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PREFACE

This manual is to provide servicing personnel with extensive information on the structure, service procedure, removal and installation procedure, disassembly, troubleshooting and more for the 3015R(h)/3515R(h)/4015R(h) and F36R(h)/F42R(h) tractor with high-end technology to ensure precise and rapid service.

Most accidents are resulted from negligence in safety precautions and directions, so it is very necessary to follow such precautions and directions to avoid any safety accident beforehand. Service technicians should provide quality service to prevent any safety accident and enhance customer satisfaction so they should fully understand the service procedure, methods, inspection points and safety precautions for accurate service.

To ensure optimum condition of your tractor, it is highly recommended to use only BRANSON genuine parts which are manufactured under strict quality assurance policy for premium quality, durability and reliability. BRANSON is always committed to provide best quality products through extensive research, study and development.

Information in this manual is subject to change without notice for improvement of the product.

Please keep this manual in a safe place. If there is any typo, incorrect information or question about this manual, feel free to contact BRANSON.

(Jan, 2016)

BRANSON TRACTORS Co. Ltd.

※ Remark

- **This manual does not contain all accidents and preventive measures that can occur during service. Make sure to have this tractor serviced only by professional technicians with care.**
- **Use only genuine parts, including engine oil and transmission fluid, specified in this manual. Otherwise, it can affect the tractor's performance seriously.**
- **Never attempt to duplicate contents and figures in this manual without prior approval by BRANSON.**

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MEANINGS OF SAFETY SYMBOLS

Precautions and instructions described in this manual and safety decals, such as DANGER, WARNING and CAUTION decals, are important for your and machine's safety. If these instructions are not followed, you and the vehicle can be severely injured and damaged. Read such precautions and instructions carefully for your safety.

If any DANGER, WARNING or CAUTION decal is damaged or missing, order it from your dealer and have it attached to the original position.

Important safety instructions are described with various symbols throughout this manual. Make sure to follow such instructions. Their design and meanings are as follows:

DANGER	This symbol indicates potentially hazardous situation which, if not observed, may result in death or moderate injury.
WARNING	This symbol indicates the most serious hazardous situation which, if not observed, may result in death or serious injury.
CAUTION	This symbol indicates potentially hazardous situation which, if not observed, may result in minor or moderate injury. Also, this can be used as a warning for an unstable action.
IMPORTANT	This symbol indicates important procedures or information to perform work with more ease and skills.
Notes	This symbol indicates information useful to users.

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HOW TO USE THIS MANUAL

1. Target readers

This manual is intended for technicians with mid to high level of service knowledge and skills for BRANSON tractors. Make sure to understand this manual fully for rapid and accurate inspection and service.

2. Order of contents

This manual is a single book for the 3015R(h)/3515R(h)/4015R(h) and F36R(h)/F42R(h) tractor and contains several useful chapters such as General Information, Engine, Clutch, Transmission, Front Axle, Hydraulic System, Electric System. Information and diagrams in this manual are described based on the standard model so they may be different from your vehicle due to different specifications by models. However, the same instructions should be followed for service.

3. Body structure of this manual

This manual is structured as follows:

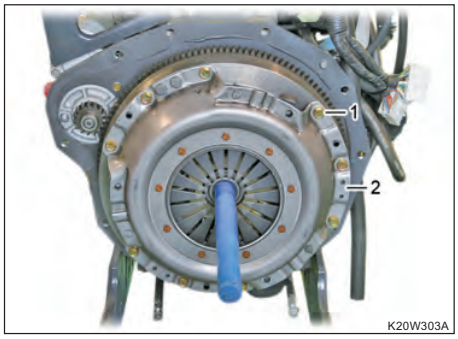
〈 Upper section 〉 ③ ①

3. DISASSEMBLY

3.1 CLUTCH HOUSING REMOVAL

1. Park the tractor on level ground and apply the hand brake.
2. Disconnect the negative battery cable.
3. Drain the transmission fluid.
4. Remove the hood and propeller shaft.
5. Disconnect the hydraulic hose, wiring connector and various cables between the vehicle body and engine.
6. Place a stand under the clutch housing and a portable jack under the engine oil pan.

3.2 CLUTCH DISASSEMBLY

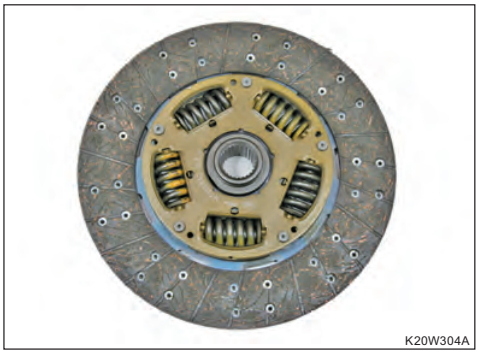


② 〈 Lower section 〉

8. Unscrew the mounting bolt (1) from the cutch housing and engine mounting flange. Then, push the front axle section to separate it from the clutch housing.

ITEM	TORQUE VALUE
M14 nut (10.9T)	16.5 kg.m (119.34 lbf.ft)
M14 bolt (10.9T)	16.5 kg.m (119.34 lbf.ft)

9. For more detailed disassembly procedures, refer to the instructions for engine removal in Chapter 2.



2. Remove the clutch disc.

④ ⑤

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HOW TO USE THIS MANUAL

① **Chapter**

This indicates the current chapter.

② **Body**

Generally, figures and diagrams are placed in the upper section of a page while information and description are set in the lower section. However, a large table or diagram may take a whole page. Each figure is assigned with a figure number and a large figure may be set in a A3-size page like a circuit diagram.

③ **Model name**

This indicates the corresponding model.

④ **Publication classification**

This indicates the publication category and date of this manual.

⑤ **Page number**

Each page is given with the corresponding number:

Example: 3-8

4. Other information

The component names used in this manual are set to reflect their functions so they may not be consistent with the ones in other materials, such as the part list and user's manual, labels and decals.

Also, as the figures and diagrams in this manual are based on the product at the time of its publication, so they may differ from your actual product. The specification and other information in this manual are subject to change without notice for design change or improvement of the product.

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◆ CLUTCH [MEC. MODEL] 3

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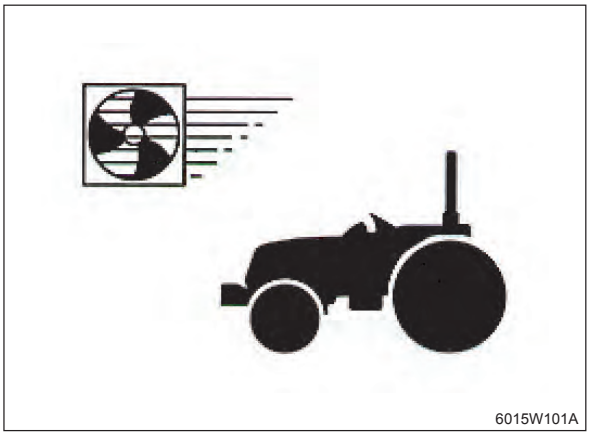
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1. GENERAL INFORMATION FOR SERVICE

1.1 FOR SAFE OPERATION

1.1.1 WORK PLACE


6015W101A

⚠ DANGER

Sufficient ventilation:

- **When grinding or sanding a painted surface or working near the exhaust gas pipe, the work area should be sufficiently ventilated to avoid inhalation of hazardous gas and particles. [Otherwise] the battery can explode, resulting in a burn.**

[Otherwise] You can inhale toxic gas, leading to an injury.

⚠ CAUTION

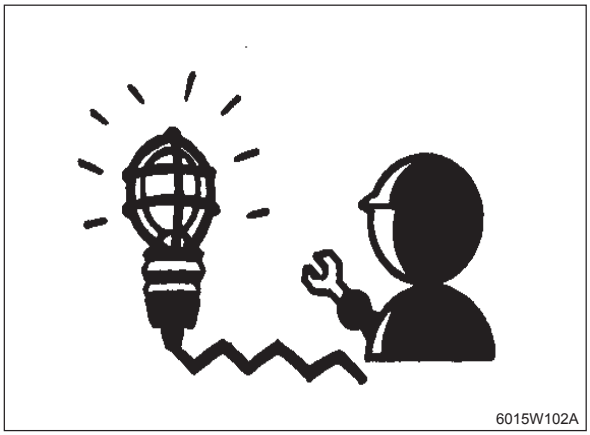
Sufficient working area:

- **To prevent an injury, secure a sufficient working area for service.**

  [Otherwise] it can lead to rollover.

⚠ CAUTION

- **Have your work place neat and clean. .**


6015W102A

⚠ CAUTION

- **The work place should be properly illuminated.**

When working in or under the machine, make sure to have a protected lighting equipment.


6015W103A

⚠ CAUTION

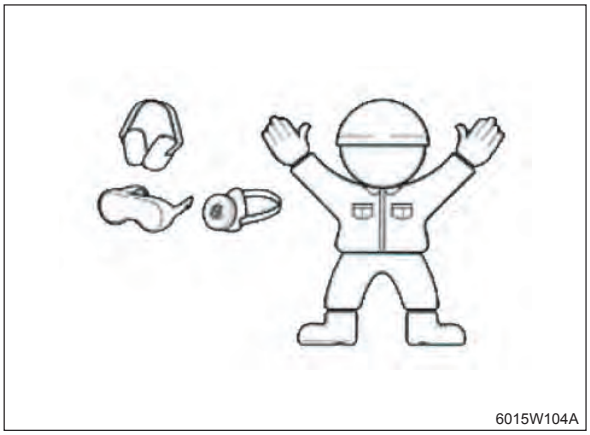
- **Have a fire extinguishing system ready in your work place.**

Have a fire extinguisher in your work place.

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1.1.2 WORKING CLOTHES AND OTHER SAFETY GEARS



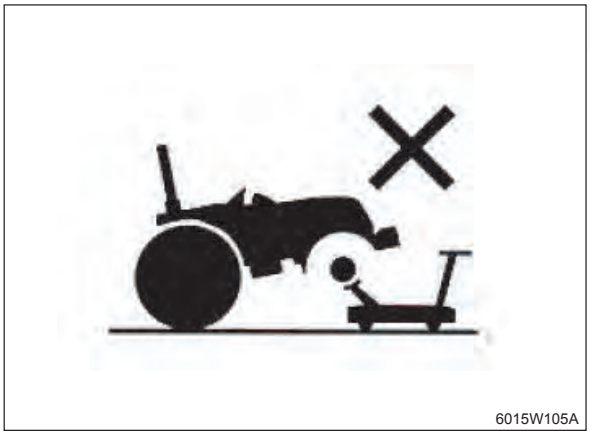
6015W104A

⚠ CAUTION

- **Wear proper working clothes to ensure your safety.**

Make sure to wear working clothes, safety hat, safety gloves, safety goggles and other safety gears for your safety.

1.1.3 TOOL



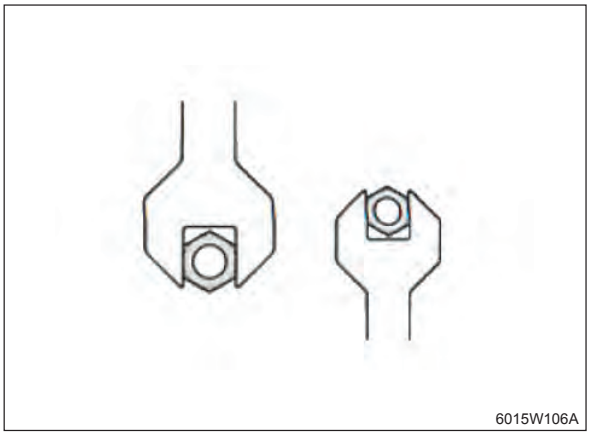
6015W105A

⚠ DANGER

- **Have a proper support and lifting equipment ready always.**

Never work on the tractor only with a wood support or other type of block or jack.

Do not use any lift or crane with insufficient rated load capacity.



6015W106A

⚠ WARNING

- **Use a proper tool.**

Use the specified tools for disassembly and assembly.

[If working on the machine without sufficient knowledge or skills], it can lead to an injury or damage to equipments and parts.

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1.1.4 STANDARD PARTS, LUBRICANT, GREASE AND OIL



6015W107A

⚠ CAUTION

Use only the specified standard parts.
[Otherwise] It can shorten the service life and cause an unexpected problem to the vehicle.

1.1.5 FINISHING UP AND CHECKING

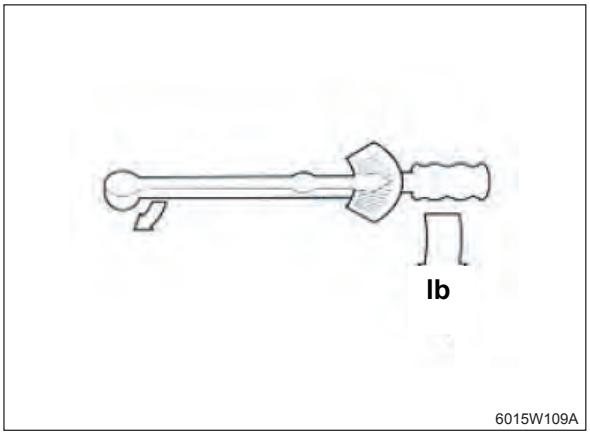


6015W108A

⚠ CAUTION

- **Before delivering the machine to your customer, make sure to inspect it according to the inspection list.**

1.1.6 TORQUE PART

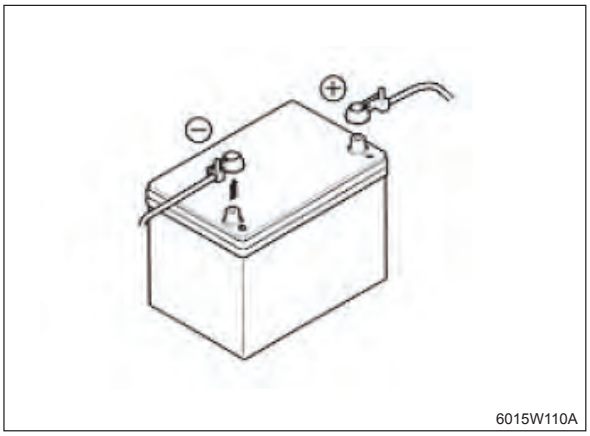


6015W109A

⚠ WARNING

Follow the torque specified in this manual.
[Otherwise] It can cause a serious accident.

1.1.7 ELECTRIC SYSTEM



6015W110A

⚠ WARNING

Shorted line:

- **To prevent the battery from discharging, disconnect the negative battery cable during inspecting the electric system.**

[Otherwise] It can cause a serious accident.

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1.1.8 SAFETY DURING SERVICE



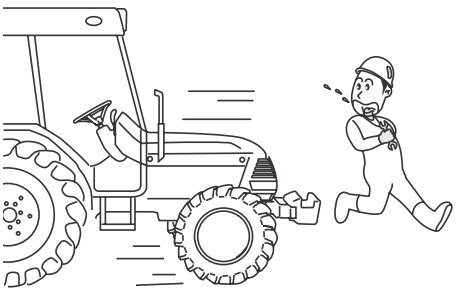
K20W150A

⚠ WARNING

Keep flammables away during fueling

- **Keep flammables, such as a cigarette, match and lighter, away from the vehicle during fueling.**

[Otherwise] it can cause a fire, leading to a burn.



K20W152A

⚠ CAUTION

Stop the engine during inspection and service

- **Make sure to stop the engine during inspection, service, repair or cleaning.**

[Otherwise] it can lead to an injury or accident.



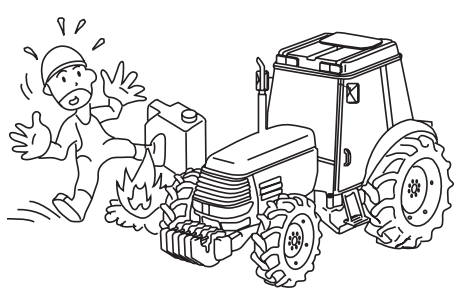
K20W151A

⚠ DANGER

Do not allow the battery fluid to contact your skin.

- **If battery fluid is on your skin or clothing, rinse it with water immediately.**

[Otherwise] you can get burnt or clothing can be damaged.



K20W153A

⚠ DANGER

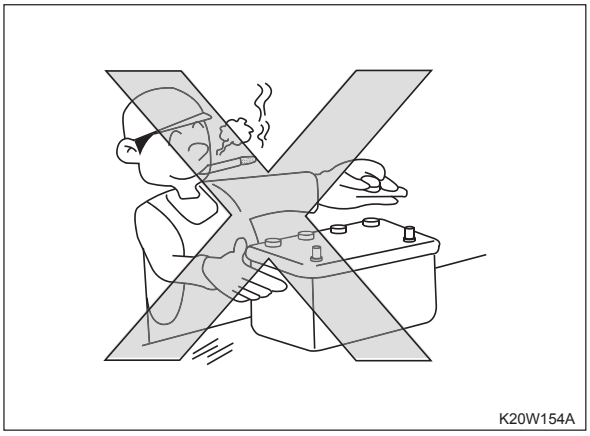
Add fuel or oil only after the engine is sufficiently cooled down.

- **Never add fuel or oil while the engine is running or hot.**

[Otherwise] Hot fuel or oil can cause a fire.

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K20W154A

DANGER

Keep flammables away during battery inspection

• Keep flammables away from the vehicle while checking and charging the battery.

[Otherwise] the battery can explode, resulting in a burn.


K20W155A

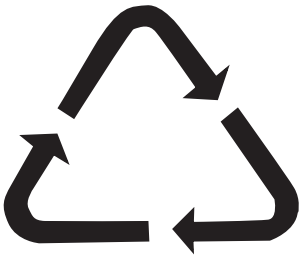
CAUTION

Follow the correct procedures for battery connection and disconnection.

• When connecting the battery, connect its positive cable first. When disconnecting it, disconnect its negative cable first.

[Otherwise] it can cause a short circuit, leading to burn, fire or electric shock injury.

1.1.9 WASTE DISPOSAL


K20W156A

WARNING

If waste is not disposed properly, it can pollute the environment and destroy the ecosystem. Make sure to dispose waste according to the applicable law.

- **When draining fuel or oil, store it in a proper container and put a label on it to prevent anyone from accidentally drinking it.**
- **When fueling or draining oil, be careful not to spill it around to prevent soil or water pollution.**
- **There are various types of hazard waste produced from the tractor, including fuel, coolant, brake fluid, oil, filter, battery and etc.**
- **Have harmful waste disposed by a specialized refuse disposal company according to the applicable law and regulations.**

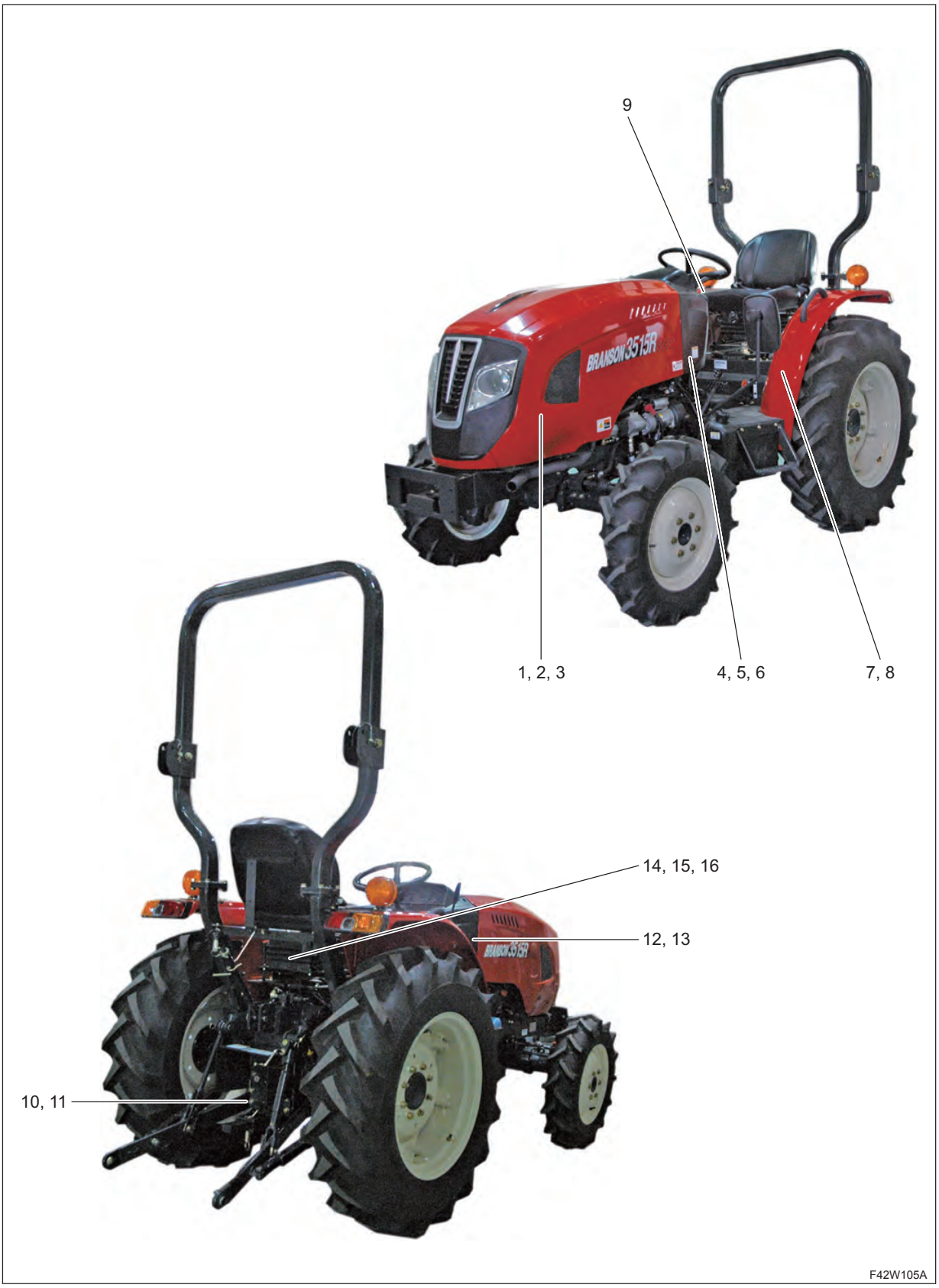
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2. LOCATION OF DECALS

To ensure safe work, check the location of the safety decals and always keep the safety precautions.

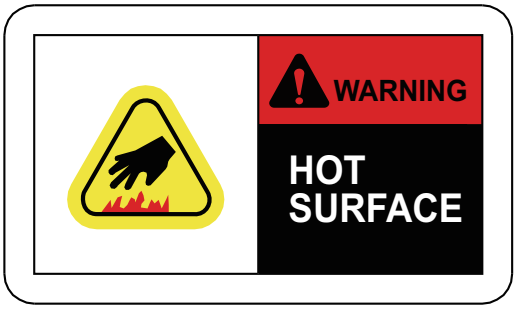
Keep the safety decals intact. If any decals is damaged or missing, attach a new decal.



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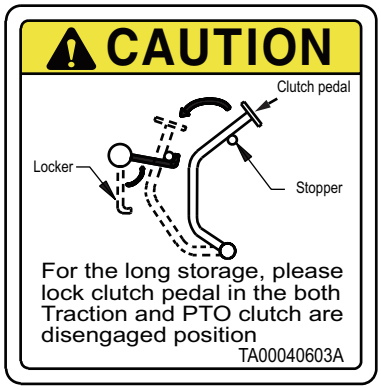
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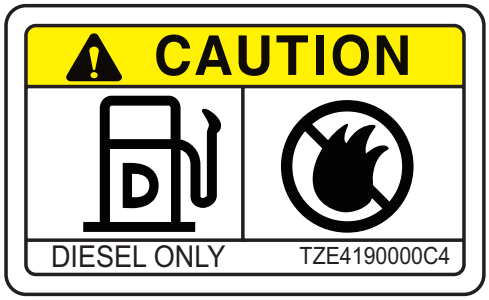
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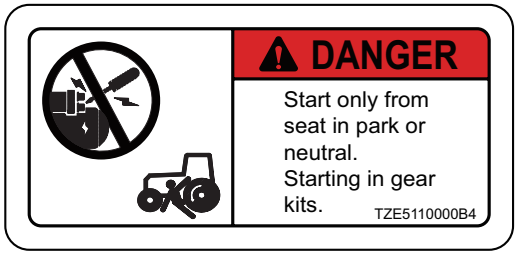
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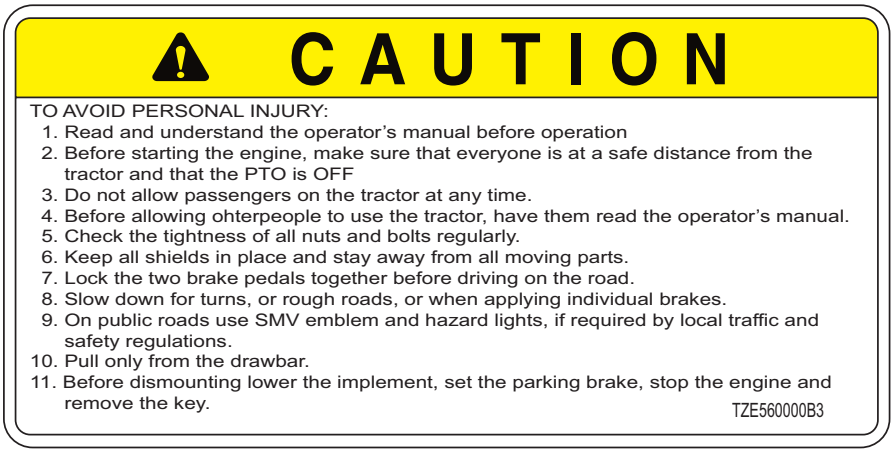
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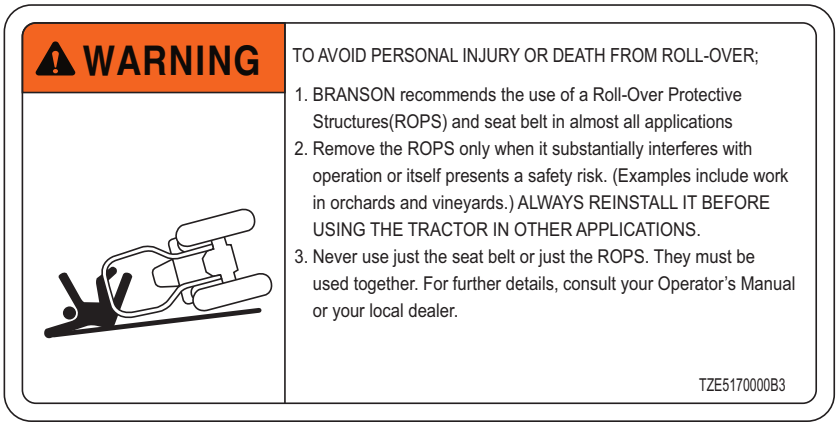
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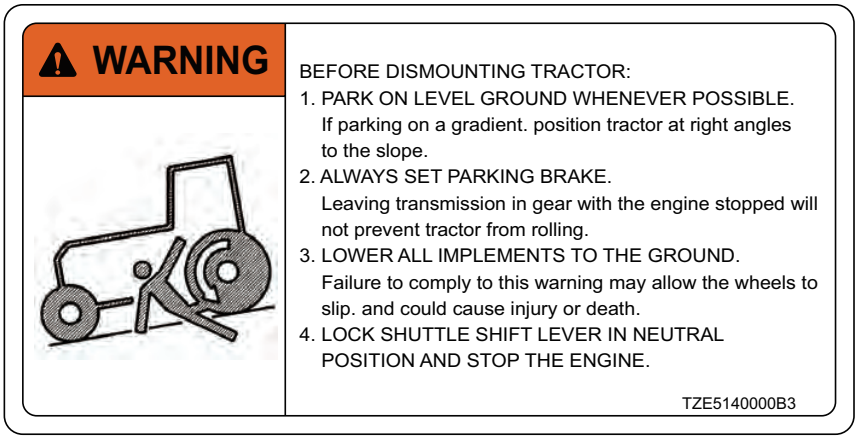
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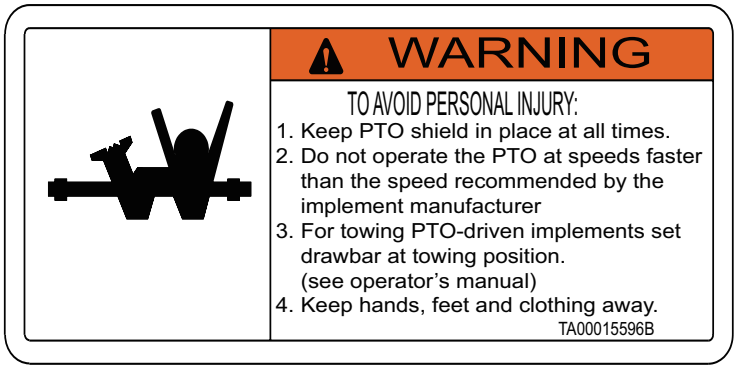
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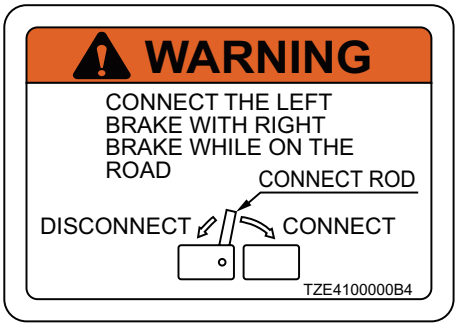
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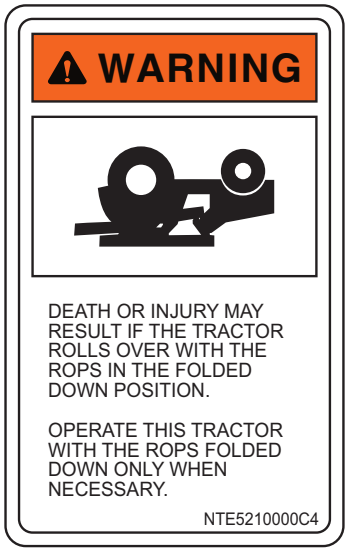
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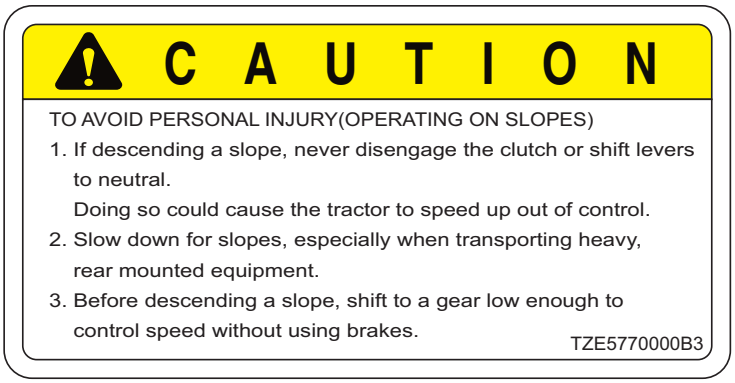
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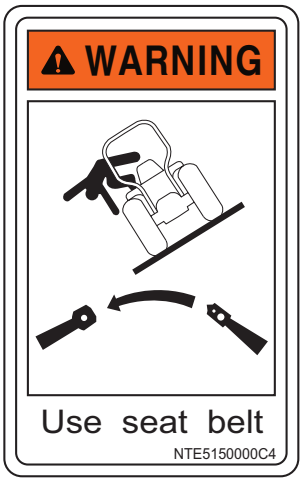
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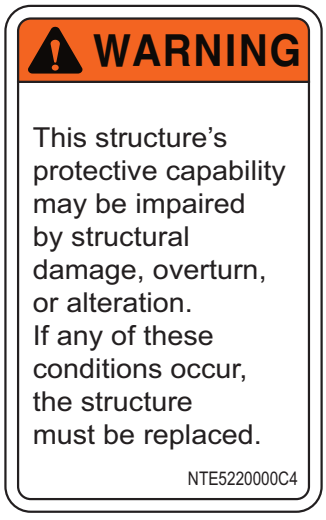
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(14) No.: NTE5150000C4



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3. GENERAL INFORMATION FOR MAINTENANCE

3.1 TIGHTENING TORQUE

3.1.1 HEX. BOLT

Unit: N.m (kgf.m) [lbf.ft]

ITEM	NO GRADE OR 4 T	7T	9 T	8.8 T	10.9 T	12.9 T
M6	8.8 (0.9) [6.4]	11 (1.1) [8.1]	-	9 (0.9) [5]	13 (1.3) [10]	14 (1.4) [9]
M8	20 (2.0) [14.7]	25 (2.6) [18.4]	14 (1.4) [10.3]	23 (2.3) [17]	33 (3.3) [25]	40 (2.9) [29]
M10	42 (4.3) [30.9]	52 (5.3) [38.3]	28 (2.9) [20.6]	45 (4.5) [33]	65 (6.5) [50]	70 (7.0) [50]
M12	68 (6.9) [50.1]	84 (8.6) [61.9]	44 (4.5) [32.4]	80 (8.0) [60]	115 (11.5) [85]	125 (12.5) [95]
M14	120 (12) [88.5]	140 (14) [103.2]	-	125 (12.5) [90]	180 (18.0) [133]	195 (19.5) [145]
M16	180 (18) [132.2]	220 (22) [162.2]	-	195 (19.5) [140]	280 (28.0) [200]	290 (29.0) [210]
M18	260 (27) [191.7]	290 (30) [213.9]	-	280 (28.0) [200]	390 (39.0) [285]	400 (40.0) [290]
M20	360 (27) [265.5]	400 (41) [295.0]	-	400 (40.0) [290]	550 (55.0) [400]	-

3.1.2 STUD BOLT

ITEM	BASE			TOLERANCE		
	N.m	kgf.m	lbf.ft	N.m	kgf.m	lbf.ft
M8	11.8 ~ 15.6	1.2 ~ 1.6	8.68 ~ 11.5	8.82 ~ 11.8	0.90 ~ 1.2	6.51 ~ 8.67
M10	24.6 ~ 31.3	2.5 ~ 3.2	18.1 ~ 23.1	19.7 ~ 25.4	2.0 ~ 2.6	14.5 ~ 18.8
M12	29.5 ~ 49.0	3.0 ~ 5.0	21.7 ~ 36.1	31.4	3.2	23.1

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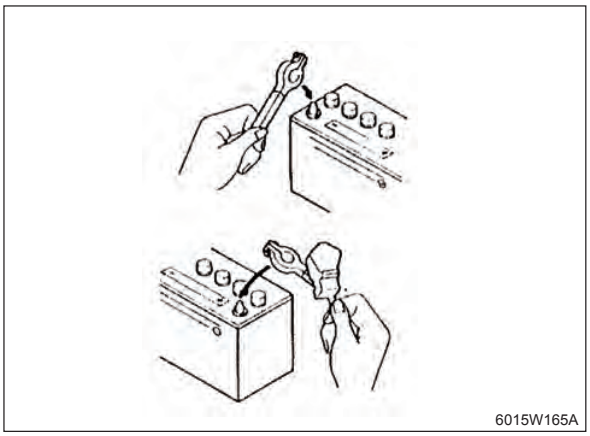
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3.2 OIL, GREASE, FUEL AND COOLANT SPECIFICATIONS

ITEM	CAPACITY		SPECIFICATION	REMARKS
	MEC. MODEL	HST MODEL		
Fuel	27 ℓ (7.13 u.s. gal)		Diesel fuel (KS 2)	Summer: S, Winter: W
Engine oil	4.3 ℓ (1.14 u.s. gal)		SAE15W-40	3015R(h)/3515R(h)/4015R(h) (Final Final Tier4): Grade CJ or higher F36R(h)/F42R(h) (Stage III A): Grade CG or higher
Grease	Small amount		High load No. 2 of KSM 2130	Multi-purpose
Coolant	Radiator : 5.0 ℓ (1.32 u.s. gal) Reservoir tank : 0.45 ℓ (0.12 u.s. gal)		BRANSON genuine anti-freeze	No. 2 of KSM 2142, permanent use
Transmission fluid and steering oil	34 ℓ (8.98 u.s. gal)	37 ℓ (9.77 u.s. gal)	TF500	Texaco TDH oil, 1893 Chevron tractor hydraulic fluid
Front axle oil	6.4 ℓ (1.69 u.s. gal)		SAE#90	Gear oil

※ If the ambient temperature is below 50°F (10°C), use diesel fuel for winter season.

3.3 ELECTRIC DEVICE SERVICE

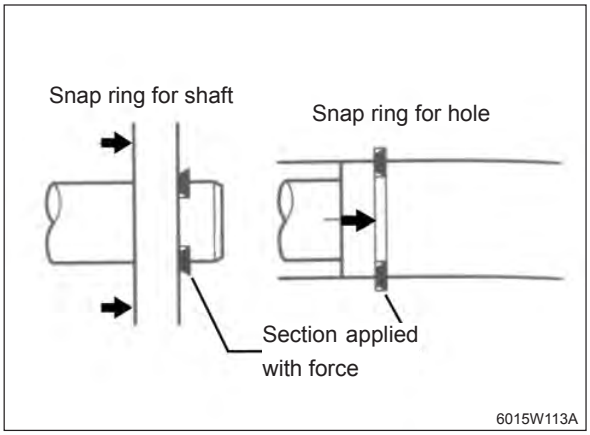

6015W165A

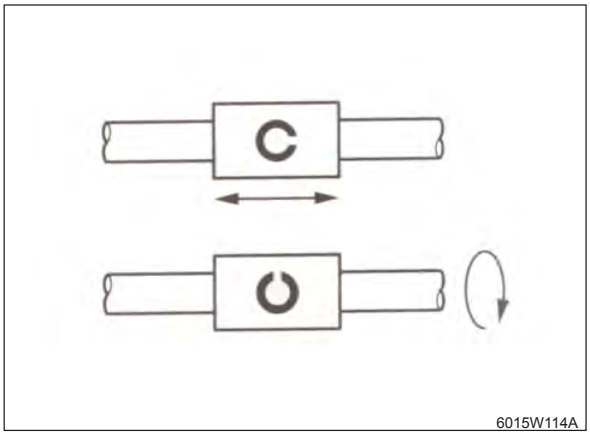
1. When disassembling or repairing any part applied with voltage, disconnect the negative battery cable first.
2. When disconnecting the battery cables, disconnect the negative cable first. When connecting them, connect the positive cable first.
3. Apply grease to the battery terminals and cover them securely after connecting the battery cables.
4. When charging the battery, it produces hydrogen gas and chlorine. Therefore, disconnect the battery and move it to an isolated well-ventilated area with no flammables and flame before charging.

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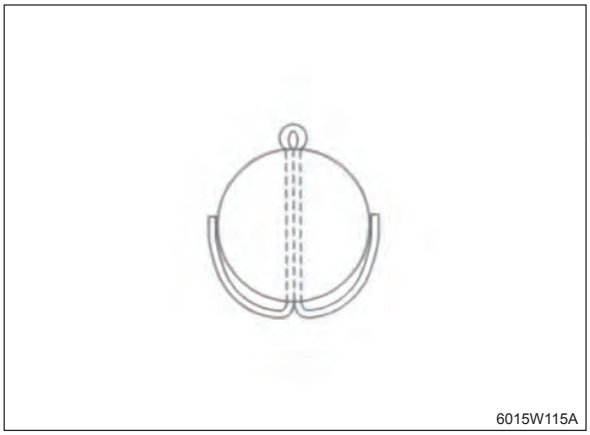
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3.4 USING STANDARD PART AND ADHESIVE

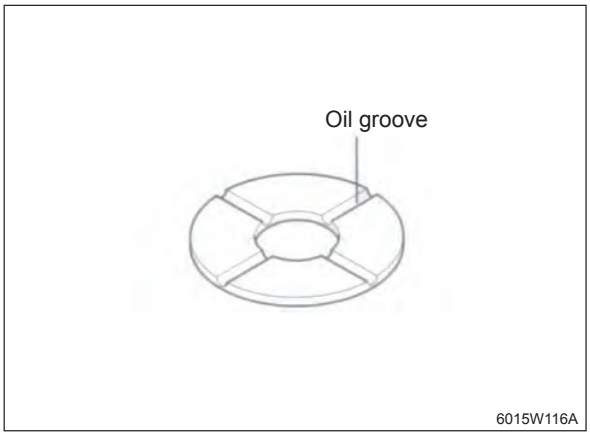




1. When replacing a worn or damaged part, use a new part that meets the international standard.
2. When replacing a packing or O-ring, fit a new one. Before installation, apply grease to the O-ring or oil seal ring.
3. When assembling a snap ring on a shaft or in a hole, ensure its sharply angled side to point the direction of force as shown in the first figure.
4. When installing a spring pin, insert its split portion in the direction to be forced as described in the second figure above.



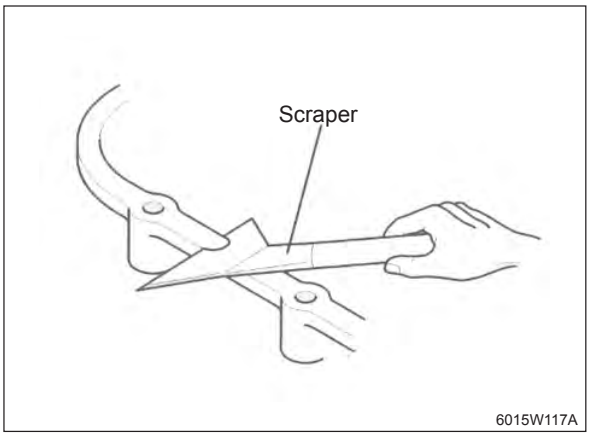
5. Replace the split pin with a new one and fix it firmly.



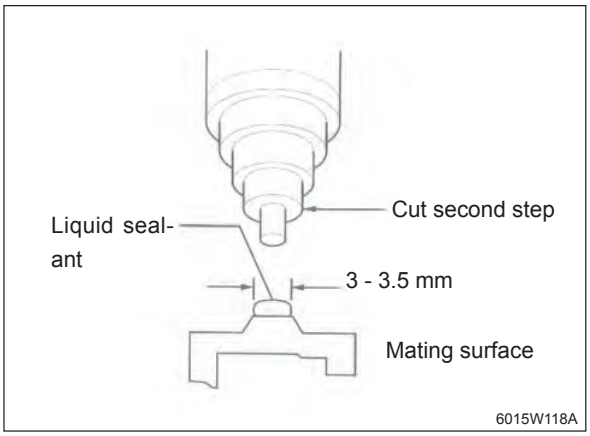
6. When the oil grooves are engaged with the thrust washer, be careful with assembly.

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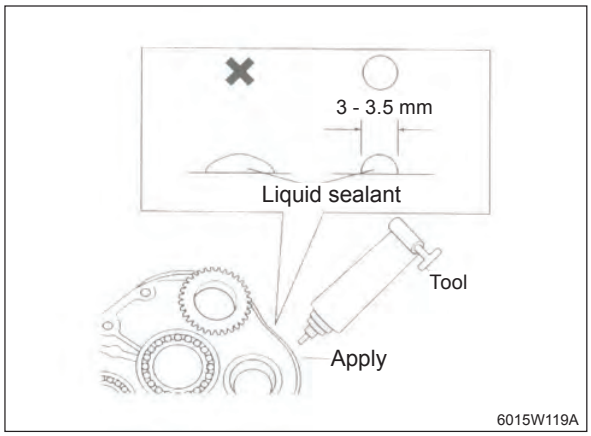
7. Use a liquid sealant removal scraper (flat) to remove any sealant left on the case. Make sure not to make any scratch bigger than 0.3 mm (0.012 in). If the surface is scratched, grind it with an oil grinder.



⚠ CAUTION

Do not use kerosene, heavy oil or diesel oil.

- **Before applying sealant: Use a proper cleaner to remove any oil and stain left on the surface. Never use gasoline.**
- **Cut the second step of the nozzle so that it can drop beads 3 to 3.5 mm wide.**
- **Fit the tube to the tool and use this tool to apply liquid sealant onto the mating surface.**



⚠ CAUTION

Spread liquid sealant. Otherwise, it can leak.

- **Apply sealant to the inner side of the attached surface.**
- **Assemble within 15 minutes after applying liquid sealant.**
- **After assembly, tighten the bolts in a diagonal order.**
- **When oiling the part, run the machine 30 minutes after oiling it.**

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4. INSPECTION AND CORRESPONDING ACTION

⚠ CAUTION
• **To inspect or service the tractor, stop the engine on level ground, apply the parking brake and chock the wheels in advance.**

4.1 DAILY INSPECTION

To prevent any future problem, it is important to be aware of the condition of the tractor. Therefore, check the followings before starting the engine:

4.1.1 CHECKING WORK PLACE

- Check that the work place hasn't had any problem.

4.1.2 CHECKING CONDITION AROUND TRACTOR

- Check the tires for inflation pressure, wear and damage.
- Check for leakage.
- Check the engine oil level.
- Check the transmission fluid level.
- Check the coolant level.
- Check the condition of the seat belt.
- Check the radiator screen and grill.
- Check the bolts and nuts on the tires are firmly tightened.
- Check the license plate and SMV emblem for damage. When necessary, clean or replace them.
- Follow all the instructions in the Danger, Warning and Caution decals.
- Clean the area around the exhaust manifold and engine muffler.

4.1.3 CHECKING WHEN SEATING ON DRIVER'S SEAT

- Check the brake and clutch pedals.
- Check the parking brake.
- Check the steering wheel.

4.1.4 CHECKING WHEN TURNING IGNITION SWITCH

- Check the function of the lamps and indicators on the instrument cluster.
- Check the head lamps, tail lamps and hazard warning flasher. When necessary, clean them.
- Check the performance of the instrument cluster and gauges.

4.1.5 CHECKING WHEN STARTING ENGINE

- Check if the lamp on the easy checker is not turned off.
- Check the color of exhaust gas.
- Check that the brake operates properly.

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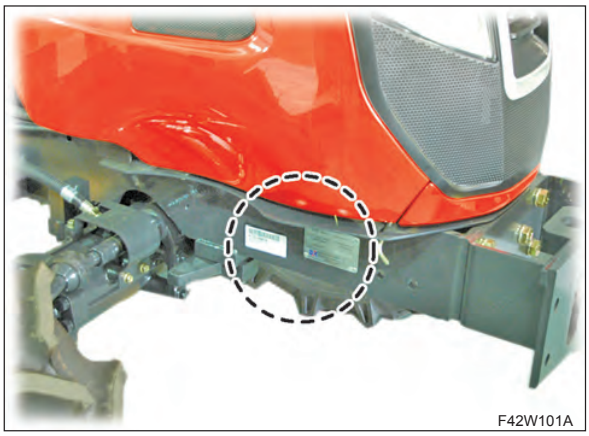
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5. GENERAL INFORMATION FOR SERVICE

5.1. MACHINE HISTORY AND INFORMATION

If you have any question or want to ask for service, check the operating hours, serial number, engine number and engine model of the tractor.

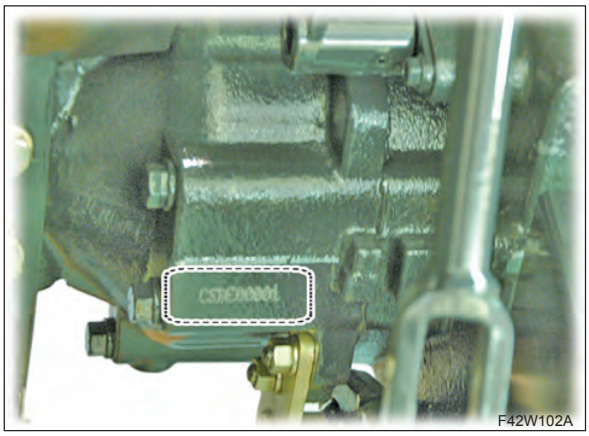
5.1.1 SERIAL NUMBER


F42W101A

Example : CSDE00001

It is specified on the serial number decal which is attached on the front right side of the front axle bracket.

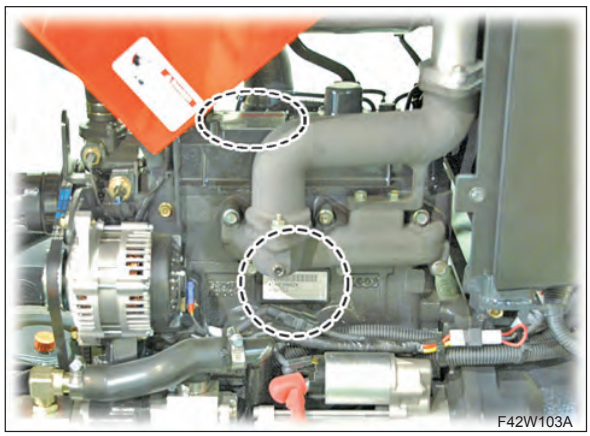
5.1.2 TRANSMISSION SERIAL NUMBER


F42W102A

Example : CSDE00001

It is stamped on the left side surface of the rear axle case.

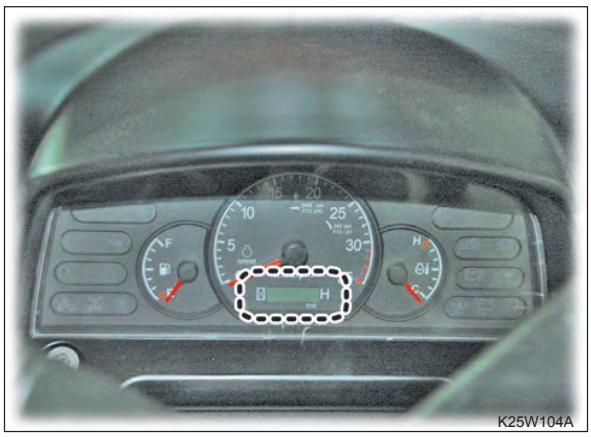
5.1.3 ENGINE NUMBER


F42W103A

Example : TANE0002

The engine number is stamped on the cylinder block and is specified on the decal which is attached to the cylinder block on the left side of the engine. Also, the decal indicating the engine model and standards is attached on the top of the engine cylinder head cover.

5.1.4 HOURMETER

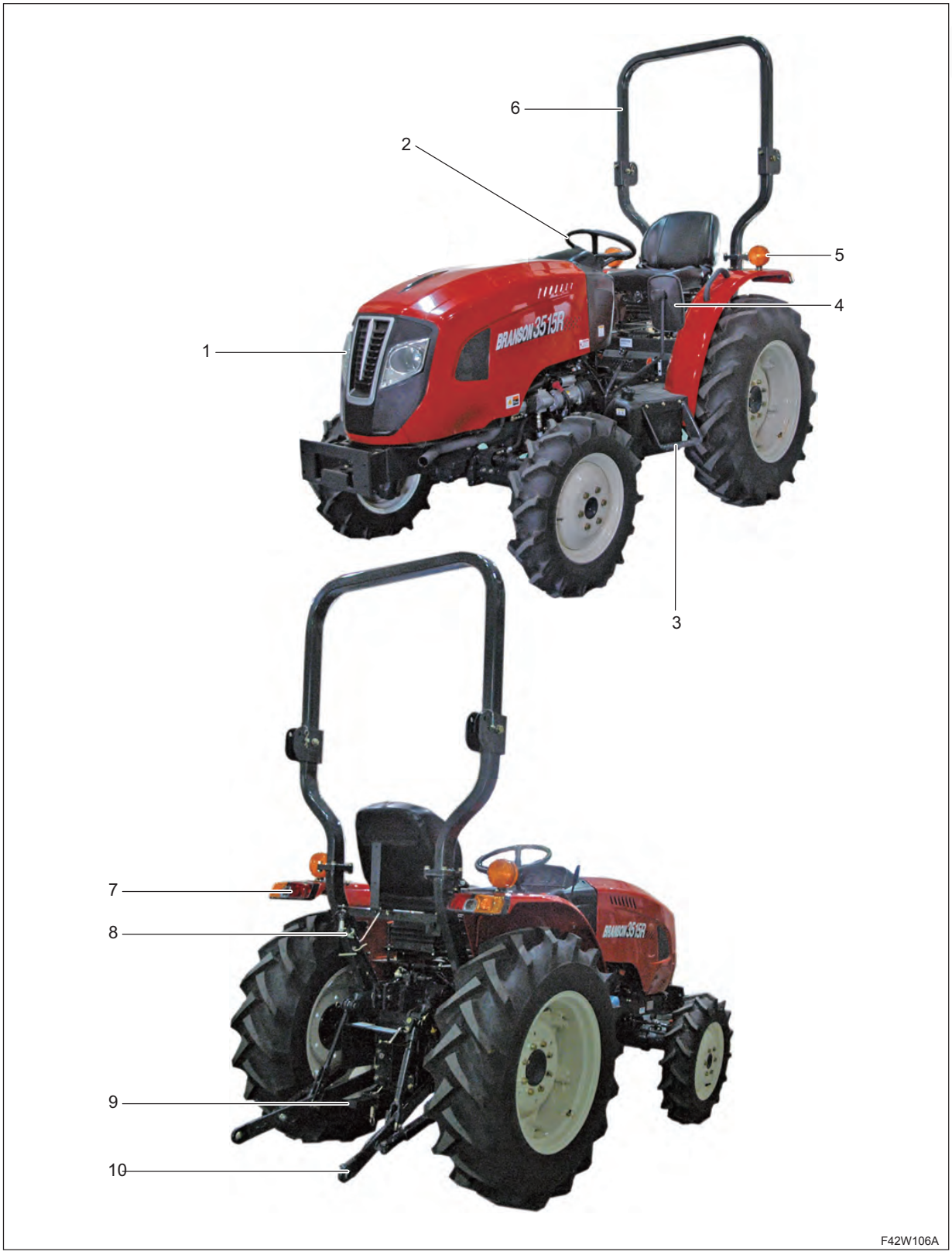

K25W104A

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6. COMPONENTS OF TRACTOR

6.1 FRONT AND REAR EXTERIOR VIEW



(1) Head lamp
(2) Handle
(3) Side step
(4) Rear view mirror
(5) Turn signal lamp
(6) ROPS assembly
(7) Combination lamp
(8) Top link
(9) Draw bar hitch assembly
(10) Lower link

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6.2 INTERIOR VIEW

MEC. MODEL



F42W108A



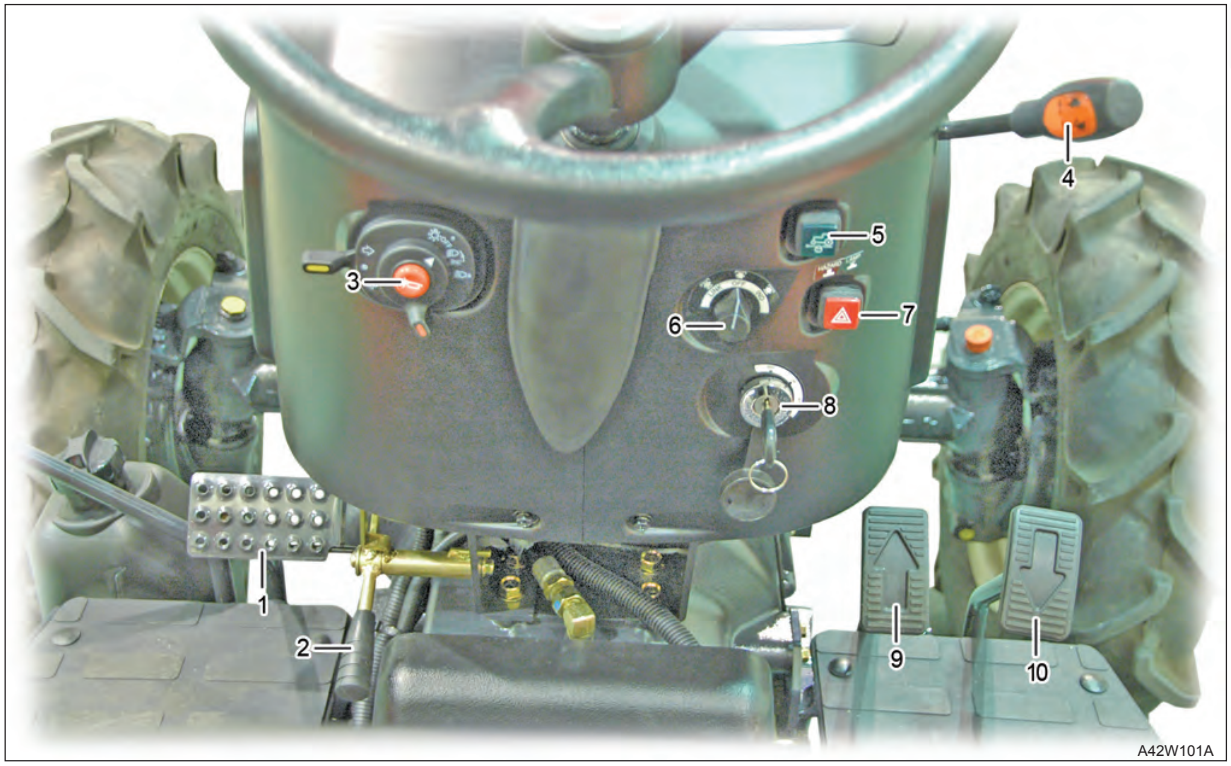
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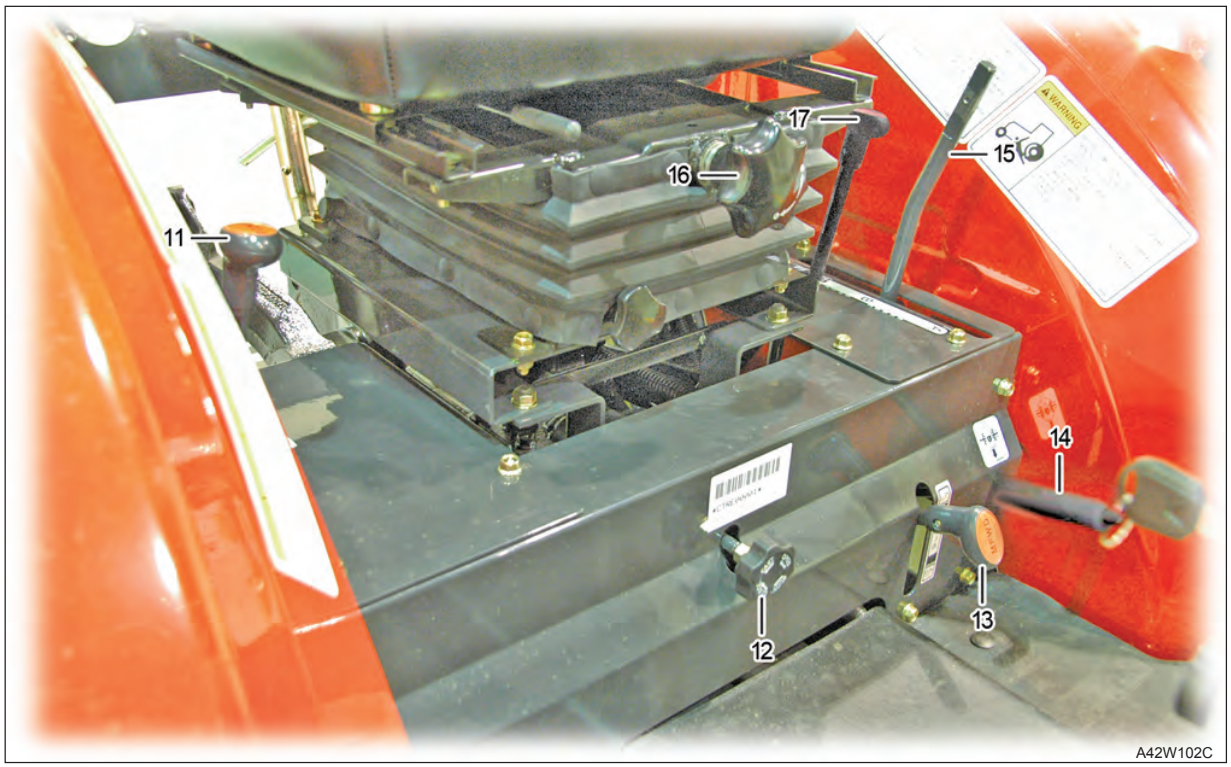
(1) Shuttle lever
(2) Turn signal/Light switch
(3) PTO ON/OFF switch
(4) Emergency switch
(5) Main switch
(6) Accel. lever
(7) Clutch pedal
(8) Brake pedal
(9) Accel. pedal
(10) Parking brake lever
(11) Main gear shift lever
(12) Position control lever
(13) Differential lock pedal
(14) Stop valve knob
(15) 4WD lever
(16) Range gear shift lever
(17) PTO gear shift lever

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HST MODEL





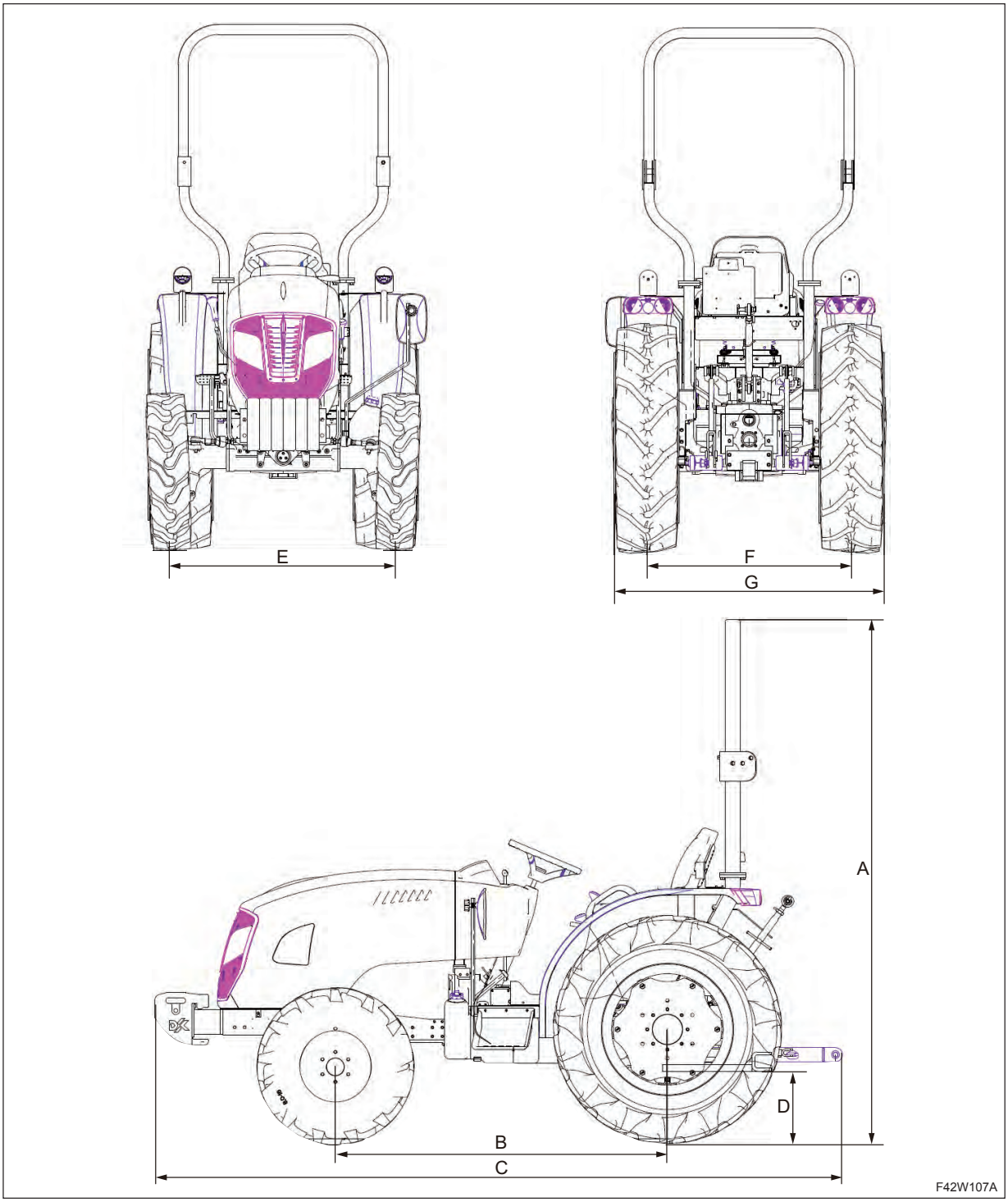
(1) Brake pedal
(2) Parking brake lever
(3) Turn signal light switch
(4) Accelerator lever
(5) Cruise switch
(6) PTO ON/OFF switch
(7) Emergency switch
(8) Main switch
(9) HST pedal (Forward)
(10) HST pedal (Reverse)
(11) Position control lever
(12) Stop valve knob
(13) 4WD lever
(14) Parking brake lever
(15) Range gear shift lever
(16) Seat adjust lever
(17) PTO gear shift lever

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7. TRACTOR SPECIFICATIONS

7.1 EXTERIOR DIMENSIONS



SIZE							mm (in.)
Model	A	B	C	D	E	F	G
3015R(h)/3515R(h)/F36R(h)	2,614 (102.9)	1,671 (65.79)	3,426 (134.88)	306 (12.05)	1,151 (45.31)	1,151 (45.31)	1,431 (56.34)
4015R(h)/F42R(h)	2,643 (104.06)	1,671 (65.79)	3,426 (134.88)	335 (13.19)	1,201 (47.28)	1,165 (45.87)	1,451 (57.13)

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7.2 MAJOR SPECIFICATIONS

MAJOR ITEMS			3015R(h)	3515R(h)/F36R(h)	4015R(h)/F42R(h)
Engine	Model		A1700N5	A1700N4	A1700T2
	Type		Vertical, water cooled 4-cycle, diesel engine		
	Emission regulation		Final Tier4	Final Tier4 / Stage III A	Final Tier4 / Stage III A
	Number of cylinders		3		
	Bore and stroke	mm (in.)	88 X 94 (3.46 X 3.70)		
	Total displacement	cc (in^3)	1,714 (104.59)		
	Rated speed	(rpm)	2,600		
	Power at rated engine rpm	kW(HP)	22(30)	25.7(35)	29.4(40)
	Intake type		Naturally	Naturally	Turbo
	Battery	(V)	12		
	Fuel		Diesel		
Capacity	Fuel tank	ℓ(u.s. gal)	27 (7.13)		
	Engine crankcase	ℓ(u.s. gal)	4.3 (1.14)		
	Coolant	ℓ(u.s. gal)	5.0 (1.32)		
	Transmission case	ℓ(u.s. gal)	MEC. MODEL: 34 (8.98), HST MODEL: 37(9.77)		
	Front axle	ℓ(u.s. gal)	6.4 (1.69)		
Dimension	Overall length (with F/weight)	mm (in.)	3,426 (134.88)		
	Overall width	mm (in.)	1,431 (56.34)		1,451 (57.13)
	Overall height	mm (in.)	2,614 (102.9)		2,643 (104.06)
	Wheel base	mm (in.)	1,671 (65.79)		
	Min. ground clearance	mm (in.)	306 (12.05)		335 (13.19)
	Tread	Front mm (in.)	1,151 (45.31)		1,201 (47.28)
		Rear mm (in.)	1,151 (45.31)		1,165 (45.87)
Transmission	Tire size	Front wheel	7.0-16 6PR		8.0-16 6PR
		Rear wheel	11.2-24 6PR		12.4-24 6PR
	Clutch		MEC. MODEL: Dry single plate clutch, HST MODEL: N/A		
	Steering system		Fully hydraulic		
	Transmission system		MEC. MODEL: Synchro shuttle, HST MODEL: HST		
	Brake system	Driving	Wet disc type		
		Parking	3015R(h), 3515R(h), 4015R(h): Foot brake lever type F36R(h), F42R(h): Hand brake lever type		

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MAJOR ITEMS			3015R(h)	3515R(h)/F36R(h)	4015R(h)/F42R(h)
Hydraulic oil	Hydraulic lift control		Position / Draft control		
	Pump flow capacity LPM		52		
	3-point hitch		CAT.1		
	Max. lift force (at lifting point) kg		1,500		
PTO	PTO (hydraulic)		Ø 35 mm - 6 splines		
	Revolution (rpm)	1st	560		
		2nd	780		
Draft system			Pin mounting type		
Driving speed	Forward km/h(MPH)		MEC. MODEL: 1.2 ~ 22.6 (0.7 ~ 14.1) HST MODEL: 0 ~ 29.27 (0 ~ 18.18)		MEC. MODEL: 1.22 ~ 23.69 (0.76 ~ 14.72) HST MODEL: 0 ~ 30.7 (0 ~ 19.07)
	Reverse km/h(MPH)		MEC. MODEL: 1.1 ~ 21.5 (0.7 ~ 13.4) HST MODEL: 0 ~ 29.27 (0 ~ 18.18)		MEC. MODEL: 1.16 ~ 22.54 (0.72 ~ 14.01) HST MODEL: 0 ~ 30.7 (0 ~ 19.07)
Weight (with F/W) kg(lbs.)			3015R/3515R/F36R/4015R/F42R: 1,450 (3,197) 3015h/3515h/F36h/4015h/F42h: 1,529 (3,371)		

※ 1. Rated engine speed: 2,600 rpm

2. Tire dynamic load radius (only for pneumatic tire): 540 (12.4 - 24), 515 (11.2 - 24)

3. Notes: The specifications are subject to change without notice.

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7.3 DRIVING SPEED

MEC. MODEL

SHIFT POSITION			SPEED			
			FORWARD DRIVING		REVERSE DRIVING	
MODEL	RANGE SHIFT	MAIN SHIFT	km/h	MPH	km/h	MPH
3015R 3515R F36R	A	1	1.2	0.7	1.1	0.7
		2	1.7	1.1	1.6	1.0
		3	2.2	1.4	2.1	1.3
		4	2.7	1.7	2.6	1.6
	B	1	3.2	2.0	3.0	1.9
		2	4.6	2.9	4.4	2.7
		3	6.0	3.7	5.7	3.6
		4	7.4	4.6	7.0	4.4
	C	1	9.7	6.0	9.2	5.7
		2	14.1	8.8	13.4	8.4
		3	18.3	11.4	17.4	10.9
		4	22.6	14.1	21.5	13.4
4015R F42R	A	1	1.22	0.76	1.16	0.72
		2	1.77	1.10	1.69	1.05
		3	2.30	1.43	2.19	1.36
		4	2.84	1.76	2.70	1.68
	B	1	3.32	2.06	3.16	1.96
		2	4.84	3.01	4.60	2.86
		3	6.28	3.90	5.97	3.71
		4	7.74	4.81	7.37	4.58
	C	1	10.15	6.31	9.66	6.00
		2	14.81	9.20	14.09	8.76
		3	19.21	11.94	18.27	11.35
		4	23.69	14.72	22.54	14.01

HST MODEL

SHIFT POSITION		SPEED (FORWARD AND REVERSE)	
TIRE SIZE	RANGE SHIFT	km/h	MPH
7-16/11.2-24	A	0 ~ 5.63	0 ~ 3.50
	B	0 ~ 15.36	0 ~ 9.54
	C	0 ~ 29.27	0 ~ 18.18
8-16/12.4-24	A	0 ~ 5.90	0 ~ 3.67
	B	0 ~ 16.1	0 ~ 10.0
	C	0 ~ 30.7	0 ~ 19.07

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8. PERIODIC INSPECTION

8.1 PERIODIC MAINTENANCE SCHEDULE TABLE

NO.	ITEMS \ RUNNING HOURS		OPERATING HOUR (HOUR OR YEAR)															
			50	100	150	200	250	300	350	400	450	500	550	600	650	700	1YR	2YR
1	Engine oil	R	⦿					●				●						
2	Engine oil filter	R	⦿					●					●					
3	Transmission fluid	R	⦿						●						●			
4	Transmission fluid filter HST filter	R	⦿						●						●			
5	Front axle fluid	R	⦿						●						●			
6	Radiator cleaning	CL	At the time the coolant is replaced															
7	Fuel oil filter and element	C		●		●		●		●		●		●		●		
		R						●						●				
8	Coolant	R	Check before every work (Replace every year)															
9	Air cleaner element	CL	●	●	●	●	●	●	●	●	●		●	●	●	●		
		R										R						
10	Fan and radiator cleaning	CL	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
11	Battery solution	R	Replace every two years															
12	Battery (specific gravity)	C		●		●		●		●		●		●		●		
13	Fuel pipe and connection	C	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
		R																●
14	Steering wheel hose	C	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
		R																●
15	Radiator hose	C				●				●				●				
		R																●
16	Hydraulic fluid hose	C		●		●		●		●		●		●		●		
		R															●	
17	Fuel hose	C		●		●		●		●		●		●		●		
		R															●	
18	Electric cables	C	●	●	●	●	●	●	●	●	●	●	●	●	●	●		

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NO.	RUNNING HOURS / ITEMS		OPERATING HOUR (HOUR OR YEAR)															
			50	100	150	200	250	300	350	400	450	500	550	600	650	700	1YR	2YR
19	Greasing	C	●	●	●	●	●	●	●	●	●	●	●	●	●	●		
20	Tightening handles	C		●		●		●		●		●		●				
21	Tightening bolts&Nuts	C	●	●		●		●		●		●		●		●		
22	Cooling fan belt	A	●	●		●		●		●		●		●		●		
23	Clutch [MEC. MOEDL]	A		●		●		●		●		●		●		●		
24	Brake	A		●		●		●		●		●		●		●		
25	Engine breed pipe	C	●	●		●		●		●		●		●		●		
26	Engine crankcase cleaning	CL						●						●				
27	Intake/exhaust valves	C												●				
28	Fuel injection valve	C												●				
29	Generator motor	C	●	●				●				●						
30	Hydraulic system	C	●	●				●				●						

※ Meanings of symbols=R:Replace C:Check A:Adjust CL:Clean

※ Inspection should be done every 50 hours. If the tractor is not used much, inspect every year.

※ Replace parts every two years regardless of running hours.

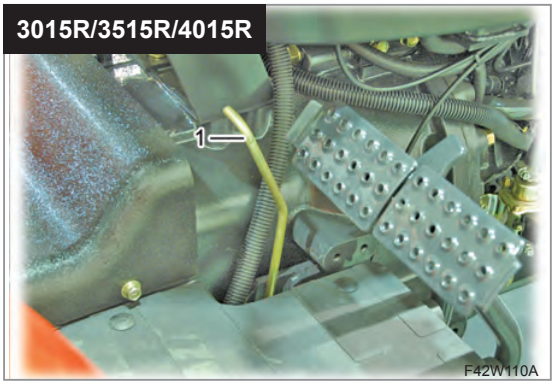
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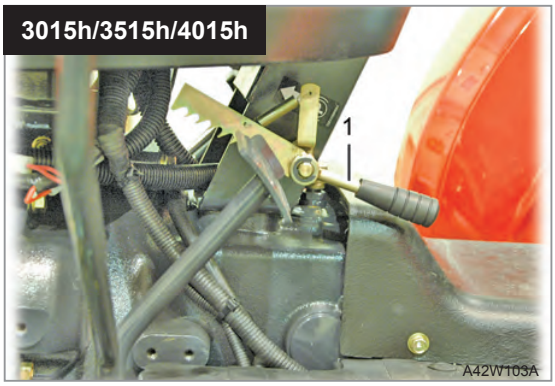
8.2 INSPECTION DESCRIPTION

⚠ CAUTION

3015R/3515R/4015R



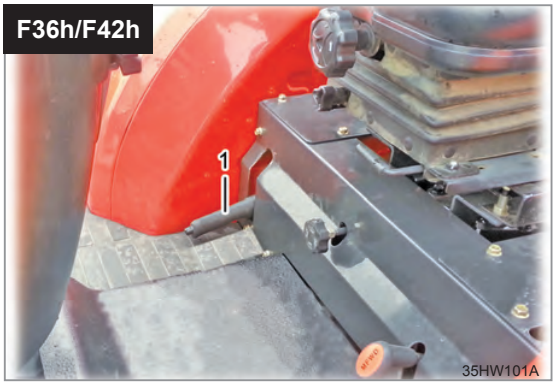
3015h/3515h/4015h



F36R/F42R



F36h/F42h

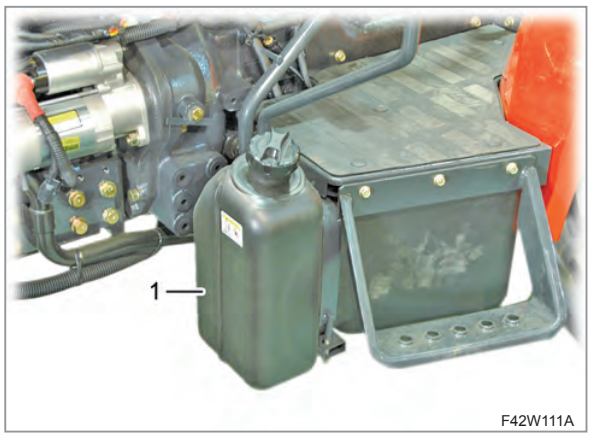


- **Before working on this machine, lower any attachment or implement on the ground and apply the parking brake (1).**

8.2.1 FUELING INTO FUEL TANK

⚠ CAUTION

- **When fueling, be careful not to spill fuel and watch out for any smoke or flame around. Make sure to fuel only with the engine stopped.**



1. Check the fuel level through the instrument cluster with the engine running.
2. When the pointer on the fuel gauge is on the first quarter zone, add fuel to the fuel tank (1).

FUEL TANK CAPACITY	27 ℓ (7.13 u.s.gal.)

⚠ CAUTION

- **Make sure that no dust enters the fuel filler hole.**
- **If the fuel tank becomes empty, air may enter the fuel system, causing an engine starting problem. Add fuel to the tank before it becomes empty.**
- **When fueling, be careful not to spill it. If spilled, wipe it out thoroughly.**
- **After daily work, top up the fuel tank to prevent any foreign material from entering the tank.**

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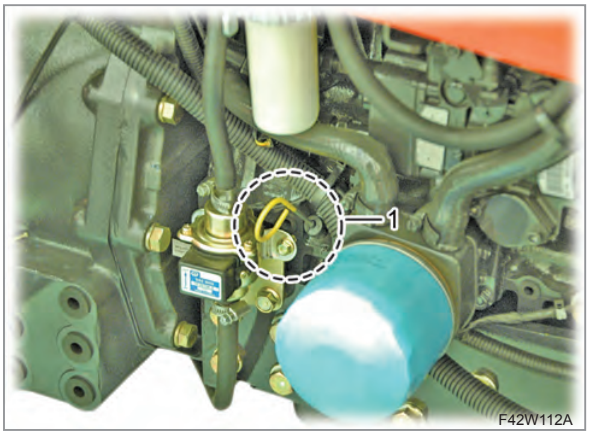
8.2.2 CHECKING ENGINE OIL

⚠ WARNING

- **Never mix different types of oil, but use the only engine oil specified by BRANSON. (SAE 15W-40, Final Tier4: grade CJ or higher, Stage IIIA: Grade CG or higher)**
- **Never attempt the start the engine without sufficient engine oil.**

⚠ CAUTION

- **Make sure to stop the engine before checking the engine oil level.**

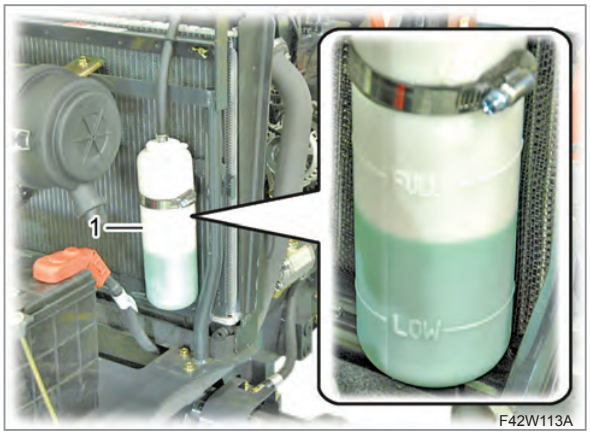


1. Make sure that the machine is parked on level ground.
2. Remove any dust around the dipstick inlet.
3. Pull out the dipstick (1), wipe its mark, insert it and pull it out again to check the oil level and oil condition.
4. The oil level should be between the min. and max. lines and the oil color should not be too dark or too light.
5. If not normal, add engine oil up to the max. line on the dipstick. (Refer to 8.2.8 Changing engine oil in this chapter.)

8.2.3 CHECKING COOLANT AMOUNT

⚠ CAUTION

- **Hot coolant or steam from the pressurized cooling system can be surged leading to a serious scald. Make sure to stop the engine before checking the coolant level. Remove the filler cap only when it is cooled down enough to touch by a hand. At this moment, release residual pressure in the system and then unscrew the cap slowly to remove it.**



1. Check the coolant level in the reservoir (1).
2. The coolant level should be between the lower and upper limits while the engine is running.
3. If the coolant level is below the min. level, add coolant up to the max. limit into the reservoir.

RESERVOIR CAPACITY	0.45 ℓ (0.12 u.s.gal.)

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8.2.4 CHECKING LAMPS


F42W114A

1. Check the head lamps, turn signal lamps and brake lamps.
2. If any lamp is malfunctioning or damaged, replace it with a new one.

8.2.5 CHECKING SEAT BELT



F42W115A

1. Inspect the seat belt (1) and its anchor at least every year. Check the belt for looseness of its anchor, cut, excessive wear or abnormal wear. If a damage is found, replace the seat belt with a new genuine BRANSON seat belt.

8.2.6 CLEANING RADIATOR DUST GRILL

⚠ CAUTION

- **Check and clean the dust grill after stopping the engine.**



A42W109A

1. Check the front of the hood or side grill for dust, and clean them accordingly.
2. Open the hood and unscrew the fix bolt (1), and then pull out the dust grill (2) to sideway to remove. Then, remove dust from the dust grill.

⚠ CAUTION

- **Clean the grille and dust grill to prevent the engine from overheating and let sufficient air flow into the air cleaner.**

8.2.7 CHECKING INSTRUMENT CLUSTER SIGNALS


F42W117A

1. Turn the ignition switch to the START position.
2. Check that the gauges and signals are working properly.
3. If not, check the corresponding lamp and electric circuit.
4. If necessary, replace the part with a new one.

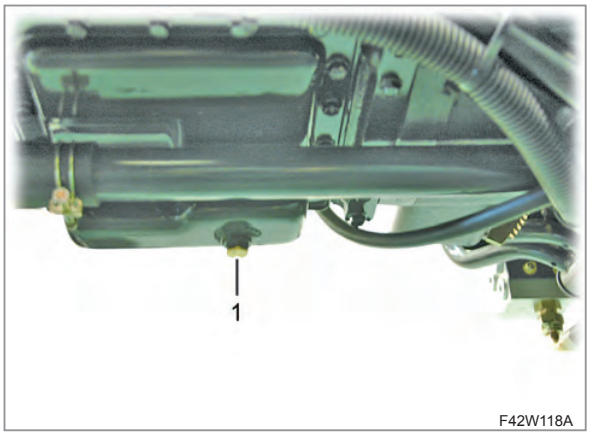
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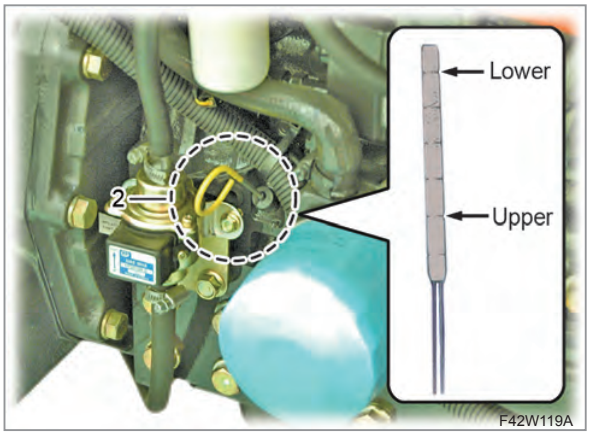
8.2.8 CHANGING ENGINE OIL

⚠ CAUTION

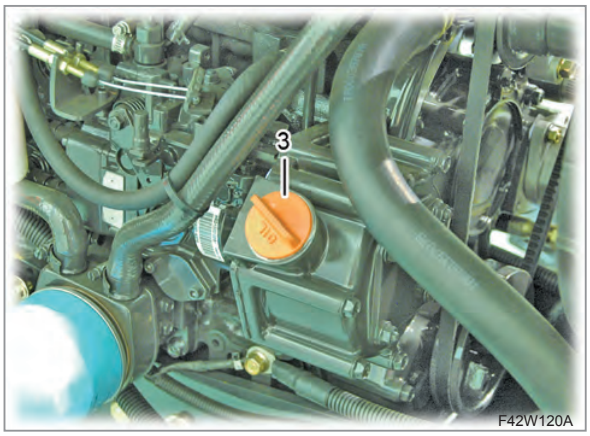
- **Make sure to stop the engine before changing engine oil.**
- **Make sure that the engine is sufficiently cooled down enough to touch by a hand.**



1. Remove the drain plug (1) to drain engine oil.
2. Fit the drain plug and tighten it to 50 N.m (37 lb.ft).
3. Add clean oil with proper viscosity to the crankcase.



4. Wait for 15 minutes and check the oil level. The oil level should be up to the upper limit on the dipstick (2).



5. Run the engine for a while and check the oil filler hole (3) and drain plug for oil leakage.

SPECIFIED AMOUNT OF ENGINE OIL	4.3 ℓ (1.14 u.s.gal.)
LUBRICANTS	3015R/3515R/4015R (Final Tier4): SAE 15W-40 Grade CJ or higher F36R/F42R (Stage IIIA): SAE 15W-40 Grade CG or higher

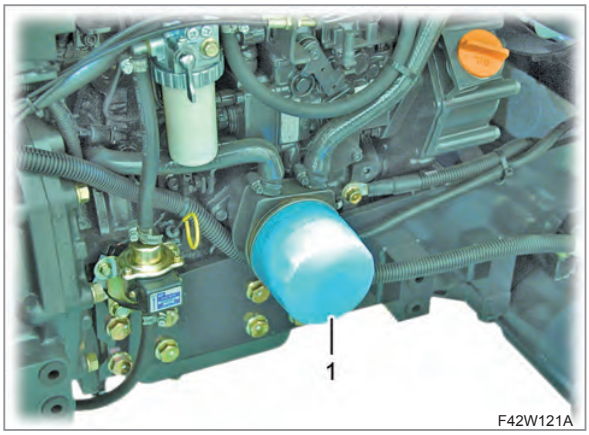
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8.2.9 REPLACING ENGINE OIL FILTER

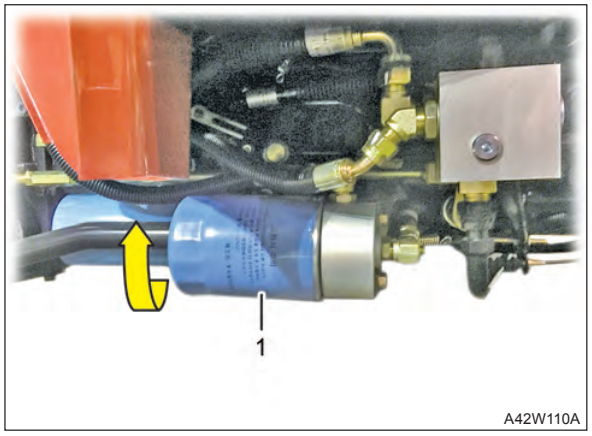
⚠ CAUTION

- **Be sure to use the only BRANSON genuine oil filter not to damage the engine. Replace the oil filter only after the engine is stopped and cooled down.**



1. Unscrew the filter element (1) and clean its mounting surface.
2. Replace the O-ring on the surface which is to be against a new filter.
3. Apply a thin film of clean oil around the seal ring of a new filter.
4. Fit the new filter and tighten it by hand.
5. Start the engine and check the filter base for oil leakage.
6. Stop the engine and check the oil level. If the level is too low, add more oil.

8.2.10 REPLACING HST FILTER [HST MODEL]



1. Turn the filter element (1) counterclockwise to remove.
2. Apply a clean oil around the seal ring of element of a new filter and tighten it.
3. Start the engine and check oil leakage after operate forward and reverse.

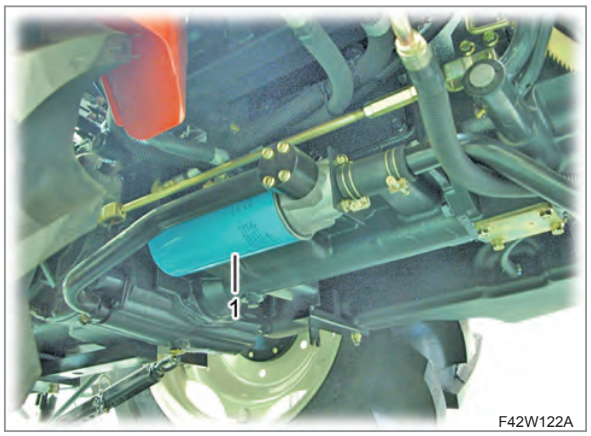
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8.2.11 REPLACING TRANSMISSION/ HYDRAULIC FILTER

⚠ CAUTION

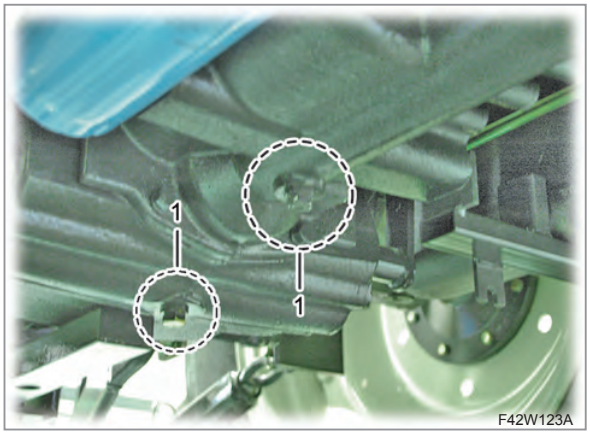
- **Replace the transmission fluid filter only after the engine is stopped and cooled down.**
- **Be sure to use the BRANSON genuine oil filter to keep the transmission intact.**



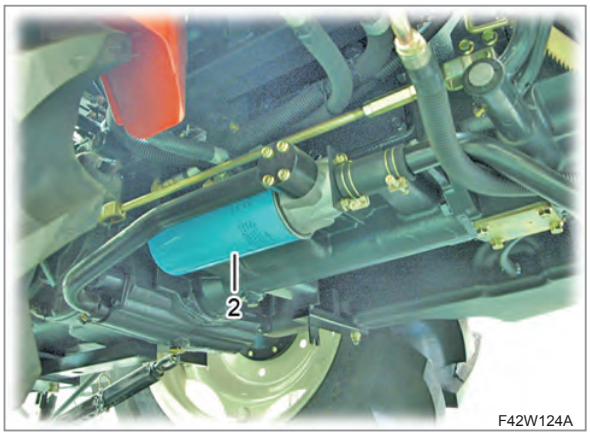
1. Remove the filter element (1) by unscrewing it.
2. Apply clean oil onto the seal ring of a new filter element and tighten this filter element.
3. Start the engine and check the filter base for fuel leakage.
4. Stop the engine and check the oil level. If the level is too low, add more oil.

8.2.12 CHANGING TRANSMISSION FLUID/ HYDRAULIC OIL

1. Start the engine and activate several hydraulic functions to increase oil temperature.
2. Park the tractor on level ground and lower the implement onto the ground.
3. Stop the engine, remove the ignition key and apply the parking brake. (Set the transmission into the neutral state.)



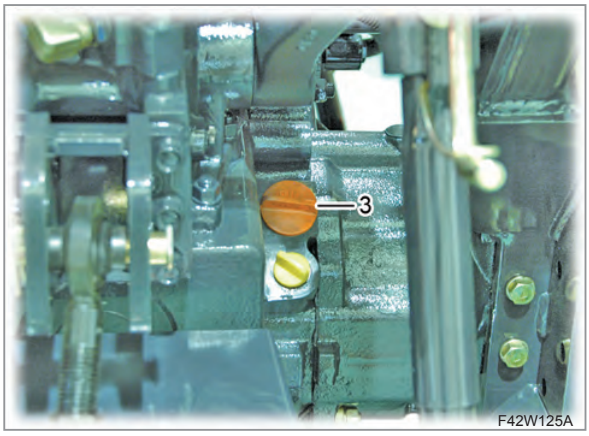
4. Remove the drain plug (1).



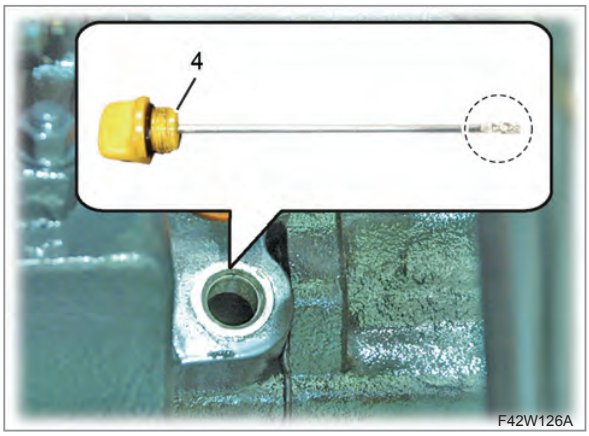
5. Replace the transmission fluid/hydraulic oil filter element (2).
6. Before adding clean oil, replace the seal and tighten the drain plug to 5 kg.m (36 lb.ft).

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7. Add transmission fluid/hydraulic oil into the transmission case through its filler hole (3).
8. Run the engine for a moment to activate the hydraulic pressure function. Stop the engine.

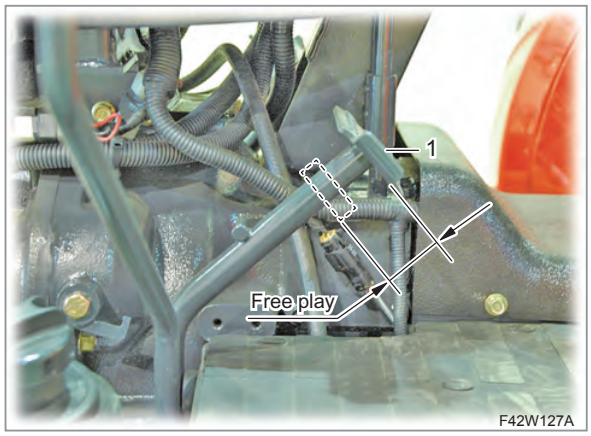


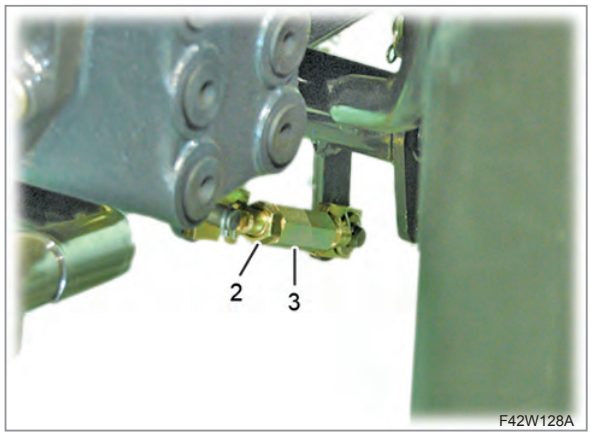
9. Wait for 10 to 15 minutes before checking the oil level. The oil level should be on the mark on the dipstick (4). If not, add oil up to the specified upper limit.

TRANSMISSION FLUID/HYDRAULIC OIL AMOUNT	**MEC. MODEL**	34 ℓ (8.98 u.s.gal.)
	HST MODEL	37 ℓ (9.77 u.s.gal.)

8.2.13 ADJUSTING CLUTCH PEDAL [MEC. MODEL]

Check that the clutch pedal moves by itself when depressing it slightly and releasing it.





1. Make sure that the machine is parked on level ground.
2. Depress the clutch pedal (1) slightly and then release it.
3. Check if the clutch pedal moves when released.
4. Unscrew the lock nut (2) of the clutch rod and adjust the turn buckle (3) to adjust the free play.
5. Tighten the lock nut.

CLUTCH PEDAL FREE PLAY	25 - 35 mm (0.98 - 1.38 in.)

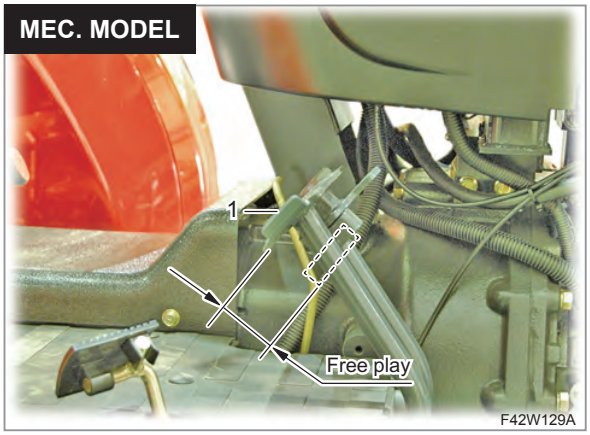
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8.2.14 ADJUSTING BRAKE PEDAL

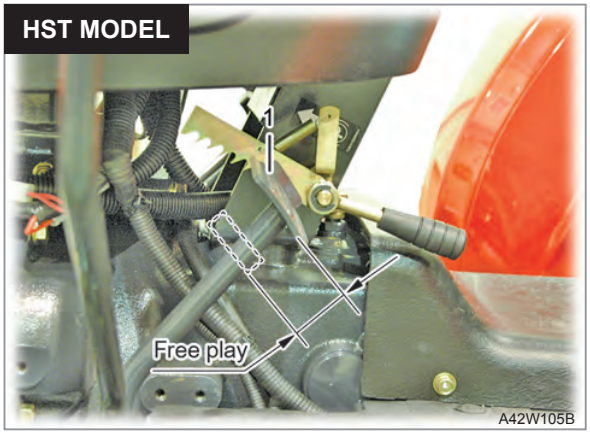
1. Release the parking brake.

MEC. MODEL

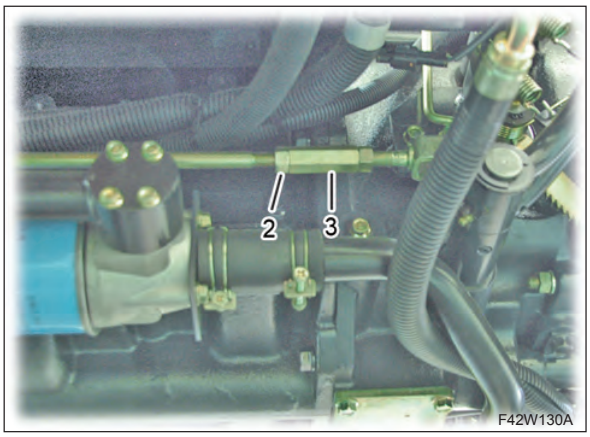


F42W129A

HST MODEL



A42W105B



F42W130A

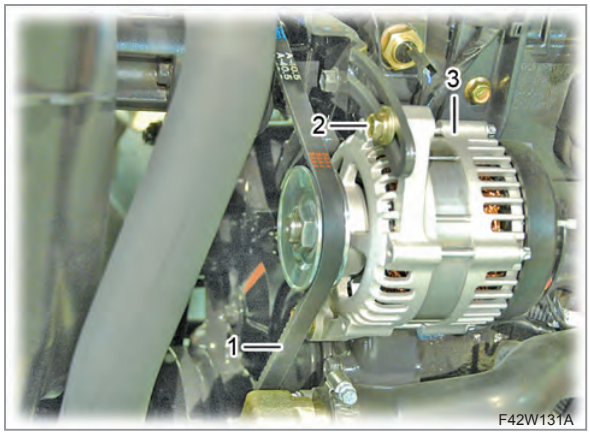
2. Depress the brake pedal (1) slightly and then release it.
3. Check the free play of the pedal when releasing it.
4. Unscrew the lock nut (2) of the brake rod under the floor and turn the turn buckle (3) to adjust the free play.
5. Adjust both pedals to the same amount of free play.
6. Tighten the lock nut.

BRAKE PEDAL FREE PLAY	5 - 10 mm (0.19 - 0.39 in)

8.2.15 ADJUSTING FAN BELT TENSION

⚠ CAUTION

- **Stop the engine before adjusting the tension of the fan belt.**
- **When adjusting the fan belt tension, be careful not to hurt your hands and damage the alternator.**



F42W131A

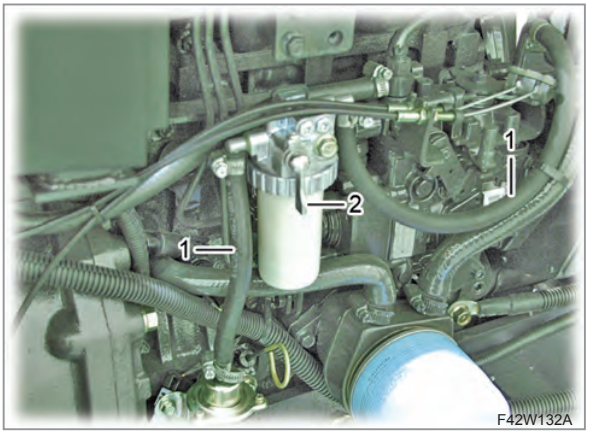
1. Stop the engine, remove the ignition key and apply the parking brake.
2. Check the tension of the fan belt (1).
3. Loosen the tension adjusting bolt (2).
4. Place a stick or pipe between the alternator (3) and cylinder block.
5. Push the alternator outwards to adjust the fan belt tension.
6. Tighten the adjusting bolt.

BELT DEFLECTION [Pressing with force of 10 kg (22 lb)]		10-15 mm (0.39-0.59 in)
TORQUE VALUE	Mounting bolt	26 Nm(19 lb.ft)
	Adjusting bolt	52 Nm(38 lb.ft)

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8.2.16 CHECKING FUEL LINE



1. Check the fuel line (1) and clamp for leakage.
2. If any abnormal condition is found, replace the corresponding part with a new one.

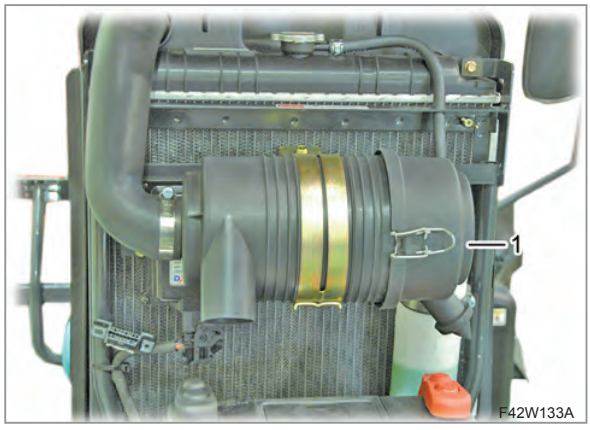
⚠ CAUTION

If replacing the fuel line, make sure to bleed the fuel system.

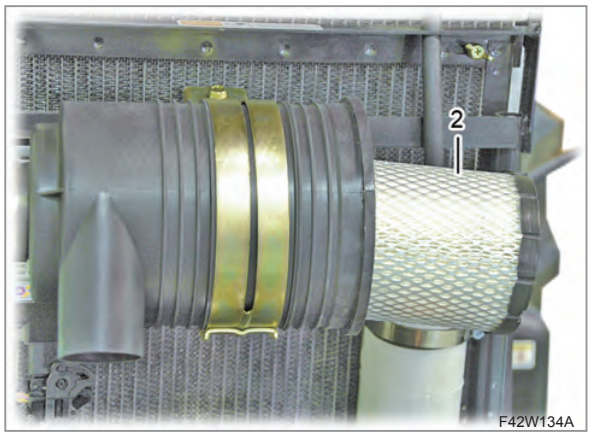
▶ BLEEDING FUEL LINE

- **Turn the cock (2) of the fuel filter to the opening position.**
- **Unscrew the bleeding bolt of the fuel filter slightly.**
- **Turn the ignition switch to crank the engine. Then, check if fuel flows through the bleeding bolt.**
- **If fuel without bubbles flows out, stop cranking the engine and tighten the bleeding bolt completely.**
- **If the engine is still hard to be started, loosen one to two nozzle holders and crank the engine to bleed the system.**

8.2.17 CLEANING AIR CLEANER ELEMENT



1. Open the air cleaner cover (1) and pull out the air cleaner element.



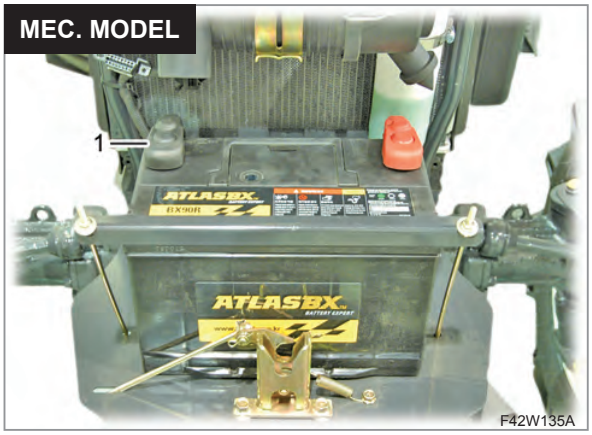
2. Remove the element (2) and dust it off. If dust is still attached to the element, insert a nozzle into it and blow dust out from inside with compressed air (up to 600 kPa, 6 bar, 90 psi).
3. Replace the part every year or every 6th cleaning schedule whichever comes first.

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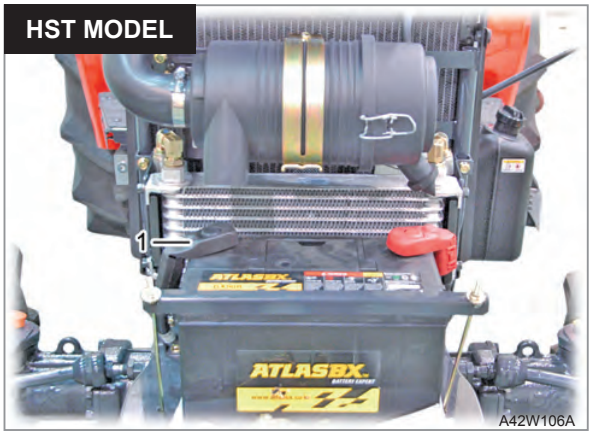
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8.2.18 BATTERY

MEC. MODEL



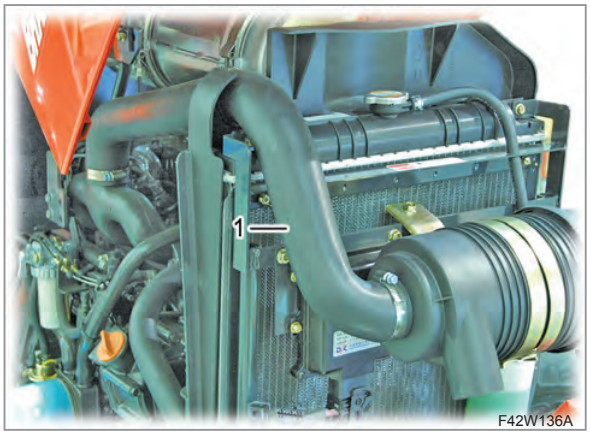
HST MODEL

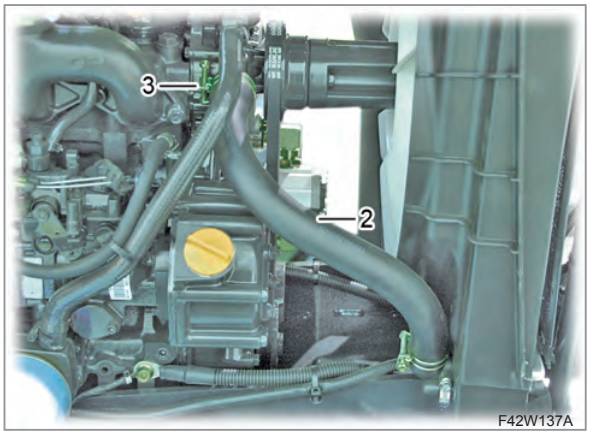


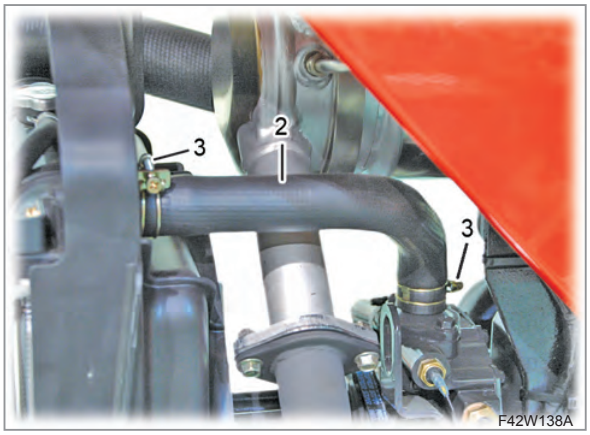
⚠ CAUTION

- **Keep any spark or flame away from the battery. It can cause explosion with its gas.**
- **To avoid a spark, disconnect the negative (ground) battery cable (1) first. When connecting the battery, connect the positive cable first.**
- **Never charge the battery with its positive and negative poles touching a metallic object. Use a voltmeter or hydrometer.**
- **If the battery is frozen, it can explode. Heat the battery to 16°C (60°F) before charging it.**
- **The battery cannot be charged when the engine speed is below 1,000 RPM. (It can be charged with the engine running at 1,500 RPM or higher speed.)**

8.2.19 CHECKING RADIATOR AND INTAKE HOSES





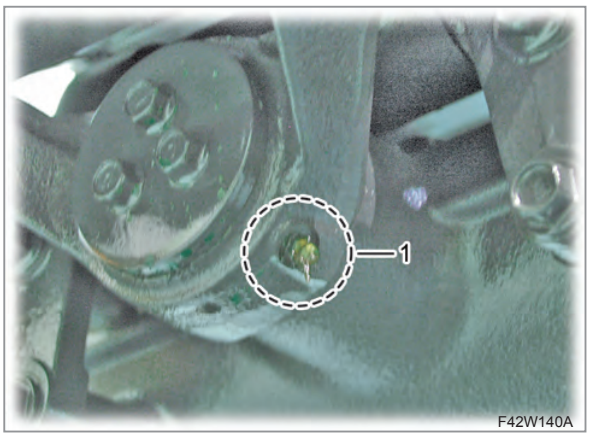


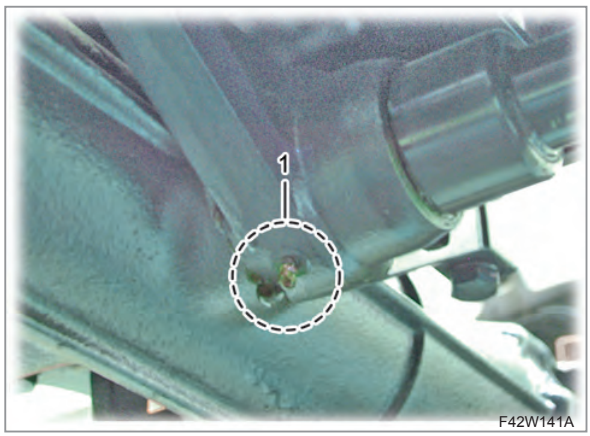
1. Check the condition of the air intake hose (1) and radiator hose (2) every six months or 200 hours of use whichever comes first.
2. Check the hose and tighten the clamp (3).
3. A leaking or damaged hose can be a major cause of dust in the engine.
4. If the hose is worn or damaged, replace it with a new one.
5. It is recommended to replace the radiator hose every two years.

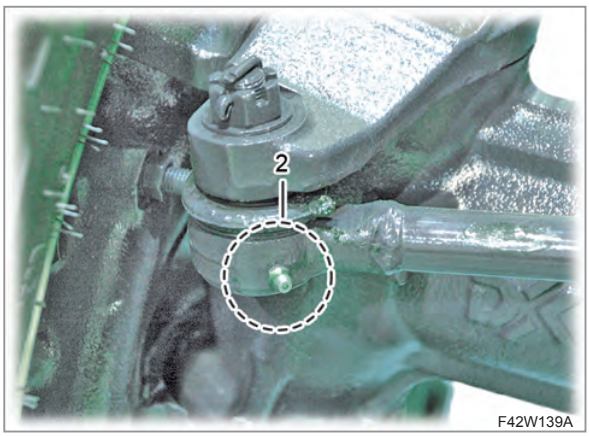
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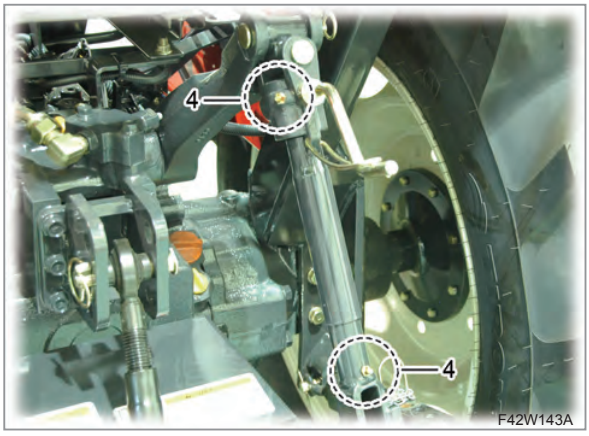
8.2.20 APPLYING GREASE











1. Apply grease every 50 hours of use.
2. Check the target positions and apply a proper amount of grease on them before beginning your work. Make sure to apply grease on them especially after working in a wet field.

- Grease applied components
  - Front/Back of front axle bracket (1)
  - Left/Right of front axle (2)
  - Left/Right of brake rod (3)
  - Lift link and more (4)

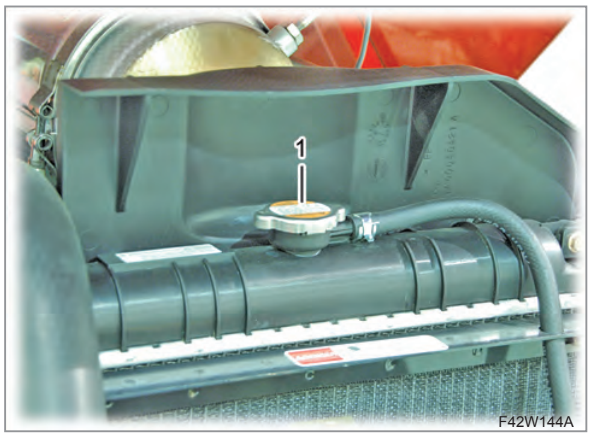
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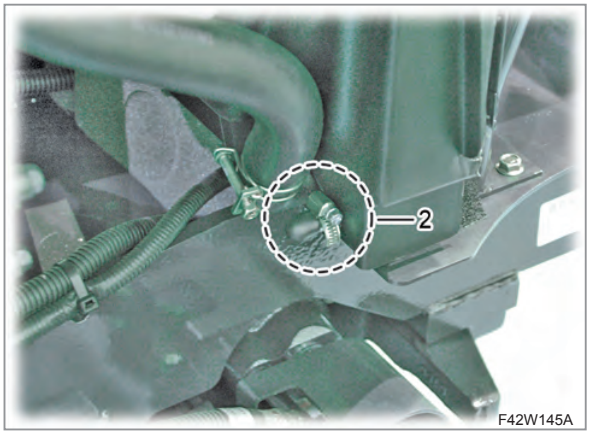
8.2.21 ADDING ANTI-FREEZE

⚠ CAUTION

- **Never remove the cap when the coolant temperature is over the boiling point. To release pressure, unscrew the radiator cap (1) slightly. Then, unscrew it completely.**
- **Never pour cold water or coolant onto the hot engine. Always use warm liquid until the engine is sufficiently cooled down.**



1. If the tractor is equipped with a cabin, turn the heater control dial to the right end.
2. To release pressure, unscrew the radiator cap (1) slightly. Then, unscrew it completely.
3. To collect coolant, place a container under the drain hole.



4. Remove the radiator drain cap (2) completely.
5. After coolant is completely removed from the radiator, fit the plug and add clean water to the system.
6. Run the engine until its temperature reaches its operating temperature.



7. Stop the engine and add clean water to the system.
8. Run the engine until its temperature reaches its operating temperature. Then, stop the engine.
9. Then, add the specified anti-freeze to the system.
10. Add the anti-freeze to the “FULL” limit mark.
11. Start the engine and run it for 15 minutes.
12. Stop the engine and add the anti-freeze up to the "FULL" mark.
13. Tighten the radiator cap.

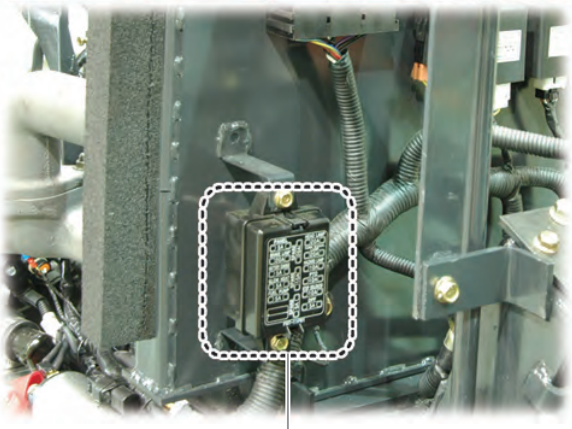
Note: For efficient cooling, the dust grill of the radiator should always be kept clean. Remove any dust or oil from it and spread any bent cooling fin straight.

RESERVOIR CAPACITY	0.45 ℓ (0.12 u.s.gal.)

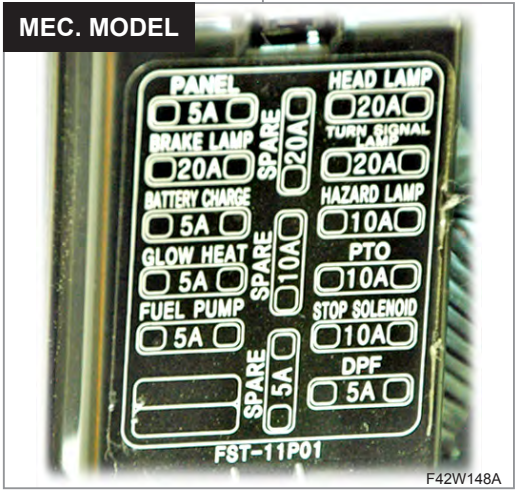
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8.2.22 FUSE AND RELAY

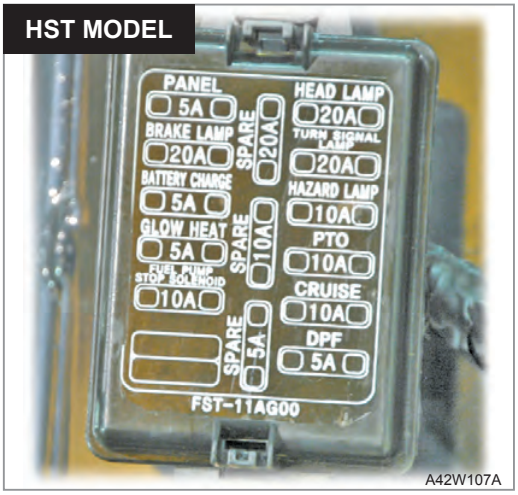


MEC. MODEL



F42W148A

HST MODEL



A42W107A

F42W147A

1. A fuse is to protect circuits from electric overload.
2. The relay control current is high load current which flows through a circuit.
3. To prevent damage to the electric system, never use a fuse with higher capacity than the one already installed.

ITEM	SPECIFICATION	DESCRIPTION
Fuse 1	5 A	Panel
Fuse 2	20 A	Brake lamp
Fuse 3	5 A	Battery charge
Fuse 4	5 A	Glow/Heat
Fuse 5	5 A	Fuel pump [MEC. MODEL]
		Fuel pump, Stop solenoid [HST MODEL]
Fuse 6	20 A	Spare
Fuse 7	10 A	Spare
Fuse 8	5 A	Spare
Fuse 9	20 A	Head lamp
Fuse 10	20 A	Turn signal lamp
Fuse 11	10 A	Hazard lamp
Fuse 12	10 A	PTO
Fuse 13	10 A	Stop solenoid [MEC. MODEL]
		Cruise [HST MODEL]
Fuse 14	5 A	DPF [3015R/3515R/4015R]

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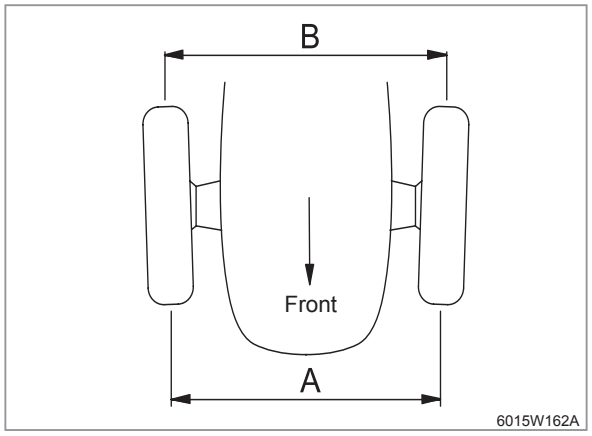
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8.2.23 TIRE INFLATION PRESSURE

1. Performance and expectancy of life of tires depend on maintaining tire's inflation pressure properly.
2. If tire inflation pressure is insufficient, it can cause premature wear. If it is excessive, it can reduce traction and increase wheel slip.
3. The specified tire pressure is different not only by working environment and load, but also by tractor models. Make sure to follow the specified standard inflation pressure set in this manual.

STANDARD	Front wheel	2.0 kg/cm^2 (28.44 psi)
	Rear wheel	1.3 kg/cm^2 (18.49 psi)
WITH LOADER	Front wheel	3.0 kg/cm^2 (42.67 psi)
	Rear wheel	2.0 kg/cm^2 (28.44 psi)

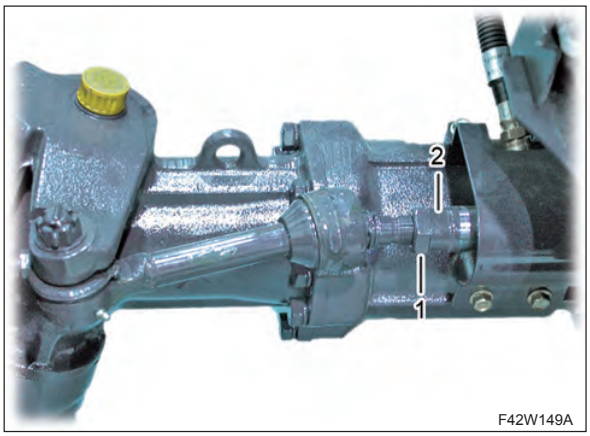
8.2.24 CHECKING TOE-IN



(A) Front distance (B) Rear distance

1. Park the machine on level ground.
2. Measure the front distance (A).
3. Measure the rear distance (B).
4. The difference (B- A) between the front distance (A) and rear distance (B) should be over 4 - 8 mm (0.157 - 0.314 in.).

8.2.25 ADJUSTING FRONT WHEEL TOE-IN

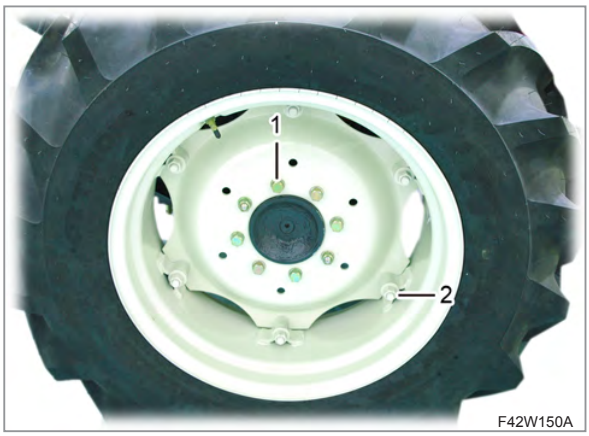


1. Unscrew the mounting nut (1) on the tie rod.
2. Turn the rod (2) inwards or outwards. (Two rods should be same in length.)
3. Adjust the toe-in and tighten the mounting nut (1).

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8.2.26 TIGHTENING WHEEL BOLT



Tighten all the bolts on the wheel after initial 4 and 8 hours of operation. Then, check tightness of the bolts every 100 hours of use.

ITEM		TORQUE VALUE
Front wheel	Hub bolt	18 - 20 kg.m (130 - 144 lb.ft) (176 ~ 196 N.m)
	Rim disc mounting bolt	22 - 24 kg.m (158 - 173 lb.ft) (216 ~ 235 N.m)
Rear wheel	Hub bolt (1)	17 - 21 kg.m (122 - 151 lb.ft) (167 ~ 206 N.m)
	Rim disc mounting bolt (2)	17 - 21 kg.m (122 - 151 lb.ft) (167 ~ 206 N.m)

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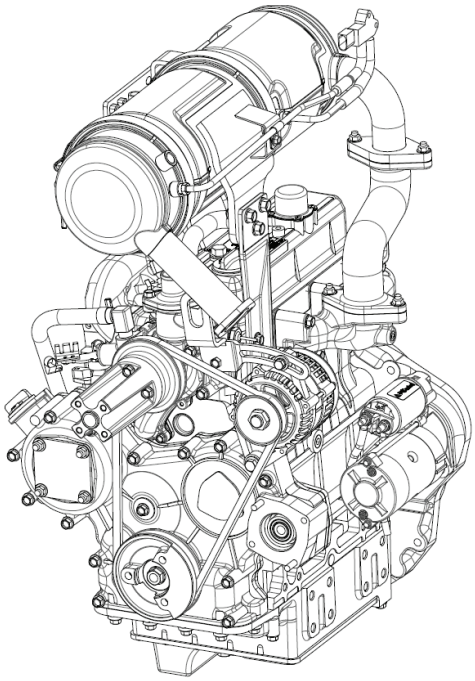
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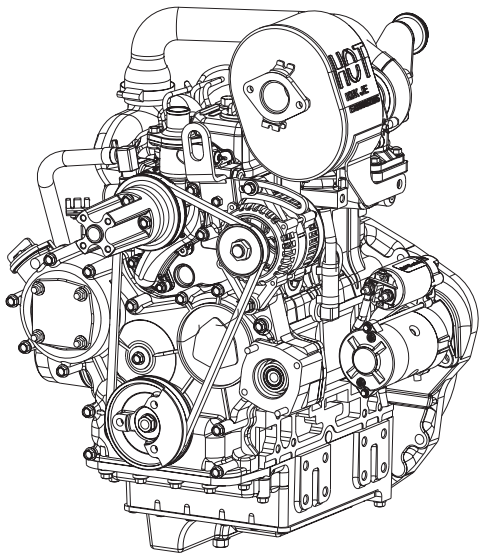
1. EXTERIOR AND NAMES OF PARTS

1.1 SPECIFICATION

3015R(h)/3515R(h)/4015R(h)



F36R(h)/F42R(h)



K23W226A

		A1700N5	A1700N4	A1700T2
Type		Vertical Water-Cooled 4 Cycle Diesel Engine		
Emission Regulation		3015R(h)/3515R(h)/4015R(h): EPA Final Tier4 F36R(h)/F42R(h): Stage III A Power Category: 19≤kW<37)		
No. of Cylinders		3		
Bore × Stroke	mm	88×94		
Displacement	cc	1,715		
Combustion System		IDI (Indirect Injection)		
Intake System		Natural Aspirated		Turbo charged
Horse Power	kW(HP)	22(30)	25.7(35)	29.4(40)
Compression Ratio		21.3 : 1		
Direction of Rotation		CCW from Flywheel Side		
Cooling System		Pressurized Radiator		
Lubricant Capacity	ℓ	4.3		
Starter	V-kW	12 - 2.2		
Alternator	V-A	12 – 50		
Dimension(L×W×H)	mm	690×527×911		

※ Specifications could be changed without notice for performance improvement

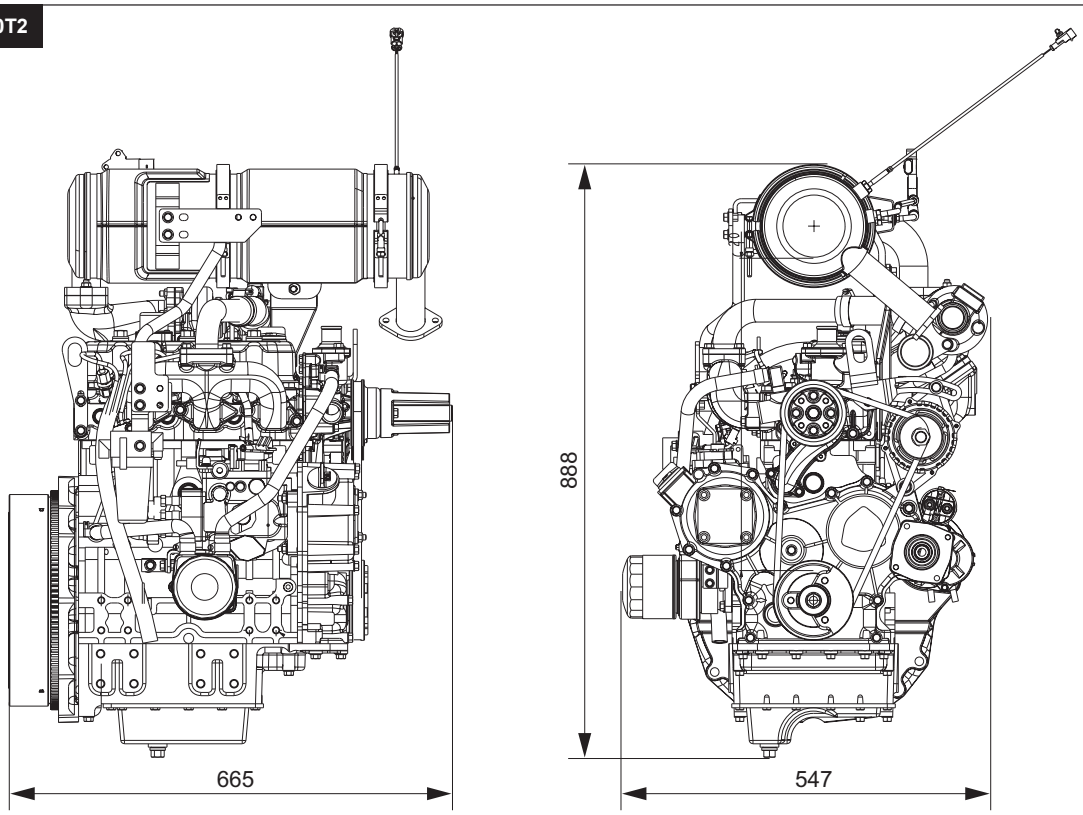
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1.2 ENGINE DIMENSIONS

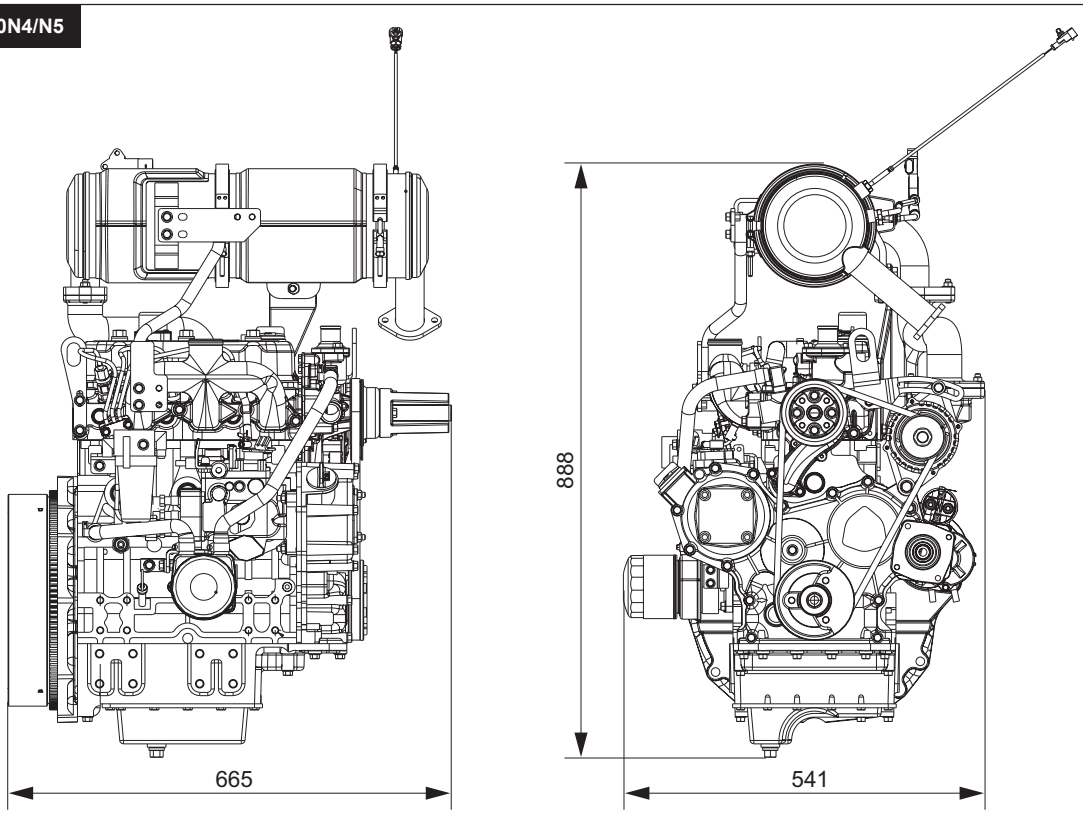
3015R(h)/3515R(h)/4015R(h)

A1700T2



F42W221A

A1700N4/N5



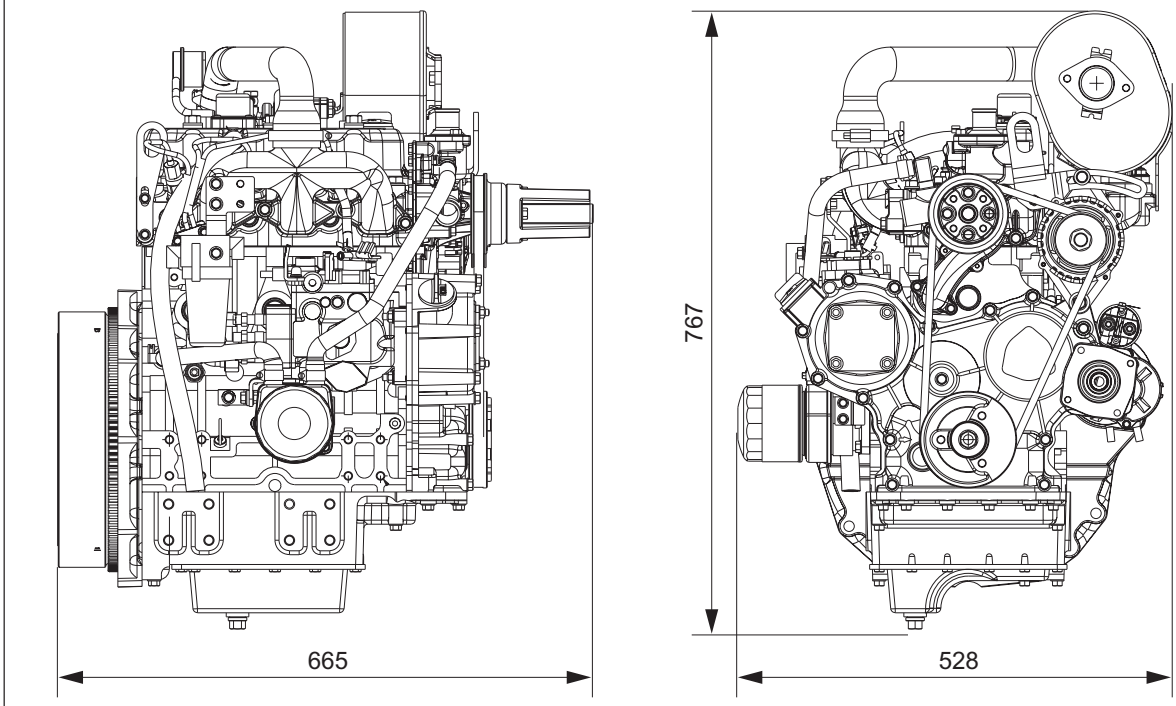
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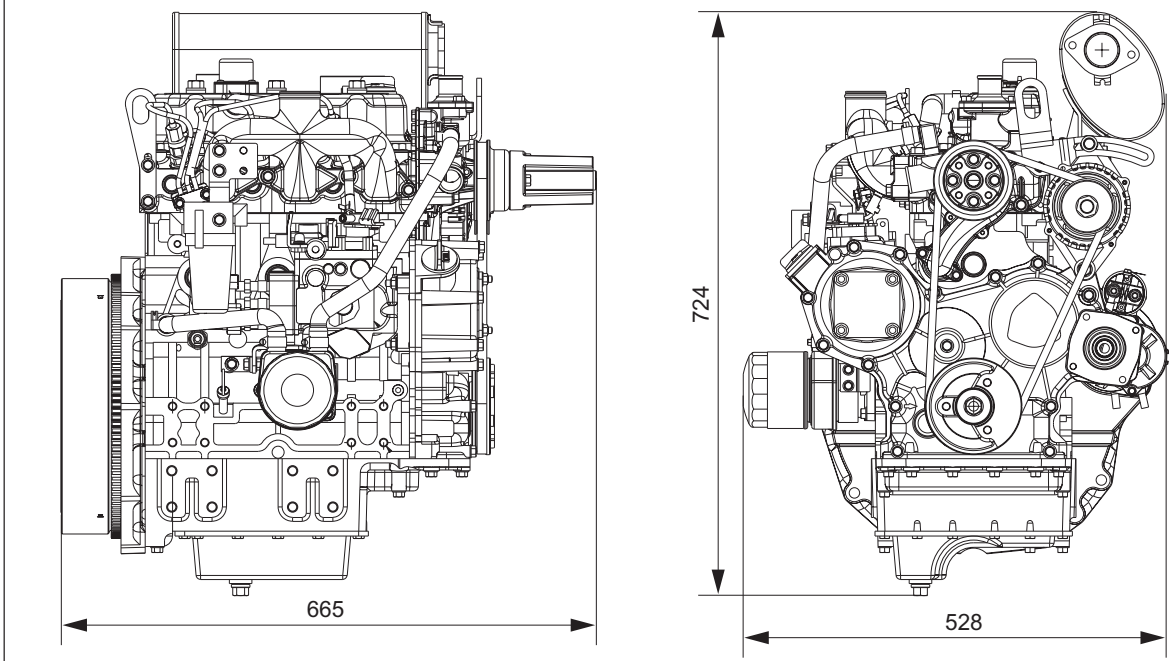
F36R(h)/F42R(h)

A1700T2



F42W223A

A1700N4

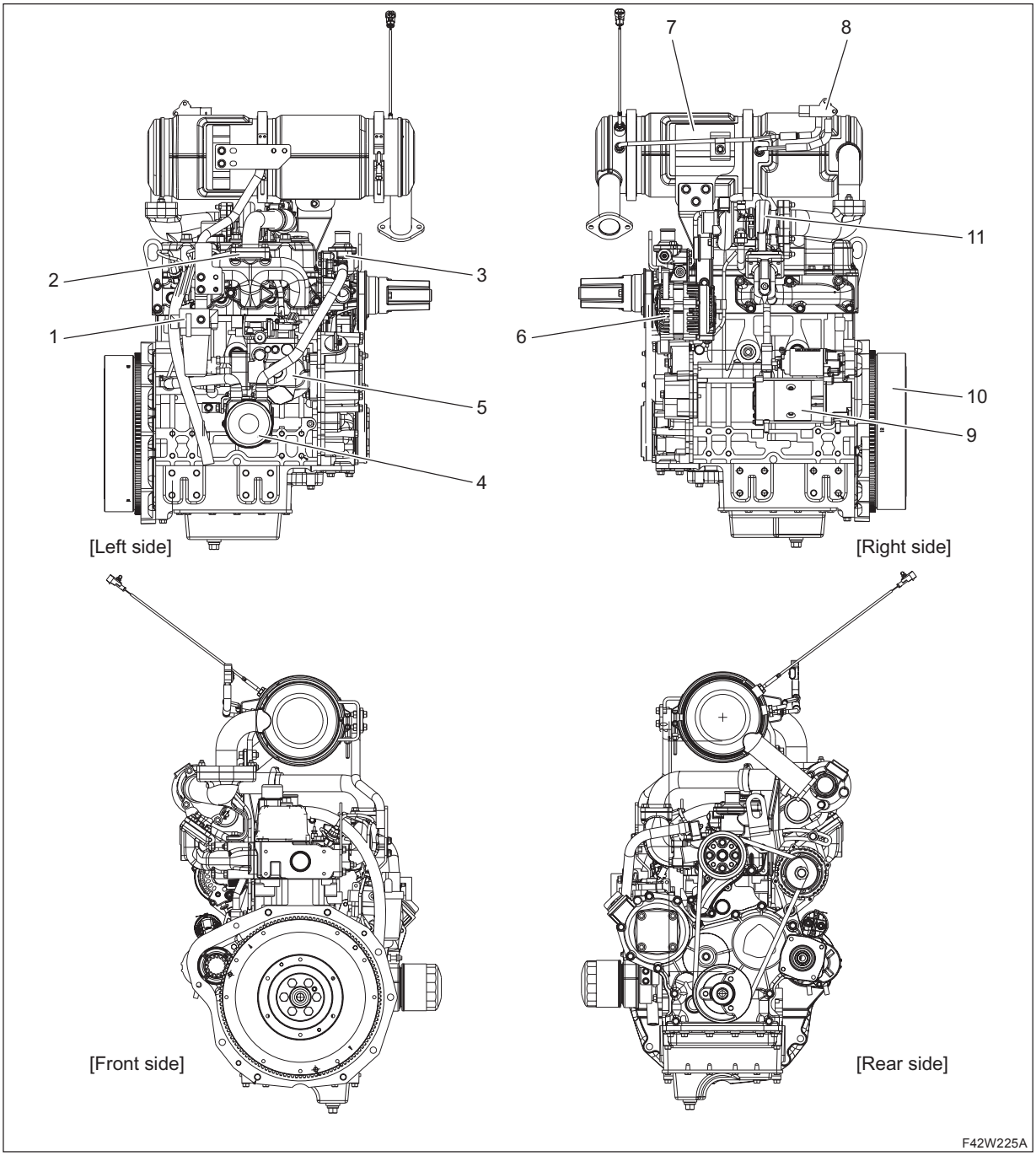


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1.3 NAME OF EACH PART



(1) Fuel filter
(2) Intake manifold
(3) Water pump
(4) Oil filter
(5) Fuel injection pump
(6) Alternator
(7) After-treatment device [3015R(h)/3515R(h)/4015R(h)]
(8) DP sensor [3015R(h)/3515R(h)/4015R(h)]
(9) Starter motor
(10) Flywheel
(11) Turbo chager

* The pictures show the locations of the major external engine components, the filters, and other service and maintenance points. Some external components will be at different locations for different engine models.

NOTE
• **The pictures are only a reference to show a typical engine.**

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3015R(h)/3515R(h)/4015R(h)

1.4 EMISSIONS REGULATIONS

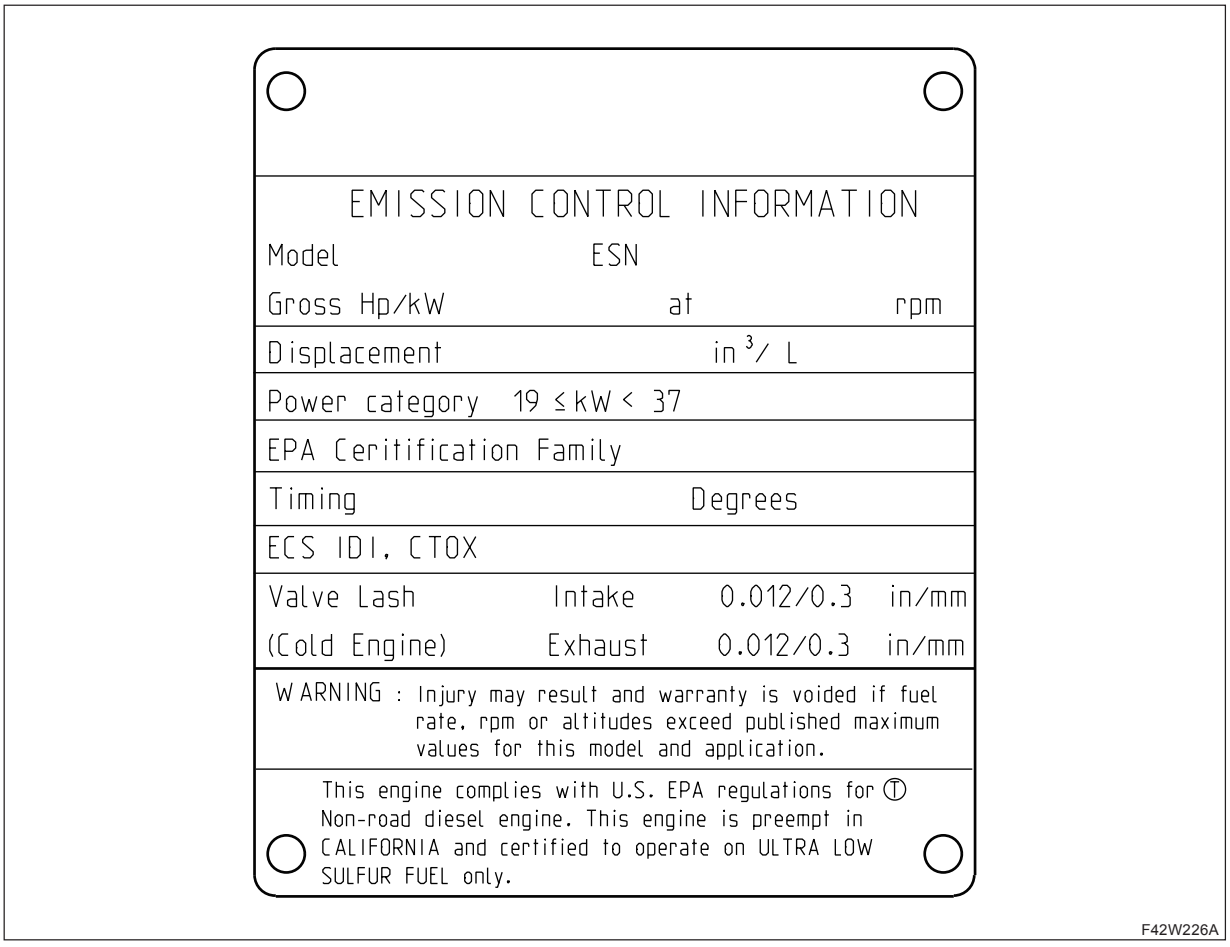
Each country conducts the emissions regulations on non-road diesel engine to prevent environmental contamination. The regulations values and enforcement time are different by each power category. In U.S, the EPA emissions regulations must be satisfied.

1.4.1 EPA EMISSIONS REGULATIONS VALUE IN U.S.

Unit: [g/kW-hr]

OUTPUT (KW)	EMISSIONS REGULATIONS	NOX + NMHC	CO	PM
19 ~ 37	Final Tier-4	4.7	5.0	0.03

1.4.2 THE EMISSIONS CERTIFICATE DECAL AND ATTACHED LOCATION



The engine which is exported to the U.S EPA area attach the following decal in head cover.

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1.4.3 WARRANTY CONDITION OF EMISSION REGULATIONS VALUE

In the maintenance of engine, make sure the warranty conditions are observed and at the same time maintenance considers degradation as time goes by next maintenance.

The case of EPA certificate engine should observe as following conditions in order to keep emission regulations.

NOTE

- **CONDITIONS ARE AS FOLLOWS**

  1) Intake air temperature: -20°C ~ 40°C

  2) Humidity: under 80%

  3) Intake air negative pressure

  Unit: [kPa (mmAq)]

ENGINE NAME	INITIAL VALUE	ALLOWANCE VALUE
A1700	≤ 2.45(250)	≤ 6.23 (635)

  4) Exhaust back pressure

  Unit: [kPa (mmAq)]

ENGINE NAME	INITIAL VALUE	ALLOWANCE VALUE
A1700	≤ 6.37 (650)	≤ 7.65 (780)

- **FUEL AND LUBRICATING OIL ARE AS FOLLOWS**

  1) Fuel: Ultra low sulfur diesel fuel.

  2) Lubricating oil: SAE 15W-40 or over CJ-4 level.

- **THE SEAL OF FUEL INJECTION QUANTITY AND ROTATION RESTRICTION DO NOT RELEASE**

  EPA certificate engine attach seal cap in injection quantity control device and removing the seal cap to change the injection quantity by final buyer is illegal. If the fuel adjusting devices need to re-adjust, make sure that emission and engine performance are the same level as the certificate values.

- **MAKE SURE TO MAINTAIN**

  Based on listed regular checklist in this manual do a repair check and record a check result/

- **THE MAINTENANCE PERIOD AND WARRANTY PERIOD OF RATED EXHAUST EMISSION COMPONENTS**

  The rated exhaust emission components in the table below should be conducted in the maintenance period. Also warranty period should be conducted conditions that based on the “maintenance checklist” in this document. And set a period to side of the first to reach one of the operation time and using number of year below table.

ITEM	MAINTENANCE PERIOD	
Related parts / Power category	Clean the Injector	Clean/Repair/Adjust - the Injector, Injection pump, others
19 ≤ kW < 37	per 1,500hr	per 3,000hr

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2. MAIN FUNCTION AND PERIODIC CHECK

2.1 PERIODIC CHECKLIST

Periodic checks and maintenance are very important for keeping the engine in optimum condition. The check contents and timing indicate in below table. So be sure to observe.

PART	ITEM		DAILY	EVERY 50HRS	EVERY 250HRS	EVERY 500HRS	1000HRS OR 1 YEARS	2000HRS OR 2 YEARS
Fuel System	Check the fuel level and refill		○					
	Clean the fuel tank			○				
	Check the fuel filter and hose related coolant		○					
	Replace the fuel filter element.					◎		
	Fuel injection valve	Pressure check adjustment					●	
	Fuel injection pump	Adjust injection timing						●
Lubricating system	Check the lubricating oil level		○					
	Replace the lubricating oil			◎ (1st time)	◎			
	Replace the lubricating oil filter			◎ (1st time)	◎			
Coolant system	Check the coolant level		○					
	Check the clogging of the radiator		○		○			
	Replace the coolant					◎		
	Adjust the fan belt tension			○ (1st time)	○			
Intake air system	Clean the air cleaner, Replace the element.				○	◎		
Engine body	Re-tighten the bolts							● (Re-tighten)
	Adjust the in/exhaust valve clearance.						●	
Electrical equipment	Check the warning lamps.		○					
	Check the battery liquid level.			○				

※ ○: Customer check / ◎: Part exchange / ●: Check in place to specified location

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2.2 CHECK THE MAIN FUNCTION

- Check the main function is the best way for performance guarantee and long life of engine.

  Please note the following information to the engine to maintain.

2.2.1 VISUAL CHECK

- Visual check of around the engine: confirm the fuel, lubricating oil, coolant system, fuel and water leakage.

  Check the hose of the each part, V-belt, and the tightening status of clamp.

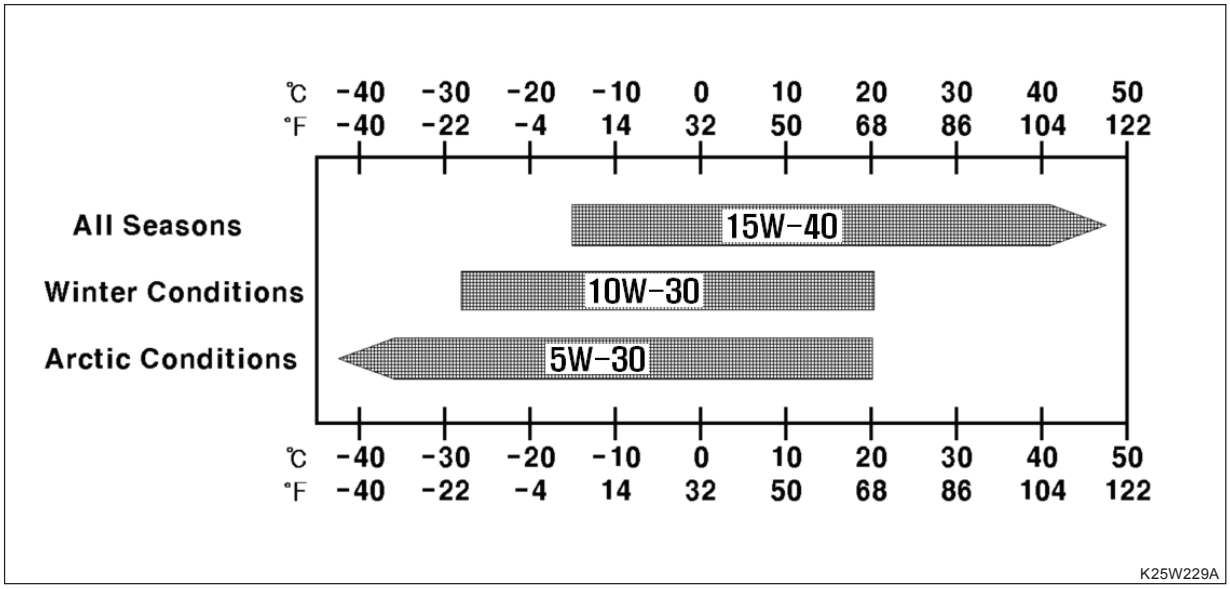
  Check the damage of components or loosening the bolt &nut.

- If you have trouble when a visual check, please refer to this manual for repairing it.

2.2.2 LUBRICATING OIL

- Diesel engine operate under unfavorable conditions than gasoline engine, so should be used the proper oil.
- If defective oil is used or lubricating oil is not changed regularly, accelerated wear of moving components and engine life may be seriously shortened.
- Oil viscosity grade use the class SAE 15W-40 , above API CJ-4 level (Final Tier4) or above API CG-4 level (StageⅢA).

  * Please refer to next graphic and use the proper oil.



- Before engine operating, check the lubricating oil level whether it is set at the right level between the L(low) mark and the H(high) mark. If necessary, add lubricating oil. If the oil is contaminated or viscosity is low, it should be changed.

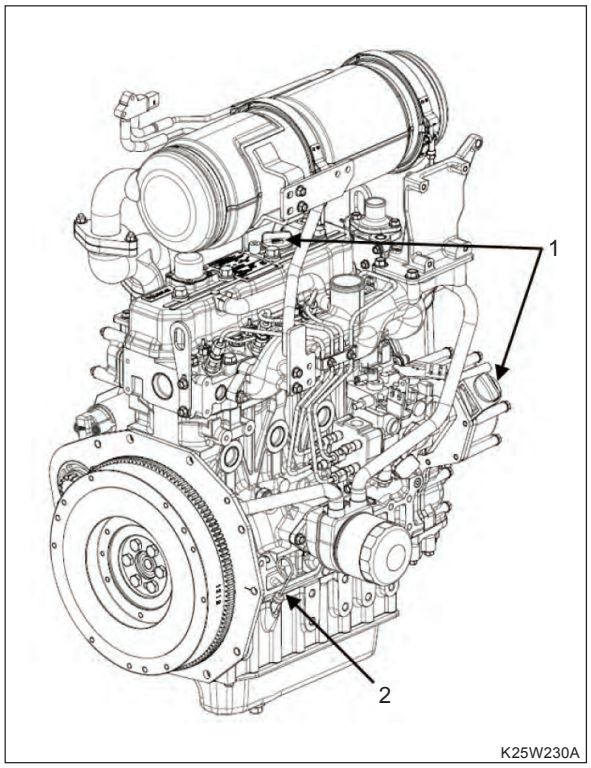
  1) While checking the lubricating oil, keep the engine horizontal.

  2) Wait for about 15 minutes after shutting off the engine to check the oil level.

  3) Check the oil level 5~6 minutes later after refilling the lubricating oil.

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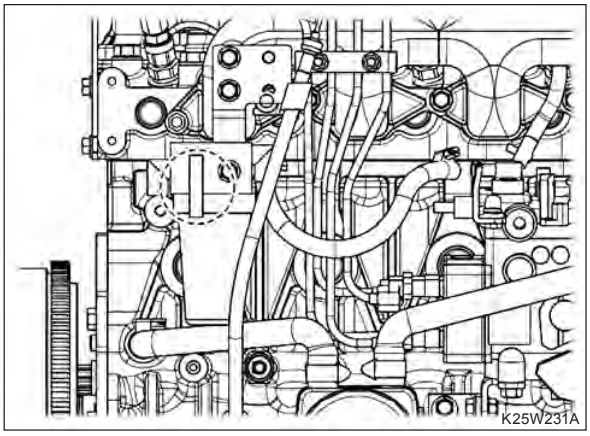


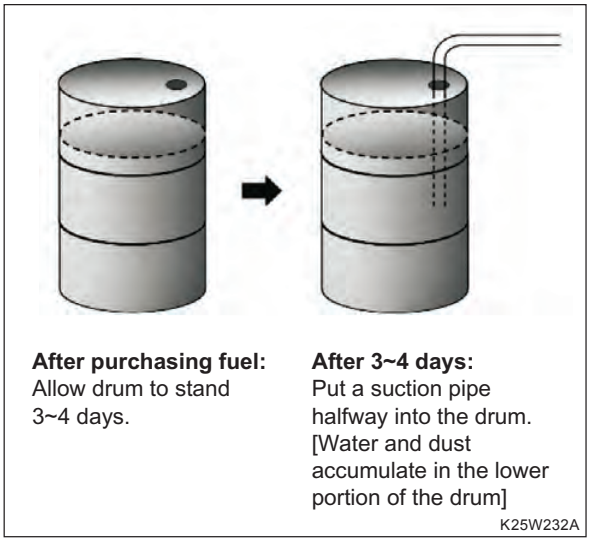
(1) Lubricating oil (2) Dip stick

- Lubricating oil and element replace which at 1st time is after 50hrs operated engine. And then 2nd time and thereafter is every 250 hr.

2.2.3 FUEL

- The characteristics of diesel engine fuel (Cetane, specific gravity, viscosity, etc) has a effect on engine start, power out, fuel consumption, the functionality of a chain of fuel, knock, emission, etc. Use the fuel that has Cetane value 40-48 and use a lower viscosity at low temperature.





- The contaminated fuel can be a cause of starting failure and the engine will emit bluish white exhaust.
- The fuel that contains water and dust can cause a serious failure, so always use clean fuel.

  1) The case which store the fuel in the house, stand the drum for several days to precipitate the water and dust to the bottom and then use the fuel at the top.

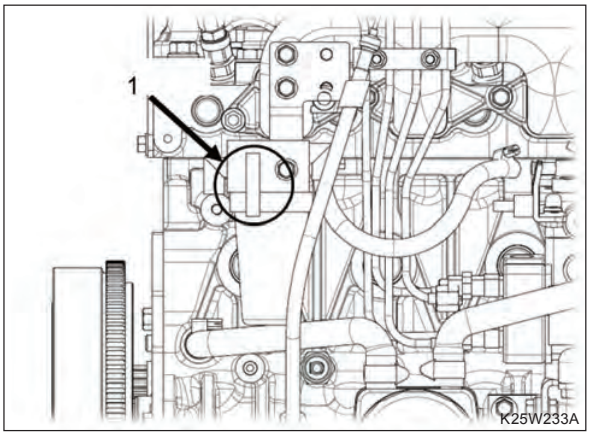
  2) Before operating the engine, open the drain cock at the bottom of the fuel tank and remove the sediments.

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- Replace the fuel filter: every 500hrs.

  If water or dust is deposits in fuel, replace the fuel filter.



(1) Air bleeding screw

- Air bleeding: The fuel system runs from the fuel tank through the fuel filter, fuel injection pump and high pressure piping, to the injector. Fuel is not injected if there is air in the fuel system. Bleed the air according to the following steps.

  1) Loosen the air bleeding screw at top of the fuel filter until foamy. And then put the clothes near the air bleeding screw for prevent overflow fuel.

  2) If fuel doesn't include bubbles, tighten the air bleeding screw.

⚠ WARNING

- **Do not lay flammable materials in engine around.**

2.2.4 COOLANT

- The coolant must use the soft water (such as tap water, etc). Hard water such as well water causes scale deposits on the coolant system. This reduces the cooling efficiency and raises the coolant temperature too high, causing seizures between the piston and the liner. Use an anticorrosive for prevent rot at summer season and use a coolant for prevent freezing at winter season.
- The anti-freezing liquid to dilute to 40~60% based on the quantity of coolant according to vehicle type.

COOLANT (VOLUME %)	30	40	50	60	70
WATER	70	60	50	40	30
FREEZING POINT (°C)	-16	-25	-35	-50	-48

- Replace the coolant: Every 500hrs or every 2years.

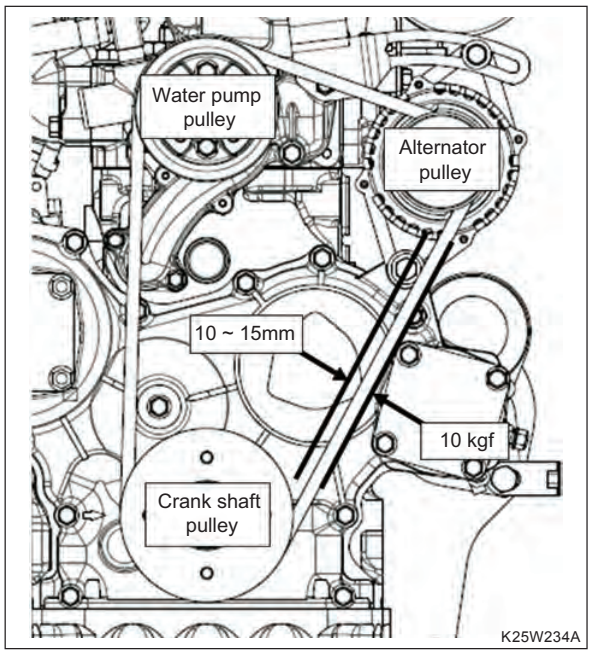
  Contaminated coolant reduces cooling efficiency so the temperature could be raised too high. This might cause the engine seizure.

- Before operating the engine, always check the amount of coolant in the sub-tank. In addition, check the amount of coolant in the radiator at least once a week. If the coolant is not enough, engine temperature will be raised high. This could be a cause of engine seizure.

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2.2.5 V-BELT.



- Too much of fan belt tension accelerates wear of the belt, in contrast, too little of belt tension leaves the pulley idle, overheats the engine, and no-load is generated. Adjust the belt tension as follows.
- The belt tension is 8~12mm in the case of new part. The case which uses the belt, adjust tension to 10~15mm.
- Correct adjustment exists when the belt can be pushed inward about 10~15mm with 10kgf (22lb) thumb pressure exerted midway between the pulleys. Check if there is oil, grease, any damage in the belt.
- Replace the belt if it is cracked or frayed.
- Replace the belt if tegument is worn out or some pieces are detached.

2.2.6 EVERY 50HRS CHECK

1. Replace the lubricating oil and oil filter: Replace the lubricating oil and oil filter at the first 50hrs.
2. Check the tension of the V-belt.

2.2.7 CHECK EVERY 250HRS

1. Replace the lubricating oil and oil filter: Replace the lubricating oil and oil filter every 250 hrs after replacing it at first 50 hrs.
2. Check & cleaning the radiator pin.
3. Cleaning the air cleaner.
4. Check the tension of the V belt.

2.2.8 CHECK EVERY 500HRS

1. Replace the fuel filter: Replace the fuel filter every 500 hrs after replacing it at first 50 hrs.
2. Replace the air cleaner elements.

2.2.9 CHECK EVERY 1,000HRS

1. Check & correct the injection pressure of injector and the spray condition (see section 5.2.)
2. Correcting the valve clearance (see section 4.3.23)

2.2.10 CHECK EVERY 2,000HRS

1. Cleaning & maintenance of the coolant path: Parts related coolant path such as radiator, water pump, cylinder block and head, oil cooler etc. occur cooling efficiency decrease by long-term use. Therefore cleaning & maintenance is required.
2. Check & replace the fuel pipe and coolant pipe: Check the hose class used in the fuel pipe or coolant pipe etc, and the blazing or defected parts replace. Although replacement timing is not reached, hose class replace once every 2 years.
3. Rapping of intake/exhaust valve: Do maintenance to ensure the leak tightness of the cylinder head.
4. Correct the injection timing and check& correct the injection pump: see section 4.3.11.

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3. DEFECT DIAGNOSIS AND MANAGEMENT

	TROUBLE	CAUSE	REPAIRING
Engine difficult to start	Starter switch but does not pinion.	1) Lack of battery capacity	1) If discharged, charging or replace. 2) If lack of the capacity because of the cold weather, raise slowly the temperature, or charging, replace.
		2) Connection of battery cable is loosen, broken, or corroded. (excessive resistance)	Correction
		3) Failure of spline which gets in gear pinion of the armature shaft.	Correct the spline.
		4) Failure of the magnetic switch plunger. Or coil disconnection and short.	Correction or replace
		5) Key-switch circuit is malfunctioning	Correction or replace
		6) Starter brush failure.	Disassembly and clear, broken components is replaced.
	Pinion engages with ring gear but does not rotate starter.	1) Lack of battery capacity.	Same the 1-1)
		2) Disconnection of cable that connect the battery and magnetic switch. Or tightening failure of the connecting wire that connect magnetic switch and terminal of motor.	Correction
		3) Gearing failure of pinion and ring gear.	Correct or replace the pinion
		4) Starter failure.	Correction or replace
		5) Tightening failure of batteries code connection area.	Re-tighten.
	Pinion not engages with ring gear and does rotate.	1) Starter installation failure.	Re-installation.
		2) Failure of plunger & dimensions adjustment	Correction
		3) Pinion sleeve spring failure.	Replace
	The pinion engages with the ring gear and starter is rotated. But engine does not rotate.	1) Overrunning clutch failure.	Replace
		2) Engine internal failure.	Repair
	Engine starts but will not keep running	1) There is not a fuel in the fuel tank.	Fill the supply tank.
		2) Air inhalation in the fuel system	Air bleeding
		3) Fuel element clogging.	Clean or replace
		4) Air inhalation in injection pump.	Air bleeding
		5) The electricity does not flow in the fuel cut solenoid valve of injection pump.	Confirm the presence of electricity from condition that key-switch is “ON”. If necessary, check the fuse or wire.
		6) Loose or failure of fuel cut solenoid valve in injection pump.	Re-tighten the solenoid valve, check the operation sound when turn On, Off the key-switch. Replace the failed solenoid.
		7) Injection pump failure	Correction or replace

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TROUBLE		CAUSE	REPAIRING
Engine difficult to start	Engine starts but will not keep running	8) Connection area of high pressure pipe is loose.	Re-tighten
		9) Injection pump sticking.	Correction or replace.
		10) Spray failure of Injection valve.	Correction or replace
		11) Inappropriate injection pressure.	Correction
		12) Glow plugs failure.	Correction or replace.
		13) Compress pressure failure. - Closing of valve failure - Cylinder gasket packing failure - The piston, piston ring, cylinder wear	Check the valve and valve seat - Correction - Replace - Replace
	Start the engine, but it will stop soon	1) Fuel pipe clogged or filter polluted.	Cleaning
		2) Air inhalation in fuel.	Air bleeding
		3) Clogging of the air hole in the fuel tank cap.	Correction
Idle condition failure		1) Maladjustment of the accelerator lever.	Correct acceleration lever and cable
		2) Air inhalation in injection pump.	Air bleeding
		3) Injector failure	Correction or replace
		4) Injection timing failure	Correction
		5) Injection pump failure.	Correction or replace
Engine power output low		1) Improper valve clearance	Correction
		2) Adhesion failure of the valve.	Check the valve and valve sheet
		3) Cylinder head gasket gas leak.	Replace the gasket.
		4) Wearing to piston, sticking and breakage.	Replace the piston ring
		5) Air intake quantity shortage.	Clean the element in air cleaner.
		6) Injection timing failure	Correction
		7) Fuel injection quantity shortage.	Correct the pump flow rate.
		8) Injection pressure failure or sticking	Adjusting or replace the injector
		9) Clogging the fuel pipe system.	Correction
		10) Air inhalation in fuel.	Air bleeding
		11) Water inhalation in fuel.	Replace the fuel
		12) Freezing and solidity wax status of fuel line.	After putting in warm garage until disappear the freezing or wax, operate the air bleeding.
		13) Injection pump failure	Replace the injection pump

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TROUBLE		CAUSE	REPAIRING
Engine overheat		1) Coolant shortage or fur forms	Refill or clean up
		2) Fan is loose, damage, or not balanced	Correction or replace
		3) Water pump performance degradation.	Correction or replace
		4) Valve clearance unsuitable	Correction
		5) Resistance increase in exhaust system.	Clean up or Replacement
		6) Clogging the radiator air path.	Clean up
		7) Inappropriate injection timing.	Correct the injection timing
		8) Cylinder head gasket breakage.	Replace the head gasket.
		9) Shortage or failure the lubricating oil.	Refill or Replacement.
Engine noise excessive	Crankshaft metal	1) Oil clearance increase by wearing the metal or crankshaft.	Replace the metal or polishing the crankshaft.
		2) Eccentricity wearing to crankshaft	Polishing or replace the crankshaft.
		3) Seizure of metal	Replace the metal or polishing the crankshaft.
	Connecting rod metal	1) Wearing to crankshaft pin metal.	Replace the metal.
		2) Wearing to crankshaft pin.	Replace the crankshaft.
		3) Bending to connecting rod.	Correction or replace.
		4) Seizure of crankshaft pin metal	Replace the metal or polishing the crankshaft.
		5) Oil supply shortage by clogging the oil line.	Clean the oil line
	Piston, Piston pin and piston ring	1) Piston clearance increase piston by wearing the piston and piston ring.	Replace piston and piston ring
		2) Wearing the piston pin diameter and piston pin	Replace
		3) Wearing to piston	Replace
		4) Piston wear or failure	Replace
		5) Piston ring failure	Replace
	Engine noise excessive	1) Wearing to crankshaft, thrust bearing.	Replace the thrust bearing.
	others	2) Excessive backlash of timing gear.	Replace the timing gear.
		3) Excessive valve clearance.	Correct the Valve clearance.
		4) Wearing to valve part.	Correction or replace
		5) Water pump bearing failure	Replace the pump.

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TROUBLE		CAUSE	REPAIRING
Fuel consumption excessive		1) Fuel leak	Check and if necessary, replace the all pipe and re-tighten connection area.
		2) Clogging the return pipe or hose	- Twisting, crushing of the return line is checked. Defective parts are replaced.
			- If lines were clogged, executes the air bleeding after boring the compressed air.
		3) Inappropriate injection timing.	Correction
		4) Check the compression pressure.	Correction or replace
		5) Injection valve failure (spray, pressure, etc)	Correction or replace
		6) Injection pump failure (excessive injection quantity)	Correction or replace
		7) Check the head gasket	Replace
Lubricating oil consumption excessive	Oil up	1) Cylinder and piston excessive clearance	Replace
		2) Wearing to piston ring, ring groove.	Replace the piston ring
		3) Inappropriate piston ring setting inlet location	Correct the location
		4) Clogging the air breather	Clean up
		5) Excessive refill of lubricating oil.	Correction
	Oil Down	1) Loosing the valve stem and valve guide.	Replace
		2) Cylinder head gasket failure	Replace the gasket
		3) Valve stem seal failure	replace
	Oil leak	1) Connection area loosing in each part.	Tighten
		2) Packing failure in each part.	Replace the packing
		3) Oil seal failure.	Replace the oil seal
Lubricating oil pressure drop		1) Inappropriateness of the fuel quality.	Replace the specified oil.
		2) Pressure-control valve failure.	Replace
		3) Wearing to oil pump.	Replace
		4) Oil pipe failure.	Correction or replace
		5) Wearing to crank metal or crank pin.	Metal replace

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TROUBLE		CAUSE	REPAIRING
Engine knocking		1) Mismatch the injection timing.	Correction
		2) Injection pressure failure	Correction
		3) Failure of the injection function.	Disassembly& Correction
		4) Shortage of the intake air	Clean the air cleaner
		5) Lubricating oil enter into the combustion chamber. - Oil up - Oil down - Oil viscosity is low.	 - Correction - Correction - Replace the appropriate oil.
		6) Engine temperature is low.	Warm-up.
Smoke excessive	White exhaust smoke	1) Injection timing is late.	Correction
		2) Compression pressure is low.	Correction
		3) Water inhalation in fuel.	Replace
		4) Air intake quantity shortage	Correction
		5) Lubricating oil enter into the combustion chamber.	Correction
	Black exhaust smoke	1) Injection timing is too late.	Correction
		2) Becoming overload.	Correct the appropriate load.
		3) Injection quantity is too many.	Injection limit spring failure.
		4) Injection unevenness	Correction
		5) Spray failure of the injection valve.	Correction or replace
		6) Intake air shortage	Clean the Air-cleaner

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3015R(h)/3515R(h)/4015R(h)

4. DPF SYSTEM

This section explains how to operate the DPF systems and help maintenance methods according to warning alarm levels. This data logger enables comprehensive monitoring of the DPF conditions to need DPF cleaning, check the cause of trouble – shooting to keep running the DPF system in good condition.

To operate correctly and efficiently, please kindly keep in mind this instructions and comments stated below;

1. Please be sure to follow and refer to the diagram in this manual when installing.
2. Please be sure to act in manual when alarm on or off and check system conditions by fault diagnosis device.
3. If you are aware of DPF system fault, Please send us data which is downloaded from “DPF Data Logger” in E-mail for analysis.

4.1 INTRODUCTION

The logger named “DPF Data Logger” is one of devices which record several data sources of Diesel Particle Filter (“DPF”). (DPF is used to collect particulate matter (“SOOT”) from diesel engine exhaust gas. It has a structure for filtering “SOOT” and passing gas through Wall Flow Substrate.) In case of accumulating SOOTs continuously, engine back-pressure becomes higher and then come into critical situation. To avoid this situation, the lamp will be running to know you what remove SOOT from DPF. Thus DPF Data Logger is available for logging temperature and pressure of DPF and running lamp in each critical situation.

4.2 DPF DATA LOGGER

4.2.1 INSTALLATION

It can be operated the date in initial installation through CAN communication scanner and can be analyzed data which is downloaded through USB device

4.2.2 SIGNAL LAMP

The lamp is used to alarm user when DPF should be cleaned or there is a problem with temperature / pressure sensor. When the lamp is turned on, user can detect the status using scanner.

4.2.3 SCANNER (FAULT DIAGNOSIS DEVICE)

It can be checking the DPF condition and any problems with sensors through CAN communication.

4.2.4 LOGGING DATA

Data stored in DPF data logger can be downloaded through USB communication. There are two of methods. One is to download data from customer’s car to PC through OBD2 connecter (Low speed download mode), another is to download data directly from logger after separating DPF data logger from customer’s car by a staff of service department (High speed download mode). If you need to analyze the data, please send us the data via e-mail (ktm@endss.com).

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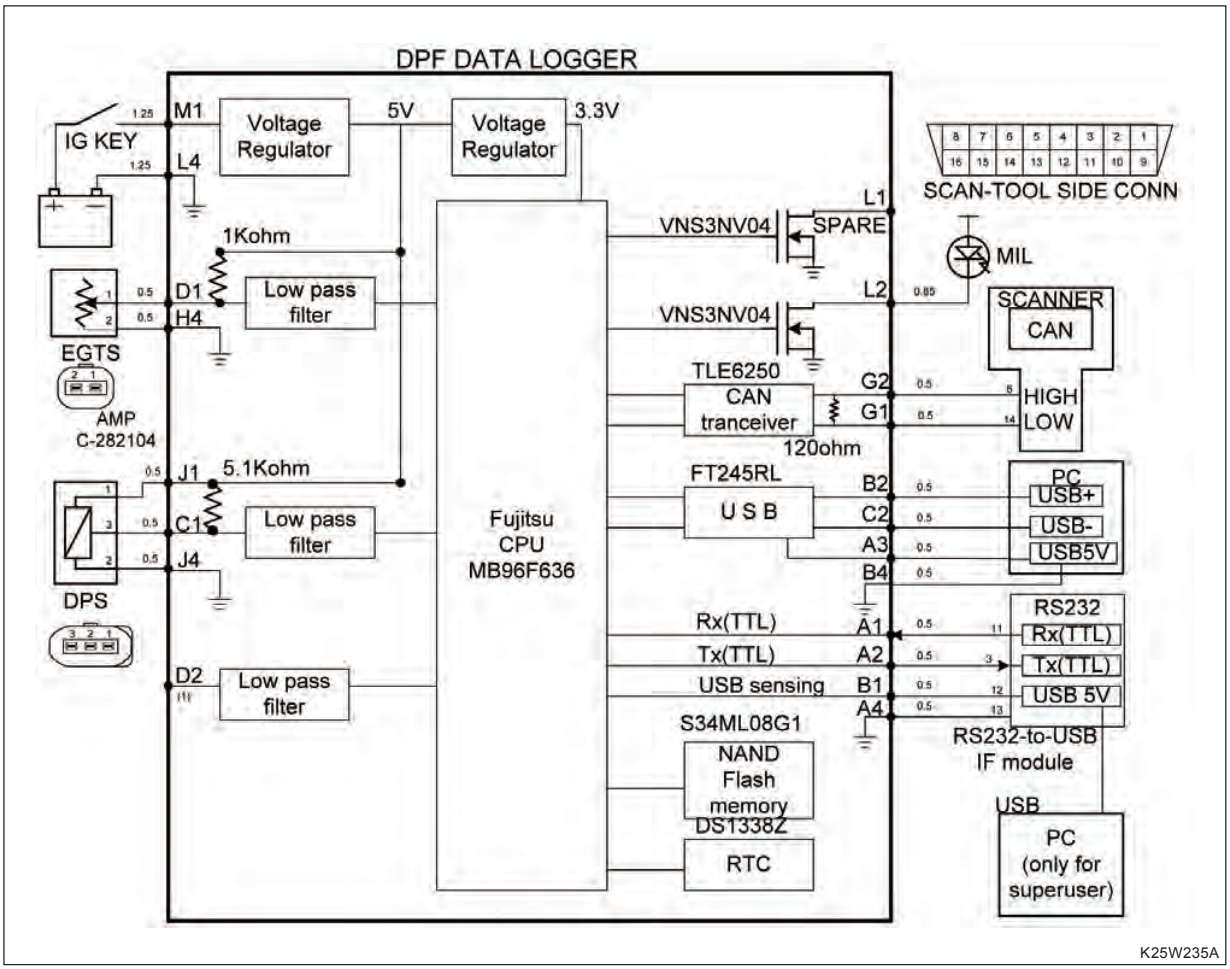
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4.3 FEATURES (INPUT / OUTPUT)

4.3.1 DATA LOGGER SPECIFICATION

ITEM	SPEC
Input Current Range	Maximum 200mA (Using Ignition key battery)
Input Voltage Range	7V ~ 18V
Leakage current	0mA
DPS sensor power supply	Maximum 50mA, 5V±0.2V
DPS Sensor	0 ~ 5V
EGTS Sensor	1 Kohm pull-up in logger
CAN Communication	CAN low, high to communicate with scanner, 250Kbps for DPF status check
RS232 communication	Communication to download data stored in “DPF data logger” or to reprogram and check DPF condition
LED Lamp	Warn the DPF conditions (working 1 Amp)

4.3.2 HARDWARE BLOCK DIAGRAM OF DPF DATA LOGGER



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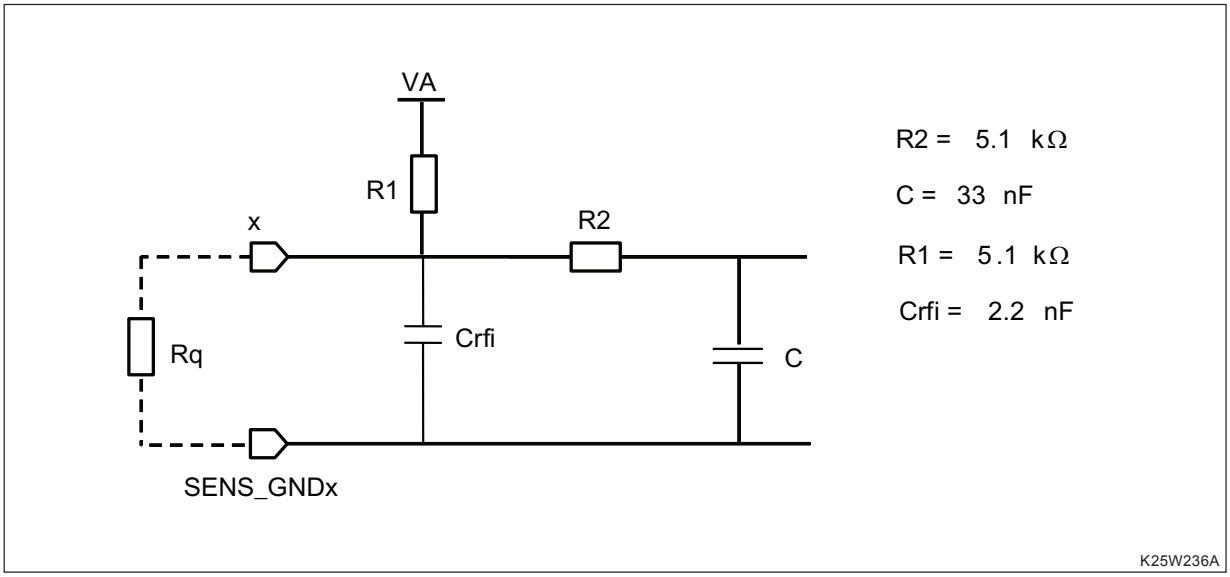
4.4 ELECTRIC SPECIFICATION

4.4.1 DPS SENSOR

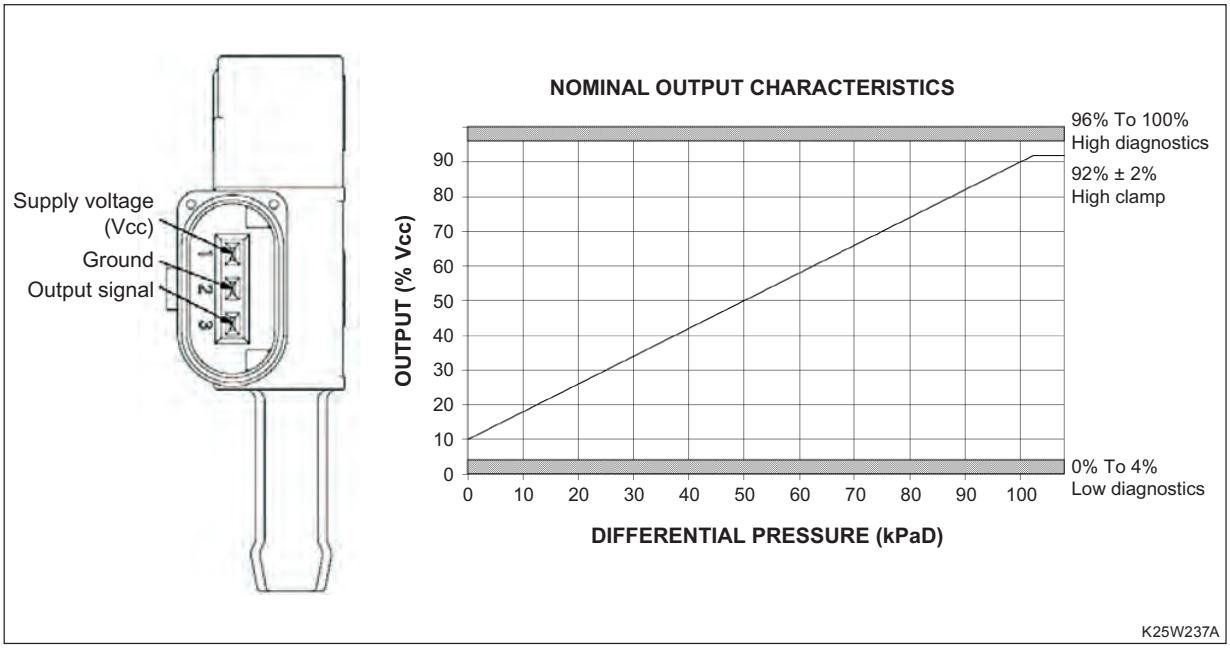
INTRODUCTION

Check the pressure difference between DPF inlet and outlet to measure the collected SOOTs

CIRCUIT



TABLE



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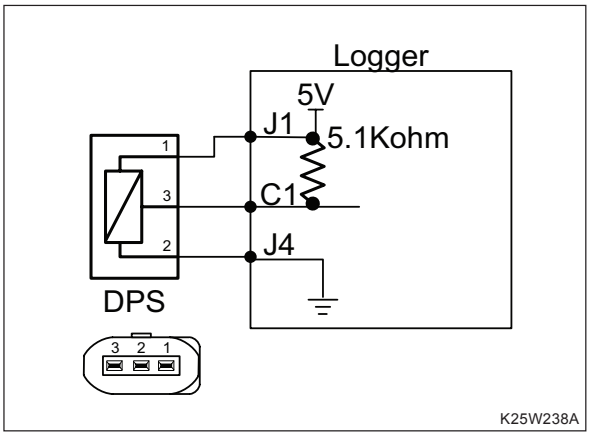
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DIAGNOSTICS

The following sensor diagnostics are when the sensor is properly connected with a 5kohm pull-up load to Vcc.

FAULT PIN OUTPUT
Open 1 > 96%Vcc
Open 2 > 96%Vcc
Open 3 > 96%Vcc
Short 1-2 < 4%Vcc
Short 1-3 > 96%Vcc
Short 2-3 < 4%Vcc

PART CHECK



1) SCANNER

1] (DIAGNOSTIC) - 4] Engine - 1] DPF Logger - 1] Self check - 8] Differential pressure voltage - 9] Differential pressure

2) Check the voltage 0.5± 0.2V under atmosphere (Voltage of atmospheric pressure = 5V*10%)

3) How to check:

1. Turn off ignition switch.
2. Separate pressure sensor from connector.
3. Separate hose from pressure sensor.
4. Loosen bolts and separate pressure sensor from car

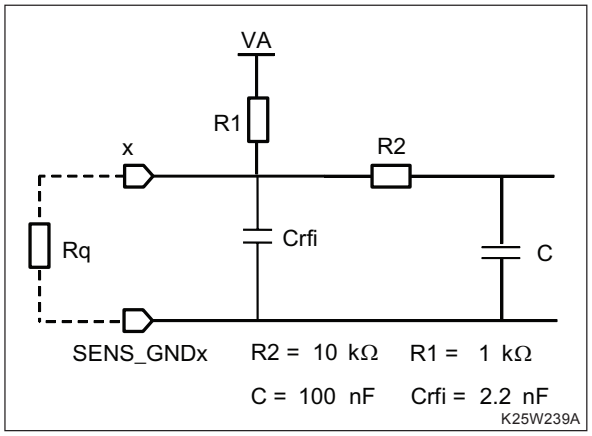
4) DPS sensor installation torque: 1.0 ~ 1.2 kgf•m

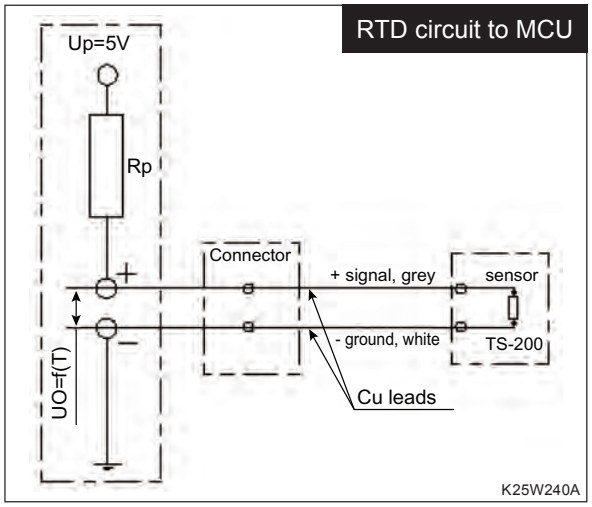
4.4.2 EGTS SENSOR (EXHAUST GAS TEMPERATURE SENSOR)

INTRODUCTION

Check the temperature of the exhaust gas from DPF and data logger records the temperature of the exhaust gas in Logger.

CIRCUIT





- Voltages
  - Power supply: Up = +5V ± 0.1%
  - Output voltage: UO = See table
- Resistances
  - Pull up resistance: Rp = 1000 Ω ± 0.1%
  - Lead resistance: R1 = 005 Ω (Ml-cable + Cu-leads)
  - TS-200 0°C: RO = 200
  - Total TS-200 resistance: Rs = See table

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TABLE

$Rs = R1 + R0 (1 + \alpha T + \beta T^2)$

$\alpha = 3.8285\ 10^{-3}$

$\beta = 3.8285\ 10^{-3}$

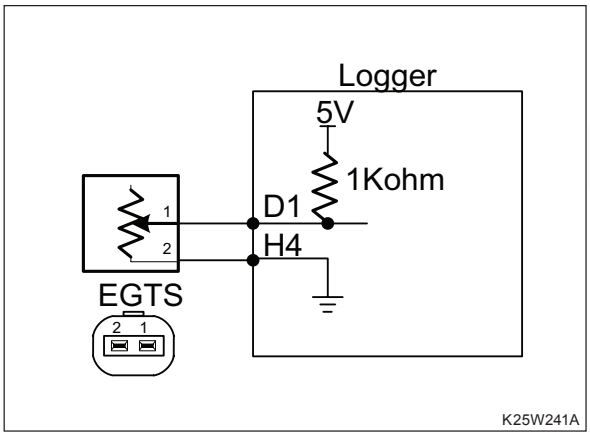
T (°C)	Rs (Ω)	UO (V)
-40	169.7	0.725
-20	185.1	0.781
0	200.5	0.835
25	219.6	0.900
50	238.5	0.963
100	275.9	1.081
150	312.7	1.191
200	349.0	1.293
250	384.6	1.389
300	419.7	1.478
350	454.2	1.562
400	488.1	1.640
450	521.4	1.713
500	554.1	1.783
600	617.8	1.909
700	679.2	2.022
800	738.2	2.123
850	766.8	2.170

DIAGNOSTICS

The following sensor diagnostics are when the sensor is properly connected with a 1kohm pull-up load to Up.

FAULT PIN OUTPUT
Open (Signal of Sensor) > 95%Vcc
Open (Ground of Sensor) > 95%Vcc
Open (Signal and Ground) > 95%Vcc
Short (Signal to Ground) < 5%Vcc

PART CHECK



1) SCANNER

1] (DIAGNOSTIC) - 4] Engine - 1] DPF Logger - 1] Self check - 10] Exhaust gas Temperature. Voltage - 11] Exhaust gas Temperature.Voltage

2) How to check:

1. Turn off ignition switch
2. Separate EGTS sensor from connector
3. Measure resistance at normal temperature by multi-meter
4. Check the resistance value as 220 ± 20Ω at room temperature(25°C)

3) Note: Different resistance values in different temperatures after driving need checking to the resistance value in reference to original value.

4) EGTS sensor installation torque: 4.0 ~ 5.0 kgf•m

⚠ CAUTION

- **Don't separate only sensor from main board to avoid gas leak out of tail pipe**
- **Check sensor when it is dropped in use.**

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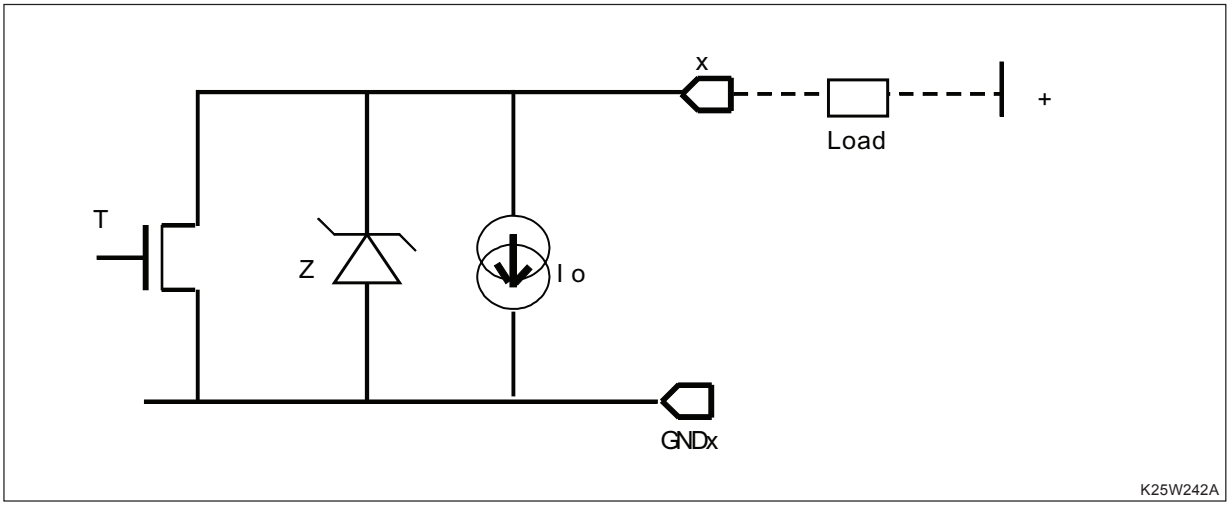
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4.4.3 DPF CHECK LED LAMP

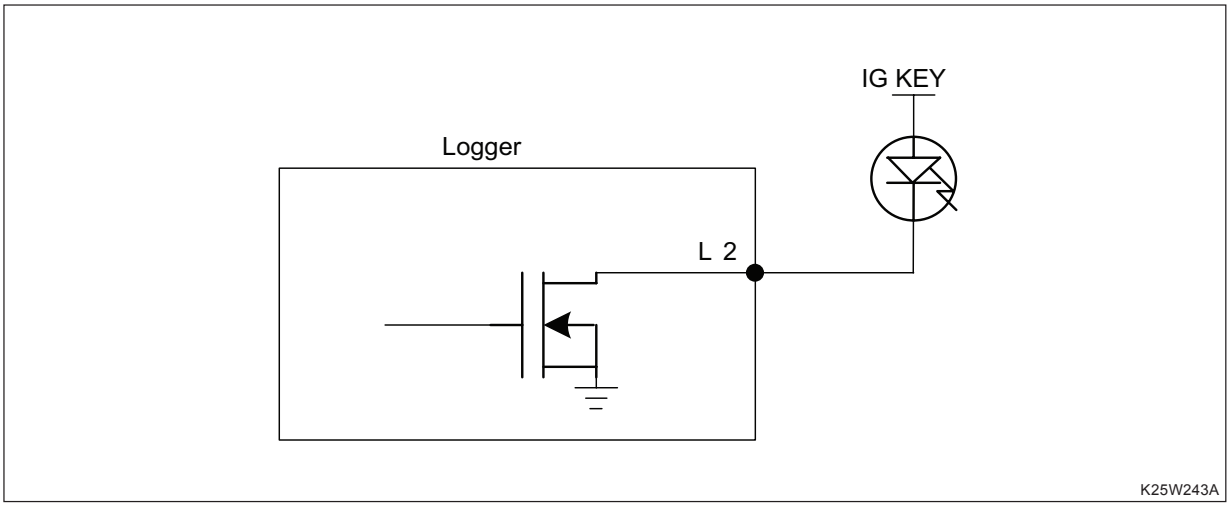
INTRODUCTION

Check lamp to show the DPF conditions.

CIRCUIT



WIRING



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DPF LAMP ON/OFF

- If IGNITION KEY ON: Lamp ON for 1 sec

DANGER LEVEL	CONDITION	LAMP DISPLAY
EMERGENCY	1. △P > setting values(Pressure, time) It means DPF is clogged with Particular. 2. EGTS > setting value(Temp. time) It means that DPF almost melt.	Continuous
CAUTION	Sensor malfunction	Every 0.5sec.
CHECK	Working time > setting value(working time) (*possible erasing lamp with scanner)	Every 2.0sec.

*) Setting1: emergency differential pressure setting: only super-user can set using scanner

SCANNER – 1] DIAGNOSTIC - 4] Engine - 1] DPF Logger - 2] Change setting - 1] DPS Warning Pressure – F1(Increase) or F5(Decrease)

*) Setting2: emergency pressure time setting: only super-user can set using scanner

SCANNER – 1] DIAGNOSTIC - 4] Engine - 1] DPF Logger - 2] Change setting - 2] DPS Warning Time – F1(Increase) or F5(Decrease)

*) Setting3: emergency exhaust temperature setting: only super-user can set using scanner

SCANNER – 1] DIAGNOSTIC - 4] Engine - 1] DPF Logger - 2] Change setting - 3] EGTS Warning Temperature- F1(Increase) or F5(Decrease)

*) Setting4: emergency temperature time setting: only super-user can set using scanner

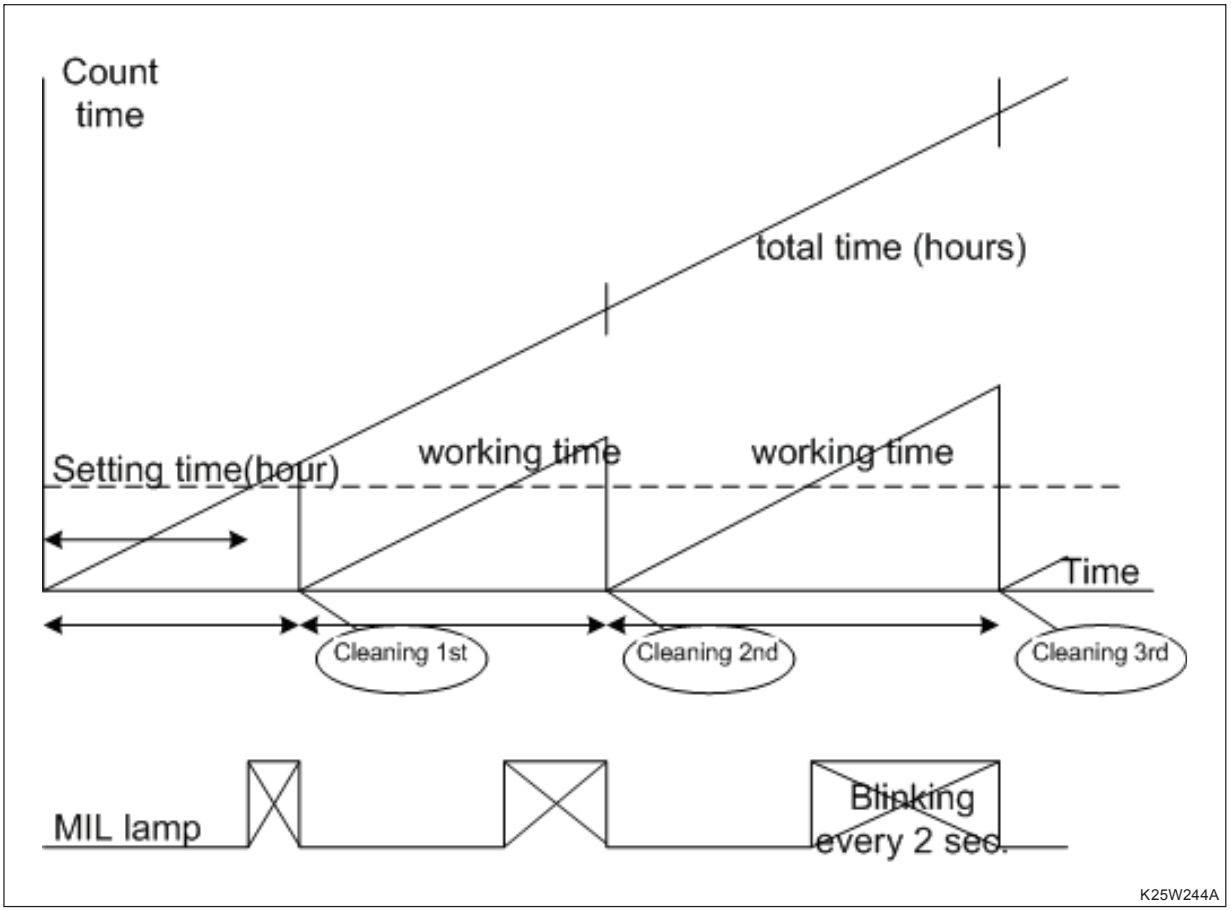
SCANNER – 1] DIAGNOSTIC - 4] Engine - 1] DPF Logger - 2] Change setting - 4] EGTS Warning Time – F1(Increase) or F5(Decrease)

*) Setting5: DPF Cleaning Count :

SCANNER – 1] DIAGNOSTIC - 4] Engine - 1] DPF Logger - 2] Change setting - 5] Reset DPF Cleaning Count – F1(Increase)

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*) DPF Cleaning: DPF check lamp blinking in every 2 seconds indicates that engine operation hour exceed setting value to make alarm for DPF cleaning maintenance. DPF check lamp will turn off if “Cleaning” is selected via scanner after DPF cleaning.

ACTION WHEN LAMP TURNS ON

DANGER LEVEL	TEMPORARY ACTION	LAMP DISPLAY
EMERGENCY	1. Stop car and engine if lamp light blinks while driving 2. Call customer service 3. Caution ! : DPF could be damaged seriously if you keep driving even though lamp blinks	Continuous
CAUTION	1. Go to service shop for a inspection when lamp blinking 2. Check sensor in service shop	Every 0.5 sec.
CHECK	1. Go to service shop for a inspection when lamp blinking 2. Carry out a cleaning of DPF	Every 2.0 sec.

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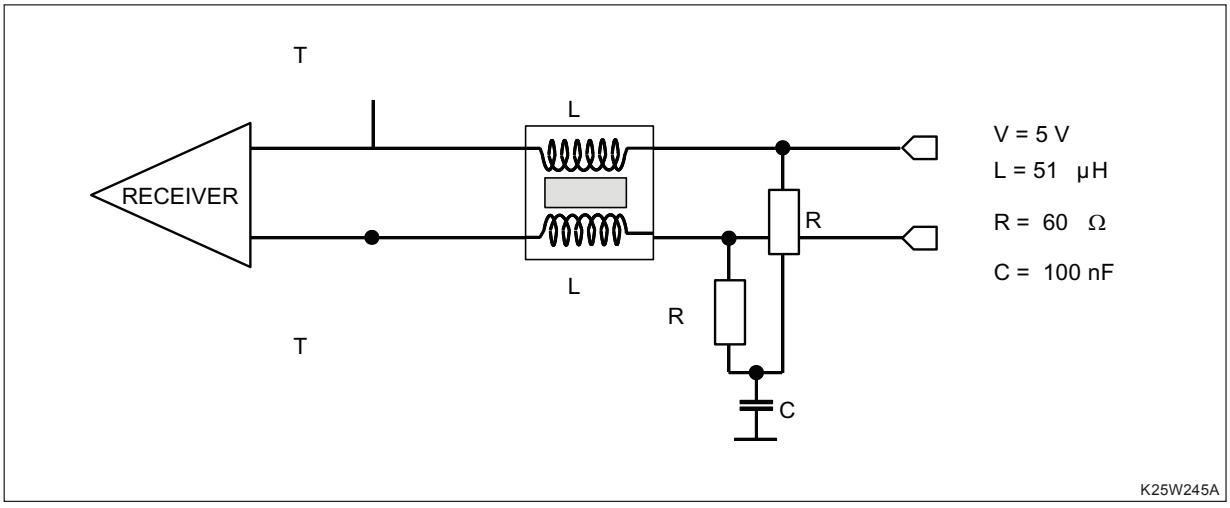
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4.4.4 CAN COMMUNICATION

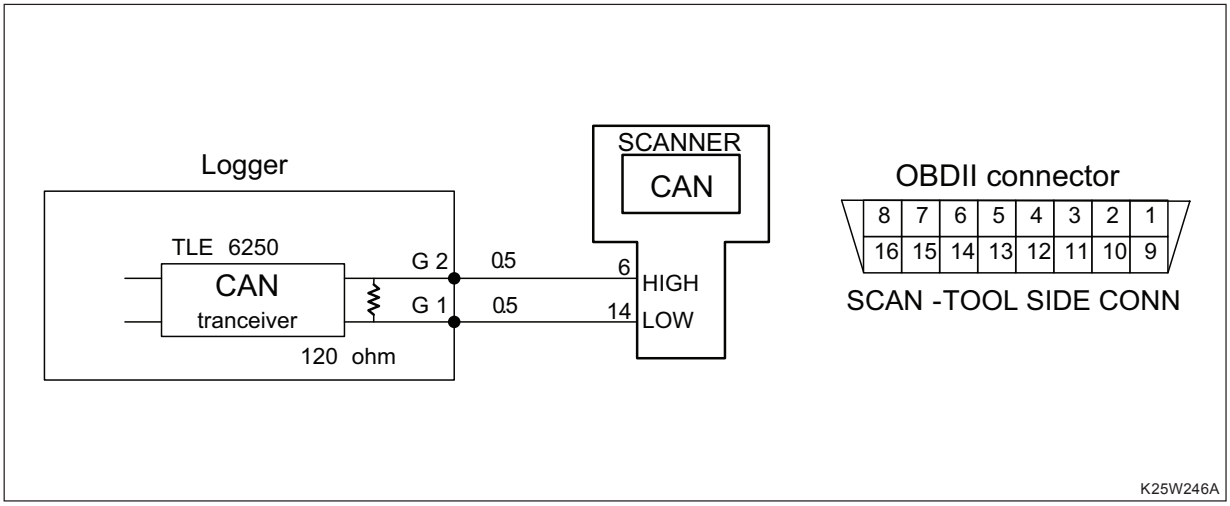
INTRODUCTION

A circuit connecting to scanner, which helps check a condition of DPF and repair.

CIRCUIT



WIRING



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SCANNER CHECK

1) Connect scanner tool to OBDII terminal in IG key off or on

2) Ignition key on

3) Press a power button on scanner

4) SCANNER – 1] DIAGNOSTIC - 4] Engine - 1] DPF Logger - 1] Auto check

5) It indicates an error between Logger and CAN communication when displaying “00” value on data list

6) Call customer service department for inspection of scanner if communication is not running

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4.4.5 PC RS232 COMMUNICATION (LOW SPEED DATA DOWNLOAD AND REPROGRAM)

INTRODUCTION

A circuit connecting to scanner, which helps check a condition of DPF and repair.

1) Using 4 pins connecter between RS232 connecter and Data logger connector

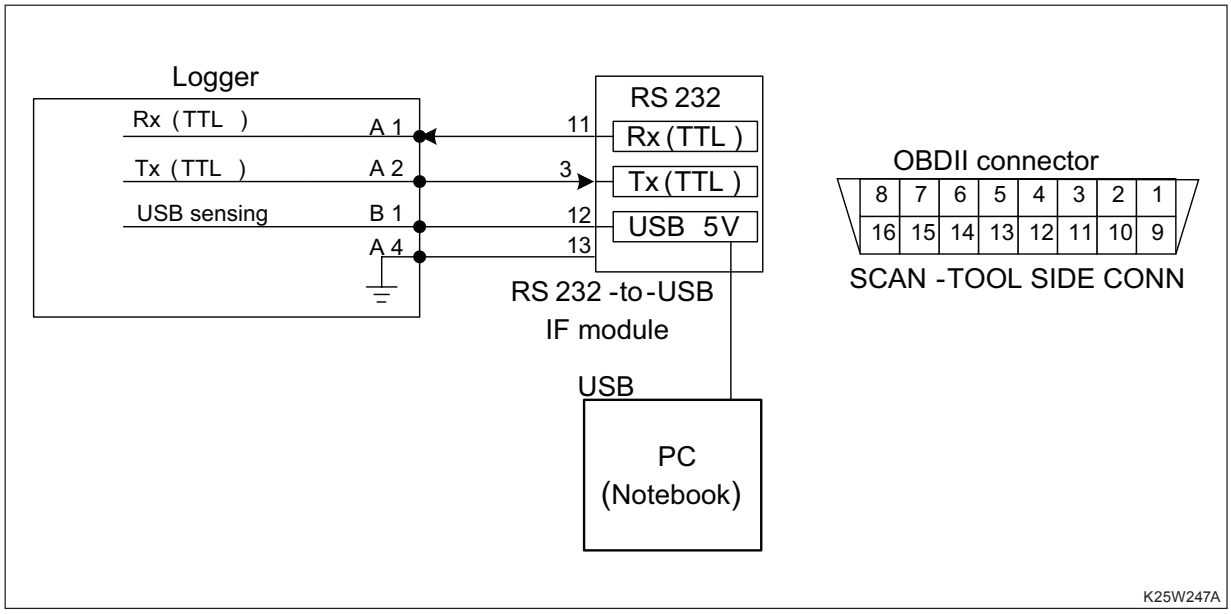
2) 4pin connector (RS232_RX, RS232_TX, RS232_GND, USB1_CONNECT)

3) Logger reprogram : Connect RS232-to-USB Interface module to PC and start to download HEX file when turn IG_KEY ON while running reprogram execution file provided

4) USB1_CONNECT : Signal to detect connecting RS232-to-USB I/F module from external

5) Data Download from Logger : Select downloading times to setting key among 2 second/10 secod/ 60 second because it needs about 19 hours to download at a speed of 115200BR (115200,8,N,1)

WIRING



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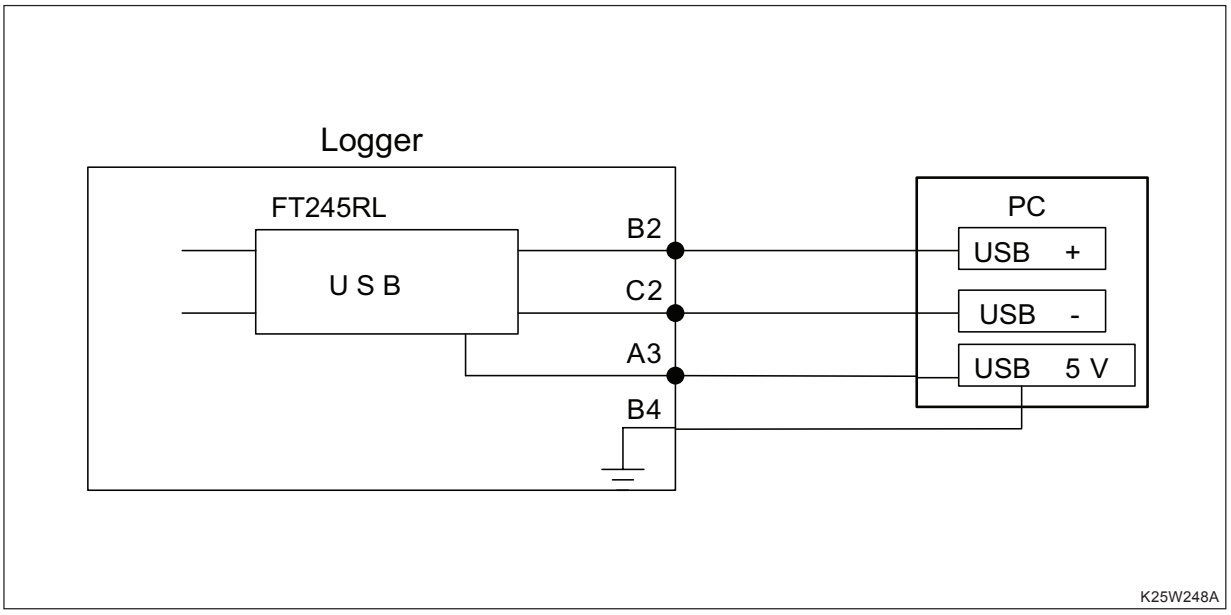
4.4.6 PC USB2 COMMUNICATIONS (HIGH SPEED DATA DOWNLOAD)

INTRODUCTION

High speed downloading tool for DPF engineer only

1) Maximum length of USB connector should not exceed 200 mm and it has 6 pin connector only
2) Need 4 pin connecter ((USB2 power supply, USB2 ground, USB2_POSI, USB2_NEG) for high speed download in option and it does not connect to wire-harness.
3) Communication speed: 1GB data will take 200 seconds to download with a speed of 12megaBR (Using extra logger connecter)

WIRING



4.4.7 RTC(REAL TIME CHECK) POWER SUPPLY (WARRANTY FOR 5 YEARS)

RTC power supply (Warranty for 5 years)

RTC IC is used to memorize present time without electric power. The present time is recorded one time when IG key ON.

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4.5 NOTE

4.5.1 RUNNING TEMPERATURE RANGE

- -40°C ~ 105°C

4.5.2 CASE: WATER-PROOF CASE

4.6 WARRANTY

4.6.1 WE GUARANTEE DPF DATA LOGGER FOR 5 YEARS AFTER SHIPMENT

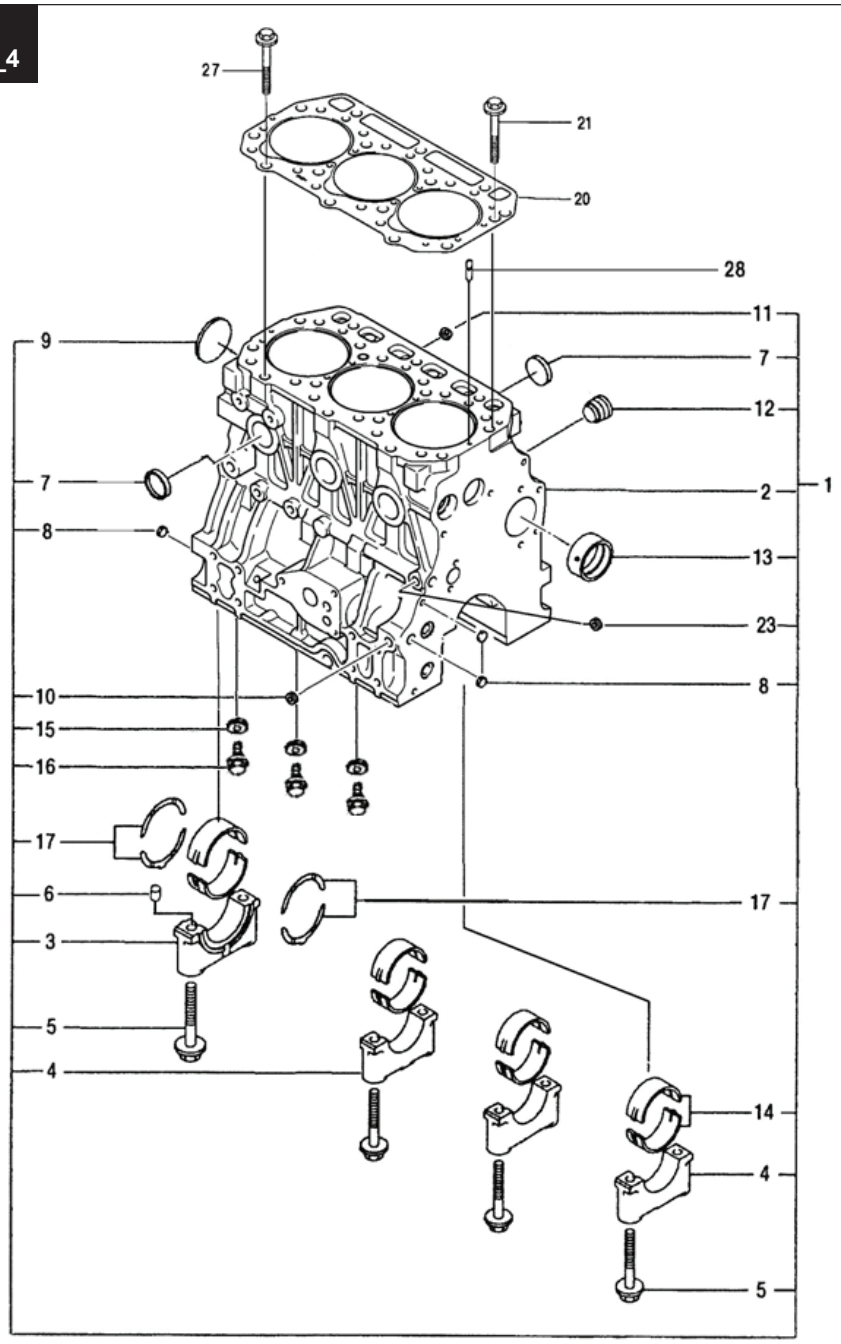
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5. SECTIONAL VIEW FOR MAJOR COMPONENTS

5.1 CYLINDER BLOCK

A1700N4_ETR
A1700N4_UTR_4



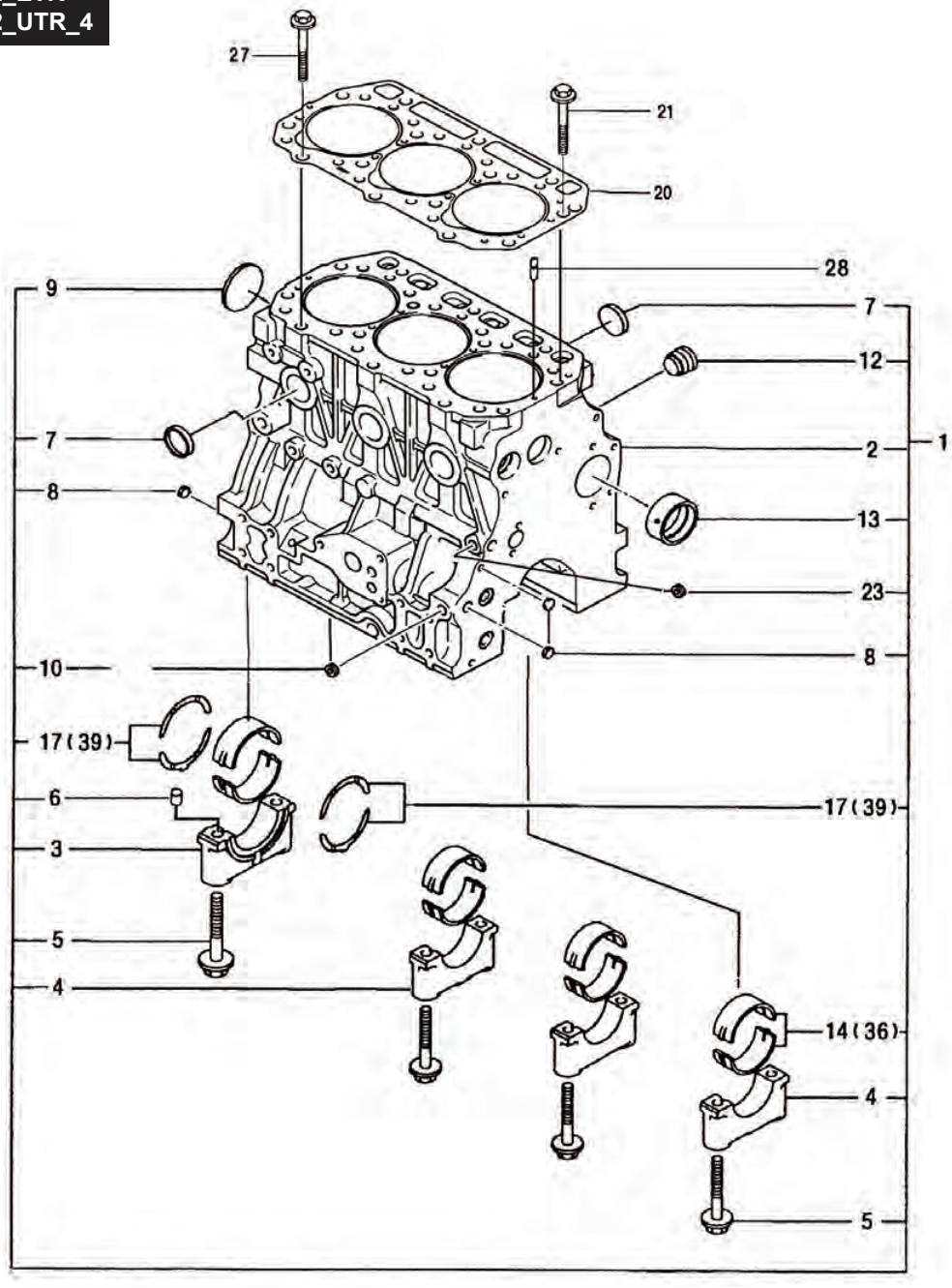
COMPONENTS

(1) Block ass'y, cylinder
(2) Block, cylinder
(3) Bearing cap 1
(4) Bearing cap 2
(5) Bolt, bearing cap
(6) Spring pin
(7) Plug 30
(8) Plug 12
(9) Plug 50
(10) Plug pt 1/4
(11) Plug, pt 3/8
(12) Plug(block heater)
(13) Bush(cam shaft)
(14) Bearing ass'y, main(std)
(15) Packing
(16) Bolt 8 ×12
(17) Bearing ass'y, thrust
(20) Gasket, head
(21) Bolt(head, cylinder)
(23) Plug pt 1/8
(27) Bolt(head, cylinder)
(28) Pin(oil)

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A1700T2_ETR
A1700T2_UTR_4



COMPONENTS

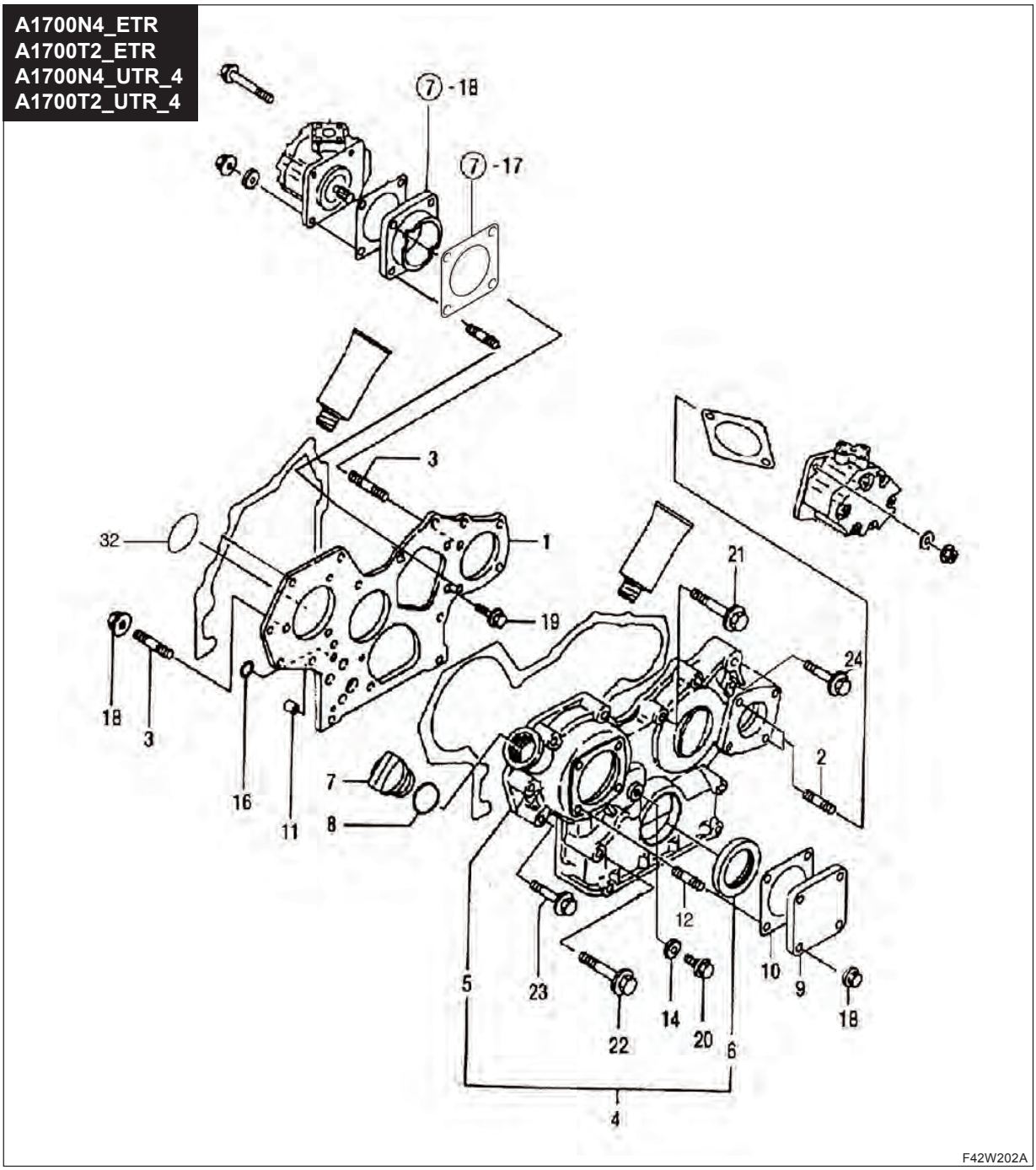
(1) Cylinder block ass'y
(2) Cylinder block
(3) Bearing cap(1)
(4) Bearing cap(2)
(5) Bearing cap bolt
(6) Spring pin
(7) Sealing plug, Ø30
(8) Plug, Ø12
(9) Plug, Ø50
(10) Tapper plug, pt 1/4
(12) Plug(block heater)
(13) Bush(cam shaft)
(14) Main bearing ass'y
(17) Thrust bearing ass'y
(20) Head gasket
(21) Cylinder head bolt(long)
(23) Tapper plug, pt 1/8
(27) Cylinder head bolt(short)
(28) Pin(oil)

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5.2 GEAR CASE

A1700N4_ETR
A1700T2_ETR
A1700N4_UTR_4
A1700T2_UTR_4



COMPONENTS

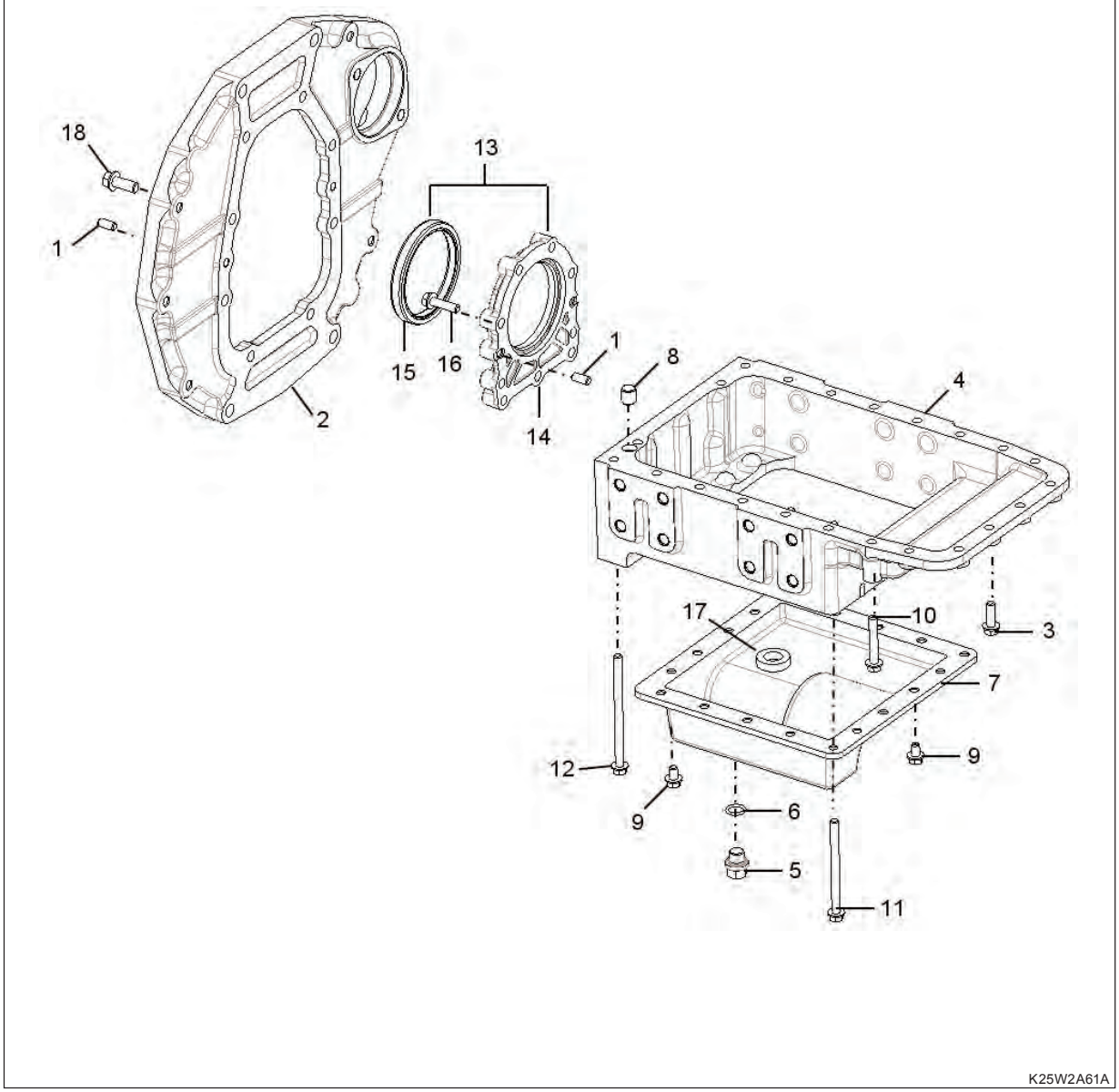
(1) Flange, gear case
(2) Stud bolt, M8 X L22
(3) Stud bolt, M8 X L20
(4) Gear case ass'y
(5) Gear case
(6) Oil seal
(7) Lub-oil filler cap
(8) O-ring
(9) Cover
(10) Packing
(11) Knock pin
(12) Stud bolt
(14) Copper packing, Ø8
(16) O-ring
(18) Flange nut, M8
(19) Bolt, M8 X L16
(20) Flange bolt, M8 × L22
(21) Flange bolt, M8 × L60
(22) Flange bolt, M8 × L90
(23) Flange bolt, M8 × L85
(24) Flange bolt, M8 × L50
(32) O-ring

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5.3 FLYWHEEL HOUSING AND OIL PAN

A1700N4_ETR
A1700T2_ETR
A1700N4_UTR_4
A1700T2_UTR_4



COMPONENTS

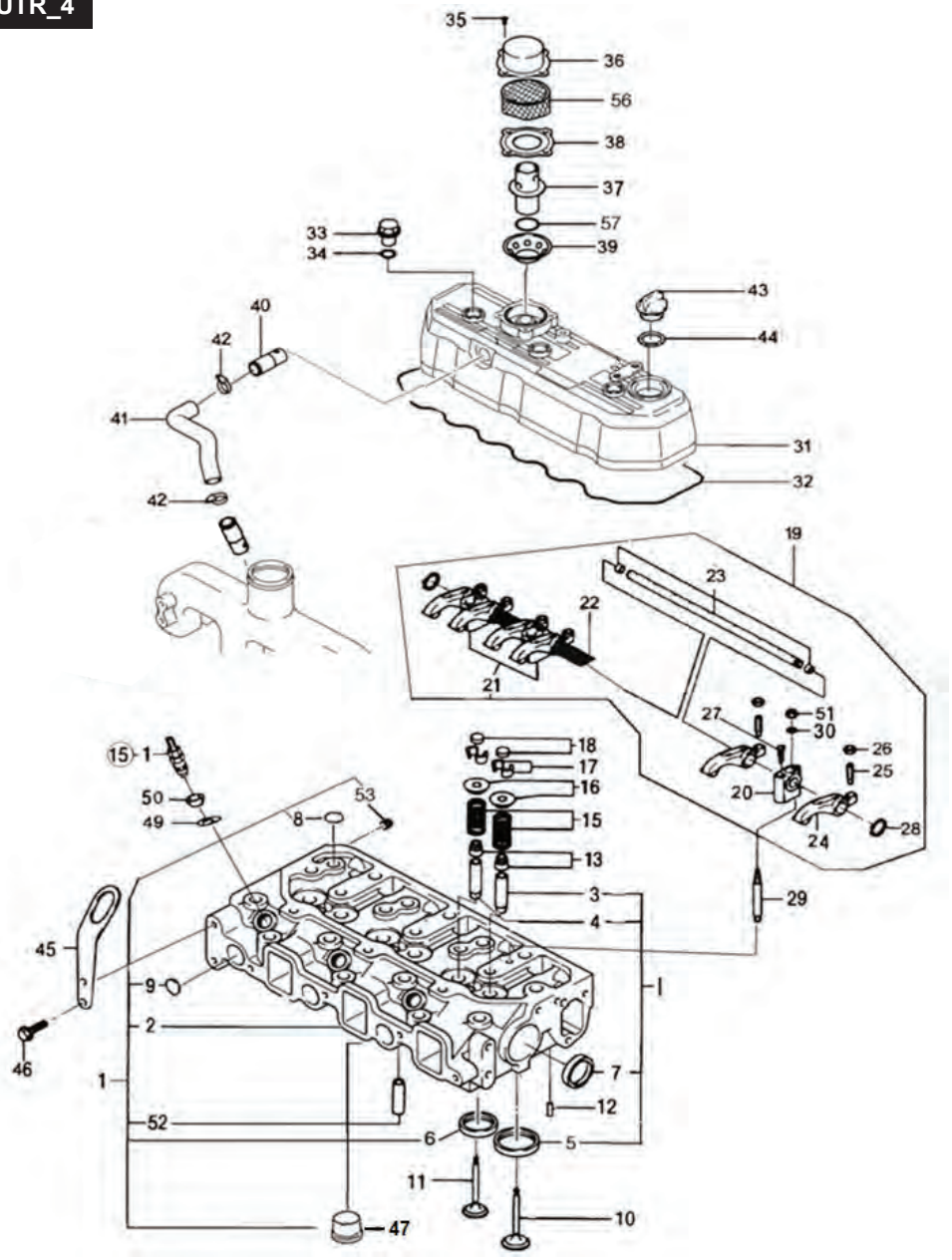
(1) Paraller pin
(2) Flange mounting
(3) Flange bolt, M8 X L25
(4) Oil pan
(5) Lub-oil drain plug, M14
(6) O-ring
(7) Lower cover
(8) Knock pin
(9) Flange bolt, M8×L12
(10) Flange bolt, M8×L50
(11) Flange bolt, M8×L100
(12) Flange bolt, M8×L120
(13) Oil seal housing ass'y
(14) Oil seal housing
(15) Oil seal
(16) Flange bolt, M8×L30
(17) Magnet
(18) Flange bolt, M10×L25

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5.4 CYLINDER HEAD AND HEAD COVER

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A1700N4_UTR_4



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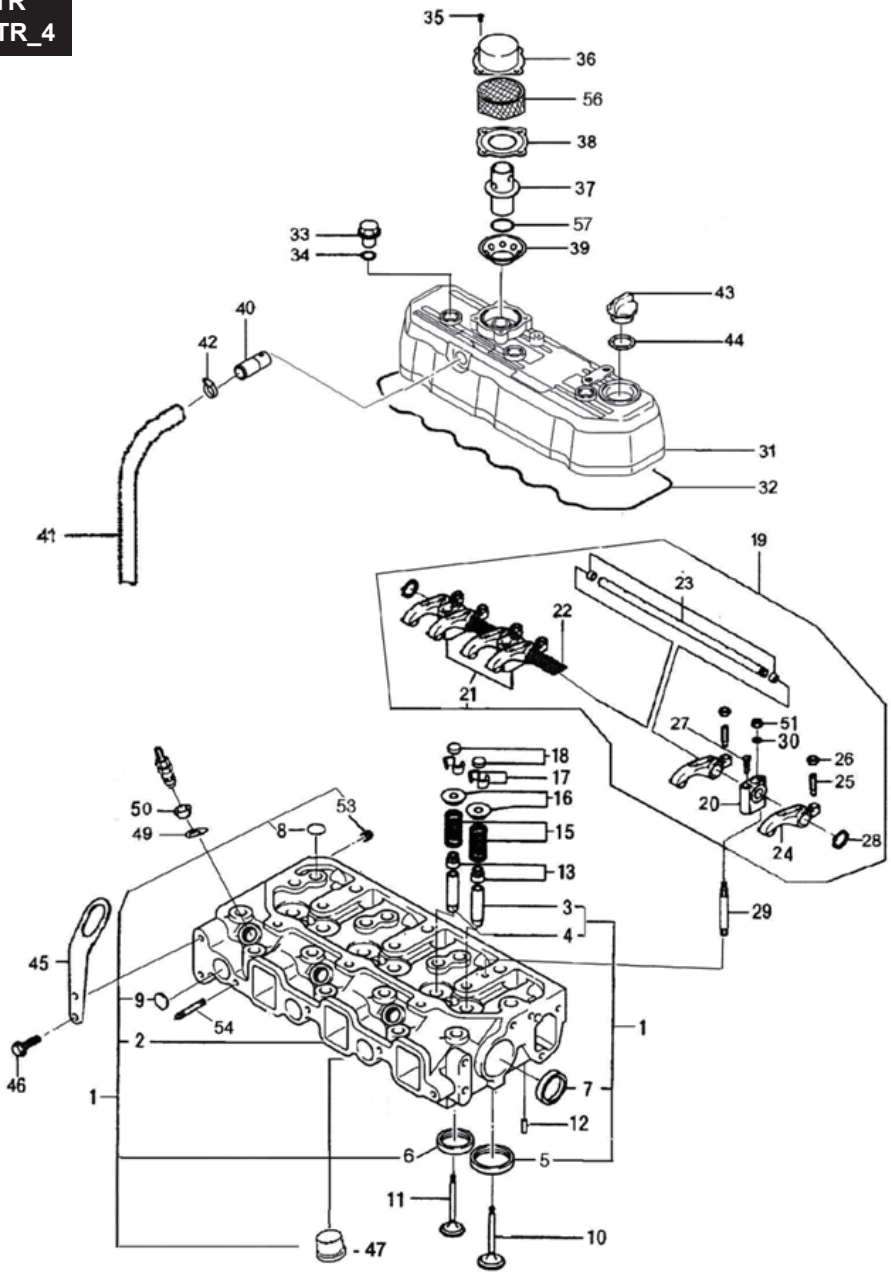
COMPONENTS

(1) Head ass'y, cylinder
(2) Head, cylinder
(3) Guide, suc valve
(4) Guide, exh valve
(5) Seat, suc valve
(6) Seat, exh valve
(7) Plug 40
(8) Plug 22
(9) Plug 22
(10) Valve, suction
(11) Valve, exhaust
(12) Pin, parallel 4×10
(13) Seal,valve shaft
(15) Spring, valve
(16) Retainer, valve spring
(17) Cotter, valve spring
(18) Cap, valve
(19) Shaft ass'y, rocker arm
(20) Support (A)
(21) Support (B)
(22) Spring(rocker arm)
(23) Shaft, rocker arm
(24) Rocker arm
(25) Screw, valve
(26) Nut, adjusting
(27) Screw, stop 8×10
(28) Circlip
(29) Bolt, stud
(30) Washer 12
(31) Cover, head
(32) Packing, head cover
(33) Cap, bonnet
(34) O-ring (P)
(35) Screw 4×10
(36) Cover, breather
(37) Valve, pressure relief
(38) Gasket, breather
(39) Plate, breather adjusting
(40) Tube, breather
(41) Hose, palin
(42) Clip, hose 20
(43) Oil filler
(44) O-ring (P)
(45) Lift
(46) Bolt, flange 8 x 16
(47) Pre chamber
(49) Seal,injector
(50) Spacer, nozzle
(51) Nut m12
(53) Plug pt 1/8
(56) Baffle
(57) O-ring

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A1700T2_ETR
A1700T2_UTR_4



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COMPONENTS

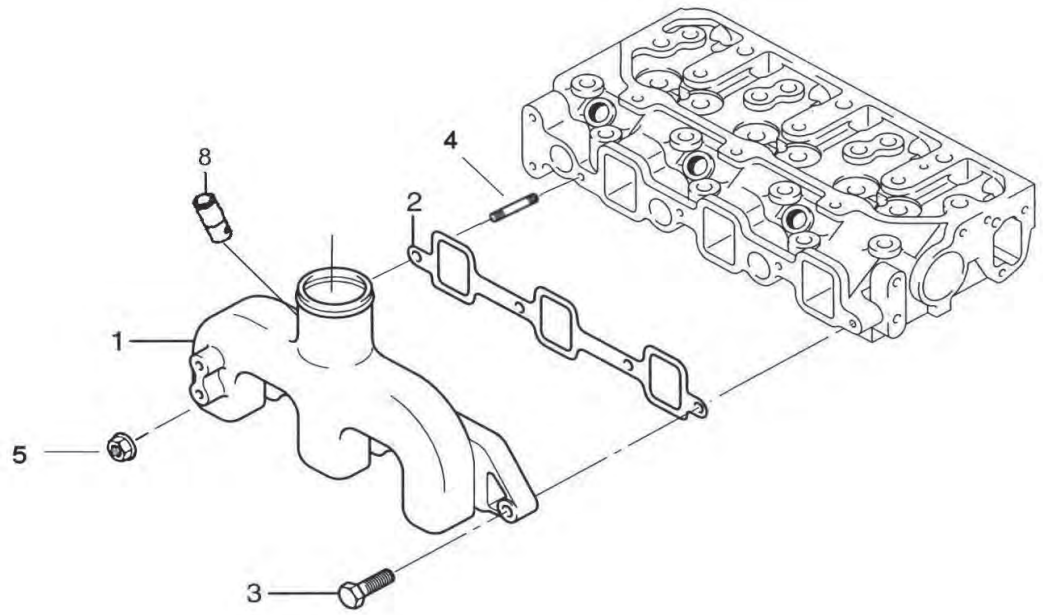
(1) Head ass'y, cylinder
(2) Head, cylinder
(3) Guide, suc valve
(4) Guide, exh valve
(5) Seat, suc valve
(6) Seat, exh valve
(7) Plug 40
(8) Plug 22
(9) Plug 22
(10) Valve, suction
(11) Valve, exhaust
(12) Pin, parallel 4×10
(13) Seal,valve shaft
(15) Spring, valve
(16) Retainer, valve spring
(17) Cotter, valve spring
(18) Cap, valve
(19) Shaft ass'y, rocker arm
(20) Support(A)
(21) Support(B)
(22) Spring(rocker arm)
(23) Shaft, rocker arm
(24) Rocker arm
(25) Screw, valve
(26) Nut, adjusting
(27) Screw, stop 8×10
(28) Circlip
(29) Bolt, stud
(30) Washer 12
(31) Cover, head
(32) Packing, head cover
(33) Cap, bonnet
(34) O-ring (P)
(35) Screw 4×10
(36) Cover, breather
(37) Valve, pressure relief
(38) Gasket, breather
(39) Plate, breather adjusting
(40) Tube, breather
(41) Hose, palin
(42) Clip, hose 20
(43) Oil filler
(44) O-ring (P)
(45) Lift
(46) Bolt, flange 8 x 16
(47) Pre chamber
(49) Seal,injector
(50) Spacer, nozzle
(51) Nut M12
(53) Plug pt 1/8
(54) Stud bolt
(56) Baffle
(57) O-ring

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5.5 INTAKE MANIFOLD

A1700N4_ETR
A1700N4_UTR_4



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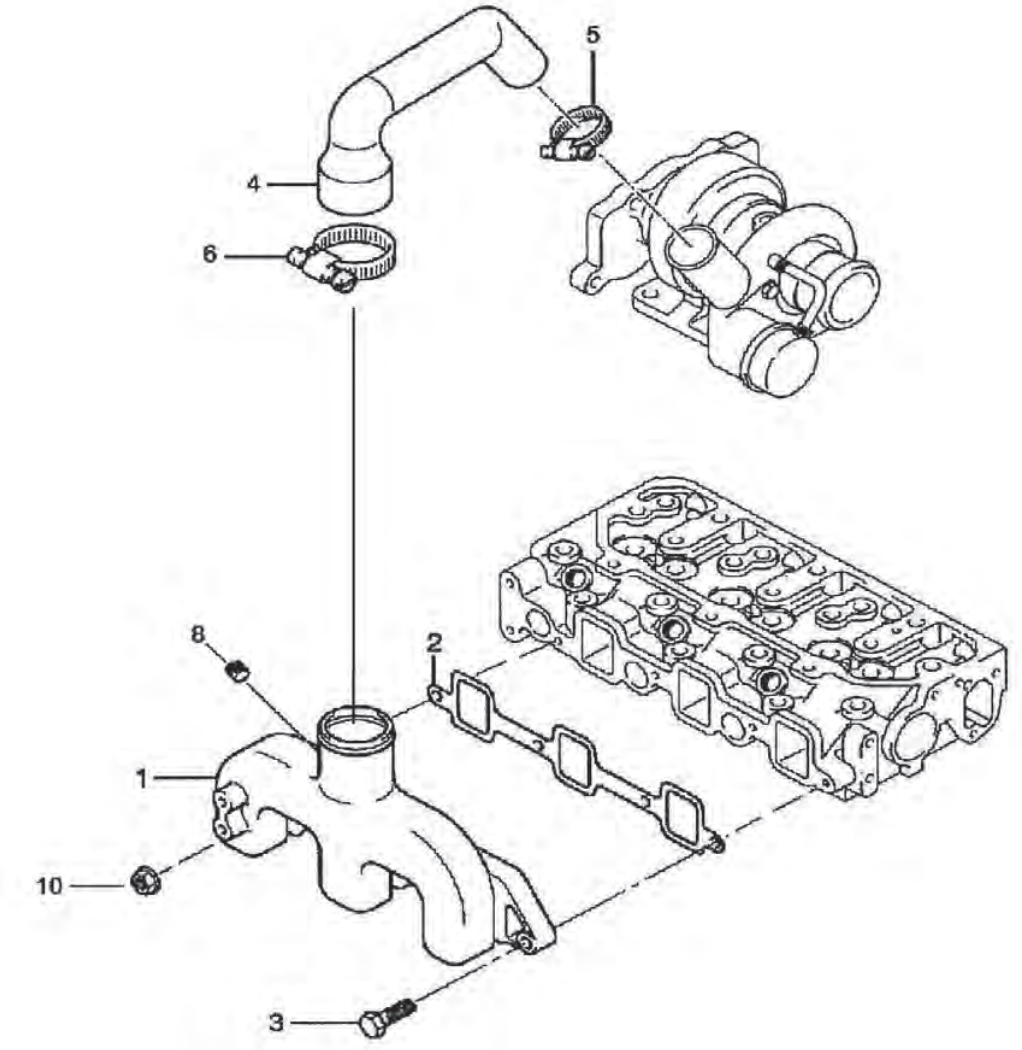
COMPONENTS

(1) Manifold, int.
(2) Packing(manifold, int)
(3) Bolt, flange 8 x 30
(4) Bolt, stud 8 x 35
(5) Nut, hexagon flange
(8) Tube, breather

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A1700T2_ETR



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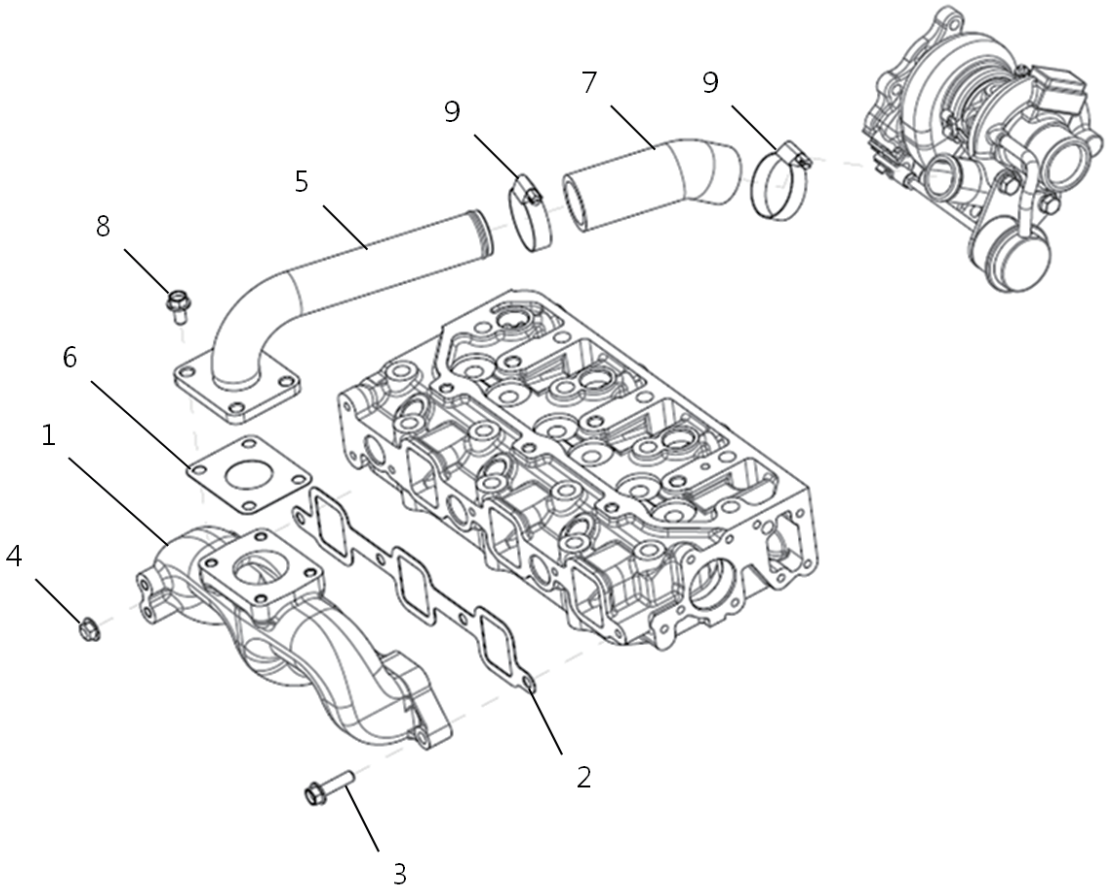
COMPONENTS

(1) Manifold, int.
(2) Packing(manifold, int)
(3) Bolt, flange 8 x 30
(4) Hose c, suc.
(5) Clip, hose 48
(6) Clip, hose 70
(8) Plug, pt 3/8
(10) Nut, flange 8

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A1700T2_UTR_4



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COMPONENTS

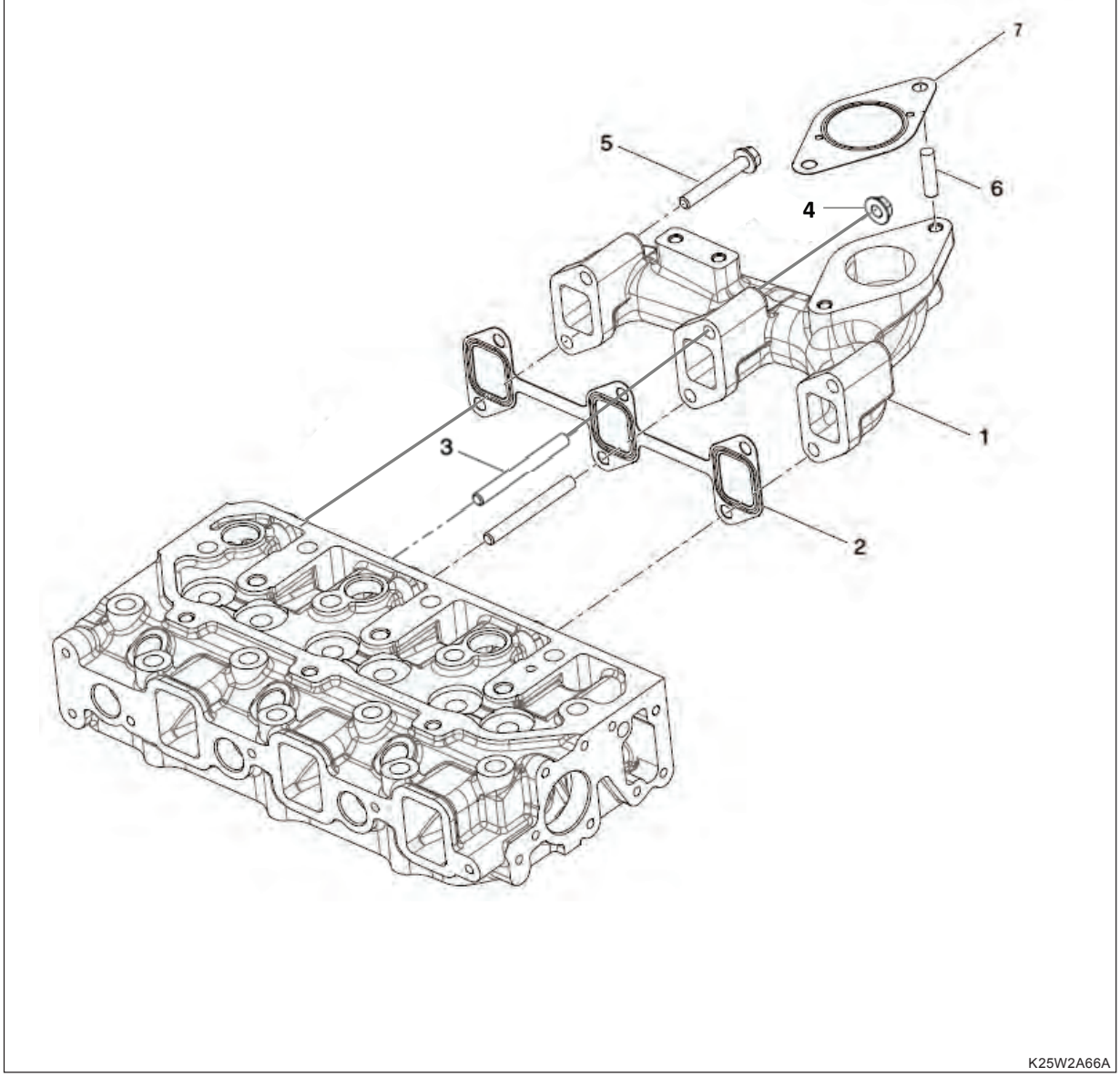
(1) Intake manifold
(2) Packing, intake manifold
(3) Flange bolt, M8 x L30
(4) Flange nut, M8
(5) Intake pipe
(6) Gasket, intake pipe
(7) Intake hose
(8) Flange bolt, M8 x L16
(9) Hose clip, Ø48

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5.6 EXHAUST MANIFOLD

A1700N4_UTR_4



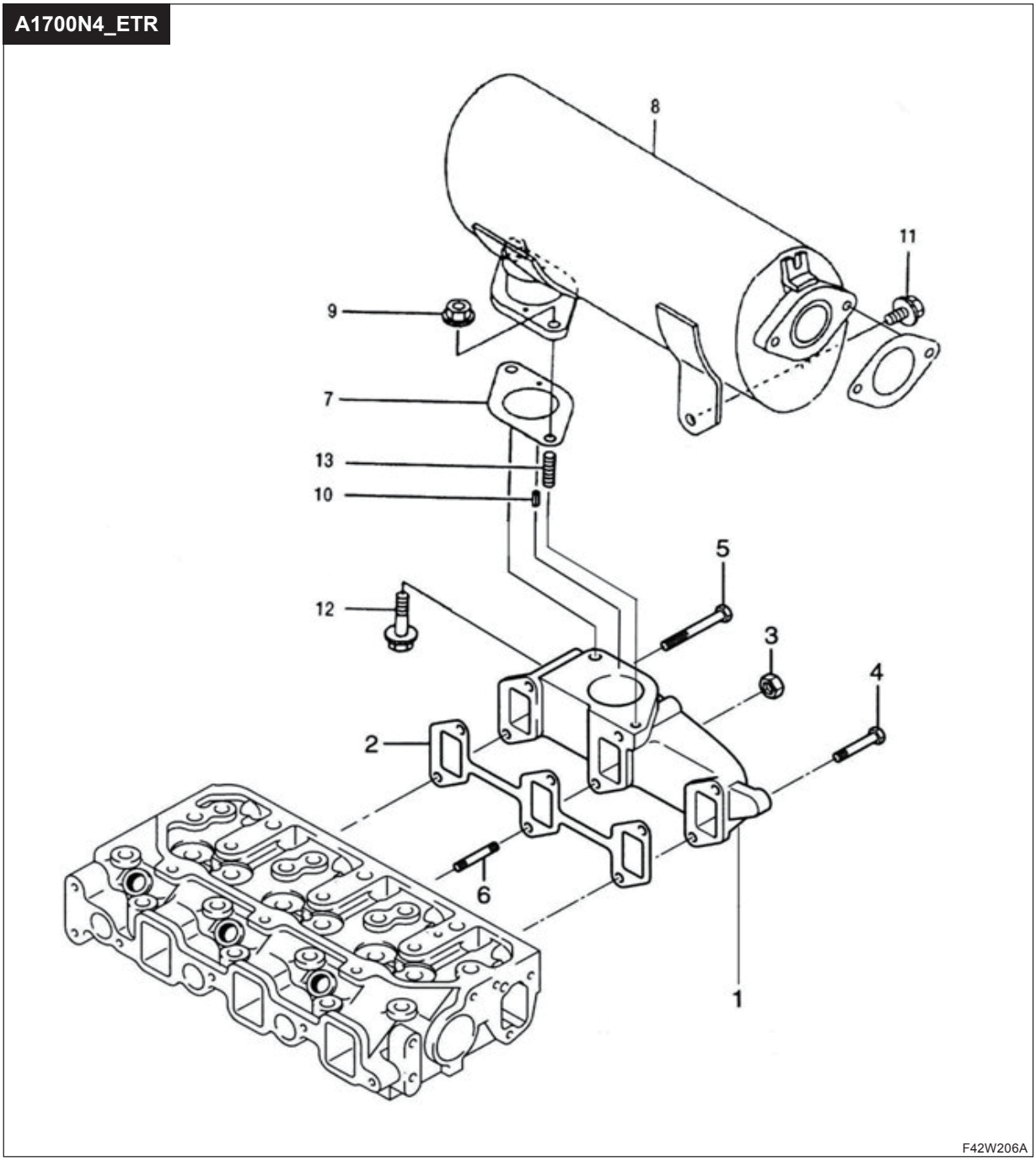
COMPONENTS

(1) Manifold, exhaust
(2) Gasket, exh. Manifold
(3) Bolt, stud
(4) Nut, flange 8
(5) Bolt, flange 8 x 80
(6) Bolt, stud 8 x 22
(7) Gasket(silencer)

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A1700N4_ETR



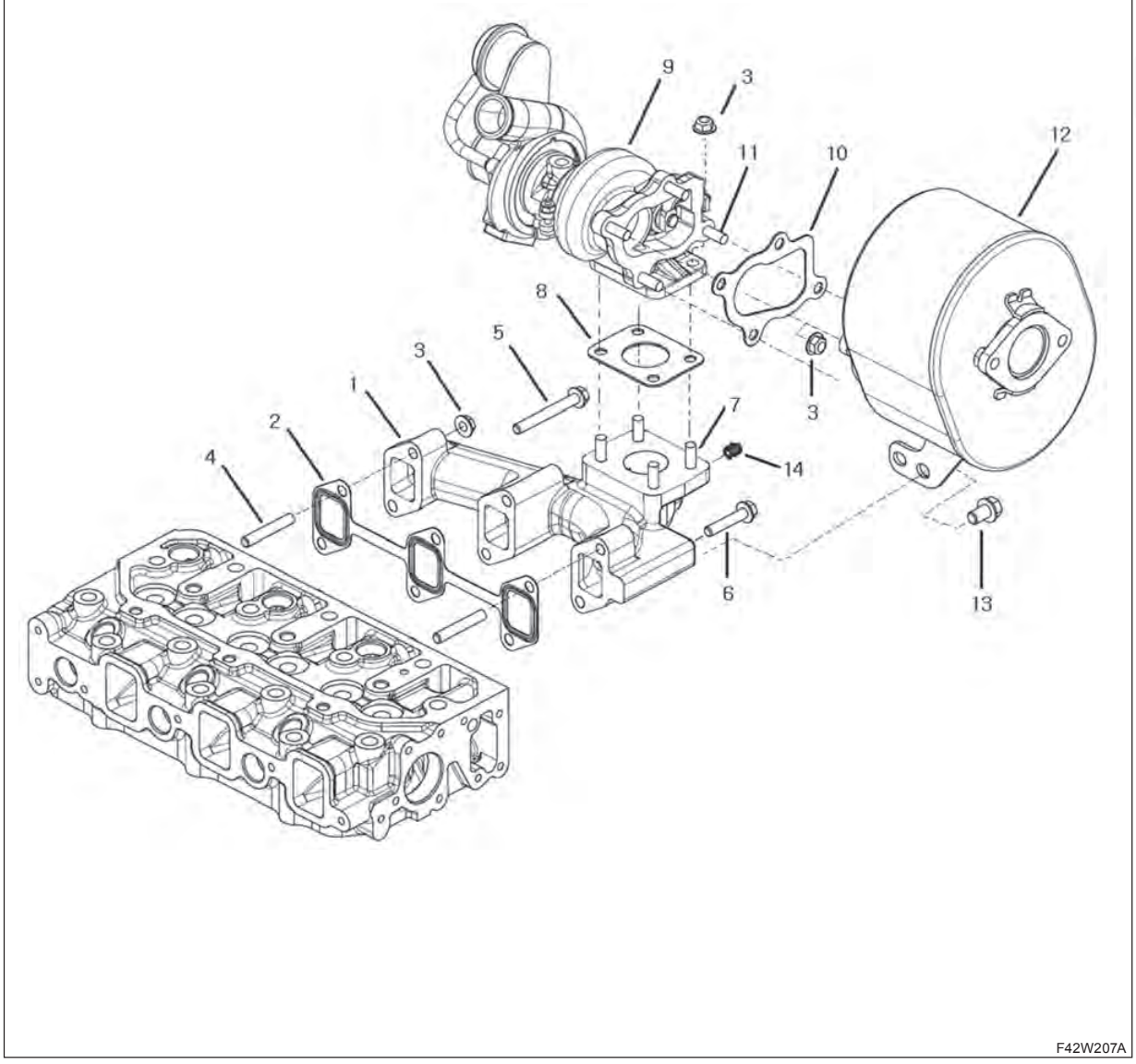
COMPONENTS

(1) Manifold, exhaust
(2) Gasket, exh. Manifold
(3) Nut, flange 8
(4) Bolt, flange 8 × 45
(5) Bolt, stud 8 × 50
(6) Bolt, flange 8 × 80
(7) Gasket(silencer)
(8) Silencer, exhaust
(9) Nut, flange 8
(10) Pin, spring
(11) Bolt, flange 8 x 16
(12) Bolt, flange 8 × 40
(13) Bolt, stud 8 x 22

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A1700T2_ETR



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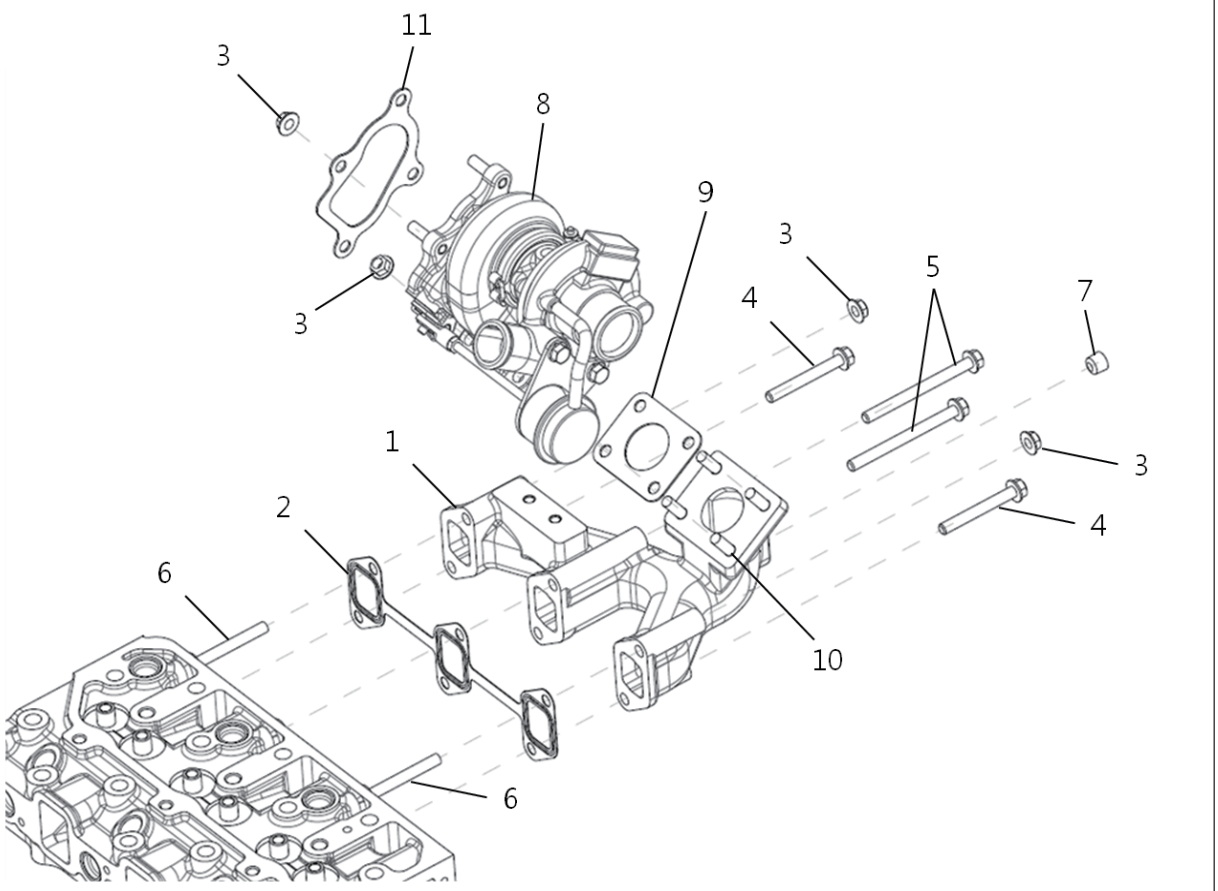
COMPONENTS

(1) Manifold, exhaust
(2) Gasket, exh. Manifold
(3) Nut, flange 8
(4) Bolt, stud 8 x 40
(5) Bolt, flange 8 ×65
(6) Bolt, flange 8 × 80
(7) Bolt, stud 8 x 22
(8) Gasket(T/C in)
(9) Turbo charge
(10) Gasket(T/C out)
(11) Bolt, stud 8 x 22
(12) Silencer, exhaust
(13) Bolt, flange 10 x 16
(14) Plug, pt 1/4

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A1700T2_UTR_4



F42W208A

COMPONENTS

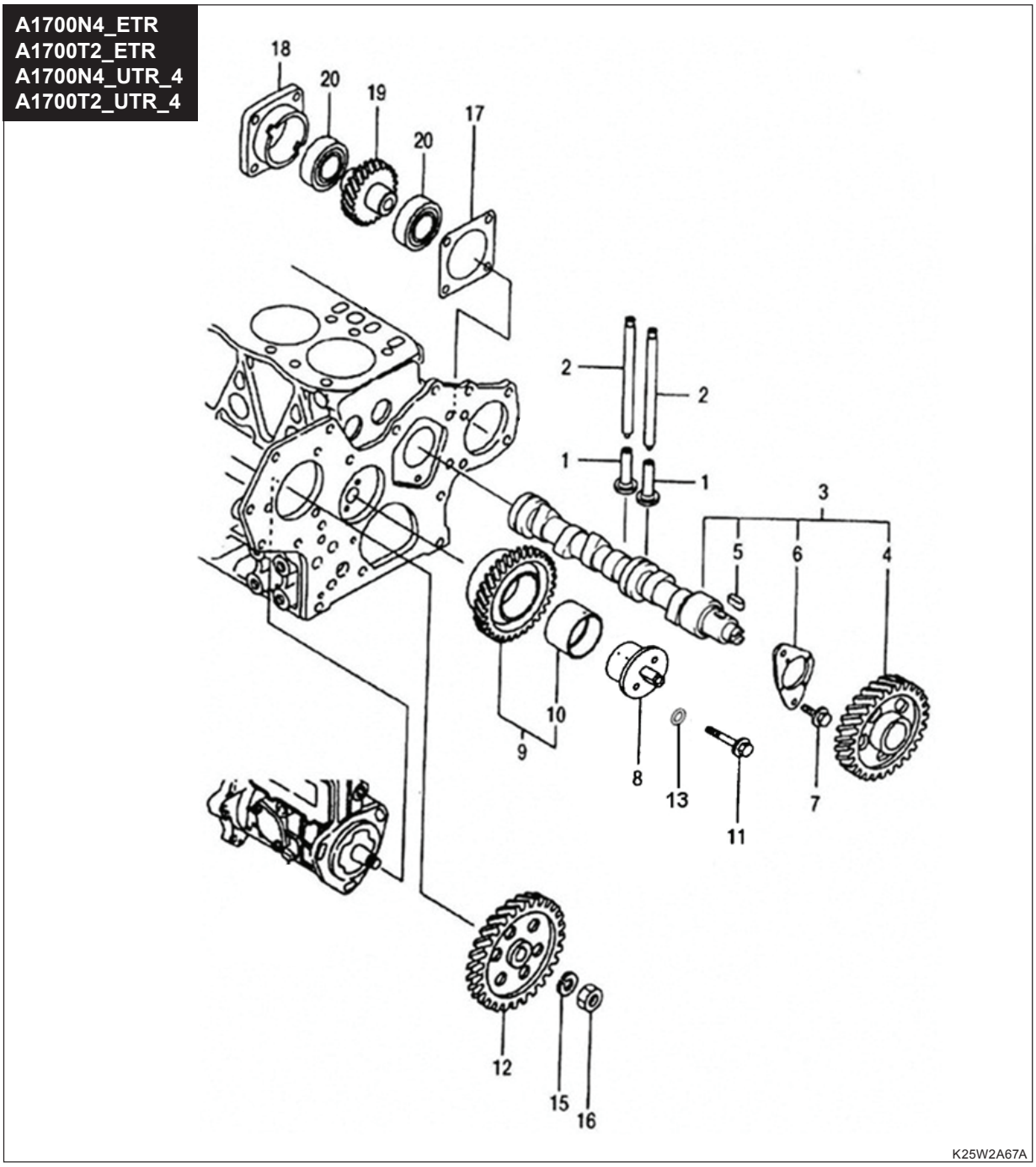
(1) Exhaust manifold
(2) Gasket, exhaust manifold
(3) Flange nut, M8
(4) Flange bolt, M8 x L65
(5) Flange bolt, M8 x L95
(6) Stud bolt, M8 x L65
(7) Tapper plug, pt 1/4
(8) Turbo charger
(9) Gasket, turbo charger in
(10) Stud bolt, M8 x L22
(11) Gasket, turbo charger out

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5.7 CAMSHAFT AND DRIVE GEAR

A1700N4_ETR
A1700T2_ETR
A1700N4_UTR_4
A1700T2_UTR_4



COMPONENTS

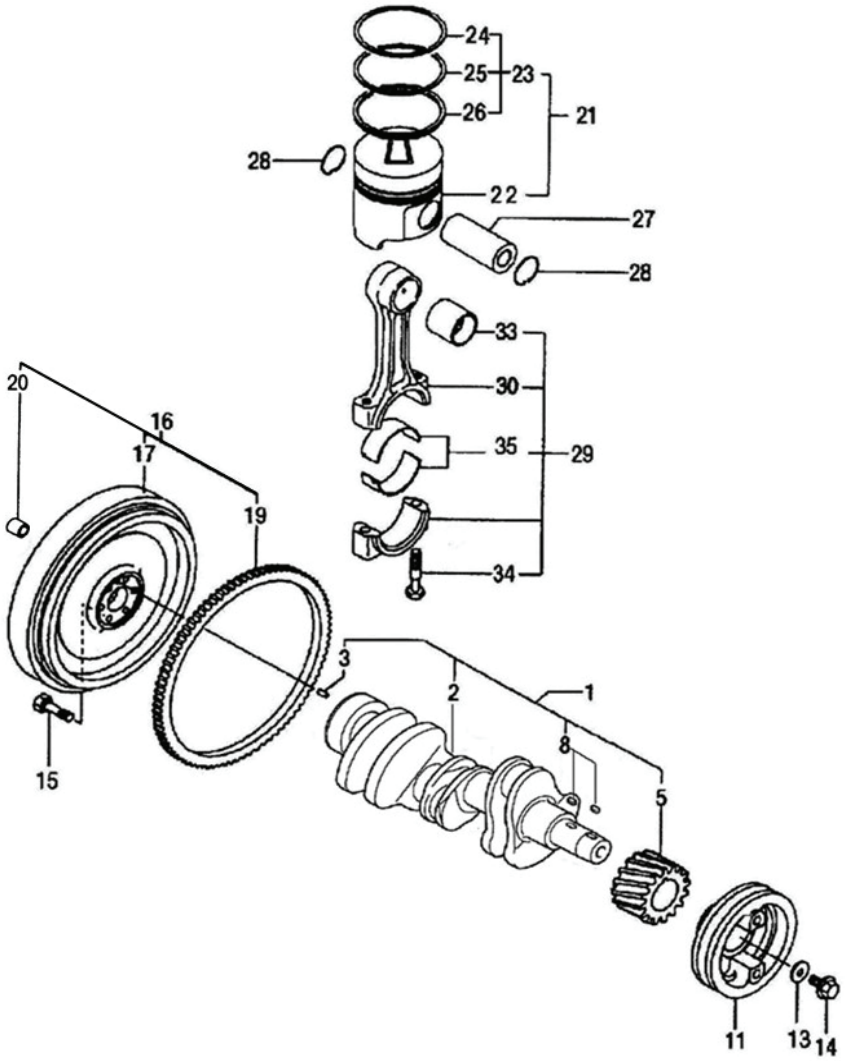
(1) Tappet
(2) Push rod
(3) Camshaft assembly
(4) Camshaft gear
(5) Sliding key
(6) Thrust bearing (camshaft)
(7) Hex. flange bolt
(8) Idle gear shaft
(9) Idle gear assembly
(10) Bushing (idle gear)
(11) Bolt (idle shaft)
(12) Fuel injection pump gear
(15) Spring washer
(16) Hex. nut
(17) Packing
(18) Hydraulic pump gear cover
(19) Hydraulic pump drive gear assembly
(20) Ball bearing (with deep groove)

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5.8 CRANKSHAFT AND PISTON

A1700N4_ETR
A1700T2_ETR
A1700N4_UTR_4
A1700T2_UTR_4



K25W2A68A

COMPONENTS

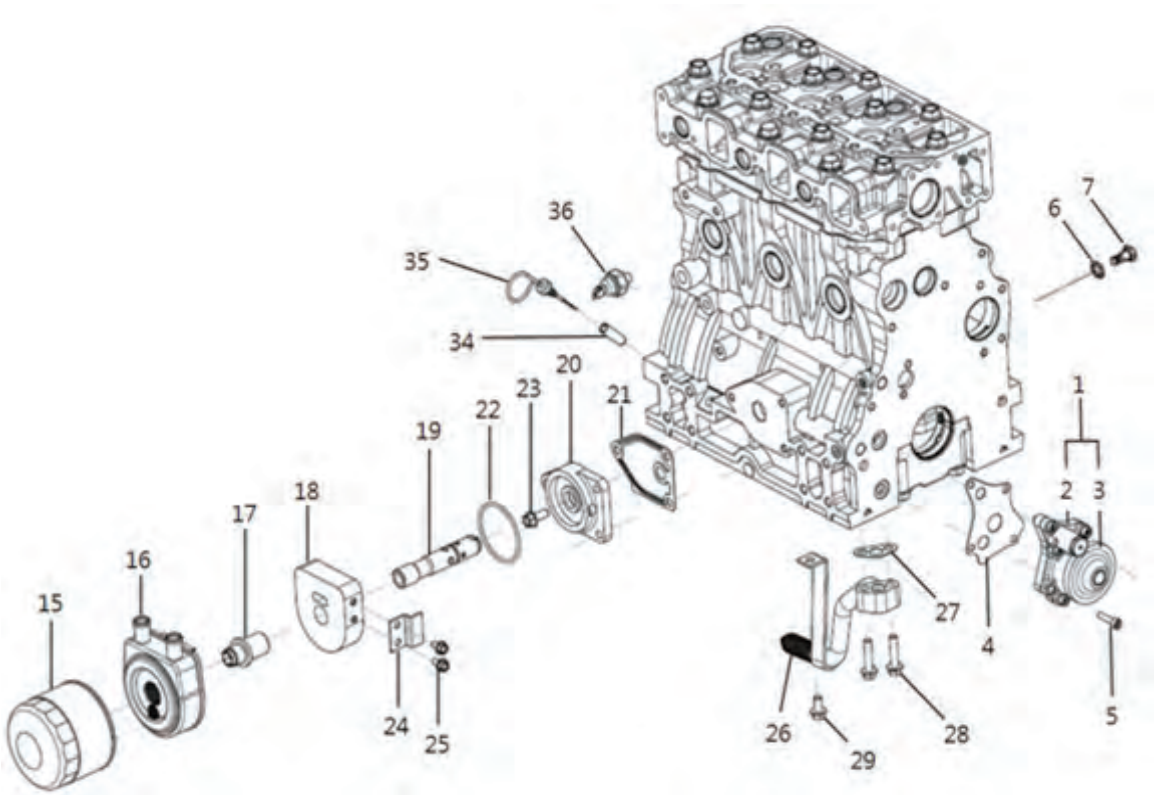
(1) Crank shaft ass'y
(2) Crank shaft
(3) Pin, parallel 8 × 16
(5) Gear, crank
(8) Key 7 × 14
(11) V-pulley(crank shaft)
(13) Washer(V-pulley) 8
(14) Bolt(V-pulley)
(15) Bolt, fly wheel
(16) Fly wheel ass'y (single 3cyl)
(17) Fly wheel (single 3cyl)
(19) Gear, ring
(20) Bearing, ball 6302
(21) Piston ass'y
(22) Piston
(23) Piston ring ass'y
(24) Piston ring (1st)
(25) Piston ring (2nd)
(26) Piston ring (oil)
(27) Pin, piston
(28) Ring, ratainer
(29) Connecting rod ass'y
(30) Connecting rod
(33) Bush(piston pin)
(34) Bolt(connecting rod)
(35) Bearing, crank pin

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5.9 LUBRICATION SYSTEM

A1700N4_ETR
A1700N4_UTR_4



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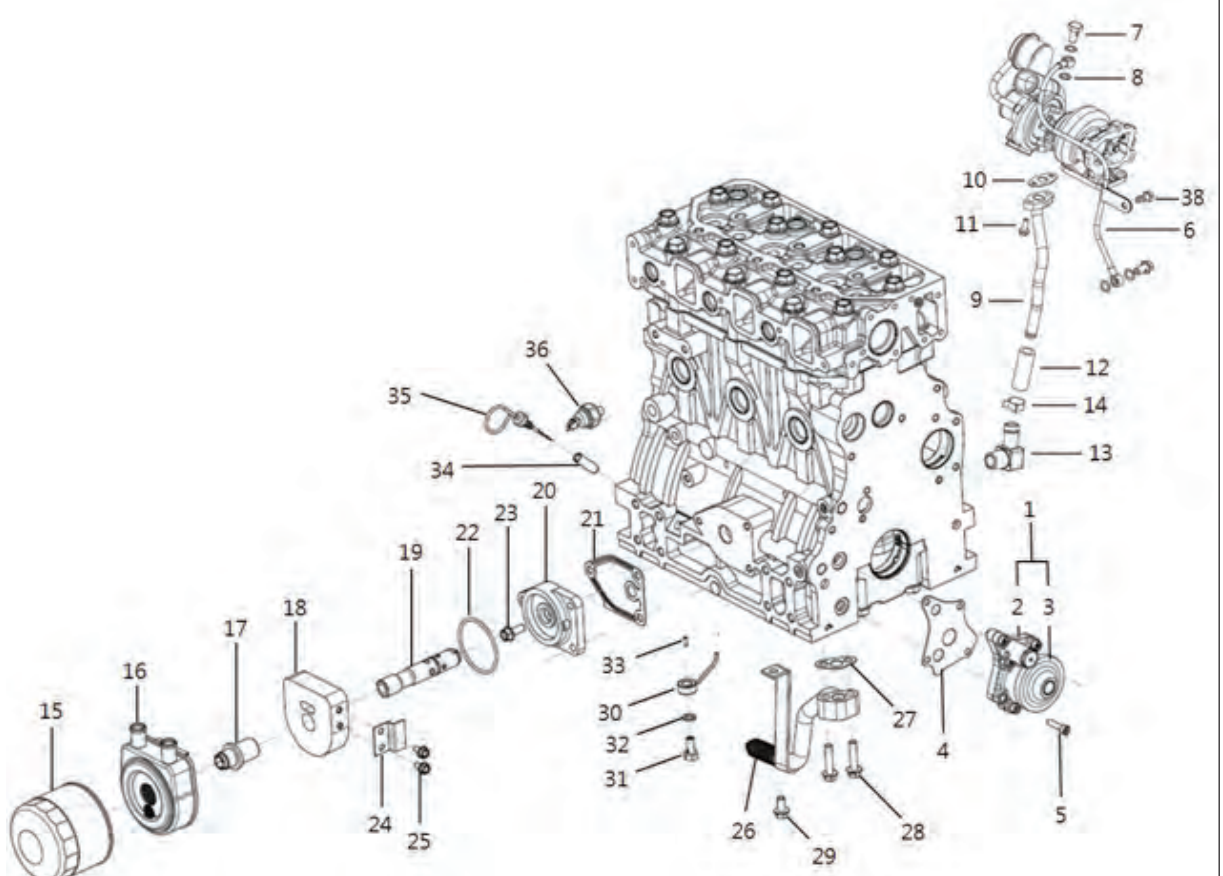
COMPONENTS

(1) Lub-oil pump ass'y
(2) Lub-oil pump
(3) Oil pump gear
(4) Packing, oil pump
(5) Bolt, M6 x L25
(6) Washer,sealing
(7) Screw,hexagon head cap
(15) Oil filter
(16) Oil cooler
(17) Bolt, oil cooler
(18) Space, oil cooler
(19) Oil pressure control valve
(20) Bracket, oil filter
(21) Packing, oil filter
(22) O-ring
(23) Flange bolt, M8 x L20
(24) Bracket, oil cooler
(25) Flange bolt, M6 × L12
(26) Oil suction pipe
(27) Packing, oil suction pipe
(28) Flange bolt, M8 x L35
(29) Flange bolt, M8 x L16
(34) Guide, dipstick
(36) Dipstick
(37) Oil pressure switch

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A1700T2_ETR



F42W210A

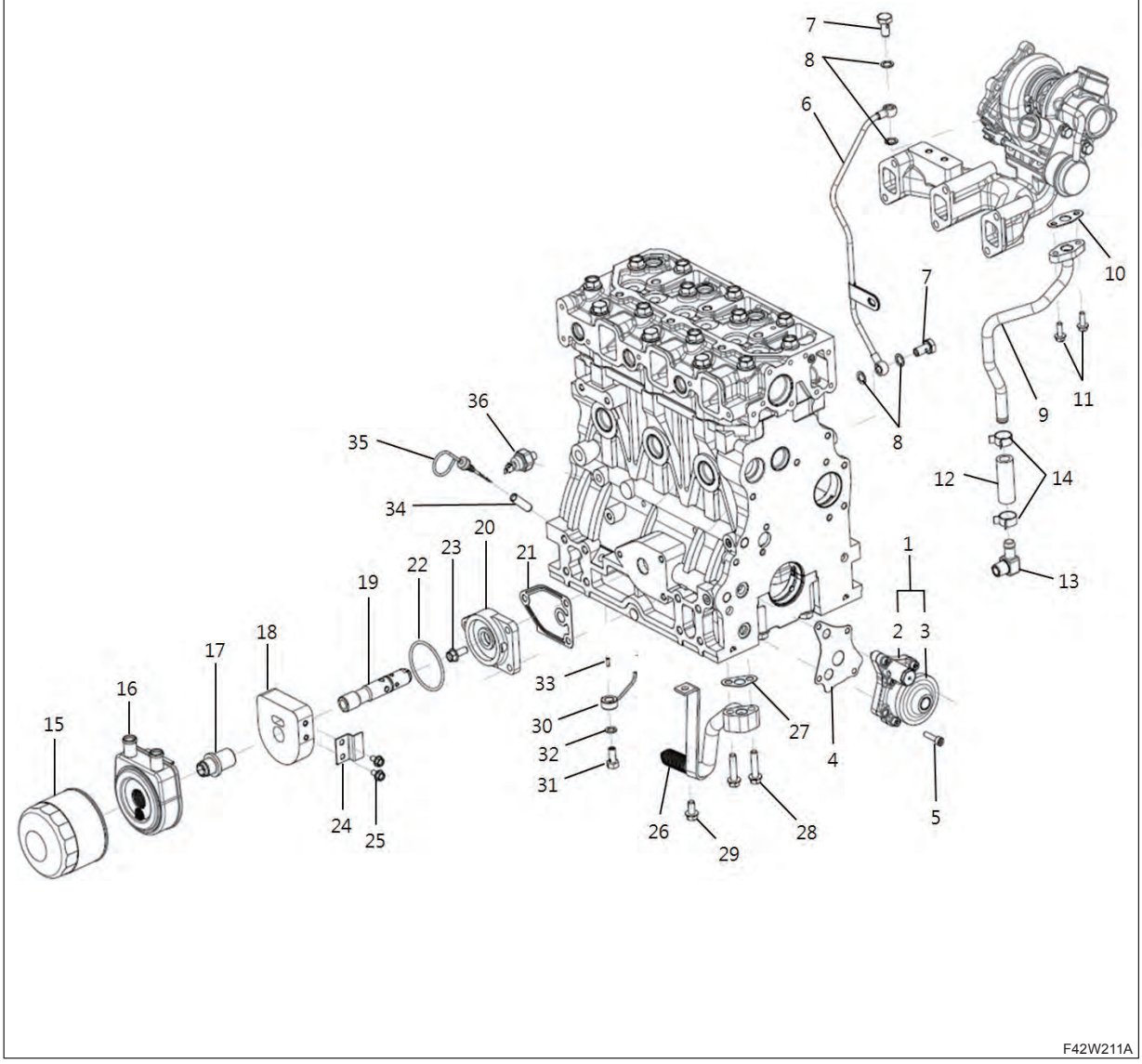
COMPONENTS

(1) Lub-oil pump ass'y
(2) Lub-oil pump
(3) Oil pump gear
(4) Packing, oil pump
(5) Bolt, M6 x L25
(6) Lub-oil pipe, T/C inlet
(7) Pipe bolt
(8) Copper packing, Ø10
(9) Lub-oil pipe, T/C outlet
(10) Packing, T/C lub-oul outlet
(11) Flange bolt, M6 x L18
(12) Connecting hose
(13) 90˚ Elbow
(14) Hose clip, Ø20
(15) Oil filter
(16) Oil cooler
(17) Bolt, oil cooler
(18) Space, oil cooler
(19) Oil pressure control valve
(20) Bracket, oil filter
(21) Packing, oil filter
(22) O-ring
(23) Flange bolt, M8 x L20
(24) Bracket, oil cooler
(25) Flange bolt, M6 × L12
(26) Oil suction pipe
(27) Packing, oil suction pipe
(28) Flange bolt, M8 x L35
(29) Flange bolt, M8 x L16
(30) Nozzle jet
(31) Check valve
(32) Copper packing, Ø8
(33) Spring pin
(34) Guide, dipstick
(36) Dipstick
(37) Oil pressure switch
(38) Flange, bolt 8 × 12

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A1700T2_UTR_4



COMPONENTS

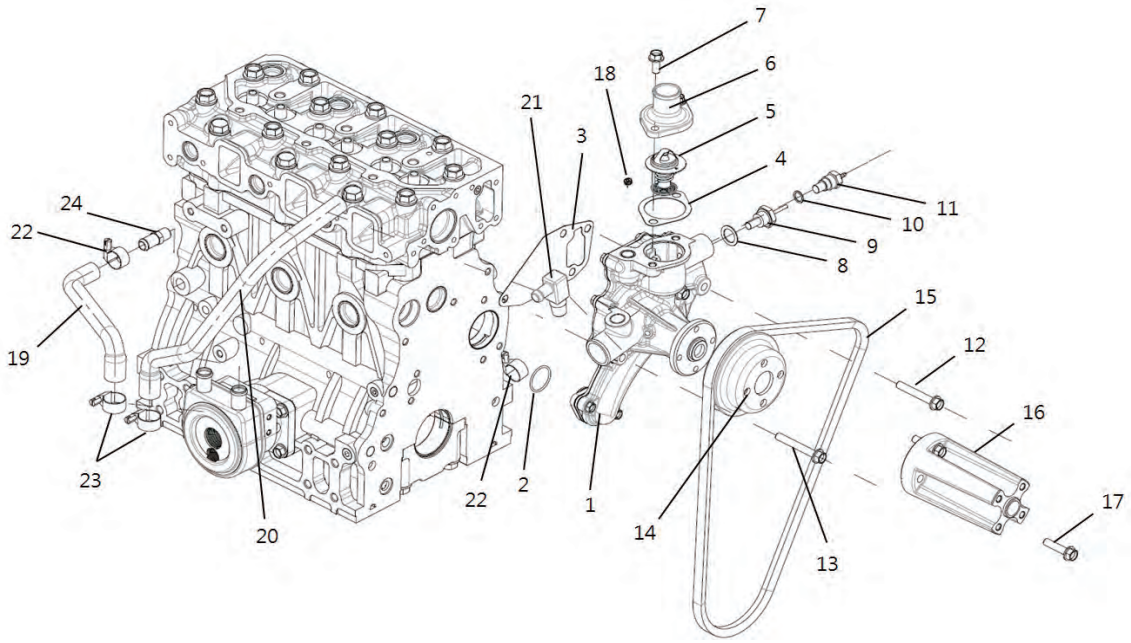
(1) Lub-oil pump ass'y
(2) Lub-oil pump
(3) Oil pump gear
(4) Packing, oil pump
(5) Bolt, M6 x L25
(6) Lub-oil pipe, t/c inlet
(7) Pipe bolt
(8) Copper packing, Ø10
(9) Lub-oil pipe, T/C outlet
(10) Packing, T/C lub-oul outlet
(11) Flange bolt, M6 x L18
(12) Connecting hose
(13) 90˚ Elbow
(14) Hose clip, Ø20
(15) Oil filter
(16) Oil cooler
(17) Bolt, oil cooler
(18) Space, oil cooler
(19) Oil pressure control valve
(20) Bracket, oil filter
(21) Packing, oil filter
(22) O-ring
(23) Flange bolt, M8 x L20
(24) Bracket, oil cooler
(25) Flange bolt, M6 × L12
(26) Oil suction pipe
(27) Packing, oil suction pipe
(28) Flange bolt, M8 x L35
(29) Flange bolt, M8 x L16
(30) Nozzle jet
(31) Check valve
(32) Copper packing, Ø8
(33) Spring pin
(34) Guide, dipstick
(36) Dipstick
(37) Oil pressure switch

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5.10 COOLING SYSTEM

A1700N4_ETR
A1700T2_ETR
A1700N4_UTR_4
A1700T2_UTR_4



F42W212A

COMPONENTS

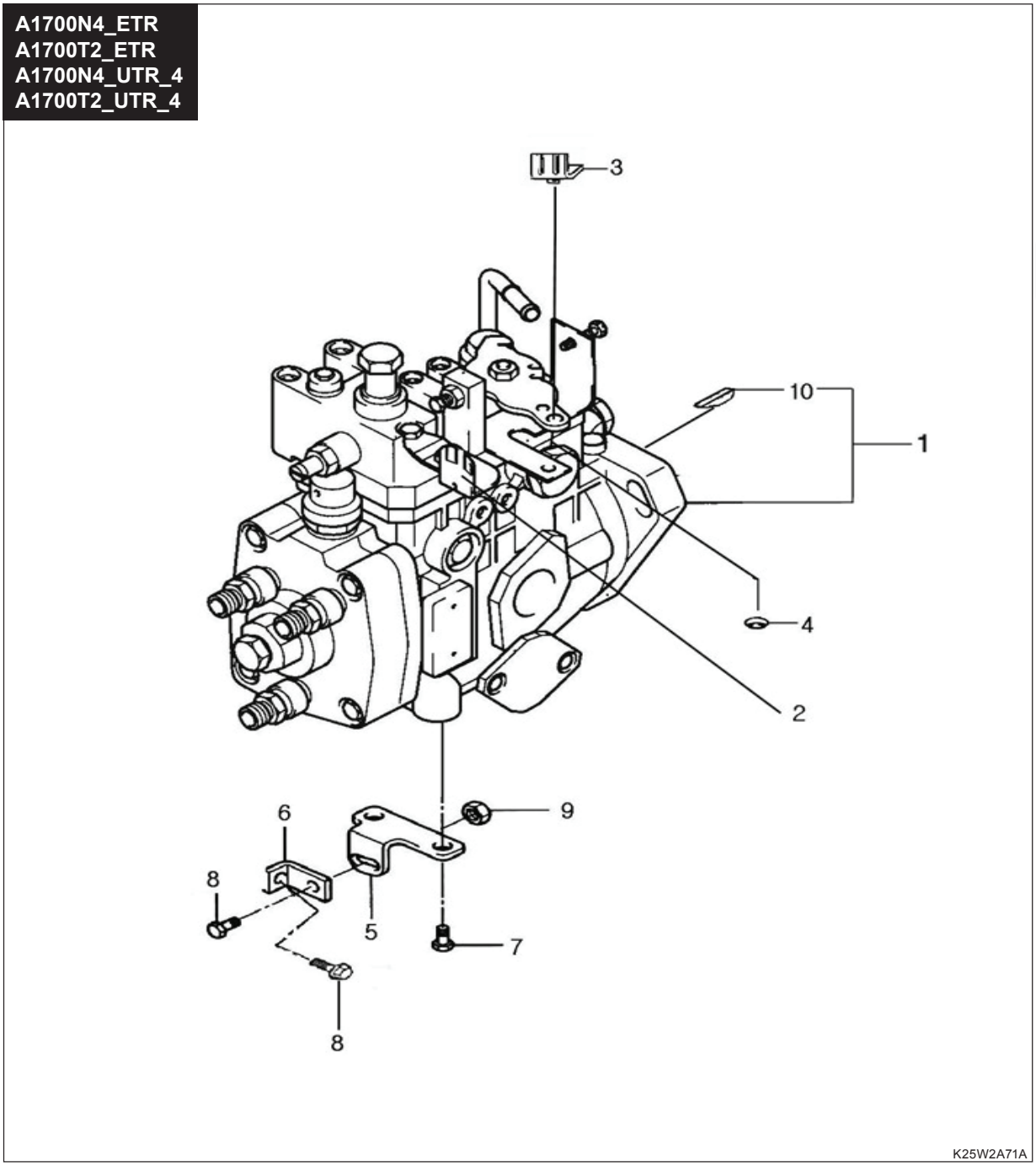
(1) Water pump ass'y
(2) O-ring
(3) Packing, water pump
(4) Packing, cover
(5) Thermostat
(6) Cover, thermostat
(7) Flange bolt, M8 × L18
(8) Copper packing, Ø16
(9) Sensor, glow plug
(10) Copper packing, Ø10
(11) Coolant temp. Sensor
(12) Flange bolt, M8 × L60
(13) Flange bolt, M8 × L55
(14) V-pully
(15) V-belt
(16) Spacer, cooling fan
(17) Flange bolt, M8 × L35
(18) Taper plug, pt 3/8
(19) Cooling hose A
(20) Cooling hose B
(21) 90˚ Elbow
(22) Hose clamp, Ø25
(23) Hose clamp, Ø22
(24) Joint, pt 1/4

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5.11 FUEL INJECTION PUMP

A1700N4_ETR
A1700T2_ETR
A1700N4_UTR_4
A1700T2_UTR_4



COMPONENTS

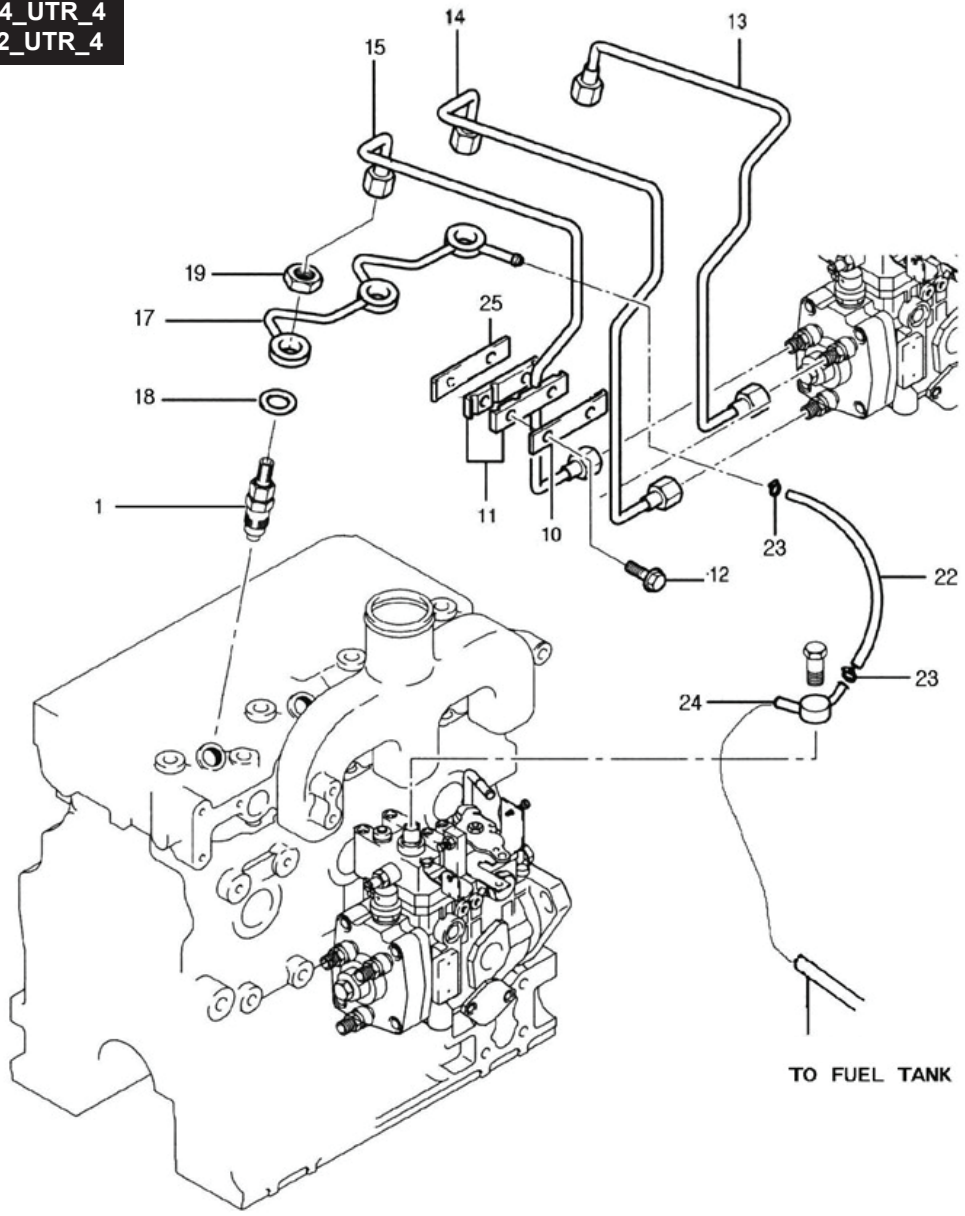
(1) Fuel injection pump ass'y
(2) Support
(3) Hook
(4) E-type retaining-ring
(5) Bracket,pump(A)
(6) Bracket,pump(B)
(7) Screw, hexagon head cap
(8) Bolt, flange 8 x 16
(9) Nut, flange
(10) Key,woodruff

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5.12 FUEL INJECTION SYSTEM AND VALVE

A1700N4_ETR
A1700T2_ETR
A1700N4_UTR_4
A1700T2_UTR_4



COMPONENTS

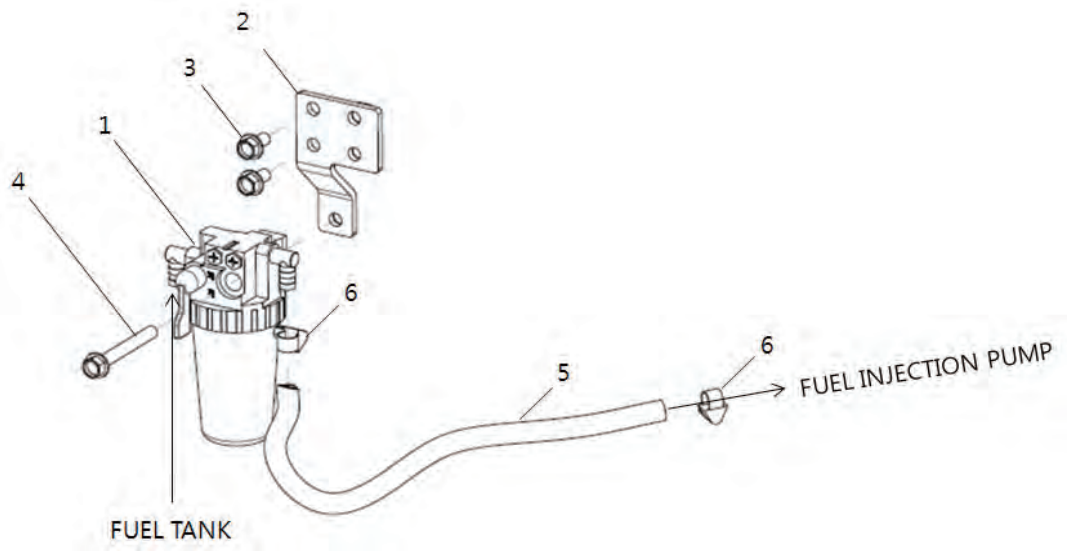
(1) Fuel injection valve assembly
(10) Bracket (fuel pipe)
(11) Bracket rubber (fuel pipe)
(12) Bracket plate
(13) Fuel pipe assembly (A)
(14) Fuel pipe assembly (B)
(15) Fuel pipe assembly (C)
(16) Fuel pipe assembly (D)
(17) Return pipe assembly
(18) Packing (joint)
(19) Hex. mounting nut
(22) Return hose
(23) Hose clip
(24) Joint
(25) Hex. flange nut

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5.13 FUEL SYSTEM

A1700N4_ETR
A1700T2_ETR



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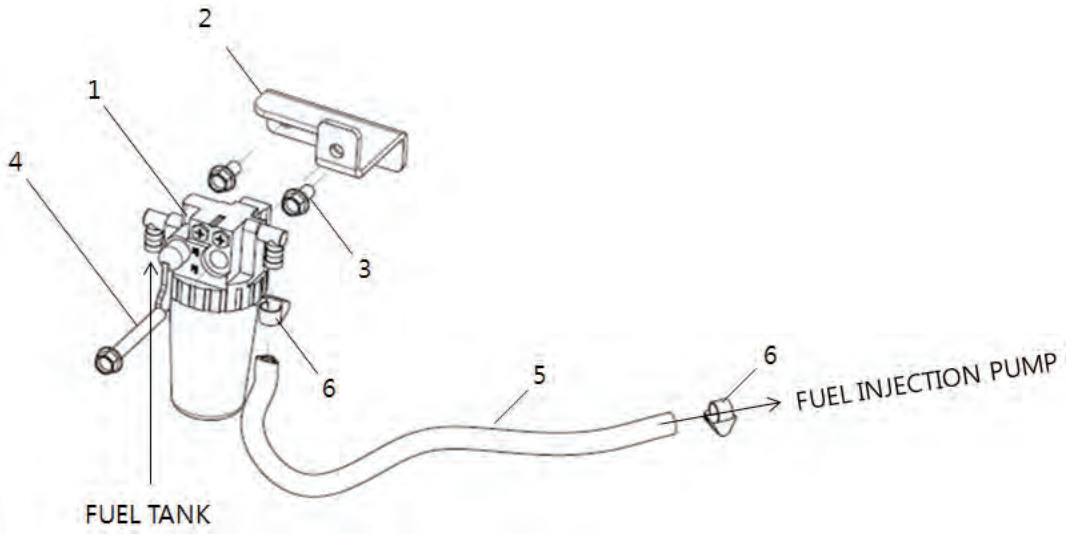
COMPONENTS

(1) Fuel filter ass'y
(2) Bracket, fuel filter
(3) Bolt, flange
(4) Bolt, flange
(5) Hose, fuel ass'y
(6) Hose clip, Ø13

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A1700N4_UTR_4
A1700T2_UTR_4



F42W214A

COMPONENTS

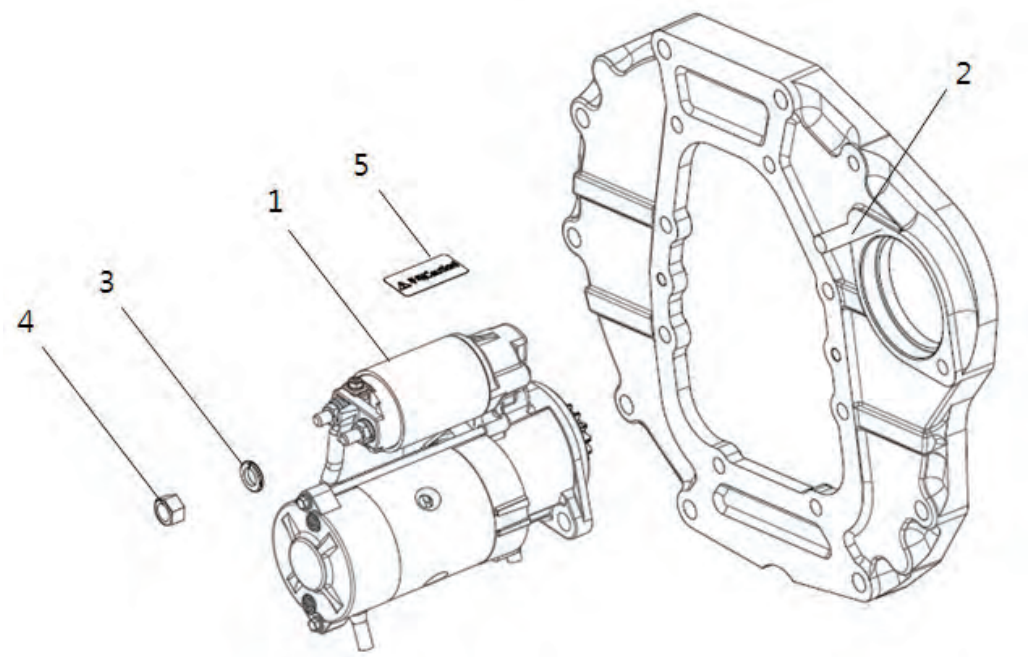
(1) Fuel filter ass'y
(2) Bracket, fuel filter
(3) Flange bolt, M8 x L16
(4) Flange bolt, M8 x L16
(5) Fuel hose
(6) Hose clip, Ø13

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5.14 START MOTOR

A1700N4_ETR
A1700T2_ETR
A1700N4_UTR_4
A1700T2_UTR_4



F42W219A

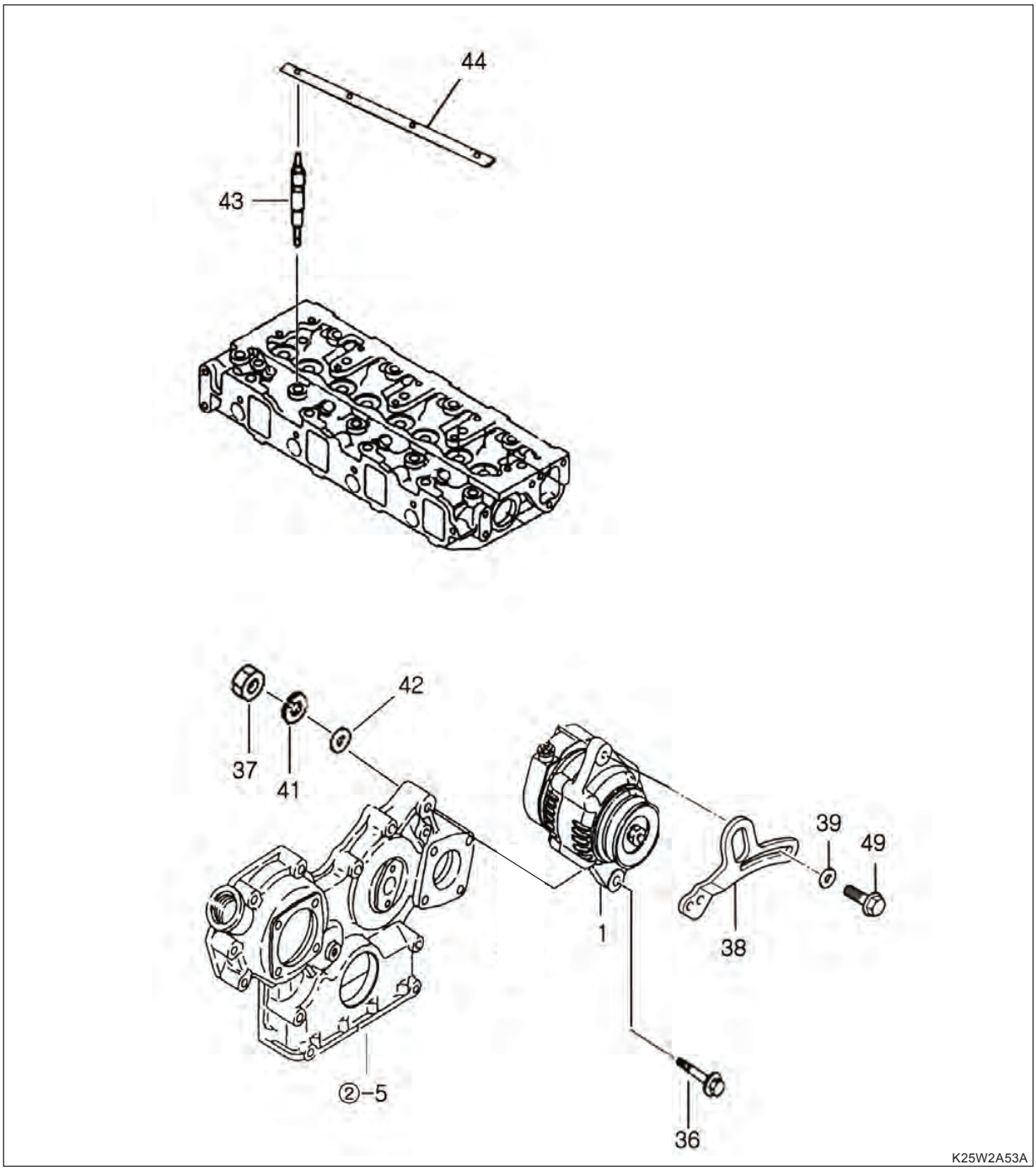
COMPONENTS

(1) Starter
(2) Stud bolt, M12 x L30
(3) Spring washer
(4) Nut, M12
(5) Caution plate

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5.15 ALTERNATOR AND ELECTRIC SYSTEM



COMPONENTS

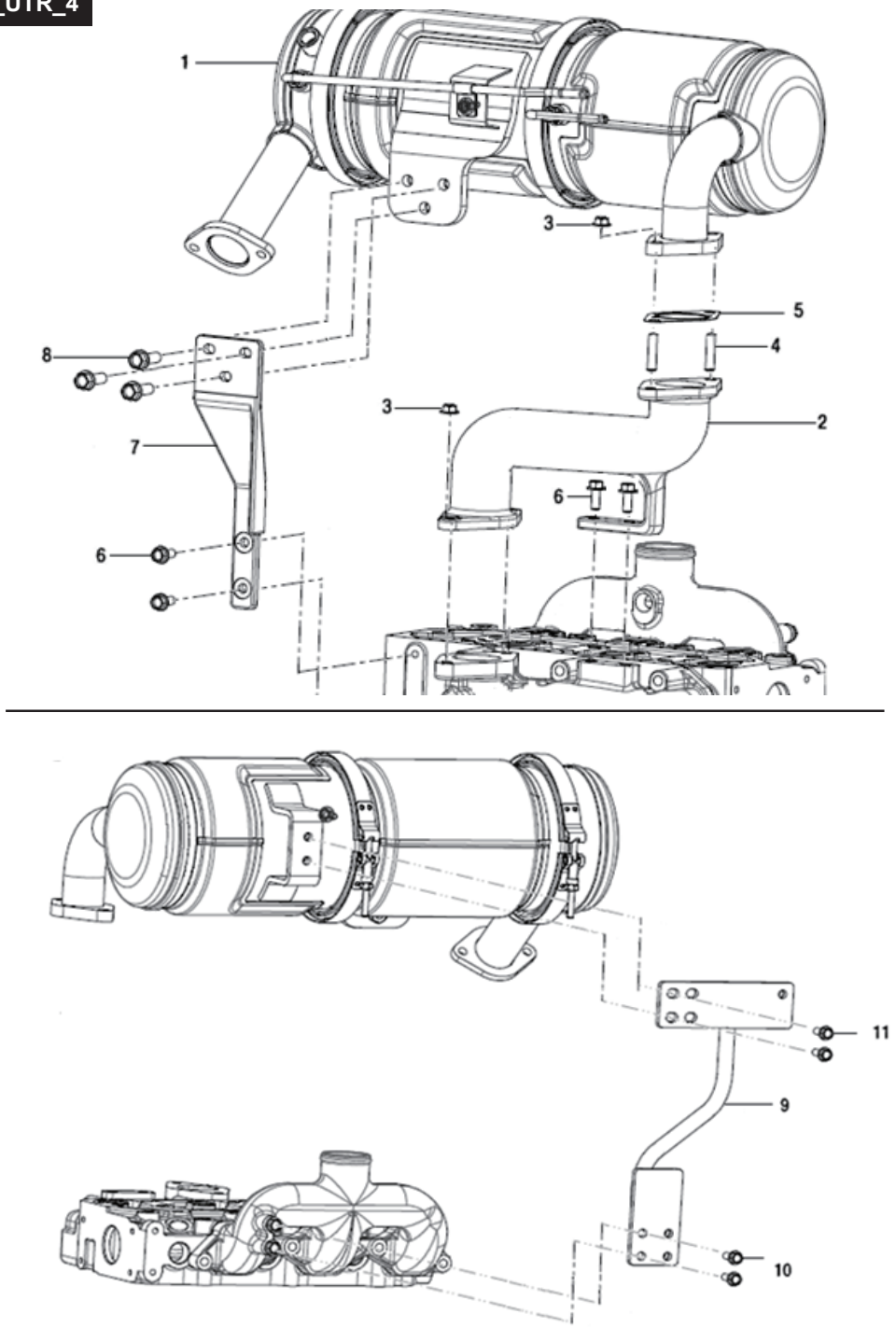
(1) Alternator(12V-45A)
(1) Alternator(12V-70A)
(36) Bolt 10
(36) Bolt 8
(37) Nut 10
(37) Nut 8
(38) Bracket
(39) Washer
(41) Washer, lock
(42) Washer
(42) Washer
(43) Plug, thermostart
(44) Connector
(49) Bolt 8×30

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5.16 DPF APPLICATION SYSTEM

A1700N4_UTR_4



F42W215A

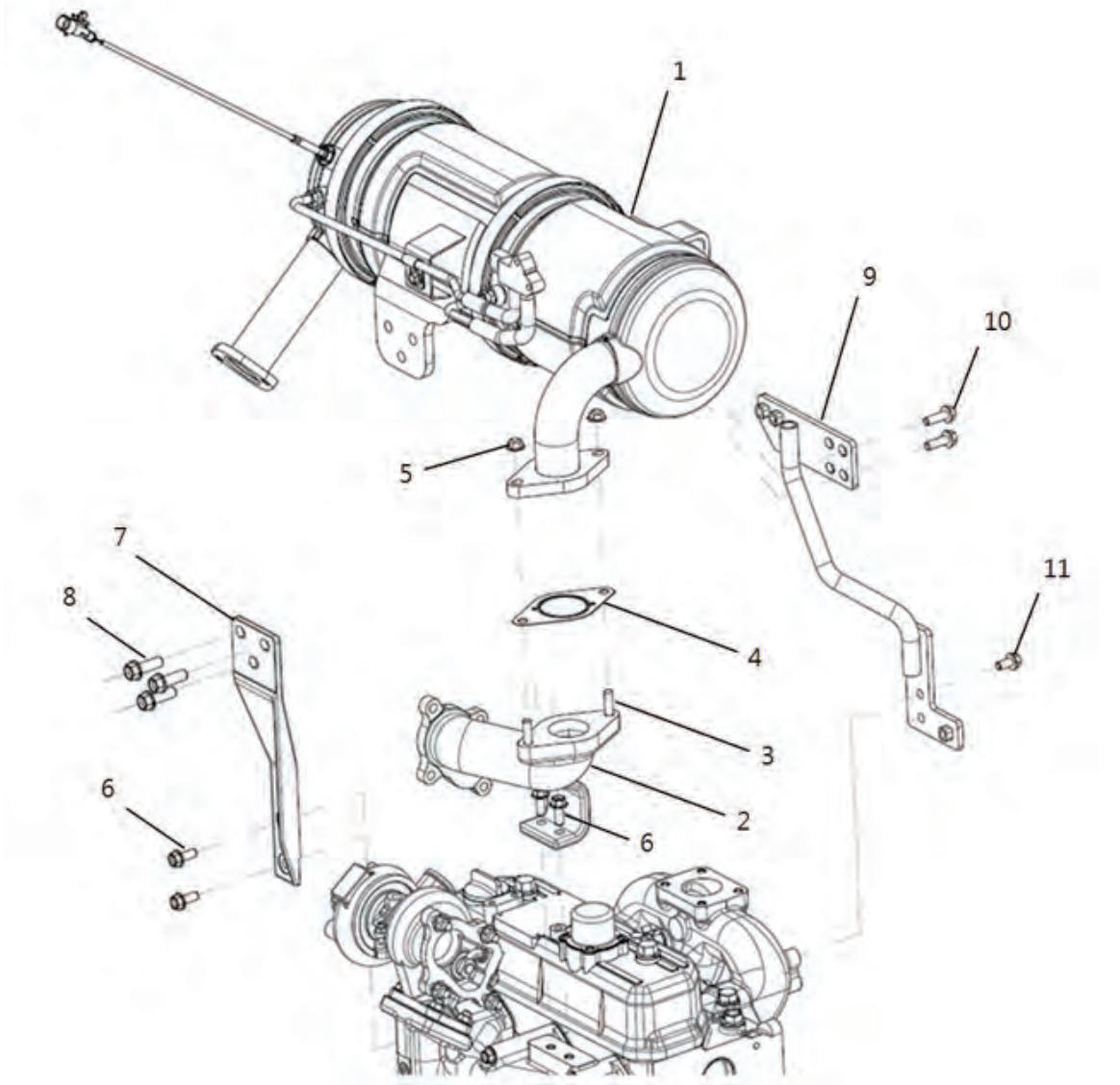
COMPONENTS

(1) Dpf
(2) Dpf supprort(A)
(3) Nut, flange 8
(4) Stud bolt
(5) Gasket
(6) Bolt, flange
(7) Dpf supprort(B)
(8) Bolt, flange
(9) Dpf bracket
(10) Bolt, flange
(11) Bolt, flange

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A1700T2_UTR_4



F42W216A

COMPONENTS

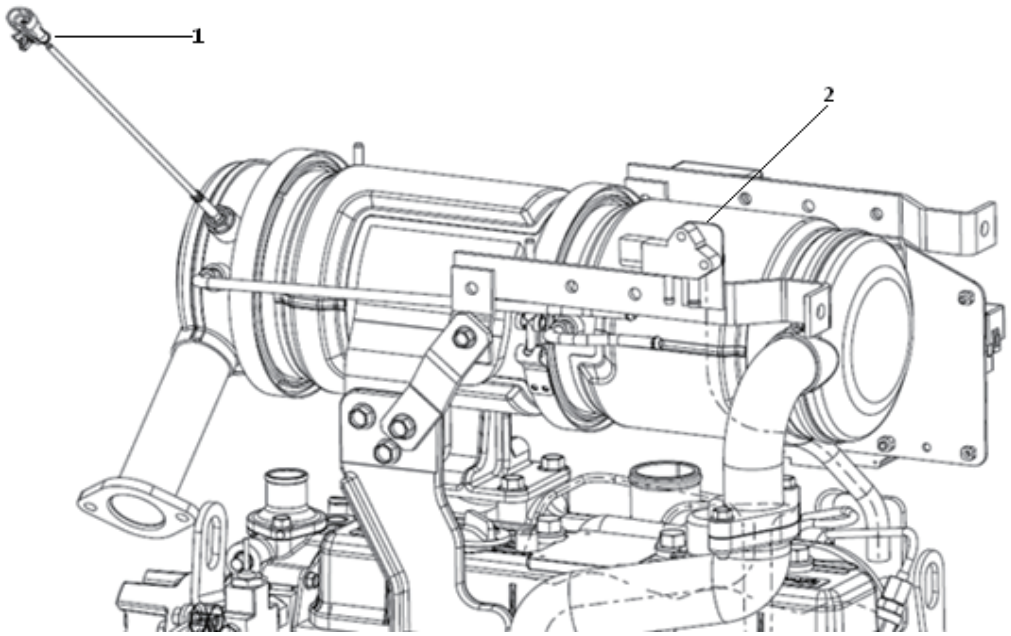
(1) Dpf system
(2) Dpf fixed housing
(3) Stud bolt, M8 x L25
(4) Gasket
(5) Flange nut, M8
(6) Flange bolt, M8 x L20
(7) Dpf support
(8) Flange bolt, M10 x L30
(9) Dpf fixed bracket
(10) Flange bolt, M8 x L25
(11) Flange bolt, M8 x L16

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5.17 DPF'S SENSOR OPTION

A1700N4_UTR_4



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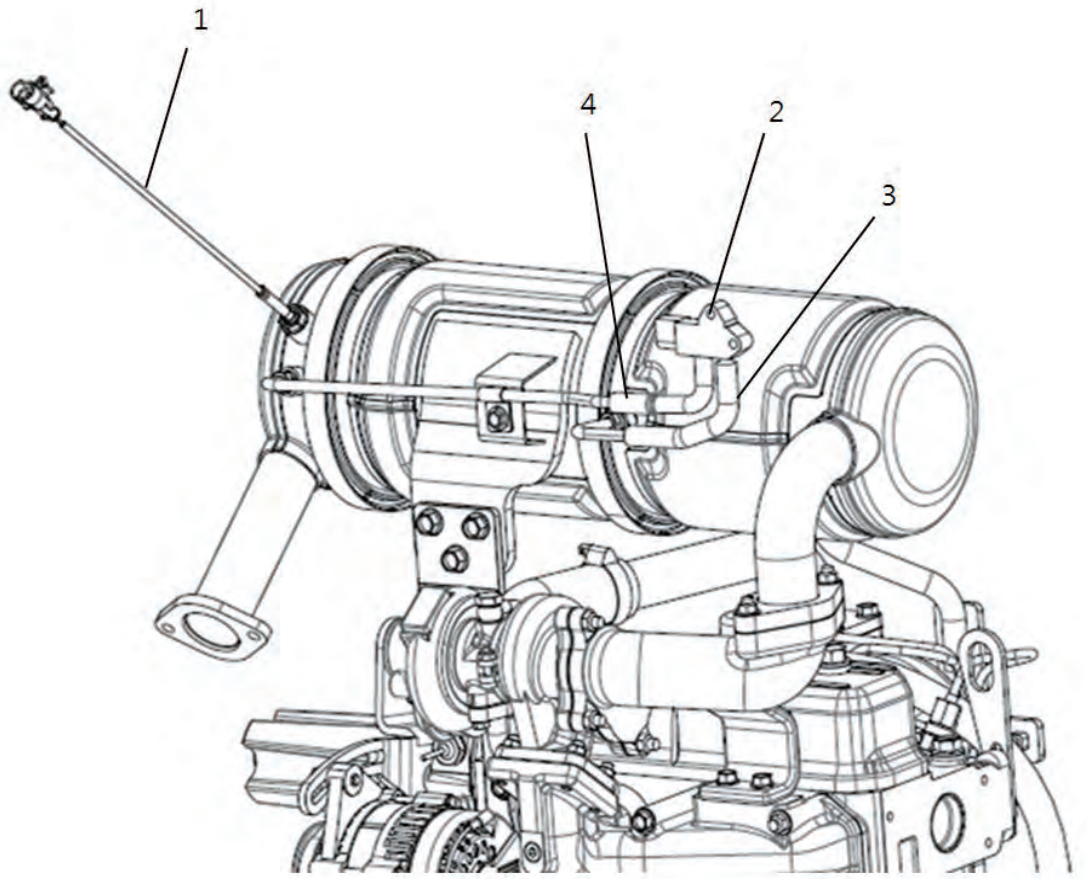
COMPONENTS

(1) Temperature sensor
(2) DPF diff, pressure sensor
(3) Hose A, diff. Pressure sensor
(4) Hose B, diff. Pressure sensor

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A1700T2_UTR_4



F42W218A

COMPONENTS

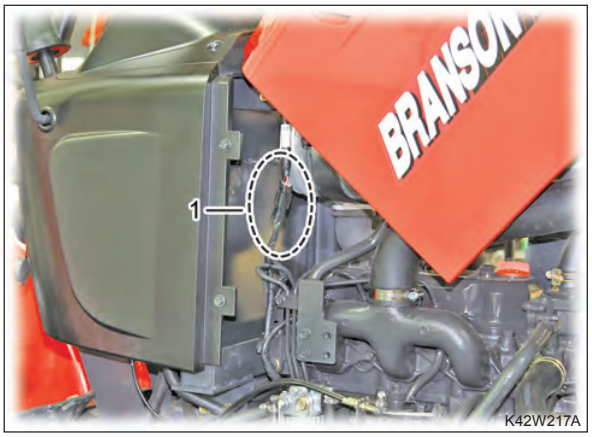
(1) Temperature sensor
(2) DPF diff, pressure sensor
(3) Hose A, diff. Pressure sensor
(4) Hose B, diff. Pressure sensor

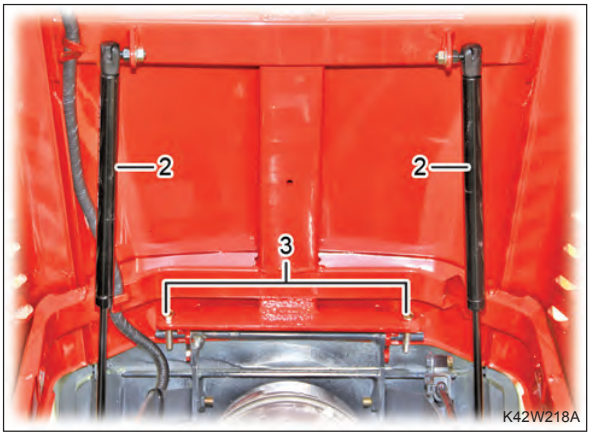
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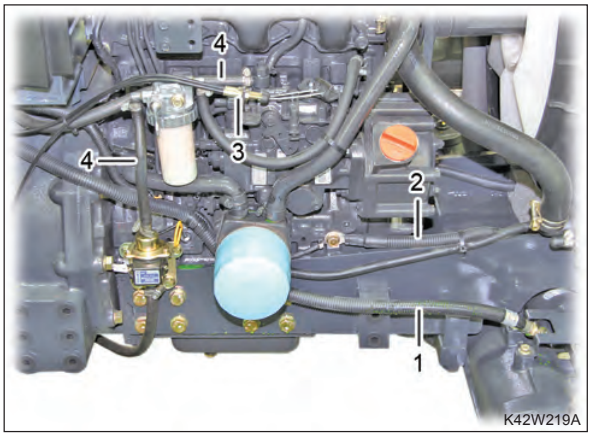
6. DISASSEMBLY AND SERVICE

6.1 ENGINE REMOVAL

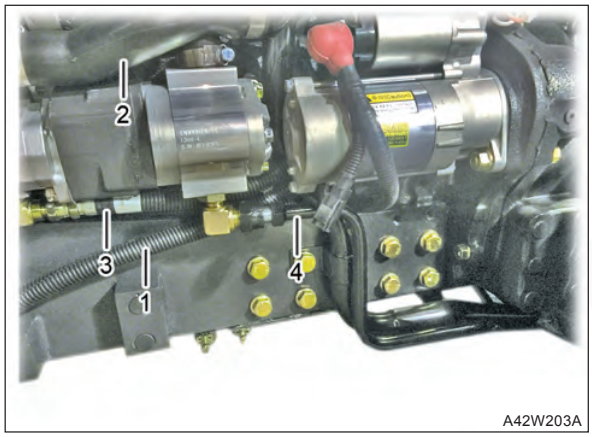




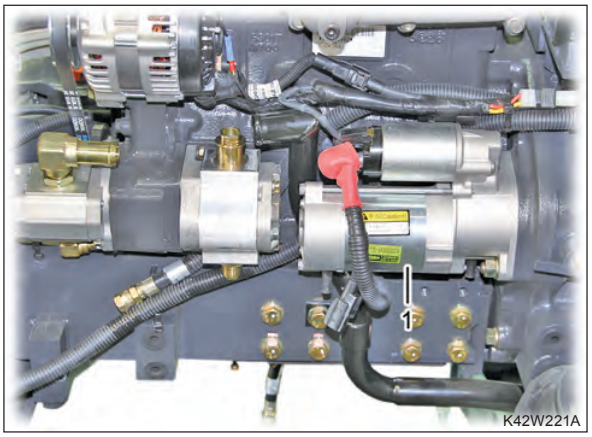
1. Open the bonnet to disconnect the head lamp wiring connector (1), gas cylinder (2). Then, unscrew the bonnet mounting bolts (3) to remove the bonnet.



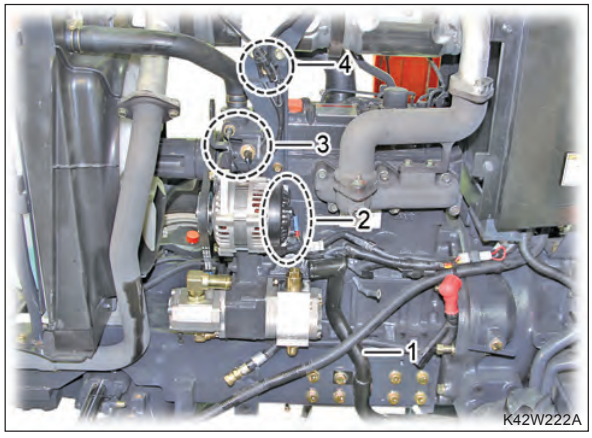
2. Disconnect the steering cylinder hose (1), ground wire (2), accelerator cable (3) and fuel hose (4) from right side of the engine.



3. Disconnect the steering cylinder hose (1), hydraulic pump suction hose (2), steering unit hose (3) and hydraulic pipe (4) from left side of the engine.



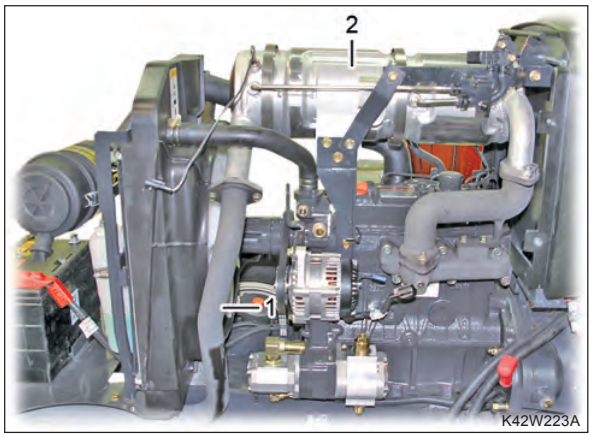
4. Remove the start motor (1).



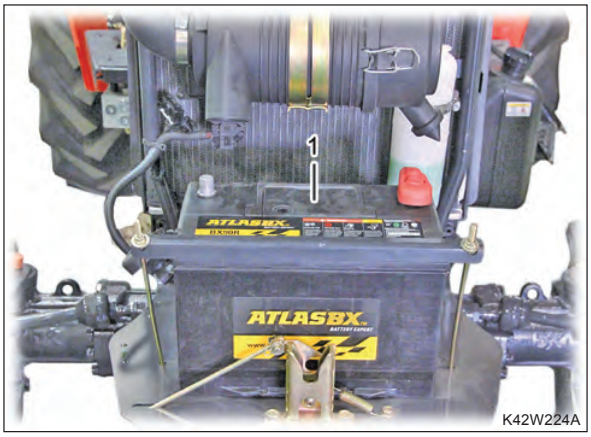
5. Disconnect the hydraulic suction pipe(1), generator wiring connector (2), coolant temperature sensor connector (3) and DPF wiring connector (4).

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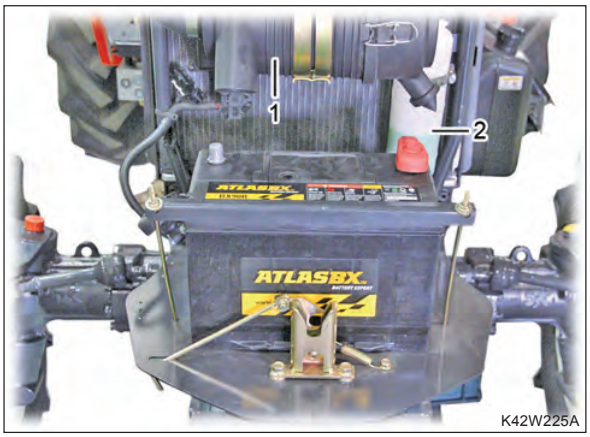
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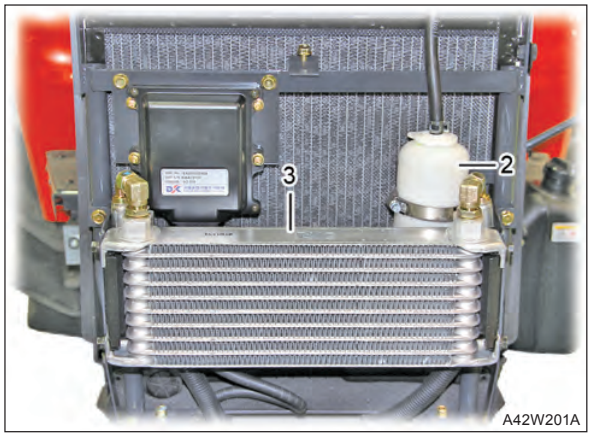


6. Remove the exhaust pipe (1) and DPF assembly (2).

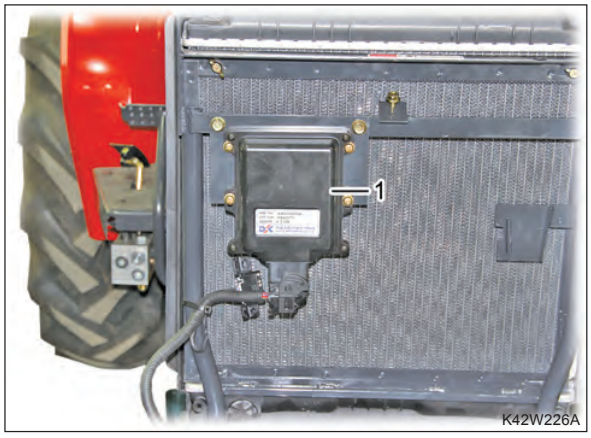


7. Remove the battery (1).





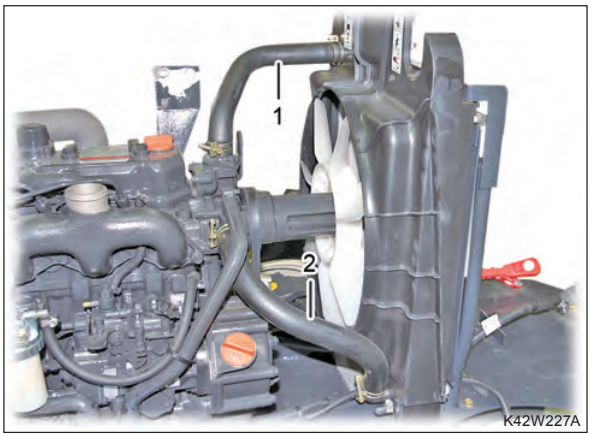
8. Remove the air cleaner (1) and reservoir tank (2). Remove the oil cooler(3). [HST MODEL]



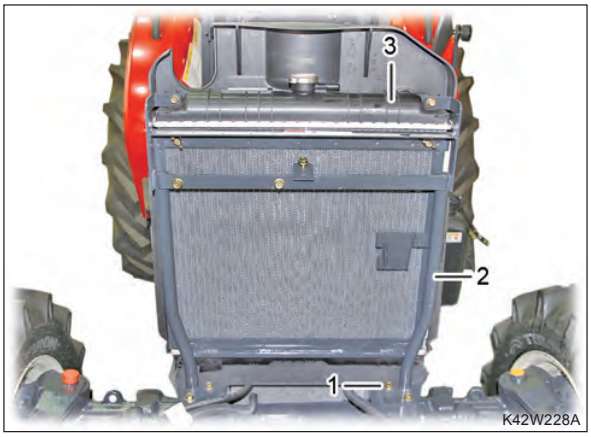
9. Remove the ECU (1).

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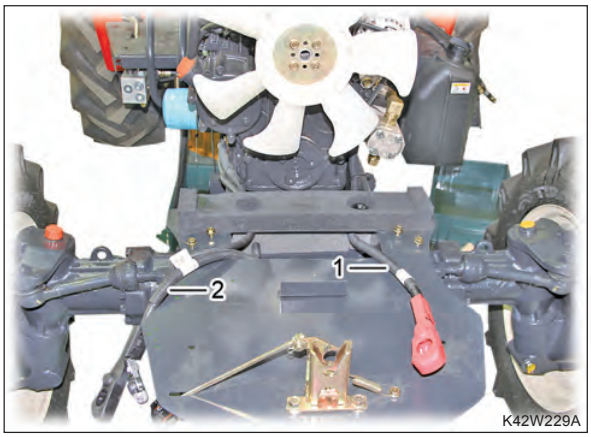
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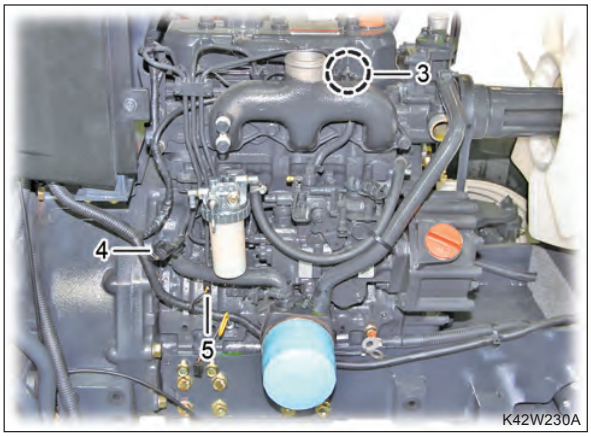


10. Disconnect the radiator hose (Upper: 1, Lower: 2).

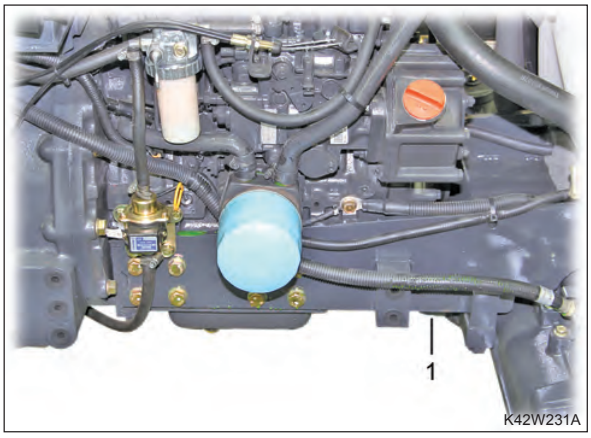


11. Unscrew the radiator support mounting bolts (1)(4EA) to remove the radiator support (2) and radiator (3).





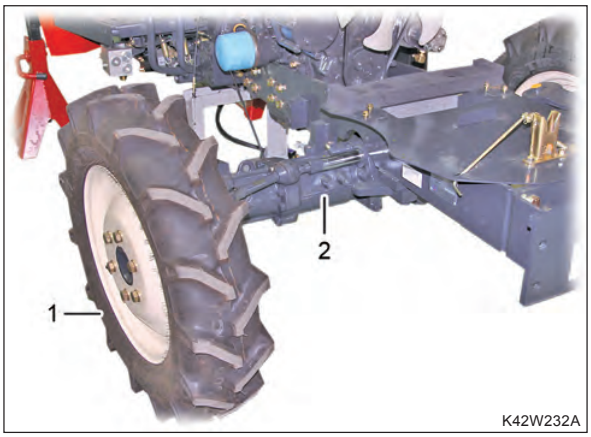
12. Disconnect the positive (+) battery line (1) and negative (-) battery line (2). Then, disconnect glow plug wiring (3), fuel solenoid connector(4) and oil pressure switch connector (5) and organize the engine wiring into the instrument panel.

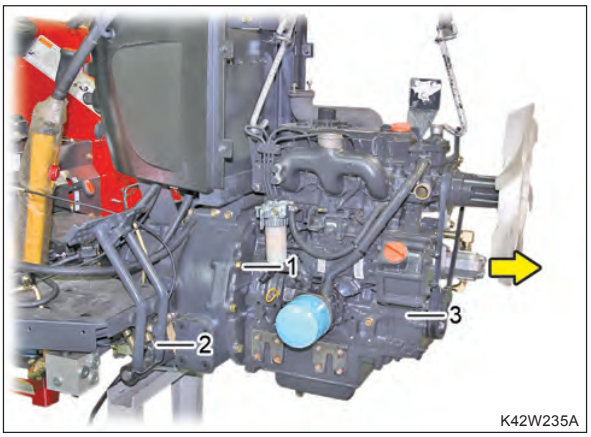


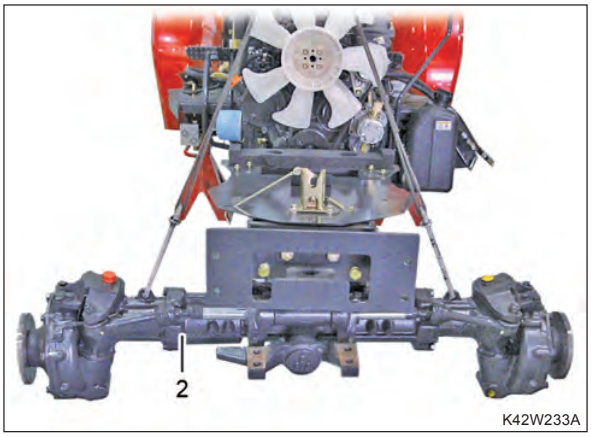
13. Remove the propeller shaft (1). (Refer to "Propeller shaft disassembly and assembly" in chapter 5)

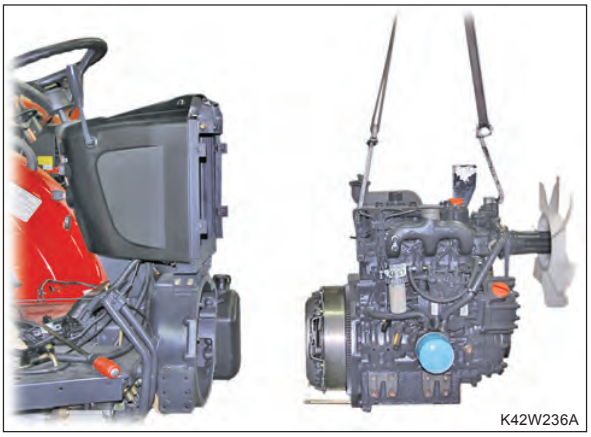
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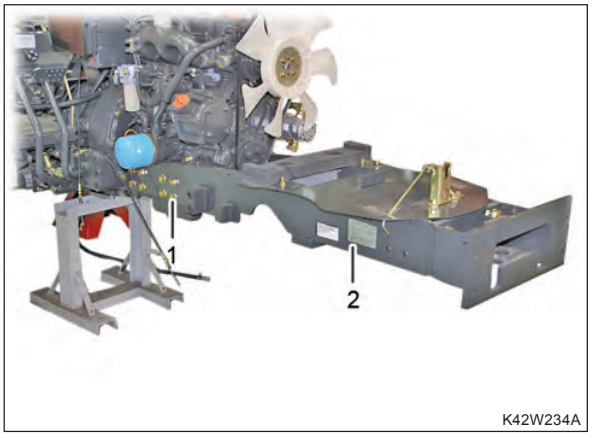








14. Remove the front wheel(1) and front axle (2). (Refer to "Disassembly and assembly" in chapter 5).

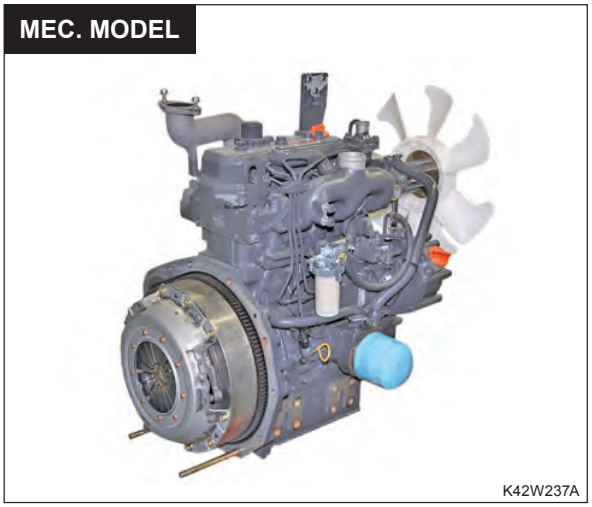


15. Unscrew the bracket assembly mounting bolts (1)(16EA) of front axle and remove the front axle bracket assembly (2).

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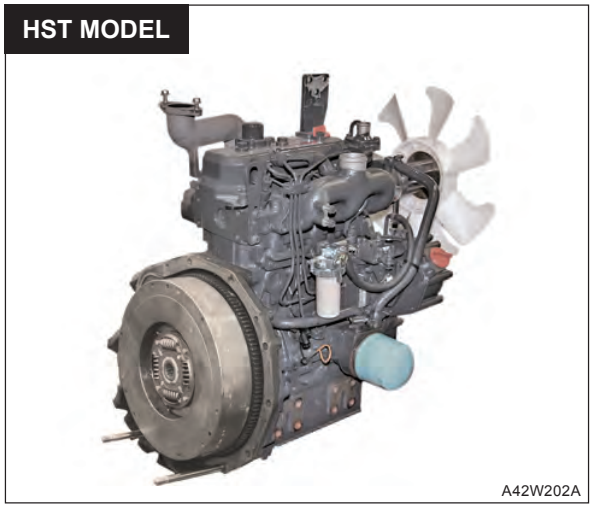
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MEC. MODEL



K42W237A

HST MODEL



A42W202A

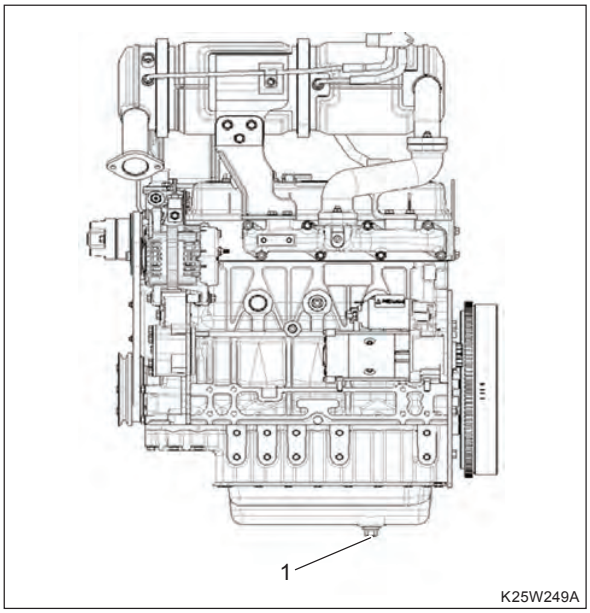
16. Install a engine removal hooks and use a hoist to lift the engine. Then, unscrew the engine and clutch housing mounting bolts (1)(8EA) and nuts (2)(2EA) to remove the engine assembly (3) using a hoist.

6.2 DISASSEMBLY OF ENGINE

6.2.1 GENERAL PRECAUTIONS

1. Select the place that must be neatly arranged.
2. Disassemble parts must be carefully handled for prevention of injury or taint. Prepare some vessels for keeping of disassemble parts.
3. Prepare the solvent and compressed air for cleaning of parts.
4. Use the tools that are in good condition and be sure you understand how to use them before performing any job.
5. Disassembly procedure complicate and put the display to identity in order to prevent the damage in parts when many parts disassemble. Then work can facilitate when assemble it.

6.2.2 LUBRICATING OIL



K25W249A

Loosen the drain plug (1) from the bottom of the oil pan and drain the oil to the prepared vessel.

⚠ CAUTION

- **Don't allow hot oil to directly contact skin.**

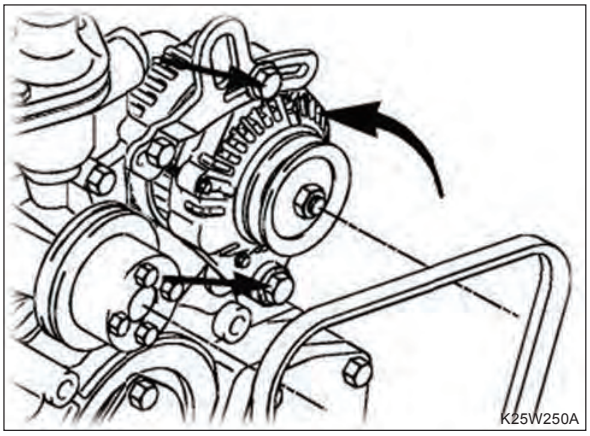
⚠ WARNING

- **Disposal of waste oil must be treated the related regulations.**

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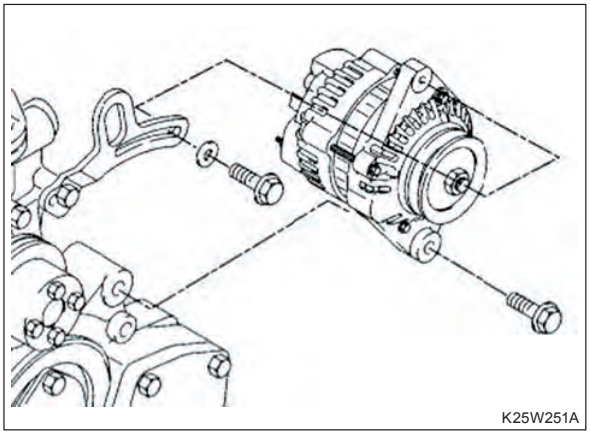
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6.2.3 V-BELT, V-PULLEY



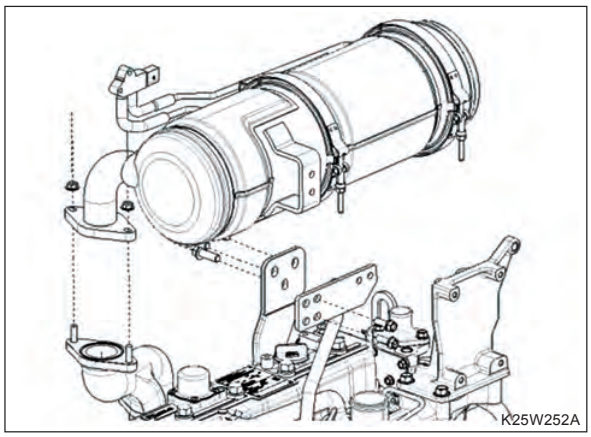
1. Loosen the bolts that hold the V-pulley.
2. Loosen the tension bolt and the bolt that hold the alternator, remove the V-belt after relaxation of belt.
3. Disassemble the V-pulley.

6.2.4 ALTERNATOR



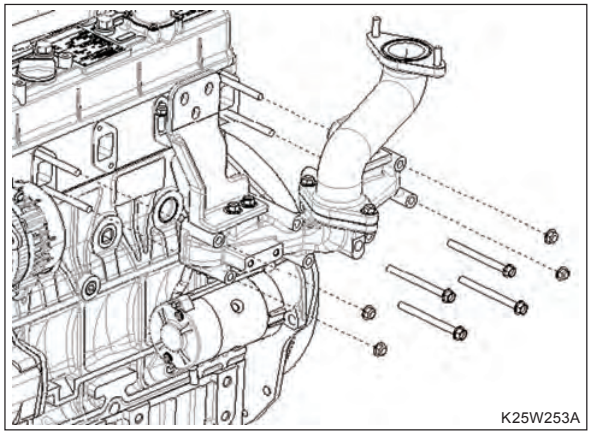
1. Loosen the bolt and washer that hold the upper side of alternator.
2. Loosen the bolt in lower side.
3. Disassemble the alternator.

6.2.5 AFTER-TREATMENT DEVICE (ATD) [3015R(h)/3515R(h)/4015R(h)]



1. Loosen the bolts that hold the ATD.
2. Loosen the nuts that connect the ATD and DPF fixing housing.
3. Disassemble the ATD. (When disassembling the ATD, should be careful because ATD is heavy.)

6.2.6 EXHAUST MANIFOLD

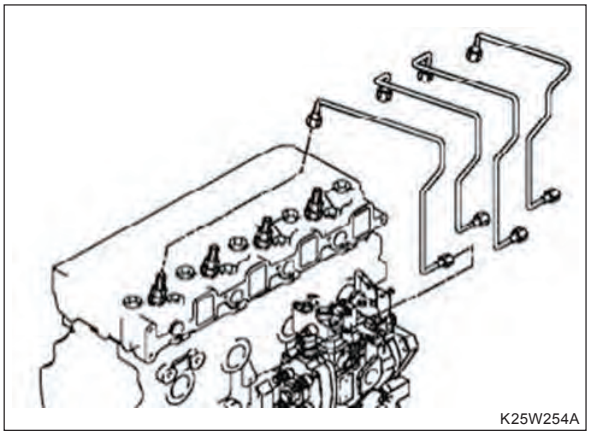


1. Loosen the bolts and nuts that hold the exhaust manifold.
2. Disassemble the exhaust manifold and steel gasket.

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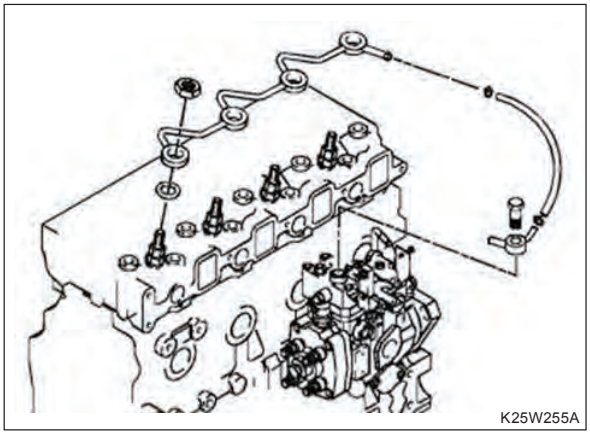
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6.2.7 FUEL INJECTION PIPES



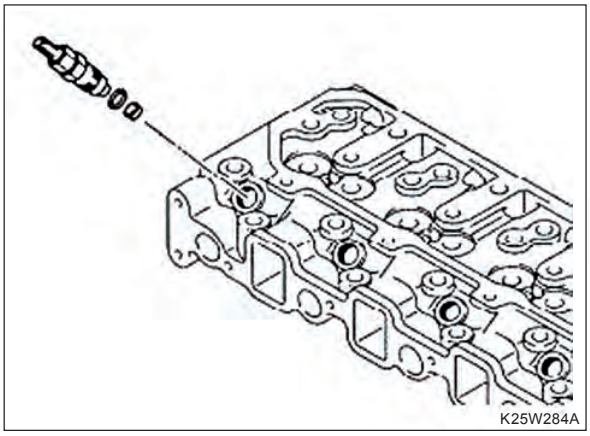
1. Loosen the bolts that hold fuel injection pipes assembly.
2. Loosen the nuts in fuel injection pump side.
3. Loosen the nuts in head cover side.
4. Disassemble the fuel injection pipes.

6.2.8 FUEL DRAIN LINE



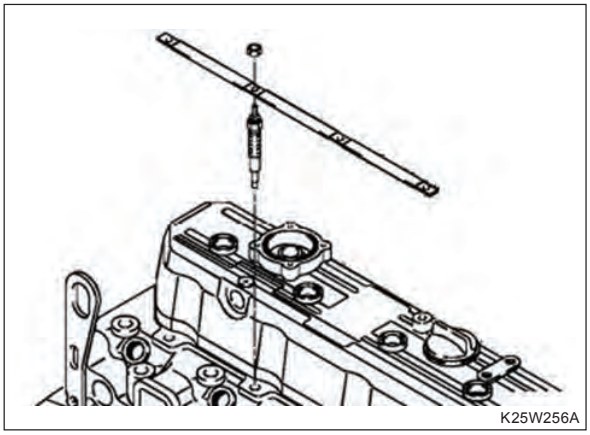
1. Disassemble the fuel drain hose.
2. Loosen the bolts that hold the fuel drain pipe and remove the drain pipe.

6.2.9 FUEL INJECTION VALVE (INJECTOR)



1. Disassemble the injectors.
2. Disassemble the sealing washers and nozzle spaces
3. cup from the injectors. (Do not re-use the sealing washer and the nozzle space cup)

6.2.10 GLOW PLUG

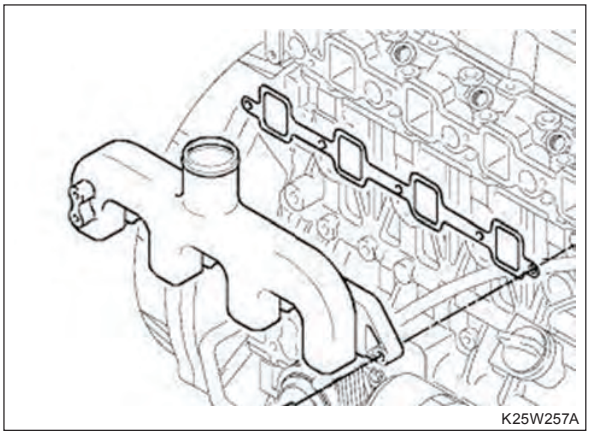


1. Disassemble the wire harness from the connector.
2. Loosen the nuts that hold the connector.
3. Disassemble the glow plugs.

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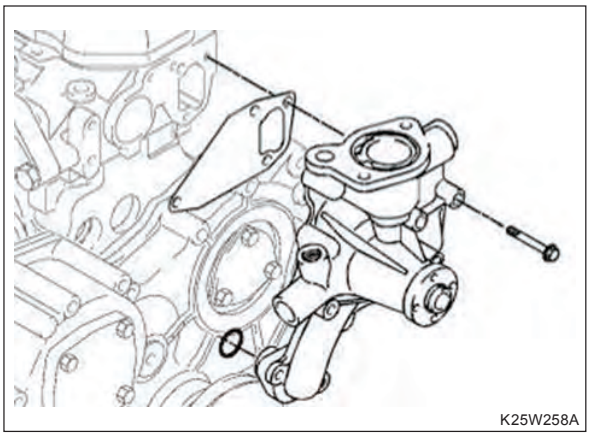
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6.2.11 INTAKE MANIFOLD


K25W257A

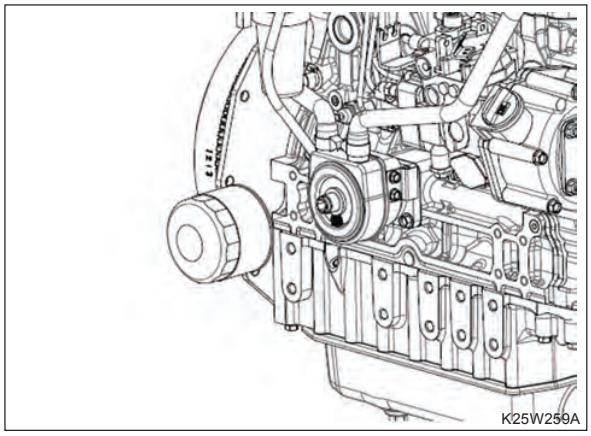
1. Loosen the clamp that holds breather hose connecting Intake manifold and cylinder head.
2. Loosen the bolts and nut that hold the intake manifold.
3. Disassemble the intake manifold.
4. Disassemble the packing.
5. Do not re-use the packing.

6.2.12 WATER PUMP


K25W258A

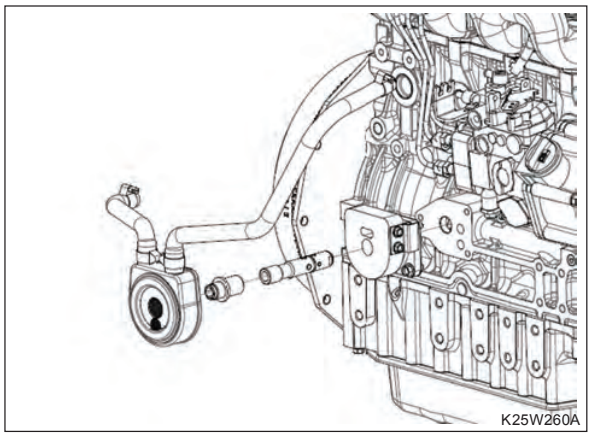
1. Loosen the bolts that hold the V-pulley.
2. Disassemble the V-pulley.
3. Loosen the bolts that hold the water pump.
4. Disassemble the water pump and packing.
5. Do not re-use the packing

6.2.13 OIL FILTER


K25W259A

1. Disassemble the oil filter using by tool.

6.2.14 OIL COOLER

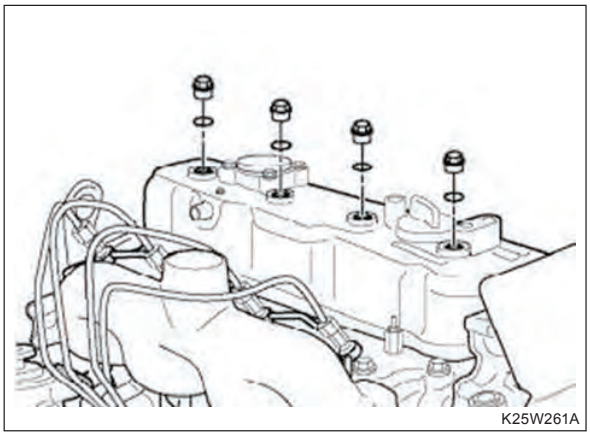

K25W260A

1. Loosen the clamps that hold the hoses.
2. Disassemble the hoses.
3. Disassemble the bolt that holds the oil cooler by using tool.
4. Disassemble the oil cooler.
5. Loosen the bolts that hold cooler bracket
6. Disassemble the cooler bracket.

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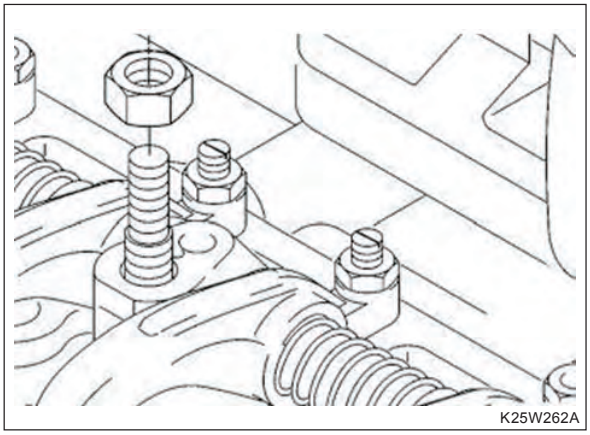
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6.2.15 HEAD COVER



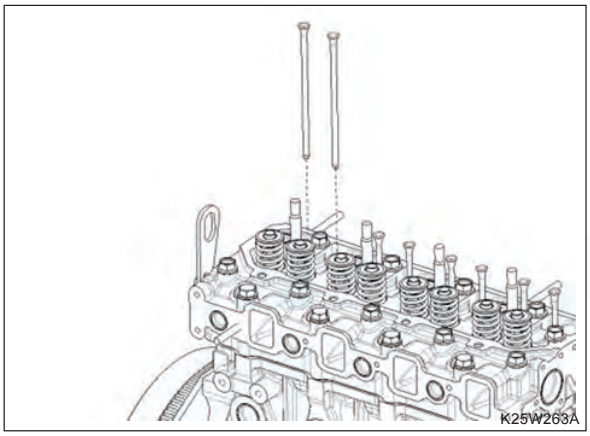
1. Loosen the nuts that hold the head cover.
2. Disassemble the head cover.
3. Disassemble the packing from head cover.
4. Do not re-use the packing.

6.2.16 ROCKER-ARM SHAFT



1. Loosen the bolts that hold the rocker arm shaft
2. Disassemble the rocker arm shaft.

6.2.17 PUSH ROD

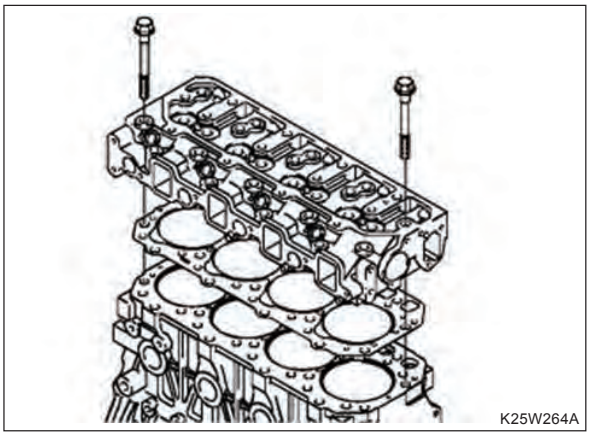


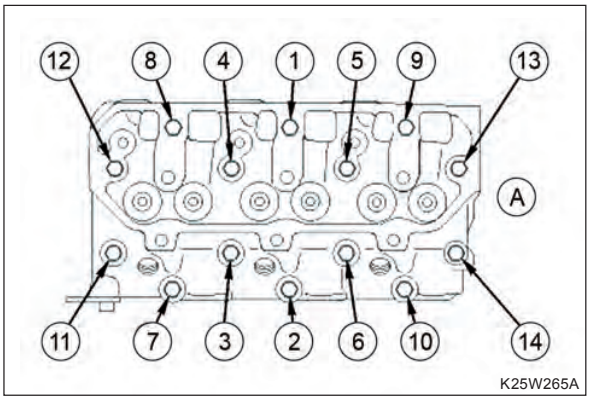
Disassemble the push rod. (Arrange the push rod in order from front side after disassemble it.)

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6.2.18 CYLINDER HEAD


K25W264A

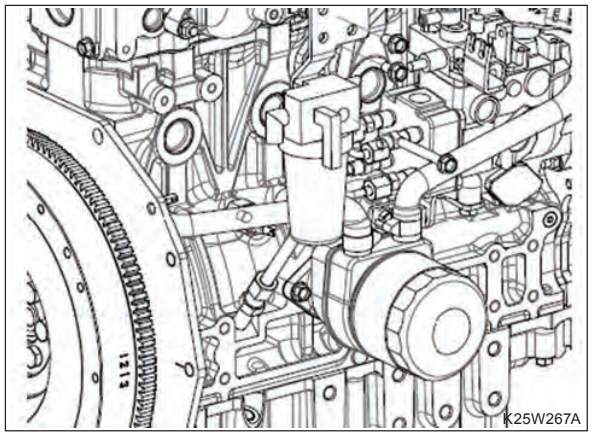


K25W265A

1. Loosen the 14 clamping bolts in order.
   (Order: Outside(14) → Inside(1))
2. Disassemble the cylinder head assembly.
3. Disassemble the gasket.
4. Do not re-use the gasket.

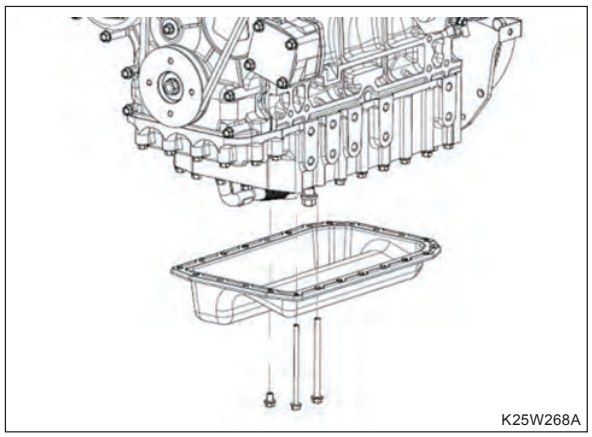
CAUTION
• **Do not cause scratch to the upper plain of cylinder block and the lower plain of the cylinder head.**

6.2.19 FUEL FILTER


K25W267A

1. Loosen the clamp that holds hose connecting fuel filter pump and fuel injection pump.
2. Loosen the bolts that hold the fuel filter bracket.
3. Disassemble the fuel filter and fuel filter bracket.

6.2.20 OIL PAN

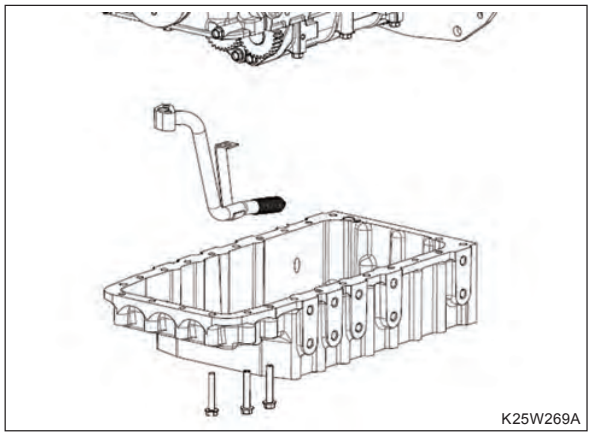

K25W268A

1. Loosen the bolts that hold the oil pan.
2. Disassemble the oil pan.
3. Disassemble the packing of oil suction pipe.
4. Clean the liquid packing on oil pan and adapter.

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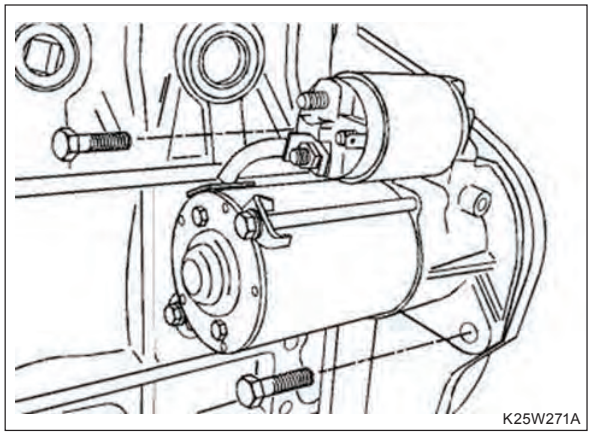
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6.2.21 FRAME AND OIL SUCTION PIPE



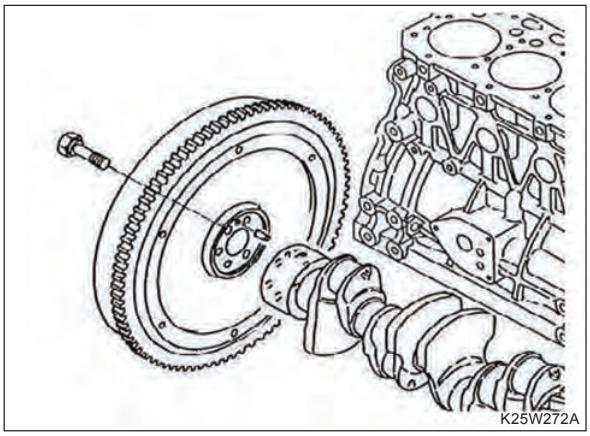
1. Loosen the 20 bolts that hold frame.
2. Disassemble frame.
3. Clean the liquid packing on face of frame
4. Loosen the 2 bolts that hold the oil suction pipe.
5. Disassemble the oil suction pipe.

6.2.22 STARTER



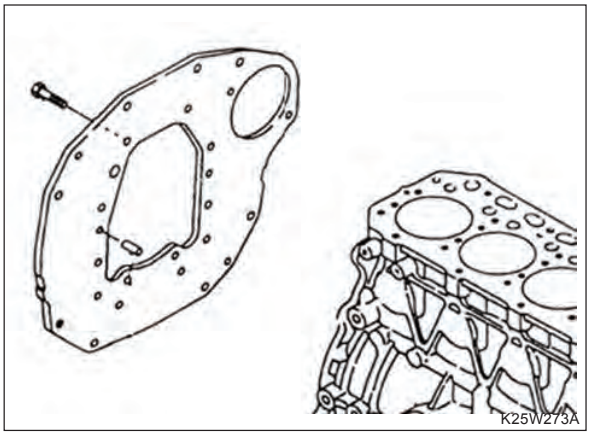
1. Loosen the bolts that hold the starter motor.
2. Disassemble the starter motor.

6.2.23 FLYWHEEL



1. Loosen the bolts that hold the flywheel.
2. Disassemble the flywheel.

6.2.24 MOUNTING FLANGE

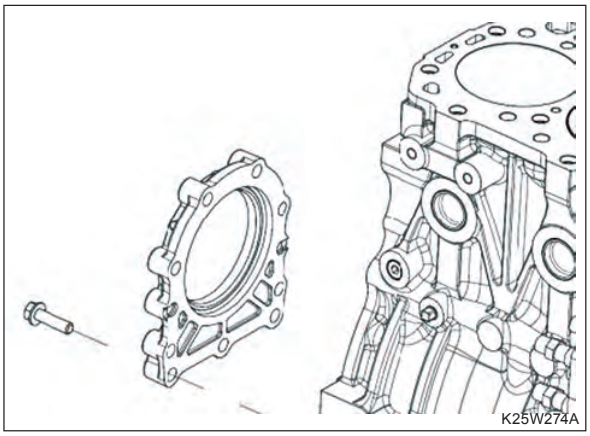


1. Loosen the bolts that hold the mounting flange.
2. Disassemble the mounting flange.

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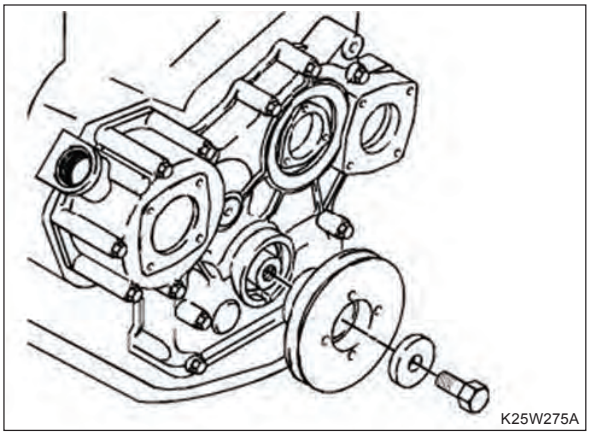
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6.2.25 OIL SEAL HOUSING



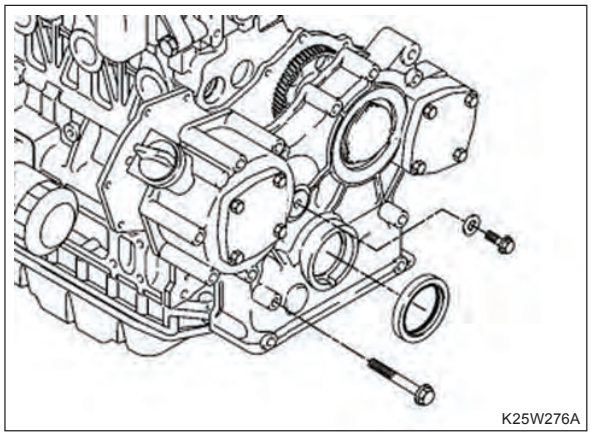
1. Loosen the 9 clamping bolts.
2. Disassemble the oil seal housing.
3. Clean the liquid packing on oil seal housing.

6.2.26 CRANK PULLEY



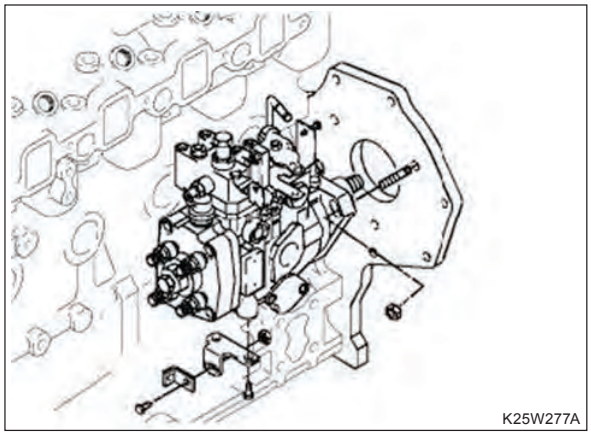
1. Loosen the bolt that holds the crank pulley.
2. Disassemble the crank pulley.

6.2.27 GEAR CASE



1. Loosen the bolts that hold the gear case.
2. Disassemble the gear case.
3. Clean the liquid packing on gear case flange and gear case.

6.2.28 FUEL INJECTION PUMP

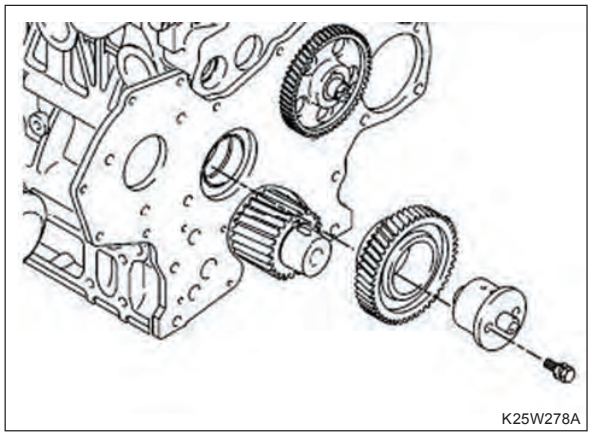


1. Loosen the bolt that holds the fuel injection pump gear.
2. Disassemble the fuel injection pump gear.
3. Loosen the bolts that hold support bracket.
4. Disassemble the support bracket.
5. Loosen the bolts that hold the fuel injection pump.
6. Disassemble the fuel injection pump.

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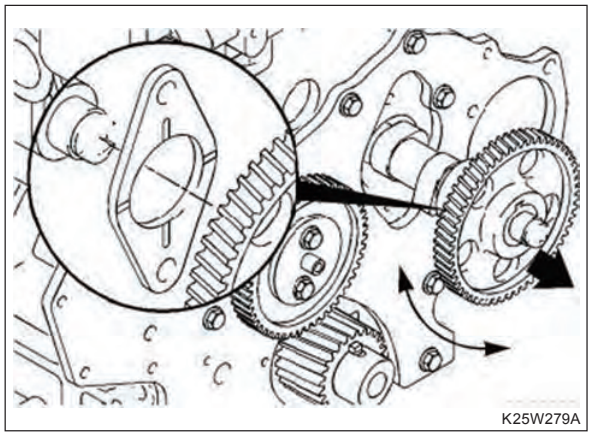
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6.2.29 IDLE SHAFT AND IDLE GEAR



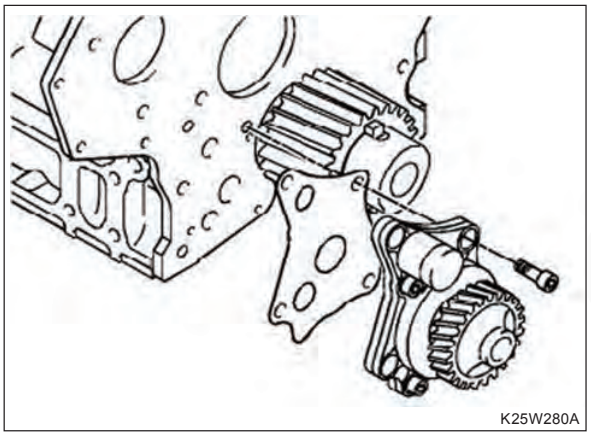
1. Loosen the bolts that hold idle shaft and idle gear.
2. Disassemble the idle shaft and idle gear.

6.2.30 CAM SHAFT ASSEMBLY



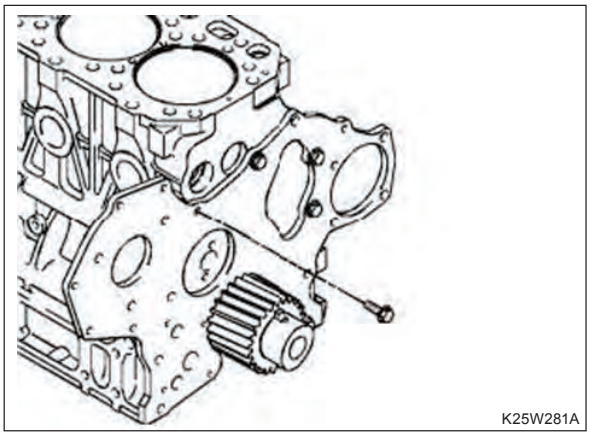
1. Loosen the bolts that hold the cam shaft.
2. Disassemble the cam shaft with turning it.
3. Cam shaft will be damaged if forcibly disassemble.

6.2.31 OIL PUMP



1. Loosen the bolts using by hexagon wrench.
2. Disassemble the oil pump.
3. Do not re-use the O-ring and packing.

6.2.32 GEAR CASE FLANGE

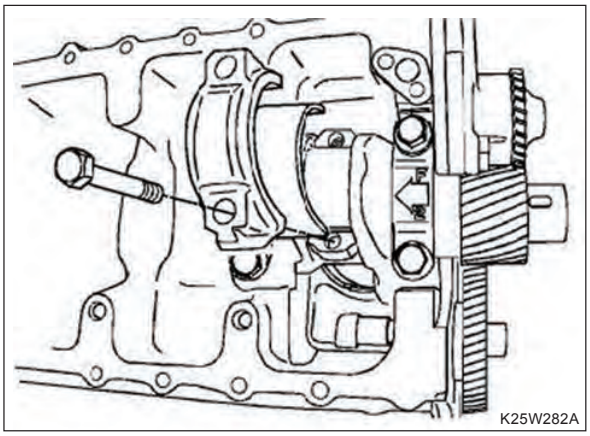


1. Loosen the bolts that hold the gear case flange.
2. Disassemble the gear case flange.

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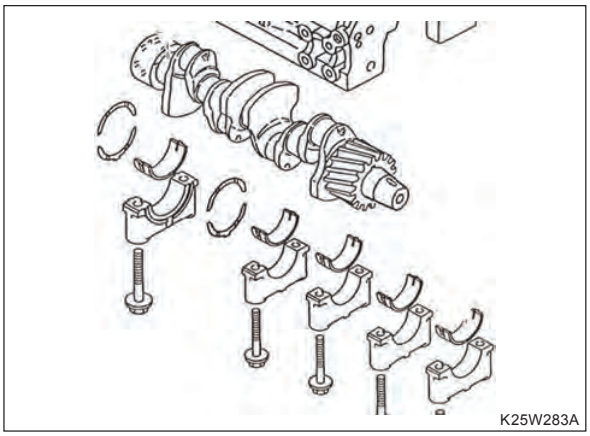
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6.2.33 PISTON AND CONNECTING ROD


K25W282A

1. Loosen the bolts that hold small end of connecting rod.
2. Disassemble cap of the small end of connecting rod.
3. Push the piston and connecting rod away from the crankshaft with the handle of a hammer.
4. Disassemble the piston and connecting rod.
5. Disassemble the bearing of pin from the connecting rod.
6. Take note of assembling position since in case of re-use they shall be fitted in the same position.
7. Do not use the bearings.

6.2.34 CRANK SHAFT


K25W283A

1. Loosen the bolts that hold main bearing cap.
2. Disassemble the crank shaft.

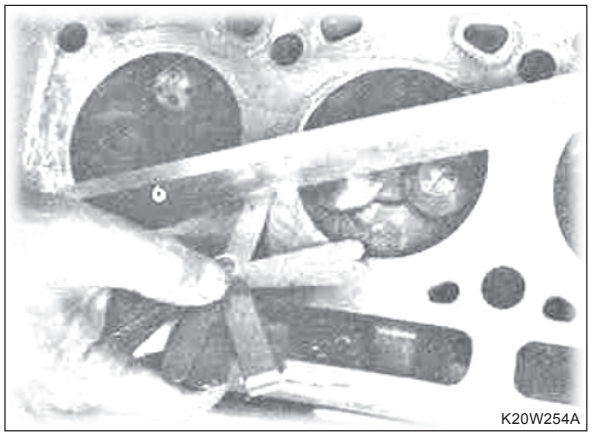
6.3 MAIN PARTS INSPECTION & MAINTENANCE

6.3.1 CYLINDER HEAD

DISASSEMBLY

1. Disassemble the valve cotter, spring, retainer by the valve spring with disassembly tools.
2. Disassemble the intake valve and exhaust valve.
3. Keep those disassembled parts by matching cylinders.

CHECK THE CYLINDER HEAD


K20W254A

1. Before cleaning the cylinder head, check that whether or not gas leak, damage, crack of water, gas, etc.

• Check the cracking in head combustion surface by color check.

2. Check the invisible crack or damage by water pressure testing or magnetic particle testing.
3. Check the plane degree of the cylinder head's bottom if there is any gas leak from gasket.

• Replace the cylinder head if the check result is out oflimit.

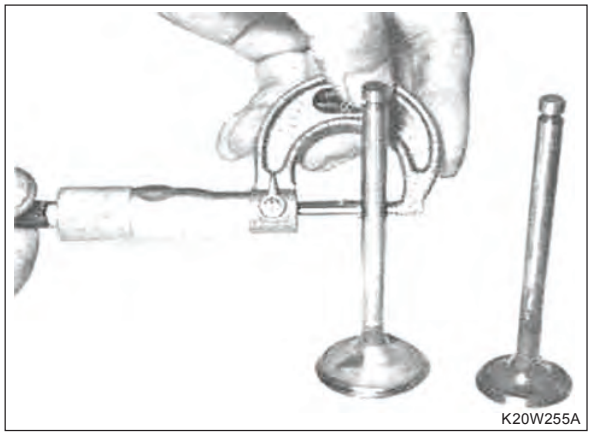
SPECIFICATION	Less than 0.05 mm
LIMIT	More than 0.15 mm

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INTAKE & EXHAUST VALVE & VALVE GUIDE

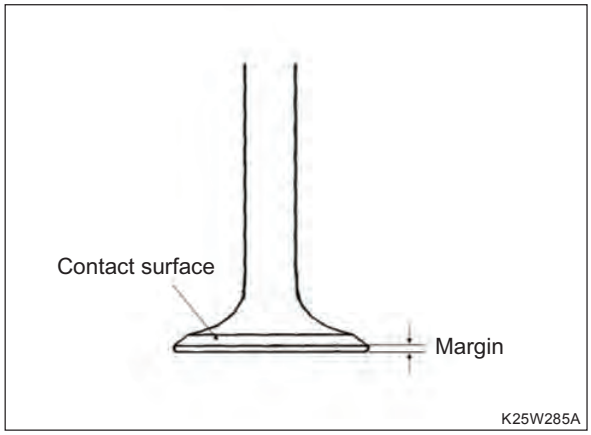
▶ VALVE



- Measure the valve stem outer diameter. If the wear is over the limit, replace the valve.

SPECIFICATION	LIMIT
7.96 ~ 7.97 mm	7.9 mm

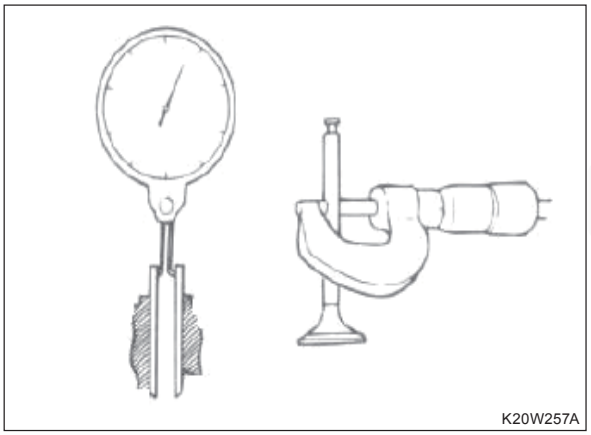
▶ VALVE SHEET CONTACT SURFACE



- Check the valve sheet contact surface and if necessary, modify it with grinding paper. And if it got damaged a lot, replace it if it got damaged a lot.
- Check the margin(thickness of valve head) and if less than the limit, replace it.

SPECIFICATION	1.2 mm
LIMIT	0.5 mm

▶ VALVE GUIDE



- Measure the distance between the valve guide and valve stem.

  If the distance is more than limit, replace the valve or valve guide or either parts.

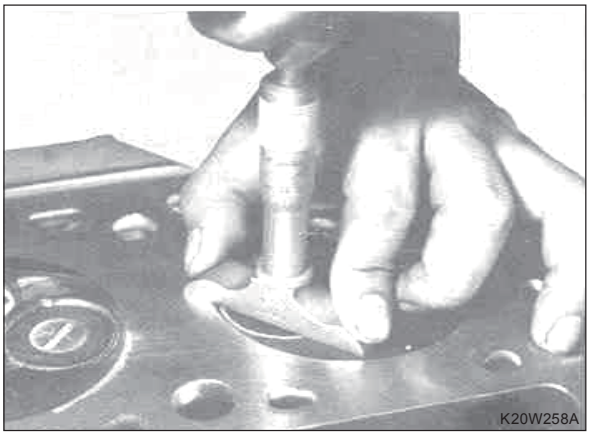
SPECIFICATION	0.04 ~ 0.05 mm
LIMIT	0.2 mm

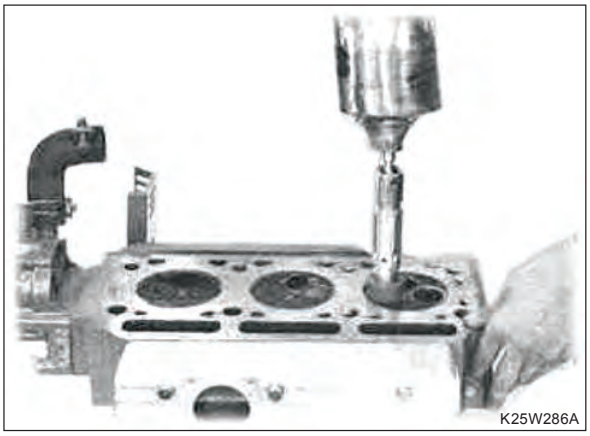
- Valve guide and the valve sheet should be machined at the same time. (Valve guide must assemble by the press machine.)
- Valve guide Inner diameter: 8.010 ~ 8.025 mm
- Valve guide's projecting quantity from the head surface : 13 mm

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▶ VALVE SHEET





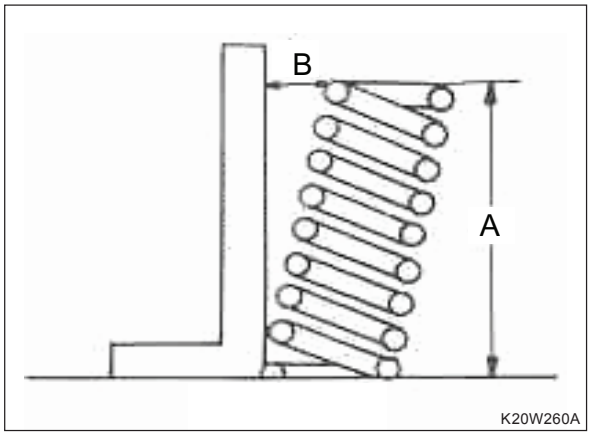
If the valve's difference is more than limit, replace the valve sheet.

SPECIFICATION	0.7 mm
LIMIT	1.0 mm

- Modifying the valve sheet
  - When modifying the valve sheet, if necessary, replace the valve guide.
  - Modify the sheet width and sheet angle according to the specification by special tools or valve grinder.

INTAKE VALVE SEAT ANGLE	EXHAUST VALVE SEAT ANGLE
60°	45°

▶ VALVE SPRING



Squareness, free-length, transformation, etc. of valve spring are direct cause of damage such as valve stem uneven wear, etc. Therefore check certainly it when disassembling.

If the measurement value is over the limit, replace

ITEM	SPECIFICATION	LIMIT
Free length (A)	46 mm	-
Inclination (B)	-	1.2 mm
Spring load	12.2 kg / 39.6 mm	-

▶ CYLINDER HEAD ASSEMBLY

1. Clean the cylinder head.
2. Replace the new valve stem seal and assemble the stem seal to the valve guide by special tool

⚠ CAUTION

- **Stem seal assembling quality affects to oil consumption.**

3. Assemble the valve after putting the oil on valve stem and valve guide.
4. Assemble the valve spring and valve retainer.
5. Assemble the valve cotter by special tool.
6. Beat it slightly by Urethane hammer and check it.

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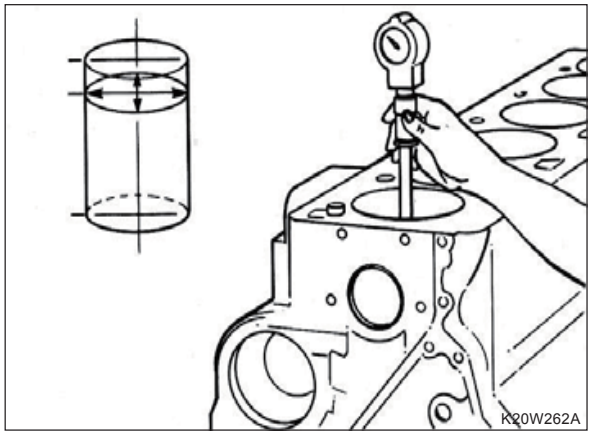
6.3.2 CYLINDER BLOCK

CHECK THE CYLINDER BLOCK

▶ CHECK THE CRACK AND ETC IN EACH PART

- If damaged by freezing or rollover, check first by sight before disassembly. If there is defect, execute the color checking.
- Check points: Cylinder head bolts, screws: crack, etc.
- If the damage is serious, replace the cylinder block and if the damage is minor, modify it.
- To test the crack or water leak, execute the water pressure test.
- When replacing the freezing protection plug, put some bonds to the plug's circumference.(Three Bond 1194 or equivalent)

▶ MEASURING THE CYLINDER INSIDE DIAMETER



- Measure the cylinder inside diameter and if the measurement value is over limit, replace it.

(mm)

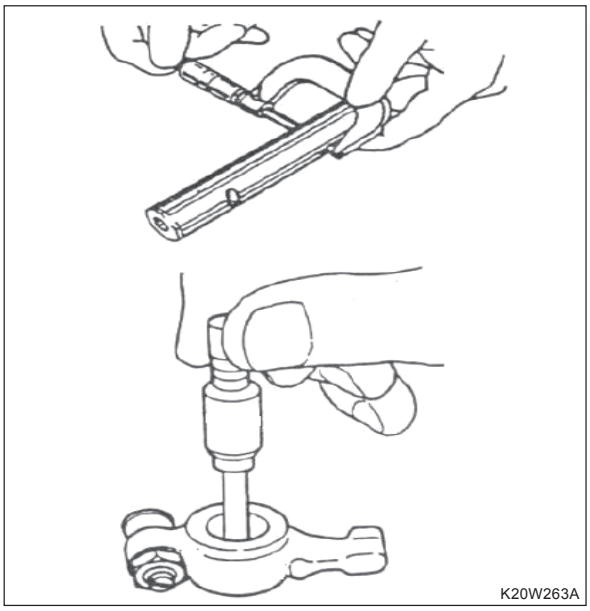
ITEM	SPECIFICATION	LIMIT
Cylinder inside diameter	88.005 ~ 88.025	88.20
Cylinder roundness	0.0~0.01	0.03
Cylinder cylindricity	0.0~0.015	0.03

- Measuring position : Measure the engine front and thrust parts and the upper area 20 mm, Mid area, bottom area. (Average)

6.3.3 VALVE DEVICE

Rocker arm assembly needs to be maintained clearly and exactly because it is related with timing of the valve open & close and the engine performance.

CHECK THE ROCKER ARM



1. Rocker arm shaft outer diameter and rocker arm Inner diameter

If the measurement of the shaft outer diameter and rocker arm Inner diameter is over the limit, replace it.

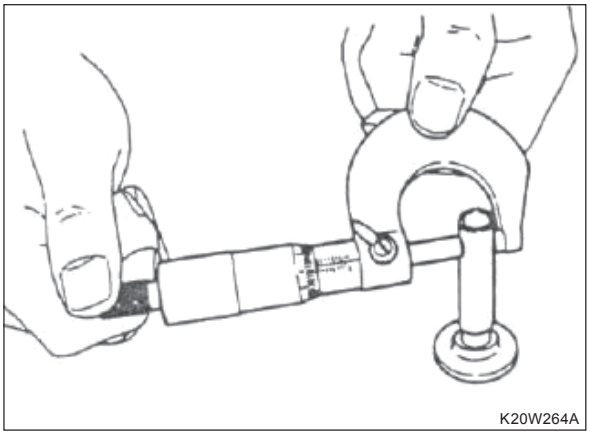
(mm)

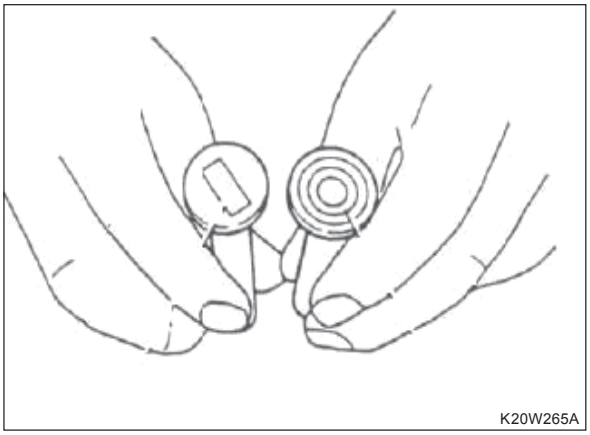
ITEM	SPECIFICATION	LIMIT
Shaft Outer Diameter	18.959 ~ 18.98	18.95
Rocker arm inside diameter	19.0 ~ 19.021	19.09
clearance	0.02 ~ 0.062	0.14

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TAPPET


K20W264A


K20W265A

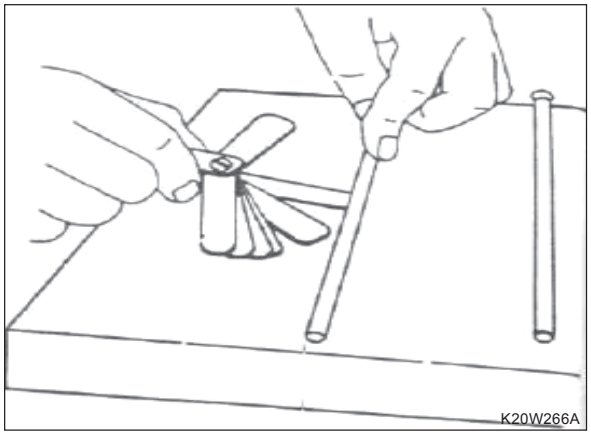
If the measurement of the tappet outer diameter and cylinder block is over the limit, replace it.

(mm)

ITEM	SPECIFICATION	LIMIT
Tappet outer diameter	14.227 ~ 14.249	14.18
Guide inside diameter	14.260 ~ 14.280	14.30
clearance	0.011 ~ 0.056	0.12

- Tappet's contacting condition to camshaft : If uneven wear, disfigurement or damage is serious, replace the tappet.

PUSH ROD


K20W266A

- Put the push rod on the surface plate and measure the bending degree by gap gauge. If it is over the limit, replace it.

(mm)

LIMIT	Below 0.3

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6.3.4 PISTON & PISTON RING

CHECK THE PISTON

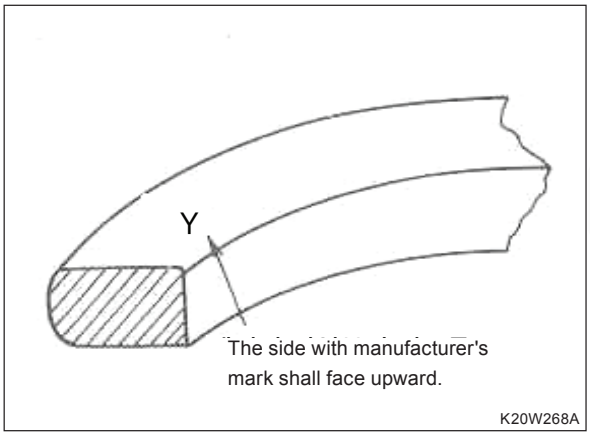
▶ PISTON OUTER DIAMETER

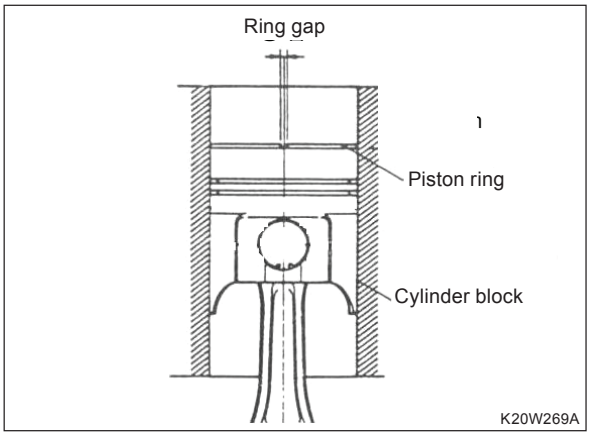
- If the main measurement value is over the limit, replace the pistons
- If there is any damage or scratch on the surface, replace it
- Piston outer diameter

(mm)

ITEM	SPECIFICATION	LIMIT
Piston outer diameter	87.95 ~ 87.97	87.90
Minimum clearance with cylinder	0.060 ~ 0.080	-

▶ PISTON RING





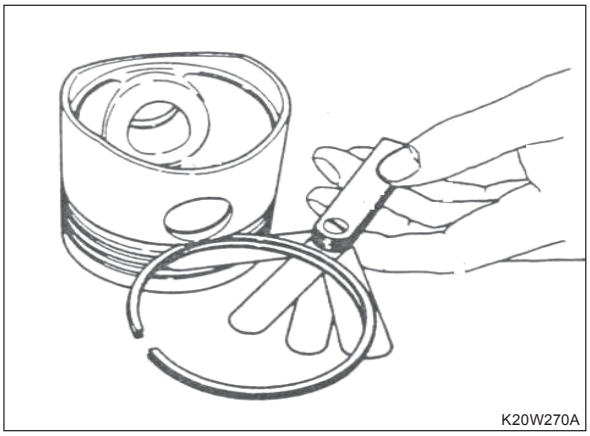
- When replacing the piston ring, make the ring groove clean. And assemble it toward top of the piston to be saw the mark on top and make sure it moves well.
- When the piston ring assemble, ring's cut direction shouldn't be in side-pressured area and make it cross each other by 120 degree.
- Measure each main area and replace it if it is over limit.
- Measure the piston ring clearance

(mm)

ITEM	SPECIFICATION	LIMIT
First Ring	0.25~0.40	1.5
Second Ring	0.50~0.70	1.5
Oil Ring	0.20~0.40	1.5

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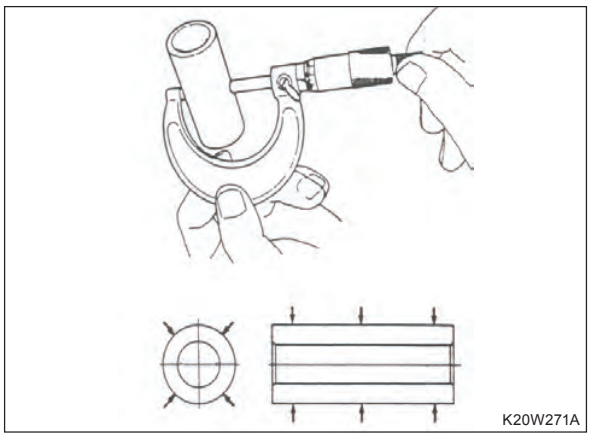

K20W270A

- Measure the clearance between piston ring and ring groove.

(mm)

ITEM	SPECIFICATION	LIMIT
First Ring	0.07 ~ 0.11	-
Second Ring	0.07 ~ 0.11	-
Oil Ring	0.03 ~ 0.07	-

▶ PISTON PIN

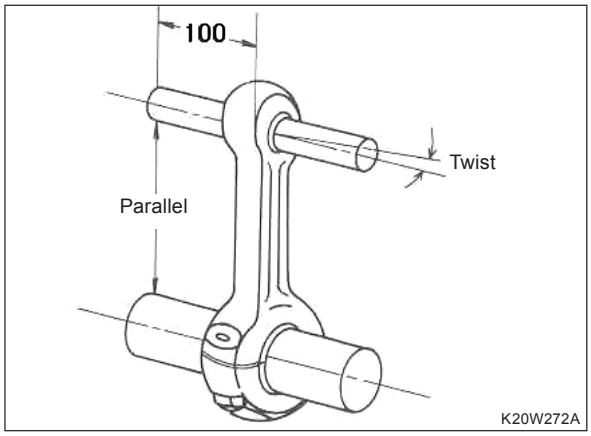

K20W271A

- If it wears or uneven wear is over the limit, replace it.

(mm)

ITEM	SPECIFICATION	LIMIT
Piston pin outer diameter	29.991 ~ 30.0	29.90
pin bush inside diameter	30.0 ~ 30.008	30.02
Clearance	0 ~ 0.017	0.12

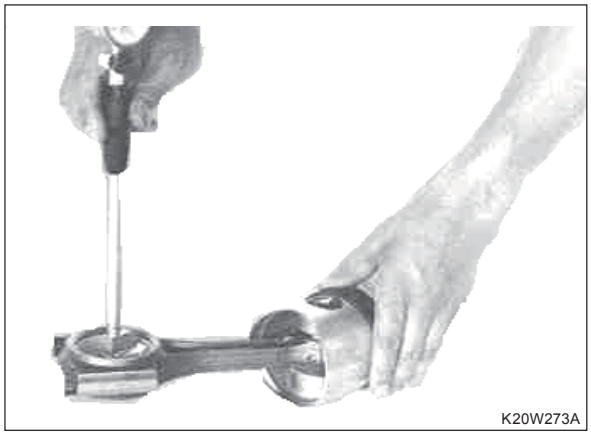
▶ CONNECTING ROD



K20W272A

- Measure the parallel and twist degree of big end and small end. If the measurement value is over the limit, replace it.

ITEM	SPECIFICATION	LIMIT
Twist and parallel degree	by 100 mm, 0.05 mm	0.08 mm


K20W273A

- Check big end of the connecting rod

(mm)

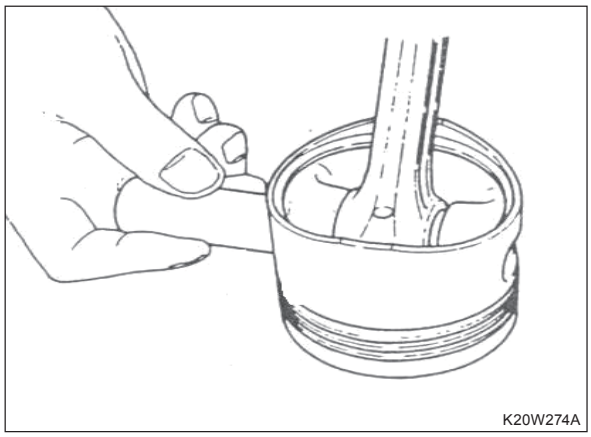
ITEM	SPECIFICATION	LIMIT
Big end inside diameter	53.0 ~ 53.019	-
Metal thickness	1.485~1.500	-
Crank pin outer diameter	49.950 ~ 49.964	49.91
Oil clearance	0.036 ~ 0.095	0.15

- If the measurement value is over the limit, replace the pin bearing. If necessary, replace the connecting rod.

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REPLACE THE PISTON

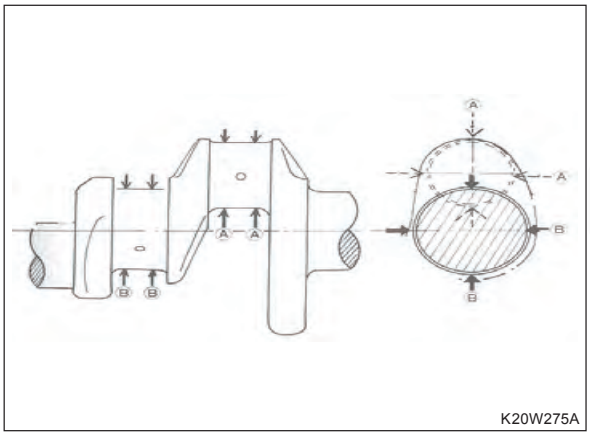


1. Replacing of piston ring and connecting rod should be operated in clean surrounding.
2. Make sure the piston ring is movable easily after assembly.
3. Assemble the piston pin stop ring to the piston.
4. Put some oil to the piston pin and assemble the connecting rod.
5. Assemble the piston pin stop ring.
6. When the piston is needed to replace, make sure the piston pin has to be replaced, too.

6.3.5 CRANK SHAFT

CHECK THE CRANKSHAFT

▶ **CHECK THE CRANKSHAFT JOURNAL**



- If there is any crack or damage, replace it.
- Measure every main part, and if it is over the limit, replace the main bearing. If necessary, replace the crankshaft.

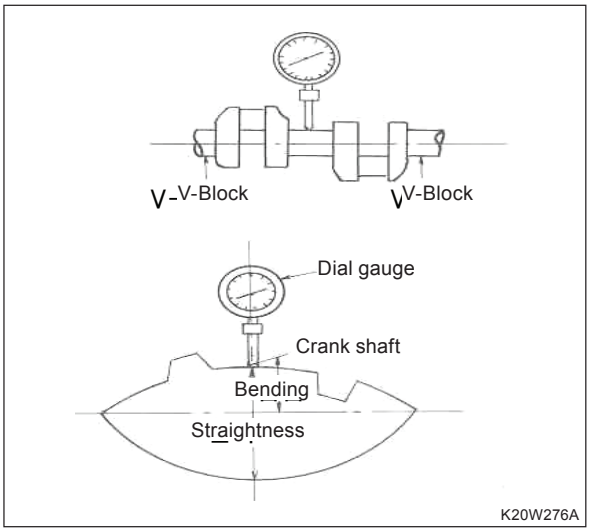
(mm)

ITEM	SPECIFICATION	LIMIT
Crank journal outer diameter	53.950 ~ 53.964	53.91
Metal thickness	1.987 ~ 2	-
Oil clearance	0.036 ~ 0.095	0.15

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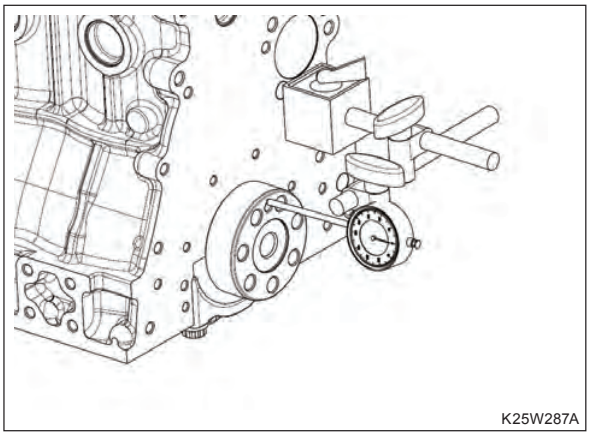
▶ CHECK THE CRANKSHAFT BENDING DEGREE



- Measure the bending degree of crankshaft.
- Fix both journal side of the camshaft to the v Block on the surface plate. Measure the straightness at the center of the rolling crankshaft by the dial gauge. If it is over the limit, replace it.

BENDING DEGREE SPECIFICATION	Below 0.02 mm

▶ CHECK THE CRANKSHAFT SIDE CLEARANCE



- Measure the crankshaft side clearance.
- Install the magnetic base at the end of the crankshaft and put the dial gauge on it. Measure the crankshaft-side side clearance. Replace the thrust bearing or crankshaft if it is over the limit.

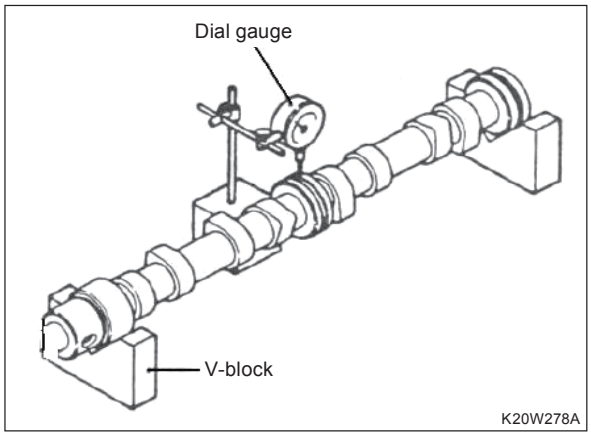
ITEM	SPECIFICATION
Thrust Clearance	0.09 ~ 0.271 mm

6.3.6 CAM SHAFT

CHECK THE CAMSHAFT

▶ CHECK THE CAMSHAFT'S FIGURE

Check the wear on contacting surface between the tappet and the cam. Also, check the cam gear damage.



▶ CHECK THE CAMSHAFT BENDING DEGREE

- Measure the camshaft bending degree.
- Fix both journal side of the camshaft to the V block on the surface plate. Check the journal waving by the dial gauge at the center of the rolling camshaft. The bending degree is the half of the journal oscillation.

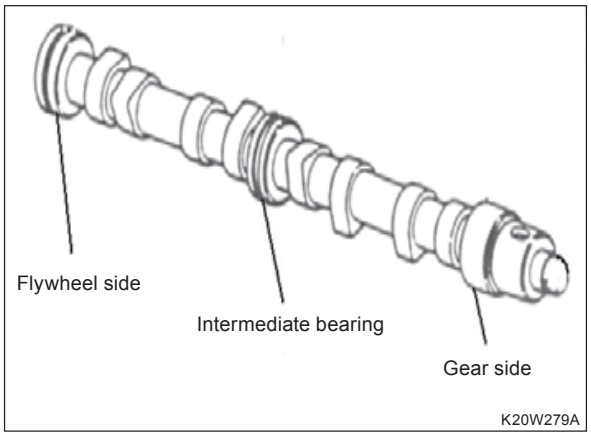
(mm)

ITEM	SPECIFICATION	LIMIT
Bending degree	Below 0.02	0.05

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▶ CHECK THE CAMSHAFT JOURNAL

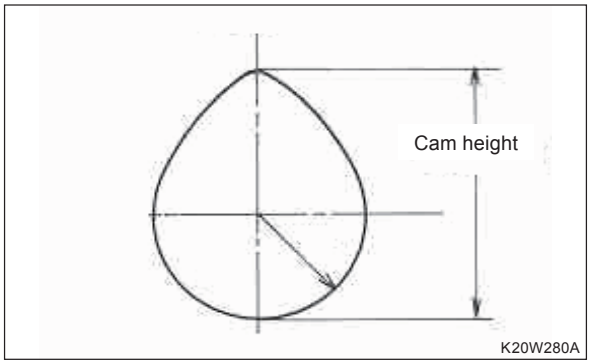


Measure the outer diameter of camshaft by micrometer. The Oil clearance is calculated after measuring the difference between camshaft inner diameter of the cylinder block by cylinder gauge and camshaft outer diameter.

(mm)

ITEM		SPECIFICATION
Gear side	Outer diameter	44.950 ~ 44.964
	Oil clearance	0.066 ~ 0.110
Middle	Outer diameter	44.916 ~ 44.930
	Oil clearance	0.070 ~ 0.130
Fly wheel side	Outer diameter	44.950 ~ 44.964
	Oil clearance	0.066 ~ 0.110

▶ CHECK THE HEIGHT OF INTAKE·EXHAUST CAM



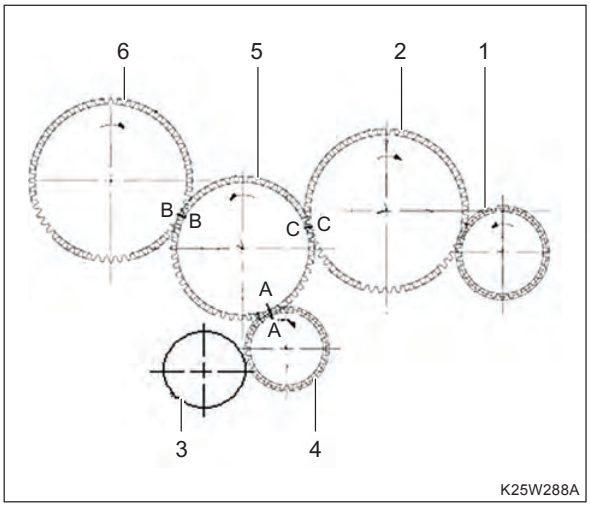
(mm)

ITEM		SPECIFICATION
Cam height	intake	37.98 ~ 38.02
	exhaust	37.98 ~ 38.02

6.3.7 GEARS

CHECK THE GEARS

▶ CHECK THE GEARS



(1) Hydraulic pump drive gear
(2) Camshaft gear
(3) Oil pump gear
(4) Crank gear
(5) Idle gear
(6) Fuel injection pump gear

Check each gear's tooth side and replace them if there is any damage or wear.

▶ CHECK THE GEAR BACKLASH

(mm)

BACK LASH	Crank gear, Camshaft gear, Idle gear, Fuel injection pump gear	0.07 ~ 0.15
	Hydraulic pump drive gear Oil pump gear	0.11 ~ 0.19

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6.4 THE ENGINE ASSEMBLY

6.4.1 CAUTION BEFORE ASSEMBLING THE ENGINE

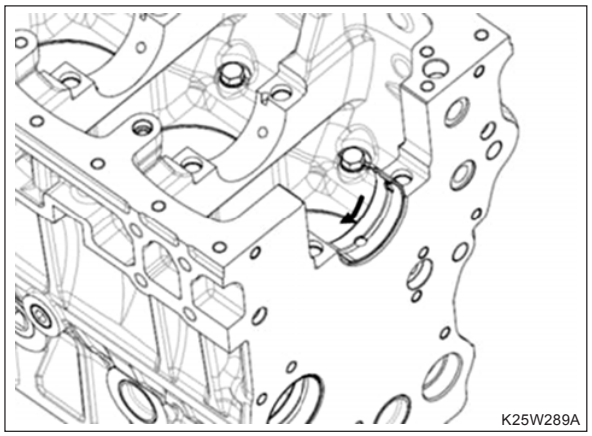
- Carefully clean and arrange disassemble parts.
- Check the tool box and jig.
- Prepare and check the spare parts. (Gasket, o-ring, packing, etc)
- Clean the work place during assemble the engine.
- Assemble the engine according to work sheet and order in this book.
- Tightening torque of screws, bolts and nuts are worked within the factory specification. And check the drive part.
- Check removed parts and spare parts after assembling.

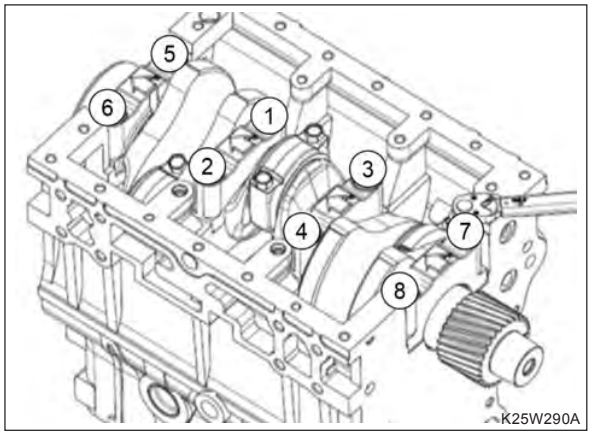
6.4.2 CYLINDER BLOCK

Put down the cylinder block head plate used the support on the work-bench.

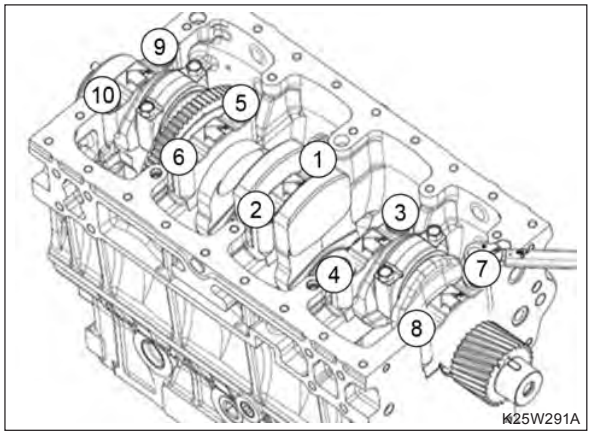
6.4.3 CRANKSHAFT

ASSEMBLY PROCEDURE


K25W289A



K25W290A



K25W291A

1. Cylinder block and bearing cap assemble with the new main bearing. Oil hole of main bearing assemble into the cylinder block.
2. Apply the lubricating oil on the crankshaft journal.
3. Put down the crankshaft on the cylinder block.

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⚠ WARNING

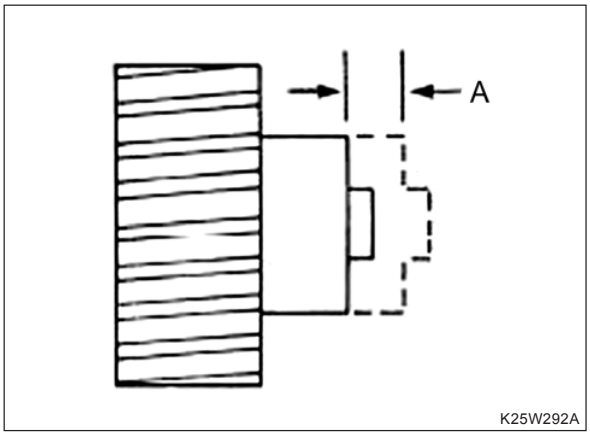
- **Use the hoist or lift for safe work.**
- **Thrust bearing assemble that the oil groove into outside.**
- **Assemble the bearing cap after same direction with the cylinder block number.**
- **Cylinder block number start the gear case flange that is No. 1.**
- **The arrow of bearing cap is the front direction.**
- **Lubricate the lubricating oil on the bolt of main bearing.**
- **Assemble the bearing cap bolt according to the factory specification and follow procedure.**

  A. Assemble the bearing cap bolt tentatively.

  B. Assemble the bearing cap bolt according to assembling procedure. (1→8)

  (Tightening torque : 12.5 kg-m)
- **Check the crankshaft rotation.**

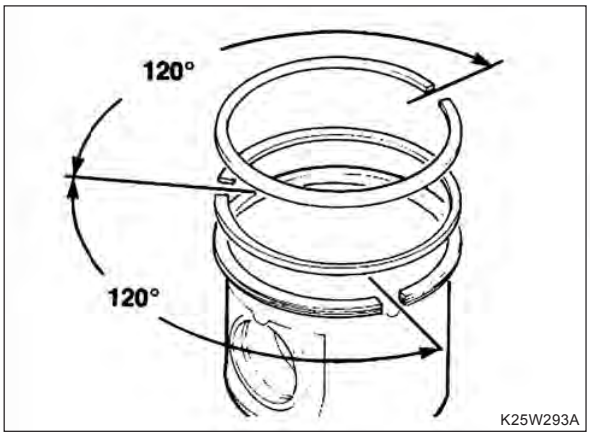
CHECK THE CLEARANCE OF CRANKSHAFT SIDE

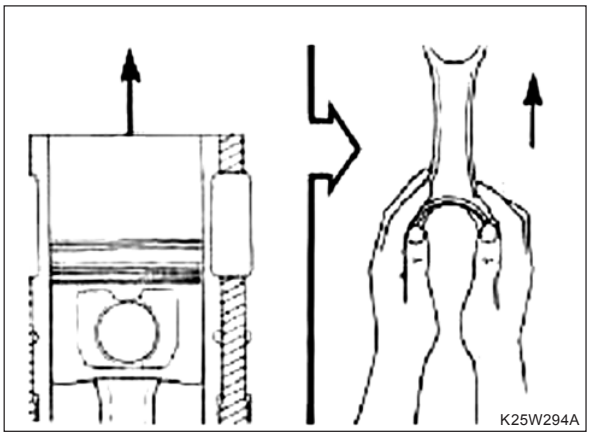


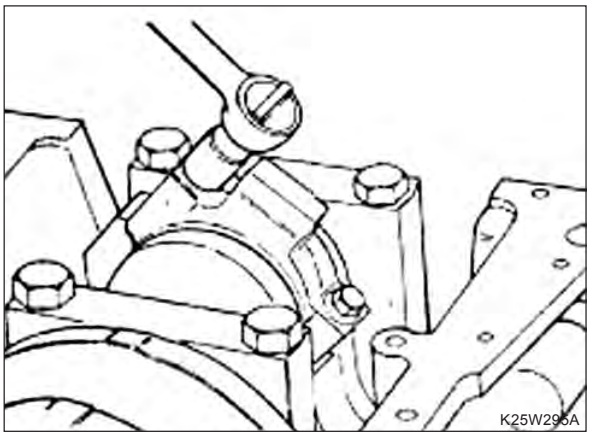
1. Check the clearance of crankshaft side by dial gauge.
2. The clearance of crankshaft side: 0.090 ~ 0.271 mm

6.4.4 PISTON AND CONNECTING ROD

ASSEMBLY PROCEDURE







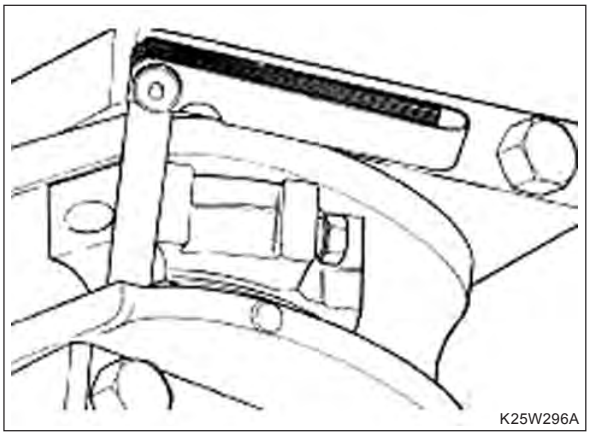
1. Assemble the piston assembly and connecting rod.
2. Apply the lubricating oil on the cylinder block and
3. piston.
4. Each gap of piston ring locate 120 degree.
5. Assemble the crank pin bearing on the connecting rod. (Apply the lubricating oil on the crankshaft pin and crank pin bearing.)

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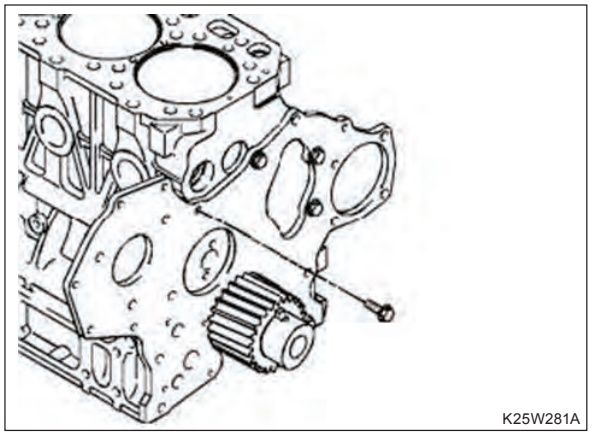
6. Press the piston ring. (With jig)
7. Rotate it and locate the crankshaft pin to TDC.
8. Assemble the piston in cylinder. (Please sure that piston and ring is not damaged.)
9. After assembly, crankshaft rotate 180° and locate BTDC. And assemble the connecting rod cap with new bearing.
10. Locate same direction between connecting rod big endand serial number of cap.
11. Assemble the cap bolt within the factory specification and follow procedure.
    A. Assemble the bearing cap bolt tentatively.
    B. Assemble the bearing cap bolt according to assembly procedure. (Tightening torque : 7.5 kg-m)
12. Check the crankshaft rotation.

CHECK THE CLEARANCE OF CONNECTING ROD SIDE


K25W296A

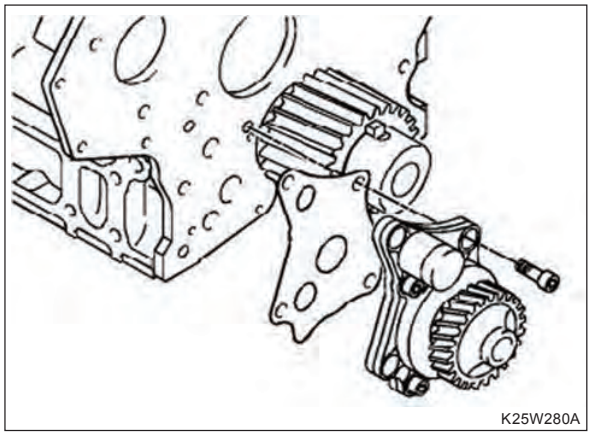
1. Check the clearance of connecting rod and cap. (Use clearance gage.)
2. Side clearance : 0.15 ~ 0.35 mm

6.4.5 GEAR CASE FLANGE


K25W281A

1. Apply the liquid gasket on the gear case flange. (Use Loctite 5060 or similar liquid gasket.)
2. Assemble the gear case flange and bolts to hold the gear case flange. (Tightening torque: 2.7 kg•m)

6.4.6 OIL PUMP

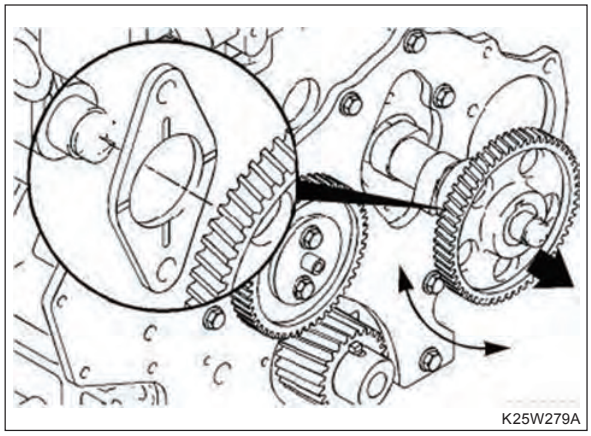

K25W280A

1. Assemble the oil pump with O-ring.
2. Tighten the bolts to hold the oil pump. (Tightening torque: 2.7 kg•m)

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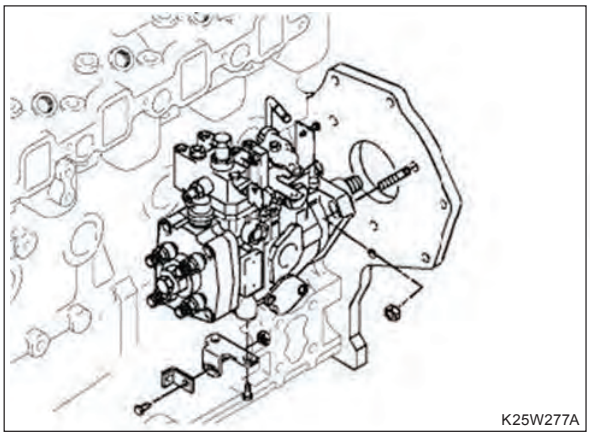
6.4.7 CAMSHAFT



1. Apply the lubricating oil on the journal, cam, thrust bearing.
2. Assemble the camshaft with turning it.
3. Assemble the bolts in cylinder block to hold the cam shaft. (Tightening torque: 2.7 kg•m)
4. Cam shaft will be damaged if forcibly assemble.

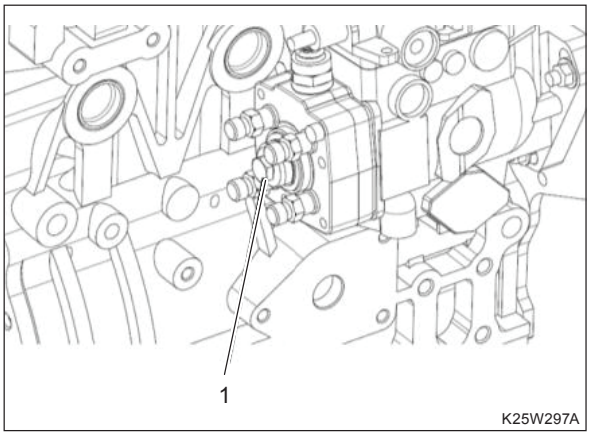
6.4.8 INJECTION PUMP

ASSEMBLY



1. Assemble the o-ring in fuel injection pump and it in gear case flange. (Assemble the key radius type on the fuel injection pump shaft.)
2. Line up the injection pump gear and 'B' mark of idle gear (See 5.3.9), and then assemble the bolt and spring washer to hold fuel injection pump tentatively.
3. Line up the injection timing of injection pump. (Reference the section (2).)
4. Assemble the nuts to hold the fuel injection pump.
5. Assemble the support bracket.

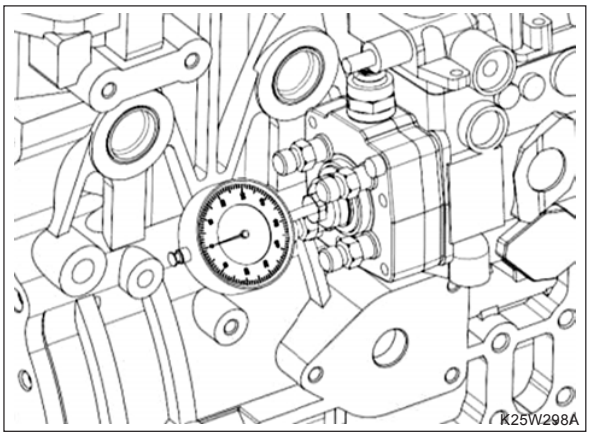
LINE UP THE INJECTION TIMING

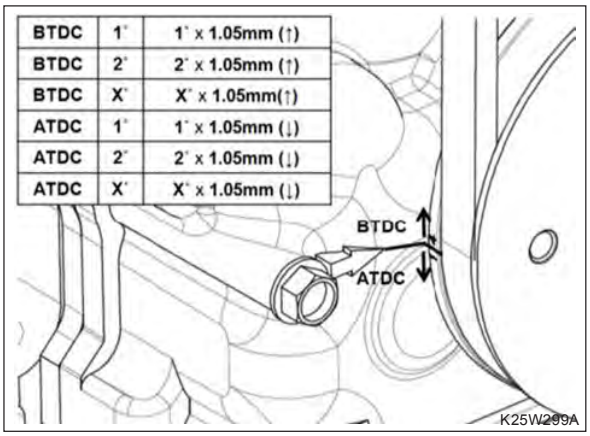


1. Disassemble the timing check plug (1) of fuel injection pump.
2. Assemble the dial gage. (with the jig)

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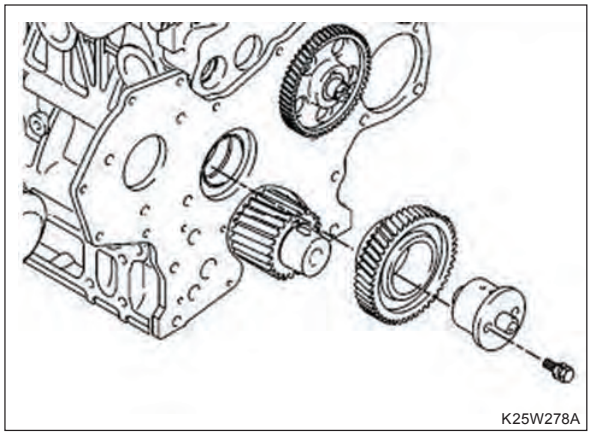
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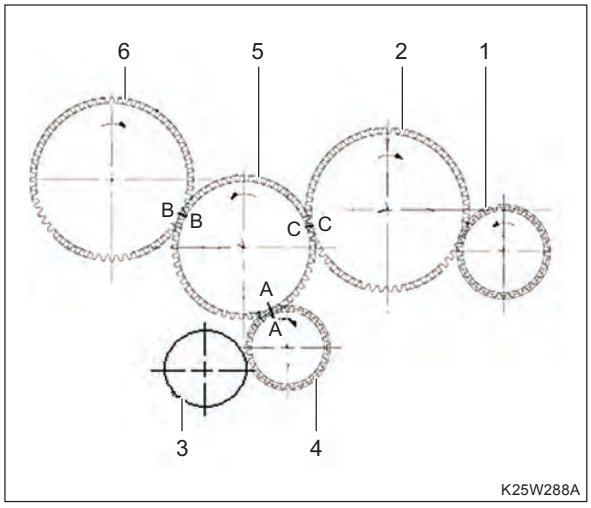




3. Rotate the crank pulley CCW until indicator of dial gage doesn't move by rotating the crank pulley. And then where gauge pin stopped line up zero point of dial gauge by rotating the dial gauge.
4. Rotate the crank pulley CW slowly until line up "→" mark of gear case and "Injection timing" line using by sharp something of crank pulley.
5. The indicator of dial gage line up "0" mark in dial gage by swing the fuel injection pump.
6. Tighten the 3 bolts that hold fuel injection pump.
7. After adjusting injection timing, check the injection timing again.
8. Disassemble the dial gage.
9. Assemble the timing check plug.

6.4.9 IDLE GEAR





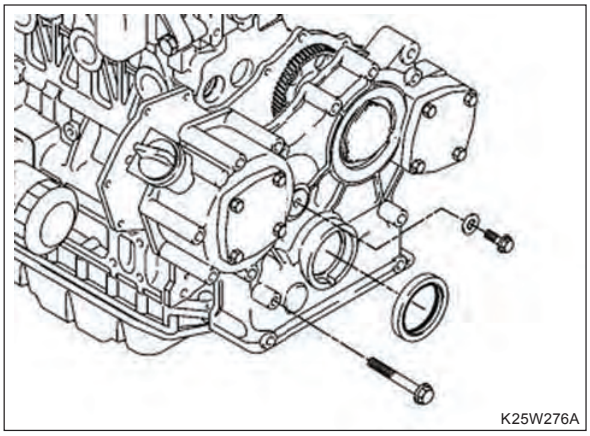
(1) Hydraulic pump drive gear
(2) Camshaft gear
(3) Oil pump gear
(4) Crank gear
(5) Idle gear
(6) Fuel injection pump gear

1. Apply the lubricating oil on the bush.
2. Assemble the idle gear. (Check the mark A, B, C.)
3. Assemble the idle gear shaft.
4. Tighten the bolts to hold the shaft of idle gear (Tightening torque : 2.7 kg•m).

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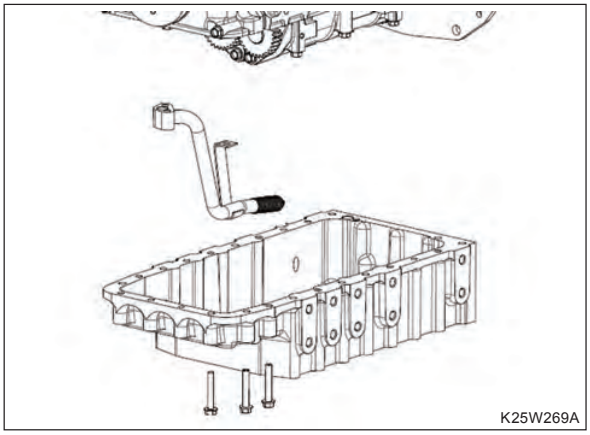
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6.4.10 GEAR CASE



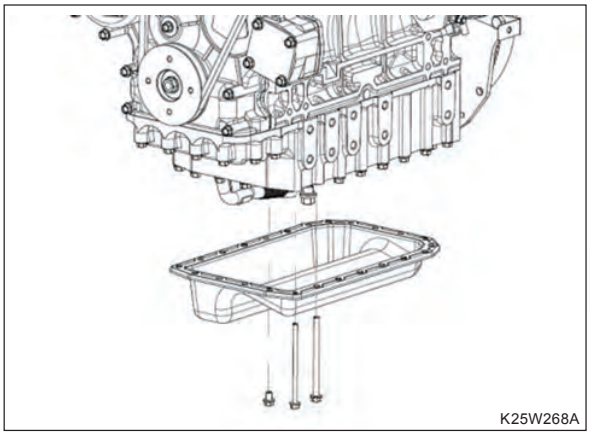
1. Apply the liquid packing on the gear case. (Use Loctite 5060 or similar product.).
2. Assemble the bolts to hold the gear case. (Tightening torque : 2.7 kg•m).

6.4.11 FRAME AND OIL SUCTION PIPE



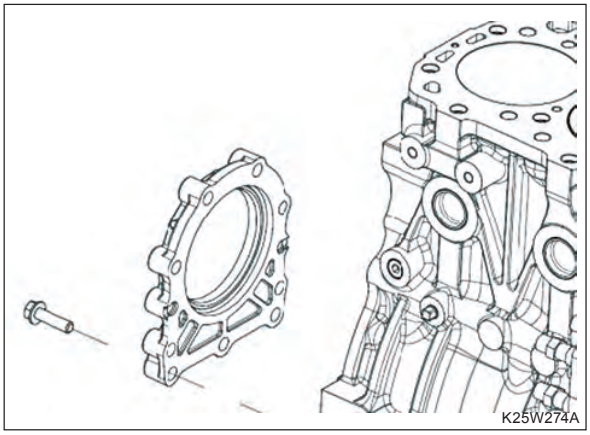
1. Assemble the oil suction pipe with packing.
2. Tighten the bolts to hold oil suction pipe. (Tightening torque: 2.7 kg•m)
3. Apply the liquid packing on the frame. (Use Loctite 5060 or similar product.)
4. Assemble the frame.
5. Assemble the bolts to hold frame. (Tightening torque: 2.7 kg•m)

6.4.12 OIL PAN



1. Apply the liquid packing on the oil pan. (Use Loctite 5060 or similar product.)
2. Assemble the oil pan.
3. Tighten the bolts to hold oil pan. (Tightening torque: 2.7 kg•m)

6.4.13 OIL SEAL HOUSING

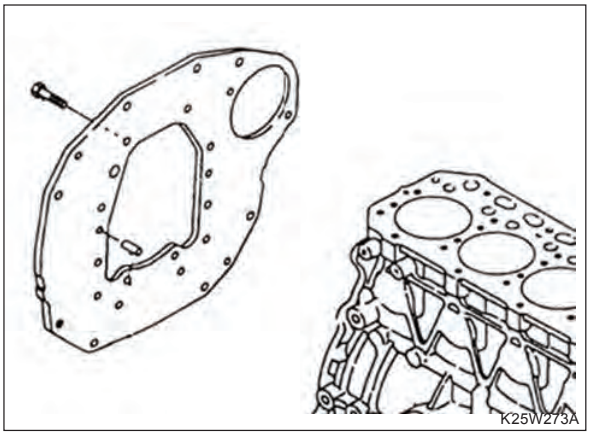


1. Apply the liquid packing on the oil seal housing. (Use Loctite 5060 or similar product.)
2. Assemble the oil seal housing.
3. Tighten the bolts to oil seal housing. (Tightening torque: 2.7 kg•m)

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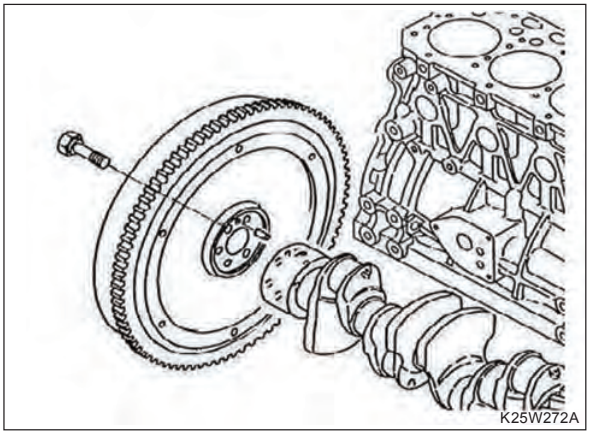
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6.4.14 MOUNTING FLANGE



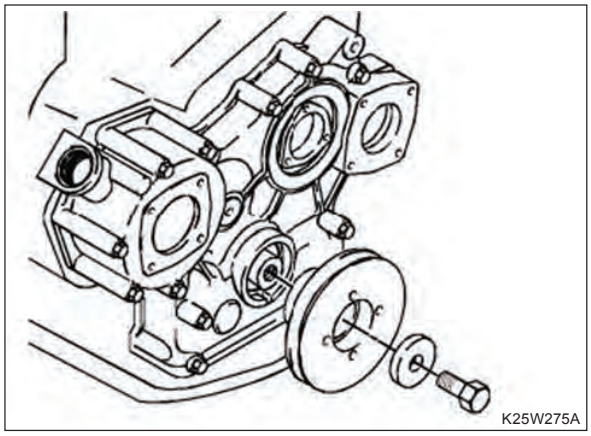
1. Assemble the mounting flange.
2. Tighten the bolts to hold mounting flange. (Tightening torque: 2.7 kg•m)

6.4.15 FLYWHEEL



1. Assemble the flywheel.
2. Assemble the flywheel bolt within the factory specification and follow procedure.
   A. Tighten the bolt. (Tightening torque: 3.0 kg•m)
   B. And then tighten the bolt again to hold the flywheel. (Tightening torque: 9.0 kg•m)

6.4.16 CRANK PULLEY

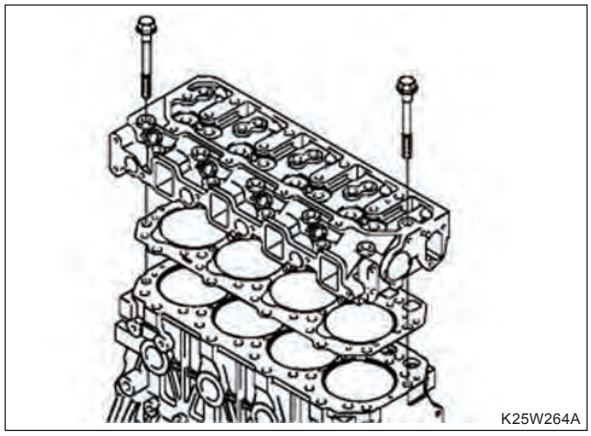


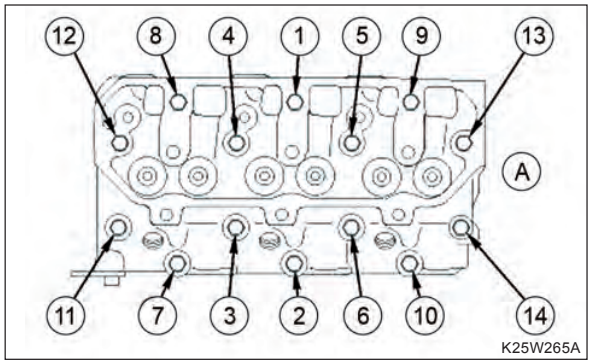
1. Assemble the crank pulley and washer.
2. Tighten the bolt to crank pulley. (Tightening torque: 11.5 kg•m)

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6.4.17 CYLINDER HEAD





1. Assemble the head gasket.
2. Tighten the bolts to the cylinder head in order.
   (Order: Inside(1) → Outside(14))

   A. The bolt lubricates the lubricating oil.

   B. Assemble the cylinder head bolt tentatively.

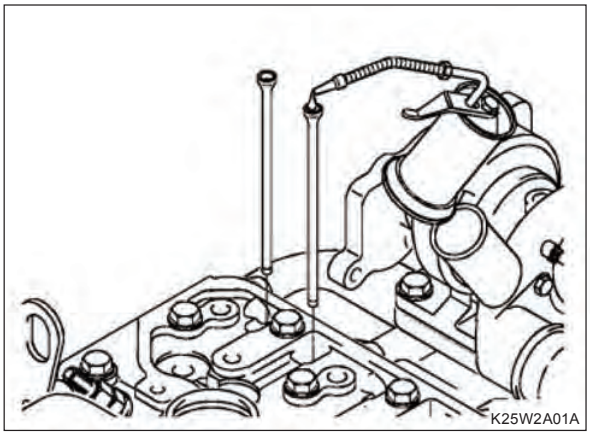
   C. Assemble the bolt according to factory procedure. (Tightening torque: 5.2kg•m)

   D. Disassemble to 360 deg.

   E. Re-tighten the bolt.(Tightening torque : 6.8 kg•m)

   F. Tightening it into 90 degree by using angle mapper. (Actual tightening torque: 12.0±1.0 kg•m)

6.4.18 PUSH ROD

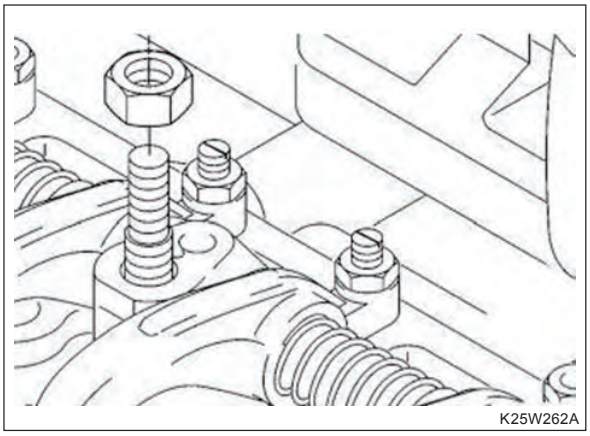


1. Assemble the push rod in socket of tappet in order.
2. Lubricate the lubricating oil on the push rod.

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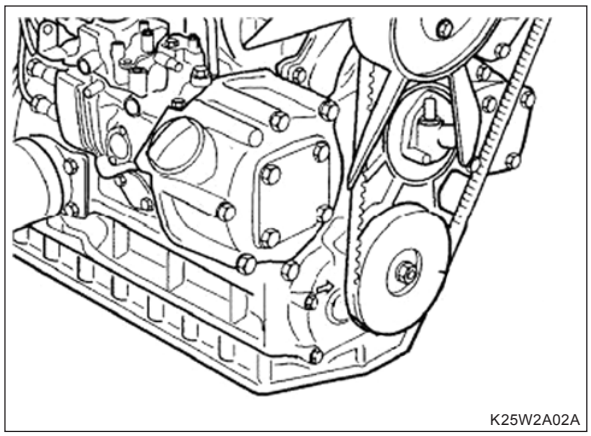
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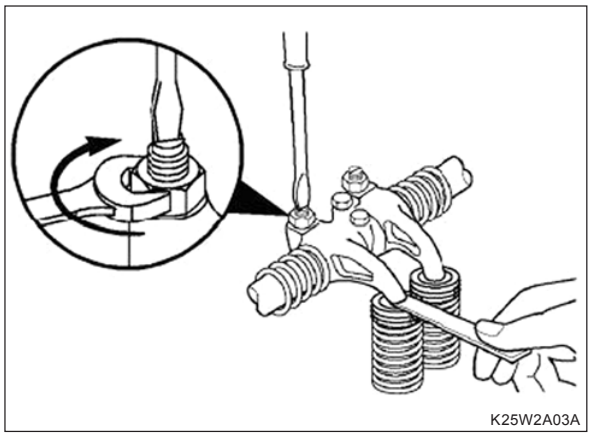
6.4.19 ROCKER ARM ASSEMBLY


K25W262A

1. Apply the lubricating oil to rocker arm shaft and bush. And assemble the bolt to rocker arm shaft.
2. The adjustment bolt of rocker arm should untie.
3. Assemble the bolt. (Tightening torque : 6.0 kg-m)

ADJUSTMENT PROCEDURE OF VALVE CLEARANCE.


K25W2A02A


K25W2A03A

1. Rotate the engine until the first cylinder stay on TDC. Line up the mark '→' of crank pulley and the mark '0' of gear case.
2. Install the gauge between rocker arm and valve stem.
3. Adjust the clearance with rotating the adjustment bolt.

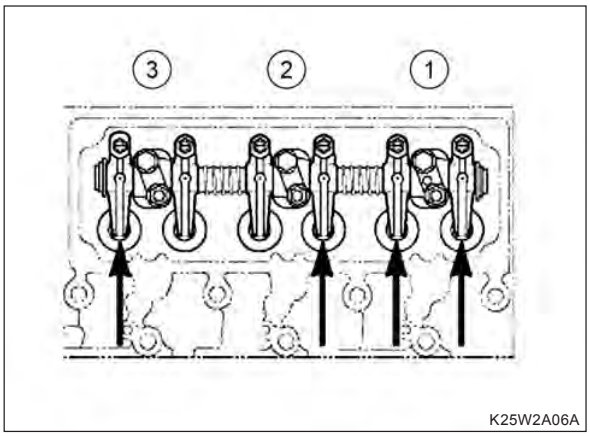
VALVE CLEARANCE (ENGINE COOLED STATUS)	
Intake valve	Exhaust valve
0.3 mm	0.3 mm
NOTE: Lower 60°C [140°F]	

4. Tighten the adjustment blot.
(Tightening torque: 2.7 kg•m)

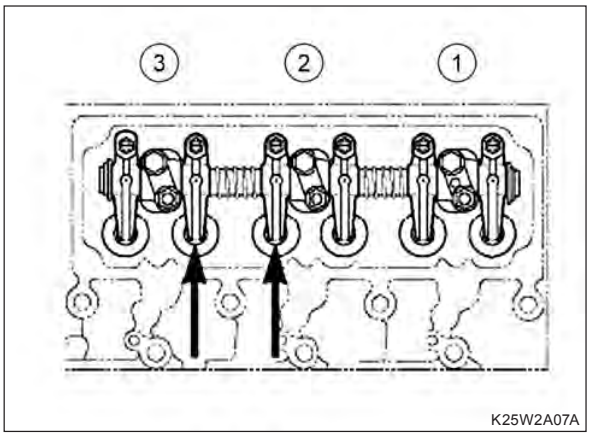
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ADJUSTMENT PROCEDURE



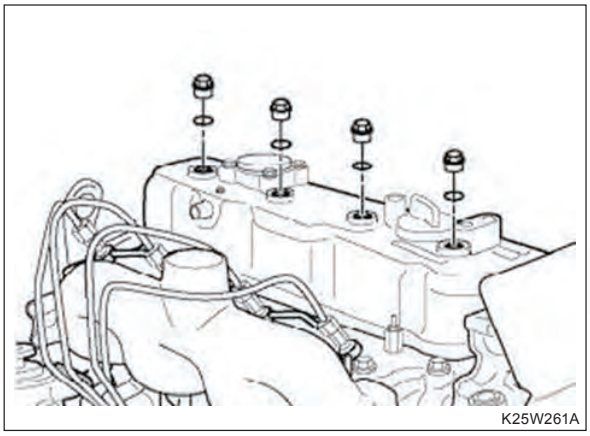
K25W2A06A



K25W2A07A

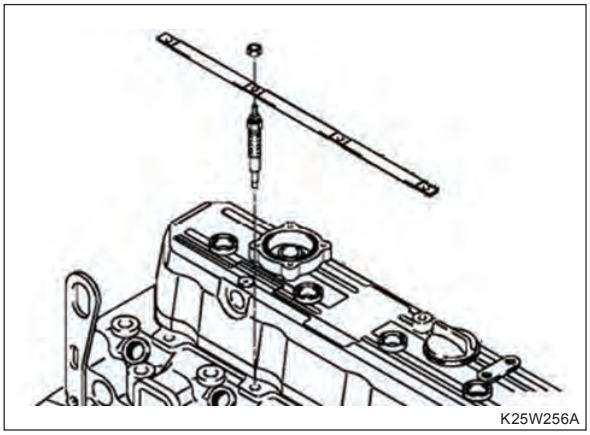
1. Rotate the engine until the first cylinder stay on TDC
2. Adjust the intake valve of cylinder '1' and '2'.
3. Adjust the exhaust valve of cylinder '1' and '3'.
4. Rotate the crankshaft to rotation direction of engine. (360 degree.)
5. Adjust the intake valve of cylinder '3'.
6. Adjust the exhaust valve of cylinder '2''.

6.4.20 CYLINDER HEAD COVER


K25W261A

1. Assemble the new gasket and head cover.
2. Tighten the nuts to hold the head cover. (Tightening torque : 2.0 kg-m).

6.4.21 GLOW PLUG

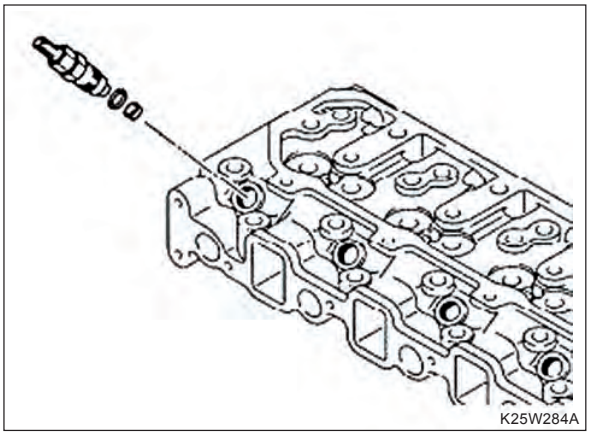

K25W256A

1. Tighten the glow plug.
2. Assemble the connector and tighten the nuts.

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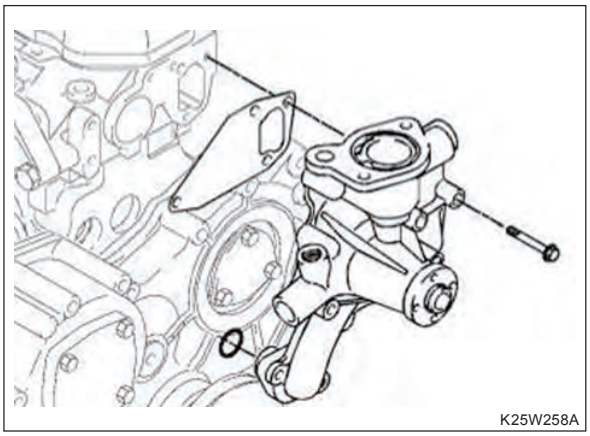
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6.4.22 INJECTION VALVE (INJECTOR)



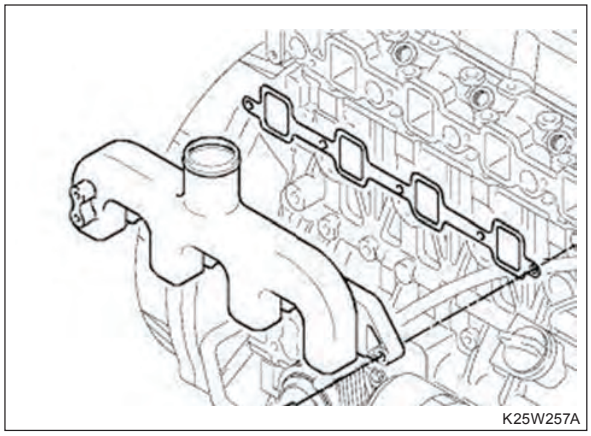
1. Assemble the new nozzle space cup and sealing washer.
2. Assemble and use the flat plate of injector. (Tightening torque : 7.5 kg-m)

6.4.23 WATER PUMP



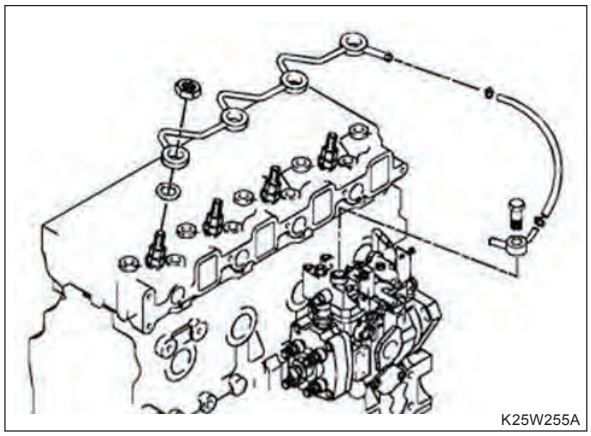
1. Assemble the water pump with new packing.
2. Tighten the bolts to water pump. (Tightening torque: 2.7 kg•m)
3. Assemble the V-pulley.
4. Tighten the bolts to V-pulley. (Tightening torque: 2.7 kg•m)

6.4.24 INTAKE MANIFOLD



1. Assemble the intake manifold with new packing.
2. Tighten the bolts and nuts to hold the intake manifold. (Tightening torque: 2.7 kg•m)

6.4.25 FUEL DRAIN PIPE

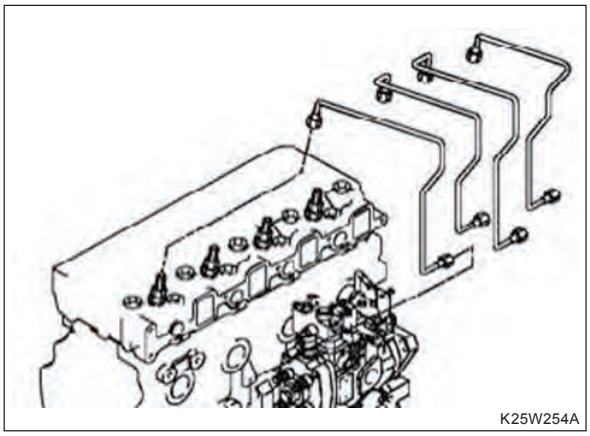


1. Assemble the new packing.
2. Tighten the nuts after install the drain pipe. (Tightening torque : 2.3 kg-m)
3. Assemble the drain hose. (Drain pipe ~ injection pump.)

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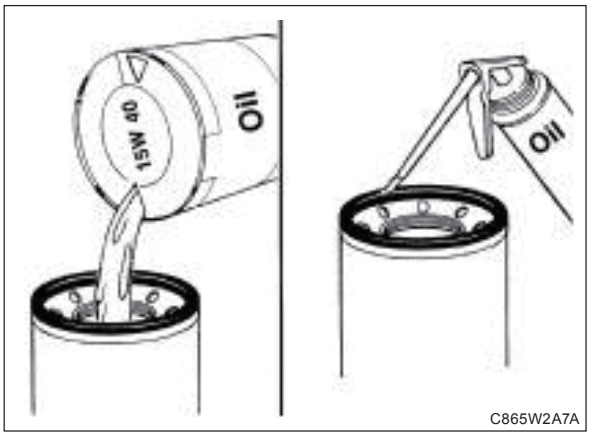
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6.4.26 FUEL SUPPLY PIPE.



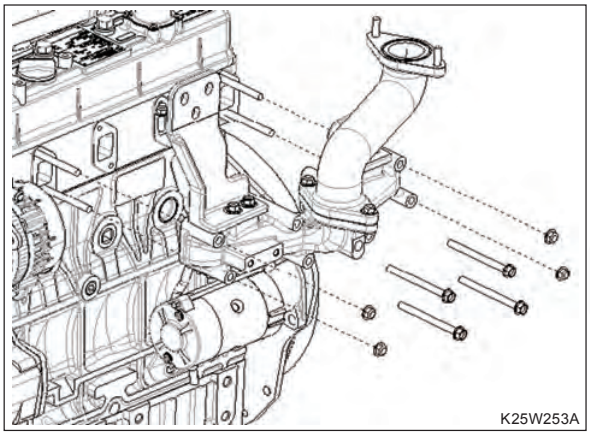
1. Assemble the high pressure pipe.
2. Tighten nuts between fuel injection pump and fuel injection valve. Use two wrenches in order to prevent rotating the relative parts. (Tightening torque : 2.7 kg-m)
3. Assemble the fuel line clamp.

6.4.27 OIL FILTER



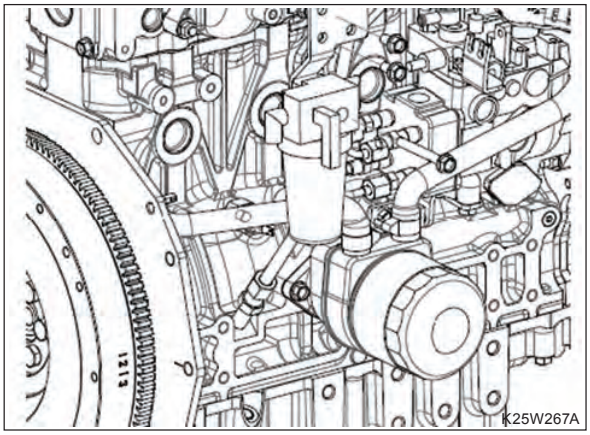
1. Assemble the oil filter using by tool.
2. If it is new part, put the lubricating oil in the oil filter.

6.4.28 EXHAUST MANIFOLD



1. Assemble the exhaust manifold with new gasket.
2. Tighten the bolts and nuts to hold exhaust manifold. (Tightening torque: 2.7 kg•m)

6.4.29 FUEL FILTER

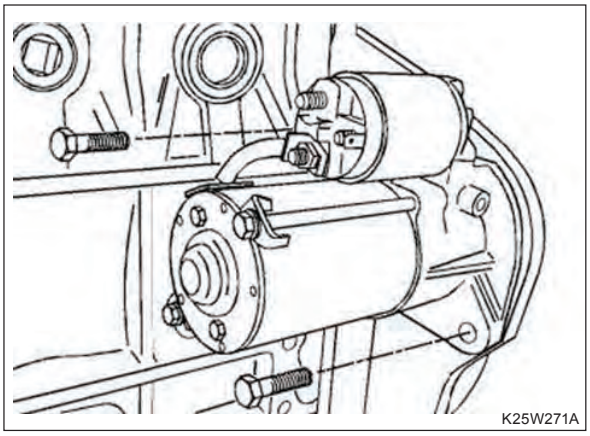


1. Assemble the fuel filter bracket with fuel filter.
2. Tighten the bolts to hold the fuel filter.
3. Connect the fuel filter and fuel inlet of fuel injection pump by using the hose.
4. Tighten the clamps to hold the hose.

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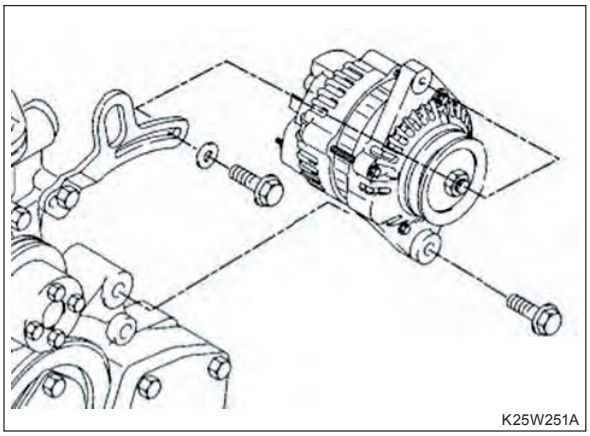
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6.4.30 STARTER



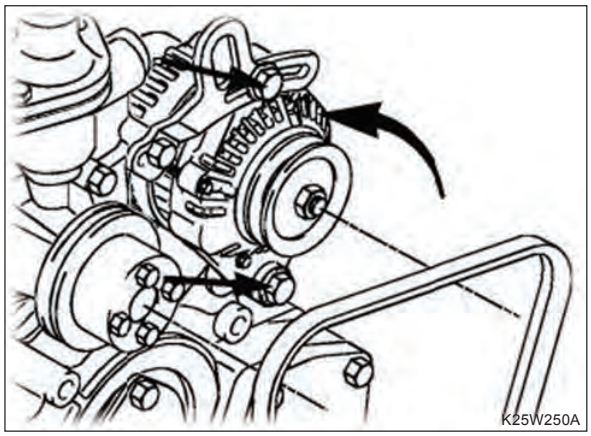
1. Assemble the starter.
2. Tighten the bolts to hold starter.

6.4.31 ALTERNATOR



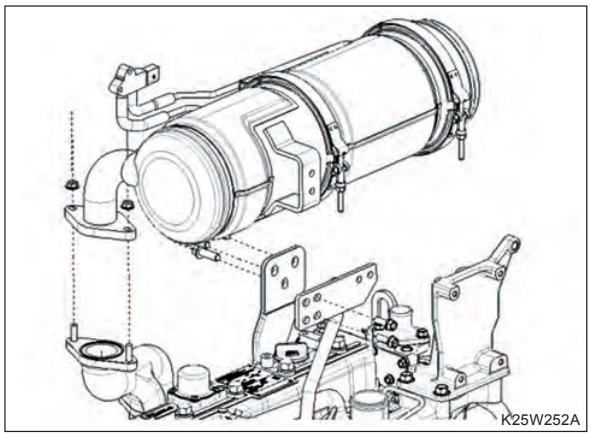
1. Assemble the alternator.
2. Tighten the lower side bolt with washers tentatively.
3. Tighten the clamping bolt and washer that hold the upper side of alternator tentatively.
4. The bolts that hold alternator are re-tightened after adjusting the tension of V-belt.

6.4.32 V-BELT



1. Adjust the tension of alternator after that tighten the adjust bolt and bolts.

6.4.33 AFTER-TREATMENT DEVICE (ATD) [3015R(h)/3515R(h)/4015R(h)]



1. Assemble ATD.
2. Tighten the bolts to hold the ATD. (When assembling the ATD, should be careful because ATD is heavy.)

6.4.34 LUBRICATING SYSTEM

1. Supply the lubricating oil. (15W-40 CJ-4 or CG-4)
2. Check the mark of oil level gauge. (mark “F”)

OIL CAPACITY (LITER)	
ENGINE MODEL	LUBRICATING OIL
A1700	4.3

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6.5 ENGINE OPERATION

6.5.1 OPERATION ADVANCE PREPARATION WORK

1. Fill the new lubricating oil through the filler port.
2. Connect the coolant hose and fill the coolant.
3. Connect the fuel hose to fuel tank.
4. Execute the air bleeding of the fuel line.

6.5.2 ENGINE OPERATION

Because the friction surface is not used enough in case of the new engine, useful life could be shortened due to overload or over speed in oil film. Therefore must comply with the below.

UNTIL THE FIRST 50HRS

1. The engine operates between 1200rpm~1500rpm in no load until the temperature of the engine becomes normal operation condition.
2. Avoid the overload or continuous high speed operation.
3. Avoid the no load high speed operation.
4. Avoid the sudden acceleration or sudden stop of the engine.
5. Must comply with check and inspection procedure.

6.5.3 RUNNING-IN OPERATION CHECKLIST

Must comply with the following information while the initial running-in operation.

1. Check the lubricating oil level frequently (maintain between the upper limit and lower limit in lubricating oil level)
2. Check the oil pressure warning lamp. If lamp is lit, lubricating oil shortage or lubrication system is problem. Therefore must be check.
3. Check the coolant gauge and confirm that whether or not coolant circulate smoothly.

After finishing the running-in operation (50hrs), replace the lubricating oil and oil filter. (Lubricating oil according to the local characteristics used.)

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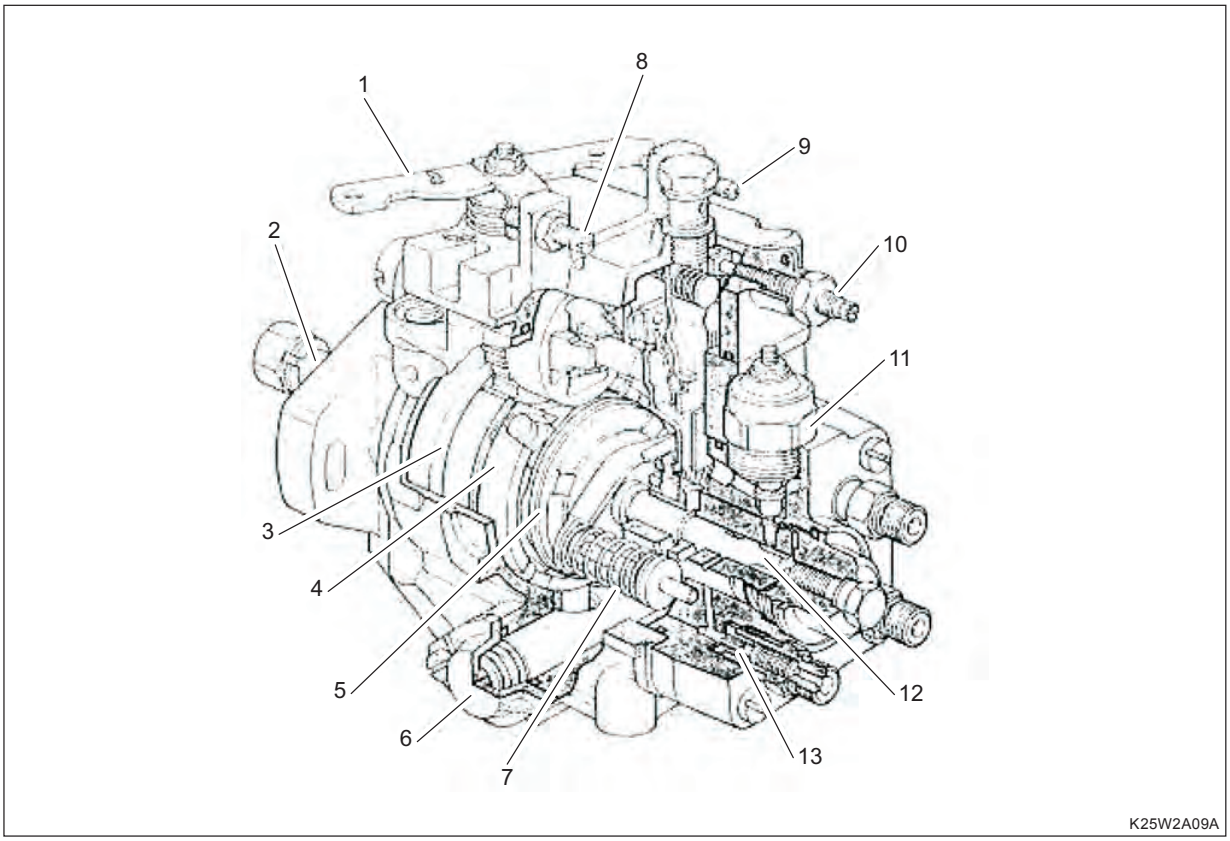
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6.6 ENGINE IMPORTANT PARTS MAINTENANCE

6.6.1 FUEL INJECTION PUMP

Injection pump is distributor injection type (VE) mounted on the gear case flange and driven by injection pump gear. The fuel is supplied in each cylinder by one plunger rotation and reciprocating motion. The fuel is sucked from fuel tank by external feed pump and internal feed pump. And then fuel send to injection pump through fuel filter. Low-pressure fuel sucks in pump chamber and is controlled by regulating valve. The fuel enter high pressure chamber through barrel suction port via injection pump head path from pump chamber. High-pressured fuel made by plunger inject through injection valve according to injection timing. Excessive fuel in injection pump returns fuel tank through fuel return hose via over flow valve.

The injection pump is cooled and lubricated by the fuel circulation. Remaining fuel also returns fuel tank through over flow hose after collecting in the injection pump. Water in the fuel reduces pump useful life. Therefore must manage not to enter water, dirt into the fuel system.



(1) Control lever
(2) Drive shaft
(3) Feed pump
(4) Roller holder
(5) Cam disk
(6) Timer
(7) Plunger spring
(8) High speed control bolt
(9) Low speed control bolt
(10) Full-load adjusting screw
(11) Fuel cut solenoid
(12) Plunger
(13) Delivery valve

▶ SPECIFICATION

ITEM		SPECIFICATION	REMARK
Type of Fuel filter		Cartridge element type	
Injection pump	Type	VE Type (Distributor Type)	
	Direction of rotation	Right (driving shaft to the right in)	
	Sequence of injection	1-3-2 (3Cyl.)	
	Type of governor	All Speed	
	Fuel cut solenoid	12V / 8Ω	
Injection valve	Type of nozzle	Semi-Throttle Type	
	Type of holder	Screw insertion type	

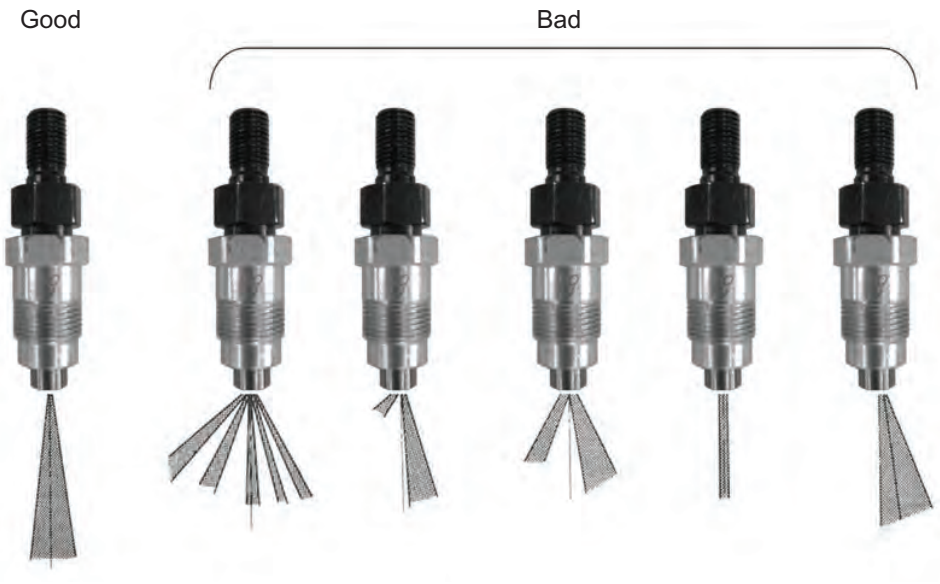
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6.6.2 INJECTOR

Spray shape of the injector is the important element that affects in efficiency. Therefore must properly adjust and maintain.

INJECTOR SPRAY SHAPE CHECK



K25W2A10A

After injector injection pressure is adjusted to 120±5kg/cm^2, affixes it in injector tester and every second 4~ 6 time fabricates the lever. Check the spray condition and if it is abnormal, injector replace or clean.

1. Check whether the spray condition is good.
2. The case which is defective, disassemble the injection valve and replace the injector tube or assembly.
3. After the spray stopped, check whether or not after drop.
4. The case which is defective, disassemble the injection valve and replace the injector tube or assembly.

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CHECK AND ADJUSTMENT OF THE INJECTOR

▶ CHECK AND ADJUSTMENT OF THE INJECTION OPENING PRESSURE

1. Mounting on injector in tester.
2. Handle of the tester is operated at 1time per second.
3. Indicator of the manometer is slowly rising and indicator shakes during injection. After looking at starting shaking points of the indicator, check whether opening pressure is standard value.

STANDARD PRESSURE	**OPENING PRESSURE**	Standard value
	ADJUSTING PRESSURE	standard value +5~10 kg/cm^2
LIMIT PRESSURE		Above standard value -10kg/cm^2

4. The case which is defective, disassemble the injector and replace the thickness of the shim. And then injection opening pressure adjusts standard value.

⚠ WARNING

- **Be careful when disassembling the injector does not enter dust etc.**

5. If you can't adjust injection pressure despite replace a thickness of the shim, injector replaces the assembly.

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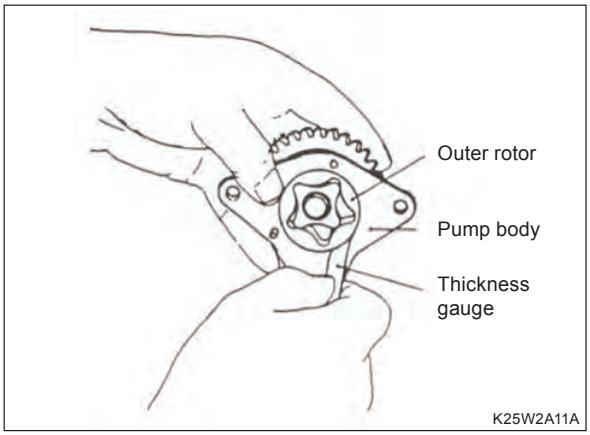
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6.6.3 OIL PUMP

Oil pump, as trochoid pump, driven by crank shaft gear is compact as well as pressure fluctuation is small. And 3.5kg/cm^2 pressure supply to each part.

When discharging pressure of the oil pump is low, check the flow rate. And the case which does not have defective, the check of oil pump is necessary with the next method.

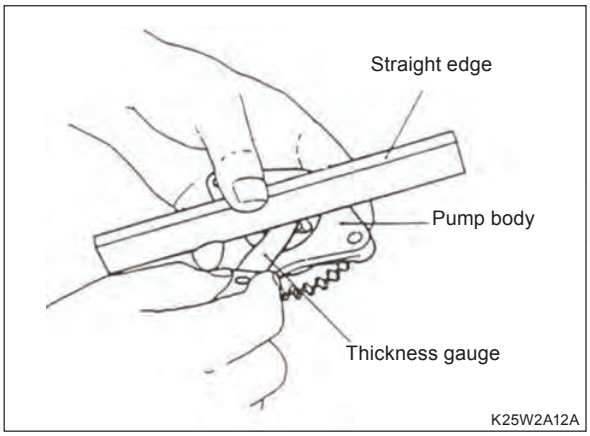
CLEARANCE OF BETWEEN OUT ROTOR AND PUMP BODY



Checking a clearance of between out rotor and pump body by thickness gauge.

ITEM	STANDARD
Clearance (mm)	0.10 ~ 0.16

CLEARANCE OF PUMP BODY, OUTER ROTOR AND INNER ROTOR



Check a clearance of pump body, outer rotor and inner rotor by thickness gauge.

ITEM	STANDARD
Clearance (mm)	0.03 ~ 0.09

CLEARANCE OF BETWEEN INNER ROTOR SHAFT AND OIL PUMP COVER

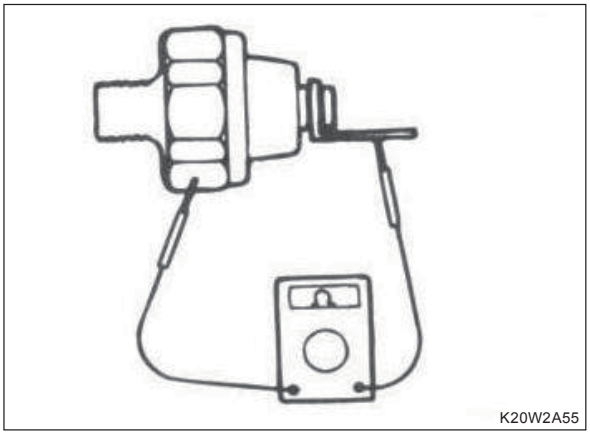
After measuring a rotor shaft outer diameter and oil pump cover inner diameter, calculate the difference between the inner diameter and outer diameter.

ITEM	STANDARD
Clearance (mm)	0.013 ~ 0.043

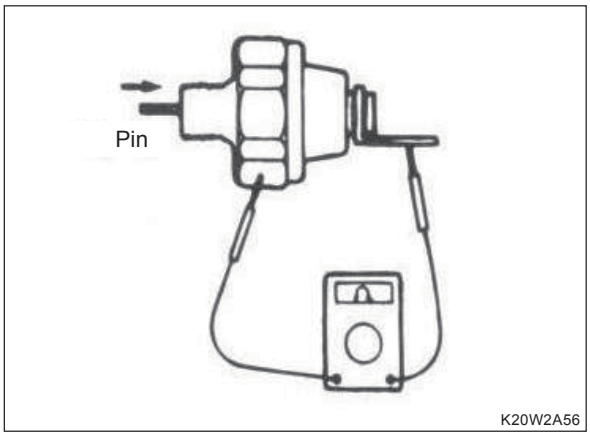
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6.6.4 PRESSURE SWITCH



Connects the tester (Ω) in between the terminal and the body, and check whether or not applying an electric current. If applying an electric current, it is normality and if not applying an electric current, replace the switch.



The thin rod puts in oil hole and slightly presses. At this point, If applying an electric current, it is normality and if not applying an electric current, replace the switch.

When inflicting an air press of 0.5kg/cm^2 in the oil hole, it is normality if not applying an electric current. At this point, check whether or not leak the air and if leaking the air, the case which damages the diaphragm. Therefore replace the switch.

6.6.5 COOLIN SYSTEM

This engine is water cooling type. Combustion heat and oil heat are absorbed by coolant and emitting those at the outside. As a result, engine can operate normally the engine.

Coolant supplied by water pump circulates the oil cooler through coolant hose and absorbs the oil heat. And coolant absorbs combustion heat through water jacket of cylinder block and coolant path of cylinder head.

Coolant absorbing the oil heat and combustion heat is sent to thermostat of water pump. If temperature of coolant is lower than valve open temperature of thermostat, re-circulate inside the cylinder. And if temperature of coolant is higher than valve open temperature of thermostat, flow the radiator. After emitting the heat which absorbs from the coolant in radiator, coolant again circulates to water pump.

CHECK THE WATER PUMP

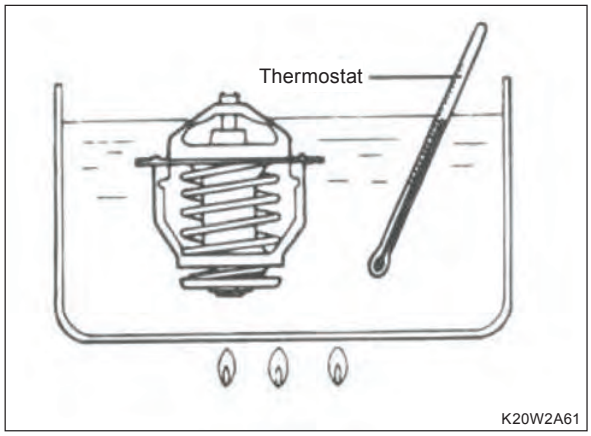
The water pump must check following item. If water pump is defective, replace water pump assembly.

1. Leak of water pump (Check if water flows out from the drain hole on the bottom of the pump body during operation)
2. Damage or crack of water pump body
3. Damage or crack of impeller
4. Damage of bearing assembly (When rotating the pump shaft gently, it should be rotated freely without any interference.)

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THERMOSTAT



Thermostat constantly maintain the coolant temperature and is used to improve thermal efficiency by preventing heat loss.

When heating the thermostat in water, check the valve open temperature.

VALVE OPEN TEMP	72.0°C ± 2°C (start open)
	85.0°C ± 2°C (full open)

- Valve expansion lift: Above 8mm

6.6.6 OVERHEAT

If stopping the engine when overheating the engine, stop the circulation of the coolant and overheating can be serious locally. Also if quick freezing, crack will be able to occur in cylinder head, cylinder block etc,.

Do not confusion In this case, engine rotates at low speed and coolant temperature does to make fall naturally.

Then after, supplies the coolant and removes the cause.

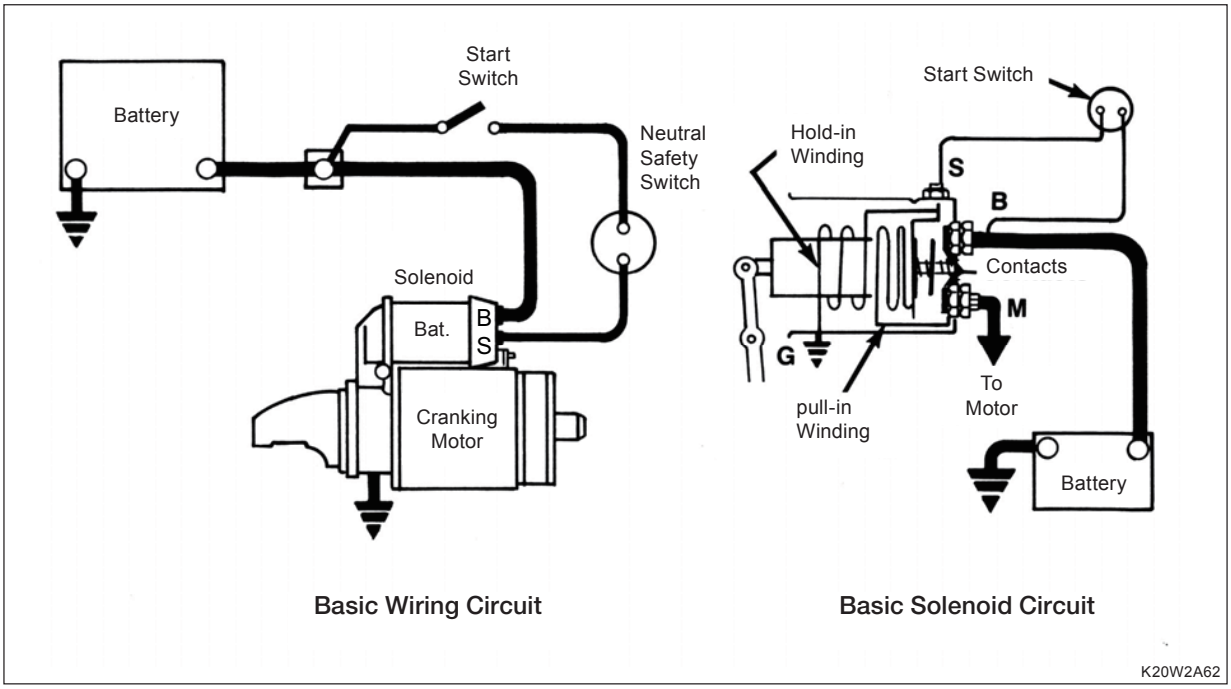
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6.7 ELECTRICAL SYSTEM

6.7.1 STARTER

BASE CIRCUIT DIAGRAM

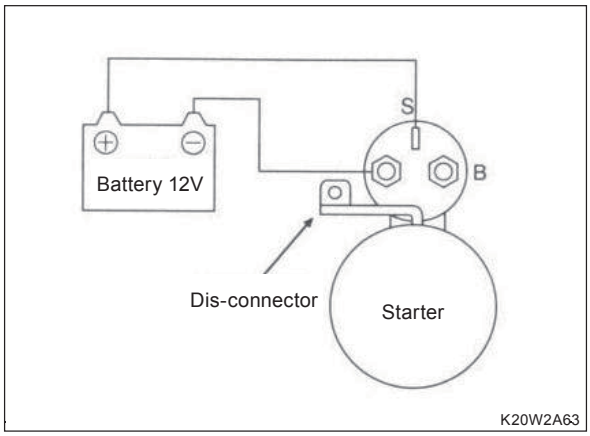


SPECIFICATION

ITEM	SPECIFICATION
Output	12V / 2.2kW
Pinion number of teeth	15
No-load voltage	11.5V

CHECK

▶ **PULL IN COIL TEST OF MAGNETIC SWITCH(SOLENOID)**



The case which connects battery between S-M terminal, if plunger comes in and the pinion comes out, the pull in winding is normality. If the pinion does not come out, replace the magnetic switch.

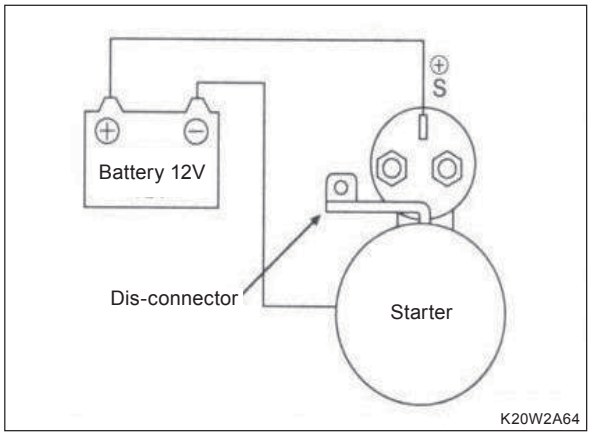
⚠ CAUTION

- **When this check doing to, separates connector from M terminal.**
- **Don't connect continuously more than 10 second.**

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▶ PULL IN COIL TEST OF MAGNETIC SWITCH(SOLENOID)

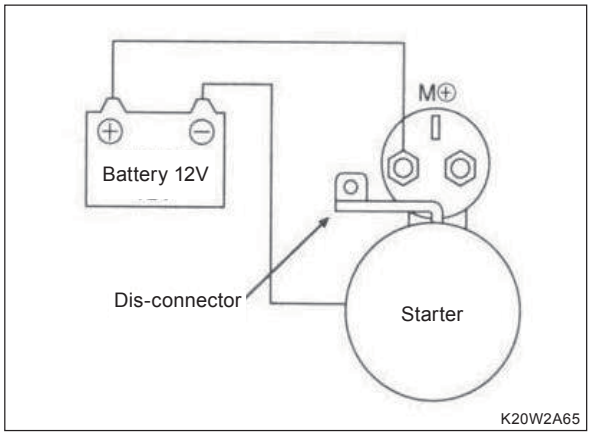


The case which connects battery between S-M terminal, if plunger comes in and the pinion comes out, the pull in winding is normality. If the pinion does not come out, replace the magnetic switch.

⚠ CAUTION

- **Don't connect continuously more than 10 second.**

▶ MAGNETIC SWITCH RETURN TEST

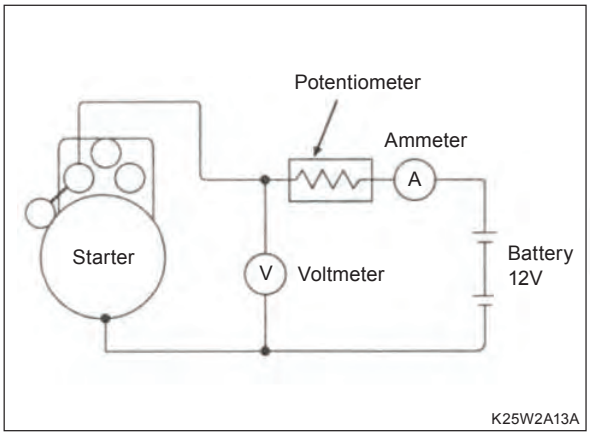


Until stopper pulls out the pinion by manual in the condition which connects between M terminal of magnetic switch and body. If pinion returns immediately when taking off hand, both coils are normality.

⚠ CAUTION

- **Don't connect continuously more than 10 second.**

▶ NO-LOAD TEST



1. Connect the starter motor, battery, voltmeter, ammeter and variable resistance as picture.
2. If rotated when you switch to ON after making the variable resistance with the maximum, starter motor is normality. Rheostat adjusts to 11V in voltmeter. And if current and number of rotation are other case in regulation, presumes the cause of breakdown base on next table and repair it.

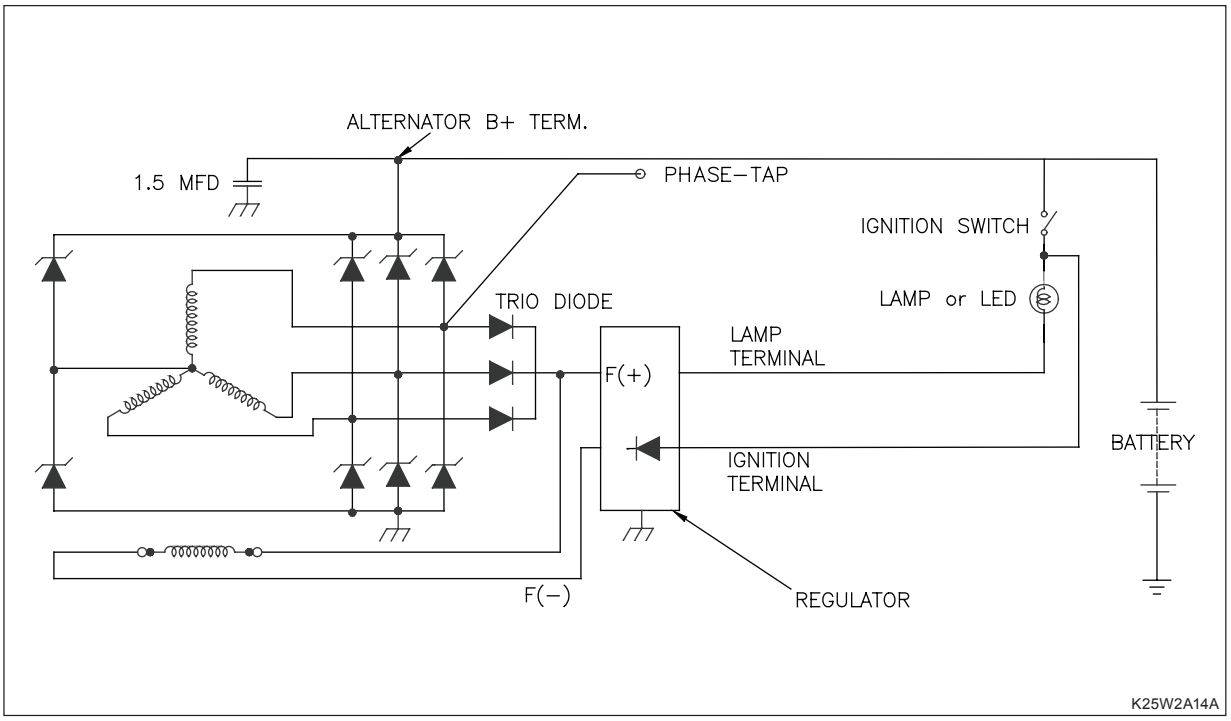
ACTUAL STATE	CAUSE
Electric current is large current and number of rotation is low. (Neither torque is much strong)	- Stain of metal, oil contamination - Wear the pole peace of armature core - Short of armature
Electric current is large current and doesn't rotate at all.	- Earth of electronic switch - Earth of armature coil, field coil - Seizure of metal
Electric current does not flow and does not rotate.	- Disconnection of armature coil, field coil - Disconnection of brush, pigtail - Contamination of armature, connection defect between brush and armature by Highmica etc,.
Electric current is small current and number of rotation is low. (Neither the torque is much strong)	- Connection defect of field coil contact part (If shunt coil is disconnected or connection defect, rotation degree is also high)
Electric current is large current and number of rotation is high.	- Short of field coil

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6.7.2 ALTERNATOR

BASE CIRCUIT DIAGRAM



SPECIFICATION

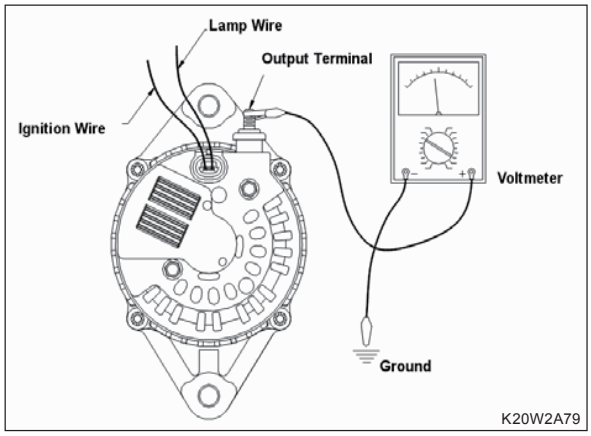
ITEM	CONTENT
TYPE	Rectifier Alternator
CAPACITY	12.0V / 50A
MOTOR VELOCITY	1,000~18,000 rpm
REGULATOR SETTING VOLTAGE	14.7 ± 0.3V
TEMPERATURE COMPENSATE	-7 ± 3mV/°C

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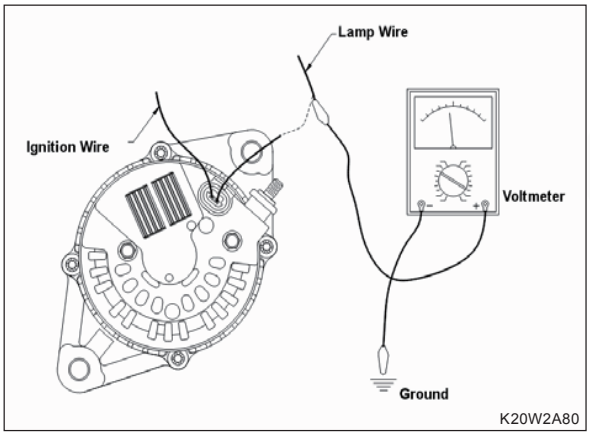
CHECK

▶ ALTERNATOR OUTPUT VOLTAGE TEST ON ENGINE RUNNING CONDITION.



1. Connect positive (+) of voltmeter lead to alternator output Terminal (B+) and negative (-) lead to a ground on alternator.
2. With engine running about 1500 RPM and all accessories turned on, output voltage must be 13.4 ~ 15.7(V).
3. If output is not measure, or if voltage is not constant, check alternator output circuit for loose.
4. If output is still not measure, check brushes and slip rings for wear, dirt or damage.
5. If brushes and slip rings are good, alternator is damaged internally. Disassemble alternator and test components.

▶ IGNITION CIRCUIT TEST AT IGNITION KEY ON CONDITION

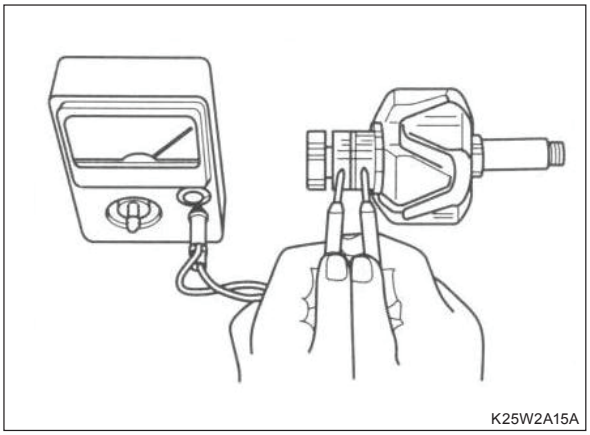


1. Unplug Ignition terminal of regulator connector from voltage regulator
2. Connect positive (+) voltmeter lead to Ignition wire on the wiring harness and negative (-) voltmeter lead to a ground terminal.
3. Voltmeter should indicate battery voltage. If battery voltage is not measured, check Ignition circuit for loose or dirty connection or damaged wiring.

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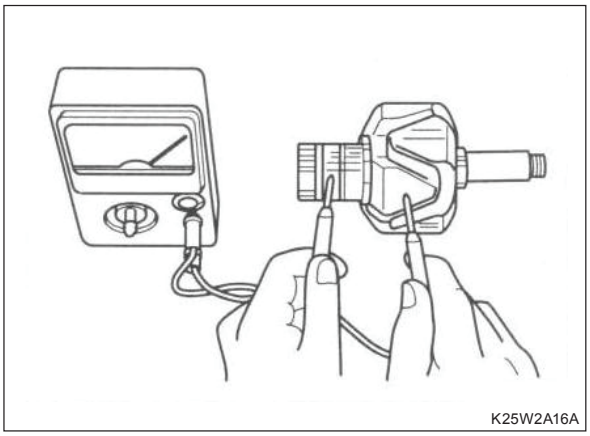
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▶ ROTOR


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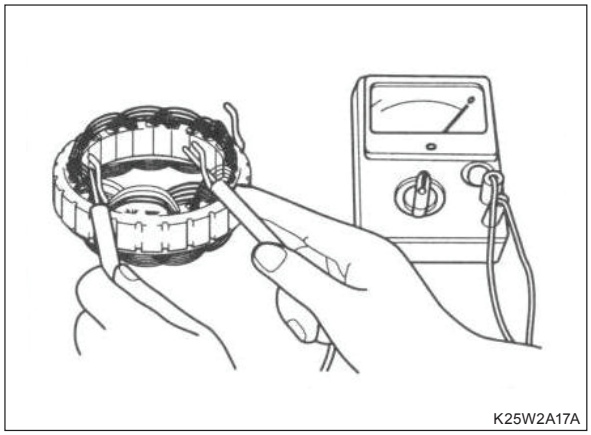
1. Check the conductivity of rotor coil. Confirm that whether or not conductivity between slip rings. Measure the resistance value and if the resistance value is very small, it is short. But if it is not conductivity or short, replace the rotor assembly.

STANDARD	about 27.5Ω / 20°C

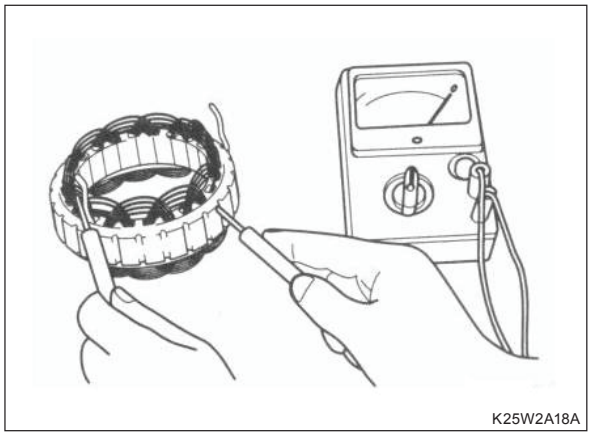

K25W2A16A

2. Check the earth of rotor coil. Confirm that whether or not conductivity between slip ring and earth. If it is electric conduction, replace the rotor assembly.

▶ STATOR


K25W2A17A

1. Check the conductivity of stator. Confirm that whether or not conductivity between coil and lead. If it is not electric conduction, replace the stator assembly.


K25W2A18A

2. Check the earth of coil. Confirm that where or not conductivity between coil and core. If it is electric conduction, replace the stator assembly.

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6.7.3 CAUTION FACT OF ELECTRIC WIRING

ALTERNATOR

- Do not reverse connection the battery.

  If reverse connecting the plus (+) and minus (-) of battery cable, the diode of alternator is damaged and does not become charging. Also the starter coil burn out. Battery must be produced by correcting the length of battery cable or by making the structure which prevents a reverse connection in order for not to become the reverse connection.

- Charging output voltage not use the control purpose.

  The engine number of rotation and output voltage are not constant proportion. Therefore output voltage forbids using the control purpose.

- Use the specified V-belt.
- Do not high-pressure cleaning using the high pressure washing machine.

  If alternator does high-pressure cleaning, charging becomes defect due to insert water in brush.

STARTER

- Use the battery which satisfied specification.

  Starting performance of engine depend on capacity of battery. This battery capacity should be change according to temperature condition and using condition in work machine. Consequently, select the battery which satisfied specification and must use it.

- Total wire resistance of battery cable(+,-) must be less than 2/1000Ω.

  If total wire resistance is out of standard value, it is cause of breakdown and functional loss in starter.

- If wire resistance of starter must be more than standard value.

  Reciprocation wire total resistance between starter and key switch (Or power relay, safety relay: when using) must be less than 5/100Ω.

- Do not high pressure cleaning with high pressure washing machine.

  Waterproof of starter is level which is no problem when pouring the water or rain usually. Consequently, do not high pressure cleaning or be submerged.

CURRENT LIMIT

- Do not use excessive discharged battery (under 8V). Abnormal high voltage is generated when using it. As a result, other electronic sub assembly is damaged. Excessive discharged battery uses after charging.
- Do not separate the battery during the operation. If separating the battery during the operation, malfunction the current limit and not control the output voltage. In this case, electronic sub assembly is damaged by generating the continuous high voltage.

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7. MAINTENANCE STANDARD TABLE

7.1 MAIN BOLT TIGHTENING TORQUE

ITEM	SIZE	HEXAGON(mm)	TIGHTENING TORQUE(kgf·cm)	NOTE
Cylinder head bolt	M11×1.5	17	① 800 kgf·cm	(1200 kgf·cm)
			② 360° disassum.	
			③ 520kgf·cm(Long bolt)	
			570kgf·cm(Short bolt)	
			④ ③+ 90°	
Connecting rod bolt	M10×1.25	14	300kgf·cm + 60°	(700 kgf·cm)
Flywheel clamping bolt	M10×1.25	17	300kgf·cm + 60°	(900 kgf·cm)
Metal cap clamping bolt	M12×1.5	17	600kgf·cm + 60°	(1250 kgf·cm)
Crankshaft V-pulley clamping bolt	M14×1.5	19	① 750	
			② 1150±100	
Glow plug	M10×1.25	12	275±25	
Injection valve	M20×1.5	22	750±50	
Valve adjusting screw clamping bolt	M8×1.25		270±30	
Balancer housing clamping bolt	M8×1.25	12	270±30	
Idle gear shaft clamping bolt	M8×1.25	12	270±30	
Nozzle Return pipe Nut	M12×1.5	17	370±50	
Nozzle jet bolt	M8×1.25	13	170±50	
Injection pump gear clamping bolt	M12×1.25	19	900±100	
Alternator bracket nut	M10×1.5	14	530±70	
Oil seal housing clamping bolt	M8×1.25	12	270±30	
Oil suction tube clamping bolt	M8×1.25	12	270±30	
Thermostat cover bolt	M8×1.25	12	270±30	
Rocker arm support hold nut	M12×1.25	19	600±50	
Camshaft thrust bearing bolt	M8×1.25	12	270±30	

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7.2 STANDARD BOLT & NUT TIGHTENING TORQUE

(Unit: kgf•cm)

SIZE	4T		7T		9T	
	NORMAL THREAD	FINE THREAD	NORMAL THREAD	FINE THREAD	NORMAL THREAD	FINE THREAD
M 5	40±5	-	60±10	-	90±10	-
M 6	60±10		130±10		135±10	
M 8	150±20		270±30		330±20	
M 10	300±50	240±40	530±70	420±60	690±30	550±30
M 12	530±70	420±60	900±100	720±80	1130±70	900±60
M 14	780±70	620±60	1350±150	1080±120	1850±150	1480±120
M 16	1250±150	1000±120	1900±200	1520±160	2580±220	2060±220
M 18	1750±150	1400±120	2650±250	2120±200	3800±300	3040±240
M 20	2450±250	1960±200	3700±400	2960±320	5400±400	4320±320

PT PLUG	SIZE	1/8	1/4	3/8	1/2	3/4
	ALUMINUM	150±20	200±30	250±30	350±50	460±50
	CASTING	200±20	250±30	360±30	560±50	770±50

HOLLOWNESS BOLT	M 8	M 12	M 14	M 16	
	150±20	300±50	450±50	550±50	

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7.3 SERVICE DATA

7.3.1 CYLINDER HEAD

ITEM			STANDARD	LIMIT	NOTE
Cylinder head combustion surface distortion			below 0.03	0.15	
Valve seat angle	Intake		120°	-	
	Exhaust		90°	-	
Valve seat width	Intake		1.73	2.23	
	Exhaust		2.12	2.62	
Intake valve	Valve stem outer dia.		Ø 7.96 ~ Ø 7.97	Ø 7.9	
	Valve guide inner dia.		Ø 8.010 ~ Ø 8.025	Ø 8.1	
	Oil clearance		0.040 ~ 0.055	0.15	
Exhaust valve	Valve stem outer dia.		Ø 7.96 ~ Ø 7.97	Ø 7.9	
	Valve guide inner dia.		Ø 8.010 ~ Ø 8.025	Ø 8.1	
	Oil clearance		0.040 ~ 0.055	0.15	
Valve guide projection(from head surface)			13	-	
Valve sinking depth	Intake valve		0.7	1	
	Exhaust valve		0.7		
Thickness of valve head	Intake valve		1.2	0.5	
	Exhaust valve		1.2		
Intake valve timing	Open	b. TDC	9° ~ 19°	-	
	Close	a. BDC	37° ~ 47°		
Exhaust valve timing	Open	b. BDC	37° ~ 47°		
	Close	a. TDC	9° ~ 19°		
Valve spring	Free length		46.1	-	
	Inclination		-	1.2	
	Tension (when compressed to 1mm length)		1.883	-	
Intake & Exhaust valve clearance			0.15 ~ 0.25	0.25 ~ 0.35	-

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7.3.2 CYLINDER BLOCK

ITEM		STANDARD	LIMIT	NOTE
Cylinder bore	L	Ø 88.015 ~ Ø 88.025	Ø 88.20	
	S	Ø 88.005 ~ Ø 88.015		
Cylinder roundness		0 ~ 0.01	0.03	
Cylindricity		0 ~ 0.015	0.03	

7.3.3 VALVE ROCKER ARM

ITEM		STANDARD	LIMIT	NOTE
Intake & Exhaust rocker arm	Rocker arm shaft outer dia.	Ø 15.959 ~ Ø 15.98	Ø 18.95	
	Rocker arm inner dia.	Ø 19.0 ~ Ø 16.021	Ø 19.09	
	Oil clearance	0.020 ~ 0.062	0.14	
Pushrod bending		0.03 or less	0.25 or less	-
Tappet	Tappet stem outer dia.	Ø 14.224~Ø 14.249	Ø 14.18	
	Tappet guide hole inner dia.	Ø 14.260~Ø 14.280	Ø 14.30	
	Oil clearance	0.011 ~ 0.056	0.12	

7.3.4 PISTON

ITEM		STANDARD	LIMIT	NOTE
Piston outer dia.	A	Ø 87.965~Ø 87.975	Ø 87.90	
	C	Ø 87.960~Ø 87.965		
Minimum clearance between piston and cylinder block		0.040 ~ 0.070	-	
Top clearance		0.8	-	
Piston and piston pin	Piston pin outer dia.	Ø 30.0 ~ Ø 29.991	Ø 29.90	
	Piston pin hole inner dia.	Ø 30.0 ~ Ø 30.008	Ø 30.02	
	Oil clearance	0 ~ 0.017	0.12	

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7.3.5 PISTON RING

ITEM		STANDARD	LIMIT	NOTE
Top ring	Ring groove width	2.06 ~ 2.08	-	
	Ring width	1.97 ~ 1.99	-	
	Ring and ring groove clearance	0.07 ~ 0.110	-	
	End clearance	0.20 ~ 0.35	1.5	
2nd ring	Ring groove width	2.06 ~ 2.08	-	
	Ring width	1.97 ~ 1.99	-	
	Ring and ring groove clearance	0.07 ~ 0.110	-	
	End clearance	0.45 ~ 0.65	1.5	
Oil ring	Ring groove width	3.02 ~ 3.04	-	
	Ring width	3.97 ~ 3.99	-	
	Ring and ring groove clearance	0.03 ~ 0.07	-	
	End clearance	0.20 ~ 0.40	1.5	

7.3.6 CONNECTING ROD

ITEM		STANDARD	LIMIT	NOTE
Crankpin side	Crank pin pushing inner dia.	Ø 53.0 ~ Ø 53.019	-	
	Crank pin metal thickness	1.487 ~ 1.50	-	
	Crank pin outer dia.	Ø 49.95 ~ Ø 49.964	Ø 49.91	
	Oil clearance	0.038 ~ 0.095	0.15	
Piston pin side	Piston pin bush inner dia.	Ø 30.025 ~ Ø 30.038	Ø 30.10	
	Piston pin outer dia.	Ø 29.991 ~ Ø 30.0	Ø 29.90	
	Oil clearance	0.025 ~ 0.047	0.2	
Twist and parallelism		Ø 0.05/100mm	Ø 0.08	

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7.3.7 CAMSHAFT

ITEM		STANDARD	LIMIT	NOTE
Gear side	Camshaft journal outer diameter	Ø 44.950 ~ Ø 44.964	Ø 44.89	
	Oil clearance	0.066 ~ 0.110	-	
Intermediate	Camshaft journal outer diameter	Ø 44.916 ~ Ø 44.930	Ø 44.89	
	Oil clearance	0.070 ~ 0.130	-	
Flywheel side	Camshaft journal outer diameter	Ø 44.950 ~ Ø 44.964	Ø 44.89	
	Oil clearance	0.066 ~ 0.110	-	

7.3.8 CRANKSHAFT

ITEM		STANDARD	LIMIT	NOTE
Crank journal	Crankshaft journal outer dia.	Ø 53.950 ~ Ø 53.964	Ø 53.91	
	Bearing metal thickness	1.987 ~ 2.000	-	
	Oil clearance	0.036 ~ 0.095	0.15	
Bending		0.02 or less	0.02 or less	-

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CHAPTER 3 CLUTCH [MEC. MODEL]

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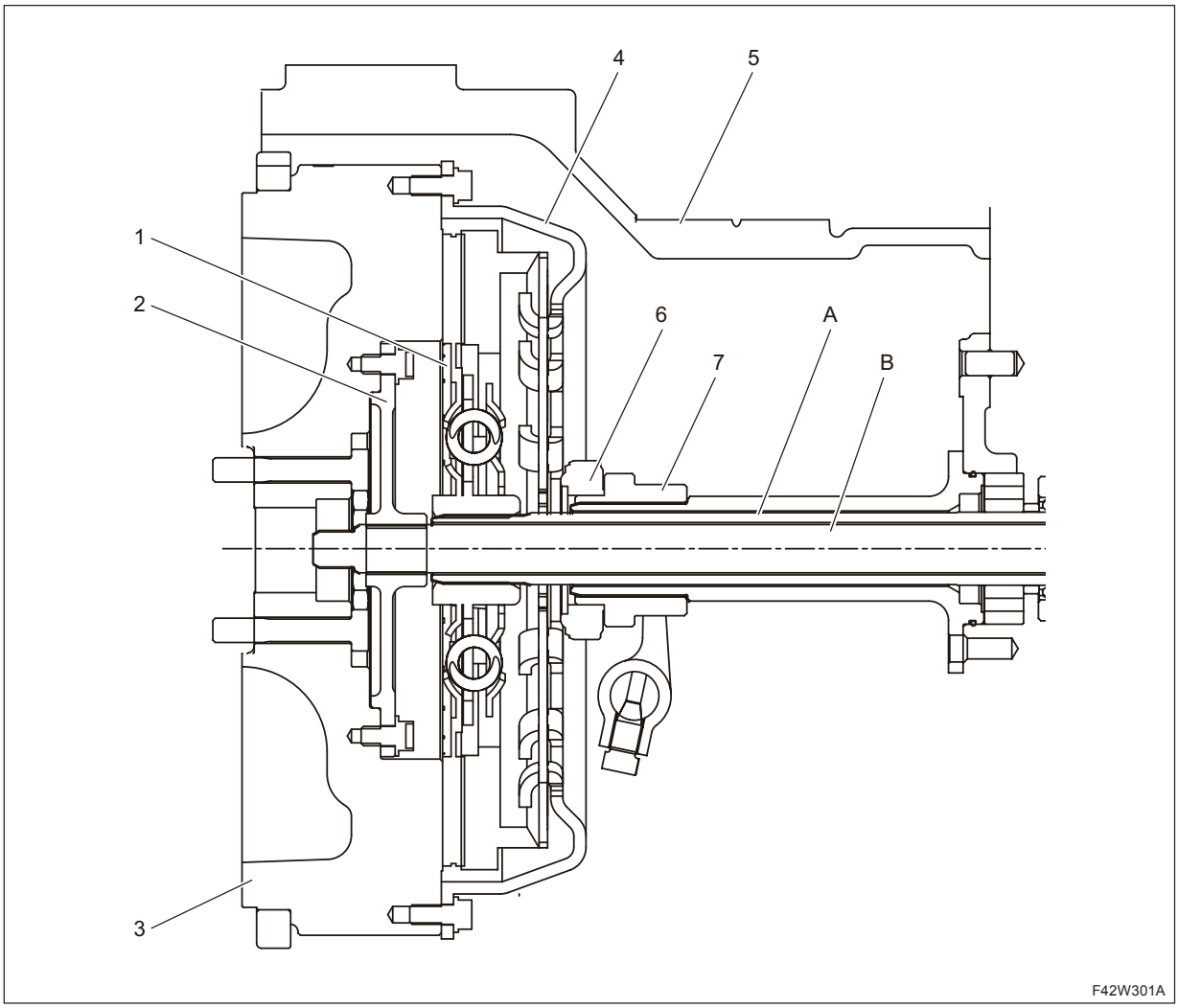
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1. OVERVIEW

The clutch is to deliver or cut off power from the engine to the transmission. When the clutch disc is pressed against the flywheel, the rotating force from the engine is delivered into the transmission through the shaft which is connected to the spline boss of the clutch.

However, when the clutch pedal is depressed, its clutch rod pulls the release shaft which then pushes the release bearing in the clutch housing to press the clutch cover spring. As a result, the clutch disc is separated from the flywheel, so rotating force from the engine is no longer transmitted to the transmission.

1.1 SECTIONAL VIEW OF CLUTCH ASSEMBLY



(1) Clutch disc assembly
(2) PTO sleeve
(3) Flywheel
(4) Clutch disc cover
(5) Clutch housing
(6) Release bearing
(7) Bearing sleeve
(A) Main shaft (outer): hollow shaft
(B) Main PTO shaft (inner): solid shaft

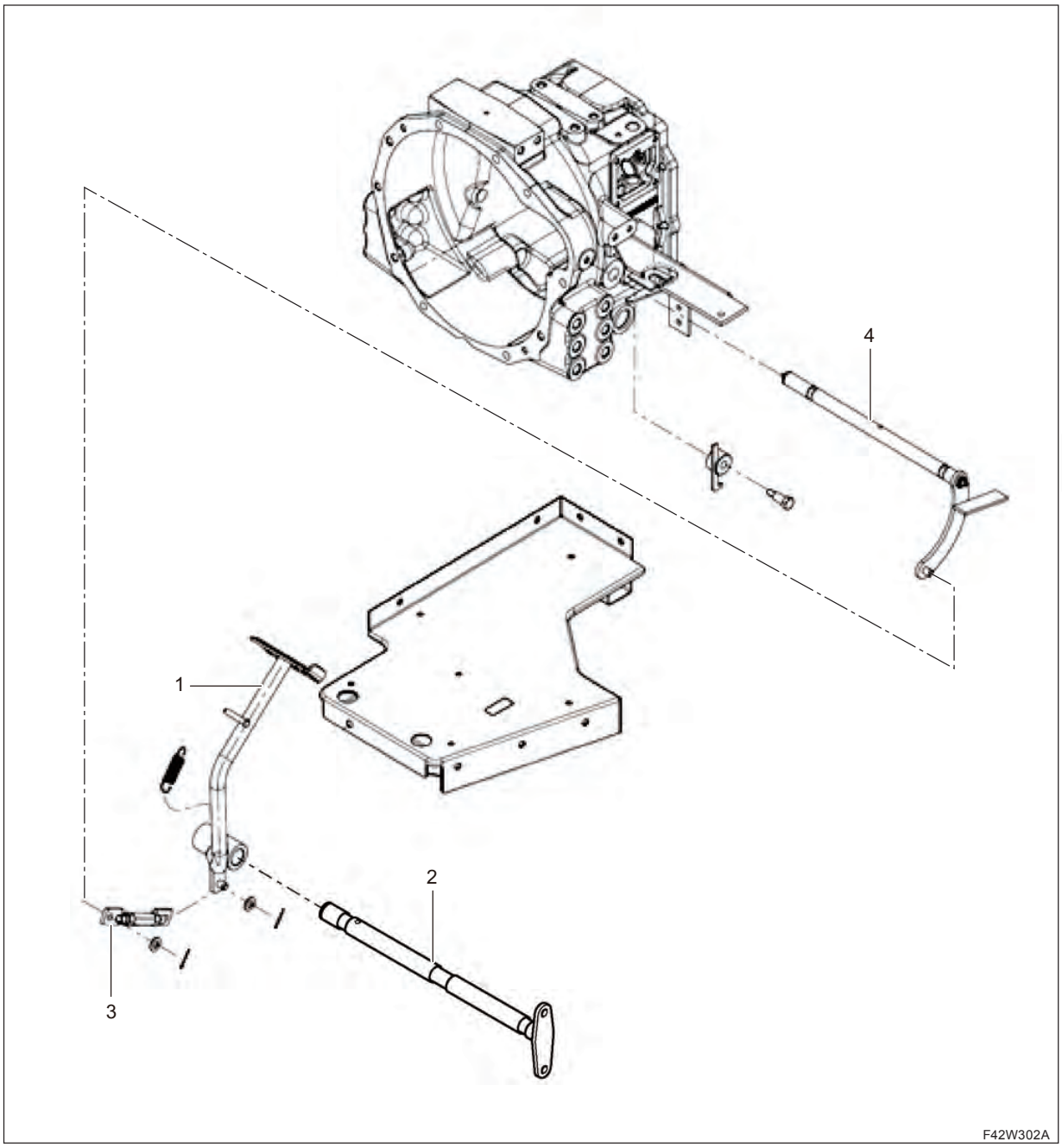
As shown in the figure above, the hollow shaft A (main shaft (outer)) is fixed to the boss of the clutch disc assembly with splines while the solid shaft B (main PTO shaft (inner)) is fixed to the PTO sleeve (2) of the flywheel with splines.

When the engine is running, the rotating force is delivered to each shaft. When the main clutch is disengaged in this state, the hollow shaft A does not rotate as it is fixed to the clutch disc assembly. However, as the solid shaft B is connected to the flywheel with the PTO sleeve, it rotates continuously. As a result, the PTO shaft connected to the solid shaft B is driven independently regardless of the driving shift condition.

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1.2 CLUTCH PEDAL COMPONENTS

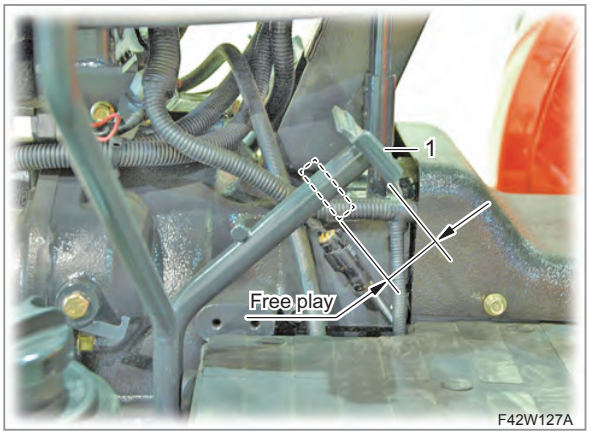


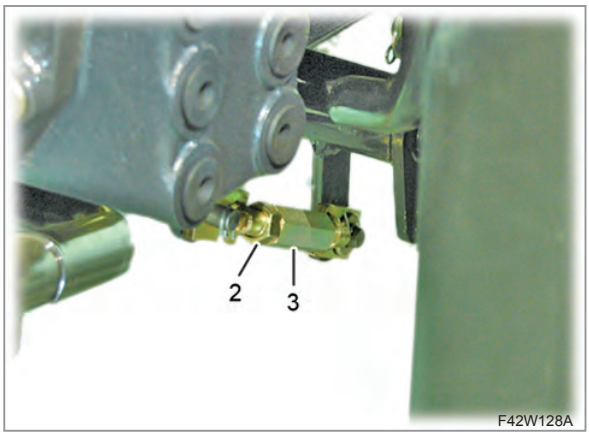
(1) Clutch pedal
(2) Brake shaft
(3) Clutch rod
(4) Release shaft

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1.3 CLUTCH PEDAL PLAY ADJUSTMENT





1. Depress the clutch pedal (1) slightly. Then, release it.
2. Measure its free play.

ITEM	STANDARD
Clutch pedal free play	25 - 35 mm (0.98 - 1.38 in)

3. If the free play is out of the specification, unscrew the mounting nut (2) of the clutch rod and turn the turn buckle (3) to adjust the free play. Then, tighten the mounting nut.

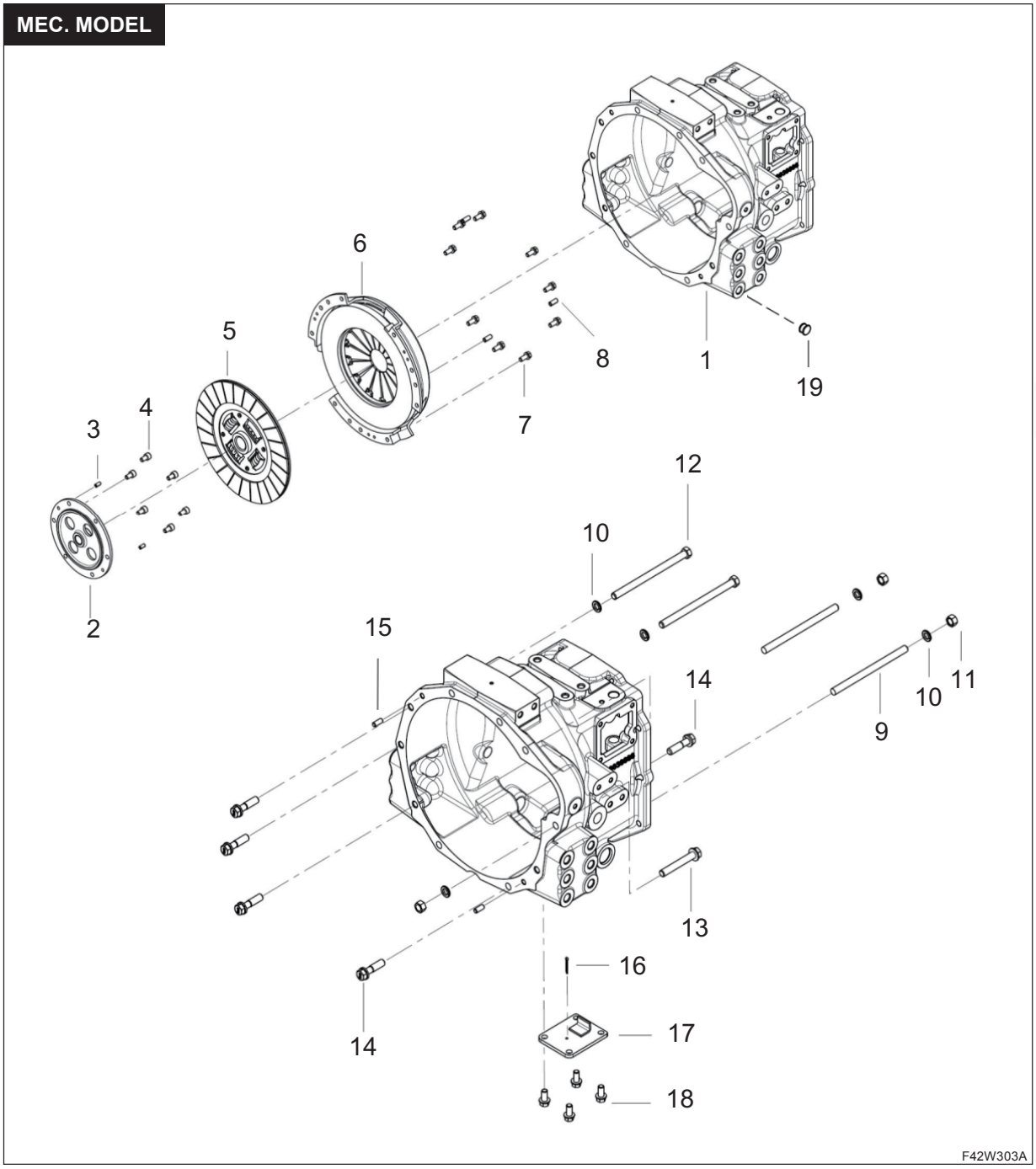
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2. SECTIONAL VIEW FOR MAJOR COMPONENTS

2.1 CLUTCH HOUSING

MEC. MODEL



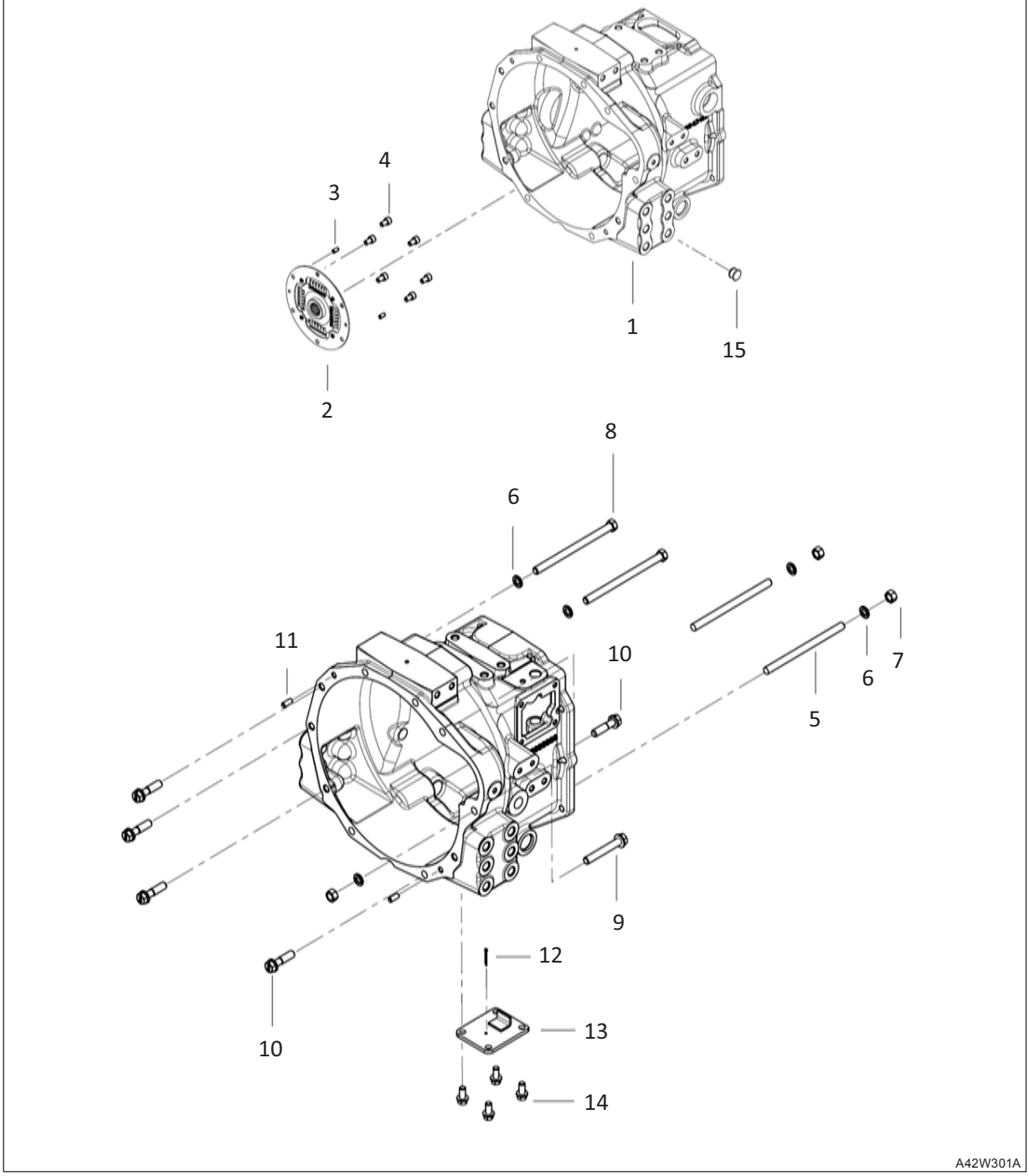
COMPONENTS

(1) Clutch housing
(2) Sleeve, PTO
(3) Spring pin
(4) Hexagon socket bolt
(5) Clutch disc ass'y
(6) Clutch cover ass'y
(7) Bolt w/washer
(8) Spring pin
(9) Stud bolt
(10) Spring washer
(11) Hex nut
(12) Hex bolt
(13) Hex bolt
(14) Hex bolt(SW)
(15) Pin
(16) Cotter pin
(17) Cover assy
(18) Hex flange bolt
(19) Pin, rubber

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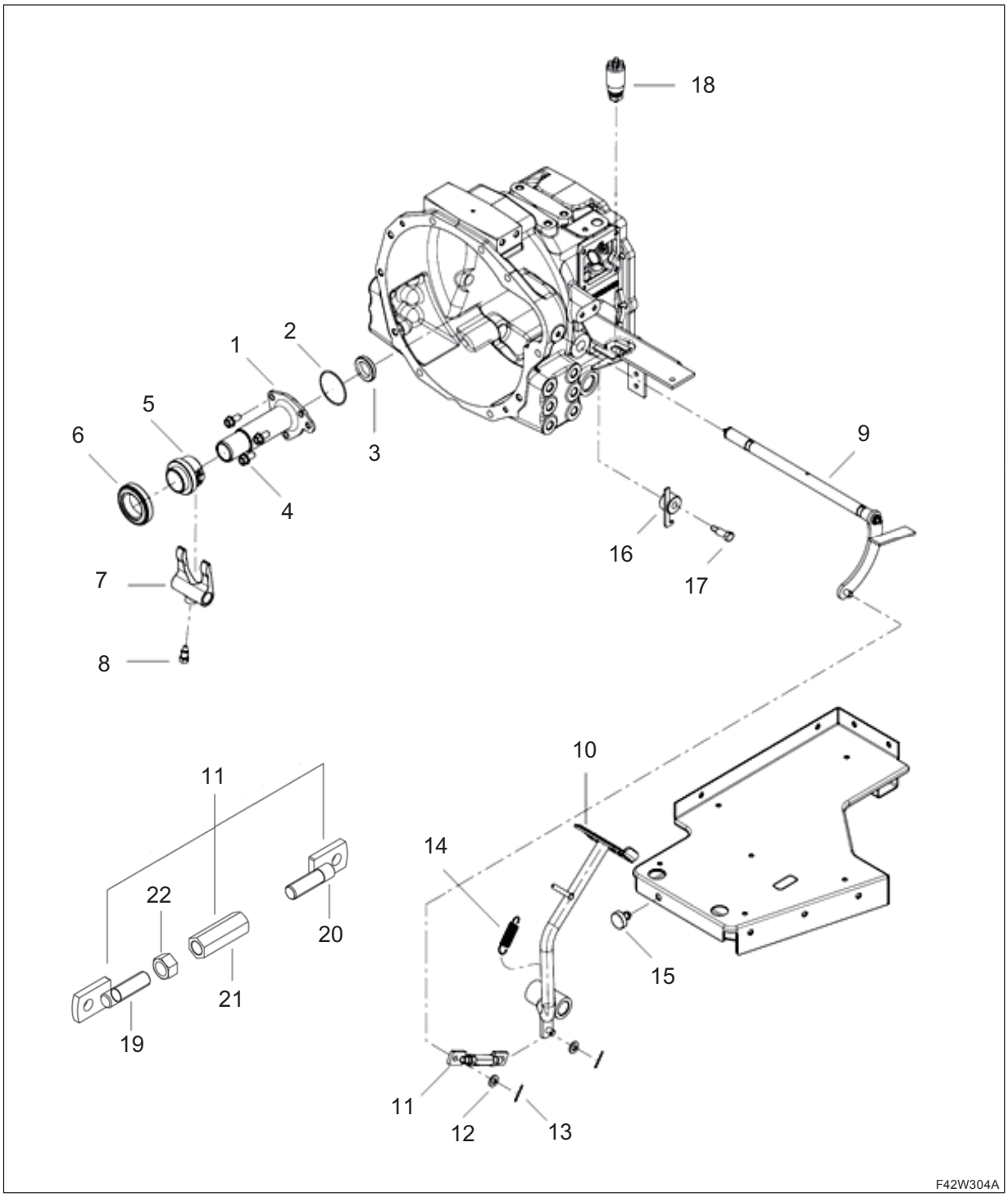
COMPONENTS

(1) Clutch housing
(2) Damper, pto
(3) Spring pin
(4) Hexagon socket bolt
(5) Stud bolt
(6) Spring washer
(7) Hex nut
(8) Hex bolt
(9) Hex bolt
(10) Hex bolt(sw)
(11) Pin
(12) Cotter pin
(13) Cover assy
(14) Hex flange bolt
(15) Pin, rubber

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2.2 CLUTCH RELEASE



COMPONENTS

(1) Cover
(2) O-ring
(3) Oil seal
(4) Hex flange bolt
(5) Sleeve, bearing
(6) Release bearing ass'y
(7) Yoke, clutch shift
(8) Bolt
(9) Release shaft(main clutch)
(10) Clutch pedal
(11) Clutch road
(12) Plain washer
(13) Cotter pin
(14) Spring
(15) Stopper
(16) Lock, clutch pedal
(17) Bolt
(18) Safety switch, clutch
(19) Rod
(20) Rod
(21) Turn buckle
(22) U-nut

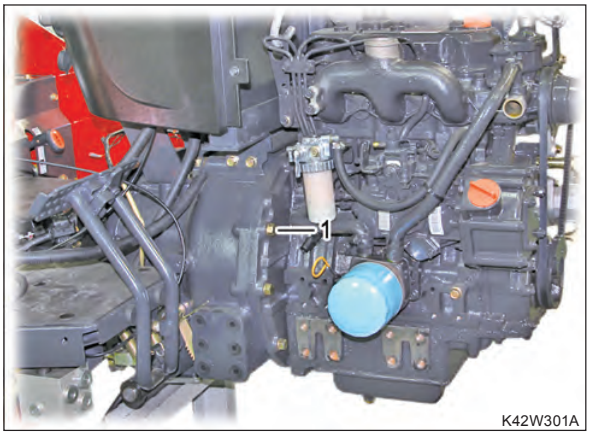
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3. DISASSEMBLY

3.1 CLUTCH HOUSING REMOVAL

1. Park the tractor on level ground and apply the hand brake.
2. Disconnect the negative battery cable.
3. Drain the transmission fluid.
4. Remove the hood and propeller shaft.
5. Disconnect the hydraulic hose, wiring connector and various cables between the vehicle body and engine.
6. Place a stand under the clutch housing and a portable jack under the engine oil pan.
7. Remove all the related parts, including the fuel hose and main wiring connector, between the engine and vehicle body.

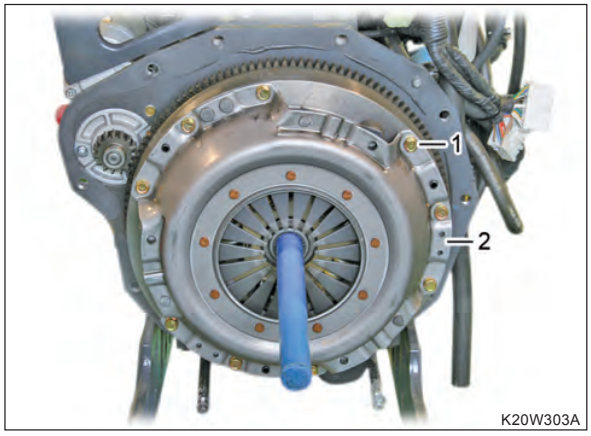


8. Unscrew the mounting bolt (1) from the cutch housing and engine mounting flange. Then, push the front axle section to separate it from the clutch housing.

ITEM	TORQUE VALUE
M14 nut (10.9T)	16.5 kg.m (119.34 lbf.ft)
M14 bolt (10.9T)	16.5 kg.m (119.34 lbf.ft)

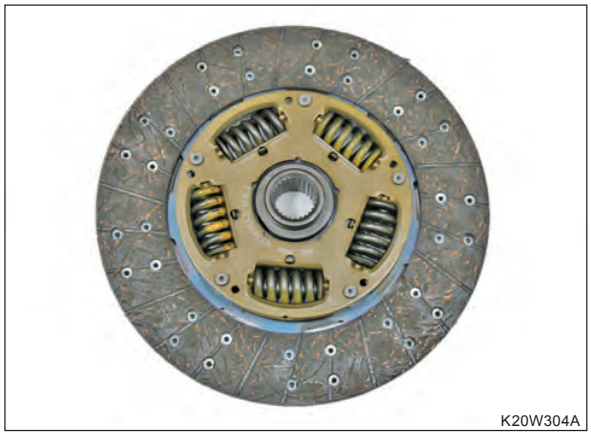
9. For more detailed disassembly procedures, refer to the instructions for engine removal in Chapter 2.

3.2 CLUTCH DISASSEMBLY



1. Unscrew the clutch assembly mounting bolts (1) from the engine flywheel to remove the clutch cover (2).

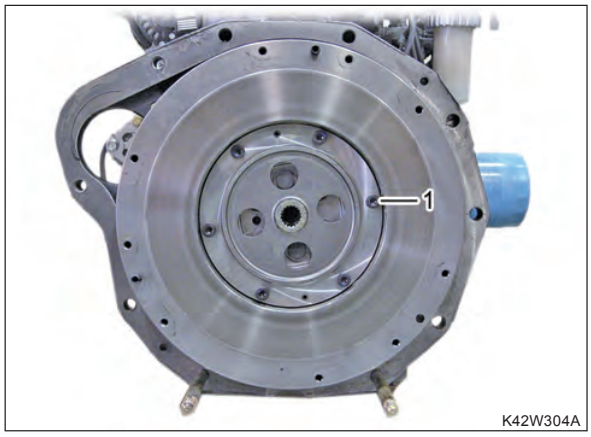
ITEM	TORQUE VALUE
Clutch assembly mounting bolt	2.3 - 2.6 kg.m (17 - 19 lbf.ft)

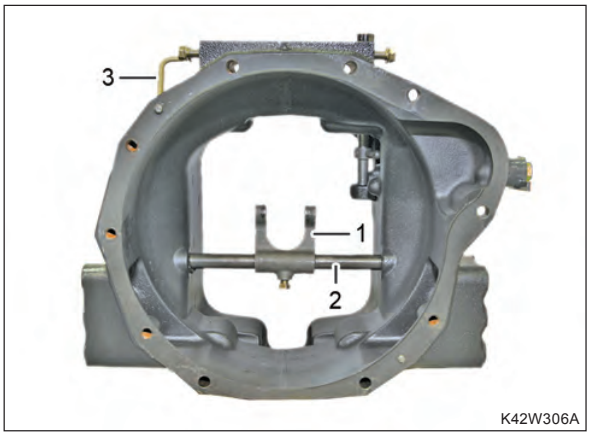


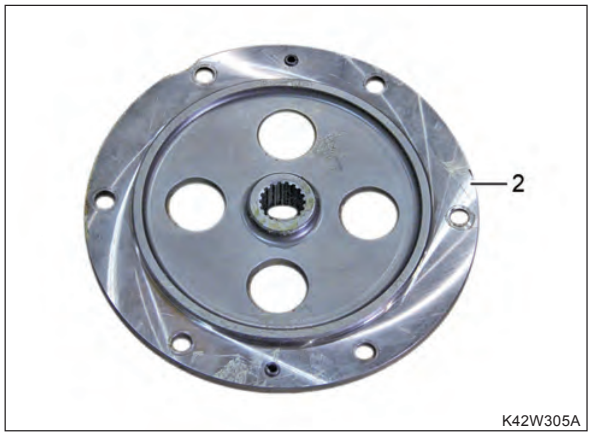
2. Remove the clutch disc.

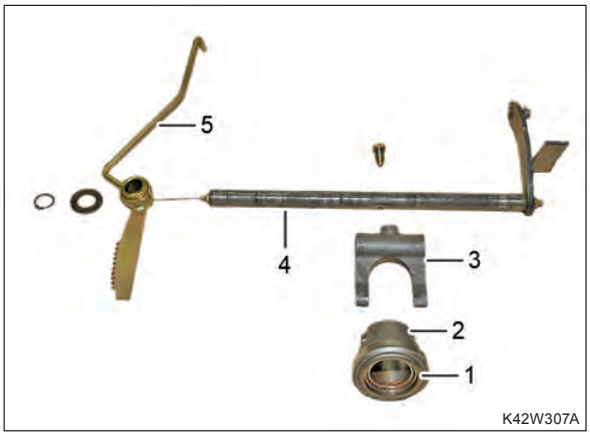
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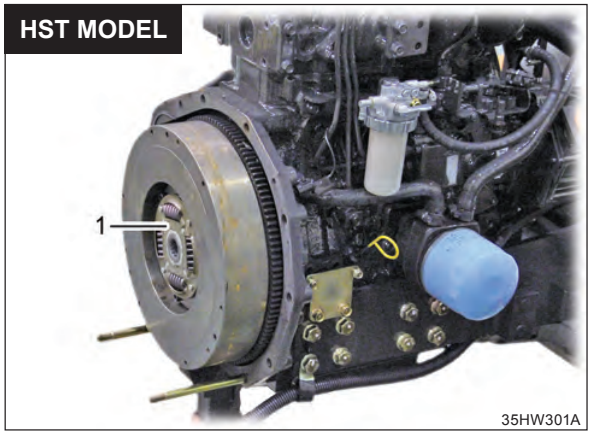


3. Unscrew the PTO sleeve mounting bolts (1) to remove the PTO sleeve (2).

ITEM	TORQUE VALUE
PTO sleeve mounting bolt	2.3 - 2.6 kg.m (17 - 19 lbf.ft)

4. As necessary, remove the release bearing (1), sleeve (2), clutch shift yoke (3), release shaft (4) and parking brake lever (5) from the clutch housing.

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4. As necessary, unscrew the mounting bolts to remove the PTO damper (1).

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CHAPTER 4 TRANSMISSION

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1. OVERVIEW

1.1 SPECIFICATION

<table>
<tr><th colspan="3">ITEM</th><th colspan="4">SPECIFICATION</th></tr>
<tr><td rowspan="11">Transmission system</td><td rowspan="4">MEC. MODEL</td><td>Shuttle type</td><td colspan="4">Mechanical, synchromesh</td></tr>
<tr><td>Main shift</td><td colspan="4">4 speeds, synchromesh</td></tr>
<tr><td>Range shift</td><td colspan="4">3 speeds, constant-mesh</td></tr>
<tr><td rowspan="2">Shifting gear and driving speed</td><td rowspan="2">F12 X R12</td><td>7 - 16
11.2 - 24</td><td>Forward driving: 1.2 - 22.6 km/h (0.746 - 14.044 MPH)
Reverse driving: 1.1 - 21.5 km/h (0.684 - 13.360 MPH)</td></tr>
<tr><td>8 - 16
12.4 - 24</td><td>Forward driving: 1.2 - 23.7 km/h (0.746 - 14.727 MPH)
Reverse driving: 1.2 - 22.5 km/h (0.746 - 13.982 MPH)</td></tr>
<tr><td rowspan="4">HST MODEL</td><td>Shuttle type</td><td colspan="4">Hydrostatic</td></tr>
<tr><td>Main shift</td><td colspan="4">HST</td></tr>
<tr><td>Range shift</td><td colspan="4">3 speeds, constant-mesh</td></tr>
<tr><td rowspan="2">Shifting gear and driving speed</td><td rowspan="2">CVT</td><td>7 - 16
11.2 - 24</td><td>Forward driving: 0 - 29.27 km/h (0 - 18.18 MPH)
Reverse driving: 0 - 29.27 km/h (0 - 18.18 MPH)</td></tr>
<tr><td>8 - 16
12.4 - 24</td><td>Forward driving: 0 - 30.7 km/h (0 - 30.7 MPH)
Reverse driving: 0 - 30.7 km/h (0 - 30.7 MPH)</td></tr>
<tr><td colspan="2" rowspan="4">PTO shift</td><td colspan="2">Type</td><td colspan="2">Independent PTO</td></tr>
<tr><td colspan="2">Stage</td><td colspan="2">2</td></tr>
<tr><td colspan="2">Revolution</td><td>1st: 560 rpm</td><td>2nd: 780 rpm</td></tr>
<tr><td colspan="2">PTO shaft</td><td colspan="2">Ø 35 mm, 6 splines</td></tr>
<tr><td colspan="2">Rear axle</td><td colspan="4">Reduction ratio: $\frac{6}{37} \times \frac{16}{65} = 0.03992$</td></tr>
<tr><td rowspan="2">Brake</td><td colspan="2">Main brake</td><td colspan="4">Wet multi-plate clutch</td></tr>
<tr><td colspan="2">Parking brake</td><td colspan="4">3015R(h)/3515R(h)/4015R(h): Foot brake lever type
F36R(h)/F42R(h): Hand brake</td></tr>
<tr><td colspan="3" rowspan="2">Transmission fluid</td><td colspan="2">Capacity</td><td colspan="2">MEC. MODEL: 34ℓ (8.98 u.s. gal),
HST MODEL: 37ℓ (9.77 u.s. gal)</td></tr>
<tr><td colspan="2">Specification</td><td colspan="2">TF 500</td></tr>
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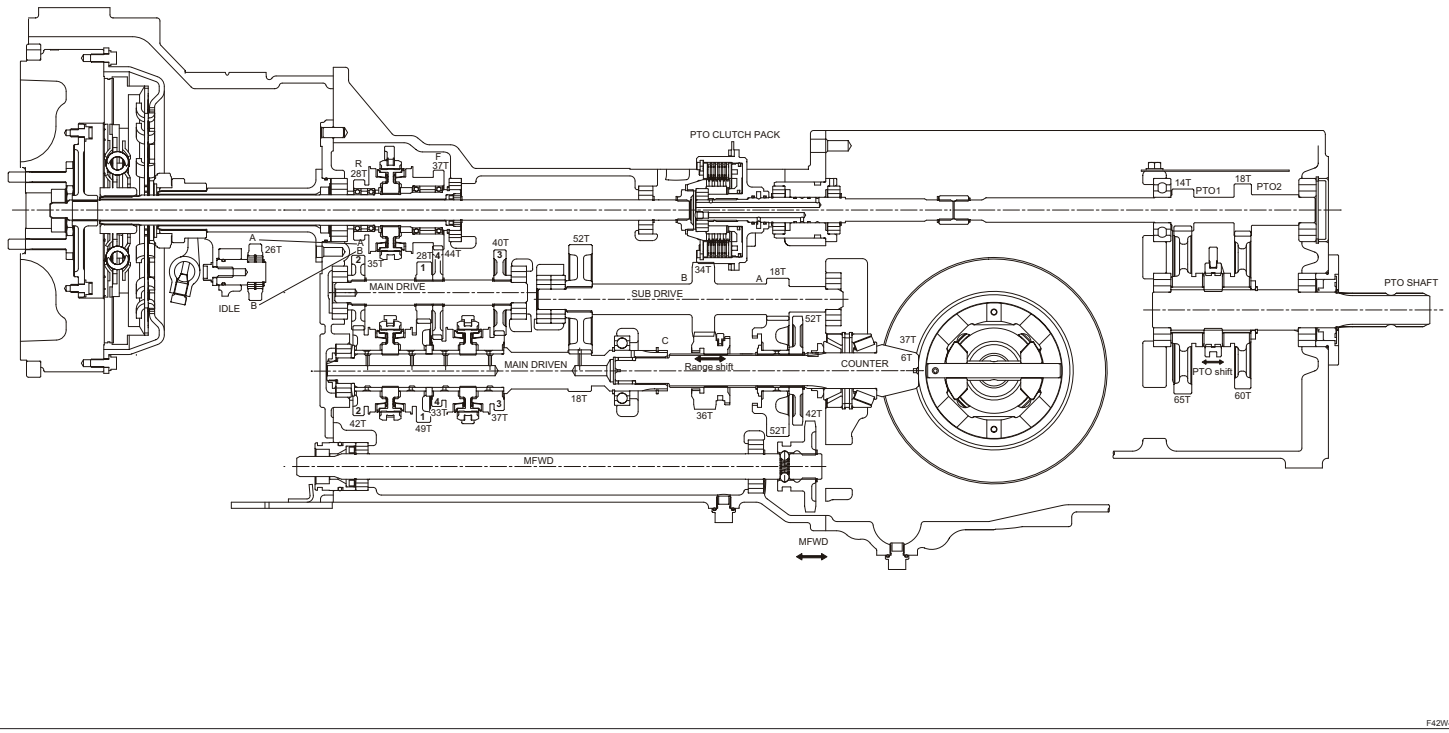
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1.2 POWER TRANSFER

1.2.1 TRANSMISSION ASSEMBLY DIAGRAM

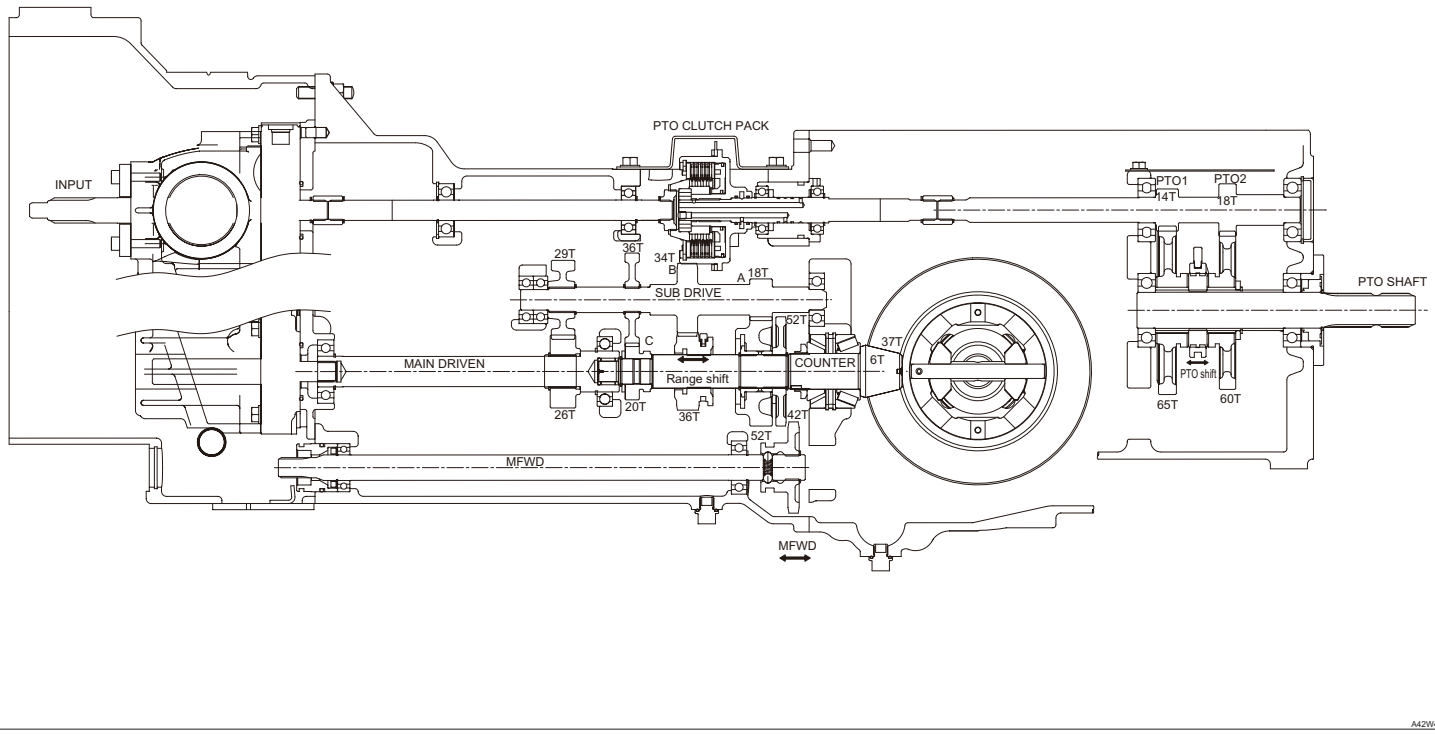
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HST MODEL

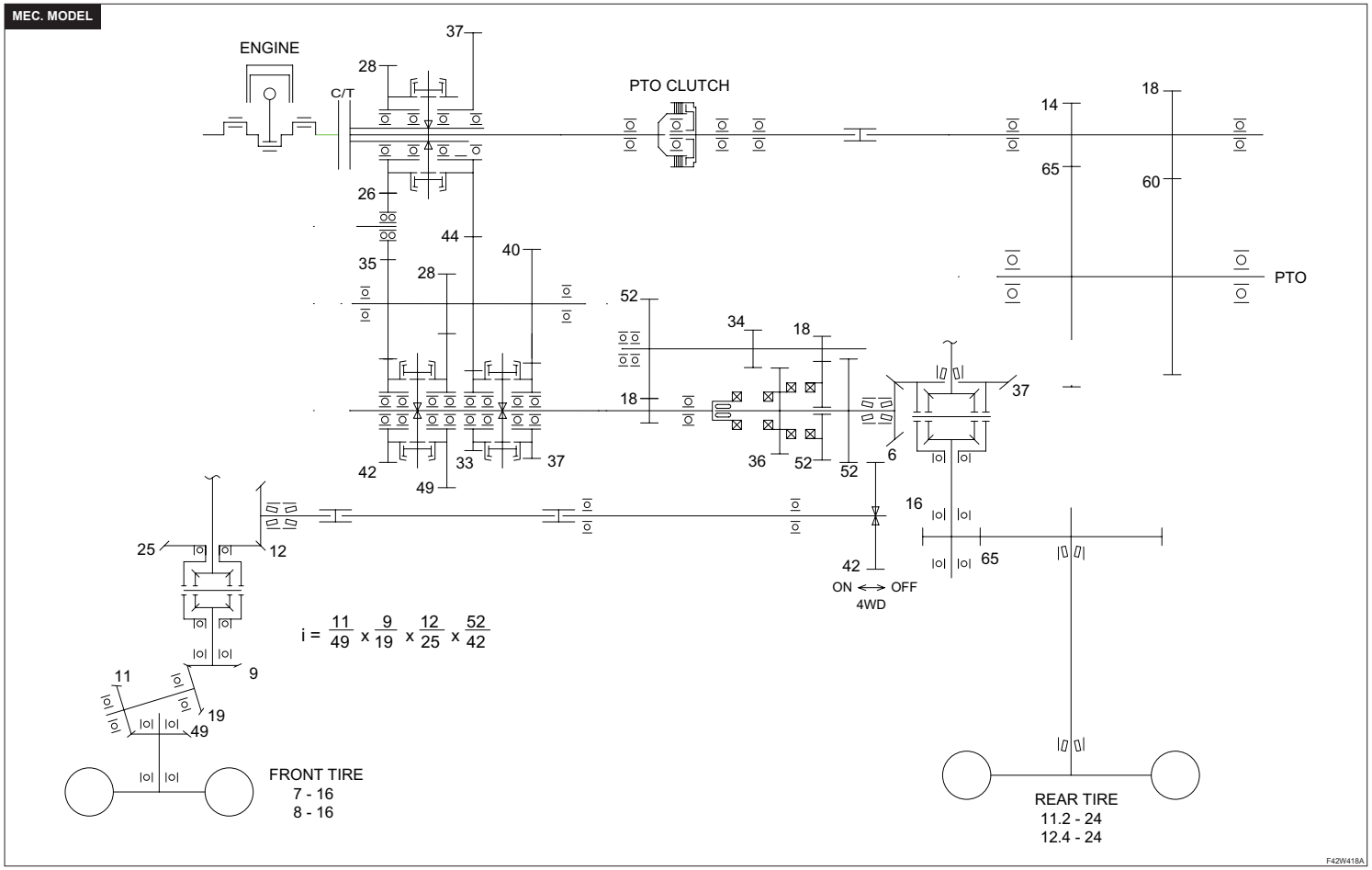


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1.2.2 POWER FLOW CHART

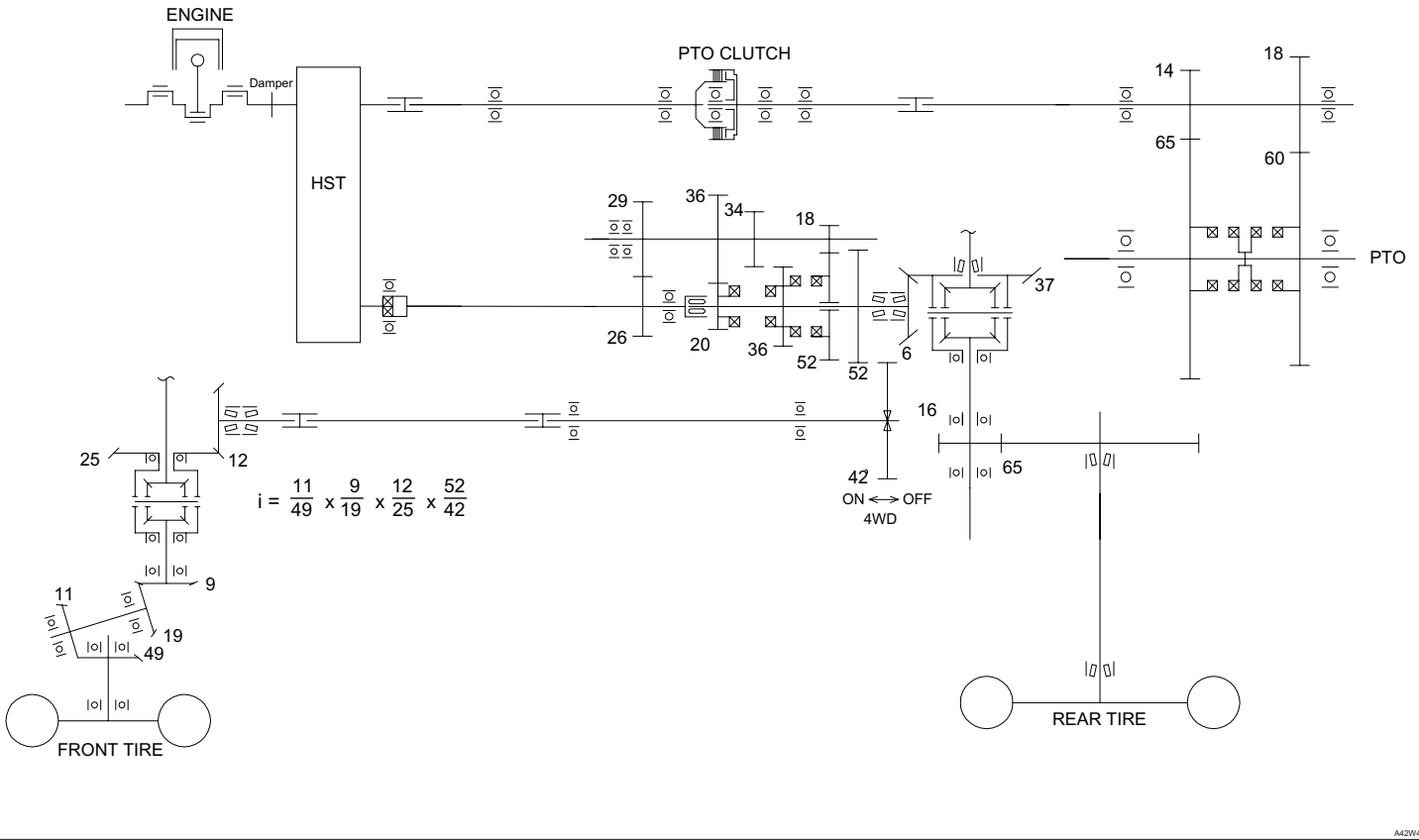
MEC. MODEL



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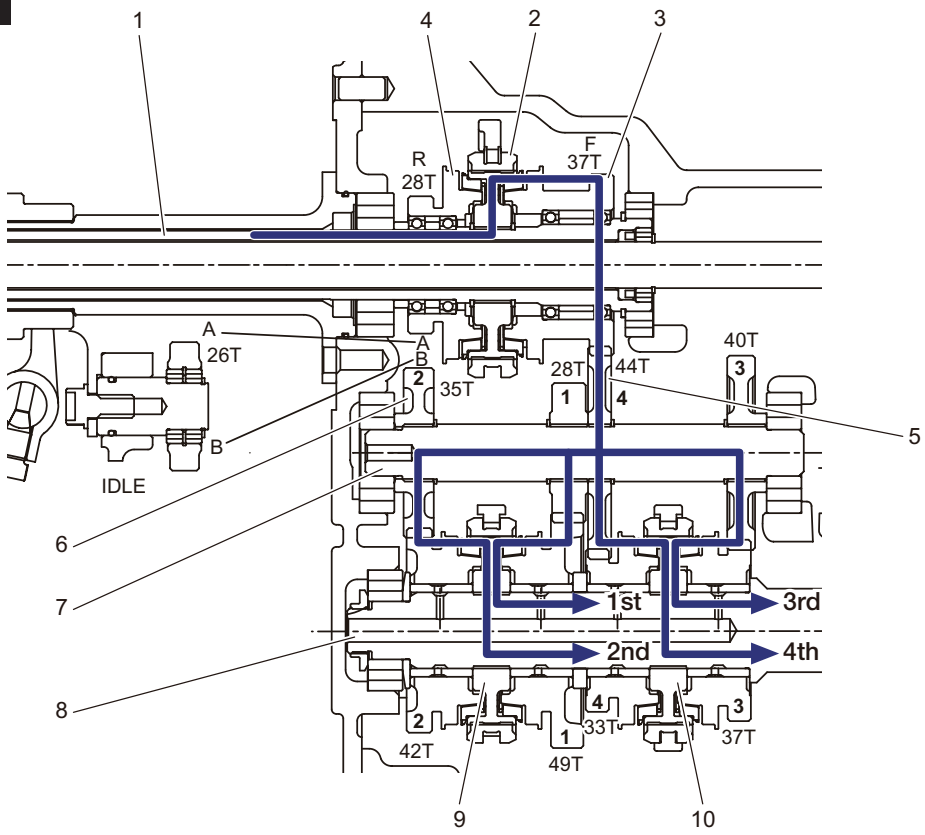
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2. STRUCTURE AND OPERATING PRINCIPLE

2.1 MAIN SHIFT

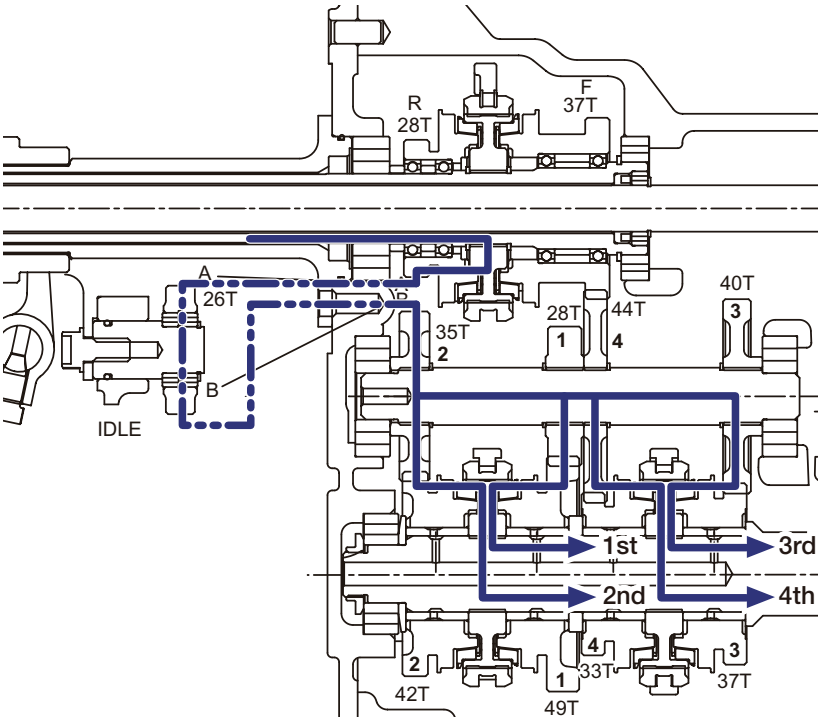
MEC. MODEL

FORWARD



F42W419A

REVERSE



F42W420A

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The engine's rotating force delivered through the main shaft (1) is transferred to the forward driving gear (3) or reverse driving gear (4) by selection of the main shaft sleeve (2). Then, this power rotates the main shift dive shaft (7) through its 44T gear (forward driving) (5) or 35% gear (reverse driving) (6).

As the drive gears for each speed are fixed to the main shift drive shaft with splines, this shaft's rotation turns the drive gears, delivering the rotating power to the gears engaged to the main shift driven shaft (8).

The main shift driven shaft is connected to the hub for the 1st/2nd gear (9) and the hub for the 3rd/4th gear (10) with splines.

Therefore, when the sleeve is engaged with the required speed gear, the rotating force delivered to each speed gear of the main shift drive shaft is supplied to the main shift driven shaft through its gears.

▶ **MAIN SHIFT 1ST (FORWARD)**

Main shaft → Hub → Sleeve → 37T gear → 44T gear → Main shift drive shaft → 28T gear → 49T gear → Sleeve → Hub → Main shift driven shaft

▶ **MAIN SHIFT 2ND (FORWARD)**

Main shaft → Hub → Sleeve → 37T gear → 44T gear → Main shift drive shaft → 35T gear → 42T gear → Sleeve → Hub → Main shift driven shaft

▶ **MAIN SHIFT 3RD (FORWARD)**

Main shaft → Hub → Sleeve → 37T gear → 44T gear → Main shift drive shaft → 40T gear → 37T gear → Sleeve → Hub → Main shift driven shaft

▶ **MAIN SHIFT 4TH (FORWARD)**

Main shaft → Hub → Sleeve → 37T gear → 44T gear → 33T gear → Sleeve → Hub → Main shift driven shaft

▶ **MAIN SHIFT 1ST (REVERSE)**

Main shaft → Hub → Sleeve → 28T gear → 26T gear (Idle shaft) → 35T gear → Main shift drive shaft → 28T gear → 49T gear → Sleeve → Hub → Main shift driven shaft

▶ **MAIN SHIFT 2ND (REVERSE)**

Main shaft → Hub → Sleeve → 28T gear → 26T gear (Idle shaft) → 35T gear → 42T gear → Sleeve → Hub → Main shift driven shaft

▶ **MAIN SHIFT 3RD (REVERSE)**

Main shaft → Hub → Sleeve → 28T gear → 26T gear (Idle shaft) → 35T gear → Main shift drive shaft → 40T gear → 37T gear → Sleeve → Hub → Main shift driven shaft

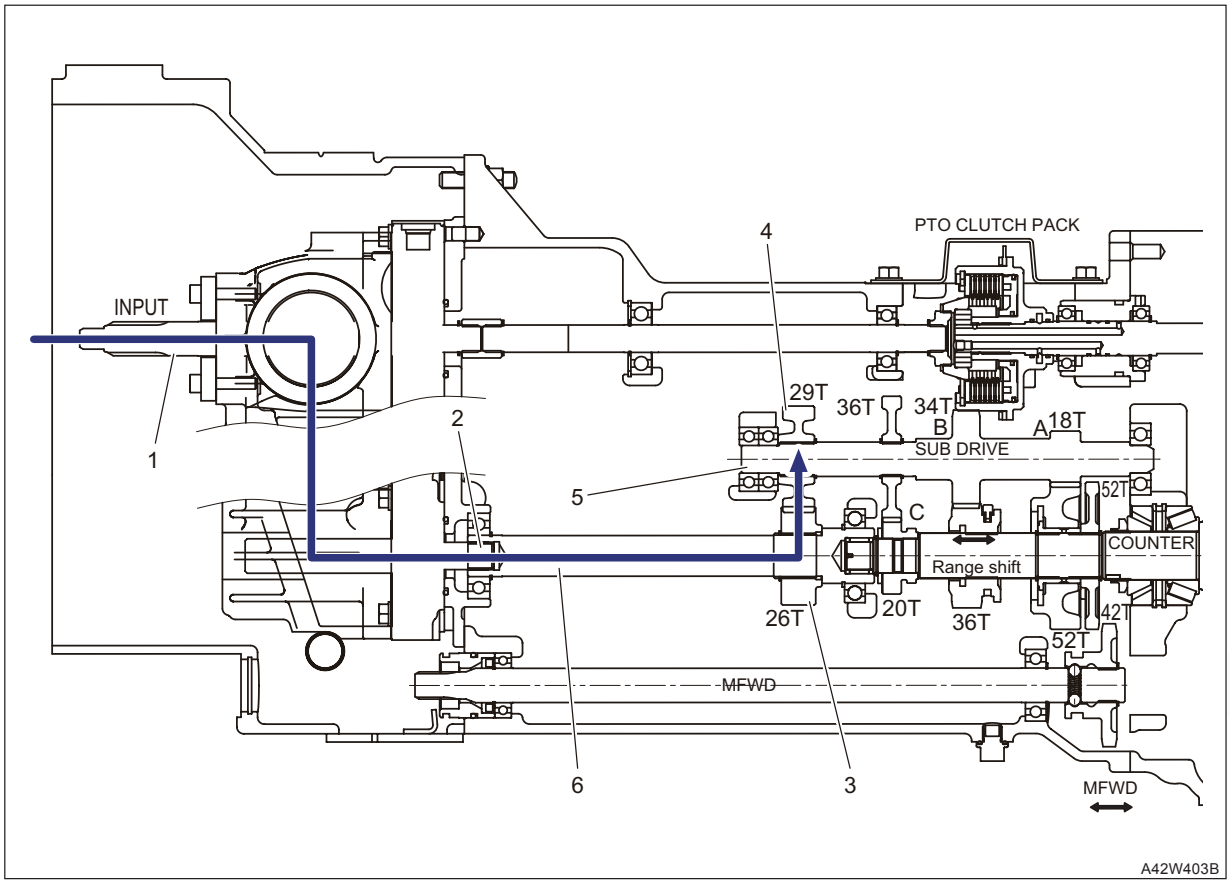
▶ **MAIN SHIFT 4TH (REVERSE)**

Main shaft → Hub → Sleeve → 28T gear → 26T gear (Idle shaft) → 35T gear → Main shift drive shaft → 44T gear → 33T gear → Sleeve → Hub → Main shift driven shaft

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HST MODEL



The engine torque is transferred to the HST through the HST input shaft (pump shaft) (1). Then, it is converted to hydraulic pressure in the HST to turn the HST motor shaft (2). As the HST motor shaft is connected to the range shift drive shaft (6), rotation of the range shift drive shaft turns the 26T gear (3) which then turns the range shift drive shaft (5) through the engaged 29T gear (4).

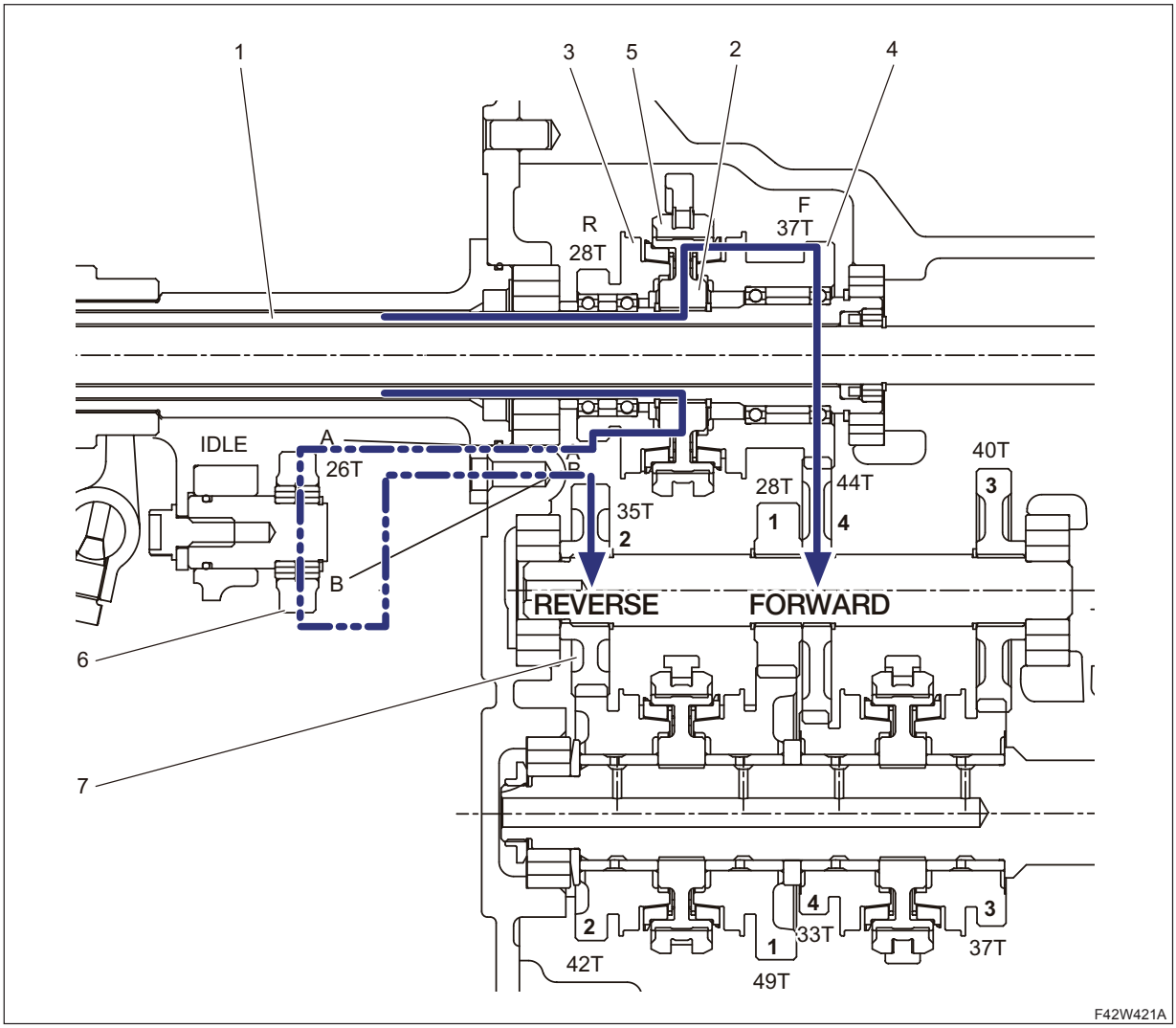
Therefore, the amount of depression of the forward driving pedal determines the hydraulic pressure quantity for the HST input shaft (pump shaft), and this change of hydraulic pressure leads to consequential change in HST motor shaft speed, enabling continuous shift operation.

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2.2 F-R SHUTTLE SHIFT

MEC. MODEL



The engine's rotating force delivered through the main shaft (1) turns the hub (2) constantly. The hub has the reverse driving gear (3) and forward driving gear (4) on its left and right, and the driving direction (forward/reverse) is selected by movement of the sleeve (5). To select the forward driving, the sleeve is moved to the right to be engaged with the forward driving gear. Then, the rotating force of the engine turns the 44T gear of the main shift drive shaft which is engaged with the 37T gear of the forward driving gear.

As a result, each gear fixed to the main shift drive shaft with splines receives this rotating power.

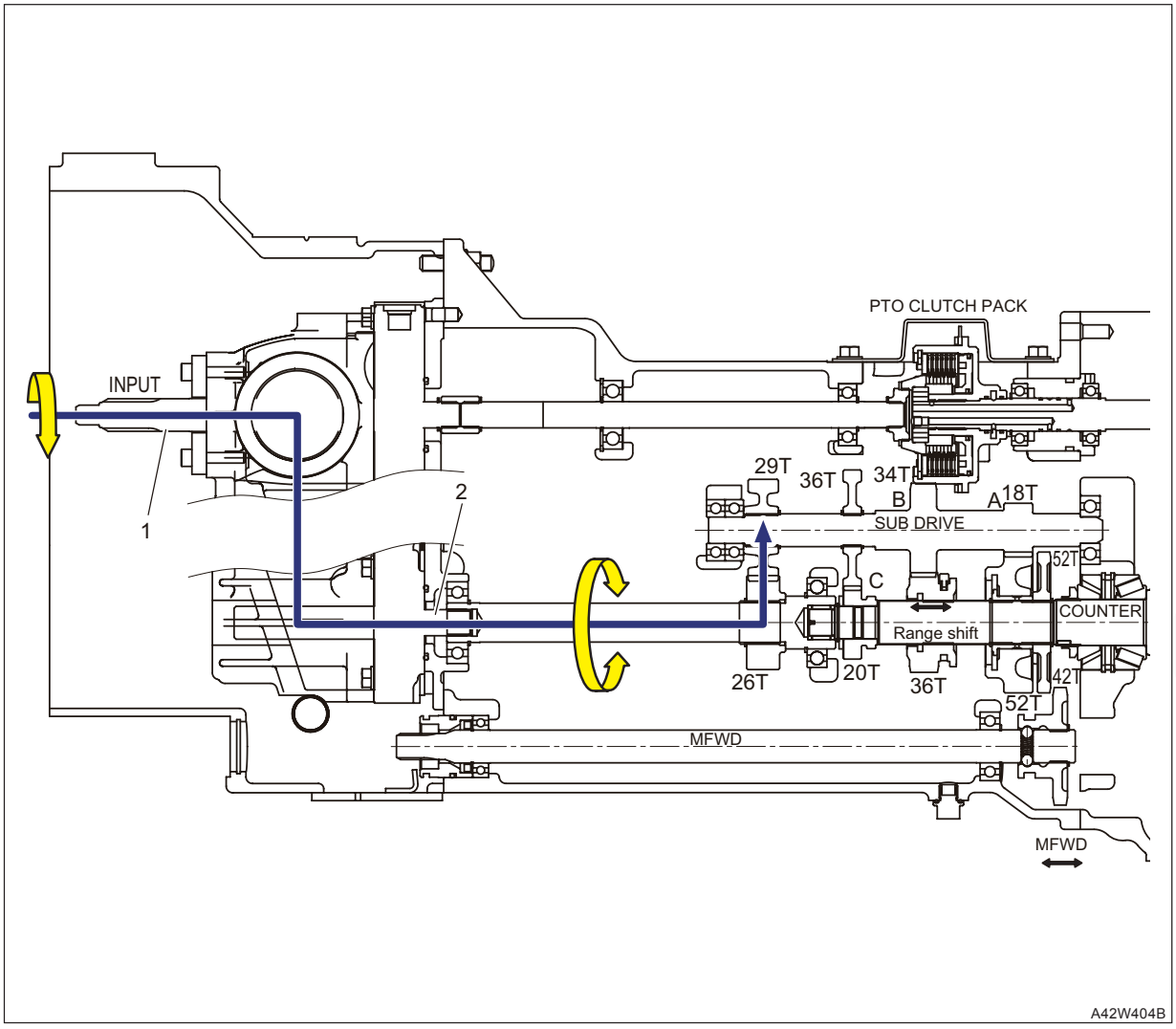
Also, to select the reverse driving, the sleeve is moved to the left to be engaged with the reverse driving gear. As a result, the 28T gear of the reverse driving gear is engaged with the 26T gear (6) of the idle shaft to transfer the rotating force. Then, the 26T gear is engaged with the 35T gear (7) of the main shift drive shaft to turn the main shift drive shaft.

For the reverse driving operation, as the rotating power is delivered finally to the main shift drive shaft through the idle shaft, the main shift drive shaft is rotated in the reverse direction, driving the vehicle in the reverse direction.

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HST MODEL



As the HST input shaft (pump shaft) (1) is rotated by the engine torque, the internal piston delivers hydraulic pressure to the HST motor shaft (2).

The HST pump shaft is installed with the swash plate which is tilted between -18° and +18°. The angle of the swash plate is changed according to the depressing condition of the HST pedal.

When the swash plate of the HST pump shaft starts to tilt toward the positive x-axis from 0° (neutral position) gradually, the amount of hydraulic oil delivered to the HST motor shaft is increased, resulting in increase of the vehicle speed. When the swash plate moves toward the negative x-axis from 0°, the delivery direction of hydraulic oil is reversed, resulting in reverse rotation of the HST motor shaft.

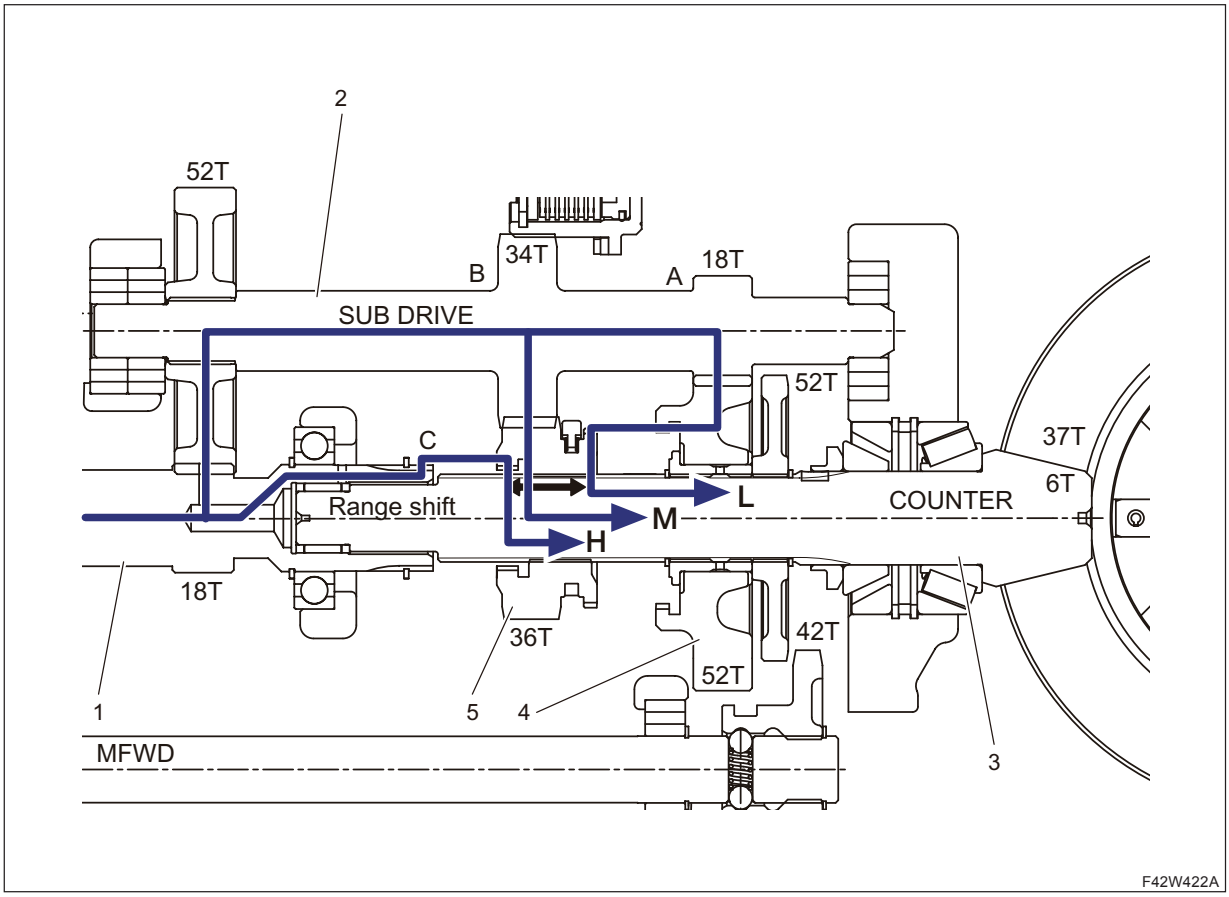
Therefore, the rotating direction of the HST motor shaft is switched between forward direction and reverse direction according to the selected direction (forward/reverse driving) of the HST pedal, and this direction control is applied to gears in the transmission to drive the vehicle forward or backward.

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2.3 RANGE SHIFT

MEC. MODEL



The rotating power transferred through the main shift driven shaft (1) is delivered to the range shift drive shaft (2) by the range shift drive shaft's 52T gear which is engaged and rotated with the 18T gear of the main shift driven shaft. As the 18T gear of the range shift drive shaft is engaged with the 52T gear (4) of the bevel pinion counter shaft (3), the 52T gear is turned constantly.

Also, the connection of the main shift driven shaft and counter shaft does not transfer power due to the internal needle bearing, but idles only.

To select the range shift 1st gear (low speed), the 2nd gear (5) of the range shift driven gear is pushed to the right to be engaged with the 52T gear (4). Then, the rotating force reduced at the reduction ratio by the 18T gear and 52T gear of the range shift drive shaft passes through the range shift driven gear's 2nd gear to be delivered to the countershaft.

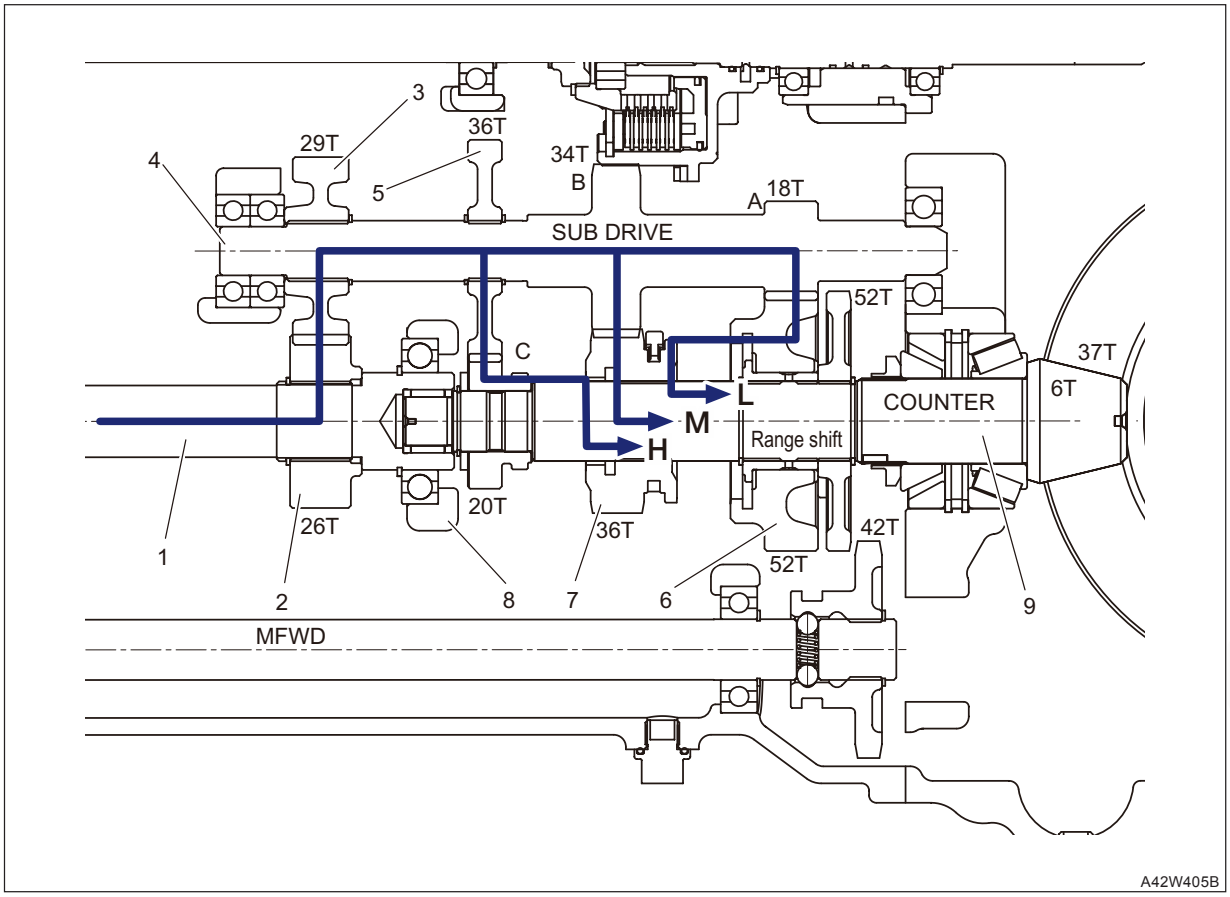
To select the range shift 2nd gear (mid speed), the 2nd gear of the range shift driven gear is engaged with the 34T gear of the range shift drive shaft. Then, the rotating force of the range shift drive shaft is delivered to the countershaft after it is reduced at the reduction ratio by the 34T and 36T gears.

Also, to select the range shift 3rd gear (high speed), the 2nd gear of the range shift driven gear is pushed to the left to be engaged with the splines at the end of the main shift driven shaft. Then, the rotating power delivered to the main shift driven shaft is supplied to the countershaft without any reduction.

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HST MODEL



The torque delivered to the range shift drive shaft (1) turns the range shift drive gear shaft (4) through the 26T gear (2) and 29T gear (3). The 29T gear is rotated continuously. Also, the 20T gear (8) and 52T gear (6) are rotated as well as they are engaged with the 34T gear and 18T gear of the range shift drive gear shaft and 36T gear (5).

On the other hand, the range shift drive shaft and countershaft (9) idle from each other due to their internal needle bearings. Therefore, the 20T gear (8) and 52T gear (6) are rotated, sliding.

When the range shift driven 2nd gear (7) is pushed to the rightmost position for low speed (L) shift operation, the spline in the 52T gear is engaged with the spline on the range shift driven 2nd gear. Then, the torque reduced by engagement of the 52T gear and 18T gear of the range shift drive gear shaft is delivered to the countershaft through the range shift driven 2nd gear which is fixed to the countershaft with splines.

For mid speed (M) shift operation, the torque is transferred to the countershaft after it is reduced by engagement of the 34T gear of the range shift drive gear shaft with the 36T range shift driven 2nd gear (7).

When the range shift driven 2nd gear (7) is moved to the leftmost position for high speed (H) shift operation, it is engaged with the 20T gear (8). Then, the torque at the specified speed ratio with engagement of the 20T gear (8) with the 36T gear (5) of the range shift drive gear shaft is delivered to the final countershaft through the range shift driven 2nd gear.

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POWER TRANSFER

▶ LOW SPEED (L)

Range shift drive shaft (1) → 26T gear (2) → 29T gear (3) → Range shift drive gear shaft (4) → 18T gear → 52T gear (6) → 36T range shift driven gear 2nd (7) → Counter shaft (9)

▶ MID SPEED (M)

Range shift drive shaft (1) → 26T gear (2) → 29T gear (3) → Range shift drive gear shaft (4) → 34T gear → 36T range shift driven gear 2nd (7) → Counter shaft (9)

▶ HIGH SPEED (H) (H)

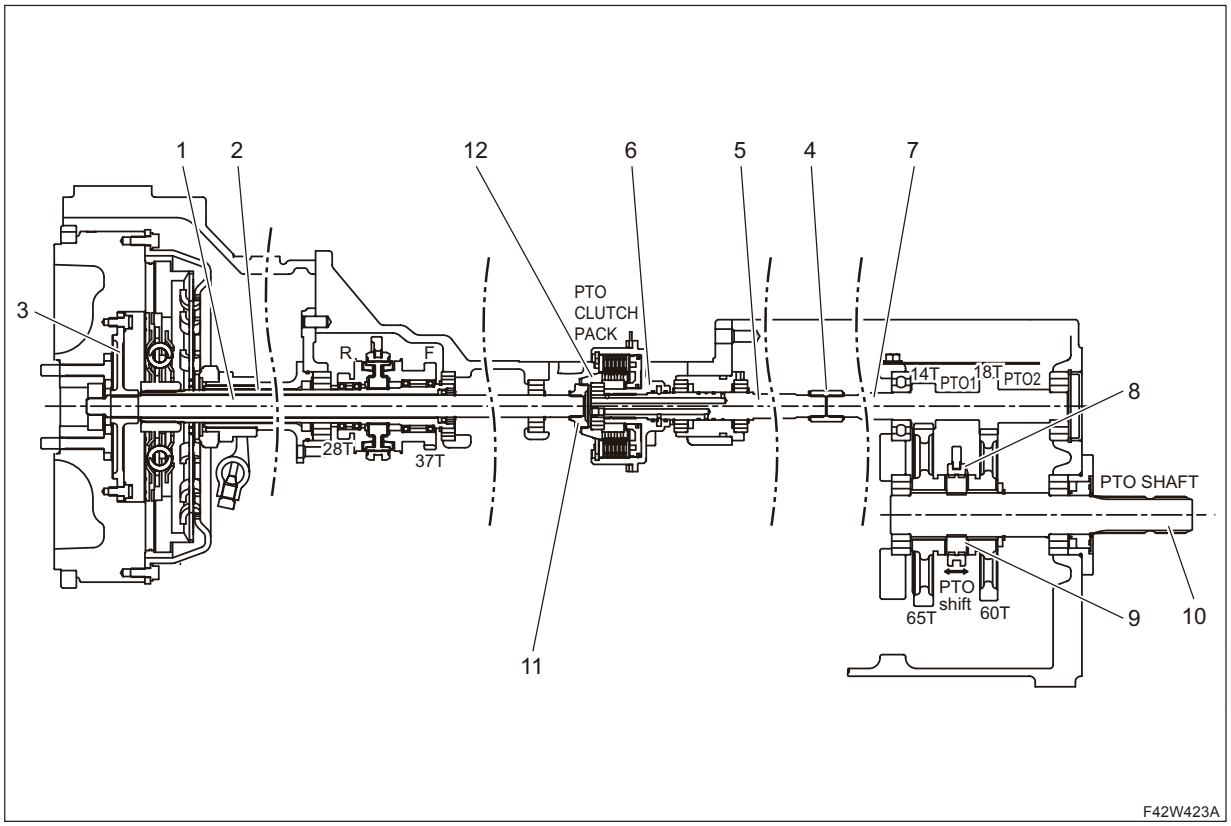
Range shift drive shaft (1) → 26T gear (2) → 29T gear (3) → Range shift drive gear shaft (4) → 36T gear (5) → 20T gear (8) → 36T range shift driven gear 2nd (7) → Counter shaft (9)

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2.4 PTO SHIFT

MEC. MODEL



This vehicle is equipped with an independent PTO which receives engine power continuously regardless of the engagement status of the main clutch and its power is controlled by its separate PTO clutch. The engine power to drive the PTO is delivered through the main PTO shaft (inner) (1). This main PTO shaft (inner) is fixed to the PTO sleeve (3) of the flywheel with splines, passing through the main shaft (outer) (2) which is a hollow shaft. Therefore, this shaft is rotated, regardless of the main clutch, as long as the engine runs, and it is connected to the PTO clutch and the joint (4) in the middle to deliver the rotating force to the PTO shift section through the PTO drive gear shaft (7).

As the joint (11), which is fixed to the end of the main PTO shaft with splines, engages the clutch hub (12) and the clutch hub is connected to the clutch disc as one unit, they idle together in a normal condition. When oil is drawn to the PTO clutch for PTO operation, this oil pushes the internal piston so the pressure plate is compressed against the clutch disc, rotating the whole PTO clutch assembly. Then, this rotating force is transferred to the PTO clutch shaft (5) which is connected to the PTO clutch assembly with splines. Therefore, the PTO drive shaft (7) is engaged with the joint, rotating together.

When the PTO sleeve (8) is moved to the left for the PTO 1st gear shift, the speed of the PTO is determined by the engagement ratio of the 14 gear and 65 gear and the PTO shaft (10) is rotated at this speed. When it is moved to the right for the PTO 2nd gear shift, the PTO speed is determined by the engagement ratio of the 18 gear and 60 gear and this speed is transmitted to the PTO shaft through the PTO hub (9).

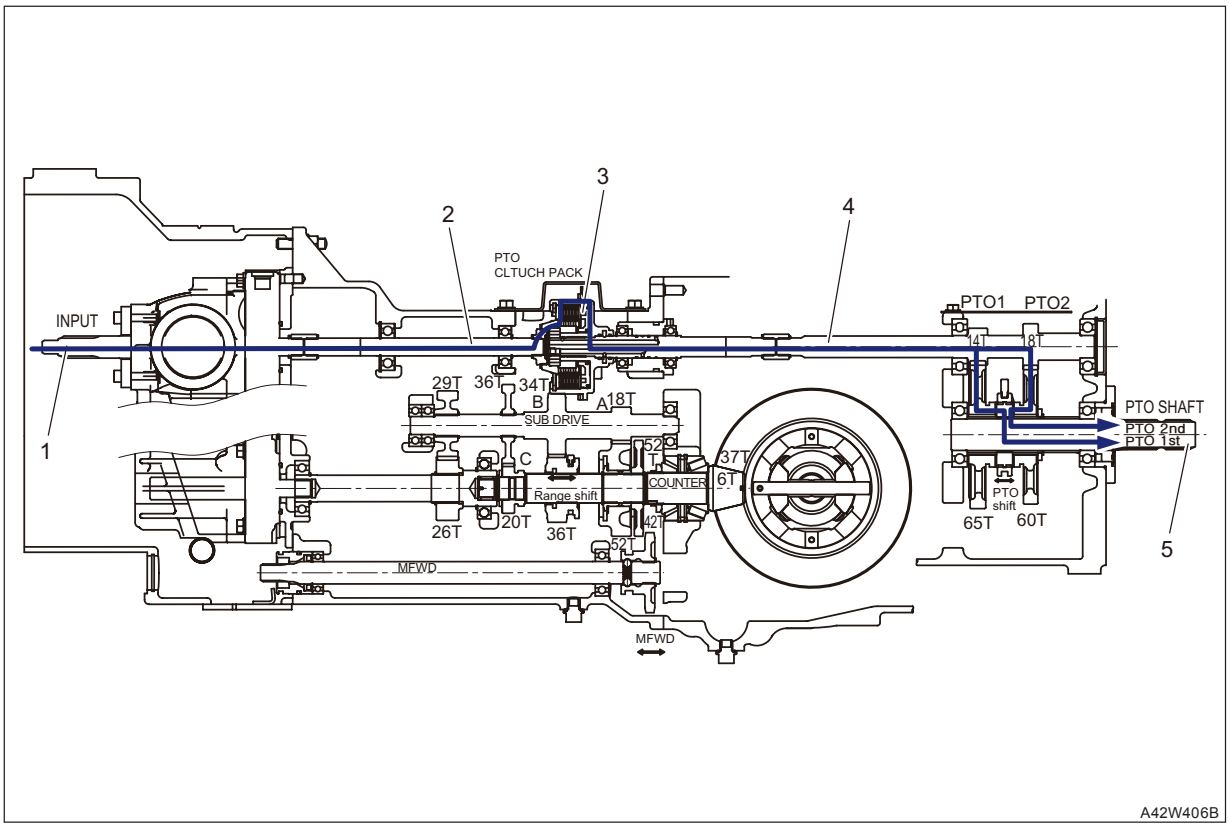
▶ PTO RPM

- PTO 1st gear: engine 2,600 rpm $\times \frac{14}{65}$ = 560 rpm
- PTO 2nd gear: engine 2,600 rpm $\times \frac{18}{60}$ = 780 rpm
- Engine speed at PTO 540 rpm: 2,507 rpm
- Engine speed at PTO 750 rpm: 2,500 rpm

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HST MODEL



As the HST input shaft (pump shaft) (1) is rotated by the engine torque and it is directly connected to the PTO shaft (2) with the joint, this forms the driveline system for PTO operation.

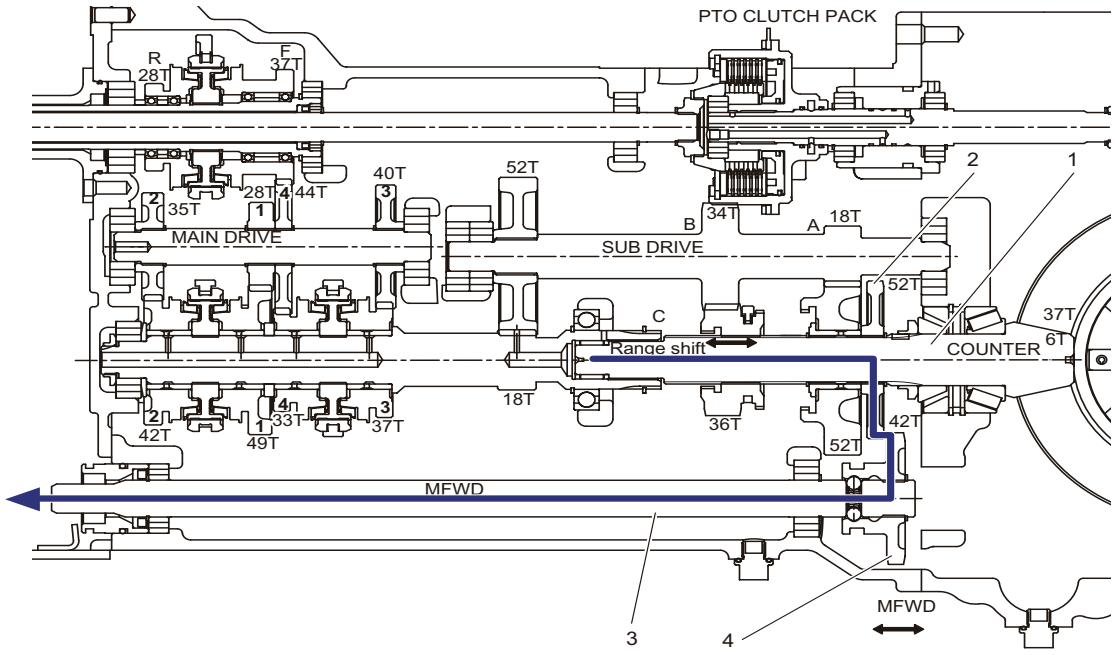
As the PTO clutch (3) is engaged, the 65T and 60T gears of the PTO shaft (5), which are engaged with the 14T and 18T gears of the PTO drive gear shaft (4), are rotated. As the PTO hub is connected by shift operation of the PTO lever, PTO torque of the 1st and 2nd gears is delivered to the PTO shaft.

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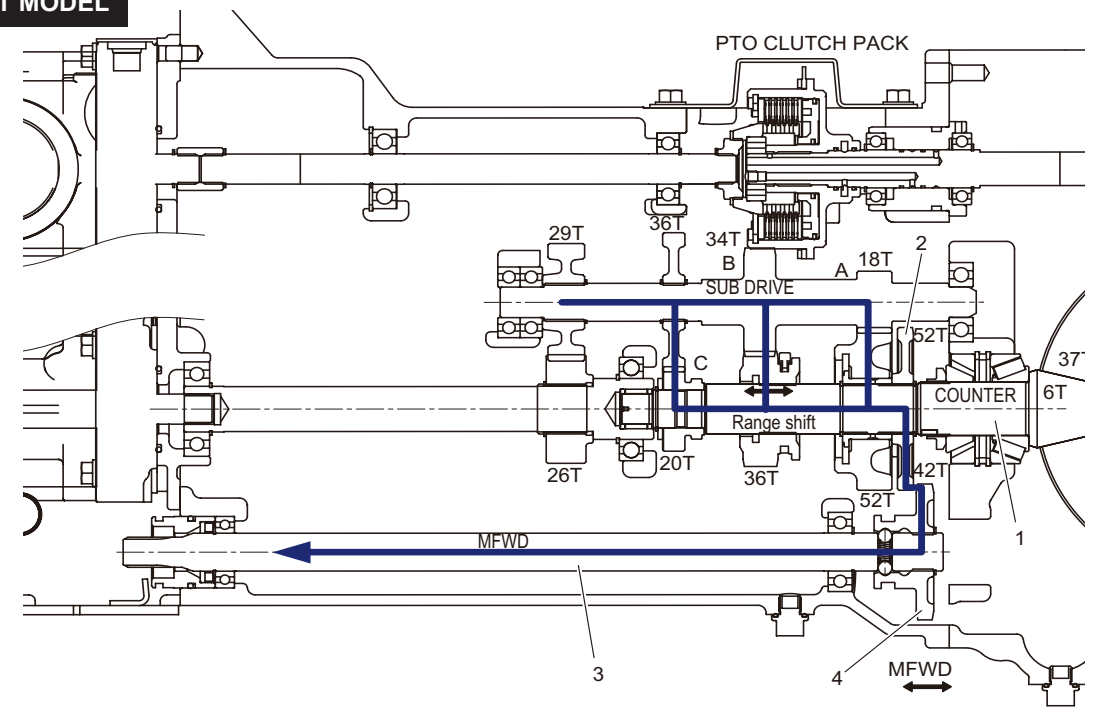
2.5 4WD

MEC. MODEL



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HST MODEL



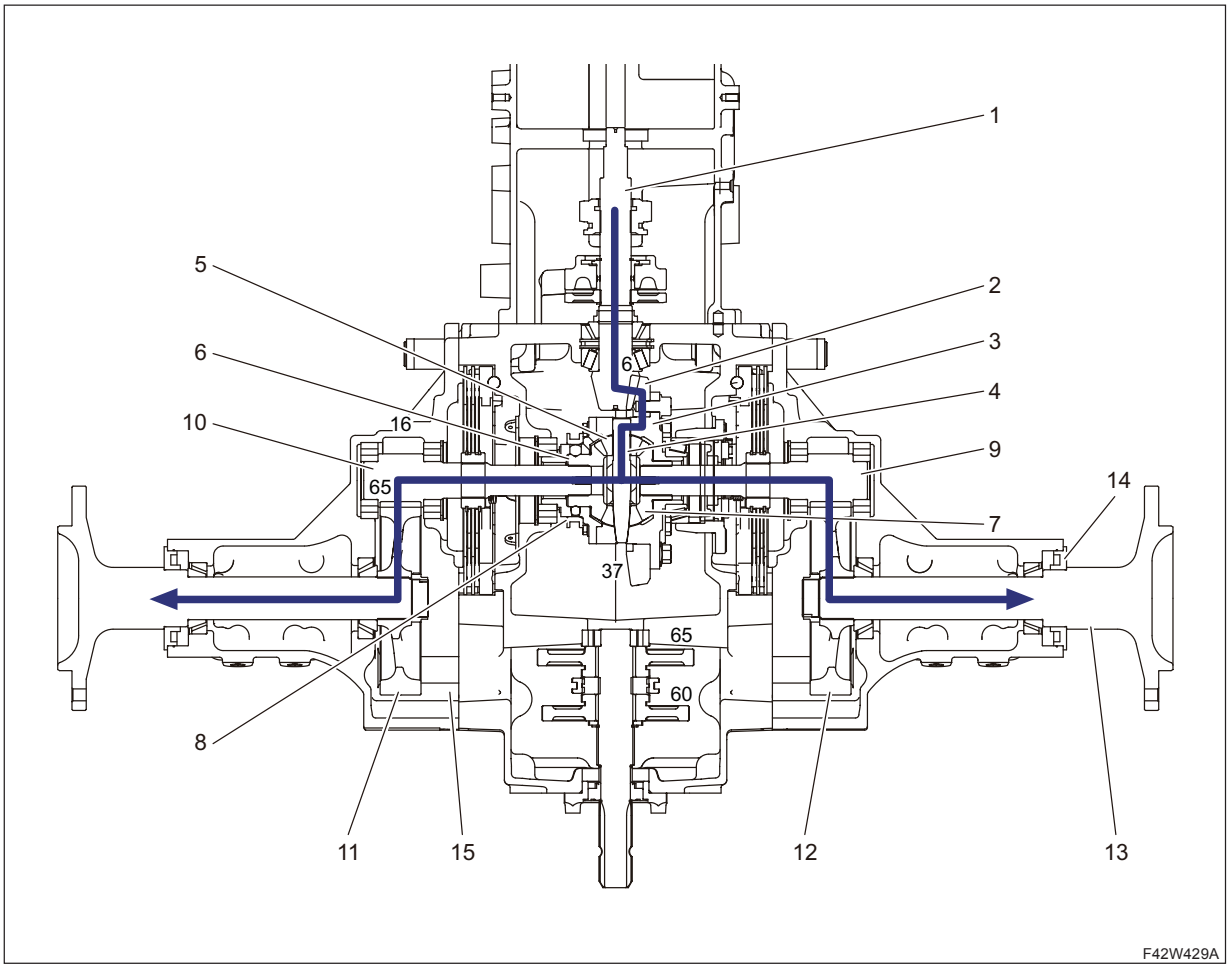
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When the countershaft (1) rotates for range shift operation, the 52T gear, which is the 4WD drive gear (2) of the countershaft, rotates constantly. Therefore, when the 4WD driven gear (4) of the 4WD drive shaft (3) is moved to the left to be engaged with the 4WD drive gear, the 4WD drive and driven gears are engaged and rotated together. Then, the rotating power reduced at the reduction ratio by the 52T gear and 42T gear is delivered to the 4WD drive shaft to turn the front axle through the propeller shaft.

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2.6 REAR AXLE



(1) Counter shaft
(2) Ring gear
(3) Differential case
(4) Pinion shaft
(5) Differential pinion
(6) Differential side gear (B)
(7) Differential side gear (A)
(8) Differential thrust assembly
(9) Final pinion (R)
(10) Final pinion (L)
(11) Rear axle gear (LH)
(12) Rear axle gear (RH)
(13) Rear axle
(14) Oil seal
(15) Rear axle housing

2.7.1 POWER TRANSFER

When rotating force arrives at the counter shaft (1), it rotates the differential case (3) through the ring gear (2). As the differential rotates, the differential pinion (5) and differential side gear (7) inside the differential case to deliver the rotating force to the final pinion (9).

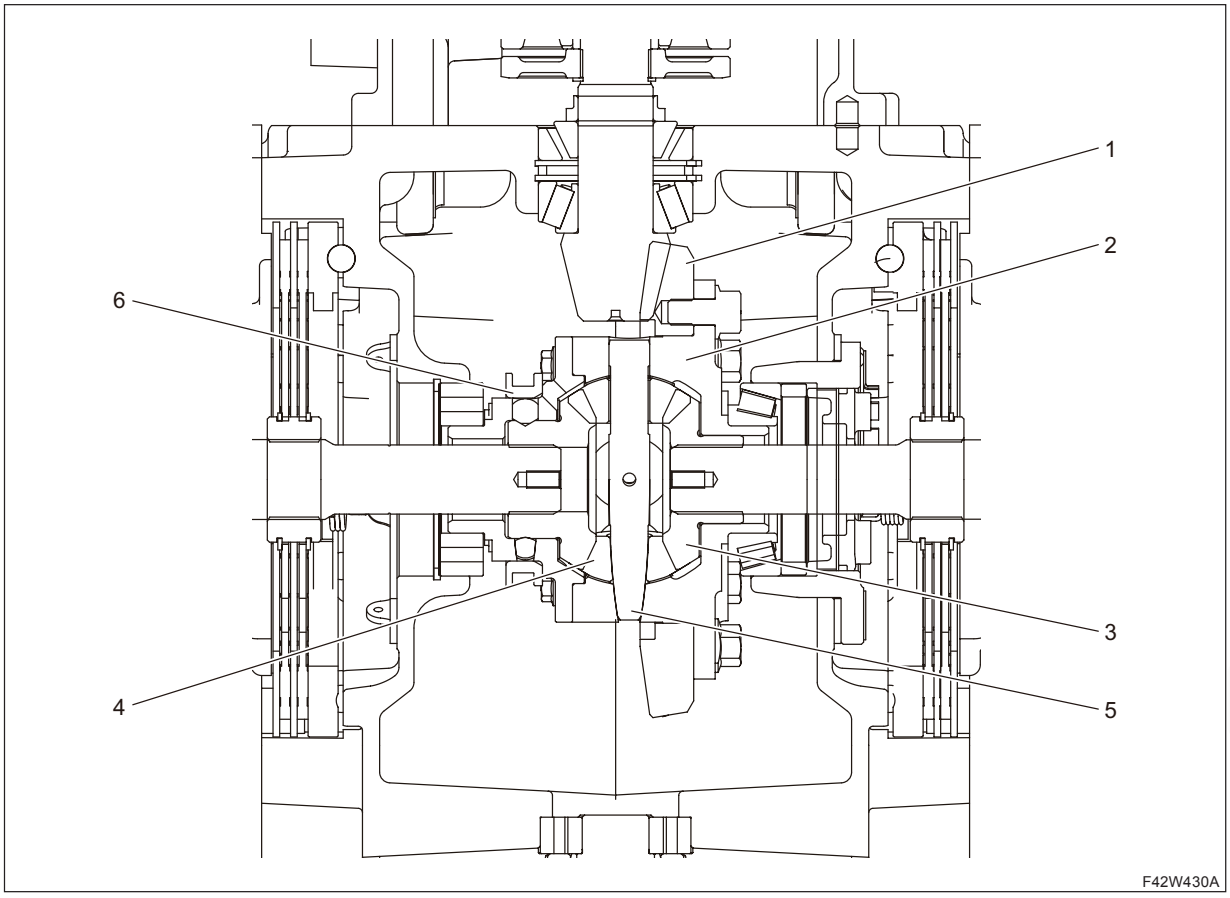
Then, the speed of the rotating force at the final pinion is reduced through engagement of the 16 gear of the final pinion with the 65 rear axle gear (11), and it is finally transmitted to the rear axle (13), which is connected with splines, in order to rotate the rear wheels.

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3. OPERATION AND ADJUSTMENT

3.1 DIFFERENTIAL SYSTEM



The differential system is to rotate the left wheel and right wheel at different speeds for smooth turning. When turning, this system rotates the inner wheel in the turning direction slower and the outer wheel faster to turn the vehicle in the desired direction.

Also, when a wheel got stuck in mud, it is hard to escape the pit since the wheel in mud with no friction rotates at faster speed and the wheel on road with friction does not rotate due to the differential system. To prevent this situation, the vehicle is equipped with the differential lock. The differential lock moves the differential lock slide to fix the differential case and differential side gear together with the pin, resulting in rotation of the side gear on the other side as well. Therefore, the wheels on both sides are rotated at the same speed to escape the pit.

The differential system consists of the ring gear (1), differential case (2), differential side gear (3), differential pinion (4), differential pinion shaft (5) and differential lock slide (6).

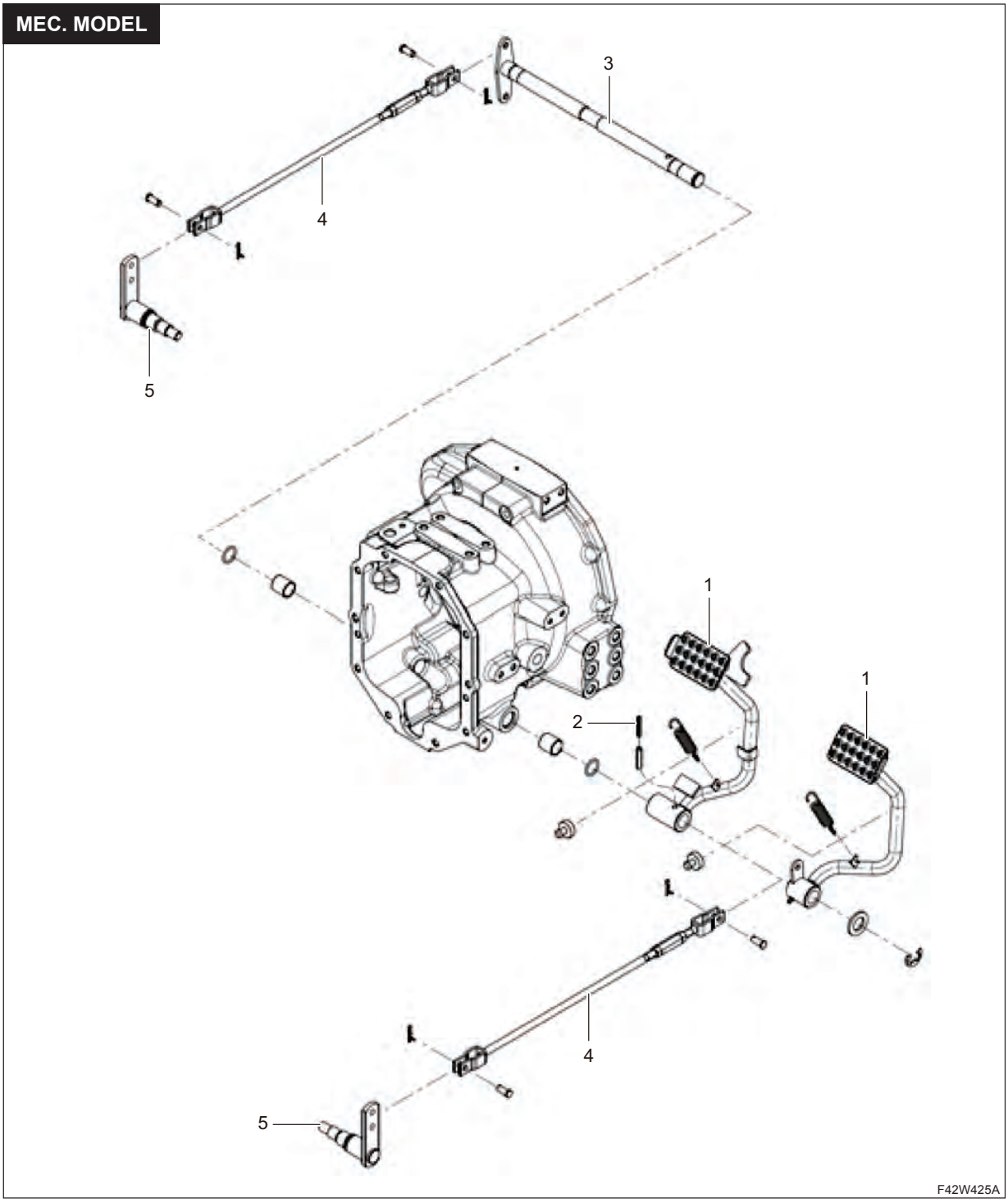
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3.2 BRAKE

3.2.1 OVERVIEW

MEC. MODEL



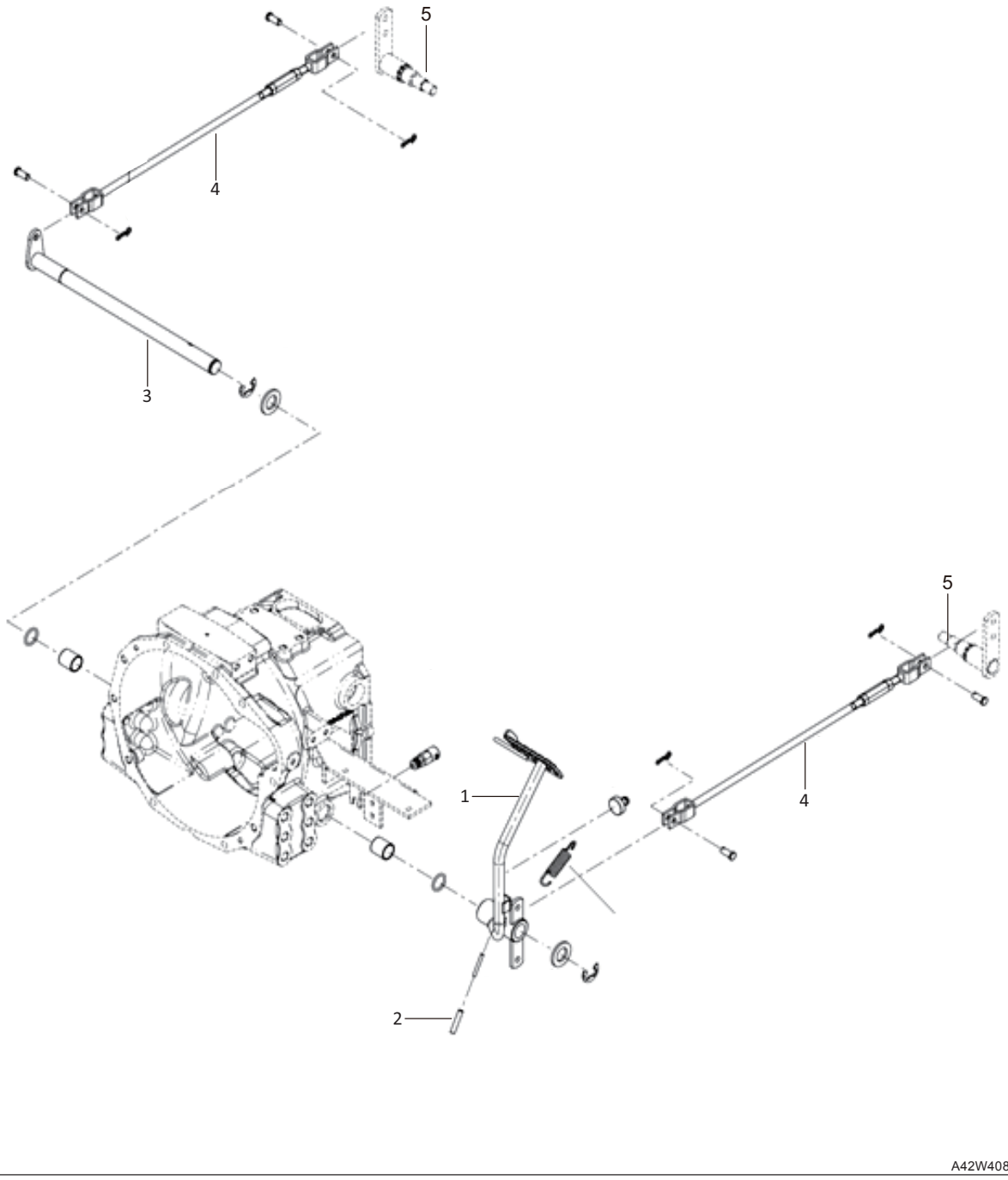
When the brake pedal (1) is depressed, the brake shaft (3), which is fixed with the brake pedal boss and spring pin (2), starts to rotate. Then, as the brake shaft is connected to the brake rod (4) with the snap pin, the shaft pulls the rod which then turns the brake activating brake lever (5) to operate the internal brake.

As this brake is a wet multi-plate type, it is soaked in oil for superior lubrication, cooling and durability.

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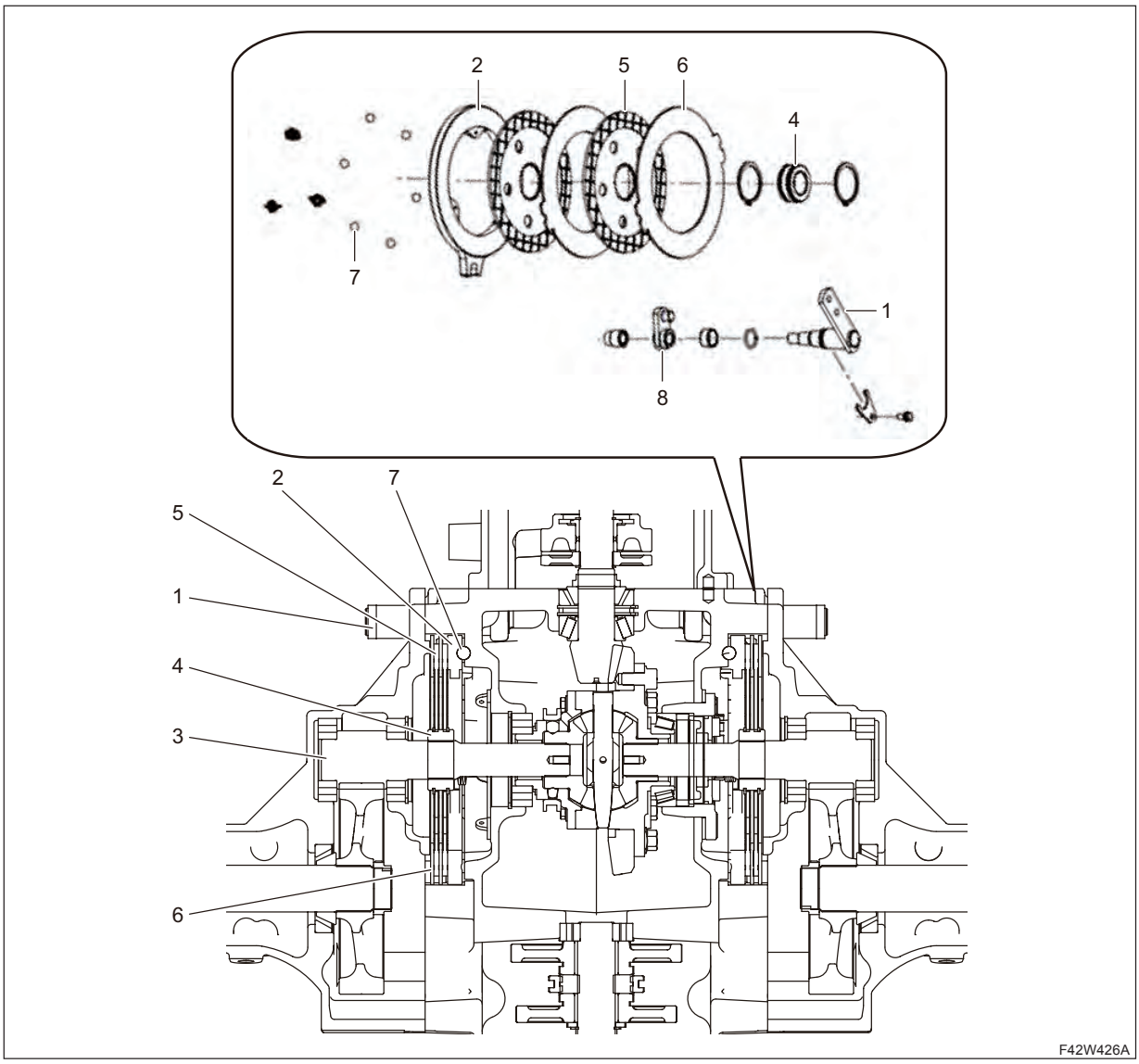
HST MODEL



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3.2.2 OPERATING PRINCIPLE OF BRAKE



(1) Brake lever
(2) Cam plate
(3) Final pinion
(4) Boss
(5) Disc
(6) Pressure plate
(7) Steel ball
(8) Brake inside arm

When the brake lever (1) is pulled by transferred power, the brake inside arm (8) fixed by the splined boss is rotated as well. Also, as the protruded parts on the brake inside arm are fit to the grooves of the cam plates (LH/RH) (2), the cam plates are rotated as well.

On the other side, the final pinion (3) is fixed to the differential side gear with splines, rotating together, and its other side is connected to the boss (4) with splines. This boss is fixed to 2 discs (5) with splines as one unit. Also, the pressure plates (6) are installed in between the friction discs and these pressure plates are fixed to the rear axle housing.

Therefore, when the brake pedal is depressed, the brake lever is moved to rotate the cam plate. Then, the steel ball (7) installed in the groove on the slant of the cam plate pushes the cam plate inward, producing driving force. This driving force compresses the friction discs and plates. As the pressure plates are fixed by the rear axle housing, they stop rotating.

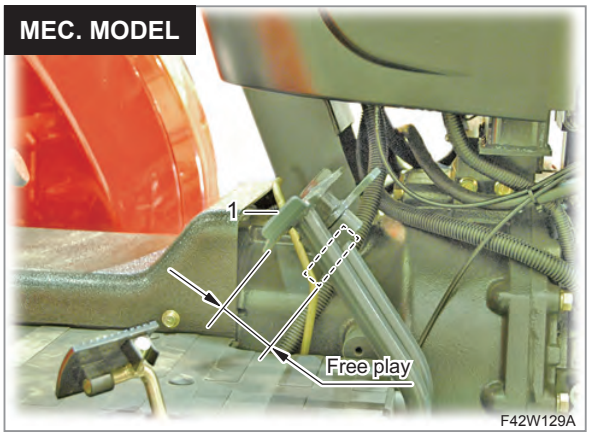
As a result, the final pinion fixed to the boss stops rotating as well, leading to stop of the vehicle.

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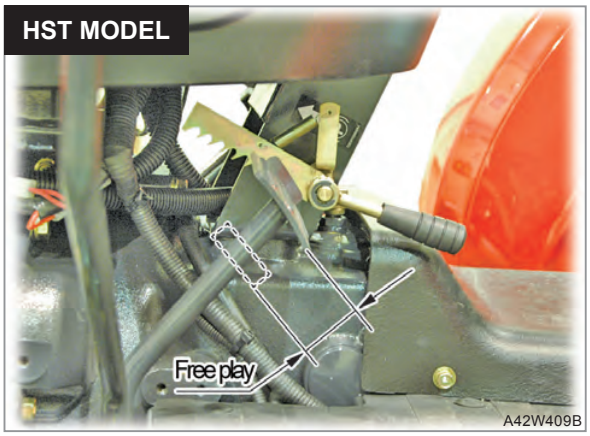
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3.2.3 BRAKE PEDAL FREE PLAY ADJUSTMENT

MEC. MODEL

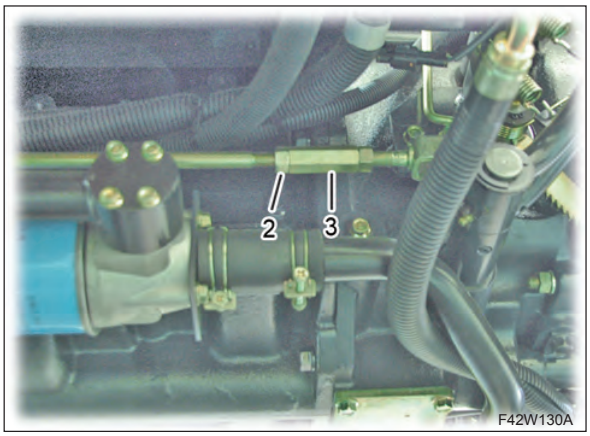


HST MODEL



1. Depress the brake pedal (1) slightly. Then, release it.
2. Measure its free play.

ITEM	STANDARD
Brake pedal free play	5 - 10 mm (0.19 - 0.39 in)
* The free play for both pedals should be identical.	



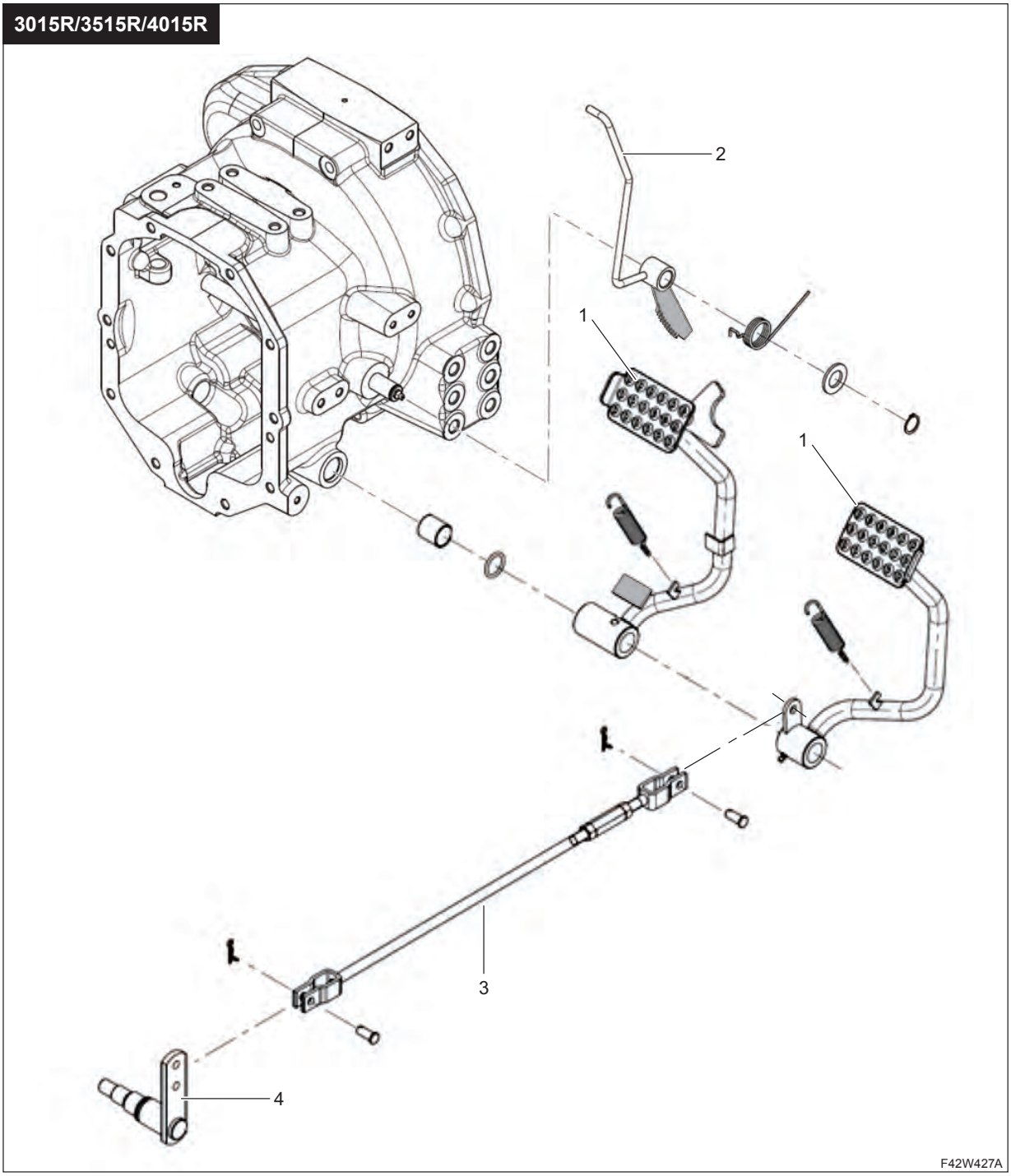
3. If the free play is out of the standard, unscrew the mounting nuts (2) of the brake rods (LH/RH) on the brake shaft section and use the turnbuckle (3) to adjust the free play. After adjusting the free play of the both sides, tighten the mounting nuts.

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3.3 PARKING BRAKE OPERATION

3015R/3515R/4015R

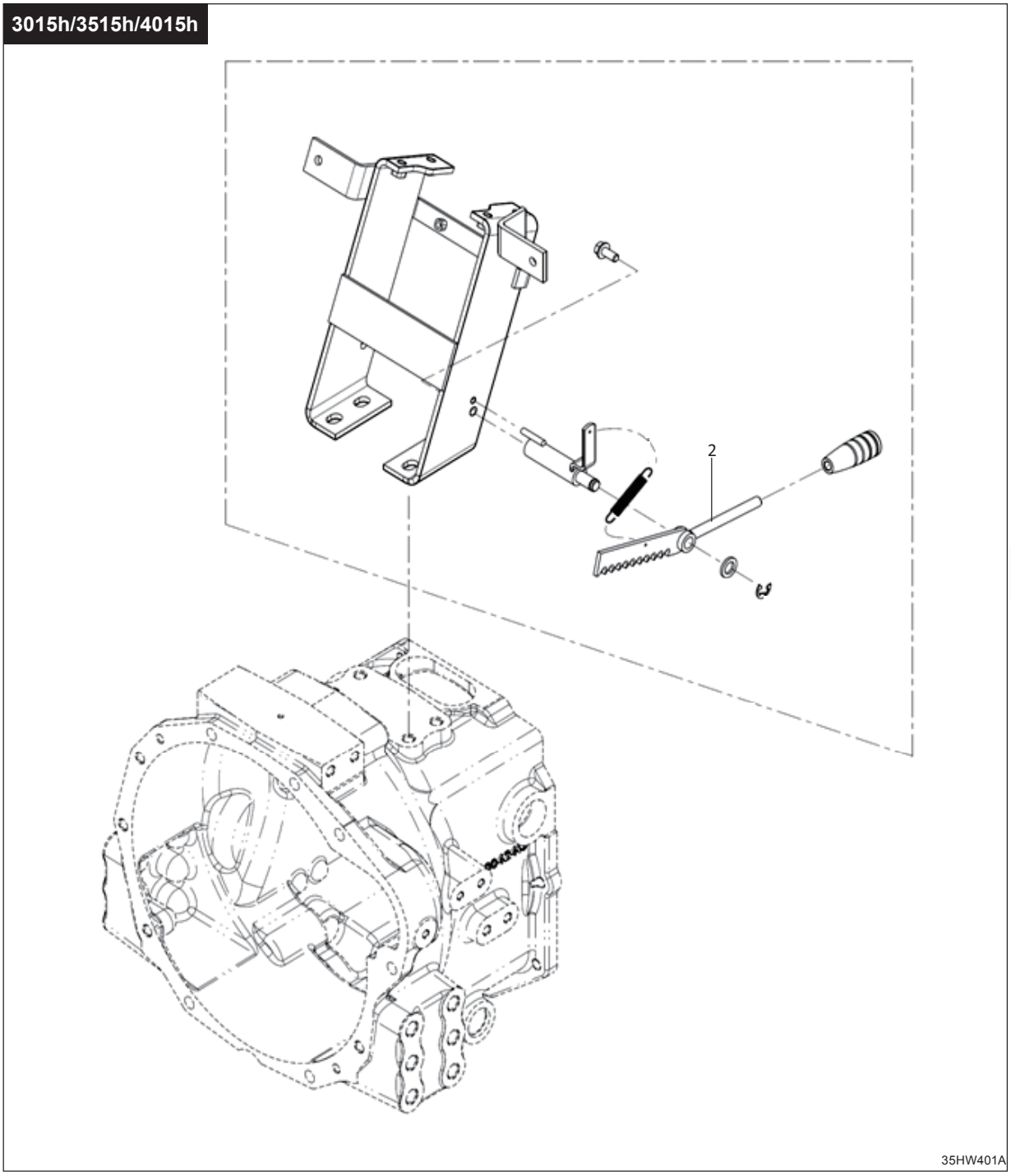


(1) Brake pedal
(2) Parking brake lever
(3) Brake rod
(4) Brake lever

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3015h/3515h/4015h



(2) Parking brake lever

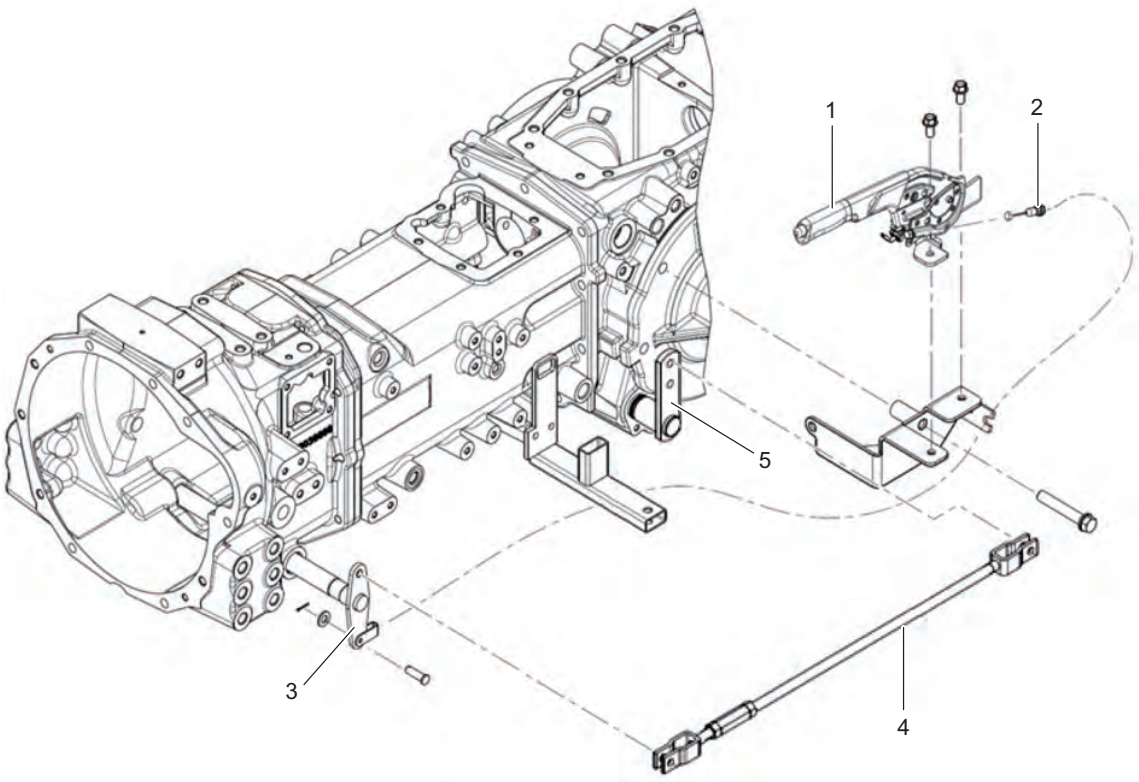
With the brake pedal (1) depressed firmly, pull the parking brake lever (2) to engage the gear tooth with the fixing plate of the brake pedal.

As the brake pedal is operated, the brake rod (3), which is connected to the brake shaft and brake pedal, is pulled to activate the brake lever (4) in order to apply braking force for the left/right brakes.

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F36R/F42R

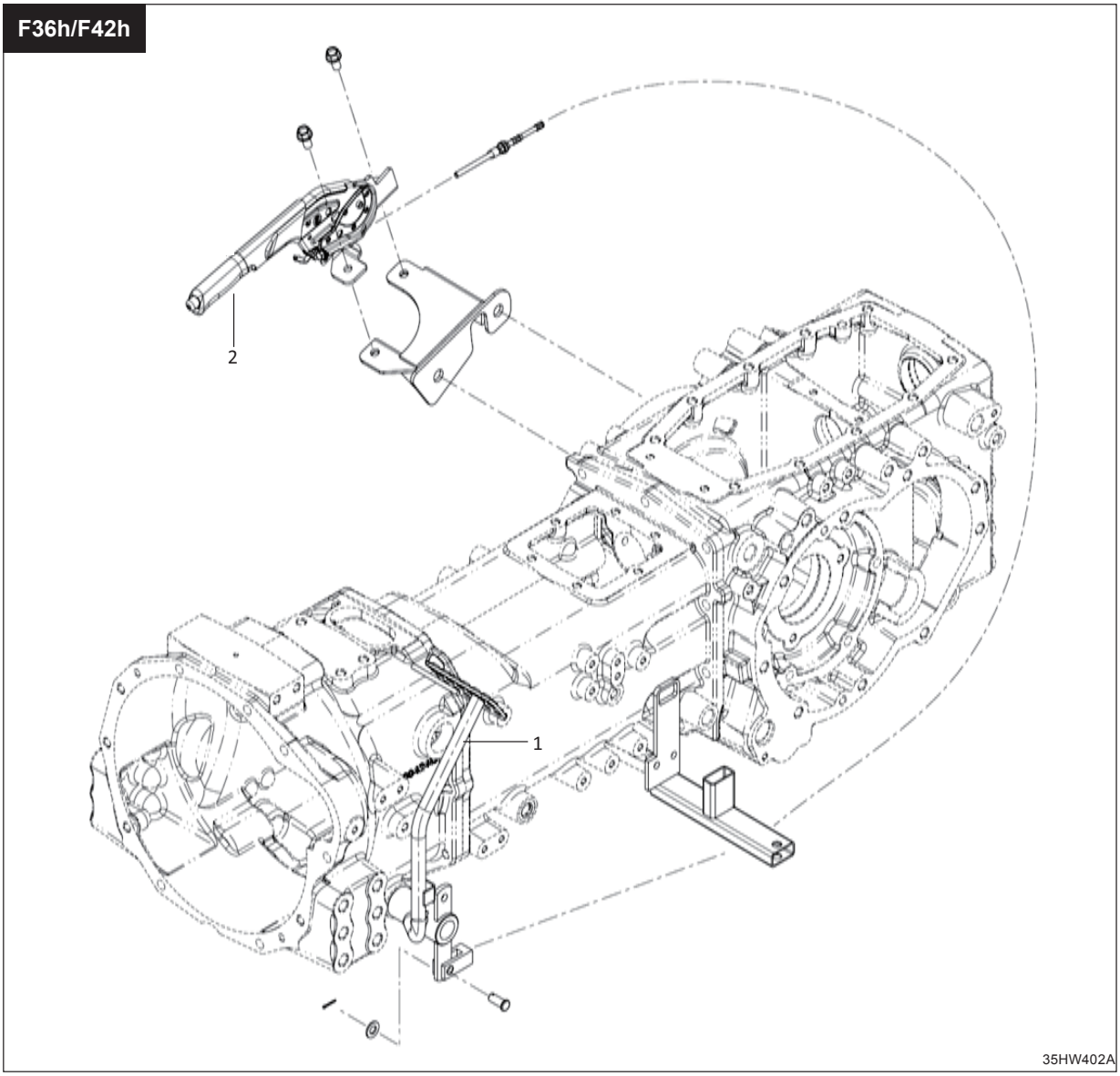


(1) Parking brake lever
(2) Parking brake wire
(3) Brake shaft
(4) Brake rod
(5) Brake lever

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F36h/F42h



(1) Parking brake lever (2) Parking brake wire

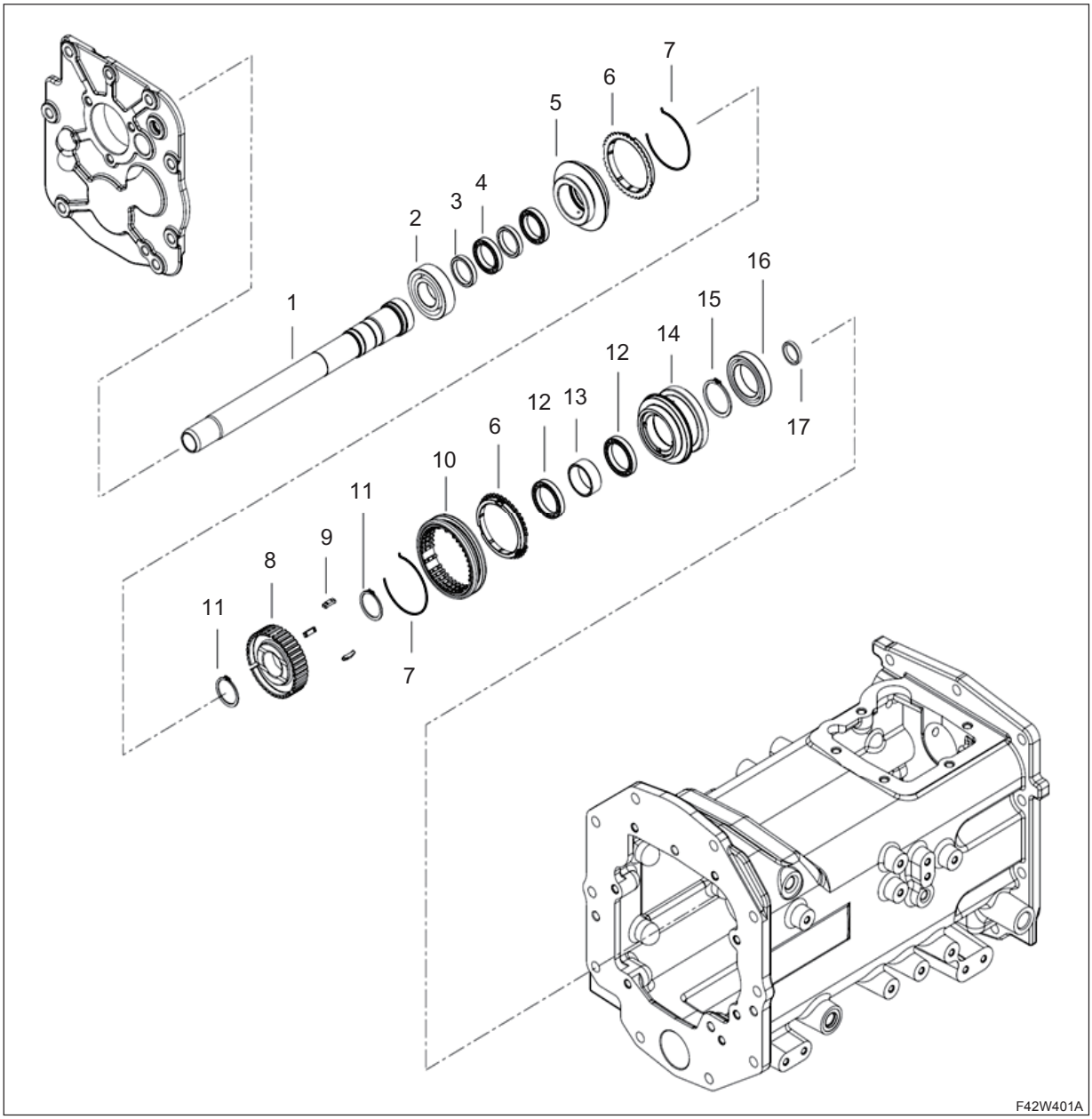
When the parking brake lever (1) is pulled, the parking brake cable (2) pulls the brake shaft (3). Then, the left brake rod (4), which is connected to the brake shaft, activates the left brake lever (5) while the right brake rod on the brake pedal side, which is fixed to the brake shaft with the spring pin, activates the right brake lever to produce braking force for each brake. Also, the parking brake is coupled with the brake pedals. Therefore, pulling the parking brake lever with the brake pedals depressed can achieve sufficient braking force more easily.

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4. SECTIONAL VIEW FOR MAJOR COMPONENTS

4.1 SHAFT, F/R DRV [MEC. MODEL]



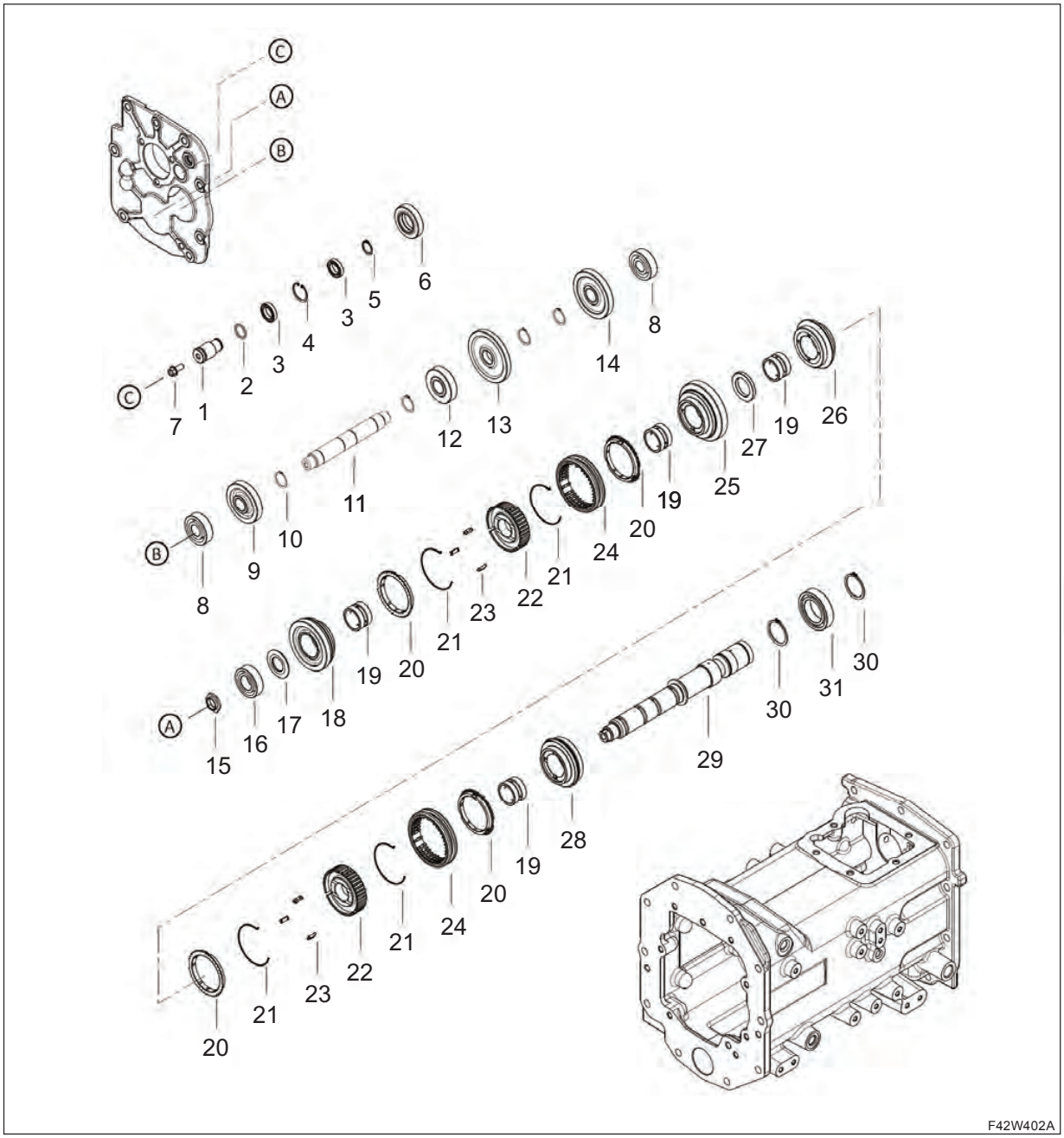
COMPONENTS

(1) Shaft, F/R drv
(2) Ball baring
(3) Spacer
(4) Ball baring
(5) Gear, backward drv
(6) Synchro ring
(7) Spring
(8) Hub
(9) Key
(10) Sleeve
(11) Snap ring
(12) Ball baring
(13) Spacer
(14) Gear, forward drv
(15) Snap ring
(16) Ball baring
(17) Oil seal

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4.2 MAIN SHIFT [MEC. MODEL]



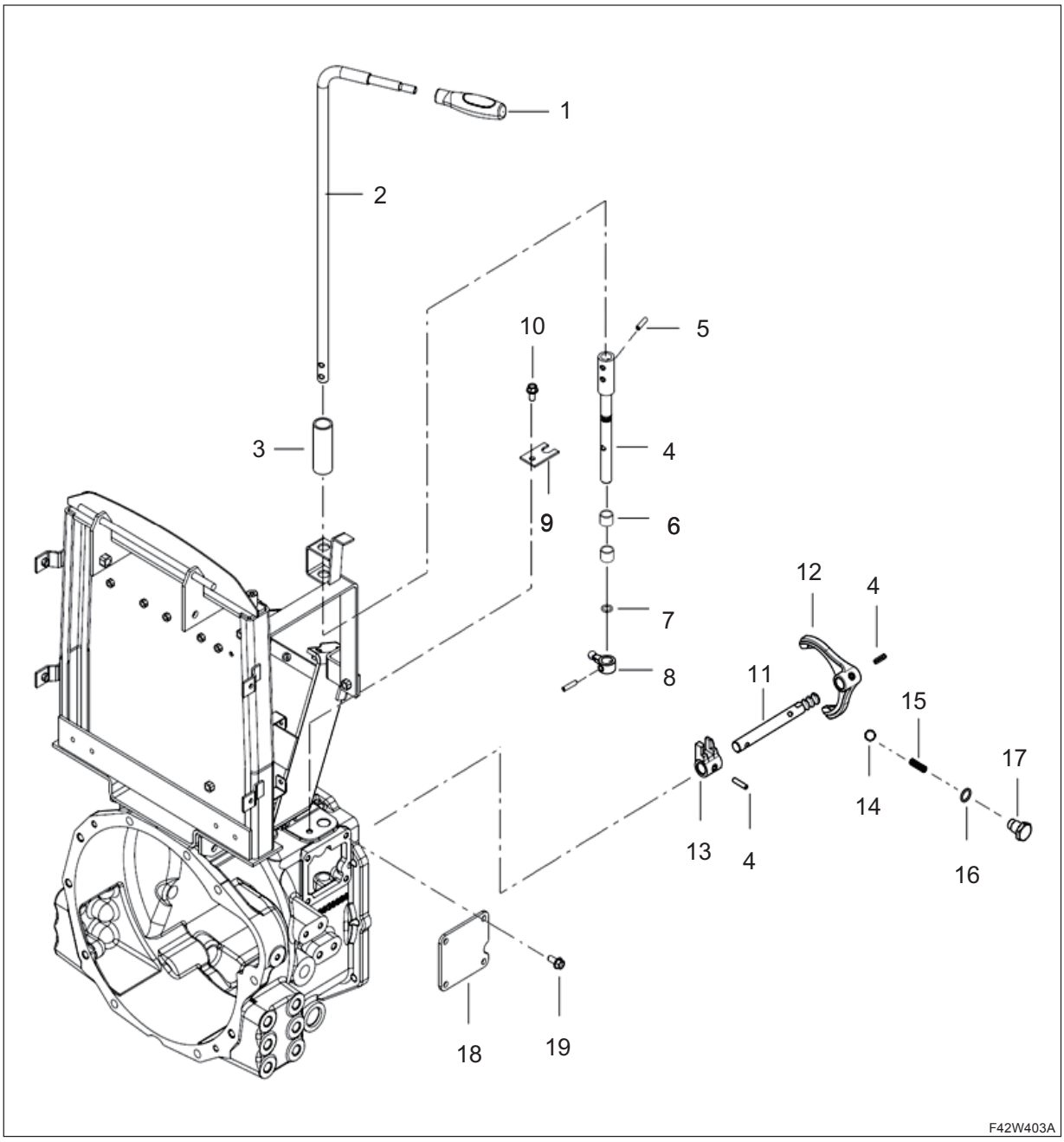
COMPONENTS

(1) Shaft, idle(rear)
(2) O-ring
(3) Ball bearing
(4) Snap ring
(5) Snap ring(C-type)
(6) Gear, idle(rear)
(7) Hex flange bolt
(8) Ball bearing
(9) Gear 2, main shift
(10) Snap ring(C-type)
(11) Spacer shaft, main shift
(12) Gear 1, main shift
(13) Gear 4, main shift
(14) Gear 3, main shift
(15) Nut, lock
(16) Ball bearing
(17) Spcer
(18) Gear-M/shift drvn 2
(19) Sleeve
(20) Synchro ring
(21) Spring
(22) Hub
(23) Key
(24) Sleeve
(25) Gear-M/shift drvn 1
(26) Gear-M/shift drvn 4
(27) Spacer
(28) Gear-M/shift drvn 3
(29) Shaft-M/sthift
(30) Snap ring(C-type)
(31) Ball bearing

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4.3 SHUTTLE ASS'Y [MEC. MODEL]



COMPONENTS

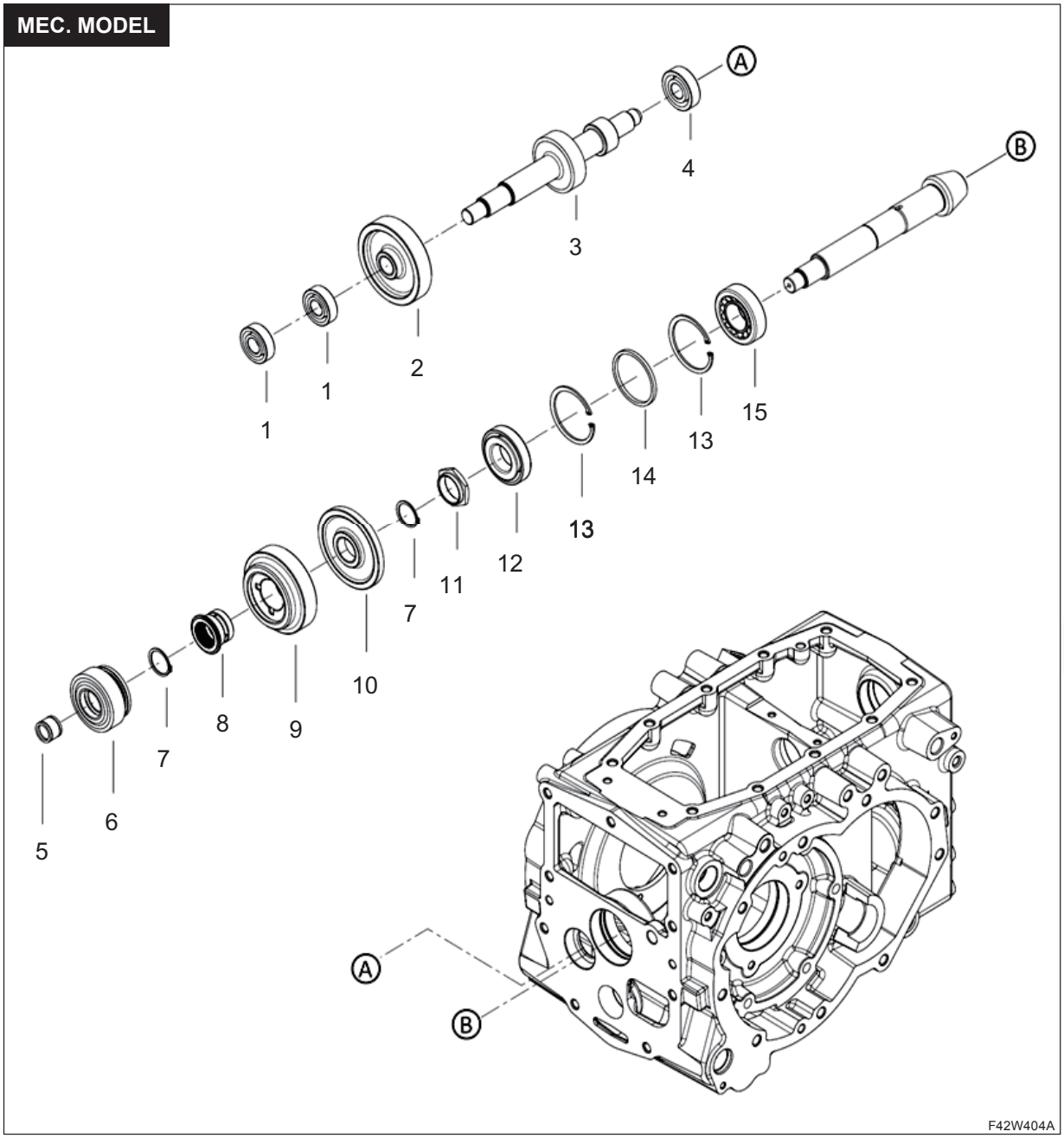
(1) Knob, shuttle
(2) Lever, shuttle
(3) Cover, rubber
(4) Shaft, shuttle
(5) Spring pin
(6) Bush
(7) O-ring
(8) Arm, shuttle
(9) Plate
(10) Hex flange bolt
(11) Shaft, fork(shuttle)
(12) Fork, shuttle
(13) Shifter, shuttle
(14) Steel ball
(15) Spring
(16) O-ring
(17) Bolt
(18) Cover
(19) Hex flange bolt

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4.4 RANGE SHIFT GEAR

MEC. MODEL



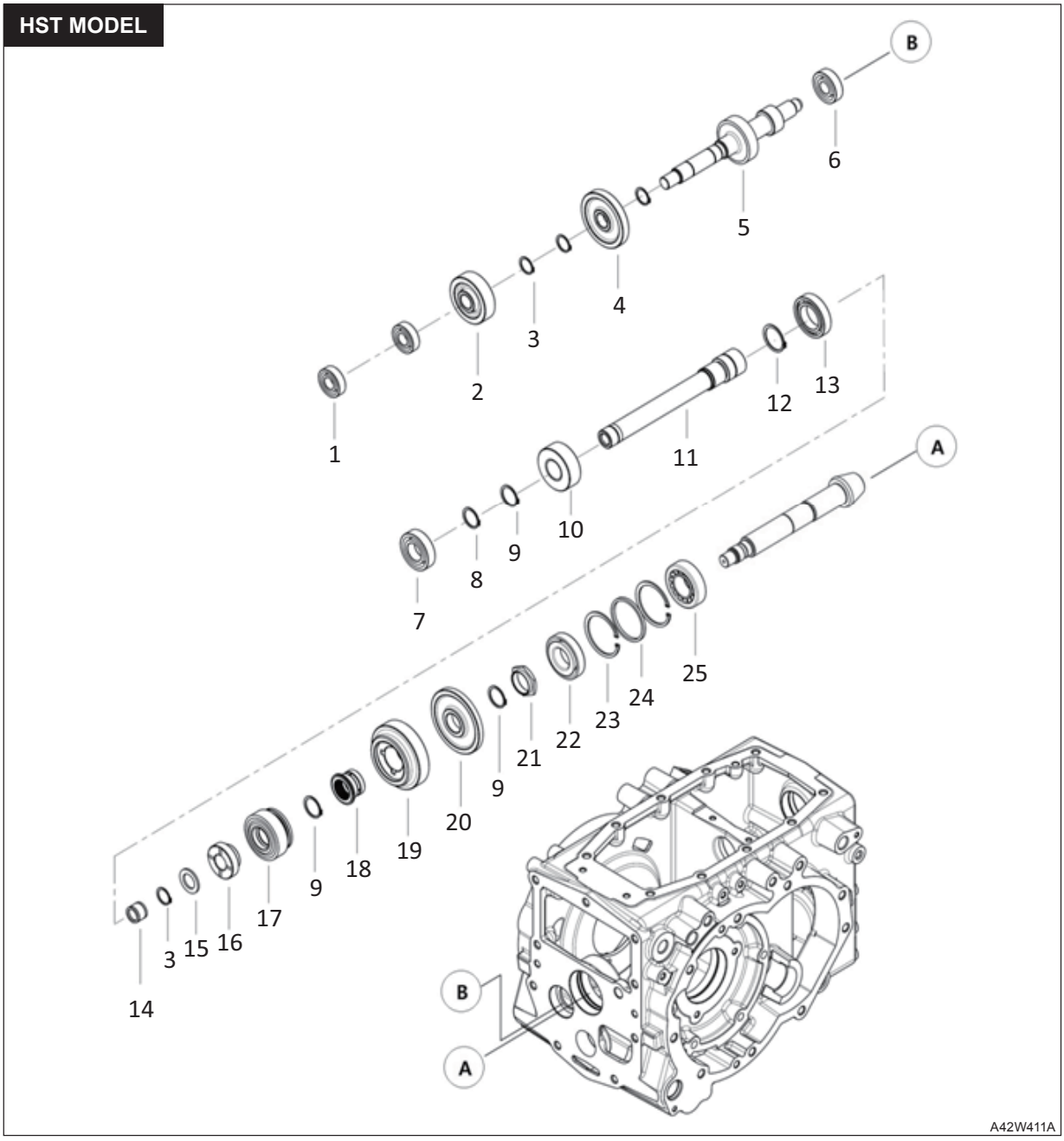
COMPONENTS

(1) Ball bearing
(2) Range shift drive gear
(3) Range shift drive shaft
(4) Ball bearing
(5) Niddle bearing
(6) Range shift driven gear 2nd
(7) Snap ring
(8) Sleeve
(9) Range shift driven gear 1nd
(10) Four wheel drive gear
(11) Stop nut
(12) Taper roller bearing
(13) Snap ring
(14) Spacer
(15) Taper roller bearing(32207c)

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HST MODEL



COMPONENTS

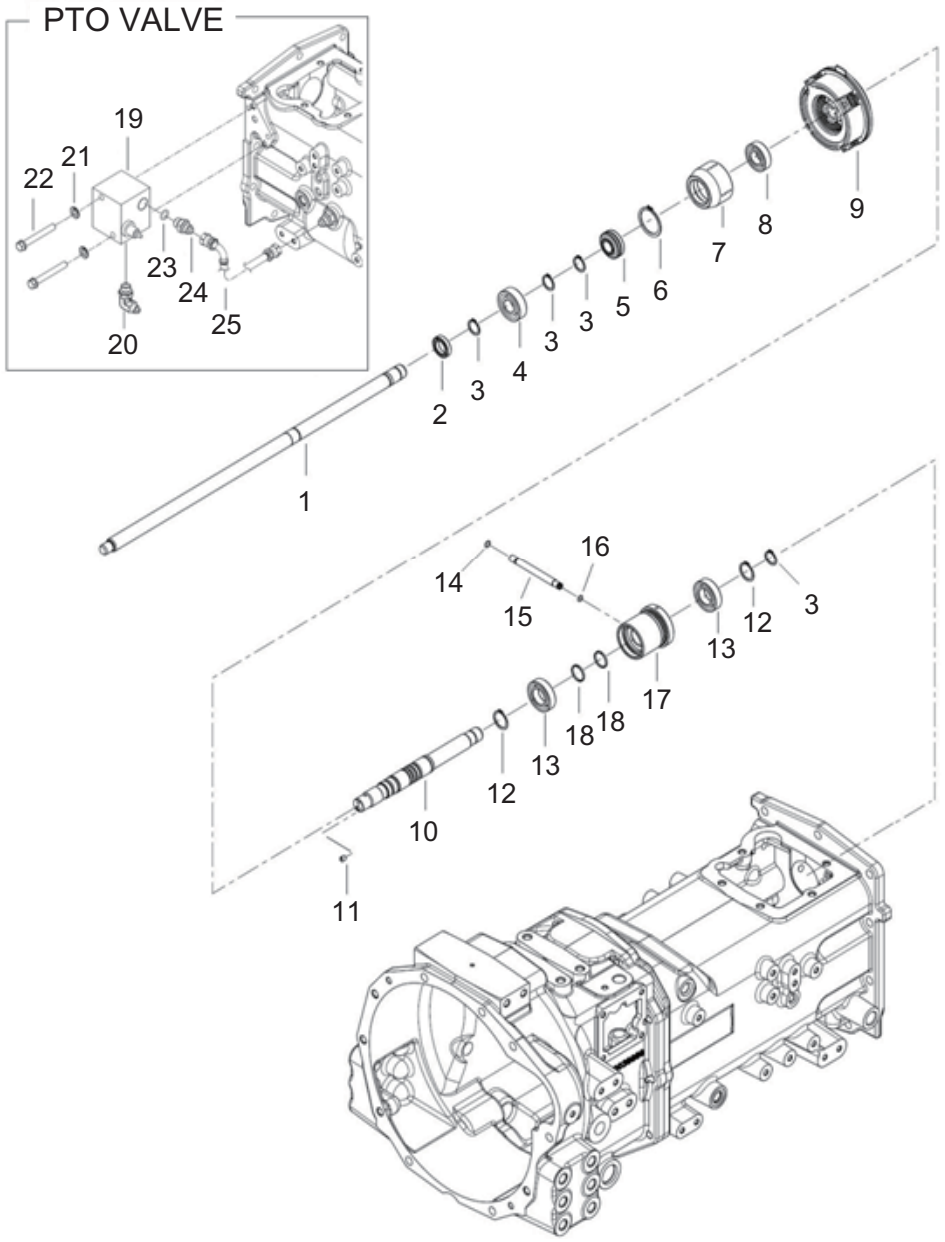
(1) Ball bearing
(2) Range driven gear
(3) Snap ring
(4) Gear, range c
(5) Range driven shaft
(6) Ball bearing
(7) Ball bearing
(8) Snap ring
(9) Snap ring
(10) Range driven gear
(11) Range shaft
(12) Snap ring
(13) Ball bearing
(14) Niddle bearing
(15) Collar
(16) Gear, range c driven
(17) Range shift driven gear 2nd
(18) Sleeve
(19) Range shift driven gear 1nd
(20) Four wheel drive gear
(21) Stop nut
(22) Taper roller bearing
(23) Snap ring
(24) Spacer
(25) Taper roller bearing(32207c)

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4.5 MAIN P.T.O SHAFT

MEC. MODEL



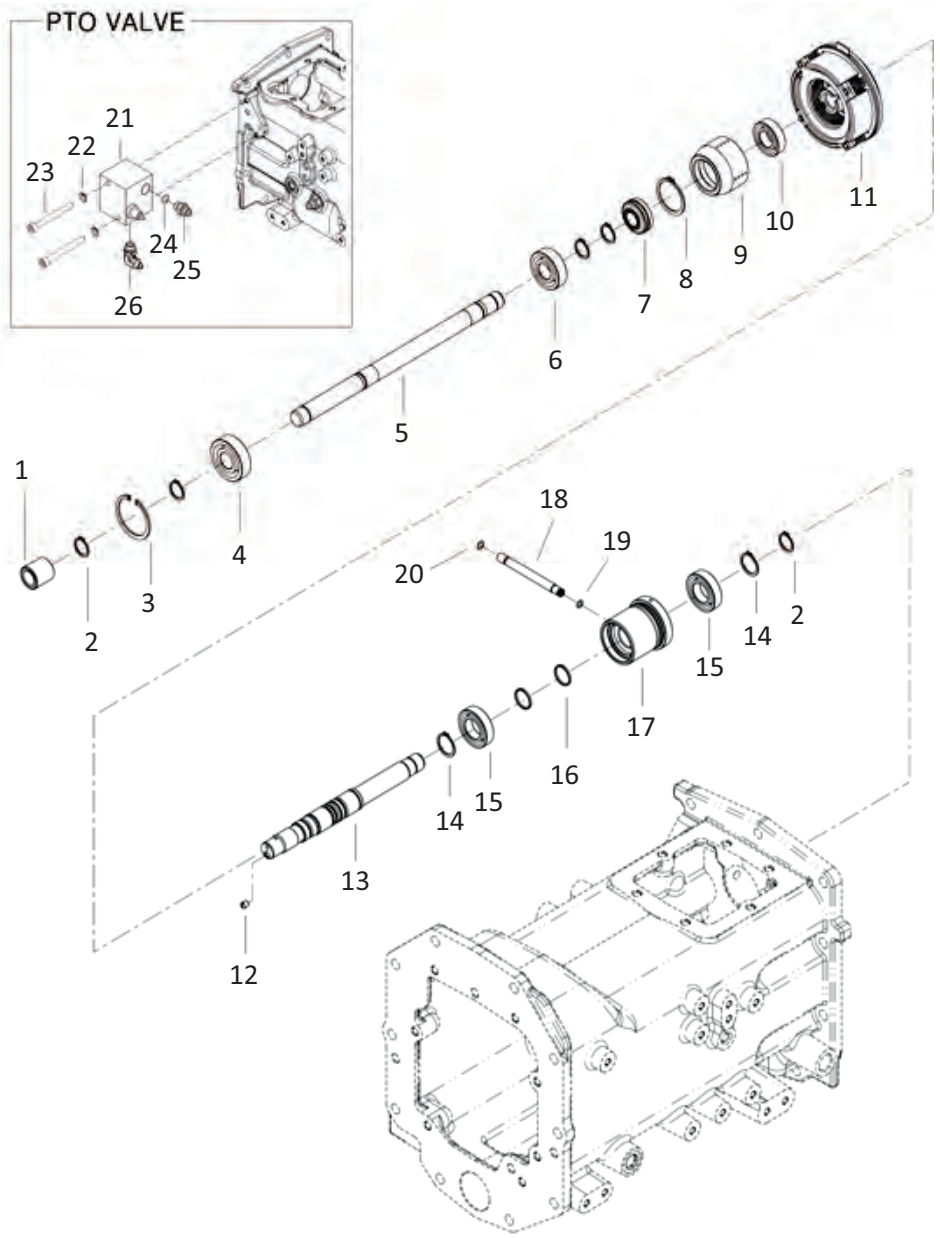
COMPONENTS

(1) Main PTO shaft
(2) Oil seal
(3) Snap ring
(4) Ball bearing
(5) Joint
(6) Snap ring
(7) Clutch hub
(8) Ball bearing
(9) PTO clutch ass'y
(10) PTO clutch shaft
(11) Stop screw
(12) Snap ring
(13) Ball bearing
(14) O-ring
(15) Clutch input pipe
(16) O-ring
(17) Sleeve
(18) Seal ring
(19) PTO valve
(20) Elbow
(21) Spring washer
(22) Hex bolt
(23) O-ring
(24) Connector
(25) Hose

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HST MODEL



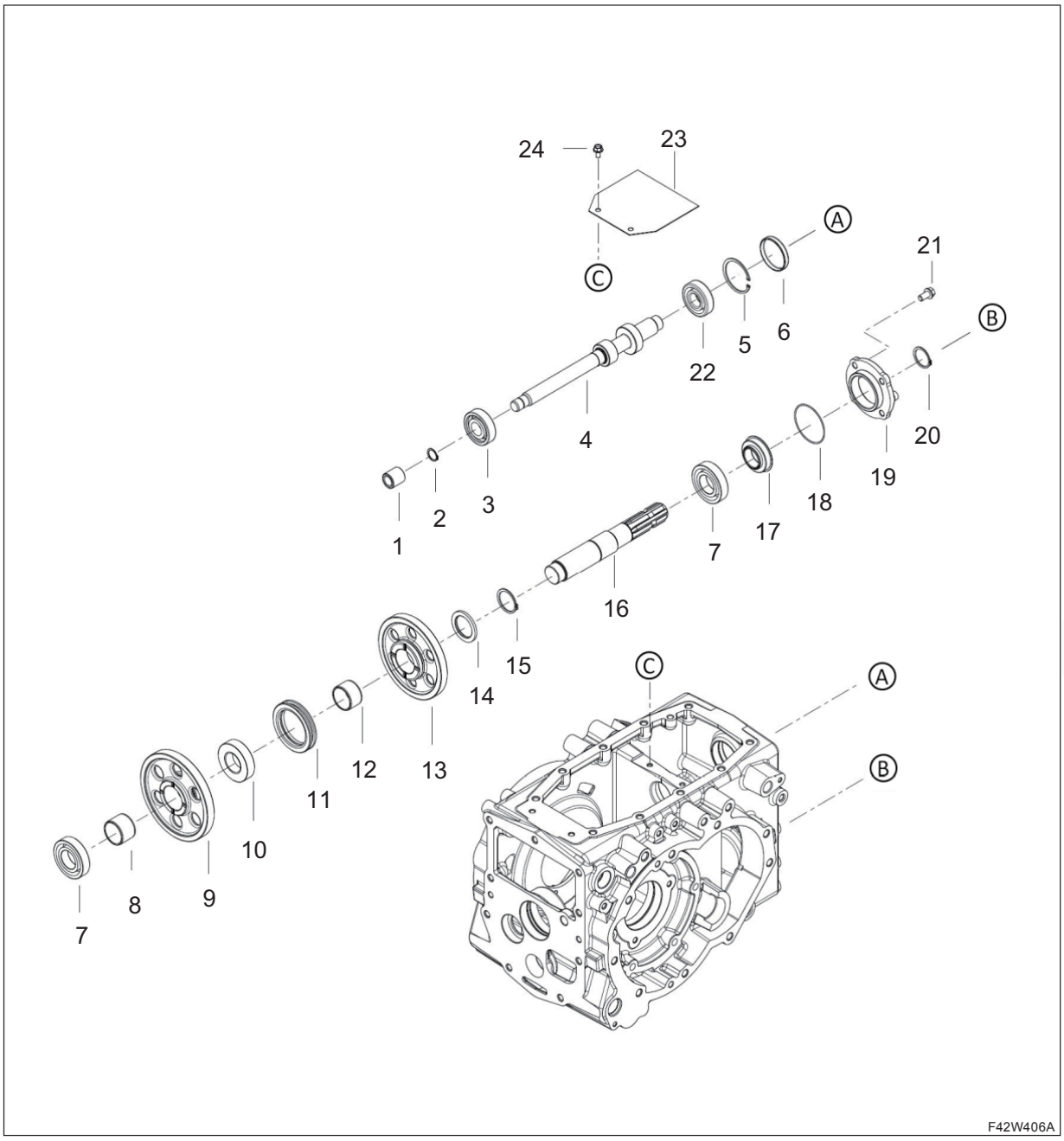
COMPONENTS

(1) Joint
(2) Snap ring
(3) Snap ring
(4) Ball bearing
(5) Main pto shaft
(6) Ball bearing
(7) Joint
(8) Snap ring
(9) Clutch hub
(10) Ball bearing
(11) Pto clutch ass'y
(12) Stop screw
(13) Pto clutch shaft
(14) Snap ring
(15) Ball bearing
(16) Sealring
(17) Sleeve
(18) Clutch input pipe
(19) O-ring
(20) O-ring
(21) Pto valve
(22) Spring washer
(23) Hexagon socket bolt
(24) O-ring
(25) Connecter
(26) Elbow

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4.6 PTO DRIVE SHAFT



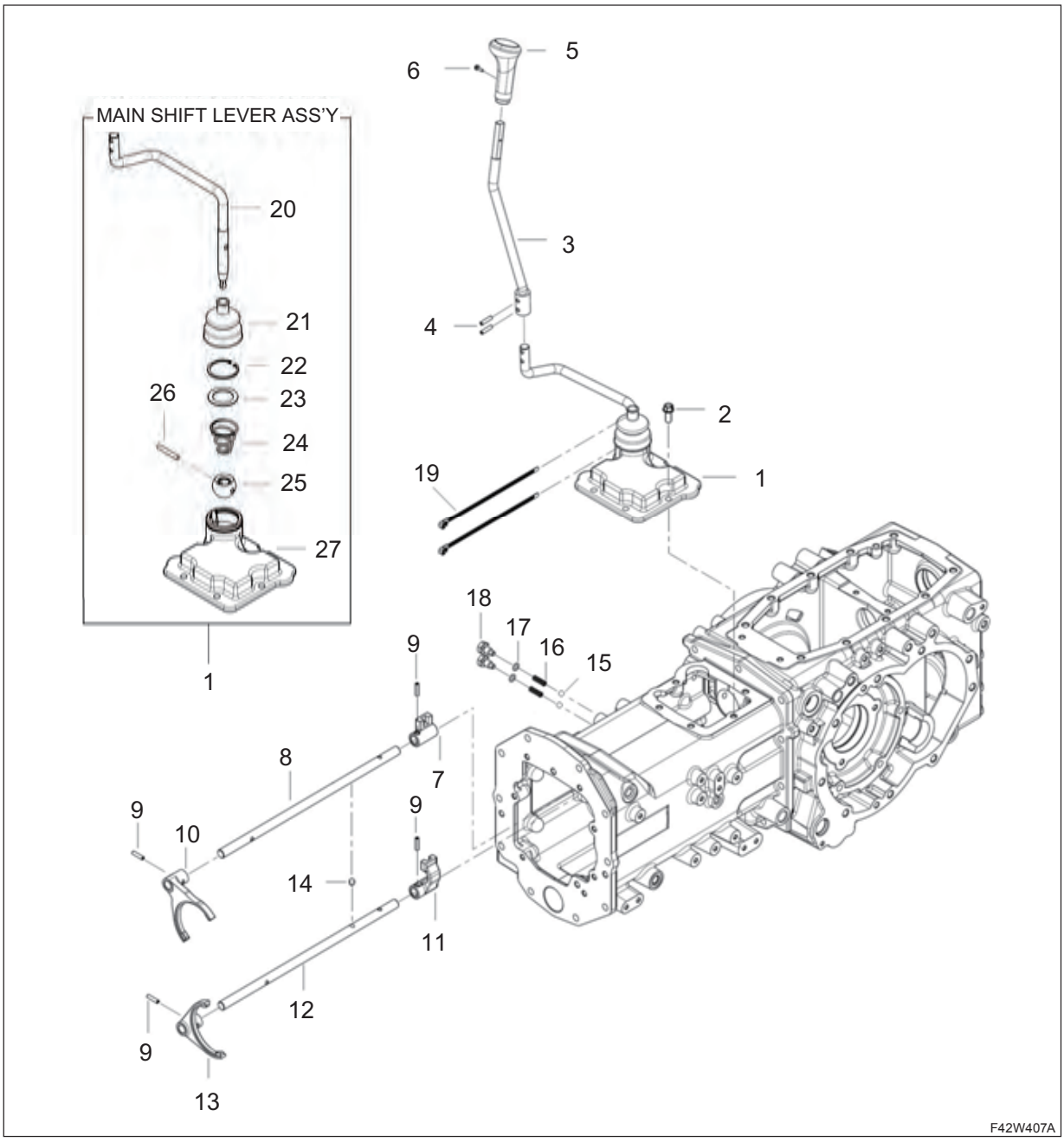
COMPONENTS

(1) Joint
(2) Snap ring
(3) Ball bearing
(4) Shaft, PTO drive
(5) Snap ring
(6) Seal cap
(7) Ball bearing
(8) Bush
(9) Gear, PTO1
(10) Hub, PTO
(11) Sleeve, PTO
(12) Bush
(13) Gear, PTO2
(14) Washer
(15) Snap ring
(16) Shaft, PTO drive
(17) Oil seal
(18) O-ring
(19) Cover, PTO
(20) Snap ring
(21) Hex flange bolt
(22) Ball bearing
(23) Plate
(24) Hex flange bolt

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4.7 FORK, MAIN SHIFT [MEC. MODEL]



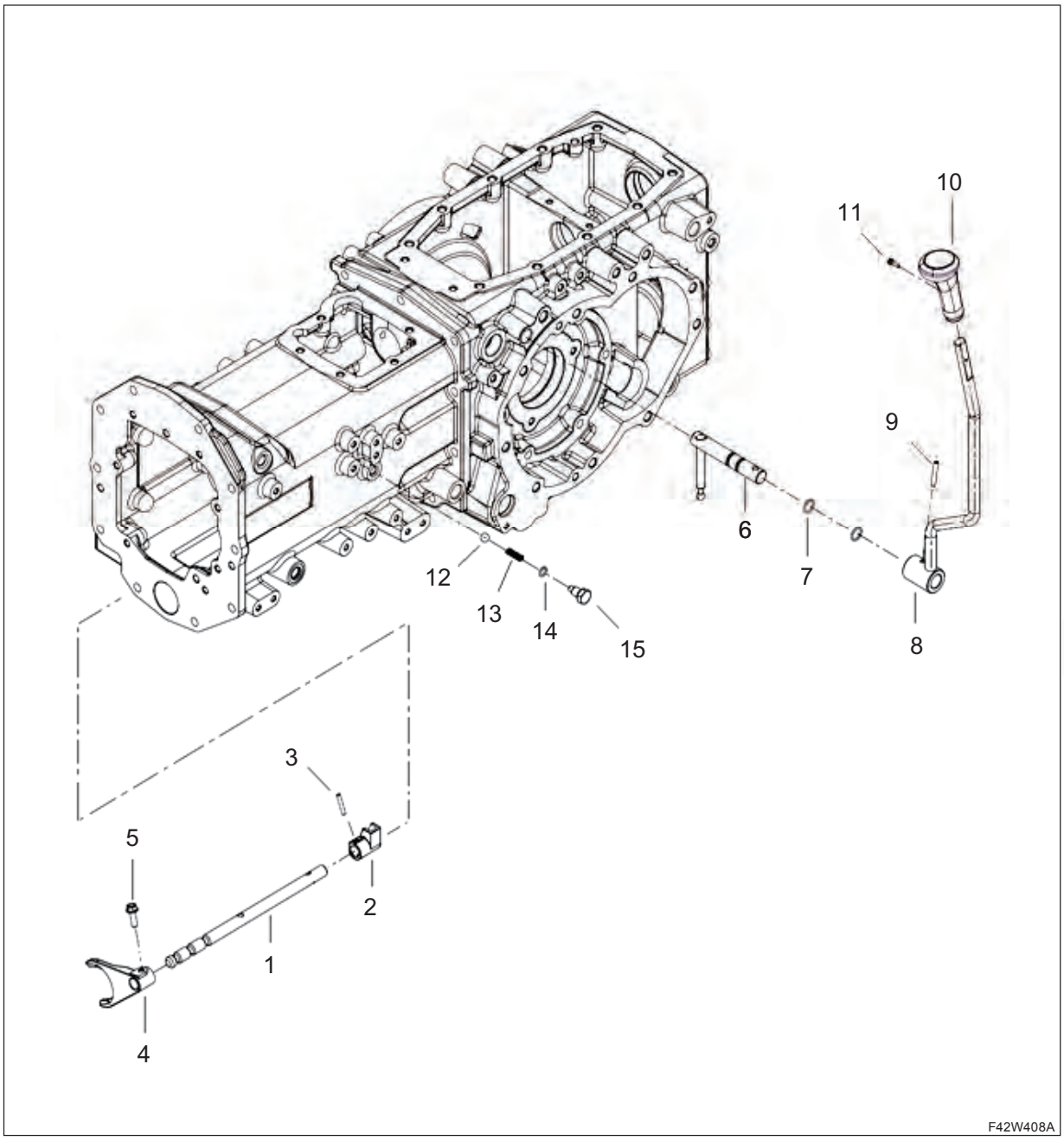
COMPONENTS

(1) Main shift lever ass'y
(2) Hex flange bolt
(3) Main shift lever
(4) Spring pin
(5) Main shift knob ass'y
(6) Screw
(7) Main shifter
(8) Main shift fork shaft
(9) Spring pin
(10) Main shift fork
(11) Main shifter
(12) Main shift fork shaft
(13) Main shift fork
(14) Pin
(15) Steel ball
(16) Spring
(17) O-ring
(18) Bolt
(19) Band
(20) Main shift lever(lower)
(21) Boots
(22) Snap ring
(23) Spacer
(24) Spring
(25) Ball
(26) Pin
(27) Case, main shift

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4.8 LEVER ASS'Y, RANGE SHIFT



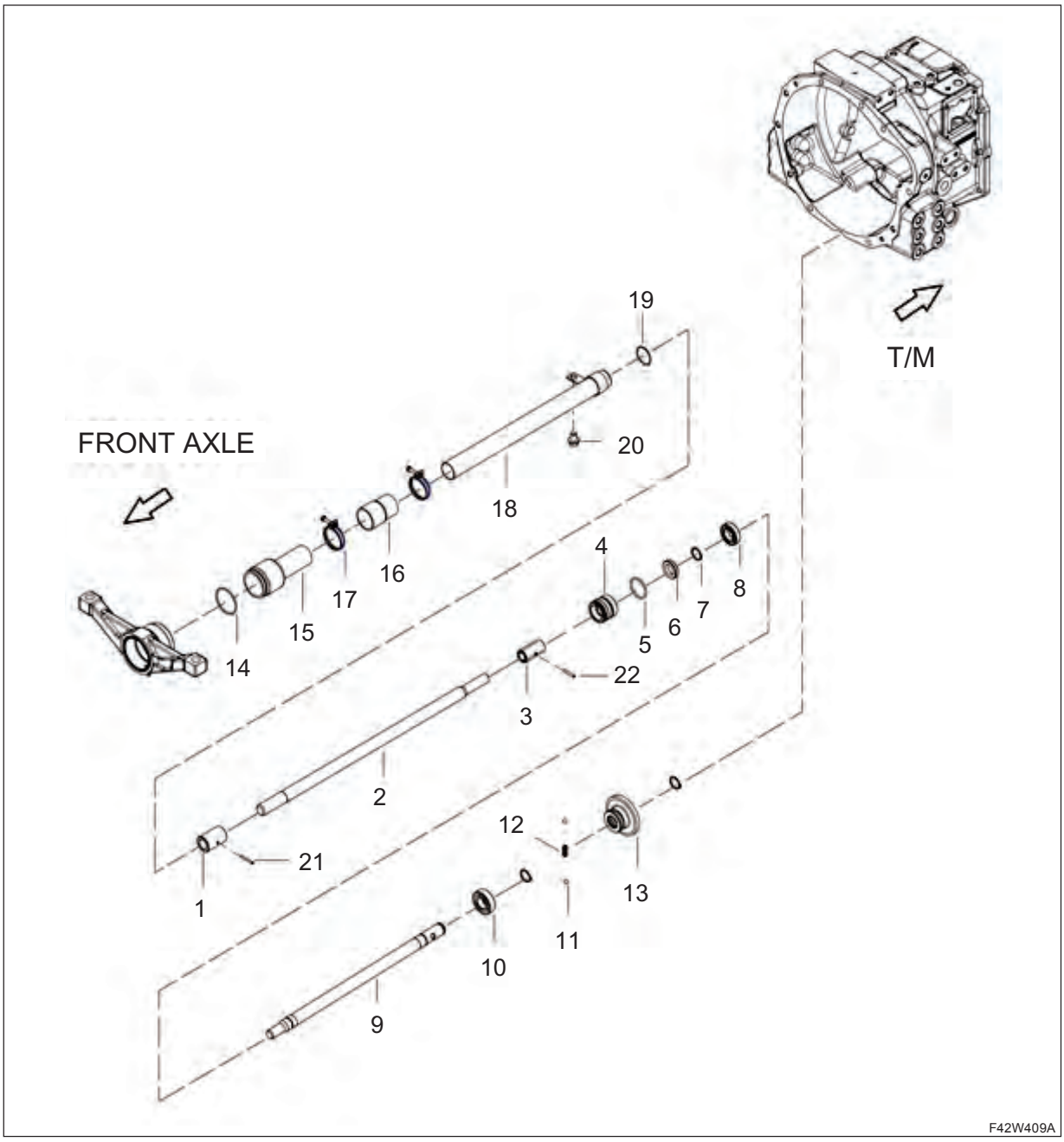
COMPONENTS

(1) Range shift fork shaft
(2) Range shifter
(3) Spring pin
(4) Range shift fork
(5) Hex bolt w/washer
(6) Shaft, range shift
(7) O-ring
(8) Range shift lever
(9) Spring pin
(10) Range shift knob(k3)
(11) Screw
(12) Steel ball
(13) Spring
(14) O-ring
(15) Bolt

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4.9 FRONT DRIVE SHAFT



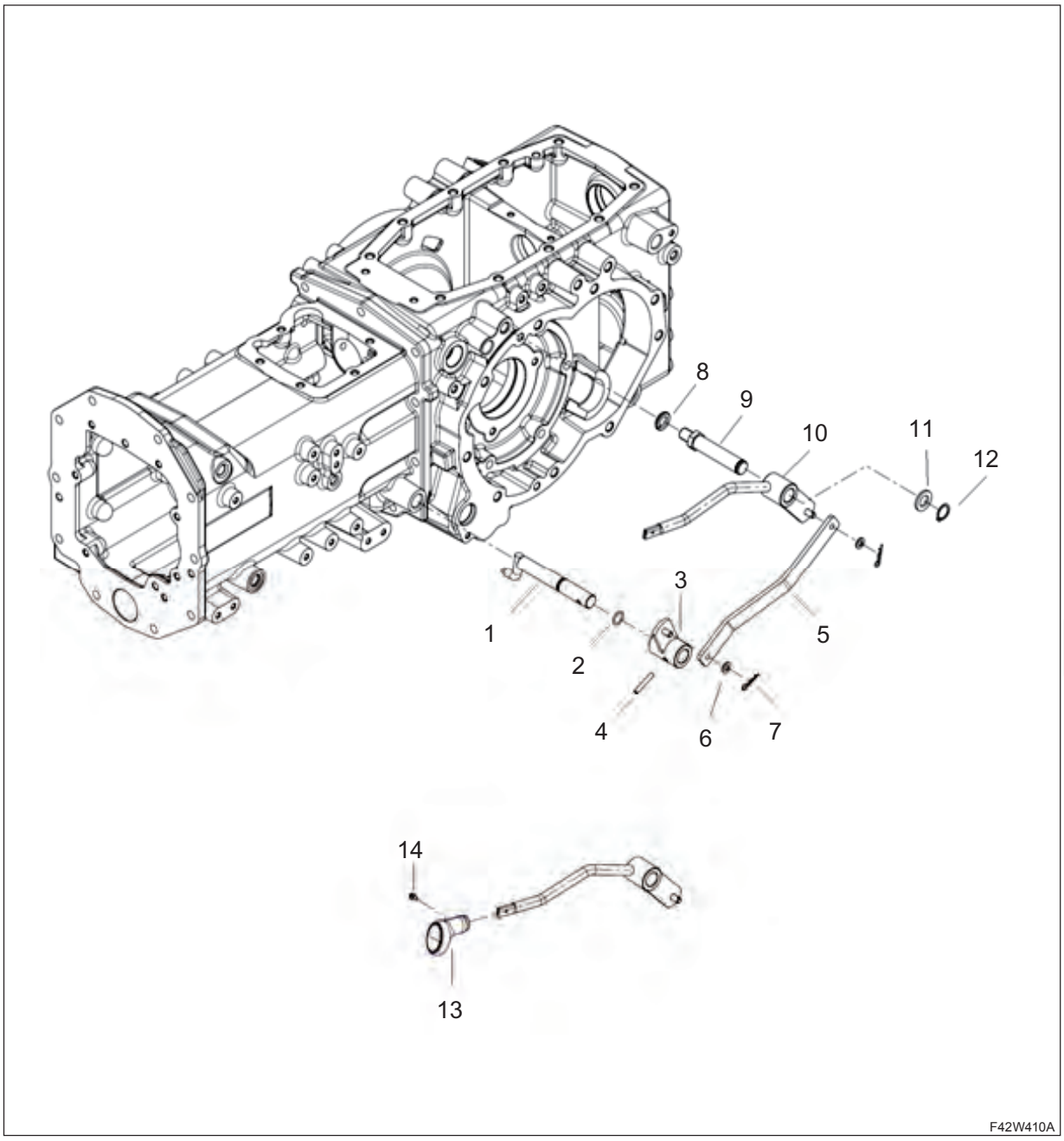
COMPONENTS

(1) Couple ring R
(2) Propeller shaft
(3) 4nd drive joint
(4) Oil seal housing
(5) O-ring
(6) Oil seal
(7) Snap ring
(8) Ball bearing
(9) 4dn drive shaft
(10) Ball bearing
(11) Steel ball
(12) Spring
(13) 4dn driven gear
(14) Stop O-ring
(15) Shaft cover(front)
(16) Shaft cover boots
(17) Hose band
(18) Shaft cover(back)
(19) Stop O-ring
(20) Hex flange bolt
(21) Spring pin
(22) Spring pin

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4.10 4WD LEVER



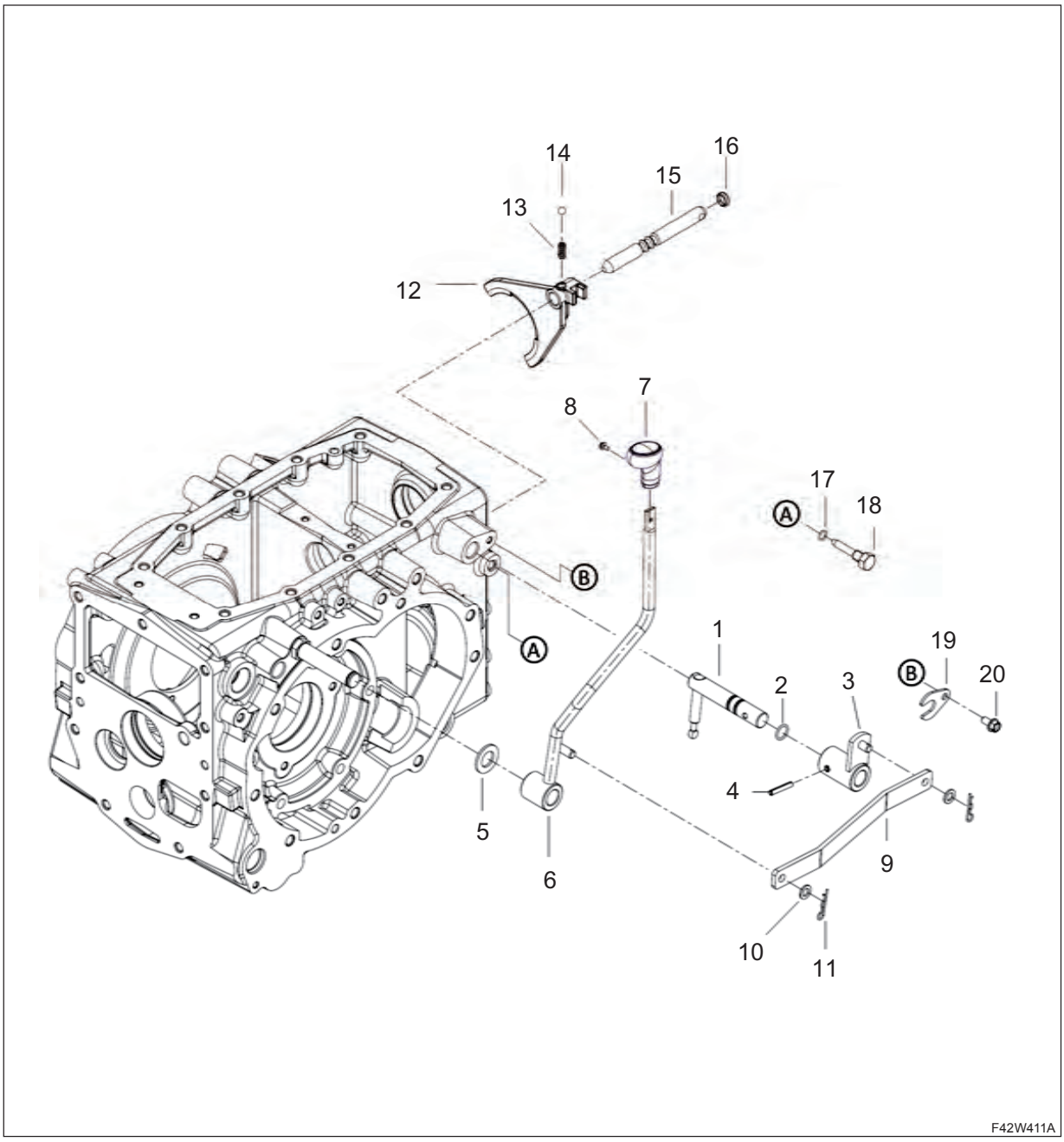
COMPONENTS

(1) 4nd lever
(2) O-ring
(3) Front wheel shift arm
(4) Spring pin
(5) 4nd lever link
(6) Washer
(7) Snap pin
(8) Spring washer
(9) PTO lever shaft
(10) 4nd lever
(11) Washer
(12) Snap ring
(13) Front wheel drive knob ass'y
(14) Screw

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4.11 FORK & LEVER, PTO



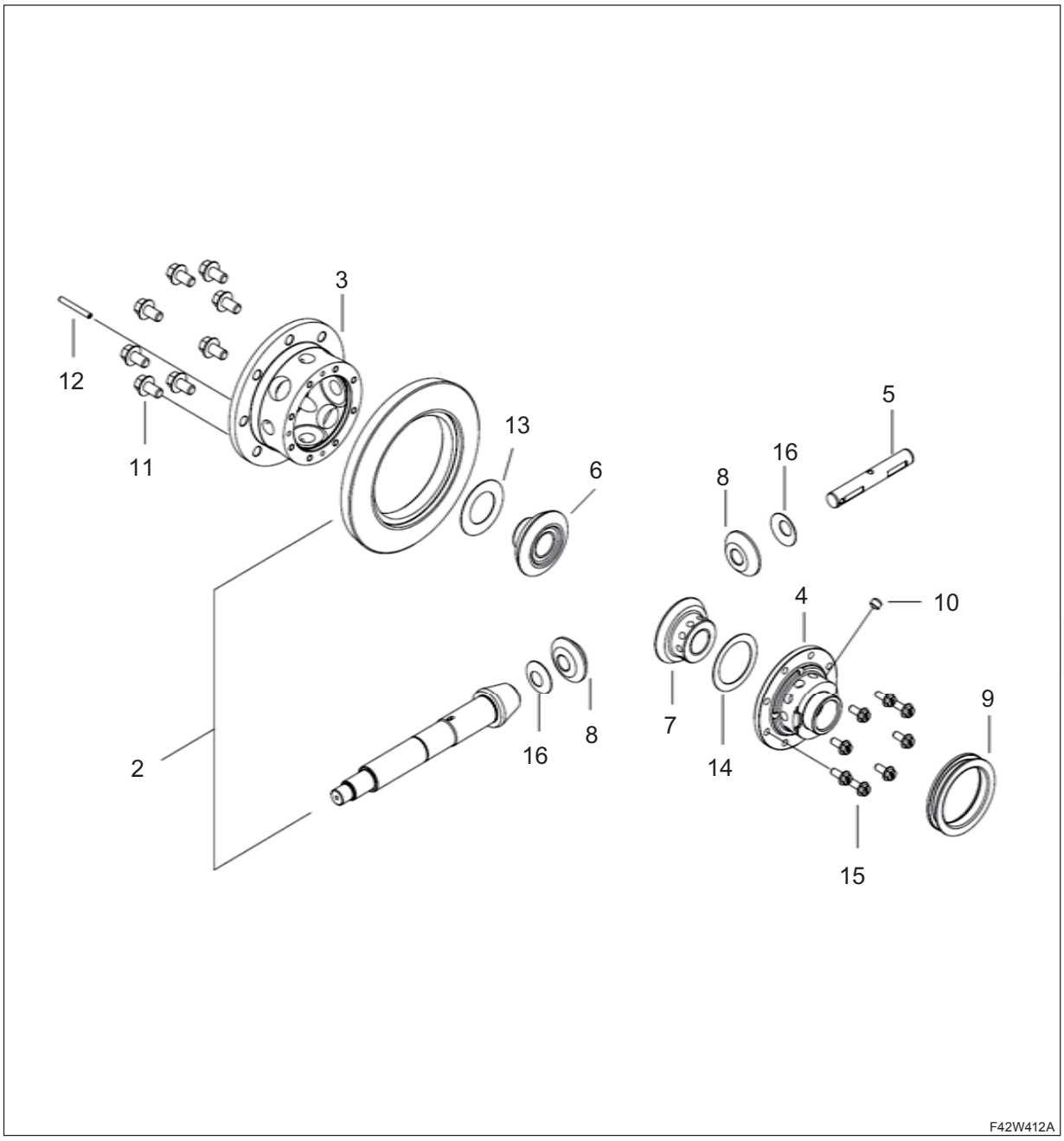
COMPONENTS

(1) Shaft, PTO change
(2) O-ring
(3) Change arm, PTO
(4) Spring pin
(5) Washer
(6) PTO change lever
(7) PTO knob ass'y
(8) Screw
(9) PTO lever link
(10) Washer
(11) Snap pin
(12) PTO fork
(13) Spring
(14) Steel ball
(15) PTO fork shaft
(16) Seal cap
(17) O-ring
(18) Stop bolt
(19) Plate
(20) Hex plange bolt

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4.12 RING GEAR & DIFF.GEAR ASS'Y



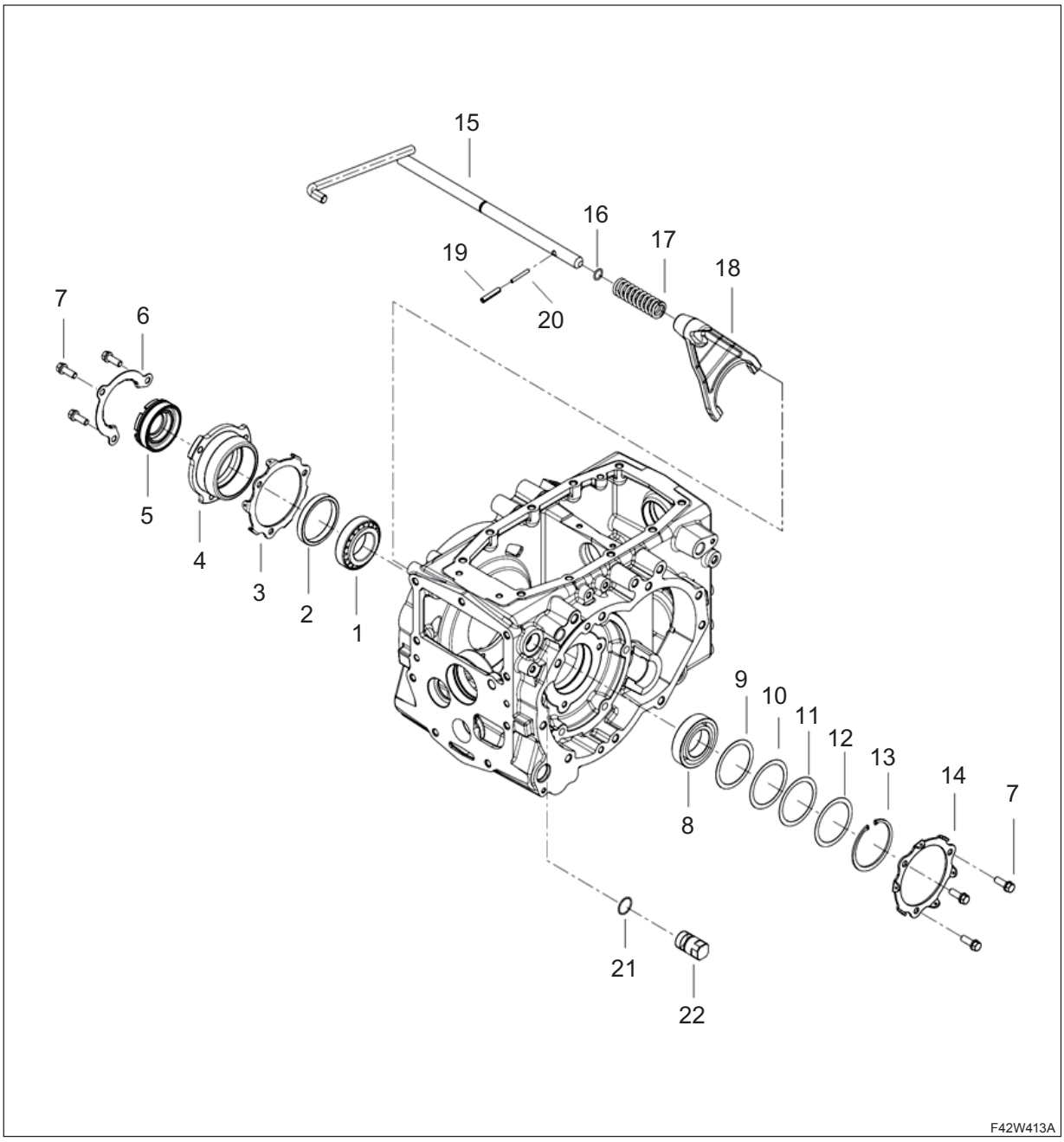
COMPONENTS

(1) Differential ass'y
(2) Ring gear ass'y
(3) Differential case(right)
(4) Differential case(left)
(5) Differential shaft
(6) Differential side gear r
(7) Differential side gear l
(8) Pinion, differential
(9) Differential stop slider
(10) Roller
(11) Bolt
(12) Spring pin
(13) Thrust washer
(14) Washer
(15) Bolt
(16) Thrust washer

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4.13 DIFFERENTIAL



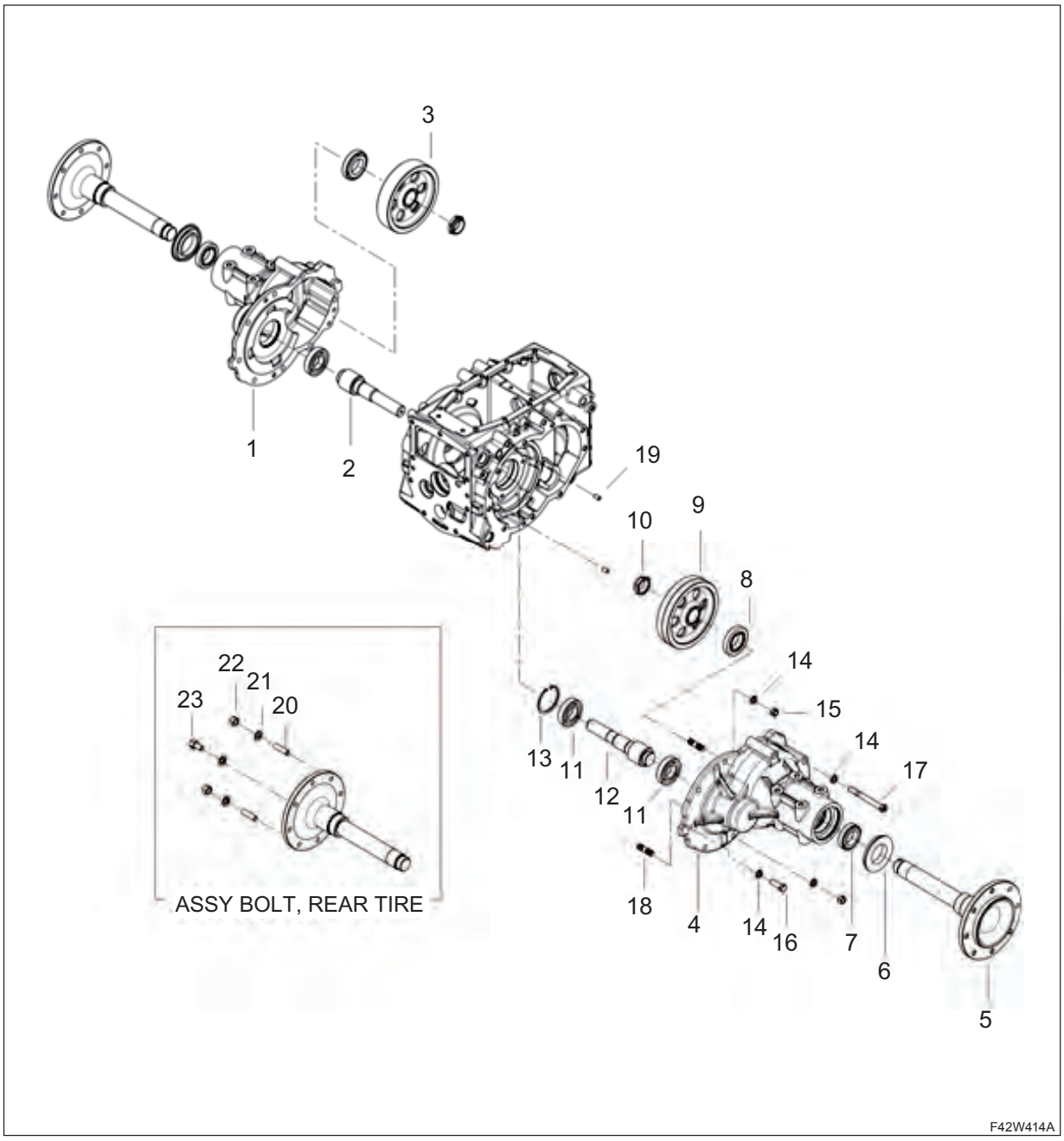
COMPONENTS

(1) Taper roller bearing
(2) Spacer
(3) Spring holder
(4) Bearing support
(5) Screw
(6) Stop plate
(7) Washer ass'y hex bolt
(8) Ball bearing
(9) Shim
(10) Shim
(11) Shim
(12) Shim
(13) Snap ring
(14) Spring holder
(15) Differential pedal
(16) O-ring
(17) Differential spring
(18) Differential fork
(19) Spring pin
(20) Spring pin
(21) O-ring
(22) Adapter

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4.14 DRIVING PART, REAR AXLE



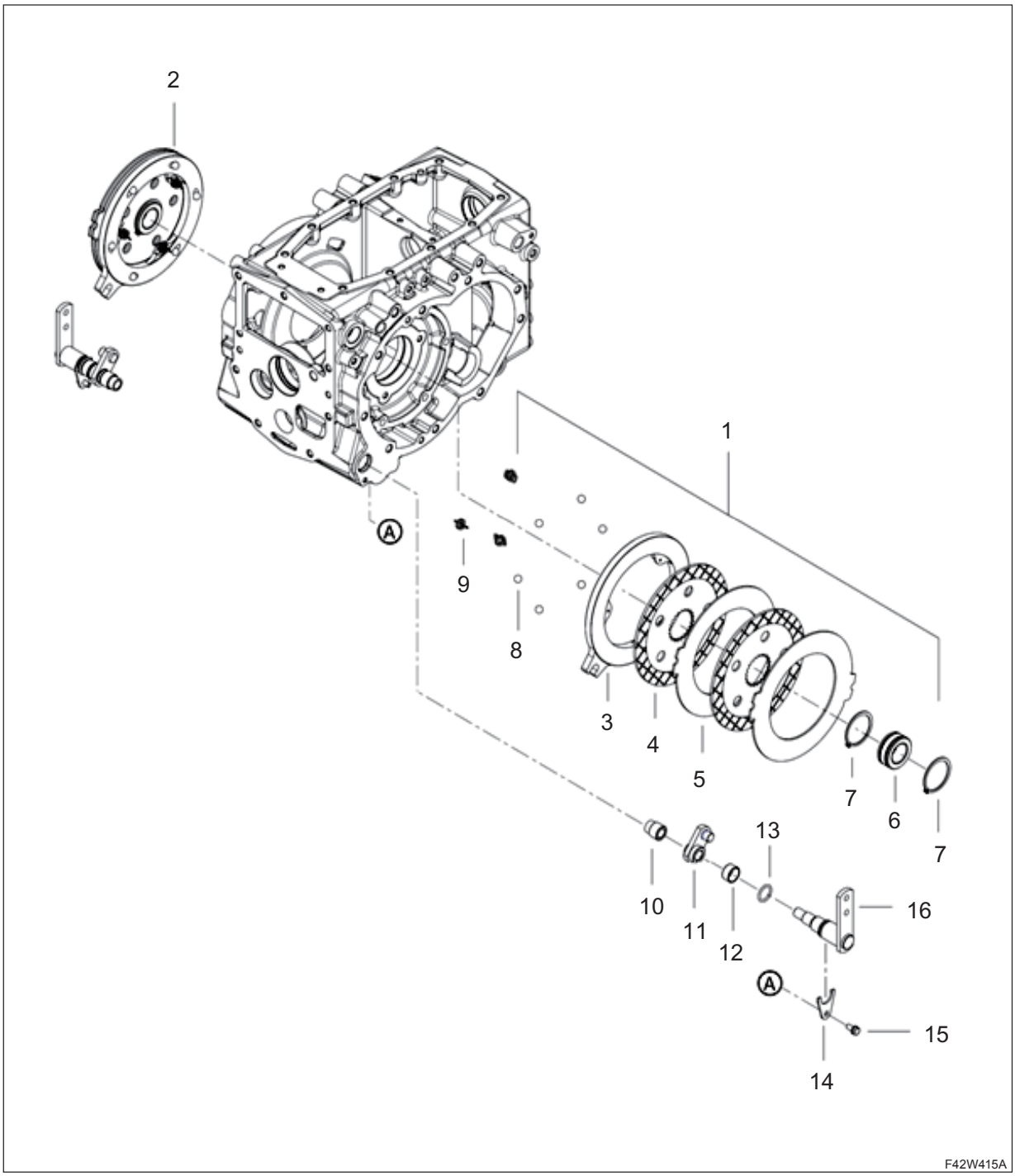
COMPONENTS

(1) Housing, rear axle(right)
(2) Final pinion (right)
(3) Final gear (right)
(4) Housing, rear axle(left)
(5) Rear axle
(6) Oil seal
(7) Taper roller bearing
(8) Taper roller bearing
(9) Final gear(left)
(10) Rock nut
(11) Ball bearing
(12) Final pinion(left)
(13) Snap ring
(14) Spring washer
(15) Hex nut
(16) Bolt
(17) Bolt
(18) Stud bolt
(19) Pin
(20) Stud bolt
(21) Washer
(22) Hex nut
(23) Bolt

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4.15 BRAKE



COMPONENTS

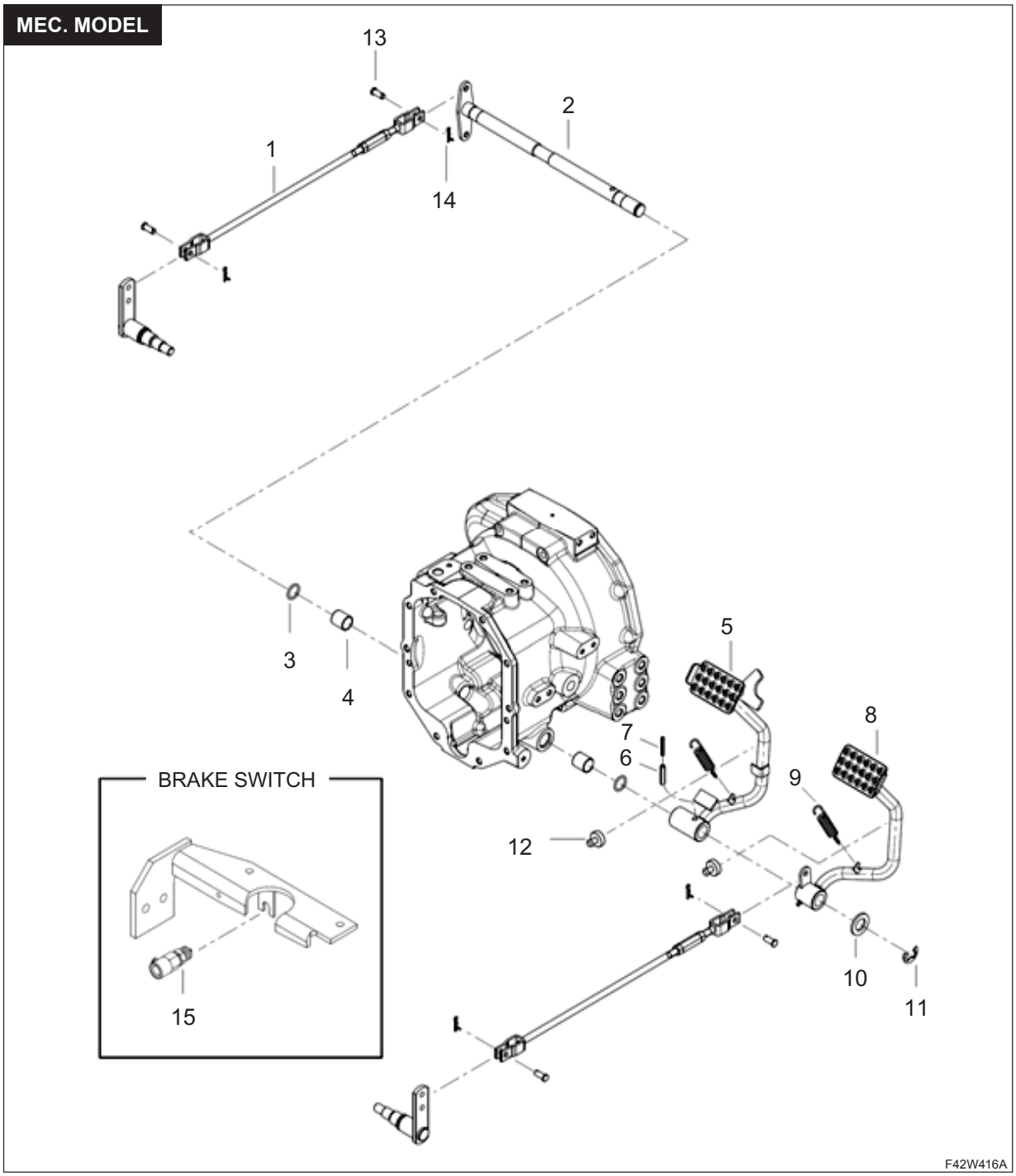
(1) Brake ass'y (left)
(2) Brake ass'y (right)
(3) Cam plate(left)
(3) Cam plate(right)
(4) Disk
(5) Pressure plate
(6) Boss
(7) Snap ring
(8) Steel ball
(9) Spring
(10) Brake lever bush
(11) Brake inside arm
(12) Dry bush
(13) O-ring
(14) Plate
(15) Hex bolt w/washer
(16) Brake lever

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4.16 BRAKE PEDAL

MEC. MODEL



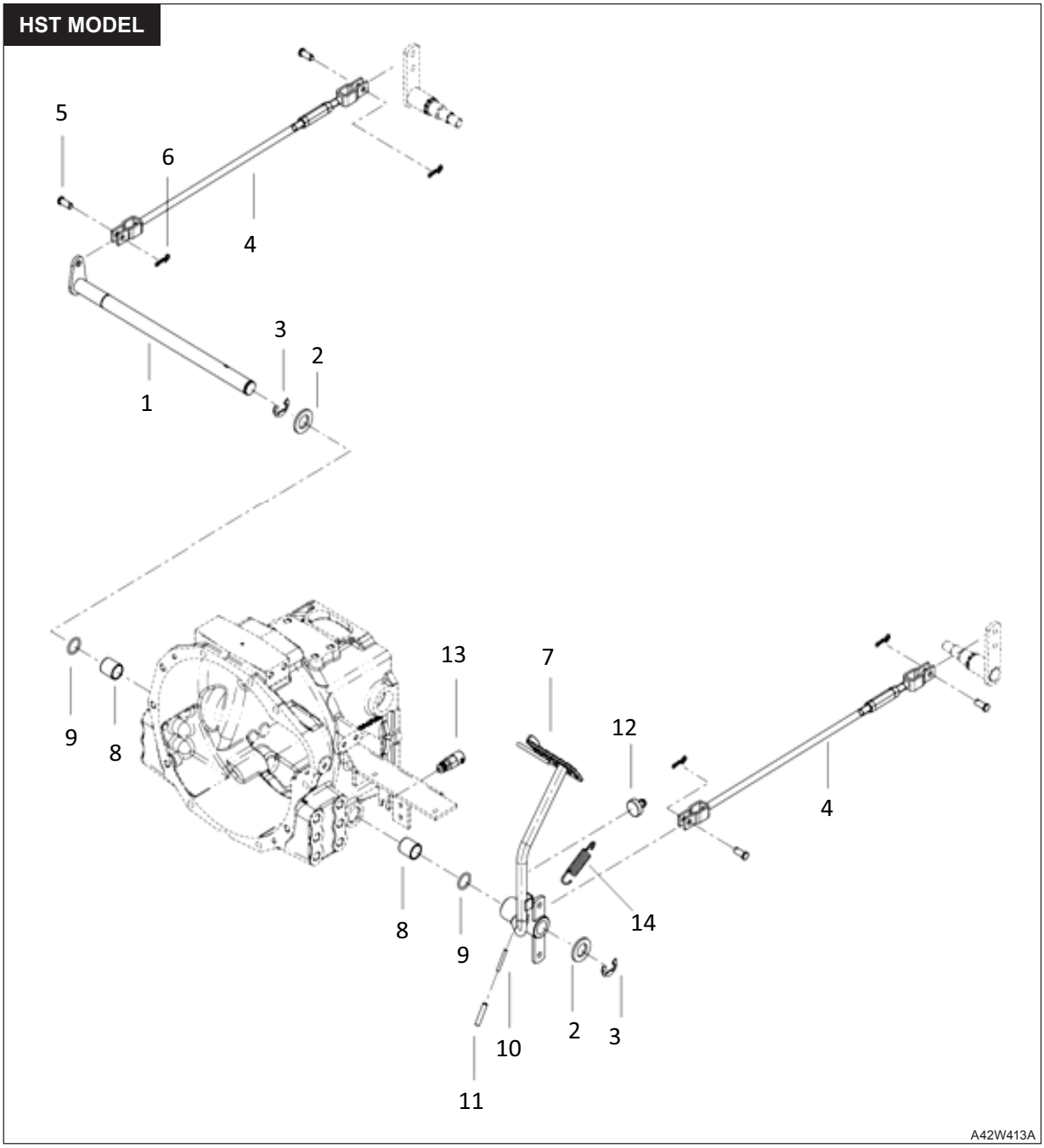
COMPONENTS

(1) Brake rod ass'y
(2) Brake shaft ass'y
(3) O-ring
(4) Dry bush
(5) Brake pedal
(6) Spring pin
(7) Spring pin
(8) Brake pedal
(9) Return spring
(10) Washer
(11) Snap ring
(12) Rubber stopper
(13) Pin
(14) Snap pin
(15) Stop lamp switch

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HST MODEL



COMPONENTS

(1) Brake shaft ass'y
(2) Washer
(3) Snap ring
(4) Brake rod ass'y
(5) Pin
(6) Snap pin
(7) Brake pedal
(8) Dry bush
(9) O-ring
(10) Spring pin
(11) Spring pin
(12) Rubber stopper
(13) Stop lamp switch
(14) Return spring

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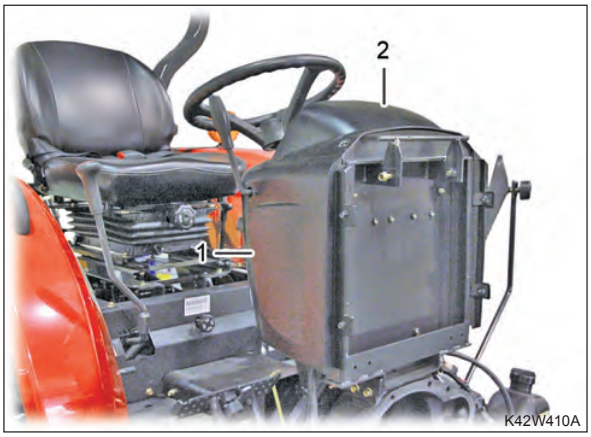
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5. DISASSEMBLY AND SERVICE

MEC. MODEL

5.1 CLUTCH HOUSING REMOVAL

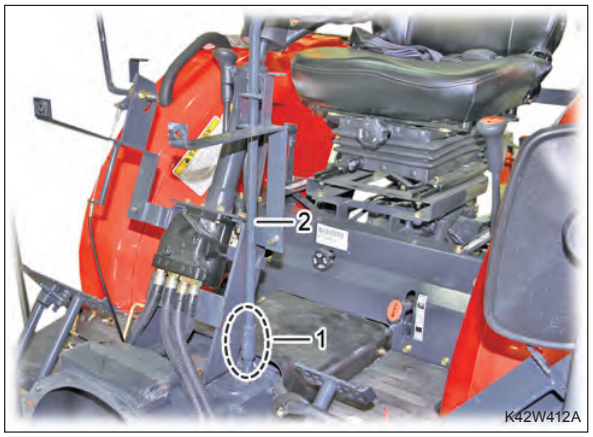
1. Remove the engine assembly.



2. Remove the dashboard (R, L)(1) and instrument panel cover (2).



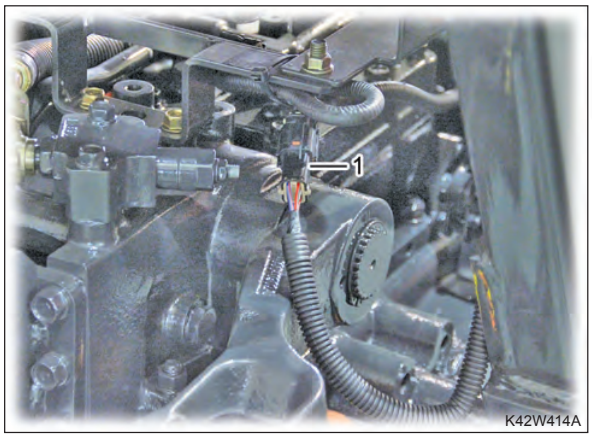
3. Remove the bonnet hinge assembly (1).

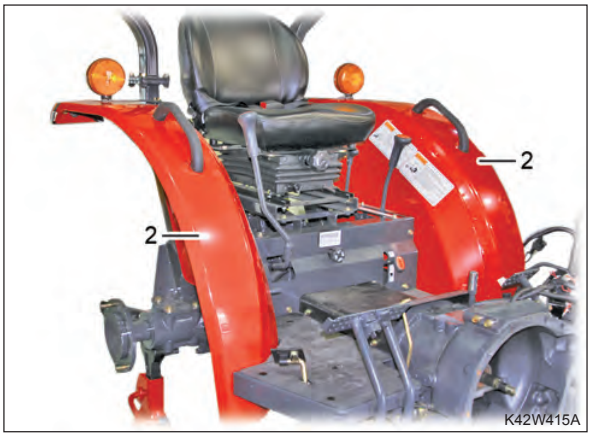


4. Pull out the spring pin (1)(2EA) to remove the F-R shuttle lever (2).



5. Remove the steering column assembly (1).

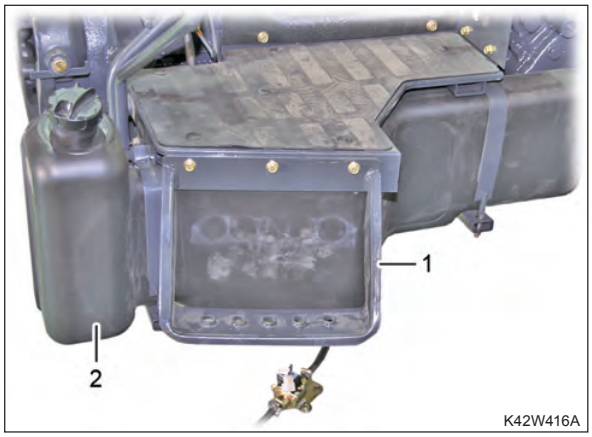




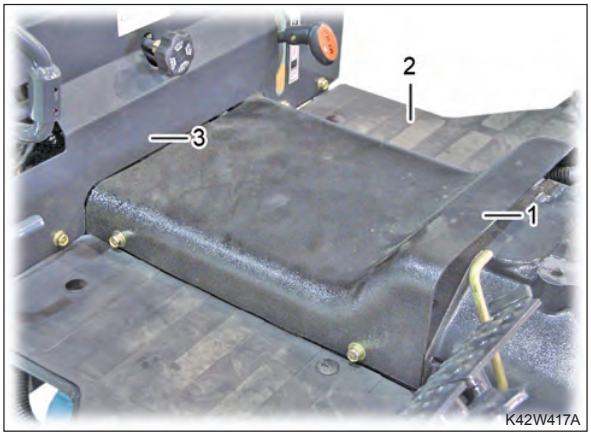
6. Disconnect the combination lamp wiring connector(1) and remove the fender assembly (2)(LH, RH).

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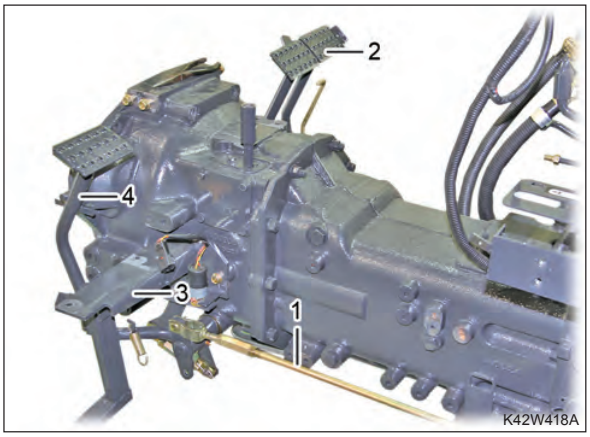
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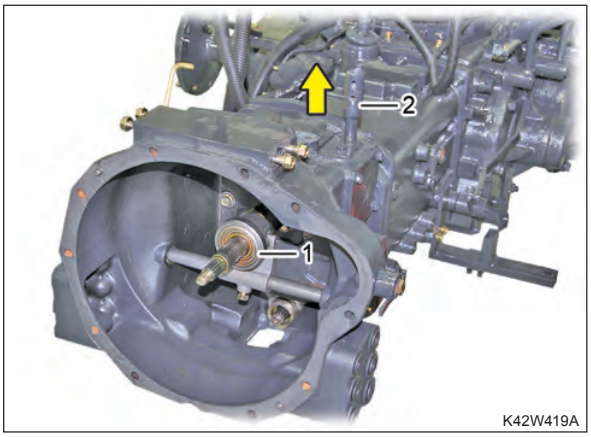
7. Remove the footstep (1) and fuel tank (2).



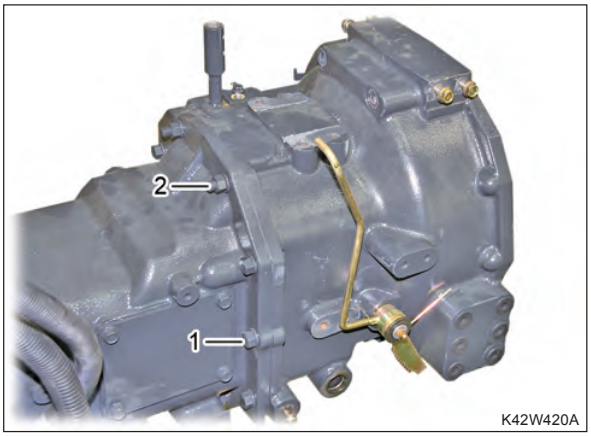
8. Remove the transmission case cover (1), floor mat (2)(LH, RH), dust cover assembly (3).

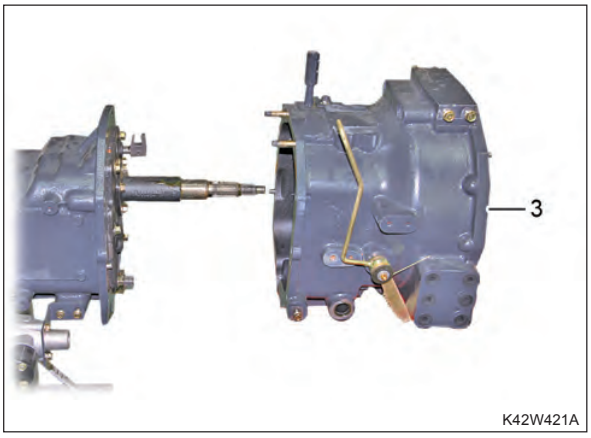


9. Remove the brake rod (1), brake pedal (2), footstep support assembly (3) and clutch pedal(4).



10. Remove the release bearing sleeve (1) and lift the shuttle shaft (2) to separate it from the fork.

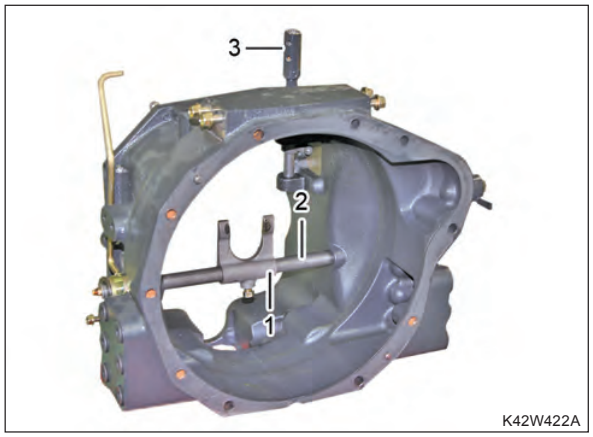




11. Unscrew the clutch housing & transmission case mounting bolts (1)(8EA) & nuts (2)(2EA) and remove the clutch housing (3).

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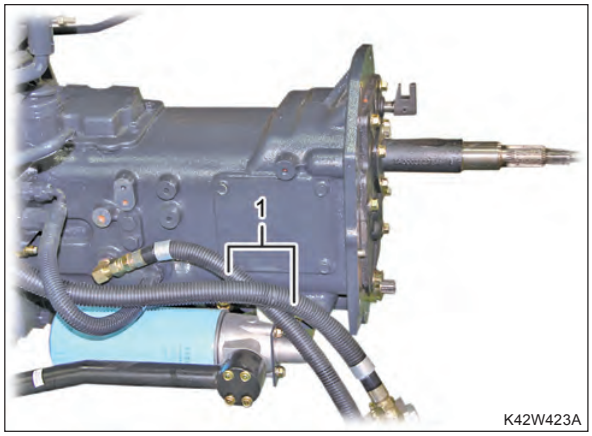
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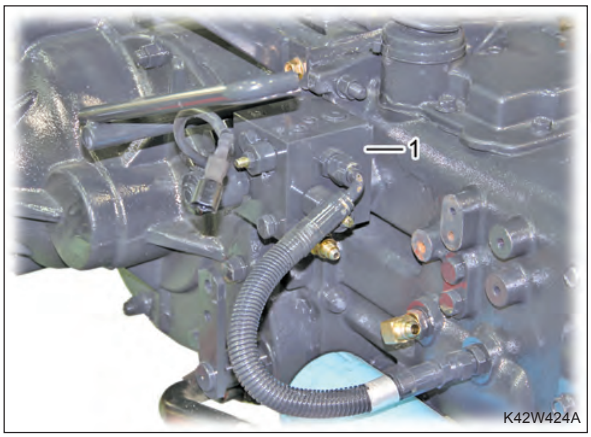
12. Remove the release yoke (1), release shaft (2) and shuttle shaft (3) from the clutch housing.

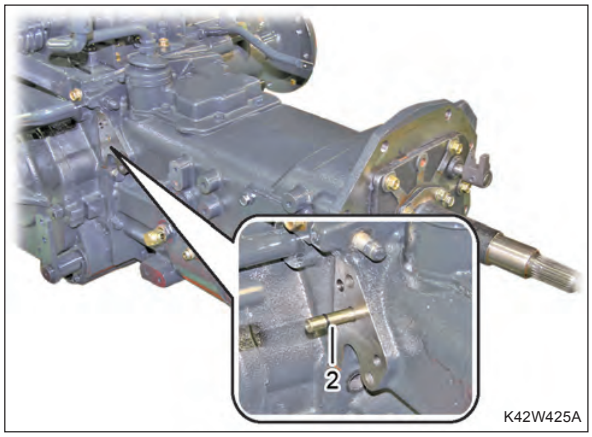
5.2 TRANSMISSION CASE ASSEMBLY DISASSEMBLY

1. Remove the clutch housing assembly.



2. Remove the high pressure hose (1) of front outlet valve.

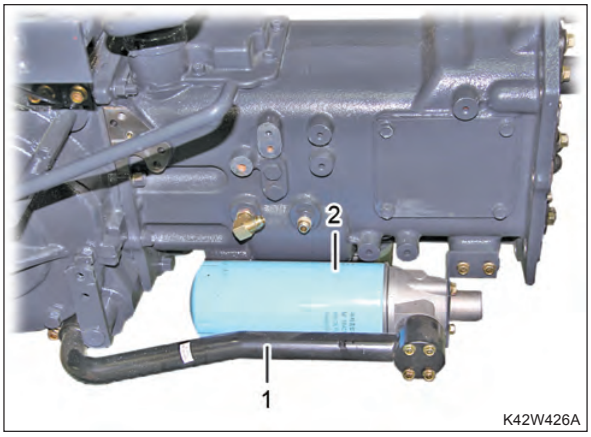




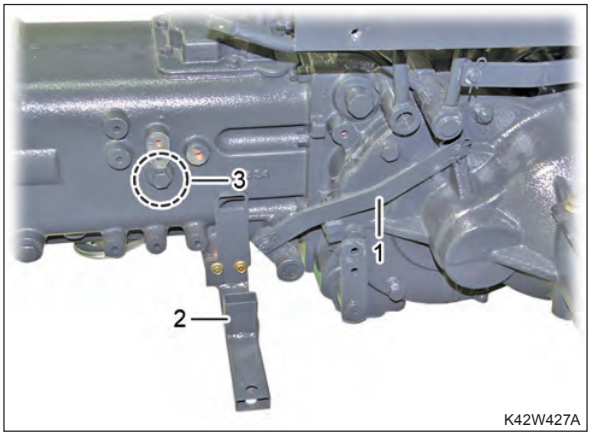
3. Remove the PTO valve(1) and disconnect the PTO clutch input pipe (2).

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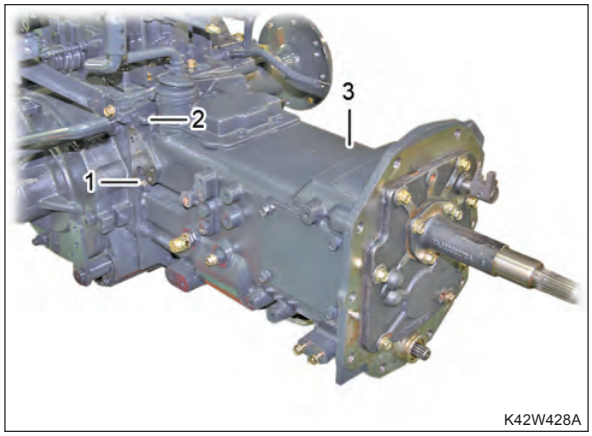
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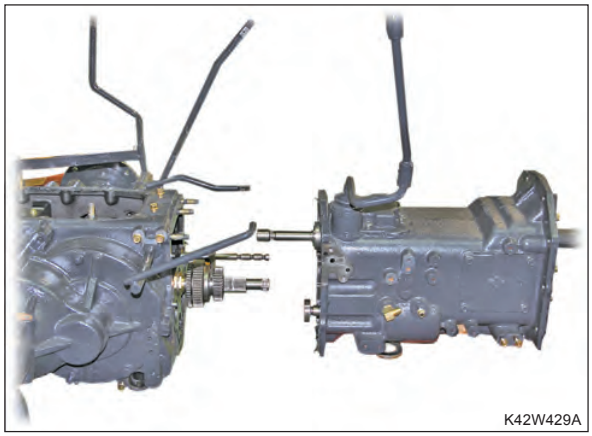


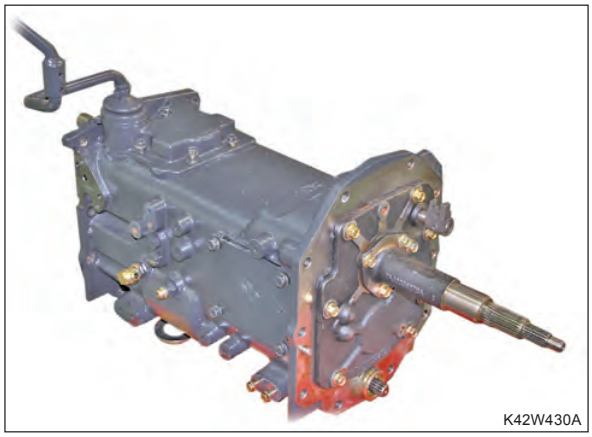
4. Remove the filter low pressure pipe (1) and hydraulic filter (2).



5. Remove the 4WD lever link (1) and fuel tank rear supporter (2). Then, unscrew the plug (3) to remove the spring and steel ball from in the hole.





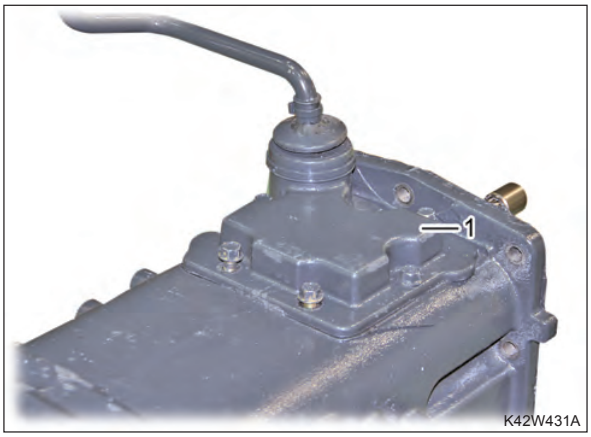


6. Unscrew the rear axle case & transmission case mounting bolts (1)(6EA) & nuts (2)(3EA) to remove the transmission case assembly (3).

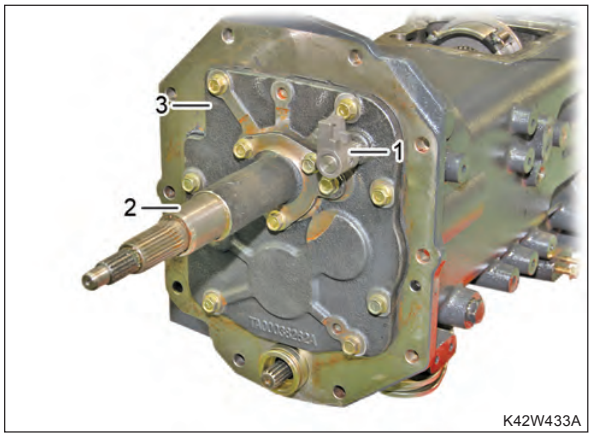
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5.3 TRANSMISSION CASE ASSEMBLY COMPONENTS DISASSEMBLY

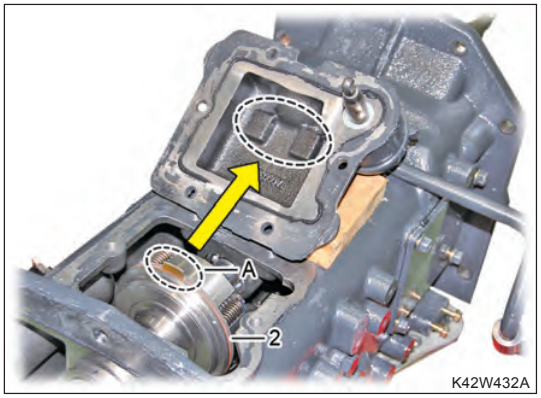


1. Remove the main shift lever assembly (1).

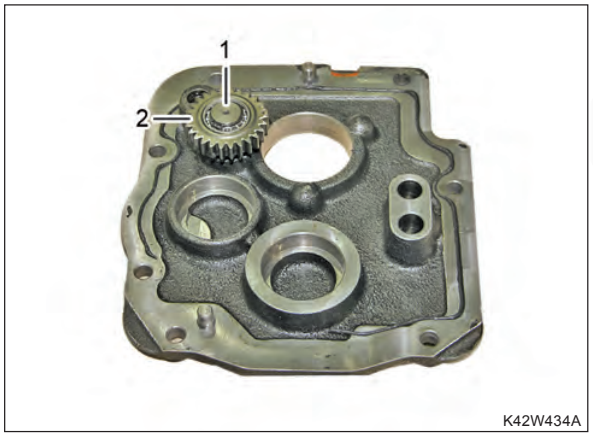


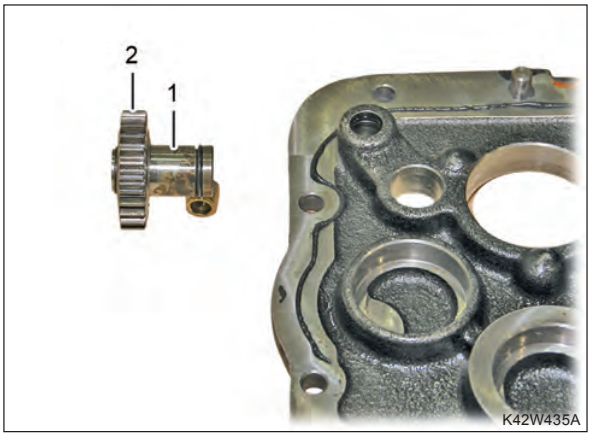
2. Remove the shuttle shift (1), oil seal cover (2) of main shaft and plate (3).

Notes



- **When installing the main shift lever assembly, set the brake plate protrusion (A) of the PTO clutch pack into the groove of the case.**
- **The brake plate (2) of the PTO clutch pack is set apart from the PTO clutch and fixed into the groove while the rear PTO is in operation. Only the PTO clutch pack body is rotated in this state. When the rear PTO is turned off in this state, the PTO clutch pack stops rotating as well. However, it may be rotated further by inertia of the rotating rear implement. To prevent such rotation by inertia, the PTO clutch is equipped with the brake plate. The brake plate is combined with the PTO clutch pack by compression of the piston returned by the internal spring when the PTO clutch is disengaged.**

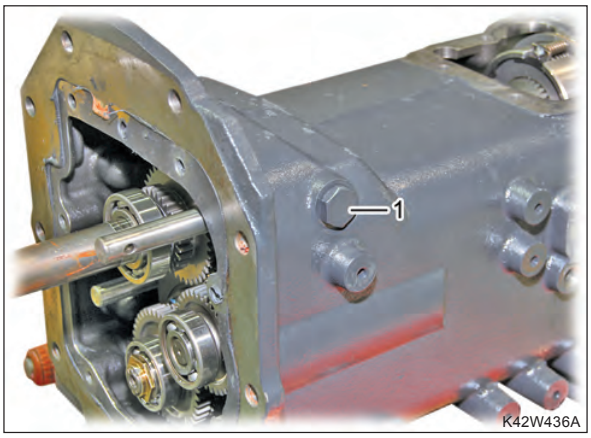


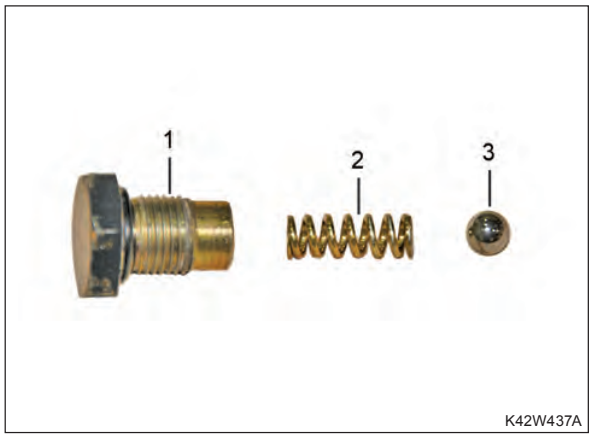


3. Remove the reverse idle shaft (1) and reverse idle gear (2) from the plate.

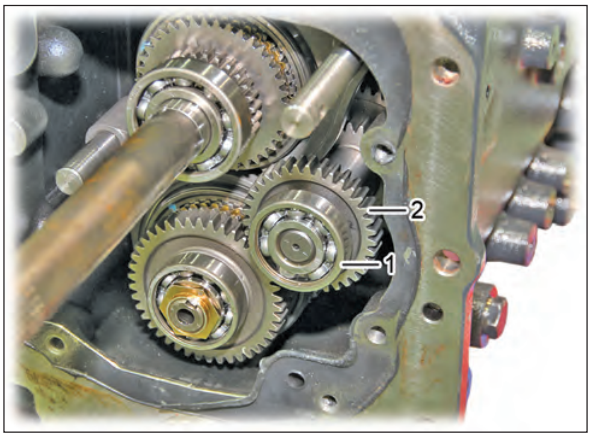
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4. Unscrew the plug (1) to remove the spring (2), steel ball (3).



5. Remove the main shift drive shaft bearing (1) and main shift 2nd drive gear (2).

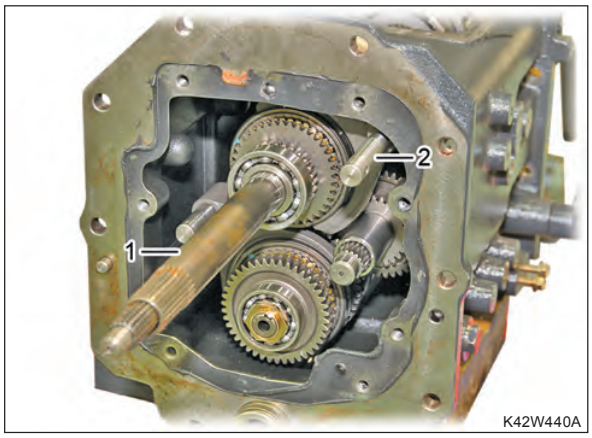
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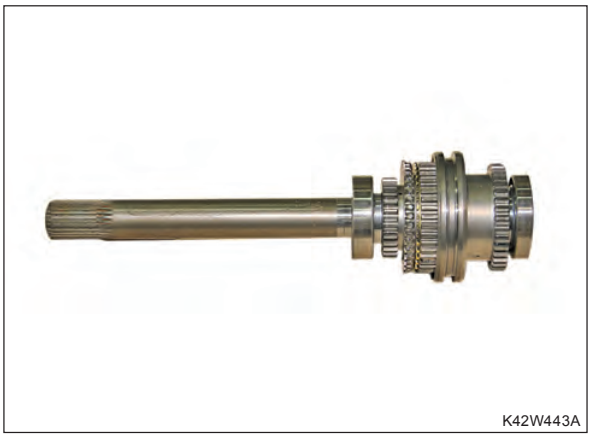


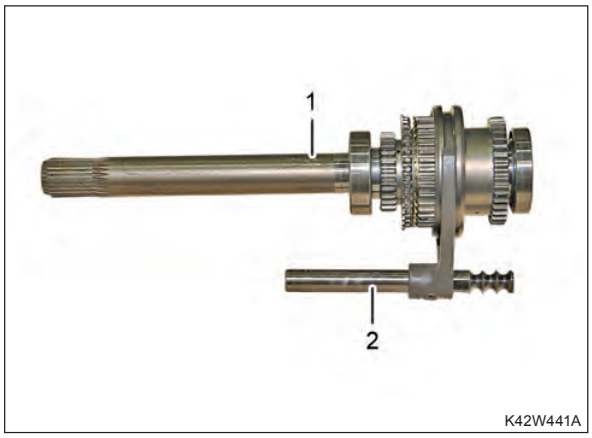
- **When installing the main shift 2nd gear, its long boss (A) should face the plate.**

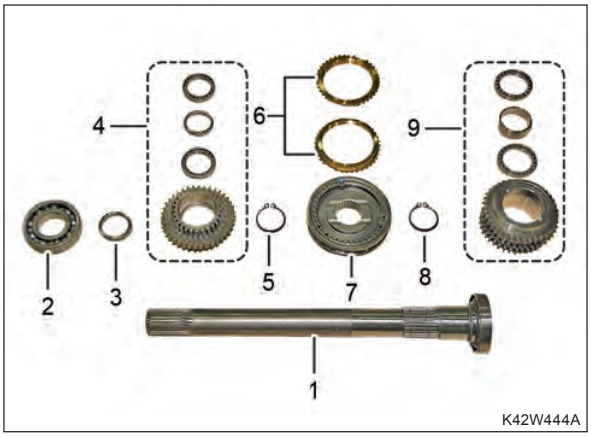
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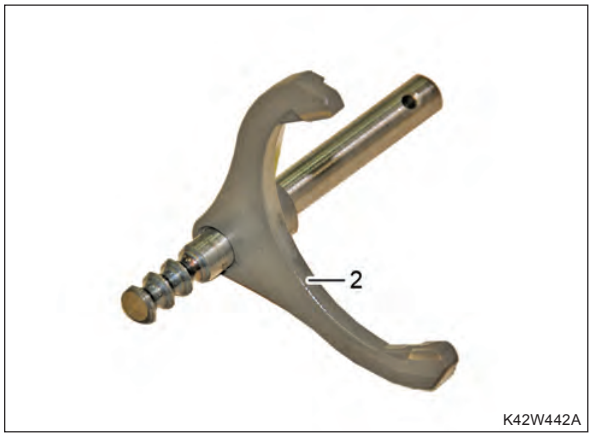
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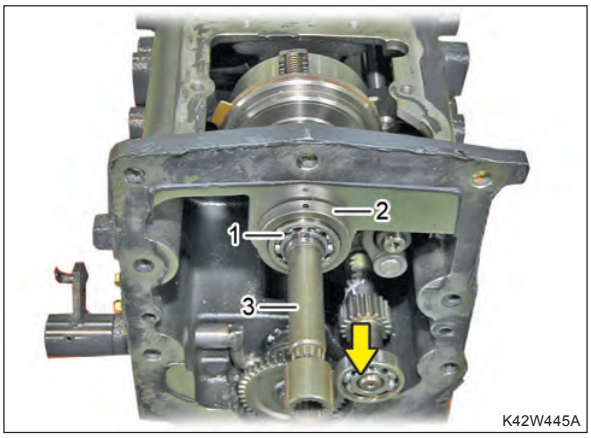


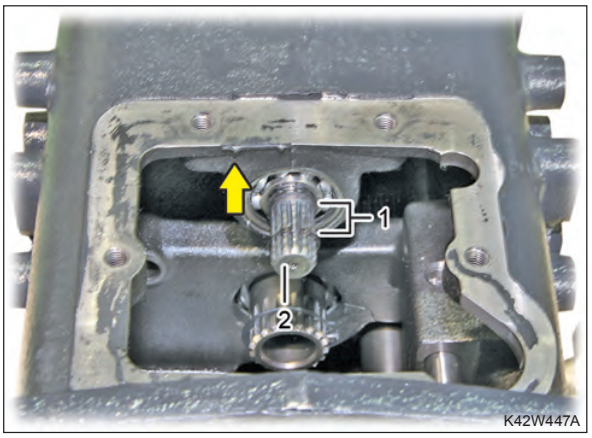
6. Remove the main shaft assembly (1) and F-R fork shaft (2) simultaneously.

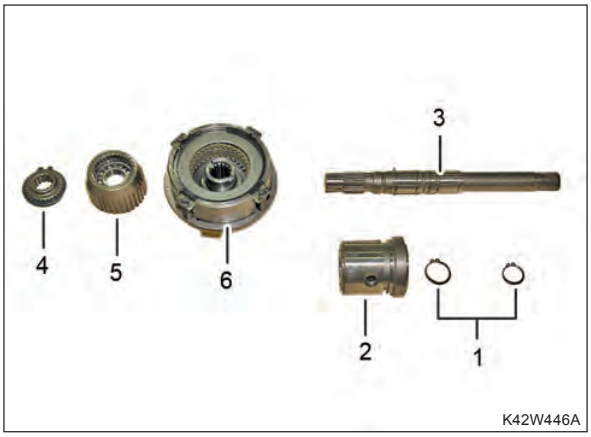
7. Remove the ball bearing (2), spacer (3), reverse drive gear assembly (4), snap ring (5), synchronizer ring (6), Hub Sleeve assembly (7), snap ring (8), Forward drive gear assembly (9) from the main shaft (1) in order.

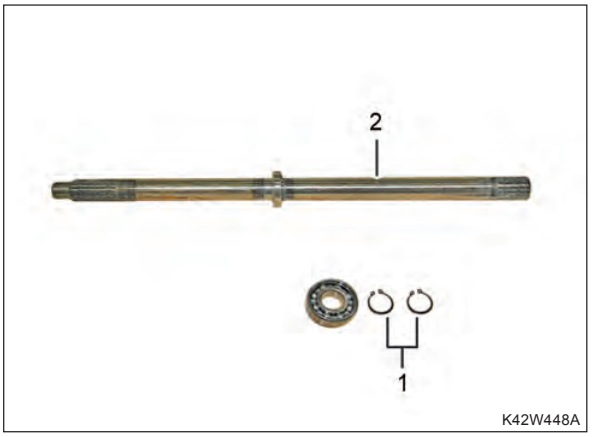
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8. Remove the PTO clutch shaft snap ring (1) and sleeve (2). Then, remove the PTO clutch shaft (3), joint (4), clutch hub (5) PTO clutch assembly (6) simultaneously.

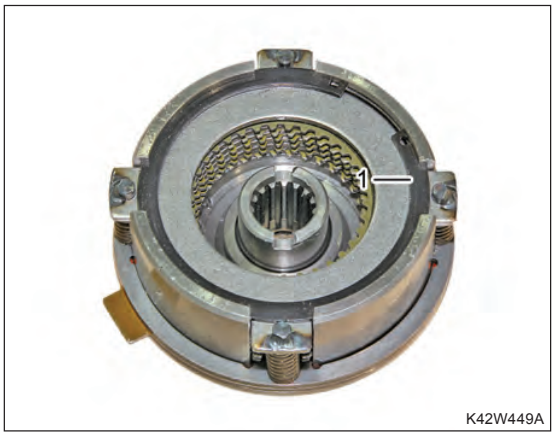
9. Remove the main PTO shaft snap ring (1)(2EA) and main PTO shaft (2).

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Notes

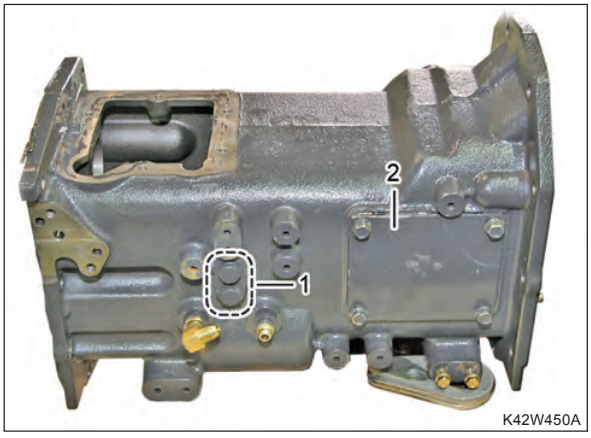
▶ **PTO CLUTCH PACK COMPONENTS DISASSEMBLY**



K42W449A

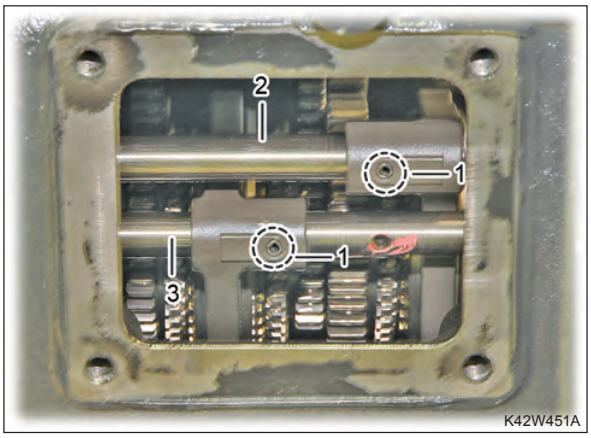

K20W4A05

- Pull out the stop ring (1) and remove the spring, pressure plate, plate, disc, brake, piston, case.

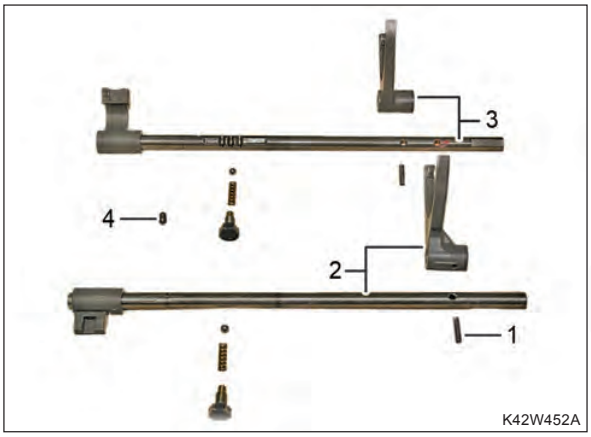


K42W450A

10. Unscrew the plug (1) and remove the spring and steel ball. Then, remove the main shift fork cover (2).



K42W451A



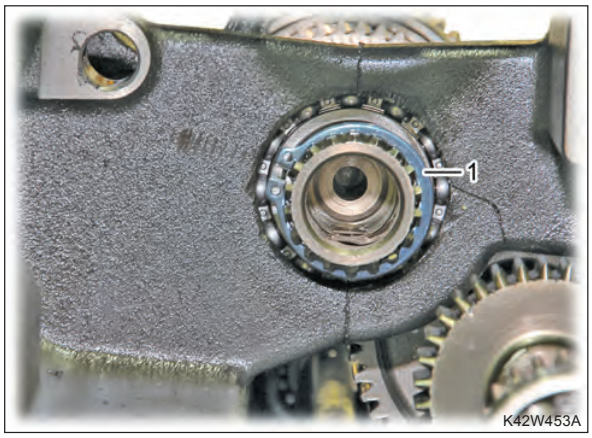
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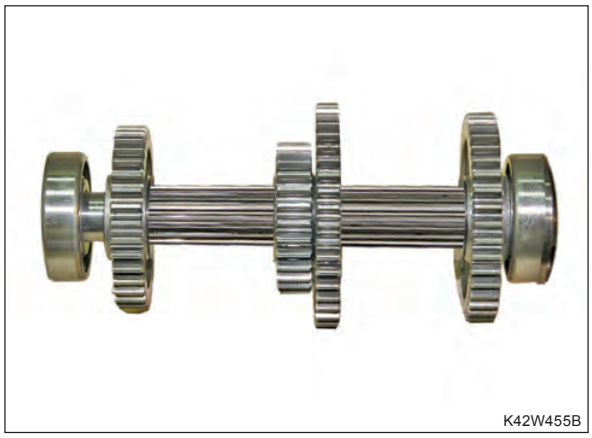
11. Pull out the spring pin (1) and remove the main shift fork shaft, main shift fork (1-2nd)(2), (3-4th)(3) and anti-pairing pin (4).

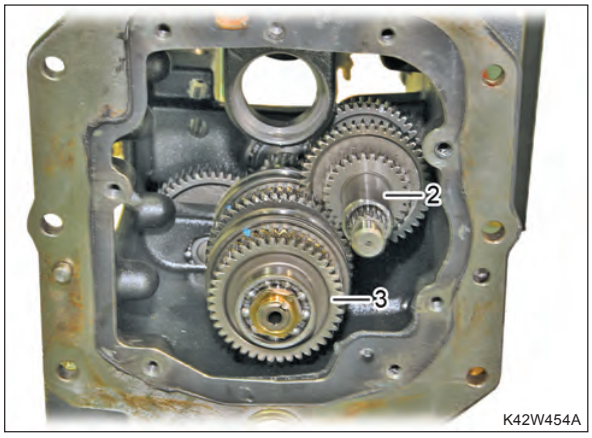
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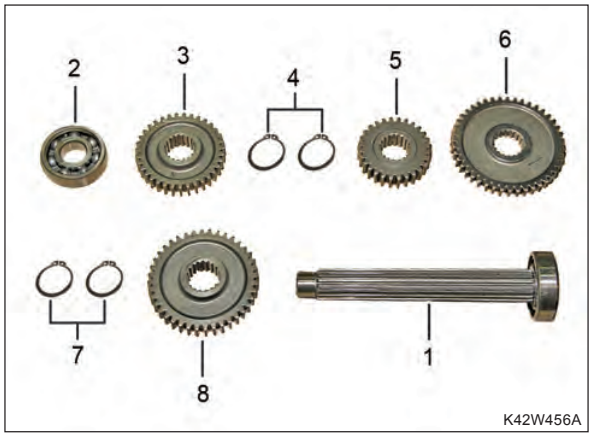
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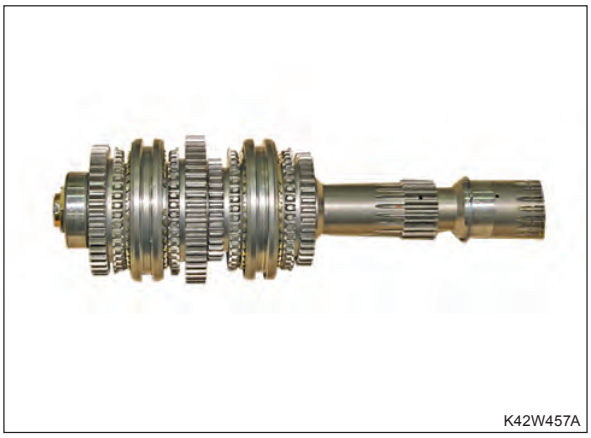


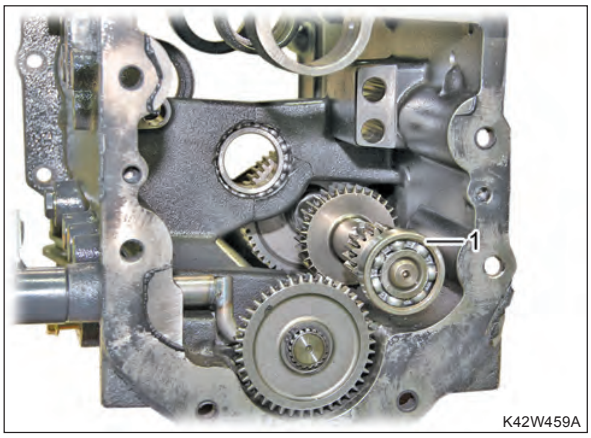
12. Remove the main shift driven shaft snap ring (1). Then, remove the main shift drive shaft assembly (2) and main shift driven shaft assembly (3) simultaneously.

13. Remove the ball bearing (2), main shift 2nd drive gear (3), snap ring (4)(2EA), main shift 1st drive gear (5), main shift 4th drive gear (6), snap ring (7)(2EA) and main shift 3rd drive gear (8) from the main shift drive shaft (1) in order.

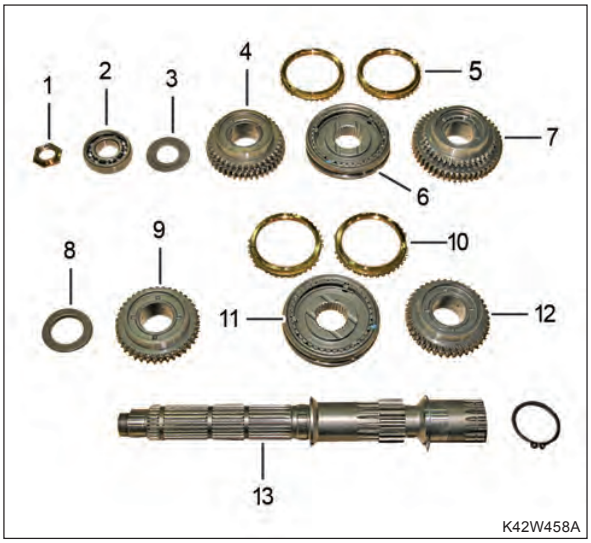
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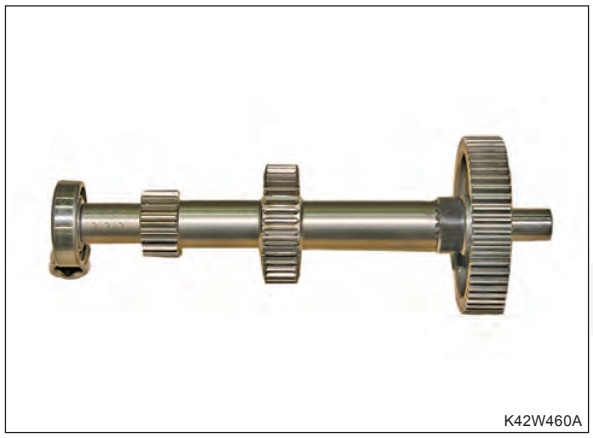


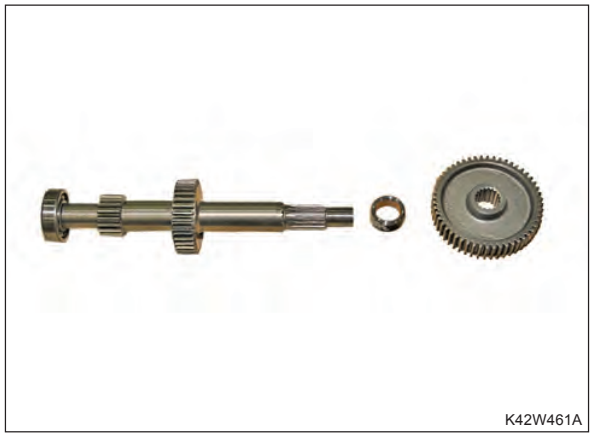
K42W459A



K42W458A

14. Unscrew the mounting nut (1) and remove the ball bearing (2), spacer (3), main shift 2nd driven gear (4), synchronizer ring (5), sleeve (6), main shift 1st driven gear (7), spacer (8), main shift 4th driven gear (9), synchronizer ring (10), sleeve (11), main shift 3rd driven gear (12) from the main shift driven shaft (13) in order.


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K42W461A

15. Remove the range shift drive shaft (1).

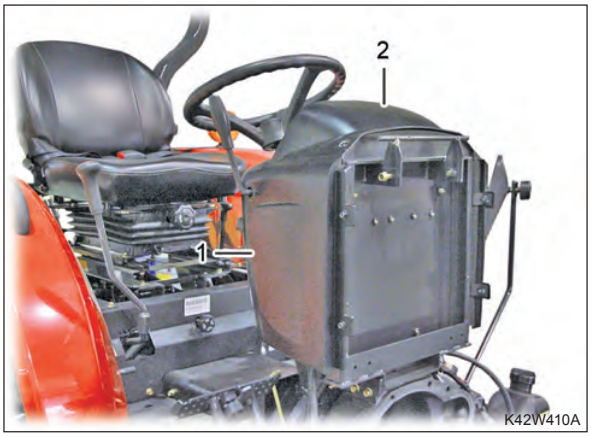
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HST MODEL

5.1 CLUTCH HOUSING REMOVAL

1. Remove the engine assembly.



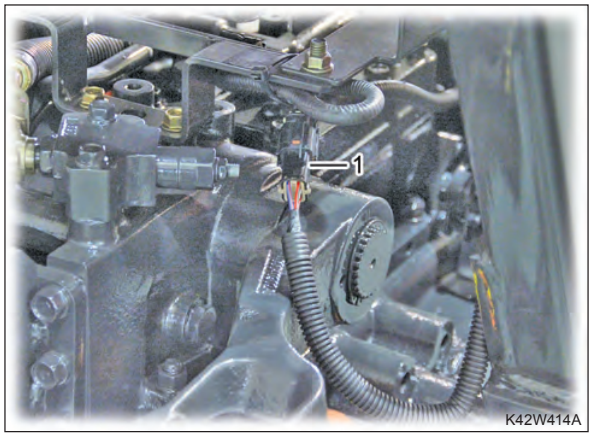
2. Remove the dashboard (R, L)(1) and instrument panel cover (2).

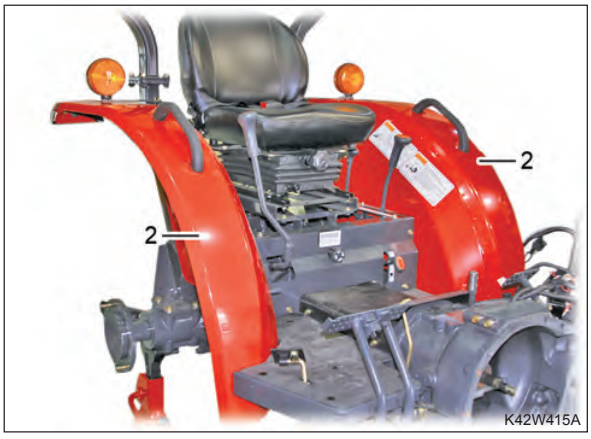


3. Remove the bonnet hinge assembly (1).



4. Remove the steering column assembly (1).

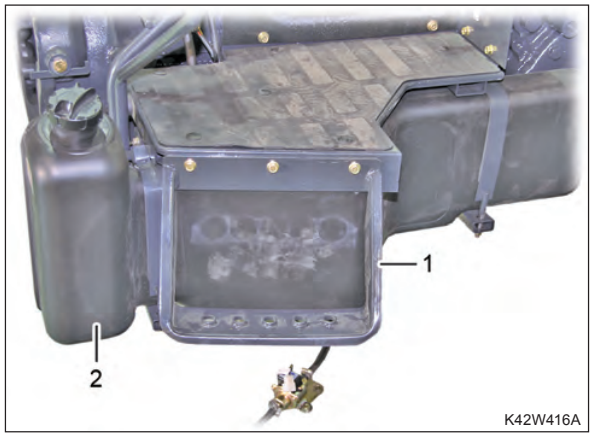




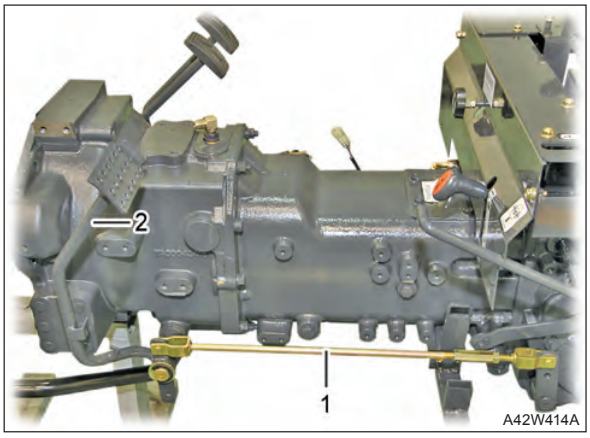
5. Disconnect the combination lamp wiring connector (1) and remove the fender assembly (2)(LH, RH).

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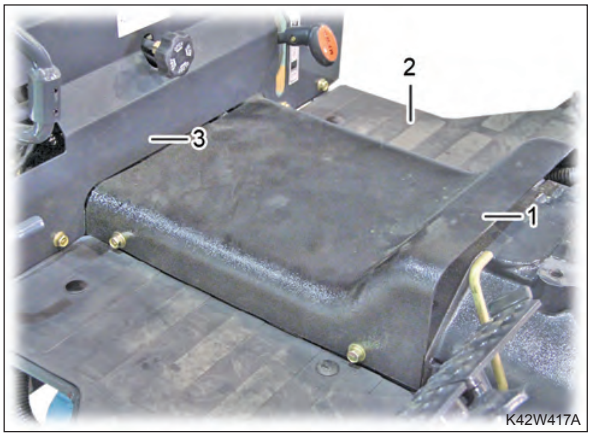
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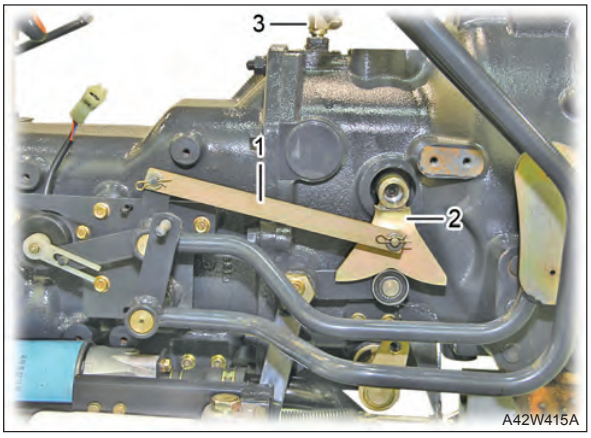
6. Remove the footstep (1) and fuel tank (2).



8. Remove the brake rod (1), brake pedal (2).



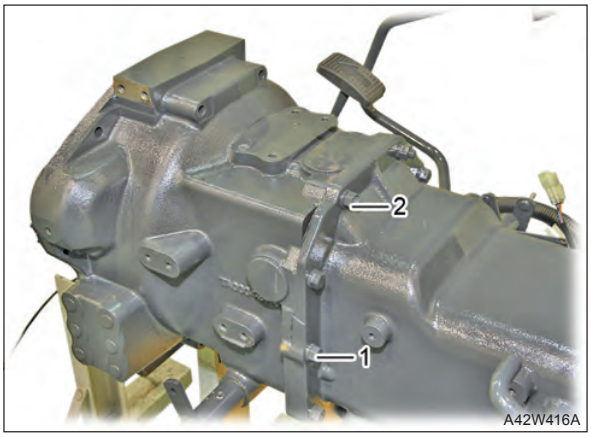
7. Remove the transmission case cover (1), floor mat (2)(LH, RH), dust cover assembly (3).

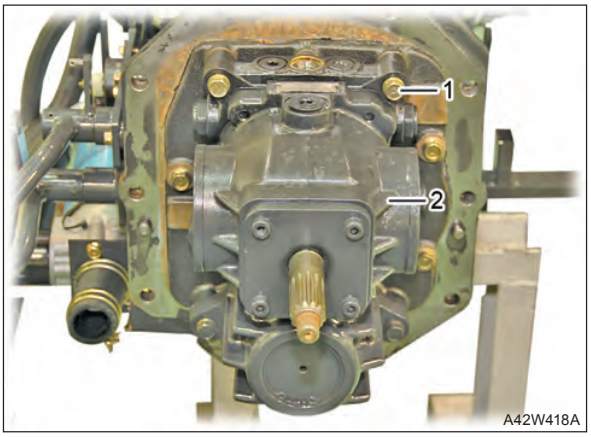


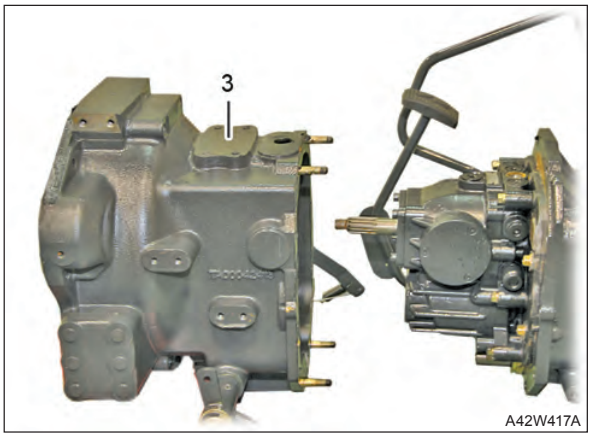
9. Remove the HST arm connecting plate (1), HST arm (2) and elbow (3).

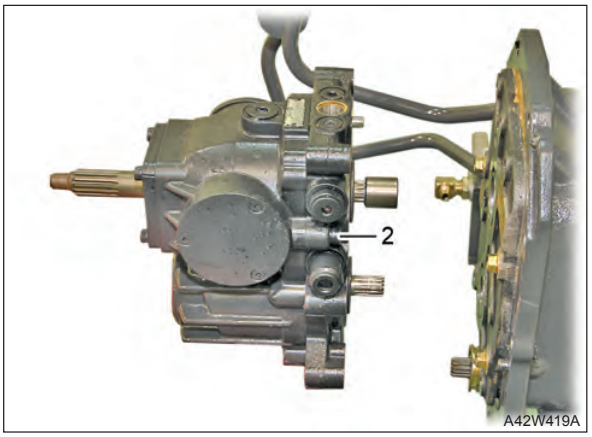
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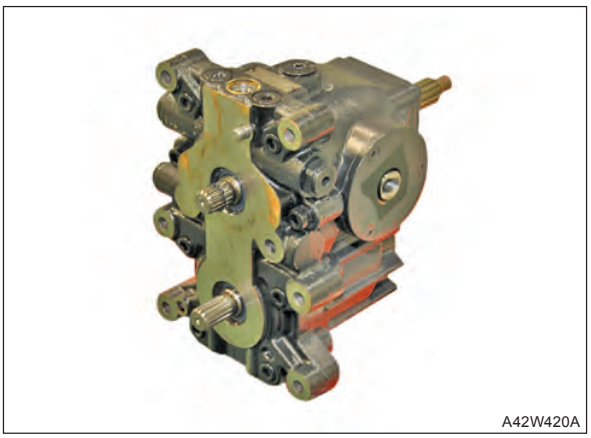








10. Unscrew the clutch housing & transmission case mounting bolts (1)(6EA) & nuts (2)(4EA) and remove the clutch housing (3).



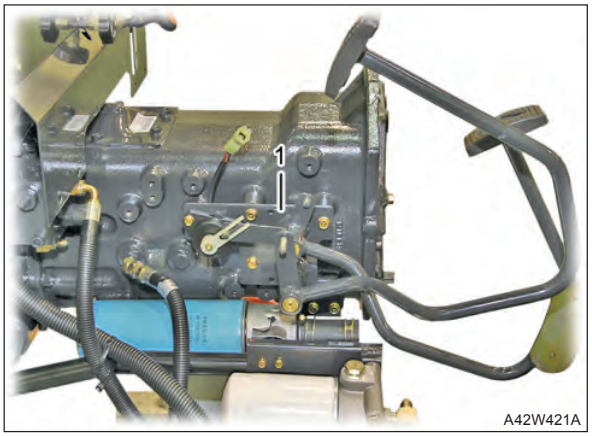
11. Unscrew the HST mounting bolts (1)(6EA) and remove the HST (2) from the transmission case.

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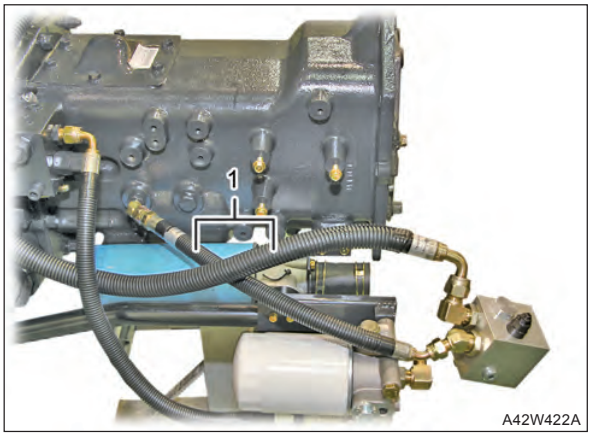
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5.2 TRANSMISSION CASE ASSEMBLY DISASSEMBLY

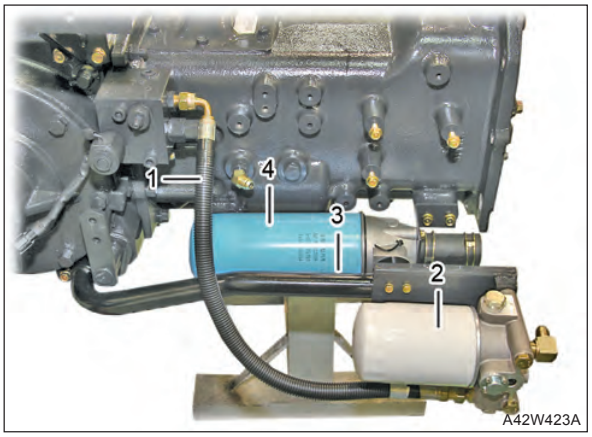
1. Remove the clutch housing assembly.
2. Remove the HST assembly.



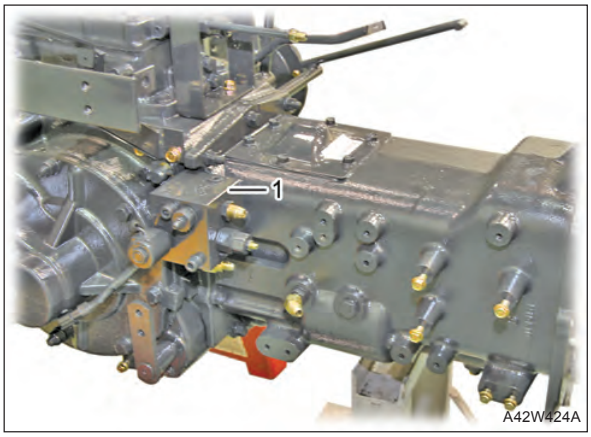
3. Remove the HST pedal pedal assembly (1).

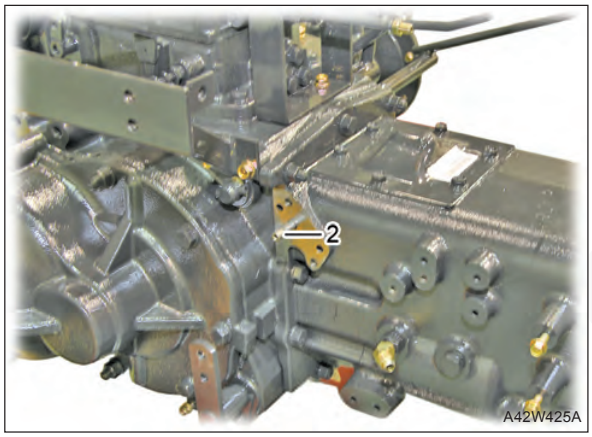


4. Remove the high pressure hose (1) of front outlet valve.

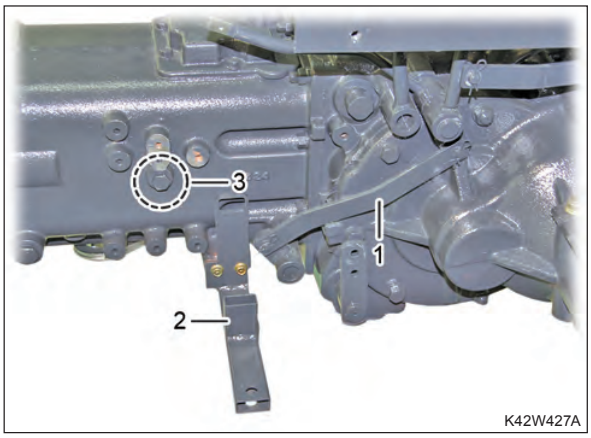


5. Remove the PTO valve hydraulic hose (1), HST filter (2), hydraulic oil suction pipe (3) and hydraulic filter (4).





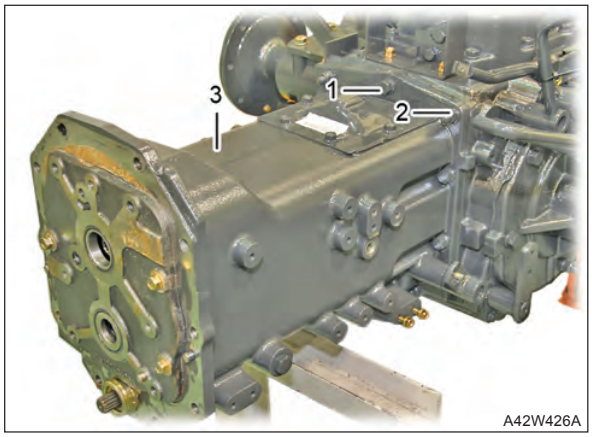
6. Remove the PTO valve(1) and disconnect the PTO clutch input pipe (2).



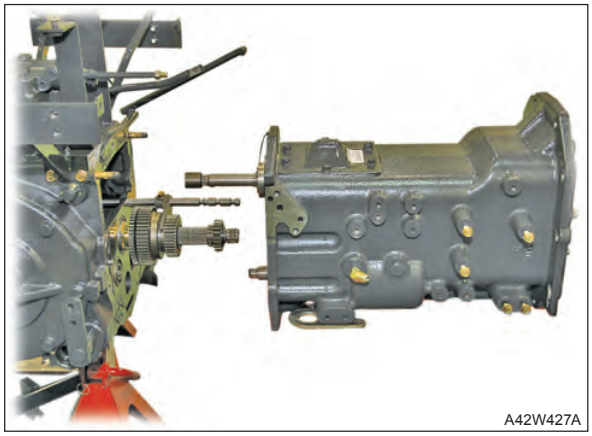
7. Remove the 4WD lever link (1) and fuel tank rear supporter (2). Then, unscrew the plug (3) to remove the spring and steel ball from in the hole.

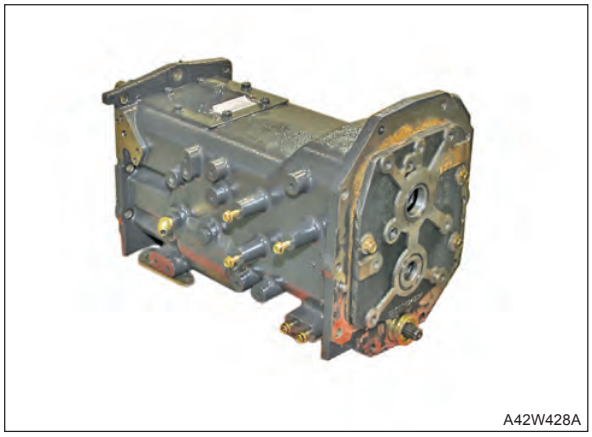
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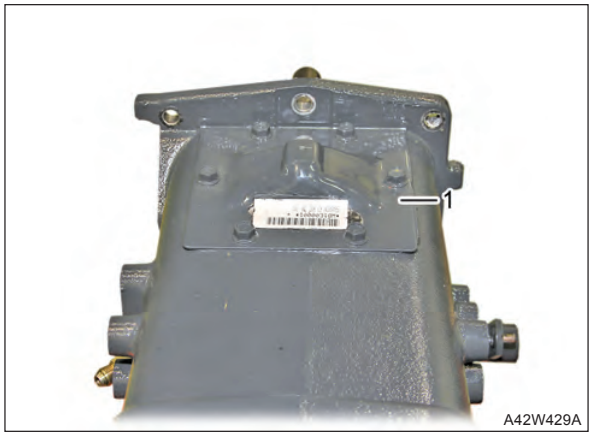
A42W426A


A42W427A


A42W428A

8. Unscrew the rear axle case & transmission case mounting bolts (1)(7EA) & nuts (2)(2EA) to remove the transmission case assembly (3).

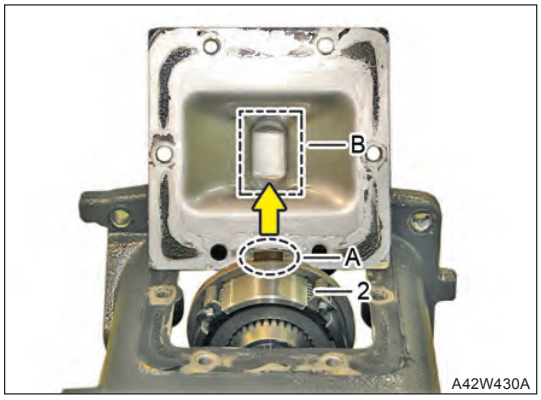
5.3 TRANSMISSION CASE ASSEMBLY COMPONENTS DISASSEMBLY



A42W429A

1. Remove the PTO clutch cover (1).

Notes

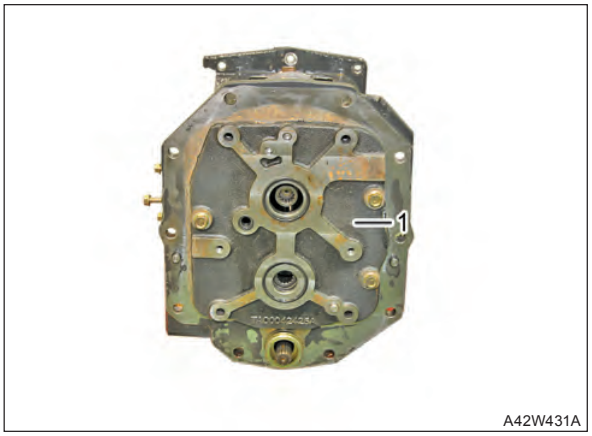


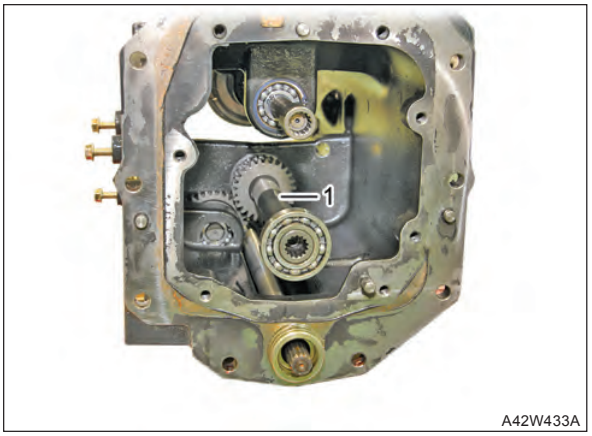
A42W430A

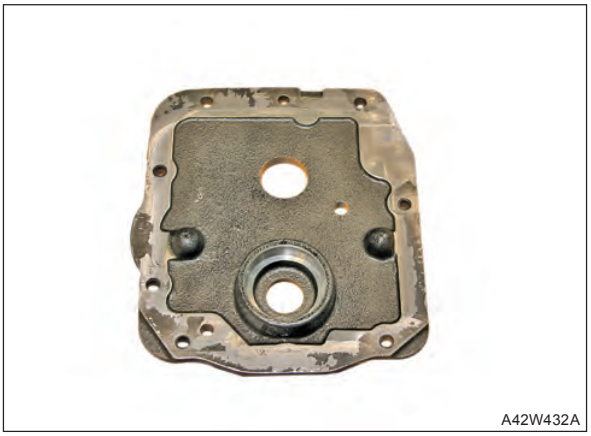
- When installing the PTO clutch cover, set the brake plate protrusion (A) of the PTO clutch pack into the groove of the case.
- The brake plate (2) of the PTO clutch pack is set apart from the PTO clutch and fixed into the groove while the rear PTO is in operation. Only the PTO clutch pack body is rotated in this state. When the rear PTO is turned off in this state, the PTO clutch pack stops rotating as well. However, it may be rotated further by inertia of the rotating rear implement. To prevent such rotation by inertia, the PTO clutch is equipped with the brake plate. The brake plate is combined with the PTO clutch pack by compression of the piston returned by the internal spring when the PTO clutch is disengaged.

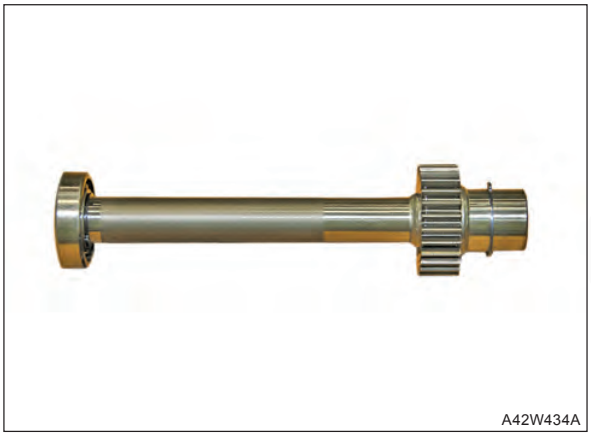
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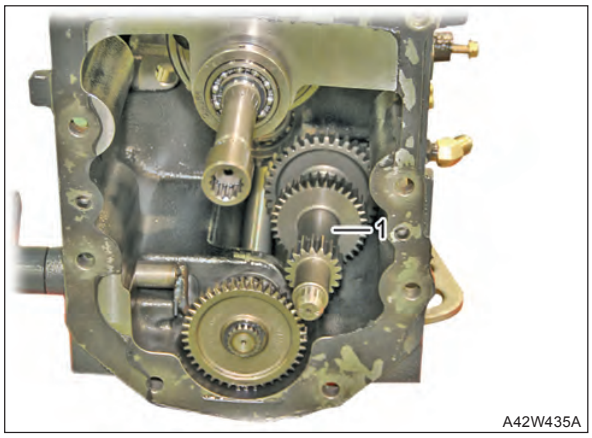


2. Remove the plate (1).

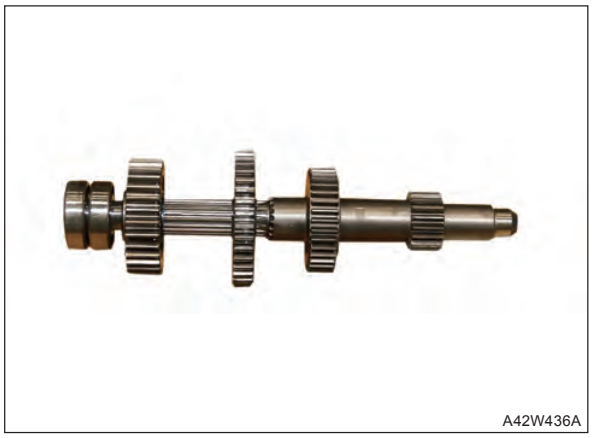
3. Remove the range shift drive shaft (1).

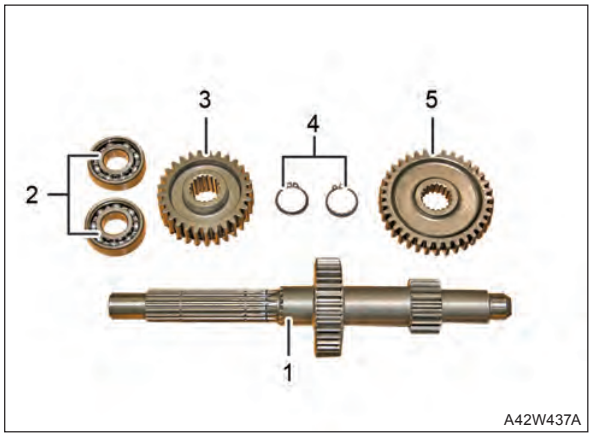
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A42W435A

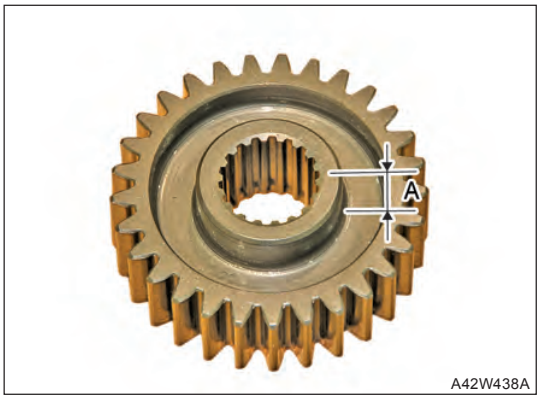

A42W436A



A42W437A

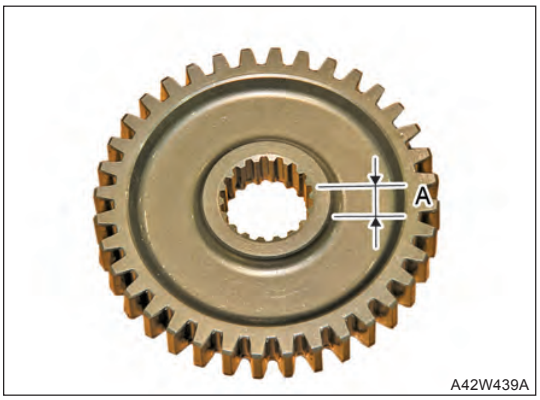
4. Remove the range shift drive gear shaft (1), ball bearing (2), range shift driven gear [29T] (3), snap ring (4) and range shift (C) drive gear [36T] (5) from the range shift drive gear shaft in order.

Notes



A42W438A

1. During the range shift driven gear installation, make sure that the higher part of boss (A) section toward ball bearing side.

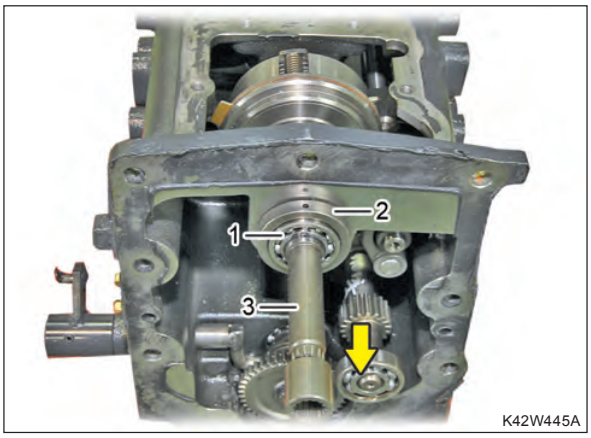


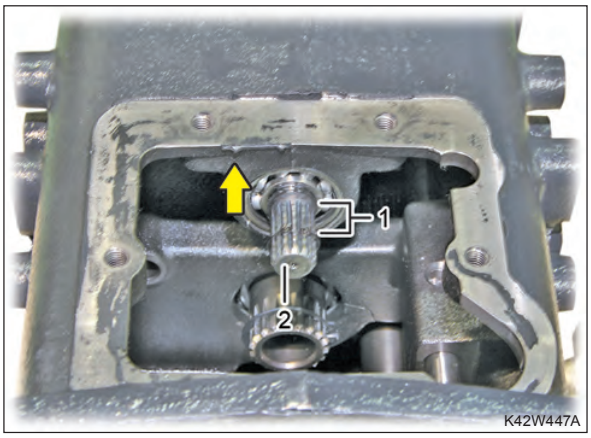
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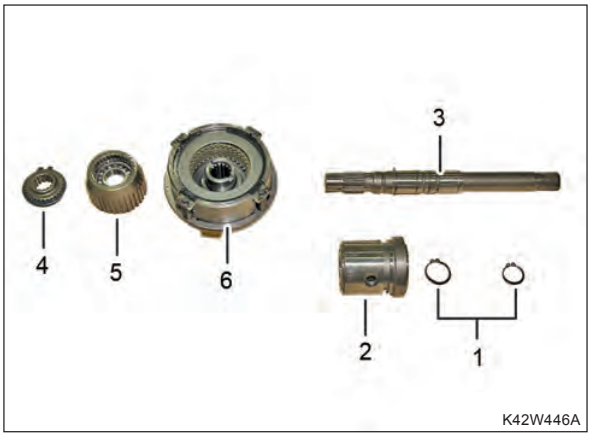
2. During the range shift C drive gear installation, make sure that the lower part of boss (A) section toward ball bearing side.

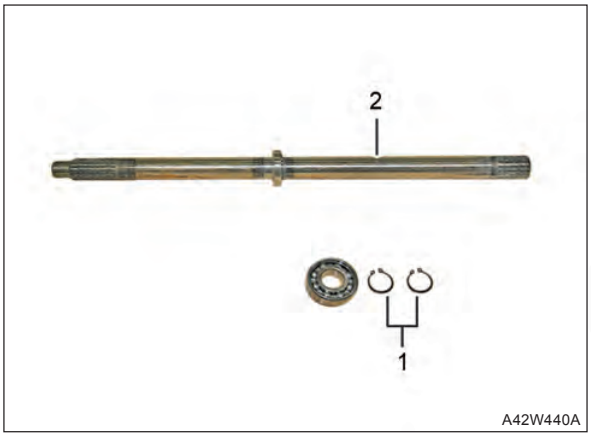
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5. Remove the PTO clutch shaft snap ring (1) and sleeve (2). Then, remove the PTO clutch shaft (3), joint (4), clutch hub (5) PTO clutch assembly (6) simultaneously.

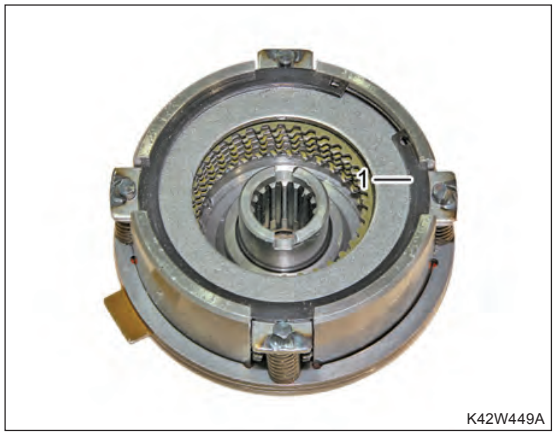
6. Remove the main PTO shaft snap ring (1)(2EA) and main PTO shaft (2).

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Notes

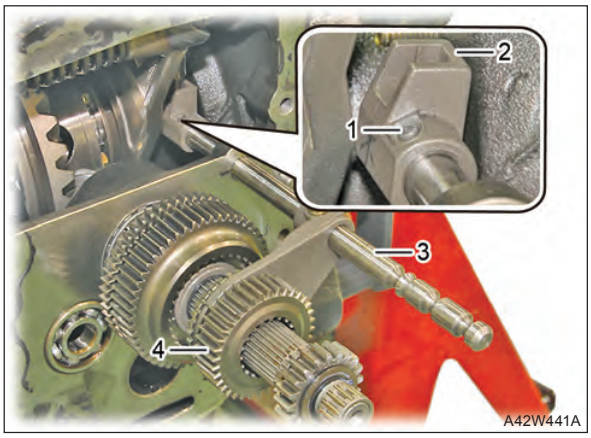
▶ **PTO CLUTCH PACK COMPONENTS DISASSEMBLY**



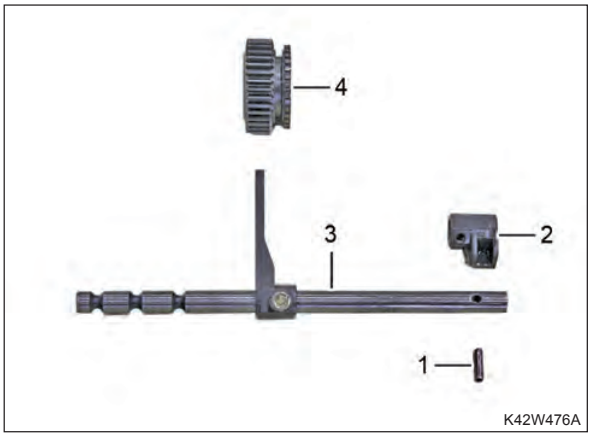
K42W449A


K20W4A05

- Pull out the stop ring (1) and remove the spring, pressure plate, plate, disc, brake, piston, case.



A42W441A

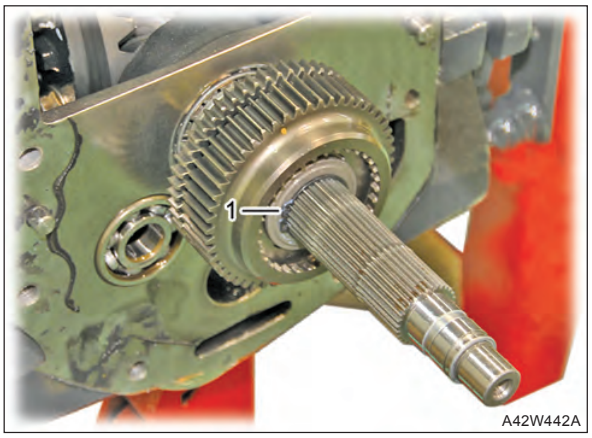


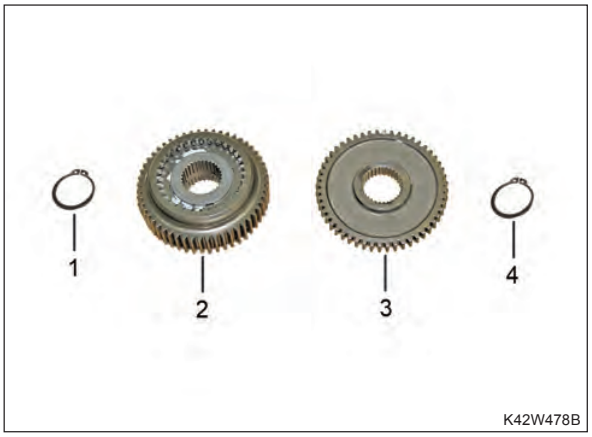
K42W476A

7. Pull out the spring pin (1) and remove the range shift shifter (2). Then, remove the range shift fork shaft (3) and range shift driven gear 2nd (4) simultaneously.

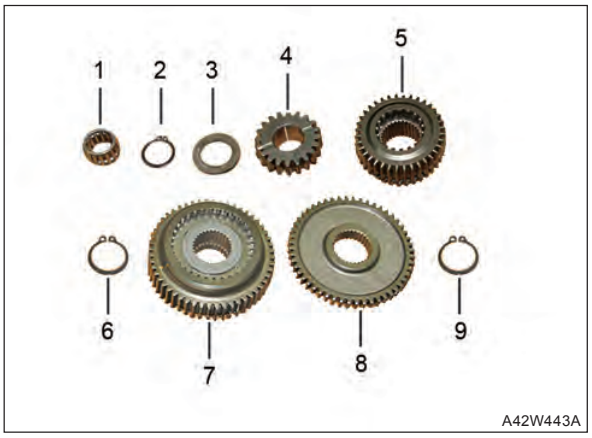
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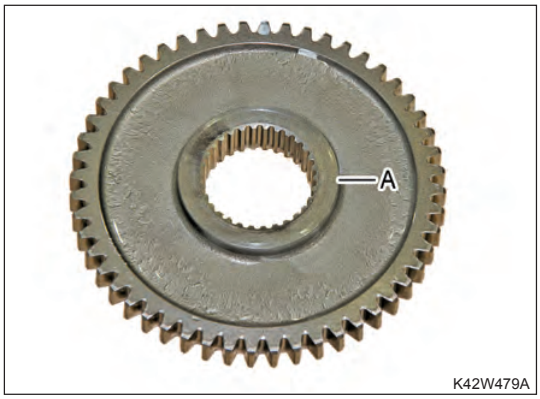


8. Pull out the snap ring (1) and remove the range shift driven gear 1st (2), 4WD gear (3) and snap ring (4).

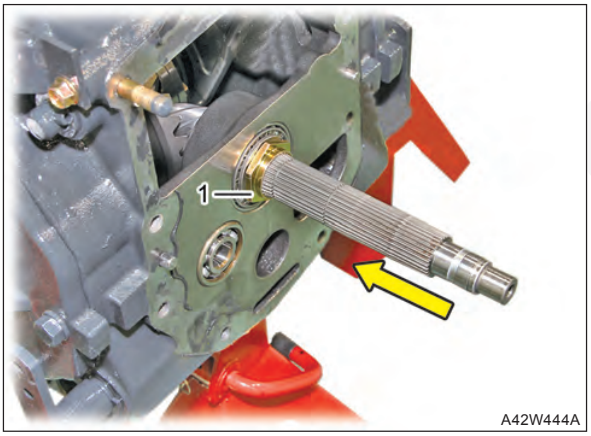


9. Remove the needle bearing (1), snap ring (2), spacer (3), range shift C driven gear (4), range shift driven gear 2nd (5), snap ring (6), range shift driven gear 1st (7), 4WD gear (8) and snap ring (9) from the counter shaft in order.

Notes



- **When installing the 4WD gear, its higher boss (A) should face the range shift driven gear 1st.**



10. Unfold the caulking part of the counter shaft mounting nuts (1) to unscrew the mounting nuts. Then, remove the counter shaft in the rear axle case by tapping outside direction. (Remove the differential system assembly first)

Mounting nut
tightening torque .....78.4 ~ 98 N.m
8 ~ 10 kgf.m
57.6 ~ 72 lb.ft

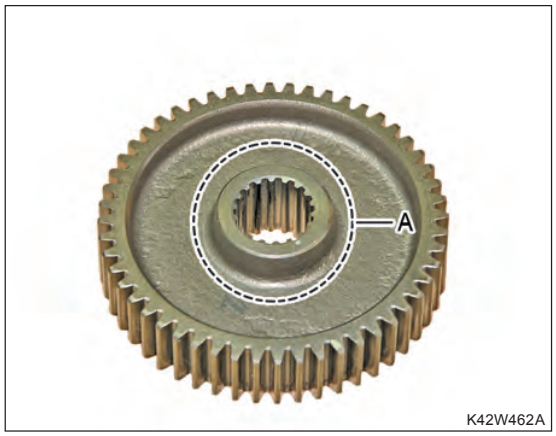
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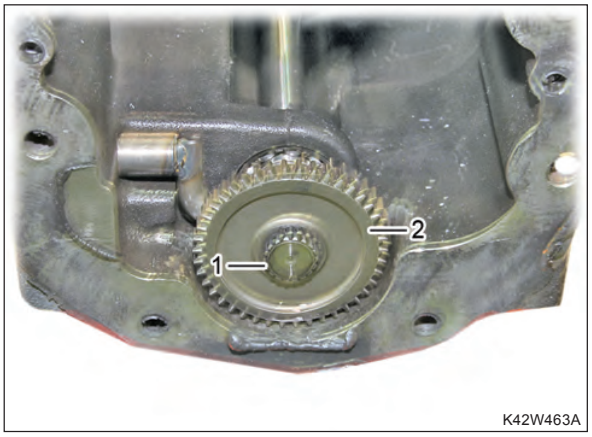
5.3.1 4WD SHAFT DISASSEMBLY [MEC. MODEL/HST MODEL]

Notes

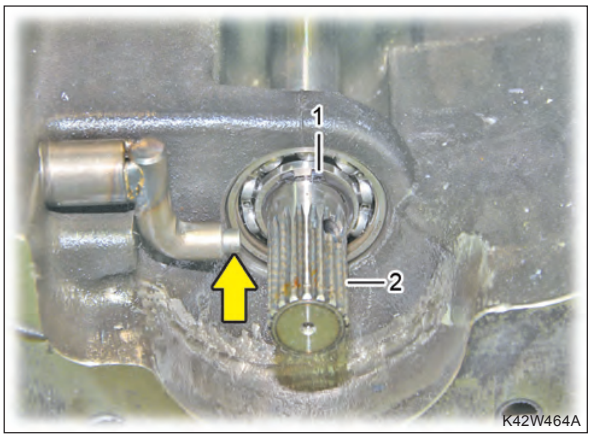
▶ **MAIN SHIFT DRIVEN SHAFT DISASSEMBLY**



- When installing the range shift drive gear, its long boss (A) should face the clutch housing.



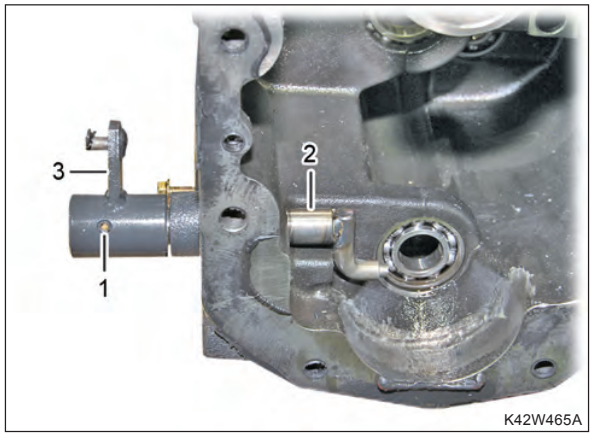
1. Pull out snap ring (1) and remove the 4WD gear (2).

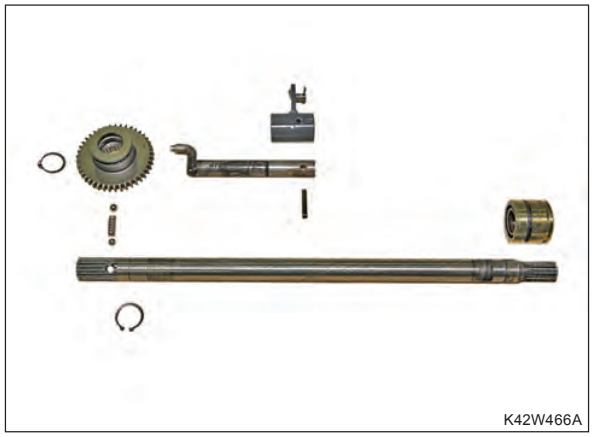


2. Pull out snap ring (1) and remove the 4WD shaft (2), oil seal housing in the clutch housing side direction.

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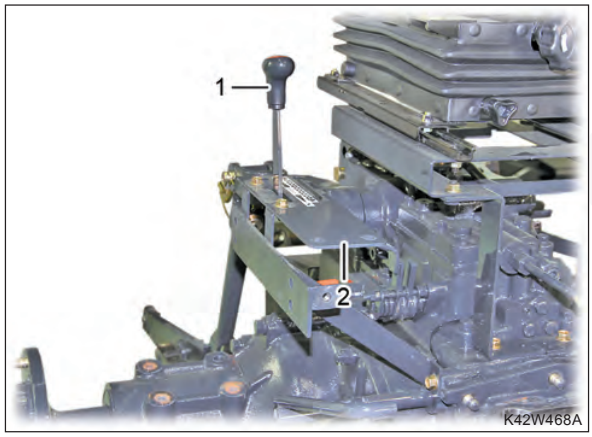


3. Remove the spring pin (1) from the outside of the transmission case, 4WD lever (2) and front wheel shift arm (3).

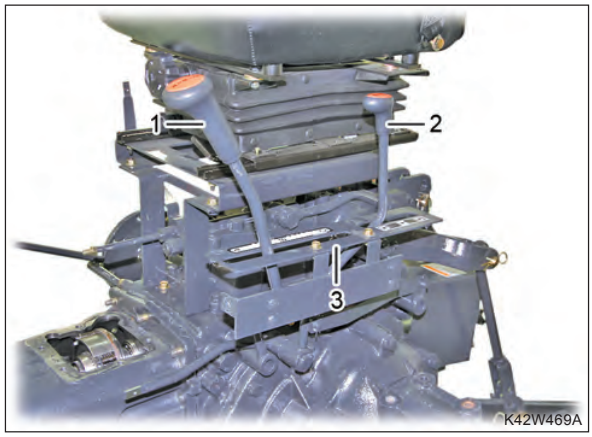
5.4 REAR AXLE CASE DISASSEMBLY



1. Remove the ROPS (1).



2. Remove the position control knob (1) and lever cover (2).



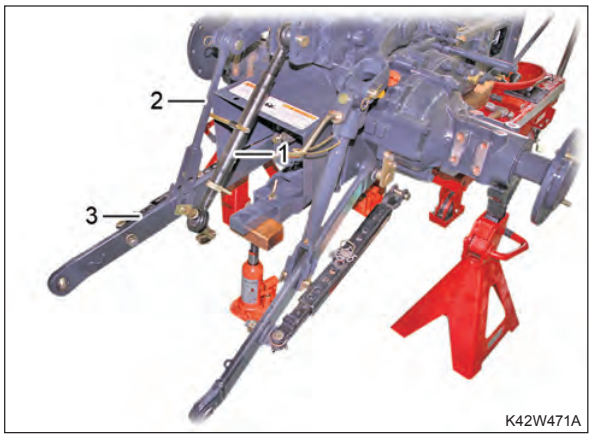
3. Remove the range shift lever knob (1), PTO lever knob (2) and lever cover (3).

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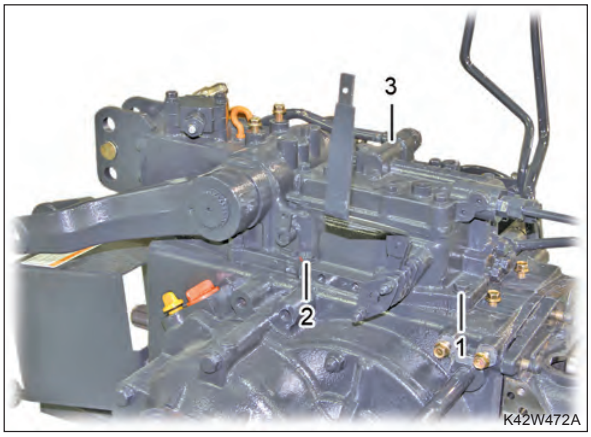
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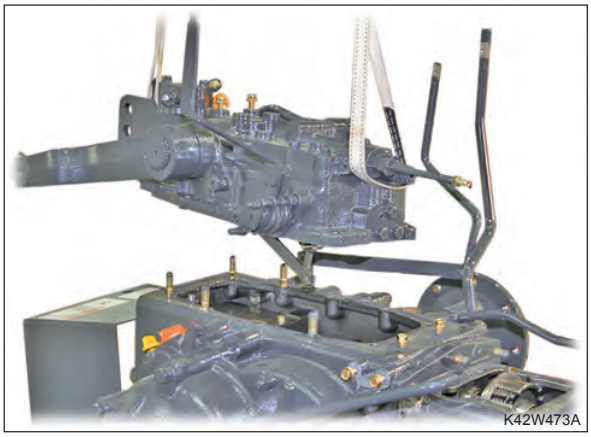


4. Unscrew the seat bracket mounting bolts (1)(4EA) and remove the seat bracket (2) and seat (3) simultaneously.

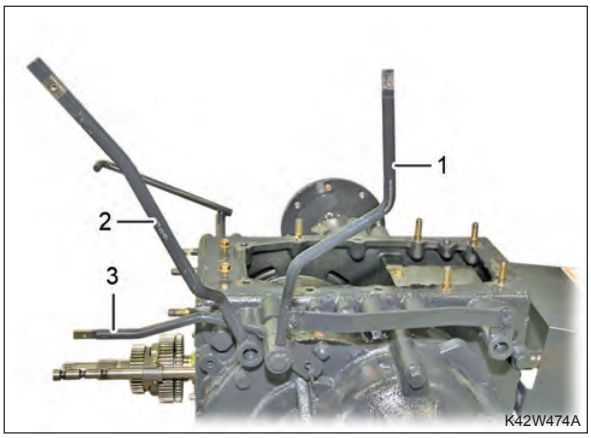


5. Remove the top link (1), lift link assembly (2) and lower link (3).





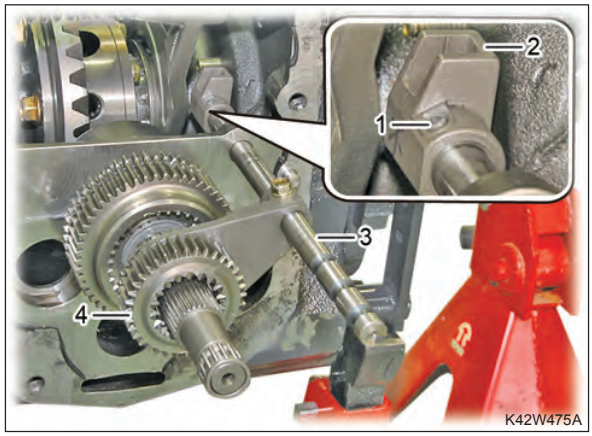
6. Unscrew the hydraulic cylinder case mounting bolts (1)(5EA), nuts (2)(5EA) to remove the hydraulic cylinder case (3).

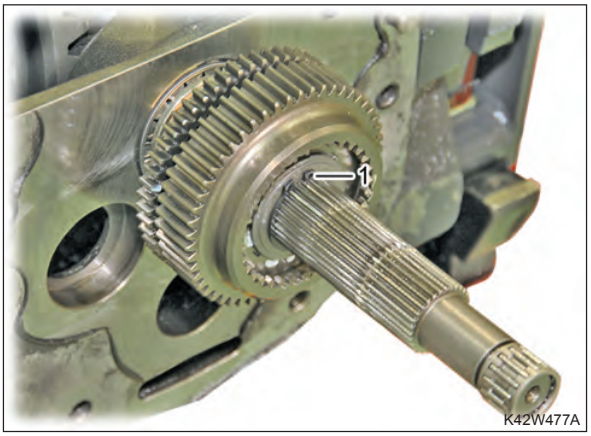


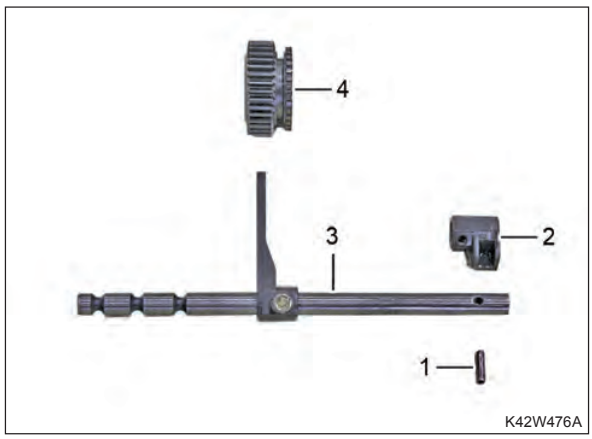
7. Remove the PTO shift lever (1), range shift lever (2) and 4WD lever (3).

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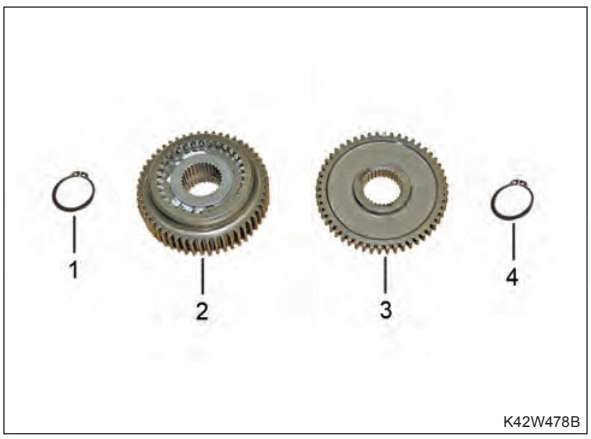
https://truckmanualshub.com/





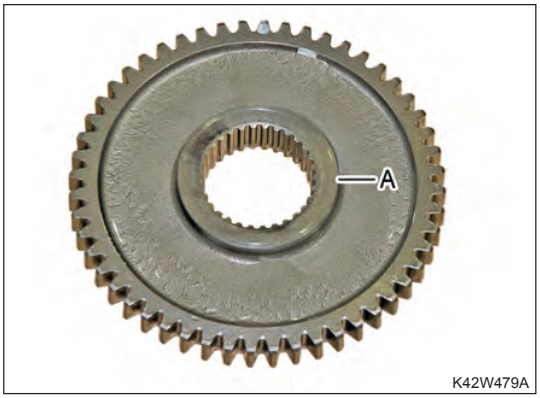


8. Pull out the spring pin (1) and remove the range shift shifter (2). Then, remove the range shift fork shaft (3) and range shift driven gear 2nd (4) simultaneously.



9. Pull out the snap ring (1) and remove the range shift driven gear 1st (2), 4WD gear (3) and snap ring (4).

Notes

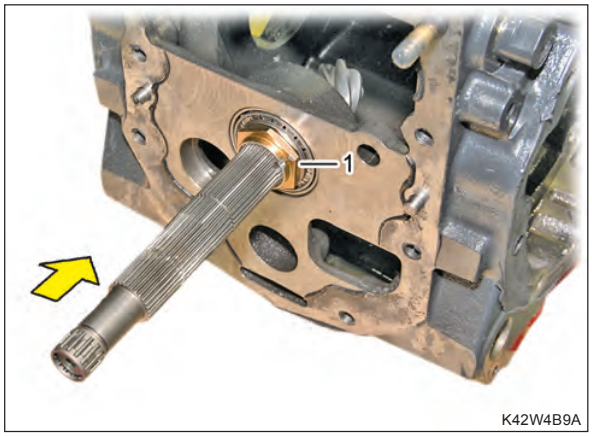


- **When installing the 4WD gear, its higher boss (A) should face the range shift driven gear 1st.**

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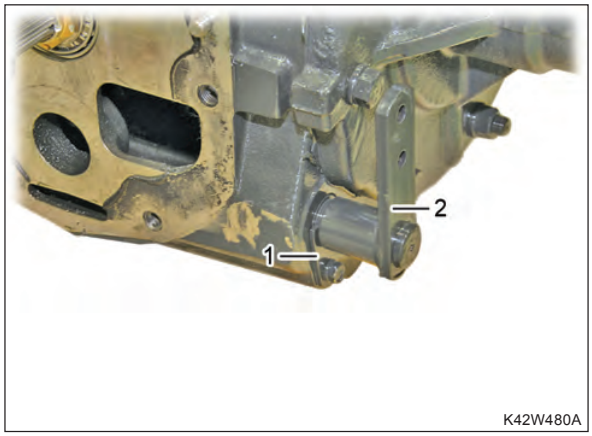
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5.4.1 REAR AXLE DRIVE SECTION DISASSEMBLY



10. Unfold the caulking part of the counter shaft mounting nuts (1) to unscrew the mounting nuts. Then, remove the counter shaft in the rear axle case by tapping outside direction. (Remove the differential system assembly first)

Mounting nut
tightening torque .....78.4 ~ 98 N.m
8 ~ 10 kgf.m
57.6 ~ 72 lb.ft

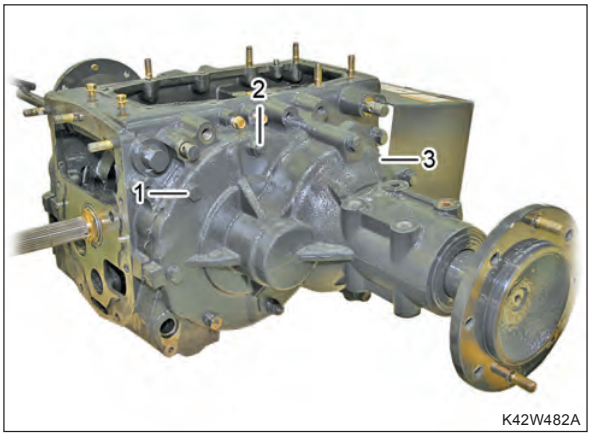




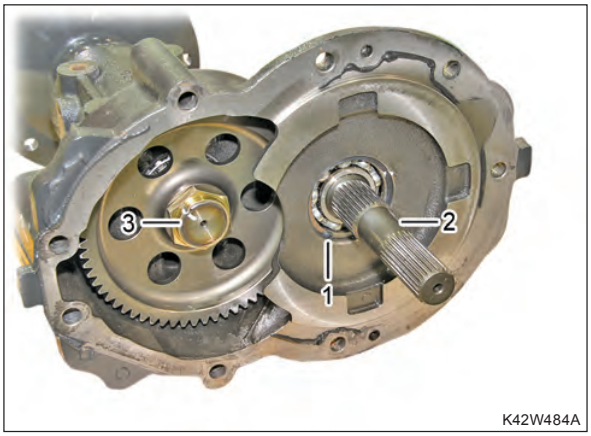
1. Remove the brake lever plate (1) and brake lever (2).

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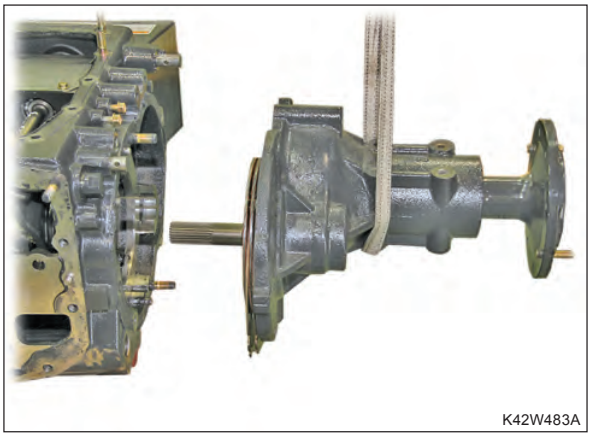
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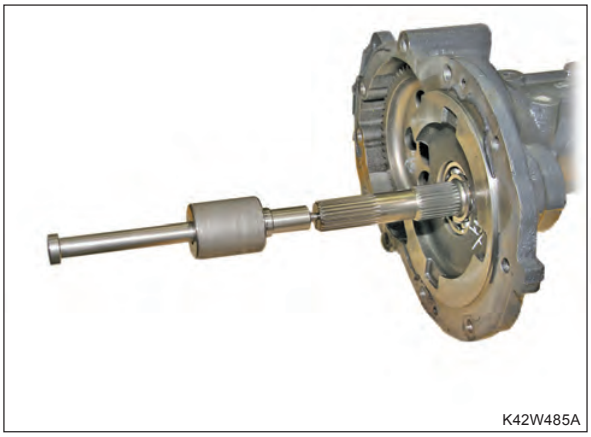


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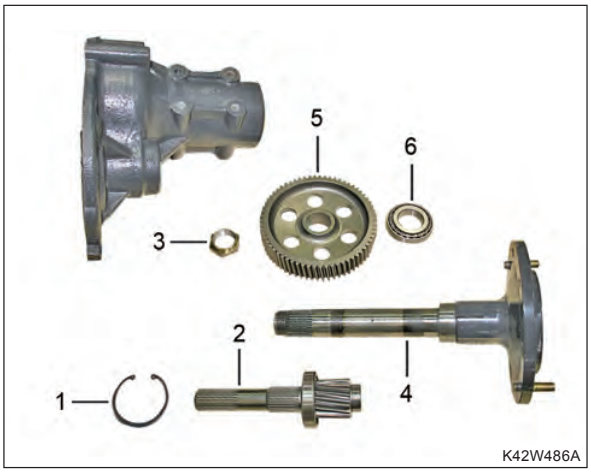


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2. Unscrew the rear axle housing mounting bolts (1)(7EA) and nuts (2)(2EA) to remove the rear axle housing assembly (3).



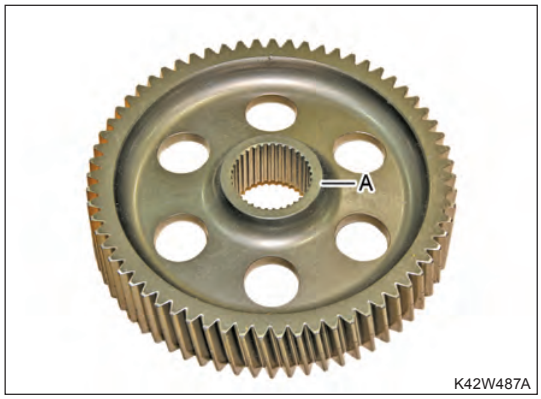
K42W486A

3. Pull out the snap ring (1) of the rear axle housing final pinion to remove the final pinion (2). Unscrew the lock nut (3) and remove the rear axle (4), final gear (5) and taper roller bearing (6).

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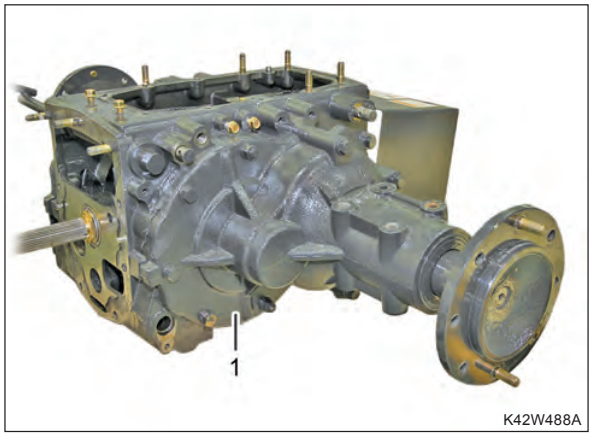
Notes



K42W487A

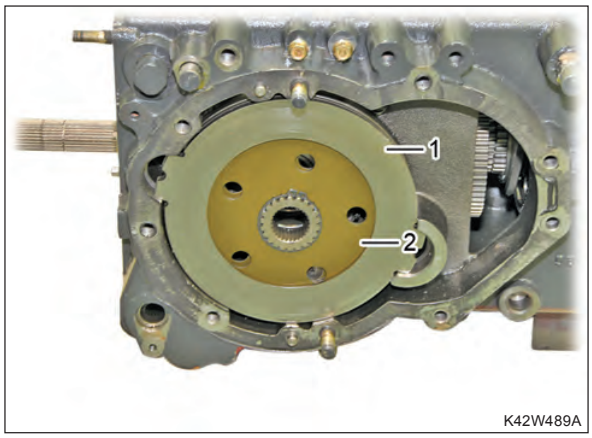
- **When installing the final gear, its higher boss (A) should toward the inside.**

5.4.2 BRAKE ASSEMBLY DISASSEMBLY

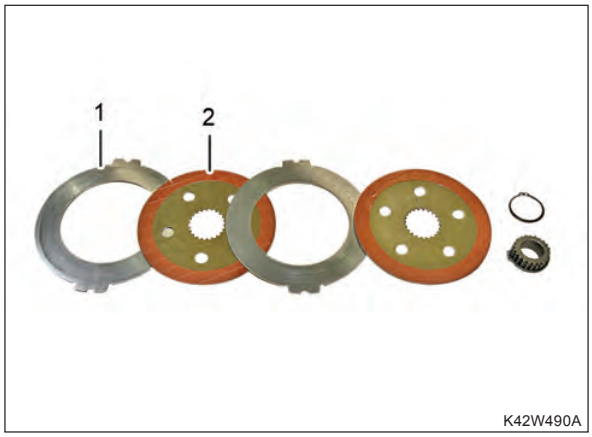


K42W488A

1. Remove the rear axle housing assembly (1).



K42W489A

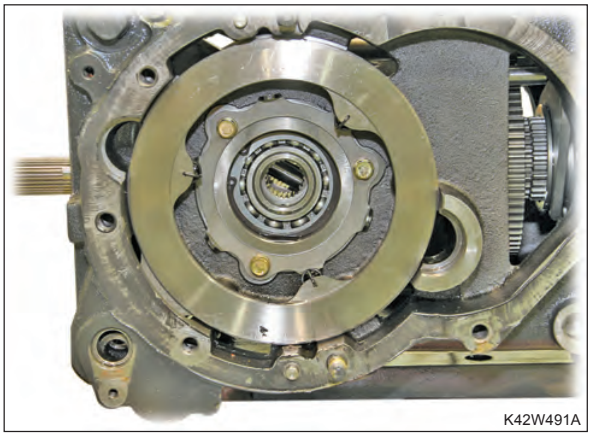


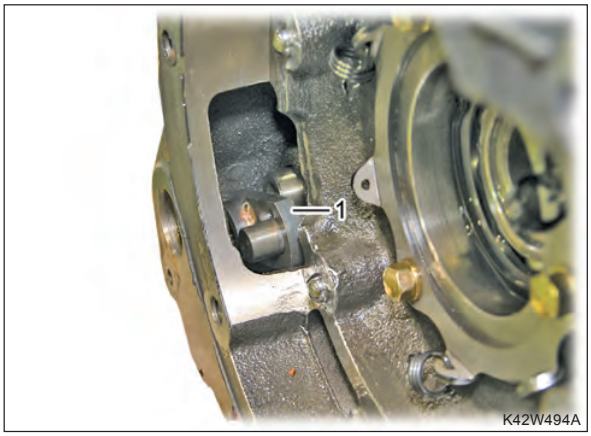
K42W490A

2. Remove the pressure plate (1) and disc (2).

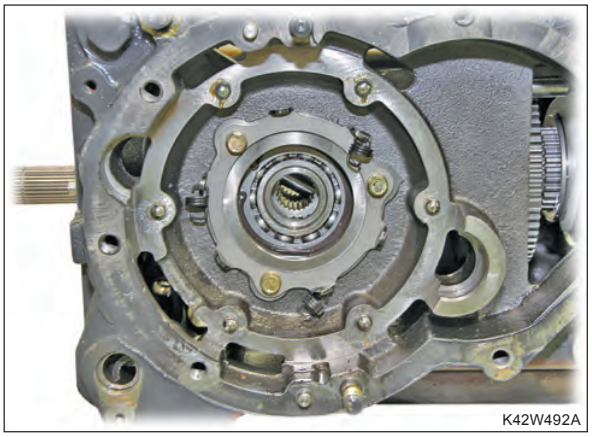
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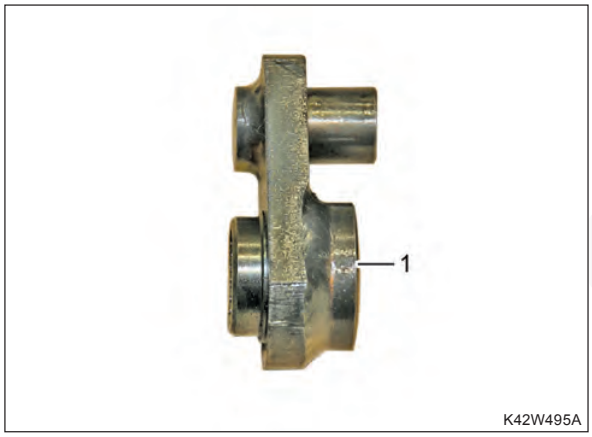
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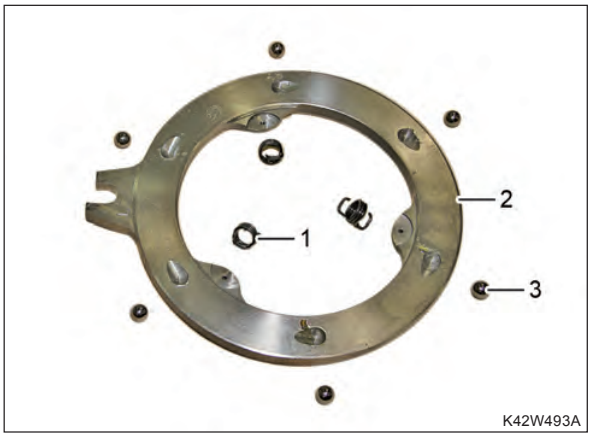


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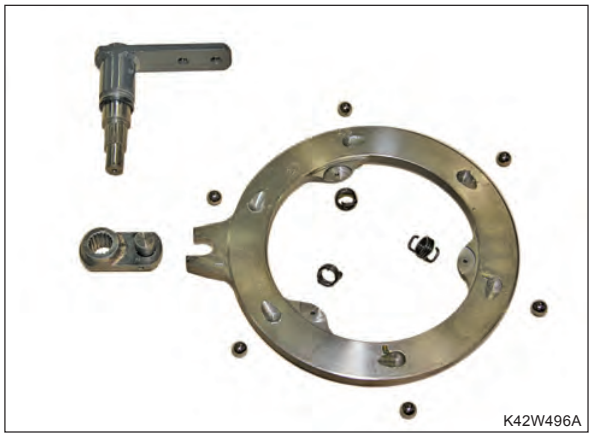

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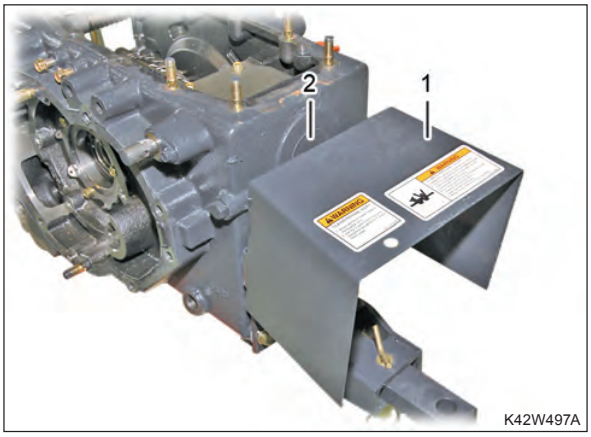
3. Remove the spring (1), cam plate (2) and steel ball (3).

4. Remove the inner arm (1) in the rear axle case.

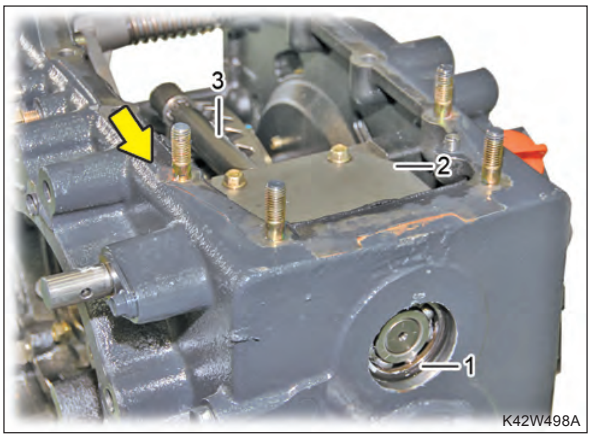
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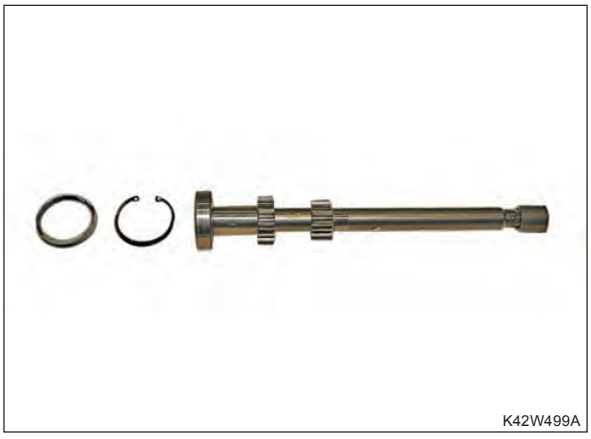
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5.4.3 PTO SHIFT GEAR DISASSEMBLY

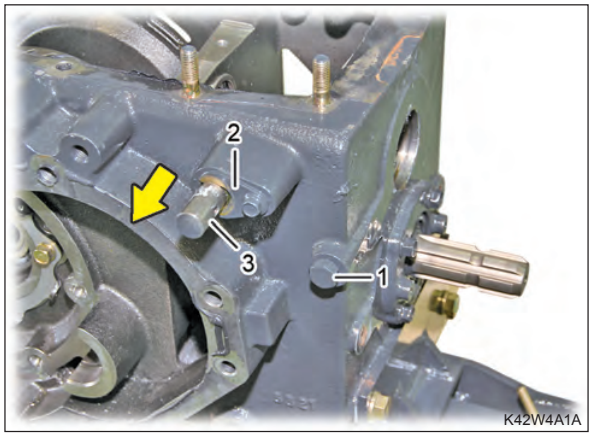


1. Remove the PTO cover (1) and seal cap (2).

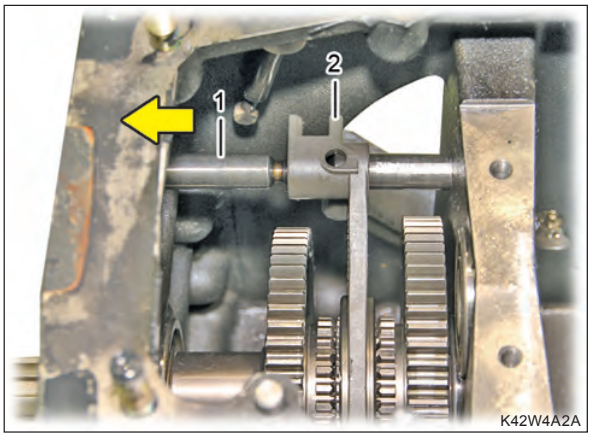


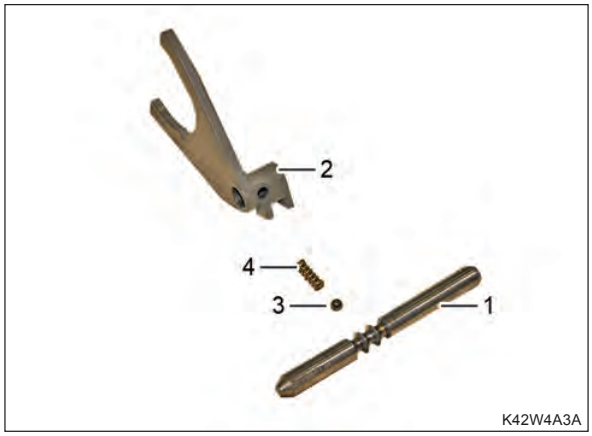


2. Pull out the snap ring (1) and remove the plate (2) and PTO drive gear shaft (3).



3. Unscrew the PTO fork shaft mounting bolt (1) and remove the PTO shift shaft mounting plate (2). Then, pull out the PTO shift shaft (3) to remove it from the PTO fork groove.

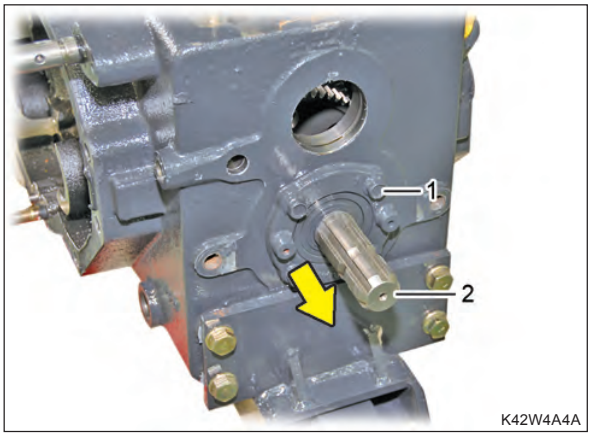


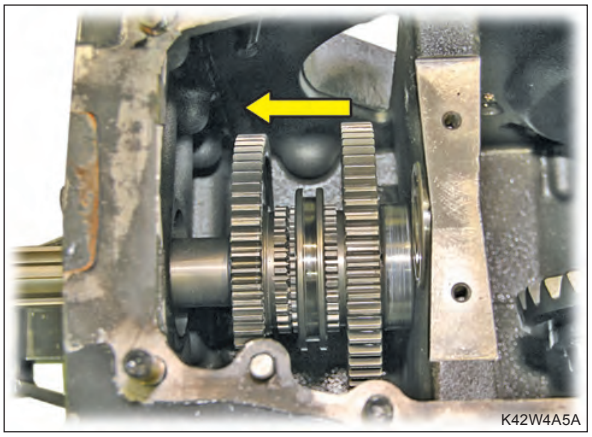


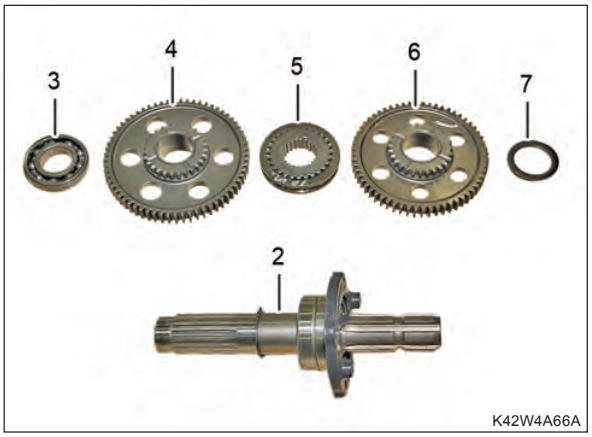
4. Pull out the PTO fork shaft (1) and remove the PTO fork (2), steel ball (3) and spring (4).

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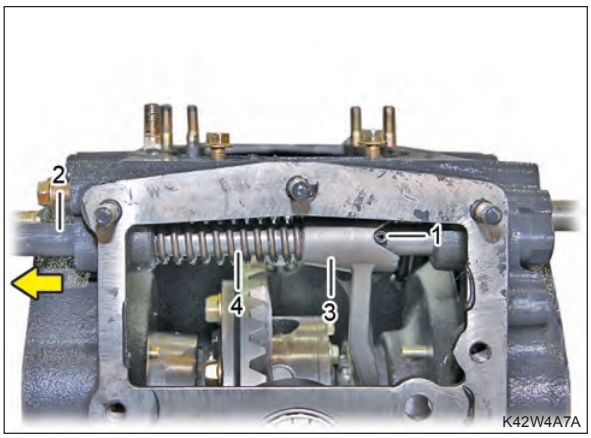




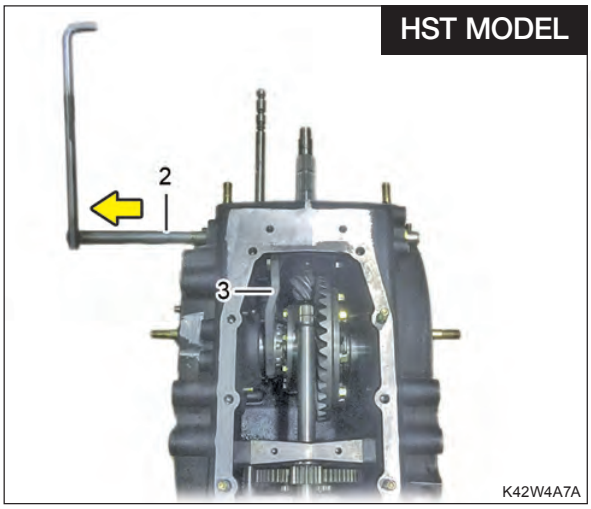
5. Unscrew the PTO shaft cover bolts (1) to remove the PTO shaft (2), ball bearing (3), PTO driven gear 1st (4), PTO hub sleeve (5), PTO driven gear 2nd (6) and washer (7).

5.4.4 DIFFERENTIAL SYSTEM DISASSEMBLY

1. Remove the rear axle case from the transmission. Then, remove the rear axle housing and hydraulic cylinder case.



HST MODEL

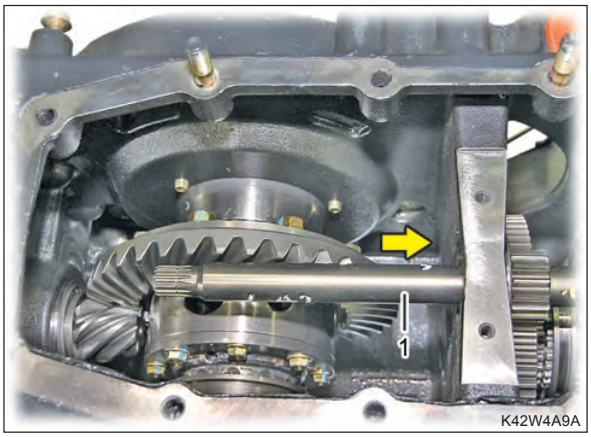




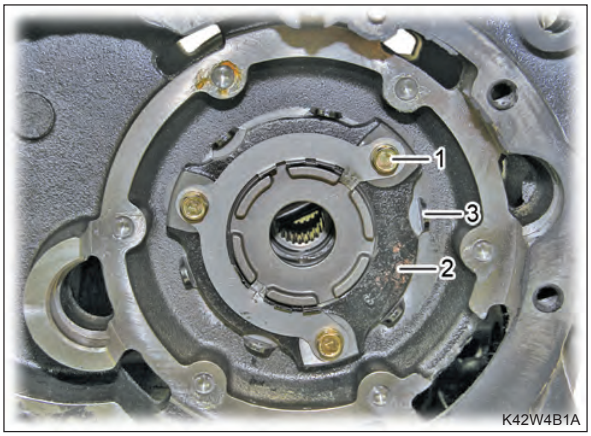
2. Pull out the differential lock pedal spring pin (1) and remove the differential lock pedal (2) in the arrow direction. Then, remove the differential fork (3) and differential spring (4).

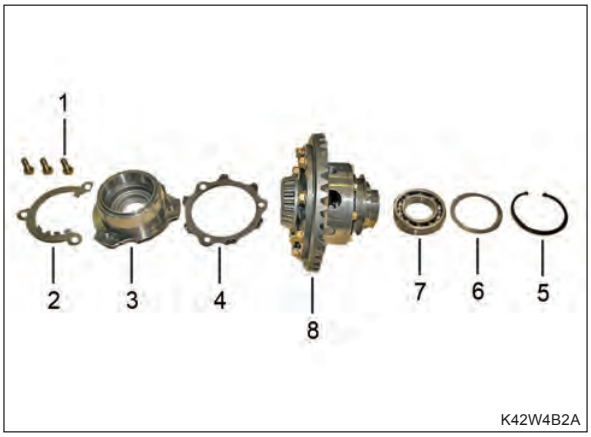
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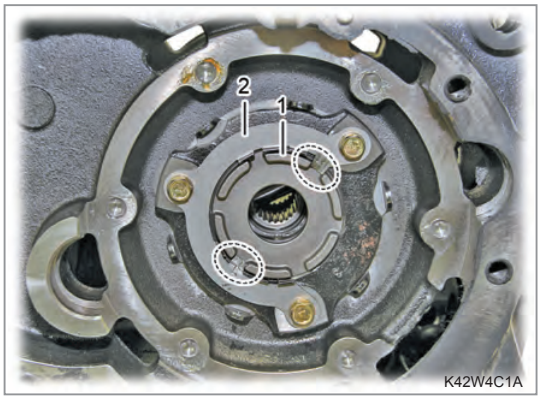
3. Remove the PTO drive gear shaft (1).





4. Unscrew the bolts (1) and remove the mounting plate (2), bearing support (3) and spring holder (4). Pull out the snap ring (5) on the opposite side and remove the shim (6), ball bearing (7) and differential system assembly (8).

IMPORTANT

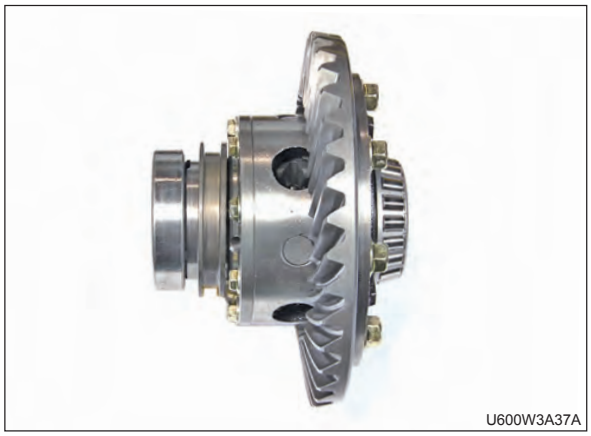


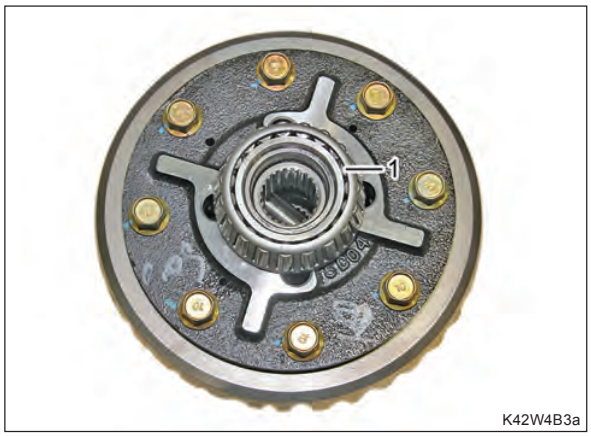
- **When installing the screw (1) to the bearing support, tighten it to the specified torque and caulk the mounting plate (2) to the screw groove to fix the screw firmly.**
  Tightening torque.....78.4 ~ 98 N.m
  8 ~ 10 kgf.m
  57.6 ~ 72 lb.ft

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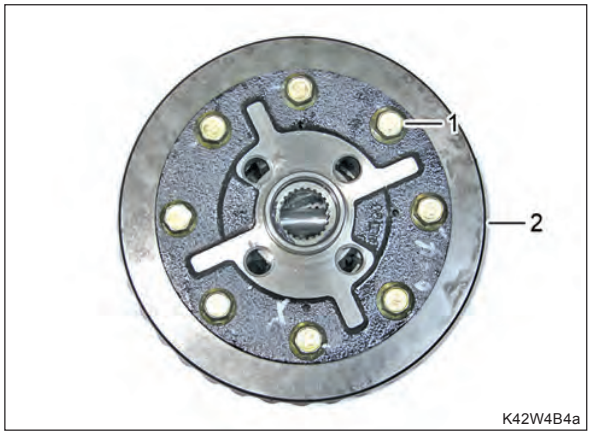
DIFFERENTIAL SYSTEM COMPONENTS DISASSEMBLY


U600W3A37A



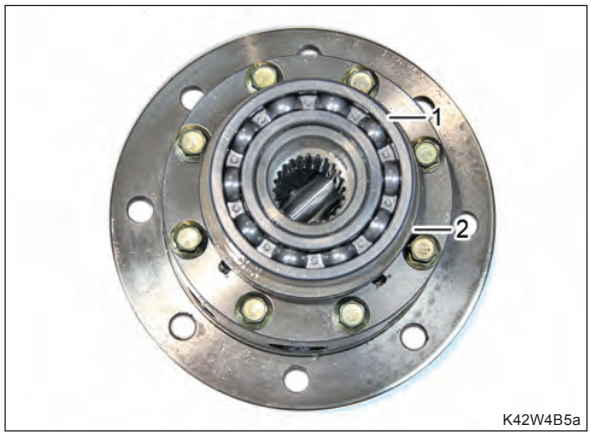
K42W4B3a

1. Invert the rear differential system assembly to remove the taper roller (1).



K42W4B4a

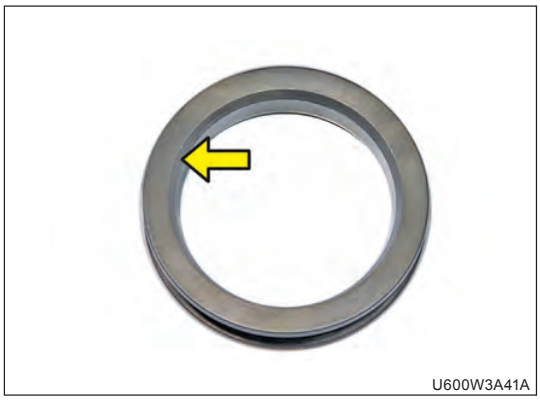
2. Unscrew the differential system case 1 mounting bolts (1) and remove the ring gear (2).



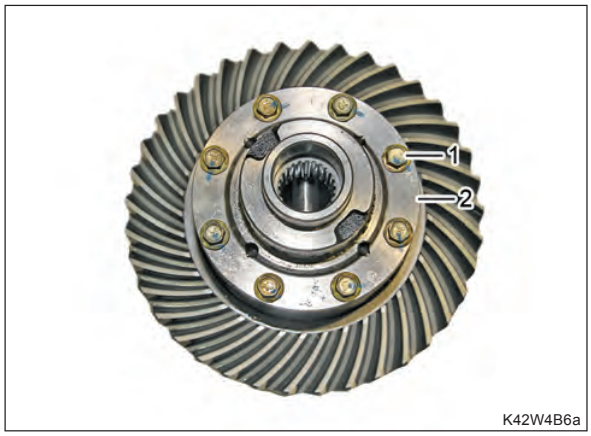
K42W4B5a

3. Remove the ball bearing(1) and differential lock hub (2).

Notes


U600W3A41A

- When installing the final gear, its higher boss (A) should toward the inside.

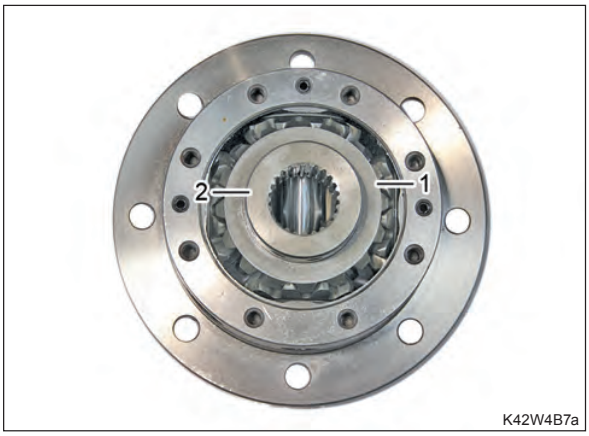


K42W4B6a

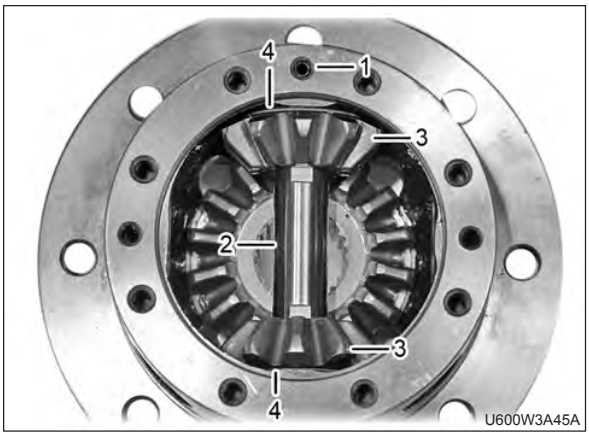
4. Unscrew the differential system case 2 mounting bolts(1) and remove differential system case 2 (2).

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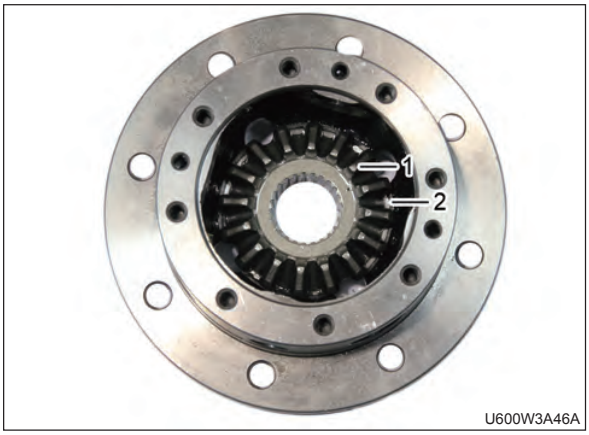
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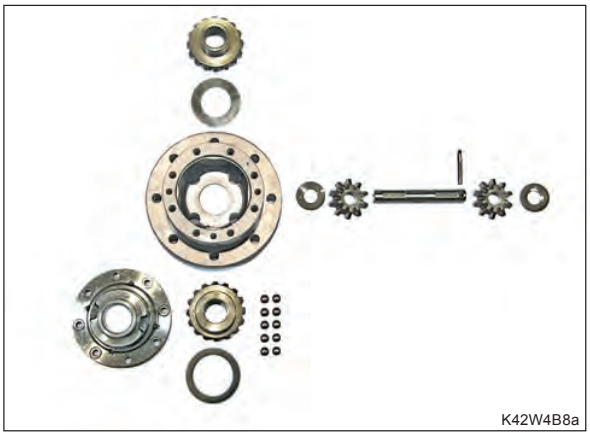
5. Remove the washer (1) and side gear (2).



6. Pull out the differential shaft 2 mounting spring pin (1) and differential shaft 2 (2) to remove the pinion drive gear (3) and thrust washer (4).

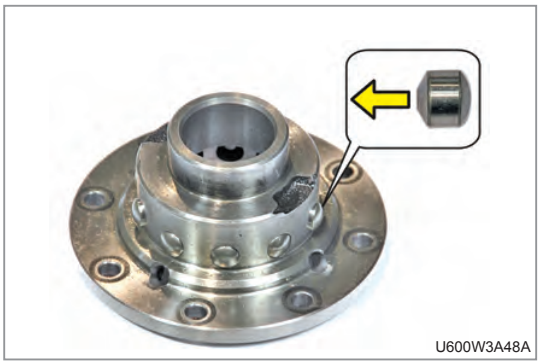


7. Remove the side gear (1) and washer (2).



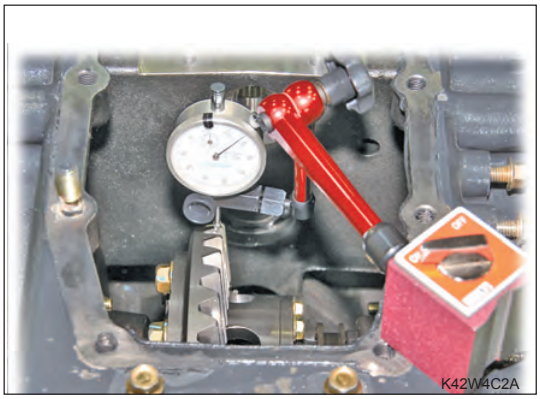
8. Install in the reverse order of removal.

IMPORTANT



- **When installing the roller to the differential case, the flat end of the roller should face the groove of the side gear.**

Notes



- **Check the backlash of the ring gear using a dial gauge.**
  Specified value.....0.15 ~ 0.25 mm
  (0.0059 ~ 0.0098 in.)
- **After adjustment of backlash, there should be no lateral free play of the differential assembly. To adjust the backlash, use shims between the ball bearing and snap ring.**

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CHAPTER 5 FRONT AXLE

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1. OVERVIEW

1.1 SPECIFICATIONS

1. Tread ..... 7 - 16: Standard - 1,151 mm (45.315 in)
   Narrow - 1,104 mm (43.465 in)
   8 - 16: Standard - 1,201 mm (47.283 in)
   Narrow - 1,130 mm (44.488 in)
2. Tire size ..... 7 - 16 6PR / 8 - 16 6PR
3. Front wheel alignment..... Toe-in: 4 - 8 mm (0.157 - 0.315 in.)
4. Oil ..... Standard: TF500, Gear oil #90 equivalent goods
   Capacity: 6.4 ℓ (1.69 u.s.gal)
5. Differential system ..... Pinion and ring gear backlash: 0.15 - 0.2 mm (0.0059 - 0.0079 in.)
   Pinion drive torque: 0.032 - 0.16 kgf.m / 0.314 - 1.568 N.m / 0.230 - 1.152 lbf.ft
6. Front gear case..... Front final gear and final pinion backlash: 0.15 - 0.3 mm (0.0059 - 0.0118 in)

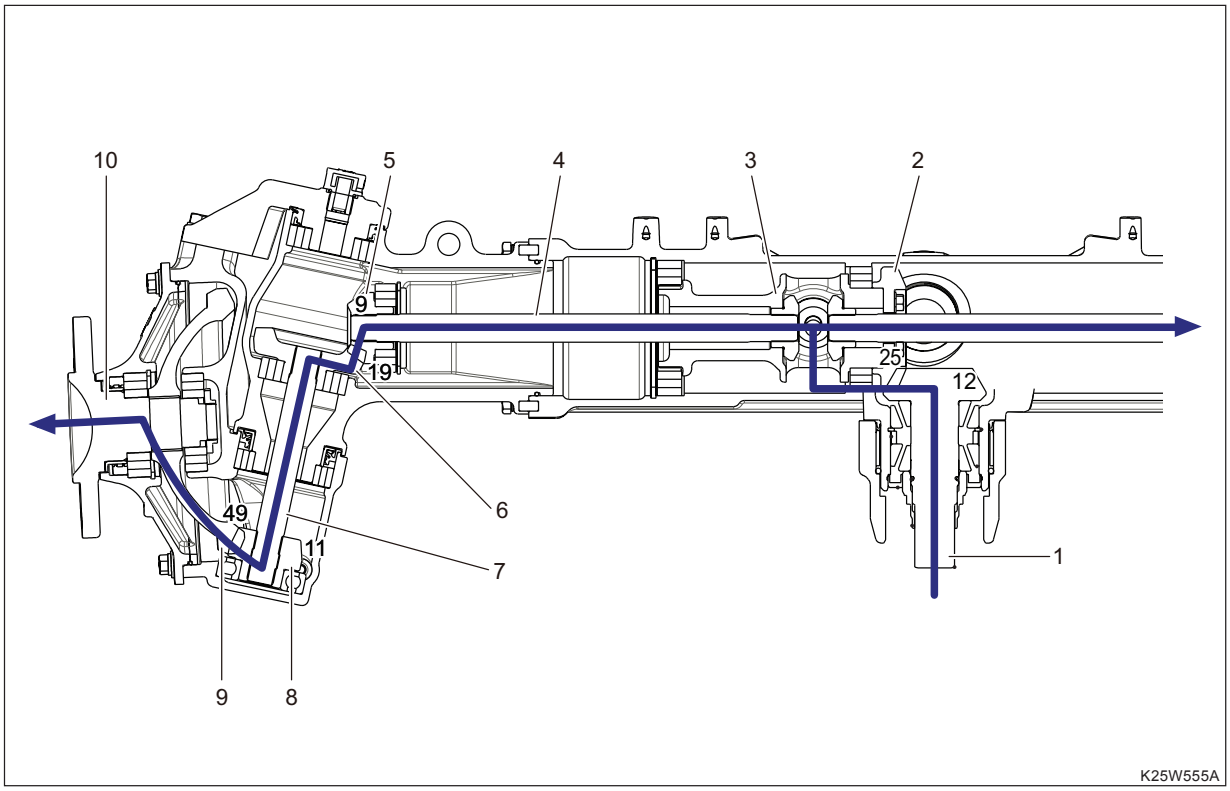
1.2 TIGHTENING TORQUE FOR MAJOR COMPONENTS

MAJOR COMPONENTS		TORQUE VALUE
Knuckle arm and tie-rod end	Slotted nut	137.2 N.m 14.0 kgf.m 100.8 lbf.ft
Front axle case and front gear case	Hex. bolt	112.7±9.8 N.m 11.5±1 kgf.m 82.8±7.2 lbf.ft
	Washer mounting hex. bolt	88.2±9.8 N.m 9.0±1 kgf.m 64.8±7.2 lbf.ft
Front bearing case	Washer mounting hex. bolt	51.9±2.9 N.m 5.3±0.3 kgf.m 38.2±2.2 lbf.ft
Pinion bearing retainer	Hex. socket cap bolt	32.3 N.m 3.3 kgf.m 23.8 lbf.ft

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1.3 POWER TRANSFER



(1) Drive pinion
(2) Ring gear
(3) Differential case
(4) Front 1st shaft
(5) 9 bevel gear
(6) 19 bevel gear
(7) Front 2nd shaft
(8) 11 bevel gear
(9) 49 front final gear
(10) Front spindle

5

When the 4WD mode is selected, rotating force from the 4WD shaft of the transmission is passed through the propeller shaft and is delivered to the front axle section through the drive pinion (1) of the front axle case.

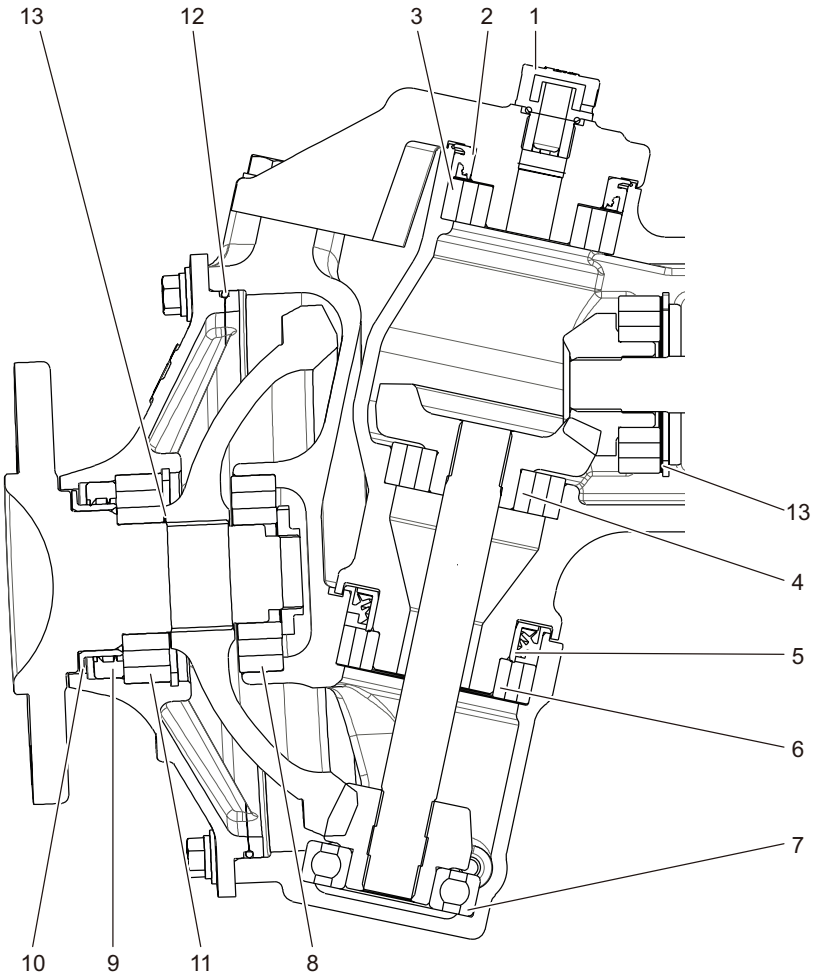
The 12 gear of the drive pinion is engaged with the 25 ring gear (2) of the front differential, rotating together at the reduced speed, and the differential case (3) integrated with the ring gear is rotated as well. Then, as the differential pinion shaft is rotated together, the differential pinion gear and differential side gear are engaged with each other, rotating together. Therefore, this rotating force is transmitted to the front 1st shaft (4) since it is fixed to the differential side gear with splines.

After the rotating force is passed through the front 1st shaft, it is delivered to the front gear case through the 9 bevel gear (5) and 19 bevel gear (6). Then, it is passed to the 49 front final gear (9) through the front 2nd shaft (7) and 11 bevel gear (8). Finally, this force is delivered to the front wheels installed to the 49 front final gear to turn the wheels.

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1.4 KNUCKLE SECTION



(1) Oil cap assembly
(2) Oil seal
(3) Ball bearing
(4) Ball bearing
(5) Oil seal
(6) Ball bearing
(7) Ball bearing
(8) Ball bearing
(9) Oil seal
(10) Sleeve
(11) Ball bearing
(12) O-ring
(13) Shim

The knuckle section is a part to perform driving and steering functions in the front axle section, and it (knuckle arm + front gearbox) revolves around the fixed king pin section (front gear case).

Four vertically set ball bearings and three laterally set ball bearings withstand vertical and lateral load applied to the front axle. Also, the rotating parts of the front spindle and front gear box are equipped with special oil seals to ensure superior sealing performance even in a wet condition.

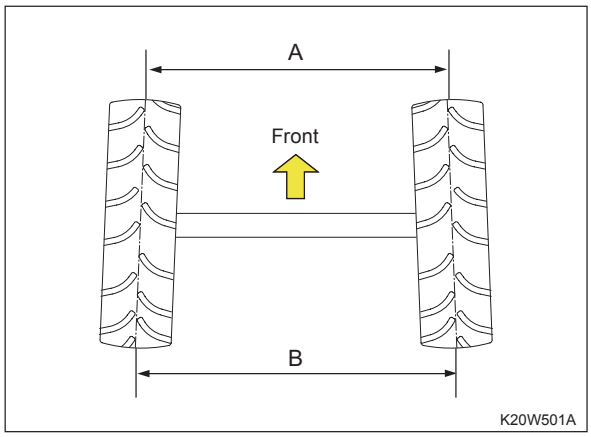
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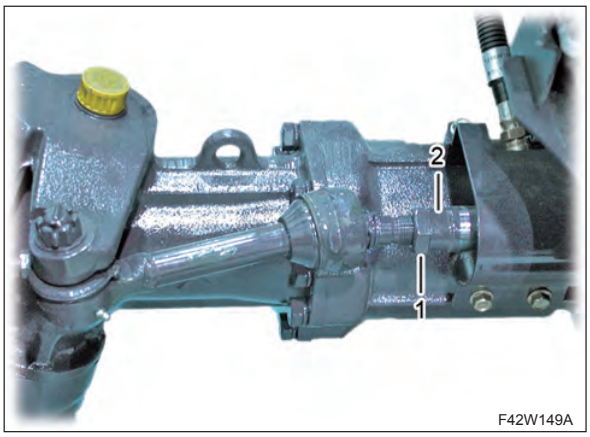
2. INSPECTION AND ADJUSTMENT

2.1 TOE-IN

1. Park the tractor on firm level ground and turn the steering wheel to set both front wheels in the straight ahead position. Then, stop the engine.



2. Measure the distance between the centers of the tires at the center of the hub of the front axle as shown in the figure.
3. Measure the rear width between the front tires with the same method.
4. Subtract the front width (A) from the rear width (B). The value should be 4 - 8 mm (0.157 - 0.315 in.).



5. If the result is out of the specification, unscrew the tie-rod end mounting nut (1) from the knuckle arm and turn the rod (2) to adjust the distance between the centers.

Notes

Front tire inflation pressure	With loader	3.0 kgf/cm^2 42.66 psi
	Standard	2.0 kgf/cm^2 28.44 psi

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3. TROUBLESHOOTING

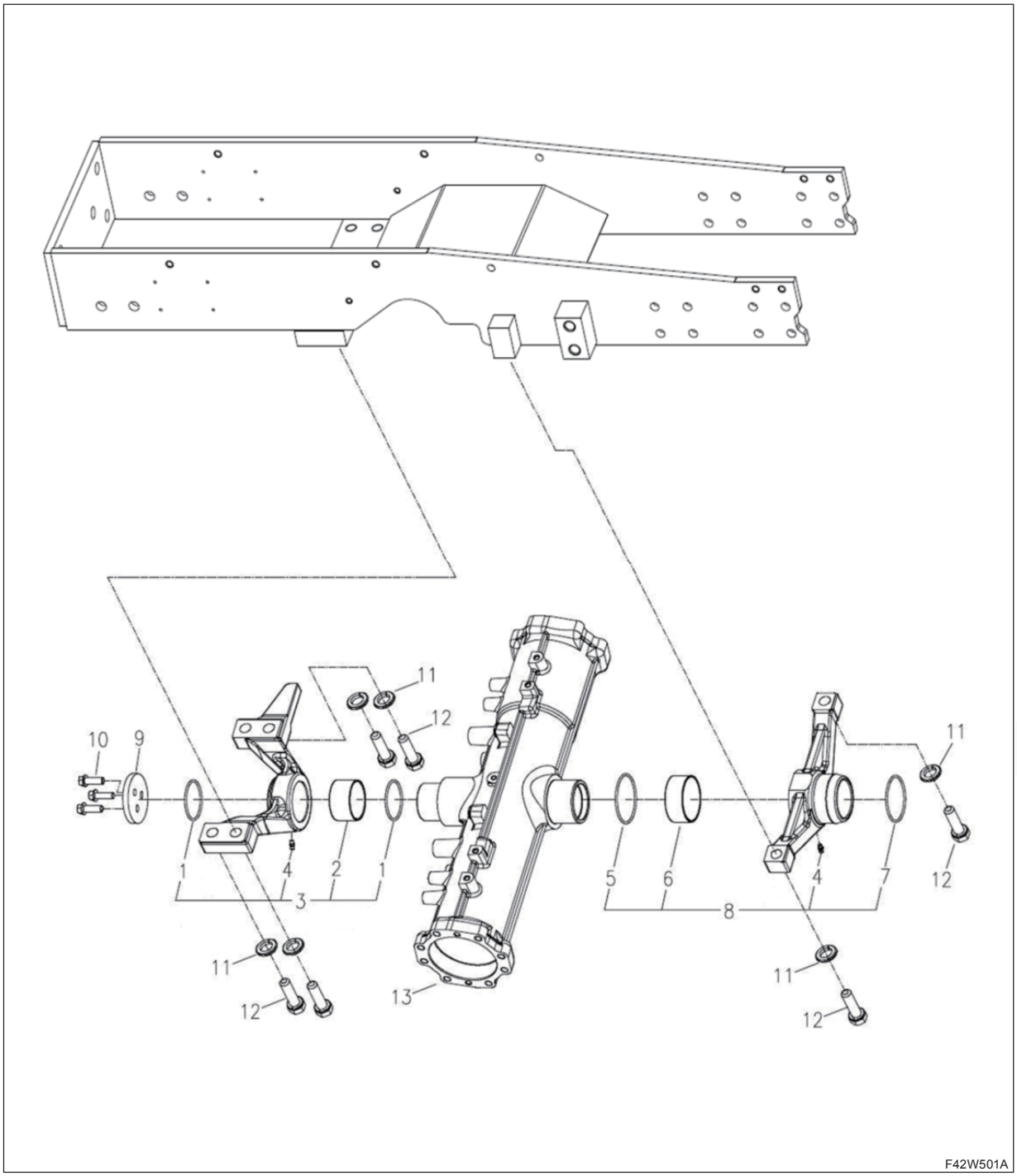
PROBLEMS	CAUSE OR SYMPTOM	SOLUTION
The front wheels rattle.	• Poorly adjusted toe-in • Abnormal tire inflation pressure	• Adjust the toe-in (4 - 8 mm). • Inflate the tire to the proper pressure level (2.0 kgf/cm^2).
The front tires are worn excessively.	• Poorly adjusted toe-in • Excessive inflation pressure	• Adjust the toe-in. • Adjust the tire pressure to the proper level.
It is hard to steer the vehicle.	• Poorly adjusted toe-in • Damaged tie rod • Defective steering cylinder connection and PST valve	• Adjust the toe-in. • Replace the tie rod. • Check and repair the hydraulic line.
Noise is generated from the front axle.	• Damaged internal gear • Insufficient front axle oil • Improper backlash	• Disassemble, inspect and repair • Add fluid. • Adjust the backlash.

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4. SECTIONAL VIEW FOR MAJOR COMPONENTS

4.1 CENTER PIN SUPPORT



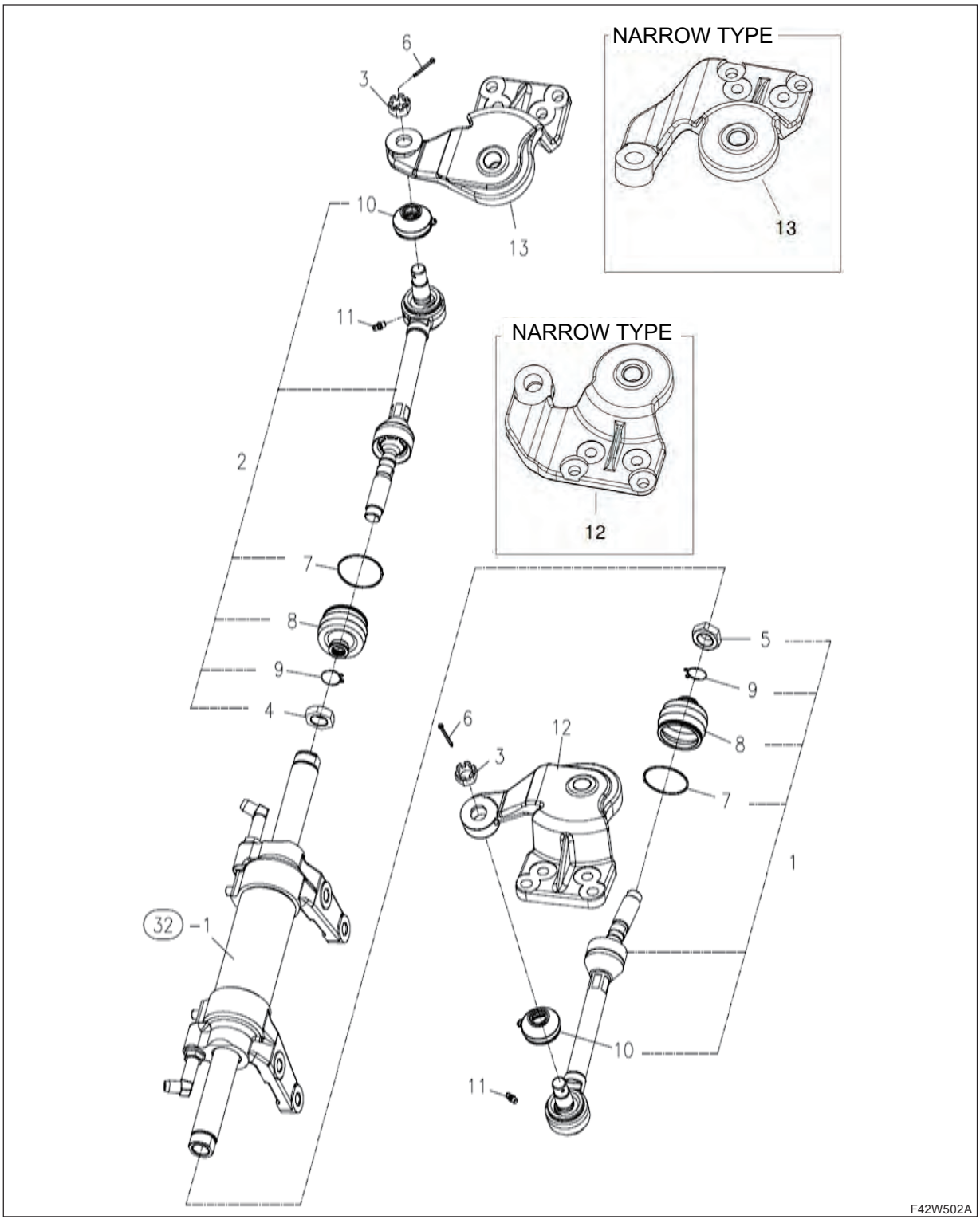
COMPONENTS

(1) O-ring
(2) Bush
(3) Front Axle Supprot Ass'y
(4) Nipple,grease
(5) O-ring
(6) Bush
(7) O-ring
(8) Rear Axle Supprot Ass'y
(9) Plate
(10) Hex Flange Bolt
(11) Spring Washer
(12) Hex Bolt
(13) Case

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4.2 TIE ROD



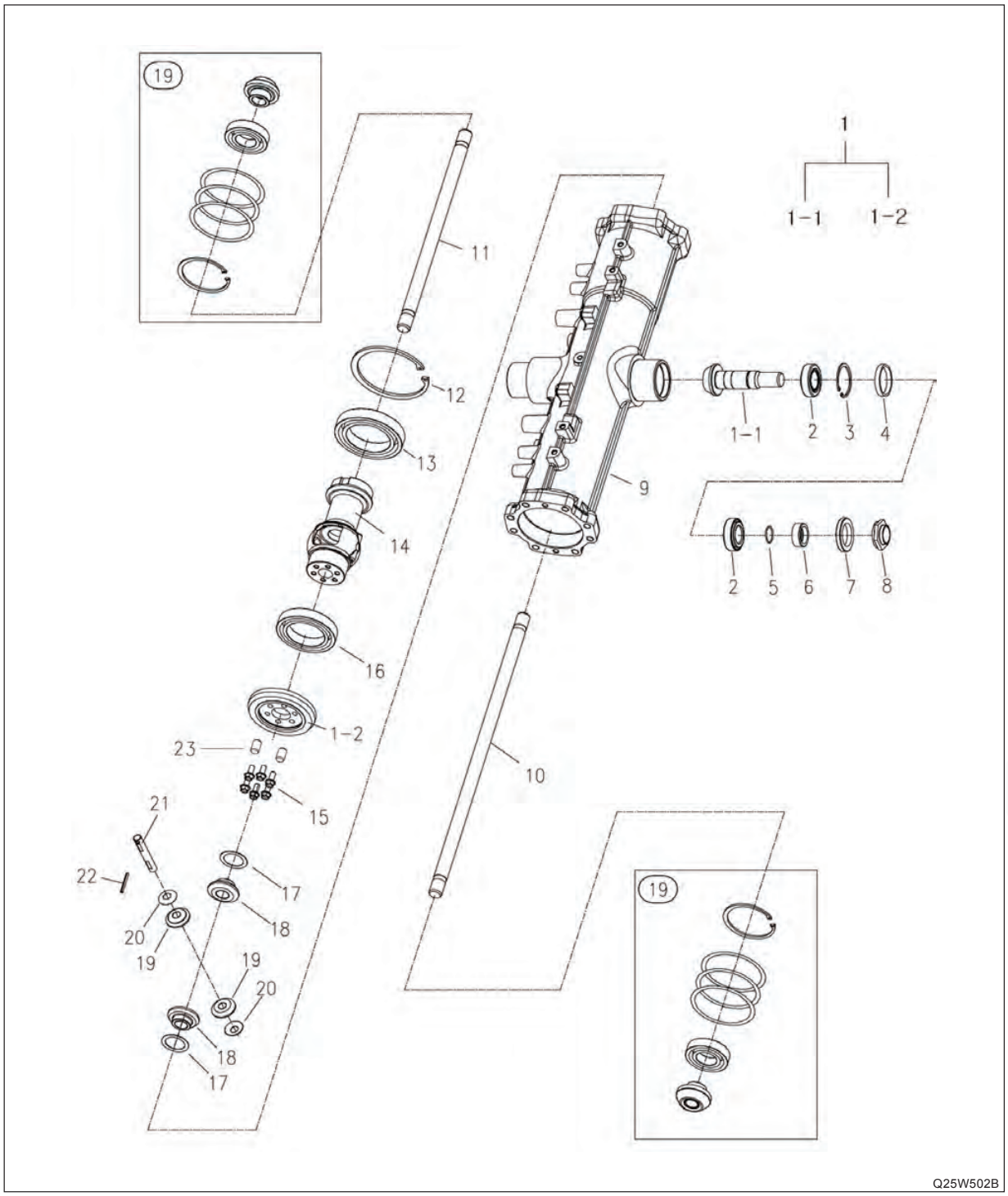
COMPONENTS

(1) Tie rod ass'y, L
(2) Tie rod ass'y, R
(3) Nut
(4) Nut
(5) Nut
(6) Cotter pin
(7) Ring
(8) Cover
(9) Clip
(10) Cover
(11) Grease nipple
(12) Knuckle arm(L)
(13) Knuckle arm(R)

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4.3 RING GEAR AND DIFFERENTIAL GEAR



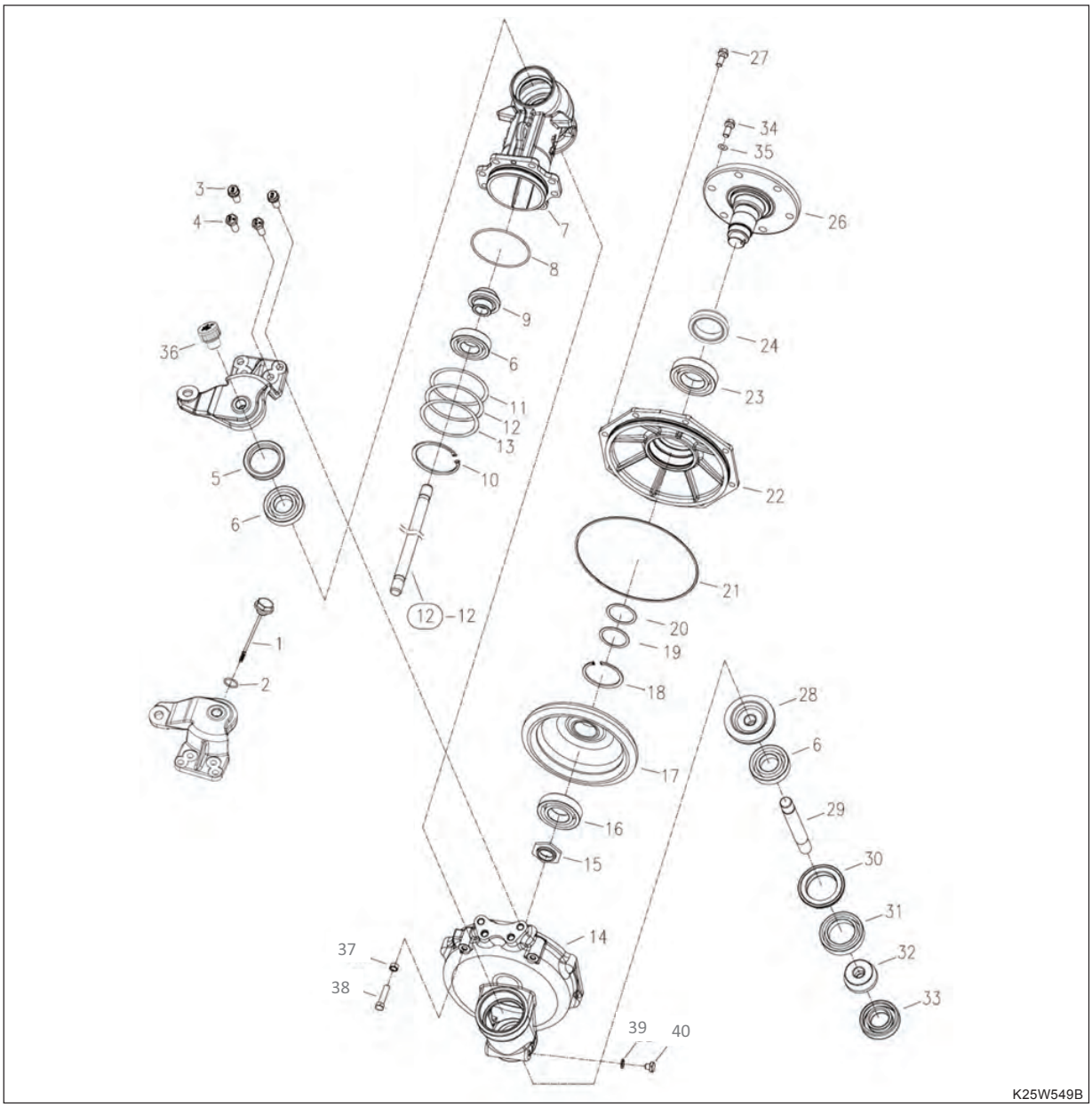
COMPONENTS

(1) Ring gear ass'y
(1-1) Drive pinion
(1-2) Ring gear
(2) Roller bearing
(3) Snap ring
(4) Collar
(5) O-ring
(6) Bush
(7) Oil seal
(8) Nut
(9) Case
(9) Case
(10) Front first shaft
(10) Front first shaft
(11) Front first shaft
(11) Front first shaft
(12) Snap ring
(13) Ball bearing
(14) Differential case
(15) Hex flange bolt
(16) Ball bearing
(17) Liner
(18) Differential gear 14
(19) Differential gear 10
(20) Liner
(21) Shaft, differential pinion
(22) Spring pin
(23) Pin

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4.4 4WD GEAR CASE



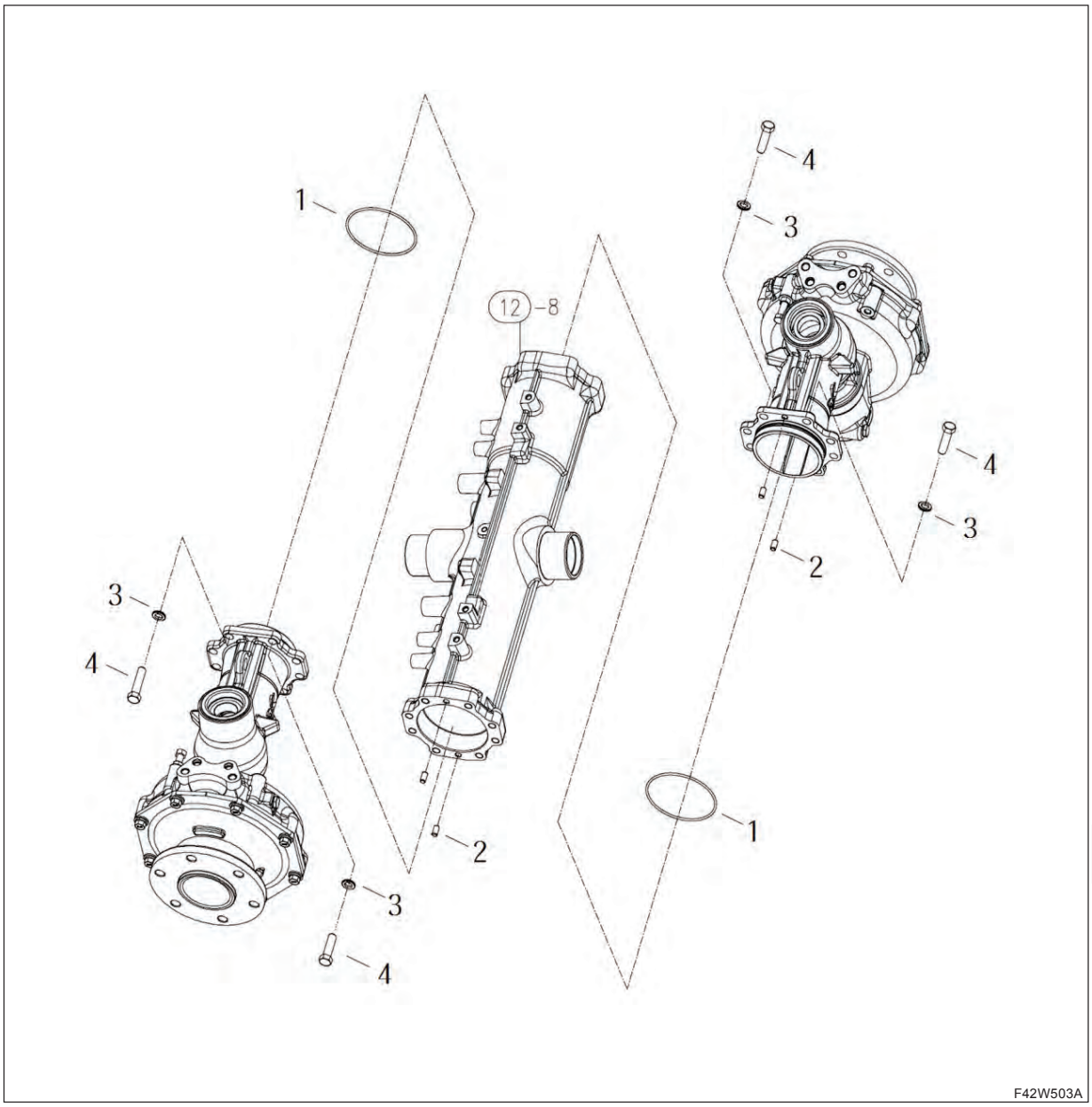
COMPONENTS

(1) Oil level
(2) O-ring
(3) Bolt w/washer
(4) Reamer blot
(5) Oil seal
(6) Ball bearing
(7) Housing front gear
(7) Housing front gear
(8) O-ring
(9) Front first pinion
(10) Snap ring
(11) Shim 0.2T
(12) Shim 0.3T
(13) Shim 0.5T
(14) Housing front gear
(15) Lock nut
(16) Ball bearing
(17) Gear brvel 49T
(18) Snap ring
(19) Shim 0.2T
(20) Shim 0.5T
(21) O-ring
(22) Housing front bearing
(23) Ball bearing
(24) Oil seal
(26) Front spindle
(27) Bolt w/washer
(28) Gear, front second shaft
(29) Front second shaft
(30) Seal
(31) Ball bearing
(32) Gear bevel 11T
(33) Bearing
(34) Bolt(m14x1.5P)
(35) Spring, washer
(36) Cap, oil
(37) Hex net
(38) Hex bolt
(39) Seal washer
(40) Plug m10

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4.5 SPACER



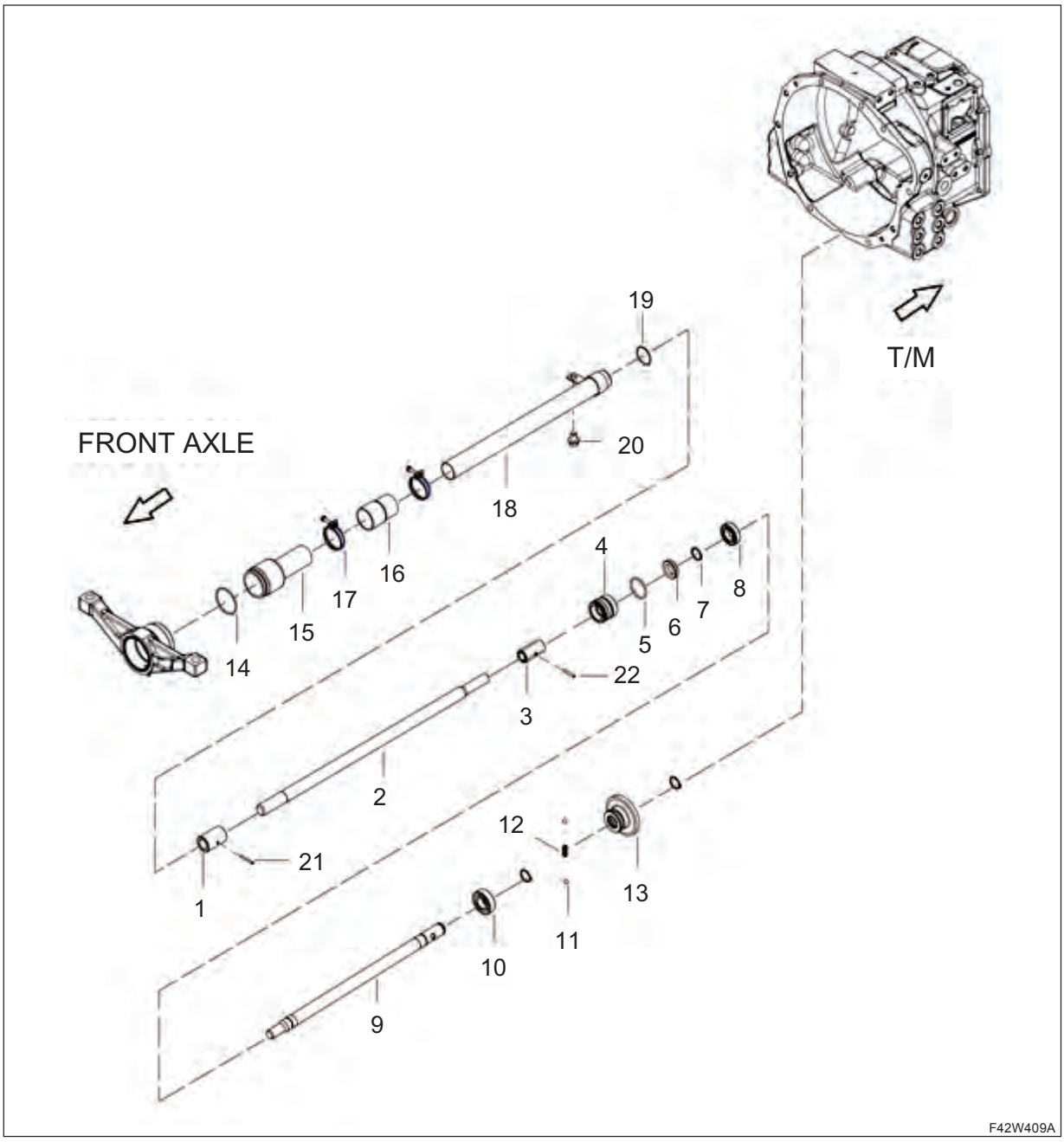
COMPONENTS

(1) O-ring
(2) Pin
(3) Spring Washer
(4) Bolt

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4.6 FRONT DRIVE SHAFT



COMPONENTS

(1) Couple ring R
(2) Propeller shaft
(3) 4th drive joint
(4) Oil seal housing
(5) O-ring
(6) Oil seal
(7) Snap ring
(8) Ball bearing
(9) 4th drive shaft
(10) Ball bearing
(11) Steel ball
(12) Spring
(13) 4th driven gear
(14) Stop O-ring
(15) Shaft cover(front)
(16) Shaft cover boots
(17) Hose band
(18) Shaft cover(back)
(19) Stop O-ring
(20) Hex flange bolt
(21) Spring pin
(22) Spring pin

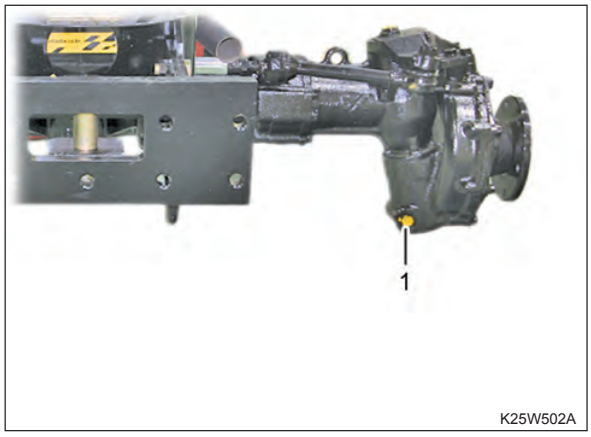
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5. DISASSEMBLY AND SERVICE

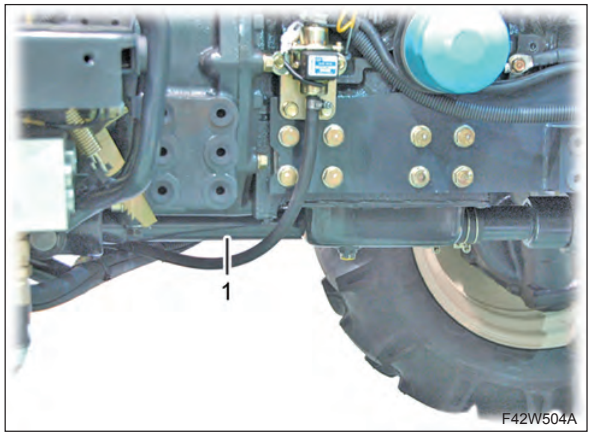
5.1 FRONT AXLE CASE ASSEMBLY REMOVAL

1. Park the tractor on firm level ground.



2. Unscrew the drain plug (1) on the bottom of the front axle case to drain oil from the front axle case.

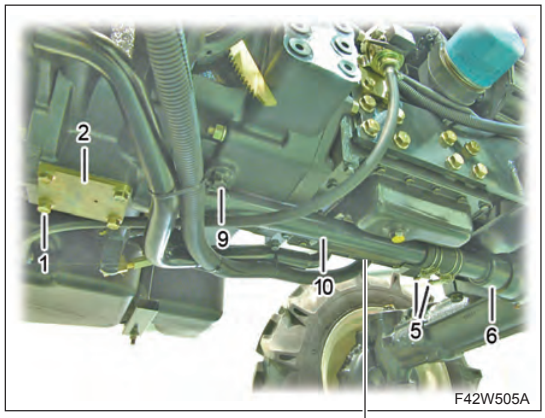
OIL CAPACITY FOR FRONT AXLE	6.4ℓ (1.69 u.s.gal)

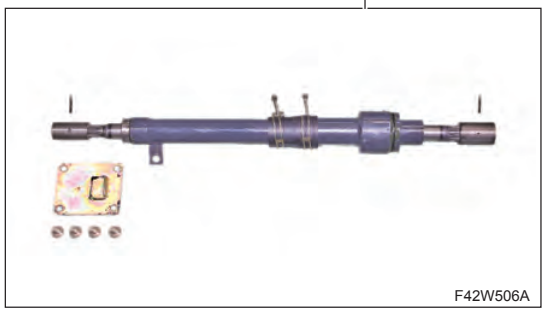


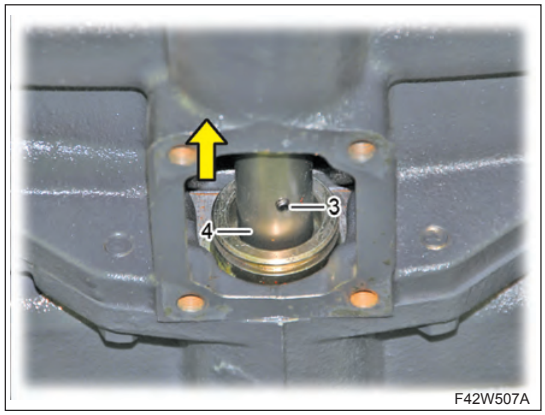
3. Remove the propeller shaft (1).

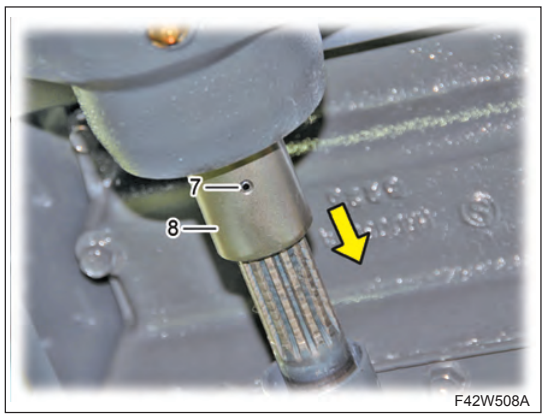
Notes

▶ **PROPELLER SHAFT DISASSEMBLY AND ASSEMBLY**







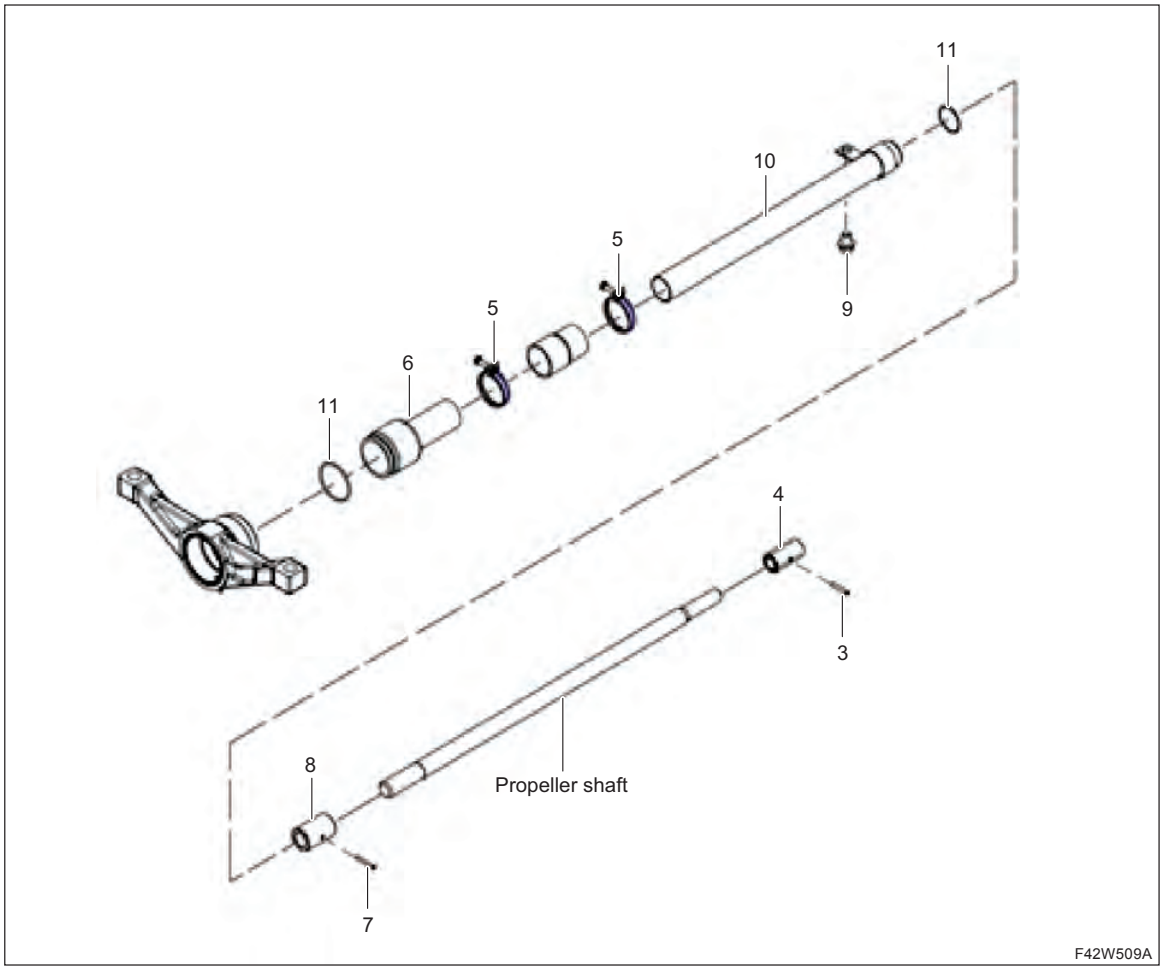


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Notes

▶ PROPELLER SHAFT DISASSEMBLY AND ASSEMBLY



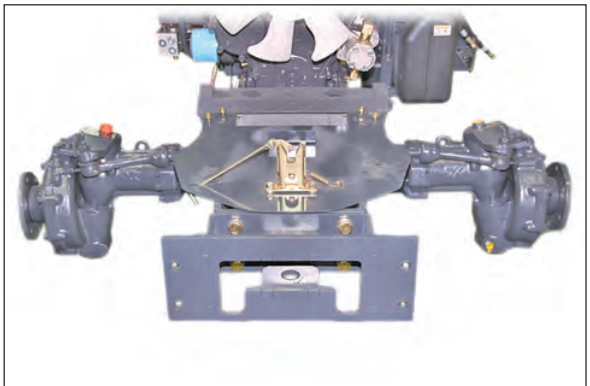
1. Unscrew the cover mounting bolts (1) and remove the cover (2). Then, remove the coupling pin (3) and pull out the coupling (4) in the arrow direction (front side of vehicle) to remove the 4WD shaft.
2. After loosening the shaft cover booth band (5) and pull out the shaft cover (FRT)(6) in the front bracket.
3. Pull out the coupling pin (7) and remove the coupling (8) from the bevel pinion.
4. Unscrew the mounting bolts (9) of the shaft cover (RR) and pull out the shaft cover (RR)(10) to remove the propeller shaft assembly.

⚠ CAUTION

- **Check the O-rings (11) (2 EA) in the propeller shaft. If any one is faulty, replace it with a new one.**
- **Apply grease to the surface of a new O-ring and be careful not to miss any O-ring.**

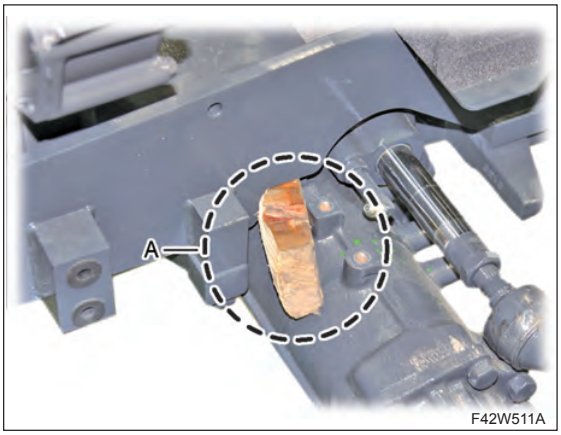
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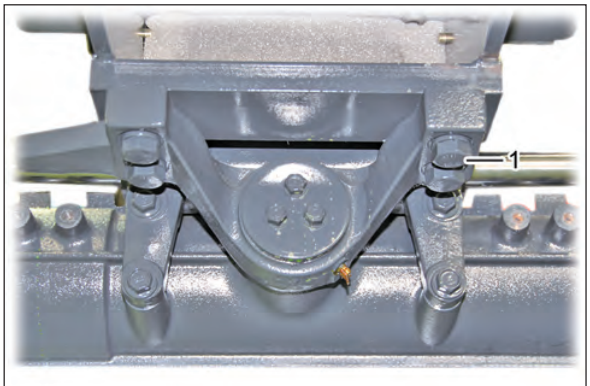
4. Place a stand under the engine oil pan. With the front of the tractor lifted slightly, remove the front tires.

⚠ CAUTION

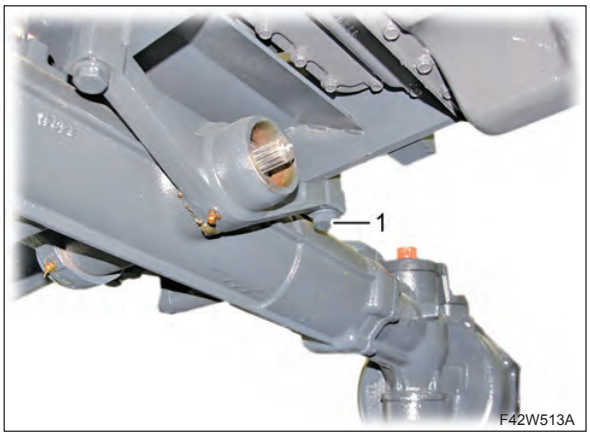


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- **After removing one tire, the center of gravity of the front axle case is shifted so the body starts to lean. Therefore, fit a wooden wedge block (A) between the front axle case and front axle bracket before removing the front tires.**



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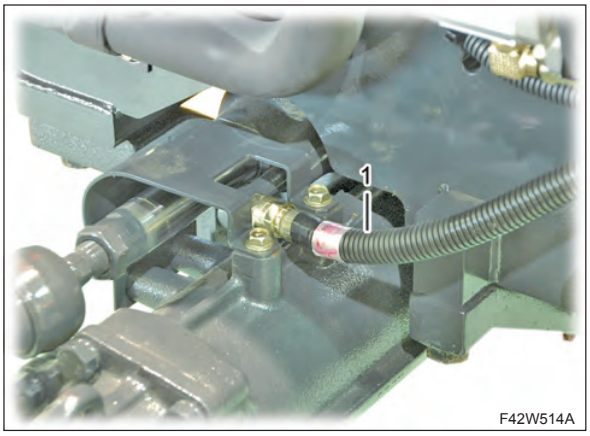
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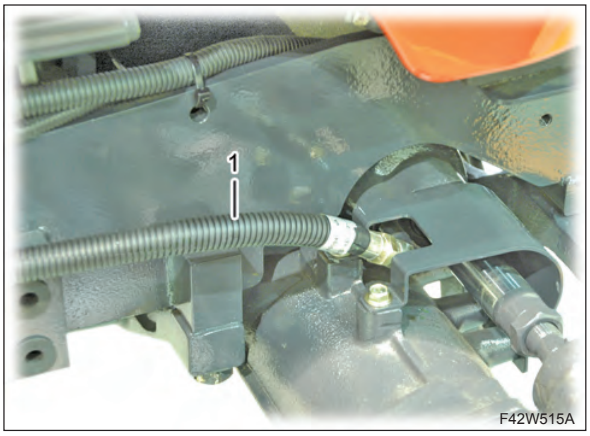
5. Support the front axle case with a portable hydraulic jack or hoist. Then, unscrew the mounting bolts (1) of the front and rear supports to separate the supports from their front axle bracket.

ITEM	TORQUE VALUE
Mounting bolt	392 N.m 40 kgf.m 288 lbf.ft

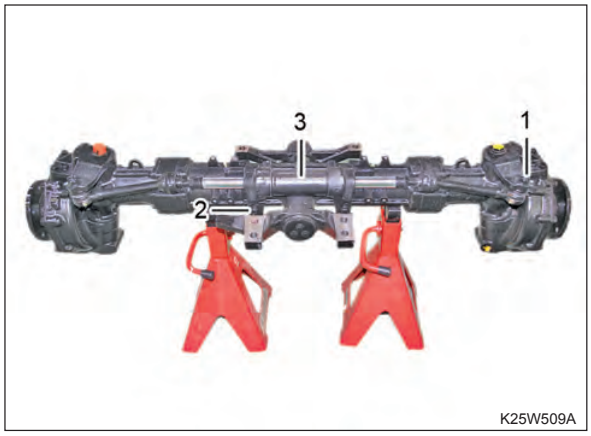
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6. Disconnect each PST cylinder hydraulic hose (1). Then, remove the front axle case assembly.

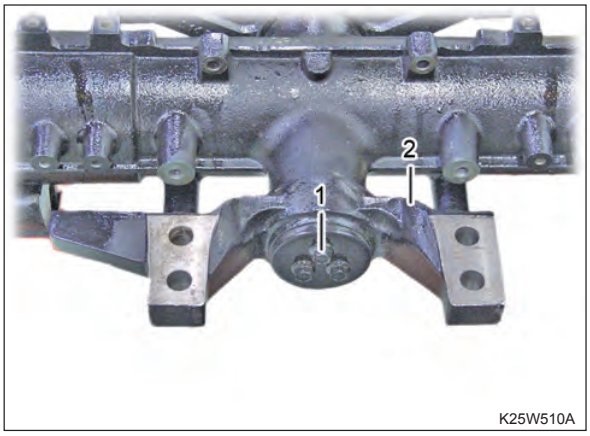


7. Unscrew the slotted nut (1) of the tie rod end from the front axle case assembly and unscrew the PST cylinder mounting bolt (2) to separate the PST cylinder (3). When re-installing the PST cylinder, apply Loctite to the threads of its mounting bolt.

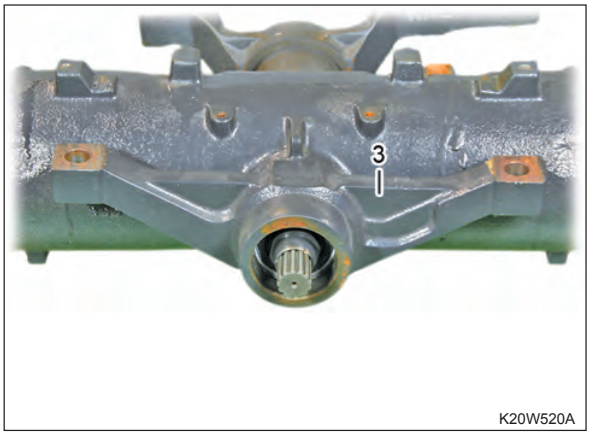
ITEM	TORQUE VALUE
PST cylinder mounting bolt	88.2 N.m 9.0 kgf.m 64.8 lbf.ft
Slotted nut	264.6 N.m 27 kgf.m 194.4 lbf.ft

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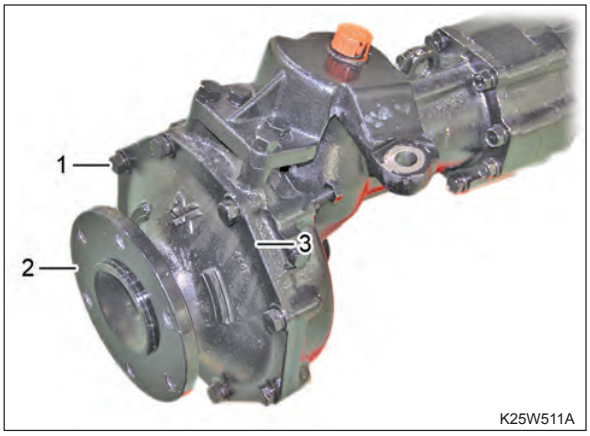


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8. Remove the support (front) thrust plate (1) from the front axle case assembly. Then, pull out the support (front) (2) and support (rear) (3) to remove them.

5.2 FRONT AXLE CASE COMPONENT DISASSEMBLY

5.2.1 FRONT GEAR CASE



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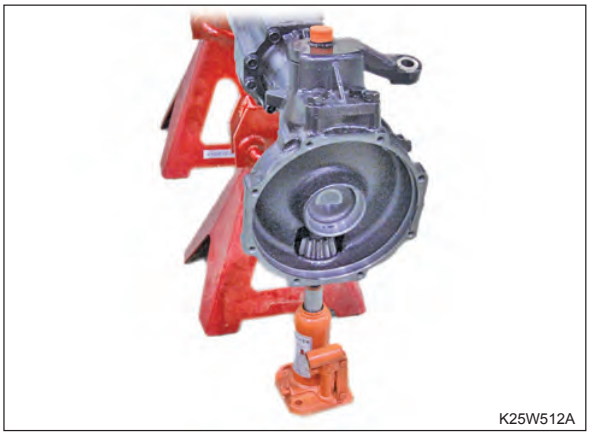
1. Unscrew the front bearing case mounting bolts (1) and remove the front spindle (2) and front bearing case (3) assembly together.

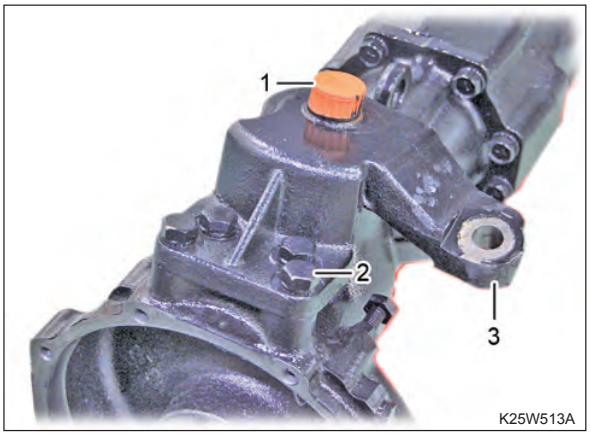
ITEM	TORQUE VALUE
Mounting bolt	51.9±6.9 N.m 5.3±0.7 kgf.m 38.2±5.0 lbf.ft

5

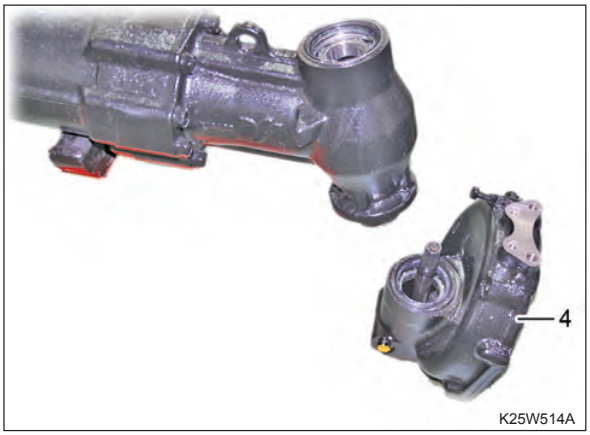
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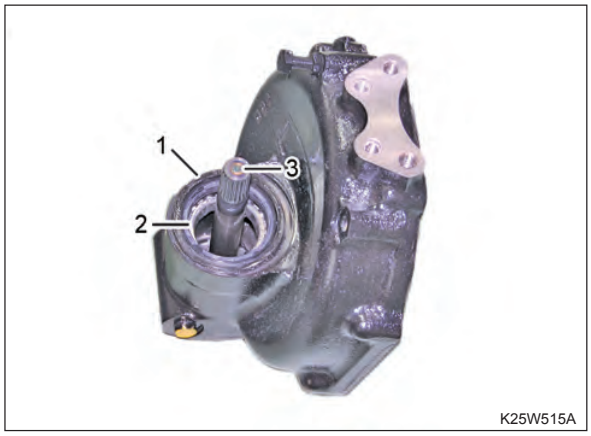
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K25W514A

2. Place a jack under the front gearbox and unscrew the filler plug (1) and knuckle arm mounting bolts (2).
3. Lift up the knuckle arm (3) to remove it. Then, pull down the front gearbox (4) to separate it.

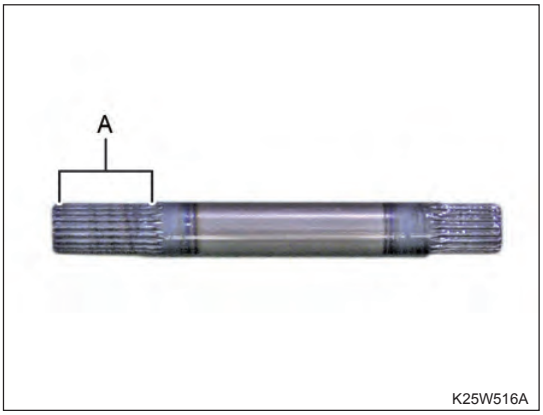
ITEM	TORQUE VALUE
Mounting bolt	88.2 N.m 9.0 kgf.m 64.8 lbf.ft



K25W515A

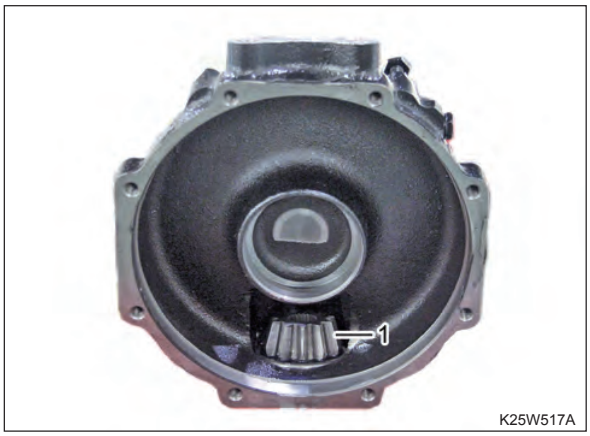
4. Remove the bearing seal (1), ball bearing (2) and front 2nd shaft (3) from the front gearbox by lifting them up.

Notes



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- **During the front 2nd shaft installation, make sure that the long side section (A) of the spline is toward the bevel gear 11T.**

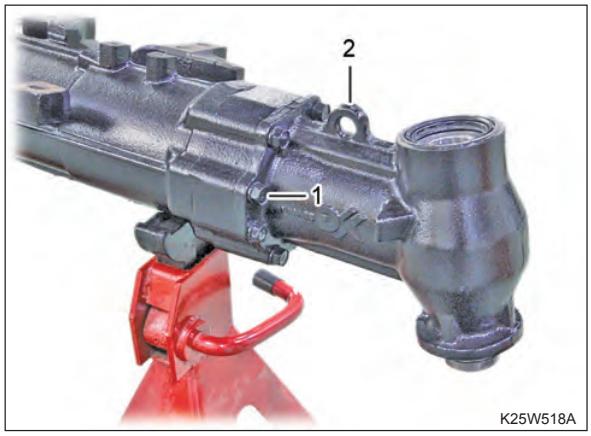


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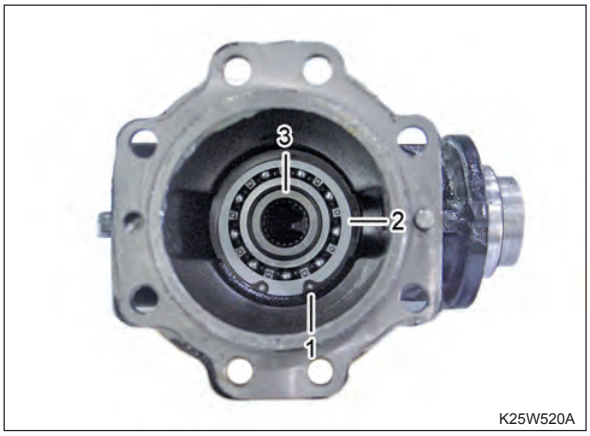
5. Lift up the bevel gear (1) from the front gearbox to remove it.

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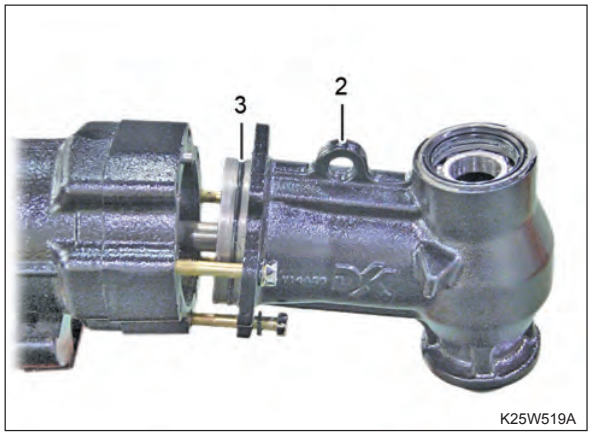
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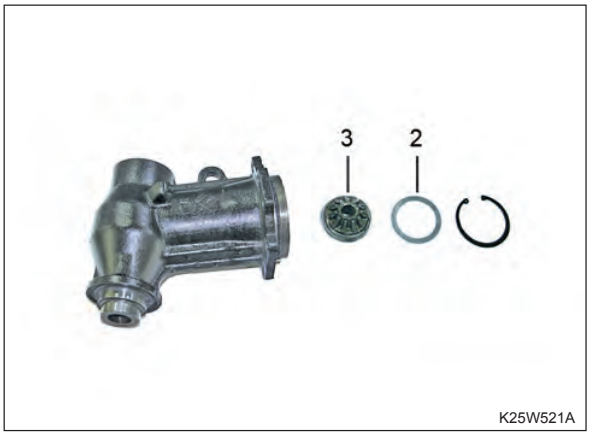
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6. Unscrew the front axle case support bolts (1) to separate the front gear case assembly (2).

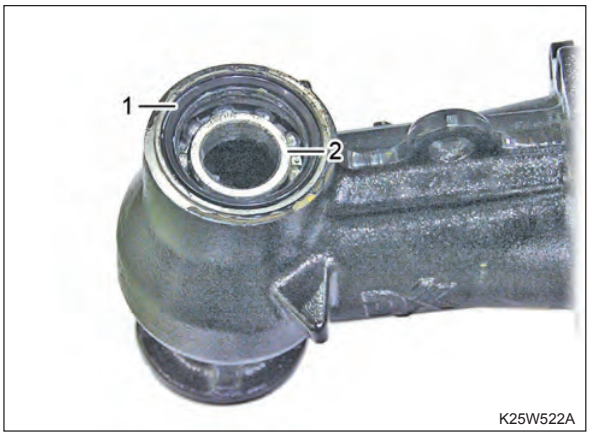
Notes
• **Apply grease to the O-ring (3) of the front axle case when re-installing it.**

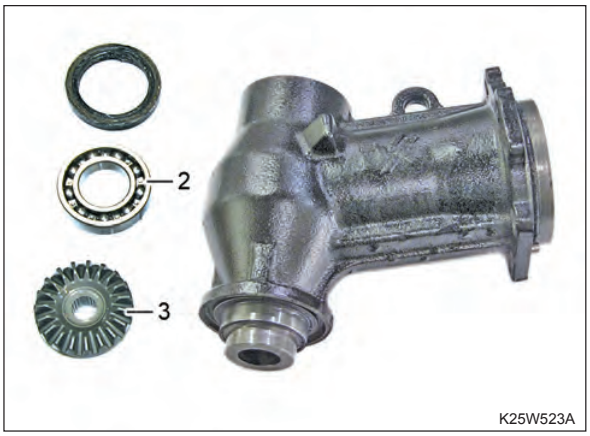
ITEM	TORQUE VALUE
Support bolt (1)	88.2 N.m 9.0 kgf.m 64.8 lbf.ft

7. Pull out the snap ring (1) for hole and remove the shim (2) and front 1st shaft pinion (3). At this moment, check the amount of the shims between the snap ring and bearing so that the same amount of the shims can be fitted during assembly.

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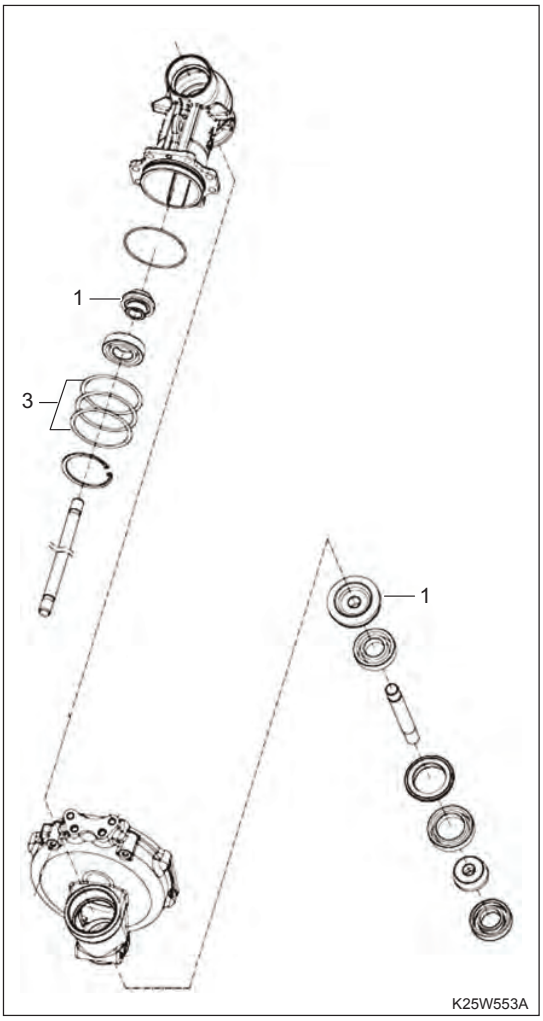
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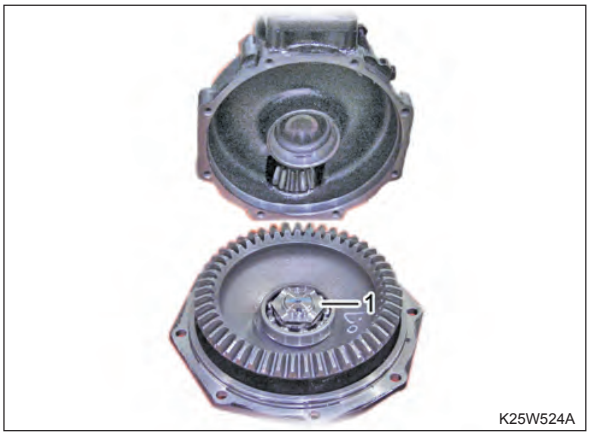


8. Remove the oil seal (1) from the front gear case. Then, remove the deep-groove ball bearing (2) and front 2nd shaft gear (3).

Notes



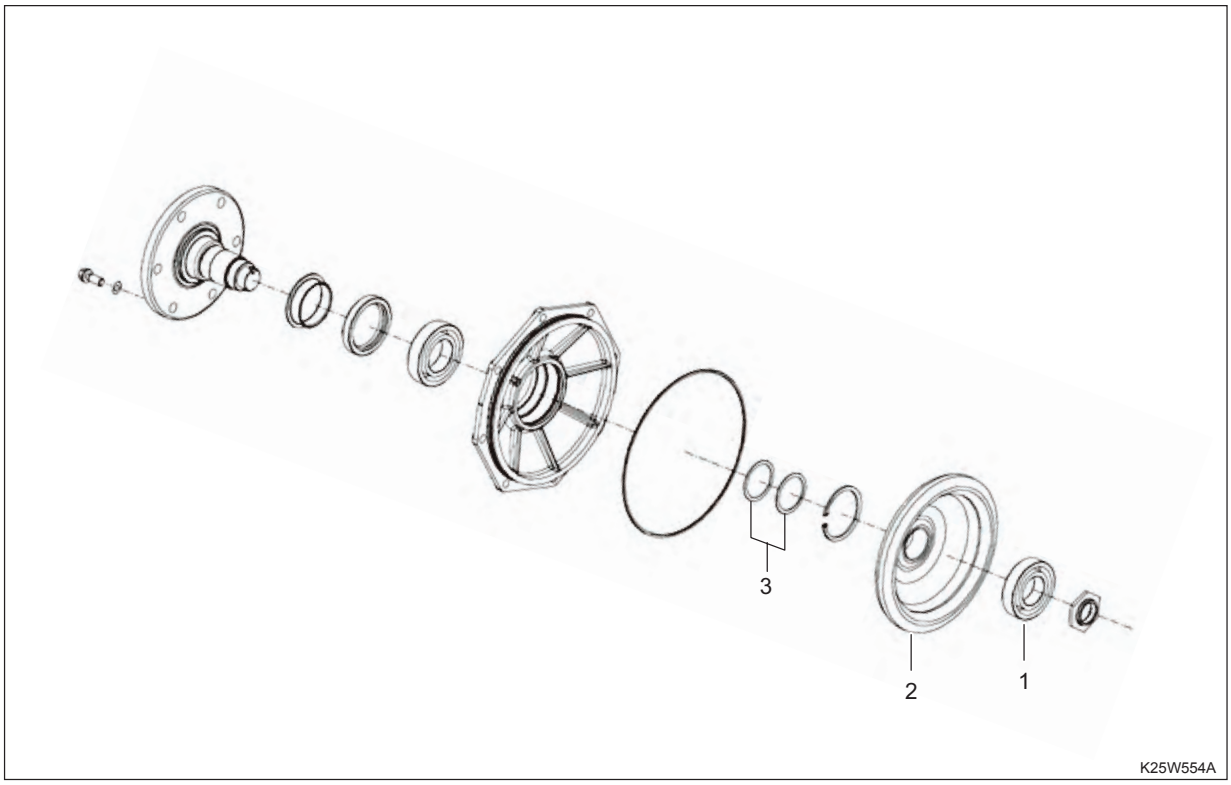
- **Adjust the backlash between the front 1st shaft pinion (1) and front 2nd shaft gear (2) to 0.15 - 0.3 mm (0.006 - 0.012 in.) using 0.2T, 0.3T and 0.5T shims (3).**

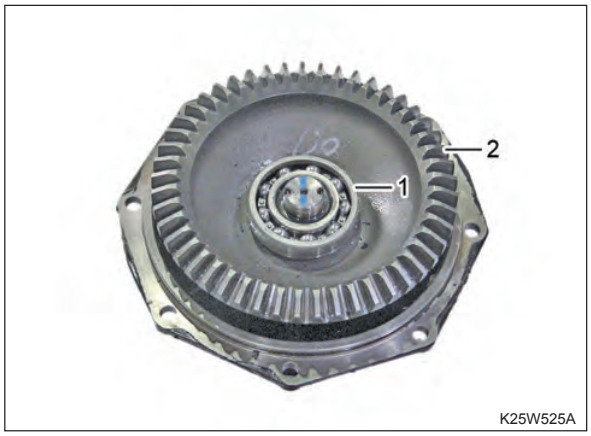


9. Unscrew the front spindle mounting lock nut (1) from the front bearing case assembly.

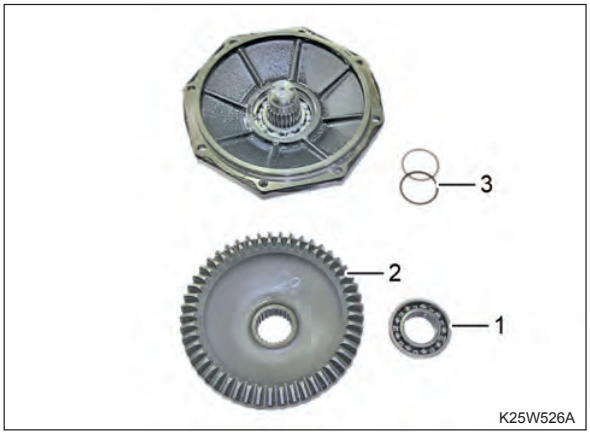
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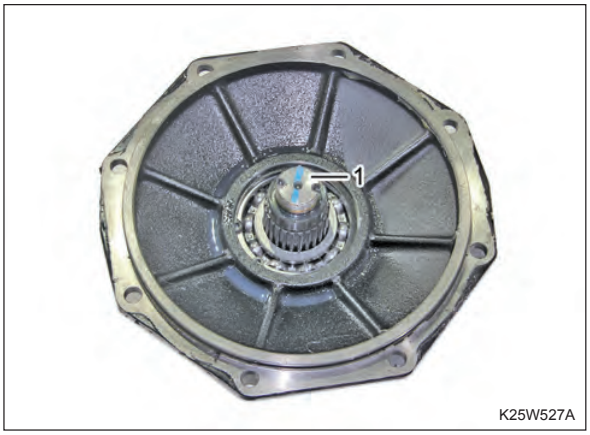


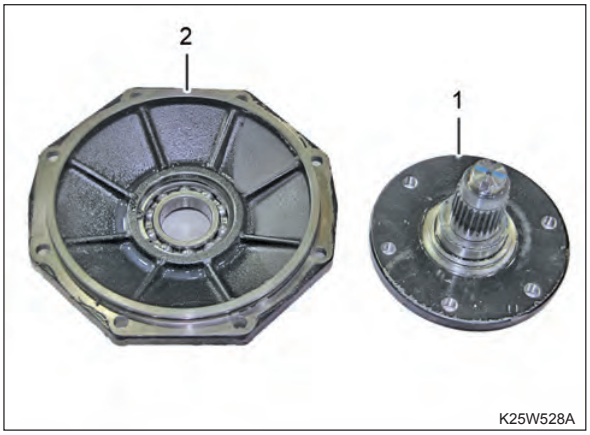
10. Remove the bearing (1) and front final gear (2). Then, remove the adjust shim (3).



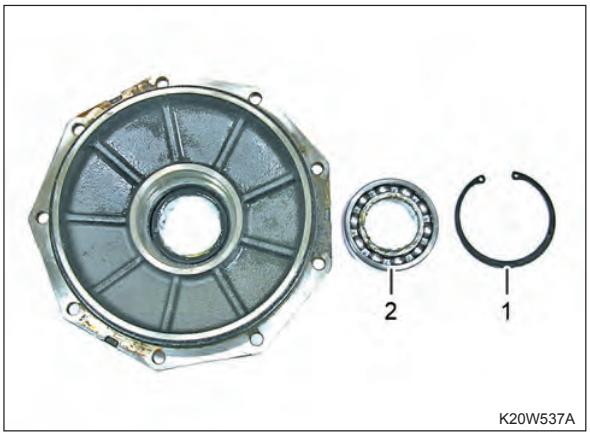
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11. Separate the front spindle (1) and front bearing case (2) from each other.



12. Pull out the snap ring for hole (1) from the front bearing case and remove the deep-groove ball bearing (2).

FRONT SPINDLE INSTALLATION

1. Insert the front final gear into the front spindle, install the washer, lock washer and mounting bolt and tighten the bolt to the specified torque. Then, bend the lock washer to press it against the bolt head.

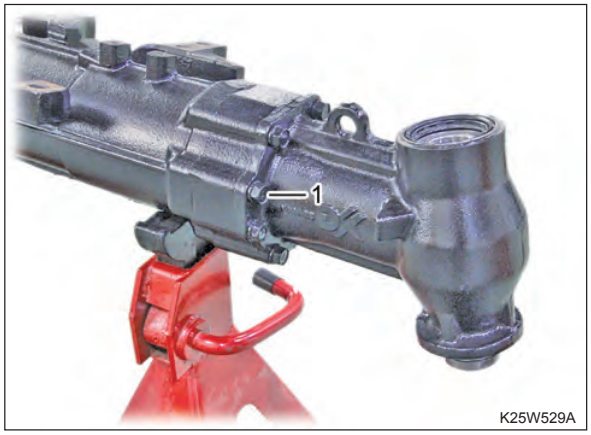
ITEM	TORQUE VALUE
Mounting bolt	51.9 N.m 5.3 kgf.m 38.2 lbf.ft

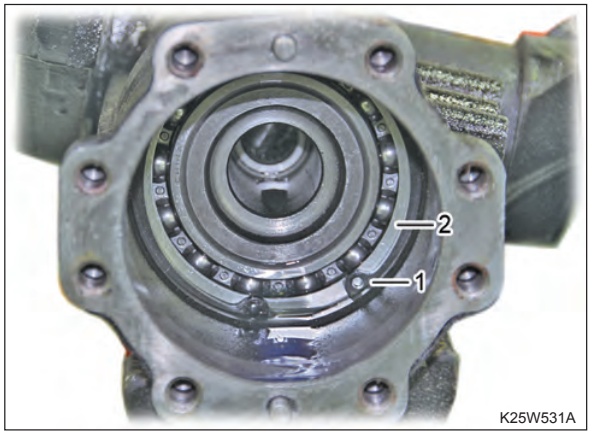
2. Apply grease to the O-ring of the front bearing case and fit it to the front gearbox.

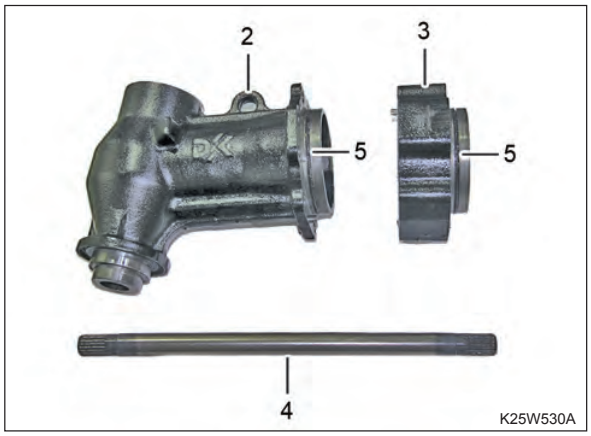
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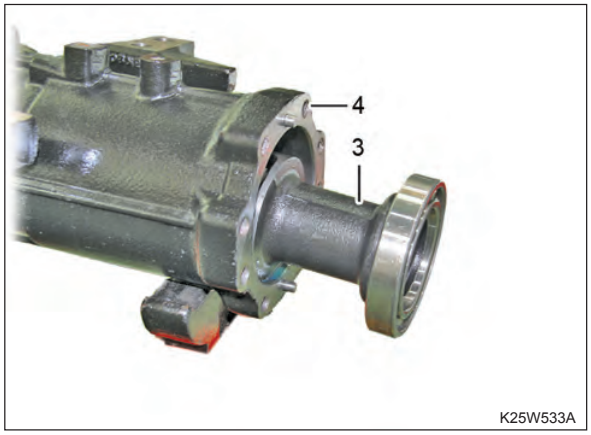
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5.2.2 FRONT DIFFERENTIAL







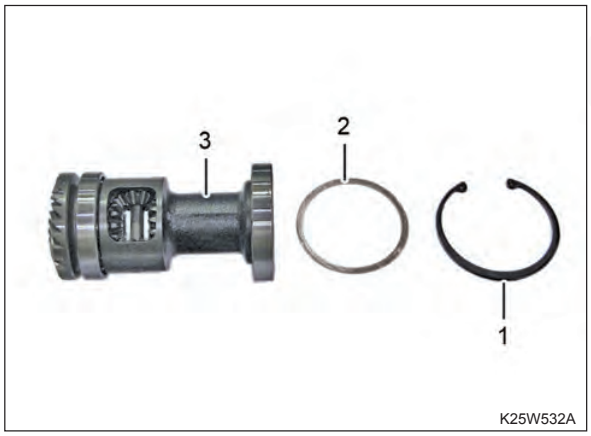


1. Unscrew the front gear case mounting bolts (1) to remove the front gear case (2), spacer (3) and front 1st shaft (4) together.

ITEM	TORQUE VALUE
Mounting bolt	88.2 N.m 9.0 kgf.m 64.8 lbf.ft

Notes

- **Apply grease to the O-ring (5) of the front axle case when re-installing it.**



2. Pull out the snap ring (1) and adjusting shim (2) to remove the differential case assembly (3) from the front axle case (4).

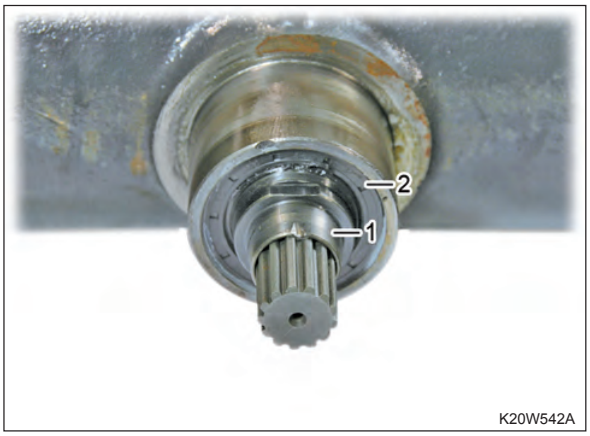
ITEM	TORQUE VALUE
Mounting bolt	29.4 N.m 3.0 kgf.m 21.6 lbf.ft

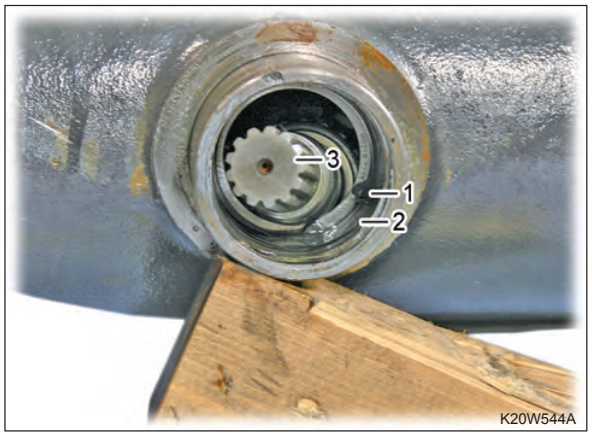
Notes

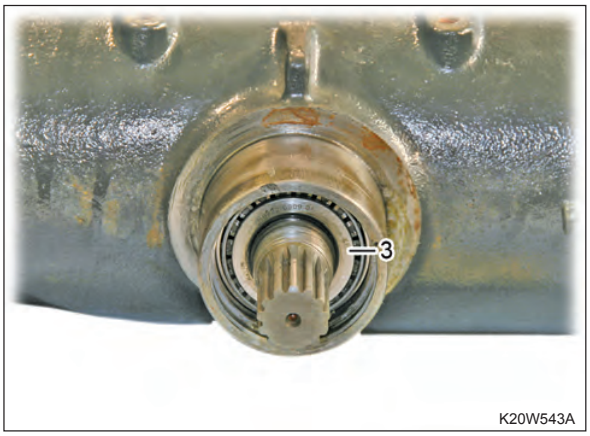
- **Apply Loctite to the threads of the bearing retainer mounting bolt during re-installation.**

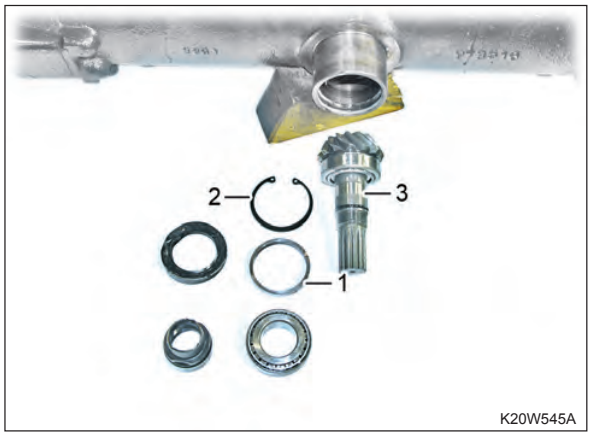
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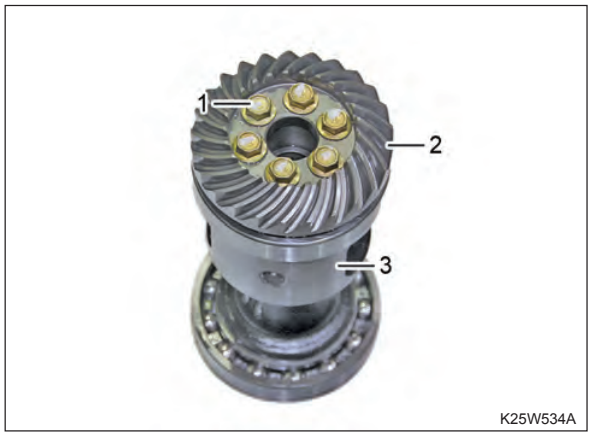
3. Unscrew the seal collar (1) from the drive pinion, pull out the oil seal (2) and remove the taper roller bearing (3).

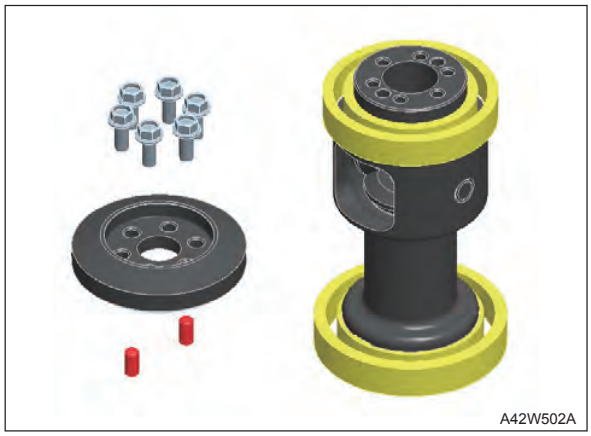
4. Pull out the collar (1) and snap ring (2). Then, remove the drive pinion (3) by pushing into the front axle case hole.

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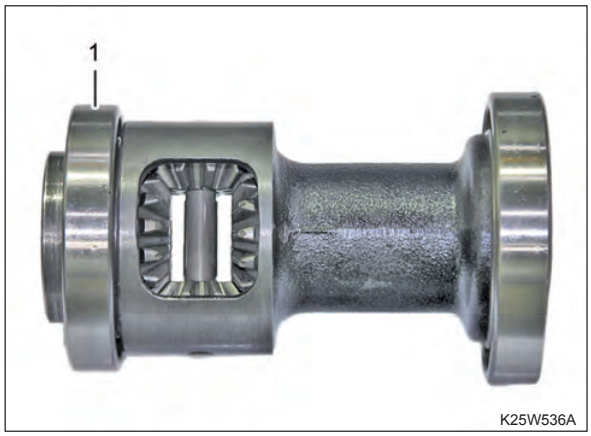
5.2.3 FRONT DIFFERENTIAL ASSEMBLY DISASSEMBLY



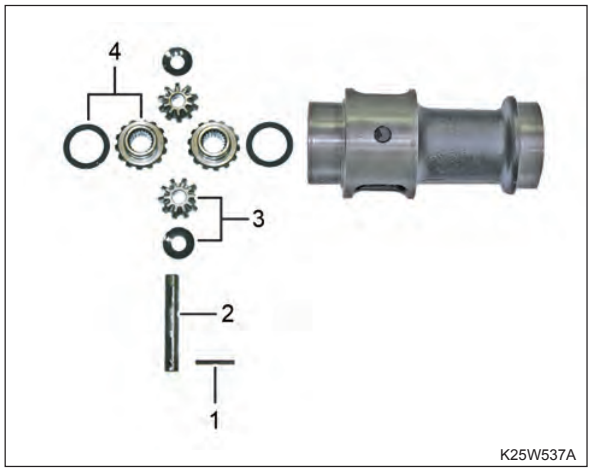


1. Unscrew the ring gear mounting bolts (1) from the front differential assembly to separate the ring gear (2) and differential case (3).

ITEM	TORQUE VALUE
Mounting bolt M8(10.9T)	34.3 N.m 3.5 kgf.m 25.2 lbf.ft



2. Remove the ball bearings (1) from both sides of the differential case assembly.



3. Pull out the spring pin (1) from the knock pin hole of the differential case. Then, remove the differential pinion shaft (2) and differential pinion gear 10 (3) together. And then, remove the differential side gear and liner (4).
4. Assemble in the reverse order of disassembly.

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CHAPTER 6 HYDRAULIC SYSTEM

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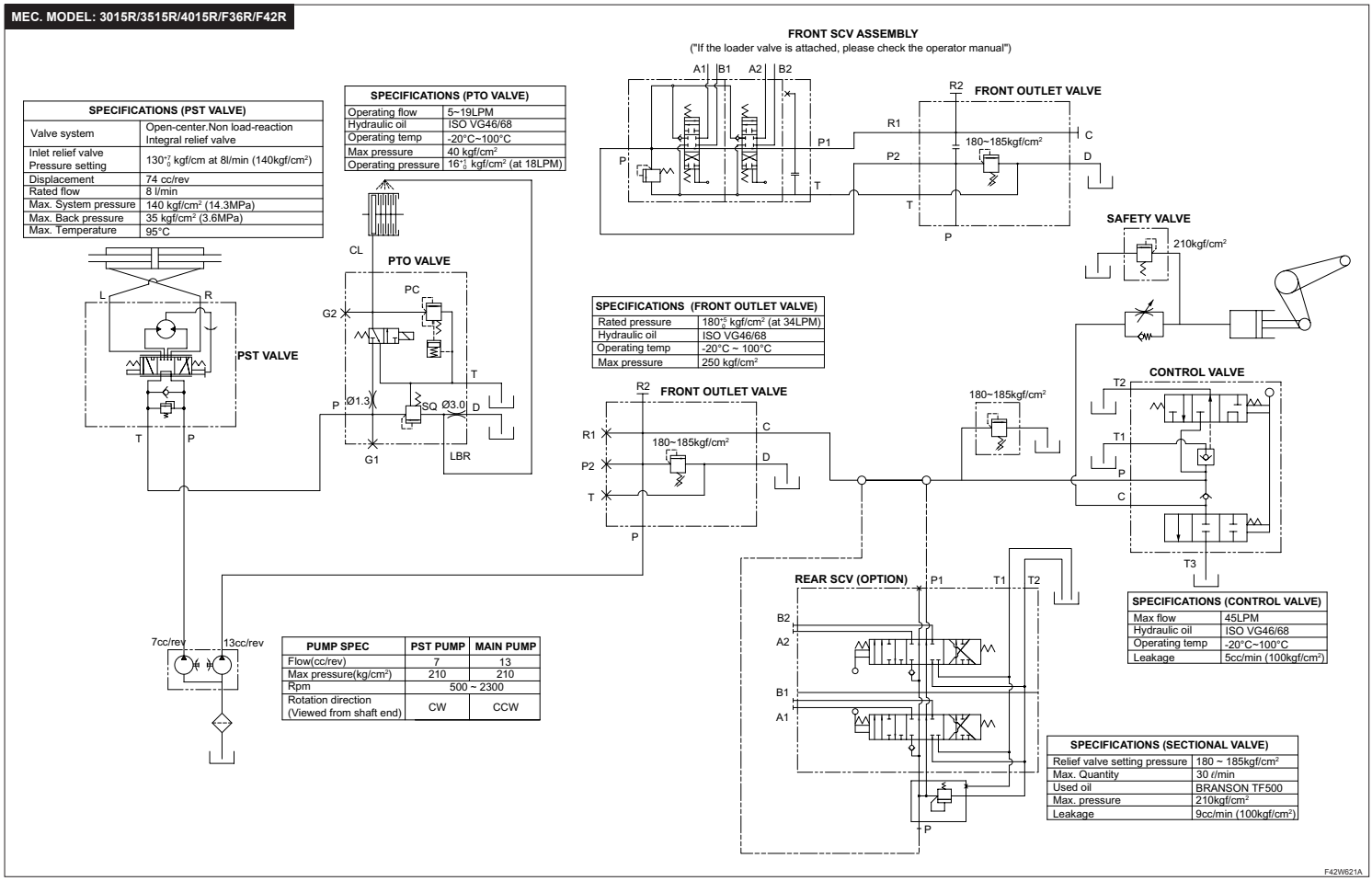
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1. CIRCUIT DIAGRAM FOR HYDRAULIC SYSTEM

MEC. MODEL: 3015R/3515R/4015R/F36R/F42R



SPECIFICATIONS (PST VALVE)	
Valve system	Open-center.Non load-reaction Integral relief valve
Inlet relief valve Pressure setting	130$^{+7}_{0}$ kgf/cm at 8l/min (140kgf/cm²)
Displacement	74 cc/rev
Rated flow	8 l/min
Max. System pressure	140 kgf/cm² (14.3MPa)
Max. Back pressure	35 kgf/cm² (3.6MPa)
Max. Temperature	95°C

SPECIFICATIONS (PTO VALVE)	
Operating flow	5~19LPM
Hydraulic oil	ISO VG46/68
Operating temp	-20°C~100°C
Max pressure	40 kgf/cm²
Operating pressure	16$^{+1}_{0}$ kgf/cm² (at 18LPM)

SPECIFICATIONS (FRONT OUTLET VALVE)	
Rated pressure	180$^{+5}_{0}$ kgf/cm² (at 34LPM)
Hydraulic oil	ISO VG46/68
Operating temp	-20°C ~ 100°C
Max pressure	250 kgf/cm²

PUMP SPEC	PST PUMP	MAIN PUMP
Flow(cc/rev)	7	13
Max pressure(kg/cm²)	210	210
Rpm	500 ~ 2300	
Rotation direction (Viewed from shaft end)	CW	CCW

SPECIFICATIONS (CONTROL VALVE)	
Max flow	45LPM
Hydraulic oil	ISO VG46/68
Operating temp	-20°C~100°C
Leakage	5cc/min (100kgf/cm²)

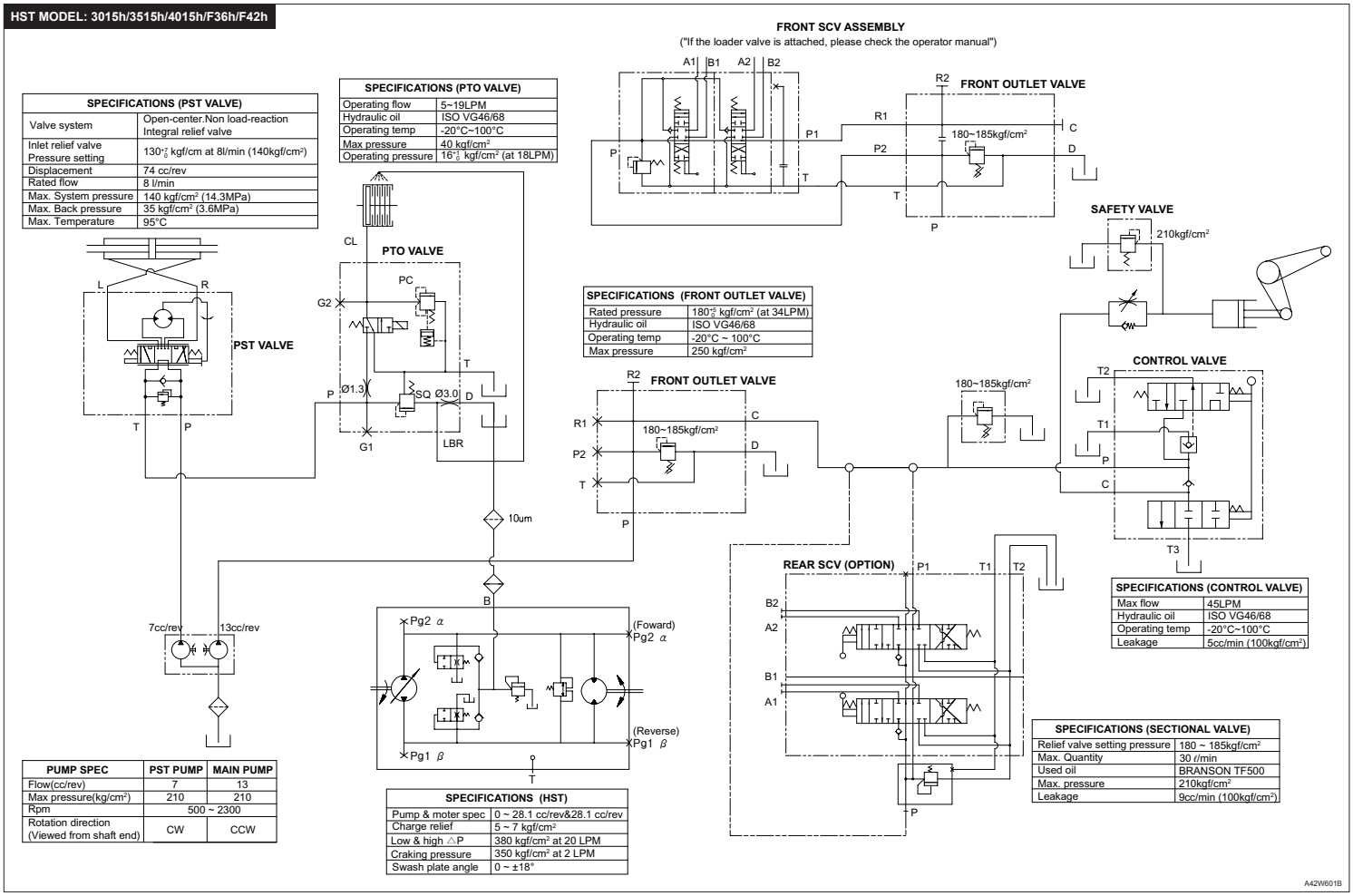
SPECIFICATIONS (SECTIONAL VALVE)	
Relief valve setting pressure	180 ~ 185kgf/cm²
Max. Quantity	30 ℓ/min
Used oil	BRANSON TF500
Max. pressure	210kgf/cm²
Leakage	9cc/min (100kgf/cm²)

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HST MODEL: 3015h/3515h/4015h/F36h/F42h



SPECIFICATIONS (PST VALVE)	
Valve system	Open-center.Non load-reaction Integral relief valve
Inlet relief valve Pressure setting	130$^{+7}_{0}$ kgf/cm at 8l/min (140kgf/cm²)
Displacement	74 cc/rev
Rated flow	8 l/min
Max. System pressure	140 kgf/cm² (14.3MPa)
Max. Back pressure	35 kgf/cm² (3.6MPa)
Max. Temperature	95°C

SPECIFICATIONS (PTO VALVE)	
Operating flow	5~19LPM
Hydraulic oil	ISO VG46/68
Operating temp	-20°C~100°C
Max pressure	40 kgf/cm²
Operating pressure	16$^{+1}_{0}$ kgf/cm² (at 18LPM)

SPECIFICATIONS (FRONT OUTLET VALVE)	
Rated pressure	180$^{+5}_{0}$ kgf/cm² (at 34LPM)
Hydraulic oil	ISO VG46/68
Operating temp	-20°C ~ 100°C
Max pressure	250 kgf/cm²

SPECIFICATIONS (CONTROL VALVE)	
Max flow	45LPM
Hydraulic oil	ISO VG46/68
Operating temp	-20°C~100°C
Leakage	5cc/min (100kgf/cm²)

SPECIFICATIONS (SECTIONAL VALVE)	
Relief valve setting pressure	180 ~ 185kgf/cm²
Max. Quantity	30 ℓ/min
Used oil	BRANSON TF500
Max. pressure	210kgf/cm²
Leakage	9cc/min (100kgf/cm²)

PUMP SPEC	PST PUMP	MAIN PUMP
Flow(cc/rev)	7	13
Max pressure(kg/cm²)	210	210
Rpm	500 ~ 2300	
Rotation direction (Viewed from shaft end)	CW	CCW

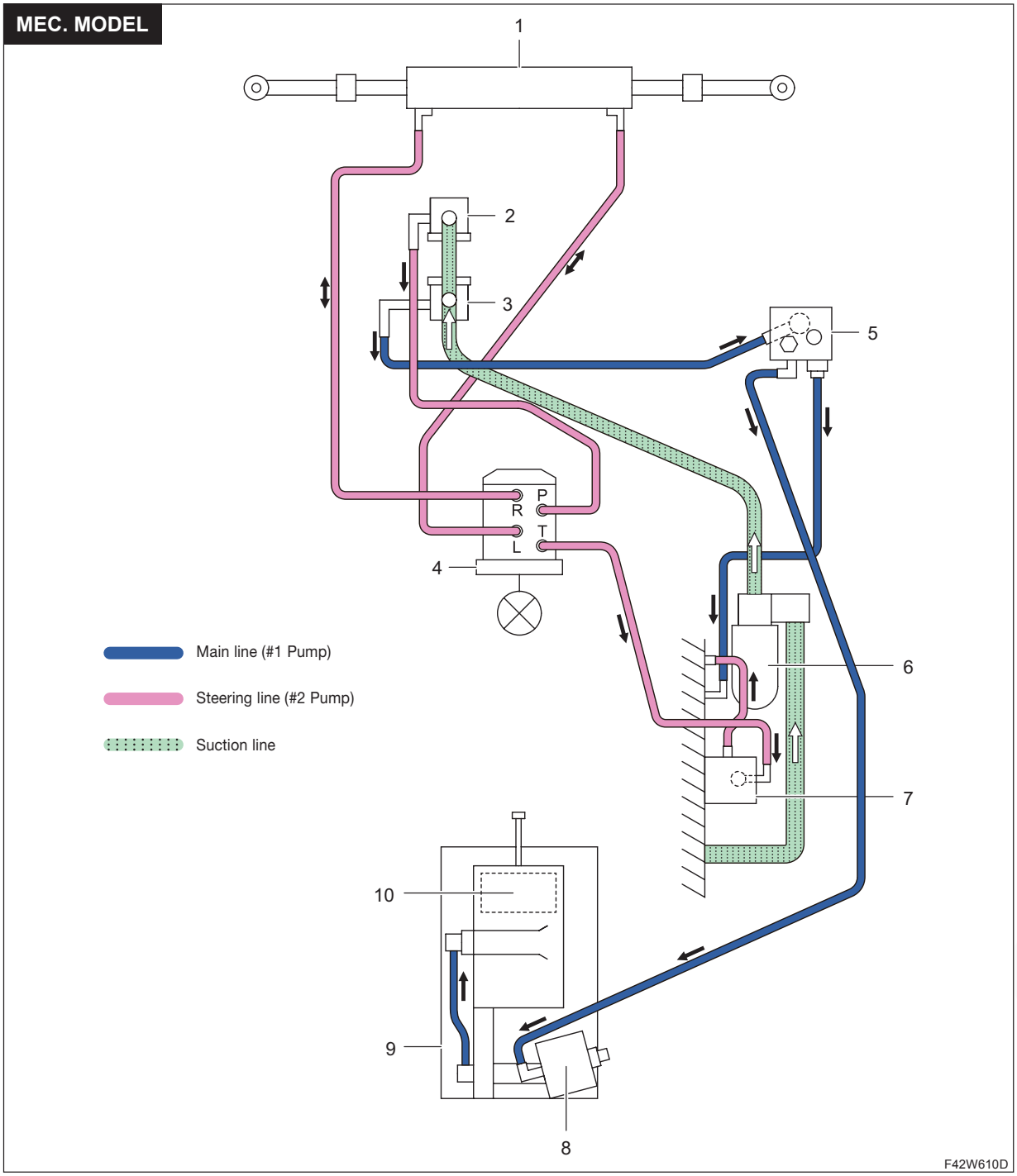
SPECIFICATIONS (HST)	
Pump & moter spec	0 ~ 28.1 cc/rev&28.1 cc/rev
Charge relief	5 ~ 7 kgf/cm²
Low & high △P	380 kgf/cm² at 20 LPM
Craking pressure	350 kgf/cm² at 2 LPM
Swash plate angle	0 ~ ±18°

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2. DIAGRAM FOR HYDRAULIC SYSTEM

MEC. MODEL



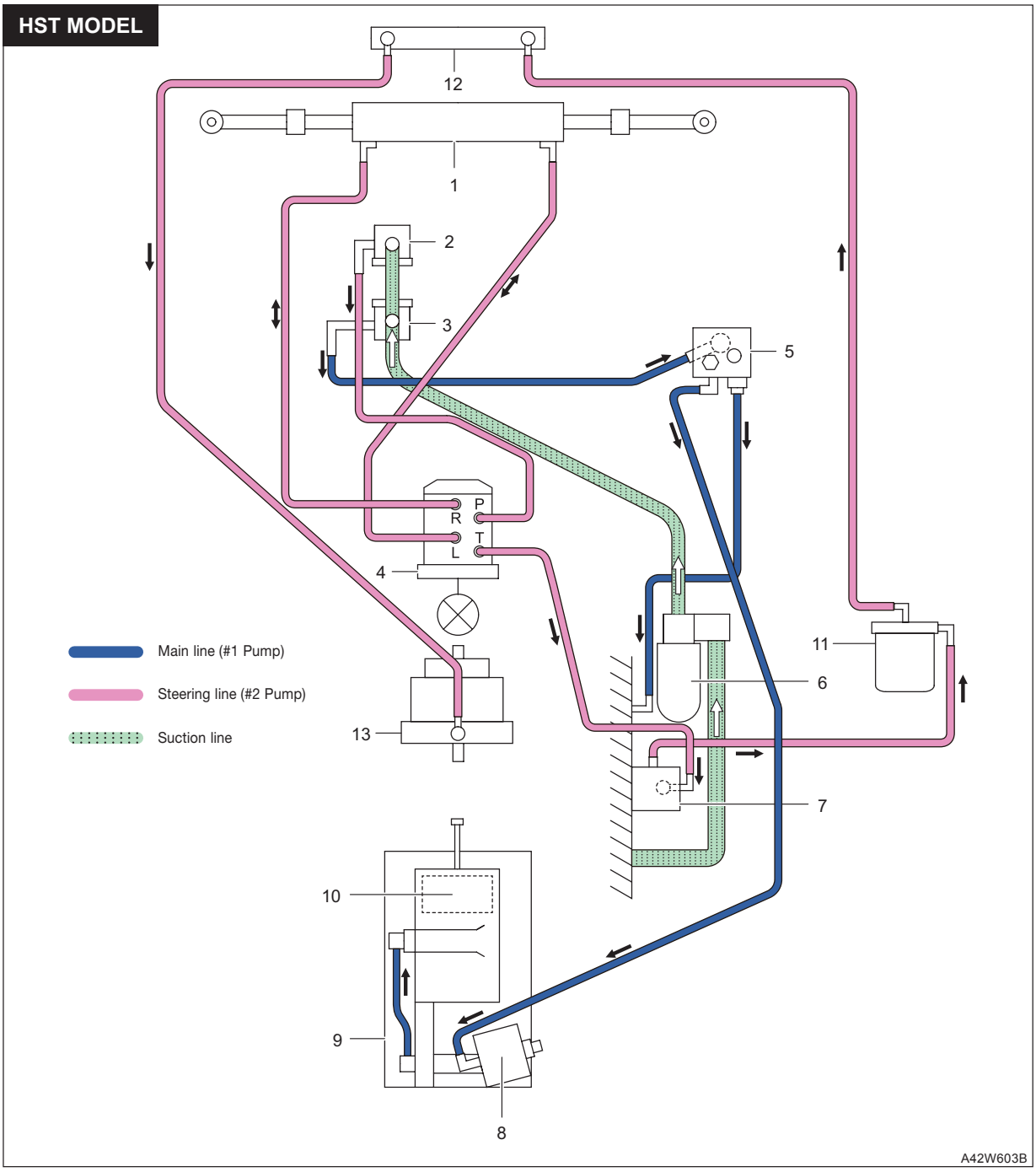
(1) PST cylinder
(2) Hydraulic pump (7 cc)
(3) Hydraulic pump (13 cc)
(4) PST valve
(5) Front outlet valve
(6) Hydraulic filter
(7) PTO valve
(8) Rear relief valve
(9) Hydraulic cylinder case

The hydraulic system can be divided into two parts; implement section and steering/PTO section. Firstly, the implement section receives hydraulic oil from the primary gear pump (13 cc/rev.) and supplies this oil to the SCV valve (if equipped) or front outlet valve for load operation, SCV (rear) valve (if equipped) for rear implement operation and control valve, which is the lift valve for the 3-point hitch, in order.

Secondly, the steering/PTO section receives hydraulic oil from the secondary gear pump (7.0 cc/rev.) and supplies this oil to the PST valve for power steering and PTO valve for PTO control in order.

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(1) PST cylinder
(2) Hydraulic pump (7cc)
(3) Hydraulic pump (13cc)
(4) PST valve
(5) Front outlet valve
(6) Hydraulic filter
(7) PTO valve
(8) Rear relief valve
(9) Hydraulic cylinder case
(10) Control valve
(11) HST filter
(12) Oil cooler
(13) HST

For the HST model, the hydraulic circulation circuit of the primary gear pump (13 cc/rev.) is the same to the one for the mechanical model. However, these two models have different methods for hydraulic pressure delivery of the secondary gear pump (7.0 cc/rev.).

Hydraulic oil supplied from the secondary gear pump is used to operate the PST valve and PTO valve. Then, it is carried from the PTO valve into the HST filter to be filtered. After filtered, it is led into the oil cooler to be cooled down to a sufficient level before it is delivered to the HST for HST operation.

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3. MAJOR COMPONENT SPECIFICATIONS

3.1 PST VALVE

TYPE	OPEN CENTER, NON-LOAD REACTION TYPE INTEGRAL RELIEF VALVE	
Relief valve setting pressure	12.8 - 13.5 MPa 130 - 137 kgf/cm^2 1,857 - 1,959 psi	at 8 ℓ/min
Capacity	74 cc/rev	
Rated flow	8 ℓ/min	
Max. system pressure	13.7 MPa 140 kgf/cm^2 1,988 psi	
Maximum back pressure	3.4 MPa 35 kgf/cm^2 498 psi	
Max. temperature	95 ℃ 203 °F	
Steering input torque (when energized)	1.47 N.m 0.15 kgf.m 1.08 lbf.ft	Reference
Filter	Nominal 10 μm	

3.2 HYDRAULIC PUMP

	Primary pump	Secondary pump
Theoretical discharge volume	13.0 cc/rev	7.0 cc/rev
Maximum pressure	210 kgf/cm^2	210 kgf/cm^2
Revolving speed	500 - 2,500 rpm	500 - 3,000 rpm
Turning direction (when seeing from end of shaft)	Counterclockwise	Clockwise

3.3 CONTROL VALVE

Max. flow	45 ℓ/min.
Operating pressure	180 kgf/cm^2

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3.4 FRONT OUTLET VALVE

Relief valve setting pressure	180 ~ 185 kgf/cm^2
Max pressure	250 kgf/cm^2

3.5 REAR SCV VALVE

Relief valve setting pressure	180 ~ 185 kgf/cm^2
Nominal flow	30 ℓ/min.
Max. pressure	210 kgf/cm^2

3.6 PTO VALVE

Sequence valve setting pressure	16.0 kgf/cm^2
Operating flow	5 ~ 19 ℓ/min.
Max pressure	40 kgf/cm^2

3.7 HST [HST MODEL]

Displacement	Pump	0 ~ 28.1 cc/rev
	Motor	28.1 cc/rev
Pump swash plate angle		0 ~ ± 18°
Power input rotate direction		C.W (View on shaft end)
Charge relief set pressure		5~7 kgf/cm^2
Filter		10 μm
Neutral valve (orifice)		Ø0.8

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3.8 OIL COOLER [HST MODEL]

Air flow	5 m/sec
Flow	20 LPM
Heat rejection rate	Min. 4,400 kcal/h

3.9 PST CYLINDER

Type	Double-rod double acting type
Rod O.D.	Ø 30 mm
Cylinder I.D.	Ø 55 mm
Stroke	184.4 mm
Relief setting pressure	130 kgf/cm^2

3.10 HYDRAULIC FILTER

Filtering area	4,972 cm^2
Max. fineness	110 ± 8 μ

3.11 HST FILTER [HST MODEL]

Filtering area	2,677 cm^2
Rated flow	30 LPM
Fineness	20 μ

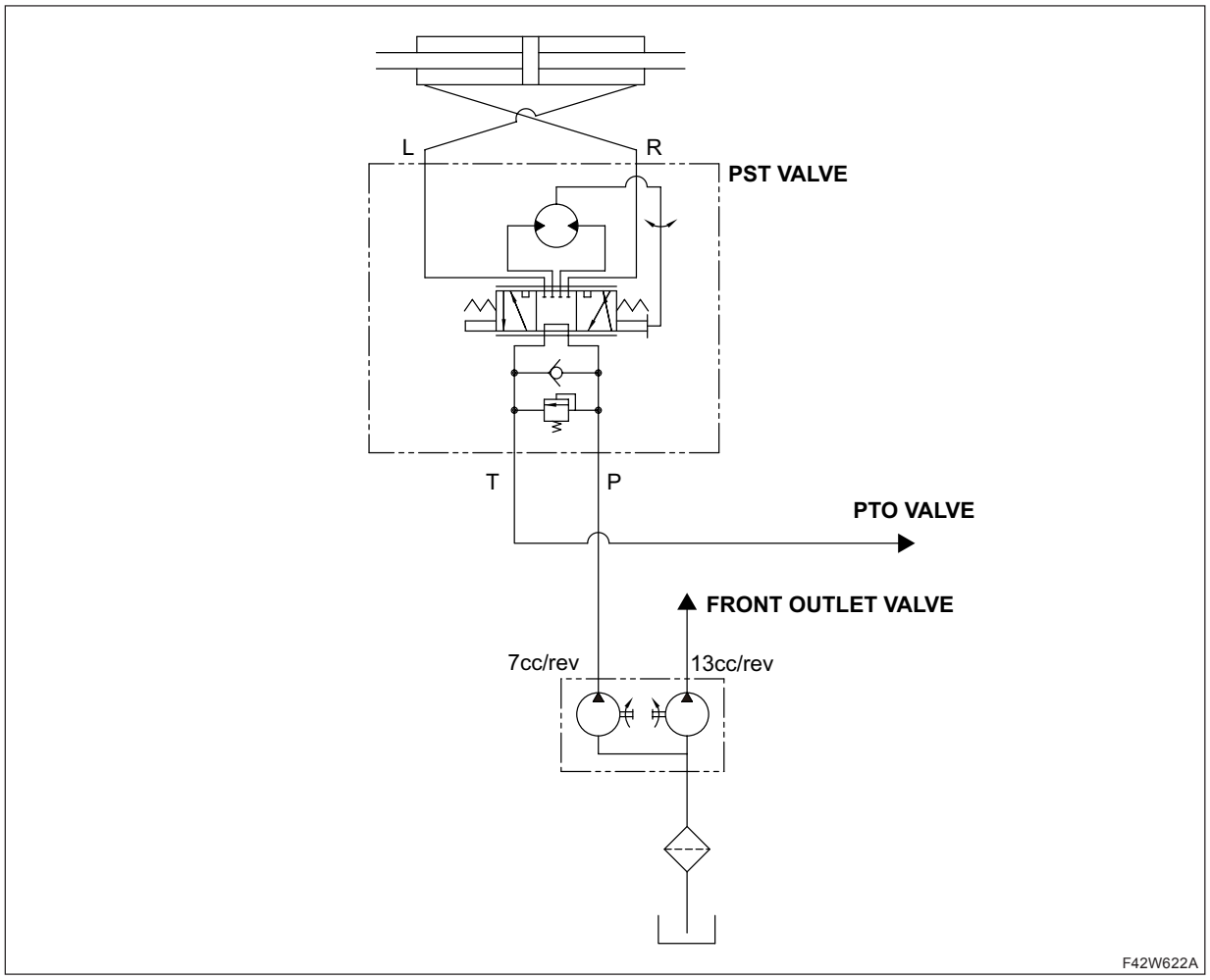
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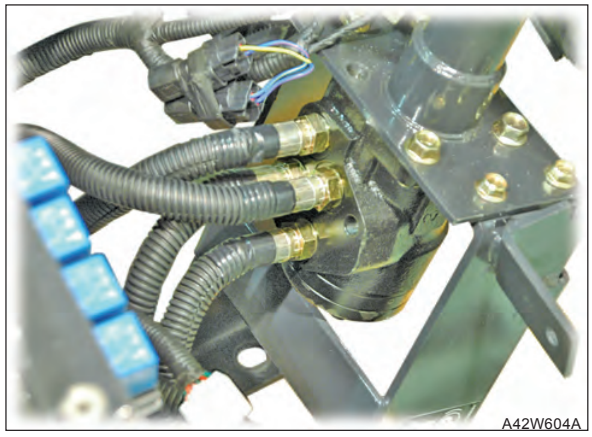
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4. STRUCTURE AND OPERATION

4.1 STEERING VALVE

4.1.1 OVERVIEW





Hydraulic oil from the hydraulic pump (secondary) is supplied to the steering valve which is installed under the steering wheel.

When the engine is started, oil is supplied to the left or right of the PST cylinder according to the turning direction of the steering wheel. Then, the corresponding PST cylinder is extended or retracted to turn the vehicle to the desired direction.

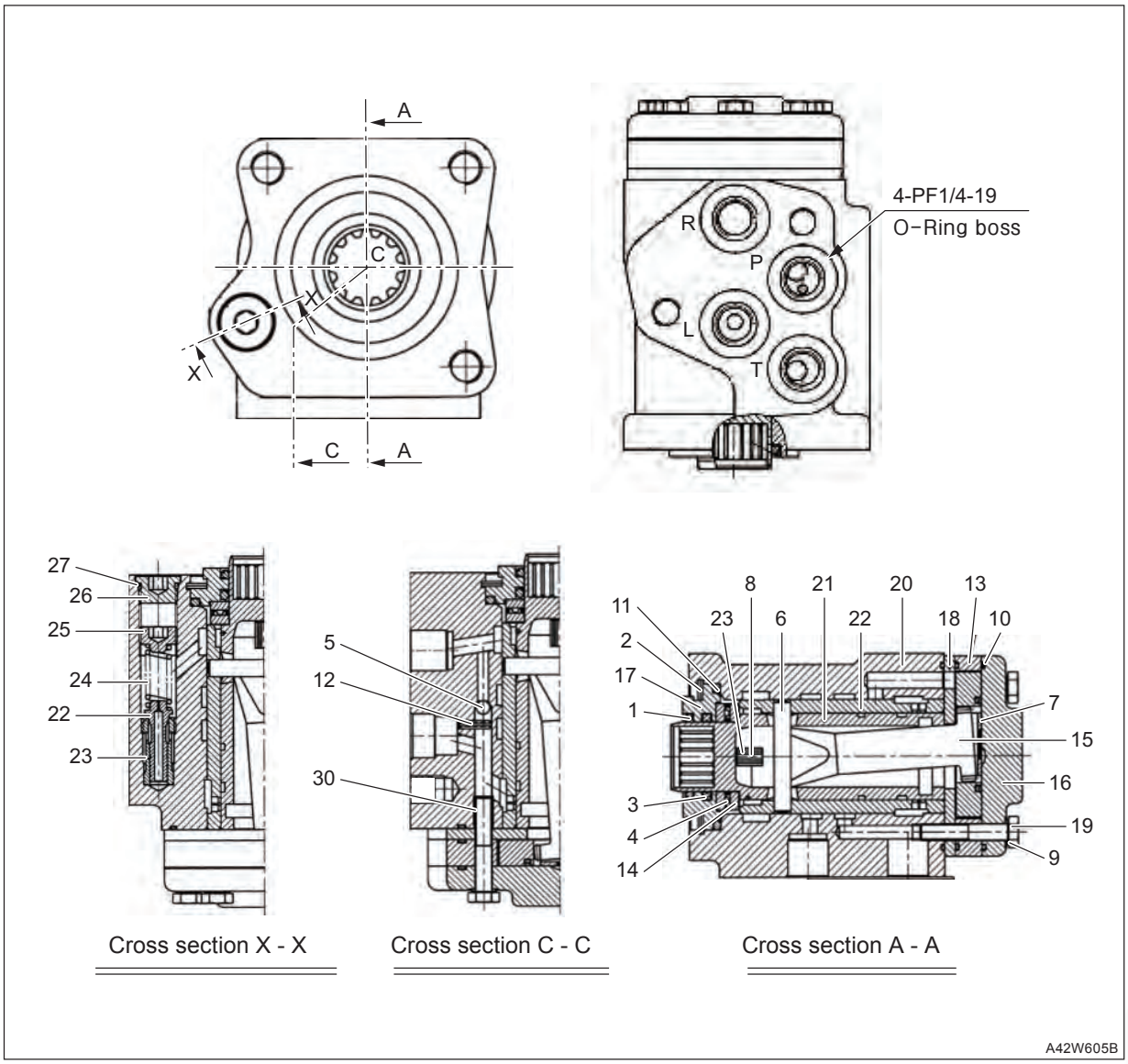
Then, oil used from the PST cylinder is returned to the tank through the steering valve, return hose and PTO valve and it is recirculated by the pump to be used again.

This steering valve is a non-load reaction type which means that the steering wheel is not returned automatically once it is turned to one side.

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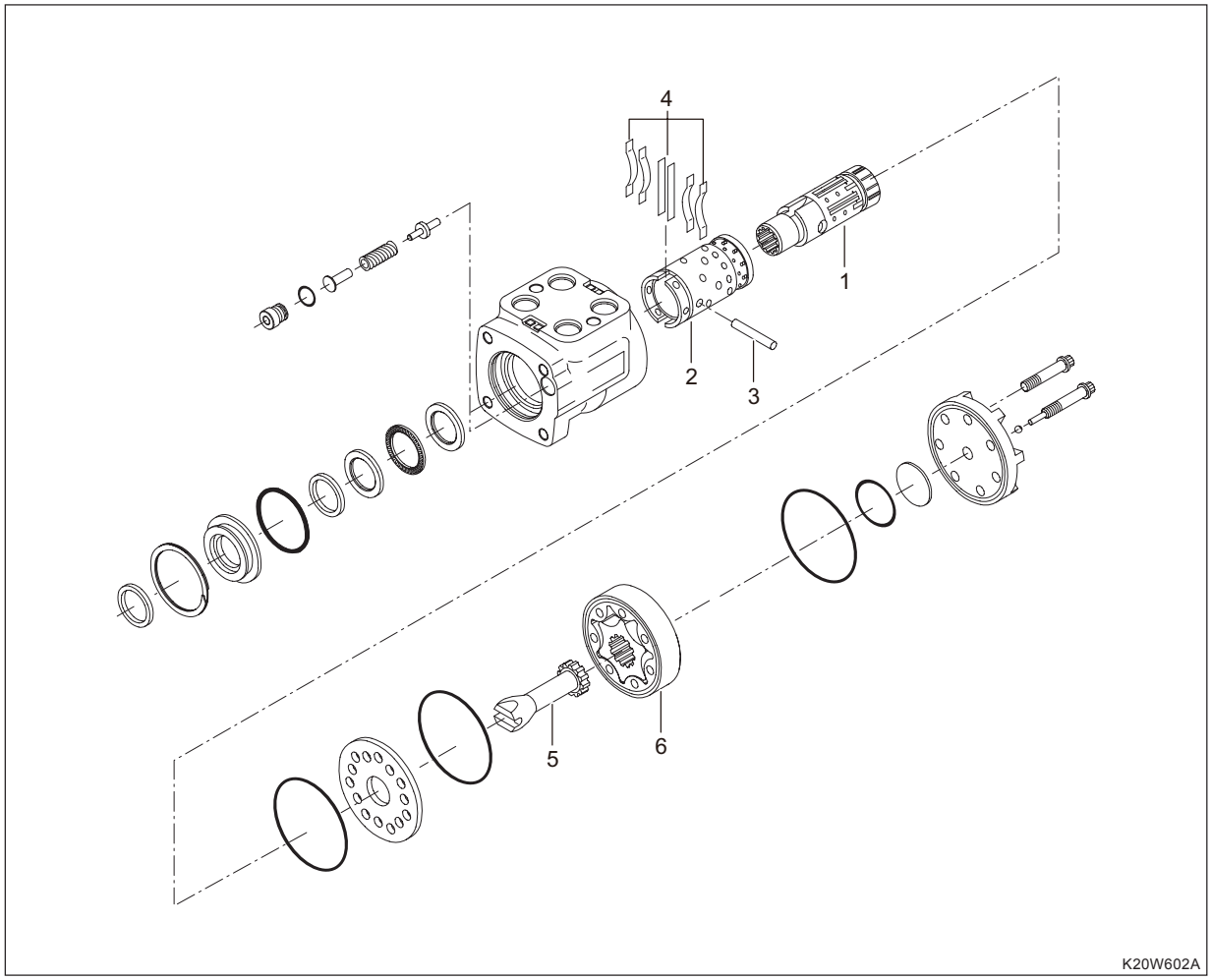
4.1.2 INTERNAL STRUCTURE AND OPERATING PRINCIPLE



(1) Dust seal
(2) Retaining ring
(3) Quad ring
(4) Thrust bearing
(5) Ball
(6) Pin
(7) Spacer
(8) Center spring
(9) Washer
(10) O-ring
(11) O-ring
(12) Spring pin
(13) Gerotor set
(14) Bearing race
(15) Drive
(16) End cap
(17) Gland bushing
(18) Plate
(19) Cap screw
(20) Housing
(21) Spool
(22) Sleeve
(23) Plate spring
(24) Spool
(25) Bushing
(26) Spring
(27) Control screw
(28) Plug
(29) O-ring
(30) Heli coil

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(1) Spool
(2) Sleeve
(3) Pin
(4) Leaf spring
(5) Drive shaft
(6) Gerotor (inner rotor)

The steering wheel is engaged with the steering valve spool with splines. Therefore, when the steering wheel is turned, the spool is turned as well. The spool (1) is covered with the sleeve (2) and these are fixed by the pin (3). Therefore, when the spool is turned by the steering wheel, this pin is rotated as well to turn the sleeve. The inside diameter of the pin hole of the sleeve is matched to the outside diameter of the pin, so the pin fits to the hole tightly. However, the pin hole of the spool is larger than the pin. Therefore, when the spool is rotated, the sleeve cannot be rotated with the spool immediately, but it is rotated approx. 10 degrees (the amount of free play of the spool pin hole) behind the spool. For example, when the steering wheel is being turned clockwise, the sleeve is turned approx. 10 degrees behind the spool, so the holes for the right turn among the holes of the sleeve and spool are aligned to supply hydraulic oil to the steering cylinder for right turn. When the steering wheel is stopped, the spool is stopped simultaneously but the sleeve turns 10 degrees further before stopping. This is because the leaf spring binds the spool and sleeve and it exerts a force to return the relative positions of the spool and sleeve to the neutral positions. Since force of this spring is not so strong, so it does not have any effect when the steering wheel is being turned. However, when the steering wheel is stopped, it returns the spool and sleeve to the neutral position. Then, the neutral holes among the several holes of the spool and sleeve are aligned, so the steering cylinder does not move, keeping its original position.

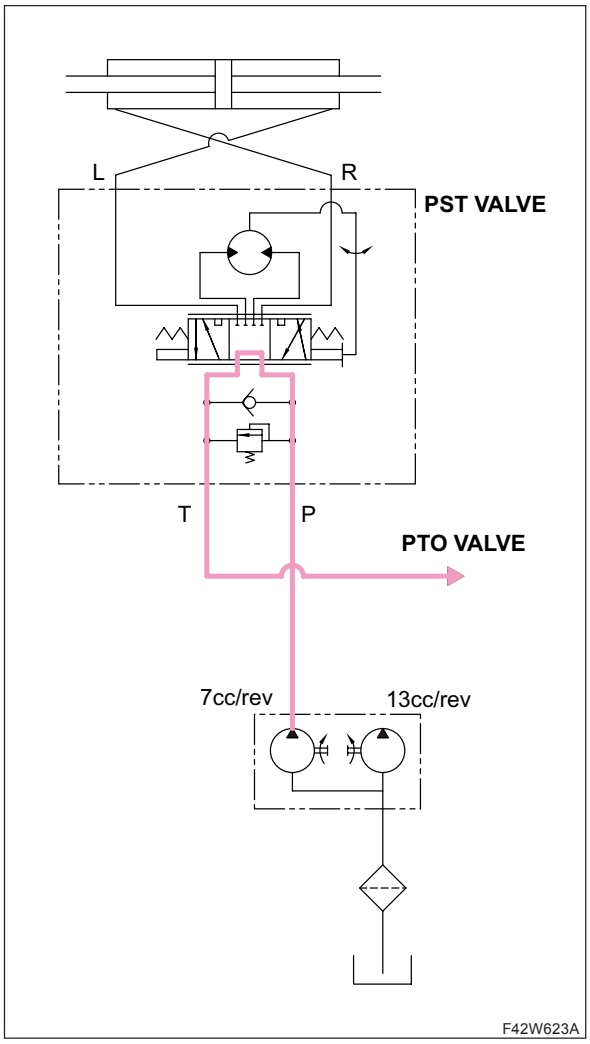
On the other side, when the steering wheel is turned, the spool rotates and turns the sleeve through the pin, but it turns the drive shaft (5) as well. Then, this drive shaft turns the inner rotor (6) of the Gerotor pump under the steering valve. This Gerotor pump is to enable steering even when the engine is stopped. When the steering wheel is turned, the rotor in the Gerotor is rotated to produce and supply hydraulic oil to the steering cylinder.

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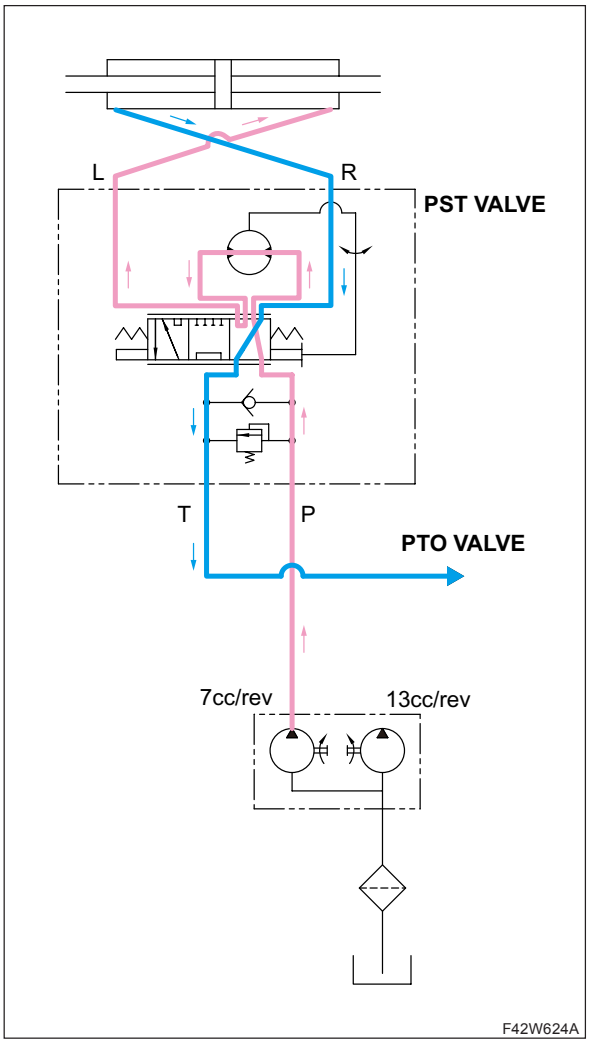
4.1.3 EXAMPLES OF STEERING WHEEL OPERATION

NEUTRAL



Hydraulic oil delivered from the secondary gear pump is sent to the PST valve through the port P. When the steering wheel is stopped, only the neutral holes of the spool and sleeve of the PST valve are aligned, so hydraulic oil at the port P is returned through the port T and is supplied to the PTO valve side.

LEFT TURN

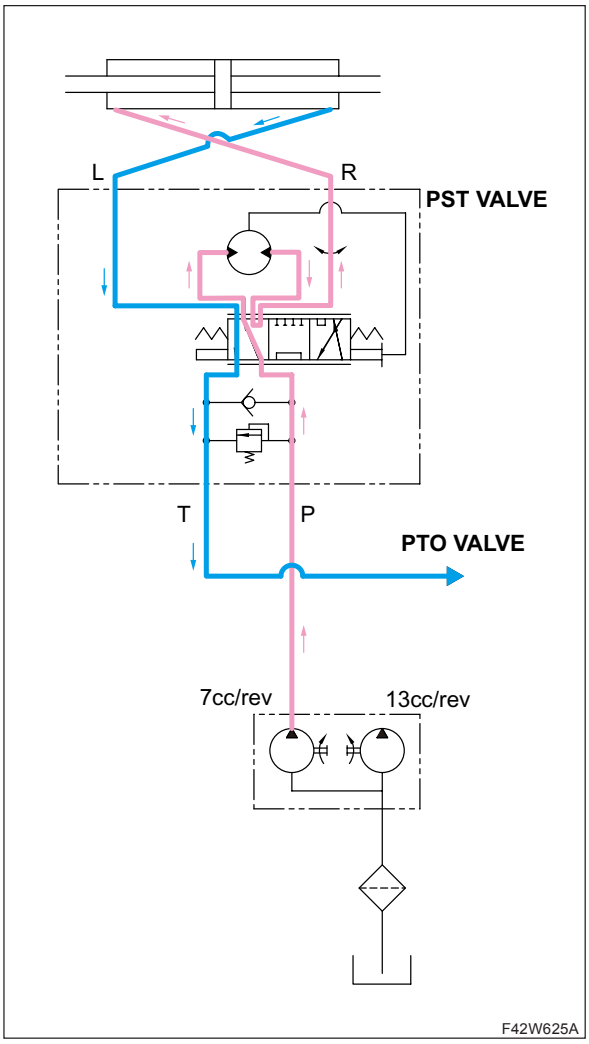


When the steering wheel is turned counterclockwise, the sleeve is turned counterclockwise approx. 10 degrees behind the spool, so the oil holes of the spool and sleeve for the left turn operation are aligned. Therefore, hydraulic oil at the port P is passed through the spool, sleeve and Gerotor and is supplied to the right port of the PST cylinder through the port L. On the other hand, hydraulic oil at the left port of the PST cylinder is flowed through the port R, returned through the return holes of the spool and sleeve for left turn and port T, and delivered to the PTO valve. Therefore, the PTO valve receives the same amount of hydraulic oil whether the steering wheel is turned or not.

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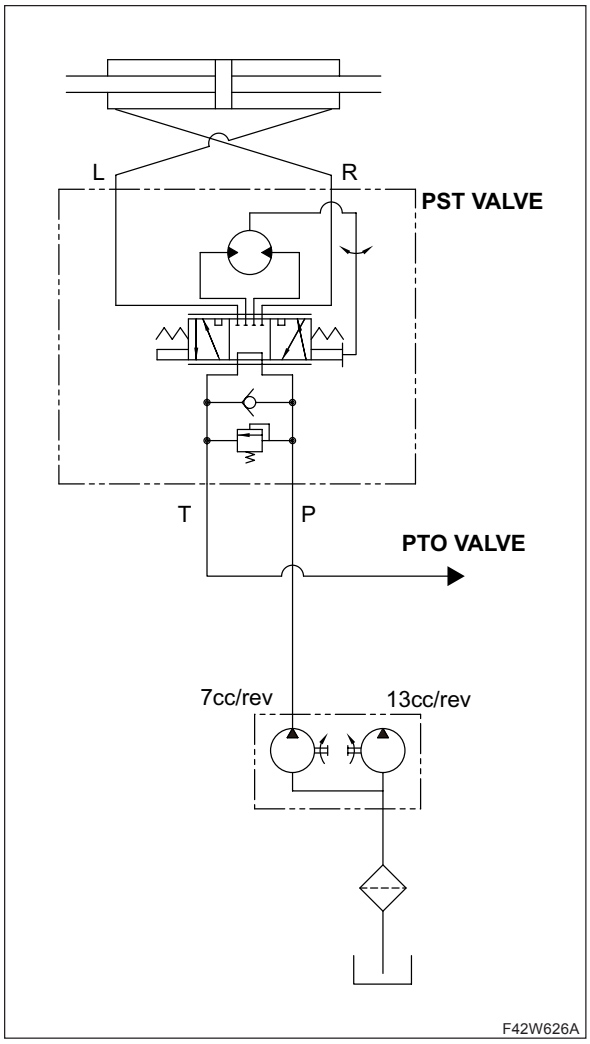
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RIGHT TURN



When the steering wheel is turned clockwise, the sleeve is turned clockwise approx. 10 degrees behind the spool, so the oil holes of the spool and sleeve for the right turn operation are aligned. Therefore, hydraulic oil at the port P is passed through the spool, sleeve and Gerotor and is supplied to the left port of the PST cylinder through the port R. On the other hand, hydraulic oil at the right port of the PST cylinder is flowed through the port L, returned through the return holes of the spool and sleeve for right turn and port T, and delivered to the PTO valve.

OPENING RELIEF VALVE

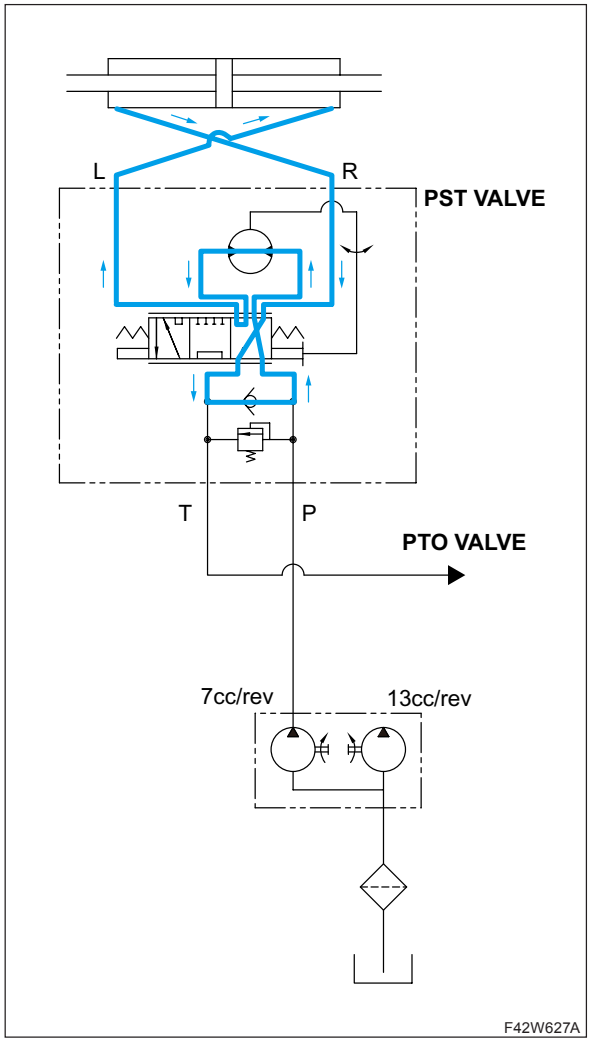


When the PST cylinder is moved to the left or right end and there is no more space to move further, pressure of hydraulic oil flowed through the port P increases over the relief valve setting pressure, 130~137 kgf/cm^2, resulting in opening of the relief valve. Then, hydraulic oil flowed through the port P is passed through the relief valve, returned through the port T, and delivered to the PTO valve.

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MANUAL STEERING (LEFT TURN)

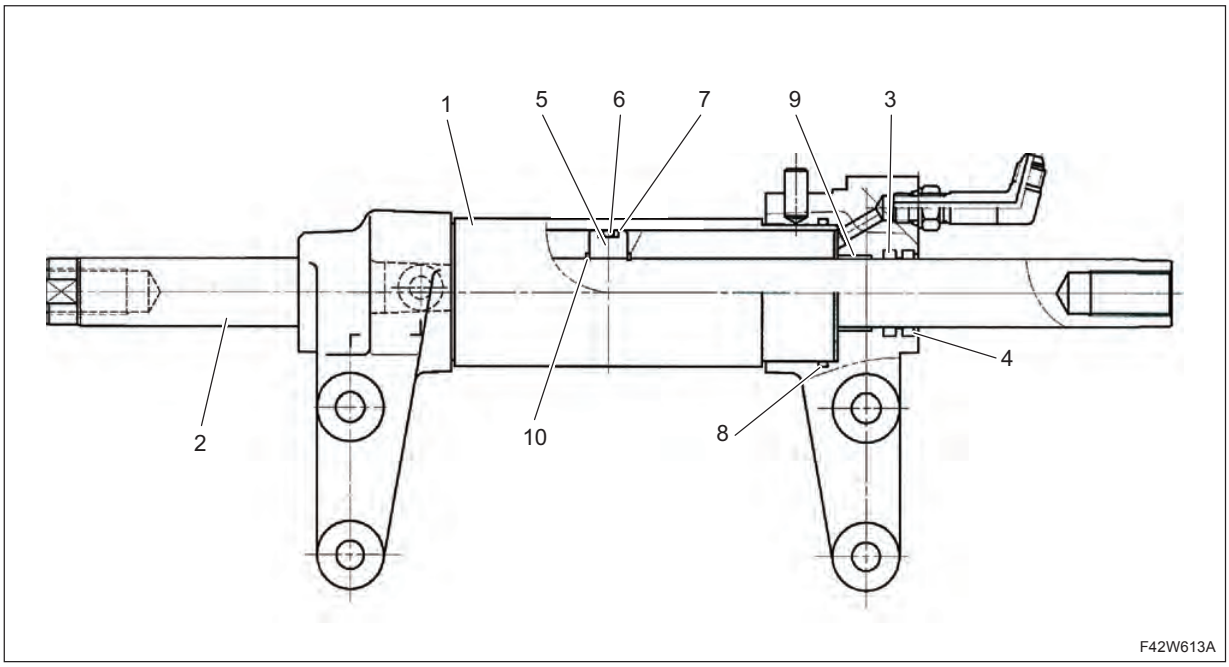


When the steering wheel is turned with the engine stopped, the spool, sleeve and Gerotor pump are rotated as described previously. For example, when the steering wheel is manually turned counterclockwise, hydraulic oil at the left side of the PST cylinder is sucked through the port R and is flowed to the Gerotor through the sleeve and spool. Then, after hydraulic oil is pressurized in the Gerotor, it is flowed into the left side of the check valve through the spool and sleeve and leaves the right side of the valve. Finally, it passes through the spool, sleeve and port L and flows into the right port of the PST cylinder to complete the manual left turn operation. For right turn, hydraulic oil is sucked through the port L from the right port of the PST cylinder and is flowed into the left port of the PST cylinder through the port R to complete the manual right turn operation.

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4.2 PST CYLINDER



(1) Cylinder tube (3) U-packing (5) Piston (7) X-ring (9) Bushing
(2) Piston rod (4) Dust seal (6) Backup ring (8) O-ring (10) Stop ring (type C)

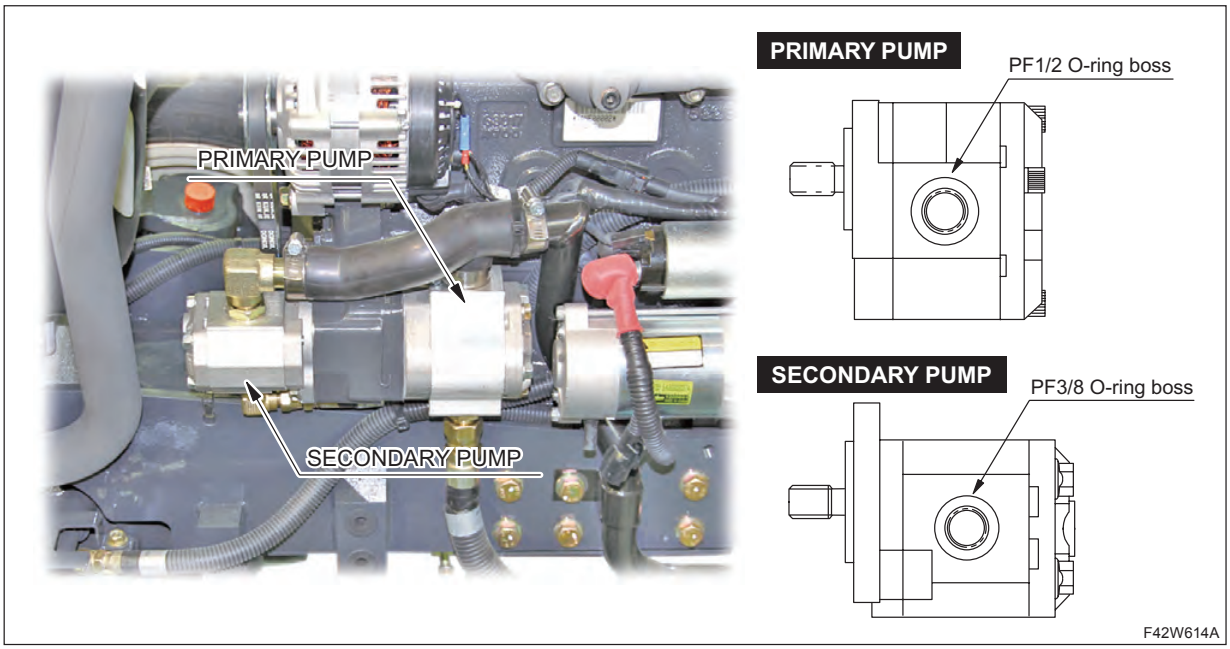
The PST cylinder is a double-rod double acting type cylinder which performs double rod operation for steering without a need of a separate tie rod.

ITEM	SPECIFICATIONS
Type	Double-rod double acting piston
Rod O.D. (mm)	ø 30
Cylinder I.D. (mm)	ø 55
Cylinder O.D. (mm)	ø 65
Stroke (mm)	184.4
Weight	7.8 kg
Relief setting pressure	130 kgf/cm^2

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4.3 HYDRAULIC PUMP



The hydraulic pump is a gear type and consists of the primary pump as the main pump (13 cc/rev) and secondary pump as the steering pump (7.0 cc/rev). The drive shaft set between these two pumps receives engine power directly through the drive gear of the engine crankcase.

- Pump capacity (at rated engine RPM)

  Primary pump: 13 cc/rev. X 2,600 rpm = 33.8 lpm

  Secondary pump: 7.0 cc/rev. X 2,600 rpm = 18.2 lpm

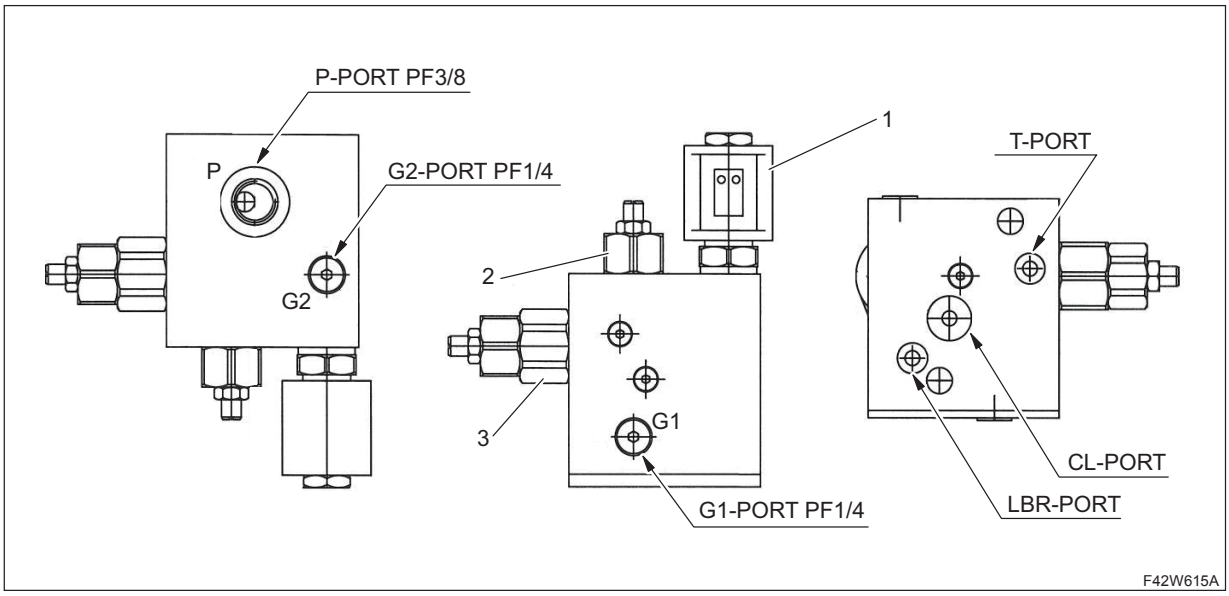
▶ PUMP SPECIFICATIONS

ITEM	MAIN PUMP (PRIMARY PUMP)	STEERING PUMP (SECONDARY PUMP)
Theoretical discharge volume	13 cc/rev	7.0 cc/rev
Maximum pressure	210 kgf/cm^2	←
Rotating direction	Counterclockwise	Clockwise
Operating oil	TF 500	←
Usable oil temperature range	-20 ~ 100 ℃	←
Relief setting pressure	160 ±5 kgf/cm^2	←
Max. usable turning peed	2,340 rpm	←
Min. usable turning peed	970 rpm	←
Pressure on suction side	-0.2 - 1.0 kgf/cm^2	←

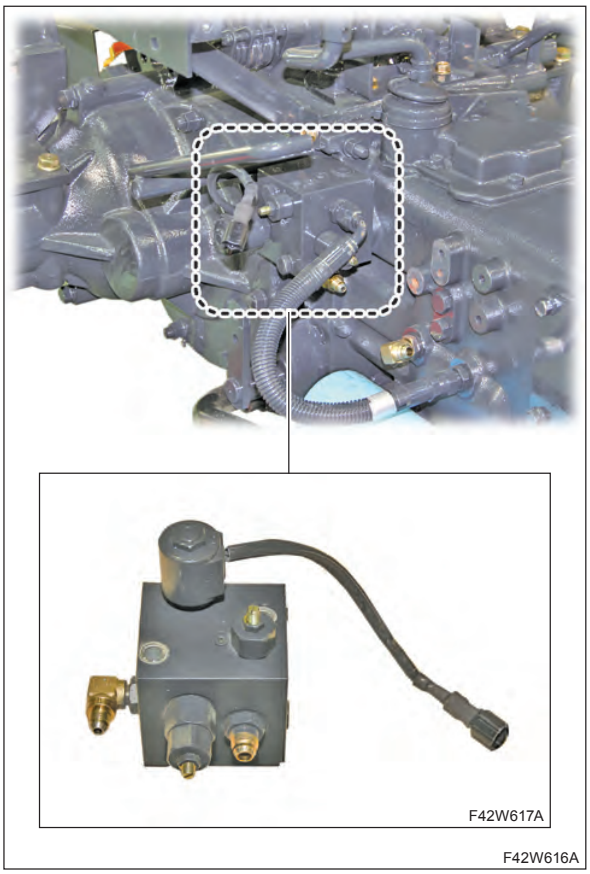
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4.4 PTO VALVE



(1) Solenoid valve (2) Sequence valve (3) DRV valve



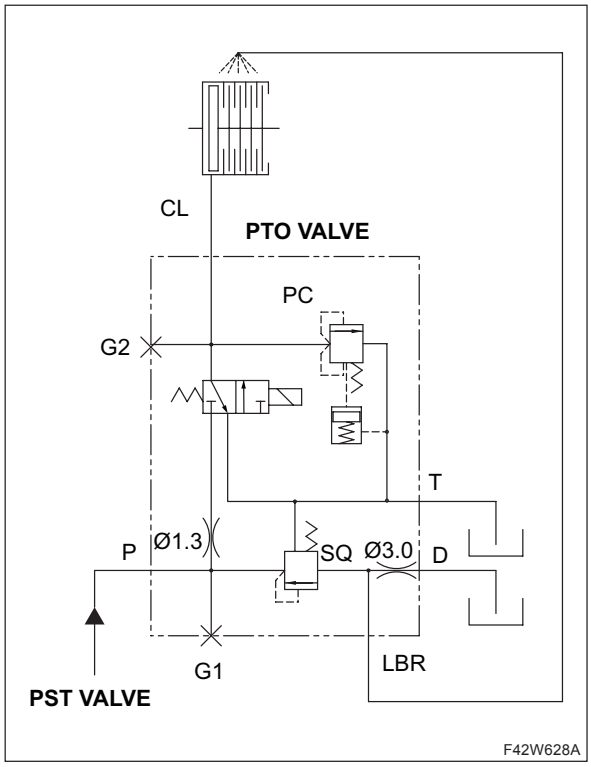
The PTO valve is installed to the rear right side of the transmission case. It receives oil from the PST valve to lubricate and operate the PTO clutch and it is turned ON and OFF by the PTO switch.

▶ PUMP SPECIFICATIONS

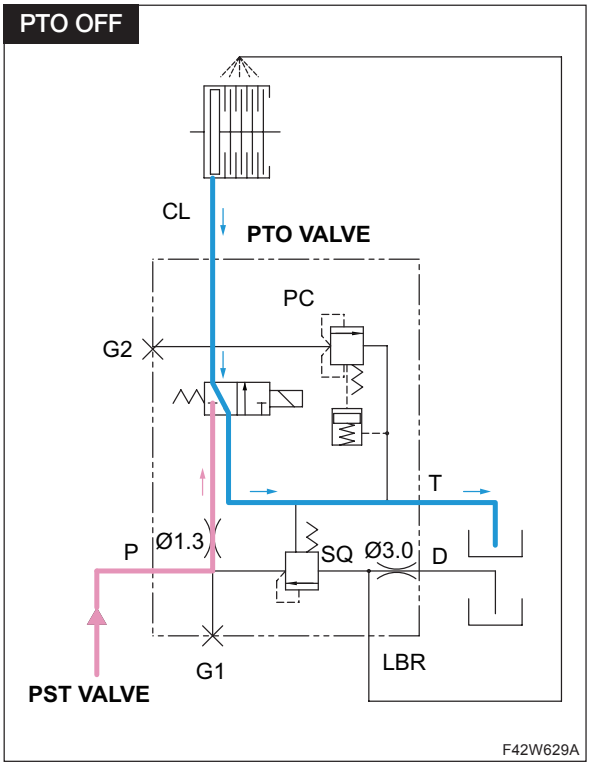
ITEM	SPECIFICATION
Operating flow	5 - 19 ℓ/min.
Operating pressure	Max. 40 kgf/cm^2
Sequence valve setting pressure	16.0 kgf/cm^2
Operating temperature range	-20°C ~ 100°C

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The port T of the PST valve discharges hydraulic oil continuously regardless of movement of the steering wheel and all of this oil is flowed to the port P of the PTO valve. The PTO valve consists of the sequence valve, which is opened at 16 kgf/cm^2, DRV valve and electrically operated ON/OFF solenoid valve.

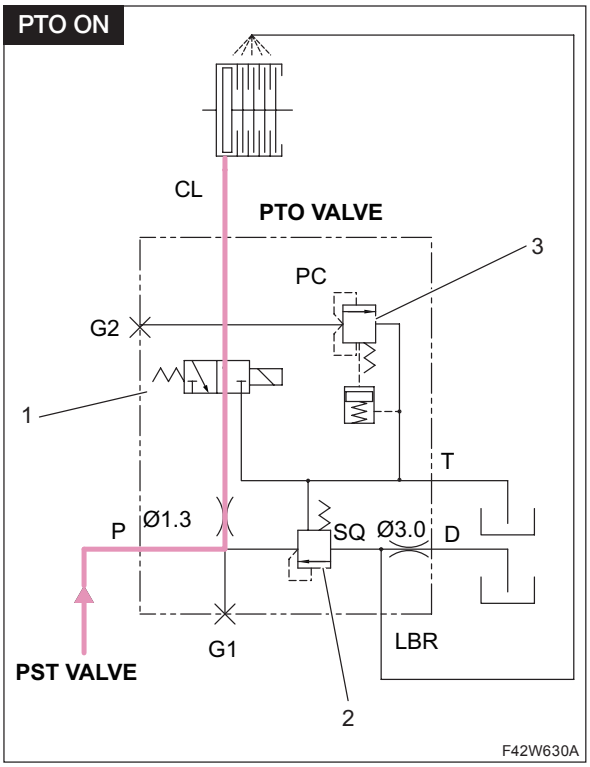


The electric solenoid spool is turned ON and OFF by the driver's operation of the PTO switch. When the main spool is OFF, The flow P sent from the PST valve is led to the main spool through the Ø1.3 orifice and is trapped while oil discharged from the PTO clutch passes through the main spool to be returned to the tank.

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PTO ON



When the PTO switch is set the ON position by the driver, the magnet of the electric solenoid is activated to pull the spool in the left direction as shown in the circuit diagram. Then, hydraulic oil is passed through the solenoid spool (1) and is supplied to the piston of the PTO clutch through the port CL. There is a Ø1.3 mm orifice before the solenoid spool. Therefore, at the initial valve opening state, more hydraulic oil is applied to the sequence valve (2) than the PTO piston so that the amount of opening of the sequence valve is large for smooth initial engagement of the PTO clutch and reduction of shock. After a certain period of time, hydraulic oil of 16 kgf/cm^2 is delivered to the piston to achieve the maximum level of the delivered torque of the PTO clutch.

The DRV valve (3) is connected in the middle of the port PC line in which pressure is applied for the piston when the PTO is activated. This valve delays engagement of the PTO clutch to reduce engagement shock. It discharges hydraulic oil from the port CL to delay the PTO engagement initially right after the PTO engagement is activated. Then, after several seconds, this valve is closed to achieve the maximum level of torque that the PTO clutch delivers.

4.5 REAR SCV VALVE

F SERIES-EU: 2 PORTS STANDARD



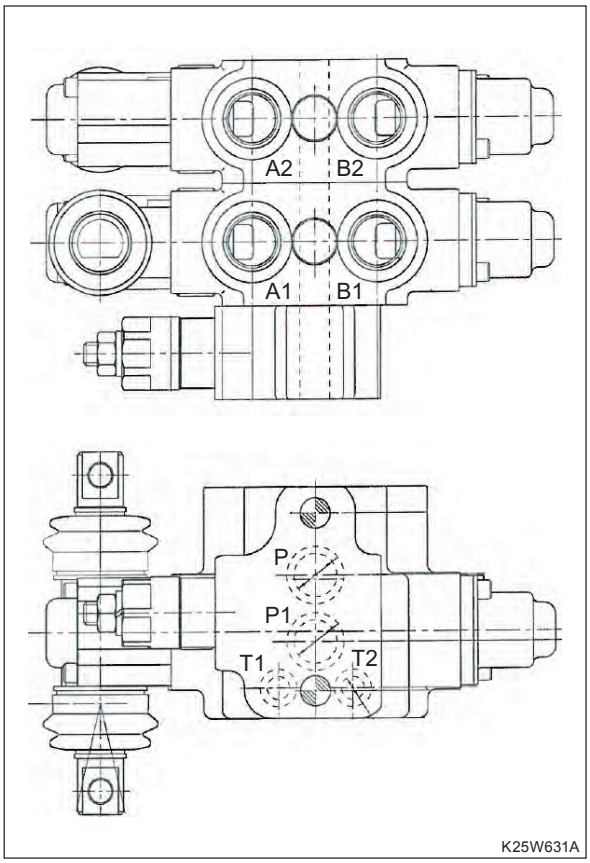
F SERIES-AU: 4 PORTS STANDARD,
15 SERIES-US: 4 PORTS OPTIONAL

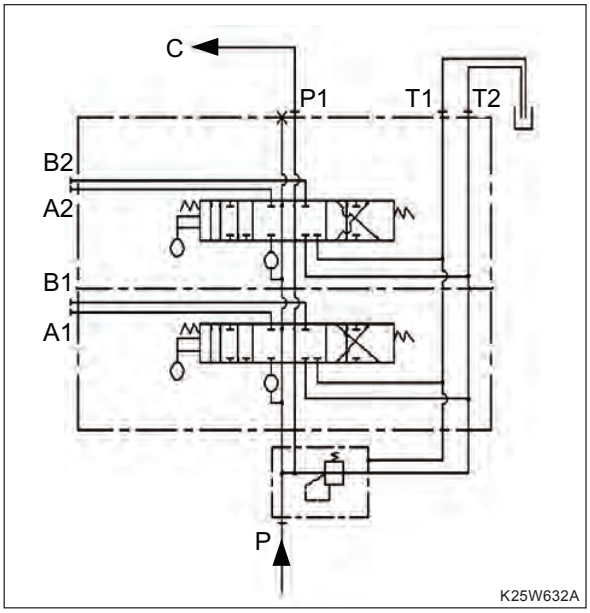


The rear SCV valve is installed to the rear section of the tractor and receives hydraulic oil at a high pressure through the carryover operation.

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The rear SCV valve is a rear auxiliary hydraulic valve and is equipped with two double acting spools for use of an implement with two kinds of double acting cylinders. Its inlet is equipped with the relief valve of 180 ~ 185 kgf/cm^2 to protect the circuit. Its two spools are simple return type double acting valves.

The spools of the rear SCV valve are double acting valves, but they also can be used for implements equipped with single acting cylinders. As shown in the circuit diagram above, when hydraulic oil is applied to the port connected to the single acting cylinder, this single acting cylinder is extended. When hydraulic oil is applied to the opposite direction, hydraulic oil is trapped so the relief valve of 180 ~ 185 kgf/cm^2 is opened to protect the circuit. However, the port connected to the single acting cylinder is opened as well simultaneously. Therefore, this single acting cylinder is retracted by weight of the implement or crops and oil in the cylinder is drained and returned to the transmission.

It is okay to use the double acting valve for operation of a single acting cylinder as described. However, if a single acting cylinder is used for an extended period of time, the relief valve is operated continuously, causing several problems, including rise of transmission fluid temperature and fatigue of the gear pump.

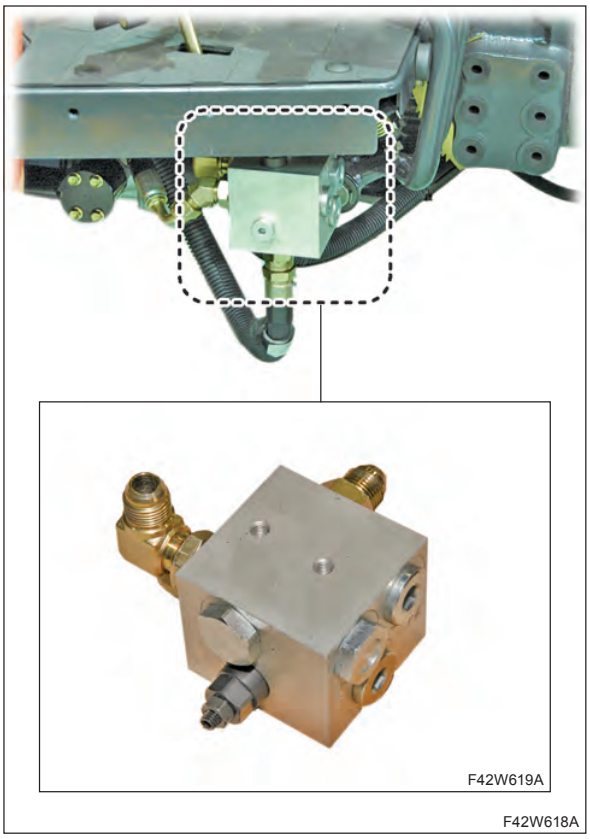
▶ VALVE SPECIFICATIONS

ITEM	SPECIFICATION
Max. flow	30 ℓ/min.
Max. operating pressure	210 kgf/cm^2
Relief valve setting pressure	180 ~ 185 kgf/cm^2
Operating oil	BRANSON TF500

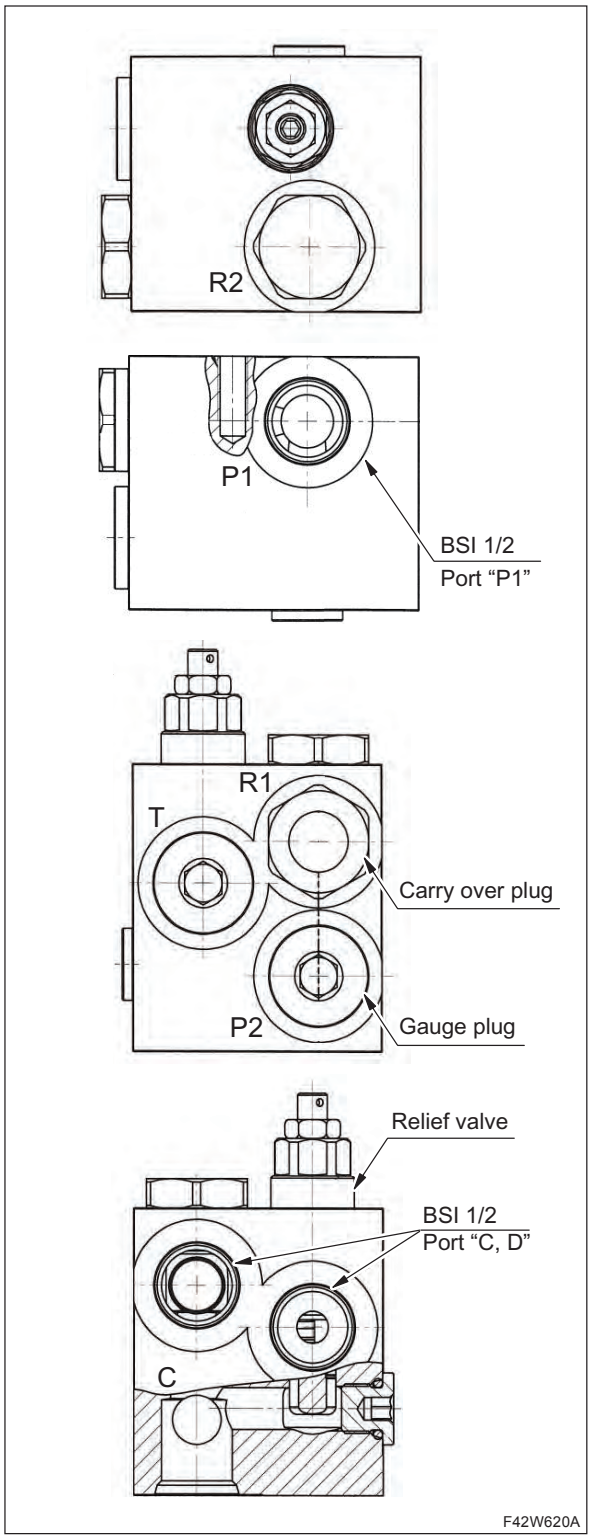
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4.6 FRONT OUTLET VALVE ASSEMBLY

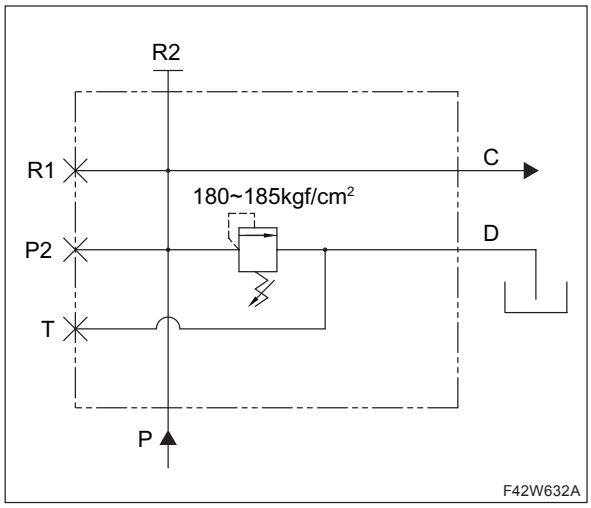


The front outlet valve assembly is installed under the front section of the step on the right side. It is connected to the main gear pump (primary pump) to receive hydraulic oil at a high pressure from the gear pump before any other components mainly for operation of an external implement, such as a loader.



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The front outlet valve assembly is an open center type. When this valve (i.e. loader) is not in use, hydraulic oil from the hydraulic pump is passed through this valve and is supplied to the rear SCV valve after it. Passing hydraulic oil to the next device for its use from the valve is called Carryover, and this is done through the port C, carryover port.

Also, the front outlet valve assembly is equipped with the relief valve (main 180 ~ 185 bar). This valve is opened to protect the hydraulic circuit when excessive pressure is applied in the hydraulic circuit by external shock during rear implement or lift operation.

▶ VALVE SPECIFICATIONS

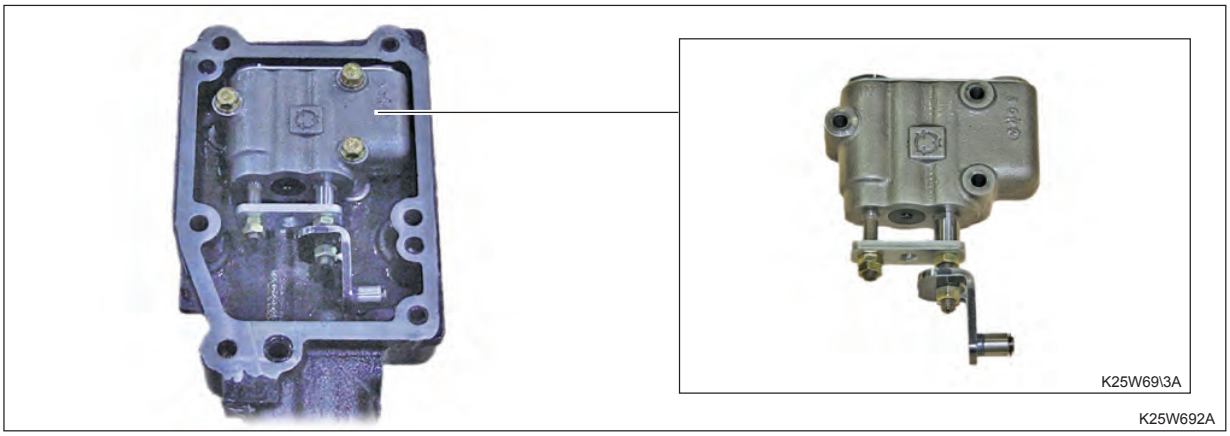
ITEM	SPECIFICATION
Relief valve setting pressure	180 ~ 185 kgf/cm^2
Operating oil	BRANSON TF500

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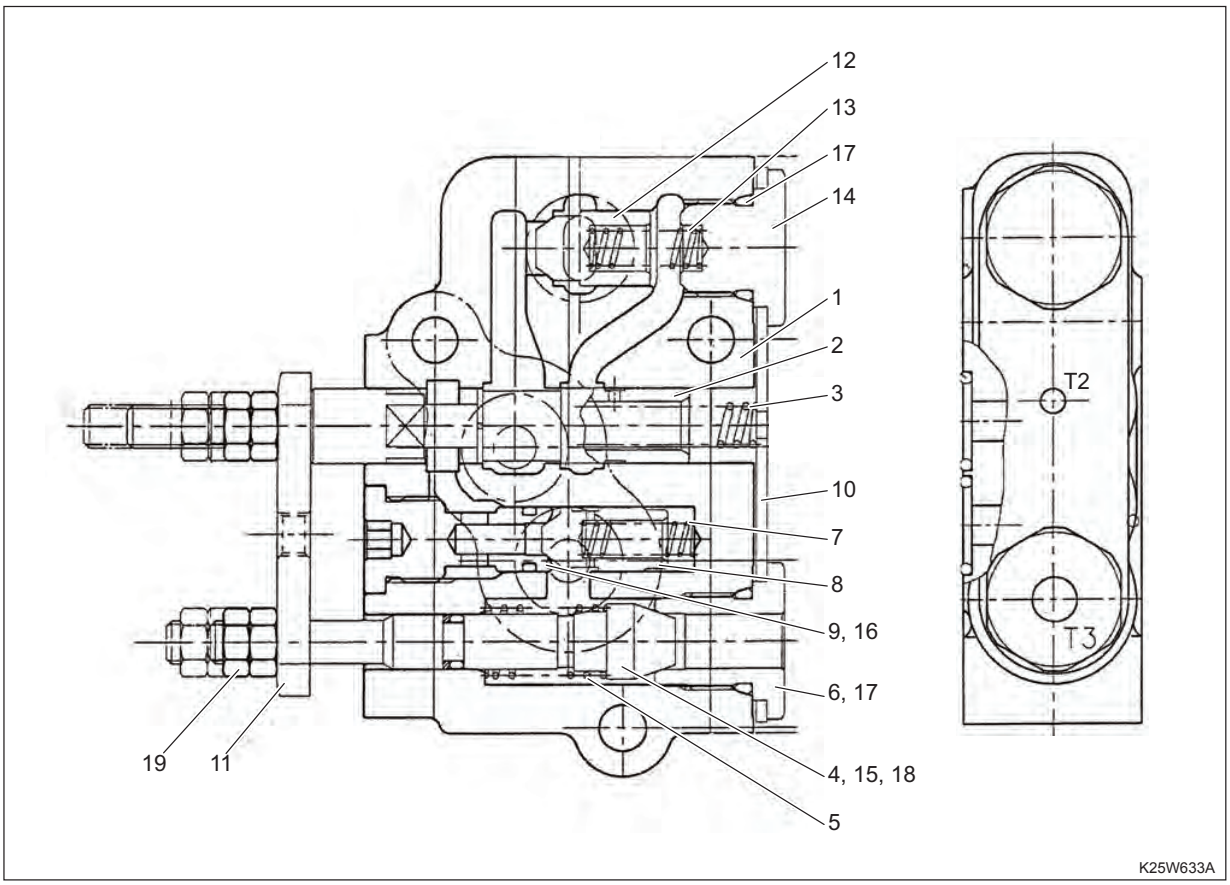
4.7 CONTROL VALVE

▶ OVERVIEW



The control valve is installed in the hydraulic cylinder cover and it receives oil at a high pressure from the front outlet valve or the rear SCV valve (if equipped) through carryover operation. The internal spool is operated according to the position of the control lever to lift or lower the lift arm or set it in the neutral status.

▶ COMPONENTS

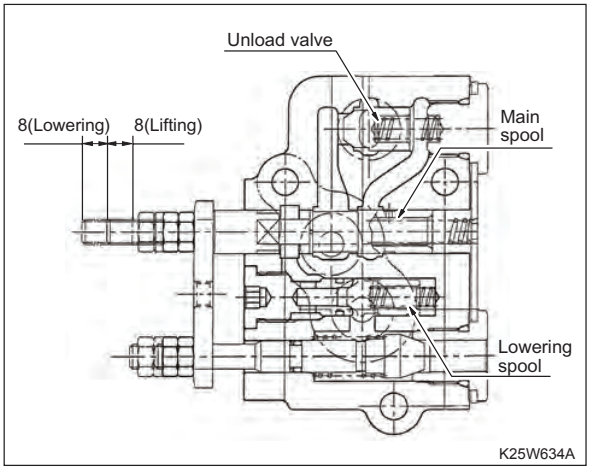


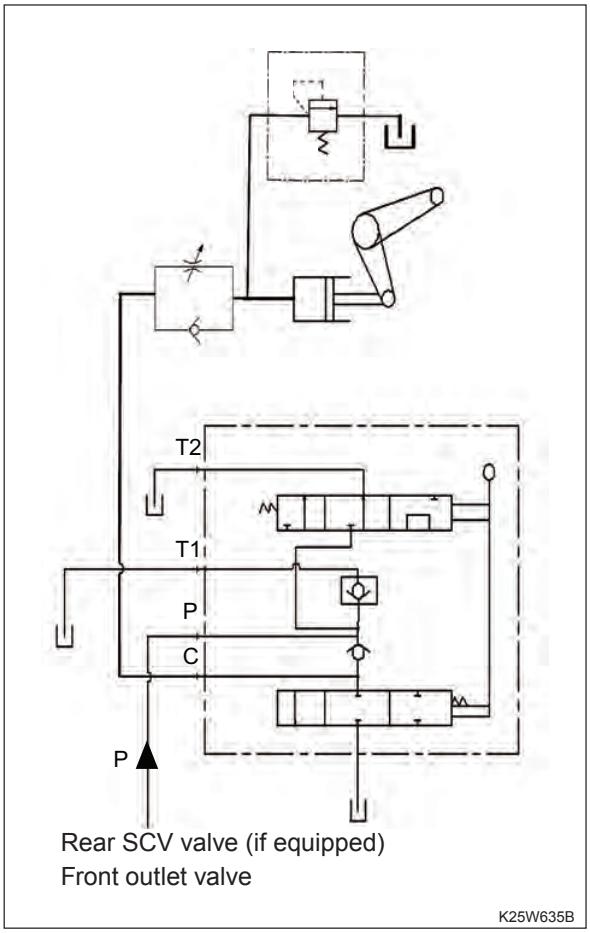
(1) Body
(2) Main spool
(3) Main spring
(4) M.Check poppet
(5) M.Check spring
(6) M.Check plug
(7) L.Check spring
(8) L.Check
(9) L.Check seat
(10) Plate-A
(11) Plate-B
(12) U.L. Check
(13) U.L. Spring
(14) U.L. Plug
(15) O-ring
(16) O-ring
(17) O-ring
(18) Backup ring
(19) Nut

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▶ OPERATING PRINCIPLE





This valve is operated by connecting the link in the lift cylinder mechanically to the position lever that the driver operates. The main spool of the control valve is pushed in or out according to the position of the lever in order to lift or lower the lift arm.

For example, if the position ordered by the position control lever is higher than the current position of the lower link, the main spool of the valve is pushed in by the link structure set in the hydraulic cylinder case. Then, hydraulic oil is supplied to the cylinder to lift the lift arm and lower link.

On the contrary, if the position ordered by the position control lever is lower than the current position of the lower link, the main spool of the control valve is pushed out by the link structure set in the hydraulic cylinder case. Then, the lowering spool is operated to drain hydraulic oil in the lift cylinder in order to lower the lower link.

When the position ordered by the position control lever is matched to the actual position of the lower link after lifting or lowering operation, the spool of the control valve is kept in the neutral position by the link structure set in the hydraulic cylinder case. Therefore, the lower link is maintained in the current position.

▶ VALVE SPECIFICATIONS

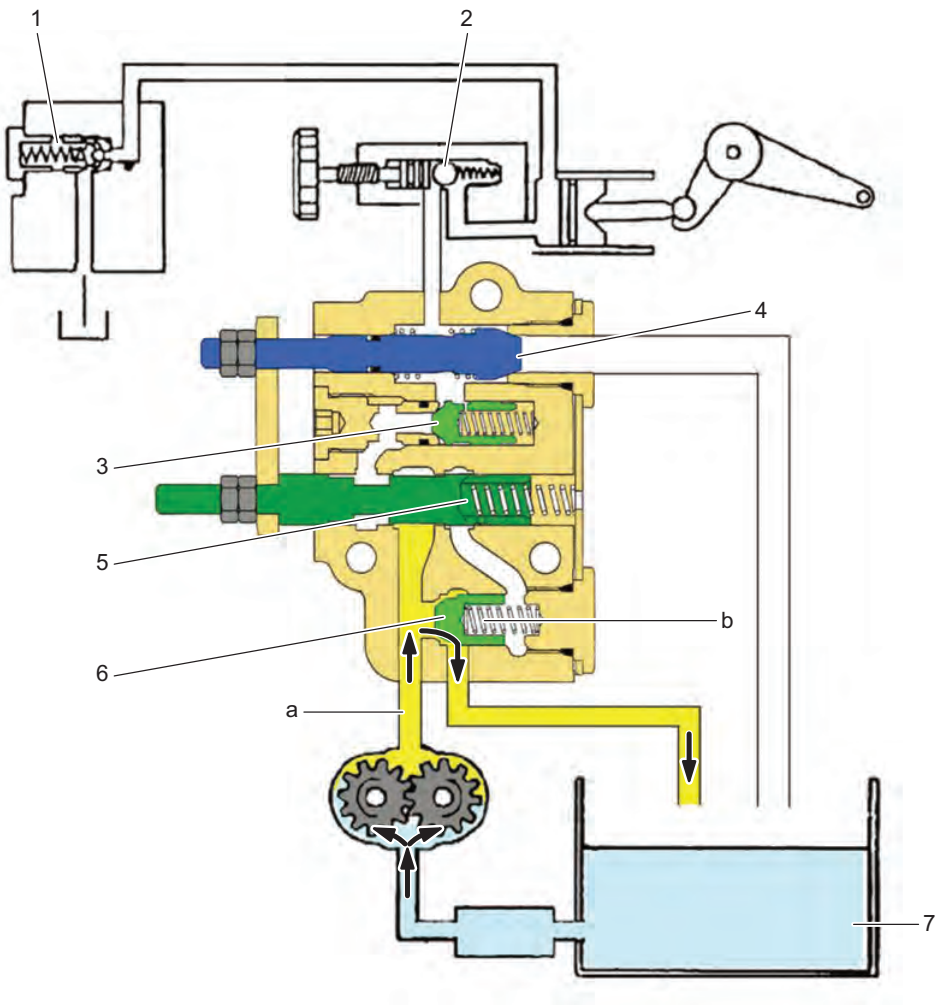
ITEM	SPECIFICATION
Max. flow	45 ℓ/min.
Operating oil	BRANSON TF500
Operating pressure	180 kgf/cm^2

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4.7.1 OPERATION AND OIL FLOW

▶ **NEUTRAL**



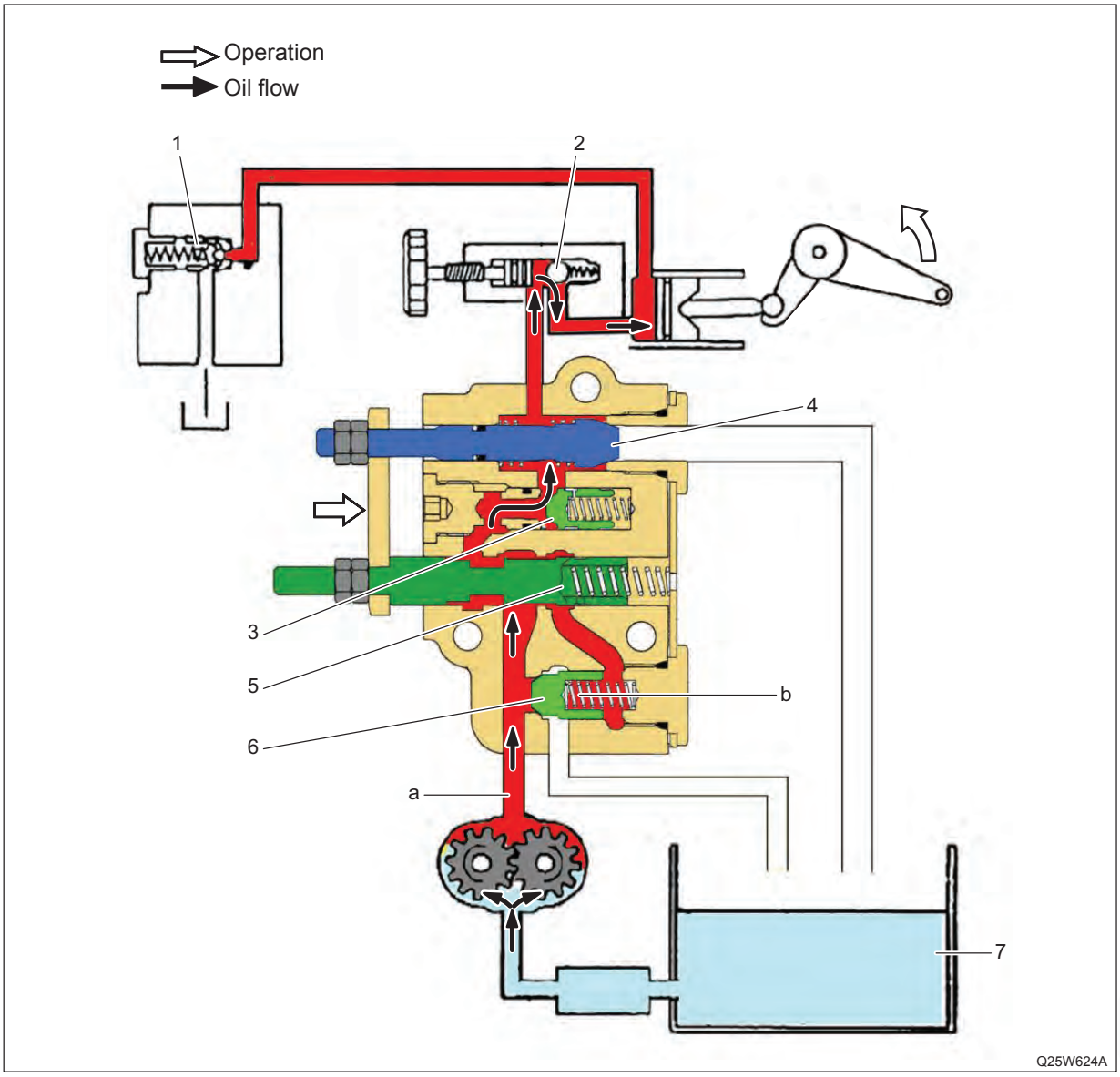
(1) Safety valve
(2) Slow return valve
(3) Load check valve
(4) Mechanical valve
(5) Main spool
(6) Unload valve
(7) Oil tank

The pressure (b) applied to the back of the unload valve spring is removed. (it opens the spool and is sucked into tank.) As the unload valve is opened by the pressure (a), the oil in the pump is returned to the tank and the pressure drops. The load check valve and mechanical check valve are kept closed.

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▶ LIFTING (RAPID LIFTING)



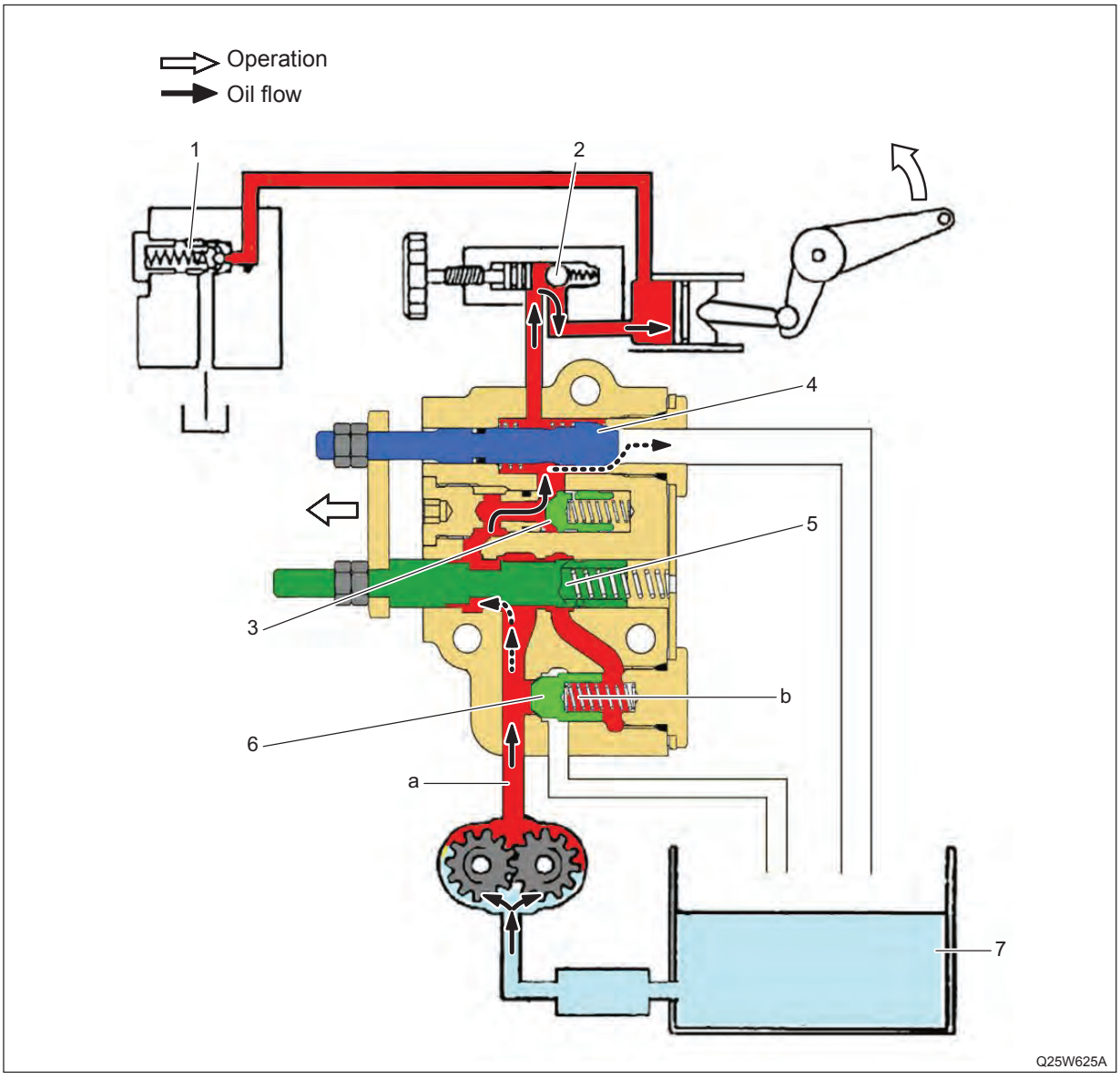
(1) Safety valve
(2) Slow return valve
(3) Load check valve
(4) Mechanical valve
(5) Main spool
(6) Unload valve
(7) Oil tank

The unload valve is applied with the pilot pressure (a) and (b) so it is closed by the spring force. As the pressure in the pump rises, oil flows through the flow passage in the spool and opens the load check valve to flow into the cylinder (rapid lifting). The mechanical check valve is kept closed.

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▶ LIFTING (LOW-SPEED LIFTING)



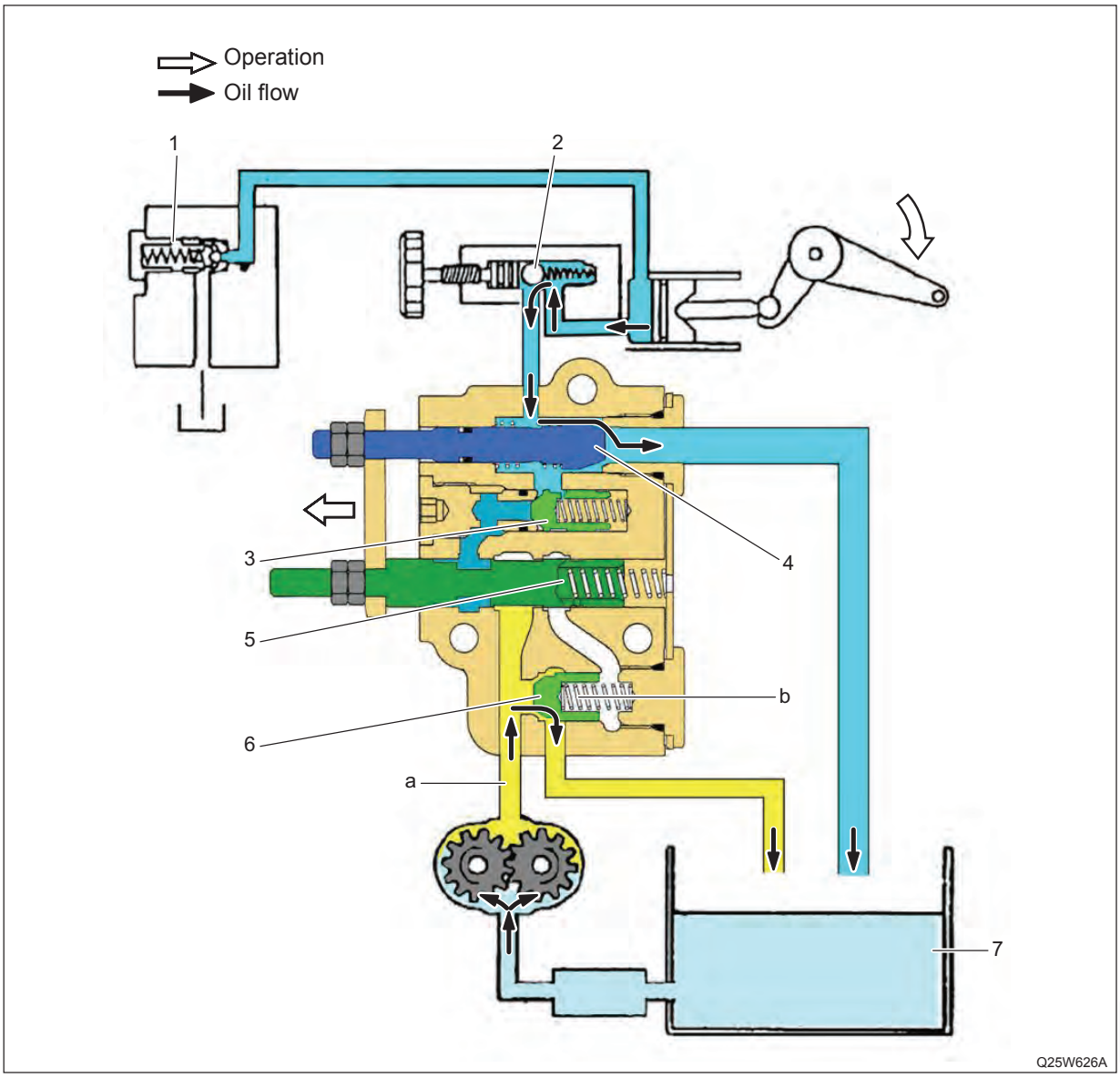
(1) Safety valve
(2) Slow return valve
(3) Load check valve
(4) Mechanical valve
(5) Main spool
(6) Unload valve
(7) Oil tank

As the hydraulic lift is lifted, the feedback link is moved to push the main spool closer to the neutral position. Then, the mechanical valve open slightly and the oil flow of main spool to return oil back to the tank. But the majority of oil is led into the cylinder to reduce shock occurred by lifting operation.

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▶ LOWERING



(1) Safety valve
(2) Slow return valve
(3) Load check valve
(4) Mechanical valve
(5) Main spool
(6) Unload valve
(7) Oil tank

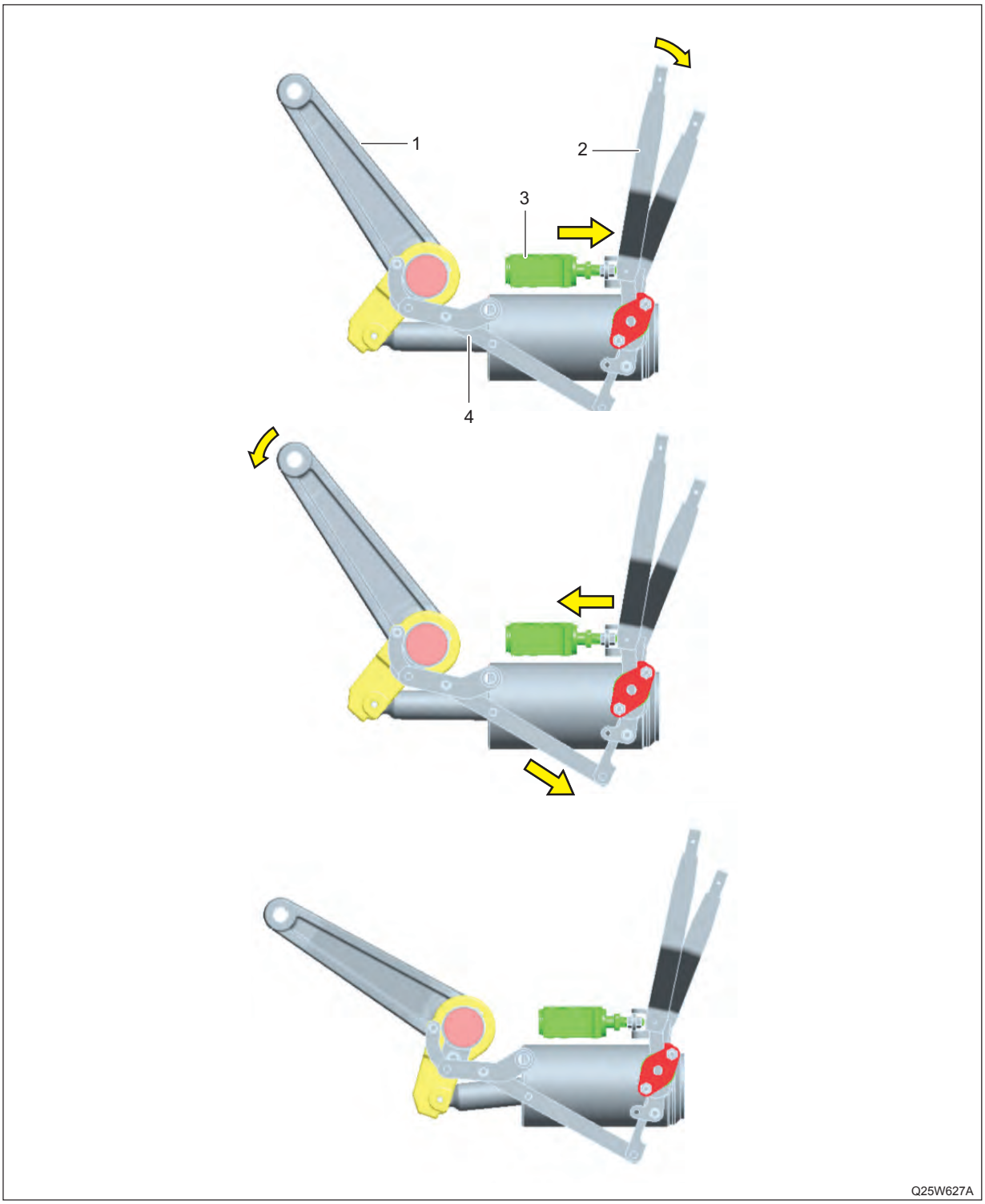
Oil in the hydraulic pump opens the unload valve and enters the tank as in the neutral state. As oil in the hydraulic cylinder moves the spool, the mechanical valve, which is directly connected to the main spool with the pin, is opened to return the oil back to the tank.

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4.7.2 CONTROL LEVER OPERATION

▶ **LOWERING**



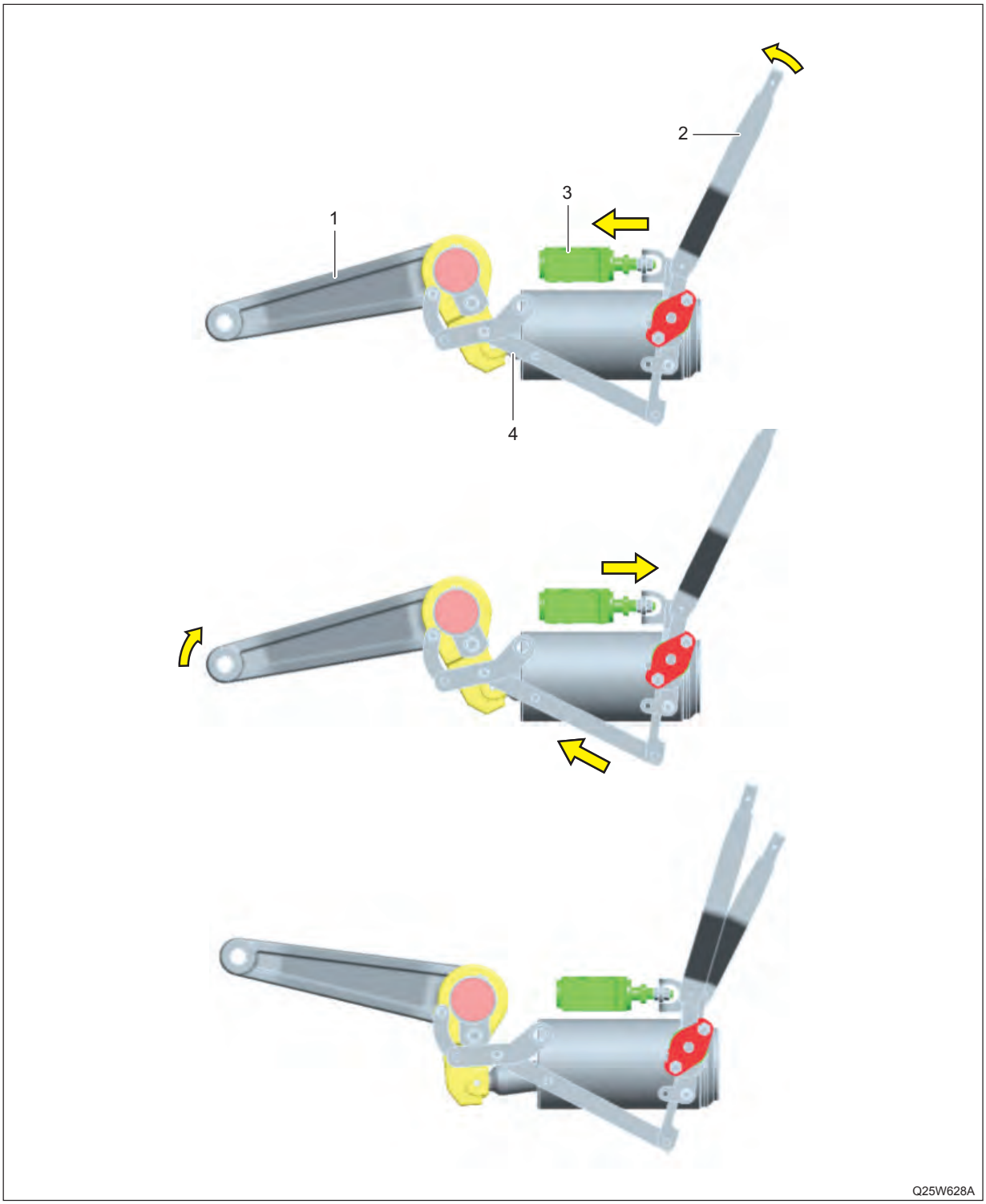
(1) Lift arm (2) Control lever (3) Control valve (4) Feedback rod

When setting the control lever to the Lowering position, pressure applied to the spool is released so the spool is returned to its original position by the spring. Therefore, oil in the cylinder is returned back to the tank, the lift arm is lowered, and the spool is returned to the neutral position by the feedback rod.

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▶ LIFTING



(1) Lift arm (2) Control lever (3) Control valve (4) Feedback rod

When the control lever is set to the Lifting position, the control valve spool behind the hydraulic cylinder case is pressed and oil is flowed into the cylinder. Then, the piston lifts the lift arm. However, as the feedback rod installed to the lift arm is operated to provide a lifting signal in this state, the spool of the control valve is returned to the neutral position even with the control lever still in the lifting position. Therefore, the spool is returned to the neutral position during the lowering operation as well.

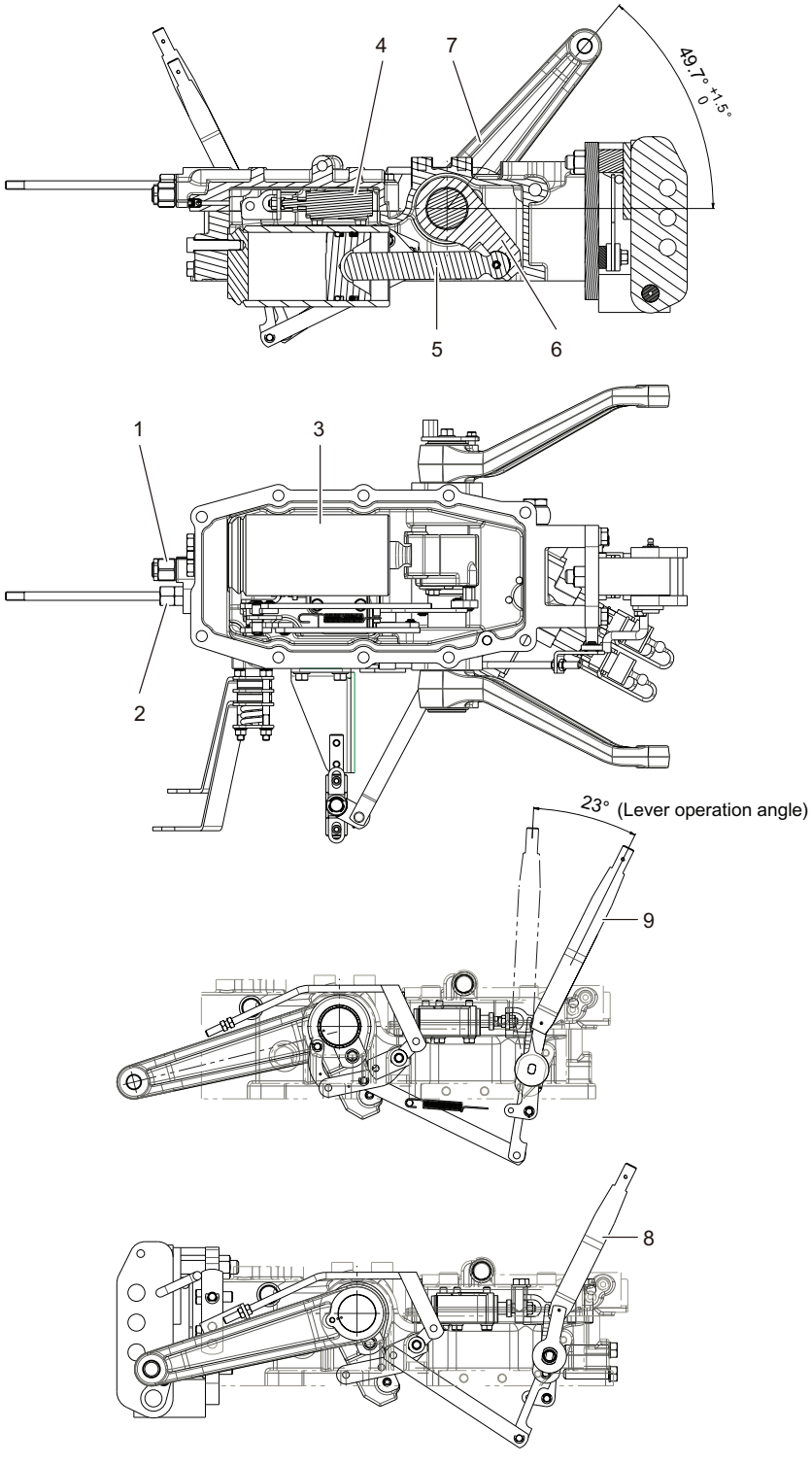
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4.8 HYDRAULIC CYLINDER CASE ASSEMBLY

4.8.1 HYDRAULIC CYLINDER CASE

COMPONENTS

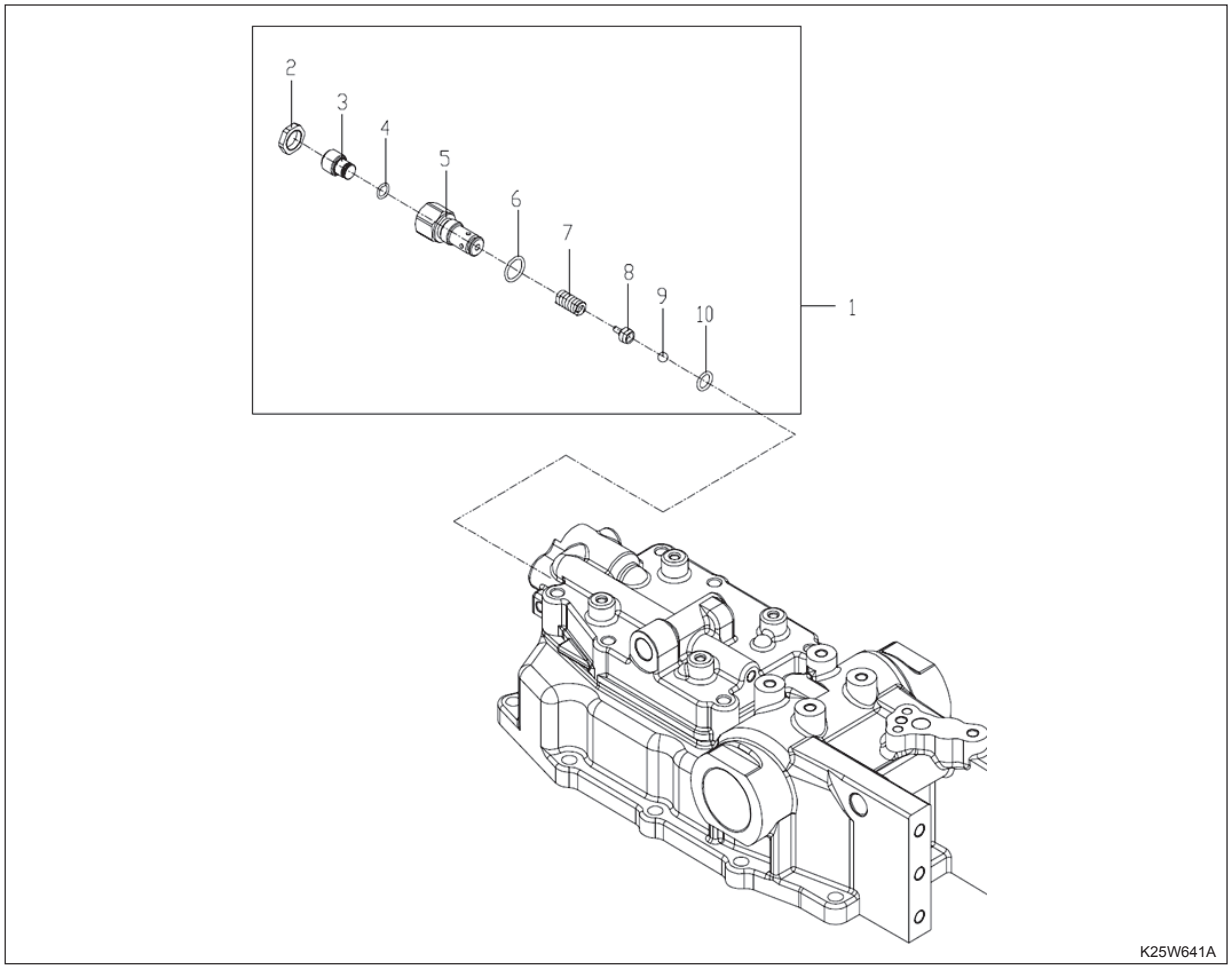


(1) Safety valve
(2) Lowering speed control valve
(3) Cylinder assy
(4) Lift/Lowering valve
(5) Piston rod
(6) Lift crank
(7) Lift arm
(8) Draft lever assy
(9) Position lever assy

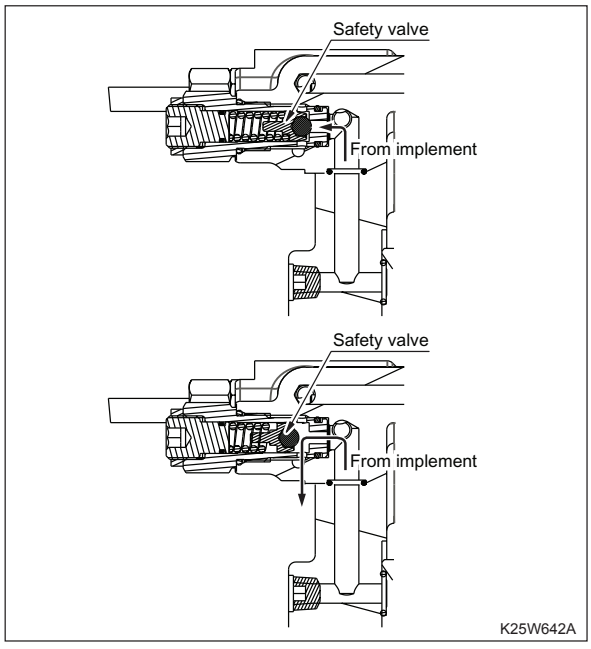
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4.8.2 SAFETY VALVE



(1) Safety valve ass'y
(2) Nut
(3) Bolt
(4) O-ring
(5) Body, safety valve
(6) O-ring
(7) Spring
(8) Ball guide
(9) Steel ball
(10) O-ring



The piston of the hydraulic cylinder case is supplied with hydraulic oil through the lift solenoid valve of the control valve. If the lift arm is overloaded by this oil, pressure in the circuit rises continuously.

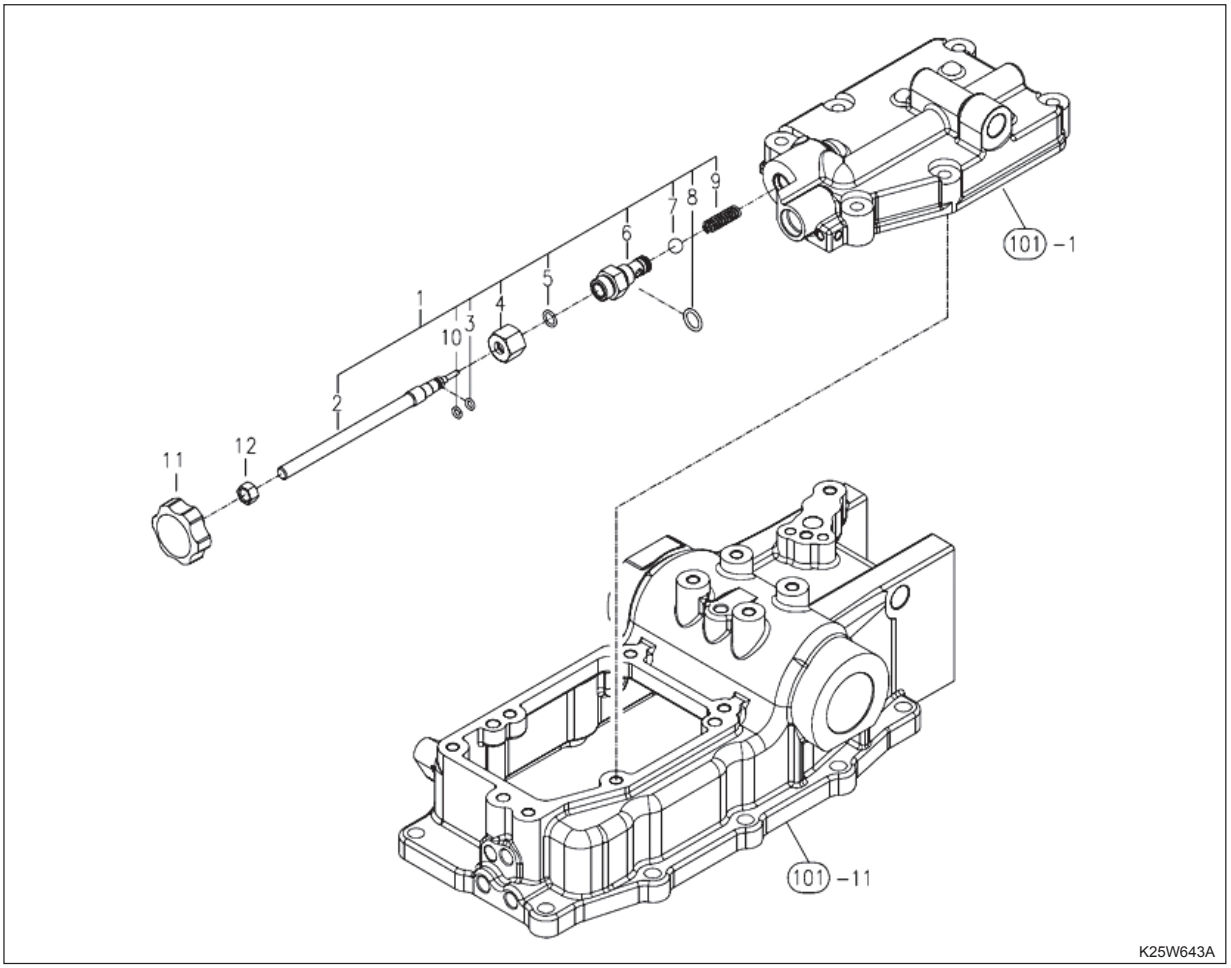
In other words, if impact pressure is applied from an external source to an implement and this pressure is over a certain limit, the safety valve is opened to drain oil back to the tank in order to protect the internal circuit of the hydraulic implement.

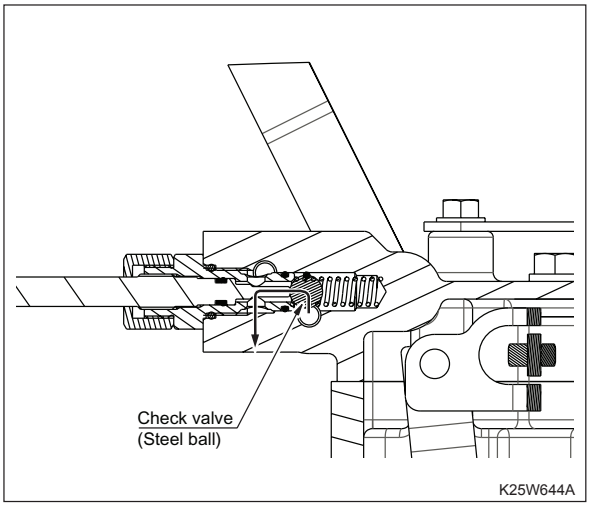
RELIEF VALVE SETTING PRESSURE	210 ± 10 kgf/cm^2

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4.8.3 STOP VALVE (ALSO AS SLOW RETURN VALVE)





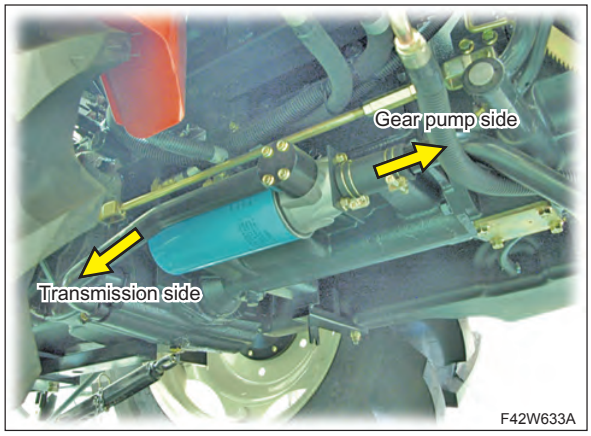
Stop valve is used to stop lowering or adjust the lowering speed of the hydraulic lift. When turning the handle counterclockwise, the lowering speed of the lift arm increases. Turning it clockwise slows down the lowering speed. Also, when turning it clockwise to its end, the oil flow passage is blocked so the lift arm is stopped at the current position.

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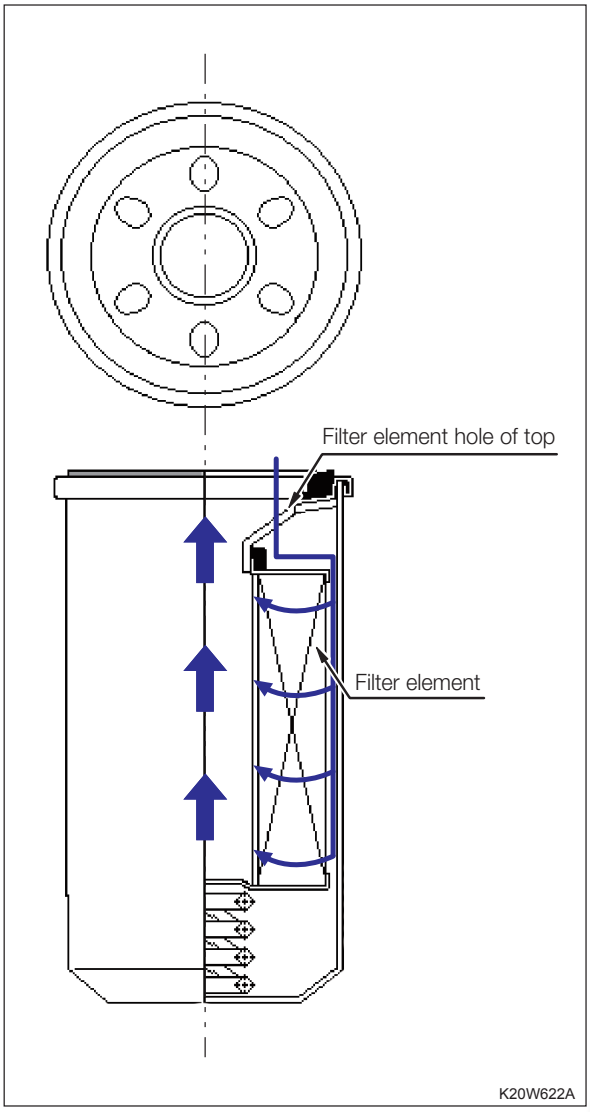
4.9 HYDRAULIC FILTER AND STRAINER

4.9.1 HYDRAULIC FILTER



The hydraulic filter is installed under the transmission to filter oil in the oil tank (transmission) before this oil is delivered to the gear pump.

Hydraulic oil is flown through the hole on the top of the oil filter cartridge and is passed from the outside to the inside of the filter. Then, it is flowed in through the hole in the middle of the cartridge.



▶ **FILTER ELEMENT SPECIFICATIONS**

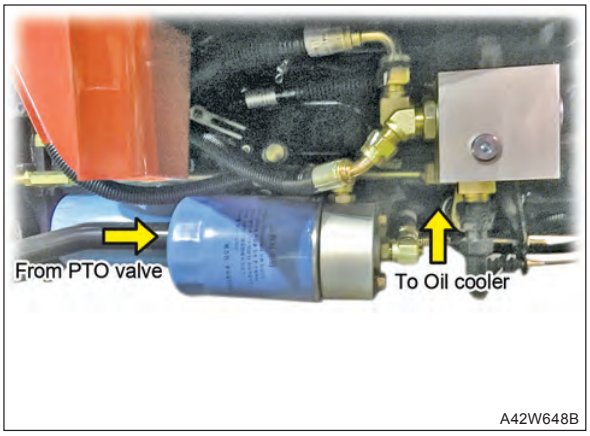
Filtering area	4,972 cm^2
Number of folds	55
Folding width	195 × 17 × 55 folds
Bursting strength	4.5 bar
Max. fineness	110±8 μ
Min. fineness	92±8 μ

Notes
• **Hydraulic filter replacement: after initial 50 hours, and then every 300 hours of use**

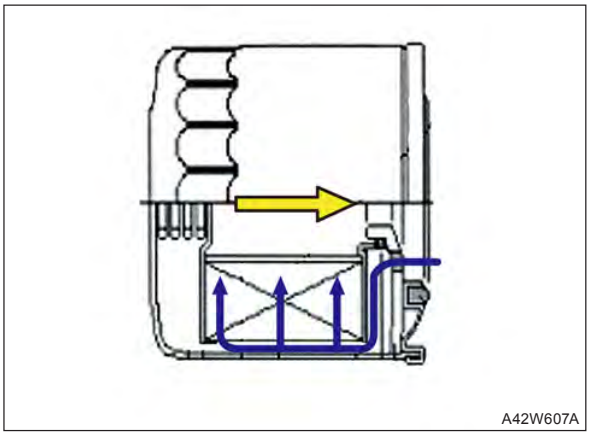
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4.9.2 HST FILTER [HST MODEL]



The HST filter is installed below the right floor. As oil delivered from the PTO valve side passes through the HST filter, it is filtered before it returns into the oil cooler for cooling and flows into the HST.



▶ SPECIFICATIONS

Filtering area	2,677 cm^2
Number of folds	75
Folding width	105 × 17 × 75 folds
Rated flow	30 ℓ /min
Bursting strength	17 kgf/cm^2
Fineness	20 μ

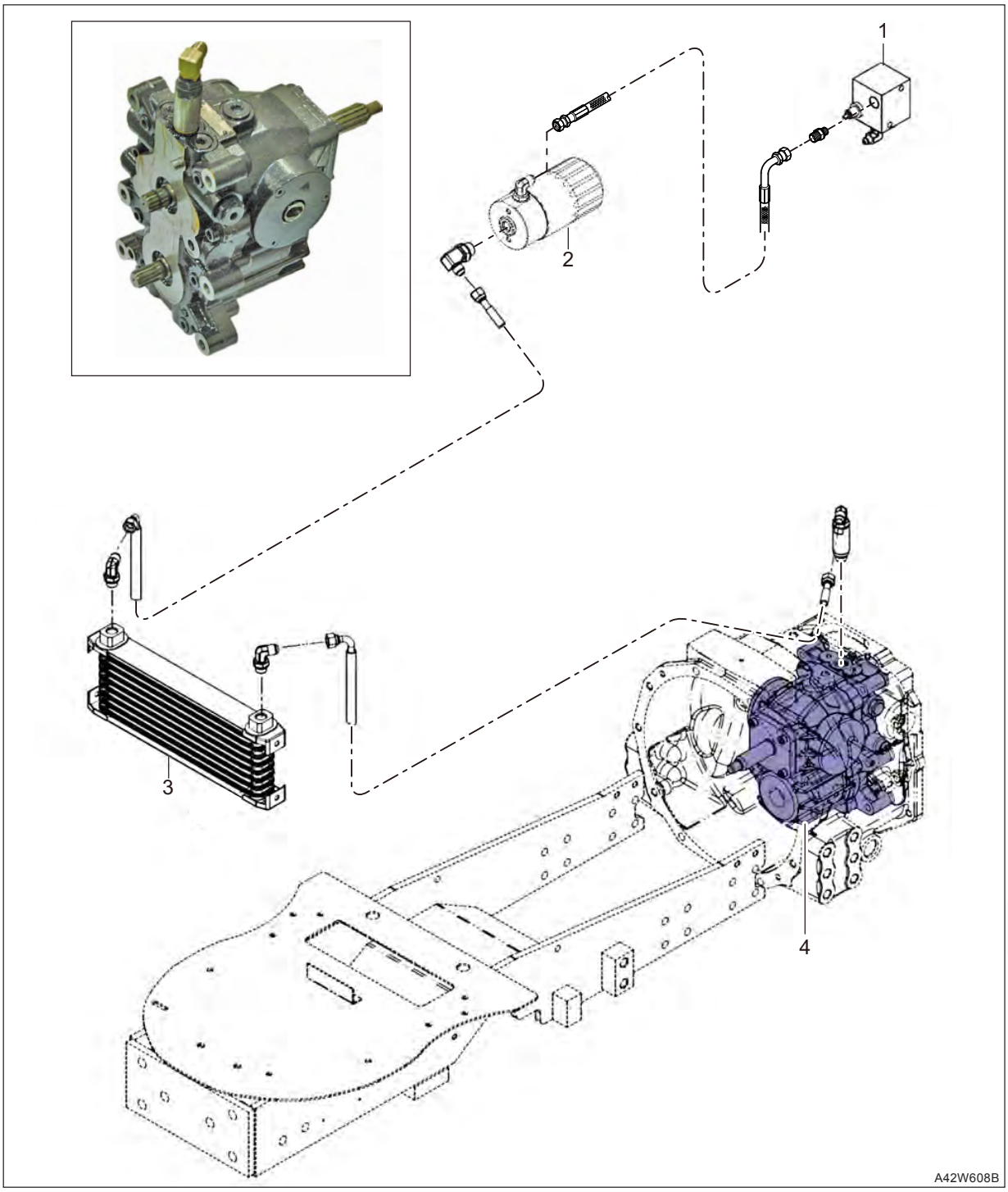
Notes
• **Replace after initial 50 hours, and then every 300 hours of use**

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4.10 HST(HYDROSTATIC TRANSMISSION) [HST MODEL]

4.10.1 HST PASSAGE COMPOSITION



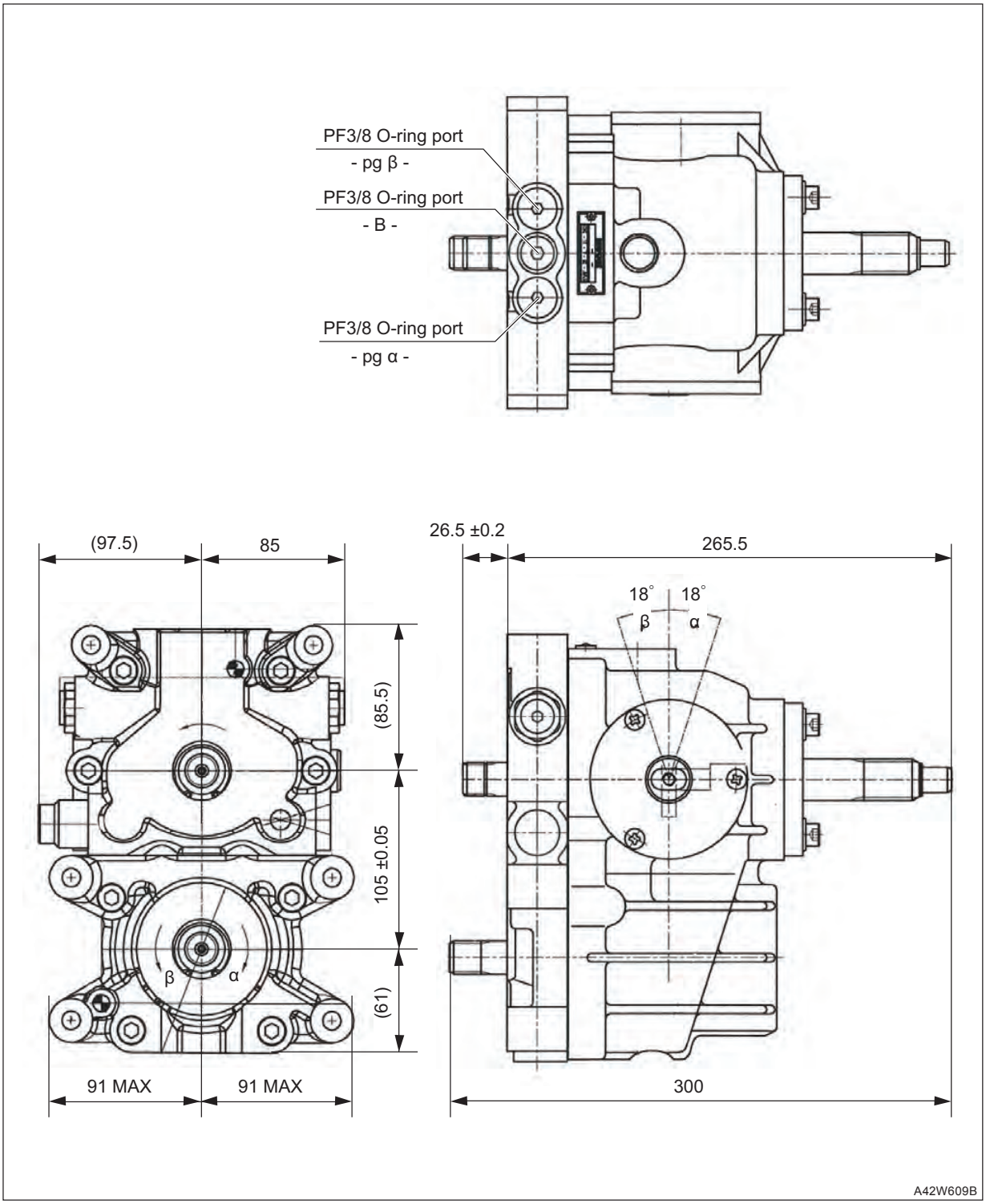
(1) PTO valve (2) HST filter (3) Oil cooler (4) HST

The HST (Hydro-Static Transmission) consists of the variable capacity pump, fixed capacity motor, check valve, high-pressure relief valve, etc. and it is installed to the transmission to supply turning force to the transmission. The input shaft of the HST is connected to the spring damper which is installed to the flywheel of the engine with the spline. to receive turning force from the engine. Its HST pump is driven by receiving this turning force through the input shaft of the HST, and hydraulic oil led into the HST is sent to the hydraulic motor to supply new rotating force to the transmission. As the HST pump can adjust hydraulic flow variably, it can adjust the speed of the HST motor variably and the rotating direction of the motor through the internal swash plate for forward and reverse driving.

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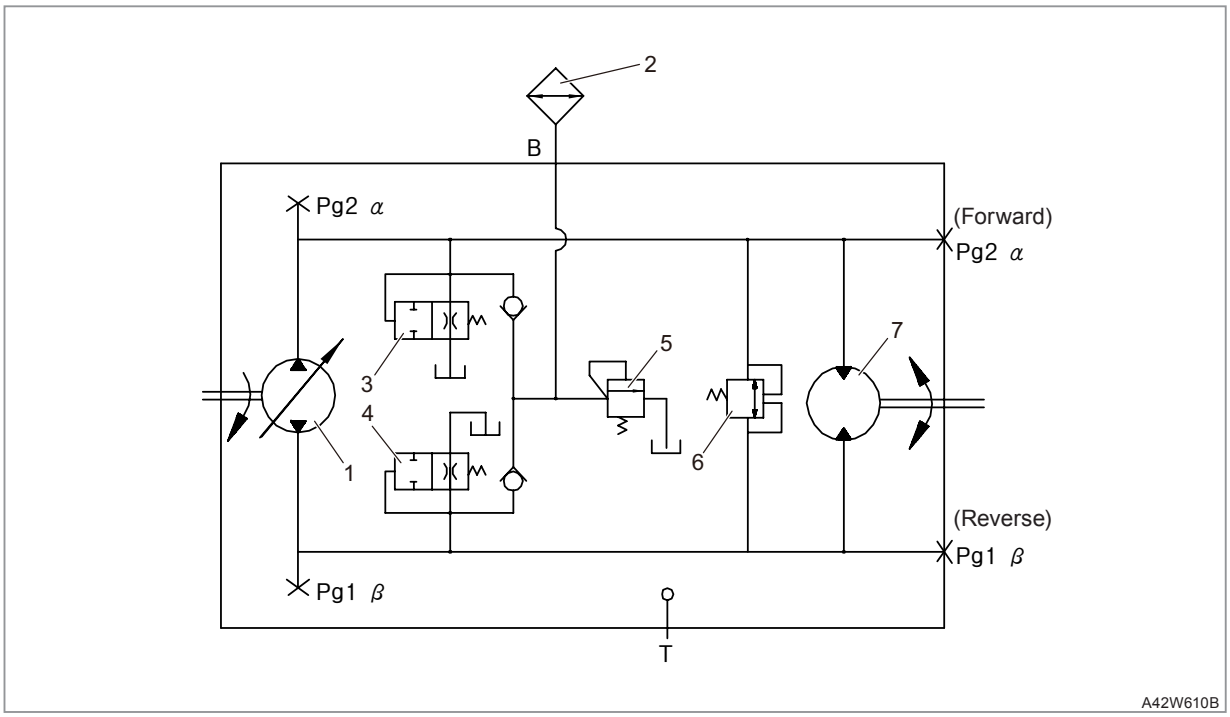
4.10.2 EXTERIOR DIMENSION



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4.10.3 CIRCUIT DIAGRAM

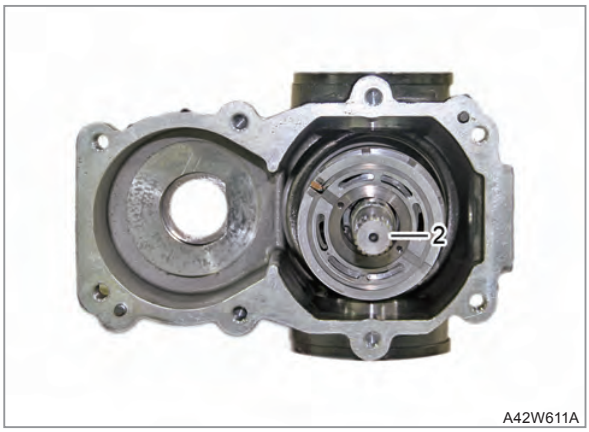


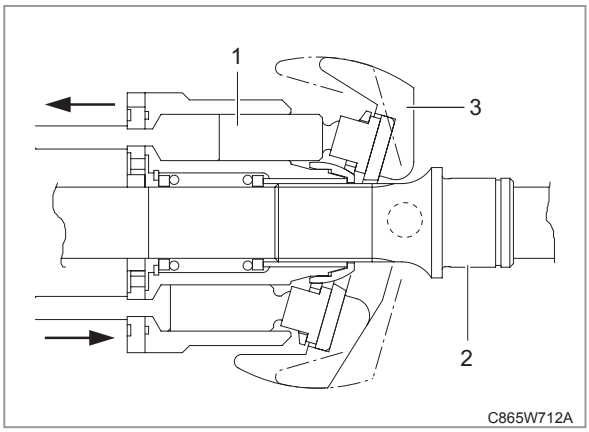
(1) HST pump
(2) Oil cooler
(3) Neutral valve
(4) Neutral valve
(5) Charge relief valve
(6) Main relief valve
(7) HST motor

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4.10.4 HST PUMP





(1) Piston (3) Swash plate
(2) Shaft

The pump in the HST is equipped with several pistons (1) to control hydraulic flow with reciprocating motion. Also, it uses its swash plate (3) to hydraulic flow and flow direction. The piston attached to its cylinder is in contact with the inclined surface of the swash plate, sliding on this surface in reciprocating motion in the cylinder.

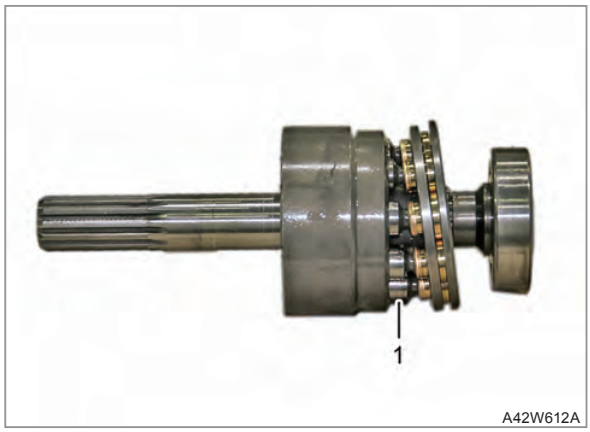
Therefore, Every time the shaft (2) rotates once, the pistons reciprocate once as well. The pistons on one side in the cylinder suck oil while the pistons on the other side in the cylinder discharge oil, forming one cycle.

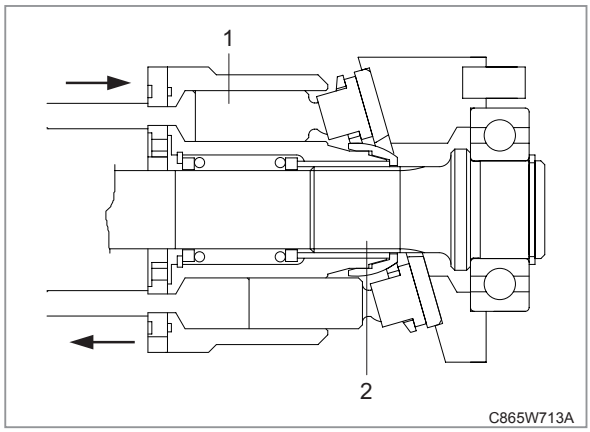
Therefore, the cylinder is divided into the high-pressure side and low-pressure side. When, the inclined side of the swash plate is changed, these sides are switched.

This is where the direction of flow changes when the HST pedal is depressed the "forward" or "reverse". Then, the rotating direction of the motor shaft in the HST is changed to enable forward or reverse driving.

The inclination of the swash plate in the pump is adjusted within the range of -18° - +18°, and its angle determines the driving direction and vehicle speed.

4.10.5 HST MOTOR





(1) Piston (2) Shaft

The motor in the HST has a shape similar to the pump, but it is equipped with the fixed swash plate, making it a fixed capacity type.

After hydraulic oil is compressed in the pump, it is led into the motor to drive it. The piston in the motor has a structure similar to a pump, but the swash plate of the motor is fixed at the angle of 18°. Therefore, when each piston receives high-pressure oil, it is extended to push out the swash plate. However, as the swash plate is fixed, this force is blocked by the swash plate and rotates the cylinder assembly instead.

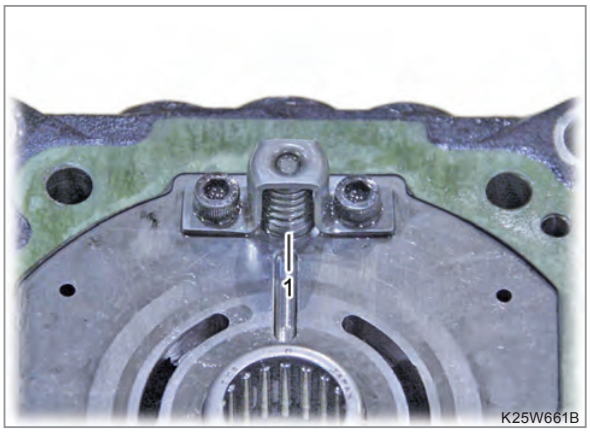
Therefore, one half of the cylinder space expands while the other half of the cylinder space contacts. Oil discharged in this state is returned to the suction line toward the pump, completing one cycle.

The speed of the motor is determined by the amount of oil flow of the pump, and the rotating direction of the motor is determined by the direction of oil flow.

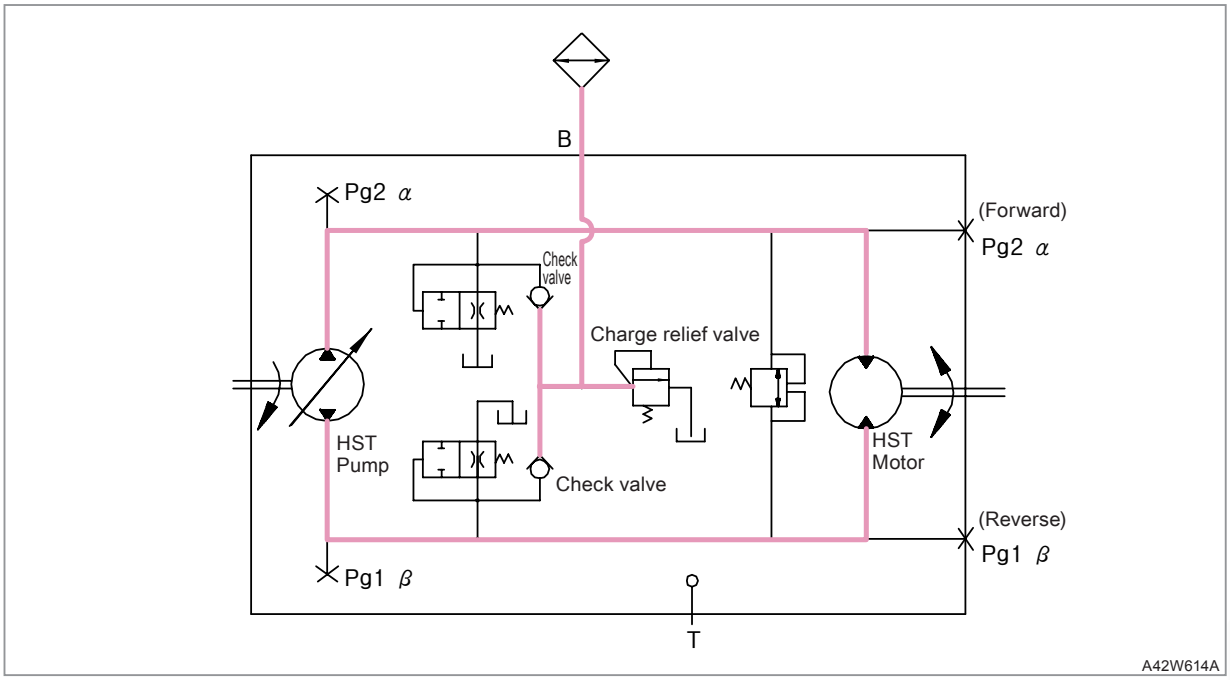
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4.10.6 CHARGE RELIEF VALVE



(1) Charge relief valve



Most of oil is circulated in between the pump and motor in the HST. There is no separate charge pump. Instead, the gear pump of the vehicle body supplies hydraulic oil through the passage.

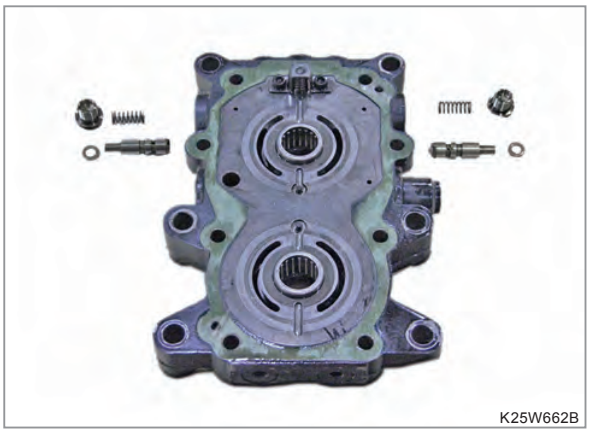
Most of oil is circulated through the circuit, but oil leakage occurs in the process. Therefore, this amount of oil loss should be supplemented in the circuit continuously. For this, the pump for charge continuously supplies oil to the low-pressure side circuit in which oil is returned from the motor. The setting pressure of the charge relief valve is 5 ~ 7 kgf/cm^2. When pressure rises due to surplus oil or load in the high-pressure side, the charge relief valve opens to send oil to the oil tank.

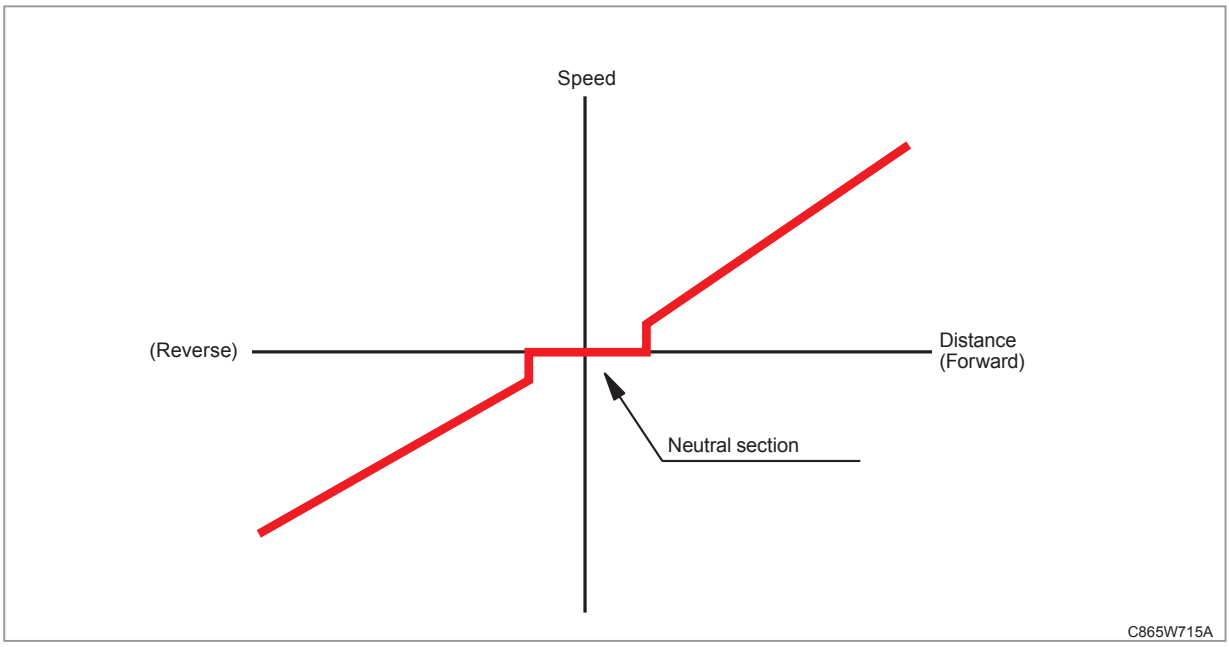
During forward or reverse driving, high pressure is formed in the compression side of the pump while low pressure is formed in the suction side, leading to oil loss in the low pressure side. If this leads to pressure drop, the charge relief valve is closed and oil is supplemented through the check valve.

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4.10.7 NEUTRAL VALVE


K25W662B

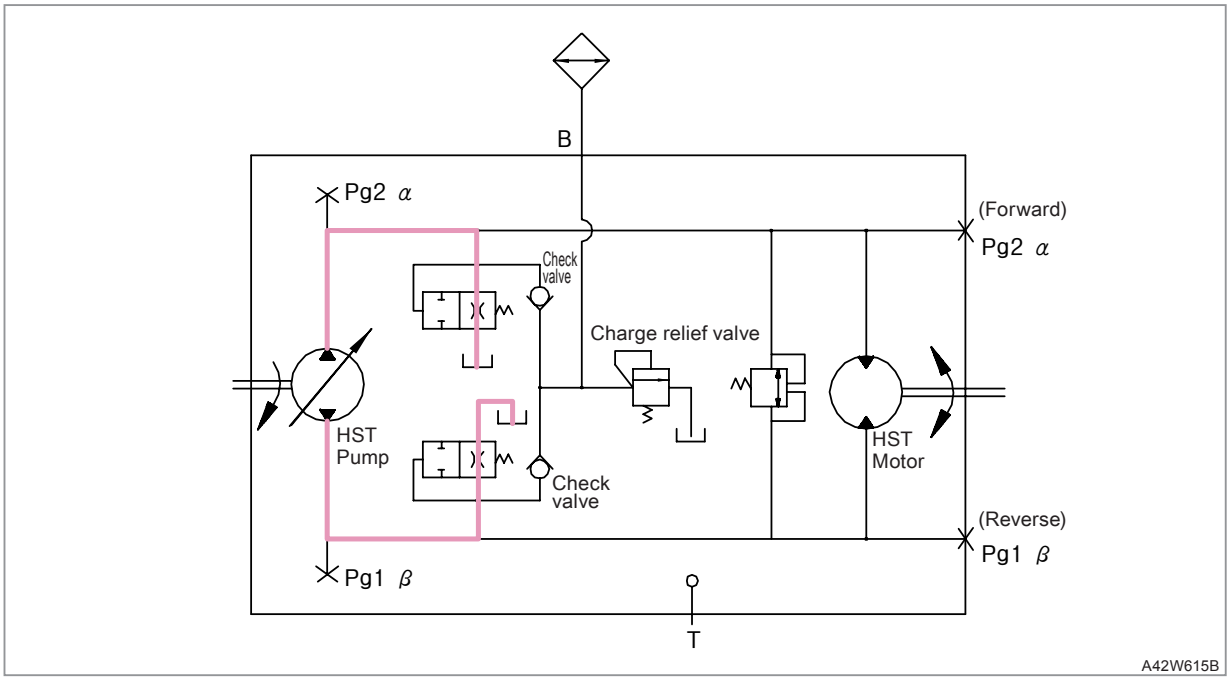


C865W715A

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NEUTRAL



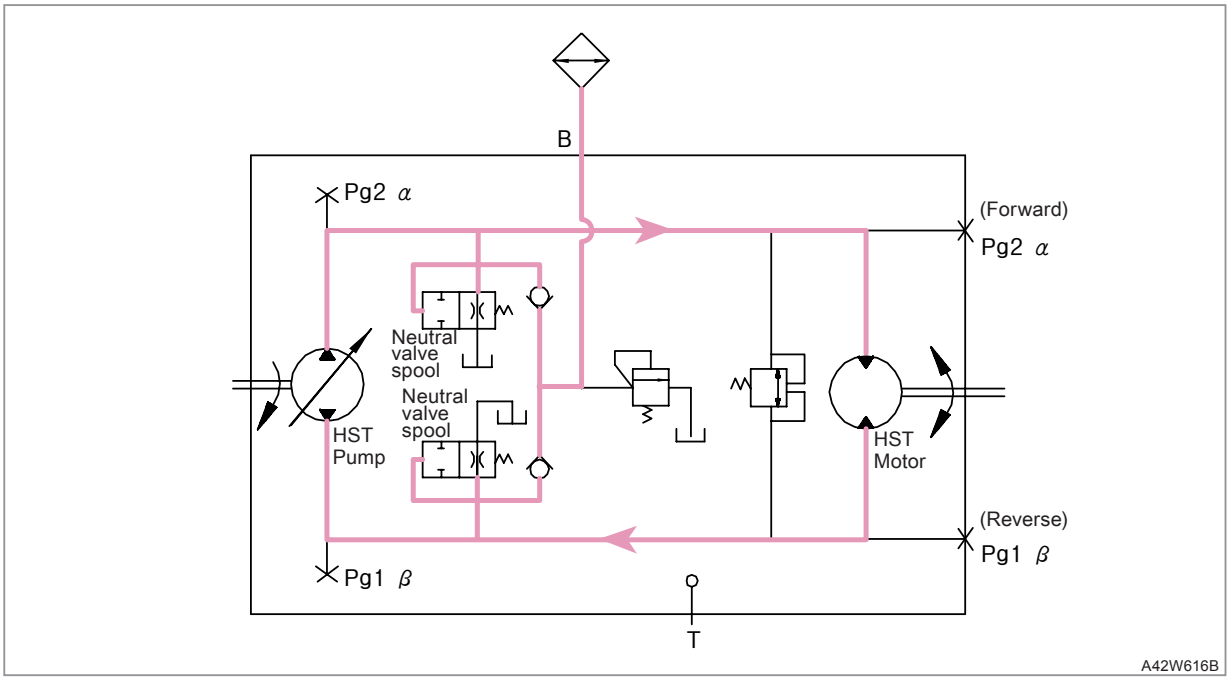
In the HST pump operation process, it is almost impossible to set the swash plate at 0° exactly to keep the neutral state (no oil flow). Also, it is impossible for the driver to set the angle of the swash plate to 0° for the neutral setting. To solve this problem, the neutral valve is installed to obtain the minimum range to keep the neutral state.

When the angle of the swash plate is close to, but not exactly 0°, a small amount of oil is discharged to the motor. In this case, the neutral valve drains this oil through its orifice to prevent internal pressure rise before it reaches the motor. This also prevents minute operation of the hydraulic motor.

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FORWARD/REVERSE DRIVING

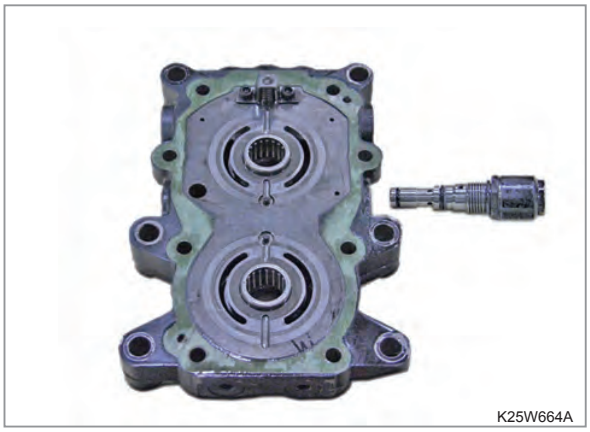


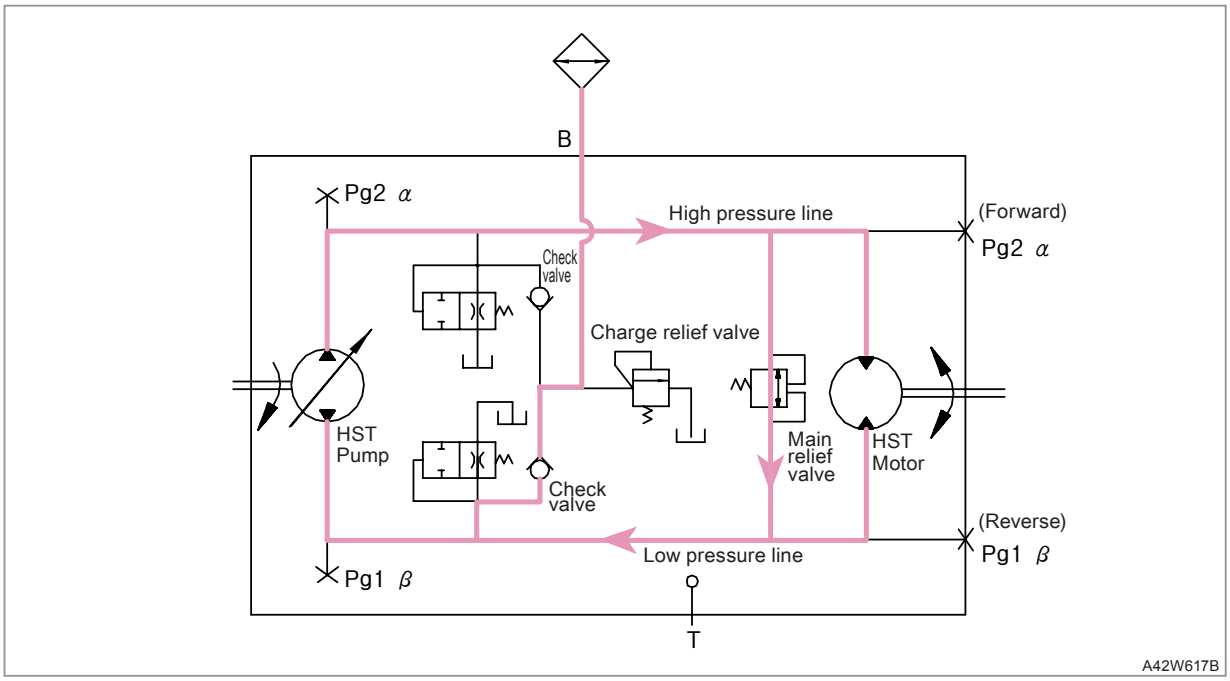
When operating the forward/reverse pedal for forward or reverse driving, the angle of the swash plate is increased so oil flow toward the pump is also increased. As a result, hydraulic pressure rises gradually and eventually exceeds the setting pressure of the return spring of the neutral valve. Then, the spool of the neutral valve is moved to close the orifice, leading oil to the motor through the internal circuit.

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4.10.8 MAIN RELIEF VALVE


K25W664A



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The setting pressure of the main relief valve is 380 kgf/cm2 (37.2 MPa) to protect the internal circuit in case of HST overload.

When the main relief valve is activated during forward or reverse driving, oil in the high-pressure side circuit is delivered to the low-pressure side circuit to prevent damage of the internal circuit due to load.

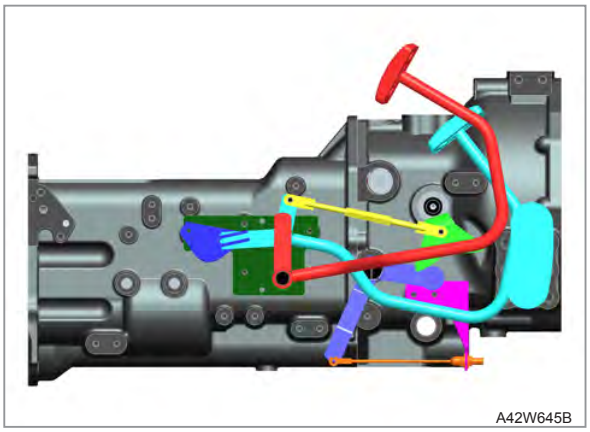
On the other hand, oil supplied by the charge pump is sent to the low-pressure circuit through the check valve on the neutral valve side.

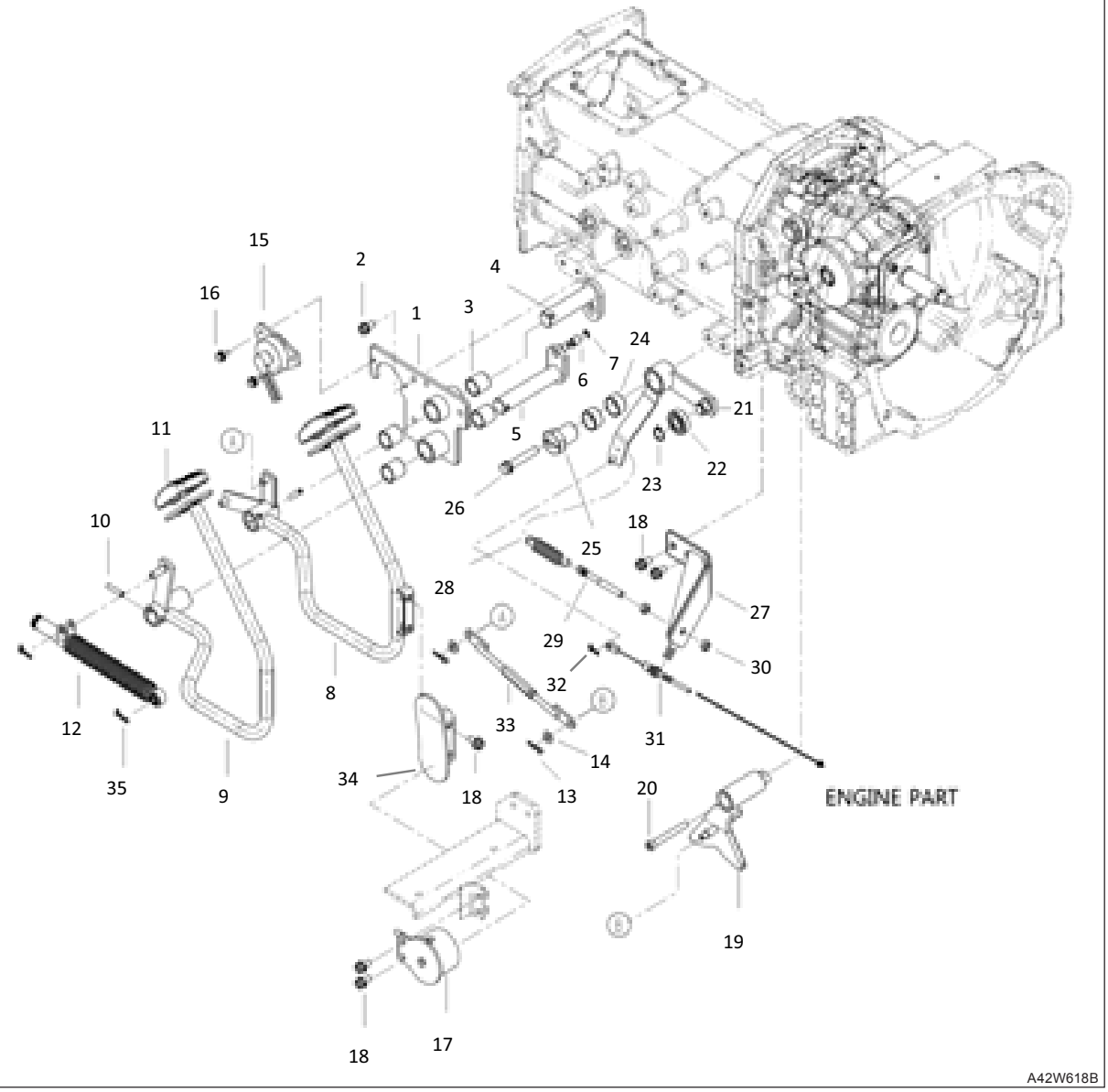
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4.10.9 HST PEDAL AND LINK

COMPONENTS





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(1) Bracket assy, pedal
(2) Hex flange bolt
(3) Bush
(4) Shaft assy, front
(5) Shaft assy, rear
(6) Roller
(7) Snap ring
(8) Pedal ass'y, front
(9) Pedal ass'y, rear
(10) Spring pin
(11) Pedal cover
(12) Damper
(13) Snap pin
(14) Plain washer
(15) Switch(fr)
(16) Bolt w/washer
(17) Cruise magnet
(18) Hex flange bolt
(19) Joint
(20) Hexagon socket bolt
(21) Arm ass'y
(22) Ball bearing
(23) Snap ring
(24) Bush
(25) Shaft
(26) Bolt w/washer
(27) Holder assy, spring
(28) Spring
(29) Bolt
(30) Hex nut
(31) Wire
(32) Snap pin
(33) Rod assy
(34) Bracket assy, cruise
(35) Snap pin

The forward and reverse driving pedals are installed at different hinge point shafts (4 & 5) and they are interlinked.

Therefore, when the forward driving pedal is depressed, the reverse driving pedal is lifted and vice versa. There is the rod (33) between the forward driving pedal and connecting joint (19). The connecting joint is rotated for the amount of movement of the pedal in the reverse direction for the forward/backward driving.

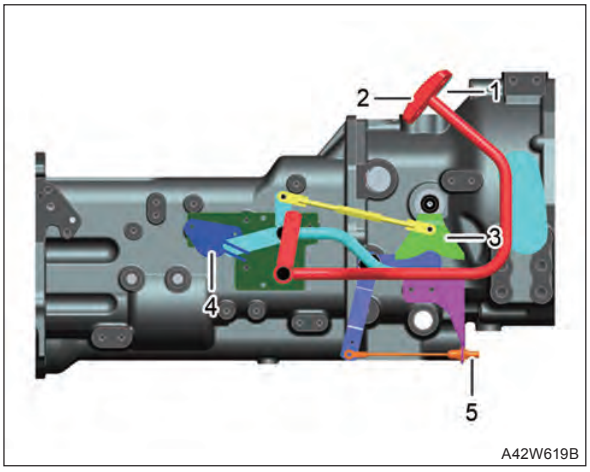
The connecting joint is connected to the swash plate of the HST. While it is turned clockwise or counterclockwise, it determines the driving direction (forward/reverse) and driving speed. Also, the connecting joint is engaged with the neutral control bracket (21). This neutral control bracket has the ball bearing (22) which slides along the curve of the connecting joint according to the rotating direction of the joint, moving the neutral control bracket accordingly. Then, its motion in the same direction for the connecting joint pulls or release the HST accelerator cable (31), which is connected to the neutral control bracket, to determine the engine speed.

Also, the safe start neutral switch (15) is connected to the rear bracket of the forward driving pedal to detect the neutral position. The cruise control bracket (34) is attached with the electromagnet (17) which fixes the forward driving pedal at the specified position in the cruise control mode to maintain the constant driving speed.

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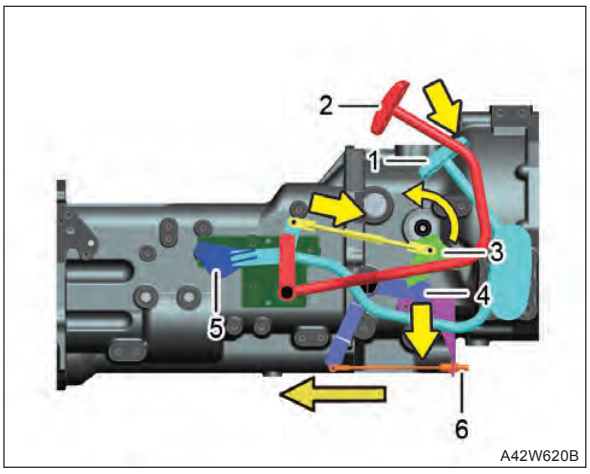
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NEUTRAL



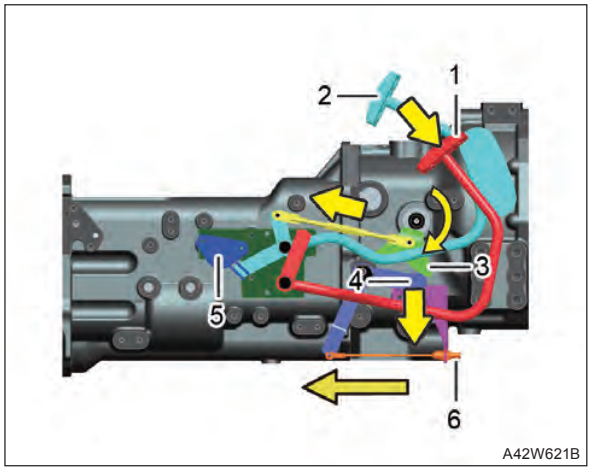
- Align the forward pedal (1) and reverse pedal (2).
- Maintaining the connecting joint (3) in the neutral state
- Detecting the neutral condition of the safe start neutral switch (4)
- Maintaining the idle state of the HST accelerator cable (5)

FORWARD DRIVING



- Lowering the forward driving pedal (1) and lifting the reverse driving pedal (2)
- Turning the connecting joint (3) clockwise
  - Changing the angle of the HST swash plate (0 - +18˚)
- Turning and lowering the neutral control bracket (4) clockwise
- Detecting the forward condition of the safe start neutral switch (4)
- Pulling the HST accelerator cable (6) - Increase of the engine speed

REVERSE DRIVING

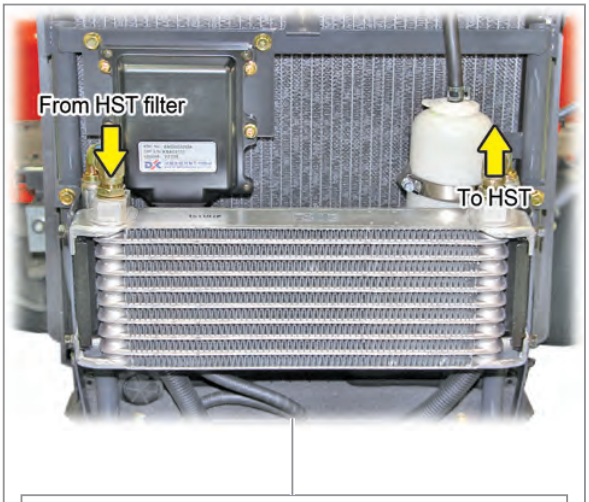


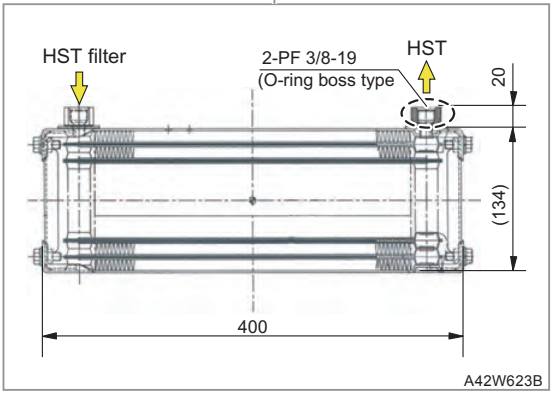
- Lowering the reverse driving pedal (1) and lifting the forward driving pedal (2)
- Turning the connecting joint (3) counterclockwise
  - Changing the angle of the HST swash plate (0 - +18˚)
- Turning and lowering the neutral control bracket (4) clockwise
- Detecting the reverse condition of the safe start neutral switch (5)
- Pulling the HST accelerator cable (6) - Increase of the engine speed

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4.11 OIL COOLER [HST MODEL]





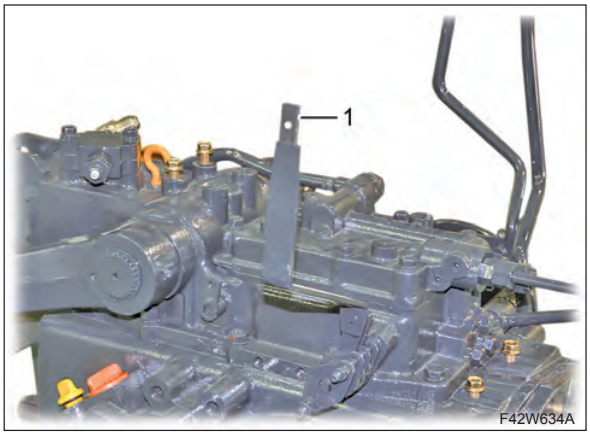
A42W622B

The oil cooler is installed to the face of the radiator in the engine compartment. Oil is heated while passing through the steering system and PTO valve. This hot oil flows through the oil cooler which lowers the oil temperature to a proper level enough for the HST operation.

SPECIFICATIONS

Temperature of oil-intake	90 °C
Heat rejection rate	Min 4,400 kcal/h
Core type	DRAWN CUP type

4.12 POSITION CONTROL



(1) Position control lever

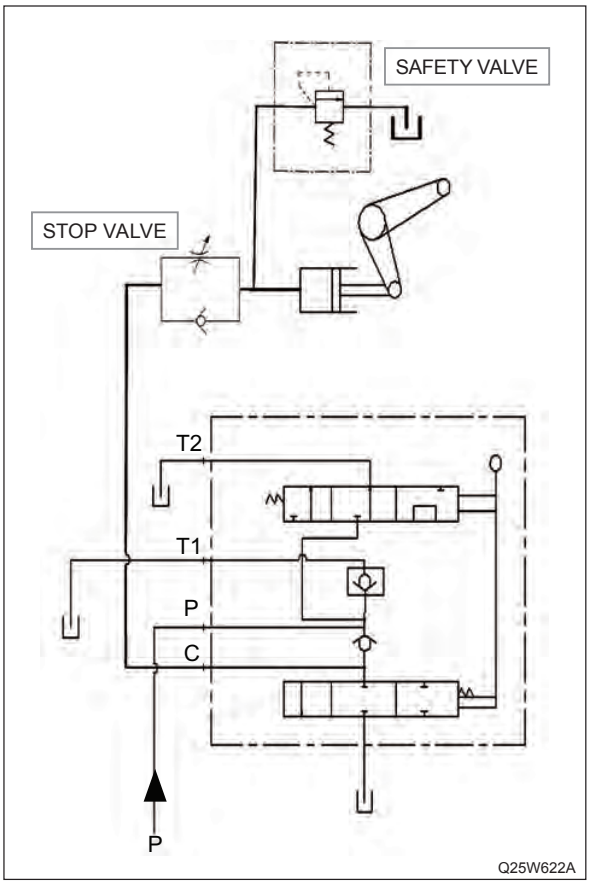
The position control lever (1) is used to control the position of the 3-point hitch. The control valve and feedback link mechanism are used to lift and lower an implement.

The position of the implement can be set by the position control lever. When it is pushed forward, the lift arm is lowered. Pulling it lifts the lift arm.

When the position control lever is moved, its link moves the control valve spool in the hydraulic cylinder case to the lifting or lowering position. As soon as the lever stops moving, the spool is returned to its neutral position to stop the 3-point hitch.

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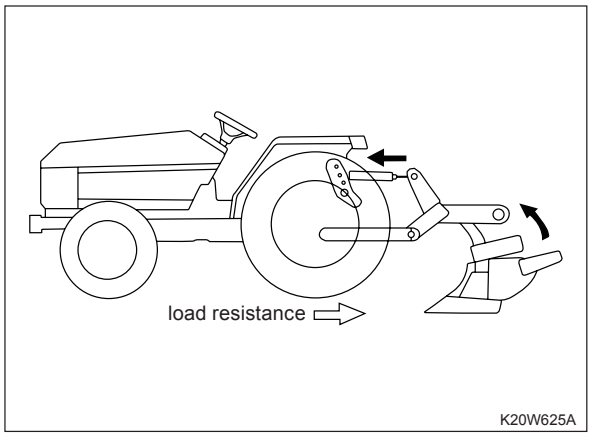
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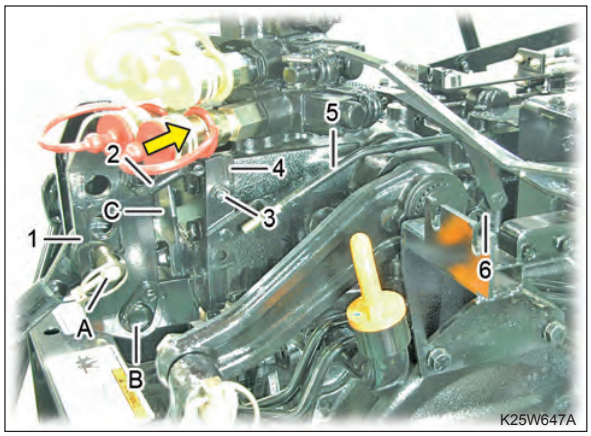


Oil from the pump pushes the piston through the control valve to lift the lift arm. When the lift arm is lowered by weight of the implement, oil in the piston is flown out through control valve and is returned to the transmission case.

The lowering speed of the implement can be adjusted with the stop valve on the front of the hydraulic cylinder case. Turning the stop valve counterclockwise increases the lowering speed while turning it clockwise decreases the lowering speed. When turning the valve clockwise, it is locked so the lift arm stops lowering.

4.13 DRAFT CONTROL





The draft control is a device that controls load by vertical movement of the lift arm (implement) against load resistance of an implement during draft work with an implement, such as a plow and cultivator.

When an implement is loaded, load is applied to the top link connection (A) through the top link.

When the top link connection is applied with load, it pushes the top link hinge at the point B. Then, the bracket (2) is pushed forward to push the connecting link DF (4). Therefore, the lower section of the link DF is pulled at the shaft (3) so the draft rod (5) connected to this lower section is pulled as well. As a result, the draft arm (6) connected to the draft rod is turned and the link in the hydraulic cylinder case is operated to operate the control valve. Finally, hydraulic oil pushes the piston in the hydraulic cylinder to lift the lift arm. Then, the implement is lifted to lessen applied load.

When draft load is lowered, the implement is lowered by its weight and oil in the cylinder is pushed out by the piston.

To perform draft control, remove the connecting plate (C). Make sure to install it after work.

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5. TROUBLESHOOTING

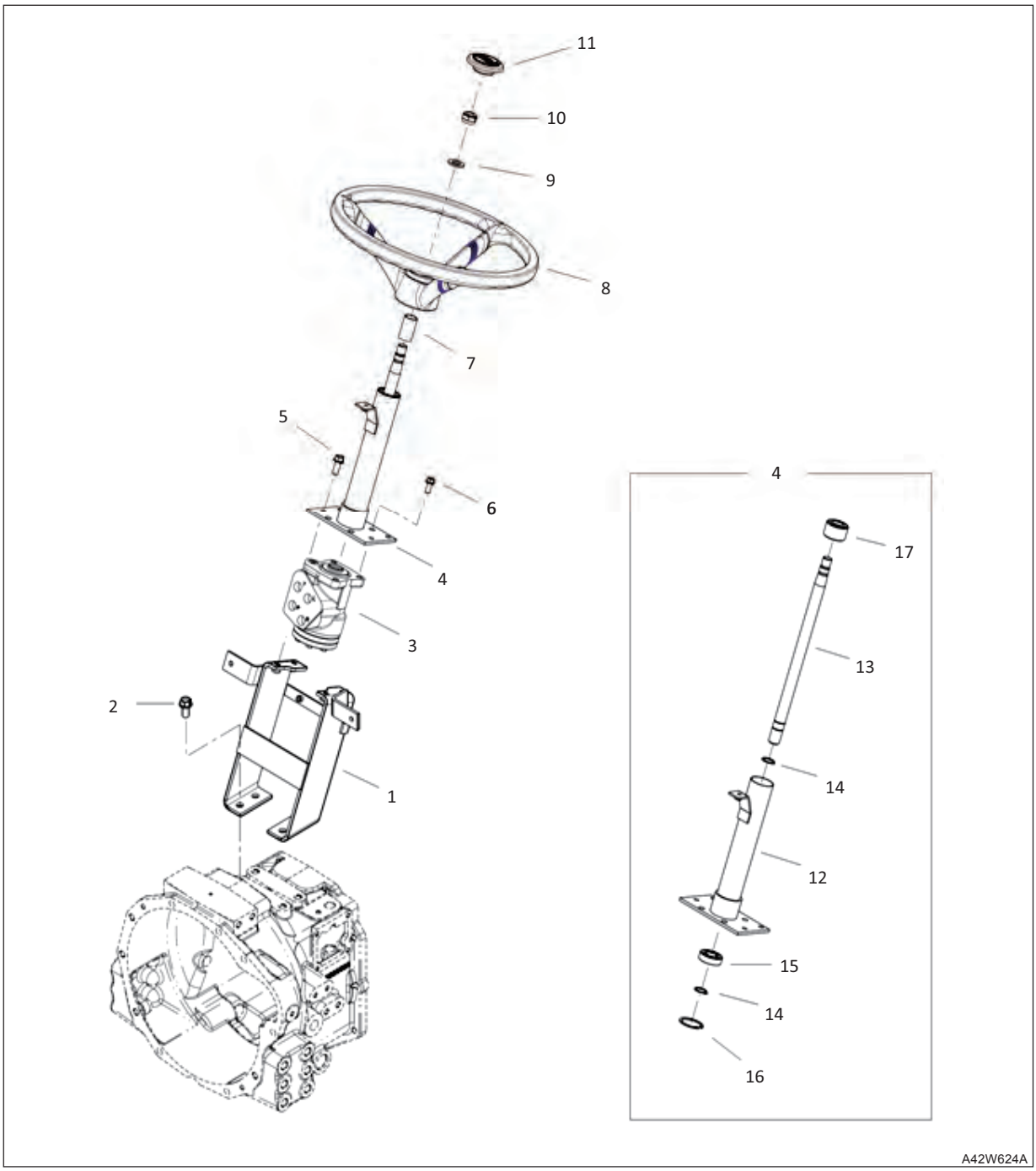
PROBLEMS	CAUSE OR SYMPTOM	SOLUTION
The 3-point hitch cannot be lifted.	• Improperly installed control valve • Damaged control valve • Foreign material stuck in control valve or spool stuck • Insufficient transmission fluid • Clogged oil filter • Damaged hydraulic pump • Damaged cylinder piston ring of hydraulic cylinder case	• Remove and re-install it. • Replace it with a new one. • Remove, clean and repair it. • Add transmission fluid. • Clean or replace it. • Repair or replace it. • Check the backup ring and O-ring and replace it as necessary.
The 3-point hitch cannot be lowered.	• Damaged stop valve • Foreign material stuck in control valve	• Check and repair the stop valve. • Remove and clean the control valve.
Impossible to drive forward or backward [HST MODEL]	• Damaged power train • Clogged HST internal circuit • Incorrectly set neutral position of HST pedal • Insufficient hydraulic oil amount • Clogged HST filter • Faulty HST	• Check and adjust the power train • Check if the check valve, relief valve, etc. and clean them accordingly. • Set the HST neutral range correctly • Add oil • Clean or replace • Replace the HST
Excessively heated oil [HST MODEL]	• Insufficient oil in transmission • Low setting pressure of relief valve • Low discharge pressure of gear pump • Clogged oil cooler	• Add oil • Set the setting pressure properly or replace the relief valve • Check and repair the pipe • Clean the filter • Clean or replace the valve seat • Clean
Impossible to stop with lever in HST pedal neutral position [HST MODEL]	• Incorrectly set neutral position of HST • Faulty neutral valve	• Adjust the neutral position correctly • Clean and remove foreign materials

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6. SECTIONAL VIEW FOR MAJOR COMPONENTS

6.1 STEERING COLUMN



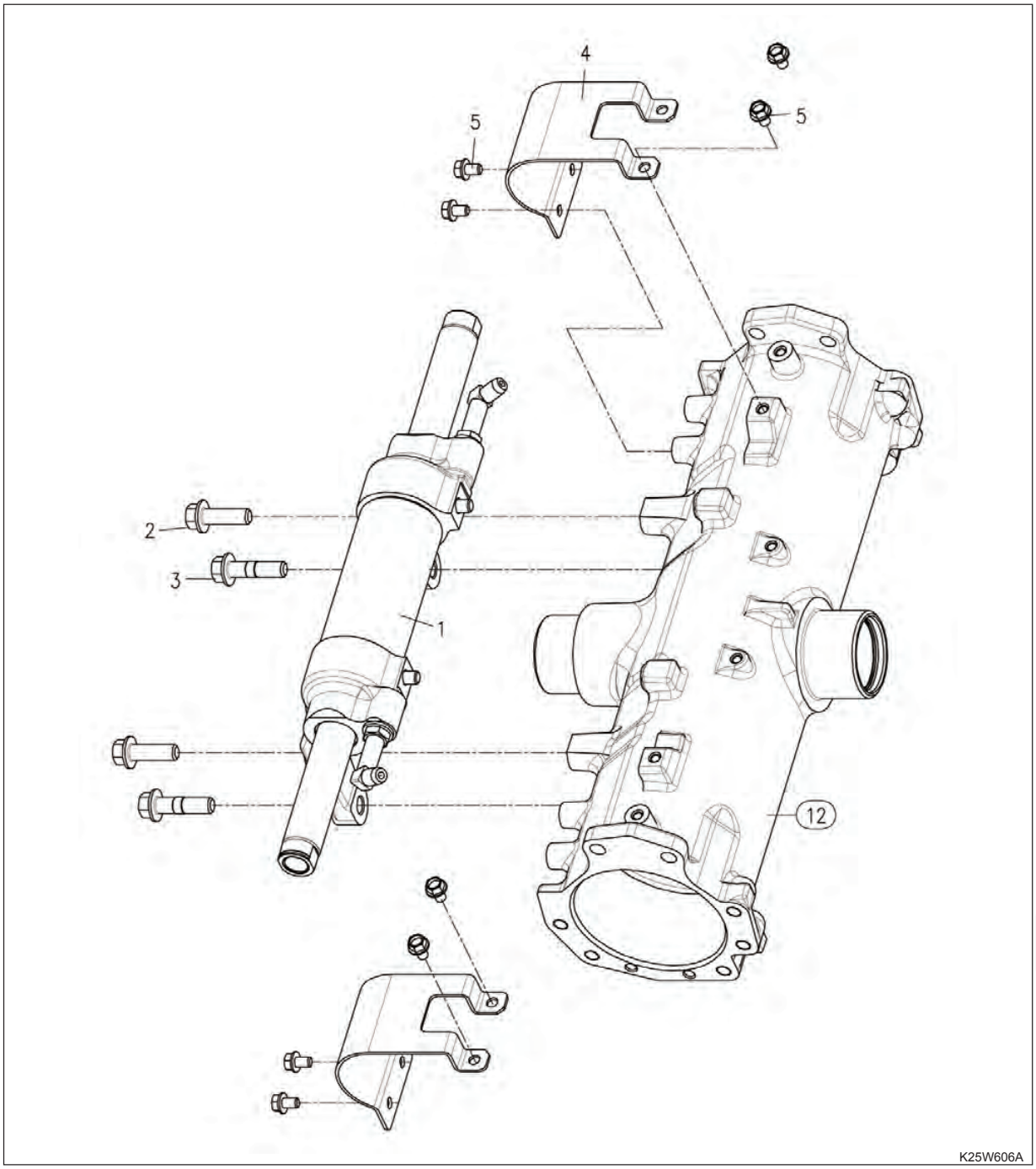
COMPONENTS

(1) Support, steering
(2) Hex flange bolt
(3) PST valve ass'y
(4) Column, steering
(5) Hex flange bolt
(6) Hex flange bolt
(7) Cover(shaft)
(8) Steering wheel ass'y
(9) Plain washer
(10) U-nut
(11) Steering cap
(12) Pipe assy, steering
(13) Shaft, steering
(14) Snap ring
(15) Ball bearing
(16) Snap ring
(17) Column bush

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6.2 P.S.T CYLINDER



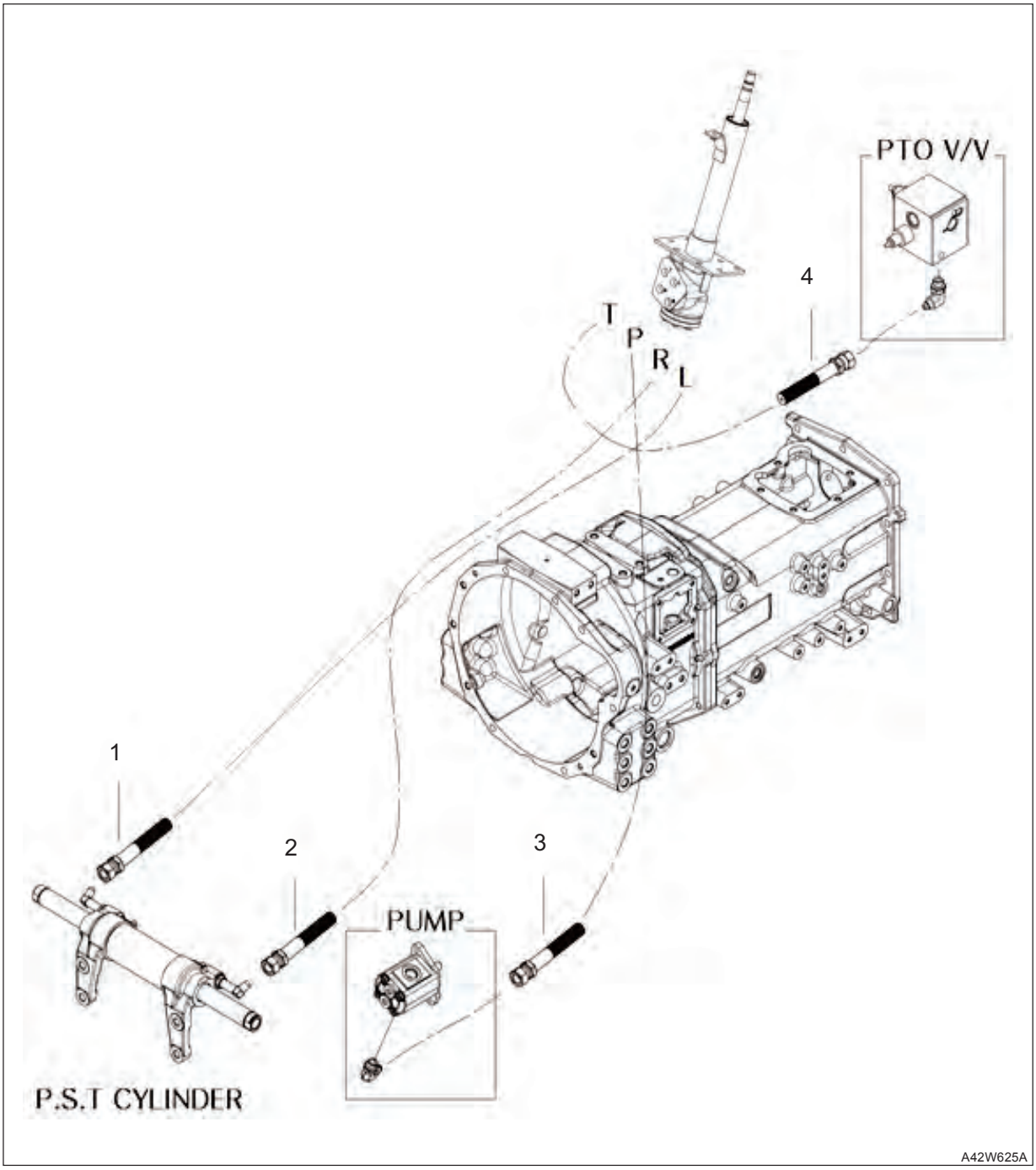
COMPONENTS

(1) P.S.T cylinder ass'y
(2) Hex flange bolt
(3) Hex flange bolt
(4) Cover, P.S.T cylinder
(5) Hex flange bolt

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6.3 P.S.T PIPE



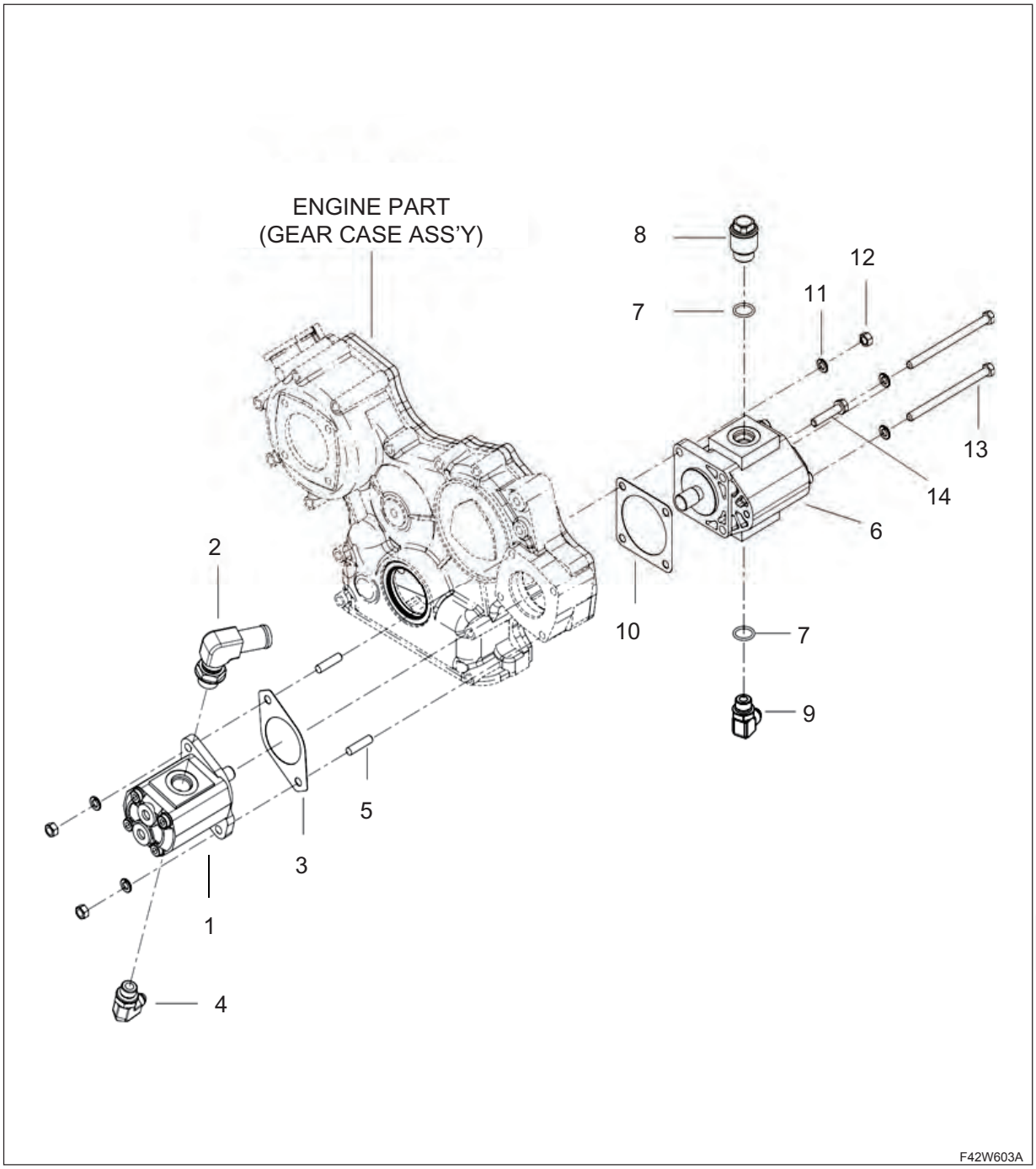
COMPONENTS

(1) Hose
(2) Hose
(3) Hose
(4) Hose

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6.4 HYD PUMP



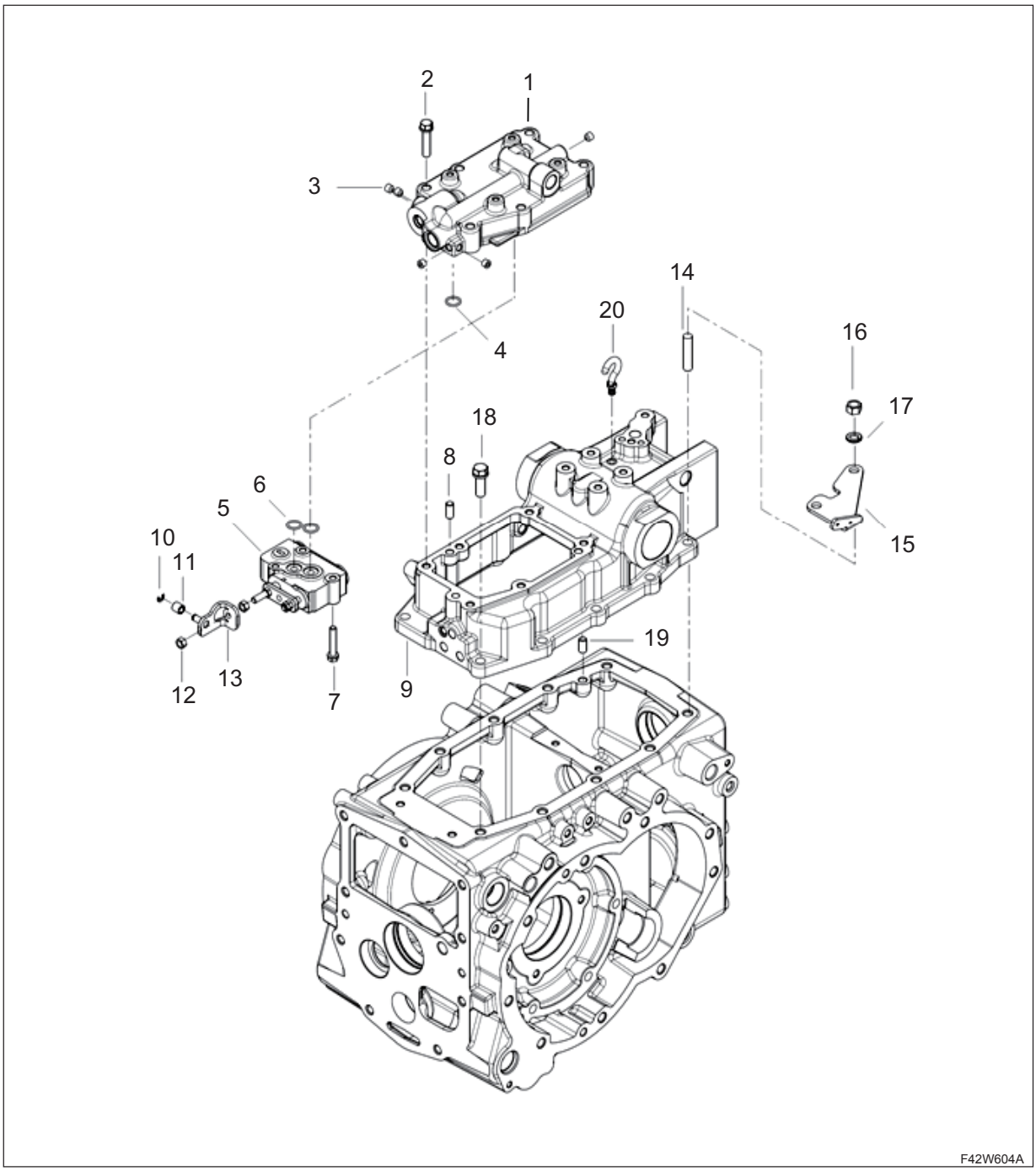
COMPONENTS

(1) Hyd pump
(2) Elbow
(3) Packing
(4) Elbow
(5) Stud bolt
(6) Hyd pump
(7) O-ring
(8) Joint
(9) Elbow
(10) Packing
(11) Spring washer
(12) Hex nut
(13) Hex bolt
(14) Bolt w/washer

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6.5 CASE, HYD CYLINDER



COMPONENTS

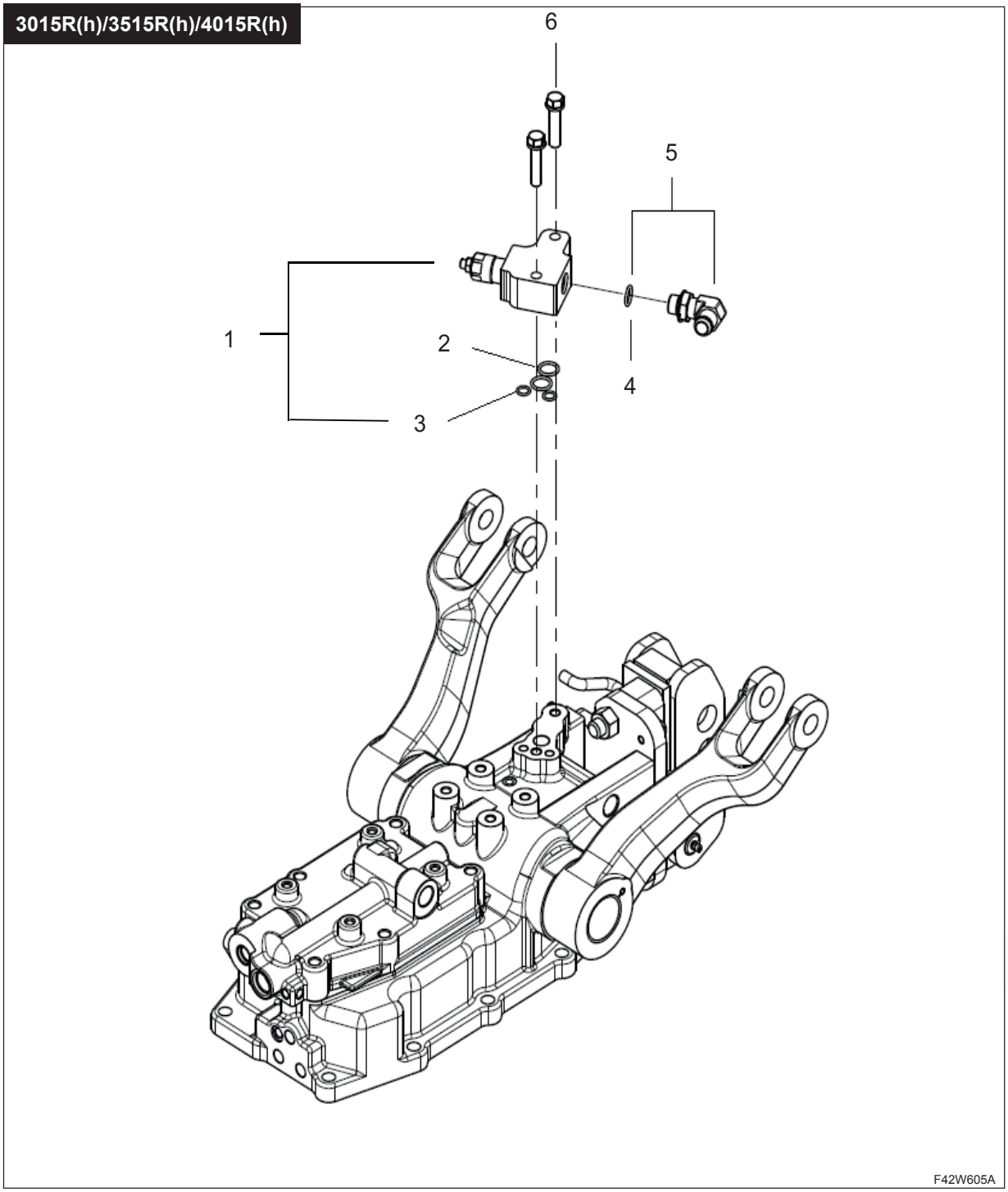
(2) Bolt w/washer
(3) Plug
(4) O-ring
(5) Control, valve ass'y
(6) O-ring
(7) Bolt w/washer
(8) Pin
(9) Case, hyd cylinder
(10) Snap ring
(11) Roller
(12) Hex nut
(13) Clabis ass'y
(14) Stud bolt
(15) Bracket, switch
(16) Spring washer
(17) Hex nut
(18) Bolt w/washer
(19) Pin
(20) Air breather

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6.6 RELIEF VALVE

3015R(h)/3515R(h)/4015R(h)



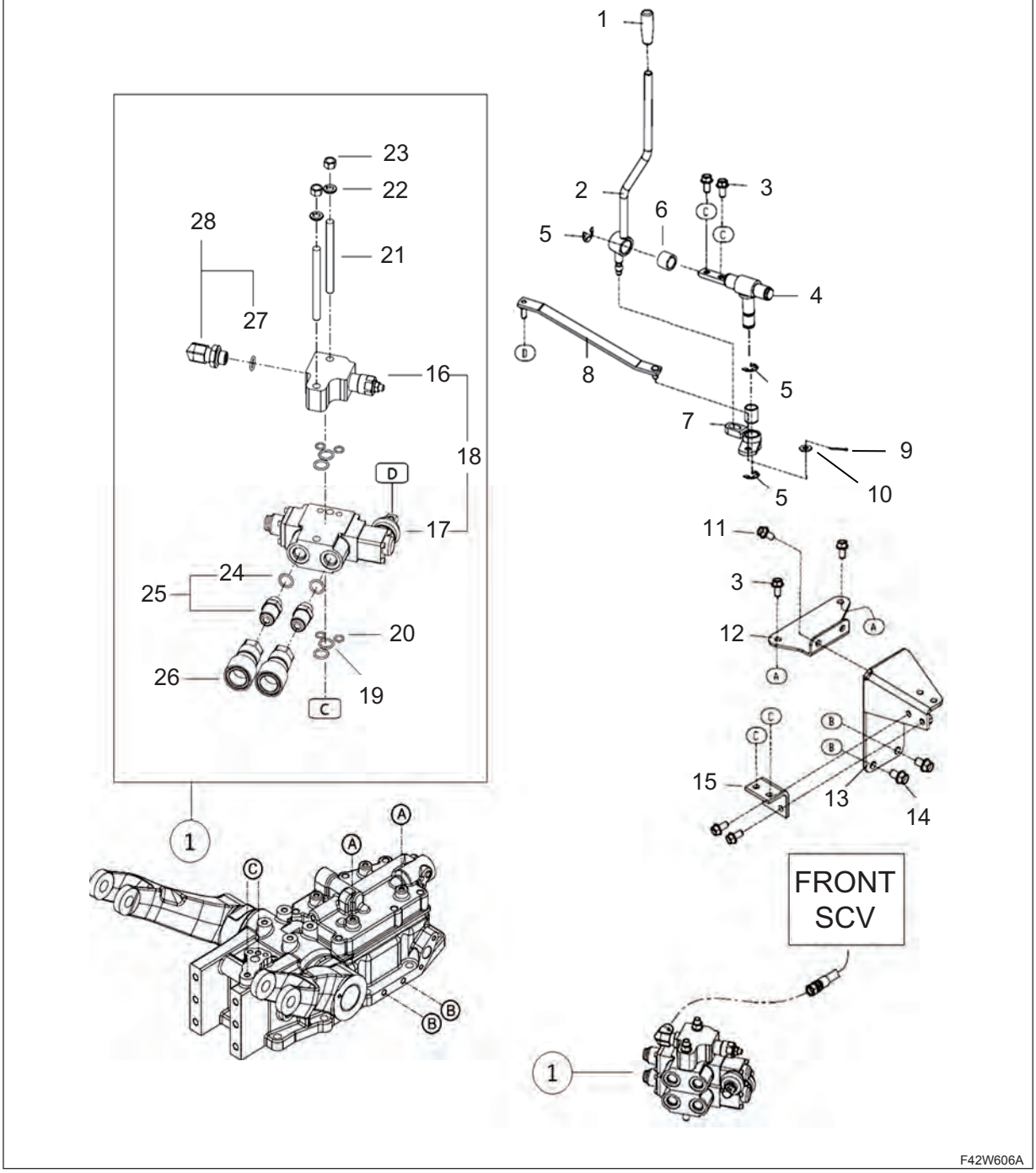
COMPONENTS

(1) Valve, relief
(2) O-ring
(3) O-ring
(4) O-ring
(5) Elbow
(6) Washer ass'y hex bolt

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F36R(h)/F42R(h)



F42W606A

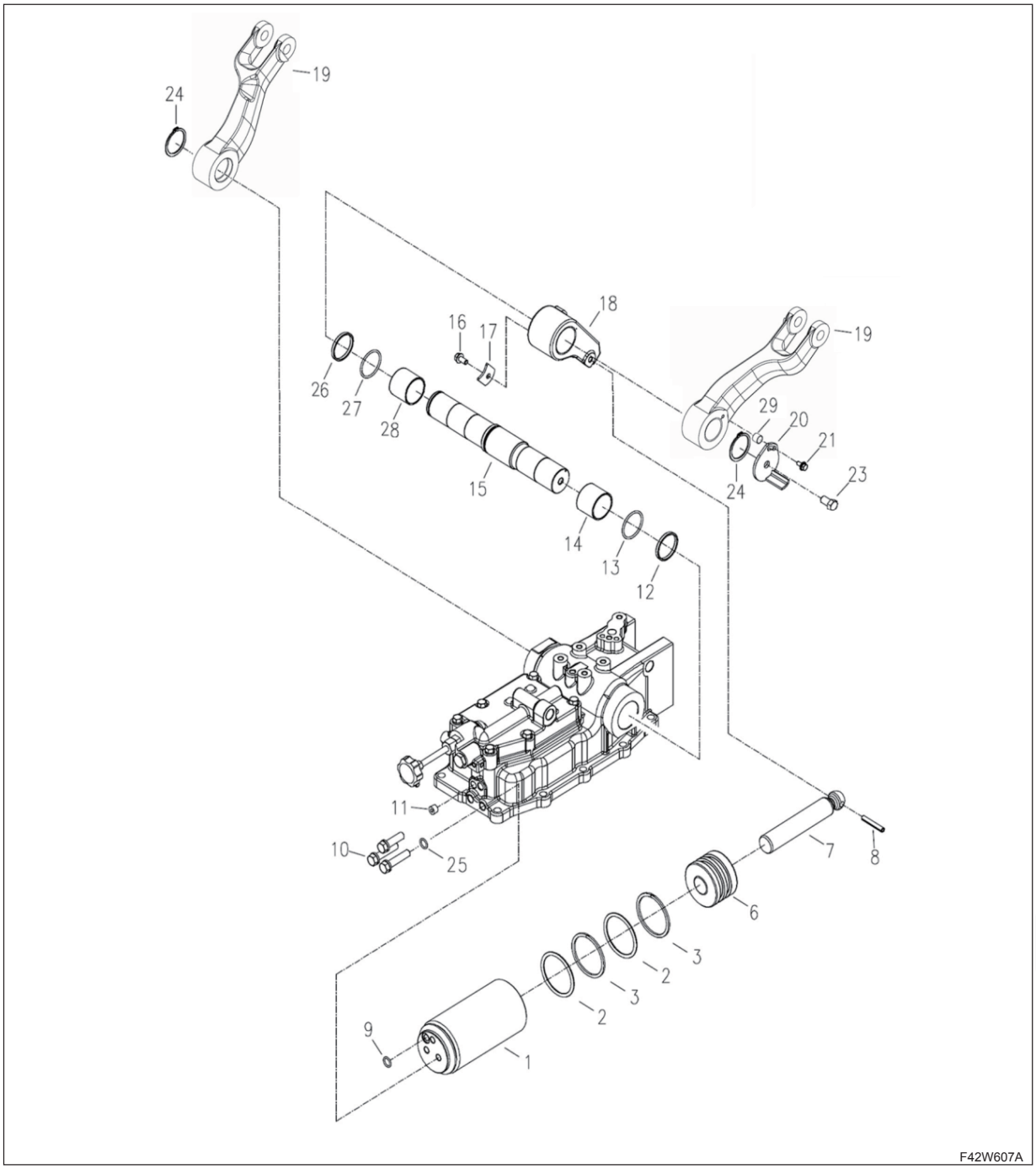
COMPONENTS

(1) Knob, scv lever
(2) Lever A ass'y
(3) Hex flange bolt
(4) Shaft ass'y
(5) Snap ring(E)
(6) Bush
(7) Boss B ass'y
(8) Link(1) ass'y
(9) Cotter pin
(10) Plain washer
(11) Hex flange bolt
(12) Bracket ass'y
(13) Bracket, scv lever
(14) Hex flange bolt
(15) Bracket
(16) Cover relief
(17) Scv PTO 3sd
(18) Scv(2port)
(19) O-ring
(20) O-ring
(21) Stud bolt
(22) Spring washer
(23) Hex nut
(24) O-ring
(25) Joint(1/2)
(26) Joint arm(1/2)
(27) O-ring
(28) Elbow

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6.7 PISTON ASS'Y



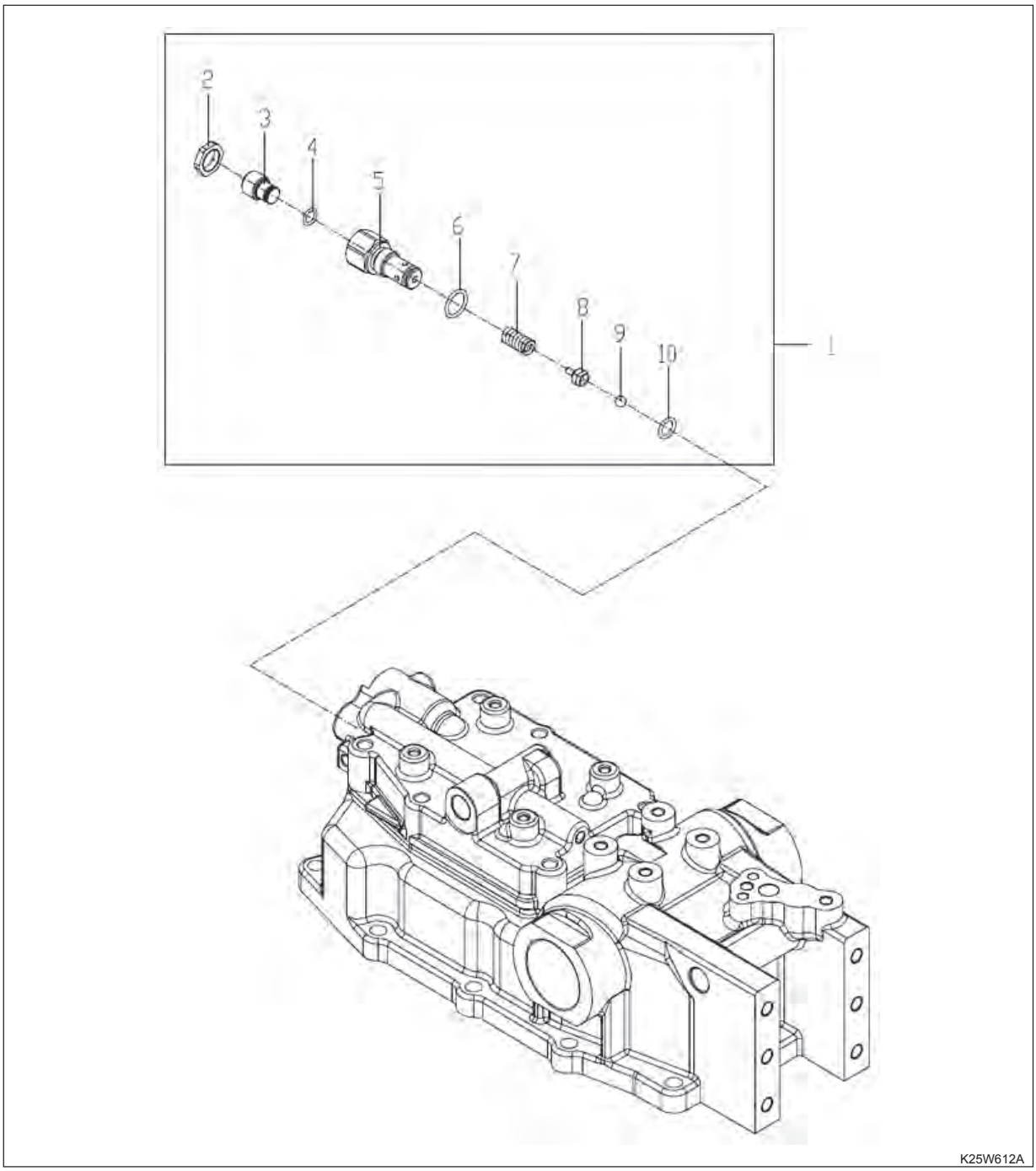
COMPONENTS

(1) Piston ass'y
(2) O-ring
(3) Ring
(6) Piston
(7) Rod, piston
(8) Spring pin
(9) O-ring
(10) Hex bolt
(11) Plug
(12) Ring, backup
(13) O-ring
(14) Bush
(15) Shaft, lift link
(16) Hex flange bolt
(17) Plate
(18) Crank, lift
(19) Arm, lift
(20) Cam ass'y
(21) Hex flange bolt
(23) Hex flange bolt
(24) Snap ring(C-type)
(25) Bonded seal
(26) Ring, backup
(27) O-ring
(28) Bush
(29) Collar

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6.8 SAFTY VALVE



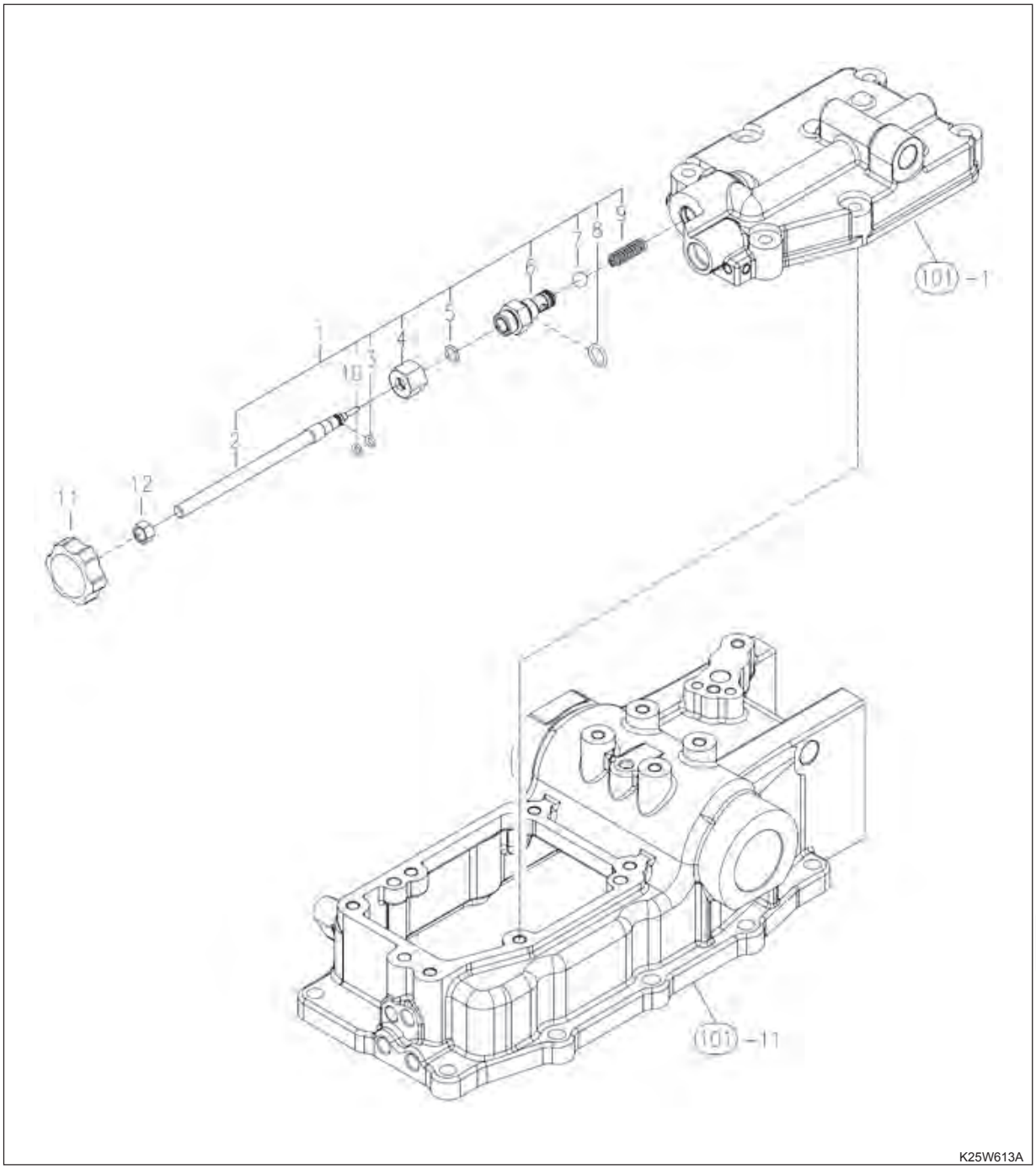
COMPONENTS

(1) Safety valve ass'y
(2) Nut
(3) Bolt
(4) O-ring
(5) Body, safety valve
(6) O-ring
(7) Spring
(8) Ball guide
(9) Steel ball
(10) O-ring

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6.9 STOP VALVE



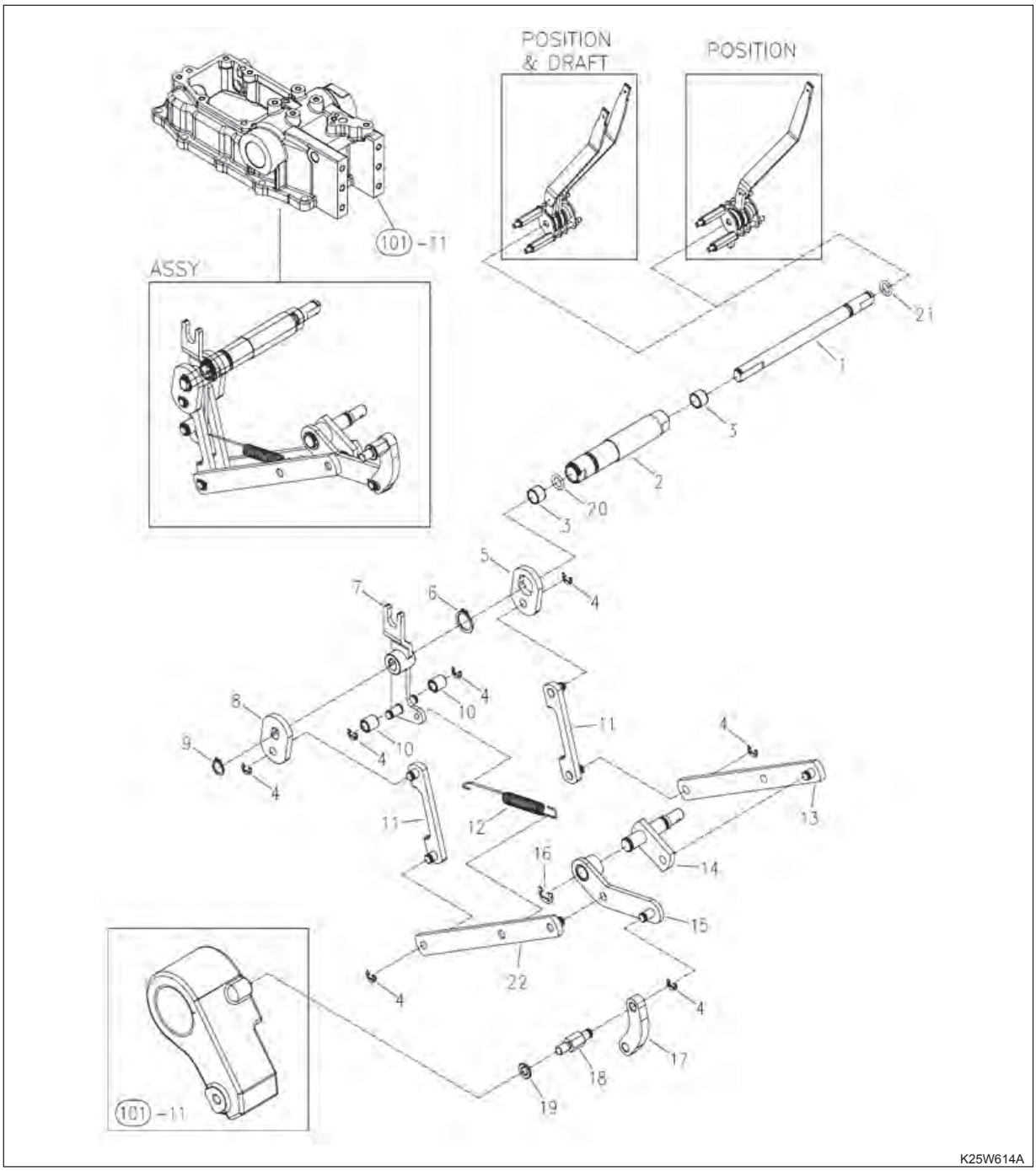
COMPONENTS

(1) Stop V/V
(2) Stop bolt
(3) O-ring
(4) Nut
(5) O-ring
(6) Body, stop V/V
(7) Steel ball
(8) O-ring
(9) Spring
(10) Ring, backup
(11) Knob
(12) Hex nut

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6.10 HYD CONTROL POSITION TYPE

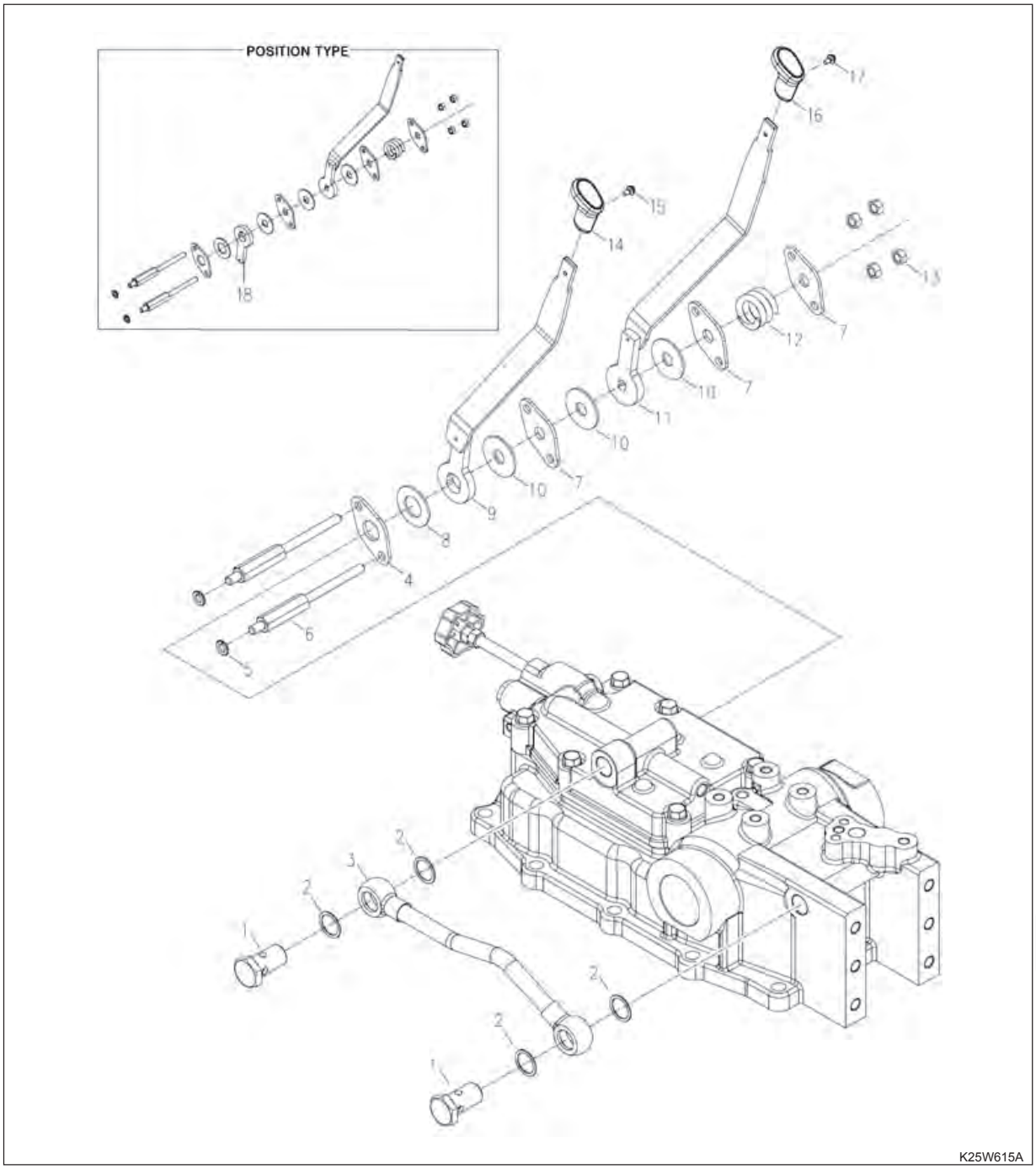


COMPONENTS

(1) Shaft,position lever
(2) D-control shaft
(3) Bush
(4) Snap ring(E)
(5) Plate
(6) Snap ring
(7) Link ass'y
(8) Plate
(9) Snap ring
(10) Roller
(11) Link B ass'y
(12) Spring
(13) Link
(14) Link ass'y(in)
(15) Link, feed back
(16) Snap ring(E)
(17) Link
(18) Pin, feed back
(19) Spring washer
(20) O-ring
(21) O-ring
(22) Link, position

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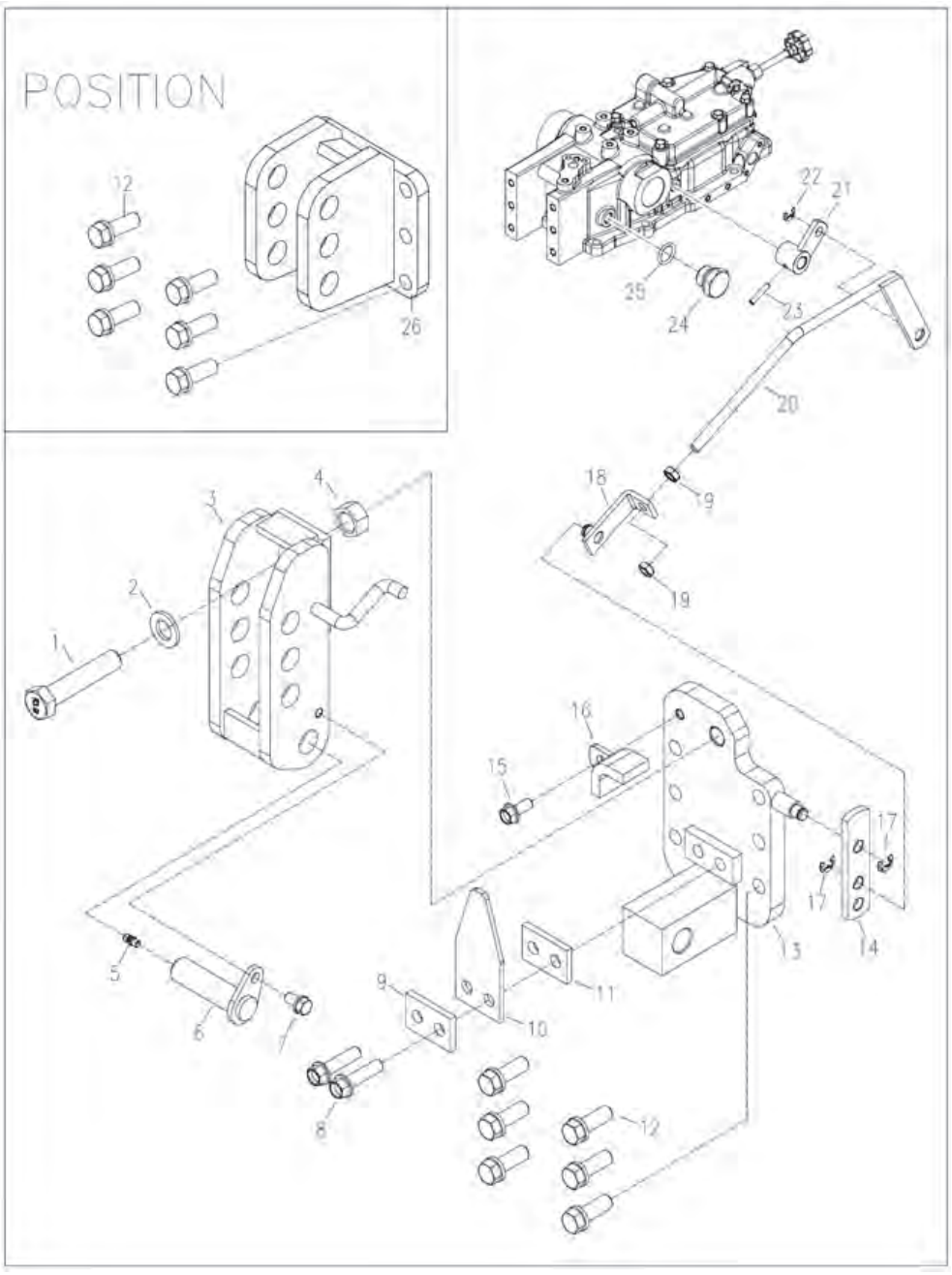
COMPONENTS

(1) Connector
(2) Bonded seal
(3) Bracket
(4) Bracket
(6) Bolt
(7) Bracket A
(8) Plate, friction
(9) Lever, D-control
(10) Plate A
(11) Lever, P-control
(12) Spring
(13) Hex nut
(14) Knob ass'y, draft control
(15) Screw
(16) Knob ass'y, positoin control
(17) Screw
(18) Arm,lever

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6.11 DRAFT CONTROL



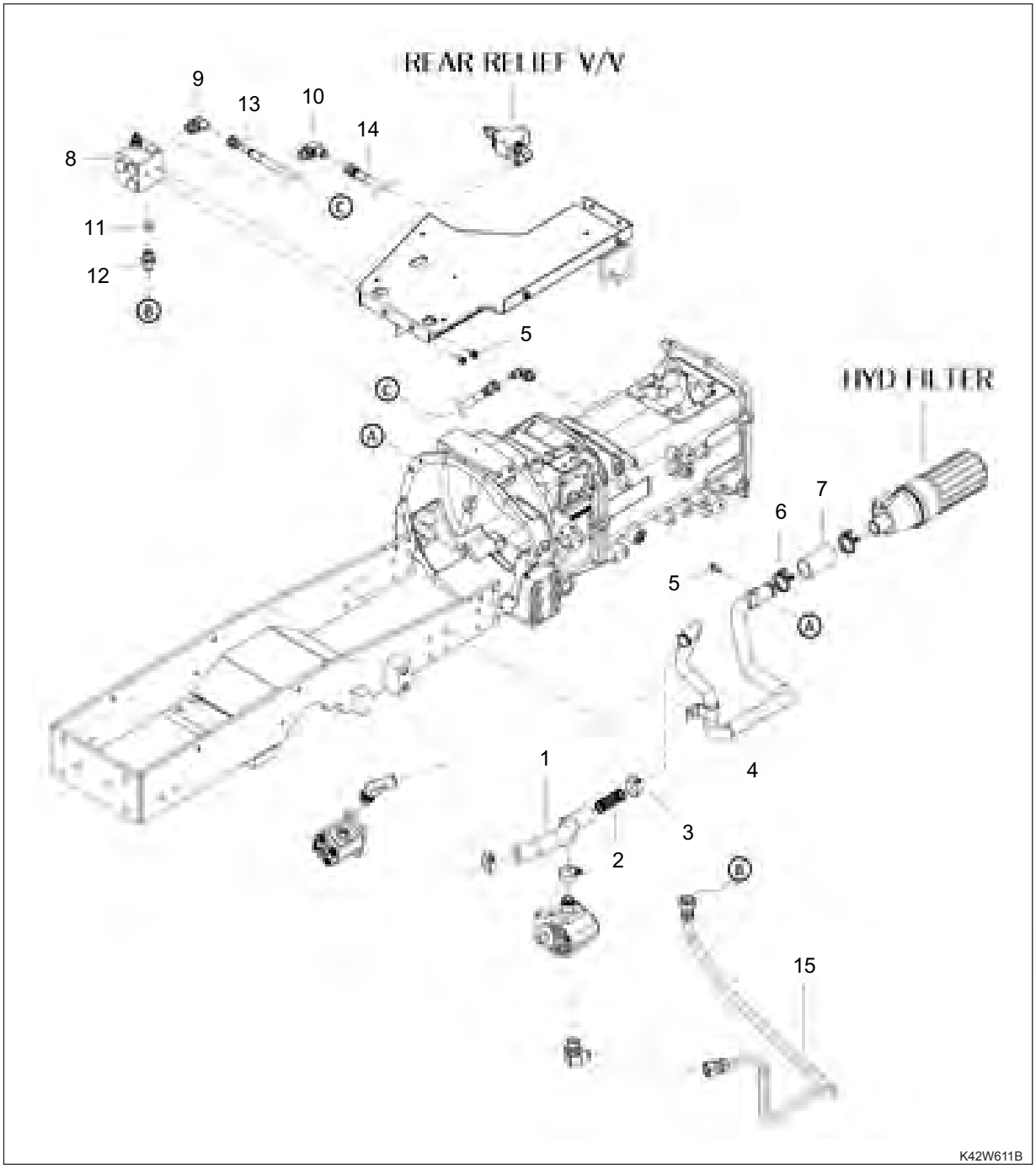
COMPONENTS

(1) Hex bolt
(2) Washer
(3) Hinge D, top link
(4) Hex nut
(5) Nipple
(6) Pin, hinge
(7) Bolt w/washer
(8) Hex flange bolt
(9) Plate
(10) Plate, hinge
(11) Plate
(12) Bolt w/washer
(13) Support D, hinge
(14) Plate
(15) Hex flange bolt
(16) Plate ass'y
(17) Snap ring(E)
(18) Plate ass'y
(19) Hex fix nut
(20) Rod
(21) Link ass'y(out)
(22) Snap ring(E)
(23) Spring pin
(24) Body
(25) O-ring
(26) Hinge, top link

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6.12 HYD PIPING



COMPONENTS

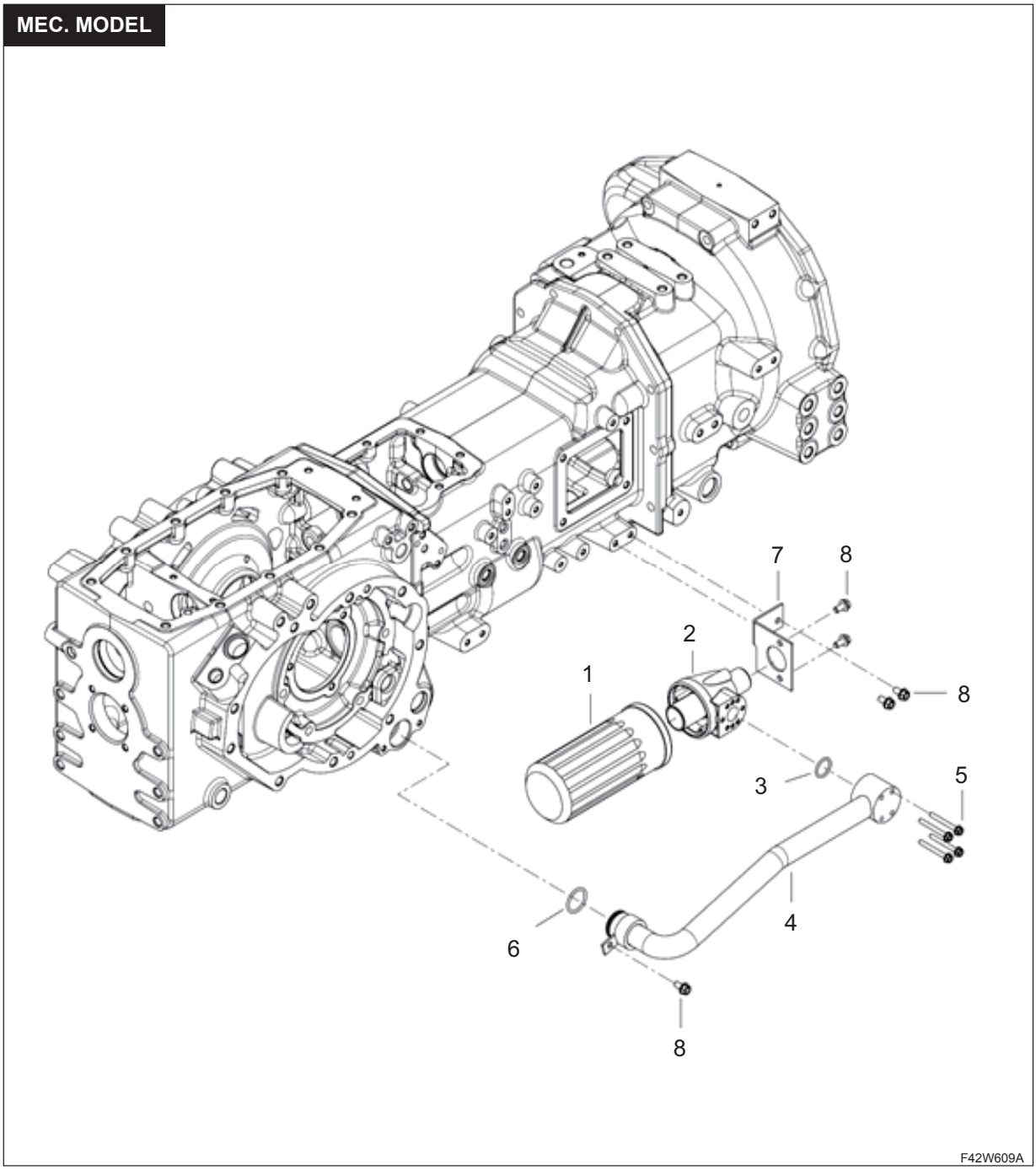
(1) Rubber hose
(2) Spring a
(3) Hose clamp
(4) Pipe ass'y , lower pressure
(5) Hex flange bolt
(6) Hose band
(7) Lower pressure hose
(8) Front out valve
(9) Elbow
(10) Elbow
(11) O-ring
(12) Nipple
(13) Hose
(14) Higher hose
(15) Pipe ass'y , higher pressure

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6.13 HYD FILTER

MEC. MODEL



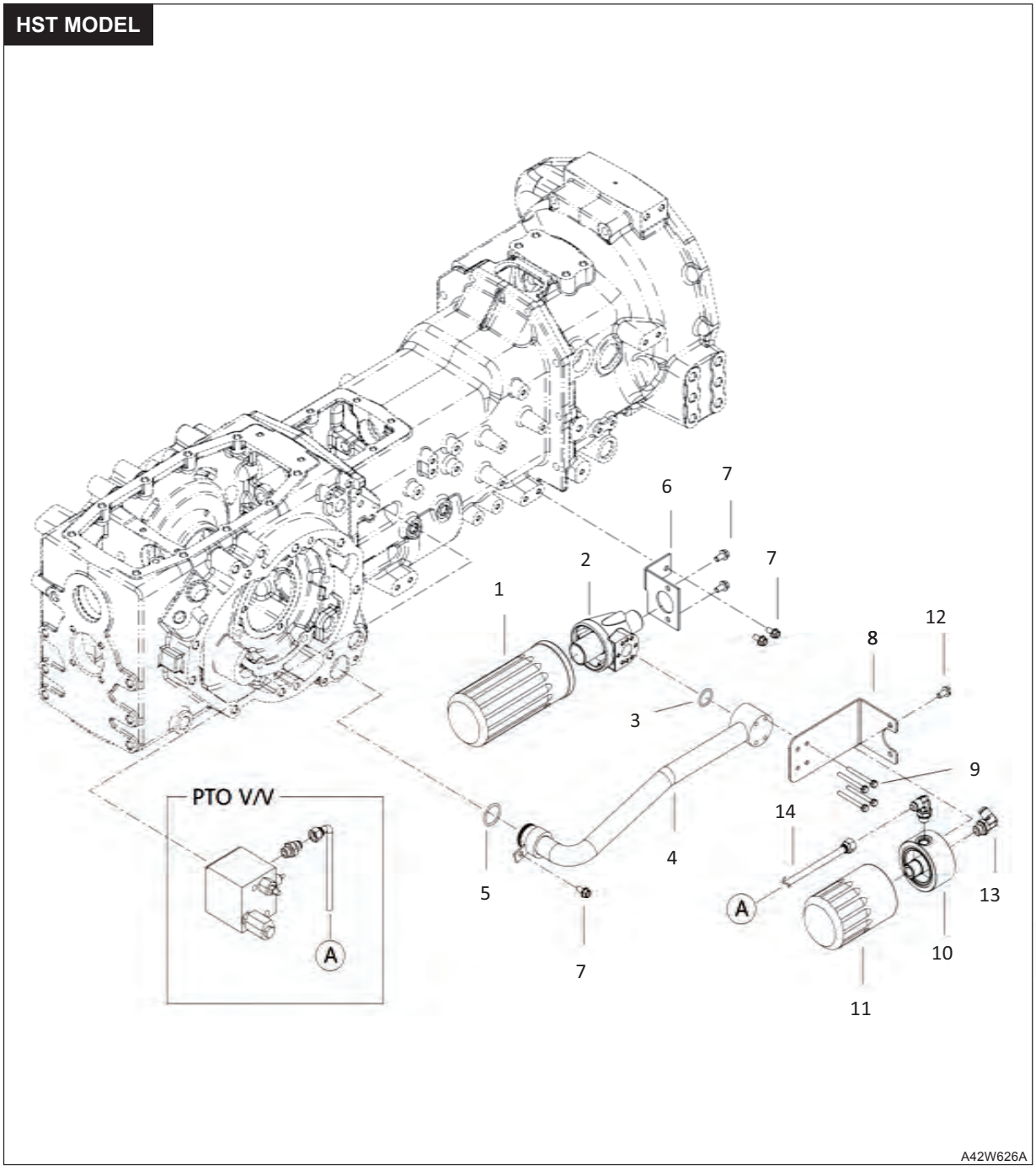
COMPONENTS

(1) Filter
(2) Filter cover
(3) O-ring
(4) Lower pressure pipe(filter)
(5) Hex flange bolt
(6) O-ring
(7) Filter cover bracket
(8) Hex flange bolt

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HST MODEL



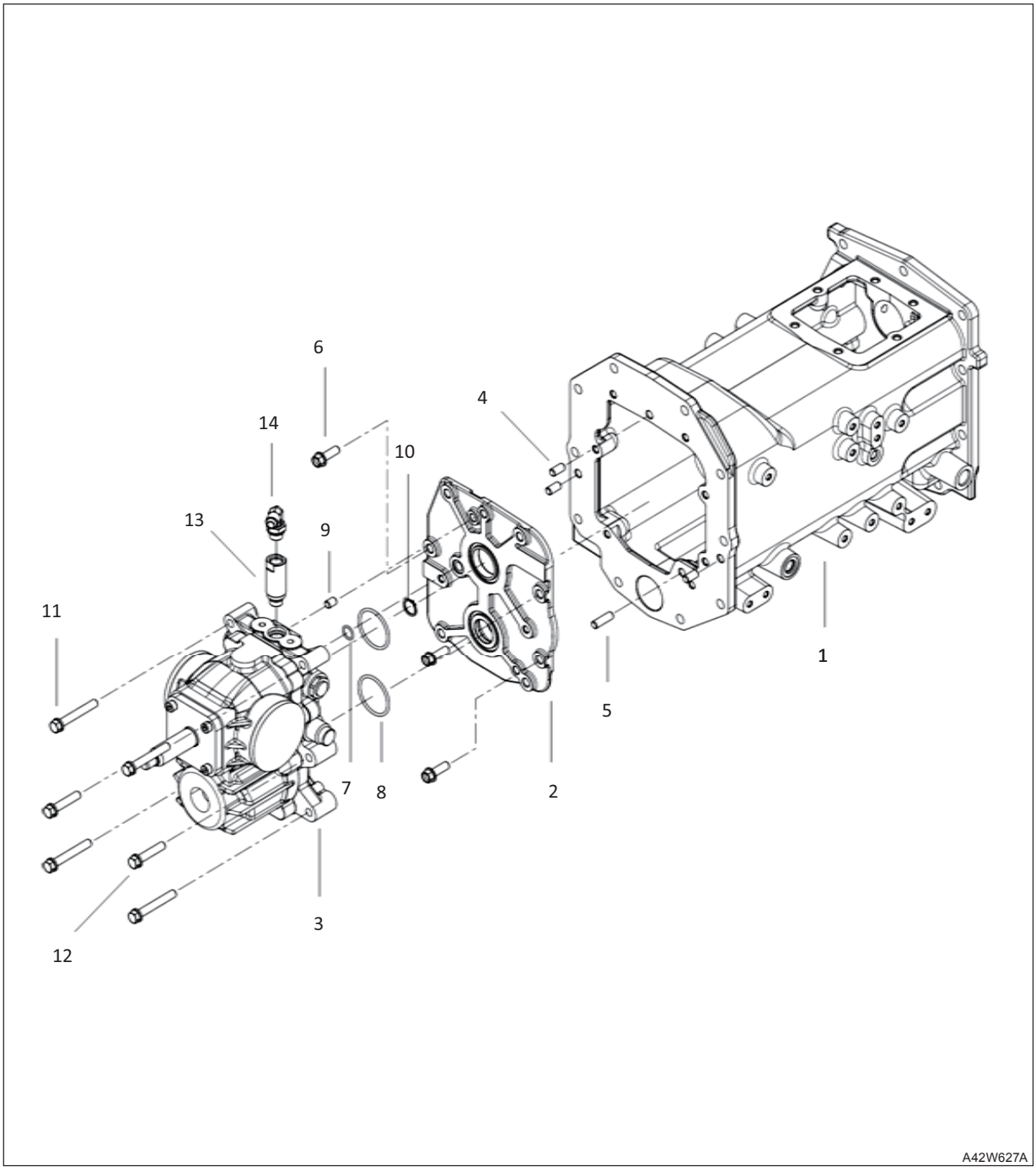
COMPONENTS

(1) Filter
(2) Filter cover
(3) O-ring
(4) Lower pressure pipe(filter)
(5) O-ring
(6) Filter cover bracket
(7) Hex flange bolt
(8) Bracket
(9) Bolt w/washer
(10) Filter cover
(11) Filter
(12) Hex flange bolt
(13) Elbow
(14) Hose

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6.14 HYD PUMP [HST MODEL]



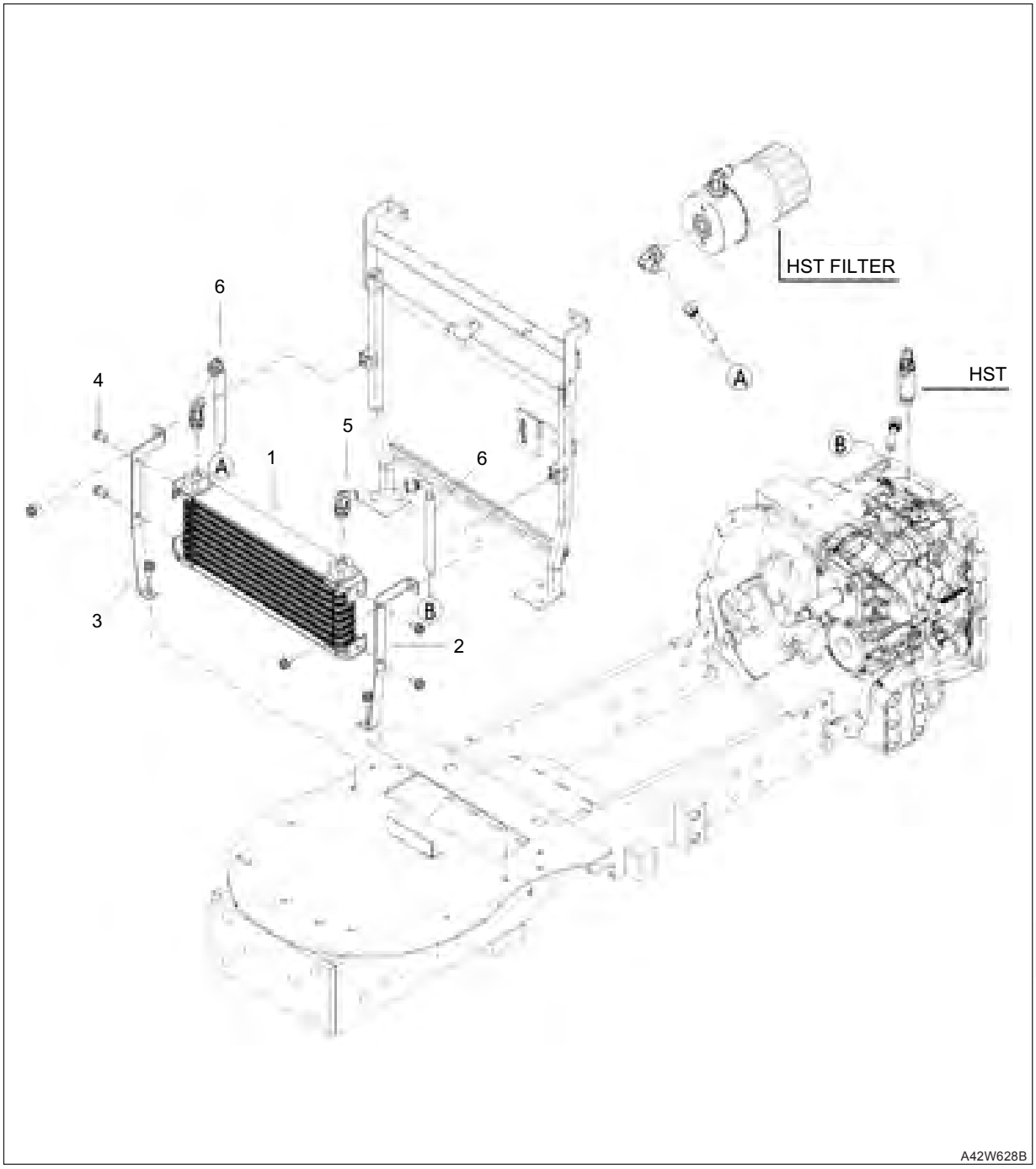
COMPONENTS

(1) Mission case
(2) Plate
(3) Hst 28cc
(4) Parallel pin
(5) Parallel pin
(6) Hex flange bolt
(7) O-ring
(8) O-ring
(9) Parallel pin
(10) Snap ring
(11) Hex bolt w/washer
(12) Hex bolt w/washer
(13) Adaptor(3/8)
(14) Elbow

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6.15 OIL COOLER [HST MODEL]



COMPONENTS

(1) Oil cooler
(2) Bracket, oil cooler(l)
(3) Bracket, oil cooler®
(4) Hex flange bolt
(5) Elbow
(6) Hose

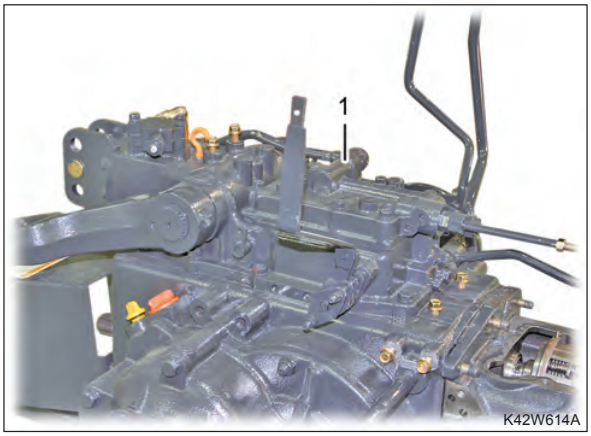
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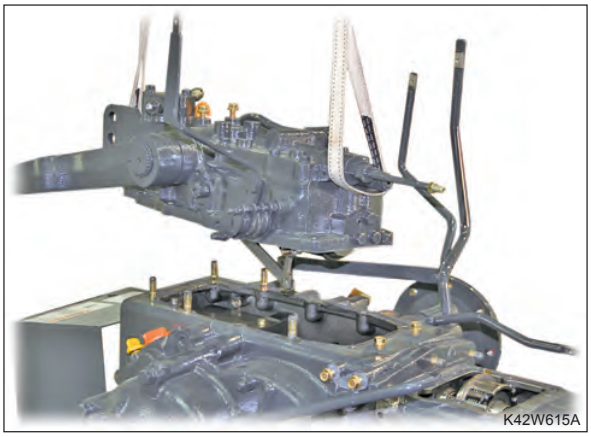
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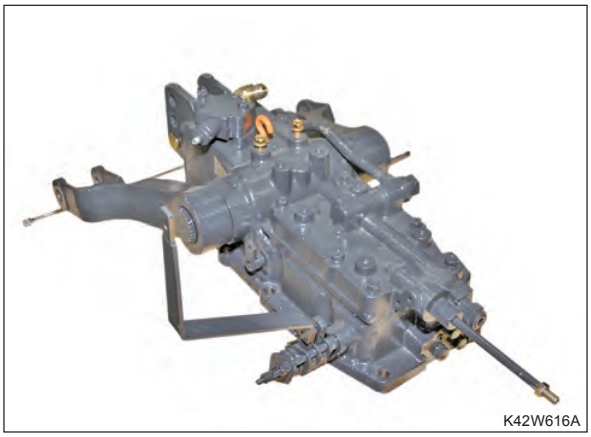
7. DISASSEMBLY AND SERVICE

7.1 HYDRAULIC CYLINDER CASE ASSEMBLY DISASSEMBLY AND ASSEMBLY

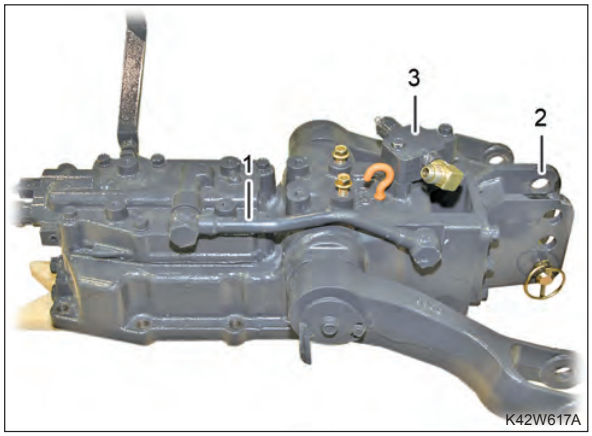
1. Remove the fender and plate of under the seat.





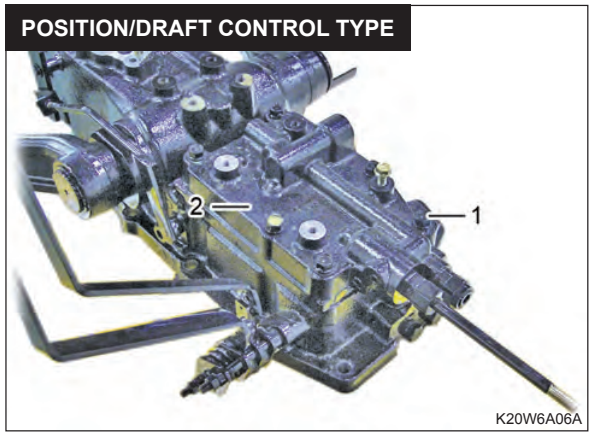


2. Remove the hydraulic cylinder case assembly (1).

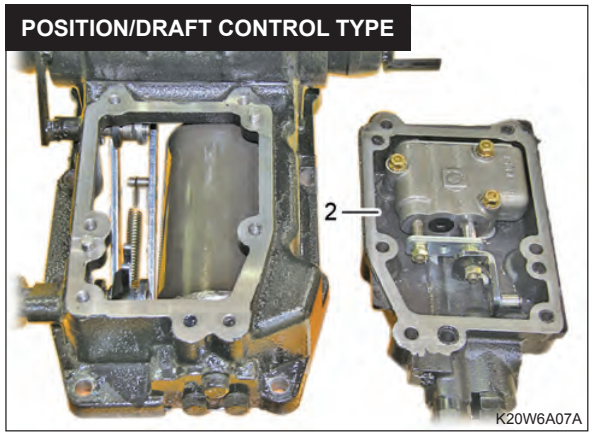


3. Disconnect the hydraulic pipe (1) and remove the top link bracket assembly (2) and rear relief valve (3).

POSITION/DRAFT CONTROL TYPE



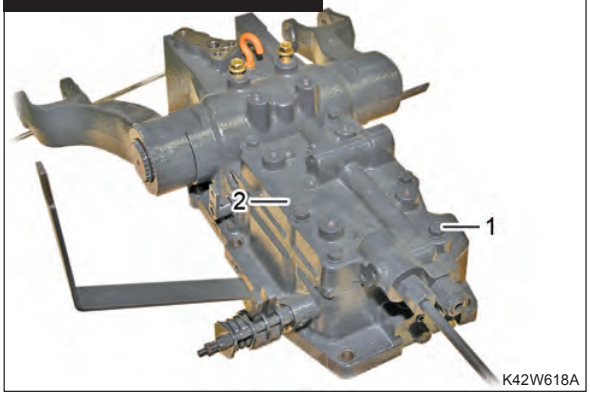
POSITION/DRAFT CONTROL TYPE

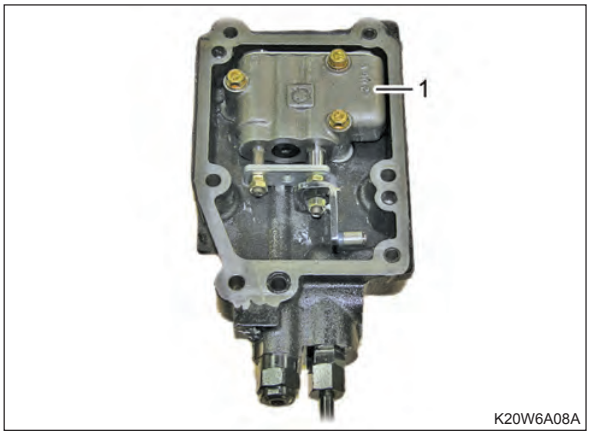


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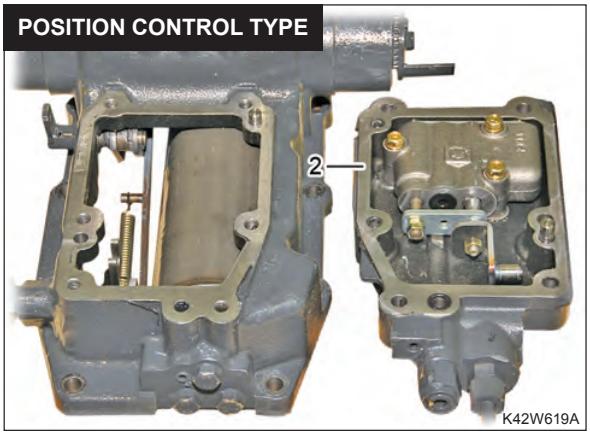
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POSITION CONTROL TYPE





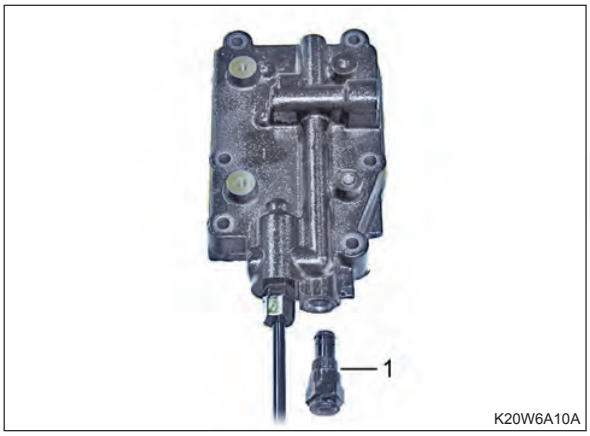
POSITION CONTROL TYPE





4. Unscrew the hydraulic cylinder cover mounting bolts (1) to remove the hydraulic cylinder cover (2).

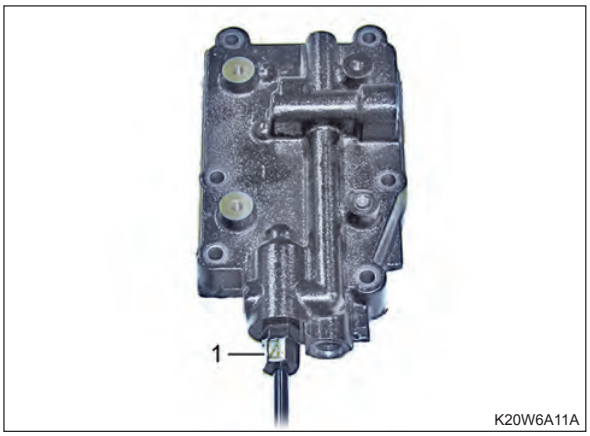
5. Remove the control valve (1) from the hydraulic cylinder cover.

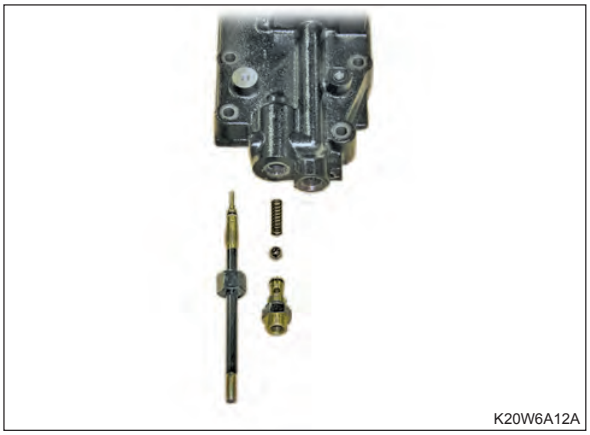


6. Remove the safety valve (1) from the hydraulic cylinder cover.

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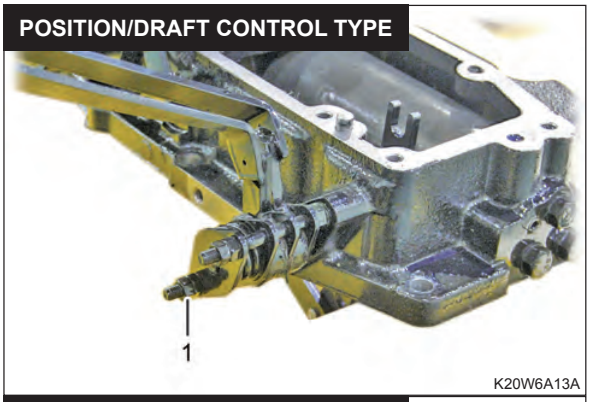
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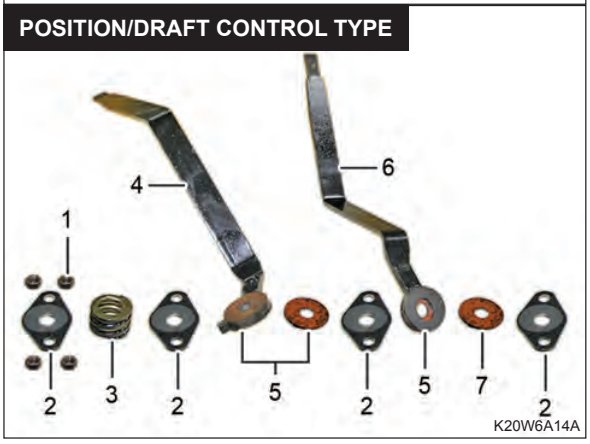


7. Remove the lowering speed control valve assembly (1).

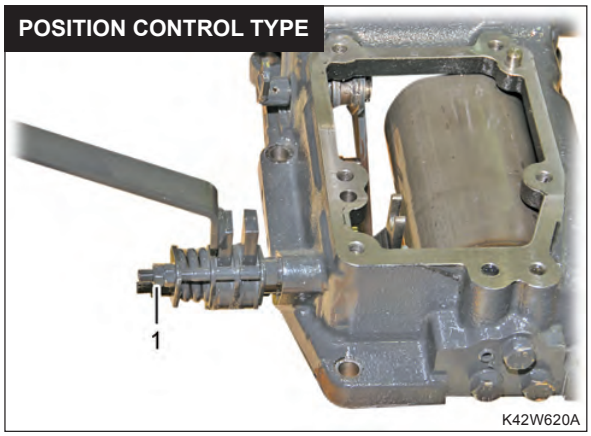
POSITION/DRAFT CONTROL TYPE



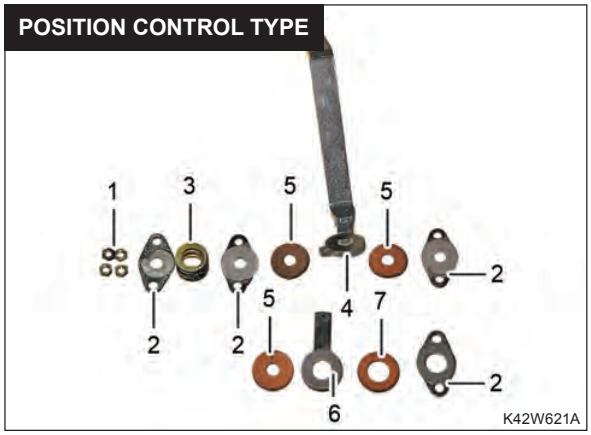
POSITION/DRAFT CONTROL TYPE



POSITION CONTROL TYPE



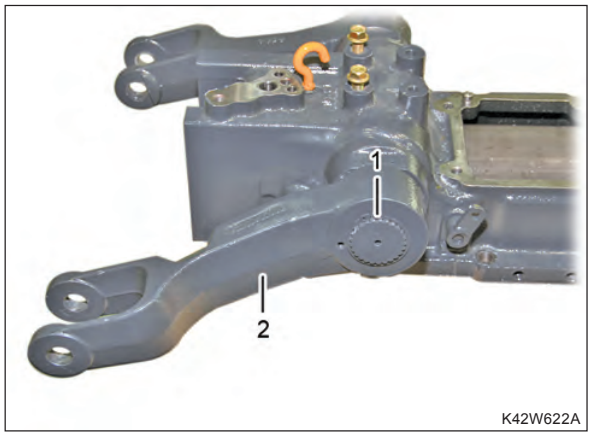
POSITION CONTROL TYPE



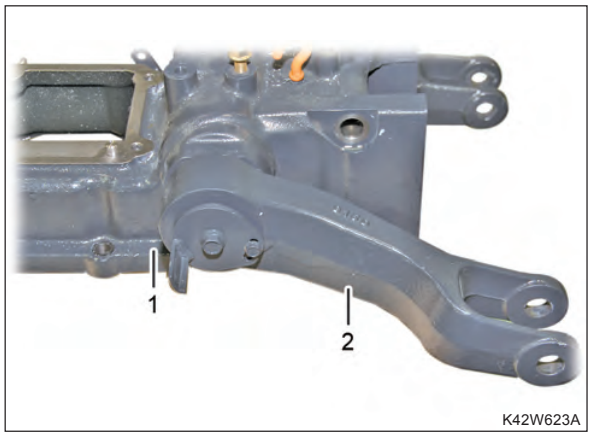
8. Unscrew the lever retaining nut (1). Then, remove the bracket A (2), spring (3), bracket A (2), plate (5), P lever (4), plate (5), bracket A (2), plate (5), D lever (6), friction plate (7) and bracket (2) in order.

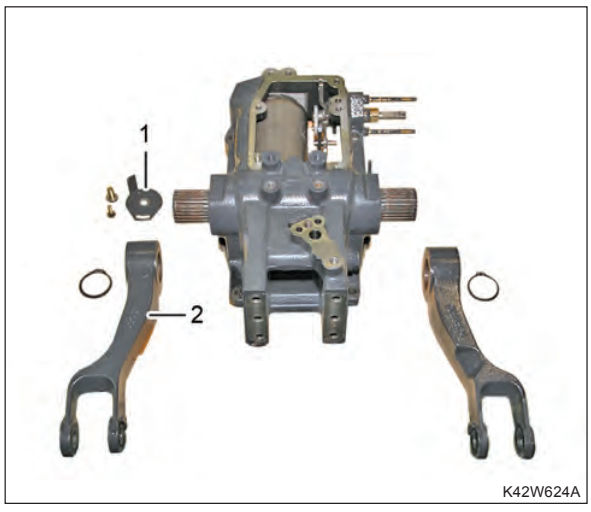
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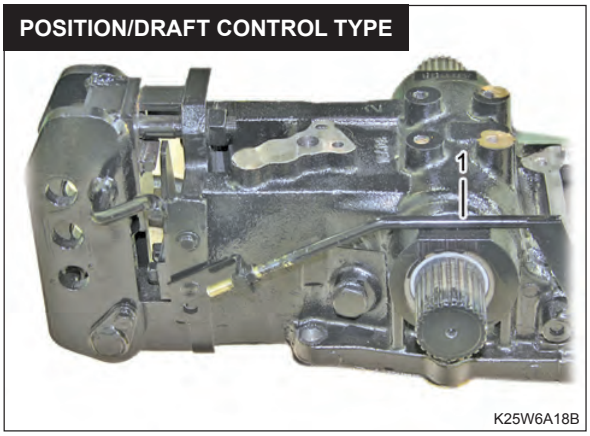
9. Pull out the snap ring (1) from the right side. Then, disconnect the lift arm (2).



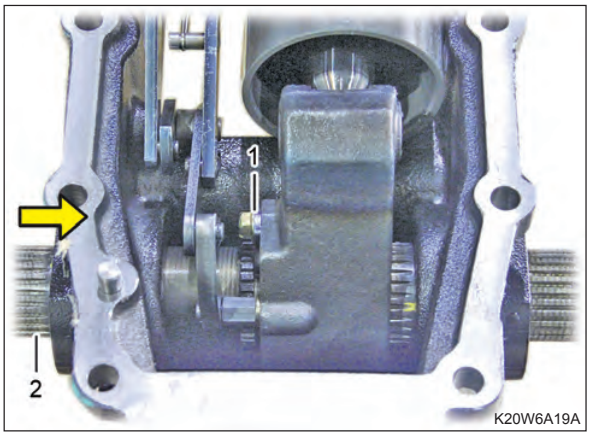


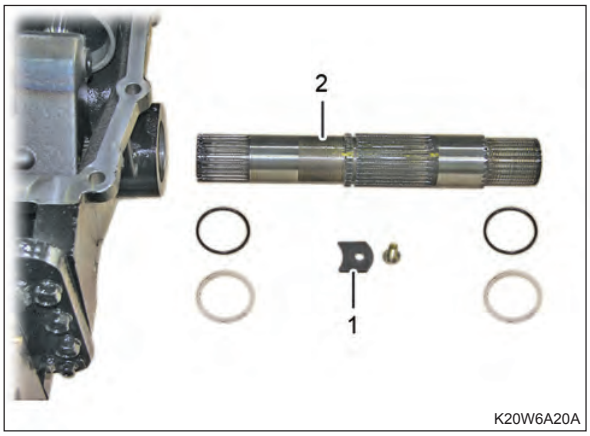
10. Remove the cam assembly (1) from the left side and pull out the snap ring. Then, disconnect the lift arm (2).

POSITION/DRAFT CONTROL TYPE



11. Disconnect the draft control rod (1).

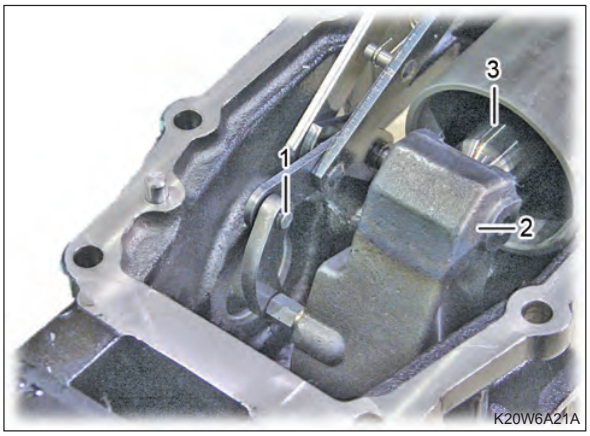


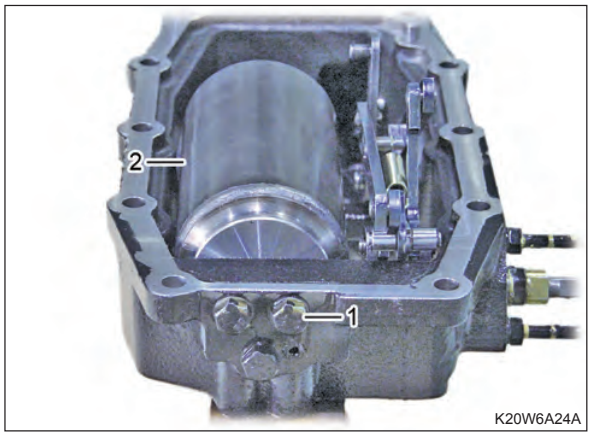


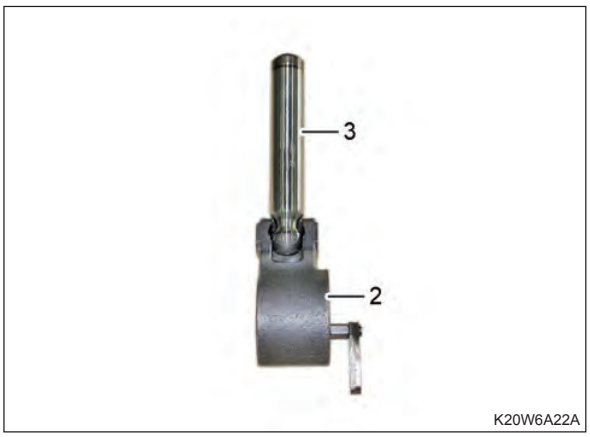
12. Unscrew the plate (1) and pull out the lift link shaft (2) to the right.

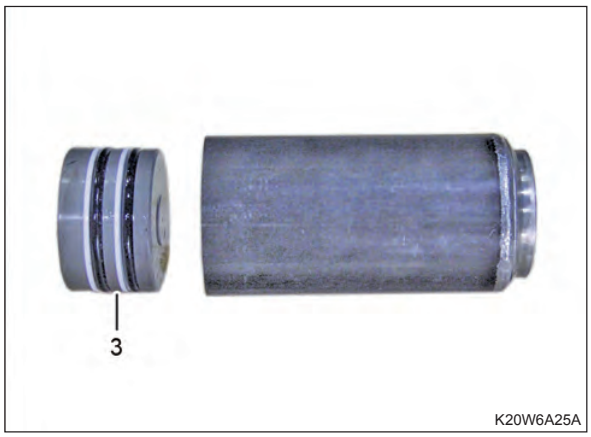
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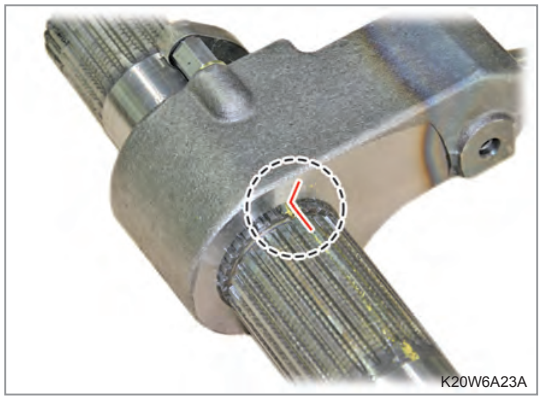




13. Pull out the E-type snap ring (1) for the lift crank link. Then, remove the lift crank (2) and piston rod (3) together.

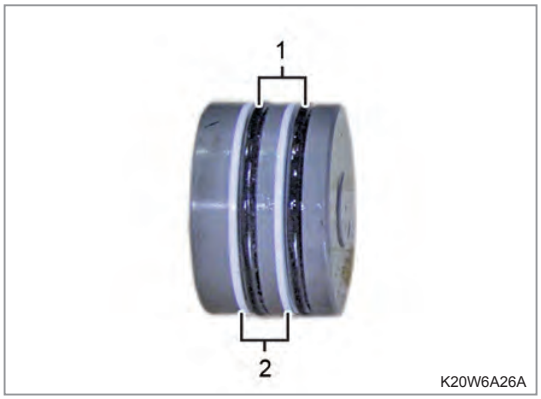
14. Unscrew the hex. bolt (1) and remove the piston assembly (2) to separate the piston (3) from the piston assembly.

IMPORTANT



- **Insert the lift link shaft from the right to the left side, aligning the matching mark on the lift link shaft with the matching mark on the lift crank.**

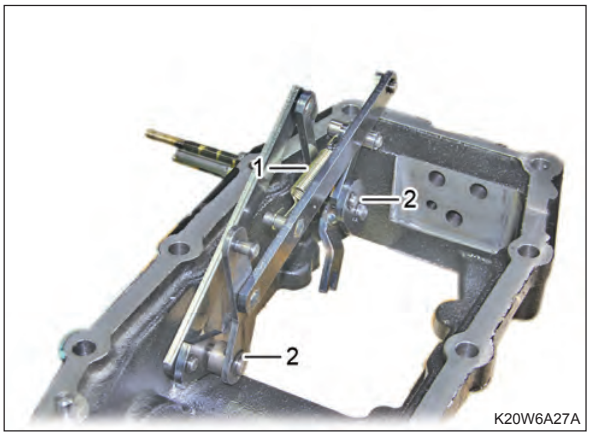
Notes

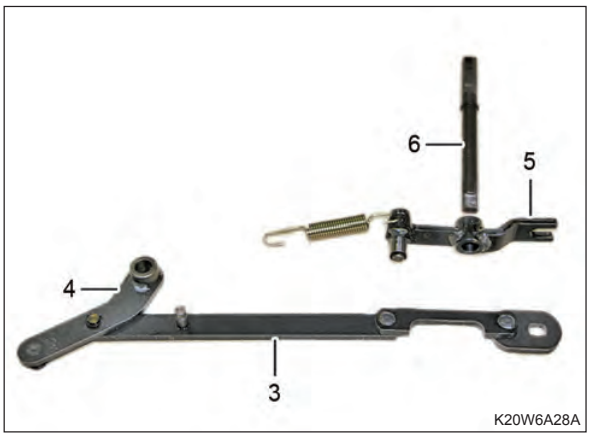


- **Check how much the O-ring (1) and backup ring (2) for the piston are worn, and replace any defective or excessively worn one with a new one.**

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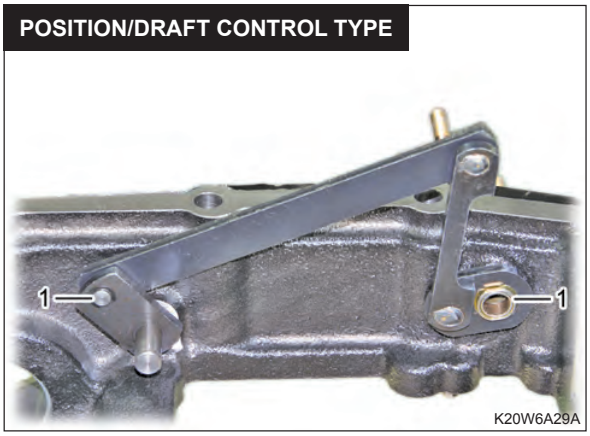
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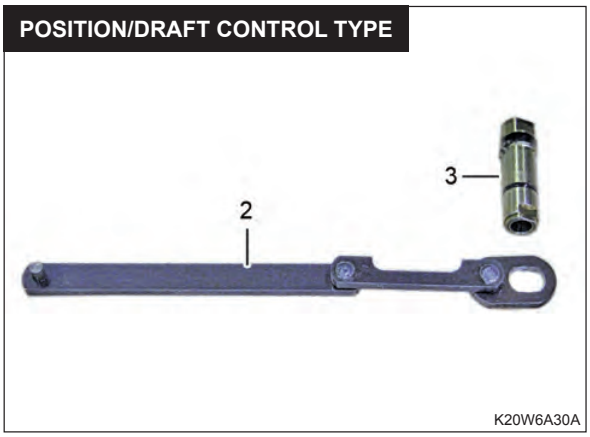


15. Remove the spring (1) and pull out the E-snap ring (2). Then, remove the position link (3), position feedback link (4), connecting link (5) and position lever shaft (6).

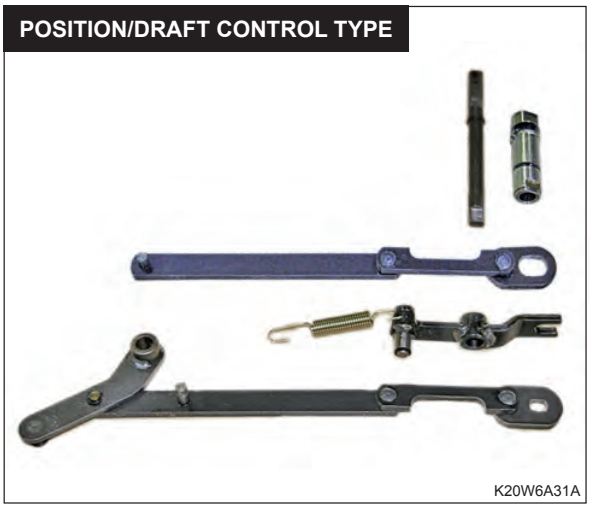
POSITION/DRAFT CONTROL TYPE



POSITION/DRAFT CONTROL TYPE



POSITION/DRAFT CONTROL TYPE

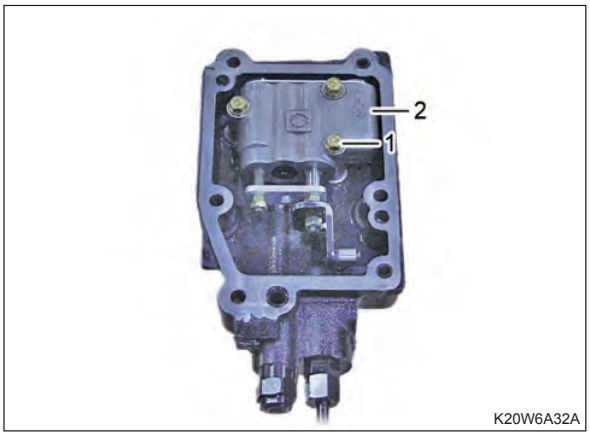


16. Pull out the snap ring (1) and disconnect the draft load control link (2) and D control shaft (3).
17. Assemble in the reverse order of disassembly.

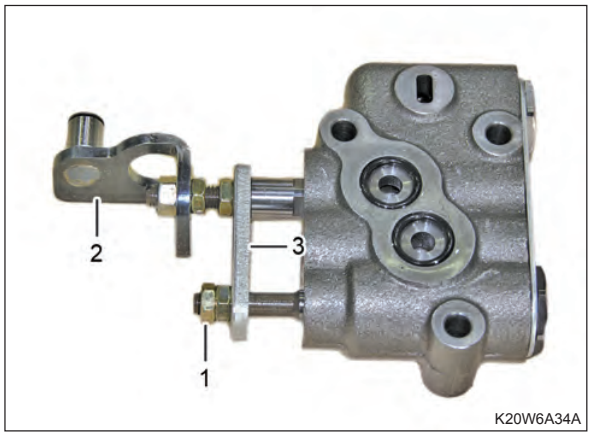
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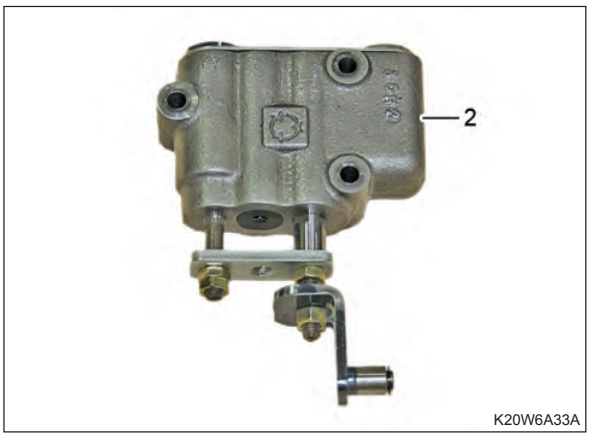
7.2 CONTROL VALVE DISASSEMBLY

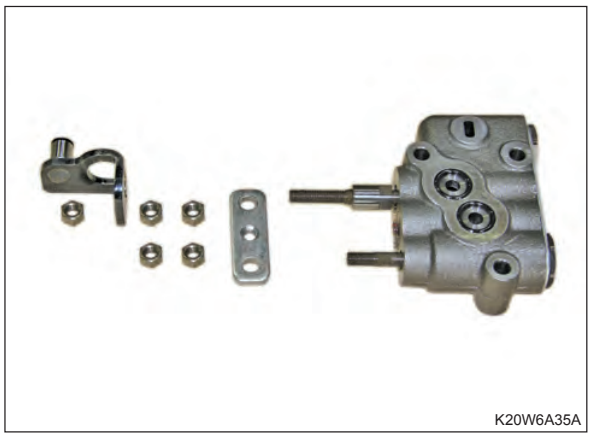


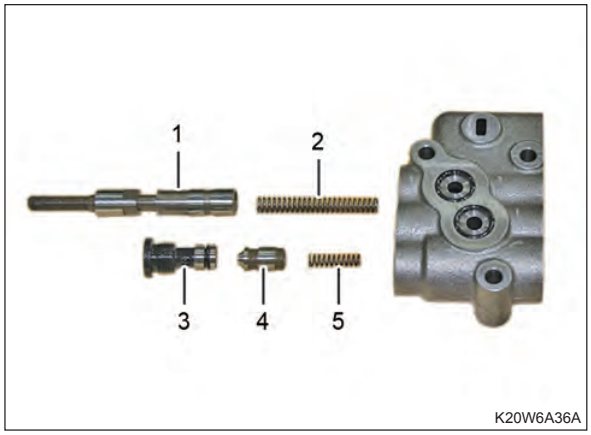
1. Unscrew the control valve mounting bolts (1) from the hydraulic cylinder cover to remove the control valve (2).



2. Unscrew the hex. nut (1) from the control valve to separate the clevis assembly (2) and plate (3).



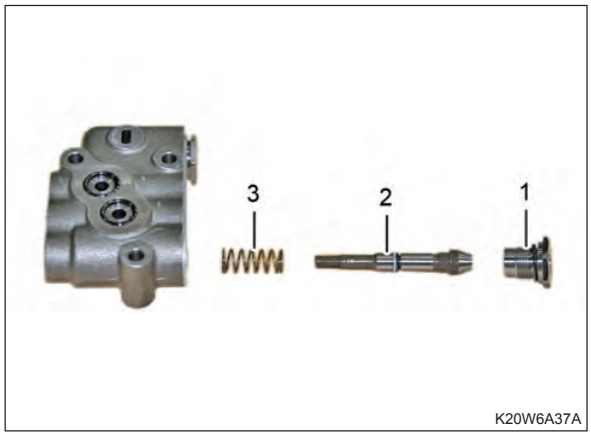




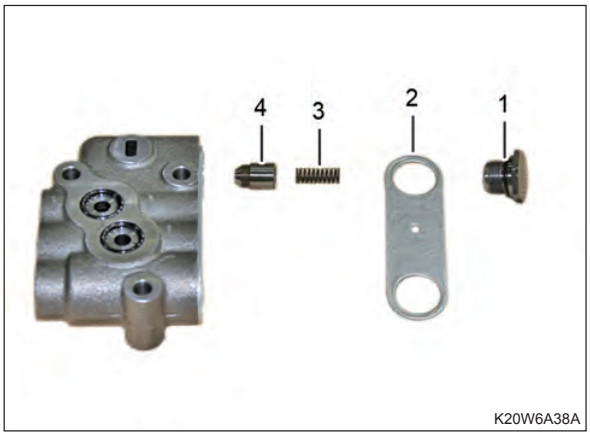
3. Remove the main spool (1), main spring (2), load check (3), load check seat (4) and load check spring (5) from the control valve.

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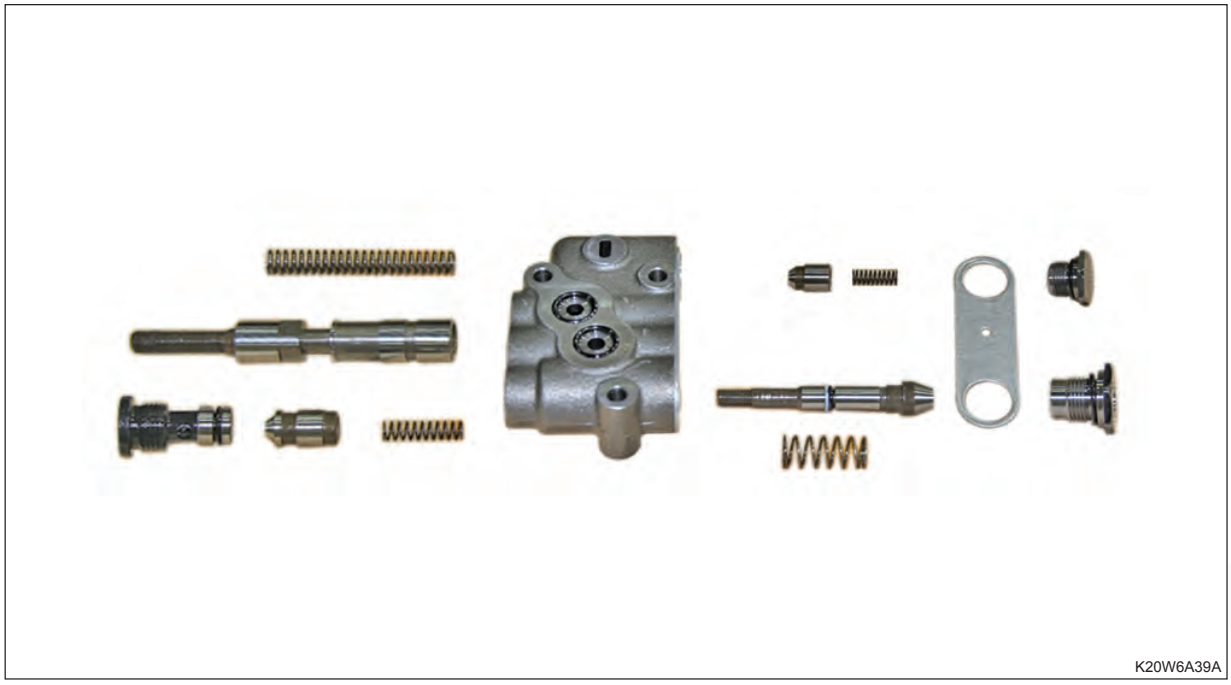
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4. Unscrew the main check plug (1) and remove the main check poppet (2) and main check spring (3).



5. Unscrew the unload plug (1) and remove the plate (2), unload spring (3) and unload check (4).



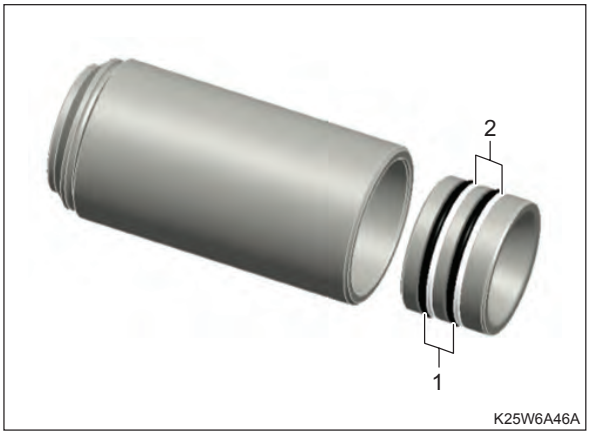
6. Assemble in the reverse order of disassembly.

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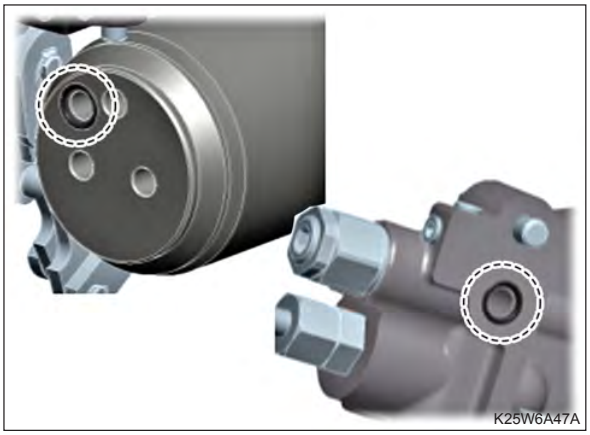
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HYDRAULIC CYLINDER INSTALLATION STANDARD

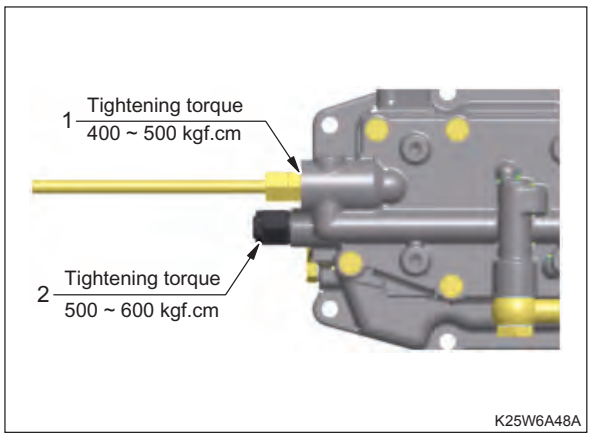
1. Keep all hydraulic components clean and remove any foreign material and dust from them before their installation.



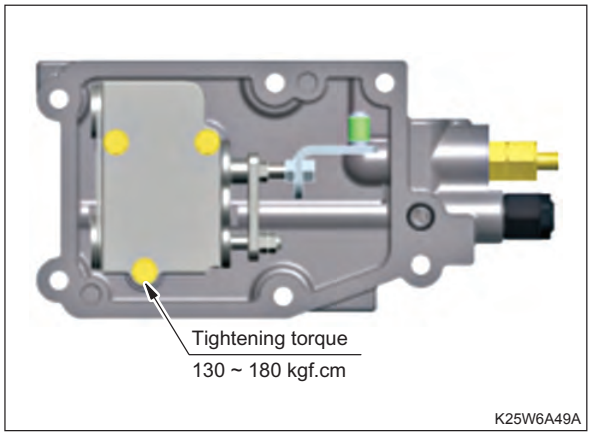
2. When installing the O-ring (1) and backup ring (2) to the piston, install them in the correct direction. (Apply transmission fluid to them before installation.)

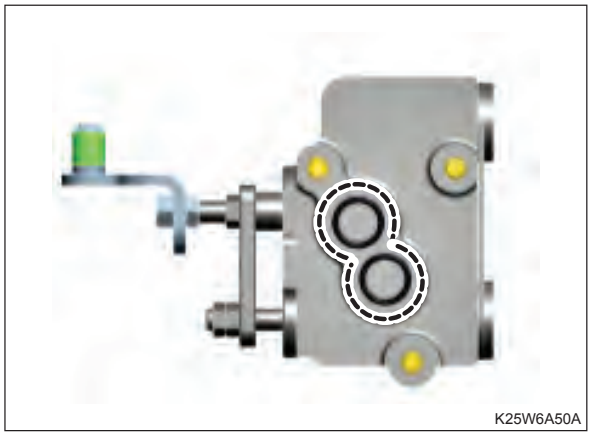


3. Check if the O-rings for the hydraulic cylinder and hydraulic cylinder cover are missing or damaged. Apply grease on them before their installation.



4. When installing the safety valve (1) and lowering speed control valve (2), check if their O-rings are missing or damaged. Also, apply grease on them before installation.

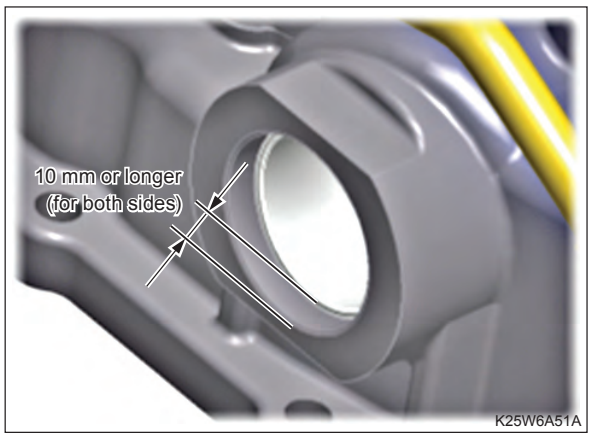




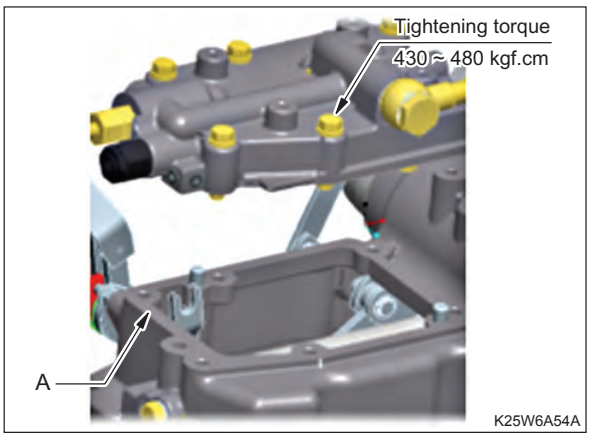
5. When installing the lifting/lowering control valve, check if its O-ring is missing or damaged. Also, apply grease on it before installation. Also, tighten the mounting bolt to the specified torque.

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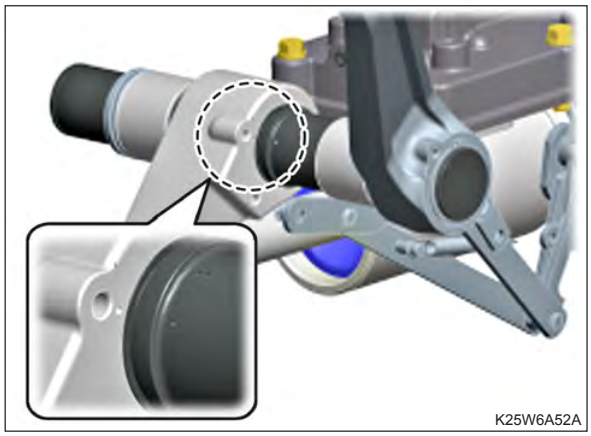
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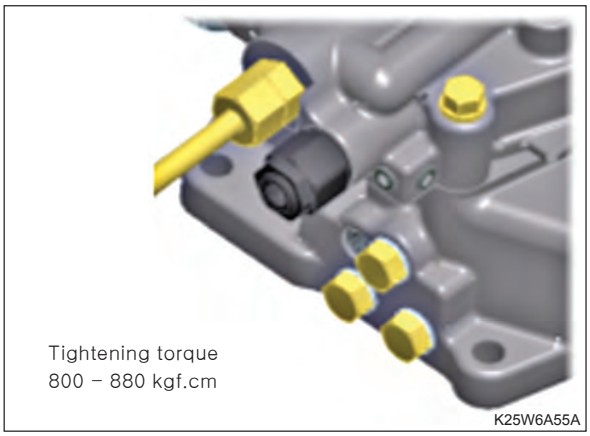
6. When pressing in the hydraulic cylinder case bushing, select the correct size and use a pressing jig.



9. When installing the hydraulic cylinder cover, apply liquid gasket (A) on it in advance.



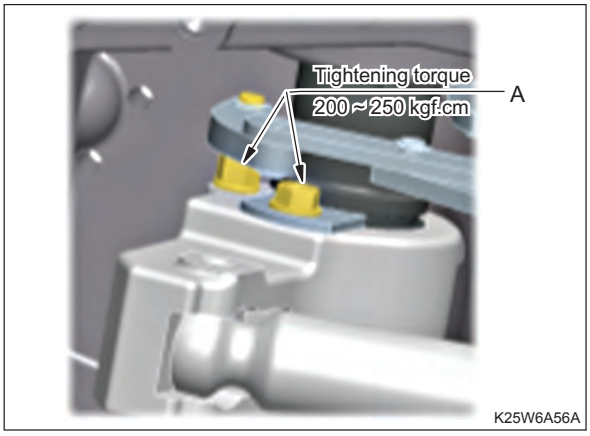
7. When installing the lift crank shaft and crank, align their matching marks.



10. When installing the hydraulic cylinder, apply LOCTITE on it and follow the specified tightening torque.



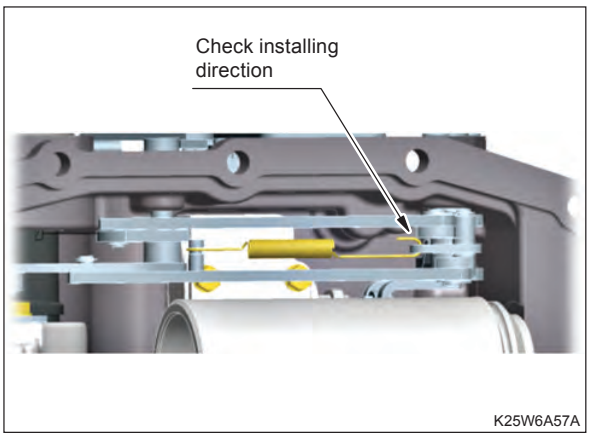
8. When installing the lift crank shaft and lift arm, align their matching marks.



11. When installing the link, apply LOCTITE (A) on it and follow the specified tightening torque.

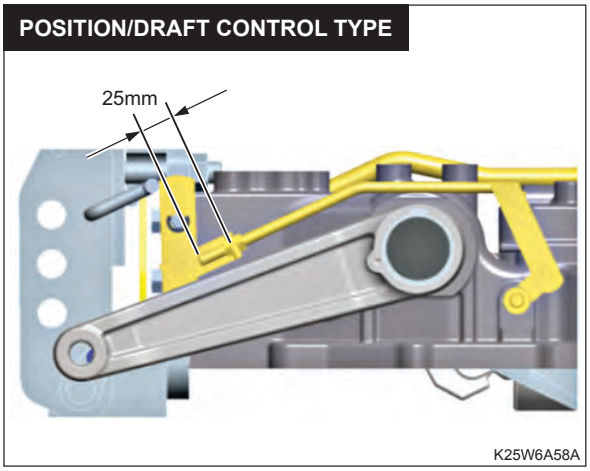
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12. When installing the return spring, set its longer section to the front.

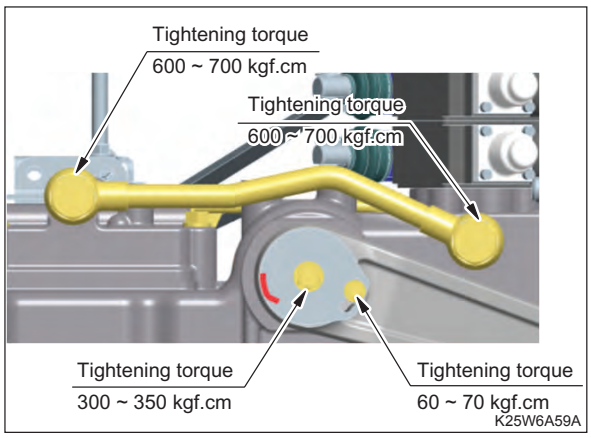
POSITION/DRAFT CONTROL TYPE



13. Setting length of draft control rod: 25 mm (distance between rod end and bracket)

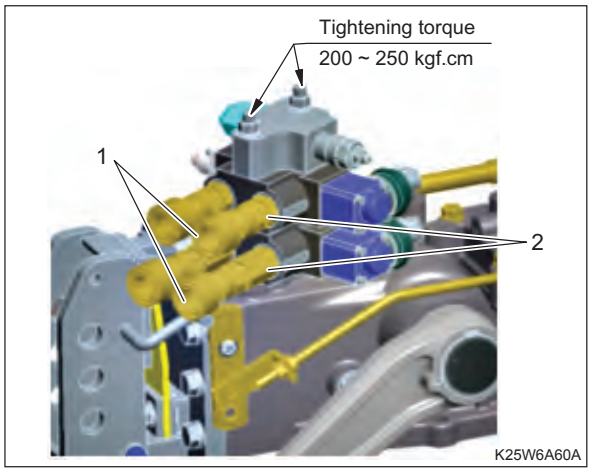
NOTE

- **How to adjust draft sensitivity**
  1) **High sensitivity (shallow): Adjust the length of the mounting nut to 25 mm or longer.**
  2) **Low sensitivity (deep): Adjust the length of the mounting nut to 25 mm or shorter.**



14. Tighten the high-pressure pipe to the specified torque and install the cam correctly according to the specification specified in the figure. (When installing the cam assembly, turn it counterclockwise for 5 mm from the end of the long hole.)

OPTIONAL

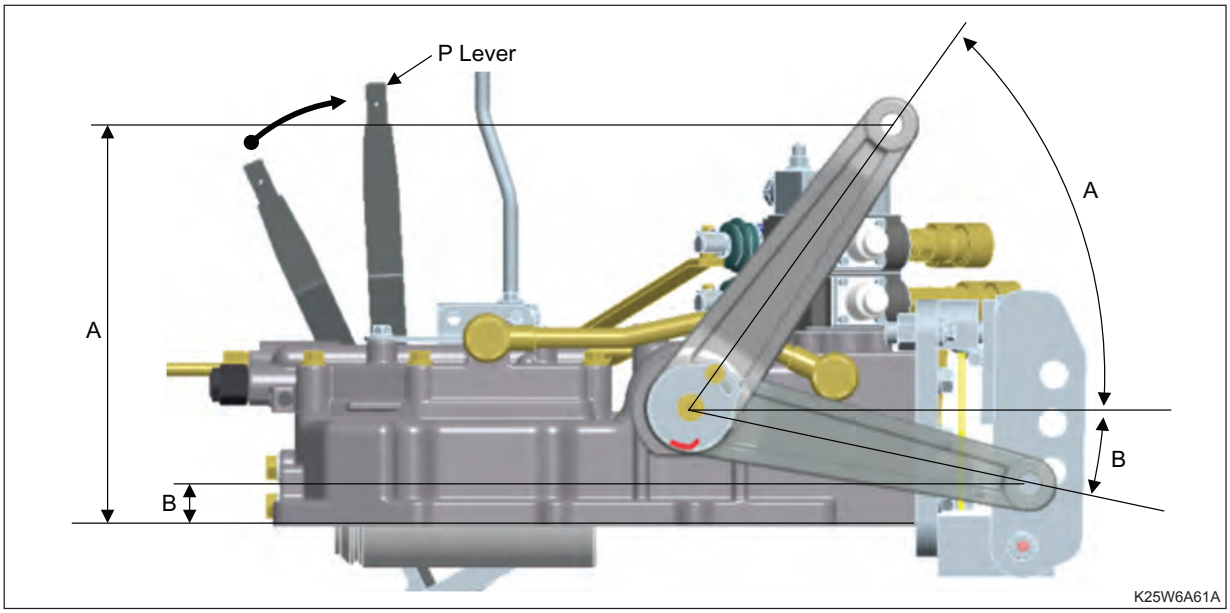


15. When installing the rear SCV, make sure that its O-ring is not missing or damaged.
16. When installing the SCV, tighten its nut to the specified torque (200 - 250 kgf.cm).
17. When installing the quick coupler (1) and joint (2), wrap them with seal tape.

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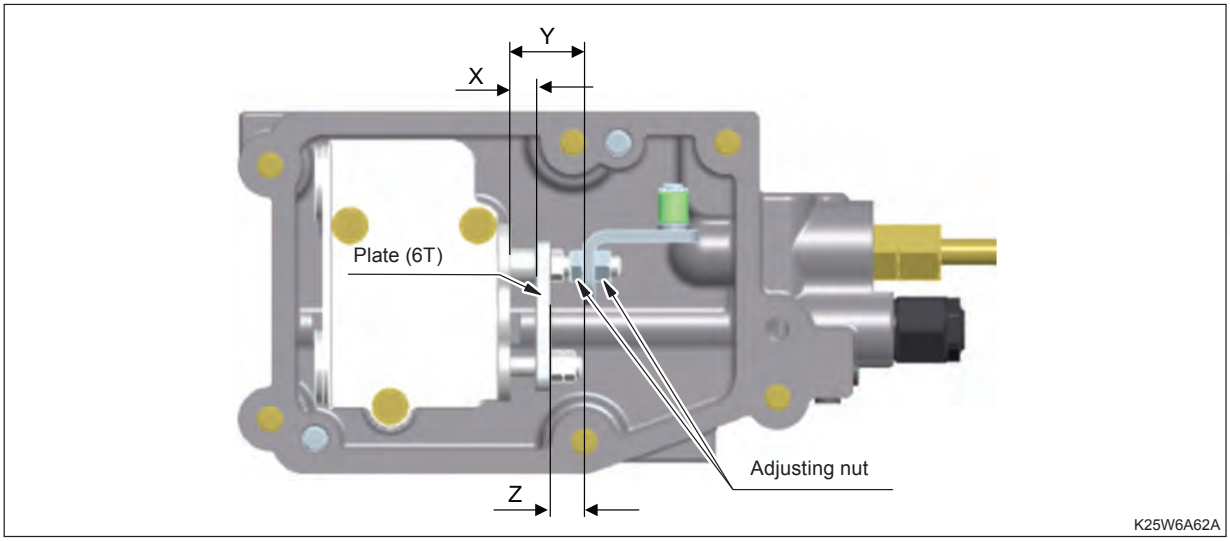
▶ CONTROL VALVE SETTING BY DIFFERENT LIFT ARM ANGLES



1. P lever pulled to the max. lifting position

A (LIFTING ANGLE)	A (LIFTING HEIGHT)	B (LOWERING ANGLE)	B (LOWERING HEIGHT)
47.5°~49°	269~273.5	16.3°~17.3°	14.8~10.3

2. If the lifting angle or lowering angle is out of the specified range, adjust it with the clevis adjusting nut. (Initial setting value: Y 29 mm or Z 13 mm with X 10 mm) (Repeat adjustment 2 to 3 times for precise setting.)



3. Apply LOCTITE to the adjusting nut before its installation.
   - Excessive lifting height: decrease the length Y and Z
   - Insufficient lifting height: increase the length Y and Z

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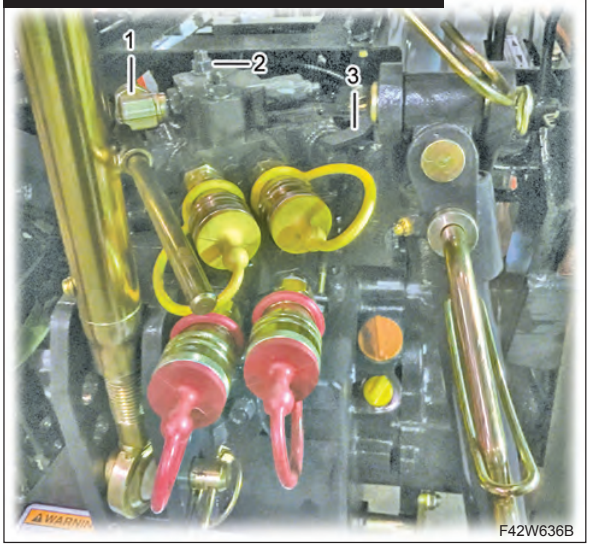
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7.3 REAR SCV VALVE DISASSEMBLY

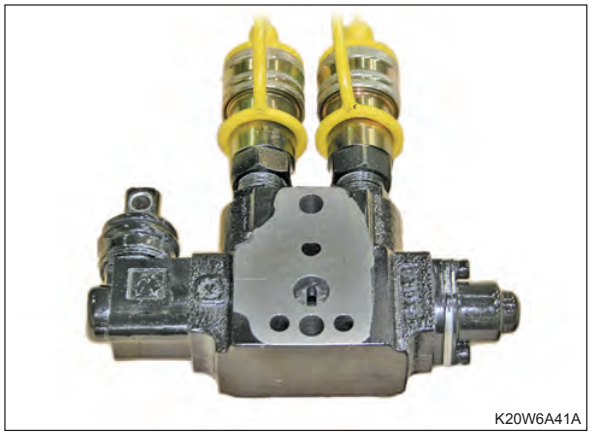
F SERIES-EU: 2 PORTS STANDARD

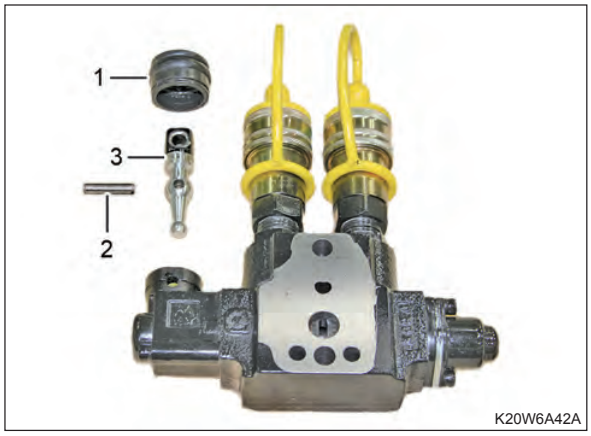


F SERIES-AU: 4 PORTS STANDARD,
15 SERIES-US: 4 PORTS OPTIONAL

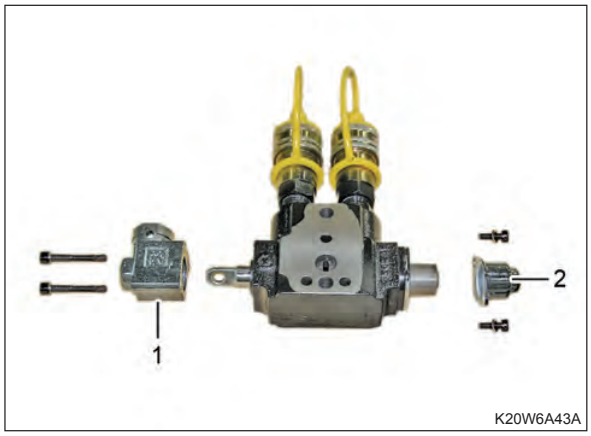


1. Disconnect all the hydraulic pipes (1) to the rear SCV valve from the back of the tractor and unscrew the mounting nuts (2), and disconnect the connecting bracket (3) to remove the rear SCV valve assembly.





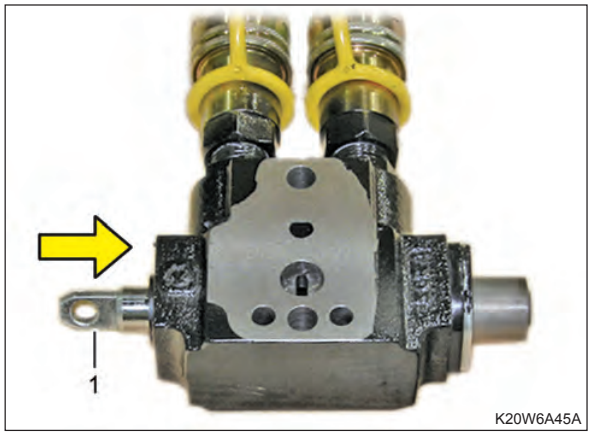
2. Remove the rubber bellows (1) and pull out the retaining pin (2). Then, remove the arm (3).

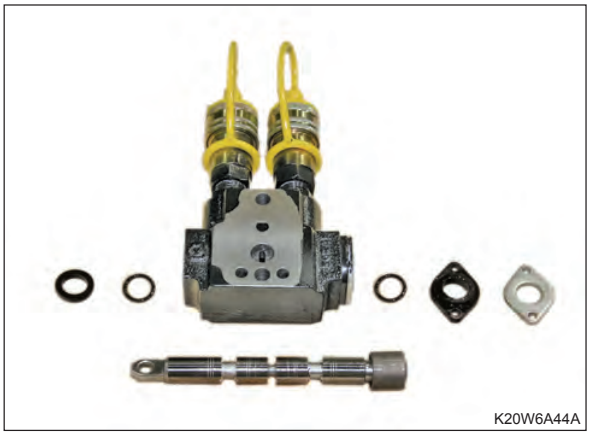


3. Remove the covers (1 & 2).

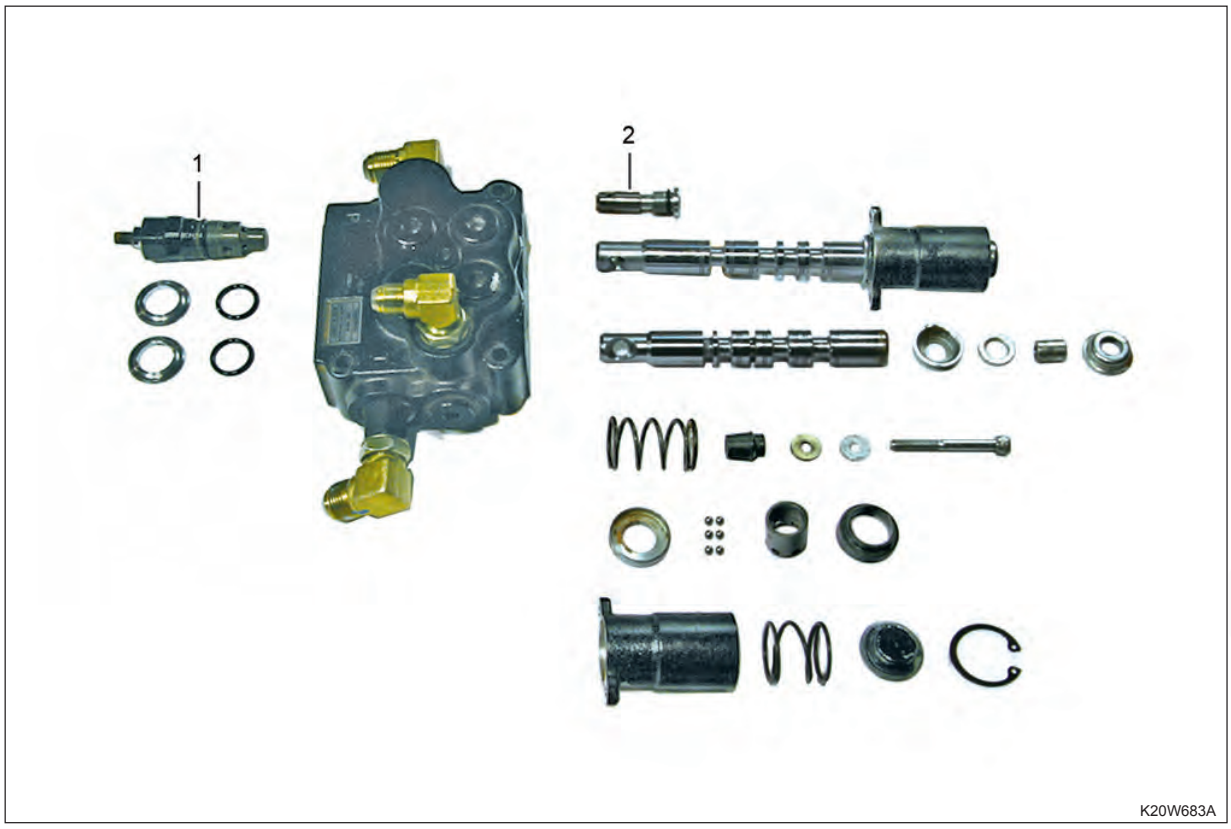
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4. Pull out the spool (1) in the arrow direction.

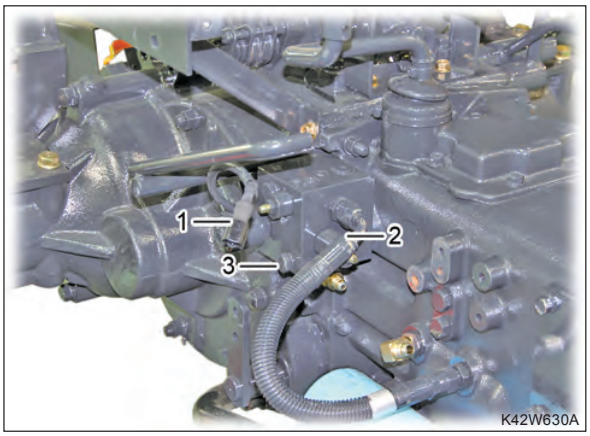


4. Unscrew the relief valve (1) from the other side to remove it. Then, pull the spool (2) to remove it.

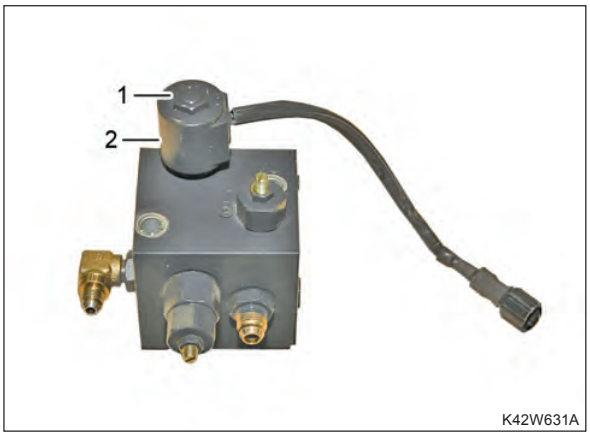
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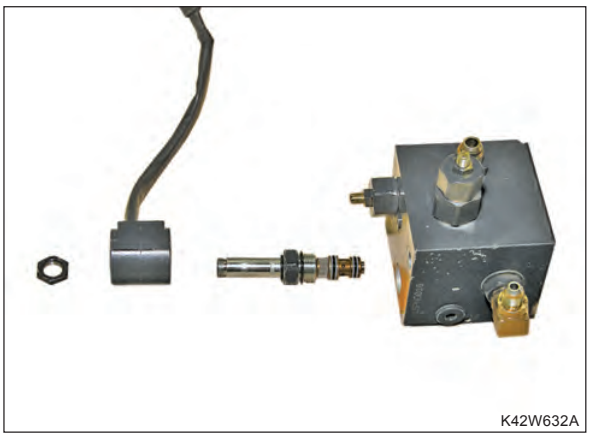
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7.5 PTO VALVE DISASSEMBLY

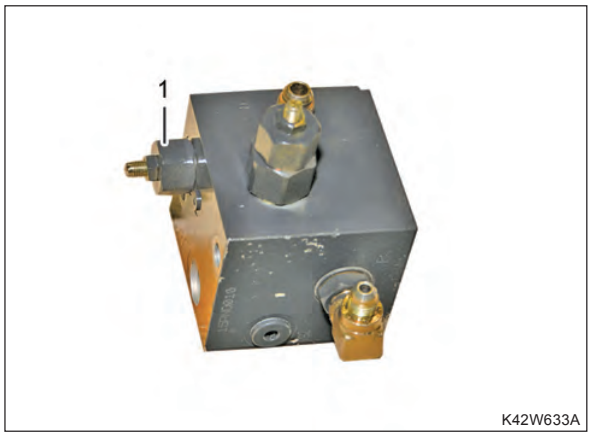


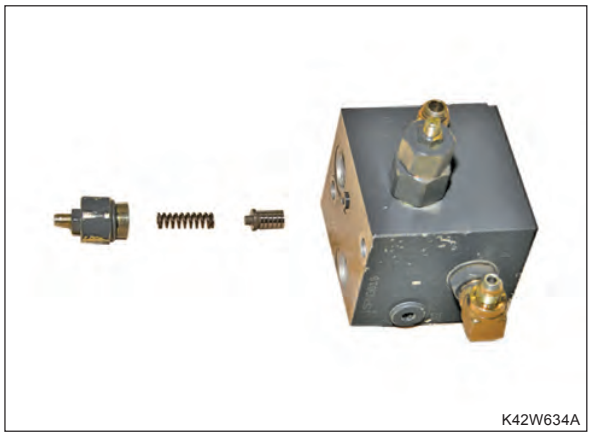
1. Disconnect the PTO valve wiring (1) connector and hydraulic pipe (2) and unscrew the mounting bolts (3) to remove the PTO valve assembly.





2. Unscrew the mounting nuts (1) from the PTO valve assembly to remove the solenoid valve (2).

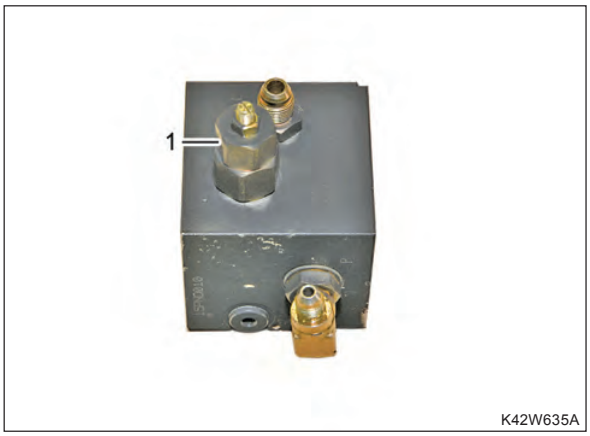


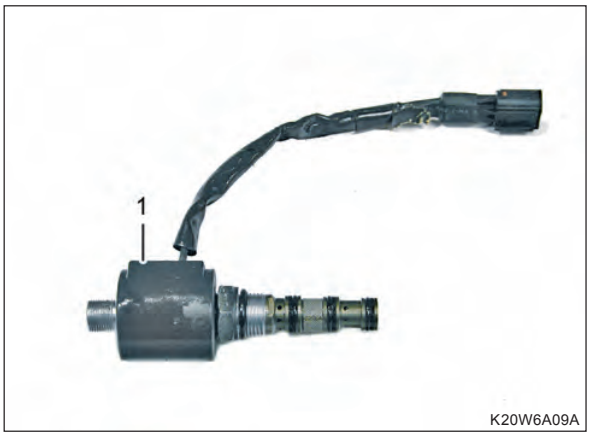


3. Remove the sequence valve (1).

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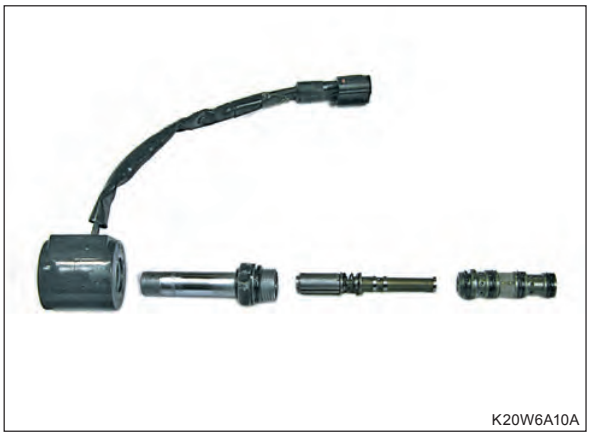
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4. Remove the DRV valve (1).



5. Remove the magnet housing (1) of the PTO solenoid. Remove the internal valve and spool as well.

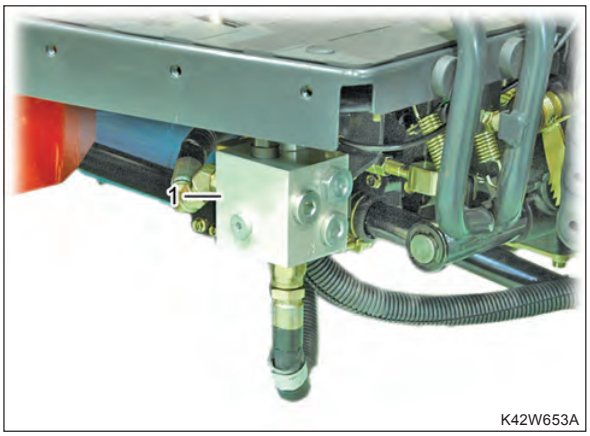


6. Assemble in the reverse order of disassembly.

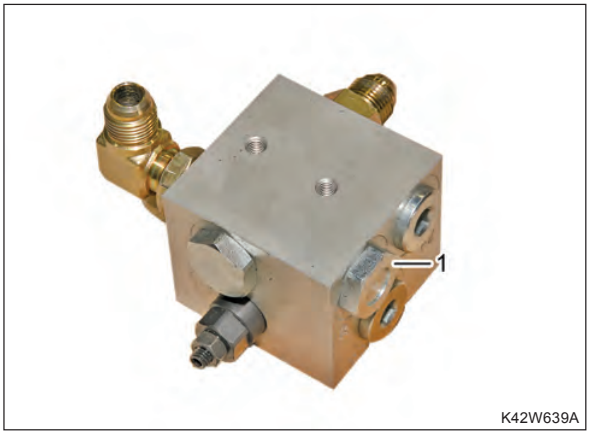
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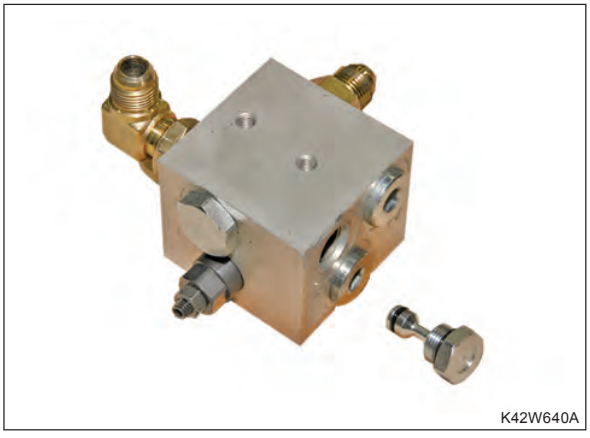
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7.6 FRONT OUTLET VALVE DISASSEMBLY

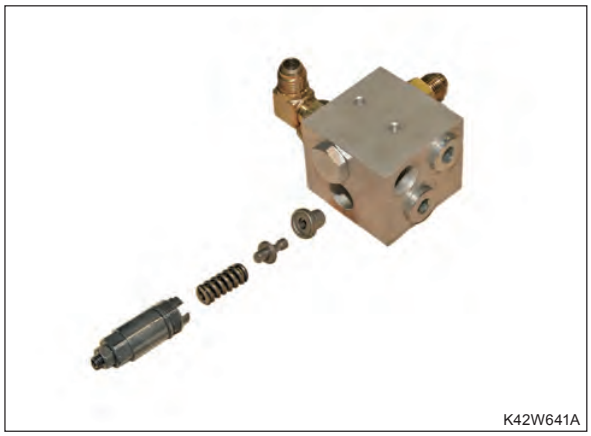


1. Disconnect the hydraulic hose from the front outlet valve and unscrew the bracket mounting bolts to remove the front outlet valve (1) assembly.

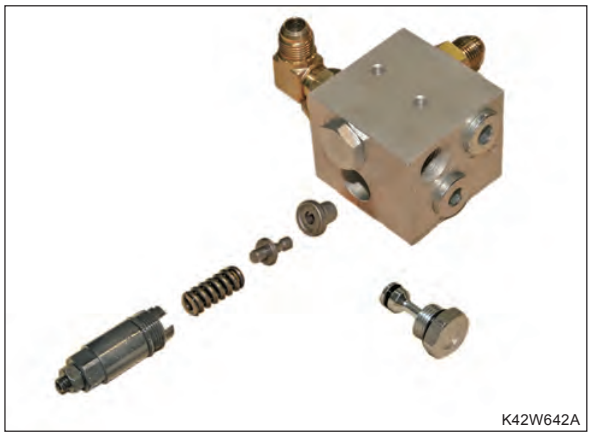




2. Remove the carry over plug (1).



3. Remove the relief valve.



4. Assemble in the reverse order of disassembly.

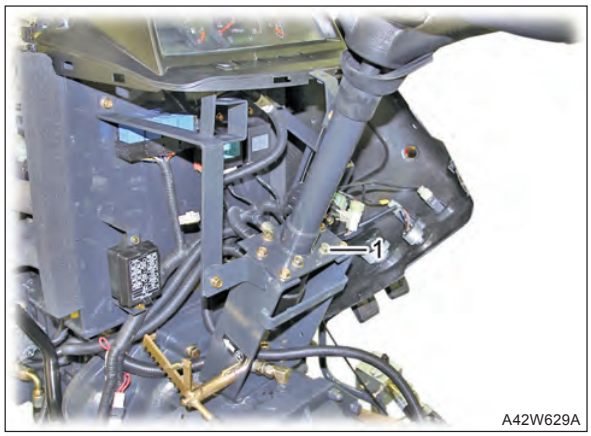
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7.7 STEERING VALVE DISASSEMBLY



1. Remove the upper dashboard part (1) and column cover (2).



2. Unscrew the steering valve assembly mounting bolts (1) under the steering wheel and push down the steering valve assembly to remove it.

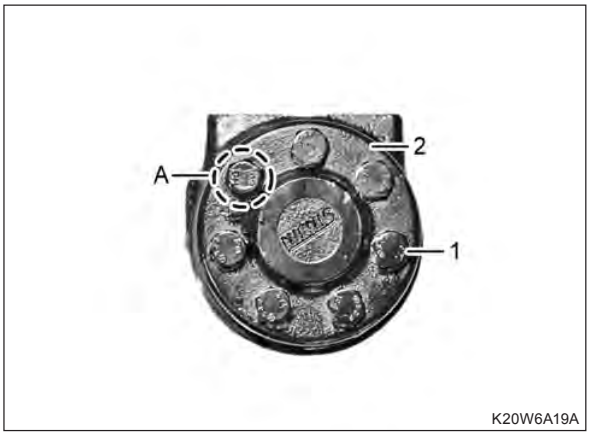




3. Remove the hydraulic hoses (1) from the steering valve assembly.

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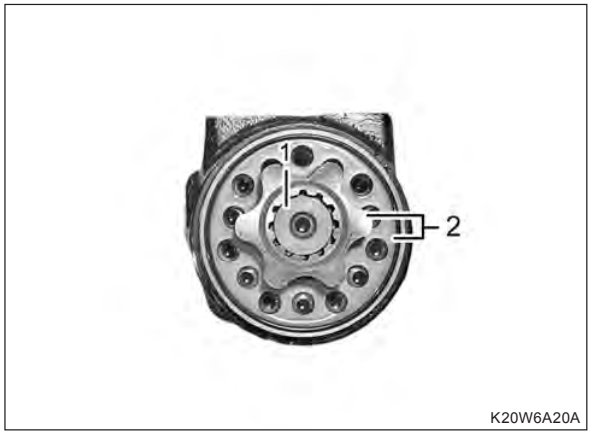
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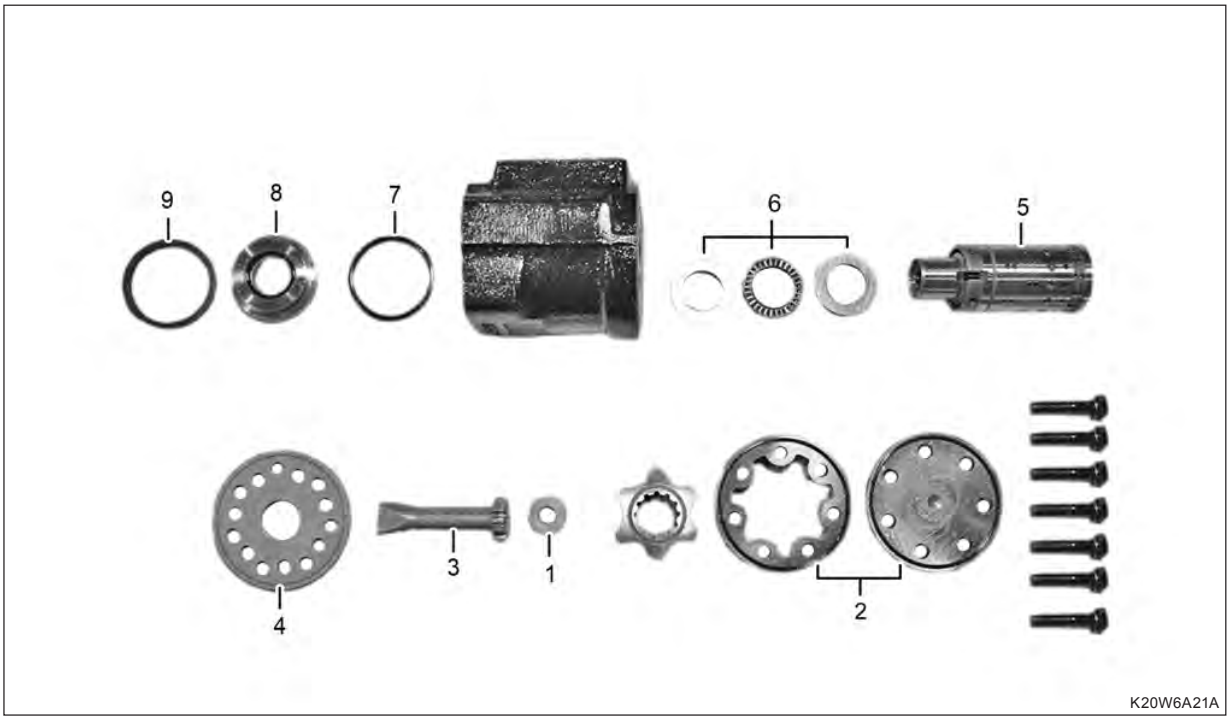
4. Unscrew the end cap mounting bolts (1) from the steering valve assembly to remove the end cap (2).

IMPORTANT

- **The bolt A among the end cap mounting bolts is longer than the other ones. Make sure to install it correctly.**



5. Remove the spacer (1) and gerotor set (2) in order.



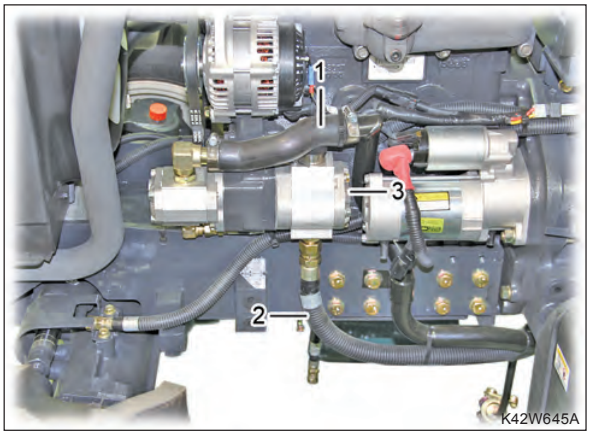
6. Pull out the drive (3) and remove the plate (4), spool and sleeve assembly (5), thrust bearing (6), O-ring (7), grand bushing (8) and retaining ring (9) in order.

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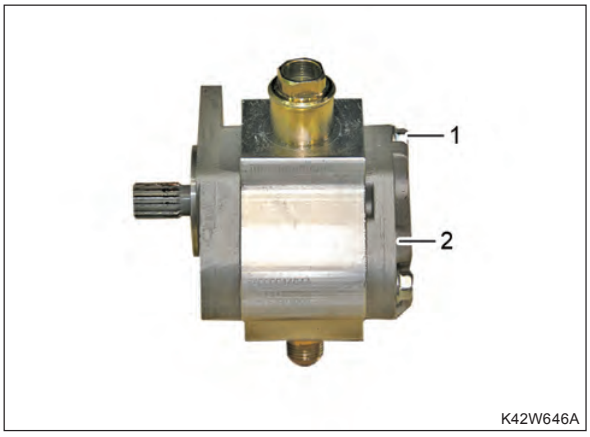
7.8 HYDRAULIC PUMP DISASSEMBLY

13 cc

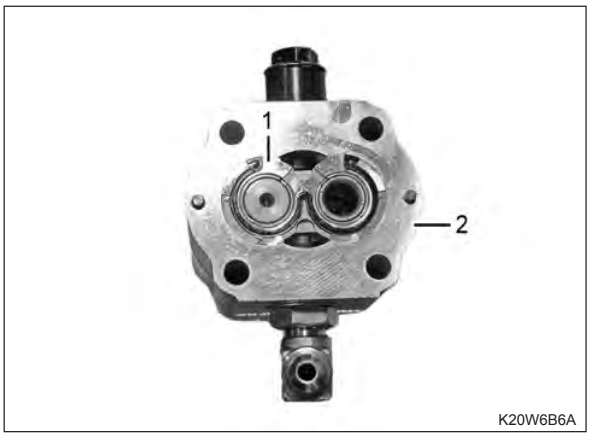


1. Disconnect the hydraulic pipe (1) and hydraulic hose (2) from the hydraulic pump on the left side of the engine. Then, unscrew the mounting bolt (3) to remove the hydraulic pump assembly.

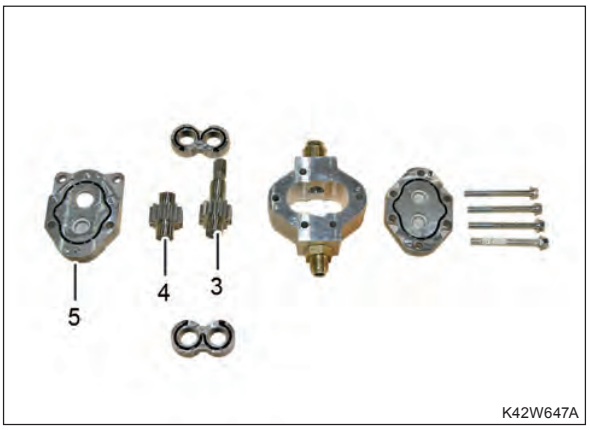
ITEM	TORQUE VALUE
Mounting bolt	21.56 ± 2.94 N.m 2.2 ± 0.3 kgf.m 15.84 ± 2.16 lbf.ft



2. Unscrew the housing mounting bolts (1) and remove the rear cover (2).

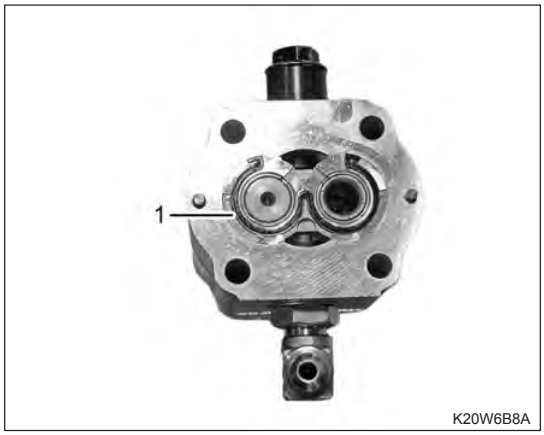


3. Separate the shaft holding block (1) and each housing (2) from the cabin.



4. Remove the drive gear (3), driven gear (4) and front cover (5).

IMPORTANT



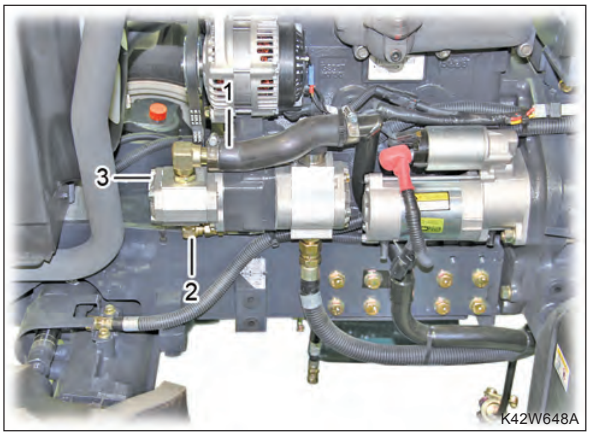
- **The seal (1) of the shaft holding block should face the housing when assembling it.**

5. Assemble in the reverse order of disassembly.

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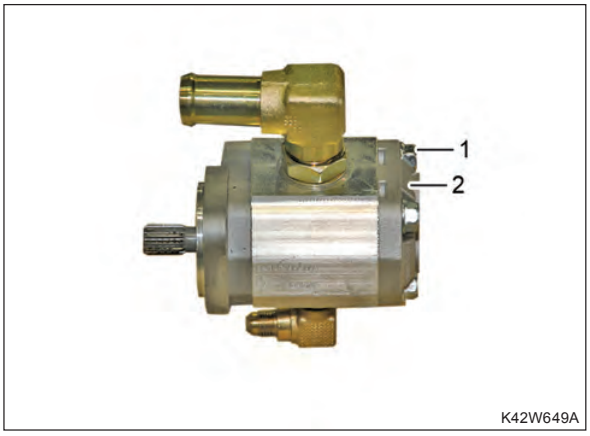
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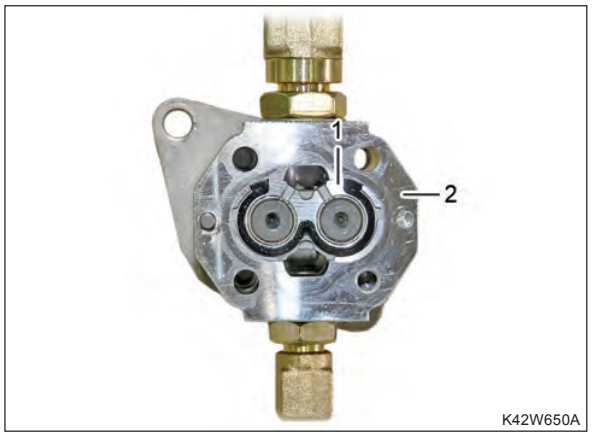


1. Disconnect the hydraulic pipe (1) and hydraulic hose (2) from the hydraulic pump on the left side of the engine. Then, unscrew the mounting bolt (3) to remove the hydraulic pump assembly.

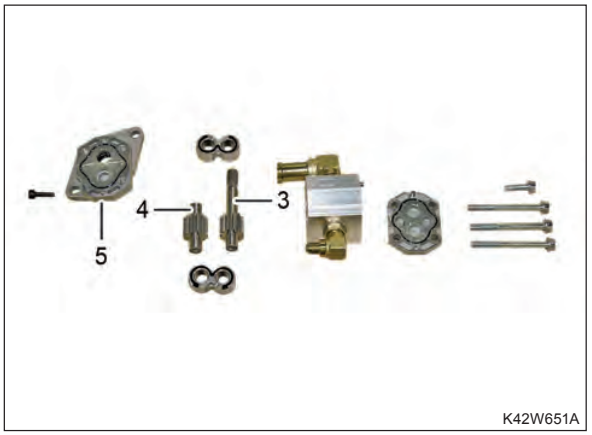
ITEM	TORQUE VALUE
Mounting bolt	21.56 ± 2.94 N.m 2.2 ± 0.3 kgf.m 15.84 ± 2.16 lbf.ft



2. Unscrew the housing mounting bolts (1) and remove the rear cover (2).

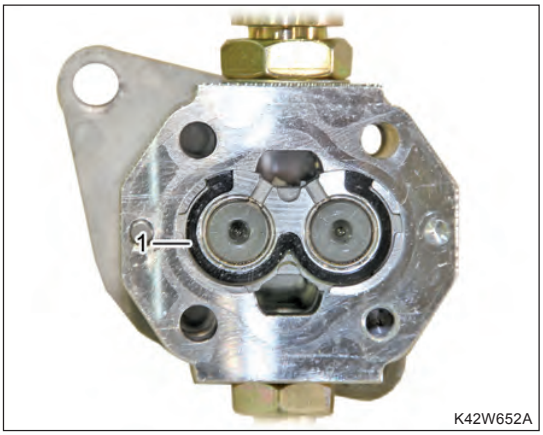


3. Separate the shaft holding block (1) from the housing (2).



4. Remove the drive gear (3), driven gear (4) and front cover (5).

IMPORTANT



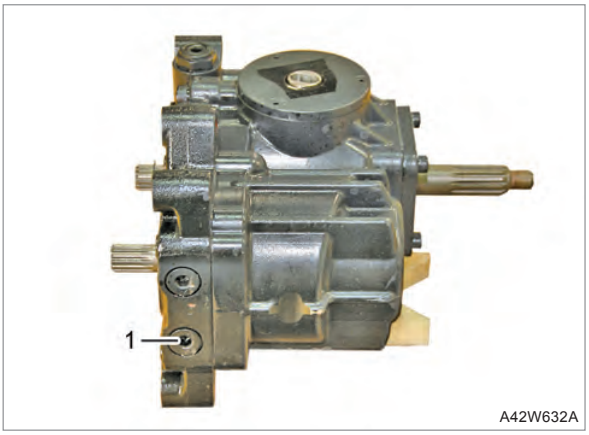
- **The seal (1) of the shaft holding block should face the housing when assembling it.**
- **And open section of the seal should face the suction side of the housing.**

5. Assemble in the reverse order of disassembly.

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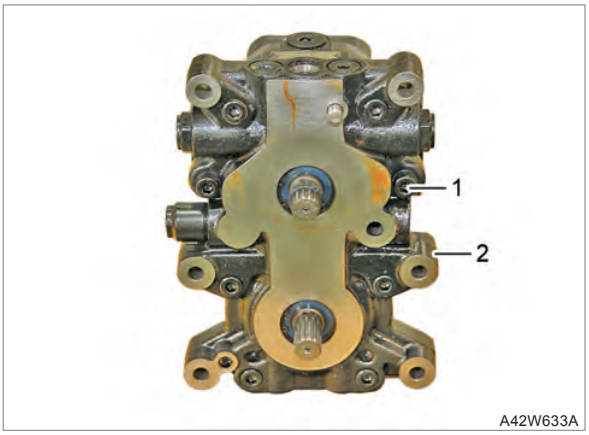
7.9 HST [HST MODEL]

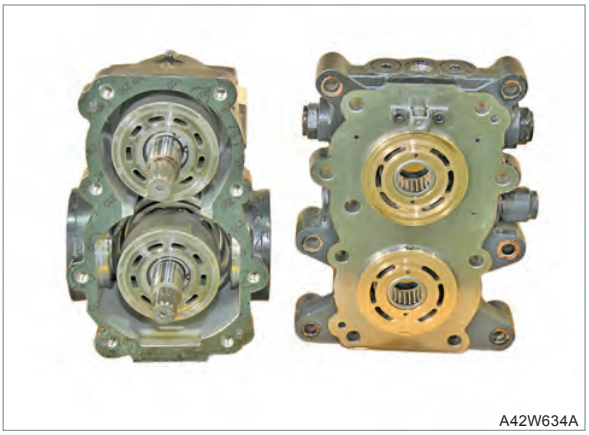


1. Unscrew the drain plug (1) from the bottom of the HST front cover to drain oil.

8-mm L-shape wrench

FRONT COVER DISASSEMBLY

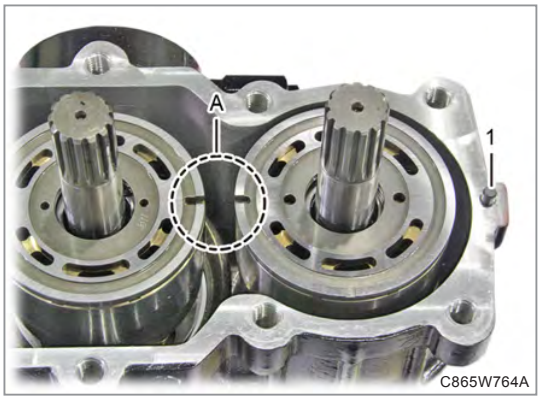




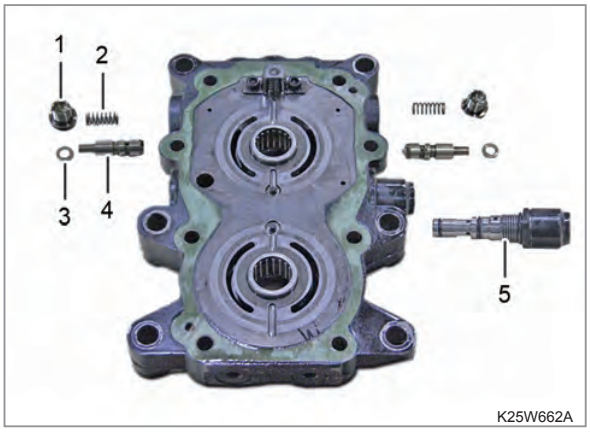
2. Unscrew eight HST front cover mounting bolts (1) to remove the front cover (2).

M12 BOLT	8 EA
10-mm L-shape wrench	

Notes



- **Align the grooves (A) of the valve plate with the knock pin (1) of the HST case during assembly.**

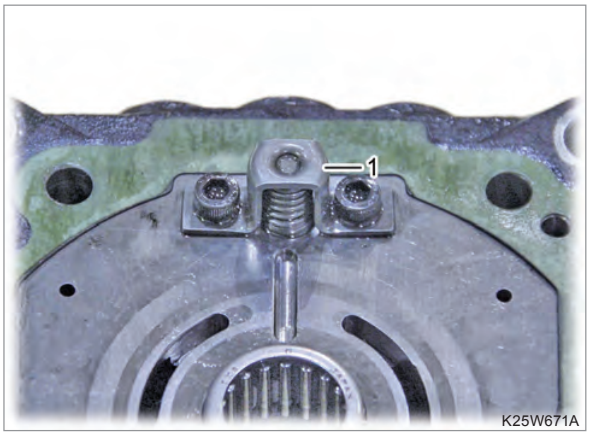


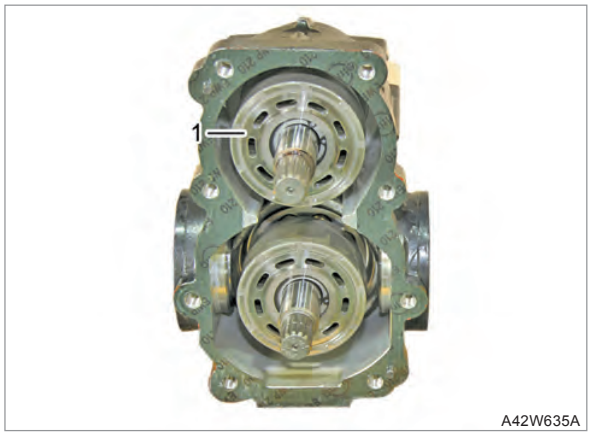
3. Remove the plug (1), spring (2), spring seat (3) and spool (4) from the upper section of the front cover. Then, remove the main relief valve (5).

10-mm L-shape wrench
8-mm L-shape wrench

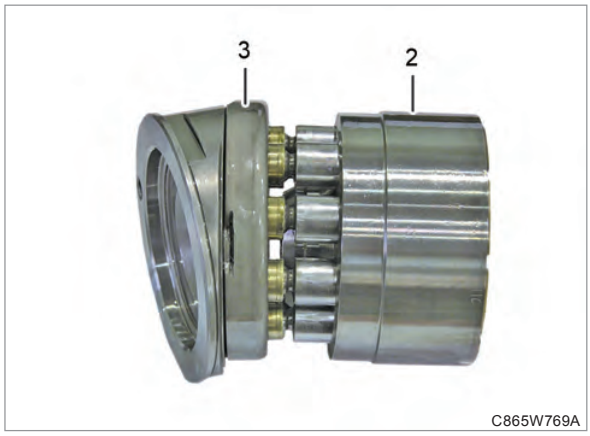
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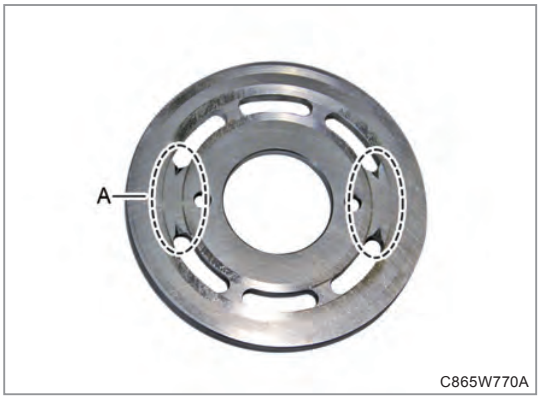


4. Unscrew the spring holder (1) from the inner upper section of the front cover. Then, remove the spring (2) and check valve (3).

M6 BOLT	5 EA
5-mm L-shape wrench	

5. Remove the valve plate (1) on the motor side. Then, separate the cylinder block (2) and piston assembly (3).

Notes



- **Set the valve plate grooves (A) on the motor side toward the cylinder block during assembly (groove in section A: two (both directions)**

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C865W771A

- Valve plate


C865W774A

- Piston assembly

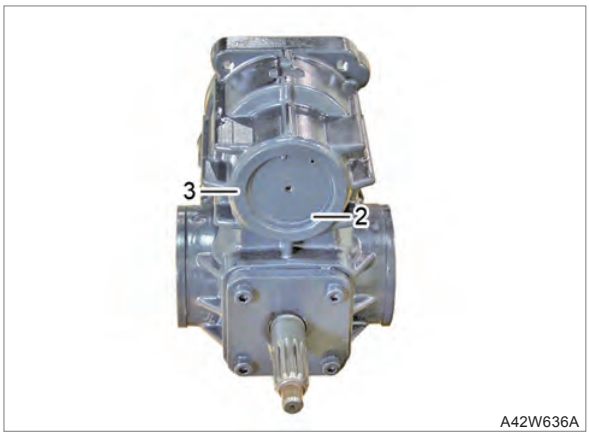

C865W772A

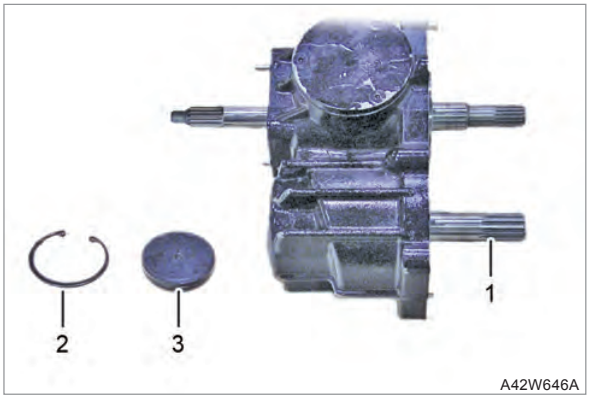

C865W773A

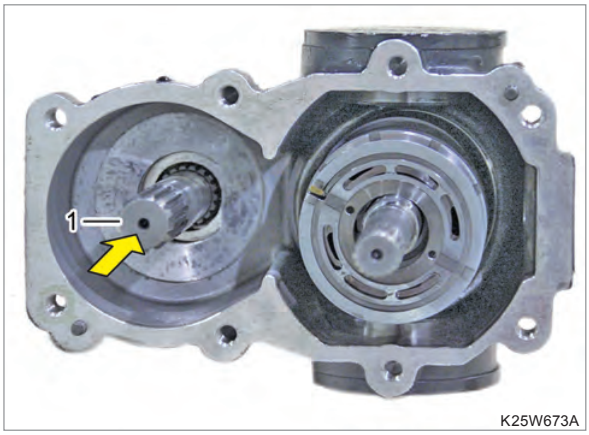
- Cylinder block

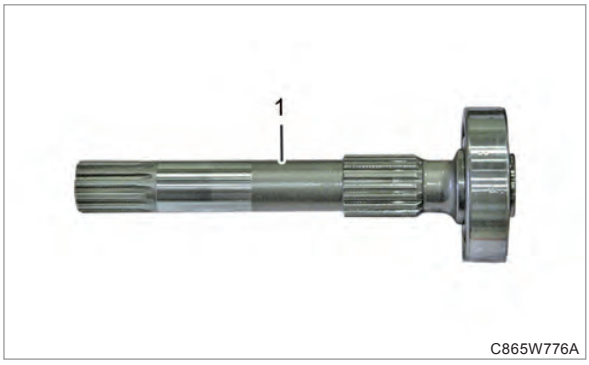
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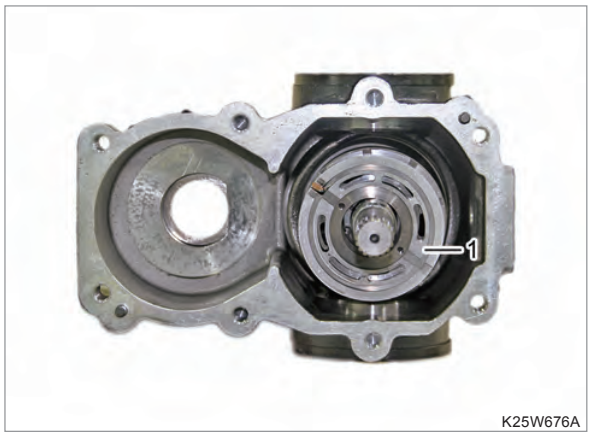


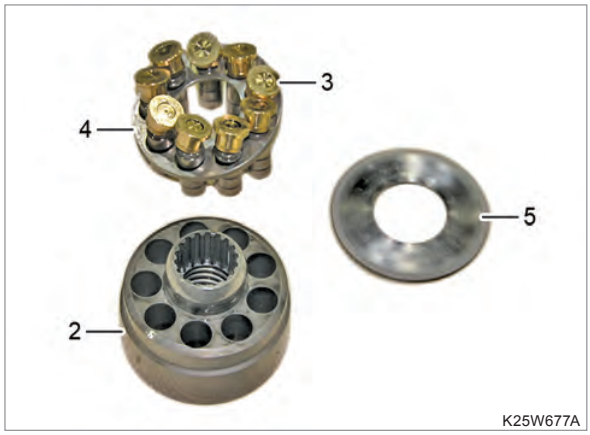






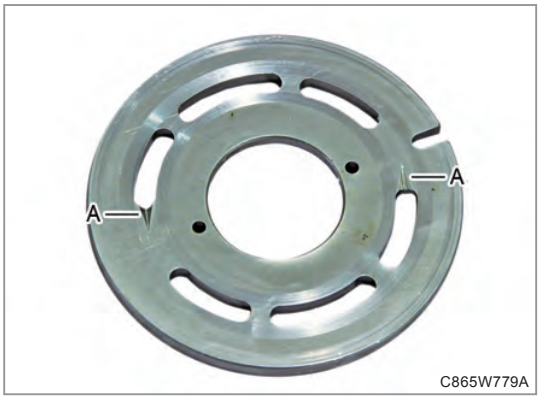
6. Pull out the snap ring (2) from rear of motor shaft and remove the cover (3) and motor shaft(1) by tapping snap ring direction.





7. Remove the valve plate (1) on the pump side. Then, remove the cylinder block (2), piston (3), set plate (4) and shoe plate (5) after separate the cylinder block and piston assembly.

Notes

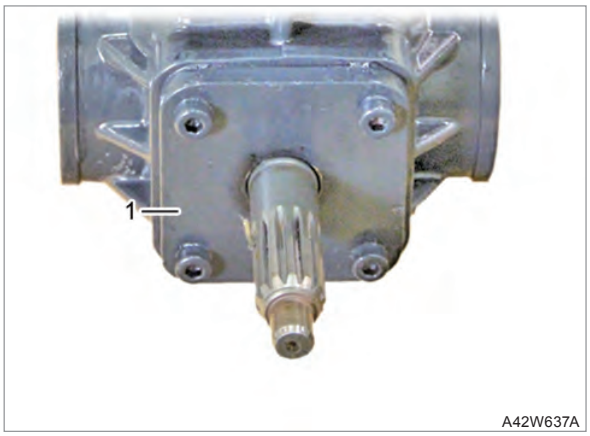


- **Set the valve plate grooves (A) on the pump side toward the cylinder block during assembly (groove in section A: one (rotating direction))**

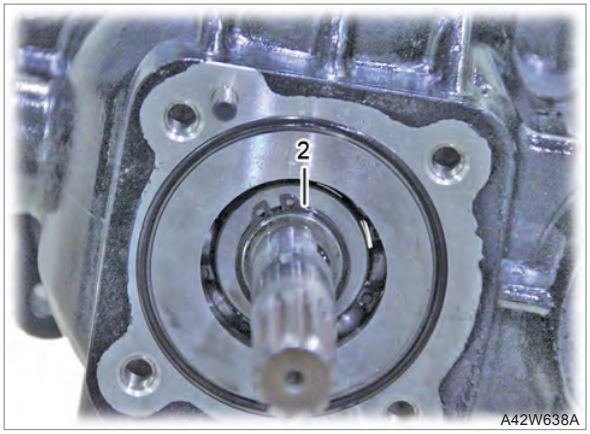
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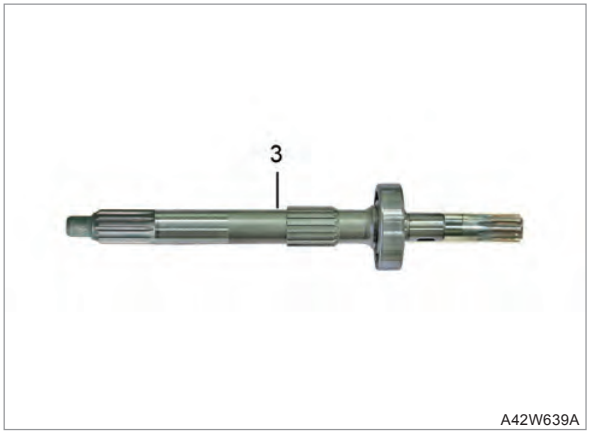
PUMP SHAFT DISASSEMBLY



A42W637A



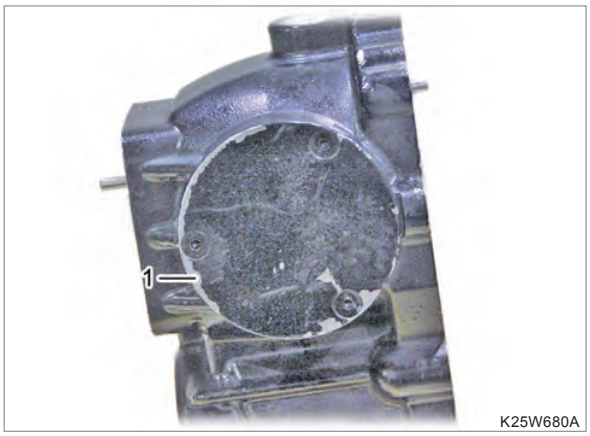
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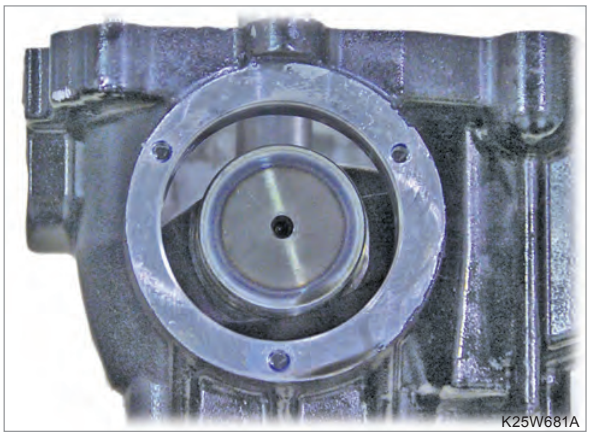
A42W639A

8. Remove the pump shaft cover(1). And pull out the snap ring (2) from the inside and disconnect the pump shaft (3).

SWASH PLATE DISASSEMBLY



K25W680A


K25W681A

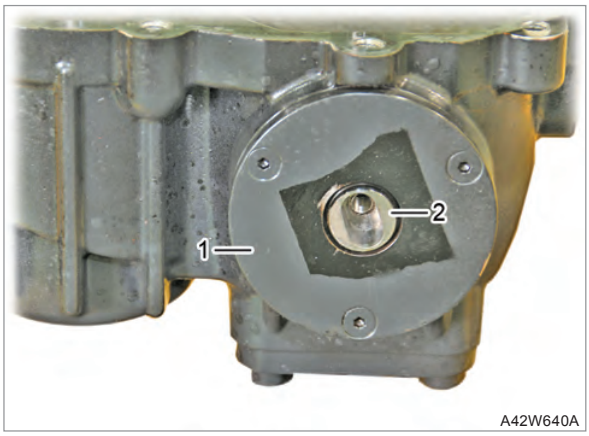
9. Remove the cover (1).

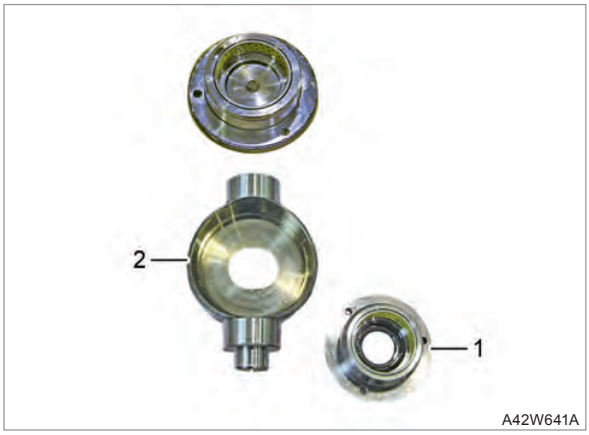
M6 BOLT	3 EA
5-mm L-shape wrench	

6

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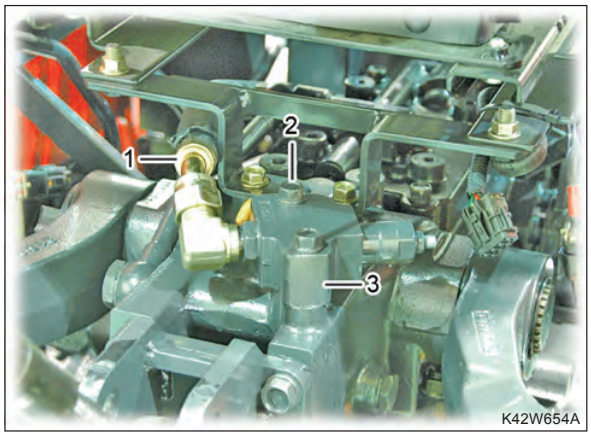


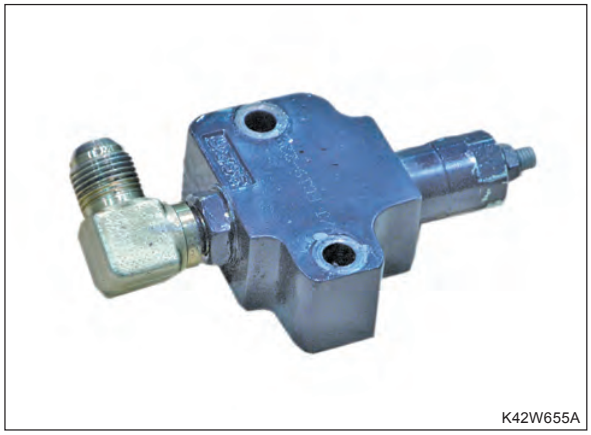


10. **Remove the swash cover (1) to remove the** swash plate (2).

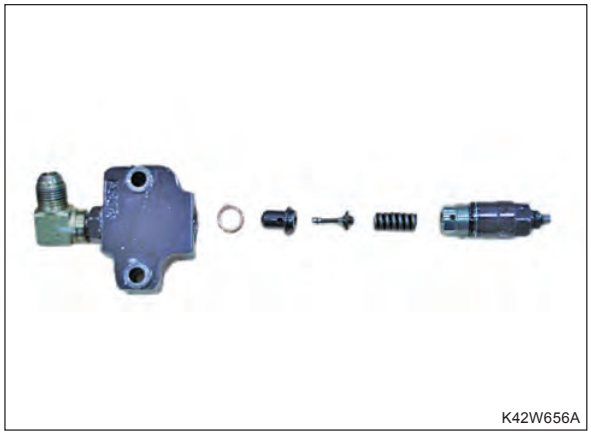
M6 BOLT	3 EA
4-mm L-shape wrench	

7.10 RELIEF VALVE BLOCK DISASSEMBLY





1. Disconnect the hydraulic hose (1) of the relief valve block from the back of the tractor and unscrew the mounting bolts (2) to remove the relief valve (3).

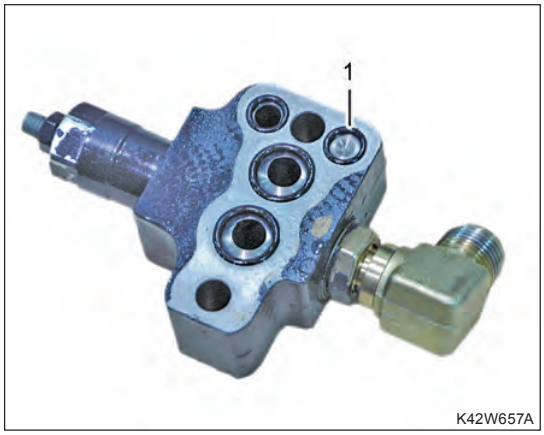


2. Remove the relief valve.

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⚠ CAUTION



- **Make sure that the O-ring is correctly installed and apply grease on the mating surface of O-ring when the reinstalling.**

8. INSPECTION, ADJUSTMENT AND TEST

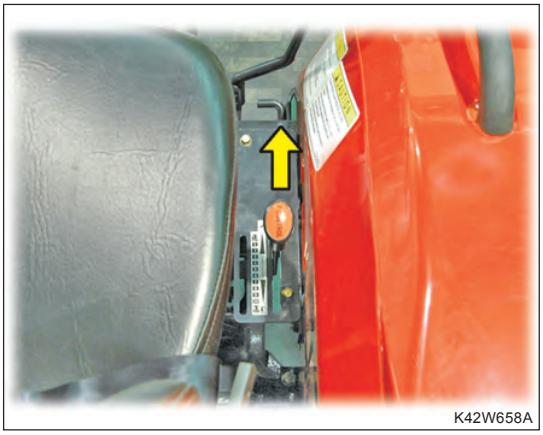
1. When testing oil flow or pressure for the hydraulic kit, warm up the engine to obtain proper oil temperature.

⚠ CAUTION

- **Do not place the SCV lever or joystick lever into the extending or retracting position for an extended period of time. Hydraulic oil can be overheated.**
- **Overheated hydraulic oil can damage the hydraulic kit or cause an injury.**

Notes

▶ **OIL WARMING-UP PROCEDURE**



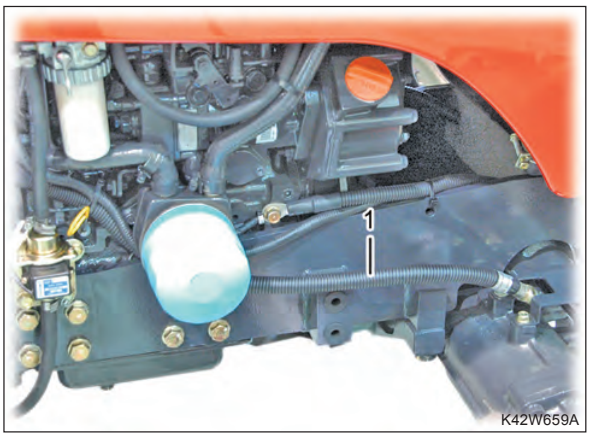
1. **Lower the 3-point hitch completely.**
2. **Idle the engine at a low speed.**
3. **Pull the SCV lever (If equipped) backwards to set the system in the relief status.**
4. **Pull the lever backwards until the suction line becomes too hot to touch.**
   - **The oil temperature at this point should be approx. 38 - 43℃ (100 - 110℉).**

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8.1 PST VALVE

8.1.1 RELIEF VALVE PRESSURE TEST

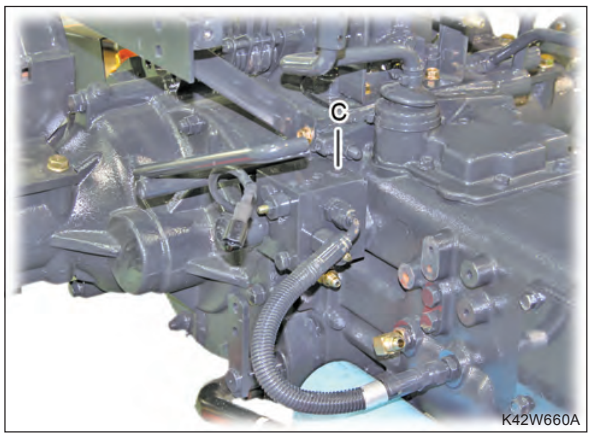


1. Remove the hydraulic hose (1) from the right side of the steering cylinder.
2. Connect a hydraulic pressure gauge, hose and adapter between the steering cylinder port and hydraulic hose.
3. Start the engine and idle it at a high speed.
4. Turn the steering wheel to its left end position. Check the needle on the gauge when the relief valve is operated.

- Relief setting pressure:
  130 kgf/cm^2 [12.74 MPa / 1,849 psi]
- If the measurement is out of the standard, resetting the relief valve or replace the PST valve.

8.2 PTO VALVE

8.2.1 SEQUENCE VALVE PRESSURE TEST



1. Unscrew the port G1 plug (PF1/4)(C) of the PTO valve and connect an adapter, hydraulic pressure gauge and hydraulic hose.
2. Start the engine and run it at 2,600 rpm.
3. Check the pressure when it starts to drop while it is rising.
4. Read the pressure value on the hydraulic pressure gauge.

- Sequence valve setting pressure:
  16 kgf/cm^2 (1.57 MPa / 227.5 psi)

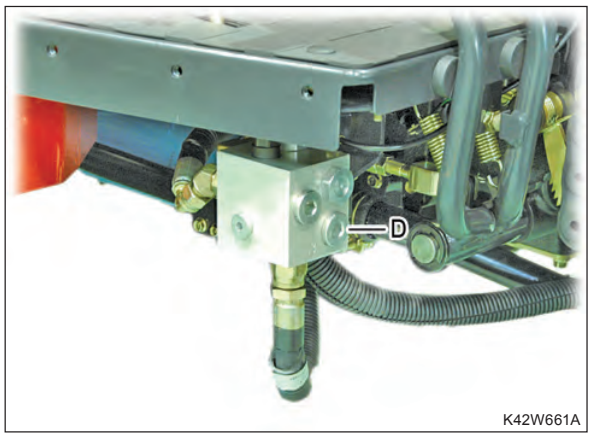
5. If the pressure cannot reach the specified value, adjust the sequence valve or replace the PTO valve.

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8.3 FRONT OUTLET VALVE

8.3.1 RELIEF VALVE PRESSURE TEST



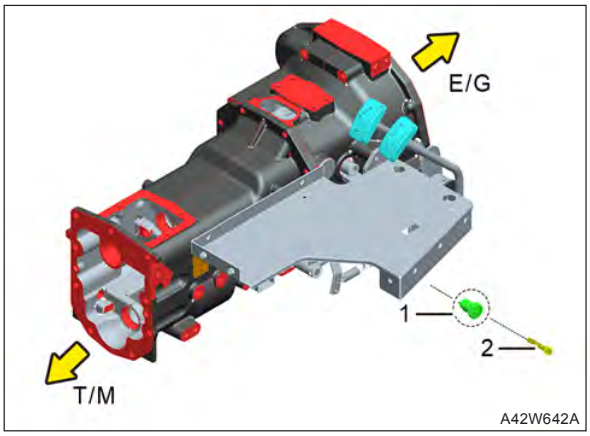
1. Unscrew the plug for relief valve pressure checking (PF1/4)(D) of the front outlet valve and connect an adapter, hydraulic pressure gauge and hydraulic hose.
2. Start the engine and run it at 2,600 rpm.
3. With the 3-point link fixed to the structure or certain load applied to the structure, pull the position control lever backward and observe that the pressure gradually rises. Then, check the pressure value when it starts to drop.
4. Check the pressure value when the relief valve operating sound is heard with the rear SCV valve pulled (if equipped).

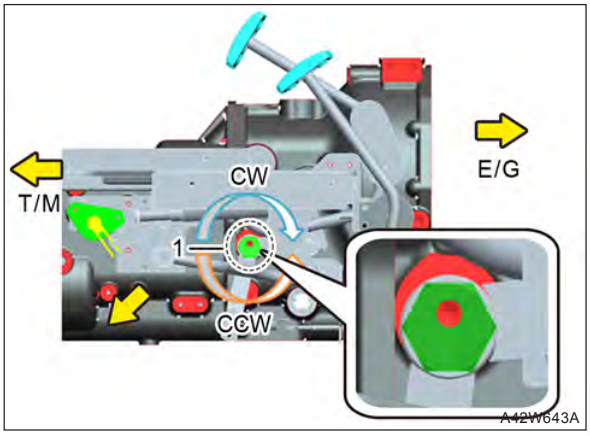
- Relief setting pressure:
  180 ~ 185 kgf/cm^2 (17.64 ~ 18.13 MPa / 2,560 ~ 2,631 psi)

5. If the pressure cannot reach the specified value, adjust the relief valve or replace the front outlet valve.

8.4 HST NEUTRAL SETTING [HST MODEL]

1. Lift the vehicle off the ground so that the wheels idle above the ground.
2. Set the engine to idle speed.
3. Set the range shift lever to the low position.
4. Check if the wheels rotate forward or backward with the HST pedal released.





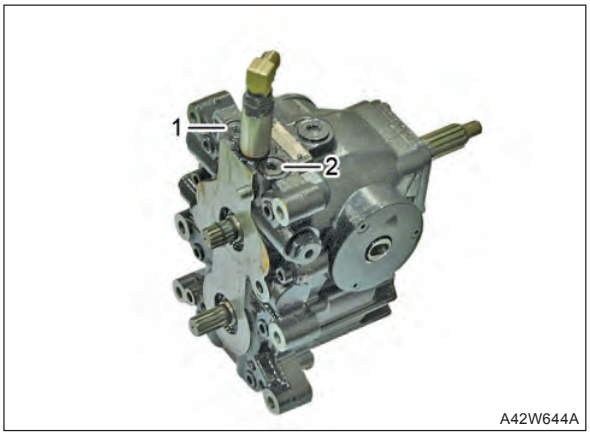
5. If the wheels rotate in the forward direction with the HST pedal released, unscrew the mounting bolt (2) and turn the shaft (1) counterclockwise slowly as shown in the figure. Tighten the mounting bolt to the position where the wheels stop rotating.
6. If the wheels rotate in the backward direction, turn the shaft (1) clockwise to find the position where the wheels stop rotating. Then, fix the shaft to that position by tightening the mounting bolt (2).

Notes
• **Adjust the forward/reverse driving condition with the mounting bolt (2) fit loosely.** • **Adjust the shaft (1) using a 32-mm spanner.** • **In the neutral state, the mounting bolt (2) forms an "I" shape.**

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8.5 HST MAIN RELIEF VALVE PRESSURE TEST



(1) Pressure measuring port of high pressure relief valve (forward driving) (PT 3/8)
(2) Pressure measuring port of high pressure relief valve (reverse driving) (PT 3/8)

1. Remove the plug (1) from the pressure measuring port of the HST high pressure relief valve and set the pressure gauge (500 kgf/cm^2 or higher).
2. Start the engine and place the range shift lever in the 3rd gear shift position. Then, depress the brake pedal fully and depress the shuttle shift pedal repeatedly to increase the oil temperature.
3. Set the engine speed to 2,600 RPM and depressing the forward pedal fully. Then, measure the pressure of the high pressure relief valve (for forward driving).
4. If the measurement is out of the standard (380 kgf/cm^2), check the high-pressure relief valve and HST body.
5. Perform the same measurement for the reverse driving side.

⚠ WARNING

- **If the tractor moves with the brake pedal depressed, it can cause an accident. Stop the test immediately and resume the test after the service.**
- **Never let anyone other than the driver get near the front and rear side of the tractor. Any observer can be hit by a tractor during the test and he/she can seriously get injured.**

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CHAPTER 7 ELECTRIC SYSTEM

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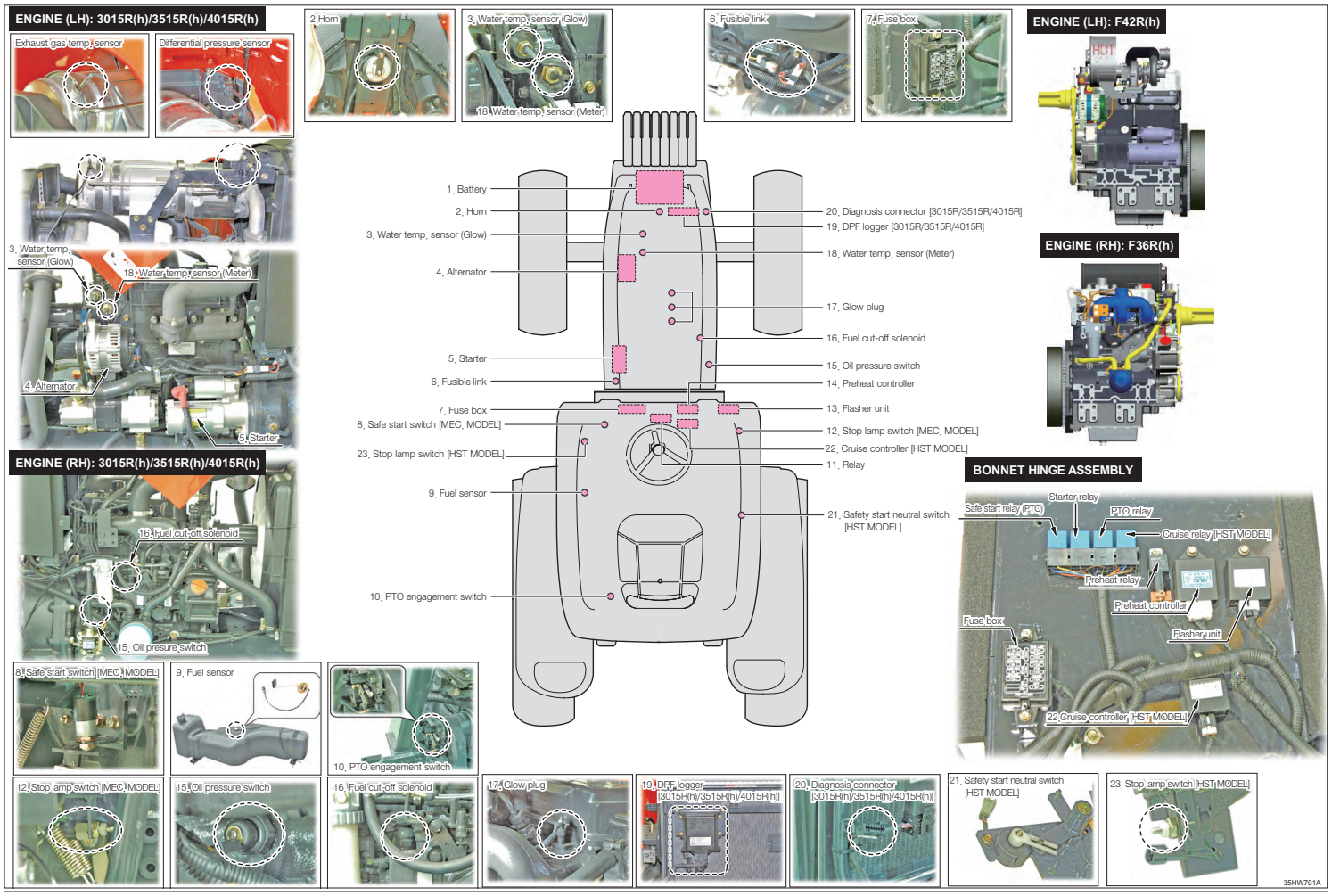
ITEM	STANDARD
Battery	12 V 90 Ah
Alternator	12 V 50 Ah
Starter	12 V 2.2 Kw
Preheat relay	DC 12 V, 70 A
PTO engagement switch	Rated current: 14 V 15 A
Safety switch	12 V 10 A
Preheat controller	Voltage range: DC 8 - 16 V
Flasher unit	Voltage range: DC 10 - 16 V
Direct signal lamp (front)	12 V 21 W/5 W
Combination lamp (rear)	12 V 27 W, 12 V 8 W, 12 V 21 W/5 W
Head lamp	HS1 12V 35W/35W
Horn	12 V , 350 ± 2 Hz, 110 ± 5 dB
Fusible link	60 A X 2 EA
Cruise controller [HST MODEL]	DC 12V 1A
Safety start neutral switch [HST MODEL]	DC 13V

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2. MAJOR ELECTRIC COMPONENT LAYOUT DIAGRAM

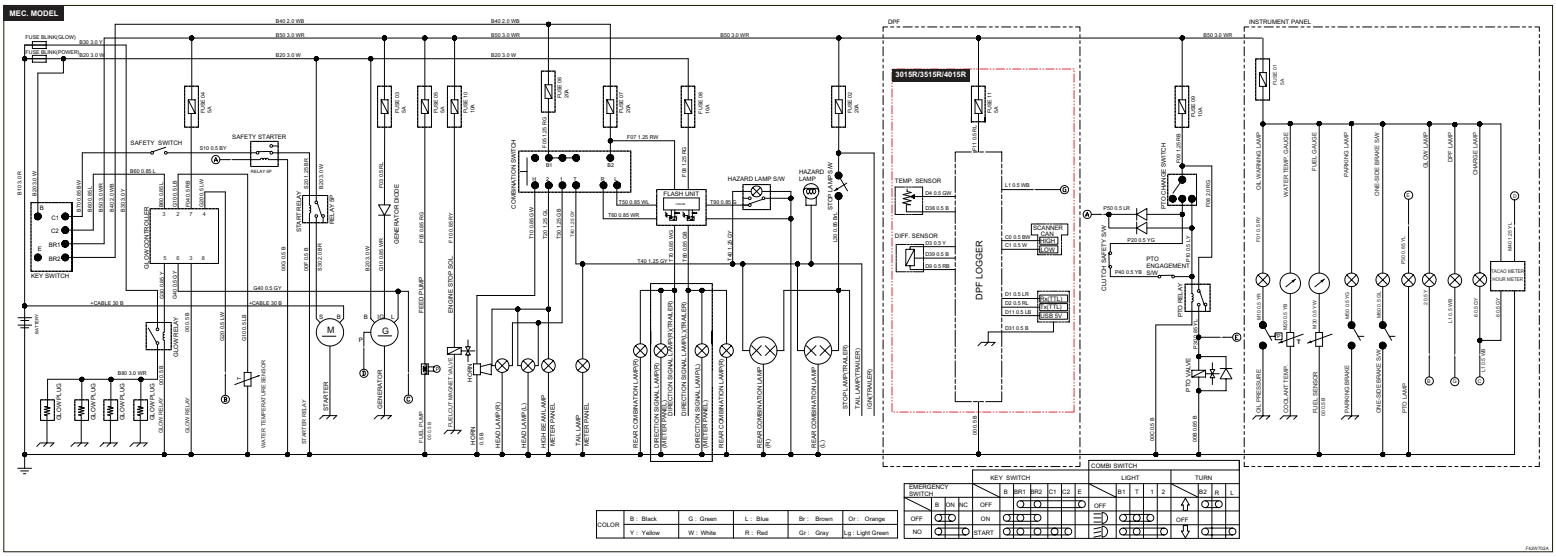


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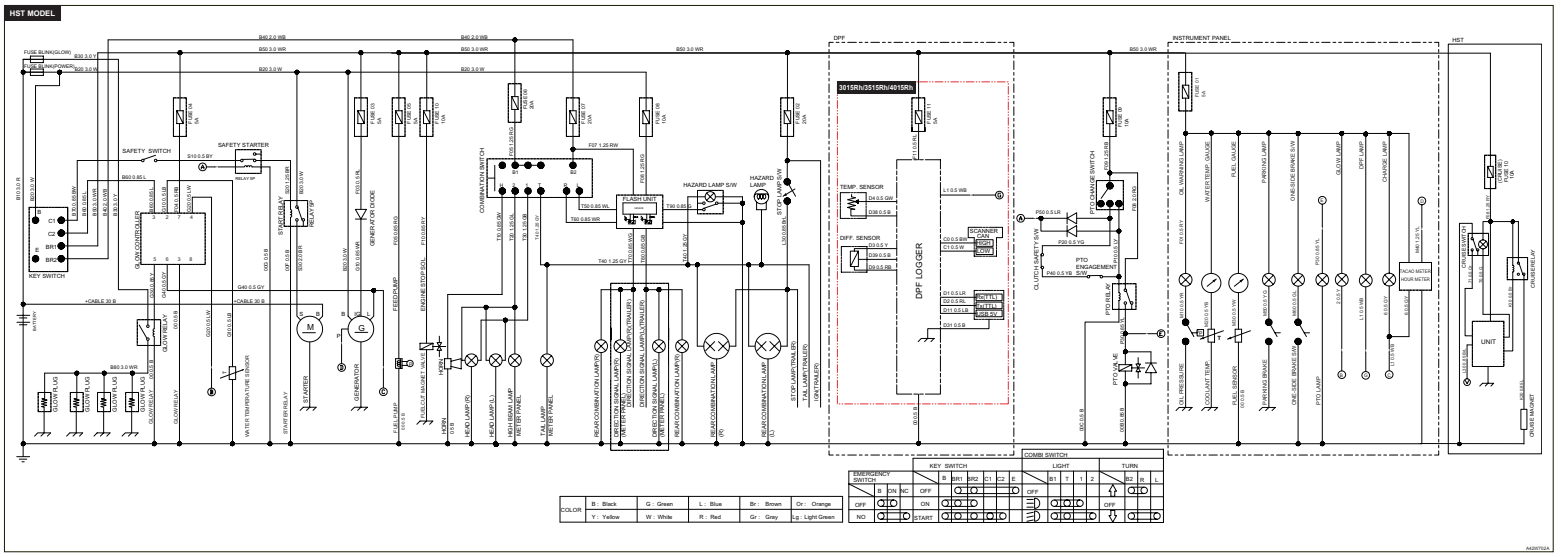
3. ELECTRIC WIRING DIAGRAM



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HST MODEL

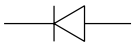
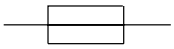
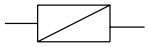
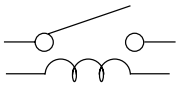
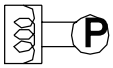
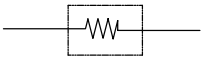
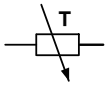


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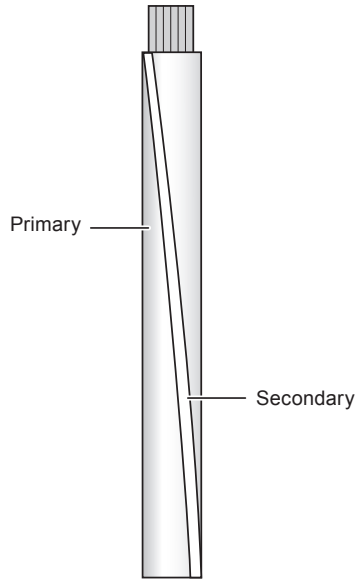
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3.1 SYMBOLS AND WIRING COLOR DEFINITION IN ELECTRIC CIRCUIT

3.1.1 SYMBOL

SYMBOL	DESCRIPTION	SYMBOL	DESCRIPTION
	Battery		Diode
	Fusible link		Gauge
	Fuse		Lamp
	Relay		Feed pump
	Switch		Fuel cut-off solenoid
	Starter		Horn
	Alternator		Beacon
	Glow plug		Water temp. sensor

3.1.2 COLOR DEFINITION



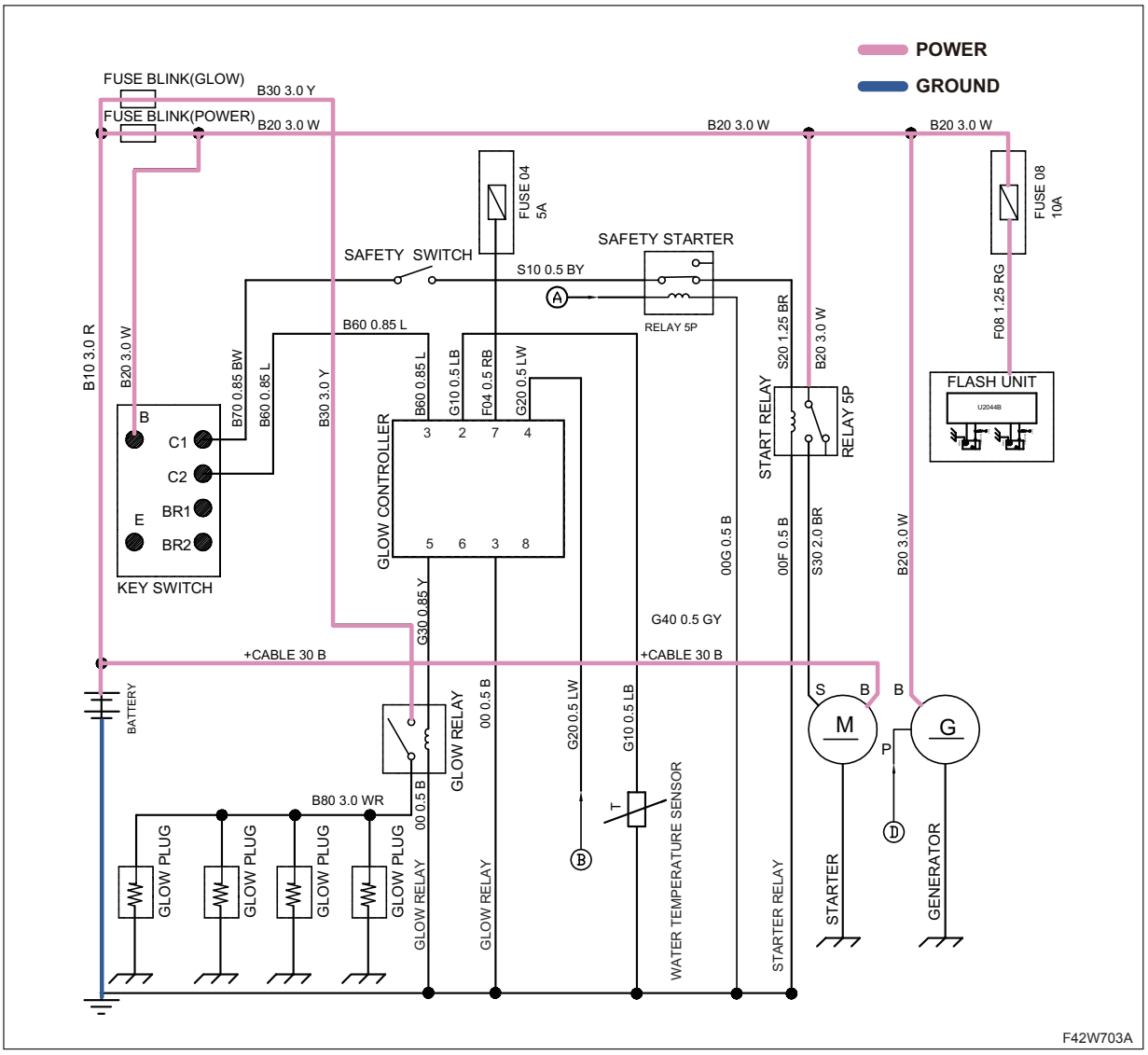
SYMBOL	COLOR
B	Black
Y	Yellow
G	Green
W	White
L	Blue
R	Red
Br	Brown
Gr	Gray
Or	Orange
Lg	Light green
BW	Black (primary) + White (secondary)
YG	Yellow (primary) + Green (secondary)

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4. CIRCUIT CONFIGURATION BY MAJOR FUNCTION

4.1 BATTERY AND FUSIBLE LINK

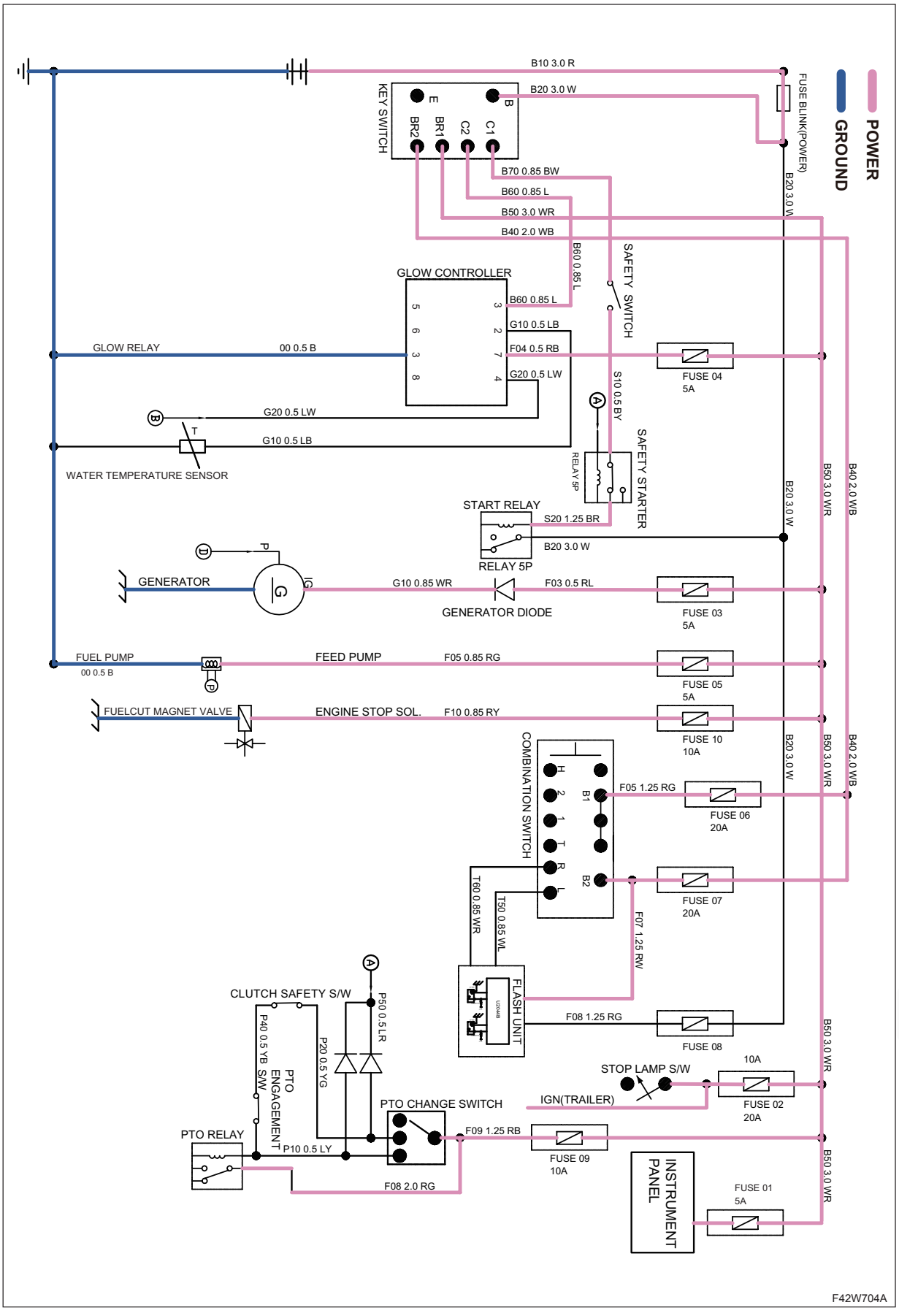


There are two fusible links at the end of the wiring 3.0R above the battery in the left section of the circuit diagram. The fusible link on the wiring 3.0Y is to supply main power to the glow relay. When the glow relay is energized, power is supplied to the glow plug to operate it. The fusible link on the wiring 3.0W is related to all other electric devices except main power for preheating operation. It supplies power to the start relay, generator, flasher unit.

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4.2 IGNITION SWITCH ON



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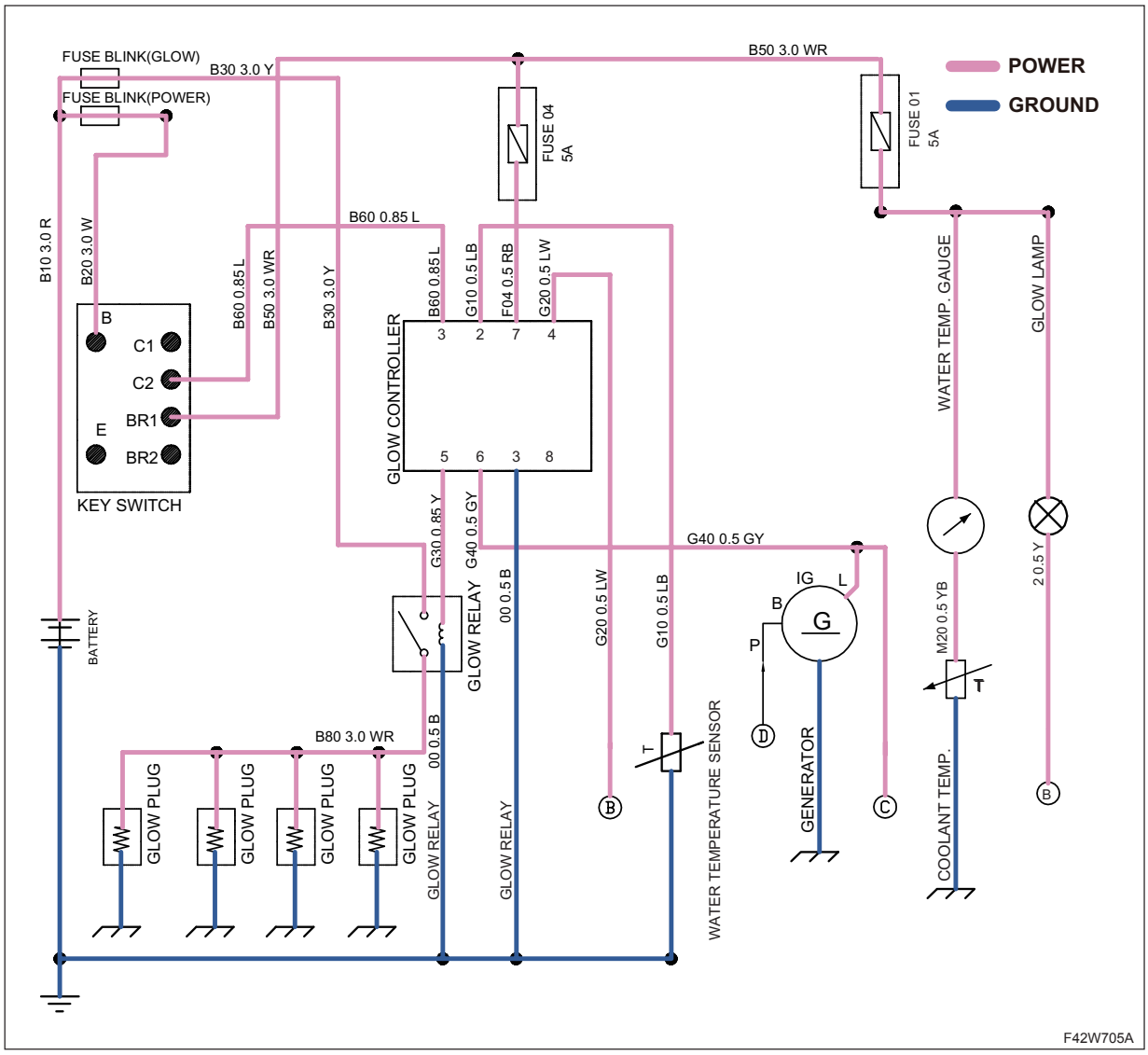
The ignition switch is located in the upper left section of the circuit diagram. This switch receives battery power through the wiring 3.0W.

1) ACC: When the ignition switch is turned to the 1st stage, ignition switch ON power is supplied through the terminal BR2 and wiring 2.0WB. When following the wiring 2.0WB from the terminal BR2 in the circuit diagram, this wiring is passed through two 20 A fuses and is connected to the combination switch for input power. Power supplied through the first fuse (No. 06) is delivered to various lamps through the combination switch. Power supplied through the second fuse (No. 07, 20 A) is delivered to the flasher unit, turn signal lamps and hazard warning switch through the turn signal lamp switch.
2) ON: When the ignition switch is turned to the 2nd stage, ignition switch ON power is supplied through the terminal BR1 and wiring 3.0WR. Firstly, an ignition switch ON signal is delivered to the glow controller through the 5 A fuse and wiring 0.5RB. The glow controller starts to control preheat operation as soon as it receives this signal. Secondly, this power is delivered to the terminal IG of the generator through the 5 A fuse and wiring 0.5RL, passing through the diode. Thirdly, it is connected to the fuel feed pump through the 5 A fuse and wiring 0.85RG to run the fuel feed pump with the ignition switch ON. Fourthly, it is connected to the fuel cut-off solenoid through the 10 A fuse and wiring 0.85RY to supply and cut off fuel depending on the position of the ignition switch (ON/OFF). Fifthly, it is delivered to the brake lamp switch switch through the 20 A fuse. Sixthly, it is supplied to the PTO selection switch through the 10 A fuse and wiring 1.25RB. Seventhly, it is connected to the instrument cluster through the 5 A fuse as main power for the instrument cluster.
3) Manual preheating: When the ignition switch is held in between the ON and START positions, the manual preheating signal is supplied to the glow controller from the terminal C2 through the wiring 0.85L to activate manual preheating.
4) START: When the ignition switch is turned to the START position, an engine start signal is supplied from the terminal C1 through the wiring 0.85BW. This start signal is passed through the safety switch and is delivered to the safe start relay. When the safe start relay receives a PTO engagement signal from (A), the 5P relay is energized so the relay main power is disconnected. Therefore, the engine cannot be started when the PTO switch is set in the ON position. When the safety switch is connected and the PTO switch is in the OFF position, power is supplied to the coil of the start relay so main power of the start relay is directly supplied to the start motor for cranking.

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4.3 PREHEAT



The circuit related to the preheat operation is located in the left section of the above circuit diagram.

As soon as the ignition switch is turned to the ON position, preheating operation is started and the preheat indicator on the instrument cluster is turned ON. When the ignition switch is returned to the ON position from the START position, after-heating operation is started. However, if the engine is not started so the generator is not operated properly, after-heating operation is not performed.

-. It receives the manual preheating signal from the ignition switch through the wiring 0.85L.

-. It receives the coolant temperature signal through the wiring 0.5LB.

-. It receives the ignition switch ON signal through the wiring 0.5RB.

-. It sends power to the preheat indicator on the instrument cluster through the wiring 0.5LW and instrument cluster wiring (B).

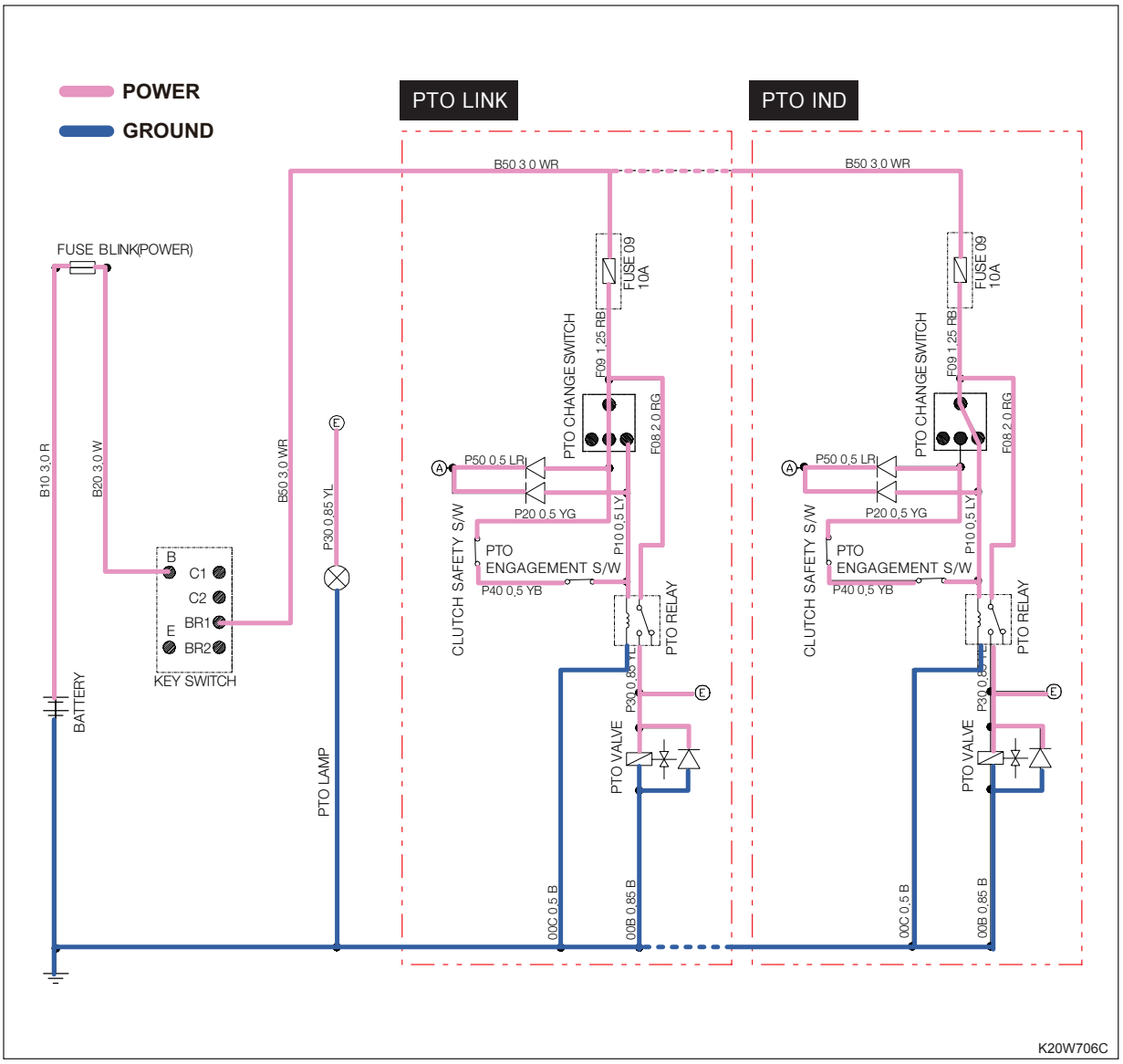
-. The wiring 0.85Y is a output wiring for the glow relay coil signal. When the glow relay coil is energized by this signal output, main power is directly supplied from the battery through the fusible link for preheating and wiring 3.0Y to the glow plugs installed to each cylinder in the engine.

-. The wiring 0.5GY is connected to the terminal L which is a direct current output terminal of the generator. This is to enable after-heating operation only when the generator is normally running.

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4.4 PTO OPERATION



1) LINK: This is activated when the PTO switch is set in the LINK position. As power is supplied to the PTO switch through the wiring 1.25RB, it is sent out through the wiring 0.5YG. This signal is sent to the PTO safe start relay through the wiring 0.5LR and diode first to prevent the engine from starting when the PTO switch is set in the ON position. The wiring 0.5YG is connected to the clutch safety switch. This switch is installed to the driving clutch pedal to stop PTO when the clutch pedal is depressed. Therefore, when the PTO switch is set to the Manual position, depressing the driving clutch pedal stops the PTO.

   The wiring 0.5YB is passed through another switch before it is connected to the PTO relay. This is the PTO engagement switch which is installed to the 3-point hitch lift arm lever. When setting the 3-point hitch to the lifting position, the PTO engagement switch becomes open to stop the PTO.

2) IND: This is activated when the PTO selection switch is set in the IND position. As power is supplied to the PTO switch through the wiring 1.25RB, it is sent out through the wiring 0.5LY. This signal is sent to the PTO safe start relay through the wiring 0.5LR and diode first to prevent the engine from starting when the PTO switch is set in the ON position. Then, it is directly supplied to the PTO relay to operate the PTO regardless of the operation of the driving clutch or 3-point hitch lift arm lever.

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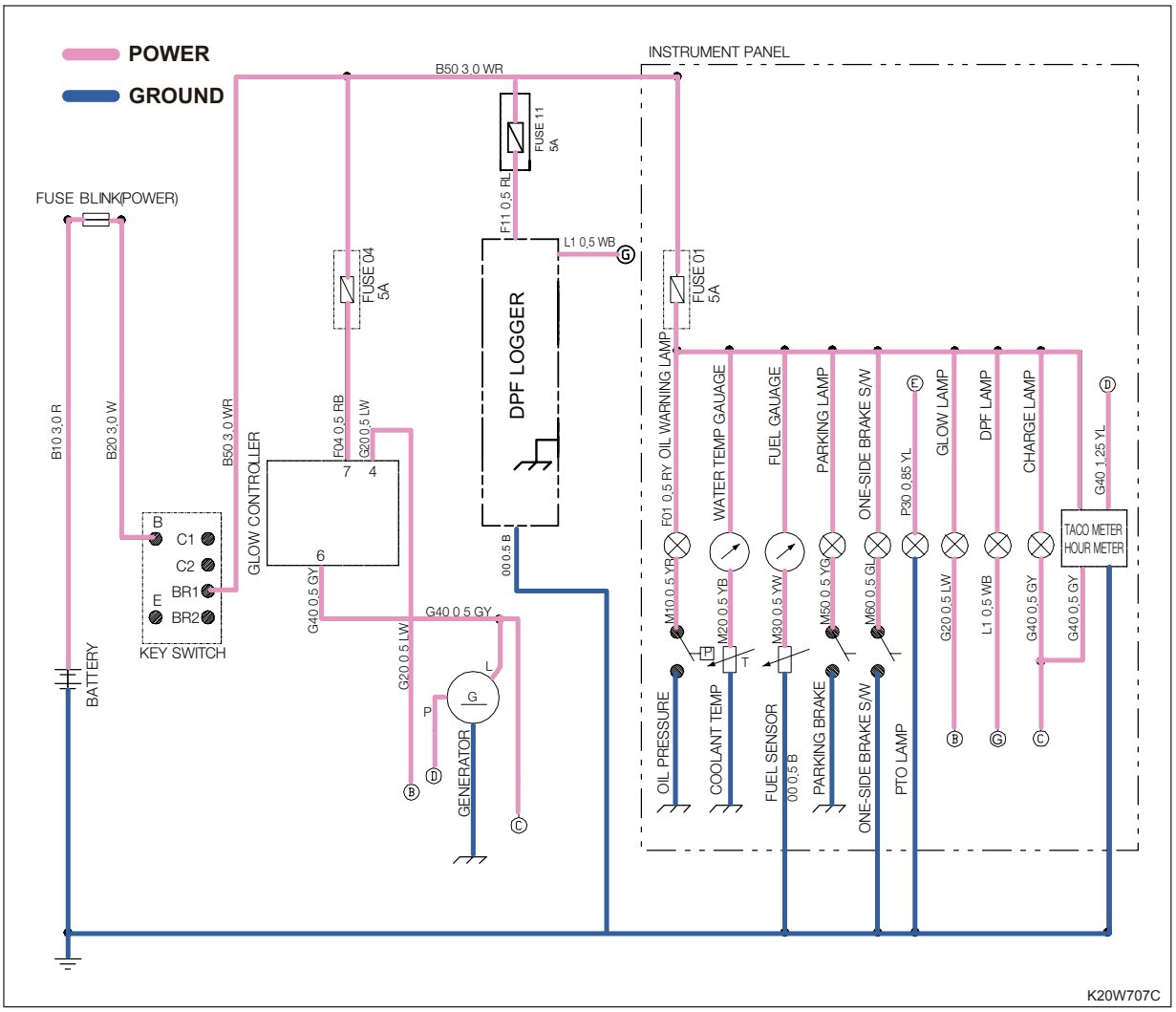
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3) PTO relay and PTO indicator: The PTO relay coil power is supplied through the wiring 0.5YG or 0.5LY depending on the position of the PTO selection switch. The main power of the PTO relay is connected to the ignition switch ON power passed through the 10 A fuse. The main power of the PTO relay is sent through the wiring 0.85YL. It is sent to the instrument cluster through the connecting wiring (E) to inform the driver with the PTO operation status before it reaches the PTO valve. Therefore, the PTO indicator on the instrument cluster can be turned on properly even when the PTO is not operated due to malfunction of the PTO valve. Also, when the PTO selection switch is set in the LINK position, the PTO indicator on the instrument cluster goes off even though the PTO is turned off only temporarily by operation of the driving clutch pedal or lift arm lever. Make sure to maintain high standards of safety in this condition.

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4.5 INSTRUMENT CLUSTER AND SENSORS



The instrument cluster receives its main power through the 5 A fuse when the ignition switch is set to the ON position.

1) Oil pressure warning: The oil pressure warning lamp switch is connected to the ground side of the wiring 0.5RY. It is turned on by controlling electricity supplied to its negative terminal.

2) Coolant temperature gauge: The coolant temperature sensor is connected to the coolant temperature gauge through the wiring 0.5YB. The gauge is operated by controlling the electricity supplied to its negative terminal.

3) Fuel gauge: The fuel gauge is connected to the fuel sensor through the wiring 0.5YW. The fuel gauge on the instrument cluster is operated by controlling electricity supplied to its negative terminal.

4) Parking indicator (optional): The parking indicator is connected to the parking switch through the wiring 0.5YG. The parking indicator on the instrument cluster is operated by controlling electricity supplied to its negative terminal.

5) One-side brake warning lamp (optional): The one-side brake warning lamp is connected to the one-side brake switch through the wiring 0.5GL. This lamp on the instrument cluster is operated by controlling electricity supplied to its negative terminal.

6) PTO indicator (optional): The PTO indicator on the instrument cluster is supplied with '+' power through the connecting wiring (E) and wiring 0.85YL (main power output line of the PTO relay) for its illumination.

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7) **Preheat indicator: The preheat indicator on the instrument cluster is connected to the wiring 0.5LW** (preheat indicator output line of the preheat controller) through the connecting wiring (B). The preheat controller controls electricity supplied to the negative terminal of the indicator to turn it on.

8) **Charge warning lamp: The charge warning lamp is connected to the output terminal L of the generator** through the connecting wiring (C). Therefore, when the generator is not in operation, the ignition switch ON power at the input terminal of the instrument cluster is sent to the ground side through the generator to turn on the charge warning lamp. When the generator is activated to start charging, charging power is sent from the terminal L of the generator. Then, both terminals of the lamp are applied with positive power, making no potential difference. Therefore, the charge warning lamp is turned off when the generator charges normally.

9) **Tachometer: The hourmeter and tachometer have two input terminals and two output terminals. One** input terminal is supplied with ignition ON power (the instrument cluster input power). The other input terminal is connected to the terminal P (alternating current wave terminal) of the generator through the connecting wiring (D) to receive alternating current wave power from the generator. This alternating current wave is converted to the RPM to be displayed on the tachometer on the instrument cluster.

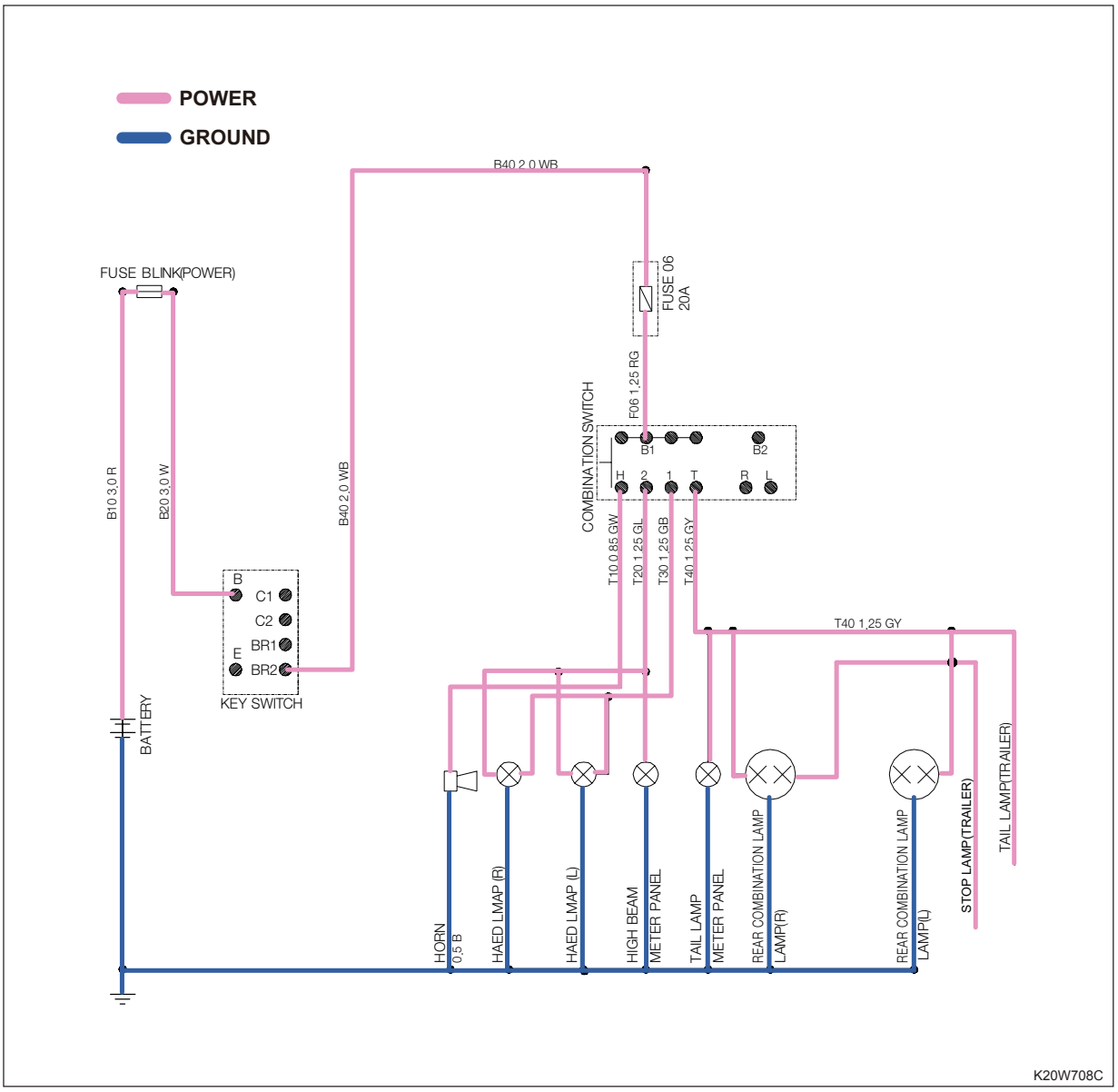
10) **Hourmeter: One of the output terminal of the hourmeter is a ground terminal while the other output** terminal is connected to the terminal L (the direct current output terminal) of the generator through the connecting wiring (C) and wiring 0.5GY. Therefore, the hourmeter is operated as long as the generator is in proper operation.

11) **DPF lamp: The DPF lamp is connected to the wiring 0.5WB (DPF lamp output line of the DPF** LOGGER) through the connecting wiring (G). Therefore, the DPF lamp is turn on when the DPF operating signal is sent to the instrument cluster by the DPF LOGGER.

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4.6 COMBINATION SWITCH AND HEAD LAMP



The combination switch receives power from the terminal ACC of the ignition switch through the wiring 1.25RG and 20 A fuse.

1) **Horn: The terminal H, which is located in the left end position among the terminals of the combination** switch, is connected to the horn through the wiring 0.85GW to activate the horn when the horn switch is pressed.

2) **High beam: The terminal No. 2 of the combination switch is connected to the head lamp high beam** through the wiring 1.25GL. It is also connected to the high beam indicator on the instrument cluster.

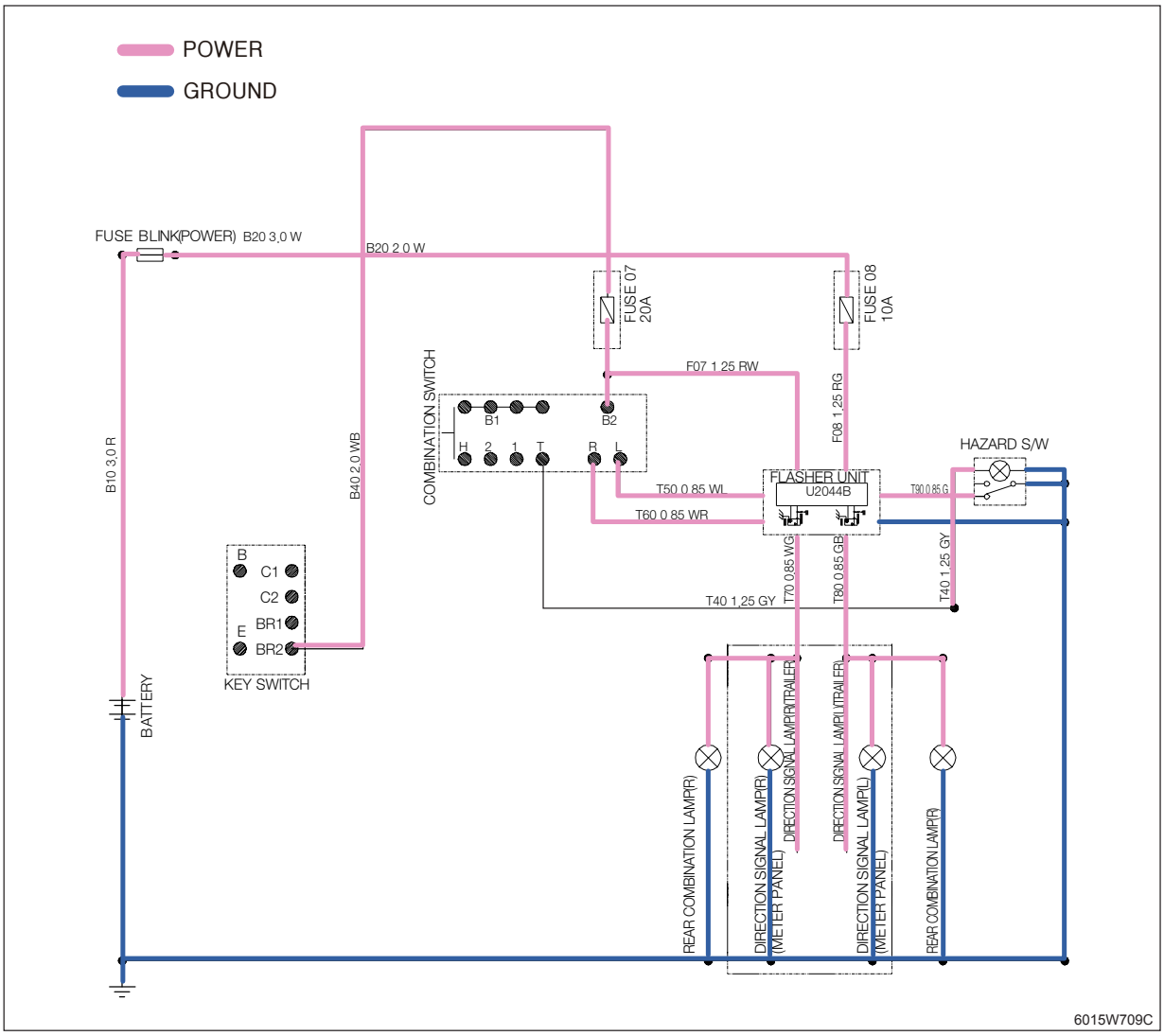
3) **Low beam: The terminal No. 1 of the combination switch is connected to the head lamp low beam** through the wiring 1.25GB. As shown in the circuit diagram, the high beam and low beam bulbs are integrated into one unit which receives power for both beams.

4) **Position/Tail lamp: The terminal T of the combination switch is for the position lamp or tail lamp. It is** connected to the front/rear combination lamp and instrument cluster illumination lamp through the wiring 1.25GY.

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4.7 TURN SIGNAL LAMP SWITCH, HAZARD WARNING FLASHER AND FLASHER UNIT



The turn signal lamp switch of the combination switch receives power from the terminal ACC of the ignition switch through a separate 20 A fuse.

1) **Right turn: When setting the turn signal lamp switch to the right turn position, power is supplied to the** flasher unit from the terminal R through the wiring 0.85WR. Then the flasher unit changes continuous power to intermittent power supplied to the front combination lamp, rear combination lamp and right turn signal indicator on the instrument cluster to make each lamp flicker.

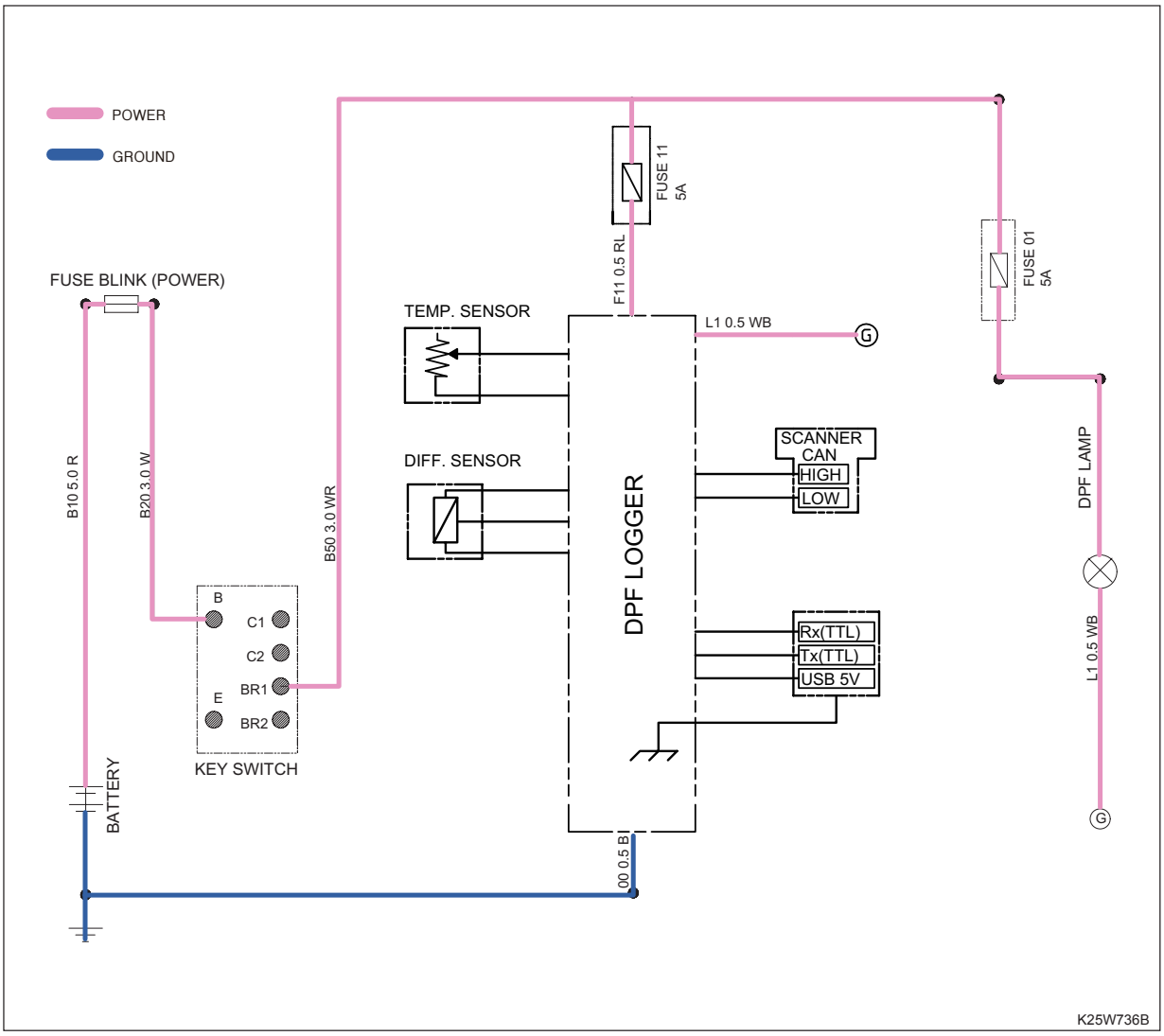
2) **Left turn: When setting the turn signal lamp switch to the left turn position, power is supplied to the** flasher unit from the terminal L through the wiring 0.85WL. Then the flasher unit changes continuous power to intermittent power supplied to the front combination lamp, rear combination lamp and left turn signal indicator on the instrument cluster to make each lamp flicker.

The flasher unit has two input power wirings. One is the wiring 1.25RW which receives power from the terminal ACC of the ignition switch. It branches off after the turn signal lamp fuse (20 A) and is connected to the flasher unit. The power from the terminal ACC is used for the turn signal lamp when the flasher unit receives a turn signal lamp signal from the turn signal lamp switch. The other input wiring is the wiring 2.0W which supplies power directly from the battery through the 10 A fuse. This power is used for the turn signal lamps on both sides when the hazard warning flasher switch is activated. This power is also used by the fusible link for the ignition switch. Also, power for the hazard warning flasher is supplied to the hazard warning flasher of the trailer as well.

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4.8 DPF LOGGER [3015R(h)/3515R(h)/4015R(h)]



When the ignition switch is turned to the ON position, power flows through the wiring 3.0WR to be delivered to the DPF logger through the fuse No. 11 (5 A).

If a faulty condition is detected by the differential pressure sensor of the DPF, the corresponding signal is delivered to the instrument cluster through Ⓖ to turn on the DPF warning lamp.

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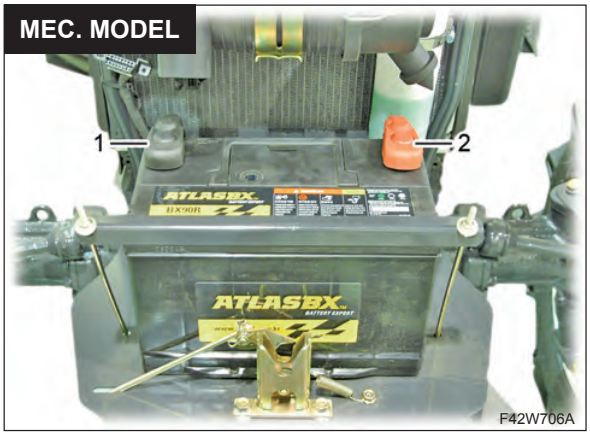
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5. SERVICE TIPS AND COMPONENTS OF ELECTRIC SYSTEM

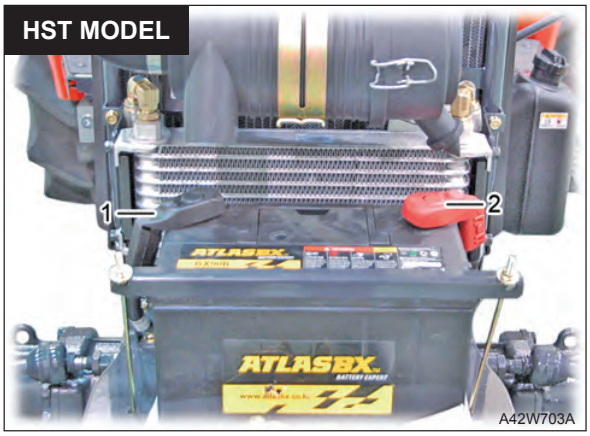
5.1 SERVICE TIPS

5.1.1 BATTERY

MEC. MODEL



HST MODEL



1. Stop the engine and remove the ignition key.
2. Open the hood and disconnect the negative battery cable (1) first and then the positive battery cable (2).
3. Unscrew the bolt from the battery mounting to remove the battery.
4. Replace the battery with a new one if necessary.
5. When re-installing the battery, connect the positive cable first and then the negative cable firmly.

Notes

- **Loose battery terminal can cause a spark or poor charging performance.**
- **If the cable terminal is contaminated, clean it thoroughly and apply grease on it.**

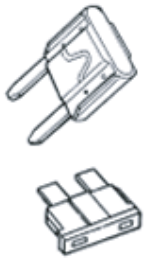
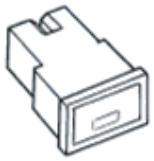
⚠ CAUTION

- **Keep flames or sparks away from the battery. It can explode due to gas production during its operation.**
- **As the battery discharges naturally, charge it every month (for 8 to 10 hours at 7 A).**
- **Make sure to use the battery with the specified capacity.**
- **Be sure to attach the rubber boots to the battery positive terminal and booster terminal.**

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5.1.2 FUSE

FUSE	 6015W702A
FUSIBLE LINK	 6015W703A
SLOW-BLOW FUSE	 6015W704A

If any electric part is malfunctioning, check the fuse first.

1. Make sure to use the fuse with the specified capacity.
2. Check if any fusible link is open.

Notes

- **When continuity is detected by touching both terminals with a tester, it is normal. If continuity is not detected, replace the part with a new one.**

3. Check that the slow-blow fuse is bolted into the slow-blow fuse box to the specified torque firmly.

⚠ CAUTION

- **Do not replace the fuse with other metal wires or aluminum foil. It can lead to electric shock and fire.**
- **If the nut of the slow-blow fuse is not tightened firmly, it can cause a fire. Make sure to tighten it firmly.**

5.1.3 ELECTRIC WIRING

1. If any electric part is malfunctioning, check its electric wiring.
2. Check if the electric wiring is in contact with another part, it is peeled off or its contact is loose.

   If it is peeled off, wind insulating tape around it.
3. If water enters the contact area, it can cause malfunction. Wipe out any moisture and dry it sufficiently.
4. Try to disconnect and re-connect any related connectors. Check if a terminal is misaligned or improperly engaged.
5. Inspect it regularly with the engine running after every 50 hours of use or after every season even though there is no apparent sign of damage.

⚠ WARNING

- **Never attempt to modify electric wirings of the machine. It can cause a fire.**

Notes

▶ **INSPECTION ORDER FOR ELECTRIC SYSTEM AND CIRCUIT FAILURE**

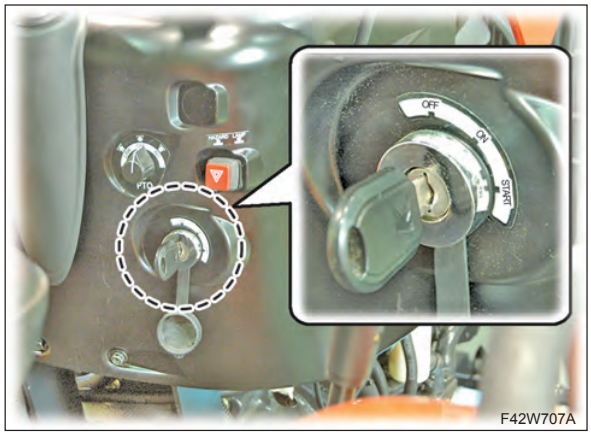
- **Battery → Fusible link → Fuse → Ignition relay → Switch → Load**

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5.2 COMPONENTS

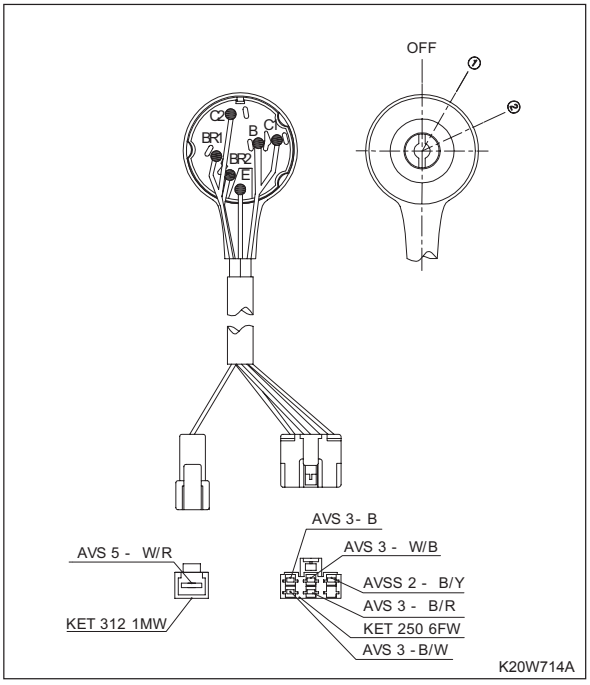
5.2.1 IGNITION SWITCH



The ignition switch is installed on the dashboard from the right side of the steering wheel. When turning the ignition switch clockwise to the first position, "ON" is selected. When turning it to its end, the engine is started.

When releasing the switch as soon as the engine is started, the switch is automatically returned to the ON position.

▶ **CONNECTOR AND WIRING DIAGRAM**



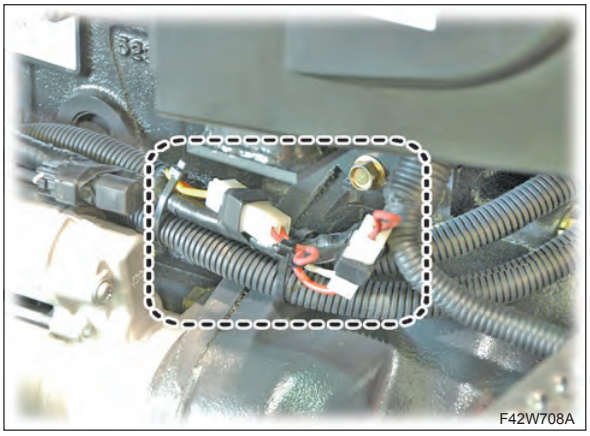
ITEM		TERMINAL SYMBOL				
		B	BR1 BR2	C1	C2	E
SWITCHING POSITION	OFF		●			●
	①	●	●			
	②	●	●			
		●		●		
		●			●	

7

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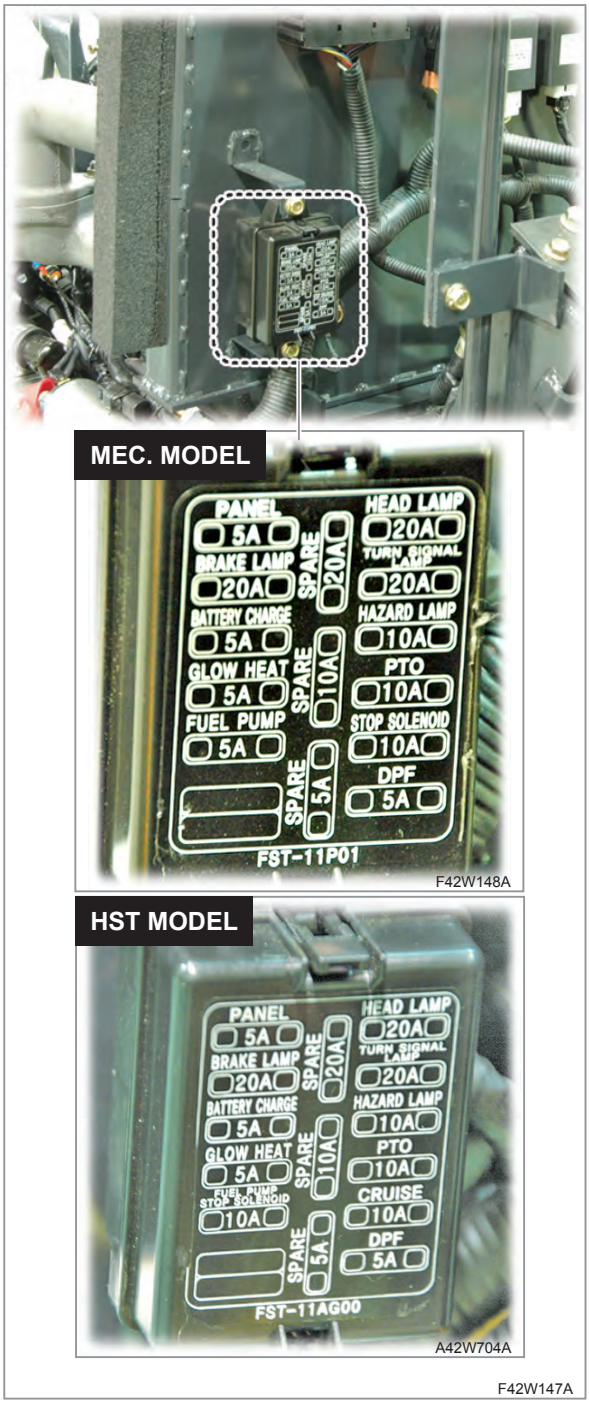
5.2.2 FUSIBLE LINK


F42W708A

The fusible link is installed on the top of the starter in the left section of the engine compartment. If malfunction occurs in any electric system but the battery is intact, check the condition of the fusible link first.

There are two 60 A fusible links. One is for main power and the other one is for preheating.

5.2.3 FUSE BOX



The fuse box is installed on the left lower section of the bonnet hinge assembly.

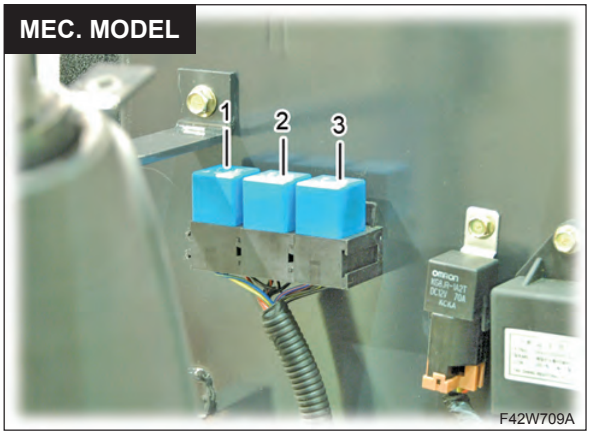
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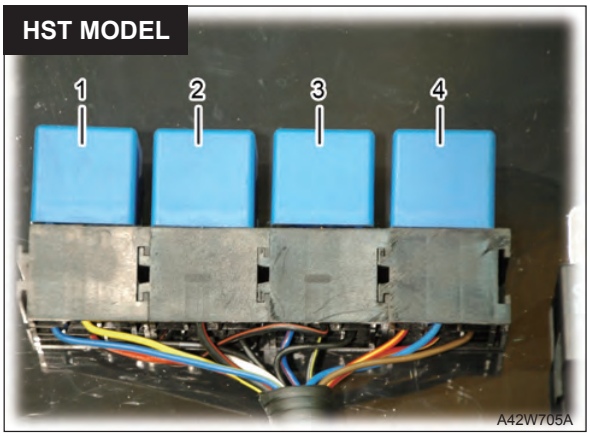
Fuse 1 (5 A): Panel
Fuse 2 (20 A): Brake lamp
Fuse 3 (5 A): Battery charge
Fuse 4 (5 A): Glow/Heat
Fuse 5 (5 A): Fuel pump [MEC. MODEL]/
Fuel pump, Stop solenoid [HST MODEL]
Fuse 6 (5 A, 10 A, 20 A): Spare
Fuse 7 (20 A): Head lamp
Fuse 8 (20 A): Turn signal lamp
Fuse 9 (10 A): Harzard lamp
Fuse 10 (10 A): PTO
Fuse 11 (10 A): Stop solenoid [MEC. MODEL]/
Cruise [HST MODEL]
Fuse 12 (5 A): DPF [3015R(h)/3515R(h)/4015R(h)]

5.2.4 RELAY 5P

MEC. MODEL



HST MODEL



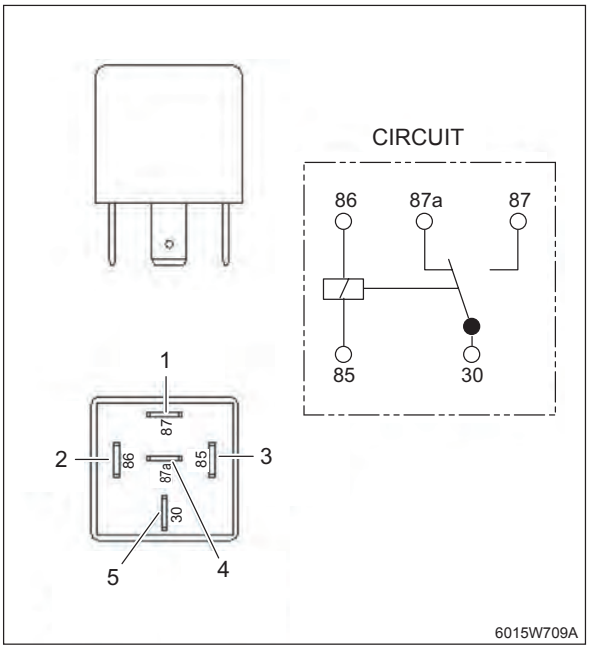
(1) Safe start relay (PTO)
(2) Starter relay
(3) PTO relay
(4) Cruise relay

The relay 5P is installed on the upper left section of the bonnet hinge assembly to supply power to functions for each operating device.

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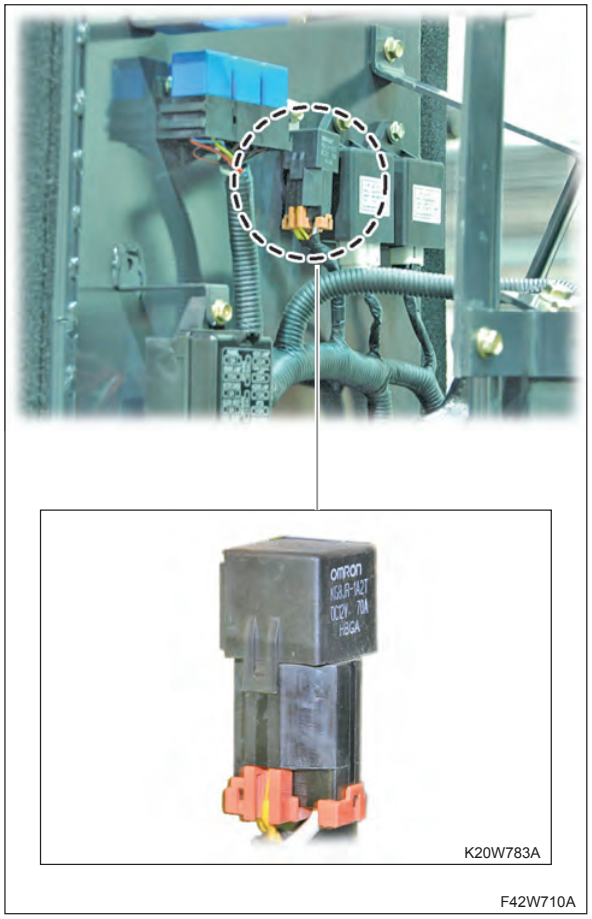
https://truckmanualshub.com/

▶ CONNECTOR AND TEST



ITEM	TESTING LOCATION		RESULT
	⊕ TERMINAL	⊖ TERMINAL	
Resis-tance	②	③	Approx. 87 Ω
Resis-tance	①	④	0Ω present
Conti-nuity	①	⑤	∞Ω not present

5.2.5 PREHEAT RELAY

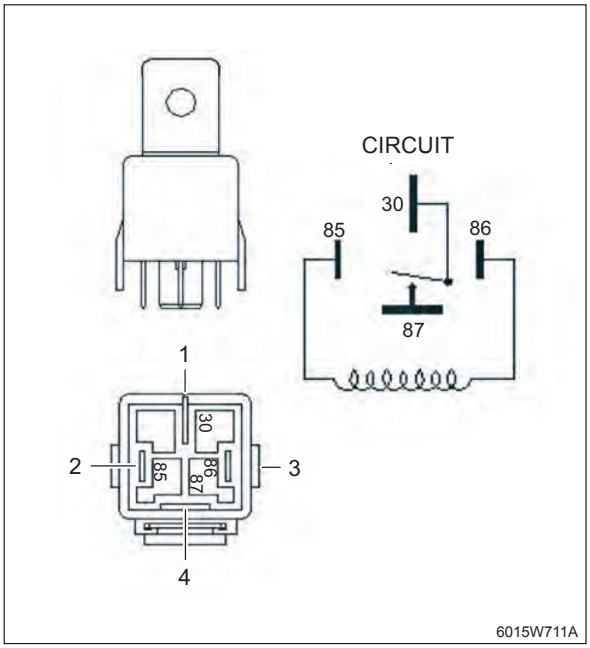


The preheat relay is installed on the upper middle section of the bonnet hinge assembly to supply power to the glow plug.

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▶ CONNECTOR AND TEST

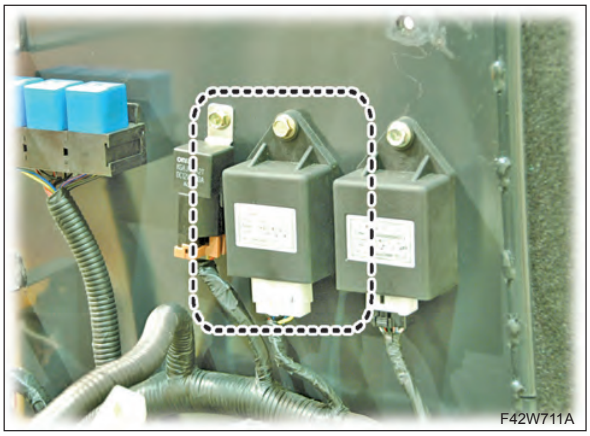


TERMINAL NO.	RESISTANCE (Ω)
① and ②	∞
③ and ④	∞
② and ③	Some Ω (continuity present)

Applying (+) to ③ and (-) to ②

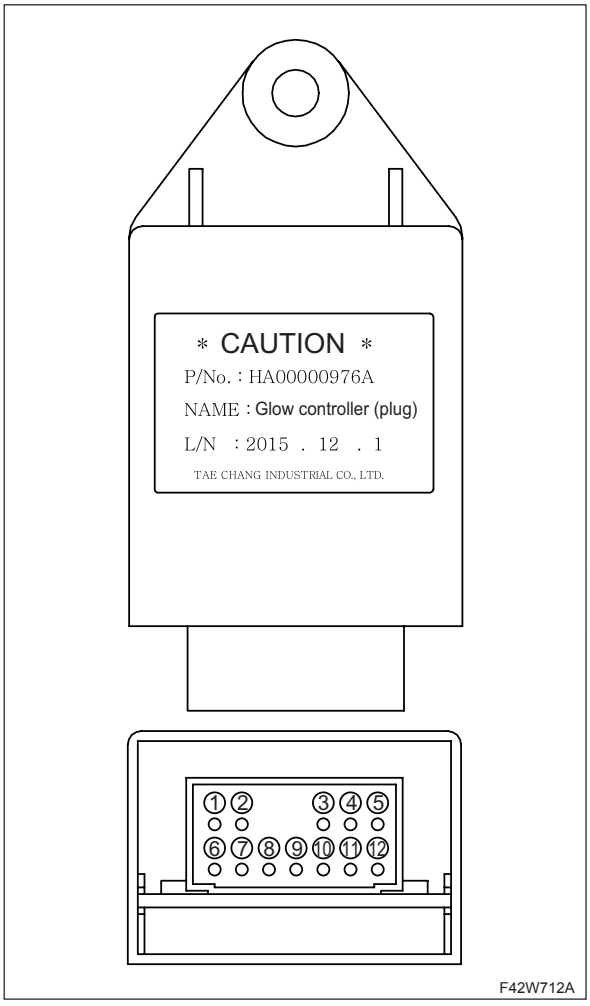
TERMINAL NO.	RESISTANCE (Ω)
① and ④	0

5.2.6 PREHEAT CONTROLLER



The preheat controller is installed on the upper right section of the bonnet hinge assembly. It receives a signal from the coolant temperature sensor to adjust the preheating time, turns on the preheat indicator on the instrument cluster, and detects a signal from the generator to turn off the charge warning lamp.

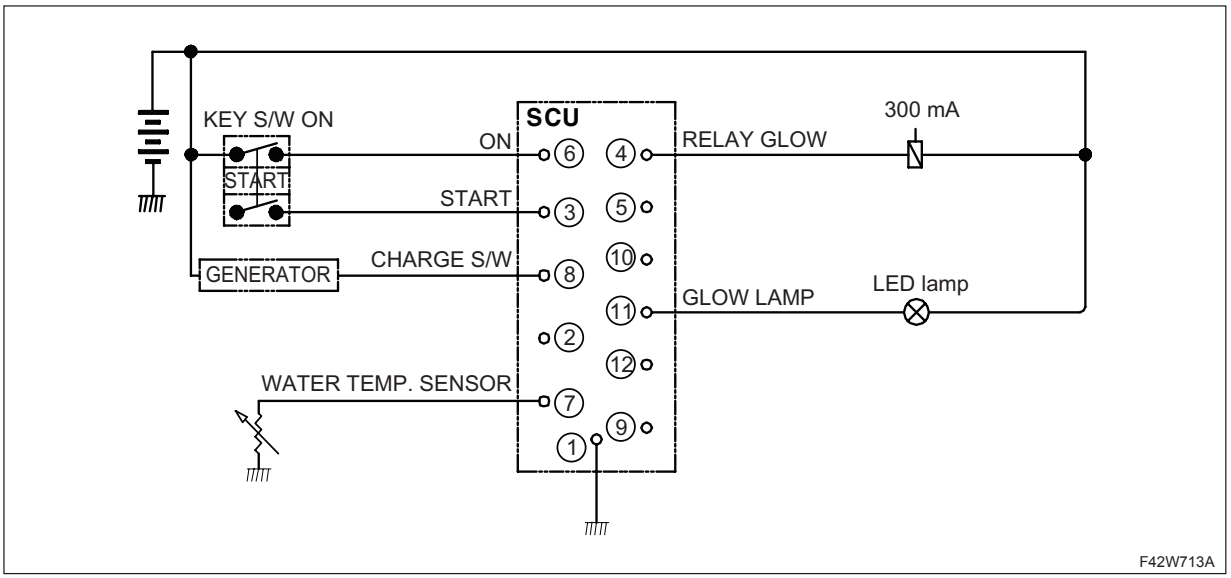
▶ CONNECTOR AND CIRCUIT DIAGRAM



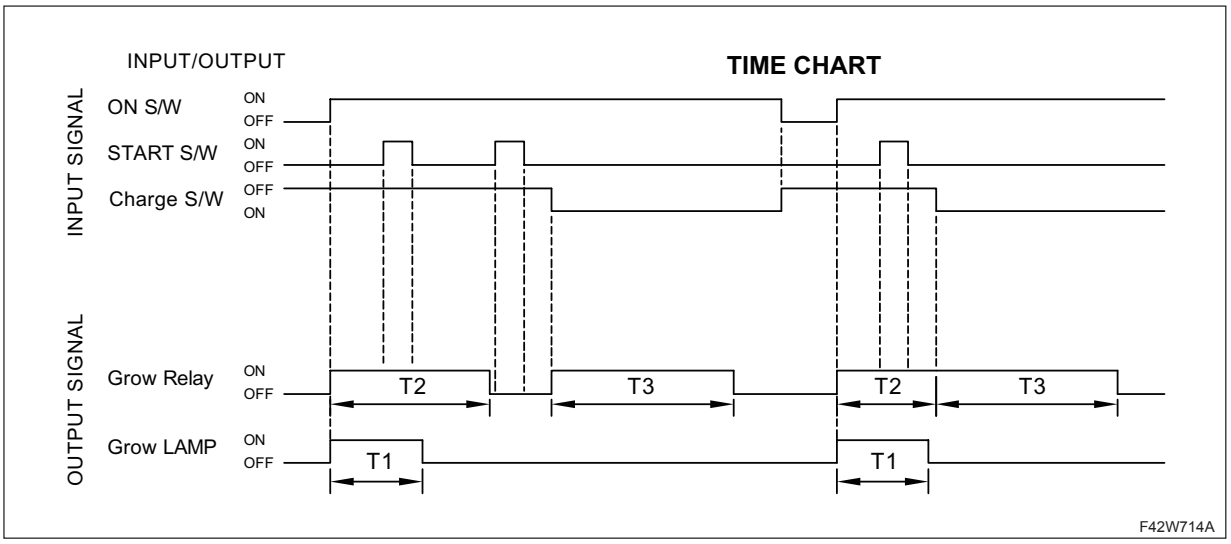
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▶ CONTACT DIAGRAM



▶ OPERATING SEQUENCE AND CHARACTERISTICS

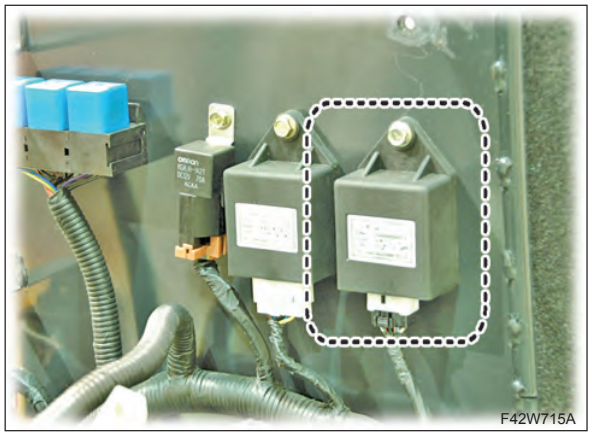


ITEM	WATER TEMP. SENSOR RESISTANCE (KΩ)	TIME (SEC.)	REMARKS
T1: Indicator ON time (sec.)	19.5 (-30℃)	14.0 ± 3.5	-
	9.6 (-15℃)	10.0 ± 3.0	
	1.2 (+40℃)	4.0 ± 1.5	
T2: Preheating time (sec.)	4.5 (+5℃)	30.0 ± 8.0	Relay (37 Ω)
	2.8 (+40℃)	5.0 ± 1.3	
T3: After-heating time (sec.)	1.2 (+40℃)	120 ± 30	
	0.6 (+60℃)	5.0 ± 1.3	

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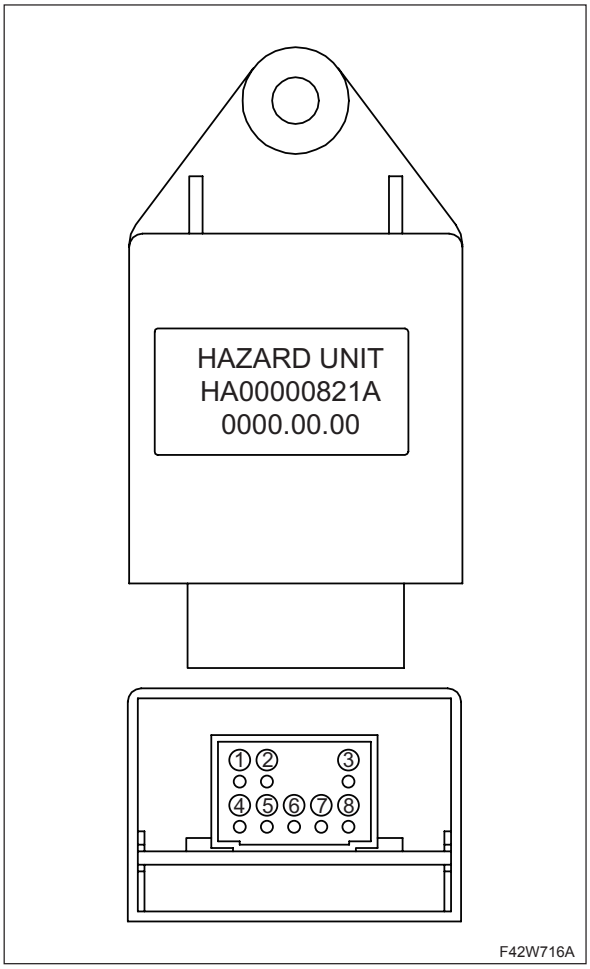
5.2.7 FLASHER UNIT


F42W715A

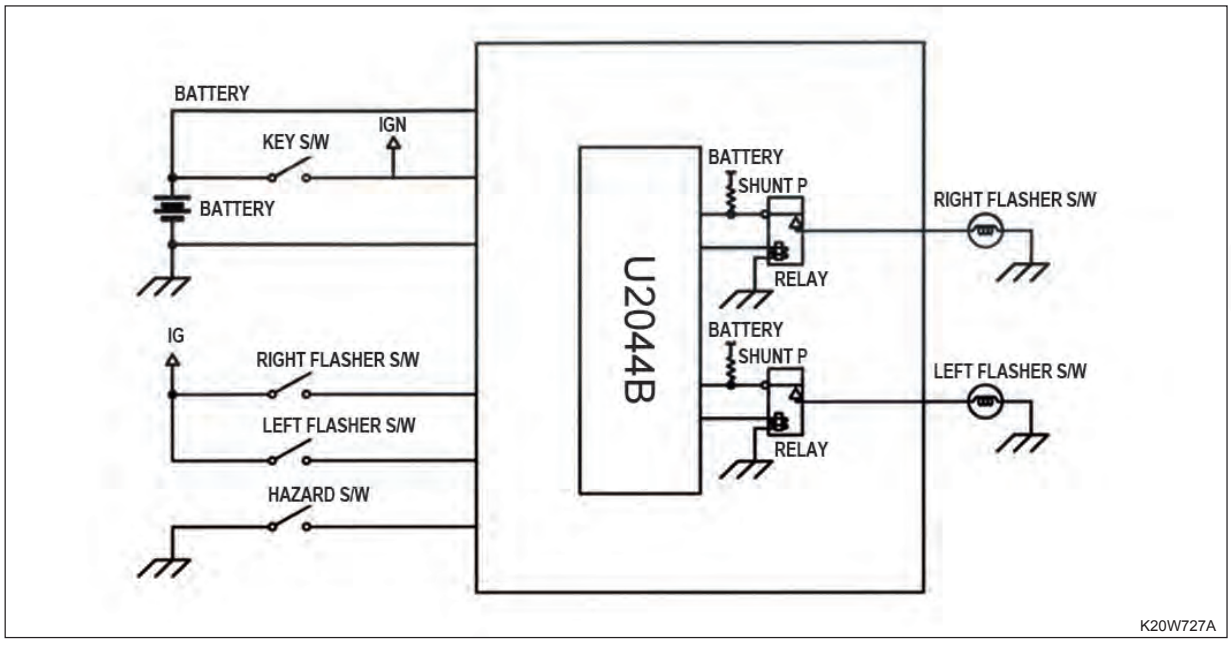
The flasher unit is installed beside of the preheat controller on the upper right section of the bonnet hinge assembly. It makes the turn signal lamps blink when the flasher switch is operated.

NO.	PIN NAME
1	RIGHT FLASHER LAMP
2	LEFT FLASHER S/W
3	RIGHT FLASHER S/W
4	BATTERY
5	LEFT FLASHER LAMP
6	IG (+)
7	HAZARD S/W
8	GND

▶ **CONNECTOR AND CIRCUIT DIAGRAM**



F42W716A

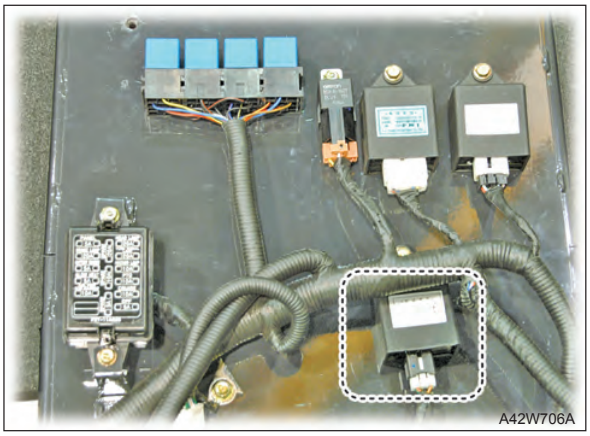


K20W727A

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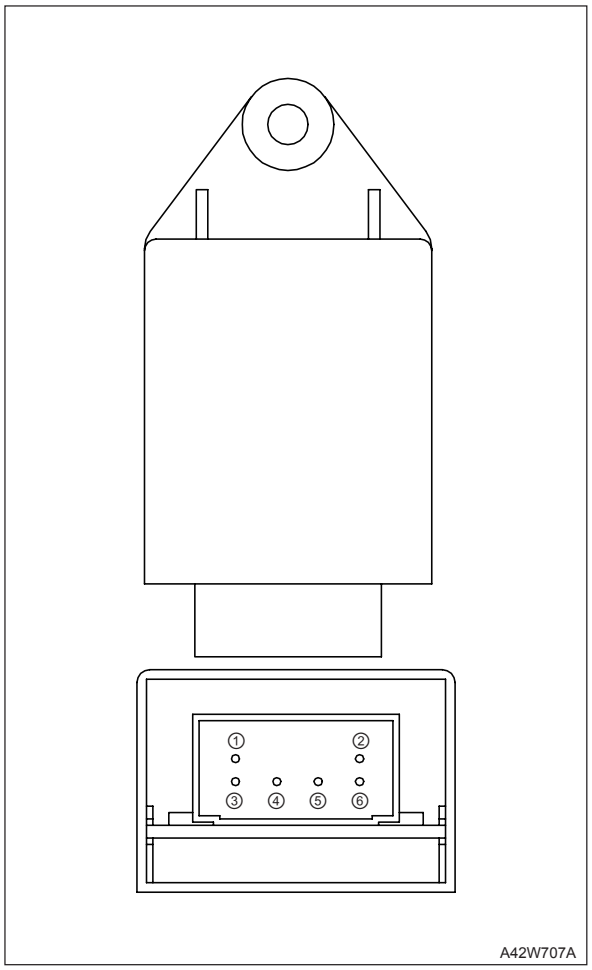
https://truckmanualshub.com/

5.2.8 CRUISE CONTROLLER [HST MODEL]

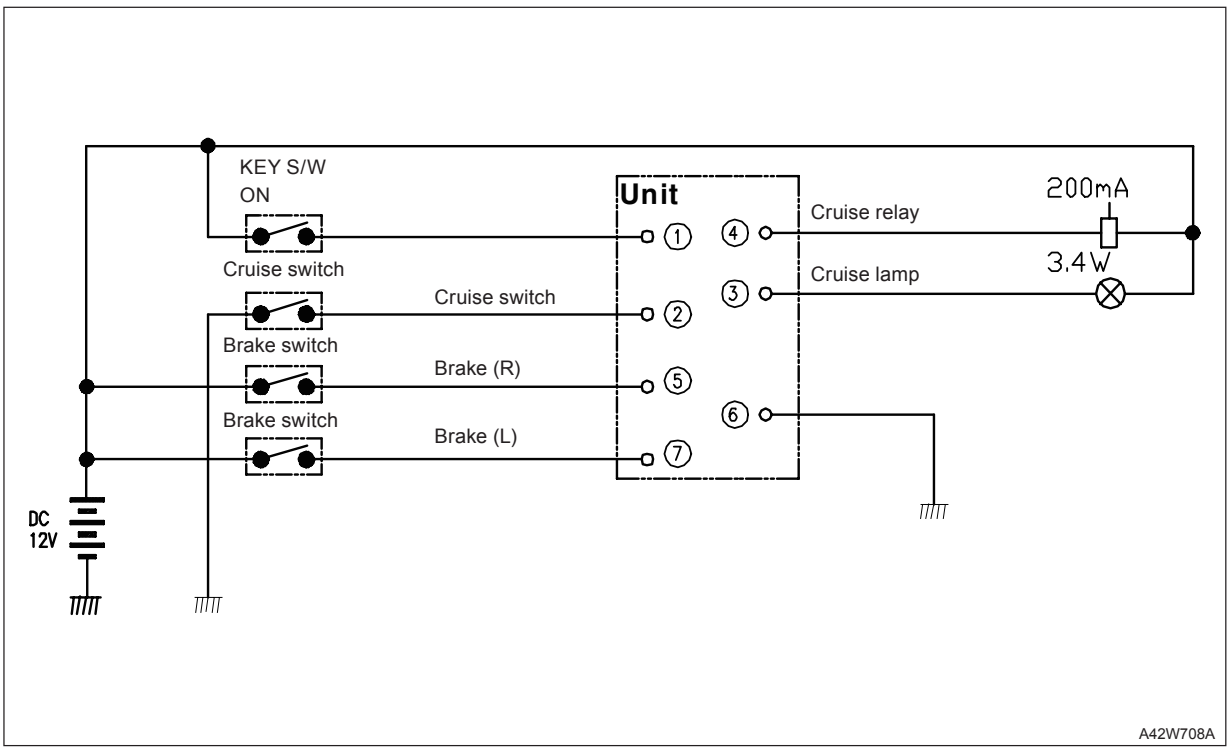

A42W706A

The cruise controller is installed on the right lower section of the hood hinge to control the cruise control relay and cruise control lamp for the cruise control operation.

▶ CONNECTOR AND CIRCUIT DIAGRAM



A42W707A

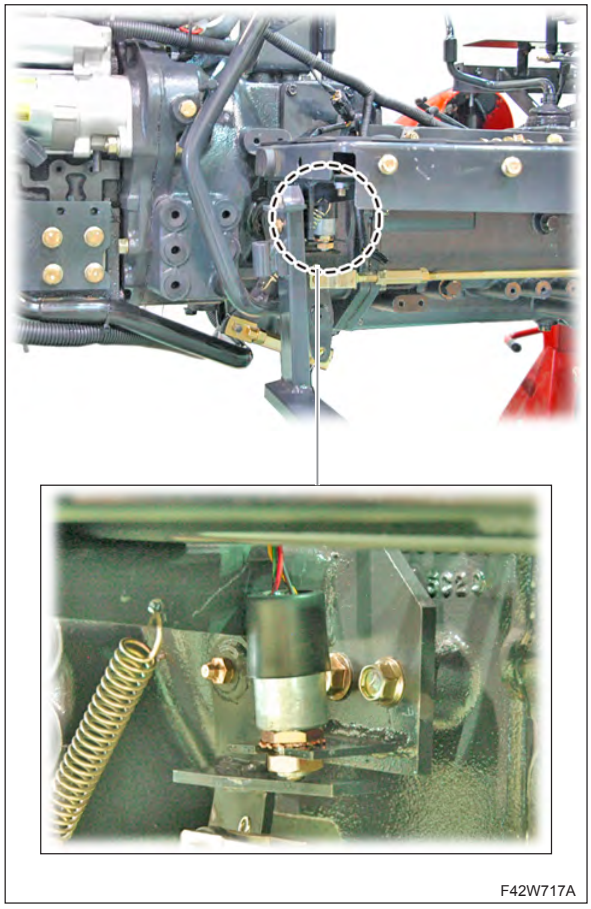


A42W708A

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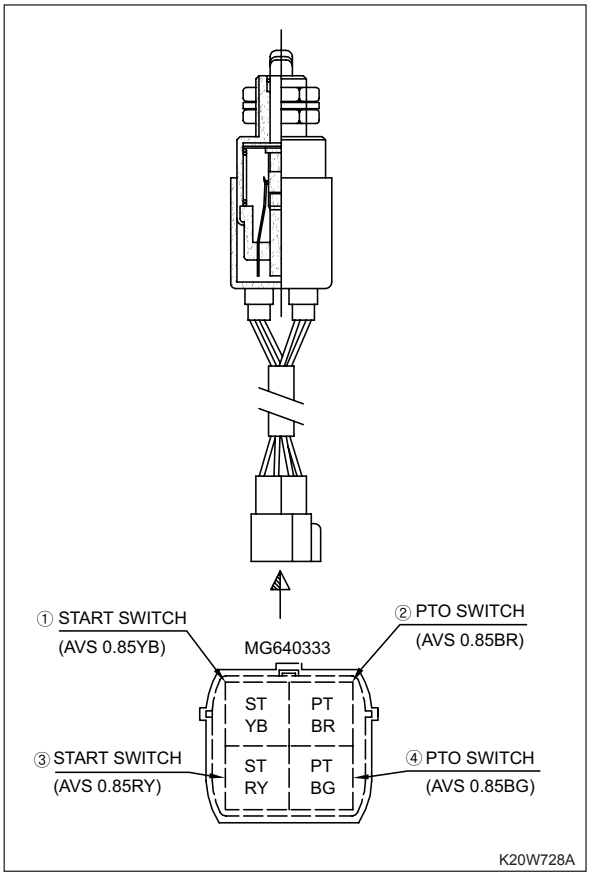
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5.2.9 SAFE START SWITCH [MEC. MODEL]



The safe start switch is installed under the left foot rest. This switch is to prevent the engine from starting when the clutch pedal is not depressed.

▶ CONNECTOR AND TEST



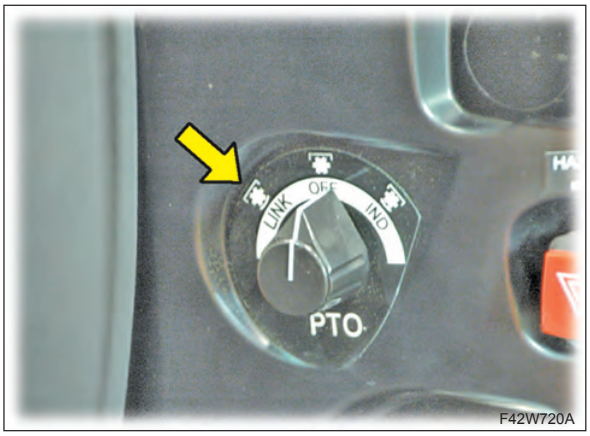
ITEM	CONNECTION		STATUS	RESULT
	+	—		
Resistance	1	3	Clutch pedal depressed	0Ω
	2	4		

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5.2.10 PTO ENGAGEMENT SWITCH

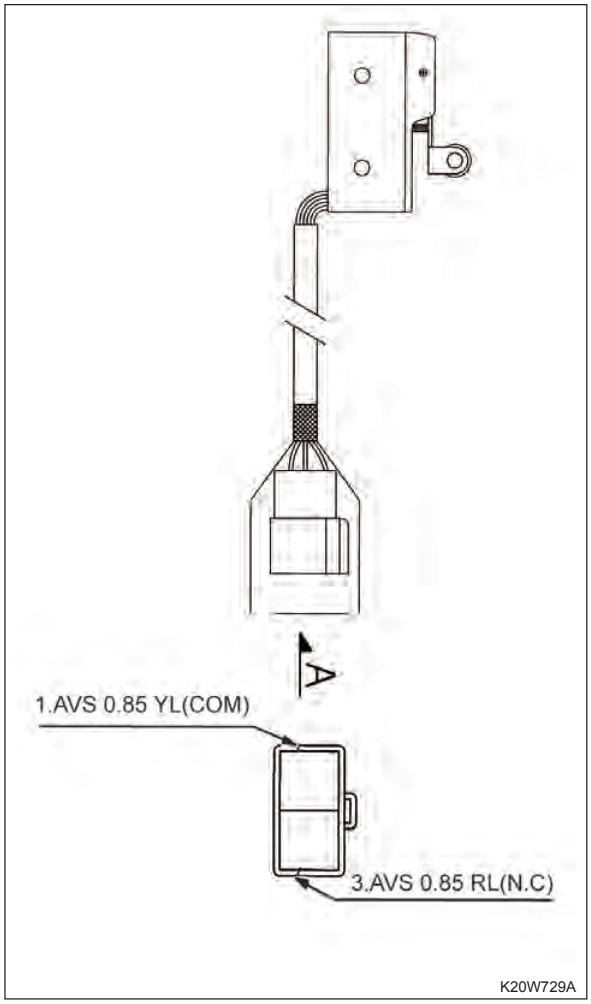

F42W719A



F42W720A

The PTO engagement switch is installed to the side of the lift arm on the left side of the hydraulic cylinder case. When the PTO selection switch is set to the LINK position, this switch stops the PTO as soon as it detects the lift arm reaching the set height.

▶ CONNECTOR



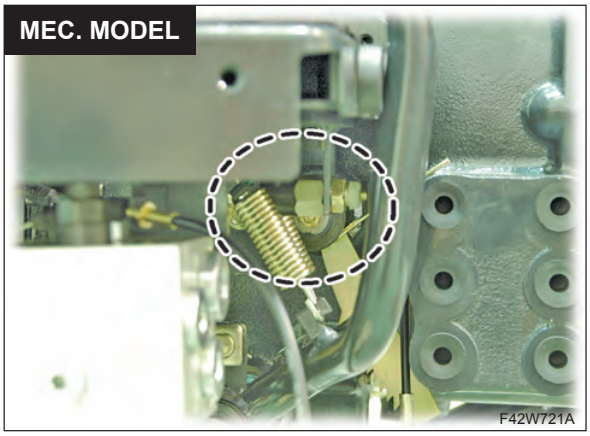
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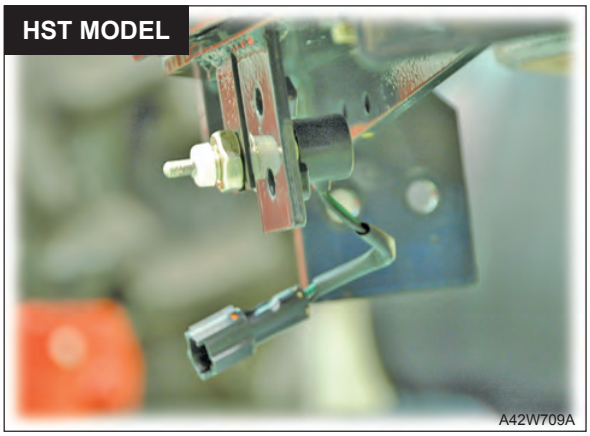
5.2.11 STOP LAMP SWITCH

MEC. MODEL



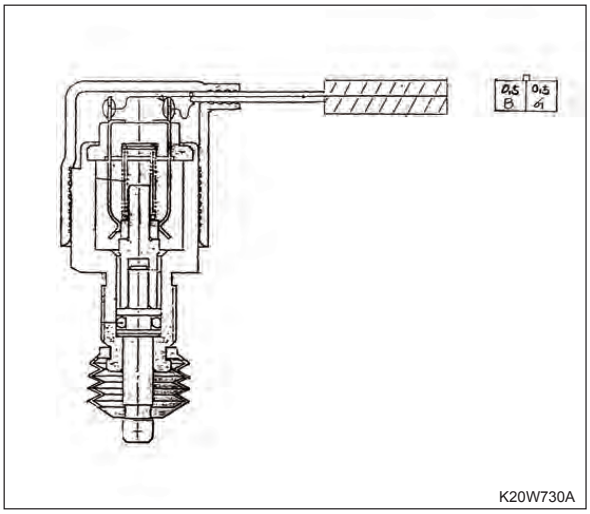
The stop lamp switch is installed under the right foot rest. According to operation of the brake pedal, the switch contact is connected so the stop lamps of the rear combination lamps are turned on.

HST MODEL

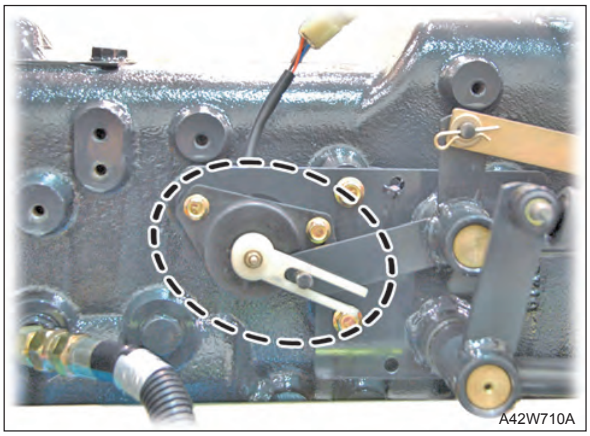


The stop lamp switch is installed under the left foot rest.

▶ **CONNECTOR**

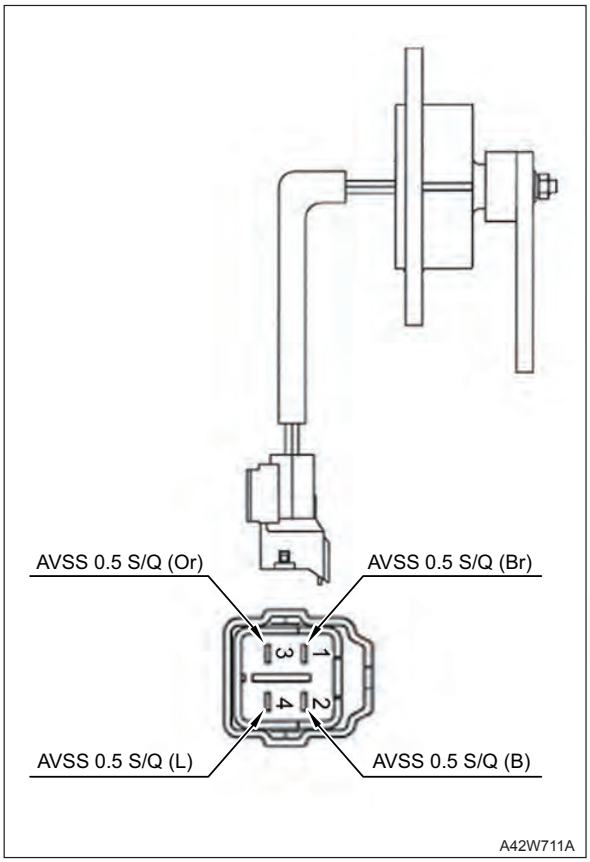


5.2.12 SAFETY START NEUTRAL SWITCH [HST MODEL]



The safe start neutral switch is installed on the rear section of forward pedal. This switch detects the pedal position and to prevent the engine from starting when the switch is not neutral.

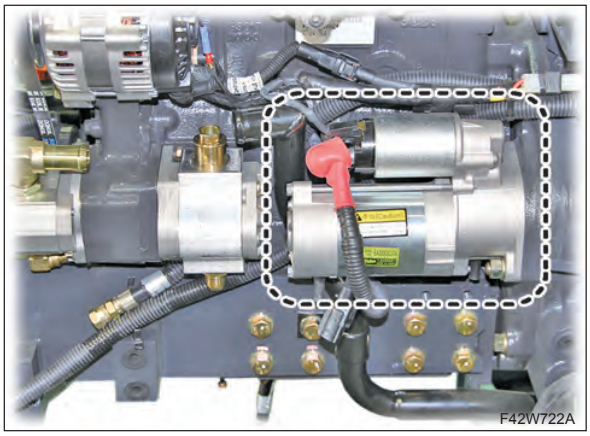
▶ **CONNECTOR**



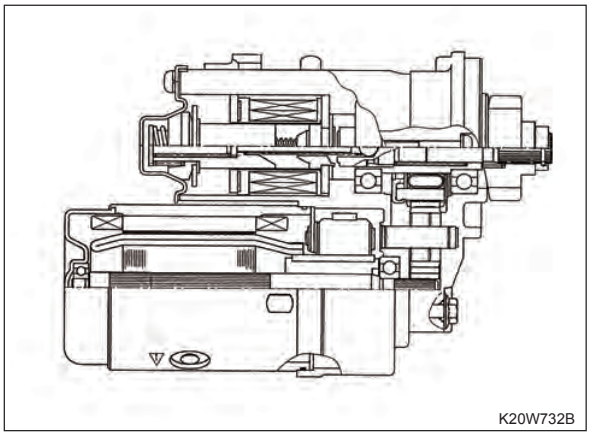
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5.2.13 STARTER

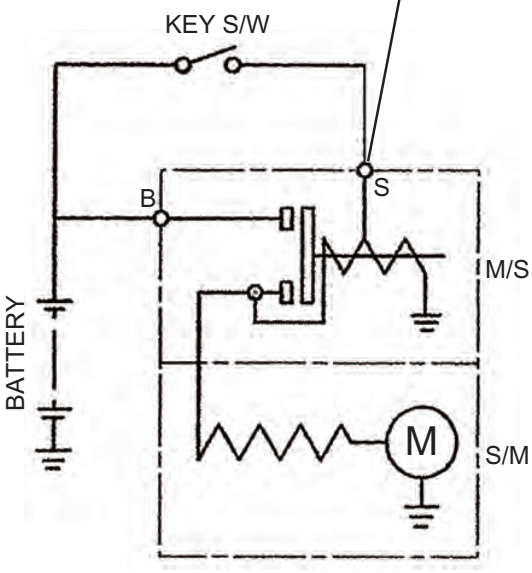


The starter is installed to the rear left section of the engine.



▶ CIRCUIT DIAGRAM

MAGNET SWITCH SPEC.	
RUSH CURRENT	60A or less (11V 20°C)
HOLDING CURRENT	15A or less (11V 20°C)



F42W756A

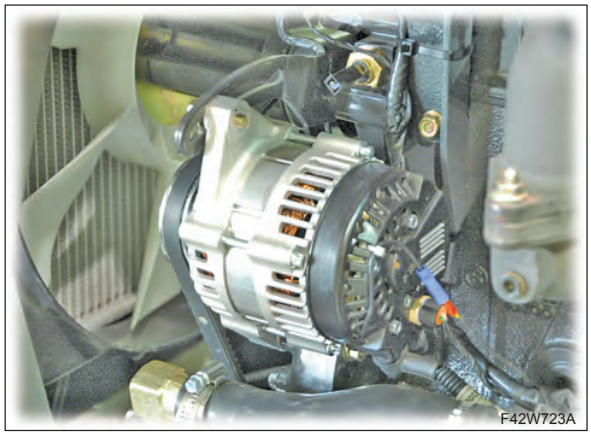
▶ SPECIFICATION

NOMINAL POWER	2.2 kw
VOLTAGE	12 V
RATED TIME	30 sec.
ROTATION	Clockwise (when seeing from pinion side)
WEIGHT	Approx. 5.2 kg

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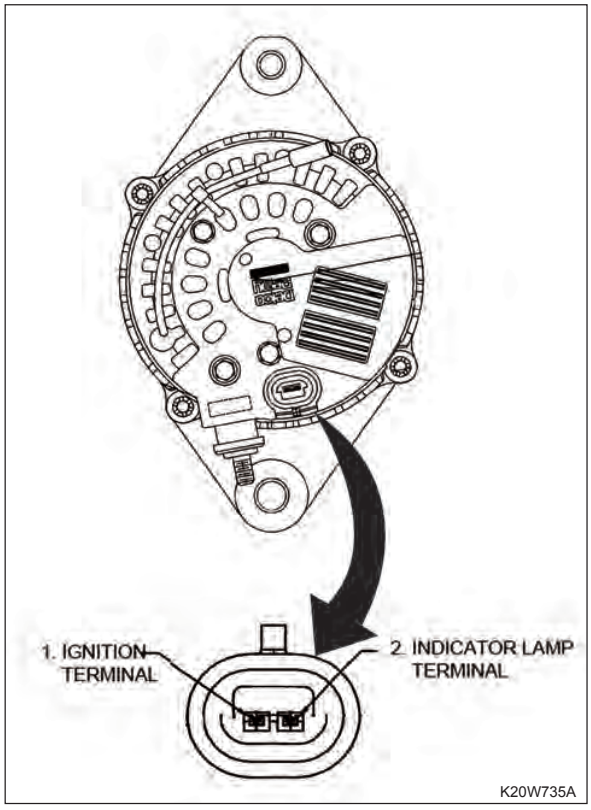
5.2.14 ALTERNATOR



The alternator is installed in the left front section of the engine and it is integrated with the IC regulator.

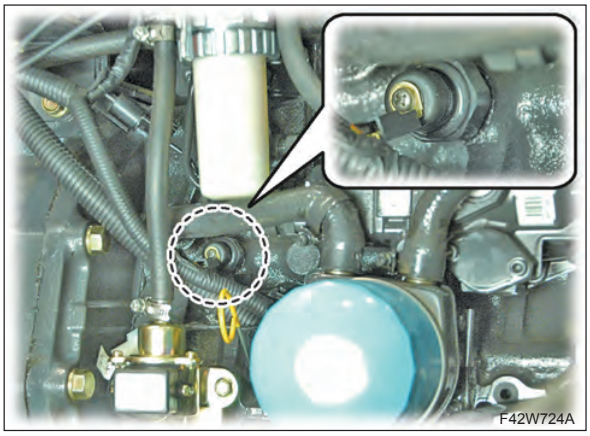
It supplies power to components with high electric load and charges the battery.

▶ CONNECTOR TEST



ITEM	CONNECTION		STATUS	RESULT
	+	−		
CONNECTOR DC POWER	1	Ground (Chassis)	Ignition switch ON	Approx. 12 V
	2	Ground (Chassis)		

5.2.15 ENGINE OIL PRESSURE SWITCH



The engine oil pressure switch is installed to the cylinder block on the right side of the engine. When pressure is built in the engine, the contact of the oil pressure switch is connected to send a signal to the instrument cluster assembly.

When the pressure in the engine drops below 0.5 ± 0.1 kgf/cm^2, the engine oil pressure warning lamp on the instrument cluster comes on.

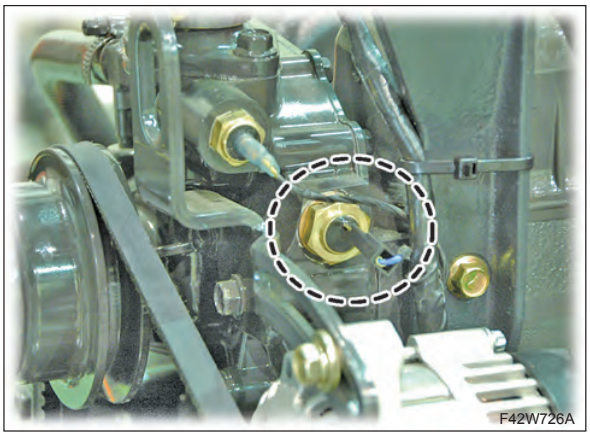
▶ CONNECTOR TEST

ITEM	CONNECTION		STATUS	RESULT
	+	−		
Resis-tance	A	Ground (Chassis)	Engine stopped	0 Ω
			Engine running	∞ Ω
DC power	B		Oil pressure warning lamp 「ON」 Ignition switch 「ON」	12 V

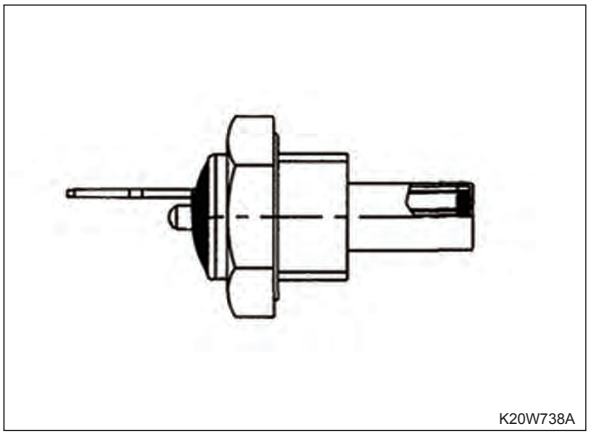
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5.2.16 COOLANT TEMPERATURE SENSOR (PREHEATING)



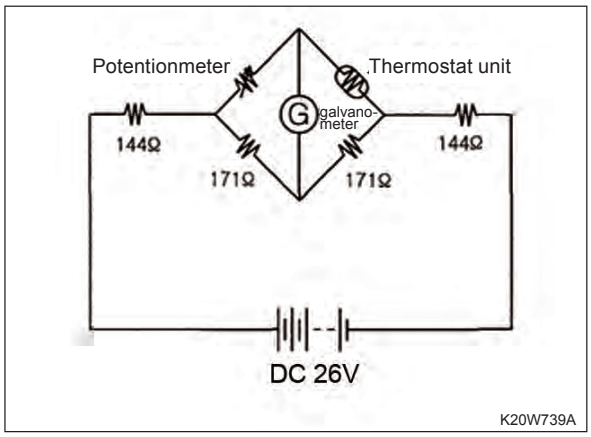
The coolant temperature sensor (preheating) is installed to the coolant flange behind the cooling fan, It sends various resistance values according to the coolant temperature to the instrument cluster to display the coolant temperature on the coolant gauge.



▶ RESISTANCE BY COOLANT TEMPERATURE

TEMPERATURE (℃)	-30	-15	10	20	40
RESISTANCE DIFFERENCE (Ω)	19.5	9.6	3.4	2.4	1.2

▶ MEASURING CIRCUIT



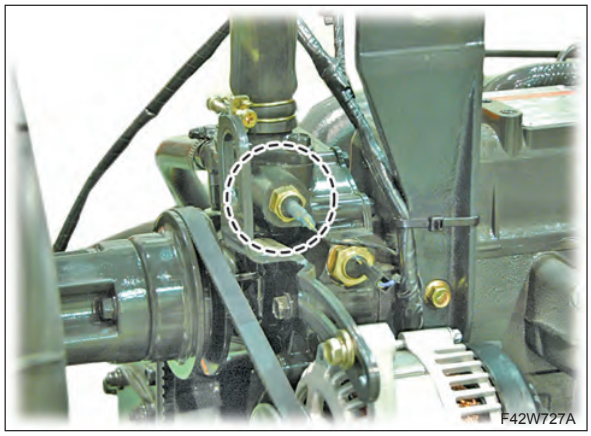
▶ SENSOR TEST

ITEM	CONNECTION		STATUS	RESULT
	+	—		
Resis-tance	1	Ground (Chassis)	–	Resistance changed by coolant temperature
DC power	2	Ground (Chassis)	Ignition switch 「ON」	Approx. 12 V

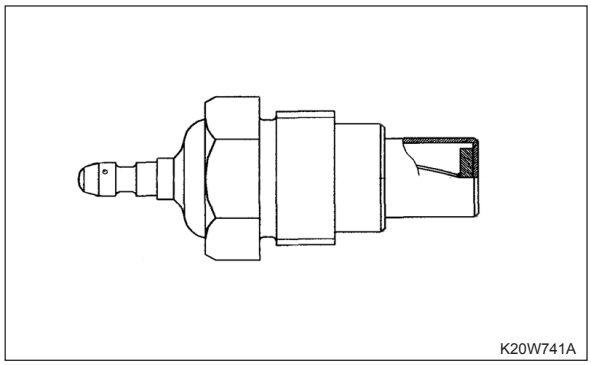
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5.2.17 COOLANT TEMPERATURE SENSOR (METER)



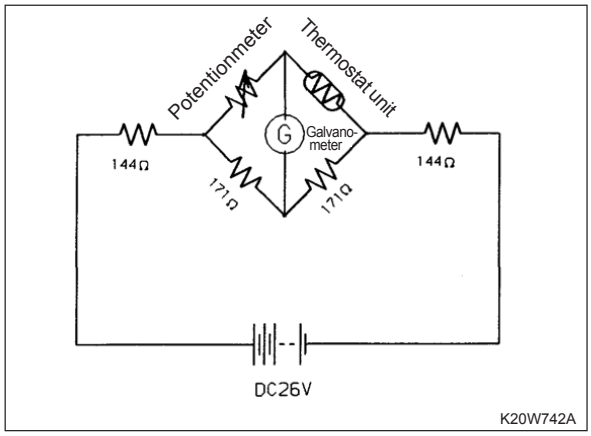
The coolant temperature sensor (meter) is installed to the outlet of the heater hose in front of the coolant flange to supply information to the preheat controller in order to determine the preheat indicator ON time and preheat relay connection time.



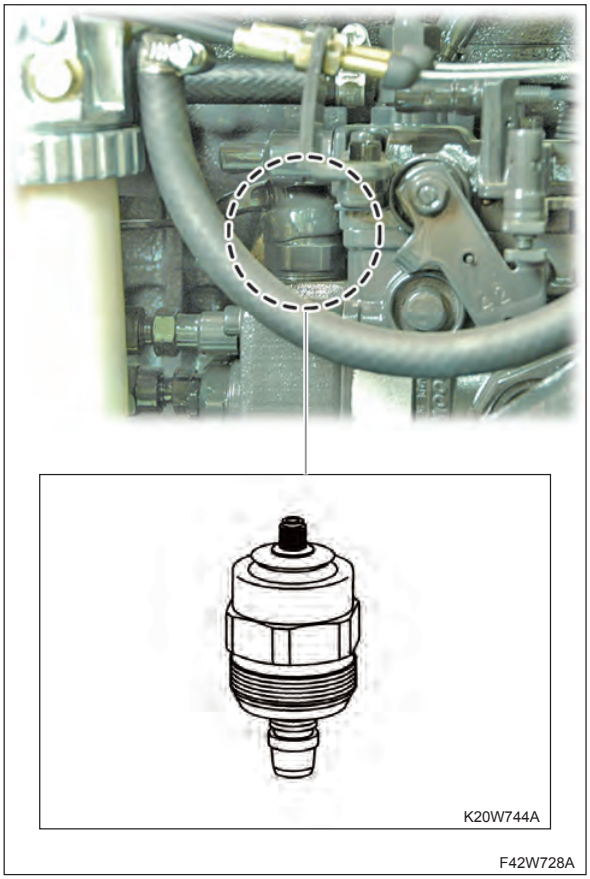
▶ RESISTANCE BY COOLANT TEMPERATURE

TEMPERATURE (°C)	(35)	(50)	80	(100)	(105)	115	(120)	(140)
RESISTANCE (KΩ)	(670)	(350)	118±6	(63.5)	(54.5)	42±2.5	(36.2)	(22)

▶ MEASURING CIRCUIT



5.2.18 FUEL CUT-OFF SOLENOID



The fuel cut-off solenoid is installed behind the injection pump in the right section of the engine to allow or block fuel entering the engine depending on the position (ON/OFF) of the ignition switch.

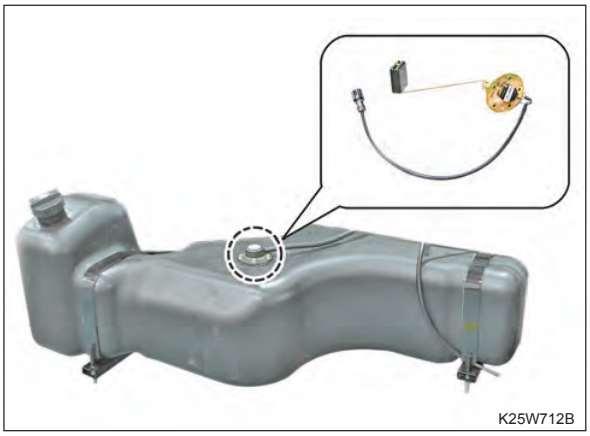
▶ SPECIFICATION

RATED VOLTAGE	12 V
POWER CONSUMPTION	16 W
START VOLTAGE	6.5 V
HOLDING VOLTAGE	2.5 V
OPENING VOLTAGE	0.5 V

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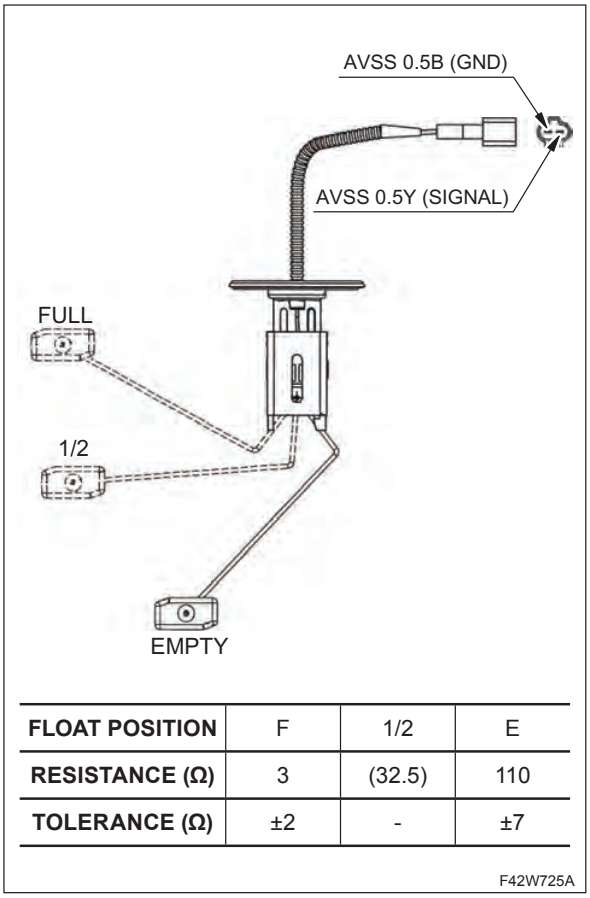
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5.2.19 FUEL SENSOR



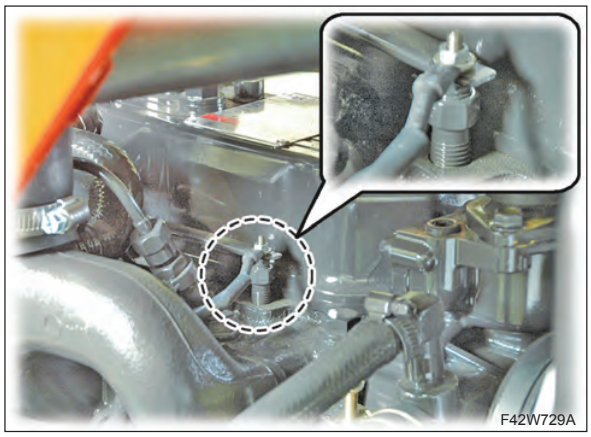
The fuel sensor is installed to the top of the left fuel tank and consists of the float and variable resistor. The float detects the fuel level and the sensor sends the corresponding resistance value to the fuel gauge on the instrument cluster to display the fuel level.

▶ RESISTANCE BY FLOAT POSITION



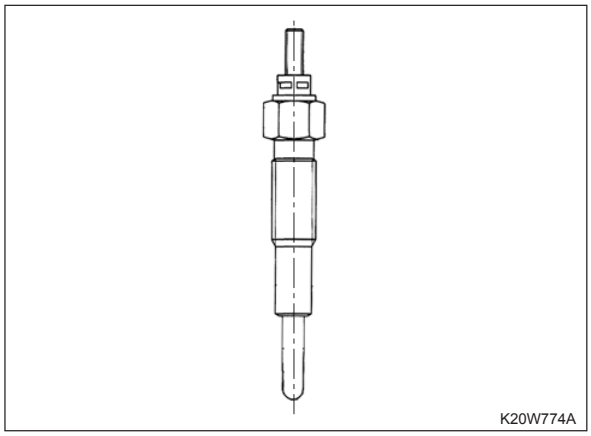
FLOAT POSITION	F	1/2	E
RESISTANCE (Ω)	3	(32.5)	110
TOLERANCE (Ω)	±2	-	±7

5.2.20 GLOW PLUG



The glow plug is installed to the engine cylinder head to heat the intake air in the pre-combustion chamber in order to facilitate engine starting. The current of the glow plug should be 10 A within 5 seconds after it is applied with DC 11 V and its temperature should rise to 800° in approx. 4.5 seconds.

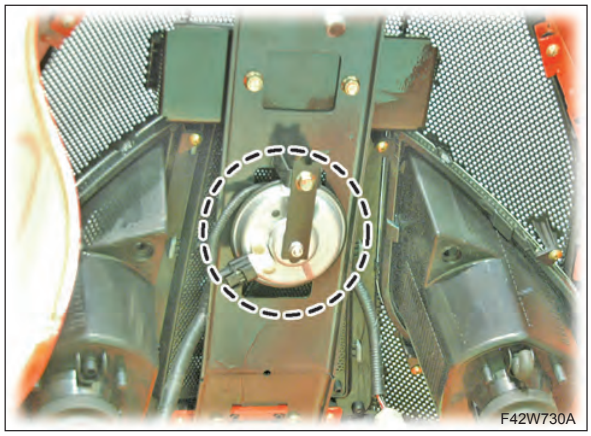
▶ FEATURE



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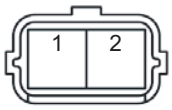
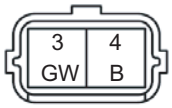
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5.2.21 HORN



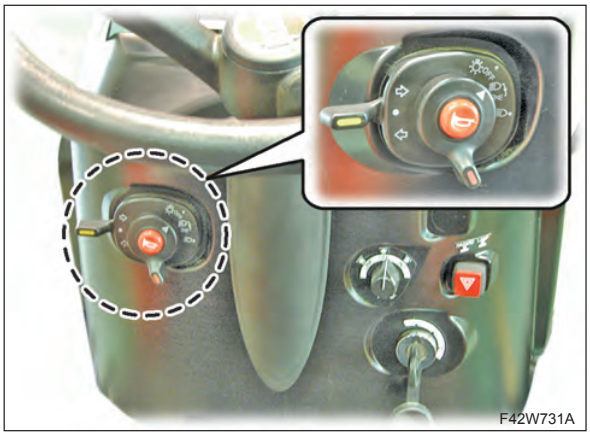
The horn (1) is installed between the left and right head lamps on the front of the hood.

▶ CONNECTOR TEST

Connector A	
Connector B	

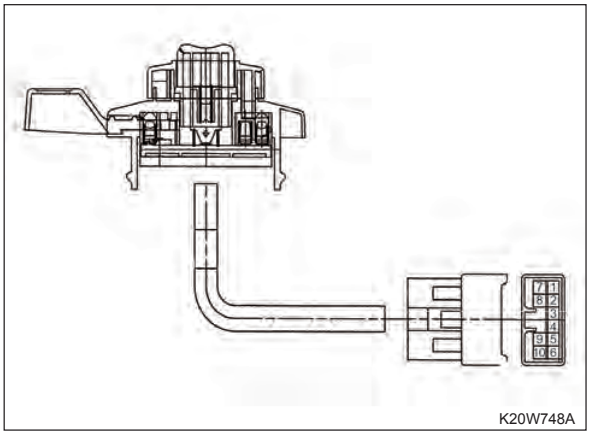
ITEM	CONNECTION		STATUS	RESULT
	+	—		
Resistance	2	1	-	Approx. 4.7 Ω
	3	Ground (Chassis)	Ignition switch 「ON」 Horn operated	Approx. 4.7 Ω
	4		-	-

5.2.22 COMBINATION SWITCH



The combination switch is installed to the left side of the dashboard for operation of the head lamp high/low beam, turn signal lamps and horn.

▶ CONNECTOR AND WIRING DIAGRAM

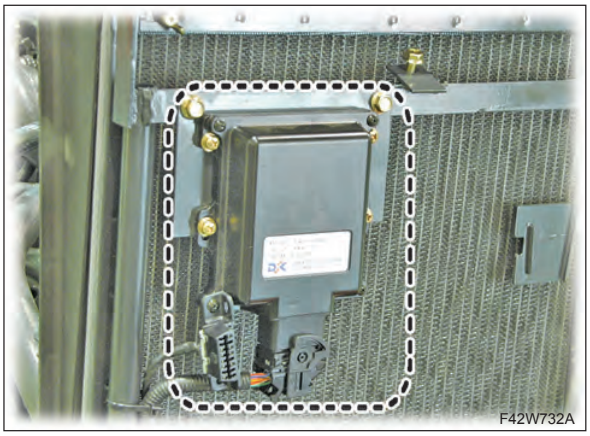


HEAD LAMP					TURN SIGNAL LAMP				HORN		
ITEM	B1	T	1	2	ITEM	B2	R	L	ITEM	B3	H
WIRING COLOR	RY	Y	OR	BR	WIRING COLOR	G	RW	GW	WIRING COLOR	8	LW
CIRCUIT NO.	9	5	4	10	CIRCUIT NO.	8	3	2	CIRCUIT NO.	7	1
○					⇨	○—○			FREE		
≡○	○—○—○				OFF				PUSH	○—○	
≡○	○—○——○				⇦	○——○					

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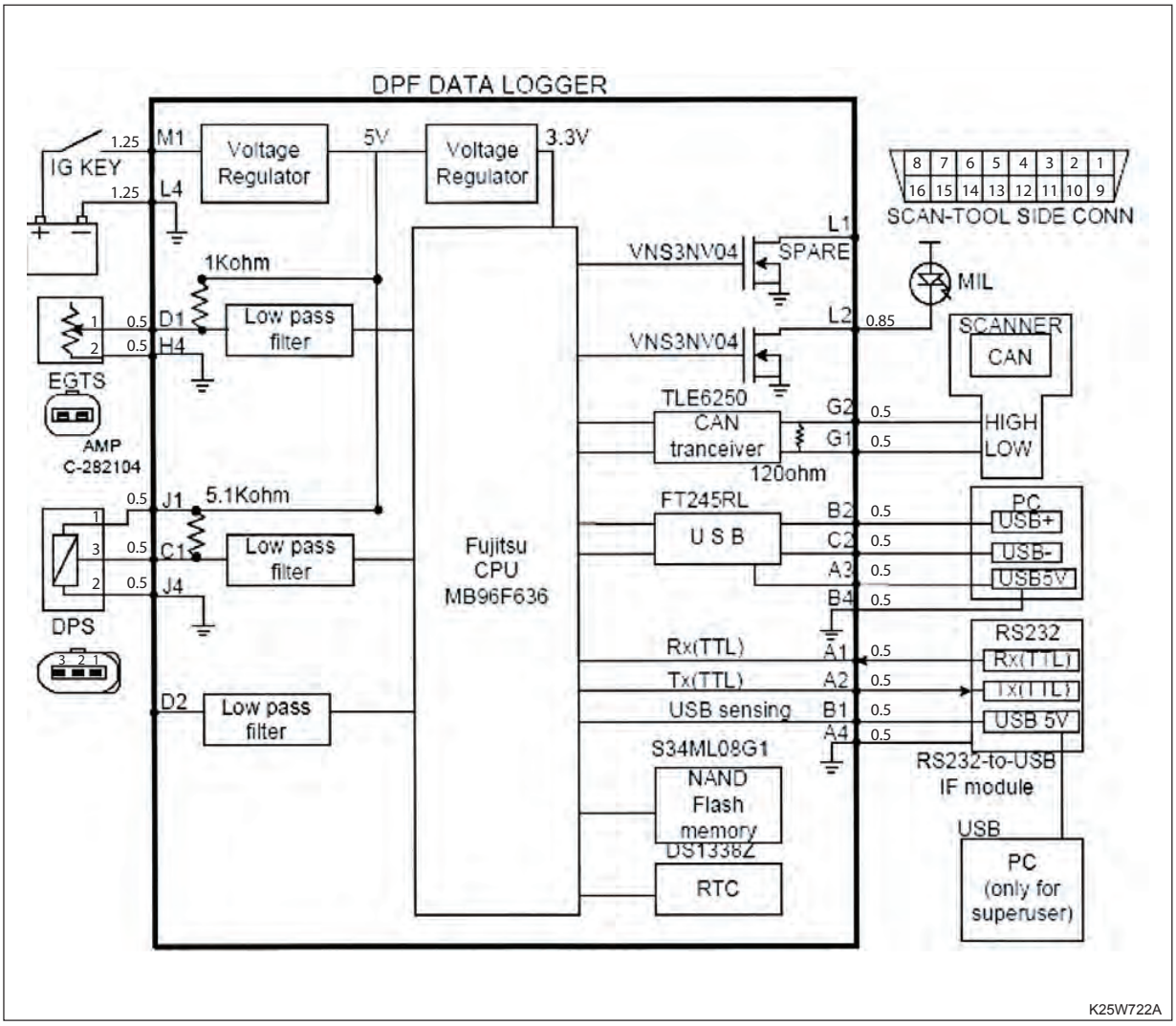
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5.2.23 DPF LOGGER [3015R(h)/3515R(h)/4015R(h)]


F42W732A

The DPF logger is installed front upper side of the radiator in the front section of the engine compartment, and it receives information from various engine sensors to maintain the optimum engine combustion condition for emission control.

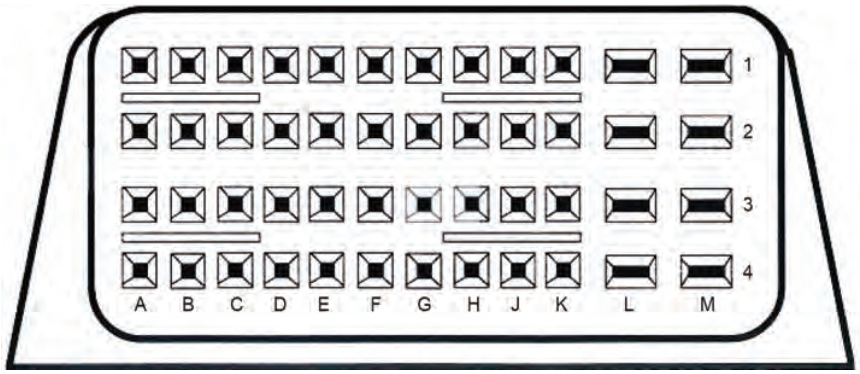
CIRCUIT & CONNECTOR



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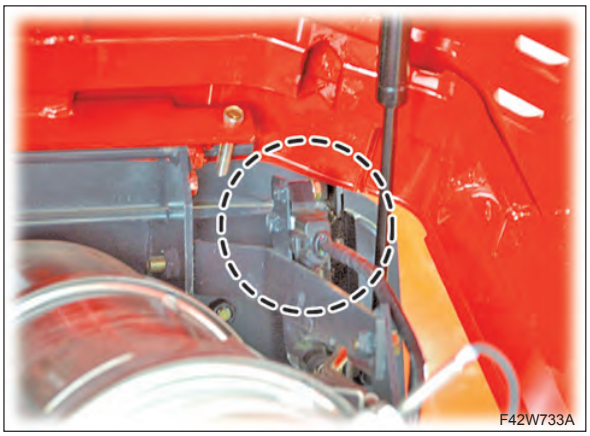
K25W723A

NO	WIRE	DESIGNATION	ASSOCIATED FUNCTION
ANALOG INPUTS			
C1	-	DPS	Differential Pressure sensor
J1	-	DPS_5V	Power of DPS (5Volt)
J4	-	DPS_GND	Ground of DPS
D1	-	EGTS	Exhaust Gas Temperature Sensor
H4	-	EGTS_GND	Ground of EGTS
SWITCH INPUTS			
H1	-	(REPROGRAM)	Reserved (Logger reprogram switch)
DRIVER OUTPUTS			
L2	-	DPF_LAMP	Check lamp of DPF (LED type)
L1	-	(BOOZER)	SPARE (CAUTION BOOZER)
CAN COMM (For diagnosis scanner)			
G2	-	CAN_HIGH	CAN high to SCANNER
GI	-	CAN_LOW	CAN low to SCANNER
G4	-	CAN_GND	Ground of CAN communication
PC RS232 COMM. (For industrial data download or Reprogram)			
A2	-	TX_TIL	TX 232 TTL communication from logger 0 USB
A1	-	RX_TIL	RX 232 TIL communication from USB to logger
B1	-	USB1_SENSING	Signal of USB1 connection
A4	-	RS232_GND	Ground of RS232 communication
PC USB COMM. (For superuser high speed data download)			
B2	-	USB2_POS	USB2 positive of notebook (max. 200mm wire)
C2	-	USB2_NEG	USB2 negative of notebook (max. 200mm wire)
A3	-	USB2_VCC	Power of USB2 communication(max. 200mm wire)
B4	-	USB2_GND	Ground of USB2 communication(max. 200mm wire)
POWER			
M	-	IG_KEY	Power of data logger
L4	-	GND	Ground of data logger

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5.2.24 DIFFERENTIAL PRESSURE SENSOR [3015R(h)/3515R(h)/4015R(h)]



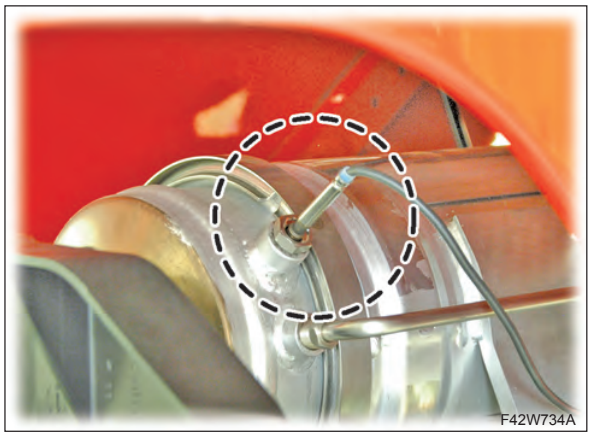
The differential pressure sensor is installed to the side of the DPF in the engine compartment.

Exhaust gas discharged from the engine exhaust valve passes through the inlet of the DPF and escapes the outlet of the DPF to be discharged to the atmosphere.

In this process, the pressure difference between the inlet and outlet is measured by the differential pressure sensor, and this information is delivered to the DPF logger to control the combustion process.

If a large amount of PMs is accumulated so the pressure difference between the inlet and outlet is over the limit, post injection is performed into the cylinders to burn PMs in order to keep the proper pressure level in the DPF.

5.2.25 EXHAUST GAS TEMPERATURE SENSOR [3015R(h)/3515R(h)/4015R(h)]



The exhaust gas temperature sensor is installed to the rear section of the DPF.

This sensor measures the temperature of the exhaust gas and supplies this information to the DPF logger to maintain a proper level of exhaust gas temperature.

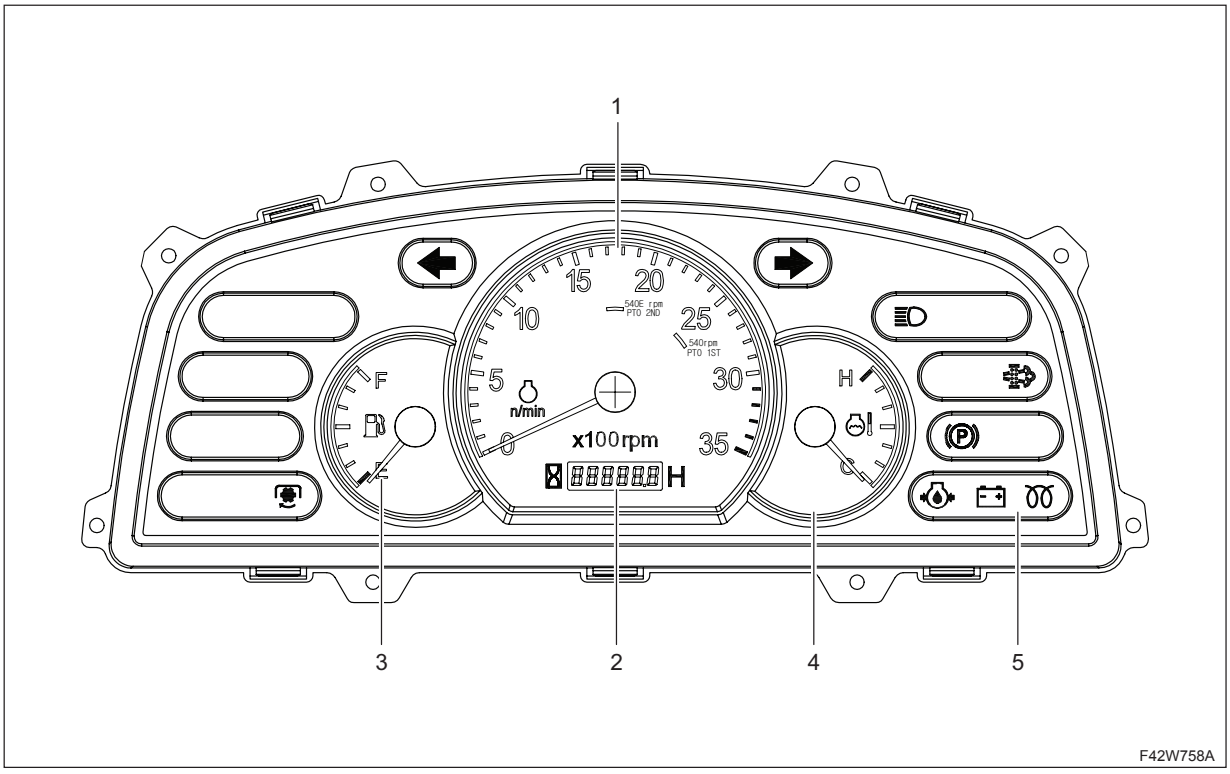
For example, if the temperature of the exhaust gas passing through the PDF is below a certain level, the fuel injection amount is increased by the DPF logger to increase the regeneration temperature. If the temperature of the exhaust gas is over a certain level, the fuel injection amount is decreased to maintain a proper level of temperature.

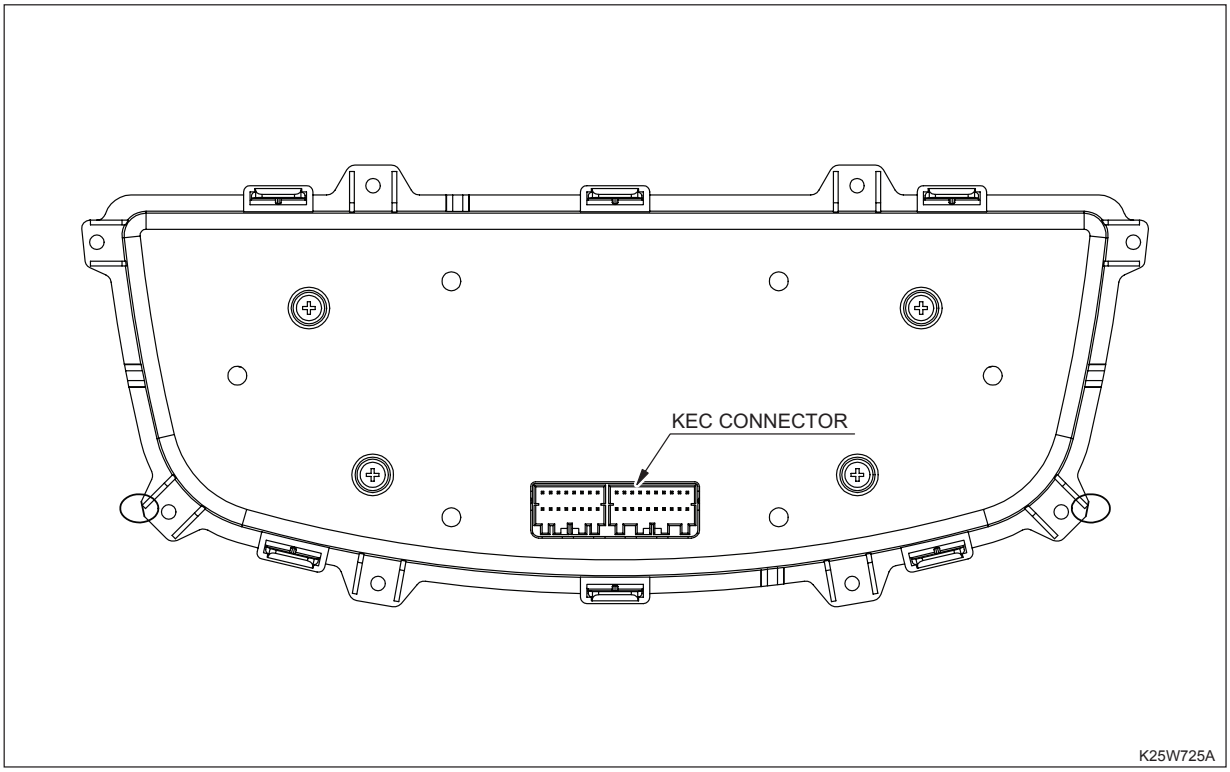
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5.2.26 INSTRUMENT CLUSTER

▶ CONFIGURATION AND PERFORMANCE SPECIFICATIONS

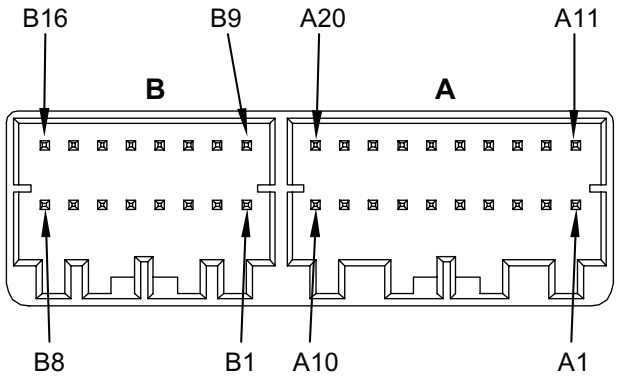




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▶ CONNECTOR



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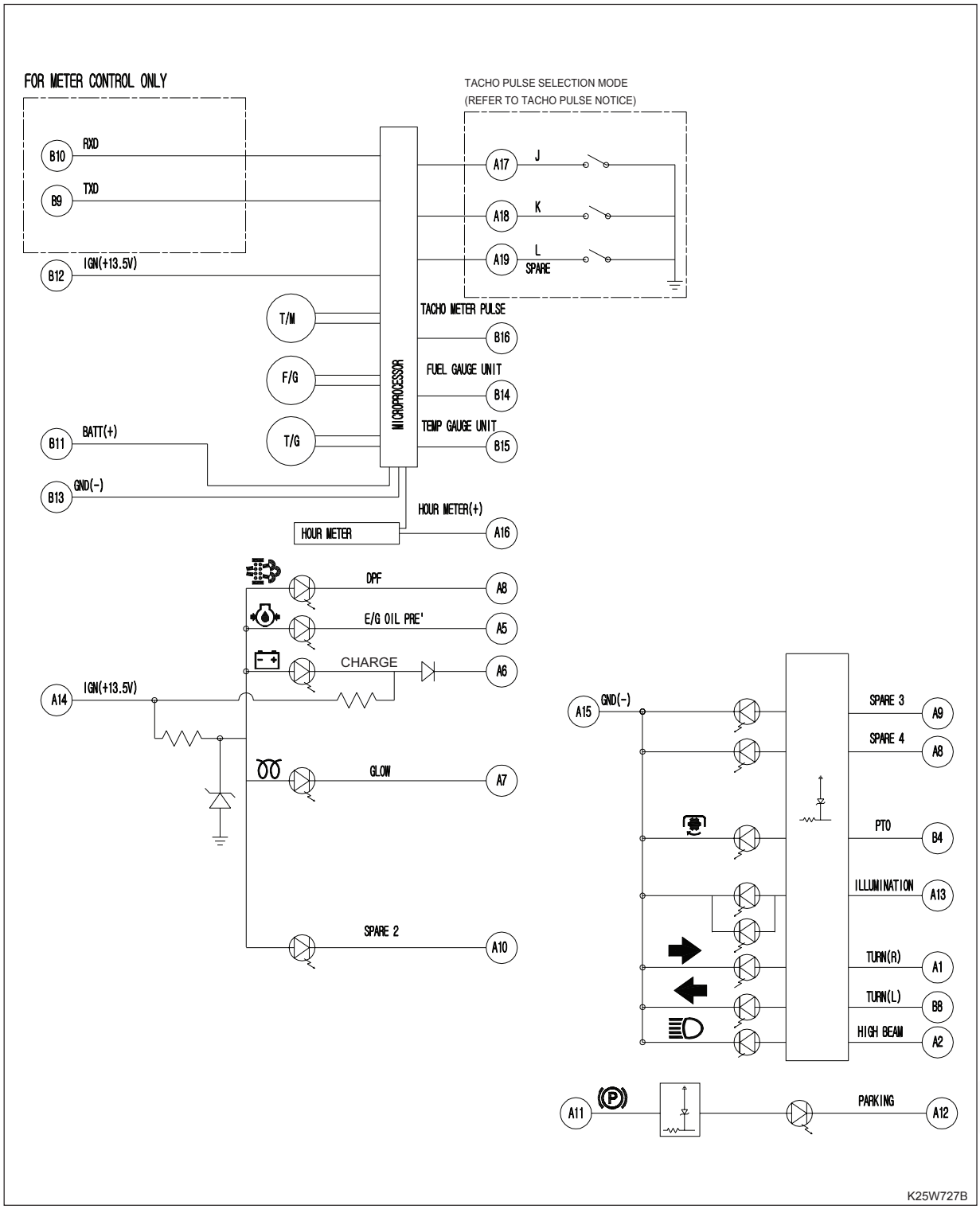
	PIN NO.	NAME	REMARKS
A	A1	TURN (R)	+
	A2	HIGH BEAM	+
	A3	BRAKE RELEASE	-
	A4	WATER SEPARATOR	-
	A5	E/G OIL PRESSURE	-
	A6	CHARGE	-
	A7	GLOW	-
	A8	DPF	
	A9	SPARE 3	-
	A10	SPARE 2	
	A11	PARKING(+)	+
	A12	PARKING(-)	-
	A13	ILLUMINATION	+
	A14	IGN(+13.5V)	+
	A15	GND(-)	-
	A16	HOUR METER(+)	+
	A17	J	-
	A18	K	-
	A19	L(SPARE)	-
	A20		

	PIN NO.	NAME	REMARKS
B	B1	SPARE 1	
	B2	Q/T	+
	B3	4WD	+
	B4	PTO	+
	B5	LIFT	-
	B6	HIGH SPEED	-
	B7	NEUTRAL	-
	B8	TURN(L)	+
	B9	TXD	
	B10	RXD	
	B11	BATT(+ REGULAR POWER)	+
	B12	IGN(+13.5V)	+
	B13	GND(-)	-
	B14	FUEL GAUGE UNIT	
	B15	TEMP GAUGE UNIT	
	B16	TACHO METER PULSE	

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▶ CIRCUIT

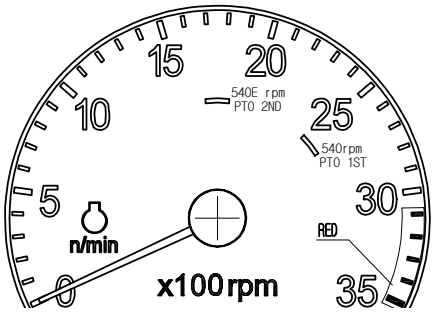


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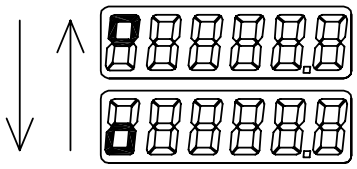
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▶ PERFORMANCE SPECIFICATIONS

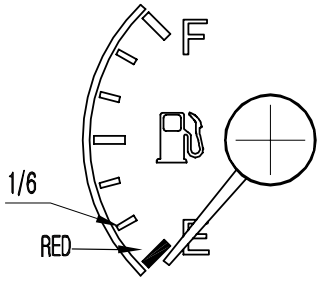
1. Tachometer

PTO RPM		PTO 540 rpm → **2,600 rpm**				
Operating range		0 - 3,500 rpm				
Indicator characteristics	Position (rpm)	1,000	2,000	2,500	2,860	3,000
	Tolerance (rpm)	± 50	(± 100)	(± 100)	± 50	± 50
A - Frequency (Hz)		163.4	326.8	408.5	467.3	490.2
B - Frequency (Hz)		179	358	447.6	512	537.1
Zone						

2. Hourmeter

Type	LCD type
Rated voltage	DC 12V)
Max. displaying time	9999.9 hours
Time accuracy	± 5 sec./24 hr.(for continuous operation)
Display	

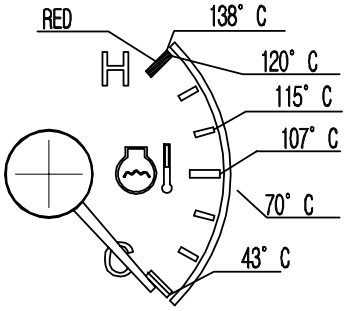
3. Fuel gauge

Type		STEPPER MOTOR			
Operational voltage		DC 12 V			
Indicator characteristics	Position	E	1/6	1/2	F
	Resistance (Ω)	95	(42.5)	18	7
	Tolerance (°)	± 3.5	-	± 3.5	± 3.5
Zone					

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4. Temp. gauge

Type		STEPPER MOTOR					
Operational voltage		DC 12 V					
Indicator characteristics	Position	43	70	107	115	120	138
	Resistance (Ω)	240.5	103.2	38	34.1	30.5	21.2
	Tolerance (°)	(± 3.5)	(± 3.5)	± 3.5	(± 3.5)	± 3.5	(± 3.5)
Zone							

5. Indicator

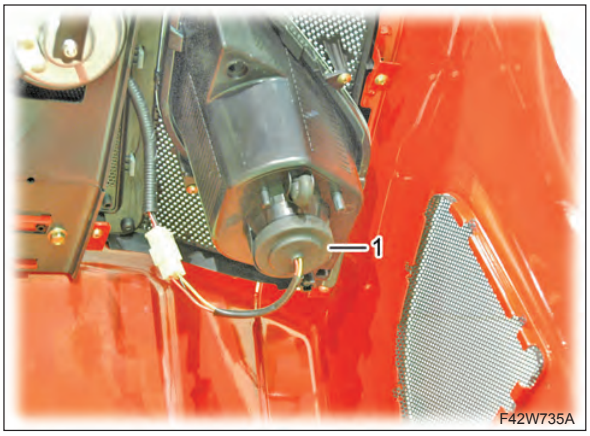
SYMBOL									
NAME	Turn(L)	Turn(R)	Upper beam	E/g oil	Park	Charge	DPF	Preheat	PTO
COLOR	Green	Green	Blue	Red	Red	Red	Yellow	Red	Yellow
LAMP	LED								

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5.3 LAMP BULB REPLACEMENT

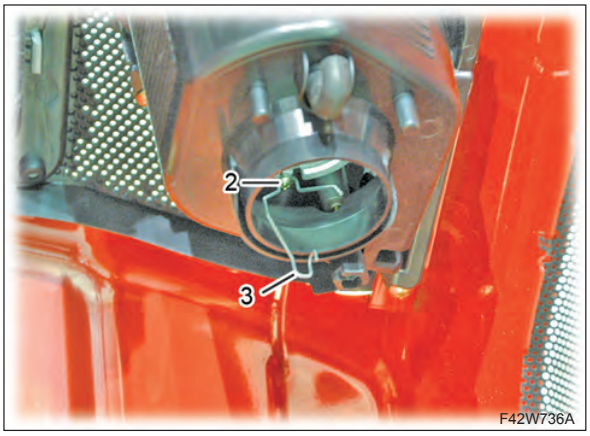
5.3.1 HEAD LAMP

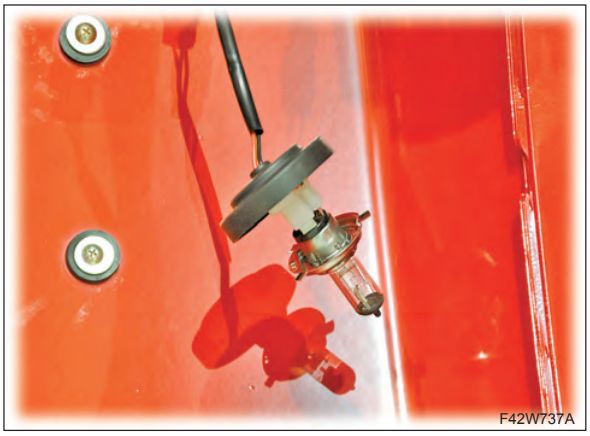


1. Pull the cap (1) out to disconnect it.



3. Bulb specification: HS1 12 V 35 W/35 W





2. Loosen the screw (2) and release the spring holder (3). Then, remove the socket with bulb..

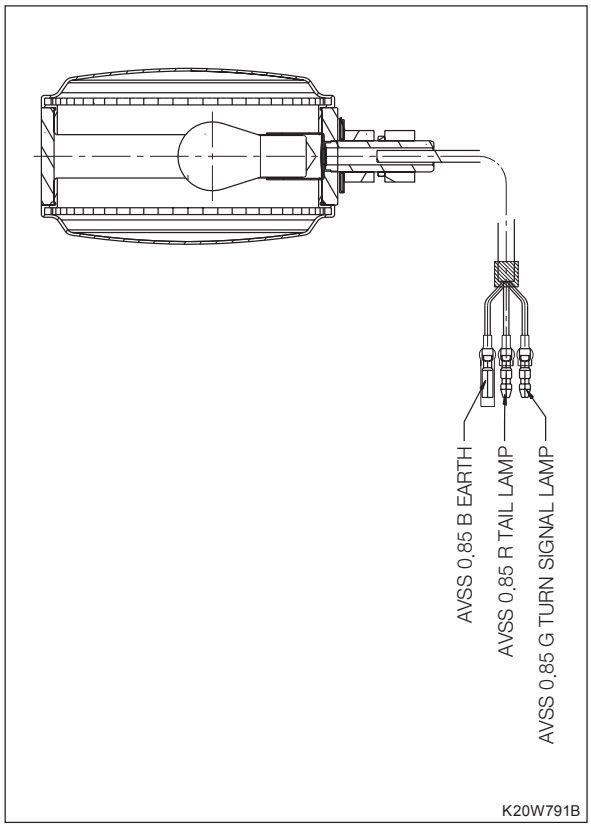
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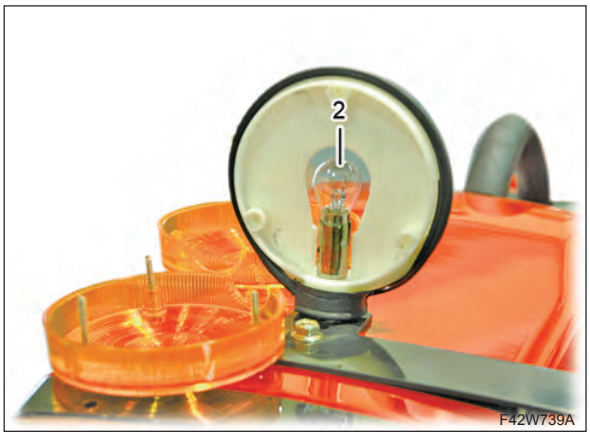
5.3.2 FRONT TURN SIGNAL LAMP

3015R(h)/3515R(h)/4015R(h)





1. Unscrew the front and rear lens mounting screws (1).



2. Remove the bulb (2) by pressing and turning it clockwise.



2. Replace it with a new one.

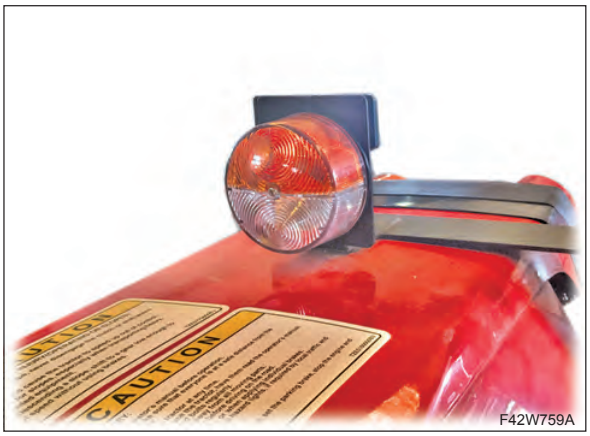
   Bulb specification: 12 V 21 W/5 W

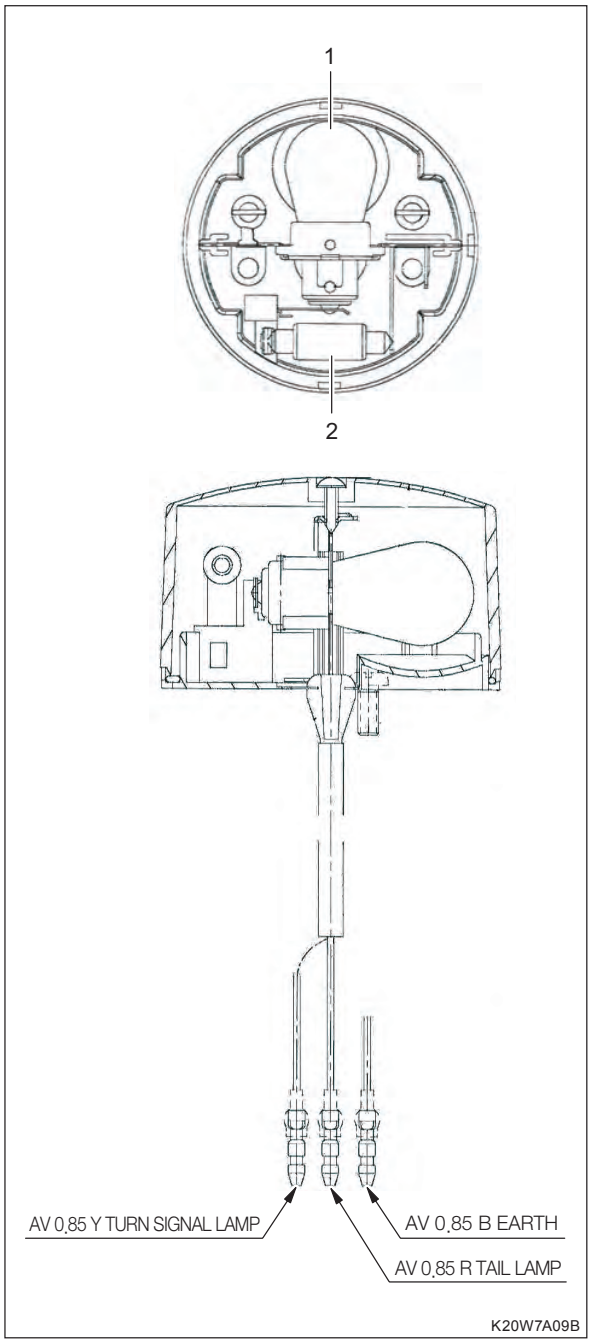
7

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F36R(h)/F42R(h)





- Bulb specification: ① 12 V 21 W
  ② 12 V 5 W

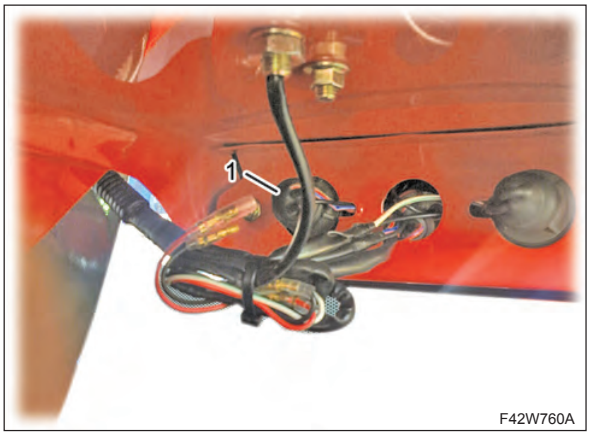
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5.3.3 REAR COMBINATION LAMP

F36R(h)/F42R(h)

▶ SOCKET DISASSEMBLY



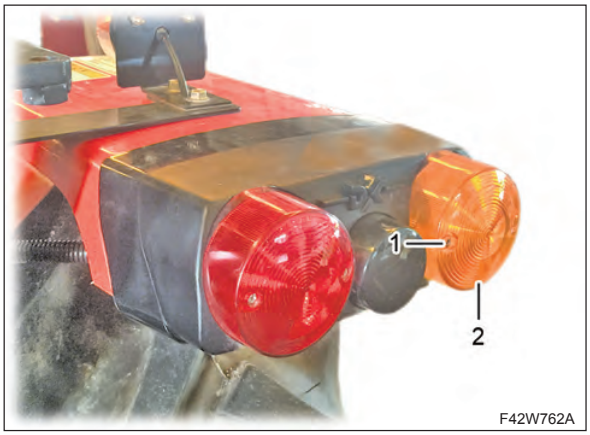
1. Unscrew the grommet assembly (1) clockwise to remove it.

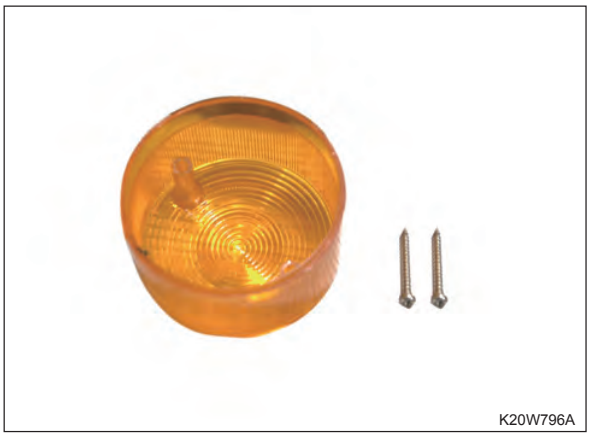


2. Remove the bulb.

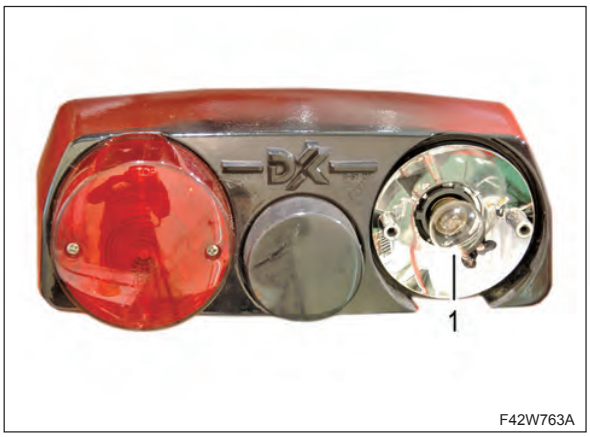
   Bulb specification: 12 V 21 W
   12 V 12 W/5 W

▶ LENS DISASSEMBLY





1. Unscrew the lens mounting screws (1) of the rear combination lamp and pull the lens (2) to remove it.



2. Remove the bulb (1) by pressing and turning it.

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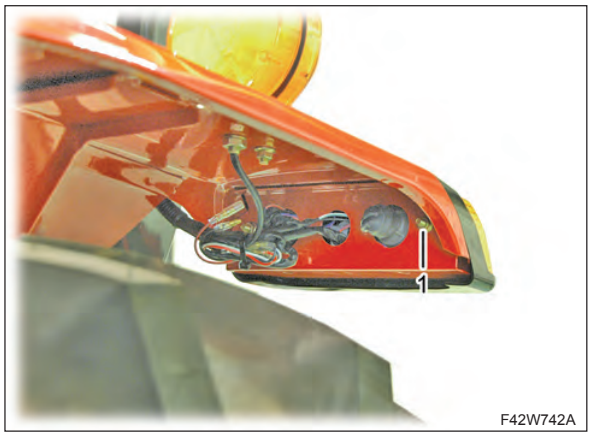

K20W798A

3. Replace the bulb with a new one.

   Bulb specification:
   Right - 12 V 21 W/5 W (brake/tail lamp)
   Left - 12 V 12 W (turn signal lamp)

3015R(h)/3515R(h)/4015R(h)


F42W741A

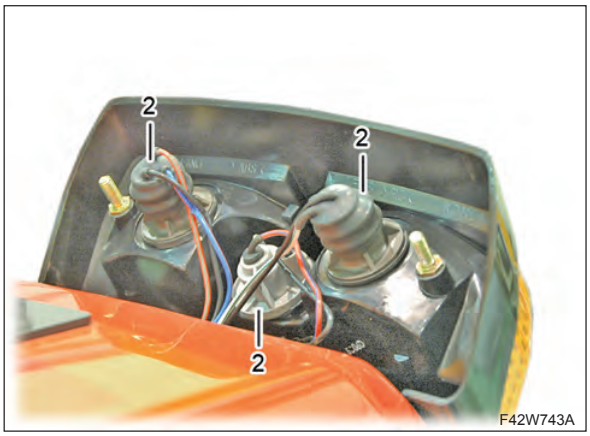


F42W742A

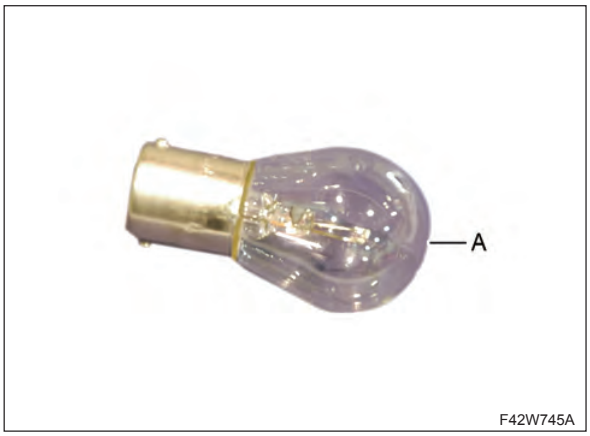
1. Unscrew the mounting nuts (1) of the rear combination lamp in the fender.

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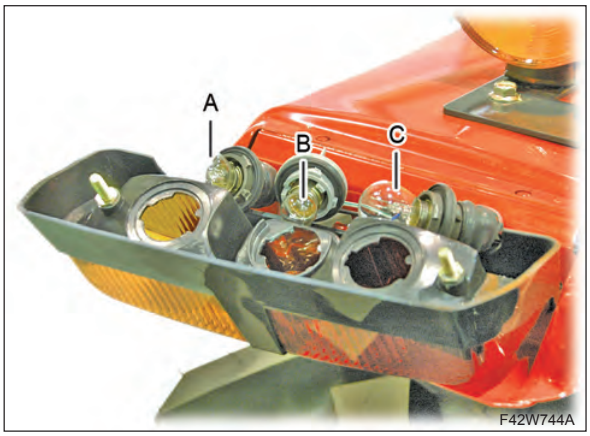
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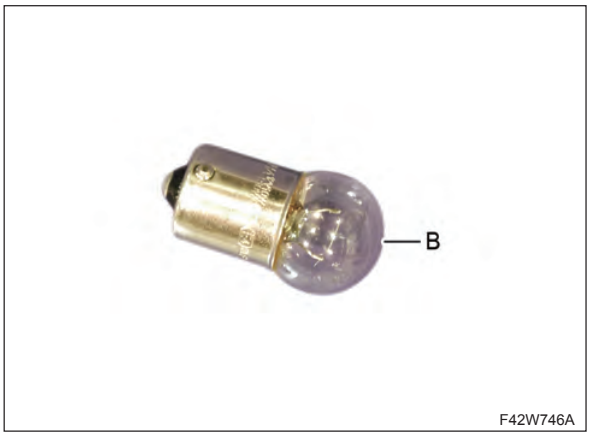
F42W743A



F42W745A



F42W744A



F42W746A

2. Press the each socket assembly (2) and turn it counterclockwise to remove.



F42W747A

3. Replace the bulb with a new one.

   Bulb specification:

   Ⓐ Left - 12 V 27 W (turn signal lamp)

   Ⓑ Middle - 12 V 8 W (Backup/Work lamp)

   Ⓒ Right - 12 V 21 W/5 W (brake/tail lamp)

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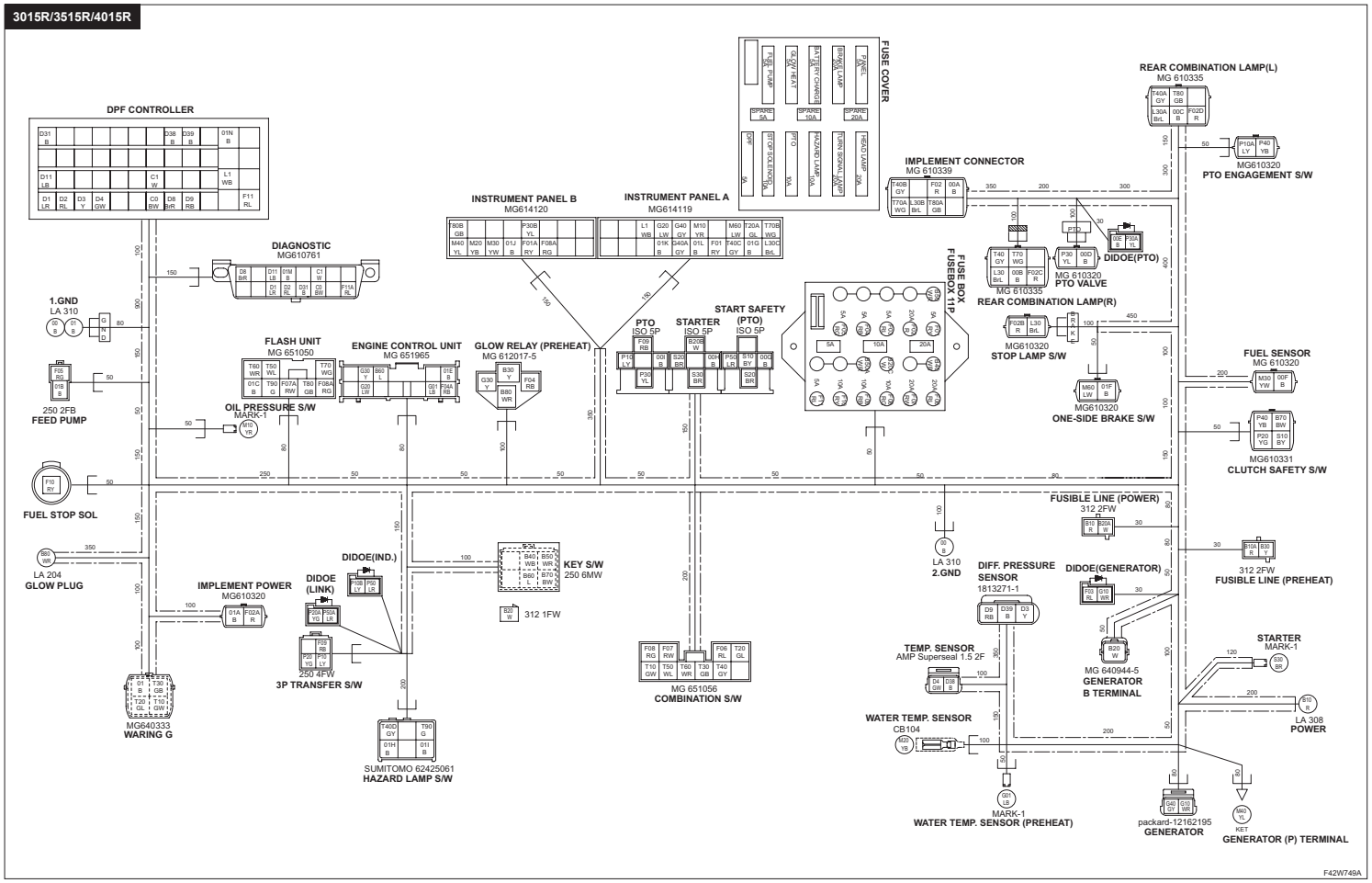
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5.4 WIRING DIAGRAM

5.4.1 MAIN WIRING DIAGRAM

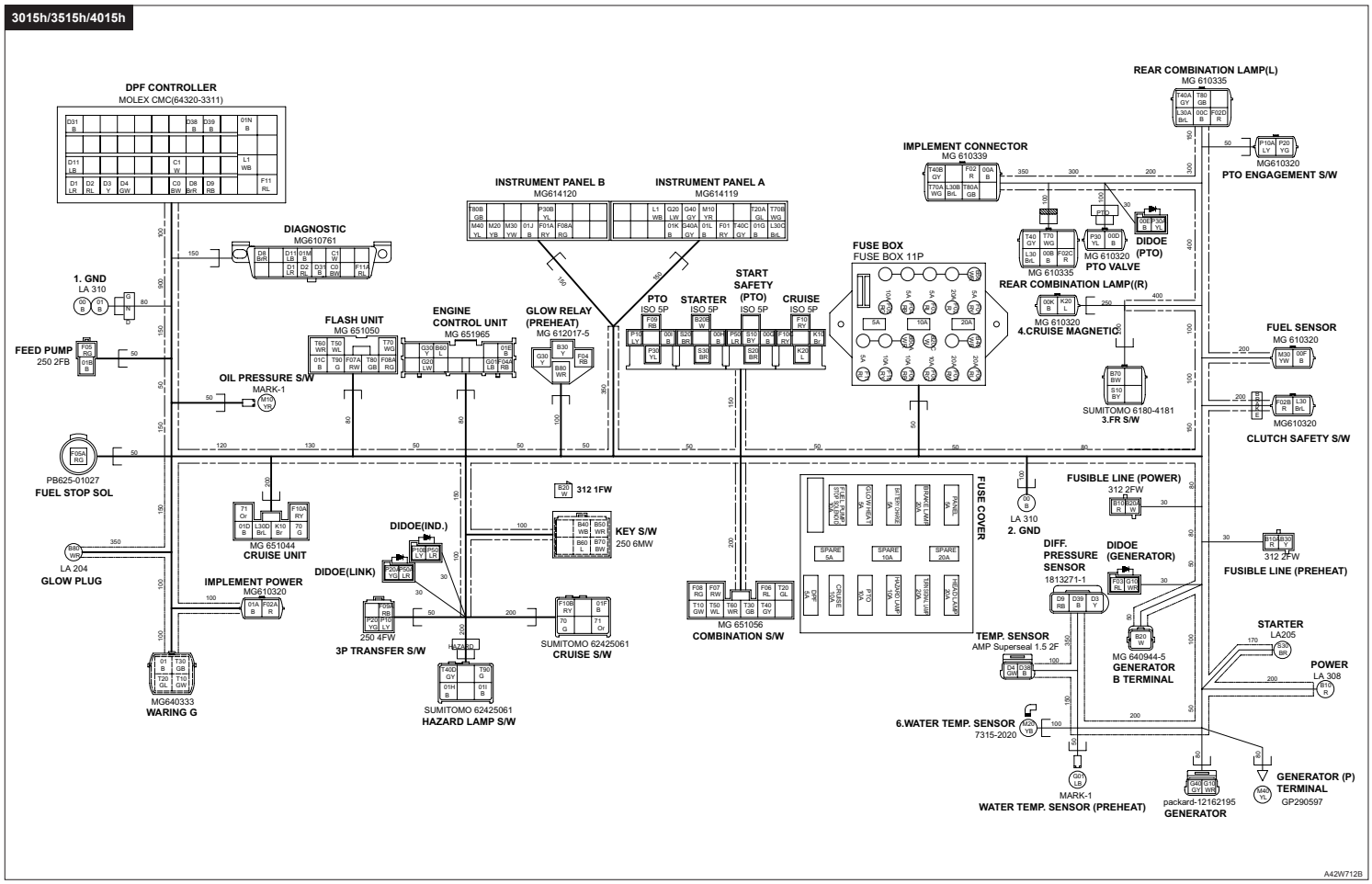
3015R/3515R/4015R



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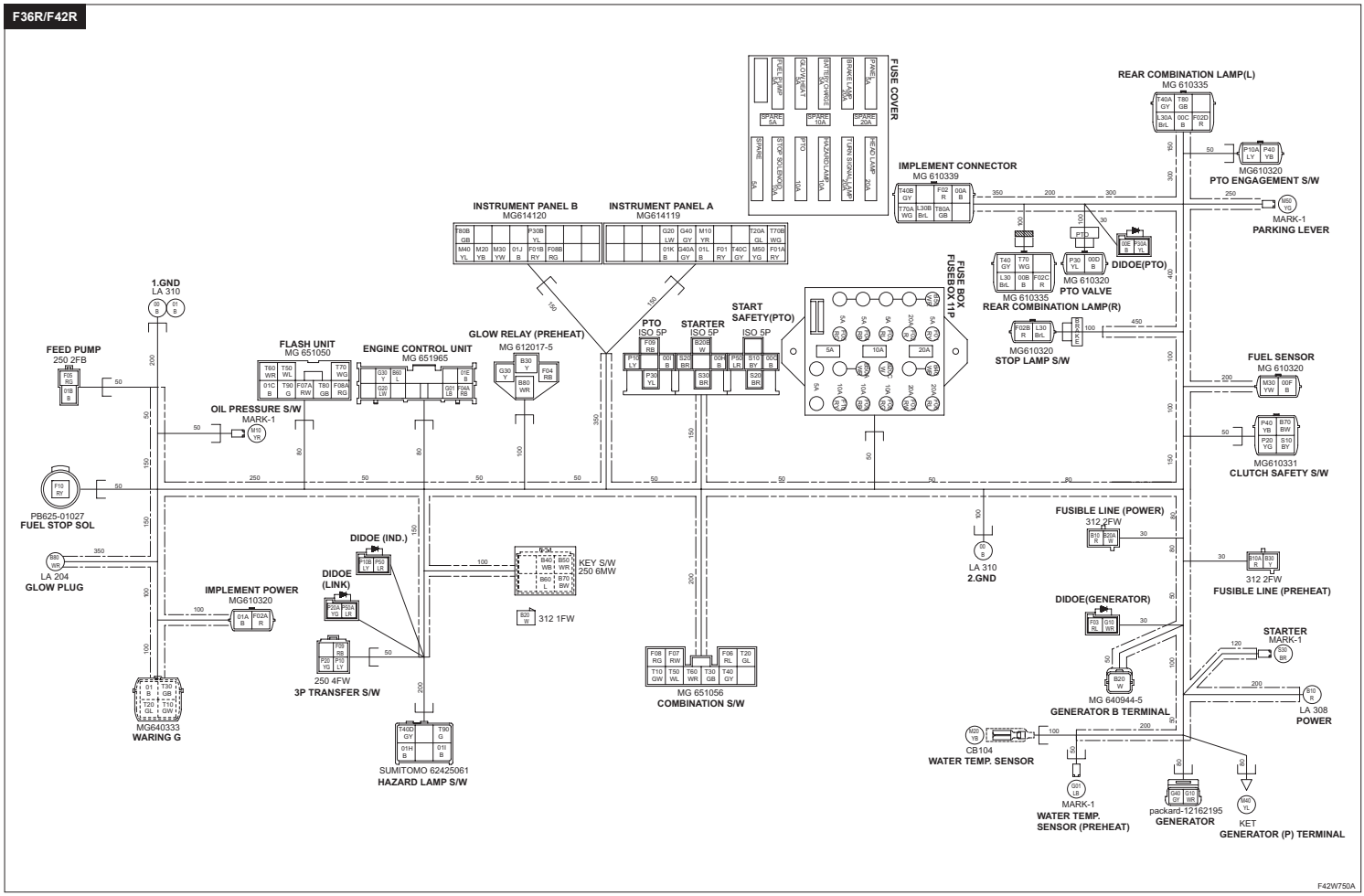
3015h/3515h/4015h



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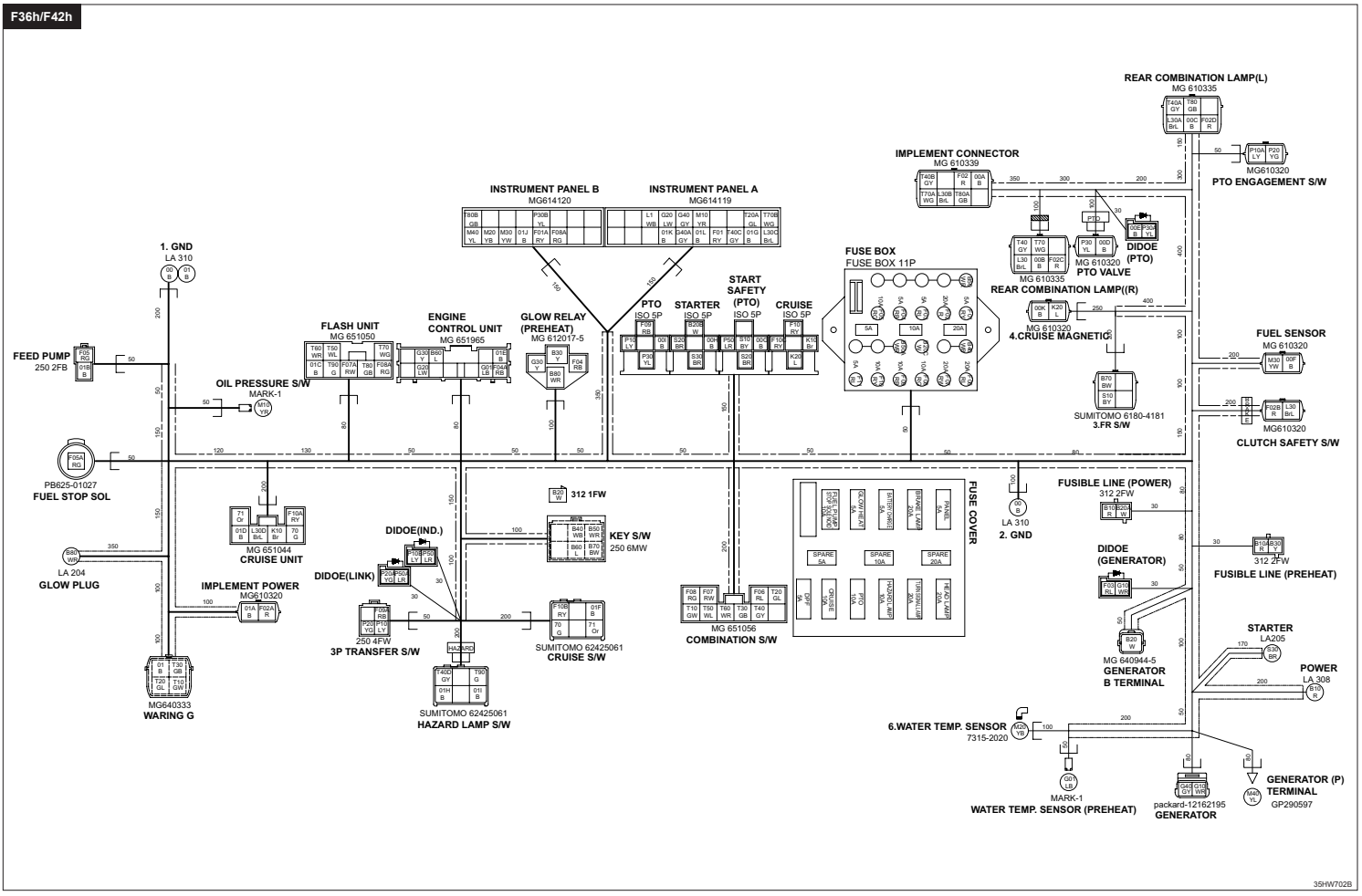
F36R/F42R



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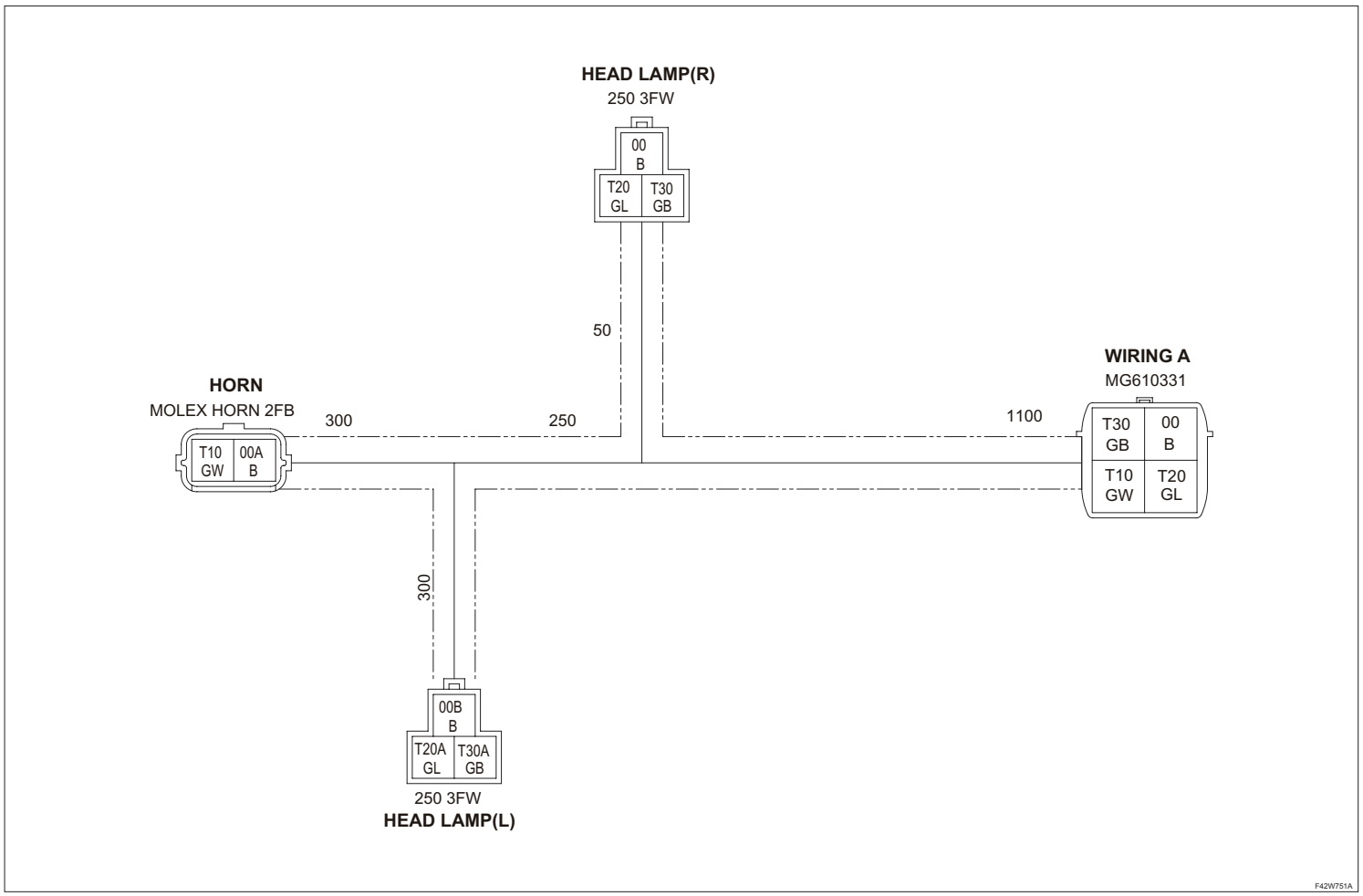
F36h/F42h



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5.4.2 BONNET WIRING DIAGRAM (WIRING G)



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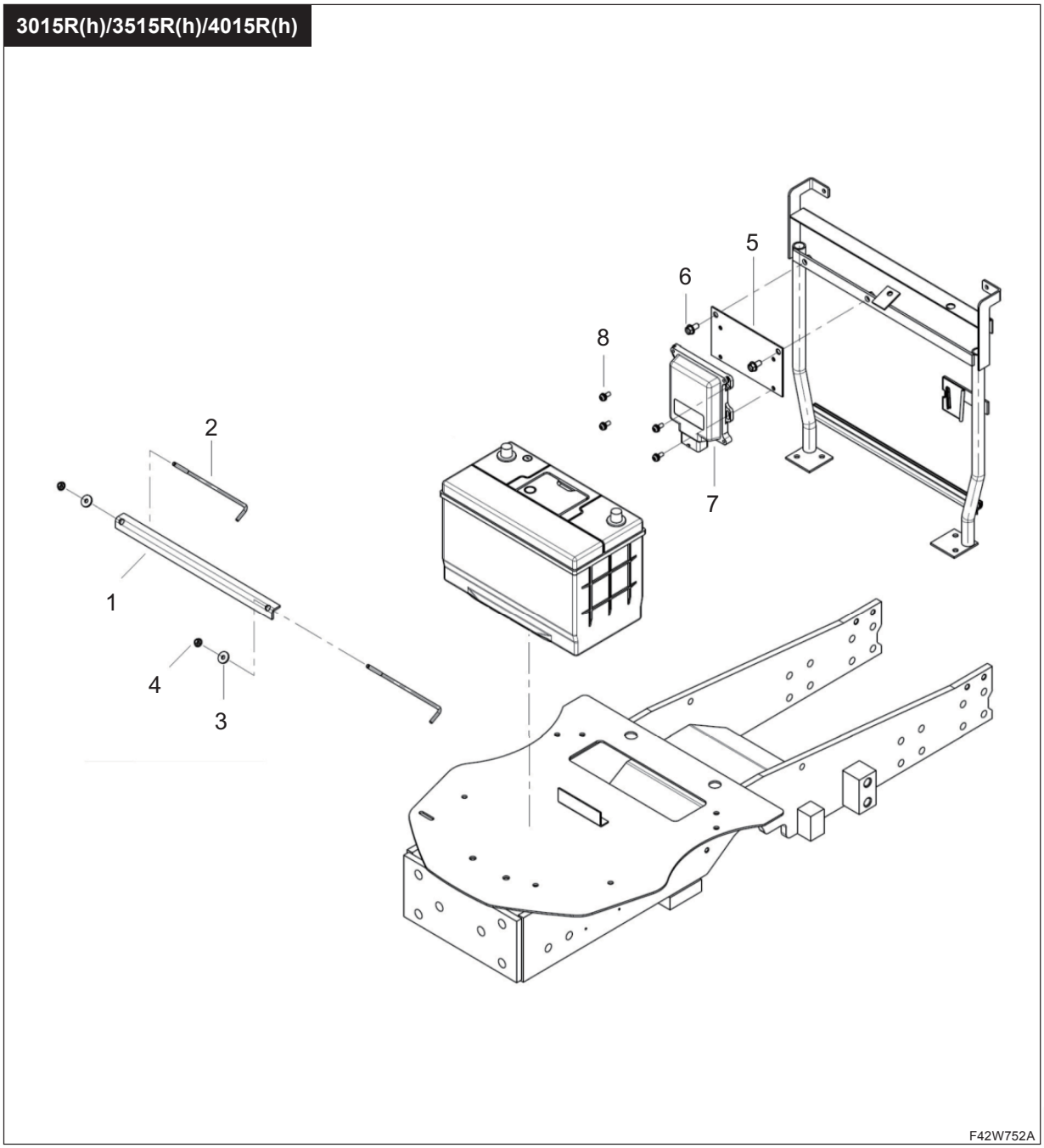
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6. SECTIONAL VIEW FOR MAJOR COMPONENTS

6.1 BATTERY

3015R(h)/3515R(h)/4015R(h)



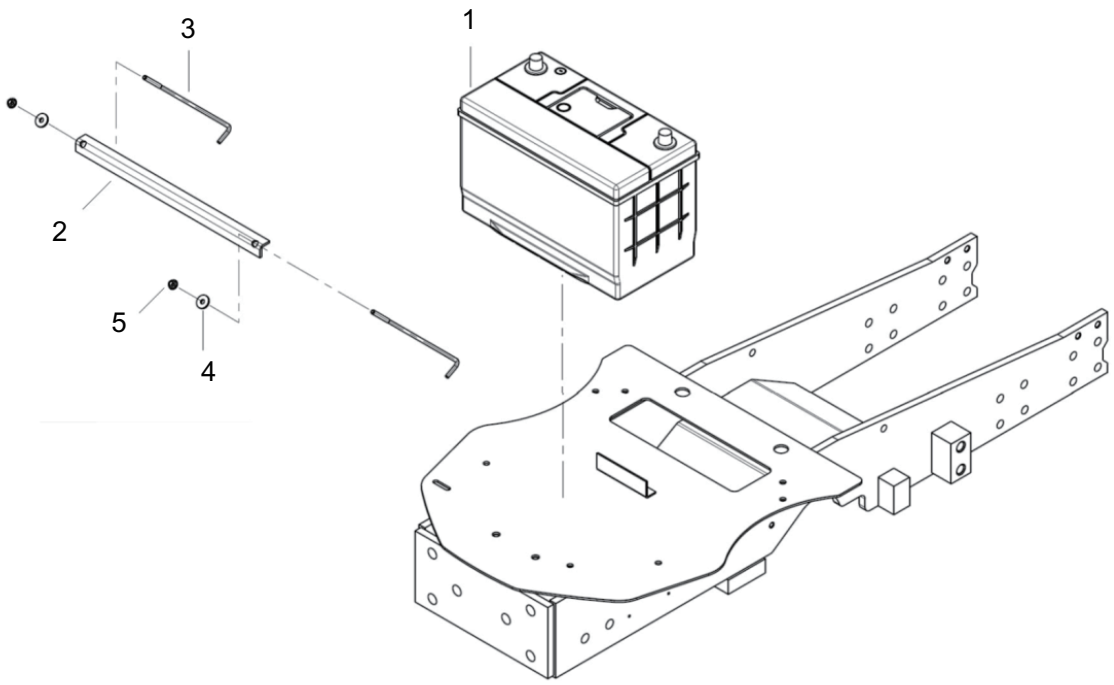
COMPONENTS

(1) Battery stop bracket
(2) Stop rod
(3) Washer
(4) Hex flange nut
(5) Bracket(DPF logger)
(6) Hex flange bolt
(7) DPF logger
(8) Screw

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F36R(h)/F42R(h)



F42W753A

COMPONENTS

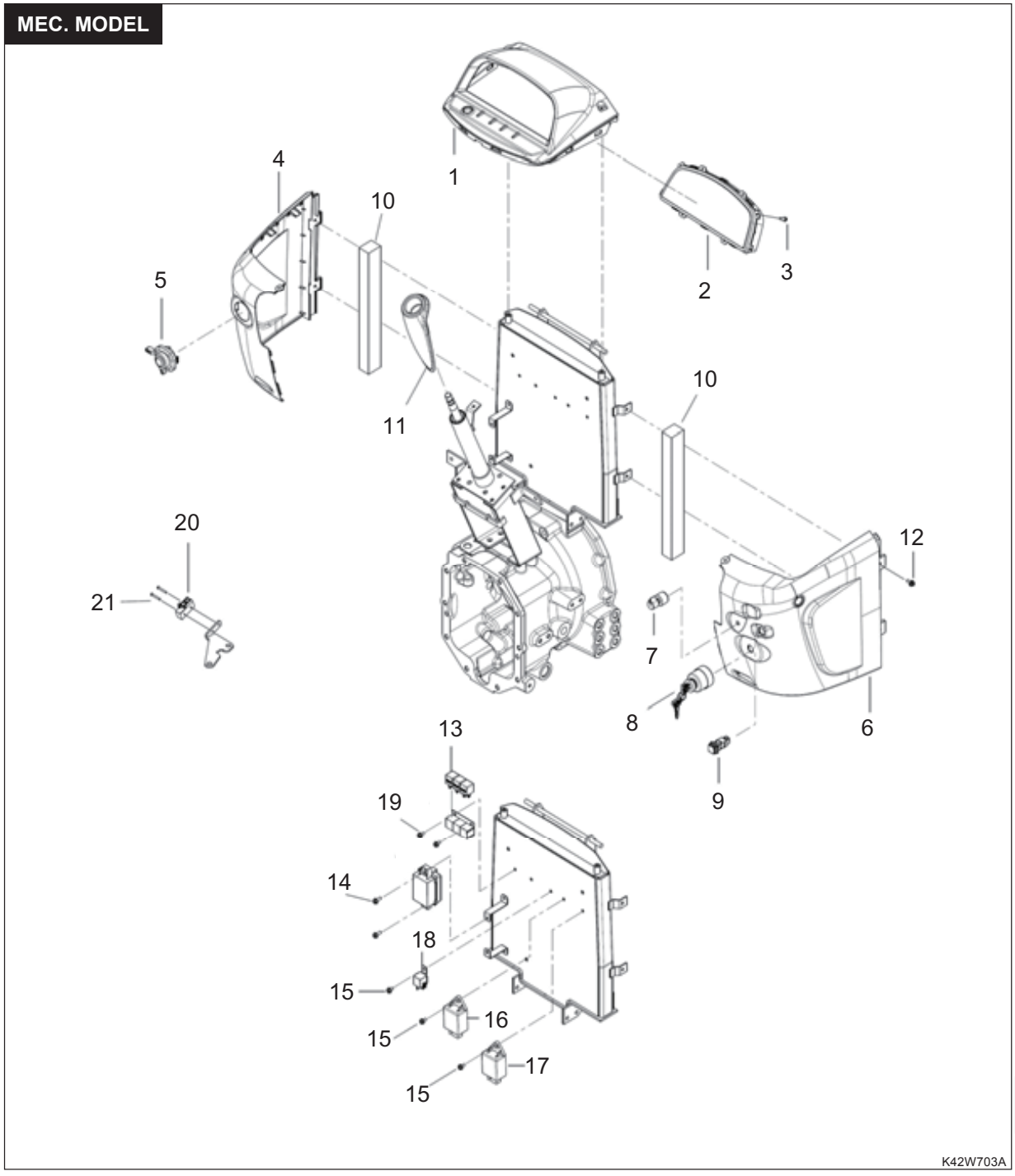
(1) Battery
(2) Battery stop bracket
(3) Stop rod
(4) Washer
(5) Hex flange nut

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6.2 SWITCH

MEC. MODEL



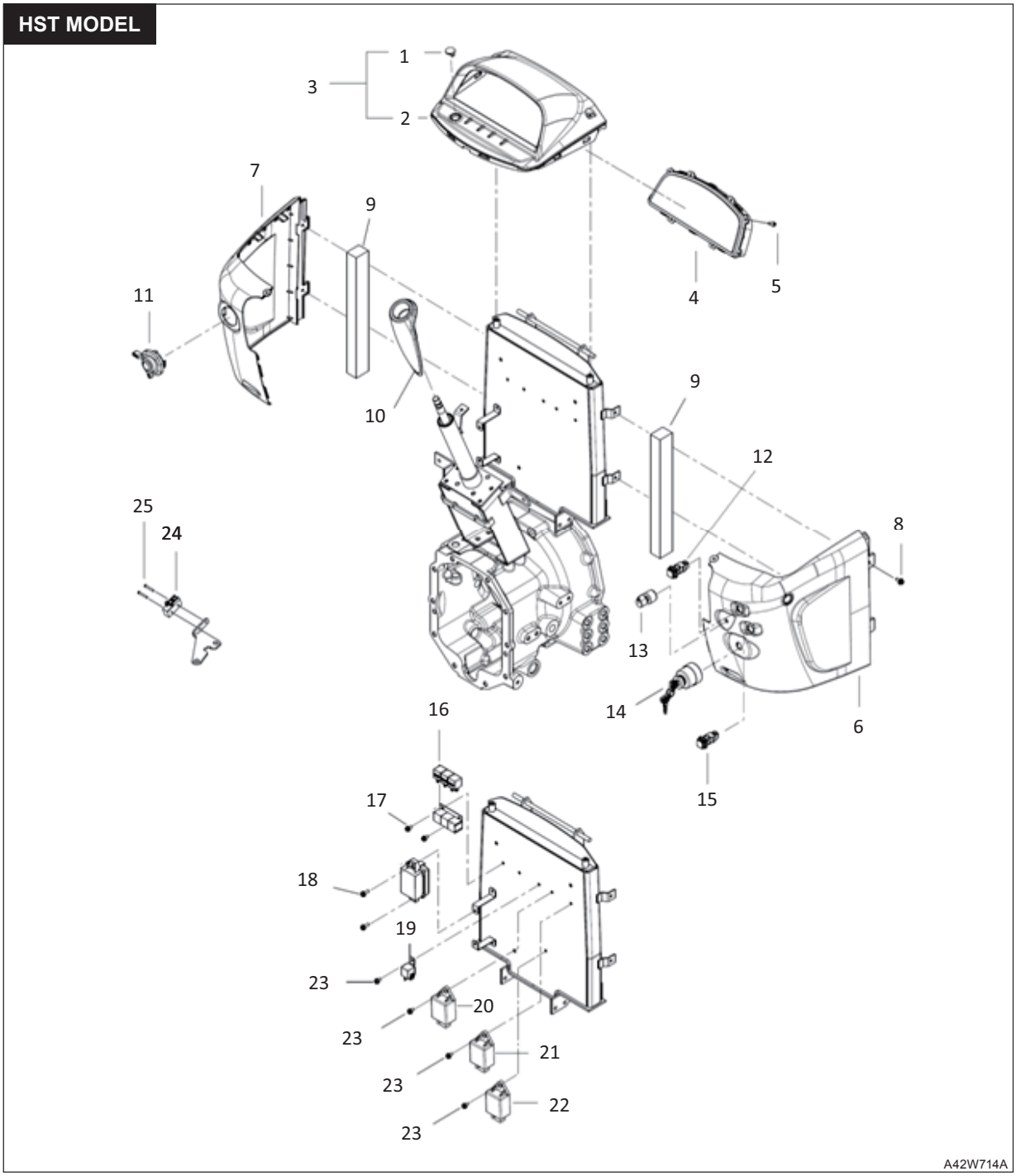
COMPONENTS

(1) Meter cover
(2) Meter
(3) Screw
(4) Dashboard L
(5) Combination switch
(6) Dashboard R
(7) Front wheel s/w
(8) Start switch ass'y
(9) Emergency switch
(10) Urethane
(11) Column cover
(12) Bolt
(13) Relay
(14) Hex flange bolt
(15) Hex flange bolt
(16) Controller
(17) Flasher unit
(18) Glow relay
(19) Hex bolt(+)
(20) PTO connect switch
(21) Screw

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HST MODEL



COMPONENTS

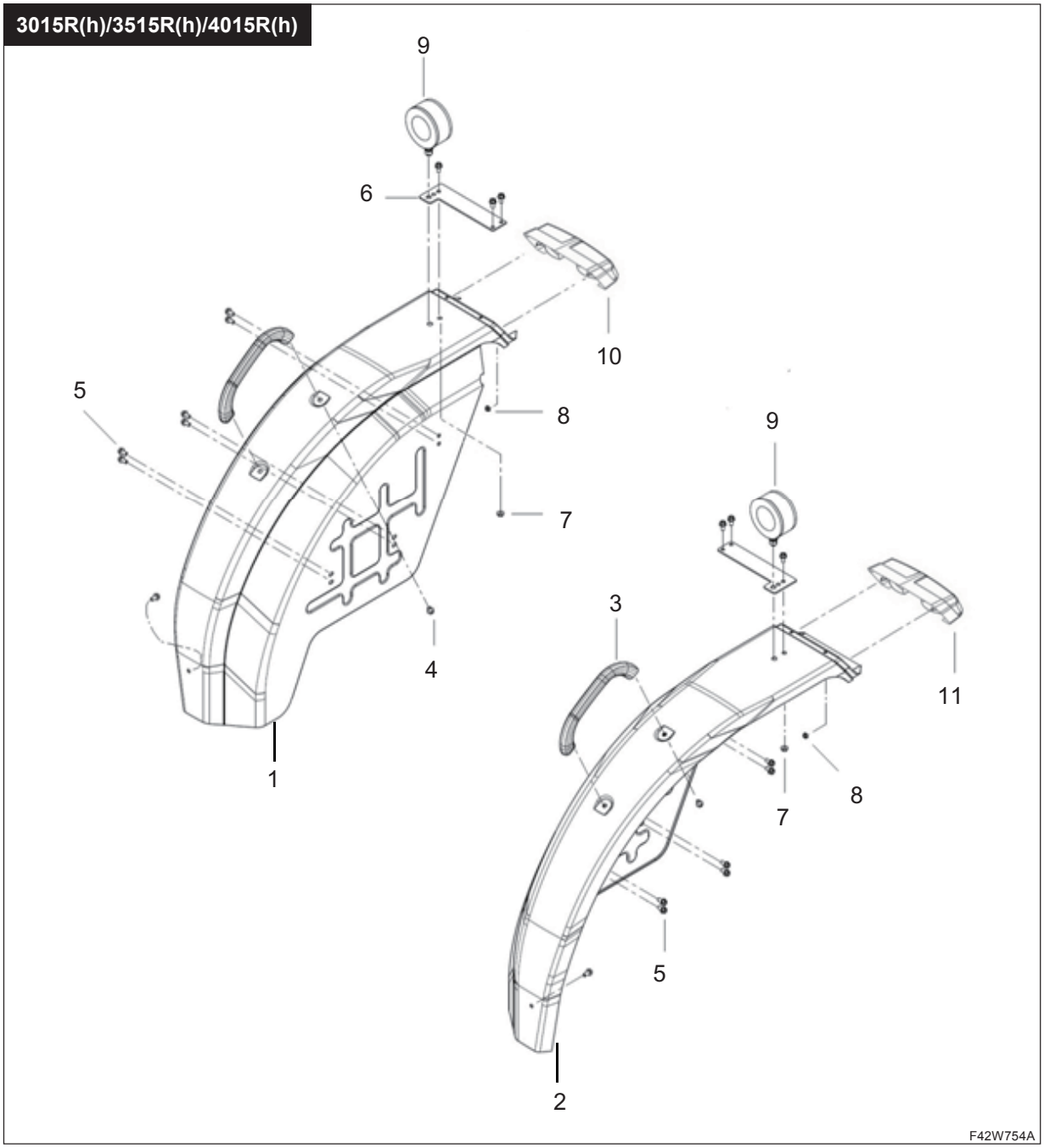
(1) Cap
(2) Meter cover
(3) Meter cover assy
(4) Meter
(5) Screw
(6) Dashboard r
(7) Dashboard l
(8) Bolt
(9) Urethane
(10) Column cover
(11) Combination switch
(12) Switch, cruise
(13) Front wheel s/w
(14) Start switch ass'y
(15) Emergency switch
(16) Relay
(17) Hex bolt(+)
(18) Hex flange bolt
(19) Glow relay
(20) Controller
(21) With a flash unit
(22) Controller
(23) Hex flange bolt
(24) Pto connect switch
(25) Screw

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6.3 FENDER

3015R(h)/3515R(h)/4015R(h)



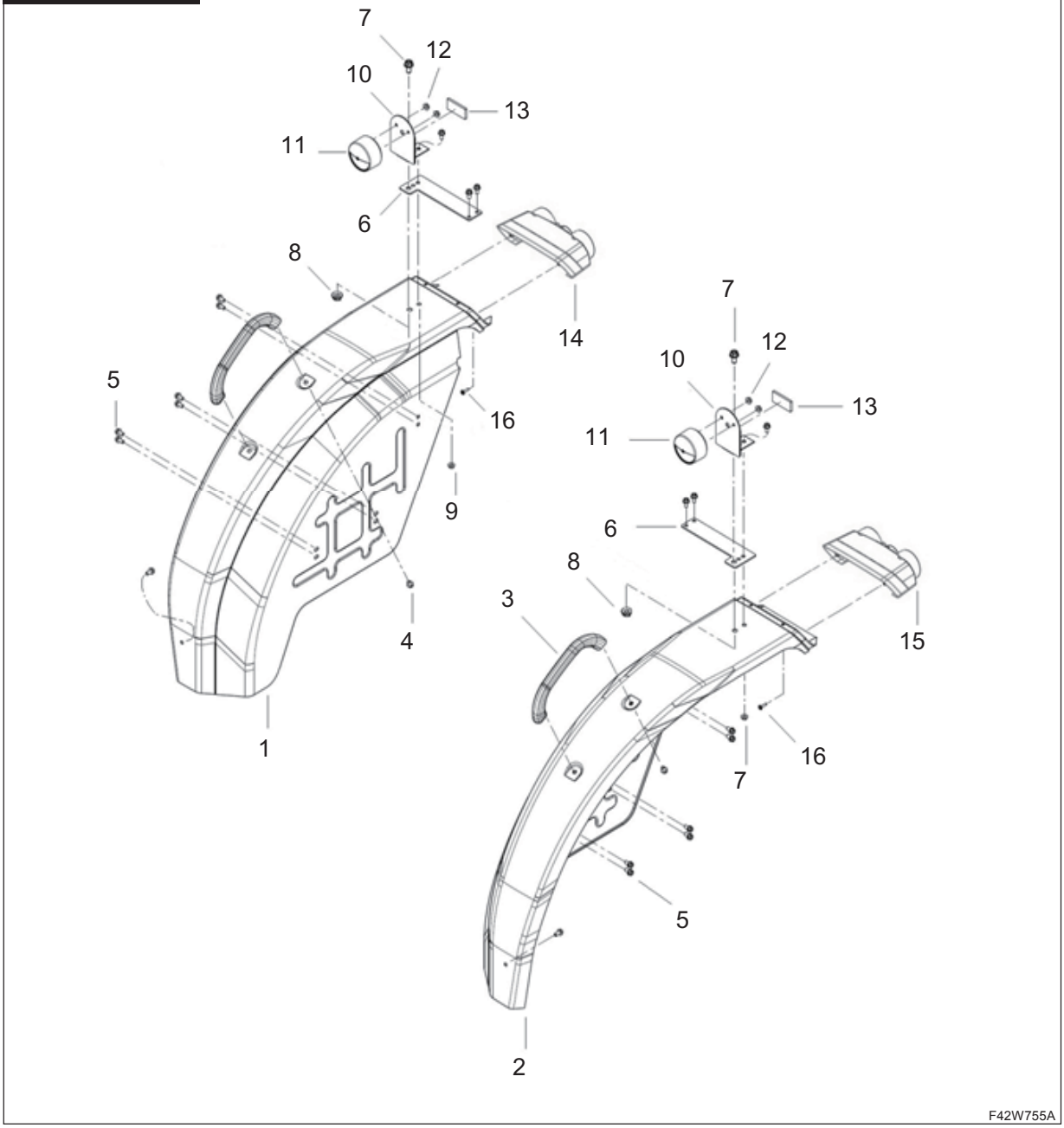
COMPONENTS

(1) Fender R ass'y
(2) Fender L ass'y
(3) Fender grip
(4) Hex flange bolt
(5) Hex flange bolt
(6) Fender support bracket
(7) Hex flange nut
(8) Hex flange nut
(9) Direction lamp ass'y
(10) Combination lamp(R)
(11) Combination lamp(L)

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F36R(h)/F42R(h)



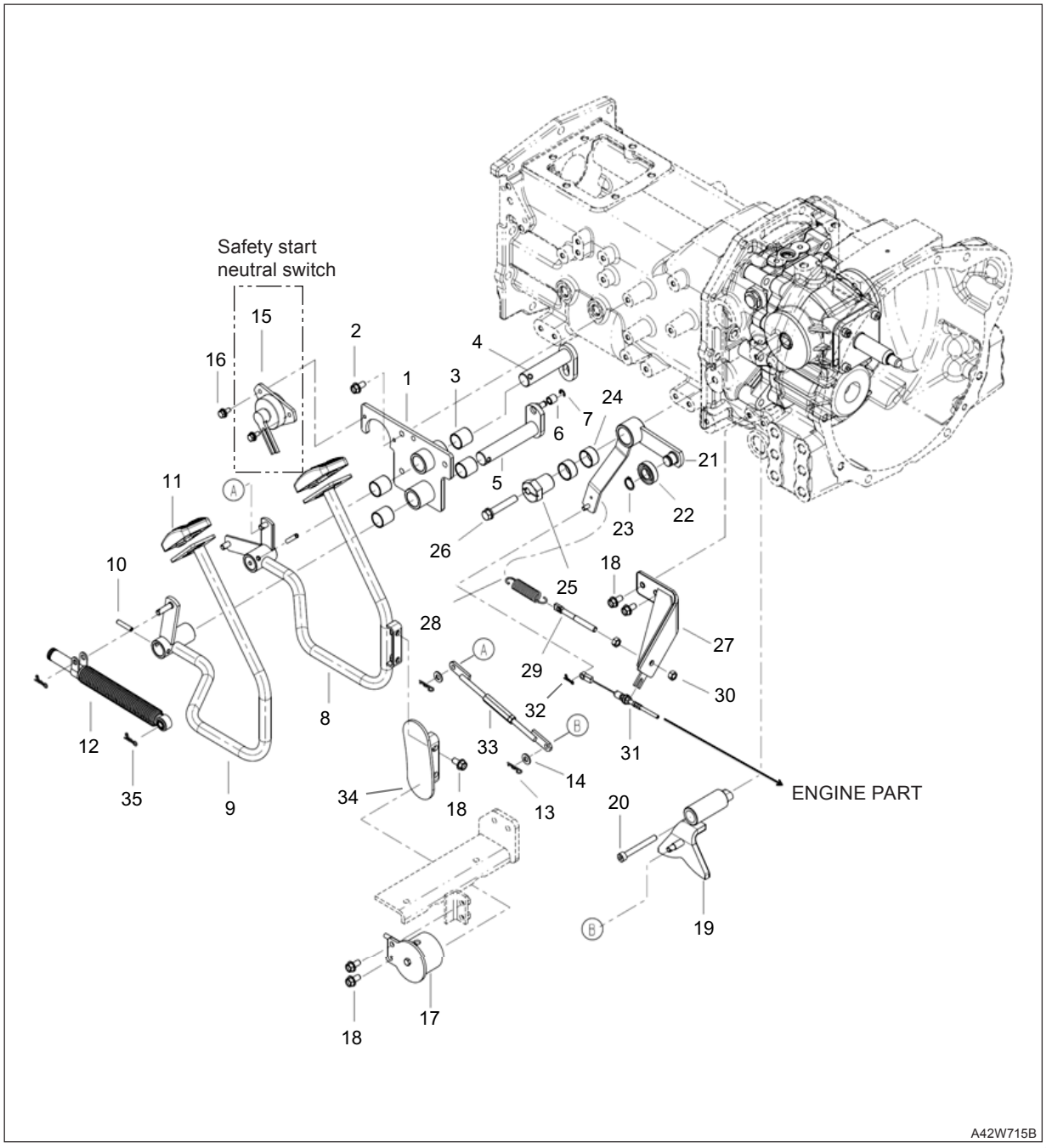
COMPONENTS

(1) Fender R ass'y
(2) Fender L ass'y
(3) Fender grip
(4) Hex flange bolt
(5) Hex flange bolt
(6) Fender support bracket
(7) Hex flange bolt
(8) Hex flange nut
(9) Hex flange nut
(10) Bracket
(11) Combination lamp
(12) Hex flange nut
(13) Reflector
(14) Combination lamp(R)
(15) Combination lamp(L)
(16) Tapping screw

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6.4 HST PEDAL [HST MODEL]



COMPONENTS

(1) Bracket assy, pedal
(2) Hex flange bolt
(3) Bush
(4) Shaft assy, front
(5) Shaft assy, rear
(6) Roller
(7) Snap ring
(8) Pedal ass'y, front
(9) Pedal ass'y, rear
(10) Spring pin
(11) Pedal cover
(12) Damper
(13) Snap pin
(14) Plain washer
(15) Switch(FR)
(16) Bolt w/washer
(17) Cruise magnet
(18) Hex flange bolt
(19) Joint
(20) Hexagon socket bolt
(21) Arm ass'y
(22) Ball bearing
(23) Snap ring
(24) Bush
(25) Shaft
(26) Bolt w/washer
(27) Holder assy, spring
(28) Spring
(29) Bolt
(30) Hex nut
(31) Wire
(32) Snap pin
(33) Rod assy
(34) Bracket assy, cruise
(35) Snap pin

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7. TROUBLESHOOTING

INSPECTION ITEM / SYMPTOM	Safety Switch	Safe start Relay	Ignition switch	Starter Motor	Battery	Fuse and fusible link	Fuel cut-off solenoid	Preheat Controller	Preheat Relay	Coolant temperature sensor (preheat)	Alternator	Instrument panel	Light bulb	Fuse	Flasher unit
The engine cannot be started (start motor operated)				●	●		●								
The engine cannot be started (start motor not operated)	●	●	●	●	●	●									
The engine can be started without depressing the clutch pedal.									●						
The engine cannot be stopped.							●								
The preheat indicator does not come on.						●		●	●	●		●			
The preheat indicator does not go off.								●	●						
The charge warning lamp does not come on.						●					●	●			
The charge warning lamp does not go off.											●				
The head lamp does not come on.													●	●	
The turn signal lamp does not come on.													●	●	●
The horn does not sound.														●	

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