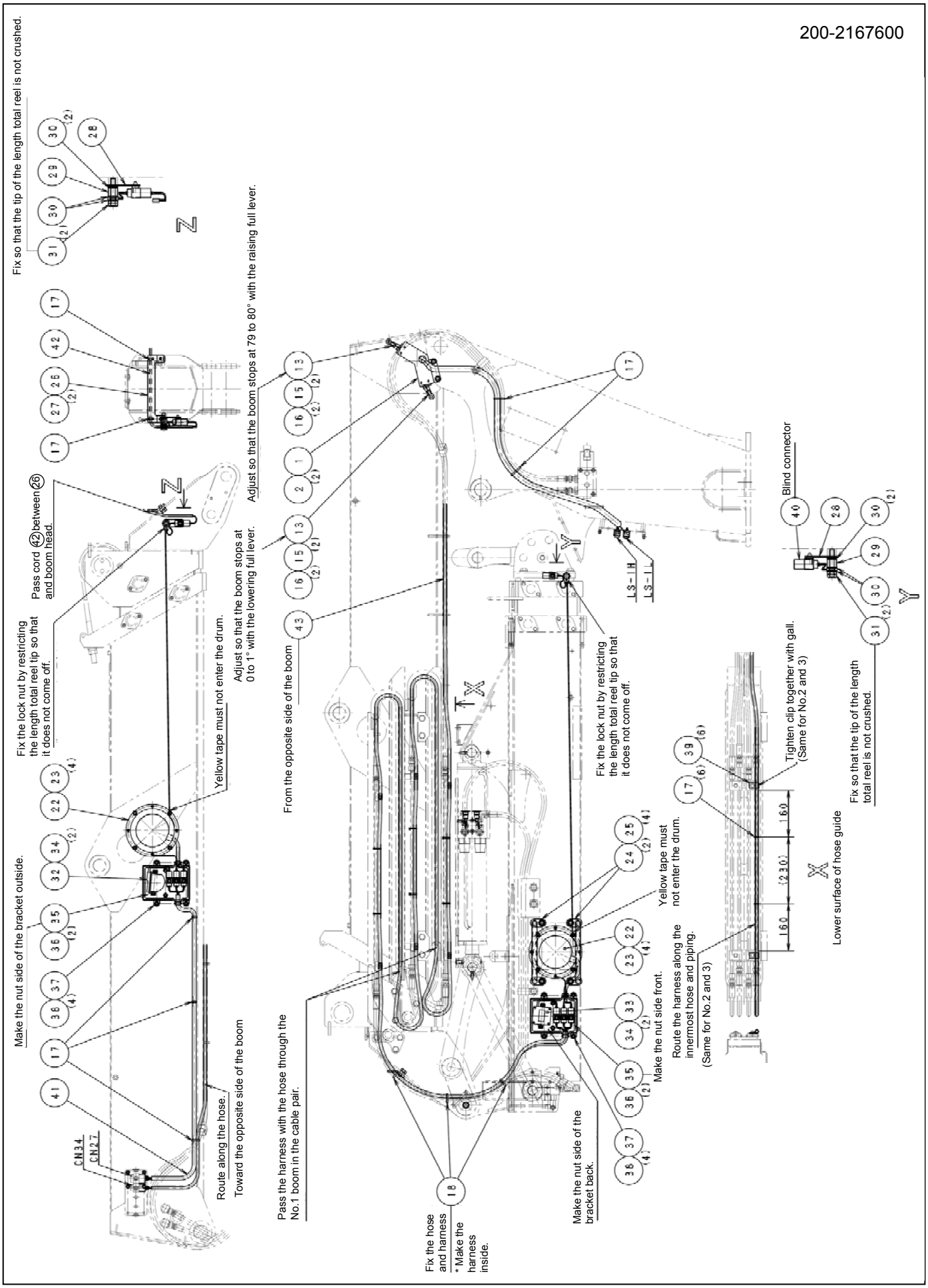


SAM13720

(1) Monitor
(2) Emergency stop cancel switch
(3) Controller [2 pieces at the bottom of monitor, 1 piece inside post]
(4) Total length of main boom (side of main boom)
(5) Total length of jib (side of jib)
(6) Main boom angle meter (side of main boom)
(7) Jib angle meter (side of jib)
(8) Pressure sensor (main boom derricking cylinder section, 2 pieces)

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1.2 BOOM DISPLACEMENT DETECTION

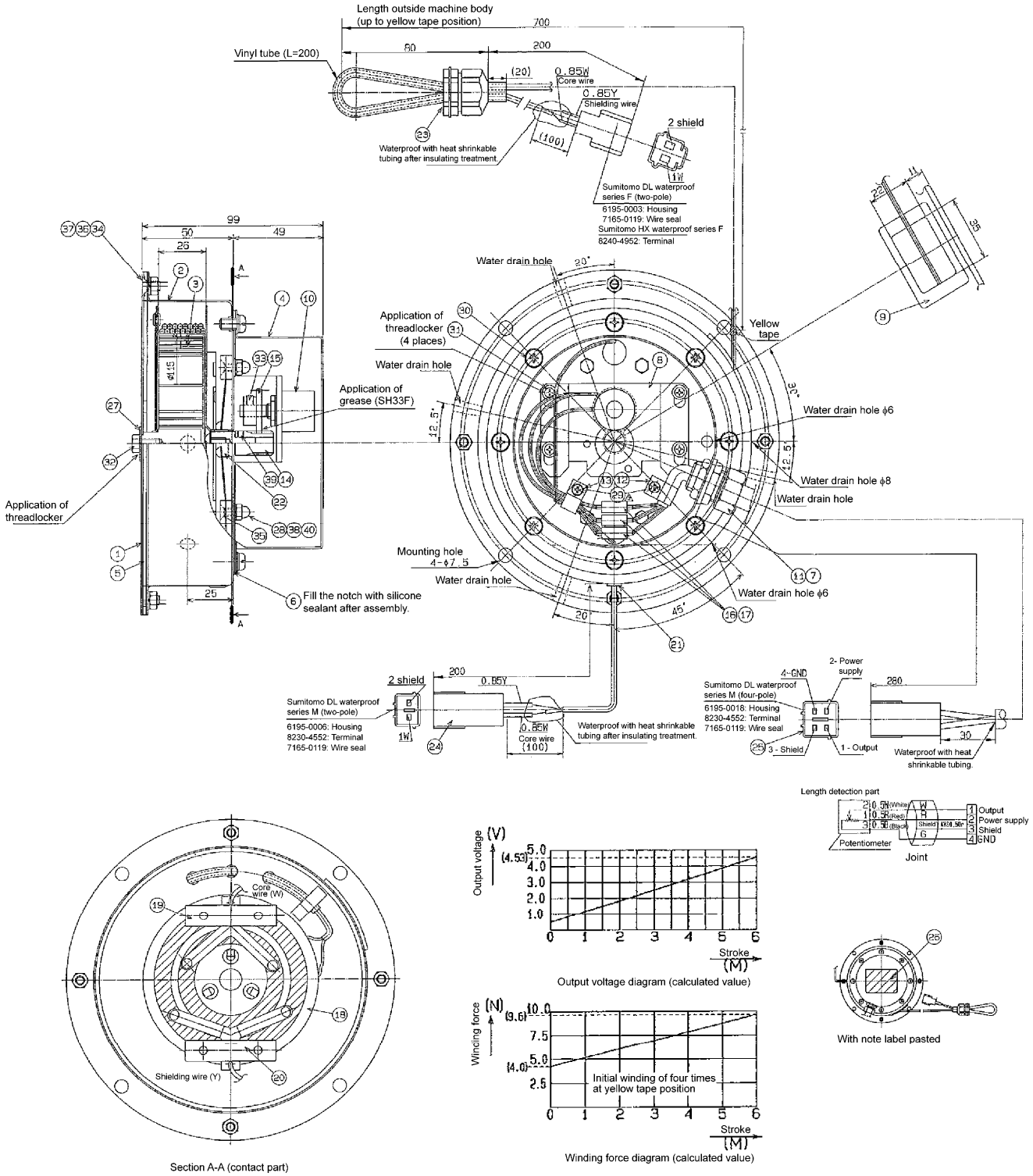


Number	Name	Q'ty	Note
1	Board	1	Item number: 353-4486500
2	Sems bolt	2	Komatsu item number: 01024-80816
13	Limit switch	2	Item number: 200-4641500
15	Hexagon socket head screw	4	M5 × 0.8 × 16L (plated)
16	Spring washer	4	M5 × Type 2 (plated)
17	Cable tie	14	Item equivalent to Shibakei CV-150
18	Cable tie	3	Item number: 28912-90210 (Item equivalent to HellermannTyton T50R-DH-W)
22	Total length reel	2	Item number: S200M3296000
23	Sems bolt	8	Komatsu item number: 01024-80616
24	Total length guard	2	Item number: 200-4655300
25	Sems bolt	4	Komatsu item number: 01024-81020
26	Harness guide	1	Item number: 200-4655500
27	Sems bolt	2	Komatsu item number: 01024-81020
28	Connector plate	2	Item number: 200-4655700
29	Cord guide	2	Item number: 200-4655600
30	Plain washer	8	M10 × Regular circle (plated)
31	Hexagon nut	4	M10 × 1.5 × Type 3
32	Angle detector	1	Item number: 103S97200000
33	Angle meter (360°)	1	Item number: S200M3297000
34	Sems bolt	4	Komatsu item number: 01024-80616
35	Angle meter bracket	2	Item number: 200-4655200
36	Sems bolt	4	Komatsu item number: 01024-80616
37	Angle meter cover	2	Item number: 200-3361100
38	Sems bolt	4	Komatsu item number: 01024-80616
39	Clamp	6	Item number: 22961-08100 (COT-08)
40	Dead turns blind connector	1	Item number: 200-4641300
41	Boom measurement harness	1	Item number: 200-3361700
42	Cord reel relay cord	1	Item number: 200-4656000
43	Jib measurement harness	1	Item number: 200-3361200

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1.2.1 TOTAL LENGTH REEL

S200M3296000



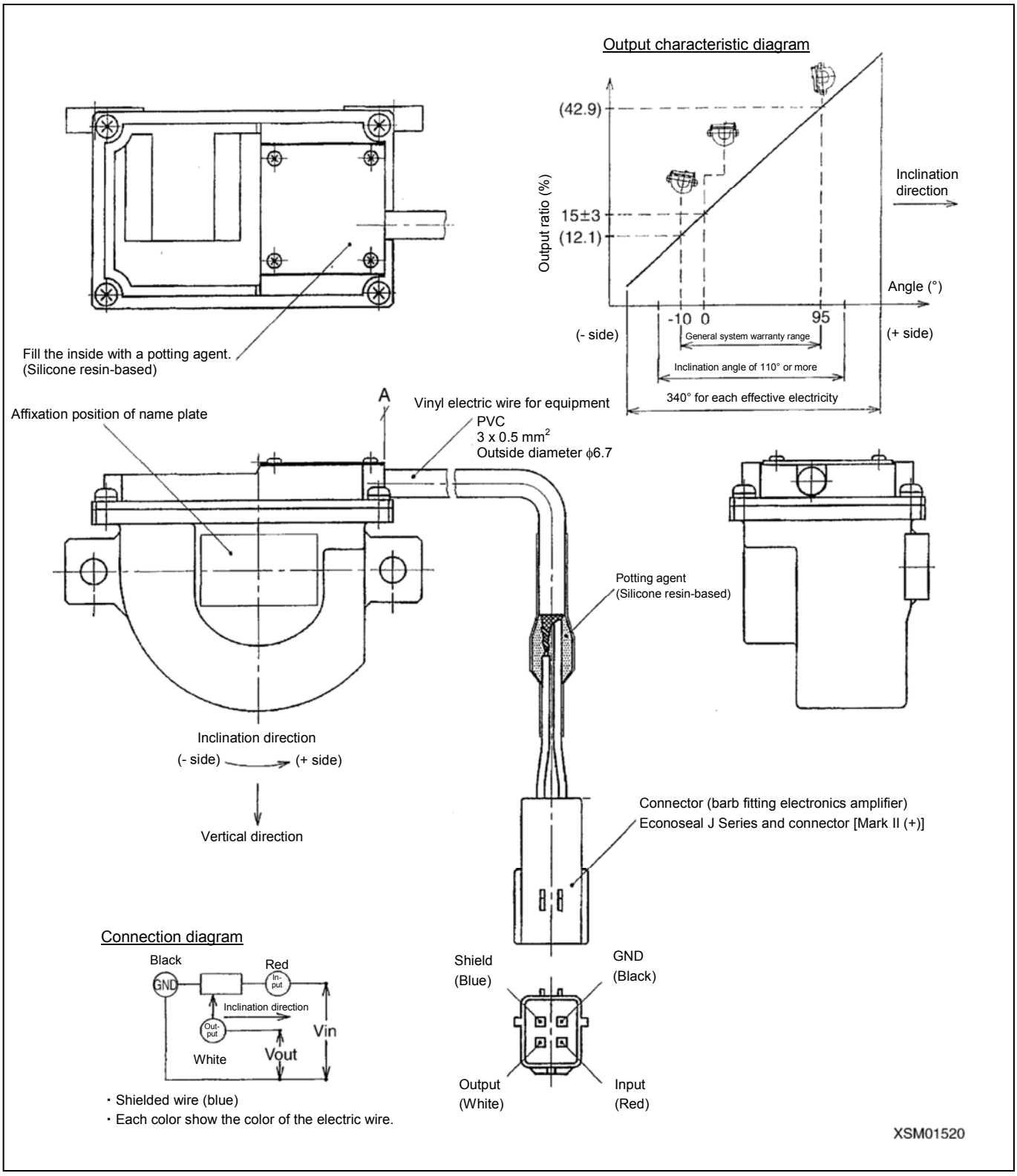
Note: When replacing the total length reel, do not allow the yellow tape of the main cord to enter the drum. If the main cord enters the drum, the potentiometer will malfunction.

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Number	Name	Q'ty	Note
1	Base plate	1	
2	Case	1	
3	Drum assembly	1	
4	Cover	1	
5	Packing	1	
6	Packing	1	
7	Seal washer	1	
8	Bracket	1	
9	Cord guide	1	
10	Potentiometer	1	
11	Cord clamp	1	
12	Nylon clip	1	
13	Nylon clip	1	
14	Gear	1	
15	Gear	1	
16	Bullet terminal (male)	3	
17	Bullet terminal (female)	3	
18	Contact ring assembly	1	
19	Contact assembly (inner)	1	
20	Contact assembly (outer)	1	
21	Rubber bushing	1	
22	Collar	1	
23	Main cord assembly	1	
24	Sub cord assembly	1	
25	Microphone cord assembly	1	
26	Note label	1	
27	Special washer	1	
28	Hexagon cap nut	4	M4
29	Iron small sized sems screw	2	M4 x 8 (with plain washer and spring washer)
30	Iron small sized sems screw	8	M5 x 8 (with plain washer and spring washer)
31	Iron small sized sems screw	4	M5 x 10 (with plain washer and spring washer)
32	Hexagon head bolt	1	M5 x 8
33	Hexagon socket head cap screw	1	M4
34	Hexagon nut	4	M5
35	Countersunk head screw	4	M4 x 12
36	Countersunk head screw	4	M5 x 12
37	Spring washer	4	Nominal size 5
38	Spring washer	4	Nominal size 4
39	Hexagon socket head cap screw	1	M3
40	Plain washer	4	M4

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1.2.2 ANGLE DETECTOR



Specifications	
Inclination angle	110° or more (with this illustration as 0°, 98° or more on the plus side and 12° or more on the minus side)
Overall accuracy	±1% at the time of excitation (including linearity and hysteresis)
Responsiveness	Approx. 1 second at inclination angle of 90° (must be good in the operating temperature)
Built-in potentiometer (equivalent to CP-2F)	
Effective electrical angle	340° +2°/-3°
Total resistance value	1 kOhm±20%
Index point	Adjust the output in this illustration (0°) to 15±3%
Insulation resistance	200 MOhm or more DC 500V
Withstand voltage	AC 500V 1 minute
Normal rated power	0.5W/50°C
Environmental performance	
Operating temperature range	-30 to 80°C
Storage temperature range	-40 to 80°C
Vibration resistance	50 m/S^2 33 Hz 2 hours each for 3 axes
Shock resistance	200 m/S^2 3 times each for 6 directions
Sealing performance	IP64
Damper oil used	Silicon oil 500 mm^2/s (Toshiba Silicon TSF451-500)

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1.2.3 ANGLE METER (360°)

S200M3297000

Fig.1

Dimension
外形

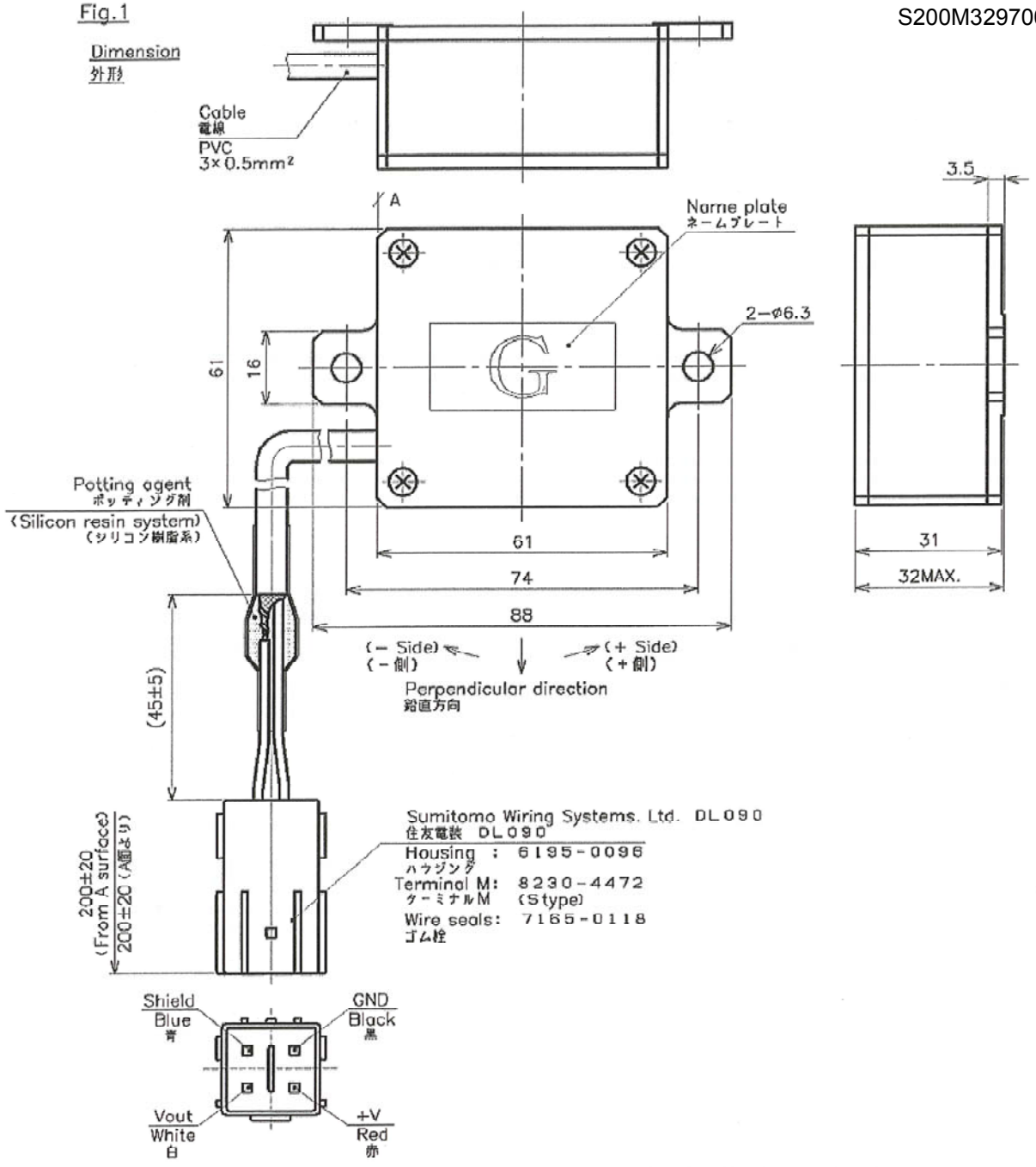


Fig.2

Output characteristic
出力特性

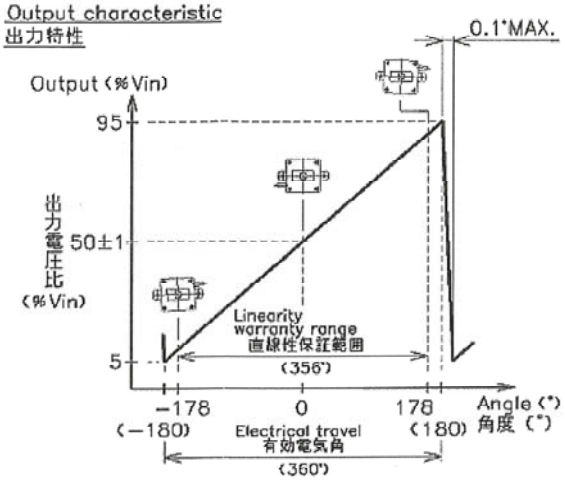
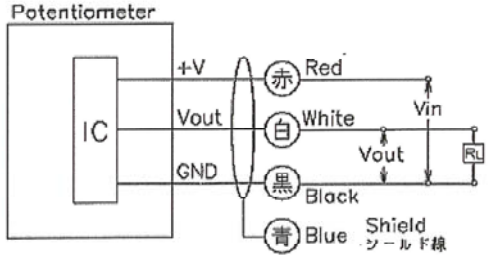


Fig.3

Schematic
結線



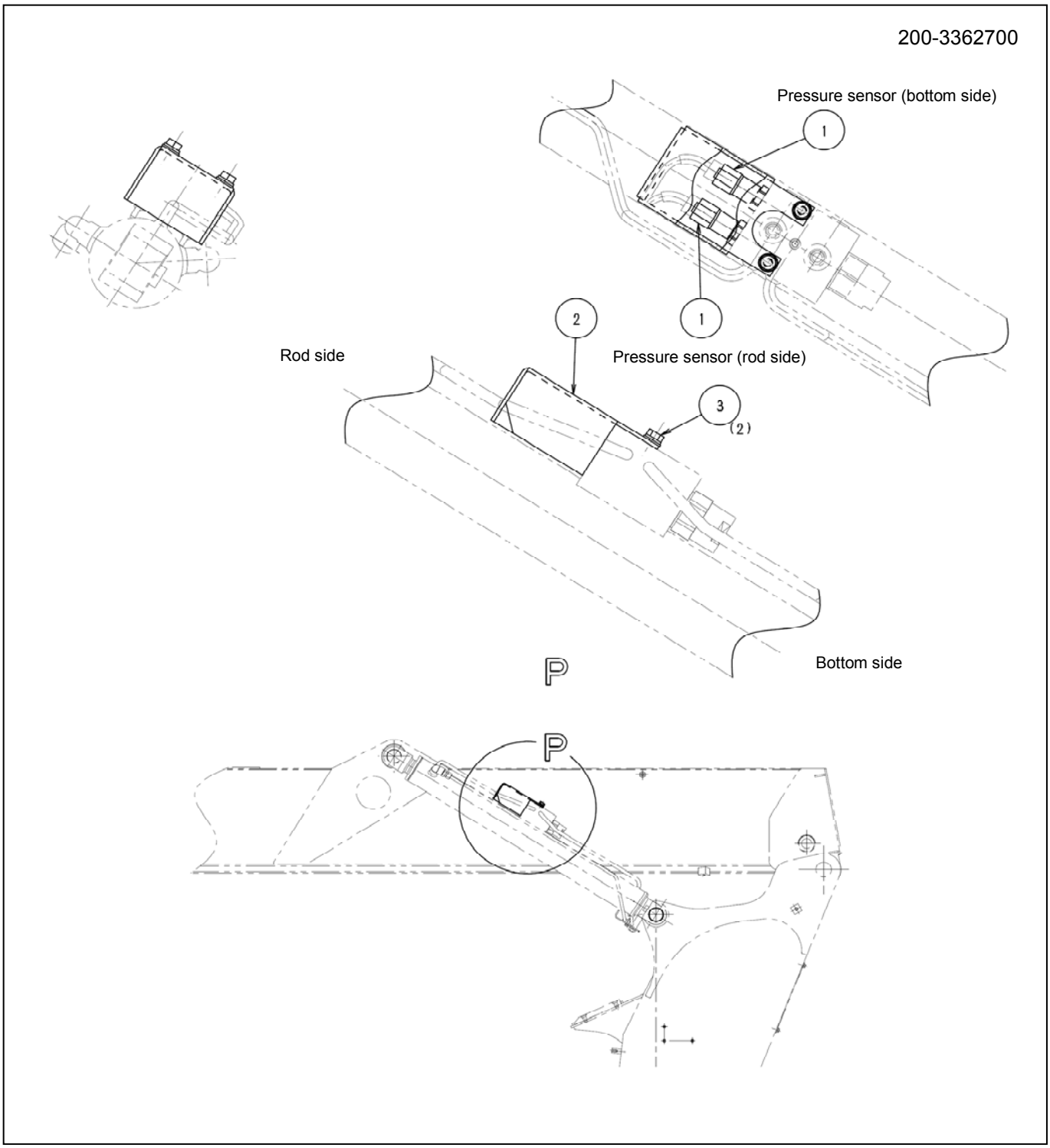
• Red, white, black and blue indicate cable colors.

• 赤，白，黒，青 は電線の色を表す。

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Specifications	
Manufacturer model	WR-7UHA360-01 Midori Precisions
Effective inclination angle	±180°
Index point	Adjust the output in this illustration (0°) to 50±1% Vin
Absolute linearity	±0.4%FS (FS = 360°)
Inclination angle sensitivity	1.08° MAX (0.3%FSMAX, FS = 360°) including hysteresis
Applied voltage	DC 5V±0.5V
Load resistance	10 KOhm to 150 KOhm
Consumption current	10mA MAX
Temperature drift	1.08° MAX (0.3%FSMAX, FS = 360°) at -30 to +80°C (standard difference of +25°C)
Step response (time constant)	Approx. 0.3 seconds (25°C) at inclination angle of 45°
Oil viscosity	500 mm^2/s
Environmental performance	
Operating temperature range	-30 to 80°C
Storage temperature range	-40 to 80°C
Sealing performance	IP64
Vibration	50 m/S^2 5 to 500 Hz 2 hours each for 3 axes
Shock	500 m/S^2, 11 ms, 3 times each for 6 directions
Electro magnetic immunity	100 V/m, 200 MHz to 1 GHz, output fluctuation amount ±1% Vin
Resistance to static electricity	±15 KV

1.3 LOAD DETECTION



Number	Name	Q'ty	Note
1	Pressure and oil temperature sensor (25)	2	Item number: S200J3315000
2	Pressure sensor cover	1	Item number: 349-3204200
3	Hexagon head bolt with washer	2	M8 x 1.25 x 15L (plated, with PW and SW)

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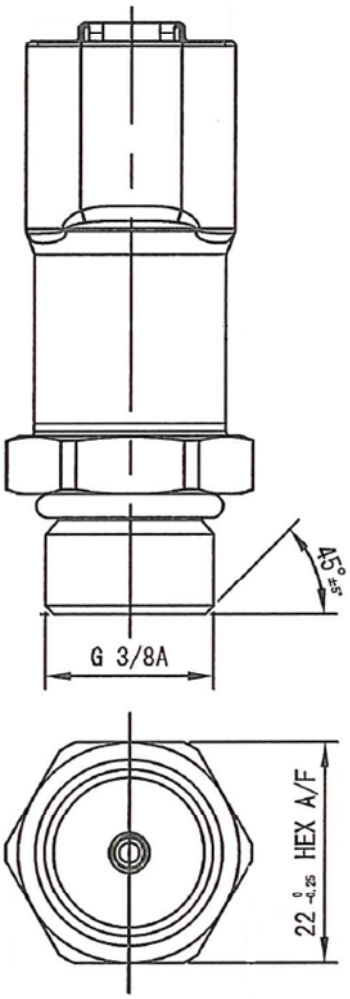
1.3.1 PRESSURE AND OIL TEMPERATURE SENSOR

S200J 3315000

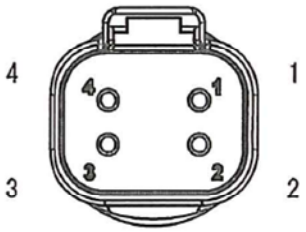


1. Mechanical structure

1.	Connection screw	G3/8A (JIS B2351 Type 0)
2.	Medium contact part	17-4 PH Stainless Steel
3.	Connector connection shape	Deutsch DT04-4P
4.	Protection structure	IP67
5.	Recommended tightening torque	70 to 75 N·m
6.	Terminal arrangement	Cord 8



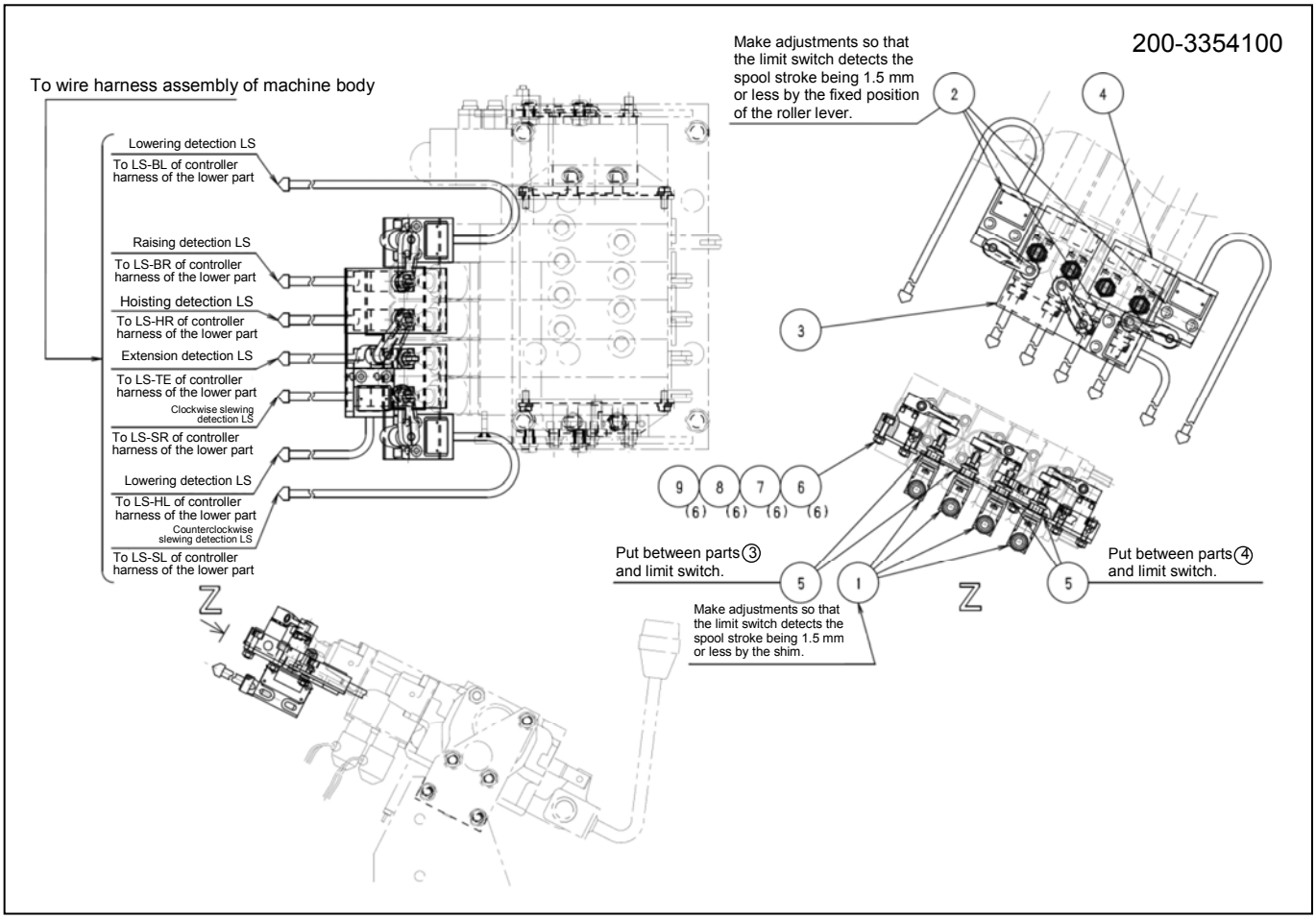
Pin No.	Function
1	Common (0V)
2	Power supply (+)
3	Vout 2 (temperature output)
4	Vout 1 (pressure output)



Specifications	
Manufacturer model	3101T0250S2L8000 Danaher ICG Japan
Pressure range	0 to 25 MPa
Withstand pressure	50 MPa
Secular change	±0.1% FS/year
Mechanical accuracy	±0.25% FS (Overall value of nonlinearity, hysteresis and reproducibility)
Mechanical stability	±0.2% FS (10,000,000 cycles, after application of FS pressure)
Temperature characteristics	±0.15% FS/10°C
Temperature output range	-40 to +125°C
Temperature compensation range	-40 to +105°C
Operating temperature range	-40 to +105°C
Zero tolerance	±0.5% FS
Span tolerance	±0.5% FS
Response time	1 ms
Protection structure	IP67
Vibration	40G: Peak sine wave
Shock	In conformity with the drop test of IEC68-2-32 procedure 1
Output	0.5 to 4.5V DC
Input voltage	5V DC±10%
Consumption current	MAX 6.5 mA (at no load)

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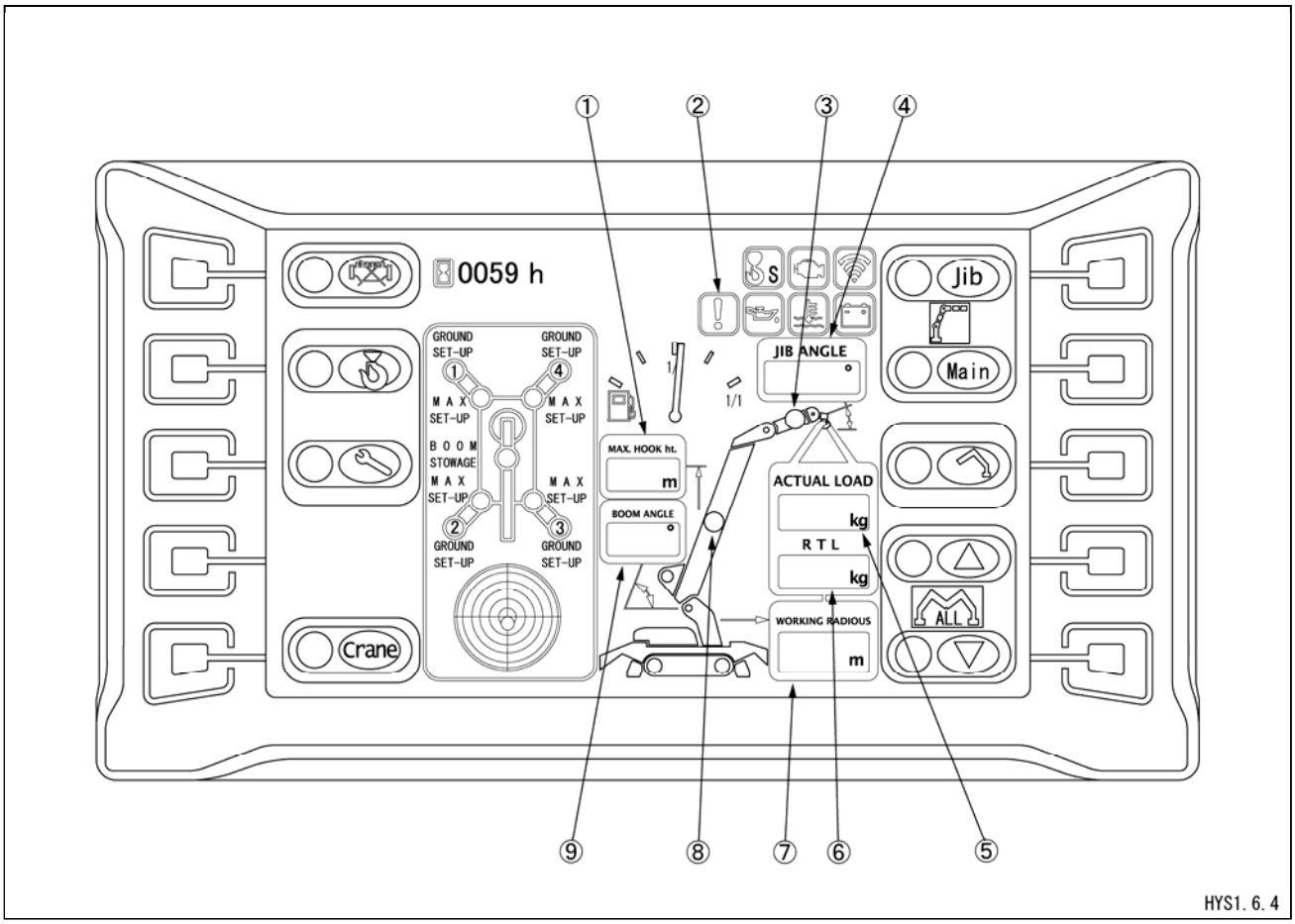
1.4 LEVER DETECTION



Number	Name	Q'ty	Item No.
1	Limit switch (D4E type)	4	S102M2523000
2	Limit switch (D4C type)	3	S102M2522000
3	Limit switch mounting bracket	1	353-3239800
4	L-SW mounting bracket	1	200-4629100
5	Shim	4	353-4486200
6	Hexagon socket head cap screw (M5 x 20L)	6	21079-05020
7	Hexagon nut (M5 x Type-1)	6	21211M05210
8	Plain washer (M5 x Small circle)	6	21741M05002
9	Spring washer (M5 x Type-2)	6	21711M05002

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1.5 COMPONENTS OF MONITOR



(1) Lifting height display
(2) Abnormality occurrence display
(3) Display of number of jib sections
(4) Jib angle display
(5) Actual load display
(6) Rated total load display
(7) Working radius display
(8) Display of number of main boom sections
(9) Main boom angle display

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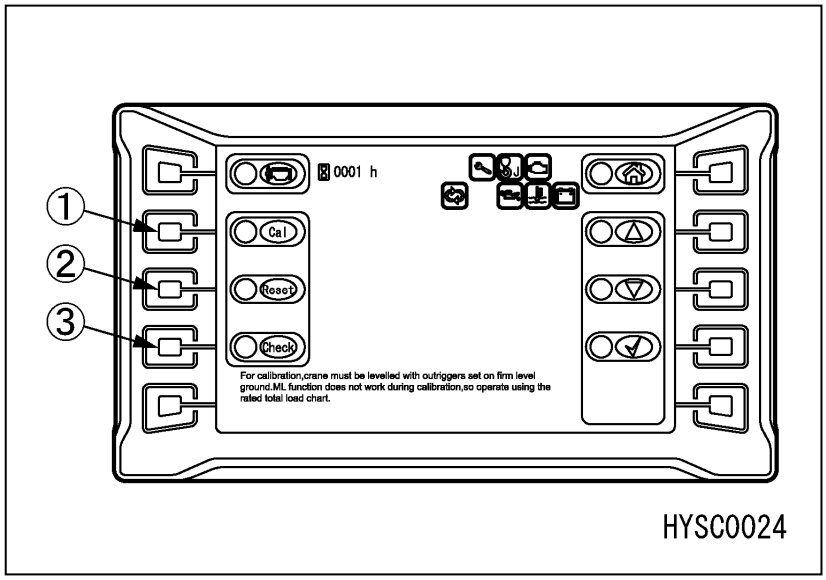
1.6 MOMENT LIMITER CALIBRATION PROCEDURE

First, make the machine body horizontal and enter the crane mode.
You cannot enter the calibration screen unless you are in the crane mode.
Select the calibration mode from the service mode.
See “19.2.3 SERVICE MODE” for the monitor structure so far.

Be careful that when you enter the calibration screen, the safety devices are in the following state.

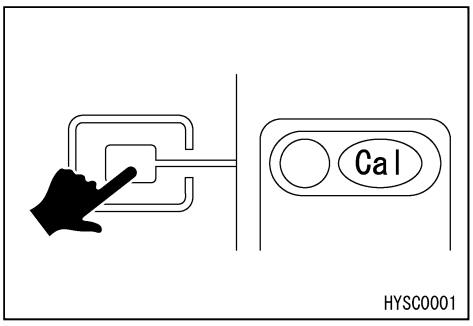
- Slewing restriction: Valid
- Grounding detection: Valid
- Boom upper limit and lower limit switch: Invalid (Buzzer sounds)
- Over-hoisting sensor and over-lowering limit switch: Invalid (Buzzer sounds)

Calibration menu



(1) Calibration mode
(2) Calibration data reset
(3) Calibration data check

(1) [cal] Calibration mode
While turning ON “Emergency release SW”, press the “cal” button to move to the calibration mode.
The screen does not change if the “cal” button alone is pressed.



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(1.1) Setting of machine state

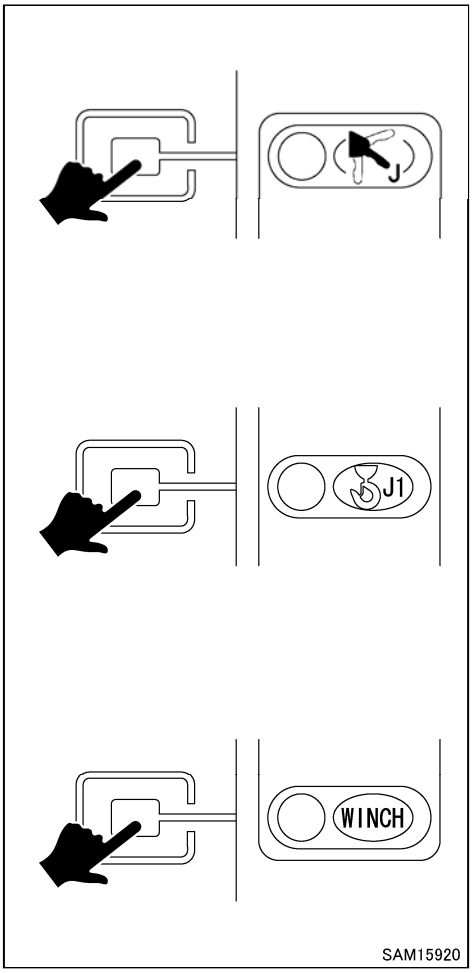
J (Fixed hook): Yes/No

J1 (1 fall hook): Yes/No

WINCH (Installation of winch): Yes/No

Select applicable items with respect to the machine state and equipment at the time of calibration.

(A green circle denotes selection while a blue circle denotes no selection.)



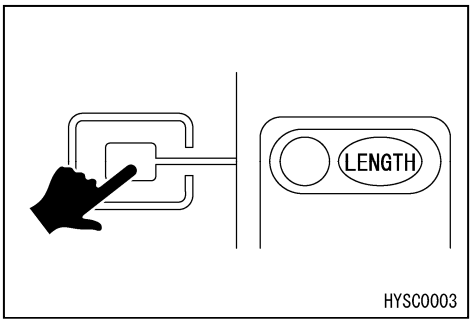
NOTES
Calibration for fixed hook can only be done in “Middle position”. Before calibrating, make sure actual position of fixed hook is also in “Middle position”.

- When having calibrated Length, be sure to calibrate Load.
- When having calibrated Angle, be sure to calibrate Load.

(1.1.1) Calibration of length

Select “LENGTH” and calibrate the boom and jib length display.

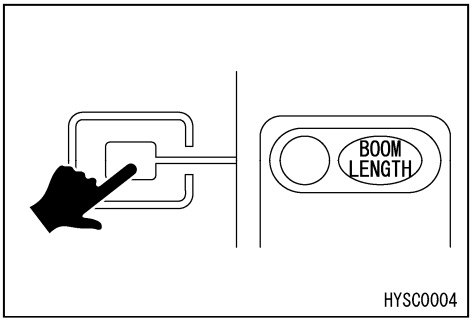
Refer to (1.1.1.1) Calibration of boom length when you wish to calibrate boom length, and to (1.1.1.2) Calibration of jib length when you wish to calibrate jib length.



(1.1.1.1) Calibration of boom length

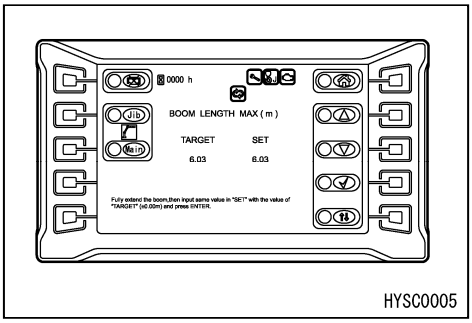
Calibrate the boom length.

Select “BOOM LENGTH”.



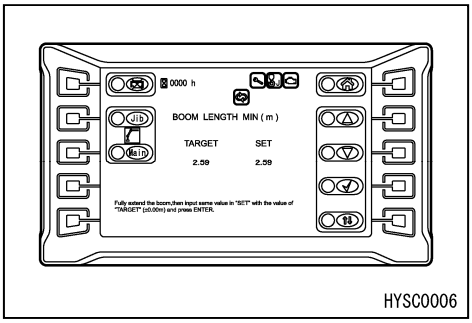
https://truckmanualshub.com/

(1.1.1.1.1) Calibration of boom length MAX
Calibrate when the boom is extended to the maximum.
Keep the boom extended to the maximum.
Use the cursor move button (▲ or ▼) so that the numerical value of “SET” is “6.03±0 m” of “TARGET” and press the Enter button.
In the case of manual operation, the boom can be switched with [Jib. Main].
The calibration screen can be switched between MAX and MIN with [↑↓].



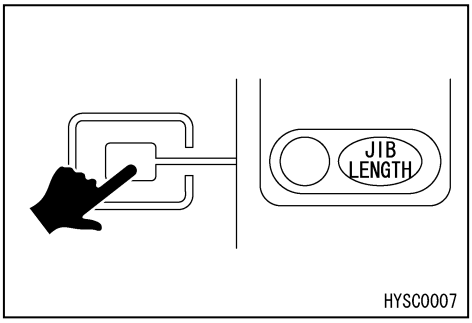
HYSC0005

(1.1.1.1.2) Calibration of boom length MIN
Calibrate when the boom is extended to the minimum.
Keep the boom contracted to the minimum.
Use the cursor move button (▲ or ▼) so that the numerical value of “SET” is “2.59±0 m” of “TARGET” and press the Enter button.



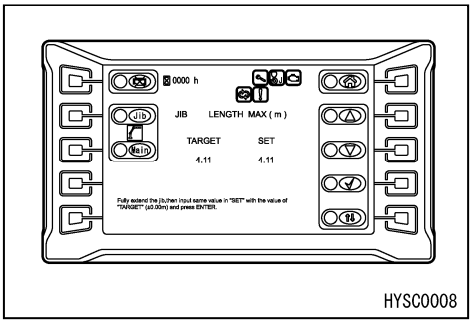
HYSC0006

(1.1.1.2) Calibration of jib length
Calibrate the boom length.
Select “JIB LENGTH”.



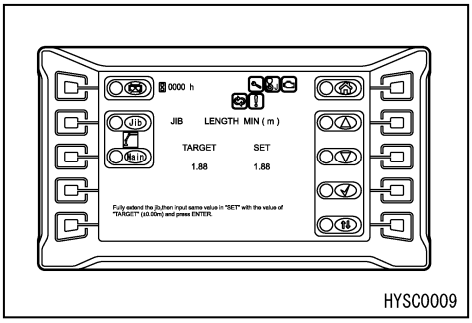
HYSC0007

(1.1.1.2.1) Calibration of jib length MAX
Calibrate when the jib is extended to the maximum.
Keep the jib extended to the maximum.
Use the cursor move button (▲ or ▼) so that the numerical value of “SET” is “4.11±0 m” of “TARGET” and press the Enter button.



HYSC0008

(1.1.1.2.2) Calibration of jib length MIN
Calibrate when the jib is extended to the minimum.
Keep the jib contracted to the minimum.
Use the cursor move button (▲ or ▼) so that the numerical value of “SET” is “1.88±0 m” of “TARGET” and press the Enter button.

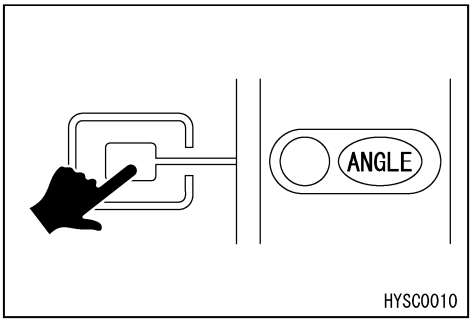


HYSC0009

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(1.1.2) Calibration of angle

Select “ANGLE” and calibrate the boom and jib angle display.

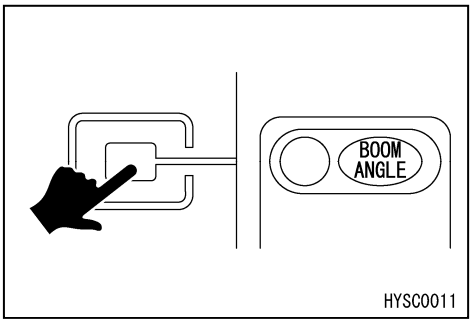


(1.1.2.1) Calibration of boom angle

Calibrate the boom angle.

Select “BOOM ANGLE”.

When installing an angle meter to the boom, install it on a flat plane around the area where the angle meter of the moment limiter is installed.

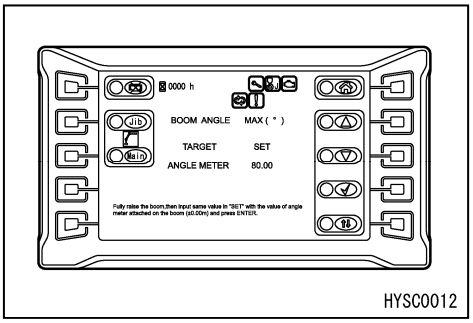


(1.1.2.1.1) Calibration of boom angle MAX

Calibrate when the boom angle is maximum.

Install an angle meter to the boom and set the boom angle to “full raising”.

Use the cursor move button (▲ or ▼) so that the numerical value of “SET” is ±0 of the displayed value of the angle meter and press the Enter button.

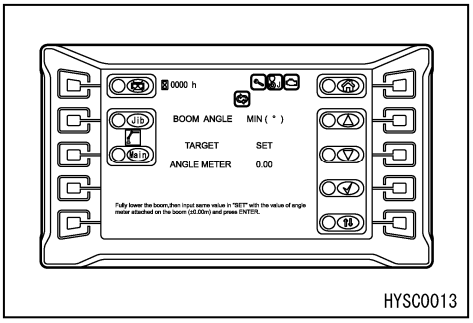


(1.1.2.1.2) Calibration of boom angle MIN

Calibrate when the boom angle is minimum.

Install an angle meter to the boom and set the boom angle to “full lowering”.

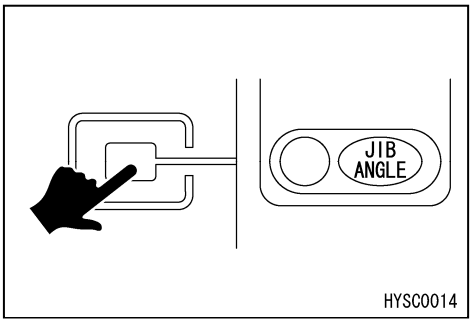
Use the cursor move button (▲ or ▼) so that the numerical value of “SET” is ±0 of the displayed value of the angle meter and press the Enter button.



(1.1.2.2) Calibration of jib angle

Calibrate the jib angle.

Select “JIB ANGLE”.



(1.1.2.2.1) Calibration of jib angle MAX

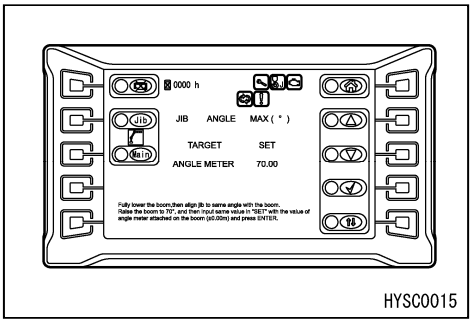
Calibrate when the jib angle is maximum.

First, set the boom and the jib straight so that their angles are the same.

Install an angle meter to the boom and set the boom angle to “70°”.

Be careful that if the angle meter is installed to the jib, the position is so high that it cannot be seen.

Use the cursor move button (▲ or ▼) so that the numerical value of “SET” is “70.00±0°” and press the Enter button.



HYSC0015

(1.1.2.2.2) Calibration of jib angle MIN

Calibrate when the jib angle is minimum.

Lower the jib fully and set it to a “stowed state”.

Lower the boom fully as well and set it to a “fully stowed state”.

Install an angle meter to a flat plane of the jib.

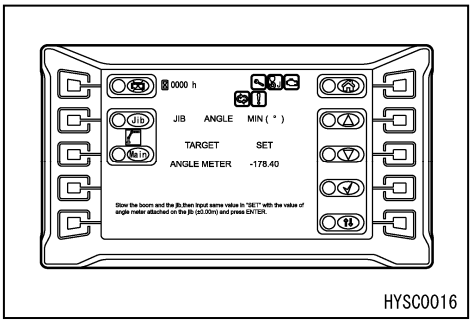
Use the cursor move button (▲ or ▼) so that the numerical value of “SET” is the “displayed absolute value - 180°” and press the Enter button.

Example: When a displayed value is -1.40°: 1.40° - 180° = -178.60°

This is a SET value.

When a displayed value is +1.55°: 1.55° - 180° = -178.45°

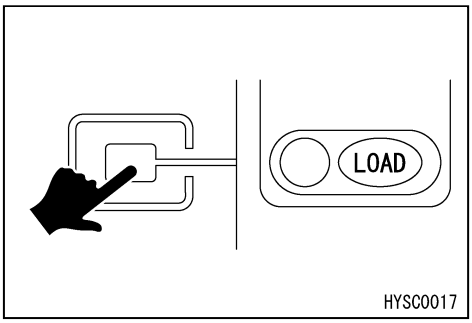
This is a SET value.



HYSC0016

(1.1.3) Calibration of load

Select “LOAD” and calibrate the actual load display.



HYSC0017

(1.1.3.1) Position setting

Set the working equipment posture at the time of calibration of actual load.

Move the crane so that numerical values of the boom length, boom angle and jib angle of “SET” fall into the range of “TARGET”.

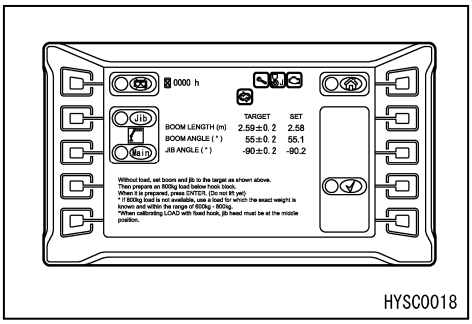
BOOM LENGTH: 2.59±0.2(m)

BOOM ANGLE: 55±0.2(°)

JIB ANGLE: -90±0.2(°)

Slowly stop the boom angle by lowering operation.

When the numerical values of “SET” fall into the range of “TARGET”, press the Enter button.



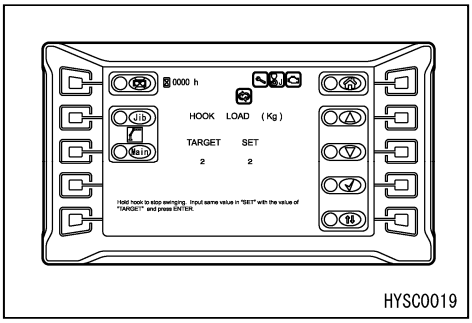
HYSC0018

Fully contract the jib length to prevent interference with the ground.

The work can be performed efficiently if a weight of 600 to 800 kg is prepared in advance directly beneath the hook at the setting position.

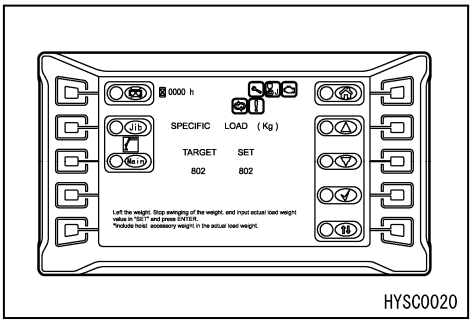
https://truckmanualshub.com/

(1.1.3.1.1) Calibration of actual load (no load: hook only)
Calibrate a load at no load (hook weight only).
Keep the working equipment posture as it was set.
Use the cursor move button (▲ or ▼) so that the numerical value of "SET" is "2 kg" of "TARGET" and press the Enter button.
However, in the case of one fall hook of the optional winch, "TARGET" is "20 kg".



HYSC0019

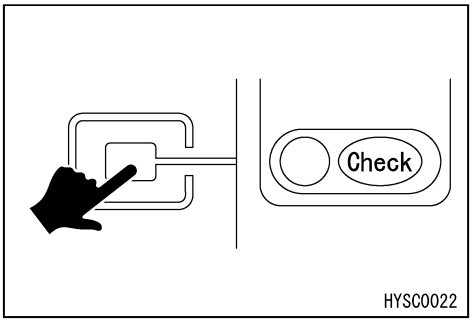
(1.1.3.1.2) Calibration of actual load (at load)
Calibrate a load at load (including hook weight).
Keep the working equipment posture as it was set.
Hoist the weight prepared for extension/contraction of the jib (or up and down of the winch).
Use the cursor move button (▲ or ▼) so that the numerical value of "SET" is "weight of weight + slinging wire weight + hook weight", stop sway of the load and press the Enter button after 10 seconds.
Example Weight: 800 kg
Slinging wire: 5 kg
Hook: 2 kg
Set the value of SET to a total of 807 kg.



HYSC0020

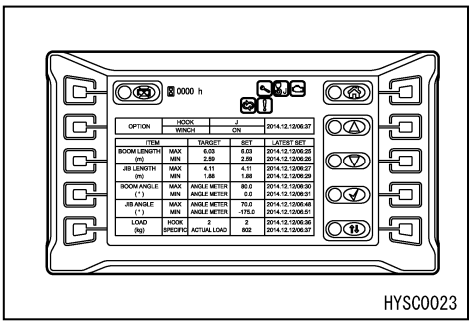
Be careful not to overwind when working with a winch.

(2) [CHECK] Check of calibration data
The data, when calibrated last, can be checked.
When "CHECK" is selected, the screen changes and the status is displayed.
Check that the values of calibrated items (SET) and the date (LATEST SET) are entered.



HYSC0022

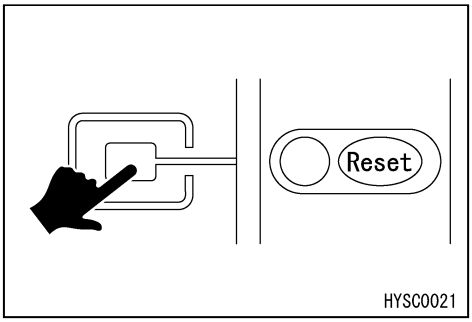
HOOK	J1	Calibrated as with fixed hook.
	JM	Calibrated as with single fall hook.
WINCH	ON	Winch unit is mounted when calibrated. (If "HOOK" is in "JM", WINCH is always "ON"
	OFF	Winch unit is not mounted when calibrated.



HYSC0023

(3) [Reset] Calibration data reset
Reset the calibration data.
When "RESET" is selected, the "N/Y" screen is displayed. Select using the cursor move button (▲ or ▼) and press the Enter button.
N: No reset is made.
Y: A reset is made.

Be sure to calibrate after reset.



HYSC0021

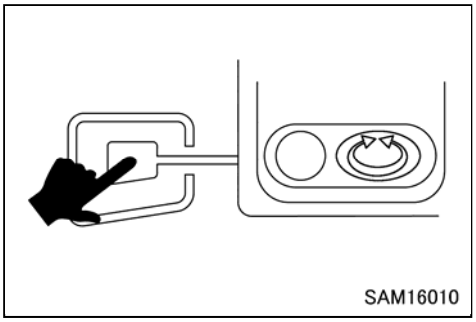
https://truckmanualshub.com/

1.7 SLEW ANGLE CALIBRATION PROCEDURE

First, make sure the vehicle body is level and that it is in crane mode.
If the vehicle is not in the crane mode, you cannot go into the calibration screen.

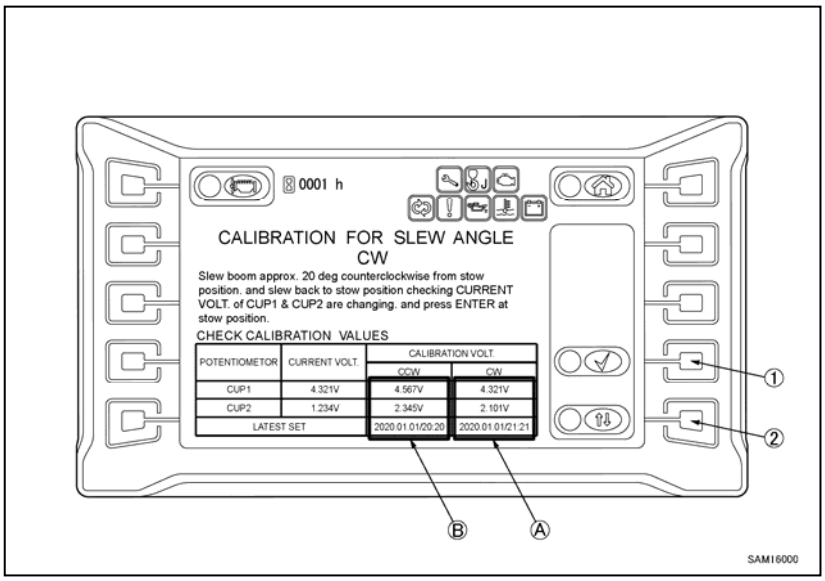
Select Calibration Mode from Service Mode.
For the monitor configuration so far, refer to item “19.2.3 Service Mode.”

Switch to the Calibration Mode by pressing “Slewing Angle Calibration Switch” while pressing “Emergency Canceling Switch.”
Pressing only the “Slewing Angle Calibration Switch” does not switch the screen to Calibration Mode.



Going into the Slewing Angle Calibration Mode switches the screen to “Clockwise Calibration” screen where the calibration can be done.

Calibration screen



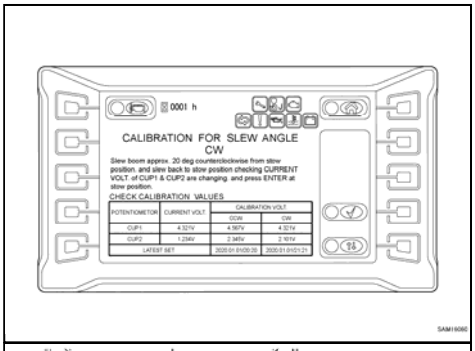
(1) Confirm button
(2) Page Switching button
(A) Clockwise calibration value
(B) Counterclockwise calibration value

When carrying out a calibration, the calibration value and calibration date and time are entered.

It is possible to calibrate using one direction only. However, we recommend calibrating in both directions to reduce angle detection errors.

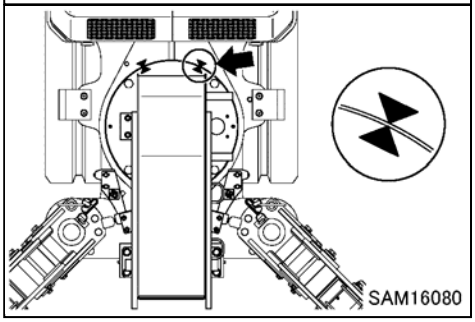
(1.1) Clockwise calibration [CW]
Starting from an angle of 20 degrees to the right as viewed from the monitor side, begin a clockwise slew and press the Confirm button (check mark) when the boom is facing storage direction.
During this period of slewing, confirm that the “CURRENT VOLT” of CUP1 and CUP2 has been changing.

Pressing the Confirm button causes the screen to switch to the “Counterclockwise calibration” screen.



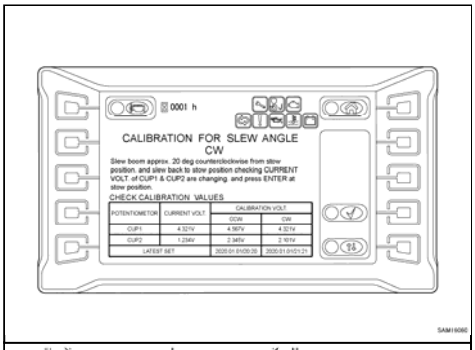
Use the match mark in the post part to align the boom to the storage position.

If the boom has passed the storage position, slew the boom again starting at around 20 degrees.



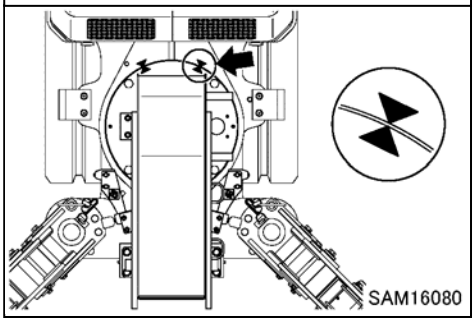
(1.2) Counterclockwise calibration [CCW]
Starting from an angle of 20 degrees to the left as viewed from the monitor side, begin a counterclockwise slew and press the Confirm button (check mark) when the boom is facing storage direction.
During this period of slewing, confirm that the “CURRENT VOLT” of CUP1 and CUP2 has been changing.

Pressing the Confirm button causes the screen to switch to the “Clockwise calibration” screen.



Use the match mark in the post part to align the boom to the storage position.

If the boom has passed the storage position, slew the boom again starting at around 20 degrees.



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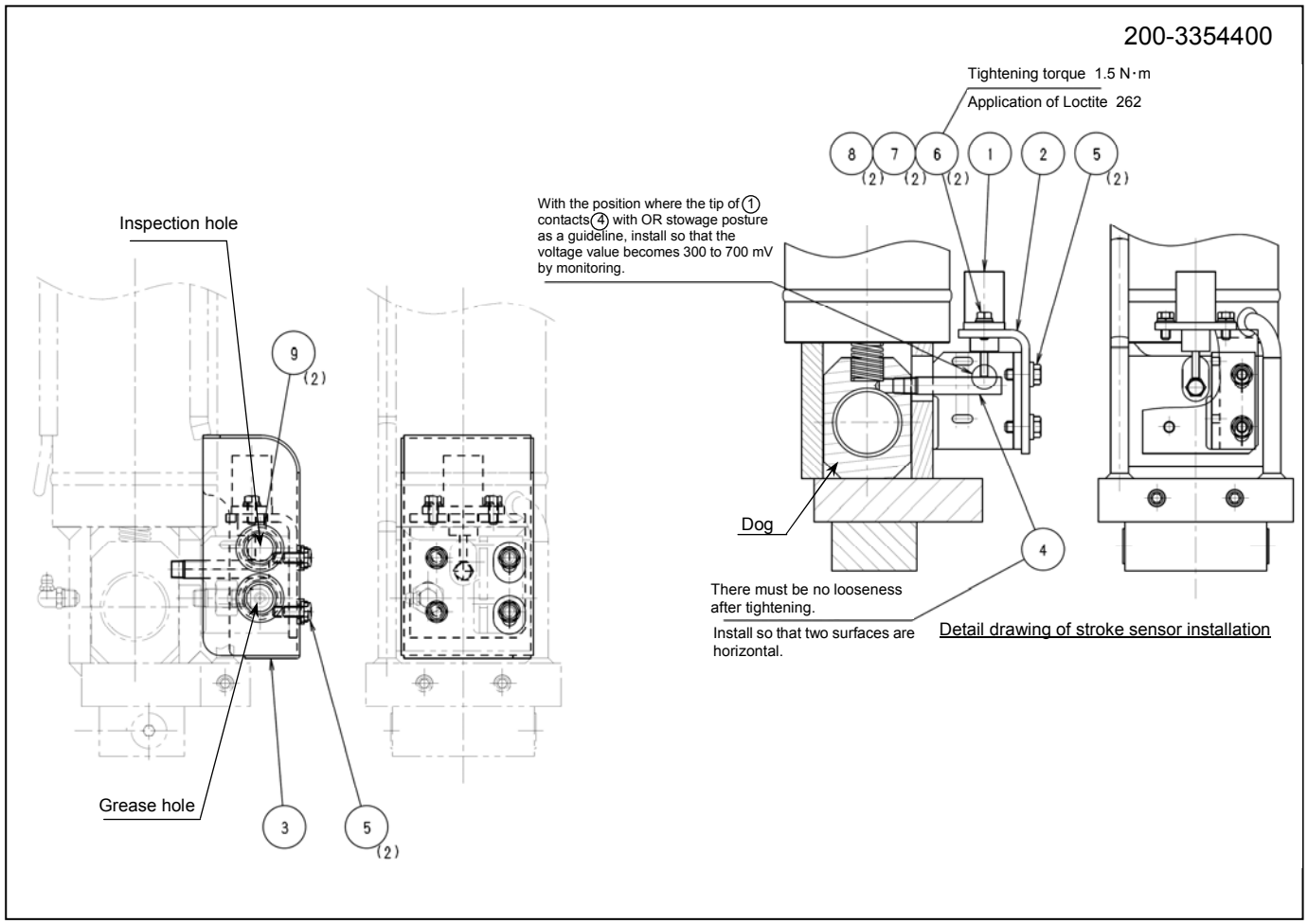
2. OUTRIGGER SAFETY DEVICE

2.1 SETTING DETECTION

Unless grounding is not detected, the crane mode cannot be entered. Therefore, the crane cannot be operated.

2.1.1 SETTING DETECTION ASSEMBLY

When the outrigger is grounded, the dog is pushed upward. At the same time, the pin moves and the stroke sensor is pushed to detect grounding.



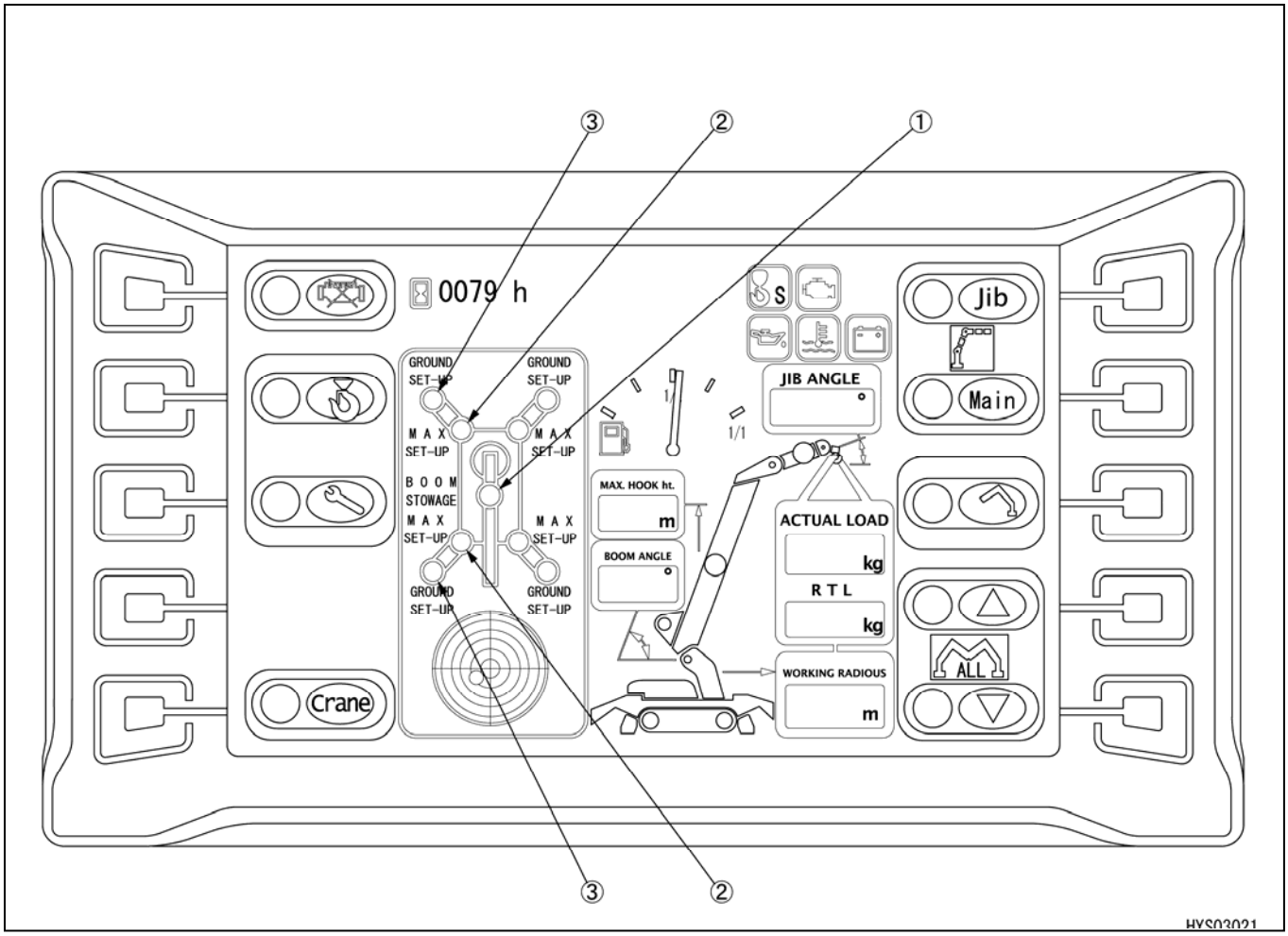
Number	Name	Q'ty	Note
1	Stroke sensor	1	S200M3157000
2	Sensor bracket	1	200-4627000
3	Sensor cover	1	200-3356600
4	Pin	1	200-4635600
5	Sems bolt	4	Komatsu item number: 01024-80616
6	Hexagon head bolt	2	M5 × 0.8 × 12L (plated 4.8)
7	Spring washer	2	M5 × Type-2 (plated)
8	Plain washer	2	M5 × Regular circle (plated)
9	Grommet	2	C-30-SG-20A

2.1.2 WORKING OF SETTING DETECTION

The setting of outriggers is detected.

The lamp (3) of the monitor lights up in green when the outrigger tray sets, and blinks in red when the tray floats (stowed).

If there is an abnormality in which the lamp (3) of the monitor does not light up when the outriggers are set, inspect and repair the setting detection assembly.



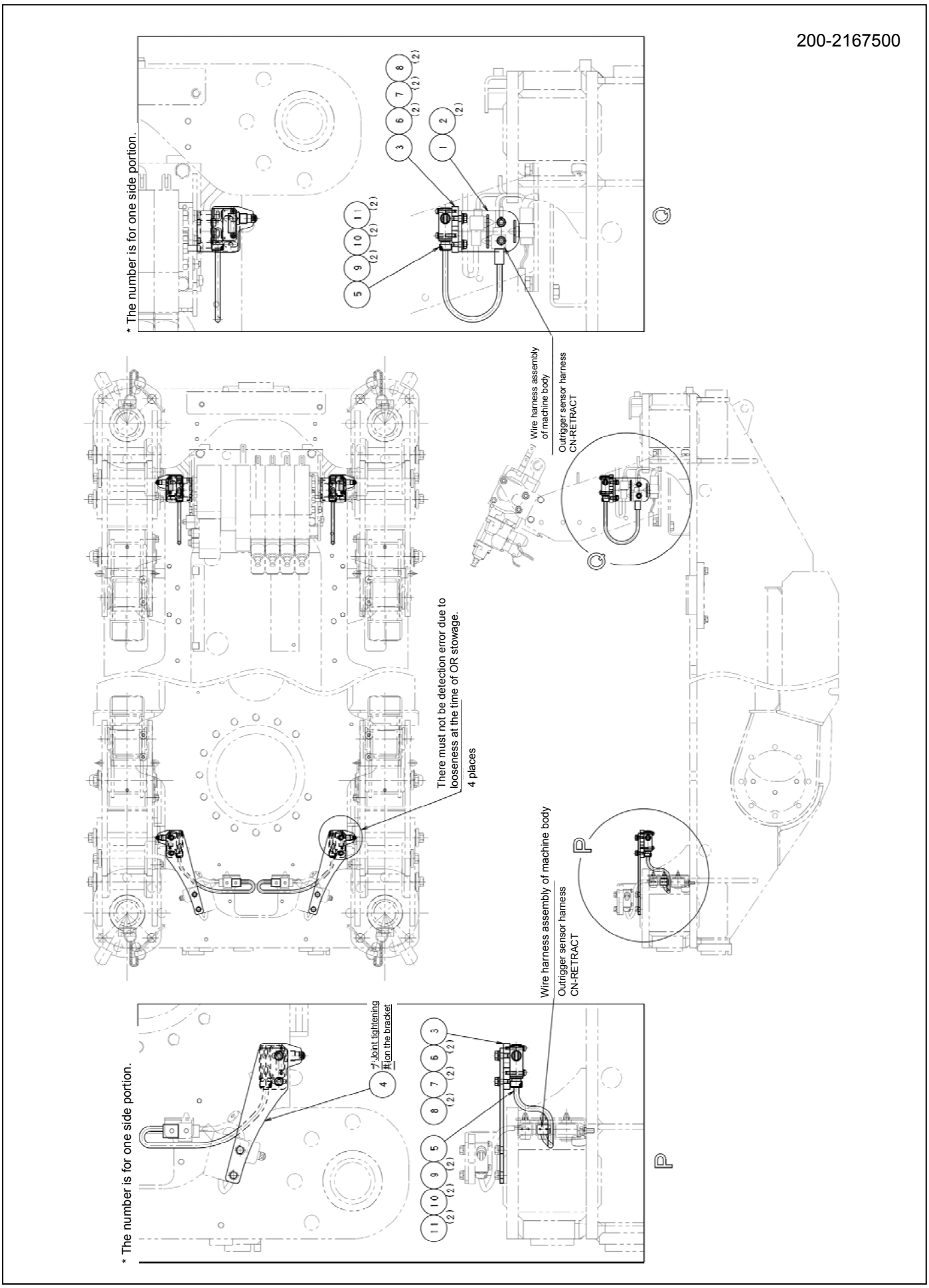
Monitor

(1) Main boom / jib stowing lamp
(2) Maximum outrigger extension lamp
(3) Outrigger grounding lamp

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2.2 OR STOWAGE DETECTION

2.2.1 OR STOWAGE DETECTION ASSEMBLY



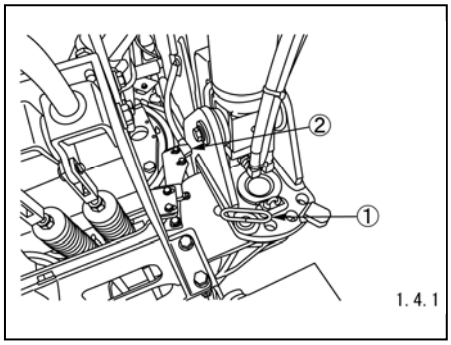
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Number	Name	Q'ty	Note
1	LS bracket F	2	Item number: 200-4638500
2	Sems bolt	4	Komatsu item number: 01024-80616
3	LS mounting plate	4	Item number: 200-4638400
4	LS bracket R	2	Item number: 200-4638600
5	Rotary and setting limit switch	4	Item number: S102M2524000
6	Hexagon head bolt	8	M6 × 1.0 × 14L (plated 4.8)
7	Spring washer	8	M6 × Type 2 (plated)
8	Plain washer	8	M6 × Regular circle (plated)
9	Hexagon head bolt	8	M4 × 0.7 x 25L (plated)
10	Spring washer	8	M4 × Type-2 (plated)
11	Plain washer	8	M4 × Small circle (plated)

2.2.2 WORKING OF OR STOWAGE DETECTION DEVICE

The stowage state of outriggers is detected.
When all of four outriggers are detected as stowage, the monitor display turns to the travel mode screen.
The outriggers operate when the rotary is rotated from the outrigger stowed state and the limit switch of OR stowage detection is canceled.

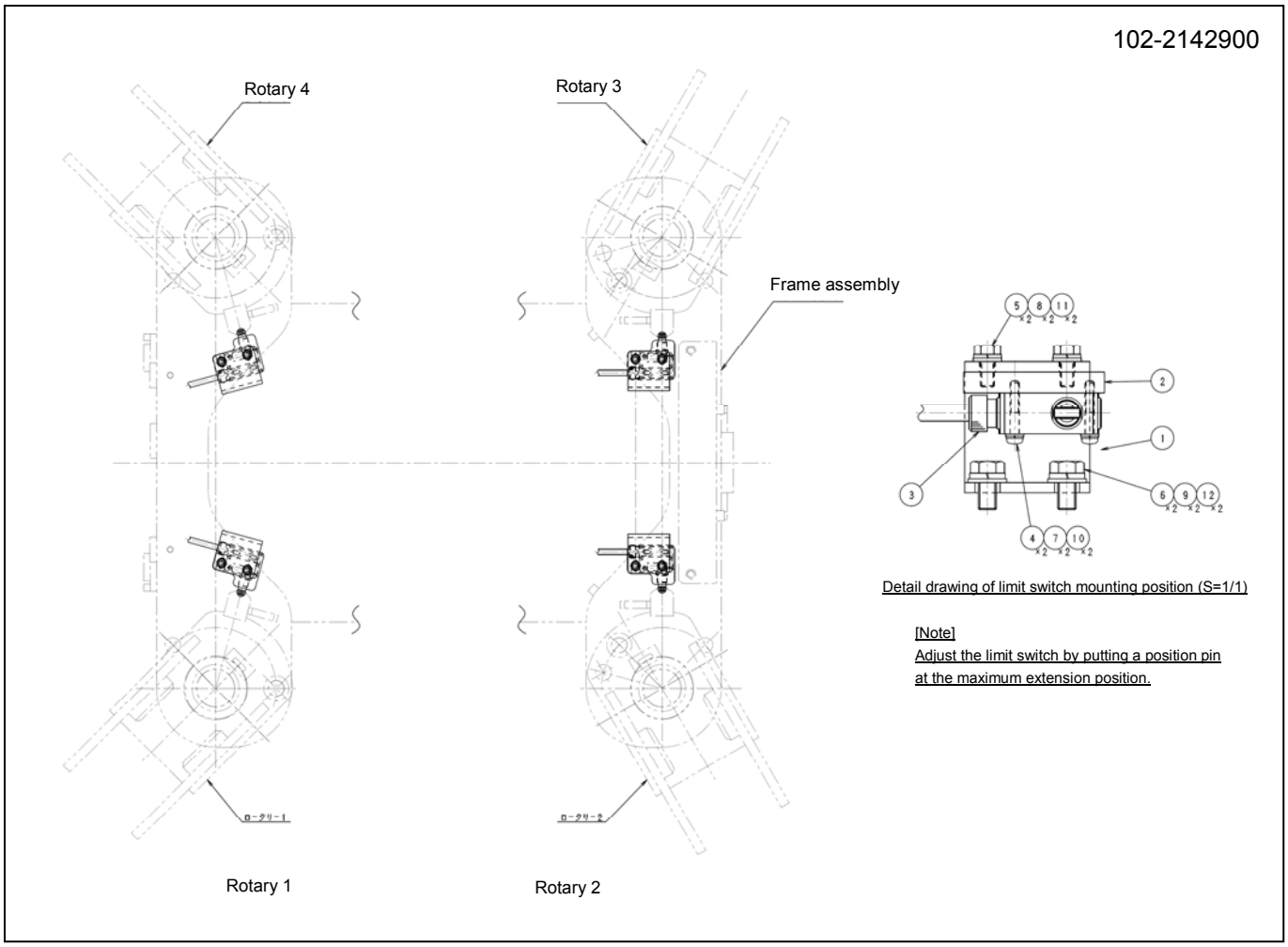
If the outriggers do not operate when the limit switch of OR stowage detection is canceled, inspect and repair the limit switch, etc.



Outrigger stowed

2.3 OR POSITION DETECTION

2.3.1 OR POSITION DETECTION ASSEMBLY

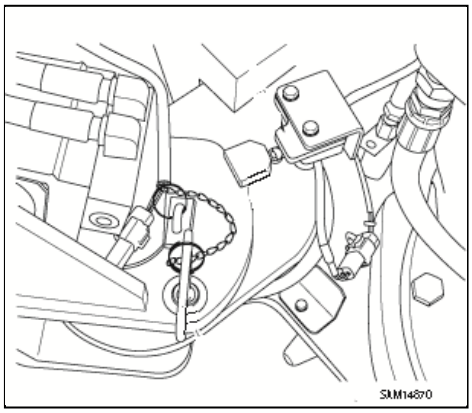


Number	Name	Q'ty	Note
1	LS bracket A	4	Item number: 102-4584300
2	LS mounting plate	4	Item number: 103-4531300
3	Dead turns detection LS	4	Item number: 103-4530900
4	Cross-recessed pan head screw	8	M4 × 0.7 × 25L
5	Hexagon head bolt	8	M6 × 1.0 v 14L (plated 4.8)
6	Hexagon head bolt	8	M8 × 1.25 × 16L (plated 4.8)
7	Spring washer	8	M4 × Type-2
8	Spring washer	8	M6 × Type-2
9	Spring washer	8	M8 × Type-2
10	Plain washer	8	M4 × Small circle (plated)
11	Plain washer	8	M6 × Regular circle (plated)
12	Plain washer	8	M8 × Regular circle (plated)

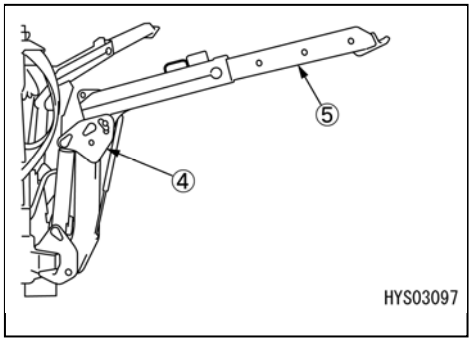
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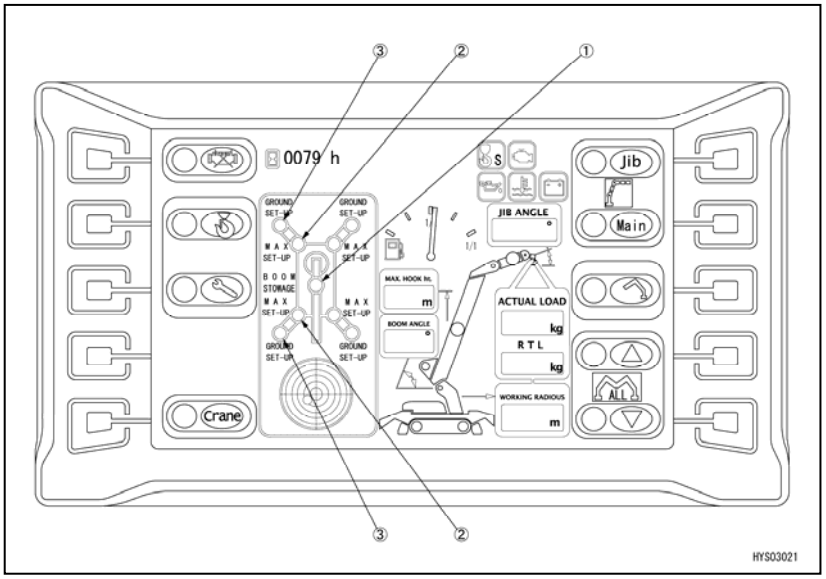
2.3.2 WORKING OF OR POSITION DETECTION DEVICE

Of the maximum extension conditions of outriggers, the rotary position being the maximum (standard position) is detected.
When the outrigger rotary is rotated to be positioned at the maximum extension (standard) and besides, the hole position (4) of the top box is set to MAX and the inner box (5) is pulled out to the maximum, the outriggers are set to the maximum position and the lamp (2) of the monitor lights up in green.
When even one of the top or inner box is not at the maximum position, the lamp (2) lights up in yellow.



If the lamp does not light up when the outriggers are set to the maximum extension, inspect and repair the limit switch, etc.



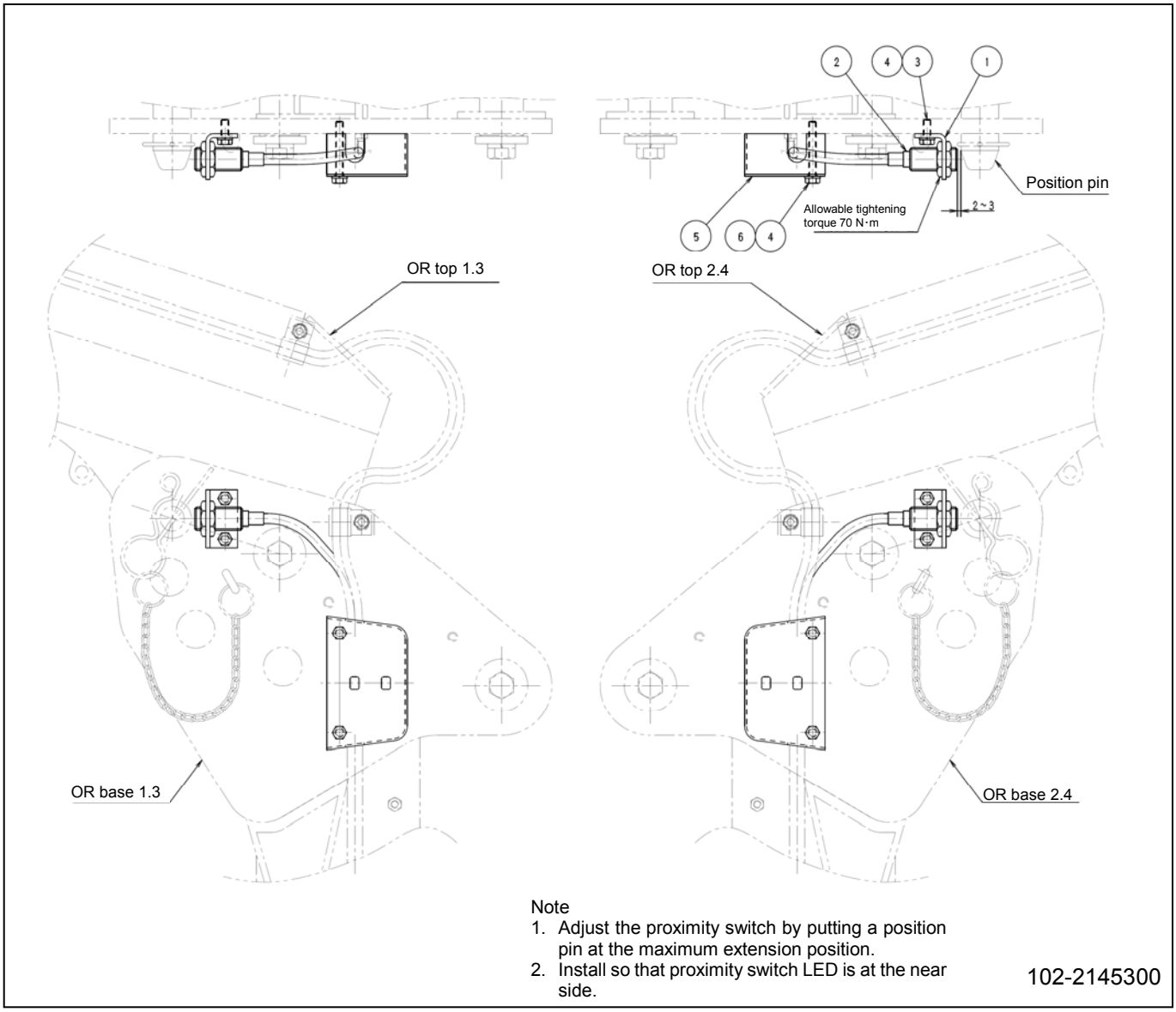


Monitor

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2.4 OR OPEN DETECTION

2.4.1 OR OPEN DETECTION ASSEMBLY



Note
1. Adjust the proximity switch by putting a position pin at the maximum extension position.
2. Install so that proximity switch LED is at the near side.

102-2145300

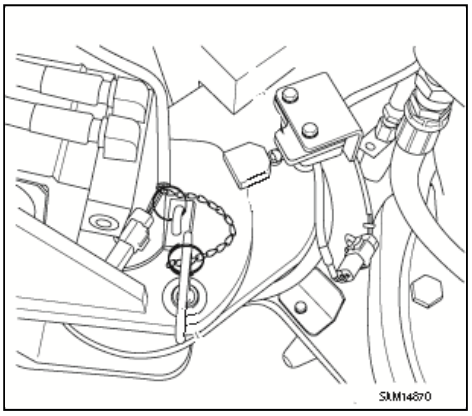
Number	Name	Q'ty	Note
1	Switch BK	4	Item number: 353-4485900-1
2	OR top proximity switch	4	Item number: 353S75812000
3	Hexagon head bolt	8	M6 × 1.0 x 16L (plated 4.8)
4	Spring washer	16	M6 × Type 2 (plated)
5	Connector cover A	4	Item number: 101-4587300
6	Hexagon head bolt	8	M6 × 1.0 × 45L (plated 4.8)

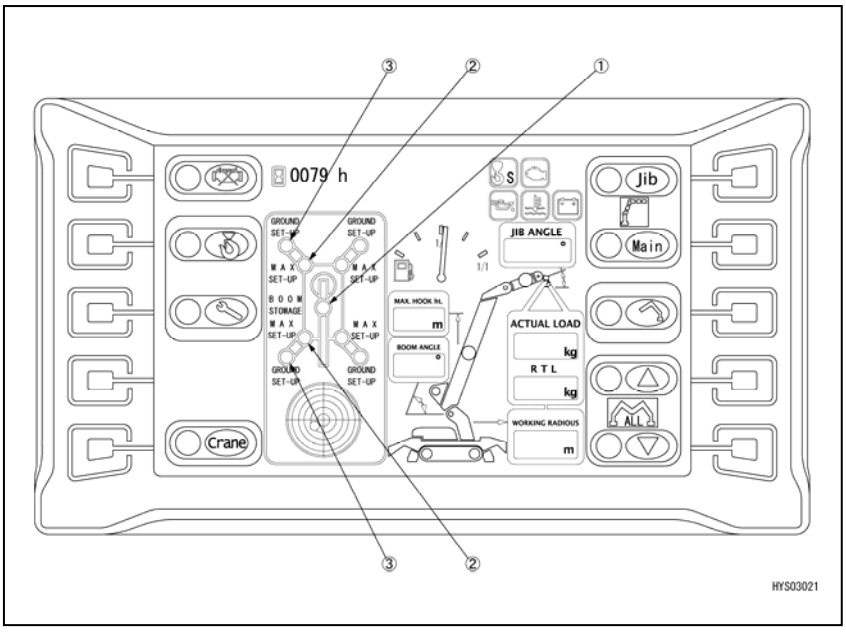
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2.4.2 WORKING OF OR OPEN DETECTOR

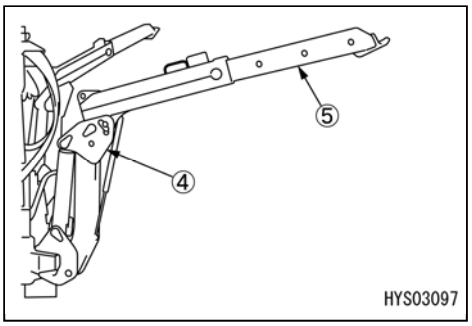
Of the maximum extension conditions of outriggers, the outrigger top box position being the maximum (MAX position) is detected.
When the outrigger rotary is rotated to be positioned at the maximum extension (standard) and besides, the hole position (4) of the top box is set to MAX and the inner box (5) is pulled out to the maximum, the outriggers are set to the maximum position and the lamp (2) of the monitor lights up in green.
When even one of the top or inner box is not at the maximum position, the lamp (2) lights up in yellow.

If the lamp does not light up when the outriggers are set to the maximum extension, inspect and repair the limit switch, etc.





Monitor

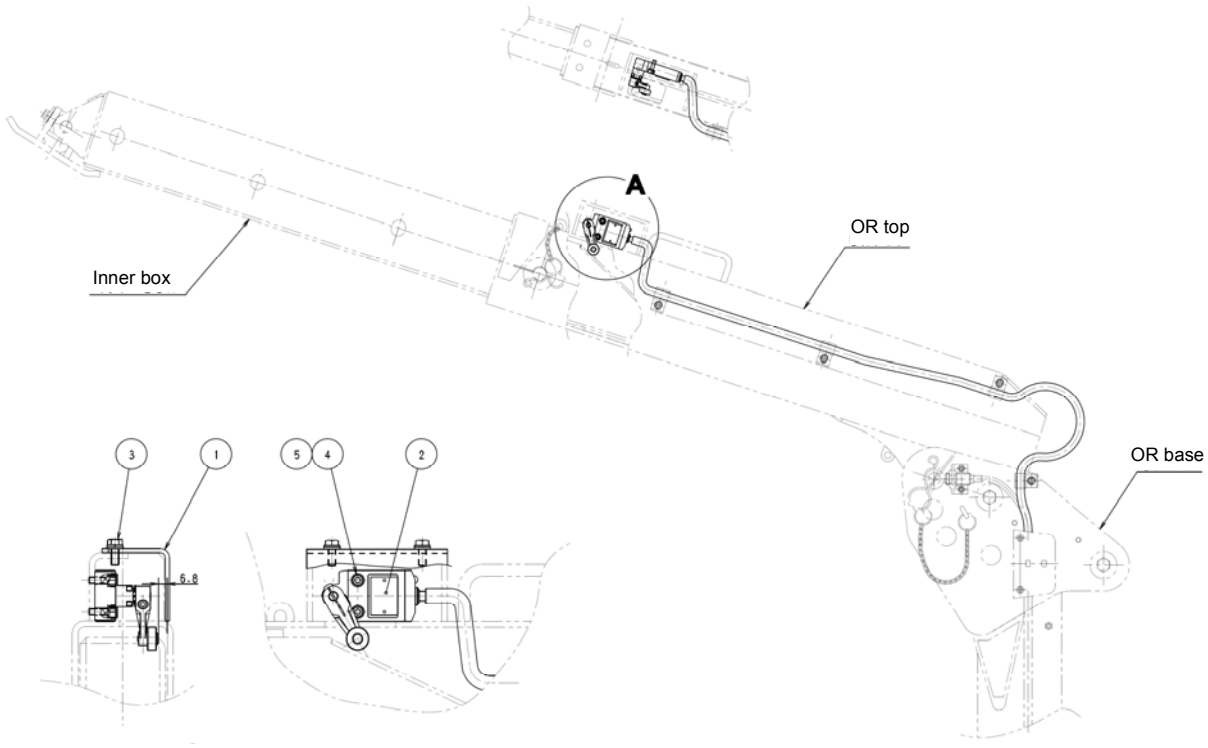


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2.5 OR EXTENSION DETECTION

2.5.1 OR EXTENSION DETECTION ASSEMBLY

102-2145400



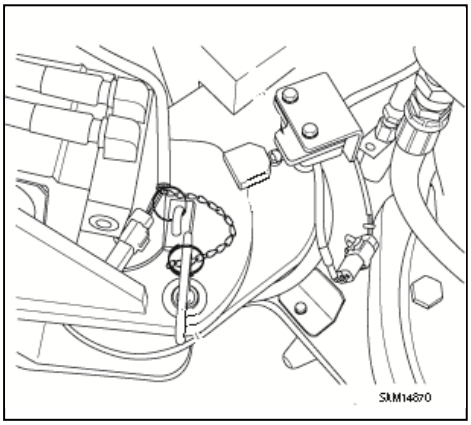
Detail drawing of part A (S = 1/2)

Note
Make adjustments so that the LS roller touches the inner box with the inner box extended to the maximum extended position.

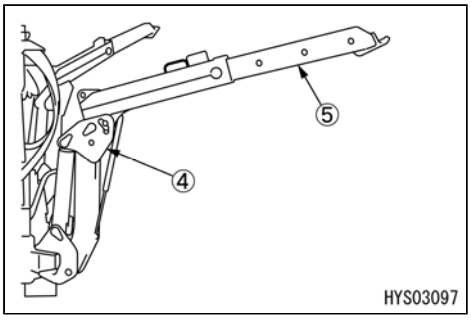
Number	Name	Q'ty	Note
1	Cover	4	Item number: 353-4487100
2	Limit switch	4	Item number: 353S75813000
3	Hexagon head bolt with washer	8	M6 × 1.0 × 16L
4	Hexagon socket head screw	8	M6 × 1.0 × 16L
5	Spring washer	8	M6 × Type-2

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2.5.2 WORKING OF OR EXTENSION DETECTION DEVICE



Of the maximum extension conditions of outriggers, the outrigger inner box position being the maximum (maximum extension position) is detected.
When the outrigger rotary is rotated to be positioned at the maximum extension (standard) and besides, the hole position (4) of the top box is set to MAX and the inner box (5) is pulled out to the maximum, the outriggers are set to the maximum position and the lamp (2) of the monitor lights up in green.
When even one of the top or inner box is not at the maximum position, the lamp (2) lights up in yellow.



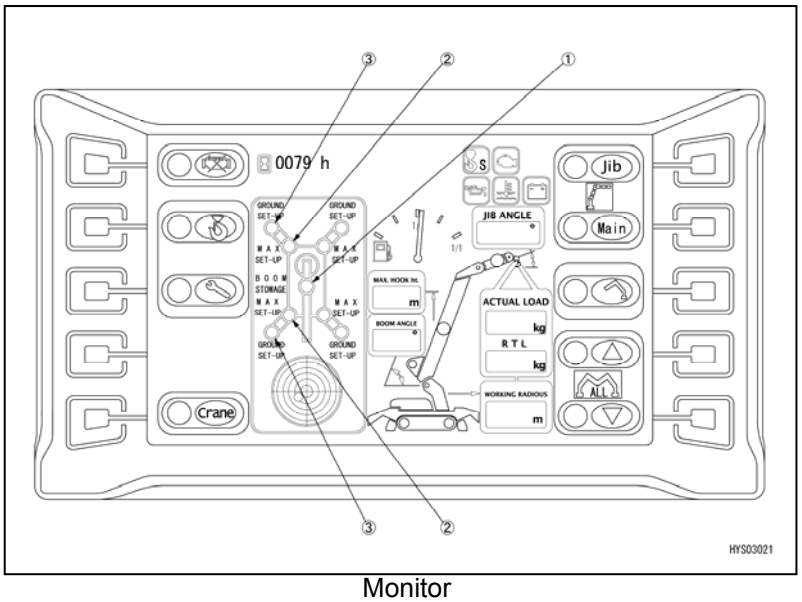
The lighting-up conditions of (1) are as follows.

- When the slewing angle of the boom is out of the storage position, the lamp is turned off.
- When the slewing angle of the boom is within the storage positon, the lamp blinks green.
- The lamp illuminates in green when all work equipments are stowed. Unless (1) illuminates in green, the outriggers cannot be operated. In the case of remote control operation, the outrigger mode cannot be entered.
  A warning sound of “peep” sounds.

[Condition in which all work equipments are stowed]

- Jib full contraction
- Jib angle (whether the angle with respect to the main boom is stowage, within 5°)
- Boom full contraction
- Boom full lowering (Lower limit switch is pressed.)
- The slewing angle of the boom is within the storage position.
- The jib angle is excluded when the machine body angle is 3° or more.

If the lamp does not light up when the outriggers are set to the maximum extension, inspect and repair the limit switch, etc.

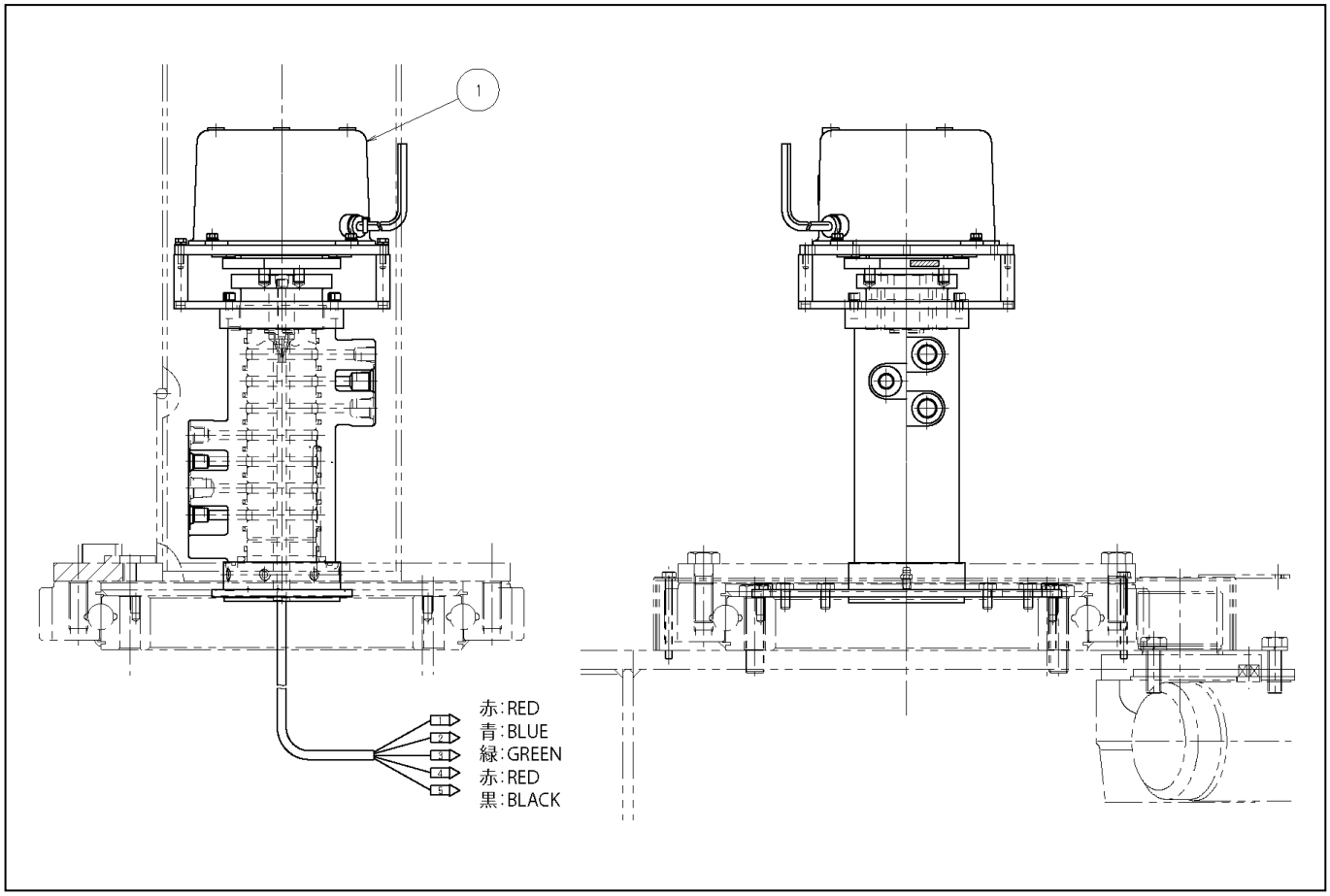


Monitor

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2.6 SLEWING DIRECTION DETECTION

2.6.1 SLEWING DIRECTION DETECTION ASSEMBLY



Number	Name	Q'ty	Note
1	Rotary brush	1	Item number: S106L3569000

For details of the rotary brush, refer to “10.3 ROTARY BRUSH.”

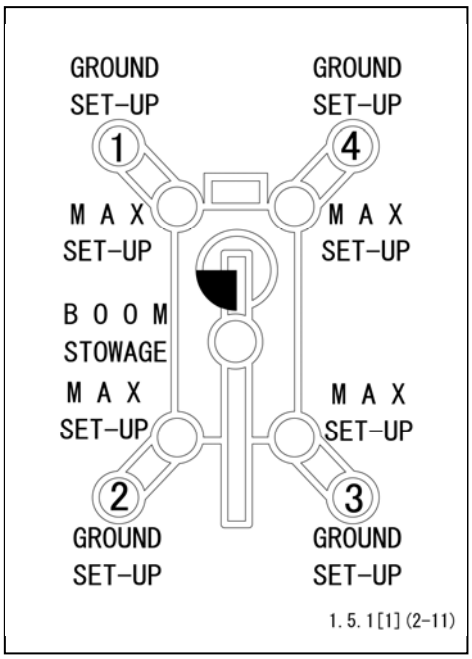
https://truckmanualshub.com/

2.6.2 WORKING OF SLEWING DIRECTION DETECTION

Main boom slewing position lamp

This lamp turns on to indicate the position where the main boom is slewing. Upon slewing of the main boom, out of the four divided lamps, the one in the slewing direction turns blue.

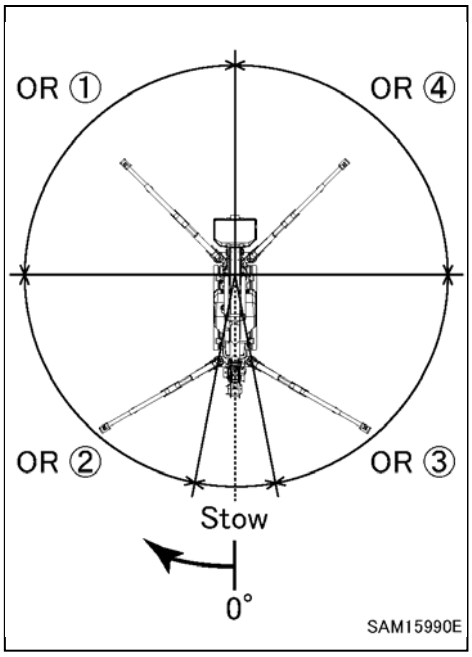
The slewing position of the main boom is detected by the potentiometer above the rotary joint.



NOTES
When the main boom is in the stowing direction, the entire main boom slewing position lamp turns off.

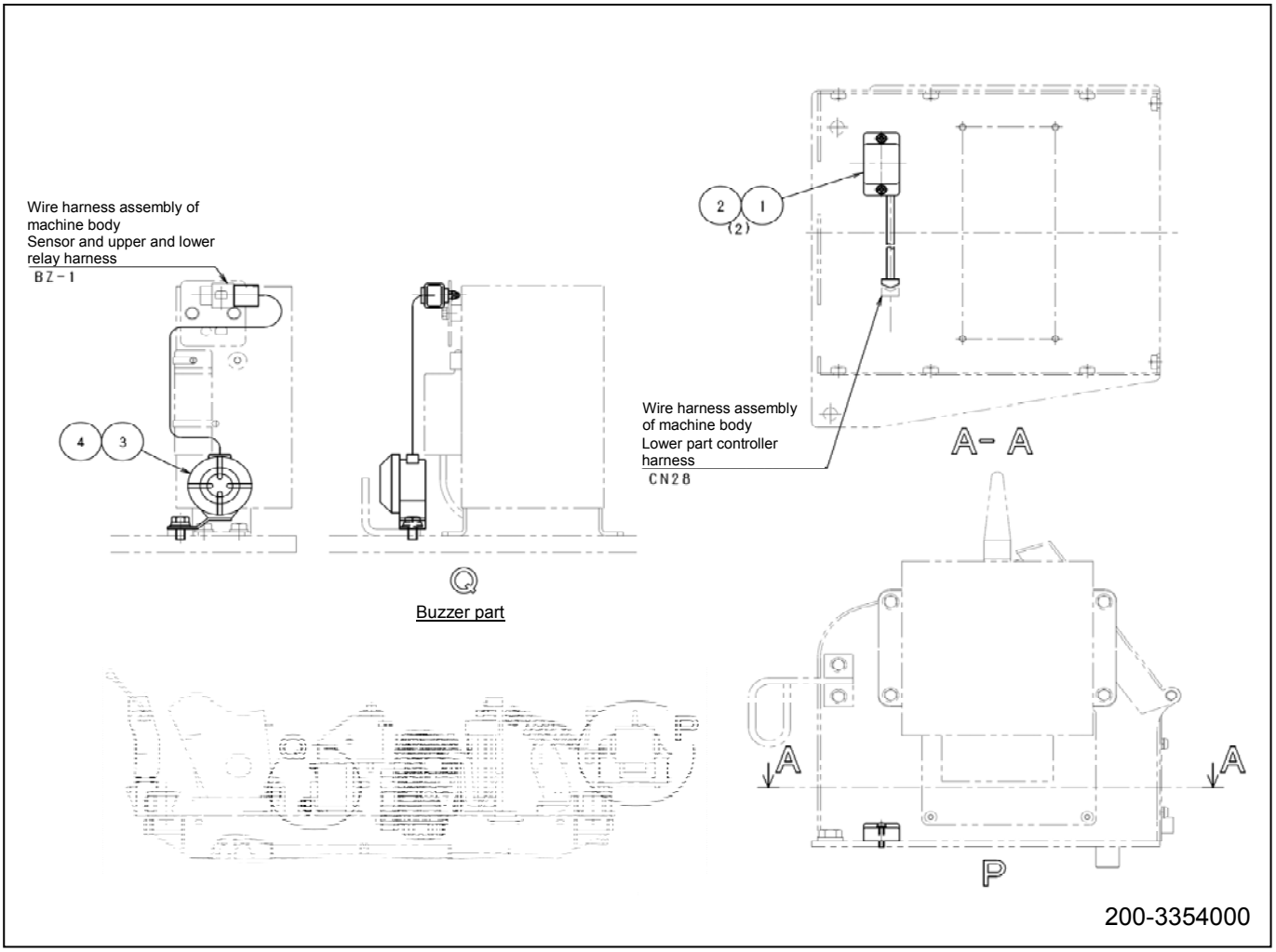
The table below shows the conditions under which the slewing directions are detected.

Boom Direction				
OR1	OR2	Stow	OR3	OR4
180°≥ θ > 90°≥ θ ≥ 6° > θ > 354°≥ θ ≥ 270° > θ > 180°				
		(0±6°)		



3. TIP-OVER WARNING DEVICE

3.1 INSTALLATION POSITION

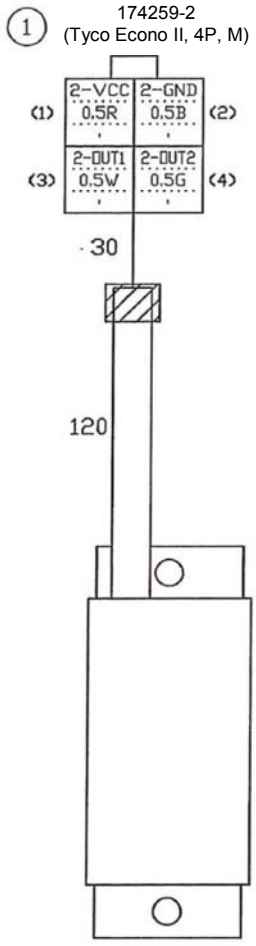


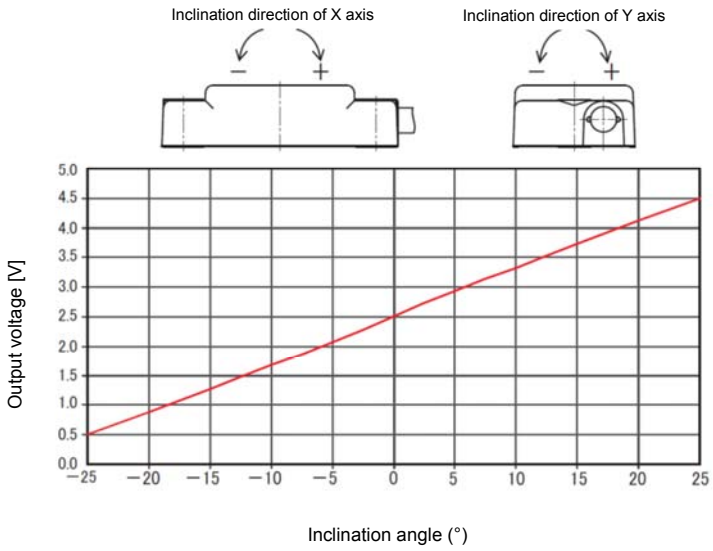
Number	Name	Q'ty	Item No.
1	Inclination sensor assembly	1	Item number: 200-4660600
2	Cross-recessed pan head screw with washer	2	M4 × 0.7 × 20L (with PW and SW, plated)
3	Buzzer assembly	1	Item number: 200-4640800
4	Bolt with washer	1	M8 × 1.25 × 16L (with PW and SW, plated)

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3.2 APPEARANCE AND SPECIFICATION OF DEVICE

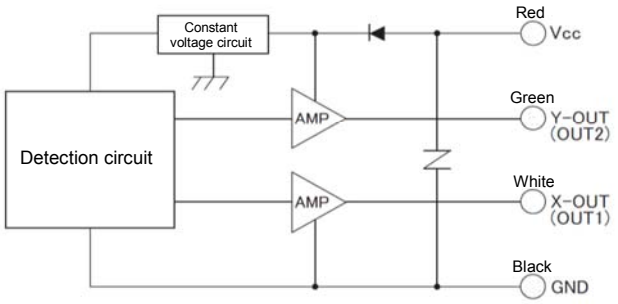
200-4660600





inclination sensor
Maeda item number: S200M3357000
EIC-122EA (Sensatec)

2)
1-1 : 0.5R : DC10.8~30.0V
1-3 : 0.5W : X-OUT
1-4 : 0.5G : Y-OUT
1-2 : 0.5B : GND



See “STRUCTURE AND MAINTENANCE PROCEDURE 19.2.6 LIST OF ERROR CODES” for the error judgment.

Specifications		
Model		EIC-122EA (Sensatec)
Detectable inclination angle range		±25°
Detection angle		±10° (right and left, fore and aft)
Power supply voltage		DC12 to 24V
Working voltage range		DC10.8 to 30V
Consumption current		15 mA or less (at DC 12V and 25°C)
Output	Output voltage	DC 0.5V to 4.5V±0.15V (DC 12V, 25°C, with one axis fixed to 0°)
	Horizontal voltage	DC 2.5V±0.1V (DC 12V, 25°C)
Linearity		±1% FS or less
Response time		0.18 seconds (step response, time constant, 25°C)
Load resistance		100 KOhm or more
Inclination angle at the time of detection start		0.1° or less
Operating temperature range		-20°C to +70°C
Storage temperature range		-25°C to +75°C
Withstand voltage		AC 500V 1 minute (between terminal batch and mount)
Insulation resistance		100 MOhm or more at DC 500V Megger (between terminal batch and mount)
Vibration resistance		Durability: 10 to 55 Hz amplitude 1.5 mm 2 hours each for 3 directions of X, Y and Z (when non-energized)
Shock resistance		Durability: 1000 m/S^ (approx. 100G) 3 times each for 3 directions of X, Y and Z (when non-energized)
Protection structure		IP67

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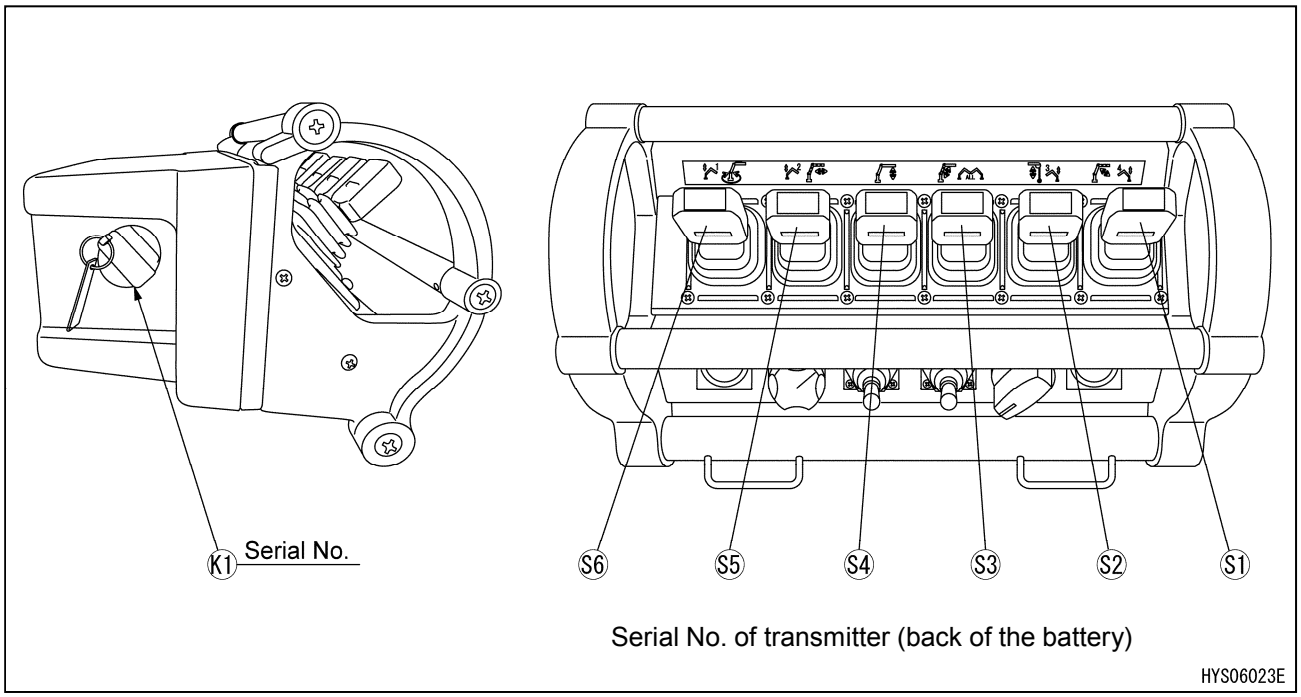
REMOTE CONTROL

1. COMPONENTS OF THE TRANSMITTER	4-2
1.1 UPPER PART COMPONENTS OF THE TRANSMITTER	4-2
1.2 LOWER PART COMPONENTS OF THE TRANSMITTER	4-2
1.3 DESCRIPTION OF COMPONENTS OF THE TRANSMITTER	4-3
1.4 DIAGNOSIS OF THE TRANSMITTER STATUS LED (D1)	4-5
2. COMPONENTS OF THE RECEIVER	4-8
2.1 COMPONENTS OF THE RECEIVER	4-8
2.2 INSPECTION AFTER TURNING ON THE TRANSMITTER	4-10
2.3 INSPECTION OF RECEIVER	4-10
3. SAFETY DEVICE OF REMOTE CONTROLLER	4-11
4. HANDLING BATTERY	4-12
4.1 REPLACEMENT TIMING OF BATTERY	4-12
4.2 REPLACEMENT METHOD OF BATTERY	4-12
4.3 CHARGING METHOD OF BATTERY	4-13
5. TROUBLESHOOTING	4-14
5.1 BEFORE TROUBLESHOOTING	4-14
5.2 ERRORS IN THE REMOTE CONTROLLER	4-15
6. ELECTRICAL WIRING DIAGRAM FOR REMOTE CONTROLLER	4-17
7. PRINCIPLE SPECIFICATION LIST	4-18
8. SERVICE LOCATIONS	4-19

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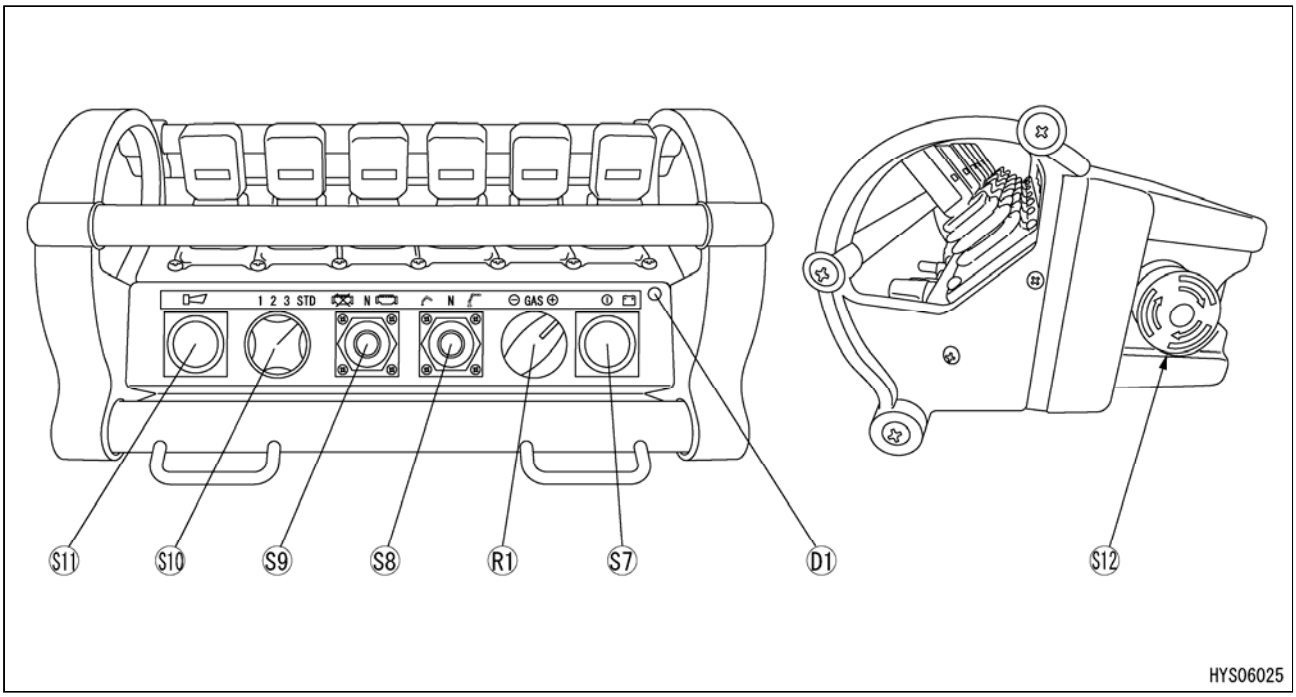
1. COMPONENTS OF THE TRANSMITTER

1.1 UPPER PART COMPONENTS OF THE TRANSMITTER



(K1) Electronic key/Serial No.
(S1) Main boom derricking/No.4 outrigger operation lever
(S2) Hook raising and lowering/No.3 outrigger operation lever
(S3) Main boom telescoping/collective outrigger operation lever
(S4) Jib derricking
(S5) Jib telescoping/No.2 outrigger operation lever
(S6) Slewing/No.1 outrigger operation lever

1.2 LOWER PART COMPONENTS OF THE TRANSMITTER

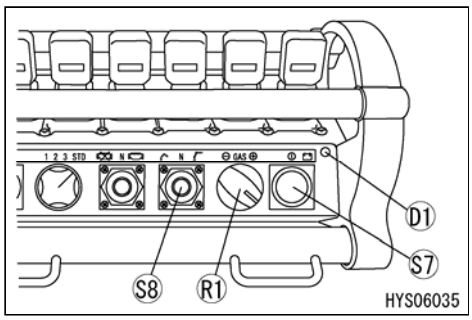


(D1) Status LED
(R1) Acceleration dial (engine speed)
(S7) Start button
(S8) Outrigger/Crane selector switch
(S9) Engine start/stop switch
(S10) Speed selection rotary switch
(S11) Horn switch
(S12) Emergency stop switch

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1.3 DESCRIPTION OF COMPONENTS OF THE TRANSMITTER

[1] STATUS LED (D1)



This displays the power supply of the Transmitter.

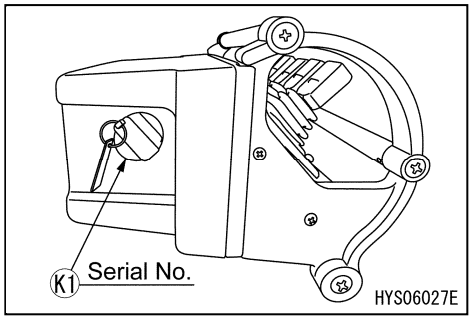
- Flashing of green LED: The power of the Transmitter is ON.
- Flashing of red LED (signal sound): The voltage of the battery is dropping.

The Transmitter stops in a few minutes if it is used as it is.

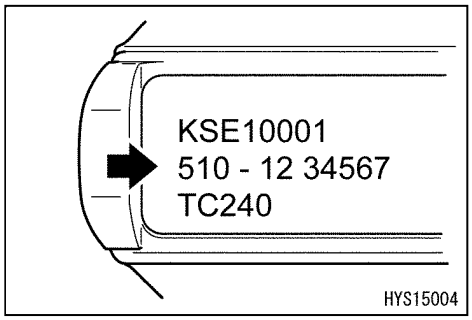
Replace the battery with a charged one.

See “REMOTE CONTROL 1.4 DIAGNOSIS OF THE TRANSMITTER STATUS LED (01)” for the light emission pattern.

[2] ELECTRONIC KEY (K1)



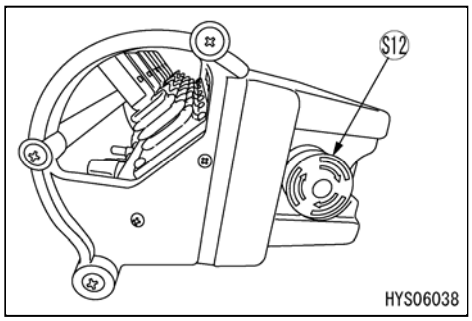
The key has ID data necessary for operation of the Transmitter. Install it on the Transmitter.



The remote controller does not operate unless serial No. of the electronic key matches that of the receiver.

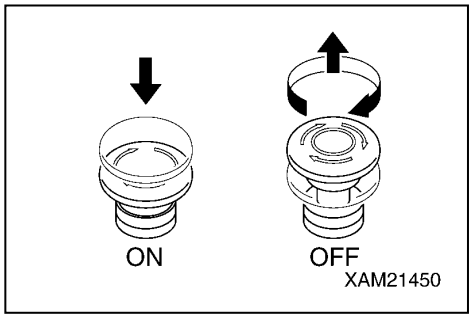
If serial numbers match each other, the remote controller can be used even when the main body of the transmitter is different. (spare, etc.)

[3] EMERGENCY STOP SWITCH (S12)



This is used to turn OFF the power of the Transmitter.

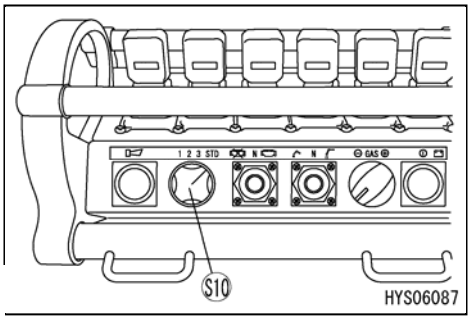
- ON: Press the switch. The power of the Transmitter turns OFF. The engine also stops.
- OFF: Turn the switch clockwise. The switch returns to the original position.



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[4] SPEED SELECTOR ROTARY SWITCH: S10

When it is required to operate the Crane at low speed, the maximum speed of the Crane is limited if the speed selector rotary switch is set to any of 1, 2 and 3, and speed control at low speed can be performed smoothly.



Set value of speed selector rotary switch

1····· Micro speed 1
2····· Micro speed 2
3····· Micro speed 3 (User micro speed mode)
STD ····· Ordinary (Linked operation with acceleration dial R1)

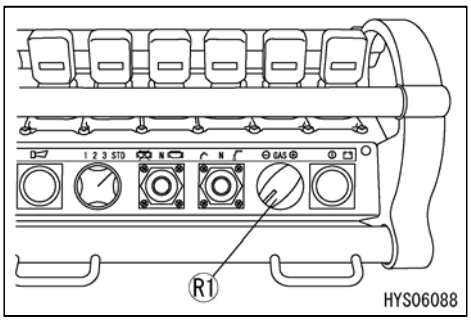
Slow
Fast

In the outrigger operation, the setting is automatically set to STD.

[5] ACCELERATION DIAL: R1

This is used to adjust the maximum engine speed.

1. Set the acceleration dial (engine speed) to any position. (The maximum engine speed can be set to increase on the + side.)
2. Set the speed selector rotary switch (S10) to STD.
3. When each operation lever is pushed down, the Crane speed increases according to the operation amount and the engine speed increases also.



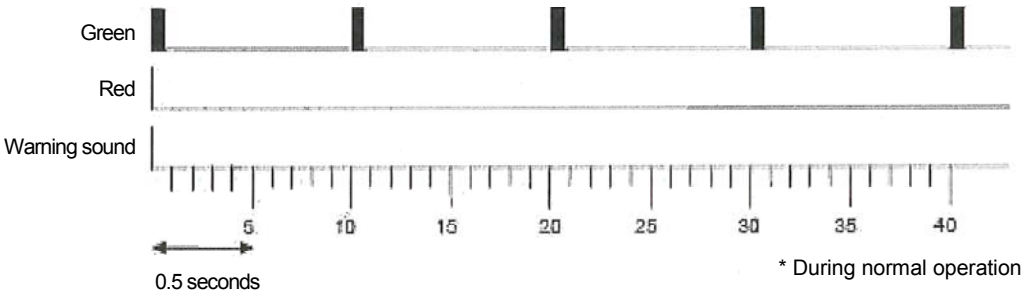
NOTES
1. When the speed selector rotary switch is set to STD, the acceleration dial is set to MAX (turn the dial fully to the + side) and each operation lever is pushed down to the maximum, the Crane speed becomes the maximum (engine speed also becomes the maximum).
2. When the speed selector rotary switch is set to STD and the acceleration dial is set to MIN (return the dial fully to the - side), engine speed does not increase even if each operation lever is pushed down to the maximum.

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1.4 DIAGNOSIS OF THE TRANSMITTER STATUS LED (D1)

[1] Normal operating state

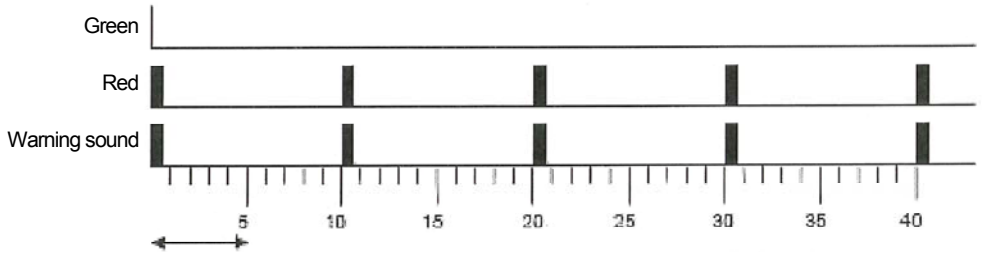
Radio waves are transmitted from the high frequency module.
When the battery voltage is normal:



* During normal operation

[2] Error state

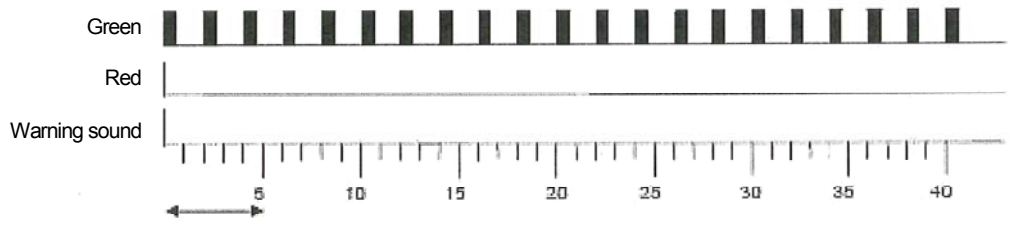
[2-1] When the battery voltage is low



* The battery replacement is required although operation is being performed.

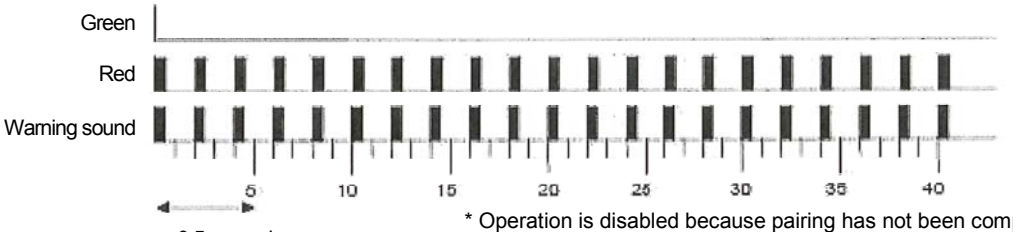
[2-2] The initialization of the high frequency module is being performed.

The battery voltage is normal:



* Operation is disabled because pairing has not been completed.

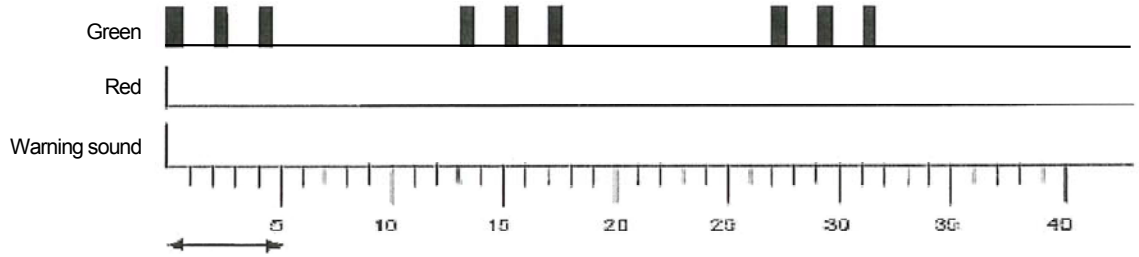
When the battery voltage is low



* Operation is disabled because pairing has not been completed.
  Replace the battery.

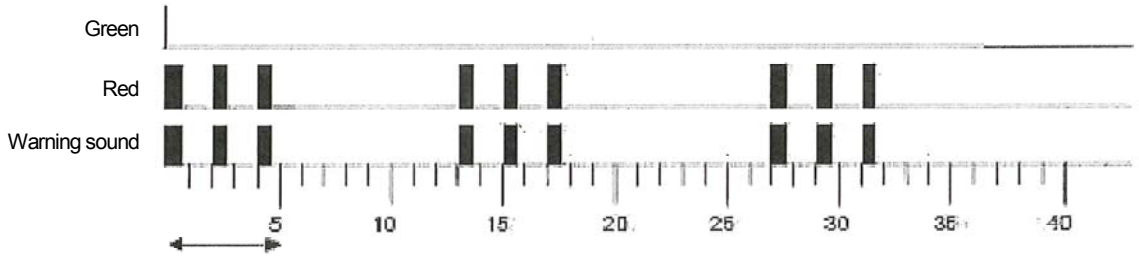
[2-3] If the operation switch is ON when the transmitter power supply is turned ON

The battery voltage is normal:



* Operation is disabled. Place the operation switch in neutral before turning the power ON.

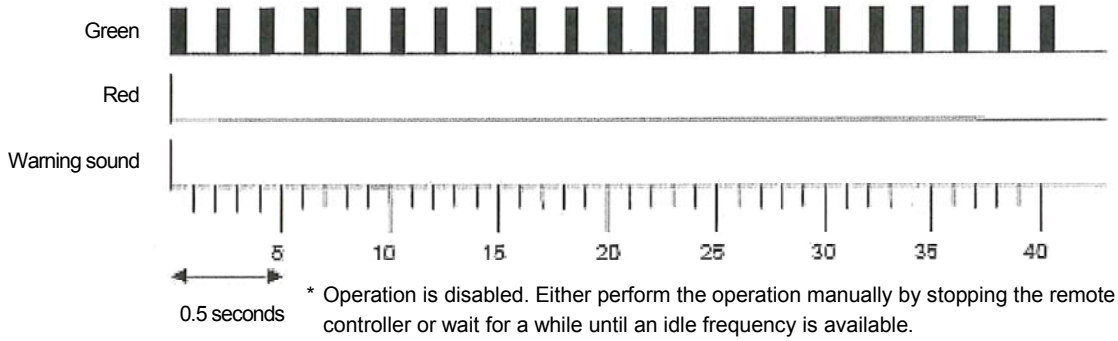
When the battery voltage is low



* Operation is disabled. Replace the battery.

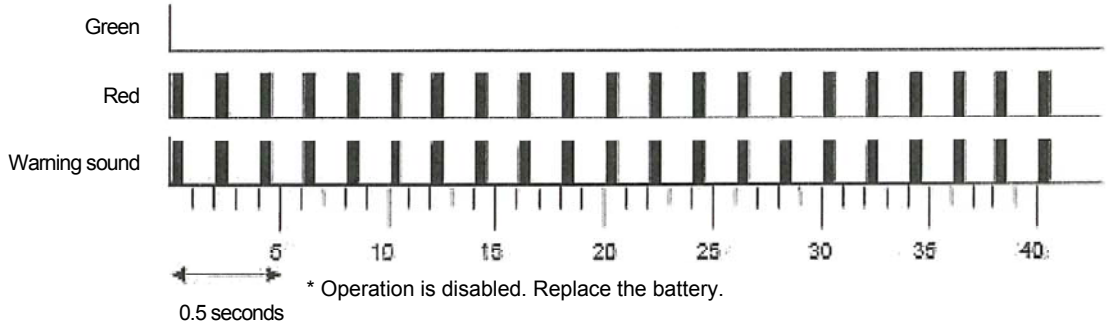
[2-4] Although the transmitter is normal, there is no idle frequency of the high frequency module.

The battery voltage is normal:



* Operation is disabled. Either perform the operation manually by stopping the remote controller or wait for a while until an idle frequency is available.

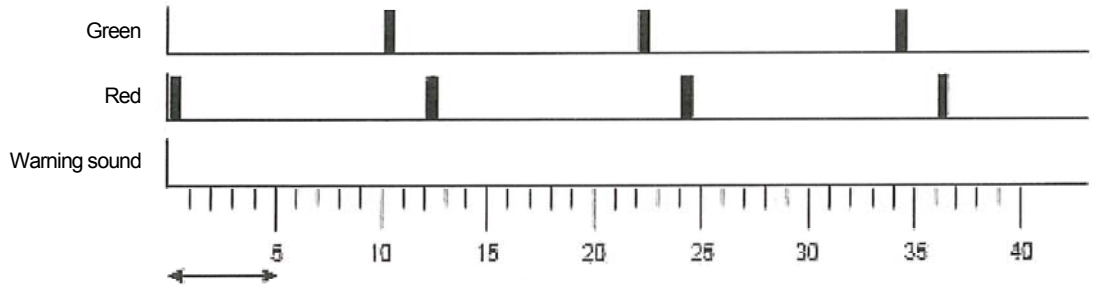
When the battery voltage is low



* Operation is disabled. Replace the battery.

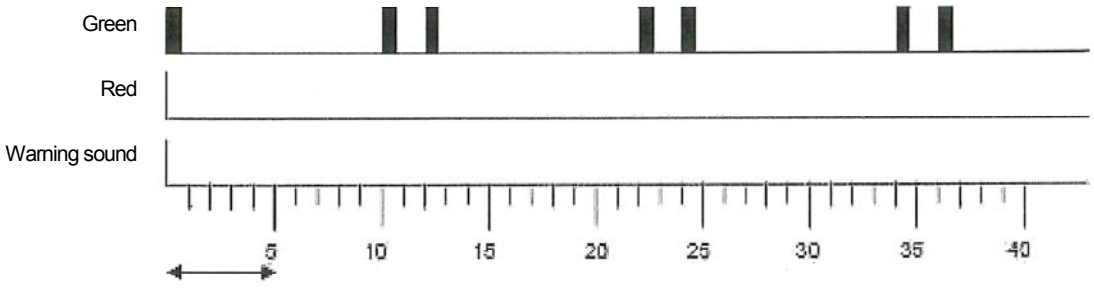
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[2-5] Read error of electronic key iON data or inconsistent with configuration data of the device.



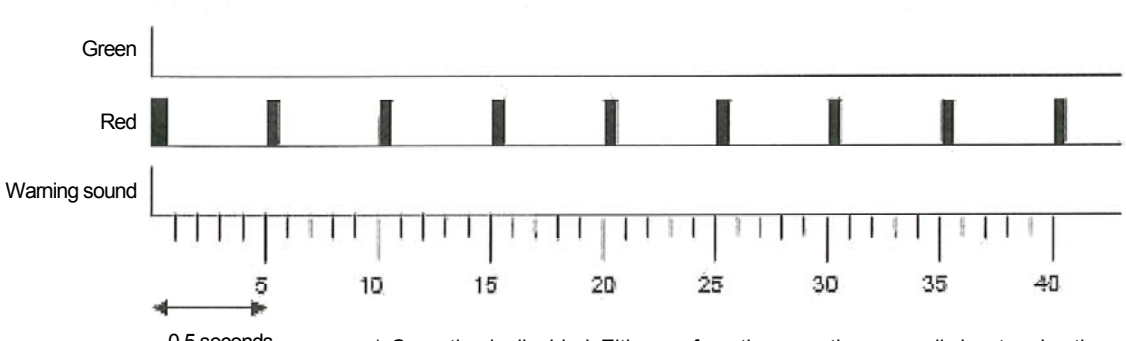
* Operation is disabled. Check the electronic key.

[2-6] Read error of configuration data of the device



* Operation is disabled. Either perform the operation manually by stopping the remote controller or turn the power ON again after a while.

[2-7] Configuration data error of the device: Configuration data error of the device or CRC value (error detection) error

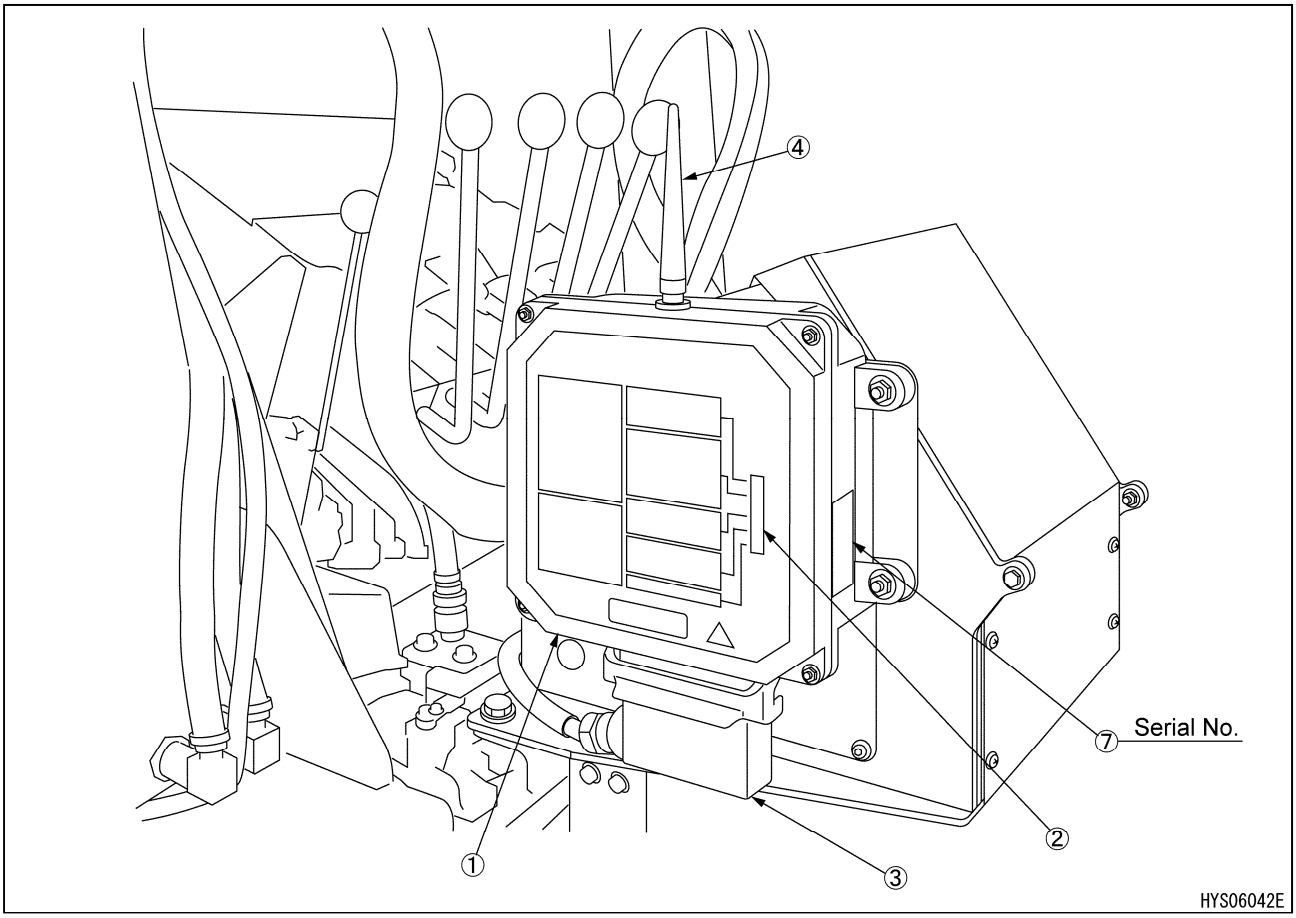


* Operation is disabled. Either perform the operation manually by stopping the remote controller or turn the power ON again after a while.

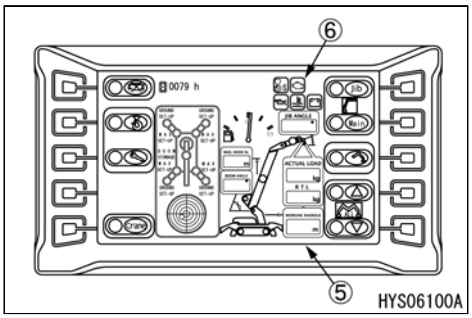
https://truckmanualshub.com/

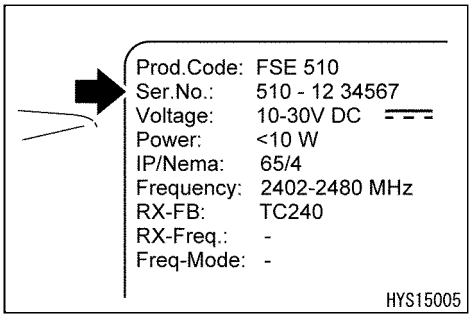
2. COMPONENTS OF THE RECEIVER

2.1 COMPONENTS OF THE RECEIVER



(1) Receiver
(2) Monitor LED
(3) Connector
(4) Antenna
(5) Monitor
(6) Remote control mode display
(7) Serial No.





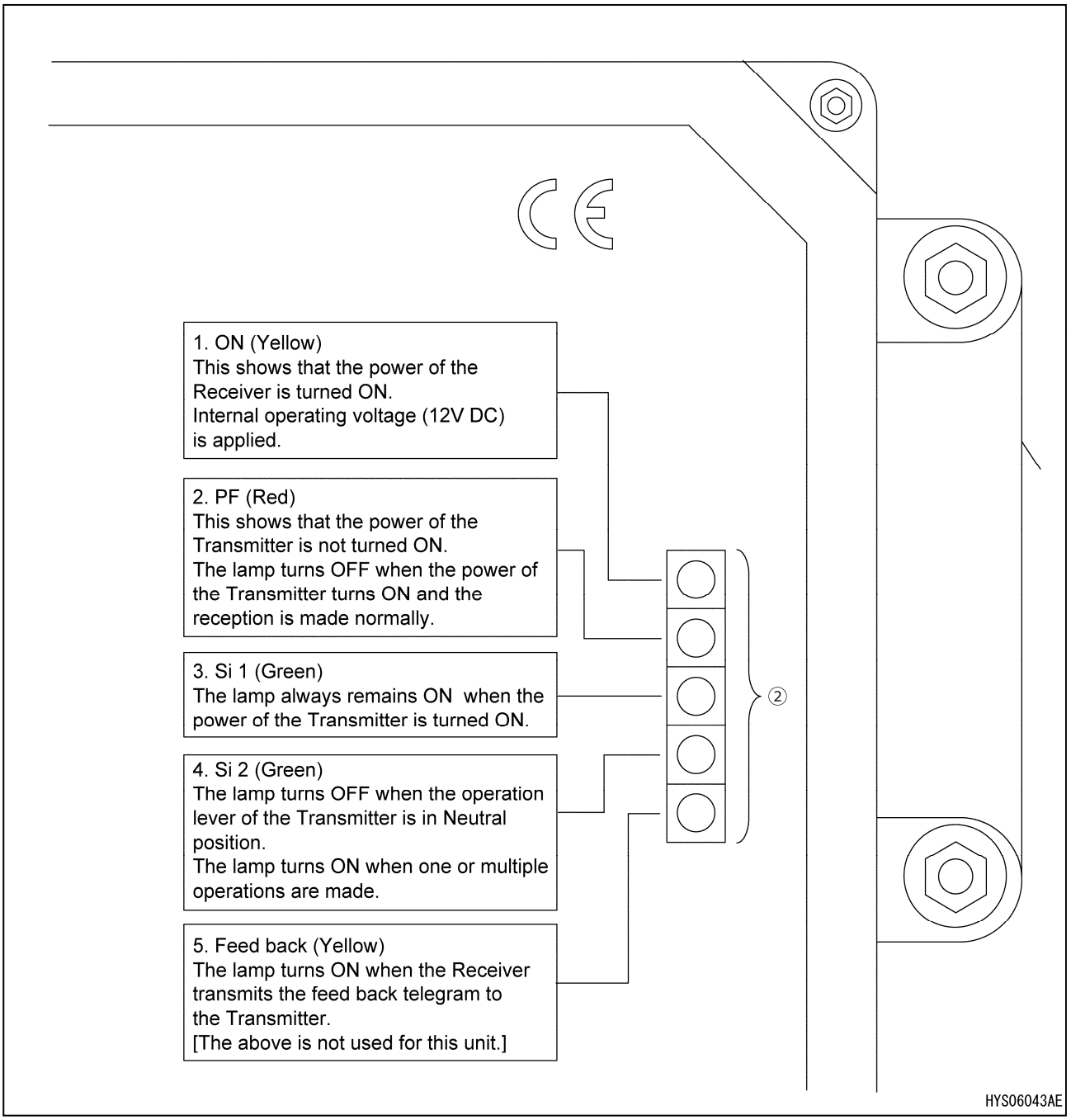
https://truckmanualshub.com/

[1] RECEIVER (1)

The receiver, receiving devices and control devices are stowed.

[2] MONITOR LED (2)

The Transmitter cover is equipped with monitor LED that shows the operation status of the remote control system.



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2.2 INSPECTION AFTER TURNING ON THE TRANSMITTER

Perform the following inspections while the Transmitter power is “ON”:

[1] CHECKING DISPLAY AFTER TURNING THE POWER ON

Press the start button (S7) twice when the control lever of the Transmitter is in the neutral position.
The button cannot be pressed for the second time unless coupling between the transmitter and receiver is completed.(Max. 10 seconds)
Check that the power is properly turned ON and that the status LED (D1) flashes in green.
Immediately stop the use of the remote control system if the status LED (D1) does not flash.
The failure of the remote control system is conceivable in the case of no entry when the second button input is performed for 10 seconds or longer.

NOTES

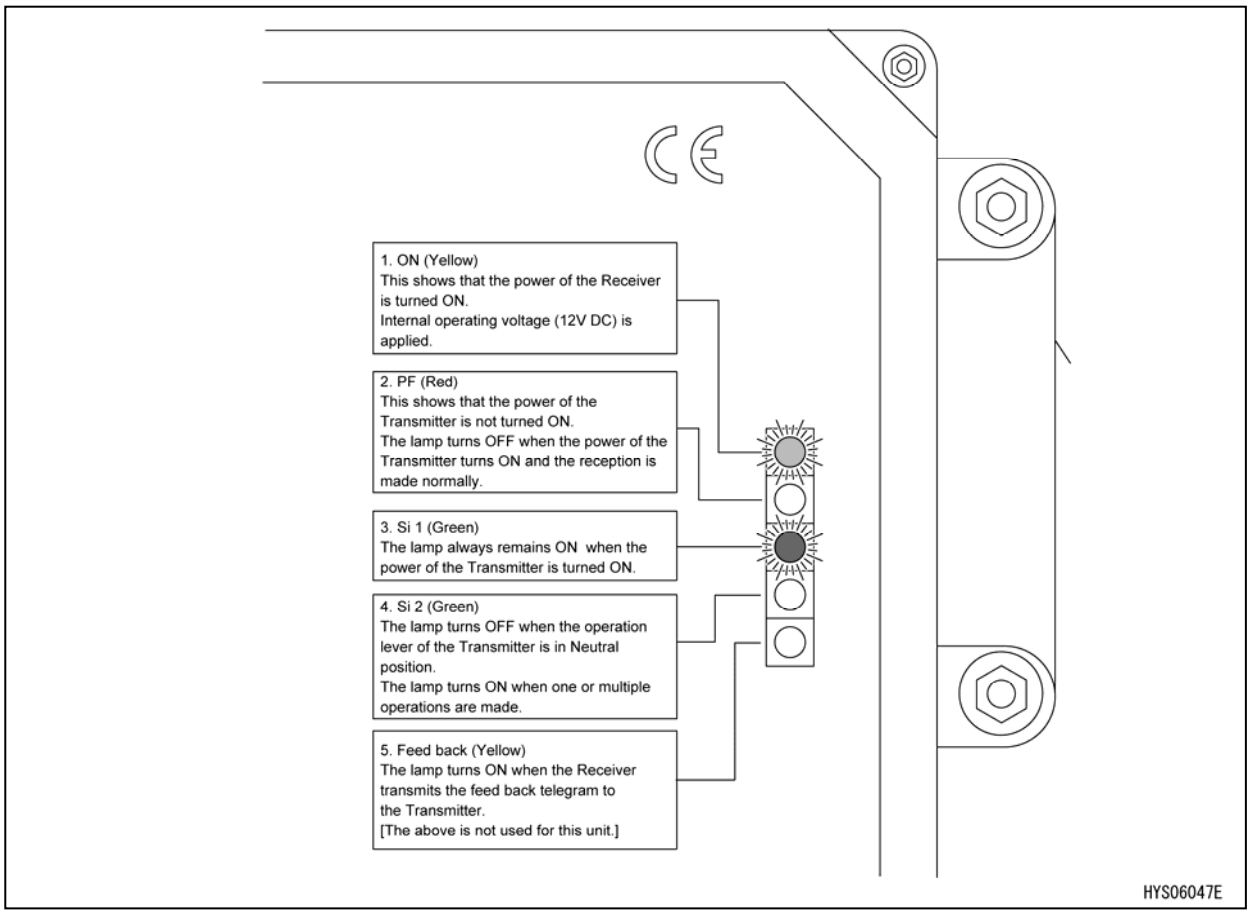
- The crane does not start to operate when the start button (S7) is pressed just once.
- When a radio wave is properly received, a remote control mode display illuminates on the monitor.
  (Figure on the right)
  No manual operation can be performed.



HYS06000a

2.3 INSPECTION OF THE RECEIVER

- Operate “ON/OFF” of the main starter switch and check that the power of the Receiver is turned ON or OFF.
  LED ON (yellow) on the uppermost part of the monitor LED (2) comes ON.
- When pressing the “Start button” (S7) of the Transmitter twice and operating the power to the “ON” position, check that two locations of the monitor LED (2) shown in the figure below come ON.



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3. SAFETY DEVICE OF REMOTE CONTROLLER

(1) Misoperation avoidance function when the remote control system is interrupted

This is a function to return to the state in which nothing is pressed (Forced zero position) if communications are not established when the power is turned ON or if communications are interrupted (poor reception or beyond reaching distance) during operation.

This is a function to avoid misoperation or erroneous activation when connections of the remote control system are interrupted.

To resume, place the operation lever of the Transmitter in the neutral position and press the start button twice to turn the power “ON”.

(2) Electronic Key

This system is provided with an electronic key.

The key has ID data necessary for the Transmitter and the system is not activated without the electronic key.

(3) Automatic Power OFF Circuit

Power of the Transmitter will automatically turn OFF when the remote control of crane operations is discontinued for approximately 15 minutes.

To resume, place the operation lever of the Transmitter in the neutral position and press the start button twice to turn the power “ON”.

(4) Transmitter Battery Voltage Drop Display

When the battery voltage drops, the status LED of the Transmitter flashes in red and the signal sound starts to sound.

The Transmitter stops in a few minutes if it is used as it is.

Replace the battery with a charged one.

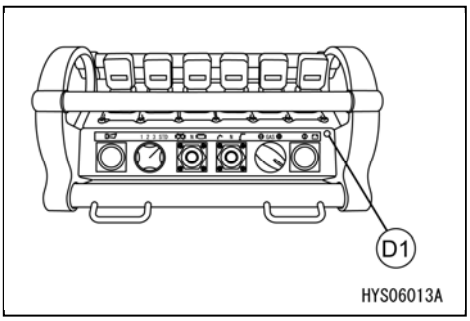
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4. HANDLING BATTERY

NOTES
・The battery used for the Transmitter is an exclusive battery. The model is BA225030 (6V DC/1500mAh).

4.1 REPLACEMENT TIMING OF BATTERY

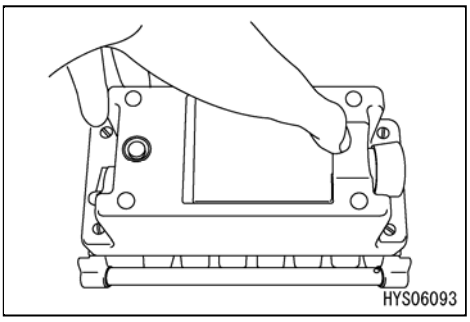
Replace the battery when the status LED (D1) of the Transmitter flashes in red and a signal sound starts to sound.
If the battery is not replaced, the Transmitter stops in a few minutes.



4.2 REPLACEMENT METHOD OF BATTERY

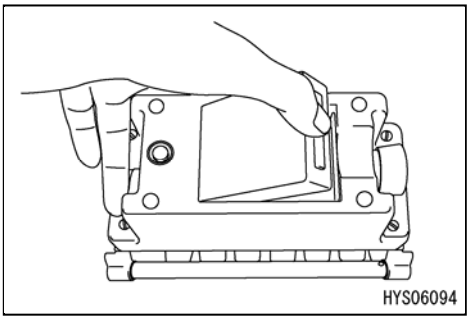
Replace the battery of the Transmitter in the procedure described below.

1. Press the emergency stop switch (S12) to turn the power of the transmitter "OFF".



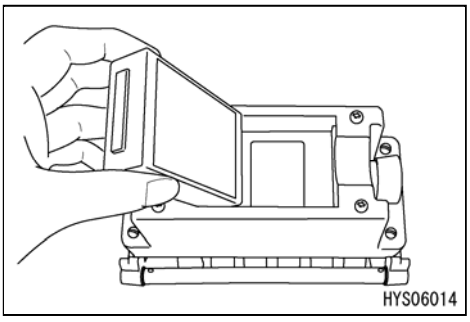
2. Lift the battery upward while pushing it. The battery comes off.

3. Insert a charged battery into the Transmitter while pushing it.



4. Return the emergency stop switch (S12).

5. Check that the power turns “ON” with the start button (S7).
   Press the start button (S7) twice and check that the status LED (D1) flashes in green.



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4.3 CHARGING METHOD OF BATTERY

To charge the battery, use only the supplied battery charger.

⚠ WARNING

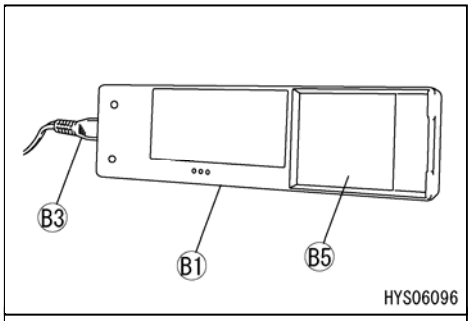
- **Use the battery charger only for charging of the battery described on the model label.**
- **Do not charge the battery in an explosion hazardous area under any circumstances.**
- **Use the battery charger only under the voltage condition described on the back.**
- **Do not use the battery charger outside the described temperature range.**
- **Protect the battery charger from overheat, dust, humidity, etc.**
- **Do not cover the battery charger with an object during charging.**
- **Pull the battery charger out of the power supply when not in use.**
- **If any damage is found on the battery charger body or its cord, stop using it at once.**
- **Do not modify or change the battery charger or cord.**

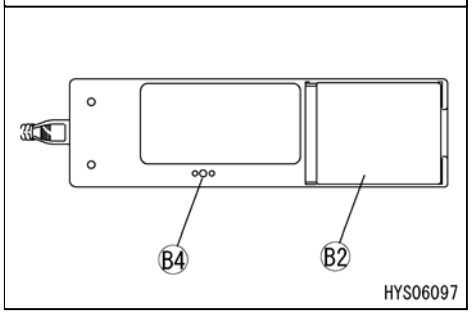
CAUTION

- **The battery capacity depends on the number of years used and environmental temperature. The capacity decreases when the battery becomes old.**
  The battery capacity decreases substantially at 0C° or less and at 40C° or above.
- **Be sure to charge the battery before the initial use or when at least 6 months have passed since the last use. The whole capacity can be used from around the time when the battery is discharged and charged 3 to 5 times.**
- **Charge the battery at ambient temperature of 0 - 40C°.**
- **Charge the battery when the status LED (D1) flashes in red and an intermittent signal sound starts to sound.**
- **To avoid overdischarge, charge the battery fully before long-term storage. Be careful not to leave the battery standing for 6 months or longer.**
- **Keep the battery at room temperature.**
- **Use a supplied protective cap at the time of storage and never allow the battery to be short-circuited.**
- **When the battery is correctly used, it can be charged and discharged 500 times or more.**
- **When the overdischarged battery is charged, red LED illuminates for a few seconds before charging starts (orange LED comes on).**

Charge the battery of the Transmitter in the procedure described below.

1. Install the battery (B2) to the charging case (B5) while pushing it.
   Connect the battery charger (B1) to the cord (B3) and insert the cord plug into the power supply (100-240V AC).
3. The battery charger LED (B4) illuminates in orange and charging starts.
4. When charging is completed (after 1 - 2 hours), LED (B4) turns into green.
5. After charging is completed, disconnect the cord plug from the power supply.





NOTES

- The charging state is displayed in the following 3 LED lamps.
  Green LED: Illuminates when charging is completed.
  Orange LED: Illuminates during charging.
  Red LED: Illuminates when the battery is overdischarged or fails.

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5. TROUBLESHOOTING

5.1 BEFORE TROUBLESHOOTING

"While the Crane operates perfectly from control on the machine body side, part or whole functions are inoperable from the remote control." In the event of failure as above, perform the DIAGNOSIS shown in the following pages.

CAUTION
Before performing troubleshooting on the following page onward, check according to the inspection item order shown below. **Such an error may be occasionally fixed by simple practice, such as applying another operation procedure or replacing the battery.** **In the case of an electric failure of this equipment, the crane can be operated with manual operation on the machine body side after the power is turned "OFF" with the emergency stop switch of the Transmitter.**

Check item	Cause and Action
Does the crane operate with the operation on the machine body side?	If the crane operates, there is an abnormality in this equipment. If the crane does not operate, troubleshoot the machine body.
Is the power turned ON with the Transmitter and main key switches?	If the power is not turned ON, turn it ON.
Does the emergency stop switch remain ON?	Cancel the emergency stop switch on the Transmitter and machine body side.
Is the outrigger/crane selector switch in the neutral (N) position?	Switch the outrigger/crane selector switch.
Does the status LED of the Transmitter flash in green?	If it flashes in red, replace the battery with a charged battery.
Is the Transmitter deformed or broken?	If the Transmitter is deformed or broken, repair or replace it.
Is each operation lever of the Transmitter in the neutral position?	If the control levers or operation switches show any sign of a fault or malfunction, repair or replace them.

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5.2 ERRORS IN THE REMOTE CONTROLLER

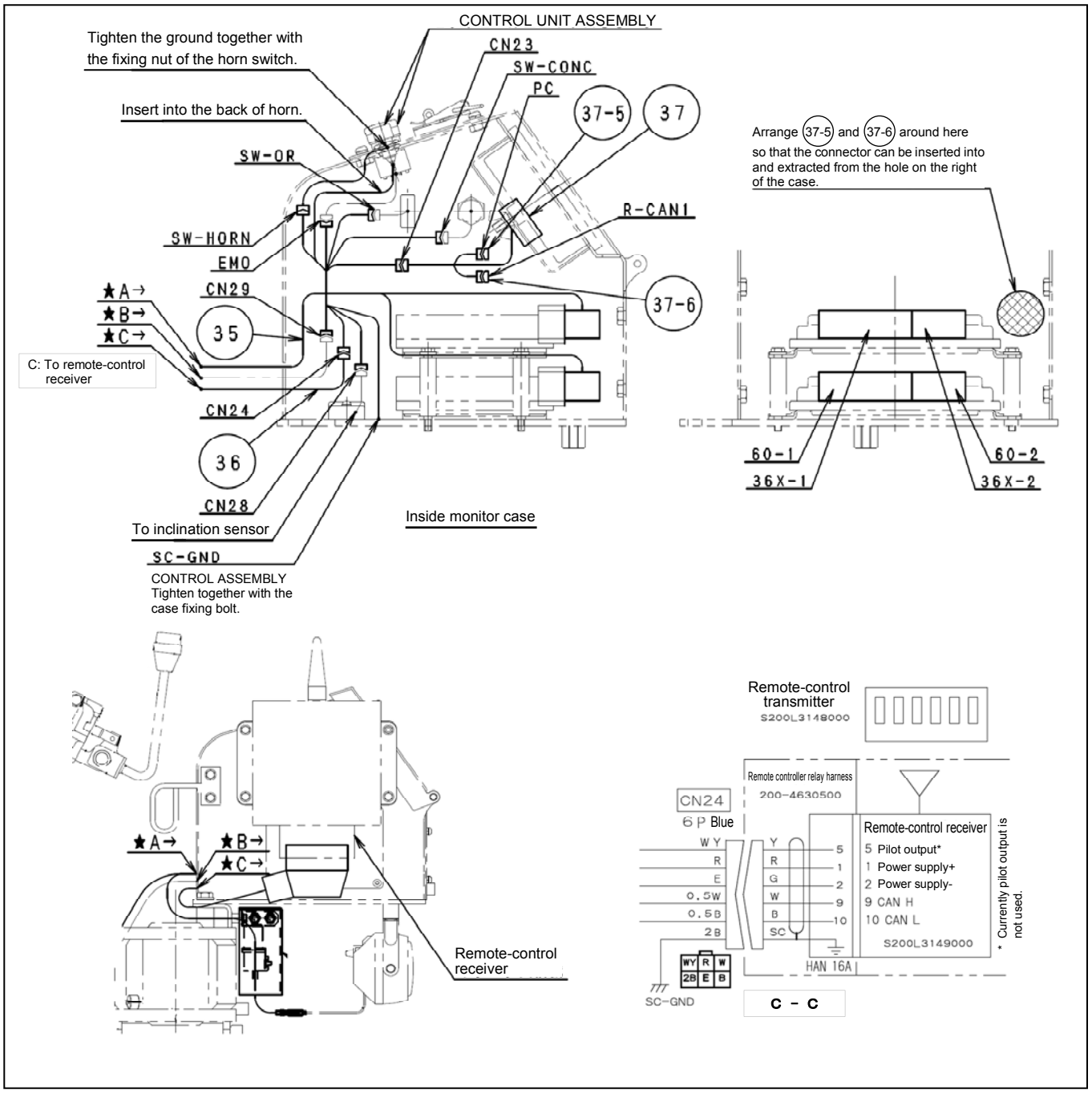
- When diagnosing the error, always verify on the monitor LED of the Receiver and the status LED (D1) on the Transmitter. Then, match the error with a suitable description from the table below, guess the cause and take actions.
- First, perform the “Remedy 1” in the table, then continue to “Remedy 2” if the error persists.

Symptom		Major Cause(s)	Remedy	
Transmitter	Receiver		Remedy 1	Remedy 2
When the power of the Transmitter is turned ON with the start button (S7), the status LED (D1) does not flash in green. (remains OFF)	———	• Reception error/Beyond reachable range	• Press the emergency stop switch once to cancel and then press the start button twice. • Perform the above operation near the Receiver.	★ Inspection, repair, replacement
		• The operation lever is not in the neutral position.	• Check that the operation lever is in the neutral position and press the start button twice.	★ Inspection, repair, replacement
		• The emergency stop switch remains ON.	• Cancel the emergency stop switch.	
		• The battery is faulty. (the life of the battery, etc.)	• Replace the battery with a charged one.	★ Inspection, repair, replacement
		• The power is not turned ON.	• Check the battery terminal for damage and contamination. • Insert the battery correctly.	★ Inspection, repair, replacement
		• The operating temperature range is exceeded.	• Use it in the range of 0 - 40C°.	
When the power of the Transmitter is turned ON with the start button (S7), the status LED (D1) flashes in red.	———	• The battery is over discharged.	• Replace the battery with a charged one. • Charge the battery with the exclusive battery charger and replace.	★ Inspection, repair, replacement
		• The battery is faulty. (the life of the battery, etc.)	• Replace the battery with a charged one.	★ Inspection, repair, replacement
Although the status LED(D1) of the Transmitter flashes in green, the crane speed is slow.	———	• The speed selector rotary switch is set to 1, 2 and 3.	• Set the speed selector rotary switch to STD.	

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Symptom		Major Cause(s)	Remedy	
Transmitter	**Receiver**		**Remedy 1**	**Remedy 2**
Although the status LED (D1) of the Transmitter flashes in green, the crane does not operate even if the operation lever is operated. (It operates properly from manual operation on the crane body side.)	———	• The “outrigger/crane” selector switch is in the neutral (N) position.	• Switch the “outrigger/crane” selector switch.	
		• The start button is pressed only once.	• Press the start button twice and check that the remote control mark is displayed on the monitor.	
	ON of the monitor LED (yellow) does not illuminate.	• Broken wire on the Receiver side	★ Inspection, repair, replacement	
		• Fault of the Receiver	★ Inspection, repair, replacement	

6. ELECTRICAL WIRING DIAGRAM FOR REMOTE CONTROLLER



Number	Name	Q'ty	Note
35	Lower part controller harness	1	Item number: 200-2171800
36	Remote controller relay harness	1	Item number: 200-4630500
37	Display harness	1	Item number: 200-3344900
37-5	Blanking	1	Item number: 200-4665600
37-6	Attenuator for CAN	1	Item number: 200-4665700

7. PRINCIPLE SPECIFICATION LIST

Item		
Compliant Radio Law		Overseas specification
Radio frequency		2402-2480MHzband
Transmission output		100 mW
Channel spacing		1 MHz
Reachable range of radio waves		100 m or longer (under a good condition where there is no radio interference)
Unique address		Extracted and set from 1 million or more addresses at the time of shipment from factory
Waterproof		IP65
System configuration		Combined use of manual operation and remote control operation
Transmitter antenna		Built-in type
Operating status display		Status LED ・Battery status display ・Reception fault Monitor LED ・Receiver power status display ・Transmitter power status display ・Feedback and telegram display
Safety device		Emergency stop switch
		Misoperation avoidance function during interruption of remote control
		Electronic key (unique address)
		Automatic power OFF device (Auto power off device) Approx. 15 minutes
		Transmitter stop function when battery capacity decreases
		Alarm switch
Power of transmitter		Battery BA225030 (6VDC-1500mAh)
Power of receiver		Power of crane main body (12VDC)
Continuous operating hours of Transmitter		Approx. 20 hours
Ambient operating temperature		-25˚C to +70˚C
Transmitter mass		Approx. 1.5 Kg (including battery)
Operation items of Transmitter	Operation lever switch	Main boom derricking/No.4 outrigger
		Hook raising and lowering/No.3 outrigger
		Main boom telescoping/All outriggers
		Jib derricking
		Jib telescoping/No.2 outrigger
		Slewing/No.1 outrigger
	Push button switch	Start button
		Horn
		Emergency stop switch
	Toggle switch	Engine start/stop
		Outrigger/Crane selector switch
	Rotary switch	Speed selector rotary
	Dial switch	Accelerator
Battery charging	Power supply voltage	100 to 240VAC 10 to 30VDC
	Charging time	1 to 2 hours
	Ambient operating temperature	10 to 40˚C

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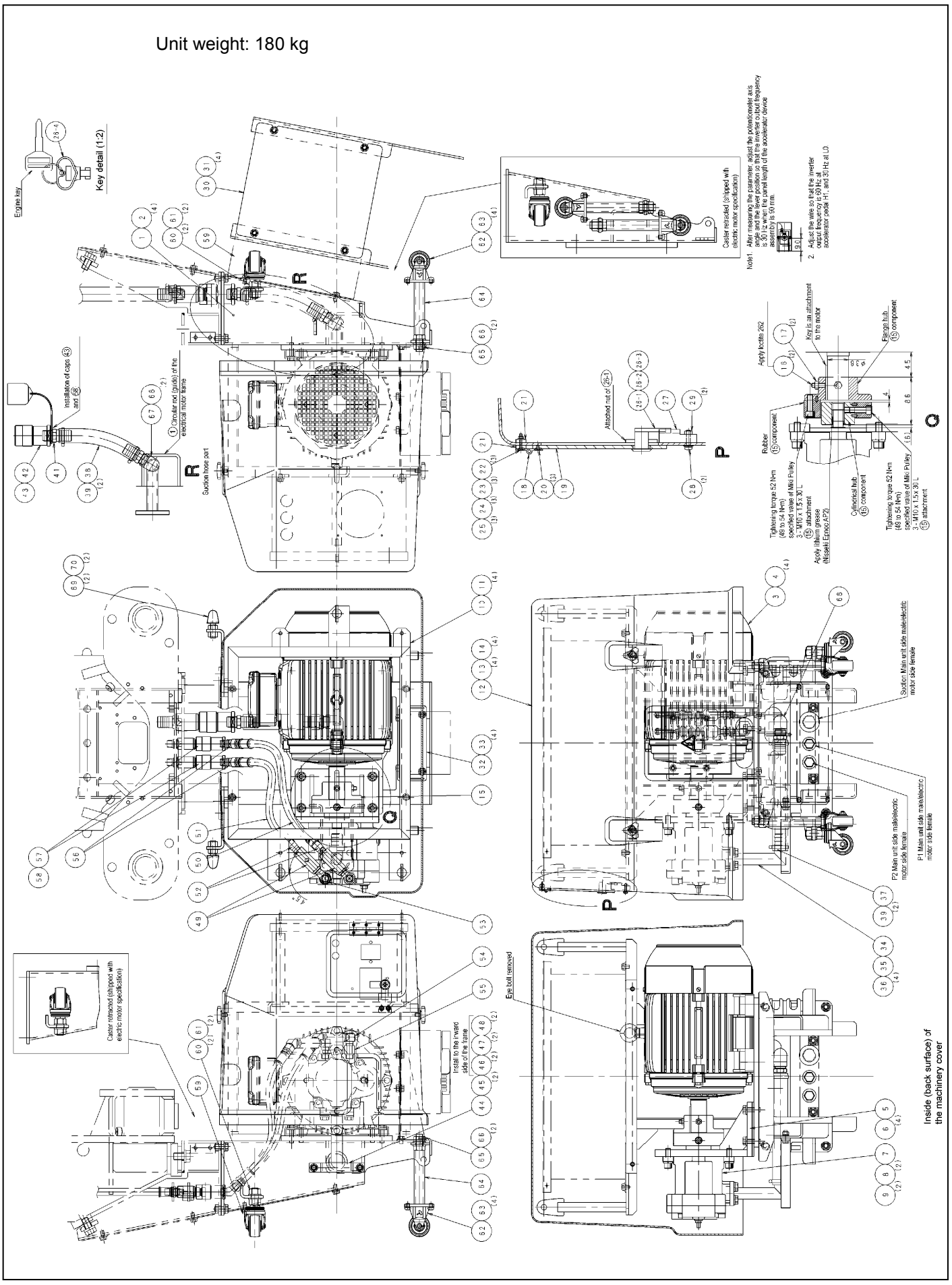
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ELECTRIC MOTOR

1. ELECTRICAL MOTOR UNIT ASSEMBLY	5-2
1.1 POWER UNIT	5-5
1.2 EXTERNAL APPEARANCE / SPECIFICATION OF THE PUMP	5-6
2. CONTROL PANEL ASSEMBLY (CE SPECIFICATION 380V)	5-7
2.1 INVERTER PANEL	5-8
2.2 EXTERNAL APPEARANCE AND NAME OF EACH SECTION	5-9
2.3 NAME AND CONTENT OF THE DIGITAL OPERATOR	5-10
2.4 DETAIL OF INVERTER SET ITEMS	5-12
2.5 ALARM DISPLAY AND COUNTERMEASURE	5-13
2.6 LIST OF ALARM CODES	5-15
2.7 TROUBLESHOOTING	5-19
2.8 MAINTENANCE AND INSPECTION	5-25
2.9 NOTE ABOUT DISPOSAL	5-28
3. POWER SUPPLY BOX	5-29
4. ELECTRICAL DIAGRAM	5-31
5. ELECTRIC MOTOR BOX HARNESS	5-33

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1. ELECTRICAL MOTOR UNIT ASSEMBLY



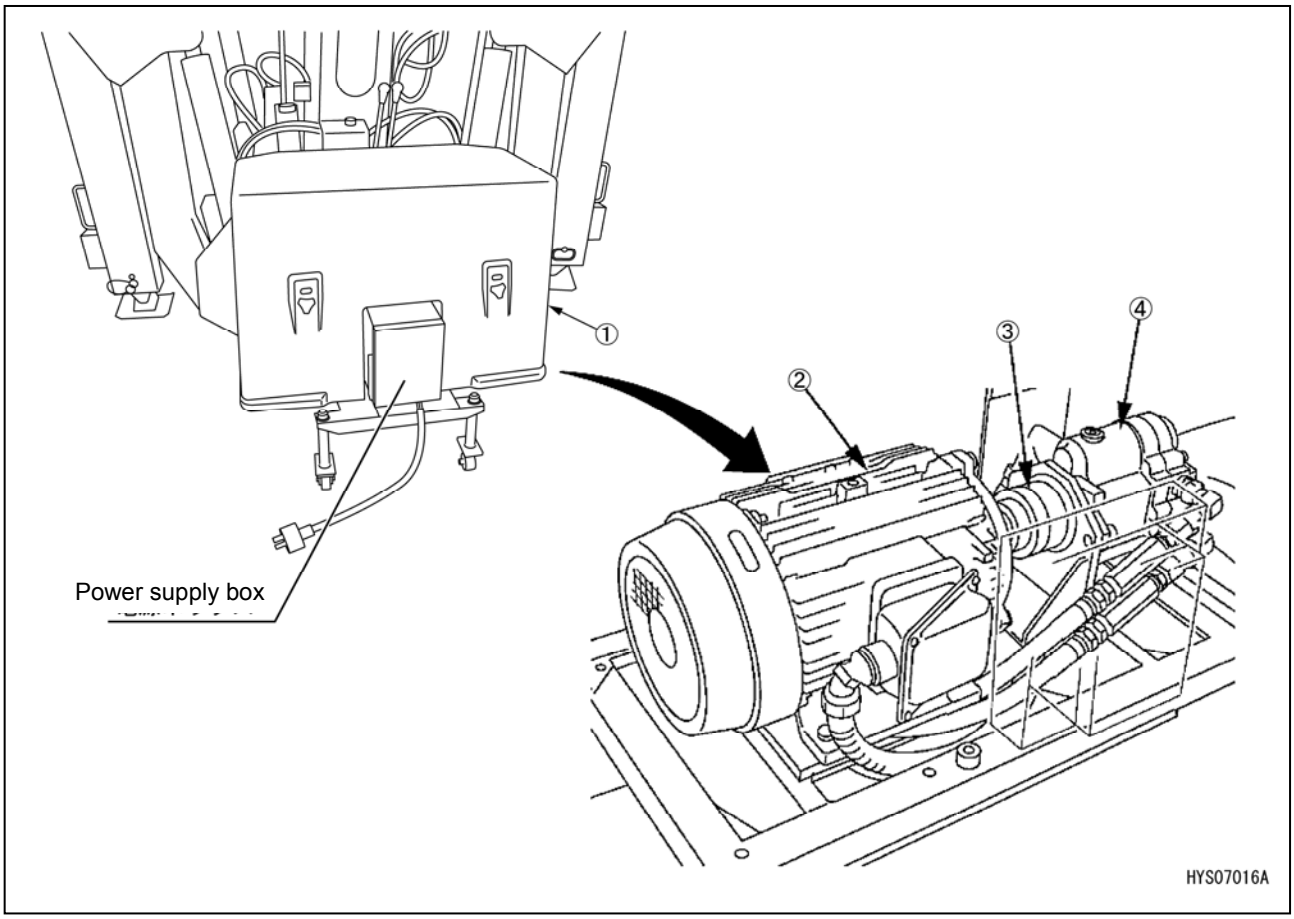
Number	Name	Q'ty	Note
1	Motor-operated frame [SN:-MK0049] Motor-operated frame [SN:MK0050-]	1 1	Item number: 200-2164000 Item number: 200-2182000
2	Sems bolt	4	Komatsu item number: 01024-81025
3	Motor 285C (Sin CE)	1	S102M3046000
4	Sems bolt	4	Komatsu item number: 01024-81035
5	P bracket	1	Item number: 353-3219000
6	Sems bolt	4	Komatsu item number: 01024-81035
7	Hydraulic pump	1	Item number: 329S33800002
8	Hexagon socket head cap screw	2	M12 × 1.75 × 35L (12.9)
9	Spring washer	2	M12 × Type-2 (plated)
10	Control panel block	1	Item number: 200-2164100
11	Sems bolt	4	Komatsu item number: 01024-81016
12	Unit cover	1	Item number: 200-1172900
13	Large triangle knob	4	Item number: 350-4405000
14	Circular plain washer	4	Item number: 21742-08315 (8 × 24 × 2.0 plated)
15	Shaft coupling	1	Item number: 353S77800000
16	Seal ring with hexagon socket	2	M8 × 1.25 × 25L (flat point)
17	Hexagon nut	2	M8 × 1.25 × Type 1 (plated 4T)
18	Brass pull flat type hinge	1	Item number: 27350-05307 (B-202-7 Takigen)
19	Meter door	1	Item number: 102-4581000
20	Cross-recessed head machine screw	3	M3 × 0.5 × 6L (plated)
21	Hinged seating A	2	Item number: 102-4581100
22	Cross-recessed head machine screw	3	M3 × 0.5 × 20L (plated)
23	Hexagon nut	3	M3 × 0.5 × Type 1 (plated 4T)
24	Plain washer	3	M3 × Small circle (plated)
25	Spring washer	3	M3 × Type-2 (plated)
26	Plastic bit lock	1	Item number: 353S69400000 (CP-316-A Takigen)
26-1	Housing	1	Item number: 353S69401000 (200-9044 With stainless nut Takigen)
26-2	Insert	1	Item number: 353S69402000 (200-9160 Takigen)
26-3	Rotating cam	1	Item number: 353S69403000 (200-5322 Takigen)
26-4	Key	1	Item number: 353S69404000 (204-0408 Takigen)
27	Spacer	1	Item number: 102-4580500
28	Cross-recessed pan head screw with washer	2	M5 × 0.8 × 20L (PW, SW, built in, plated)
29	Hexagon nut	2	M5 × 0.8 × Type 1 (plated 4T)
30	Cover	1	Item number: 200-4639700
31	Sems bolt	4	Komatsu item number: 01024-81012
32	Power supply BOX-BKT	1	Item number: 200-4639800
33	Sems bolt	4	Komatsu item number: 01024-81012
34	Suction elbow	1	Item number: 200-3350700
35	O-ring	1	Item number: 26210-20390 (P39-1B)
36	Sems bolt	4	Komatsu item number: 01024-81025
37	Suction hose A	1	Item number: (22813S25028 BS oil proof O.K.excel-100 25 × 2B 280L spiral on entire perimeter)
38	Suction hose B	1	Item number: 22813S25022 (BS oil proof O.K.excel-100 25 × 2B 220L spiral on entire perimeter)
39	Jubilee band	4	Item number: 22972S04000 (1X-40 φ40 – φ30)
40	Missing number		
41	Barb fitting	1	Item number: 22951-07270 (R3/4 × φ27)
42	Flat face coupler (female)	1	Item number: 25580-11200 (F35-6S Nitto)

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Number	Name	Q'ty	Note
43	Coupler cap	1	Item number: 25590-13000 (60466 Nitto)
44	Pipe guard	1	Item number: 200-4640000
45	Sems bolt	2	Komatsu item number: 01024-80825
46	Plain washer	2	M8 × Regular circle (plated)
47	Spring washer	2	M8 × Type-2 (plated)
48	Hexagon nut	2	M8 × 1.25 × Type 1 (plated 4T)
49	Check valve	2	Item number: 349S60200000
50	PE1 hose	1	Item number: 22744S85050 (YFH2109 1005=1005 500L spiral on entire perimeter)
51	PE2 hose	1	Item number: 22744S85043 (YFH2109 1005=1005 430L spiral on entire perimeter)
52	Male 45° elbow	2	Item number: 22611-10650 (1036-06)
53	O ring boss male 90° elbow	1	Item number: 22031-29500 (1105-06)
54	Male 90° elbow	1	Item number: 22031-27500 (2086-06)
55	O ring boss female connector	1	Item number: 22031-43500 (1068-06)
56	Male 45° elbow	2	Item number: 22611-10650 (1036-06)
57	Coupler socket	2	Item number: 25580-10600 (F35-3S Nitto)
58	Cap	2	Item number: 25590-11000 (60464 Nitto)
59	Rotating caster	2	Item number: 200-4641900
60	Hexagon nut	4	M16 × 2.0 × Type 1 (plated 8T)
61	Plain washer	4	M16 × Regular circle (plated)
62	Fixed caster	2	Item number: 200-4642000
63	Cross-recessed round head screw	8	M8 × 1.25 × 10L (with PW, plated)
64	Caster BKT	2	Item number: 200-4639900
65	Hexagon nut	2	M16 × 2.0 × Type 1 (plated 4T)
66	Plain washer	4	M16 × Regular circle (plated)
67	Elbow	1	Item number: 22011-01770 (PT3/4-PT3/4 low pressure)
68	Barb fitting	2	Item number: 22951-07270 (HN-1627)
69	Rubber stopper [SN:MK0050-]	2	Item number: 353-4451700
70	Hexagon nut [SN:MK0050-]	2	M12 × 1.75 × Type 1 (plated 4T)

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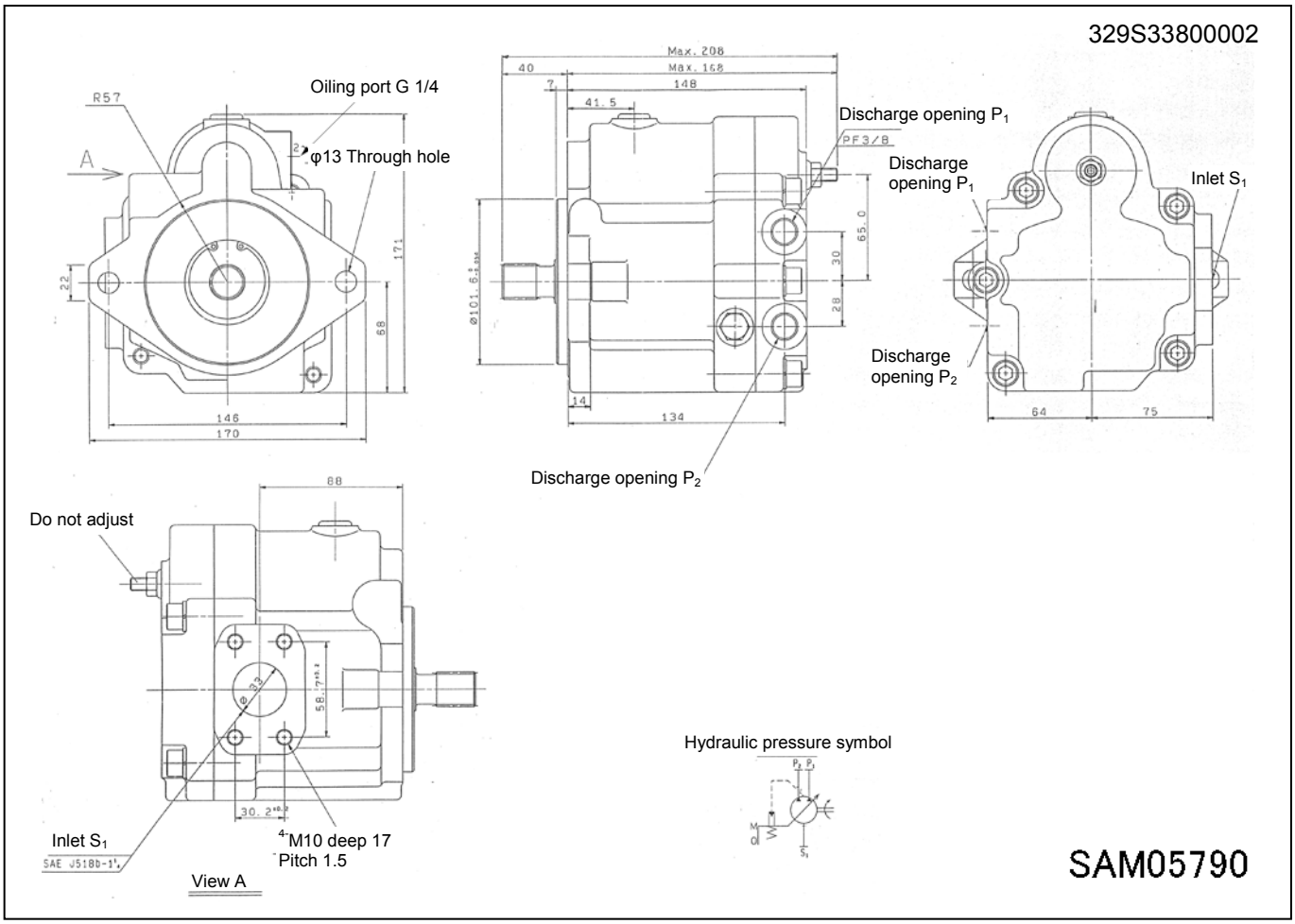
1.1 POWER UNIT



(1) Power unit cover
(2) Electric motor
(3) Coupling
(4) Hydraulic pump

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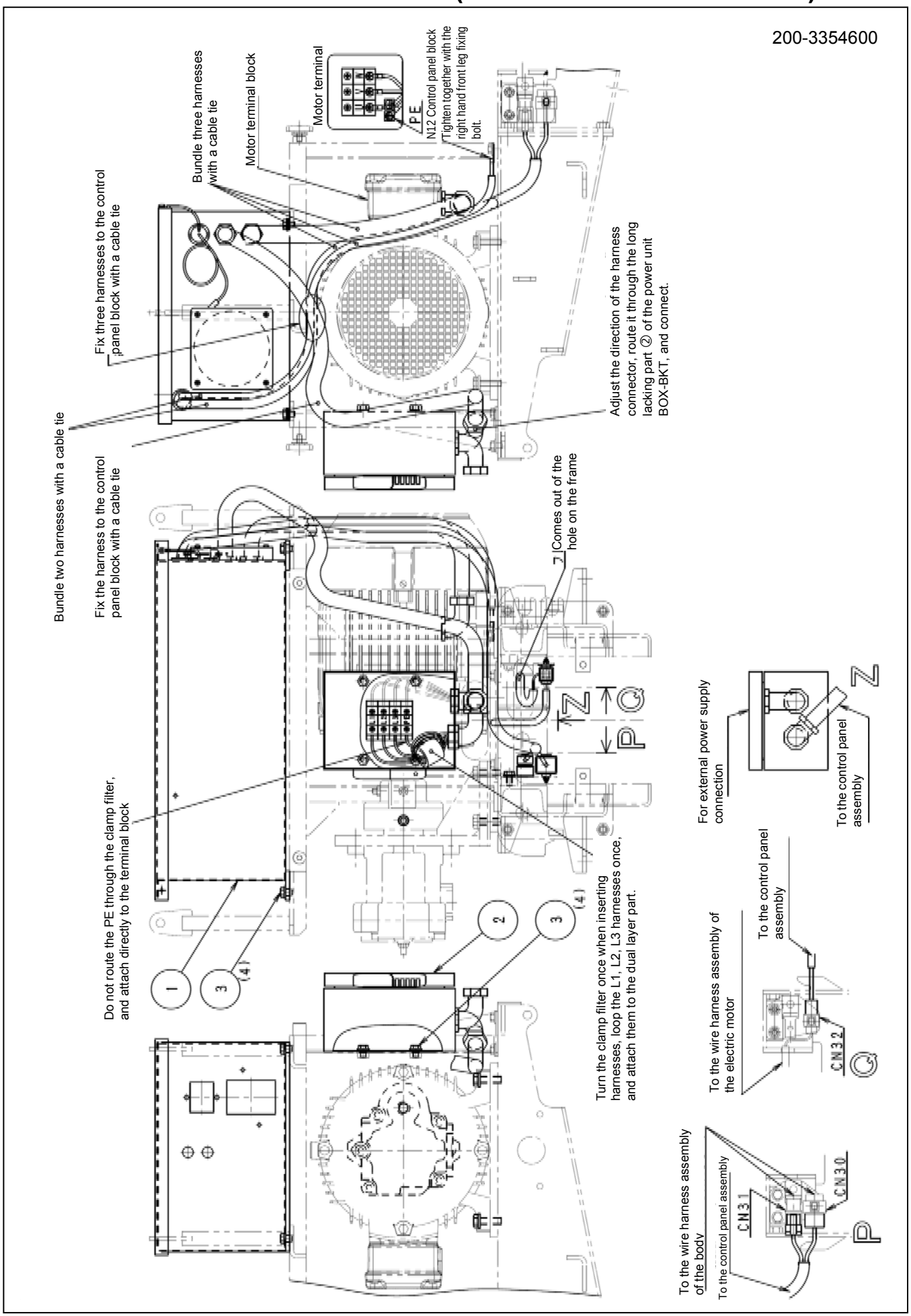
1.2 EXTERNAL APPEARANCE / SPECIFICATION OF THE PUMP



Specifications				
Pump capacity		P1 + P2: 8.6 + 8.6 cc/rev	Oil used	ISO VG 32, 46
Maximum pressure		P1: 20.59 MPa P2: 20.59 MPa	Oil temperature range	−20 to 100°C
			Hydraulic fluid pollution level	Within NAS level 11
Rotation	Rated	1800 Min^{-1}	Suction strainer	150 Mesh
	Maximum	2000 Min^{-1}	Line filter	10 μm
Variable control mechanism		Fixed horsepower control	Vibration level	Within 10 G
Direction of rotation		Right (seen from the spindle side)	Suction pressure	−0.02 to + 0.04 MPa
Mass		13 kg		(Suction speed within 2 m/sec)
Paint color		Color of anti-rust coating	Oiling	Fill the pump case with clean hydraulic fluid before starting the pump.

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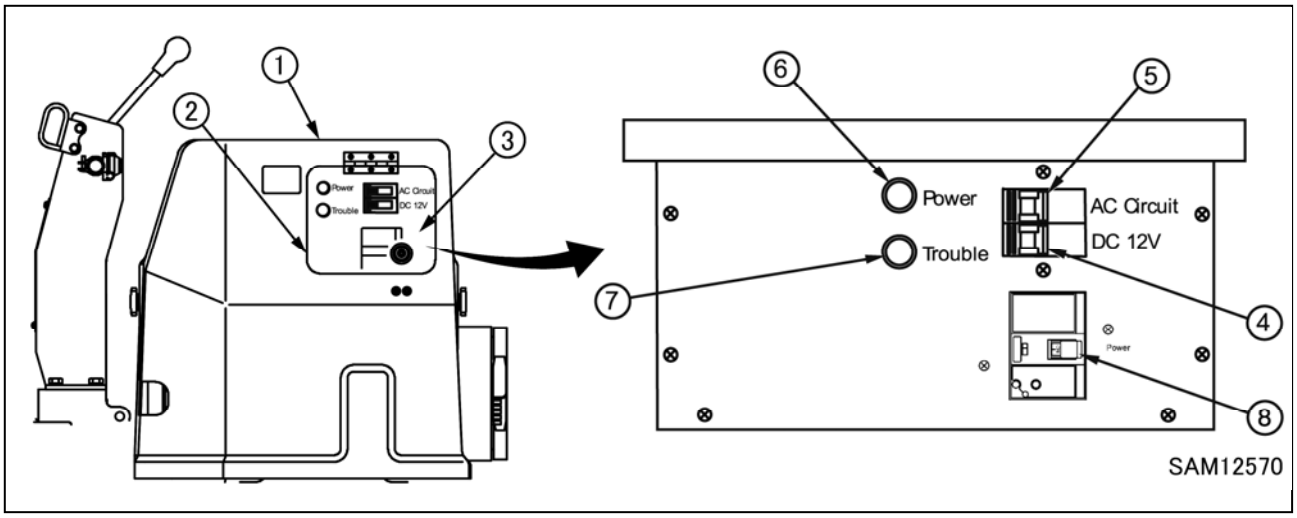
2. CONTROL PANEL ASSEMBLY (CE SPECIFICATION 380V)



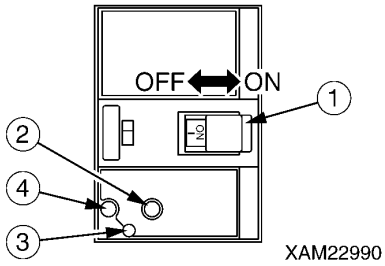
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Number	Name	Q'ty	Note
1	Inverter unit	1	Item number: S200M3122000
2	Power box (IW2-WEG)	1	Item number: S102M3062000
3	Sems bolt	8	Komatsu item number: 01024-80816

2.1 INVERTER PANEL



(1) Power unit cover
(2) Protective cover
(3) Inverter panel
(4) DC12V Power supply switch
(5) Alternating-current circuit power supply switch
(6) Power lamp (white)
(7) Trouble lamp (red)
(8) Main breaker (with a leak detector)

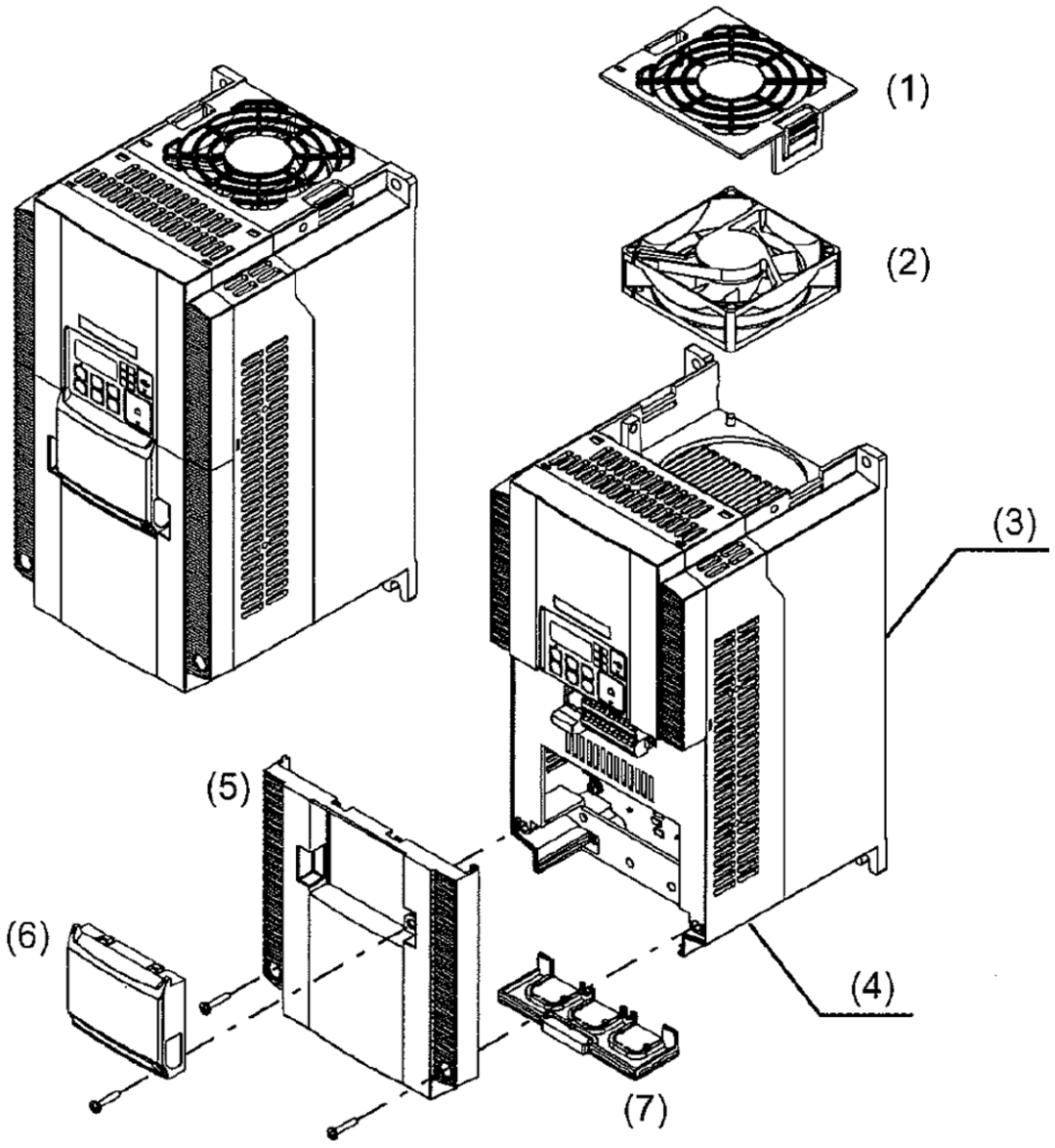


(1) Breaker
(2) Overvoltage/ground-fault indication button (yellow)
(3) Trip button (red)
(4) Ground-fault test button (gray)

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2.2 EXTERNAL APPEARANCE AND NAME OF EACH SECTION

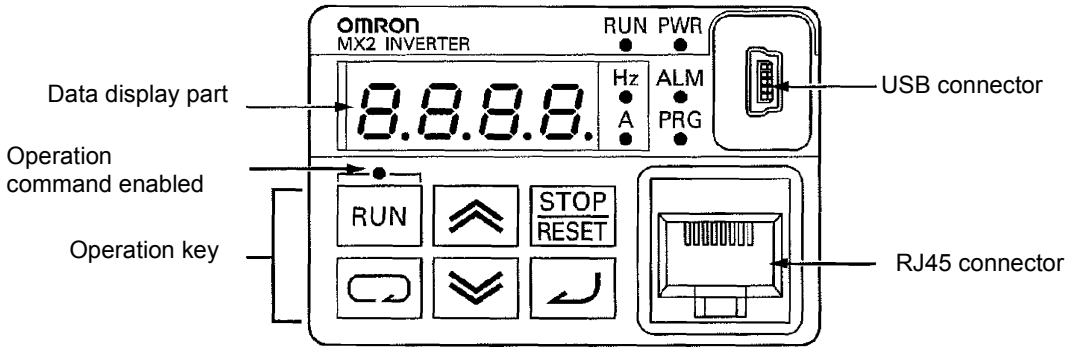
3G3MX2-A4055-V1



(1) Cooling fan cover
(2) Cooling fan
(3) Cooling fin
(4) Main unit case
(5) Terminal block cover
(6) Option cover
(7) Electric wire drawer panel

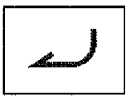
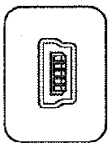
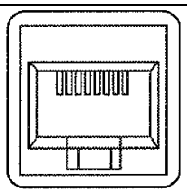
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2.3 NAME AND CONTENT OF THE DIGITAL OPERATOR



Display	Name	Content
PWR ●	POWER LED	Lights up (green) when the inverter power is being supplied.
ALM ●	ALARM LED	Lights up (in red) when the inverter is tripped. Refer to “Method to release (reset) the trip status” for the trip release method.
PRG ●	Program LED	Lights up (in green) when data that can be changed (setting value) is displayed on the display part. If there is an inconsistency in the setting value, the LED will blink.
RUN ●	RUN (running) LED	Lights up (in green) when the inverter is running. (The LED lights up with “OR” condition of [Run command exists] and [Inverter outputting], so it will light up when the run command is issued with 0 Hz setting frequency, or during the deceleration after the run command OFF.)
Hz ●	Monitor LED (Hz)	Lights up (in green) when the data displayed in the display part is frequency.
A ●	Monitor LED (A)	Lights up (in green) when the data displayed in the display part is current.
⌐●¬	Operation command enabled indicator LED	Lights up (in green) when the run command is set in the operator. (when the RUN key is enabled on the operator)
8.8.8.8.	Display part	Displays data (in red) such as various parameters and frequency/setting values.
RUN	RUN key	Runs the inverter. However, this is enabled when the run command is operator.
STOP/RESET	STOP/RESET key	The inverter decelerates/stops. (The STOP/RESET key is enabled (default setting) even when the run command is not set to the operator, but this can be disabled in the settings (b087).) Resets (returns from trip status) when the inverter is tripping.

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Display	Name	Content
	Mode key	When parameter is displayed; moves to the following parameter group. When data is displayed; cancels the setting and returns to the parameter display. When in individual input mode; moves the blinking line to the left when not at the furthest left digit. Moves to the furthest right digit if at the furthest left digit. Displays the data of the output frequency monitor (d001), regardless of the display screen, when long-pressed for more than three seconds.
	Enter key	When parameter is displayed; moves to data display. When data is displayed; saves the setting after confirming them (saves to EEPROM) and returns to the parameter display. When in individual input mode; confirms the blinking line, and moves the blinking line to the right.
	Increment key	Adds parameter or setting data. Accelerates if long-pressed. Enters the "individual input mode" where each line can be edited individually, when the increment and decrement key is pressed simultaneously.
	Decrement key	Decreases parameter or setting data. Accelerates if long-pressed. Enters the “individual input mode” where each line can be edited individually, when the increment and decrement key is pressed simultaneously.
	USB connector	Connector to connect with computers (mini-B type). Use when connecting with the support tool “CX-Drive” for the inverter/servo.
	RJ45 connector	Connector (RS-422) for the optional remote operator connection. The keys on the main unit will be disabled when the remote operator is connected. The items to display in the display part at this stage can be configured in b150.

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2.4 DETAIL OF INVERTER SET ITEMS

The initial setting is as shown in the table below.

Setting number	Function name	Set value
A001	Selection of first frequency reference	01: Control circuit terminal board
A002	Selection of first operation reference	01: Control circuit terminal board
A003	First base frequency	50.0
A011	FV start frequency	30.00
A012	FV end frequency	60.00
A013	FV start ratio	45
A014	FV end ratio	60
A015	Selection of FV start	00: Start frequency A011
A016	Analog input filter	30
A019	Selection of multistep speed	01: Bit
A021	Multistep speed reference 1	10.00
A022	Multistep speed reference 2	30.00
A041	Selection of first torque boost	00: Manual torque boost
A061	Upper limit of first frequency	60.00
A062	Lower limit of first frequency	10.00
A081	Selection of first AVR	01: Normally OFF
A082	Selection of first motor receiving voltage	400: Default value (setting not necessary)
b001	Selection of restart during momentary power interruption and under voltage	02: Frequency matching restart
b002	Allowed time for momentary power interruption and under voltage	25.0
b003	Waiting time for restart	0.3
b013	Selection of first electronic thermal properties	00: Reduced torque characteristics
b083	Carrier frequency	2.0
b089	Automatic carrier frequency reduction	02: Valid, dependent on fin temperature
C003	Multi-function input selection 3	32: SF1
C004	Multi-function input selection 4	33: SF2
C005	Multi-function input selection 5	255: NO
C006	Multi-function input selection 6	12: EXT
C007	Multi-function input selection 7	16: FV/F1
C036	Multi-function relay contact selection	00: NO (a contact)

Set the software lock by manual operation after writing the setting.

Setting number	Set value
b031	02: Change disabled except b031

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2.5 ALARM DISPLAY AND COUNTERMEASURE

2.5.1 ALARM DISPLAY

When the inverter detects a fault, the inverter trips and turns on the ALARM LED, and displays the alarm code. If the increment key is pressed while the alarm is displayed, the detailed information at the time of the alarm, such as the output frequency, current, DC voltage can be observed.

Check each signal such as the run command before releasing (resetting) the alarm.

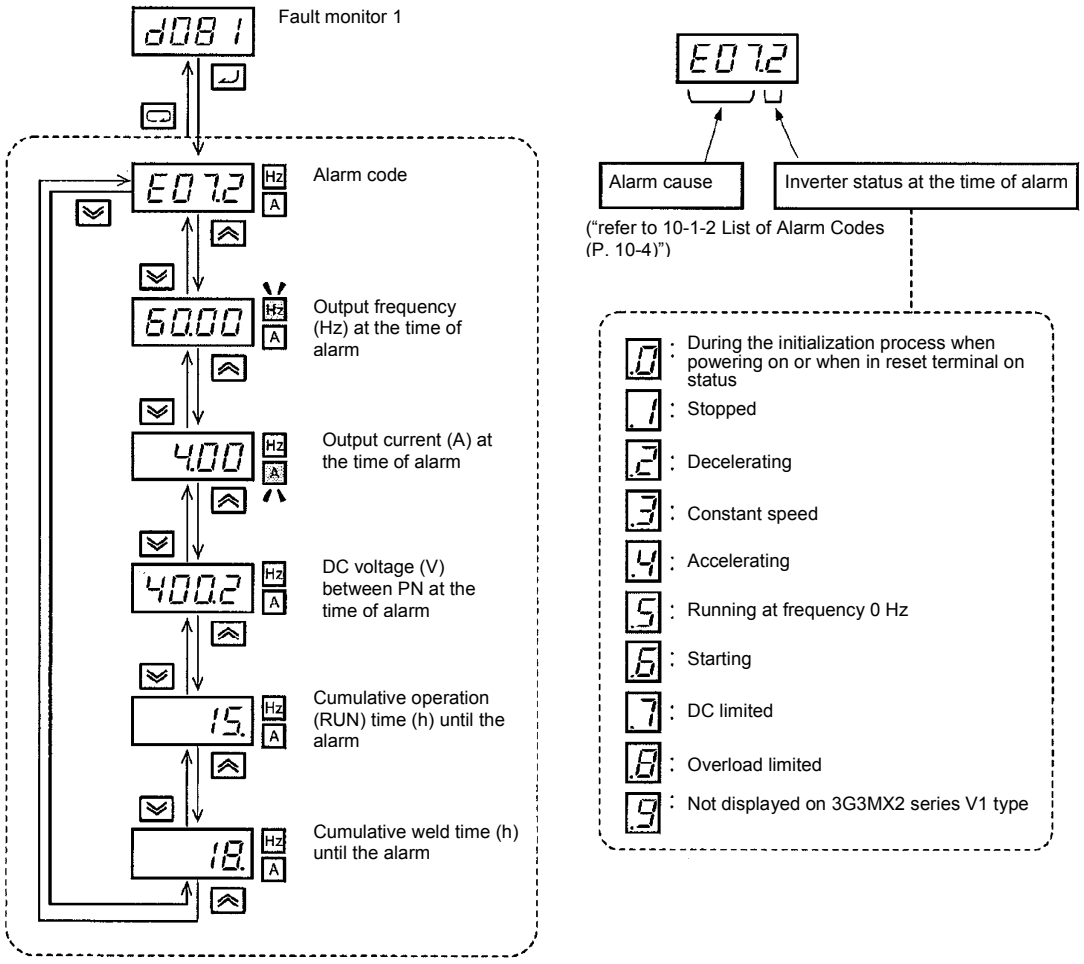
Investigate the cause of the trip from the displayed alarm code, and remove the cause before resetting.

The parameters cannot be changed, and writing to the EEPROM with communication cannot be performed while the inverter is tripped, so change the parameters after powering on or after resetting the trip.

In this section, the countermeasures for issues occurring after the operation of the inverter are being explained.

2.5.2 FAULT MONITOR DISPLAY

The current and past alarms can be observed in the fault monitor 1 to 6 (d081 to d086). The latest alarm is displayed in the fault monitor 1 (d081).



Precautions

The inverter status at the time of alarm may be different from the operation observed from the motor. When the PID control character and frequency is inputted with analogue signals, the inverter may repeat the acceleration status in small increments due to the fluctuation of the analogue signal even when the motor seems to be running at constant speed.

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2.5.3 METHOD FOR RELEASING (RESETTING) THE TRIP STATUS

The following two methods exist for resetting the trip status of the inverter.

- Pressing the STOP/RESET key on the digital operator.
  The trip status can be reset if “00: enable” or “02: enable only reset” is set for the stop key selection (b087).
- Enter reset input from the control circuit terminal block.
  Set “18: RS (reset)” in one of the multi function input S1 to S7 selection (C001 to C007).

  The trip status may not be released depending on the cause.
  In that case, turn the power off and turn it on again.

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2.6 LIST OF ALARM CODES

Name	Content		Alarm code	Check content and countermeasures	Reference
Overcurrent protection	If the motor is restrained or if it is put under sudden acceleration/deceleration, large amount of current will flow into the inverter, and may cause damage. Therefore, the protection circuit will activate at approximately 200% of the inverter rated output current, and trips.	During constant speed operation	E01.☐	Are there any sudden changes in load? • Decrease the amount of load changes. Are there any short-circuits? • Check the output line. Are there any ground faults? • Check the output line and motor.	
		During deceleration	E02.☐	Are there any sudden deceleration? • Make the deceleration time longer.	
		During acceleration	E03.☐	Are there any sudden acceleration? • Make the acceleration time longer. Are motor locks observed? • Check the motor and wiring. Is the torque boost high? • Lower the torque boost. • Is the setting and adjustments of the motor correct when in PM motor?	
		Other	E04.☐	Is the DC control too high? • Lower the damping force.	
Overload protection[*1]	The output current of the inverter is being monitored, and if the internal electric thermal detects an overload of the motor, it will trip. If the overload protection of the motor and inverter is separated under the settings of the motor electric thermal function selection (b910), it will function as a motor overload protection.		E05.☐	Is there excessive load? • Lower the load factor. Is the thermal level (b012/b212) correct? • Adjust so that it is correct.	
Overload protection of the limiting resistor	Trips when the activity ratio of the regenerative braking exceeds the activity ratio configured in b090.		E06.☐	Are there any sudden deceleration? • Make the deceleration time longer. Is the run cycle too short? • Make the run cycle longer.	
Overcurrent protection	If the DC current between P/+2 and N/- becomes too high, it may result in damage. Therefore, the motor will trip if the DC current between P/+2, N/- exceeds approximately DC 400V (200 V level)/800 V (400 V level) due to the rising of regenerative energy or receiving voltage.		E07.☐	Are there any sudden deceleration? • Make the deceleration time longer. Are there any ground faults? • Check the output line and motor. Is the motor being rotated from the load side? • Reduce the regenerative power. Is the receiving voltage rising? • Lower the receiving voltage, limit the power supply variation, use AC reactor for input.	
EEPROM error[*2]	Trips when faults in the internal EEPROM occur due to abnormal rising of external noise or temperature. (May result in CPU errors in some cases.)		E08.☐	Is there any source of strong noise? • Take measures for the noise. Is the cooling efficiency dropping? • Check the cooling fin for clogging, and clean. • Replace cooling fan.	

*1: Reset operation will not be available until approximately 10 seconds elapses after the trip (after the protection function activates).

*2: Reset operation with the RS port or the STOP/RESET key will not be available when errors occur. Turn the machine off once. If an error occurs when powering on the next time, the memory is damaged, or the parameter has not been saved properly. Initialize and reconfigure the parameter.

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Name	Content	Alarm code	Check content and countermeasures	Reference
Insufficient voltage	When the inverter receiving voltage reduces, the output will be cutoff if the receiving voltage drops below the specified value, since the control circuit does not function properly. Also it will trip if the DC voltage between P/+2, N/- drops below approximately DC 173 V (200 V level)/ DC 345 V (400 V level).	E09.□	Is the power voltage dropping? • Check the power supply. Is the voltage source capacity sufficient? • Check the power supply. Is the thyristor of the inrush current prevention circuit damaged? • Check that the DC voltage between P/+2, N/- drops only when the output current is high.	
Current detector error	Trips when a fault occurs in the current detector.	E10.□	Inverter fault • Repair.	
CPU error*2	Trips when a malfunction or fault occurs in the internal CPU.	E11.□	Is there any source of strong noise? • Take measures for the noise. Inverter fault. • Repair.	
External trip	Trips when the multi function input terminal set in the external trip (12: EXT) turns ON.	E12.□	External device fault. • Check the external device.	
USP error	Trips if the power is turned on when the run signal is inputted to the inverter. (Only when the USP function is selected)	E13.□	Is the power being turned ON while the run signal is being inputted? • Check the run signal.	
Ground fault protection*2	Trips if ground fault is detected between the output part of the inverter and the motor when the power is being turned ON. (If residual voltage exists in the motor, this function will not operate.)	E14.□	Are there any ground faults? • Check the output line and motor. Are there any faults in the inverter itself? • Remove the output line and check. Are there any faults in the main circuit part? • Check the main circuit (refer to [Section 11 Maintenance/Inspection].	
Receiving voltage overvoltage protection	Trips if overvoltage state of the receiving voltage continues for 100 seconds while the inverter is stopped. (The overvoltage detection value is approximately DC 390 V at 200 V level, and DC 780 V at 400 V level for the DC voltage between P/+2, N/1.)	E15.□	Is the receiving voltage too high? • Reduce the receiving voltage. • Limit the power supply variation. • Use AC reactors for input.	
Temperature faults	Trips if the main circuit temperature exceeds the specified value due to high ambient temperature.	E21.□	Is the unit installed vertically? • Check the installation. Is the ambient temperature too high? • Lower the ambient temperature.	
CPU communication error	Trips when a malfunction or fault occurs in the internal CPU communication.	E22.□	Is there any source of strong noise? • Take measures for the noise. Inverter failure. • Repair.	
Main circuit fault	Trips when a fault occurs in the main circuit board.	E25.□	Is there any source of strong noise? • Take measures for the noise. Inverter failure. • Repair.	

*2: Reset operation with the RS port or the STOP/RESET key will not be available when errors occur. Turn the machine off once. If an error occurs when powering on the next time, the memory is damaged, or the parameter has not been saved properly. Initialize and reconfigure the parameter.

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Name	Content	Alarm code	Check content and countermeasures	Reference
Driver error*2	Error items for driver IC detection equipped in the inverter. Trips to protect the main element, when momentary overcurrent (approximately 350% of the rated current), main element temperature faults are observed, or drops in the main element driving power occur. (Restart run cannot be carried out on this trip.)	E30.☐	Are there any short-circuits? • Check the output line. Are there any ground faults? • Check the output line and motor. Is the main element damaged? • Check IGBT. Refer to “Method for Checking the Inverter and Converter Parts” for the checking method. Is the cooling fin clogged? • Clean the fin.	
Thermistor error	When the thermistor input function is enabled, temperature faults are detected from the resistor value of the external thermistor, and trips.	E35.☐	Is the motor temperature too high? • Check the temperature. Is the thermistor damaged? • Check the thermistor. Is there noise mixing in the thermistor signal? • Separate the wirings.	
Brake error	Trips if the inverter fails to detect the ON/OFF of the brake within the brake control operation fault detection time (b124) after the brake release output, when the brake control function is enabled (b120 = 01).	E36.☐	Is the brake performing the ON/OF operation? • Check the brake. Is the b124 setting short? • Make the b124 long. Is the brake check signal being inputted? • Check the wirings.	
Emergency cutoff*3	Trips when the safety input of GS1 or GS2 has been inputted.	E37.☐	Are there misinputs of the GS1, GS2? • Check the wirings and sequence. Is the parameter set properly? • Check the settings of the GS input operation selection (b145).	
Low speed range overload protection (inverter overload protection)	The electric thermal in the inverter detects and trips if overload occurs in very low speed ranges below 0.2 Hz. (However, high frequency may remain in the error log.) If the overload protection of the motor and inverter is separated under the settings of the motor electric thermal function selection (b910), it can function as an inverter overload protection as well.	E38.☐	Is there excessive load? • Lower the load factor.	
Operator bad connection	Trips when faults or breakages exist at the external operator (optional).	E40.☐	Are there any communication errors? • Check and replace the cables. This error will not be detected if b165 is set to 02 (ignore).	

*2: Reset operation with the RS port or the STOP/RESET key will not be available when errors occur. Turn the machine off once. If an error occurs when powering on the next time, the memory is damaged, or the parameter has not been saved properly. Initialize and reconfigure the parameter.

*3: Releasing with the STOP/RESET key is not available. Release by powering ON again or with the RS (reset) terminal.

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Name	Content	Alarm code	Check content and countermeasures	Reference
Modbus communication fault	Trips if timeout occurs when the setting for the communication error selection is trip (C076 = 00).	E41.☐	Is the communication speed correct? • Check the settings. Is the wiring distance appropriate? • Check the communication cables. Are there any breakages? • Check the wirings.	
Driveprogramming fault	• Program fault (E43.☐ – E45.☐) • User trip (E50.☐ – E59.☐)	E43.☐ – E59.☐	Refer to “DriveProgramming Users Manual (SBCE-369)” for details.	
Optional unit fault	Error reported from optional units.	E60.☐ – E68.☐	Refer to the manuals of the optional units for details.	
Optional unit timeout	Trips when timeouts occur in the communication between the inverter and the optional units.	E69.☐	Optional units are disconnected. • Check if the fixing screws are loose, and that the optional units are properly attached with the inverter. Optional units are damaged. • If the optional units are properly attached, they may be damaged.	
Encoder breakage	Trips if the status, where the motor rotation detected by the encoder is below the start frequency (b082), continues consecutively for more than the encoder breakage detection time (P077 ≠ 0), when the output frequency is above the creep speed setting (P015).	E80.☐	Breakage or bad connection of the encoder wirings. • Check the encoder wirings. The actual motor rotation is below the start frequency (b082) for more than the breakage detection time (P077). • Parameter adjustment Make P077 longer, and P015 higher. This also occurs when the motor rotation is below the start frequency during the simple positioning. • Parameter adjustment Make P077 longer, and P015 higher.	
Overspeed	Trips when the motor rotation is over maximum frequency × overspeed fault detection level (P026 ≠ 0).	E81.☐	Determined in the speed detection of the encoder. Breakage or bad connection of the encoder wirings • Check the encoder wirings. Inconsistency in the encoder pulse value. • Check the encoder pulse value. P011 The actual motor rotation is over the fault detection level. • Adjust the overspeed fault detection level P026.	
Positioning control range trip	Trips when the current position exceeds the specified position range (P072, P073) in the simple positioning control.	E83.☐	Check the current position. • Check the parameter (P072, P073). • Check the origin point.	

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2.7 TROUBLESHOOTING

Refer to the following countermeasures if the inverter does not display any faults regardless of the operation being faulty, or if the inverter does not operate as intended.

Refer to “Alarm Display and Countermeasures” if the inverter outputs a fault display and trips.

Symptom	Content of the likely cause	Countermeasures	Reference
The power does not turn ON (The POWER LED on the main unit does not light up)	Short circuit line between +1, P/+2 terminal or the DC reactor is disconnected.	Connect the short circuit line or the DC reactor.	
	Breakage in the input line.	Check the wirings.	
The motor does not operate when the run command is issued.	The primary run command selection (A002) is incorrect.	Set the primary run command selection (A002) properly.	
	The primary frequency command selection (A001) is incorrect.	Properly set the primary frequency command selection (A001) according to the input method of the frequency command, and set the frequency.	
	The frequency setting is 0 Hz.	Input the analogue voltage or current signal corresponding to the frequency to the FV terminal or FI terminal if the primary frequency command selection (A001) is “01: control circuit terminal block”. Refer to “Frequency Command Selection” for the details on analogue voltage/current switch.	
		Set the frequency to the output frequency setting/monitor (F001) if the primary frequency command selection (A001) is “02: operator”.	
		Input the frequency according to the setting value of the primary frequency command selection (A001) (the frequency entered appears on F001).	
		Set the frequency on multi step speed command 0 to 15 (A020 to A035, A220) if in multi step speed operation.	
	Not assigned to the multi function input terminal (run command).	If performing the run command with the multi function input terminal, appoint “00: FW”, “01: RV” to the terminal to be used. If performing the run command with the 3 wire input method, appoint “20: STA”, “21: STP”, “22: F/R”.	
	Multi step speed setting “02: CF1” to “05: CF4” is assigned to the multi function input terminal, and is in ON state.	Turn OFF the multi step speed setting. If the multi step speed setting is ON, it will run in multi step speed operation, so if the frequency set in multi step speed command 1 to 15 (A021 to A035) is 0 (default value), it will not run.	
	Both the non-inverting input and inverting input is ON.	Turn either but not both, when performing the run command with the input terminal of non-inverting/inverting input.	
	Run direction restriction selection (b035) is set, and non-inverting or inverting is prohibited.	Properly set the run direction restriction selection (b035).	
	The connection position of the wirings, or the short circuit line of the input terminal of the run command is wrong.	Correct the wirings. (the ON/OFF state of the input terminal can be checked on the multi function input monitor (d005).)	

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Symptom	Content of the likely cause	Countermeasures	Reference
The motor does not operate when the run command is issued.	The wirings of the analogue input or variable resistor of the frequency command is wrong.	Correct the wirings. • Measure the voltage between FV to SC terminal with a tester and check that the correct voltage is flowing if using the analogue voltage or variable resistor input. • Disconnect the wirings and measure the current between current source to FI terminal with a tester and check that the correct current is flowing if using the analogue current input.	
	“51: F-TM (force terminal block)” is assigned to the multi function input terminal to run with the operator, and it is in ON state.	Turn OFF the assigned terminal.	
	“31: OPE (force operator function)” is assigned to the multi function input terminal to run with the control circuit terminal block, and it is in ON state.	Turn OFF the assigned terminal.	
	The inverter is tripped. (ALARM LED lights up, and “Exxx” is displayed)	Press the STOP/RESET key to release the trip (reset), and find the cause and perform countermeasures from the alarm code, and then restart.	
	Safety function switching switch is ON, and either the multi function input terminal S3/GS1, or S4/GS2 is OFF.	Turn both of the safety input GS1 and GS2 if using the safety function. Turn the switching switch OFF if not used.	
	“18: RS (reset)”, “14: CS (commercial switch)”, “11: FRS (freelance top)” is assigned to the multi function input terminal, and it is in ON state.	Turn OFF the corresponding terminal.	
	“84: ROK (run OK signal)” is assigned to the multi function input terminal, and it is in OFF state.	Turn ON the assigned terminal.	
	There is a breakage in the wiring from the inverter to the motor, and the wirings within the motor.	Check the wirings.	
	Excessive load.	Reduce the load.	
	The motor is being restrained.	Release the restrain.	
The rotational speed of the motor does not increase.	Poor contact in the analogue input or variable resistor of the frequency command.	Check the wirings. • Measure the voltage between FV to SC terminal with a tester and check that the correct voltage is flowing if using the analogue voltage or variable resistor input. • Disconnect the wirings and measure the current between voltage source to FI terminal with a tester and check that the correct current is flowing if using the analogue current input.	
	The overload restriction or the overcurrent restriction function is operating.	Disable the function, or raise the operation level.	
	The primary maximum frequency (A004) and frequency maximum limit (A061/A261) settings are low.	Change the settings.	
	Acceleration time is long	Shorten the acceleration time (F002/F202/A092/A292).	
	“06: JG (jogging)” is assigned to the multi function input terminal, and it is in ON state.	Turn OFF the assigned terminal.	
	“02: CF1” to “05: CF4” are assigned to the multi function input terminal, and is in ON state.	Turn OFF the multi step speed setting. (If the multi step speed setting is ON, it will run in multi step speed operation, so it will run according to the frequency set in the multi step speed command 1 to 15 (A021 to A035).)	
	Excessive load.	Reduce the load.	
	The motor is being restrained.	Release the restrain.	

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Symptom	Content of the likely cause	Countermeasures	Reference
The frequency cannot be set in the output frequency setting/monitor (F001) with the operator.	The operator is not set as the primary frequency command selection (A001).	Set “02: operator” as the primary frequency command selection (A001).	
	“51: F-TM (force terminal block)” is assigned to the multi function input terminal, and it is in ON state.	Turn OFF the assigned terminal.	
The specified parameter is not displayed.	“01: individual function display” or “04: basic display” is set as the display selection (b037).	Set “00: display all” as the display selection (b037).	
	“86: DISP (fixed display)” is assigned to the multi function input terminal, and it is in ON state.	Turn OFF the assigned terminal.	
The operator key does not function.	“86: DISP (fixed display)” is assigned to the multi function input terminal, and it is in ON state.	Turn OFF the assigned terminal.	
The parameters cannot be changed.	The inverter is running.	Stop the inverter, and reset the settings after the motor slows down and stops. If set to the mode where changes are permitted while running (b031 = 10), some of the parameters can be changed while running.	
	Soft locked.	Disable the soft lock selection (b031).	
The motor is reverse rotating.	The phase sequence of the wirings to the motor is incorrect. (The phase sequence specification of the motor itself is U/T1, V/T2, W/T3, and not in normal rotation.)	Either reverse two wires of U/T1, V/T2, W/T3, or match to the phase sequence of the motor.	
	The 3 wire input function is used, and the non-inversed rotation/inversed rotation logic is incorrect.	Check the “22: F/R (3 wire non-inversed/inversed)” logic of the multi function input terminal.	
The motor runs in inversed rotation when run with the RUN key.	The run direction selection (F004) is incorrect.	Change the run direction selection (F004) setting.	
Trips with the overcurrent protection (E03) when running.	The acceleration time is too short.	Extend the acceleration time (F002/F202/A092/A292).	
		Use a run pattern where the acceleration is temporary paused with the acceleration/deceleration stop function.	
	Excessive load.	Reduce the load.	
		Tune with the torque boost function.	
		Set “02: free V/f setting” or “03: sensor less vector control” for the control method (A044/A244) and tune.	
	Overload restriction (b021/b024) is in “00: disable”.	Enable the overload restriction (b021/b024).	
	[If tripping occurs when running due to overcurrent, regardless of the overload restriction being enabled]		
	Overload restriction level (b022/b025) is high.	Reduce the overload restriction level (b022/b025).	
	Overload restriction invariable (b023/b026) is short.	Raise the overload restriction invariable (b023/b026).	
The STOP/RESET key does not function.	The STOP/RESET key is set to disable.	Properly set the stop key selection (b087).	
	The deceleration overcurrent restriction function (b130) is enabled.	Set the deceleration overcurrent restriction function (b130) to “00: disable”, or adjust the operation level of each function.	
	Momentary stop/UV deceleration stop function selection (b050) is enabled.	Set the momentary stop/UV deceleration stop function selection (b050) to “00: disable”, or adjust the operation level of each function.	

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Symptom	Content of the likely cause	Countermeasures	Reference
The motor/machine noise is loud.	The carrier frequency is low.	Raise the carrier frequency (b083).However, noise and leakage current from the inverter may increase. Derating may be required for the output current depending on the model. Refer to the “Derating table” for the details.	
	The rotation frequency of the motor and the natural frequency of the machine are resonating.	Change the set frequency. If the motor resonates during acceleration/deceleration, use the frequency jump function (A063 to A068) to avoid the resonating frequency.	
	Overexcitation of the motor.	Match the standard frequency (A003/A203), motor receiving voltage selection (A082/A282) to the motor rating. If the issue is not resolved, lower the output voltage gain (A045/A245) by a small amount. Or set “02: free V/f setting” for the control method (A044/A244) and tune.	
Trips with overload protection (E05).	The electric thermal level is not correct.	Properly set the electric thermal level (b012/b013).	
Trips with overvoltage protection (E07) during deceleration.	Deceleration time is short.	Extend the deceleration time (F003/F203/A093/A293).	
	The deceleration overcurrent restriction function selection (b130) is set to “00: disable”.	Enable the deceleration overcurrent restriction function selection (b130). (However, when this function is enabled, the actual deceleration time may become longer than the set value. Refer to “Deceleration Overcurrent Restriction Function” for details.	
	[If the motor trips (E07) due to overvoltage during deceleration, regardless of the deceleration overcurrent restriction function selection (b130) enabled]		
	The value in the deceleration overcurrent restriction ratio gain (b133), deceleration overcurrent restriction reset time (b134) is inappropriate.	Change the setting values. Refer to “Deceleration Overcurrent Restriction Function” for details.	
	The deceleration overcurrent restriction level (b131) is high.	Reduce the deceleration overcurrent restriction level (b131). (However, if the setting is too low, the motor may not decelerate, so the minimum value should be receiving voltage × √2 × 110%.)	
Trips with thermistor error (E35).	“19: TH (external thermistor)” is assigned to the multi function input terminal S5/TH, and DC 24 V is being inputted.	Remove the TH assignment.	
The output frequency becomes unstable.	Each parameter is not correct.	Move the output frequency away from the power source frequency.	
		Change the stability constant (H006/H206).	
	The changes in load are large.	Raise the motor and inverter capacities.	
	The power source voltage is fluctuating.	Reduce the fluctuation.	
Lacking torque.	Each parameter is not correct. [During acceleration/constant speed]	Raise the main torque boost voltage (A042/A242) and manual torque boost frequency (A043/A243).	
		Set torque boost selection (A042/A241) to “01: automatic torque boost”.	
		Reduce the carrier frequency (b083).	
		Set the control method (A044/A244) to “03: sensor less vector control”.	
	Each parameter is not correct [During deceleration]	Extend the deceleration time (F003/F203/A093/A293).	
		Turn the AVR selection (A081/A281) OFF.	
		Use either the breaking resistor or regenerative braking unit.	
The inverter trips, or free runs, or decelerates to a stop when the digital operator is removed.	The operation selection for operator breakage is inappropriate.	Set the operator breakage operation selection (b165) to “02: ignore”.	

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Symptom	Content of the likely cause	Countermeasures	Reference
Unable to run/set with Modbus communication.	The changes on the communication parameter are not reflected.	If the communication transmission speed selection (C071), communication parity selection (C074), or communication stop bit selection (C075) were changed, restart the power or reset (Turn ON then OFF on the RS terminal).	
	The primary/secondary run command selection (A002/A202) is incorrect.	Set the primary/secondary run command selection (A002/A202) to “03: Modbus communication”.	
	The primary/secondary frequency command selection (A001/A201) is incorrect.	Set the primary/secondary frequency command selection (A001/A201) to “03: Modbus communication”.	
	The communication speed setting is incorrect.	Set the correct communication speed on the communication transmission speed selection (C071).	
	The station number setting is incorrect. Or is overlapping.	Set the correct station number on the communication station number selection (C072).	
	The communication parity setting is incorrect.	Set the correct communication parity on the communication parity selection (C074).	
	The communication stop bit setting is incorrect.	Set the correct stop bit on the communication stop bit selection (C075).	
	Incorrect wiring.	Route the wires properly to the RS+, RS- terminal of the control circuit terminal block.	
	Incorrect address.	• Check that the coil address and register address are correct, and that the value “−1” from the register number is set. • If the Modbus mapping function is being used, check that the setting is correct, and fix accordingly.	
The circuit breaker activates when running the inverter.	The leakage current of the inverter is large.	Reduce the carrier frequency (b083).	
		Raise the sensitive current of the leakage breaker. Or replace with circuit breaker with higher sensitive current.	
DC breaking does not operate.	The DC breaking has not been set.	Set the DC breaking (A054).	
	The DC breaking time has not been set.	Set the DC breaking time (A055).	
Trips with insufficient voltage (E09).	Voltage drop due to insufficient power capacity.	Raise the power capacity.	
Noise is observed on television sets and radio near the inverter.	Noise emitted from the inverter.	Place the cables of the inverter as far as possible from the television set and radio.	
Optional units fault (E60 to E68) occurs.	The optional units detected a failure and reported them.	Refer to the manuals of the optional units.	
	Inverter failure; the optional unit connector is not operating normally.	If the issue cannot be solved on the optional unit side, it may be a failure. If the issue cannot be solved after checking the bad linkage and contamination of the connection part, replace the inverter.	
Optional units fault (E69) occurs.	Communication cannot be carried out after the optional unit has been detected. Optional unit may be loose.	Check for bad linkage, contamination of the connection part of the optional unit connector. Check that the terminal block cover of the inverter and the cover of the optional unit are properly linked, and that the screws are properly installed.	
	The endian function of the Modbus mapping function is set improperly.	Set Modbus mapping endian selection (P400) to “00: big endian”.	

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Symptom	Content of the likely cause	Countermeasures	Reference
Unable to run/set from the optional unit (communication unit).	The primary/secondary run command selection (A002/A202) is incorrect.	Set the primary/secondary run command selection (A002/A202) to “04: optional unit”.	
	The primary/secondary frequency command selection (A001/A201) is incorrect.	Set the primary/secondary frequency command selection (A001/A201) to “04: optional unit”.	
	Incorrect address.	Check that the index/sub index (EtherCat) and Class/Instance/Attribute (CompoNet/DeviceNet) are correct.	
	Modbus mapping function is set.	Set the Modbus mapping function selection (P200) to “00: standard Modbus address”.	
Unable to connect the CX-Drive.	CX-Drive version is incorrect.	Prepare Ver. 2.8 if connecting 3G3MX2 series V1 type.	
	The software number of the inverter is inconsistent.	Match the CX-Drive to the software number of the inverter to connect to.	
	The endian function of the Modbus mapping function is set improperly.	Set Modbus mapping endian selection (P400) to “00: big endian”.	
Unable to set the parameter from CX-Drive.	The inverter is running.	Stop the inverter, and reset the settings after the motor slows down and stops. If set to the mode where changes are permitted while running (b031 = 10), some of the parameters can be changed while running.	
	Modbus mapping function is set.	Set the Modbus mapping function selection (P200) to “00: standard Modbus address”.	
Overload protection (E05) occurs on brake control.	Inverter is running in brake restrain state.	Release the run command of the inverter in brake restrain state. Overload protection may occur in DC breaking.	
Brake error (E36) occurs on brake control.	Brake control release current has not been reached.	Either make the brake control release wait time (b121) longer, or reduce the brake control release current (b126).	
	Brake check signal is not being inputted.	• Correct the wirings of the brake check signal (44: BOK). If not in use, remove the brake check signal from the multi function input setting. • Correct the sequence so that the brake check signal (44: BOK) is inputted after the brake release. • Replace the brake if it is damaged.	
Load drops on brake control.	Insufficient brake control release current.	• Raise the brake control release current (b126). • Set the control method (A044/A244) to “03: sensor less vector control”.	
	The frequency to release/restrain the brake is low.	Raise either the brake control release frequency (b125), brake control restrain frequency (b127) or the creep speed setting (P015).	
PM motor rotates on startup.	The motor magnetic pole position is incorrect on startup.	Set the PM motor start method selection (H123) to “01: default position estimation enabled”.	
Overcurrent protection (E03) occurs when starting with the PM motor.	PM motor is out of step.	Raise the PM motor start current (H117). Adjust according to the “PM motor mode adjustment”.	
	Excessive load.	Reduce the load. Or make the acceleration time longer.	

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2.8 MAINTENANCE AND INSPECTION

⚠ DANGER	
Compulsory	- Perform daily check. If maintenance and inspections are not performed, failures and damage cannot be found, which may result in accidents. - Perform the following steps before starting the inspection. (1) Cutoff “OFF” the input power. (2) Check that the charge lamp is off after 10 minutes has elapsed. (3) Use a tester that is capable of measuring DC high voltage (more than DC 800V), and check that the DC main circuit voltage (between PA–PC) is under 45V. If this step is not performed before inspection, it may lead to an electrical shock.

Perform daily inspections and periodical inspections to avoid failure due to aging, life of parts and impact from the environment such as temperature, humidity, dust, and vibration.

2.8.1 DAIRY INSPECTION

Electrical parts are weak against heat. In order to increase the life of the unit, place in an environment where dust does not cumulate, and where the ambient temperature is low, and well ventilated.

The purpose of the daily inspection is to maintain the environment, and to discover operational abnormalities before accidents occur by comparing operation data records.

Inspection target	Inspection procedure			Criterion
	Check item	Cycle	Inspection method	
1. Room environment	1) Dust, temperature, gas	As required	1) Visual inspection, thermometer, olfaction	1) Improve areas of concern.
	2) Dripping of water and other liquid	As required	2) Visual inspection	2) Pay attention to scratches.
	3) Room temperature	As required	3) Thermometer	3) Maximum 60°C
2. Component and parts	1) Vibration, noise	As required	Feeling of the box external	If abnormal, open the door, and inspect the trance, reactor, contactor, relay and cooling fan. Stop the operation if necessary.
3. Operation data (Output side)	1) Load current	As required	1) Moving iron type AC amperometer	Must be within rated. No large changes shall be observed compared to the normal data.
	2) Voltage (*)	As required	2) Rectifier type AC amperometer	
	3) Temperature	As required	3) Thermometer	

(*) The voltage may vary depending on the measuring equipment. The same tester or amperometer should be used for inspections, and the indicated value shall be recorded.

■ Check point

1. Whether there are any abnormalities in the installation environment
2. Whether there are any abnormalities in the cooling system
3. Whether there is any abnormal vibration or sound
4. Whether there is any abnormal heat or discolorization
5. Whether there is any abnormal smell
6. Whether there are any abnormal vibration, sound or temperature in the motor
7. Whether there are any cumulation of debris (conductive material)

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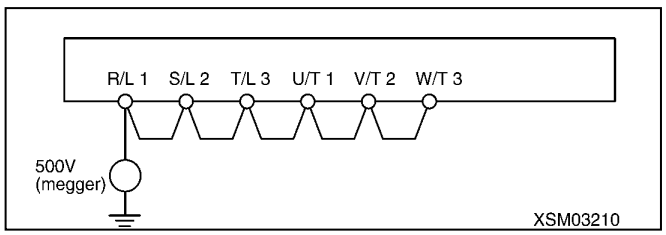
2.8.2 REGULAR MAINTENANCE

Preform periodic inspections every three to six months according to the usage frequency.

⚠ DANGER	
Regulation	- Perform the following steps before starting the inspection. (1) Cutoff “OFF” the input power. (2) Check that the charge lamp is off after 10 minutes has elapsed. (3) Use a tester that is capable of measuring DC high voltage (more than DC 800V), and check that the DC main circuit voltage (between PA–PC) is under 45V. If this step is not performed before inspection, it may lead to an electrical shock.
Prohibited	- Parts must not be replaced. May result in electrical shock, fire, or injury. Parts replacement must be ordered to the vendor.

■ Places of inspection

1. Whether there are any loose screws on the wiring terminal. Retorque with a driver.
2. Whether there are any faulty standoffs at the wiring terminal standoff positions. Visually inspect for traces of heat at the places of standoffs.
3. Whether there is any damage on the wiring and cables. Perform visual inspections.
4. Clean off any debris and dust. Remove the debris and dust with an electrical vacuum cleaner. Pay attention to the ventilation ports and printed boards when cleaning. Unpredicted accidents may occur if debris or dust accumulates. Keep clean.
5. The large capacity electrolytic capacitors used in the inverter tends to decay if left for a long period without any electricity flowing.
   If not being used for a long period, allow electricity to flow for at least five hours once in two years so that the large capacity electrolytic capacitors recover their characteristics. Check the inverter operation at the same time. It is recommended that commercial power shall not be directly connected to the inverter, and equipments such as thruidakus are used, and the input voltage be raised gradually.
6. When performing insulation tests, use 500V mega, and only perform with the main circuit terminal block as the target. Never perform insulation tests on control terminals or print boards other than the main circuit. When performing insulation tests on the motor, disconnect the output terminal U, V, W and perform only on the motor. When performing insulation tests on surrounding circuits other than the motor, remove all of the wires connected to the inverter, so that no test voltage flows to the inverter.
   (Note) Always remove the wires connected to the main circuit terminal block, and perform on only the inverter itself.



7. Do not perform pressure tests since it may damage the internal parts.
8. Voltage and temperature check
   Recommended amperometer:
   Input side → moving iron type amperometer (⫲)
   Output side → Rectifier type amperometer (⏩)
   It is easier to identify abnormalities if the temperature surrounding the inverter is always measured during the startup, operation, and stop process.

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■ **Replacements of end of life parts**

The inverter is composed of many electrical parts including semiconductor elements. Secular changes will occur on the following parts, due to the structure and physical properties. If ignored, the inverter performance will be reduced, and may result in failures, so in order to avoid failures, periodical inspections are required.

Note) The life of the parts may be affected by the ambient temperature and the usage conditions. The following lifetime of the parts is under normal environmental conditions.

1) Cooling fan

The life of the cooling fan which cools down the heating parts is approximately 30,000 hours (2 to 3 years under constant operation). Replacements are required when abnormal sound or frequency is observed.

2) Smoothing capacitor

The aluminum electrolytic capacitors for smoothing on the main circuit DC part will be affected by the ripple current, and the characteristics will decay. The design life is 10 years, but it is recommended that replacements should be performed every 5 years when used under normal environmental conditions. Since they are attached directly on the print board, the smoothing capacitors along with the print board shall be replaced.

[General Criterion for the Inspection Items]

- Whether there is any liquid leakage
- Whether the safety valve is open
- Measurements of electric capacity and measurements of insulation resistance

Note) The replacement cycle for each parts can be determined by checking the running time. Contact the branches and offices of Thoshiba Industrial Products and Systems Corporation for replacements. For safety reasons, customers shall never perform replacements of parts.

■ **Standard replacement period of main parts**

The replacement cycle of parts under normal usage environment/condition (ambient temperature, ventilation conditions, weld time) is as the following table.

This replacement cycle is not the life of the parts, but is based on the failure rate according to the years being used.

Parts name	Standard replacement years	Method of replacement and others
Cooling fan	2 to 3 years	Replace with new item
Aluminum electrolytic capacitors for smoothing on the main circuit	5 years	Replace with new item
Relay contactor	—	Determine according to inspections
Aluminum electrolytic capacitors on the print board	5 years	Replace with new board

Extracted from “Guideline for General Inverter Periodical Replacements” (October, 2001 edition) Japan Electrical Manufacturers’ Association.

Note) The life of parts varies depending on the usage environment.

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2.9 NOTE ABOUT DISPOSAL

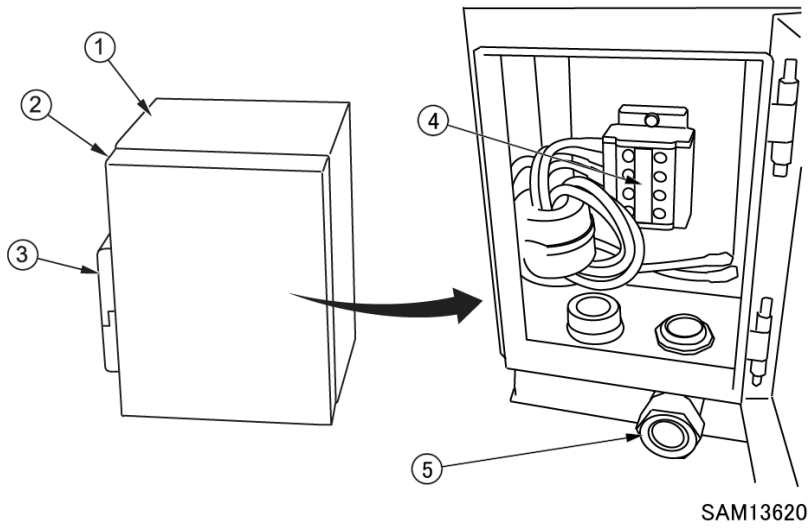
⚠CAUTION	
 **Compulsory**	- Contact a specialized waste and disposal agent (*) when disposing this unit. If disposed without contacting these agents, the capacitors may explode and emit poisonous gas, which may result in injuries. (*) Waste and disposal agents are “Industrial Waste Collectors and Transporters” or “Industrial Waste Disposal Operators”. If the industrial waste is collected, transported and disposed by non-qualified personnel, penalties may apply by law. (Laws regarding the treatment and cleaning of industrial waste)

Contact a specialized waste and disposal agent when disposing the inverter.

If disposed without contacting these agents, the capacitors may explode and emit poisonous gas, which may result in injuries.

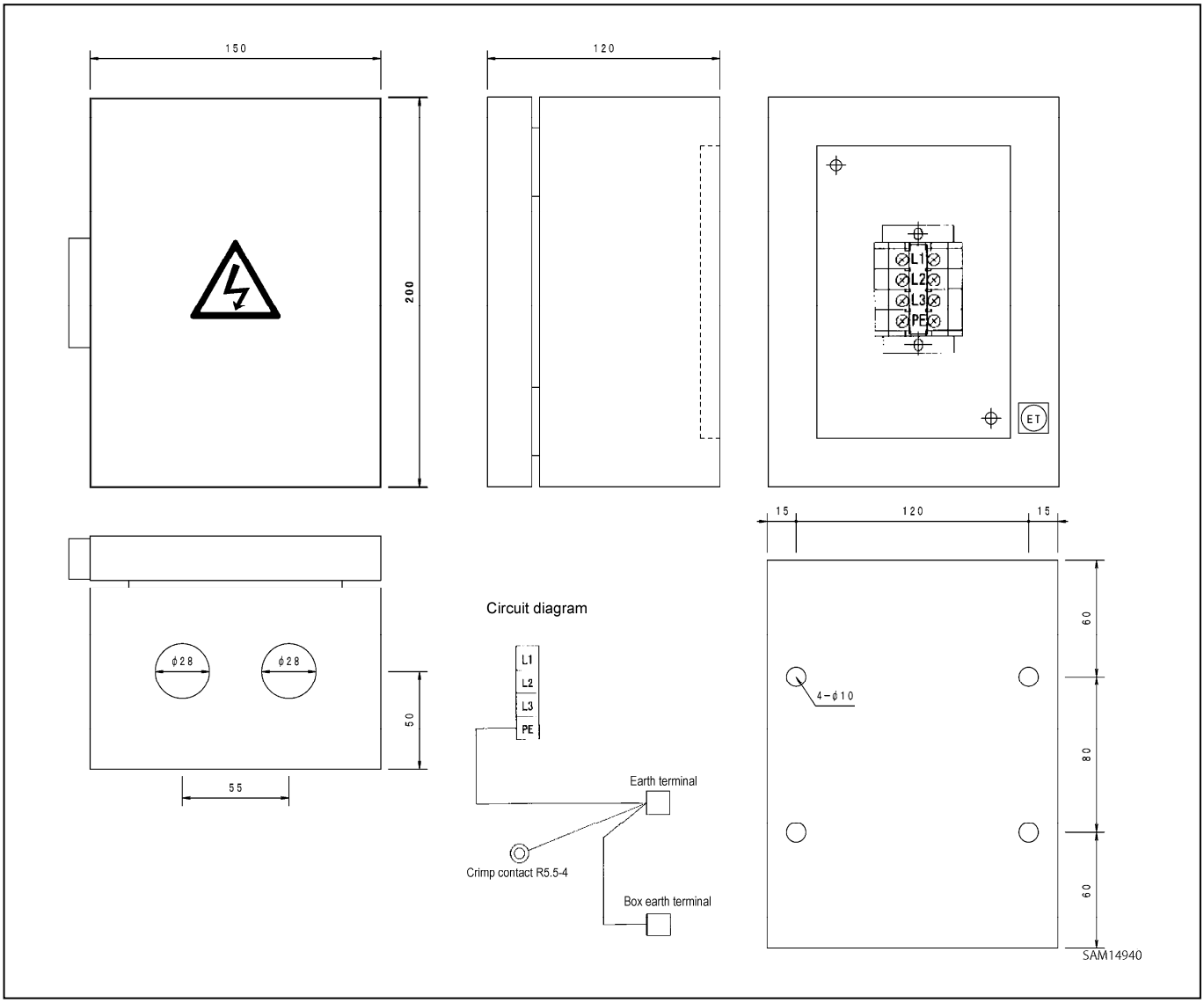
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3. POWER SUPPLY BOX



(1) Power supply box
(2) Power supply box door
(3) Door handle
(4) Terminal block
(5) Cable inserting hole

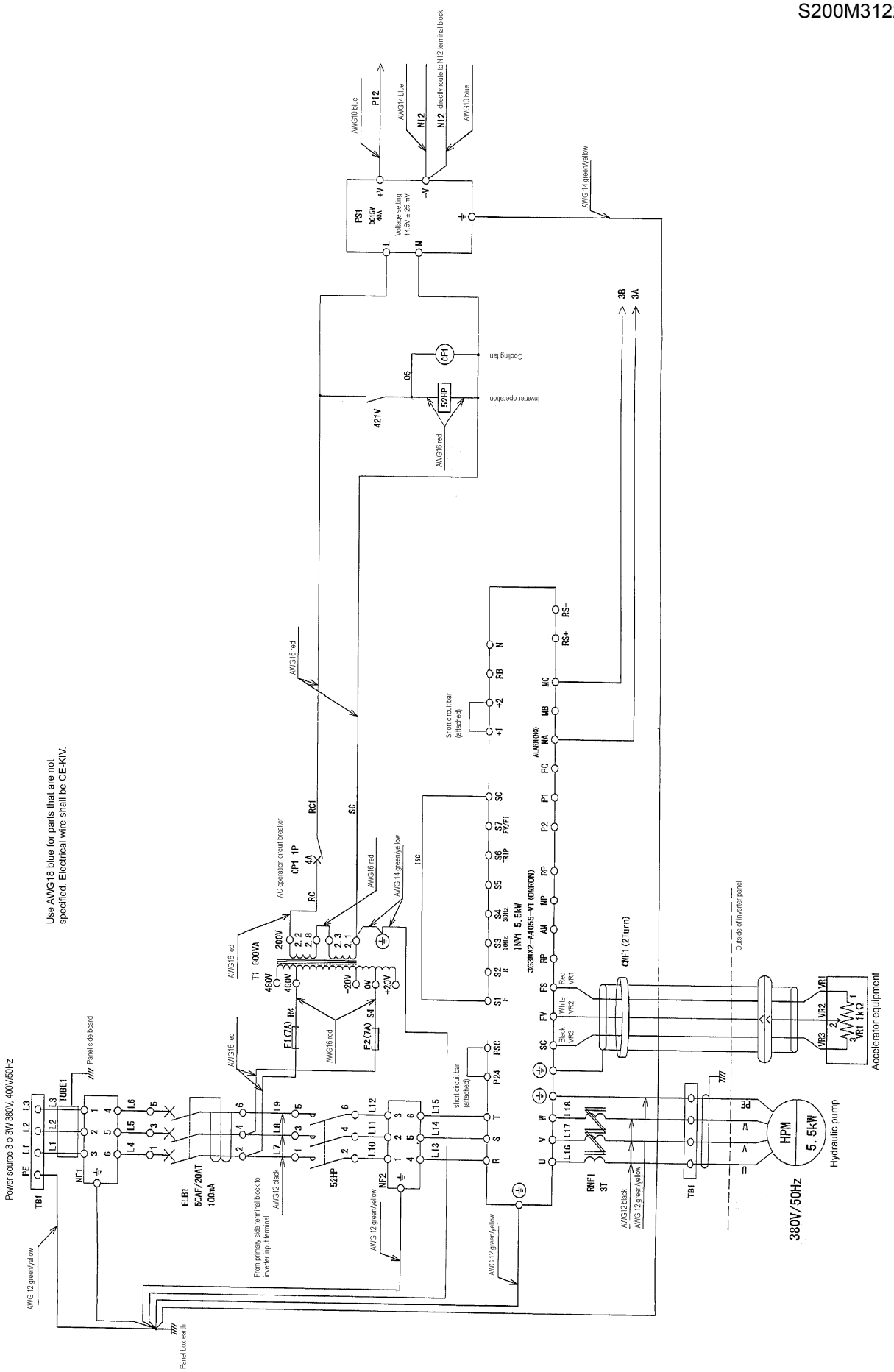
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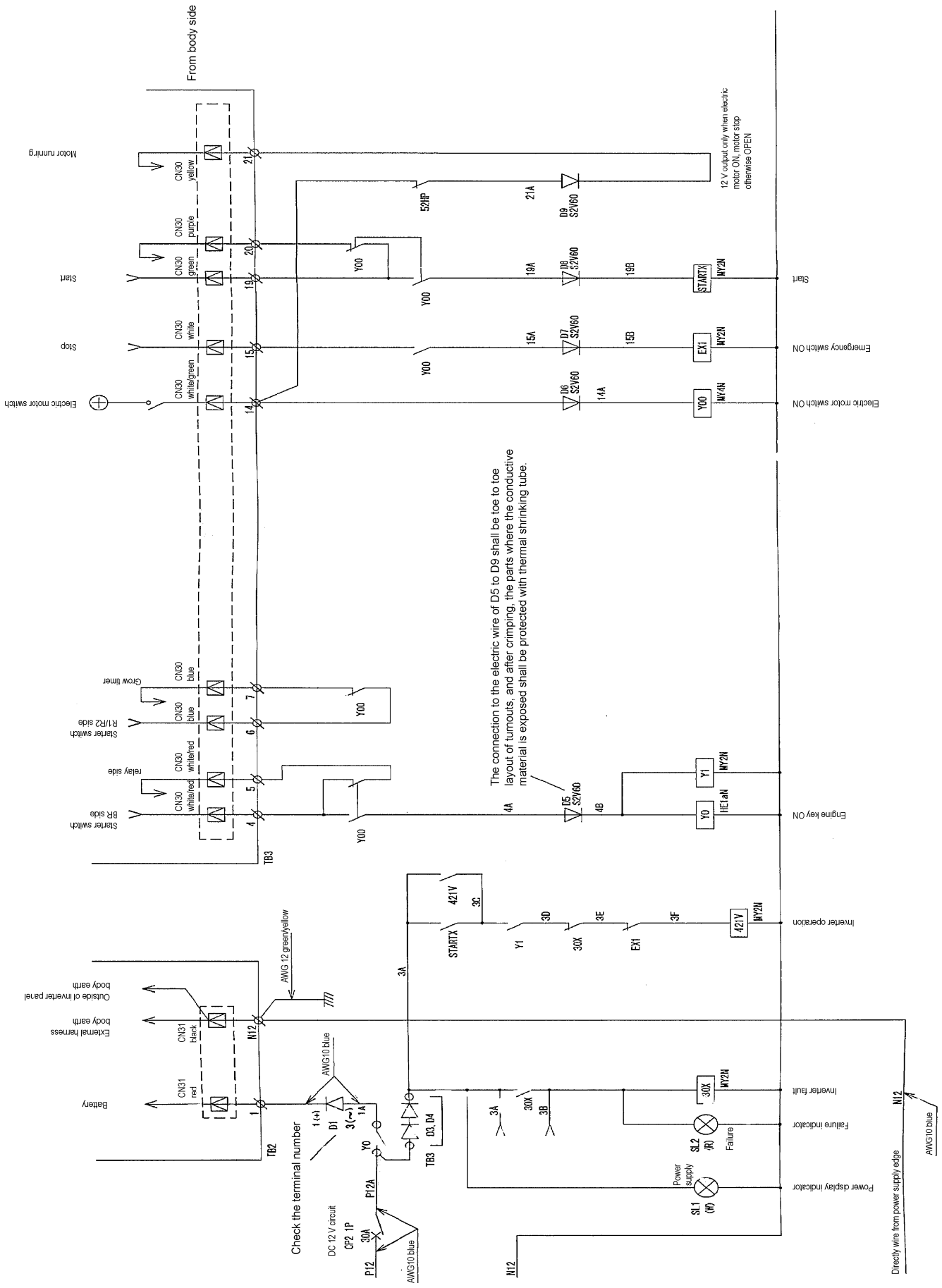
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4. ELECTRICAL DIAGRAM

S200M3122000-01



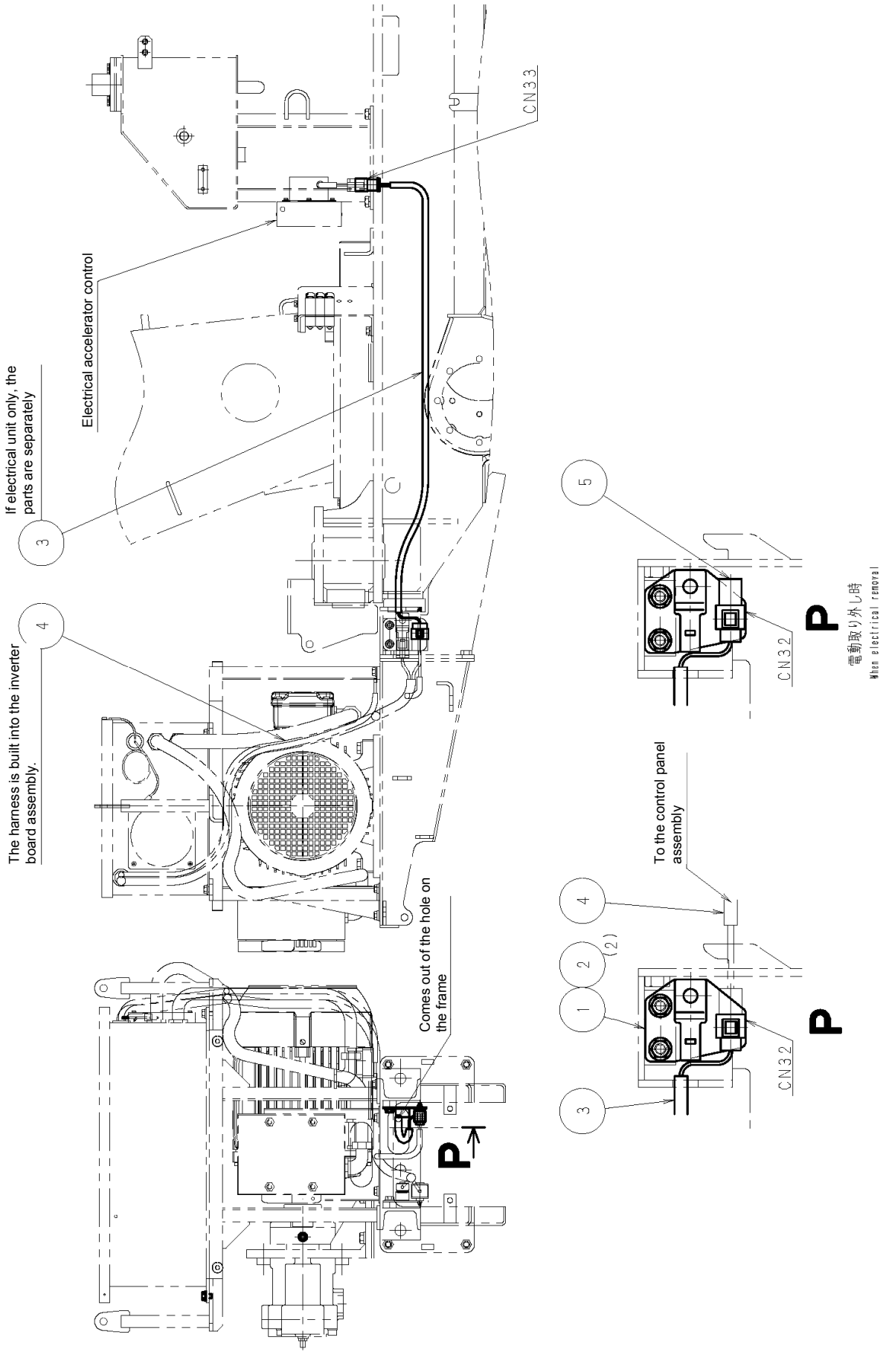
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5. ELECTRIC MOTOR BOX HARNESS

200-3353900



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Number	Name	Q'ty	Note
1	Connector BKT	1	Item number: 200-4639500
2	Sems bolt	2	Komatsu item number: 01024-80816
3	Electric motor box accelerator harness	1	Item number: 200-4644800
4	Electric motor box harness	1	Item number: 200-3350900
5	Lamp blind connector	1	Item number: 200-4640900 Insert into CN32 when removing electric motor unit packaged separately

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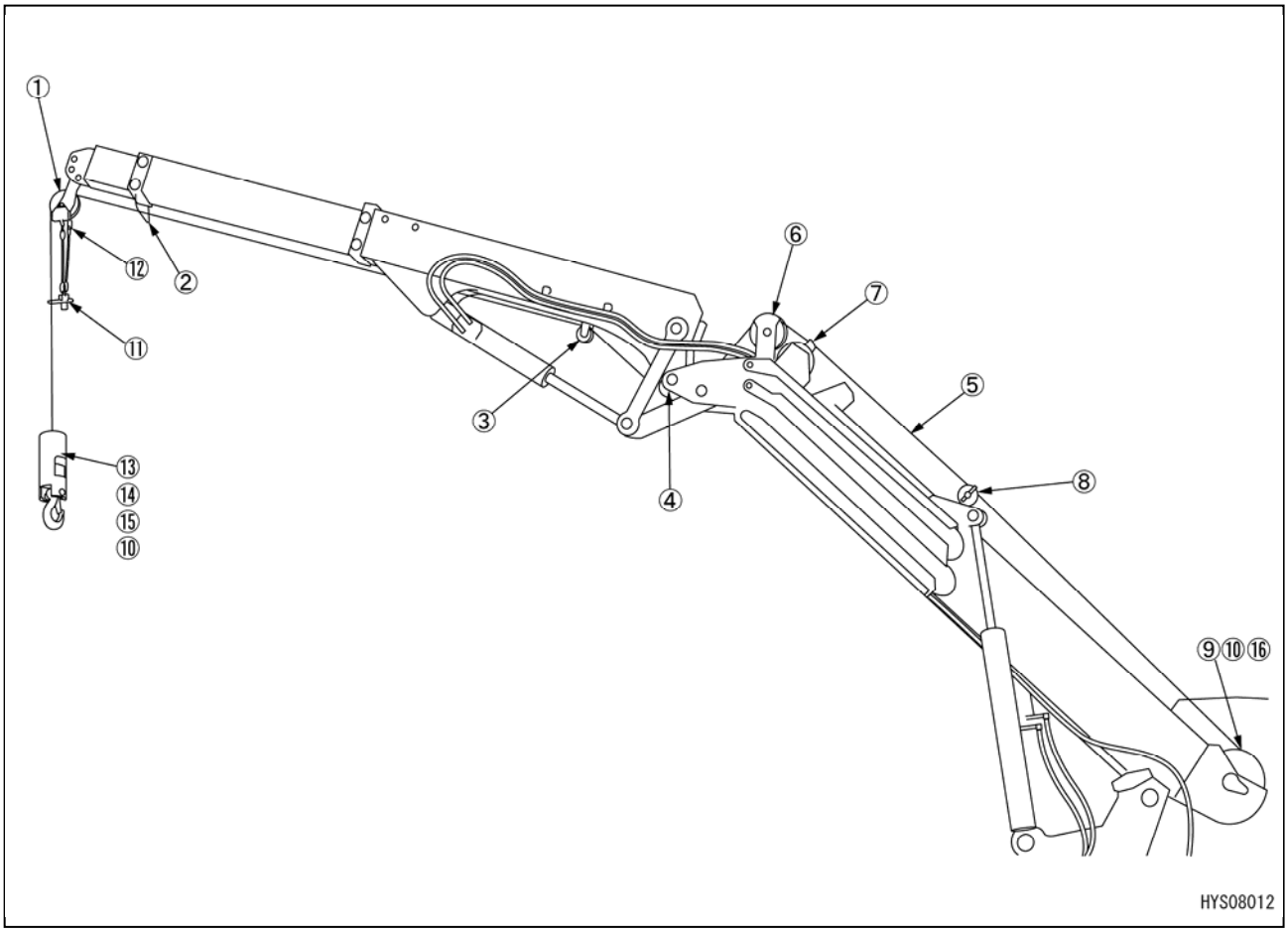
OPTIONAL WINCH

1. OPTIONAL WINCH	6-2
1.1 WINCH MACHINE SECTION	6-2
1.2 WINCH ACCESSORIES	6-3
1.3 WINCH UNIT	6-5
1.3.1 APPEARANCE AND SPECIFICATIONS OF WINCH MOTOR	6-7
1.3.2 INTERNAL STRUCTURE OF WINCH MOTOR	6-8
1.3.3 FAILURE CAUSE AND COUNTERMEASURE	6-10
1.3.4 PRECAUTIONS IN WINCH MOTOR	6-10
1.4 OVER LOWERING DETECTION DEVICE	6-12
1.5 IRREGULAR WINDING PREVENTION ROLLER	6-12
2. OVER-HOISTING PREVENTION DEVICE ASSEMBLY	6-13
2.1 OVER-HOISTING PREVENTION DEVICE	6-14
3. INSTALLATION OF WIRE ROPE	6-15
4. WORKING RADIUS/LIFTING HEIGHT OF ONE FALL WINCH	6-17
5. SPECIFICATIONS OF OPTIONAL WINCH	6-18

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1. OPTIONALWINCH

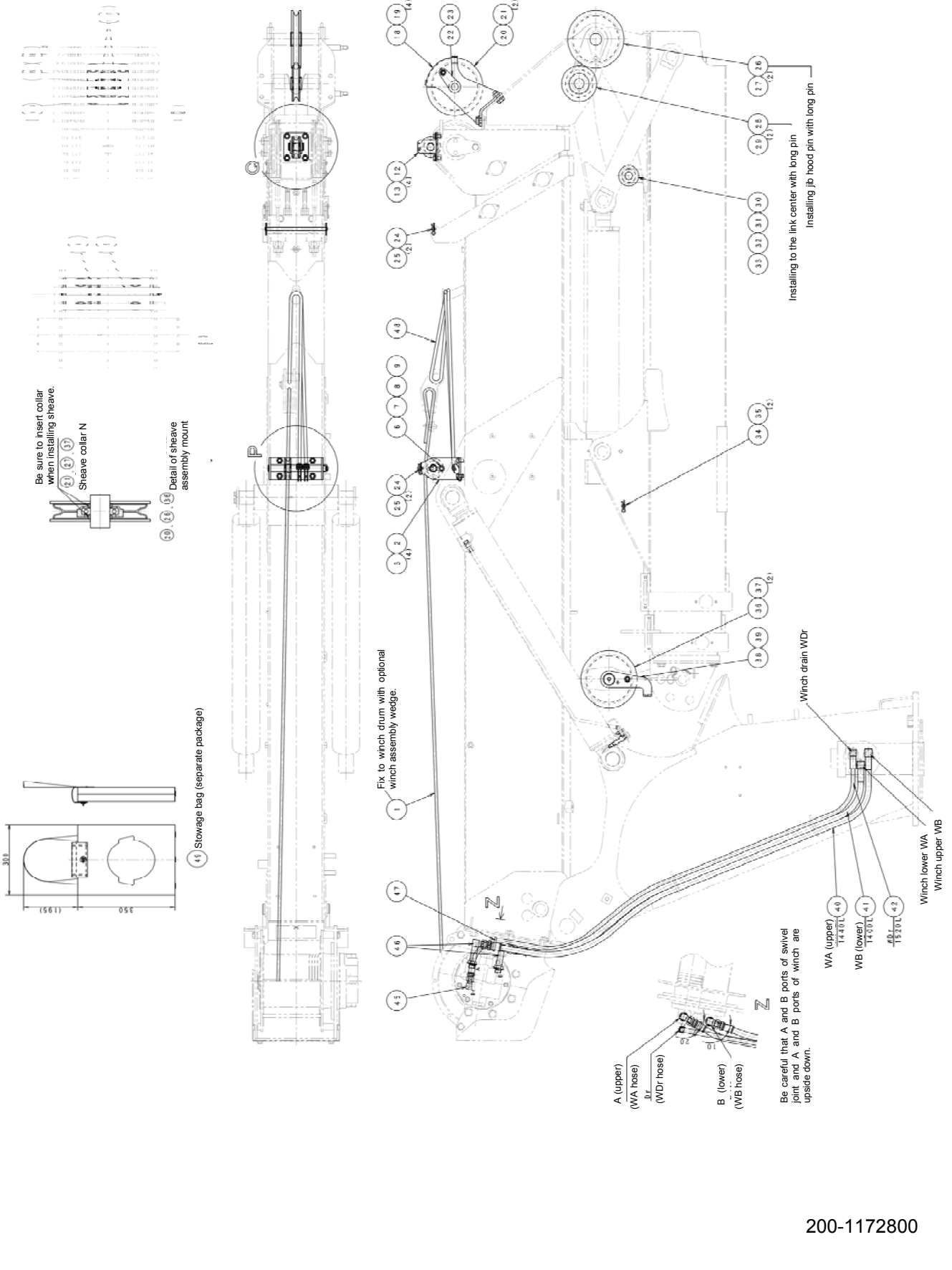
1.1 WINCH MACHINE SECTION



(1) Load sheave at jib tip
(2) Jib wire guide
(3) Jib guide sheave
(4) Jib idler sheave
(5) Wire rope
(6) Sheave at upper part of main boom tip
(7) Upper part of main boom tip Guide sheave
(8) Intermediate upper part of main boom Guide sheave
(9) Winch drum
(10) Rope wedge
(11) Weight for detecting over hoisting stop
(12) Over hoist detector
(13) Hook block
(14) Wedge socket
(15) Wire clip
(16) Over lowering stop device

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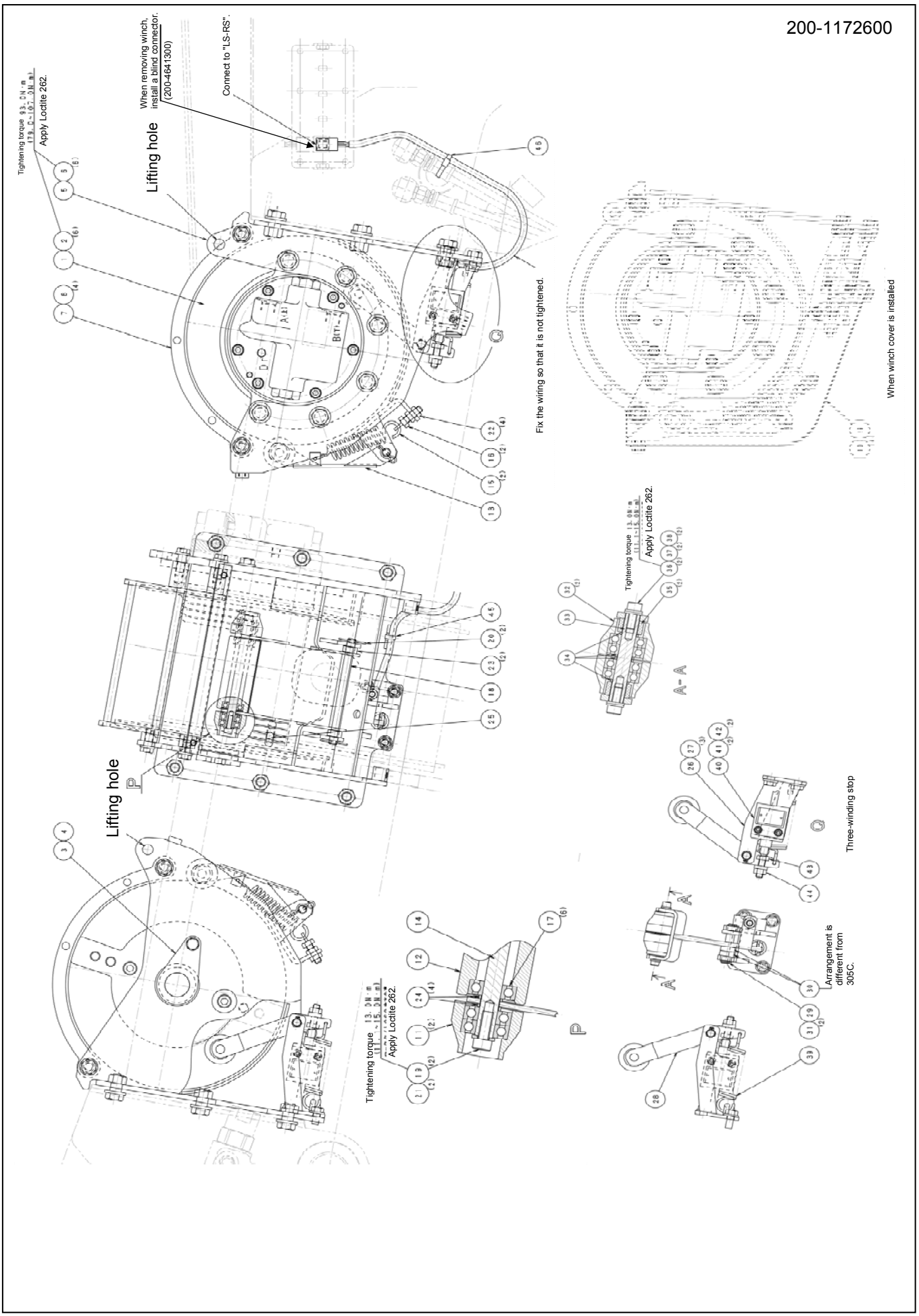
1.2 WINCH ACCESSORIES



Number	Name	Q'ty	Item No.
1	Wire rope	1	Item number: 336S44500001
2	Snap sheave bracket	1	Item number: 200-4631100
3	Sems bolt	4	Komatsu item number: 01024-80816
4	Snap sheave A	1	Item number: 315-4238300
5	Snap sheave pin	1	Item number: 200-4642100
6	Split pin	1	Item number: 21510-80045
7	Hexagon head bolt	1	M6 × 1.0 × 15L (plated 4.8)
8	Spring washer	1	M6 × type 2 (plated)
9	Plain washer	1	M6 × Regular circle (plated)
10	Missing number		
11	Missing number		
12	Sheave bracket	1	Item number: 200-4642200
13	Sems bolt	4	Komatsu item number: 01024-80816
14	Snap sheave A	1	Item number: 315-4238300
15	Guide roller pin	1	Item number: 551-4026200
16	Snap ring	2	Item Number: 21911-02002 (Type C for shaft 20)
17	Guide roller collar	2	Item number: 552-4136000
18	Sheave bracket	1	Item number: 200-3345800
19	Sems bolt	4	Komatsu item number: 01024-81030
20	Sheave assembly	1	Item number: 300S18400000
21	Sheave collar N	2	Item number: 1832-16019-0 (figure number 4673675)
22	Sheave pin	1	Item number: 200-4631300
23	Sems bolt	1	Komatsu item number: 01024-80812
24	Wire check pin	2	Item number: 200-4637900
25	Snap pin	4	Item number: 21561-10001 (nominal size 10 JASO F-203-88)
26	Sheave assembly	1	Item number: 300S18400000
27	Sheave collar N	2	Item number: 1832-16019-0 (figure number 4673675)
28	Snap sheave	1	Item number: 200-4653500
29	Collar (6L)	2	Item number: 200-4653600
30	Snap sheave A	1	Item number: 315-4238300
31	Snap sheave pin	1	Item number: 200-4629000
32	Hexagon head bolt	1	M6 × 1.0 × 12L (plated 4.8)
33	Spring washer	1	M6 × type 2 (plated)
34	Pin	1	Item number: 200-4637100
35	Snap pin	2	Item number: 21561-10001 (nominal size 10 JASO F-203-88)
36	Sheave assembly	1	Item number: 300S18400000
37	Sheave collar N	2	Item number: 1832-16019-0 (figure number 4673675)
38	Sheave pin	1	Item number: 200-4656100
39	Sems bolt	1	Komatsu item number: 01024-80812
40	WA hose	1	Item number: 22750SF5144 (NWP210-9-1440L 0590 = 1005 (spiral around the perimeter))
41	WB hose	1	Item number: 22750SF5140 (NWP210-9-1400L 0590 = 1005 (spiral around the perimeter))
42	WDr hose	1	Item number: 22740SF3152 (NWP35-6-1520L 0590 = 1005 (spiral around the perimeter))
43	Missing number		
44	Missing number		
45	Hose adapter	1	Item number: 22611-10531 (9034-02-04)
46	Hose adapter	2	Item number: 22611-12250 (1071-74A-06)
47	Cable tie	1	Item equivalent to Shibakei CV-150
48	Rubber for stowage	1	Item number: S102W3082000
49	Stowage bag	1	Item number: 200-3362200

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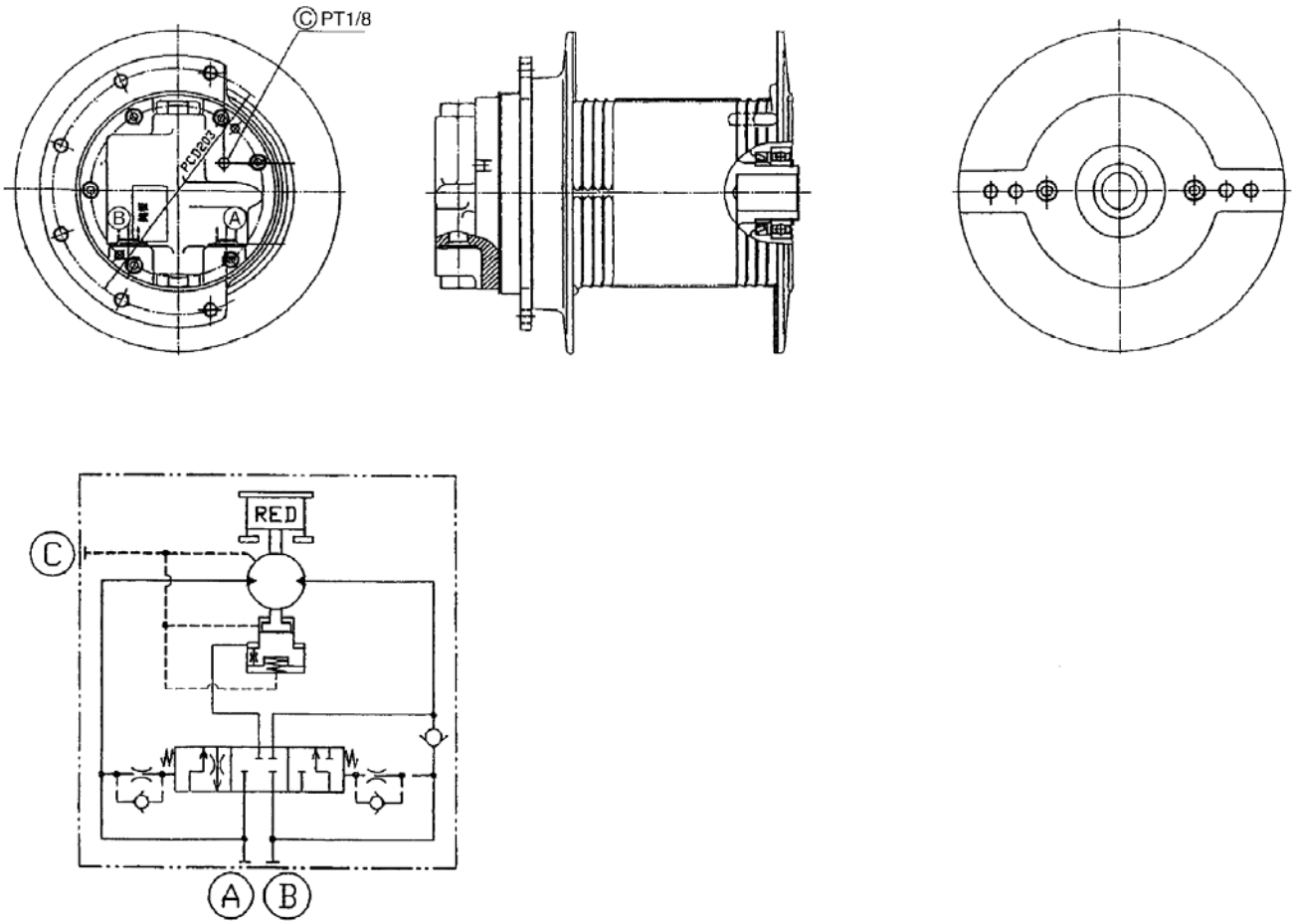
1.3 WINCH UNIT



Number	Name	Q'ty	Item No.
1	Winch unit assembly	1	Item number: 349S55900001
2	Sems bolt	6	Komatsu item number: 01024-81225
3	Pin	1	Item number: 349-4397900
4	Sems bolt	1	Komatsu item number: 01024-80820
5	Winch case	1	Item number: 200-1168700
6	Sems bolt	6	Komatsu item number: 01024-81225
7	Wire guard	1	Item number: 200-3349900
8	Sems bolt	4	Komatsu item number: 01024-81025
9	Winch cover	1	Item number: 200-3355000
10	Sems bolt	4	Komatsu item number: 01024-80816
11	Wire presser roller A	2	Item number: 347-4403800
12	Wire presser roller B	1	Item number: 349-4397500
13	Roller arm	1	Item number: 349-3179500
14	Roller pin	1	Item number: 349-4397600
15	Spring	2	Item number: 349-4397700
16	Spring adjusting bolt	2	Item number: 349-4397800
17	Bearing	6	Item number: 25012-06000 (#6000ZZ)
18	Roller arm pin	1	Item number: 349-4398200
19	Hexagon socket head screw	2	M6 × 1.0 × 15L (plated 10.9)
20	Snap pin	2	Item number: 21561M10001 (nominal size 10 plated)
21	Plain washer	2	M6 x Regular circle (plated)
22	Hexagon nut	4	M8 × 1.25 × Type 1 (plated 4T)
23	Collar (7L)	2	Item number: 336-4331800
24	Roller spacer	4	Item number: 103-4566900
25	Wedge	1	Item number: 1835-16007-0 (figure number 4672824)
26	Roller arm bracket	1	Item number: 200-3350000
27	Sems bolt	3	Komatsu item number: 01024-80816
28	Roller arm	1	Item number: 102-3343400
29	Arm pin	1	Item number: 349-4418300
30	Collar	2	Item number: 336-4331800
31	Snap ring	2	Item Number: 21911-01002 (Type C for shaft 10)
32	Wire presser roller A	2	Item number: 347-4403800
33	Roller pin	1	Item number: 104-4573100
34	Roller spacer	4	Item number: 103-4566900
35	Roller spacer B	2	Item number: 104-4573200
36	Hexagon socket head screw	2	M6 × 1.0 × 15L (plated 10.9)
37	Plain washer	2	M6 × Regular circle (plated)
38	Spring washer	2	M6 × type 2 (plated)
39	Spring	1	Item number: 104-4578300
40	Limit switch	1	Item number: S102M2527000
41	Hexagon socket head screw	2	M5 × 0.8 x 16L (plated 10.9)
42	Spring washer	2	M5 × Type-2 (plated)
43	Hexagon head bolt	1	M8 × 1.25 × 25L (plated 10.9)
44	Hexagon nut	1	M8 × 1.25 × Type 1 (plated 10T)
45	Cable tie	1	Item equivalent to Shibakei CV-150
46	Cable tie	1	Equivalent to HellermannTyton T50R-DH-W

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1.3.1 APPEARANCE AND SPECIFICATIONS OF WINCH MOTOR

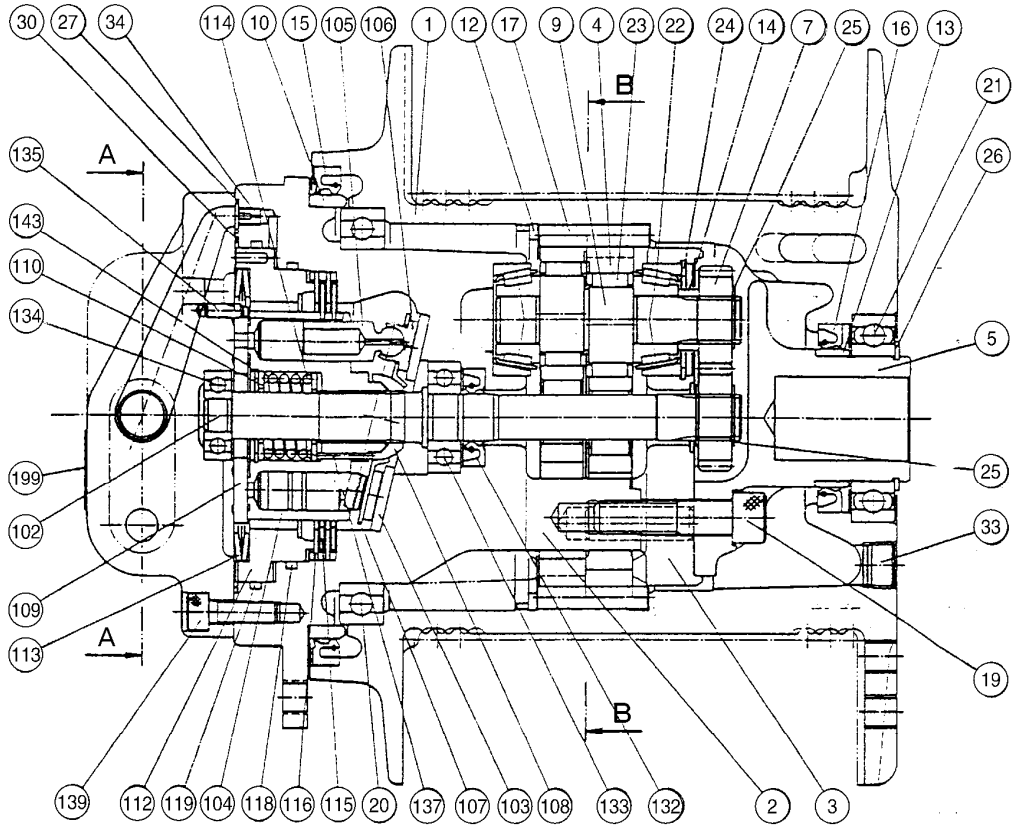


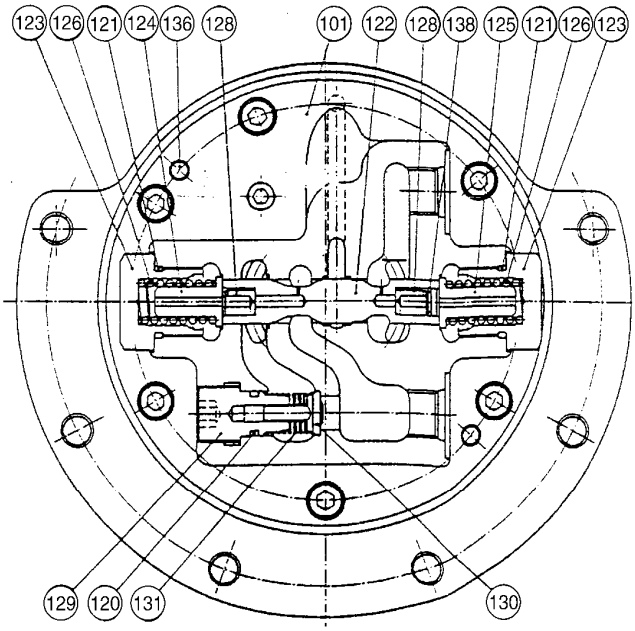
Circuit Diagram

Specifications		
Specifications of Reduction Gear		
Reduction Ratio		28.7
Max. Output Torque		1030 N·m (105 kgf·m)
Max. Output Revolution		123 min^{-1}
Specifications of Hydraulic Oil Motor		
Capacity per Stroke		17.3 cm^3/rev
Max. Common Use Pressure		20.6 MPa (210 kgf/cm^2)
Max. Revolution		3200 min^{-1}
Max. Flow Capacity		50 L / min
Mechanical Brake	Max. Braking Torque	58.8 N·m (6 kgf·m)
	Release Pressure	0.98 MPa (10 kgf/cm^2)

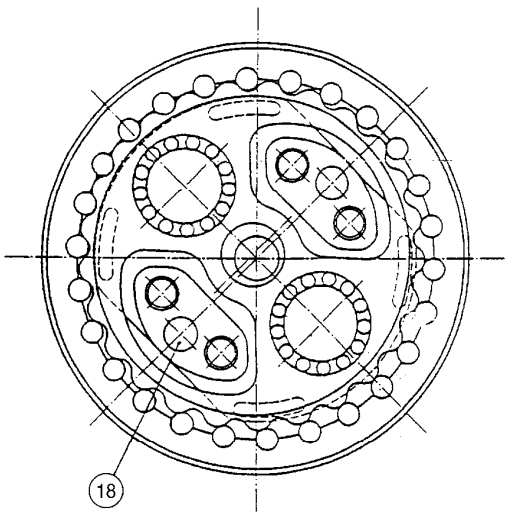
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1.3.2 INTERNAL STRUCTURE OF WINCH MOTOR





Section A – A



Section B – B

XSM01060E

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NO.	DESCRIPTION	Q'TY	NO.	DESCRIPTION	Q'TY	NO.	DESCRIPTION	Q'TY
1	Drum	1	24	Snap Ring (For Hole)	2	114	Spring	1
	Spindle Kit	1	25	C Type Snap Ring (For Shaft)	4	115	Friction Plate	2
	·Spindle Assembly	1	26	Snap Ring (For Shaft)	1	116	Plate	2
2	··Spindle	1	27	O-Ring	1	118	O-Ring	1
3	··Hold Flange	1	30	O-Ring	1	119	O-Ring	1
18	·Parallel Pin	2	33	Hex. Head Socket Plug	2	120	O-Ring	1
19	·Hex. Head Socket Bolt	4	34	Orifice	1	121	O-Ring	2
	RV Gear Assembly	1		Rear Flange Kit	1	123	Plug	2
4	·RV GEAR	2	101	·Rear Flange	1	124	Stopper	1
9	·Crankshaft	2	122	·Spool	1	125	Stopper	1
22	·Taper Roller Bearing	4	199	·Name Plate	1	126	Spring	2
23	·Needle Bearing	4	102	Shaft	1	128	Orifice	2
5	Shaft	1	103	Thrust Plate	1	129	Plug	1
	Spar Gear	1	104	Cylinder Block	1	130	Valve	1
7	·Spar Gear	3		Piston Kit	1	131	Spring	1
10	Bushing	1		·Piston Assembly	9	132	Oil Seal	1
12	Snap Ring	1	105	··Piston	1	133	Ball Bearing	1
13	Inner Ring	1	106	··Shoe	1	134	Ball Bearing	1
14	Distance Piece	2	107	Retainer Plate	1	135	Parallel Pin	2
15	Oil Seal	1	108	Thrust Bawl	1	136	Parallel Pin	2
16	Oil Seal	1	109	Timing Plate	1	137	Roller	3
17	Pin	26	110	Washer	2	138	Round R Type Snap Ring	1
20	Ball Bearing	1	112	Piston	1	139	Hex. Head Socket Bolt	6
21	Ball Bearing	1	113	Plane Spring	2	143	Round R Type Snap Ring	1

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1.3.3 FAILURE CAUSE AND COUNTERMEASURE

●Trouble of winch motor

Symptom	Cause	Remedy
A. There are abnormal noise and vibration.	1. Air remains in the circuit and motor.	• Completely bleed air from the circuit. When the motor generates negative pressure, the air in the case is sucked. Therefore, air may not bled completely. Inspect the drain piping.
	2. Cavitation (occurrence of negative pressure)	• Restudy the hydraulic circuit and take measures to prevent the occurrence of negative pressure.
B. Normal rotational speed cannot be achieved.	3. Insufficient flow rate of oil	• Study the supply circuit such as the pump circuit and leak from the relief valve and eliminate the cause.
	4. Overheat, increase in leak amount due to inappropriate viscosity of hydraulic oil	• Eliminate the cause.
	5. Failure in the motor	• Replace the motor. (Check an outside drain amount of the motor. If the drain amount is normal, there is often other cause.)
C. Normal torque cannot be achieved.	6. Normal pressure is not generated due to an error in the circuit on the motor inlet side.	• Study the supply circuit such as the pump circuit and relief valve and eliminate the cause.
	7. Abnormally high pressure is generated in the circuit on the motor outlet side.	• Study the return side circuit and eliminate the cause. For example, clogging of circuits, clogging of the return filter or reverse installation
	8. Increase in leak amount due to overheat	• Eliminate the cause.
	9. Failure in the motor	• Replace the motor.

* In general, inspection of an outside drain amount is very effective for trouble shooting of the motor. Empirically, if the outside drain amount is normal, the motor has no abnormality in many cases.

1.3.4 PRECAUTIONS IN WINCH MOTOR

1. Gear oil change timing

(1) First change (first change after operation start) : 500 hours

(2) Second time onward : Every 1000 hours or yearly

However, if gear oil decreased for some reason, check the cause, take measures and replenish gear oil.

Gear oil change quantity: 0.75L

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2. Procedure for Gear Oil Exchange:

Gear Oil for exchange should be the same type and brand. Do not mix different oil.

(1) Lower hook as well as any load to the ground.

(2) Set face of refuel port and drain port perpendicular to horizontal level. (Refer to a figure below)

(3) Suspend hydraulic pump.

⚠ WARNING

Change oil after lowering Hook as well as any load to the ground and halt whole machine. Otherwise, accidental fall of load and/or unforeseeable motion may cause injury.

⚠ CAUTION

Motor, after operation, may be extremely hot. Allow oil to cool before change. Otherwise, a gush of hot oil may cause burns.

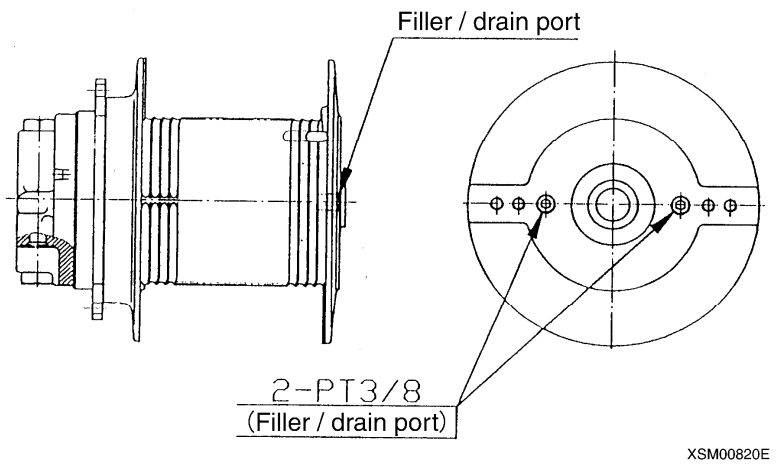
(4) Dump gear oil

Remove plugs of both refuel and drain for exchange.

Or, remove refuel plug for refilling.

(5) Pour 0.2 gal (0.75 liter) of gear oil from the port, or to the level of refuel port for refilling.

(6) Tighten plugs to ports. Always use seal tapes when tighten plugs.



3. Maintenance

Perform daily maintenance and inspection of items below before starting motor, CH01A.

⚠ WARNING

Except abnormal noise check of item (3) below, always start maintenance and inspection only after lowering hook as well as any load to the ground and halt this winch and hydraulic pump. Maintenance and/or inspection during operation may cause injury or burns.

(1) Oil leakage (Hydraulic oil and Gear oil)

(2) Loose bolts.

(3) Abnormal noise.

⚠ CAUTION

Drum, after operation, may be extremely hot. Use a thermometer for measurement of temperature and never touch drum and/or rear flange to prevent burns.

(4) Extraordinary temperature raise of drum and/or rear flange body.

[Maximum allowable temperature under uninterrupted services is 176°F (80°C)]

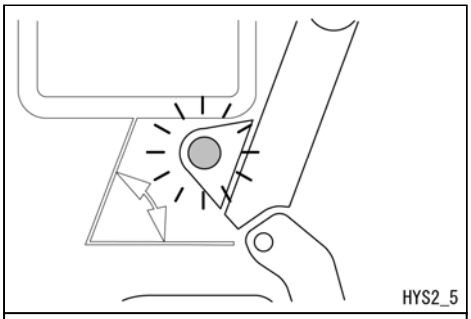
(5) Assure that gear oil has been correctly changed, periodically.

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1.4 OVER LOWERING DETECTON DEVICE

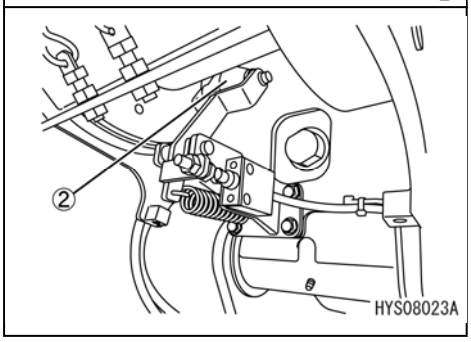
[1] OPERATION OF OVER LOWERING PROTECTIVE DEVICE

- When the hook is lowered and an amount of wire rope in the winch drum becomes small, the dead turns lamp is displayed on the monitor.
- When hook lowering operation is performed, the alarm issues a continuous sound “peep”.
- The hook lowering action is automatically stopped.



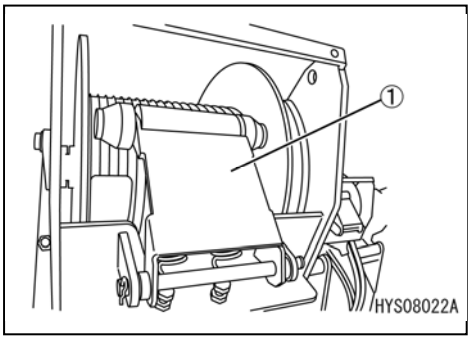
[2] INSPECTION OF EXCESSIVE UNWIND DETECTOR

When the hook is lowered and 3 loops or less of wire rope is left in the winch drum, check if the alarm sounds “peep” continuously and hook lowering action stops automatically.
If lowering operation does not stop automatically, the excessive unwind detector may be faulty or the circuit may be open.
Check the detection roller (2) of the over lowering prevention for deformation and abnormality.



1.5 IRREGULAR WINDING PREVENTION ROLLER

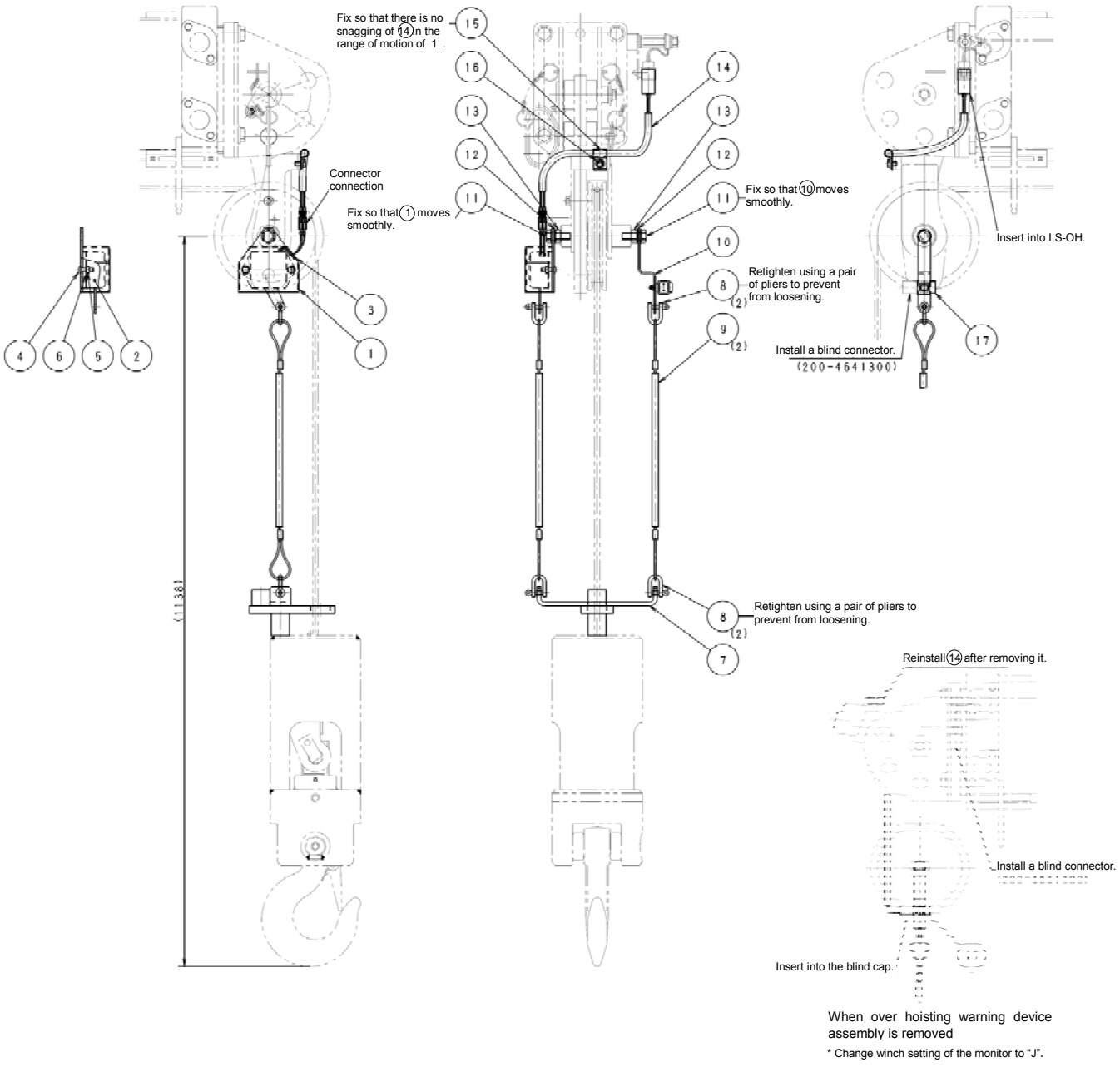
Check the irregular winding prevention roller (1) for deformation and abnormality.



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2. OVER-HOISTING PREVENTION DEVICE ASSEMBLY

200-2167700



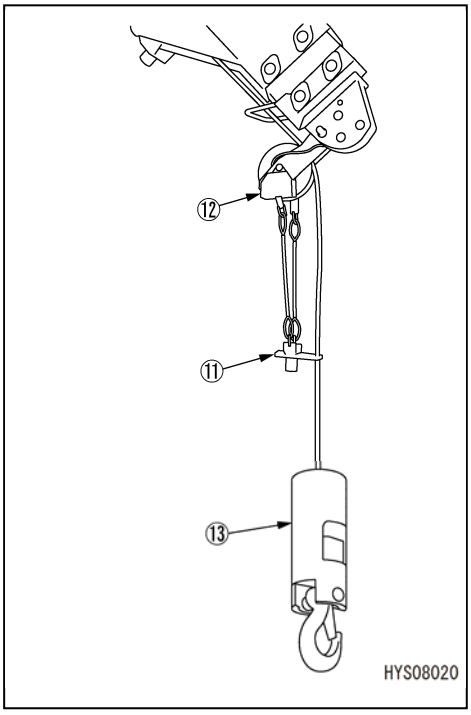
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Number	Name	Q'ty	Item No.
1	Case	1	Item number: 551-4036800
2	Detector	1	Item number: S551-4041200
3	Grommet	1	Item number: N8711-27900 (C-30-NG-79-C Takigen)
4	Hexagon socket button head screw	2	M6 × 1.0 × 20L (plated)
5	Hexagon nut	2	M6 × 1.0 × Type 1 (plated)
6	Conical spring washer	2	Item number: 21721M06011 (nominal size 6 × 1H plated)
7	Protect weight	1	Item number: 200-4660500
8	Shackle	4	Item number: N7061-06000 (D-shackle 1/4")
9	Protective rope 400L	2	Item number: 541-4628700
10	Plate	1	Item number: 200-4656200
11	Sems bolt	2	Komatsu item number: 01024-81030
12	Plain washer	2	M10 × Regular circle (plated)
13	Hexagon nut	2	M10 × 1.5 × Type 1 (plated)
14	Over-hoisting detector relay cord	1	Item number: 200-4659200
15	Clamp	1	Item number: 22961-08100 (COT-08)
16	Sems bolt	1	Komatsu item number: 01024-80610
17	Blind connector holder	1	Item number: 200-4659600

2.1 OVER-HOISTING PREVENTION DEVICE

[1] OPERATION OF OVER HOIST PROTECTIVE DEVICE

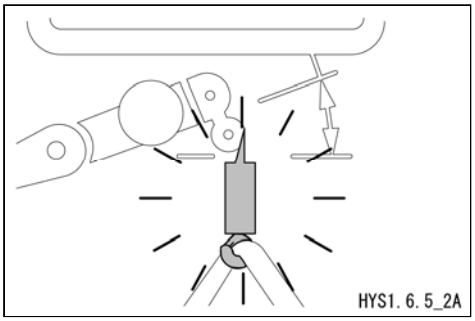
(11) Weight
(12) Over hoist detector
(13) Hook block



When the hook block (13) approaches the tip of the jib and pushes up the weight (11), the over-hoisting stop device sounds an alarm buzzer of the crane operation part and warns over hoisting, and the moment when monitor display of the over-hoist detector flashes in red, the following operations stop automatically.

- Winding up of winch
- Main boom and jib extension
- Jib derrick-up

[2] INSPECTION OF OVER HOIST DETECTOR



When performing winch raising and main boom extension operation, jib extension operation and jib hoist-up operation, respectively, with the hook block (13) set to an over-hoist state, check that the alarm buzzer sounds, and winch raising and main boom extension operation, jib extension operation and jib hoist-up operation stop.
If the alarm does not stop sounding, the over hoist detector may be faulty or the circuit may be open.
Check wire ropes for over hoist weight for damage and if any abnormality is found, replace.

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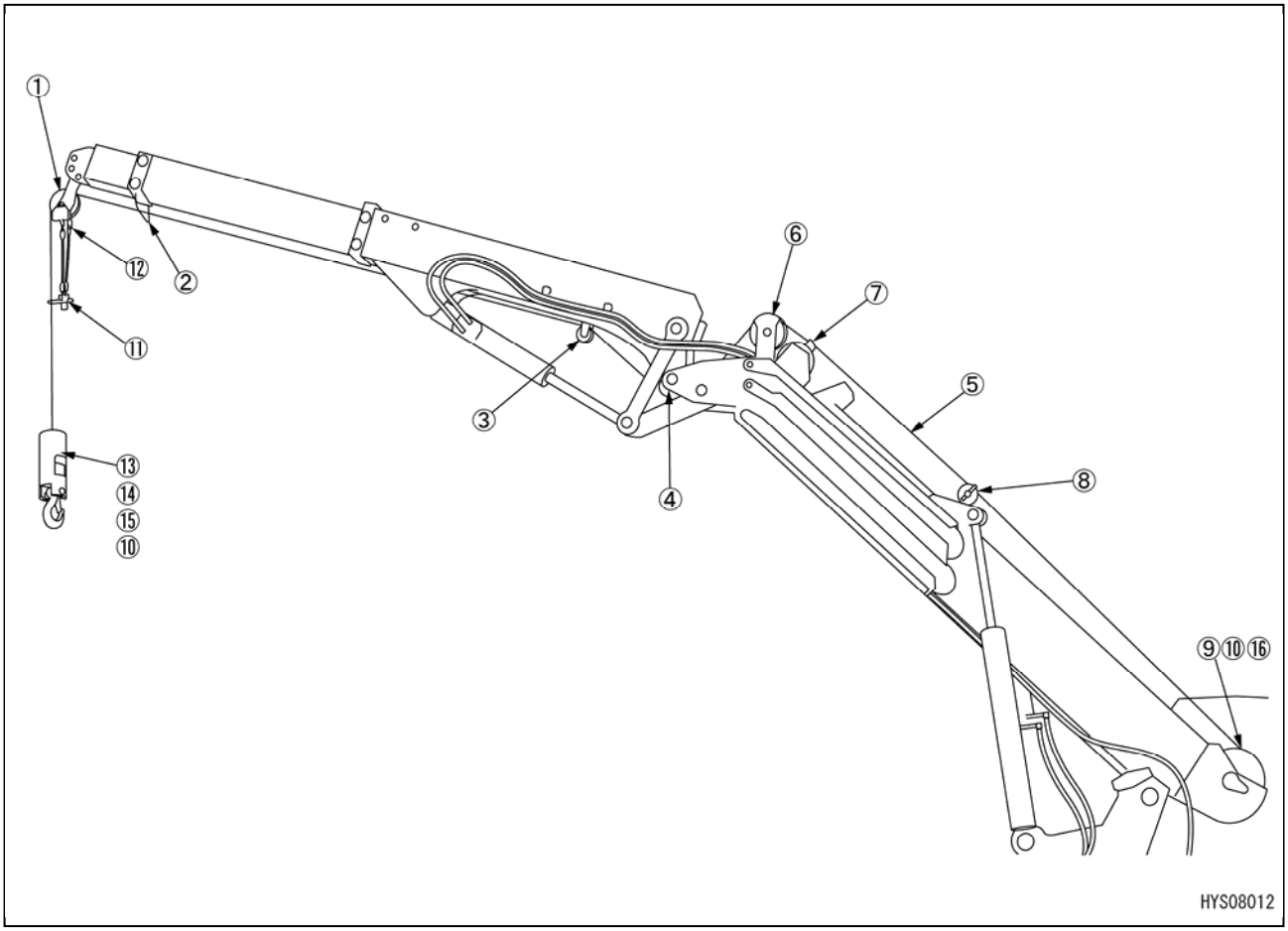
3. INSTALLATION OF WIRE ROPE

⚠ WARNING

Be sure to attach the rope wedge properly to secure the wire rope. Serious accidents may occur if the wire rope is detached during crane operations.

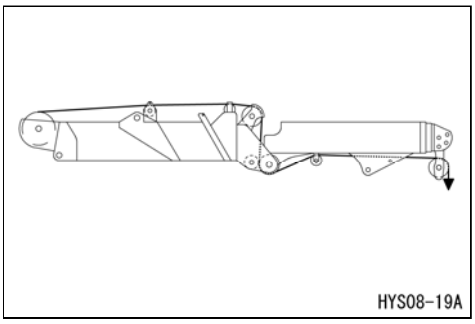
CAUTION

- Avoid irregular winding of the wire rope on the winch drum.
- Always hoist an object (2.9 to 4.9KN {300 to 500 kg}) with the main boom and jib extended and raised fully immediately after attaching a new rope. Repeat raising and lowering the hook several times until the new rope conforms.
- The wire rope is coiled.Exercise caution not to form a kink in the rope when winding it up.Be sure to unravel by rotating the rope to pull it out of the winch drum.



Use the following procedure to attach the wire rope.

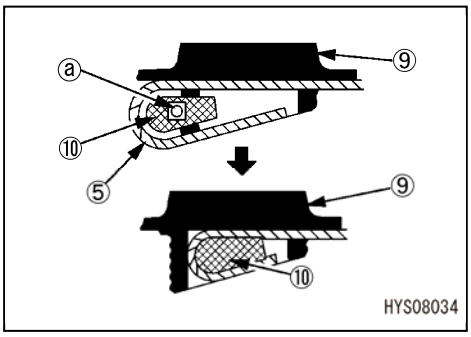
1. With the end of the wire rope held, draw the wire rope (5) through the weight of the over hoist detector (11), load sheave (1) at the jib end, wire guide (2) of the jib, guide sheave (3) of the jib, and also the idler sheave (4) of the jib.

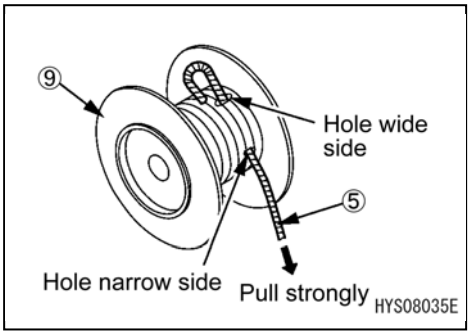


2. Next, draw the wire rope (5) through the sheave (6) on the upper part of the main boom end, guide sheave (7) on upper part of the main boom end, and guide sheave (8) on the intermediate upper part of the main boom.

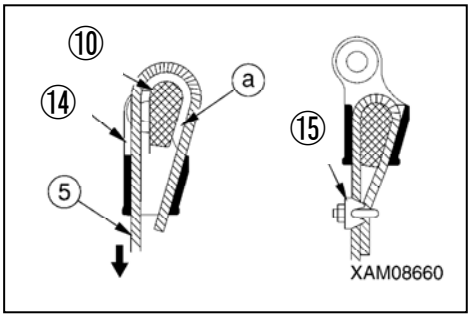
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3. Draw the wire rope (5) through the rope attachment hole of the winch drum (9). Secure the wire rope (5) to the winch drum (9), following the procedure provided below.
4. (1) Draw the slackened wire rope (5) through the winch drum (9).
5. (2) The rope wedge (10) should be in position (a). Pass the wire rope (5) around the rope wedge and yank at the rope in the direction indicated by the arrow.
   Adjust the length of the wire rope (5) to keep the end of the wire rope from protruding from the narrow hole in the winch drum (9).
6. Operate the winch lever slowly to “UP” (push it toward you) to wind up the wire rope (5) onto the winch drum (9).





7. Secure the end of the wire rope (5) to the wedge socket (14), following the procedure provided below.
8. (1) Draw the wire rope (5) through the wedge socket (14) as shown in the diagram to the right.
9. (2) The rope wedge (10) should be in position (a), and yank at the wire rope (5) in the direction indicated by the arrow.
10. Attach the wire clip (15) to the wire rope (5).
11. 7. Secure the wedge socket (14) to the hook block, and tighten the wedge socket pin fixing bolt.
12. 8. Place the boom derricking lever in the “Raise” position (pull it toward you) or the boom telescoping lever in the “Extend” position (pull it toward you) to raise the hook block.

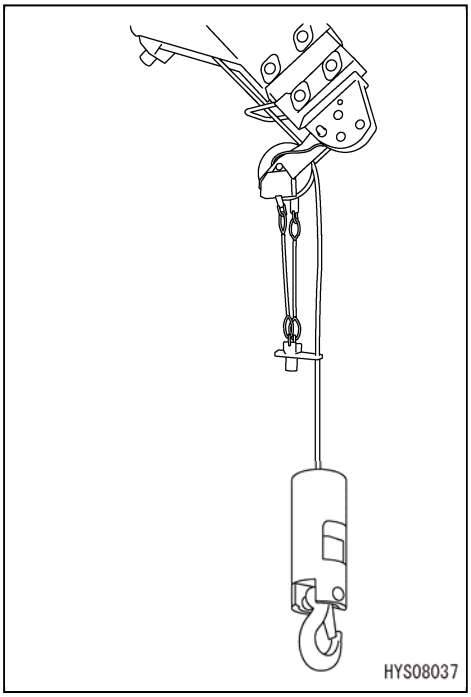


NOTES
Winch operation is allowed only after the hook block is raised.

13. Raise the jib as high as possible, and operate the winch lever to “DOWN” (push it forward) to pay out the wire rope of the winch drum as close to the ground as possible.

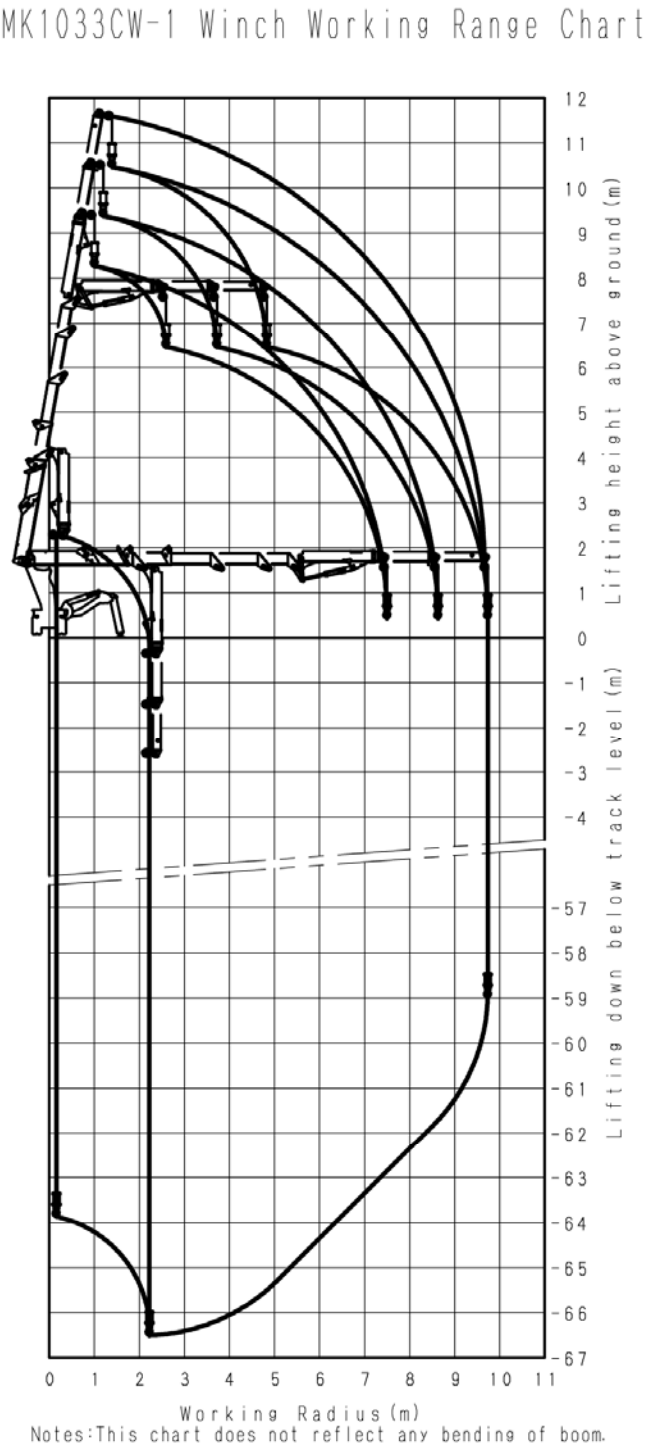
NOTES
Do not allow the hook block to contact the ground.

14. With the wire rope (5) held under tension, operate the winch lever to “UP” (push it toward you) to wind up the wire rope (5) on to the winch drum (9).



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4. WORKING RADIUS/LIFTING HEIGHT OF ONE FALL WINCH



SAM13650

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5. SPECIFICATIONS OF OPTIONAL WINCH

Equipment/Item		
Weight	Unit weight	100 kg
Performance	Maximum rated total load × working radius	0.82 t × 2.3 m (main boom 2nd stage 65°/jib 1st stage 65°)
	Maximum working radius	9.73 m
	Maximum lifting height above ground	66.5 m
Winch system	Type	Swash plate axial piston motor differential planetary gear type, friction disc type brake
	Hook hoist speed	37.8m/min (drum5layers, hook 1 fall)
	Hoist wire rope	IWRC 6 × WS (26) 0/0 B type φ8 × 73 m
	Rated pressure	20.6 MPa(210 kgf/cm²)
Safety device	Over hoist detector, excessive unwind detector, alarm buzzer, hydraulic safety valve, wire rope latch	

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