

# BAD BOY



## TRACTORS



## 50 SERIES TRACTORS

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**5045H, 5045CH, 5045S, 5045CS**

**5055H, 5055CH, 5055S, 5055CS**

## SERVICE MANUAL

**Before ordering parts please check for the latest Parts Manual update on the Tractor tab of the Bad Boy Mowers Dealer Zone.**

Revised: 7/10/25

# 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 BB5045/BB5055 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 Bad Boy genuine parts which are manufactured under strict quality assurance policy for premium quality, durability and reliability. Bad Boy 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 Bad Boy Tractors

## ※ 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 Bad Boy**

# MEANINGS OF SAFETY SYMBOLS

Precautions and instructions described in this manual and safety decals, such as DANGER, WARNING and CAUTION decals, are important for you and your 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:

 <b>DANGER</b>	This symbol indicates potentially hazardous situation which, if not observed, may result in death or moderate injury.
 <b>WARNING</b>	This symbol indicates the most serious hazardous situation which, if not observed, may result in death or serious injury.
 <b>CAUTION</b>	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.
 <b>IMPORTANT</b>	This symbol indicates important procedures or information to perform work with more ease and skills.
<b>Notes</b>	This symbol indicates information useful to users.

# 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 Bad Boy 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 BB5045/BB5055 tractor and contains several useful chapters such as General Information, Engine, Clutch, Transmission, Front Axle, Hydraulic System, Electric System and Cabin and HVAC. 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**

BB5045/BB5055 TRACTOR

**1**

CHAPTER 3 CLUTCH

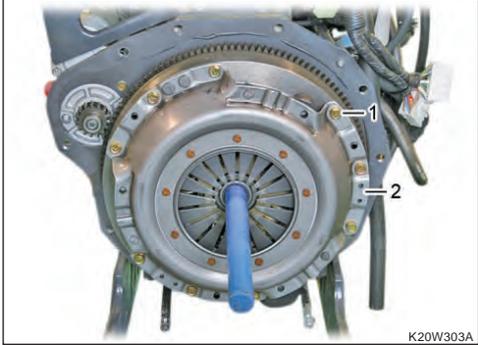
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**3. DISASSEMBLY**

**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 coolant and transmission fluid.
4. Remove the hood and propeller shaft.
5. Disconnect the hydraulic hose, wiring connector, heater hose, A/C hose and various cables from the cabin body.
6. Remove the cabin.
7. Place a stand under the clutch housing and a

**3.2 CLUTCH DISASSEMBLY**



K20W303A

< Lower section >

**2**

9. Unscrew the mounting bolt (1) from the clutch housing and engine flywheel housing. 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)

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



K20W304A

2. Remove the clutch disc.

B50S-202406

3-9

**4**

**5**

# 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: 3-9

## 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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# CHAPTER 1 GENERAL INFORMATION

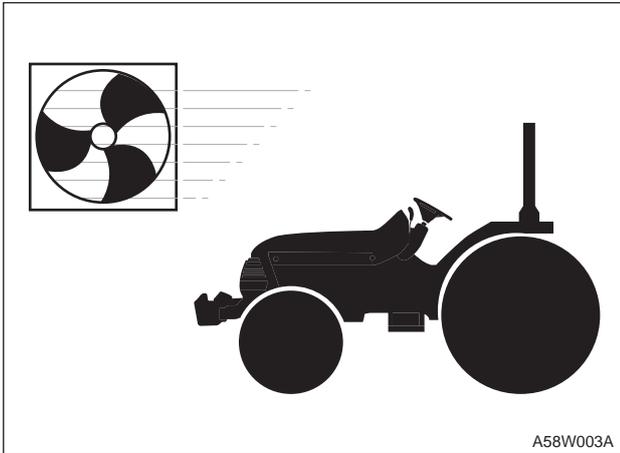
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1. GENERAL INFORMATION FOR SERVICE

1.1 FOR SAFE OPERATION

1.1.1 WORK PLACE



**⚠ 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.

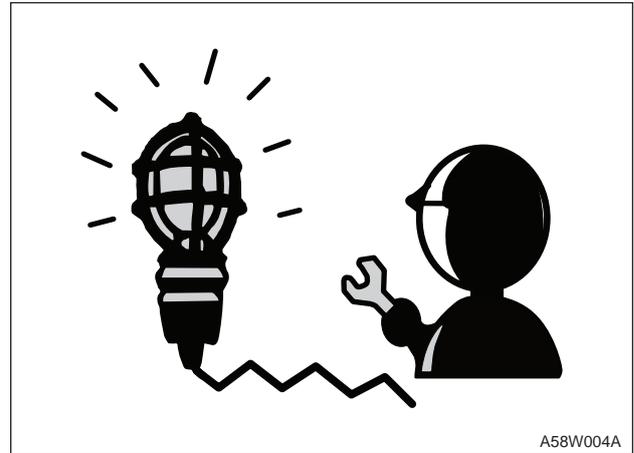
**⚠ CAUTION**

**Sufficient working area:**

- To prevent an injury, secure a sufficient working area for service. [Otherwise] it can lead to rollover.

**⚠ CAUTION**

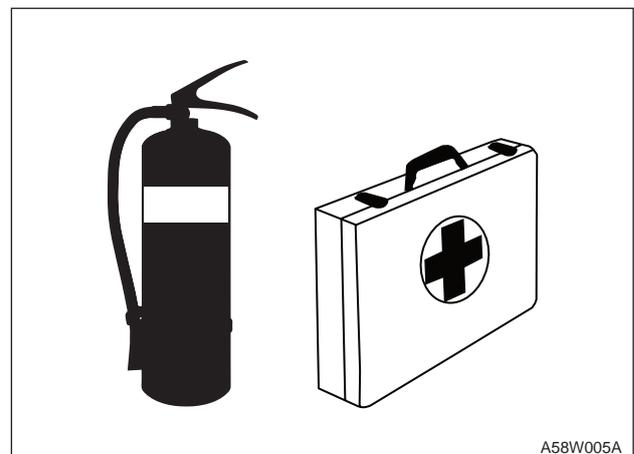
- Have your work place neat and clean.



**⚠ CAUTION**

- The work place should be properly illuminated.

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

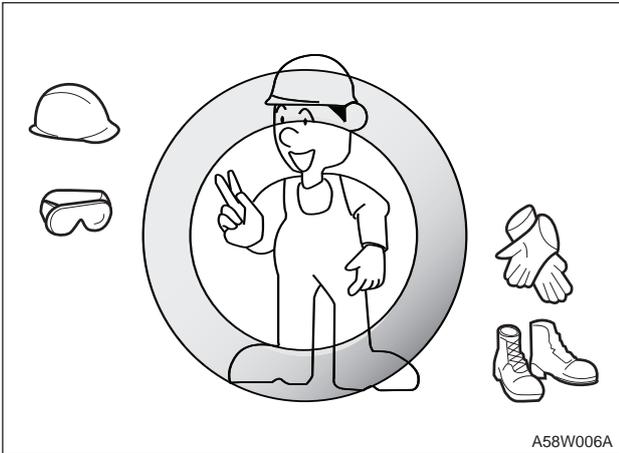


**⚠ CAUTION**

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

Have a fire extinguisher in your work place.

1.1.2 WORKING CLOTHES AND OTHER SAFETY GEARS



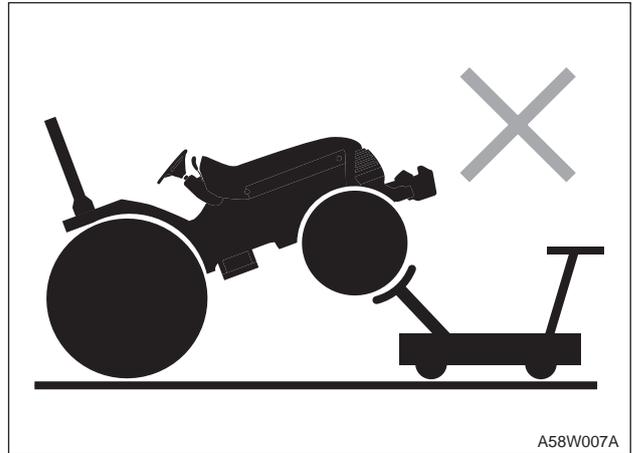
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**⚠ CAUTION**

- Wear proper working clothes to ensure your safety.

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

1.1.3 TOOL



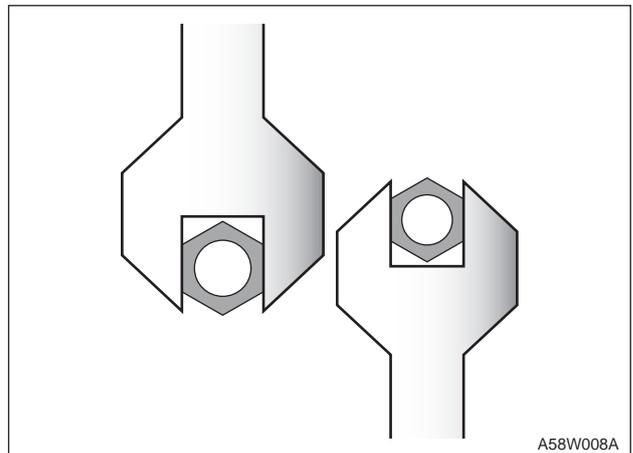
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**⚠ DANGER**

- 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.



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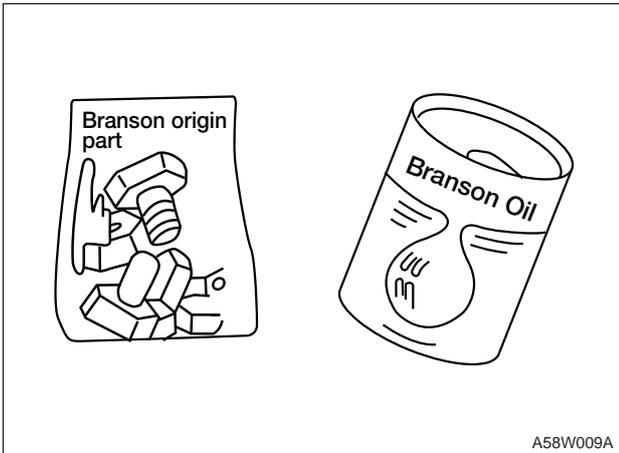
**⚠ WARNING**

- 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.

1.1.4 STANDARD PARTS, LUBRICANT, GREASE AND OIL

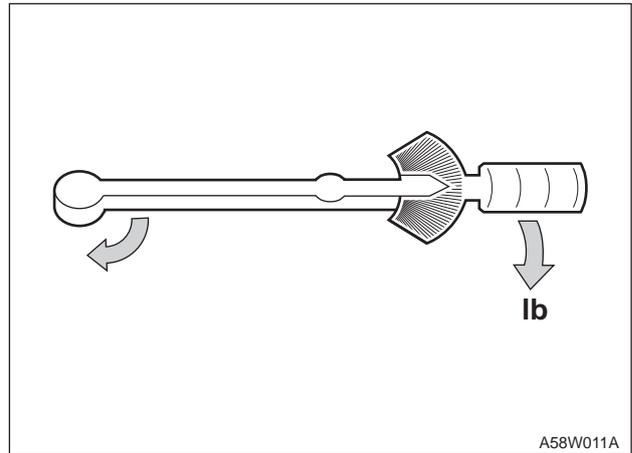


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**⚠ CAUTION**

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

1.1.6 TORQUE PART



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**⚠ WARNING**

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

1.1.5 FINISHING UP AND CHECKING

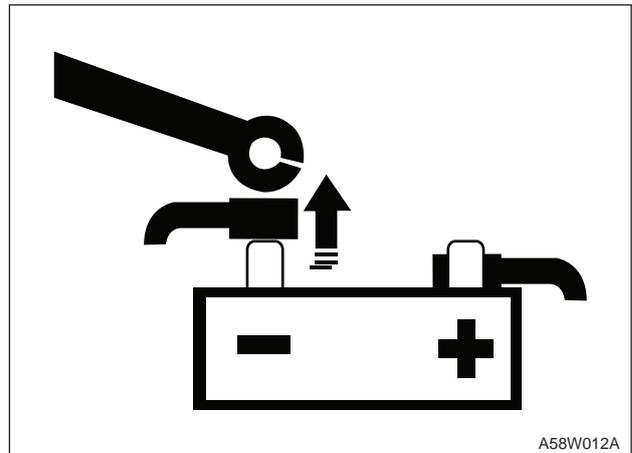


A58W010A

**⚠ CAUTION**

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

1.1.7 ELECTRIC SYSTEM

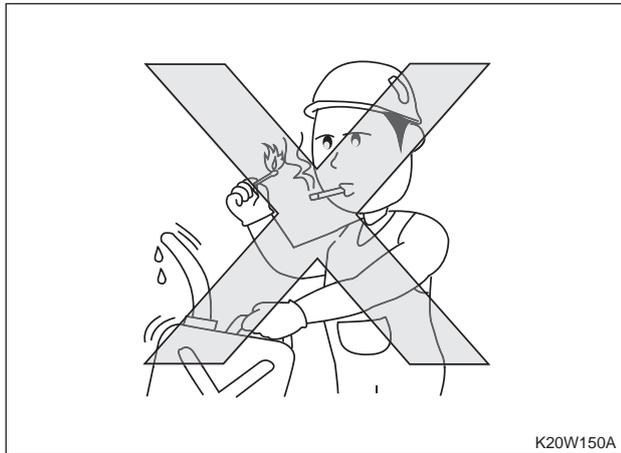


A58W012A

**⚠ 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.

1.1.8 SAFETY DURING SERVICE



**⚠ 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.

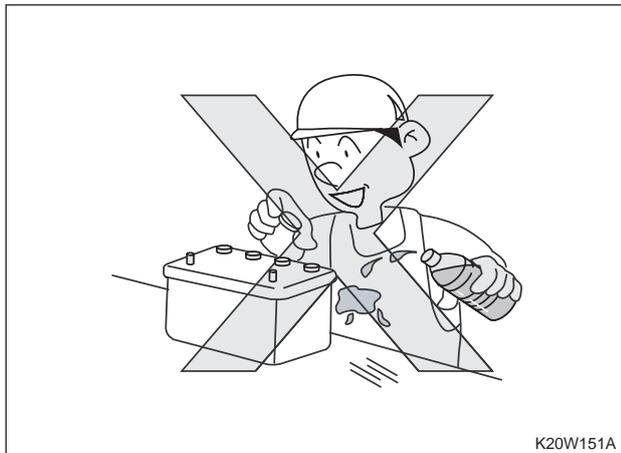


**⚠ CAUTION**

**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.

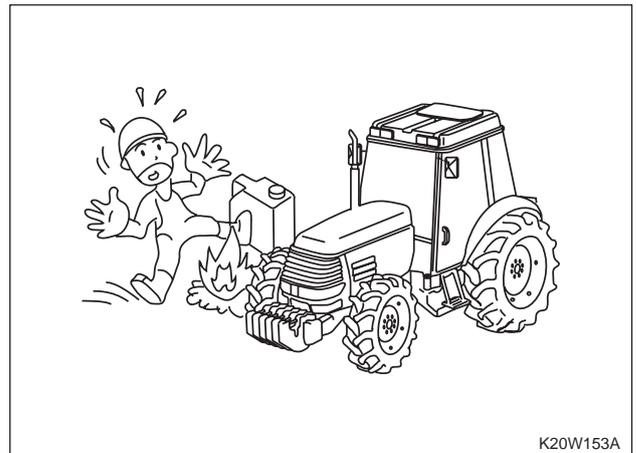


**⚠ DANGER**

**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.



**⚠ 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.



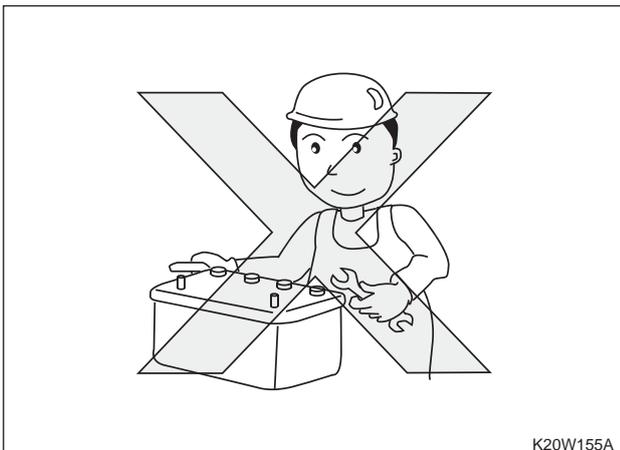
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**⚠ DANGER**

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.



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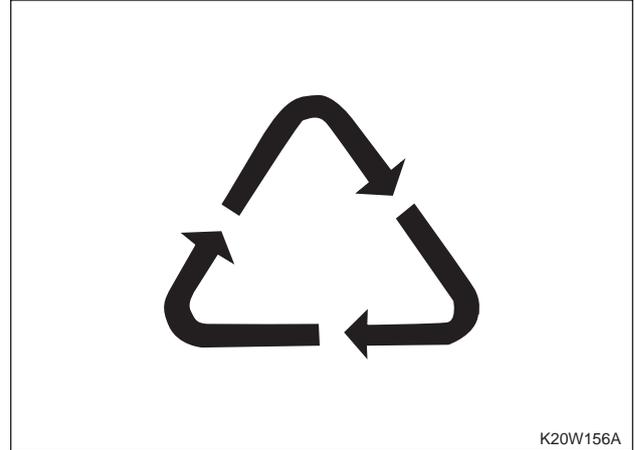
**⚠ CAUTION**

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



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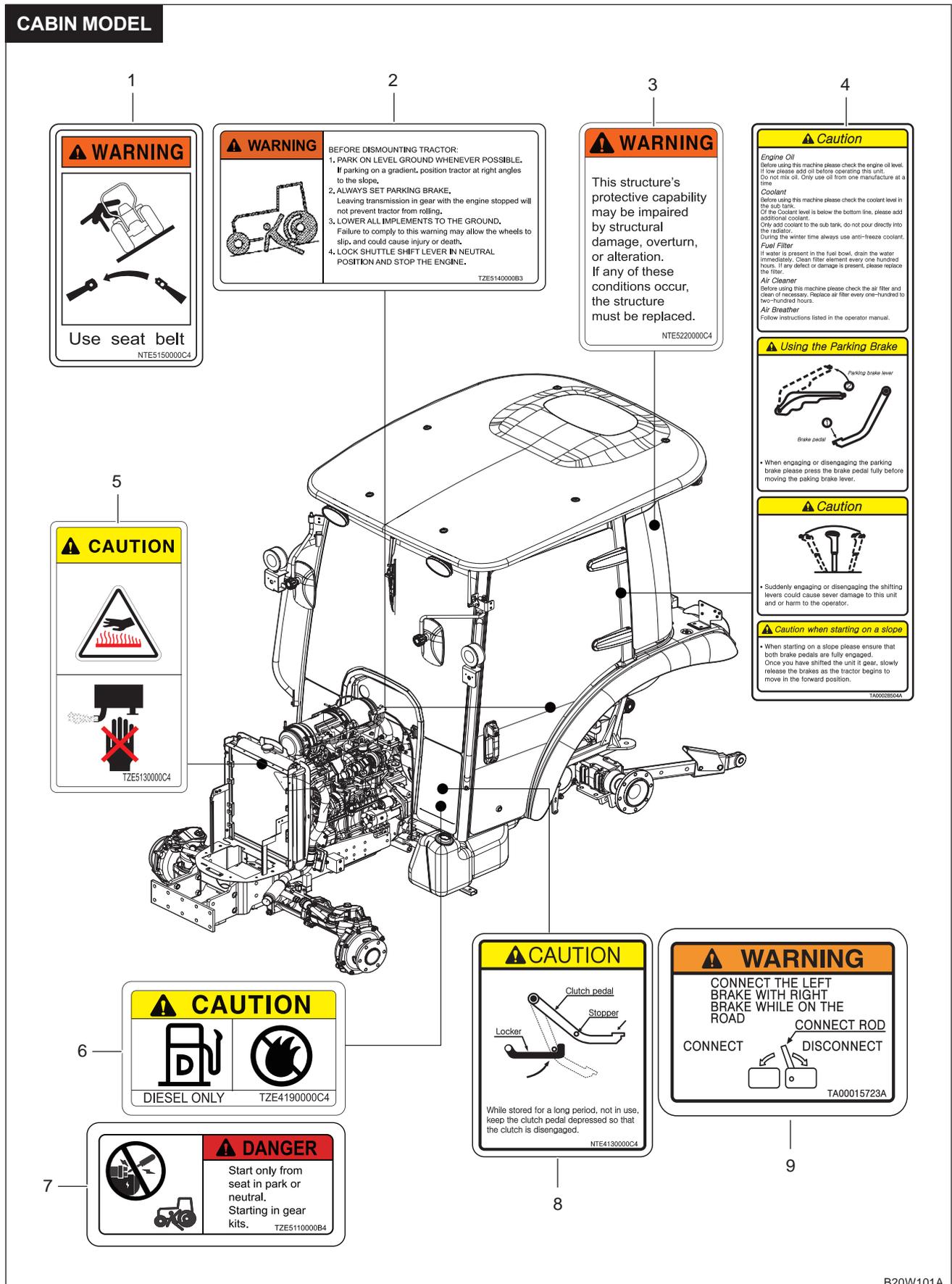
**⚠ WARNING**

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.

## 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 decal is damaged or missing, attach a new decal.



CABIN MODEL

**Warning**

- Work in ventilated area.
- Do not work long hours air conditioner, because it make exhaust air. If you don't have an air cleaner, open the door and get outside air into the area.

**Caution**

Before operating this machine please read the operators manual or the safe operation how to operate the tractor. Always check the oil, coolant, and fuel levels before operating this unit.

**Starting**

- Do not use a screwdriver or any other tool to jump the starter as a means of cranking the unit.
- The operator should only start this unit from the operators station. Starting this unit anywhere other than the operator's platform can cause serious injury.
- When starting this unit it is critical to ensure that main shift lever, range shift lever, and pto shift lever are all in the neutral position.
- While operating this unit always ensure that safety devices are being used correctly. For example always wear your seat belt and ensure that the cab cover is installed.
- Never start this unit while others are close by. Only crank and operate this unit once others are at a safe distance. This includes starting, operating implements, operating a loader, or using a backhoe.
- After starting this unit allow the tractor to idle five minutes with the air lever and the shift lever in the neutral position.
- In cold weather allow the glow plugs to cycle through one time before trying to start this unit.

**Driving**

- When turning on a slope or uneven surface please reduce your speed.
- When traveling downhill please shift into low range before you begin moving.
- Do not operate this unit in narrow or unsafe places: the potential for rollover could exist in these conditions.
- When climbing a steep slope, always do so in reverse.
- While driving the tractor make sure that the two brake pedals are latched together, and do not engage differential lock while moving.
- The operator should be the only person on the tractor. Carrying passengers on the tractor or implement can cause serious injury.
- Do not lean on, or stand on pto cover at anytime.
- Do not suddenly stop, turn, or jump the clutch on this unit at anytime.
- While operating on a public road, always abide by the law.

**Operating**

- Use caution in wet conditions, turning suddenly can cause the tractor to become stuck.
- When operating this unit, always maintain a safe working distance from others.

**Parking**

- When parking the tractor make sure all implements or attachments are on the ground before turning of the engine. This include the front loader.
- When parking on a slope always apply the parking brake and chock the tires.

**Servicing**

- Before servicing this machine always turn the engine off.
- When checking electrical components always disconnect the negative terminal of the battery.
- For information regarding service issues or service help please contact your local dealer.
- Always allow time for the radiator coolant to cool and relieve pressure before removing the radiator cap.

**Caution**

Lock the joystick. Release joystick.

When the joystick is not being used, always put it in the locked position.

TA00028501A

**WARNING**

TO AVOID PERSONAL INJURY:

- Attach pulled or towed loads to the drawbar only.
- Use the 3-point hitch only with equipment designed for 3-point hitch usage.

TZE5120000B4

**WARNING**

TO AVOID PERSONAL INJURY:

- Keep PTO shield in place at all times.
- Do not operate the PTO at speeds faster than the speed recommended by the implement manufacturer.
- For towing PTO-driven implements set drawbar at towing position. (see operator's manual)
- Keep hands, feet and clothing away.

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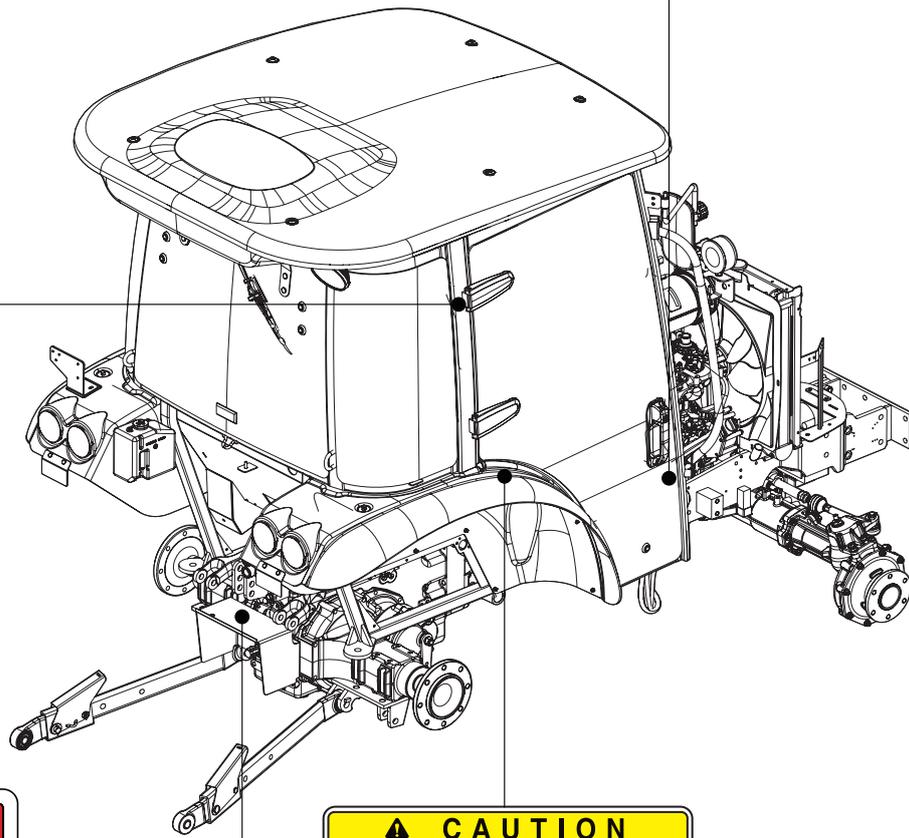
**WARNING**

CONNECT THE LEFT BRAKE WITH RIGHT BRAKE WHILE ON THE ROAD

CONNECT ROD

DISCONNECT      CONNECT

TZE4100000B4



**CAUTION**

TO AVOID PERSONAL INJURY:

- Read and understand the operator's manual before operation
- Before starting the engine, make sure that everyone is at a safe distance from the tractor and that the PTO is OFF
- Do not allow passengers on the tractor at any time.
- Before allowing other people to use the tractor, have them read the operator's manual.
- Check the tightness of all nuts and bolts regularly.
- Keep all shields in place and stay away from all moving parts.
- Lock the two brake pedals together before driving on the road.
- Slow down for turns, or rough roads, or when applying individual brakes.
- On public roads use SMV emblem and hazard lights, if required by local traffic and safety regulations.
- Pull only from the drawbar.
- Before dismounting lower the implement, set the parking brake, stop the engine and remove the key.

TZE60000B3

**WARNING**

Breathing diesel engine exhaust exposes you to chemicals known to the state of California to cause cancer and birth defects or other reproductive harm.

- Always start and operate the engine in a well-ventilated area.
- If in an enclosed area, vent the exhaust to the outside.
- Do not modify or tamper with the exhaust system.
- Do not idle the engine except as necessary.

For more information go to [www.P65Warnings.ca.gov/diesel](http://www.P65Warnings.ca.gov/diesel).

**WARNING** Cancer and Reproductive Harm - [www.P65Warnings.ca.gov](http://www.P65Warnings.ca.gov).

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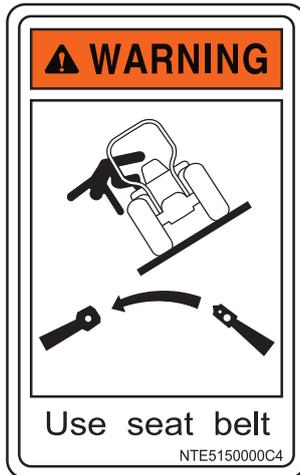
**WARNING**

TO AVOID PERSONAL INJURY OR DEATH FROM ROLL-OVER:

- BRANSON recommends the use of a Roll-Over Protective Structure (ROPS) and seat belt in almost all applications.
- Remove the ROPS only when it substantially interferes with operation or itself presents a safety risk. (Examples include work in orchards and vineyards.) ALWAYS REINSTALL IT BEFORE USING THE TRACTOR IN OTHER APPLICATIONS.
- Never use just the seat belt or just the ROPS. They must be used together. For further details, consult your Operator's Manual or your local dealer.

TZE517000B3

(1) SEAT BELT (NTE5150000C4)



(2) CAUTION-GETTING OFF (TZE5140000B3)

	<p><b>BEFORE DISMOUNTING TRACTOR:</b></p> <ol style="list-style-type: none"> <li><b>PARK ON LEVEL GROUND WHENEVER POSSIBLE.</b> If parking on a gradient, position tractor at right angles to the slope.</li> <li><b>ALWAYS SET PARKING BRAKE.</b> Leaving transmission in gear with the engine stopped will not prevent tractor from rolling.</li> <li><b>LOWER ALL IMPLEMENTS TO THE GROUND.</b> Failure to comply to this warning may allow the wheels to slip, and could cause injury or death.</li> <li><b>LOCK SHUTTLE SHIFT LEVER IN NEUTRAL POSITION AND STOP THE ENGINE.</b></li> </ol> <p style="text-align: right; font-size: small;">TZE5140000B3</p>
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(3) WARNING (NTE5220000C4)

	<p>This structure's protective capability may be impaired by structural damage, overturn, or alteration. If any of these conditions occur, the structure must be replaced.</p> <p style="text-align: right; font-size: small;">NTE5220000C4</p>
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(4) WARNING CAUTION (TA00028504A)

<p><b>Engine Oil</b> Before using this machine please check the engine oil level. If low please add oil before operating this unit. Do not mix oil. Only use oil from one manufacture at a time</p> <p><b>Coolant</b> Before using this machine please check the coolant level in the sub tank. Of the Coolant level is below the bottom line, please add additional coolant. Only add coolant to the sub tank, do not pour directly into the radiator. During the winter time always use anti-freeze coolant.</p> <p><b>Fuel Filter</b> If water is present in the fuel bowl, drain the water immediately. Clean filter element every one hundred hours. If any defect or damage is present, please replace the filter.</p> <p><b>Air Cleaner</b> Before using this machine please check the air filter and clean of necessary. Replace air filter every one-hundred to two-hundred hours.</p> <p><b>Air Breather</b> Follow instructions listed in the operator manual.</p>

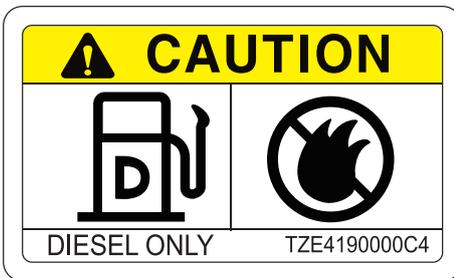
<ul style="list-style-type: none"> <li>When engaging or disengaging the parking brake please press the brake pedal fully before moving the parking brake lever.</li> </ul>

<ul style="list-style-type: none"> <li>Suddenly engaging or disengaging the shifting levers could cause sever damage to this unit and or harm to the operator.</li> </ul>
<ul style="list-style-type: none"> <li>When starting on a slope please ensure that both brake pedals are fully engaged. Once you have shifted the unit it gear, slowly release the brakes as the tractor begins to move in the forward position.</li> </ul> <p style="text-align: right; font-size: small;">TA00028504A</p>

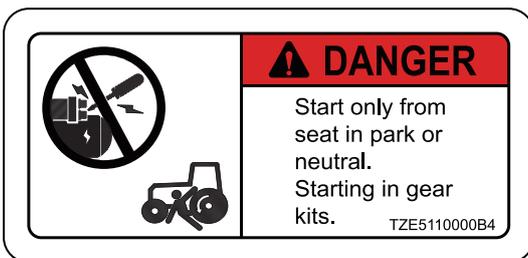
(5) CAUTION (TZE5130000C4)



(6) REFUEL (TZE4190000C4)



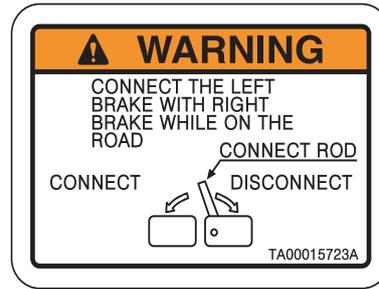
(7) START (TZE5110000C4)



(8) SINGLE CLUTCH (NTE4130000C4)



(9) BRAKE PEDAL(HST) (TA00015723A)



(10) WARNING CAUTION (TA00028501A)

**Warning**

- Work in ventilated area. Do not work long hours air conditioner, because it make exhaust air. If you don't have an air cleaner, open the door and get outside air into the area.

**Caution**

Before operating this machine please read the operators manual so that you fully understand how to operate this machine. Always check the oil, coolant, and fuel levels before operating this unit.

**Starting**

1. Do not use a screwdriver or any other tool to jump the starter as a means of cranking this unit.
2. The operator should only start this unit from the operators station. Starting this unit anywhere other than the operator's platform can cause serious injury.
3. When starting this unit it is critical to ensure that main shift lever, range shift lever, and pto shift lever are all in the neutral position.
4. While operating this unit always ensure that safety devices are being used correctly. For example always wear your seat belt and ensure that the pto cover is installed.
5. Never start this unit while others are close by. Only crank and operate this unit once others are at a safe distance. This includes starting, operating implements, operating a loader, or using a backhoe.
6. After starting this unit allow the tractor to idle five minutes with the pto lever and the shift lever in the neutral position.
7. In cold weather allow the glow plugs to cycle through one time before trying to start this unit.

**Driving**

1. When turning on a slope or uneven surface please reduce your speed.
2. When traveling downhill please shift into low range before you begin moving.
3. Do not operate this unit in narrow or unsafe places; the potential for roll over could exist in these conditions.
4. When climbing a steep slope, always do so in reverse.
5. While driving the tractor make sure that the two brake pedals are latched together, and do not engage differential lock while moving.
6. The operator should be the only person on the tractor. Carrying passengers on the tractor or implement can cause serious injury.
7. Do not step on, or stand on pto cover at anytime. 8. Do not suddenly stop, turn, or jump the clutch on this unit at anytime. 9. While operating on a public road, always abide by the law.

**Operating**

1. Use caution in wet conditions, turning suddenly can cause the tractor to become stuck.
2. When operating this unit, always maintain a safe working distance from others.

**Parking**

1. When parking the tractor make sure all implements or attachments are on the ground before turning of the engine. This includes the front end loader.
2. When parking on a slope always apply the parking break and chock the tires.

**Servicing**

1. Before servicing this machine always turn the engine off first.
2. When checking electrical components always disconnect the negative terminal of the battery.
3. For information regarding service issues or service help please contact you local dealer.
4. Always allow time for the radiator coolant to cool and relieve pressure before removing the radiator cap.

**Caution**

Lock the joystick

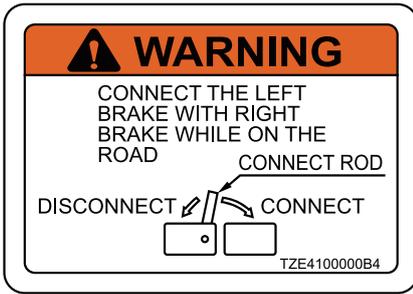
Release joystick

Front  
Left Right  
Back

- When the joystick is not being used, always put it in the locked position.

TA00028501A

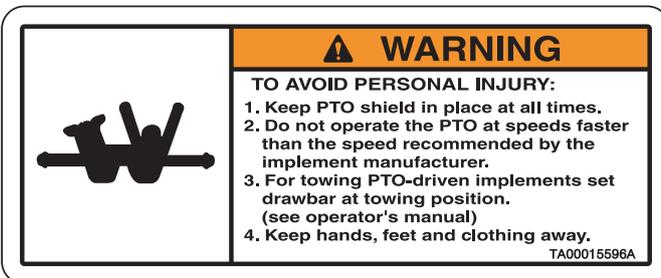
(11) BRAKE PEDAL (TZE410000B4)



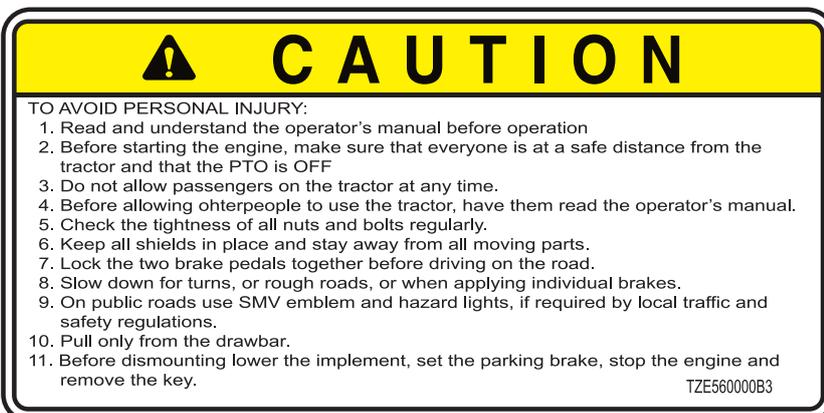
(12) WARNING-CONNECTION (TZE512000B4)



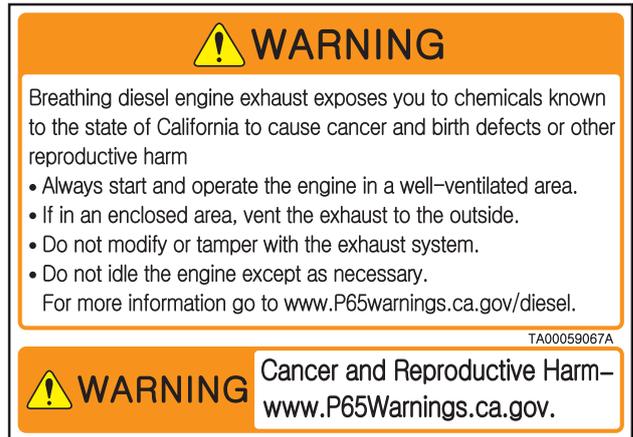
(13) WARNING-PTO (TA00015596B)



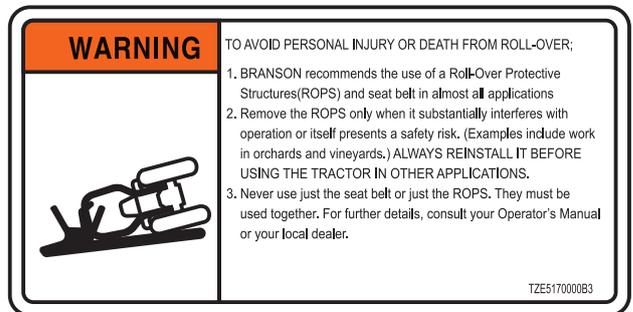
(14) CAUTION-SAFETY (TZE516000B3)



(15) WARNING-CALIFORNIA (TA00059067A)



(16) WARNING-ROPS (TZE517000B3)



**ROPS MODEL**

1

**WARNING**

Set loader joystick safety lock during no use.

2

**WARNING**

CONNECT THE LEFT BRAKE WITH RIGHT BRAKE WHILE ON THE ROAD

DISCONNECT  CONNECT 

CONNECT ROD

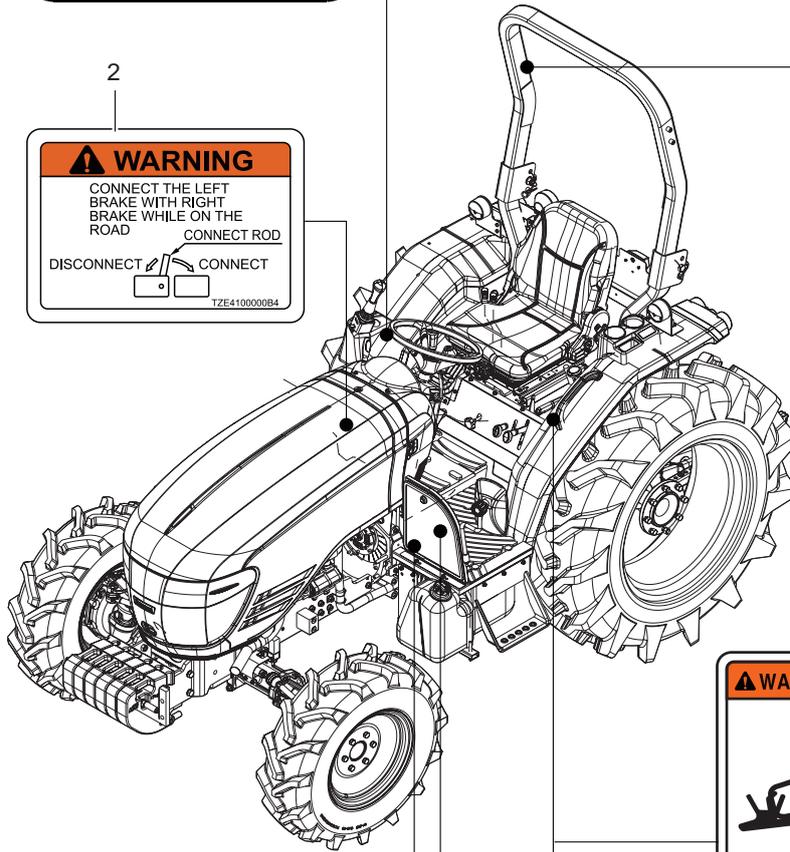
TZE410000B4

6

**WARNING**

This structure's protective capability may be impaired by structural damage, overturn, or alteration. If any of these conditions occur, the structure must be replaced.

NTE522000C4



7

**WARNING**

TO AVOID PERSONAL INJURY OR DEATH FROM ROLL-OVER:

1. BRANSON recommends the use of a Roll-Over Protective Structures (ROPS) and seat belt in almost all applications
2. Remove the ROPS only when it substantially interferes with operation or itself presents a safety risk. (Examples include work in orchards and vineyards.) ALWAYS REINSTALL IT BEFORE USING THE TRACTOR IN OTHER APPLICATIONS.
3. Never use just the seat belt or just the ROPS. They must be used together. For further details, consult your Operator's Manual or your local dealer.

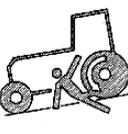


TZE517000B3

**WARNING**

BEFORE DISMOUNTING TRACTOR:

1. PARK ON LEVEL GROUND WHENEVER POSSIBLE. If parking on a gradient, position tractor at right angles to the slope.
2. ALWAYS SET PARKING BRAKE. Leaving transmission in gear with the engine stopped will not prevent tractor from rolling.
3. LOWER ALL IMPLEMENTS TO THE GROUND. Failure to comply to this warning may allow the wheels to slip, and could cause injury or death.
4. LOCK SHUTTLE SHIFT LEVER IN NEUTRAL POSITION AND STOP THE ENGINE.



TZE514000B3

3

**CAUTION**

DIESEL ONLY TZE419000C4

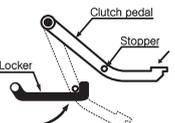
4

**DANGER**

 Start only from seat in park or neutral. Starting in gear kits.

TZE511000B4

**CAUTION**



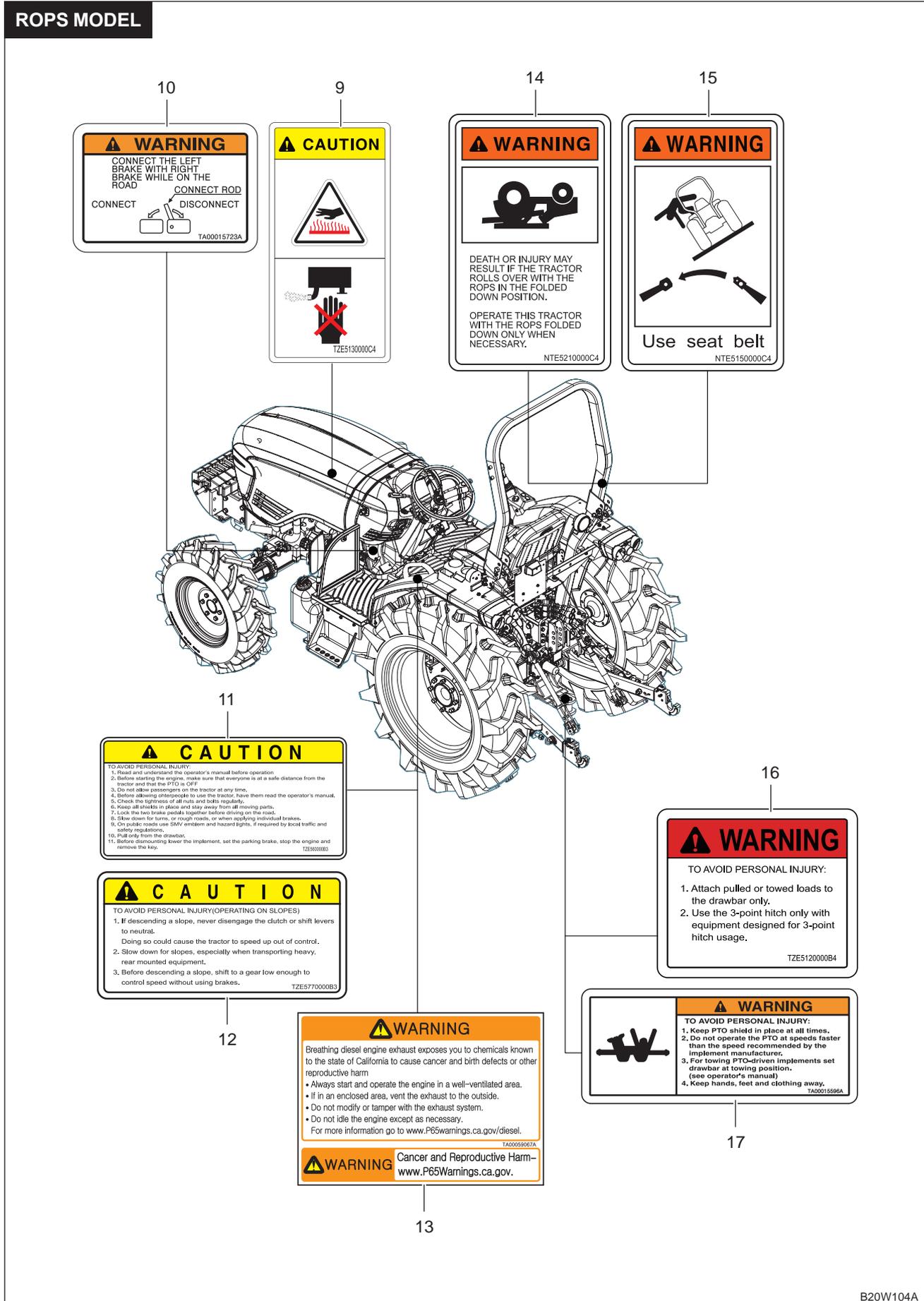
Clutch pedal  
Stopper  
Locker

While stored for a long period, not in use, keep the clutch pedal depressed so that the clutch is disengaged.

NTE413000C4

5

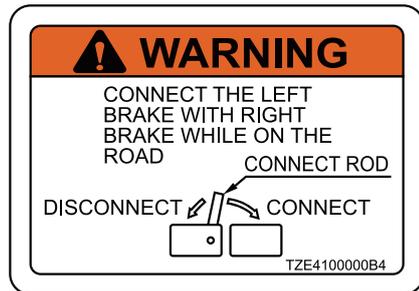
8



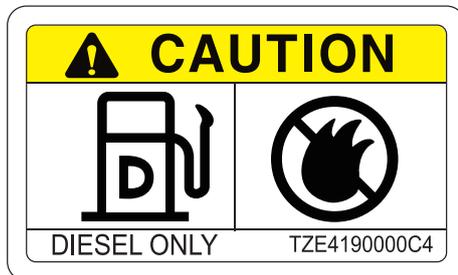
(1) JOYSTICK (TA00026342C)



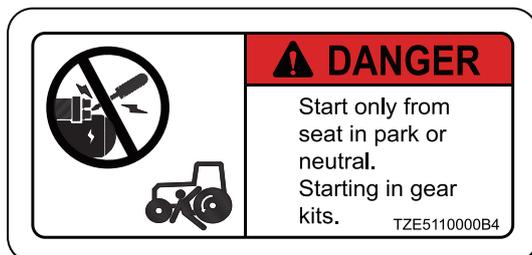
(2) BRAKE PEDAL (TZE4100000B4)



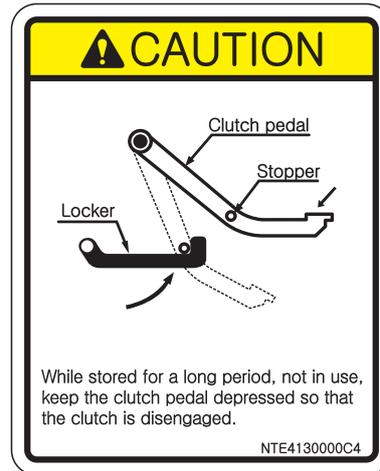
(3) REFUEL (TZE4190000C4)



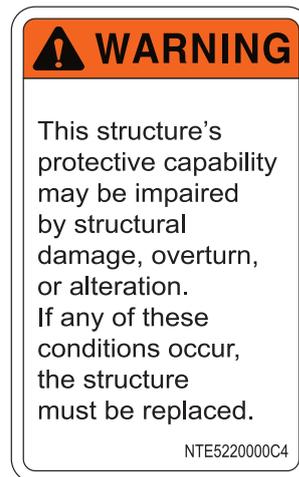
(4) START (TZE5110000C4)



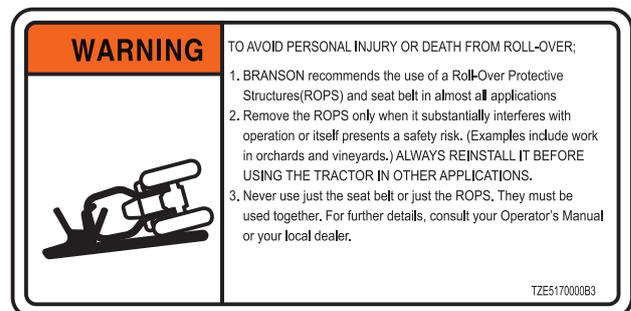
(5) SINGLE CLUTCH (NTE4130000C4)



(6) WARNING (NTE5220000C4)

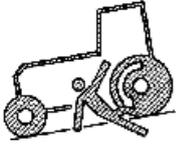


(7) WARNING-ROPS (TZE5170000B3)



(8) CAUTION-GETTING OFF (TZE5140000B3)

<b>⚠ WARNING</b>	<p><b>BEFORE DISMOUNTING TRACTOR:</b></p> <ol style="list-style-type: none"> <li><b>PARK ON LEVEL GROUND WHENEVER POSSIBLE.</b> If parking on a gradient, position tractor at right angles to the slope.</li> <li><b>ALWAYS SET PARKING BRAKE.</b> Leaving transmission in gear with the engine stopped will not prevent tractor from rolling.</li> <li><b>LOWER ALL IMPLEMENTS TO THE GROUND.</b> Failure to comply to this warning may allow the wheels to slip, and could cause injury or death.</li> <li><b>LOCK SHUTTLE SHIFT LEVER IN NEUTRAL POSITION AND STOP THE ENGINE.</b></li> </ol>
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TZE5140000B3

(12) CAUTION-SAFETY (TZE5770000B3)

<b>⚠ CAUTION</b>
<p><b>TO AVOID PERSONAL INJURY(OPERATING ON SLOPES)</b></p> <ol style="list-style-type: none"> <li>If descending a slope, never disengage the clutch or shift levers to neutral. Doing so could cause the tractor to speed up out of control.</li> <li>Slow down for slopes, especially when transporting heavy, rear mounted equipment.</li> <li>Before descending a slope, shift to a gear low enough to control speed without using brakes.</li> </ol>

TZE5770000B3

(9) CAUTION (TZE5130000C4)

<b>⚠ CAUTION</b>

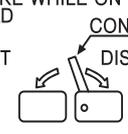


TZE5130000C4

(13) WARNING-CALIFORNIA (TA00059067A)

<b>⚠ WARNING</b>		
<p>Breathing diesel engine exhaust exposes you to chemicals known to the state of California to cause cancer and birth defects or other reproductive harm</p> <ul style="list-style-type: none"> <li>• Always start and operate the engine in a well-ventilated area.</li> <li>• If in an enclosed area, vent the exhaust to the outside.</li> <li>• Do not modify or tamper with the exhaust system.</li> <li>• Do not idle the engine except as necessary.</li> </ul> <p>For more information go to <a href="http://www.P65warnings.ca.gov/diesel">www.P65warnings.ca.gov/diesel</a>.</p>		
TA00059067A		
<table border="0"> <tr> <td style="text-align: center; vertical-align: middle;"><b>⚠ WARNING</b></td> <td style="padding-left: 10px; vertical-align: middle;"> <b>Cancer and Reproductive Harm—</b>  <a href="http://www.P65Warnings.ca.gov">www.P65Warnings.ca.gov</a> </td> </tr> </table>	<b>⚠ WARNING</b>	<b>Cancer and Reproductive Harm—</b> <a href="http://www.P65Warnings.ca.gov">www.P65Warnings.ca.gov</a>
<b>⚠ WARNING</b>	<b>Cancer and Reproductive Harm—</b> <a href="http://www.P65Warnings.ca.gov">www.P65Warnings.ca.gov</a>	

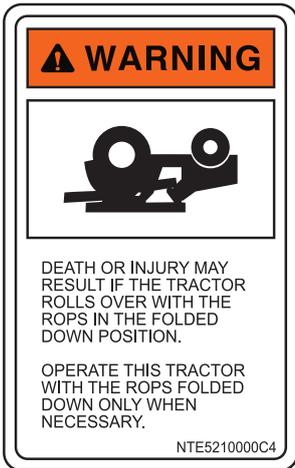
(10) BRAKE PEDAL(HST) (TA00015723A)

<b>⚠ WARNING</b>
<p>CONNECT THE LEFT BRAKE WITH RIGHT BRAKE WHILE ON THE ROAD</p> <p style="text-align: center;">CONNECT ROD</p> <p>CONNECT      DISCONNECT</p> 
TA00015723A

(11) CAUTION-SAFETY (TZE5160000B3)

<b>⚠ CAUTION</b>
<p><b>TO AVOID PERSONAL INJURY:</b></p> <ol style="list-style-type: none"> <li>1. Read and understand the operator's manual before operation</li> <li>2. Before starting the engine, make sure that everyone is at a safe distance from the tractor and that the PTO is OFF</li> <li>3. Do not allow passengers on the tractor at any time.</li> <li>4. Before allowing other people to use the tractor, have them read the operator's manual.</li> <li>5. Check the tightness of all nuts and bolts regularly.</li> <li>6. Keep all shields in place and stay away from all moving parts.</li> <li>7. Lock the two brake pedals together before driving on the road.</li> <li>8. Slow down for turns, or rough roads, or when applying individual brakes.</li> <li>9. On public roads use SMV emblem and hazard lights, if required by local traffic and safety regulations.</li> <li>10. Pull only from the drawbar.</li> <li>11. Before dismounting lower the implement, set the parking brake, stop the engine and remove the key.</li> </ol>
TZE5160000B3

(14) WARNING (NTE5210000C4)



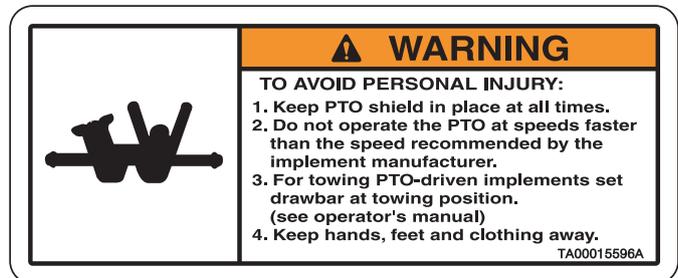
(16) WARNING-CONNECTION (TZE5120000B4)



(15) SEAT BELT (NTE5150000C4)



(17) WARNING-PTO (TA00015596B)



### 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

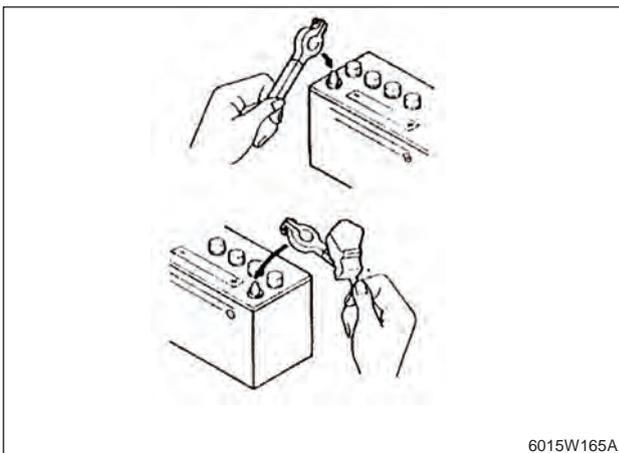
ITEM	BASE			TOLERANCE		
	N.m	kgf.m	lbf.ft	N.m	kgf.m	lbf.ft
M8 (8 mm, 0.31 in.)	11.8 ~ 15.6	1.2 ~ 1.6	8.68 ~ 11.5	8.82 ~ 11.8	0.90 ~ 1.2	6.51 ~ 8.67
M10 (10 mm, 0.39 in.)	24.6 ~ 31.3	2.5 ~ 3.2	18.1 ~ 23.1	19.7 ~ 25.4	2.0 ~ 2.6	14.5 ~ 18.8
M12 (12 mm, 0.47 in.)	29.5 ~ 49.0	3.0 ~ 5.0	21.7 ~ 36.1	31.4	3.2	23.1

### 3.2 OIL, GREASE, FUEL AND COOLANT SPECIFICATIONS

ITEM	CAPACITY		SPECIFICATION	REMARKS
	MEC MODEL	HST MODEL		
Fuel	45 ℓ (11.88 u.s. gal)		Diesel fuel (KS 2)	Summer: S, Winter: W
Engine oil	T1700: 5.3 ℓ (1.40 u.s. gal) T2300: 6.5 ℓ (1.72 u.s. gal)		SAE15W-40	Grade CG or higher
Grease	Small amount		High load No. 2 of KSM 2130	Multi-purpose
Coolant	T1700: 4.9 ℓ (1.29 u.s. gal) T2300: 5.6 ℓ (1.48 u.s. gal)		BBT genuine anti-freeze	No. 2 of KSM 2142, permanent use
Transmission fluid and steering oil	38 ℓ (10.03 u.s. gal)	35 ℓ (9.24 u.s. gal)	TF500	Texaco TDH oil, 1893 Chevron tractor hydraulic fluid
Front axle oil	7.0 ℓ (1.85 u.s. gal)		SAE#90	Gear oil

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

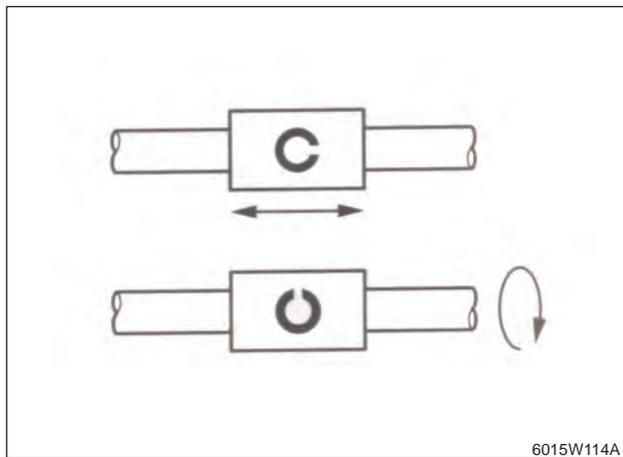
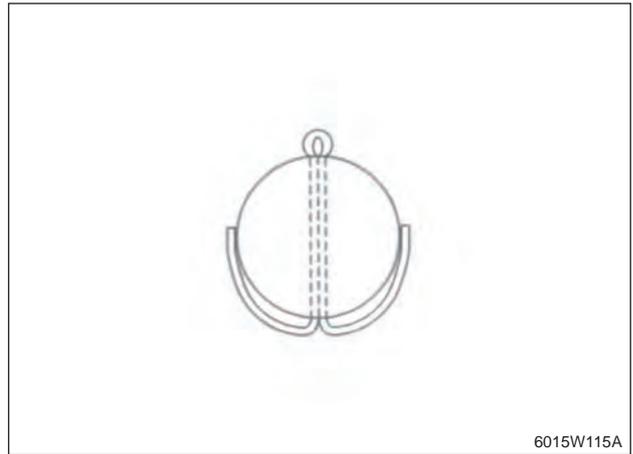
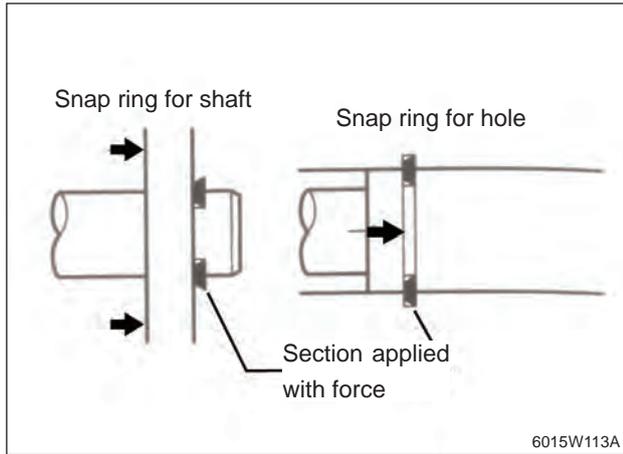
### 3.3 ELECTRIC DEVICE SERVICE



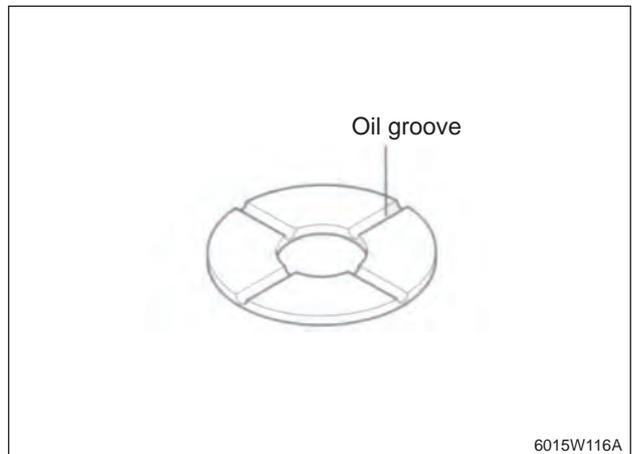
6015W165A

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.

3.4 USING STANDARD PART AND ADHESIVE

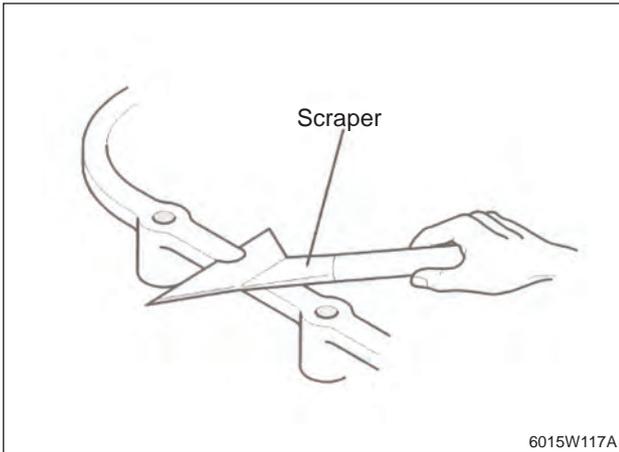


5. Replace the split pin with a new one and fix it firmly.

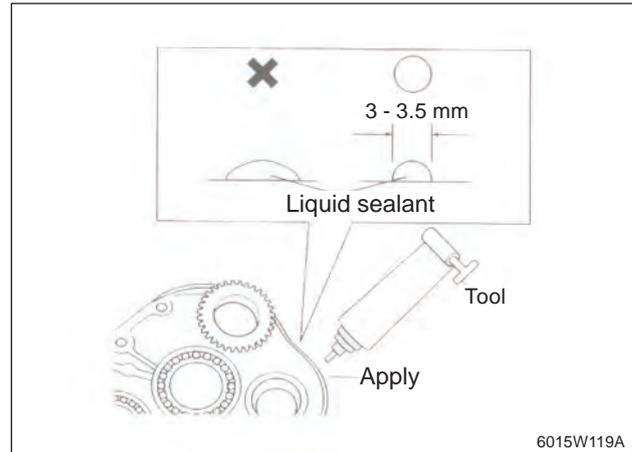


1. When replacing a worn or damaged part, use a new part that meets the international standard.
2. When replacing a packing or O-ring, fit a new one. Before installation, apply grease to the O-ring or oil seal ring.
3. When assembling a snap ring on a shaft or in a hole, ensure its sharply angled side 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.

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



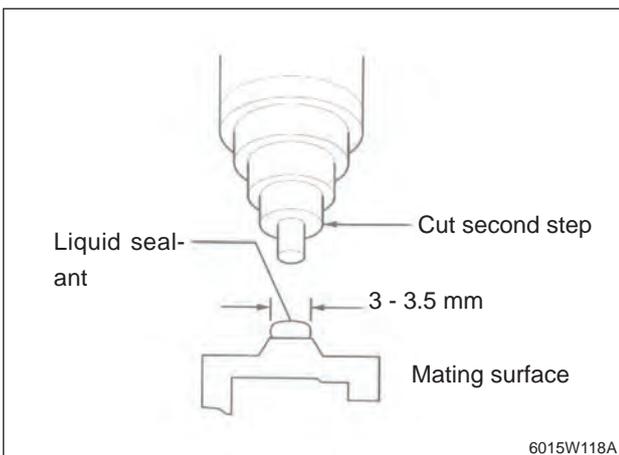
7. Use a liquid sealant removal scraper (flat) to remove any sealant left on the case. Make sure not to make any scratch bigger than 0.3 mm (0.012 in). If the surface is scratched, grind it with an oil grinder.



**⚠ CAUTION**

**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.**



**⚠ 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.**

## 4. INSPECTION AND CORRESPONDING ACTION

 <b>CAUTION</b>
--

- |  |
|--|
| <ul style="list-style-type: none"><li>• To inspect or service the tractor, stop the engine on level ground, apply the parking brake and chock the wheels in advance.</li></ul> |
|--|

1

### 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:

#### 4.4.1 CHECKING WORK PLACE

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

#### 4.4.2 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.

#### 4.4.3 CHECKING WHEN SEATING ON DRIVER'S SEAT

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

#### 4.4.4 CHECKING WHEN TURNING IGNITION SWITCH

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

#### 4.4.5 CHECKING WHEN STARTING ENGINE

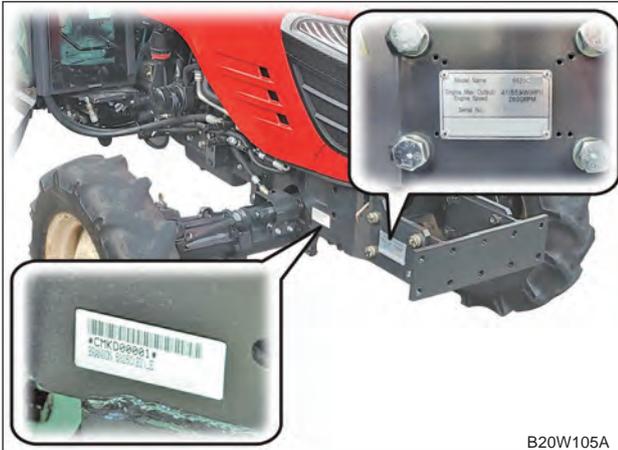
- Check if the lamp on the easy checker is not turned off.
- Check the color of exhaust gas.
- Check that the brake operates properly.

## 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

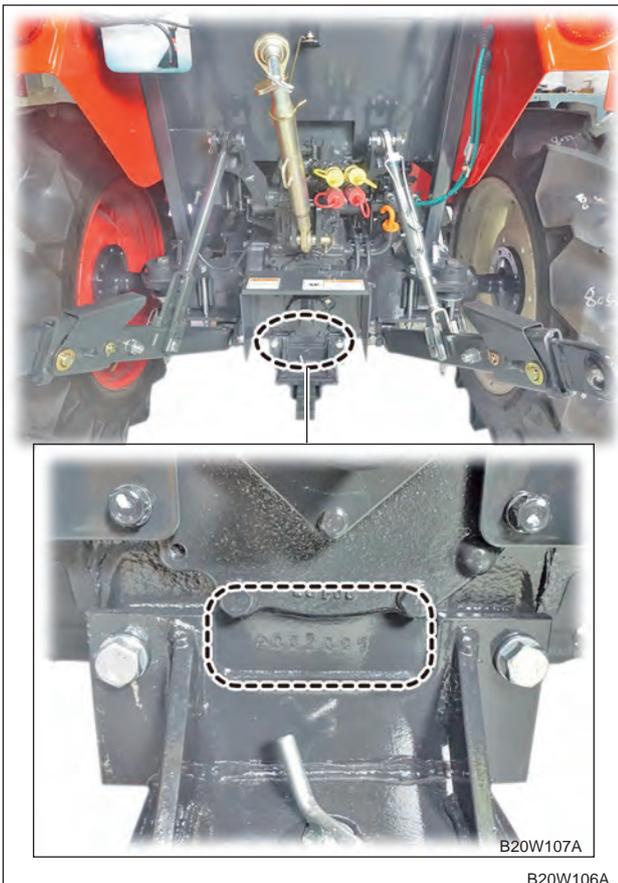


B20W105A

Example : FAGK00029

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



B20W107A

B20W106A

Example : 2007005

It is stamped on the transmission case surface on the top of the PTO cover.

#### 5.1.3 ENGINE NUMBER



B20W108A

Example : TCCK00093

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

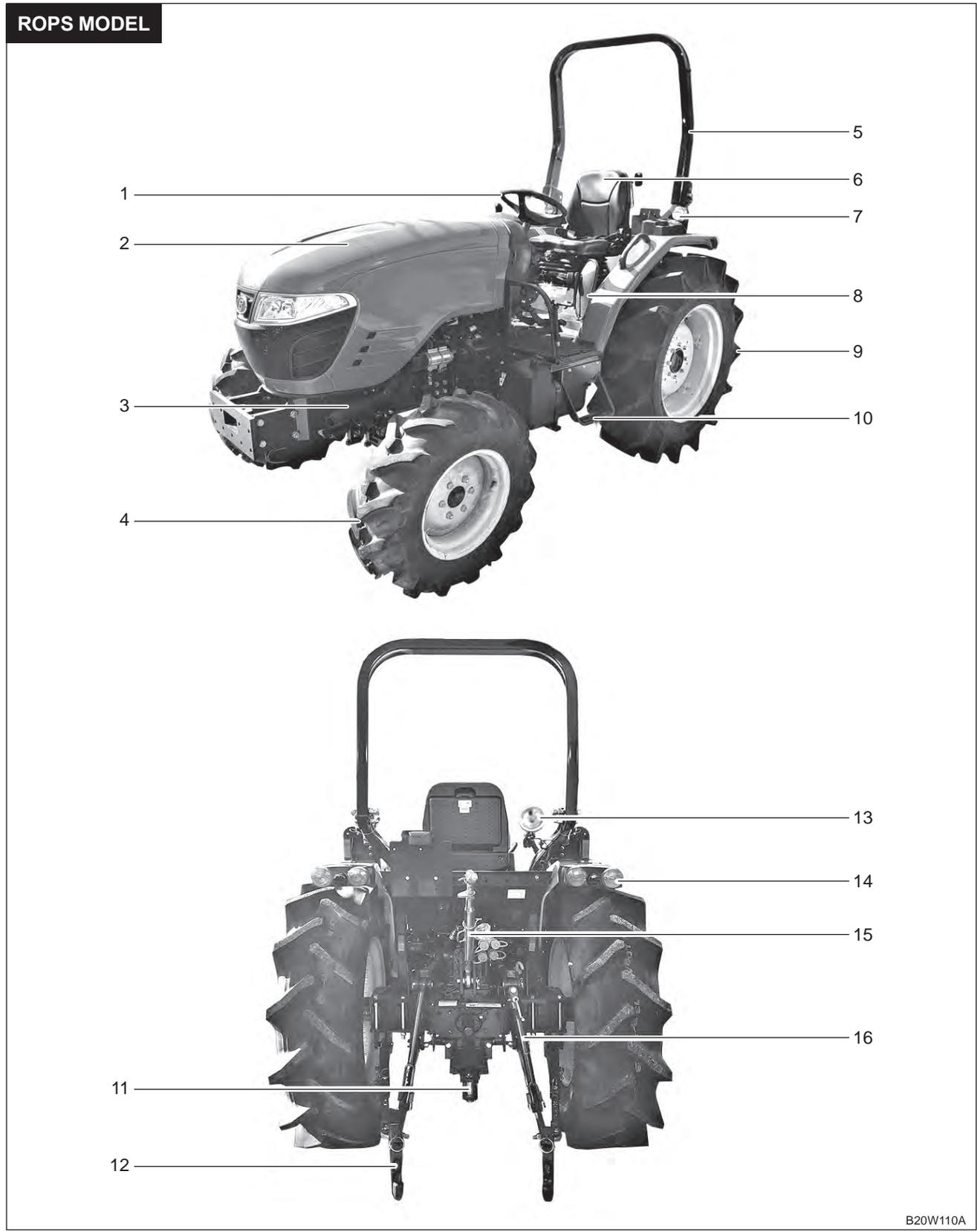


K25W104A

6. COMPONENTS OF TRACTOR

6.1 FRONT AND REAR EXTERIOR VIEW





B20W110A

- |                             |                      |                            |
|-----------------------------|----------------------|----------------------------|
| (1) Steering wheel (handle) | (7) Combination lamp | (13) Working lamp          |
| (2) Hood                    | (8) Side mirror      | (14) Rear combination lamp |
| (3) Muffler                 | (9) Rear tire        | (15) Top link              |
| (4) Front tire              | (10) Step            | (16) Lift link             |
| (5) ROPS frame              | (11) Draw bar        |                            |
| (6) Seat                    | (12) Lower link      |                            |

6.2 INTERIOR VIEW

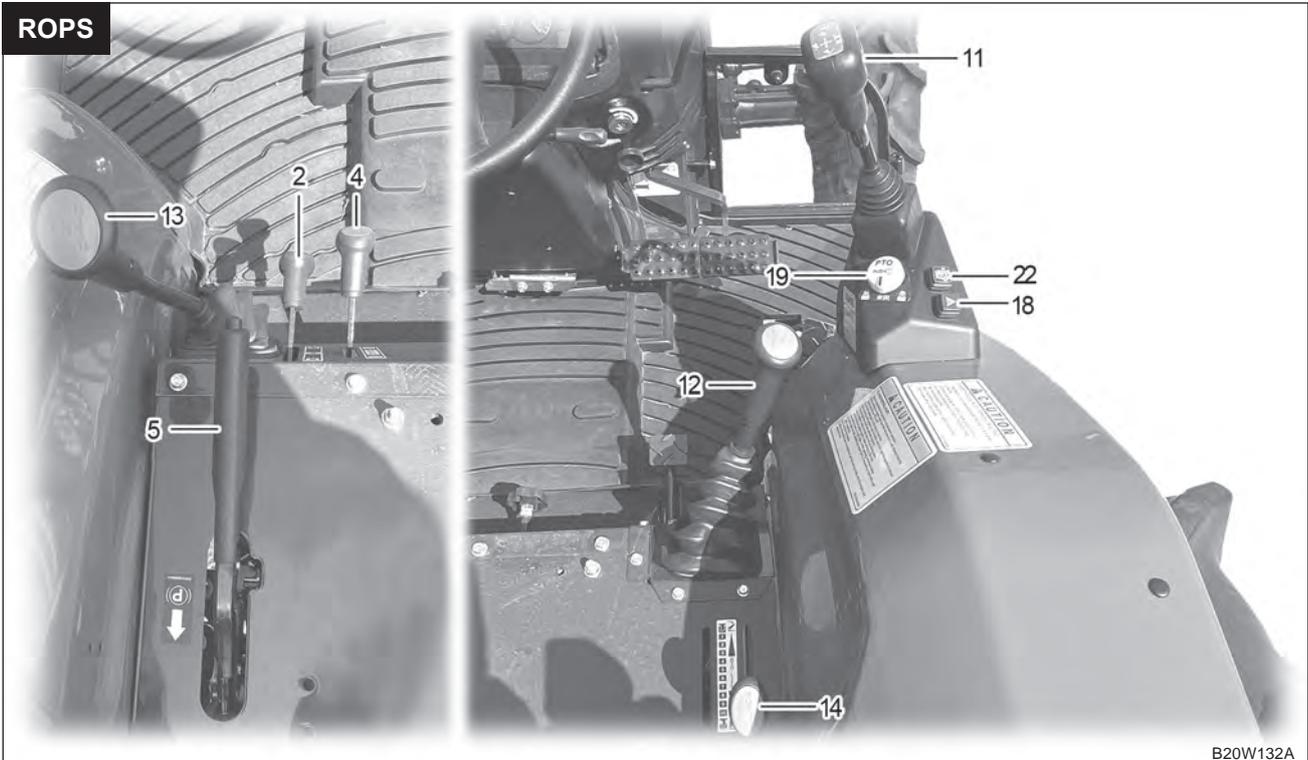
**MEC MODEL**

**CABIN**



B20W111A

**ROPS**

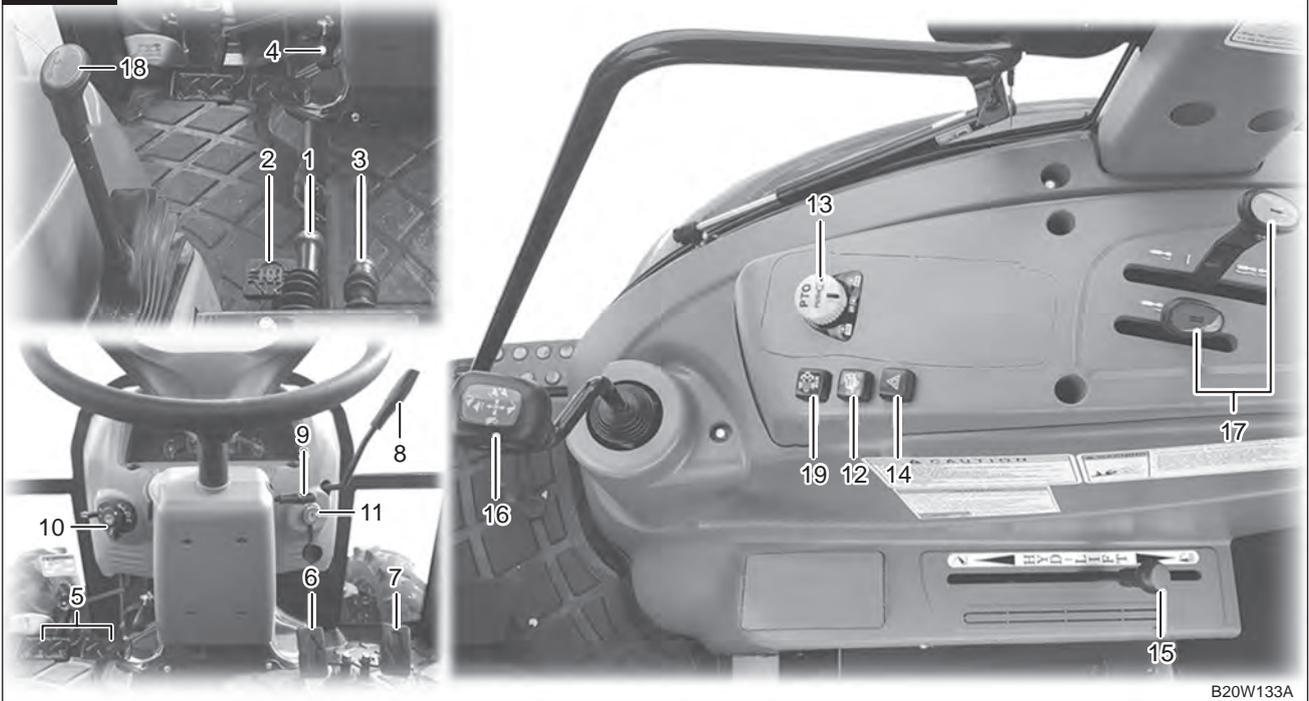


B20W132A

- |                             |                        |                                    |                              |
|-----------------------------|------------------------|------------------------------------|------------------------------|
| (1) Shuttle shift lever     | (7) Brake pedal        | (13) Range shift lever             | (19) PTO switch              |
| (2) PTO shift lever         | (8) Combination switch | (14) Position control lever        | (20) Stop valve knob         |
| (3) Differential lock pedal | (9) Tilt lever         | (15) SCV lever                     | (21) Power socket            |
| (4) 4WD lever               | (10) Accelerator pedal | (16) Accelerator lever             | (22) DPF regeneration switch |
| (5) Parking brake lever     | (11) Joystick lever    | (17) Ignition switch               |                              |
| (6) Clutch pedal            | (12) Main shift lever  | (18) Hazard warning flasher switch |                              |

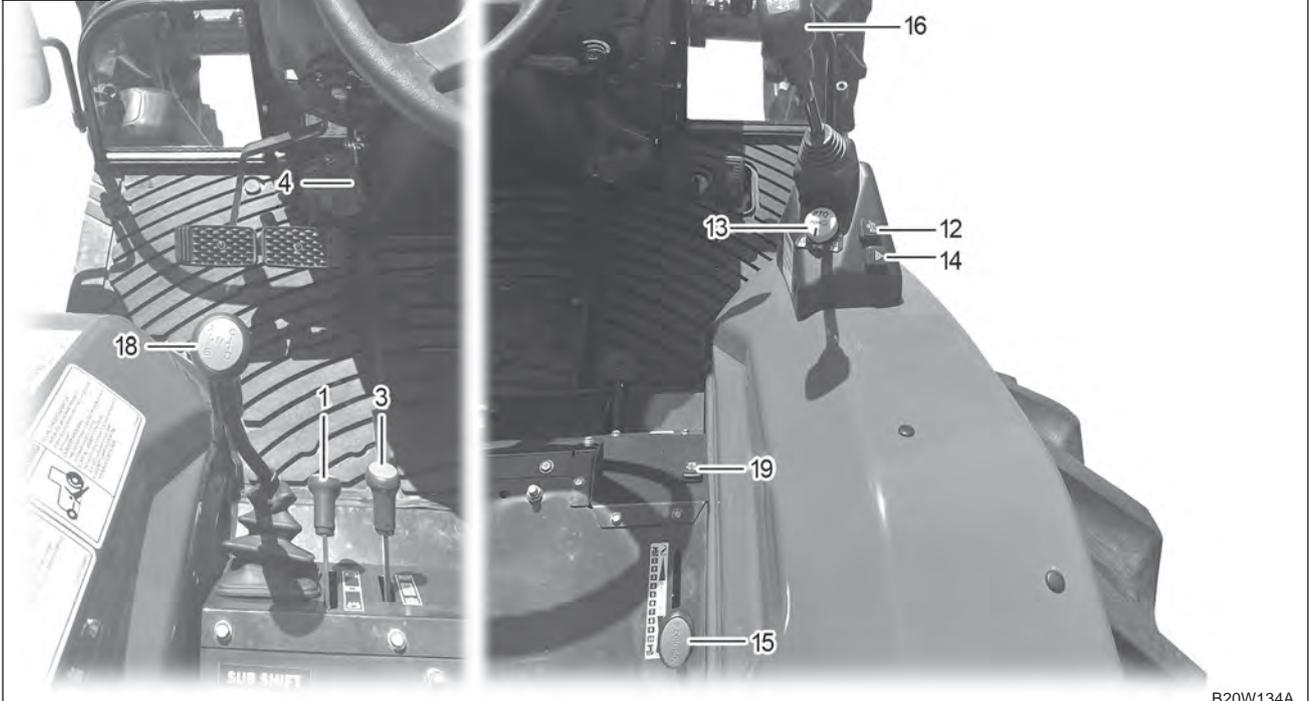
**HST MODEL**

**CABIN**



B20W133A

**ROPS**

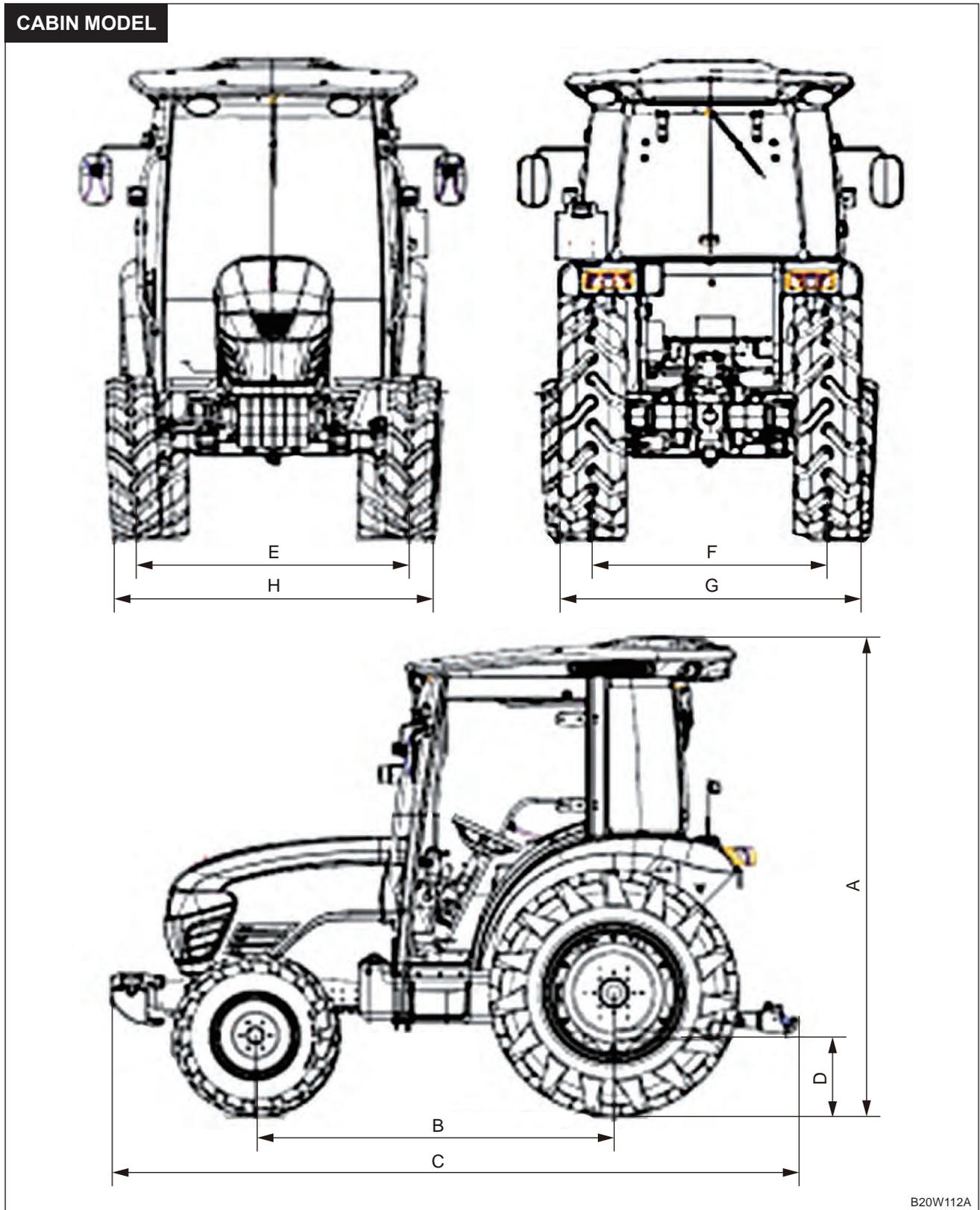


B20W134A

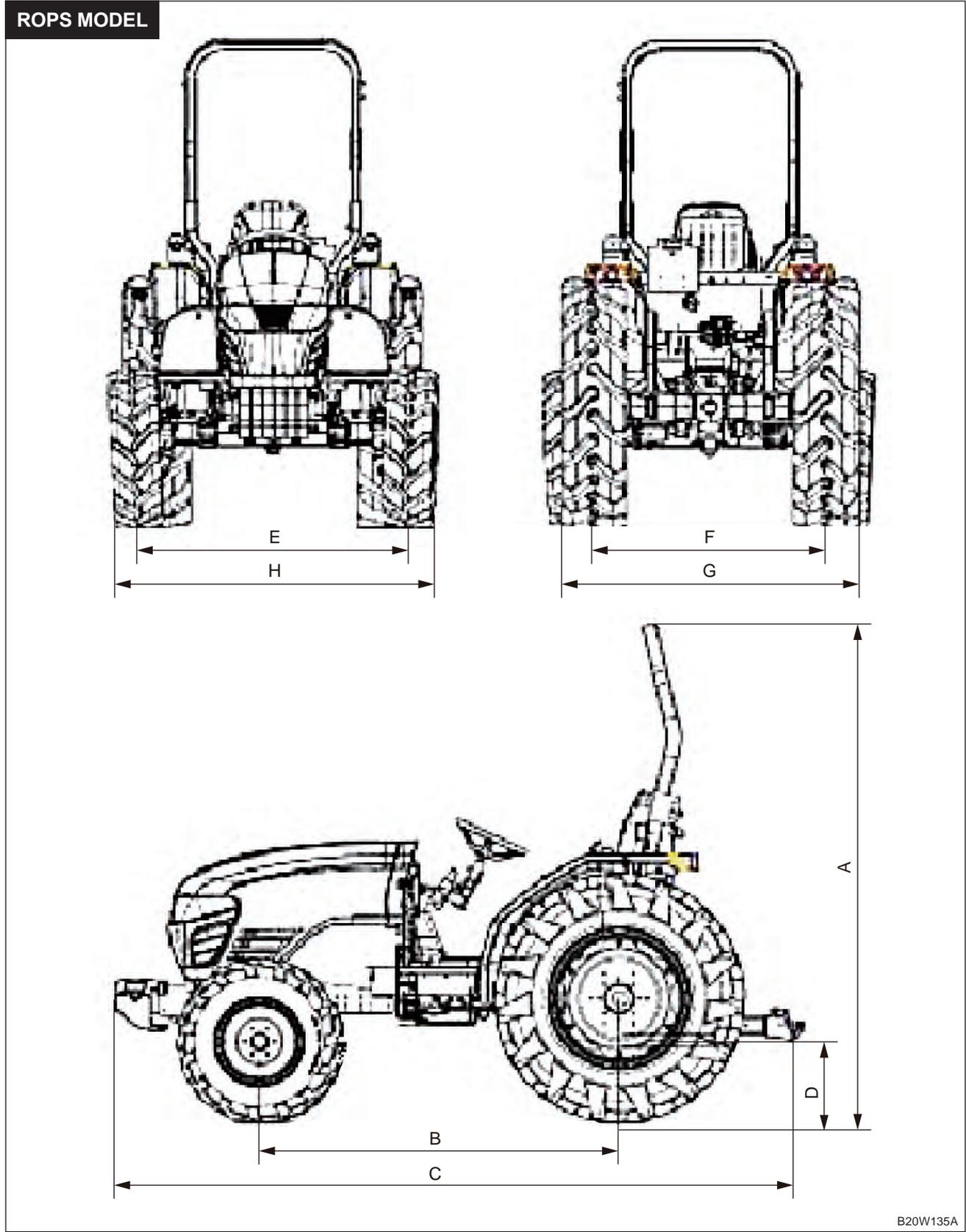
- (1) PTO shift lever
- (2) Differential lock pedal
- (3) 4WD lever
- (4) Parking brake lever
- (5) Brake pedal
- (6) HST pedal (Forward)
- (7) HST pedal (Reverse)
- (8) Accelerator lever
- (9) Tilt lever
- (10) Combination switch
- (11) Ignition switch
- (12) Cruise control switch
- (13) PTO selection switch
- (14) Hazard warning flasher switch
- (15) Position control lever
- (16) Joystick lever
- (17) SCV lever
- (18) Range shift lever
- (19) DPF Regeneration Switch

7. TRACTOR SPECIFICATIONS

7.1 EXTERIOR DIMENSIONS



Dimensions								mm (in.)
Applied tire size	A	B	C	D	E	F	G	H
9.5 - 16	2,463	1,806	3,421	391	1,415	1,205	1,540	1,650
13.6 - 26	(96.97)	(71.10)	(134.69)	(15.39)	(55.71)	(47.44)	(60.63)	(64.96)



B20W135A

**Dimensions**

mm (in.)

Applied tire size	A	B	C	D	E	F	G	H
9.5 - 16	2,463	1,806	3,421	391	1,415	1,205	1,540	1,650
13.6 - 26	(96.97)	(71.10)	(134.69)	(15.39)	(55.71)	(47.44)	(60.63)	(64.96)

7.2 MAJOR SPECIFICATIONS

MAJOR ITEMS		BB5045				BB5055				
		BB5045S	BB5045H	BB5045CS / BB5045CH	BB5055S	BB5055H	BB5055CS	BB5055CH		
Drive System		4 Wheel Drive								
Dimensions	Overall Length	in. (mm) 127.4 (3,236)								
	Overall Width	in. (mm) 64~72 (1,625~1,828)								
	Overall Height	in. (mm) 97.9 (2,489)								
	Wheelbase	in. (mm) 71.1 (1,806)								
	Ground Clearance	in. (mm) 15.5 (394)								
	Weight	lbs (kg)	3,831 (1,738)		4,349 (1,973)	4,349 (1,973)	3,836 (1,740)	3,836 (1,740)	4,349 (1,973)	4,349 (1,973)
Model		T2300NA				T2300T				
Type (*)		Vertical, 4 Cycle, Water Cooled, Diesel, EPA Tier4 Certified								
Combustion System		Swirl chamber								
Aspiration		Naturally				Turbo charged				
Engine	Engine Output	HP (kw)	48 (35.8)				55 (41.0)			
	Engine RPM	rpm	2600							
	Number of Cylinder		4							
	Bore x Stroke	In. (mm)	3.46 x 3.62 (88 x 92)							
	Displacement	cu.in. (cc)	139.5 (2286)							
	Type of air cleaner		Dry, Double Filter Elements							
	Fuel tank capacity		gal (L) 11.9 (45)							
	Electric	Alternator	Amps	12V 90A						
Battery		Volt	12							
Steering		Hydrostatic								
Clutch		Dry, Single								
Brake			Wet Disc	Wet Disc, Band Brake	Wet Disc	Wet Disc, Band Brake	Wet Disc	Wet Disc, Band Brake	Wet Disc	
Transmission	Main Shifting		Fully Synchronized (4 speed)	HST	Fully Synchronized (4 speed)	HST	Fully Synchronized (4 speed)	HST	Fully Synchronized (4 speed)	HST
	Forward Reverse Method		Synchro-shuttle	-	Synchro-shuttle	-	Synchro-shuttle	-	Synchro-shuttle	-
	Gear Stages (Front x Rear)		16F / 16R	4 Range	16F / 16R	4 Range	16F / 16R	4 Range	16F / 16R	4 Range
	Travel Speed	Mph (km/h)	Forward : 1.07~17.48 (1.72~28.15) Reserve : 0.99~16.77 (1.6~26.93)	Forward : 1.14 ~ 20 (1.83 ~ 32.2)	Forward : 1.07~17.48 (1.72~28.15) Reserve : 0.99~16.77 (1.6~26.93)	Forward : 2.15~19.56 (3.46~31.41) Reserve : 2.15~19.56 (3.46~31.41)	Forward : 1.07~17.48 (1.72~28.15) Reserve : 0.99~16.77 (1.6~26.93)	Forward : 1.14 ~ 20 (1.83 ~ 32.2) Reserve : 1.09 ~ 19.1 (1.75 ~ 30.8)	Forward : 1.07~17.48 (1.72~28.15) Reserve : 0.99~16.77 (1.6~26.93)	Forward : 2.15~19.56 (3.46~31.41) Reserve : 2.15~19.56 (3.46~31.41)
PTO	Type	Independent P.T.O. (6 Spline shaft)								
	Speed	rpm	584 / 791 (2600)							
	PTO Power @ 2,600 rpm	HP (KW)	38.4 (28.6)				44 (32.8)			
Hydraulic System	Type	Position control								
	3 Point Hitch	Telescopic lower link / Telescopic stabilizers								
	Category	Category I								
	Pump Flow @ 2,600 rpm	Steering Pump	4.97 GPM (19 LPM)	5 GPM (19 LPM)	4.97 GPM (19 LPM)	5 GPM (19 LPM)	4.97 GPM (19 LPM)	5 GPM (19 LPM)	4.97 GPM (19 LPM)	5 GPM (19 LPM)
	Main Pump	11.1 GPM (42 LPM)	10.3 GPM (39 LPM)	11.1 GPM (42 LPM)	10.3 GPM (39 LPM)	11.1 GPM (42 LPM)	10.3 GPM (39 LPM)	11.1 GPM (42 LPM)	10.3 GPM (39 LPM)	

- ※ 1. Rated engine speed: 2,600 rpm
- 2. Tire dynamic load radius (only for pneumatic tire): 596 (13.6 - 26)
- 3. Notes: The specifications are subject to change without notice.



7.3 DRIVING SPEED

**MEC MODEL**

SHIFT POSITION		SPEED			
		FORWARD DRIVING		REVERSE DRIVING	
RANGE SHIFT	MAIN SHIFT	KM/H	MPH	KM/H	MPH
A	1	1.719	1.068	1.607	0.999
	2	2.015	1.252	1.927	1.197
	3	2.704	1.680	2.408	1.496
	4	3.107	1.931	2.971	1.846
B	1	3.470	2.156	3.243	2.015
	2	4.068	2.528	3.890	2.417
	3	5.457	3.391	4.860	3.020
	4	6.270	3.896	5.996	3.726
C	1	7.408	4.603	6.924	4.303
	2	8.684	5.396	8.305	5.161
	3	11.648	7.238	10.375	6.447
	4	13.385	8.317	12.800	7.954
D	1	15.583	9.683	14.563	9.049
	2	18.265	11.350	17.468	10.855
	3	24.501	15.225	21.822	13.560
	4	28.153	17.494	26.924	16.731

**HST MODEL**

SHIFT POSITION	SPEED	
	KM/H	MPH
Forward	0 ~ 31.411	0 ~ 19.5
Reverse	0 ~ 31.411	0 ~ 19.5



8. PERIODIC INSPECTION

8.1 PERIODIC MAINTENANCE SCHEDULE TABLE

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

NO.	ITEMS	RUNNING HOURS	OPERATING HOUR (HOUR OR YEAR)														NOTES		
			50	100	150	200	250	300	350	400	450	500	550	1500	3000	1 YR		2 YRS	
1	Engine oil	R	⊙						●			●					●		First 50, Every 250 (1 Year)
2	Engine oil filter	R	⊙						●			●					●		
3	T/M oil filter	R	⊙										●				●		First 50, Every 500 (1 Year)
4	Line oil filter	R	⊙										●				●		
5	T/M oil	R	⊙										●				●		
6	Front axle oil	R	⊙										●				●		
7	Front axle lubrication	A	●						●										
8	Engine starting system	C	●	●	●	●	●	●	●	●	●	●	●						
9	Grease	C	●	●	●	●	●	●	●	●	●	●	●						
10	Wheel bolt torque	C	●	●	●	●		●	●	●	●	●							
11	Battery	C		●		●		●		●		●							
12	Air cleaner	CL		●		●		●		●		●							
		R										●					●		
13	Fuel filter element	C		●		●		●		●		●							
		R										●					●		
14	Fan belt	A		●		●		●		●		●							
15	Clutch	A		●		●		●		●		●							
16	Brake	A		●		●		●		●		●							
17	Radiator hose band	C				●				●									
		R																	●
18	Power steering hose	C				●		●		●		●							
		R																	●
19	Fuel hose	C		●		●		●		●		●							
		R																	●
20	Air inlet	C				●				●									●
21	Toe-in	A				●				●									

※ The jobs indicated by ⊙ must be done after the first 50 hours of operation

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

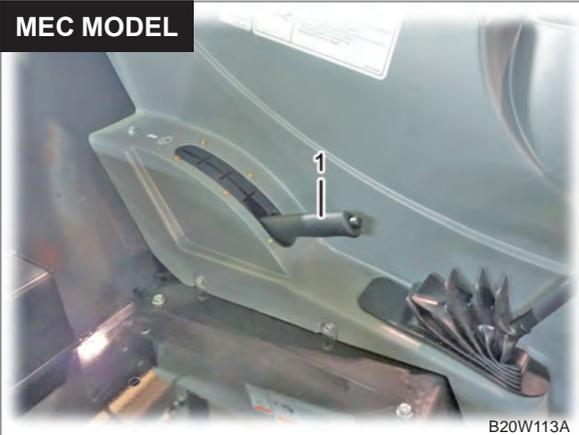
NO.	ITEMS	RUNNING HOURS	OPERATING HOUR (HOUR OR YEAR)														NOTES	
			50	100	150	200	250	300	350	400	450	500	550	1500	3000	1 YR		2 YRS
22	Engine valve clearance	A																
23	Fuel injection nozzle pressure	C												●	●			
24	Injection pump	C													●			
25	Cooling system	CL																●
26	Refrigerant	R																●
27	A/C belt tension	C				●				●								
28	A/C filter	CL				●				●								
29	A/C heater hose	C															●	
30	R-134A gas	R	When necessary															

※ The jobs indicated by ● must be done after the first 50 hours of operation

8.2 INSPECTION DESCRIPTION

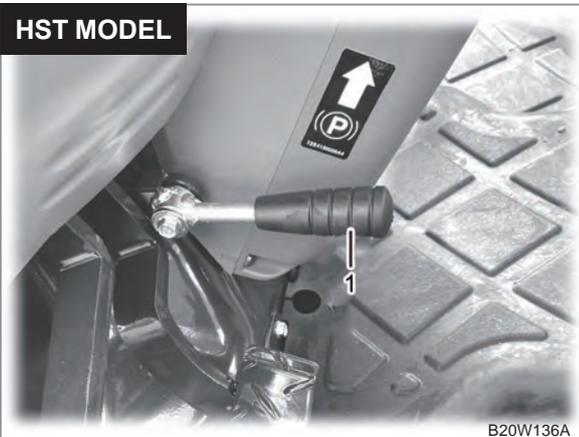
**⚠ CAUTION**

**MEC MODEL**



B20W113A

**HST MODEL**



B20W136A

- 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.



B20W114A

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).

<b>FUEL TANK CAPACITY</b>	45 ℓ (11.88 u.s.gal.)
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**⚠ 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.

8.2.2 CHECKING ENGINE OIL

**⚠ WARNING**

- Never mix different types of oil, but use the only engine oil specified by BBT (SAE 15W-40 grade CG or higher)
- Never attempt to start the engine without sufficient engine oil.

**⚠ CAUTION**

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



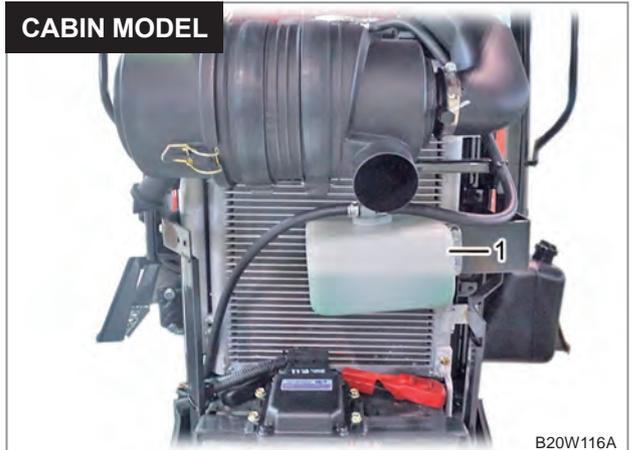
B20W115A

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 8.2.9 Changing engine oil in this chapter.)

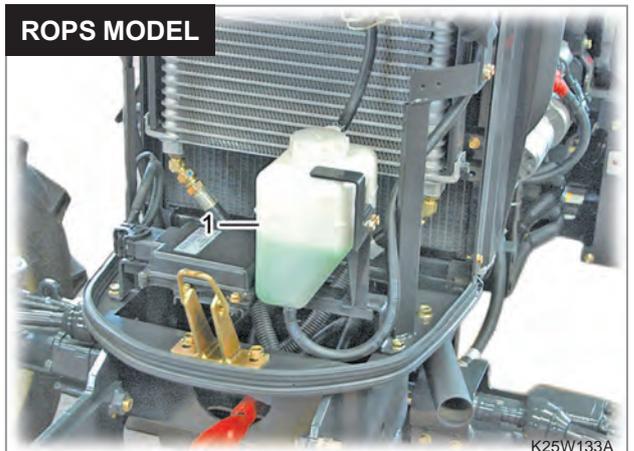
8.2.3 CHECKING COOLANT AMOUNT

**⚠ 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.



B20W116A



K25W133A

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.

<b>RESERVOIR CAPACITY</b>	0.9 ℓ (0.24 u.s.gal.)
---------------------------	-----------------------

### 8.2.4 CHECKING LAMPS



1. Check the headlamps, work 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

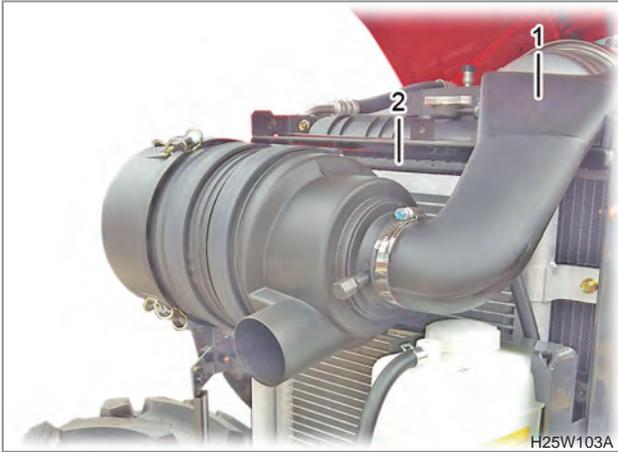


1. Inspect the seat belt (1) and its anchor at least every year. Check the belt for looseness of its anchor, cut, excessive wear or abnormal wear. If a damage is found, replace the seat belt with a new genuine BBT seat belt.

### 8.2.6 CLEANING RADIATOR DUST GRILL AND A/C CONDENSER

**⚠ CAUTION**

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



1. Check the front of the hood or side grill for dust, and clean them accordingly.
2. Open the hood, disconnect the suction pipe (1) and lift the dust grill (2) to remove. Then, remove dust from the dust grill.
3. Remove dust from the condenser by blowing compressed air from the engine side toward the outside.

**⚠ CAUTION**

- Clean the grill 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

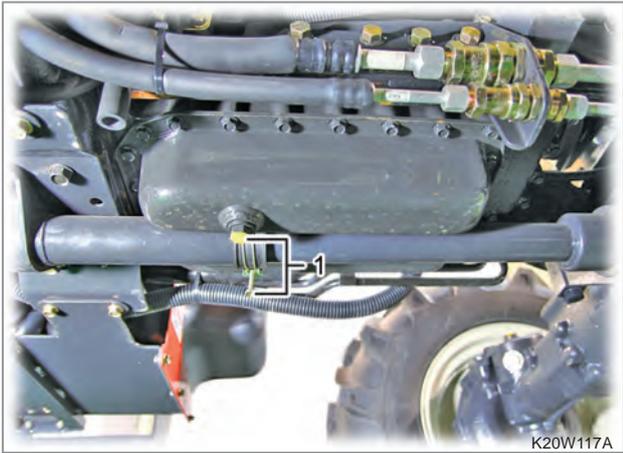


1. Turn the ignition switch to the START position.
2. Check that the gauges and signals are working properly.
3. If not, check the corresponding lamp and electric circuit.
4. If necessary, replace the part with a new one.

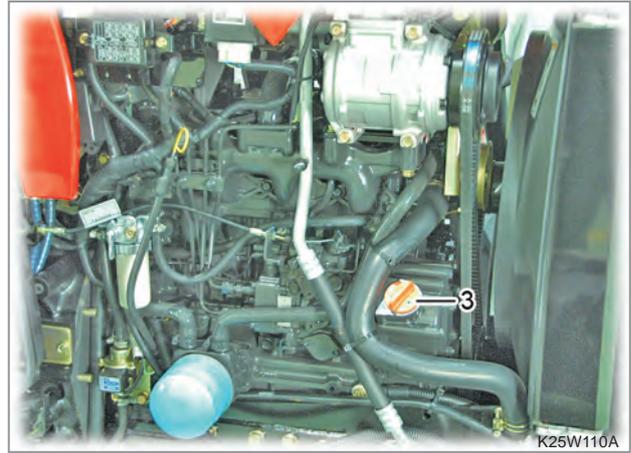
8.2.8 CHANGING ENGINE OIL

**⚠ 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.

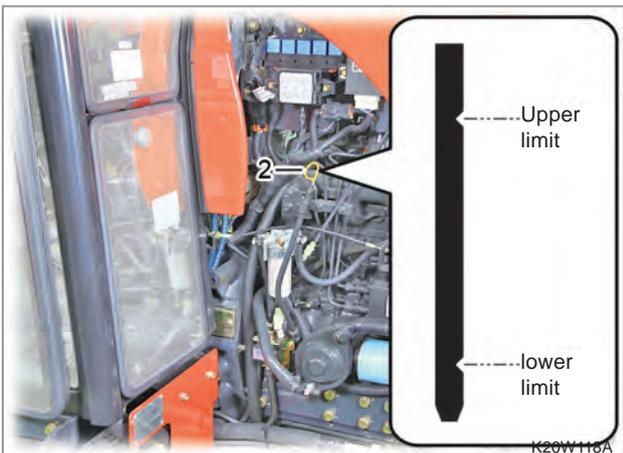


1. Remove the drain plug (1) to drain engine oil.
2. Fit the drain plug and tighten it to 50 N.m (37 lb.ft).
3. Add clean oil with proper viscosity to the crankcase.



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	
T1700	T2300
5.3 ℓ (1.40 u.s.gal.)	6.5 ℓ (1.72 u.s.gal.)
GRADE	
SAE 10W – 40 CG	



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

## 8.2.9 REPLACING ENGINE OIL FILTER

 CAUTION

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



B20W119A

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 TRANSMISSION/  
HYDRAULIC FILTER CAUTION

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

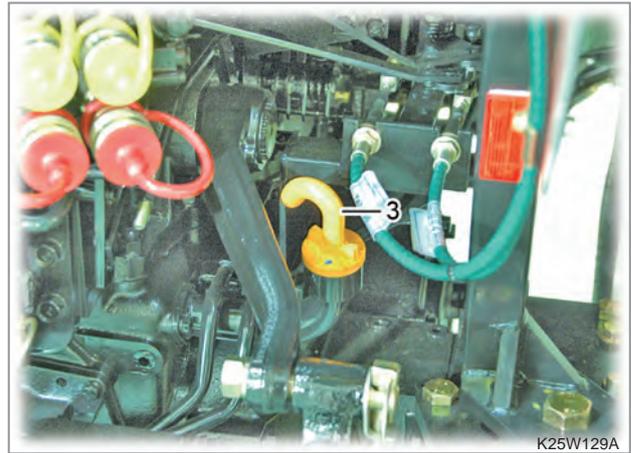


B20W120A

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.

**8.2.11 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.)



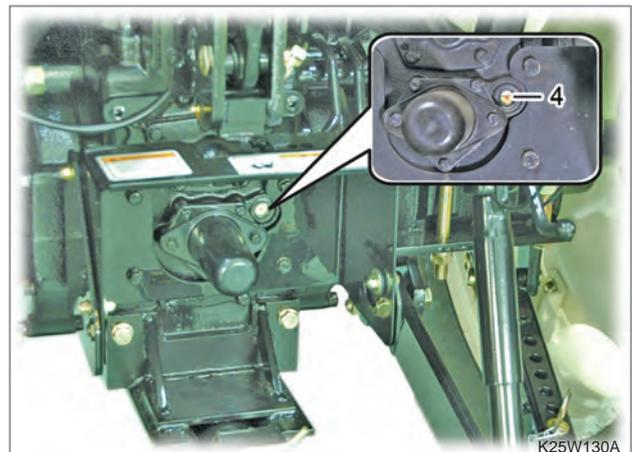
K25W129A

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.



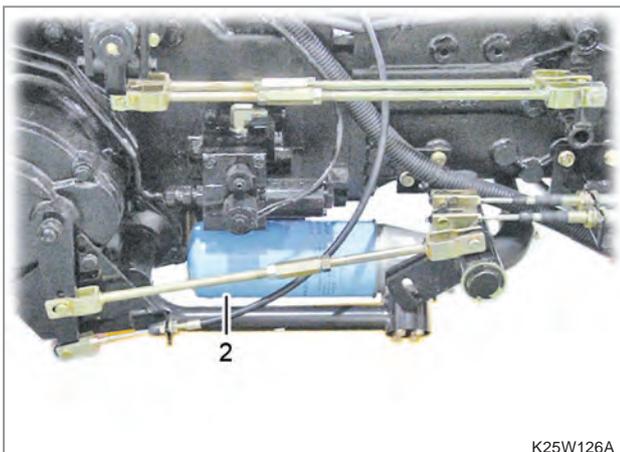
K25W125A

4. Remove the drain plug (1).



K25W130A

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



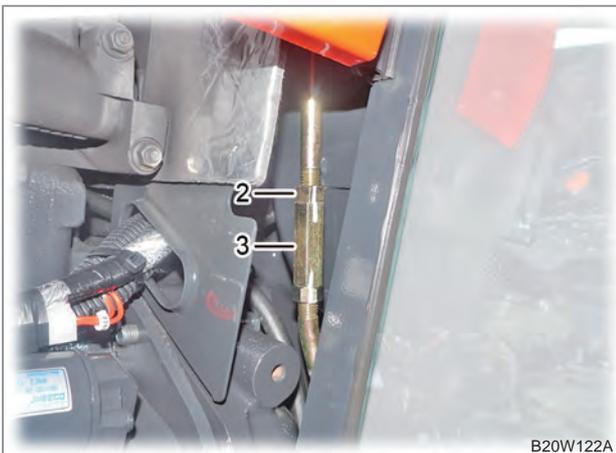
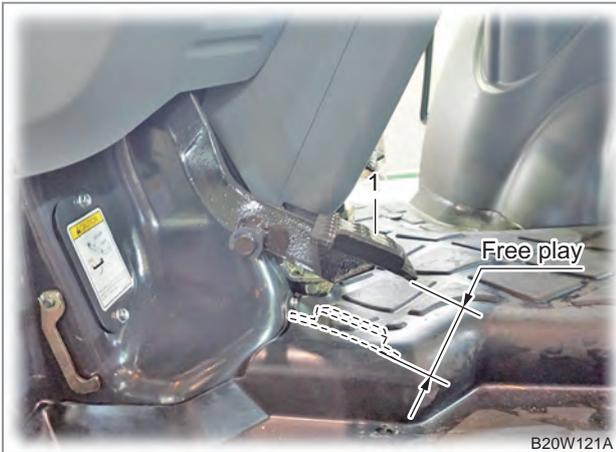
K25W126A

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).

<b>TRANSMISSION FLUID/HYDRAULIC OIL AMOUNT</b>	MEC MODEL: 38 ℓ (10.03 u.s.gal.) HST MODEL: 35 ℓ (9.24 u.s.gal.)
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**8.2.12 ADJUSTING CLUTCH PEDAL**

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

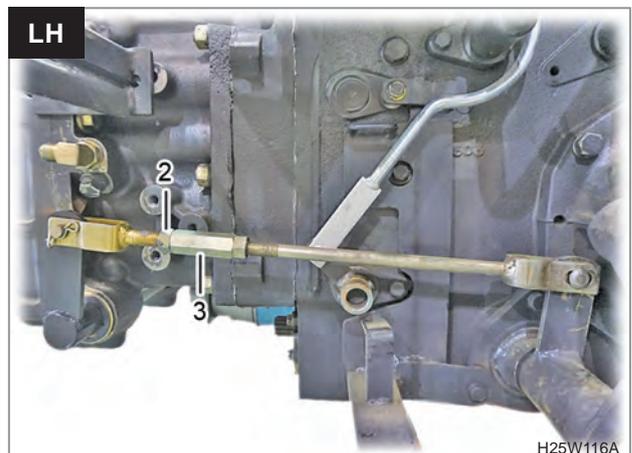
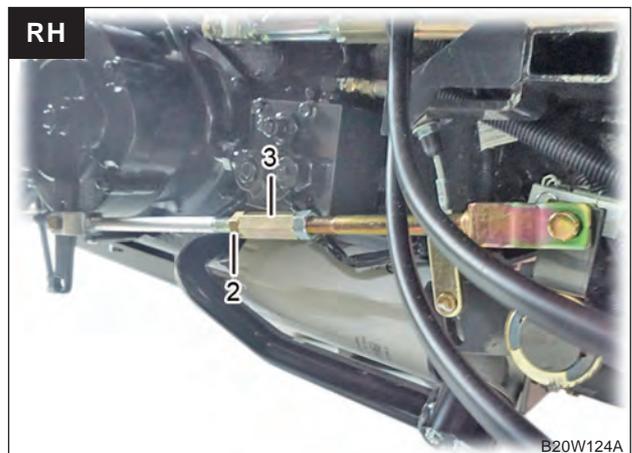
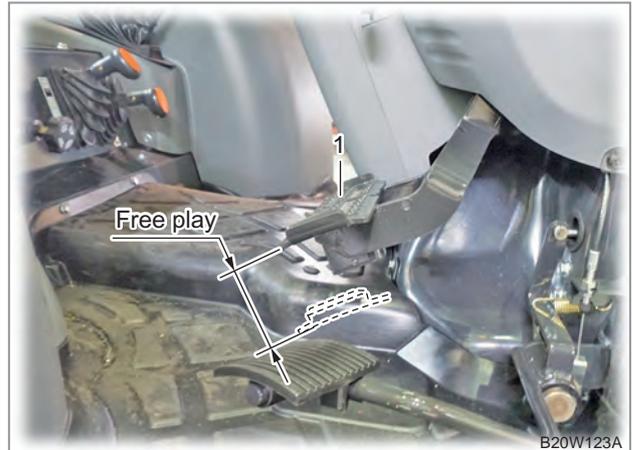


1. Make sure that the machine is parked on level ground.
2. Depress the clutch pedal (1) slightly and then release it.
3. Check if the clutch pedal moves when released.
4. Unscrew the lock nut (2) of the clutch rod and adjust the turn buckle (3) to adjust the free play.
5. Tighten the lock nut.

<b>CLUTCH PEDAL FREE PLAY</b>	25 - 35 mm (0.98 - 1.38 in.)
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**8.2.13 ADJUSTING BRAKE PEDAL**

1. Release the parking brake.



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.

<b>BRAKE PEDAL FREE PLAY</b>	5 - 10 mm (0.19 - 0.39 in.)
----------------------------------	--------------------------------

8.2.14 ADJUSTING A/C BELT TENSION

**CAUTION**

- Stop the engine before adjusting the tension of the A/C compressor belt.
- When adjusting the belt tension, be careful not to hurt your hands.



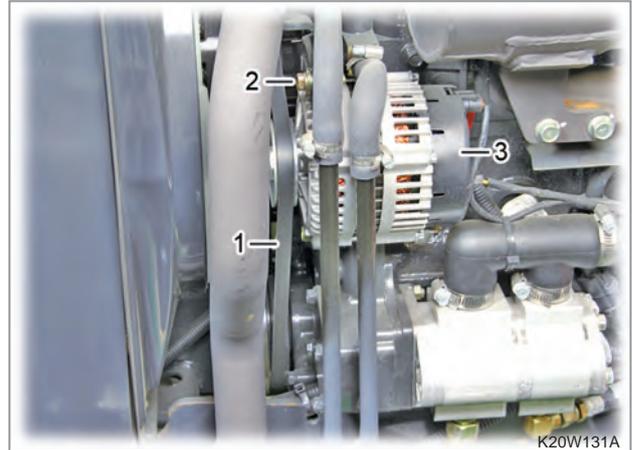
1. Stop the engine, remove the ignition key and apply the parking brake.
2. Check the tension of the belt (1).
3. If not normal, turn the tension adjusting bolt (2) to adjust the tension properly.
4. If the belt is worn, replace it with a new one.

<b>BELT DEFLECTION</b> <b>[PRESSING WITH FORCE OF 6 KG (13 LB)]</b>	10 - 15 mm (0.39 - 0.59 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.



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.

<b>BELT DEFLECTION</b> <b>[PRESSING WITH FORCE OF 6 KG (13 LB)]</b>		7 - 10 mm (0.28 - 0.39 in.)
<b>TORQUE VALUE</b>	Mounting bolt	31 N.m (23 lb.ft)
	Adjusting bolt	66 N.m (49 lb.ft)

## 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.

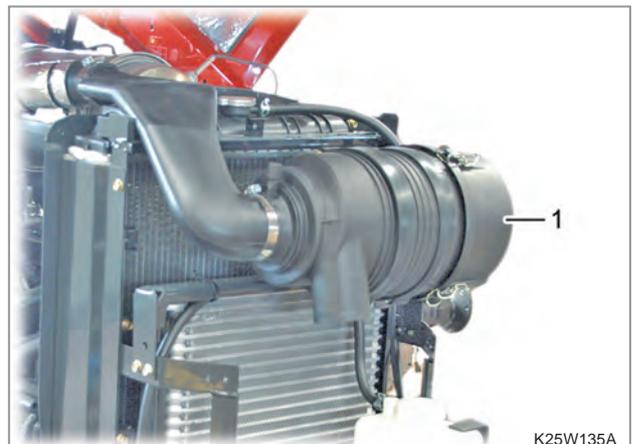
⚠ **CAUTION**

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

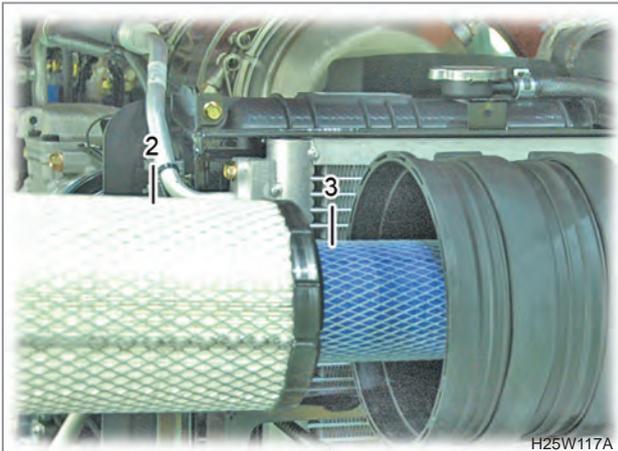
► **BLEEDING FUEL LINE**

- Turn the ignition switch to ON until the 10 seconds in order that feed pump sucks up the fuel.
- Push the throttle lever to MAX and the ignition switch to START to run the starting motor for about 10 seconds.
- 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.



H25W117A

2. Remove the element (2) (3) 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.

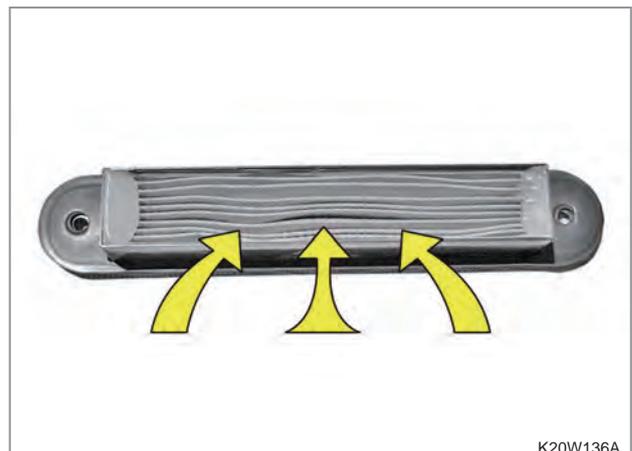
### 8.2.18 CLEANING CABIN AIR FILTER

- Whenever cleaning the air cleaner filter, remove the cabin air filter and clean it with compressed air.



B20W1216A

1. Remove the cabin air filter (1).



K20W136A

2. Dust off the filter. If dust is still attached to the filter, blow dust out from inside with compressed air (up to 600 kPa, 6 bar, 90 psi) with a nozzle.

## 8.2.19 BATTERY

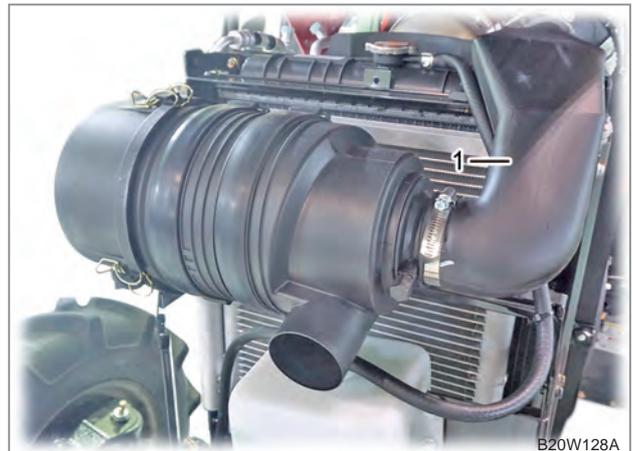


B20W127A

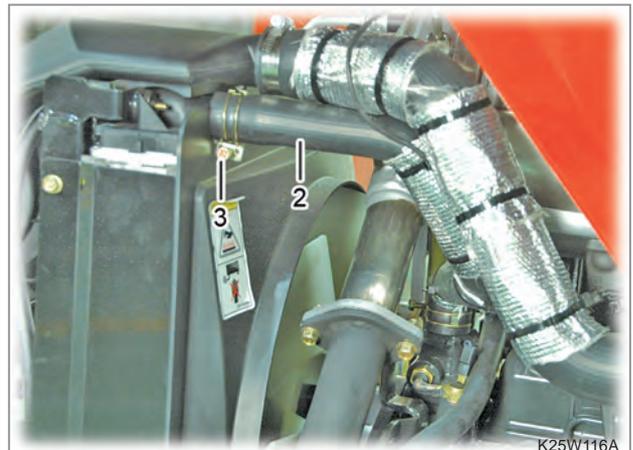
**⚠ CAUTION**

- 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.)

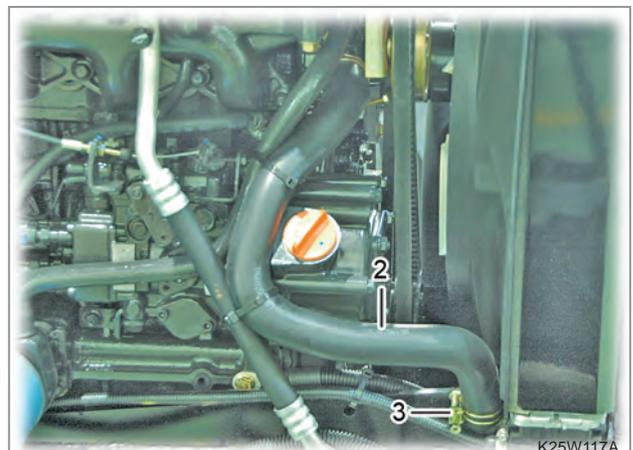
## 8.2.20 CHECKING RADIATOR AND INTAKE HOSES



B20W128A



K25W116A



K25W117A

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.

## 8.2.21 APPLYING GREASE



K25W127A



B20W129A

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
  - Left/Right of front axle
  - Left/Right of brake rod
  - Lift link and more

## 8.2.22 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.



K25W119A

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.



B20W130A

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

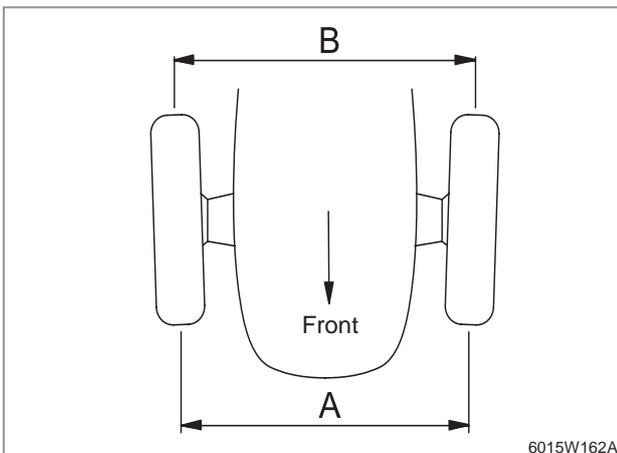


### 8.2.24 TIRE INFLATION PRESSURE

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.

<b>STANDARD</b>	Front wheel	2.0 kg/cm <sup>2</sup> (28.44 psi)
	Rear wheel	1.3 kg/cm <sup>2</sup> (18.49 psi)
<b>WITH LOADER</b>	Front wheel	3.0 kg/cm <sup>2</sup> (42.67 psi)
	Rear wheel	2.0 kg/cm <sup>2</sup> (28.44 psi)

### 8.2.25 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.).

### 8.2.26 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).

8.2.27 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 - 21 kg.m (130 - 151 lb.ft)
Rear wheel	Hub bolt (1)	18 - 21 kg.m (130 - 151 lb.ft)
	Rim disc mounting bolt (2)	26 - 31 kg.m (187 - 223 lb.ft)

8.2.28 ADJUSTING PARKING BRAKE LEVER [MEC. MODEL]



1. Release the parking brake lever.
2. Loosen the mounting nut (1) of the parking brake cable and tighten it at the point where is 20 to 25 mm away from the tip of the parking brake lever.

1

# MEMO

# CHAPTER 2 ENGINE

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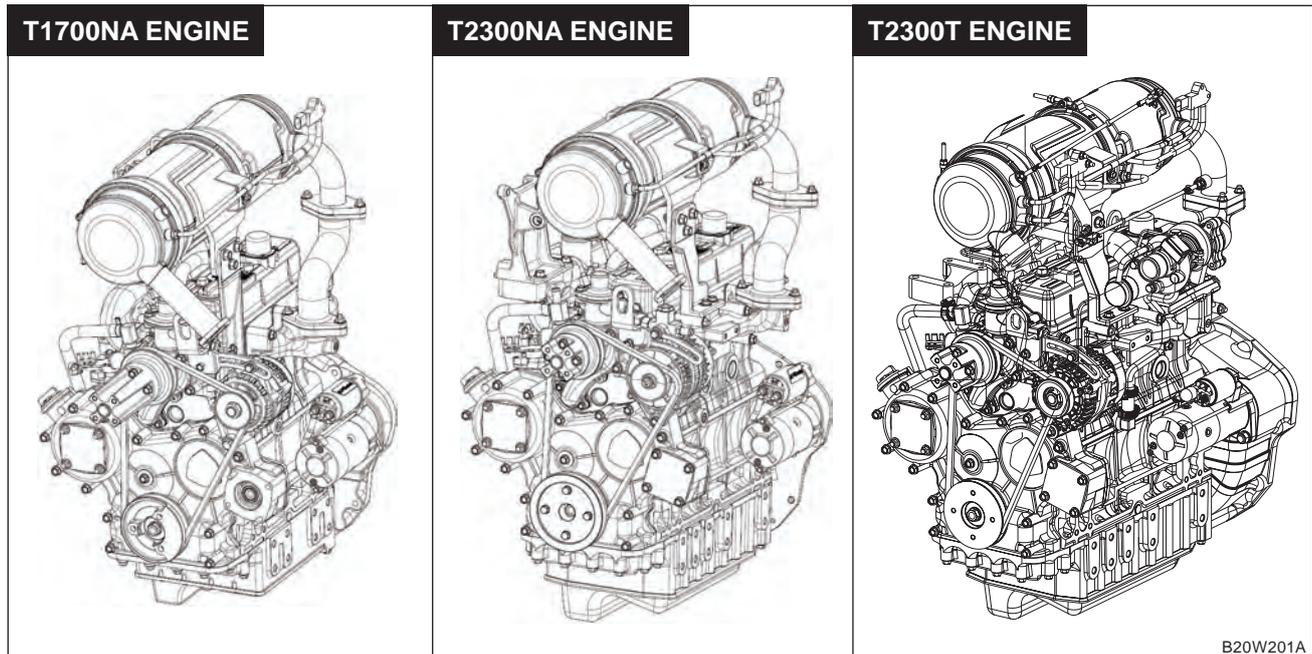
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## 1. EXTERIOR AND NAMES OF PARTS

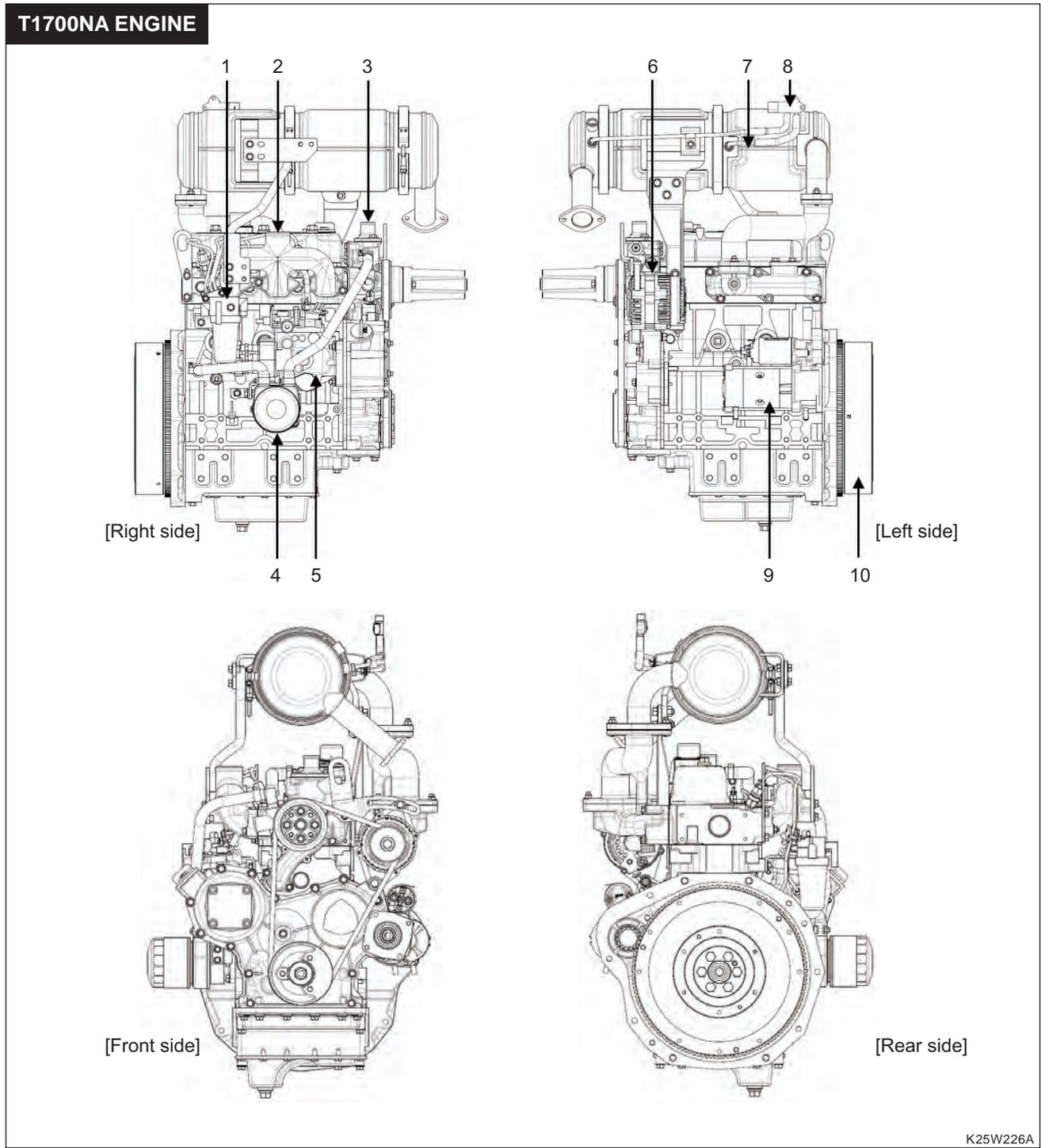
## 1.1 SPECIFICATION



		T1700NA	T2300NA	T2300T
Type		Vertical Water-Cooled 4 Cycle Diesel Engine		
Emission Regulation		EPA Final Tier-4		
No. of Cylinders		3	4	
Bore × Stroke	mm (in.)	88 x 92 (3.46 x 3.62)		
Displacement	cc	1,715	2,286	
Combustion System		IDI (Indirect Injection)		
Intake System		Natural Aspirated		Turbo charged
Horse Power	kW(HP)	25.7(35)	35.8(48)	40.4(55)
Compression Ratio		21.3 : 1		
Direction of Rotation		CCW from Flywheel Side		
Cooling System		Pressurized Radiator		
Lubricant Capacity	ℓ	5.3	6.5	
Starter	V-kW	12 - 2.2		
Alternator	V-A	12 - 50		
Dimension(L×W×H)	mm	690×527×911	682×528×948	

※ Specifications could be changed without notice for performance improvement

1.2 NAME OF EACH PART



K25W226A

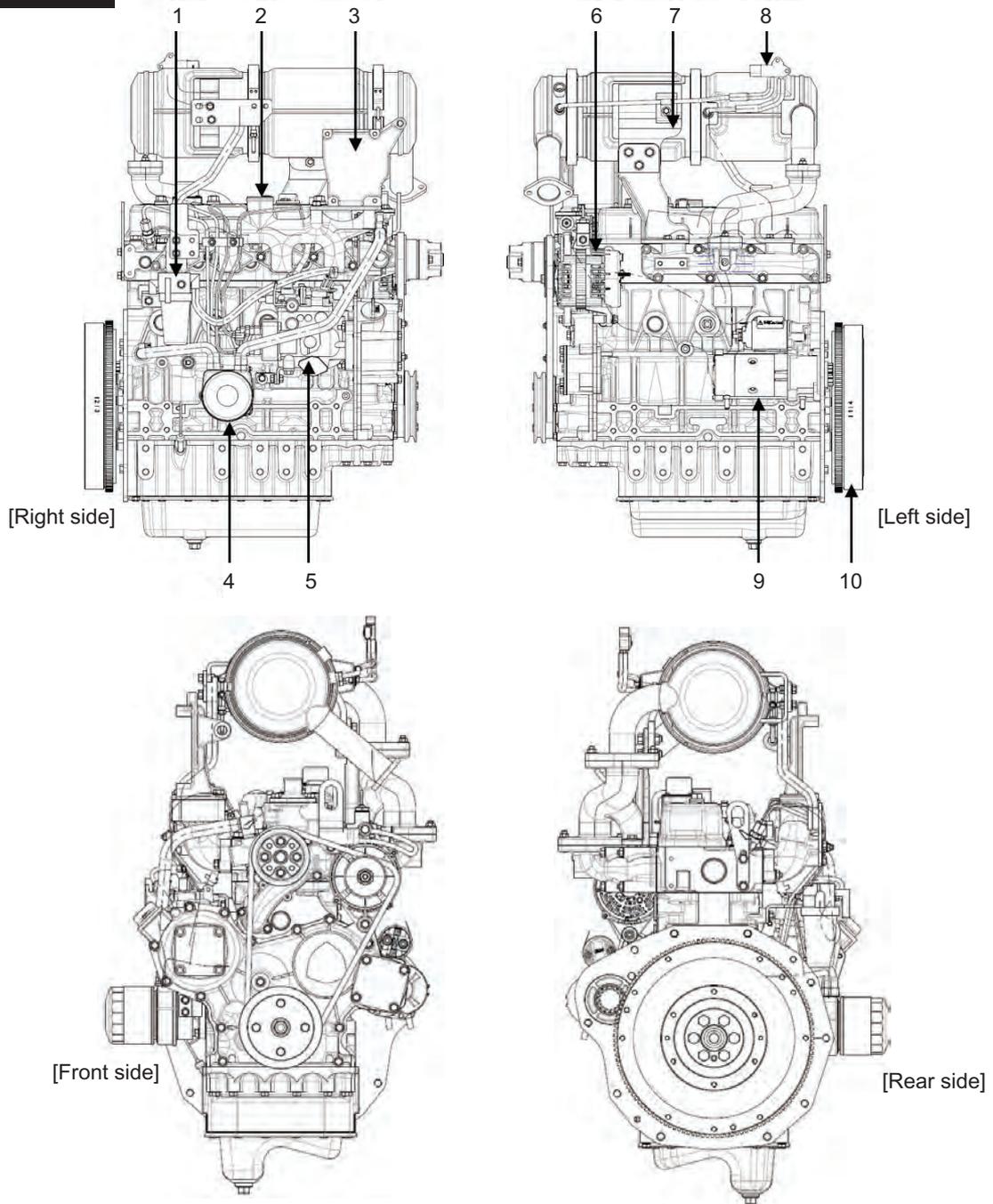
- |                     |                            |                   |
|---------------------|----------------------------|-------------------|
| (1) Fuel filter     | (5) Fuel injection pump    | (9) Starter motor |
| (2) Intake manifold | (6) Alternator             | (10) Flywheel     |
| (3) Water pump      | (7) After-treatment device |                   |
| (4) Oil filter      | (8) DP sensor              |                   |

\* 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.

**T2300NA ENGINE**



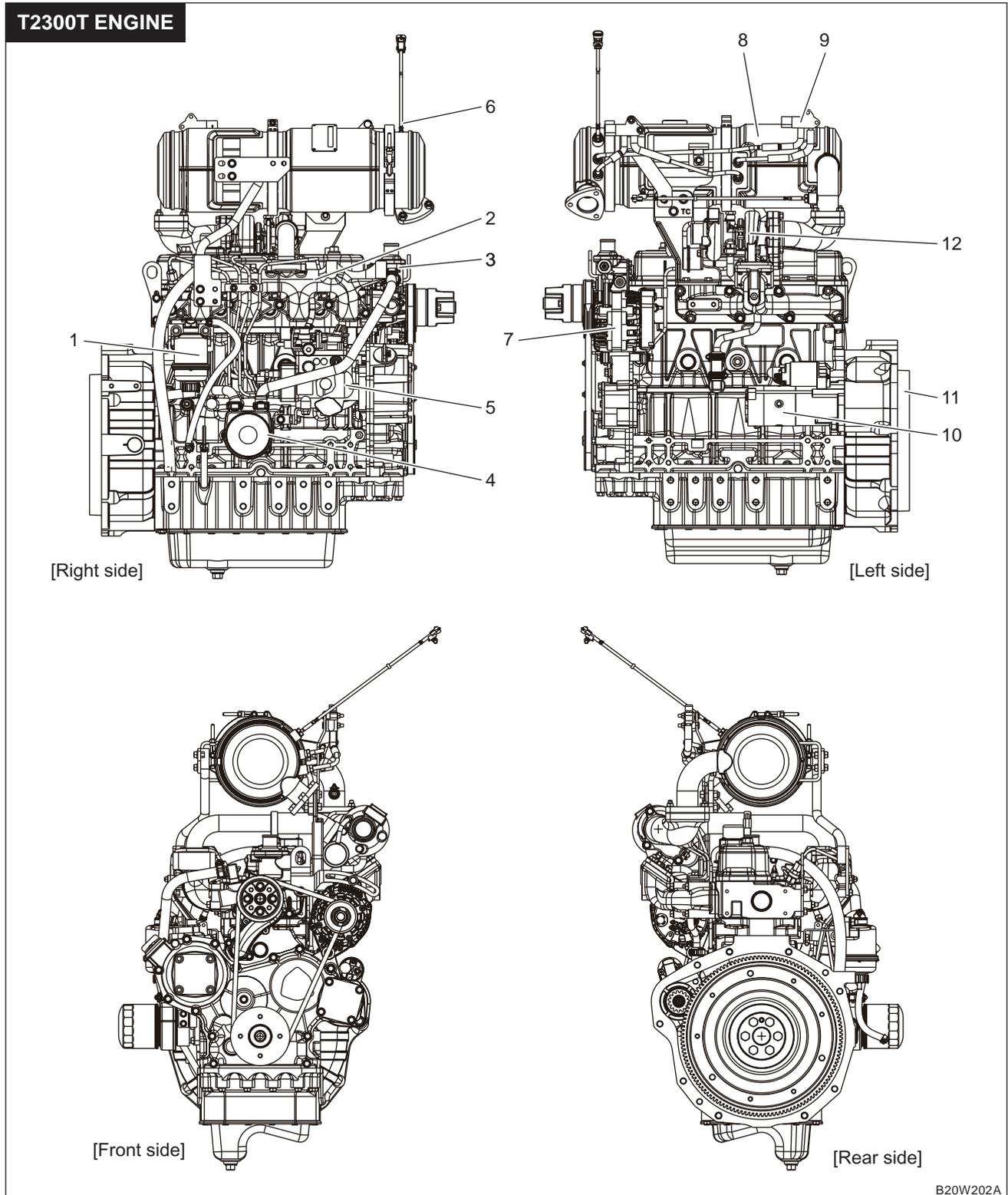
K25W227A

- |                               |                            |                   |
|-------------------------------|----------------------------|-------------------|
| (1) Fuel filter               | (5) Fuel injection pump    | (9) Starter motor |
| (2) Intake manifold           | (6) Alternator             | (10) Flywheel     |
| (3) Compressor fixing bracket | (7) After-treatment device |                   |
| (4) Oil filter                | (8) DP sensor              |                   |

\* 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.



- |                     |                              |                                |
|---------------------|------------------------------|--------------------------------|
| (1) Fuel filter     | (5) Fuel injection pump      | (9) DP (Diif. pressure) sensor |
| (2) Intake manifold | (6) Exhaust gas temp. sensor | (10) Starter motor             |
| (3) Coolant pump    | (7) Alternator               | (11) Flywheel                  |
| (4) Oil filter      | (8) After-treatment device   | (12) Turbo charger             |

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

### 1.3 EMISSIONS REGULATIONS

Each country conducts the emissions regulations on non-road diesel engine to prevent environmental contamination.

#### 1.3.1 EPA EMISSIONS REGULATIONS VALUE IN U.S.

g/kW-hr

OUTPUT (KW)	EMISSIONS REGULATIONS	NOX + NMHC	CO	PM
19 ≤ kW < 37	Tier-4	4.7	5.0	0.03
37 ≤ kW < 56	Tier-4	4.7	5.0	0.03

#### 1.3.2 THE EMISSIONS CERTIFICATE DECAL AND ATTACHED LOCATION

KUKJE MACHINERY CO.,LTD  
 www.kukjemachinery.co.kr  
 Manufactured in Korea MM/DD/YY

### EMISSION CONTROL INFORMATION

Model	ESN	<input style="width: 100%;" type="text"/>
Gross HP/kW	at	rpm
Displacement	in <sup>3</sup> / L	
Power category		
EPA Certification Family		
Timing	Degrees	
ECS IDI. CTOX		
Valve Lash (Cold Engine)	Intake Exhaust	in/mm in/mm
<p><b>WARNING</b> Injury may result and warranty is voided if fuel rate, rpm or altitudes exceed published maximum values for this model and application.</p>		
<p>This engine complies with U.S. EPA regulations for Non-road diesel engine. This engine is preempt in CALIFORNIA and certified to operate on ULTRA LOW SULFUR FUEL only.</p>		

B20W253A

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

### 1.3.3 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 engine should observe as following conditions in order to keep emission regulations.

NOTE											
<ul style="list-style-type: none"> <li> <b>CONDITIONS ARE AS FOLLOWS</b> <ol style="list-style-type: none"> <li>Intake air temperature: -20°C ~ 40°C</li> <li>Humidity: under 80%</li> <li>Intake air negative pressure                             <div style="text-align: right;">Unit: [kPa (mmAq)]</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">ENGINE NAME</th> <th style="width: 33%;">INITIAL VALUE</th> <th style="width: 33%;">ALLOWANCE VALUE</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">T1700, T2300</td> <td style="text-align: center;">≤ 2.45(250)</td> <td style="text-align: center;">≤ 6.23 (635)</td> </tr> </tbody> </table> </li> </ol> </li> </ul>			ENGINE NAME	INITIAL VALUE	ALLOWANCE VALUE	T1700, T2300	≤ 2.45(250)	≤ 6.23 (635)			
ENGINE NAME	INITIAL VALUE	ALLOWANCE VALUE									
T1700, T2300	≤ 2.45(250)	≤ 6.23 (635)									
<ol style="list-style-type: none"> <li>Exhaust back pressure                             <div style="text-align: right;">Unit: [kPa (mmAq)]</div> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">ENGINE NAME</th> <th style="width: 33%;">INITIAL VALUE</th> <th style="width: 33%;">ALLOWANCE VALUE</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">T1700, T2300</td> <td style="text-align: center;">≤ 6.37 (650)</td> <td style="text-align: center;">≤ 7.65 (780)</td> </tr> </tbody> </table> </li> </ol>			ENGINE NAME	INITIAL VALUE	ALLOWANCE VALUE	T1700, T2300	≤ 6.37 (650)	≤ 7.65 (780)			
ENGINE NAME	INITIAL VALUE	ALLOWANCE VALUE									
T1700, T2300	≤ 6.37 (650)	≤ 7.65 (780)									
<ul style="list-style-type: none"> <li> <b>FUEL AND LUBRICATING OIL ARE AS FOLLOWS</b> <ol style="list-style-type: none"> <li>Fuel: Ultra low sulfur diesel fuel.</li> <li>Lubricating oil: SAE 15W-40 or over CJ-4 level.</li> </ol> </li> </ul>											
<ul style="list-style-type: none"> <li> <b>THE SEAL OF FUEL INJECTION QUANTITY AND ROTATION RESTRICTION DO NOT RELEASE</b> <p>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.</p> </li> </ul>											
<ul style="list-style-type: none"> <li> <b>MAKE SURE TO MAINTAIN</b> <p>Based on listed regular checklist in this manual do a repair check and record a check result/</p> </li> </ul>											
<ul style="list-style-type: none"> <li> <b>THE MAINTENANCE PERIOD AND WARRANTY PERIOD OF RATED EXHAUST EMISSION COMPONENTS</b> <p>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.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 33%;">ITEM</th> <th colspan="2" style="width: 66%;">MAINTENANCE PERIOD</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"> <div style="display: flex; justify-content: space-between;"> <span>Related parts</span> <span>Power category</span> </div> </td> <td style="text-align: center;">Clean the Injector</td> <td style="text-align: center;">Clean/Repair/Adjust - the Injector, Injection pump, others</td> </tr> <tr> <td style="text-align: center;">19 ≤ kW &lt; 75</td> <td style="text-align: center;">per 1,500 hr</td> <td style="text-align: center;">per 3,000 hr</td> </tr> </tbody> </table> </li> </ul>			ITEM	MAINTENANCE PERIOD		<div style="display: flex; justify-content: space-between;"> <span>Related parts</span> <span>Power category</span> </div>	Clean the Injector	Clean/Repair/Adjust - the Injector, Injection pump, others	19 ≤ kW < 75	per 1,500 hr	per 3,000 hr
ITEM	MAINTENANCE PERIOD										
<div style="display: flex; justify-content: space-between;"> <span>Related parts</span> <span>Power category</span> </div>	Clean the Injector	Clean/Repair/Adjust - the Injector, Injection pump, others									
19 ≤ kW < 75	per 1,500 hr	per 3,000 hr									

## 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 are indicated in the table below. Be sure to observe.

PART	ITEM	DAILY	EVERY				1000HRS	2000HRS
			50HRS	100HRS	250HRS	500HRS	OR 1 YEARS	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		◎ (First)		◎			
	Replace the lubricating oil filter		◎ (First)		◎			
Coolant system	Check the coolant level	○						
	Check the clogging of the radiator	○			○			
	Replace the coolant							◎
	Adjust the fan belt tension		◎ (First)		○			
	Check for coolant cleaning and maintenance							●
	Check and replace the fuel-related, cooling water pipe							●
Intake air system	Clean the air cleaner,			○				
	Replace the element.					◎		
	T/C cleaning of the blower (if equipped)						●	
Engine body	Re-tighten the bolts							● (Re-tighten)
	Adjust the in/exhaust valve clearance.						●	
	In/exhaust valve lapping							●
Electrical equipment	Check the warning lamps.	○						
	Check the battery liquid level.		○					

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

## 2.2 CHECK THE MAIN FUNCTION

- Checking 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.

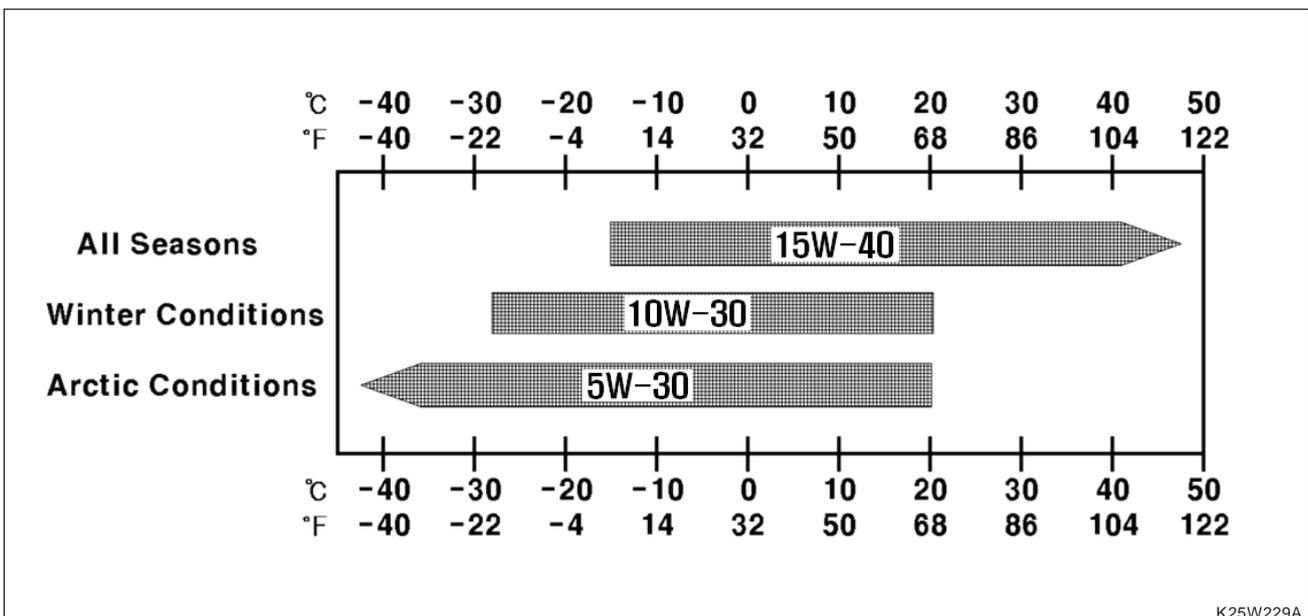
### 2.2.1 VISUAL CHECK

- 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.

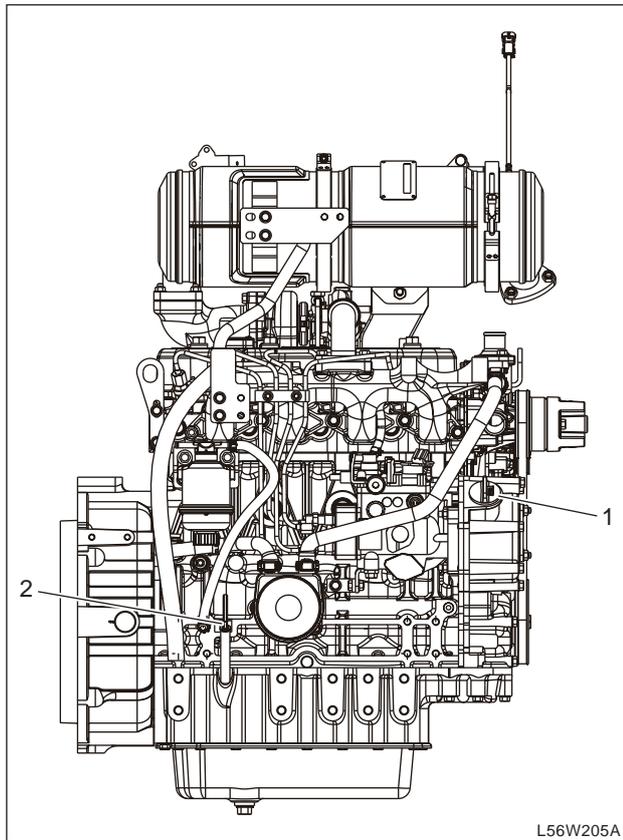
### 2.2.2 LUBRICATING OIL

- Diesel engines operate under differed conditions than gasoline engines, so proper oil should be used.
- 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 or above API CJ-4 level.

※ 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.

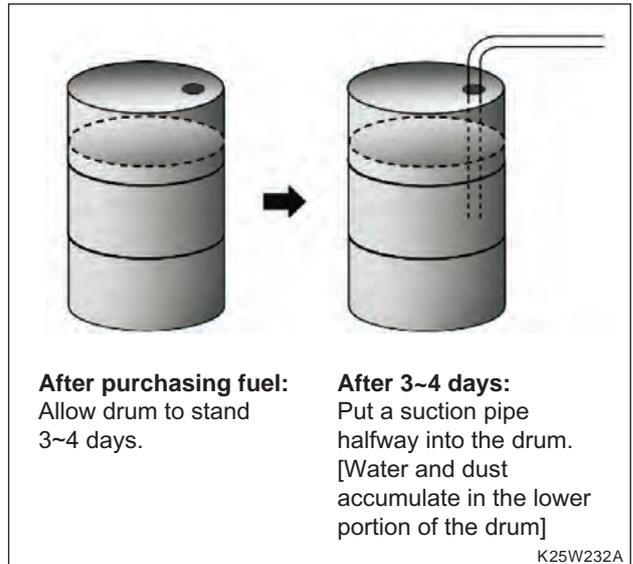


(1) Lubricating oil (2) Dip stick

- Lubricating oil and element replacement for 1st time is after operating engine for 50 hrs. And then 2nd time and thereafter is every 250 hrs. However, if the engine is used in dusty conditions, check and change the engine oil and filter more frequently.

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 more than 52 and use a lower viscosity at low temperature.



- The fuel that contains water and dust can cause a serious failure, so always use clean fuel.
- When storing fuel at home, keep the fuel container still for a few days so that water and foreign matter sink to the bottom. Then, insert a fuel suction pipe into the middle of the fuel container to suck and use the fuel in the middle section.
  - Check the integrated filter for water or foreign matter accumulated at the bottom of the fuel tank; if any is found, open drain valve (1) on the integrated filter and drain the water or foreign matter completely.

- Replace the fuel filter : every 500 hrs.  
If water or dust deposits are in fuel, replace the fuel filter.



(1) Bleed air knob

- Bleed air: 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 knob (1) at top of the fuel filter until foamy. And then put a cloth near the air bleeding screw for prevent overflow fuel.
  2. If fuel doesn't include bubbles, tighten the air bleeding knob.
  3. Check for oil leakage.

**! WARNING**

- Do not lay flammable materials in engine around.

**2.2.4 COOLANT**

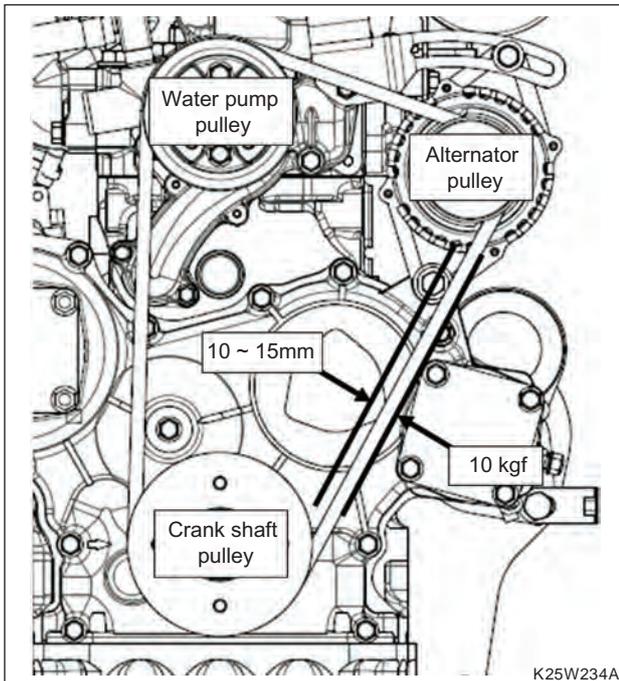
- The coolant must use the soft water (such as tap water, etc). Hard water such as well water causes scale deposits on the coolant system. This reduces the cooling efficiency and raises the coolant temperature too high, causing seizures between the piston and the liner. Use an anticorrosive to prevent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

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

Use antifreeze based on a temperature 5 - 10°C lower than the temperature of the corresponding region.

- Replace the coolant: Every 2 years. 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.

### 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 ~ 12 mm in the case of new part. The case which uses the belt, adjust tension to 10 ~ 15 mm.
- Correct adjustment exists when the belt can be pushed inward with 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 V-belt if tegument is worn out or some pieces are detached.

### 2.2.6 CHECK EVERY 50 HRS

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

### 2.2.7 CHECK EVERY 250 HRS

1. Replace the lubricating oil and oil filter: Replace the engine oil and oil filter every 250 hrs after replacing it at first 50 hrs.
2. Check & clean the radiator fan.
3. Check the tension of the V belt.

### 2.2.8 CHECK EVERY 500 HRS

1. Replace the fuel filter: Replace the fuel filter every 500 hrs.
2. Replace the air cleaner elements.

### 2.2.9 CHECK EVERY 1,000 HRS

1. Check & correct the injection pressure of injector and the spray condition.
2. Correcting the valve clearance.

### 2.2.10 CHECK EVERY 2,000 HRS

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

## 3. DEFECT DIAGNOSIS AND MANAGEMENT

TROUBLE	CAUSE	REPAIRING
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

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	

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.	

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.
		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

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

## 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.

### 4.1 INTRODUCTION

The logger named “DPF controller” is one of devices which record several data sources of Diesel Particle Filter (“DPF”). [DPF is used to collect PM (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 CONTROLLER

#### 4.2.1 COMPONENTS

ITEM	SPECIFICATIONS
Differential pressure sensor (DPS) power supply	Max. 50 mA, 5 V $\pm$ 0.2 V
Differential pressure sensor (DPS)	Detects the regeneration mode using the difference in pressure at the inlet/outlet of the emission control system, 0 - 5 V
Exhaust gas temperature sensor (EGTS)	Detects the temperature at the outlet of the emission control system; 1 k $\Omega$ pull-up in the controller
Coolant temperature sensor	Controls the glow lamp and glow plugs based on the coolant temperature
Engine speed (rpm) sensor	37-pulse, engine rpm 720°
Lamp activation 	Activates an LED lamp to notify the operator of DPF faults; operates up to 1 A (In case of a sensor error or DPF regeneration interval)

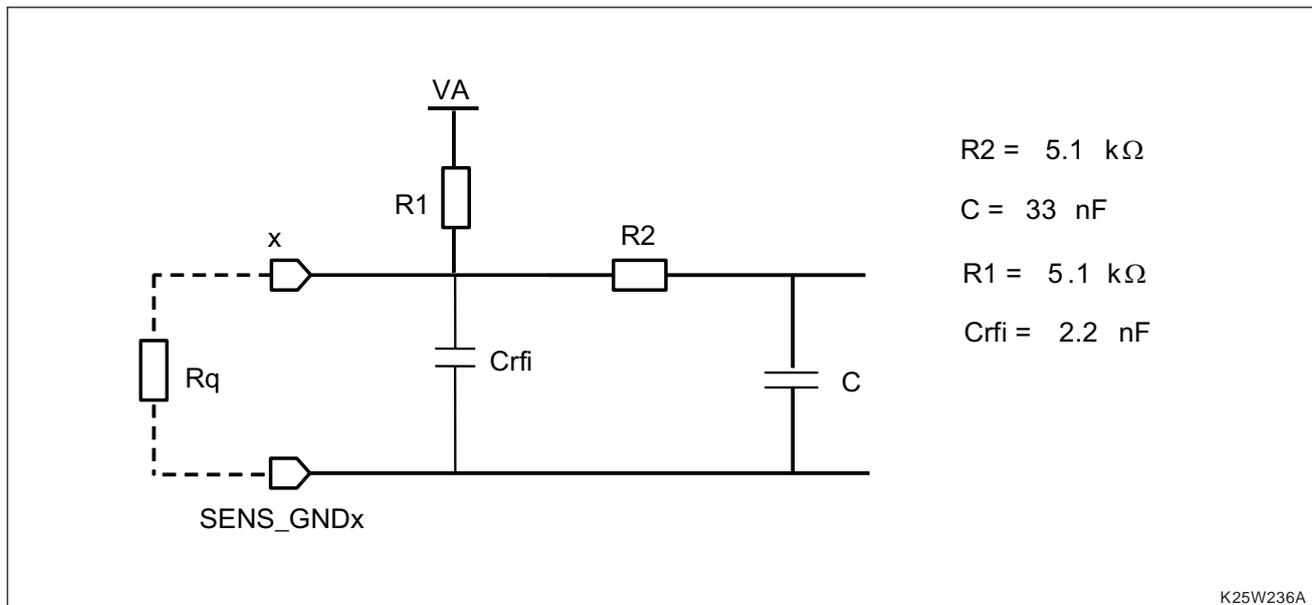
## 4.3 ELECTRIC SPECIFICATION

### 4.3.1 DPF DIFF. PRESSURE SENSOR (DPS)

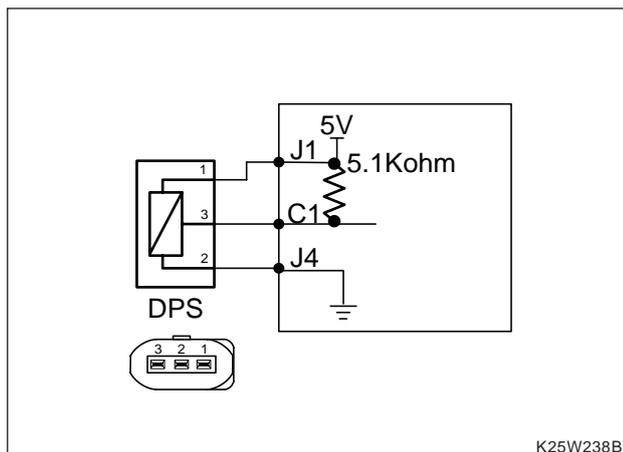
#### INTRODUCTION

The DPF differential pressure sensor (DPS) measures the difference in pressure at the inlet and outlet of the DPF system, while the controller uses the measurements from the sensor to measure the amount of soot in the DPF.

#### CIRCUIT



#### DIAGNOSIS



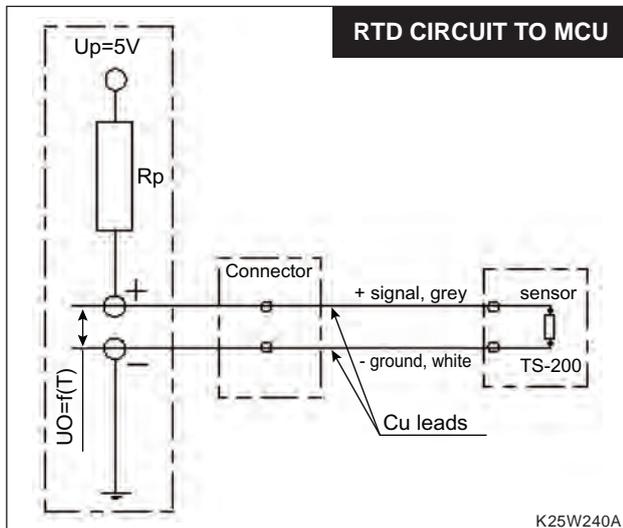
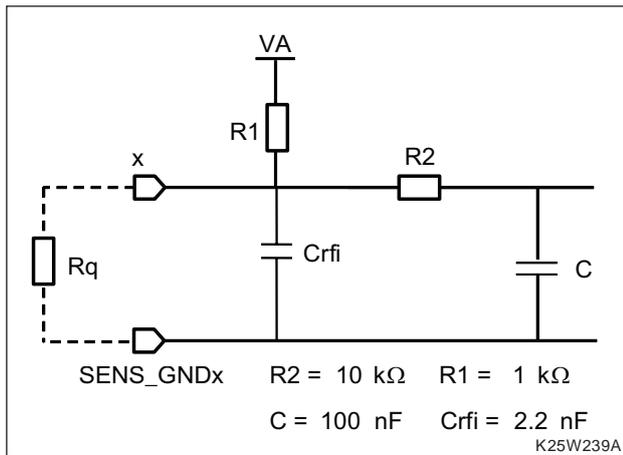
1. Check for  $0.5 \pm 0.2 \text{ V}$  at atmospheric pressure. (Atmospheric pressure voltage =  $5 \text{ V} * 10\%$ )
2. Removal procedure
  - Turn the ignition switch off.
  - Disconnect the DPF differential pressure sensor connector.
  - Disconnect the DPF differential pressure hose.
  - Unscrew the mounting bolts and remove the DPF differential pressure sensor.
4. DPS mounting torque: 1.0 - 1.2 kgf.m
5. DPS range error: If the sensor voltage is greater than 4.785 V or less than 0.3 V for longer than one second

4.3.2 EXHAUST GAS TEMPERATURE SENSOR (EGTS)

**INTRODUCTION**

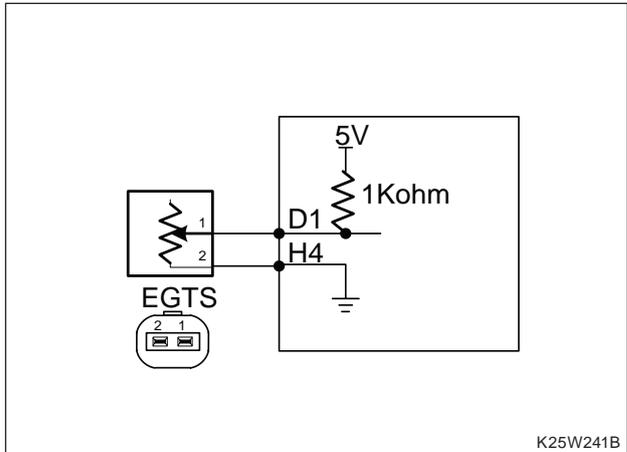
Mounted in the emission control system (DPF), the exhaust gas temperature sensor (EGTS) detects the temperature of exhaust gas entering the exhaust pipe, while the controller receives the temperature of exhaust gas discharged from the DPF.

**CIRCUIT**



- Voltages
  - Power supply:  $U_p = +5V \pm 0.1\%$
- Resistances
  - Pull up resistance:  $R_p = 1000\ \Omega \pm 0.1\%$
  - Lead resistance:  $R_1 = 005\ \Omega$   
(MI-cable + Cu-leads)
  - TS-200 0°C:  $R_0 = 200$

**DIAGNOSTICS**



1. Turn the ignition switch off.
2. Disconnect the EGTS sensor from the connector.
3. Measure the resistance on the sensor terminal with a multimeter at room temperature.
4. Check whether the resistance is  $220 \pm 20\ \Omega$  at a room temperature of  $25^\circ\text{C}$ .
5. When measurements are taken after driving the machine, different resistance values are measured depending on the temperature.
6. Refer to the specifications to check whether the resistance differs from the specified value.
7. EGTS range error: If the sensor voltage is greater than 4.785 V or less than 0.3 V for longer than one second

**PRECAUTIONS**

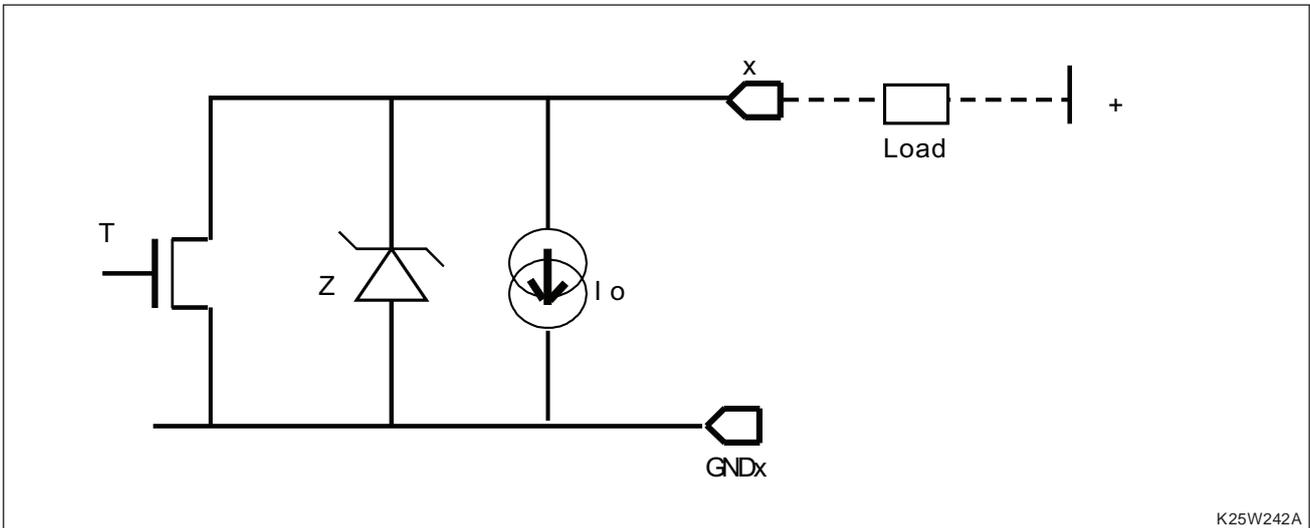
1. If possible, avoid removing the sensor unit; otherwise, leaks may occur in the exhaust pipe.
2. Dropping the unit may cause unseen damage, so make sure to check the performance before using it.
3. EGTS mounting torque: 4.0 - 5.0 kgf.m

4.3.3 DPF CHECK LED LAMP

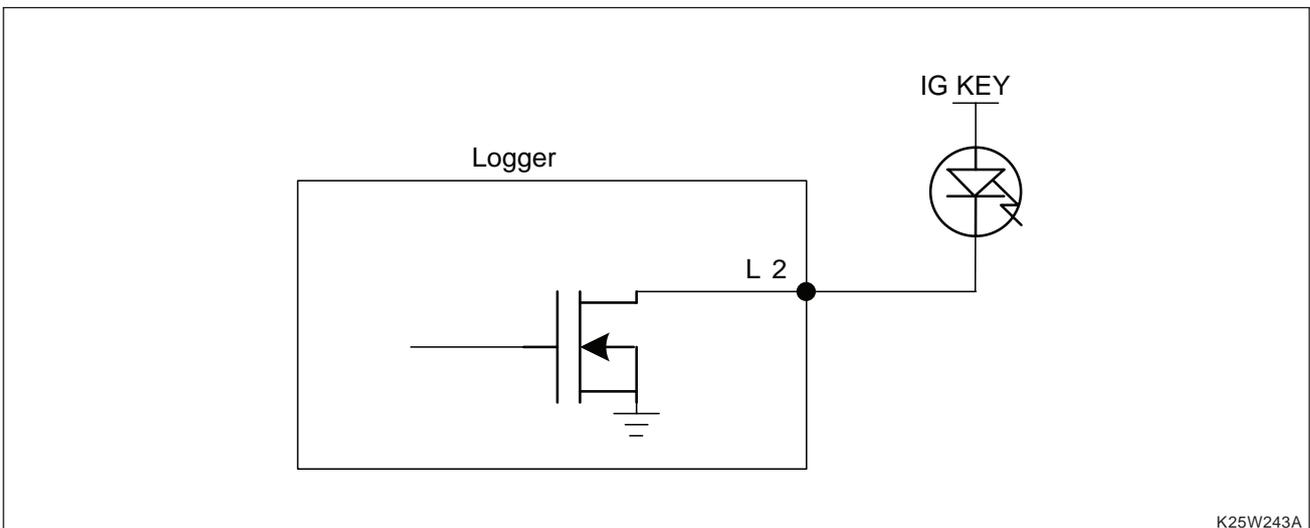
**INTRODUCTION**

Check lamp to show the DPF conditions.

**CIRCUIT**

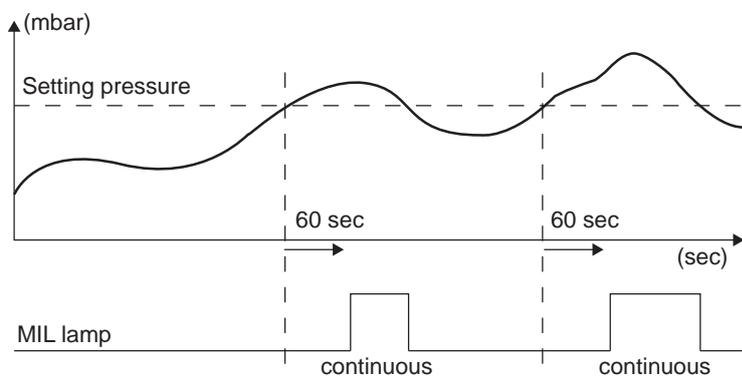


**WIRING**



**DPF LAMP BLINKING FUNCTION**

- When the ignition key is turned on, the lamp turns on for 0.5 seconds; then, the lamp turns off.
- The  lamp turns on in case of a fault in the emission control system or a regeneration interval

STATUS TYPE	CONDITIONS	LAMP FLASHING
Emergency	<p><b>1) The emission control system is clogged:</b> The differential pressure exceeds the standard differential pressure at a given engine rpm continuously for 60 seconds (detected at a minimum of 250 mbar)</p> <p><b>2) The emission control system has melted due to overheating:</b> The exhaust temperature exceeds 650°C continuously for 20 seconds.</p> 	 Lamp remains on
Caution	Error in the exhaust gas temperature sensor or the differential pressure sensor	 Lamp remains on
Check	The differential pressure remains continuously higher than the set DPF differential pressure at a given engine rpm for longer than 3 seconds (regeneration interval)	Blinks 3 times per minute (1 sec. - 1 sec. - 1 sec.) (Deactivation condition: Restart)
Emergency history	There is data of the occurrence of an emergency error	Blinks 10 times at 0.5 second intervals every time the ignition key is turned on

**EMERGENCY MEASURES FOR DPF LAMP ILLUMINATION**

STATUS TYPE	CONDITIONS	LAMP FLASHING
Emergency	<p>1. If the lamp turns on while driving the machine, stop the machine and stop the engine</p> <p>2. Request service</p> <p>CAUTION! : Continuing to drive the machine with the lamp on may severely damage the DPF.</p>	Lamp remains on
Caution	1. If the lamp is on, have the machine serviced and inspected at a workshop. (Check the sensor)	Lamp remains on
Check	1. If the lamp is on, have the machine serviced and inspected at a workshop. (Clean the DPF)	Blinks three times per minute (one-second intervals)

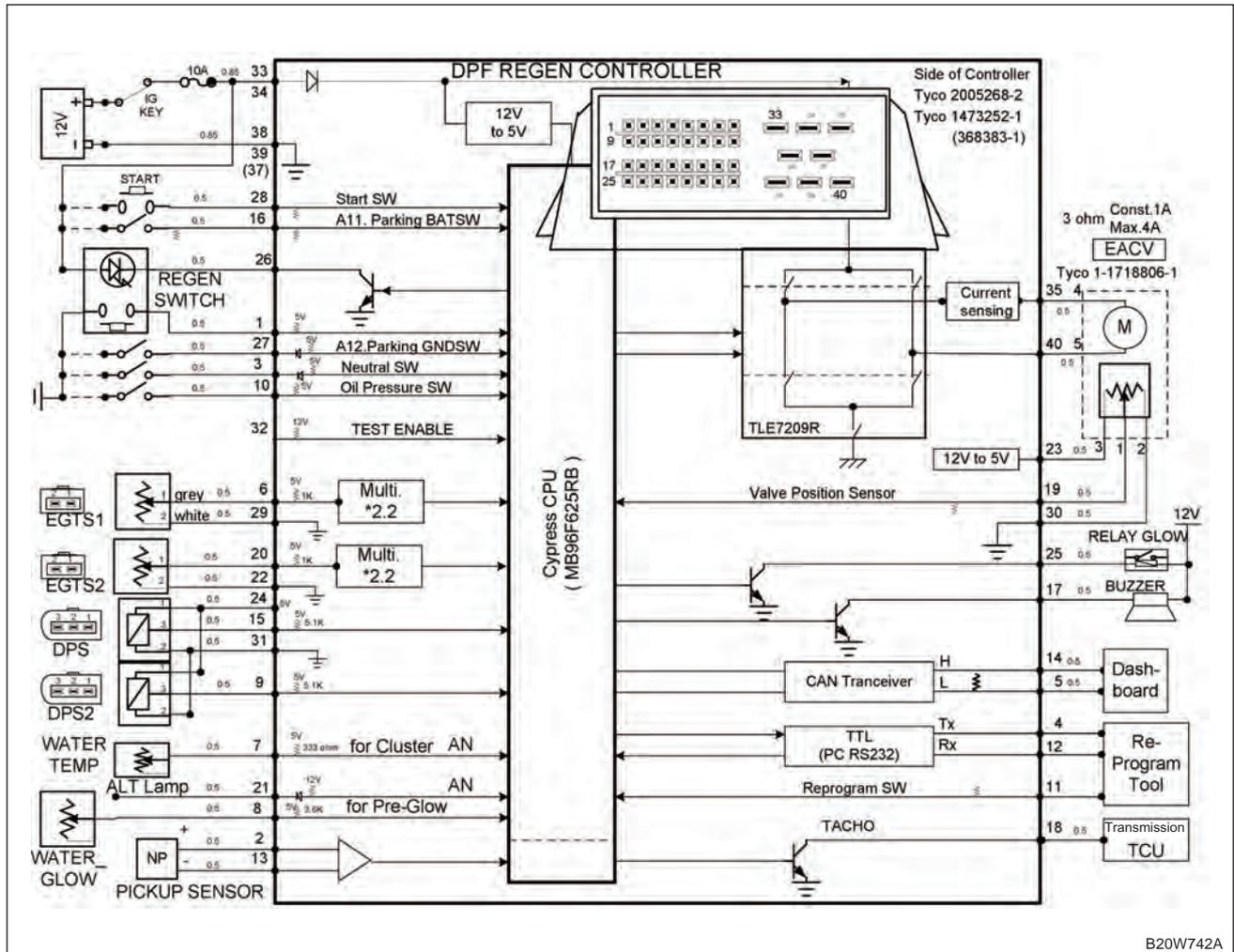
4.3.4 GLOW LAMP & GLOW RELAYS

OVERVIEW

- The glow relays and lamps are controlled based on the preheating time at each engine coolant temperature in order to enhance startability

-  Faulty coolant temperature sensor: Blinks at 0.5 second intervals
-  Faulty glow relay: Blinks at one-second intervals

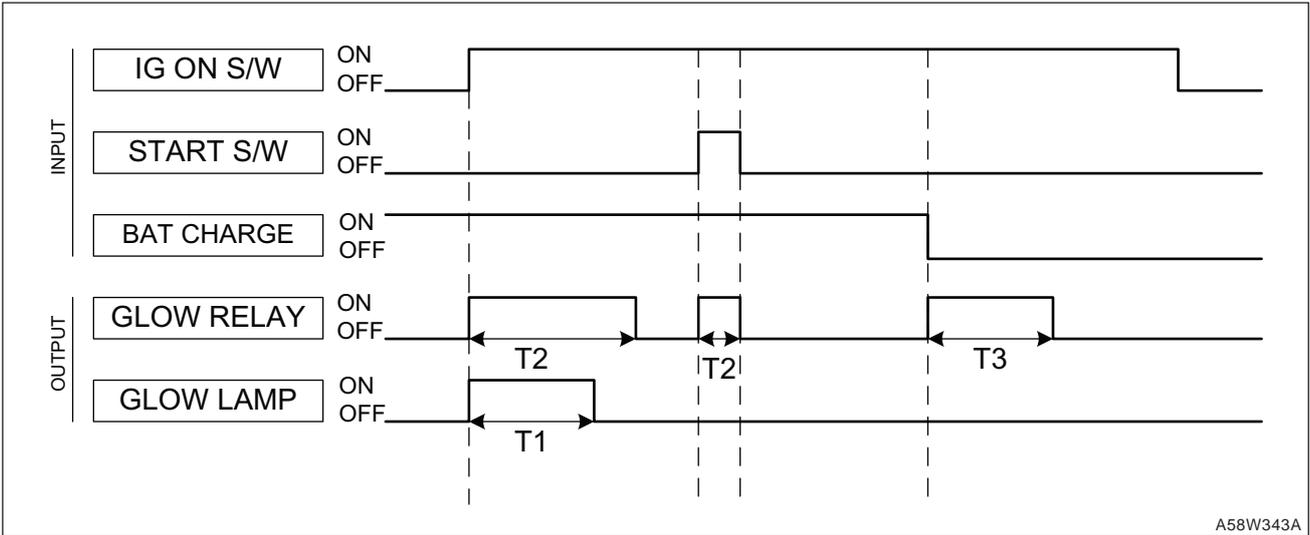
WIRING



B20W742A

- To enhance startability, the preheating time is determined based on the engine coolant temperature, and the glow relay and glow lamp are controlled accordingly.

**TIMING CHART**



A58W343A

**ACTIVATION TIME**

	TEMP. OF COOLANT TEMP. SENSOR (RESISTANCE/VOLTAGE)	ACTIVATION TIME	REMARKS
T1: Lamp activation time (sec.)	40°C or more (0.8 KΩ or less / 0.9 V or less)	4.0 sec.	<ul style="list-style-type: none"> <li>Once the ignition switch signal is received, the lamp turns off regardless of the time remaining</li> </ul>
	-15°C - 40°C (9.5 KΩ - 0.8 KΩ/ 0.9 V - 3.62 V)	10.0 sec.	
	-15°C or less (9.5 KΩ or more / 3.62 V or more)	14.0 sec.	
T2: Preheating time before starting the engine (Pre-glow time) (sec.)	40°C or more (0.8 KΩ or less / 0.9 V or less)	5.0 sec.	<ul style="list-style-type: none"> <li>Once the alternator (generator signal) begins running, the time remaining is disregarded</li> </ul>
	20°C - 40°C (0.8 KΩ - 1.8 KΩ/ 0.9 V - 1.67 V)	10.0 sec.	
	20°C or less (1.8 KΩ or more / 1.67 V or more)	30.0 sec.	
T3: Preheating time after starting the engine (After-glow time) (sec.)	60°C or more (0.4 KΩ or less / 0.5 V or less)	5.0 sec.	
	60°C or less (0.4 KΩ or more / 0.5 V or more)	120.0 sec.	

\*) When the start switch (while cranking) is turned on, the glow relay is activated even if the pre-glow (T2) time has expired.

### 4.4 DPF REGENERATION

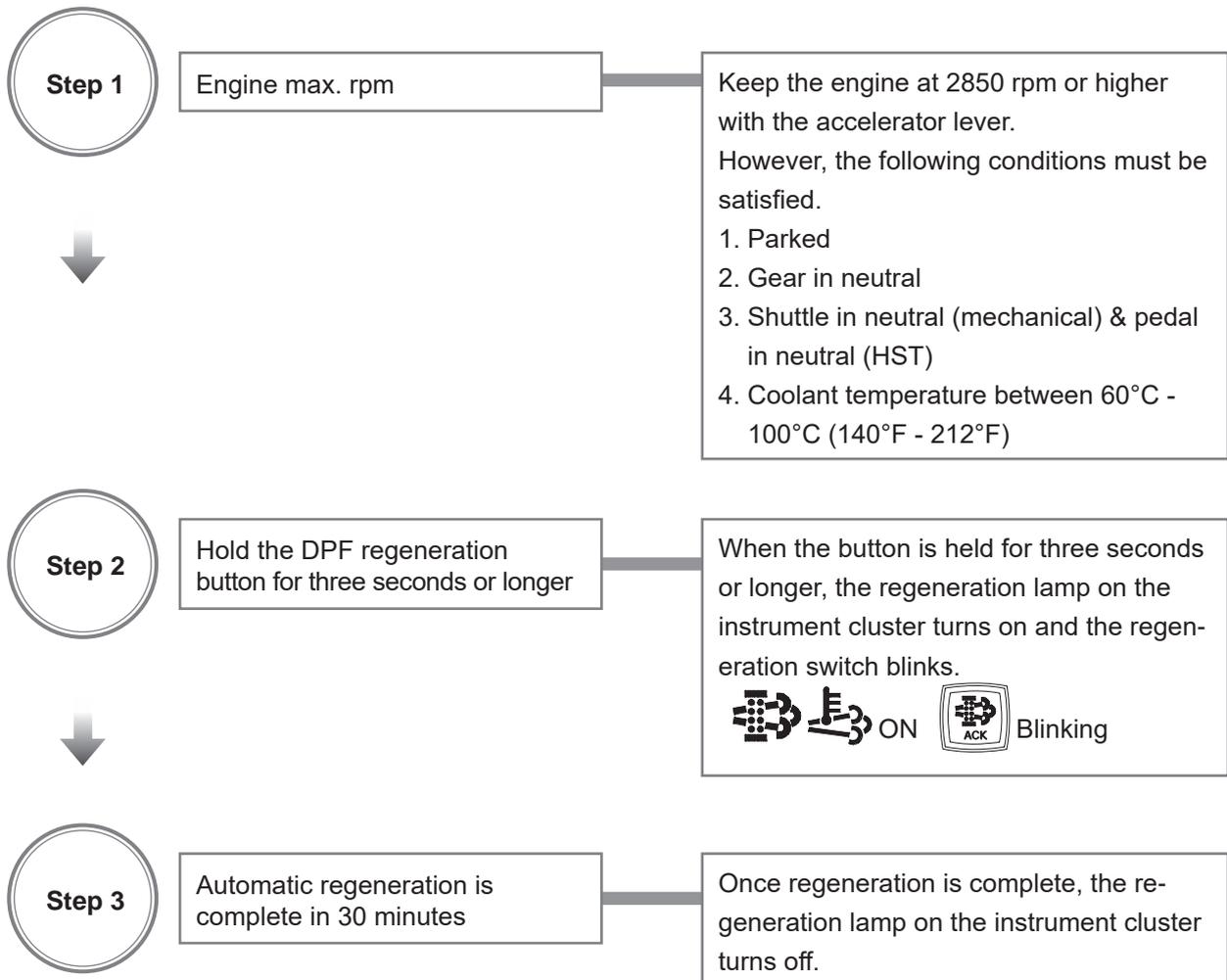
The DPF (diesel particulate filter) collects soot contained in the engine exhaust and reduces exhaust smoke. The soot collected in the filter must be burned periodically to prevent the filter from clogging and to ensure that the filter can continue collecting soot. DPF regeneration is performed by increasing the back pressure in the engine and raising the temperature of exhaust gas.

#### 4.4.1 DETERMINING THE DPF REGENERATION INTERVAL

The pressure in the differential pressure sensor is monitored while the engine is running to determine whether the DPF is full of soot. If pressure exceeding the preset differential pressure level forms for longer than three seconds, the DPF is determined to be full of soot and the driver is informed with an instrument cluster DPF warning lamp and a buzzer that regeneration is necessary.

#### 4.4.2 PERFORMING DPF REGENERATION

If the DPF regeneration warning lamp turns on, the driver must perform regeneration as follows.



## 4.5 DESCRIPTION OF INSTRUMENT CLUSTER LAMPS

### 4.5.1 SENSOR ERROR DISPLAY

1) Engine warning lamp  = 

2) After electronic exhaust valve learning takes place, a cleaning logic (valve operates 30% closed to prevent valve seizure) is activated when the key is turned on

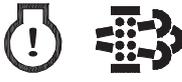
ITEM	LAMP DISPLAY		DESCRIPTION	SOLUTION
RPM error (CPS)		ON	Occurs when the engine is running but no rpm signal is received. - Criterion for starting the engine: Increase in generator voltage	Check the rpm sensor and wiring connected to the fuel injection pump
Coolant temperature error (WTS)		ON	Occurs when the coolant temperature sensor exceeds the measurable range. - Specification range : 0.16V ~ 4.78V	Check the coolant temperature sensor and wiring connected to the coolant pump
Differential pressure sensor error (DPS1, DPS2)		Blinks twice every 2.5 seconds	Occurs when the differential pressure sensor exceeds the measurable range. - Specification range of DPS1 : 0.3V ~ 4.78V - Specification range of DPS2 : 0.3V ~ 4.9V	Check the differential pressure sensor and wiring connected to the DPF assembly Check the differential pressure sensor hoses (in, out)
Exhaust temperature sensor error (T1, T2)		Blinks every 0.5 seconds	Occurs when the exhaust temperature sensor exceeds the measurable range. - Specification range : 0.3V ~ 4.78V	Check the temperature sensor and wiring connected to the DPF assembly
Electronic exhaust valve learning error (-)		Blinks for 0.5 seconds + 2 seconds	Occurs when the electronic exhaust valve position (min. and max. "V" values) is not being learned. The lamp continues blinking at intervals of 0.5 seconds + 2 seconds until the electronic exhaust valve learns successfully.	How to use learning: Within five seconds of turning the key on, press the regeneration button firmly three times. ※ Learning is required when the DPF controller or exhaust valve is replaced (new or used).
Electronic exhaust valve operation error (VALVE)		Blinks every 0.5 seconds	Occurs when the position sensor of the electronic exhaust valve exceeds the measurable range. - Specification range : 0.3V ~ 4.78V	Check the connectors and wiring connected to the electronic exhaust valve actuator
DPF error (RMV1)		ON	Occurs when the DPF is damaged or removed. 1. Occurs when differential pressure sensor 1, differential pressure sensor 2, temperature sensor 1, and temperature sensor 2 detect an error simultaneously, and 2. The engine remains at 500 rpm or higher, differential pressure sensor 1 remains at 0 mbar, and temperature sensors 1 and 2 remain at less than 100°C for three seconds or longer.	Replace the DPF if damaged Check the sensors Have the error cleared at a designated dealer or service center

ITEM	LAMP DISPLAY		DESCRIPTION	SOLUTION
DPF error (RMV2)		ON	Occurs when the DPF is damaged or removed. Occurs when 900 rpm < engine rpm < 1000 rpm, coolant temperature higher than 70°C, and 0 mbar < differential pressure sensor 2 < 3 mbar is maintained for more than three seconds.	Replace the DPF if damaged Check the sensors Have the error cleared at a designated dealer or service center
Glow relay error (-)		Blinks every 0.5 seconds	Occurs in the event of an open circuit in the glow relay (pin 25) or when a relay malfunction lasts longer than two seconds.	Check the wiring or relay connected to the glow plug
Overheated coolant (-)			When the coolant temperature exceeds 110°C (230°F) * Optional) Only applies to the HA00001566A instrument cluster	Check the coolant pump Check the fan belt (Tension, damaged, ect.) Check the radiator, hood air hole clogged

#### 4.5.2 DPF REGENERATION-RELATED INDICATORS

ITEM	LAMP DISPLAY		DESCRIPTION
DPF regeneration interval expired		ON	When a certain amount of soot accumulates in the DPF, the operator is notified that it is time for regeneration. <b>[Buzzer]</b> Buzzer sounds three times per minute
Start of DPF regeneration		Regeneration button	Hold the regeneration button for three seconds or longer at high idle (2850 rpm or higher) to enter regeneration mode. <b>[Buzzer]</b> Buzzer sounds for two seconds at the start
DPF regeneration in progress		ON	The stage where the exhaust valve is controlled to burn the soot in the DPF <b>[Buzzer]</b> Buzzer sounds once every three minutes
		Blinks at intervals of 0.5 seconds	
DPF regeneration complete	Lamp OFF		Regeneration is complete in 30 minutes. <b>[Buzzer]</b> Three minutes after DPF regeneration is complete, the buzzer sounds three times

4.5.3 ERROR DISPLAY DURING DPF REGENERATION

ITEM	LAMP DISPLAY	DESCRIPTION
Engine overheating		Regeneration stops if the coolant temperature exceeds 110°C (230°F) during DPF regeneration. Regeneration cannot be restarted for 10 minutes. <b>[Buzzer]</b> Buzzer repeatedly turns on for one second -> off for 0.5 seconds. When the temperature falls below 100°C (212°F), the buzzer turns off.
	Blinks every 0.5 seconds	
Regeneration failed		This is detected after the regeneration time has ended and occurs when the differential pressure sensor 1 does not decrease by more than 100 mbar compared to the start of regeneration even though the differential pressure was full at the start of regeneration. *) Detailed descriptions of other conditions provided separately
	Blinks every 0.5 seconds	
Regeneration failed three times in a row		This occurs if regeneration fails three consecutive times when differential pressure continues forming due to soot even through DPF regeneration has been completed <b>*) The error can be cleared at a designated dealer or service center (factory reset)</b>
	Blinks every 0.5 seconds	
Regeneration deactivated		Occurs when regeneration stops partway due to any of the following reasons - Engine speed less than 2600 rpm - DPF downstream (T2) temperature overheats past 550°C - DPF upstream (T1) temperature overheats past 650°C for more than one second - Not parked - Not neutral
	Blinks every 0.5 seconds	
Engine turned off during regeneration		The system detects when the engine is turned off during regeneration. If the differential pressure sensor 1 is greater than 130 mbar when the engine is turned on again, the corresponding lamp and switch blink for 10 minutes.
	Blinks every 0.5 seconds for 10 minutes	
DPF error		Occurs when the DPF is damaged or removed. Conditions for DPF damage: RPM 900 – 1000, coolant temperature 70°C (158°F) or higher, DPF differential pressure measured at 3 mbar or lower <b>*) The error can be cleared at a designated dealer or service center (factory reset)</b>
	ON	

### DETAILED CONDITIONS FOR REGENERATION FAILURE

When the regeneration failed lamp () blinks repeatedly) appears after entering regeneration mode

#### ► CASE 1 - DURING REGENERATION

- 1) Coolant temperature over 110°C (230°F): Engine overheated
- 2) T1 temperature over 650°C or T2 temperature over 550°C : DPF error
- 3) Sensor error detected or rpm less than 2600 rpm: Sensor error or engine failed to reach high rpm
- 4) Valve seized: Valve seizure making target position impossible to track

#### ► CASE 2 - AFTER END OF REGENERATION TIME

- 1) Coolant temperature less than 60°C (140°F): Abnormal
- 2) If the differential pressure was over 130 mbar at the start of regeneration but does not decrease by more than 100 mbar compared to the initial differential pressure: Error in DPF regeneration function

## 4.6 BUZZER CONTROL

The buzzer sounds in the following cases.

- When it is time for DPF regeneration at an engine speed of 500 rpm or higher

Buzzer activation: Three times [1S-1S-1S], repeats in one minute

- Start of regeneration

Buzzer activation: Once (2 sec.)

- Regeneration in progress:

Buzzer activation: Once every three minutes

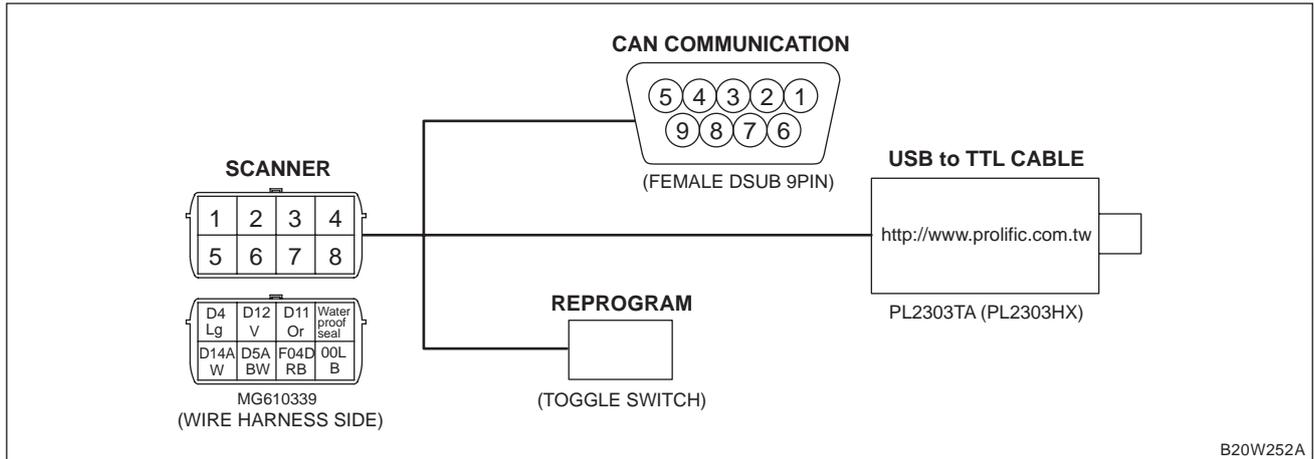
- Regeneration complete

Buzzer activation: Three minutes after regeneration is complete, the buzzer sounds three times for 0.5 seconds each

- When the engine coolant overheats (110°C (230°F) or higher) during regeneration or the valve's target position cannot be tracked for over nine seconds

Buzzer activation: Buzzer repeatedly turns on for one second and off for 0.5 seconds

4.7 SCANNER



The scanner (PC application) can be used to monitor the current sensor information, error information, and regeneration information.

4.7.1 REAL-TIME DATA ITEMS

ITEM	REMARKS
Battery	Battery voltage
Eng Speed	Engine speed
T1	DPF upstream exhaust temperature
T2	DPF downstream exhaust temperature
DPS1	Differential pressure sensor (for diagnosing the amount of soot collected)
DPS2	Differential pressure sensor (for diagnosing the state of the DPF)

4.7.2 SCANNER ERROR DIAGNOSTIC ITEMS

ITEM		REMARKS
T1 Error	Error in DPF upstream temperature sensor	- The hour meter displays the time of occurrence of the most recent error - Displays current error - The history error log allows the operator to view the history of up to 12 errors
T2 Error	Error in DPF downstream temperature sensor	
CPS Error	RPM sensor error	
Valve Error	Exhaust valve error	
WTS Error	Coolant temperature sensor error	
DPS Error	Differential pressure sensor 1 error	
DPS2 Error	Differential pressure sensor 2 error	
RMV1, RMV2	DPF removal or damage error	

4.7.3 VIEWING REGENERATION INFORMATION

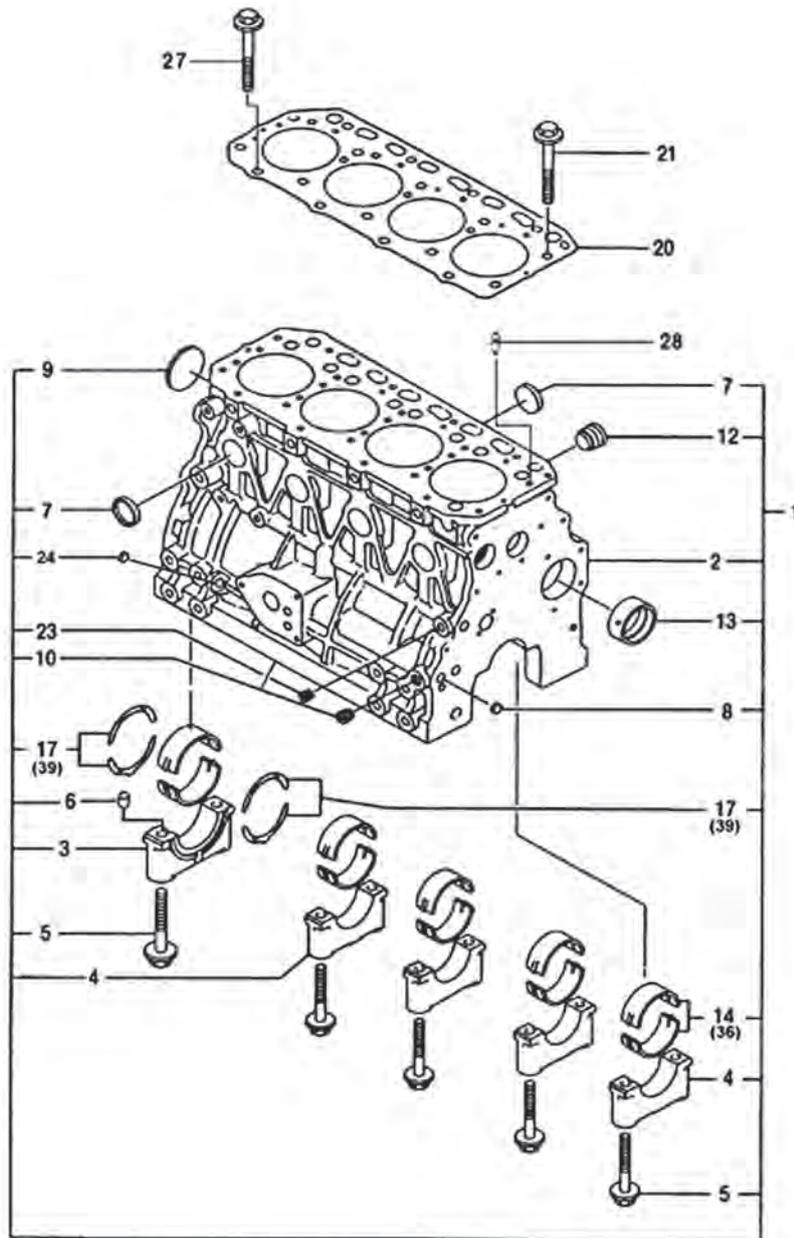
ITEM	REMARKS
Run Time	Total operating time at 300 rpm or higher
DPF Regen Success Count	Number of successful DPF regenerations
DPF Regen Log Time1	Operating time 1 after successful completion of DPF regeneration
DPF Regen Log Time2	Operating time 2 after successful completion of DPF regeneration



5. SECTIONAL VIEW FOR MAJOR COMPONENTS

5.1 CYLINDER BLOCK

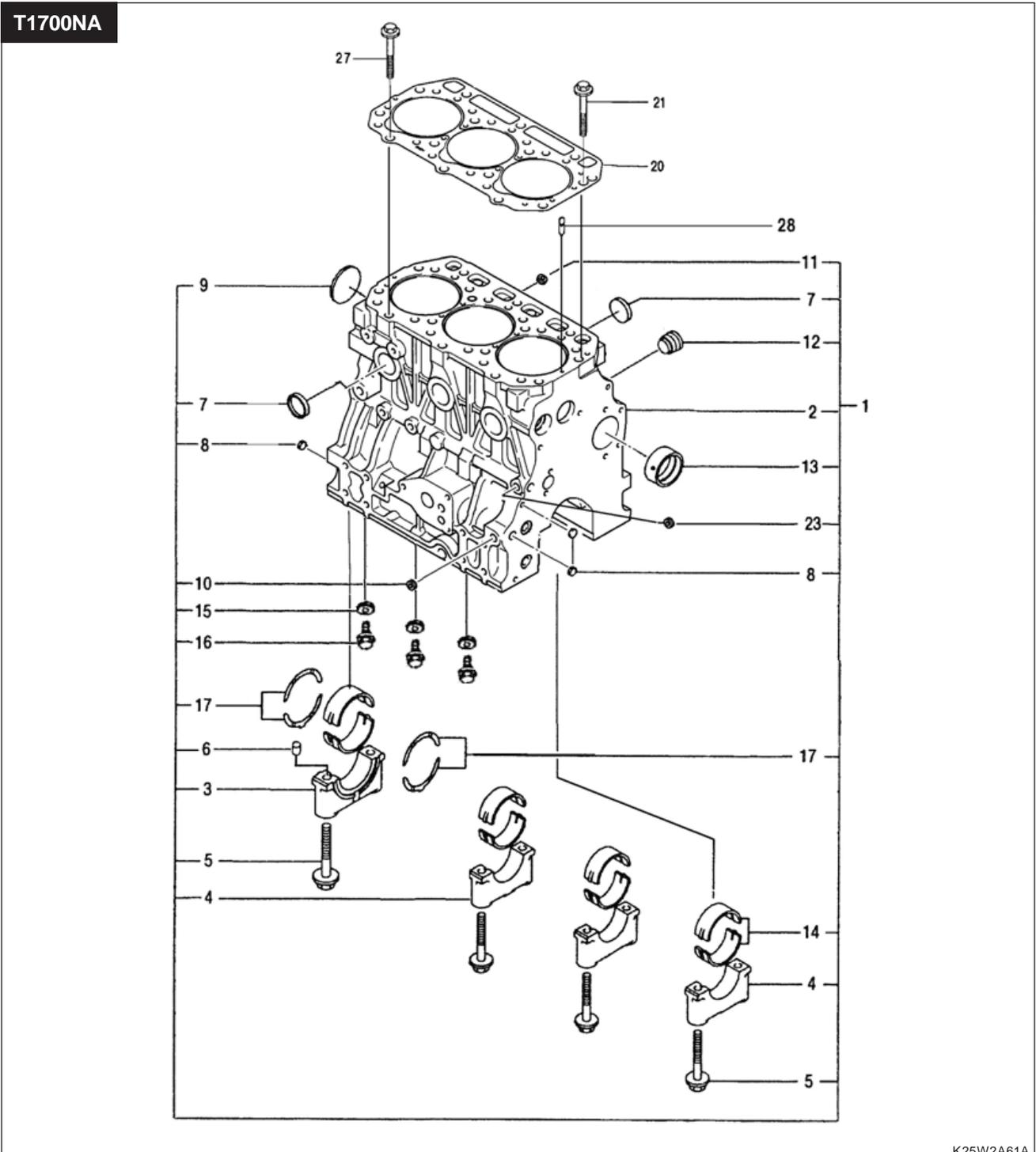
T2300NA/T2300T



K20W2B79A

COMPONENTS

- |                             |                                    |                           |
|-----------------------------|------------------------------------|---------------------------|
| (1) Cylinder block assembly | (8) Plug 12                        | (22) Head gasket          |
| (2) Cylinder block          | (9) Plug (disc type)               | (21) Bolt (cylinder head) |
| (3) Bearing cap (1)         | (10) Tapered plug (PT 1/4)         | (23) Tapered plug         |
| (4) Bearing cap (2)         | (12) Plug (block heater)           | (24) Plug                 |
| (5) Bolt (bearing cap)      | (13) Bushing (camshaft)            | (27) Bolt (cylinder head) |
| (6) Spring pin              | (14) Main bearing assembly (STD)   | (28) Pin (oil)            |
| (7) Plug (cap type)         | (17) Thrust bearing assembly (STD) |                           |

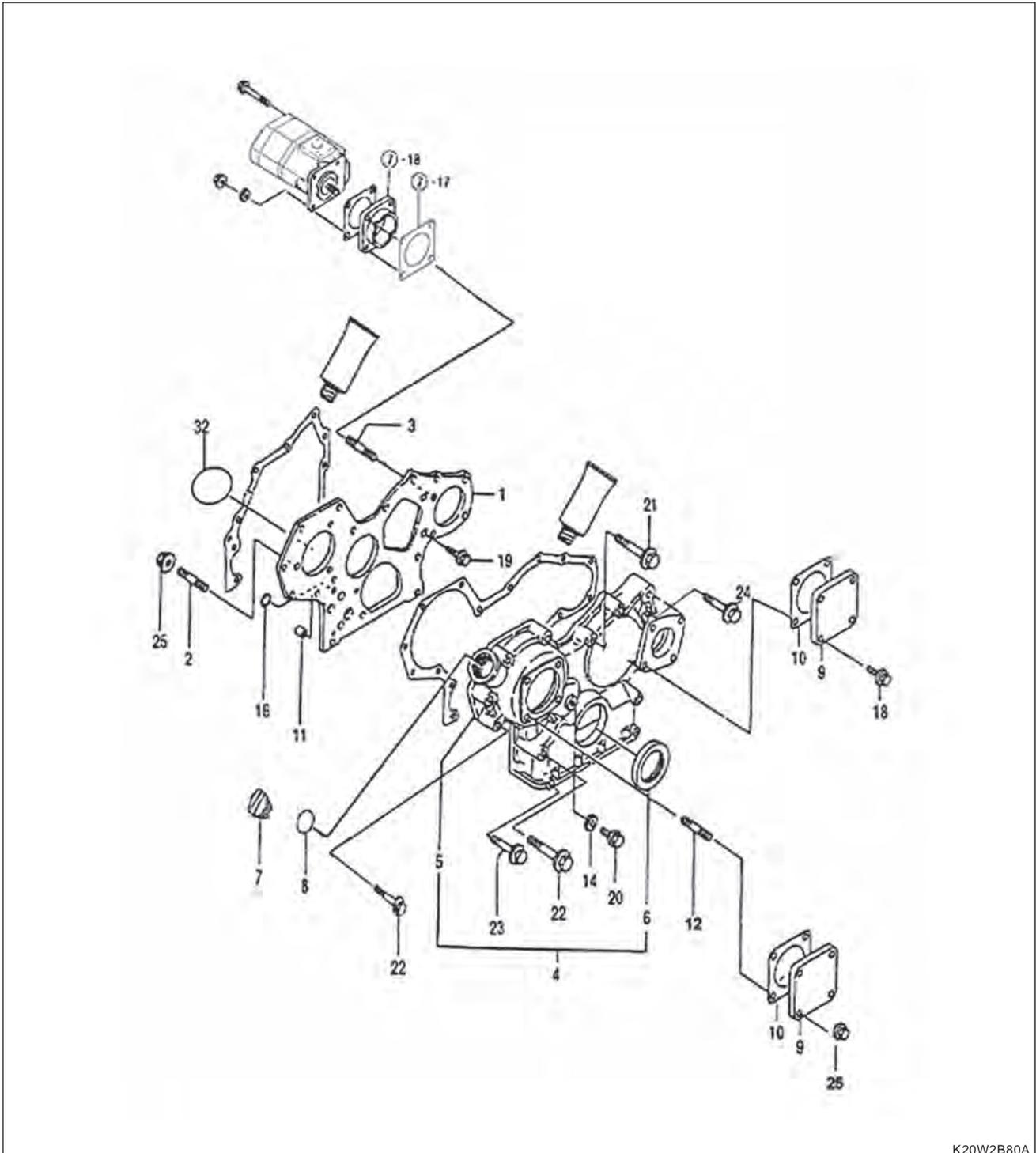


K25W2A61A

**COMPONENTS**

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

## 5.2 GEAR CASE



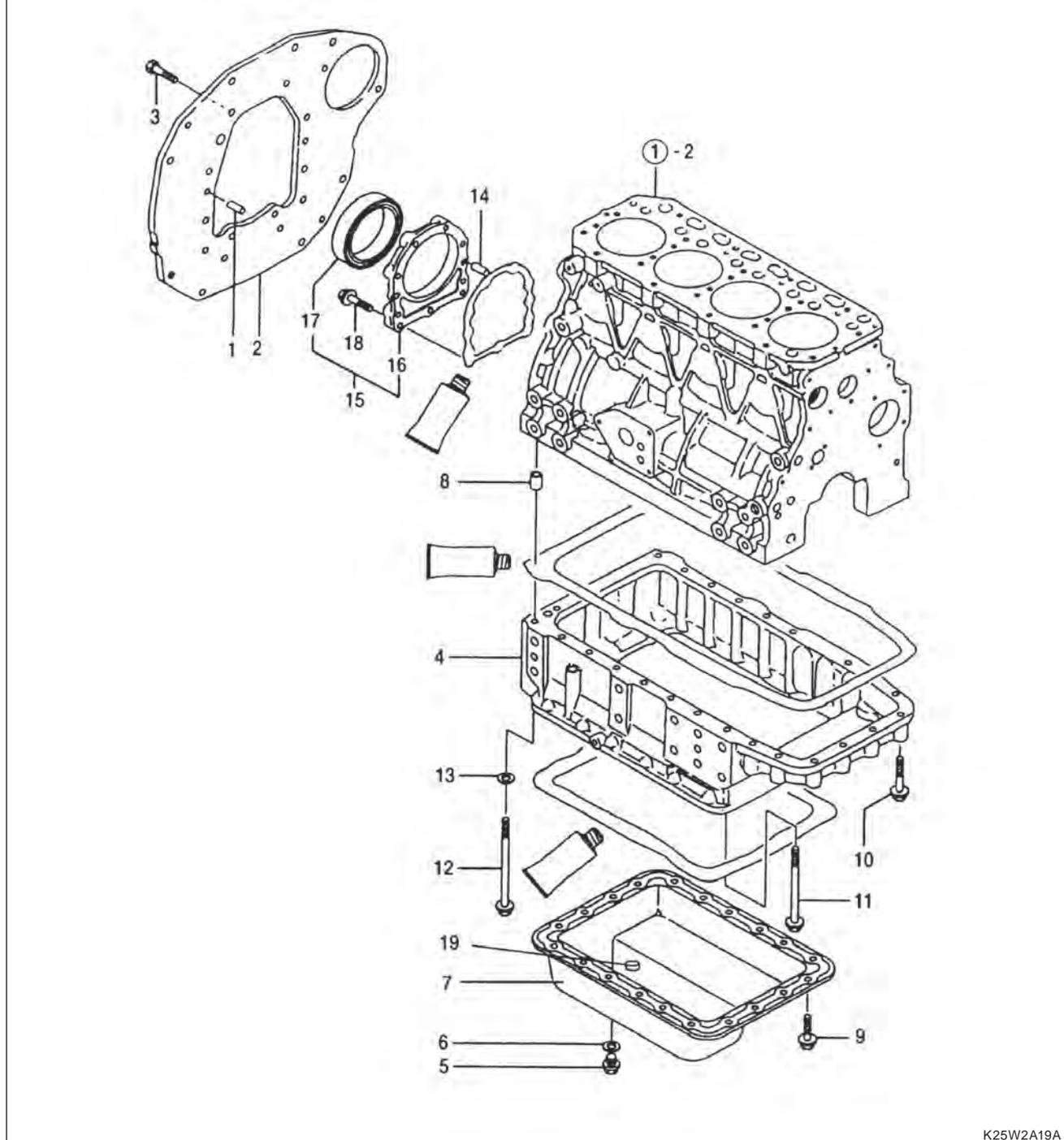
K20W2B80A

## COMPONENTS

- |                        |                       |                                   |
|------------------------|-----------------------|-----------------------------------|
| (1) Flange (gear case) | (9) Cover             | (20) Hex. flange bolt             |
| (2) Stud bolt 8 x 30   | (10) Packing          | (21) Hex. flange bolt             |
| (3) Stud bolt 8 x 35   | (11) Knock pin        | (22) Hex. flange bolt             |
| (4) Gear case assembly | (12) Stud bolt        | (23) Hex. flange bolt             |
| (5) Gear case          | (14) Copper packing   | (24) Hex. flange bolt             |
| (6) Oil seal (G)       | (16) O-ring (P type)  | (25) Hex. flange nut              |
| (7) Oil filler hole    | (18) Hex. flange bolt | (32) O-ring for mounting (S type) |
| (8) O-ring (P type)    | (19) Hex. bolt        |                                   |

5.3 FLYWHEEL HOUSING AND OIL PAN

T2300NA/T2300T

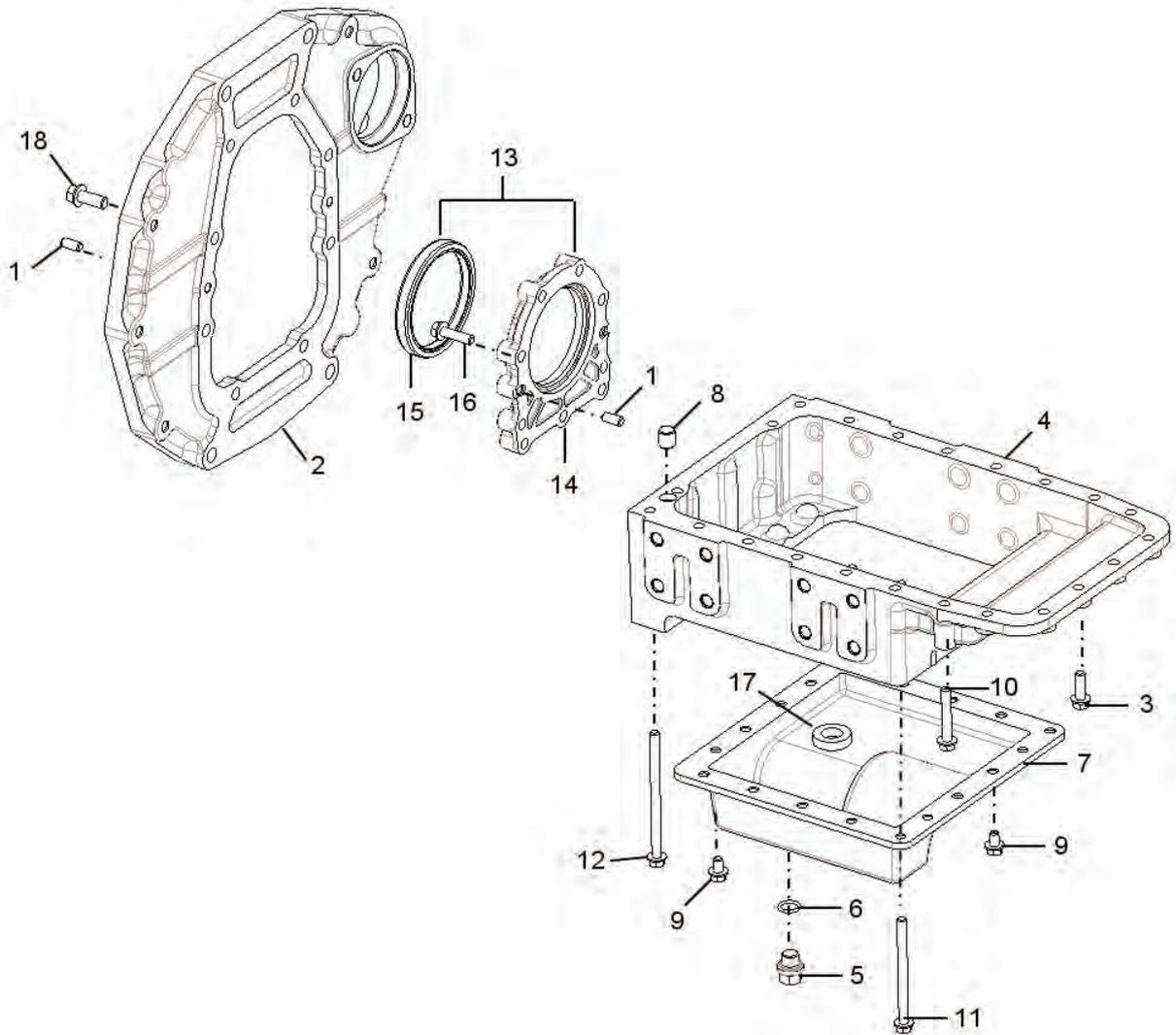


K25W2A19A

COMPONENTS

- |                          |                           |                              |
|--------------------------|---------------------------|------------------------------|
| (1) Pin, parallel 8 x 16 | (8) Pin, knock            | (15) Housing ass'y, oil seal |
| (2) Flange, mounting     | (9) Bolt, flange 8 x 12   | (16) Housing, oil seal       |
| (3) Bolt, 10 x 20        | (10) Bolt, flange 8 x 50  | (17) Oil seal (F)            |
| (4) Pan, oil             | (11) Bolt, flange 8 x 120 | (18) Bolt, flange 8 x 30     |
| (5) Plug                 | (12) Bolt, 8 x 120        | (19) Magnet                  |
| (6) O-ring (P)           | (13) Washer, spring 8     |                              |
| (7) Cover lower          | (14) Pin, parallel 8 x 16 |                              |

T1700NA



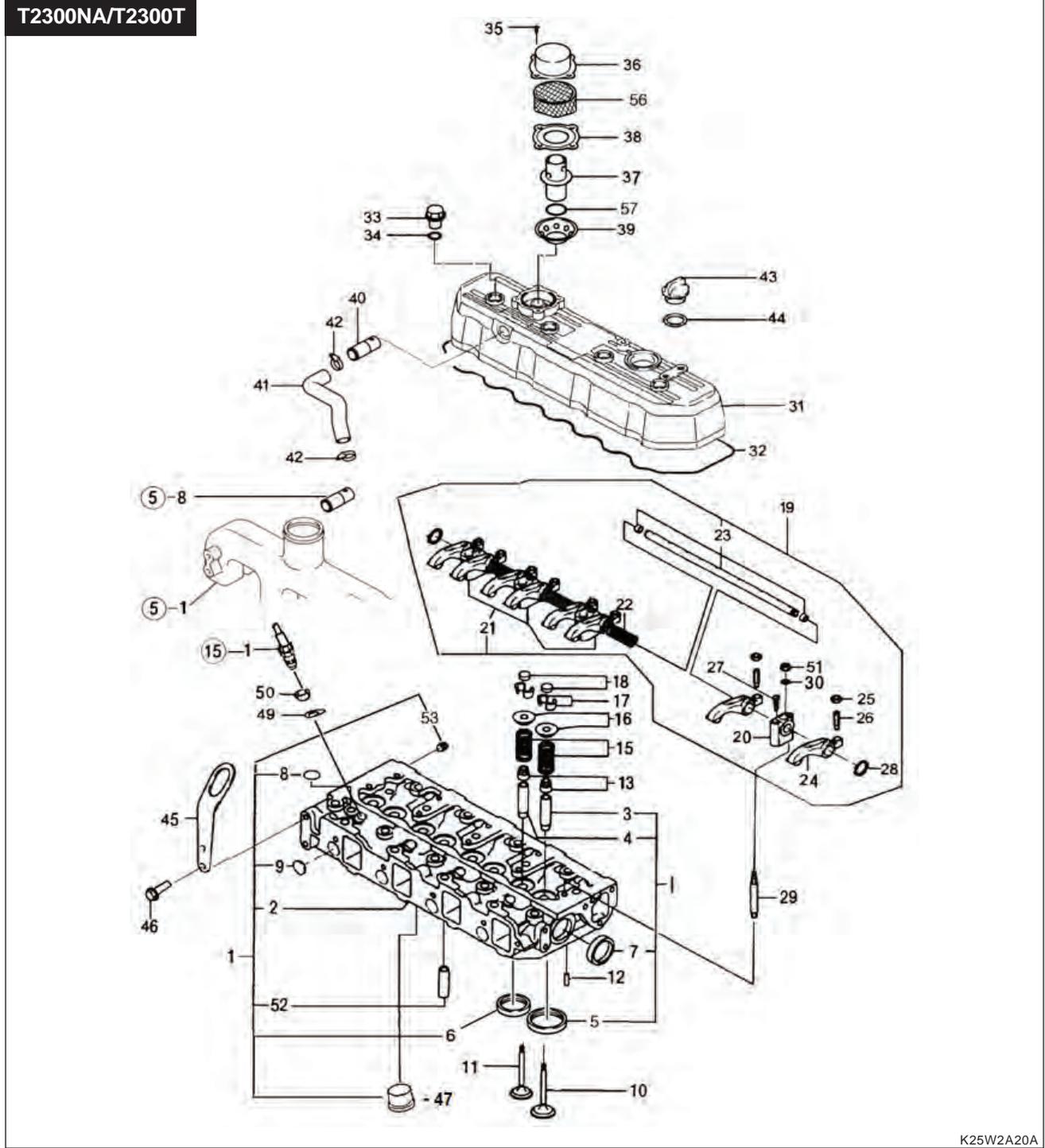
K25W2A61A

COMPONENTS

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

5.4 CYLINDER HEAD AND HEAD COVER

T2300NA/T2300T

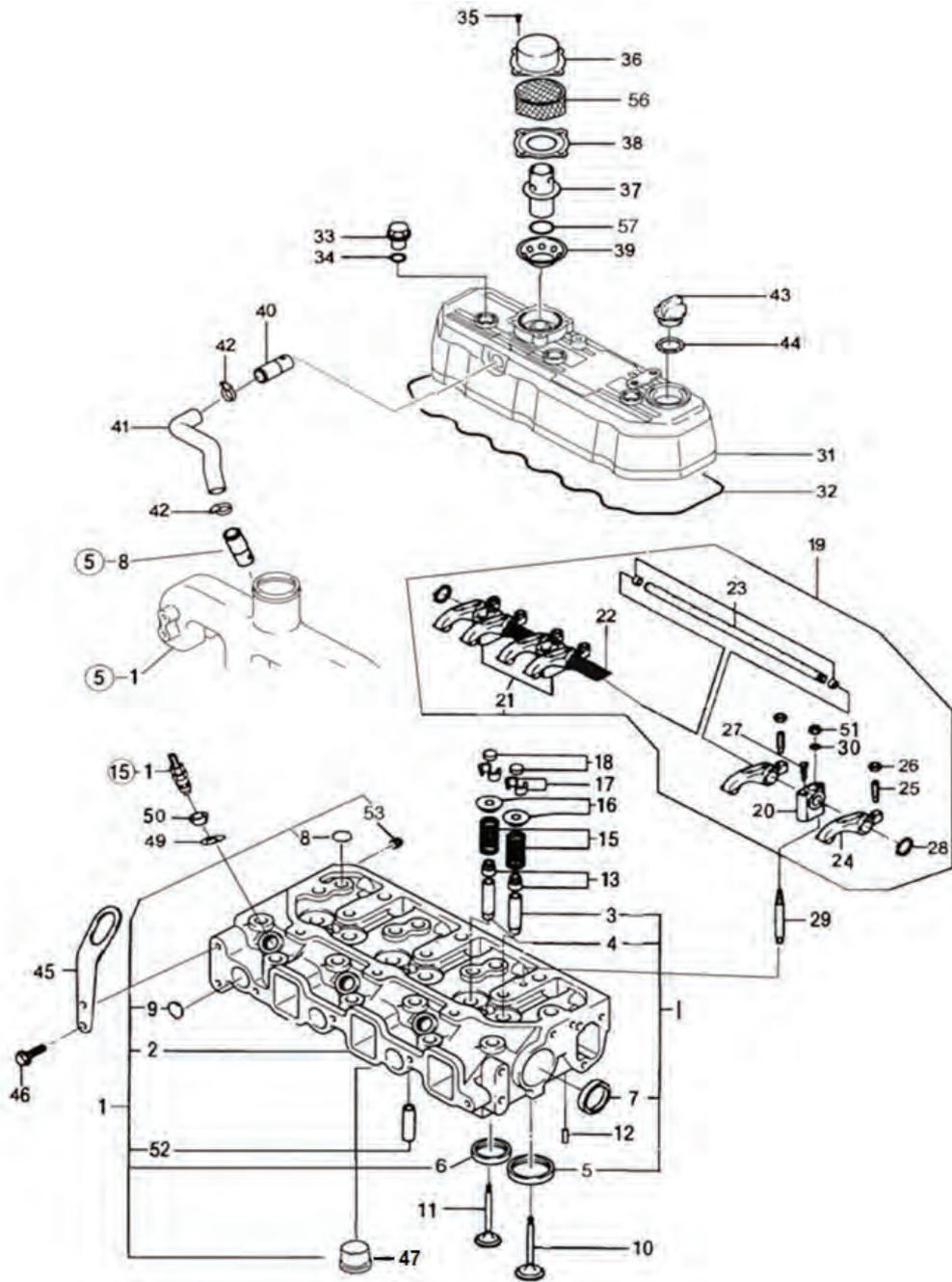


K25W2A20A

COMPONENTS

- |                          |                              |                                |                          |
|--------------------------|------------------------------|--------------------------------|--------------------------|
| (1) Head ass'y, cylinder | (15) Spring, valve           | (28) Circlip                   | (41) Hose, plain         |
| (2) Head, cylinder       | (16) Retainer, valve spring  | (29) Bolt, stud                | (42) Clip, hose 21       |
| (3) Guide, suc valve     | (17) Cotter, valve spring    | (30) Washer 12                 | (43) Oil filler          |
| (4) Guide, exh valve     | (18) Cap, valve              | (31) Cover, head               | (44) O-ring (P)          |
| (5) Seat, suc valve      | (19) Shaft ass'y, rocker arm | (32) Packing, head cover       | (45) Lift                |
| (6) Seat, exh valve      | (20) Support (A)             | (33) Cap, bonnet               | (46) Bolt, flange 8 x 16 |
| (7) Plug 40              | (21) Support (B)             | (34) O-ring (P)                | (47) Pre chamber         |
| (8) Plug 22              | (22) Spring(rocker arm)      | (35) Screw 4x10                | (49) Seal,injector       |
| (9) Plug 22              | (23) Shaft, rocker arm       | (36) Cover, breather           | (50) Spacer, nozzle      |
| (10) Valve, suction      | (24) Rocker arm              | (37) Valve, pressure relief    | (51) Nut M12             |
| (11) Valve, exhaust      | (25) Screw, valve            | (38) Gasket, breather          | (53) Plug PT 1/8         |
| (12) Pin, parallel 4x10  | (26) Nut, adjusting          | (39) Plate, breather adjusting | (56) Baffle              |
| (13) Seal, valve shaft   | (27) Screw, stop 8x10        | (40) Tube, breather            | (57) O-ring              |

T1700NA

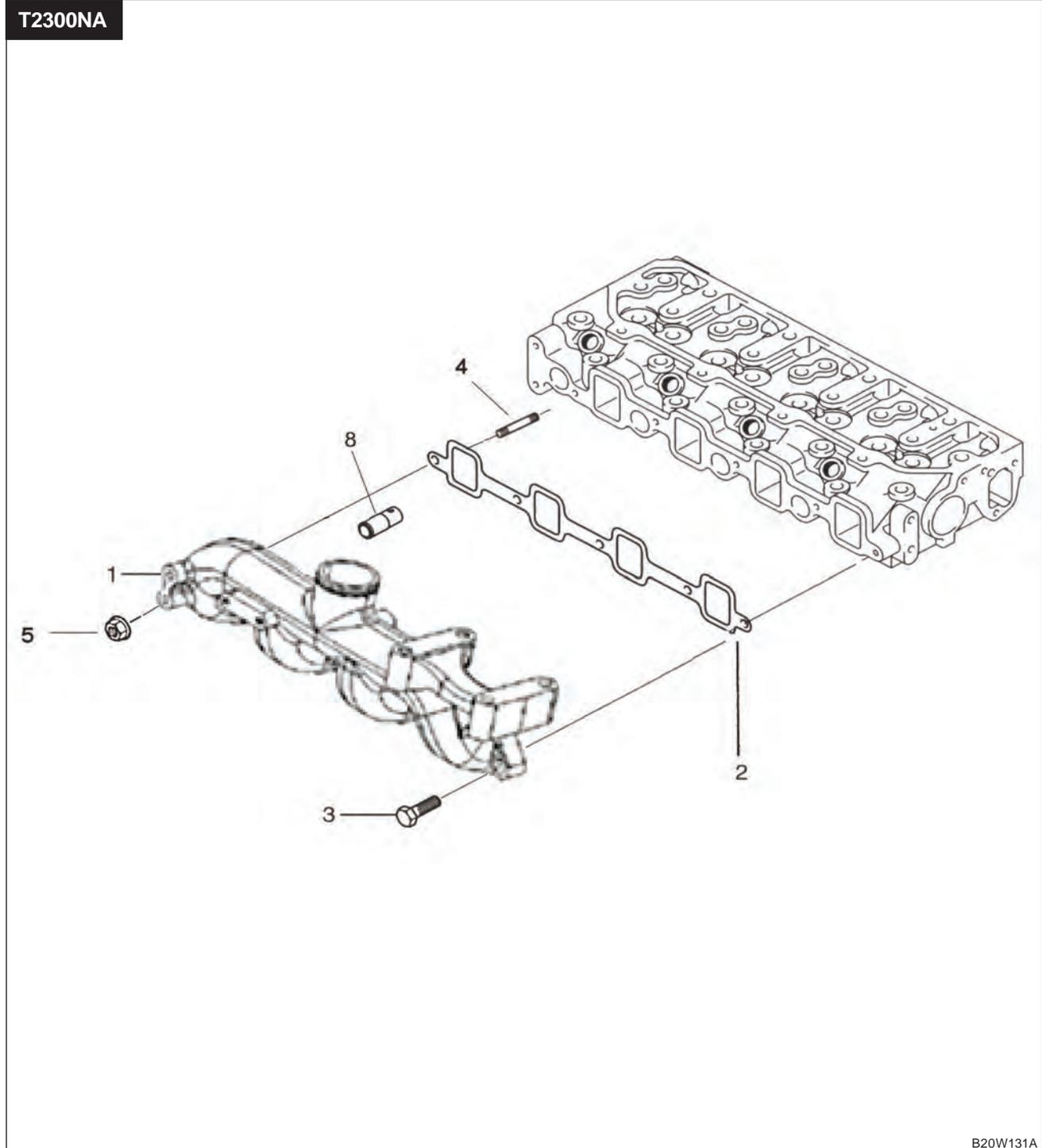


K25W2A63A

COMPONENTS

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

5.5 INTAKE MANIFOLD



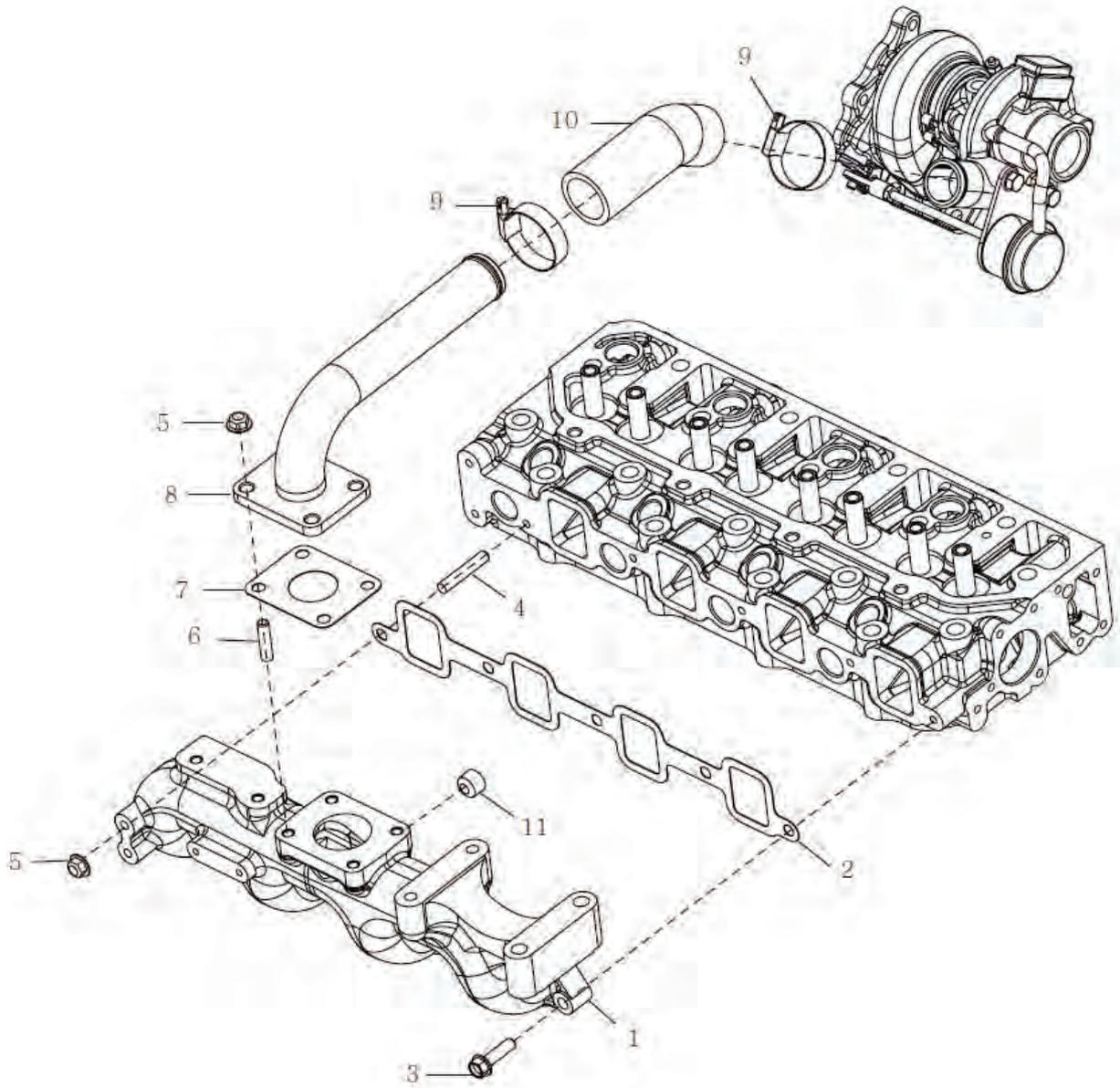
**COMPONENTS**

- (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

T2300T

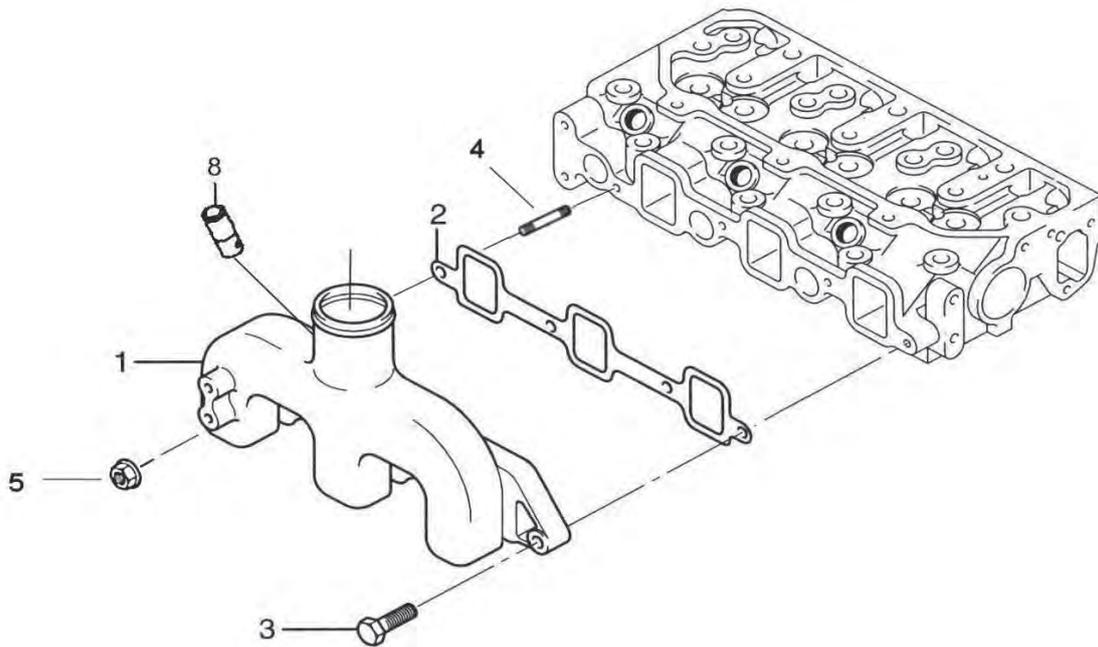


K25W2A56A

COMPONENTS

- |                           |                               |                           |
|---------------------------|-------------------------------|---------------------------|
| (1) Block ass'y, cylinder | (8) Plug 12                   | (20) Gasket, head         |
| (2) Block, cylinder       | (9) Plug 50                   | (21) Bolt(head, cylinder) |
| (3) Bearing cap(1)        | (10) Plug PT 1/4              | (23) Plug PT 1/8          |
| (4) Bearing cap(2)        | (12) Plug(block heater)       | (24) Plug, expansion      |
| (5) Bolt, bearing cap     | (13) Bush(cam shaft)          | (27) Bolt(head, cylinder) |
| (6) Spring pin            | (14) Bearing ass'y, main(STD) | (28) Pin(oil)             |
| (7) Plug 30               | (17) Bearing ass'y, thrust    |                           |

T1700NA



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COMPONENTS

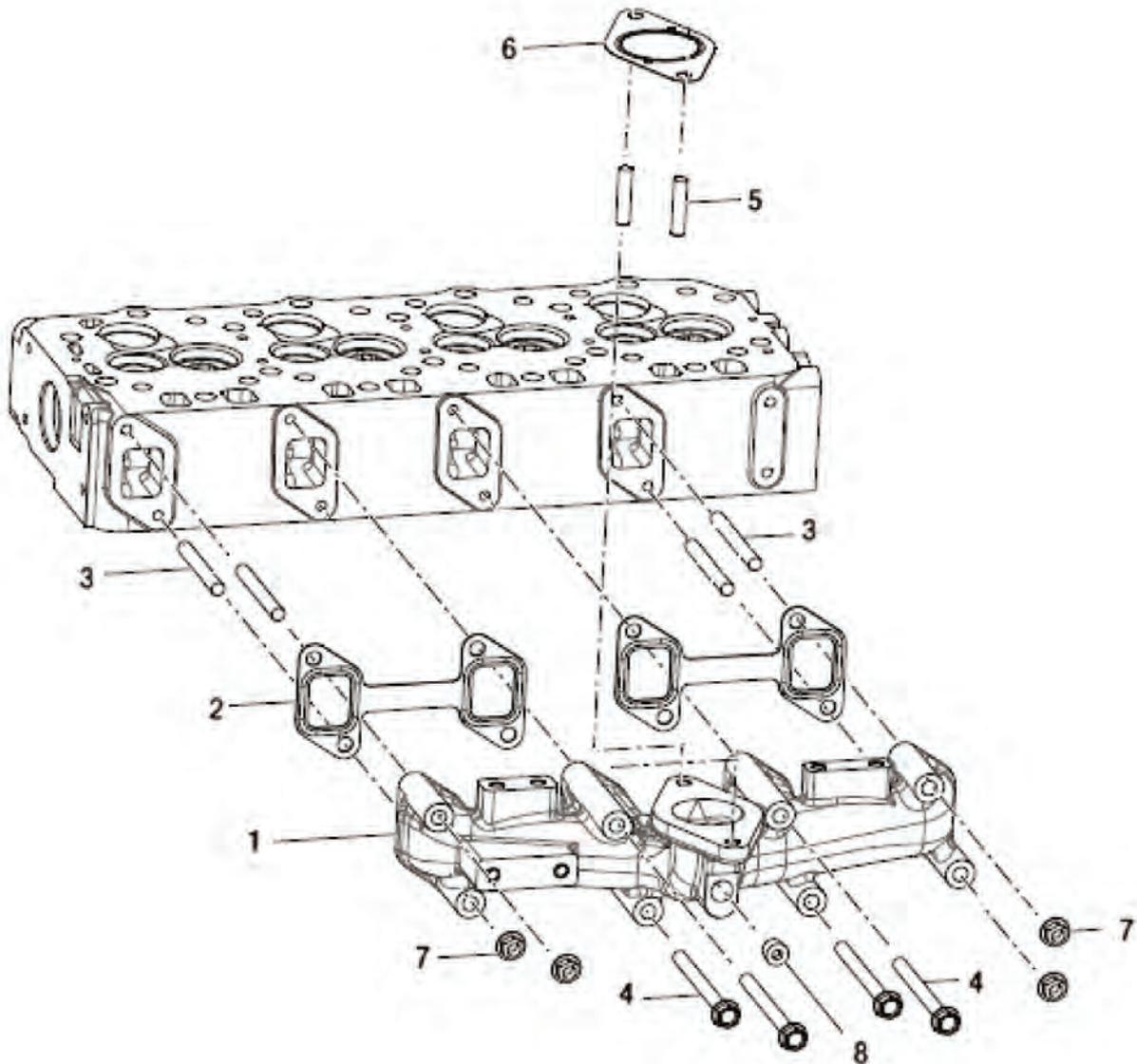
- (1) Manifold, int.
- (2) Packing(manifold, int)

- (3) Bolt, flange 8 x 30
- (4) Bolt, stud 8 x 35

- (5) Nut, hexagon flange
- (8) Tube, breather

## 5.6 EXHAUST MANIFOLD

T2300NA

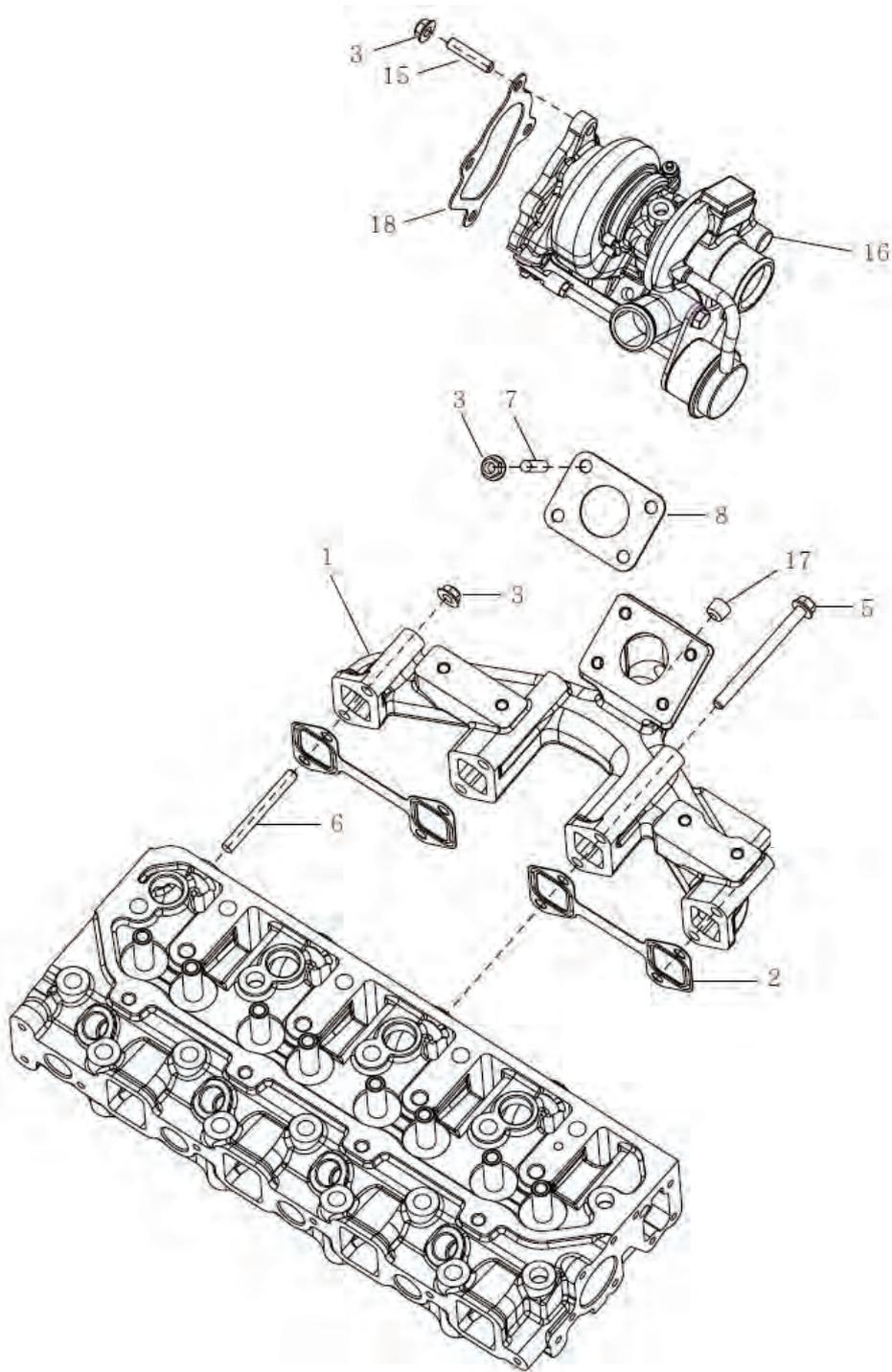


K25W2A22A

## COMPONENTS

- |                           |                         |                   |
|---------------------------|-------------------------|-------------------|
| (1) Manifold, exhaust     | (4) Bolt, flange 8 × 95 | (7) Nut, flange 8 |
| (2) Gasket, exh. Manifold | (5) Bolt, stud 8 × 25   | (8) Plug PT 1/4   |
| (3) Bolt, stud 8 × 65     | (6) Gasket(silencer)    |                   |

T2300T



K25W2A57A

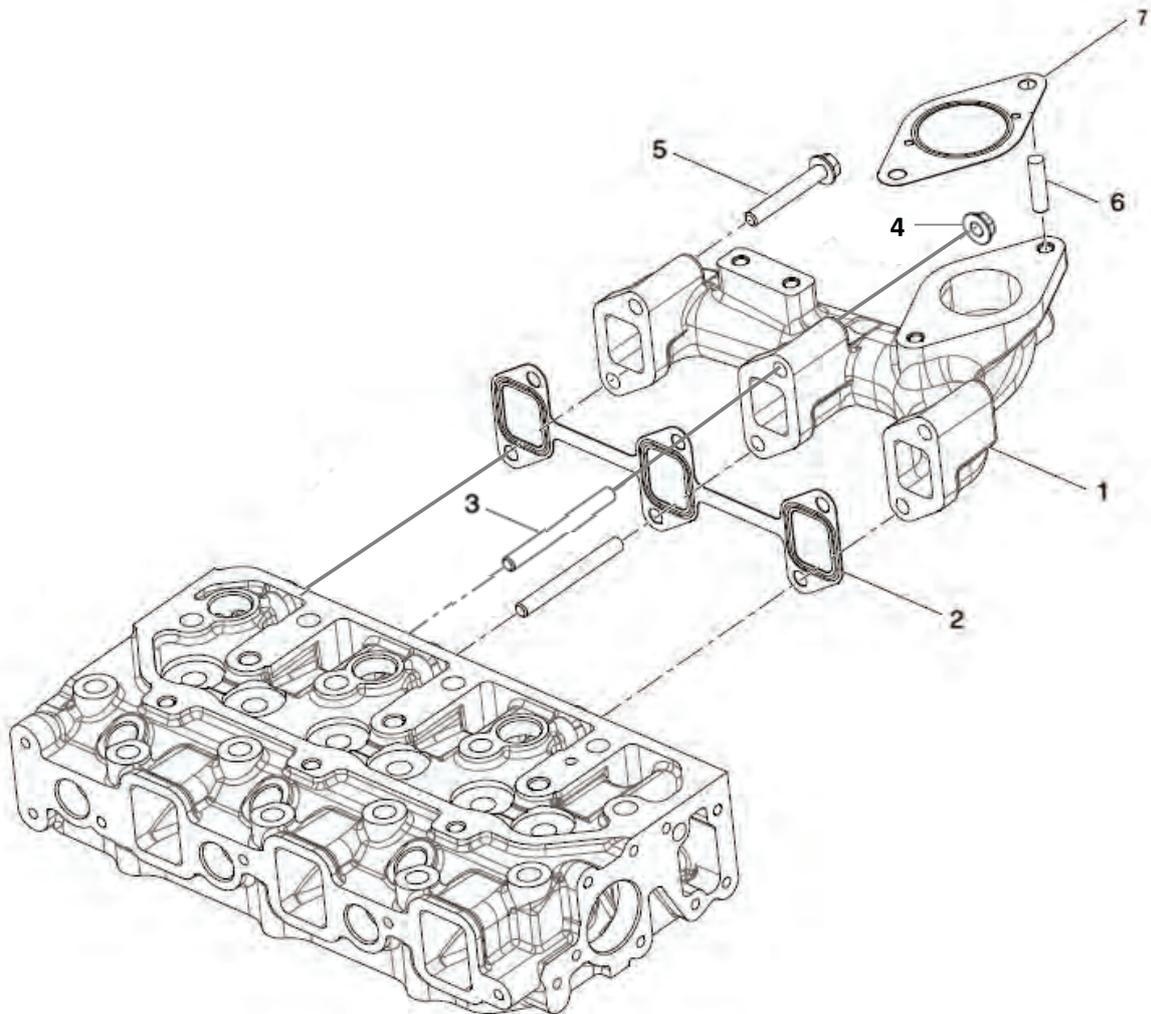
COMPONENTS

- (1) Manifold, exhaust
- (2) Gasket, exh. Manifold
- (3) Nut, flange 8
- (5) Bolt, flange 8 x 90

- (6) Bolt, stud 8 x 40
- (7) Bolt, stud 8 x 30
- (8) Gasket (T/C IN)
- (15) Bolt, stud 8 x 22

- (16) Turbo charger
- (17) Plug, PT 1/4
- (18) Gasket (T/C out)

T1700NA



K25W2A66A

### COMPONENTS

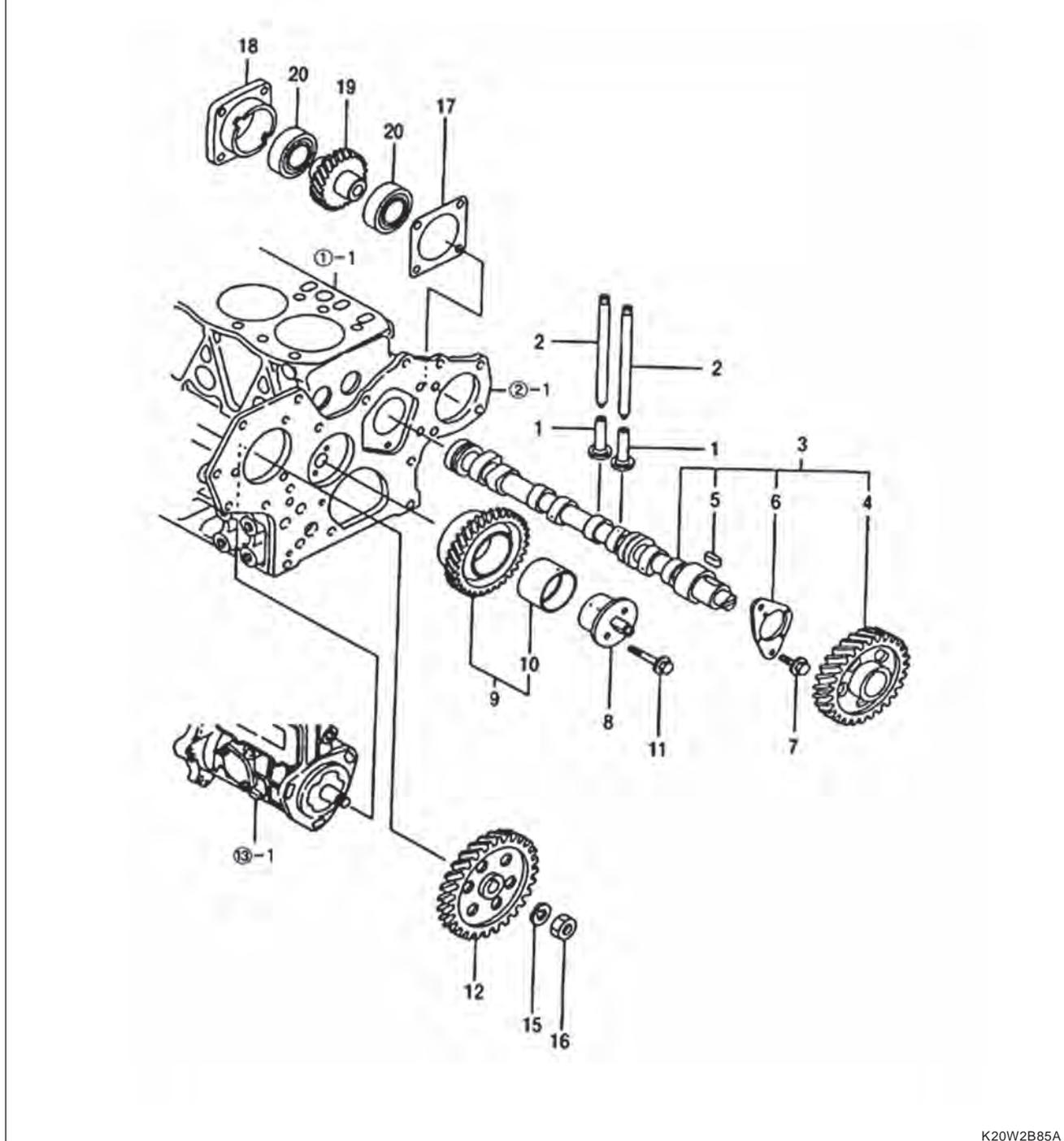
- (1) Manifold, exhaust
- (2) Gasket, exh. Manifold
- (3) Bolt, stud

- (4) Nut, flange 8
- (5) Bolt, flange 8 x 80
- (6) Bolt, stud 8 x 22

- (7) Gasket(silencer)

5.7 CAMSHAFT AND DRIVE GEAR

T2300NA/T2300T

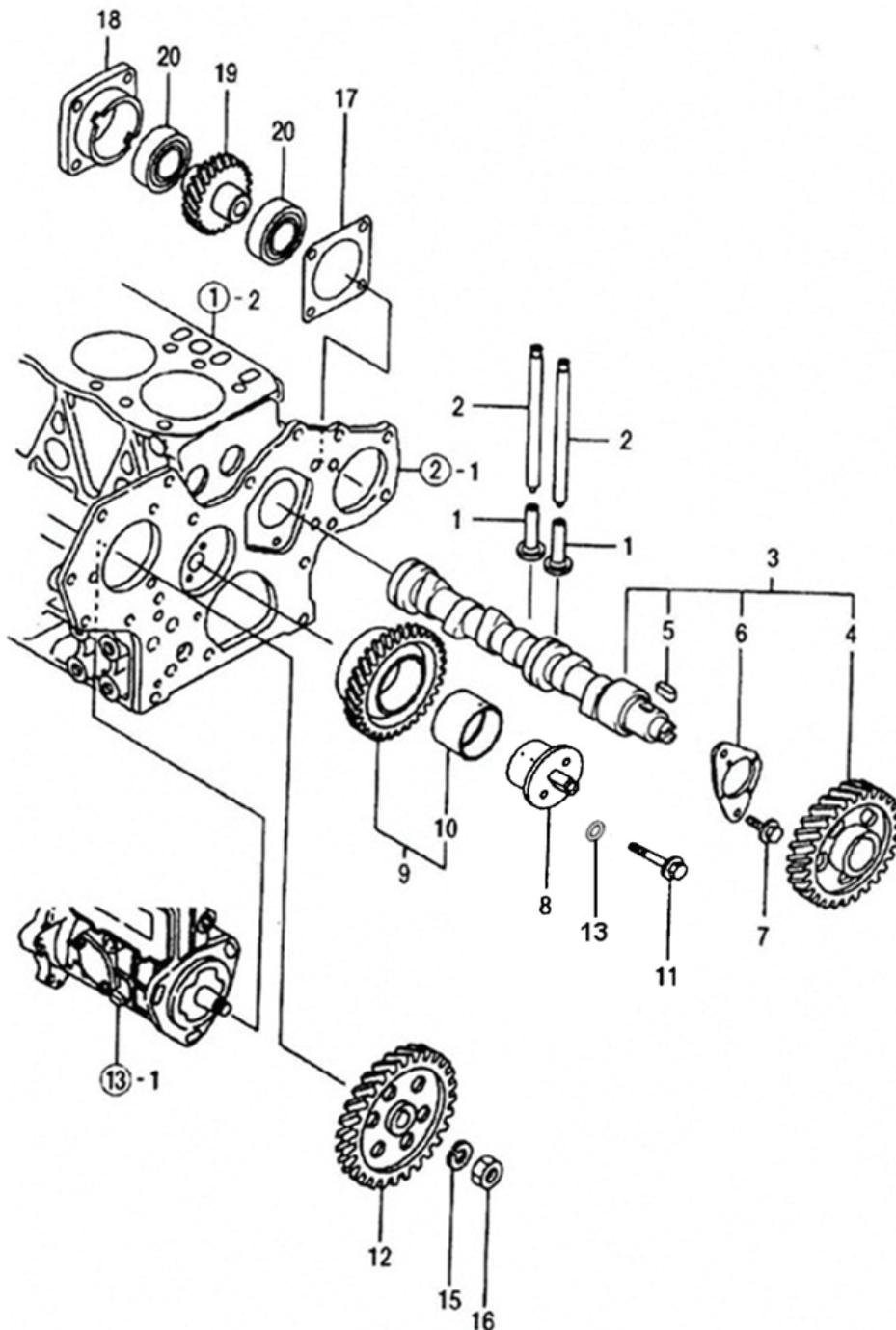


K20W2B85A

COMPONENTS

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

T1700NA



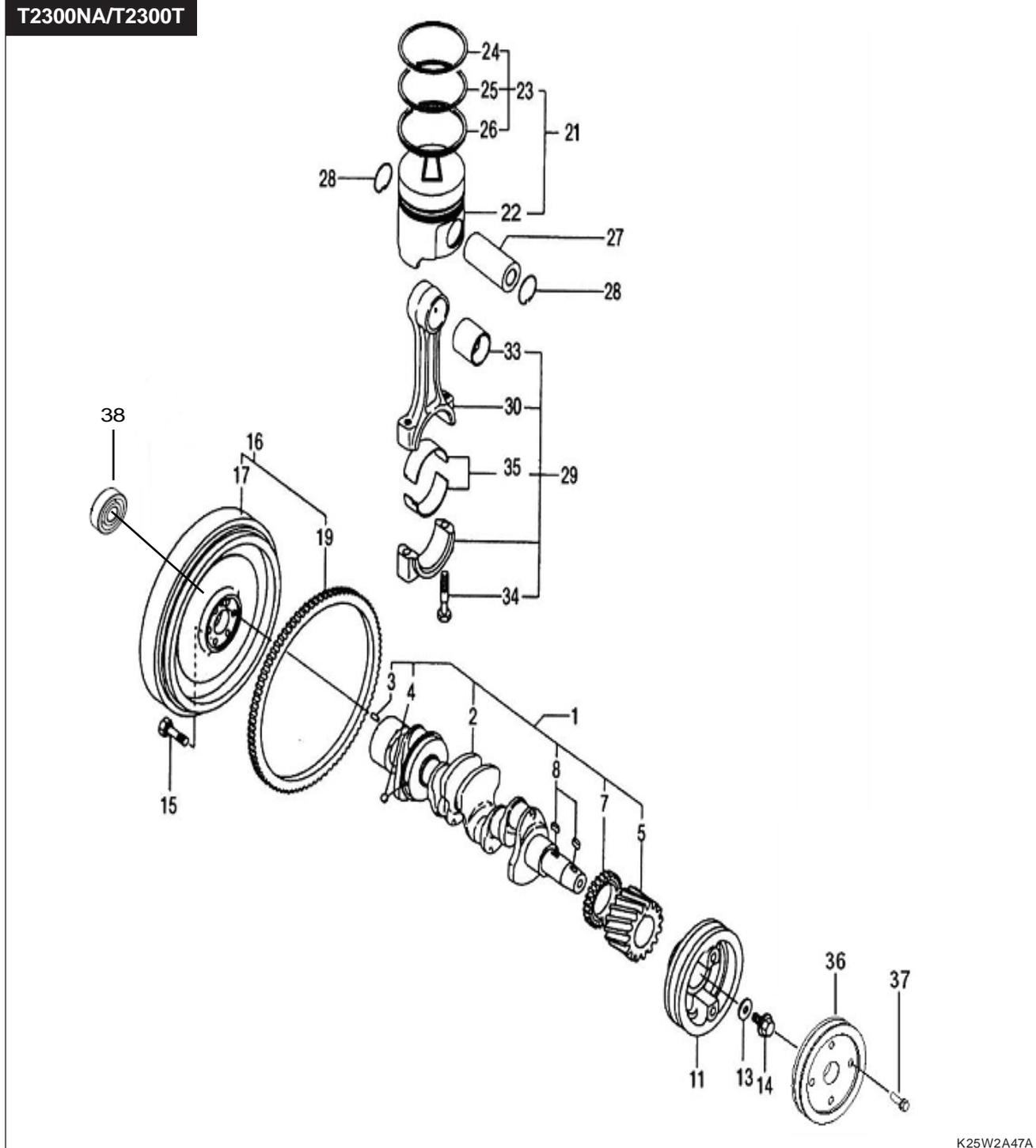
K25W2A67A

COMPONENTS

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

5.8 CRANKSHAFT AND PISTON

T2300NA/T2300T

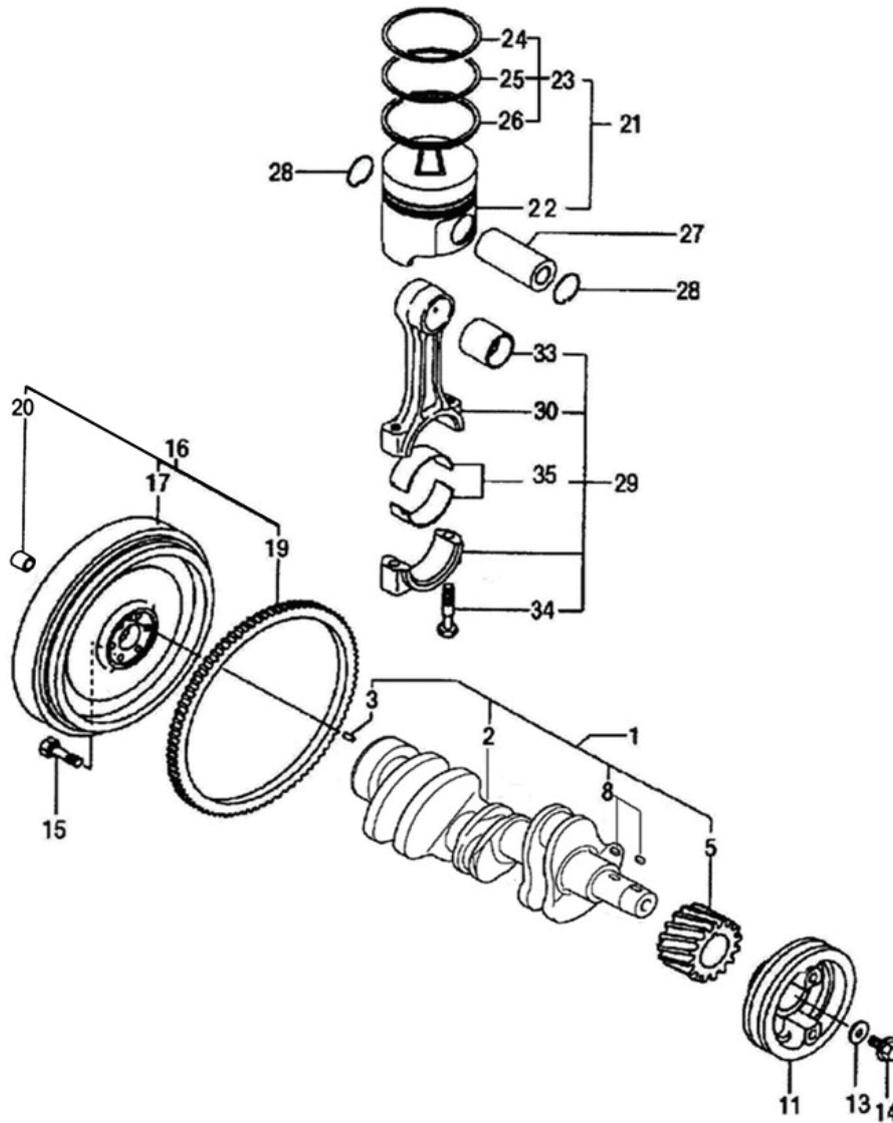


K25W2A47A

COMPONENTS

- |                            |                        |                           |
|----------------------------|------------------------|---------------------------|
| (1) Crank shaft ass'y      | (15) Bolt, fly wheel   | (27) Pin, piston          |
| (2) Crank shaft            | (16) Fly wheel ass'y   | (28) Ring, retainer       |
| (3) Pin, parallel 8×16     | (17) Fly wheel         | (29) Connecting rod ass'y |
| (4) Pin, parallel 8 x 16   | (19) Gear, ring        | (30) Connecting rod       |
| (5) Gear, crank            | (21) Piston ass'y      | (33) Bush(piston pin)     |
| (7) Gear, balance A        | (22) Piston            | (34) Bolt(connecting rod) |
| (8) Key 7×14               | (23) Piston ring ass'y | (35) Bearing, crank pin   |
| (11) V-pulley(crank shaft) | (24) Piston ring (1st) | (36) Pulley, compressor   |
| (13) Washer(V-pulley) 8    | (25) Piston ring (2nd) | (37) Bolt                 |
| (14) Bolt(V-pulley)        | (26) Piston ring (oil) | (38) Ball bearing         |

T1700NA



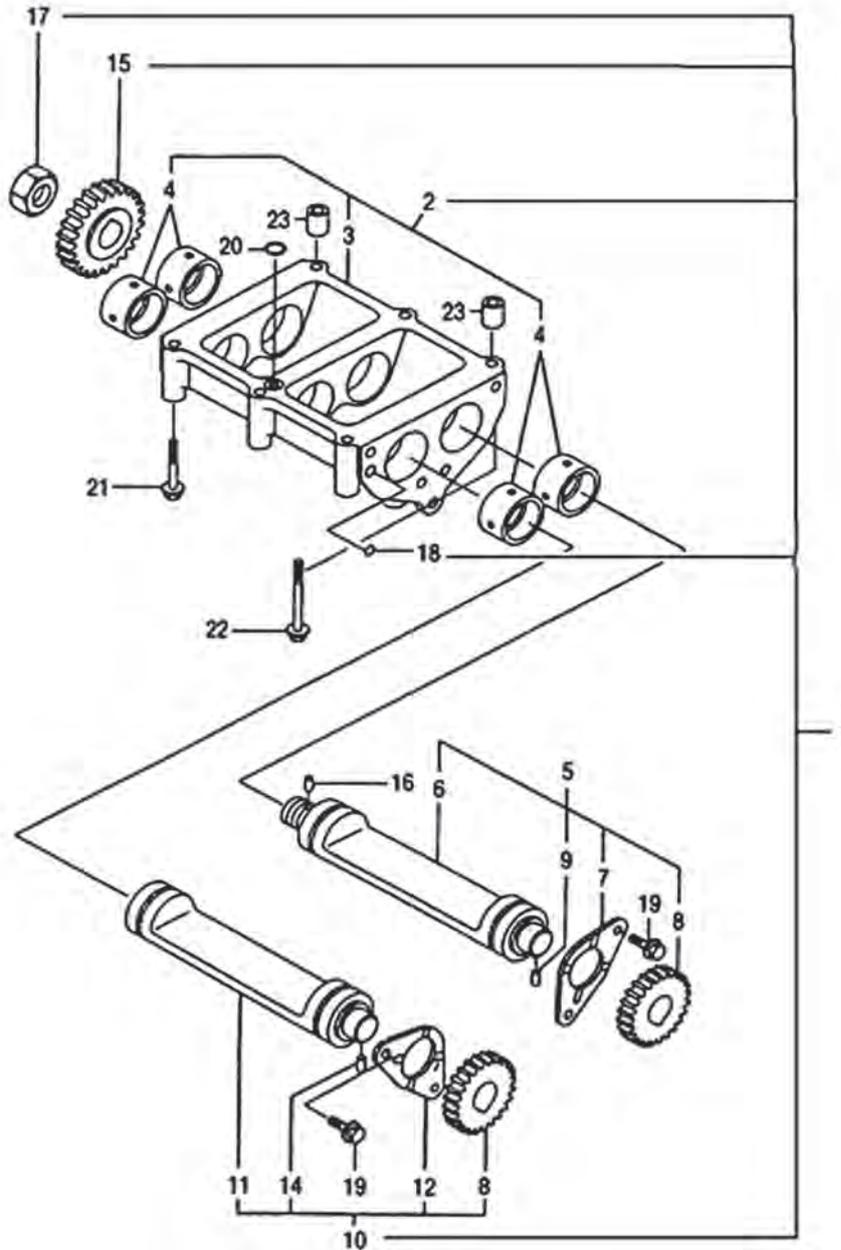
K25W2A68A

COMPONENTS

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

5.9 BALANCER

T2300NA/T2300T



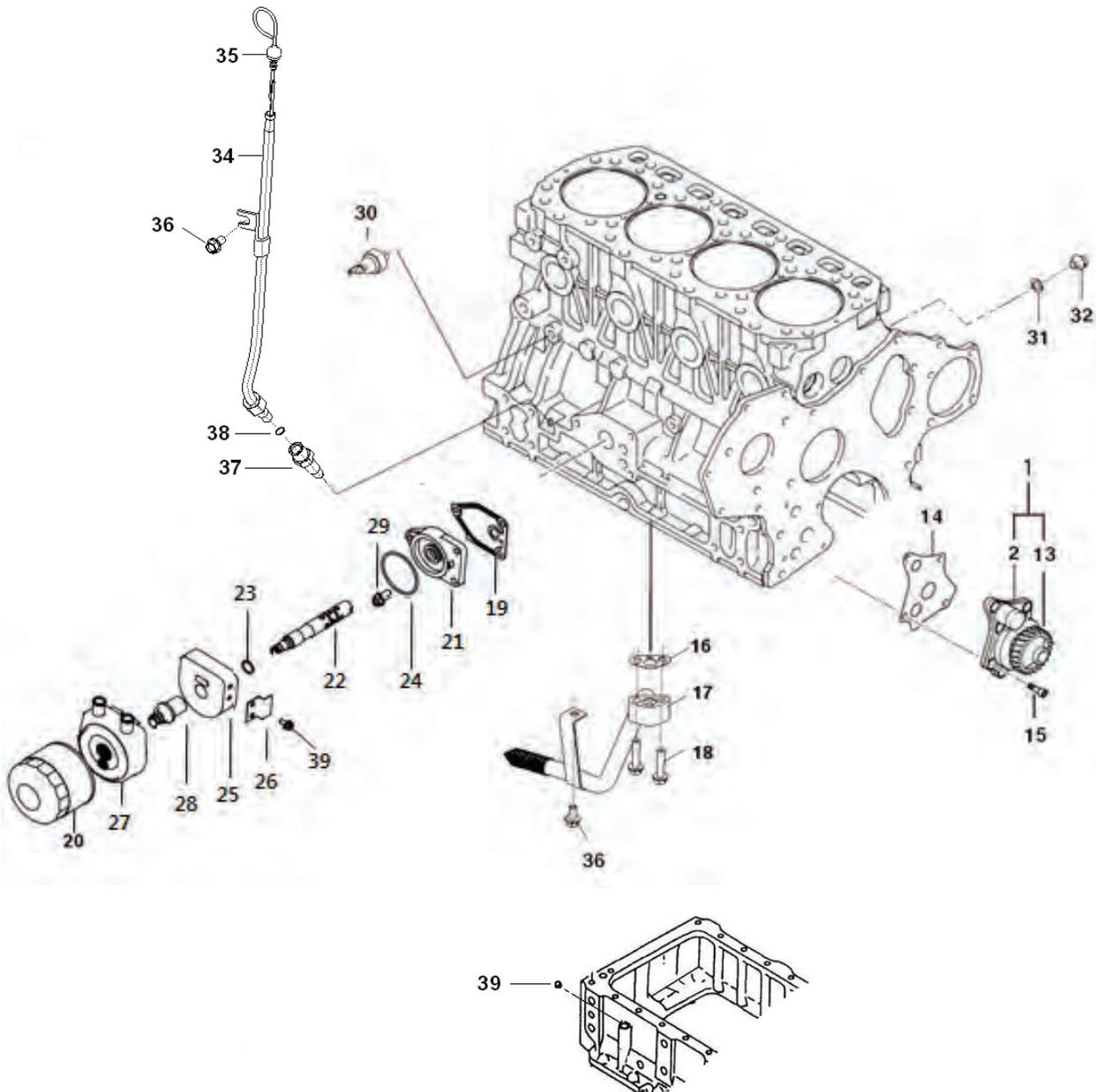
K20W2B87A

COMPONENTS

- |                                     |                                      |                       |
|-------------------------------------|--------------------------------------|-----------------------|
| (1) Balancer assembly               | (9) Dowel pin (crank gear)           | (18) Steel ball       |
| (2) Balancer case assembly          | (10) Balancer shaft (B) assembly     | (19) Hex. flange bolt |
| (3) Balancer case                   | (11) Balancer shaft (B)              | (20) O-ring (P type)  |
| (4) Bushing (balancer shaft)        | (12) Thrust bearing (balancer shaft) | (21) Hex. flange bolt |
| (5) Balancer shaft (A) assembly     | (14) Dowel pin                       | (22) Hex. flange bolt |
| (6) Balancer shaft (A)              | (15) Balancer gear (A)               | (23) Knock pin        |
| (7) Thrust bearing (balancer shaft) | (16) Dowel pin                       |                       |
| (8) Balancer gear (B)               | (17) Nut (balancer gear A)           |                       |

5.10 LUBRICATION SYSTEM

T2300NA/T2300T

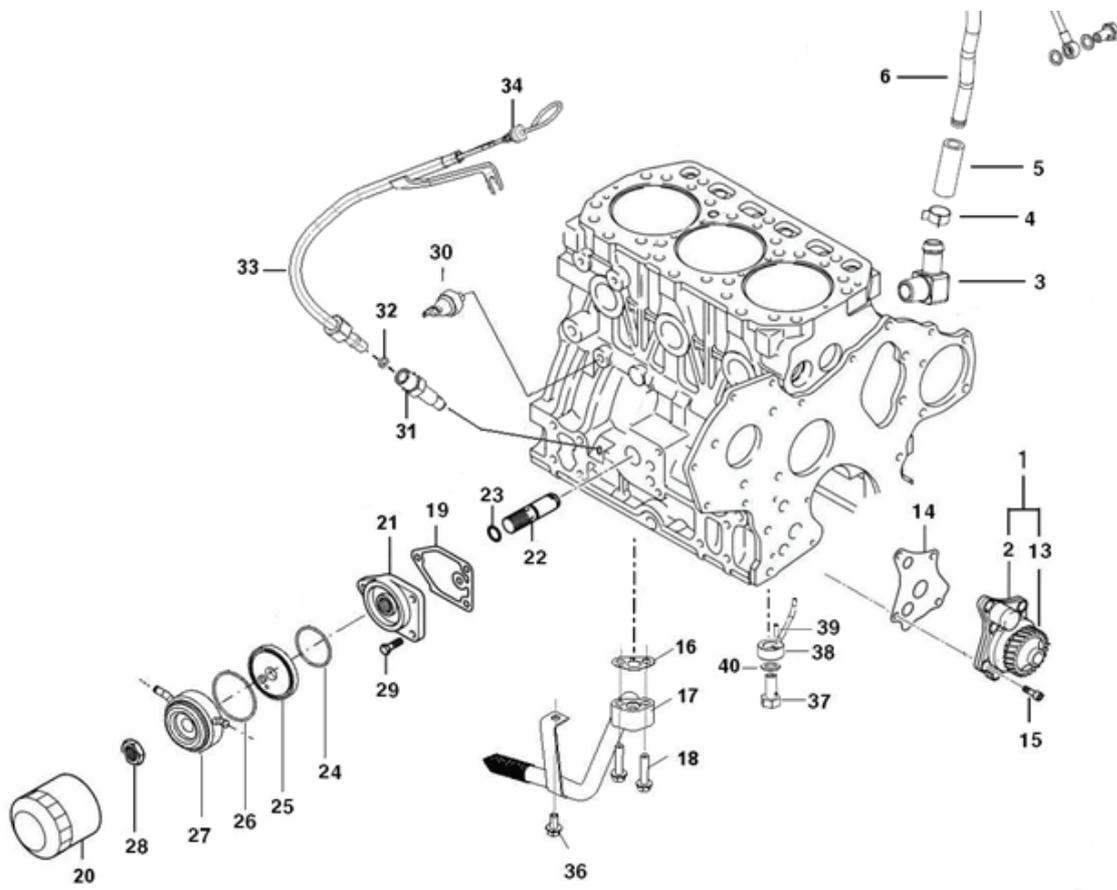


K25W2A48A

COMPONENTS

- |                            |                                 |                              |
|----------------------------|---------------------------------|------------------------------|
| (1) Pump ass'y, lub. Oil   | (21) Bracket, oil filter        | (31) Washer, sealing         |
| (2) Pump ass'y, lub. Oil   | (22) Oil control valve ass'y    | (32) Screw, hexagon head cap |
| (13) Gear, oil pump        | (23) O-ring (P)                 | (34) Guide(dipstick)         |
| (14) Packing(oil pump)     | (24) O-ring (G)                 | (35) Dipstick                |
| (15) Bolt 6 ×25            | (25) Space(oil cooler)          | (36) Bolt, flange 8 x 16     |
| (16) Bolt(oil cooler)      | (26) Bracket(oil cooler spacer) | (37) Guide(dipstick)         |
| (17) Pipe ass'y, oil inlet | (27) Oil cooler                 | (38) O-ring (P)              |
| (18) Bolt, flange 8 x 35   | (28) Bolt(oil cooler)           | (39) Plug                    |
| (19) Packing(oil filter)   | (29) Bolt, flange 8 x 20        |                              |
| (20) Filter, E/G oil       | (30) Switch, oil pressure       |                              |

T1700NA



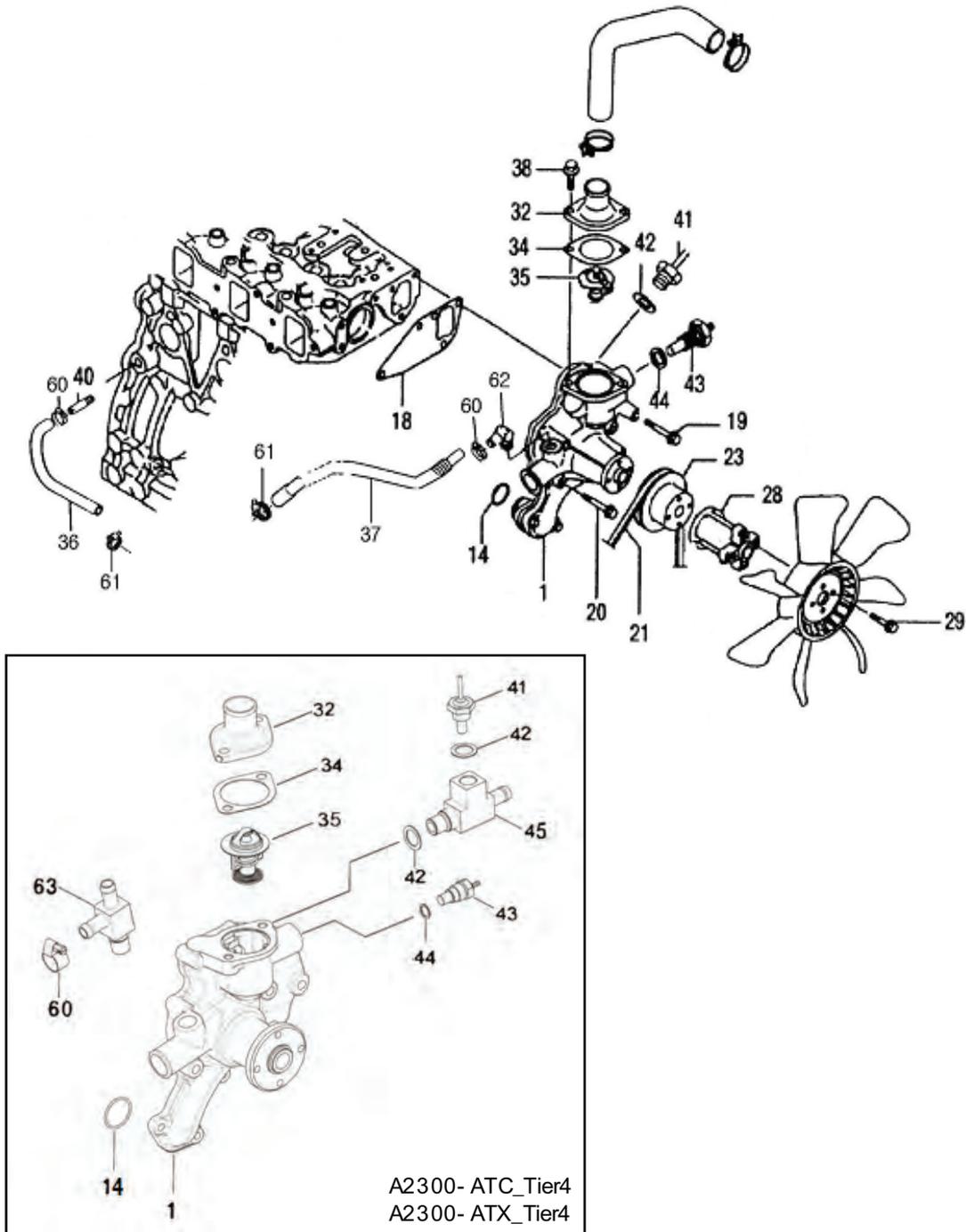
K25W2A69A

COMPONENTS

- |                            |                                 |                             |
|----------------------------|---------------------------------|-----------------------------|
| (1) Pump ass'y, lub. Oil   | (20) Filter, e/g oil            | (29) Bolt, flange 8 x 20"   |
| (2) Pump ass'y, lub. Oil   | (21) Bracket, oil filter        | (30) Switch, oil pressure   |
| (13) Gear, oil pump        | (22) Oil control valve ass'y    | (31) Guide, dipstick        |
| (14) Packing(oil pump)     | (23) O-ring (P)                 | (32) O-ring (P)             |
| (15) Bolt 6 ×25            | (24) O-ring (G)                 | (33) Pipe, guide            |
| (16) Bolt(oil cooler)      | (25) Space(oil cooler)          | (34) Dipstick               |
| (17) Pipe ass'y, oil inlet | (26) Bracket(oil cooler spacer) | (36) Bolt, flange 8 x 16    |
| (18) Bolt, flange 8 x 35   | (27) Oil cooler                 | (37) Washer,sealing         |
| (19) Packing(oil filter)   | (28) Bolt(oil cooler)           | (38) Screw,hexagon head cap |

5.11 COOLING SYSTEM

T2300NA

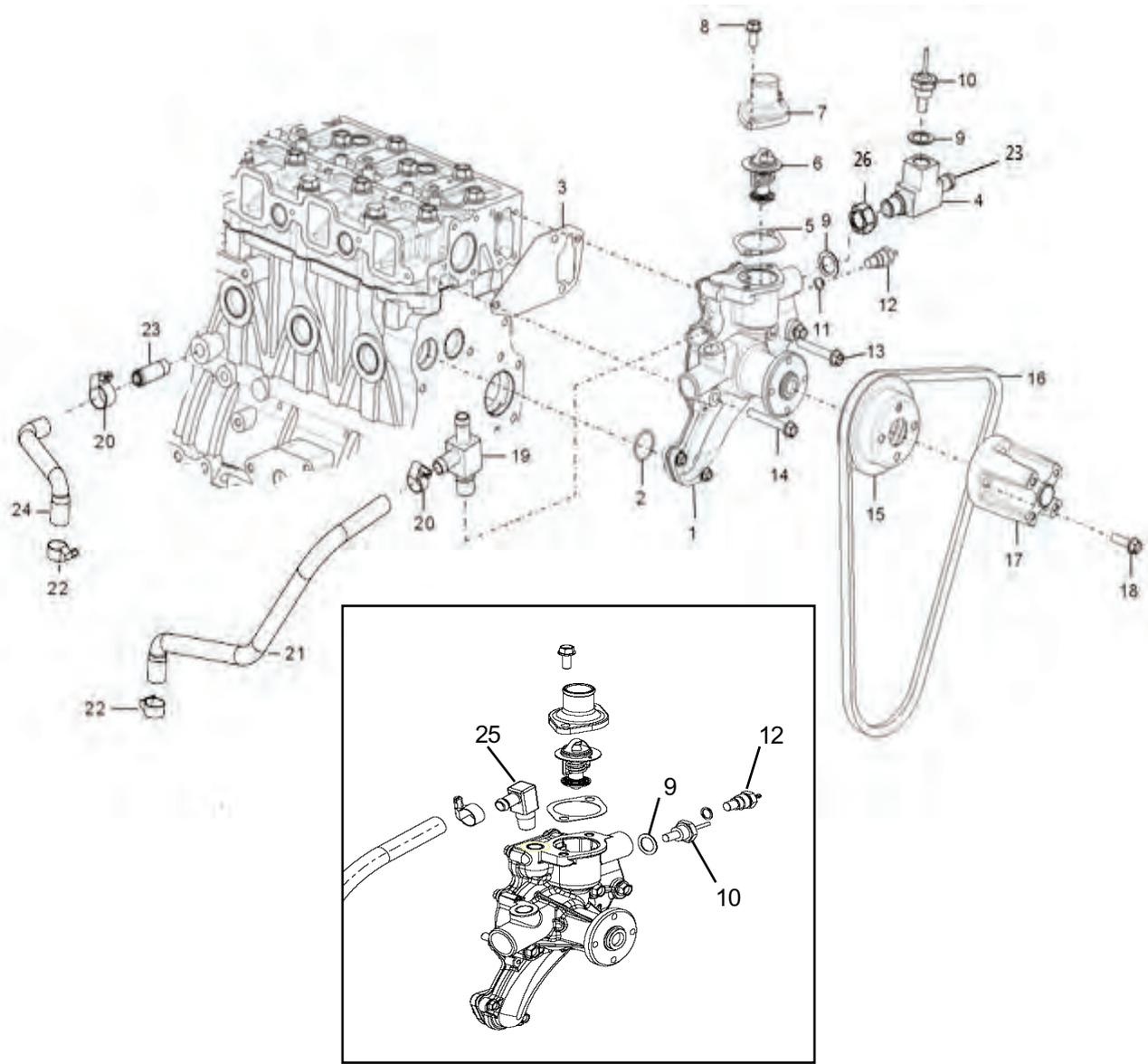


K25W2A49A

COMPONENTS

- |                               |                         |                       |
|-------------------------------|-------------------------|-----------------------|
| (1) Pump ass'y, cooling water | (32) Cover,thermostat   | (43) Sensor(C.W.Temp) |
| (14) O-ring (s)               | (34) Packing,cover      | (44) Packing 10       |
| (18) Packing                  | (35) Thermostat         | (45) T-joint          |
| (19) Bolt, flange 8x55        | (36) Hose, plain        | (60) Clamp, hose 22   |
| (20) Bolt, flange 8x60        | (37) Hose, plain        | (61) Clamp, hose 25   |
| (21) V-belt (A 40.5")         | (38) Bolt, flange 8 x18 | (62) 90 Elbow         |
| (23) V-pulley                 | (40) Joint PT 1/4       | (63) T-joint          |
| (28) Spacer,fan               | (41) Sensor(air heater) |                       |
| (29) Bolt, flange 8x30        | (42) Packing 16         |                       |

T2300T

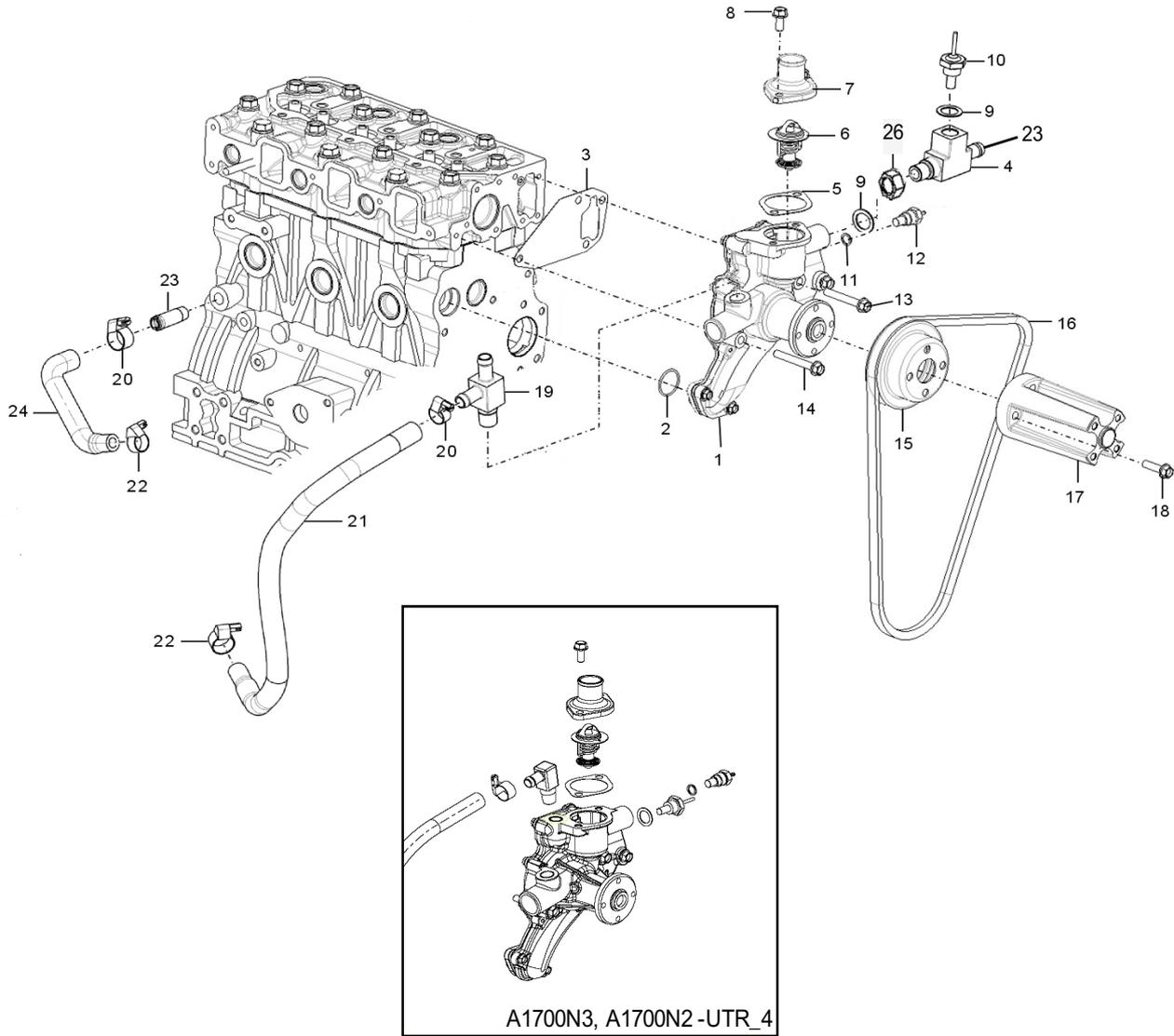


K25W2A58A

COMPONENTS

- |                               |                         |                        |
|-------------------------------|-------------------------|------------------------|
| (1) Pump ass'y, cooling water | (10) Sensor(air heater) | (18) Bolt, flange 8×30 |
| (2) O-ring (S)                | (11) Packing 10         | (19) T-joint           |
| (3) Packing                   | (12) Sensor(c.W.Temp)   | (20) Clamp, hose 25    |
| (4) T-joint                   | (13) Bolt, flange 8×55  | (21) Hose, plain       |
| (5) Packing,cover             | (14) Bolt, flange 8×60  | (22) Clamp, hose 22    |
| (6) Thermostat                | (15) V-pulley           | (23) Joint PT 1/4      |
| (7) Cover,thermostat          | (15) V-pulley           | (24) Hose, plain       |
| (8) Bolt, flange 8 ×18        | (16) V-belt (A 40")     | (25) 90 Elbow          |
| (9) Packing 16                | (17) Spacer,fan         | (26) Nut, 16           |

T1700NA



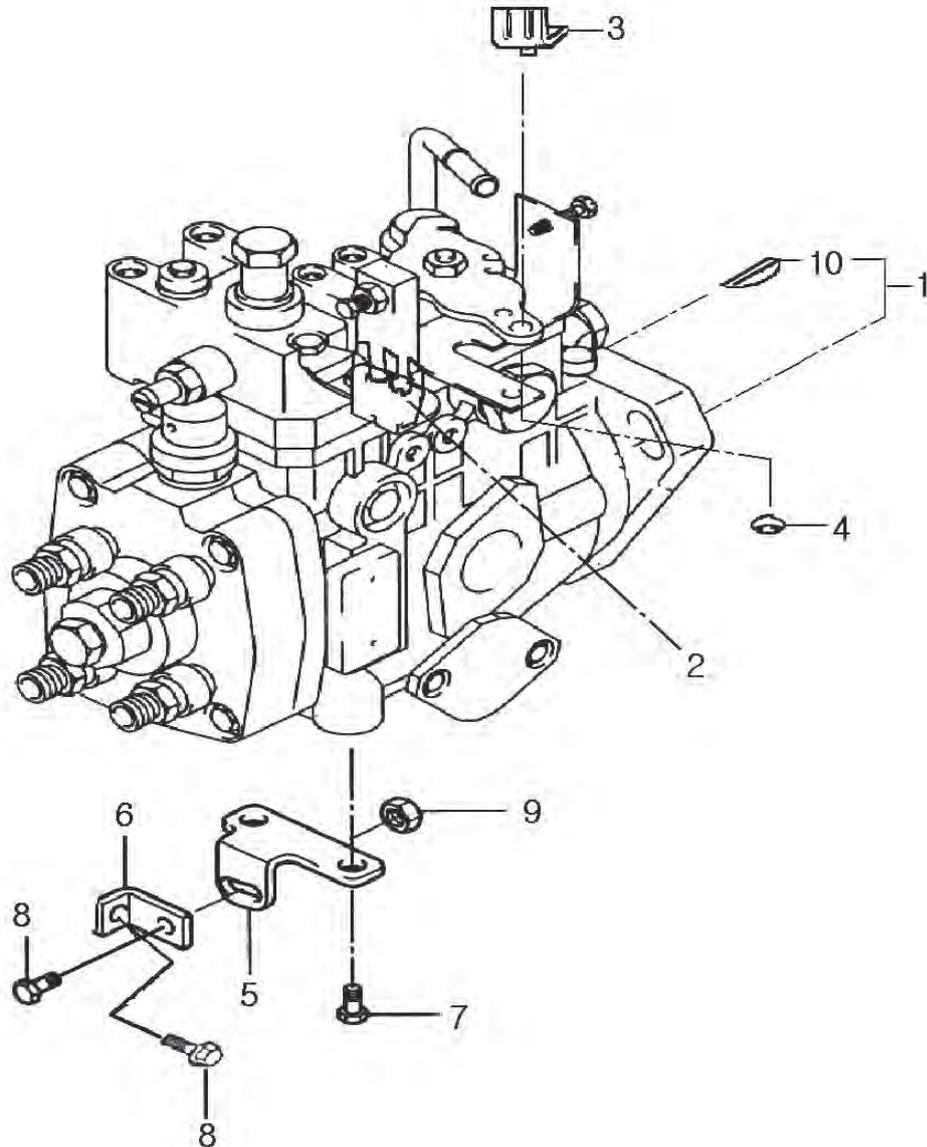
K25W2A70A

COMPONENTS

- |                            |                                 |                             |
|----------------------------|---------------------------------|-----------------------------|
| (1) Pump ass'y, lub. Oil   | (20) Filter, e/g oil            | (29) Bolt, flange 8 x 20"   |
| (2) Pump ass'y, lub. Oil   | (21) Bracket, oil filter        | (30) Switch, oil pressure   |
| (13) Gear, oil pump        | (22) Oil control valve ass'y    | (31) Guide, dipstick        |
| (14) Packing(oil pump)     | (23) O-ring (P)                 | (32) O-ring (p)             |
| (15) Bolt 6 ×25            | (24) O-ring (G)                 | (33) Pipe, guide            |
| (16) Bolt(oil cooler)      | (25) Space(oil cooler)          | (34) Dipstick               |
| (17) Pipe ass'y, oil inlet | (26) Bracket(oil cooler spacer) | (36) Bolt, flange 8 x 16    |
| (18) Bolt, flange 8 x 35   | (27) Oil cooler                 | (37) Washer,sealing         |
| (19) Packing(oil filter)   | (28) Bolt(oil cooler)           | (38) Screw,hexagon head cap |

5.12 FUEL INJECTION PUMP

T2300NA/T2300T



K25W2A50A

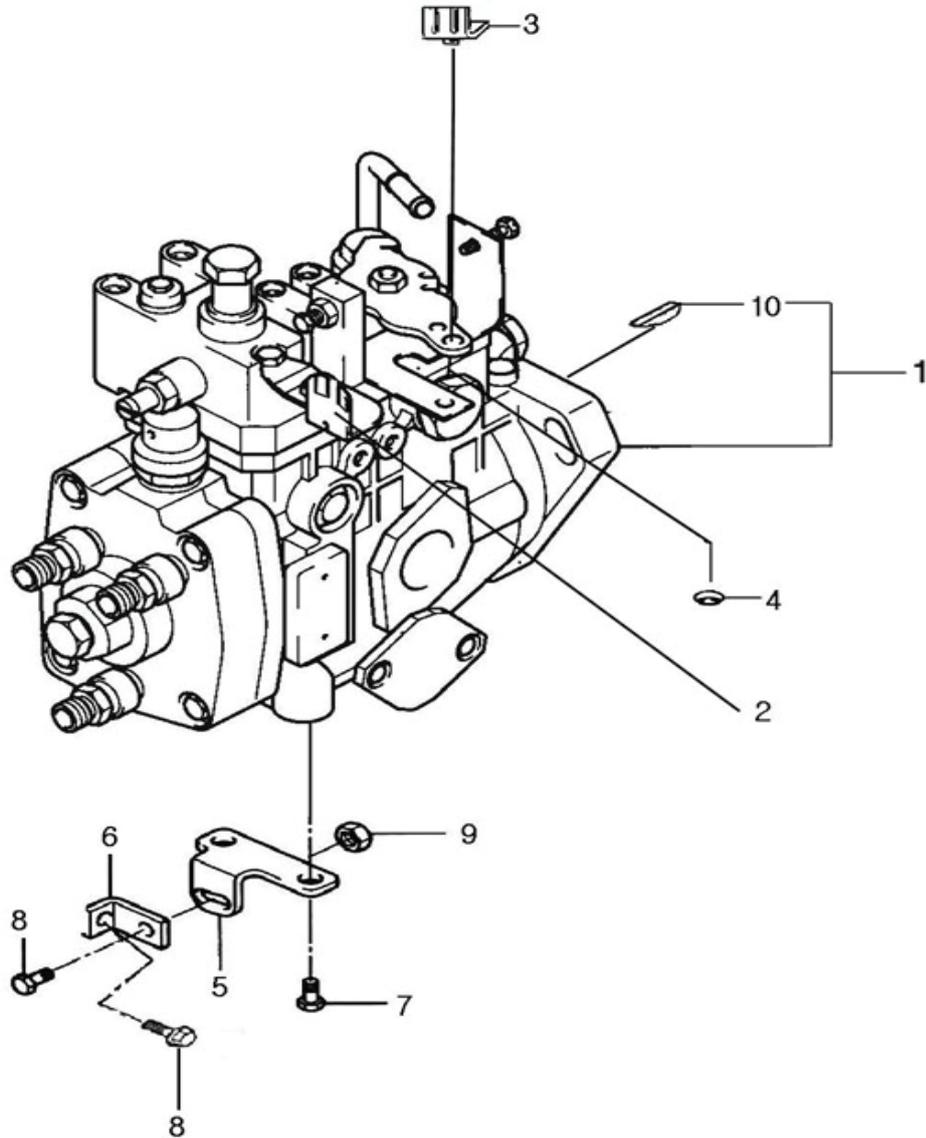
COMPONENTS

- (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

T1700NA



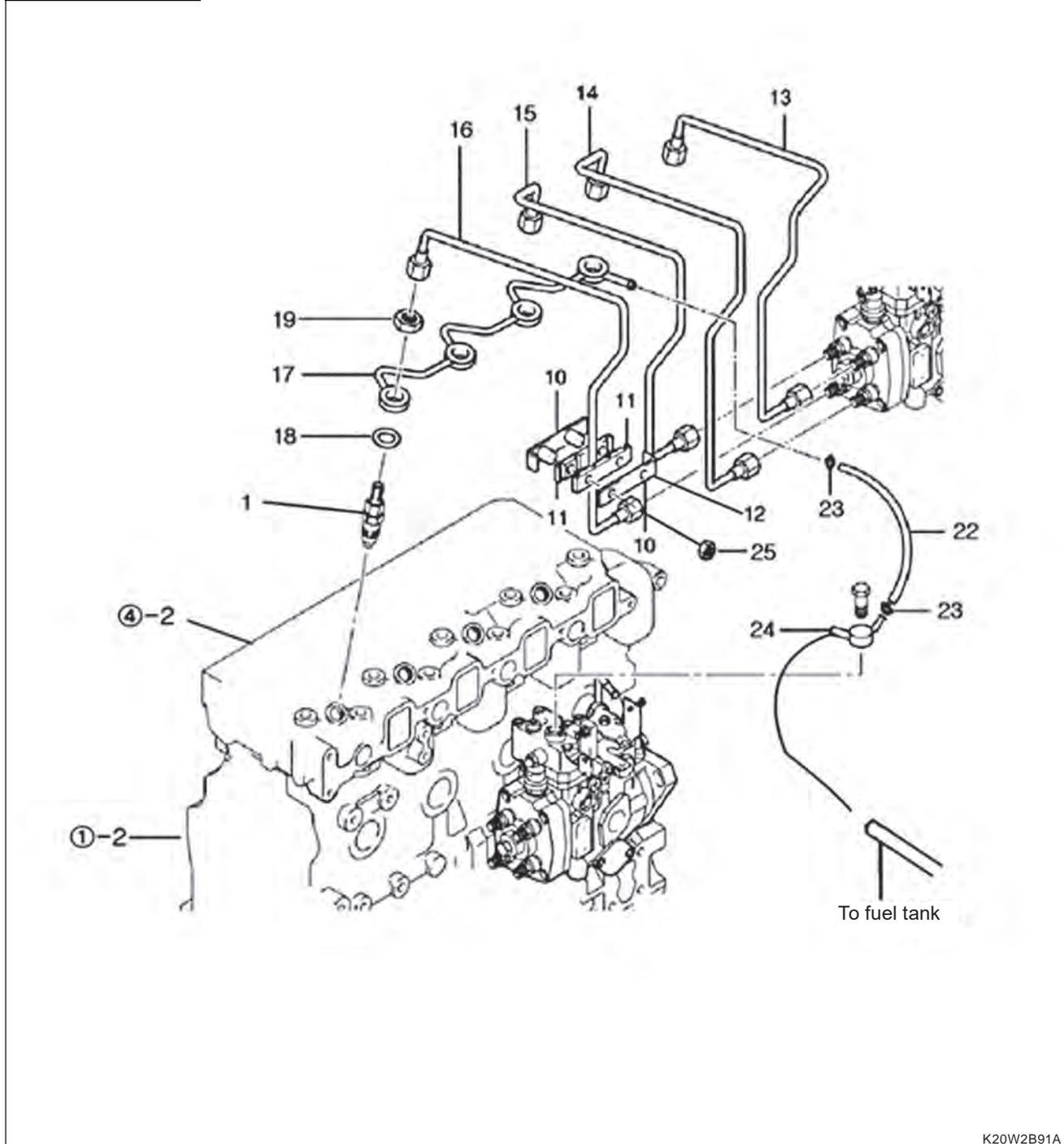
K25W2A71A

**COMPONENTS**

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

5.13 FUEL INJECTION SYSTEM AND VALVE

T2300NA/T2300T

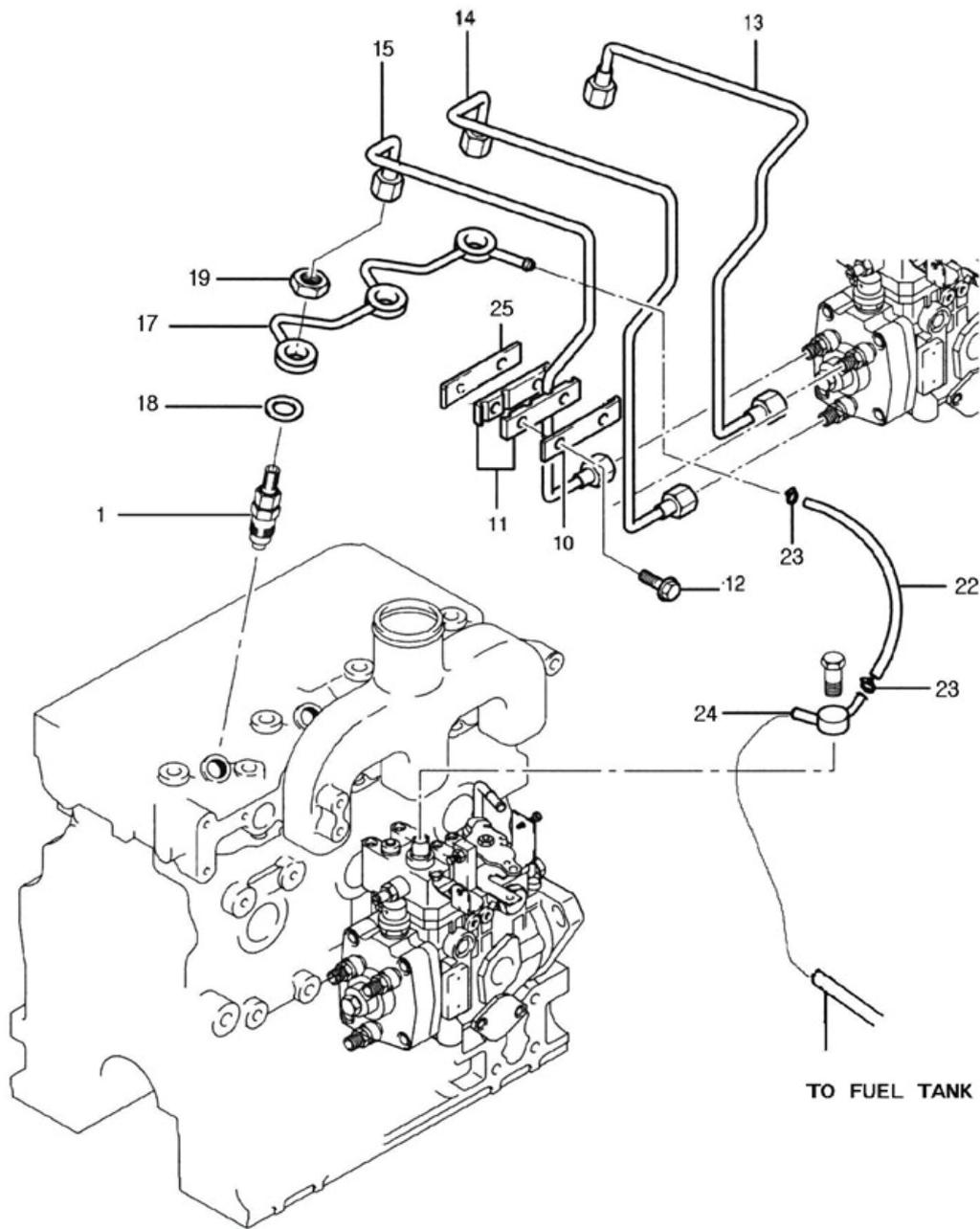


K20W2B91A

COMPONENTS

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

T1700NA

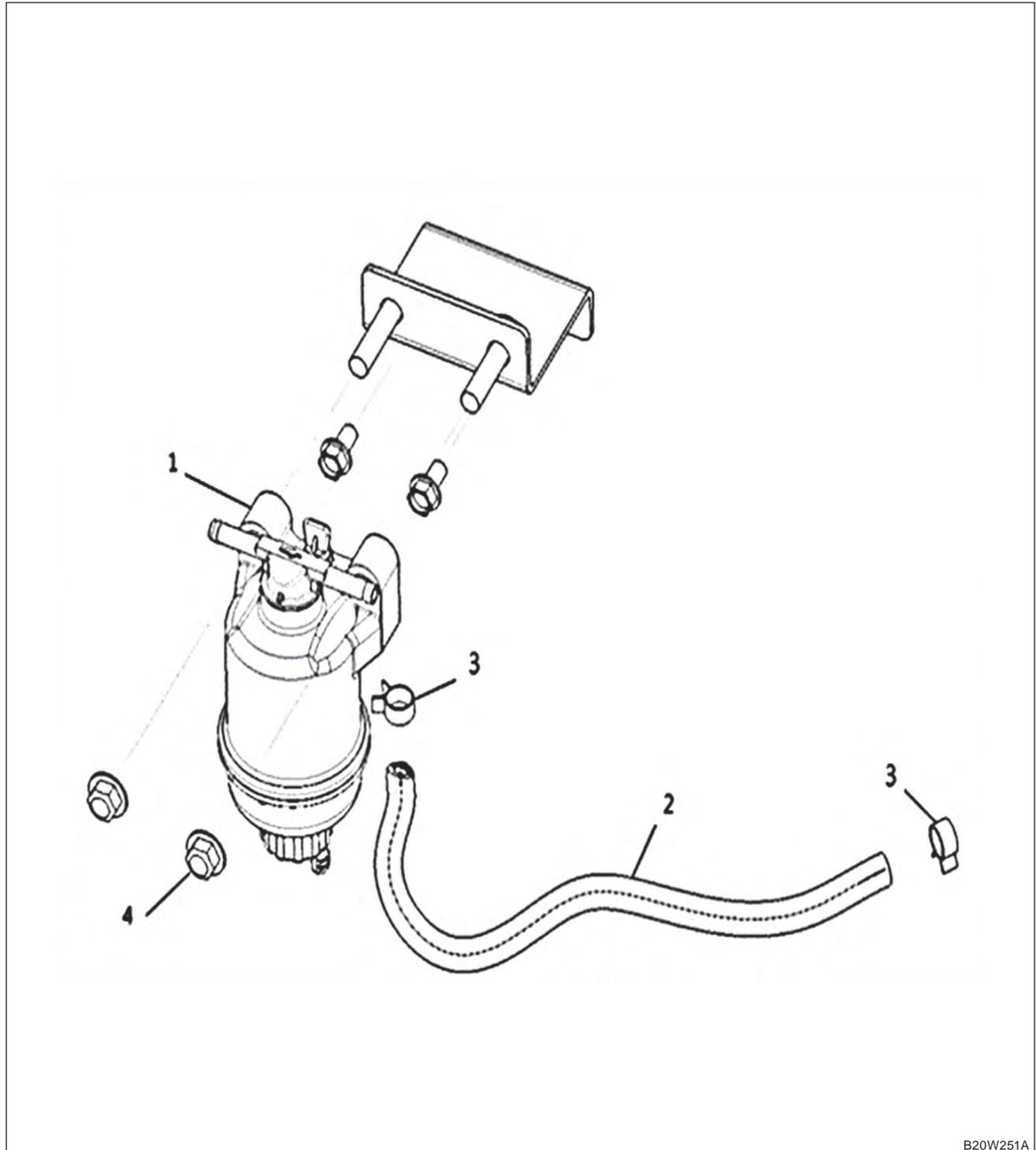


K25W2A72A

**COMPONENTS**

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

5.14 FUEL FILTER



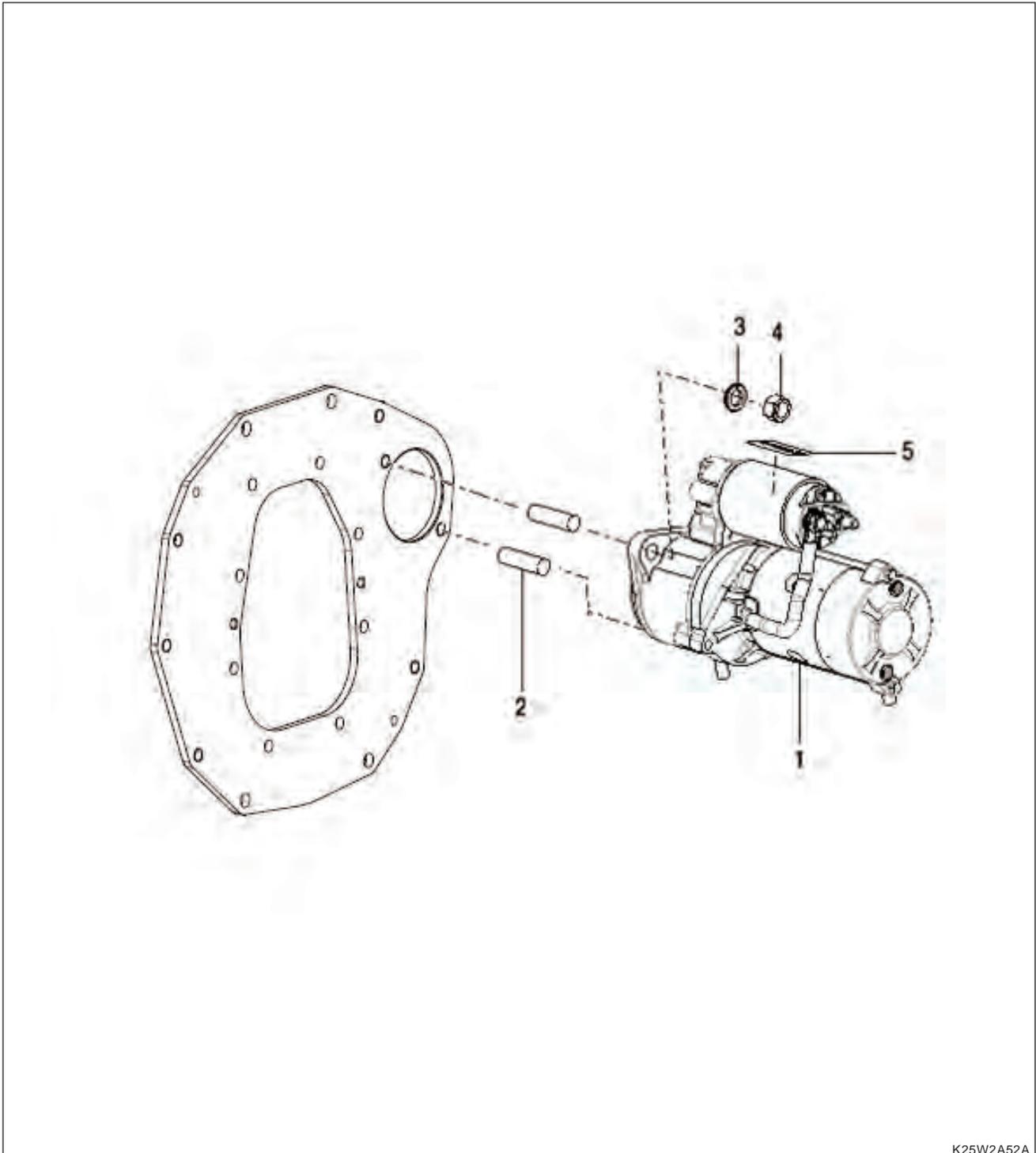
B20W251A

COMPONENTS

- (1) Fuel filter ass'y
- (2) Fuel hose

- (3) Cobra clamp (Ø13)
- (4) Nut, flange

## 5.15 START MOTOR



K25W2A52A

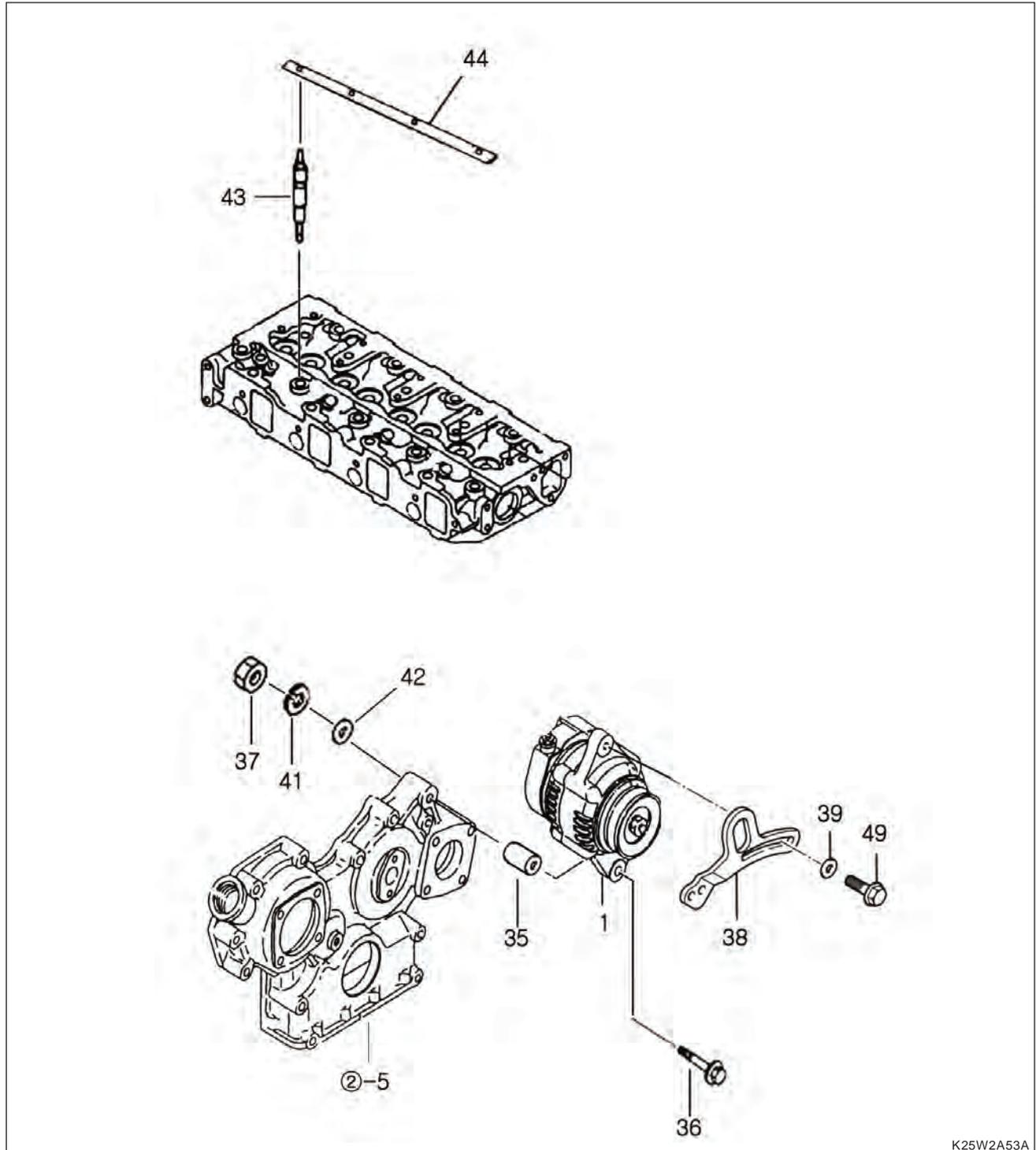
**COMPONENTS**

- (1) Starter  
(2) Stud bolt

- (3) Washer, lock  
(4) Nut, regular hexagon

- (5) Caution plate

5.16 ALTERNATOR AND ELECTRIC SYSTEM



K25W2A53A

COMPONENTS

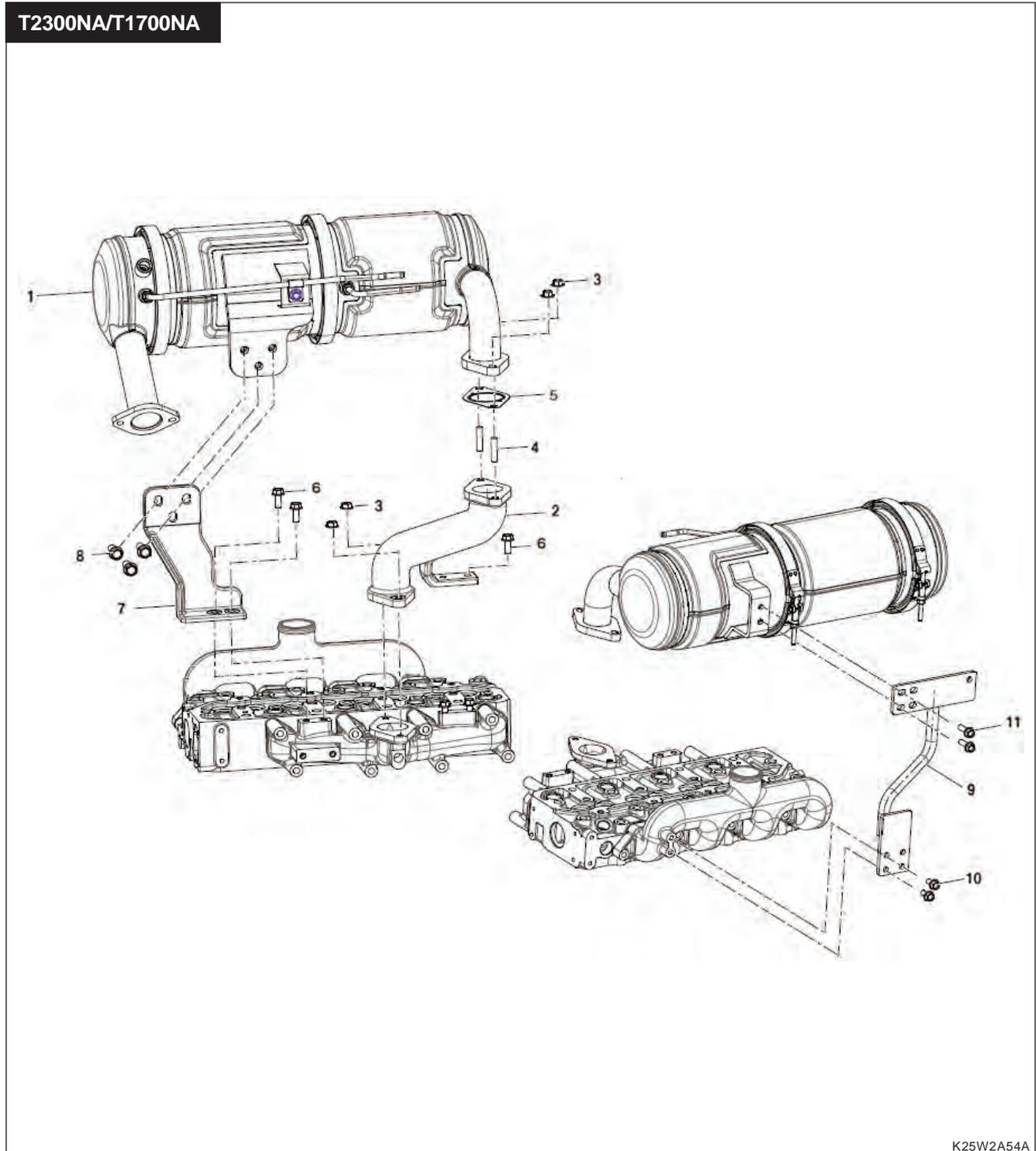
- (1) Alternator(12V-45A)
- (1) Alternator(12V-70A)
- (35) Spacer
- (36) Bolt 10
- (36) Bolt 8

- (37) Nut 10
- (37) Nut 8
- (38) Bracket
- (39) Washer
- (41) Washer, lock

- (42) Washer
- (42) Washer
- (43) Plug, thermostat
- (44) Connector
- (49) Bolt 8×30

5.17 DPF & COMPRESSOR MOUNTING

T2300NA/T1700NA

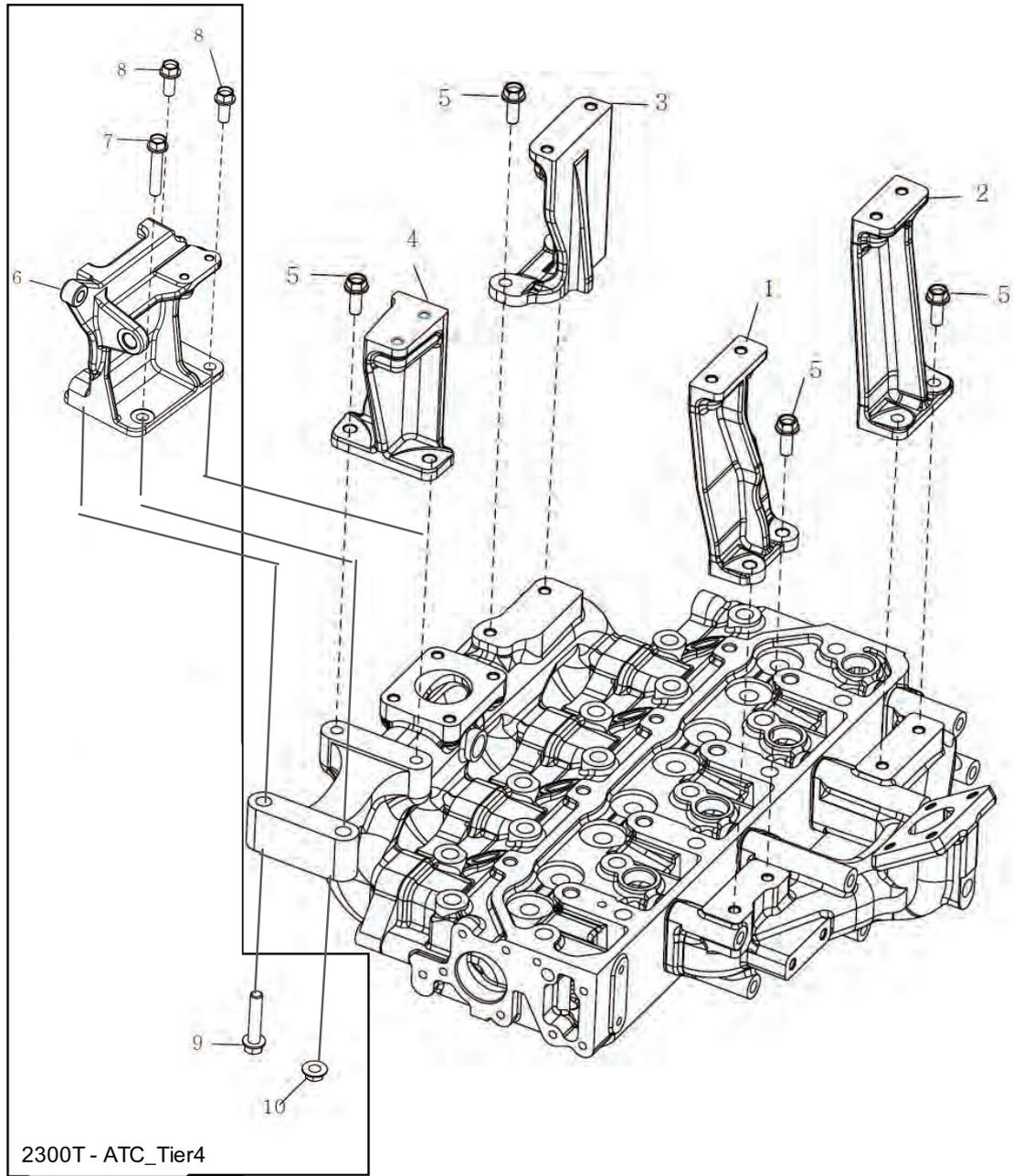


K25W2A54A

COMPONENTS

- |                    |                    |                   |
|--------------------|--------------------|-------------------|
| (1) DPF(5.66")     | (5) Gasket         | (9) DPF bracket   |
| (2) DPF support(A) | (6) Bolt, flange   | (10) Bolt, flange |
| (3) Nut, flange 8  | (7) DPF support(B) | (11) Bolt, flange |
| (4) Stud bolt      | (8) Bolt, flange   |                   |

T2300T



K25W2A59A

**COMPONENTS**

- (1) Dpf support (A)
- (2) Dpf support (B)
- (3) Dpf support (C)
- (4) Dpf support (D)

- (5) Bolt, hex flange
- (6) Compressor bracket
- (7) Bolt, hex flange
- (8) Bolt, hex flange

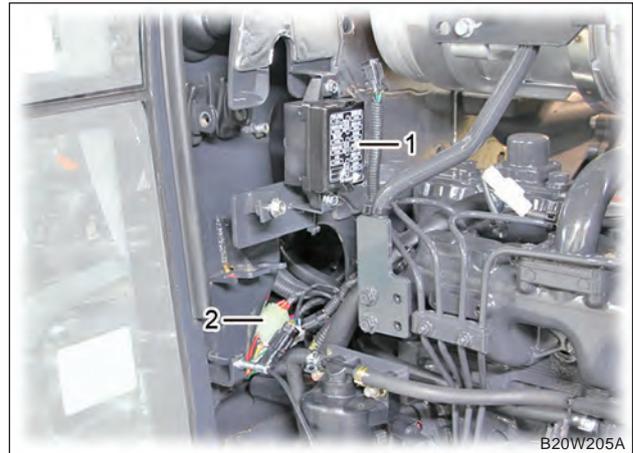
- (9) Bolt, hex flange
- (10) Nut, hex flange

## 6. DISASSEMBLY AND SERVICE

### 6.1 ENGINE REMOVAL



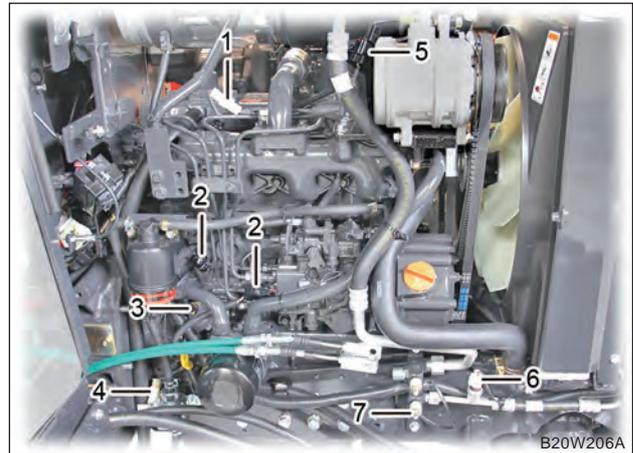
1. Open the hood and unscrew the mounting bolts (1) (3 EA) of the extension plate (2) to remove the plate.



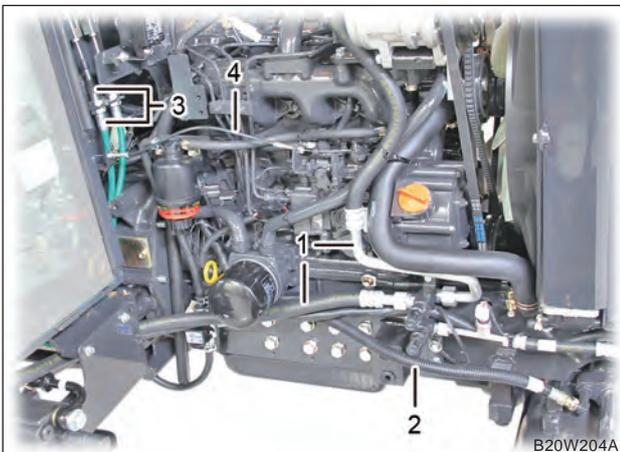
4. Remove the fuse box (1) and disconnect the main wiring harness connector (2).



2. Disconnect the headlamp wiring (1) connector and remove the hood (2).



5. Disconnect the connectors of the glow plug (1), fuel injection pump (2), engine oil pressure switch (3), fuel pump (4), A/C compressor (5), condenser (6) and ground wiring harness (7).

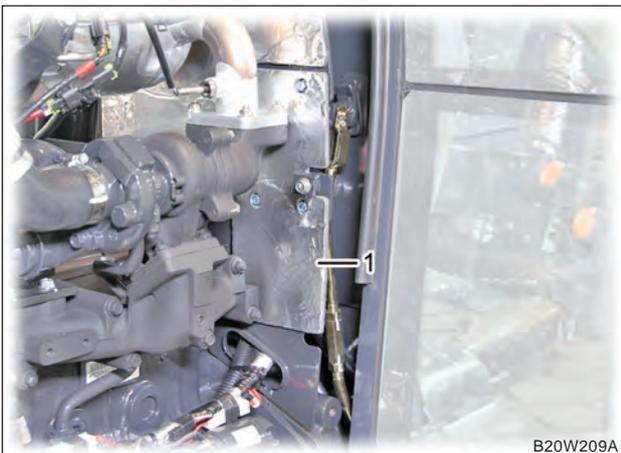


3. Disconnect the A/C hose (1), steering cylinder hose (2), brake cable (3) and accelerator cable (4) from the right side of the engine.

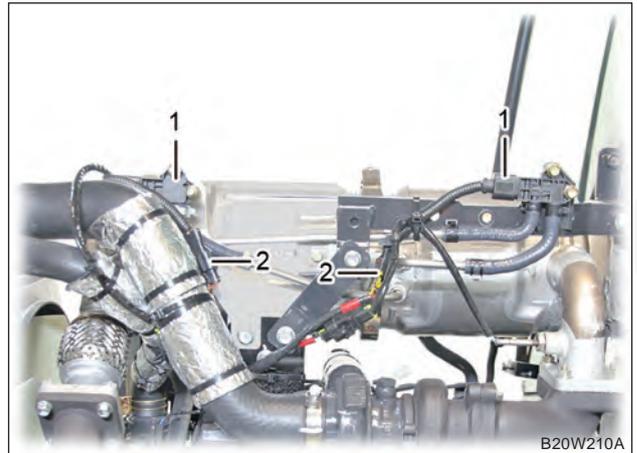


6. Disconnect the steering cylinder hydraulic hose (1) and steering unit hydraulic hose (2) from the left side of the engine.

ITEM		TORQUE VALUE
Steering hose	L, R	24.5 N·m
		2.5 kgf·m
		18.0 lb·ft
	P, T	34.3 N·m
		3.5 kgf·m
		25.3 lb·ft



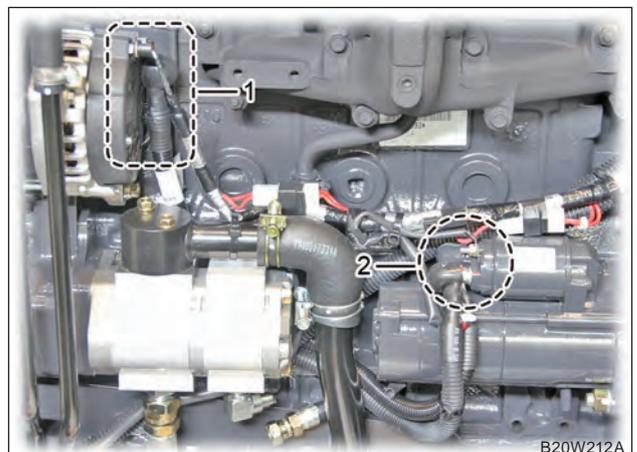
7. Remove the shield plate (1).



8. Disconnect the connectors of the DPF differential pressure sensor (1) and exhaust temp. sensor (2).



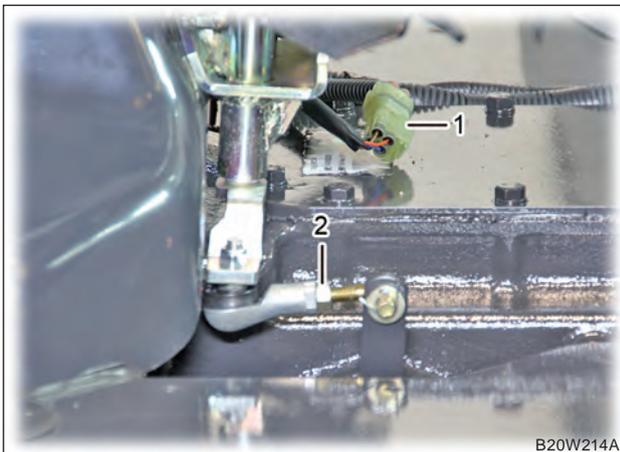
9. Disconnect the connectors of the water temp. sensor (1) and heater temp. sensor (2).



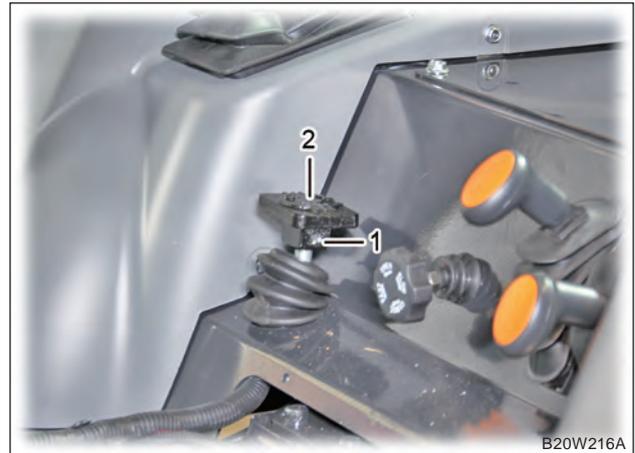
10. Disconnect the connectors of the alternator connecting wiring (1) and starter motor wiring (2),



11. Remove the mat (1) from the step and remove the maintenance plate cover (2).



12. Disconnect the shuttle switch connector (1), F-R rod assembly (2) and clutch rod (3).



13. Pull out the differential lock pedal split pin (1) and remove the differential lock pedal (2).

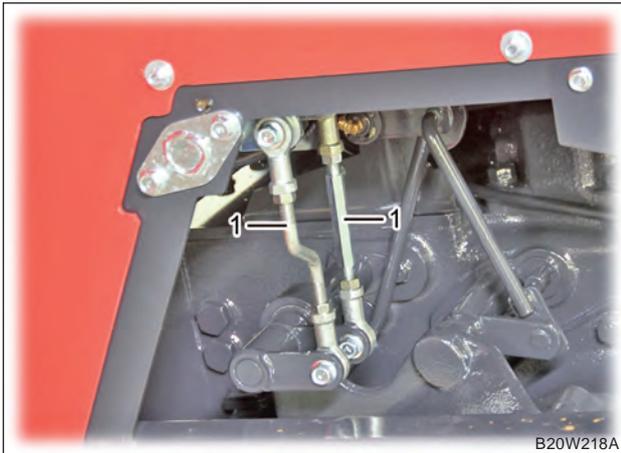
14. Remove the left and right rear wheels.

**CAUTION**

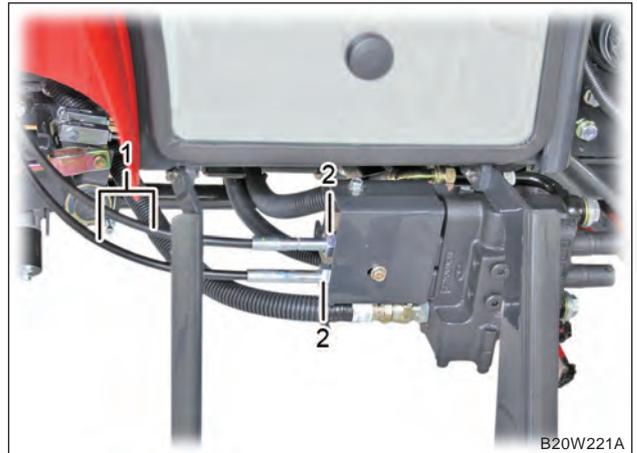
- Set a hydraulic jack or stand under the left and right of the rear axle case and transmission case.



15. Pull out the PTO lever knob (1), 4WD lever knob (2), main shift lever knob (3) and position control lever knob (4).



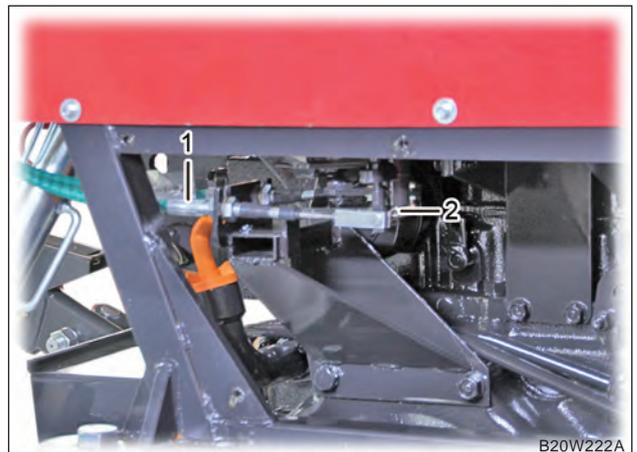
16. Remove the range shift rod (1) from the lower left section of the cabin.



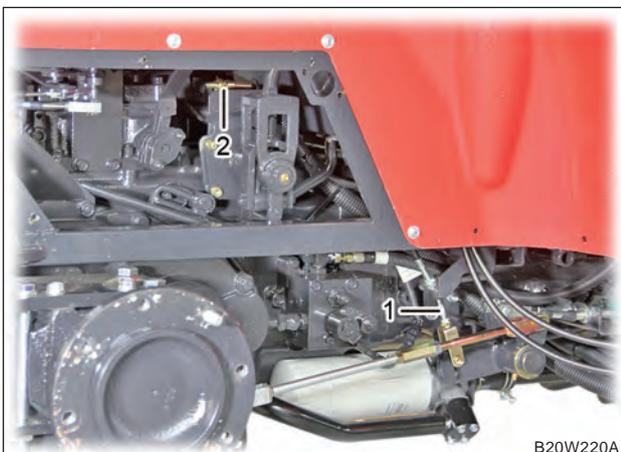
19. Unscrew the joint (2) of the front SCV cable (1) from the inside of foot step on the right side to disconnect the SCV cable.



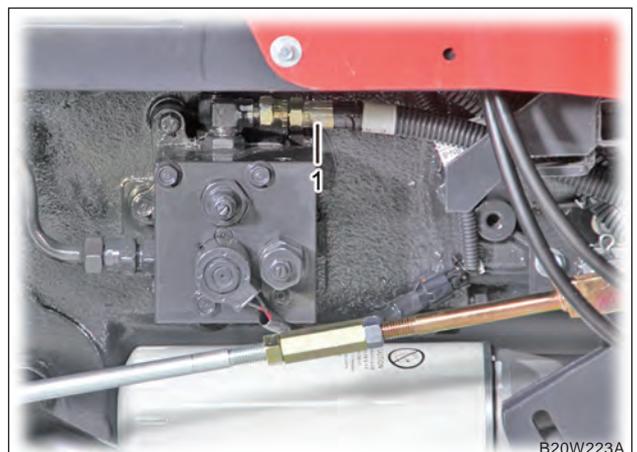
17. Disconnect the cabin heater hose (1) from the left of the vehicle body.



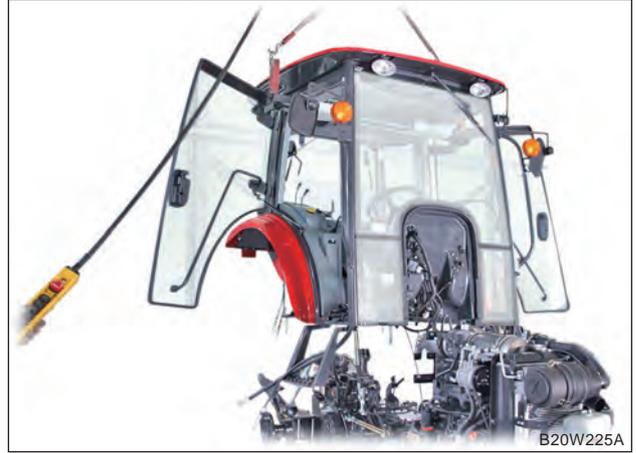
20. Pull out the connecting pin (2) of the rear SCV cable (1) to disconnect the SCV cable.



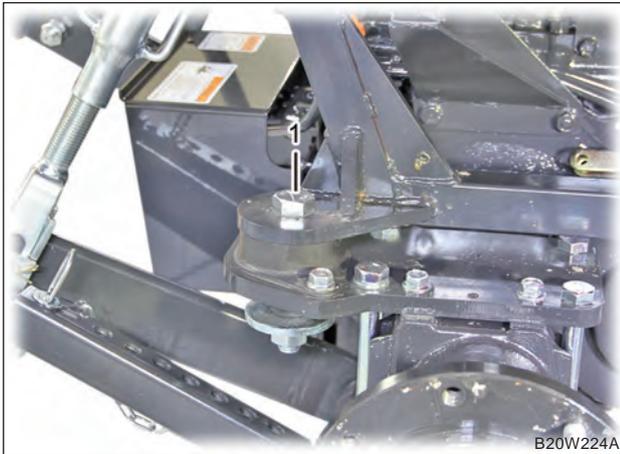
18. Disconnect the hand brake cable (1) and stop bolt (2) of the stop valve.



21. Disconnect the HST hydraulic hose (1) on top of the PTO valve.



23. Install a cabin removal jig to the cabin hooks and use a hoist to lift the cabin slowly to remove it.



22. Unscrew the front/rear cabin mounting bolts (1) to separate the cabin from the vehicle.



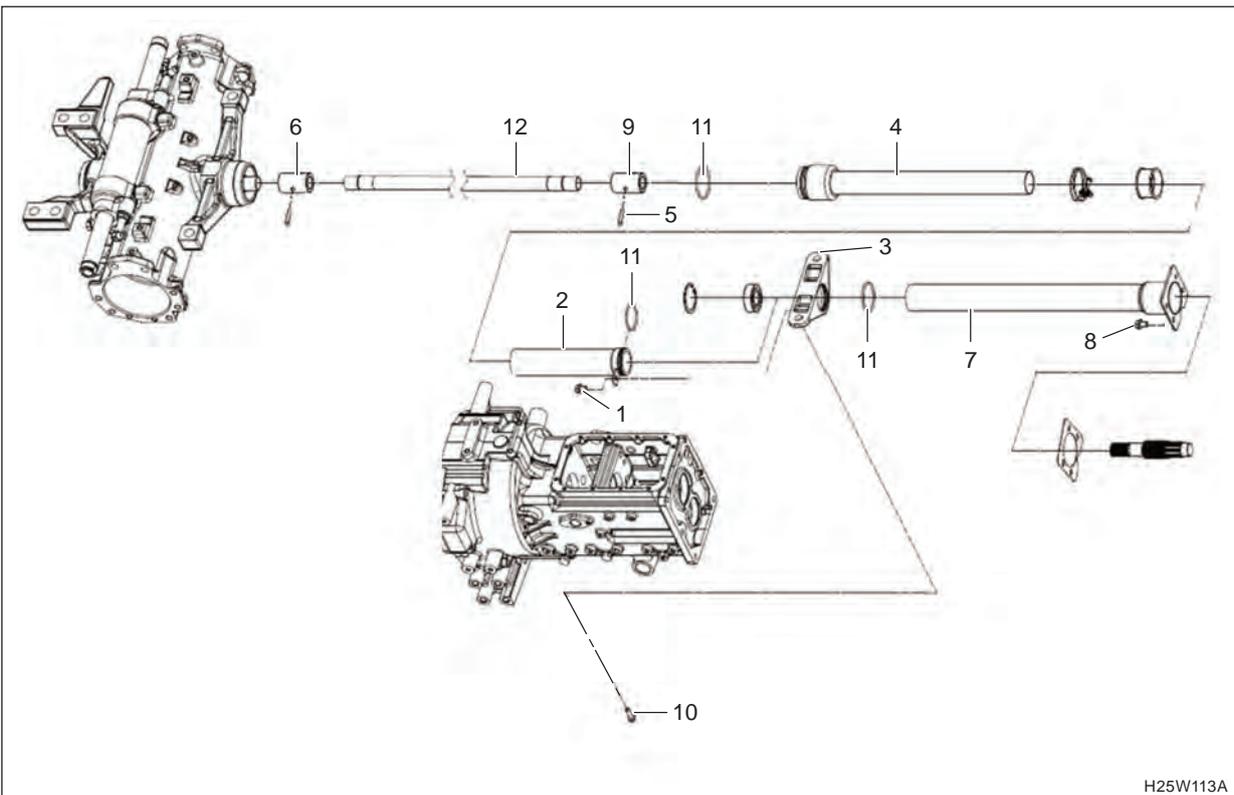
24. Remove the propeller shaft (1).

Notes

► PROPELLER SHAFT DISASSEMBLY AND ASSEMBLY



K20W2B41



H25W113A

1. Unscrew the shaft cover A mounting bolt (1) and pull the shaft cover A (2) to separate it from the bearing holder (3).
2. Pull out the shaft cover B (4) and tap out the spring pin (5) outside to move coupling (6) backward. Then, separate the coupling with the propeller shaft (12).
3. Unscrew the shaft cover C (7) mounting bolt (8) and pull the shaft cover C to separate it. Then, remove the coupling (9) in it with the same method.

4. Unscrew the bearing holder mounting bolt (10) and remove the propeller shaft assembly with the bearing holder.

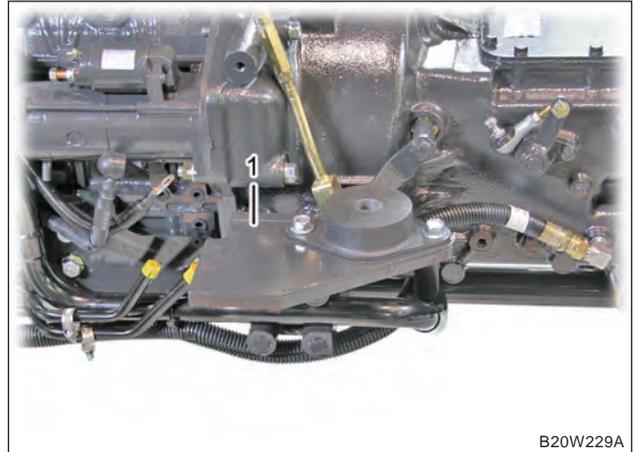
**⚠ CAUTION**

- Check the O-rings (11) (3 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.

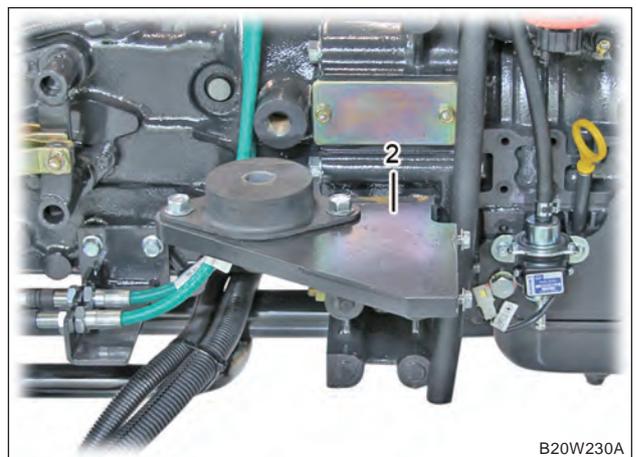


B20W226A

25. Disconnect the fuel tank sensor (1) connector and remove the fuel tank band (2). Then, remove the fuel tank assembly (3).

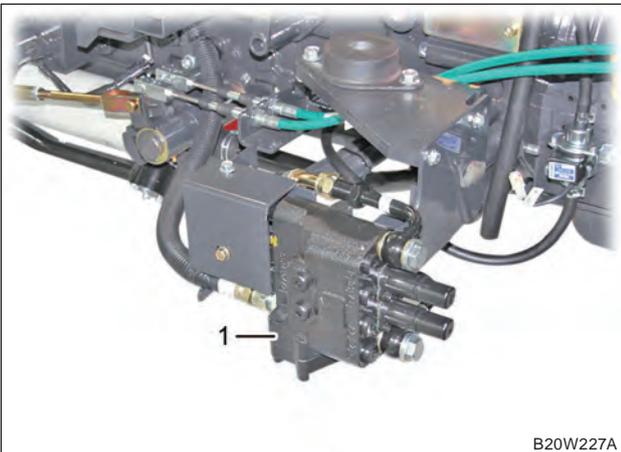


B20W229A



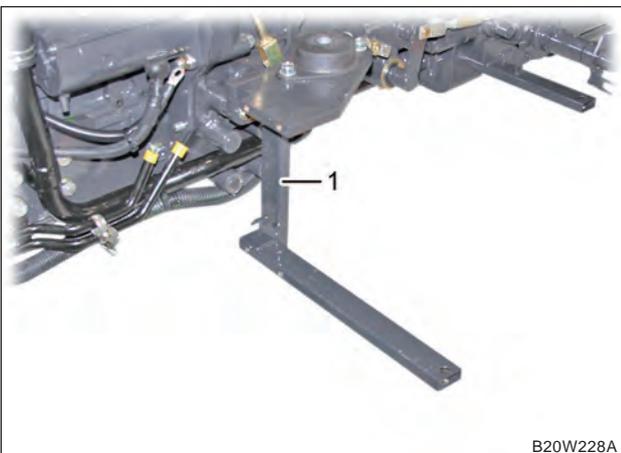
B20W230A

28. Remove the cabin support (LH: 1, RH: 2).



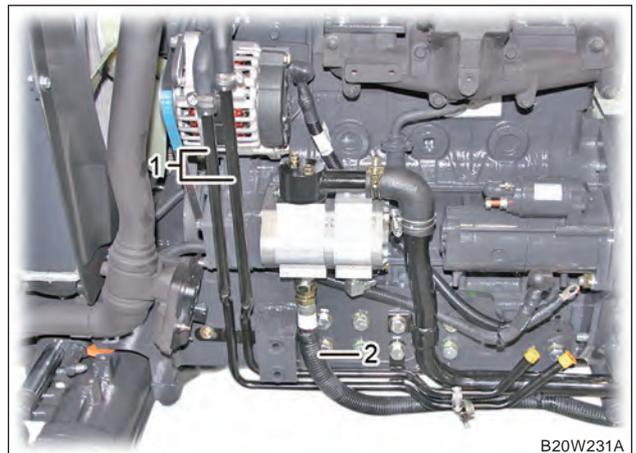
B20W227A

26. Remove the front SCV (1).



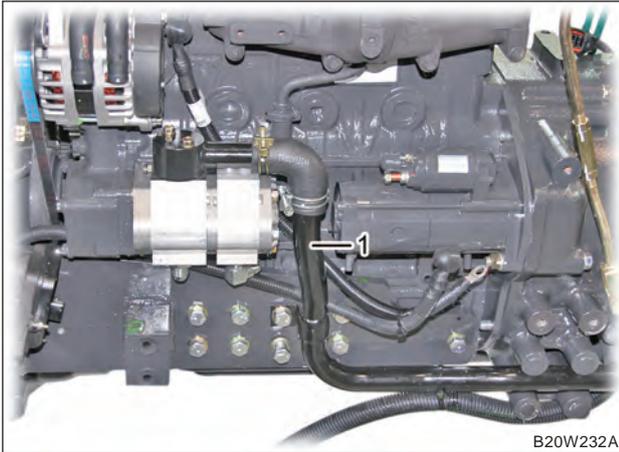
B20W228A

27. Remove the front support (1) of the fuel tank. (Mounting bolts : 2EA)



B20W231A

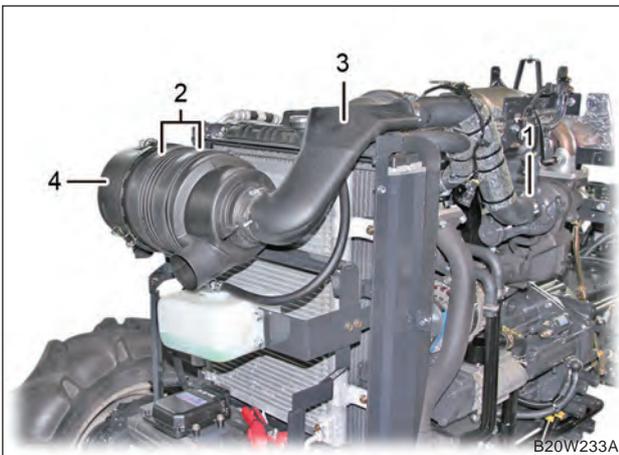
29. Disconnect the heater pipe (1) and hydraulic hose (2) from the left side of the engine.



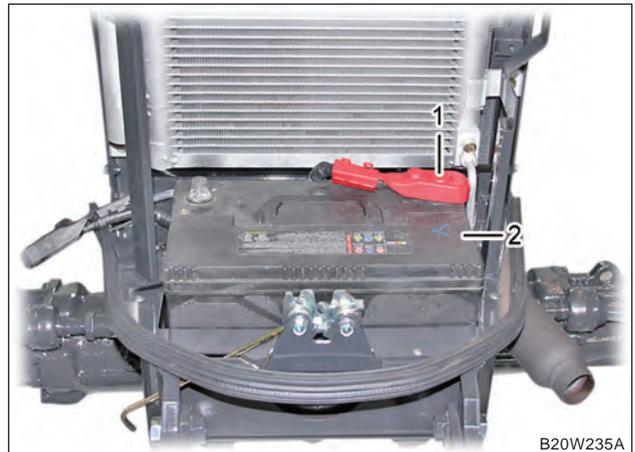
30. Disconnect the hydraulic pump suction pipe (1).



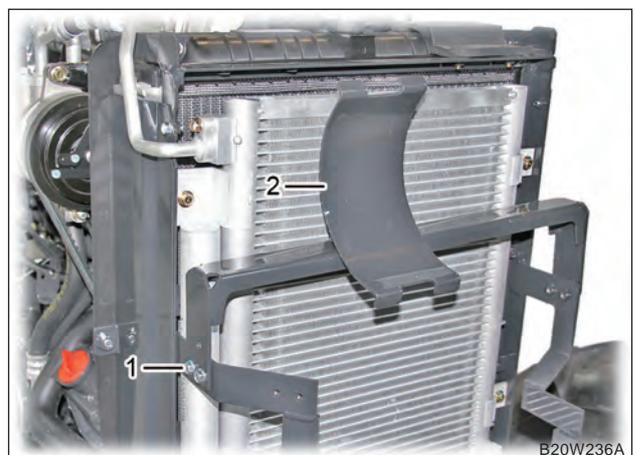
32. Disconnect the DPF controller connector (1) and unscrew the battery support mounting bolts (2) to remove the DPF controller (3) and reservoir tank (4).



31. Remove the intake pipe mounting hose clip (1) and air cleaner mounting band (2) to remove the intake pipe (3) and air cleaner assembly (4) simultaneously.



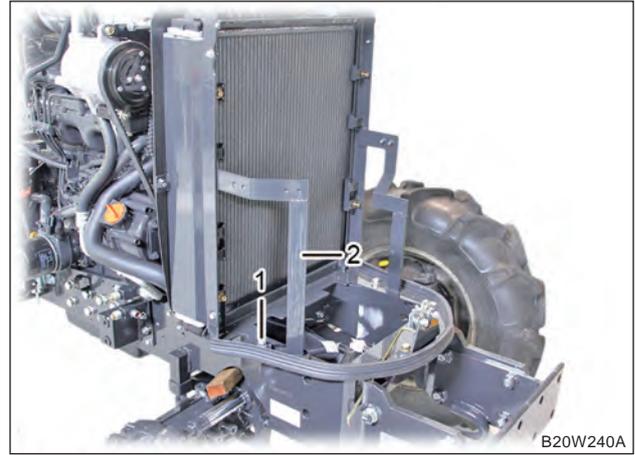
33. Disconnect the battery positive (□) terminal (1) to remove the battery (2).



34. Unscrew the air cleaner bracket assembly mounting bolts (1) to remove the air cleaner bracket assembly (2).



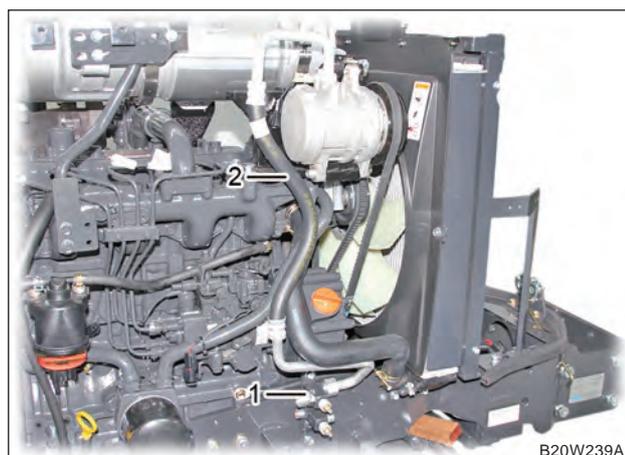
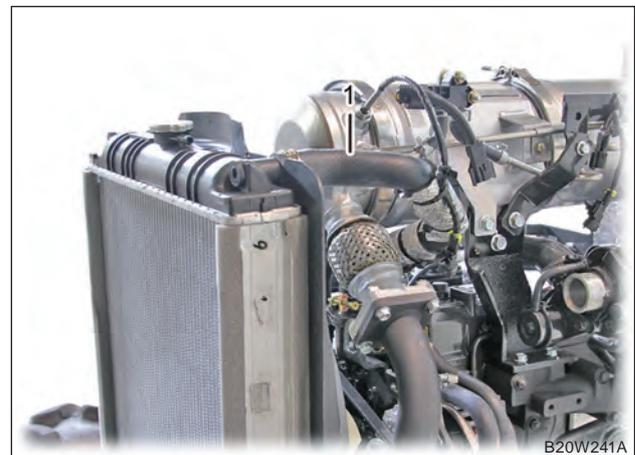
35. Disconnect the condenser hose assembly (1), (2).



38. Unscrew the grill frame mounting bolts (1) (8 EA) to remove the grill frame assembly (2).

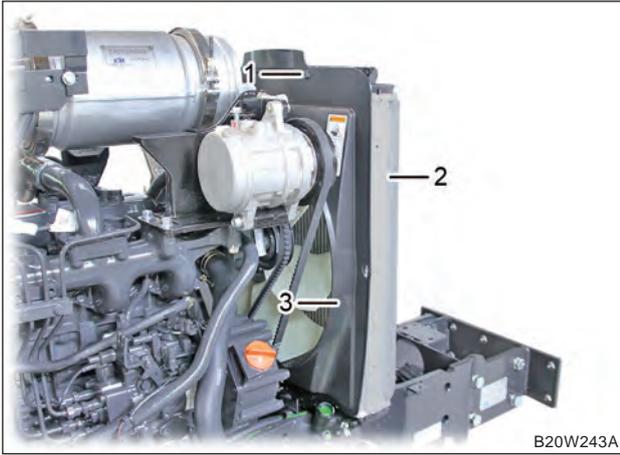


36. Unscrew the condenser mounting bolts (1) (4 EA) to remove the condenser (2).

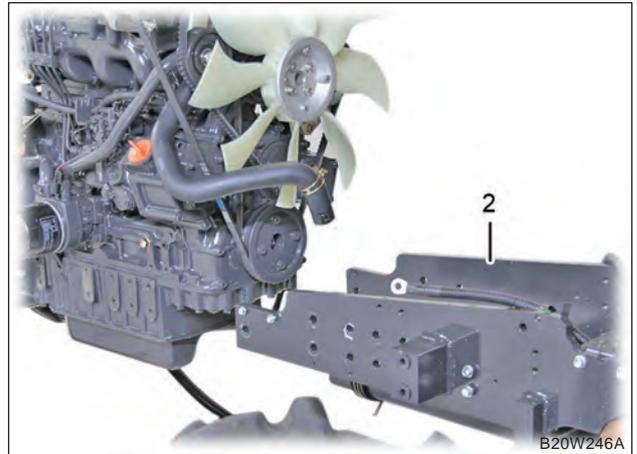
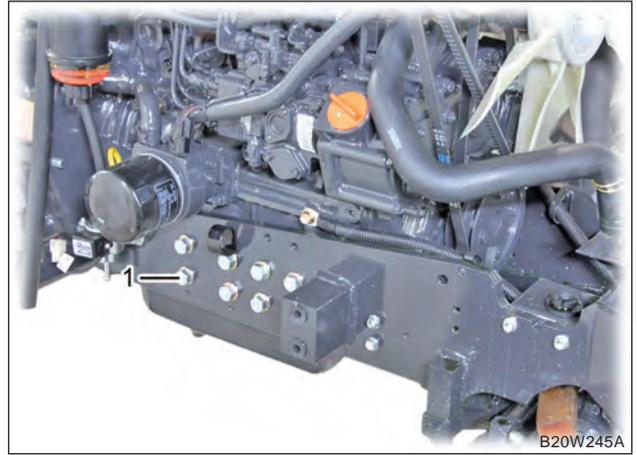


37. Remove the quick coupler bracket (1) and disconnect the compressor low-pressure hose (2).

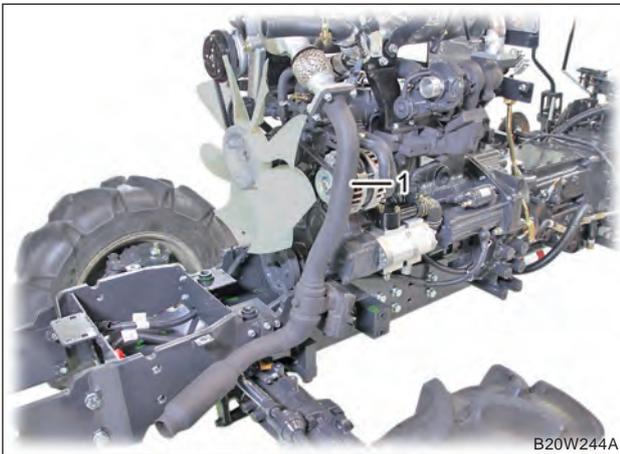
39. Disconnect the coolant hose A (1) and coolant hose B (2).



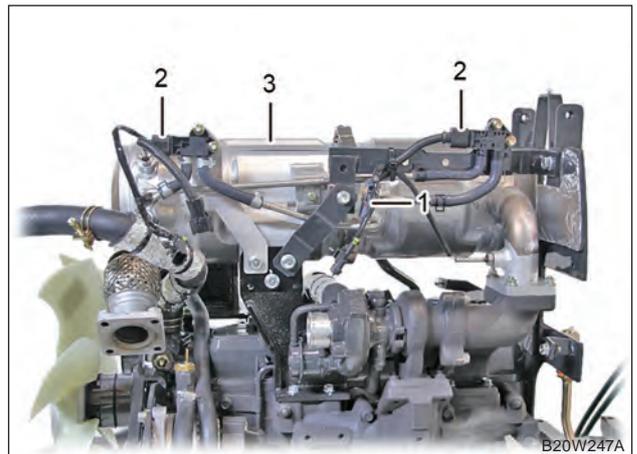
40. Unscrew the cooling fan shroud mounting bolts (1) (4 EA) to remove the radiator (2) and fan shroud (3) in order.



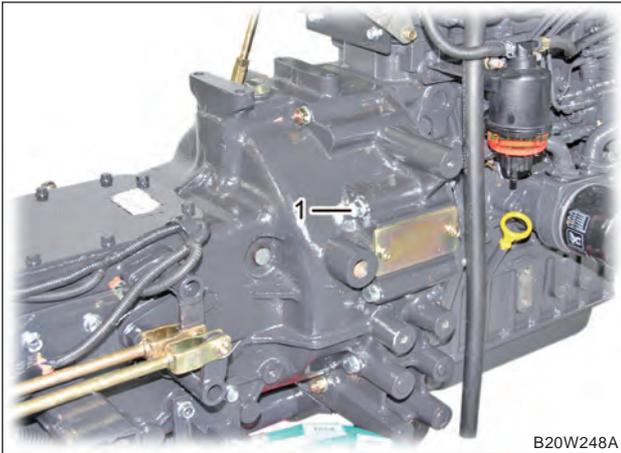
42. Unscrew the front axle bracket mounting bolts (1) (18 EA) and remove the front axle bracket assembly (2).



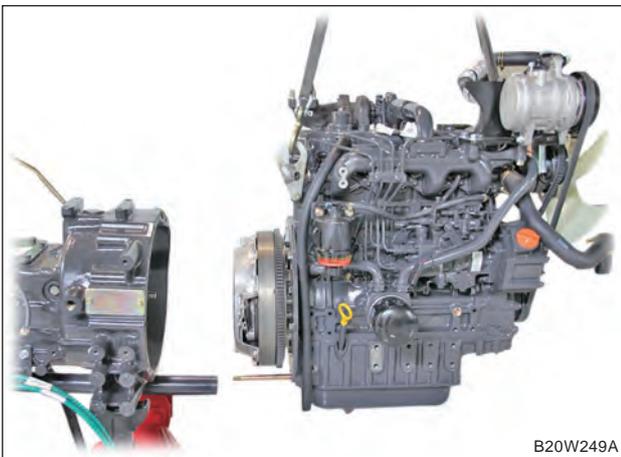
41. Remove the exhaust pipe assembly (1).



43. Disconnect the exhaust gas temp sensor connector (1) and differential pressure sensor (2) to remove the DPF (3).



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B20W249A



B20W250A

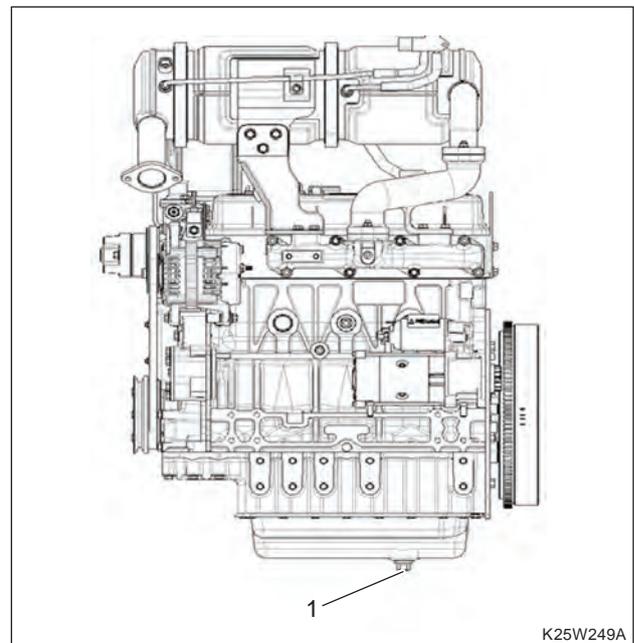
44. Support the engine with its hook and a hoist. Then, separate the clutch housing and engine by unscrewing engine mounting bolts (1) (18 EA) and nuts (2 EA) from the bottom. Then, remove the engine assembly by lifting it slowly with the hoist.

## 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

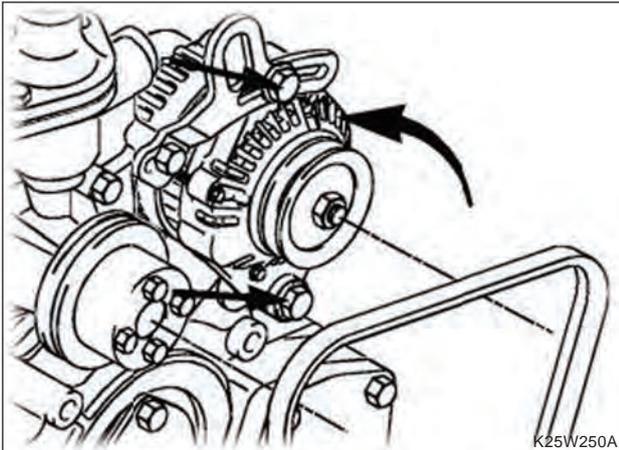
- Don't allow hot oil to directly contact skin.



#### WARNING

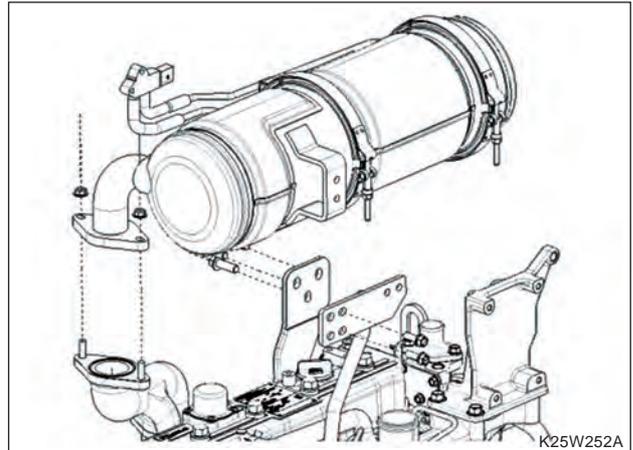
- Disposal of waste oil must be treated the related regulations.

**6.2.3 V-BELT, V-PULLEY**



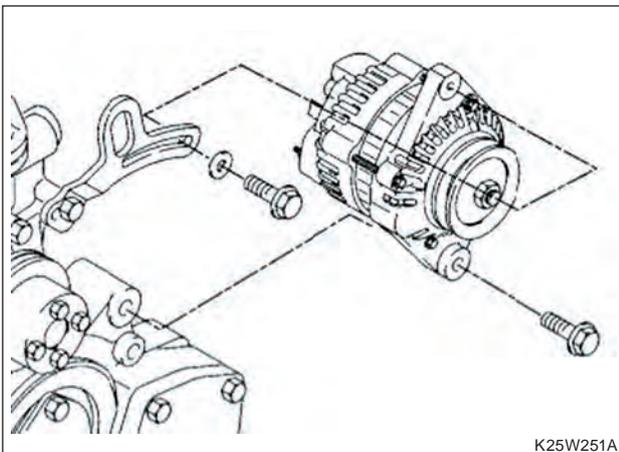
1. Loosen the bolts that hold the V-pulley.
2. Loosen the tension bolt and the bolt that hold the alternator, remove the V-belt after relaxation of belt.
3. Disassemble the V-pulley.

**6.2.5 AFTER-TREATMENT DEVICE (ATD)**



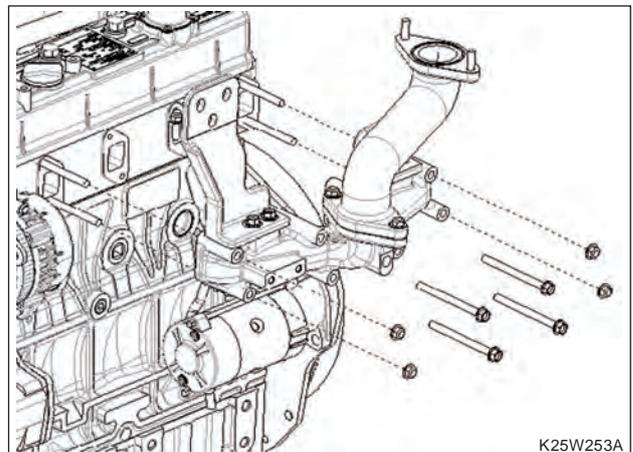
1. Loosen the bolts that hold the ATD.
2. Loosen the nuts that connect the ATD and DPF fixing housing.
3. Disassemble the ATD. (When disassembling the ATD, be careful because ATD is heavy.)

**6.2.4 ALTERNATOR**

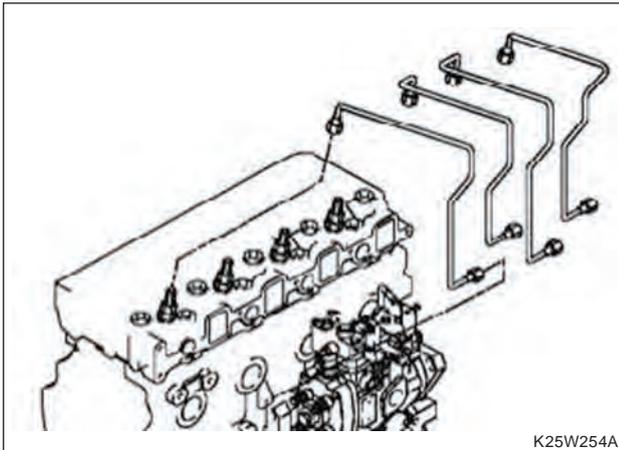


1. Loosen the bolt and washer that hold the upper side of alternator.
2. Loosen the bolt in lower side.
3. Disassemble the alternator.

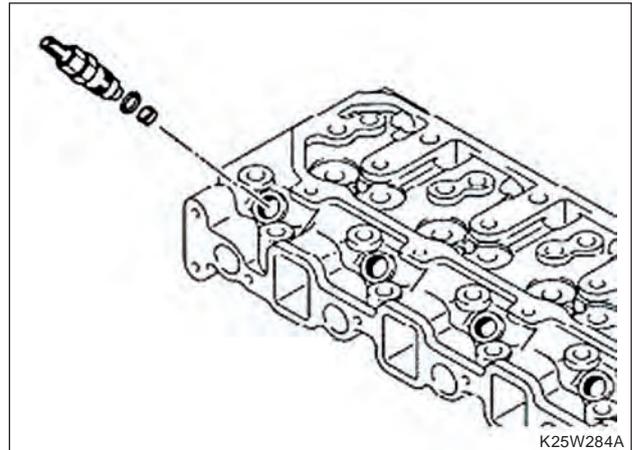
**6.2.6 EXHAUST MANIFOLD**



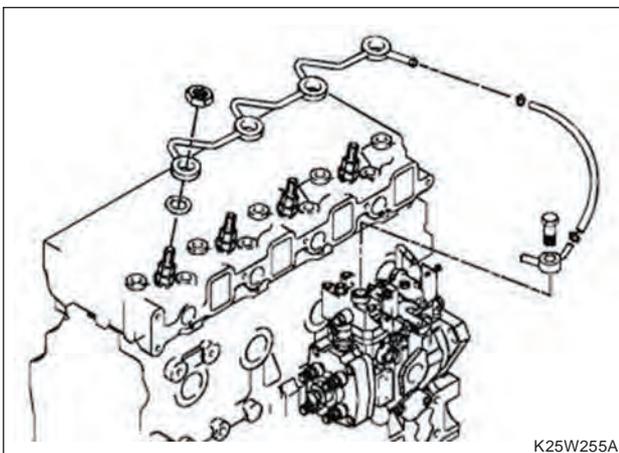
1. Loosen the bolts and nuts that hold the exhaust manifold.
2. Disassemble the exhaust manifold and steel gasket.

**6.2.7 FUEL INJECTION PIPES**

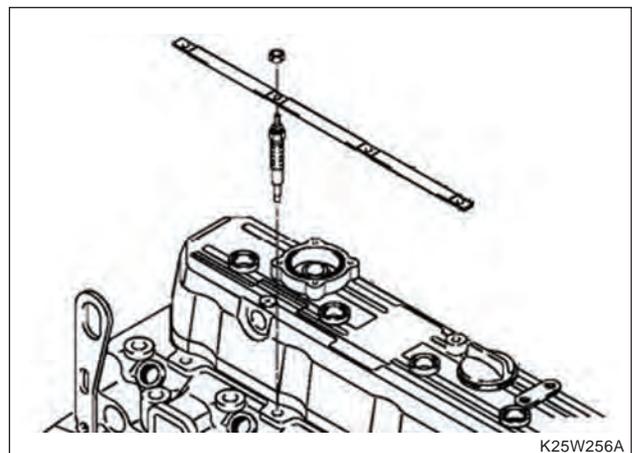
1. Loosen the bolts that hold fuel injection pipes assembly.
2. Loosen the nuts in fuel injection pump side.
3. Loosen the nuts in head cover side.
4. Disassemble the fuel injection pipes.

**6.2.9 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)

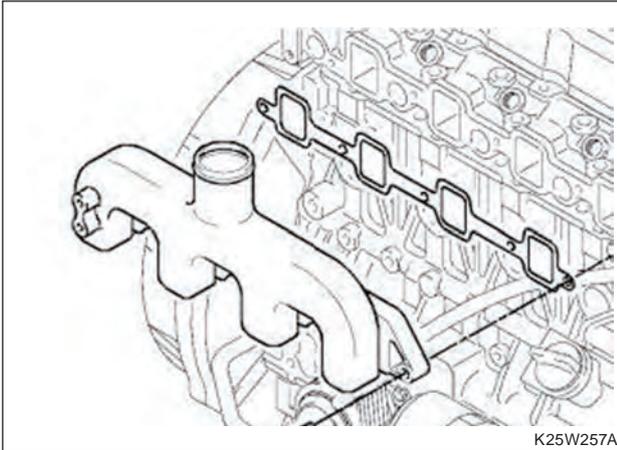
**6.2.8 FUEL DRAIN LINE**

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

**6.2.10 GLOW PLUG**

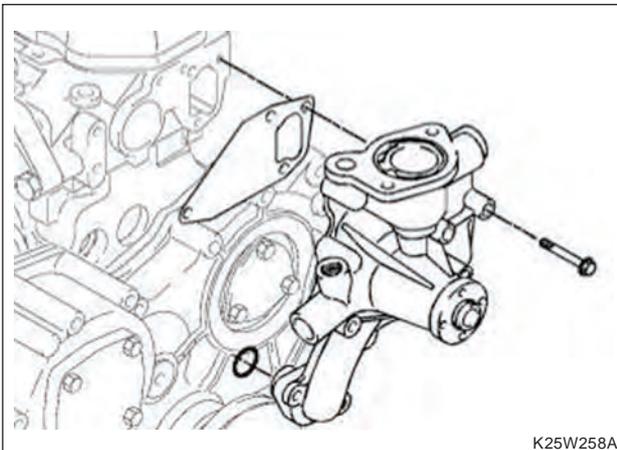
1. Disassemble the wire harness from the connector.
2. Loosen the nuts that hold the connector.
3. Disassemble the glow plugs.

### 6.2.11 INTAKE MANIFOLD



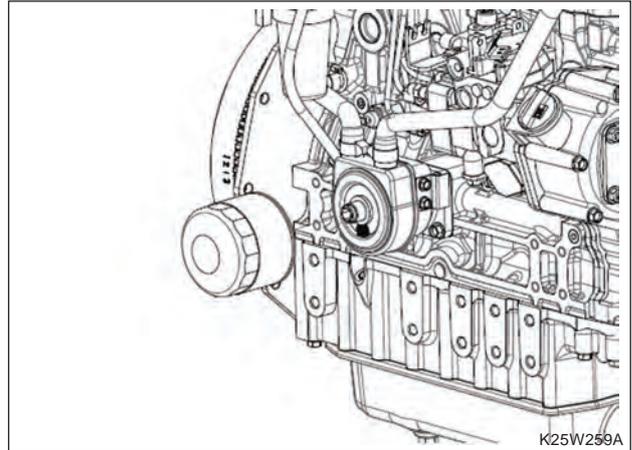
1. Loosen the clamp that holds breather hose connecting Intake manifold and cylinder head.
2. Loosen the bolts and nut that hold the intake manifold.
3. Disassemble the intake manifold.
4. Disassemble the packing.
5. Do not re-use the packing.

### 6.2.12 WATER PUMP



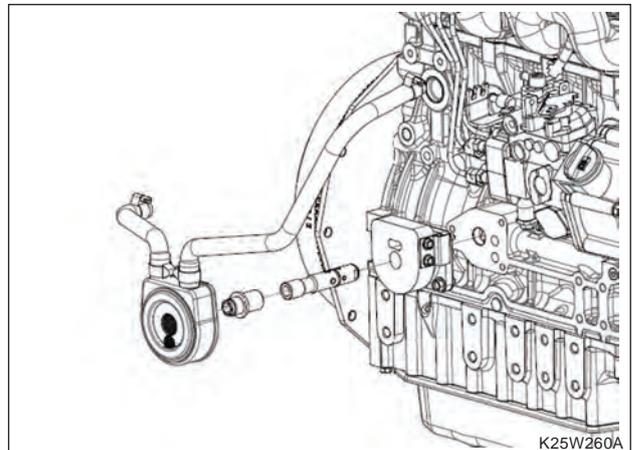
1. Loosen the bolts that hold the V-pulley.
2. Disassemble the V-pulley.
3. Loosen the bolts that hold the water pump.
4. Disassemble the water pump and packing.
5. Do not re-use the packing

### 6.2.13 OIL FILTER

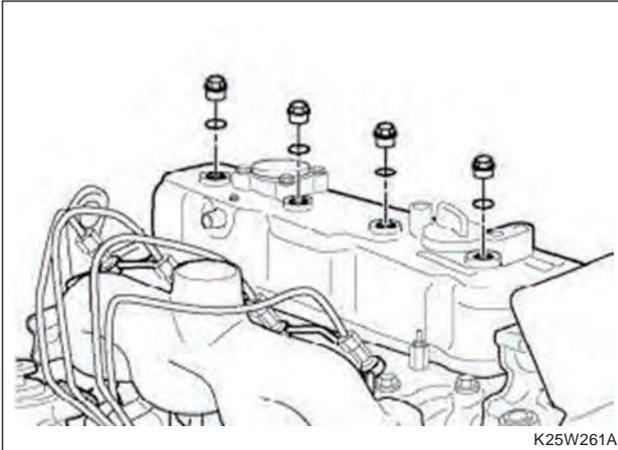


1. Disassemble the oil filter using by tool.

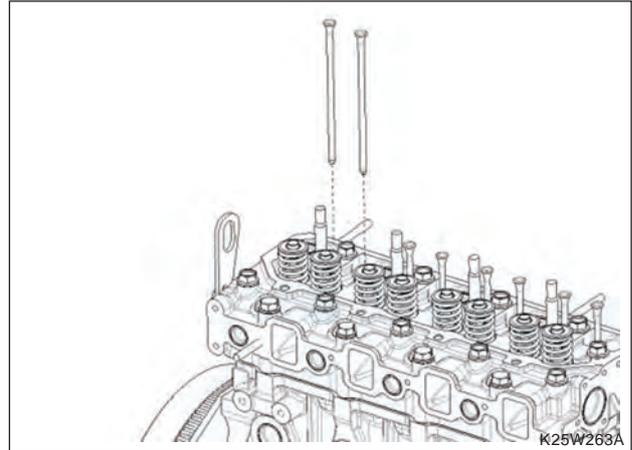
### 6.2.14 OIL COOLER



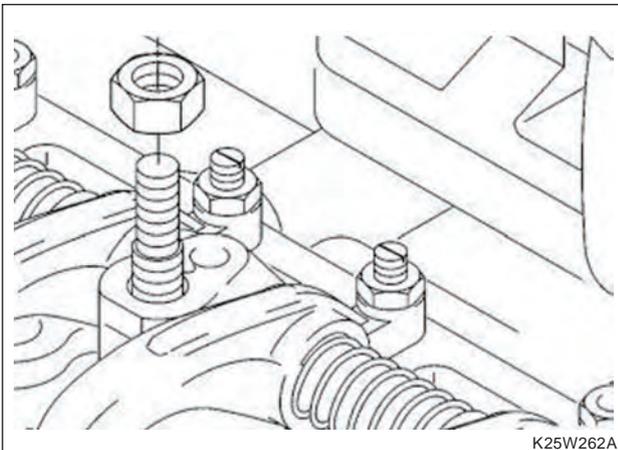
1. Loosen the clamps that hold the hoses.
2. Disassemble the hoses.
3. Disassemble the bolt that holds the oil cooler by using tool.
4. Disassemble the oil cooler.
5. Loosen the bolts that hold cooler bracket
6. Disassemble the cooler bracket.

**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.

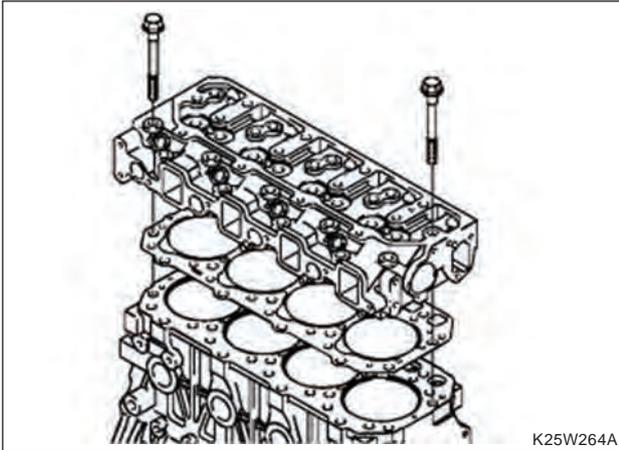
**6.2.17 PUSH ROD**

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

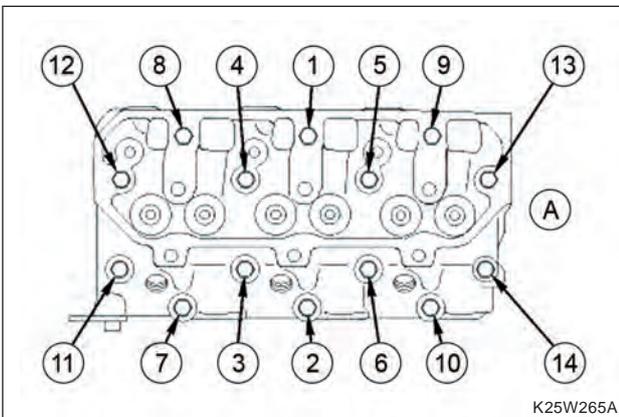
**6.2.16 ROCKER-ARM SHAFT**

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

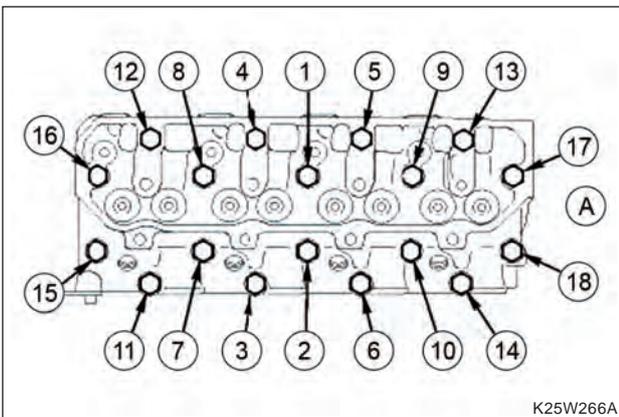
6.2.18 CYLINDER HEAD



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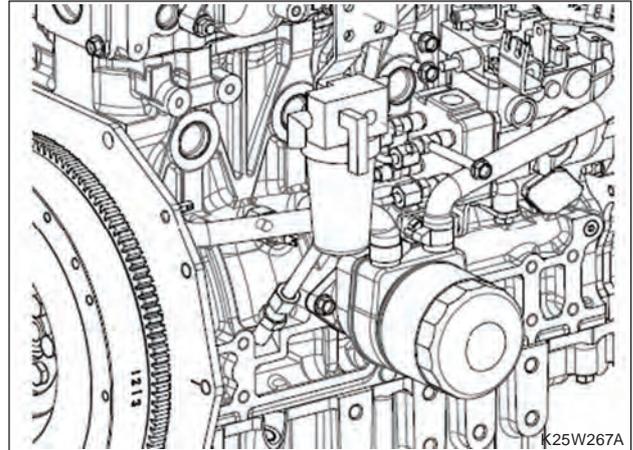
K25W266A

1. Loosen the 18 clamping bolts in order.  
(T2300 Order: Outside(18) → Inside(1))  
(T1700 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 plane of the cylinder head.

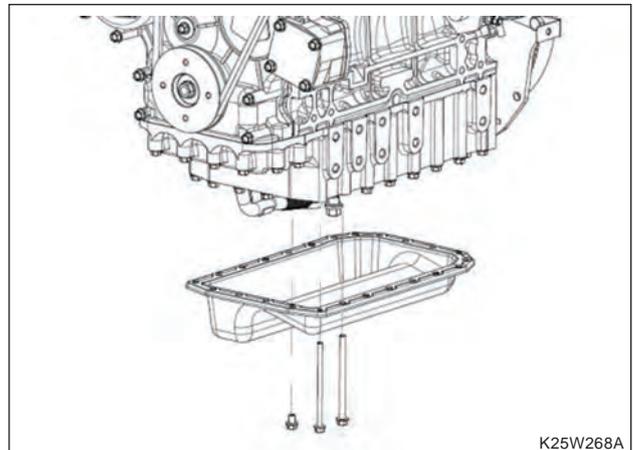
6.2.19 FUEL FILTER



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.

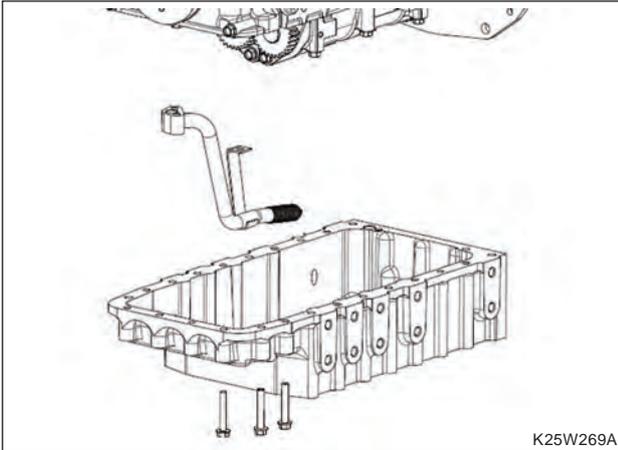
6.2.20 OIL PAN



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.

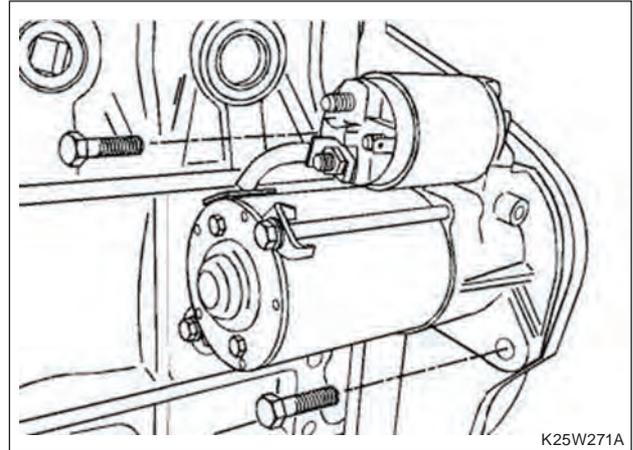
## 6.2.21 FRAME AND OIL SUCTION PIPE



K25W269A

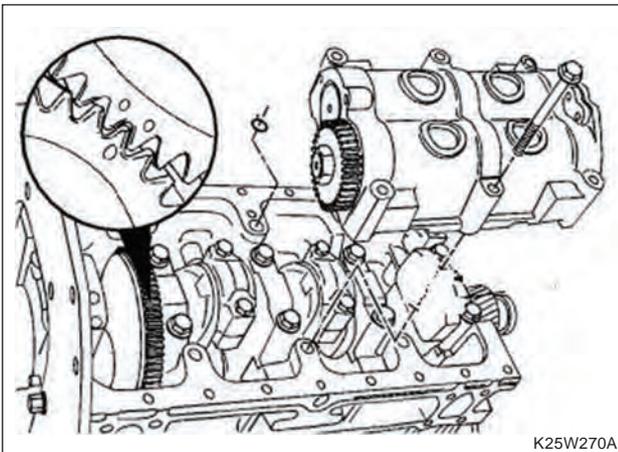
1. Loosen the 20 bolts that hold frame.
2. Disassemble frame.
3. Clean the liquid packing on face of frame
4. Loosen the 2 bolts that hold the oil suction pipe.
5. Disassemble the oil suction pipe.

## 6.2.23 STARTER



K25W271A

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

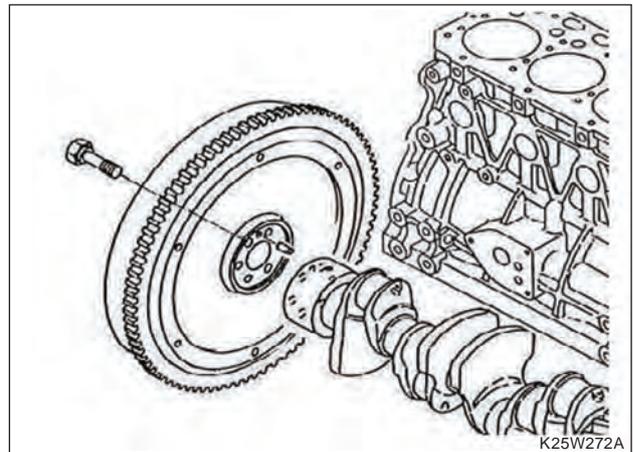
6.2.22 2<sup>ND</sup> BALANCER (ONLY T2300 ENGINE)

K25W270A

1. Loosen the 6 bolts that hold 2nd balancer.
2. Disassemble 2nd balancer.
3. Disassemble dowel pin and O-ring.

※ T1700 engine do not have 2nd balancer.

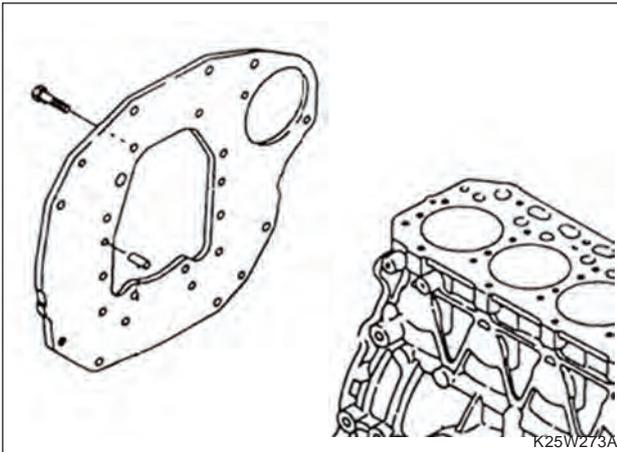
## 6.2.24 FLYWHEEL



K25W272A

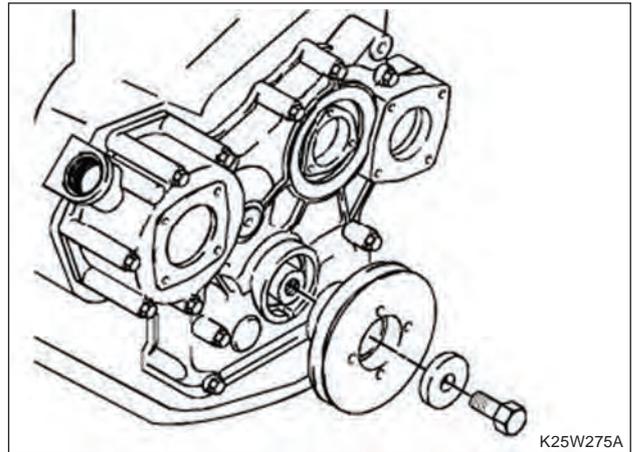
1. Loosen the bolts that hold the flywheel.
2. Disassemble the flywheel.

**6.2.25 MOUNTING FLANGE**



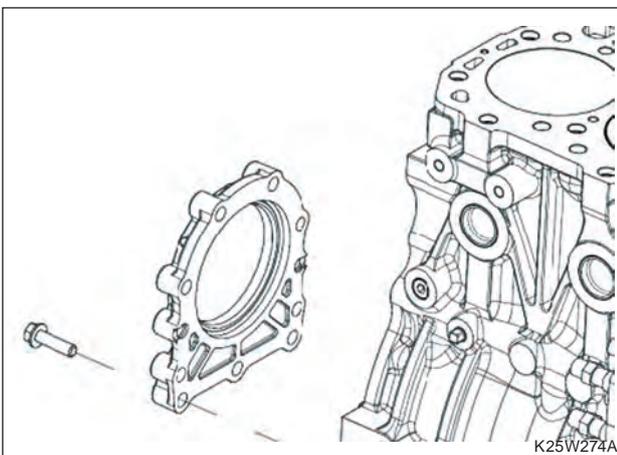
1. Loosen the bolts that hold the mounting flange.
2. Disassemble the mounting flange.

**6.2.27 CRANK PULLEY**



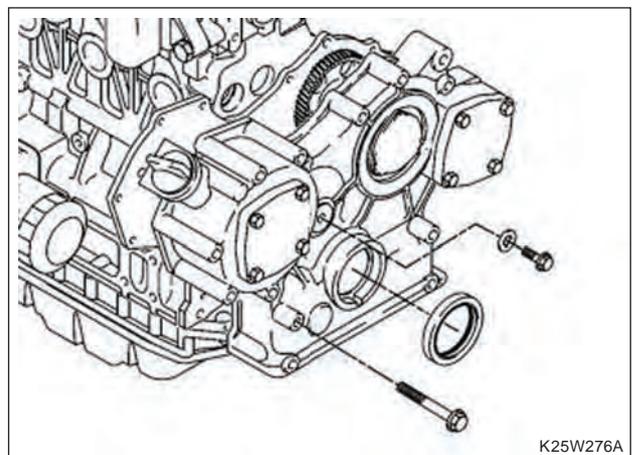
1. Loosen the bolt that holds the crank pulley.
2. Disassemble the crank pulley.

**6.2.26 OIL SEAL HOUSING**

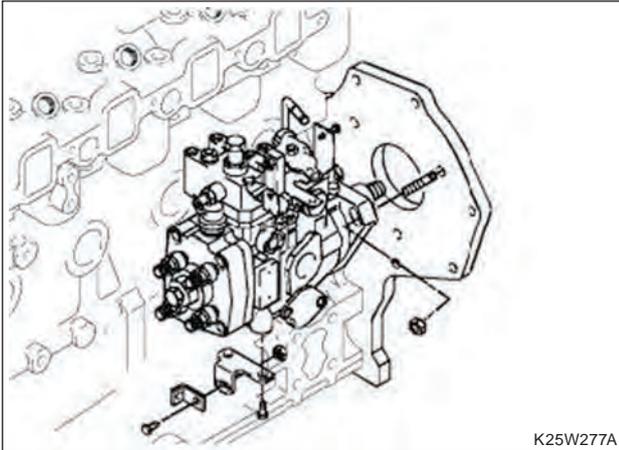


1. Loosen the 9 clamping bolts.
2. Disassemble the oil seal housing.
3. Clean the liquid packing on oil seal housing.

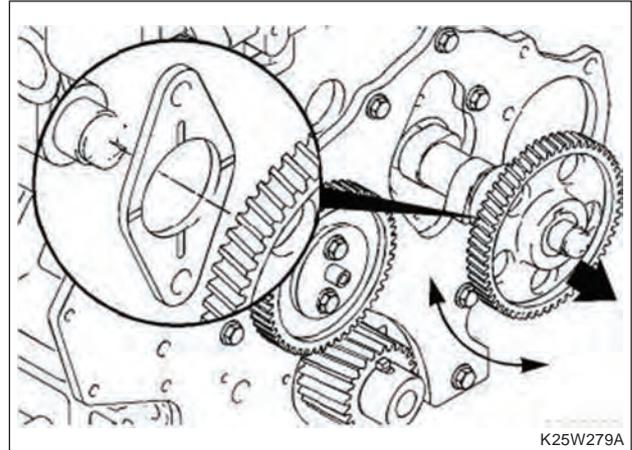
**6.2.28 GEAR CASE**



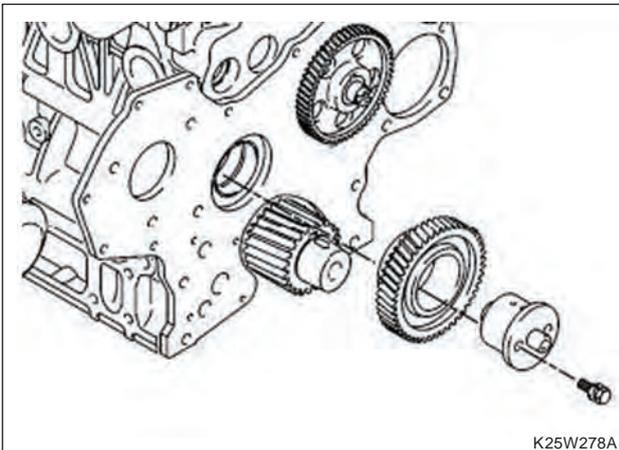
1. Loosen the bolts that hold the gear case.
2. Disassemble the gear case.
3. Clean the liquid packing on gear case flange and gear case.

**6.2.29 FUEL INJECTION PUMP**

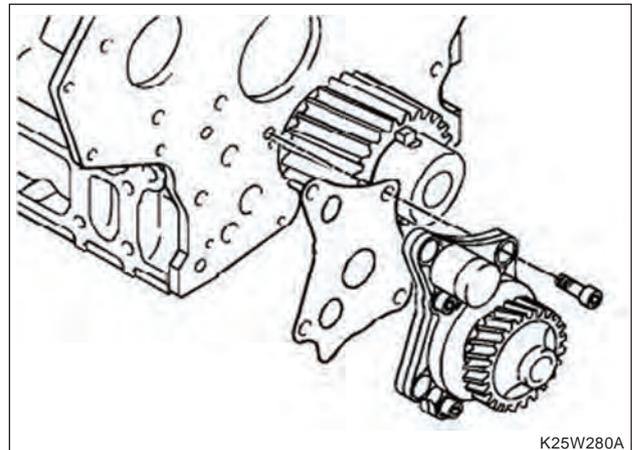
1. Loosen the bolt that holds the fuel injection pump gear.
2. Disassemble the fuel injection pump gear.
3. Loosen the bolts that hold support bracket.
4. Disassemble the support bracket.
5. Loosen the bolts that hold the fuel injection pump.
6. Disassemble the fuel injection pump.

**6.2.31 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.

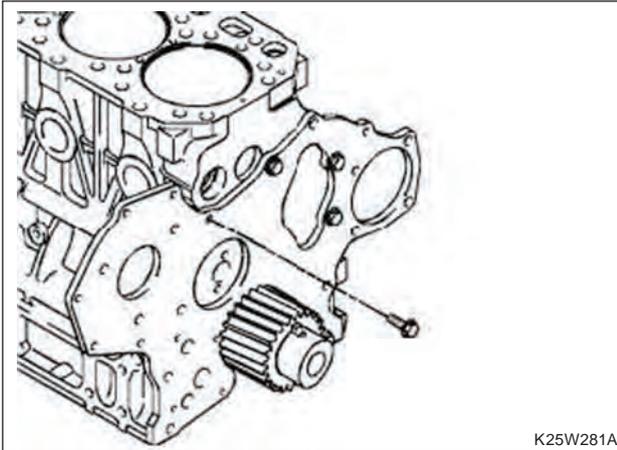
**6.2.30 IDLE SHAFT AND IDLE GEAR**

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

**6.2.32 OIL PUMP**

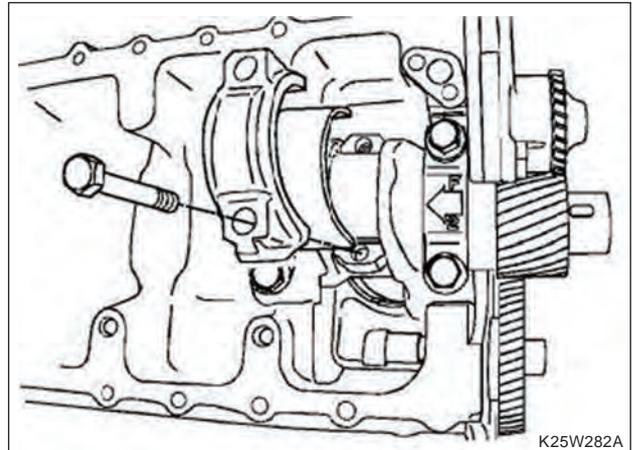
1. Loosen the bolts using by hexagon wrench.
2. Disassemble the oil pump.
3. Do not re-use the O-ring and packing.

## 6.2.33 GEAR CASE FLANGE



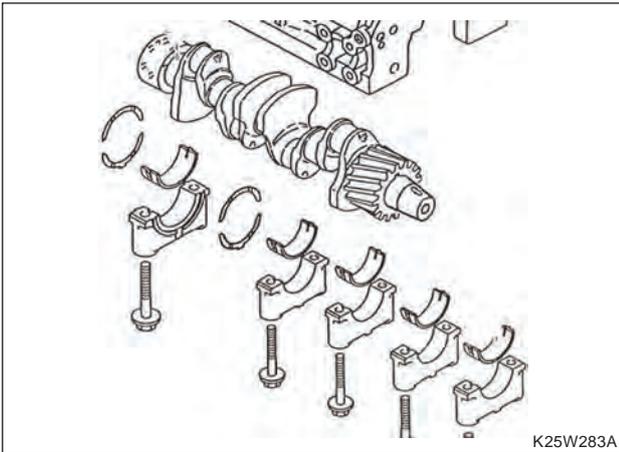
1. Loosen the bolts that hold the gear case flange.
2. Disassemble the gear case flange.

## 6.2.34 PISTON AND CONNECTING ROD



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.

6.2.35 CRANK SHAFT



K25W283A

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

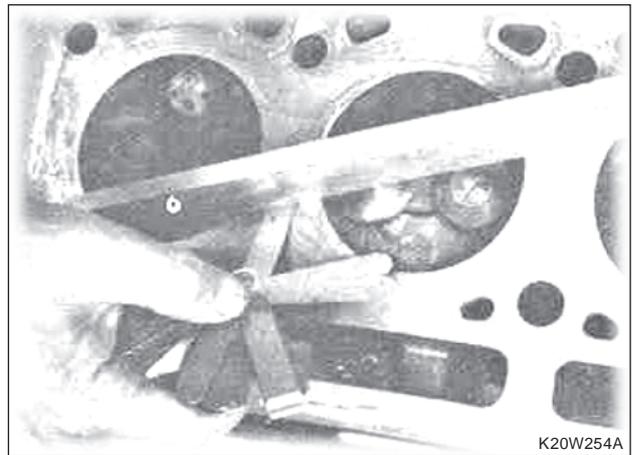
6.3 MAIN PARTS INSPECTION & MAINTENANCE

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**



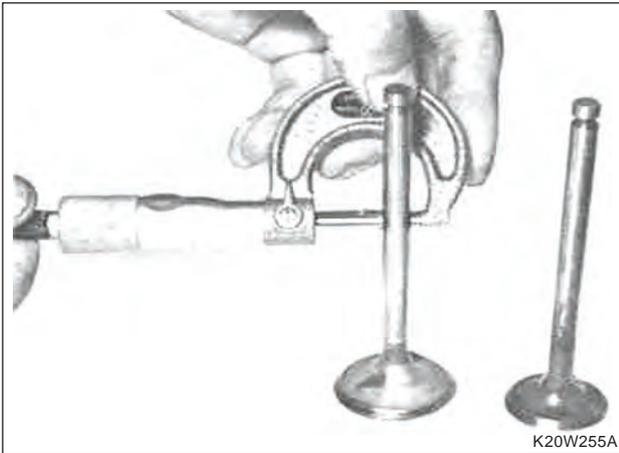
K20W254A

1. Before cleaning the cylinder head, check for leak, damage, crack from 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 of limit.

<b>SPECIFICATION</b>	Less than 0.05 mm
<b>LIMIT</b>	More than 0.15 mm

**INTAKE & EXHAUST VALVE & VALVE GUIDE**

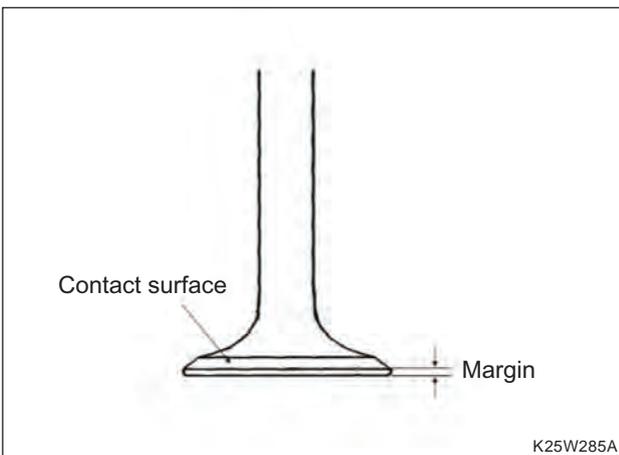
▶ **VALVE**



- 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

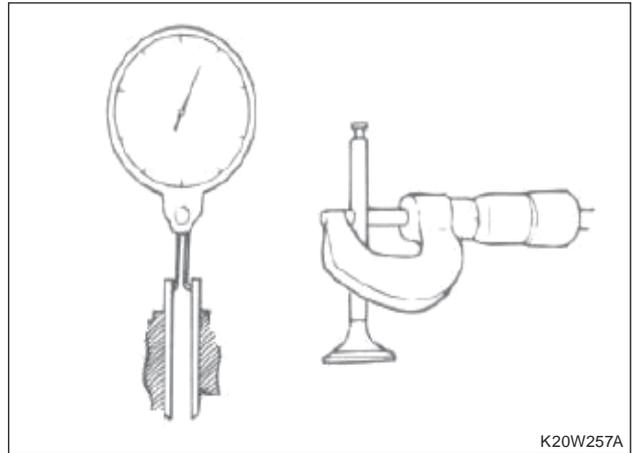
▶ **VALVE SHEET CONTACT SURFACE**



- Check the valve sheet contact surface and if necessary, modify it with grinding paper. Replace if major damage is found.
- Check the margin (thickness of valve head) and if less than the limit, replace it.

SPECIFICATION	LIMIT
1.2 mm	0.5 mm

▶ **VALVE GUIDE**

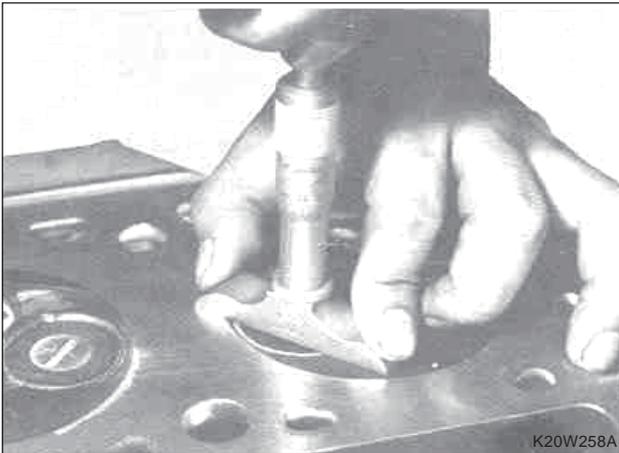


- Measure the distance between the valve guide and valve stem. If the distance is more than limit, replace the valve or valve guide or either parts.

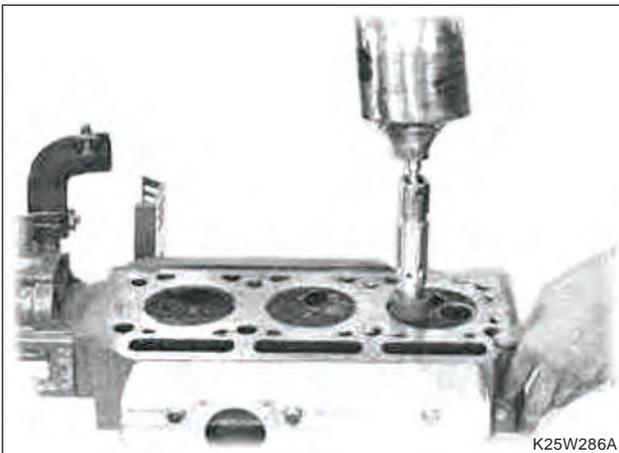
SPECIFICATION	LIMIT
0.04 ~ 0.05 mm	0.2 mm

- 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

► VALVE SHEET



K20W258A



K25W286A

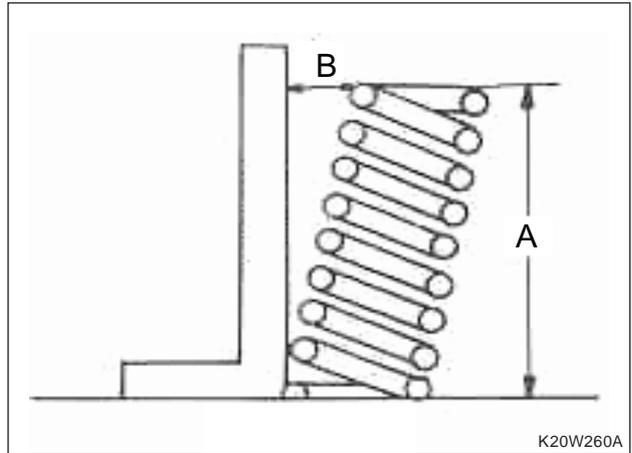
If the valve's difference is more than limit, replace the valve sheet.

<b>SPECIFICATION</b>	0.7 mm
<b>LIMIT</b>	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.

<b>INTAKE VALVE SEAT ANGLE</b>	<b>EXHAUST VALVE SEAT ANGLE</b>
60°	45°

► VALVE SPRING



K20W260A

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

<b>CAUTION</b>
<ul style="list-style-type: none"> <li>• Stem seal assembling quality affects to oil consumption.</li> </ul>

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.

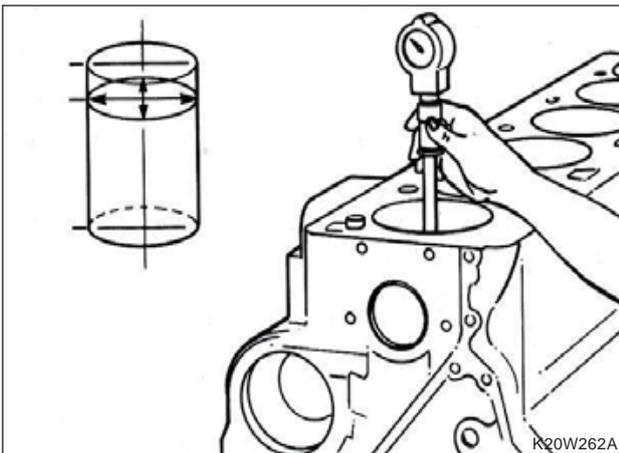
6.3.2 CYLINDER BLOCK

**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)

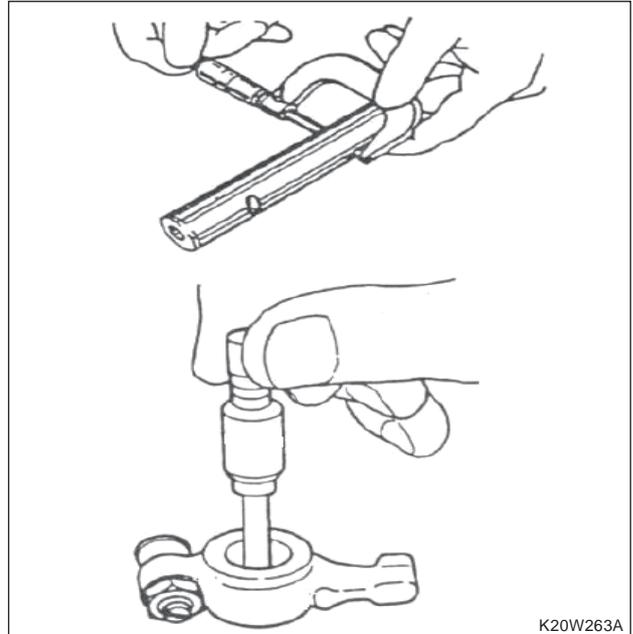
ITEM	SPECIFICATION	LIMIT
Cylinder inside diameter	88.005 ~ 88.025	88.20
Cylinder roundness	0.0~0.01	0.03
Cylinder cylindricity	0.0~0.015	0.03

- 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**



K20W263A

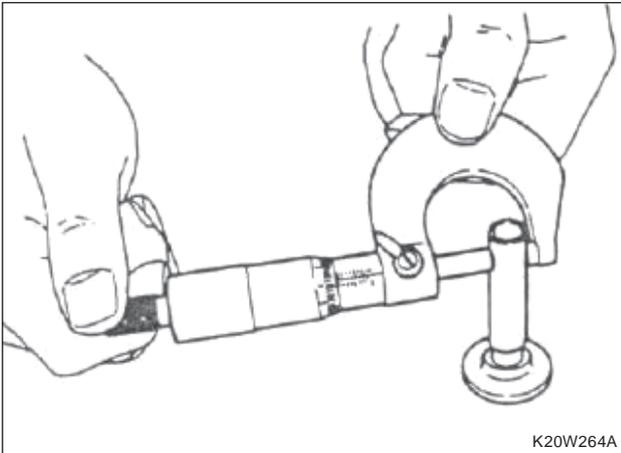
1. Rocker arm shaft outer diameter and rocker arm Inner diameter

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

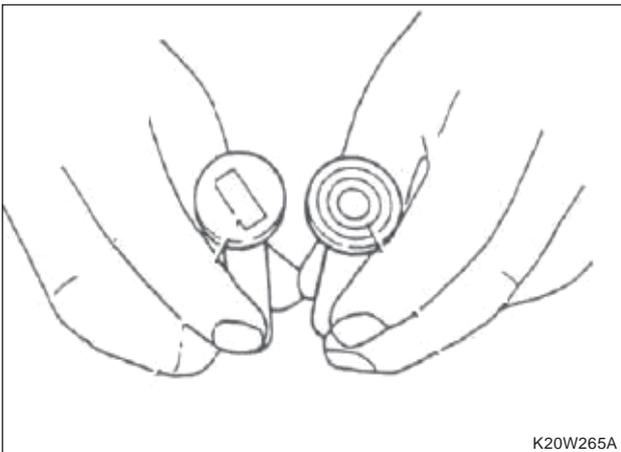
(mm)

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

**TAPPET**



K20W264A



K20W265A

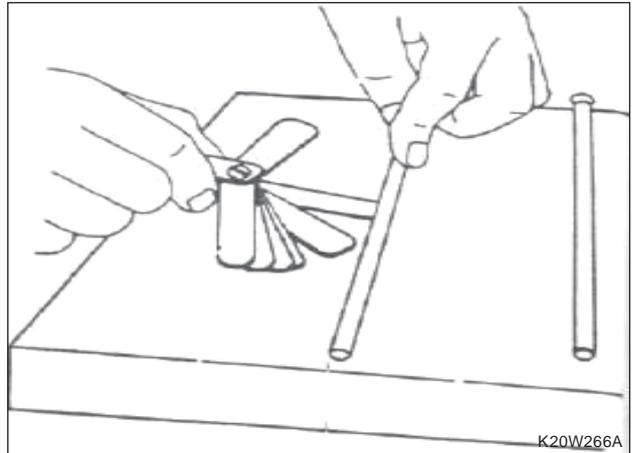
If the measurement of the tappet outer diameter and cylinder block is over the limit, replace it.

(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**

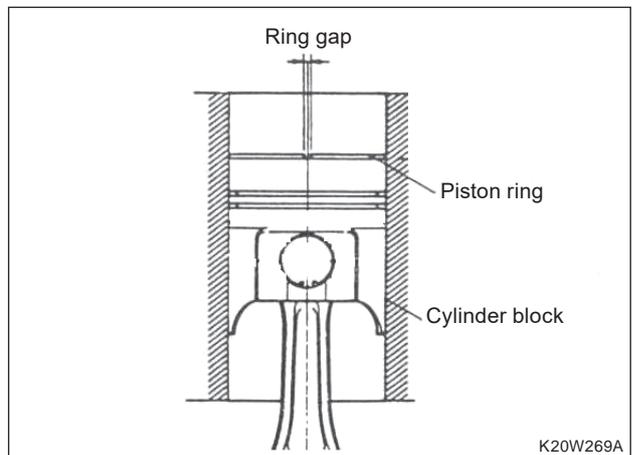
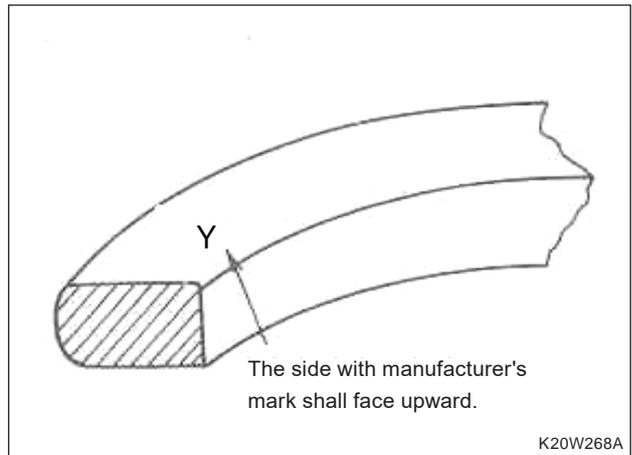
▶ PISTON OUTER DIAMETER

- 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	-

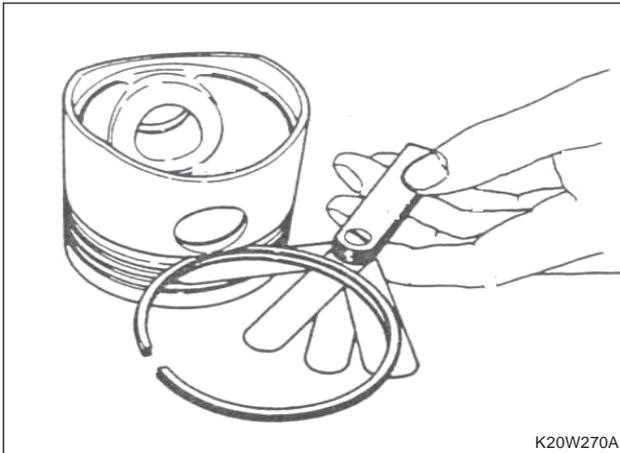
▶ PISTON RING



- 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

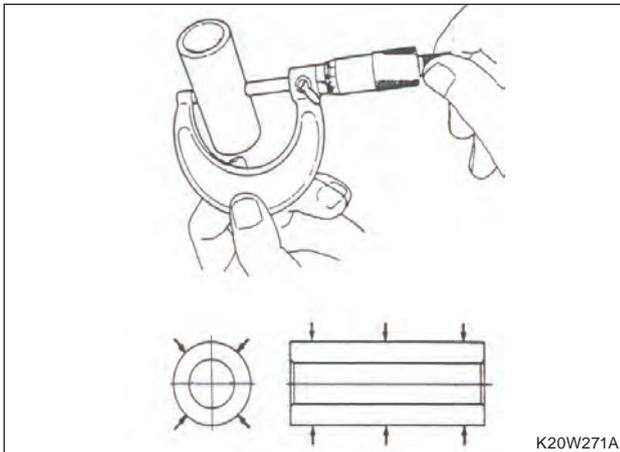


K20W270A

- 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 ~ 0.11	-

► PISTON PIN

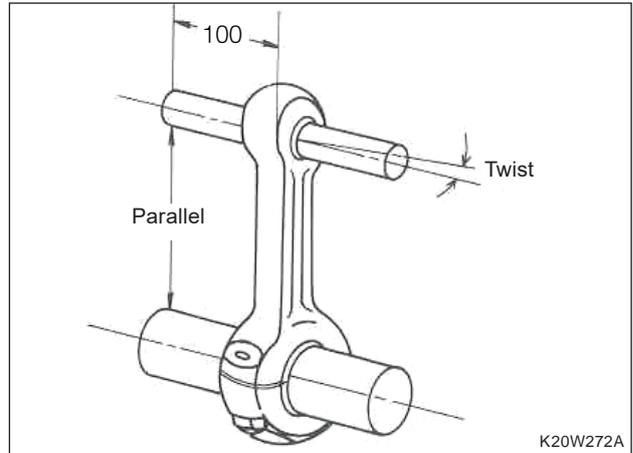


K20W271A

- 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



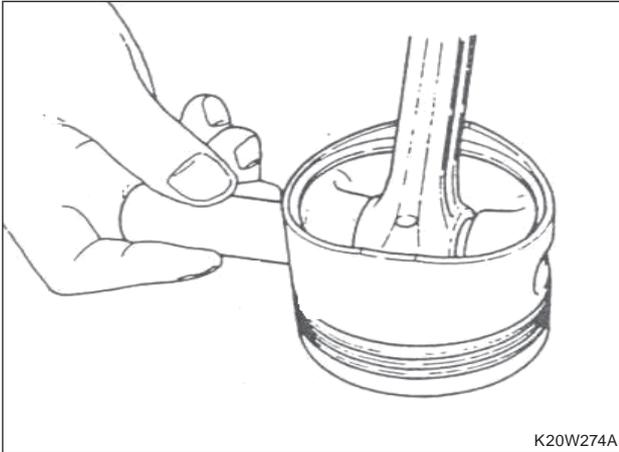
K20W273A

- 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.

**REPLACE THE PISTON**

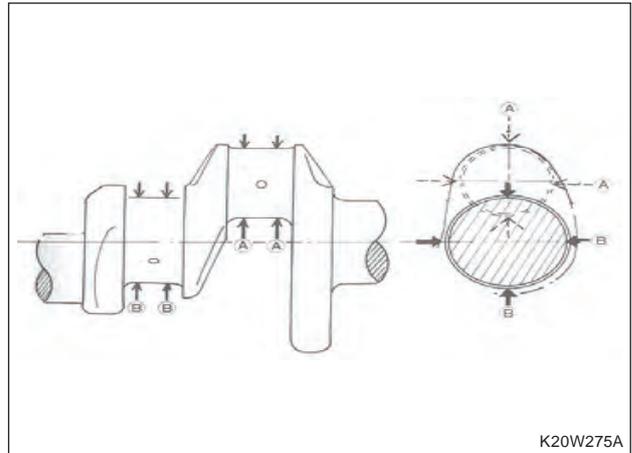


1. Replacing of piston ring and connecting rod should be operated in clean surrounding.
2. Make sure the piston ring is movable easily after assembly.
3. Assemble the piston pin stop ring to the piston.
4. Put some oil to the piston pin and assemble the connecting rod.
5. Assemble the piston pin stop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

**6.3.5 CRANK SHAFT**

**CHECK THE CRANKSHAFT**

► **CHECK THE CRANKSHAFT JOURNAL**

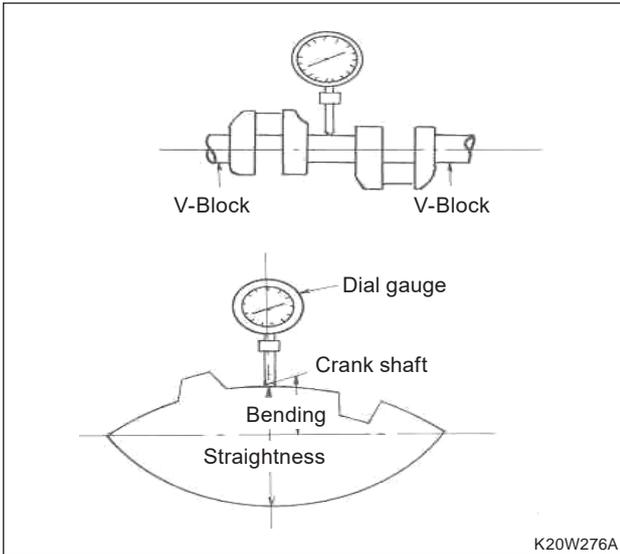


- If there is any crack or damage, replace it.
- Measure every main part, and if it is over the limit, replace the main bearing. If necessary, replace the crankshaft.

(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

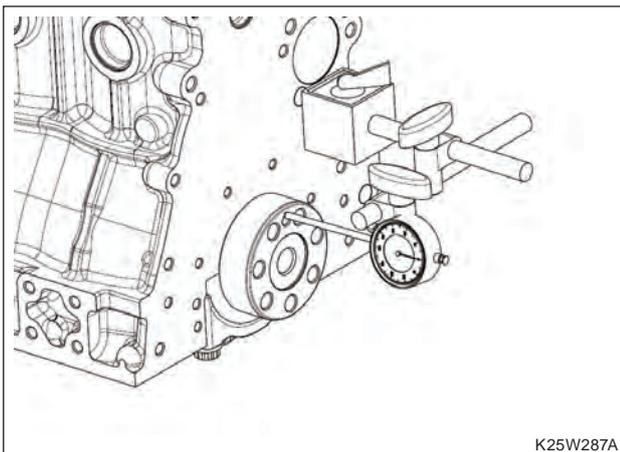
► CHECK THE CRANKSHAFT BENDING DEGREE



- 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.

<b>BENDING DEGREE SPECIFICATION</b>	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.

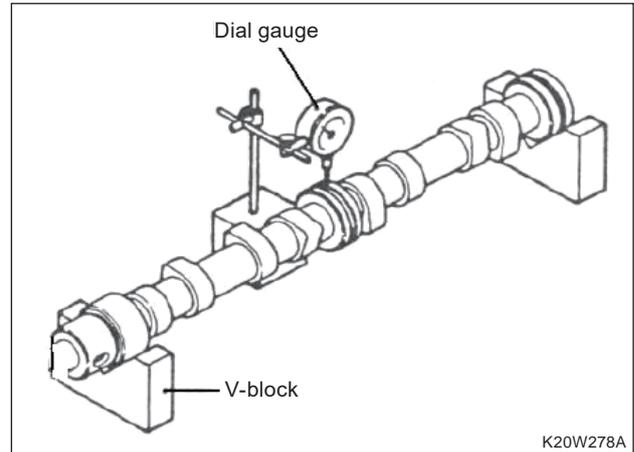
<b>ITEM</b>	<b>SPECIFICATION</b>
Thrust Clearance	0.09 ~ 0.271 mm

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.



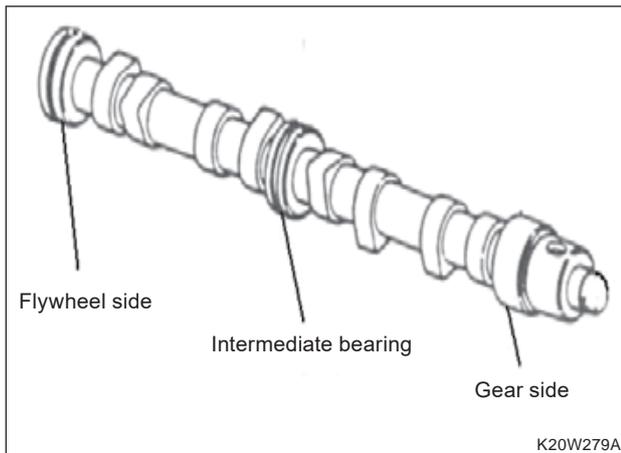
► CHECK THE CAMSHAFT BENDING DEGREE

- 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

► CHECK THE CAMSHAFT JOURNAL

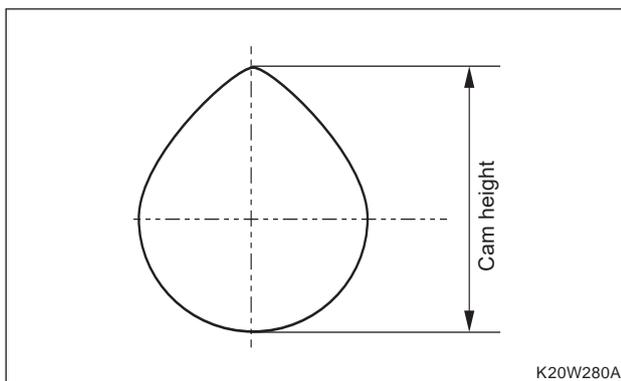


Measure the outer diameter of camshaft by micrometer. The Oil clearance is calculated after measuring the difference between camshaft inner diameter of the cylinder block by cylinder gauge and camshaft outer diameter.

(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



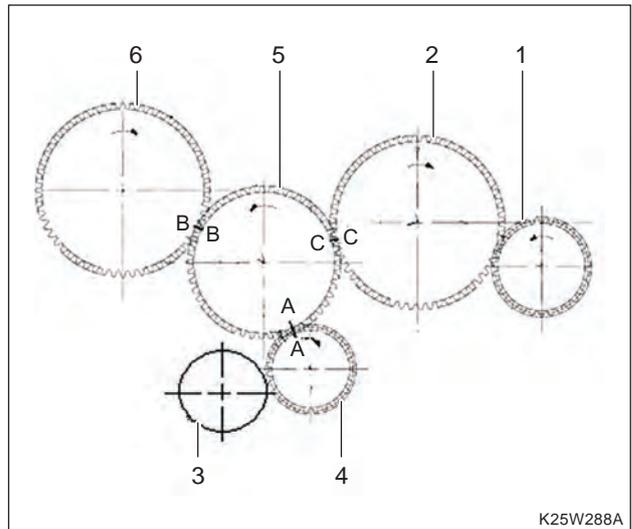
(mm)

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	Crack gear, Camshaft gear, Idle gear, Fuel injection pump gear	0.07 ~ 0.15
		Hydraulic pump drive gear Oil pump gear

## 6.4 THE ENGINE ASSEMBLY

### 6.4.1 CAUTION BEFORE ASSEMBLING THE ENGINE

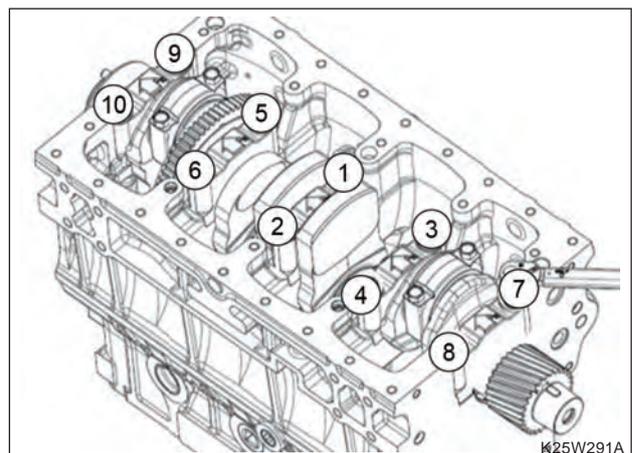
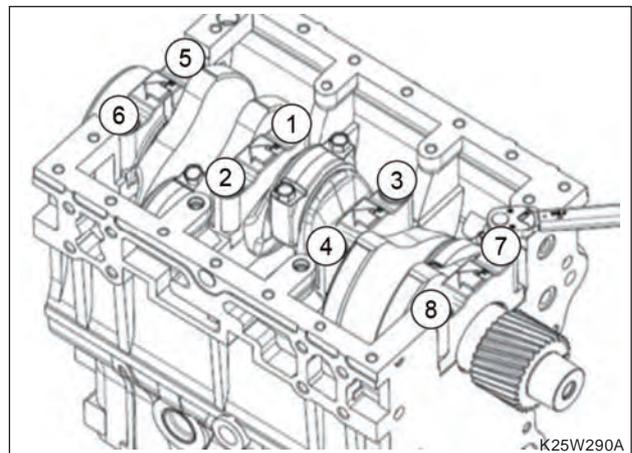
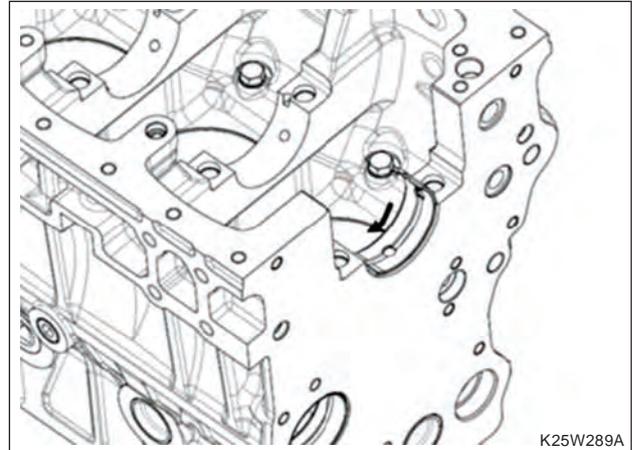
- Carefully clean and arrange disassemble parts.
- Check the tool box and jig.
- Prepare and check the spare parts. (Gasket, o-ring, packing, etc)
- Clean the work place during assemble of the engine.
- Assemble the engine according to work sheet and order in this book.
- Tightening torque of screws, 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 using the support on the work-bench.

### 6.4.3 CRANKSHAFT

#### ASSEMBLY PROCEDURE

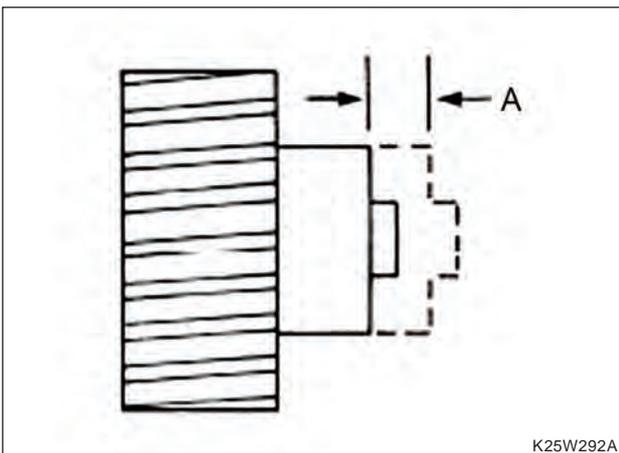


1. Cylinder block and bearing cap assemble with the new main bearing. Oil hole of main bearing assemble into the cylinder block.
2. Apply the lubricating oil on the crankshaft journal.
3. Put down the crankshaft on the cylinder block.

**⚠ 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. (T2300: 1→10, T1700: 1→8)
 (Tightening torque : 12.5kg-m)
- Check the crankshaft rotation.

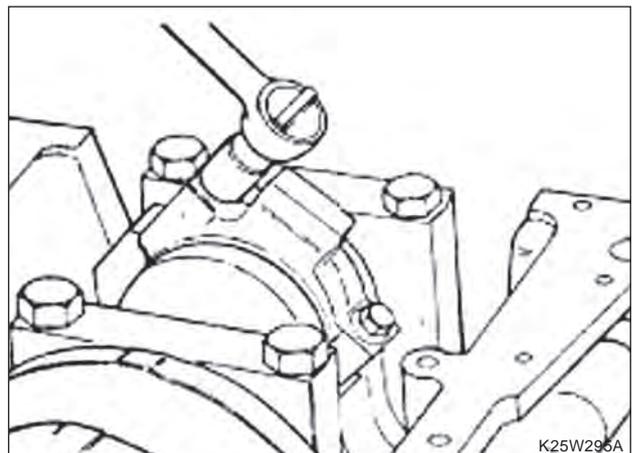
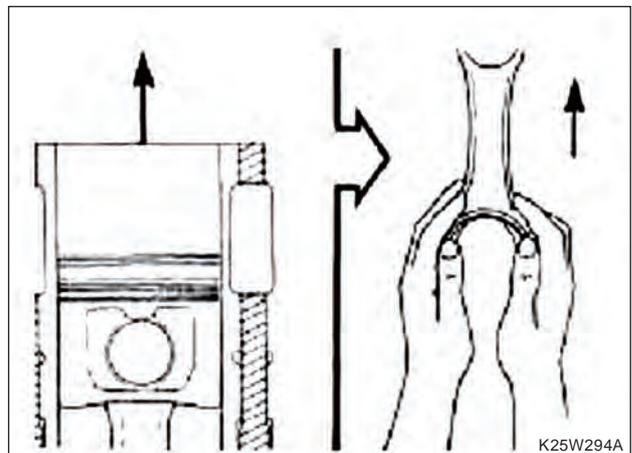
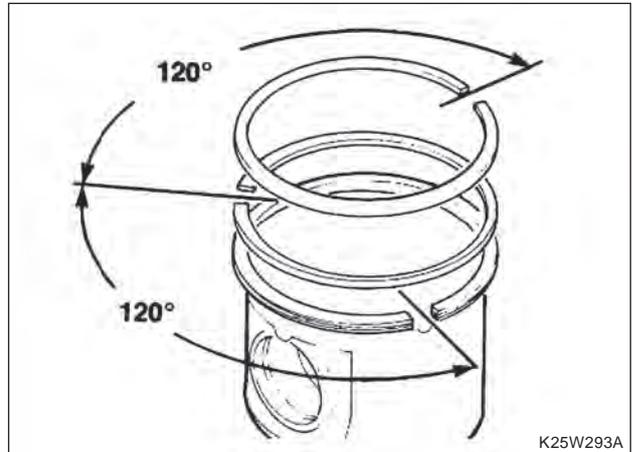
**CHECK THE CLEARANCE OF CRANKSHAFT SIDE**



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**

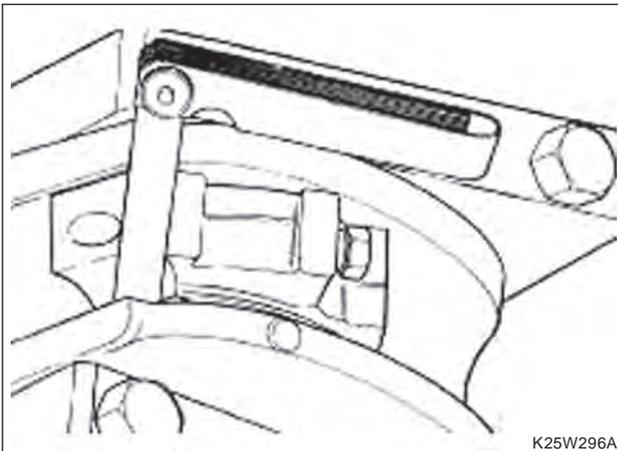
**ASSEMBLY PROCEDURE**



1. Assemble the piston assembly and connecting rod.
2. Turn the cylinder block 90 degrees.
3. Apply clean oil to the cylinder block and piston.
4. Position the piston ring gap at 120 degrees.
5. Assemble the crank pin bearing with the connecting rod. (Apply clean oil to the crankshaft pin and the pin bearing)

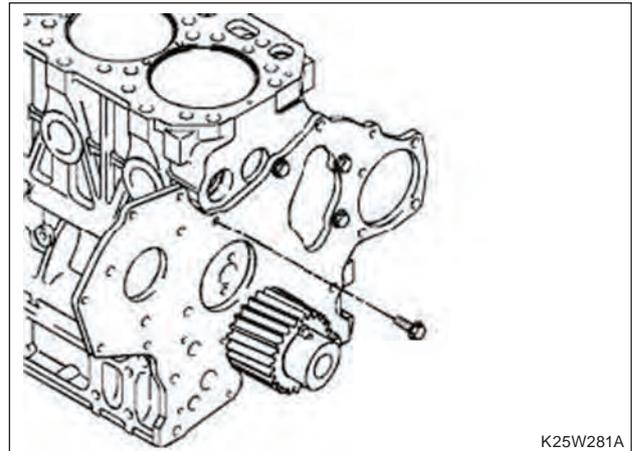
6. Press the piston ring. (With jig)
7. Rotate it and locate the crankshaft pin to TDC.
8. Assemble the piston in cylinder. (Please be sure that piston and ring is not damaged.)
9. After assembly, crankshaft rotate 180° and locate BTDC. And assemble the connecting rod cap with new bearing.
10. Locate same direction between connecting rod big end and 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



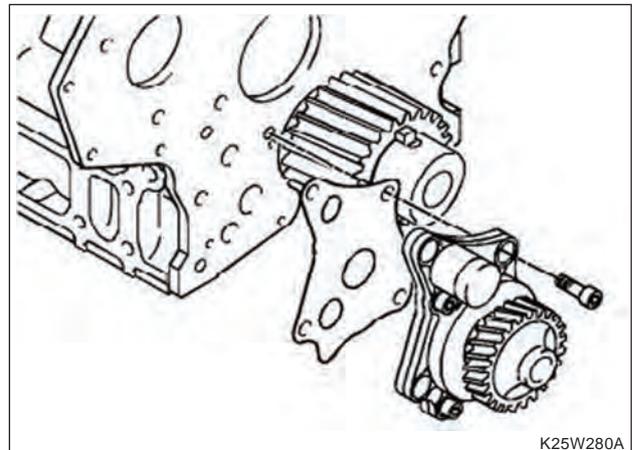
1. Check the clearance of connecting rod and cap. (Use clearance gage.)
2. Side clearance : 0.15 ~ 0.35 mm

#### 6.4.5 GEAR CASE FLANGE



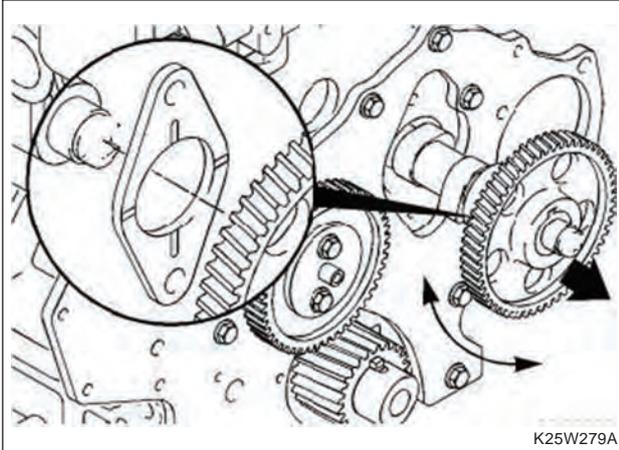
1. Apply the liquid gasket on the gear case flange. (Use Loctite 5060 or similar liquid gasket.)
2. Assemble the gear case flange and bolts to hold the gear case flange. (Tightening torque: 2.7 kg·m)

#### 6.4.6 OIL PUMP



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

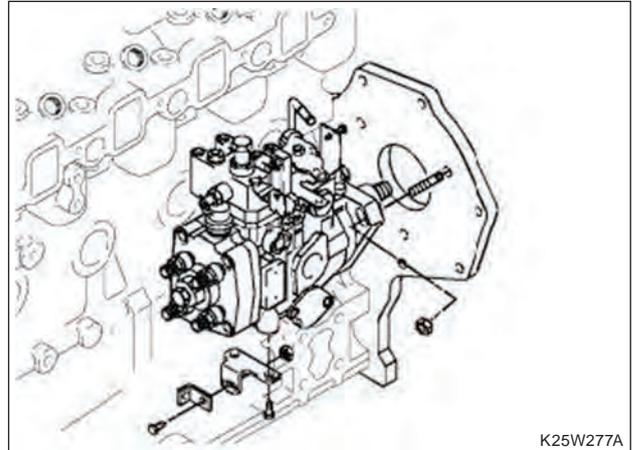
### 6.4.7 CAMSHAFT



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.

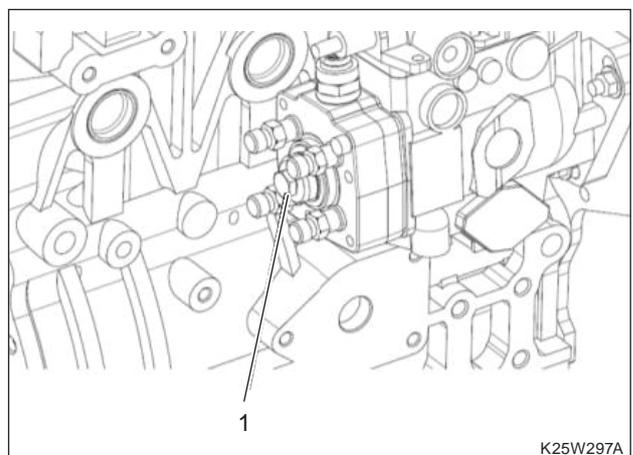
### 6.4.8 INJECTION PUMP

#### ASSEMBLY

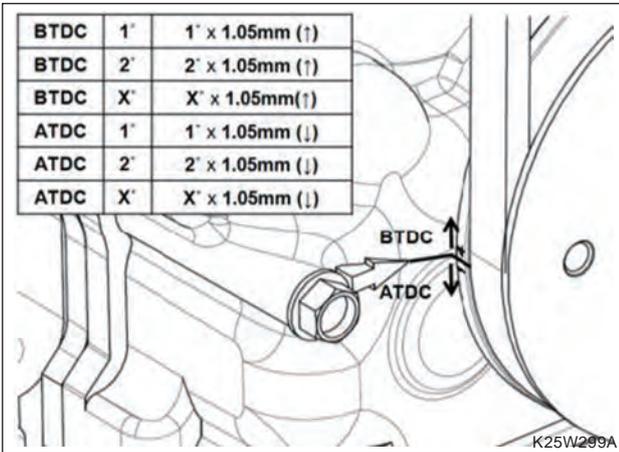
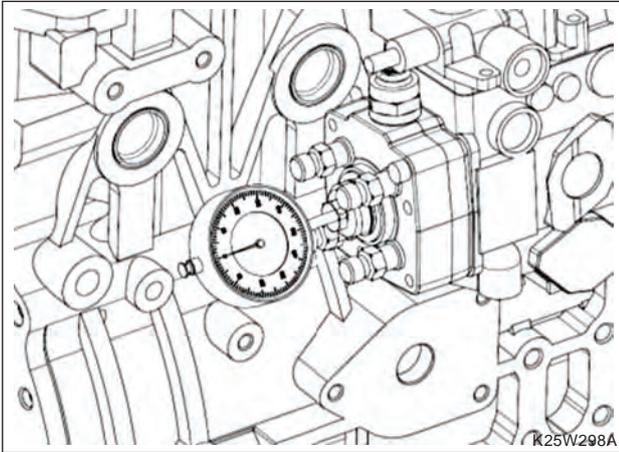


1. Assemble the o-ring in fuel injection pump and it in gear case flange. (Assemble the key radius type on the fuel injection pump shaft.)
2. Line up the injection pump gear and 'B' mark of idle gear (See 5.3.9), and then assemble the bolt and spring washer to hold fuel injection pump tentatively.
3.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

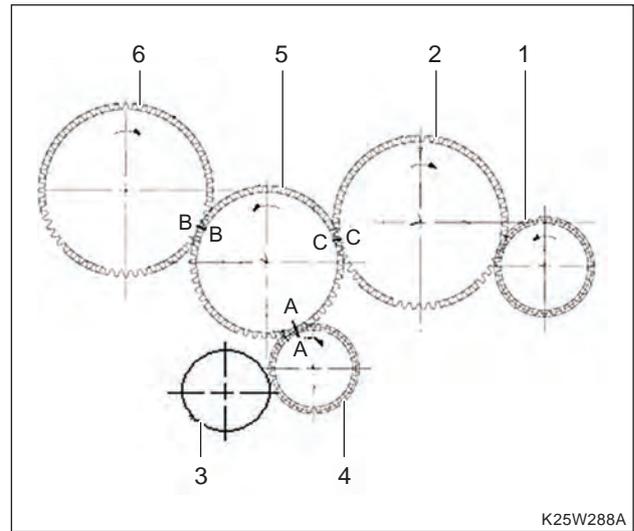


1. Disassemble the timing check plug (1) of fuel injection pump.
2. Assemble the dial gage. (with the jig)



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 gage by rotating the dial gage.
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.

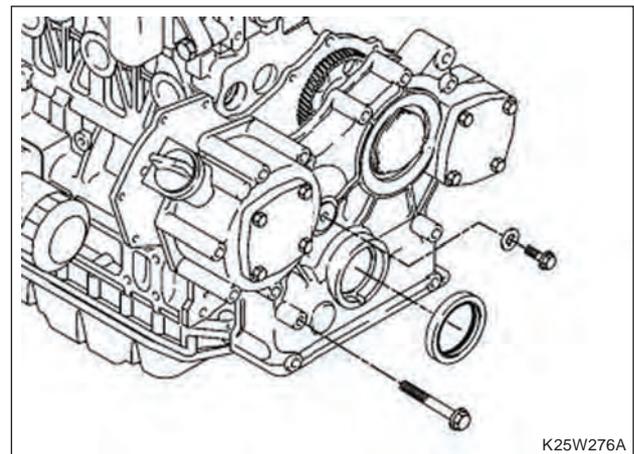
6.4.9 IDLE GEAR



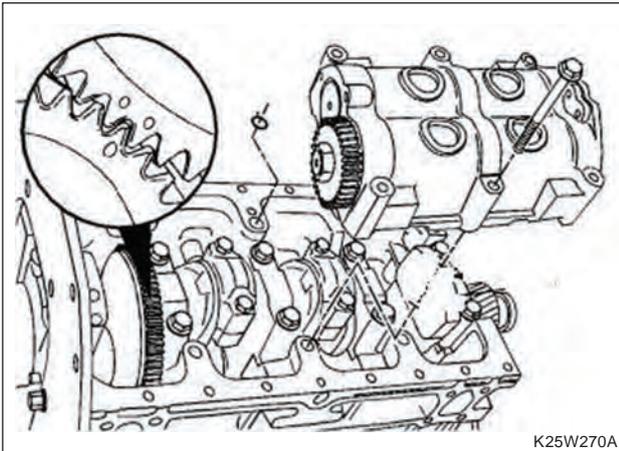
- (1) Hydraulic pump drive gear
- (2) Camshaft gear
- (3) Oil pump gear
- (4) Crank gear
- (5) Idle gear
- (6) Fuel injection pump gear

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).

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).

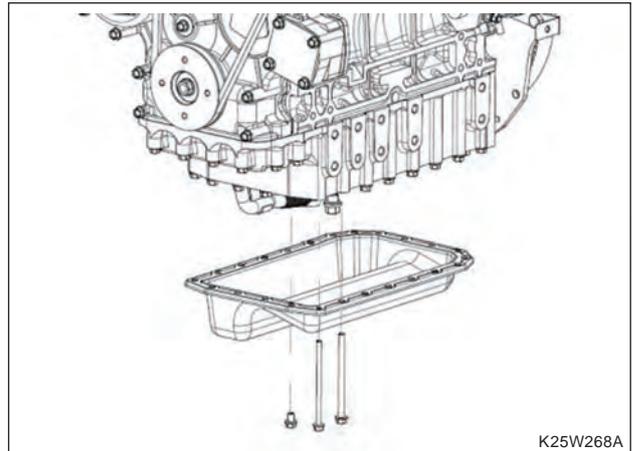
6.4.11 2<sup>ND</sup> BALANCER

K25W270A

1. Assemble the 2<sup>nd</sup> balancer. (Check the mark E-E)
2. Assemble the bolts to hold the 2<sup>nd</sup> balancer. (Tightening torque: 2.7 kg•m)

※ T1700 engine do not have 2<sup>nd</sup> balancer.

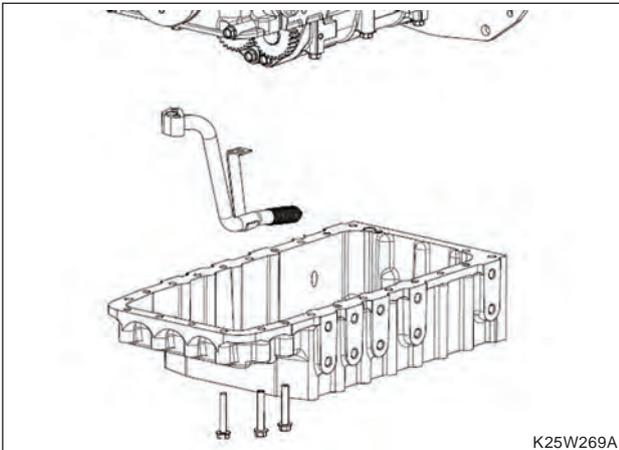
## 6.4.13 OIL PAN



K25W268A

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)

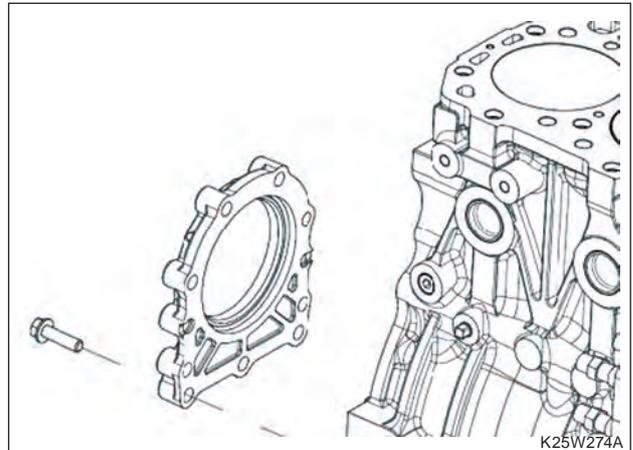
## 6.4.12 FRAME AND OIL SUCTION PIPE



K25W269A

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)

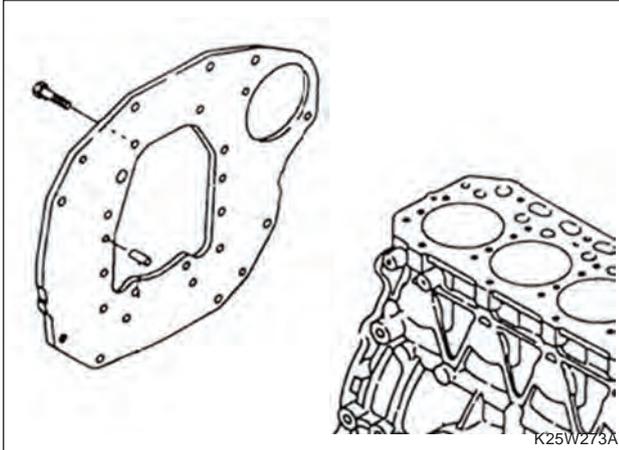
## 6.4.14 OIL SEAL HOUSING



K25W274A

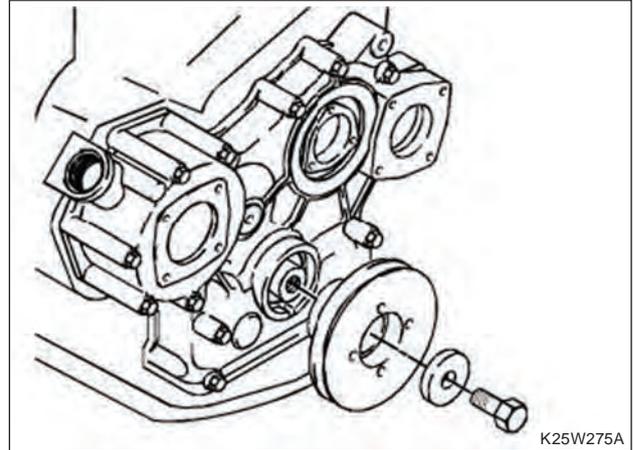
1. Apply the liquid packing on the oil seal housing. (Use Loctite 5060 or similar product.)
2. Assemble the oil seal housing.
3. Tighten the bolts to oil seal housing. (Tightening torque: 2.7 kg•m)

## 6.4.15 MOUNTING FLANGE



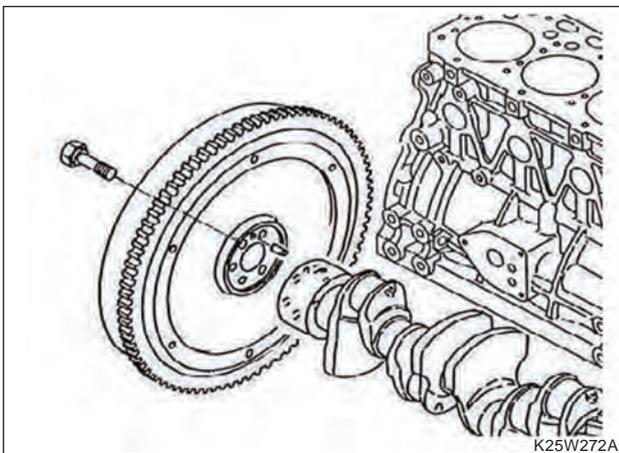
1. Assemble the mounting flange.
2. Tighten the bolts to hold mounting flange. (Tightening torque: 2.7 kg•m)

## 6.4.17 CRANK PULLEY



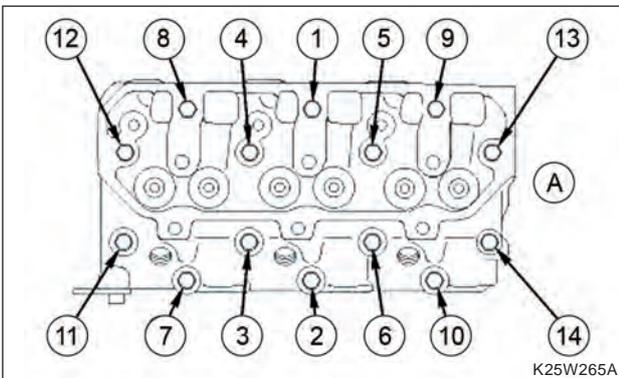
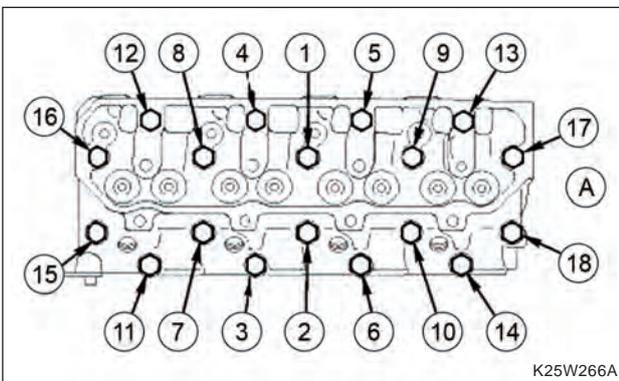
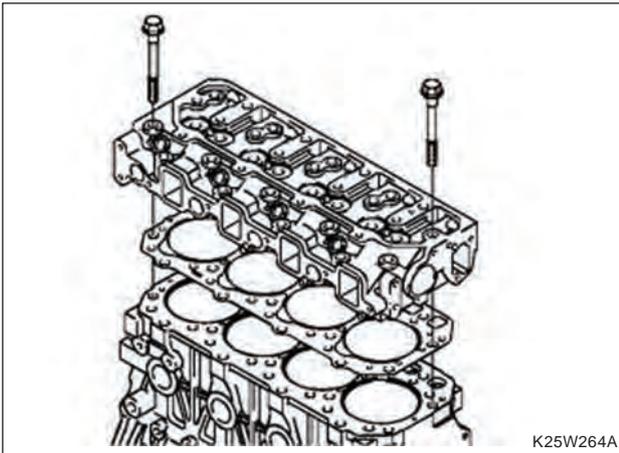
1. Assemble the crank pulley and washer.
2. Tighten the bolt to crank pulley. (Tightening torque: 11.5 kg•m)

## 6.4.16 FLYWHEEL



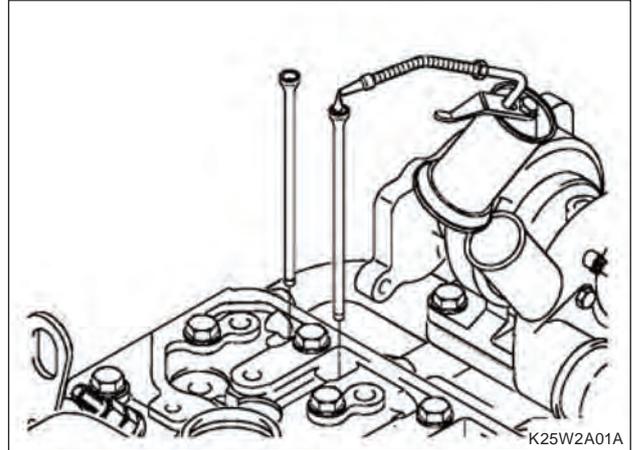
1. Assemble the flywheel.
2. Assemble the flywheel bolt within the factory specification and follow procedure.
  - A. Tighten the bolt. (Tightening torque: 3.0 kg•m)
  - B. And then tighten the bolt again to hold the flywheel. (Tightening torque: 9.0 kg•m)

6.4.18 CYLINDER HEAD



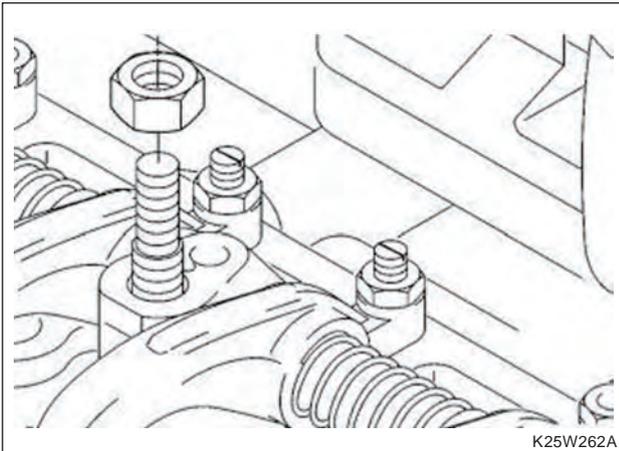
1. Assemble the head gasket.
2. Tighten the bolts to the cylinder head in order.  
 (T2300 : Order: Inside(1) → Outside(18))  
 (T1700 : Order: Inside(1) → Outside(14))  
 A. The bolt lubricates the lubricating oil.  
 B. Assemble the cylinder head bolt tentatively.  
 C. Assemble the bolt according 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)

6.4.19 PUSH ROD



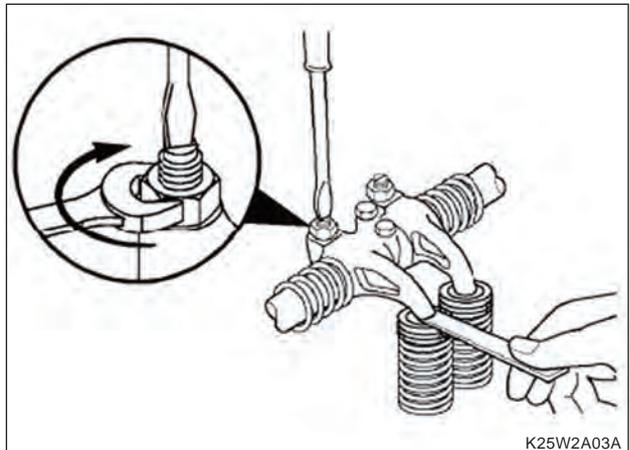
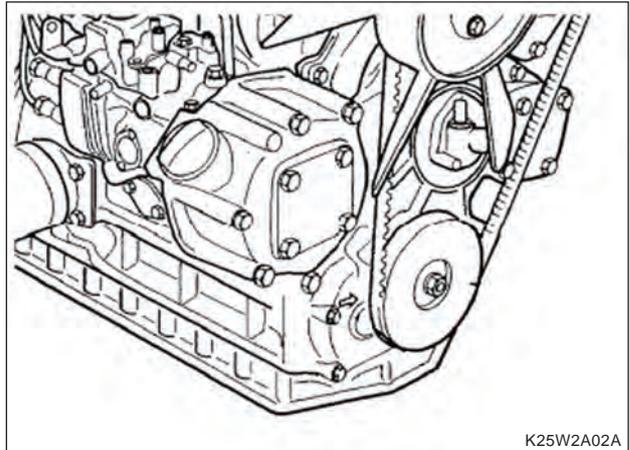
1. Assemble the push rod in socket of tappet in order.
2. Lubricate the lubricating oil on the push rod.

6.4.20 ROCKER ARM ASSEMBLY



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



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.

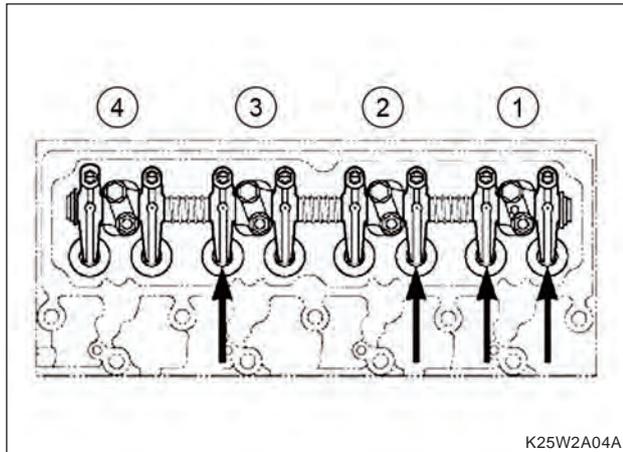
VALVE CLEARANCE (ENGINE COOLED STATUS)

Intake valve	Exhaust valve
0.3 mm	0.3 mm

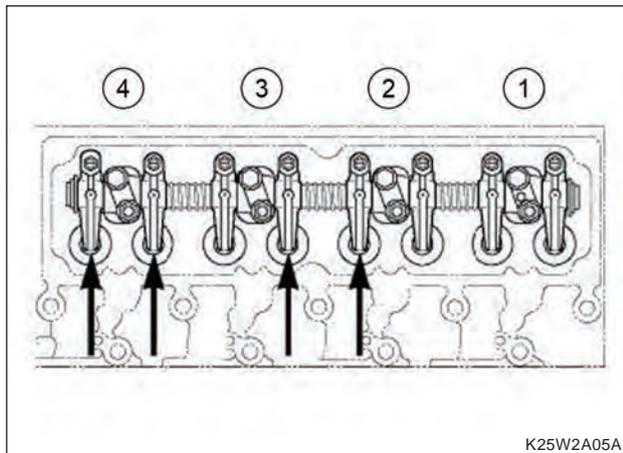
NOTE: Lower 60°C [140°F]

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

**ADJUSTMENT PROCEDURE**

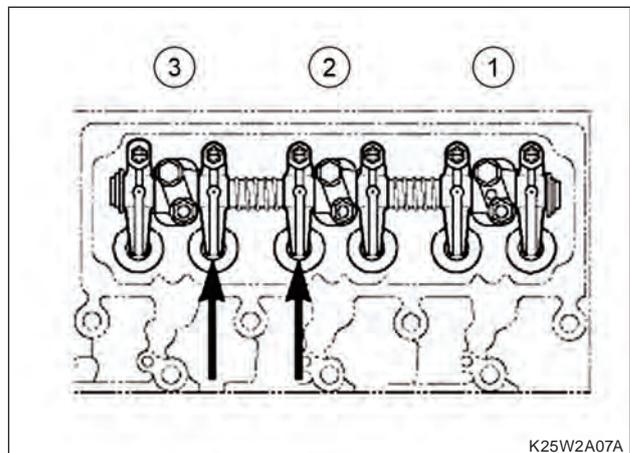
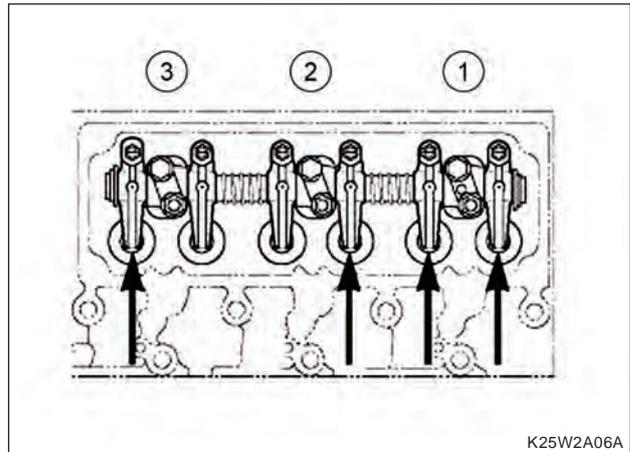


1. Adjust the intake valve of cylinder '1' and '2'.
2. Adjust the exhaust valve of cylinder '1' and '3'.
3. Rotate the crankshaft to rotation direction of engine. (360 degree.)



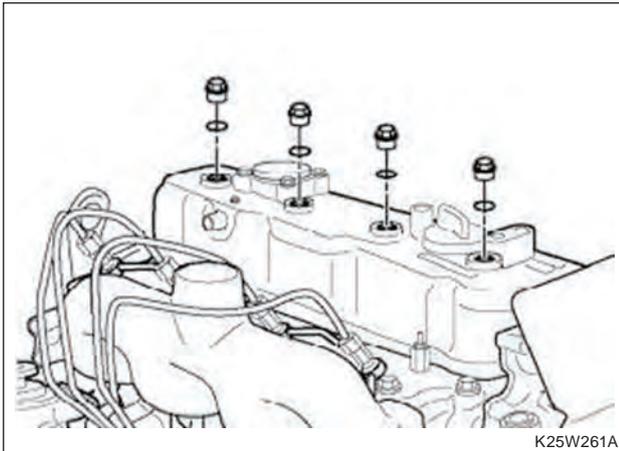
1. Adjust the intake valve of cylinder '3' and '4'.
2. Adjust the exhaust valve of cylinder '2' and '4'.

**ADJUSTMENT PROCEDURE FOR 3 CYLINDER ENGINE**



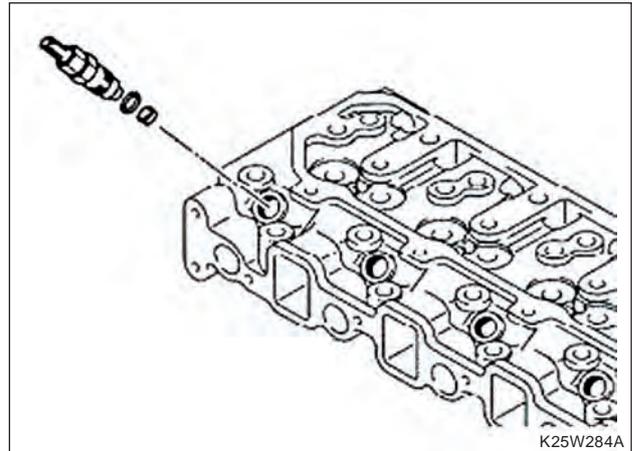
1. Rotate the engine until the first cylinder stay on TDC
2. Adjust the intake valve of cylinder '1' and '2'.
3. Adjust the exhaust valve of cylinder '1' and '3'.
4. Rotate the crankshaft to rotation direction of engine. (360 degree.)
5. Adjust the intake valve of cylinder '3'.
6. Adjust the exhaust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

## 6.4.21 CYLINDER HEAD COVER



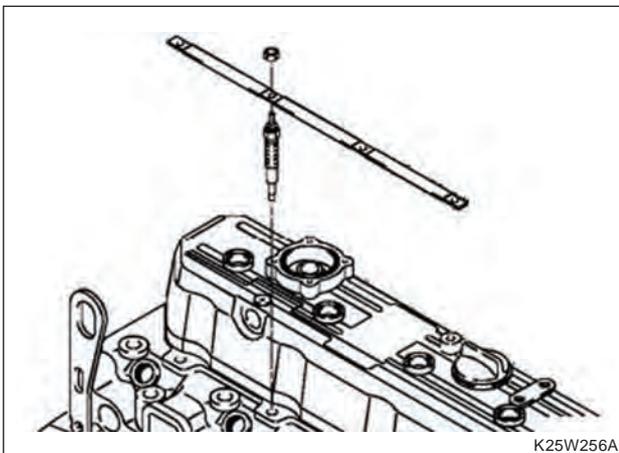
1. Assemble the new gasket and head cover.
2. Tighten the nuts to hold the head cover. (Tightening torque : 2.0 kg-m).

## 6.4.23 INJECTION VALVE (INJECTOR)



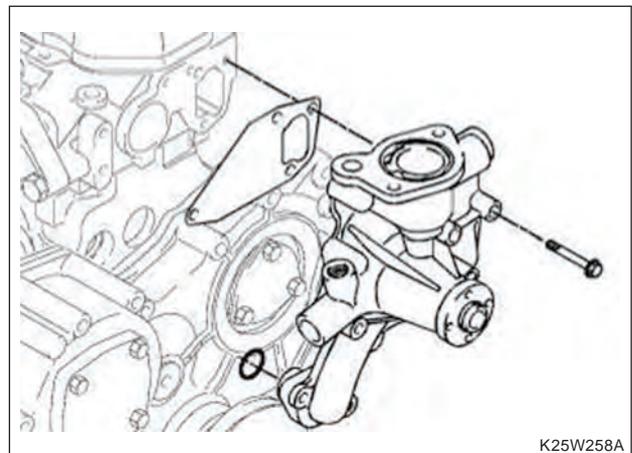
1. Assemble the new nozzle space cup and sealing washer.
2. Assemble and use the flat plate of injector. (Tightening torque : 7.5 kg-m)

## 6.4.22 GLOW PLUG



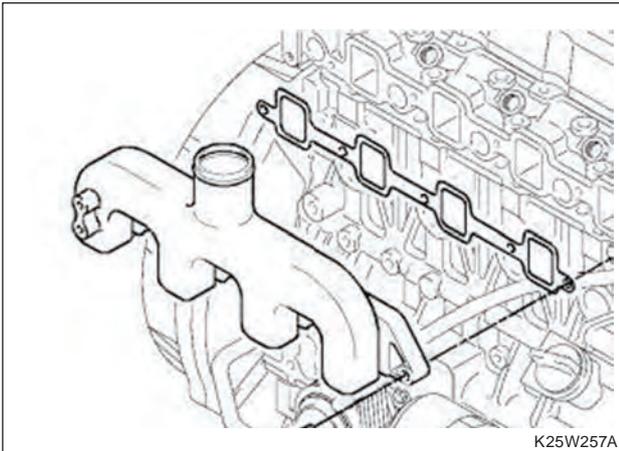
1. Tighten the glow plug.
2. Assemble the connector and tighten the nuts.

## 6.4.24 WATER PUMP



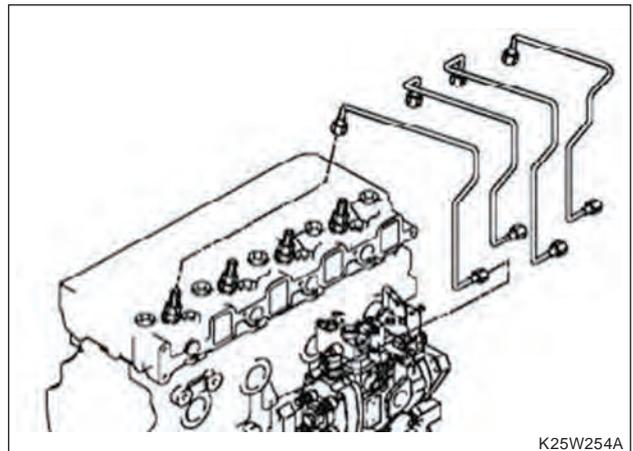
1. Assemble the water pump with new packing.
2. Tighten the bolts to water pump. (Tightening torque: 2.7 kg·m)
3. Assemble the V-pulley.
4. Tighten the bolts to V-pulley. (Tightening torque: 2.7 kg·m)

6.4.25 INTAKE MANIFOLD



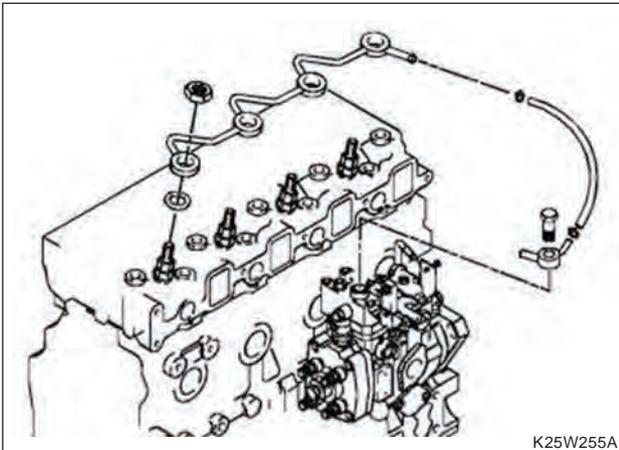
1. Assemble the intake manifold with new packing.
2. Tighten the bolts and nuts to hold the intake manifold. (Tightening torque: 2.7 kg•m)

6.4.27 FUEL SUPPLY PIPE.



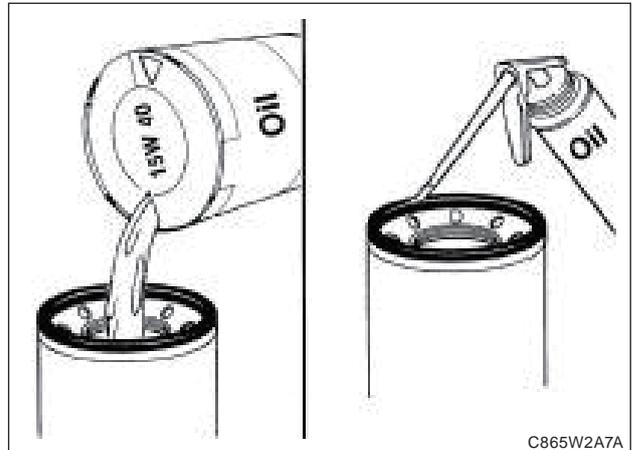
1. Assemble the high pressure pipe.
2. Tighten nuts between fuel injection pump and fuel injection valve. Use two wrenches in order to prevent rotating the relative parts. (Tightening torque : 2.7 kg-m)
3. Assemble the fuel line clamp.

6.4.26 FUEL DRAIN PIPE



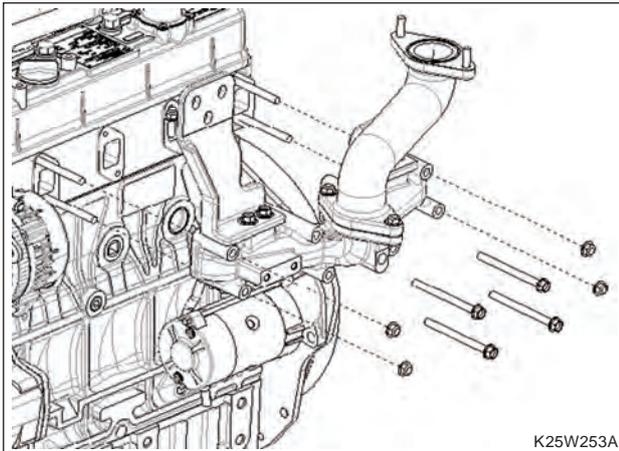
1. Assemble the new packing.
2. Tighten the nuts after install the drain pipe. (Tightening torque : 2.3 kg-m)
3. Assemble the drain hose. (Drain pipe ~ injection pump.)

6.4.28 OIL FILTER



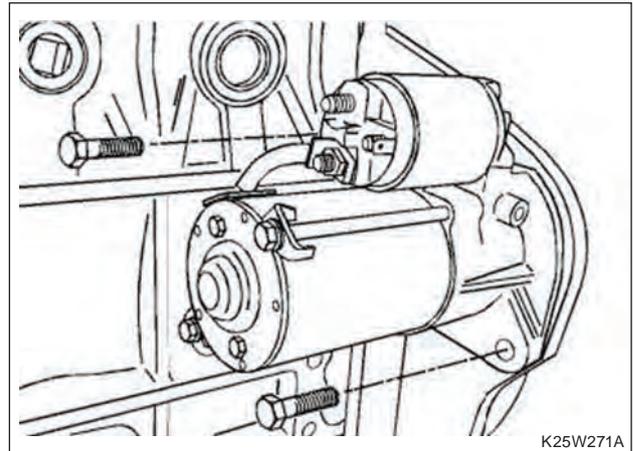
1. Assemble the oil filter using by tool.
2. If it is new part, put the lubricating oil in the oil filter.

## 6.4.29 EXHAUST MANIFOLD



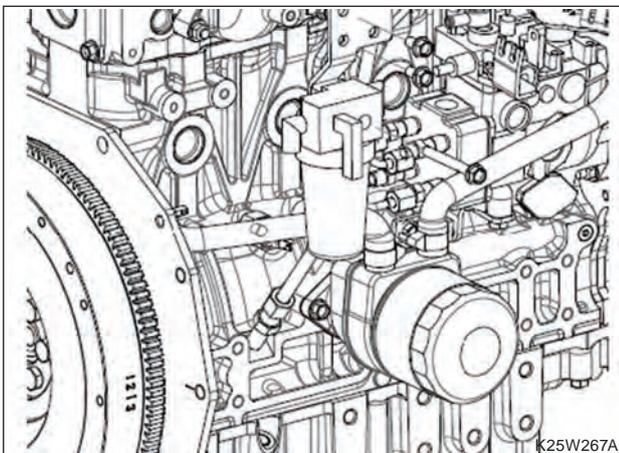
1. Assemble the exhaust manifold with new gasket.
2. Tighten the bolts and nuts to hold exhaust manifold. (Tightening torque: 2.7 kg·m)

## 6.4.31 STARTER



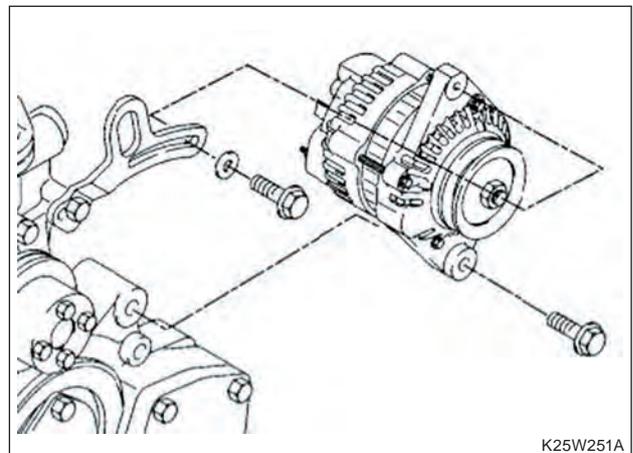
1. Assemble the starter.
2. Tighten the bolts to hold starter.

## 6.4.30 FUEL FILTER



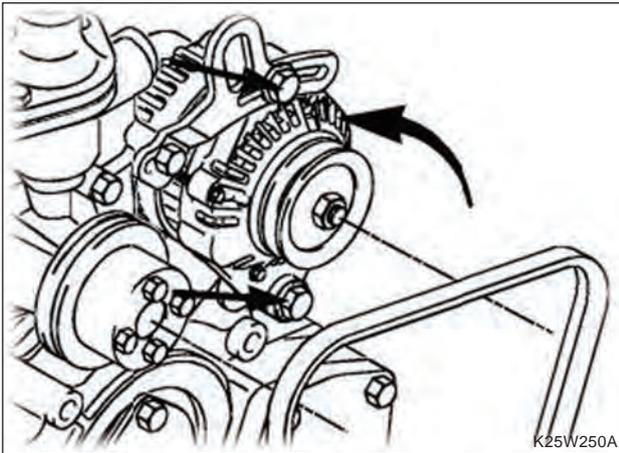
1. Assemble the fuel filter bracket with fuel filter.
2. Tighten the bolts to hold the fuel filter.
3. Connect the fuel filter and fuel inlet of fuel injection pump by using the hose.
4. Tighten the clamps to hold the hose.

## 6.4.32 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.

6.4.33 V-BELT



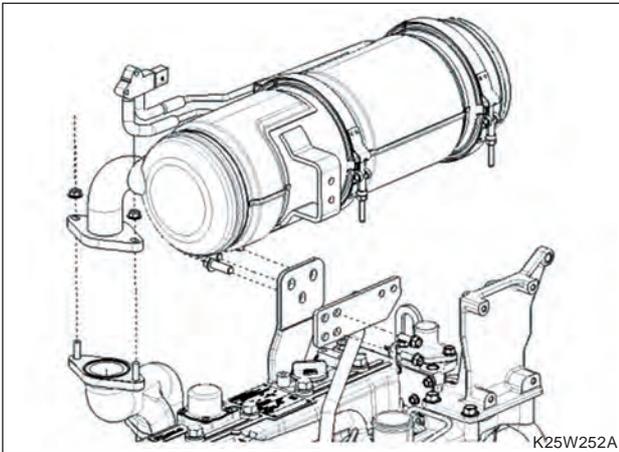
1. Adjust the tension of alternator after that tighten the adjust bolt and bolts.

6.4.35 LUBRICATING SYSTEM

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

OIL CAPACITY (LITER)	
ENGINE MODEL	LUBRICATING OIL
T1700	5.3
T2300	6.5

6.4.34 AFTER-TREATMENT DEVICE (ATD)



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

## 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.

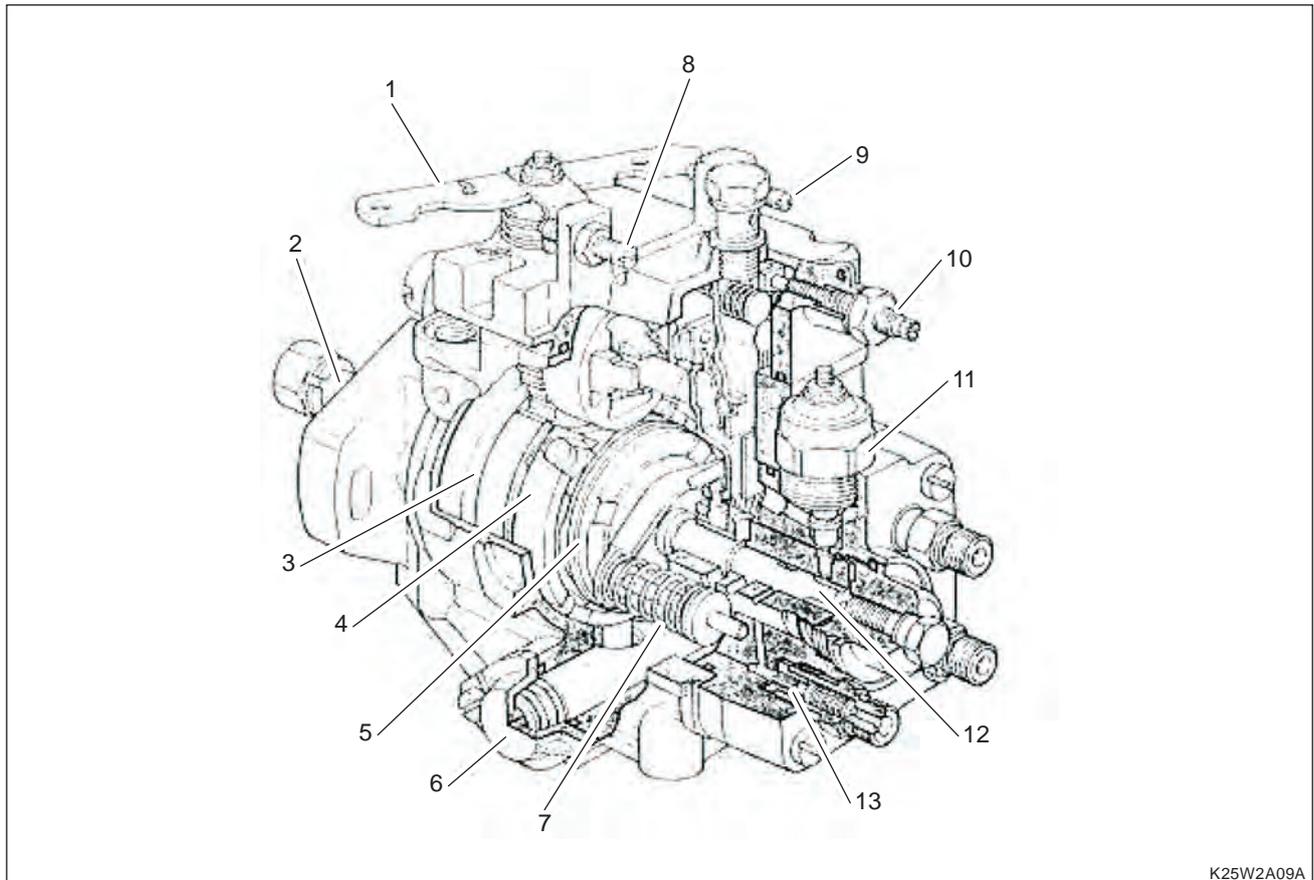
After finishing the running-in operation (50hrs), replace the lubricating oil and oil filter. (Lubricating oil according to the local characteristics used.)

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.



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

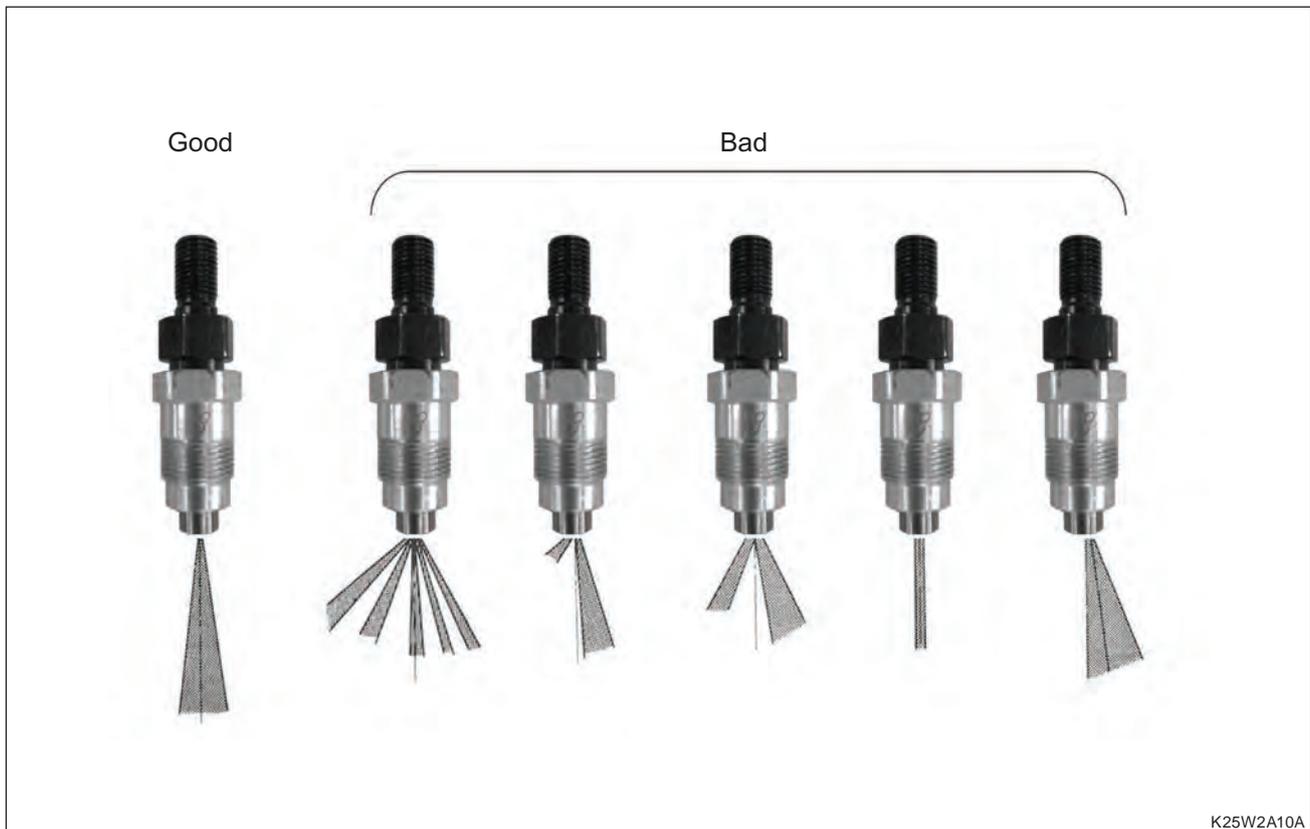
► SPECIFICATION

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	1-3-4-2 (4Cyl.) / 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	

### 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



After injector injection pressure is adjusted to  $120 \pm 5 \text{ kg/cm}^2$ , 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.

**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.

2

<b>STANDARD PRESSURE</b>	<b>OPENING PRESSURE</b>	Standard value
	<b>ADJUSTING PRESSURE</b>	standard value +5~10 kg/cm <sup>2</sup>
<b>LIMIT PRESSURE</b>		Above standard value -10kg/cm <sup>2</sup>

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.**

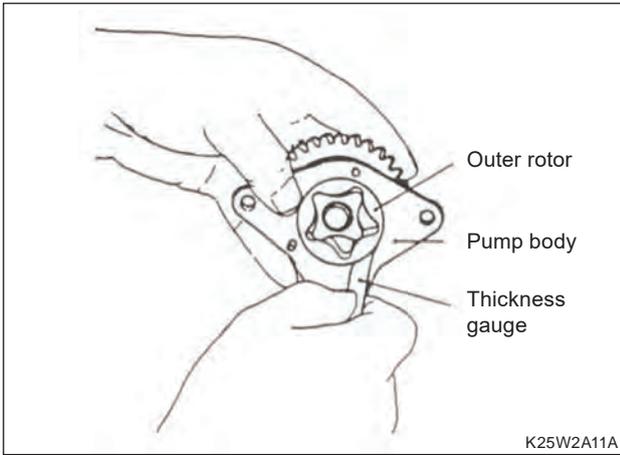
5. If you can't adjust injection pressure despite replace a thickness of the shim, injector replaces the assembly.

**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<sup>2</sup> 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.

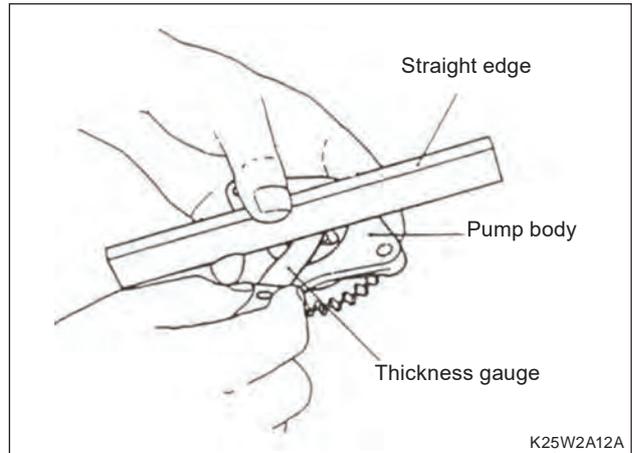
**CLEARANCE OF BETWEEN OUT ROTOR AND PUMP BODY**



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.

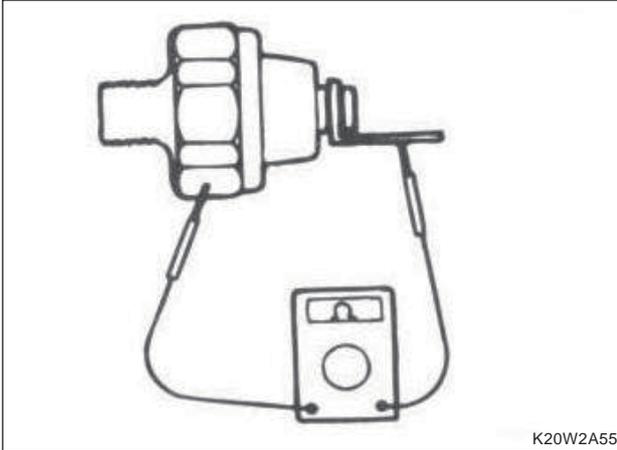
ITEM	STANDARD
Clearance (mm)	0.03 ~ 0.09

**CLEARANCE OF BETWEEN INNER ROTOR SHAFT AND OIL PUMP COVER**

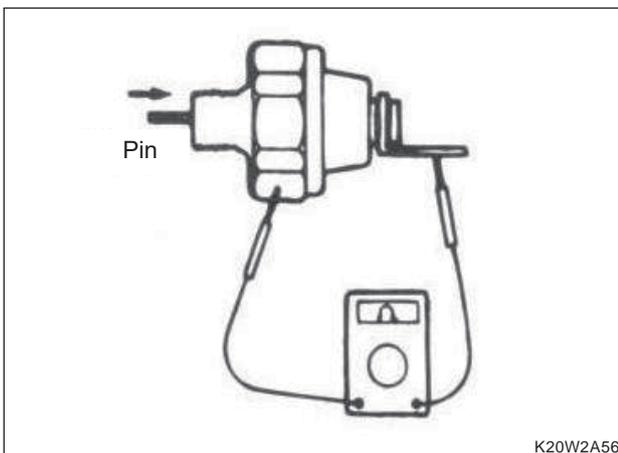
After measuring a rotor shaft outer diameter and oil pump cover inner diameter, calculate the difference between the inner diameter and outer diameter.

ITEM	STANDARD
Clearance (mm)	0.013 ~ 0.043

### 6.6.4 PRESSURE SWITCH



Connects the tester ( $\Omega$ ) 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  $0.5\text{kg/cm}^2$  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.

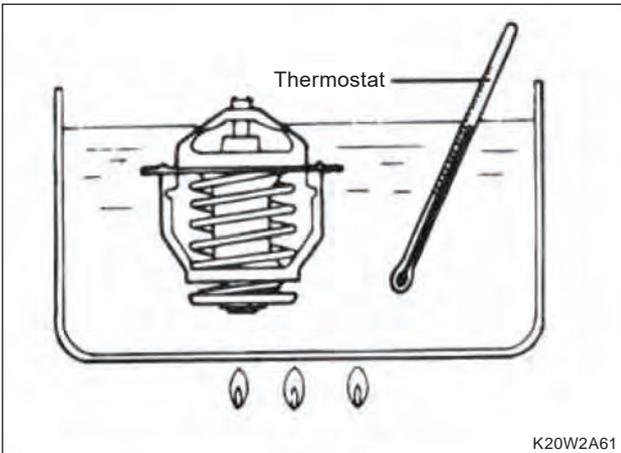
Coolant absorbing the oil heat and combustion heat is sent to thermostat of water pump. If temperature of coolant is lower than valve open temperature of thermostat, re-circulate inside the cylinder. And if temperature of coolant is higher than valve open temperature of thermostat, flow the radiator. 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.)

**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.

<b>VALVE OPEN TEMP</b>	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.,

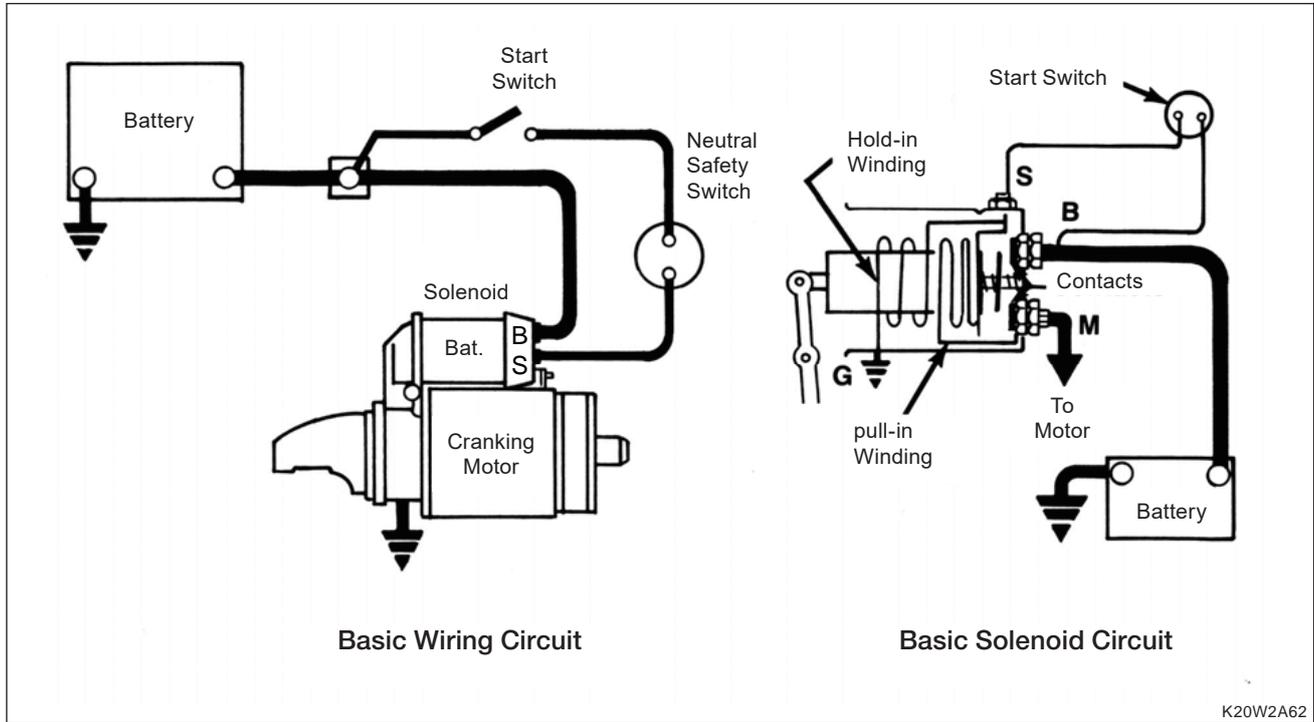
Do not confusion In this case, engine rotates at low speed and coolant temperature does to make fall naturally.

Then after, supplies the coolant and removes the cause.

6.7 ELECTRICAL SYSTEM

6.7.1 STARTER

**BASE CIRCUIT DIAGRAM**



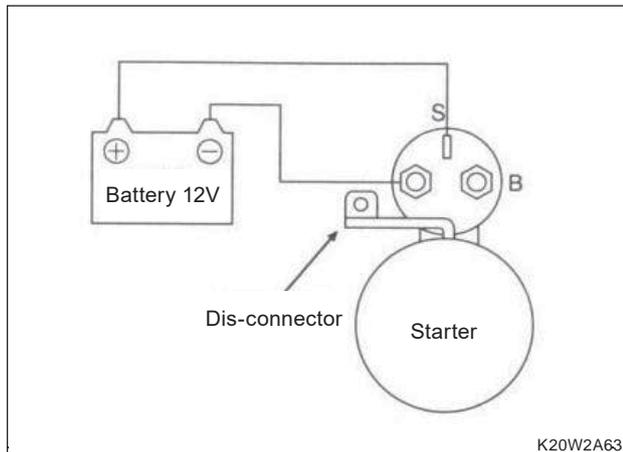
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**SPECIFICATION**

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)

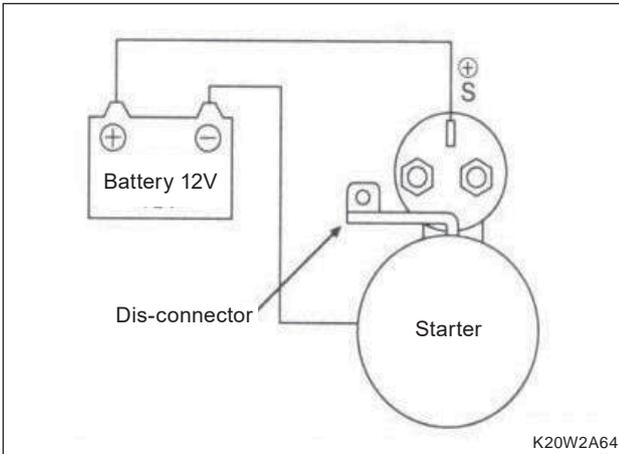


The case which connects battery between S-M terminal, if plunger comes in and the pinion comes out, the pull in winding is normality. If the pinion does not come out, replace the magnetic switch.

**CAUTION**

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

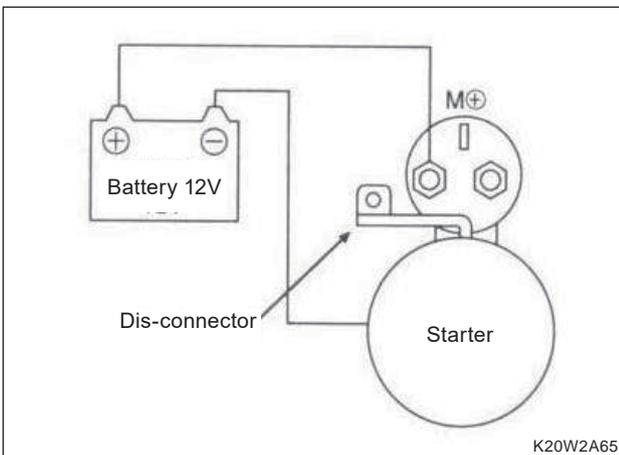
► PULL IN COIL TEST OF MAGNETIC SWITCH(SOLENOID)



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.

	<b>CAUTION</b>
<ul style="list-style-type: none"> <li>• Don't connect continuously more than 10 second.</li> </ul>	

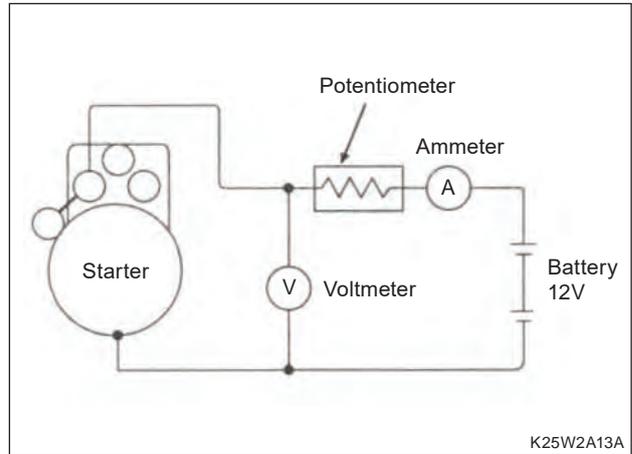
► MAGNETIC SWITCH RETURN TEST



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.

	<b>CAUTION</b>
<ul style="list-style-type: none"> <li>• Don't connect continuously more than 10 second.</li> </ul>	

► NO-LOAD TEST

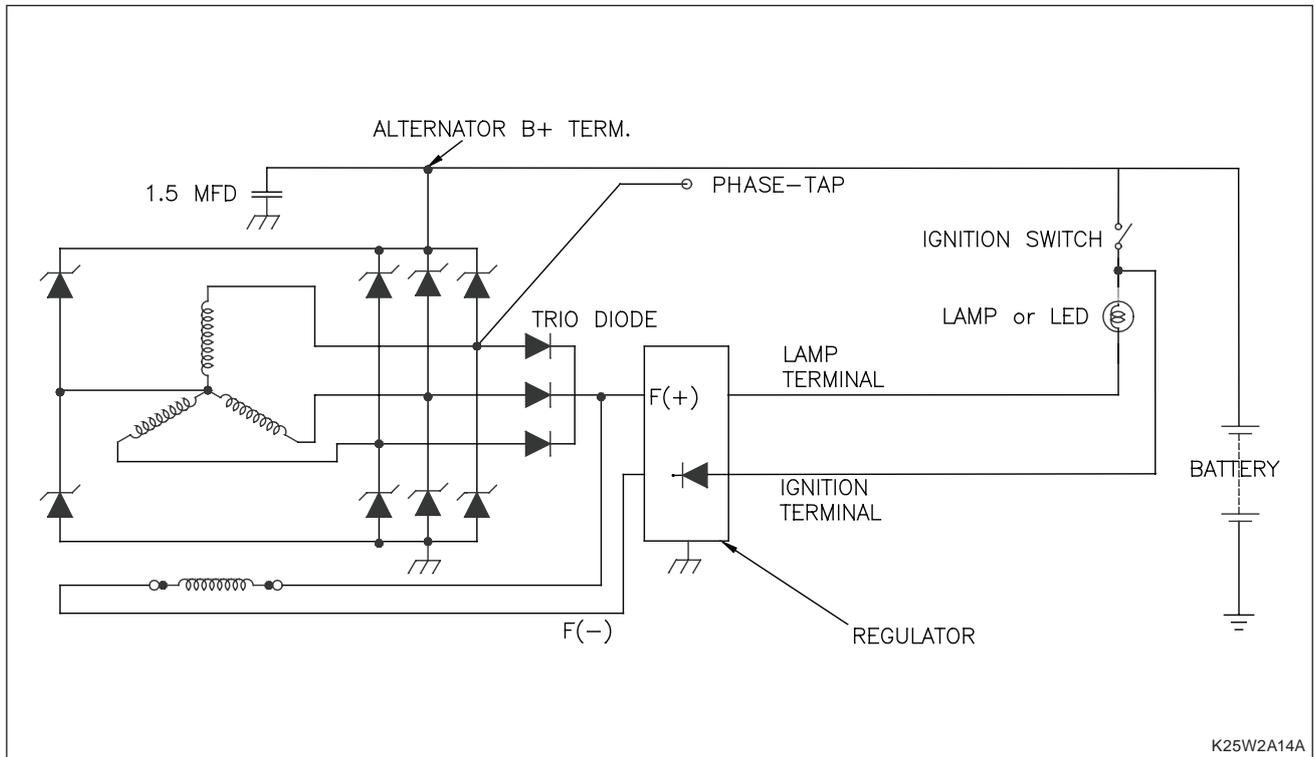


1. Connect the starter motor, battery, voltmeter, ammeter and variable resistance as picture.
2. If rotated when you switch to ON after making the variable resistance with the maximum, starter motor is normality. Rheostat adjusts to 11V in voltmeter. And if current and number of rotation are other case 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)	<ul style="list-style-type: none"> <li>- Stain of metal, oil contamination</li> <li>- Wear the pole piece of armature core</li> <li>- Short of armature</li> </ul>
Electric current is large current and doesn't rotate at all.	<ul style="list-style-type: none"> <li>- Earth of electronic switch</li> <li>- Earth of armature coil, field coil</li> <li>- Seizure of metal</li> </ul>
Electric current does not flow and does not rotate.	<ul style="list-style-type: none"> <li>- Disconnection of armature coil, field coil</li> <li>- Disconnection of brush, pigtail</li> <li>- Contamination of armature, connection defect between brush and armature by Highmica etc.,</li> </ul>
Electric current is small current and number of rotation is low. (Neither the torque is much strong)	<ul style="list-style-type: none"> <li>- Connection defect of field coil contact part (If shunt coil is disconnected or connection defect, rotation degree is also high)</li> </ul>
Electric current is large current and number of rotation is high.	<ul style="list-style-type: none"> <li>- Short of field coil</li> </ul>

6.7.2 ALTERNATOR

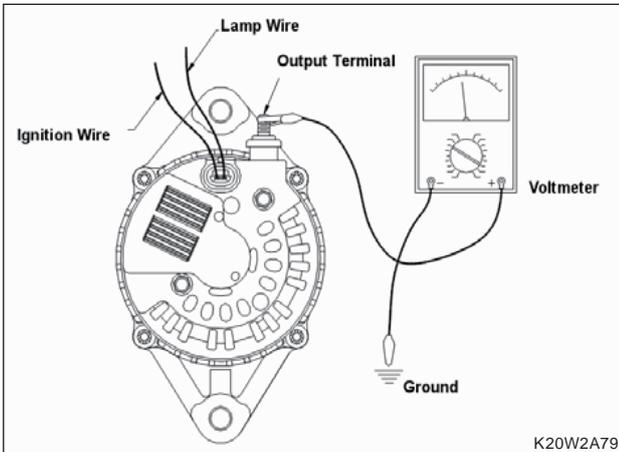
**BASE CIRCUIT DIAGRAM**



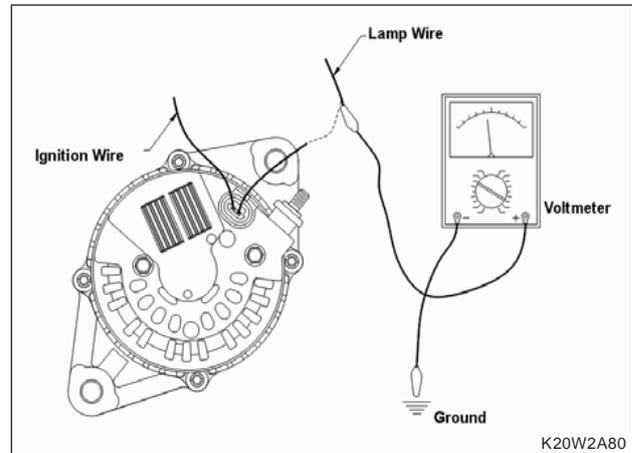
2

**SPECIFICATION**

ITEM	CONTENT
TYPE	Rectifier Alternator
CAPACITY	12.0V / 45A , 12V / 70A
MOTOR VELOCITY	1,000~18,000 rpm
REGULATOR SETTING VOLTAGE	14.7 ± 0.3V
TEMPERATURE COMPENSATE	-7 ± 3mV/°C

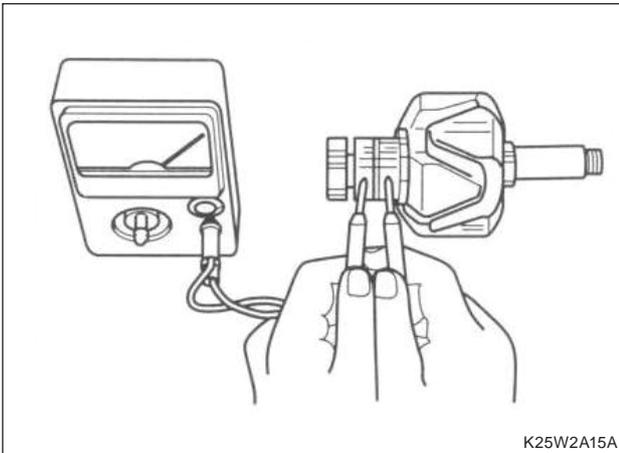
**CHECK****▶ ALTERNATOR OUTPUT VOLTAGE TEST ON ENGINE RUNNING CONDITION.**

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**

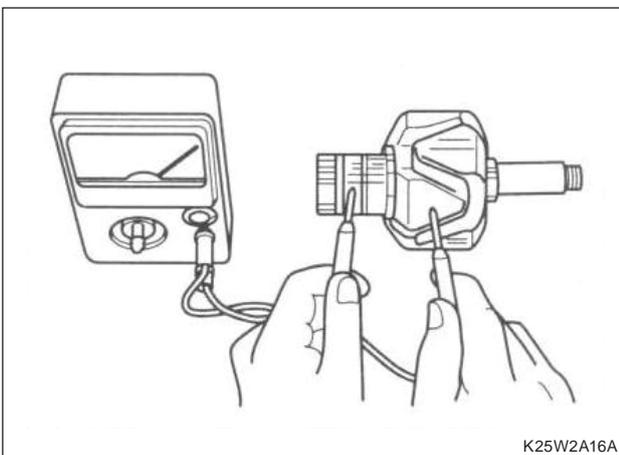
1. Unplug Ignition terminal of regulator connector from voltage regulator
2. Connect positive (+) voltmeter lead to Ignition wire on the wiring harness and negative (-) voltmeter lead to a ground terminal.
3. Voltmeter should indicate battery voltage. If battery voltage is not measured, check Ignition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

► ROTOR



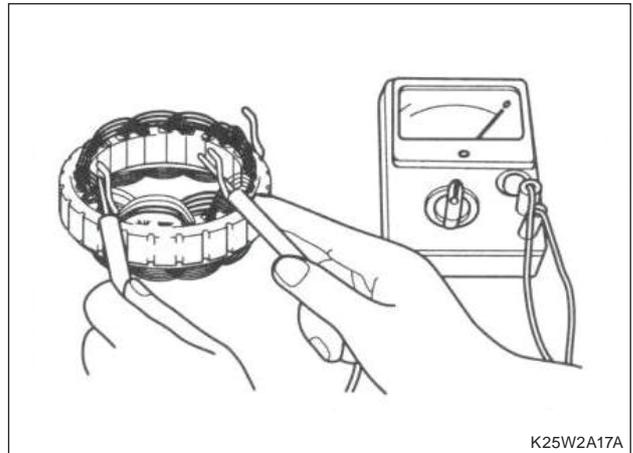
1. Check the conductivity of rotor coil. Confirm that whether or not conductivity between slip rings. Measure the resistance value and if the resistance value is very small, it is short. But if it is not conductivity or short, replace the rotor assembly.

<b>STANDARD</b>	about 27.5Ω / 20°C
-----------------	--------------------

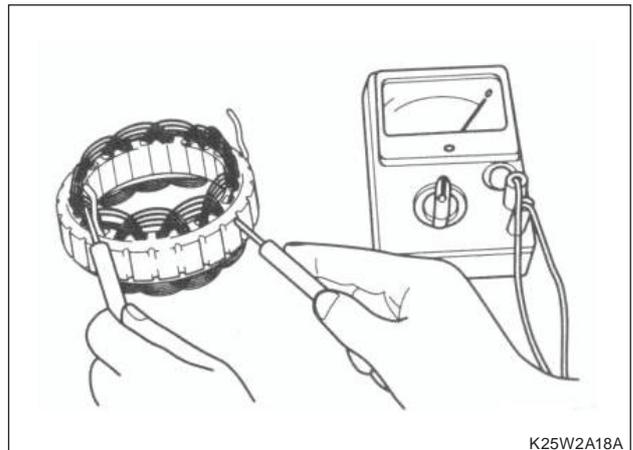


2. Check the earth of rotor coil. Confirm that whether or not conductivity between slip ring and earth. If it is electric conduction, replace the rotor assembly.

► STATOR



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.



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.

### 6.7.3 CAUTION FACT OF ELECTRIC WIRING

#### CHECK

- 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.

## 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	

## 7.2 STANDARD BOLT &amp; NUT TIGHTENING TORQUE

SIZE	4T		7T		9T	
	NORMAL THREAD	FINE THREAD	NORMAL THREAD	FINE THREAD	NORMAL THREAD	FINE THREAD
M 5	40 ± 5 kgf·cm 3.92 ± 0.49 N.m 2.89 ± 0.36 lbf.ft		60 ± 10 kgf·cm 5.88 ± 0.98 N.m 4.33 ± 0.72 lbf.ft		90 ± 10 kgf·cm 8.82 ± 0.98 N.m 6.50 ± 0.72 lbf.ft	
M 6	60 ± 10 kgf·cm 5.88 ± 0.98 N.m 4.33 ± 0.72 lbf.ft	-	130 ± 10 kgf·cm 12.74 ± 0.98 N.m 9.39 ± 0.72 lbf.ft	-	135 ± 10 kgf·cm 13.23 ± 0.98 N.m 9.75 ± 0.72 lbf.ft	-
M 8	150 ± 20 kgf·cm 14.70 ± 1.96 N.m 10.83 ± 1.44 lbf.ft		270 ± 30 kgf·cm 26.46 ± 2.94 N.m 19.49 ± 2.16 lbf.ft		330 ± 20 kgf·cm 32.34 ± 1.96 N.m 23.83 ± 1.44 lbf.ft	
M 10	300 ± 50 kgf·cm 29.40 ± 4.90 N.m 21.66 ± 3.61 lbf.ft	240 ± 40 kgf·cm 23.52 ± 3.92 N.m 17.33 ± 2.89 lbf.ft	530 ± 70 kgf·cm 51.94 ± 6.86 N.m 38.27 ± 5.05 lbf.ft	420 ± 60 kgf·cm 41.16 ± 5.88 N.m 30.32 ± 4.33 lbf.ft	690 ± 30 kgf·cm 67.62 ± 2.94 N.m 49.82 ± 2.17 lbf.ft	550 ± 30 kgf·cm 53.90 ± 2.94 N.m 39.71 ± 2.16 lbf.ft
M 12	530 ± 70 kgf·cm 51.94 ± 6.86 N.m 38.27 ± 5.05 lbf.ft	420 ± 60 kgf·cm 41.16 ± 5.88 N.m 30.32 ± 4.33 lbf.ft	900 ± 100 kgf·cm 88.20 ± 9.80 N.m 64.98 ± 7.22 lbf.ft	720 ± 80 kgf·cm 70.56 ± 7.84 N.m 51.98 ± 5.77 lbf.ft	1130 ± 70 kgf·cm 110.74 ± 6.86 N.m 81.59 ± 5.05 lbf.ft	900 ± 60 kgf·cm 88.20 ± 5.88 N.m 64.98 ± 4.33 lbf.ft
M 14	780 ± 70 kgf·cm 76.44 ± 6.86 N.m 56.32 ± 5.05 lbf.ft	620 ± 60 kgf·cm 60.76 ± 5.88 N.m 44.76 ± 4.33 lbf.ft	1350 ± 150 kgf·cm 132.30 ± 14.70 N.m 97.47 ± 10.83 lbf.ft	1080 ± 120 kgf·cm 105.84 ± 11.76 N.m 77.98 ± 8.66 lbf.ft	1850 ± 150 kgf·cm 181.30 ± 14.70 N.m 133.57 ± 10.83 lbf.ft	1480 ± 120 kgf·cm 145.04 ± 11.76 N.m 106.86 ± 8.66 lbf.ft
M 16	1250 ± 150 kgf·cm 122.50 ± 14.70 N.m 90.25 ± 10.83 lbf.ft	1000 ± 120 kgf·cm 98.00 ± 11.76 N.m 72.20 ± 8.66 lbf.ft	1900 ± 200 kgf·cm 186.20 ± 19.60 N.m 137.18 ± 14.44 lbf.ft	1520 ± 160 kgf·cm 148.96 ± 15.68 N.m 109.74 ± 11.55 lbf.ft	2580 ± 220 kgf·cm 252.84 ± 21.56 N.m 186.28 ± 15.88 lbf.ft	2060 ± 220 kgf·cm 201.88 ± 21.56 N.m 148.73 ± 15.88 lbf.ft
M 18	1750 ± 150 kgf·cm 171.50 ± 14.70 N.m 126.35 ± 10.83 lbf.ft	1400 ± 120 kgf·cm 137.20 ± 11.76 N.m 101.08 ± 8.66 lbf.ft	2650 ± 250 kgf·cm 259.70 ± 24.50 N.m 191.33 ± 18.05 lbf.ft	2120 ± 200 kgf·cm 207.76 ± 19.60 N.m 153.06 ± 14.44 lbf.ft	3800 ± 300 kgf·cm 372.40 ± 29.40 N.m 274.36 ± 21.66 lbf.ft	3040 ± 240 kgf·cm 297.92 ± 23.52 N.m 219.49 ± 17.33 lbf.ft
M 20	2450 ± 250 kgf·cm 240.10 ± 24.50 N.m 176.89 ± 18.05 lbf.ft	1960 ± 200 kgf·cm 192.08 ± 19.60 N.m 141.51 ± 14.44 lbf.ft	3700 ± 400 kgf·cm 362.60 ± 39.20 N.m 267.14 ± 28.88 lbf.ft	2960 ± 320 kgf·cm 290.08 ± 31.36 N.m 213.71 ± 23.10 lbf.ft	5400 ± 400 kgf·cm 529.20 ± 39.20 N.m 389.88 ± 28.88 lbf.ft	4320 ± 320 kgf·cm 423.36 ± 31.36 N.m 311.90 ± 23.10 lbf.ft

PT PLUG	SIZE	1/8	1/4	3/8	1/2	3/4
	ALUMINUM	150 ± 20 kgf·cm 14.70 ± 1.96 N.m 10.83 ± 1.44 lbf.ft	200 ± 30 kgf·cm 19.60 ± 2.94 N.m 14.44 ± 2.17 lbf.ft	250 ± 30 kgf·cm 24.50 ± 2.94 N.m 18.05 ± 2.17 lbf.ft	350 ± 50 kgf·cm 34.30 ± 4.90 N.m 25.27 ± 3.61 lbf.ft	460 ± 50 kgf·cm 45.08 ± 4.90 N.m 33.21 ± 3.61 lbf.ft
	CAST	200 ± 20 kgf·cm 19.60 ± 1.96 N.m 14.44 ± 1.44 lbf.ft	250 ± 30 kgf·cm 24.50 ± 2.94 N.m 18.05 ± 2.17 lbf.ft	360 ± 30 kgf·cm 35.28 ± 2.94 N.m 25.99 ± 2.17 lbf.ft	560 ± 50 kgf·cm 54.88 ± 4.90 N.m 40.43 ± 3.61 lbf.ft	770 ± 50 kgf·cm 75.46 ± 4.90 N.m 55.59 ± 3.61 lbf.ft

HOLLOW BOLT	M 8	M 12	M 14	M 16
	150 ± 20 kgf·cm 14.70 ± 1.96 N.m 10.83 ± 1.44 lbf.ft	300 ± 50 kgf·cm 29.40 ± 4.90 N.m 21.66 ± 3.61 lbf.ft	450 ± 50 kgf·cm 44.10 ± 4.90 N.m 32.49 ± 3.61 lbf.ft	550 ± 50 kgf·cm 53.90 ± 4.90 N.m 39.71 ± 3.61 lbf.ft

## 7.3 SERVICE DATA

## 7.3.1 CYLINDER HEAD

MODEL		T1700NA, T2300NA(T)	
ITEM		STANDARD	WEAR LIMIT
Cylinder head combustion surface distortion		0.03 or less	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 outside dia.	Ø7.96 ~ Ø7.97	Ø7.9
	Valve guide inside dia.	Ø8.010 ~ Ø8.025	Ø8.1
	Oil clearance	0.040 ~ 0.055	0.15
Exhaust valve	Valve stem outside dia.	Ø7.96 ~ Ø7.97	Ø7.9
	Valve guide inside dia.	Ø8.010 ~ Ø8.025	Ø8.1
	Oil clearance	0.040 ~ 0.055	0.15
Valve guide projection		13	-
Valve sinking depth	Intake valve	0.7	1.0
	Exhaust valve	0.7	
Thickness of valve head	Intake valve	1.2	0.5
	Exhaust valve	1.2	
Intake valve timing	Open	b. TDC	-
	Close	a. BDC	
Exhaust valve timing	Open	b. BDC	
	Close	a. TDC	
Valve spring	Free length		46.1
	Inclination		-
	Tension (when compressed to 1mm length)		1.883
Intake & Exhaust valve clearance		0.15 ~ 0.25	0.25 ~ 0.35

## 7.3.2 CYLINDER BLOCK

MODEL		T1700NA, T2300NA(T)	
Item		Standard	Wear limit
Cylinder bore	L	Ø88.015 ~ Ø88.025	Ø88.20
	S	Ø88.005 ~ Ø88.015	
Cylinder roundness		0 ~ 0.01	0.03
Cylindricity		0 ~ 0.015	0.03

## 7.3.3 VALVE ROCKER ARM

MODEL		T1700NA, T2300NA(T)	
Item		Standard	Wear limit
Intake & Exhaust rocker arm	Rocker arm shaft outside dia.	Ø15.959 ~ Ø15.98	Ø18.95
	Rocker arm pushing inside dia.	Ø19.0 ~ Ø16.021	Ø19.09
	Oil clearance	0.020 ~ 0.062	0.14
Pushrod bending		0.03 or less	0.25 or less
Tappet	Tappet stem outside dia.	Ø14.224 ~ Ø14.249	Ø14.18
	Tappet guide hole inside dia.	Ø14.260 ~ Ø14.280	Ø14.30
	Oil clearance	0.011 ~ 0.056	0.12

## 7.3.4 PISTON

MODEL		T1700NA, T2300NA(T)	
Item		Standard	Wear limit
Piston outside dia.	A	Ø87.965~Ø87.975	Ø87.90
	C	Ø87.960~Ø87.965	
Min. clearance between piston and cylinder		0.040 ~ 0.070	-
Top clearance		0.8	-
Piston and piston pin	Piston pin outside dia.	Ø30.0 ~ Ø29.991	Ø29.90
	Piston pin hole	Ø30.0 ~ Ø30.008	Ø30.02
	Oil clearance	0 ~ 0.017	0.12

## 7.3.5 PISTON RING

MODEL		T1700NA, T2300NA(T)	
Item		Standard	Wear limit
Top ring	Ring groove width	2.06 ~ 2.08	-
	Ring width	1.97 ~ 1.99	-
	Min. side 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	-
	Min. side 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	-
	Min. side clearance	0.03 ~ 0.07	-
	End clearance	0.20 ~ 0.40	1.5

## 7.3.6 CONNECTING ROD

MODEL		T1700NA, T2300NA(T)	
Item		Standard	Wear limit
Crankpin side	Crankpin pushing inside dia.	Ø53.0 ~ Ø53.019	-
	Crankpin metal thickness	1.487 ~ 1.50	-
	Crankpin outside dia.	Ø49.95 ~ Ø49.964	Ø49.91
	Oil clearance	0.038 ~ 0.095	0.15
Piston pin side	Piston pin pushing inside dia.	Ø30.025 ~ Ø30.038	Ø30.10
	Piston pin outside dia.	Ø29.991 ~ Ø30.0	Ø29.90
	Oil clearance	0.025 ~ 0.047	0.2
Twist and parallelism		Ø0.05/100mm or less	Ø0.08

## 7.3.7 CAMSHAFT

MODEL		T1700NA, T2300NA(T)	
Item		Standard	Wear limit
Gear side	Camshaft journal outside dia.	Ø44.950 ~ Ø44.964	Ø44.89
	Oil clearance	0.066 ~ 0.110	-
Intermediate	Camshaft journal outside dia.	Ø44.916 ~ Ø44.930	Ø44.89
	Oil clearance	0.070 ~ 0.130	-
Flywheel side	Camshaft journal outside dia.	Ø44.950 ~ Ø44.964	Ø44.89
	Oil clearance	0.066 ~ 0.110	-

## 7.3.8 CRANKSHAFT

MODEL		T1700NA, T2300NA(T)	
Item		Standard	Wear limit
Crank journal	Crankshaft journal outside dia.	Ø53.950 ~ Ø53.964	Ø53.91
	Bearing metal thickness	1.987 ~ 2.000	-
	Oil clearance	0.036 ~ 0.095	0.15
Bend		0.02 or less	0.02 or less

# CHAPTER 3 CLUTCH (MEC. MODEL)

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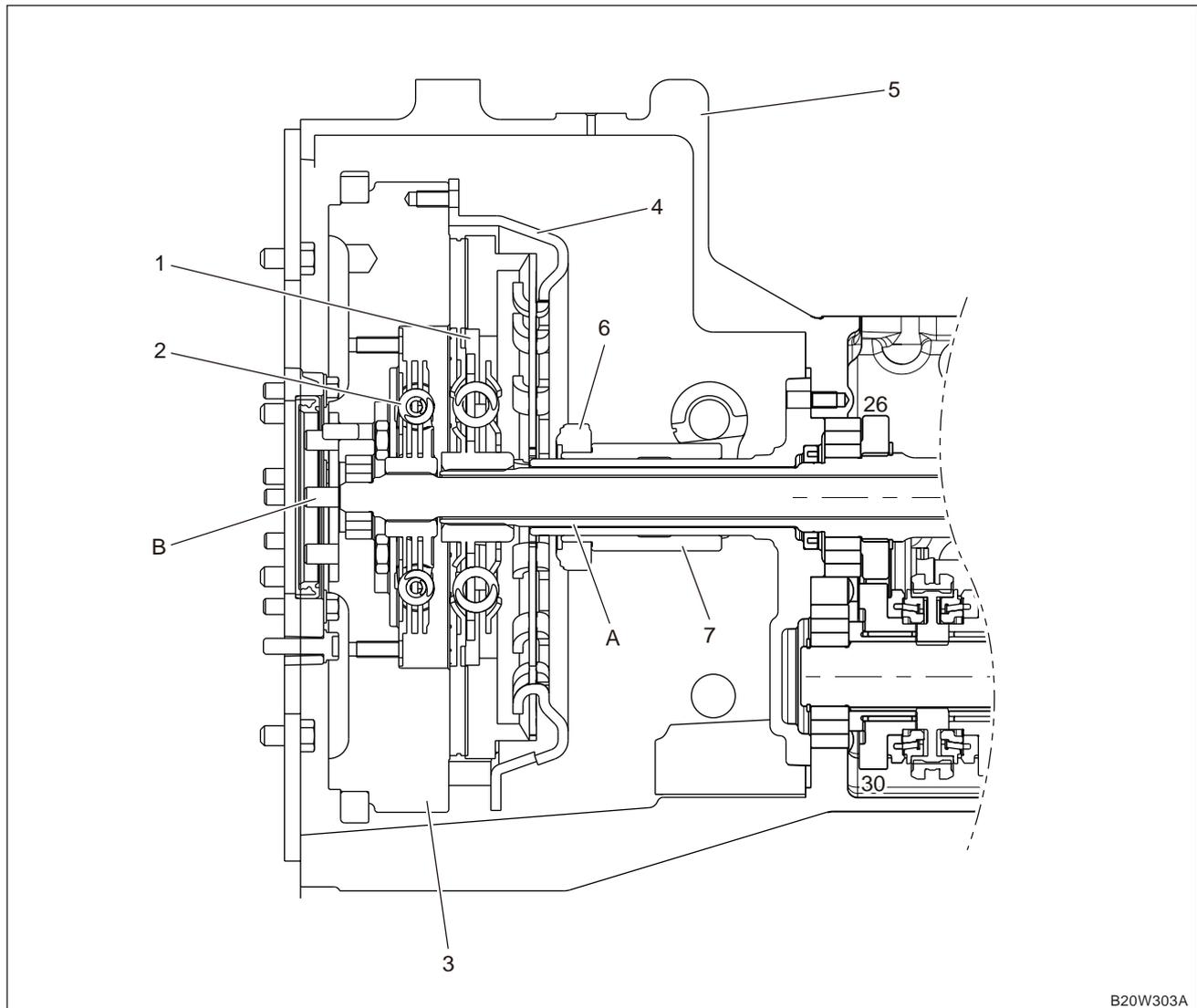
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## 1. OVERVIEW

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 damper
- (3) Flywheel
- (4) Clutch disc cover

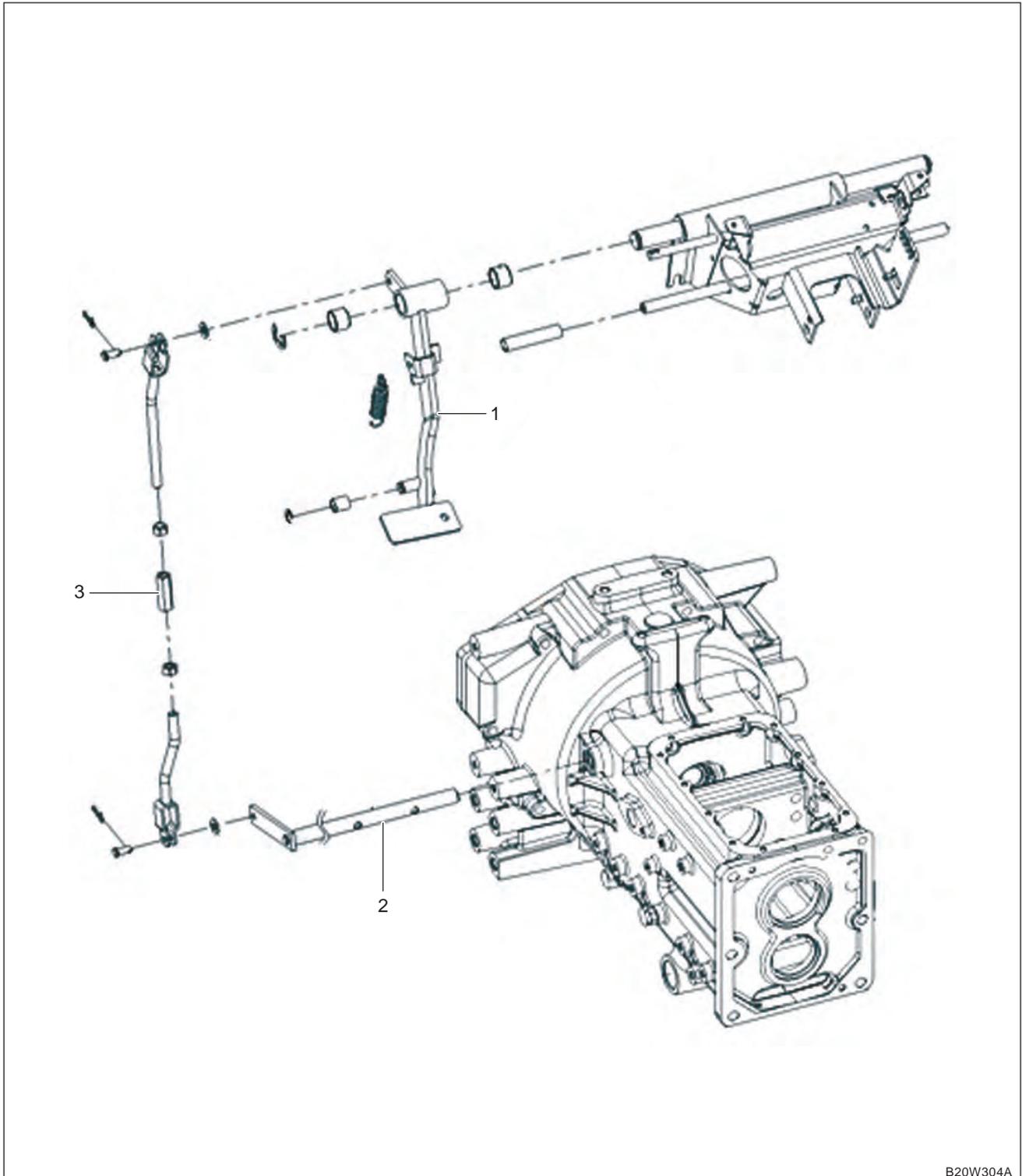
- (5) Clutch housing
- (6) Release bearing
- (7) Bearing sleeve

- (A) Main shaft (outer): hollow shaft
- (B) Main 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 shaft (inner)) is fixed to the PTO damper (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 damper, it rotates continuously. As a result, the PTO shaft connected to the solid shaft B is driven independently regardless of the driving shift condition.

1.2 CLUTCH PEDAL COMPONENTS



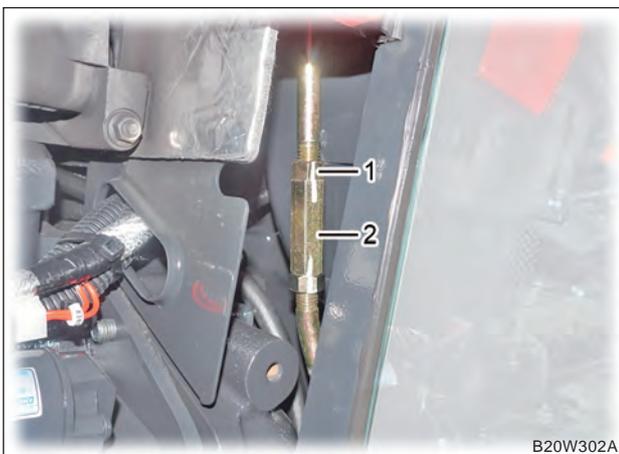
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(1) Clutch pedal

(2) Release shaft

(3) Clutch rod

## 1.3 CLUTCH PEDAL PLAY ADJUSTMENT



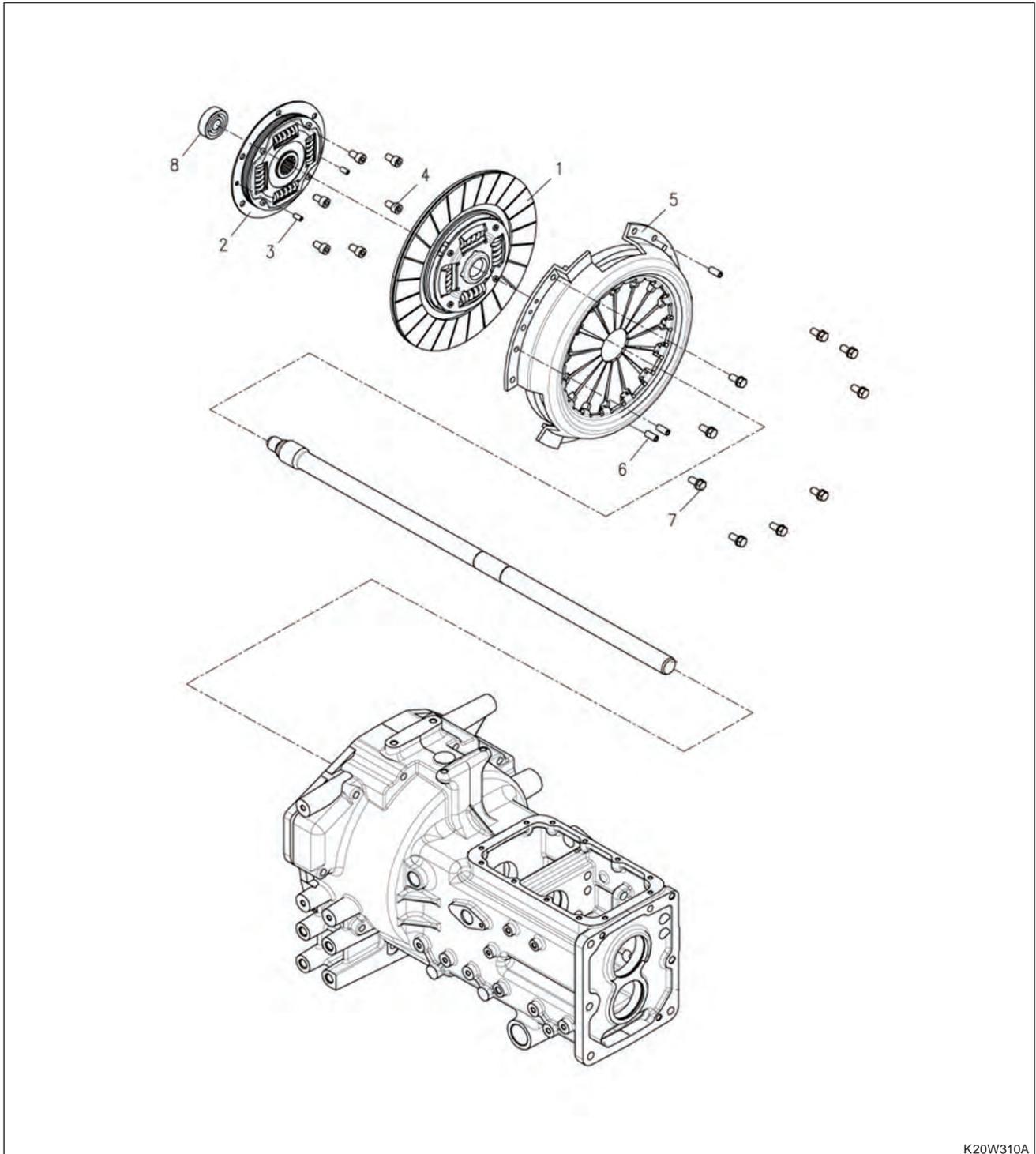
- Depress the clutch pedal slightly. Then, release it.
- Measure its free play.

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

- If the free play is out of the specification, unscrew the mounting nut (1) of the clutch rod and turn the turn buckle (2) to adjust the free play. Then, tighten the mounting nut.

2. SECTIONAL VIEW FOR MAJOR COMPONENTS

2.1 CLUTCH ASSEMBLY



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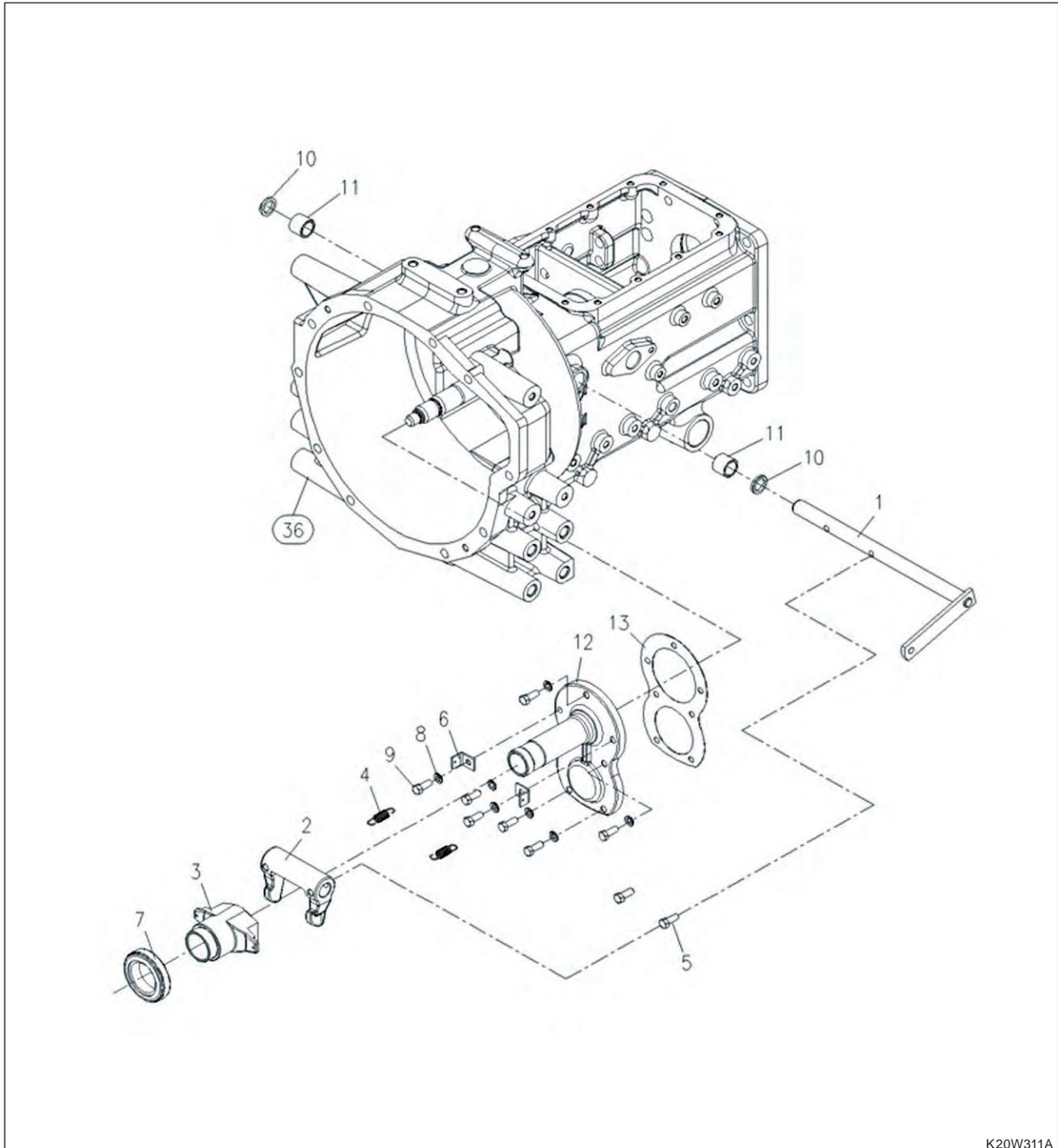
COMPONENTS

- (1) Clutch disc assembly
- (2) PTO damper
- (3) Spring pin

- (4) Bolt with hexagonal hole
- (5) Clutch cover assembly
- (6) Spring pin

- (7) Bolt with captive washer
- (8) Ball bearing (with deep groove)

## 2.2 CLUTCH RELEASE

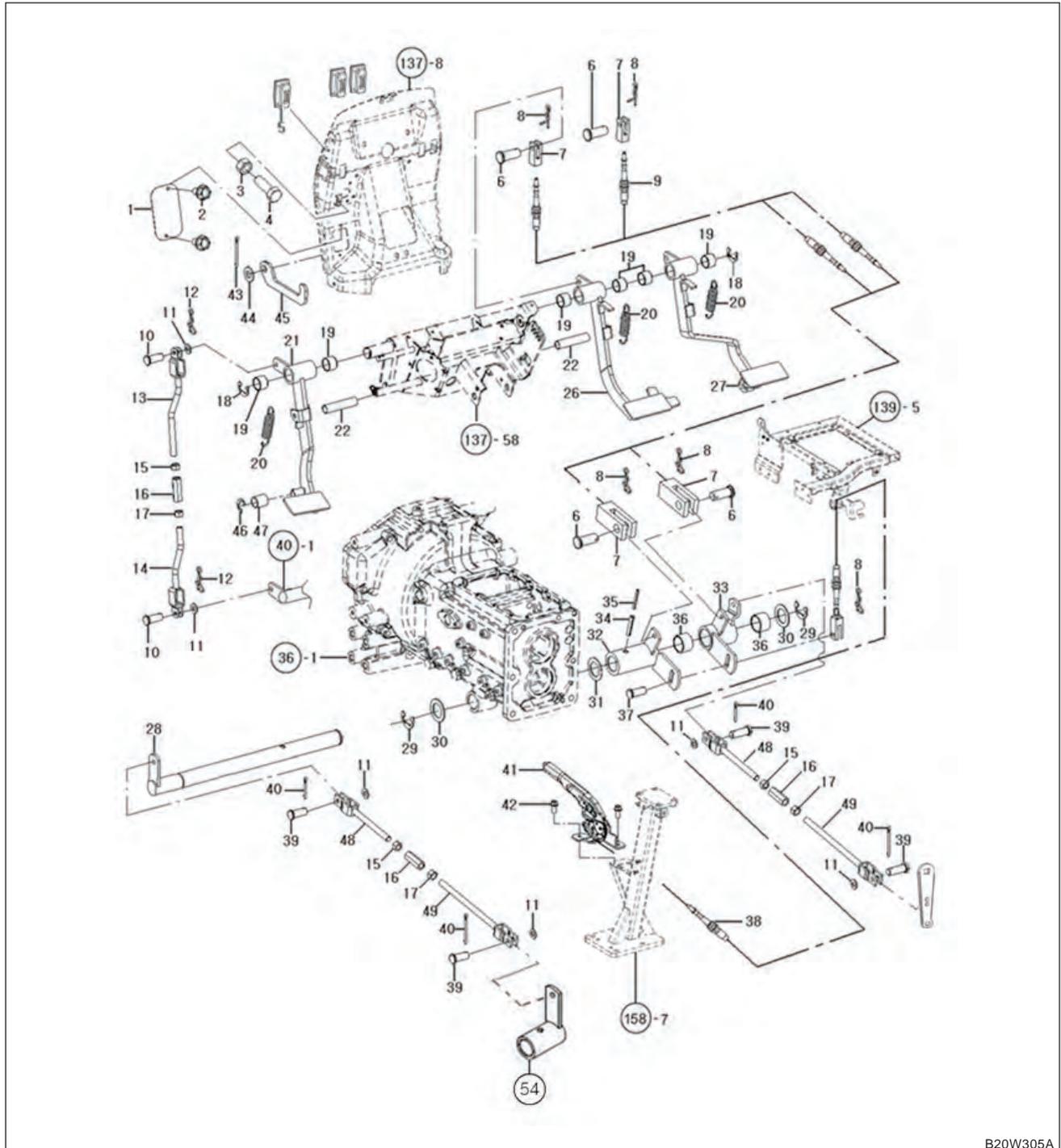


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## COMPONENTS

- |                                 |                     |                               |
|---------------------------------|---------------------|-------------------------------|
| (1) Release shaft (main clutch) | (6) Spring bracket  | (11) Bushing (20X26X22)       |
| (2) Clutch shift yoke           | (7) Bearing TK45    | (12) Main shaft oil seal case |
| (3) Bearing sleeve              | (8) Spring washer   | (13) Packing                  |
| (4) Return spring               | (9) Hex. bolt       |                               |
| (5) Reamer bolt                 | (10) Seal (20X26X4) |                               |

2.3 BRAKE, CLUTCH PEDAL



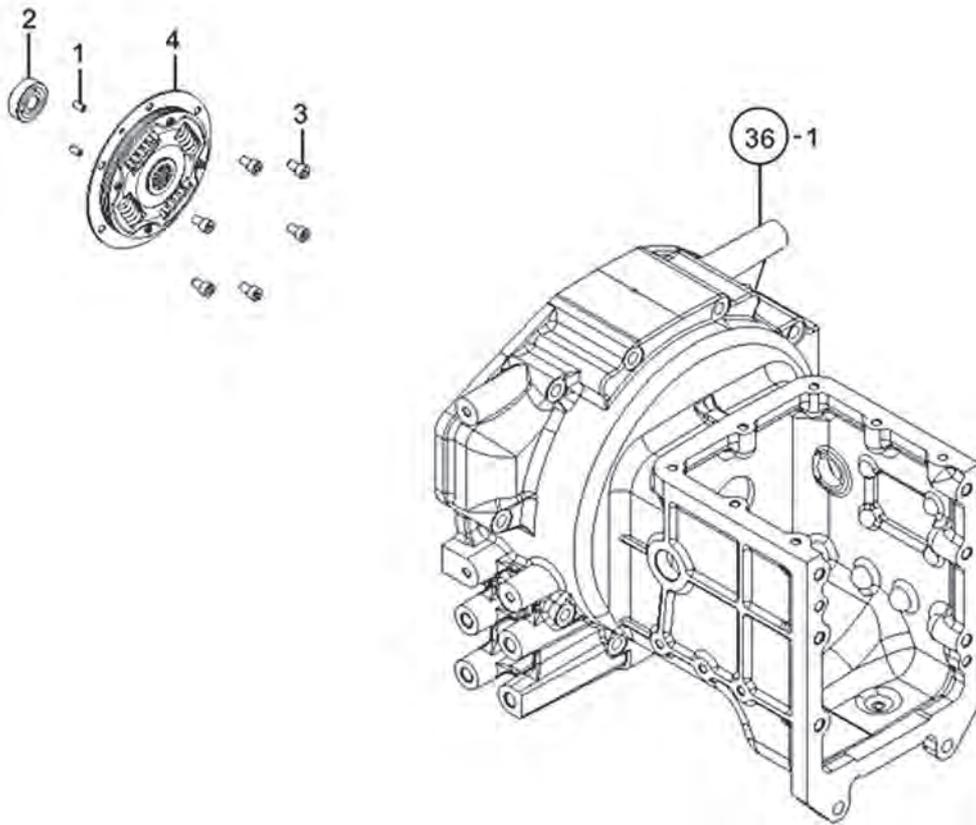
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COMPONENTS

- |                     |                             |                           |                           |
|---------------------|-----------------------------|---------------------------|---------------------------|
| (1) Cover           | (13) Clutch road(lower)     | (28) Shaft, pedal rod     | (40) Cotter pin           |
| (2) Hex flange bolt | (14) Clutch road(upper)     | (29) Snap ring(E)         | (41) Lever, parking brake |
| (3) Hex nut         | (15) Nut(left-screw)        | (30) Washer-B             | (42) Hex flange bolt      |
| (4) Hex bolt        | (16) Turn buckle            | (31) Washer-A             | (43) Cotter pin           |
| (5) Boots, pedal    | (17) Hex nut                | (32) Brake link(L)rear    | (44) Plain washer         |
| (6) Head pin        | (18) Snap ring(E)           | (33) Brake link(R)rear    | (45) Lock(clutch pedal)   |
| (7) Clevis A        | (19) Bush 25x28x20          | (34) Spring pin           | (46) Snap ring(E)         |
| (8) Protect pin 10  | (20) Return spring          | (35) Spring pin           | (47) Pipe(clutch pedal)   |
| (9) Cable, brake    | (21) Clutch pedal           | (36) Bush                 | (48) Rod(L)               |
| (10) Head pin       | (22) Pipe(stopper)          | (37) Head pin             | (49) Rod(R)               |
| (11) Plain washer   | (26) Pedal ass'y(LH), brake | (38) Cable, parking brake | (50) Rod(L)               |
| (12) Protect pin 8  | (27) Pedal ass'y(RH), brake | (39) Head pin 10x23       |                           |

2.4 PTO DAMPER

HST MODEL



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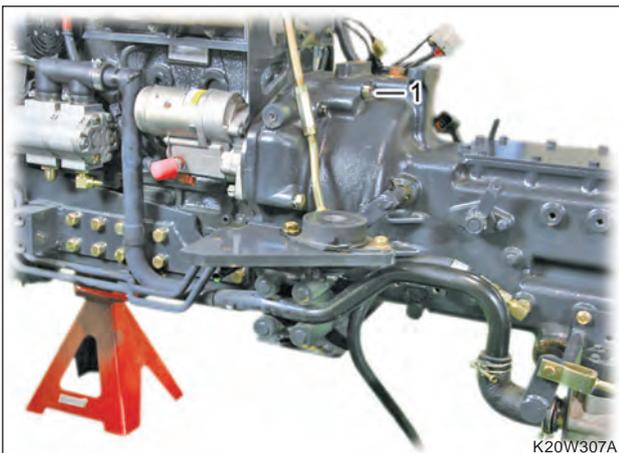
COMPONENTS

- |                  |                         |
|------------------|-------------------------|
| (1) Spring pin   | (3) Hexagon socket bolt |
| (2) Ball bearing | (4) PTO damper          |

### 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 coolant and transmission fluid.
4. Remove the hood and propeller shaft.
5. Disconnect the hydraulic hose, wiring connector, heater hose, A/C hose and various cables from the cabin body.
6. Remove the cabin.
7. Place a stand under the clutch housing and a portable jack under the engine oil pan.
8. Remove all the related parts, including the fuel hose and main wiring connector, between the engine and vehicle body.

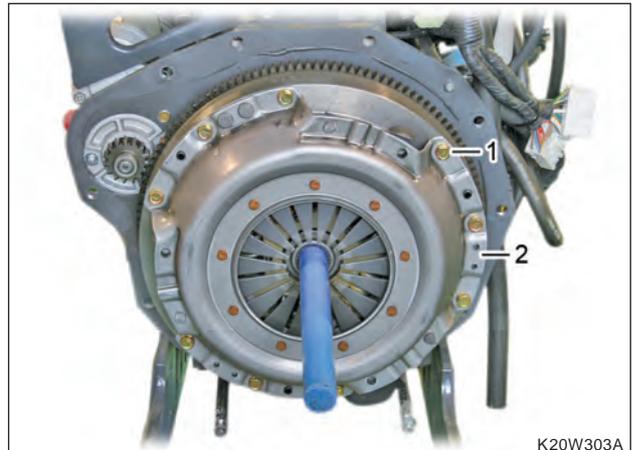


9. Unscrew the mounting bolt (1) from the clutch housing and engine flywheel housing. Then, push the front axle section to separate it from the clutch housing.

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)

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

#### 3.2 CLUTCH DISASSEMBLY

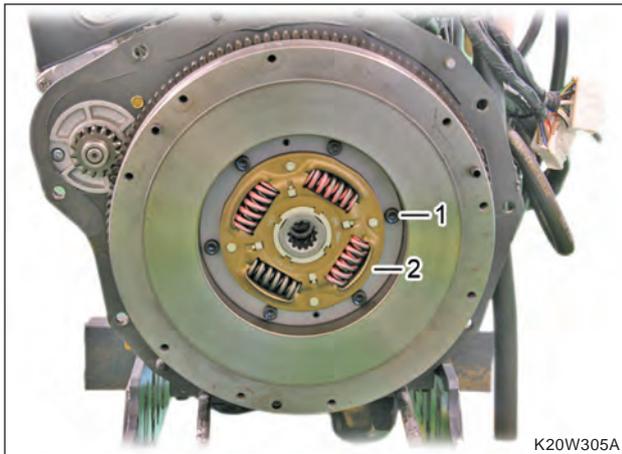


1. Unscrew the clutch assembly mounting bolts (1) from the engine flywheel housing to remove the clutch cover (2).

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



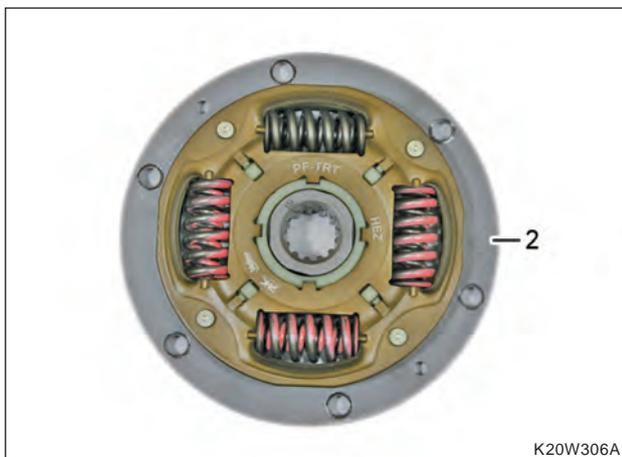
2. Remove the clutch disc.



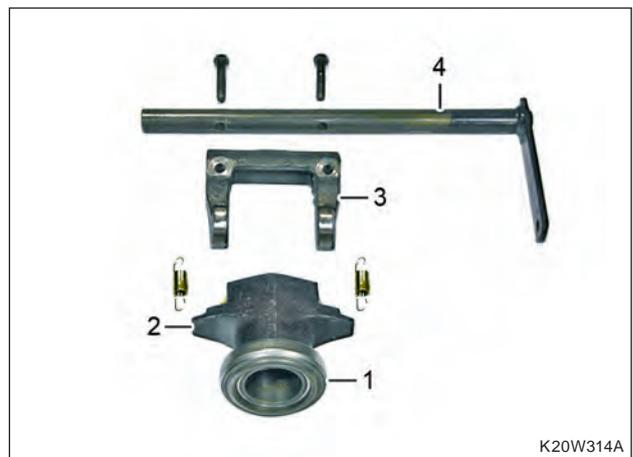
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3. Unscrew the PTO damper mounting bolts (1) to remove the PTO damper (2).

4. As necessary, remove the release bearing (1), bearing sleeve (2), clutch shifter yoke (3) and release shaft (4) from the clutch housing.

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

# CHAPTER 4 TRANSMISSION

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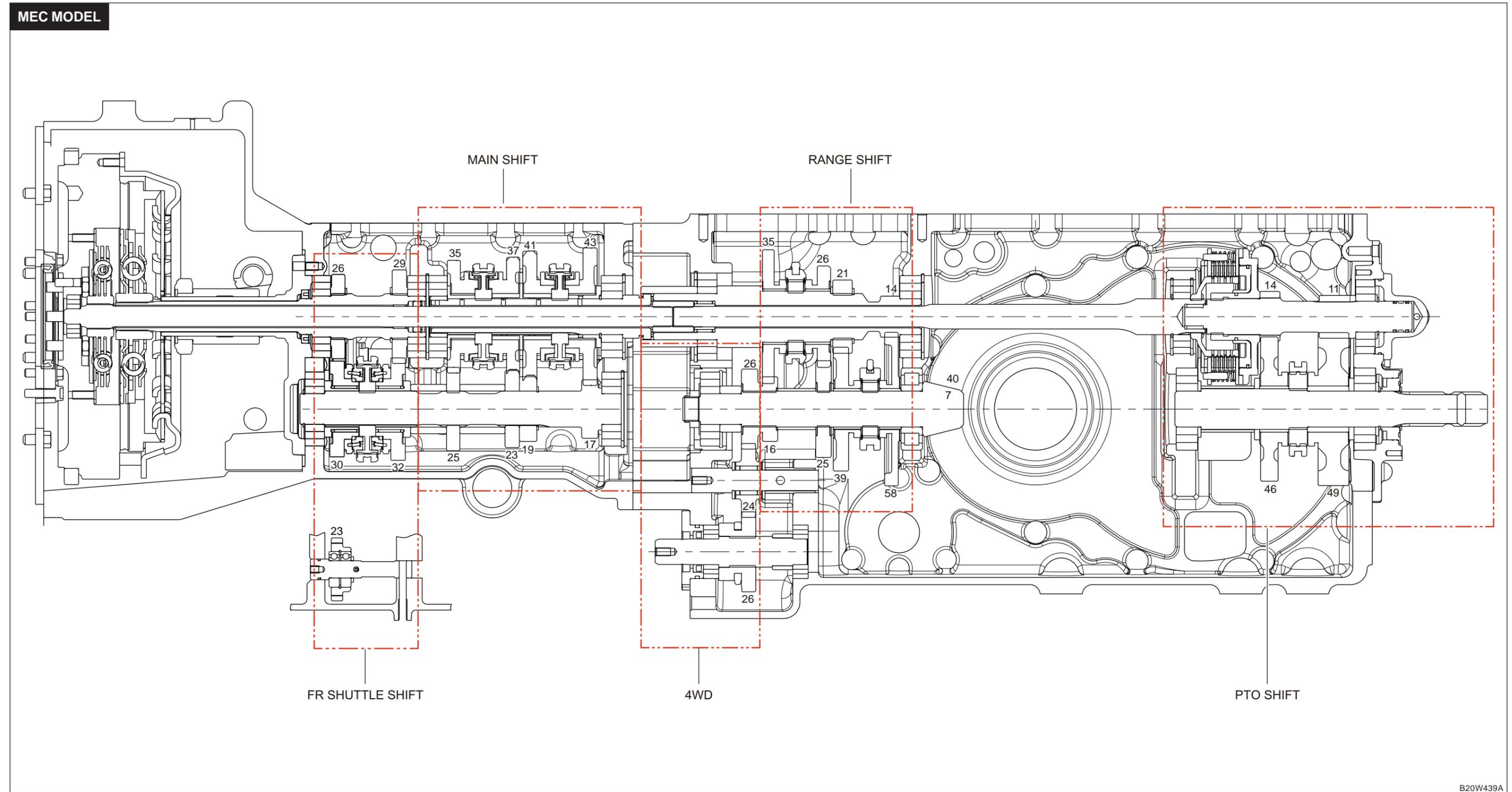
## 1. OVERVIEW

## 1.1 SPECIFICATION

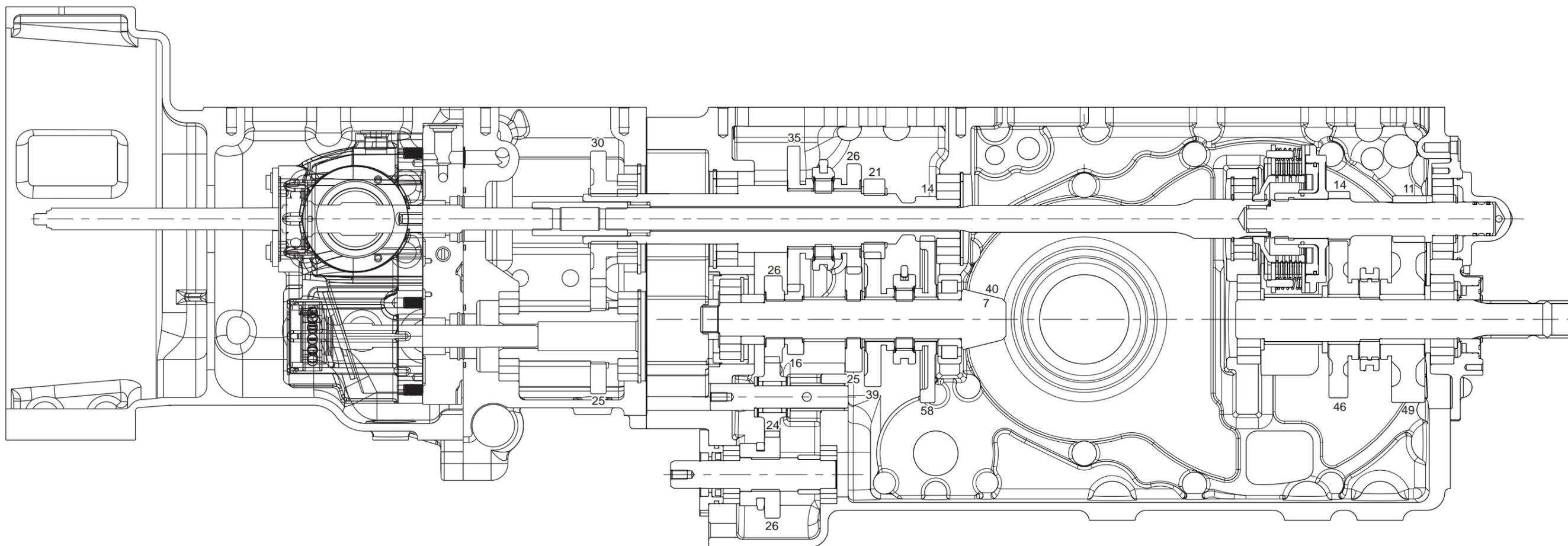
ITEM		SPECIFICATION		
Transmission system	MEC. MODEL	Shuttle type	Mechanical, Synchromesh	
		Main shift	4 speeds, Synchromesh	
		Range shift	4 speeds, Constant-mesh	
		Shifting gear and driving speed	F16 X R16 Forward driving: 1.72 - 28.15 km/h (1.07 - 17.49 MPH) Reverse driving: 1.61 - 26.92 km/h (1.00 - 16.73 MPH)	
	HST MODEL	Shuttle type	Hydrostatic	
		Main shift	HST	
		Range shift	4 speeds, Constant-mesh	
		Shifting gear	CVT (Continuously Variable Transmission)	
		Driving speed	Forward driving: 0 - 31.41 km/h (0 - 19.52 MPH) Reverse driving: 0 - 31.41 km/h (0 - 19.52 MPH)	
	PTO shift	Type	Independent PTO	
		Stage	2	
		Revolution	1st: 584 rpm	2nd: 791 rpm
		PTO shaft	Ø 35 mm, 6 splines	
	Rear axle	Reduction ratio: $\frac{7}{40} \times \frac{11}{62} = 0.03105$		
Brake	Main brake	Wet multi-plate clutch		
	Parking brake	Hand brake		
Transmission fluid	Capacity	MEC. MODEL: 38 ℓ (10.03 u.s. gal.) HST MODEL: 35 ℓ (9.24 u.s. gal.)		
	Specification	TF 500		

1.2 POWER TRANSFER

1.2.1 TRANSMISSION ASSEMBLY DIAGRAM

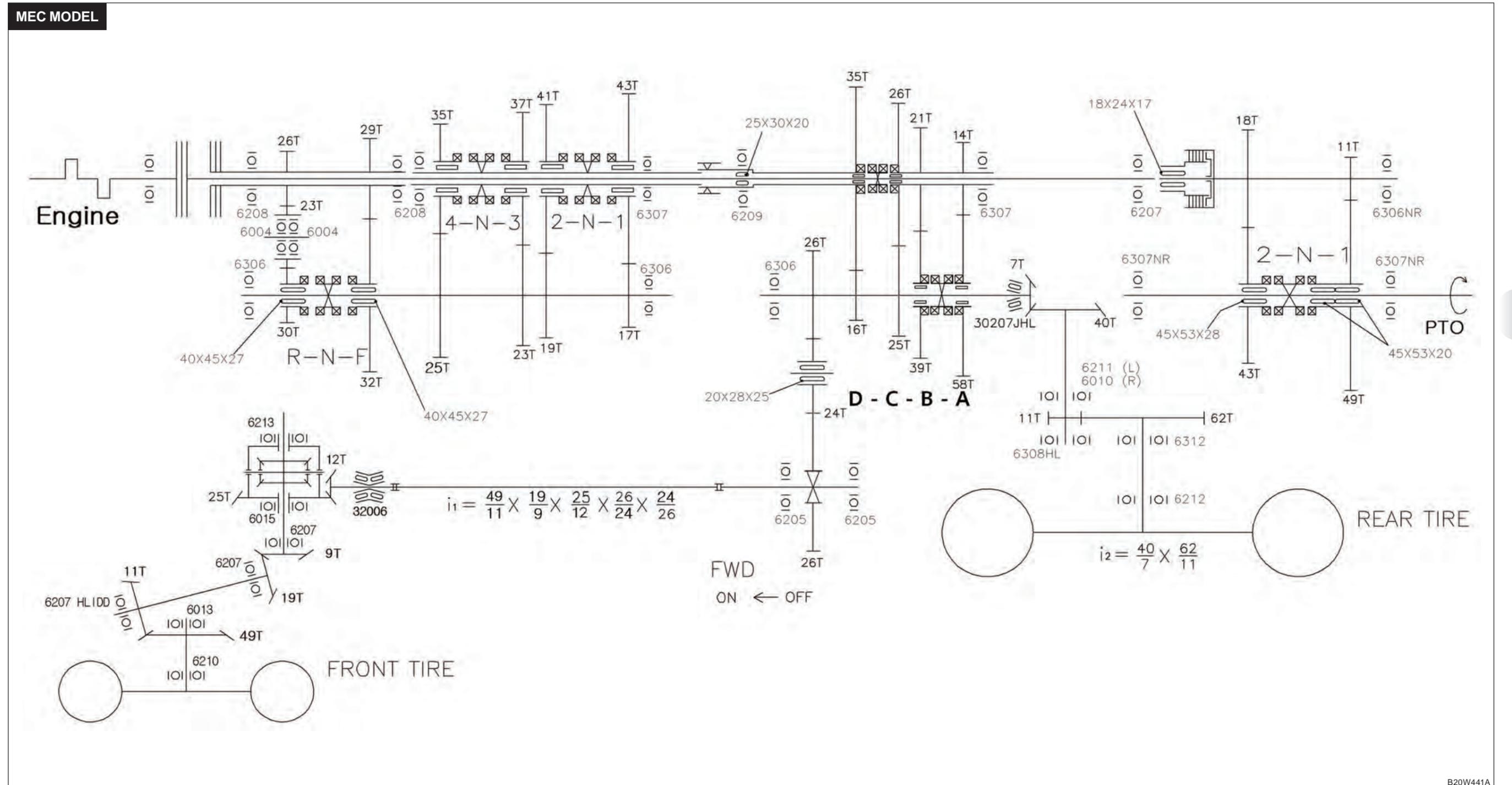


HST MODEL

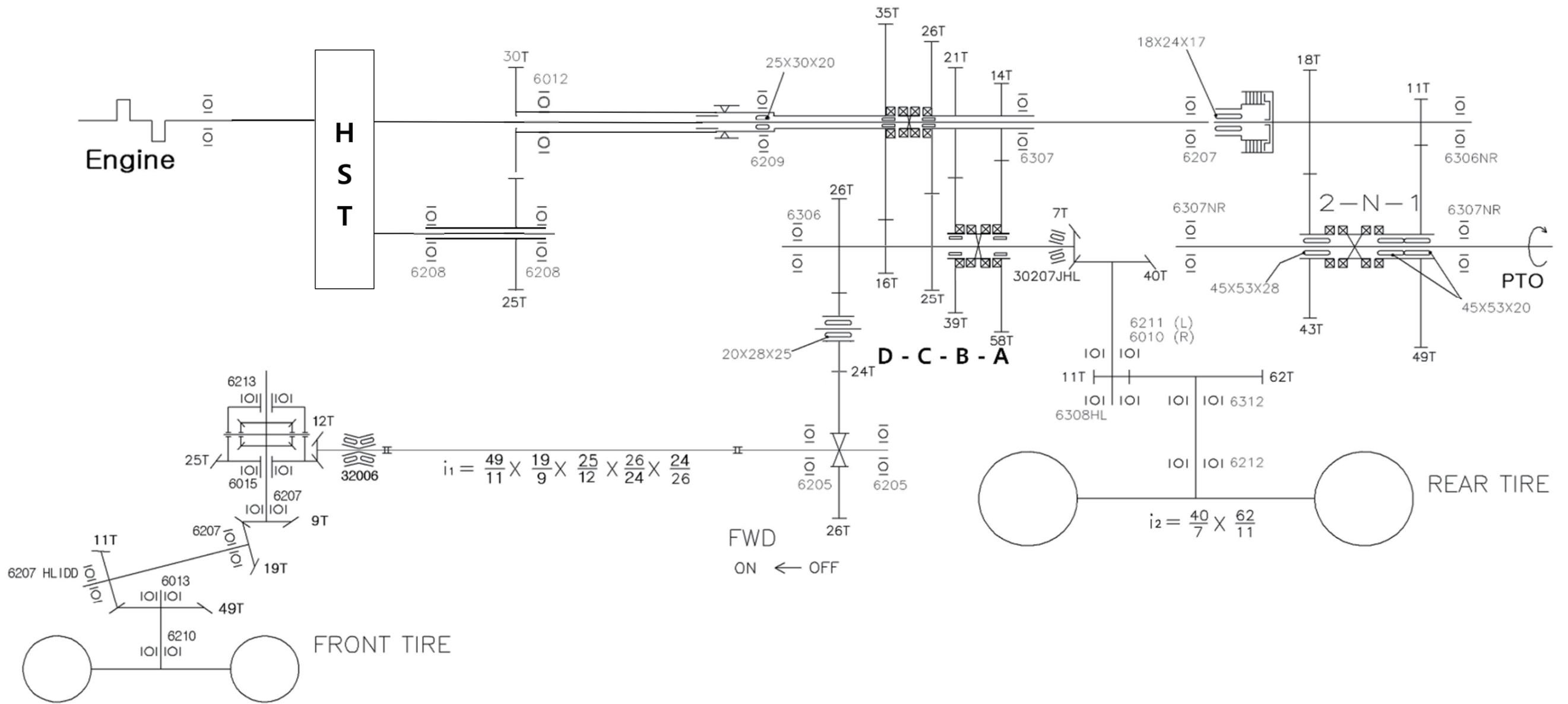


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1.2.2 POWER FLOW CHART



HST MODEL

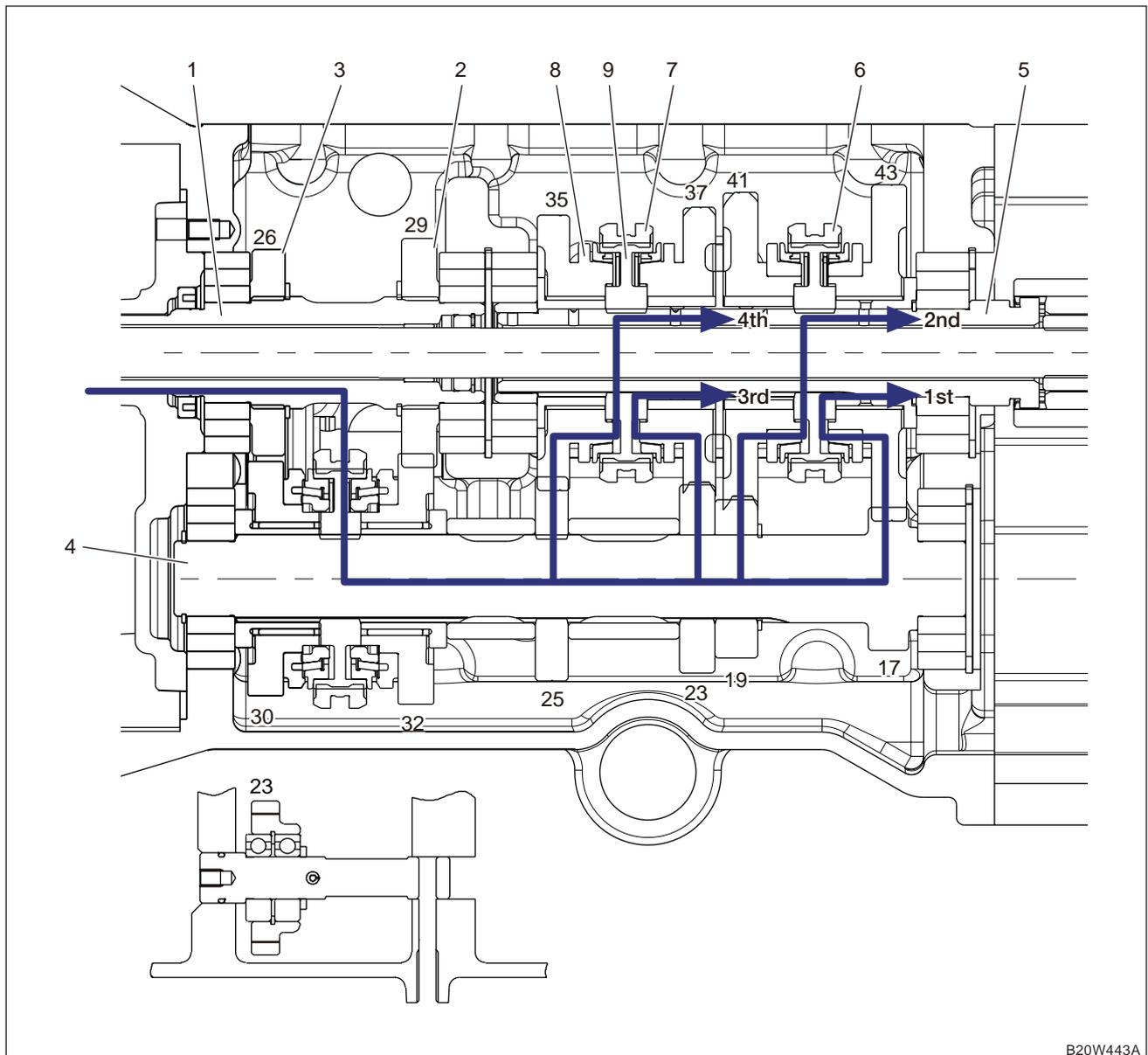


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## 2. STRUCTURE AND OPERATING PRINCIPLE

### 2.1 MAIN SHIFT

#### MEC MODEL



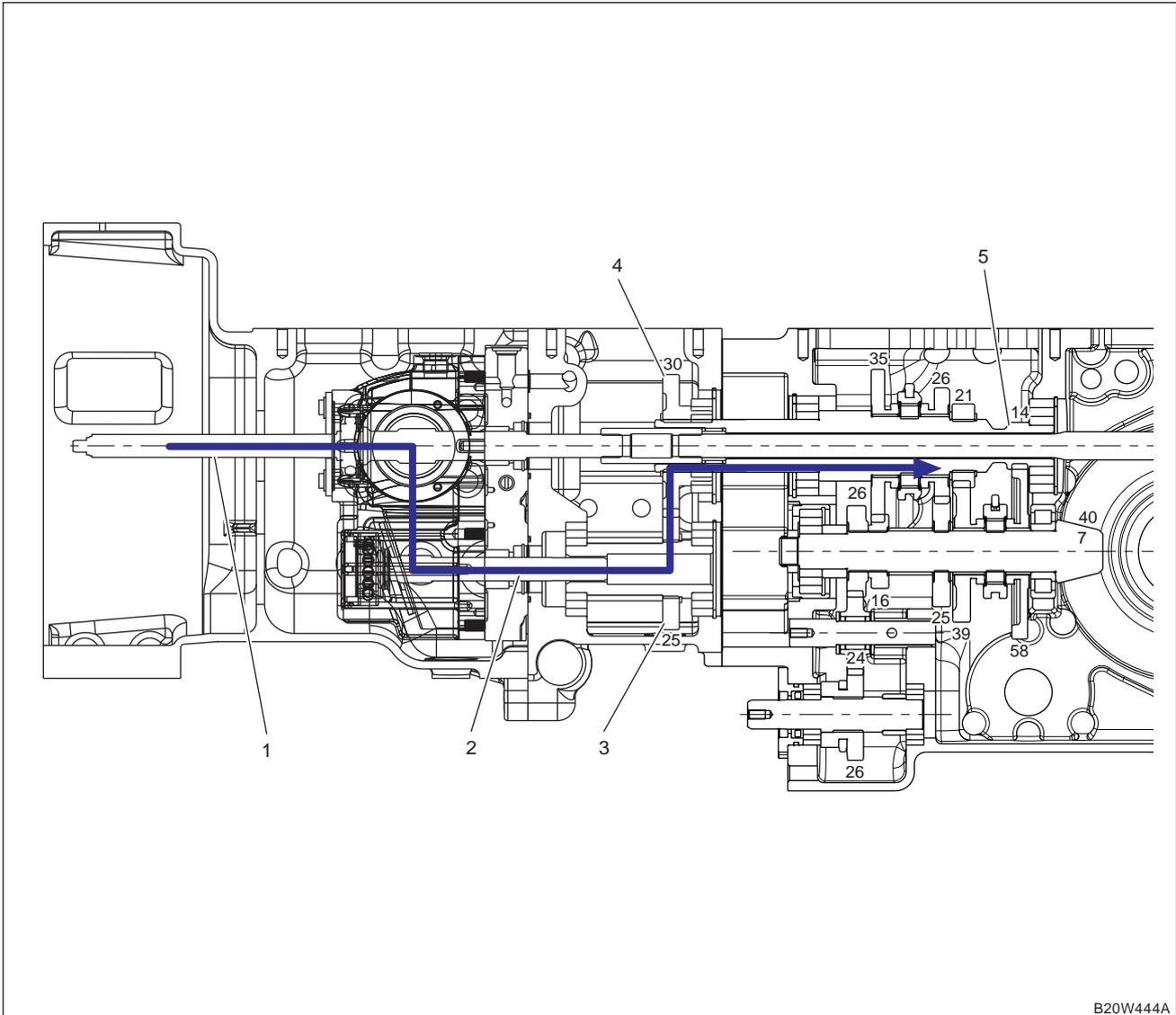
As the rotating force is arrived through the main shaft (outer) (1), it is supplied to the FR shuttle section through the forward 29 gear (2) and reverse 26 gear (3), and the countershaft (4) is rotated by the shuttle shift operation.

Therefore, as the 25 gear, 23 gear, 19 gear and 17 gear are fixed to the countershaft with splines, they rotate, turning their engaged 35 gear, 37 gear, 41 gear and 43 gear of the main shift guide shaft (5).

As a result, when the sleeve (6) is moved to the right, the main 1st gear shift is achieved. When it is moved to the left, the main 2nd gear shift is achieved. Likewise, when the sleeve (7) is moved to the right, the main 3rd gear shift is achieved. Moving it to the left achieves the main 4th gear shift.

As the movement of these sleeves transmits rotating force to each gear of the main shift guide shaft, engagement of each gear with the synchronizer ring (8) determines the RPM for the corresponding gear through the internal hub (9), rotating the main shift guide shaft at this RPM to deliver the rotating force to the next stage.

## HST MODEL

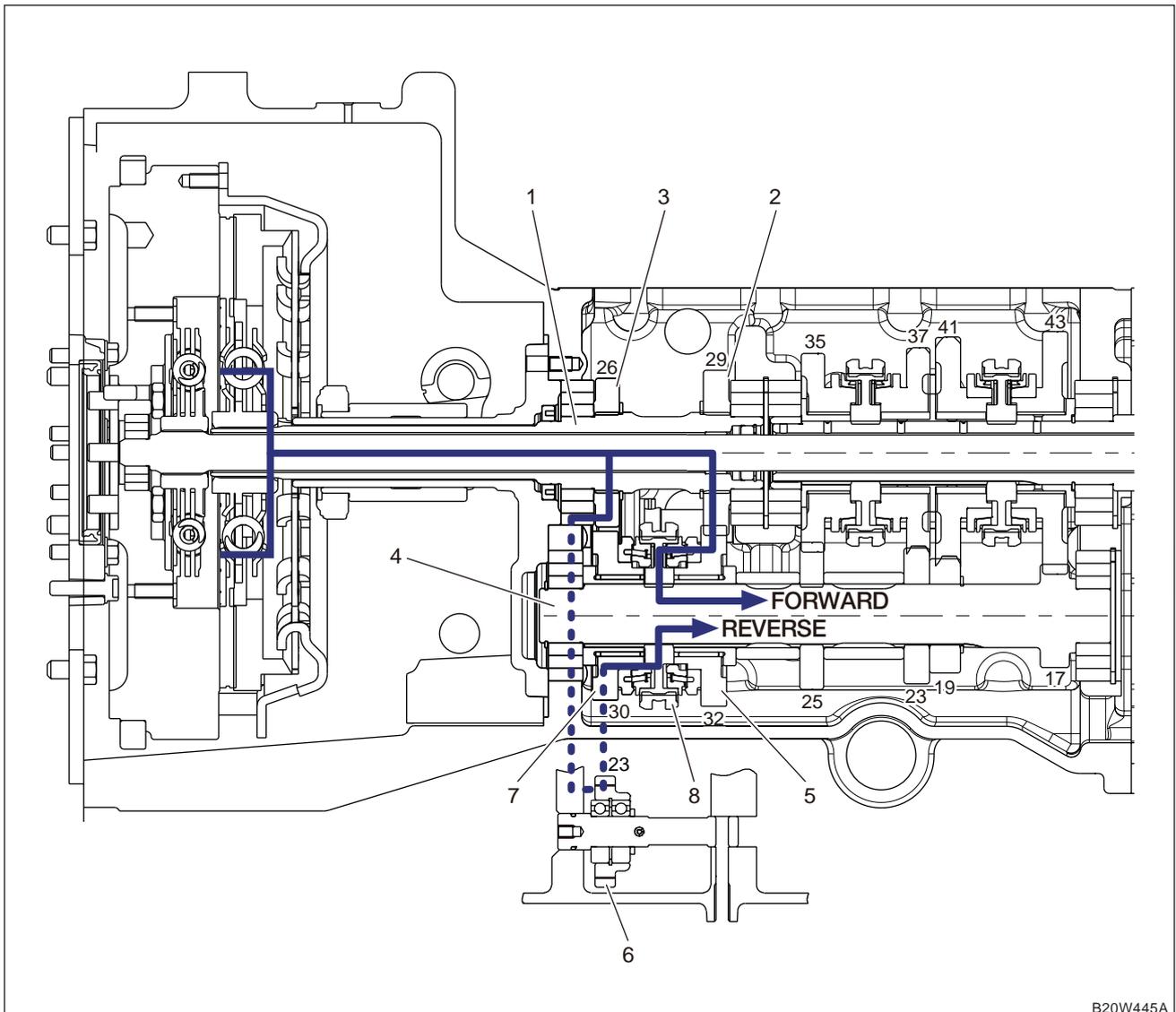


The engine revolution power delivered through the HST pump shaft (1) is supplied to the HST motor shaft (2) with the oil flow from the pump. Then, it is delivered to the 30T gear (4) through the 25T gear (3), which is connected to the motor shaft, before it is transmitted to the range shift gear 14T (5) which is fixed to the corresponding gear with splines.

Therefore, the amount of oil flow in the pump is controlled by the amount of travel (depressed amount) of the HST pedal, and the transmission is up-shifted or down-shifted continuously.

## 2.2 F-R SHUTTLE SHIFT

## MEC MODEL

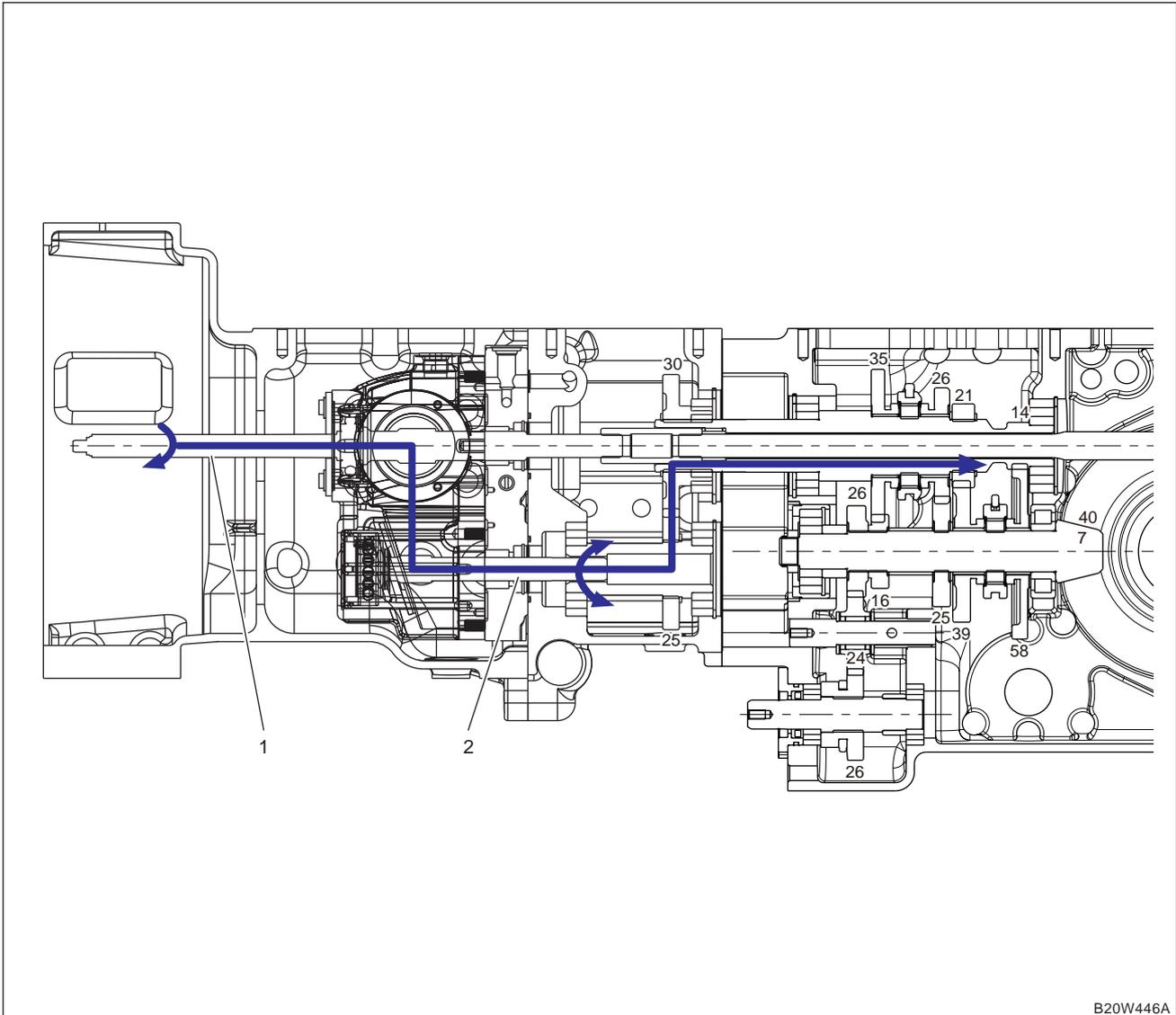


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When the rotating force is delivered from the engine through the clutch, it is passed to the transmission through the main shaft (outer) (hollow shaft) (1) which then rotates the 29 gear (2) and 26 gear (3) that are fixed to the main shaft (outer) with splines. Also, as the 29 gear and 26 gear are rotated, the 32 gear (5) of the counter shaft (4), 23 gear (6) of the reverse idle shaft and 30 gear (7) of the countershaft are rotated through their engagement.

As a result, when the sleeve (8) of the F-R shuttle section is moved to the right, the forward driving is selected. Likewise, when it is moved to the left, the reverse driving is selected. In the forward driving mode, rotating power is transmitted to the countershaft through the 29 gear and 32 gear. In the reverse driving mode, rotating power is delivered to the countershaft through the 26 gear, 23 gear and 30 gear. Then, this rotating force is passed through the 23 idle gear in the middle once again to rotate the countershaft in the reverse direction in order to supply rotating power for reverse driving.

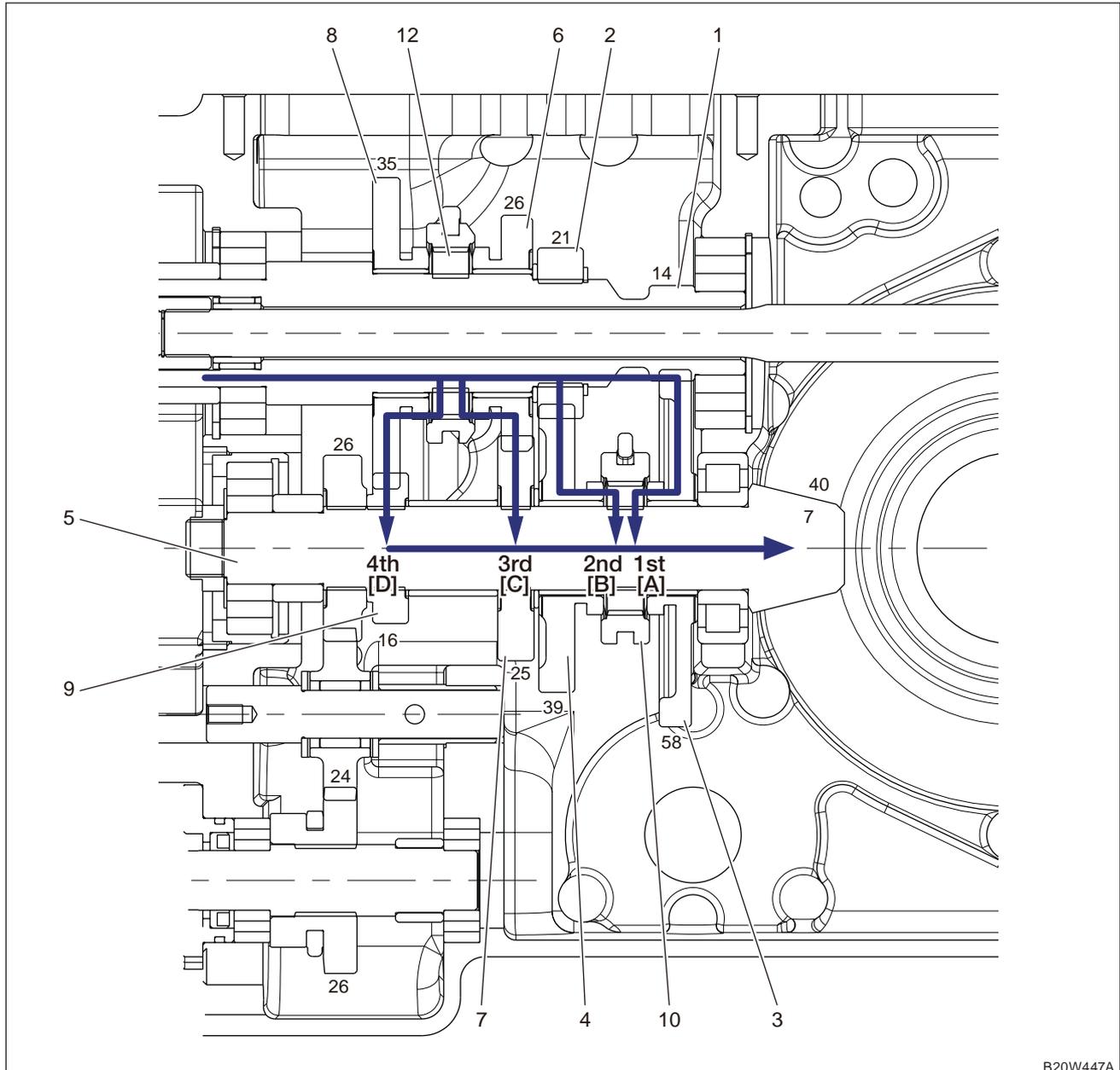
## HST MODEL



As the engine's rotating power is transmitted to the HST pump shaft (1), the oil flow is increased or decreased by the angle of the swash plate of the pump shaft, affecting the vehicle driving speed directly.

The angle of the swash plate of the pump shaft is changed from  $0^\circ$  within the range of  $+18^\circ$  and  $-18^\circ$ . The vehicle driving speed is increased or decreased in the range of  $0^\circ$  and  $18^\circ$ . When the angle of the swash plate is in the range of  $+18^\circ$  and  $-18^\circ$ , the direction of the operating fluid flow is switched between two opposite directions, so the rotating direction of the motor shaft (2) on the other side of the pump shaft is switched between the clockwise direction and counterclockwise direction. In other words, the forward driving direction is selected while the angle of the swash plate is  $+18^\circ$ . When the angle is switched to  $-18^\circ$ , the motor shaft rotates in the opposite direction, selecting the reverse driving direction.

## 2.3 RANGE SHIFT



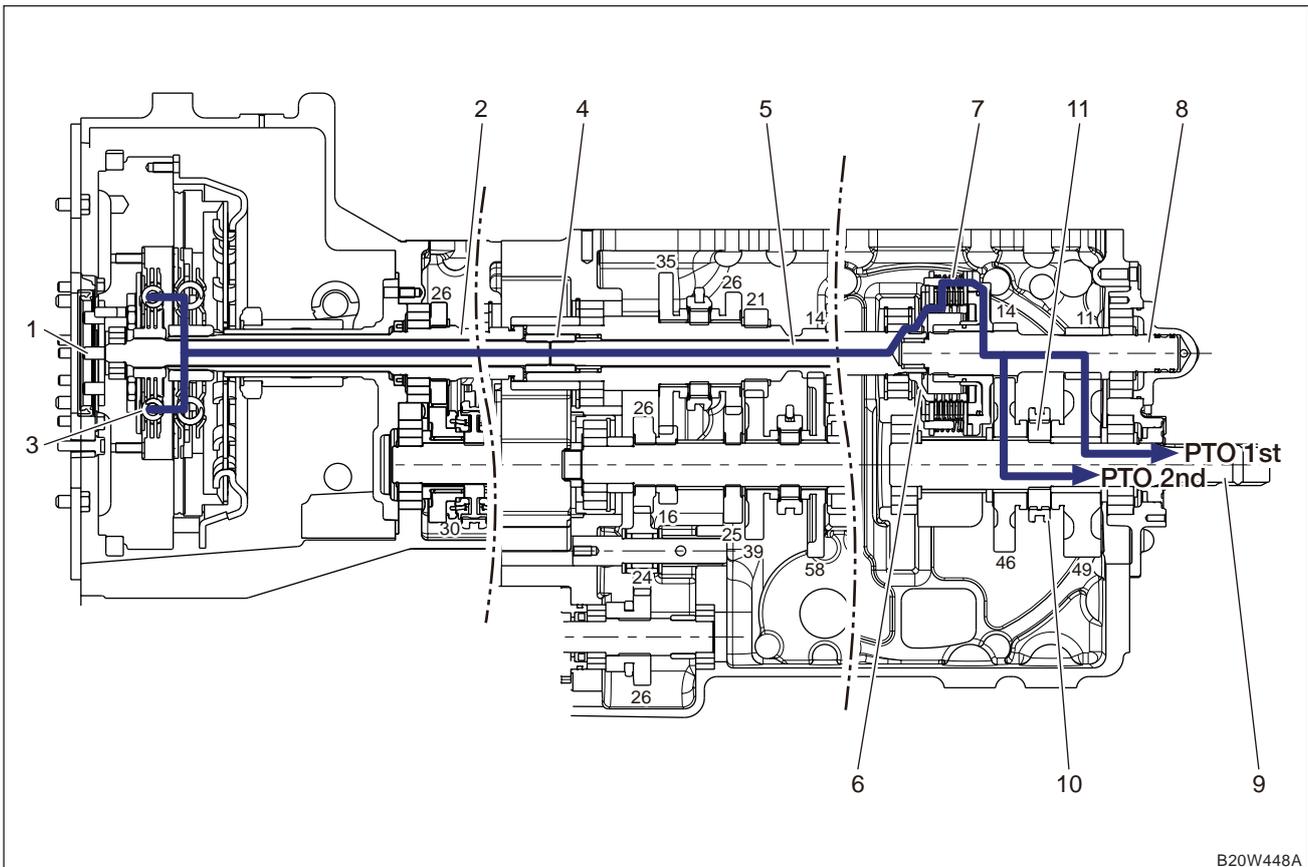
When rotating force is supplied through the main shift section, it is transmitted to the range shift 14 gear shaft (1). Then, as the 14 gear and range shift 2nd 21 gear (2) are rotated with the shaft and they are engaged with the range shift 1st 58 gear (3) and range shift 2nd 39 gear (4) of the countershaft (5), these gears are rotated as well. In addition, gear 26 (6) and gear 35 (8) on gear shaft 14 idle while hub (12) and sleeve (11) are splined to gear shaft 14 and rotate together with the latter.

The range shift section is divided into 1st, 2nd, 3rd and 4th speed stages. When the sleeve (10) is moved to the right end for the range 1st gear (low speed) shift operation, the rotating speed is determined by the gear ratio of the 14 gear to the 58 gear of the range shift 14 gear shaft. And the sleeve (10) is moved to the left end for the range 2nd gear shift operation, the rotating speed is determined by the 21 gear to the 39 gear.

Likewise, when the sleeve (11) is moved to the right slightly, rotating force is delivered through the 26 gear (6) as the range shift 3rd gear to the 25 gear (7). When the sleeve (11) is moved to the left end position for the range shift 4th gear (high speed), the rotating speed is determined by the 35 gear (8) and 16 gear (9) as the range shift 4th gear and this is supplied to the countershaft.

## 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 shaft (inner) (1). This main shaft (inner) is fixed to the PTO damper (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 spline collar (4) in the middle to deliver the rotating force to the PTO shift section through the PTO connecting shaft (5).

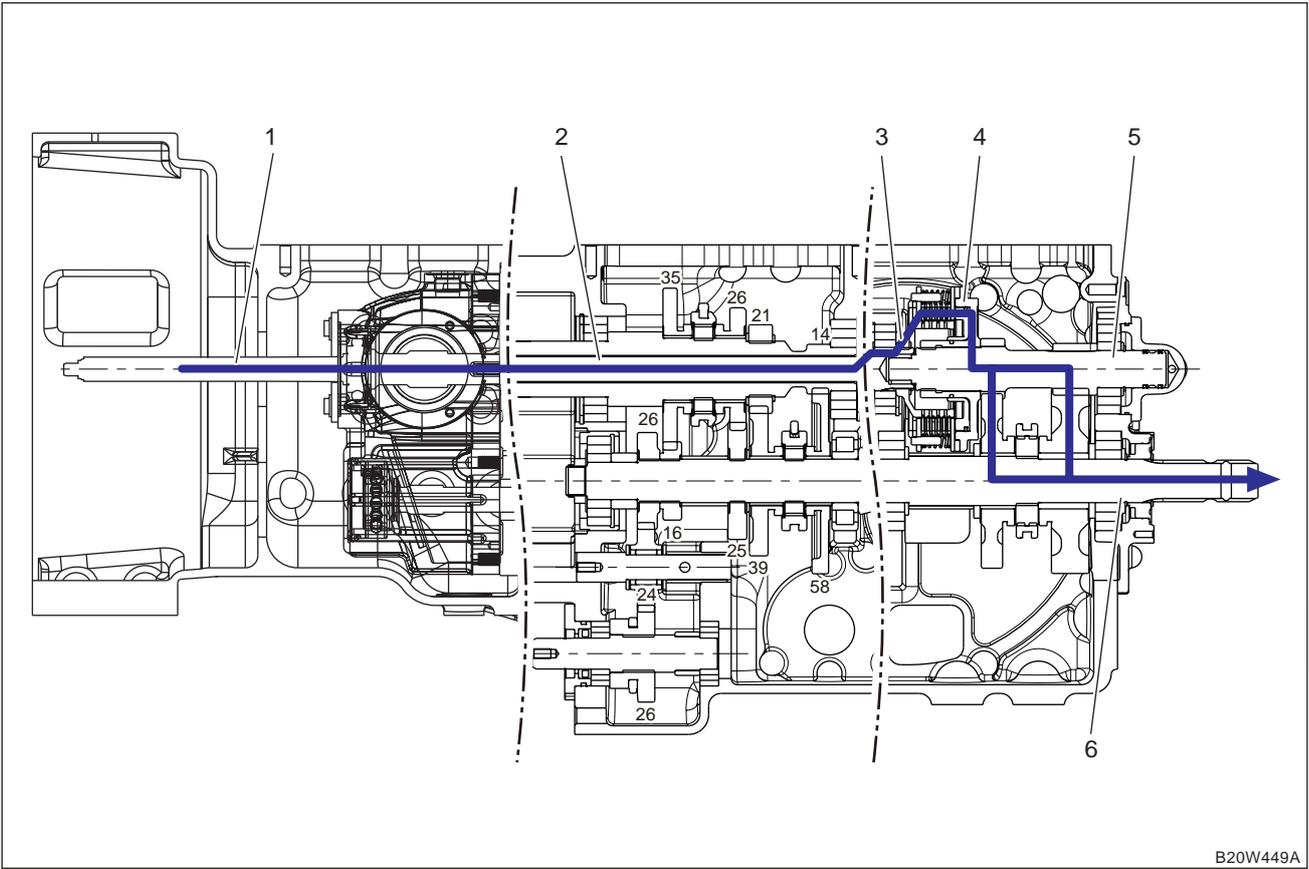
As the PTO connecting shaft is fixed to the PTO coupling (6) of the PTO clutch with splines, it idles with the clutch disc. When oil is drawn to the PTO clutch for PTO operation, this oil pushes the internal piston so the pressure plate is compressed against the clutch disc, rotating the whole PTO clutch (7) assembly. Then, this rotating force is transferred to the PTO shift shaft (8) which is connected to the PTO clutch assembly with splines. Therefore, the 14 gear, 11 gear, 49 gear and 46 gear of the PTO shaft (9) are engaged, rotating together.

When the PTO sleeve (10) is moved to the right for the PTO 1st gear shift, the speed of the PTO is determined by the engagement ratio of the 11 gear and 49 gear and the PTO shaft is rotated at this speed. When it is moved to the left for the PTO 2nd gear shift, the PTO speed is determined by the engagement ratio of the 14 gear and 46 gear and this speed is transmitted to the PTO shaft through the PTO hub (11).

## ► PTO RPM

- PTO 1st gear: engine 2,600 rpm  $\times \frac{11}{49} = 584$  rpm
- PTO 2nd gear: engine 2,600 rpm  $\times \frac{14}{46} = 791$  rpm
- Engine speed at PTO 540 rpm: 2,405 rpm
- Engine speed at PTO 750 rpm: 2,464 rpm

**HST MODEL**

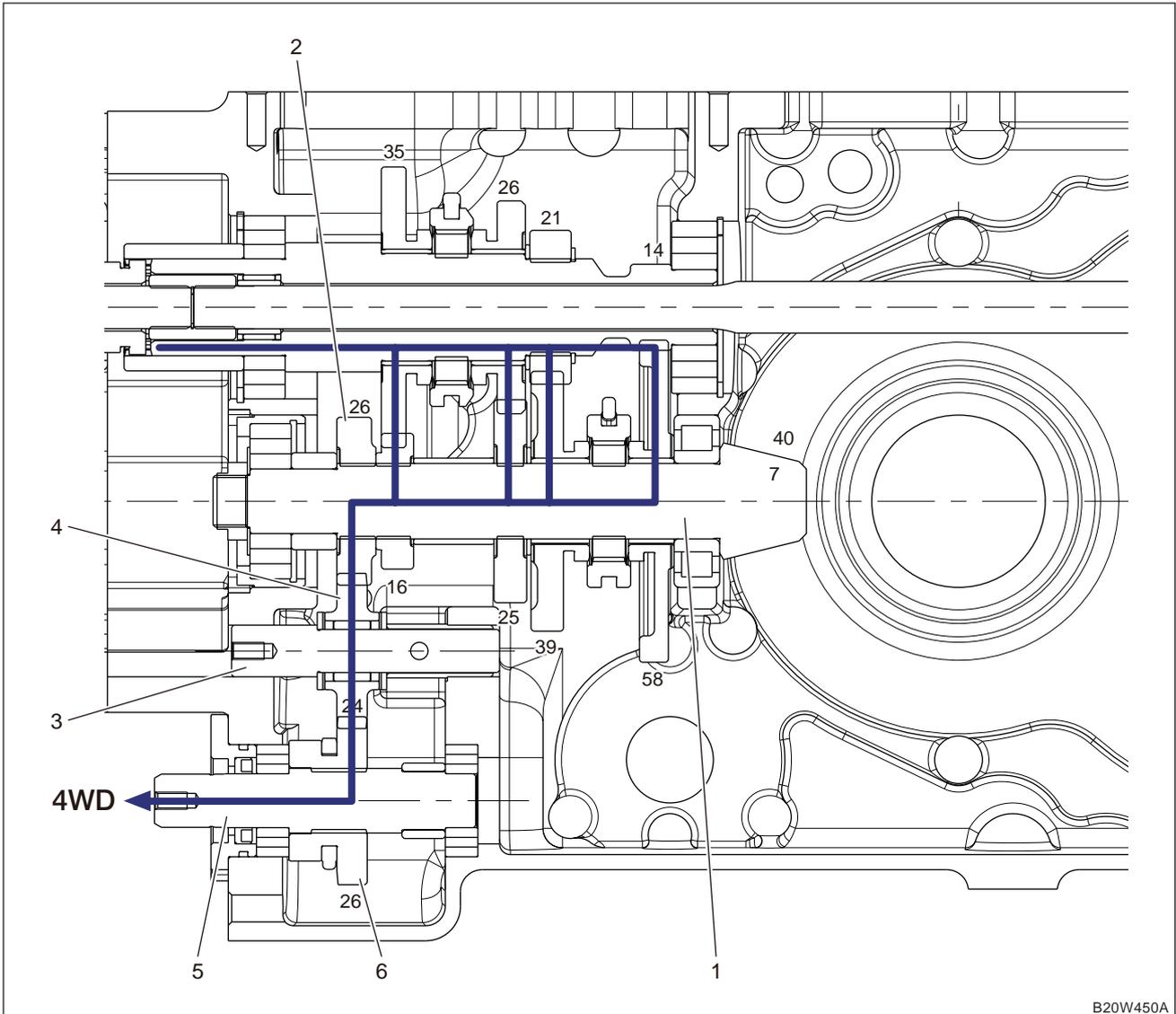


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The rotating power delivered to the HST pump shaft (1) from the engine is transferred to the coupling (3) of the PTO clutch through the internal solid shaft (2), resulting in continuous rotation of the shaft.

Therefore, when the PTO is engaged, the whole PTO clutch body (4) rotates. Then, the PTO shift shaft (5), which is fixed to the body with splines, is rotated as well to deliver the rotating power to the PTO shaft (6).

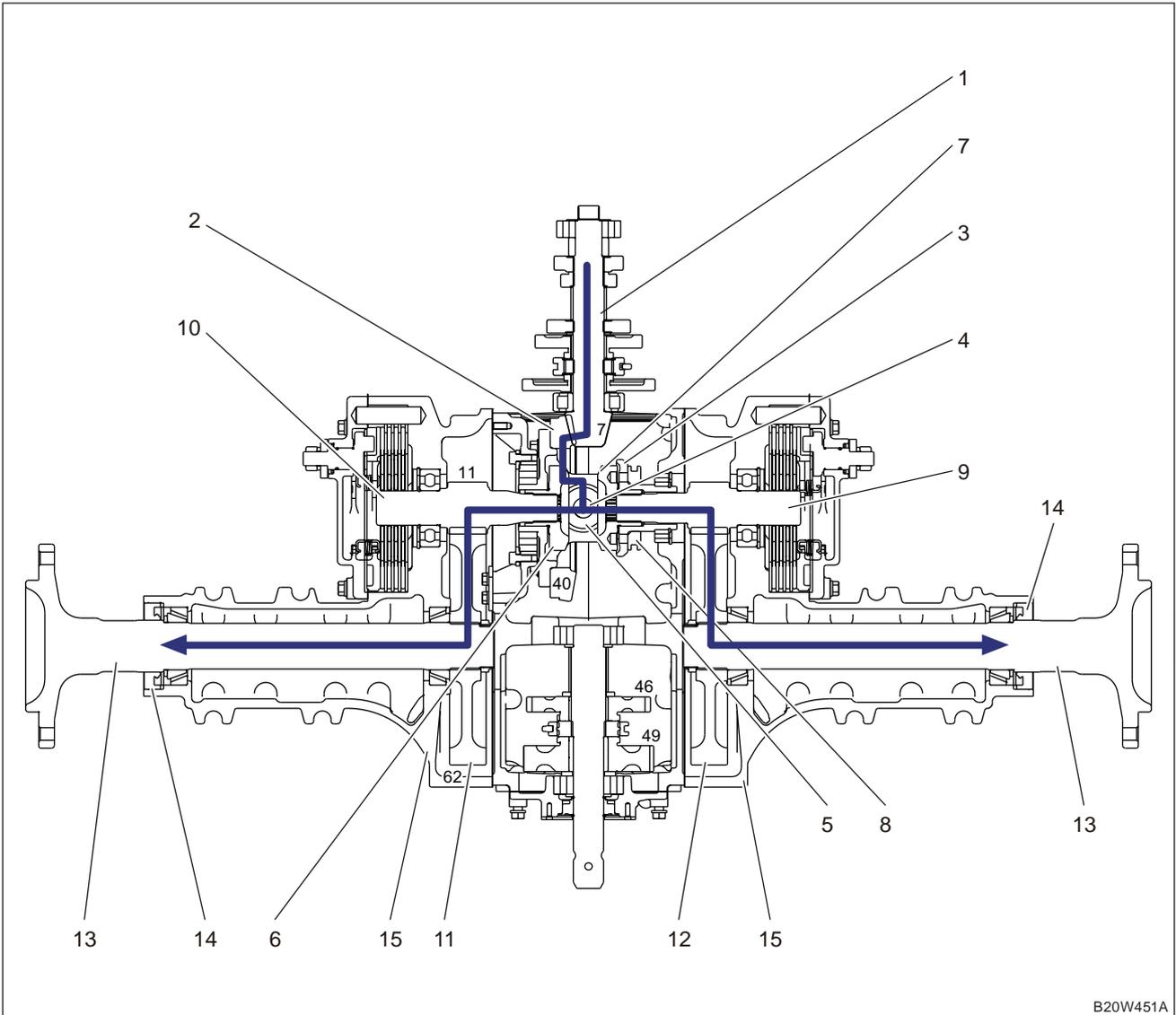
2.5 4WD



B20W450A

When rotating force is arrived at the countershaft (1), it is transmitted to the 4WD idle gear (4) of the 4WD idle shaft (3) through the 26 gear (2). When the 4WD operation is not in progress, the gear idles by the internal needle bearing. However, when the 4WD shift gear (6) of the 4WD shaft (5) is moved to the left for 4WD operation, the 4WD shift 26 gear is engaged with the 4WD idle 24 gear, so rotating power transmitted to the 4WD idle gear is passed to the 4WD shaft through the 4WD shift gear. Then, it is transferred to the front axle to turn the front wheels.

2.6 REAR AXLE



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

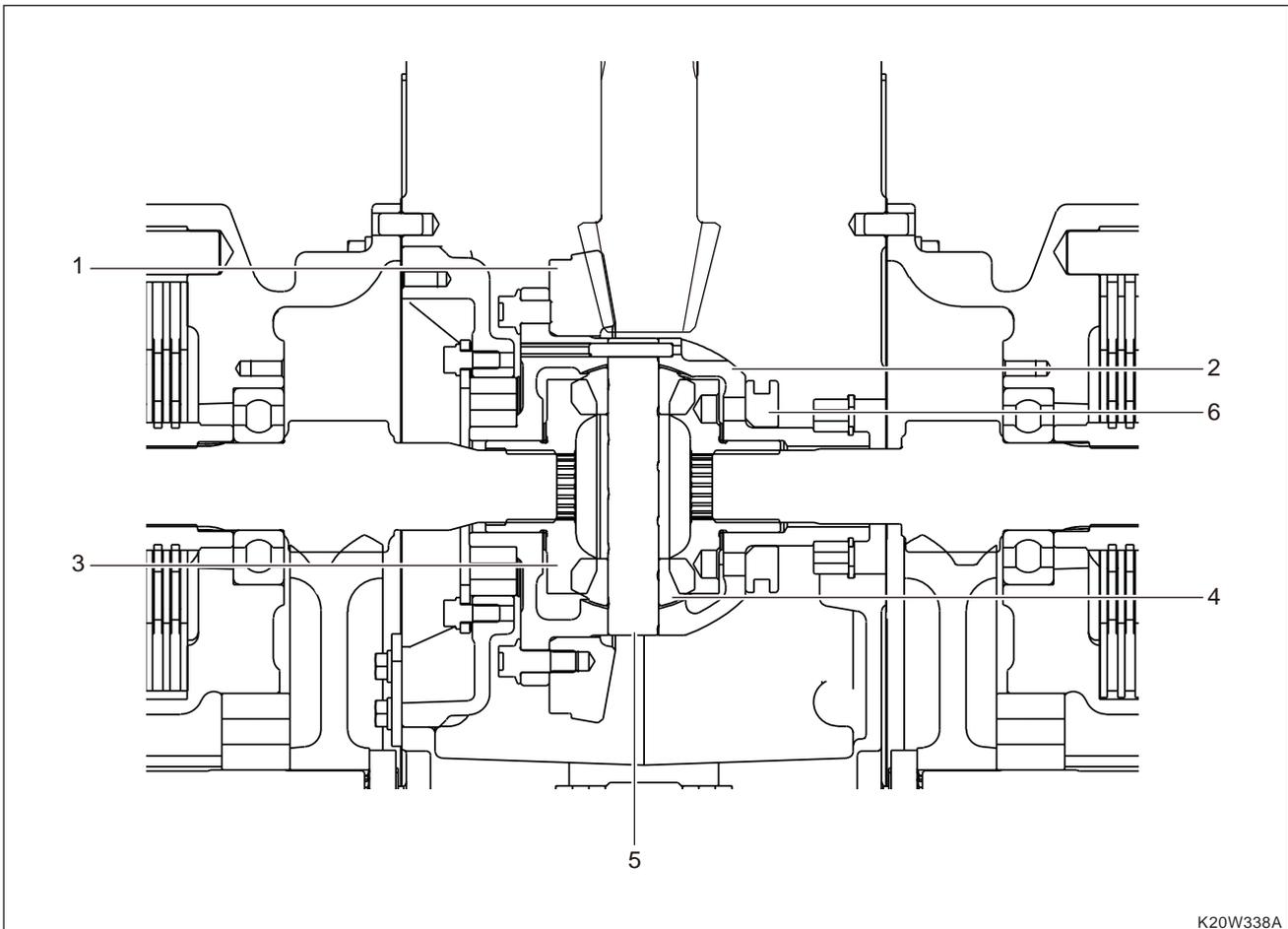
2.6.1 POWER TRANSFER

When rotating force arrives at the countershaft (1), it rotates the differential case (3) through the ring gear (2). As the differential rotates, the differential pinion (5) and differential side gear (6) inside the differential case to deliver the rotating force to the final pinion (10).

Then, the speed of the rotating force at the final pinion is reduced through engagement of the 11 gear of the final pinion with the 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.

### 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.

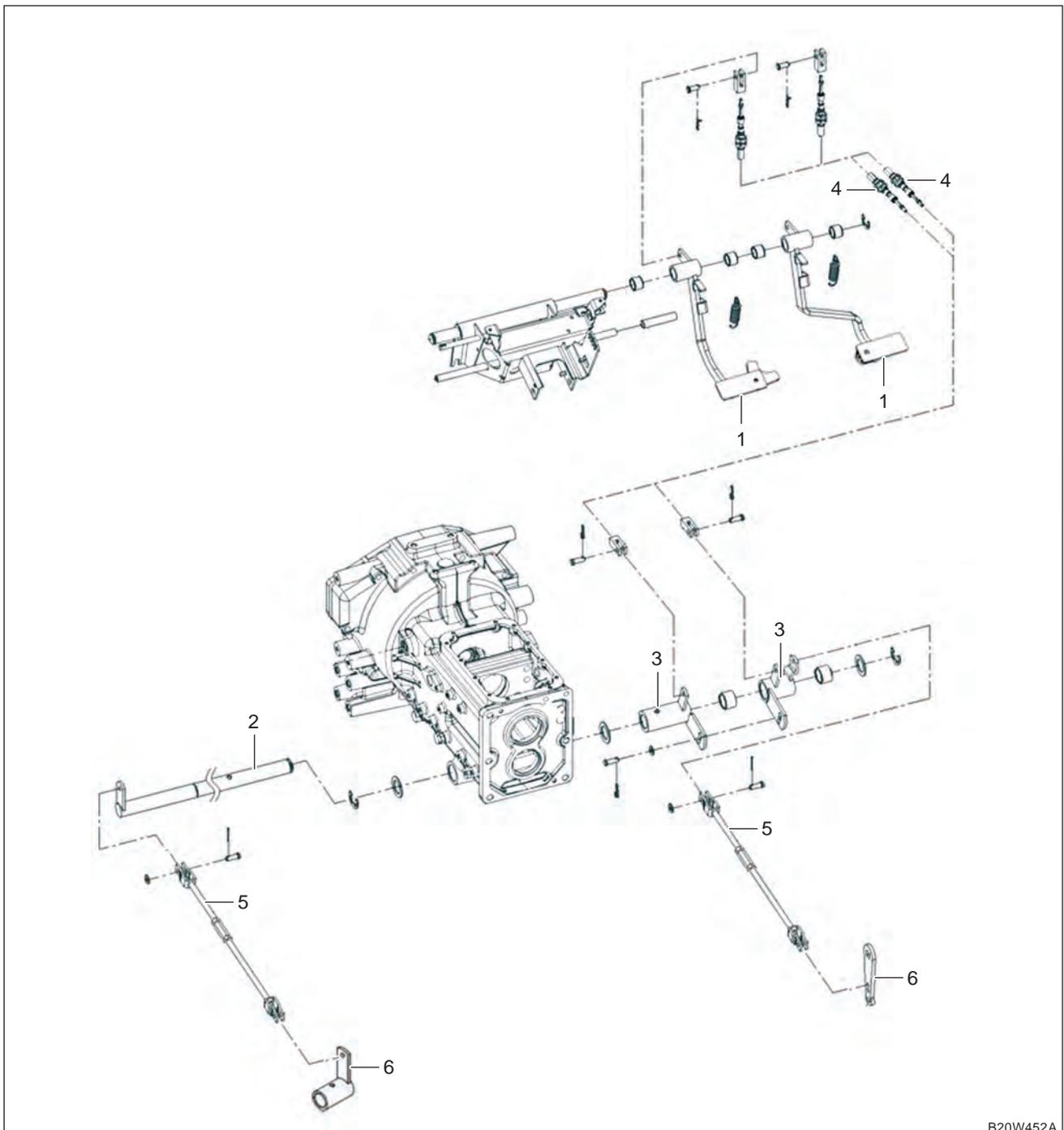
Also, when a wheel got stuck in mud, it is hard to escape the pit since the wheel in mud with no friction rotates at faster speed and the wheel on road with friction does not rotate due to the differential system. To prevent this situation, the vehicle is equipped with the differential lock. The differential 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).

## 3.2 BRAKE

### 3.2.1 OVERVIEW

#### MEC MODEL

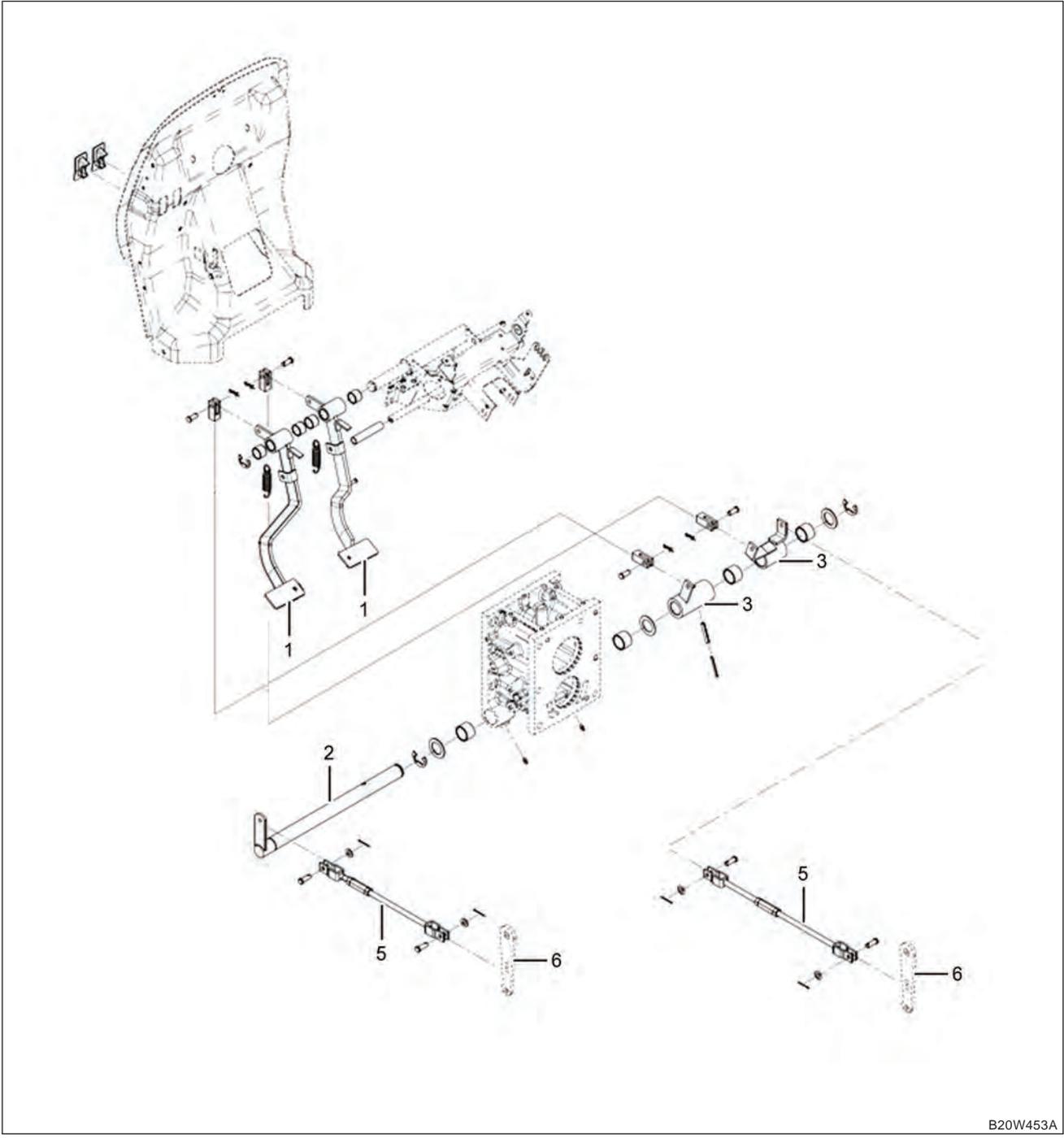


B20W452A

When the brake pedal (1) is depressed, the brake shaft is pulled by the cable (4) which is connected to the brake pedal and brake link (3) of the brake shaft (2). Also, as the brake shaft is connected to the brake rod (5), pulling the brake lever (6) operates the internal brake.

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

**HST MODEL**



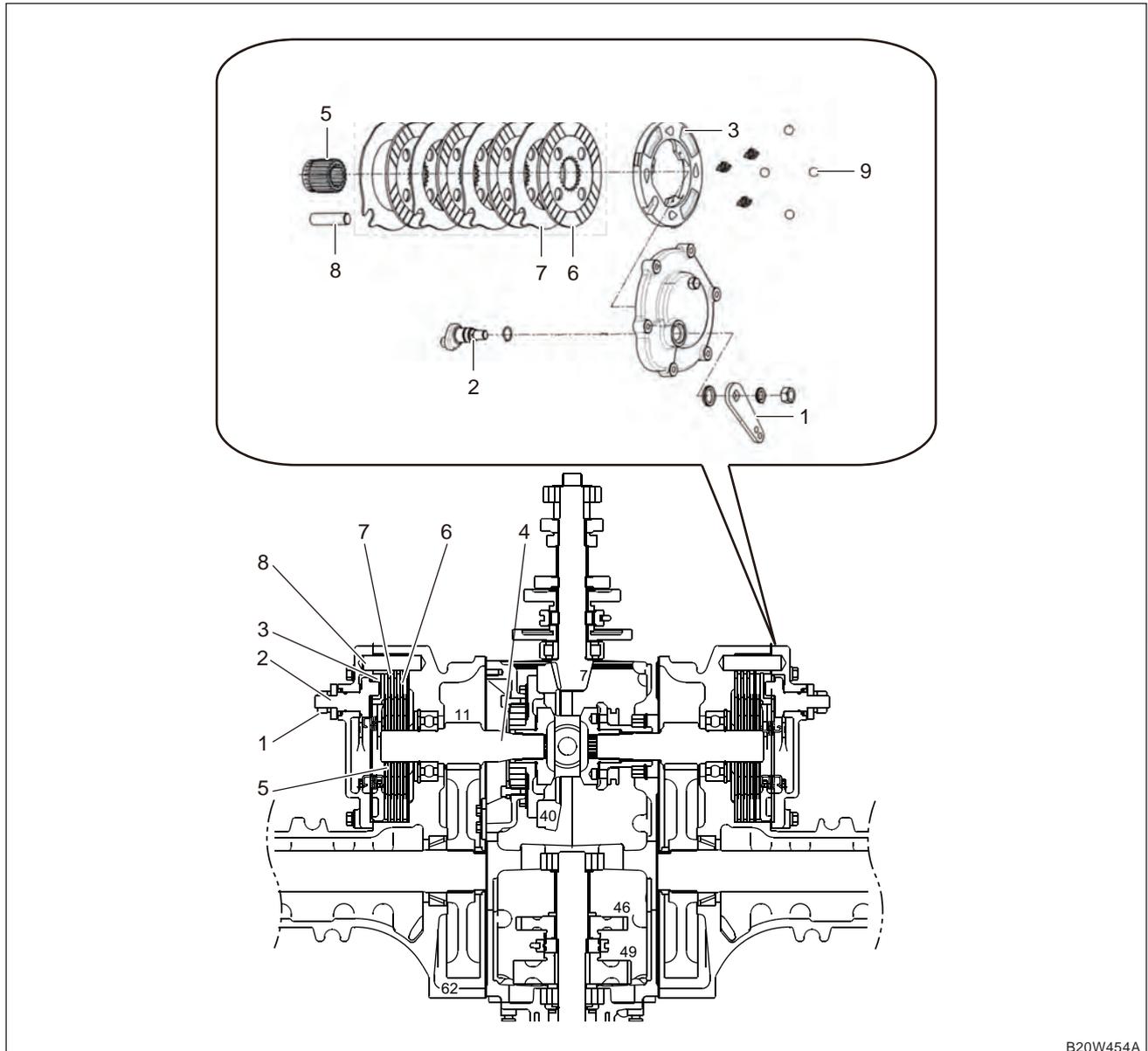
B20W453A

(1) brake pedal  
(2) brake shaft

(3) brake link  
(5) brake rod

(6) brake lever

3.2.2 OPERATING PRINCIPLE OF BRAKE



B20W454A

- |                 |                   |                |
|-----------------|-------------------|----------------|
| (1) Brake lever | (4) Final pinion  | (7) Plate      |
| (2) Brake cam   | (5) Spline hub    | (8) Shaft      |
| (3) Cam plate   | (6) Friction disc | (9) Steel ball |

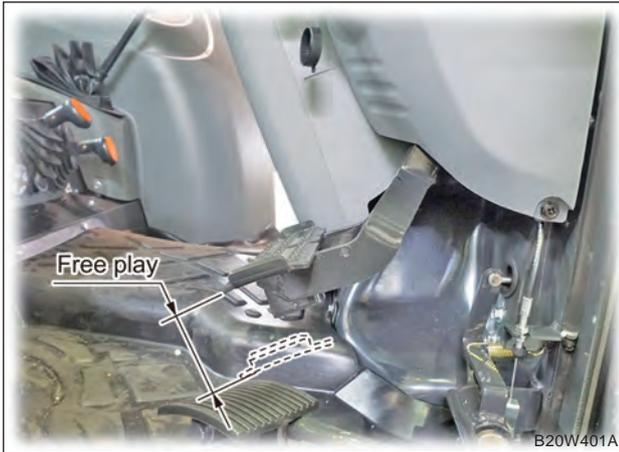
When the brake lever (1) is pulled by transferred power, the brake cam (2) fixed by the square boss is rotated as well. Also, as the protruded parts on the brake cam are fit to the grooves of the cam plates (LH/RH) (3), the cam plates are rotated as well.

On the other side, the final pinion (4) is fixed to the differential side gear with splines, rotating together, and its other side is connected to the spline hub (5) with splines. This spline hub is fixed to 4 friction discs (6) with splines as one unit. Also, the plates (7) are installed in between the friction discs and these plates are fixed to the shaft (8) which is 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 (9) 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 friction discs are fixed by the shaft, they stop rotating.

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

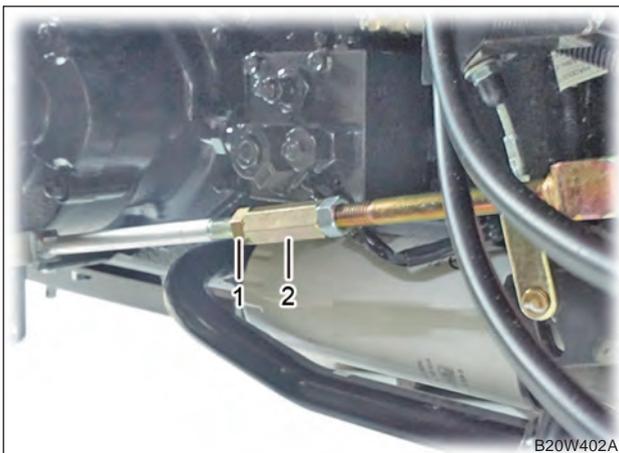
## 3.2.3 BRAKE PEDAL FREE PLAY ADJUSTMENT



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

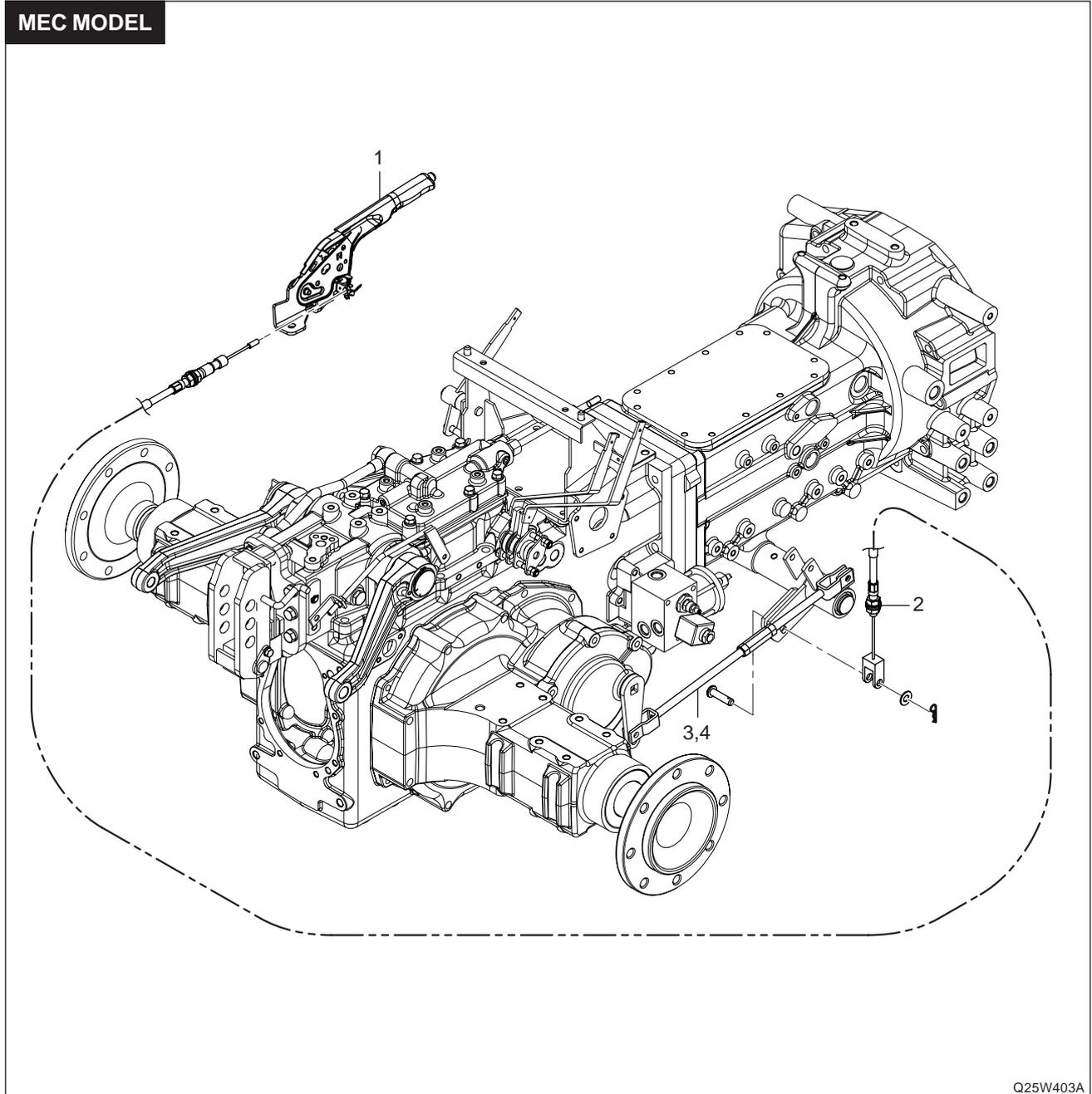
ITEM	STANDARD
Brake pedal free play	5 - 10 mm (0.19 - 0.39 in)

\* The free play for both pedals should be identical.



3. If the free play is out of the standard, unscrew the mounting nuts (1) of the brake rods (LH/RH) on the brake shaft section and use the turnbuckle (2) to adjust the free play. After adjusting the free play of the both sides, tighten the mounting nuts.

3.3 PARKING BRAKE OPERATION

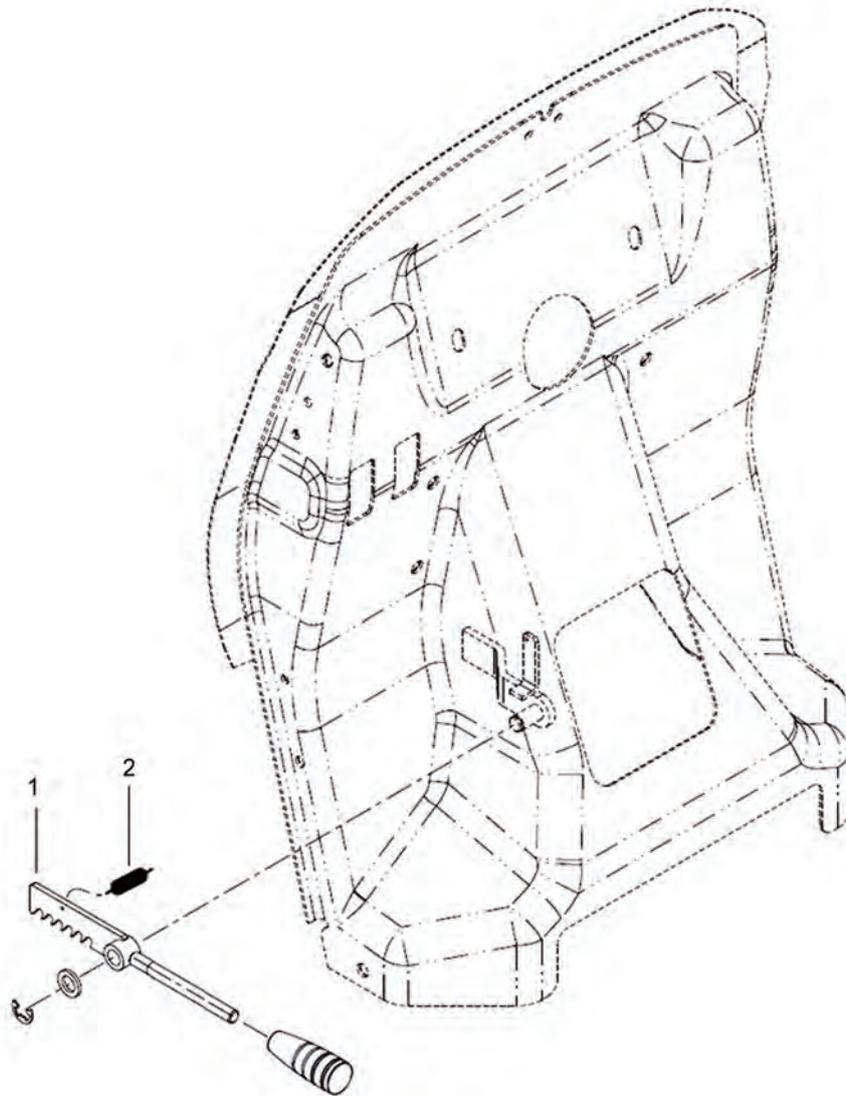


- (1) Parking brake lever
- (2) Parking brake wire (main)

- (3) Parking brake rod (LH)
- (4) Parking brake rod (RH)

When pulling the parking brake lever (1), the parking brake main wire (2) is pulled and power is transferred to the left and right parking brakes. Then, the parking brake rod (LH) (3) pulls the left brake lever and the parking brake rod (RH) (4) pulls the right brake lever for braking. 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.

## HST MODEL



H25W402A

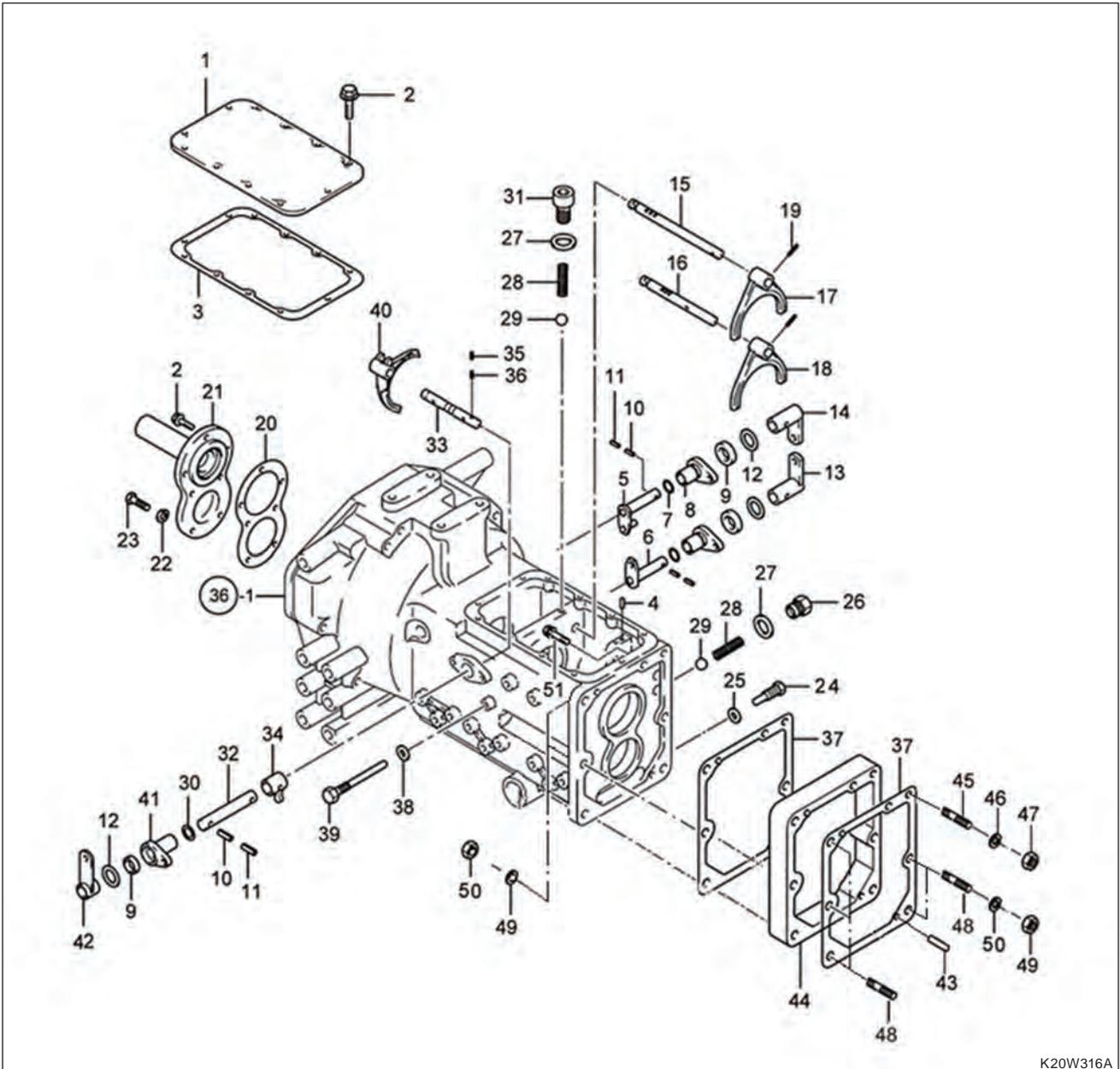
(1) Parking brake lever

(2) Spring

With the brake pedal depressed firmly, pull the parking brake lever to engage the brake lever tooth with the brake pedal. Then, tooth fix the brake pedal to maintain the main brake is engaged, and it function as parking brake.

4. SECTIONAL VIEW FOR MAJOR COMPONENTS

4.1 TRANSMISSION CASE SHIFT

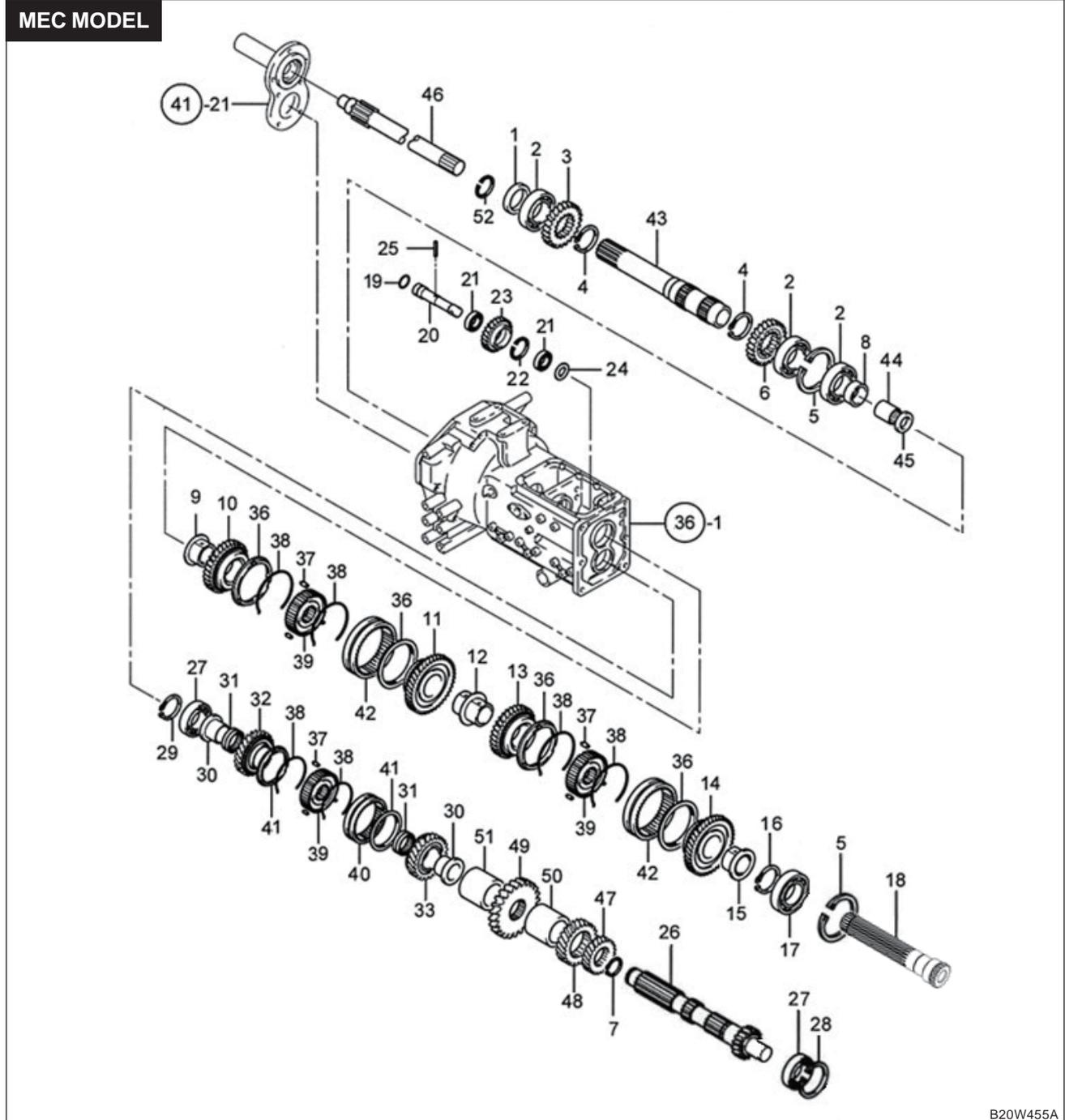


K20W316A

COMPONENTS

- |  |                                 |                                     |
|--|---------------------------------|-------------------------------------|
| (1) Upper transmission cover           | (18) Main shift fork (3-4)      | (35) Spring pin                     |
| (2) Washer mounting hex. bolt (SW)     | (19) Spring pin                 | (36) Spring pin                     |
| (3) Packing (upper transmission cover) | (20) Packing                    | (37) Packing                        |
| (4) anti-pairing gear pin              | (21) Main shaft oil seal case   | (38) Copper packing                 |
| (5) Main shift shifter lever (3-4)     | (22) Spring washer              | (39) Bolt (stepped)                 |
| (6) Main shift shifter lever (1-2)     | (23) Hex. bolt                  | (40) Shuttle fork                   |
| (7) O-ring (type P)                    | (24) Stepped mounting bolt      | (41) Shuttle shift holder           |
| (8) Main shift shifter holder          | (25) Copper packing             | (42) Shuttle link C                 |
| (9) Oil seal (type TC)                 | (26) Cap bolt                   | (43) Dowel pin                      |
| (10) Spring pin                        | (27) Copper packing             | (44) Spacer (transmission case)     |
| (11) Spring pin                        | (28) Spring                     | (45) Stud bolt                      |
| (12) Collar B                          | (29) Steel ball 5/16            | (46) Spring washer                  |
| (13) Main shift arm (3-4)              | (30) O-ring (type P)            | (47) Nut                            |
| (14) Main shift arm (1-2)              | (31) Tapered plug               | (48) Stud bolt                      |
| (15) Main shift 3-4 fork shaft         | (32) Shaft (shuttle shift)      | (49) Spring washer                  |
| (16) Main shift 1-2 fork shaft         | (33) Shuttle shifter fork shaft | (50) Nut                            |
| (17) Main shift fork (1-2)             | (34) Shuttle shaft lever        | (51) Washer mounting hex. bolt (SW) |

4.2 MAIN SHIFT GEAR

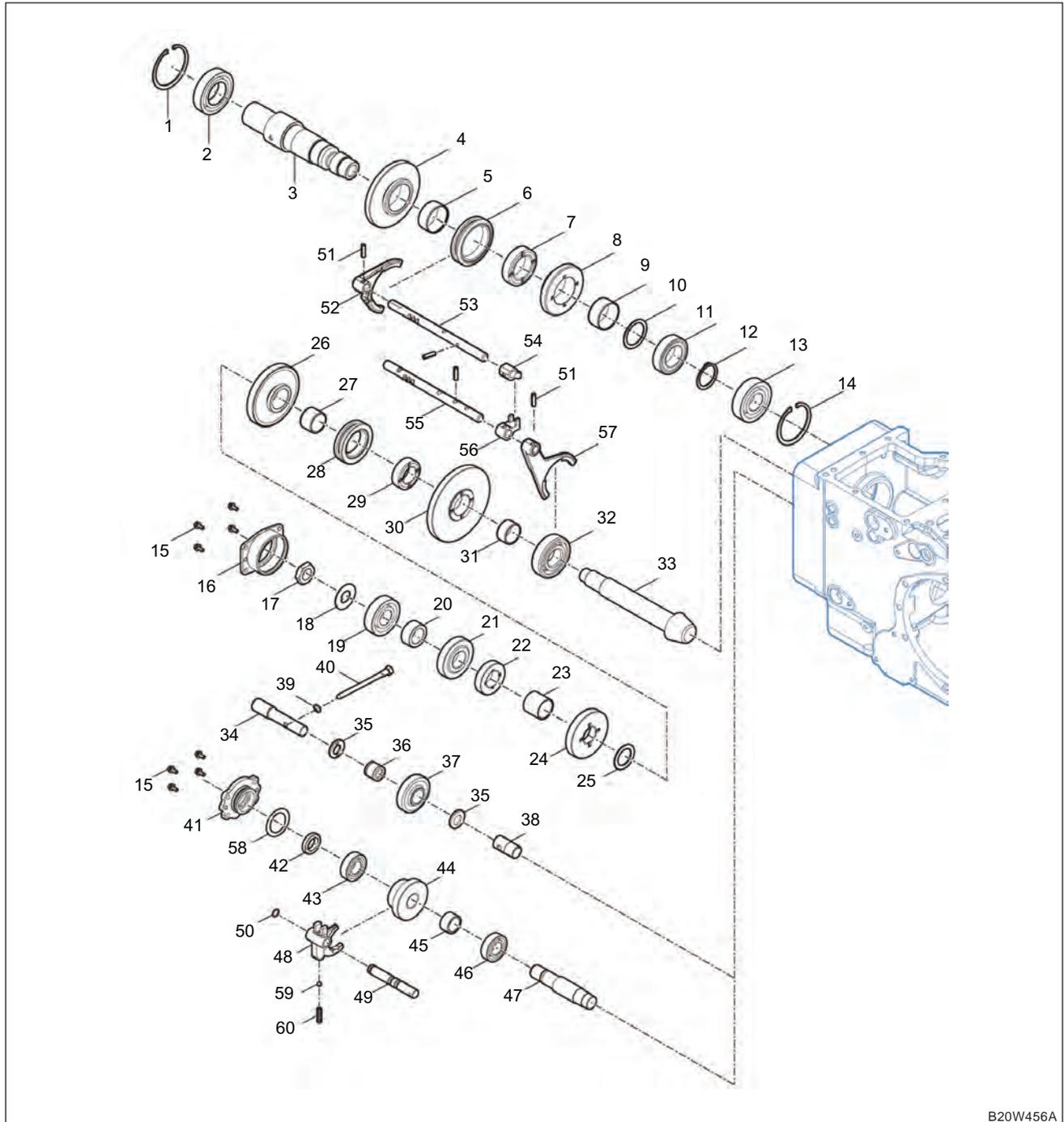


B20W455A

**COMPONENTS**

- |                        |                              |                                  |                        |
|------------------------|------------------------------|----------------------------------|------------------------|
| (1) Oil seal           | (14) Gear 43T, the1st        | (27) Ball bearing                | (42) Sleeve            |
| (2) Ball bearing       | (15) Guide bush-C            | (28) Snap ring                   | (43) Main shaft, outer |
| (3) Gear 26T, reverse  | (16) Snap ring               | (29) Snap ring                   | (44) Dry bush          |
| (4) Snap ring          | (17) Ball bearing            | (30) Guide bush-D                | (45) Oil seal          |
| (5) Snap ring          | (18) Guide shaft, main shift | (31) Needle bearing              | (46) Main shaft, inner |
| (6) Gear 29T, forward  | (19) O-ring(P-type)          | (32) Gear 30T, reverse           | (47) Gear 2nd, counter |
| (7) Snap ring          | (20) Idle shaft, reverse     | (33) Gear 32T, forward           | (48) Gear 3rd, counter |
| (8) Bush               | (21) Ball bearing            | (36) Synchro ring                | (49) Gear 4th, counter |
| (9) Guide bush A       | (22) Snap ring               | (37) Synchro ring                | (50) Spacer, front     |
| (10) Gear 32T, the 4th | (23) Idle gear 23T, reverse  | (38) Synchro ring                | (51) Spacer, rear      |
| (11) Gear 37T, the 3rd | (24) Collar                  | (39) Hub                         | (52) Snap ring         |
| (12) Guide bush-B      | (25) Spring pin              | (40) Sleeve                      |                        |
| (13) Gear 41T, the 2nd | (26) Counter shaft ass'y     | (41) Synchro ring ass'y, shuttle |                        |

4.3 4WD AND RANGE SHIFT GEAR



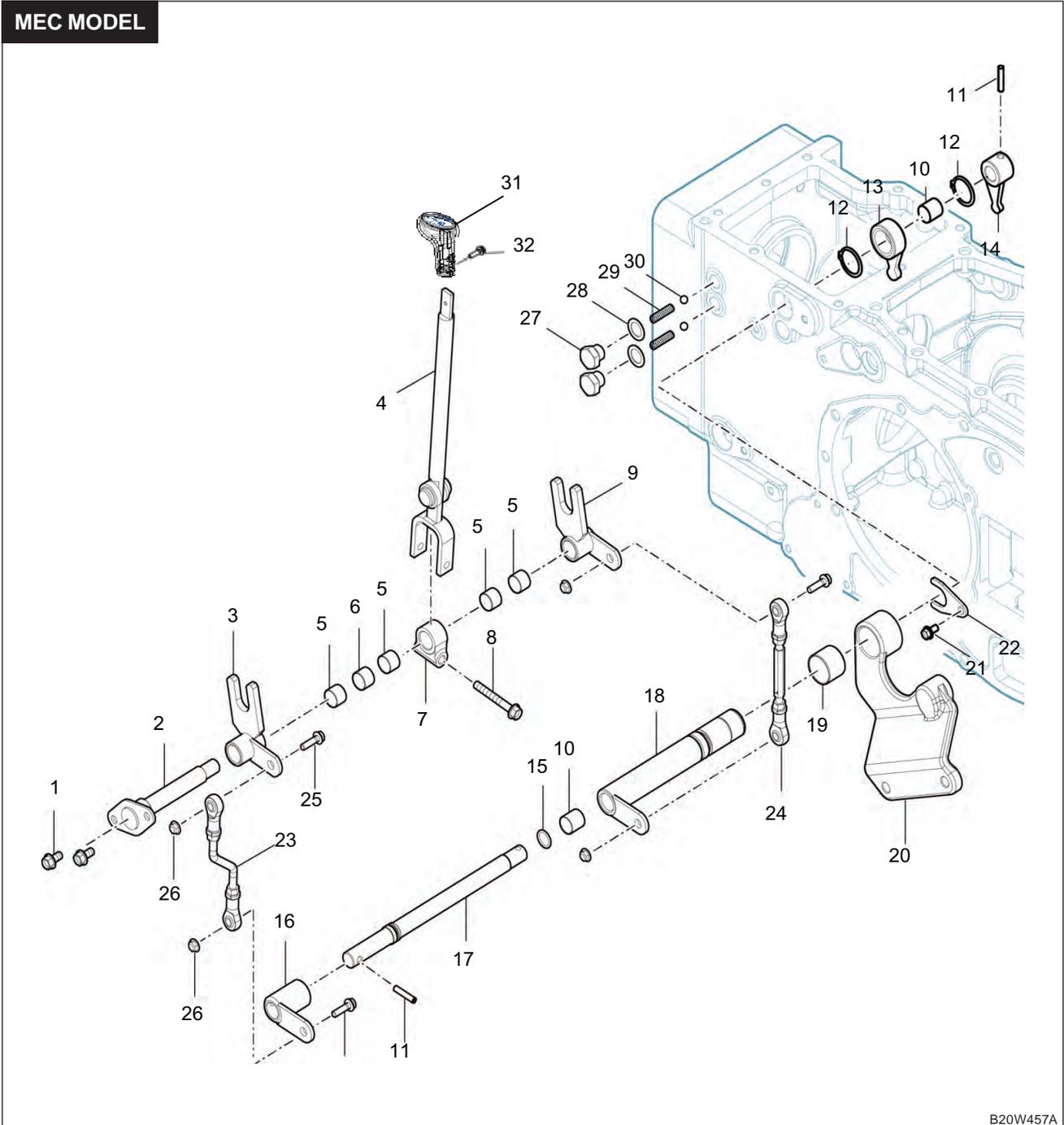
B20W456A

COMPONENTS

- |                               |                                |                      |                         |
|-------------------------------|--------------------------------|----------------------|-------------------------|
| (1) Snap ring, hole C-type    | (16) Case, bearing             | (31) Bush, 1         | (46) Bearing , ball     |
| (2) Ball bearing              | (17) Locknut                   | (32) Bearing         | (47) 4WD drive shaft    |
| (3) USB shift drive shaft     | (18) Washer                    | (33) Counter shaft   | (48) 4WD fork           |
| (4) USB shift 4th drive gear  | (19) Ball bearing              | (34) 4Wd idle shaft  | (49) 4WD fork shaft     |
| (5) Bush                      | (20) Collar                    | (35) Washer, thrust  | (50) O-ring             |
| (6) Sleeve                    | (21) 4WD_drive_gear            | (36) Bearing         | (51) Pin, spring        |
| (7) Hub                       | (22) USB shift 4th driven gear | (37) 4WD idle shaft  | (52) Fork(3-4)          |
| (8) USB shift 3th drive gear  | (23) Spacer                    | (38) Collar          | (53) Fork shaft(3-4)    |
| (9) Bush                      | (24) USB shift 3rd driven gear | (39) Bolt            | (54) Shifter boss (C-D) |
| (10) Collar                   | (25) Collar                    | (40) Washer,sealing  | (55) Fork shaft(1-2)    |
| (11) USB shift 2nd drive gear | (26) USB shift 2nd driven gear | (41) Case, oil seal  | (56) Shifter boss (A-B) |
| (12) C-ring, shaft            | (27) Bush                      | (42) Seal, oil       | (57) Fork(1-2)          |
| (13) Ball bearing             | (28) Sleeve(1-2)               | (43) Bearing, ball   | (58) O-ring             |
| (14) C-ring, hole             | (29) Hub                       | (44) 4Wd driven gear | (59) Steel ball 5/16    |
| (15) Bolt w/washer            | (30) USB shift 1st driven gear | (45) Collar          | (60) Spring             |

4.4 RANGE SHIFT LEVER

MEC MODEL

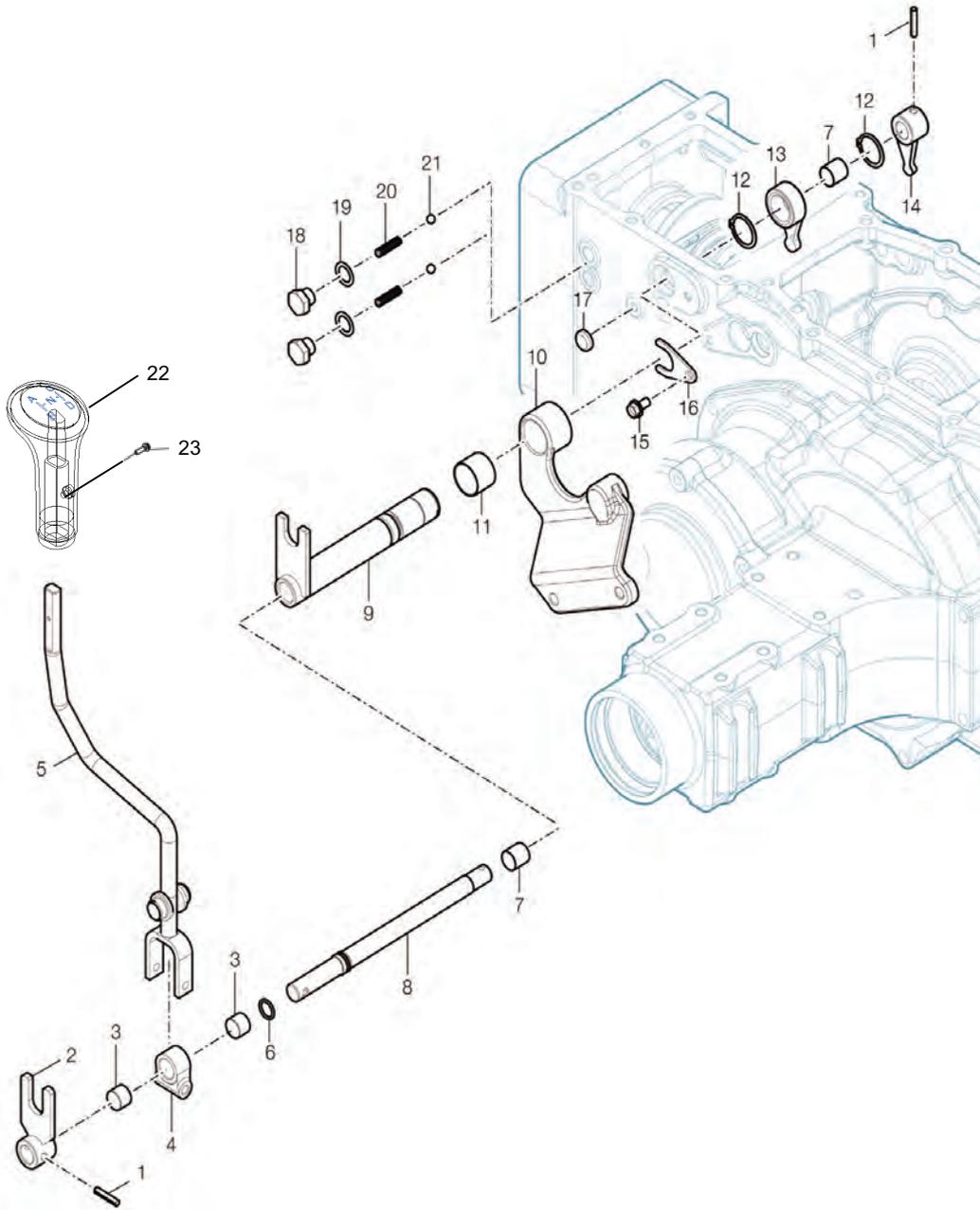


B20W457A

COMPONENTS

- |                             |                             |                                     |
|-----------------------------|-----------------------------|-------------------------------------|
| (1) Seat rail stay assembly | (13) Copper packing         | (25) Washer mounting hex. Bolt (SW) |
| (2) Collar - B              | (14) 4WD fork shaft         | (26) Range shift lever assembly - B |
| (3) Creep speed lever boss  | (15) 4WD fork               | (27) Spring pin                     |
| (4) Bushing                 | (16) Steel ball 5/16        | (28) Spring pin                     |
| (5) 4WD lever               | (17) Spring                 | (29) Range shift lever shaft        |
| (6) 4WD knob assembly       | (18) 4WD lever assembly - A | (30) O-ring (type P)                |
| (7) Snap ring (type E)      | (19) Bushing                | (31) Range shift lever              |
| (8) 4WD rod                 | (20) O-ring                 | (32) Range shift knob assembly      |
| (9) Plain washer            | (21) Shift arm holder       | (33) Range shift fork shaft         |
| (10) Split pin              | (22) Oil seal (type TC)     | (34) Range shift fork               |
| (11) Plug                   | (23) 4WD lever assembly B   | (35) Washer mounting screw (small)  |
| (12) Bolt (stepped)         | (24) Spring pin             | (36) Washer mounting screw (small)  |

**HST MODEL**

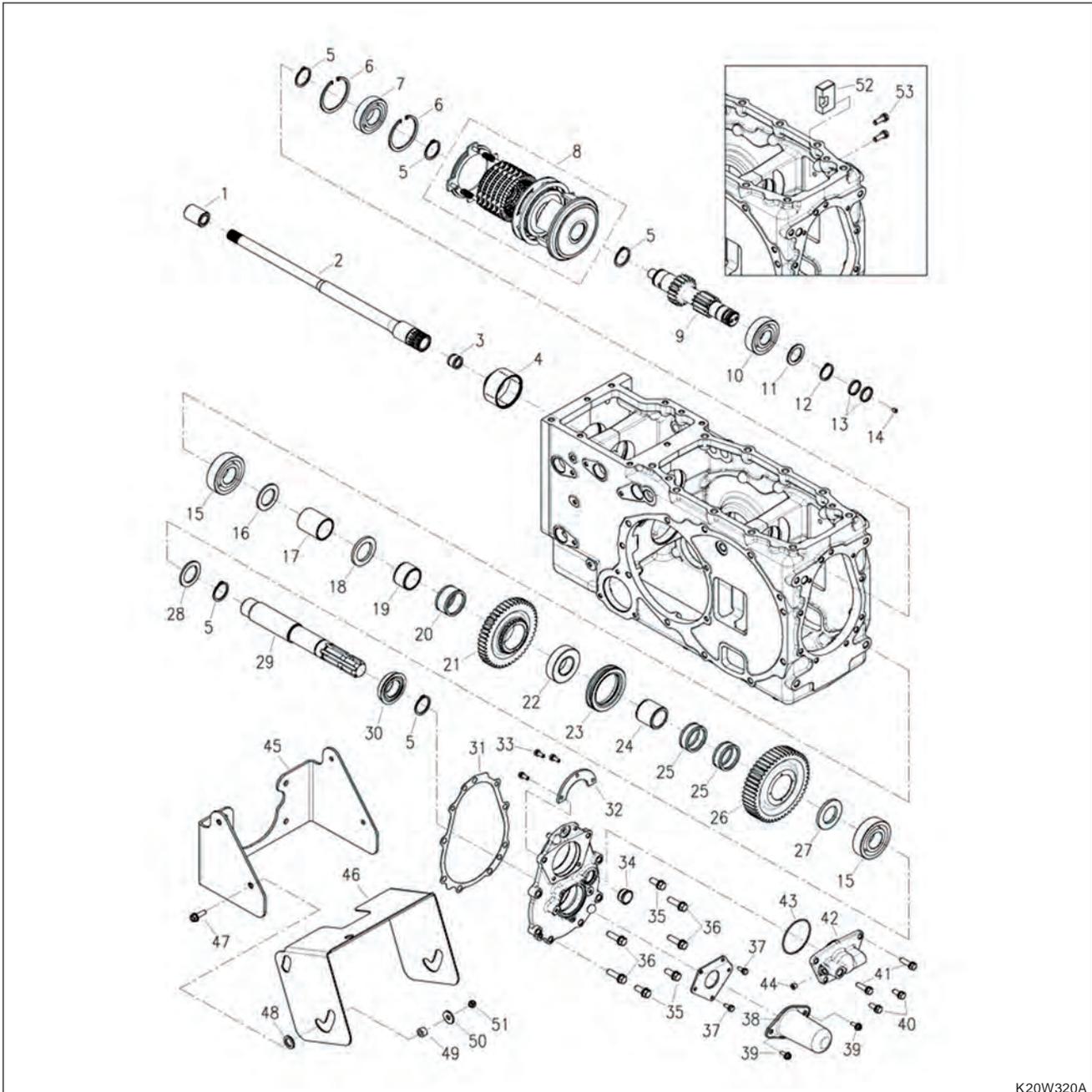


B20W458A

**COMPONENTS**

- |                        |                                |                      |
|------------------------|--------------------------------|----------------------|
| (1) Spring pin         | (9) Shifting shaft             | (17) Seal cap        |
| (2) Shifting arm ass'y | (10) Range shaft holder        | (18) Bolt            |
| (3) Dry bush           | (11) Dry bush                  | (19) Washer\ sealing |
| (4) PTO lever link PTO | (12) C-type retaining ring     | (20) Spring\ fork    |
| (5) Sub shift lever    | (13) Arm(3-4)                  | (21) Ball 5/16       |
| (6) Seal o-ring        | (14) Arm(3-4)                  | (22) Knob, sub shift |
| (7) Dry bush           | (15) Screw\hex flange head cap | (23) Screw           |
| (8) Shifter shaft(3-4) | (16) Stopper                   |                      |

## 4.5 INDEPENDENT PTO SHIFT GEAR



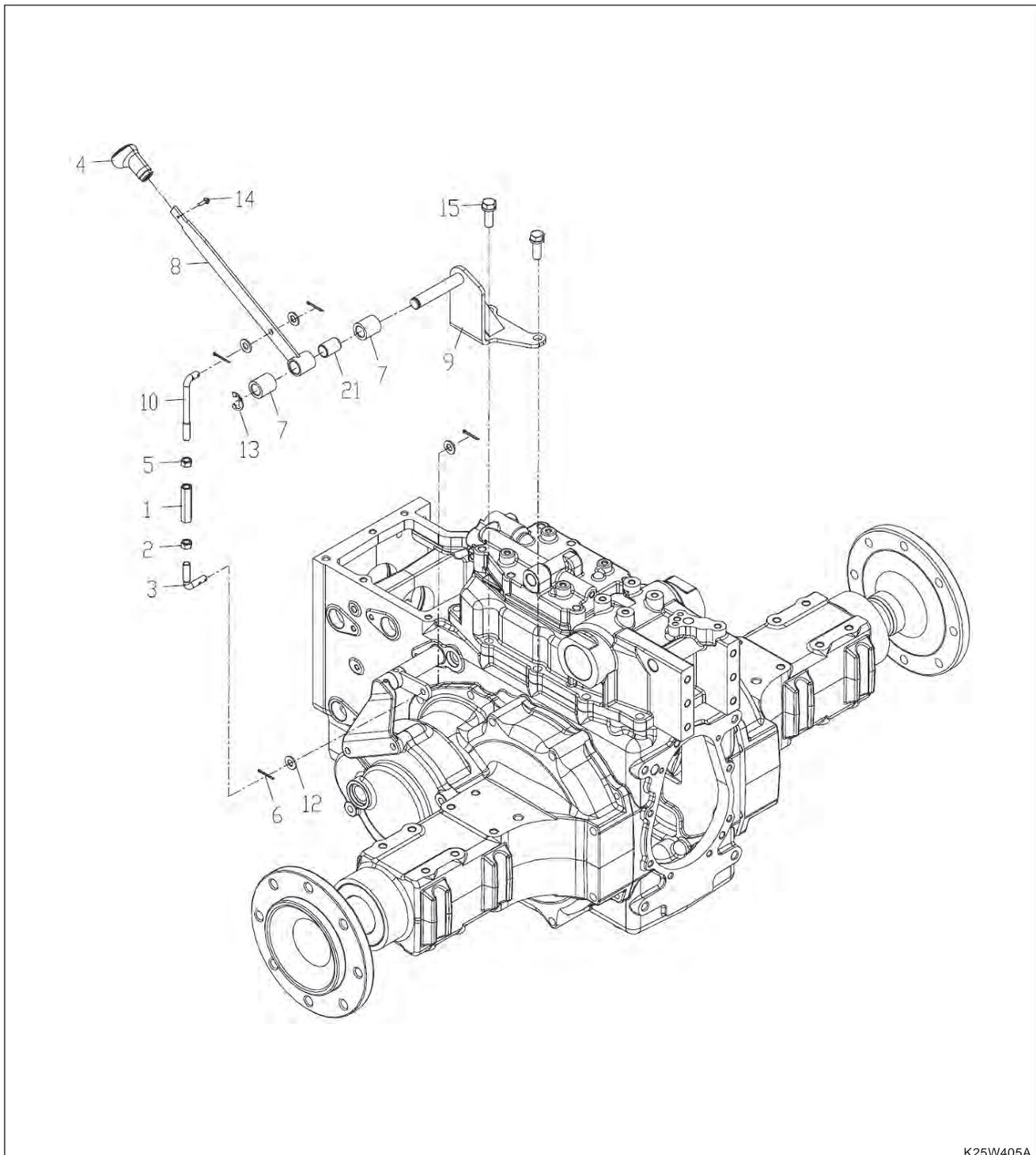
K20W320A

## COMPONENTS

- |                                   |                                     |                                     |
|-----------------------------------|-------------------------------------|-------------------------------------|
| (1) Spline collar                 | (19) Needle bushing - D             | (37) Washer mounting hex. bolt (SW) |
| (2) PTO connecting shaft          | (20) Needle bearing                 | (38) PTO cover                      |
| (3) Needle bearing                | (21) PTO gear 46T                   | (39) Hex. flange bolt               |
| (4) PTO coupling                  | (22) PTO hub A                      | (40) Washer mounting hex. bolt (SW) |
| (5) Snap ring for shaft           | (23) PTO sleeve                     | (41) Washer mounting hex. bolt (SW) |
| (6) Snap ring for hole (type C)   | (24) Needle bushing - B             | (42) Seal case                      |
| (7) Ball bearing                  | (25) Needle bearing                 | (43) O-ring (S70)                   |
| (8) PTO clutch pack               | (26) PTO 1st gear                   | (44) Tapered plug                   |
| (9) PTO shift shaft               | (27) Collar                         | (45) PTO safety cover bracket       |
| (10) Ball bearing                 | (28) Washer                         | (46) PTO shaft cover                |
| (11) Collar                       | (29) PTO shaft                      | (47) Hex. flange bolt               |
| (12) Snap ring for shaft (type C) | (30) Oil seal                       | (48) Buffer rubber                  |
| (13) Seal ring                    | (31) Packing (PTO shaft housing)    | (49) Bushing                        |
| (14) Stop screw M7x1              | (32) Bearing cover                  | (50) Plain washer                   |
| (15) Ball bearing                 | (33) Washer mounting hex. bolt (SW) | (51) Hex. U-nut                     |
| (16) Thrust washer                | (34) Sight glass                    | (52) Brake holder                   |
| (17) Spacer                       | (35) Washer mounting hex. bolt (SW) | (53) Washer mounting hex. bolt (SW) |
| (18) Collar                       | (36) Washer mounting hex. bolt (SW) |                                     |



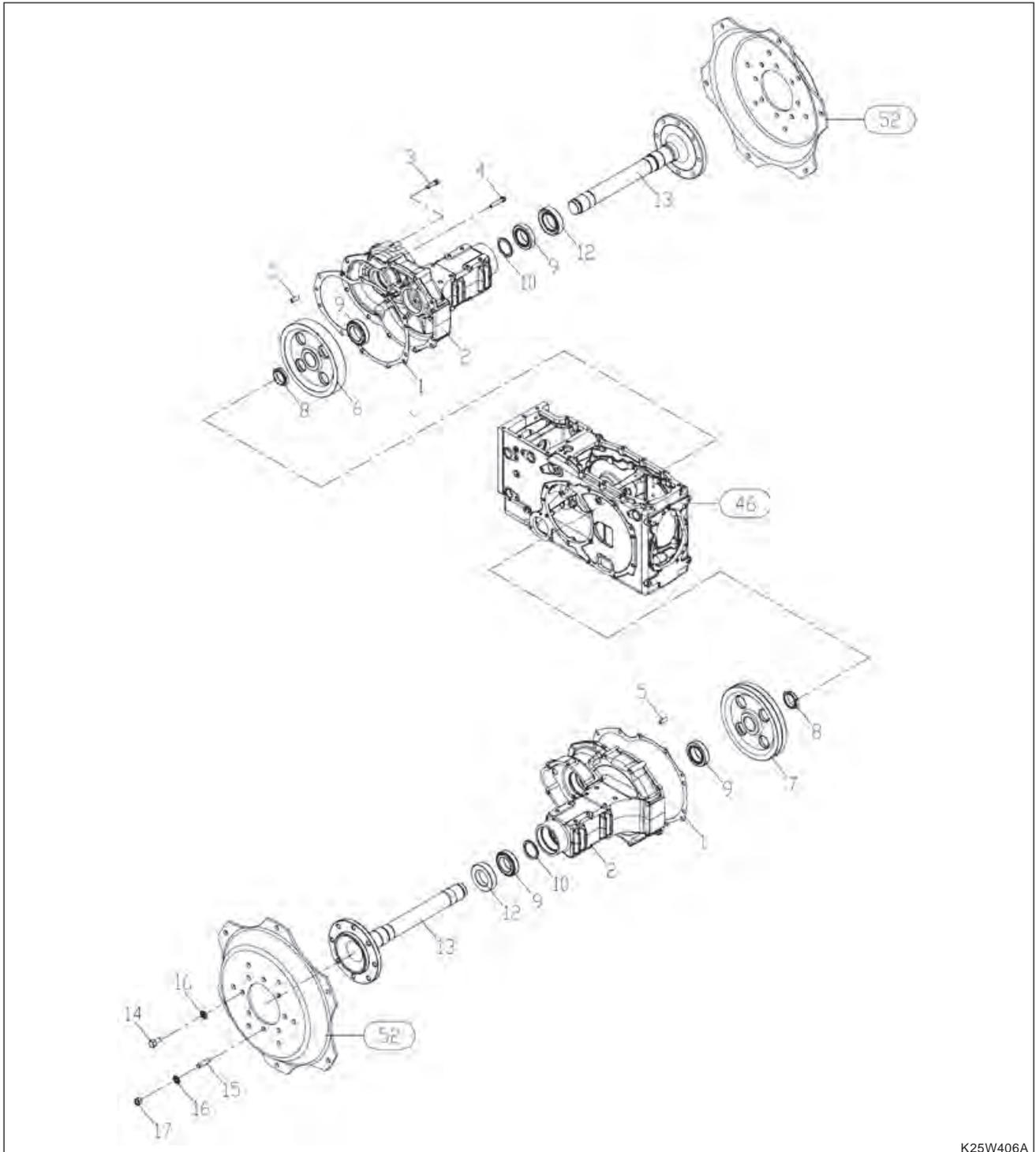
## 4.7 PTO SHIFT LEVER ASSEMBLY



### COMPONENTS

- |                        |                              |                    |
|------------------------|------------------------------|--------------------|
| (1) Turn buckle        | (7) Collar                   | (13) Snap ring     |
| (2) Nut(left screw)M10 | (8) Lever, P.T.O shift       | (14) Screw         |
| (3) Shift rod-B, P.T.O | (9) Shaft, P.T.O shift lever | (15) Bolt w/washer |
| (4) Knob, P.T.O        | (10) P.T.O rod               | (21) Bush          |
| (5) Fix nut            | (11) Bush                    |                    |
| (6) Cotter pin         | (12) Plain washer            |                    |

4.8 REAR AXLE HOUSING

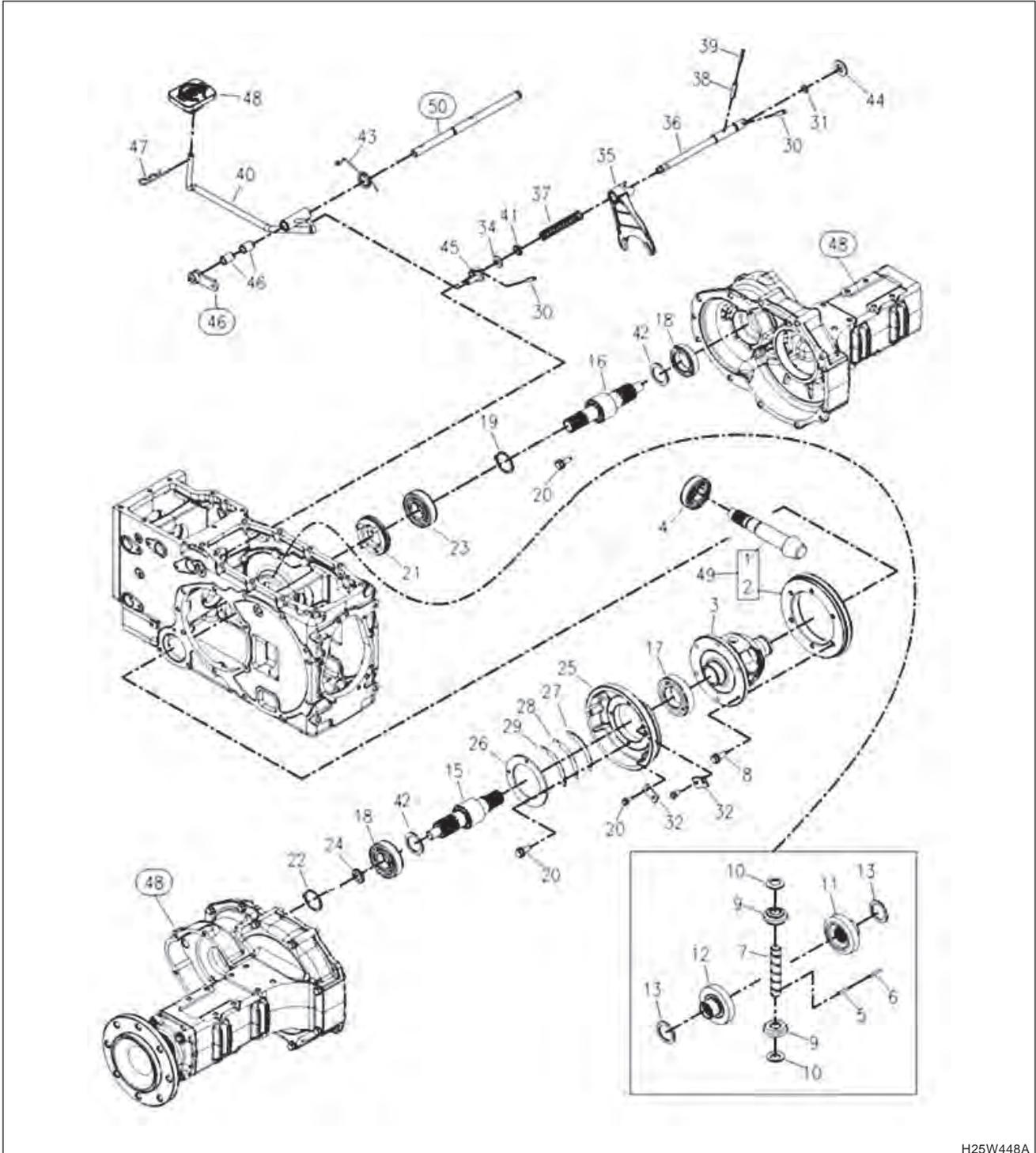


K25W406A

COMPONENTS

- |                        |                       |                      |
|------------------------|-----------------------|----------------------|
| (1) Packing, case      | (7) Gear L, rear axle | (14) Bolt (M14x1.5P) |
| (2) Housing, rear axle | (8) Nut               | (15) Stud bolt       |
| (3) Bolt w/washer      | (9) Ball bearing      | (16) Washer          |
| (4) Bolt w/washer      | (10) Spacer           | (17) Nut             |
| (5) Paraller pin       | (12) Oil seal         |                      |
| (6) Gear R, rear axle  | (13) Rear axle        |                      |

4.9 REAR AXLE DRIVING SECTION

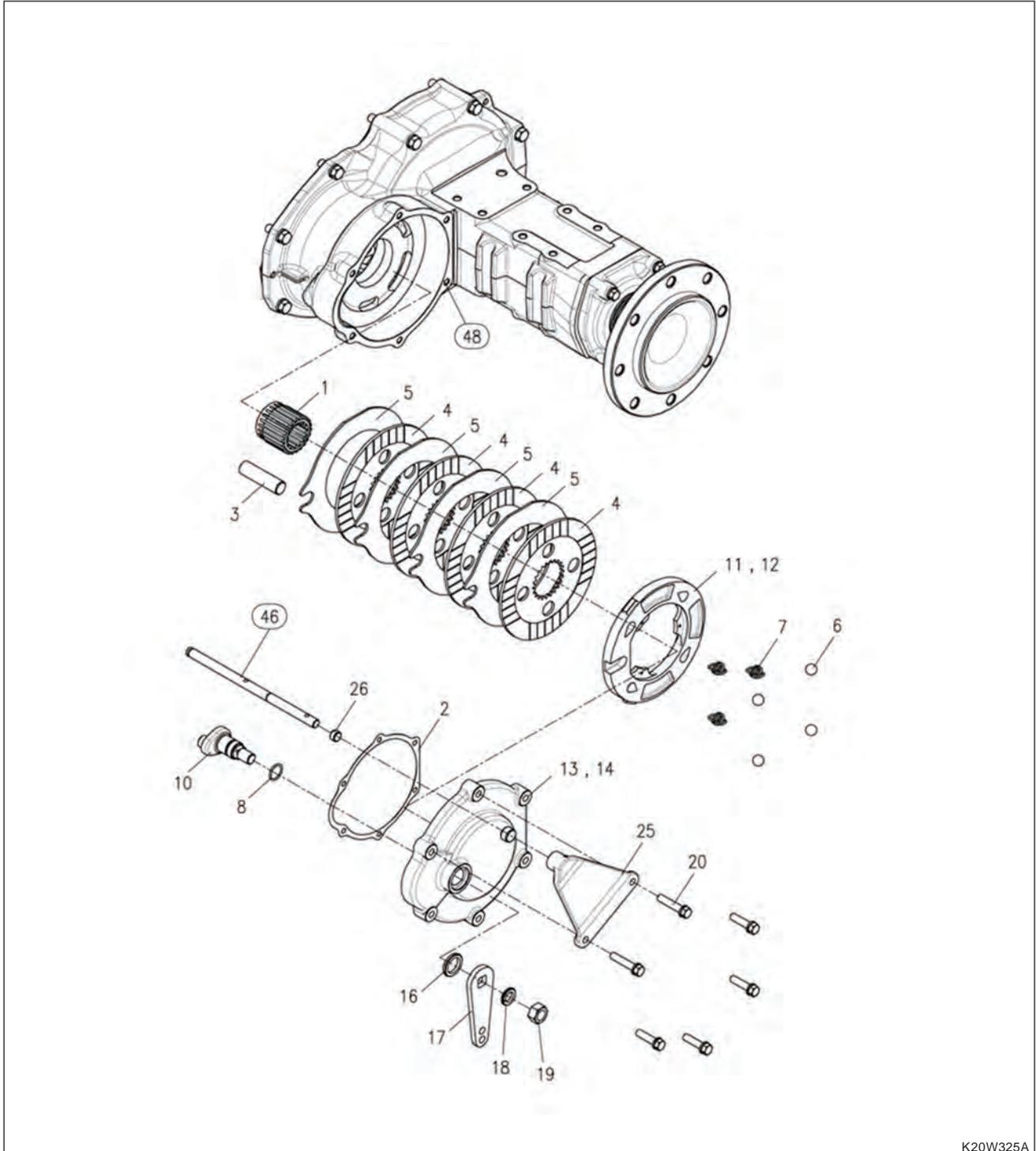


H25W448A

COMPONENTS

- |                          |                            |                     |                                |
|--------------------------|----------------------------|---------------------|--------------------------------|
| (1) Counter shaft        | (11) Gear(A), diff side    | (22) Snap ring      | (32) Retainer                  |
| (2) Ring gear            | (12) Gear(B), diff side    | (23) Ball bearing   | (34) Washer                    |
| (3) Case, differential   | (13) Liner, side gear      | (24) Snap ring      | (35) Fork, differential        |
| (4) Bearing NJ370E       | (15) Final pinion l        | (25) Carrier        | (36) Shaft, diff fork          |
| (5) Parallel pin         | (16) Final pinion r        | (26) Retainer       | (37) Spring                    |
| (6) Spring pin           | (17) Ball bearing          | (27) Shim A         | (38) Spring pin                |
| (7) Pinion shaft         | (18) Ball bearing (6308HL) | (28) Shim B         | (39) Spring pin                |
| (8) Bolt                 | (19) Snap ring             | (29) Shim C         | (40) Pedal, differential ass'y |
| (9) Pinion, differential | (20) Bolt w/washer         | (30) Spring pin     | (41) Oil seal(TC)              |
| (10) Liner, pinion       | (21) Slider, diff.Lock     | (31) O-ring(P-type) | (42) Spacer                    |

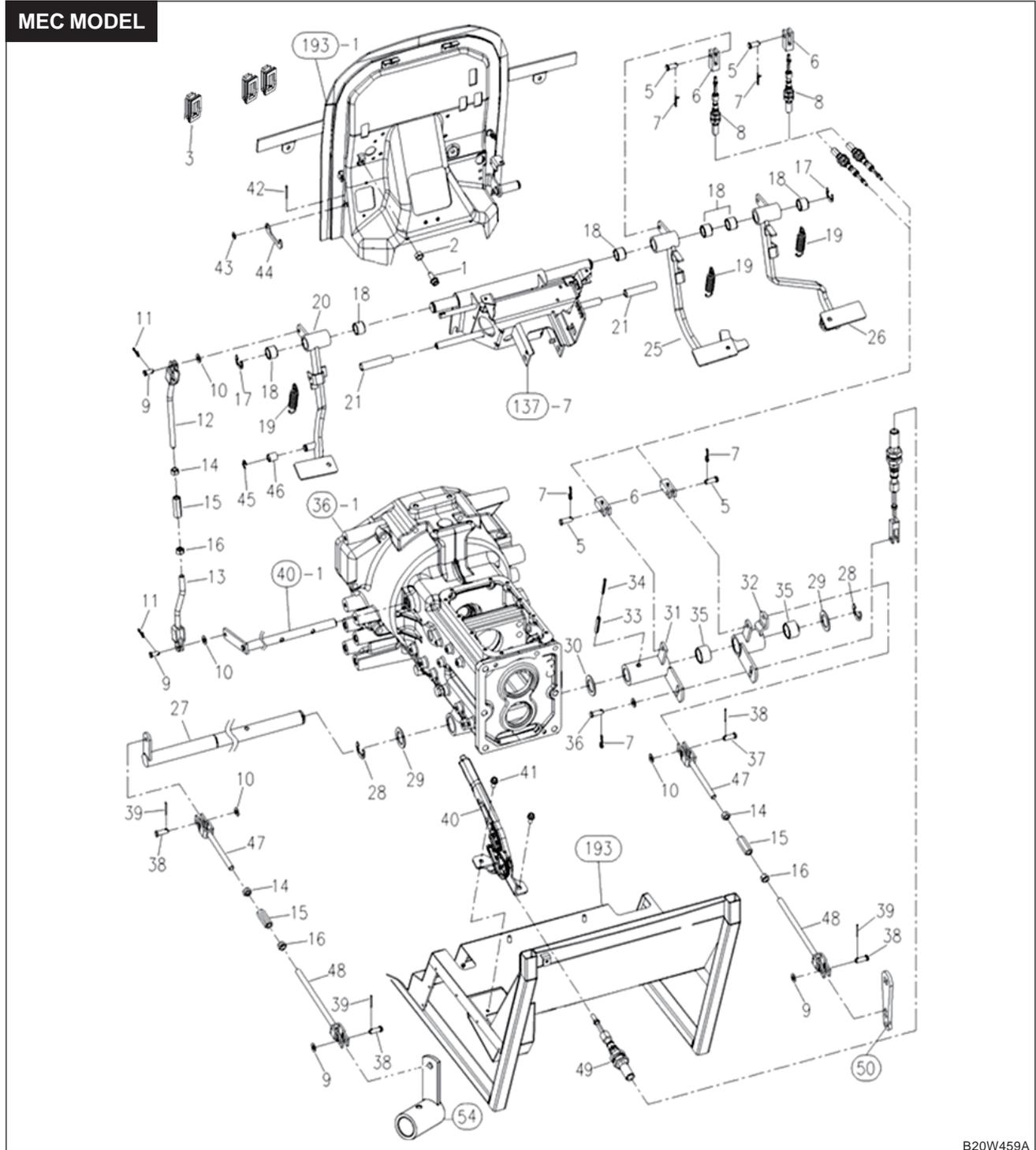
4.10 BRAKE



COMPONENTS

- |                   |                                     |                                     |
|-------------------|-------------------------------------|-------------------------------------|
| (1) Spline hub    | (8) O-ring (type P)                 | (16) Oil seal                       |
| (2) Packing       | (10) Brake cam                      | (17) Lever                          |
| (3) Shaft         | (11) Cam plate (LH)                 | (18) Spring washer                  |
| (4) Friction disc | (12) Cam plate (RH)                 | (19) Hex. nut (fine)                |
| (5) Plate         | (13) Brake cover (LH)               | (20) Washer mounting hex. bolt      |
| (6) Steel ball    | (14) Brake cover (RH)               | (25) Range shift lever shaft holder |
| (7) Spring        | (15) Washer mounting hex. bolt (SW) | (26) Bushing                        |

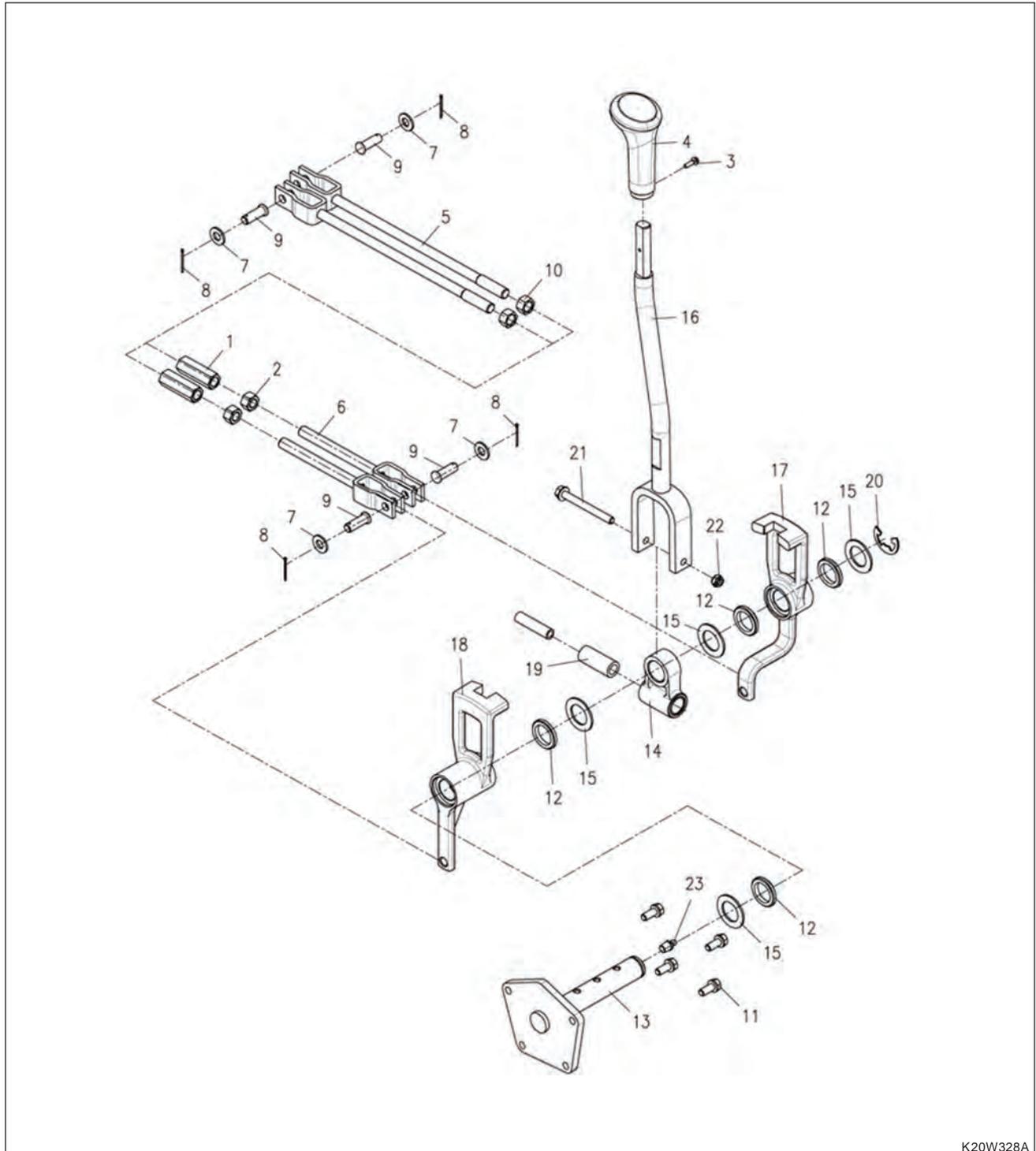
4.11 BRAKE & CLUTCH PEDAL



**COMPONENTS**

- |                         |                             |                        |                           |
|-------------------------|-----------------------------|------------------------|---------------------------|
| (1) Hex bolt            | (13) Clutch road(upper)     | (27) Shaft, pedal rod  | (39) Cotter pin           |
| (2) Hex nut             | (14) Nut(left-screw)        | (28) Snap ring(E)      | (40) Lever, parking brake |
| (3) Boots, pedal        | (15) Turn buckle            | (29) Washer-B          | (41) Hex flange bolt      |
| (5) Head pin            | (16) Hex nut                | (30) Washer-A          | (42) Cotter pin           |
| (6) Clevis A            | (17) Snap ring(E)           | (31) Brake link(L)rear | (43) Plain washer         |
| (7) Protect pin 10      | (18) Bush 25x28x20          | (32) Brake link(R)rear | (44) Lock(clutch pedal)   |
| (8) Cable, brake        | (19) Return spring          | (33) Spring pin        | (45) Snap ring(E)         |
| (9) Head pin            | (20) Clutch pedal           | (34) Spring pin        | (46) Pipe(clutch pedal)   |
| (10) Plain washer       | (21) Pipe(stopper)          | (35) Bush              | (47) Rod(L)               |
| (11) Protect pin 8      | (25) Pedal ass'y(LH), brake | (36) Head pin          | (48) Rod(R)               |
| (12) Clutch road(lower) | (26) Pedal ass'y(RH), brake | (38) Head pin 10x23    | (49) Cable, parking brake |

4.12 MAIN SHIFT LEVER



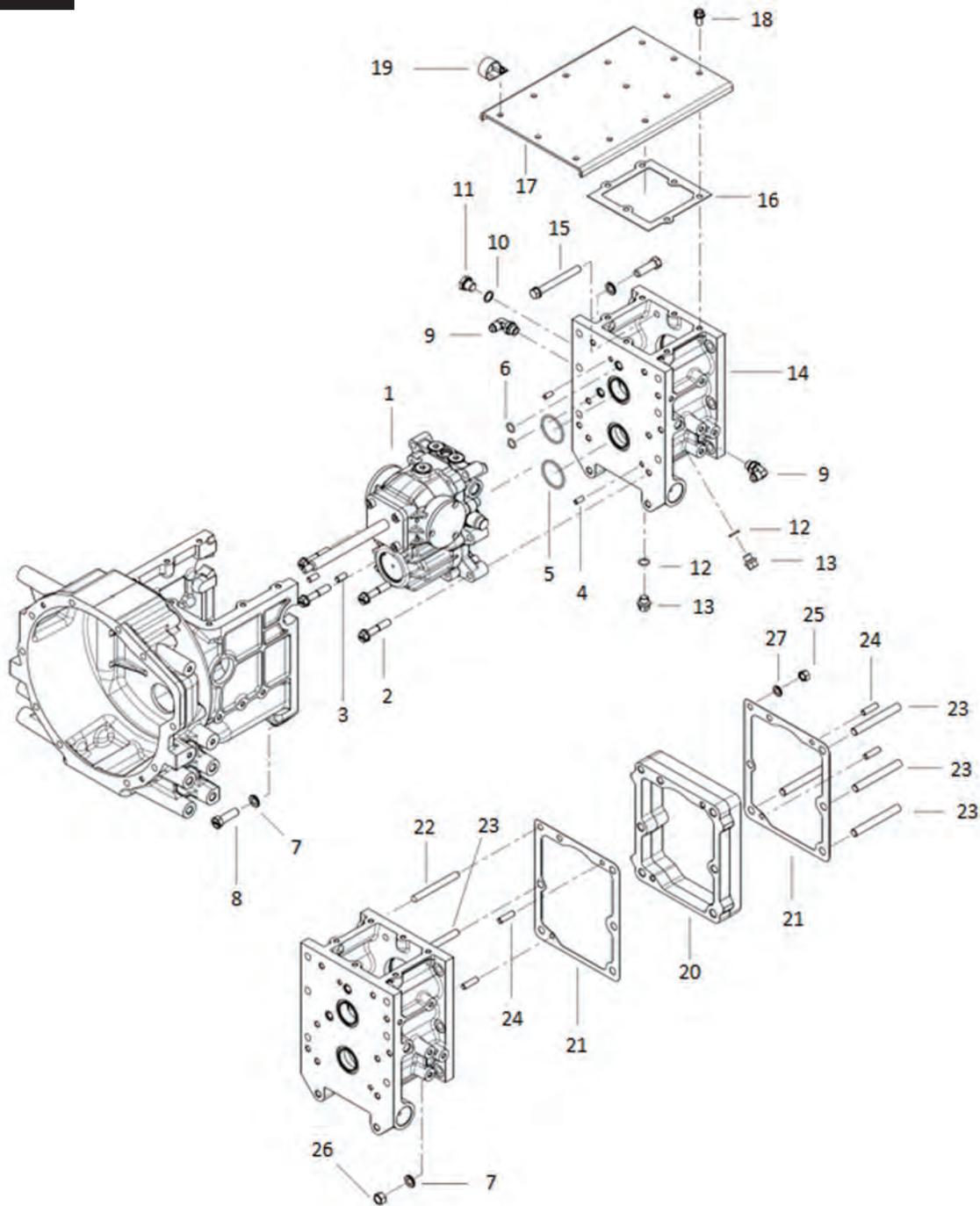
K20W328A

COMPONENTS

- |                              |                                     |                       |
|------------------------------|-------------------------------------|-----------------------|
| (1) Turnbuckle               | (9) Head pin                        | (17) Main shift arm B |
| (2) Nut (left screw)         | (10) Hex. nut                       | (18) Main shift arm A |
| (3) Small mounting screw     | (11) Washer mounting hex. bolt (SW) | (19) Rubber spring    |
| (4) Main shift knob assembly | (12) Oil seal                       | (20) E-type snap ring |
| (5) Rod (RH)                 | (13) Main shift lever shaft         | (21) Hex. flange bolt |
| (6) Rod (LH)                 | (14) Main shift lever holder        | (22) U-nut            |
| (7) Plain washer             | (15) Washer                         | (23) Grease nipple    |
| (8) Split pin                | (16) Main shift lever               |                       |

4.13 HYD SHIFT TRANSMISSION HOUSING

HST MODEL

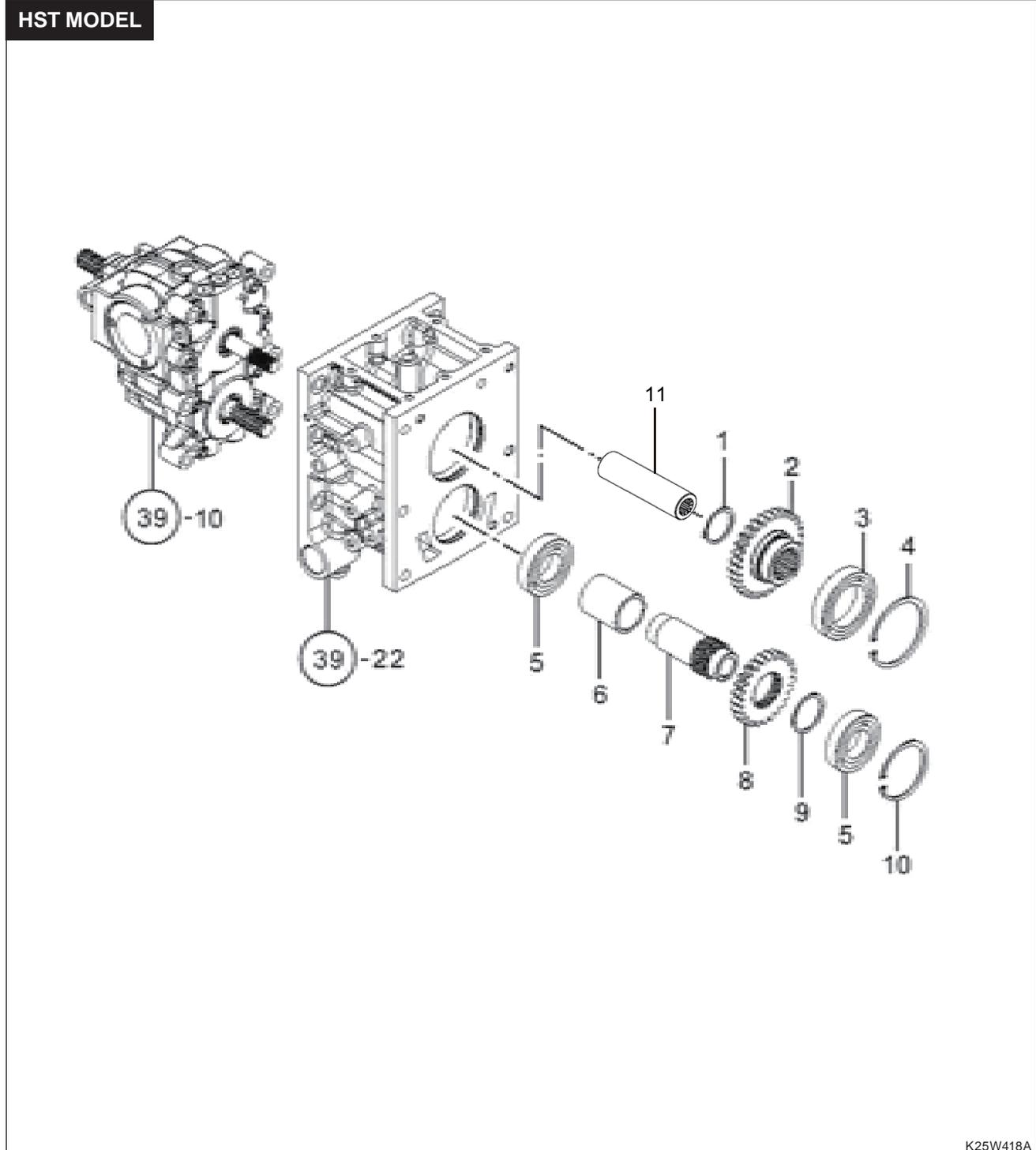


H25W404A

COMPONENTS

- |                        |                         |                    |
|------------------------|-------------------------|--------------------|
| (1) HST 28cc           | (10) Packing            | (20) Spacer        |
| (1) HST 40cc           | (11) Plug               | (21) Packing       |
| (2) Hex bolt, w/washer | (12) O-ring             | (22) Stud bolt     |
| (3) Parallel pin       | (13) Plug               | (23) Stud bolt     |
| (4) Parallel pin       | (14) Case, housing      | (24) Parallel pin  |
| (5) O-ring             | (15) Hex bolt, w/washer | (25) Hex nut       |
| (6) O-ring             | (16) Packing            | (26) Hex nut       |
| (7) Spring washer      | (17) Cover              | (27) Spring washer |
| (8) Bolt               | (18) Hex flange bolt    |                    |
| (9) Elbow              | (19) Clip               |                    |

4.14 HYD SHIFT TRANSMISSION GEAR



**COMPONENTS**

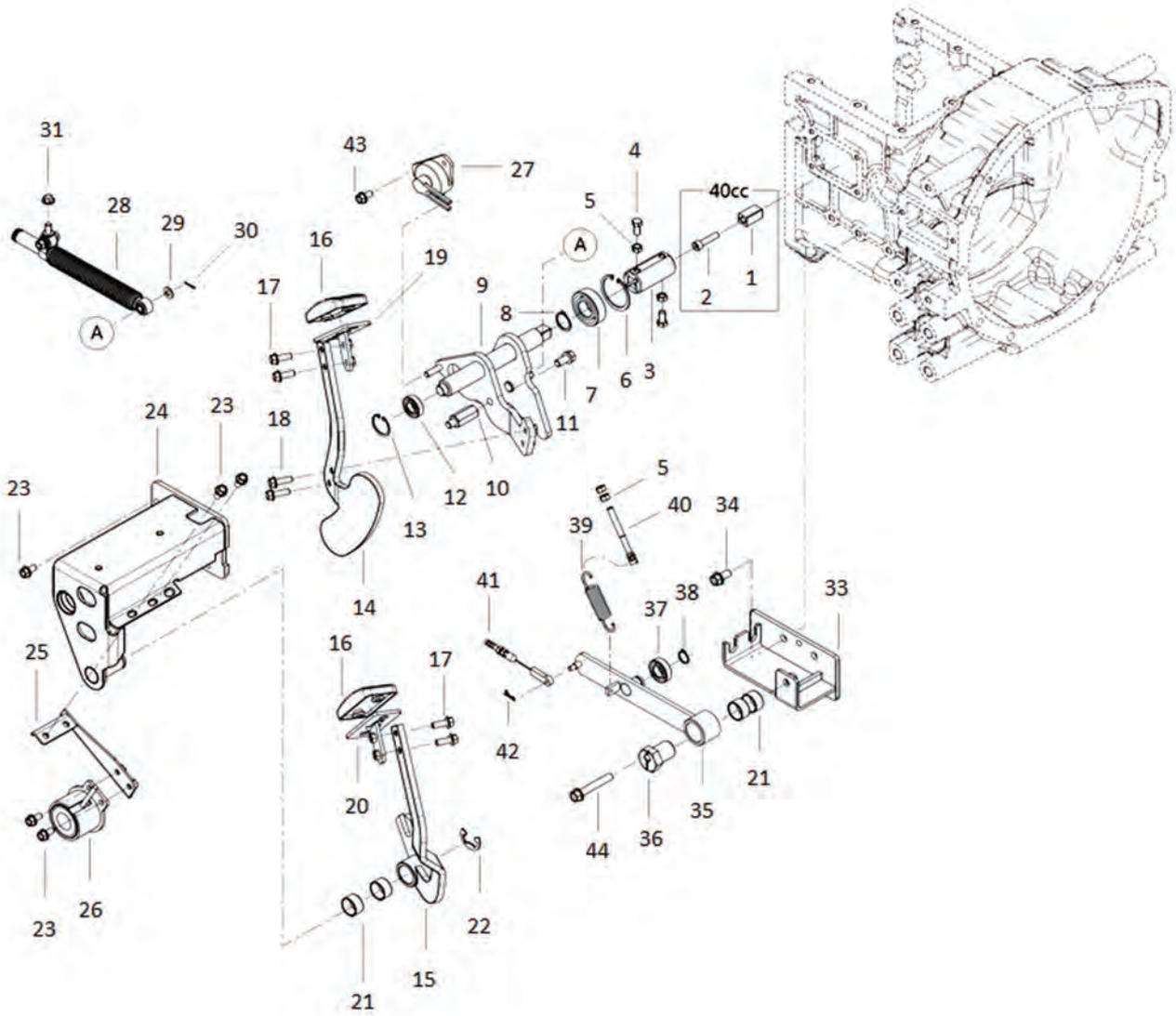
- (1) Snap ring
- (2) HST gear 30t
- (3) Ball bearing
- (4) Snap ring

- (5) Ball bearing
- (6) Collar
- (7) Joint
- (8) HST gear 25T

- (9) Snap ring
- (10) Snap ring
- (11) Spline collar

4.15 HYD SHIFT TRANSMISSION PEDAL

HST MODEL



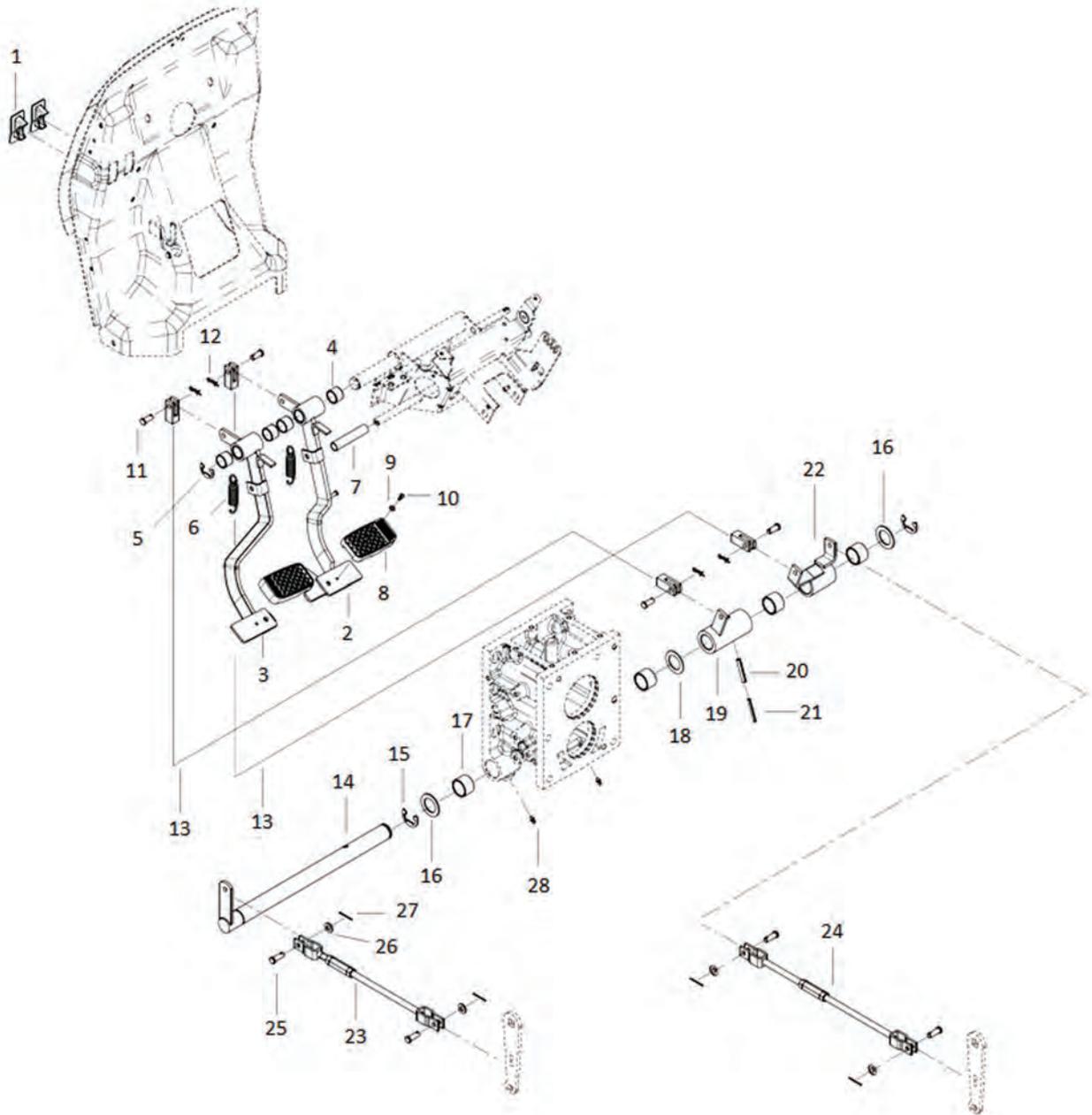
H25W405A

COMPONENTS

- |                         |                      |                            |                      |
|-------------------------|----------------------|----------------------------|----------------------|
| (1) Hst shaft           | (12) Ball bearing    | (23) Hex flange bolt       | (35) Arm ass'y       |
| (2) Hexagon socket bolt | (13) Snap ring       | (24) Bracket ass'y         | (36) Shaft           |
| (3) Joint               | (14) Arm ass'y       | (25) Bracket ass'y, magnet | (37) Ball bearing    |
| (4) Hex bolt            | (15) Arm ass'y       | (26) Cruise magnet         | (38) Snap ring       |
| (5) Hex nut             | (16) Pedal cover     | (27) Switch                | (39) Spring          |
| (6) Snap ring           | (17) Hex flange bolt | (28) Damper                | (40) Bolt            |
| (7) Ball bearing        | (18) Hex flange bolt | (29) Plain washer          | (41) Wire            |
| (8) Snap ring           | (19) Pedal ass'y, F  | (30) Cotter pin            | (42) Wire            |
| (9) Cam shaft           | (20) Pedal ass'y, R  | (31) Hex flange nut        | (43) Snap pin        |
| (10) Bolt shaft         | (21) Dry bush        | (33) Bracket ass'y, wire   | (44) Hex flange bolt |
| (11) Hex bolt w/washer  | (22) Snap ring       | (34) Hex flange bolt       |                      |

4.16 BRAKE PEDAL

HST MODEL



H25W406A

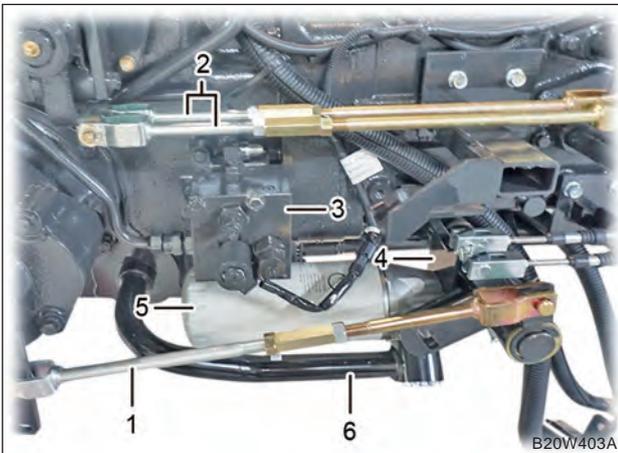
COMPONENTS

- |                            |                        |                        |                        |
|----------------------------|------------------------|------------------------|------------------------|
| (1) Boots, pedal           | (8) Cover, pedal head  | (15) Snap ring(E)      | (22) Brake line(R)rear |
| (2) Pedal ass'y(RH), brake | (9) Washer(rivet)      | (16) Washer-B          | (23) Rod ass'y, L      |
| (3) Pedal ass'y(LH), brake | (10) Rivet(pedal head) | (17) Bush              | (24) Rod ass'y, R      |
| (4) Bush 25x28x20          | (11) Head pin          | (18) Washer-A          | (25) Head pin          |
| (5) Snap ring(E)           | (12) Snap pin          | (19) Brake line(L)rear | (26) Plain washer      |
| (6) Return spring          | (13) Cable, brake      | (20) Spring pin        | (27) Cotter pin        |
| (7) Pipe(stopper)          | (14) Shaft, brake      | (21) Spring pin        | (28) Grease nipple     |

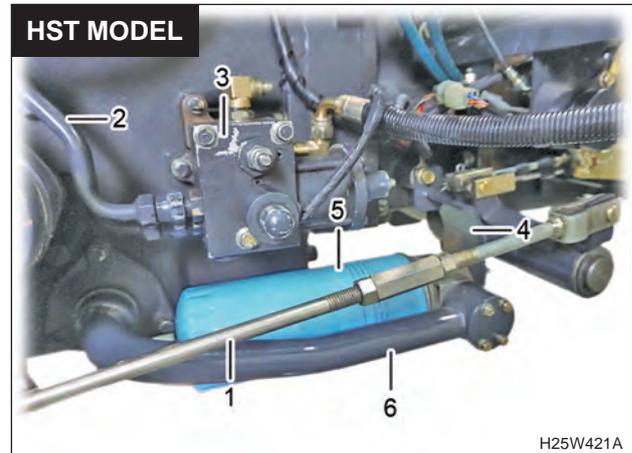
## 5. DISASSEMBLY AND SERVICE

## CABIN MODEL

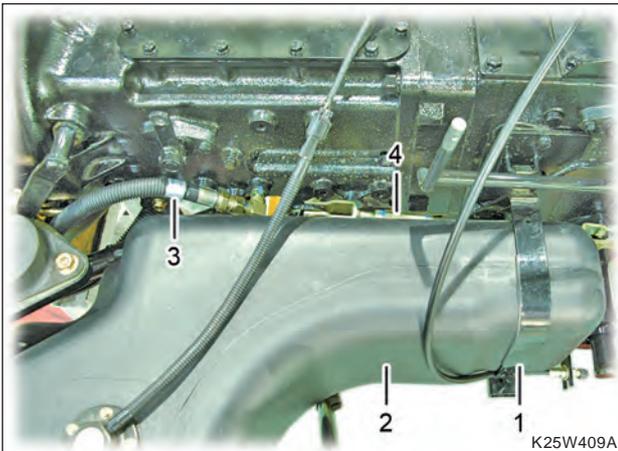
## 5.1 CLUTCH HOUSING, FLYWHEEL HOUSING REMOVAL



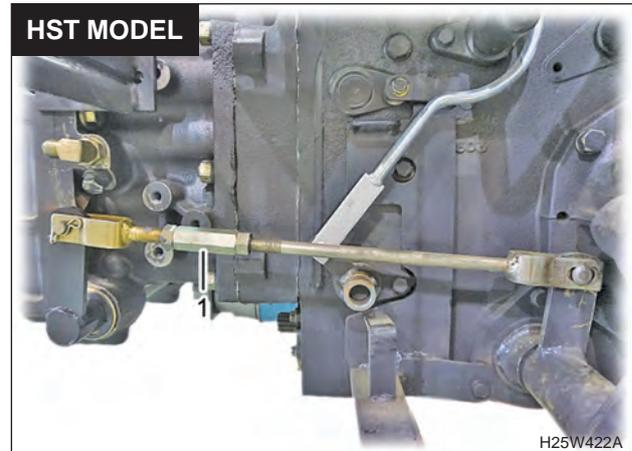
1. Remove all parts from the right side of the transmission case, including the brake rod (RH) (1), main shift rod (2), PTO valve (3), filter bracket (4), filter (5), low-pressure pipe (6) and low pressure hose simultaneously.



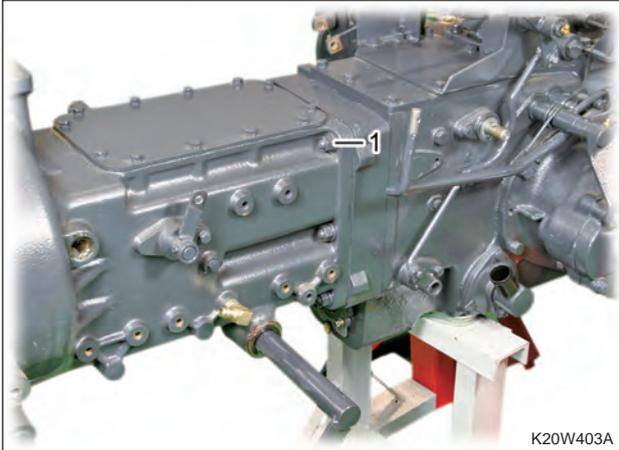
3. Remove all parts from the right side of the transmission case, including the brake rod (RH) (1), high-pressure pipe (rear) (2), PTO valve (3), filter bracket (4), filter (5) and low pressure hose (6) simultaneously.



2. Remove the fuel tank bands (1) and fuel tank (2). Then, remove the hydraulic hose (3) and the brake rod (4).



4. Remove the brake rod (1) from the left side of the transmission case.



K20W403A

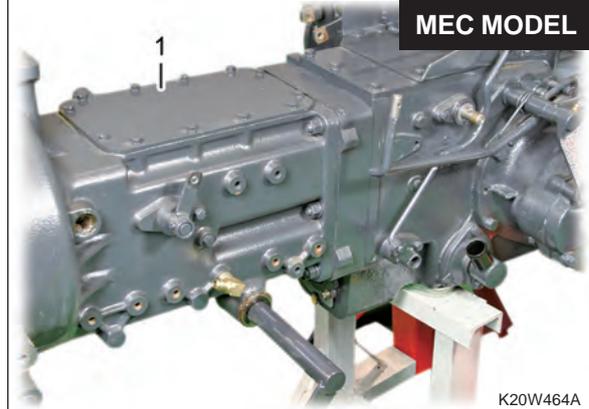


K20W405A

5. Set a lift to the clutch housing and unscrew the mounting bolts and nuts (1) between the clutch housing and rear axle case to separate the clutch housing.

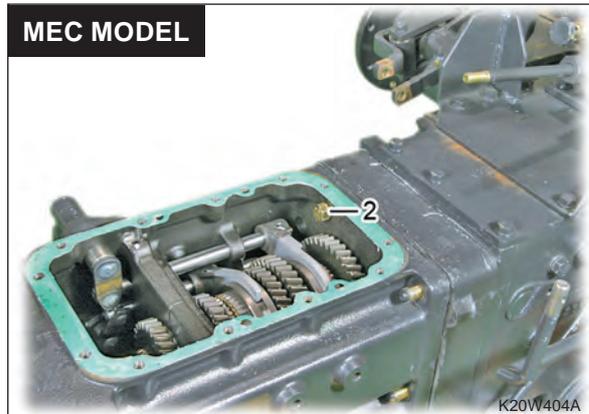
ITEM	TORQUE VALUE
Mounting bolt and nut (M14)	161.7 N.m 16.5 kgf.m 118.8 lb.ft

**CAUTION**



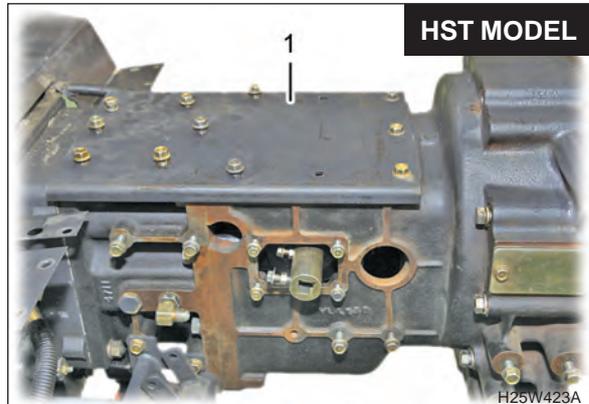
**MEC MODEL**

K20W464A



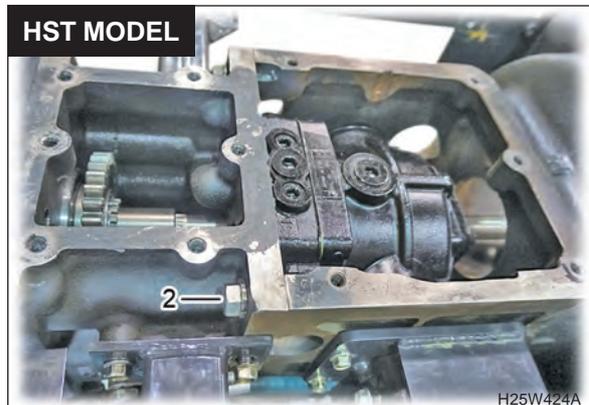
**MEC MODEL**

K20W404A



**HST MODEL**

H25W423A

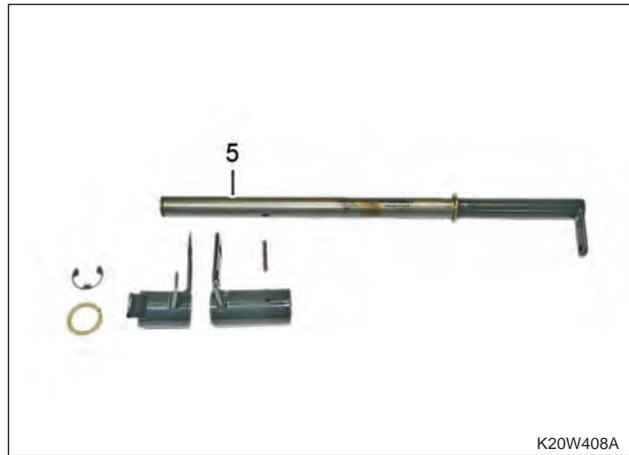
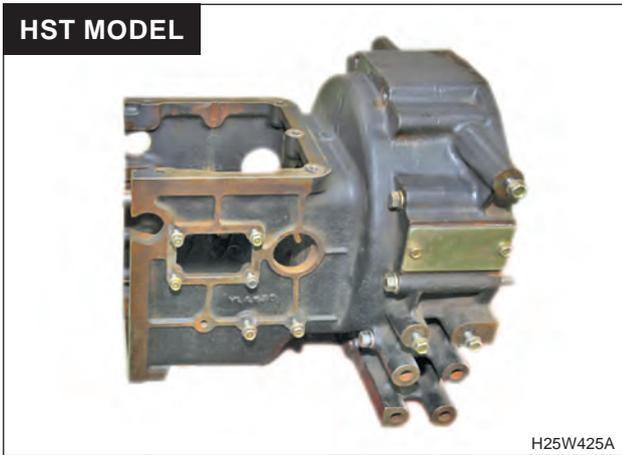
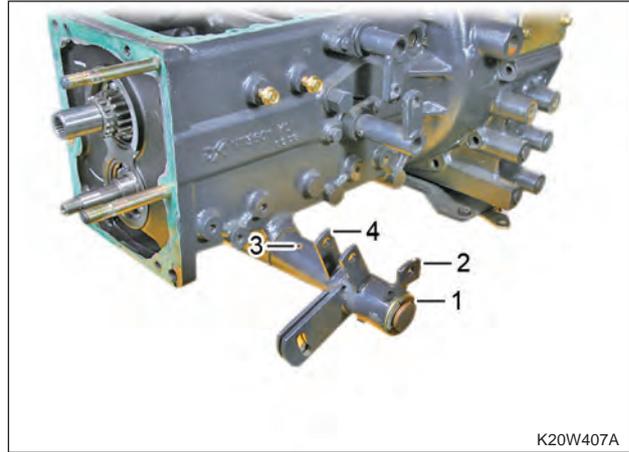
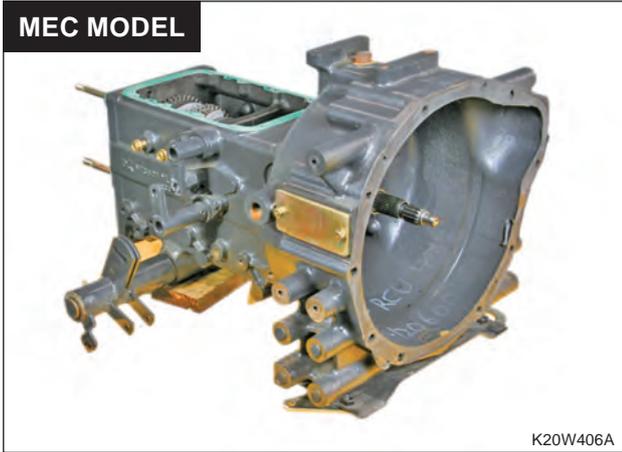


**HST MODEL**

H25W424A

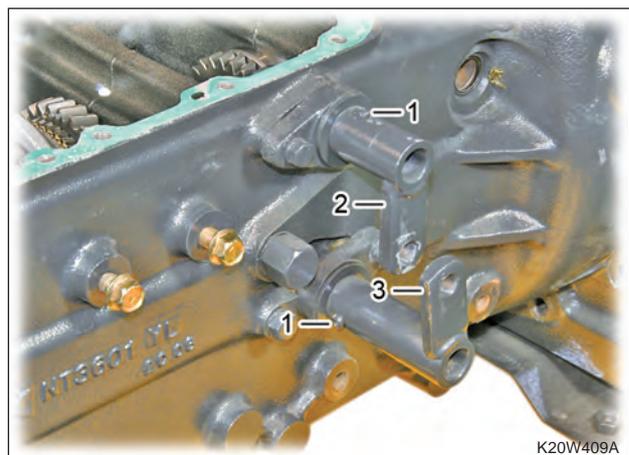
- When removing the clutch/flywheel housing, remove the upper transmission cover (1) first and unscrew the mounting bolts (2).

5.2 CLUTCH HOUSING DISASSEMBLY

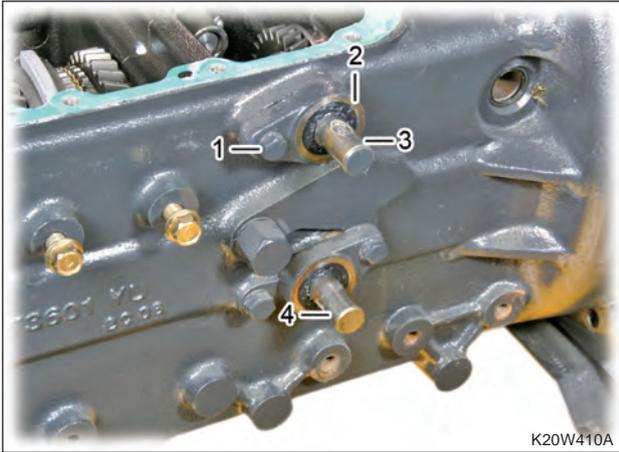


6. Set the removed clutch housing/flywheel housing in a safe place.

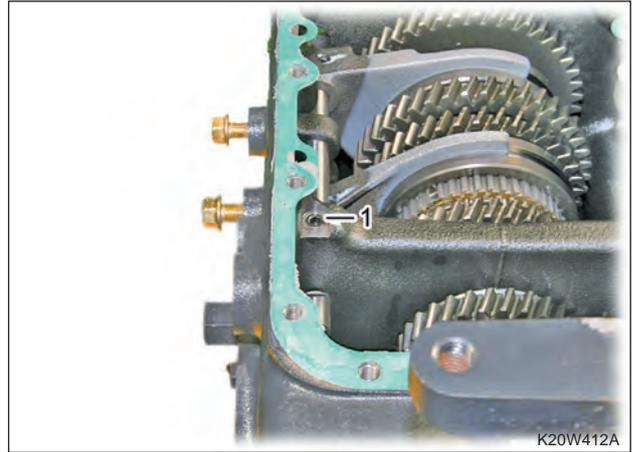
1. Pull out the brake shaft snap ring (1) and disconnect the brake link (RH) (2). Then, pull out the spring pin (3) to disconnect the brake link (LH) (4) and brake shaft (5) together.



2. Pull out the spring pin (1) and disconnect the main shift arm (1-2 gear) (2) and main shift arm (3-4 gear) (3).



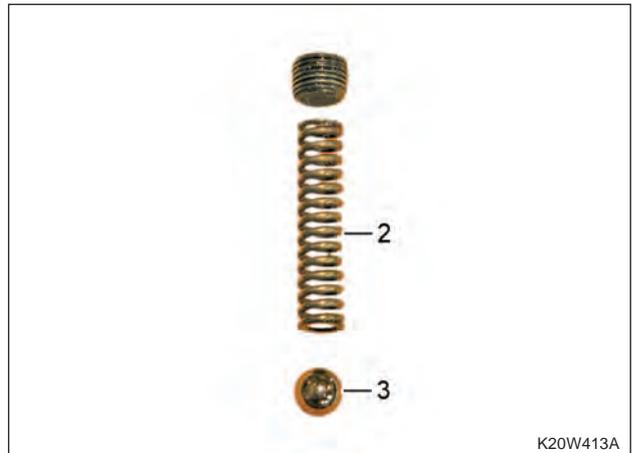
K20W410A



K20W412A



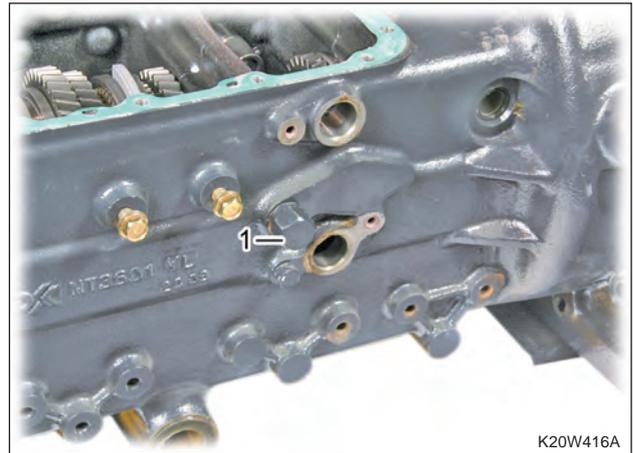
K20W411A



K20W413A

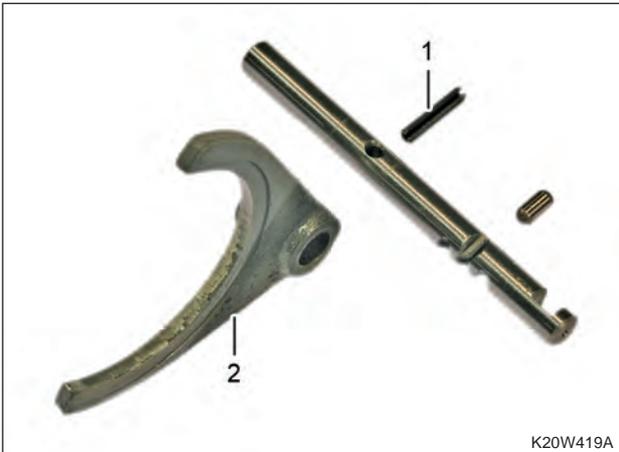
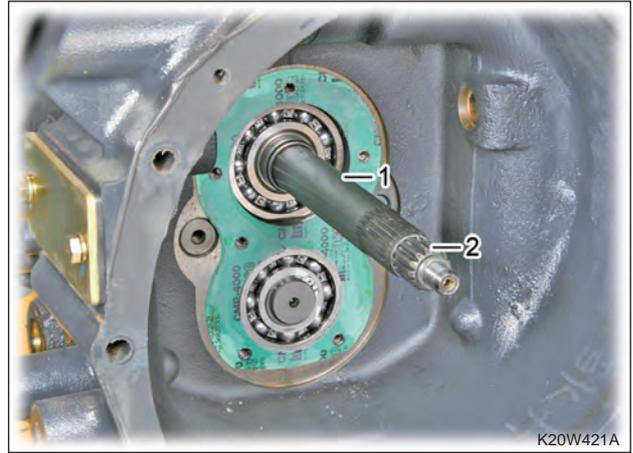
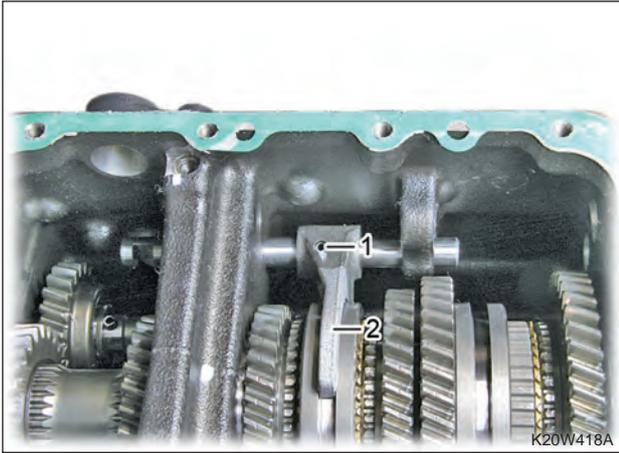
3. Unscrew the main shift shifter holder mounting bolts (1) and remove the main shift shifter holders (2) to disconnect the main shift shifter lever (3-4 gear) (3) and main shift shifter lever (1-2 gear) (4).

4. Unscrew the tapered plug (1) to remove the spring (2) and steel ball (5/16") (3).

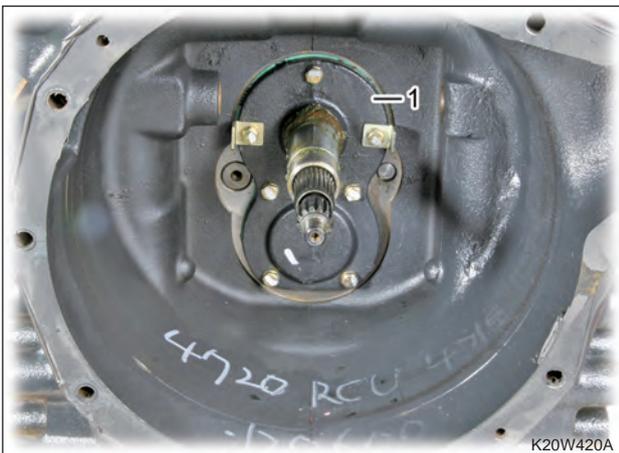


5. Pull out the main shift 1-2 gear fork shaft spring pin (1) to remove the main shift 1-2 gear fork (2).

6. Unscrew the cap bolt (1) to remove the spring (2) and steel ball (5/16") (3).



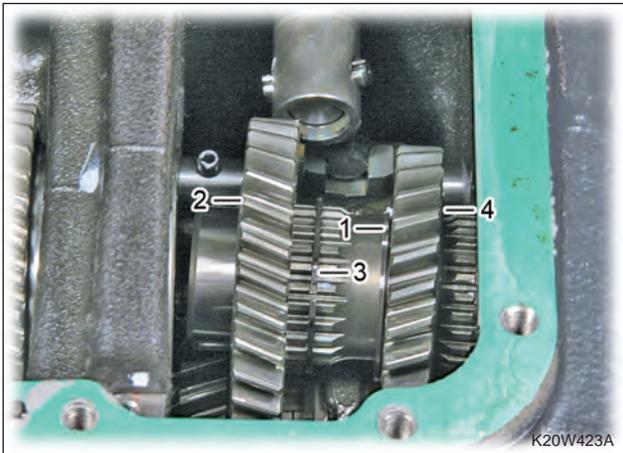
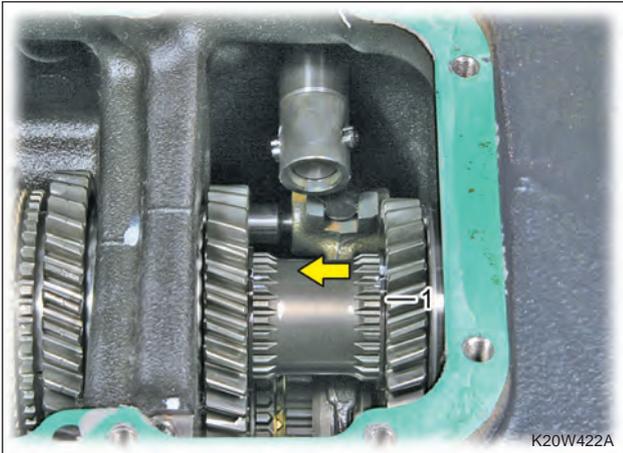
7. Pull out the main shift 3-4 gear fork shaft spring pin (1) to remove the main shift 3-4 gear fork (2).



8. Remove the main shaft oil seal case (1).

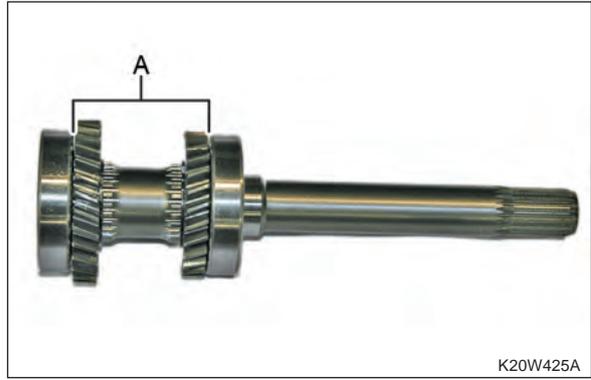
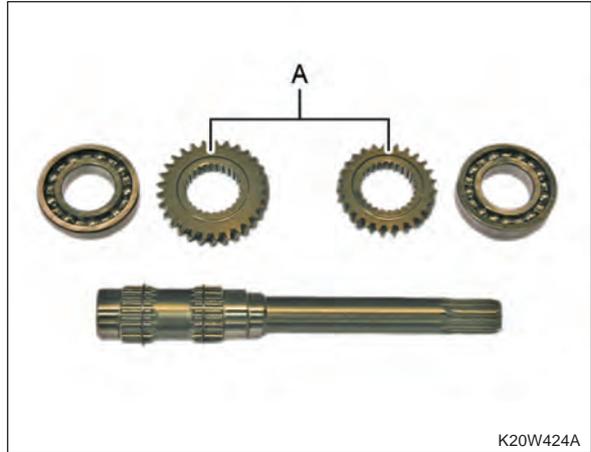
9. Pull out the main shaft (inner) (2) from the main shaft (outer) (1).

**MAIN SHAFT (OUTER) AND OTHER COMPONENT REMOVAL**

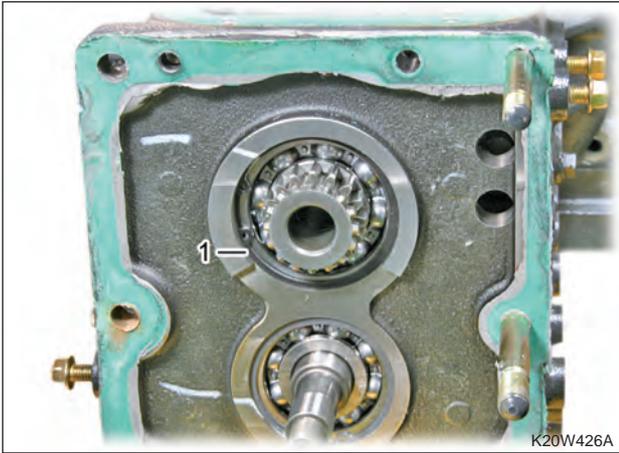


10. Move the snap ring for shaft (1) toward the inner side on the main shaft (outer). Then, while pulling out the rear main shaft (outer) toward the engine, remove the 29 forward gear (2), snap ring (3), snap ring (1) and 26 reverse gear (4) in order.

**Notes**



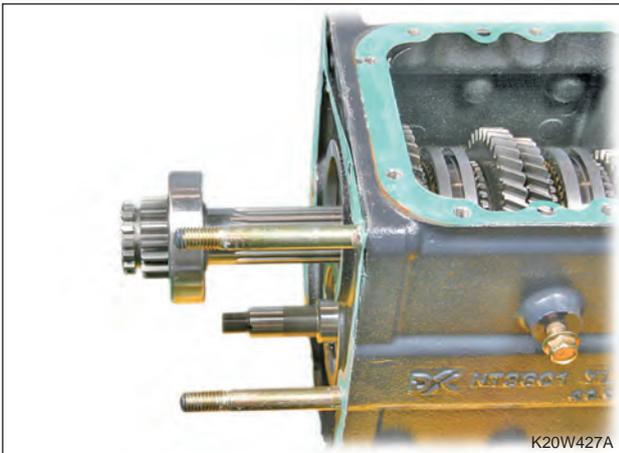
- Make sure that the boss (A) section of the forward gear and reverse gear is toward the bearing during installation.



K20W426A

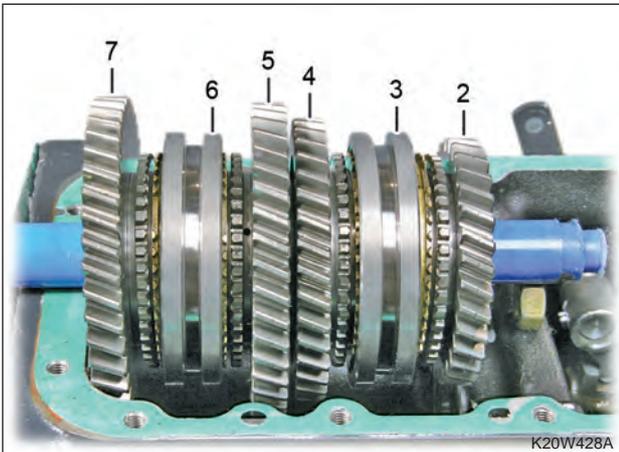


K20W429A

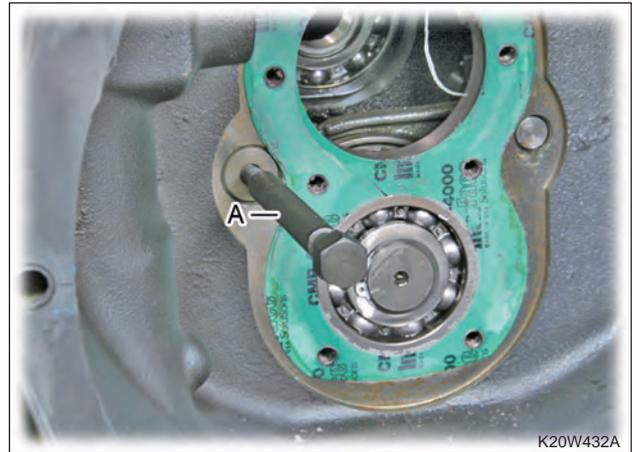
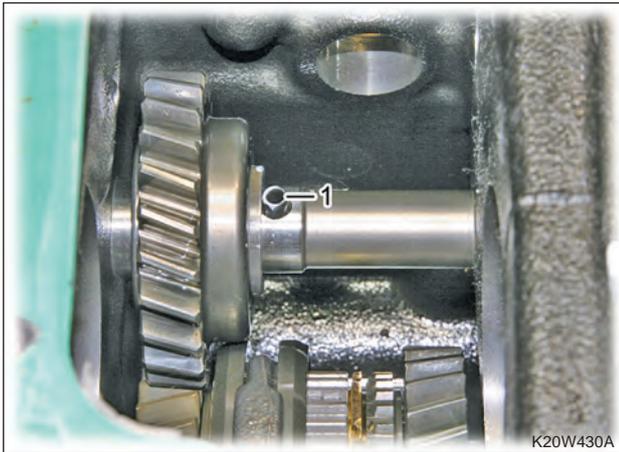


K20W427A

11. Pull out the mounting snap ring (1) of the main shift guide shaft and push the main shift guide shaft toward the transmission case to separate it. Then, remove the 4th gear (32T) (2), sleeve (3), 3rd gear (37T) (4), 2nd gear (41T) (5), sleeve (6) and 1st gear (43T) (7) together from the clutch housing.



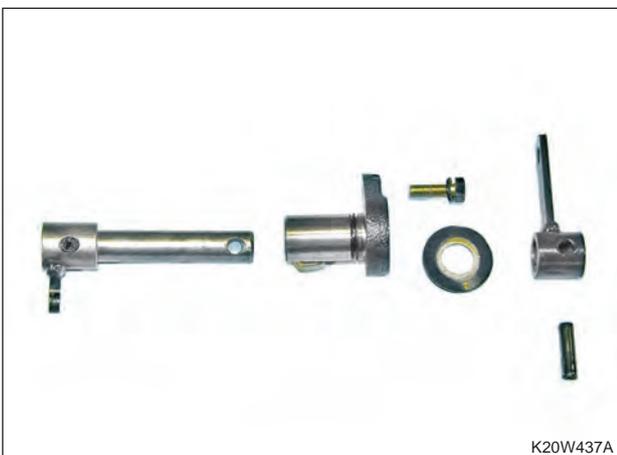
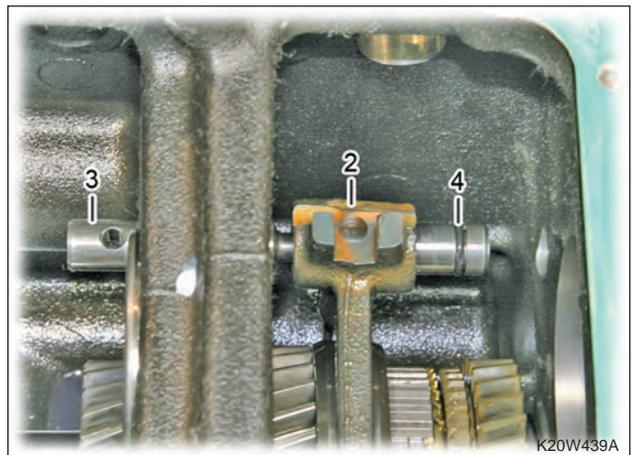
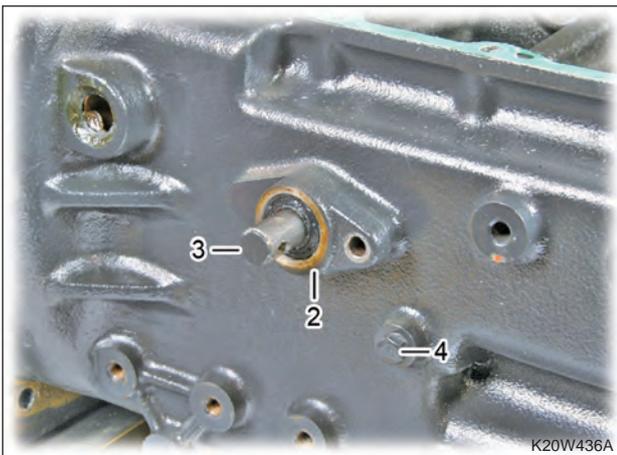
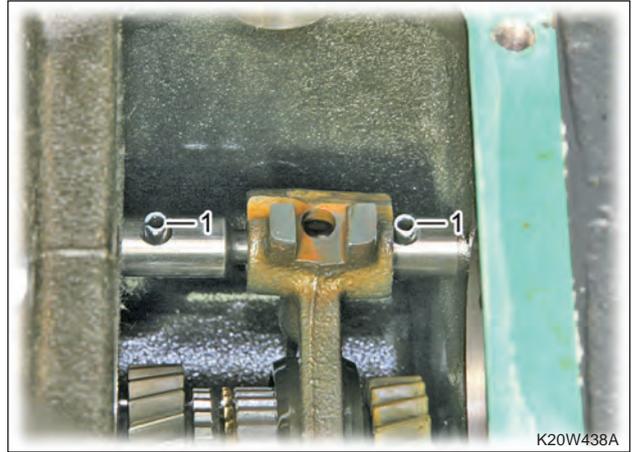
K20W428A



12. Pull out the spring pin (1) of the reverse idle shaft from the inside of the clutch housing. Then, unscrew the reverse idle shaft mounting bolts (2) from the outside of the housing.



13. Set a disassembly jig (A) to the reverse idle shaft to remove the reverse idle shaft (1) and reverse idle gear (2).

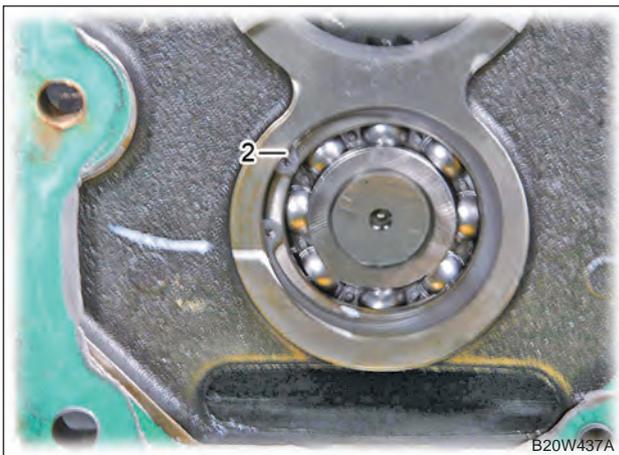


14. Pull out the shuttle link C mounting spring pin (1) to remove the shuttle link C and shuttle shifter holder (2). Then, remove the shuttle shift shaft (3) through the inside of the clutch housing and unscrew the shift fork shaft mounting bolts (4).

15. Pull out the spring pins (2 EA) (1) from the shuttle shift fork shaft to separate the shuttle shift fork (2), shuttle shift fork shaft (3) and O-ring (4).

**⚠ CAUTION**

- Be careful not to lose any steel ball and spring during disassembly and assembly.



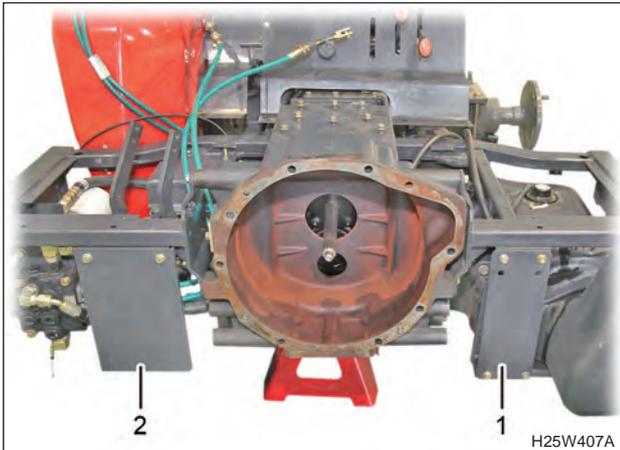
16. Pull out the snap ring (1) for the countershaft assembly and the snap ring (2) for the hole on the transmission side.



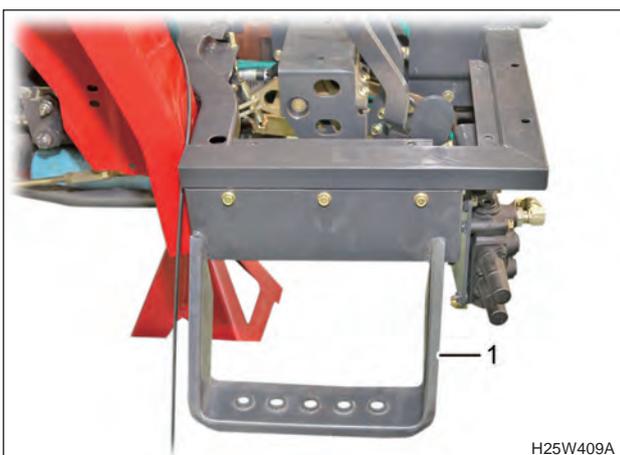
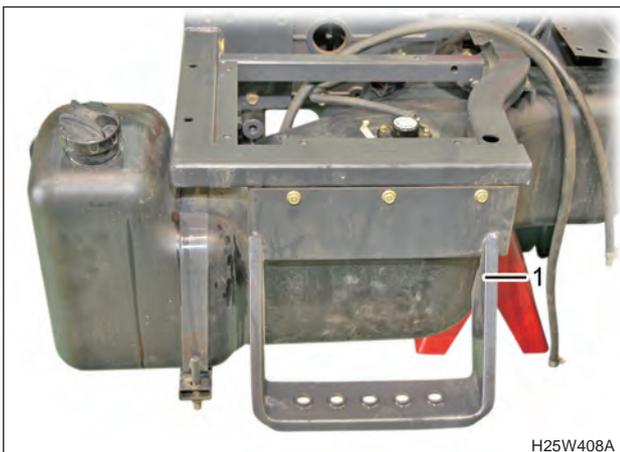
ROPS/HST MODEL

5.3 FLYWHEEL HOUSING REMOVAL

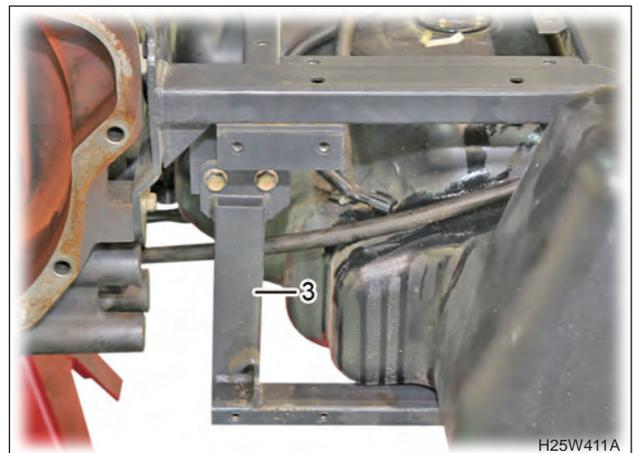
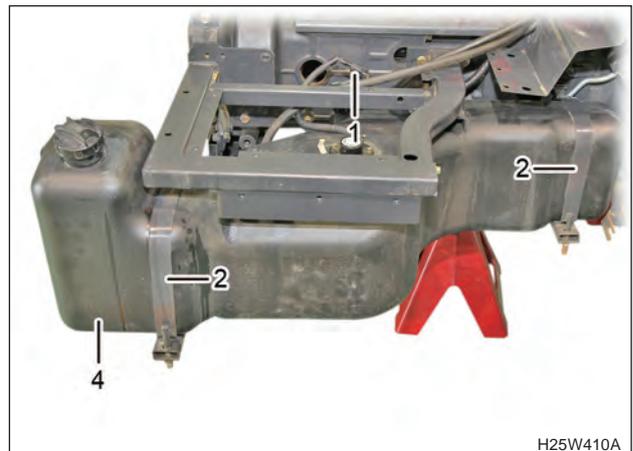
1. Remove the engine assembly.



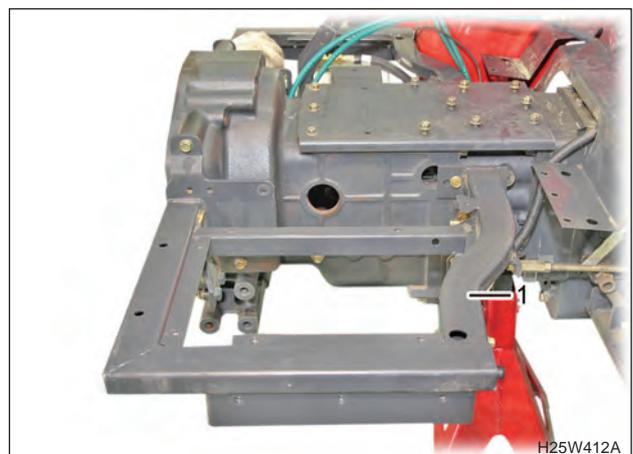
2. Remove the fuel tank cover (1) and SCV cover (2).



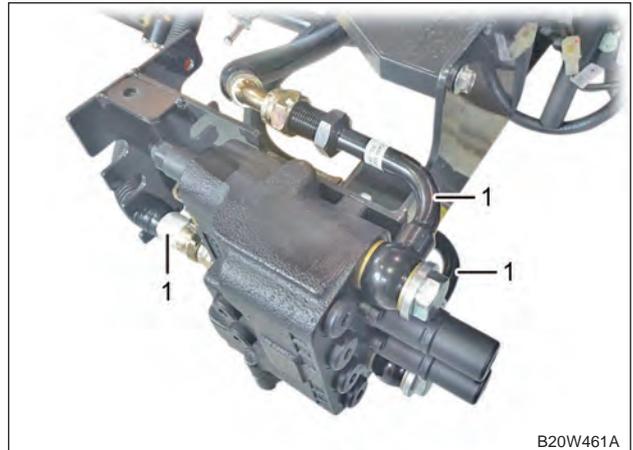
3. Remove the footstep (LH, RH) (1).



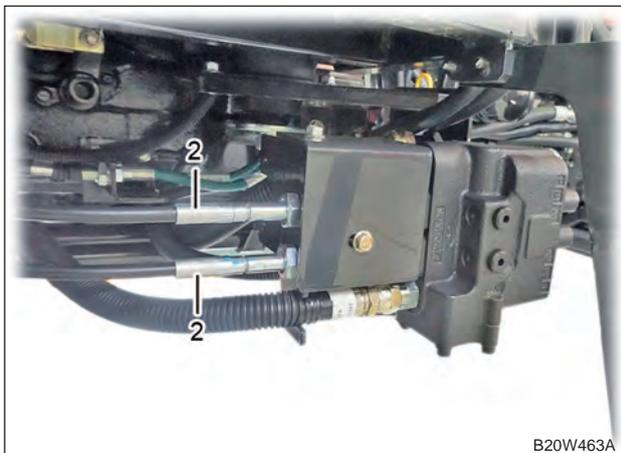
4. Disconnect the fuel sensor connector (1) to remove the fuel tank band (2) (2EA) and front support (3) of the fuel tank. Then, remove the fuel tank (4).



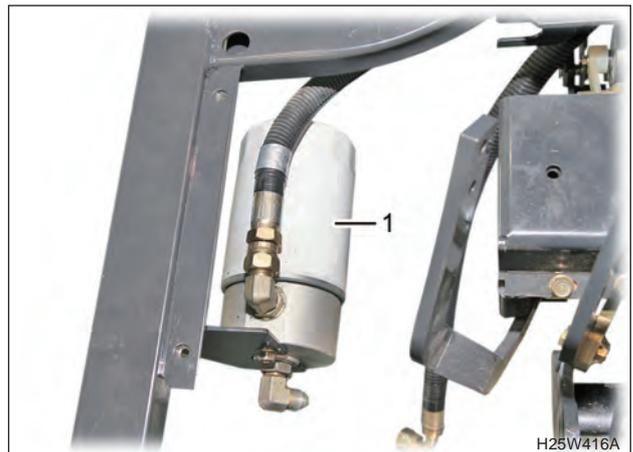
5. Remove the footstep guide (LH) (1).



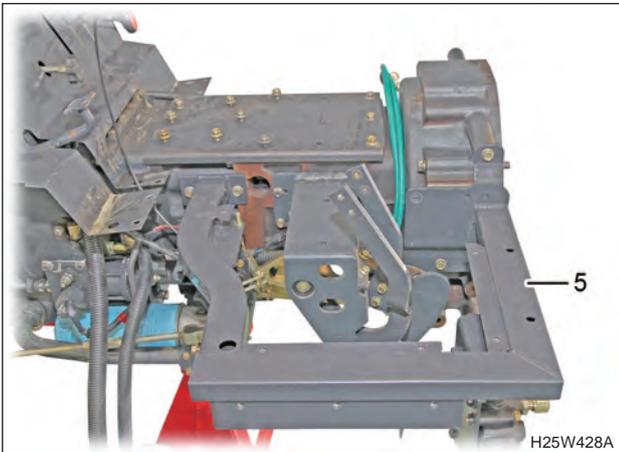
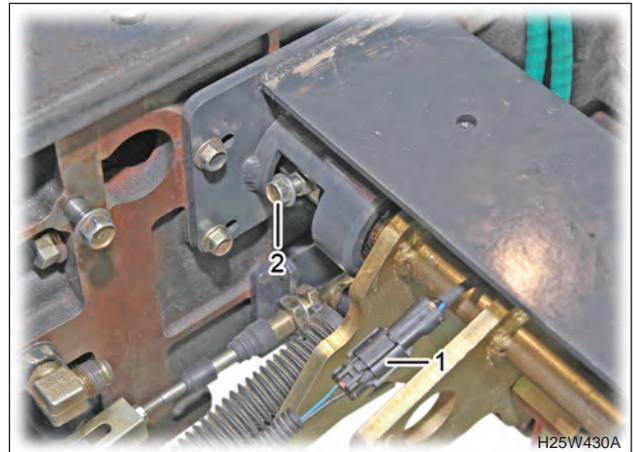
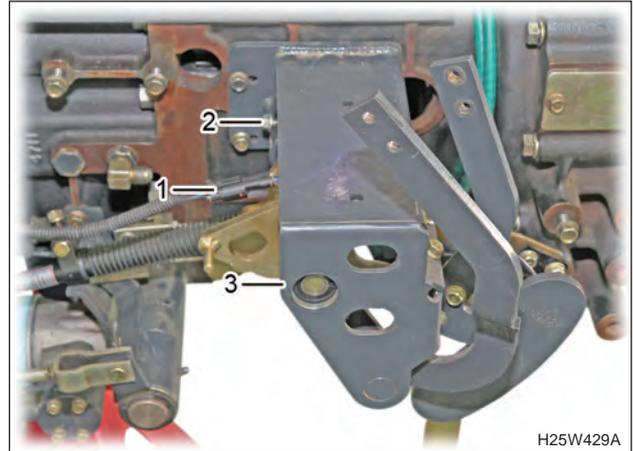
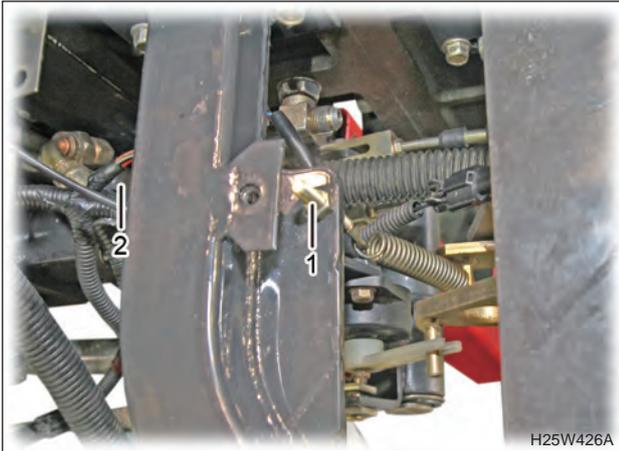
7. Disconnect the hydraulic pipes (1) from the front SCV valve.



6. Remove the joystick lever (1), joystick cable (2) and fender (RH) (3).

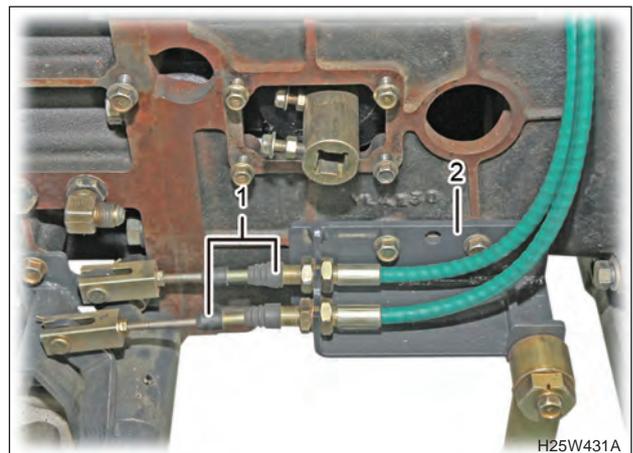


8. Remove the HST filter (1).

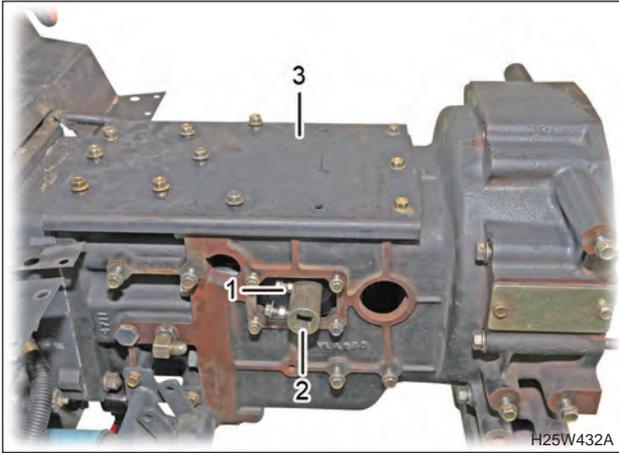


9. Remove the neutral spring rod (1), oil damper (2), mounting bolts, FR switch (3), governor cable (4) and footstep guide (RH) (5).

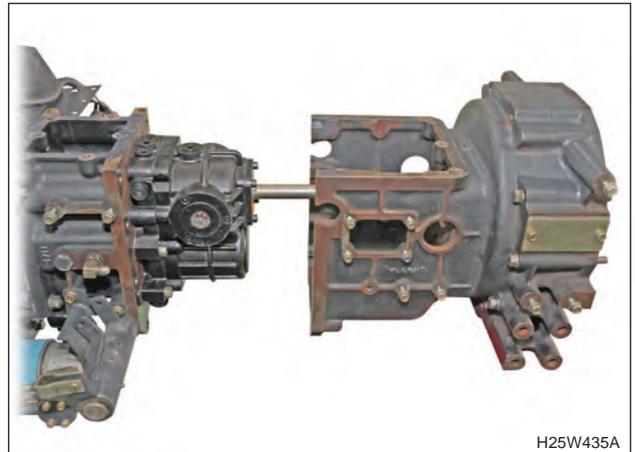
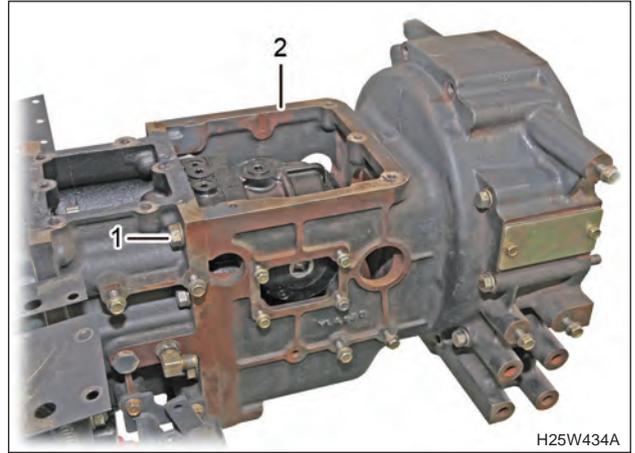
10. Disconnect the electromagnetic connector (1) and unscrew the joint mounting bolts (2). Then, remove the HST pedal bracket assembly.



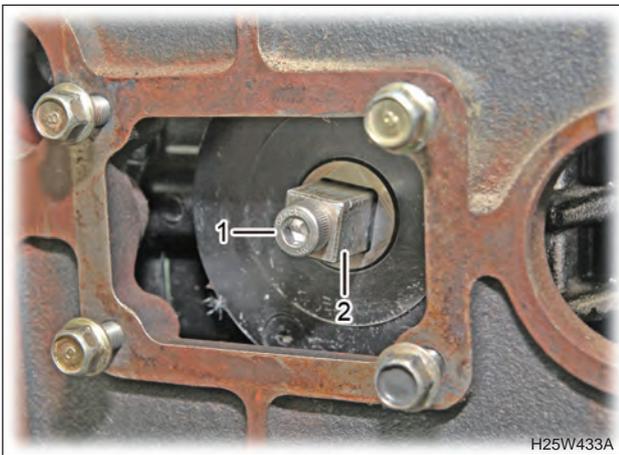
11. Disconnect the brake cable (1) and remove the wire bracket (2).



12. Unscrew the HST joint mounting bolts (1) to remove the joint (2) and remove the cover (3).

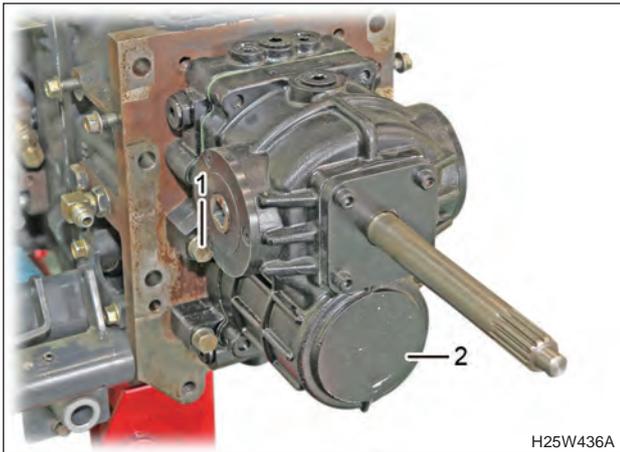


14. Unscrew the flywheel housing mounting bolts (1) (8EA) to remove the flywheel housing (2).

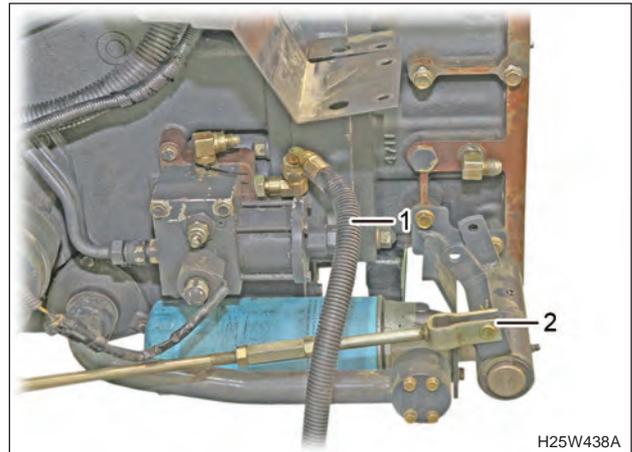


13. Unscrew the hex. bolt (1) to remove the HST shaft (2).

5.4 HOUSING CASE ASSEMBLY REMOVAL

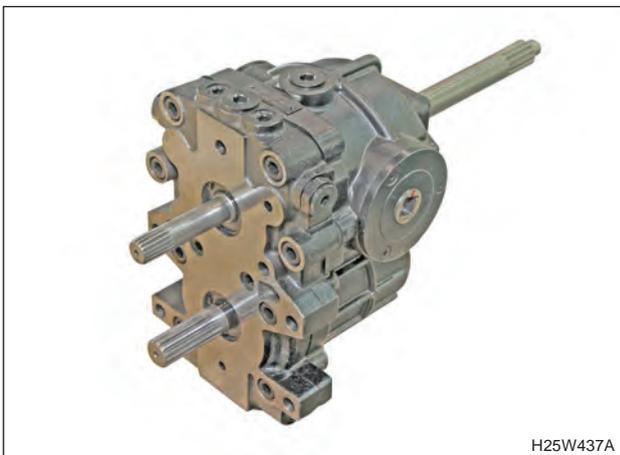


H25W436A



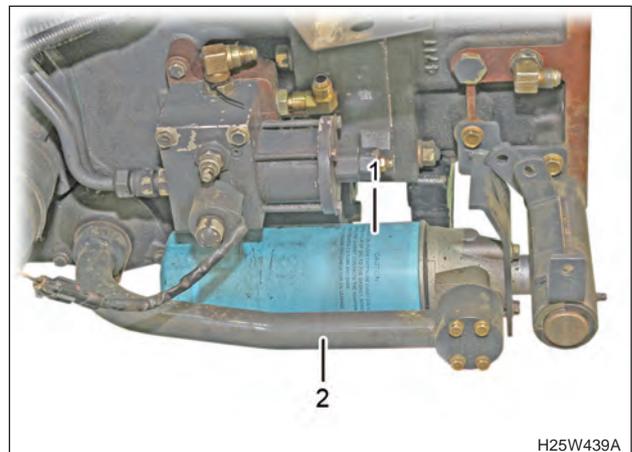
H25W438A

1. Disconnect the hydraulic hose (1) of the HST filter and brake rod (2).



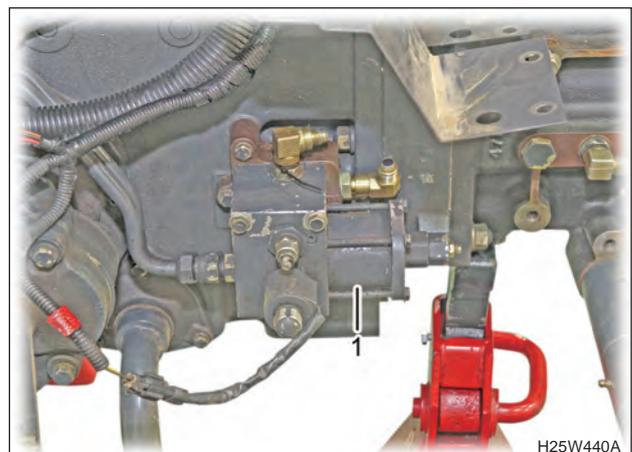
H25W437A

15. Unscrew the HST mounting bolts (1) (4EA) to remove the HST (2).



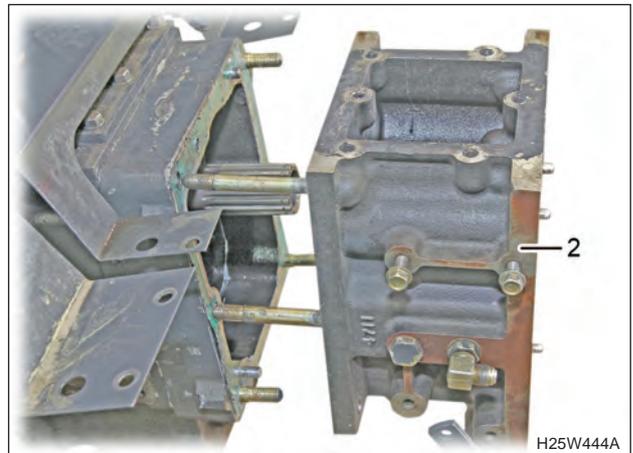
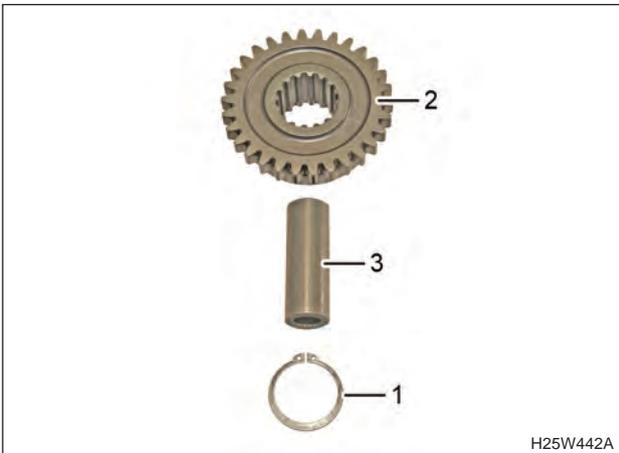
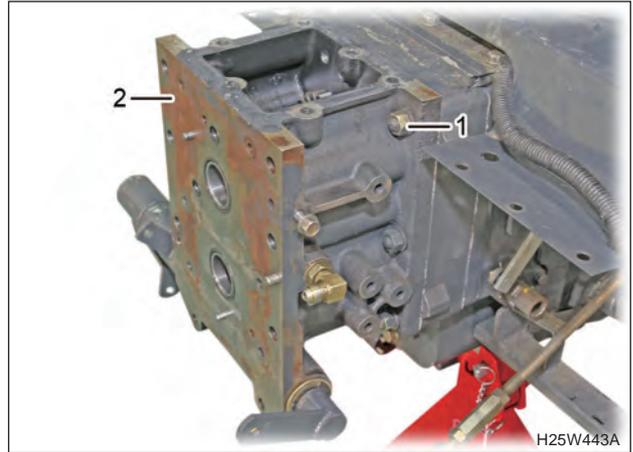
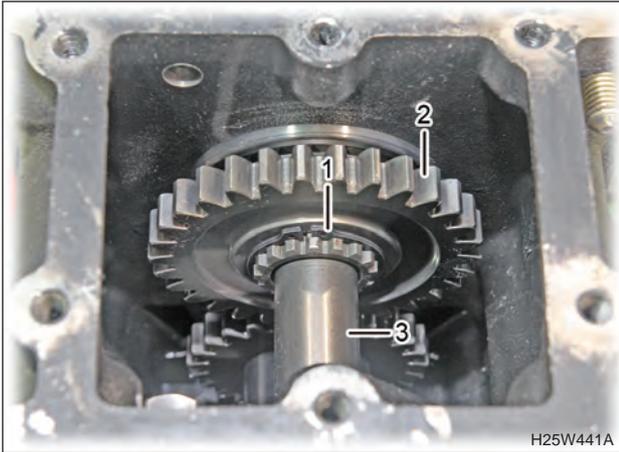
H25W439A

2. Remove the hydraulic filter (1), hydraulic oil suction pipe (2).

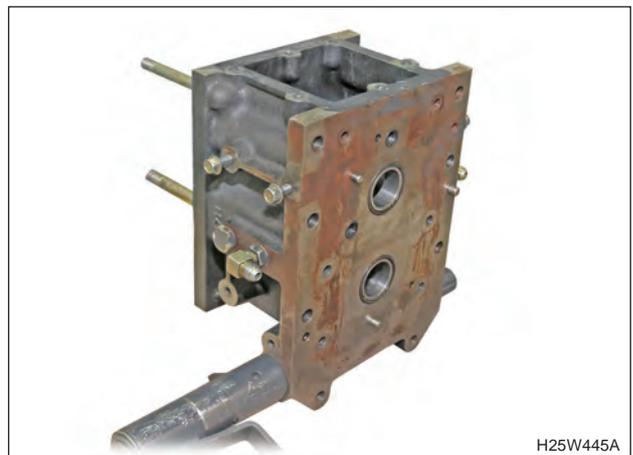


H25W440A

3. Remove the PTO valve (1).



4. Pull out the snap ring (1) and remove the HST driven gear (2) and joint (3).



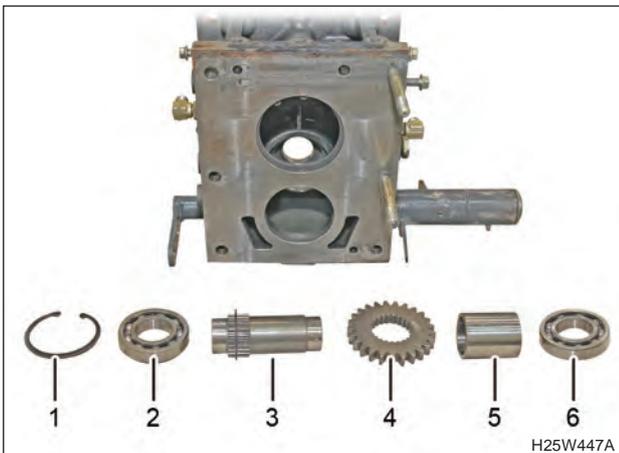
5. Unscrew the housing case mounting nuts (1) (6EA) to remove the housing case (2).

5.5 REAR AXLE CASE DISASSEMBLY

5.5.1 REAR AXLE HOUSING REMOVAL AND REAR AXLE DISASSEMBLY



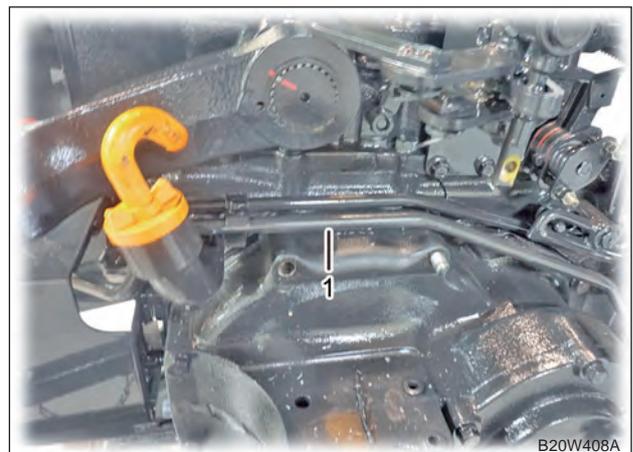
1. Remove the SCV lever bracket (1).



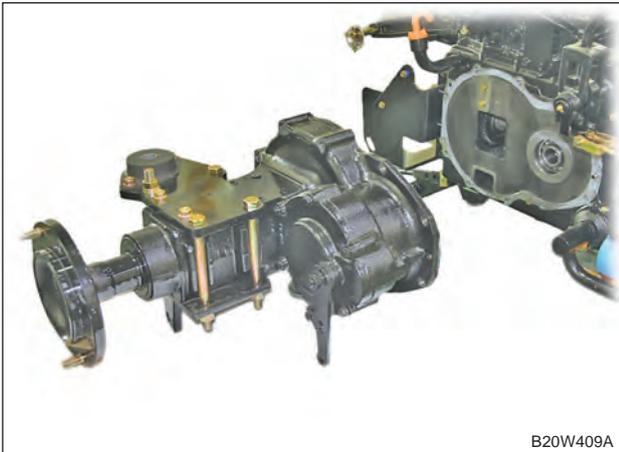
6. Pull out the snap ring (1) from the housing case and remove the ball bearing (2), joint (3), HST drive gear (4), collar (5) and ball bearing (6) in order.



2. Disconnect the brake rod (1).



3. Remove the PTO pipe (1).



4. Unscrew the rear axle housing mounting bolts (1) and use a device, such as a hoist, to separate the rear axle housing assembly.



5. Unscrew the rear axle gear mounting nut (1) from the rear axle housing assembly to remove the rear axle gear (2).

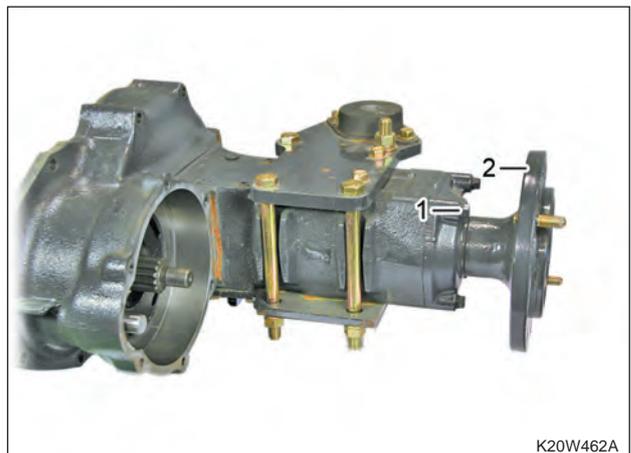
**Notes**



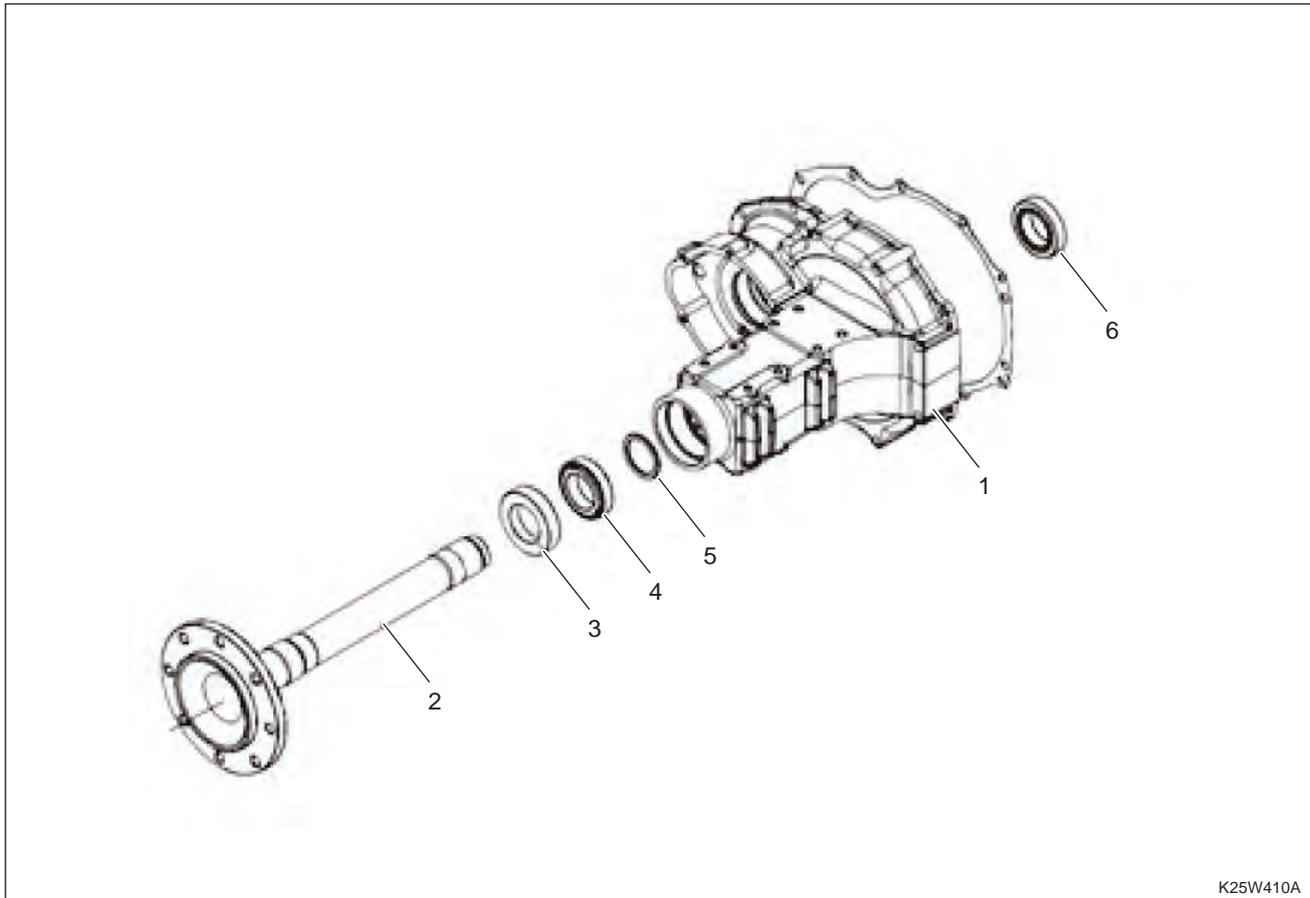
- During the rear shaft gear installation, make sure that the higher part of boss (A) section toward inside.



6. Remove the final pinion (1) from the other side.



7. Remove the rear axle (1) by tapping it.

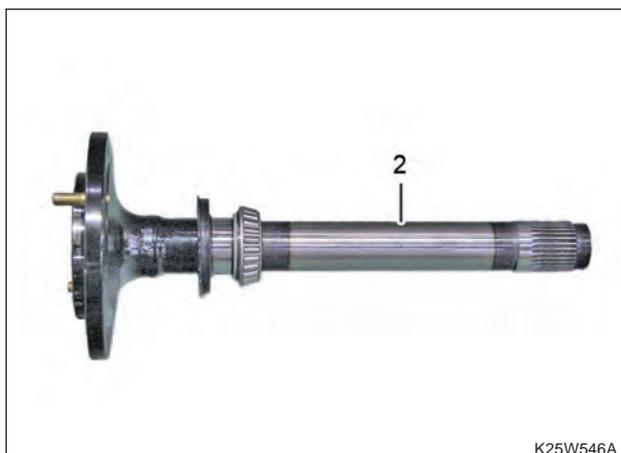


K25W410A

(1) Rear axle housing  
(2) Rear axle

(3) Oil seal  
(4) Taper roller bearing

(5) Spacer  
(6) Taper roller bearing



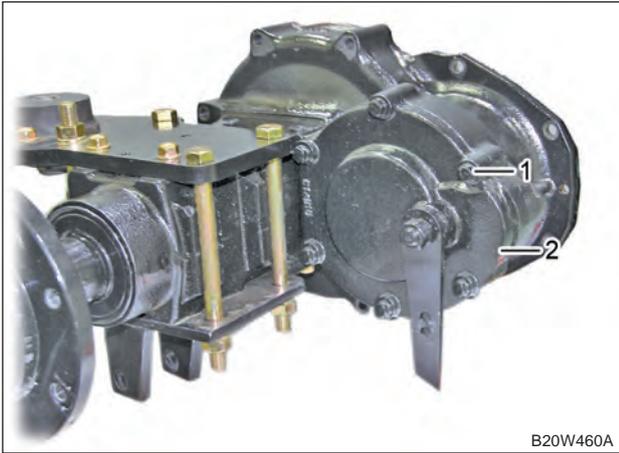
K25W546A

5. Remove the taper roller bearing (4) and oil seal (3) from the rear axle (2).

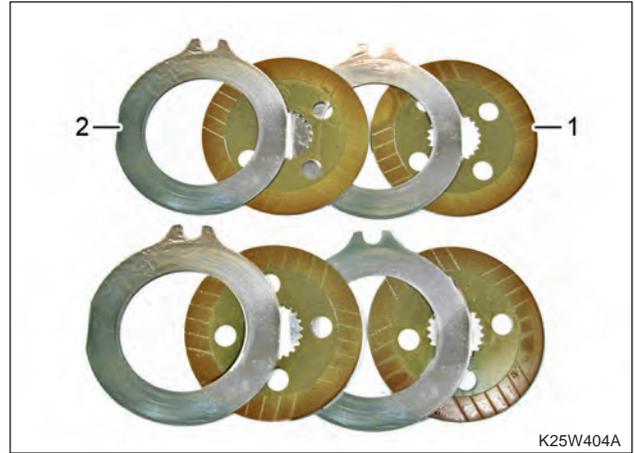
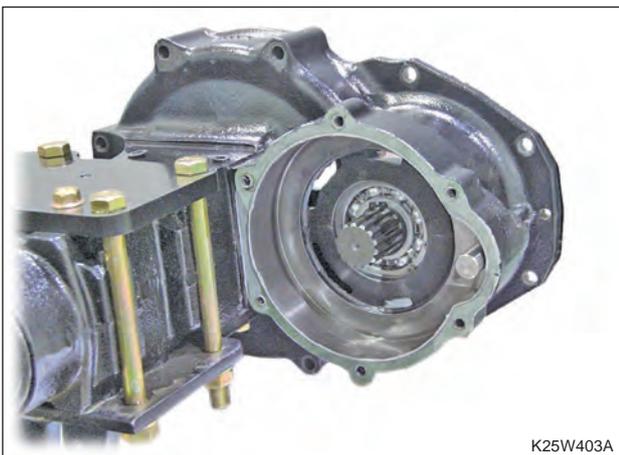
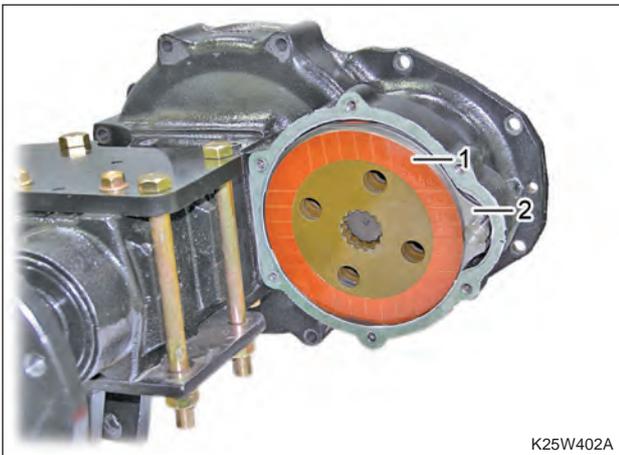
#### Notes

- When installing the oil seal, apply a small amount of grease around the mating surface.

5.5.2 BRAKE ASSEMBLY REMOVAL

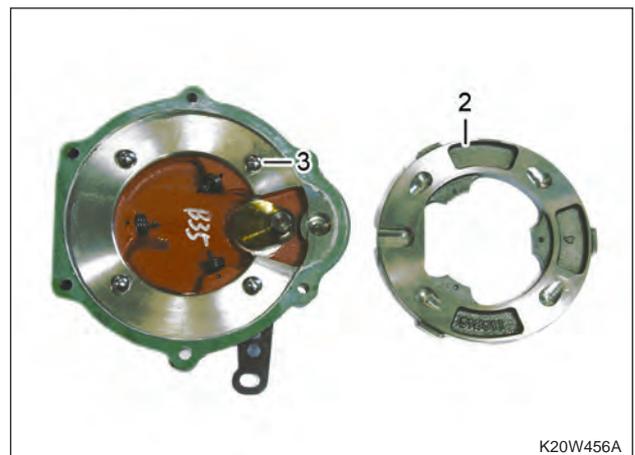
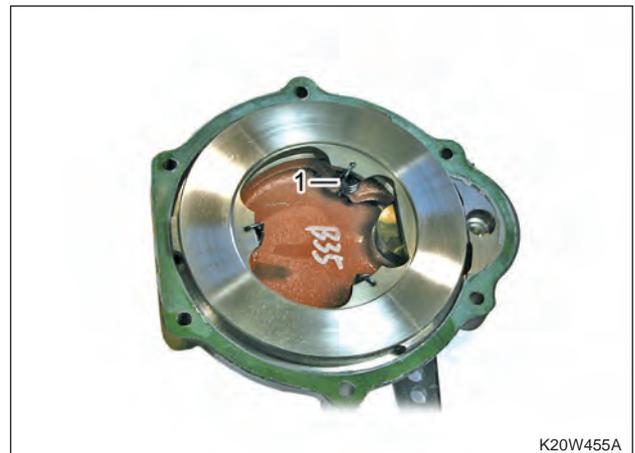


1. Unscrew the brake assembly mounting bolts (1) to remove the brake cover (2).



2. Pull out the brake friction discs (1) and plates (2).

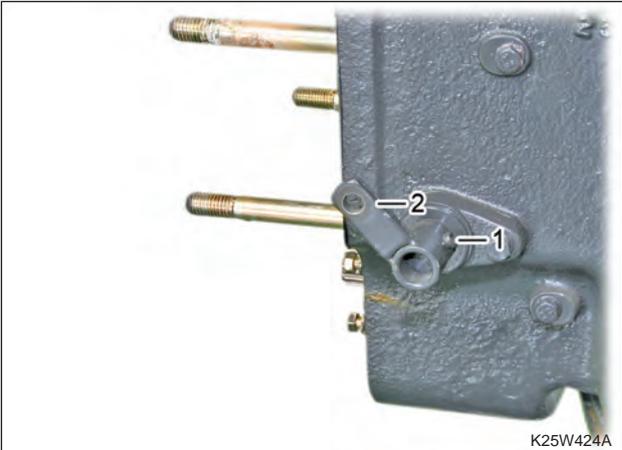
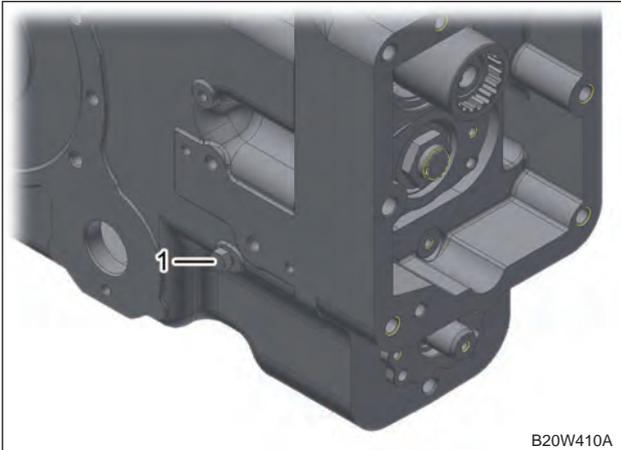
FRICITION DISCS (1)	4EA
PLATES (2)	



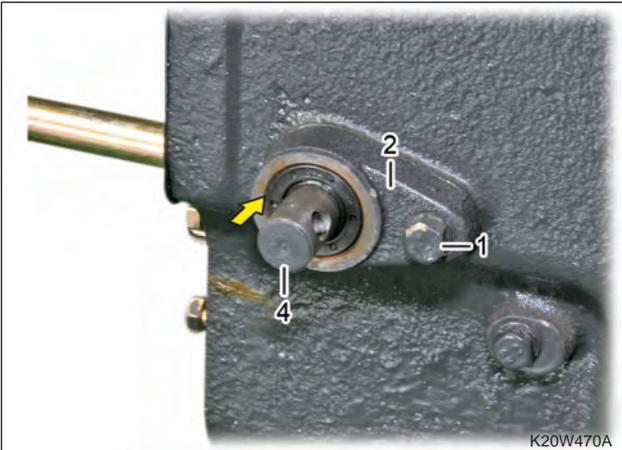
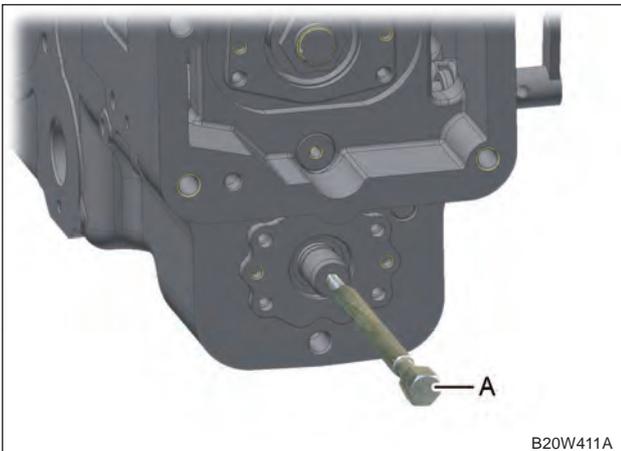
3. Remove the spring (1) from the brake cover. Then, remove the cam plate (2) and steel ball (3).

5.5.3 REAR AXLE CASE PART DISASSEMBLY

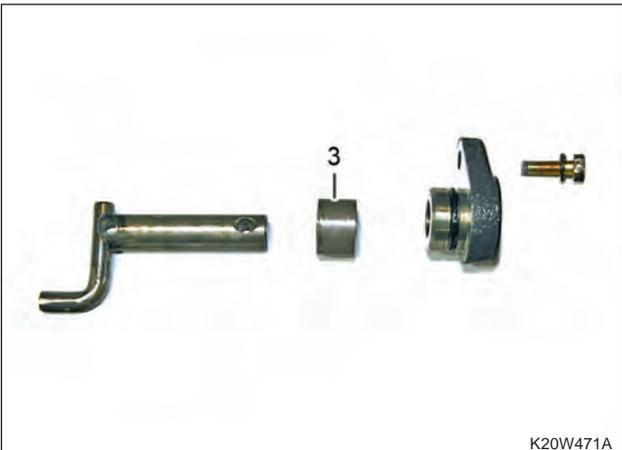
**4WD GEAR DISASSEMBLY**



2. Pull out the 4WD lever assembly B mounting spring pin (1) to remove the 4WD lever (2).



1. Unscrew the mounting bolt with captive pin (1) of the 4WD idle shaft and use a jig (A) to pull out the 4WD shaft (2). Then, remove the 4WD idle gear (3).



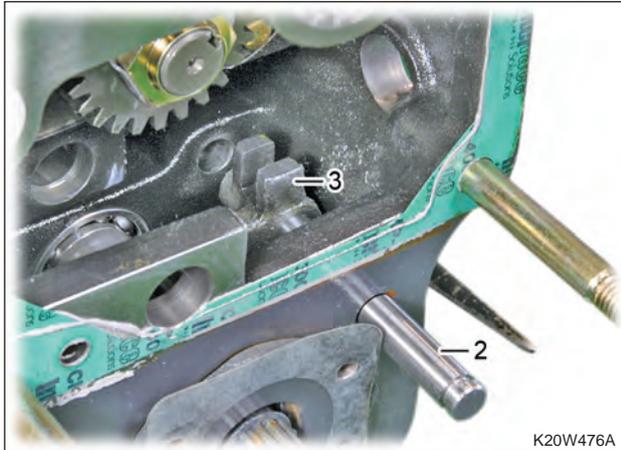
3. Unscrew the shift arm holder mounting bolt (1) to remove the shift arm holder (2). Then, remove the bushing (3) and 4WD lever assembly A (4) through the inside of the transmission case.



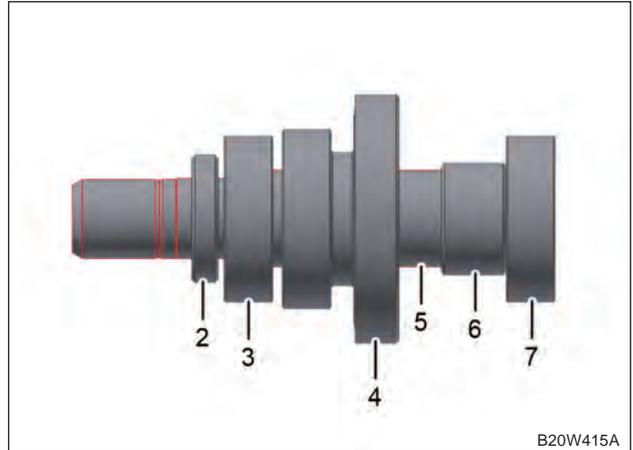
K20W475A



B20W414A



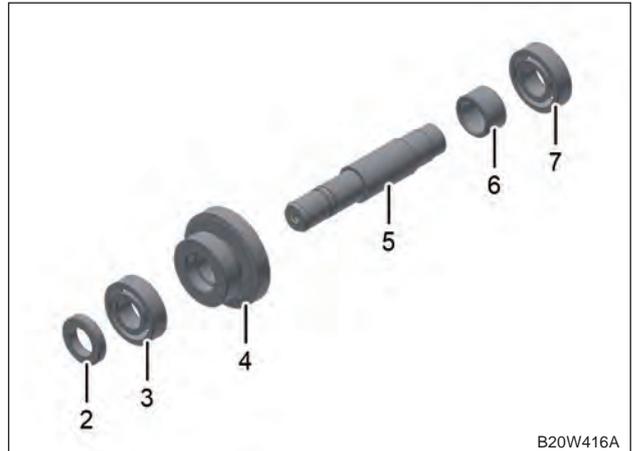
K20W476A



B20W415A



B20W413A



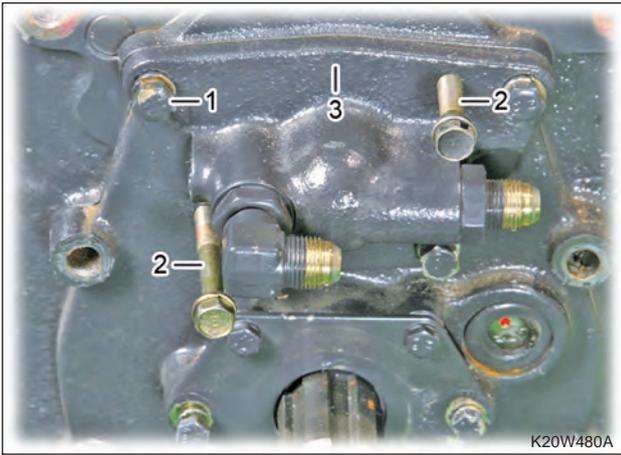
B20W416A

4. Loosen the bolt with captive pin (1) to remove the 4WD fork shaft (2) and 4WD fork (3).

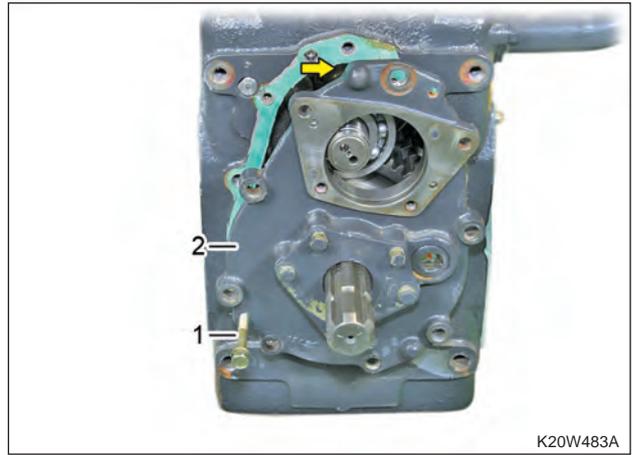
5. Remove the oil seal case (1) and tap out the 4WD drive shaft from inside to outside.

Then, remove the oil seal (2), ball bearing (3), 4WD driven gear (4), 4WD drive shaft (5), collar (6) and ball bearing (7) in order.

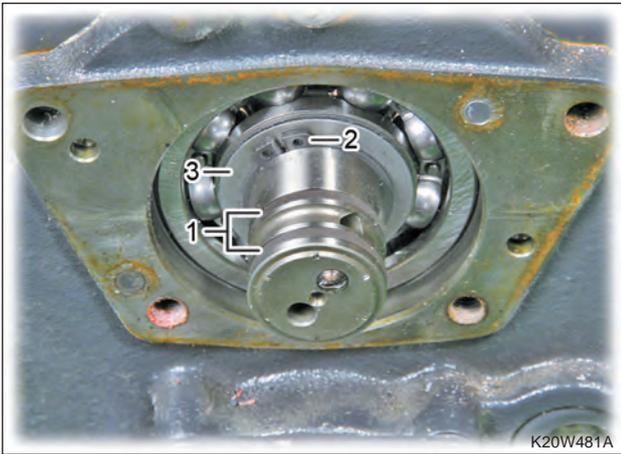
**PTO SHIFT GEAR DISASSEMBLY**



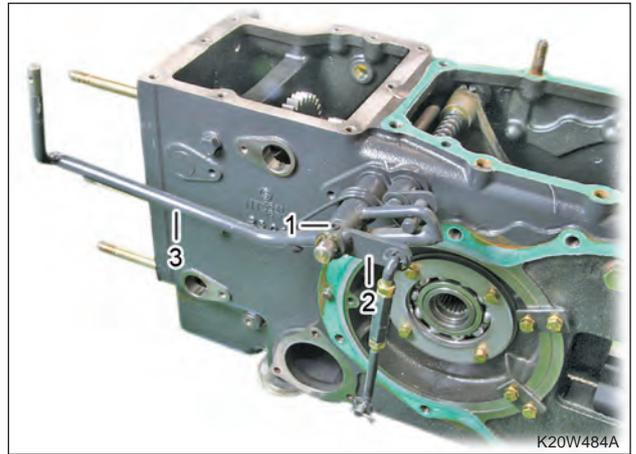
1. Unscrew the PTO shaft housing mounting bolt (1). Then, use the service bolt (2) to remove the seal case (3).



3. While tightening the service bolt (1), separate the PTO shaft housing (2) from the PTO shift shaft bearing and turn it slightly.

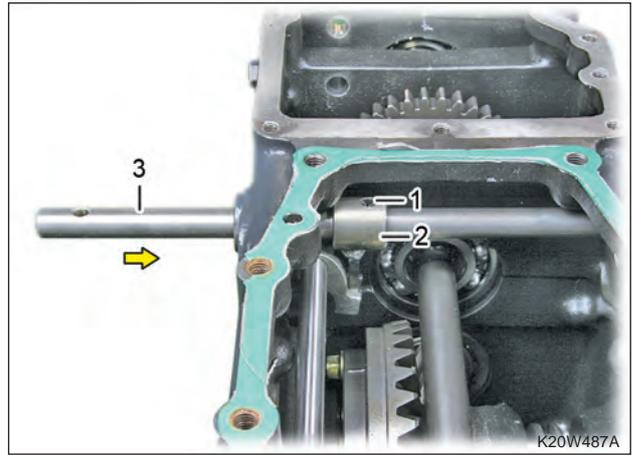
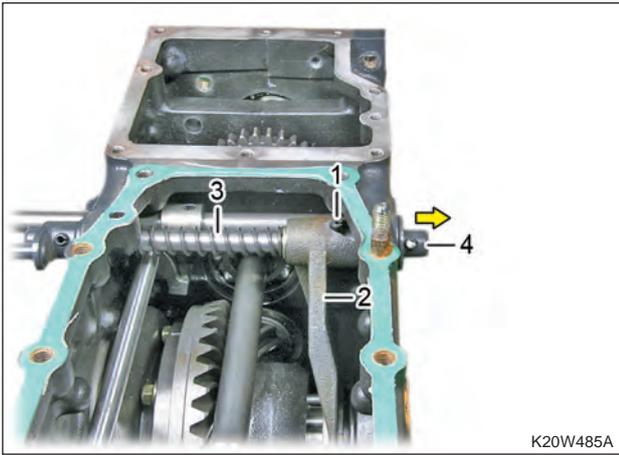


2. Remove the PTO shift shaft seal ring (1), snap ring (2) and collar (3). Then, pull out the bearing holder (4) from the transmission case.



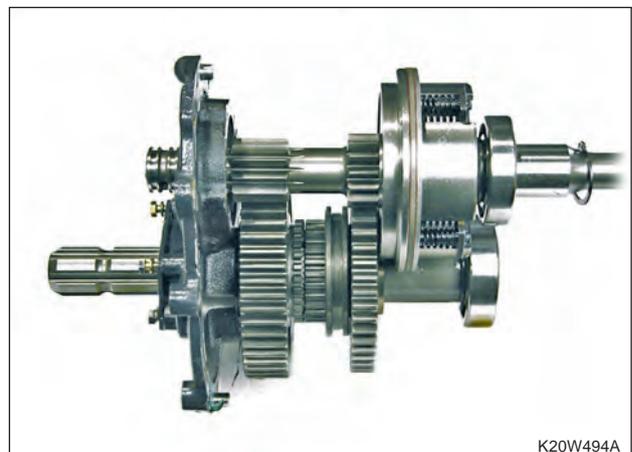
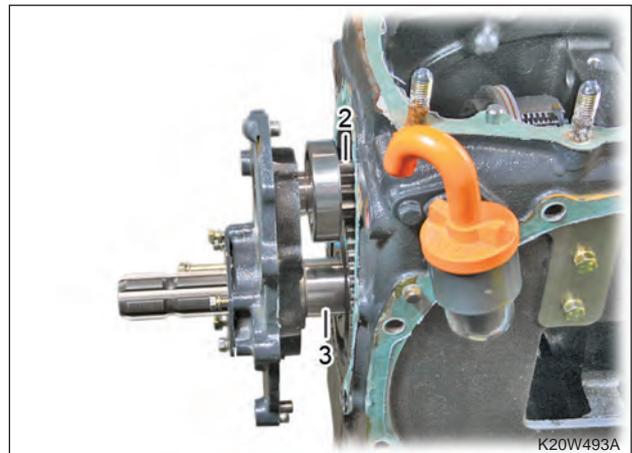
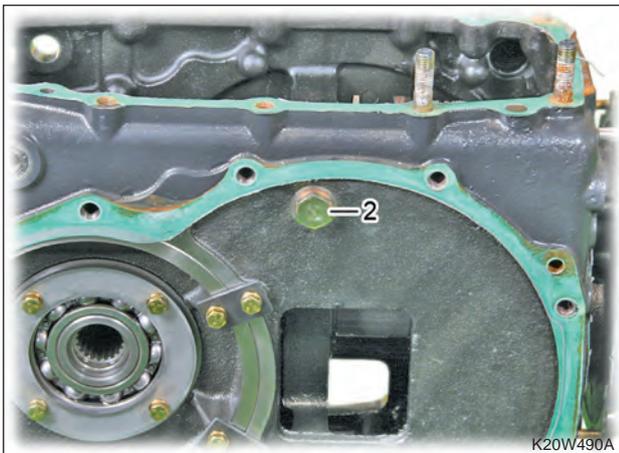
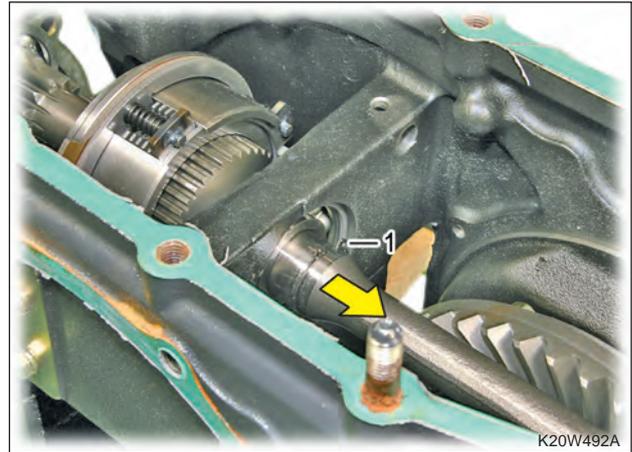
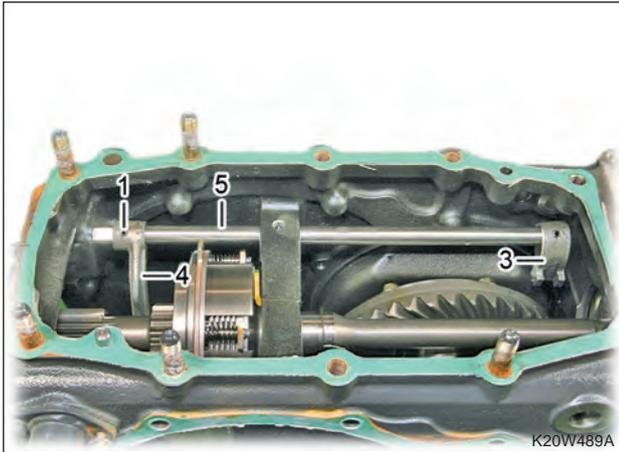
4. Pull out the spring pin (1) and remove the PTO shift lever (2) and differential pedal assembly (3).





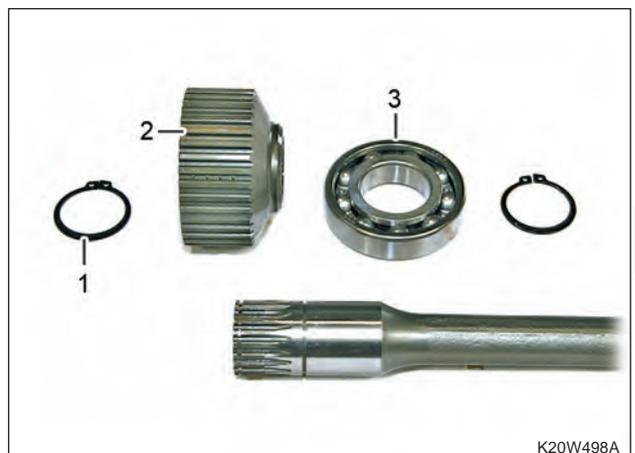
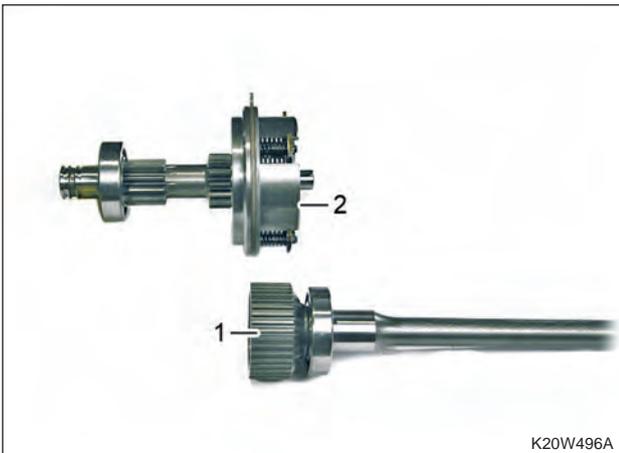
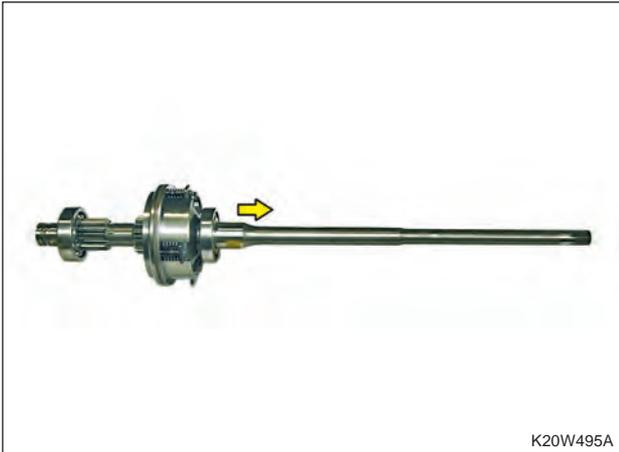
5. Remove the differential fork shaft mounting spring pins (2 EA) (1). Then, remove the differential fork (2), differential spring (3) and differential fork shaft (4) to the right side.

6. Pull out the shift arm mounting spring pin (1) and remove the shift arm assembly (2) and PTO shift lever shaft (3) to the right side.



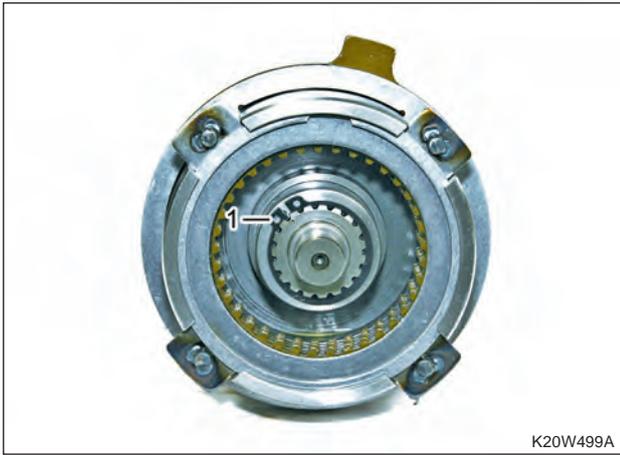
7. Pull out the PTO shift fork mounting spring pin (1), unscrew the PTO fork shaft bolt (2) and remove the spring and steel ball. Then, remove the shift boss (3), PTO shift fork (4) and PTO fork shaft (5).

8. Remove the PTO connecting shaft snap ring (1). Then, remove the PTO connecting shaft (2) and PTO shaft (3) together.

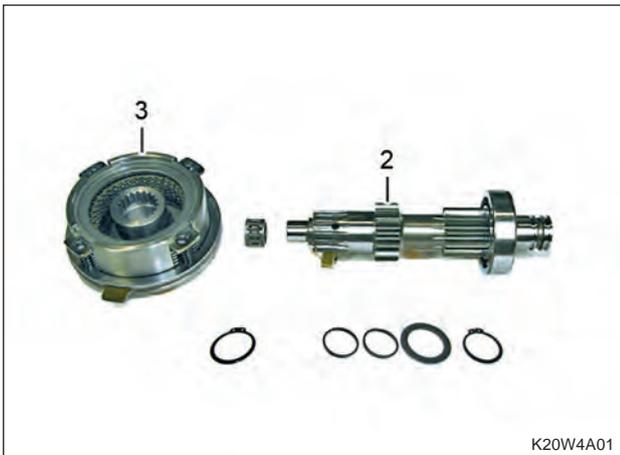


9. Pull out the PTO coupling (1) from the PTO clutch pack (2).

10. Pull out the snap ring (1) from the PTO connecting shaft. Then, remove the PTO coupling (2) and ball bearing (3).



K20W499A



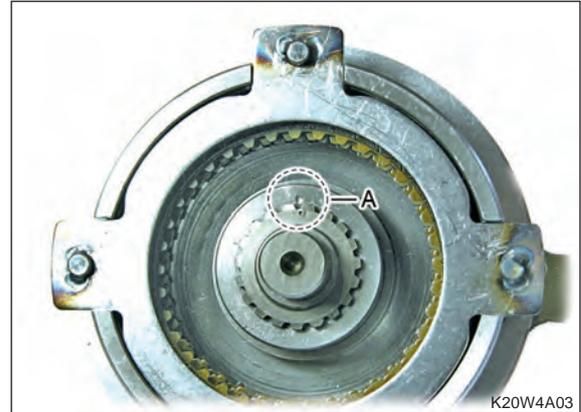
K20W4A01



K20W4A02

11. Pull out the snap ring (1) from the PTO clutch assembly. Then, remove the PTO shift shaft (1) and PTO clutch pack (2).

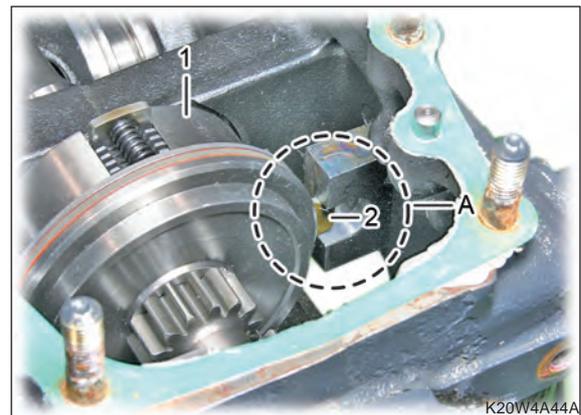
**⚠ CAUTION**



K20W4A03

- When installing the PTO clutch pack to the PTO shift shaft, align its mating mark (A).

**⊕ IMPORTANT**



K20W4A44A

- When installing the PTO clutch pack (1) to the rear axle case, set the brake plate protrusion (A) of the PTO clutch pack in 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 PTO 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.

**PTO SHAFT DISASSEMBLY**

**Notes**

► **PTO CLUTCH PACK COMPONENT DISASSEMBLY**

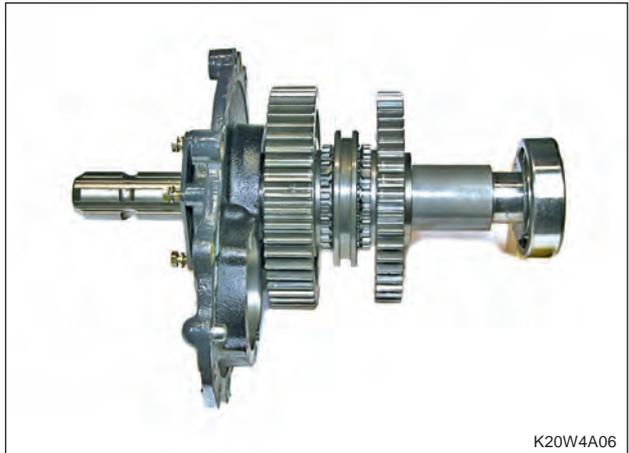


K20W4A04



K20W4A05

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



K20W4A06

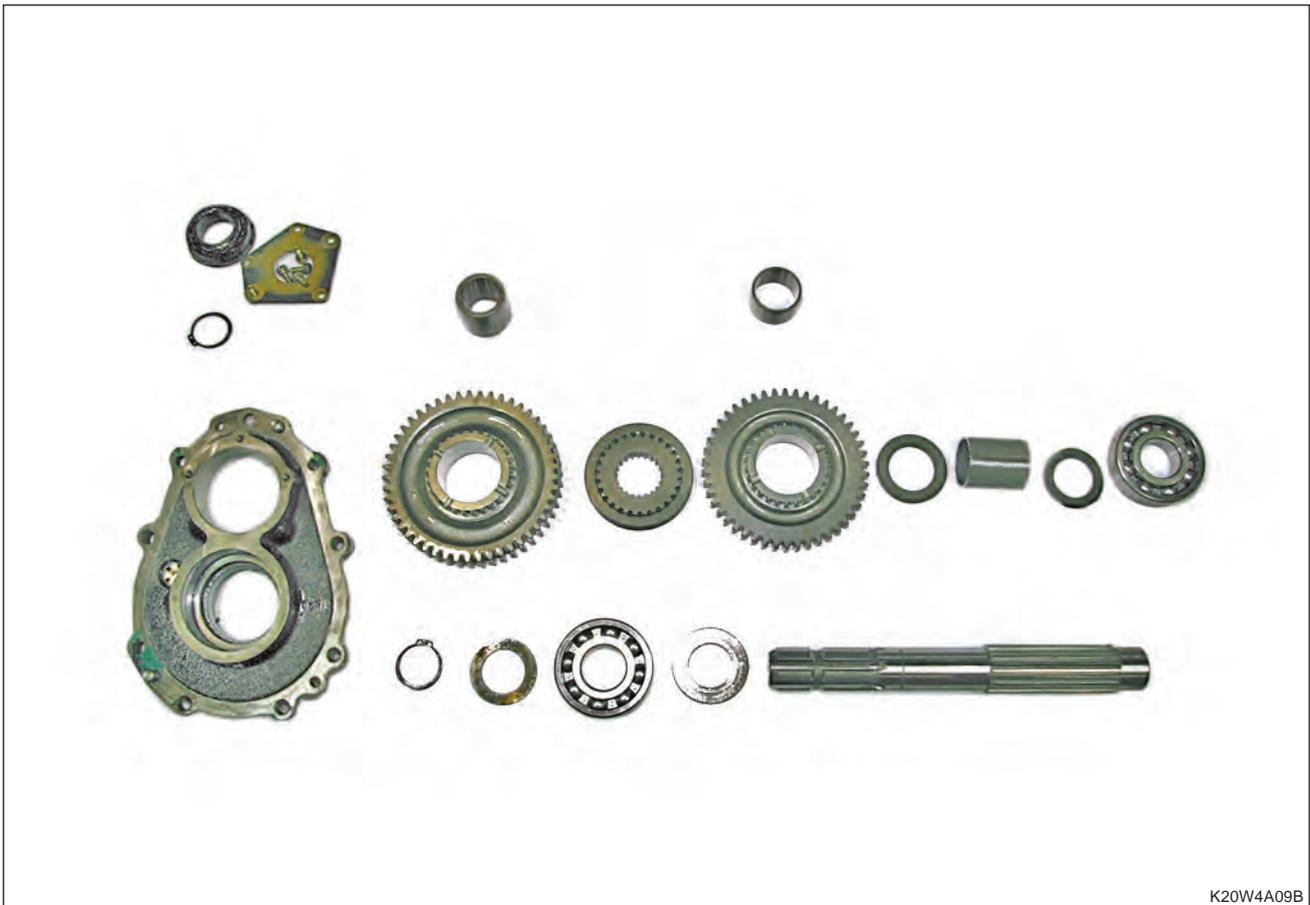


K20W4A07



K20W4A08

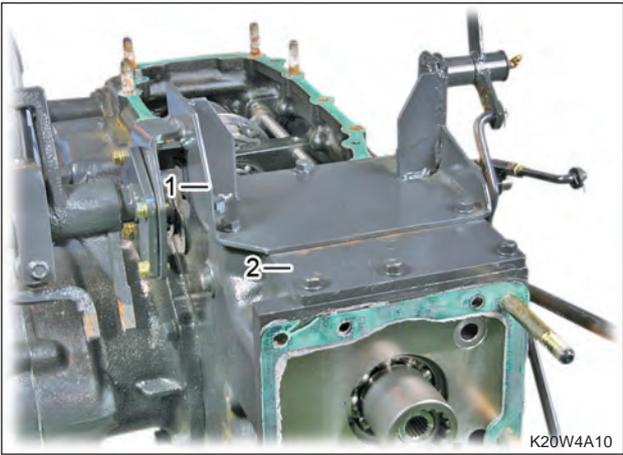
1. Unscrew the cover mounting bolts to remove the cover (1). Then, pull out the snap ring (2) from the inside and tap the shaft inward to remove it.



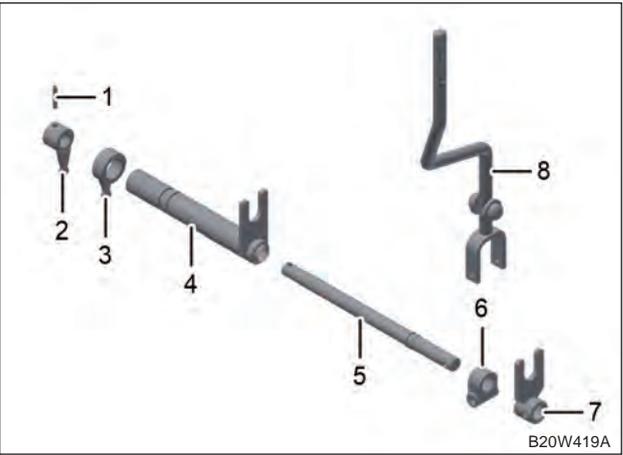
K20W4A09B

2. Remove the PTO shaft, 49 gear, 46 gear and PTO sleeve.

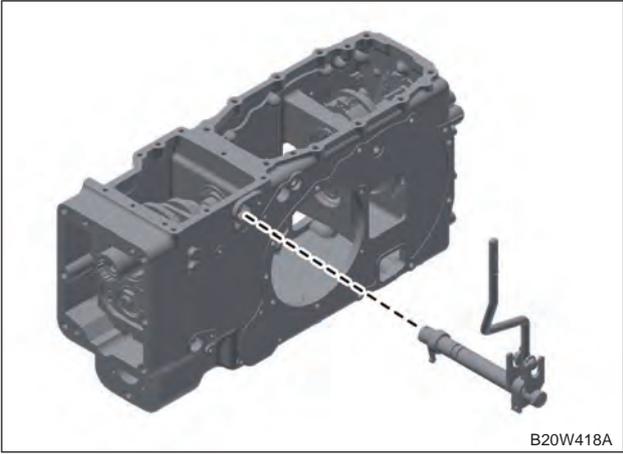
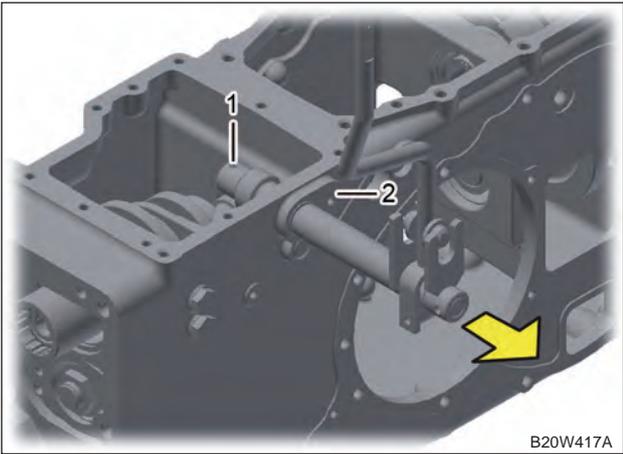
**RANGE SHIFT GEAR DISASSEMBLY**



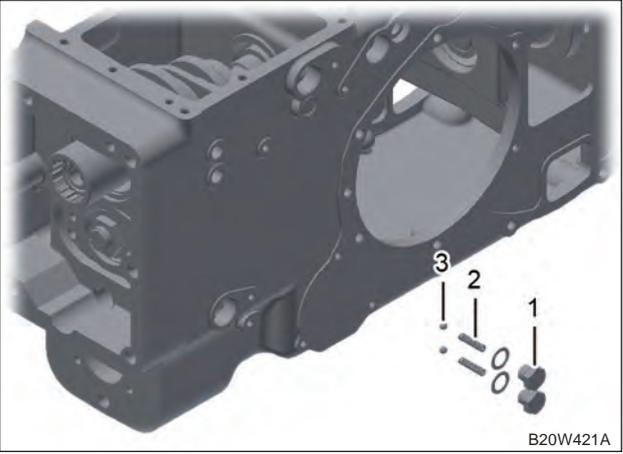
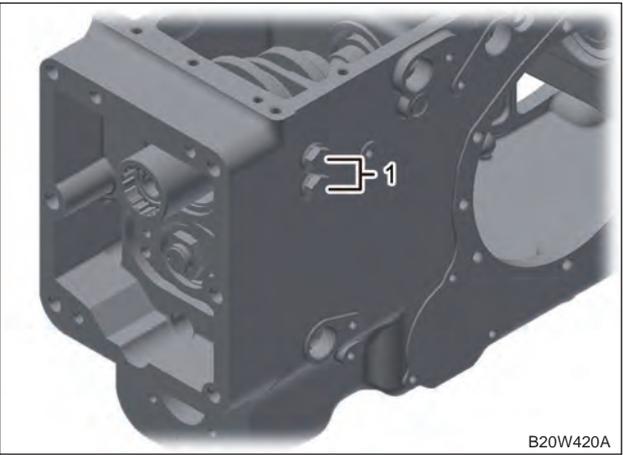
1. Remove the seat rail stay assembly (1) and rear axle case cover (2).



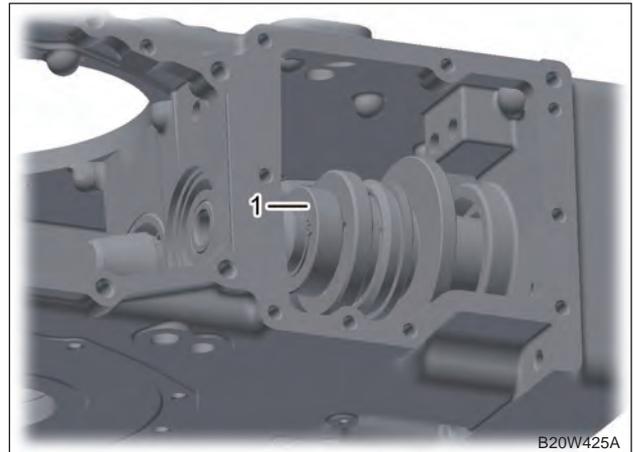
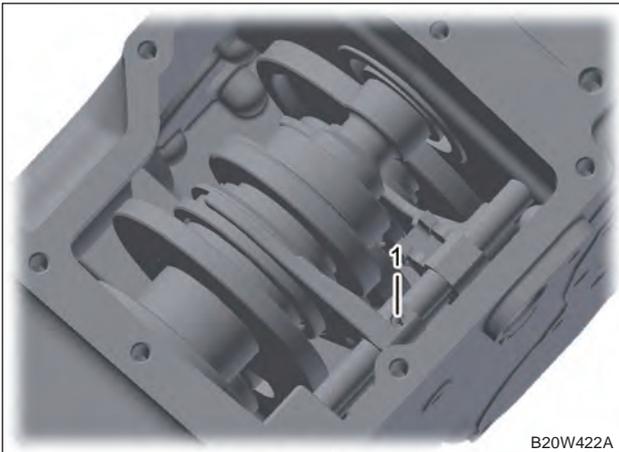
3. Remove the arm (A-B) (2), arm (C-D) (3), range shift assembly (C-D) (4), shift shaft (A-B) (5), PTO lever link (6), shift arm assembly (A-B) (7) and range shift lever (8) from the shift shaft assembly.



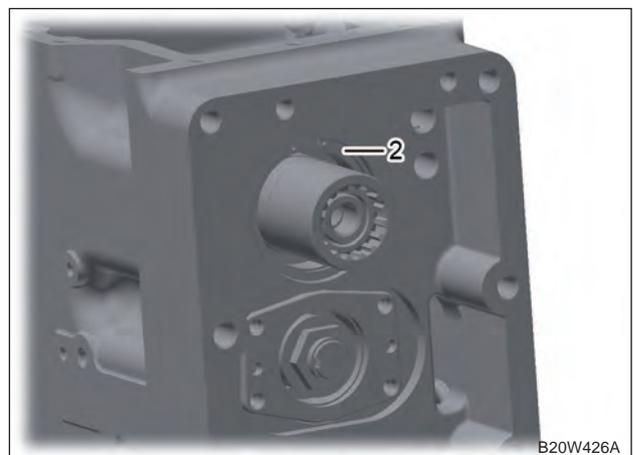
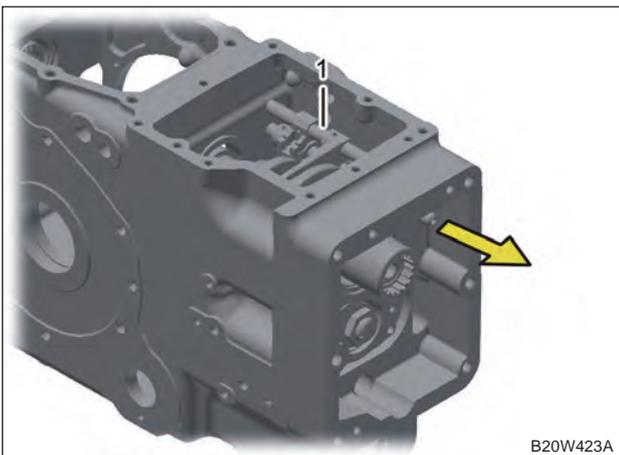
2. Tap out the arm (A-B gear) retaining spring pin and remove the stopper (2). Then. Tap the shift shaft in the arrow direction to remove the shift shaft assembly.



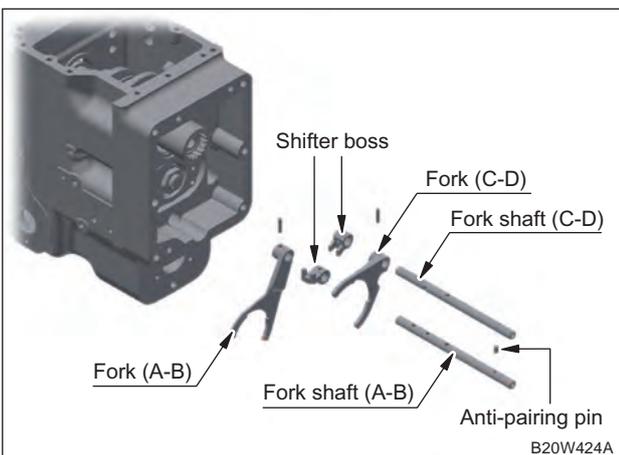
4. Unscrew the fork shaft mounting bolts (1) and remove the internal spring (2) and steel ball (3).



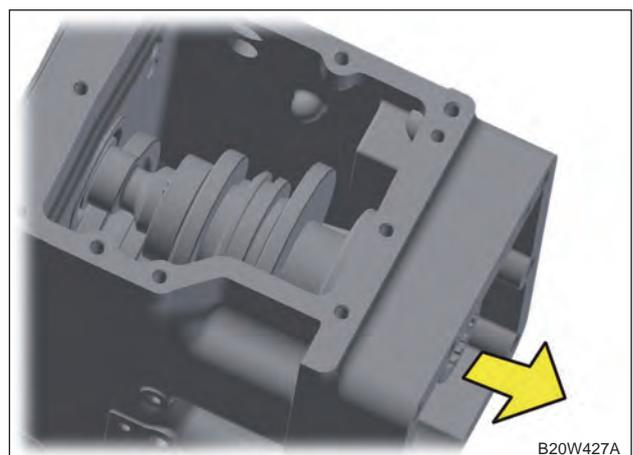
5. Pull out all fork mounting spring pins (1) (3 EA).



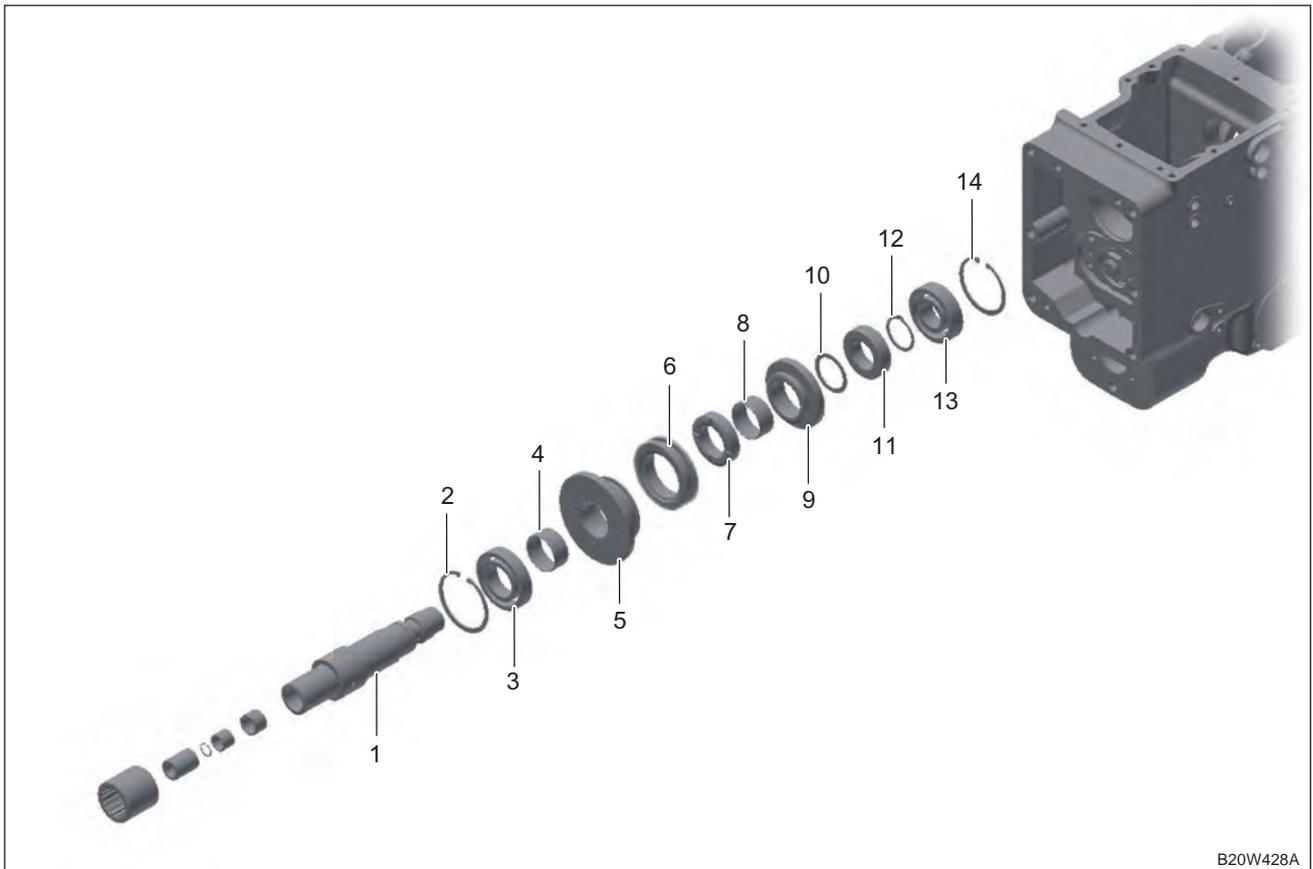
7. Pull out the 2nd drive gear snap ring (1) of the range shift drive shaft and snap ring (2) from the front of the ball bearing.



6. Tap the fork shaft in the arrow direction to remove it. Then, remove the shifter boss and all forks.



8. Tap the range shift drive shaft in the arrow direction to remove it with its gears.



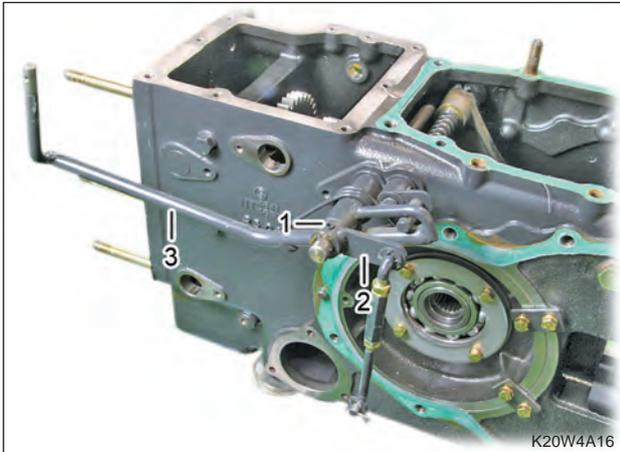
B20W428A

- |                                |                                |                                 |
|--------------------------------|--------------------------------|---------------------------------|
| (1) Range shift drive shaft    | (6) Sleeve [C-D]               | (11) Range shift drive gear [B] |
| (2) Snap ring                  | (7) Hub [C-D]                  | (12) Snap ring                  |
| (3) Ball bearing               | (8) Bush                       | (13) Ball bearing               |
| (4) Bush                       | (9) Range shift drive gear [C] | (14) Snap ring                  |
| (5) Range shift drive gear [D] | (10) Collar                    |                                 |

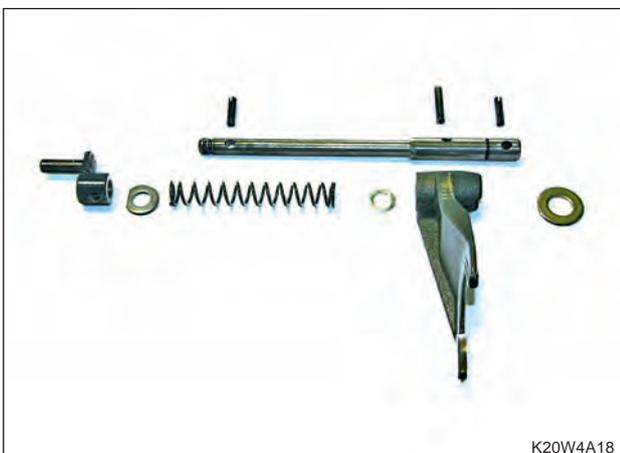
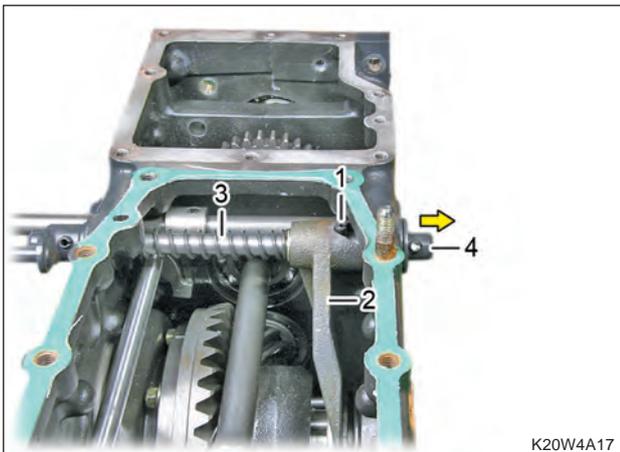
9. Disassemble the range shift drive shaft components in order.

**DIFFERENTIAL REMOVAL**

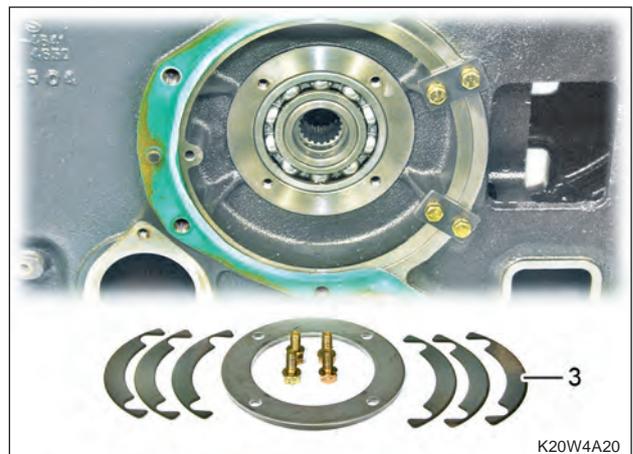
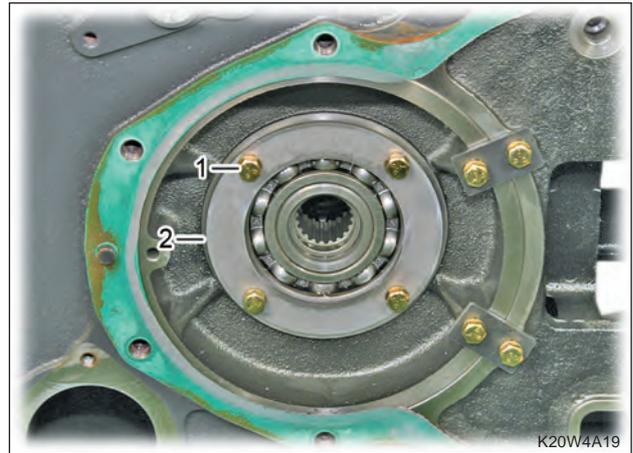
1. Remove the rear axle housing and hydraulic cylinder case from the rear axle case.



2. Pull out the differential lock pedal mounting spring pin (1) and remove the PTO shift lever (2) and differential lock pedal (3) in order.



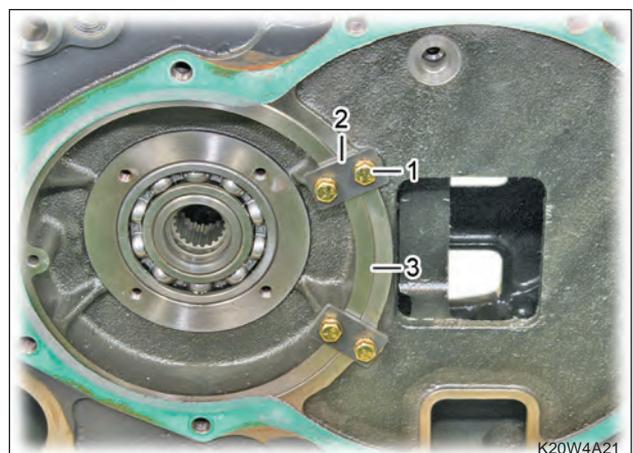
3. Remove the differential fork shaft mounting spring pin (1). Then, remove the differential fork (2), differential spring (3) and differential fork shaft (4) by tapping the differential fork shaft to the right.



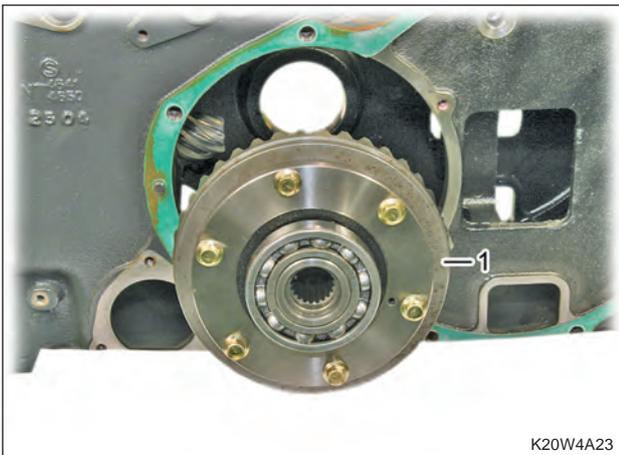
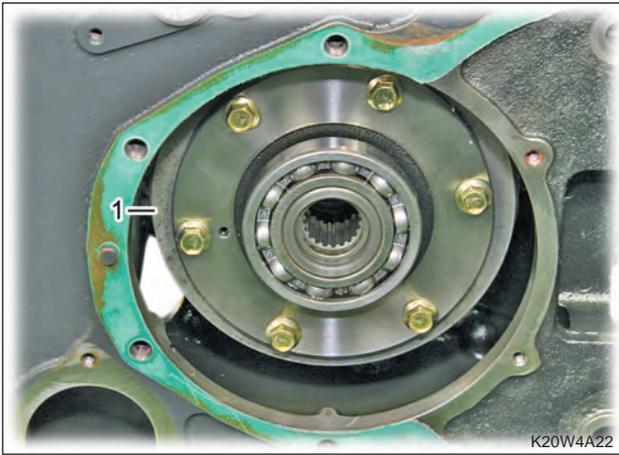
4. Unscrew the retainer mounting bolts (1) to remove the retainer (2) and adjusting shims (3).

**Notes**

- When removing the retainer, check the amount of shims in it so that the same amount of shims can be installed later.



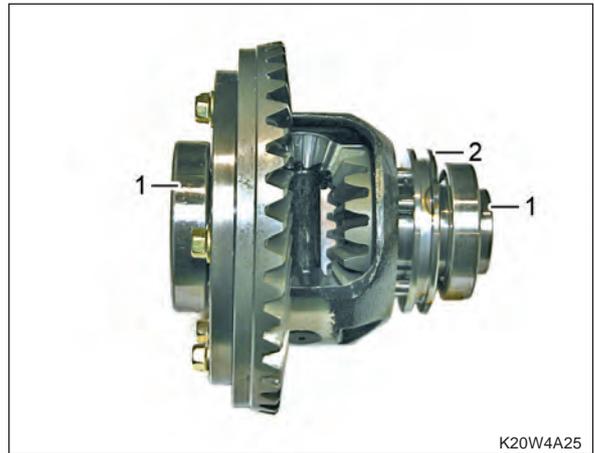
5. Unscrew the retainer mounting bolts (1) to remove the retainer (2) and carrier (3).



6. Pull the differential assembly (1) toward the carrier to remove it.

**Notes**

► **DIFFERENTIAL ASSEMBLY COMPONENT DISASSEMBLY**



1. Remove the ball bearings (1) from the left and right. Then, remove the differential lock thrust assembly (2).

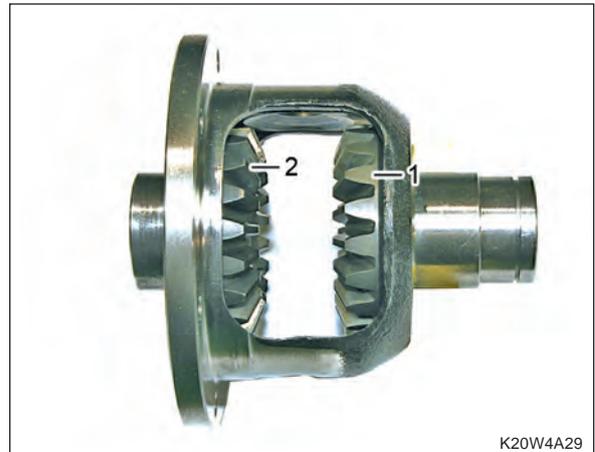
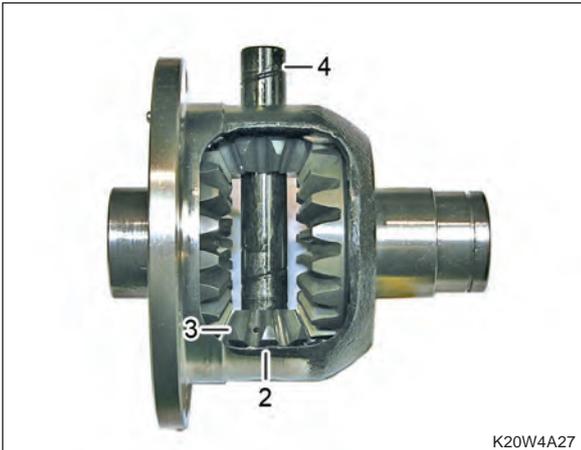


2. Unscrew the differential case mounting bolts (1) to remove the ring gear (2).

Notes

- Apply Loctite to the threads of the mounting bolt during installation.

ITEM	TORQUE VALUE
Mounting bolt	64.88 N.m
	6.62 kgf.m
	47.66 lb.ft



3. Pull out the pinion shaft spring pin (1) and remove the differential pinion liner (2), differential pinion (3) and pinion shaft (4) in order.

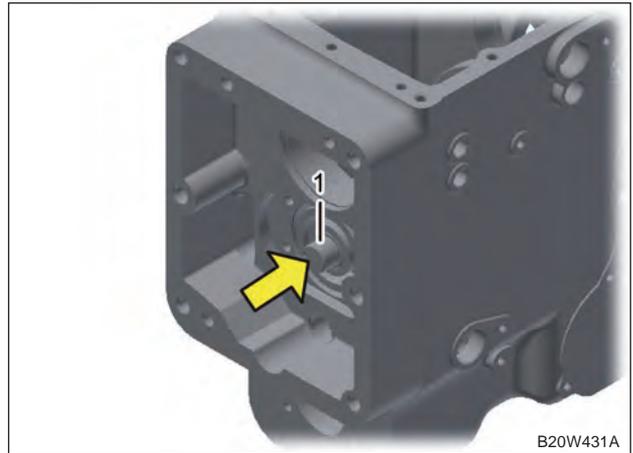
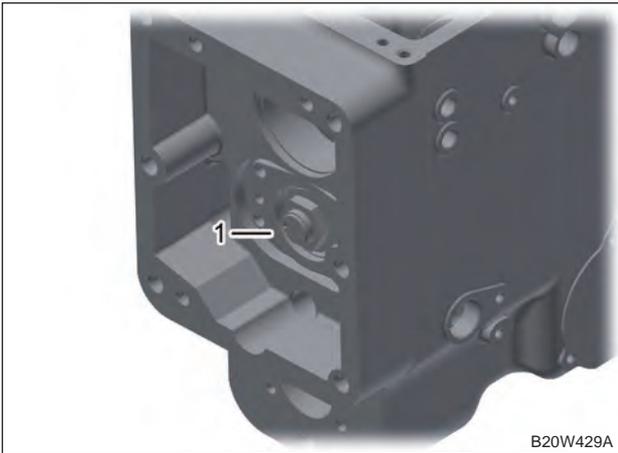
4. Remove the differential side gear A (1) and differential side gear B (2) from the differential case.

Notes

► DIFFERENTIAL BACKLASH ADJUSTMENT

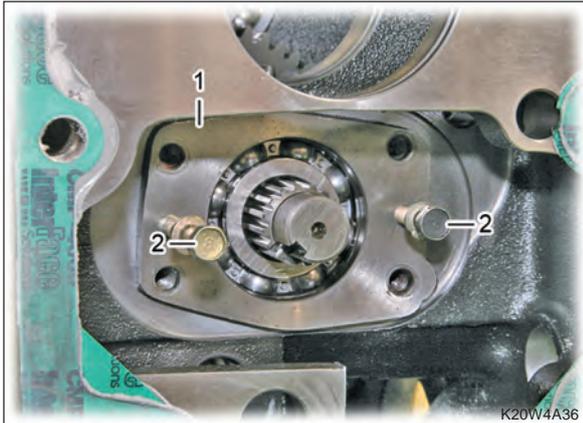
- With the differential system installed to the case, set a dial gauge onto the top of the rear axle case.
- Touch the tip of the tooth of the ring gear with the needle of the dial gauge gently. Then, measure the backlash by holding the countershaft and moving the ring gear slightly. Standard backlash: 0.1 - 0.2 mm (0.004 - 0.0078 in.)
- If the backlash is out of the standard value, adjust the backlash with the retainer shim on the differential carrier side.

**COUNTERSHAFT DISASSEMBLY**

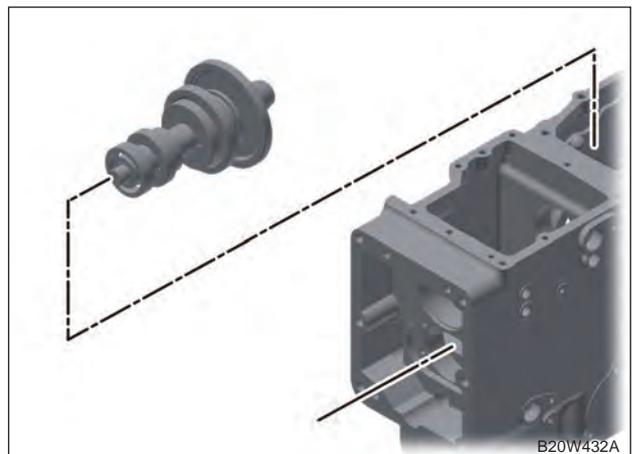


1. Unscrew the bearing case mounting bolt (1) to remove the bearing case (1).

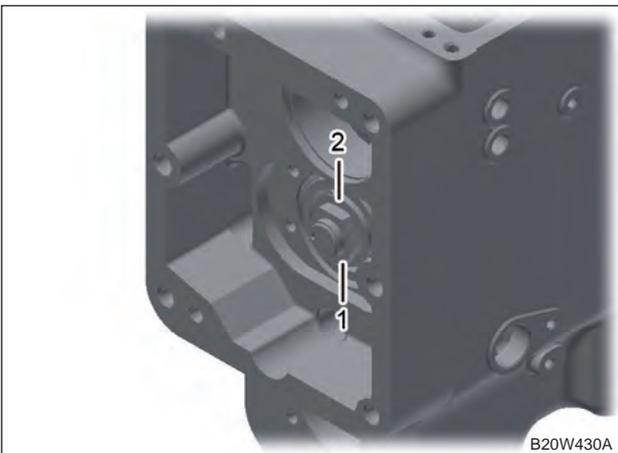
**Notes**



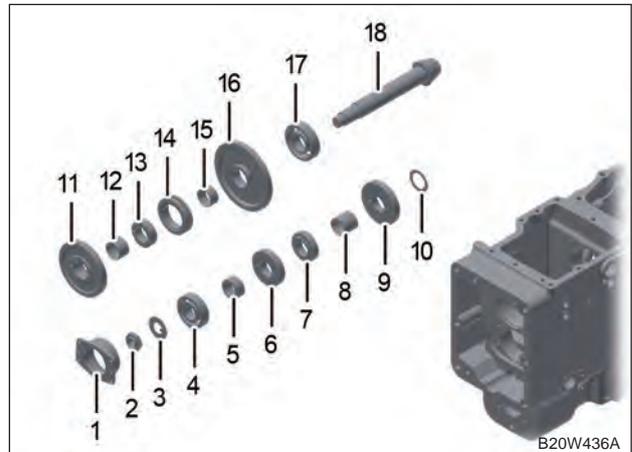
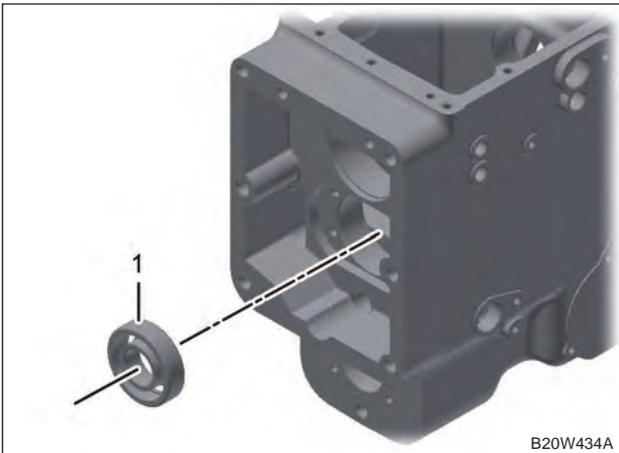
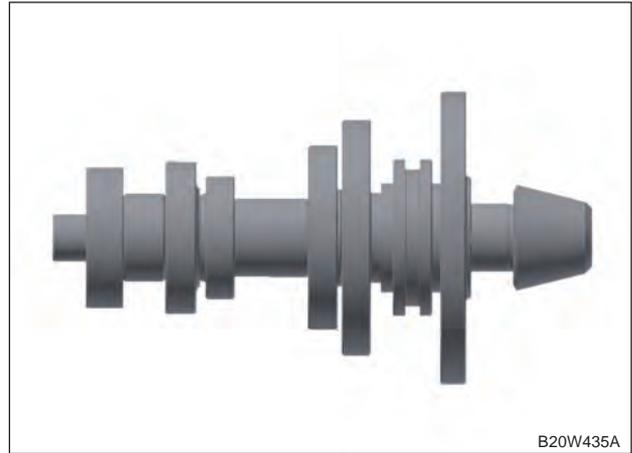
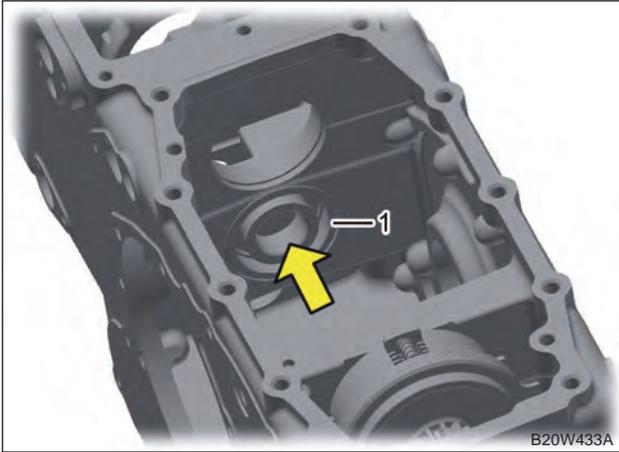
- Unscrew the bearing case mounting bolts and fit the service bolts (2) to the bearing case (1). Then, remove the bearing case while tightening both service bolts evenly.



3. Tap the counter shaft in the arrow direction to remove it with its gears.



2. Unscrew the lock nut (1) to remove the washer with rib (2).



4. Remove the roller bearing (1) in the transmission by tapping it in the arrow direction.

5. Remove the bearing case (1), lock nut (2), washer (3), ball bearing (4), collar (5), 4WD drive gear (6), range shift 4th driven gear (7), spacer (8), range shift 3rd driven gear (9), collar (10), range shift 2nd driven gear (11), bush (12), hub (13), sleeve (14), bush (15), range shift 1st driven gear (16), roller bearing (17) and counter shaft (18) in order from the counter shaft assembly.

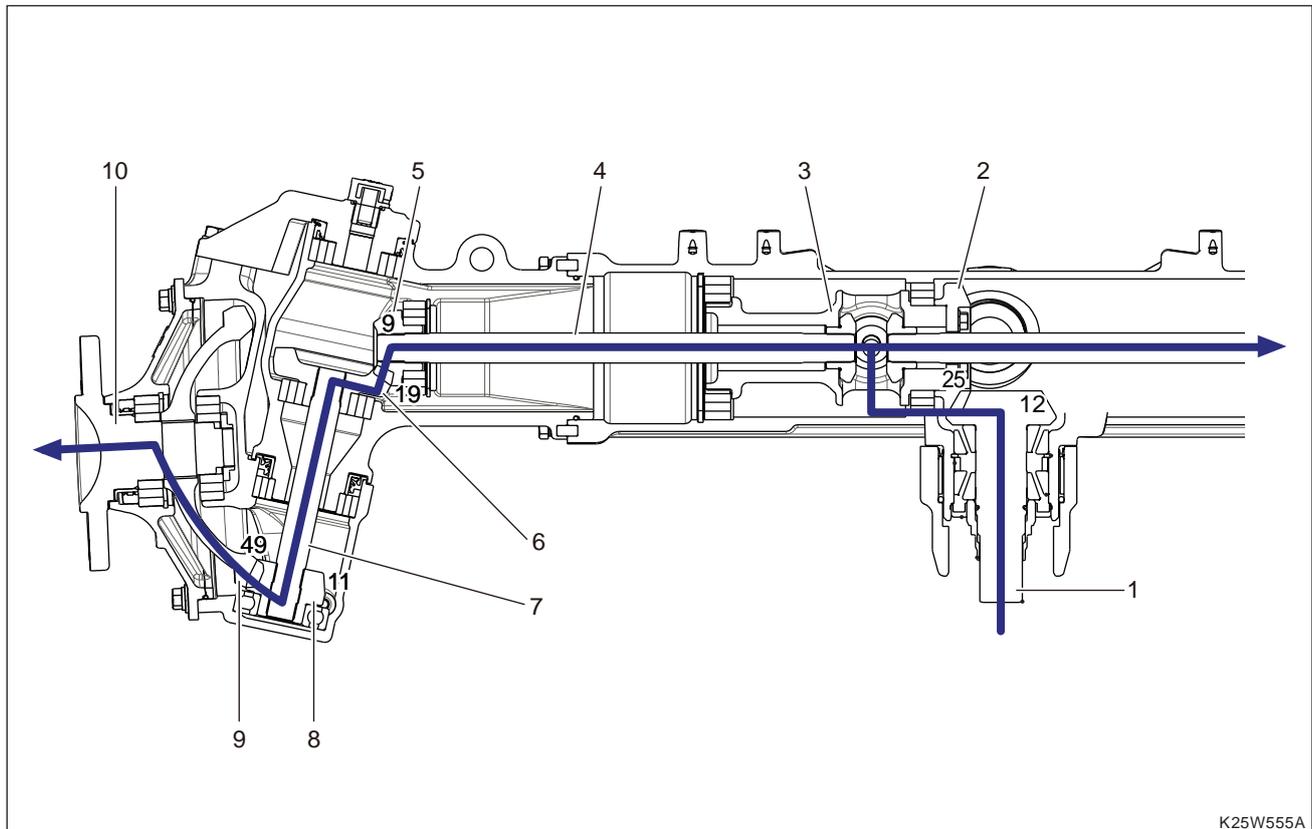
# CHAPTER 5 FRONT AXLE

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## 1.3 POWER TRANSFER



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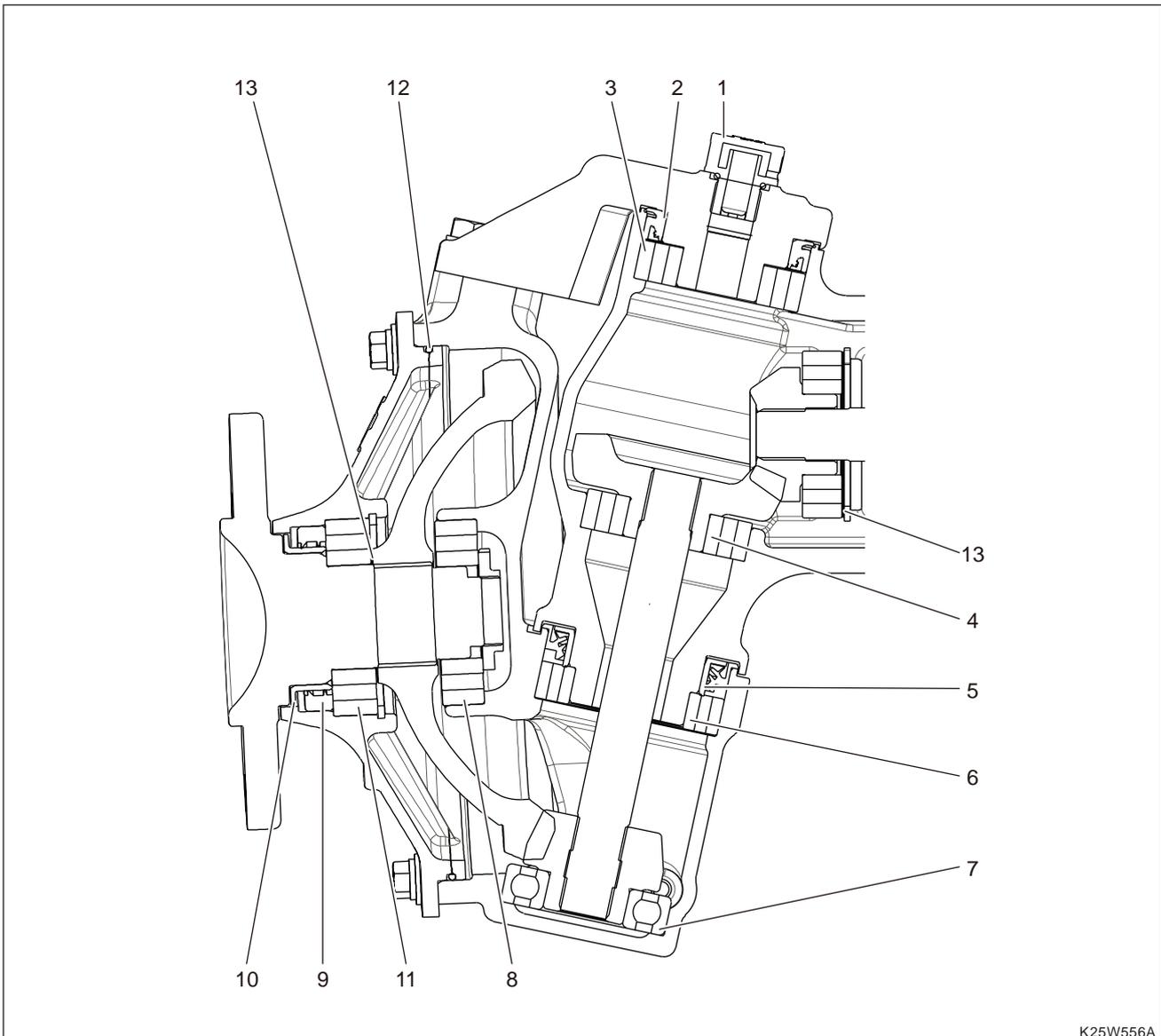
- |                       |                     |                         |
|-----------------------|---------------------|-------------------------|
| (1) Drive pinion      | (5) 9 bevel gear    | (9) 49 front final gear |
| (2) Ring gear         | (6) 19 bevel gear   | (10) Front spindle      |
| (3)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

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.

## 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

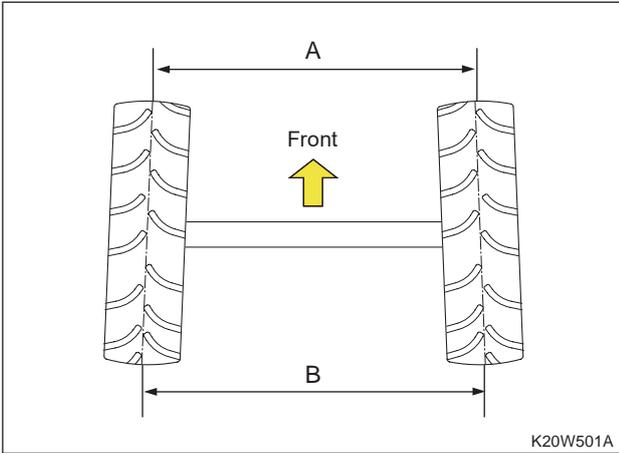
The knuckle section is a part to perform driving and steering functions in the front axle section, and it (knuckle arm + front gearbox) revolves around the fixed king pin section (front gear case).

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.

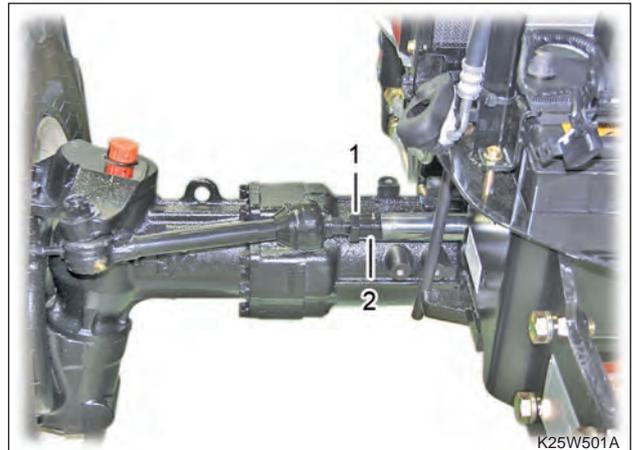
## 2. INSPECTION AND ADJUSTMENT

### 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.

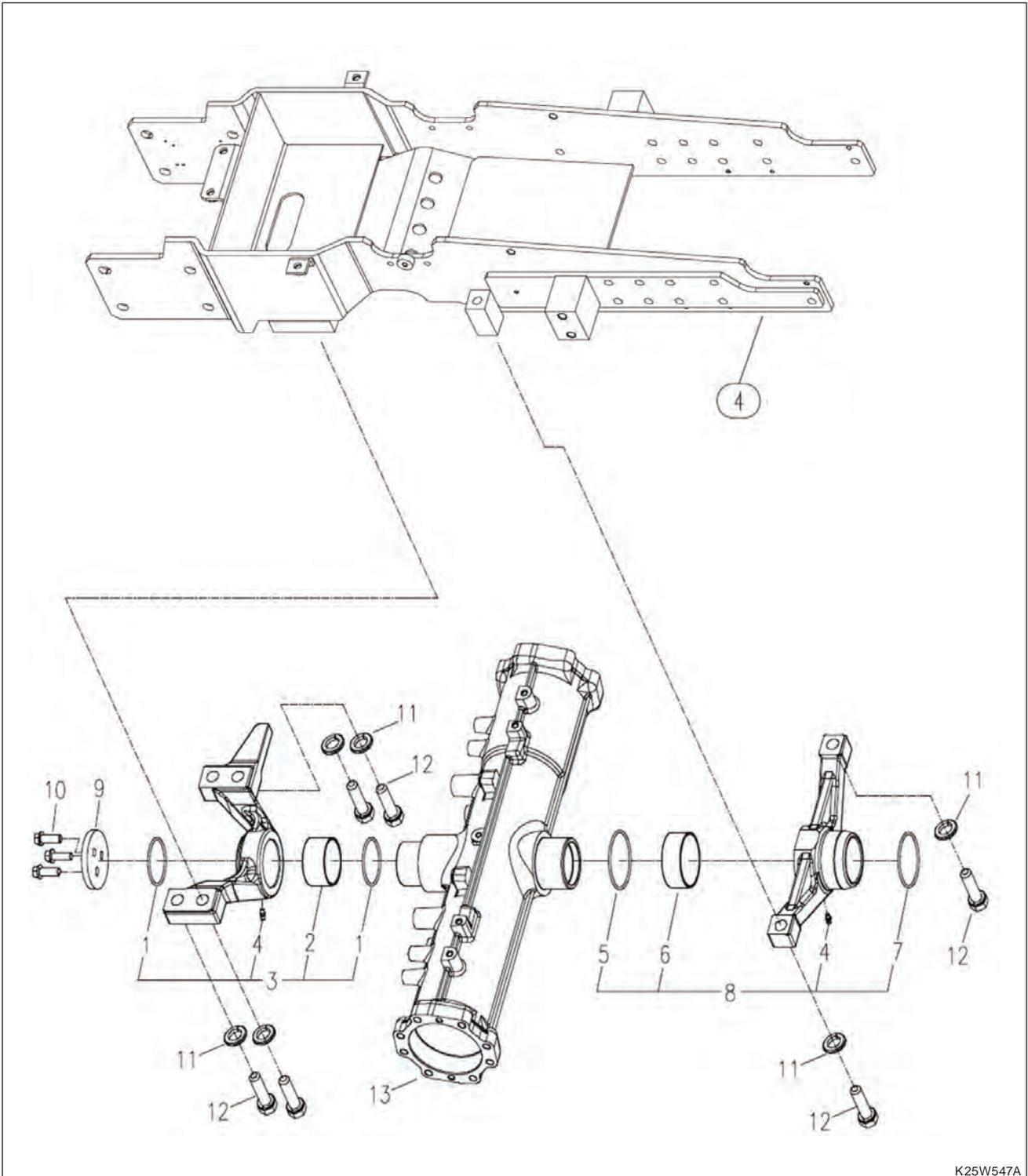
Notes		
Front tire inflation pressure	With loader	3.0 kgf/cm <sup>2</sup> 42.66 psi
	Standard	2.0 kgf/cm <sup>2</sup> 28.44 psi

### 3. TROUBLESHOOTING

PROBLEMS	CAUSE OR SYMPTOM	SOLUTION
The front wheels rattle.	<ul style="list-style-type: none"> <li>Poorly adjusted toe-in</li> <li>Abnormal tire inflation pressure</li> </ul>	<ul style="list-style-type: none"> <li>Adjust the toe-in (4 - 8 mm).</li> <li>Inflate the tire to the proper pressure level (2.0 kgf/cm<sup>2</sup>).</li> </ul>
The front tires are worn excessively.	<ul style="list-style-type: none"> <li>Poorly adjusted toe-in</li> <li>Excessive inflation pressure</li> </ul>	<ul style="list-style-type: none"> <li>Adjust the toe-in.</li> <li>Adjust the tire pressure to the proper level.</li> </ul>
It is hard to steer the vehicle.	<ul style="list-style-type: none"> <li>Poorly adjusted toe-in</li> <li>Damaged tie rod</li> <li>Defective steering cylinder connection and PST valve</li> </ul>	<ul style="list-style-type: none"> <li>Adjust the toe-in.</li> <li>Replace the tie rod.</li> <li>Check and repair the hydraulic line.</li> </ul>
Noise is generated from the front axle.	<ul style="list-style-type: none"> <li>Damaged internal gear</li> <li>Insufficient front axle oil</li> <li>Improper backlash</li> </ul>	<ul style="list-style-type: none"> <li>Disassemble, inspect and repair</li> <li>Add fluid.</li> <li>Adjust the backlash.</li> </ul>

4. SECTIONAL VIEW FOR MAJOR COMPONENTS

4.1 CENTER PIN SUPPORT

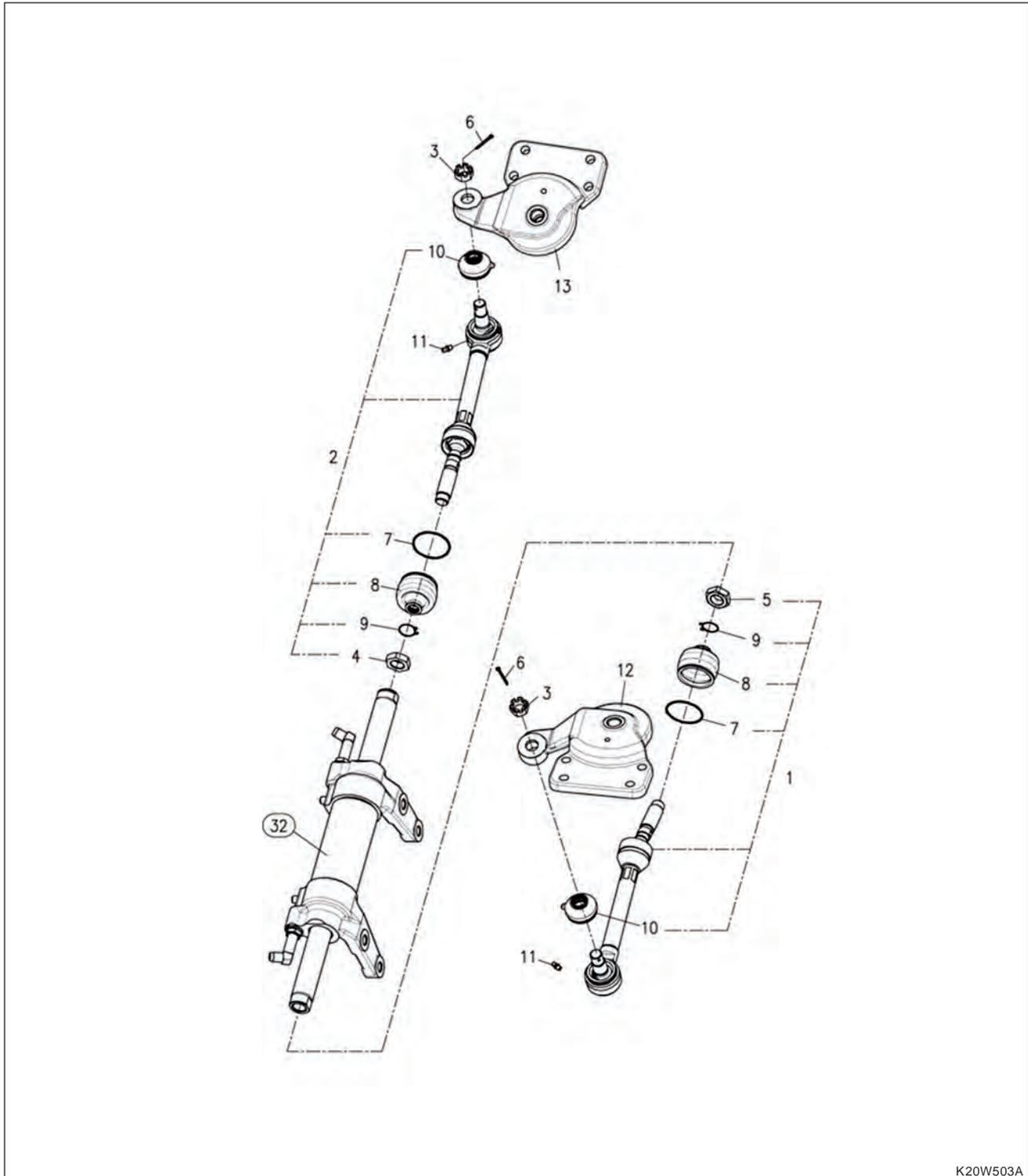


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COMPONENTS

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

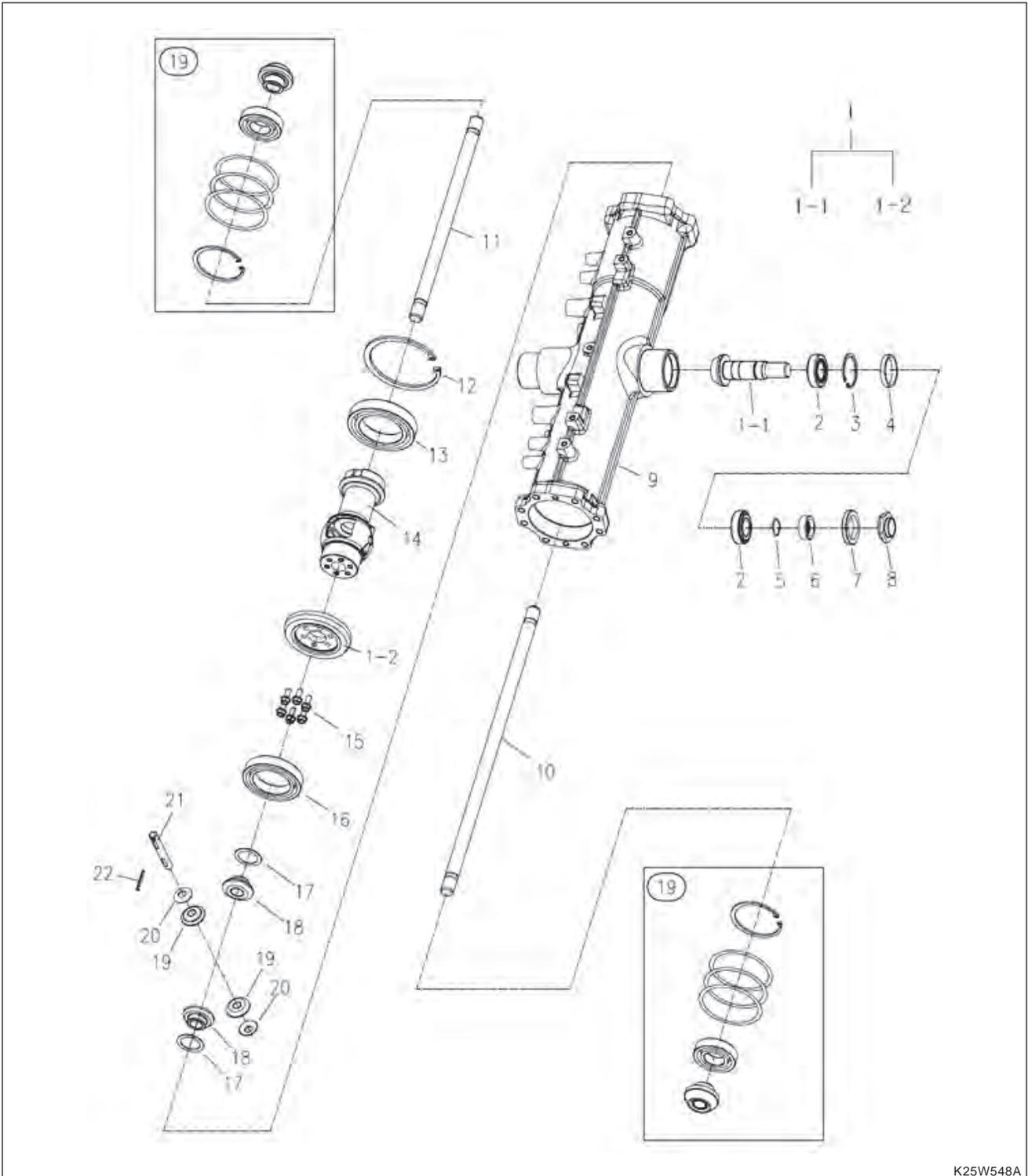
## 4.2 TIE ROD



## COMPONENTS

- |                                    |                        |                                   |
|------------------------------------|------------------------|-----------------------------------|
| (1) Tie rod L assembly             | (6) Split pin (plated) | (11) Grease nipple (type A-MT6X1) |
| (2) Tie rod R assembly             | (7) Set ring           | (12) Knuckle arm L                |
| (3) Hex. slotted nut               | (8) Dustproof cover    | (13) Knuckle arm R                |
| (4) Nut M20X1.5                    | (9) Clip               |                                   |
| (5) Nut M20X1.5 (left-hand thread) | (10) Dustproof cover   |                                   |

4.3 RING GEAR AND DIFFERENTIAL GEAR

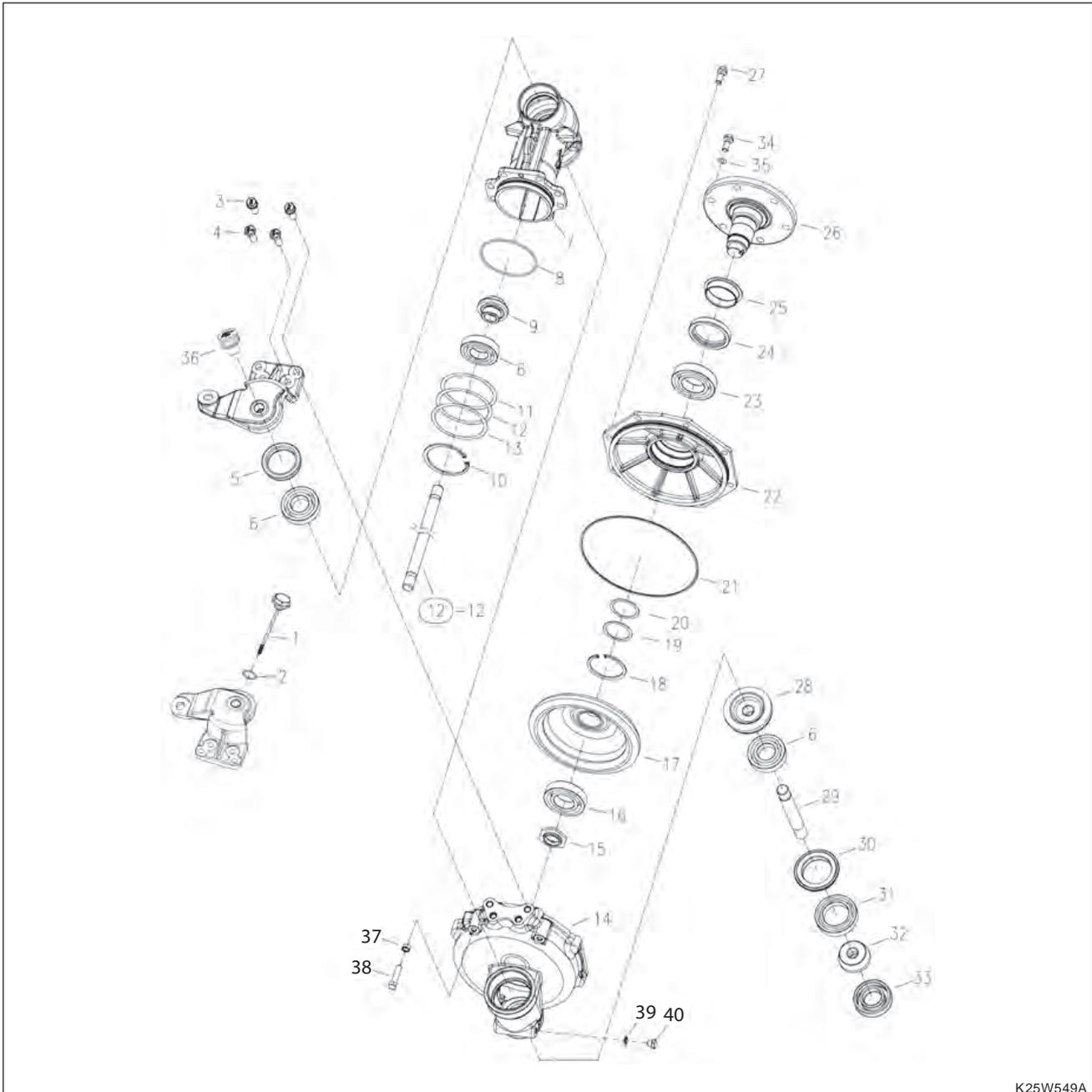


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COMPONENTS

- |                     |                        |                                 |
|---------------------|------------------------|---------------------------------|
| (1) Ring Gear Ass'y | (8) Nut                | (15) Hex Flange Bolt            |
| (1-1) Drive Pinion  | (9) Case               | (16) Ball Bearing               |
| (1-2) Ring Gear     | (10) Front First Shaft | (17) Liner                      |
| (2) Roller Bearing  | (10) Front First Shaft | (18) Differential Gear 14       |
| (3) Snap Ring       | (11) Front First Shaft | (19) Differential Gear 10       |
| (4) Collar          | (11) Front First Shaft | (20) Liner                      |
| (5) O-ring          | (12) Snap Ring         | (21) Shaft, Differential Pinion |
| (6) Bush            | (13) Ball Bearing      | (22) Spring Pin                 |
| (7) Oil Seal        | (14) Differential Case |                                 |

## 4.4 4WD GEAR CASE

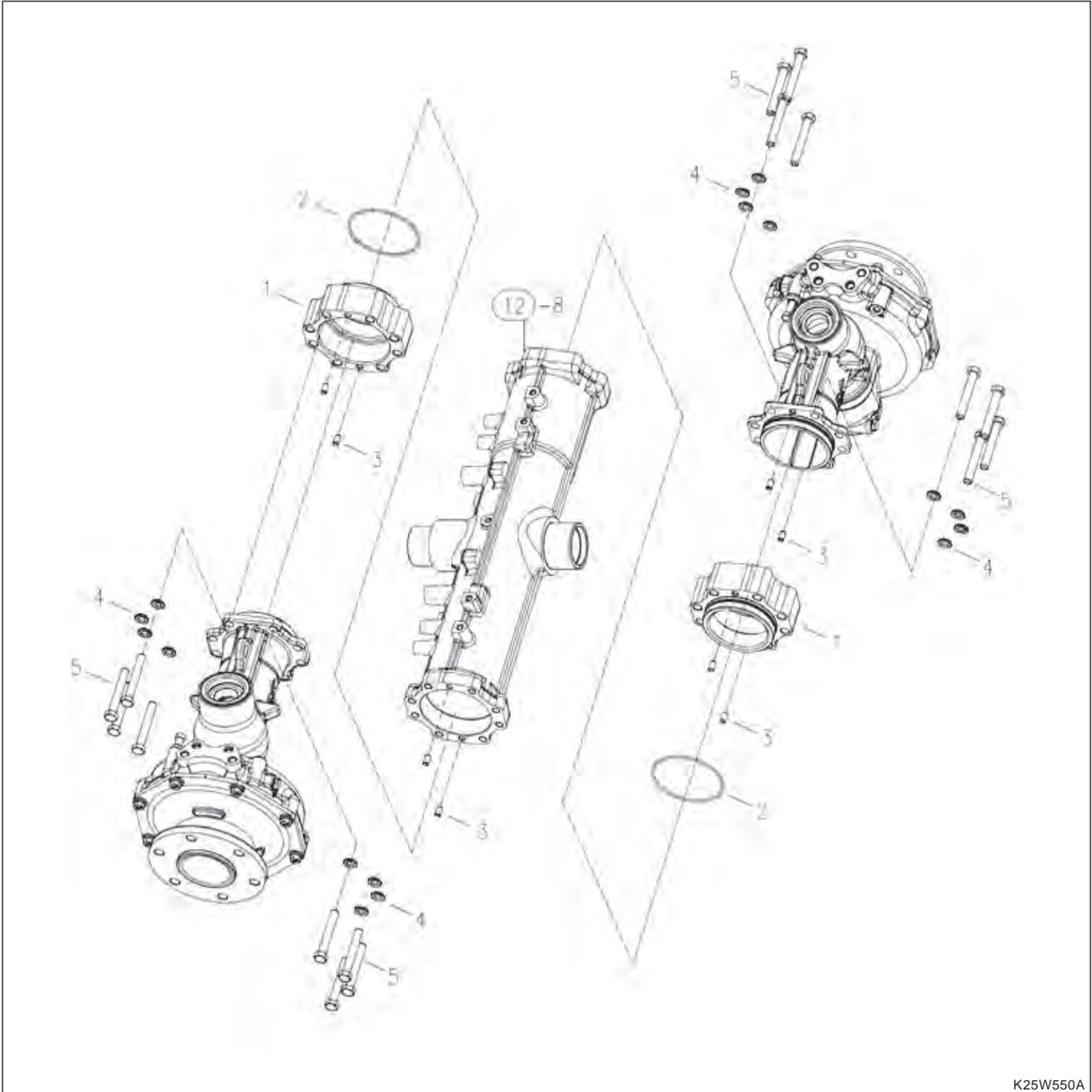


K25W549A

## COMPONENTS

- |                         |                               |                         |
|-------------------------|-------------------------------|-------------------------|
| (1) Oil level           | (15) Lock nut                 | (29) Front second shaft |
| (2) O-ring              | (16) Ball bearing             | (30) Ball bearing       |
| (3) Bolt w/washer       | (17) Gear bevel 49t           | (31) Ball bearing       |
| (4) Reamer blot         | (18) Snap ring                | (32) Gear bevel 11T     |
| (5) Oil seal            | (19) Shim 0.2T                | (33) Bearing            |
| (6) Ball bearing        | (20) Shim 0.5T                | (34) Bolt(M14x1.5P)     |
| (7) Housing front gear  | (21) O-ring                   | (35) Washer             |
| (8) O-ring              | (22) Housing front bearing    | (36) Cap, oil           |
| (9) Front first pinion  | (23) Ball bearing             | (37) Hex nut            |
| (10) Snap ring          | (24) Oil seal                 | (38) Hex bolt           |
| (11) Shim 0.2T          | (25) Sleeve                   | (39) Seal washer        |
| (12) Shim 0.3T          | (26) Front spindle            | (40) Plug M10           |
| (13) Shim 0.5T          | (27) Bolt w/washer            |                         |
| (14) Housing front gear | (28) Gear, front second shaft |                         |

4.5 SPACER



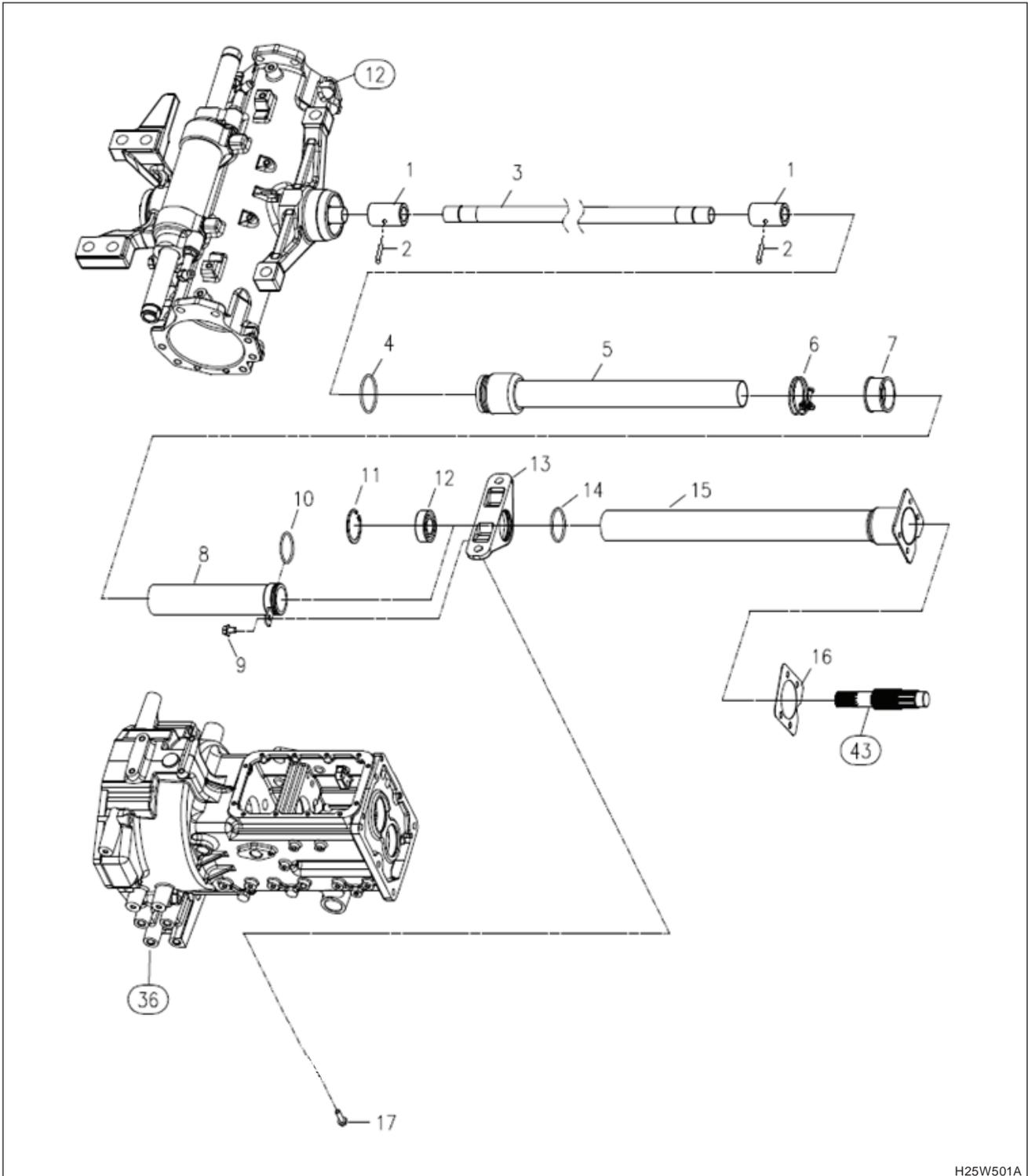
COMPONENTS

- (1) Spacer
- (2) O-ring

- (3) Pin
- (4) Spring washer

- (5) Bolt

4.6 SHAFT COVER



H25W501A

COMPONENTS

- |                         |                        |                           |
|-------------------------|------------------------|---------------------------|
| (1) Coupling R          | (7) Boots, shaft cover | (13) Baring holder        |
| (2) Spring pin          | (8) Cover shaft ass'y  | (14) O-ring               |
| (3) Propeller shaft     | (9) Hex flange bolt    | (15) Cover shaft ass'y    |
| (4) O-ring              | (10) O-ring            | (16) Packing, shaft cover |
| (5) Cover shaft (front) | (11) Snap ring         | (17) Hex flange bolt      |
| (6) Cushion rubber      | (12) Ball bearing      |                           |

## 5. DISASSEMBLY AND SERVICE

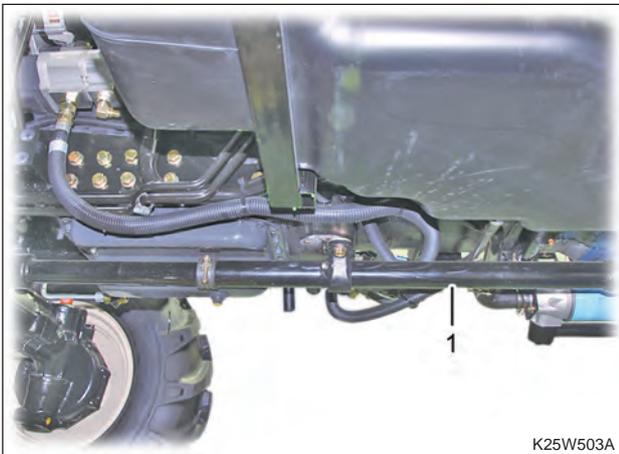
### 5.1 FRONT AXLE CASE ASSEMBLY REMOVAL

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.

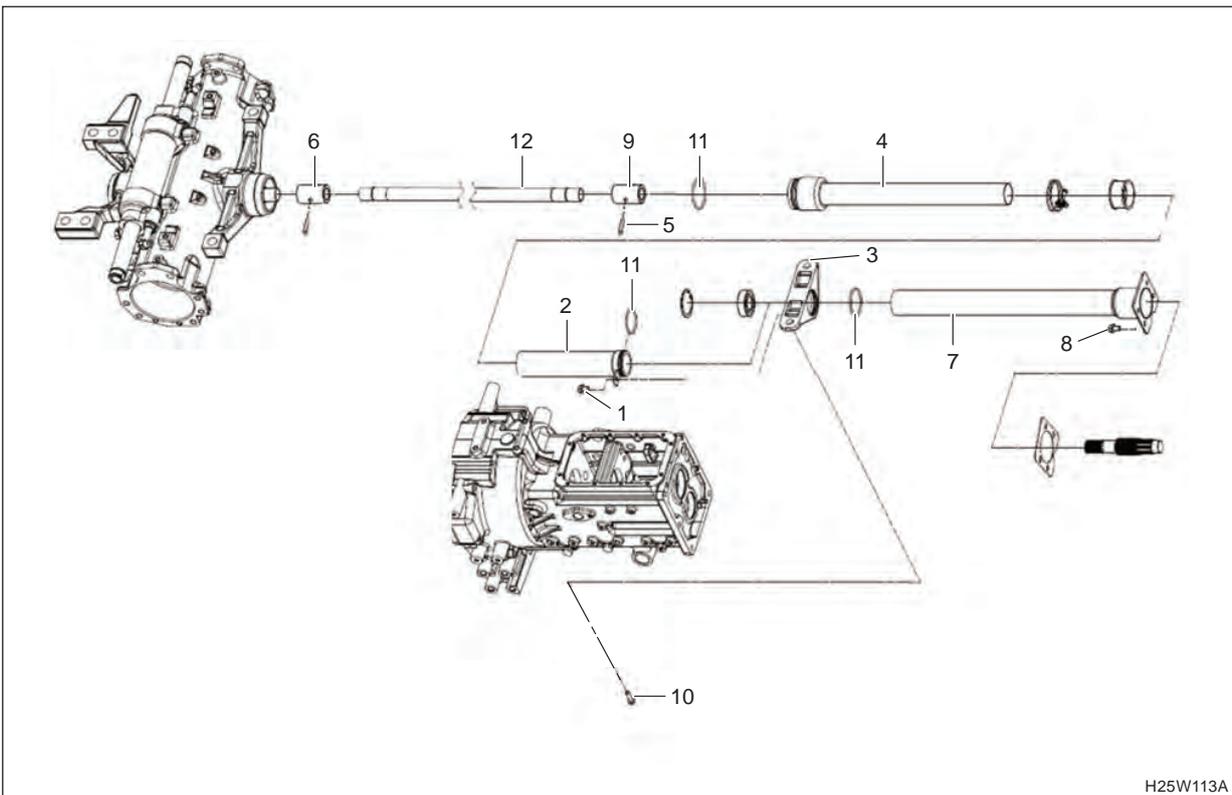
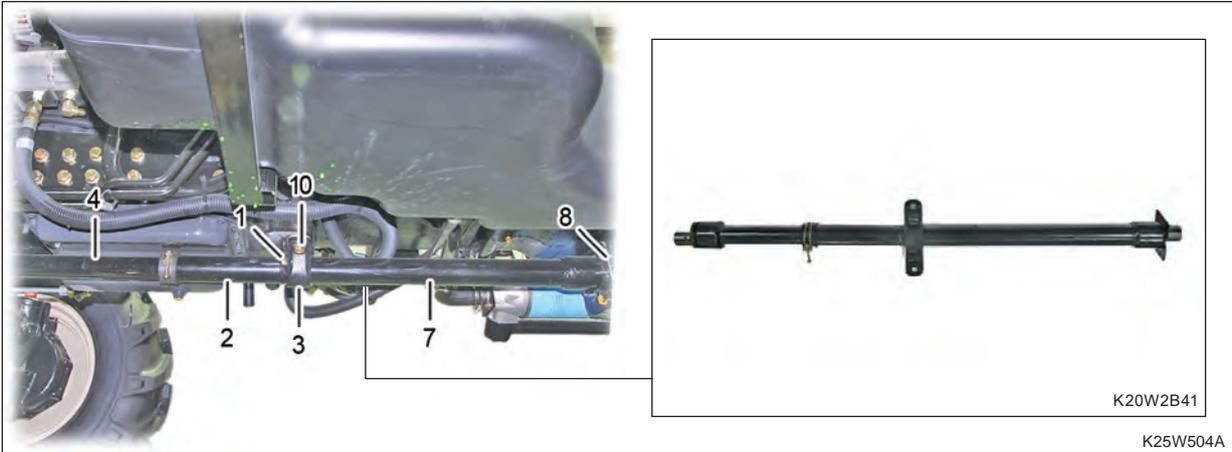
<p><b>OIL CAPACITY FOR FRONT AXLE</b></p>	<p>7ℓ (1.85 u.s.gal)</p>
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3. Remove the propeller shaft (1).

Notes

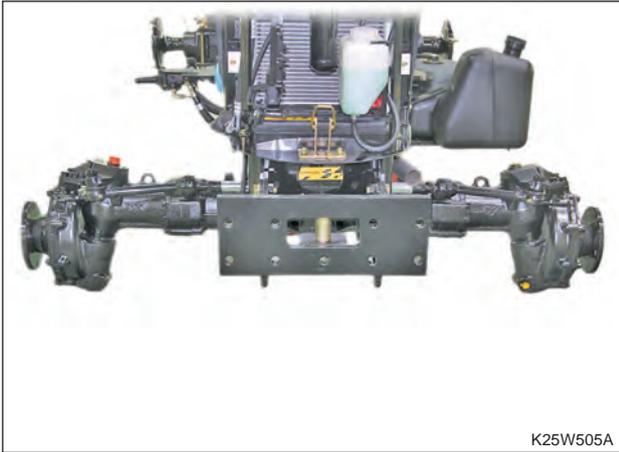
► PROPELLER SHAFT DISASSEMBLY AND ASSEMBLY



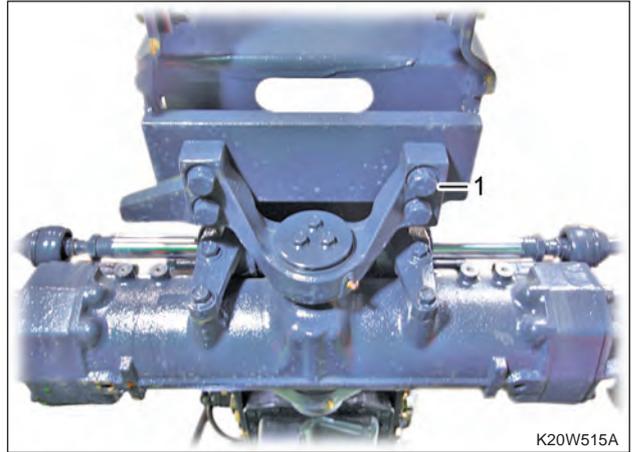
1. Unscrew the shaft cover A mounting bolt (1) and pull the shaft cover A (2) to separate it from the bearing holder (3).
2. Pull out the shaft cover B (4) and tap out the spring pin (5) outside to move coupling (6) backward. Then, separate the coupling with the propeller shaft (12).
3. Unscrew the shaft cover C (7) mounting bolt (8) and pull the shaft cover C to separate it. Then, remove the coupling (9) in it with the same method.
4. Unscrew the bearing holder mounting bolt (10) and remove the propeller shaft assembly with the bearing holder.

**⚠ CAUTION**

- Check the O-rings (11) (3 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.



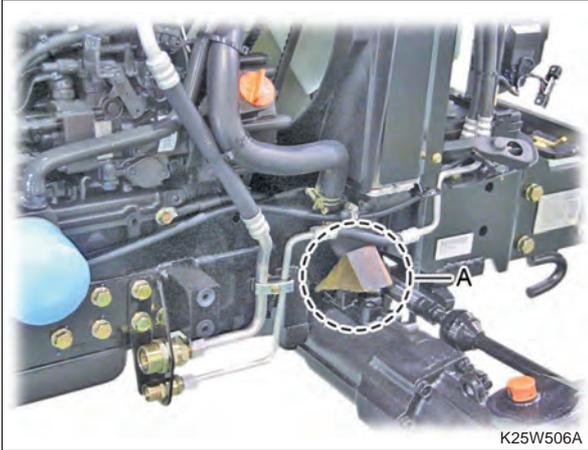
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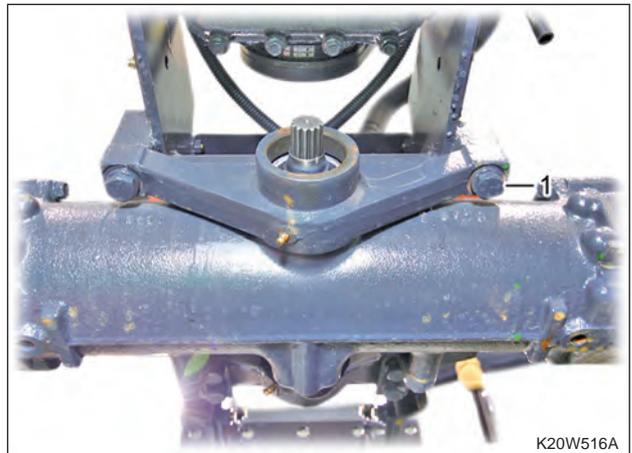
- Place a stand under the engine oil pan. With the front of the tractor lifted slightly, remove the front tires.

**CAUTION**



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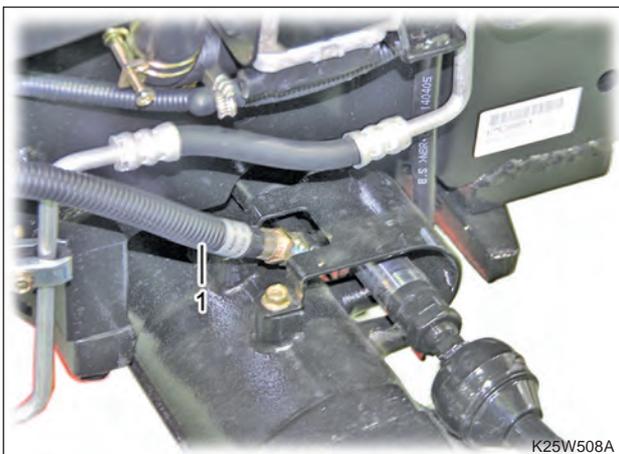
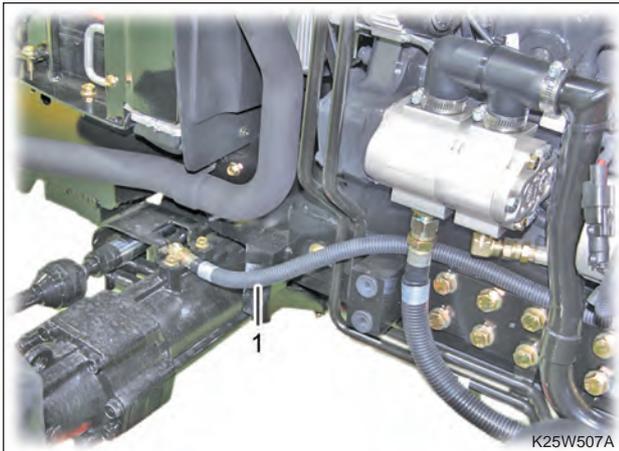
- After removing one tire, the center of gravity of the front axle case is shifted so the body starts to lean. Therefore, fit a wooden wedge block (A) between the front axle case and front axle bracket before removing the front tires.



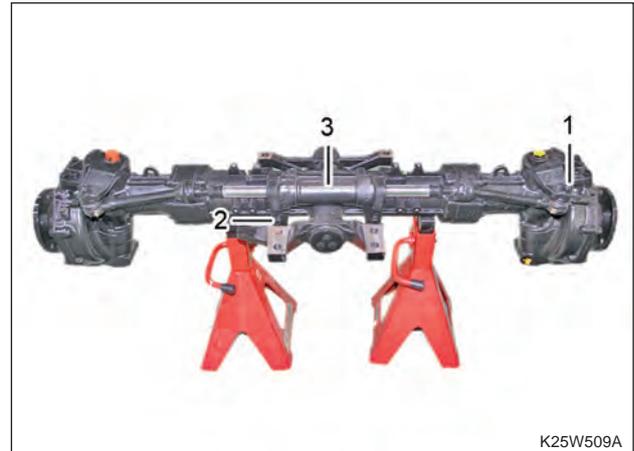
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- Support the front axle case with a portable hydraulic jack or hoist. Then, unscrew the mounting bolts (1) of the front and rear supports to separate the supports from their front axle bracket.

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



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

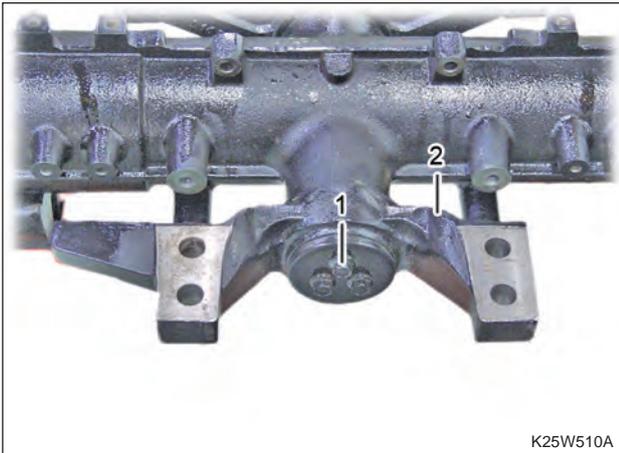


7. Unscrew the slotted nut (1) of the tie rod end from the front axle case assembly and unscrew the PST cylinder mounting bolt (2) to separate the PST cylinder (3). When re-installing the PST cylinder, apply Loctite to the threads of its mounting bolt.

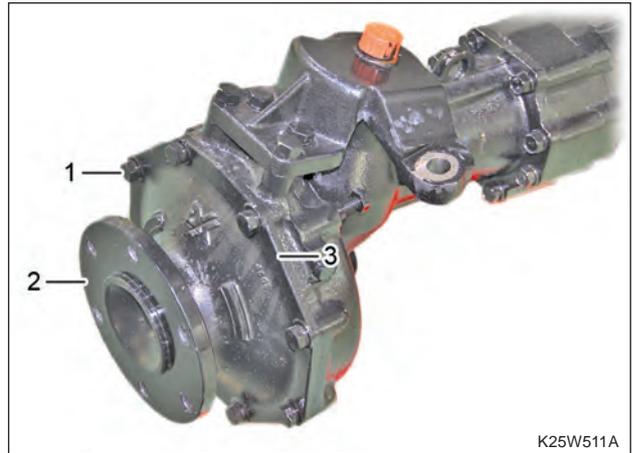
ITEM	TORQUE VALUE
PST cylinder mounting bolt	88.2 N.m
	9.0 kgf.m
	64.8 lbf.ft
Slotted nut	264.6 N.m
	27 kgf.m
	194.4 lbf.ft

5.2 FRONT AXLE CASE COMPONENT DISASSEMBLY

5.2.1 FRONT GEAR CASE

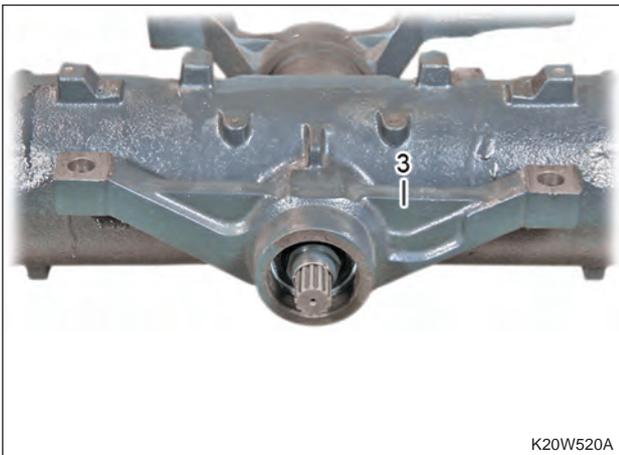


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K25W511A

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



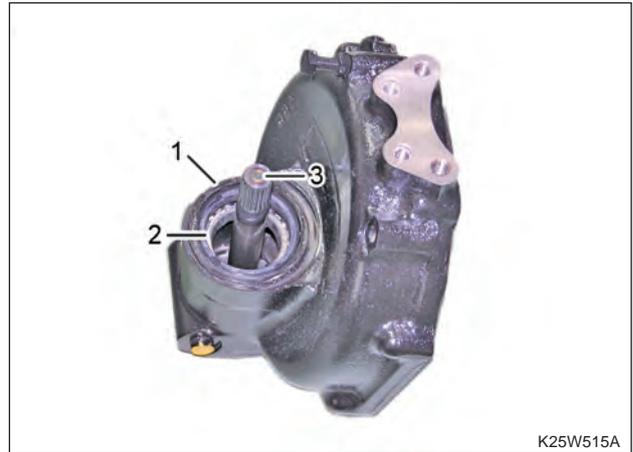
K20W520A

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.

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

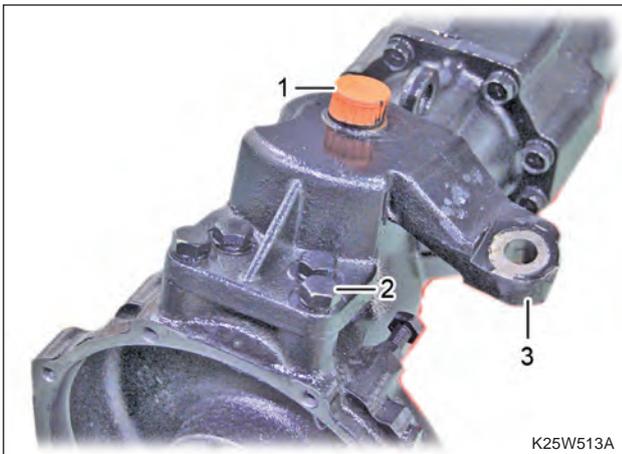


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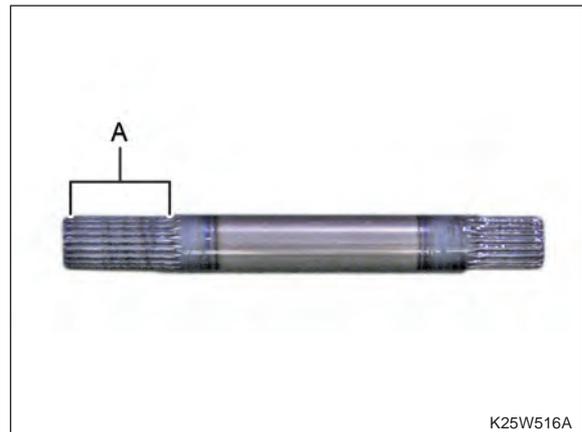
K25W515A

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



K25W513A

**Notes**



K25W516A

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



K25W514A

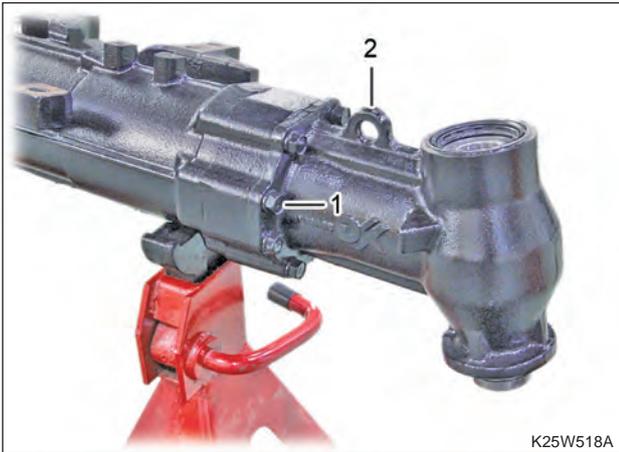
- Place a jack under the front gearbox and unscrew the filler plug (1) and knuckle arm mounting bolts (2).
- Lift up the knuckle arm (3) to remove it. Then, pull down the front gearbox (4) to separate it.

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

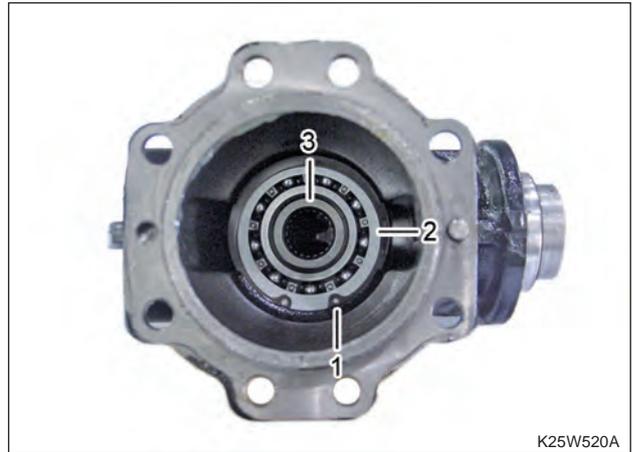


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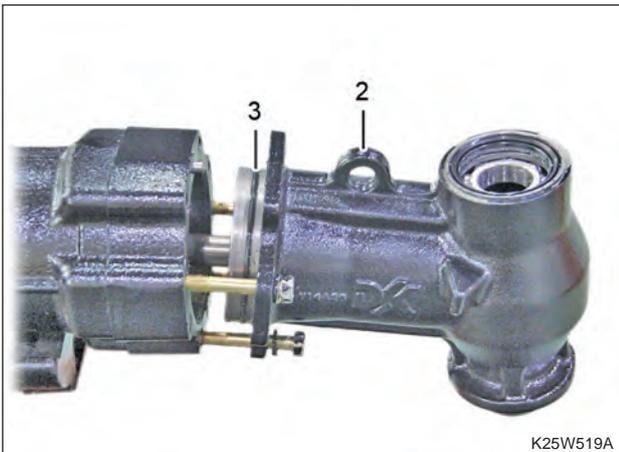
- Lift up the bevel gear (1) from the front gearbox to remove it.



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K25W520A



K25W519A



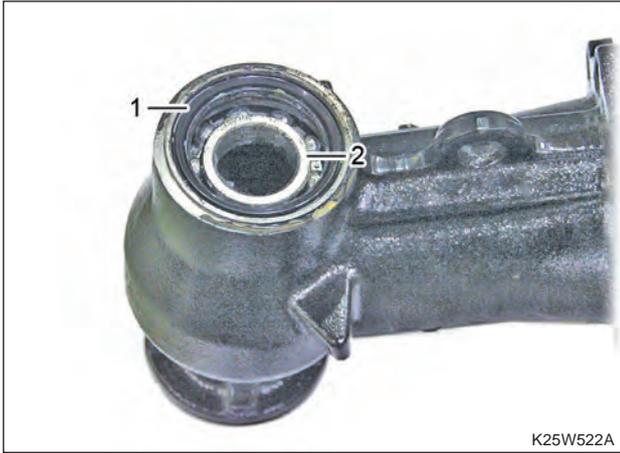
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6. Unscrew the front axle case support bolts (1) to separate the front gear case assembly (2).

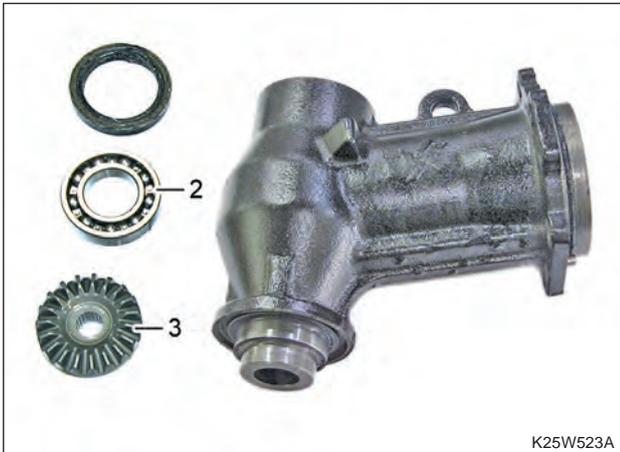
<b>Notes</b>	
<ul style="list-style-type: none"> <li>• Apply grease to the O-ring (3) of the front axle case when re-installing it.</li> </ul>	

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.

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



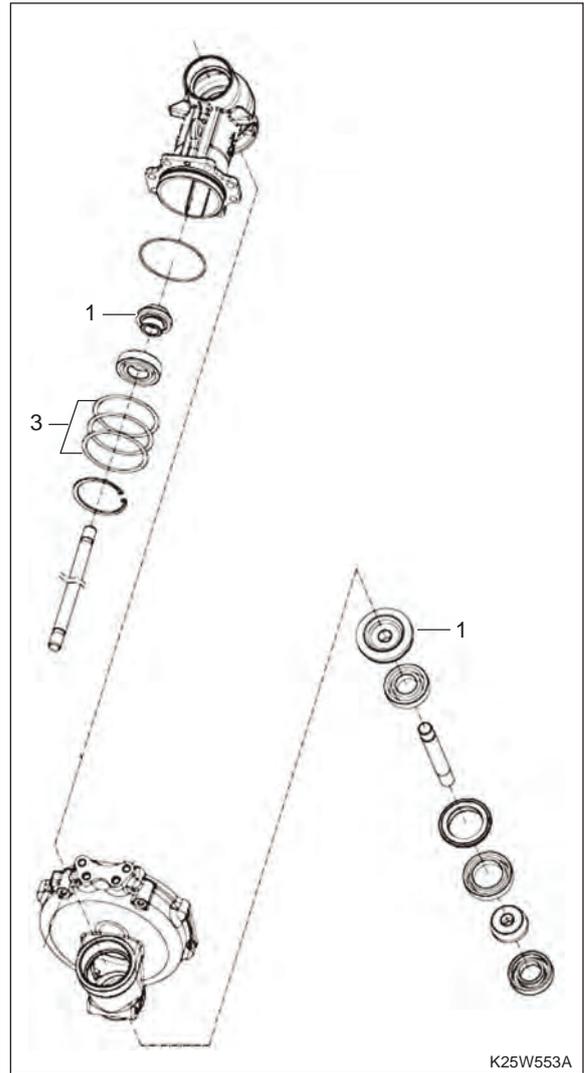
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8. Remove the oil seal (1) from the front gear case. Then, remove the deep-groove ball bearing (2) and front 2nd shaft gear (3).

Notes



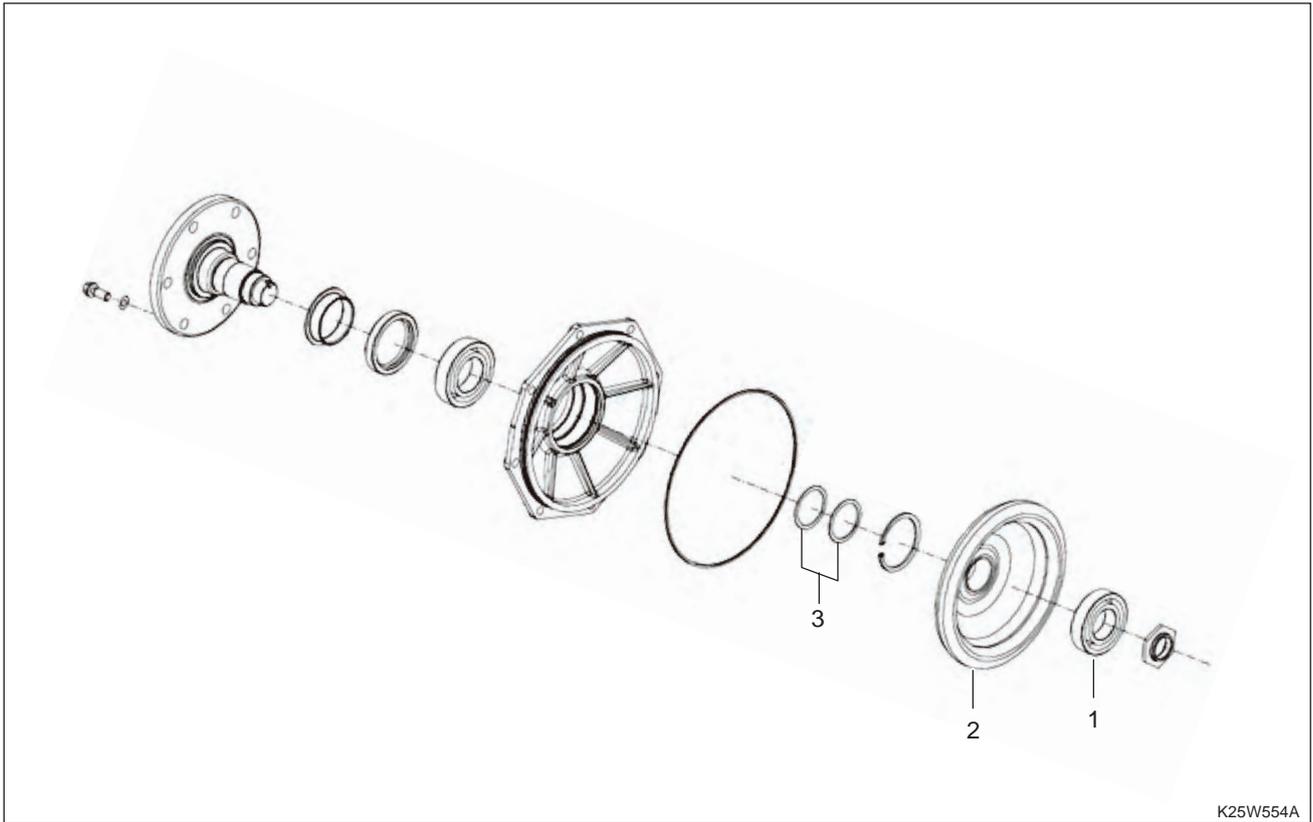
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- Adjust the backlash between the front 1st shaft pinion (1) and front 2nd shaft gear (2) to 0.15 - 0.3 mm (0.006 - 0.012 in.) using 0.2T, 0.3T and 0.5T shims (3).

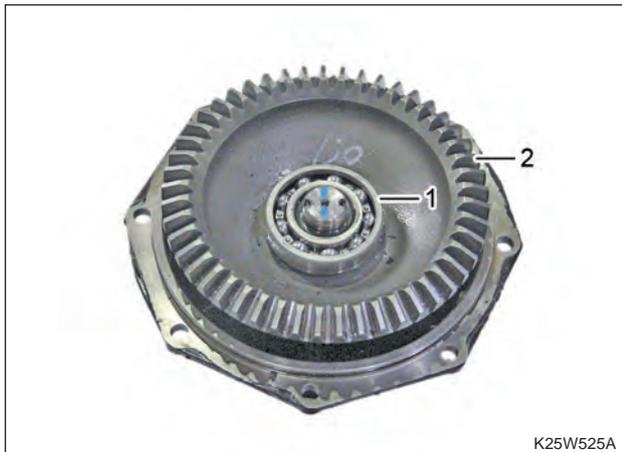


K25W524A

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



K25W554A



K25W525A

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



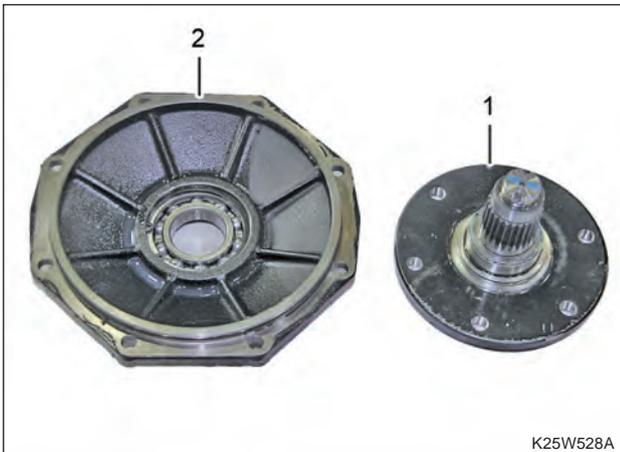
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**FRONT SPINDLE INSTALLATION**



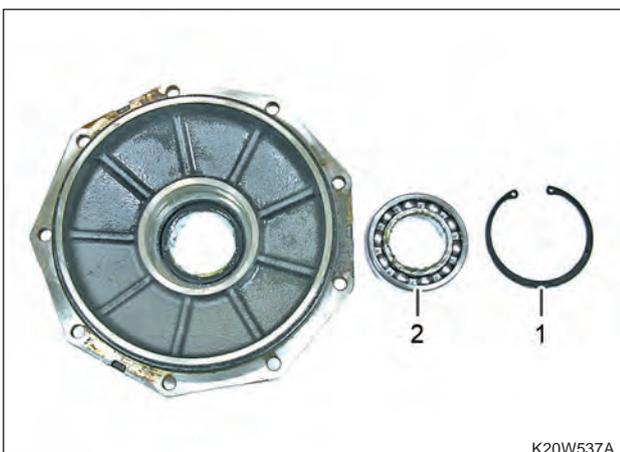
1. Insert the front final gear into the front spindle, install the washer, lock washer and mounting bolt and tighten the bolt to the specified torque. Then, bend the lock washer to press it against the bolt head.

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



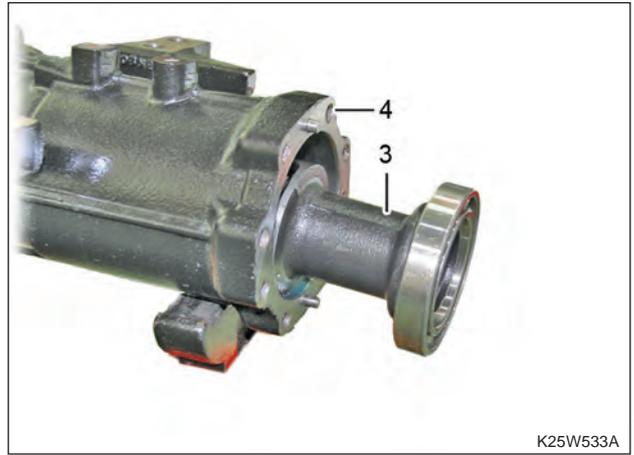
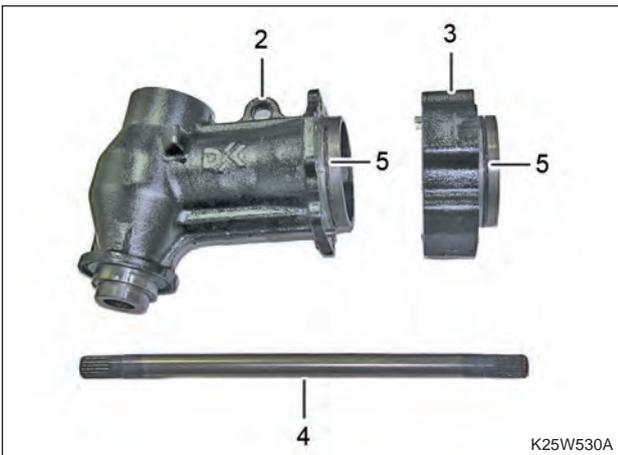
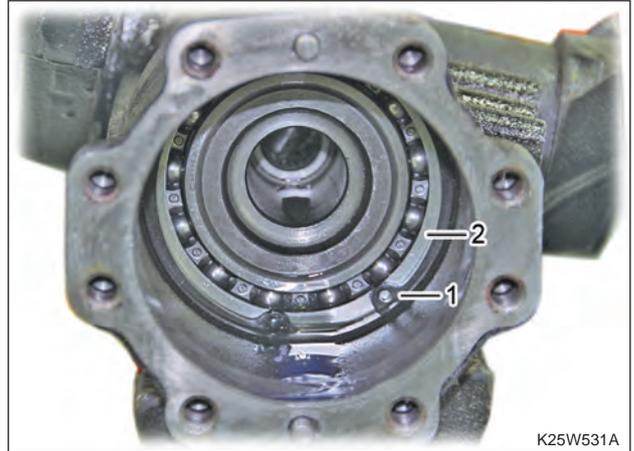
2. Apply grease to the O-ring of the front bearing case and fit it to the front gearbox.

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).

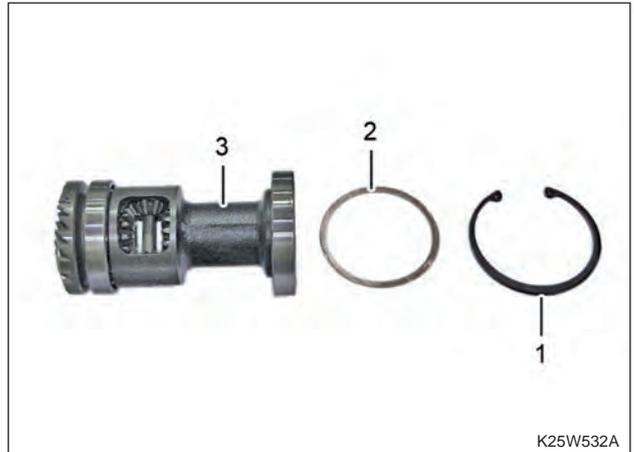
5.2.2 FRONT DIFFERENTIAL



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

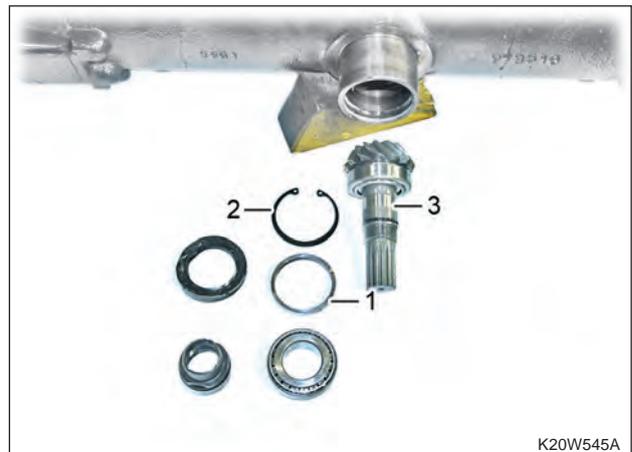
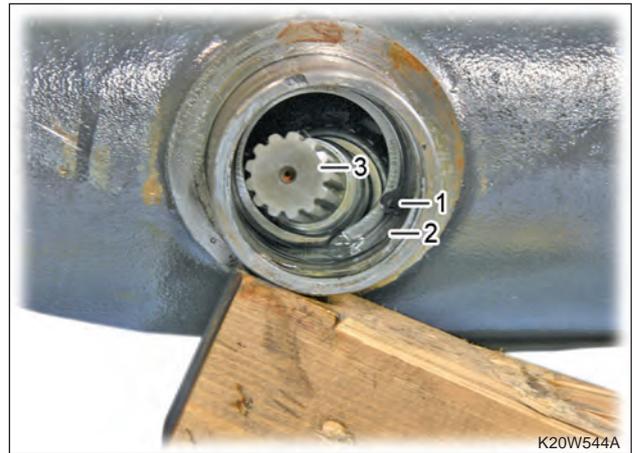
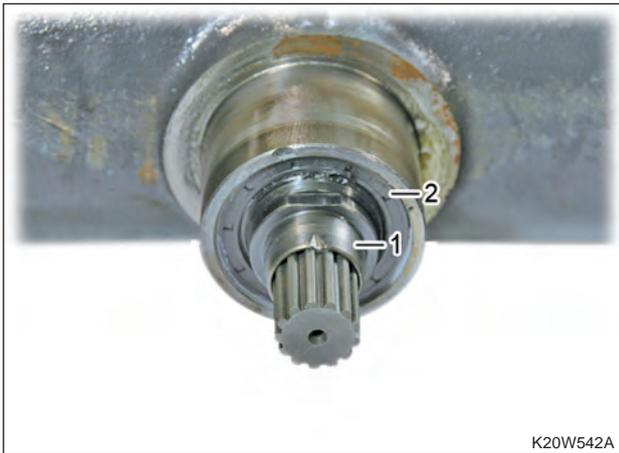
Notes
<ul style="list-style-type: none"> <li>• Apply grease to the O-ring (5) of the front axle case when re-installing it.</li> </ul>



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

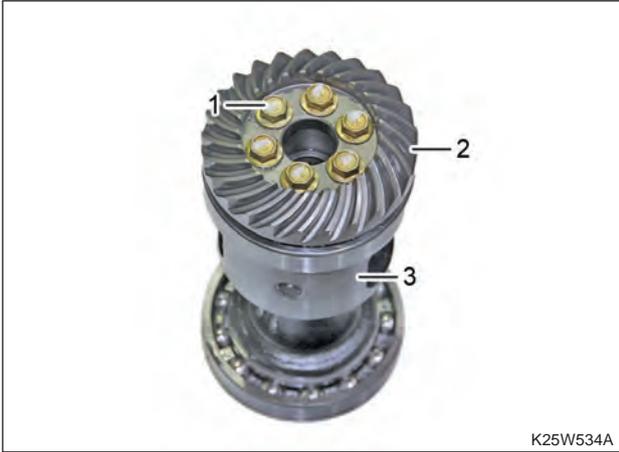
Notes
<ul style="list-style-type: none"> <li>• Apply Loctite to the threads of the bearing retainer mounting bolt during re-installation.</li> </ul>



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.

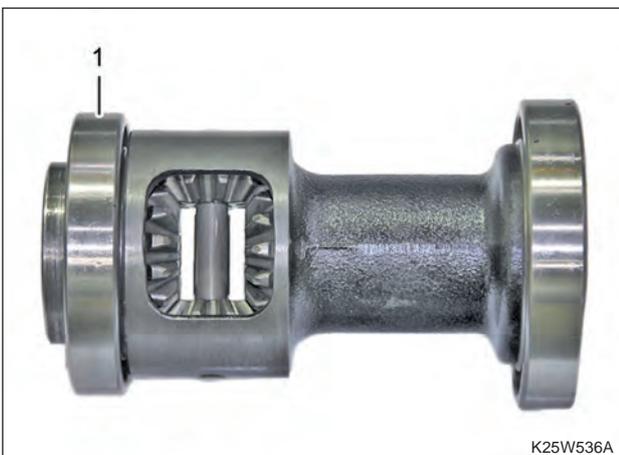
5.2.3 FRONT DIFFERENTIAL ASSEMBLY DISASSEMBLY



1. Unscrew the ring gear mounting bolts (1) from the front differential assembly to separate the ring gear (2) and differential case (3).

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.

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.

# MEMO

# CHAPTER 6 HYDRAULIC SYSTEM

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1. CIRCUIT DIAGRAM FOR HYDRAULIC SYSTEM

MEC MODEL

PST CYLINDER SPEC		
Type	Double acting piston (double rod)	
Stroke	184.4 mm	
Maximum working load (130 kgf/cm <sup>2</sup> )	Increased	2.16 ton/s
	Compressed	2.16 ton/s
Internal pressure test load (195 kgf/cm <sup>2</sup> )	Increased	3.25 ton/s
	Compressed	3.25 ton/s
Leakage	Less than 0.05 cc (for 100 mm travel)	
Weight	7.8 kg	
Rod diameter X Piston diameter	D30 x D55	

SPECIFICATION (PST VALVE)	
Max.impact pressure	140 kgf/cm <sup>2</sup>
Rated flow	8 l/min
Max.temperature	95°C
Relief pressure	130 ± 7 kgf/cm <sup>2</sup>
Displacement	74 cc/rev
Input torque	0.15 kgf.m
Filter	Nominal 10 µm
Max.back pressure	35 kgf/cm <sup>2</sup>
Slippage	MAX. 2 rpm
	Imput torque 1.78 kgf.m
Steering system	Open center non load reaction

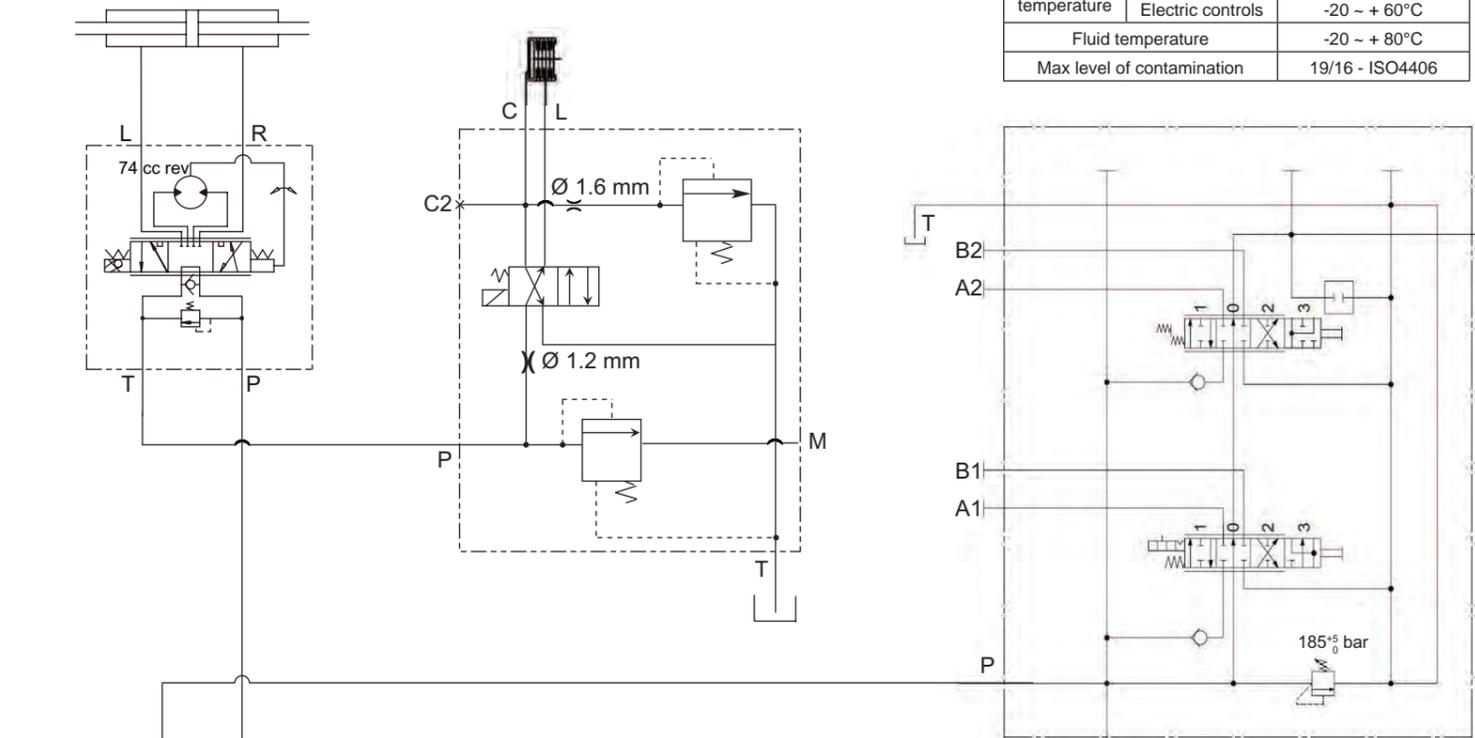
TA00062427B FRONT SCV Ass'y		
WORKING CONDITIONS (Mineral oil with viscosity 46 mm <sup>2</sup> /s at 40°C)		
Nominal flow	60 l/min	
Operating pressure	250 bar	
Max backpressure	25 bar	
Internal leakage	From A(or B) to T at 100 bar (A1, B1, A2, B2)	3 cm <sup>3</sup> /min
		95°C and 46 mm <sup>2</sup> /s
Seal material	NBR	
Hydraulic fluid	Mineral oil	
Viscosity	15 ~ 75 mm <sup>2</sup> /s	
Ambient temperature	Mechanical controls	-40 ~ + 60°C
	Electric controls	-20 ~ + 60°C
Fluid temperature	-20 ~ + 80°C	
Max level of contamination	19/16 - ISO4406	

TA00033098A LIFTING VALVE Ass'y

SPECIFICATION (SAFETY VALVE)	
Max quantity	45 l/min
Used oil	TF500
Max. pressure	175 kgf/cm <sup>2</sup>
Leakage	5 cc/min (100 kgf/cm <sup>2</sup> )

TA00036423A SCV REAR Ass'y (CABIN MODEL - US)

SPECIFICATION (SECTIONAL VALVE)	
Relief valve setting pressure	180 ~ 185 kgf/cm <sup>2</sup>
Max quantity	30 l/min
Used oil	TF500
Max pressure	210 kgf/cm <sup>2</sup>
Leakage	9 cc/min (100 kgf/cm <sup>2</sup> )



TA00025513A HYDRAULIC PUMP (16 cc X 7.2 cc)

1. PUMP SPEC		
Item	Pump 1	Pump 2
Theoretical discharge volume (cc/rev)	16	7.2
Maximum pressure (kgf/cm <sup>2</sup> )	210	180
Revolving speed	500 ~ 3,000	
Turning direction (Viewed from shaft)	C.C.W	

2. PUMP PERFORMANCE			
Pressure	Speed (rpm)	Typical Flow Data (lpm)	
		Pump 1	Pump 2
180 kgf/cm <sup>2</sup>	1,000	14.1	6.2
	1,800	26.5	11.9
	2,600	39.1	17.5

B TA00025525A HYDRAULIC FILTER

FILTER ELEMENT SPEC	
Filtering area	4,972 cm <sup>2</sup>
Number of folds	55
Folding width	195 x 17 x 55 fold
Air permeability	-
Bursting strength	4.5 bar
Max. fineness	110 ± 8 µ
Min. fineness	92 ± 8 µ

A NTB438000A3

STRAINER SPEC	
Quantity	50 l/min.
Used oil	TF500
Used oil (temp.)	80°C
Strength	Undeformed at P = 1 kgf/cm <sup>2</sup>
Filtering density	150 meshes (105 µ)
Adhesive strength	Tension, Shearing strength: 190 kgf/cm <sup>2</sup> or more
Filtering area	1057.1 cm <sup>2</sup>

NTA2050000A2 PTO VALVE (EU)

NTA2100000A2 PTO VALVE (US)

IND PTO VALVE	
Flow rate	8 ~ 18 LPM
Used pressure	Max. 170 kgf/cm <sup>2</sup>
Used oil (temp.)	-20°C ~ 100°C
T port leakage	350 cc/min
Used oil	TF500
Setting pressure (Oil temp. 50°C ~ 55°C)	11.5 ± 0.5 kgf/cm <sup>2</sup> [US] 16.0 kgf/cm <sup>2</sup> [EU]

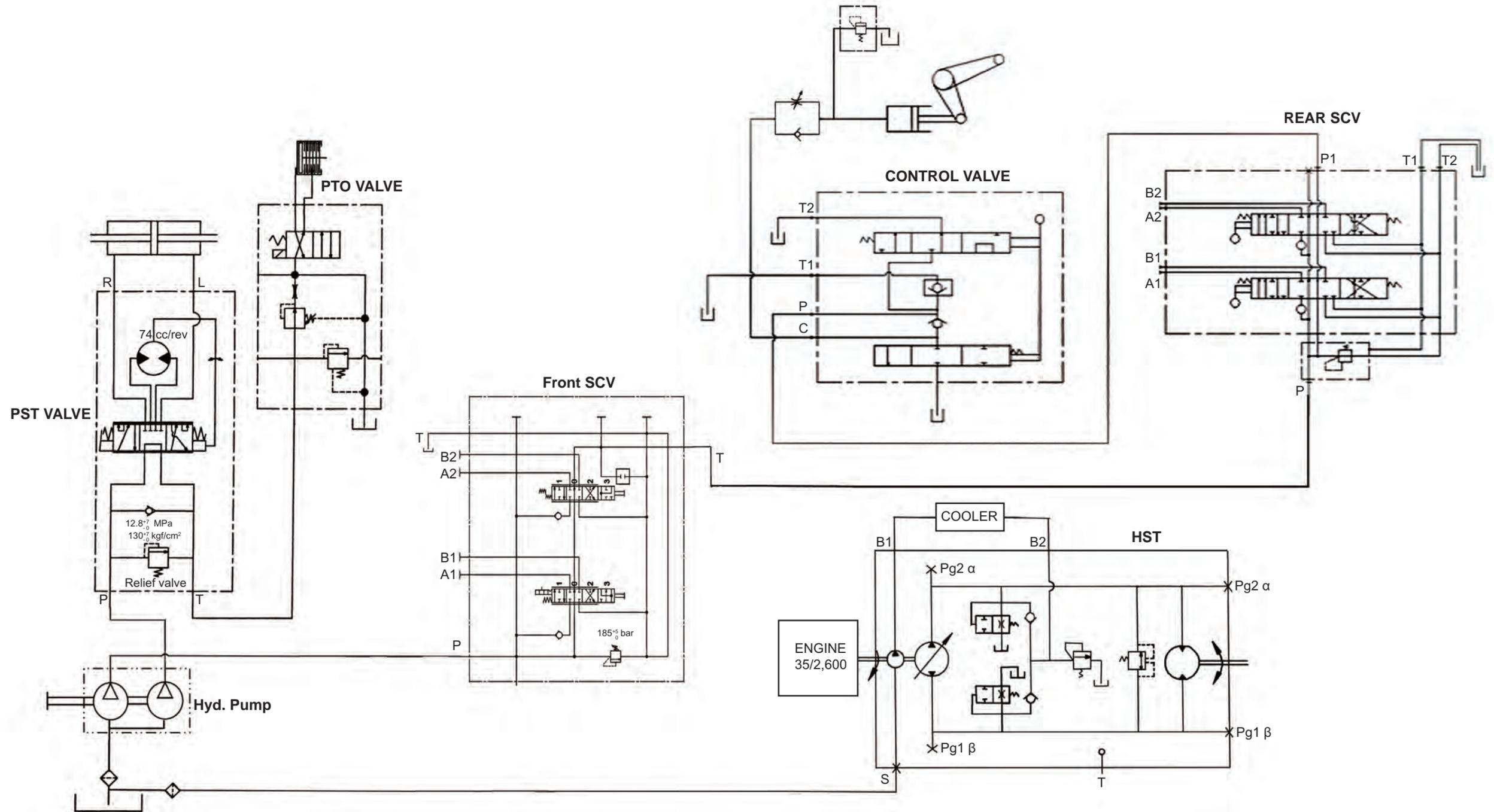
TA00036187A SAFETY VALVE

SPECIFICATION (SAFETY VALVE)	
Flow rate	0.1 ~ 0.3 l/min
Used oil	TF500
Cracking	210 kgf/cm <sup>2</sup>
Leakage	0.1 cc/min (100 kgf/cm <sup>2</sup> )

TA00026514A PTO CLUTCH PACK

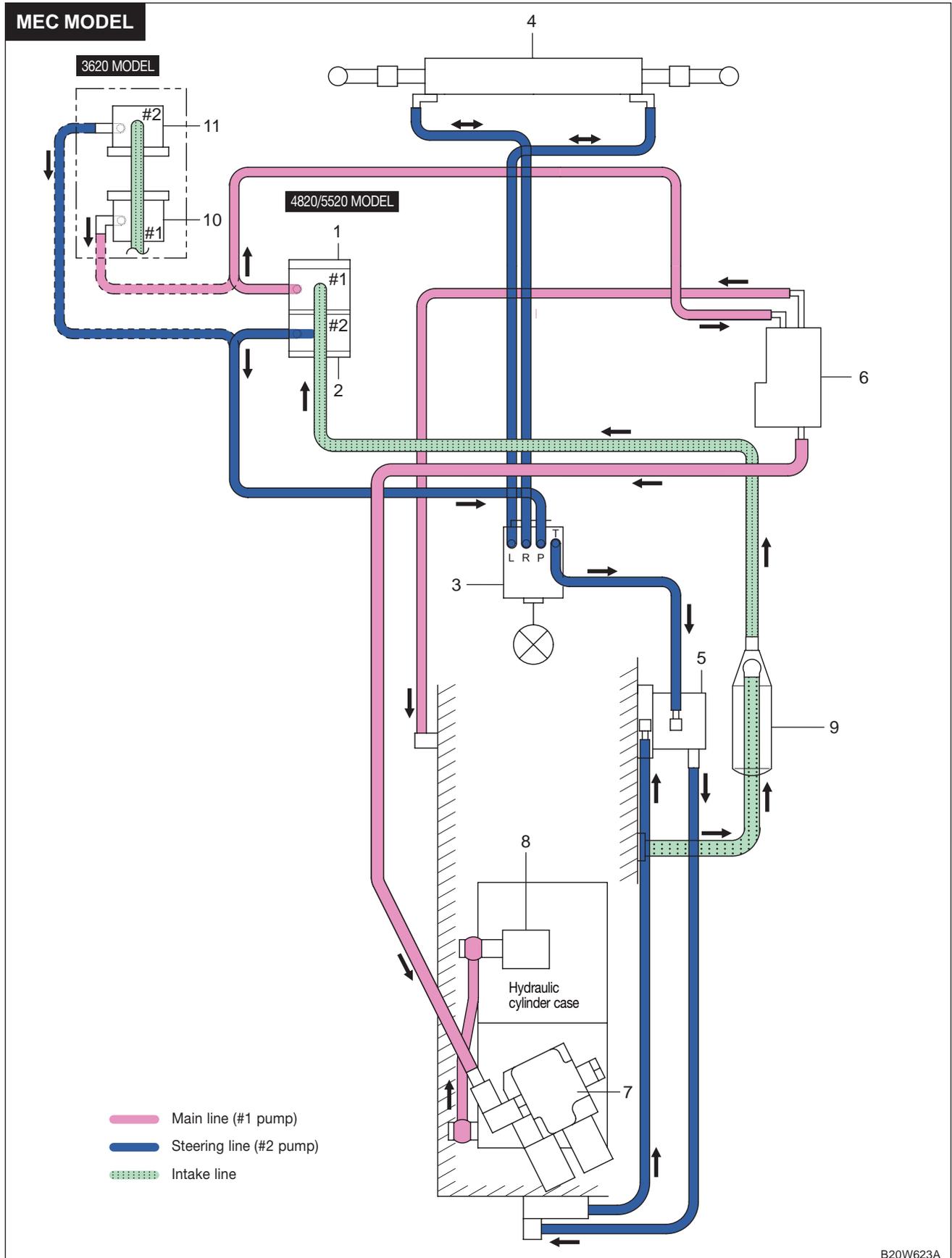
IND PTO CLUTCH PACK	
Out-flow	0.5 l/min or less at 16 kgf/cm <sup>2</sup>
Operation check	Normal operation at 10 kgf/cm <sup>2</sup>
Test oil temp.	60°C ± 5°C
Used oil	TF500
Torque (Theoretically)	47.252 kg.m
Coefficient of friction	0.13
Distance	1.96 ± 0.5 mm
Clutch rated flow pressure	16 kgf/cm <sup>2</sup>

HST MODEL



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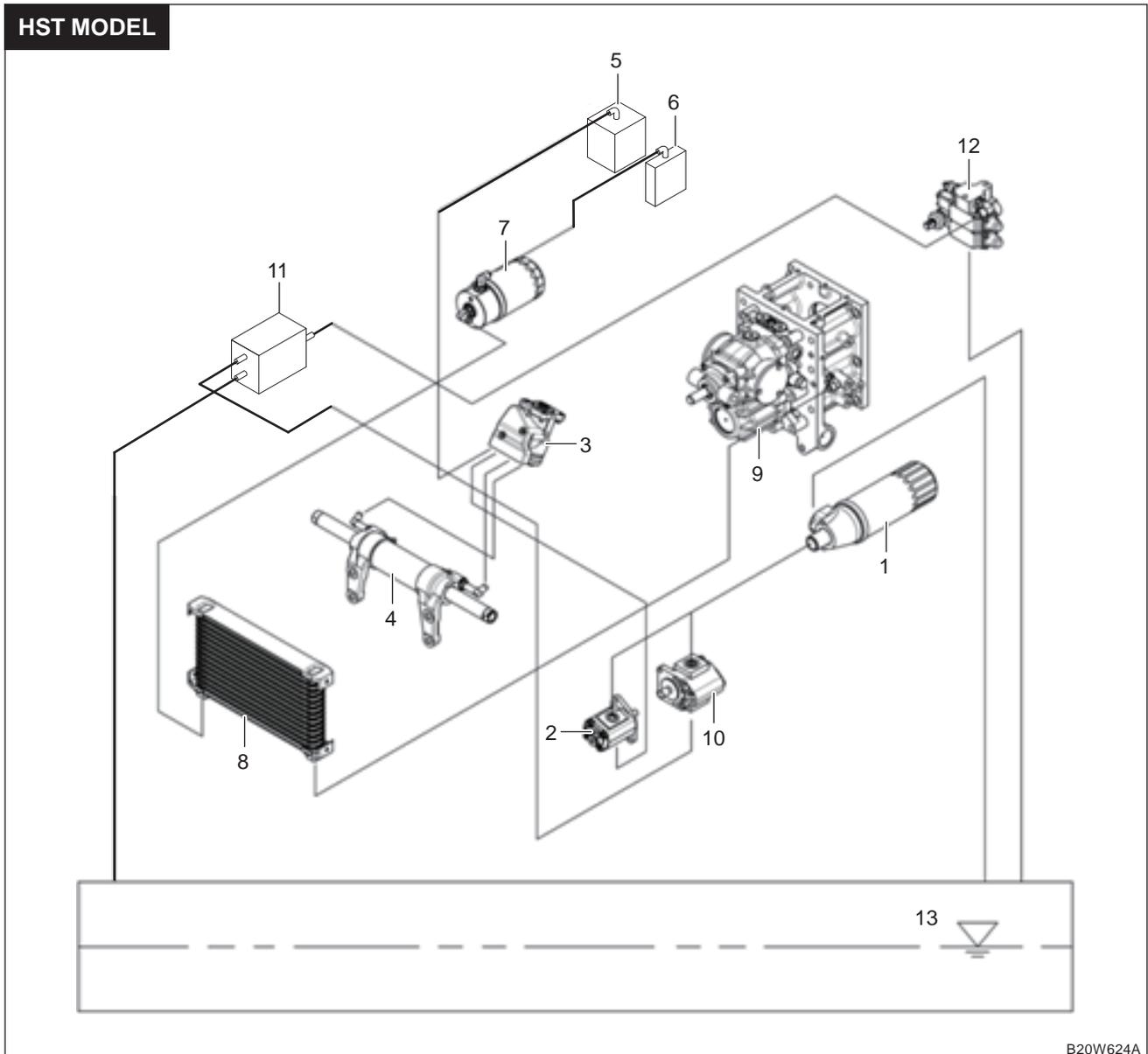
2. DIAGRAM FOR HYDRAULIC SYSTEM



- (1) Hydraulic pump (16 cc / 15 cc)
- (2) Hydraulic pump (7.2 cc)
- (3) PST valve
- (4) PST cylinder

- (5) PTO valve
- (6) Front SCV valve
- (7) Rear SCV [CABIN MODEL]
- (8) Control valve

- (9) Hydraulic filter
- (10) Hydraulic pump (13 cc)
- (11) Hydraulic pump (7.0 cc)



- (1) Hydraulic filter
- (2) Hydraulic pump
- (3) P.S.T valve
- (4) P.S.T cylinder
- (5) PTO valve

- (6) PTO Valve block
- (7) HST filter
- (8) Oil cooler
- (9) HST
- (10) Hydraulic pump

- (11) Front SCV
- (12) Rear SCV
- (13) Oil tank



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 (front) valve for load operation, SCV (rear) valve for rear implement operation and hitch 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.

#### **BB5045 / BB5055**

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 pump (16 cc/rev.), which is part of the tandem gear pump, and supplies this oil to the SCV (front) valve for load operation, SCV (rear) valve for rear implement operation and hitch 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 pump (7.2 cc/rev.) of the tandem gear pump and supplies this oil to the PST valve for power steering and PTO valve for PTO control in order.

### 3. MAJOR COMPONENT SPECIFICATIONS

#### 3.1 HST (ONLY HST MODEL)

ITEM		SPECIFICATION	
			BB5045 / BB5055
Displacement	Pump		0 ~ 40 cc/rev
	Motor		40 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 <sup>2</sup>
Neutral valve (orifice)			∅ 0.8

#### 3.2 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 <sup>2</sup> 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 <sup>2</sup> 1,988 psi	
Maximum back pressure	3.4 MPa 35 kgf/cm <sup>2</sup> 498 psi	
Max. temperature	95 °C 203 °F	
Steering input torque (when energized)	1.47 N.m 0.15 kgf.m 1.08 lbf.ft	Reference
Filter	Nominal 10 μm	

**3.3 HYDRAULIC PUMP**

ITEM	SPECIFICATION	
Theoretical discharge volume	Primary pump	13.0 cc/rev
	Secondary pump	7.0 cc/rev
Maximum pressure	Primary pump	210 kgf/cm <sup>2</sup>
	Secondary pump	210 kgf/cm <sup>2</sup>
Revolving speed	Primary pump	500 - 2,500 rpm
	Secondary pump	500 - 3,000 rpm
Turning direction (when seeing from end of shaft)	Primary pump	Counterclockwise
	Secondary pump	Clockwise

**HYDRAULIC PUMP [BB5045 / BB5055]**

ITEM	SPECIFICATION		
Theoretical discharge volume	Primary pump	HST MODEL	15.0 cc/rev
		MEC MODEL	16.0 cc/rev
	Secondary pump		7.2 cc/rev
Maximum pressure	Primary pump		210 kgf/cm <sup>2</sup>
	Secondary pump	HST MODEL	210 kgf/cm <sup>2</sup>
		MEC. MODEL	180 kgf/cm <sup>2</sup>
Revolving speed	500 ± 3,000 rpm		
Service temperature	-20 - 100°C (-4 - 212°F)		

**3.4 HITCH CONTROL VALVE**

ITEM	SPECIFICATION
Max. flow	45 l/min.
Max. pressure	175 kgf/cm <sup>2</sup>

**3.5 FRONT SCV**

ITEM	SPECIFICATION
Relief valve setting pressure	185 $\pm$ <sub>0</sub> <sup>5</sup> bar
Nominal flow	60 l/min.
Max. operating pressure	250 bar
Maximum back pressure	25 bar

**3.6 REAR SCV [CABIN MODEL]**

ITEM	SPECIFICATION
Relief valve setting pressure	180 ~ 185 kgf/cm <sup>2</sup>
Nominal flow	30 l/min.
Max. pressure	210 kgf/cm <sup>2</sup>

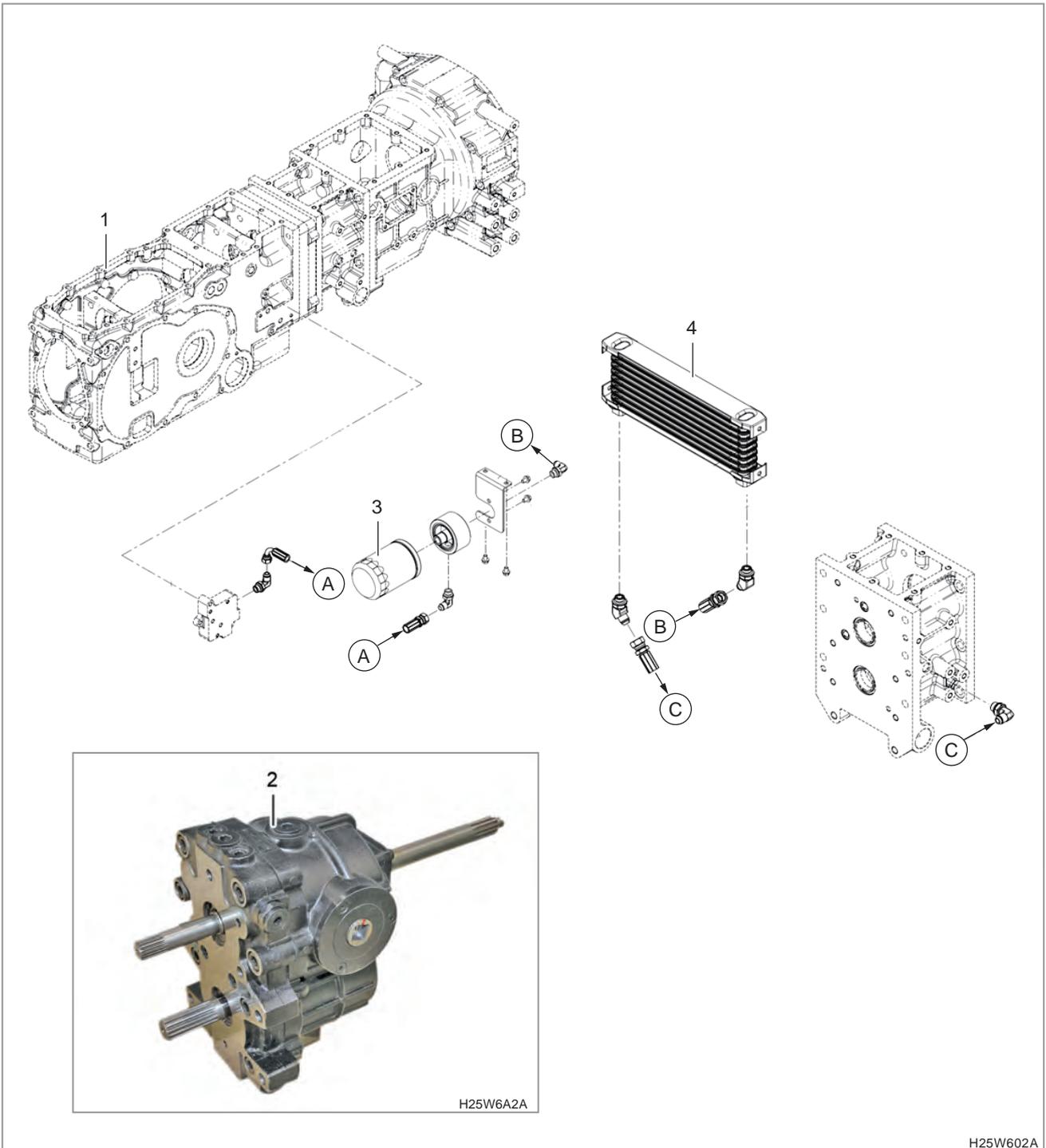
**3.7 PTO VALVE**

ITEM	SPECIFICATION
Sequence valve setting pressure	11.5 $\pm$ 0.5 kgf/cm <sup>2</sup>
Operating flow	8 ~ 18 l/min.
Operating pressure	170 kgf/cm <sup>2</sup>

4. STRUCTURE AND OPERATION

4.1 HST (HYDROSTATIC TRANSMISSION) (ONLY HST MODEL)

4.1.1 HST PASSAGE COMPOSITION



(1) Rear axle case (Oil tank)

(2) HST

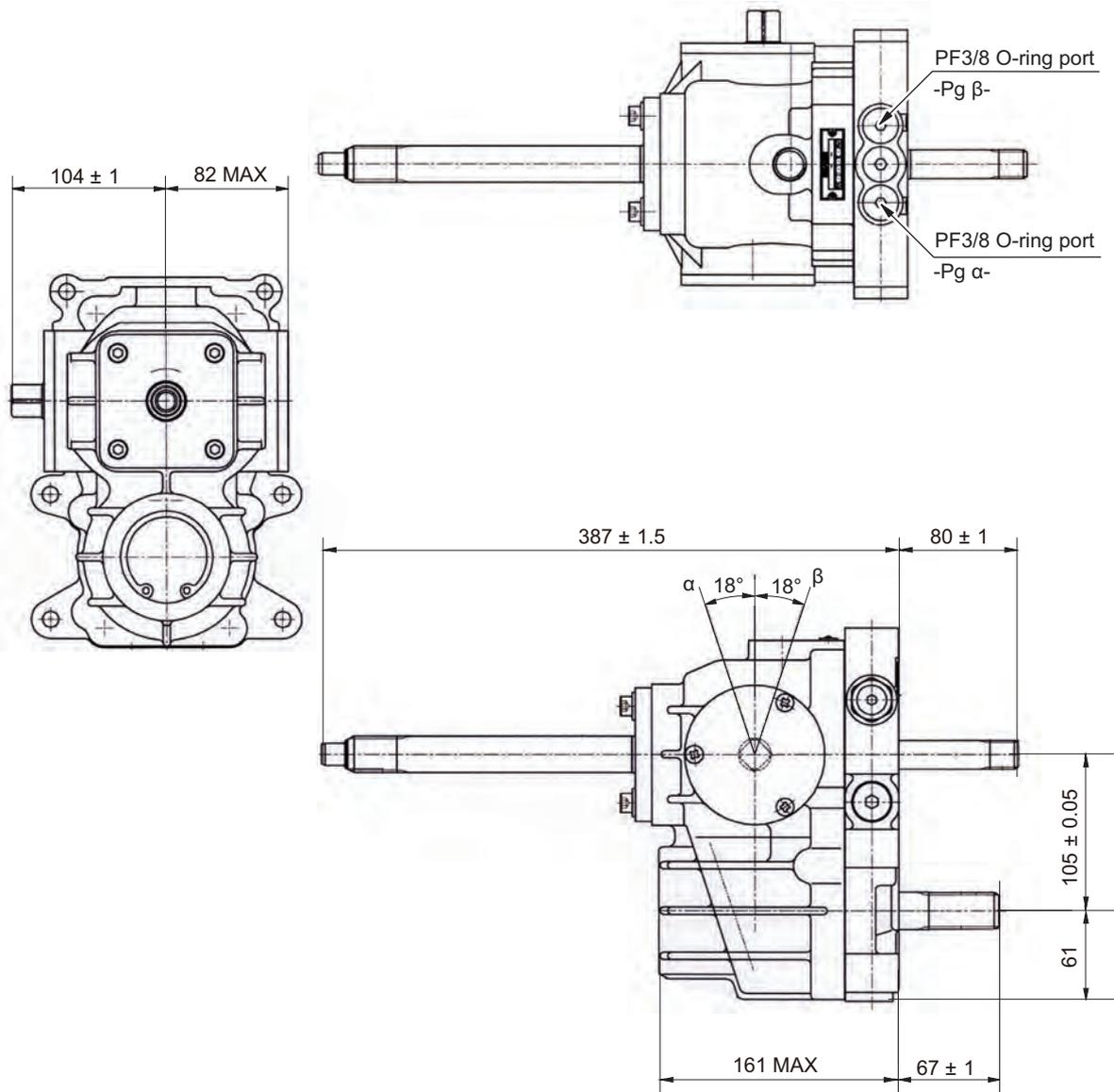
(3) HST filter

(4) Oil cooler

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. It is connected to the crankshaft pulley of the engine with the belt 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 pump 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.

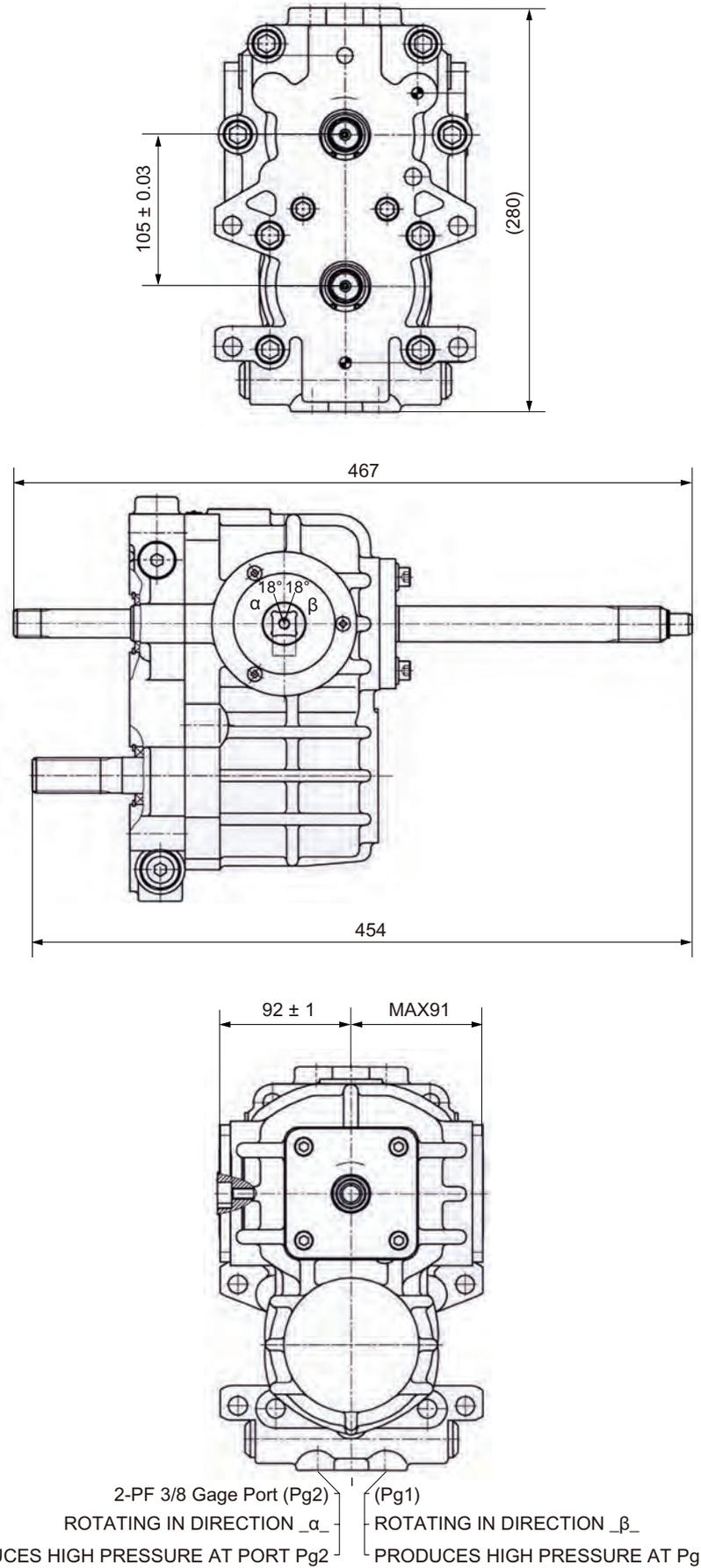
**EXTERIOR VIEW**

28 cc



H25W603A

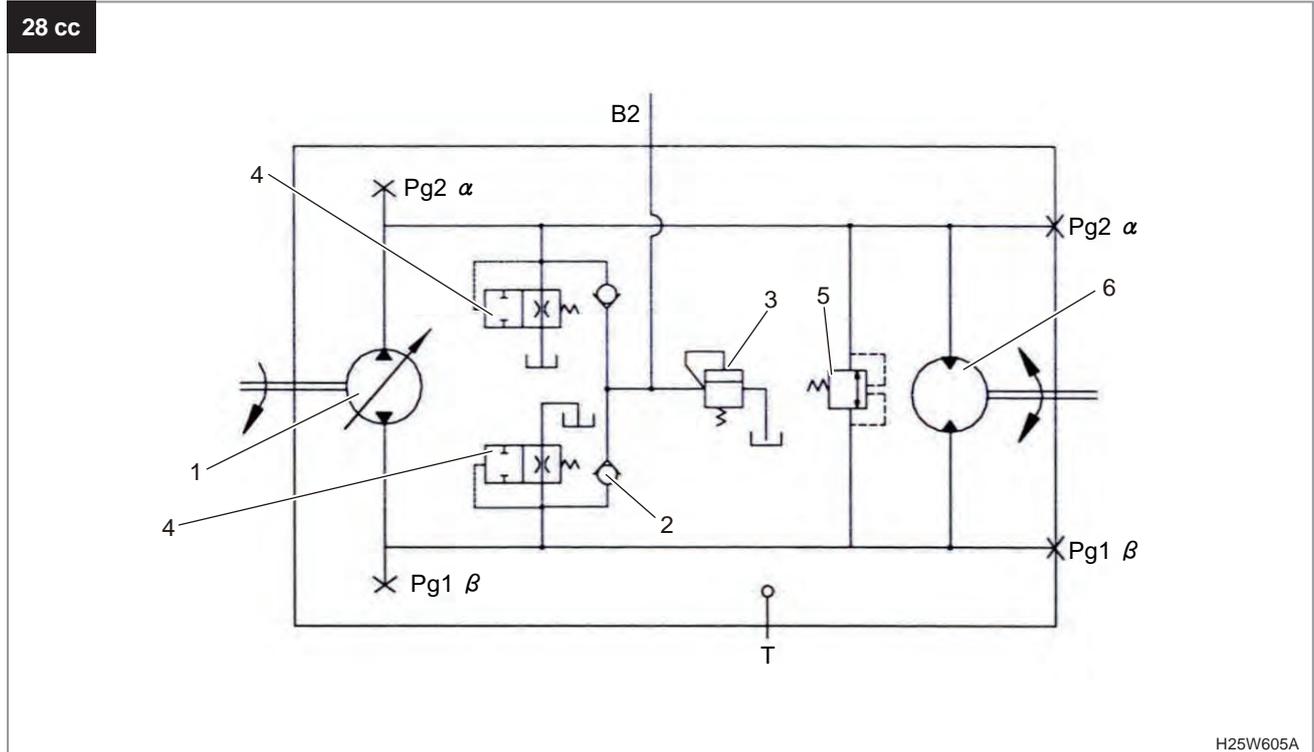
40 cc



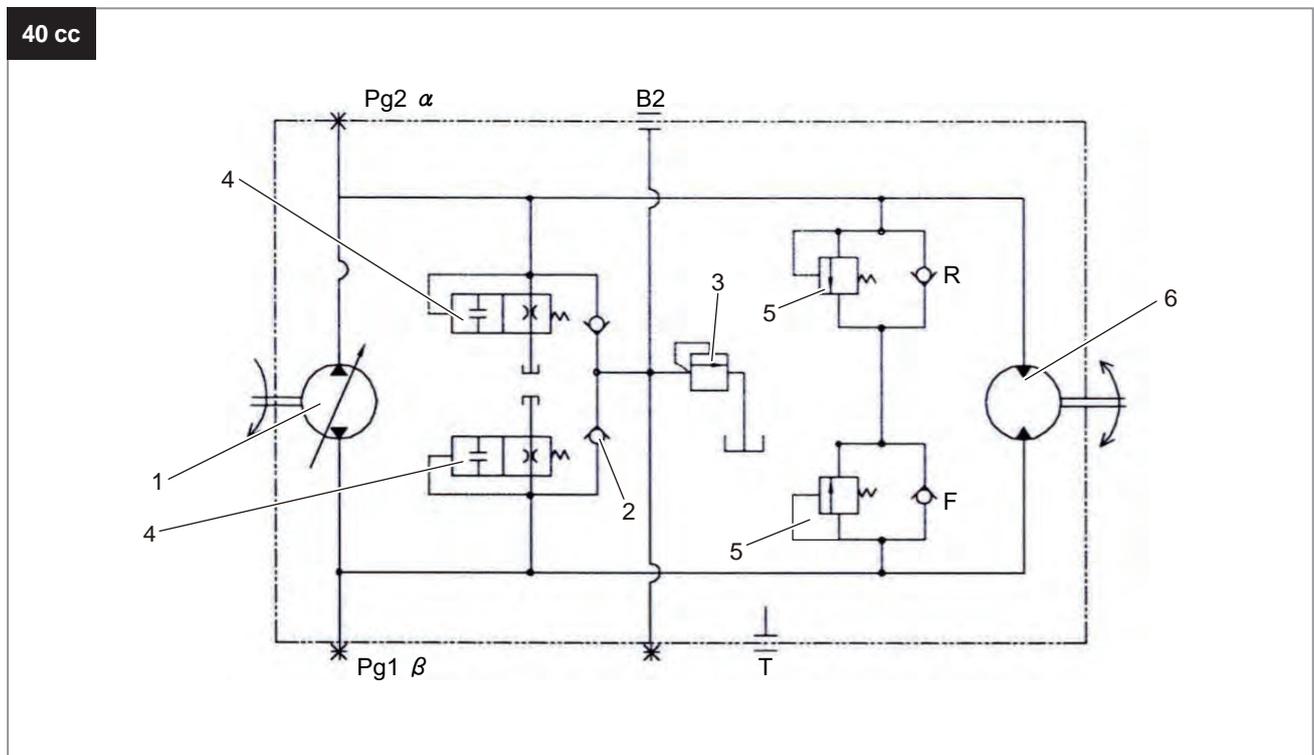
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H25W604A

4.1.2 CIRCUIT DIAGRAM

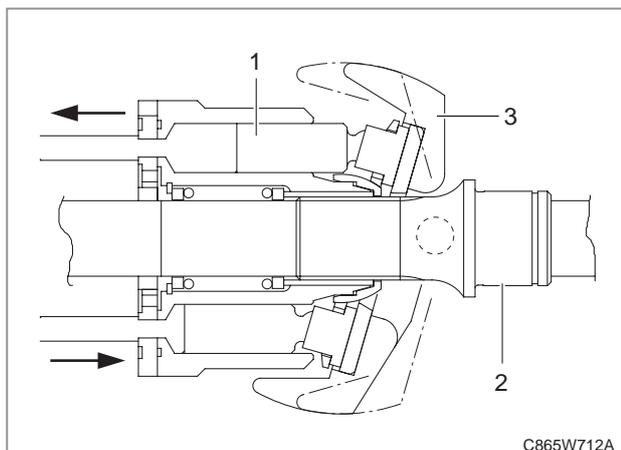
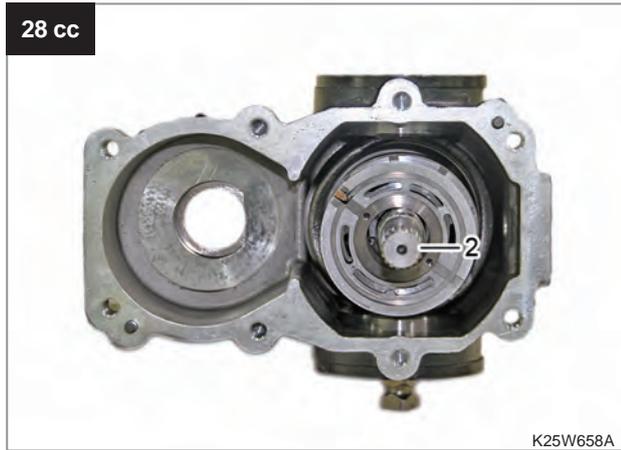


- |                 |                         |                       |
|-----------------|-------------------------|-----------------------|
| (1) HST pump    | (3) Charge relief valve | (5) Main relief valve |
| (2) Check valve | (4) Neutral valve       | (6) HST motor         |



- |                 |                         |                       |
|-----------------|-------------------------|-----------------------|
| (1) HST pump    | (3) Charge relief valve | (5) Main relief valve |
| (2) Check valve | (4) Neutral valve       | (6) HST motor         |

4.1.3 HST PUMP



(1) Piston  
 (2) Shaft  
 (3) Swash plate

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.

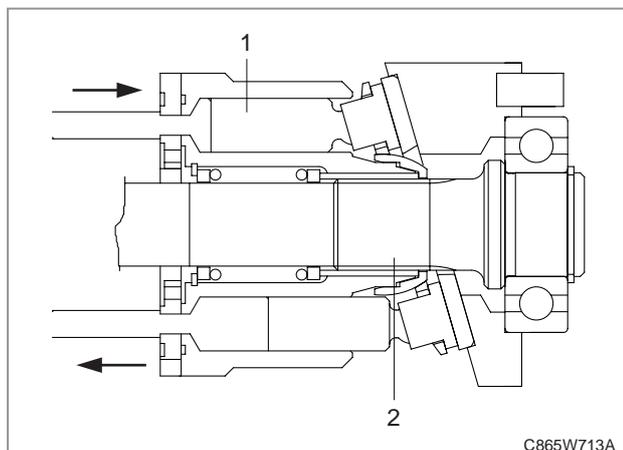
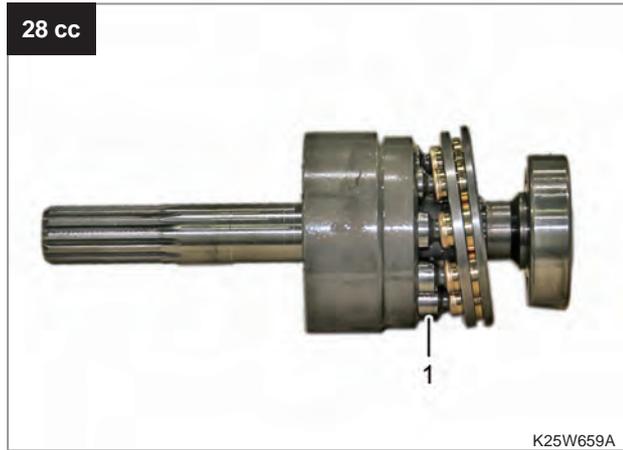
Therefore, Every time the shaft (2) rotates once, the pistons reciprocate once as well. The pistons on one side in the cylinder suck oil while the pistons on the other side in the cylinder discharge oil, forming one cycle.

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 main shift lever is shifted into the "forward" or "reverse" driving position. 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  $-18^{\circ}$  -  $+18^{\circ}$ , and its angle determines the driving direction and vehicle speed.

4.1.4 HST MOTOR



(1) Piston (2) Shaft

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.

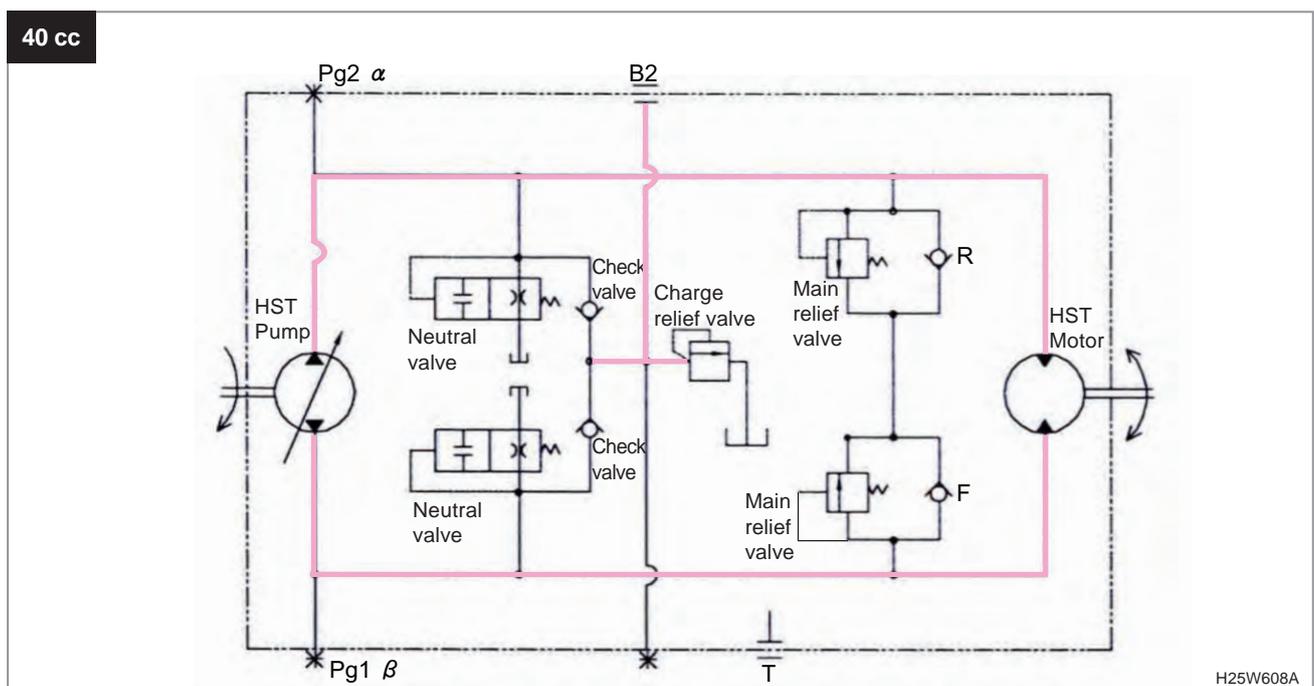
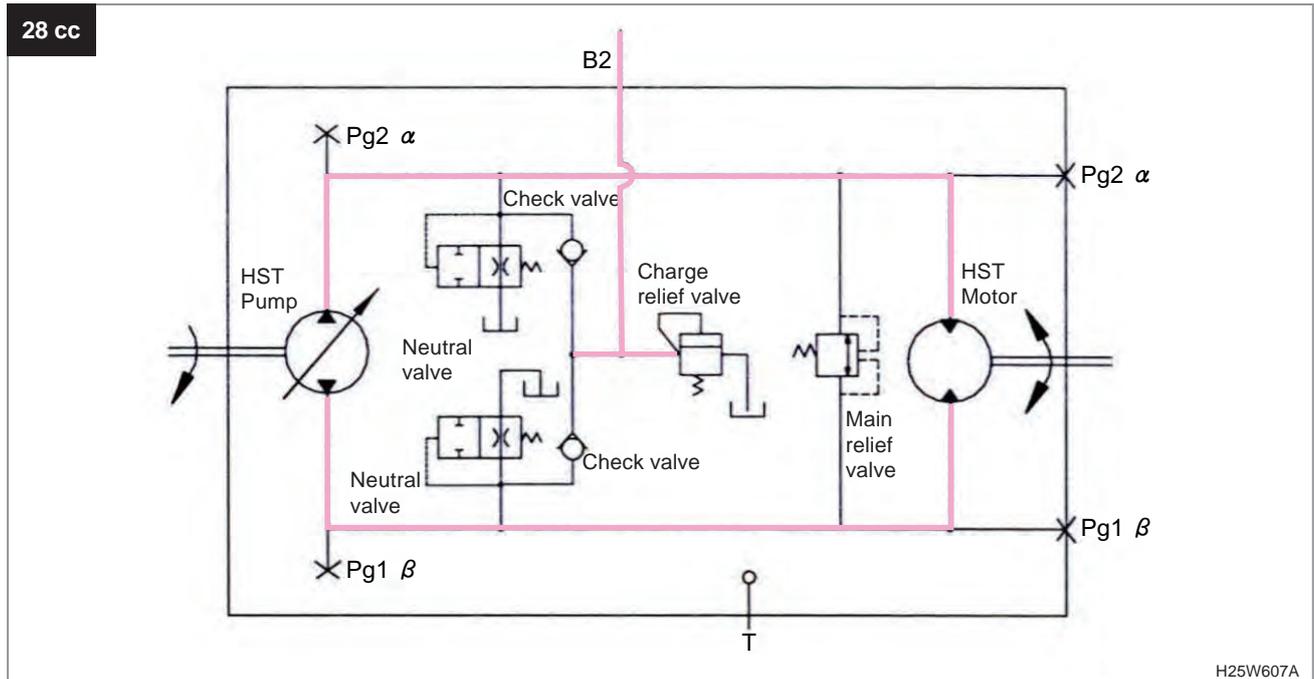
The motor in the HST has a shape similar to the pump, but it is equipped with the fixed swash plate, making it a fixed capacity type.

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

4.1.5 CHARGE RELIEF VALVE



(2) Charge relief valve

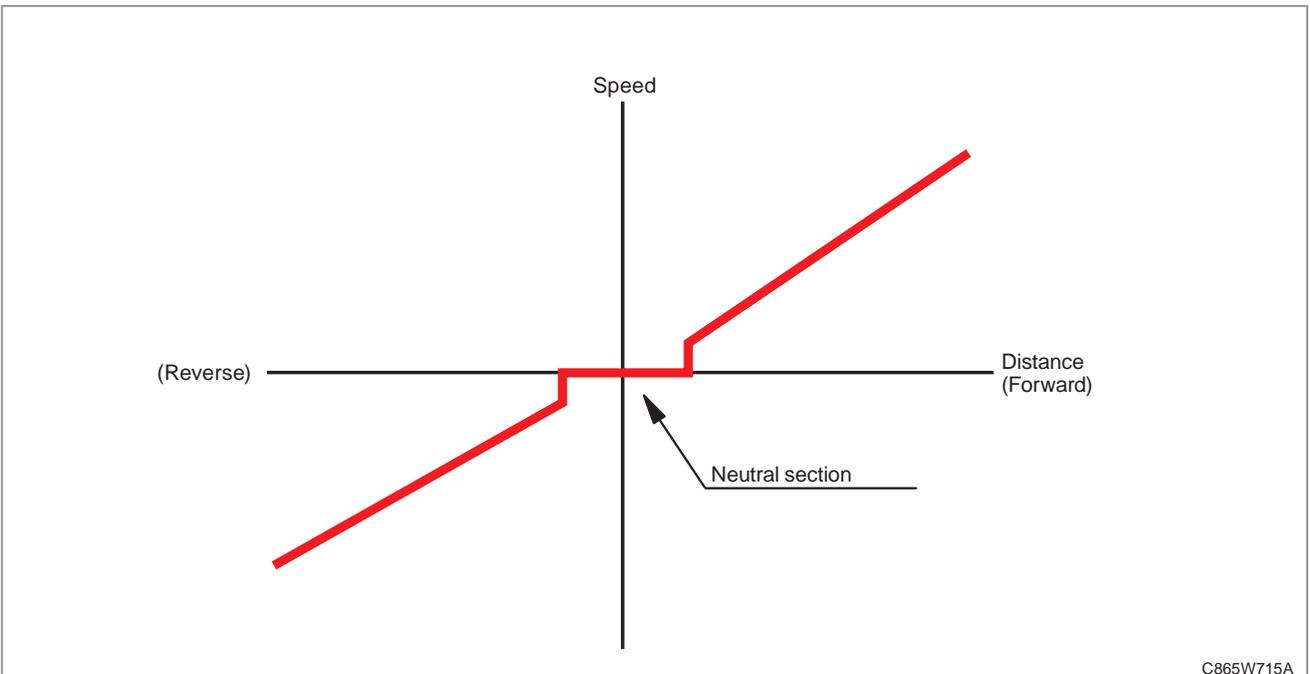


Most of oil is circulated in between the pump and motor in the HST.

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 hydraulic pump 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<sup>2</sup>. 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.

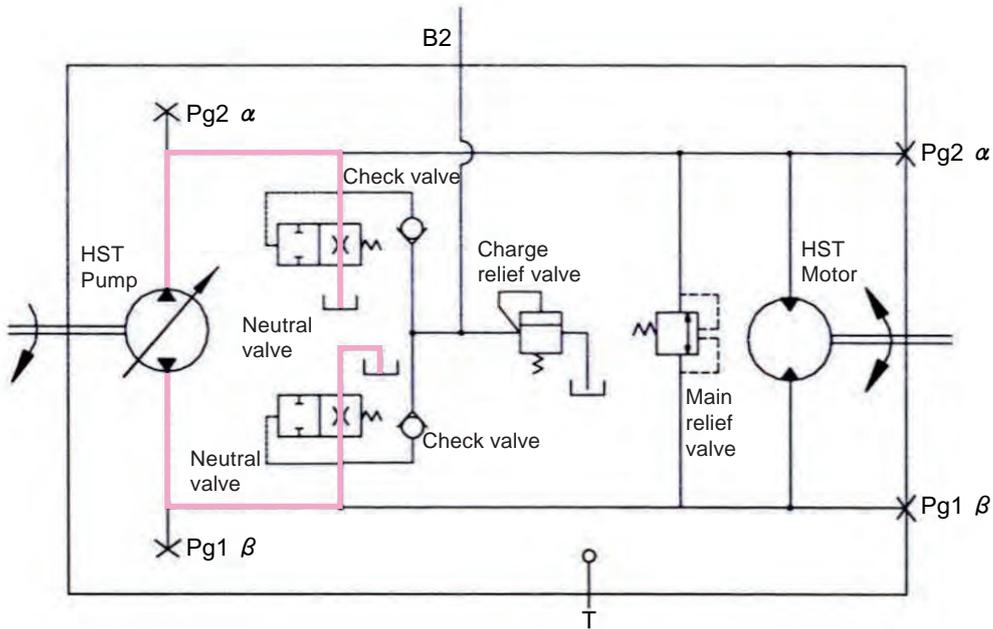
During forward or reverse driving, high pressure is formed in the compression side of the pump while low pressure is formed in the suction side, leading to oil loss in the low pressure side. If this leads to pressure drop, the charge relief valve is closed and oil is supplemented through the check valve.

4.1.6 NEUTRAL VALVE



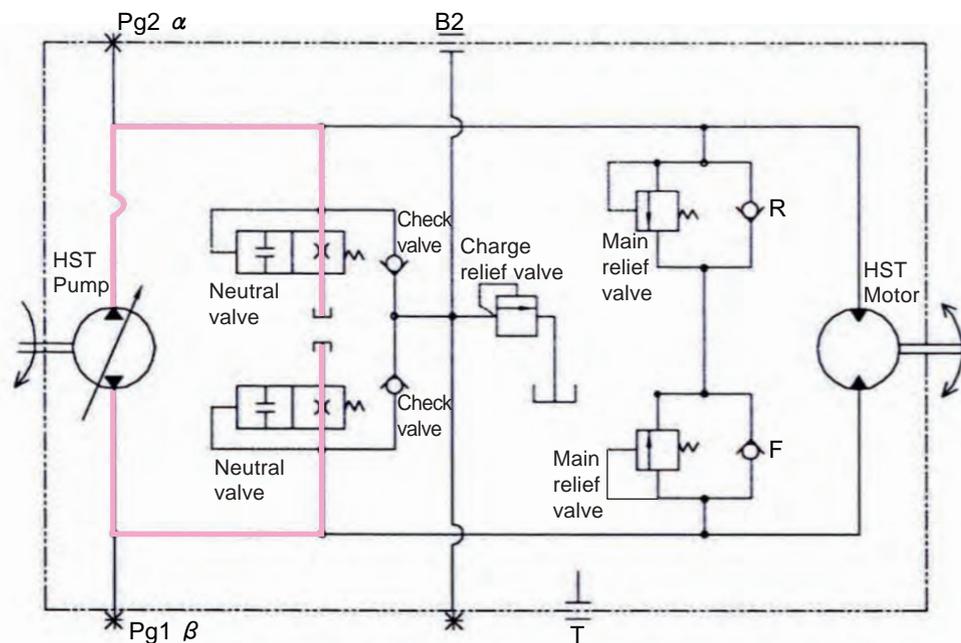
**NEUTRAL**

**28 cc**



H25W609A

**40 cc**



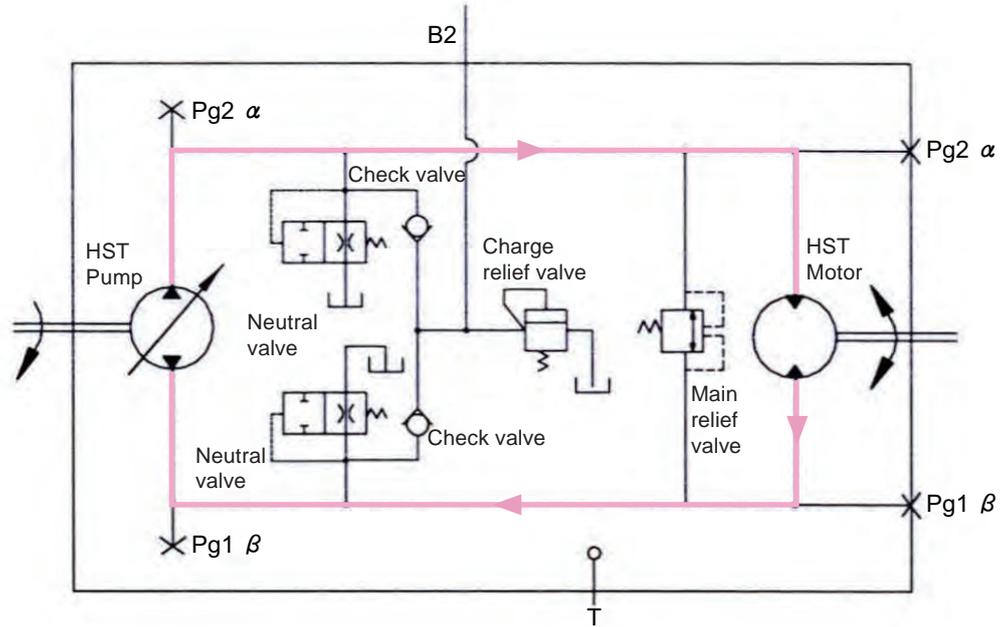
H25W610A

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 circulates this oil through its orifice to prevent internal pressure rise before it reaches the motor. This also prevents minute operation of the hydraulic motor.

**FORWARD/REVERSE DRIVING**

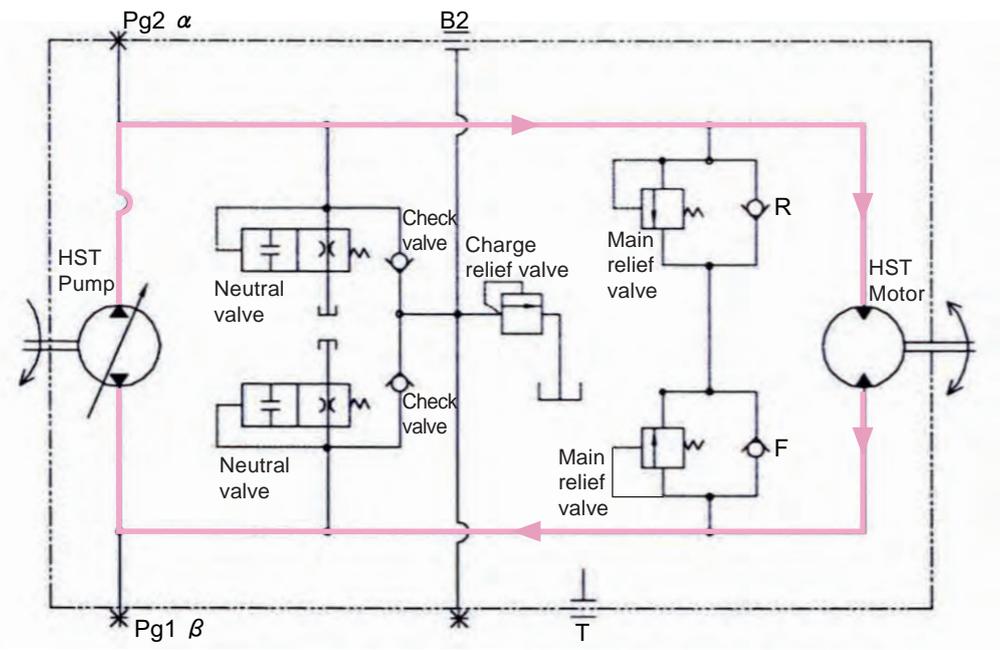
**28 cc**



H25W611A

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.

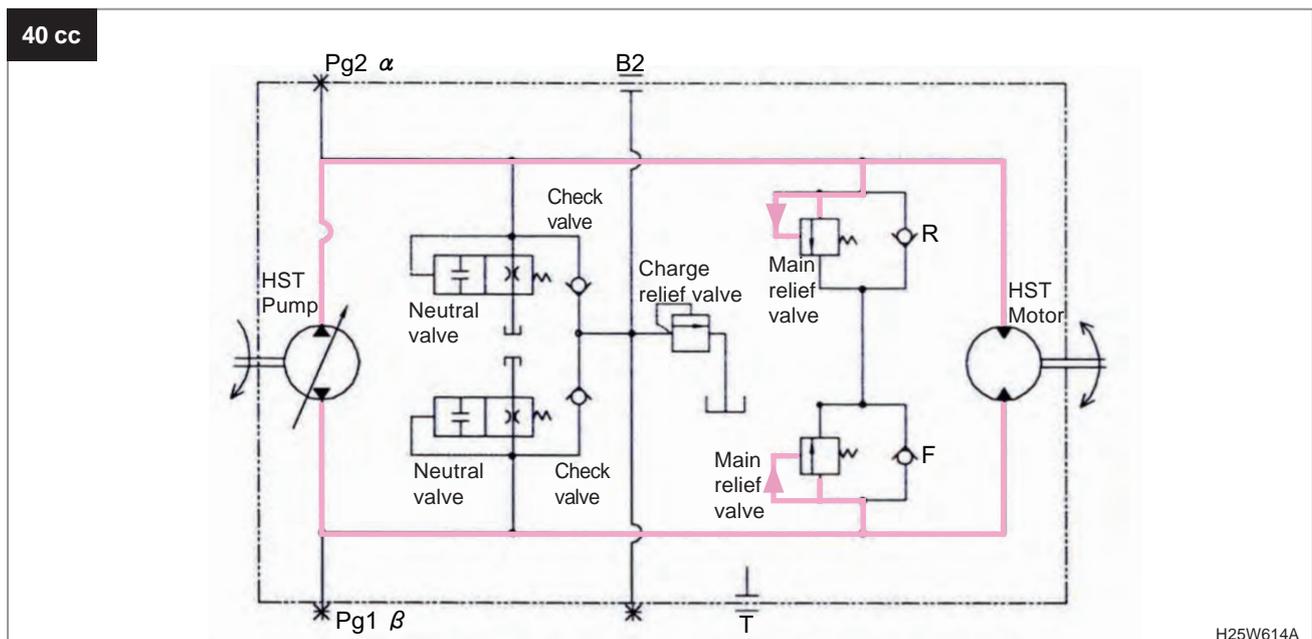
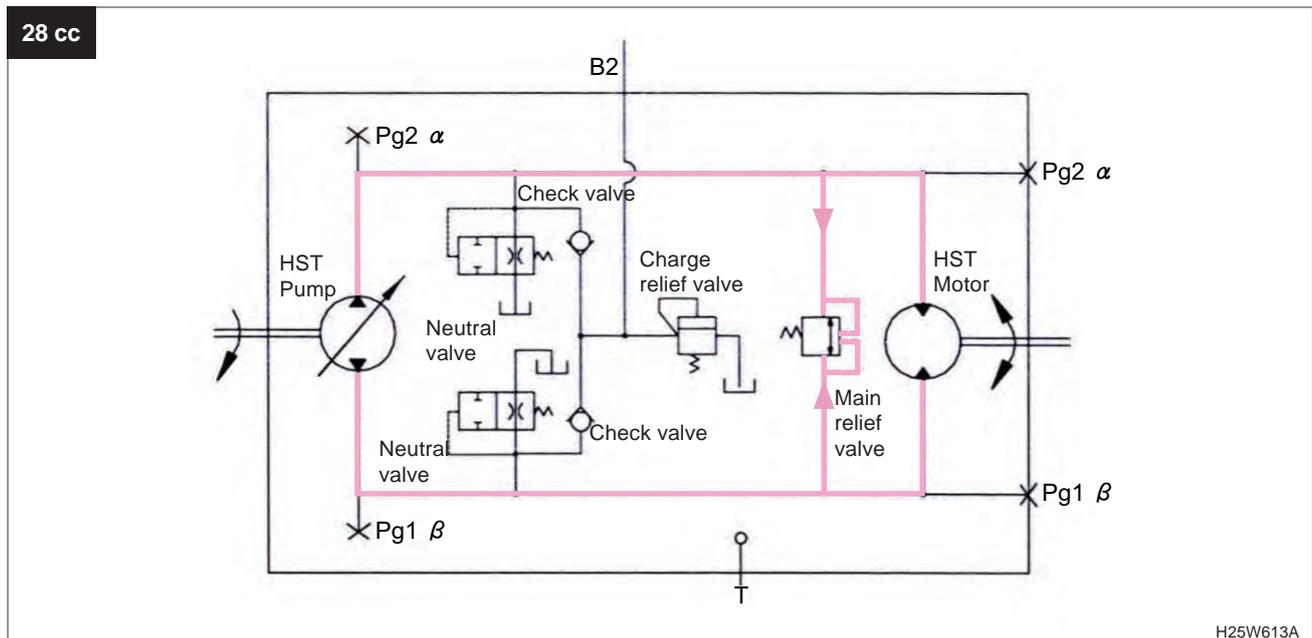
**40 cc**



H25W612A

As the angle of the swash plate increases, pressure in the hydraulic circuit for forward driving or reverse driving rises. In this state, pressure in the line from the pump to the motor rises (high pressure side) while pressure in the return line from the motor drops (low pressure side).

4.1.7 MAIN RELIEF VALVE



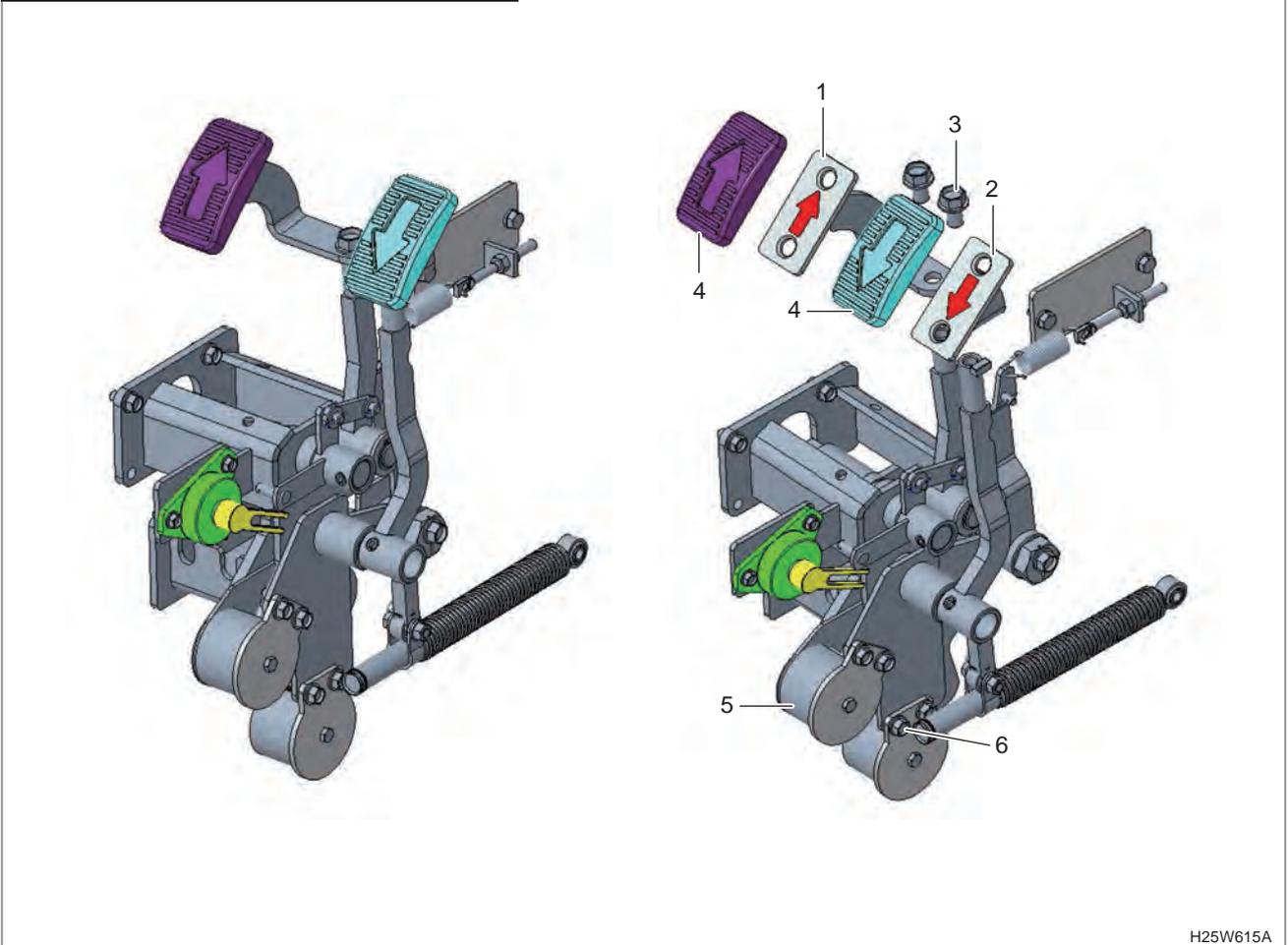
The pressure of the main relief valve is set to 380 kgf/cm<sup>2</sup> (37.2 MPa) to protect the internal circuit when the HST is overloaded.

4.1.8 HST PEDAL & LINK SECTION

**COMPONENTS**



**FORWARD/REVERSE PEDAL SECTION**

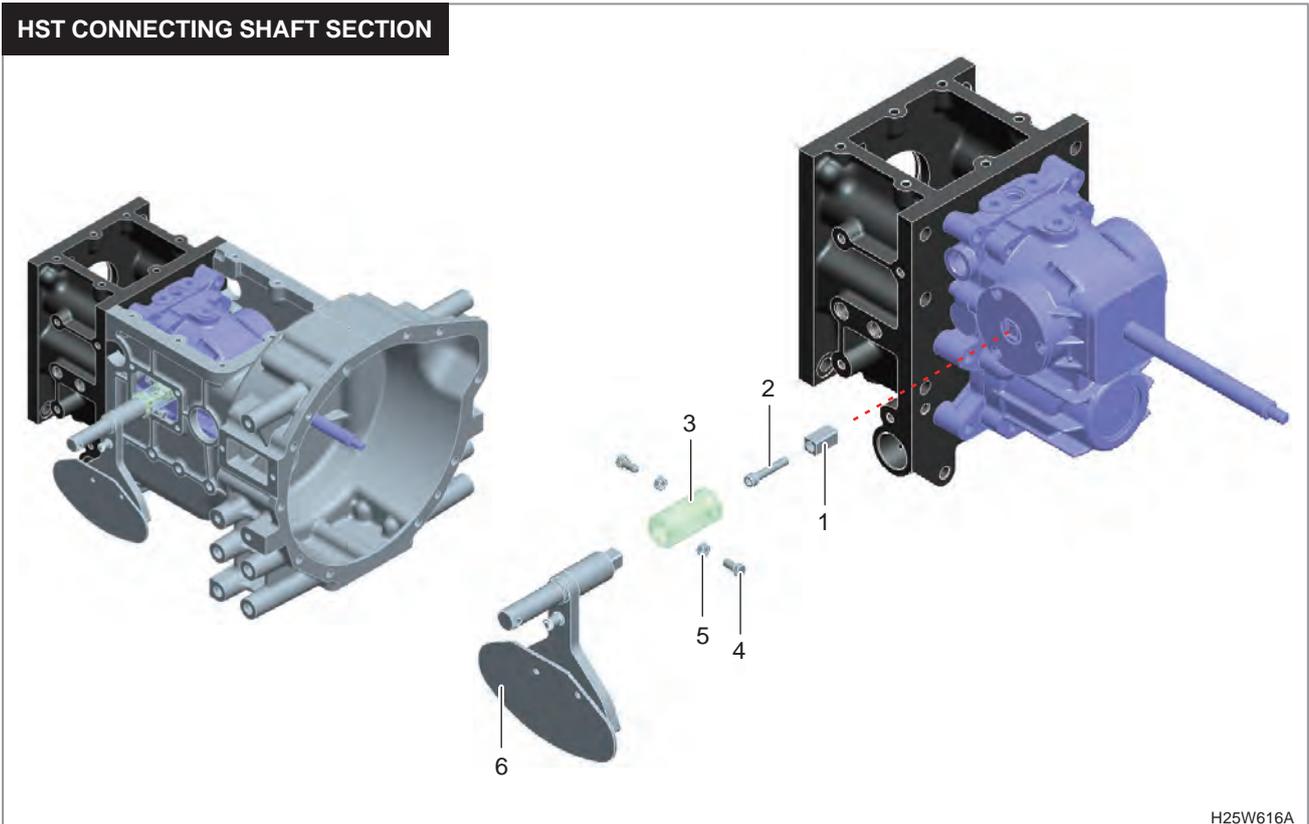


- (1) Pedal ass'y(Foreward)
- (2) Pedal ass'y (Reverse)

- (3) Bolt
- (4) Pedal cover

- (5) Magnet
- (6) Hex flange bolt

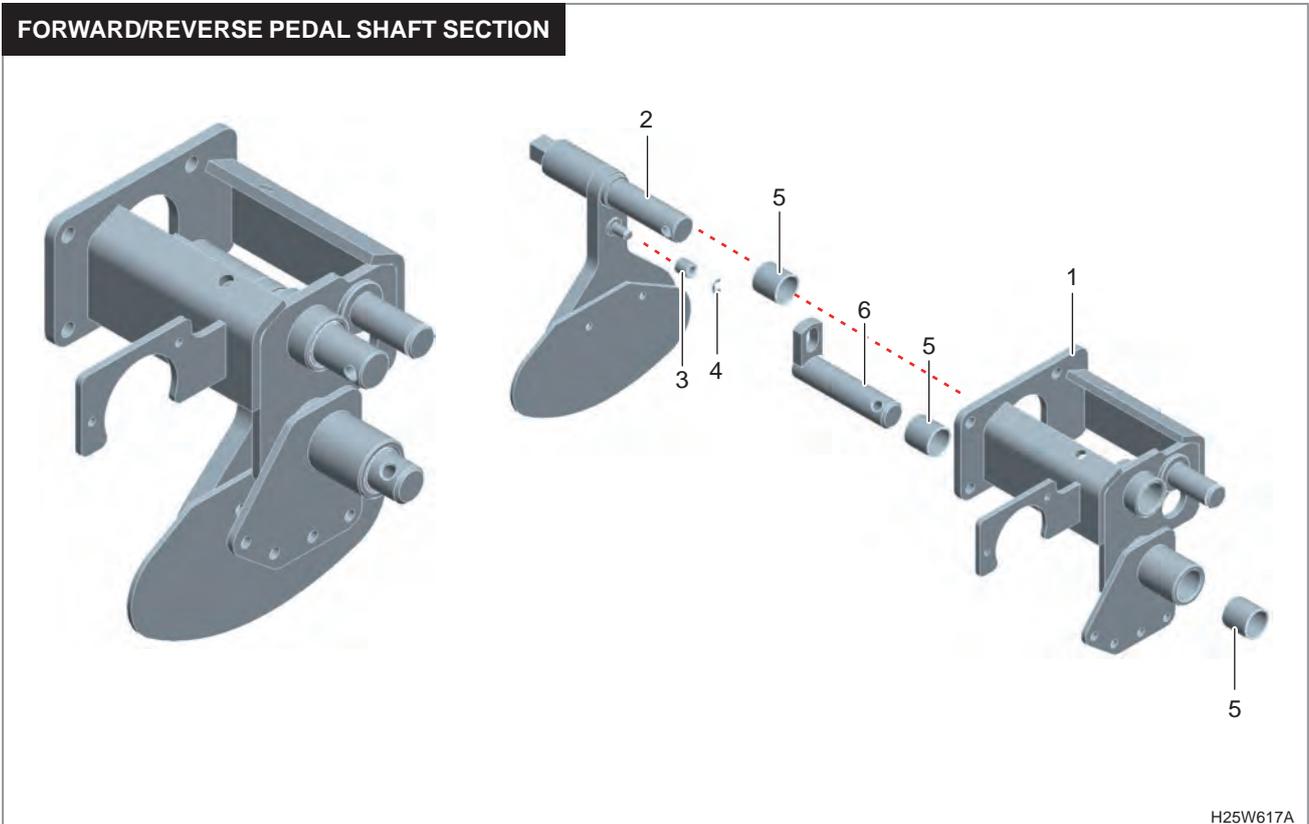
**HST CONNECTING SHAFT SECTION**



H25W616A

- (1) HST shaft
- (2) Hexagon socket bolt
- (3) Joint
- (4) Hex bolt
- (5) Hex nut
- (6) Pedal shaft ass'y (Forward)

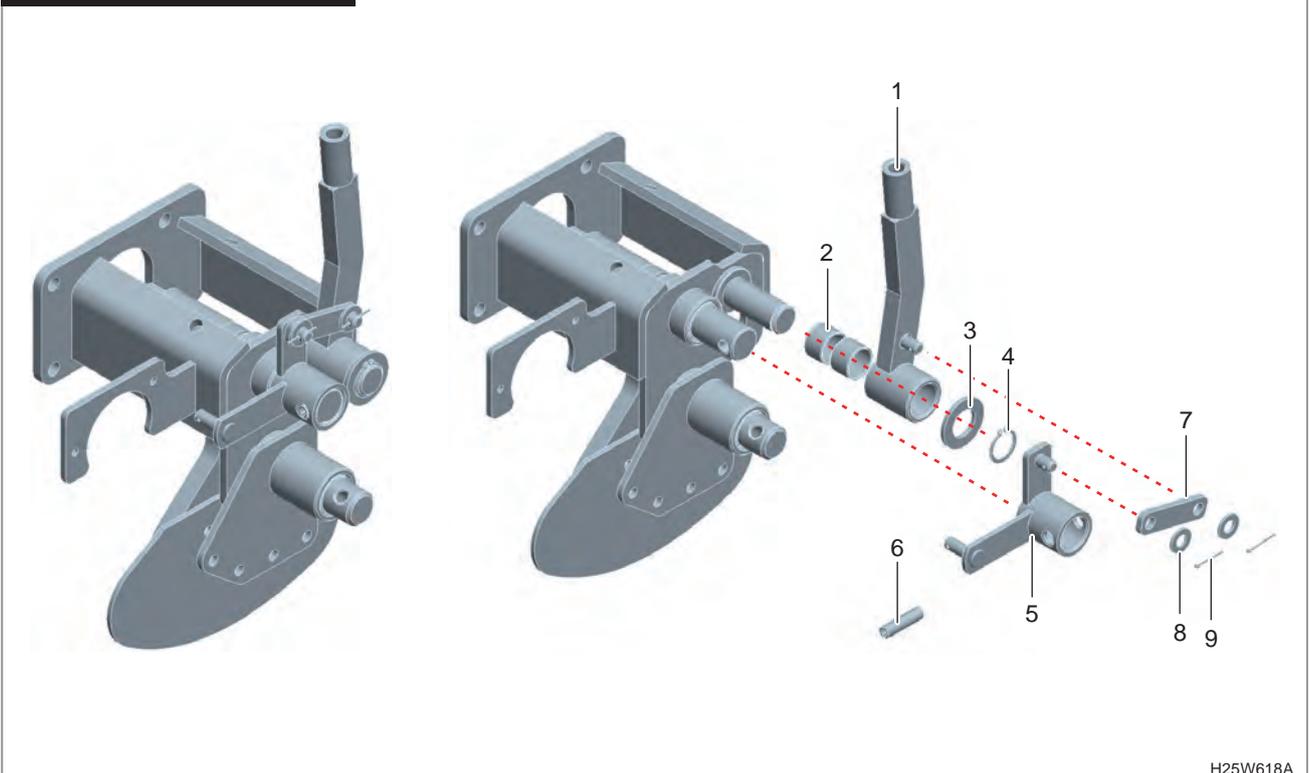
**FORWARD/REVERSE PEDAL SHAFT SECTION**



H25W617A

- (1) HST pedal bracket ass'y
- (2) Pedal shaft ass'y (Forward)
- (3) Roller
- (4) Snap ring (E)
- (5) Dry bush
- (6) Pedal shaft (Reverse)

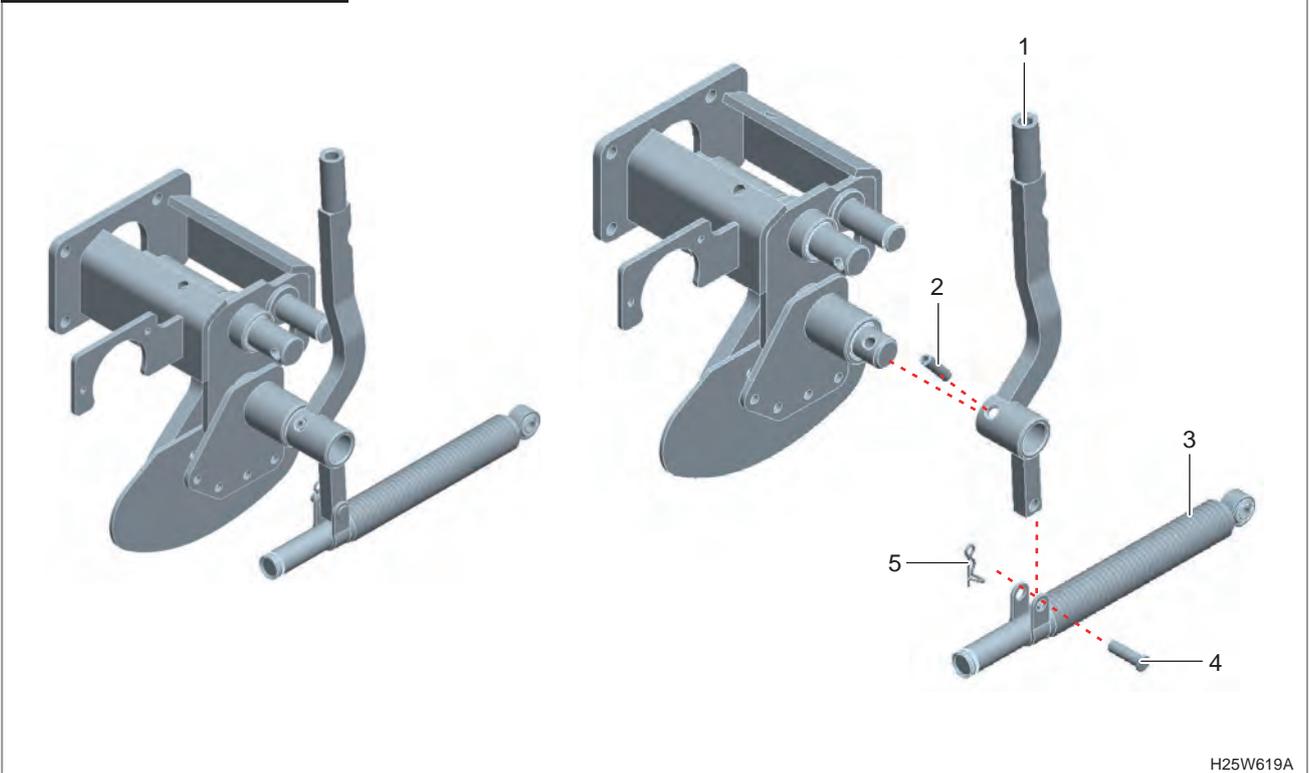
**FORWARD PEDAL SECTION**



H25W618A

- (1) Pedal ass'y(Forward)
- (2) Dry bush
- (3) Plain washer
- (4) Snap ring(C)
- (5) Pedal shaft(Forward)
- (6) Spring pin
- (7) Link
- (8) Plain washer
- (9) Cotter pin

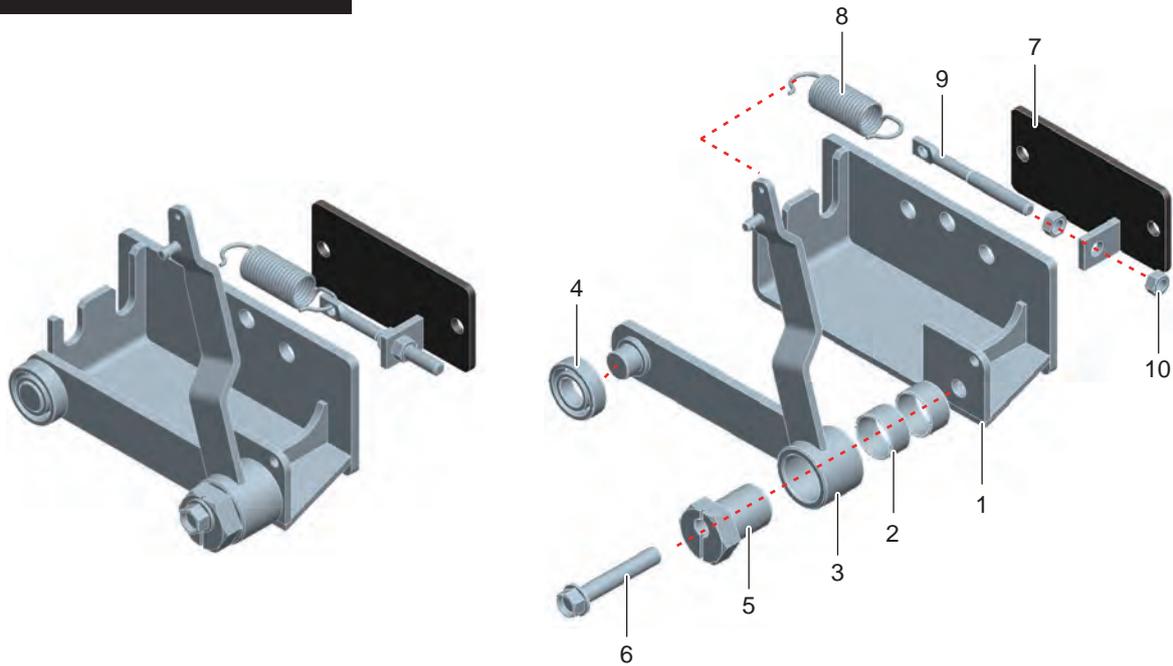
**REVERSE PEDAL SECTION**



H25W619A

- (1) Pedal ass'y(Forward)
- (2) Spring pin
- (3) Damper ass'y
- (4) Head pin
- (5) Snap pin

**NEUTRAL ADJUSTING BRACKET**



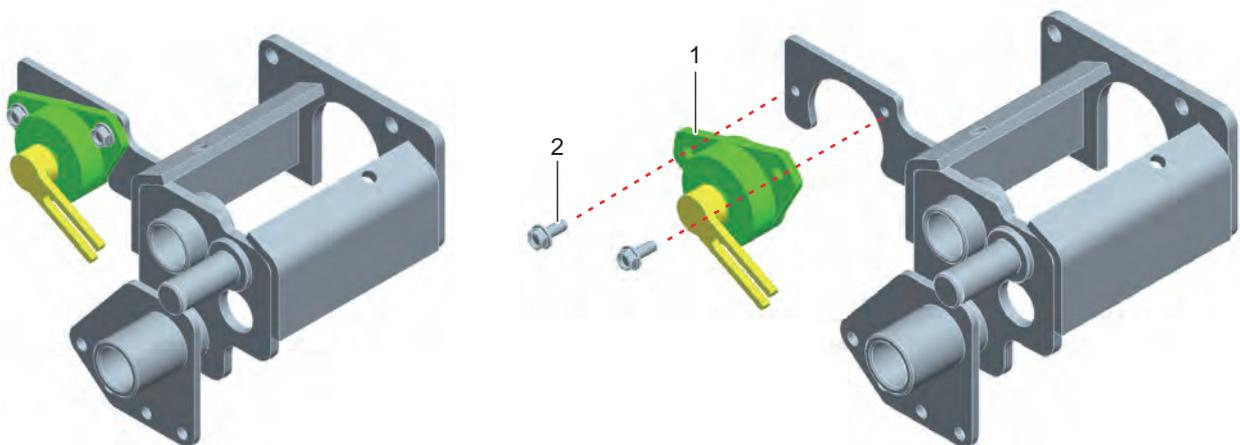
H25W620A

- (1) Bracket ass'y(Wire)
- (2) Dry bush
- (3) Neutral adjusting bracket
- (4) Bearing

- (5) Neutral Shaft
- (6) Hex flange bolt
- (7) Spring bracket
- (8) Spring

- (9) Rod
- (10) Hex nut

**SWITCH**



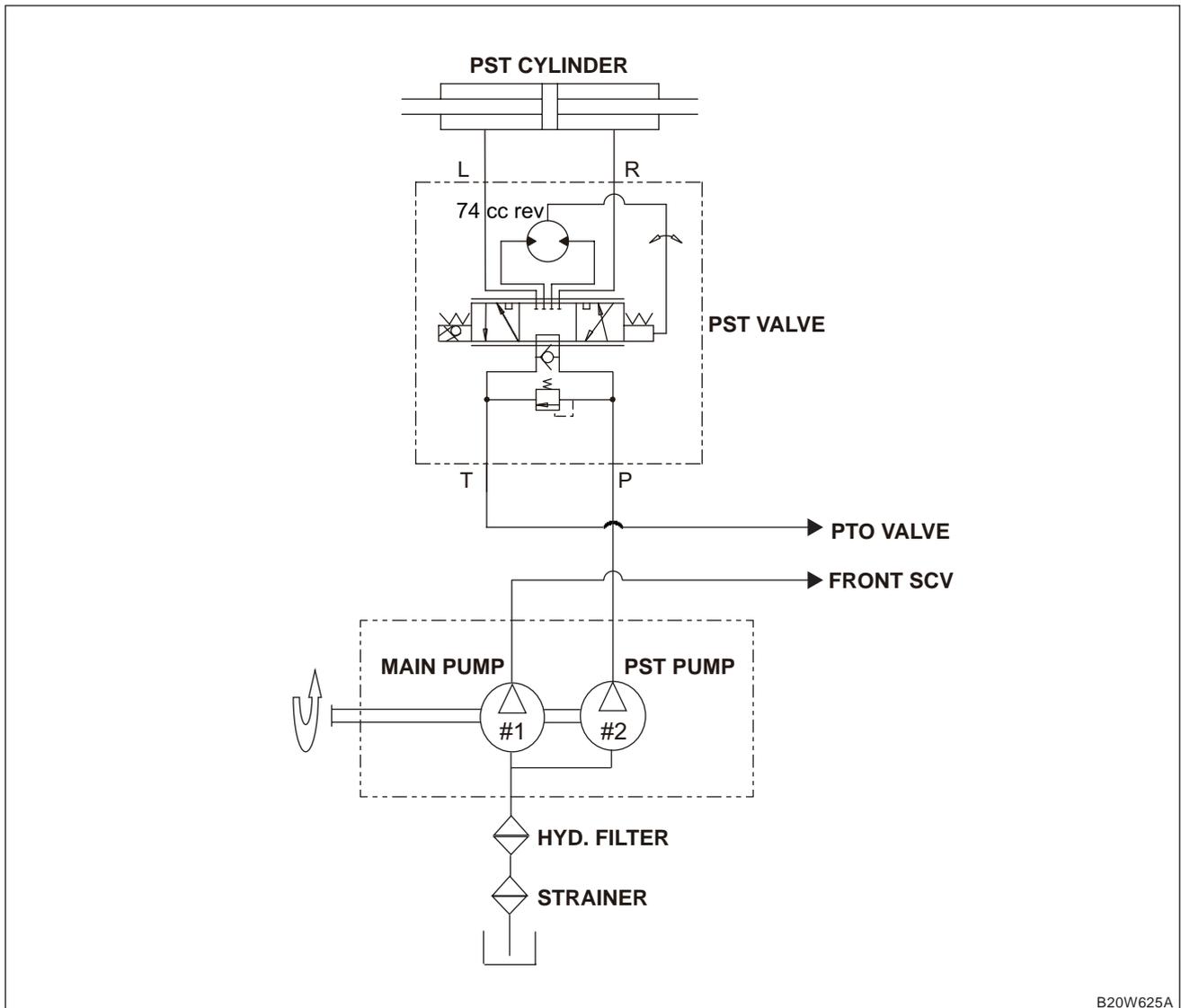
H25W621A

- (1) Switch(FR)

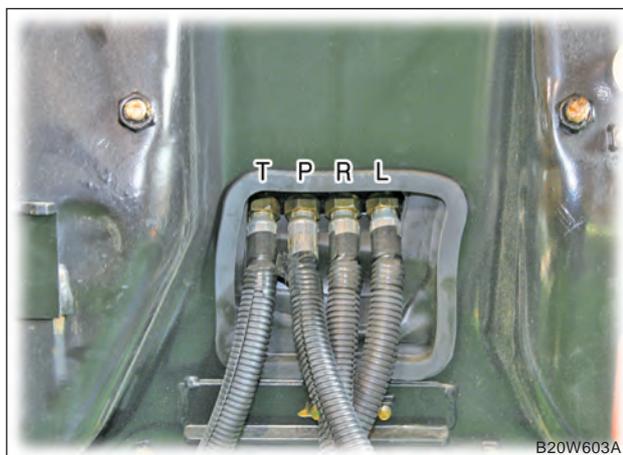
- (2) Hex flange bolt

4.2 STEERING VALVE

4.2.1 OVERVIEW



B20W625A



B20W603A

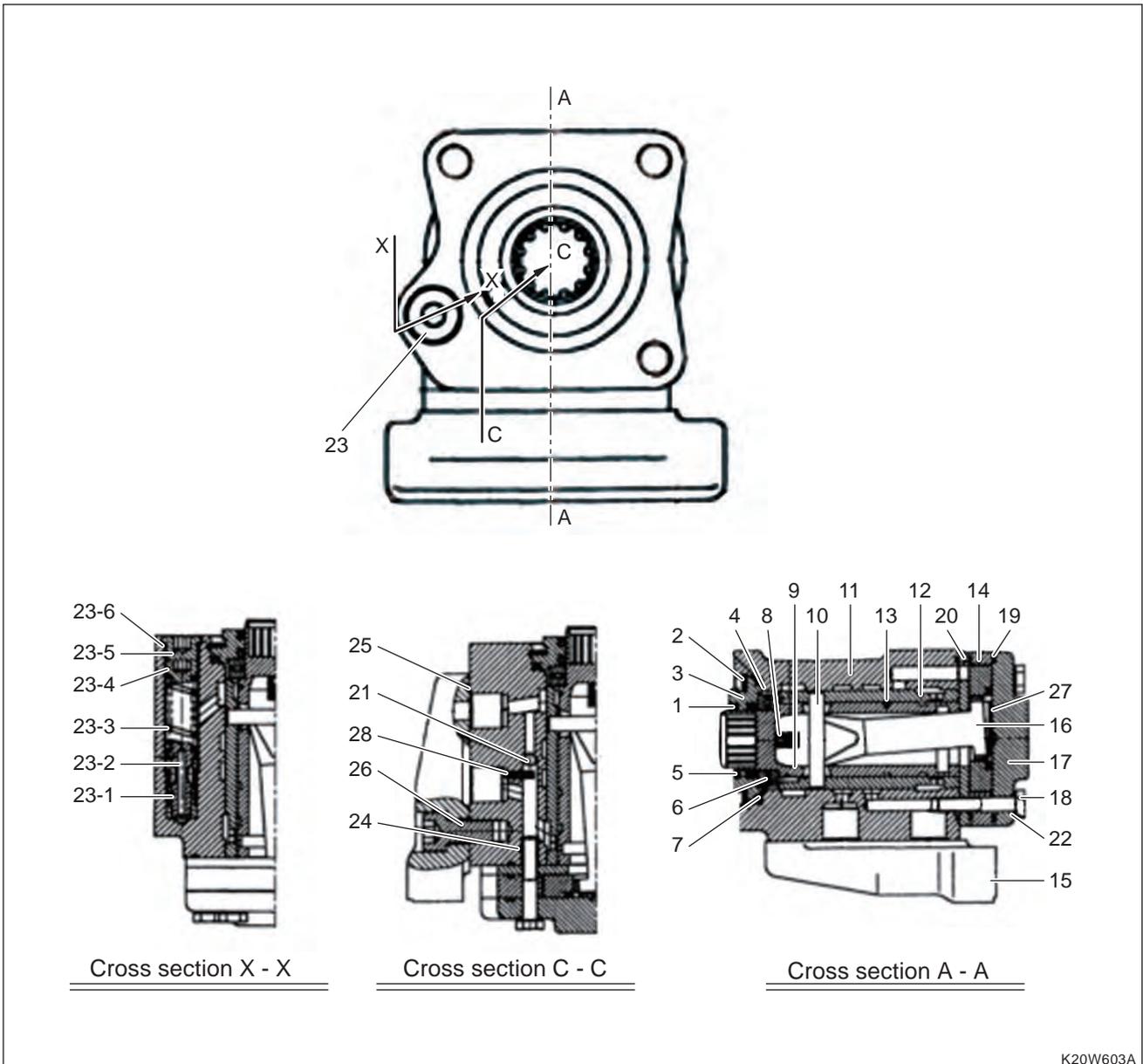
Hydraulic oil from the hydraulic pump (secondary) is supplied to the steering valve which is installed under the steering wheel in the cabin.

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.

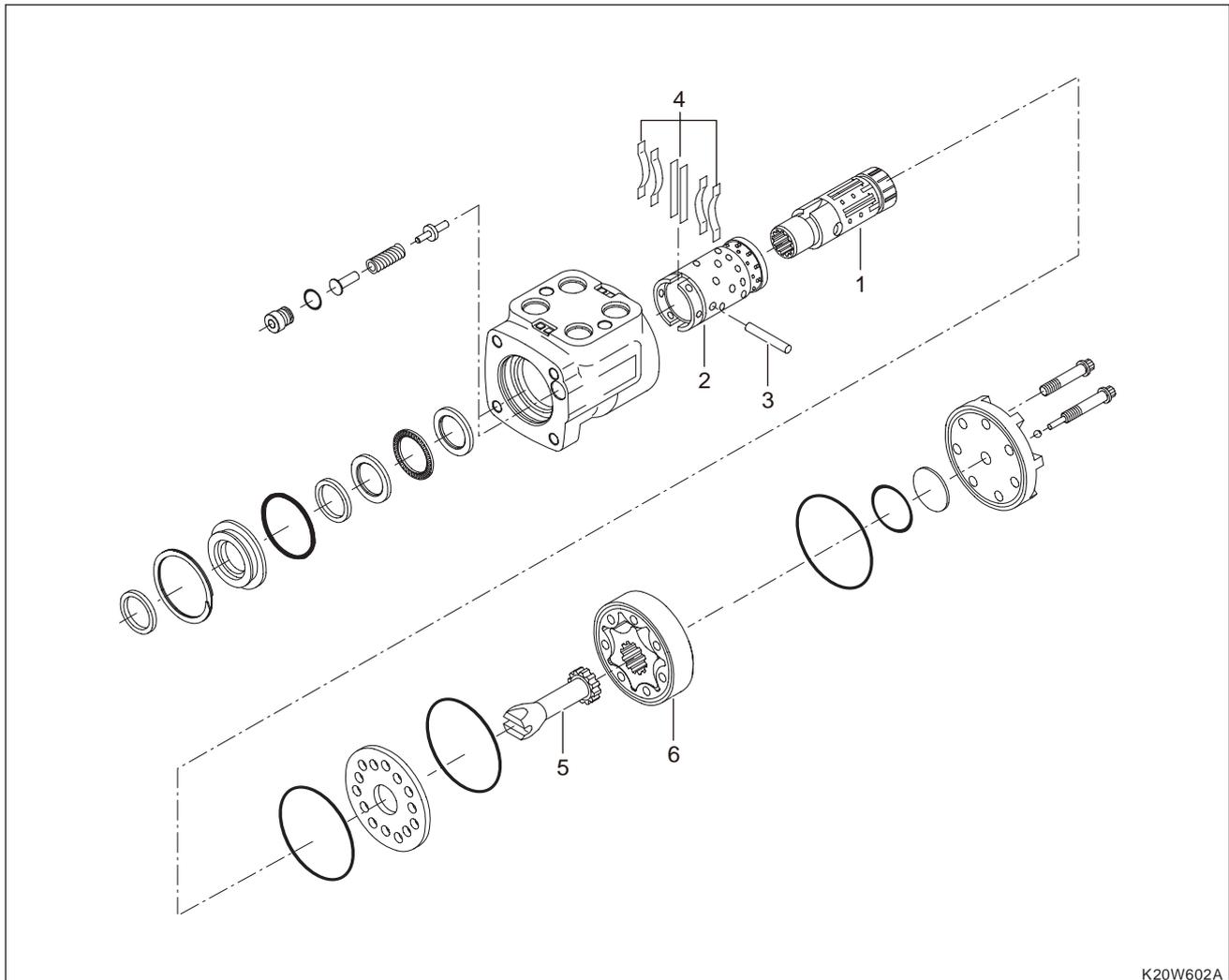
This steering valve is a non-load reaction type which means that the steering wheel is not returned automatically once it is turned to one side.

4.2.2 INTERNAL STRUCTURE AND OPERATING PRINCIPLE



K20W603A

- |                      |                  |                        |                 |
|----------------------|------------------|------------------------|-----------------|
| (1) Dust seal        | (10) Pin         | (19) O-ring            | (23-5) Plug     |
| (2) Retaining ring   | (11) Housing     | (20) Plate             | (23-6) O-ring   |
| (3) Grand bushing    | (12) Sleeve      | (21) Ball              | (24) Heli-coil  |
| (4) O-ring           | (13) Spool       | (22) Washer            | (25) O-ring     |
| (5) Cap seal         | (14) Gerotor set | (23) Relief valve      | (26) Bolt       |
| (6) Thrust bearing   | (15) Port block  | (23-1) Bushing         | (27) Spacer     |
| (7) Bearing race     | (16) Drive shaft | (23-2) Spool           | (28) Spring pin |
| (8) Centering spring | (17) End cap     | (23-3) Spring          |                 |
| (9) Leaf spring      | (18) Cap screw   | (23-4) Adjusting screw |                 |



(1) Spool  
(2) Sleeve

(3) Pin  
(4) Leaf spring

(5) Drive shaft  
(6) Gerotor (inner rotor)

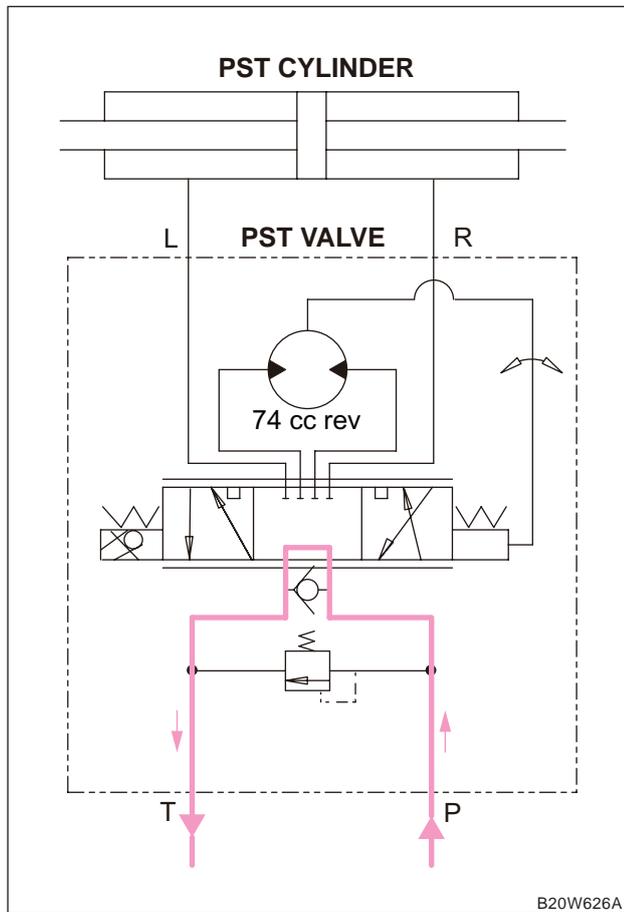
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The steering wheel is engaged with the steering valve spool with splines. Therefore, when the steering wheel is turned, the spool is turned as well. The spool (1) is covered with the sleeve (2) and these are fixed by the pin (3). Therefore, when the 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.

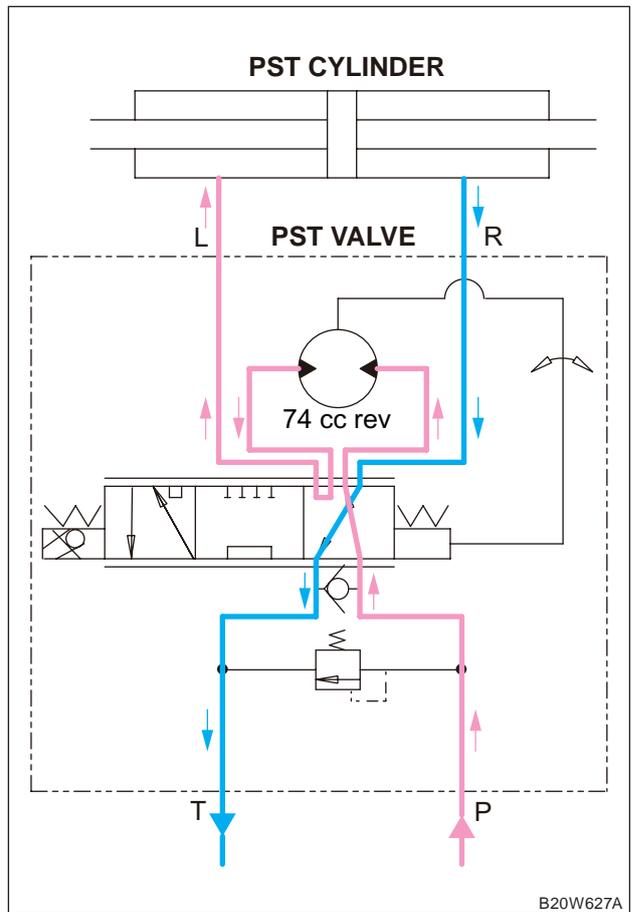
4.2.3 EXAMPLES OF STEERING WHEEL OPERATION

**NEUTRAL**



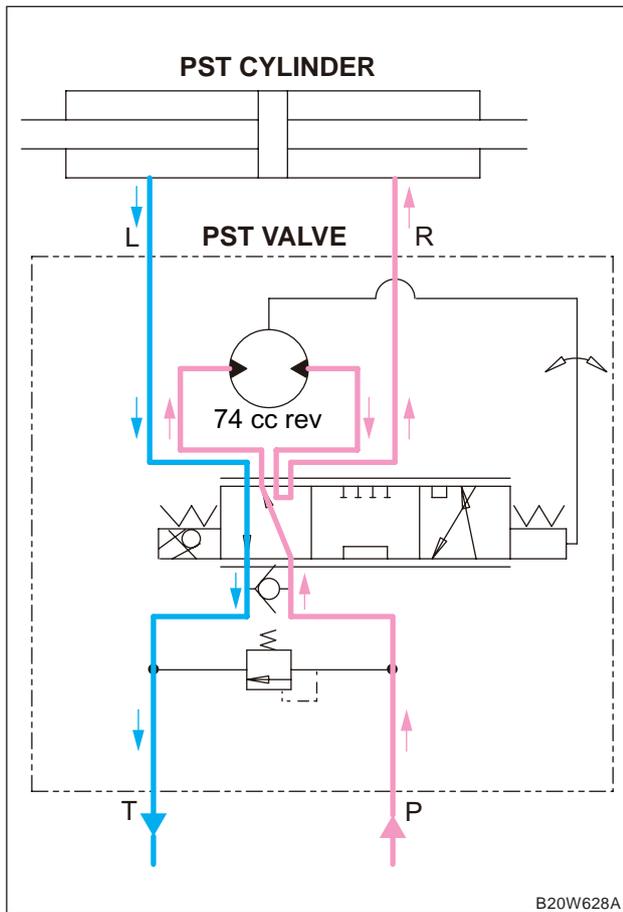
Hydraulic oil delivered from the secondary gear pump is sent to the PST valve through the port P. When the steering wheel is stopped, only the neutral holes of the spool and sleeve of the PST valve are aligned, so hydraulic oil at the port P is returned through the port T and is supplied to the PTO valve side.

**RIGHT TURN**



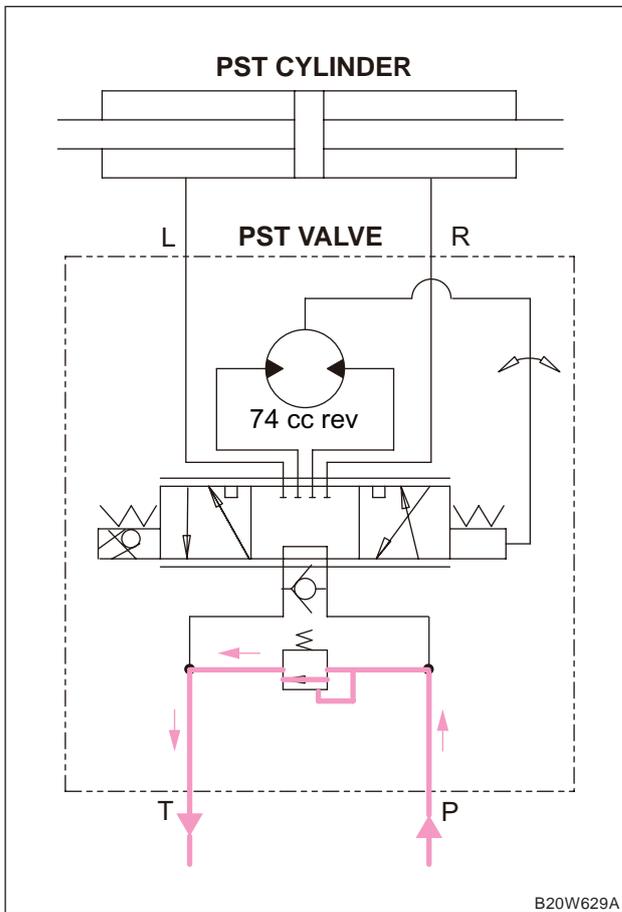
When the steering wheel is turned clockwise, the sleeve is turned clockwise approx. 10 degrees behind the spool, so the oil holes of the spool and sleeve for the right turn operation are aligned. Therefore, hydraulic oil at the port P is passed through the spool, sleeve and gerotor and is supplied to the left port of the PST cylinder through the port L. On the other hand, hydraulic oil at the right port of the PST cylinder is flowed through the port R, returned through the return holes of the spool and sleeve for right 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.

**LEFT TURN**

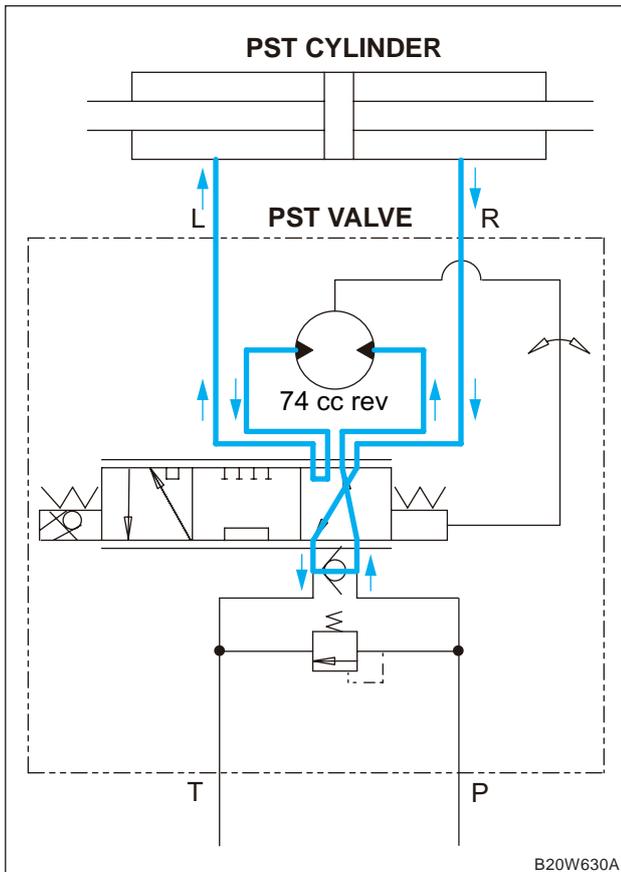


When the steering wheel is turned counterclockwise, the sleeve is turned counterclockwise approx. 10 degrees behind the spool, so the oil holes of the spool and sleeve for the left turn operation are aligned. Therefore, hydraulic oil at the port P is passed through the spool, sleeve and gerotor and is supplied to the right port of the PST cylinder through the port R. On the other hand, hydraulic oil at the left port of the PST cylinder is flowed through the port L, returned through the return holes of the spool and sleeve for left turn and port T, and delivered to the PTO valve.

**OPENING RELIEF VALVE**

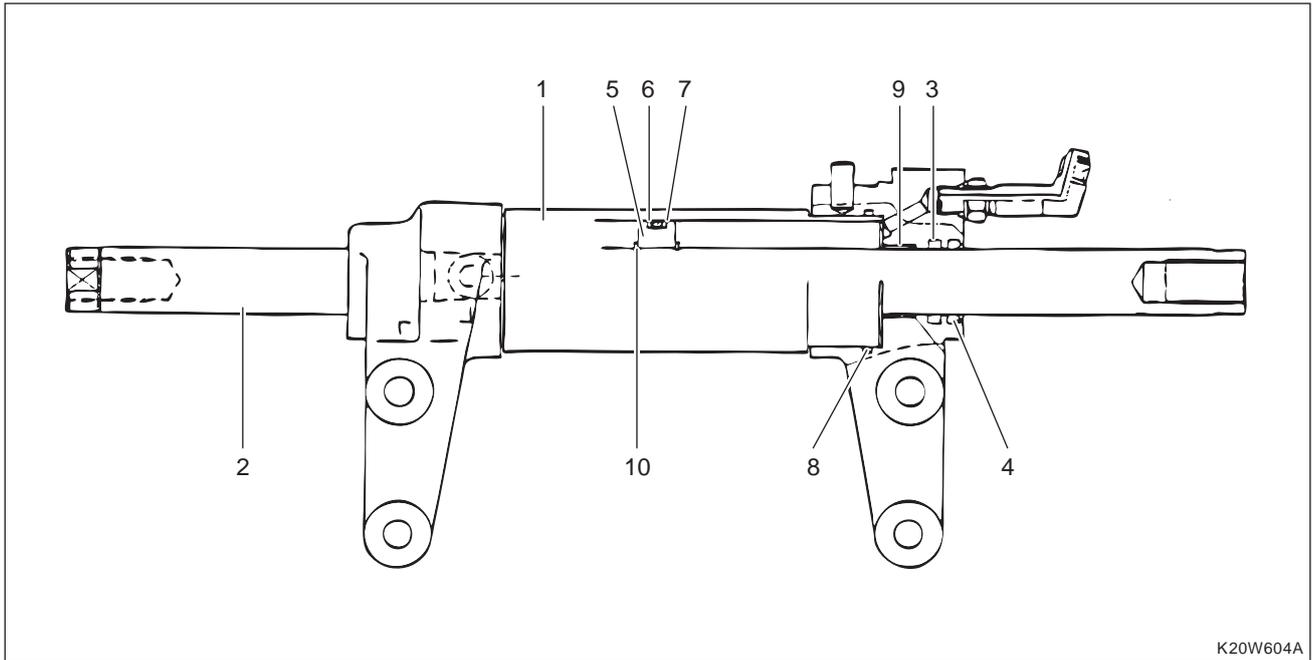


When the PST cylinder is moved to the left or right end and there is no more space to move further, pressure of hydraulic oil flowed through the port P increases over the relief valve setting pressure, 130~137kgf/cm<sup>2</sup>, resulting in opening of the relief valve. Then, hydraulic oil flowed through the port P is passed through the relief valve, returned through the port T, and delivered to the PTO valve.

**MANUAL STEERING (RIGHT 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 clockwise, hydraulic oil at the right 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 left side of the valve. Finally, it passes through the spool, sleeve and port L and flows into the left port of the PST cylinder to complete the manual right turn operation. For left turn, hydraulic oil is sucked through the port L from the left port of the PST cylinder and is flowed into the right port of the PST cylinder through the port R to complete the manual left turn operation.

4.3 PST CYLINDER

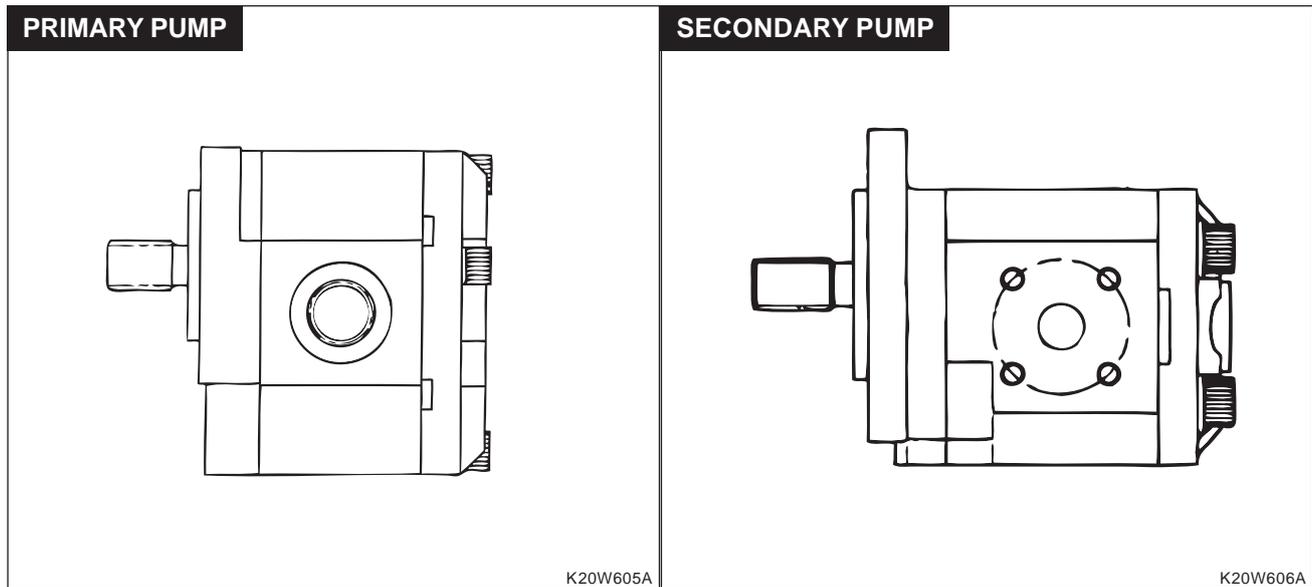


- (1) Cylinder tube
- (2) Piston rod
- (3) U-packing
- (4) Dust seal
- (5) Piston
- (6) Backup ring
- (7) X-ring
- (8) O-ring
- (9) Bushing
- (10) Stop ring (type C)

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 <sup>2</sup>

## 4.4 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)

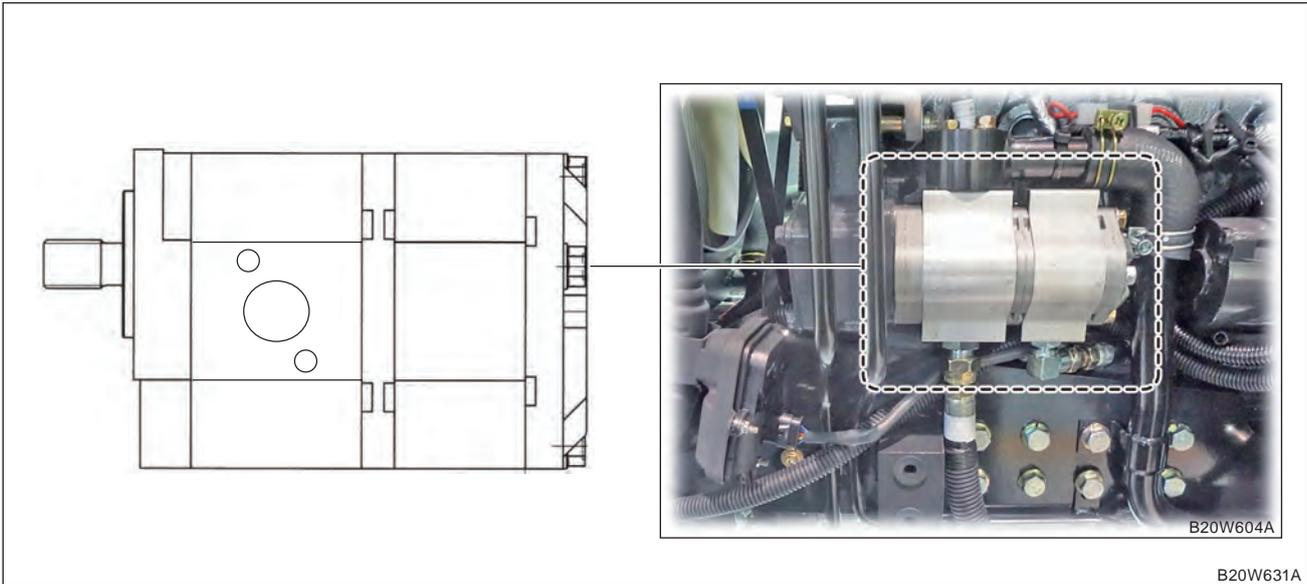
Primary pump: 13 cc/rev. X 2,600 rpm = 33.8 lpm

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 <sup>2</sup>	←
Rotating direction	Counterclockwise	Clockwise
Operating oil	TF 500	←
Usable oil temperature range	-20 ~ 100 °C	←
Relief setting pressure	160 ±5 kgf/cm <sup>2</sup>	←
Max. usable turning speed	2,340 rpm	←
Min. usable turning speed	970 rpm	←
Pressure on suction side	-0.2 ~ 1.0 kgf/cm <sup>2</sup>	←

**BB5045 / BB5055**



The hydraulic pump is installed in the left side in the engine compartment.

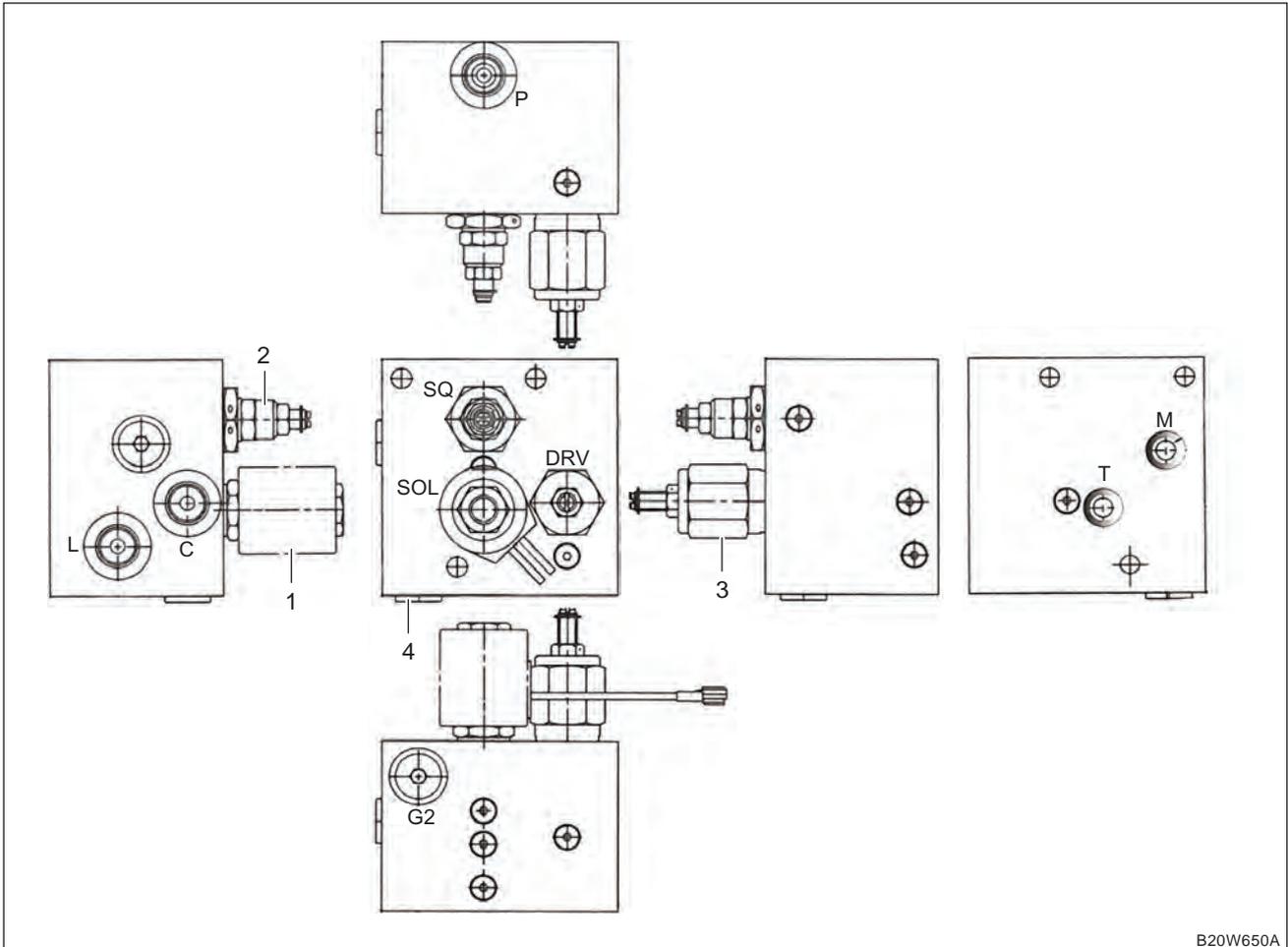
The hydraulic pump consists of the main pump (primary pump) and steering pump (secondary pump) and it is a tandem type, having two pumps in a line. As the drive shaft connected to the engine is rotated, hydraulic oil is flowed into the pump from the oil tank (transmission case) by the pair of engaged gears in the pump. Then, after this oil is pressurized, it is delivered to the valve through the outlet port.

- Pump capacity (at rated engine RPM)
  - Primary pump: 16 cc/rev. X 2,600 rpm = 41.6 lpm [MEC MODEL]  
15 cc/rev. X 2,600 rpm = 39.0 lpm [HST MODEL]
  - Secondary pump: 7.2 cc/rev. X 2,600 rpm = 18.7 lpm

► **PUMP SPECIFICATIONS**

ITEM	MAIN PUMP (PRIMARY PUMP)		STEERING PUMP (SECONDARY PUMP)
	16 cc/rev	15 cc/rev	7.2 cc/rev
Theoretical discharge volume	16 cc/rev	15 cc/rev	7.2 cc/rev
Maximum pressure	210 kgf/cm <sup>2</sup>		180 kgf/cm <sup>2</sup>
Rotating direction	Counterclockwise		←
Operating oil	TF 500		←
Usable oil temperature range	-20 ~ 100 °C		←
Relief setting pressure	190 kgf/cm <sup>2</sup>		140 kgf/cm <sup>2</sup>
Pump speed	Max.: 2,700 rpm		←
Pressure on suction side	-0.2 ~ 1.0 kgf/cm <sup>2</sup>		←

4.5 PTO VALVE

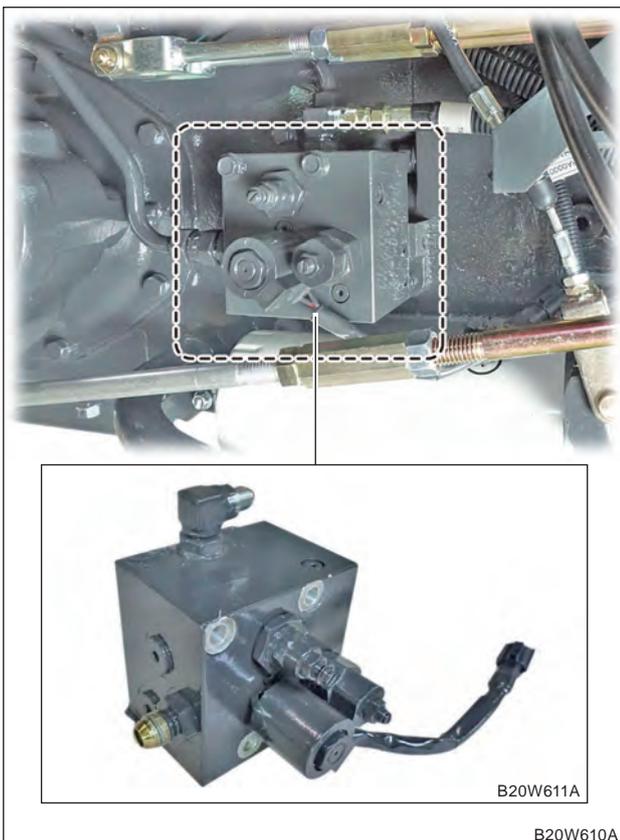


(1) Solenoid valve

(2) Sequence valve

(3) DRV

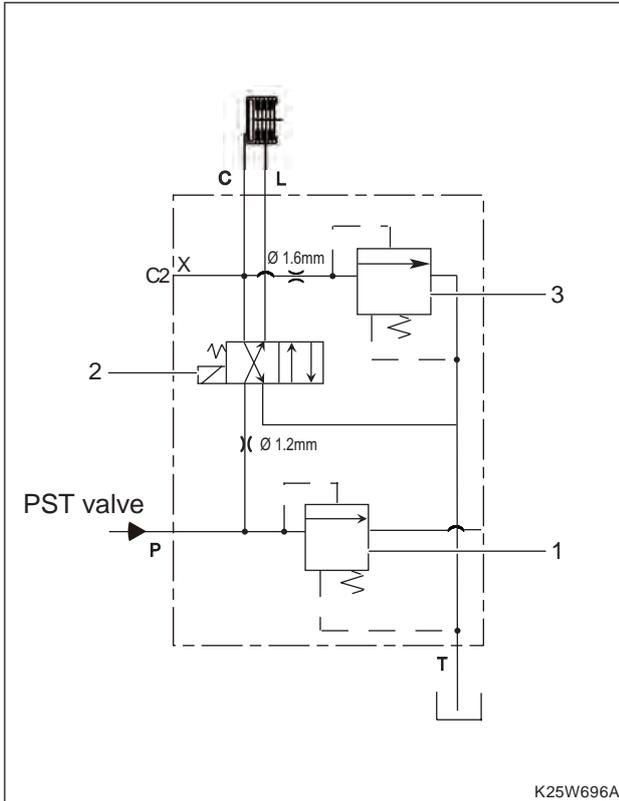
(4) Plug



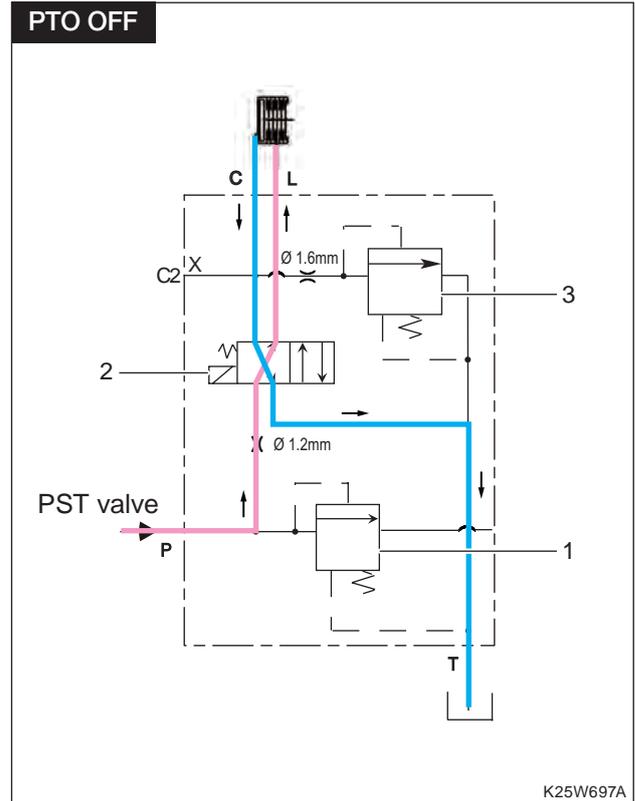
The PTO valve is installed to the right side of the rear axle case. It receives oil from the PST valve to lubricate and operate the PTO clutch and it is turned ON and OFF by the PTO switch.

► PUMP SPECIFICATIONS

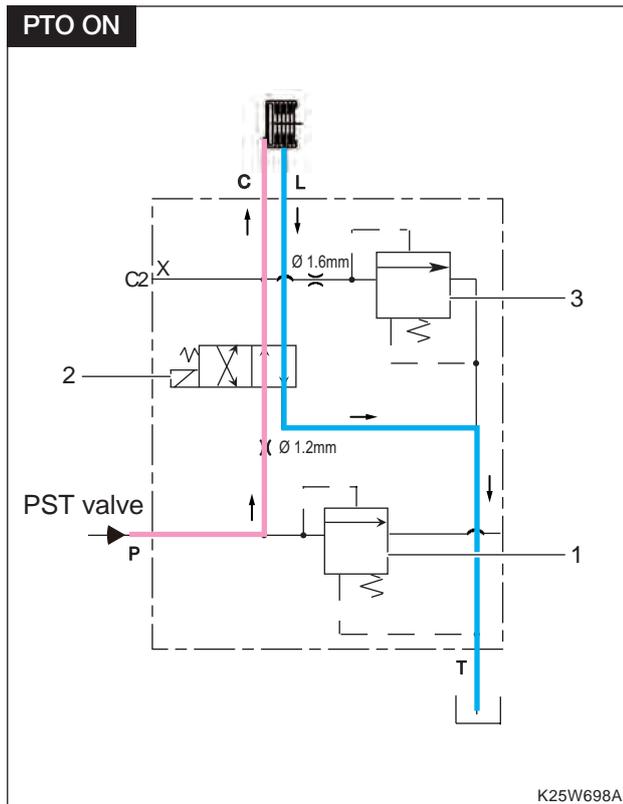
ITEM	SPECIFICATION
Operating flow	8 - 18 l/min.
Operating pressure	Max. 170 kgf/cm <sup>2</sup>
Sequence valve setting pressure	11.5 ± 0.5 kgf/cm <sup>2</sup>
Operating temperature range	-20°C ~ 100°C



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<sup>2</sup> (EU model) or 11.5 kgf/cm<sup>2</sup> (US model), modulator 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, hydraulic oil at the port P is flowed through the main spool and port L and is supplied to the lubrication line of the PTO clutch section.

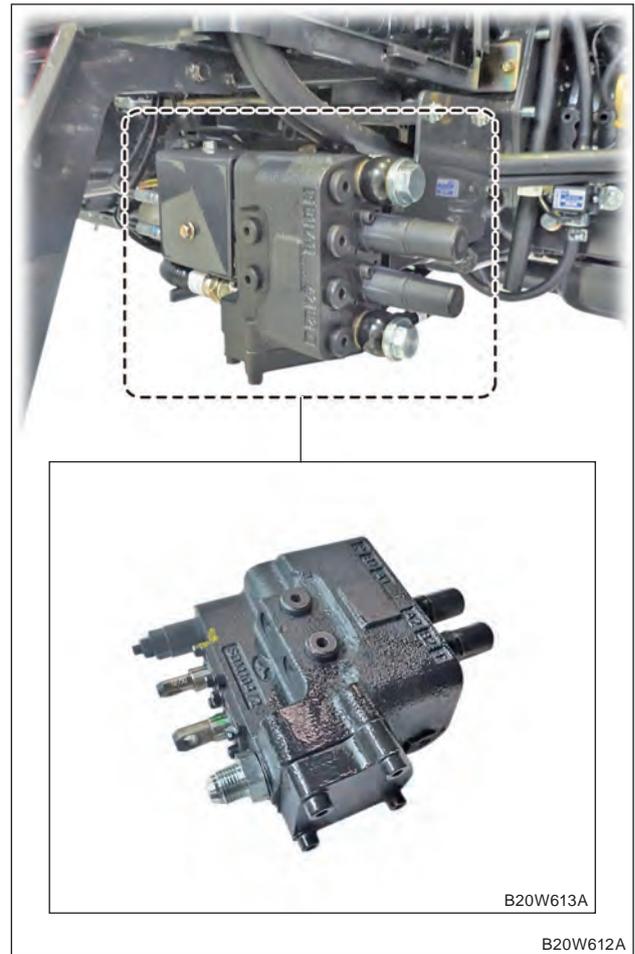


When the PTO switch is set the ON position by the driver, the magnet of the electric solenoid is activated to pull the spool in the left direction as shown in the circuit diagram. Then, hydraulic oil is passed through the solenoid spool and is supplied to the piston of the PTO clutch through the port C. There is a  $\text{Ø}1.2\text{ mm}$  orifice before the solenoid spool. Therefore, at the initial valve opening state, more hydraulic oil is applied to the sequence valve 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  $16\text{ kgf/cm}^2$  (EU model) or  $11.5\text{ kgf/cm}^2$  (US model) is delivered to the piston to achieve the maximum level of the delivered torque of the PTO clutch.

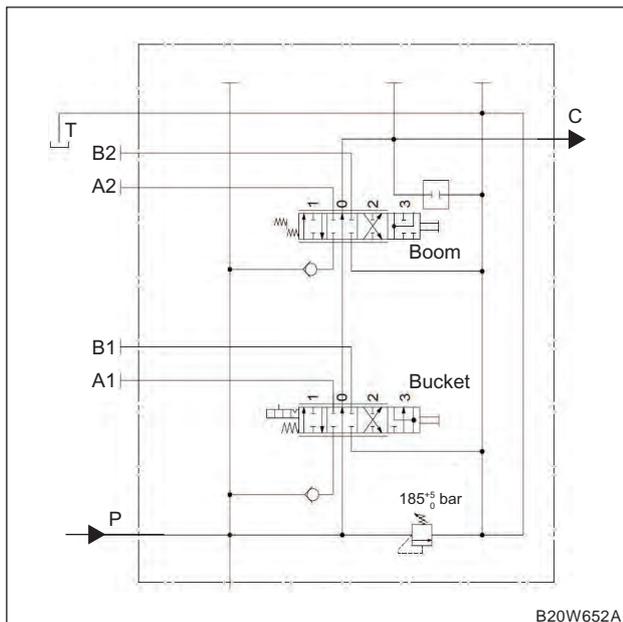
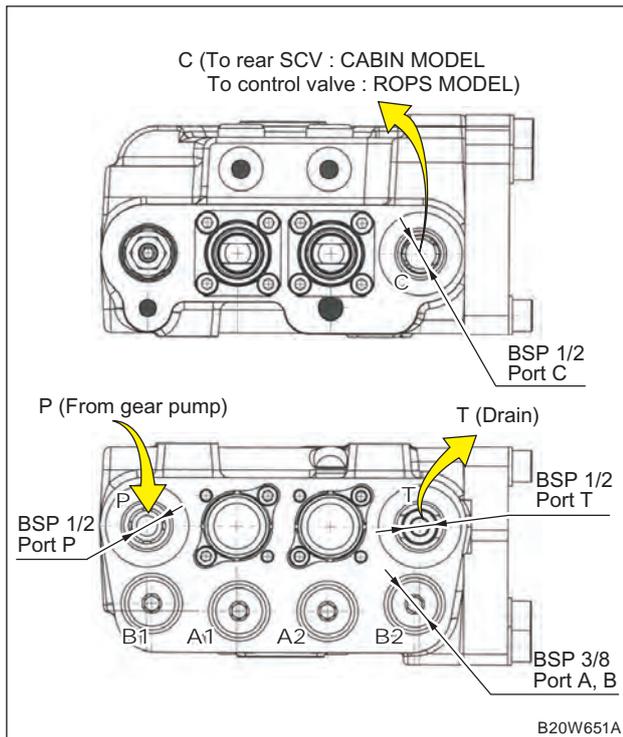
The modulation valve is connected through the  $\text{Ø}1.6\text{ mm}$  orifice in the middle of the port C line in which pressure is applied for the piston when the PTO is activated. This valve delays engagement of the PTO clutch to reduce engagement shock. It discharges hydraulic oil from the port C 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.

## 4.6 FRONT/REAR SCV

### 4.6.1 FRONT SCV



The front SCV 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.



The front SCV 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 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.

When the front SCV is in use, hydraulic oil collected from the cylinder of the external implement is returned to the transmission housing through the port T. Therefore, as long as the loader is in use, devices after the loader, including the rear hydraulic device and lift, cannot be operated simultaneously.

The front SCV is equipped with the relief valve (main 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.

There are two spools installed to the front SCV. The spool on the inlet side is to operate the bucket in the dump or rollback direction. When it is pushed one step further from the dump side, the regeneration function is activated.

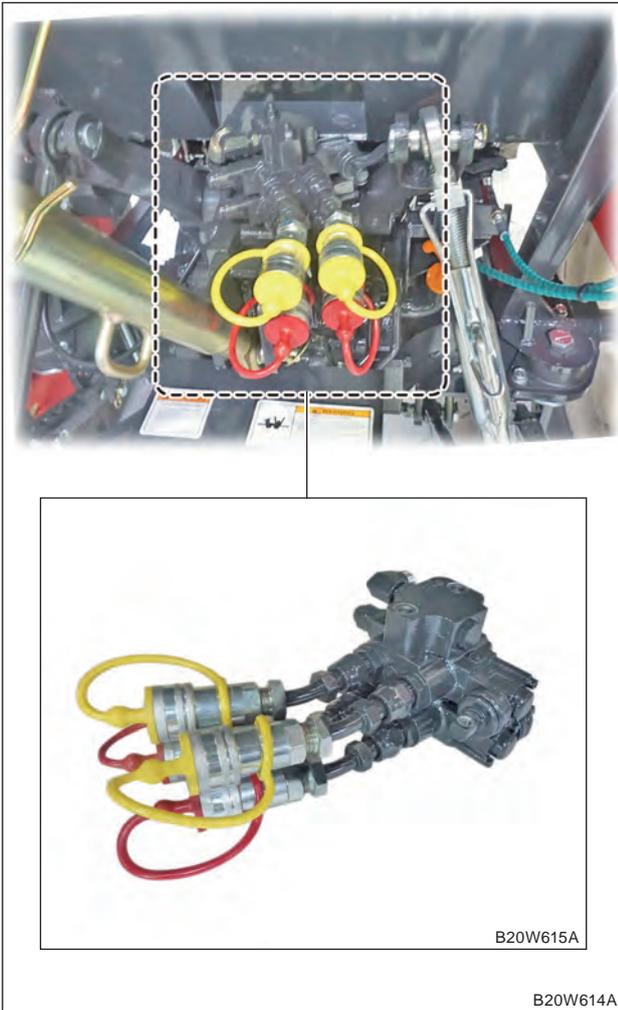
The regeneration function is to re-circulate hydraulic oil returned from the cylinder to the bucket cylinder to double the dump speed when the bucket cylinder is extended.

The spool on the outlet side is for the boom and it has a floating function. The floating circuit is located after the lowering circuit. When the spool is pushed one stage further with the loader boom lowered, the floating function is activated. When the floating function is activated, the detent function is activated as well so that the spool is not returned to the neutral position to keep the floating status.

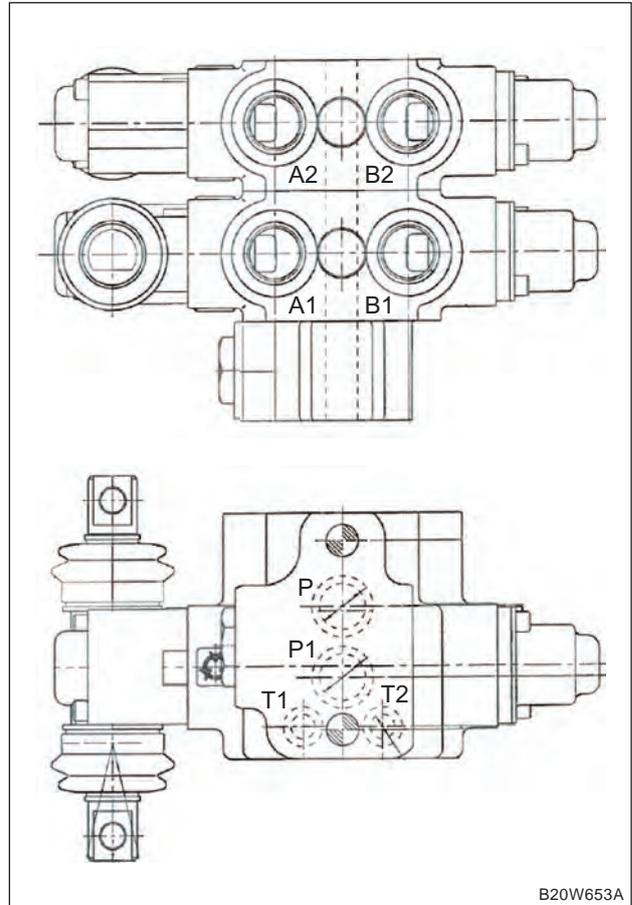
► VALVE SPECIFICATIONS

ITEM	SPECIFICATION
Nominal flow	60 l/min.
Operating pressure	250 bar
Maximum back pressure	25 bar
Relief valve setting pressure	185 ± <sup>5</sup> <sub>0</sub> bar
Operating oil	TF500

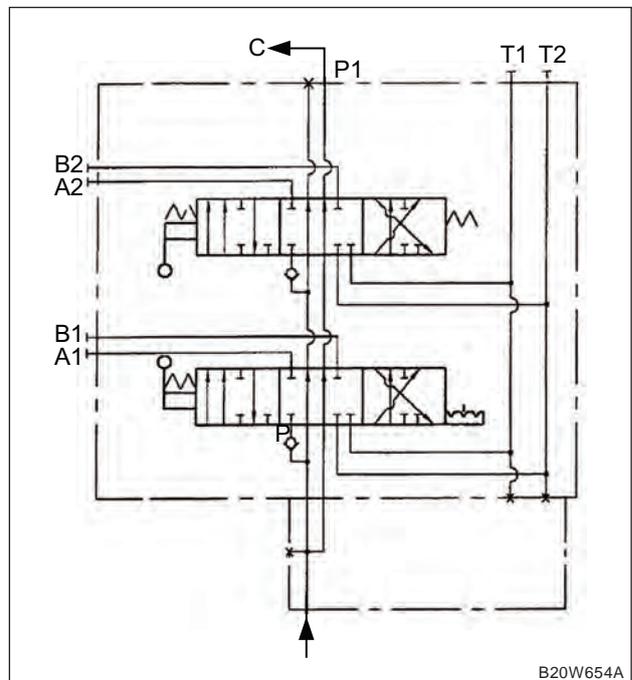
4.6.2 REAR SCV [CABIN MODEL]



The rear SCV is installed to the rear section of the tractor and receives hydraulic oil at a high pressure from the front SCV 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<sup>2</sup> 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<sup>2</sup> 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.

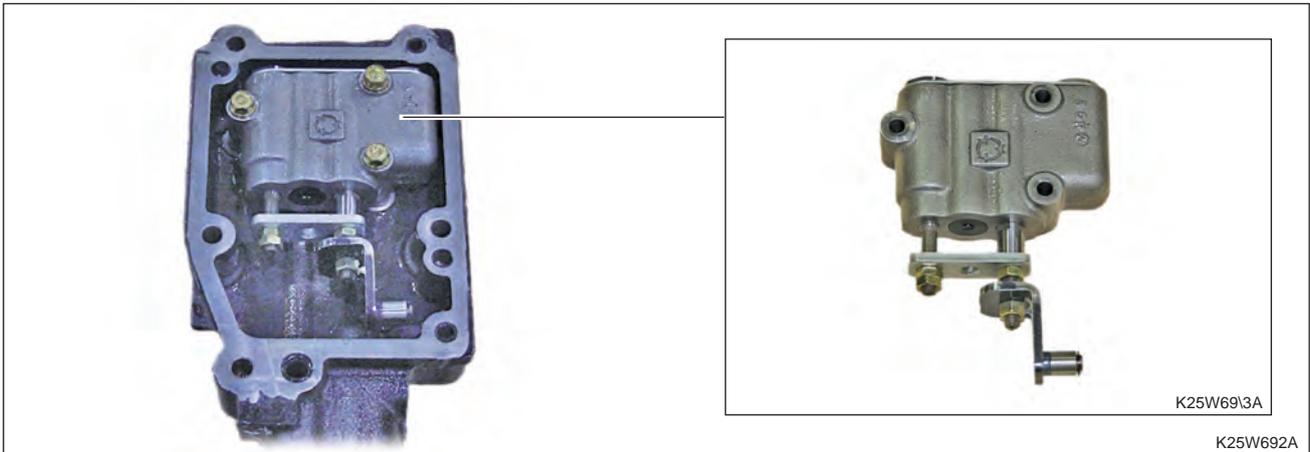
It is okay to use the double acting valve for operation of a single acting cylinder as described. However, if a single acting cylinder is used for an extended period of time, the relief valve is operated continuously, causing several problems, including rise of transmission fluid temperature and fatigue of the gear pump.

#### ► VALVE SPECIFICATIONS

ITEM	SPECIFICATION
Max. flow	30 l/min.
Max. operating pressure	210 kgf/cm <sup>2</sup>
Relief valve setting pressure	180 ~ 185 kgf/cm <sup>2</sup>
Operating oil	TF500

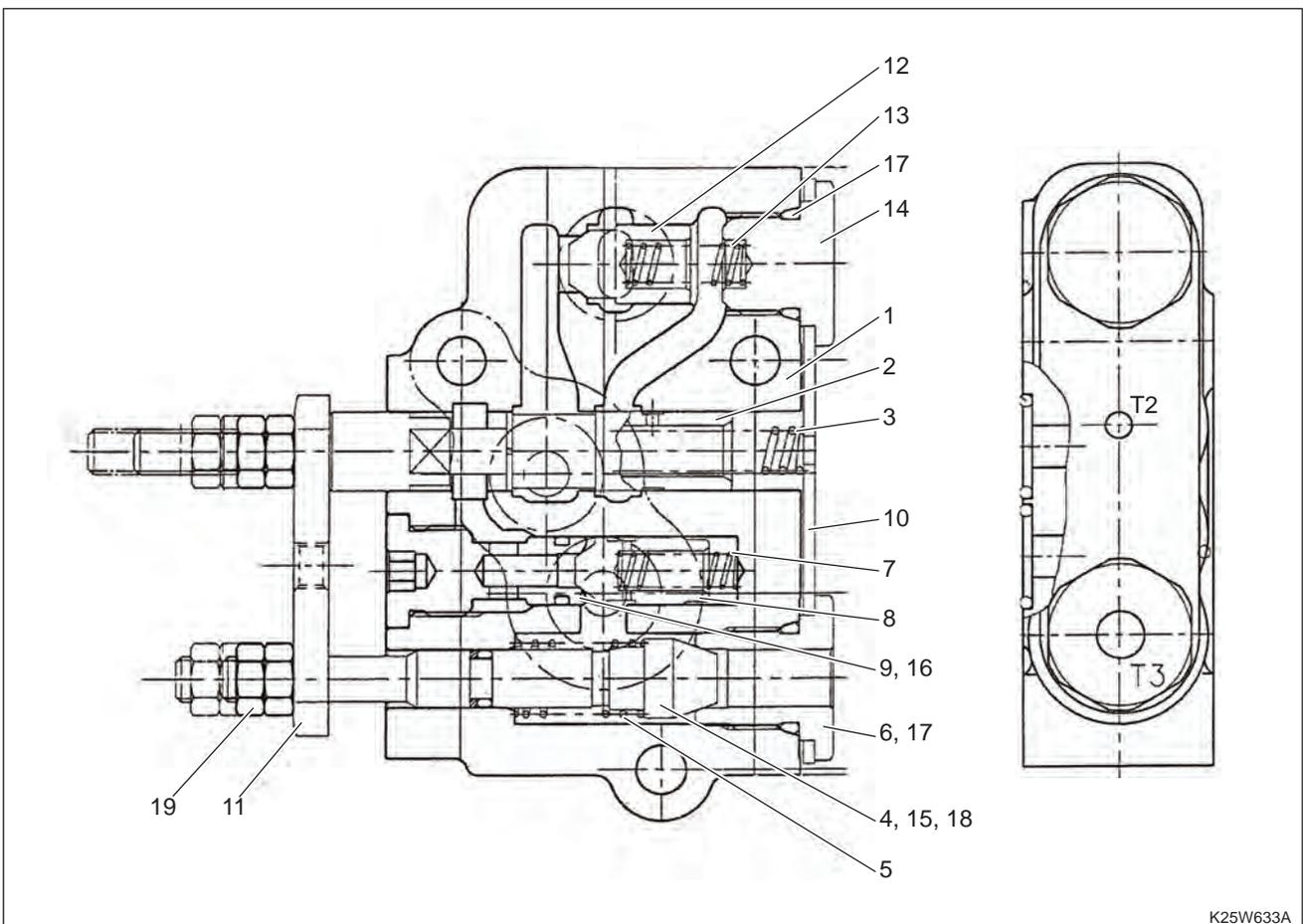
4.7 CONTROL VALVE

► OVERVIEW



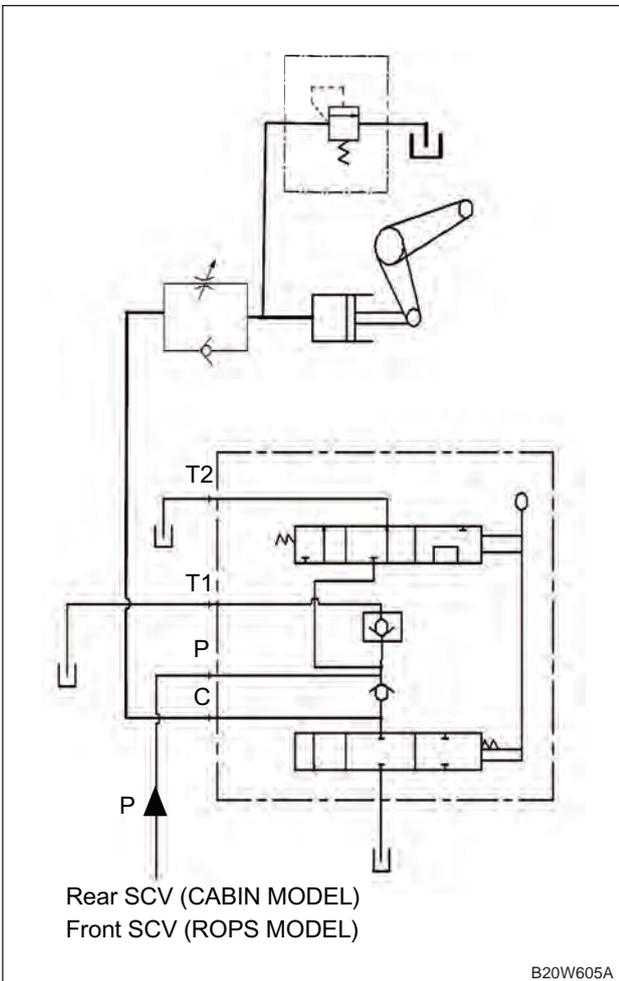
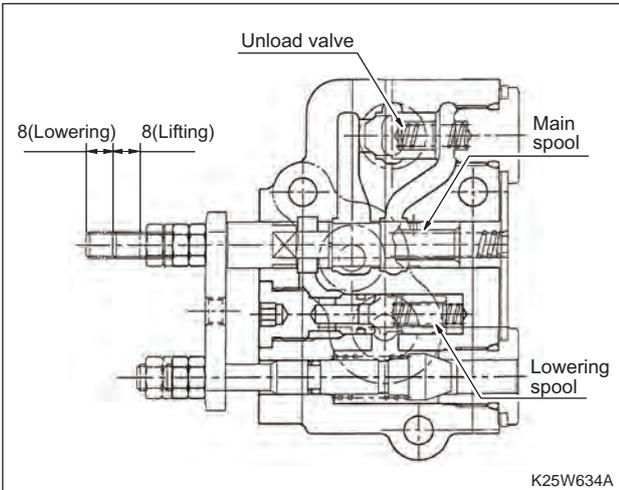
The control valve is installed in the hydraulic cylinder cover and it receives oil at a high pressure from the rear SCV (CABIN MODEL) or front SCV (ROPS MODEL) through carryover operation. The internal spool is operated according to the position of the control lever to lift or lower the lift arm or set it in the neutral status.

► COMPONENTS



- |                    |                    |                  |                  |
|--------------------|--------------------|------------------|------------------|
| (1) Body           | (6) M.Check plug   | (11) Plate-B     | (16) O-ring      |
| (2) Main spool     | (7) L.Check spring | (12) U.L. Check  | (17) O-ring      |
| (3) Main spring    | (8) L.Check        | (13) U.L. Spring | (18) Backup ring |
| (4) M.Check poppet | (9) L.Check seat   | (14) U.L. Plug   | (19) Nut         |
| (5) M.Check spring | (10) Plate-A       | (15) O-ring      |                  |

► 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.

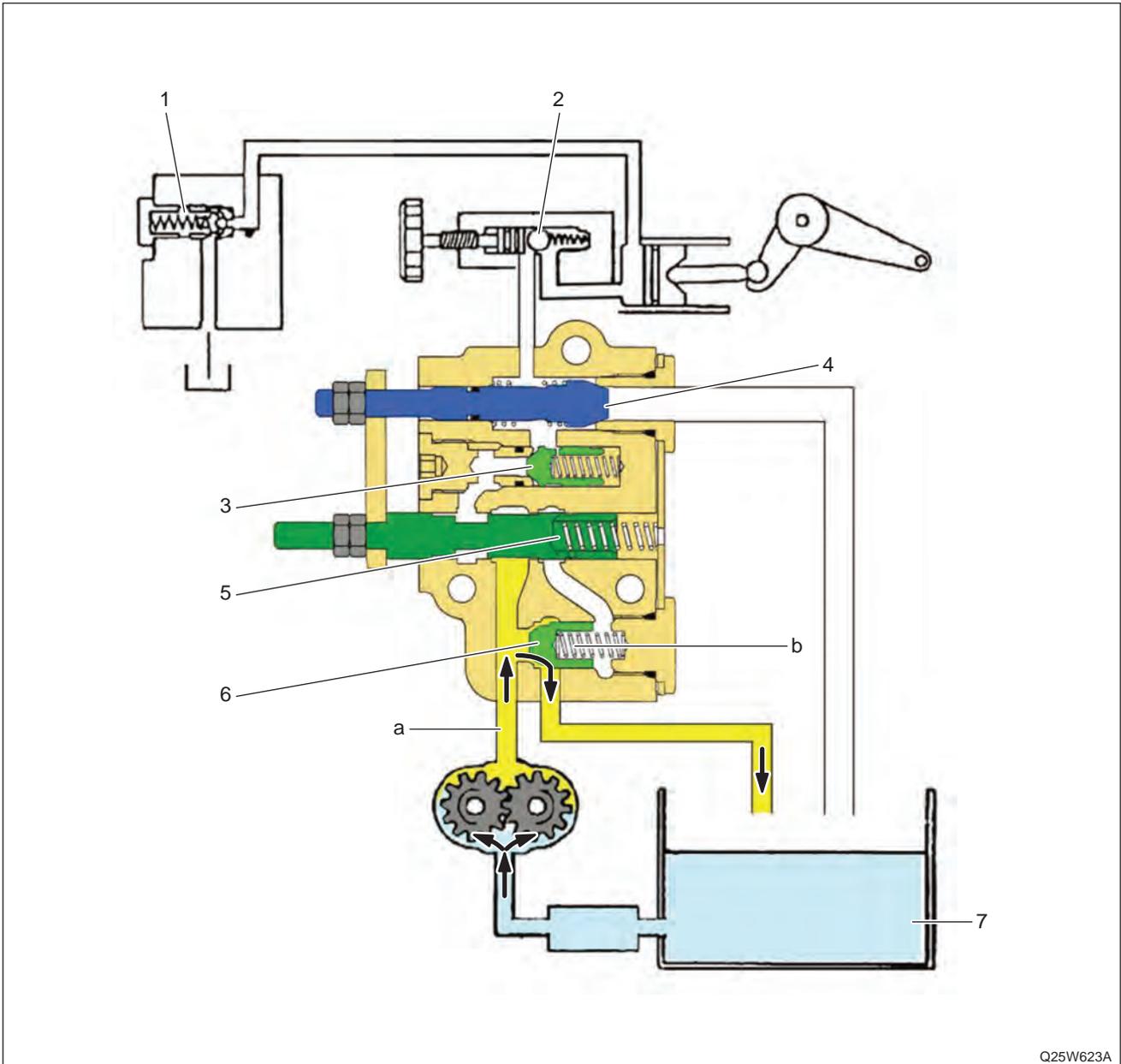
When the position ordered by the position control lever is matched to the actual position of the lower link after lifting or lowering operation, the spool of the control valve is kept in the neutral position by the link structure set in the hydraulic cylinder case. Therefore, the lower link is maintained in the current position.

► VALVE SPECIFICATIONS

ITEM	SPECIFICATION
Max. flow	45 l/min.
Operating oil	TF500
Operating pressure	175 kgf/cm <sup>2</sup>

4.7.1 OPERATION AND OIL FLOW

► NEUTRAL

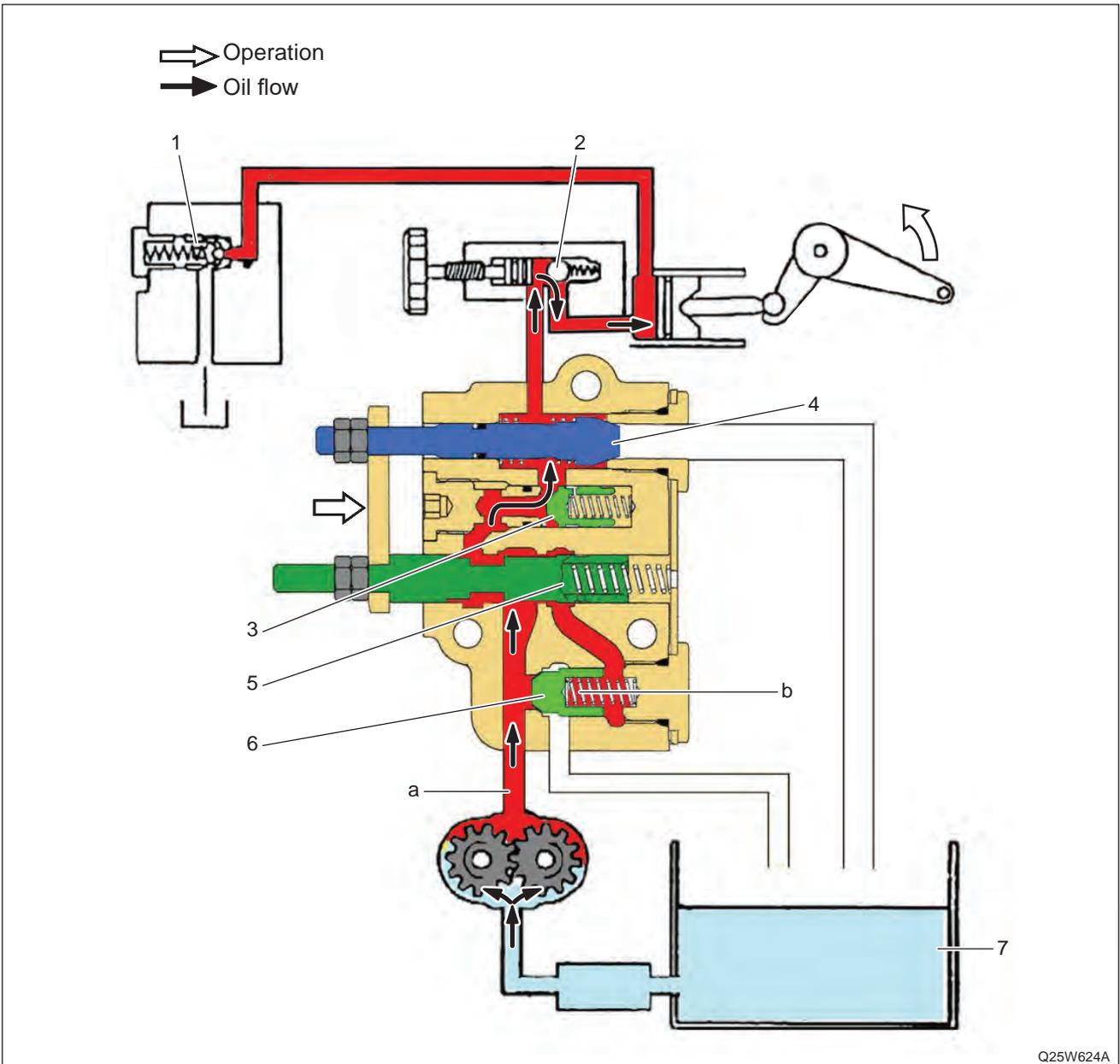


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- |                       |                      |                  |              |
|-----------------------|----------------------|------------------|--------------|
| (1) Safety valve      | (3) Load check valve | (5) Main spool   | (7) Oil tank |
| (2) Slow return valve | (4) Mechanical valve | (6) Unload valve |              |

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.

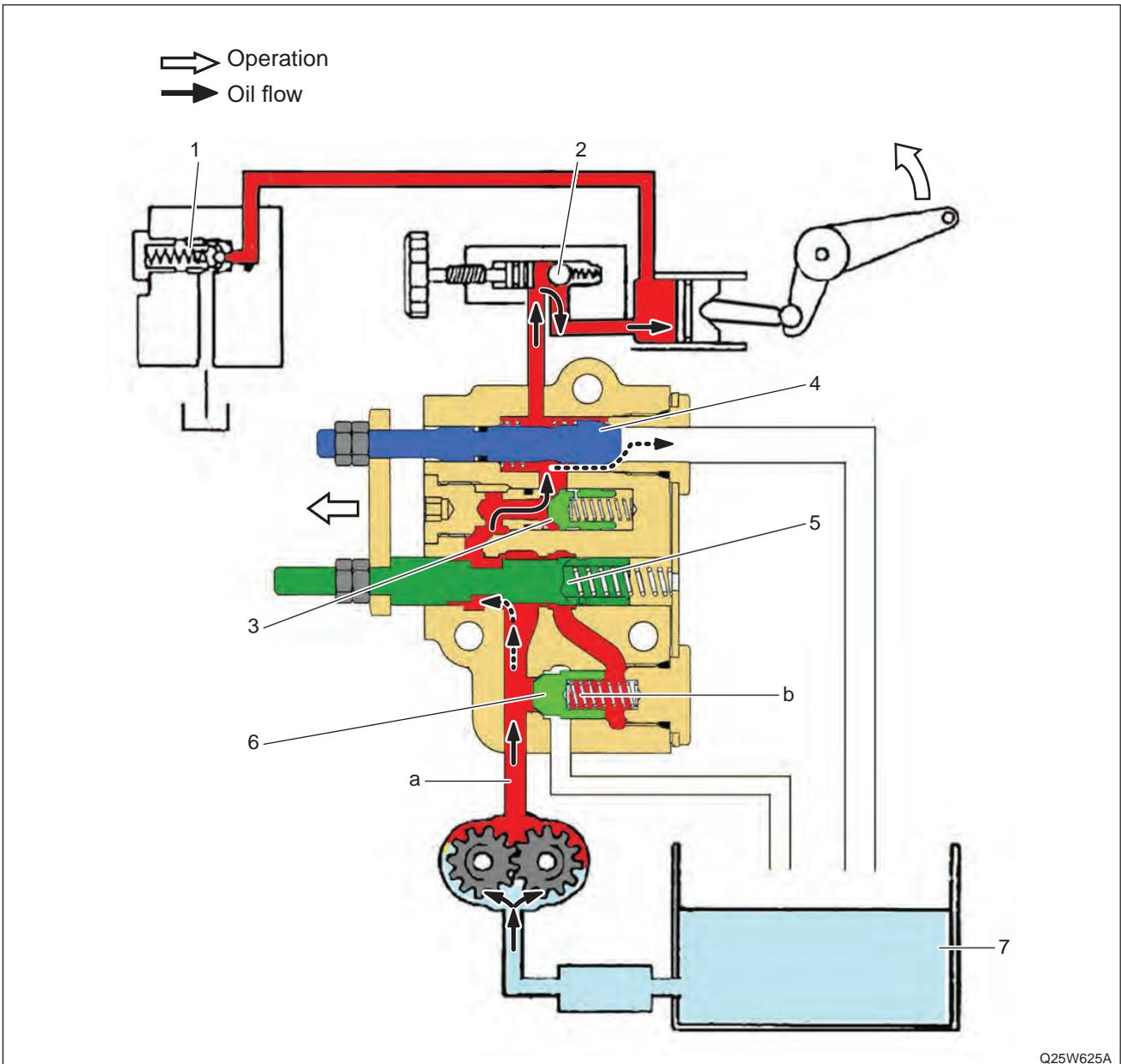
► LIFTING (RAPID LIFTING)



- |                       |                      |                  |              |
|-----------------------|----------------------|------------------|--------------|
| (1) Safety valve      | (3) Load check valve | (5) Main spool   | (7) Oil tank |
| (2) Slow return valve | (4) Mechanical valve | (6) Unload valve |              |

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.

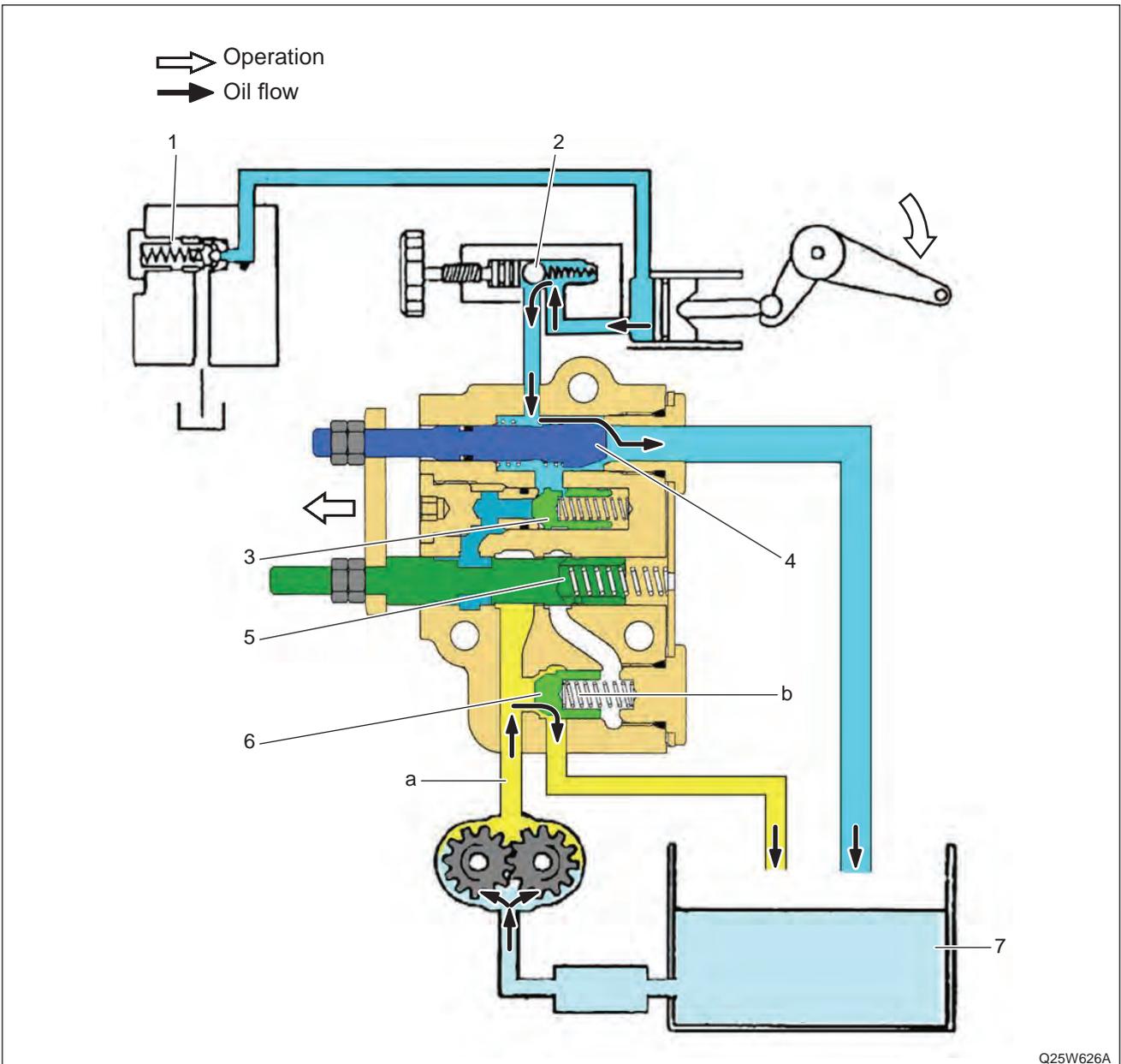
► LIFTING (LOW-SPEED LIFTING)



- |                       |                      |                  |              |
|-----------------------|----------------------|------------------|--------------|
| (1) Safety valve      | (3) Load check valve | (5) Main spool   | (7) Oil tank |
| (2) Slow return valve | (4) Mechanical valve | (6) Unload valve |              |

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.

► LOWERING

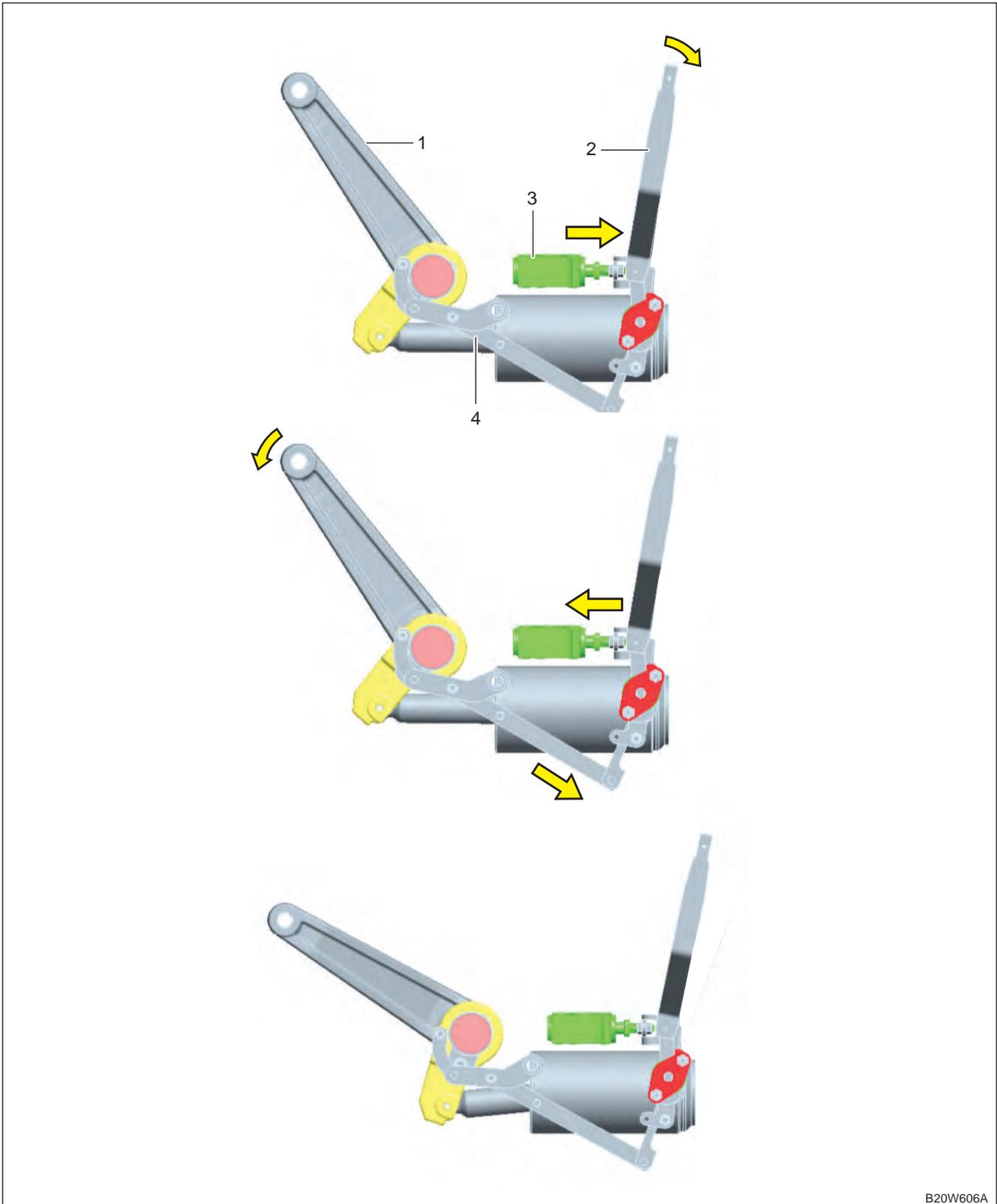


- (1) Safety valve
- (2) Slow return valve
- (3) Load check valve
- (4) Mechanical valve
- (5) Main spool
- (6) Unload valve
- (7) Oil tank

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.

4.7.2 POSITION CONTROL LEVER OPERATION

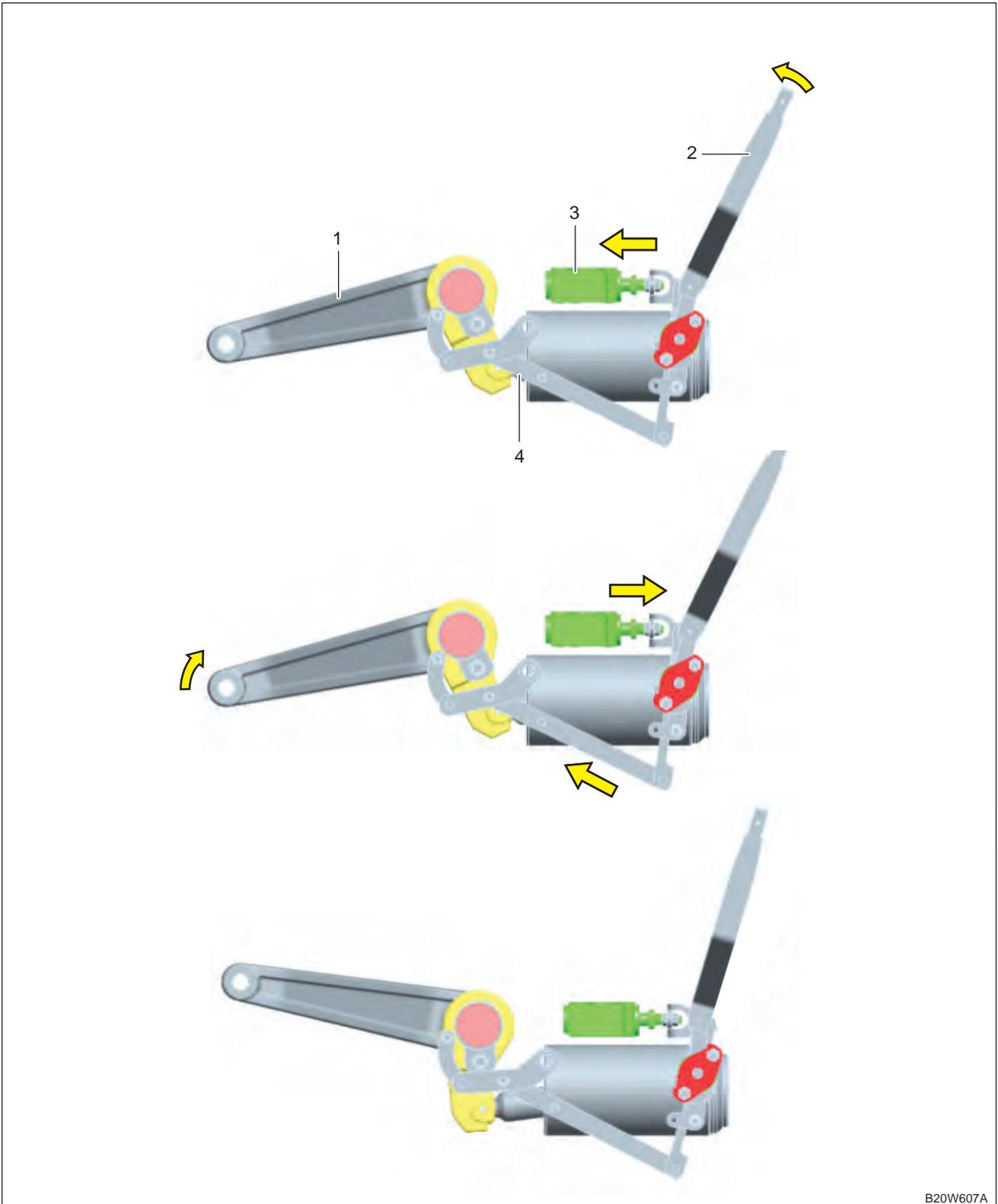
► LOWERING



(1) Lift arm                      (2) Position control lever                      (3) Control valve                      (4) Feedback rod

When setting the position 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.

► LIFTING



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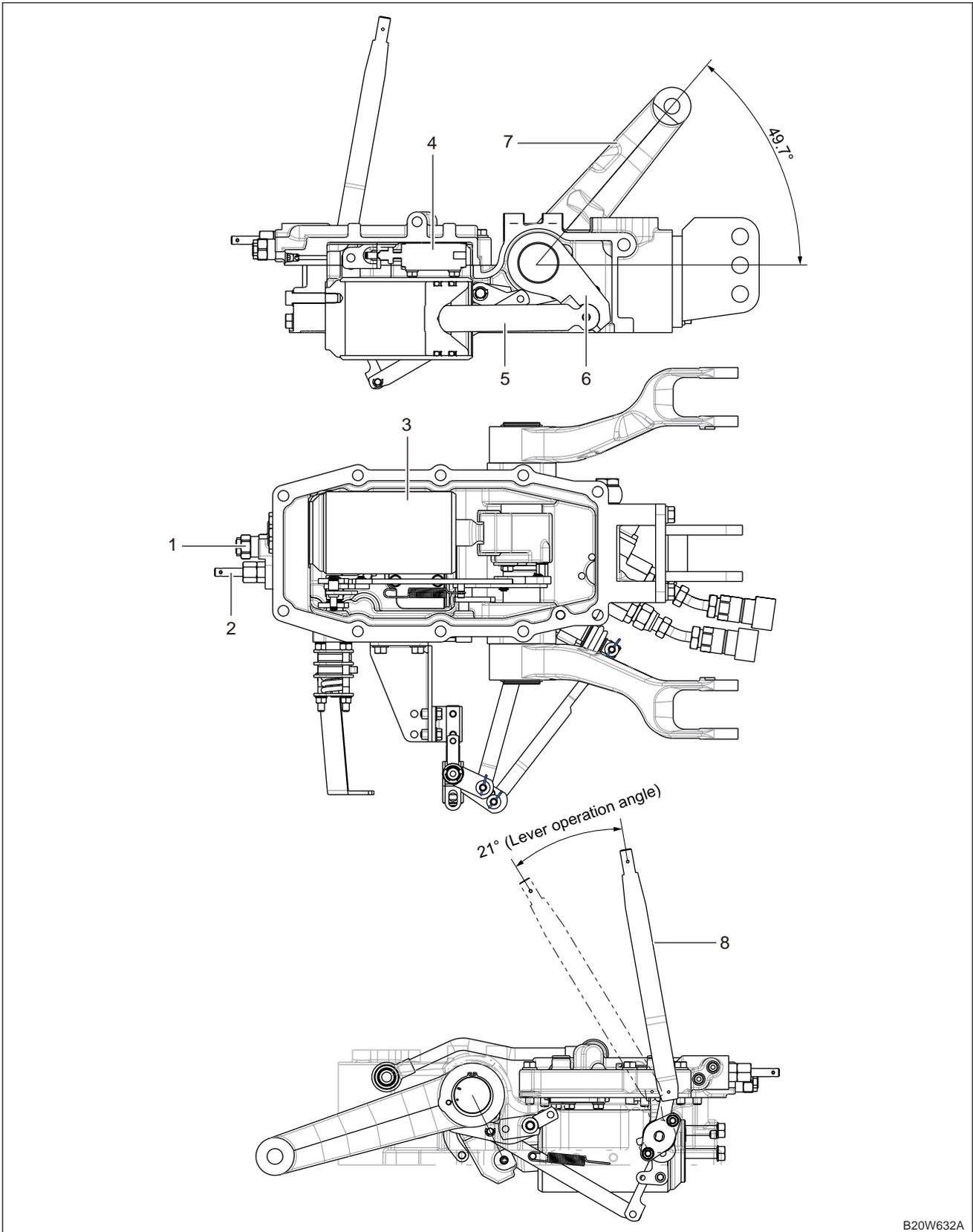
(1) Lift arm                      (2) Position control lever                      (3) Control valve                      (4) Feedback rod

When the position 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 position control lever still in the lifting position. Therefore, the spool is returned to the neutral position during the lowering operation as well.

4.8 HYDRAULIC CYLINDER CASE ASSEMBLY

4.8.1 HYDRAULIC CYLINDER CASE

**COMPONENTS**



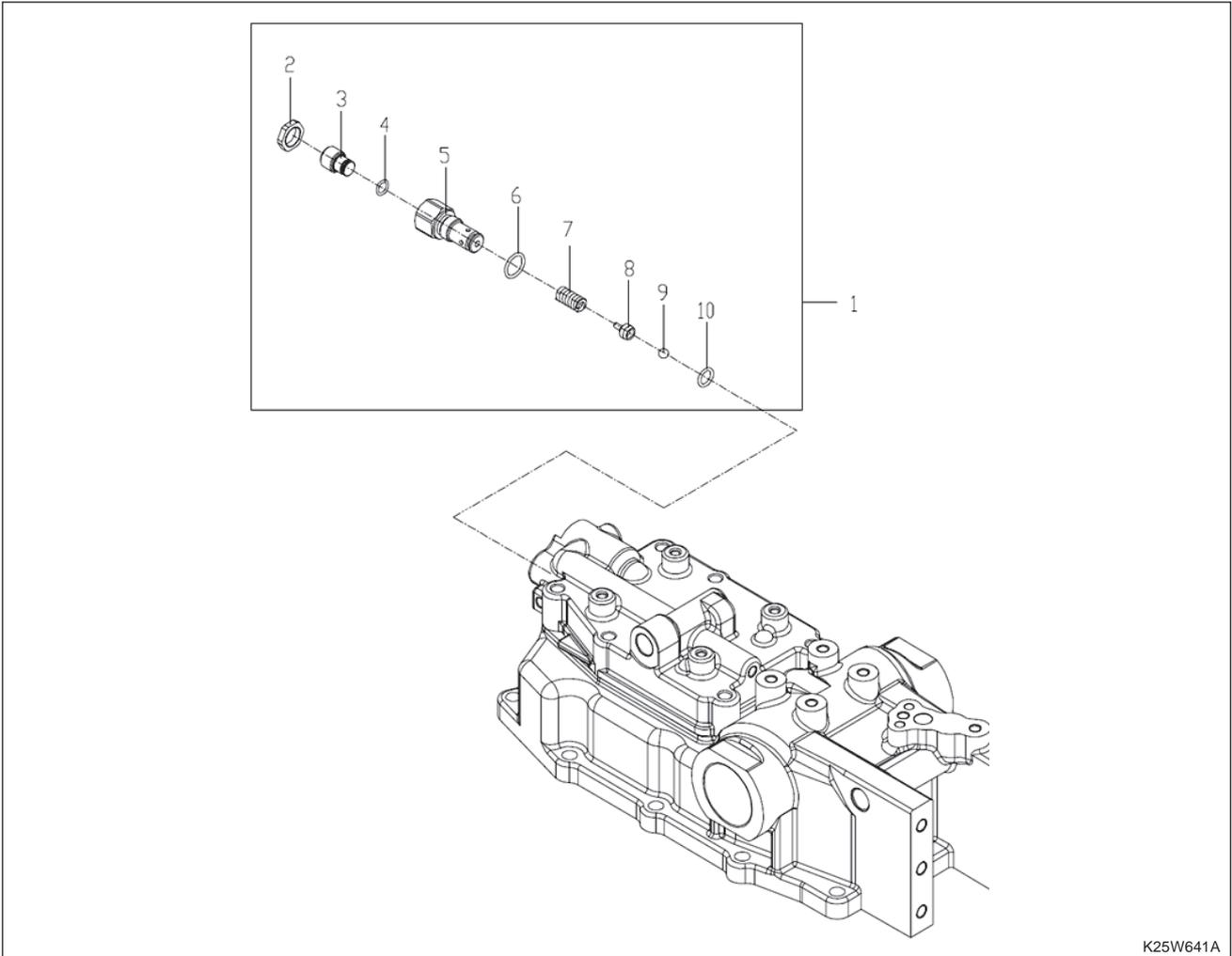
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- (1) Safety valve
- (2) Lowering speed control valve
- (3) Cylinder ass'y

- (4) Lift/Lowering control valve
- (5) Piston rod
- (6) Lift crank

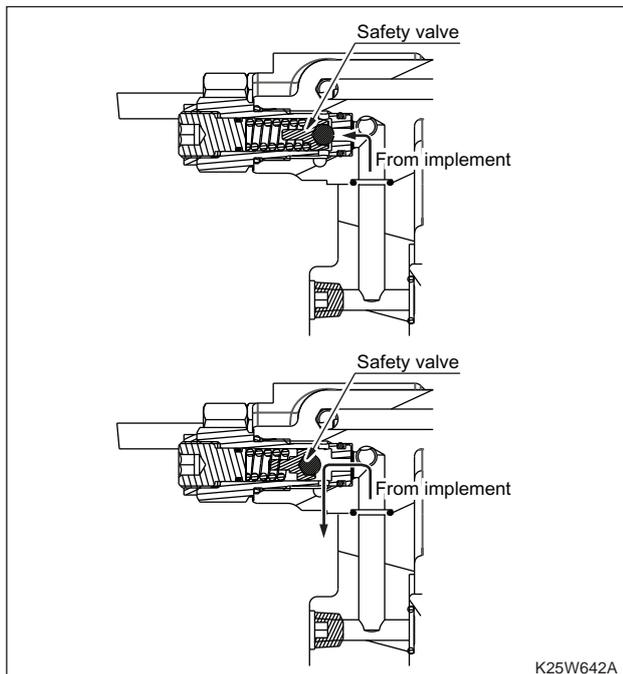
- (7) Lift arm
- (8) Position lever ass'y

4.8.2 SAFETY VALVE



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- (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



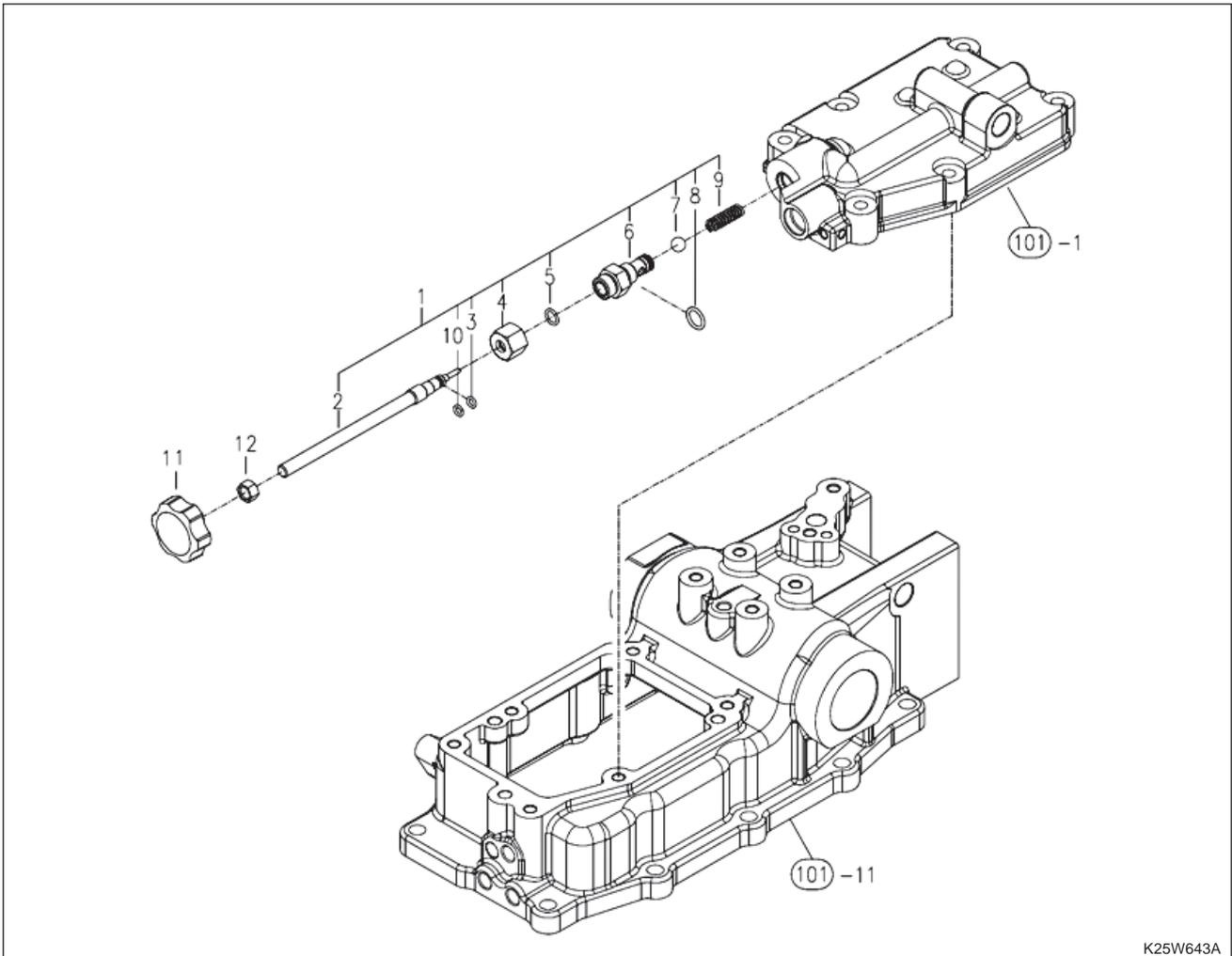
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The piston of the hydraulic cylinder case is supplied with hydraulic oil through the lift solenoid valve of the control valve. If the lift arm is overloaded by this oil, pressure in the circuit rises continuously.

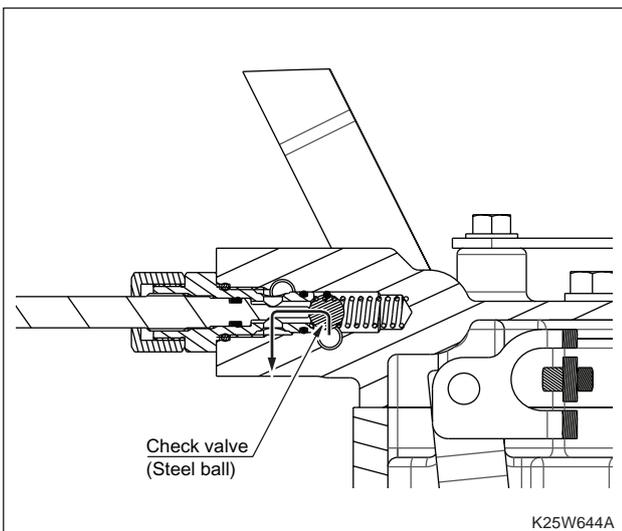
In other words, if impact pressure is applied from an external source to an implement and this pressure is over a certain limit, the safety valve is opened to drain oil back to the tank in order to protect the internal circuit of the hydraulic implement.

<b>RELIEF VALVE SETTING PRESSURE</b>	$210 \pm 10 \text{ kgf/cm}^2$
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4.8.3 STOP VALVE (ALSO AS SLOW RETURN VALVE)



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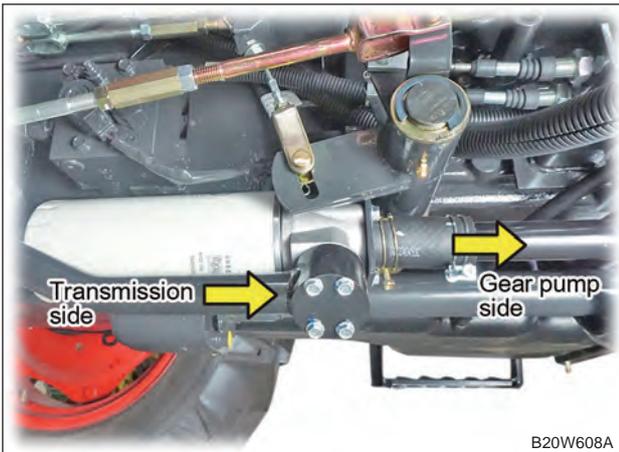


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Stop valve is used to stop lowering or adjust the lowering speed of the hydraulic lift. When turning the handle counterclockwise, the lowering speed of the lift arm increases. Turning it clockwise slows down the lowering speed. Also, when turning it clockwise to its end, the oil flow passage is blocked so the lift arm is stopped at the current position.

4.9 HYDRAULIC FILTER AND STRAINER

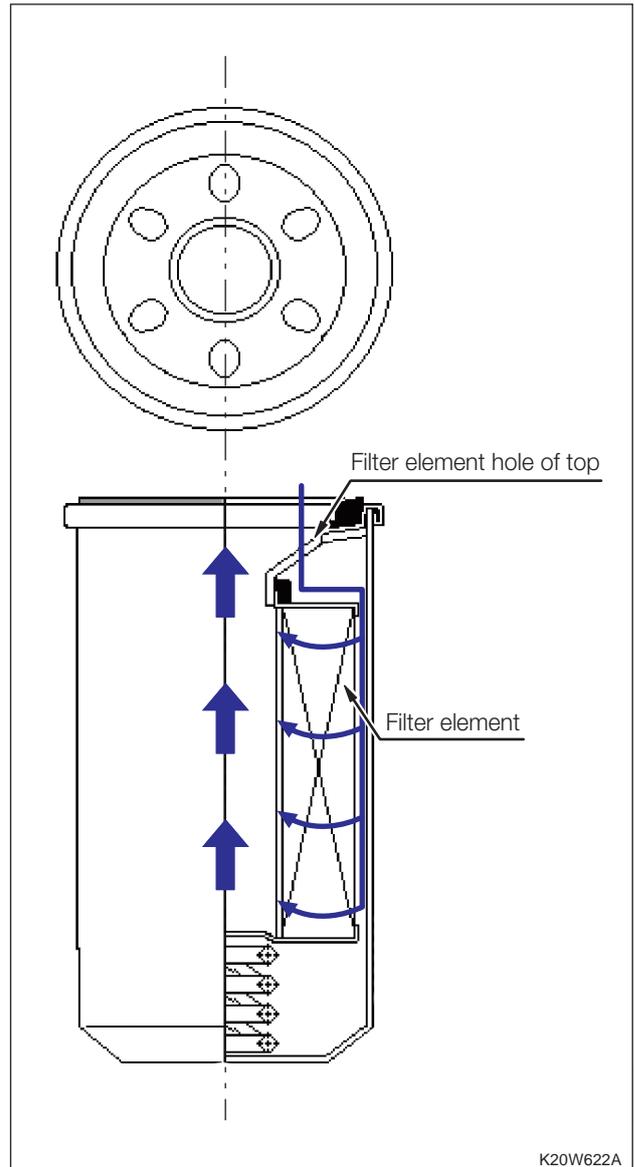
4.9.1 HYDRAULIC FILTER



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Oil supplied from the gear pump is passed through two filtering processes before it gets to the gear pump from the transmission (oil tank). The strainer is installed before the suction pipe connection for the 1st filtering and the hydraulic filter is installed in the middle between the transmission and gear pump for the 2nd filtering.

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.



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► FILTER ELEMENT SPECIFICATIONS

Filtering area	4,972 cm <sup>2</sup>
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 500 hours (or 1 year) of use**

## 4.10 POSITION CONTROL

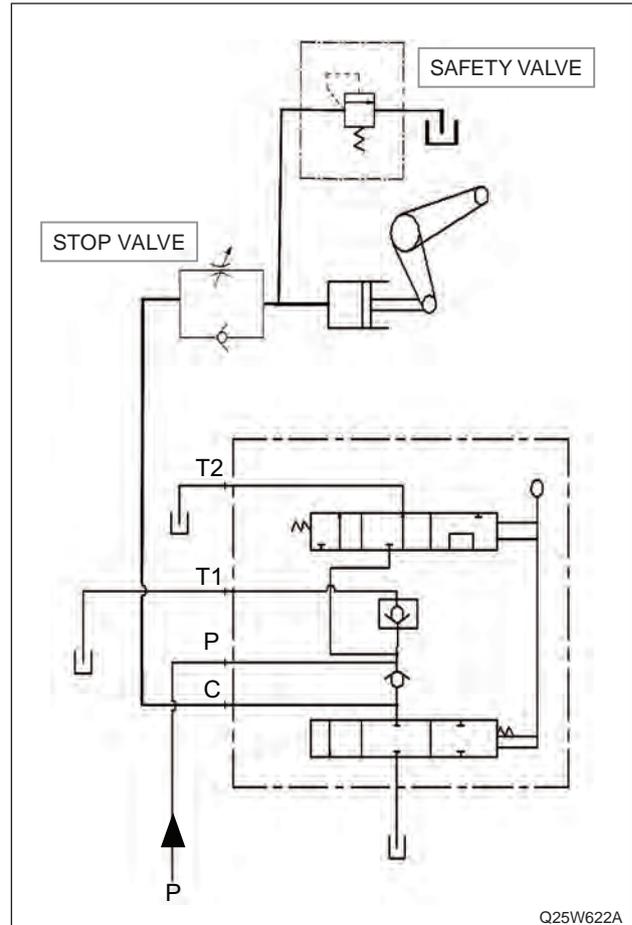


(1) Position control lever

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.



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.

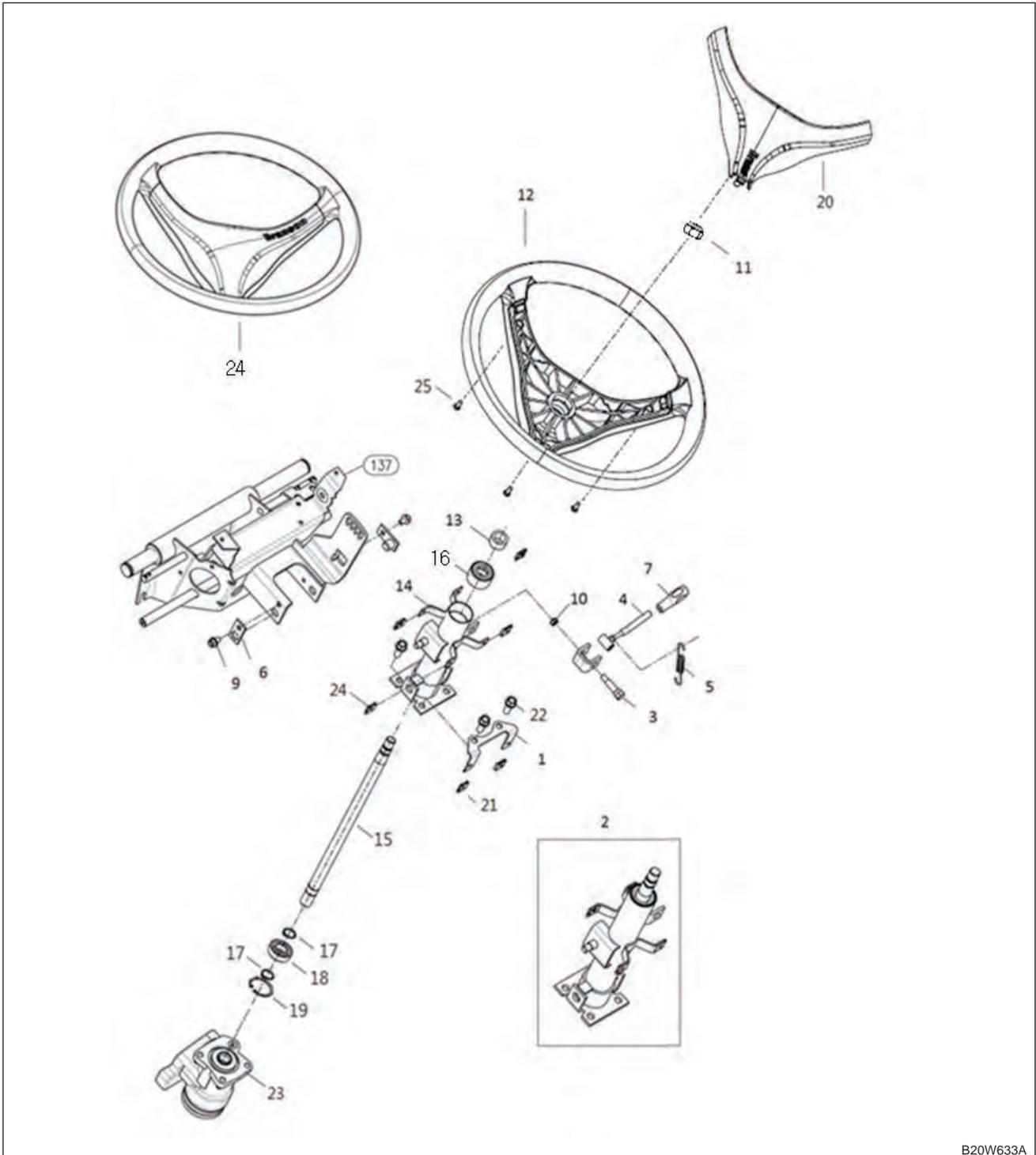
The lowering speed of the implement can be adjusted with the stop valve on the front of the hydraulic cylinder case. Turning the stop valve counterclockwise increases the lowering speed while turning it clockwise decreases the lowering speed. When turning the valve clockwise, it is locked so the lift arm stops lowering.

5. TROUBLESHOOTING

PROBLEMS	CAUSE OR SYMPTOM	SOLUTION
<p>The 3-point hitch cannot be lifted.</p>	<ul style="list-style-type: none"> <li>• Improperly installed control valve</li> <li>• Damaged control valve</li> <li>• Foreign material stuck in control valve or spool stuck</li> <li>• Insufficient transmission fluid</li> <li>• Clogged oil filter</li> <li>• Damaged hydraulic pump</li> <li>• Damaged cylinder piston ring of hydraulic cylinder case</li> </ul>	<ul style="list-style-type: none"> <li>• Remove and re-install it.</li> <li>• Replace it with a new one.</li> <li>• Remove, clean and repair it.</li> <li>• Add transmission fluid.</li> <li>• Clean or replace it.</li> <li>• Repair or replace it.</li> <li>• Check the backup ring and O-ring and replace it as necessary.</li> </ul>
<p>The 3-point hitch cannot be lowered.</p>	<ul style="list-style-type: none"> <li>• Damaged stop valve</li> <li>• Foreign material stuck in control valve</li> </ul>	<ul style="list-style-type: none"> <li>• Check and repair the stop valve.</li> <li>• Remove and clean the control valve.</li> </ul>

6. SECTIONAL VIEW FOR MAJOR COMPONENTS

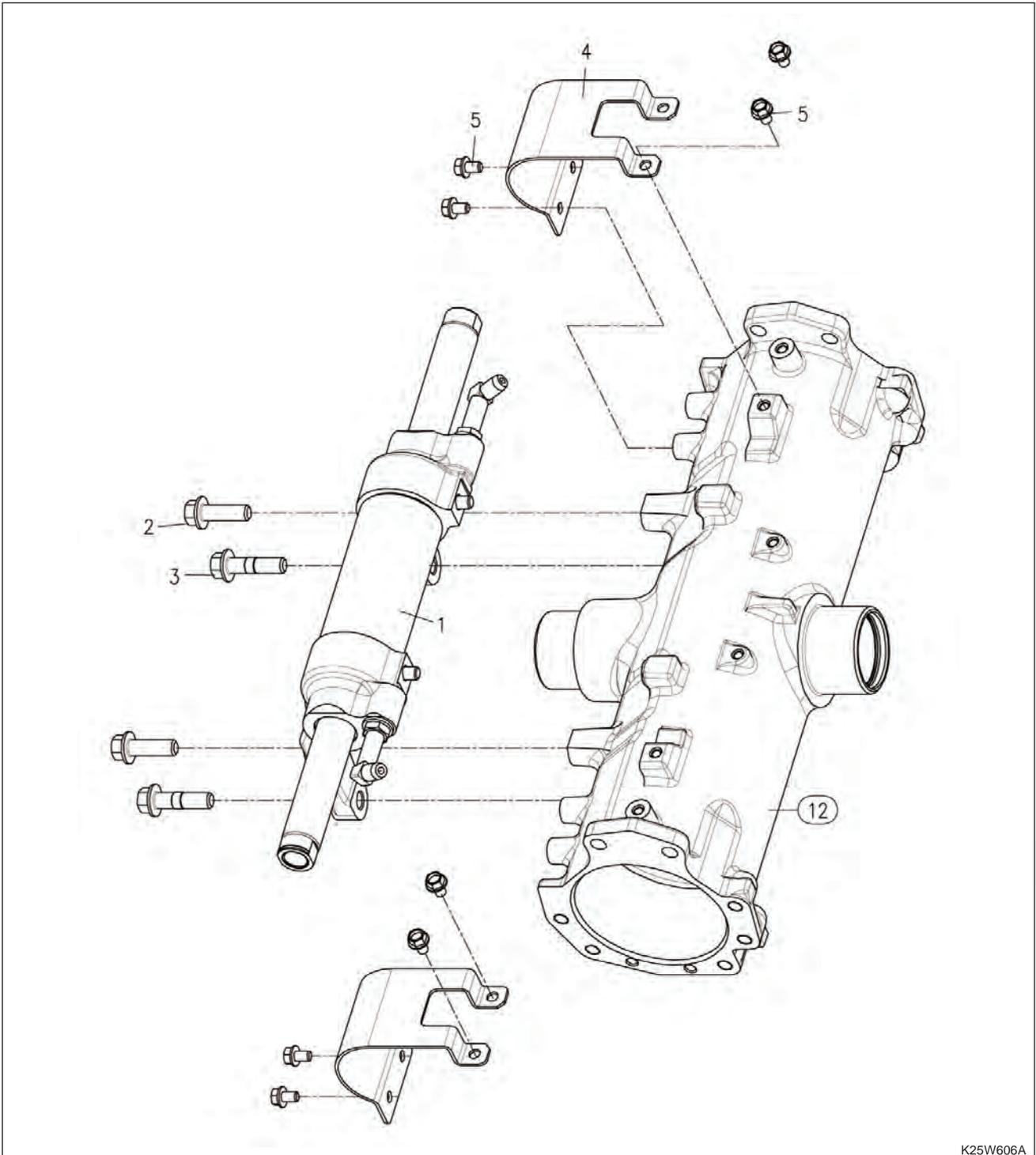
6.1 STEERING COLUMN



COMPONENTS

- |                              |                        |                           |
|------------------------------|------------------------|---------------------------|
| (1) Bracket (column cover-R) | (10) U-nut             | (18) Ball bearing         |
| (2) Column ass'y             | (11) U-nut             | (19) Snap ring            |
| (3) Tilt elver pin           | (12) Steering wheel    | (20) Cover                |
| (4) Tilt lever               | (13) Cover(shaft)      | (21) Speed nut            |
| (5) Tilt spring              | (14) Column,steering   | (22) Hex flange bolt      |
| (6) Tilt pin ass'y           | (15) Shaft, steering   | (23) PST valve ass'y      |
| (7) Lever knob               | (16) Column bush       | (24) Steering wheel ass'y |
| (9) Hex flange bolt          | (17) Snap ring(C-type) | (25) Screw                |

6.2 P.S.T CYLINDER



K25W606A

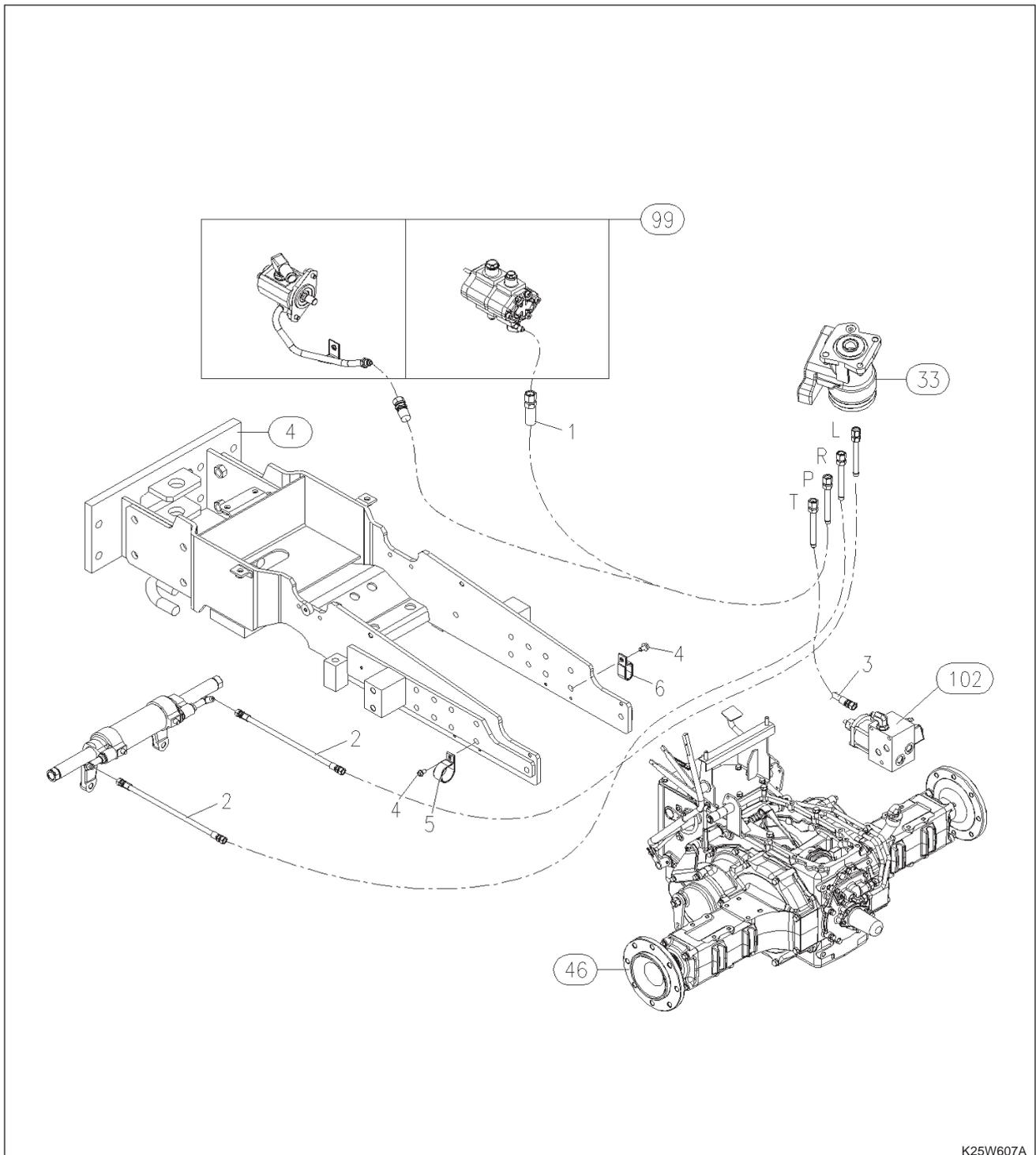
**COMPONENTS**

- (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

6.3 P.S.T PIPE



K25W607A

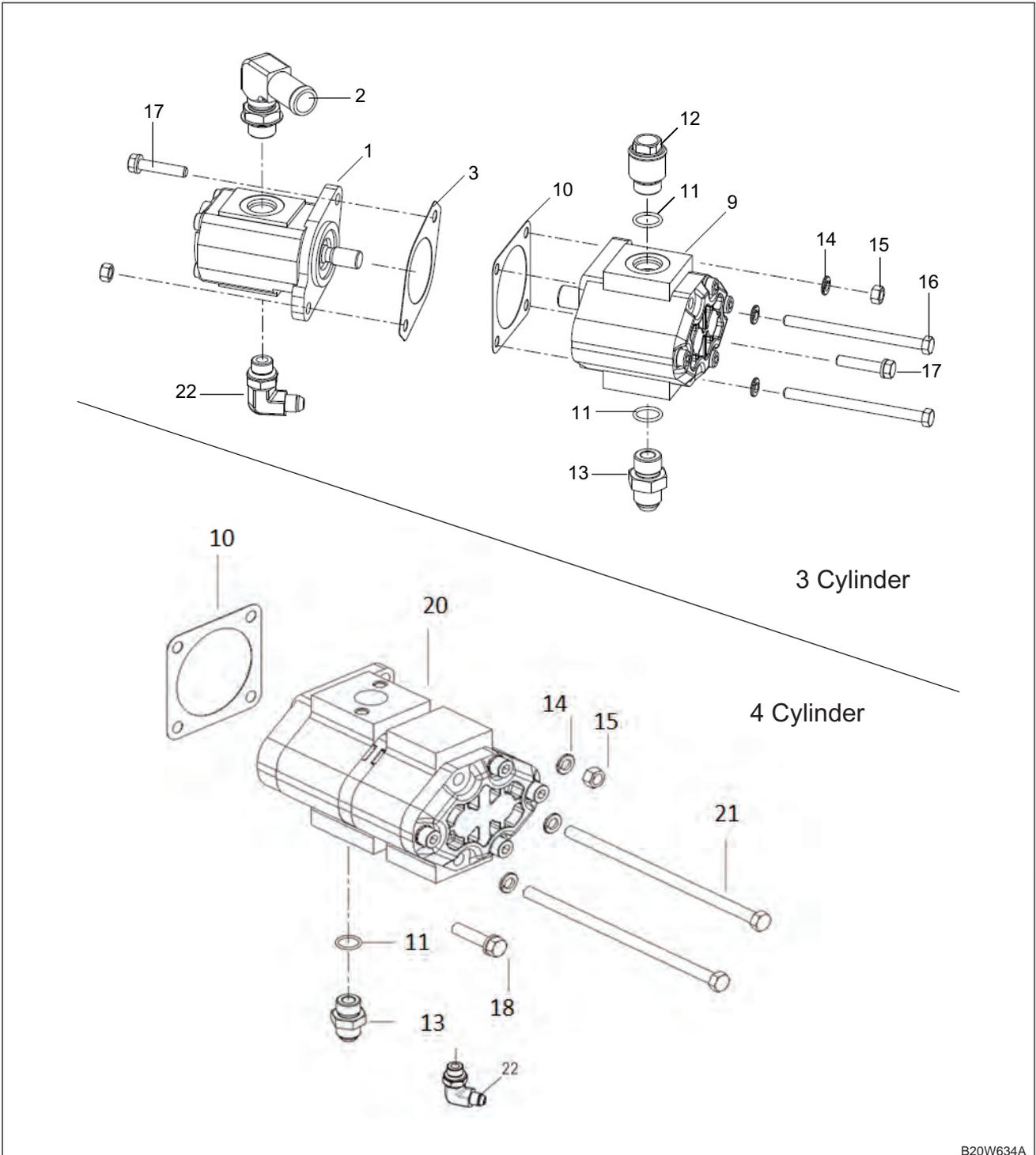
COMPONENTS

- (1) Hose
- (2) Hose

- (3) Hose
- (4) Hex flange bolt

- (5) Clip
- (6) Clip

6.4 HYD PUMP

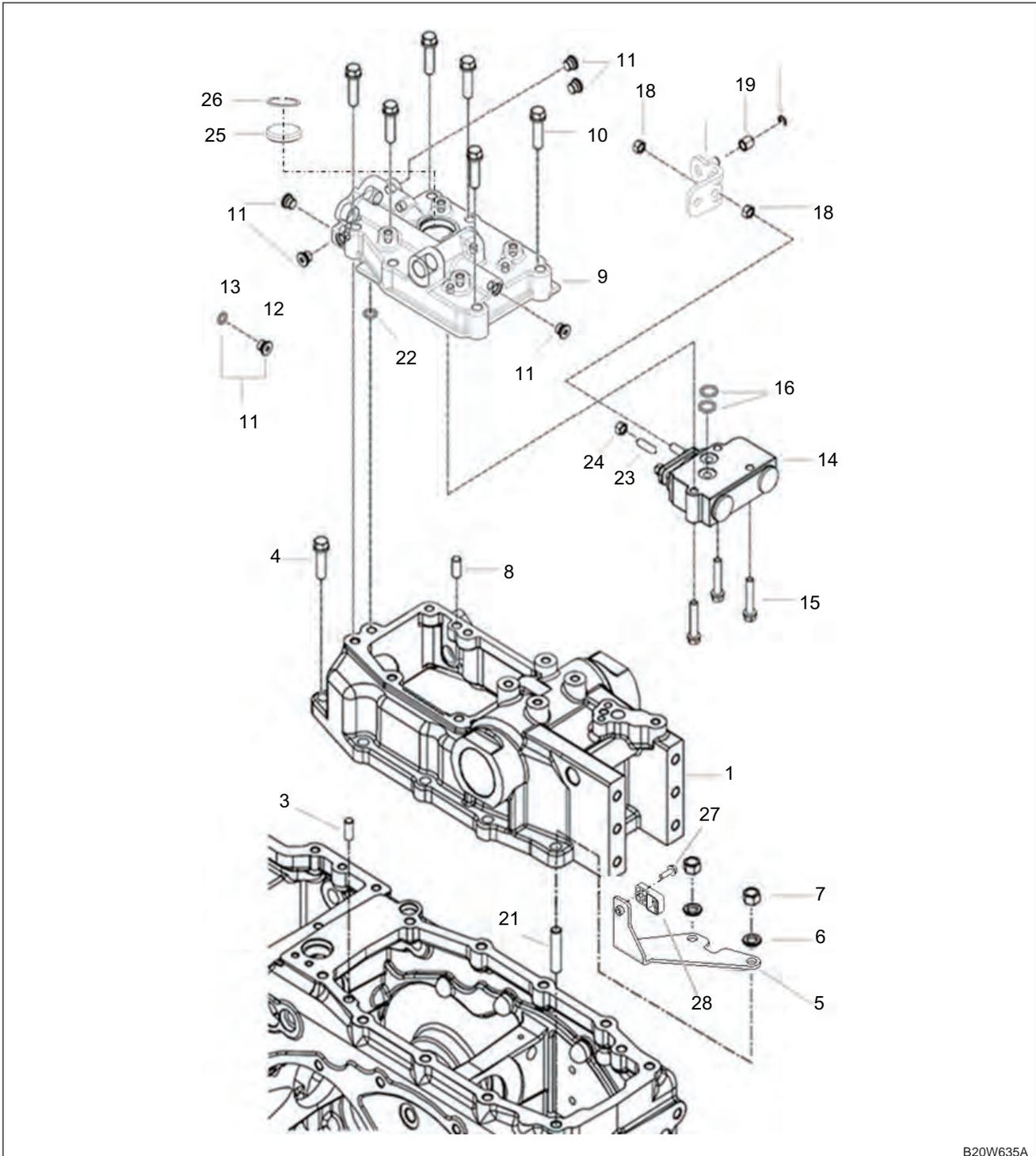


B20W634A

COMPONENTS

- |              |                    |                    |
|--------------|--------------------|--------------------|
| (1) Hyd pump | (12) Joint         | (18) Bolt w/washer |
| (2) Elbow    | (13) Nipple        | (20) Pump          |
| (3) Packing  | (14) Spring washer | (21) Bolt          |
| (9) Hyd pump | (15) Hex nut       | (22) Elbow         |
| (10) Packing | (16) Hex bolt      |                    |
| (11) O-ring  | (17) Bolt w/washer |                    |

6.5 CASE, HYD CYLINDER

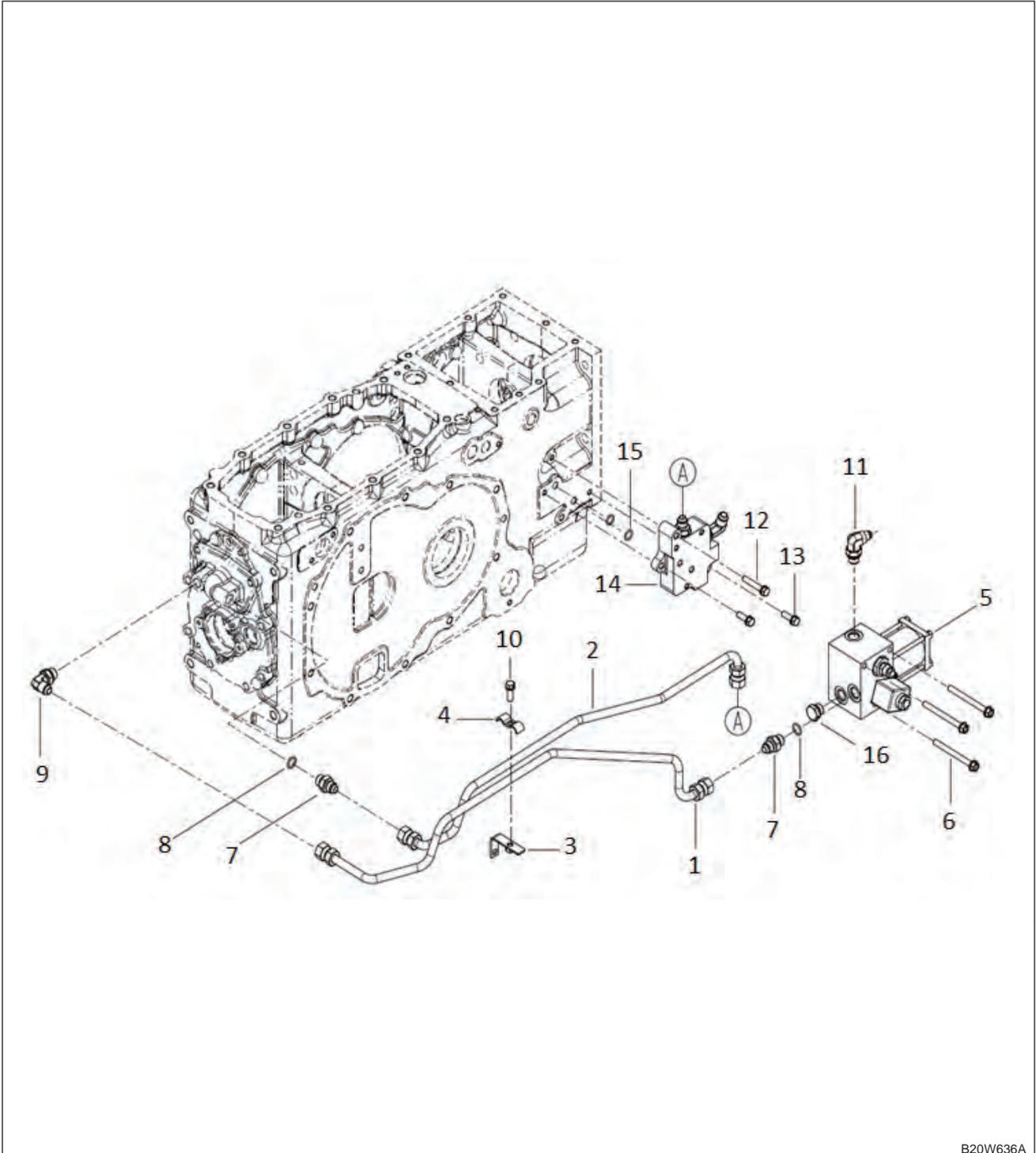


B20W635A

COMPONENTS

- |                         |                           |                      |
|-------------------------|---------------------------|----------------------|
| (1) Case, hyd cylinder  | (11) Plug ass'y           | (20) Snap ring       |
| (3) Pin                 | (12) Plug                 | (21) Stud bolt       |
| (4) Bolt w/washer       | (13) O-ring               | (22) O-ring          |
| (5) Bracket, switch     | (14) Control, valve ass'y | (23) Bolt            |
| (6) Spring washer       | (15) Bolt w/washer        | (24) Hex nut         |
| (7) Hex nut             | (16) O-ring               | (25) Sealing cap     |
| (8) Pin                 | (17) Clevis ass'y         | (26) Snap ring       |
| (9) Cover, hyd cylinder | (18) Hex nut              | (27) Hex flange bolt |
| (10) Bolt w/washer      | (19) Roller               | (28) Lift sensor     |

6.6 IND PTO SUPPORT

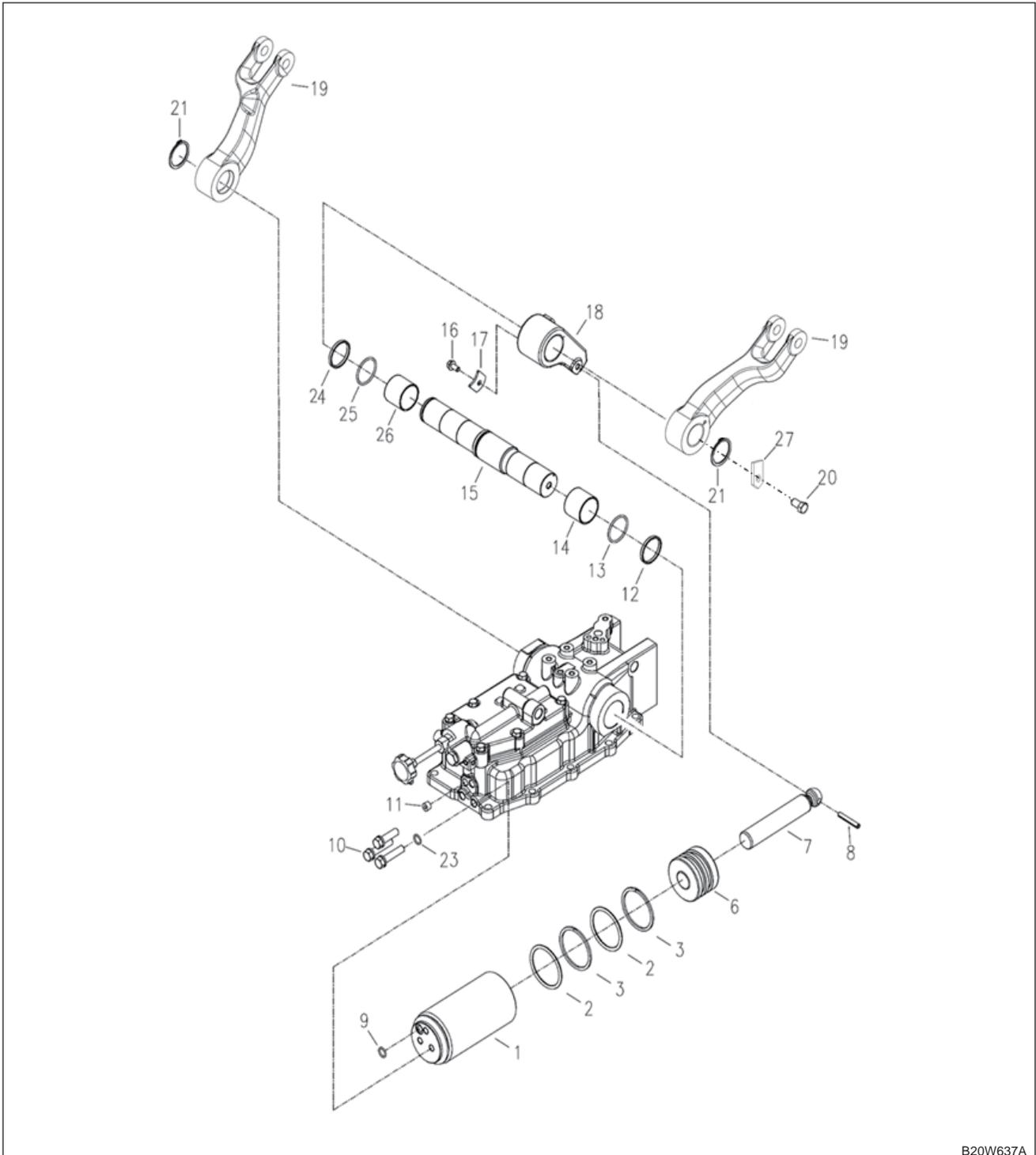


B20W636A

COMPONENTS

- |                                  |                      |                        |
|----------------------------------|----------------------|------------------------|
| (1) PTO HI-pipe                  | (7) Connect PF 3/8   | (13) Bolt w/washer     |
| (2) PTO LO-pipe                  | (8) O-ring(P)        | (14) Valve block ass'y |
| (3) Pipe support bracket (lower) | (9) Elbow            | (15) O-ring            |
| (4) Pipe support bracket (upper) | (10) Bolt w/washer   | (16) Plug              |
| (5) PTO valve                    | (11) Elbow PF1/4-3/8 |                        |
| (6) Hex flange bolt              | (12) Bolt w/washer   |                        |

6.7 PISTON ASS'Y

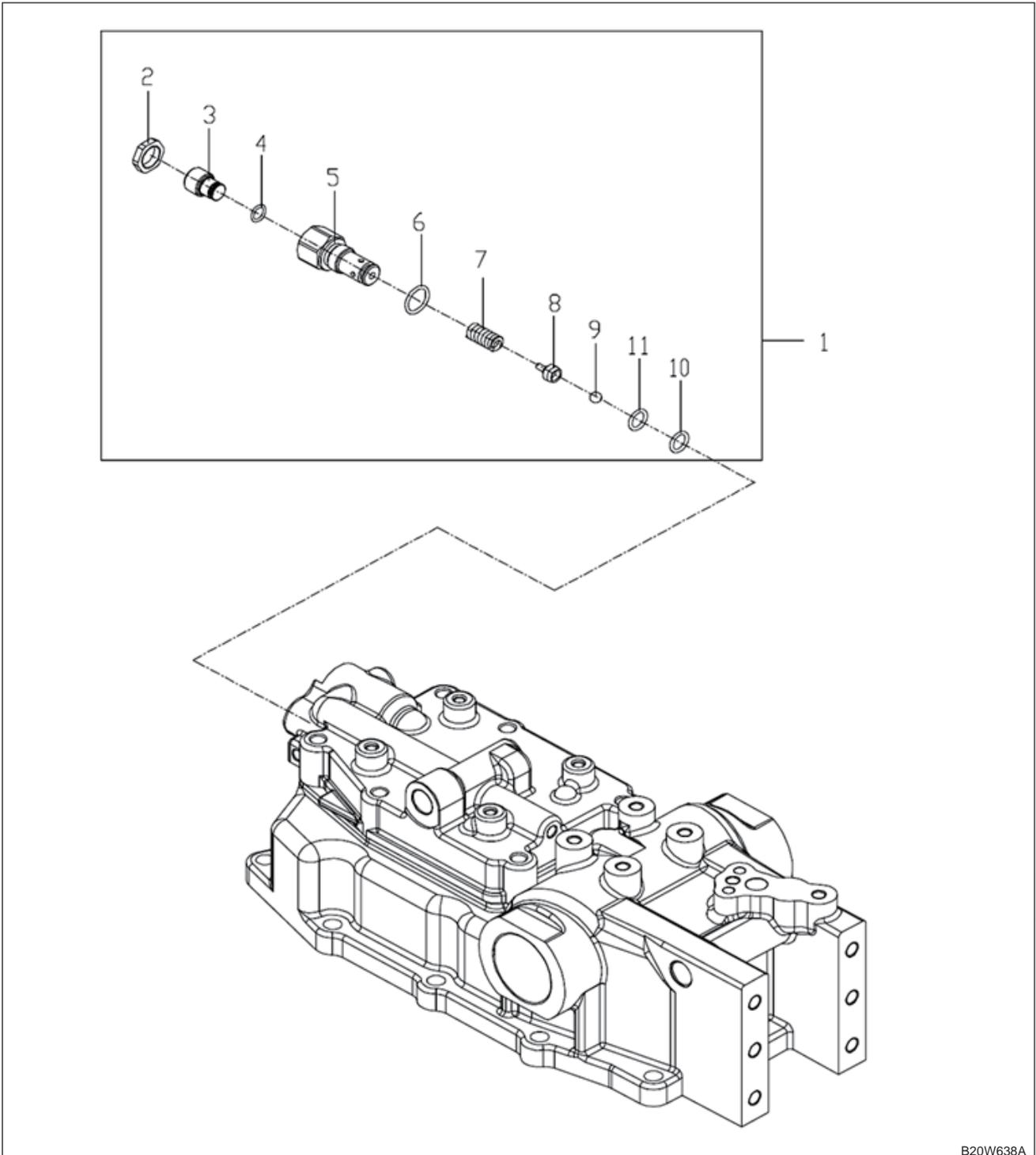


B20W637A

COMPONENTS

- |                  |                       |                        |
|------------------|-----------------------|------------------------|
| (1) Piston ass'y | (12) Ring, backup     | (21) Hex flange bolt   |
| (2) O-ring       | (13) O-ring           | (23) Hex flange bolt   |
| (3) Ring         | (14) Bush             | (24) Snap ring(C-type) |
| (6) Piston       | (15) Shaft, lift link | (25) Bonded seal       |
| (7) Rod, piston  | (16) Hex flange bolt  | (26) Ring, backup      |
| (8) Spring pin   | (17) Plate            | (27) O-ring            |
| (9) O-ring       | (18) Crank, lift      | (28) Bush              |
| (10) Hex bolt    | (19) Arm, lift        | (29) Collar            |
| (11) Plug ass'y  | (20) Cam ass'y        |                        |

6.8 SAFETY VALVE



B20W638A

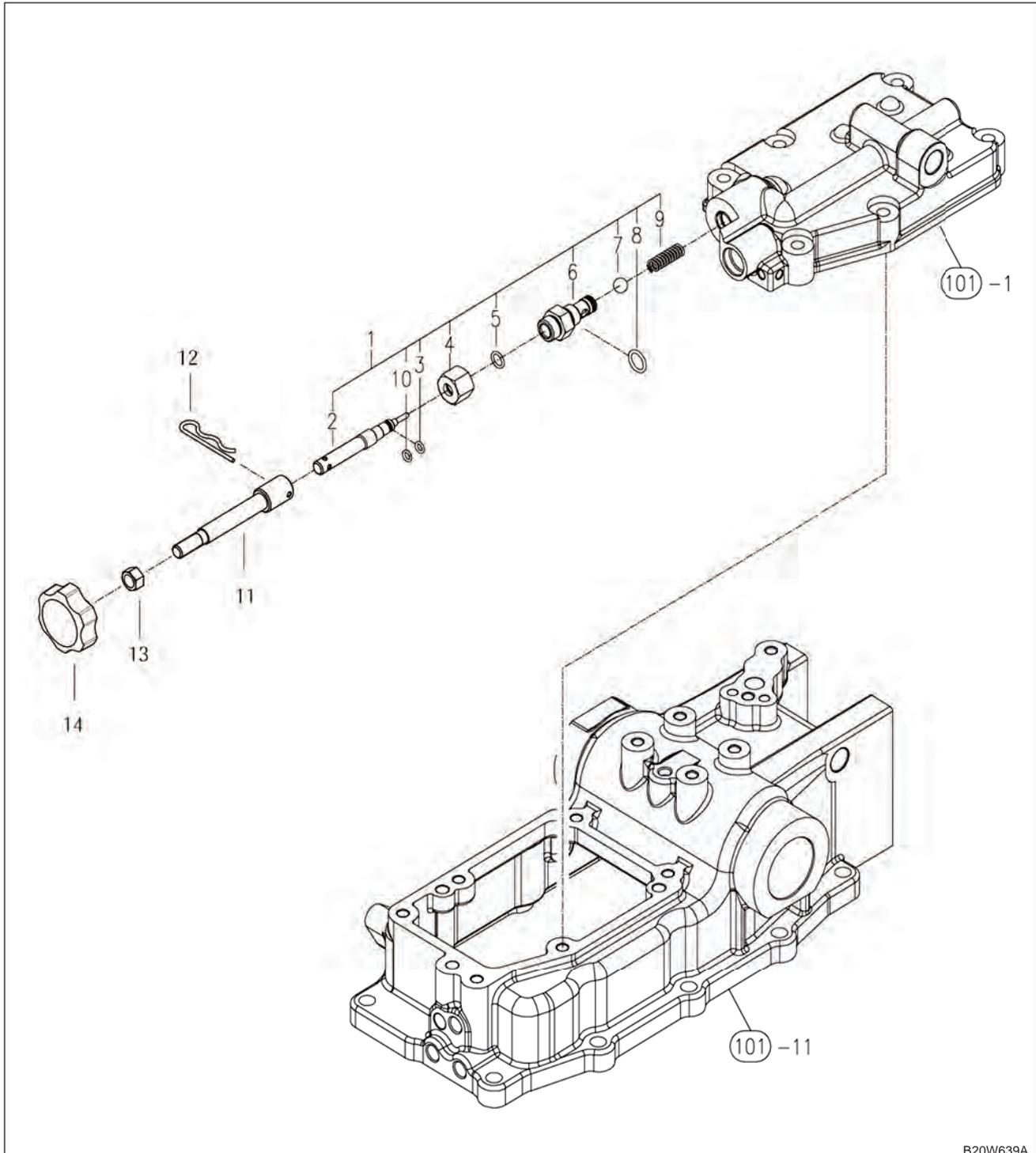
**COMPONENTS**

- (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
- (11) Backup ring

## 6.9 STOP VALVE

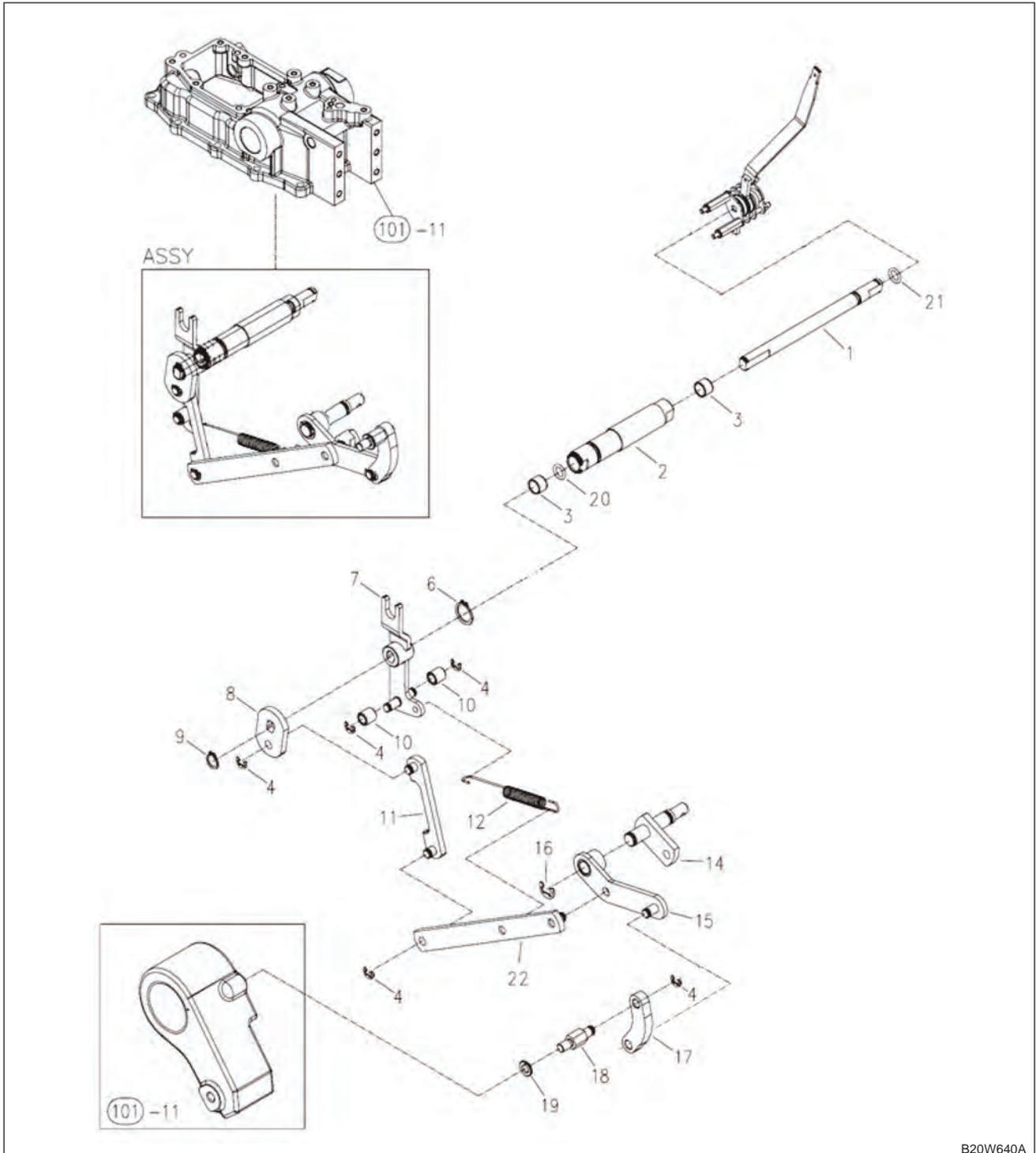


B20W639A

## COMPONENTS

- |              |                    |               |
|--------------|--------------------|---------------|
| (1) Stop V/V | (6) Body, stop V/V | (11) Bolt     |
| (2) Screw    | (7) Steel ball     | (12) Snap pin |
| (3) O-ring   | (8) O-ring         | (13) Hex nut  |
| (4) Nut      | (9) Spring         | (14) Knob     |
| (5) O-ring   | (10) Ring, backup  |               |

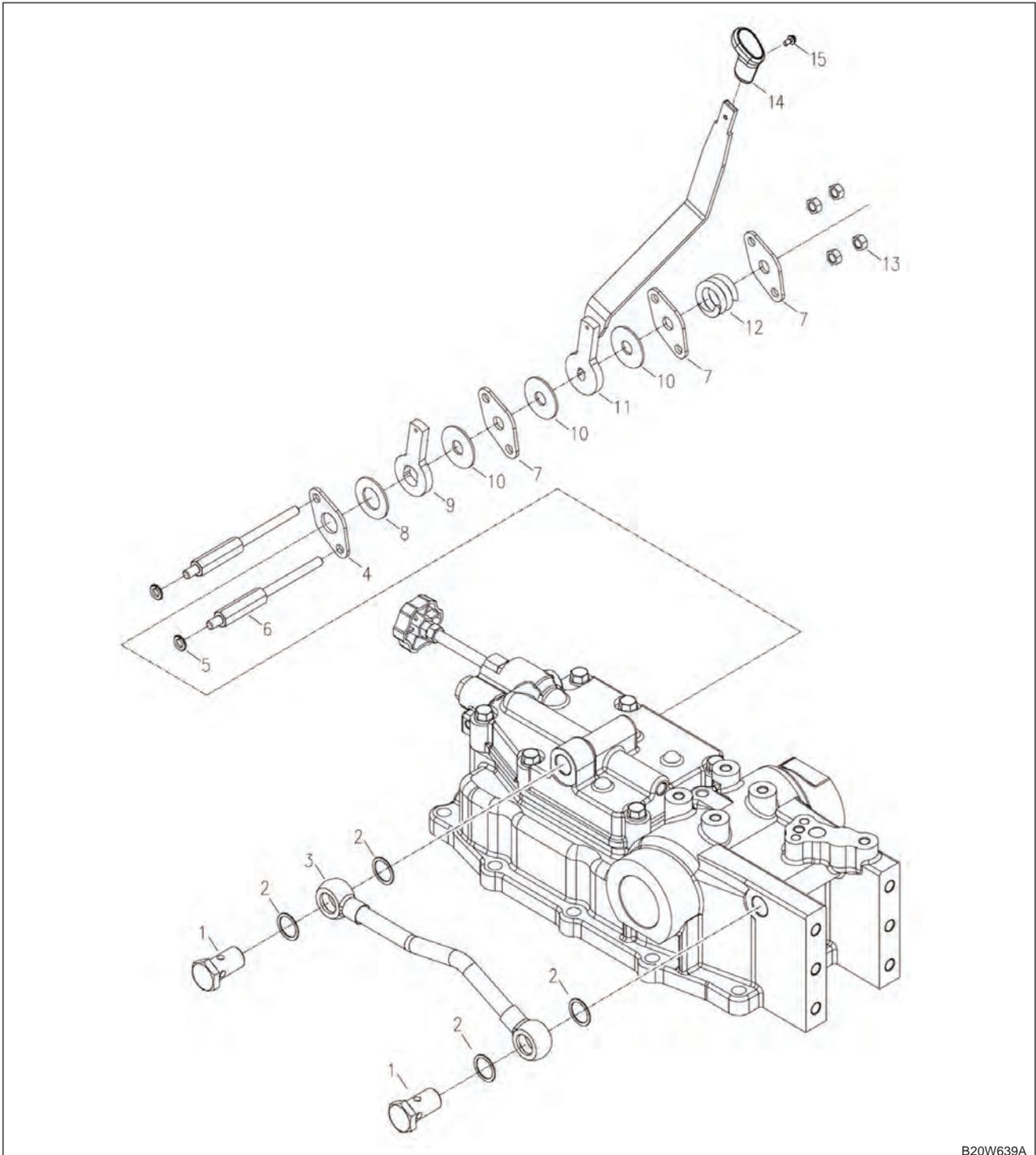
6.10 HYD CONTROL POSITION TYPE



B20W640A

COMPONENTS

- |                           |                      |                     |
|---------------------------|----------------------|---------------------|
| (1) Shaft, position lever | (9) Snap ring        | (18) Pin, feed back |
| (2) D-control shaft       | (10) Roller          | (19) Spring washer  |
| (3) Bush                  | (12) Spring          | (20) O-ring         |
| (4) Snap ring(E)          | (14) Link ass'y(in)  | (21) O-ring         |
| (6) Snap ring             | (15) Link, feed back | (22) Link, position |
| (7) Link ass'y            | (16) Snap ring(E)    |                     |
| (8) Plate                 | (17) Link            |                     |



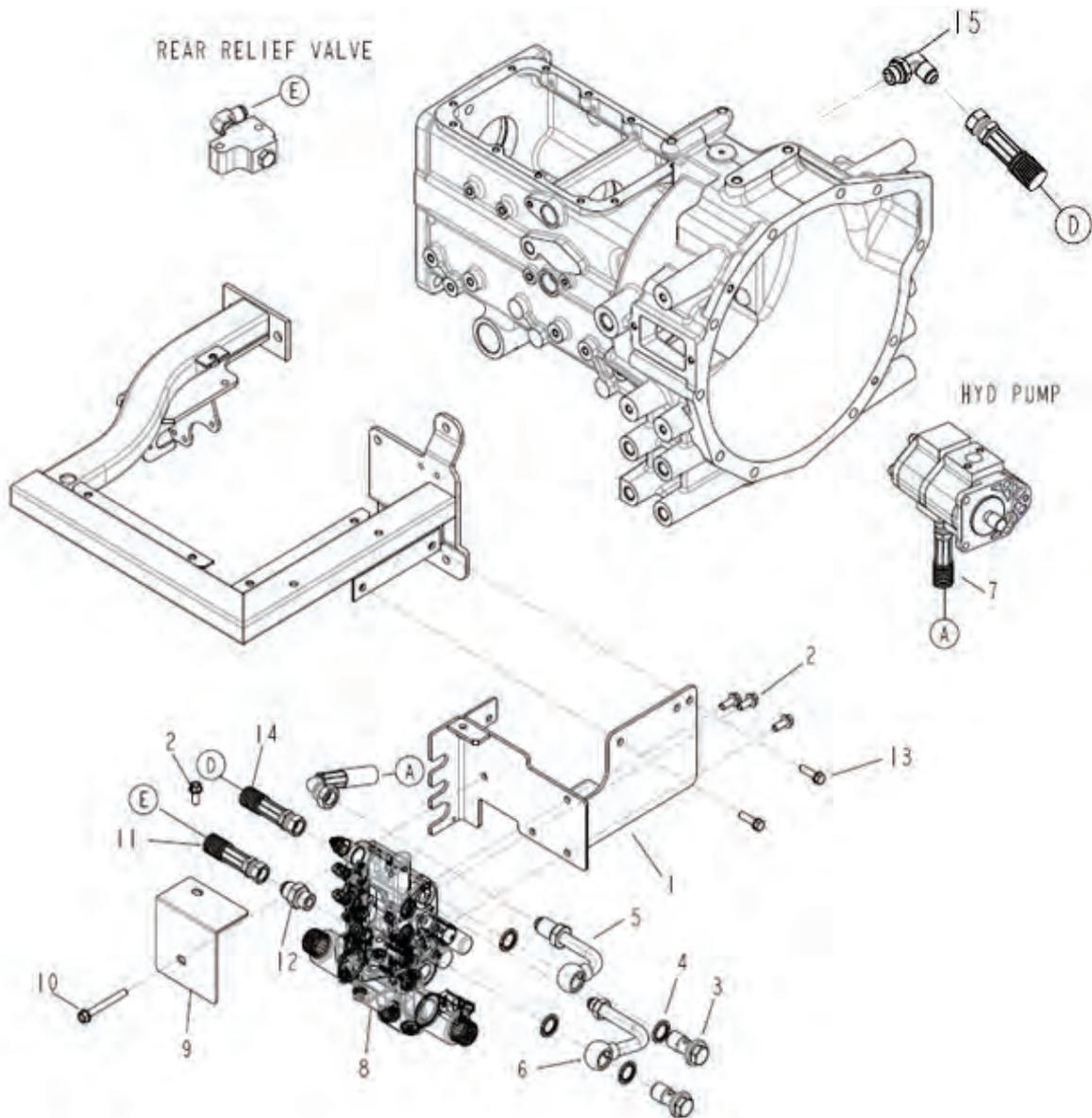
B20W639A

**COMPONENTS**

- |                 |                       |                                |
|-----------------|-----------------------|--------------------------------|
| (1) Connector   | (7) Bracket A         | (12) Spring                    |
| (2) Bonded seal | (8) Plate, friction   | (13) Hex nut                   |
| (3) Bracket     | (9) Lever, D-control  | (14) Knob ass'y, draft control |
| (4) Bracket     | (10) Plate A          | (15) Screw                     |
| (6) Bolt        | (11) Lever, P-control |                                |

6.11 HYD PIPING

**MECMODEL**

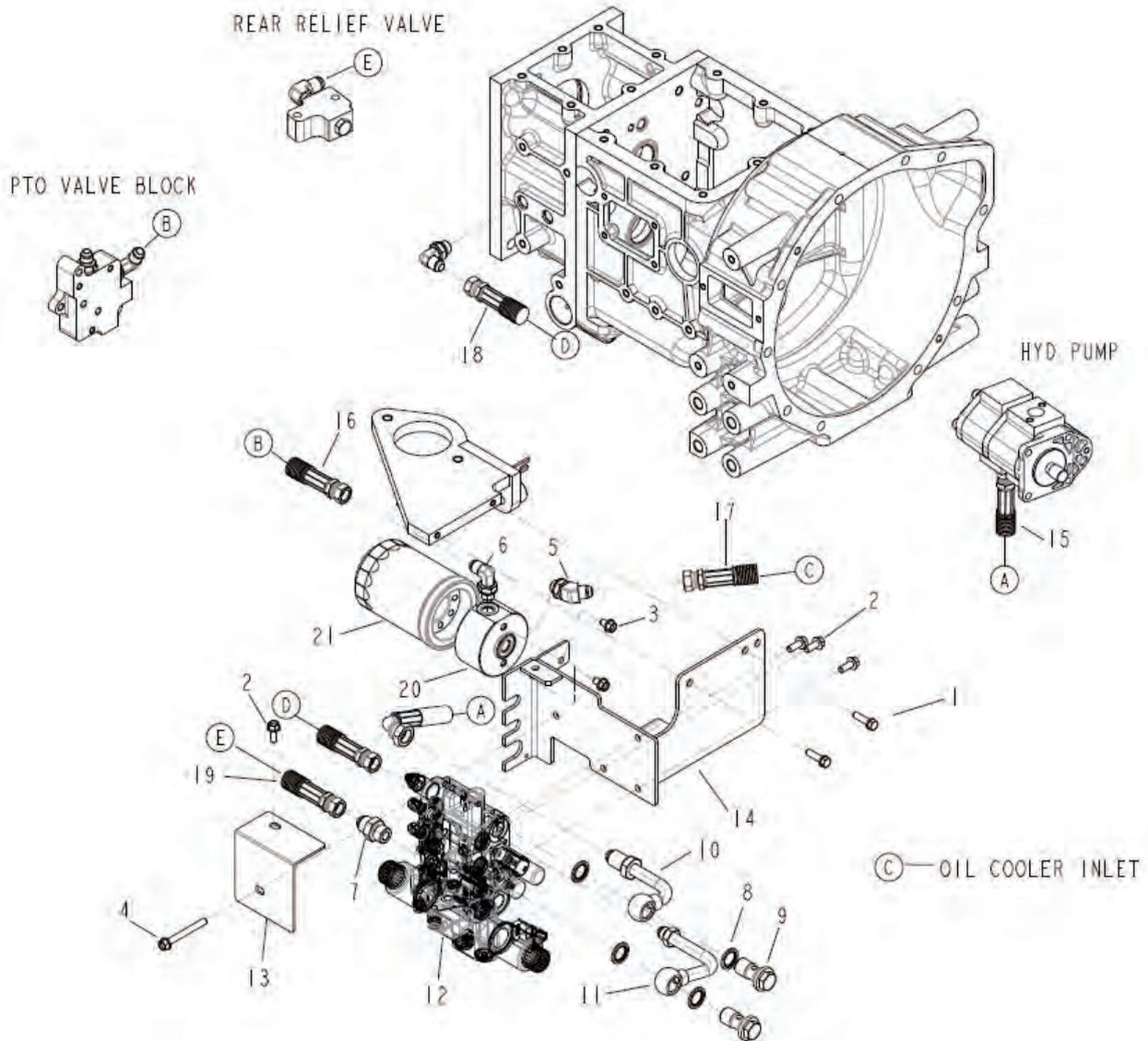


B20W642A

**COMPONENTS**

- |                       |                          |                           |
|-----------------------|--------------------------|---------------------------|
| (1) Scv bracket,ass'y | (7) Hose,high pressure F | (12) Nipple               |
| (2) Hex flange bolt   | (8) SCV valve,ass'y      | (13) Bolt w/washer        |
| (3) Bolt(PF1/2)       | (8) SCV valve,ass'y      | (14) Hose,high pressure R |
| (4) Bonded seal PF1/2 | (9) Cover(SCV)           | (15) Elbow 90             |
| (5) P-SCV_P_pipe      | (10) O-ring              |                           |
| (6) F-SCV_T_pipe      | (11) Hose, high-pressure |                           |

**HSTMODEL**



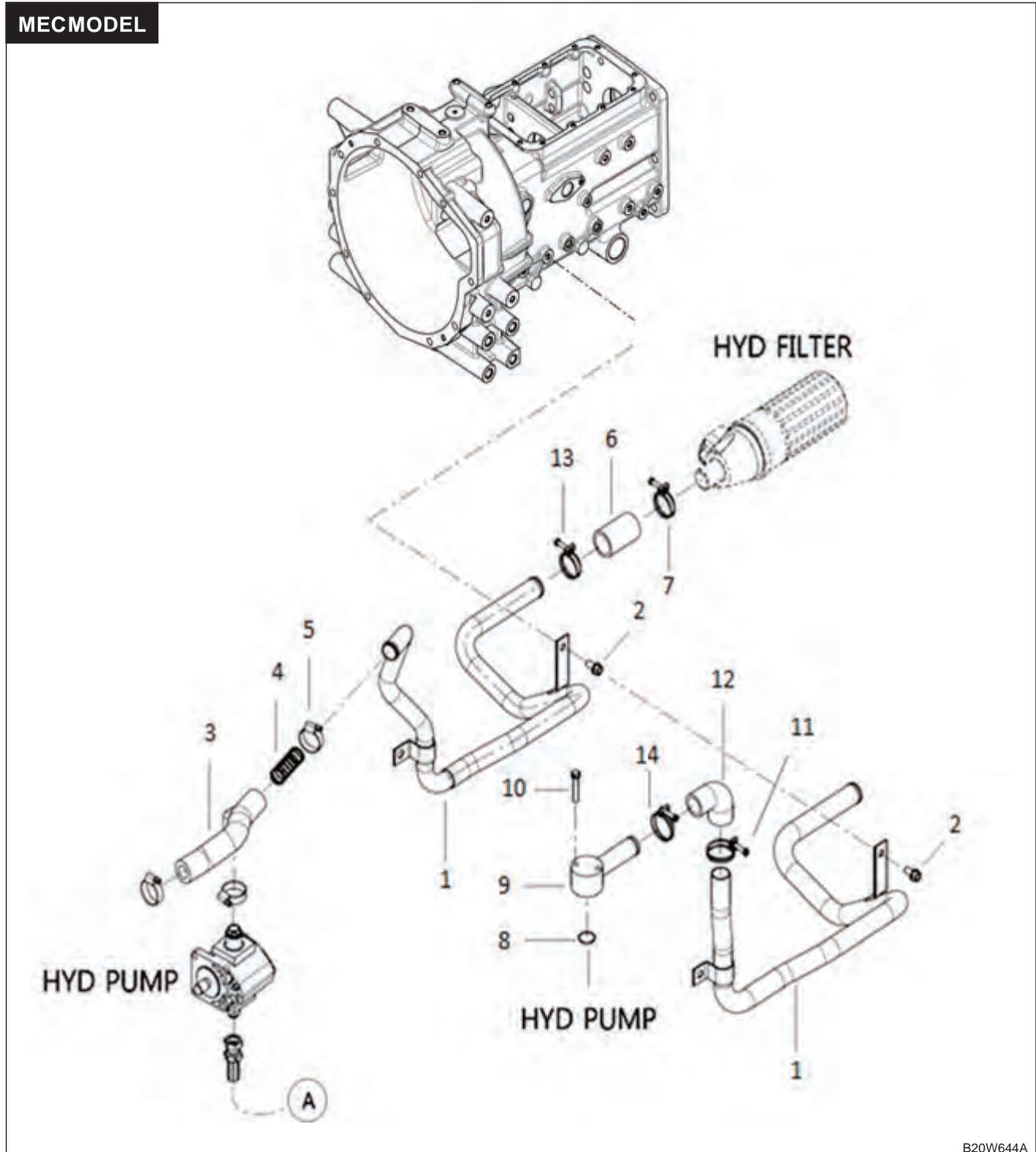
B20W643A

**COMPONENTS**

- |                         |                                |                                |
|-------------------------|--------------------------------|--------------------------------|
| (1) Hex bolt w/washer   | (9) Bolt (PF1/2)               | (16) Rubber hose,pressure      |
| (2) Hex flange bolt     | (10) Pipe ass'y, SCV-P         | (17) Rubber hose,pressure      |
| (3) Hex flange bolt     | (11) Pipe ass'y, SCV-T         | (18) Rubber hose,high pressure |
| (4) Hex flange bolt     | (12) Scv valve, ass'y          | (19) Rubber hose,pressure      |
| (5) Connector 45°       | (12) Scv valve, ass'y          | (20) Filter cover              |
| (6) Elbow 3/8           | (13) Valve bracket             | (21) Filter                    |
| (7) Nipple 1/2          | (14) Scv bracket,ass'y         |                                |
| (8) Bonded seal (PF1/2) | (15) Rubber hose,high pressure |                                |

6.12 HYD PIPING

**MECMODEL**

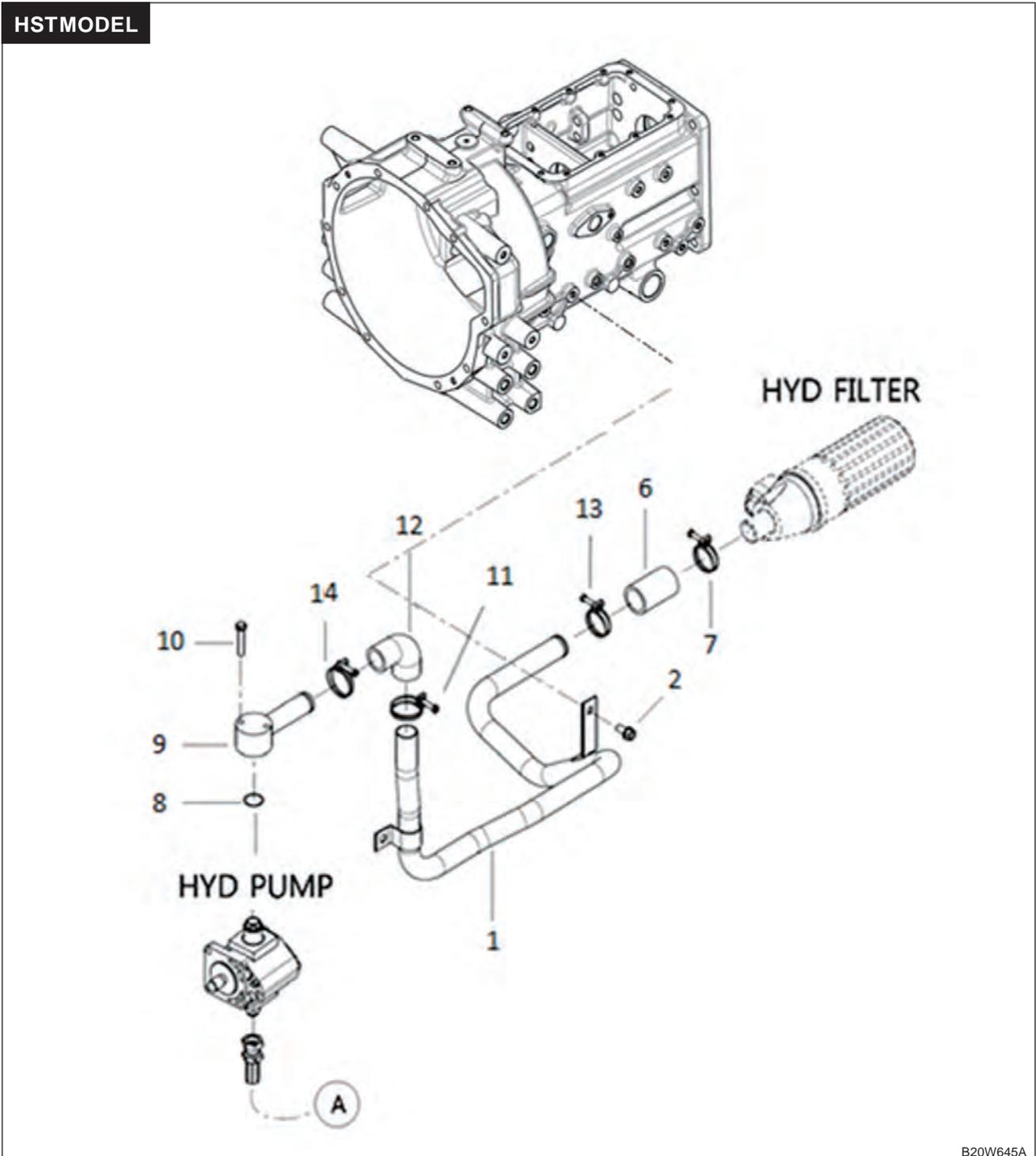


B20W644A

**COMPONENTS**

- |                               |                         |                                 |
|-------------------------------|-------------------------|---------------------------------|
| (1) Pipe ass'y,lower pressure | (5) Hose clamp          | (10) Hex bolt w/washer          |
| (1) Pipe ass'y,lower pressure | (6) Lower pressure hose | (11) Band, hose                 |
| (2) Hex flange bolt           | (7) Hose band           | (12) Rubber hose,lower pressure |
| (3) Rubber hose               | (8) O-ring              | (13) Hose band                  |
| (4) Spring A                  | (9) Pipe flange ass'y   | (14) Band, hose                 |

**HSTMODEL**



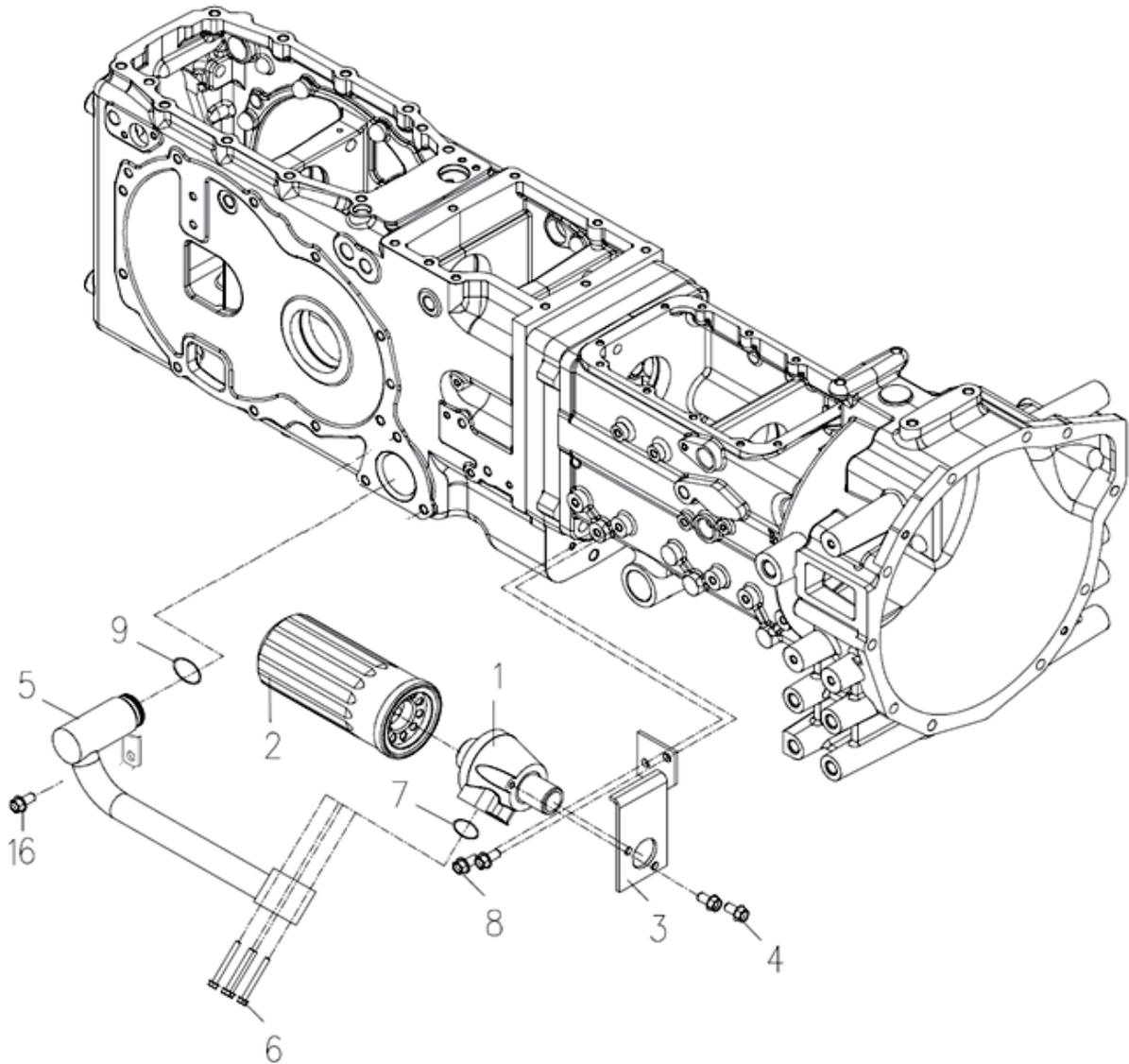
B20W645A

**COMPONENTS**

- |                               |                         |                                 |
|-------------------------------|-------------------------|---------------------------------|
| (1) Pipe ass'y,lower pressure | (5) Hose clamp          | (10) Hex bolt w/washer          |
| (1) Pipe ass'y,lower pressure | (6) Lower pressure hose | (11) Band, hose                 |
| (2) Hex flange bolt           | (7) Hose band           | (12) Rubber hose,lower pressure |
| (3) Rubber hose               | (8) O-ring              | (13) Hose band                  |
| (4) Spring A                  | (9) Pipe flange ass'y   | (14) Band, hose                 |

6.13 HYD FILTER

**MECMODEL**

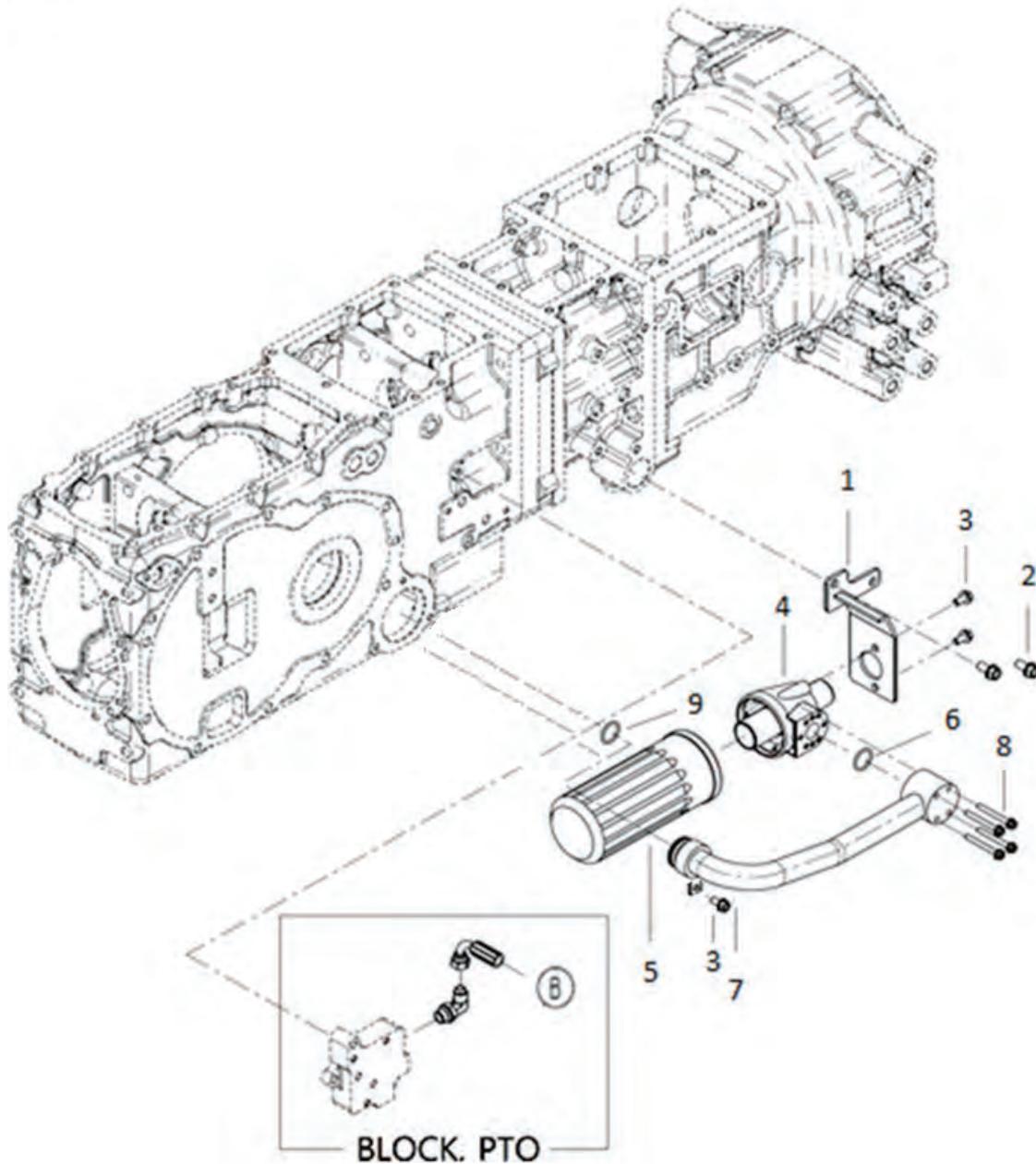


B20W646A

**COMPONENTS**

- |                     |                                 |                      |
|---------------------|---------------------------------|----------------------|
| (1) Cover, filter   | (5) Rubber hose, lower pressure | (9) O-ring           |
| (2) Filter          | (6) Hex flange bolt             | (16) Hex flange bolt |
| (3) Bracket filter  | (7) O-ring                      |                      |
| (4) Hex flange bolt | (8) Hex flange bolt             |                      |

**HSTM06EL**



B20W647A

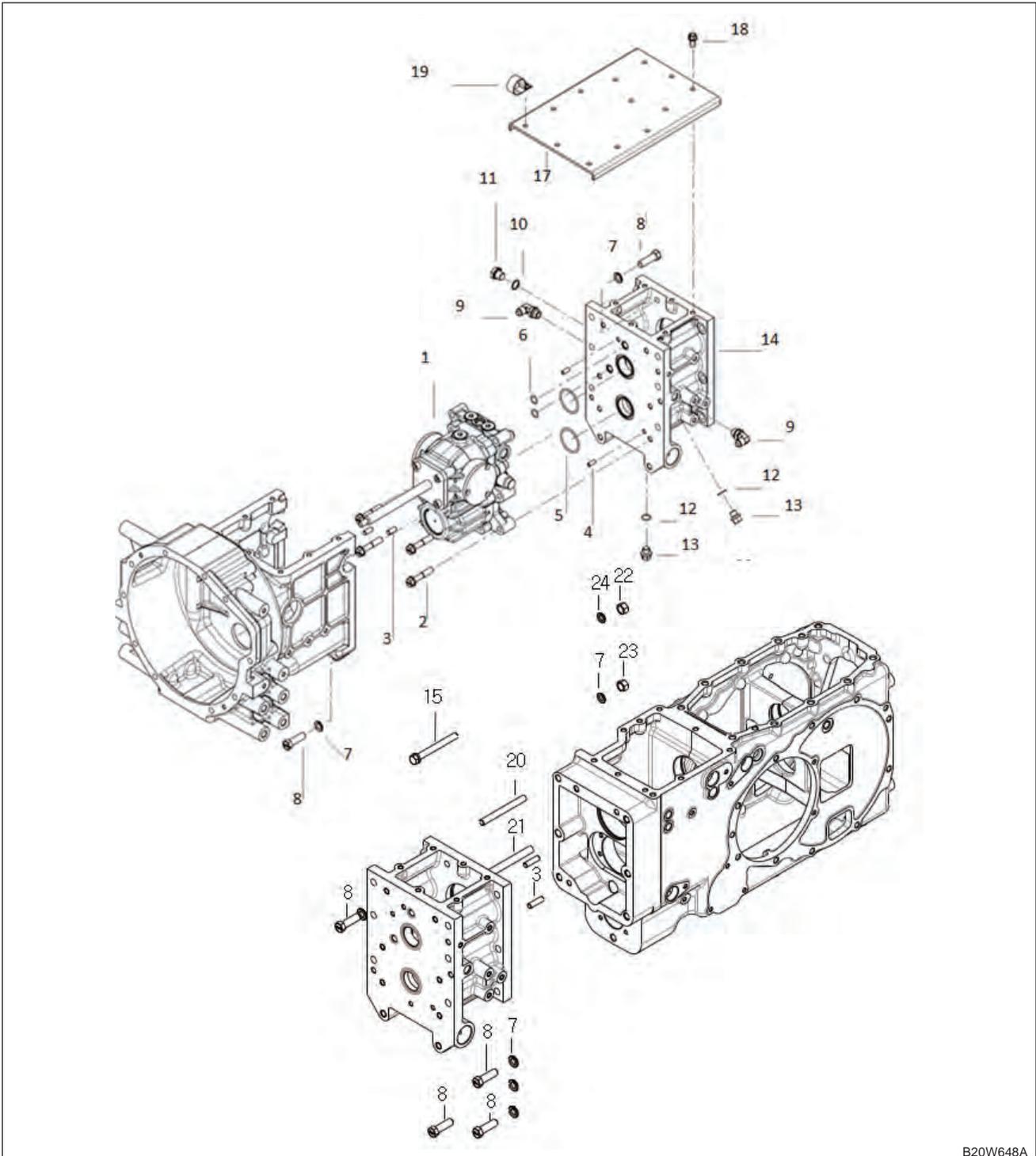
**COMPONENTS**

- (1) Bracket ass'y, filter
- (2) Hex flange bolt
- (3) Hex flange bolt

- (4) Filter cover
- (5) Filter
- (6) O-ring

- (7) Pipe ass'y
- (8) Hex flange bolt
- (9) O-ring

6.14 HYD SHIFT TRANSMISSION HOUSING

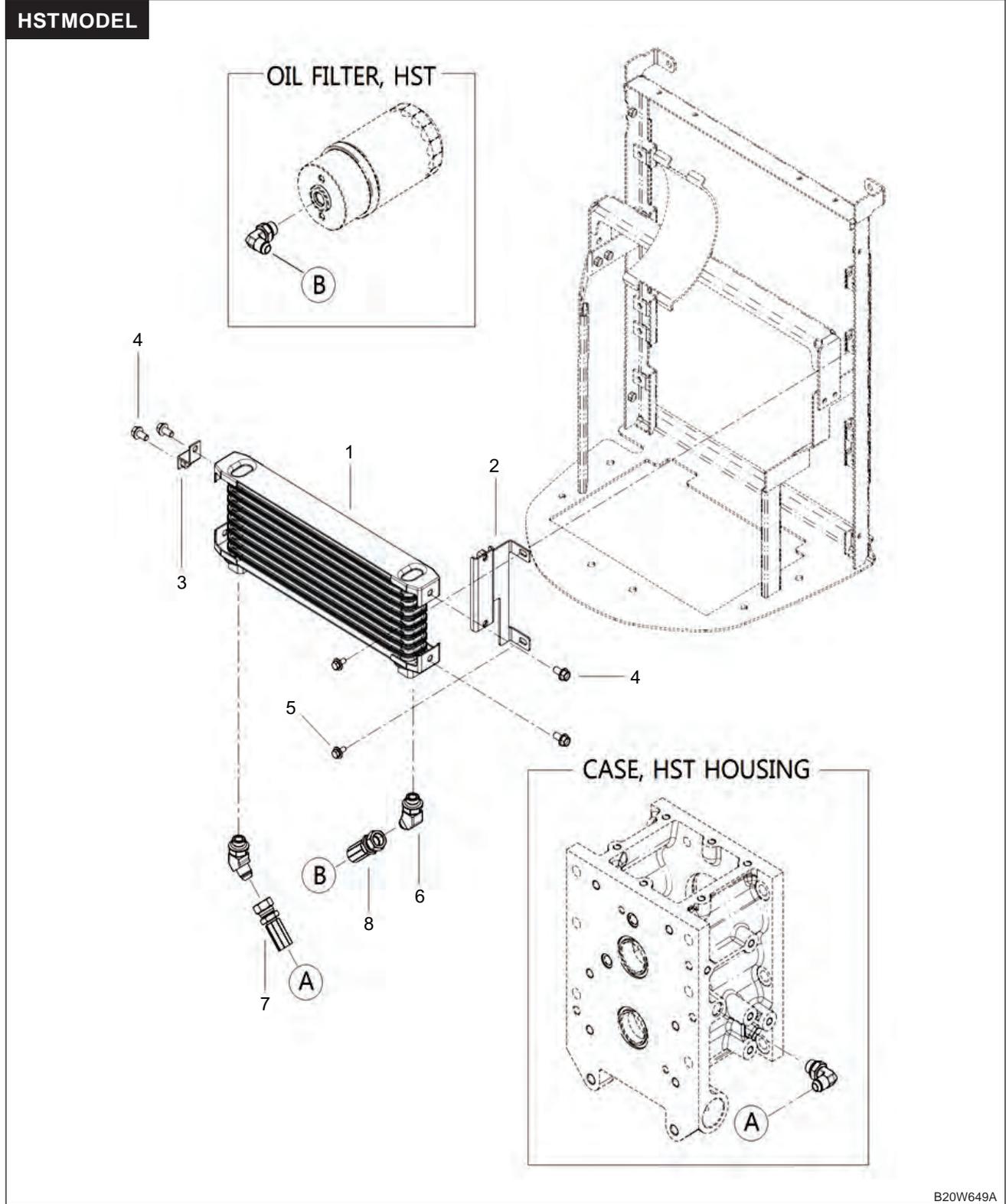


B20W648A

**COMPONENTS**

- |                        |                         |                      |
|------------------------|-------------------------|----------------------|
| (1) HST 40cc           | (9) Elbow               | (18) Hex flange bolt |
| (2) Hex bolt, w/washer | (10) Packing            | (19) Clip            |
| (3) Parallel pin       | (11) Plug               | (20) Stud bolt       |
| (4) Parallel pin       | (12) O-ring             | (21) Stud bolt       |
| (5) O-ring             | (13) Plug               | (22) Hex nut         |
| (6) O-ring             | (14) Case, housing      | (23) Hex nut         |
| (7) Spring washer      | (15) Hex bolt, w/washer | (24) Spring washer   |
| (8) Bolt               | (17) Cover              |                      |

6.15 OIL COOLER



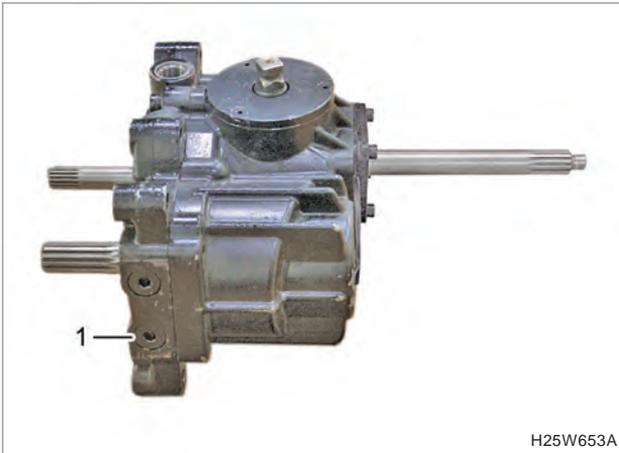
**COMPONENTS**

- |                                  |                       |                          |
|----------------------------------|-----------------------|--------------------------|
| (1) Oil cooler                   | (4) Hex flange bolt   | (7) Cooler hose_L        |
| (2) Bracket ass'y, oil cooler(l) | (5) Hex bolt w/washer | (8) Rubber hose,pressure |
| (3) Bracket ass'y, oil cooler(r) | (6) Connector         |                          |

7. DISASSEMBLY AND SERVICE

7.1 HST (HST MODEL)

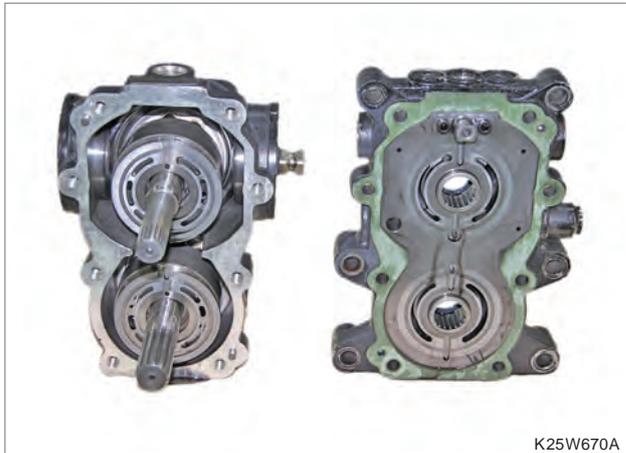
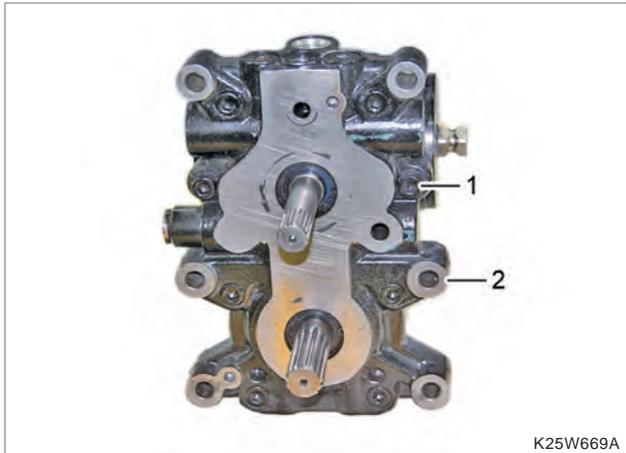
28 cc



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

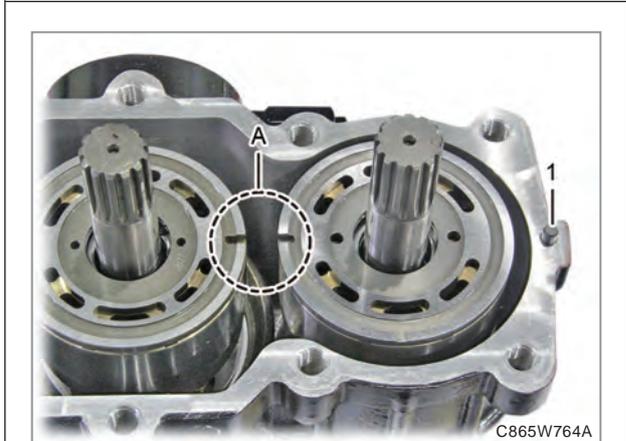


4. Unscrew eight HST front cover mounting bolts (1) to remove the front cover (2).

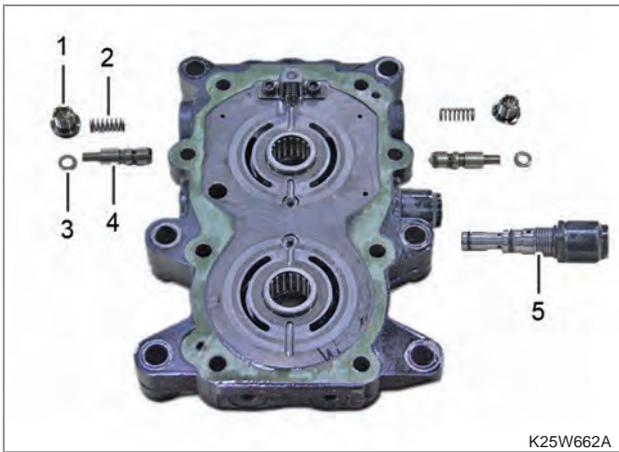
<b>M12 BOLT</b>	<b>8 EA</b>
10-mm L-shape wrench	

6

Notes



- Align the grooves (A) of the valve plate with the knock pin (1) of the HST case during assembly.



5. 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



6. Unscrew the spring holder (1) from the inner upper section of the front cover. Then, remove the spring (2) and check valve (3).

<b>M6 BOLT</b>	<b>5 EA</b>
5-mm L-shape wrench	

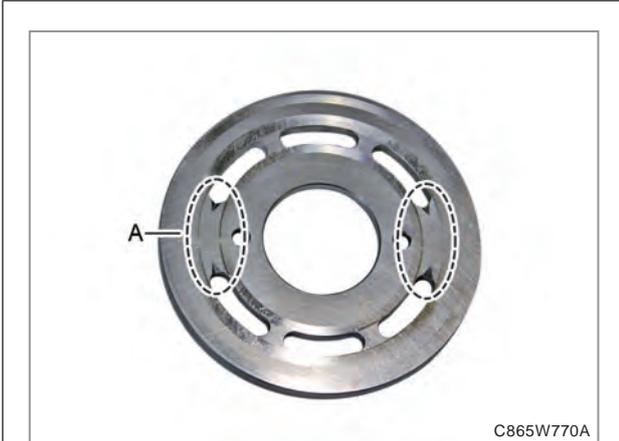


- Valve plate



7. Remove the valve plate (1) on the motor side. Then, separate the cylinder block (2) and piston assembly (3).

**Notes**



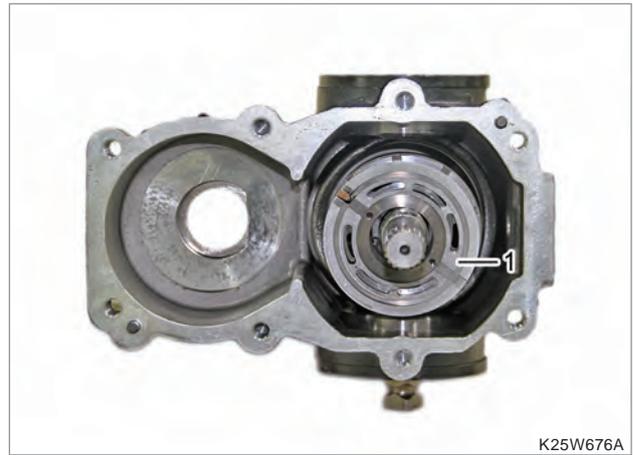
- Set the valve plate grooves (A) on the motor side toward the cylinder block during assembly (groove in section A: two (both directions))



- Cylinder block

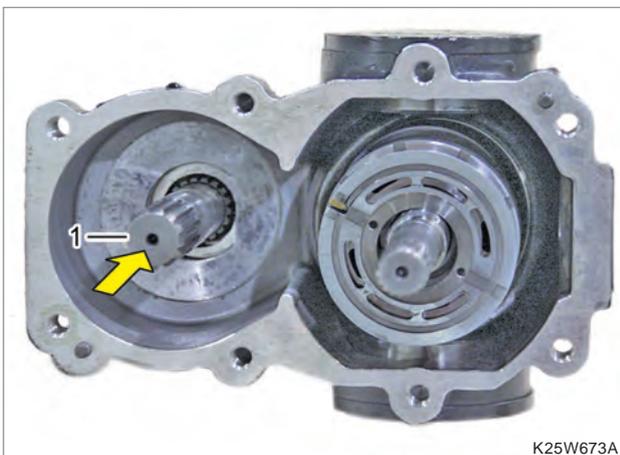


C865W774A



K25W676A

- Piston assembly

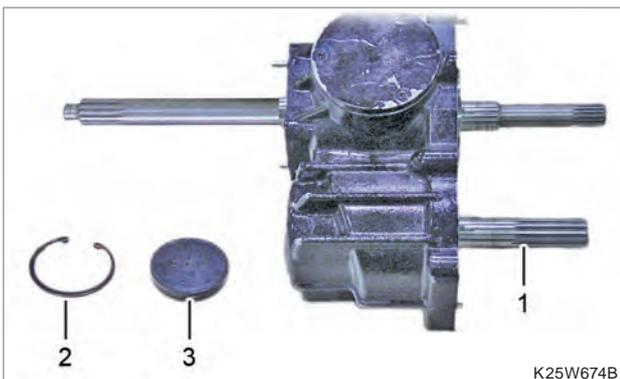


K25W673A

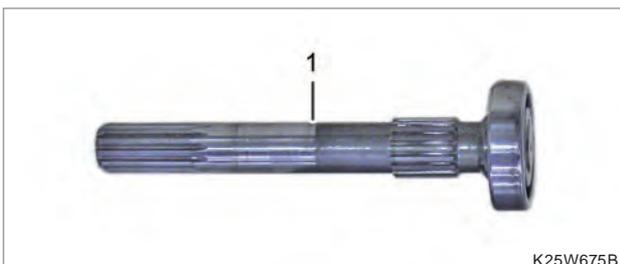


K25W677A

9. 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.



K25W674B



K25W675B

8. Pull out the snap ring (2) from rear of motor shaft (1) and remove the cover (3) and motor shaft by tapping snap ring direction.

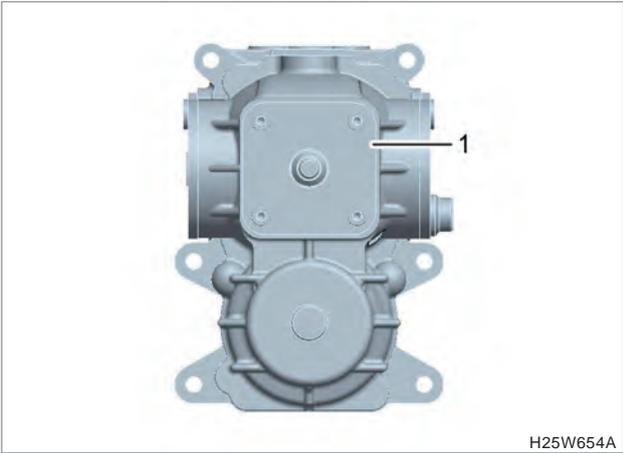
**Notes**



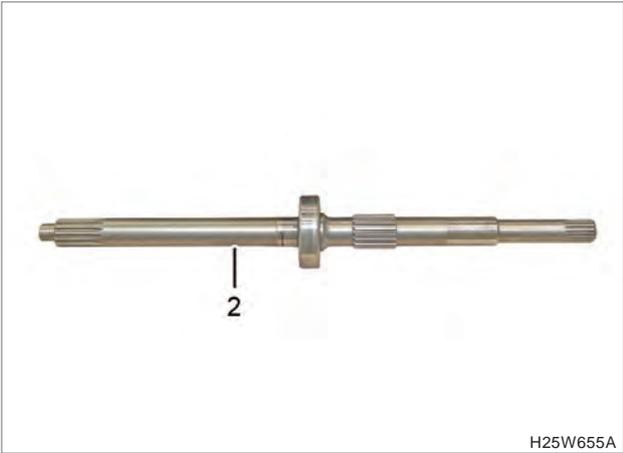
C865W779A

- Set the valve plate grooves (A) on the pump side toward the cylinder block during assembly (groove in section A: one (rotating direction))

**PUMP SHAFT DISASSEMBLY**



H25W654A



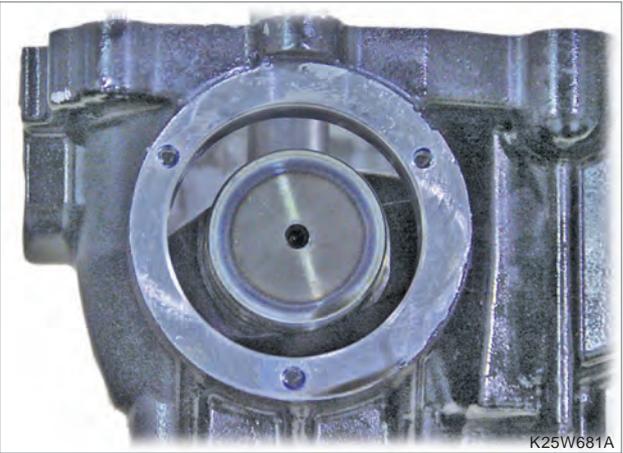
H25W655A

10. Remove the pump shaft cover (1) and pull out the inner snap ring. And then, remove the pump shaft (2).

**SWASH PLATE DISASSEMBLY**



K25W680A

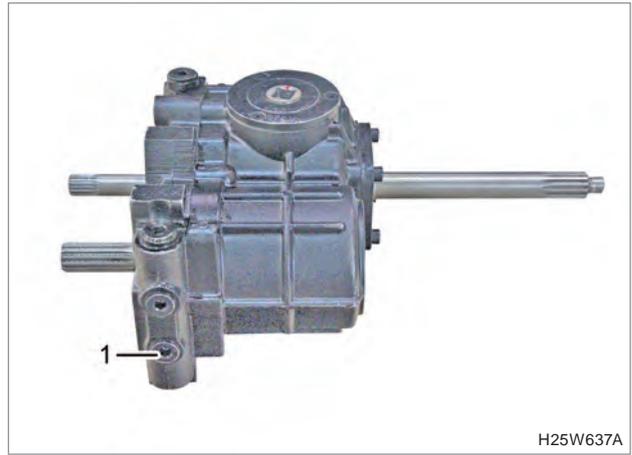
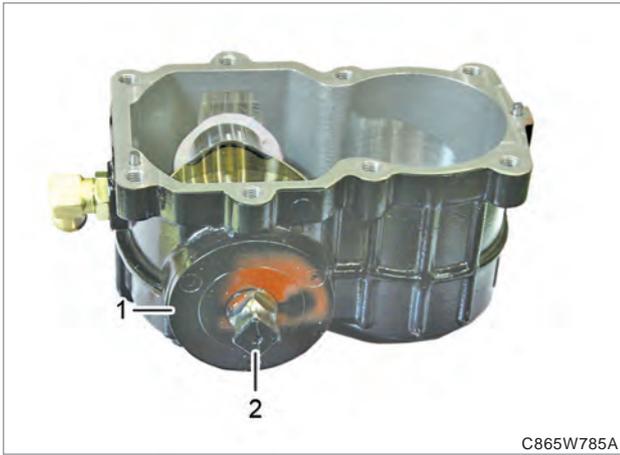


K25W681A

11. Remove the cover (1).

<b>M6 BOLT</b>	<b>3 EA</b>
5-mm L-shape wrench	

40 cc



1. Unscrew the drain plug (1) from the bottom of the HST front cover to drain oil.

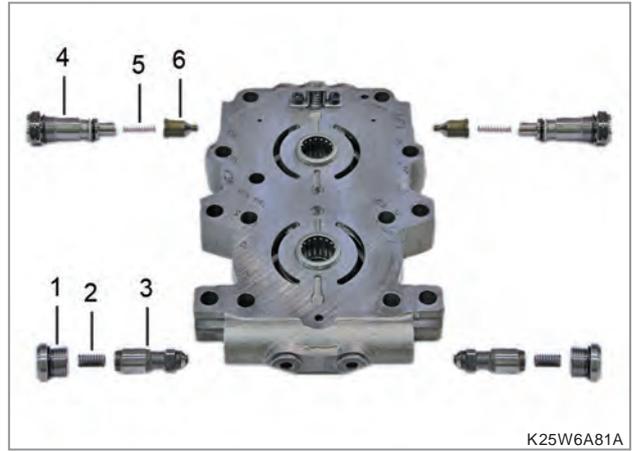
8-mm L-shape wrench



12. Remove the swash cover (1) to remove the swash plate (2).

<b>M6 BOLT</b>	<b>3 EA</b>
4-mm L-shape wrench	

**FRONT COVER DISASSEMBLY**



5. Remove the plug (1), spring (2), relief valve (3), neutral valve (4), spring (5) and poppet (6) from the front cover.

10-mm L-shape wrench
8-mm L-shape wrench

4. Unscrew eight HST front cover mounting bolts (1) to remove the front cover (2).

<b>M12 BOLT</b>	<b>8 EA</b>
10-mm L-shape wrench	



**Notes**

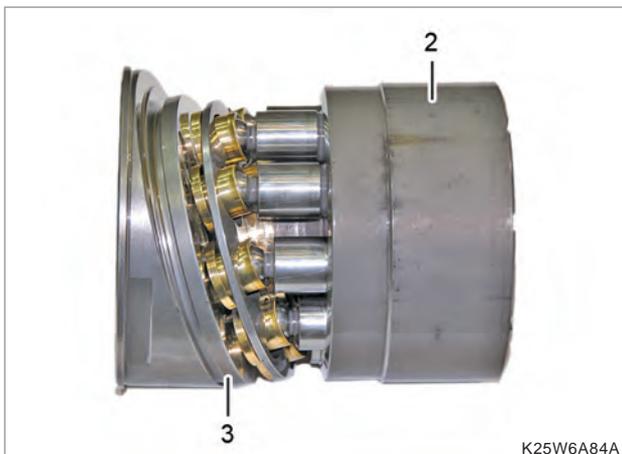
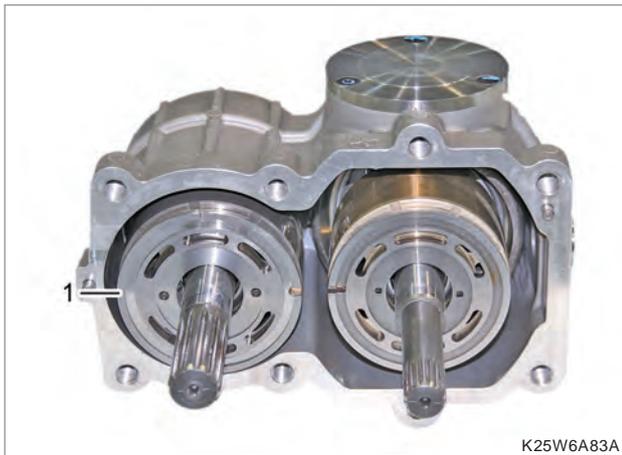
C865W764A

- Align the grooves (A) of the valve plate with the knock pin (1) of the HST case during assembly.



6. Unscrew the spring holder (1) from the inner upper section of the front cover. Then, remove the spring (2) and check valve (3).

<b>M6 BOLT</b>	<b>5 EA</b>
5-mm L-shape wrench	

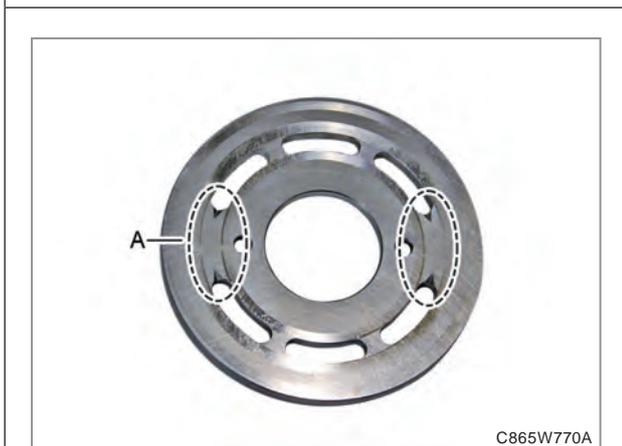


- Valve plate

7. 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))

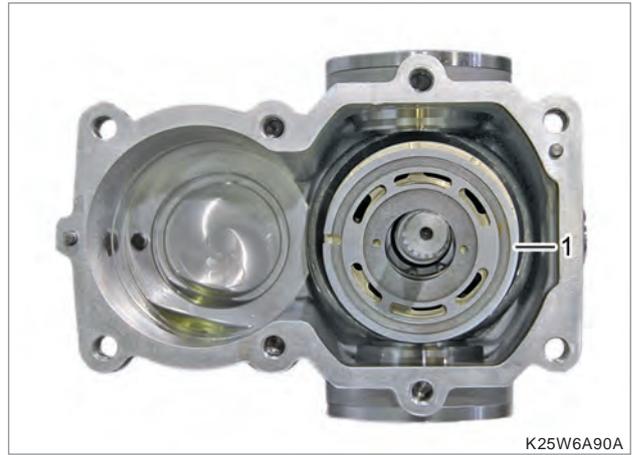


- Cylinder block

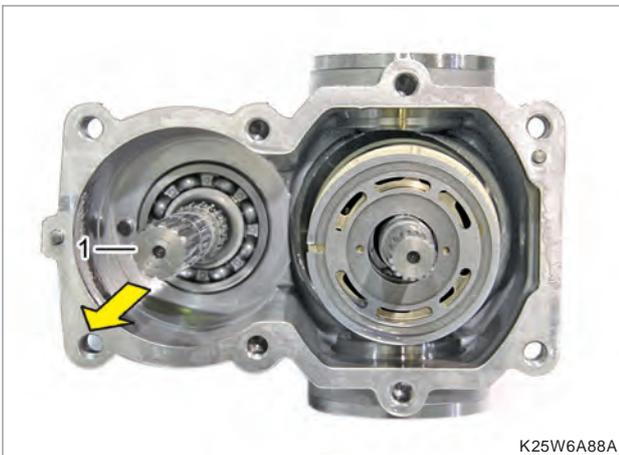


K25W6A87A

- Piston assembly



K25W6A90A



K25W6A88A



K25W675A

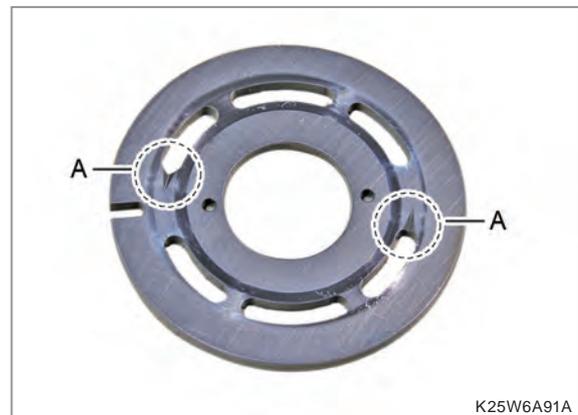
8. Tap out the motor shaft (1) as a arrow direction.



K25W6A91A

9. 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**



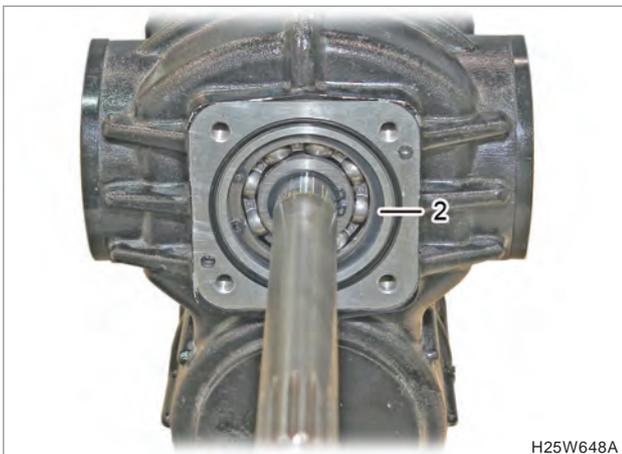
K25W6A91A

- Set the valve plate grooves (A) on the pump side toward the cylinder block during assembly (groove in section A: one (rotating direction))

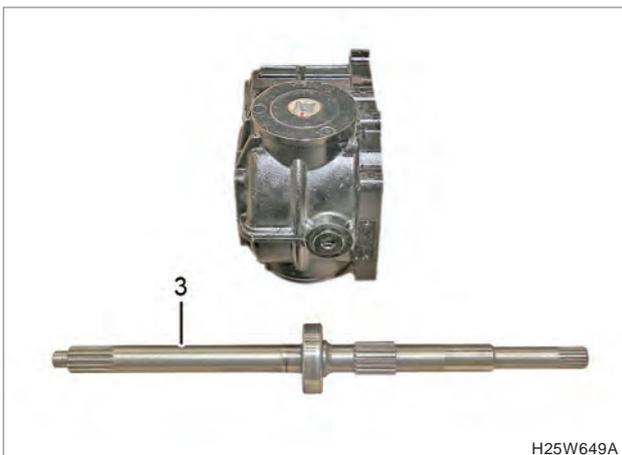
**PUMP SHAFT DISASSEMBLY**



10. Remove the pump shaft cover (1).

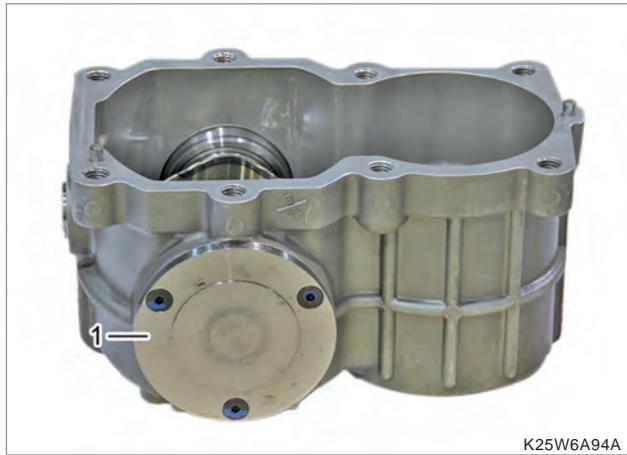


11. Remove the snap ring (2).



12. Remove the pump shaft (3).

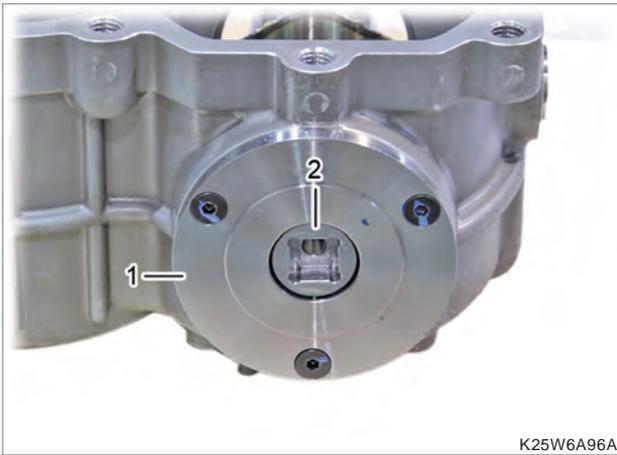
**SWASH PLATE DISASSEMBLY**



13. Remove the cover (1).



<b>M6 BOLT</b>	<b>3 EA</b>
5-mm L-shape wrench	



K25W6A96A



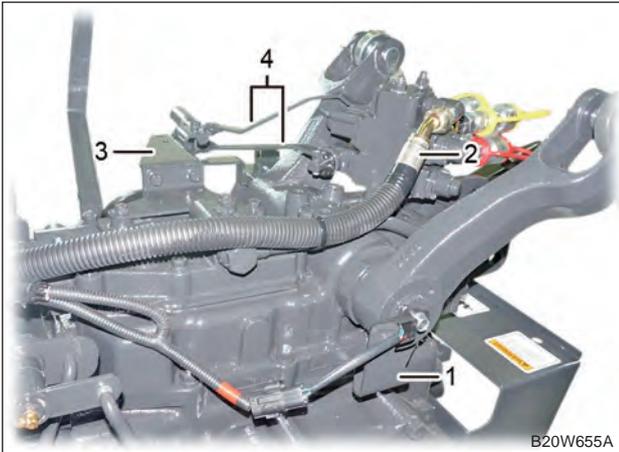
K25W6A97A

14. Remove the swash cover (1) to remove the swash plate (2).

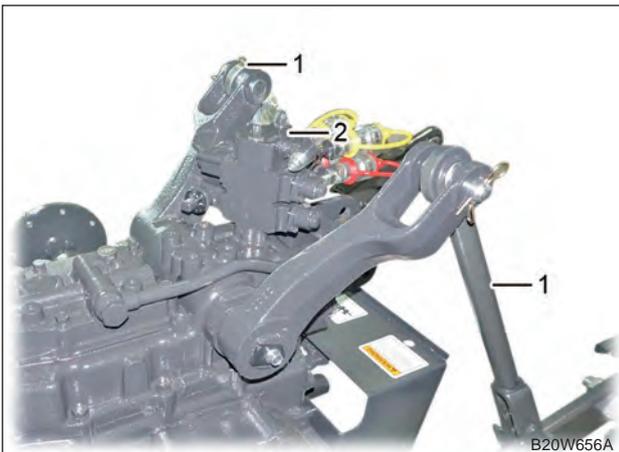
<b>M6 BOLT</b>	<b>3 EA</b>
4-mm L-shape wrench	

7.2 HYDRAULIC CYLINDER CASE ASSEMBLY DISASSEMBLY AND ASSEMBLY

1. Remove the cabin [CABIN MODEL] / the seat frame cover assembly [ROPS MODEL].



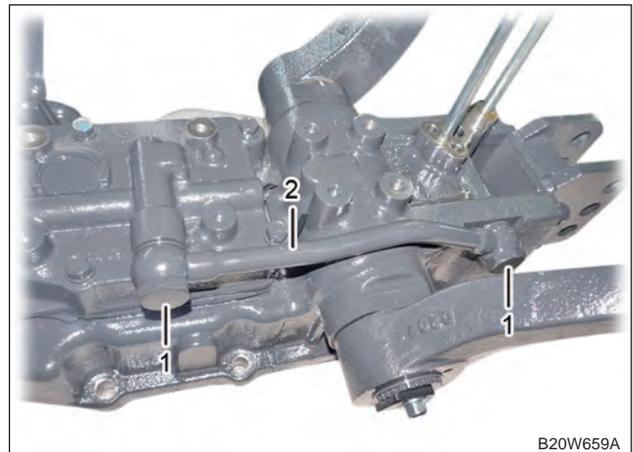
2. Remove the lift sensor bracket (1), high-pressure hose (2), SCV lever mounting bracket (3) and levers (4).



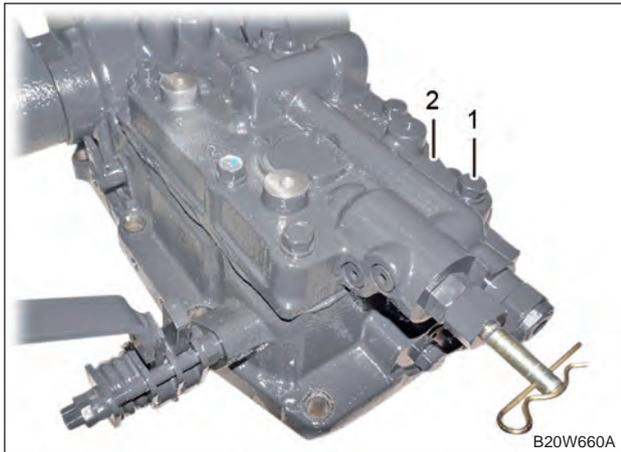
3. Disconnect the lift rods (1) from the lift arms and remove the rear SCV assembly (2). (Refer to the instruction for rear SCV removal.)



4. Unscrew the hydraulic cylinder case mounting bolts (1) to remove the hydraulic cylinder case assembly.



5. Unscrew the hollow bolts (1) to disconnect the hydraulic pipe (2).



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K20W6A08A



B20W661A



K20W6A09A

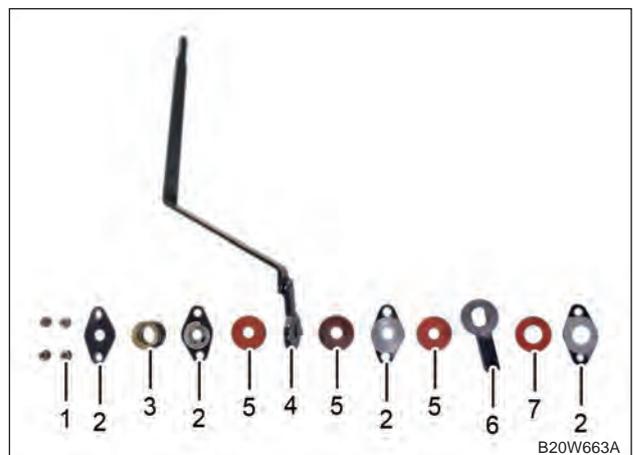
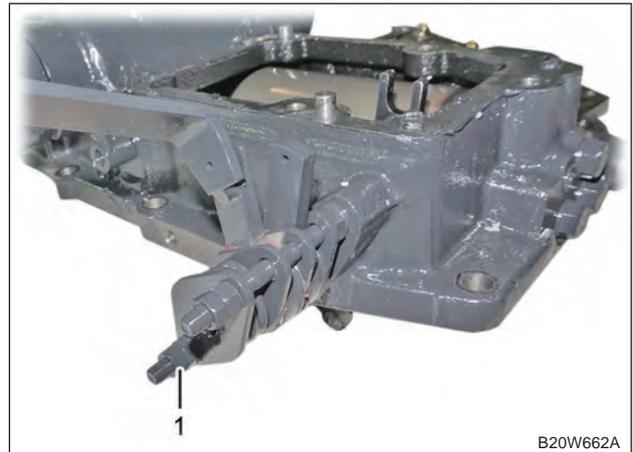
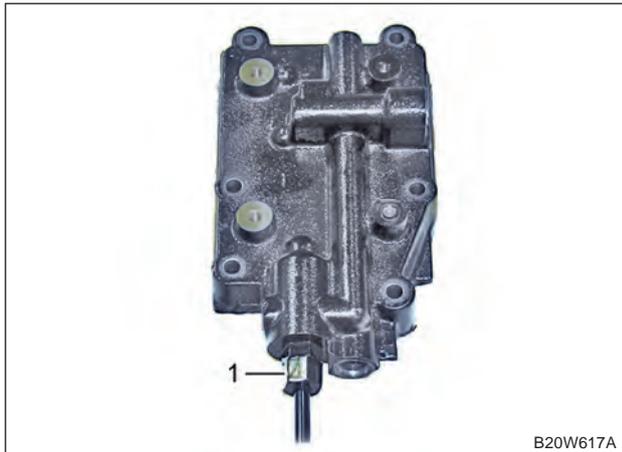
6. Unscrew the hydraulic cylinder cover mounting bolts (1) to remove the hydraulic cylinder cover (2).

7. Remove the control valve (1) from the hydraulic cylinder cover.



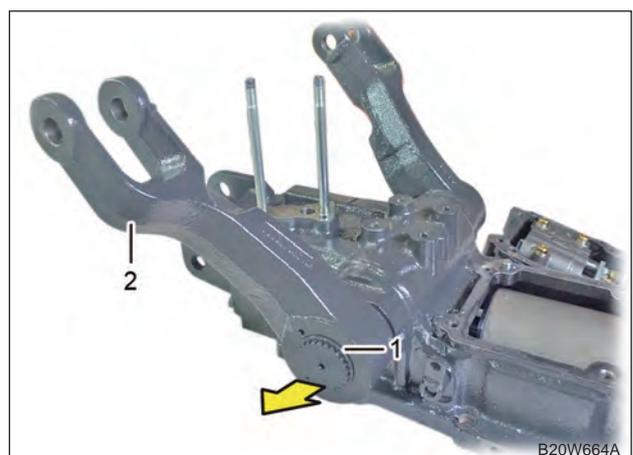
B20W616A

8. Remove the safety valve (1) from the hydraulic cylinder cover.

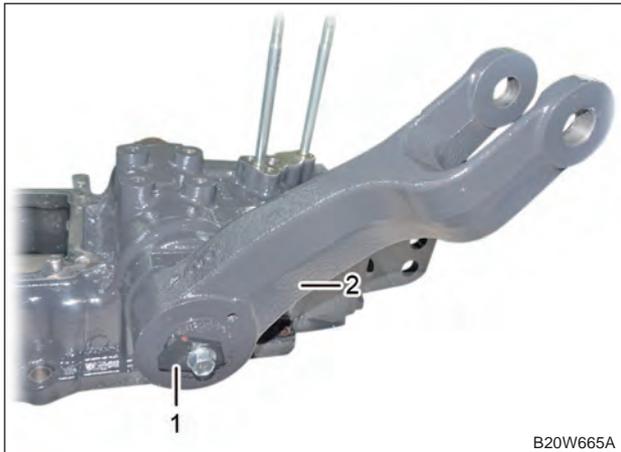


9. Remove the lowering speed control valve assembly (1).

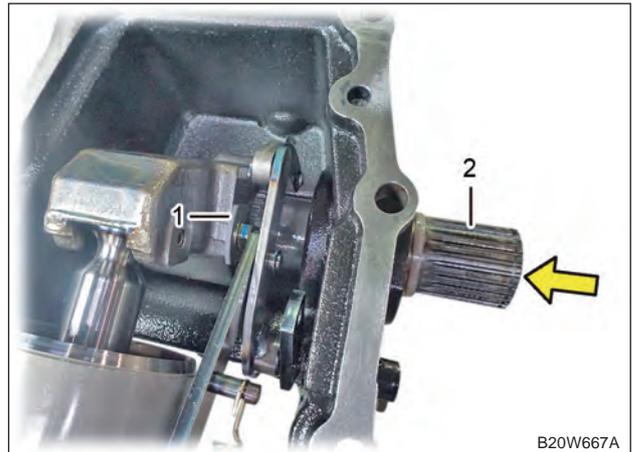
10. Unscrew the lever retaining nut (1). Then, remove the bracket A (2), spring (3), bracket A (2), plate (5), P lever (4), plate (5), bracket A (2), plate (5), lever arm (6), friction plate (7) and bracket (2) in order.



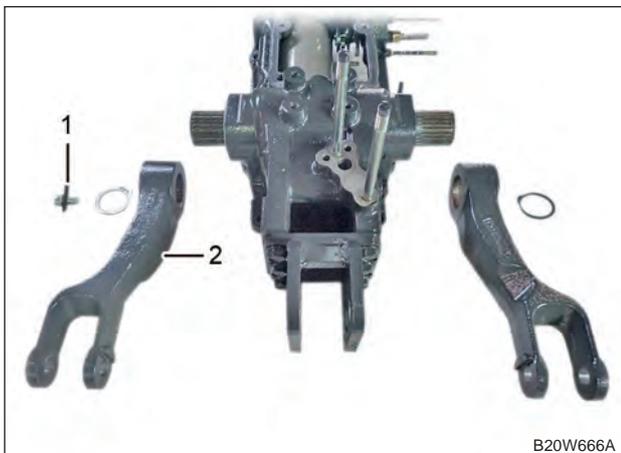
11. Pull out the snap ring (1) from the right side. Then, disconnect the lift arm (2).



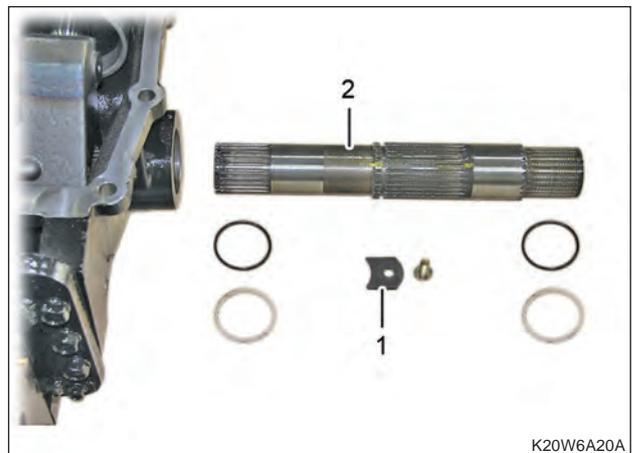
B20W665A



B20W667A



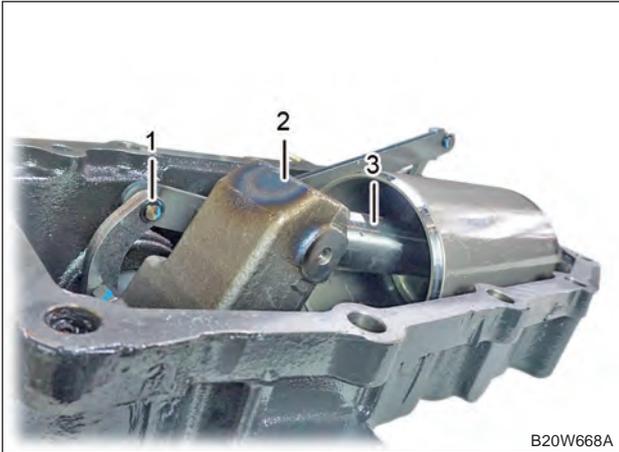
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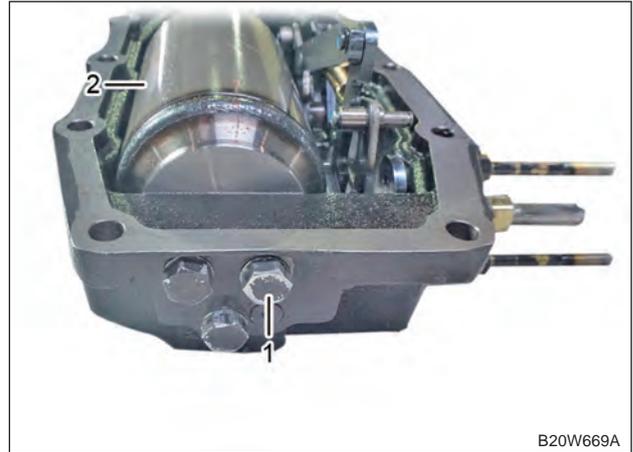
K20W6A20A

12. Remove the lift sensor (1) from the left side and pull out the snap ring. Then, disconnect the lift arm (2).

13. Remove the fixing plate (1) and pull out the lift link shaft (2) to the left.



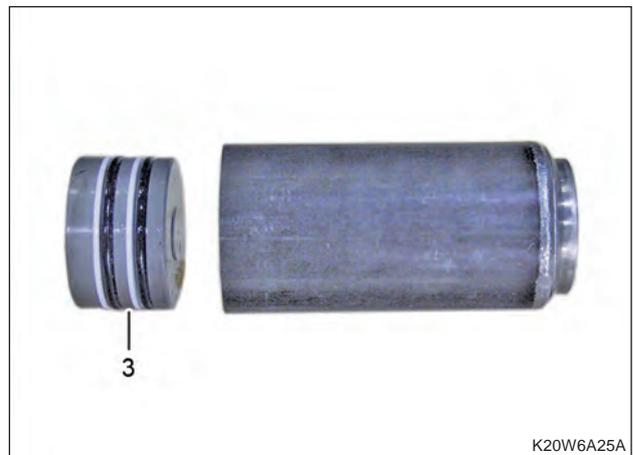
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K20W6A22A

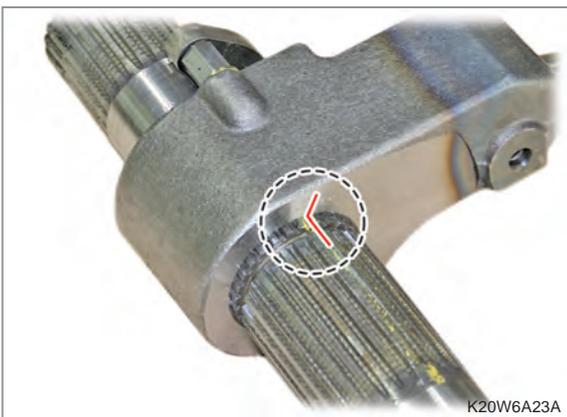


K20W6A25A

14. Pull out the E-type snap ring (1) for the lift crank link. Then, remove the lift crank (2) and piston rod (3) together.

15. Unscrew the hex. bolt (1) and remove the piston assembly (2) to separate the piston (3) from the piston assembly.

**⊕ IMPORTANT**



K20W6A23A

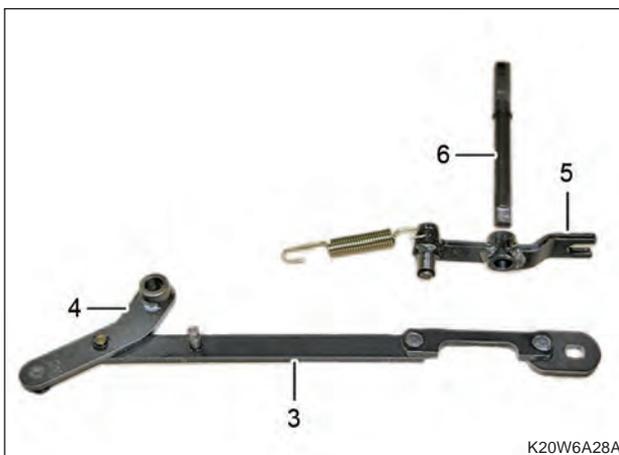
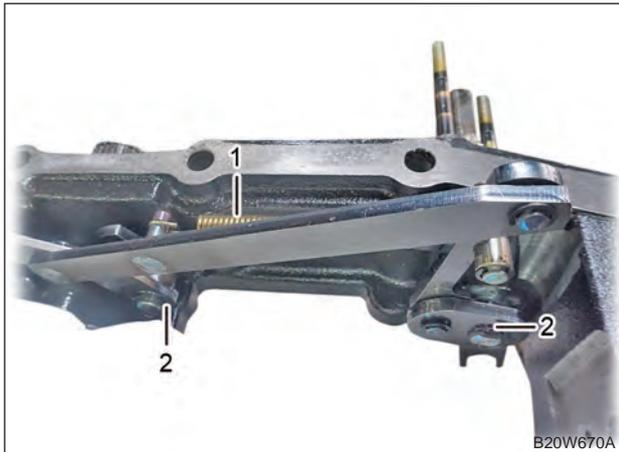
- Insert the lift link shaft from the right to the left side, aligning the matching mark on the lift link shaft with the matching mark on the lift crank.

**Notes**



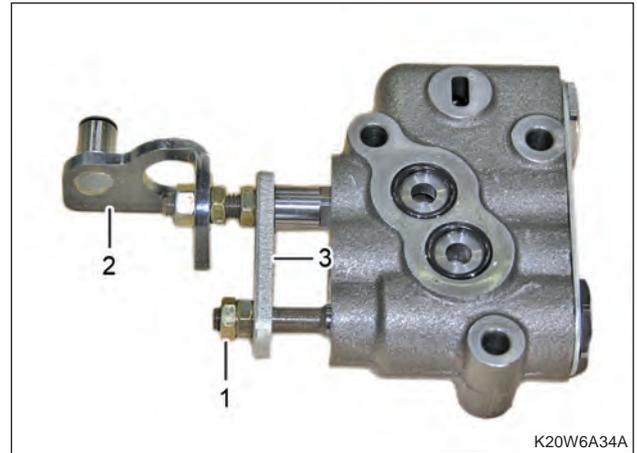
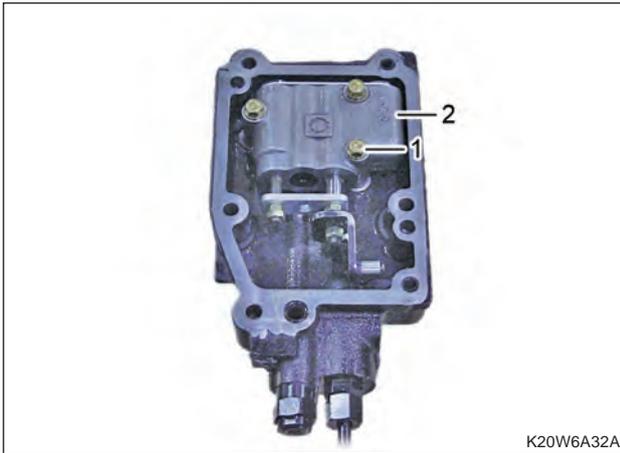
K20W6A26A

- 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.



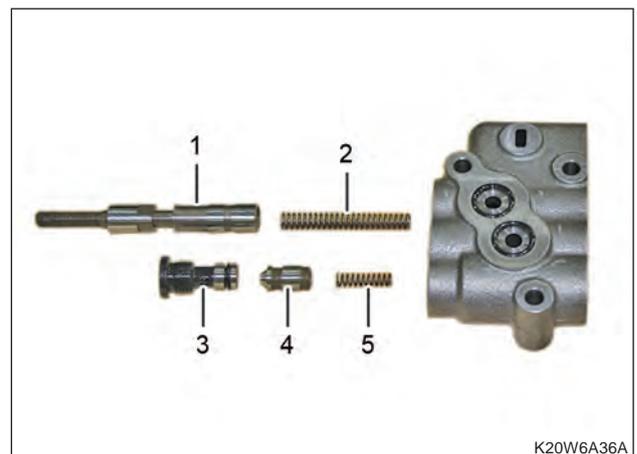
16. Remove the spring (1) and pull out the snap ring (2). Then, remove the position link (3), position feedback link (4), connecting link (5) and position lever shaft (6).
17. Assemble in the reverse order of disassembly.

7.3 CONTROL VALVE DISASSEMBLY

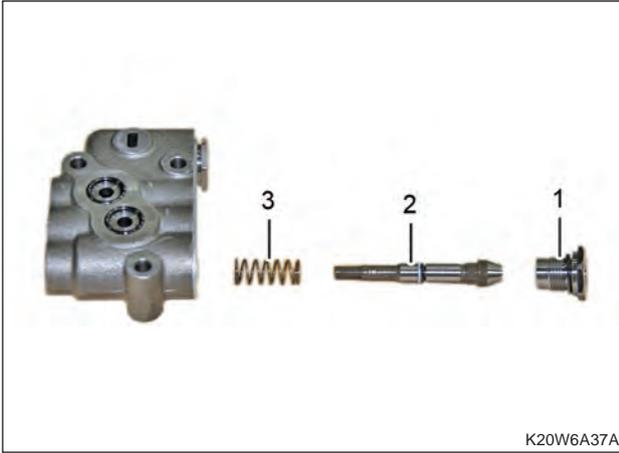


1. Unscrew the control valve mounting bolts (1) from the hydraulic cylinder cover to remove the control valve (2).

2. Unscrew the hex. nut (1) from the control valve to separate the clevis assembly (2) and plate (3).

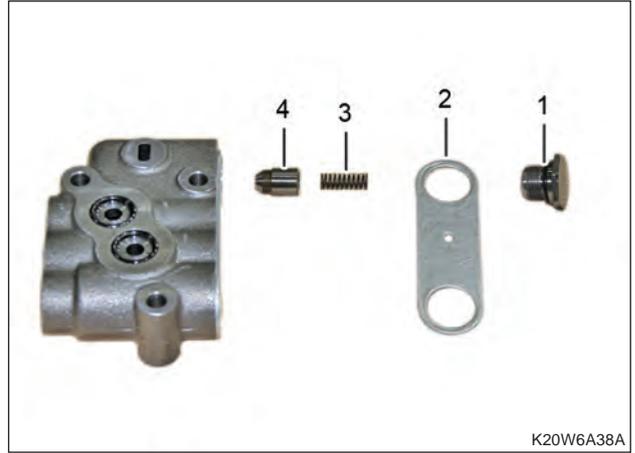


3. Remove the main spool (1), main spring (2), load check (3), load check seat (4) and load check spring (5) from the control valve.



K20W6A37A

4. Unscrew the main check plug (1) and remove the main check poppet (2) and main check spring (3).



K20W6A38A

5. Unscrew the unload plug (1) and remove the plate (2), unload spring (3) and unload check (4).



K20W6A39A

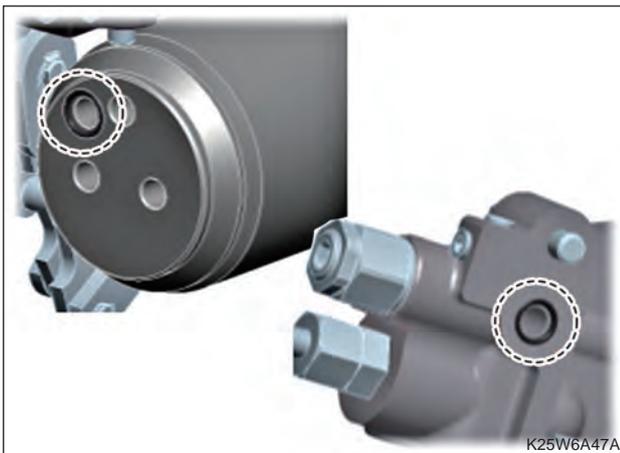
6. Assemble in the reverse order of disassembly.

**HYDRAULIC CYLINDER INSTALLATION STANDARD**

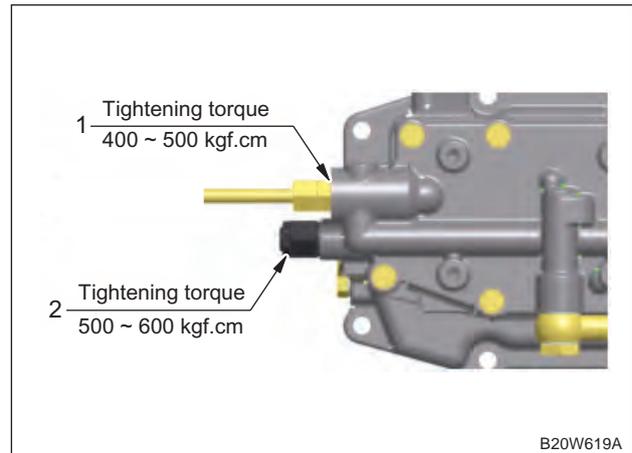
1. Keep all hydraulic components clean and remove any foreign material and dust from them before their installation.



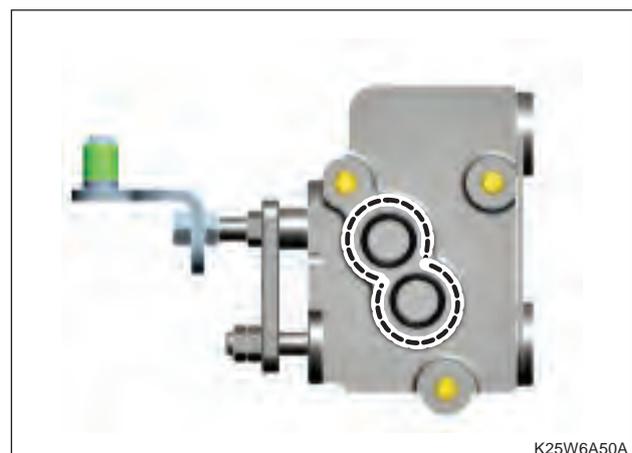
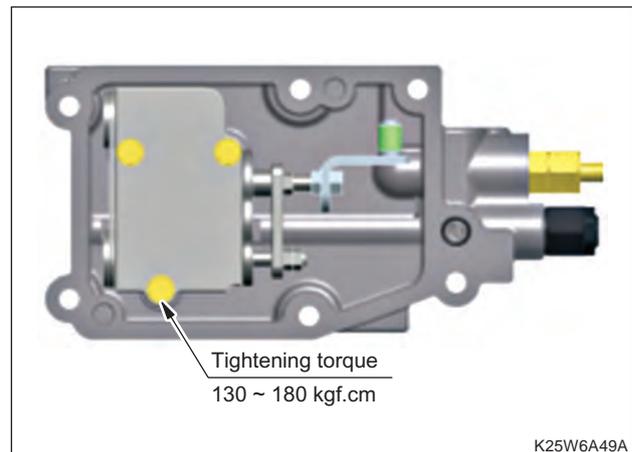
2. When installing the O-ring (1) and backup ring (2) to the piston, install them in the correct direction. (Apply transmission fluid to them before installation.)



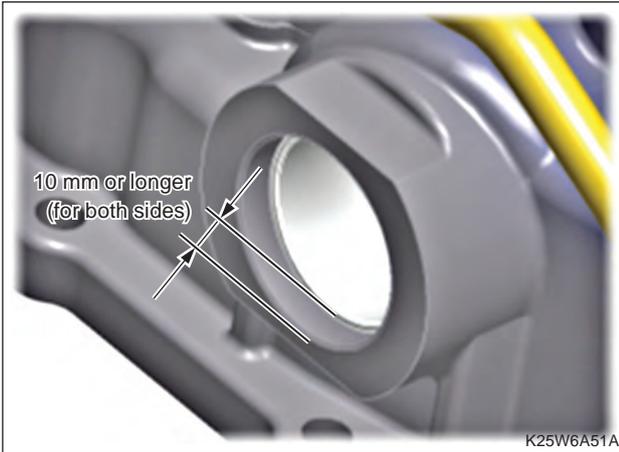
3. Check if the O-rings for the hydraulic cylinder and hydraulic cylinder cover are missing or damaged. Apply grease on them before their installation.



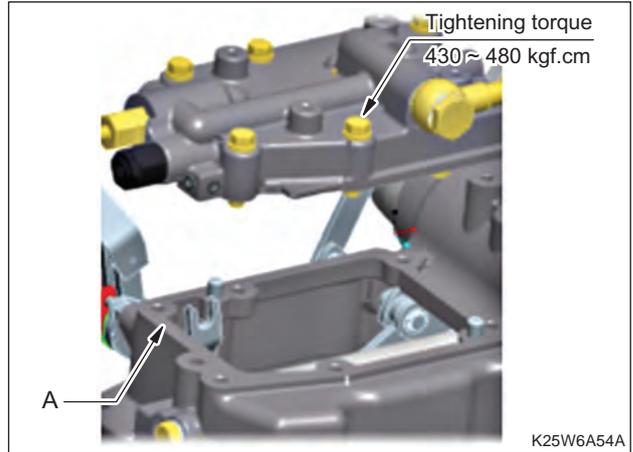
4. When installing the safety valve (1) and lowering speed control valve (2), check if their O-rings are missing or damaged. Also, apply grease on them before installation.



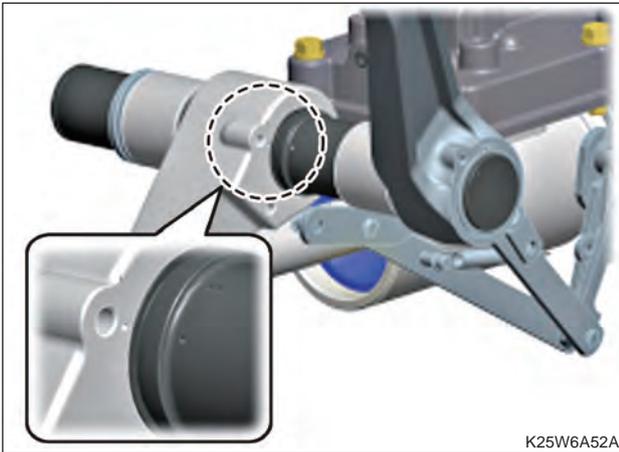
5. When installing the lifting/lowering control valve, check if its O-ring is missing or damaged. Also, apply grease on it before installation. Also, tighten the mounting bolt to the specified torque.



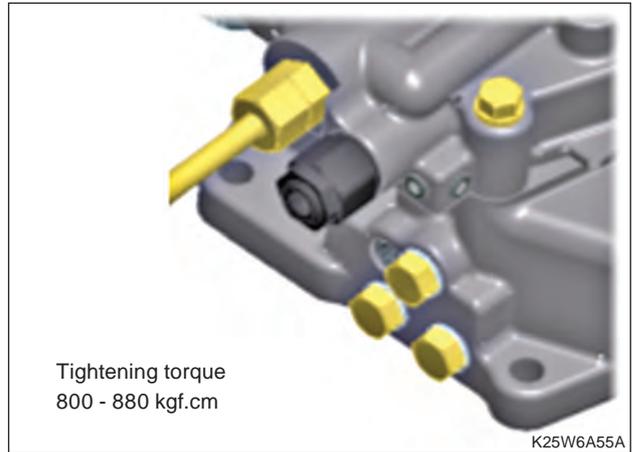
6. When pressing in the hydraulic cylinder case bushing, select the correct size and use a pressing jig.



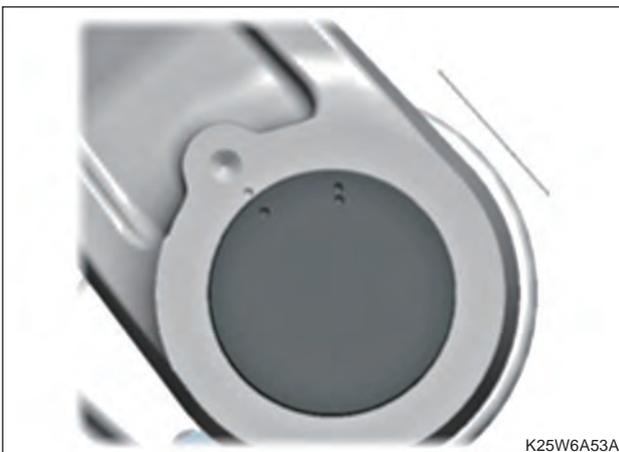
9. When installing the hydraulic cylinder cover, apply liquid gasket (A) on it in advance.



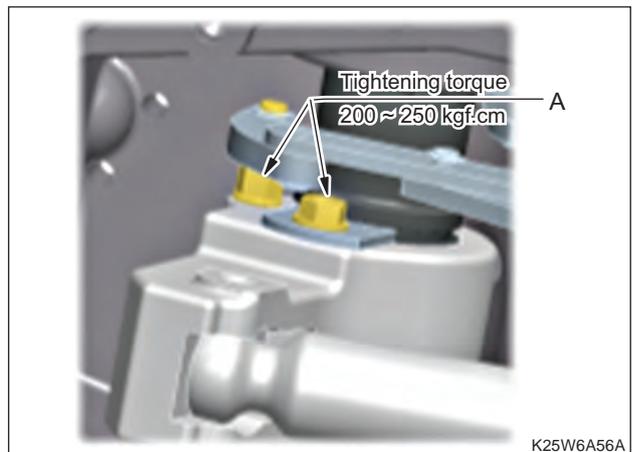
7. When installing the lift crank shaft and crank, align their matching marks.



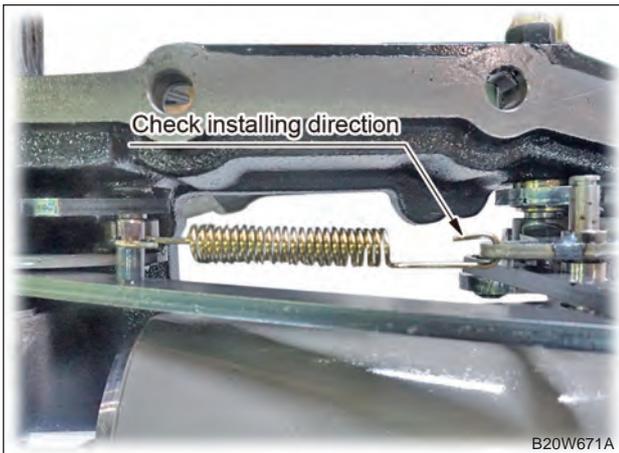
10. When installing the hydraulic cylinder, apply LOCTITE on it and follow the specified tightening torque.



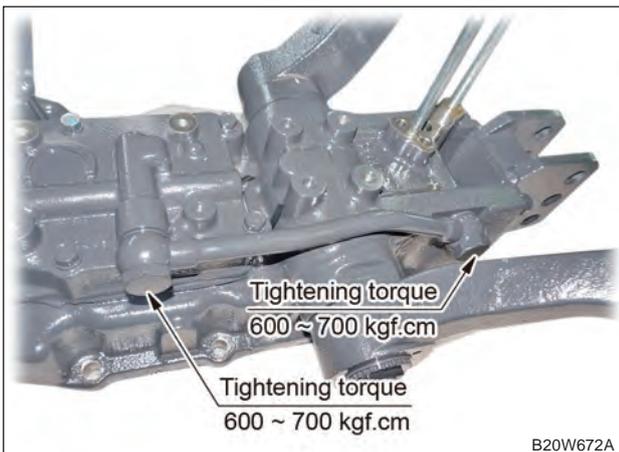
8. When installing the lift crank shaft and lift arm, align their matching marks.



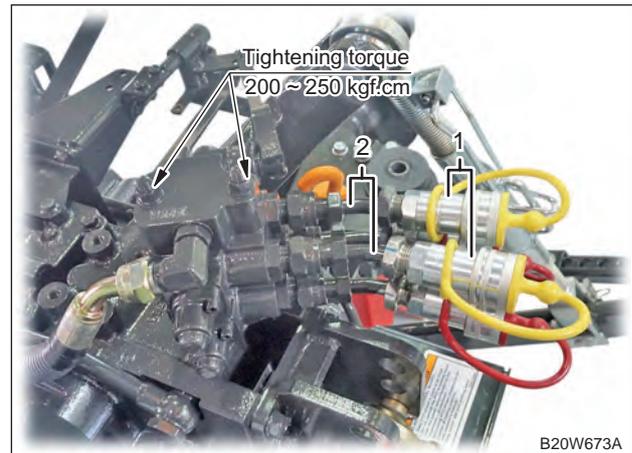
11. When installing the link, apply LOCTITE (A) on it and follow the specified tightening torque.



12. When installing the return spring, set its longer section to the front.

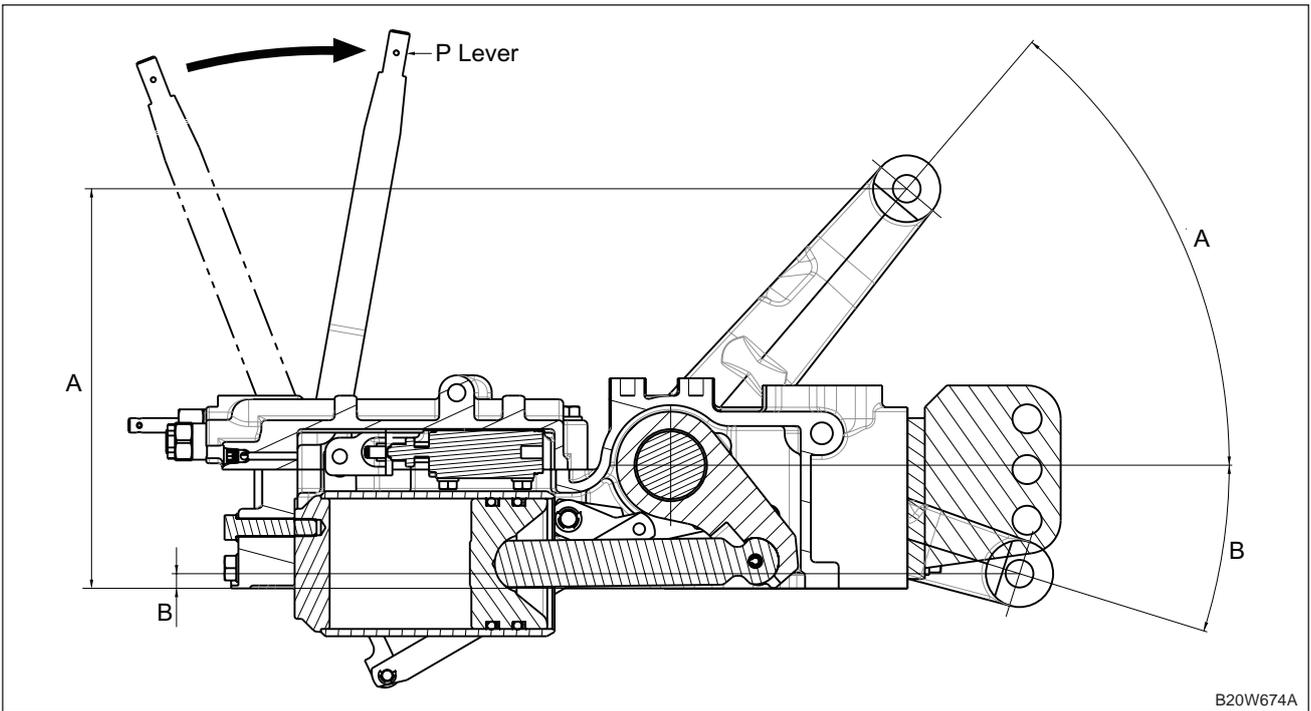


13. Tighten the high-pressure pipe to the specified torque.



14. When installing the rear SCV, make sure that its O-ring is not missing or damaged.
15. When installing the SCV, tighten its nut to the specified torque (200 ~ 250 kgf.cm).
16. When installing the quick coupler (1) and joint (2), wrap them with seal tape.

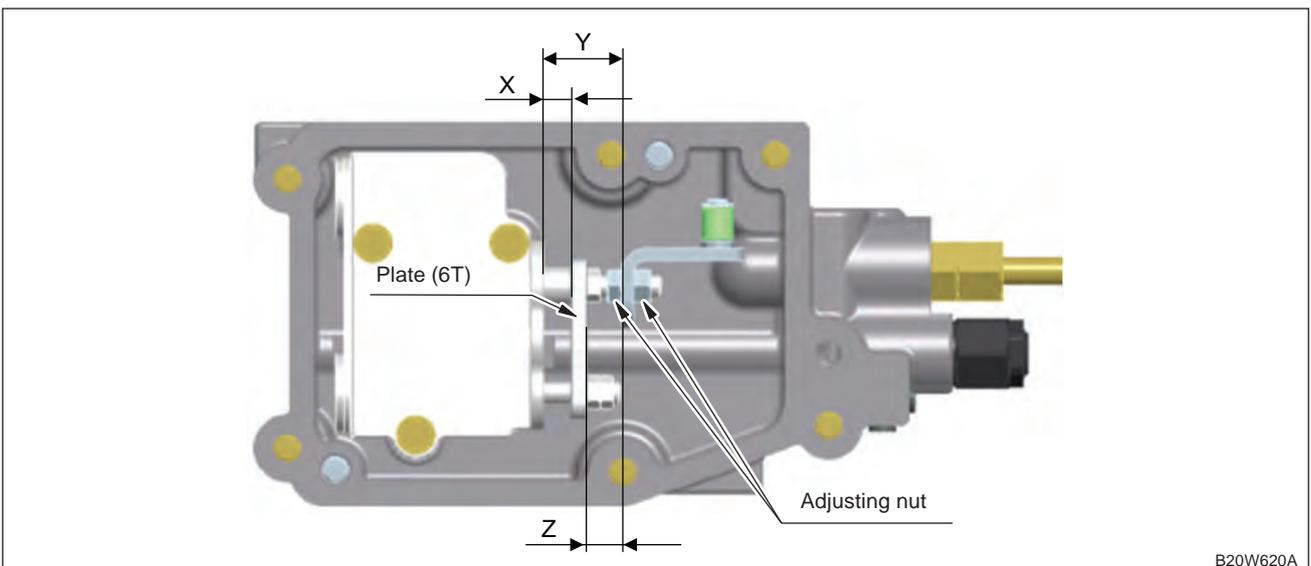
► CONTROL VALVE SETTING BY DIFFERENT LIFT ARM ANGLES



1. P lever pulled to the max. lifting position

A (LIFTING ANGLE)	A (LIFTING HEIGHT)	B (LOWERING ANGLE)	B (LOWERING HEIGHT)
49.7°	275.5	17.4°	10.0

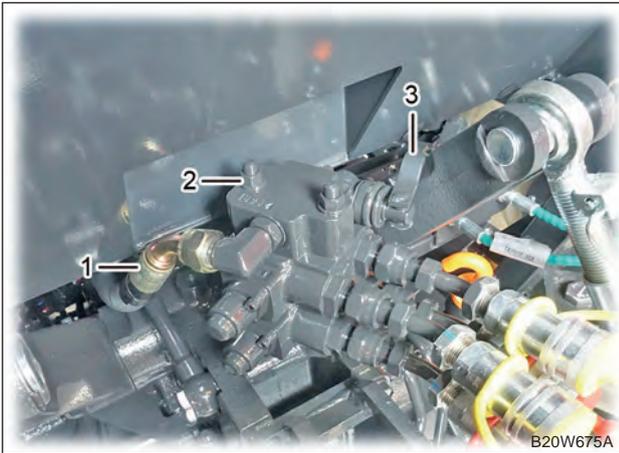
2. If the lifting angle or lowering angle is out of the specified range, adjust it with the clevis adjusting nut. (Initial setting value: Y 29 mm or Z 13 mm with X 10 mm) (Repeat adjustment 2 to 3 times for precise setting.)



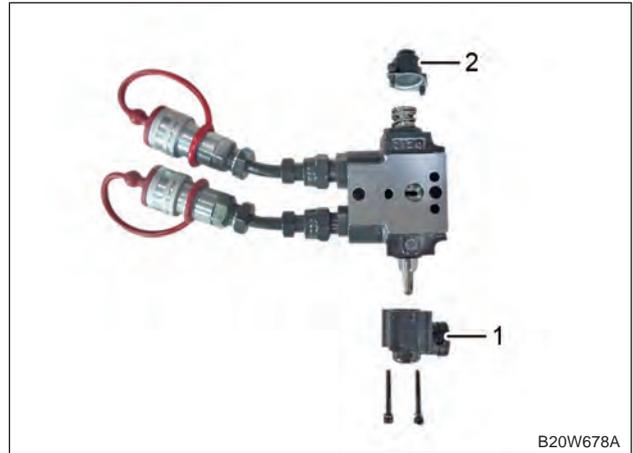
3. Apply LOCTITE to the adjusting nut before its installation.

- Excessive lifting height: decrease the length Y and Z
- Insufficient lifting height: increase the length Y and Z

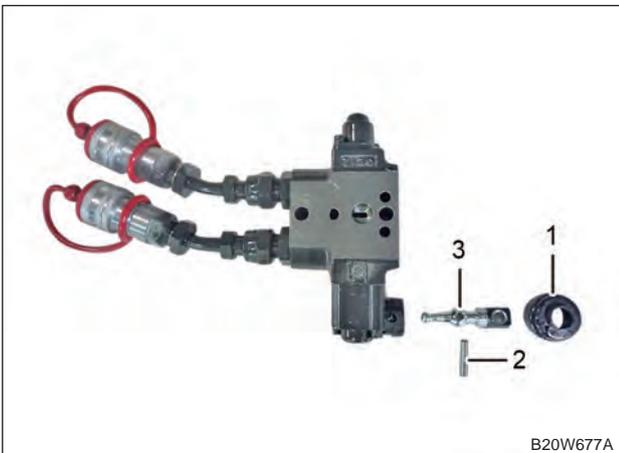
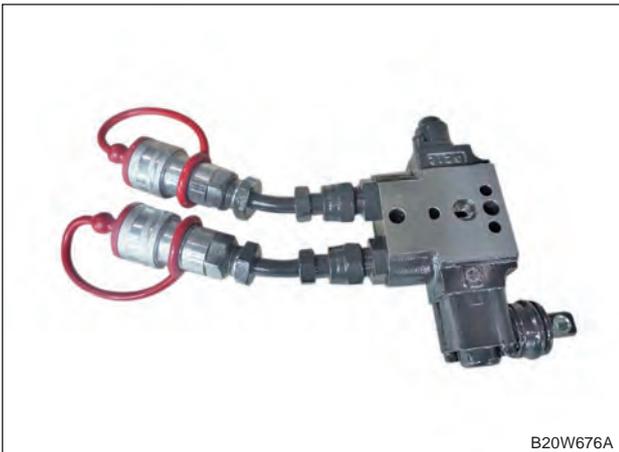
7.4 REAR SCV DISASSEMBLY



1. Disconnect all the hydraulic pipes (1) to the rear SCV from the back of the tractor and unscrew the mounting nuts (2), and disconnect the connecting bracket (3) to remove the rear SCV assembly.



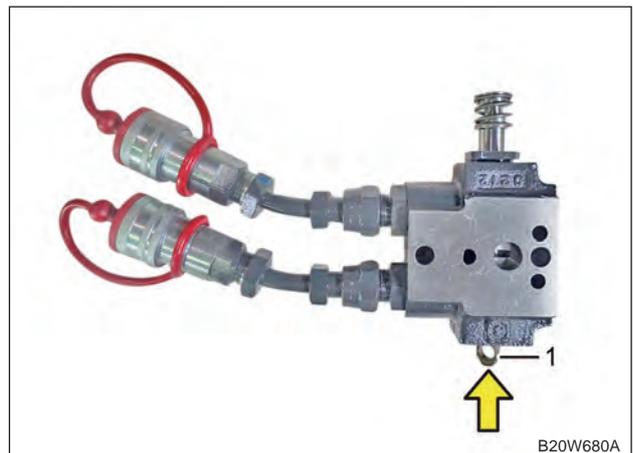
3. Remove the covers (1 & 2).



2. Remove the rubber bellows (1) and pull out the retaining pin (2). Then, remove the arm (3).



4. Pull out the spool (1) in the arrow direction.



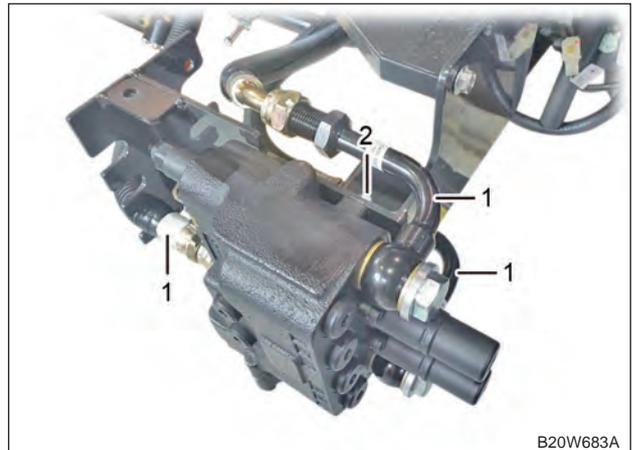
## 7.5 FRONT SCV DISASSEMBLY



5. Assemble in the reverse order of disassembly.



1. Remove the front SCV cover (1).



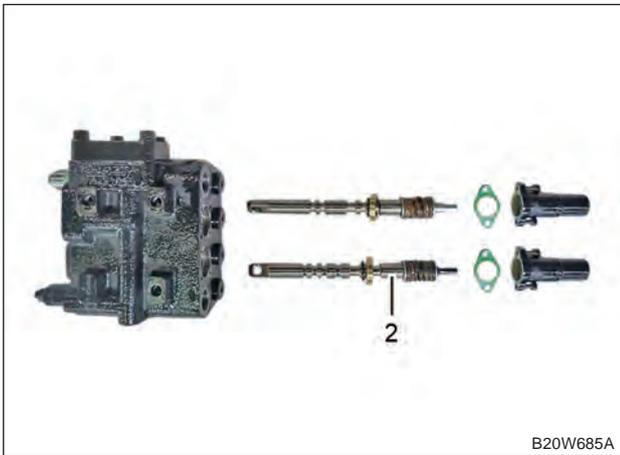
2. Disconnect all the hydraulic pipes (1) from the front SCV and unscrew the mounting bolts (2) to remove the front SCV assembly.



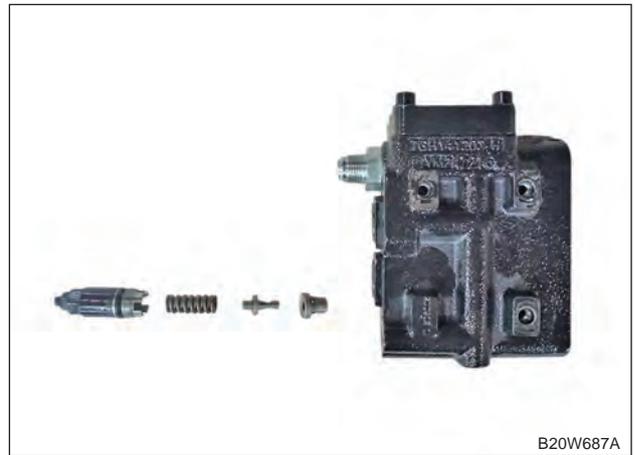
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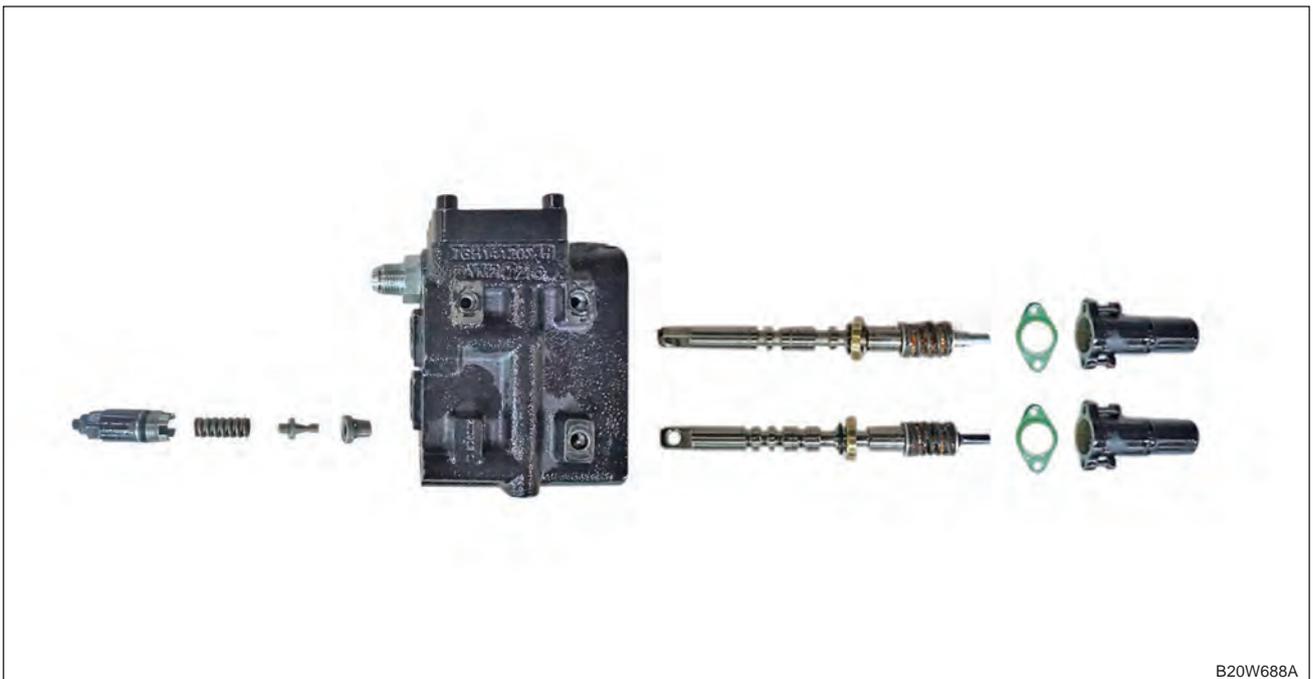
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3. Unscrew the spool cap mounting bolts (1) and then, remove the cap and spools (2).

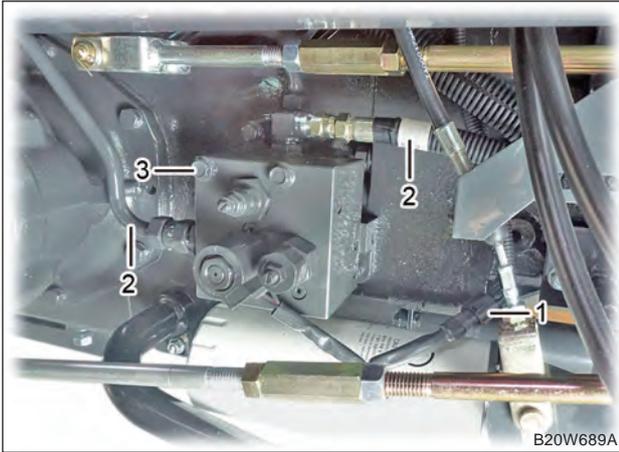
4. Unscrew the relief valve plug (1) to remove the relief valve.



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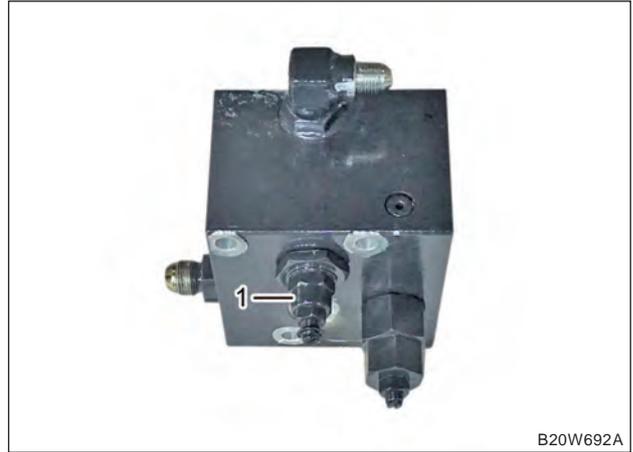
5. Assemble in the reverse order of disassembly.

7.6 PTO VALVE DISASSEMBLY

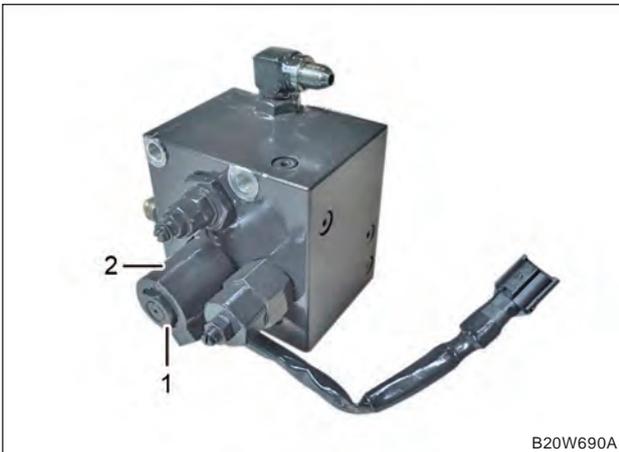


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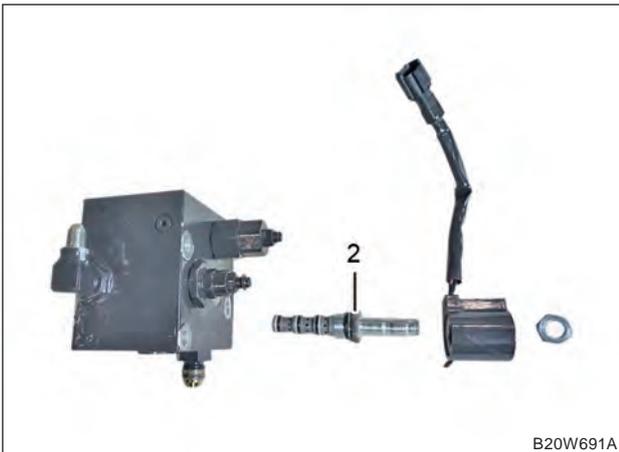
1. Disconnect the PTO valve wiring (1) connector and hydraulic pipe (2) and unscrew the mounting bolts (3) to remove the PTO valve assembly.



B20W692A

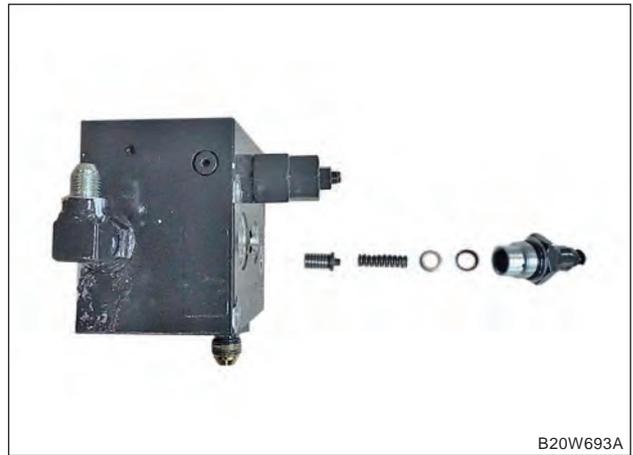


B20W690A



B20W691A

2. Unscrew the mounting plug (1) from the PTO valve assembly to separate the solenoid valve (2).



B20W693A

3. Remove the sequence valve assembly (1).

**7.7 STEERING VALVE DISASSEMBLY**

1. Disconnect the hydraulic tubes(4EA) from the steering valve to other side. (hydraulic pump, steering cylinder (L)(R), PTO valve)



B20W694A



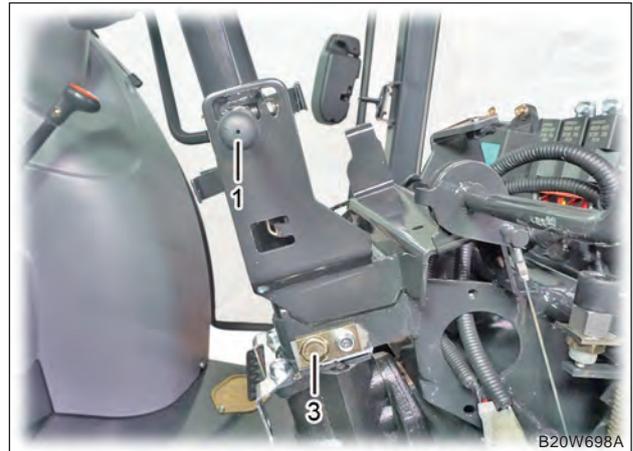
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2. Remove the upper dashboard part (1) and column cover (2).



B20W695A

4. Remove the DRV (1).



B20W698A



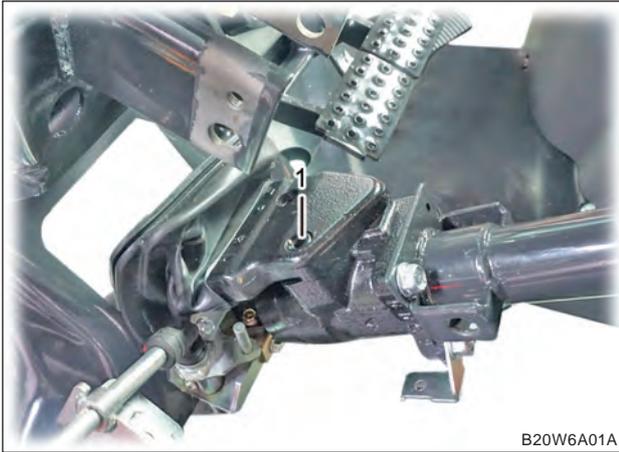
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5. Assemble in the reverse order of disassembly.

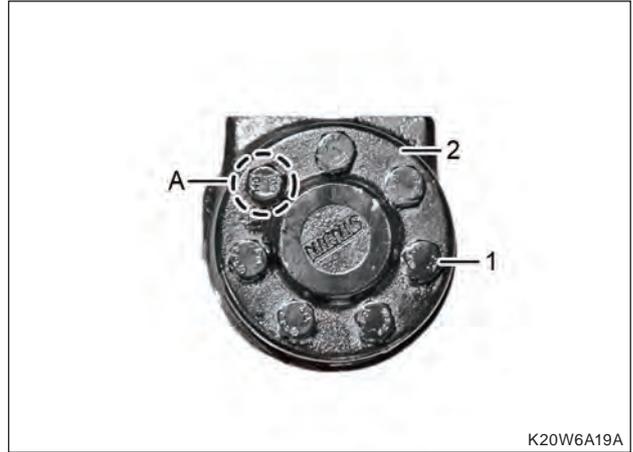


B20W699A

3. Remove the tilt lever (1) and reverse bracket (2). Then, pull out the tilt pin (3).



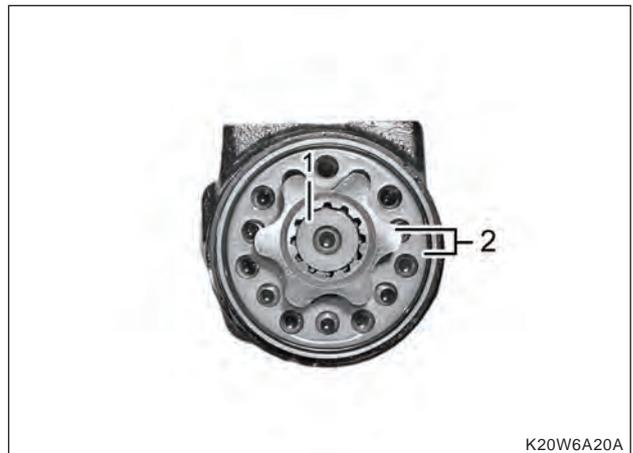
4. Unscrew the hydraulic block mounting bolts(1) to remove the hydraulic block ass'y from the steering valve assembly.



6. Unscrew the end cap mounting bolts (1) from the steering valve assembly to remove the end cap (2).

**⊕ IMPORTANT**

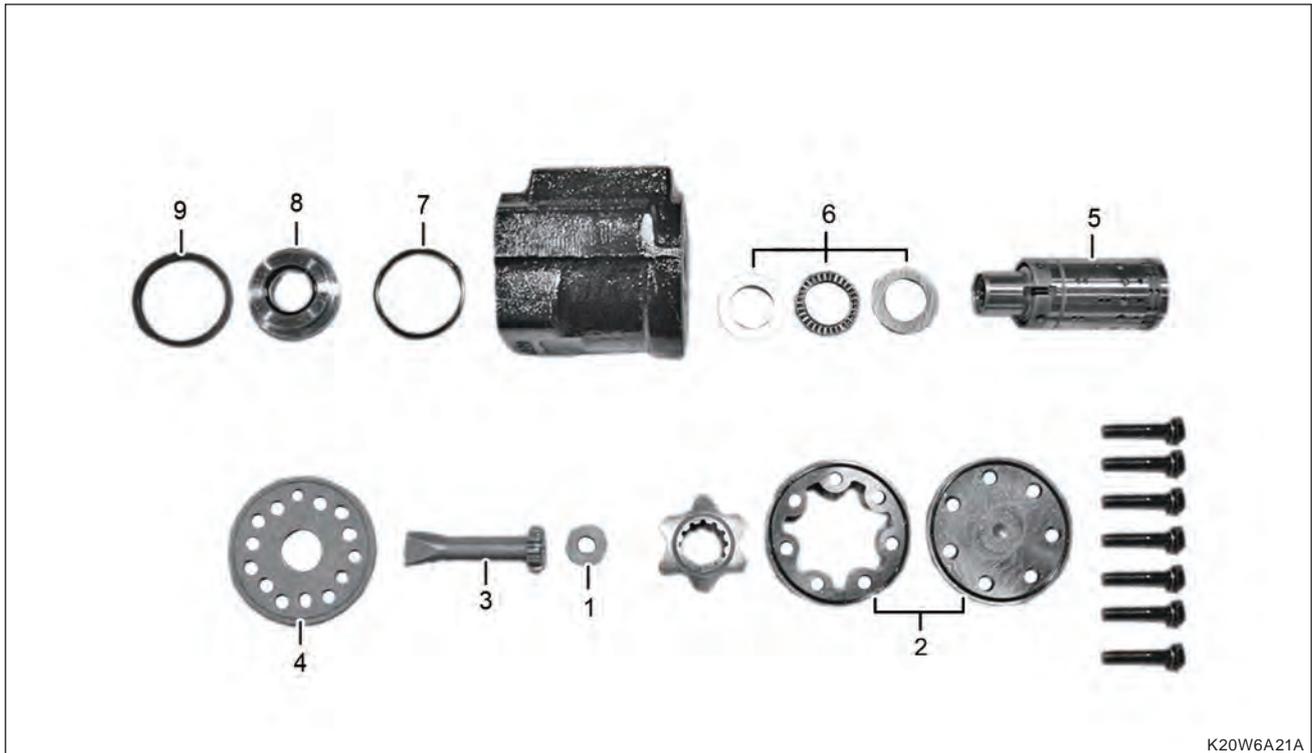
- The bolt A among the end cap mounting bolts is longer than the other ones. Make sure to install it correctly.



7. Remove the spacer (1) and gerotor set (2) in order.

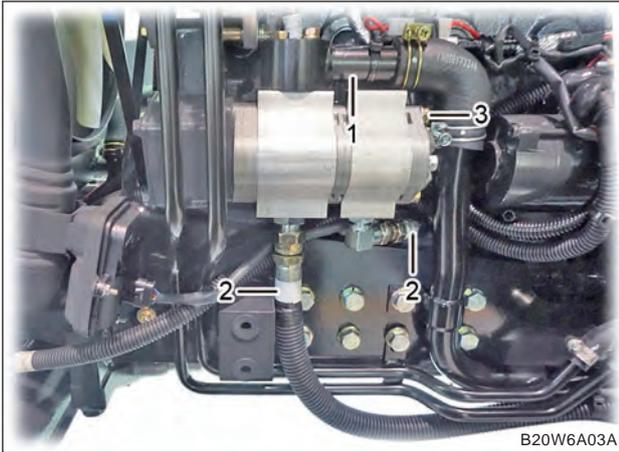


5. Unscrew the steering valve assembly mounting bolts (1) and push down the steering valve assembly to remove it.



8. 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.

7.8 HYDRAULIC PUMP DISASSEMBLY



B20W6A03A

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



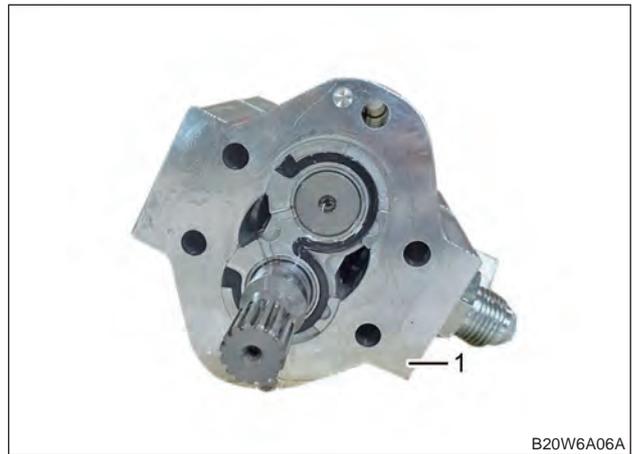
B20W6A04A

2. Unscrew the housing mounting bolts (1) and remove the front cover (2).

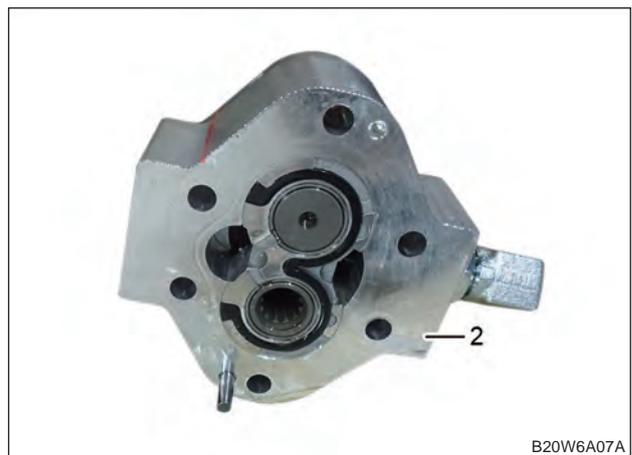
**Notes**

B20W6A05A

- Marking the gear pump with lines for reassembly before disassembling it can help prevent mistakes during reassembly.

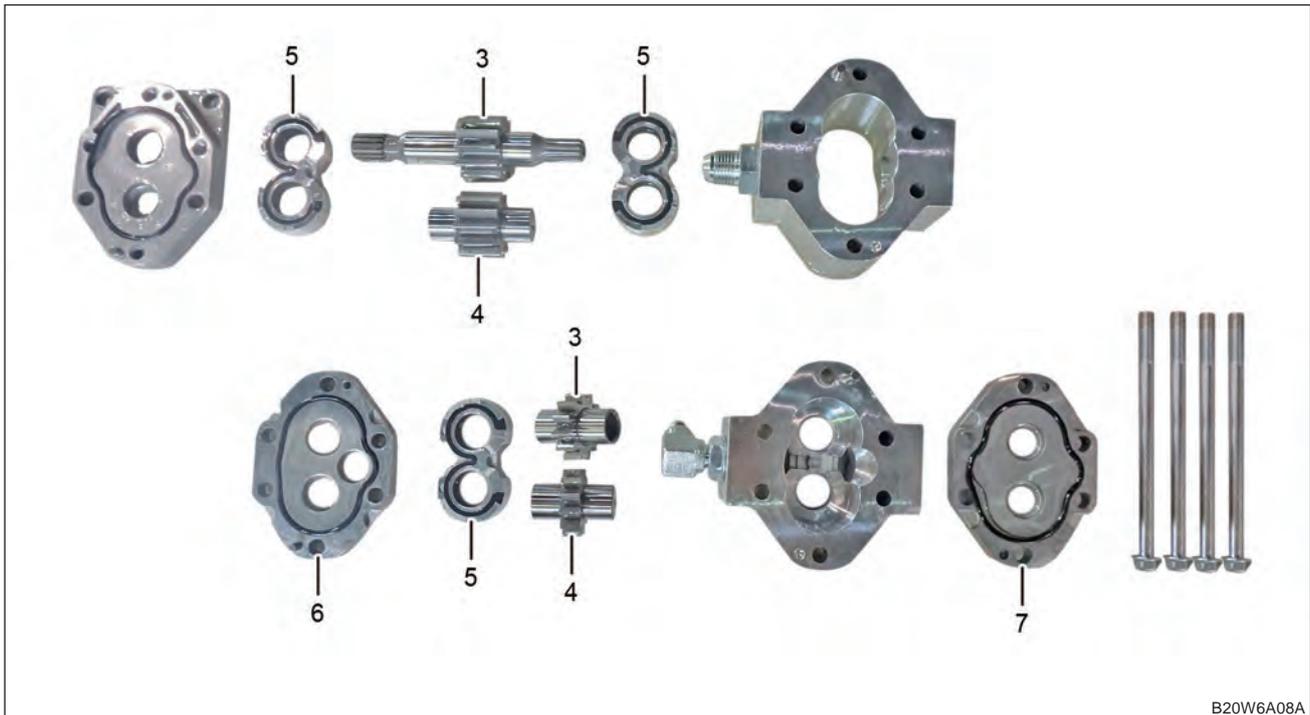


B20W6A06A



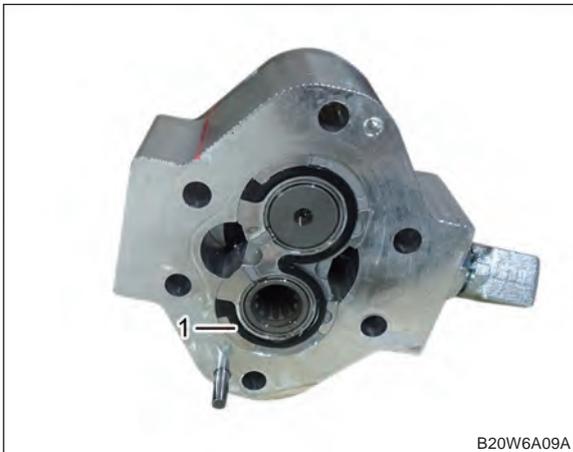
B20W6A07A

3. Separate the front housing (1) and rear housing (2) from the body.



4. Remove the drive gear (3), driven gear (4), shaft holding block (5), spacer (6) and rear cover (7).

**⊕ IMPORTANT**



- The seal (1) of the shaft holding block should face the housing when assembling it.

5. Assemble in the reverse order of disassembly.

### 8. INSPECTION, ADJUSTMENT AND TEST

- When testing oil flow or pressure for the hydraulic kit, warm up the engine to obtain proper oil temperature.

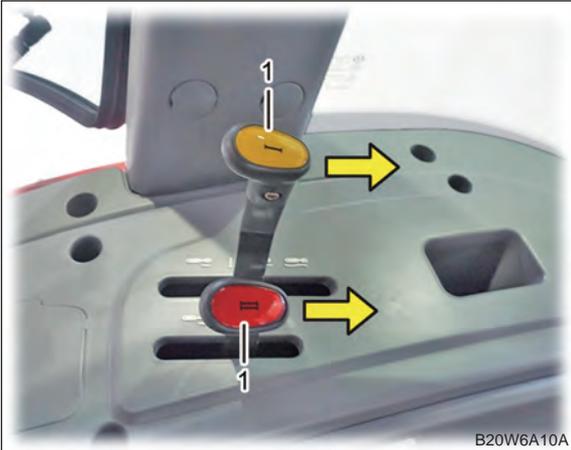
**⚠ CAUTION**

- 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**

- Lower the 3-point hitch completely.
- Idle the engine at a low speed.



B20W6A10A

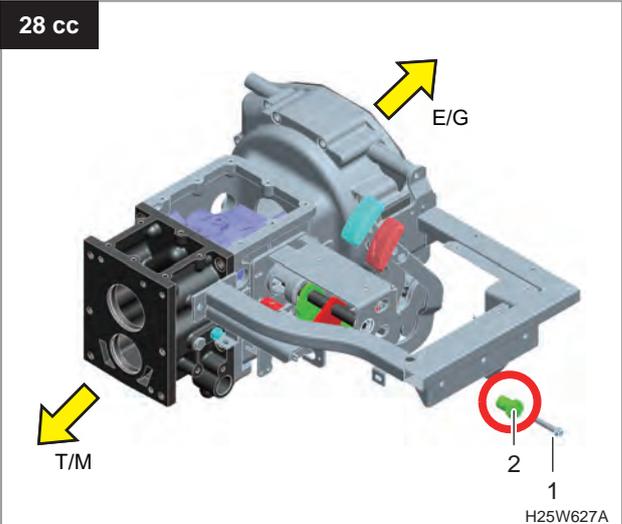
- Pull the SCV lever (1) backwards to set the system in the relief status.
- Pull the lever backwards until the suction line becomes too hot to touch.
  - The oil temperature at this point should be approx. 38 - 43°C (100 - 110°F).

### 8.1 HST (ONLY HST MODEL)

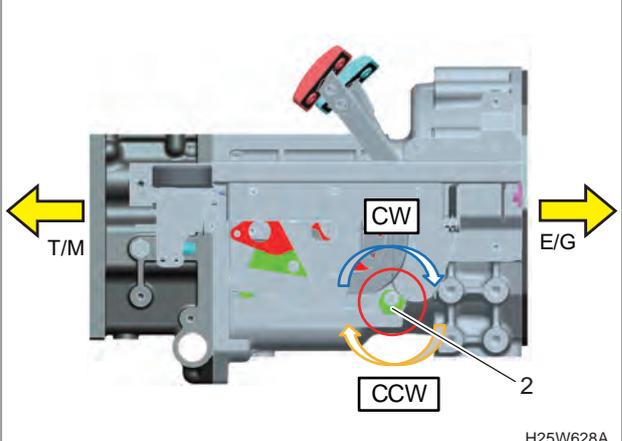
#### 8.1.1 HST NEUTRAL STATE

- Lift the vehicle off the ground so that the wheels idle above the ground.
- Set the engine to idle speed.
- Set the range shift lever to the low position.
- Check if the wheels rotate forward or backward with the HST pedal released.

**28 cc**

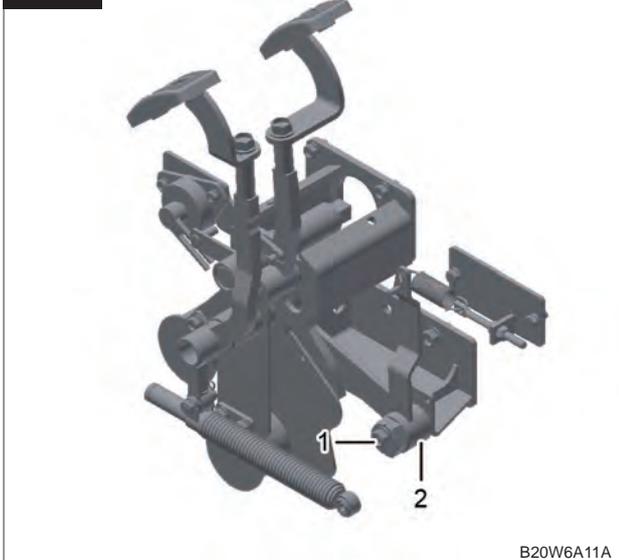


H25W627A



H25W628A

40 cc

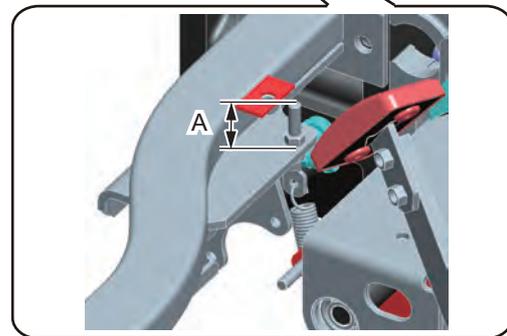
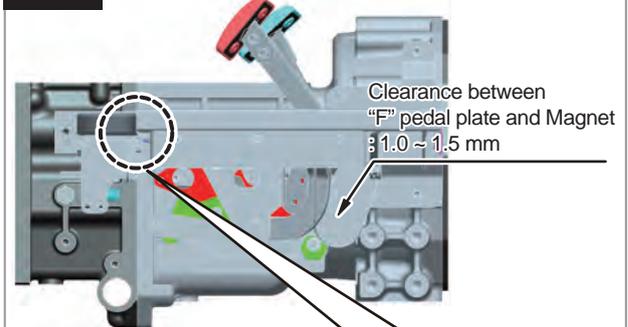


5. If the wheels rotate in the forward direction with the HST pedal released, unscrew the mounting bolt (1) and turn the shaft (2) counterclockwise slowly as shown in the figure. Tighten the mounting bolt to the position where the wheels stop rotating.
6. If the wheels rotate in the backward direction, turn the shaft clockwise to find the position where the wheels stop rotating. Then, fix the shaft to that position by tightening the mounting bolt.

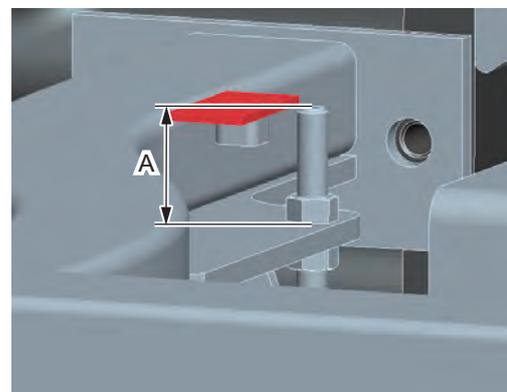
## 8.1.2 HST SETTING

## NEUTRAL SETTING

28 cc

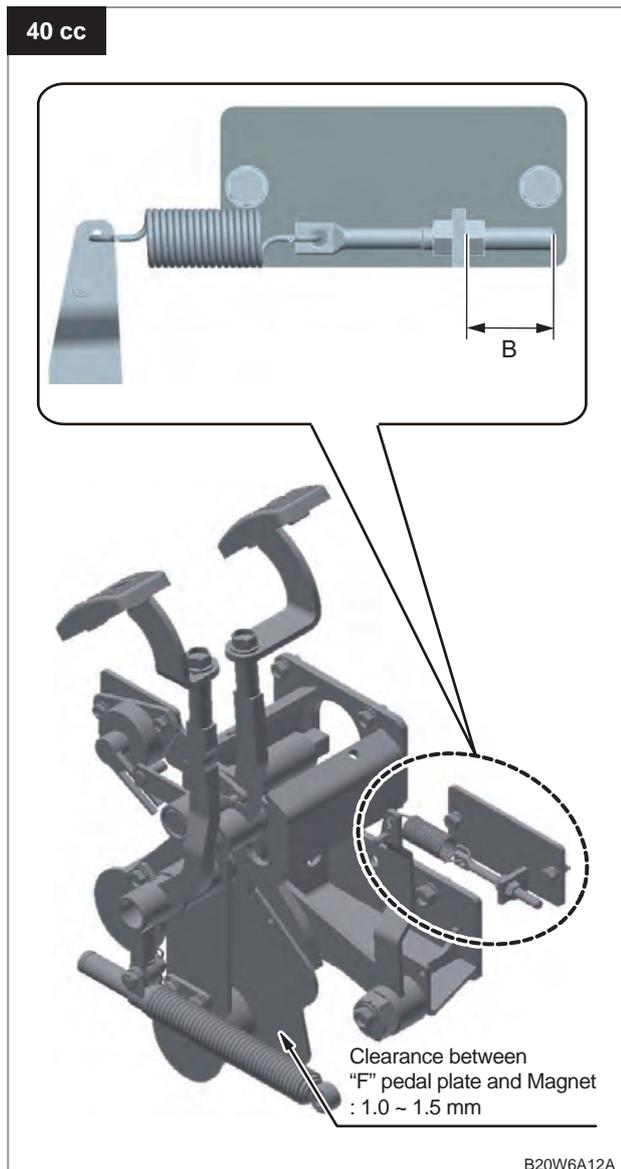


H25W630A



H25W631A

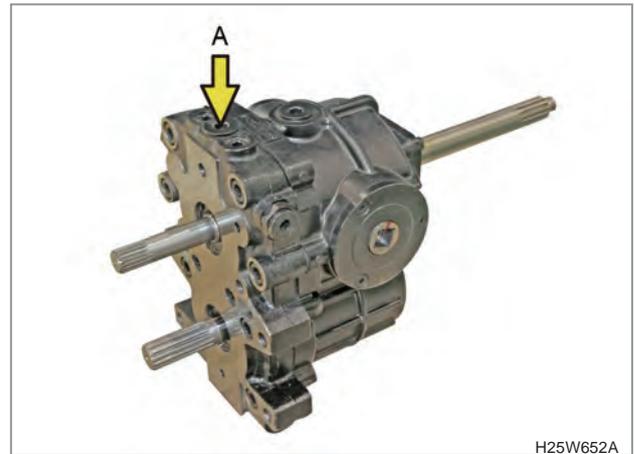
- Tension bolt setting length A: 28~30 mm



- Tension bolt setting length B: 28 ~ 30 mm

### 8.1.3 HST RELIEF PRESSURE

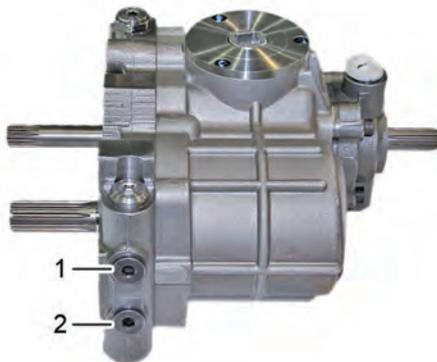
#### CHARGE PRESSURE



1. Set a elbow (1) and pressure gauge (50 kgf/cm<sup>2</sup>) to the charge pressure port (A) of the HST.
2. Set the range shift lever in the neutral position and start the engine. Then, depress the shuttle shift pedal repeatedly to increase the oil temperature.
3. Set the engine speed to 2,600 RPM and measure the charge relief pressure.
4. If the measurement is out of the standard (5 ~ 7 kgf/cm<sup>2</sup>), check the line filter, hydraulic oil amount and charge pump.

**PRESSURE OF HIGH PRESSURE RELIEF VALVE****28 cc**

K25W684A

**40 cc**

K25W6B01A

- (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<sup>2</sup> or higher).
2. Start the engine and place the range shift lever in the 4th 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<sup>2</sup>), 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.

## 8.2 PST VALVE RELIEF PRESSURE TEST



B20W6A13A

1. Remove the hydraulic hose (1) from the right side of the steering cylinder.
2. Connect a hydraulic pressure gauge, hose and adaptor between the hydraulic pipe 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<sup>2</sup>  
12.74 MPa  
1,849 psi
  - If the measurement is not without the setting, replace the relief valve.

## 8.3 REAR SCV VALVE PRESSURE TEST [CABIN MODEL]

### Notes

- Make sure that hydraulic oil leaks to the outside.
- If the oil filter was not replaced during previous inspection, replace it with a new one for accurate test result.
- Adjust the 3-point hitch linkage properly.
- Keep the hydraulic oil temperature to 38 - 43°C (100 - 110°F).



B20W6A14A

1. Install a pressure gauge to the quick coupler of the rear SCV valve.
2. Start the engine and set a speed for 2,600 rpm.
3. Move the rear SCV lever to built pressure to the tested side. Keep the lever pulled until a pressure relief sound is heard.
4. Read the pressure value on the hydraulic pressure gauge.
  - Relief setting pressure: 180 ~ 185 kgf/cm<sup>2</sup>  
17.64 ~ 18.13 MPa  
2,560 ~ 2,631 psi

## 8.4 PTO VALVE RELIEF PRESSURE TEST

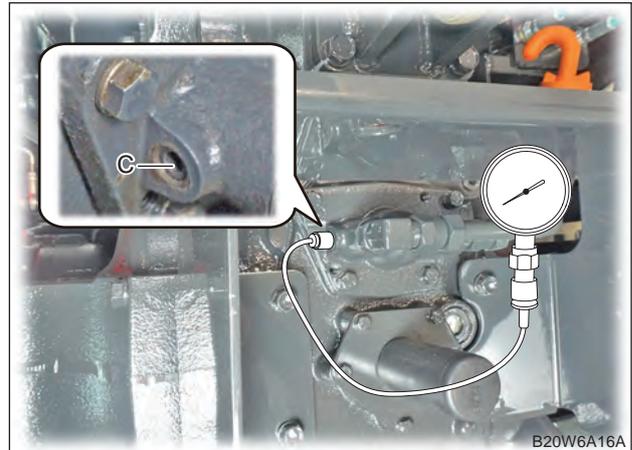
## AT THE PTO VALVE



B20W6A15A

1. Unscrew the plug (A) (G2, PF1/4) of the PTO valve and connect an adaptor, hydraulic pressure gauge and hydraulic hose.
  2. Start the engine and idle it at a low speed.
  3. Connect the PTO switch to apply pressure to the tested part. Hold the switch until an operating sound is heard from the relief valve.
  4. Read the pressure value on the hydraulic pressure gauge.
- Relief valve setting pressure:  
- 11.5 kgf/cm<sup>2</sup> (1.13 MPa / 163.5 psi)

## AT THE SEAL CASE



B20W6A16A

1. Unscrew the plug (C) from the seal case side of the PTO shaft cover on the rear side of the tractor.
2. Connect the adaptor (PT 1/8) for pressure checking and pressure gauge to check the pressure of the PTO valve as above pressure test method.
3. If the pressure is out of the specified value, clean the inside of the PTO valve or replace the new PTO valve.

# CHAPTER 7 ELECTRIC SYSTEM

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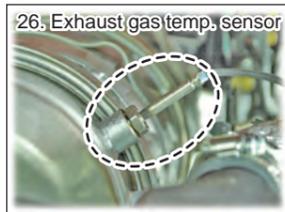
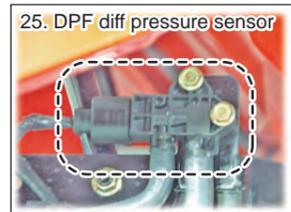
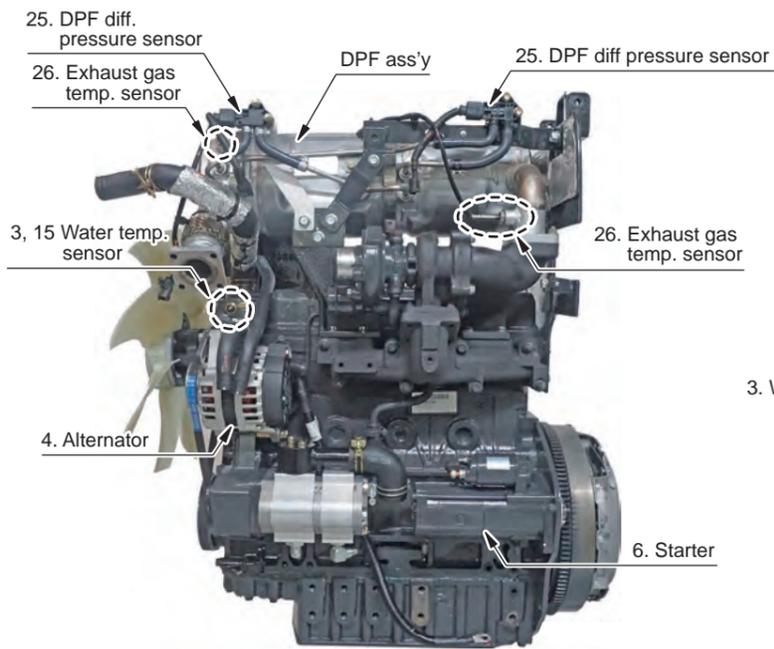
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**1. MAJOR ELECTRIC SYSTEM SPECIFICATIONS**

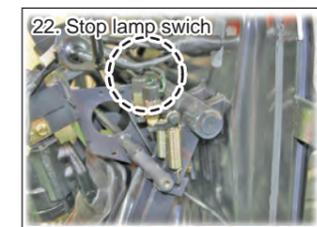
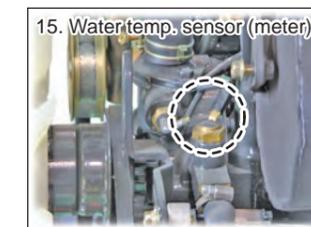
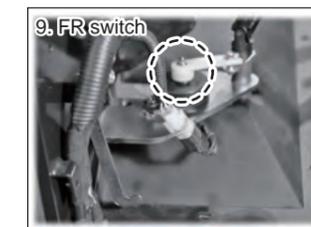
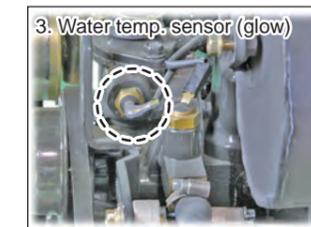
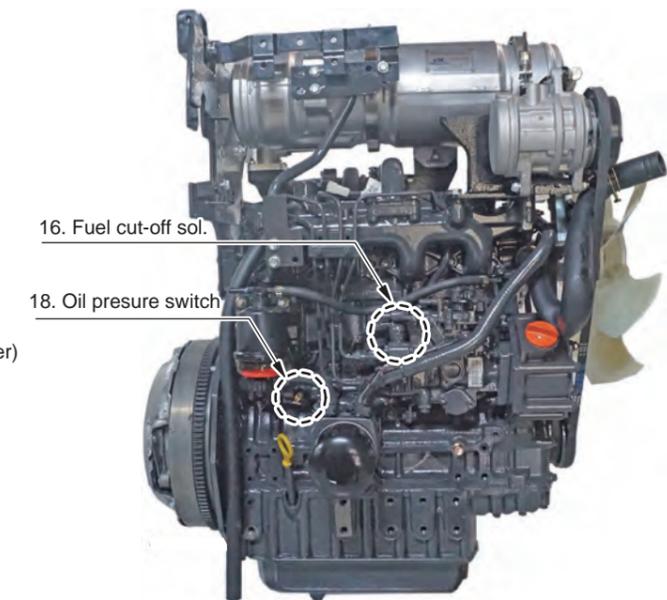
ITEM	STANDARD
Battery	12 V 90 AH
Alternator	CABIN MODEL: 12 V 70 A, ROPS MODEL: 12 V 45 A
Starter	12 V 2.2 kW
FR switch	Voltage range: DC 10 - 16 V
Preheat relay	DC 12 V, 70 A
PTO LINK switch	Rated current: 14 V 15 A
Safety switch	12 V 10 A
Preheat controller	Voltage range: DC 8 - 16 V
Flasher unit	Voltage range: DC 10 - 16 V
Work lamp	12 V 20 W
License plate lamp	12 V 10 W
Combination lamp (rear)	12 V 21 W/5 W, 12 V 8 W
Headlamp	12 V 55 W/55 W
Turn signal lamp assembly	12 V 21 W/5 W
Horn	12 V , 350 ± 2 Hz, 110 ± 5 dB
Fusible link	60 A X 2 EA

2. MAJOR ELECTRIC COMPONENT LAYOUT DIAGRAM

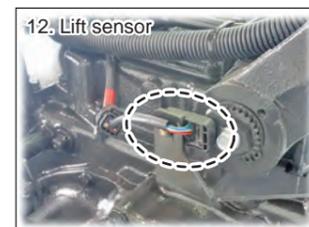
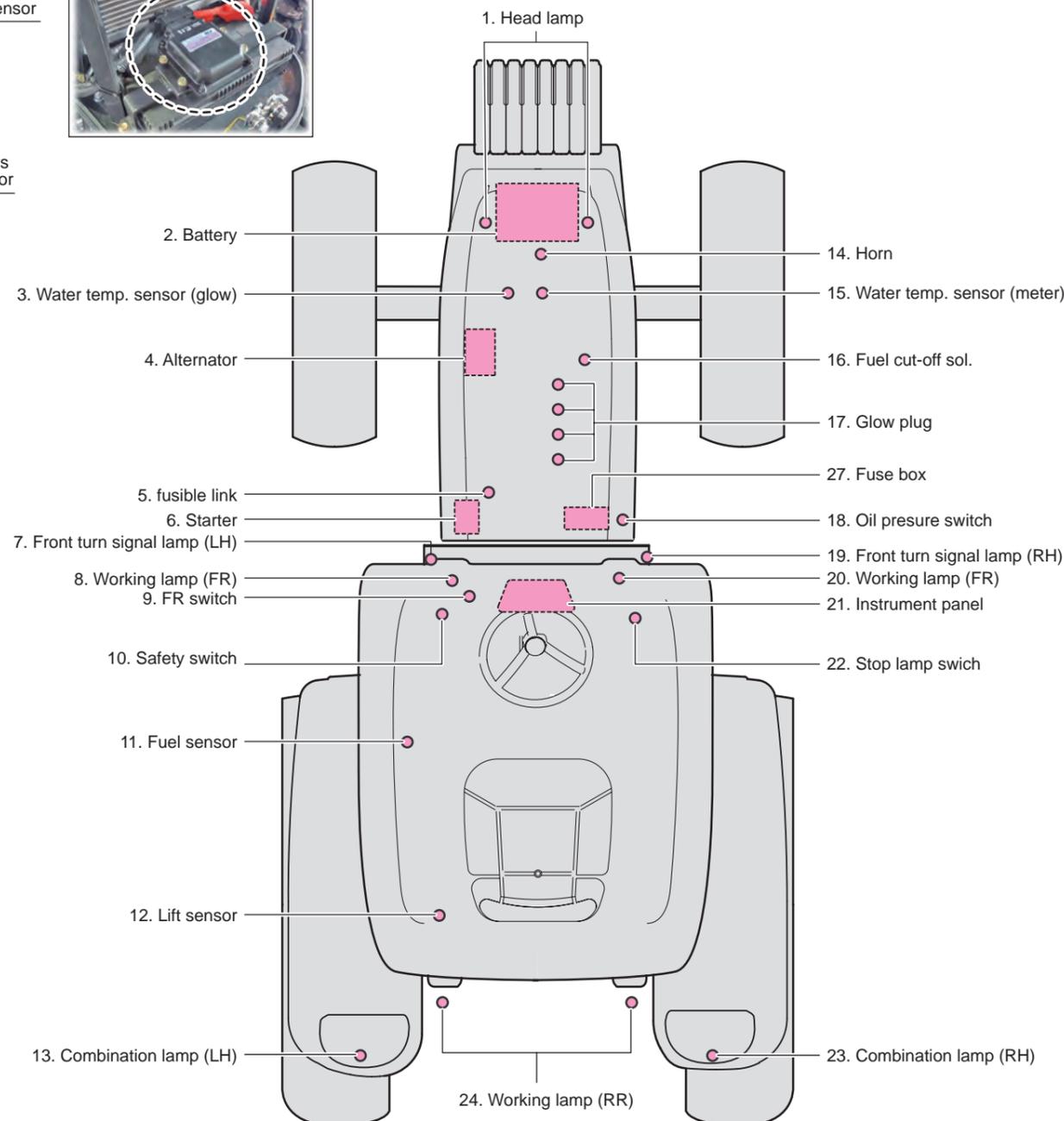
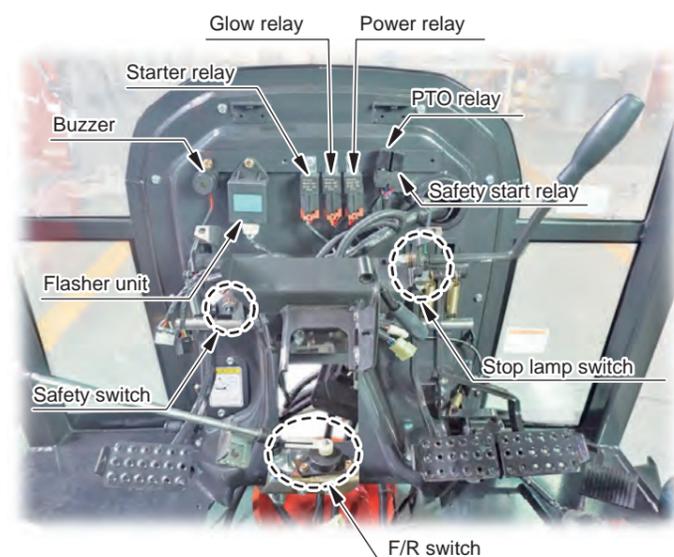
ENGINE (LH)



ENGINE (RH)

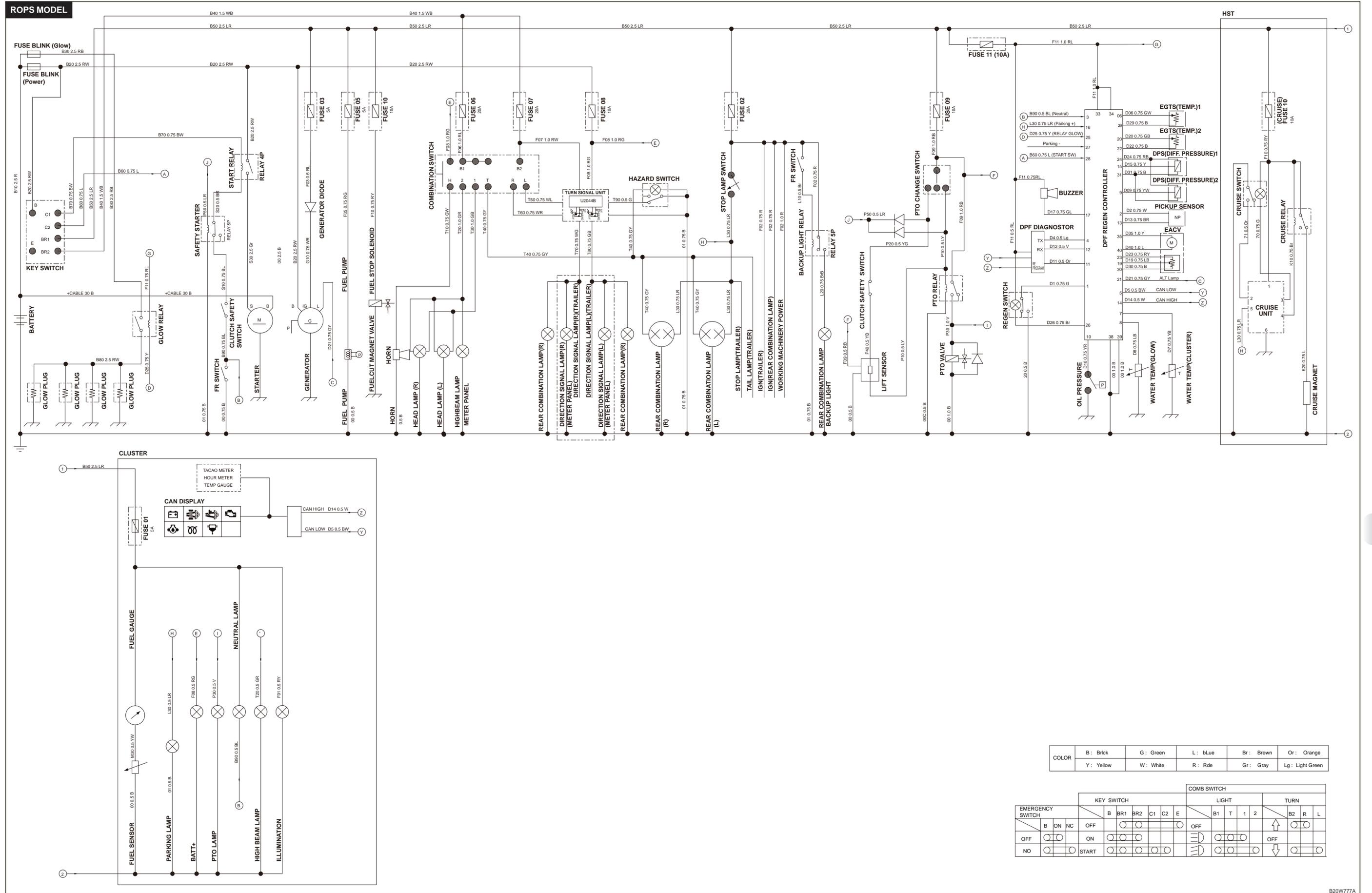


DASH BOARD





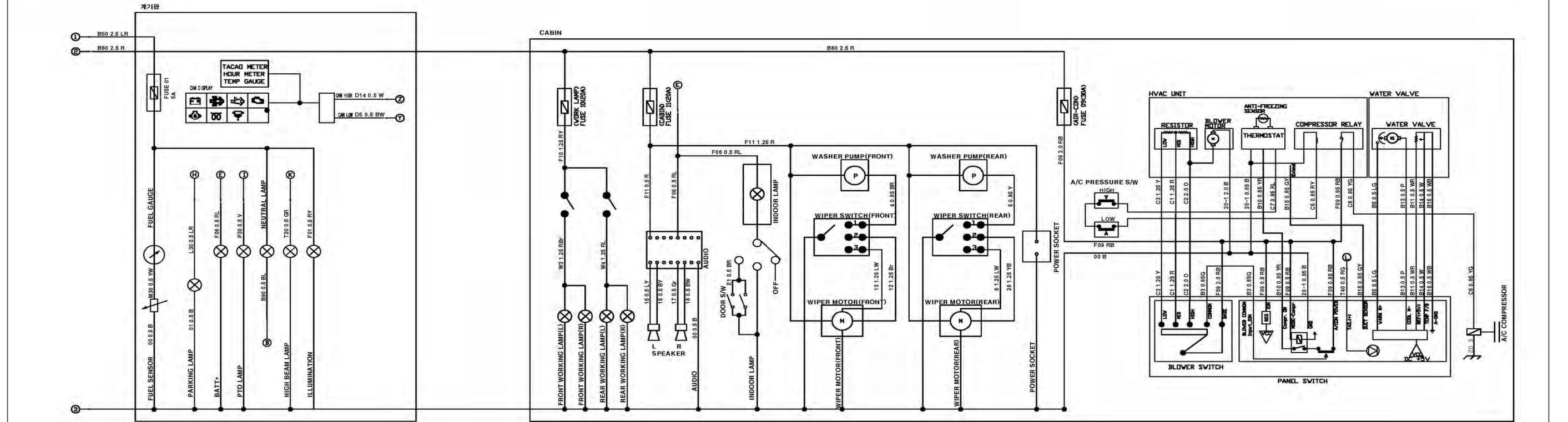
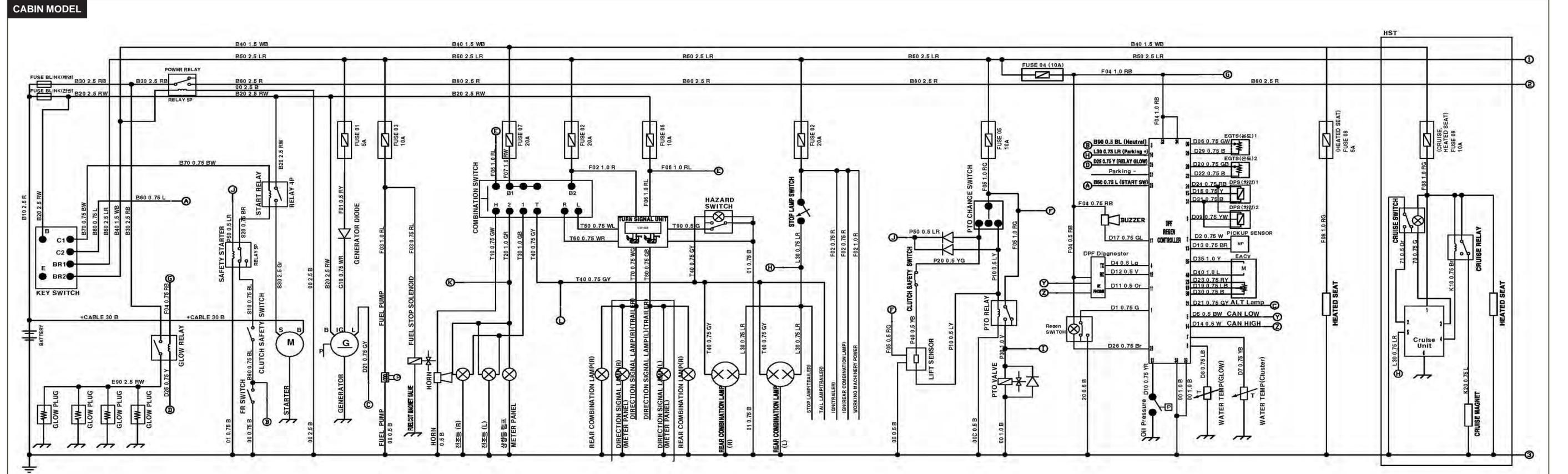
3. ELECTRIC WIRING DIAGRAM



COLOR	B : Brick	G : Green	L : bLue	Br : Brown	Or : Orange
	Y : Yellow	W : White	R : Rde	Gr : Gray	Lg : Light Green

		KEY SWITCH						COMB SWITCH							
		B	BR1	BR2	C1	C2	E	LIGHT				TURN			
EMERGENCY SWITCH								OFF	B1	T	1	2	B2	R	L
OFF	OFF	ON	ON	ON	ON	ON	ON	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF
NO	ON	START	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON	ON

B20W777A



COLOR	B : Brick	G : Green	L : Blue	Br : Brown	Or : Orange
	Y : Yellow	W : White	R : Red	Gr : Gray	Lg : Light Green

EMERGENCY SWITCH	KEY SWITCH					COMB SWITCH			
	B	ON	NC	OFF	E	LIGHT		TURN	
OFF	○	○	○	○	○	○	○	○	○
ON	○	○	○	○	○	○	○	○	○
NO	○	○	○	○	○	○	○	○	○

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		Back buzzer

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)	

## 4. SERVICE TIPS AND COMPONENTS OF ELECTRIC SYSTEM

### 4.1 SERVICE TIPS

#### 4.1.1 BATTERY



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.

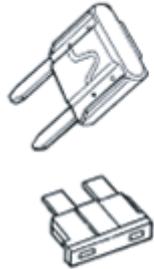
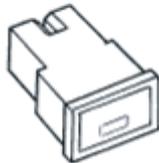
#### Notes

- **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.**

#### 4.1.2 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.**

**4.1.3 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.

 <b>WARNING</b>
<ul style="list-style-type: none"> <li>• <b>Never attempt to modify electric wirings of the machine. It can cause a fire.</b></li> </ul>

<b>Notes</b>
<p>► <b>INSPECTION ORDER FOR ELECTRIC SYSTEM AND CIRCUIT FAILURE</b></p> <ul style="list-style-type: none"> <li>• <b>Battery → Fusible link → Fuse → Ignition relay → Switch → Load</b></li> </ul>

**4.2 COMPONENTS**

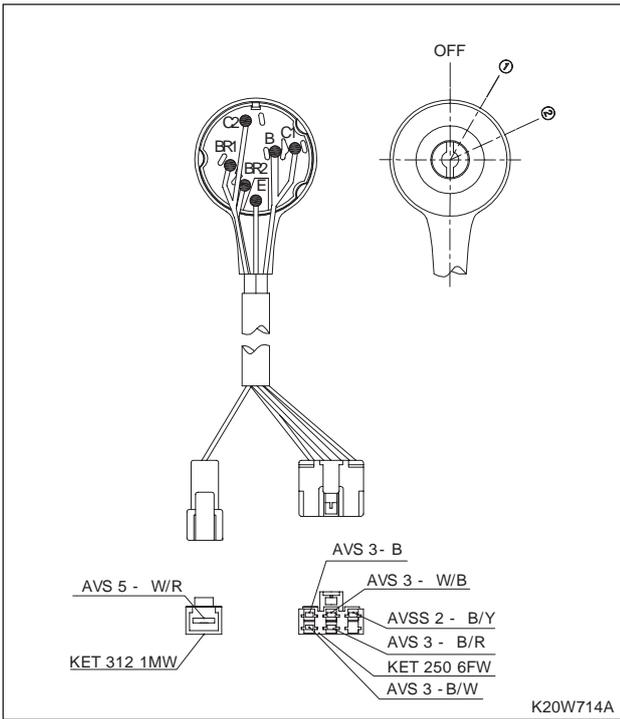
**4.2.1 IGNITION SWITCH**



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.

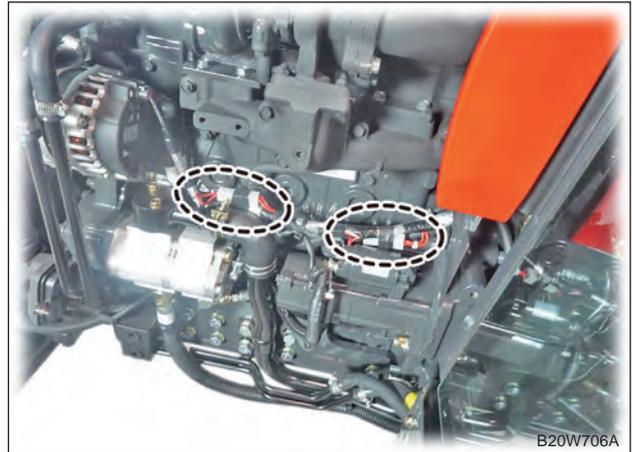
When releasing the switch as soon as the engine is started, the switch is automatically returned to the ON position.

► CONNECTOR AND WIRING DIAGRAM



ITEM	TERMINAL SYMBOL				
	B	BR1 BR2	C1	C2	E
SWITCHING POSITION	OFF		●—————●		
	①	●————●			
	②	●————●	●————●		

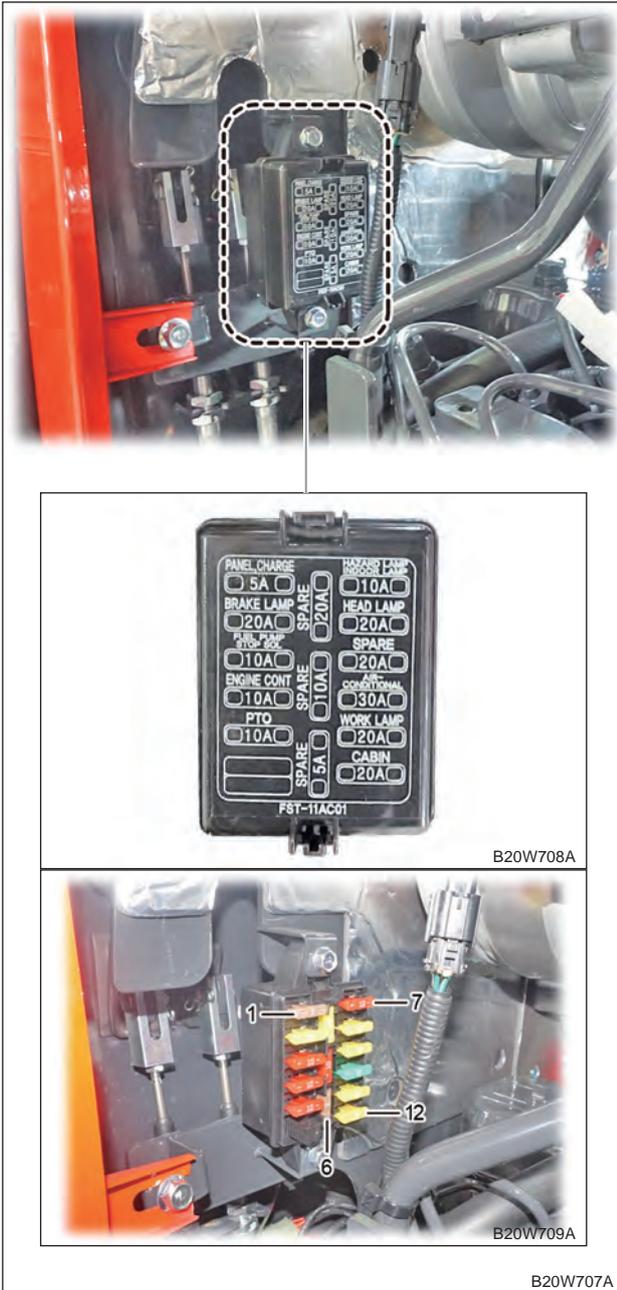
4.2.2 FUSIBLE LINK



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.

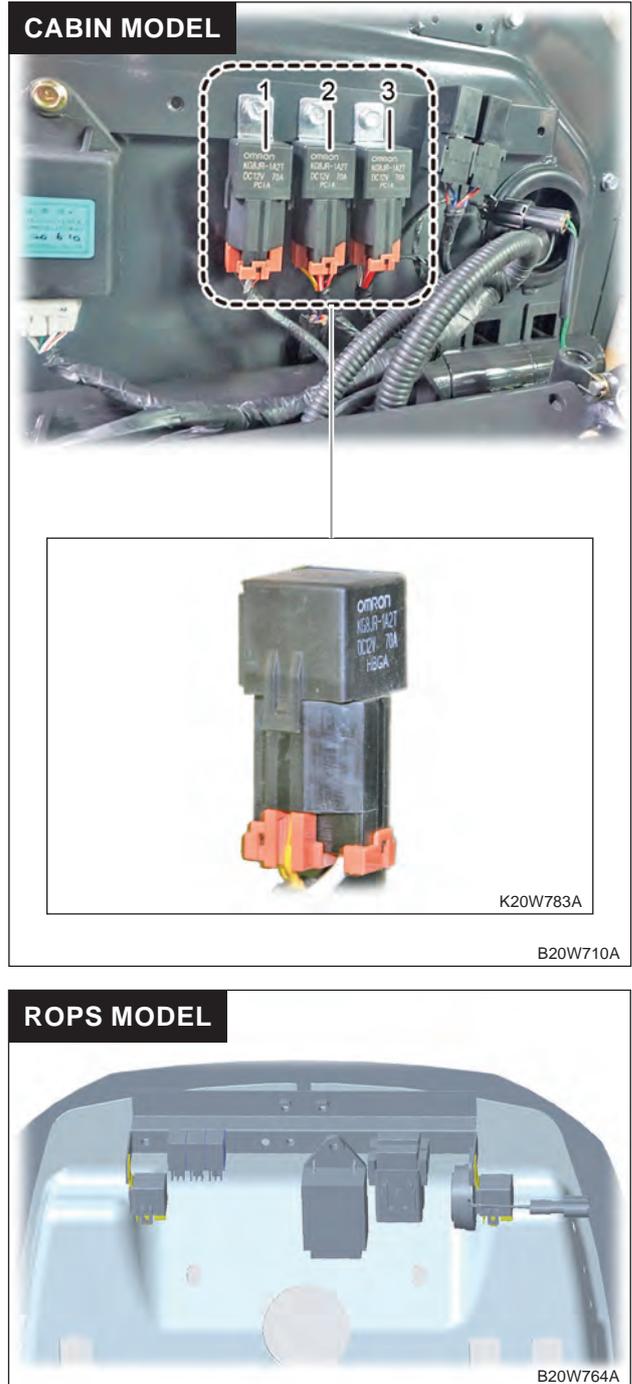
4.2.3 FUSE BOX



The fuse box is installed in the rear upper section of the engine compartment.

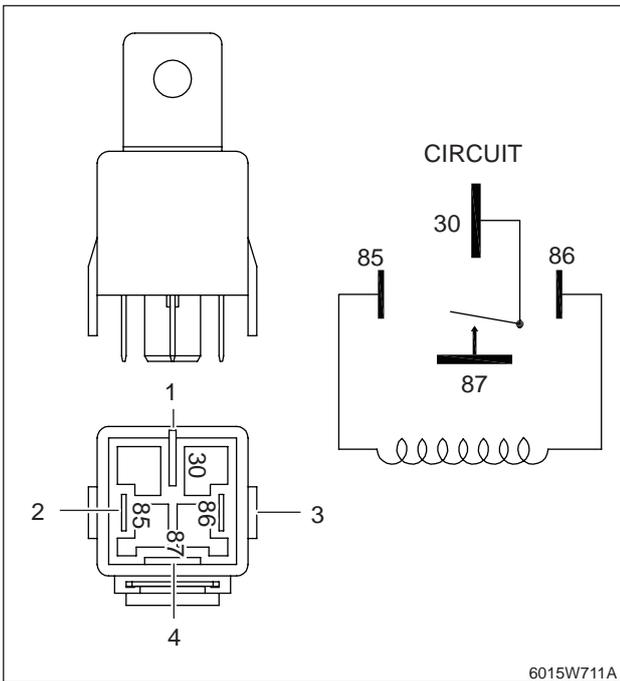
- Fuse 1 (5 A): Panel, Charge
- Fuse 2 (20 A): Brake lamp
- Fuse 3 (10 A): Fuel pump stop sol.
- Fuse 4 (10 A): ENG Cont.
- Fuse 5 (10 A): PTO
- Fuse 6 (5 A, 10 A, 20 A): Spare
- Fuse 7 (10 A): Hazard lamp, Indoor lamp
- Fuse 8 (20 A): Head lamp
- Fuse 9 (20 A): Spare
- Fuse 10 (30 A): Air conditioner
- Fuse 11 (20 A): Work lamp
- Fuse 12 (20 A): Cabin

4.2.4 4P RELAY



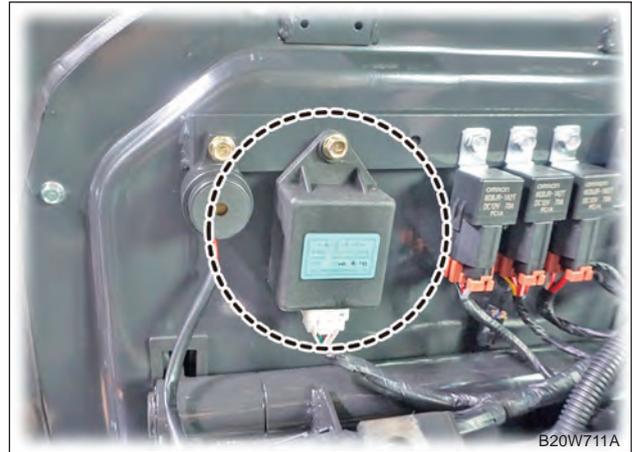
The 4P relay is installed on the upper side of the wind proof plate in the dash board. The starter relay supplies power to the starter motor, and glow relay supplies power to the glow plug, and power relay supplies power to the cabin.

► CONNECTOR AND TEST



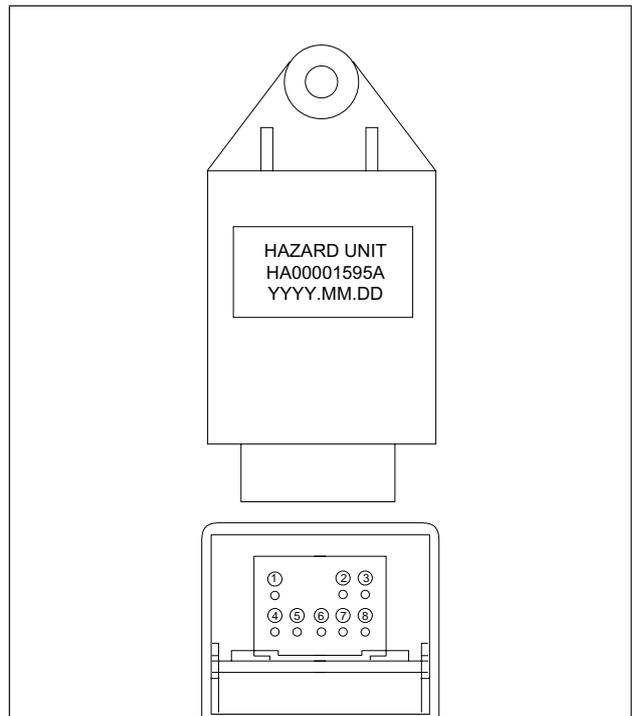
- ② and ③ are the relay coils that the terminals ①-④ are connected when the differential voltage between these two pins is over 7 V and the terminals ①-④ are disconnected when the differential voltage is below 7 V or the coils are not energized.
- When the relays are in a normal condition, the resistance of the coils ②-③ is approx. 55 Ω.

4.2.5 FLASHER UNIT



The flasher unit is installed on the upper side of the wind proof plate in the dash board. It makes the turn signal lamps blink when the flasher switch is operated.

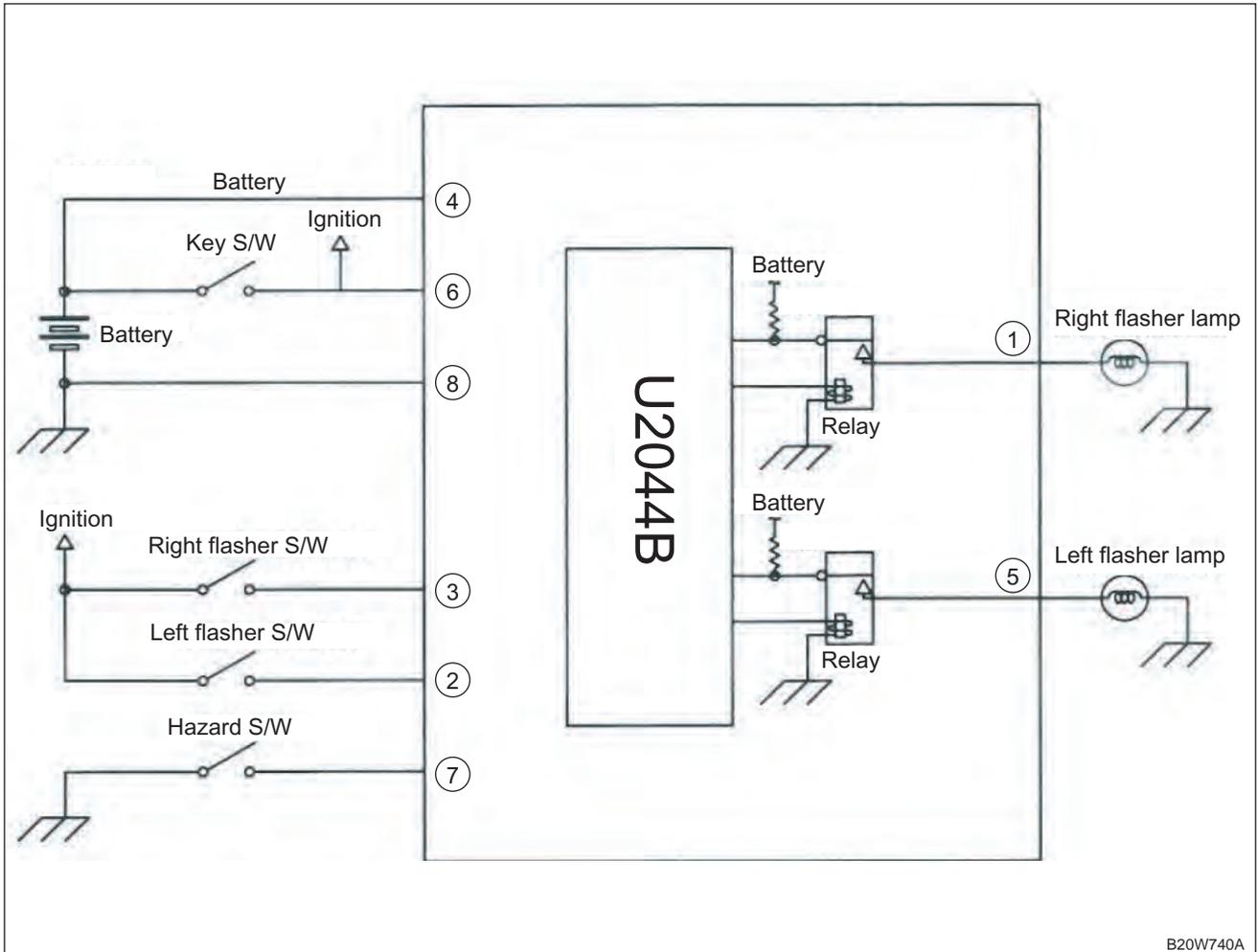
► CONNECTOR



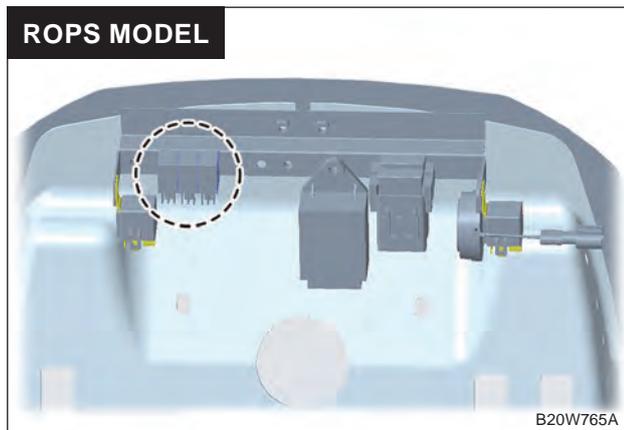
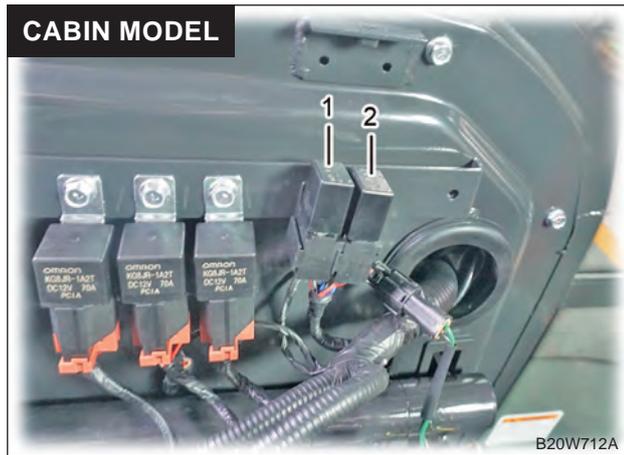
NO.	ITEM
1	Right flasher lamp
2	Left flasher switch
3	Right flasher switch
4	Battery
5	Left flasher lamp
6	IG(+)
7	Hazard switch
8	GND

35RW635A

► SYSTEM BLOCK DIAGRAM



4.2.6 MINI ISO RELAY

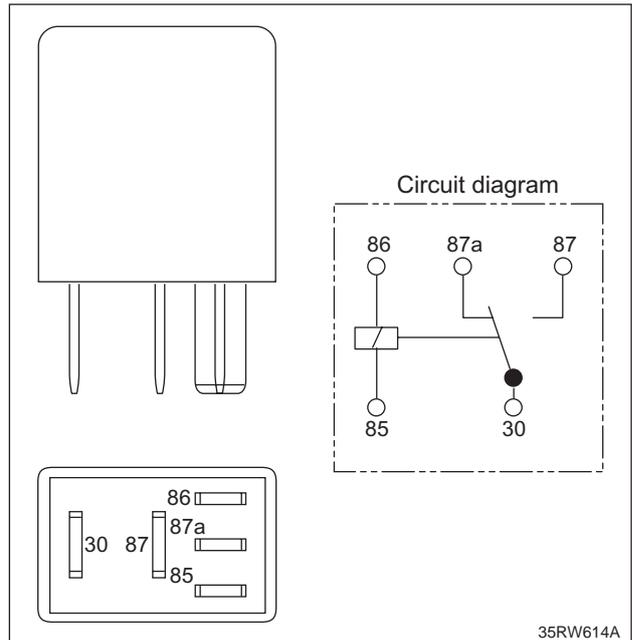


(1) PTO relay

(2) Safety start relay

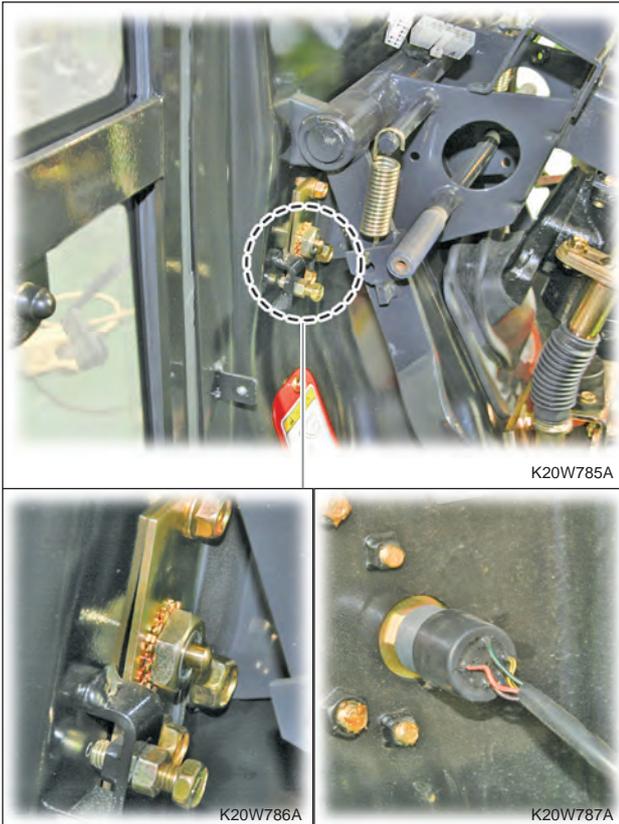
This relay is installed on the upper side of the wind proof plate in the dash board. The PTO relay supplies power to the PTO valve solenoid and safety start relay supplies power to the clutch safety switch.

► CONNECTOR & CIRCUIT DIAGRAM



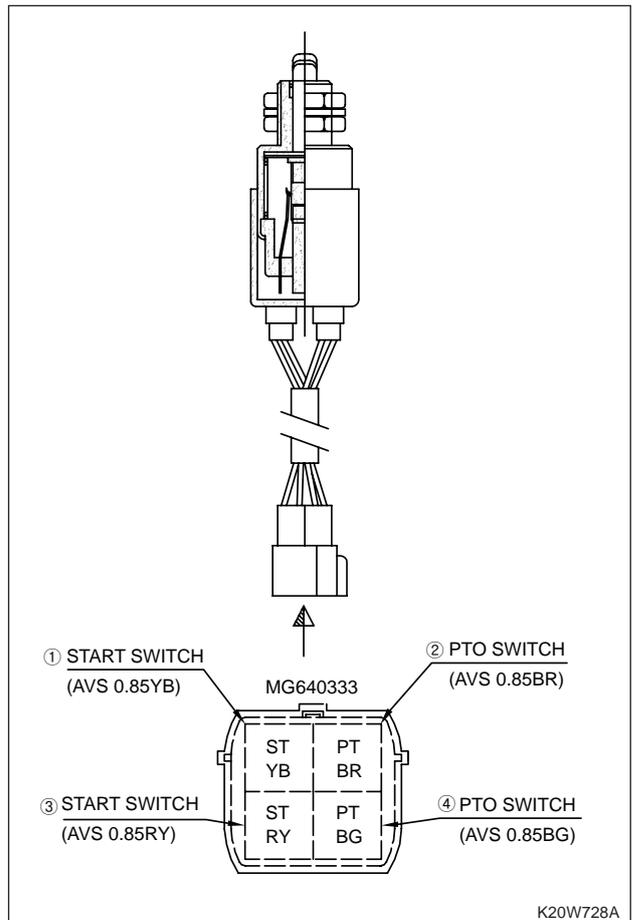
- 86 and 85 are the relay coils that the terminals 87-30 are connected when the differential voltage between these two pins is over 7 V and the terminals 87a-30 are connected when the differential voltage is below 7 V or the coils are not energized.
- When the relays are in a normal condition, the resistance of the coils 86-85 is approx. 55 Ω.

4.2.7 SAFETY START SWITCH



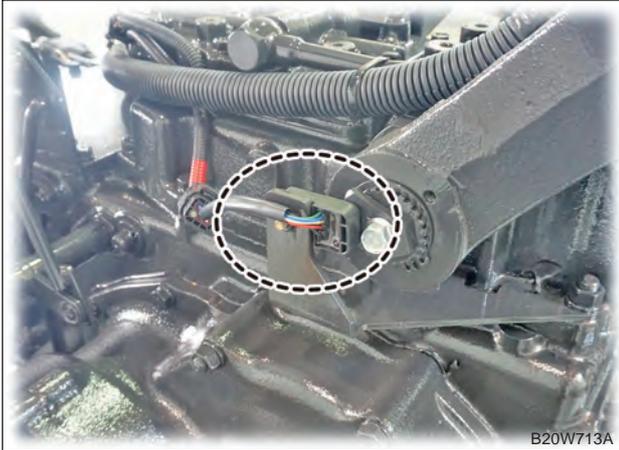
The safety start switch is installed in front of the clutch pedal. This switch is to prevent the engine from starting when the clutch pedal is not depressed.

► CONNECTOR AND TEST



- While the clutch pedal does not pressure the switch, ① and ③ are interconnected but ② and ④ are disconnected. When the clutch pedal presses the switch, ① and ③ are disconnected but ② and ④ are interconnected.

4.2.8 LIFT SENSOR



The lift sensor 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.

► CONNECTION DIAGRAM

HALL SENSOR (MAGNET)	PTO (+)	SOL OUTPUT (+)	LED	CONTROL SIGNAL (A/L) (-)
HIGH (OPEN)	ON	ON	ON	ON (-)
HIGH (OPEN)	OFF	OFF	ON	ON (-)
LOW (CLOSE)	ON/OFF	OFF	OFF	OFF

► CONNECTOR

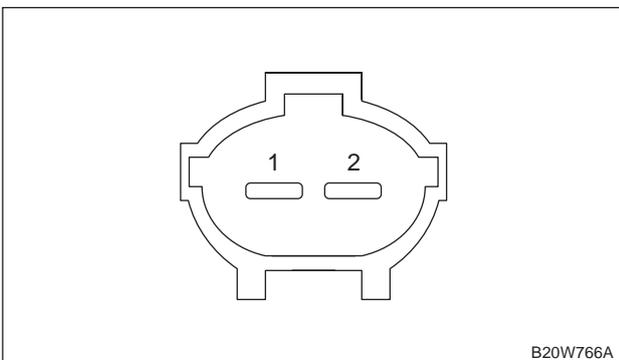
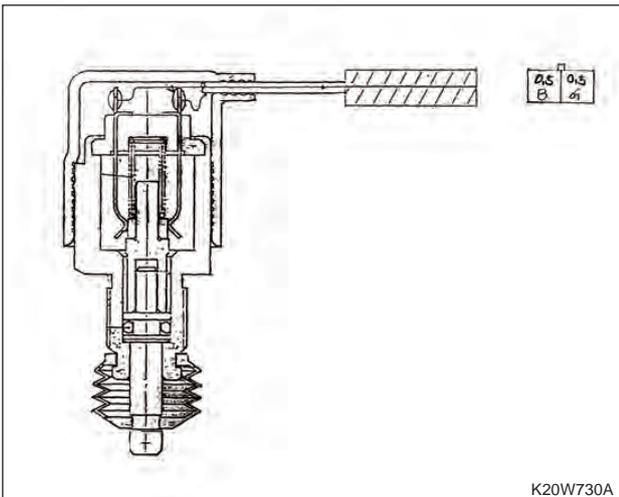
NO.	WIRE SPEC.
1	AVSS 0.5 S/Q - R (B+)
2	AVSS 0.5 S/Q - B (B-)
3	AVSS 0.5 S/Q - L (SOL+)
4	AVSS 0.5 S/Q - W (A/L-)
5	AVSS 0.5 S/Q - G (PTO+)

4.2.9 STOP LAMP SWITCH



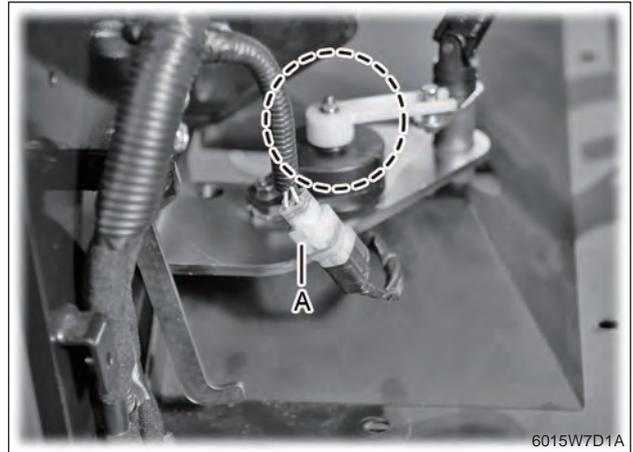
The stop lamp switch is installed on the upper right section behind the dashboard. According to operation of the brake pedal, the switch contact is connected so the stop lamps of the rear combination lamps are turned on.

► CONNECTOR



- The stop lamp switch is a N.C. (Normally Closed) type. While the brake pedal is released so the switch is pressed in, ① and ② are not connected to each other. However, when the brake pedal is depressed so the switch is returned, ① and ② are interconnected.

4.2.10 FR SWITCH



The FR switch is installed under the shuttle shift lever on the dashboard.

This switch sends a signal to the instrument cluster according to the position of the shuttle shift lever to turn on the F, R or N lamp.

► CONNECTOR TEST

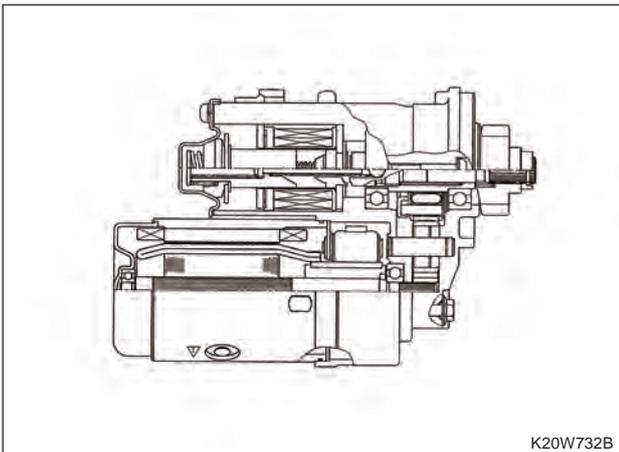
ITEM	CONNECTION		STATUS	RESULT		
	+	-				
Resistance	1	3	Shuttle shift lever neutral	0 Ω		

6015W7C9A

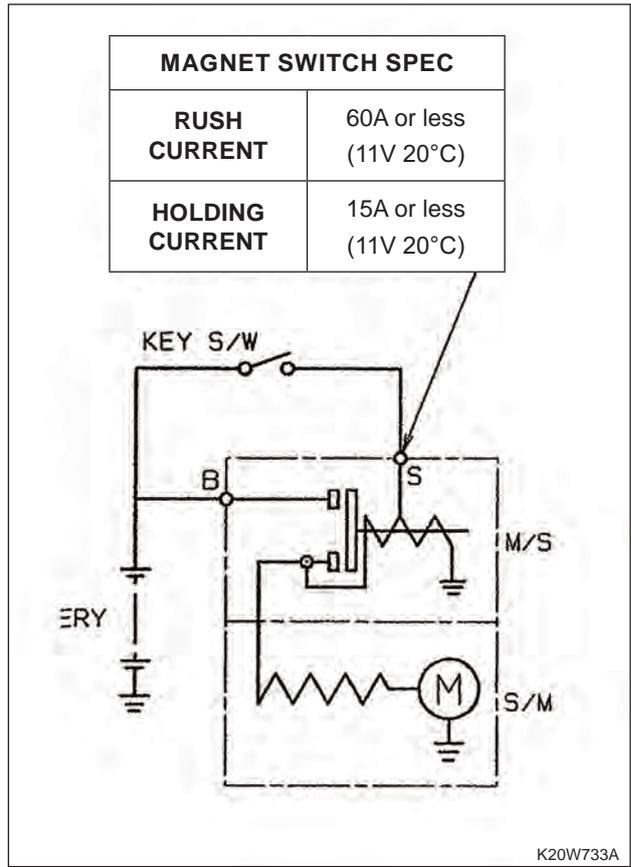
4.2.11 STARTER



The starter is installed to the rear left section of the engine.



► CIRCUIT DIAGRAM

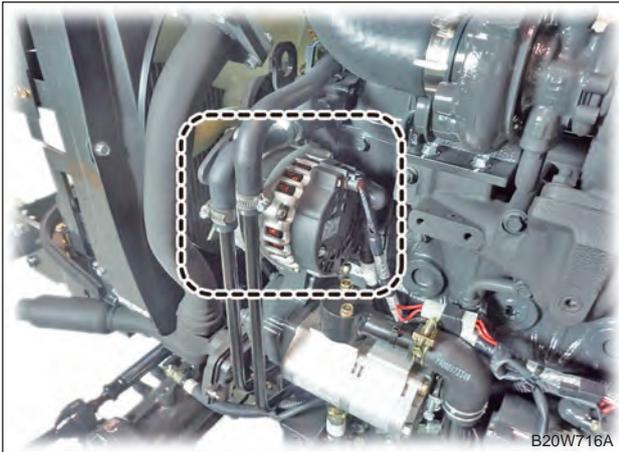


K20W733A

► SPECIFICATION

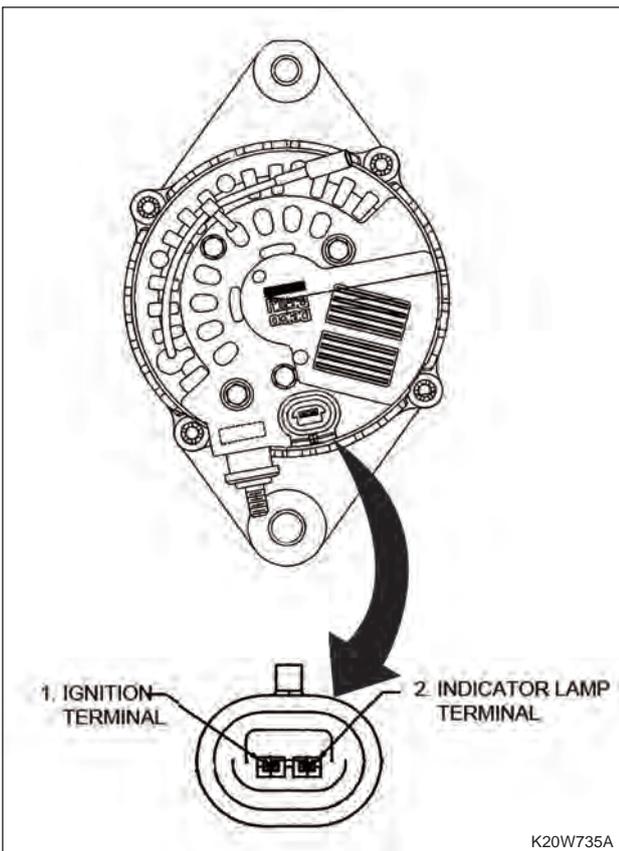
NOMINAL POWER	2.2 kw
VOLTAGE	12 V
RATED TIME	30 sec.
ROTATION	Clockwise (when seeing from pinion side)
WEIGHT	Approx. 5.2 kg

4.2.12 ALTERNATOR



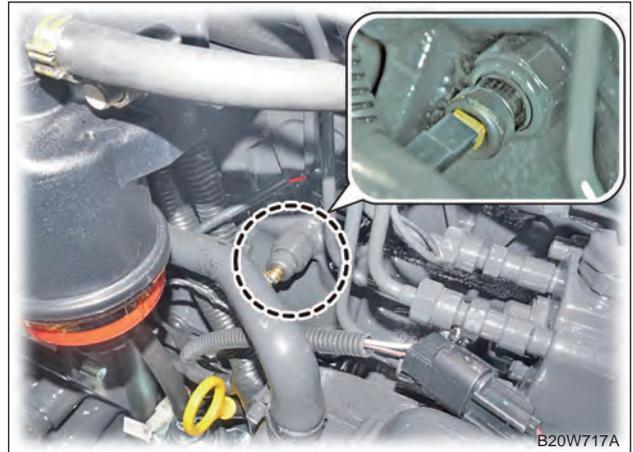
The alternator is installed in the left front section of the engine and it is integrated with the IC regulator. It supplies power to components with high electric load and charges the battery.

► CONNECTOR TEST



ITEM	CONNECTION		STATUS	RESULT
	+	-		
CONNECTOR DC POWER	1	Ground (Chassis)	Ignition switch ON	Approx. 12 V
	2	Ground (Chassis)		

4.2.13 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.

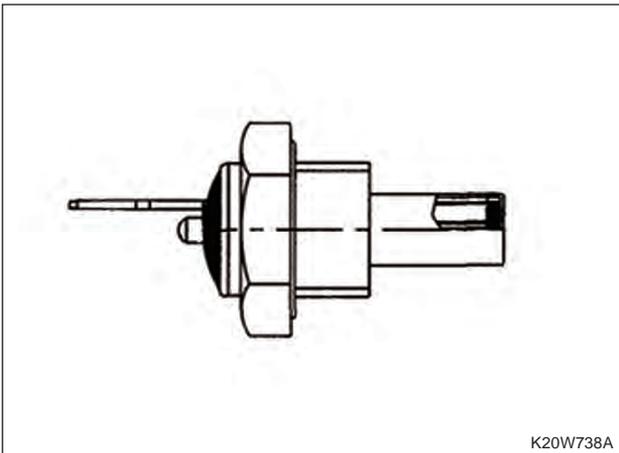
When the pressure in the engine drops below  $0.5 \pm 0.1 \text{ kgf/cm}^2$ , the engine oil pressure warning lamp on the instrument cluster comes on.

- The engine oil pressure switch is a N.O. (Normally Open) type that is open with the normal oil pressure but is shorted to body with the abnormal oil pressure.

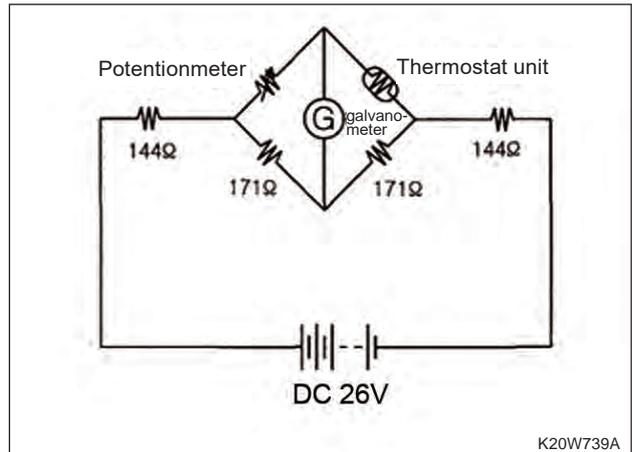
4.2.14 COOLANT TEMPERATURE SENSOR (PREHEATING)



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.



► MEASURING CIRCUIT

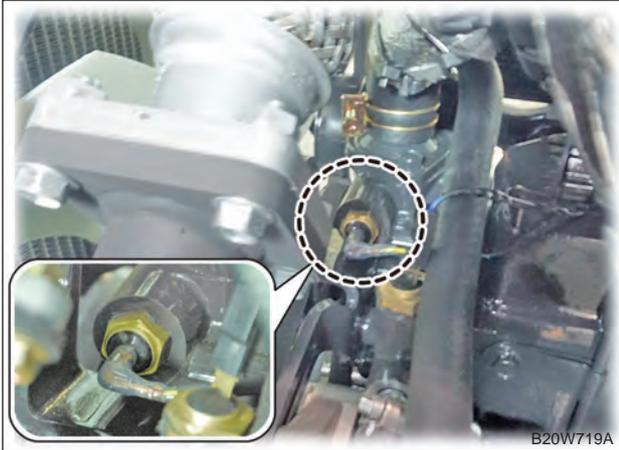


- The output value of the water temperature sensor (air heater) changes according to the interior temperature. The above table shows the normal resistance values.

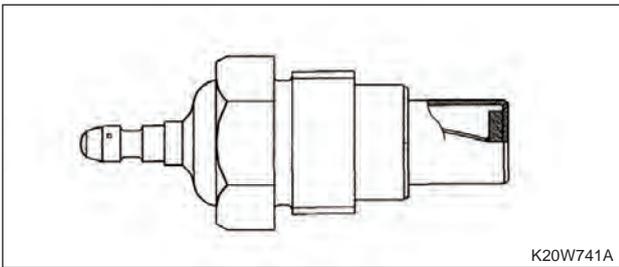
► RESISTANCE BY COOLANT TEMPERATURE

TEMPERATURE (°C)	-30	-15	10	20	40
RESISTANCE DIFFERENCE (Ω)	19.5	9.6	3.4	2.4	1.2

4.2.15 COOLANT TEMPERATURE SENSOR (METER)



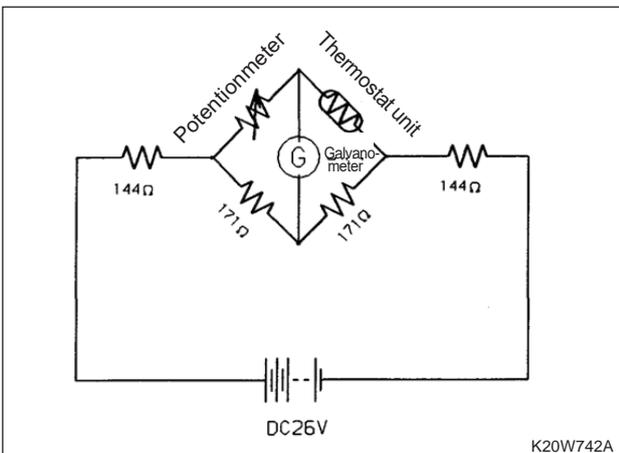
The coolant temperature sensor (meter) is installed to the outlet of the heater hose in front of the coolant flange to supply information to the preheat controller in order to determine the preheat indicator ON time and preheat relay connection time.



► RESISTANCE BY COOLANT TEMPERATURE

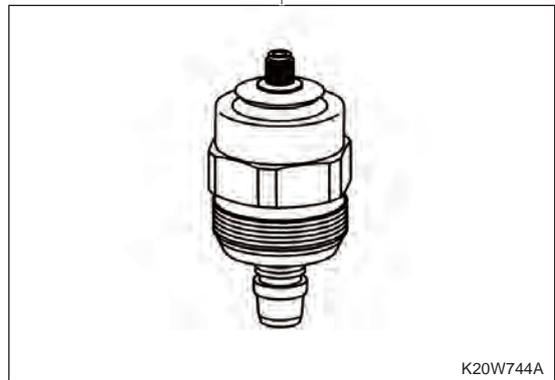
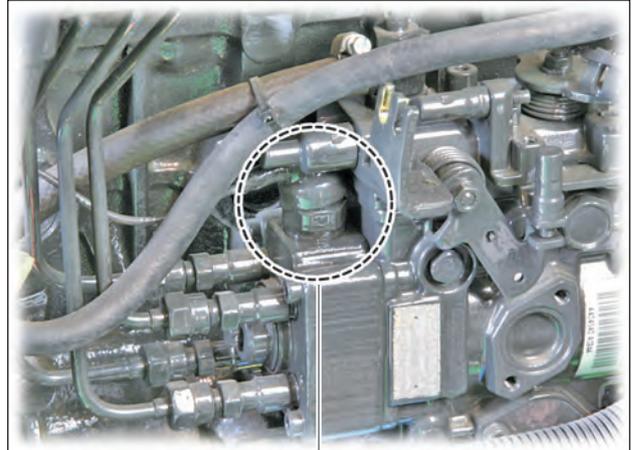
TEMPERATURE (°C)	(35)	(50)	80	(100)	(105)	115	(120)	(140)
RESISTANCE (KΩ)	(670)	(350)	118±6	(63.5)	(54.5)	42±2.5	(36.2)	(22)

► MEASURING CIRCUIT



- The output value of the water temperature sensor changes according to the interior temperature. The above table shows the normal resistance values.

4.2.16 FUEL CUT-OFF SOLENOID

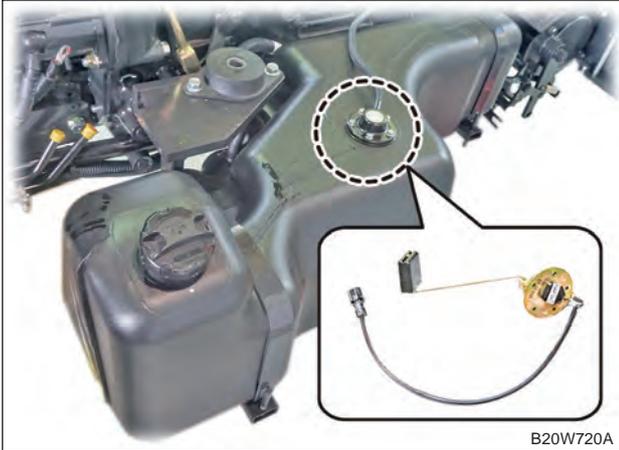


The fuel cut-off solenoid is installed behind the injection pump in the right section of the engine to allow or block fuel entering the engine depending on the position (ON/OFF) of the ignition switch.

► SPECIFICATION

RATED VOLTAGE	12 V
POWER CONSUMPTION	16 W
START VOLTAGE	6.5 V
HOLDING VOLTAGE	2.5 V
OPENING VOLTAGE	0.5 V

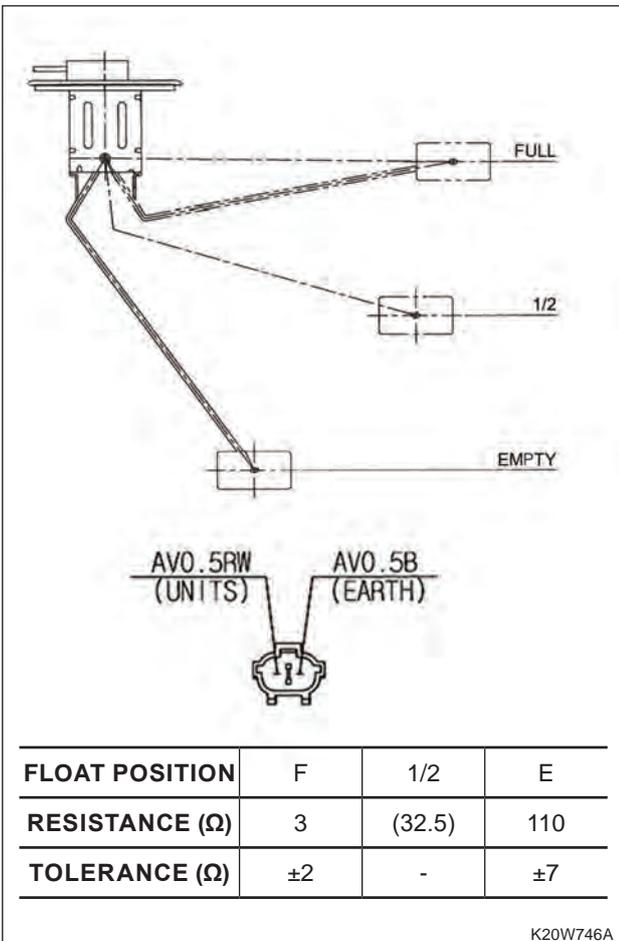
4.2.17 FUEL SENSOR



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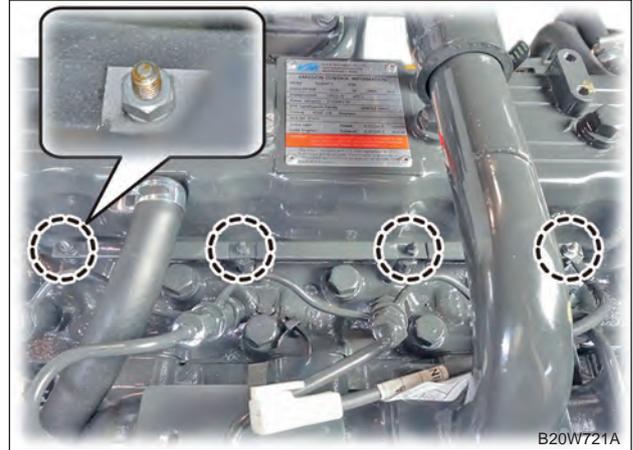
The fuel sensor is installed to the top of the left fuel tank and consists of the float and variable resistor. The float detects the fuel level and the sensor sends the corresponding resistance value to the fuel gauge on the instrument cluster to display the fuel level.

► RESISTANCE BY FLOAT POSITION



K20W746A

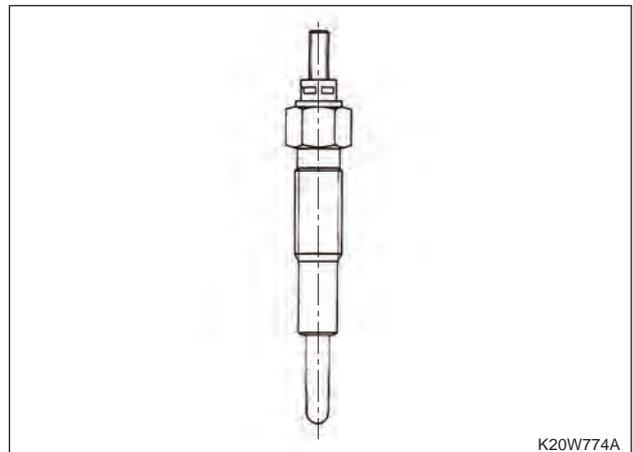
4.2.18 GLOW PLUG



B20W721A

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. 5.0 seconds.

► FEATURE



K20W774A

4.2.19 HORN



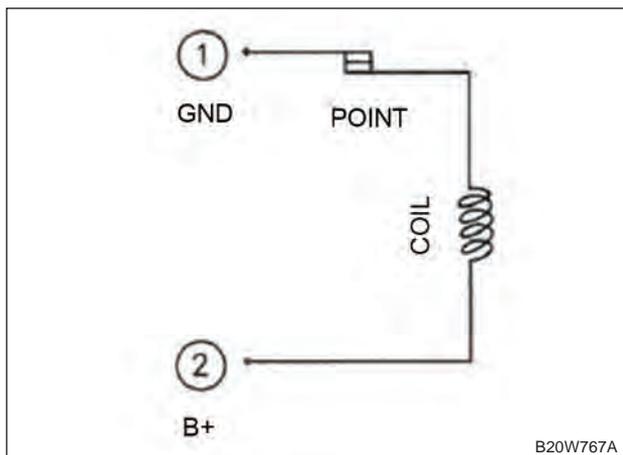
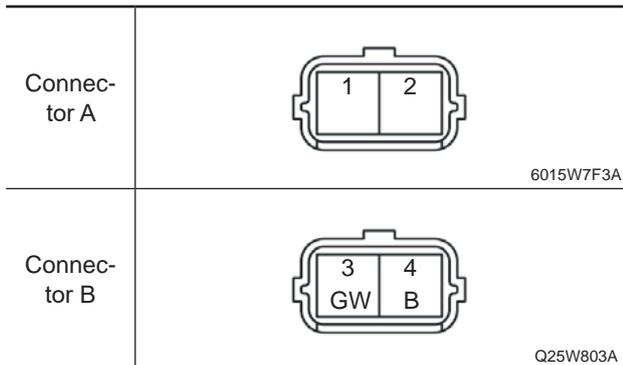
The horn (1) is installed between the left and right headlamps on the front of the hood.

4.2.20 COMBINATION SWITCH



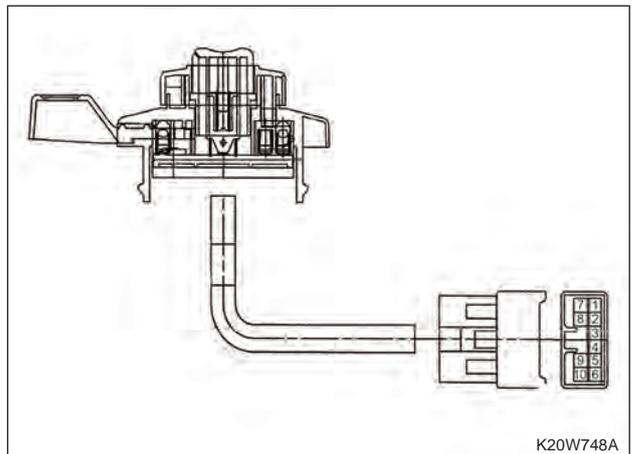
The combination switch is installed to the left side of the dashboard for operation of the headlamp high/low beam, turn signal lamps and horn.

► CONNECTOR TEST



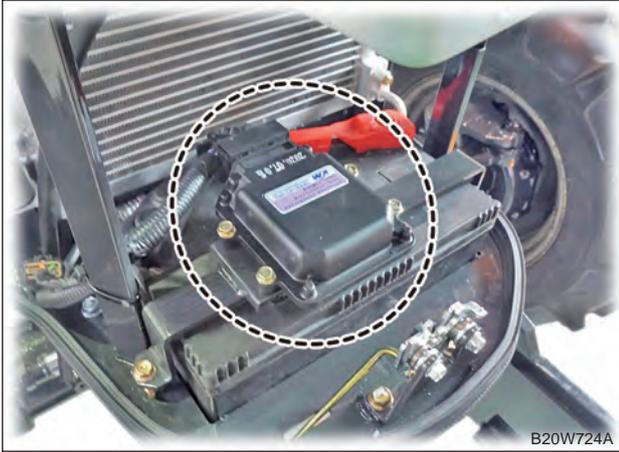
- The horn is a coil circuit as shown above. When it is energized, current flows through its coil and its vibration produces beep sound.

► CONNECTOR AND WIRING DIAGRAM



HEADLAMP					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	○	○
≡○	○	○	○		⇐	○	○				

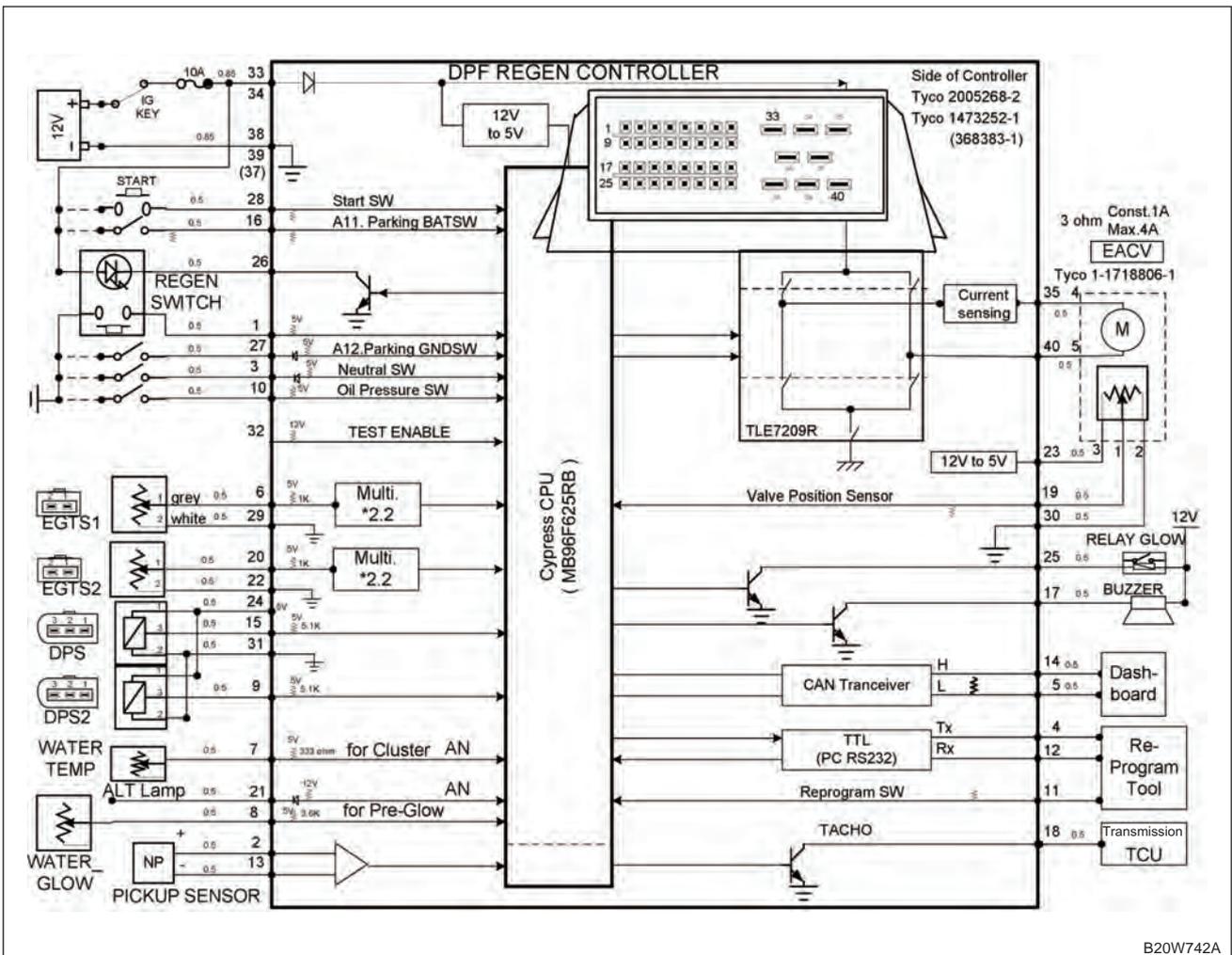
4.2.21 DPF REGEN CONTROLLER



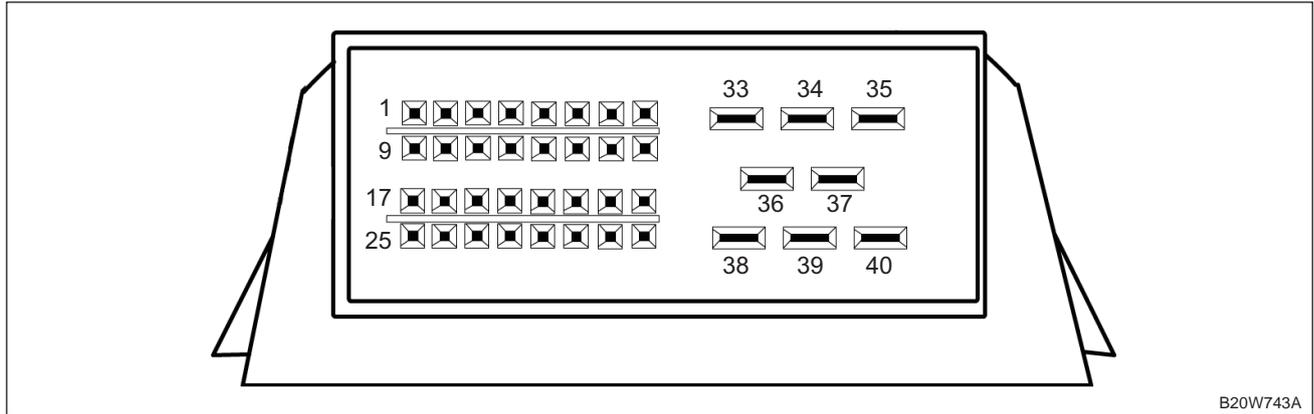
B20W724A

The DPF regen controller is installed on the battery 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



B20W742A



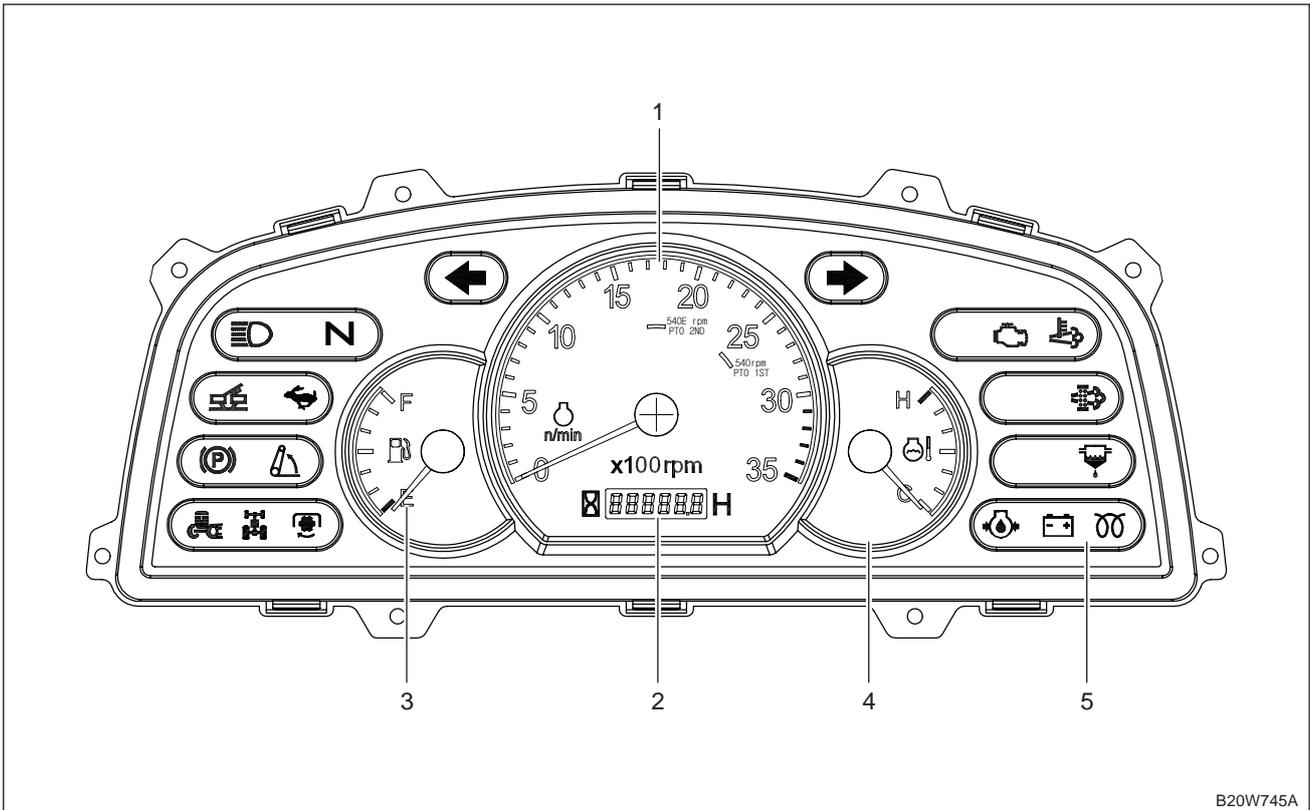
B20W743A

NO	WIRE	DESIGNATION	ASSOCIATED FUNCTION	NO	WIRE	DESIGNATION	ASSOCIATED FUNCTION
<b>ANALOG INPUTS</b>				<b>DRIVER OUTPUTS</b>			
19	-	EACV	Position of Exhaust Air Control Valve	35	-	MOTOR_P	Positive of Exhaust Flap Valve Motor
15	-	DPS	Differential Pressure Sensor	40	-	MOTOR_M	Negative of Exhaust Flap Valve Motor
9	-	DPS2	Low Scale DPS2	26	-	REGEN_BUTTON_L	Lamp of DPF Regeneration Buttone
6	-	EGTS1	Exhaust Gas Temperature #1 Sensor	25	-	RELAY_GLOW	Relay of Glow Heater
20	-	EGTS2	Exhaust Gas Temperature #2 Sensor	18	-	TACHO	Rpm out
7	-	WATER TEMP	Water Temperature Sensor For Engine	17	-	BUZZER	Buzzer alarm
8	-	WATER GLOW TEMP	Water Temperature Sensor For Glow Plug	<b>PC COMMUNICATION</b>			
<b>SWITCH INPUTS</b>				4	-	TX_TTL	TX 232 TTL communication to PC
1	-	REGEN_SW	DPF Regeneration Switch	12	-	RX_TTL	RX 232 TTL Communication from PC
10	-	OILPRESS_SW	Oil Pressure Switch	14	-	CAN_H	CAN High of Cluster
16	-	PARK_BATSW	Parking Switch of Battery Contact	5	-	CAN_L	CAN Low of Cluster
27	-	PARK_GNDSW	Parking Switch of Ground Contact	<b>POWER</b>			
3	-	NEUT_SW	Neutral Switch	33	-	IG_KEY1 #1	Power of Controller #1
21	-	ALT_L	Alternator Lamp Signal	34	-	(IG_KEY1 #2)	(Power of Controller #2)
11	-	REPROG_SW	Reprogram Switch	24	-	5V_SNS	5V of Sensors
28	-	START_SW	Start Swtich of Cranking	23	-	5V_EACV	5V of Exhaust Air Control Valve
32	-	(TEST_ENABLE)	(No recording diagnostic)	<b>GROUND</b>			
<b>PULSE INPUTS</b>				38	-	GND #1	Ground of Controller #1
2	-	NP_POS	RPM Positive from Magnetic sensor with 37 Teeth	39	-	GND #2	Ground of Controller #2
3	-	NP_NEG	RPM Negative from Magnetic sensor with 37 Teeth	(37)	-	(GND #3)	(Ground of Controller #3)
				29	-	GND_EGTS1	Ground of Exhaust Gas Temperature #1
				22	-	GND_EGTS2	Ground of Exhaust Gas Temperature #2
				31	-	GND_SNS	Ground of Differential Pressure Sensor
				30	-	GND_EACV	Ground of Exhaust Air Control Valve

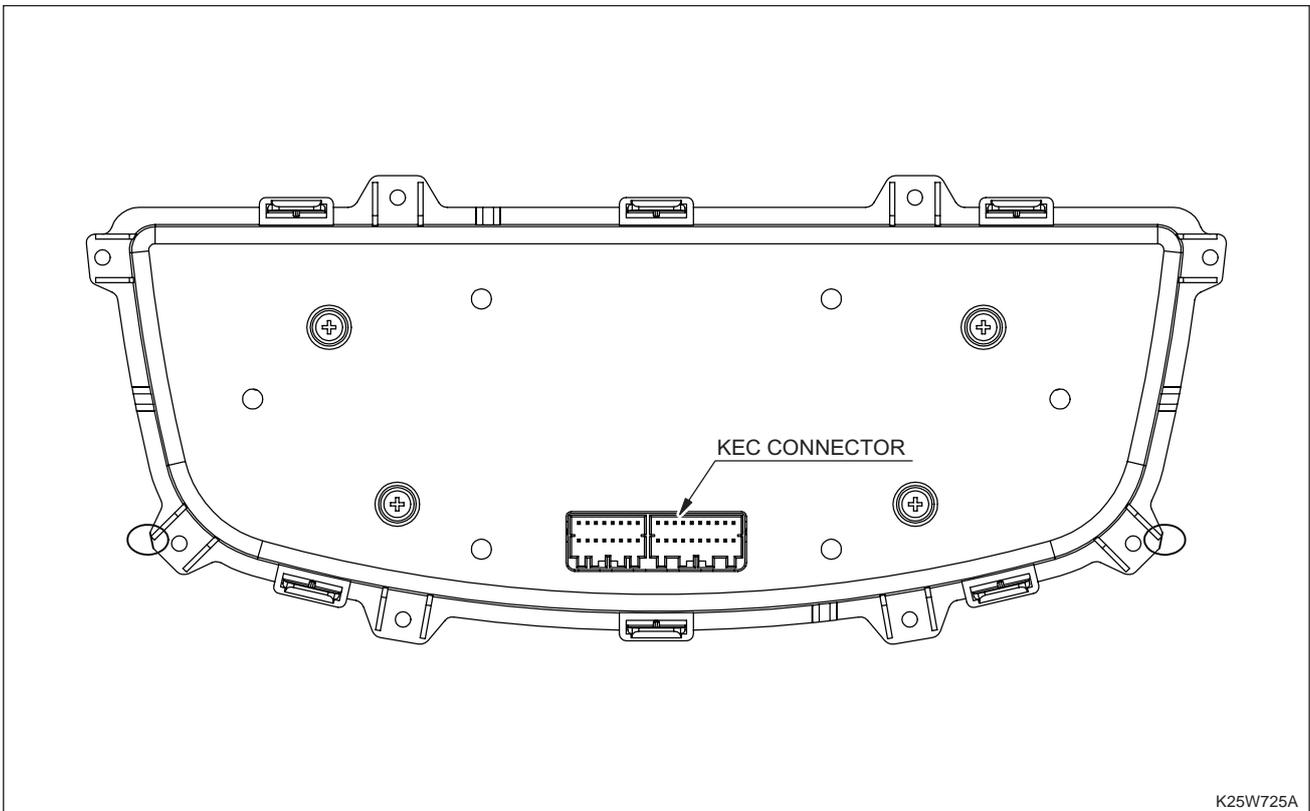


4.2.22 INSTRUMENT CLUSTER

► CONFIGURATION AND PERFORMANCE SPECIFICATIONS

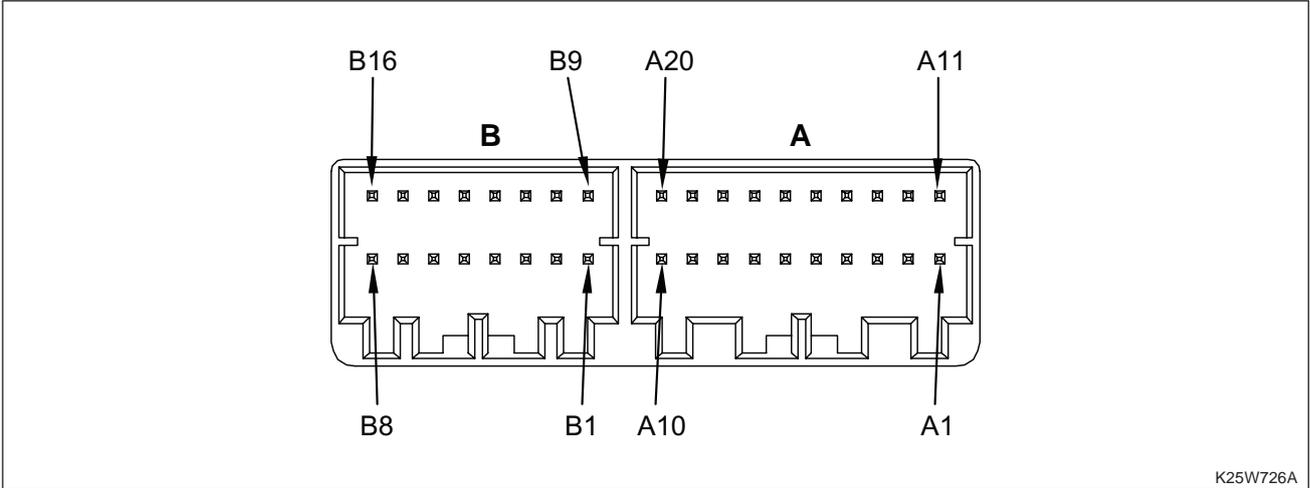


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► CONNECTOR

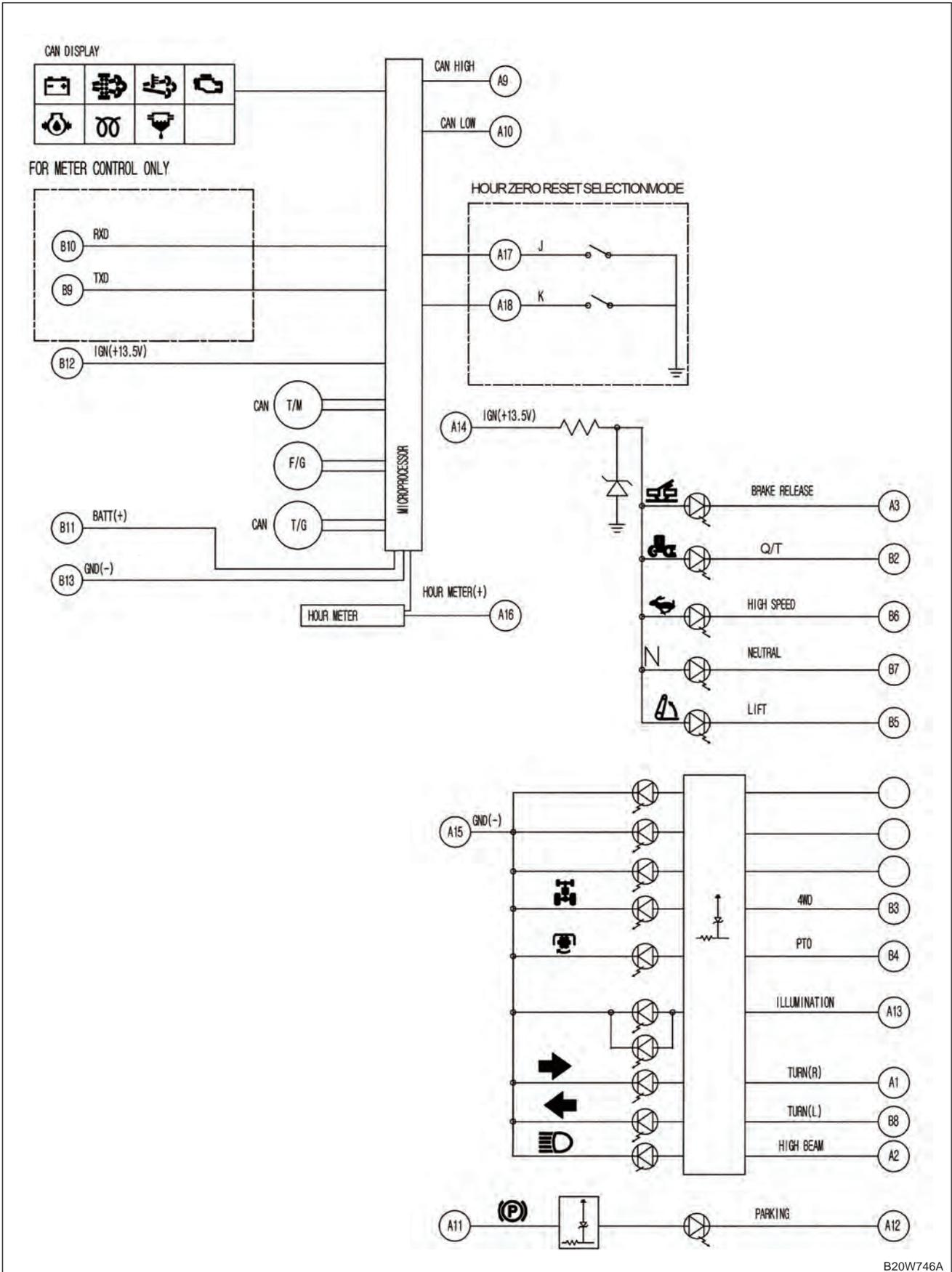


K25W726A

PIN NO.	NAME	REMARKS
A1	TURN(R)	+
A2	HIGH BEAM	+
A3	BRAKE RELEASE	-
A4		
A5		
A6		
A7		
A8		
A9	CAN HIGH	
A10	CAN LOW	
A11	PARKING(+)	+
A12	PARKING(-)	-
A13	ILLUMINATION	+
A14	IGN(+13.5V)	+
A15	GND(-)	-
A16	HOUR METER(+)	+
A17	J	-
A18	K	-
A19		
A20		

PIN NO.	NAME	REMARKS
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		
B16		

► CIRCUIT



► PERFORMANCE SPECIFICATIONS

1. Tachometer

Type		STEPPER MOTOR			
Rated voltage		DC 12V			
Input signal		CAN signal input from ECU			
Operating range		0 - 3,500 rpm			
Indicator characteristics	Position (rpm)	1,000	2,000	2,500	3,000
	Tolerance (rpm)	± 50	(± 100)	(± 100)	+ 0 - 100
Zone					

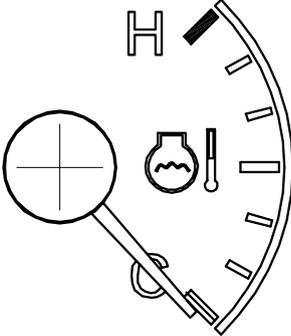
2. Hourmeter

Type	LCD type
Rated voltage	DC 12V
Max. displaying time	99999.9 hours
Time accuracy	± 5 sec./24 hr.(for continuous operation)
Operating principle	When the tachometer is working (up to 300 rpm), hour is integrated
Display	

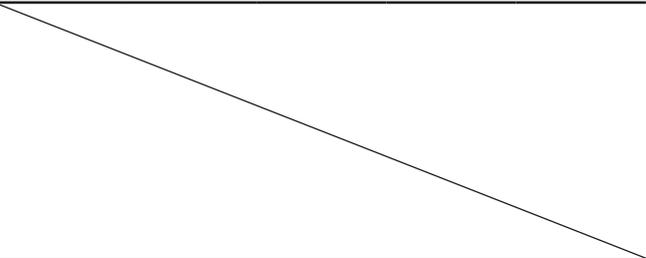
3. Fuel gauge

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					

4. Temp. gauge

Type		STEPPER MOTOR					
Operational voltage		DC 12 V					
Indicator characteristics	Position	43	70	107	115	120	138
	Resistance ( $\Omega$ )	240.5	103.2	38	34.1	30.5	21.2
	Tolerance ( $^\circ$ )	( $\pm 3.5$ )	( $\pm 3.5$ )	$\pm 3.5$	( $\pm 3.5$ )	$\pm 3.5$	( $\pm 3.5$ )
Zone							

5. Indicator

SYMBOL									
NAME	Turn(L)	Turn(R)	Upper beam	Eng. oil	Parking	Charging	Water separator	DPF	EGT
COLOR	Green	Green	Blue	Red	Red	Red	Red	Yellow	Yellow
SYMBOL			N						
NAME	Preheat	PTO	Neutral	Fail					
COLOR	Red	Yellow	Green	Red					
LAMP	LED								

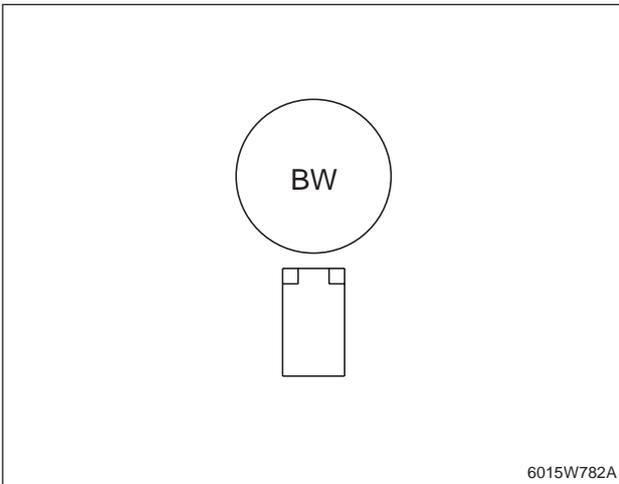
4.2.23 PARKING BRAKE SWITCH



The parking brake switch is installed in front of the parking brake.

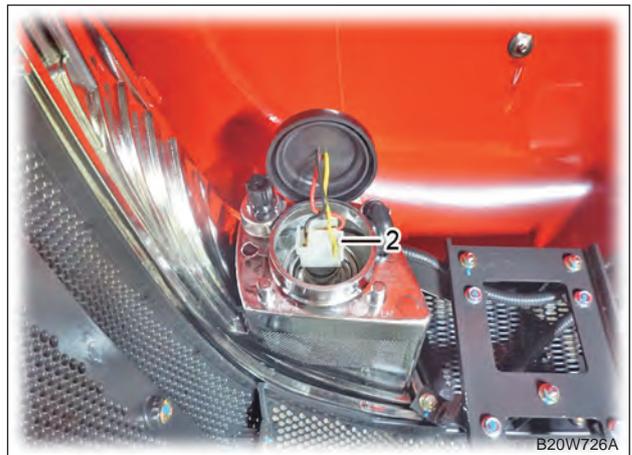
When the parking brake is applied, the switch contact is connected and the parking indicator on the instrument cluster is turned on.

► CONNECTOR



4.3 LAMP BULB REPLACEMENT

4.3.1 HEADLAMP



1. Pull the cap (1) and headlamp connector (2) out to disconnect it.

4.3.2 FRONT TURN SIGNAL LAMP

CABIN MODEL



B20W727A

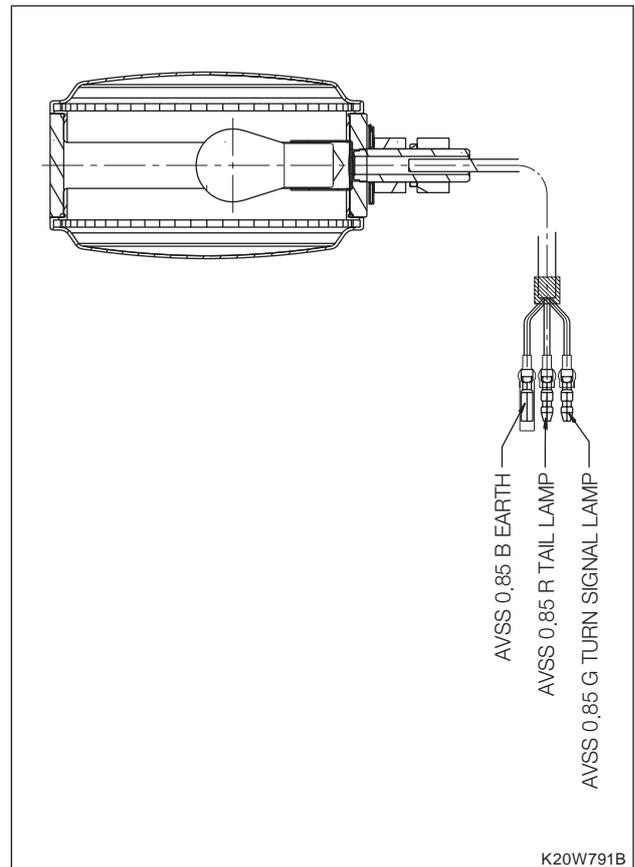


K20W790A



B20W728A

2. Release the spring holder (3) and then, remove the socket with bulb.
3. Bulb specification: 12 V 55 W / 55 W



K20W791B

1. Unscrew the front turn signal lamp mounting nut (1) to separate the front turn signal lamp. Then, pull the lamp to disconnect the connector.
2. Replace it with a new one.  
Bulb specification: 12 V 21 W / 5 W

4.3.3 REAR COMBINATION LAMP

**CABIN MODEL**



1. Remove the cover (1) on the bottom of the fender.



2. Unscrew the grommet assembly (1) clockwise to remove it.



3. Remove the bulb.  
Turn signal lamp bulb specification: 12 V 21 W



4. Unscrew the other grommet assembly clockwise to remove it.

**ROPS MODEL**

5. Remove the bulb.  
Brake/Tail lamp  
bulb specification: 12 V 21 W / 5 W



1. Disassembly and replace a bulb is same as before.

4.3.4 WORK LAMP

**CABIN MODEL**



B20W736A

1. Turn the work lamp socket (1) counterclockwise to remove it.



B20W737A

2. Disconnect the socket and connector.



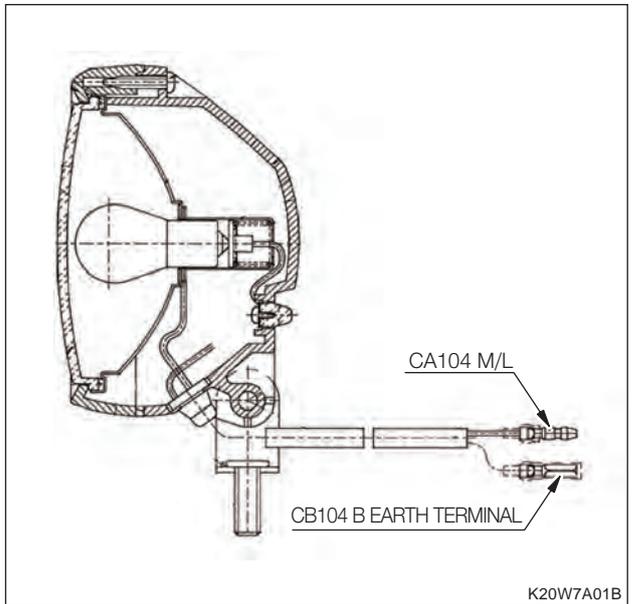
B20W738A

3. Replace the bulb with a new bulb.  
Bulb specification: 12 V 27 W

**ROPS MODEL**



B20W739A



K20W7A01B

- Bulb specification: 12 V 20 W





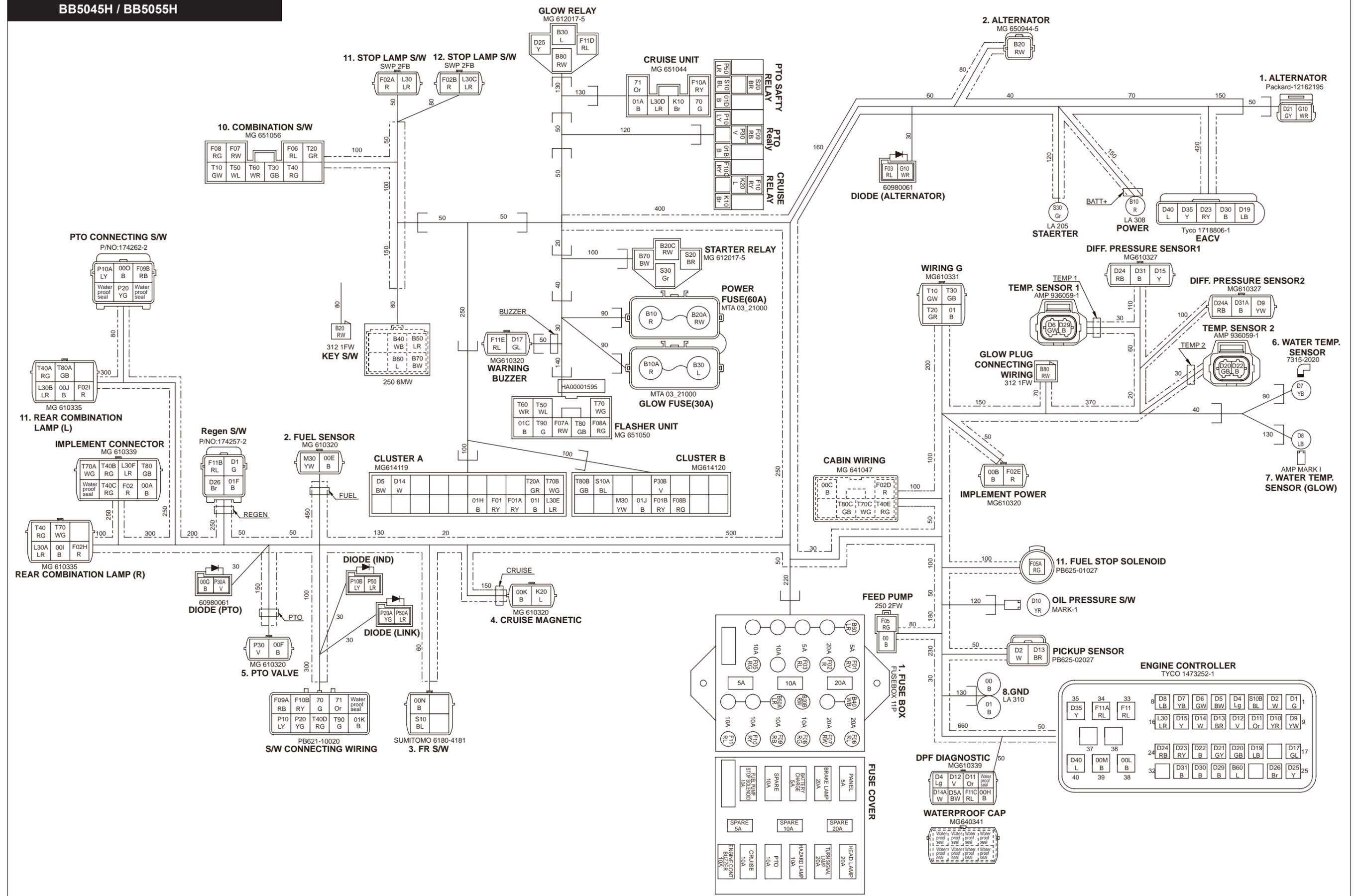
BB5045S / BB5055S

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
01	01	B	8.GND	Relay (PTO)
	01A	B	Joint from 00	S/W connecting wiring
	01C	B	Joint from 00	Flasher unit
	01E	B	Joint from 00	Relay (Start safety)
	01H	B	Joint from 00	Cluster A
	01I	B	Joint from 00	Cluster B
	01J	B	Joint from 00	Cluster A
00	00	B	8.GND	Feed pump
	00A	B	Joint from 00	Implement connector
	00B	B	Joint from 00	Wiring G
	00C	B	Joint from 00	Cabin wiring
	00D	B	Joint from 00	Implement power
	00E	B	Joint from 00	2.Fuel sensor
	00F	B	Joint from 00	5.PTO valve
	00G	B	Joint from 00	7. Diode (PTO)
	00H	B	Joint from 00	DPF diagnostic
	00I	B	Joint from 00	9. Rear combination lamp (R)
	00J	B	Joint from 00	11. Rear combination lamp (L)
	00K	B	Joint from 00	Engine controller
	00L	B	Joint from 00	Engine controller
	00M	B	Joint from 00	FR switch
	00N	B	Joint from 00	PTO connecting S/W
B10	B10	R	Power	Power fuse (60A)
	B10A	R	Joint from B10	Glow fuse (30A)
B20	B20	RW	2. Alternator	18. Key switch
	B20A	RW	Joint from B20	Power fuse (60A)
	B20B	RW	Joint from B20	1. Fuse box
	B20C	RW	Joint from B20	Starter relay
b30	B30	L	Glow FUSE(30A)	Glow relay
b40	B40	WB	18. KEY switch	1. Fuse box
b50	B50	LR	18. KEY switch	1. Fuse box
	B50A	LR	Joint from B50	1. Fuse box
b60	B60	L	18. KEY switch	Engine controller
B70	B70	BW	18. KEY switch	Starter relay
B80	B80	RW	Glow plug connecting wiring	Glow relay
B90	B90	BL	Clutch safety switch	FR switch
	B90A	BL	Joint from B90	Cluster B
	B90B	BL	Joint from B90	Engine controller
D1	D1	G	S/W connecting wiring	Engine controller
D2	D2	W	Pickup sensor	Engine controller
D4	D4	Lg	DPF diagnostic	Engine controller
D5	D5	BW	Cluster A	Engine controller
	D5A	BW	Joint from D5	DPF diagnostic
D6	D6	GW	Temp. sensor 1	Engine controller
D7	D7	YB	Water temp. sensor	Engine controller
D8	D8	LB	Water temp. sensor(Glow)	Engine controller
D9	D9	YW	Diff. pressure sensor 2	Engine controller

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
D10	D10	YR	Oil pressure switch	Engine controller
D11	D11	Or	DPF diagnostic	Engine controller
D12	D12	V	DPF diagnostic	Engine controller
D13	D13	BR	Pickup sensor	Engine controller
D14	D14	W	Cluster A	Engine controller
	D14A	W	Joint from D14	DPF diagnostic
D15	D15	Y	Diff. pressure sensor 1	Engine controller
D17	D17	GL	Warning buzzer	Engine controller
D19	D19	LB	EACV	Engine controller
D20	D20	GB	Temp. sensor 2	Engine controller
D21	D21	GY	Alternator	Engine controller
D22	D22	B	Temp. sensor 2	Engine controller
D23	D23	RY	EACV	Engine controller
D24	D24	RB	Diff. pressure sensor 1	Engine controller
	D24A	RB	Joint from D24	Diff. pressure sensor 2
D25	D25	Y	Glow relay	Engine controller
D26	D26	Br	S/W connecting wiring	Engine controller
D29	D29	B	Temp. sensor 1	Engine controller
D30	D30	B	EACV	Engine controller
D31	D31	B	Diff. pressure sensor 1	Engine controller
	D31A	B	Joint from D31	Diff. pressure sensor 2
D35	D35	Y	EACV	Engine controller
D40	D40	L	EACV	Engine controller
F01	F01	RY	1. Fuse box	Cluster A
	F01A	RY	Joint from F01	Cluster A
	F01B	RY	Joint from F01	Cluster B
F02	F02	R	1. Fuse box	Implement connector
	F02A	R	Joint from F02	11. Stop lamp switch
	F02B	R	Joint from F02	12. Stop lamp switch
	F02D	R	Joint from F02	Cabin wiring
	F02E	R	Joint from F02	Implement Power
	F02H	R	Joint from F02	Rear combination lamp (R)
	F02I	R	Joint from F02	Rear combination lamp (L)
F03	F03	RL	1. Fuse box	Diode (Alternator)
F05	F05	RG	1. Fuse box	Feed pump
F06	F06	RL	1. Fuse box	Combination switch
F07	F07	RW	1. Fuse box	Combination switch
	F07A	RW	Joint from F07	15.Flasher unit
F08	F08	RG	1. Fuse box	Combination switch
	F08A	RG	Joint from F08	15.Flasher unit
	F08B	RG	Joint from F08	Cluster B
F09	F09	RB	1. Fuse box	Relay (PTO)
	F09A	RB	Joint from F09	S/W connecting wiring
	F09B	RB	Joint from F09	PTO connecting S/W
F10	F10	RY	1. Fuse box	Fuel cut-off SOL
F11	F11	RL	1. Fuse box	Engine controller
	F11A	RL	Joint from F11	Engine controller

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
	F11B	RL	Joint from F11	S/W connecting wiring
	F11C	RL	Joint from F11	DPF diagnostic
	F11D	RL	Joint from F11	Glow relay
	F11E	RL	Joint from F11	Warning buzzer
G10	G10	WR	1. Alternator	Diode (Alternator)
L30	L30	LR	11. Stop lamp switch	Engine controller
	L30A	LR	Joint from L30	Rear combination lamp (R)
	L30B	LR	Joint from L30	Rear combination lamp (L)
	L30C	LR	Joint from L30	12. Stop lamp switch
	L30D	LR	Joint from L30	Cluster A
	L30E	LR	Joint from L30	Implement connector
M30	M30	YW	Fuel sensor	Cluster B
P10	P10	LY	Relay (PTO)	S/W connecting wiring
	P10A	LY	Joint from P10	12.PTO connecting S/W
	P10B	LY	Joint from P10	22.Diode (IND)
P20	P20	YG	Clutch safety switch	S/W connecting wiring
	P20A	YG	Joint from P20	23.Diode (Link)
P30	P30	V	Relay (PTO)	5.PTO valve
	P30A	V	Joint from P30	7.Diode (PTO)
	P30B	V	Joint from P30	ClusterB
P40	P40	YB	Clutch safety switch	PTO connecting S/W
P50	P50	LR	22.Diode (IND)	Relay (Start safety)
	P50A	LR	Joint from P50	23.Diode (Link)
S10	S10	BL	Relay (Start safety)	Clutch safety switch
S20	S20	BR	Relay (Start safety)	Starter relay
S30	S30	Gr	5.Starter S terminal	Starter relay
T10	T10	GW	Combination switch	Wiring G
T20	T20	GR	Combination switch	Wiring G
	T20A	GR	Joint from T20	Cluster A
T30	T30	GB	Combination switch	Wiring G
T40	T40	RG	Combination switch	Rear combination lamp (R)
	T40A	RG	Joint from T40	Rear combination lamp (L)
	T40B	RG	Joint from T40	10.Implement connector
	T40C	RG	Joint from T40	10.Implement connector
	T40D	RG	Joint from T40	S/W connecting wiring
	T40E	RG	Joint from T40	Cabin wiring
T50	T50	WL	Combination switch	Flasher unit
T60	T60	WR	Combination switch	Flasher unit
T70	T70	WG	Rear combination lamp (R)	Flasher unit
	T70A	WG	Joint from T70	10.Implement connector
	T70B	WG	Joint from T70	Cluster A
	T70C	WG	Joint from T70	Cabin wiring
T80	T80	GB	Flasher unit	10.Implement connector
	T80A	GB	Joint from T80	Rear combination lamp (L)
	T80B	GB	Joint from T80	Cluster B
	T80C	GB	Joint from T80	Cabin wiring
T90	T90	G	S/W connecting wiring	Flasher unit

BB5045H / BB5055H



BB5045H / BB5055H

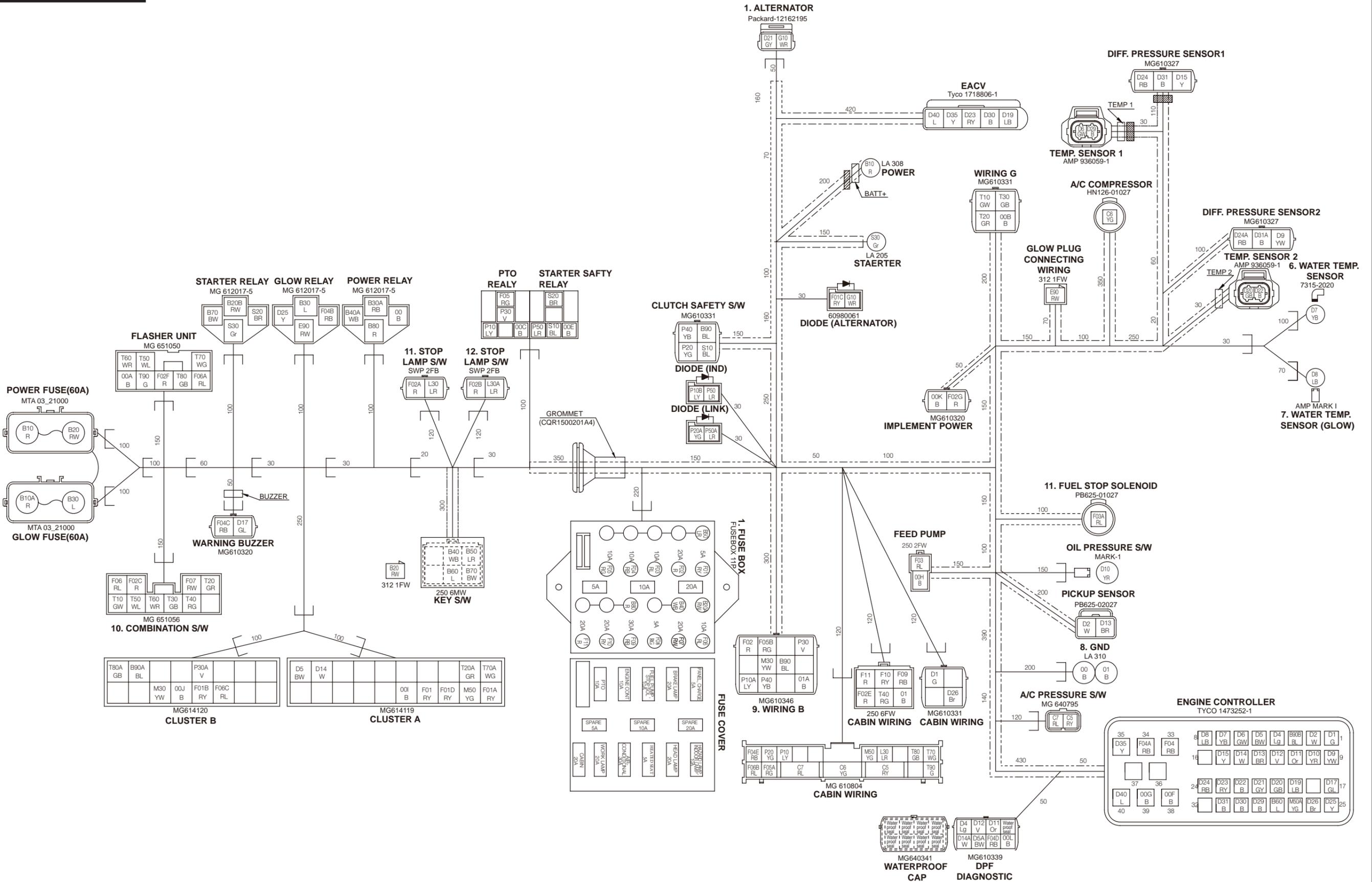
WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
01	01	B	8. GND	Wiring G
	01A	B	Joint from 00	Cruise unit
	01B	B	Joint from 00	Relay (PTO)
	01C	B	Joint from 00	Flasher unit
	01D	B	Joint from 00	Relay (Start safety)
	01F	B	Joint from 00	Regen S/W
	01H	B	Joint from 00	Cluster A
	01I	B	Joint from 00	Cluster A
	01J	B	Joint from 00	Cluster B
	01K	B	Joint from 00	S/W connecting wiring
00	00	B	8. GND	Feed pump
	00A	B	Joint from 00	Implement connector
	00B	B	Joint from 00	Implement power
	00C	B	Joint from 00	Cabin wiring
	00E	B	Joint from 00	2. Fuel sensor
	00F	B	Joint from 00	5. PTO valve
	00G	B	Joint from 00	7. Diode (PTO)
	00H	B	Joint from 00	DPF diagnostic
	00I	B	Joint from 00	9. Rear combination lamp (R)
	00J	B	Joint from 00	11. Rear combination lamp (L)
	00K	B	Joint from 00	Cruise magnetic
	00L	B	Joint from 00	Engine controller
	00M	B	Joint from 00	Engine controller
	00N	B	Joint from 00	FR switch
	00O	B	Joint from 00	PTO connecting S/W
70	70	G	S/W connecting wiring	Cruise unit
71	71	Or	S/W connecting wiring	Cruise unit
B10	B10	R	Power	Power fuse (60A)
	B10A	R	Joint from B10	Glow fuse (30A)
B20	B20	RW	2. Alternator	18. Key switch
	B20A	RW	Joint from B20	Power fuse (60A)
	B20B	RW	Joint from B20	1. Fuse box
	B20C	RW	Joint from B20	Starter relay
B30	B30	L	Glow fuse (30A)	Glow relay
B40	B40	WB	18. Key switch	1. Fuse box
B50	B50	LR	18. Key switch	1. Fuse box
	B50A	LR	Joint from B50	1. Fuse box
B60	B60	L	18. Key switch	Engine controller
B70	B70	BW	18. Key switch	Starter relay
B80	B80	RW	Glow plug connecting wiring	Glow relay
D1	D1	G	Regen S/W	Engine controller
D2	D2	W	Pickup sensor	Engine controller
D4	D4	Lg	DPF diagnostic	Engine controller
D5	D5	BW	Cluster A	Engine controller
	D5A	BW	Joint from D5	DPF diagnostic
D6	D6	GW	Temp. sensor 1	Engine controller
D7	D7	YB	Water temp. sensor	Engine controller
D8	D8	LB	Water temp. sensor(Glow)	Engine controller
D9	D9	YW	Diff. pressure sensor 2	Engine controller
D10	D10	YR	Oil pressure switch	Engine controller

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
D11	D11	Or	DPF diagnostic	Engine controller
D12	D12	V	DPF diagnostic	Engine controller
D13	D13	BR	Pickup sensor	Engine controller
D14	D14	W	Cluster A	Engine controller
	D14A	W	Joint from D14	DPF diagnostic
D15	D15	Y	Diff. pressure sensor 1	Engine controller
D17	D17	GL	Warning buzzer	Engine controller
D19	D19	LB	EACV	Engine controller
D20	D20	GB	Temp. sensor 2	Engine controller
D21	D21	GY	Alternator	Engine controller
D22	D22	B	Temp. sensor 2	Engine controller
D23	D23	RY	EACV	Engine controller
D24	D24	RB	Diff. pressure sensor 1	Engine controller
	D24A	RB	Joint from D24	Diff. pressure sensor 2
D25	D25	Y	Glow relay	Engine controller
D26	D26	Br	Regen S/W	Engine controller
D29	D29	B	Temp. sensor 1	Engine controller
D30	D30	B	EACV	Engine controller
D31	D31	B	Diff. pressure sensor 1	Engine controller
	D31A	B	Joint from D31	Diff. pressure sensor 2
D35	D35	Y	EACV	Engine controller
D40	D40	L	EACV	Engine controller
F01	F01	RY	1.Fuse box	Cluster A
	F01A	RY	Joint from F01	Cluster A
	F01B	RY	Joint from F01	Cluster B
F02	F02	R	1. Fuse box	Implement connector
	F02A	R	Joint from F02	11.Stop lamp switch
	F02B	R	Joint from F02	12. Stop lamp switch
	F02D	R	Joint from F02	Cabin wiring
	F02E	R	Joint from F02	Implement Power
	F02H	R	Joint from F02	Rear combination lamp(R)
	F02I	R	Joint from F02	Rear combination lamp(L)
F03	F03	RL	1. Fuse box	Diode(Alternator)
F05	F05	RG	1. Fuse box	Feed pump
	F05A	RG	Joint from F05	Fuel cut-off SOL
F06	F06	RL	1. Fuse box	Combination switch
F07	F07	RW	1. Fuse box	Combination switch
	F07A	RW	Joint from F07	15. Flasher unit
F08	F08	RG	1. Fuse box	Combination switch
	F08A	RG	Joint from F08	15. Flasher unit
	F08B	RG	Joint from F08	Cluster B
F09	F09	RB	1. Fuse box	Relay (PTO)
	F09A	RB	Joint from F09	S/W connecting wiring
	F09B	RB	Joint from F09	PTO connecting S/W
F10	F10	RY	1. Fuse box	Relay (Cruise)
	F10A	RY	Joint from F10	Cruise unit
	F10B	RY	Joint from F10	S/W connecting wiring
	F10C	RY	Joint from F10	Relay (Cruise)
F11	F11	RL	1. Fuse box	Engine controller
	F11A	RL	Joint from F11	Engine controller

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
	F11B	RL	Joint from F11	Regen S/W
	F11C	RL	Joint from F11	DPF diagnostic
	F11D	RL	Joint from F11	Glow relay
	F11E	RL	Joint from F11	Warning buzzer
G10	G10	WR	1.Alternator	Diode (Alternator)
K10	K10	Br	Relay (Cruise)	Cruise unit
K20	K20	L	Relay (Cruise)	Cruise magnetic
L30	L30	LR	11. Stop lamp switch	Engine controller
	L30A	LR	Joint from L30	Rear combination lamp (R)
	L30B	LR	Joint from L30	Rear combination lamp (L)
	L30C	LR	Joint from L30	12.Stop lamp switch
	L30D	LR	Joint from L30	Cruise unit
	L30E	LR	Joint from L30	Cluster A
	L30F	LR	Joint from L30	Implement connector
M30	M30	YW	Fuel sensor	Cluster B
P10	P10	LY	Relay (PTO)	S/W connecting wiring
	P10A	LY	Joint from P10	PTO connecting S/W
	P10B	LY	Joint from P10	22.Diode (IND)
P20	P20	YG	PTO connecting S/W	S/W connecting wiring
	P20A	YG	Joint from P20	23.Diode (Link)
P30	P30	V	Relay (PTO)	5.PTO valve
	P30A	V	Joint from P30	7.Diode (PTO)
	P30B	V	Joint from P30	ClusterB
P50	P50	LR	22.Diode (IND)	Relay (Start safety)
	P50A	LR	Joint from P50	23.Diode (Link)
S10	S10	BL	Relay (Start safety)	FR switch
	S10A	BL	Joint from S10	ClusterB
	S10B	BL	Joint from S10	Engine controller
S20	S20	BR	Relay (Start safety)	Starter relay
S30	S30	Gr	5. Starter S terminal	Starter relay
T10	T10	GW	Combination switch	Wiring G
T20	T20	GR	Combination switch	Wiring G
	T20A	GR	Joint from T20	Cluster A
T30	T30	GB	Combination switch	Wiring G
T40	T40	RG	Combination switch	Rear combination lamp (R)
	T40A	RG	Joint from T40	Rear combination lamp (L)
	T40B	RG	Joint from T40	10. Implement connector
	T40C	RG	Joint from T40	10. Implement connector
	T40D	RG	Joint from T40	S/W connecting wiring
	T40E	RG	Joint from T40	Cabin wiring
T50	T50	WL	Combination switch	Flasher unit
T60	T60	WR	Combination switch	Flasher unit
T70	T70	WG	Rear combination lamp (R)	Flasher unit
	T70A	WG	Joint from T70	10.Implement connector
	T70B	WG	Joint from T70	Cluster A
	T70C	WG	Joint from T70	Cabin wiring
T80	T80	GB	Flasher unit	10.Implement connector
	T80A	GB	Joint from T80	Rear combination lamp (L)
	T80B	GB	Joint from T80	Cluster B
	T80C	GB	Joint from T80	Cabin wiring
	T90	T90	S/W connecting wiring	

B20W770A

BB5045CS / BB5055CS



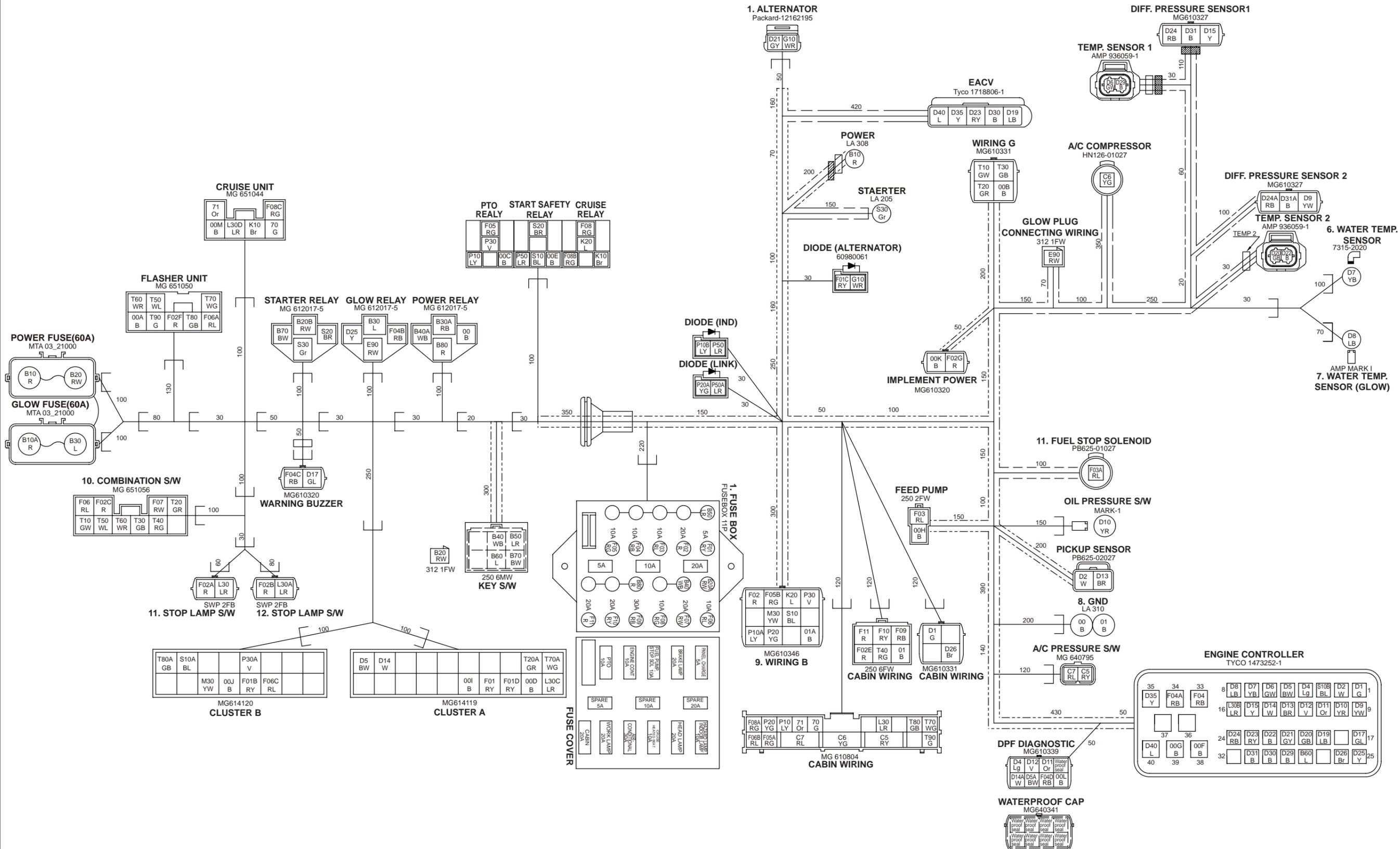
**BB5045CS / BB5055CS**

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
00	00	B	8. GND	Power relay
	00A	B	Joint from 00	15.Flasher unit
	00B	B	Joint from 00	Wiring G
	00C	B	Joint from 00	Relay (PTO)
	00E	B	Joint from 00	Relay (Start safety)
	00F	B	Joint from 00	Engine controller
	00G	B	Joint from 00	Engine controller
	00H	B	Joint from 00	Feed pump
	00I	B	Joint from 00	Cluster A
	00J	B	Joint from 00	Cluster B
	00K	B	Joint from 00	Implement Power
	00L	B	Joint from 00	DPF diagnostic
01	01	B	8.GND	Cabin wiring
	01A	B	Joint from 01	Wiring B
B10	B10	R	Power	Power fuse (60A)
	B10A	R	Joint from B10	Glow fuse (60A)
B20	B20	RW	Power fuse (60A)	18.Key switch
	B20A	RW	Joint from B20	1. Fuse box
	B20B	RW	Joint from B20	Starter relay
B30	B30	L	Glow FUSE(60A)	Glow relay
	B30A	RB	Joint from B30	Power Relay
B40	B40	WB	18. Key switch	1. Fuse box
	B40A	WB	Joint from B40	Power Relay
B50	B50	LR	18. Key switch	1. Fuse box
B60	B60	L	18. Key switch	Engine controller
B70	B70	BW	18. Key switch	Starter relay
B80	B80	R	Power Relay	1. Fuse box
B90	B90	BL	Wiring B	Clutch safety switch
	B90A	BL	Joint from B90	Cluster B
	B90B	BL	Joint from B90	Engine controller
C5	C5	RY	Cabin wiring	A/C pressure switch
C6	C6	YG	Cabin wiring	A/C compressor
C7	C7	RL	Cabin wiring	A/C pressure switch
D1	D1	G	Cabin wiring	Engine controller
D2	D2	W	Pickup sensor	Engine controller
D4	D4	Lg	DPF diagnostic	Engine controller
D5	D5	BW	Cluster A	Engine controller
	D5A	BW	Joint from D5	DPF diagnostic
D6	D6	GW	Temp. sensor 1	Engine controller
D7	D7	YB	Water temp. sensor	Engine controller
D8	D8	LB	Water temp. sensor(Glow)	Engine controller
D9	D9	YW	Diff. pressure sensor 2	Engine controller
D10	D10	YR	Oil pressure switch	Engine controller

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
D11	D11	Or	DPF diagnostic	Engine controller
D12	D12	V	DPF diagnostic	Engine controller
D13	D13	BR	Pickup sensor	Engine controller
D14	D14	W	Cluster A	Engine controller
	D14A	W	Joint from D14	DPF diagnostic
D15	D15	Y	Diff. pressure sensor 1	Engine controller
D17	D17	GL	Warning buzzer	Engine controller
D19	D19	LB	EACV	Engine controller
D20	D20	GB	Temp. sensor 2	Engine controller
D21	D21	GY	Alternator	Engine controller
D22	D22	B	Temp. sensor 2	Engine controller
D23	D23	RY	EACV	Engine controller
D24	D24	RB	Diff. pressure sensor 1	Engine controller
	D24A	RB	Joint from D24	Diff. pressure sensor 2
D25	D25	Y	Glow relay	Engine controller
D26	D26	Br	Cabin wiring	Engine controller
D29	D29	B	Temp. sensor 1	Engine controller
D30	D30	B	EACV	Engine controller
D31	D31	B	Diff. pressure sensor 1	Engine controller
	D31A	B	Joint from D31	Diff. pressure sensor 2
D35	D35	Y	EACV	Engine controller
D40	D40	L	EACV	Engine controller
E90	E90	RW	Glow plug connection wiring	Glow relay
F01	F01	RY	1. Fuse box	Cluster A
	F01A	RY	Joint from F01	Cluster A
	F01B	RY	Joint from F01	Cluster B
	F01C	RY	Joint from F01	Diode(Alternator)
	F01D	RY	Joint from F01	Cluster A
F02	F02	R	1. Fuse box	Wiring B
	F02A	R	Joint from F02	11. Stop lamp switch
	F02B	R	Joint from F02	12. Stop lamp switch
	F02C	R	Joint from F02	Combination switch
	F02E	R	Joint from F02	Cabin wiring
	F02F	R	Joint from F02	Flasher unit
	F02G	R	Joint from F02	Implement Power
F03	F03	RL	1. Fuse box	Feed pump
	F03A	RL	Joint from F03	Fuel cut-off SOL
F04	F04	RB	1. Fuse box	Engine controller
	F04A	RB	Joint from F04	Engine controller
	F04B	RB	Joint from F04	Glow relay
	F04C	RB	Joint from F04	Warning buzzer
	F04D	RB	Joint from F04	DPF diagnostic
	F04E	RB	Joint from F04	Cabin wiring

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
F05	F05	RG	1. Fuse box	Relay (PTO)
	F05A	RG	Joint from F05	Cabin wiring
	F05B	RG	Joint from F05	Wiring B
F06	F06	RL	1. Fuse box	Combination switch
	F06A	RL	Joint from F06	Flasher unit
	F06B	RL	Joint from F06	Cabin wiring
	F06C	RL	Joint from F06	Cluster B
F07	F07	RW	1. Fuse box	Combination switch
F08	F08	RG	1. Fuse box	Cabin wiring
F09	F09	RB	1. Fuse box	Cabin wiring
F10	F10	RY	1. Fuse box	Cabin wiring
F11	F11	R	1. Fuse box	Cabin wiring
G10	G10	WR	1.Alternator	Diode(Alternator)
L30	L30	LR	11. Stop lamp switch	Cabin wiring
	L30A	LR	Joint from L30	12. Stop lamp switch
M30	M30	YW	Wiring B	Cluster B
M50	M50	YG	Cabin wiring	Cluster A
	M50A	YG	Joint from M50	Engine controller
P10	P10	LY	Relay (PTO)	Cabin wiring
	P10A	LY	Joint from P10	Wiring B
	P10B	LY	Joint from P10	Diode(IND)
P20	P20	YG	Clutch safety switch	Cabin wiring
	P20A	YG	Joint from P20	Diode(Link)
P30	P30	V	Wiring B	Relay (PTO)
	P30A	V	Joint from P30	Cluster B
P40	P40	YB	Clutch safety switch	Wiring B
P50	P50	LR	Diode(IND)	Relay(Start safety)
	P50A	LR	Joint from P50	Diode(Link)
S10	S10	BL	Clutch safety switch	Relay(Start safety)
S20	S20	BR	Relay(Start safety)	Starter relay
S30	S30	Gr	5. Starter S terminal	Starter relay
T10	T10	GW	Combination switch	Wiring G
T20	T20	GR	Combination switch	Wiring G
	T20A	GR	Joint from T20	Cluster A
T30	T30	GB	Combination switch	Wiring G
T40	T40	RG	Combination switch	Cabin wiring
T50	T50	WL	Combination switch	Flasher unit
T60	T60	WR	Combination switch	Flasher unit
T70	T70	WG	Cabin wiring	Flasher unit
	T70A	WG	Joint from T70	Cluster A
T80	T80	GB	Flasher unit	Cabin wiring
	T80A	GB	Joint from T80	Cluster B
T90	T90	G	Cabin wiring	Flasher unit

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**BB5045CH / BB5055CH**

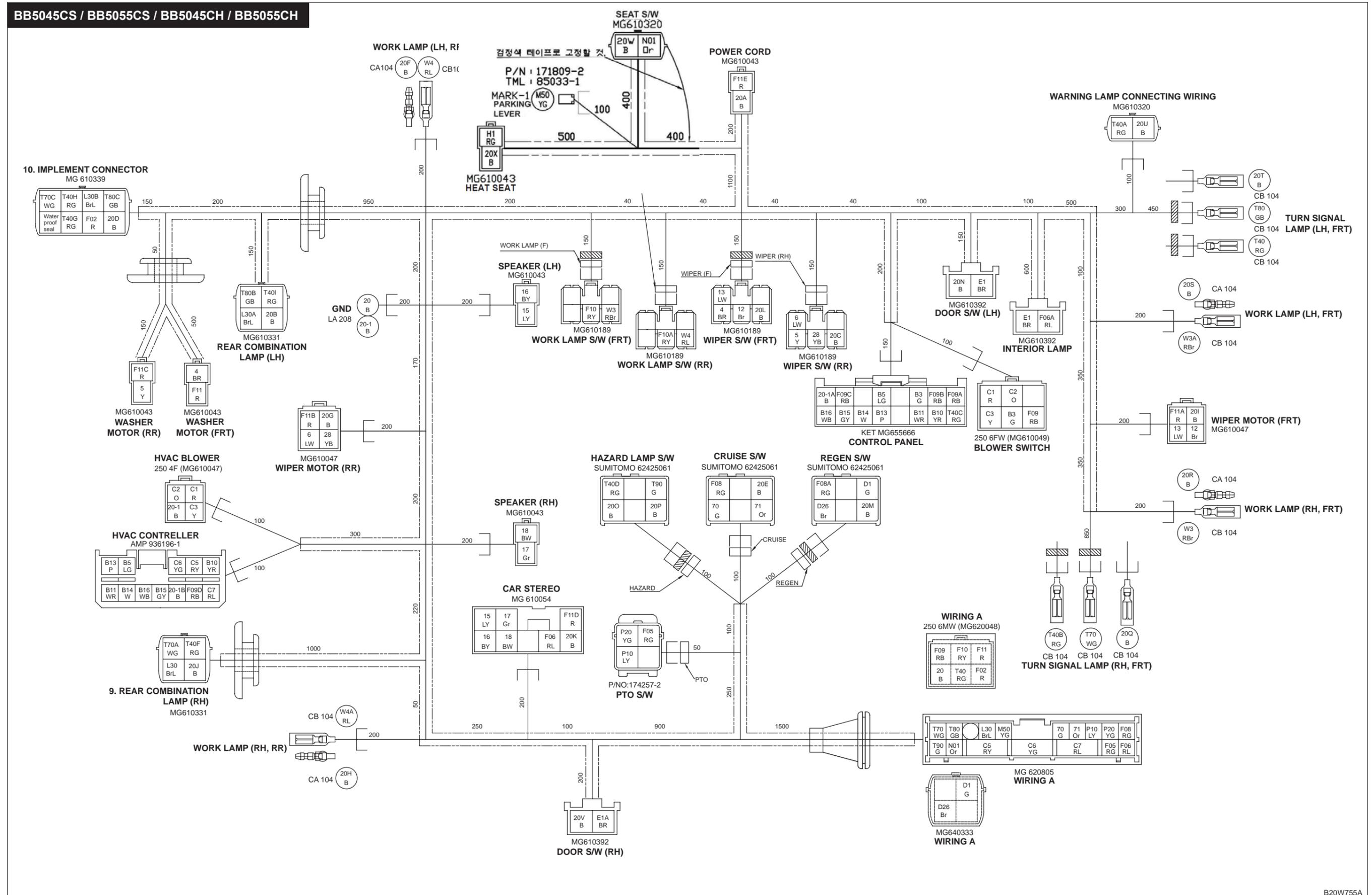
WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
0	0	B	8.GND	Power relay
	00A	B	Joint from 00	15. Flasher unit
	00B	B	Joint from 00	Wiring G
	00C	B	Joint from 00	Relay (PTO)
	00D	B	Joint from 00	Cluster A
	00E	B	Joint from 00	Relay (Start safety)
	00F	B	Joint from 00	Engine controller
	00G	B	Joint from 00	Engine controller
	00H	B	Joint from 00	Feed pump
	00I	B	Joint from 00	Cluster A
	00J	B	Joint from 00	Cluster B
	00K	B	Joint from 00	Implement power
	00L	B	Joint from 00	DPF diagnostic
	00M	B	Joint from 00	Cruise unit
1	1	B	8.GND	Cabin wiring
	01A	B	Joint from 01	Wiring B
70	70	G	Cabin wiring	Cruise unit
71	71	Or	Cabin wiring	Cruise unit
B10	B10	R	Power	Power fuse (60A)
	B10A	R	Joint from B10	Glow fuse (60A)
B20	B20	RW	Power fuse (60A)	18. Key switch
	B20A	RW	Joint from B20	1.FUSE BOX
	B20B	RW	Joint from B20	Starter relay
B30	B30	L	Glow fuse (60A)	Glow relay
	B30A	RB	Joint from B30	Power relay
B40	B40	WB	18. Key switch	1.FUSE BOX
	B40A	WB	Joint from B40	Power relay
B50	B50	LR	18. Key switch	1.FUSE BOX
B60	B60	L	18. Key switch	Engine controller
B70	B70	BW	18. Key switch	Starter relay
B80	B80	R	Power relay	1.FUSE BOX
C5	C5	RY	Cabin wiring	A/C pressure switch
C6	C6	YG	Cabin wiring	A/C compressor
C7	C7	RL	Cabin wiring	A/C pressure switch
D1	D1	G	Cabin wiring	Engine controller
D2	D2	W	Pickup sensor	Engine controller
D4	D4	Lg	DPF diagnostic	Engine controller
D5	D5	BW	Cluster A	Engine controller
	D5A	BW	Joint from D5	DPF diagnostic
D6	D6	GW	Temp. sensor 1	Engine controller
D7	D7	YB	Water temp. sensor	Engine controller
D8	D8	LB	Water temp. sensor(Glow)	Engine controller
D9	D9	YW	Diff. pressure sensor 2	Engine controller
D10	D10	YR	Oil pressure switch	Engine controller
D11	D11	Or	DPF diagnostic	Engine controller

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
D12	D12	V	DPF diagnostic	Engine controller
D13	D13	BR	Pickup sensor	Engine controller
D14	D14	W	Cluster A	Engine controller
	D14A	W	Joint from D14	DPF diagnostic
D15	D15	Y	Diff. pressure sensor 1	Engine controller
D17	D17	GL	Warning buzzer	Engine controller
D19	D19	LB	EACV	Engine controller
D20	D20	GB	Temp. sensor 2	Engine controller
D21	D21	GY	Alternator	Engine controller
D22	D22	B	Temp. sensor 2	Engine controller
D23	D23	RY	EACV	Engine controller
D24	D24	RB	Diff. pressure sensor 1	Engine controller
	D24A	RB	Joint from D24	Diff. pressure sensor 2
D25	D25	Y	Glow relay	Engine controller
D26	D26	Br	Cabin wiring	Engine controller
D29	D29	B	Temp. sensor 1	Engine controller
D30	D30	B	EACV	Engine controller
D31	D31	B	Diff. pressure sensor 1	Engine controller
	D31A	B	Joint from D31	Diff. pressure sensor 2
D35	D35	Y	EACV	Engine controller
D40	D40	L	EACV	Engine controller
E90	E90	RW	Glow plug connection wiring	Glow relay
F01	F01	RY	1.FUSE BOX	Cluster A
	F01B	RY	FJoint from 01	Cluster B
	F01C	RY	FJoint from 01	Diode (Alternator)
	F01D	RY	FJoint from 01	Cluster A
F02	F02	R	1.FUSE BOX	Wiring B
	F02A	R	Joint from F02	11. Stop lamp switch
	F02B	R	Joint from F02	12. Stop lamp switch
	F02C	R	Joint from F02	Combination switch
	F02E	R	Joint from F02	Cabin wiring
	F02F	R	Joint from F02	Flasher unit
	F02G	R	Joint from F02	Implement power
F03	F03	RL	1.FUSE BOX	Feed pump
	F03A	RL	Joint from F03	Fuel cut-off SOL
F04	F04	RB	1.FUSE BOX	Engine controller
	F04A	RB	Joint from F04	Engine controller
	F04B	RB	Joint from F04	Glow relay
	F04C	RB	Joint from F04	Warning buzzer
	F04D	RB	Joint from F04	DPF diagnostic
F05	F05	RG	1.FUSE BOX	Relay (PTO)
	F05A	RG	Joint from F05	Cabin wiring
	F05B	RG	Joint from F05	Wiring B
F06	F06	RL	1.FUSE BOX	Combination switch
	F06A	RL	Joint from F06	Flasher unit

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
	F06B	RL	Joint from F06	Cabin wiring
	F06C	RL	Joint from F06	Cluster B
F07	F07	RW	1.FUSE BOX	Combination switch
F08	F08	RG	1.FUSE BOX	Relay (Cruise )
	F08A	RG	Joint from F08	Cabin wiring
	F08B	RG	Joint from F08	Relay (Cruise )
	F08C	RG	Joint from F08	Cruise unit
	F08C	RG	Joint from F08	Cabin wiring
F09	F09	RB	1.FUSE BOX	Cabin wiring
F10	F10	RY	1.FUSE BOX	Cabin wiring
F11	F11	R	1.FUSE BOX	Cabin wiring
G10	G10	WR	1.Alternator	Diode (Alternator)
K10	K10	BR	Relay (Cruise )	Cruise unit
K20	K20	L	Relay (Cruise )	Wiring B
L30	L30	LR	11.Stop lamp switch	Cabin wiring
	L30A	LR	Joint from L30	12.Stop lamp switch
	L30B	LR	Joint from L30	Engine controller
	L30C	LR	Joint from L30	Cluster A
	L30D	LR	Joint from L30	Cruise unit
M30	M30	YW	Wiring B	Cluster B
P10	P10	LY	Relay (PTO)	Cabin wiring
	P10A	LY	Joint from P10	Wiring B
	P10B	LY	Joint from P10	Diode (IND)
P20	P20	YG	Wiring B	Cabin wiring
	P20A	YG	Joint from P20	Diode (Link)
P30	P30	V	Wiring B	Relay (PTO)
	P30A	V	Joint from P30	Cluster B
P50	P50	LR	Diode (IND)	Relay (Safety start)
	P50A	LR	Joint from P50	Diode (Link)
S10	S10	BL	Wiring B	Relay (Safety start)
	S10A	BL	Joint from S10	Cluster B
	S10B	BL	Joint from S10	Engine controller
S20	S20	BR	Relay (Safety start)	Starter relay
S30	S30	Gr	5. Starter S terminal	Starter relay
T10	T10	GW	Combination switch	Wiring G
T20	T20	GR	Combination switch	Wiring G
	T20A	GR	Joint from T20	Cluster A
T30	T30	GB	Combination switch	Wiring G
T40	T40	RG	Combination switch	Cabin wiring
T50	T50	WL	Combination switch	Flasher unit
T60	T60	WR	Combination switch	Flasher unit
T70	T70	WG	Cabin wiring	Flasher unit
	T70A	WG	Joint from T70	Cluster A
T80	T80	GB	Flasher unit	Cabin wiring
	T80A	GB	Joint from T80	Cluster B
T90	T90	G	Cabin wiring	Flasher unit

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4.4.2 WIRING DIAGRAM [CABIN]



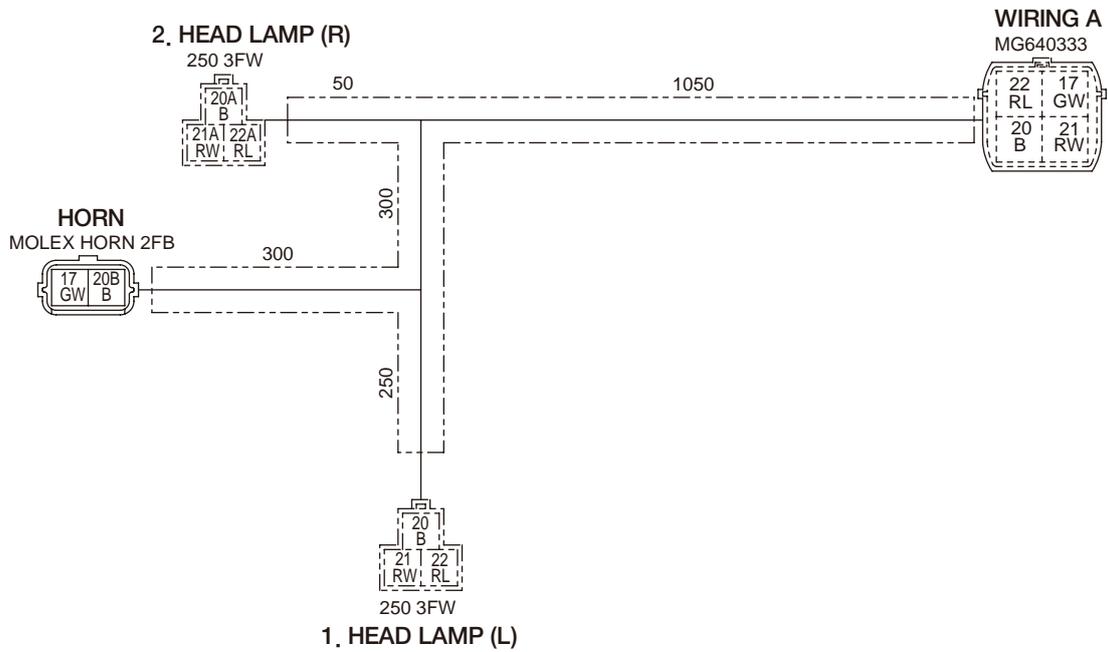
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WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
4	4	BR	Washer motor (FRT)	Wiper S/W (FRT)
5	5	Y	Washer motor (RR)	Wiper S/W (RR)
6	6	LW	Wiper S/W (RR)	Wiper motor (RR)
12	12	Br	Wiper S/W (FRT)	Wiper motor (FRT)
13	13	LW	Wiper S/W (FRT)	Wiper motor (FRT)
15	15	LY	Car stereo	Speaker (LH)
16	16	BY	Car stereo	Speaker (LH)
17	17	Gr	Car stereo	Speaker (RH)
18	18	BW	Car stereo	Speaker (RH)
20	20	B	Wiring A	GND
20-1	20-1	B	GND	HVAC blower
	20-1A	B	Joint from 20-1	Control panel
	20-1B	B	Joint from 20-1	HVAC controller
	20A	B	Joint from 20	Power cord
	20B	B	Joint from 20	Rear combination lamp (L)
	20C	B	Joint from 20	Wiper S/W (RR)
	20D	B	Joint from 20	Implement connector
	20E	B	Joint from 20	Cruise switch
	20F	B	Joint from 20	Work lamp (LH, RR)
	20G	B	Joint from 20	Wiper motor (RR)
	20H	B	Joint from 20	Work lamp (RH, RR)
	20I	B	Joint from 20	Wiper motor (FRT)
	20J	B	Joint from 20	Rear combination lamp (R)
	20K	B	Joint from 20	Car stereo
	20L	B	Joint from 20	Wiper S/W (FRT)
	20M	B	Joint from 20	Regen S/W
	20N	B	Joint from 20	Door S/W (LH)
	20O	B	Joint from 20	Hazard warning lamp switch
	20P	B	Joint from 20	Hazard warning lamp switch
	20Q	B	Joint from 20	Turn signal lamp (RH, FRT)
	20R	B	Joint from 20	Work lamp (RH, FRT)
	20S	B	Joint from 20	Work lamp (LH, FRT)
	20T	B	Joint from 20	Turn signal lamp (LH, FRT)
	20U	B	Joint from 20	Warning lamp
	20V	B	Joint from 20	Door S/W (RH)

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
	20W	B	Joint from 20	Seat switch
	20X	B	Joint from 20	Heated seat
28	28	YB	Wiper S/W (RR)	Wiper motor (RR)
70	70	G	Wiring A	Cruise switch
71	71	Or	Wiring A	Cruise switch
B10	B10	YR	Control panel	HVAC controller
B11	B11	WR	Control panel	HVAC controller
B13	B13	P	Control panel	HVAC controller
B14	B14	W	Control panel	HVAC controller
B15	B15	GY	Control panel	HVAC controller
B16	B16	WB	Control panel	HVAC controller
B3	B3	G	Control panel	Blower switch
B5	B5	LG	Control panel	HVAC controller
C1	C1	R	Blower switch	HVAC Blower
C2	C2	O	Blower switch	HVAC Blower
C3	C3	Y	Blower switch	HVAC Blower
C5	C5	RY	Wiring A	HVAC controller
C6	C6	YG	Wiring A	HVAC controller
C7	C7	RL	Wiring A	HVAC controller
D1	D1	G	Regen S/W	Wiring A
D26	D26	Br	Regen S/W	Wiring A
E1	E1	BR	Door S/W (LH)	Room lamp
	E1A	BR	Joint from D1	Door S/W (RH)
F02	F02	R	Wiring A	Trailer connector
F05	F05	RG	Wiring A	PTO selection switch
F06	F06	RL	Wiring A	Car stereo
	F06A	RL	Joint from F06	Room lamp
F08	F08	RG	Wiring A	Cruise switch
	F08A	RG	Joint from F08	Regen S/W
F09	F09	RB	Wiring A	Blower switch
	F09A	RB	Joint from F09	Control panel
	F09B	RB	Joint from F09	Control panel
	F09C	RB	Joint from F09	Control panel
	F09D	RB	Joint from F09	HVAC controller
F10	F10	RY	Wiring A	Work lamp S/W (FRT)
	F10A	RY	Joint from F10	Work lamp S/W (RR)

WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
F11	F11	R	Wiring A	Washer motor (FRT)
	F11A	R	Joint from F11	Wiper motor (FRT)
	F11B	R	Joint from F11	Wiper motor (RR)
	F11C	R	Joint from F11	Washer motor (RR)
	F11D	R	Joint from F11	Car stereo
	F11E	R	Joint from F11	Power cord
L30	L30	BrL	Wiring A	Rear combination lamp (R)
	L30A	BrL	Joint from L30	Rear combination lamp (L)
	L30B	BrL	Joint from L30	Trailer connector
M50	M50	YG	Wiring A	Parking lever
N01	N01	Or	Wiring A	Seat switch
P10	P10	LY	Wiring A	PTO selection switch
P20	P20	YG	Wiring A	PTO selection switch
T40	T40	RG	Wiring A	Turn signal lamp (LH, FRT)
	T40A	RG	Joint from T40	Warning lamp
	T40B	RG	Joint from T40	Turn signal lamp (RH, FRT)
	T40C	RG	Joint from T40	Control panel
	T40D	RG	Joint from T40	Hazard warning lamp switch
	T40F	RG	Joint from T40	Rear combination lamp (R)
	T40G	RG	Joint from T40	Trailer connector
	T40H	RG	Joint from T40	Trailer connector
	T40I	RG	Joint from T40	Rear combination lamp (L)
T70	T70	WG	Wiring A	Turn signal lamp (RH, FRT)
	T70A	WG	Joint from T70	Rear combination lamp (R)
	T70C	WG	Joint from T70	Trailer connector
T80	T80	GB	Wiring A	Turn signal lamp (LH, FRT)
	T80B	GB	Joint from T80	Rear combination lamp (L)
	T80C	GB	Joint from T80	Trailer connector
T90	T90	G	Wiring A	Hazard warning lamp switch
W3	W3	RBr	Work lamp S/W (FRT)	Work lamp (RH, FRT)
	W3A	RBr	Joint from W3	Work lamp (LH, FRT)
W4	W4	RL	Work lamp S/W (RR)	Work lamp (LH, RR)
	W4A	RL	Joint from W4	Work lamp (RH, RR)

4.4.3 WIRING DIAGRAM [G]

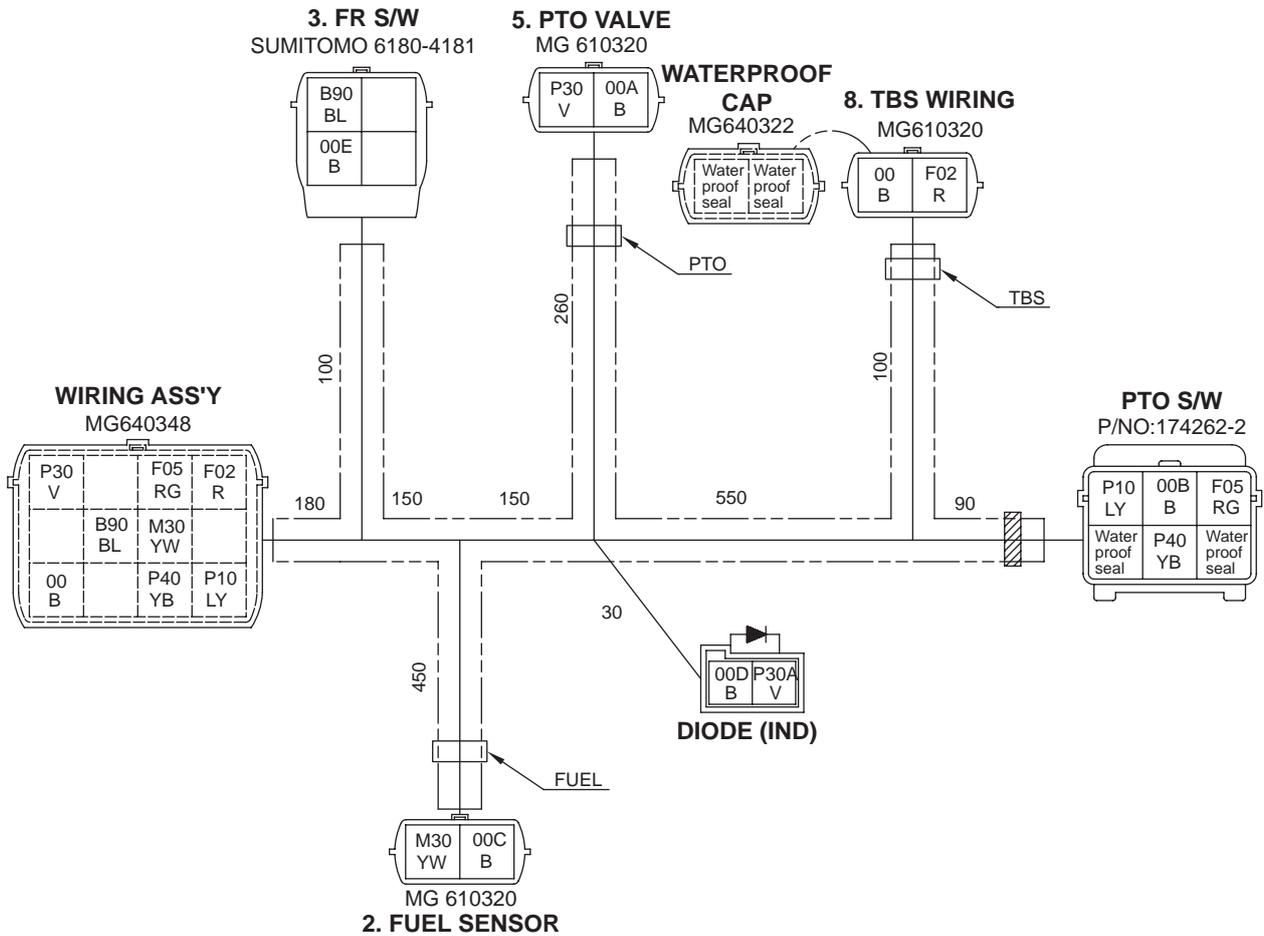


WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
17	17	GW	Wiring A	HORN
21	21	RW	Wiring A	1. Head lamp (L)
	21A	RW	Joint from L01	2. Head lamp (R)
22	22	RL	Wiring A	1. Head lamp (L)
	22A	RL	Joint from L02	2. Head lamp (R)
20	20	B	Wiring A	1. Head lamp (L)
	20A	B	Joint from G03	2. Head lamp (R)
	20B	B	Joint from G03	Horn

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4.4.4 WIRING DIAGRAM [B]

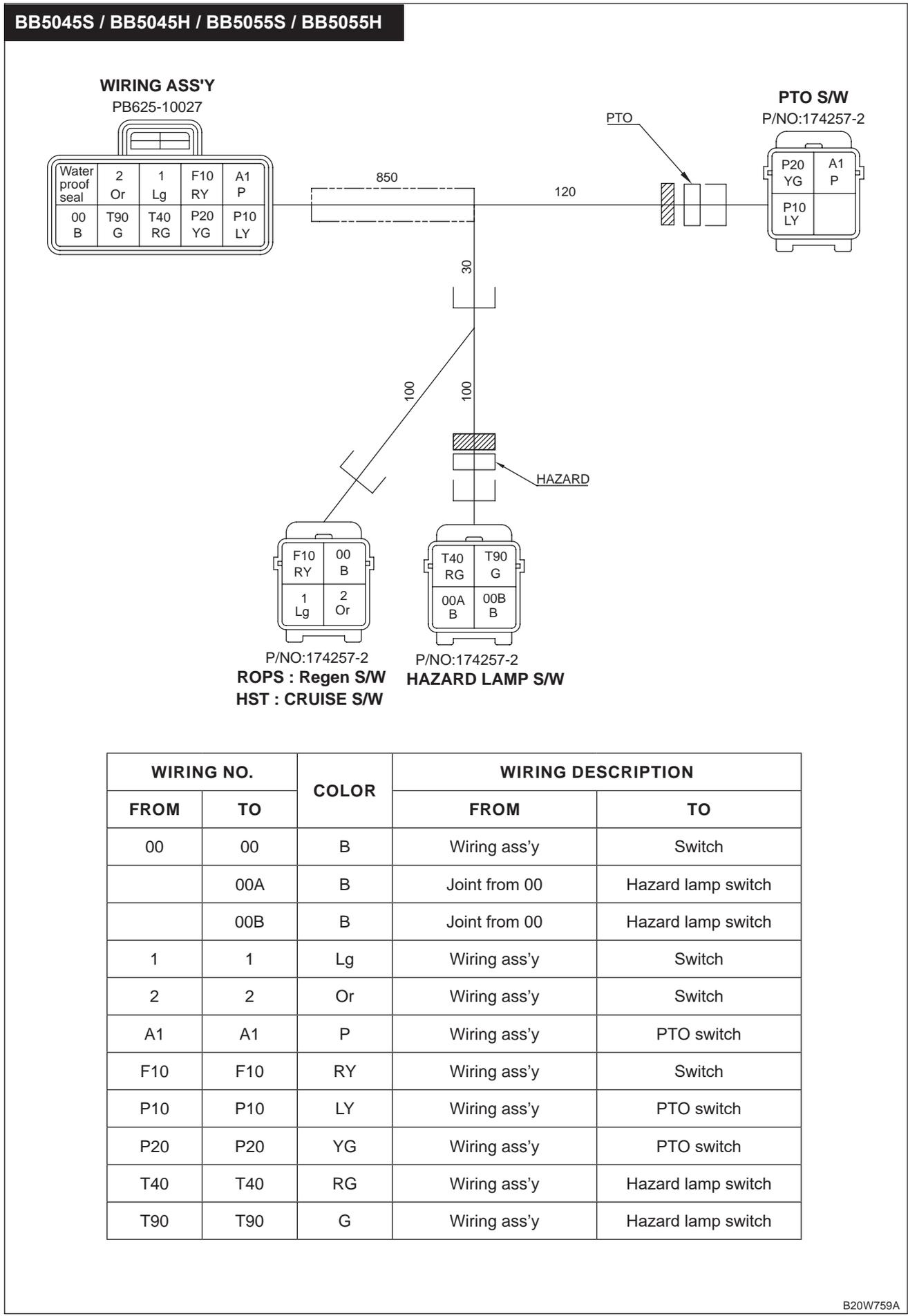
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WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
00	00	B	Wiring ass'y	8. TBS wiring
	00A	B	Joint from 00	5. PTO valve
	00B	B	Joint from 00	PTO connecting S/W
	00C	B	Joint from 00	2. Fuel sensor
	00D	B	Joint from 00	7. Diode
	00E	B	Joint from 00	3. FR S/W
B90	B90	BL	Wiring ass'y	3. FR S/W
F02	F02	R	Wiring ass'y	8. TBS wiring
F05	F05	RG	Wiring ass'y	PTO connecting S/W
M30	M30	YW	Wiring ass'y	2. Fuel sensor
P10	P10	LY	Wiring ass'y	PTO connecting S/W
P30	P30	V	Wiring ass'y	5. PTO valve
	P30A	V	Joint from P30	7. Diode
P40	P40	YB	Wiring ass'y	PTO connecting S/W

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4.4.5 WIRING DIAGRAM [SWITCH CONNECTING]

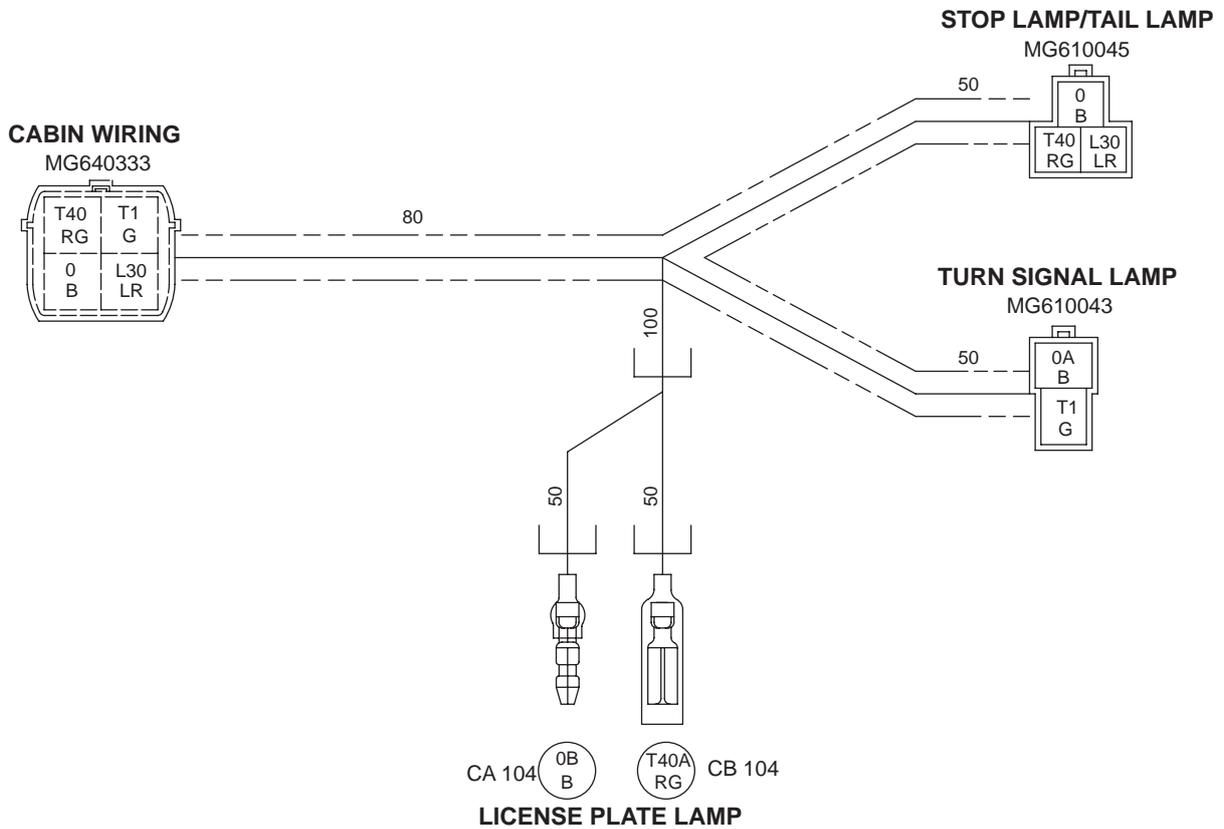


WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
00	00	B	Wiring ass'y	Switch
	00A	B	Joint from 00	Hazard lamp switch
	00B	B	Joint from 00	Hazard lamp switch
1	1	Lg	Wiring ass'y	Switch
2	2	Or	Wiring ass'y	Switch
A1	A1	P	Wiring ass'y	PTO switch
F10	F10	RY	Wiring ass'y	Switch
P10	P10	LY	Wiring ass'y	PTO switch
P20	P20	YG	Wiring ass'y	PTO switch
T40	T40	RG	Wiring ass'y	Hazard lamp switch
T90	T90	G	Wiring ass'y	Hazard lamp switch

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4.4.6 WIRING DIAGRAM [REAR COMBI-LAMP CONNECTING]

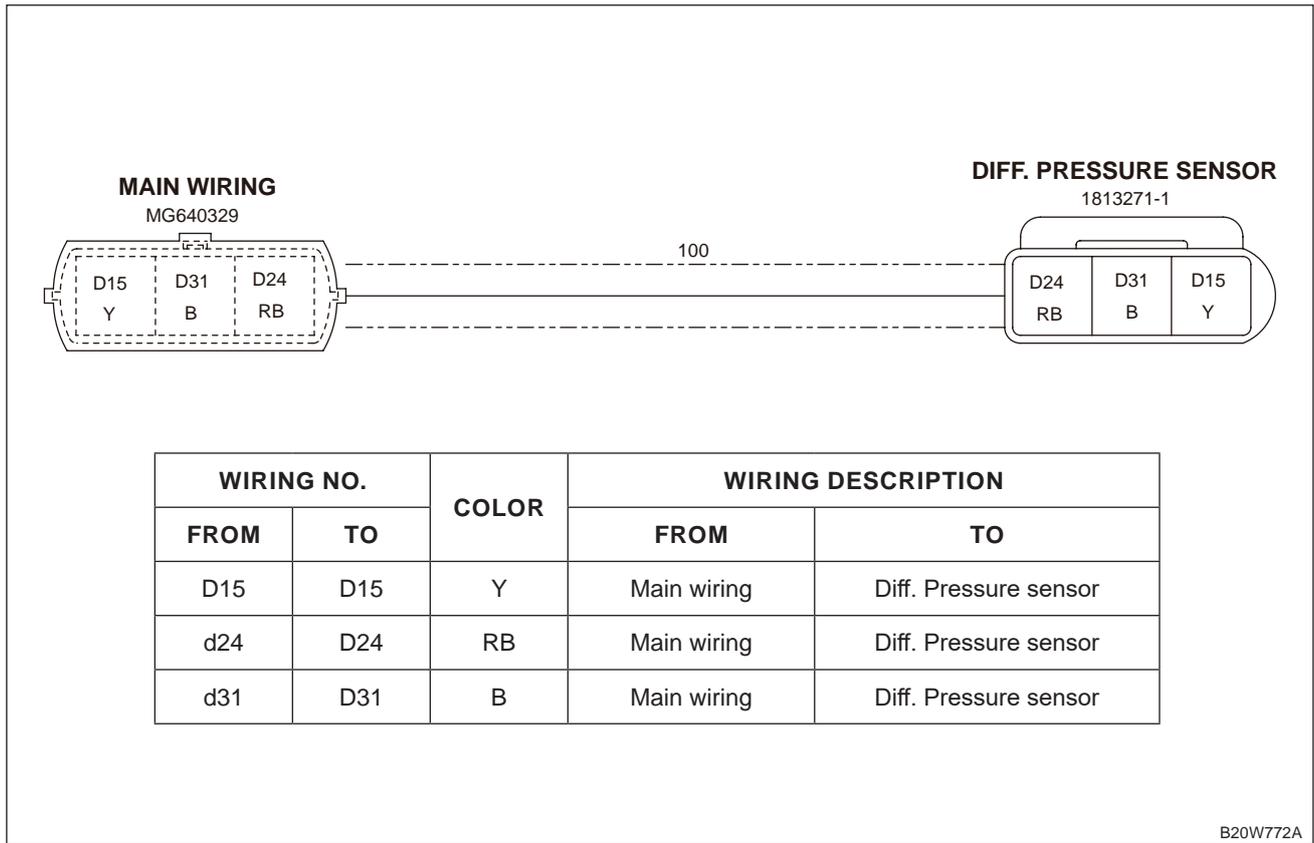
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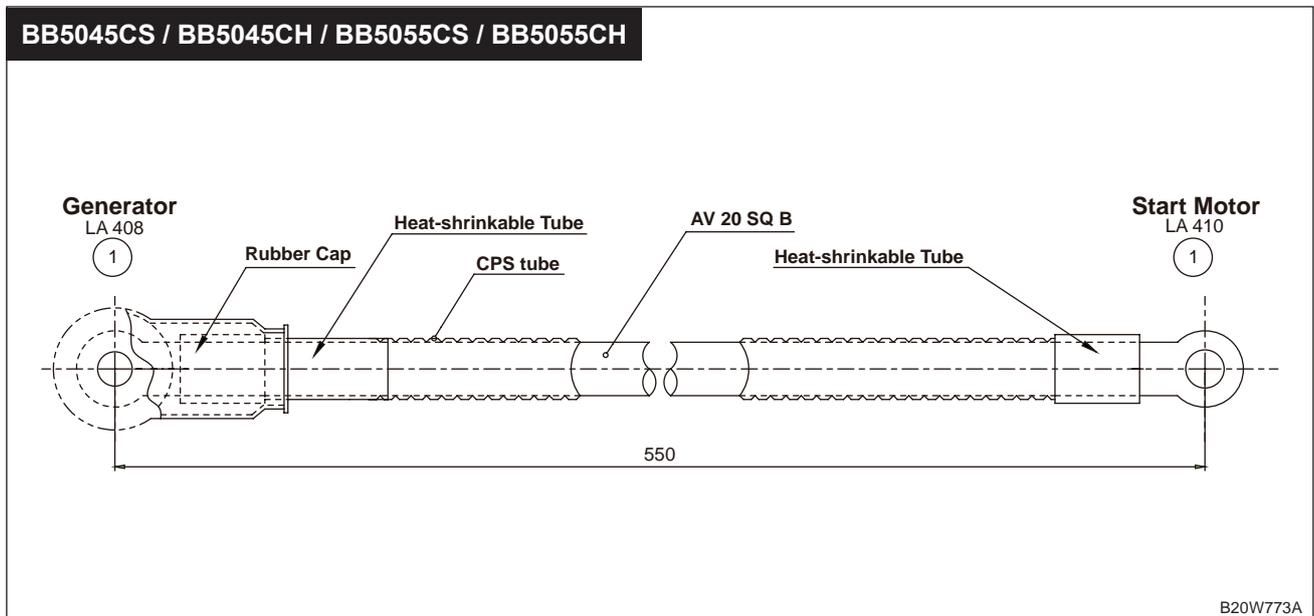
WIRING NO.		COLOR	WIRING DESCRIPTION	
FROM	TO		FROM	TO
0	0	B	Cabin wiring	Stop lamp/Tail lamp
	0A	B	Joint from 0	Turn signal lamp
	0B	B	Joint from 0	License plate lamp
L30	L30	LR	Cabin wiring	Stop lamp/Tail lamp
T1	T1	G	Cabin wiring	Turn signal lamp
T40	T40	RG	Cabin wiring	Stop lamp/Tail lamp
	T40A	RG	Joint from T40	License plate lamp

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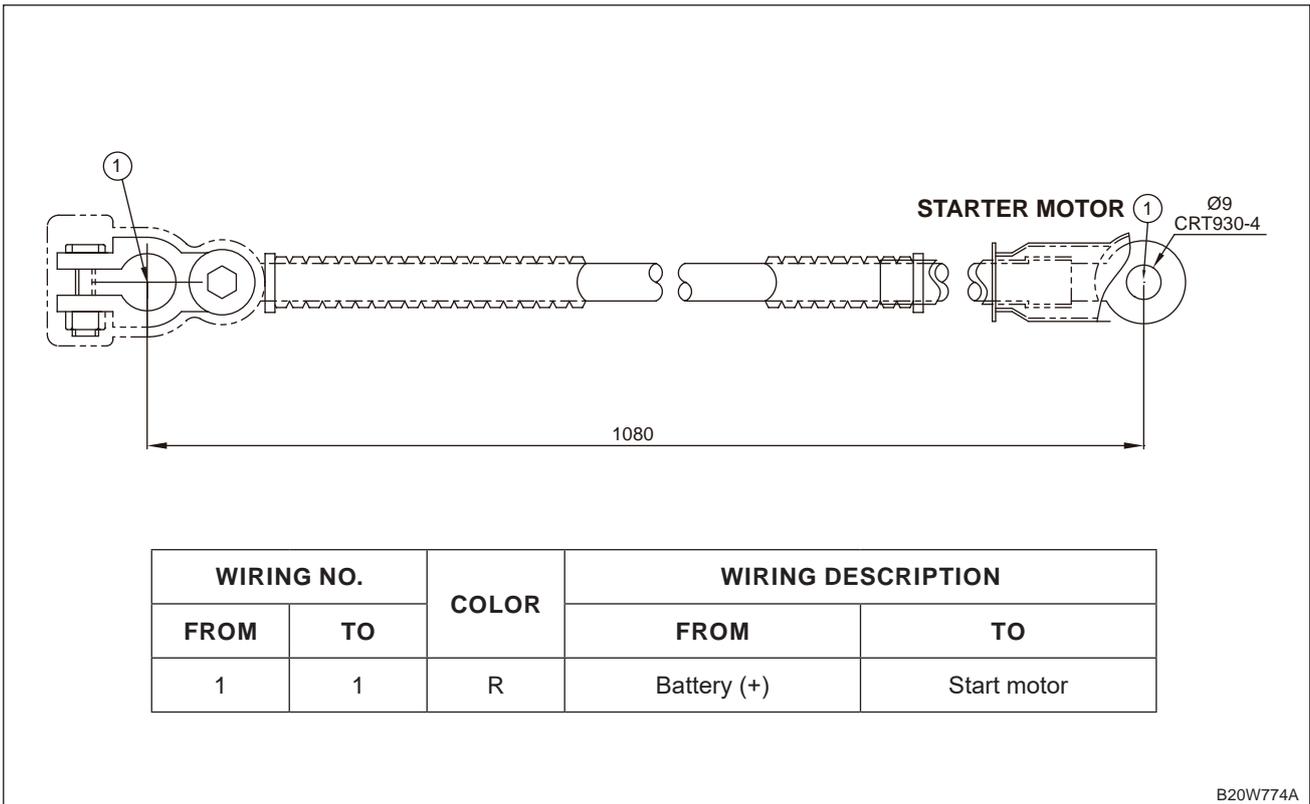
4.4.7 WIRING DIAGRAM [DIFF. PRESSURE SENSOR CONNECTING]



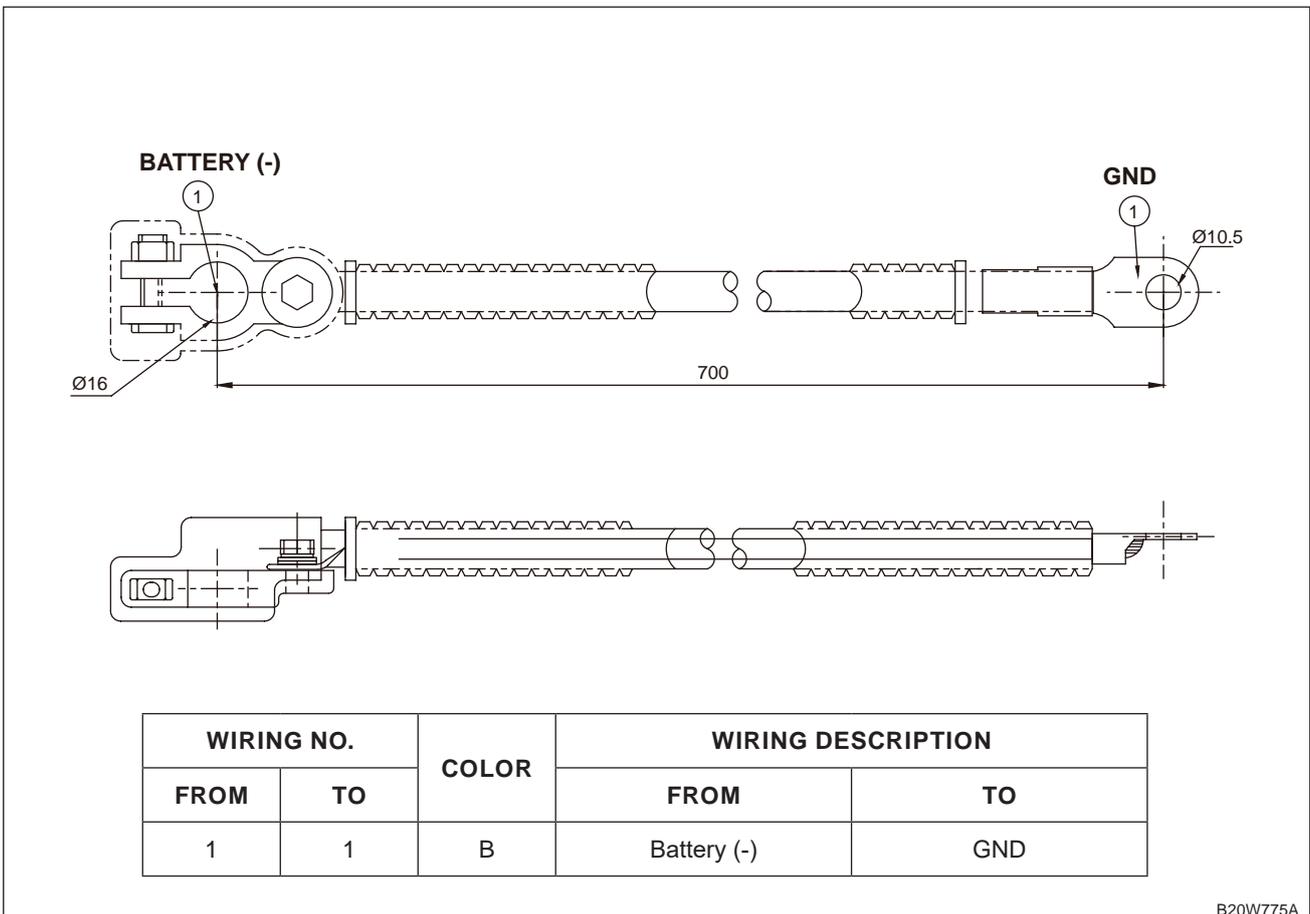
4.4.8 WIRING DIAGRAM [CHARGE CABLE]



4.4.9 WIRING DIAGRAM [CABLE(+)]

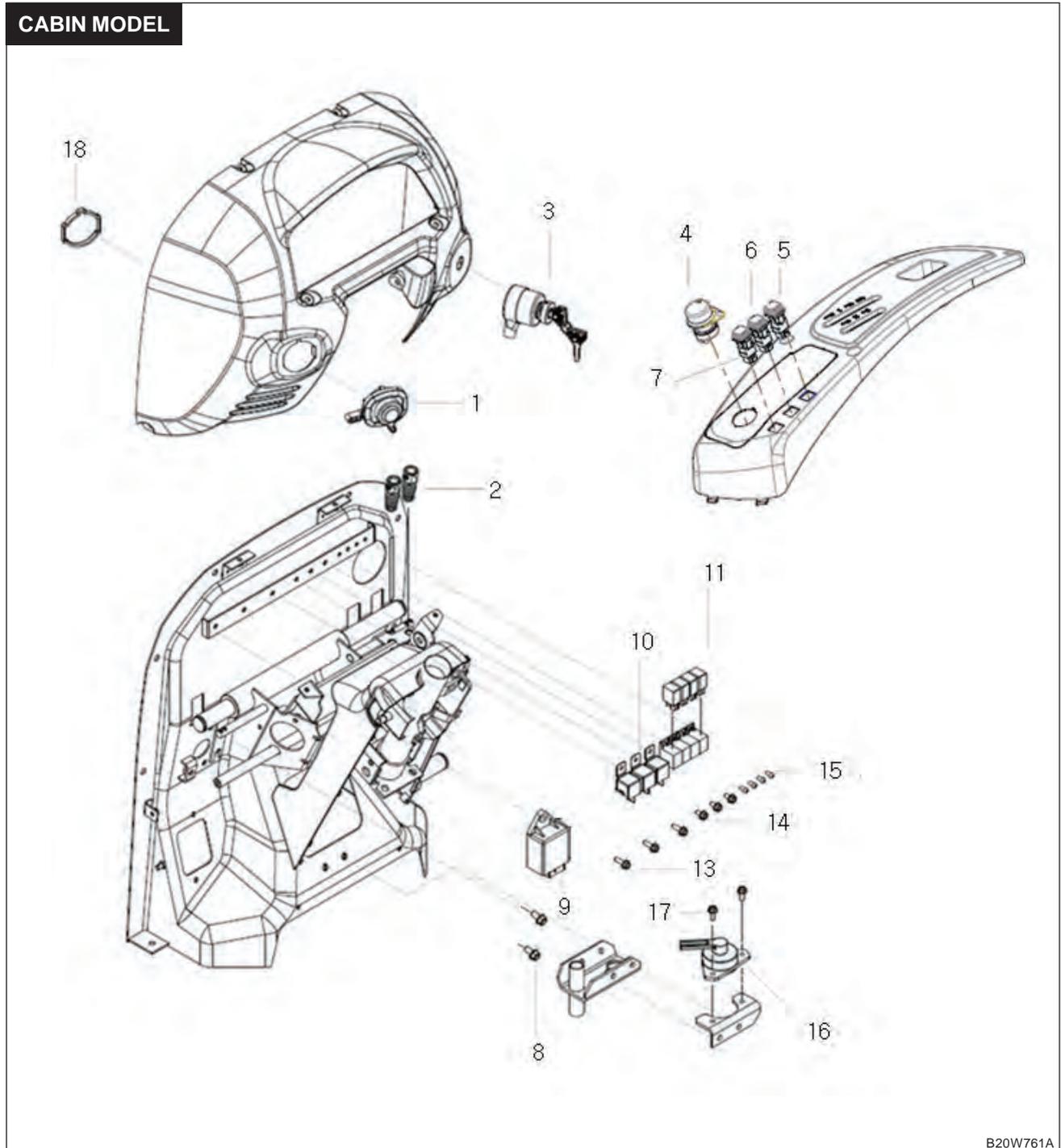


4.4.10 WIRING DIAGRAM [CABLE(-)]



5. SECTIONAL VIEW FOR MAJOR COMPONENTS

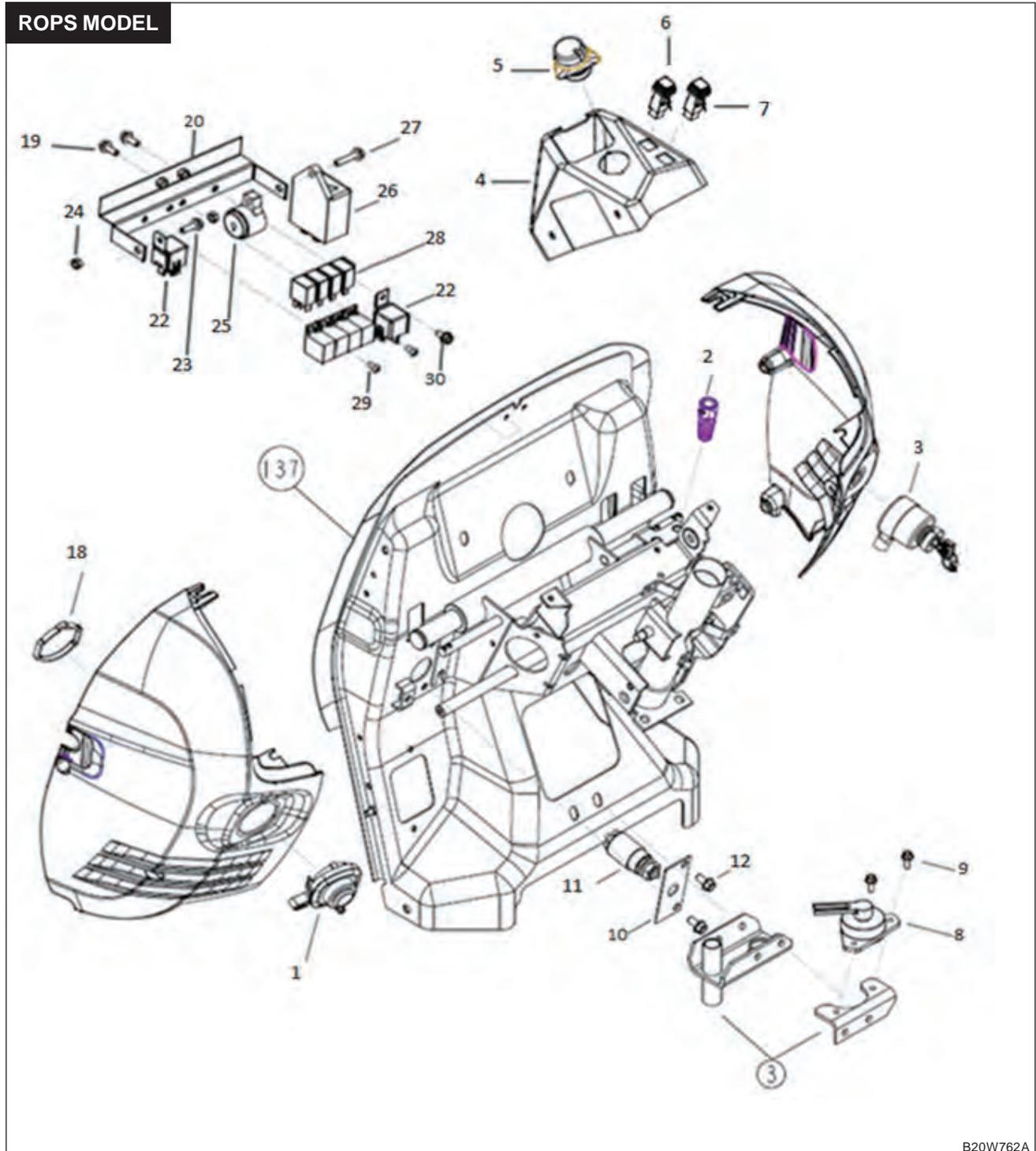
5.1 SWITCH



B20W761A

**COMPONENTS**

- |                             |                      |                      |
|-----------------------------|----------------------|----------------------|
| (1) Combination lamp switch | (7) Regen S/W        | (14) Hex flange bolt |
| (2) Stop lamp switch        | (8) Hex flange bolt  | (15) Screw           |
| (3) Starter switch ass'y    | (9) Flash relay      | (16) Switch (FR)     |
| (4) Switch, PTO             | (10) Glow relay      | (17) Hex flange bolt |
| (5) Emergency lamp switch   | (11) Mini relay      | (18) Holder          |
| (6) Cruise switch           | (13) Hex flange bolt | (21) Buzzer, warning |

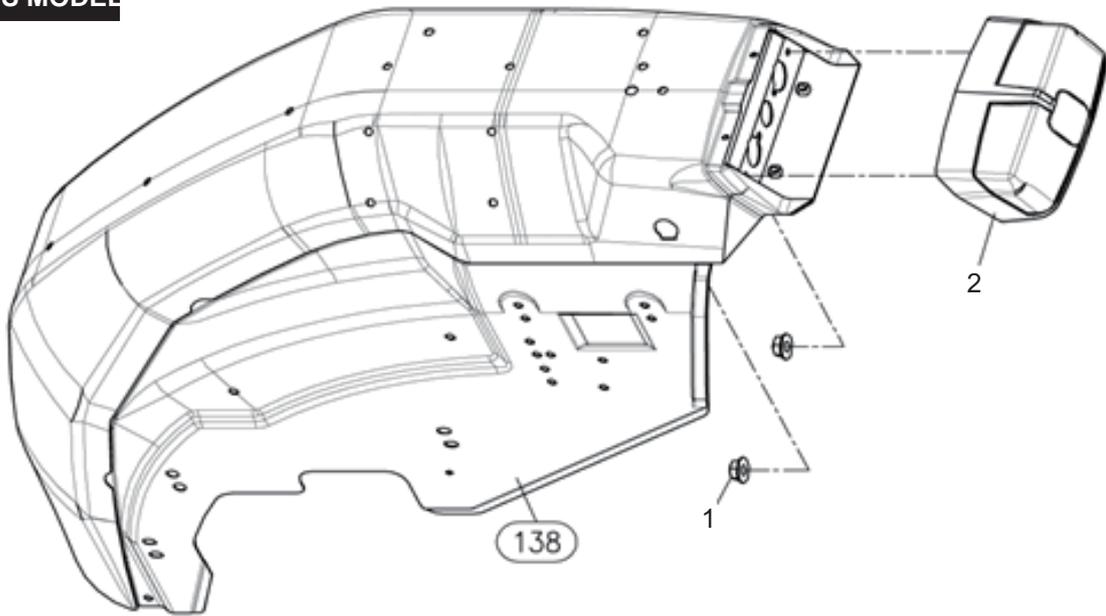


**COMPONENTS**

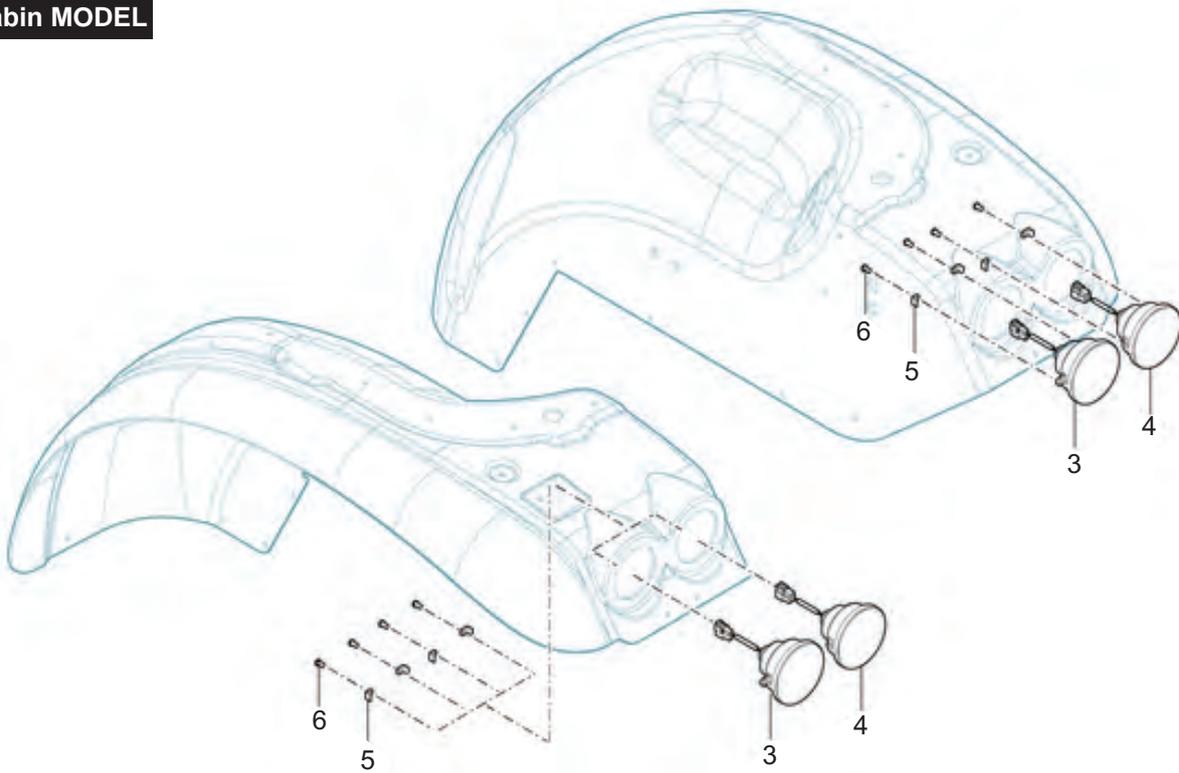
- |                             |                      |                      |
|-----------------------------|----------------------|----------------------|
| (1) Combination lamp switch | (9) Hex flange bolt  | (23) Hex flange bolt |
| (2) Stop lamp switch        | (10) Bracket switch  | (24) Hex nut         |
| (3) Starter switch ass'y    | (11) Safety switch   | (25) Buzzer, warning |
| (4) Cover, joystick         | (12) Hex flange bolt | (26) Flash relay     |
| (5) Switch, PTO             | (18) Holder          | (27) Hex flange bolt |
| (6) Emergence lamp switch   | (19) Hex flange bolt | (28) Mini relay      |
| (7) Regen S/W               | (20) Bracket ass'y   | (29) Screw           |
| (8) Switch (FR)             | (22) Glow relay      | (30) Hex flange bolt |

5.2 LAMP

ROPS MODEL



Cabin MODEL



B20W763A

COMPONENTS

- (1) Hex flange nut
- (2) Combination lamp

- (3) Rear turn signal lamp(us)
- (4) Rear stop lamp(us)

- (5) Rear lamp fixed bracket
- (6) Screw

6. TROUBLESHOOTING

INSPECTION ITEM  SYMPTOM	Safety switch	Safe start relay	Ignition switch	Controller	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 headlamp does not come on.														●	●	
The turn signal lamp does not come on.														●	●	●
The horn does not sound.															●	

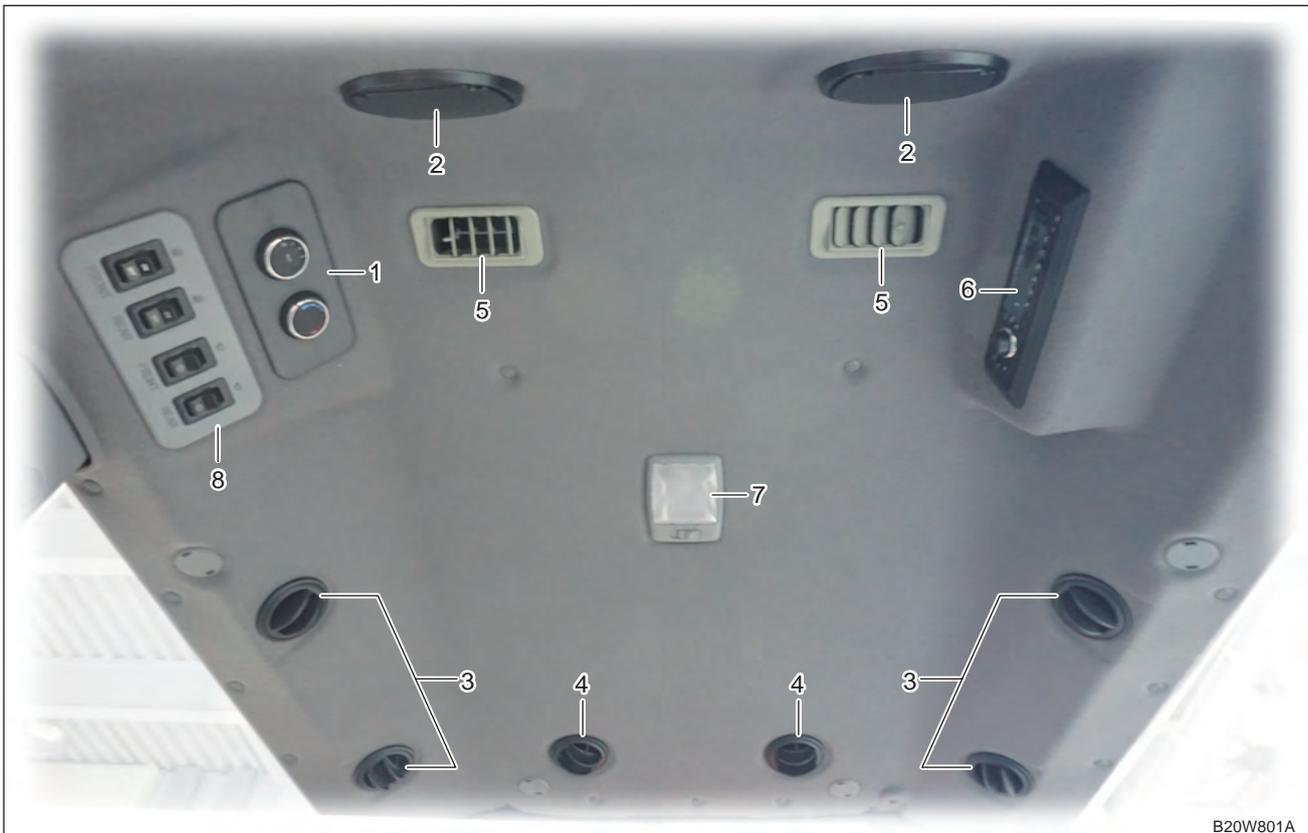
# CHAPTER 8 CABIN AND HVAC SYSTEM (CABIN MODEL ONLY)

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## 1. CABIN

### 1.1 ROOF COMPONENTS



B20W801A

- (1) A/C control switch
- (2) Speaker
- (3) Side vent

- (4) Front vent
- (5) Rear vent
- (6) Audio system

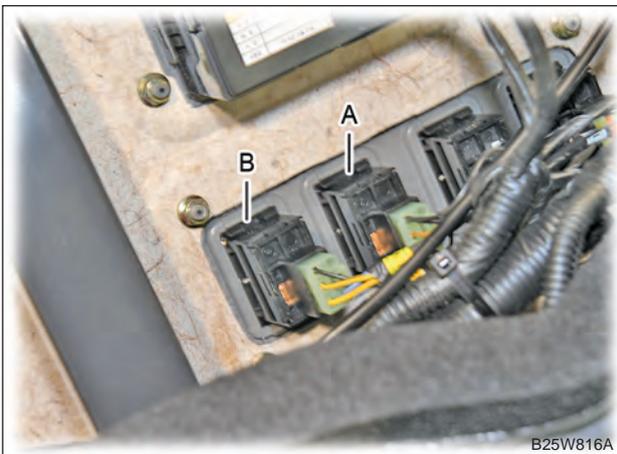
- (7) Interior lamp
- (8) Work lamp/wiper switch box

1.2 MAJOR COMPONENT INSPECTION

1.2.1 WIPER SWITCH



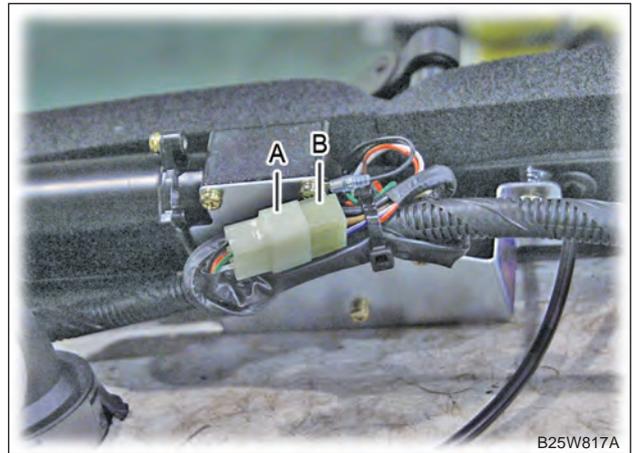
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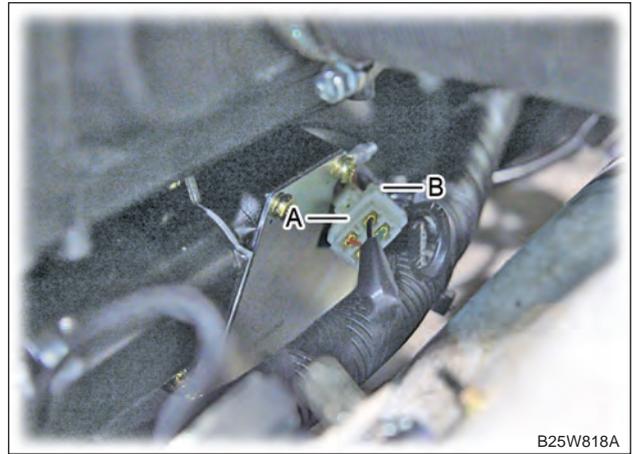
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The front and rear wiper operation switches are installed on the left side of the ceiling in the cabin.

1.2.2 WIPER MOTOR



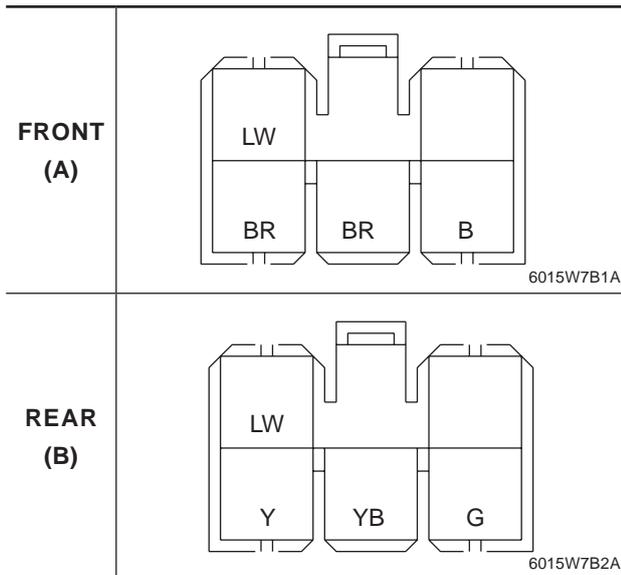
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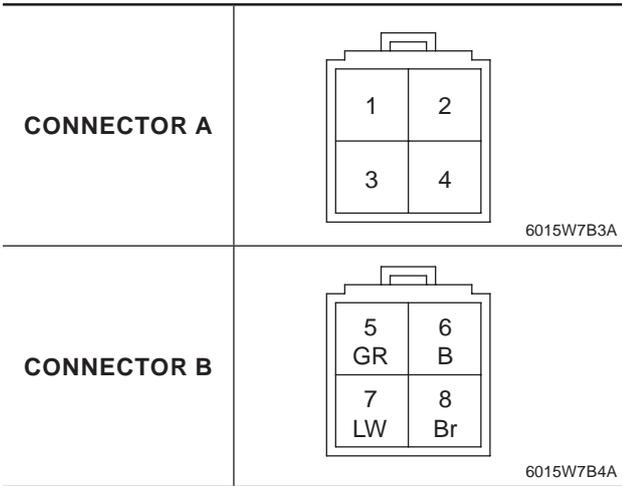
B25W818A

The wiper motors are installed in the front and rear sections of the cabin. The wiper motor is installed to the front and rear of the frame.

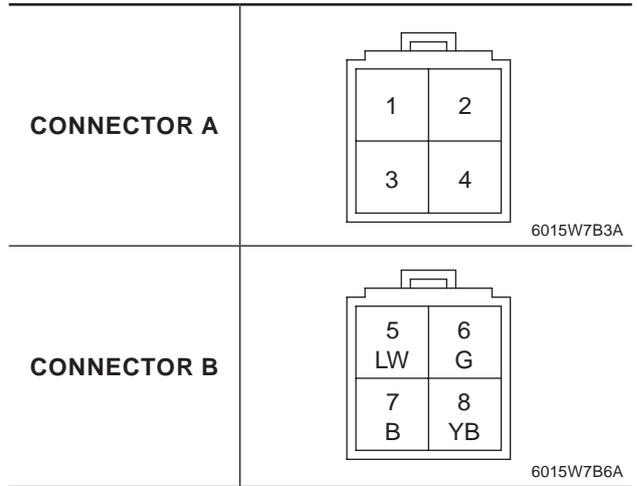
► CONNECTOR TERMINAL



► CONNECTOR TEST (FRONT WIPER MOTOR)



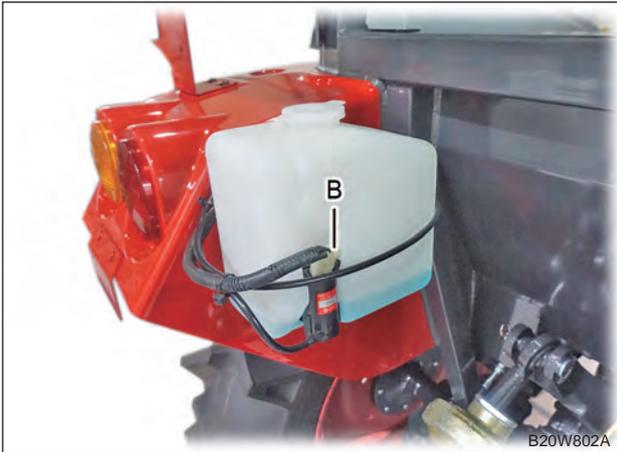
► CONNECTOR TEST (REAR WIPER MOTOR)



ITEM	CONNECTION		STATUS	RESULT	
	+	-			
Connector A	DC power	2	1	-	0 Ω
		3	1		
		4	1		
Connector B	DC power	5	6	Ignition switch 「ON」	12 V
		Resistance	8	6	Ignition switch 「ON」 Wiper switch 「ON」
	7		6	Ignition switch 「ON」 Wiper switch Pressed	
	6		Ground (Chassis)	-	

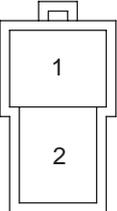
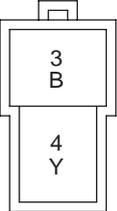
ITEM	CONNECTION		STATUS	RESULT	
	+	-			
Connector A	DC power	1	4	-	0 Ω
		2	4		
		3	4		
Connector B	DC power	8	7	Ignition switch 「ON」	12 V
		Resistance	6	7	
	5		7	Ignition switch 「ON」 Wiper switch Pressed	
	7		Ground (Chassis)	-	

1.2.3 WASHER PUMP



The washer pump is attached to the washer fluid tank in the rear section of the outer cabin.

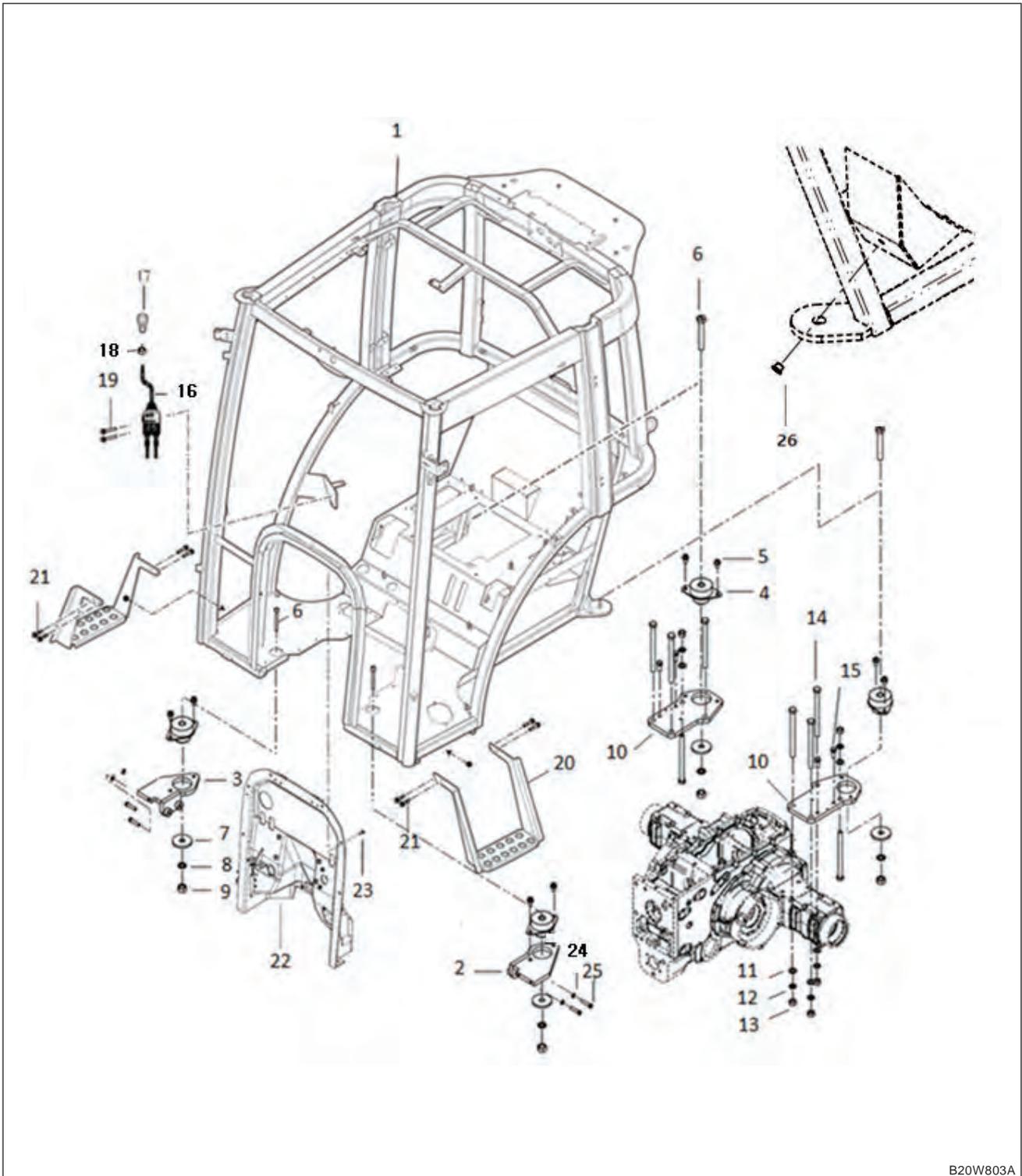
► CONNECTOR TEST

<b>CONNECTOR A</b>		6015W7B7A
<b>CONNECTOR B</b>		6015W7B8A

ITEM		CONNECTION		STATUS	RESULT
		+	-		
Connector A	Resis- tance	2	1	-	Little Ω
Connector B	DC power	4	3	Ignition switch 「ON」 Wiper switch Pressed	12 V

1.3 SECTIONAL VIEW FOR MAJOR COMPONENTS

1.3.1 CABIN FRAME ASS'Y

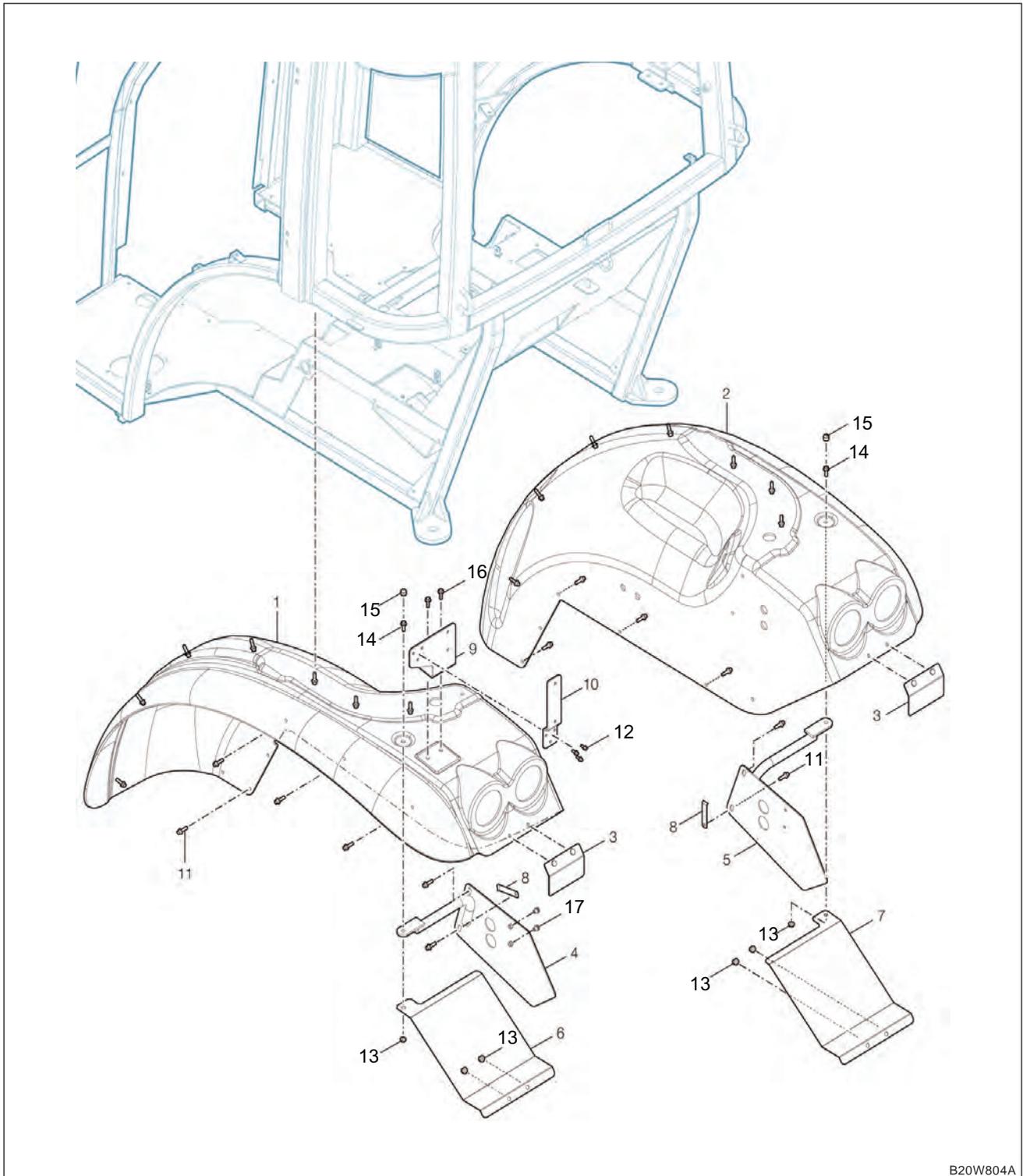


B20W803A

COMPONENTS

- |                       |                      |                      |
|-----------------------|----------------------|----------------------|
| (1) Cabin frame ass'y | (10) Bracket, rear   | (19) Hex flange bolt |
| (2) Bracket, front(L) | (11) Plain washer    | (20) Sub step ass'y  |
| (3) Bracket, front(R) | (12) Spring washer   | (21) Hex flange bolt |
| (4) Cushion rubber    | (13) Hex nut         | (22) Cover           |
| (5) Hex flange bolt   | (14) Bolt            | (23) Hex flange bolt |
| (6) Bolt              | (15) Bolt w/washer   | (24) Spring washer   |
| (7) Washer            | (16) Joy-stick       | (25) Hex bolt        |
| (8) Spring washer     | (17) Joy-stick cable | (26) Plug            |
| (9) Hex nut           | (18) Joy-stick ass'y |                      |

1.3.2 FENDER ASS'Y

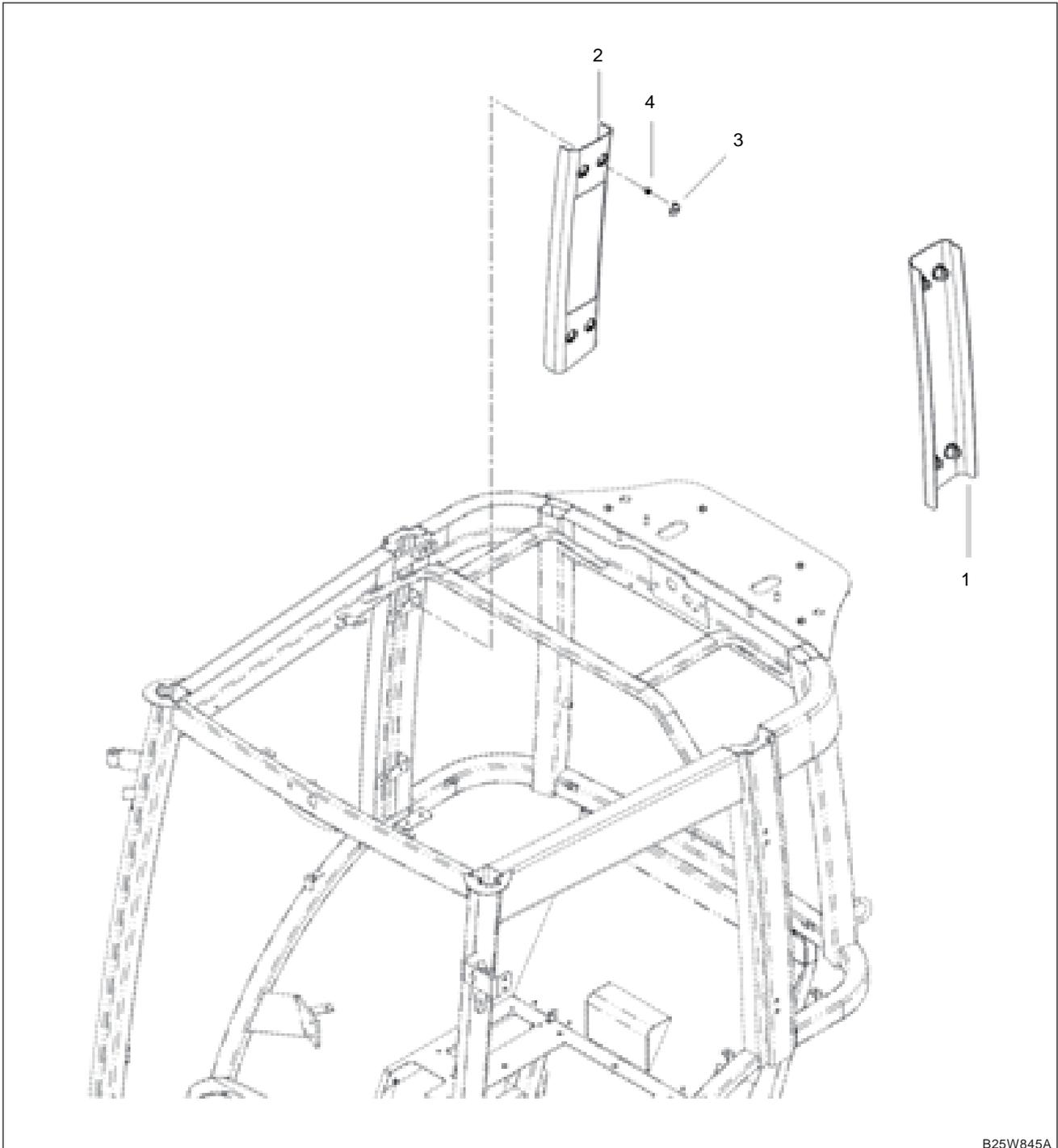


B20W804A

COMPONENTS

- |                              |                                 |                      |
|------------------------------|---------------------------------|----------------------|
| (1) Fender(L)                | (7) Cover/R                     | (13) Hex flange nut  |
| (2) Fender(R)                | (8) Clamp C,wire                | (14) Hex flange bolt |
| (3) Bracket, reflector       | (9) Bracket ass'y(number plate) | (15) Nut,cap         |
| (4) Fender support bracket/L | (10) Bracket/SMV                | (16) Hex flange bolt |
| (5) Fender support bracket/R | (11) Screw                      | (17) Nut             |
| (6) Cover/L                  | (12) Hex flange bolt            |                      |

1.3.3 PILLAR COVER ASS'Y



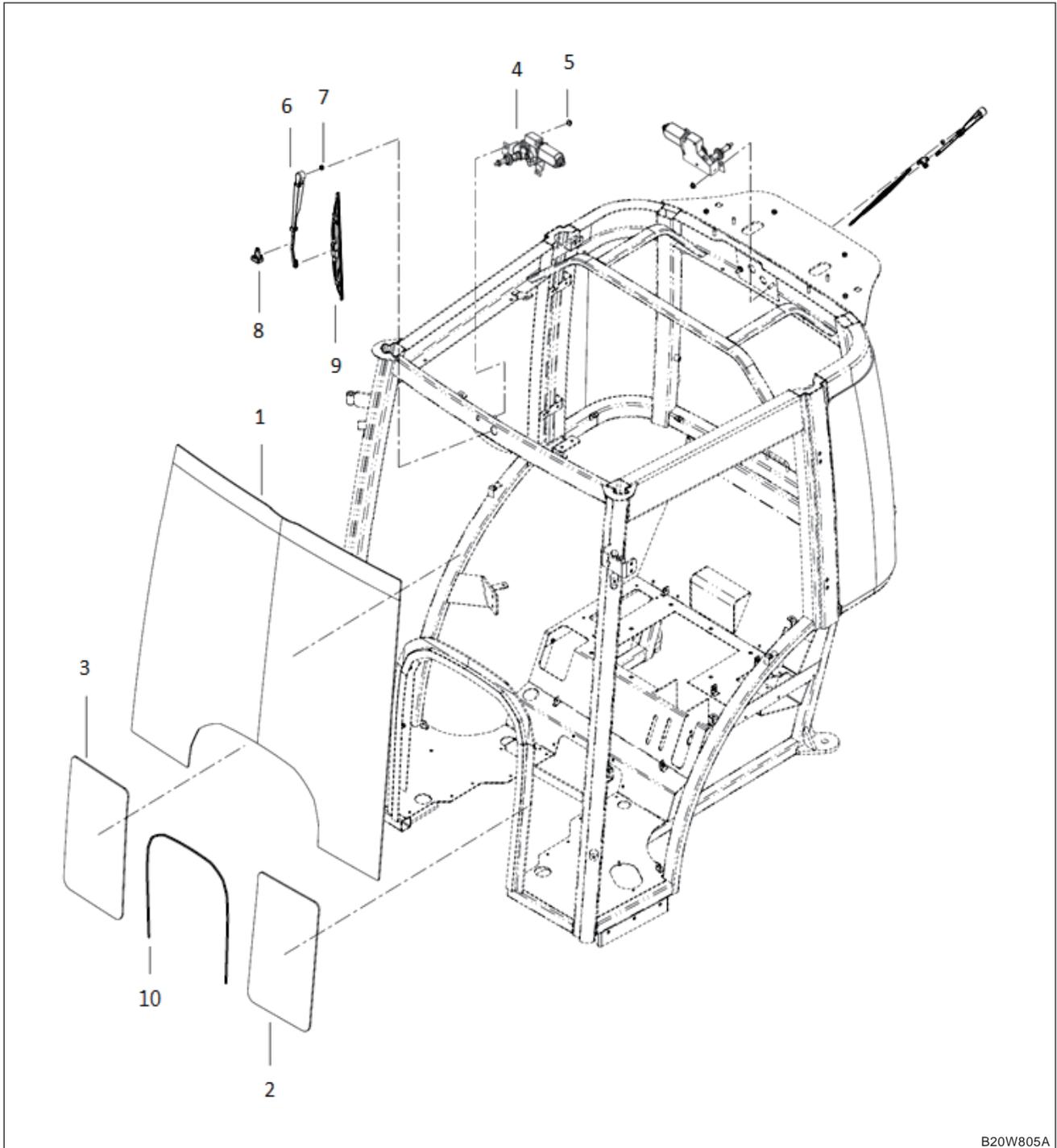
B25W845A

**COMPONENTS**

- (1) Pillar cover (L), B
- (2) Pillar cover (R), B

- (3) Cap
- (4) Hex. flange bolt

1.3.4 FRONT WINDOW ASS'Y



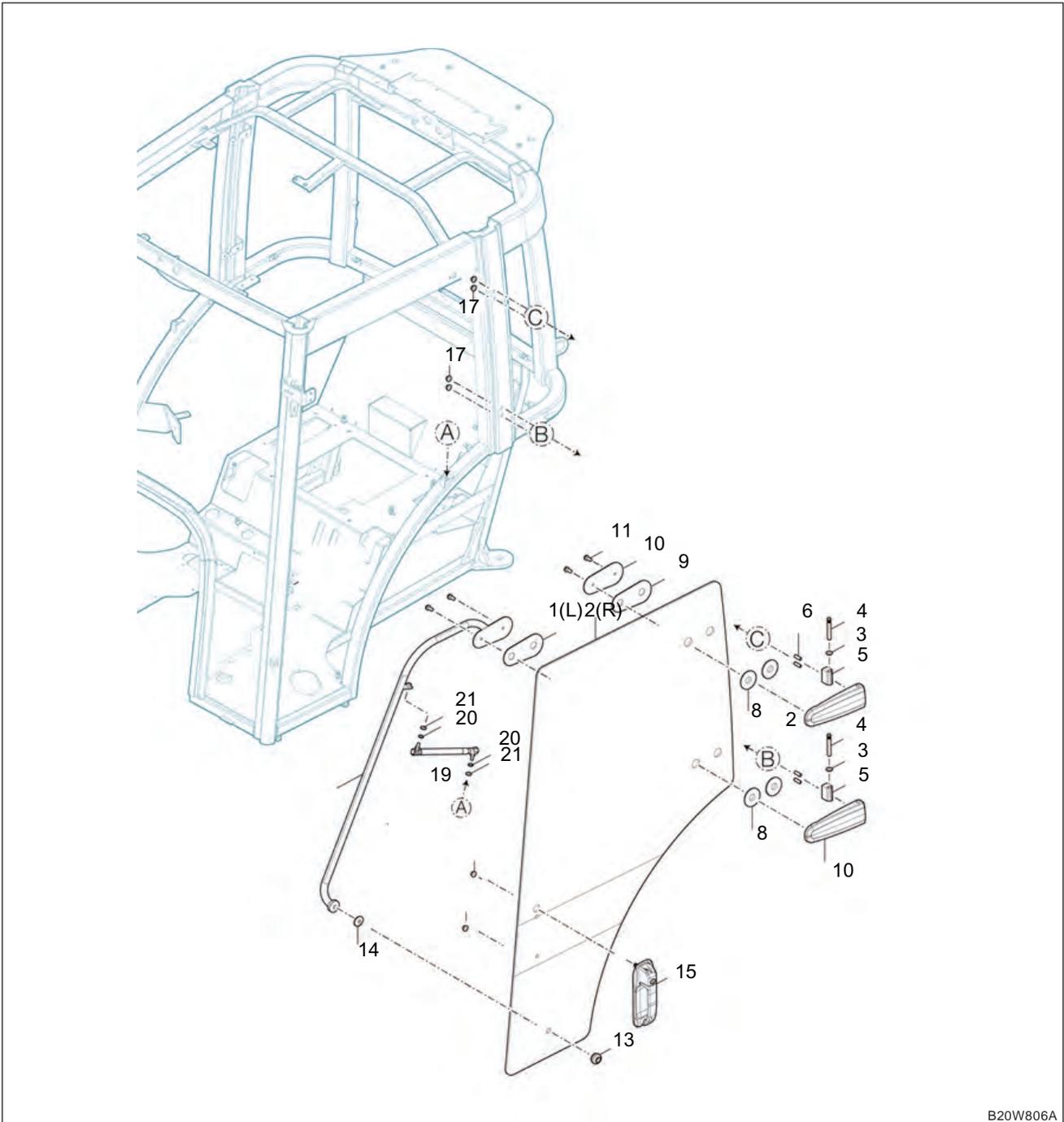
**COMPONENTS**

- (1) Front window, high
- (2) Front window(L), low
- (3) Front window(R), low
- (4) Motor, wiper

- (5) Hex flange nut
- (6) Arm, wiper
- (7) Hex nut
- (8) Nozzle, wiper

- (9) Wiper
- (10) Support sponge

1.3.5 DOOR ASS'Y

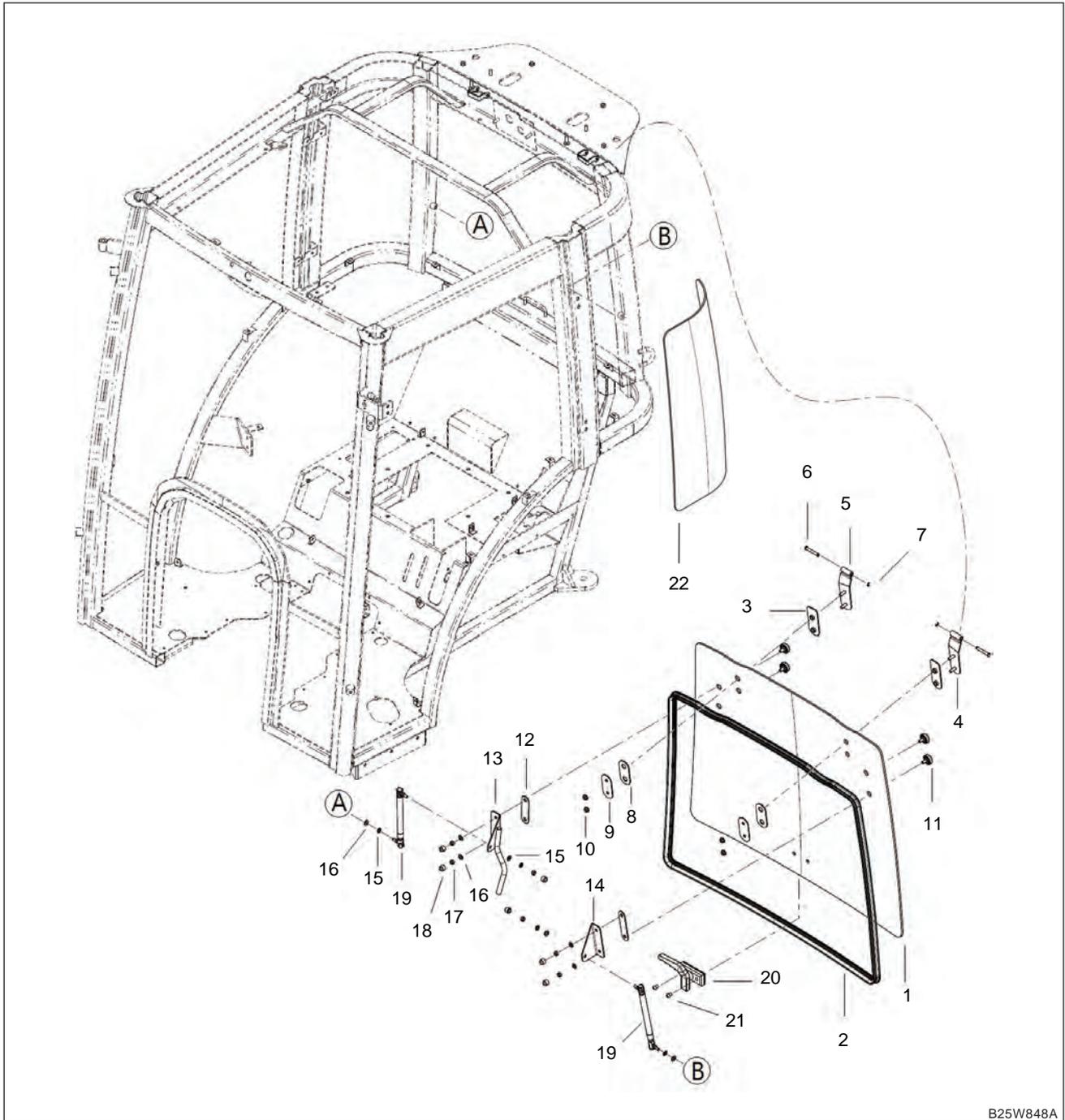


B20W806A

COMPONENTS

- |                     |                           |                     |
|---------------------|---------------------------|---------------------|
| (1) Window(L), door | (8) Packing, rubber       | (14) Packing        |
| (2) Hinge A         | (9) Packing, rubber       | (15) Door handle    |
| (3) Bush            | (10) Plate                | (17) Hex flange nut |
| (4) Pin             | (11) Screw                | (19) Gas spring     |
| (5) Support         | (12) Frame ass'y(L), door | (20) Spring washer  |
| (6) Bolt            | (12) Frame ass'y(R), door | (21) Plain washer   |
| (7) Hinge B         | (13) Cushion bolt         |                     |

1.3.6 REAR WINDOWS ASS'Y

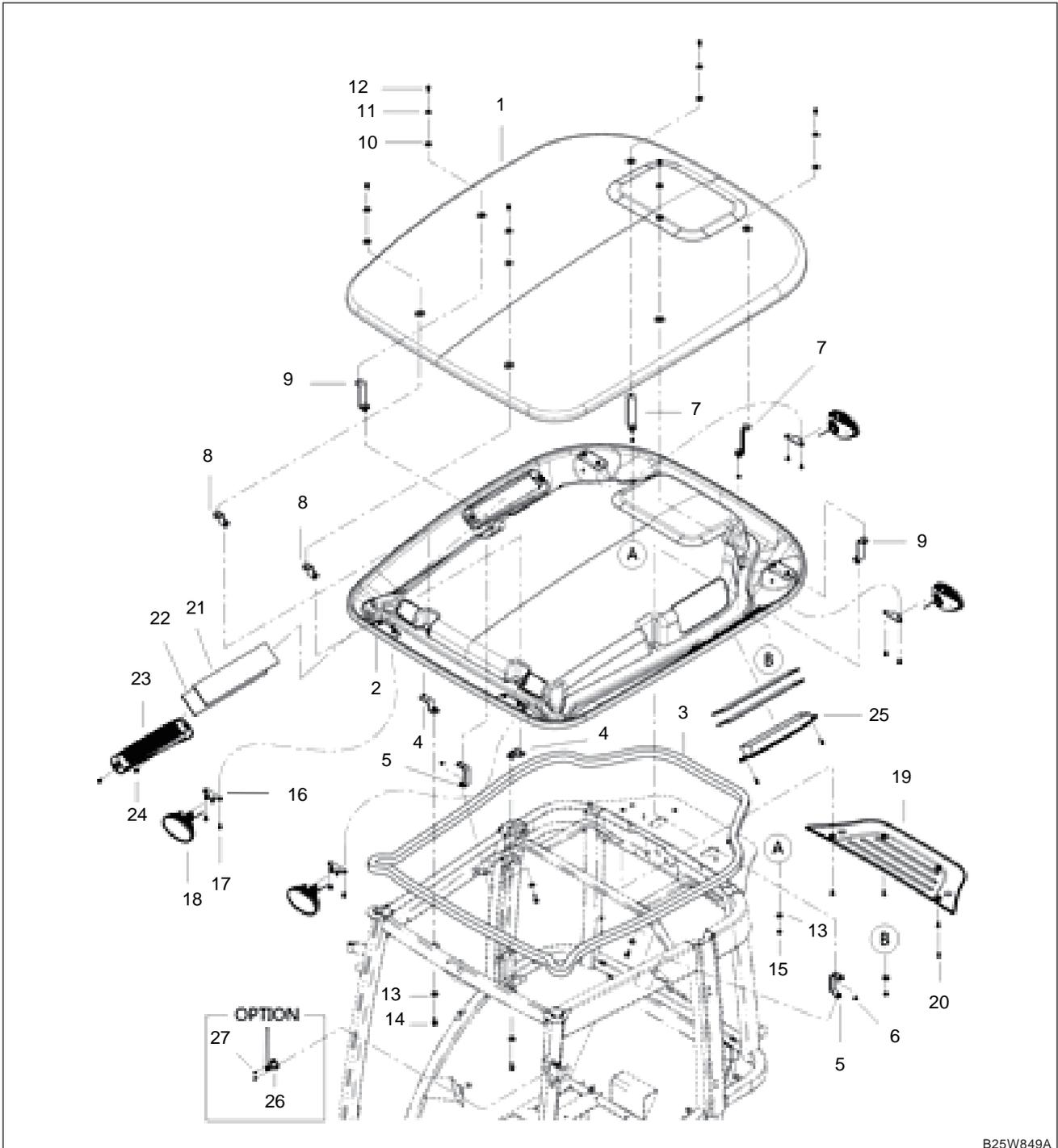


B25W848A

COMPONENTS

- |                         |                     |                        |
|-------------------------|---------------------|------------------------|
| (1) Rear window         | (9) Plate           | (17) Hex nut           |
| (2) Rear window packing | (10) Hex flange nut | (18) Cap, nut          |
| (3) Packing B           | (11) Cushion bolt   | (19) Gas spring        |
| (4) Hinge L             | (12) Packing        | (20) Door handle       |
| (5) Hinge R             | (13) Handle ass'y   | (21) Screw             |
| (6) Head pin            | (14) Bracket handle | (22) Window(L), side   |
| (7) Snap ring           | (15) Spring washer  | (22) Window(R), side   |
| (8) Packing B           | (16) Plain washer   | (23) Rear window ass'y |

1.3.7 ROOF ASS'Y

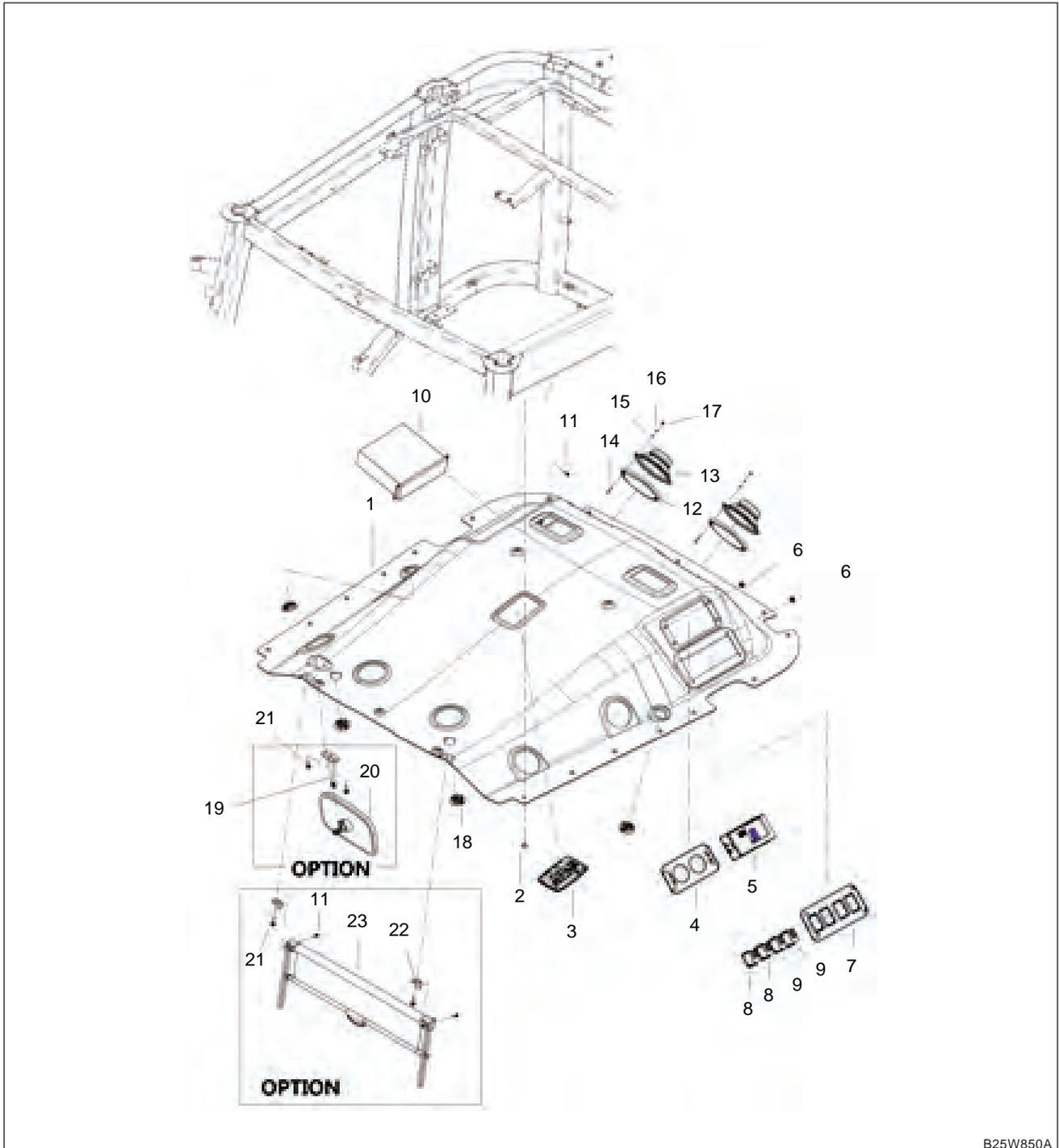


B25W849A

COMPONENTS

- |                          |                            |                    |
|--------------------------|----------------------------|--------------------|
| (1) Roof(high)           | (10) Packing               | (19) Cover, HVAC   |
| (2) Roof ass'y(low)      | (11) Washer                | (20) Screw         |
| (3) Seal                 | (12) Screw                 | (21) Element       |
| (4) Bracket ass'y(front) | (13) Plain washer          | (22) Filter        |
| (5) Bracket ass'y(rear)  | (14) Hex flange bolt       | (23) Duct(R)       |
| (6) Hex nut              | (15) Hex flange nut        | (24) Screw         |
| (7) Bracket ass'y C      | (16) Bracket, working lamp | (25) Duct(L)       |
| (8) Bracket ass'y A      | (17) Screw                 | (26) Antenna ass'y |
| (9) Bracket ass'y B      | (18) Working lamp          | (27) Screw         |

1.3.8 CEILING ASS'Y



B25W850A

COMPONENTS

- |                                |                     |                           |
|--------------------------------|---------------------|---------------------------|
| (1) Ceiling                    | (9) Switch, on/off  | (17) Hex nut              |
| (2) Fastener                   | (10) Audio          | (18) Cap                  |
| (3) Lamp, indoor               | (11) Screw          | (19) Bracket, room mirror |
| (4) Cover, A/C                 | (12) Cover, speaker | (20) Room mirror          |
| (5) Air conditioner controller | (13) Speaker        | (21) Screw                |
| (6) Net                        | (14) Screw          | (22) Bracket, sun visor   |
| (7) Cover                      | (15) Plain washer   | (23) Sun visor            |
| (8) Switch, wiper              | (16) Spring washer  |                           |

## 1.4 COMPONENT DISASSEMBLY AND ASSEMBLY

### 1.4.1 CABIN REMOVAL

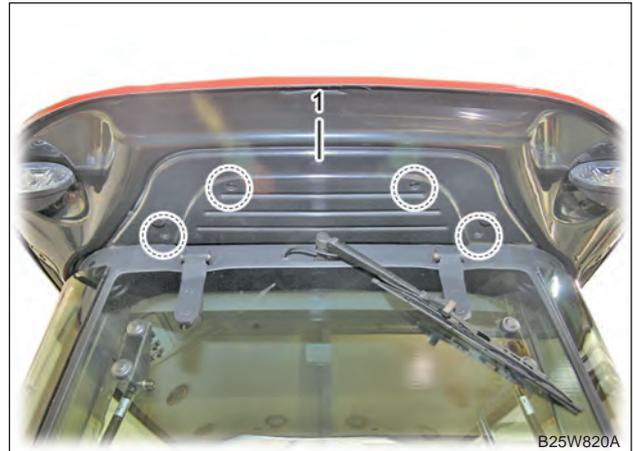
1. Park the tractor on safe and level ground, stop the engine and apply the parking brake.
2. Open the hood and disconnect the negative battery cable.
3. Drain the cooling system.



#### CAUTION

- When handling the heater hose to drain coolant, be careful not to get burnt.
4. Disconnect various devices from the cabin. Then, remove the cabin.
  5. For detailed instructions for cabin removal, refer to the instructions for engine removal in Chapter 2.

### 1.4.2 ROOF REMOVAL

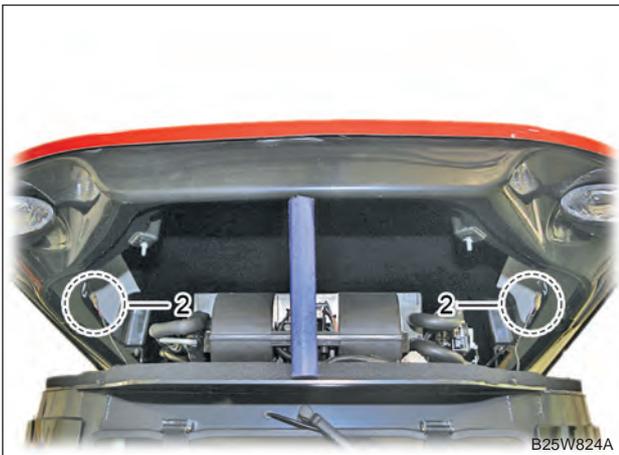
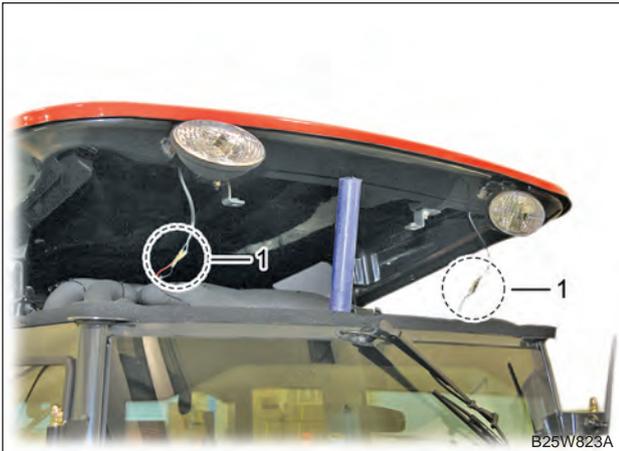


1. Remove the HVAC cover (1) on the rear side of cabin.



2. Remove the caps and bolts (4EA) (1) on the ceiling inner cabin, and unscrew the nuts (2EA) (2) on the HVAC cover.

1.4.3 MAIN COVER (RH) REMOVAL



3. Lift the roof and support the pole between the main frame and the roof.  
And then, disconnect the wiring connectors for the front (1) and rear (2) work lamps.
4. Lift the roof slowly with a jig to remove it.

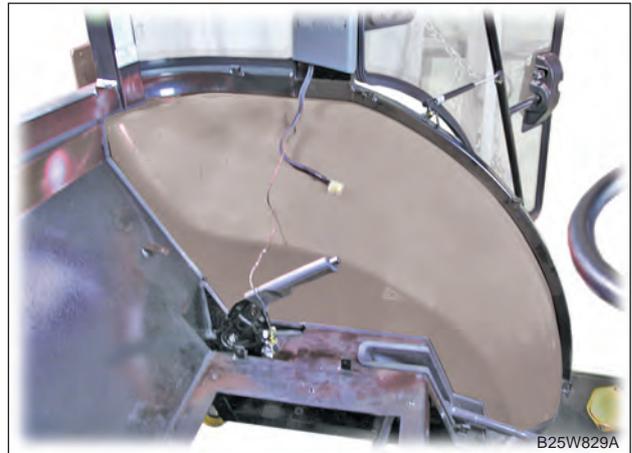


1. Pull out various knobs (1) from the lever main cover on the right side from the seat.



2. Remove the SCV lever cover (1).

1.4.4 MAIN COVER (LH) REMOVAL



1. Unscrew the mounting bolts (1) of the lever main cover (LH) to remove the lever main cover (LH).

3. Remove the right lever main cover (1).

1.4.5 PILLAR DISASSEMBLY



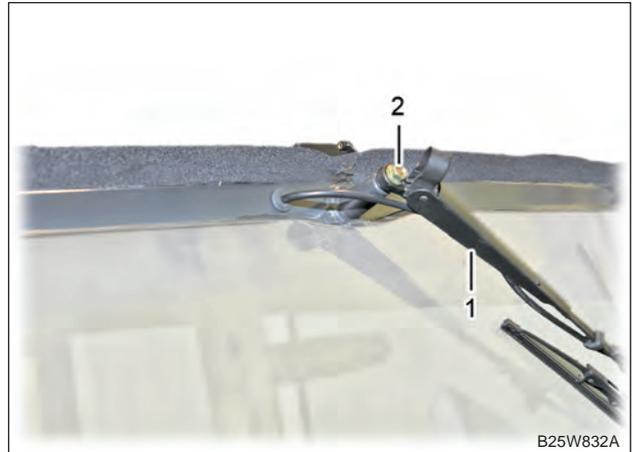
1. Remove the cap (1) of the pillar.



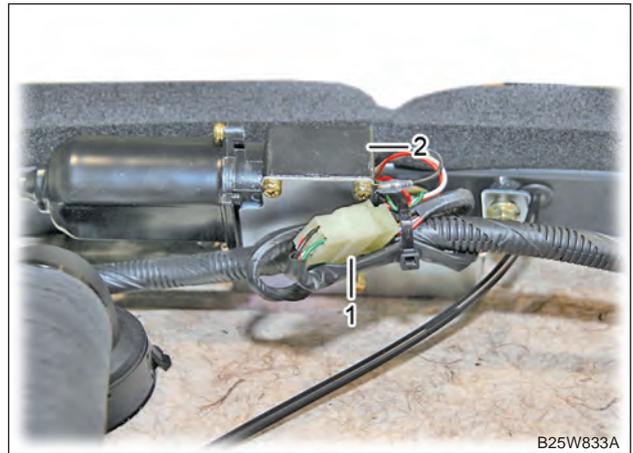
2. Unscrew pillar mounting bolts (1) and separate the pillar (2).

1.4.6 FRONT WIPER MOTOR REMOVAL

1. Remove the cabin roof.  
(Refer to 8-14 page "1.4.2 Roof removal")



2. Remove the wiper arm (1) from the front of the cabin (by opening the wiper arm cap and unscrewing the internal mounting nut (2)).



3. Disconnect the wiper motor connector (1) and unscrew the wiper motor mounting nut to remove the wiper motor (2).

## 1.4.7 OTHER COMPONENT REMOVAL

## ▶ A/C CONTROL SWITCH

## Notes



B20W812A

- During re-assembly, fill the gap (A) of the protruded part of the wiper motor shaft with silicon.



B20W813A



B20W814A

1. Remove the cabin roof.

► AUDIO SYSTEM



B20W815A



B20W817A



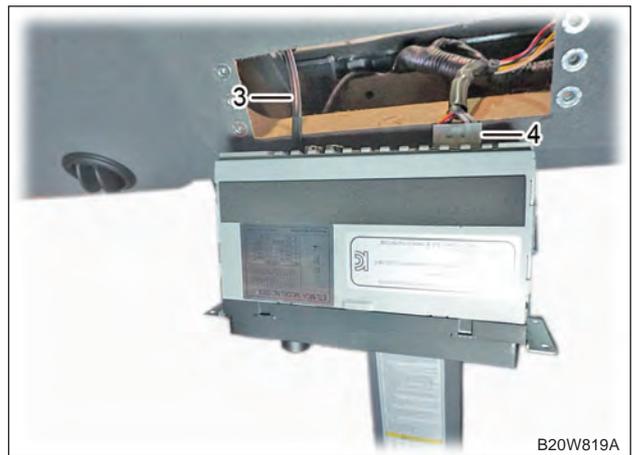
B20W816A



B20W818A

2. Pull out the whole switch box (1). Then, disconnect the connector (2) and remove the control switch box.

1. Remove the audio system cover (1) and loosen the mounting screws (2).



B20W819A

2. Disconnect the antenna jack (3) from the back. Then, disconnect the wiring connector (4) and pull the system to remove it.

## ► INTERIOR LAMP



1. Separate the interior lamp by pushing its side edge with a flat tool, such as a flat-bladed screwdriver, and pulling it out.

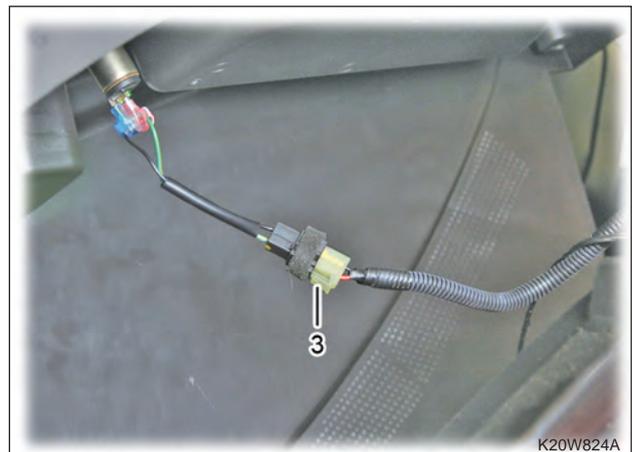


2. When necessary, it is possible to disconnect the connector to remove the whole lamp, or replace only the bulb (1).

## ► POWER SOCKET



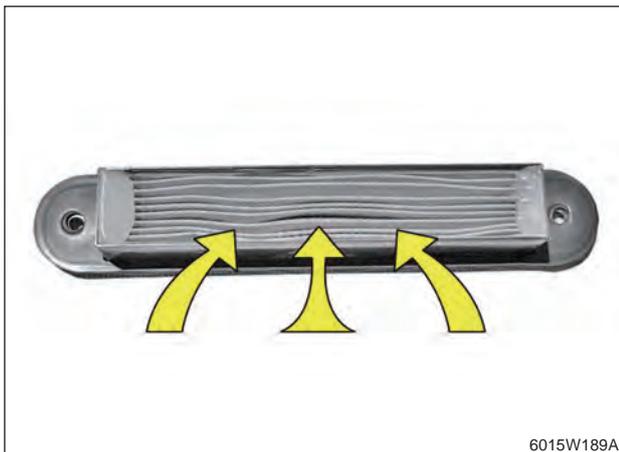
1. To remove the power socket (1) from the main cover on the left side in the cabin, remove the left main cover (2) first.



2. Disconnect the power socket wiring connector (3) to remove the power socket.

**► AIR FILTER**

1. Unscrew the mounting bolt (1) for the air filter assembly from the cabin roof to remove the filter assembly.



2. Clean the filter by blowing compressed air from the inside toward the outside of the cabin.

1.5 TROUBLESHOOTING

SYMPTOM INSPECTION ITEM	A/C CANNOT BE OPERATED.	COMPRESSOR CANNOT BE OPERATED.	THE A/C IS OPERATED ONLY IN THE 3RD STAGE, NOT IN THE 1ST AND 2ND STAGES.	WIPER MOTOR CANNOT BE OPERATED. (WITH IGNITION SWITCH ON, WIPER SWITCH ON)	WIPER MOTOR CANNOT BE OPERATED. (WITH WASHER PUMP OPERATED)	WIPER MOTOR CANNOT BE OPERATED. (WITH WASHER MOTOR OPERATED)
A/C Controller	●		●			
Evaporator	●		●			
Condenser (Receiver Drier)		●				
A/C Compressor		●				
Fuse F10 [30 A]	●					
Fuse F12 [20 A]		●				
A/C Relay		●				
Compressor Relay		●				
Heater switch		●				
Wiper motor [front]				●	●	
Wiper motor [rear]				●	●	
Washer pump [front]						●
Washer pump [rear]						●
Wiper switch [front]				●	●	●
Wiper switch [rear]				●	●	●
Fuse F12 [20 A]				●		
Fuse F12 [20 A]				●		

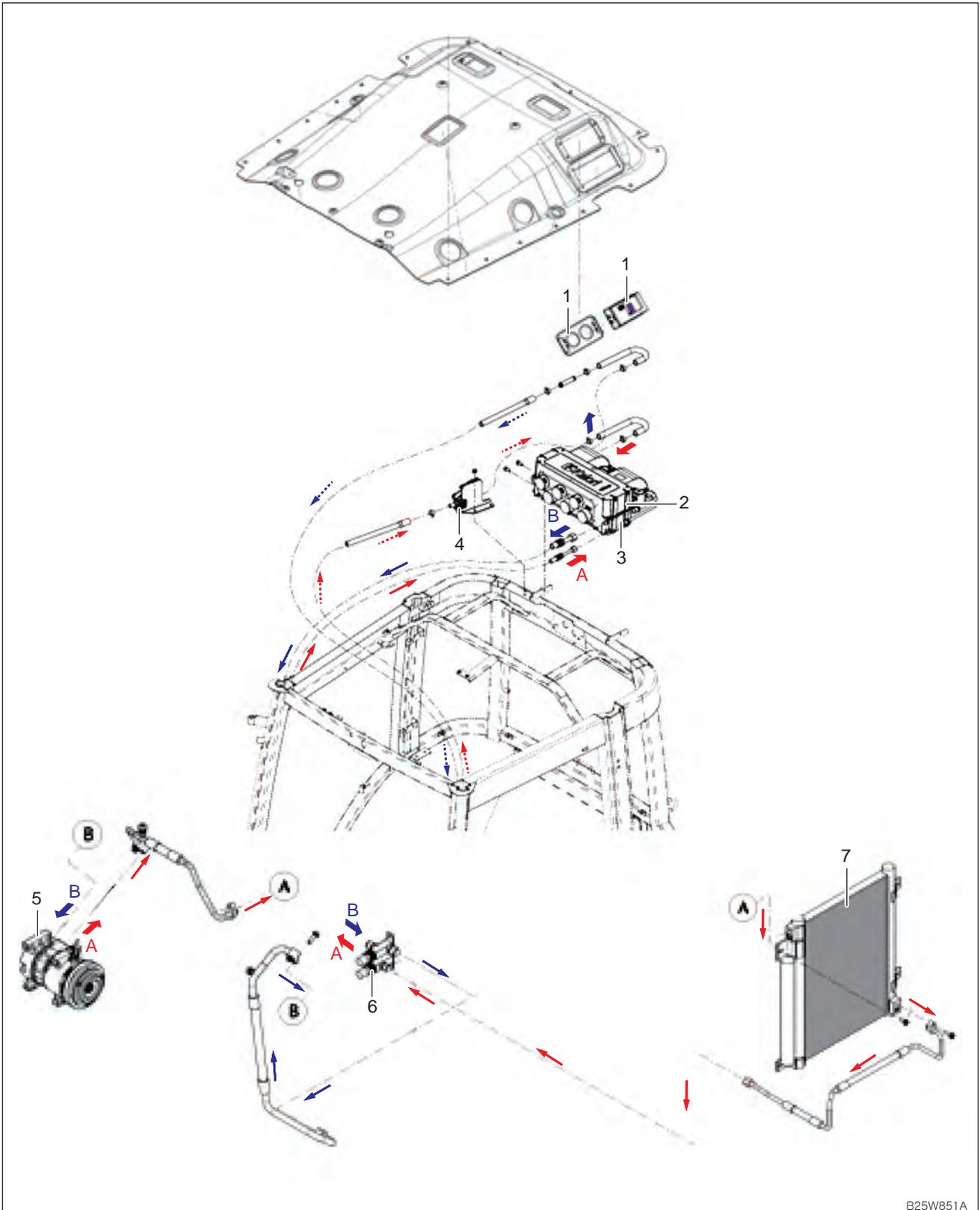
INSPECTION ITEM	SYMPTOM						
		THE WORK LAMP CANNOT BE TURNED ON. (WITH HEADLAMPS ON) (WITH IGNITION SWITCH ON, LAMP SWITCH ON, WORK LAMP SWITCH ON)	THE WORK LAMP CANNOT BE TURNED ON. (WITH HEADLAMPS OFF) (WITH IGNITION SWITCH ON, LAMP SWITCH ON, WORK LAMP SWITCH ON)	THE WORK LAMP CANNOT BE TURNED ON. (ONLY ONE HEADLAMP ON) (WITH IGNITION SWITCH ON, LAMP SWITCH ON, WORK LAMP SWITCH ON)	THE INTERIOR LAMP CANNOT BE OPERATED. (INTERIOR LAMP SWITCH ON)	THE AUDIO SYSTEM CANNOT BE OPERATED. (IGNITION SWITCH ON)	DATA CANNOT BE STORED IN THE AUDIO SYSTEM MEMORY AND THE INTERIOR LAMP CANNOT BE TURNED ON.(IGNITION SWITCH ON)
Cabin work lamp [front]	●		●				
Cabin work lamp [rear]	●						
Work lamp switch [front]							
Work lamp switch [rear]							
Work lamp relay [front]	●						
Work lamp relay [rear]	●						
Fuse F11 [20 A]	●						
Fuse F11 [20 A]		●					
Combination switch		●					
Interior lamp				●			
Audio system					●		●
Speaker							●
Cigarette lighter socket							
Fuse F12 [20 A]					●		
Fuse F7 [10 A]				●		●	●

## 2. HVAC SYSTEM

### 2.1 SPECIFICATIONS

ITEM		SPECIFICATIONS	REMARKS
A/C	Cooling capacity	3,700 kcal/h $\pm$ 5%	
	Air flow	MIN 500 m <sup>3</sup> /h $\pm$ 5%	
	Refrigerant	R-134a	
	Refrigerant capacity	800 cc	
Heater	Heating capacity	4,500 kcal/h $\pm$ 5%	
	Air flow	MIN 500 m <sup>3</sup> /h $\pm$ 5%	
Compressor	Type	SWASH PLATE	
	Displacement	87 cc/rev	
	Number of bores	10	
	Lubricant	PAG oil, 100 $\pm$ 10 g	
	Continuous allowable R.P.M	800 ~ 7,000 RPM	

2.2 HVAC SYSTEM FLOW DIAGRAM



B25W851A

- (1) A/C control switch
- (2) Evaporator
- (3) Expansion valve
- (4) Heater block valve

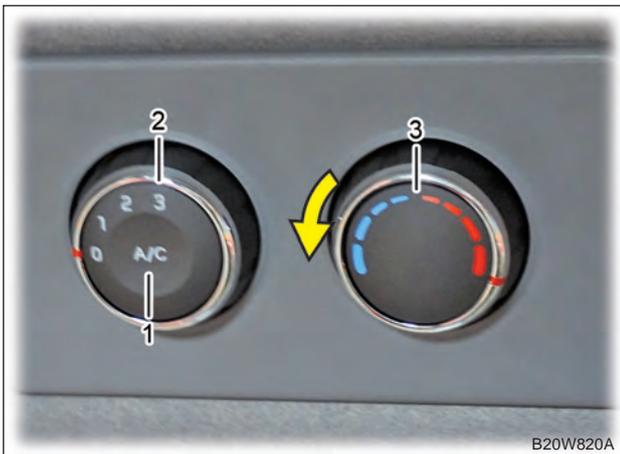
- (Line A) A/C hose (high pressure)
- (Line B) A/C hose (low pressure)
- (Line C) heater hose (low temperature)
- (Line D) heater hose (high temperature)

- (5) Compressor
- (6) Air-con coupling ass'y
- (7) Condenser

2.3 HVAC SYSTEM INSPECTION

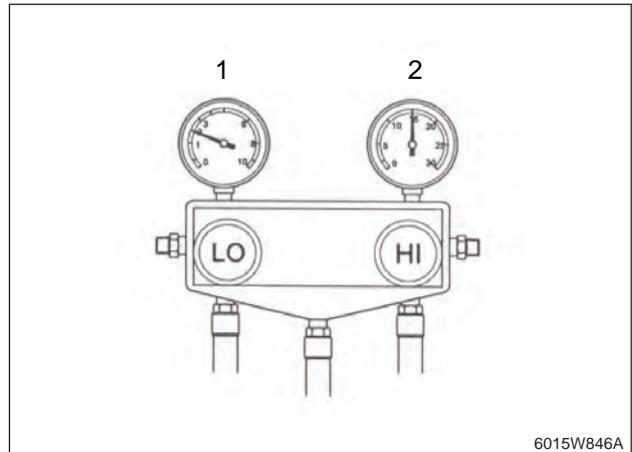
2.3.1 REFRIGERANT GAUGE TEST

1. Stop the engine, remove the ignition key and apply the parking brake.
2. Place all the shift levers in the neutral or disengagement position.
3. Open the hood.
4. Close the manifold gauge valve and install the gauge to the service valve of the A/C hose.
5. To bleed the low-pressure valve, open the valve slightly and then close it. Perform the same procedure for the high-pressure valve.
6. Start the engine and run the engine at 1,500 RPM.



7. Press the A/C switch (1) on the A/C control switch assembly, turn the blower dial (2) to the max. speed (3rd) position and turn the temperature control dial (3) to the cooling position.

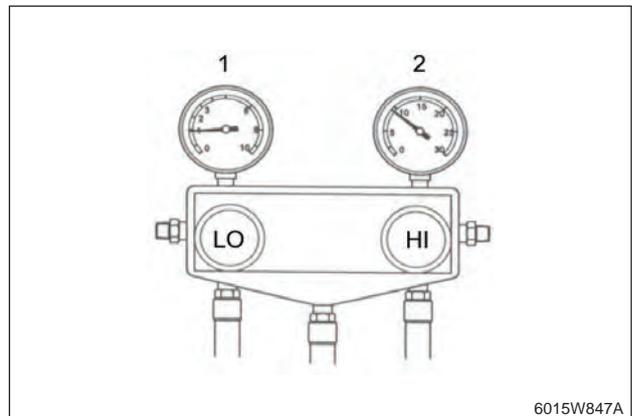
**NORMAL STATE**



(1) Low pressure (red) (2) High pressure (blue)

Specifications	Low pressure (1)	1.5 - 2.0 kg/cm <sup>2</sup> [21.3 - 28.4 psi]
	High pressure (2)	14.5 - 15 kg/cm <sup>2</sup> [206 - 213 psi]

**INSUFFICIENT REFRIGERANT**



(1) Low pressure (red) (2) High pressure (blue)

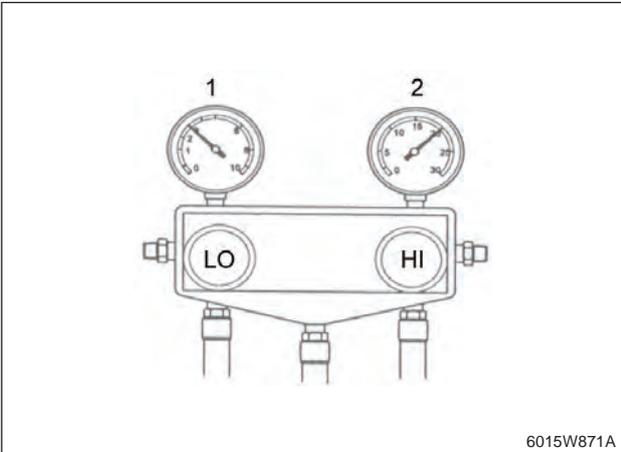
1. Symptom: Blowing air is not cool.
2. Problem: Low pressure is detected from both gauges (both high and low pressure sides).

Specifications	Low pressure (1)	0.8 kg/cm <sup>2</sup> [11.37 psi]
	High pressure (2)	8 - 9 kg/cm <sup>2</sup> [113.7 - 128 psi]

Air is visible through the sight glass of the receiver drier.

3. Cause: Refrigerant leak
4. Solution: Inspect the entire system for leakage with an electronic leakage detector.

**EXCESSIVE REFRIGERANT,  
UNABLE TO OPERATE PROPERLY**



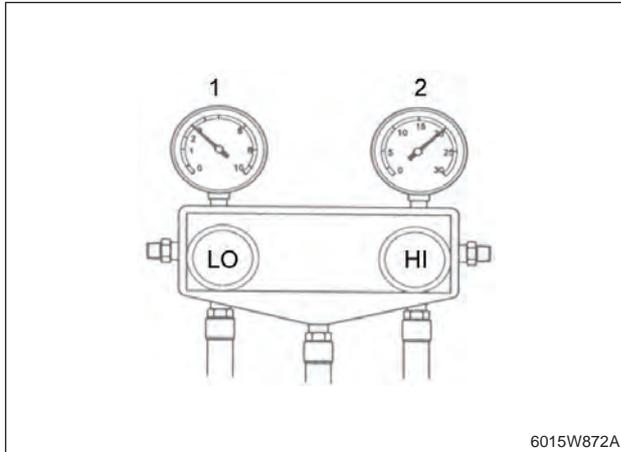
(1) Low pressure (red)      (2) High pressure (blue)

1. Symptom: Blowing air is not cool.
2. Problem: High pressure is detected at both gauges (high and low pressure gauges).

Specifi- cations	Low pressure (1)	Below 2.5 kg/cm <sup>2</sup> [35.5 psi]
	High pressure (2)	20 kg/cm <sup>2</sup> [284.4 psi]

3. Cause: Excessive refrigerant causes high pressure in the system. The condenser cannot perform its cooling function properly.  
The compressor belt is loose.
4. Solution: Clean the condenser, adjust the drive belt tension or check the motor operation.  
Check the amount of refrigerant.

**AIR IN A/C SYSTEM**



(1) Low pressure (red)      (2) High pressure (blue)

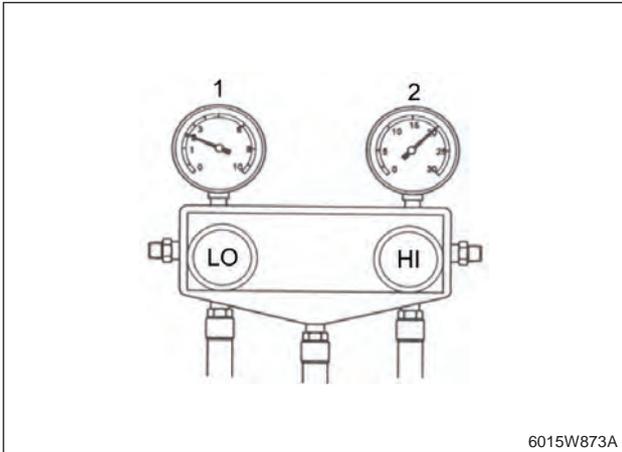
1. Symptom: Blowing air is not cool.
2. Problem: High pressure is detected at both gauges (high and low pressure gauges).

Speci- fica- tions	Low pressure (1)	Below 2.5 kg/cm <sup>2</sup> [35.5 psi]
	High pressure (2)	23 kg/cm <sup>2</sup> [327.1 psi]

- The low-pressure pipe is not cooled down.
3. Cause: The A/C system is not bled properly. (This is shown through the gauge.)
  4. Solution: Check the gauge while charging with refrigerant. Check if the refrigerant is contaminated.

<b>Notes</b>	
<ul style="list-style-type: none"> <li>• If driving the tractor for an extended period of time with air filled in the A/C system, the receiver drier may need to be replaced.</li> </ul>	

**DEFECTIVE EXPANSION VALVE**



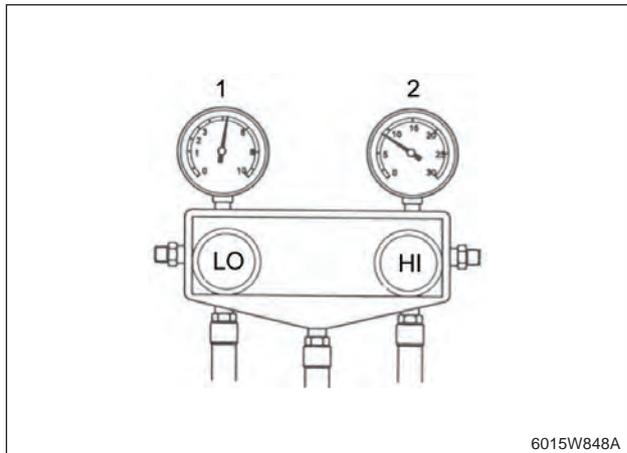
(1) Low pressure (red) (2) High pressure (blue)

1. Symptom: Blowing air is not cool.
2. Problem: High pressure is detected at both gauges (high and low pressure gauges).

Specifi- cations	Low pressure (1)	Below 2.5 kg/cm <sup>2</sup> [35.5 psi]
	High pressure (2)	19 - 20 kg/cm <sup>2</sup> [270 - 284 psi]

3. Cause: Defective expansion valve
4. Solution: Replace the expansion valve with a new one.

**ABNORMAL COMPRESSION**



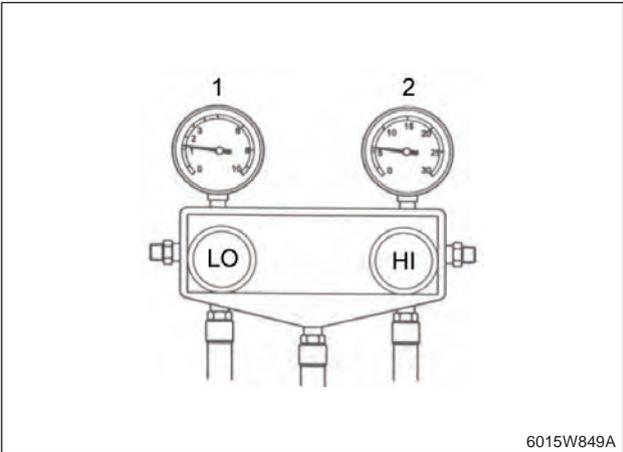
(1) Low pressure (red) (2) High pressure (blue)

1. Symptom: Blowing air is not cool.
2. Problem: High pressure is detected at the low-pressure gauge while low pressure is detected at the high-pressure gauge.

Specifi- cations	Low pressure (1)	4 - 6 kg/cm <sup>2</sup> [56 - 85.3 psi]
	High pressure (2)	7 - 10 kg/cm <sup>2</sup> [99.5 - 142 psi]

3. Cause: Defective compressor gasket or suction valve
4. Solution: Repair or replace the compressor.

**WATER IN SYSTEM**



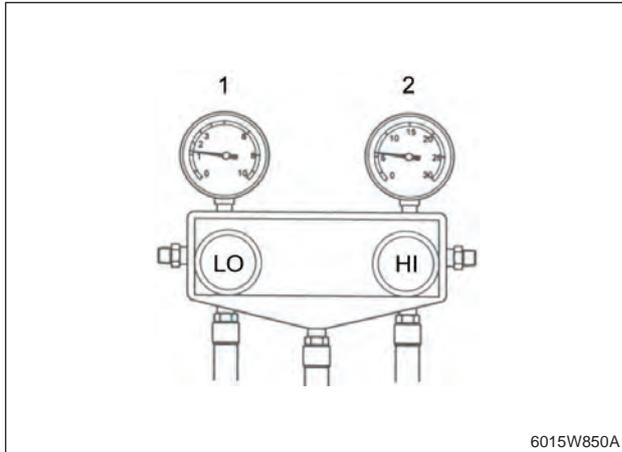
(1) Low pressure (red)      (2) High pressure (blue)

1. Symptom: Blowing air is not cool continuously.
2. Problem: The low-pressure gauge is shaking.

Specifi- cations	Low pressure (1)	0.5 - 1.5 kg/cm <sup>2</sup> [7.1 - 21.3 psi]
	High pressure (2)	7 - 15 kg/cm <sup>2</sup> [99.5 - 213.3 psi]

3. Cause: Water cooled down through the cooling cycle is trapped in the A/C system and the system operates normally only when ice melts.
4. Solution: Replace the receiver drier, vacuum the system 2 to 3 times and change refrigerant.

**ABNORMAL REFRIGERANT CIRCULATION**



(1) Low pressure (red)      (2) High pressure (blue)

1. Symptom: Air is not cool (cool only intermittently).
2. Problem: The low-pressure gauge is compressed and the high-pressure gauge indicates 5 - 6 kg/cm<sup>2</sup> [71.7- 85.3 psi].

Water is condensed on the connection of the receiver drier or expansion valve.

Specifica- tions	Low pressure (1)	0.76 kg/cm <sup>2</sup> [10.8 psi]
	High pressure (2)	6 kg/cm <sup>2</sup> [85.3 psi]

3. Cause: The A/C system is blocked by ice or water. The receiver drier is faulty.
4. Solution: If blocked by ice, vacuum the system. If blocked by water, remove water with air with the expansion valve removed. If necessary, replace the receiver drier.

## 2.3.2 REFRIGERANT MAINTENANCE

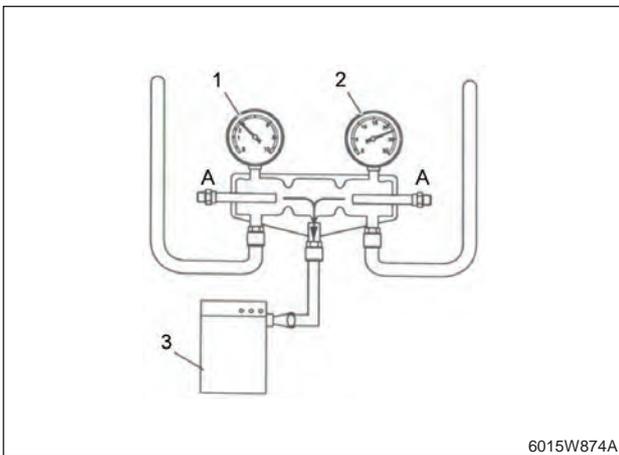
## REFRIGERANT CIRCULATION

## Notes

- If the compressor can be operated, operate the HVAC system for 10 minutes with the engine running at 2,000 rpm. Set the temperature control dial to the lowest temperature position and the blower dial to the max. (3rd) speed position. Then, refrigerant is circulated in the system and refrigerant in the compressor is indicated.

Stop the engine and perform the following procedures to circulate the A/C refrigerant.

## ► DRAIN

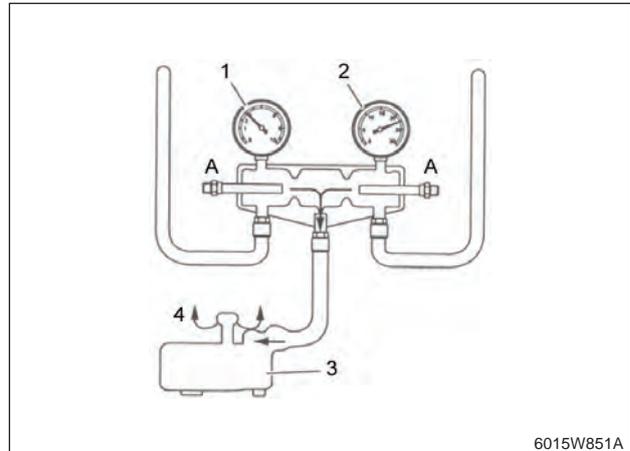


6015W874A

- (1) Low-pressure line (red)      (3) Drain tank  
(2) High-pressure line (blue)

- Connect the low-pressure hose (red) (1) from the charging station to the suction fitting of the compressor. Then, connect the high-pressure hose (blue) (2) to the drain fitting of the compressor.
- Open the high-pressure valve to drain refrigerant.
- When the high-pressure gauge indicates approx. 3.5 kg/cm<sup>2</sup> [50 psi], open the low-pressure valve.
- When all refrigerant is drained, both gauges indicate 0 kg/cm<sup>2</sup> [0 psi].
- Drain refrigerant from the system, following the instructions of the manufacturer. To prevent any foreign material from entering the A/C system, fit a cap over the fitting.

## ► VACUUM

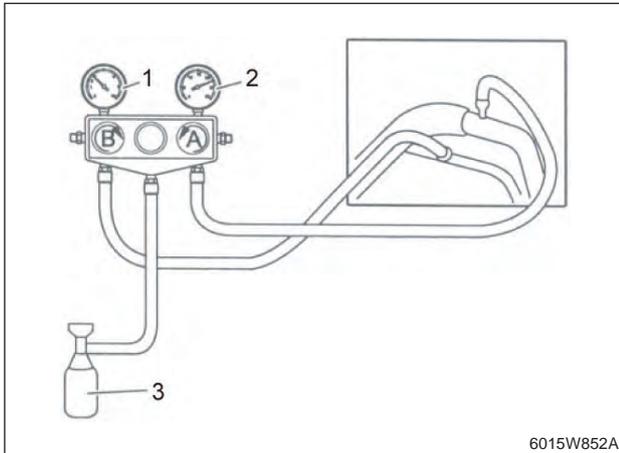


6015W851A

- (1) Low-pressure valve gauge  
(2) High-pressure valve gauge  
(3) Vacuum pump  
(A) Valve

- Connect the manifold gauges (low-pressure (red) (1) and high-pressure (blue) (2)) to the service valves.
- Connect the middle manifold hose (green) to the vacuum pump (3).
- Run the vacuum pump (3) and open both valves (low-pressure and high-pressure).
- Run the vacuum pump for 15 to 20 minutes until the gauge indicates 750 mmHg (0 kg/cm<sup>2</sup>) [0 psi].
- Close both valves, stop the vacuum pump and observe the low-pressure gauge for 5 minutes.
- If the pointer on the low-pressure gauge moves, it means that refrigerant leaks from the A/C system. Repair the leaking part and vacuum the system again according to the above procedures.
- If the pointer on the low-pressure gauge does not move, remove the vacuum pump.

## ► CHARGING



- (1) Low-pressure valve gauge
- (2) High-pressure valve gauge
- (3) Refrigerant tank



### CAUTION

- **Vacuum the system before adding refrigerant.**

- Connect the manifold gauge to the service valve of the A/C hose pipe.
- Insert the middle hose of the manifold into the refrigerant tank.
- Open the high-pressure valve to add refrigerant (350 g)[0.77 lb].
- Close the high-pressure valve. Then, run the air compressor with the engine running.



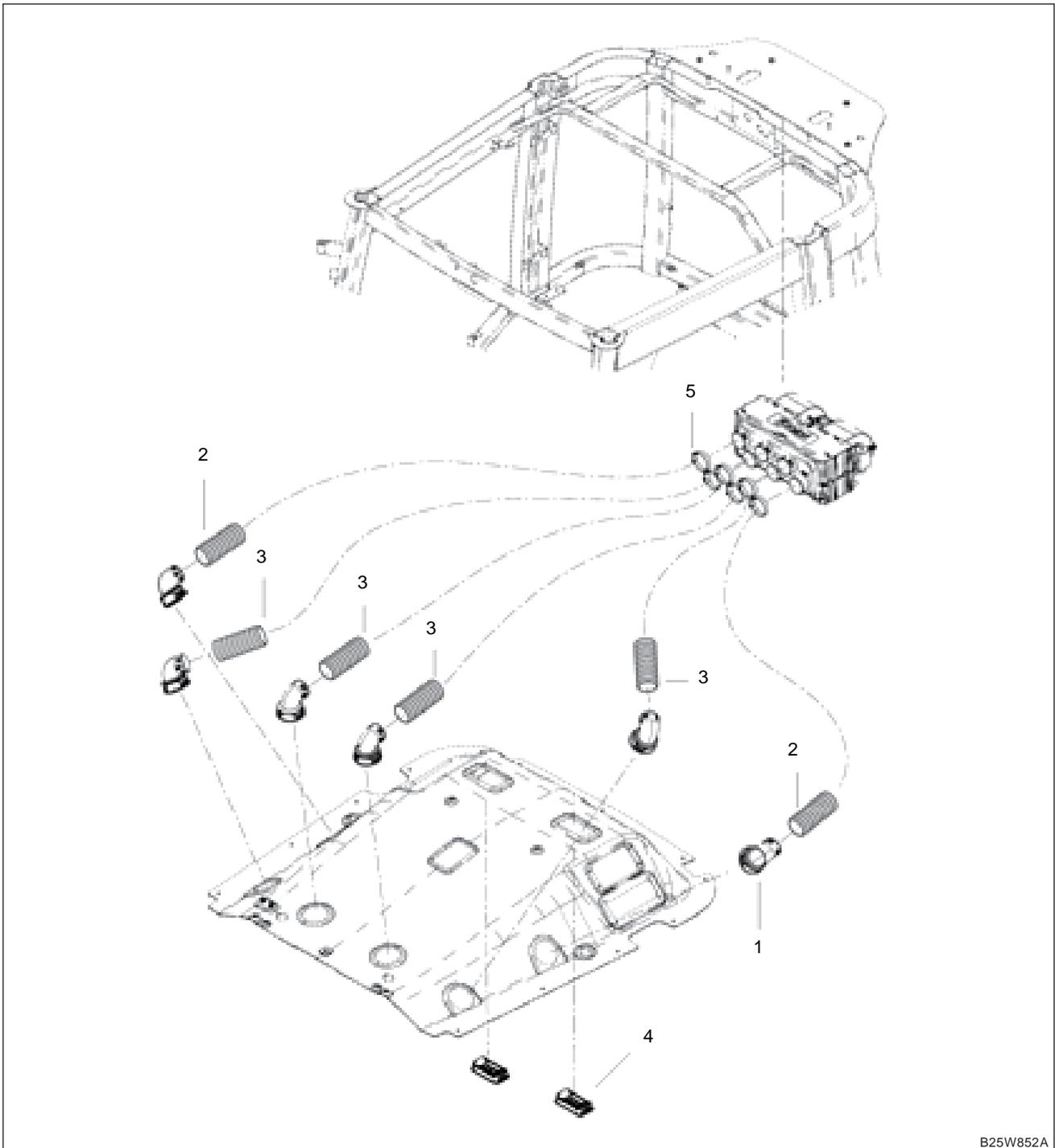
### CAUTION

- **Do not open the high-pressure valve while the air compressor is running. Pressure can be applied to refrigerant.**

- Open the low-pressure valve slightly to add a proper amount of refrigerant.
- Close the low-pressure valve when a sufficient amount is added.
- Stop the engine and disconnect all manifold gauge devices.

2.4 SECTIONAL VIEW FOR MAJOR COMPONENTS

2.4.1 A/C DUCT ASSEMBLY



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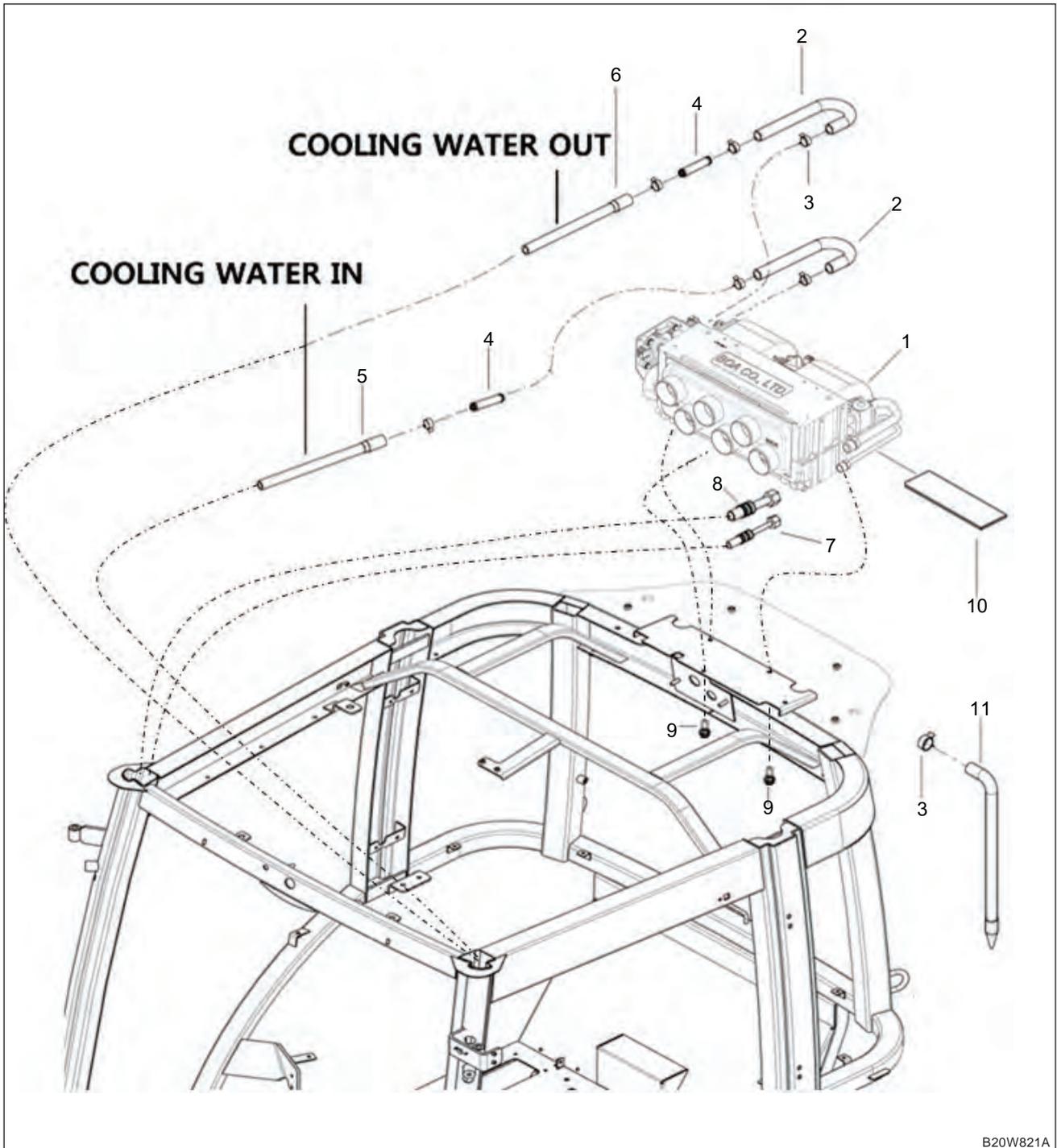
**COMPONENTS**

- (1) Louver
- (2) Tube A

- (3) Tube B
- (4) A/C grill ass'y

- (5) Hose clip

2.4.2 CABIN A/C ASSEMBLY

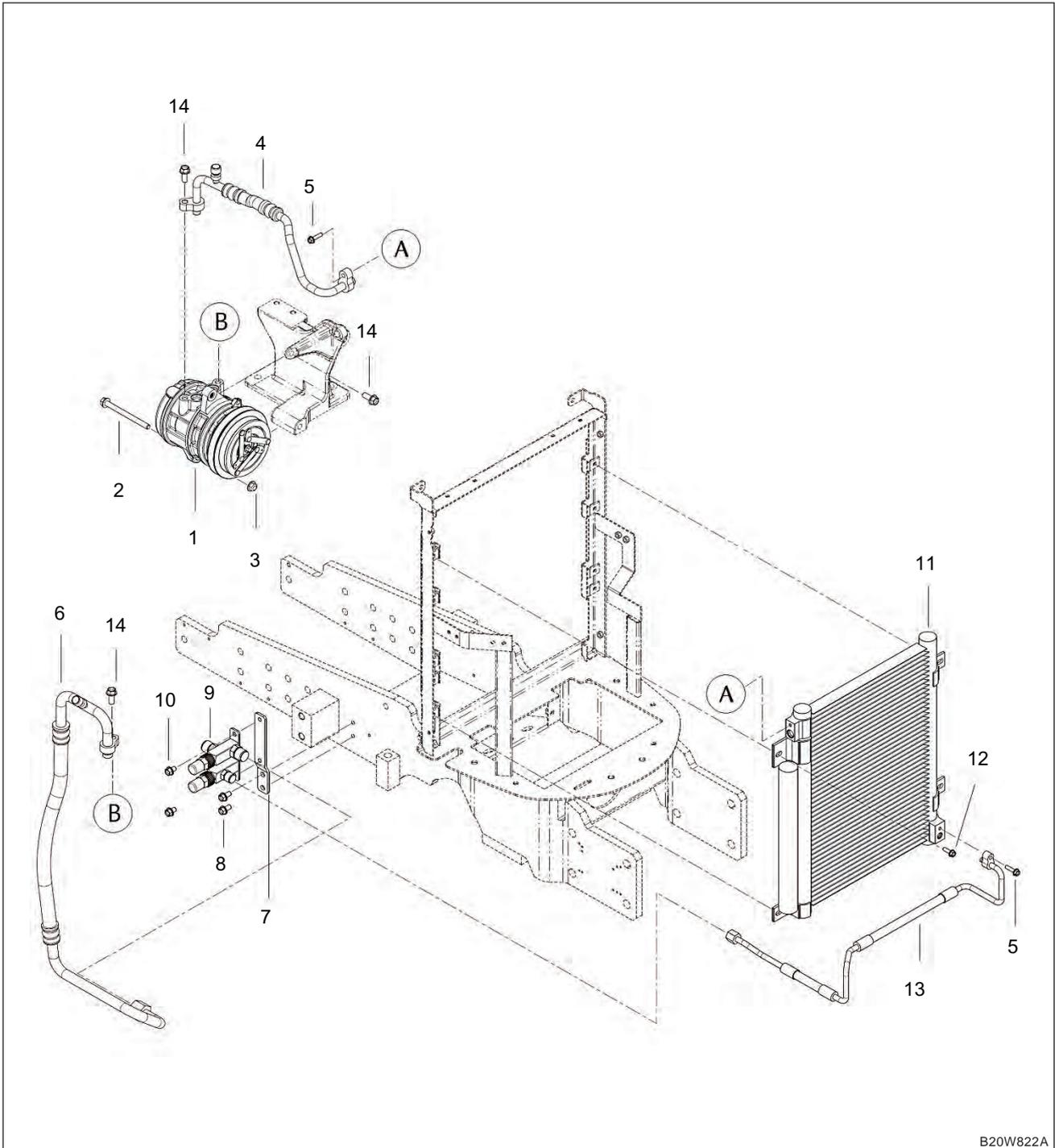


B20W821A

COMPONENTS

- |                     |                         |                     |
|---------------------|-------------------------|---------------------|
| (1) Air conditioner | (5) Hose A, heater      | (9) Hex flange bolt |
| (2) Hose            | (6) Hose b, heater      | (10) Insulator      |
| (3) Hose clamp      | (7) Hose, high pressure | (11) Hose, drain    |
| (4) Pipe            | (8) Hose, low pressure  |                     |

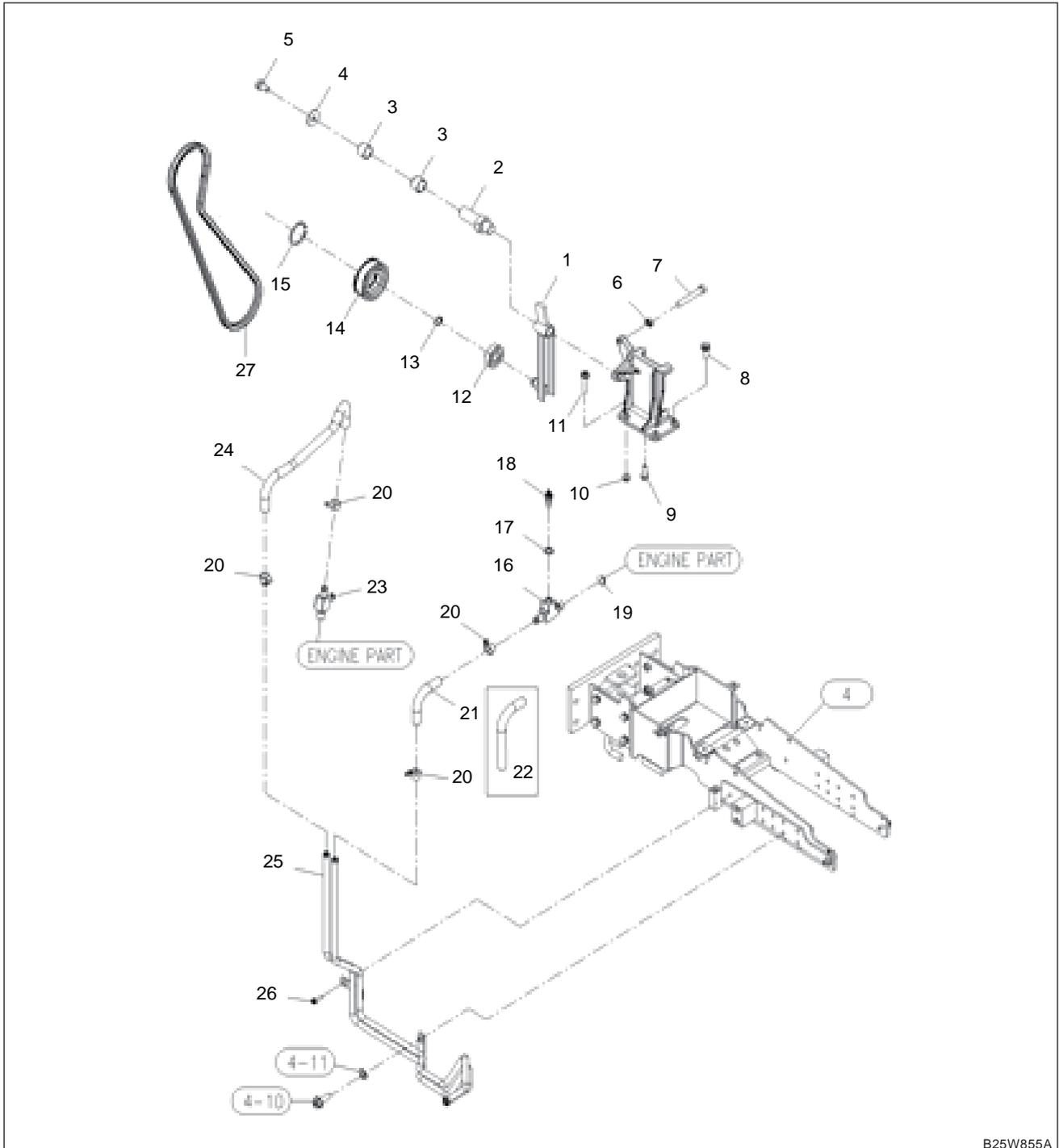
2.4.3 BODY A/C ASSEMBLY



COMPONENTS

- |                     |                           |                      |
|---------------------|---------------------------|----------------------|
| (1) Compressor      | (6) Hose , lower pressure | (11) Condenser       |
| (2) Hex flange bolt | (7) Bracket, valve        | (12) Hex flange bolt |
| (3) Hex flange nut  | (8) Hex flange bolt       | (13) Hose            |
| (4) Condenser hose  | (9) A/c coupling ass'y    | (14) Hex flange bolt |
| (5) Hex flange bolt | (10) Hex flange bolt      |                      |

2.4.4 COMPRESSOR



B25W855A

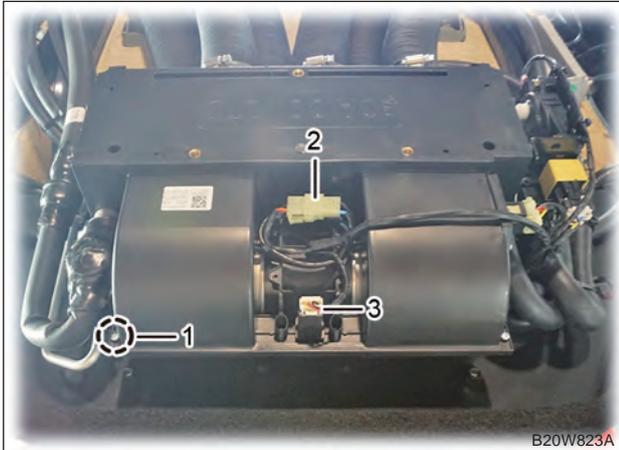
COMPONENTS

- |                        |                      |                             |
|------------------------|----------------------|-----------------------------|
| (1) Tension arm        | (10) Hex flange nut  | (19) Packing                |
| (2) Tension shaft      | (11) Hex flange bolt | (20) Hose clip              |
| (3) Dry bush           | (12) Ball bearing    | (21) Heater hose A          |
| (4) Plain washer       | (13) Snap ring       | (23) T joint                |
| (5) Hex bolt, w/washer | (14) Idler           | (24) Heater hose,B          |
| (6) Hex nut, fix       | (15) Snap ring       | (25) Heater pipe ass"y      |
| (7) Bolt, stopper      | (16) T joint         | (26) Washer spring hex bolt |
| (8) Hex flange bolt    | (17) Packing         | (27) V belt                 |
| (9) Hex flange bolt    | (18) Water sensor    |                             |

## 2.5 COMPONENT DISASSEMBLY AND ASSEMBLY

### 2.5.1 AIR CONDITIONER (EVAPORATOR) DISASSEMBLY

1. Remove the cabin roof.



2. Unscrew all mounting screws (1) on the A/C cover (upper).
3. Disconnect the blower motor connector (2) and blower motor relay connector (3).



4. Check the condition of the evaporator (1), expansion valve (2) and heater block valve (3).

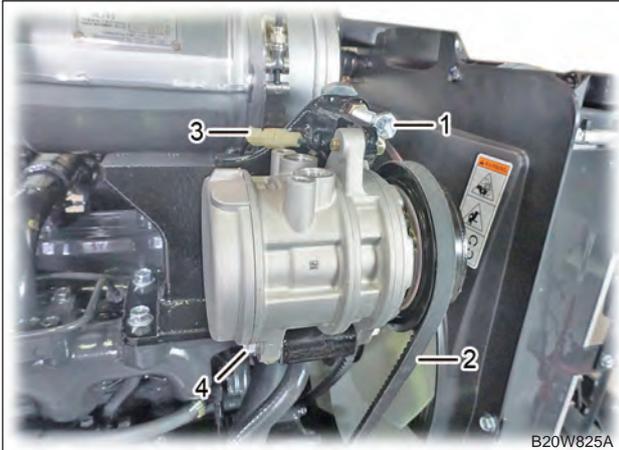
### 2.5.2 COMPRESSOR REMOVAL

1. Open the hood.
2. Disconnect the negative battery cable and drain refrigerant.



3. Disconnect the high-pressure pipe (1) from the Condenser and low-pressure pipe (2) from the A/C coupling assembly.

2.5.3 CONDENSER REMOVAL



B20W825A



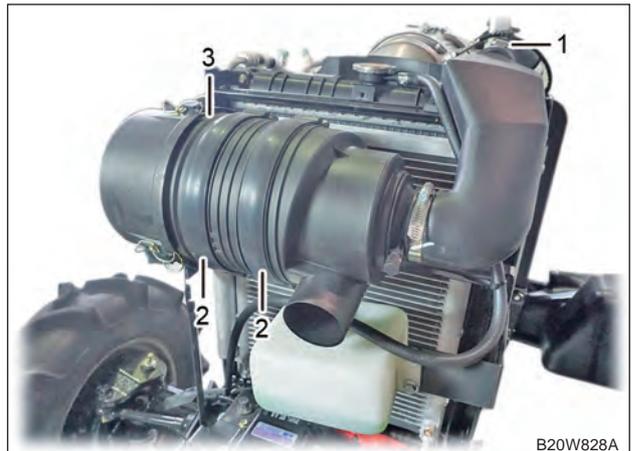
B20W827A

1. Open the hood.
2. Disconnect the negative battery cable and drain refrigerant.



B20W826A

4. Loosen the tension of the A/C belt with its tension bolt (1). Then, remove the belt (2) and disconnect the wiring connector (3). Then, unscrew the bracket mounting bolts (4) to remove the compressor.



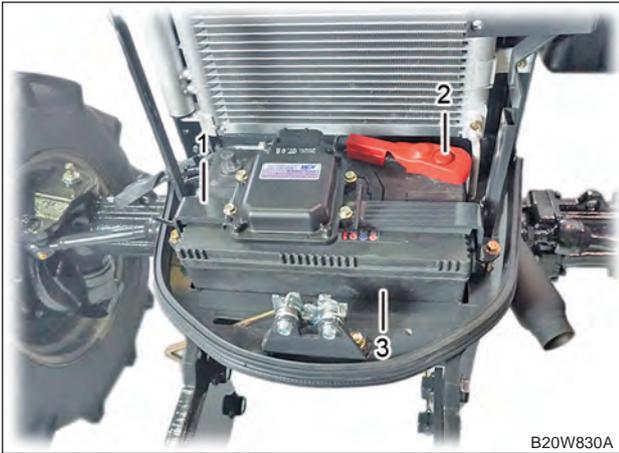
B20W828A

3. Remove the intake pipe mounting hose clip (1) and air cleaner mounting band (2) to remove the air cleaner assembly (3) simultaneously.



B20W829A

4. Remove the reservoir tank (1).



5. Remove the battery mounting bracket (1). Then, unscrew the battery positive (+) terminal (2) to remove the battery (3).



8. Unscrew the condenser mounting bolts (1) (4 EA) to remove the condenser (2).

 <b>CAUTION</b>
<ul style="list-style-type: none"> <li>• When cleaning the condenser, use compressed air or rinse it with water. Keep the pressure of compressed air below 210 kPa (2 kgf/cm<sup>2</sup>, 90 psi) and wear protective goggles and gears to prevent an injury by debris.</li> </ul>



6. Unscrew the air cleaner bracket assembly mounting bolts (1) to remove the air cleaner bracket assembly (2).

<b>Notes</b>
<ul style="list-style-type: none"> <li>• When inspection the condenser for leakage, check if the fin is bent or cracked or the shim is damaged.</li> <li>• Mix detergent and water at a 50:50 ratio and spray this solution around the condenser. Then, plug the outlet and apply pressure of 689 kPa (7 kgf/cm<sup>2</sup>, 100 psi) to the suction tube to check for leakage.</li> <li>• If necessary, repair or replace it with a new one.</li> </ul>



7. Disconnect the condenser hose (1) and compressor hose (2).

## 2.6 TROUBLESHOOTING

### 2.6.1 GENERAL INFORMATION

CAUSE OF PROBLEM	SYMPTOM	SOLUTION
The A/C belt is loose, causing abnormal noise.	When the A/C belt is loose or old, it produces a high-pitched creaking sound.	When the A/C belt is loose or old, adjust its tension after replacement.
The compressor produces a noise.	Abnormal sound is heard from the compressor or around it.	Check the bolts of the compressor and bracket. If loose, tighten them firmly.
Abnormal noise is heard from the condenser.	Abnormal noise is produced from the condenser due to broken suction valve.	Replace the suction valve.
Foreign materials are in the condenser.	Soil is in the condenser, reducing its efficiency greatly and affecting the A/C performance.	Rinse the condenser thoroughly to remove soil. Be careful not to damage the fins.
The pipe connection or compressor is contaminated with oil.	Foreign materials are in the A/C system	Check the contaminated area and inspect the compressor gasket, O-ring and shaft seal for a gas leak. If necessary, replace the corresponding part.
Abnormal noise is heard from the motor ventilation duct.	The ventilation duct motor is malfunctioning. Foreign materials are caught in the ventilation duct motor or its mounting bolt is loose.	Replace the ventilation duct motor. Remove foreign materials or tighten the mounting bolt firmly.

### 2.6.2 COOLING PROBLEM

#### ► THE FAN MOTOR DOES NOT RUN.

CAUSE OF PROBLEM	INSPECTION	SOLUTION
Blown fuse	Check the A/C fuse.	If the fuse is blown, replace it with a new one.
Open circuit	Check the wiring connector of the fan motor.	Connect the wiring again.
Defective fan motor	Connect a tester to both terminals of the motor and check for continuity. If there is continuity, it is normal.	If there is no continuity, replace the fan motor.
Damaged resistor	Check for continuity between resistors. If there is continuity, it is normal.	If there is no continuity, replace the resistor.
Damaged blower dial	Test the blower dial by turning it.	If the blower does not operate at any stage, replace the blower dial.

## ► THE COMPRESSOR ROTATES BUT COOL AIR IS NOT SUPPLIED

PROBLEMS		CAUSE OR SYMPTOM	SOLUTION
Excessive or insufficient refrigerant		Run the A/C for 5 to 10 minutes. Then, touch the high-pressure and low-pressure pipes and check the refrigerant amount through the sight glass.	
Insufficient refrigerant		There is only slight temperature difference between the high-pressure pipe and low-pressure pipe. Air bubble or condensation is visible through the sight glass.	Repair the leaking area and add refrigerant.
Excessive refrigerant		There is no air bubble even though pressure in the high-pressure pipe is high and the condenser is cooled by water.	Drain refrigerant until air bubbles are visible through the sight glass.
The refrigerant pressure is indicated high at the low-pressure side.	Defective thermostat	The magnetic clutch is disengaged before blowing air is sufficiently cooled down.	Adjust or replace
	Leaking compressor gasket or damaged valve	The pressure at the high-pressure gauge is balanced as soon as the magnetic clutch is OFF.	Repair or replace the compressor.
	Defective expansion valve connection	Water is condensed on the connection of the compressor and its temperature is below the temperature of the outlet port or evaporator pipe.	Tighten the pipe connection.
	Excessively open expansion valve	The main pressure is not changed regardless of whether the thermal case is installed or removed.	Replace
	Clogged compressor suction filter	The low-pressure hose is not cooled down, but the compressor connection is.	Clean the filter.
The refrigerant pressure is indicated low at the low-pressure side.	Insufficient refrigerant	Refer to "Insufficient refrigerant."	Add refrigerant.
	Clogged receiver drier	There is a great temperature difference from the tank outlet port and water is condensed on the tank.	Replace the receiver drier.
	Clogged expansion valve	The inlet port of the expansion valve is cooled down and water is condensed on it.	Replace the expansion valve.
	Leaking expansion valve	The outlet port of the expansion valve is not cooled down and the low-pressure gauge becomes in a vacuum state.	Replace the expansion valve.
	Clogged pipe	The pressure on the low-pressure side is decreased when the pipe is clogged.	Clean or replace the pipe.
	Defective thermostat switch	Vapor is frozen.	Add a sufficient amount of refrigerant.
The refrigerant pressure is indicated high at the high-pressure side.	Blocked condenser	The condenser is contaminated or clogged and the cooling fan rotates abnormally.	Clean, repair or replace
	Excessive refrigerant	Blown fuse, open wiring or poor contact	Adjust the amount of refrigerant.
	Air in A/C system	Refer to "Excessive refrigerant."	Bleed the system and add a proper amount of refrigerant.
The refrigerant pressure is indicated low at the high-pressure side.	Insufficient refrigerant	Refer to "Insufficient refrigerant."	Add refrigerant.

## ► THE FAN MOTOR OPERATES PROPERLY BUT AIR BLOWS POORLY

CAUSE OF PROBLEM	INSPECTION	SOLUTION
The inlet of the evaporator is blocked.	Check the evaporator for contamination.	Remove any blocking material.
Air leaks.	Check the seal of the A/C case.	Adjust
The thermostat switch is malfunctioning.	Perform the circuit test to check if the evaporator is frozen.	Replace

## ► THE COMPRESSOR DOES NOT ROTATE OR HARD TO ROTATE

CAUSE OF PROBLEM	SYMPTOM	SOLUTION
Loose drive belt	The belt shakes excessively.	Adjust the belt tension.
Internal failure of compressor	The belt slips.	Repair or replace
Voltage drop	The compressor clutch slips when the compressor is running.	Charge the battery.
Layer short	The compressor clutch slips when the compressor is running.	Replace the magnetic clutch.
Oil on clutch surface	The compressor clutch slips when the compressor is running.	Replace the clutch or clean its surface.
Excessive clearance on clutch plate	The clutch plate is adsorbed when pressed with a hand.	Adjust the clearance or replace it.
Open circuit	The compressor clutch cannot be engaged and current flow is detected between the compressor connectors.	Replace the compressor.
Damaged wiring or poor ground	The compressor clutch cannot be engaged.	Repair

**2.6.3 HEATING PROBLEM****► THE FAN MOTOR OPERATES PROPERLY BUT AIR BLOWS POORLY**

CAUSE OF PROBLEM	INSPECTION	SOLUTION
Clogged air duct	Check the duct for damage or deflection.	Correct
Air leak from duct	Check the duct connection. Check the duct seal or condition.	Correct

**► WATER LEAK**

CAUSE OF PROBLEM	INSPECTION	SOLUTION
Damaged seal	Check the heater core, core connection, hose and heater pipe for leakage.	Correct or replace
Loose connection	Check the heater core, core connection, hose and heater pipe for leakage.	Correct or replace
Punctured core	Check the heater core.	Replace

**► AIR BLOWS PROPERLY BUT IT IS NOT HEATED PROPERLY**

CAUSE OF PROBLEM	INSPECTION	SOLUTION
Low refrigerant temperature	Check the refrigerant temperature.	Replace the thermostat.
Insufficient refrigerant	Check refrigerant amount	Add coolant
Insufficient coolant	Check if the coolant pipe is clogged.	Bleed and correct
Air not blown to heater core	Check the air mix door and seal.	Adjust or replace the control cable or replace the seal.

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