

## **Installation and Maintenance Manual**

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# **Foreword**

## **Synopsis**

This manual is being as a assistant information for improving the maintenance quality for maintainer and help understanding this type of product and it also provides correct maintenance method and judgment criteria. The users should correctly understand each part of contents shown in this manual and finish maintenance by using of this manual.

This manual mainly contains the necessary technical information during maintenance. This manual is divided into several parts below and each part is divided into several sections in order to easy to read and understand.

### **Structure and Function**

The content of this part detailed explains the structure and function of each component, which not only provides the opportunity to understand the structure, but also provides the approach to settle problems.

### **Test and Adjustment**

This part provides the test methods before and after maintenance and the adjustment method after test, meanwhile, the illustrations are accompanied to describe the faults and the causes from occurring.

### **Maintenance Standard**

This part gives the standard for the inspection and disassembly of parts.

#### **Note**

The parameters and properties indicated in this manual subject to change without notice due to the technical improvement. The parameters provided in this manual are the latest ones.

# How to Read this Manual



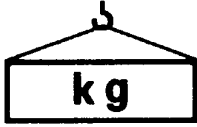

As a maintenance guide, each item indicated in this manual avoid as possible the repeated similar type of information. So it is need to retrieve simultaneous the information shown in other parts during maintenance period.

## Supplement and Renew

You should contact with our subsidiaries for the supplements or other change to obtain the latest maintenance information.

## Symbols

To make this manual more applicable, this manual adopts the symbols below for the very important parts and steps that need special attention.

Symbols	Items	Description
	Safety Marks	Special attentions should be paid to safety when operate this item.
	Attention	Special attentions should be paid to the technical requirements and other watchful items and standards when operate this item.
	Hanging Up	Special attentions should be paid to select chain with proper lifting capacity or other requirements when lift the heavy.
	Tightening Torque	Attentions should be paid to ensure the necessary tightening torque during assembly.

# **Safety Notes**

## **Safety Hints**

### **Safety Caution Notes:**

Correct maintenance is the important factor of safe operation. We specially recommend our company's maintenance technology in terms of high efficiency and safety, which detailed describe in this manual. It is need to use the special tools provided by our company during maintenance period.

To avoid unnecessary injuries, ▲ symbols indicated in this manual mean the safety hints. All items indicated such symbols should be conducted carefully. If the risk is occurring or to be occurred, please give priority to the safety and adopt necessary to settle it.

### **General Rules**

Mistake operation is very dangerous. You should carefully read this Operation and Maintenance Manual prior to operation.

1. Carefully read the hint marks stuck on the machine body prior to refill the lubrication oil or maintenance.
2. Put on the safety helmet and wear working clothing during operation period. No wear loosen clothing or clothing without clasps is allowed.
  - Wear the protection eyeglasses when strike the components with hammer.
  - Wear the protection eyeglasses when operate within the place where the crusher located or other crushing places.
3. The welding should be conducted by workers who has trained and has welding experience if the welding is required, meanwhile, the welding gloves, aprons, protection sleeves, welding working helmet and other working clothing that suit to the welding operation.
4. When more than two persons are conducting during operation period, each step should be confirmed by each other prior to actions are taken. Remind your colleague prior to conduct any step and put the warning board indicated as "Under Repairing" on the area the operators need attentions.
5. Ensure each tool can be operated reliable and know its correct use method.
6. Select one area to place the repairing tools and the dismantled components within repairing shops and ensure the tools and components are arranged in order and correctly. Ensure the workplace is clean, free of dust and oil. Please smoking within the smoking area and no smoking is allowed during working.

### **Preparation before Operation**

7. The machine should be parked on the hard flat ground during refill oil or repairing period and protect the tires with edges to prevent them from sliding.
8. Remove the blade, scarifier, ripper or some other work equipments on the ground before maintenance. If it is fail to finish the above items, insert the safety pin or use the stopper to prevent the work equipments from dropping. Ensure the operation lever is locked and put on the safety warning signs.
9. Use the supporting block or jack or other supporting articles to support the machine when

disassemble or assemble.

10. Remove the dirt or oil stains from the ascending and descending area on the stair or vehicle. Ascend and descend the vehicle by using of handrail, stair or steps. If there is no handrail, stair or steps to ascend and descend, please don't jump onto or jump from the vehicle.

### **Notes during operation**

11. Please loose slowly them when disassemble cartridge cap, discharging oil plug or pressure testing screw plug to avoid the oil sprout out. Release the pressure within the loops prior to disassemble or remove components of the hydraulic system or water cycle system or air pressure system.
12. The temperature of water and engine oil are very high when the engine is just flameout, so special attention should be paid to prevent from burning. The repairing or maintenance of hydraulic system or water cycle system can be conducted only after the temperature of oil and water are cooled.
13. Dismantle the connections of battery prior to operation. Normally dismantle the down lead of cathode.
14. It is need to use the electric hoist or crane to remove the heavier elements and check the wiring, chains or hook for safety and ensure the electric hoist or crane has enough lifting capacity. Put the lifting components on the proper place. The action should be slow when use the electric hoist or crane to prevent the dismantled components from damaging. No maintenance is allowed on the components that are still hanging up on the electric hoist or hook.
15. Please first loose the two bolts at both ends, then release slowly the interior pressure or elasticity, then remove the two bolts when dismantle the cap that has interior pressure or built-in spring.
16. Please pay attention to avoid damage or break the wires when dismantle components, otherwise will result in the electric sparks from occurring.
17. Prevent the fuel or hydraulic oil from spilling out when dismantles the oil pipes. Once the fuel or hydraulic oil spilled out on the ground, please wipe them off immediately. The fuel or hydraulic oil on the ground will cause you slip and easy to result in the fire.
18. Clean the components with gasoline is prohibited, especially, you'd apply fewer gasoline to clean the electric elements.
19. Please ensure that the components should be in the same original locations when assembly and replace the damaged components.
  - Care should be paid to ensure the vehicle would not interfere with other components once it working when assembles the hose or electric wires.
20. Ensure the oil pipe from twist when install the high-pressure oil pipe. The broken oil pipes are very dangerous and please pay more attention to it and ensure the correctness of the connecting components.
21. Ensure the required tightening torque when assemble or install the components. When assemble protection components, such as indication boards, or strongly vibration components or rotation components with high-speed, more attentions should be paid. Check if the installation is right.
22. Don't insert your fingers or arms when calibrate the two holes to avoid damage.
23. Check if the measuring tools are in the right positions when measure the pressure.

# Description of Hanging Up

## Hanging Up

The heavier components with more than 25 kg should be lifted with electric hoist or other lifting tools.

- Please check the contents below if the components can't be removed from the vehicle.
  - 1) Check if the connecting bolts have been dismantled completely.
  - 2) Check if there are some other components or covers interfere with them, which affect the disassembly.

### Hanging up rope

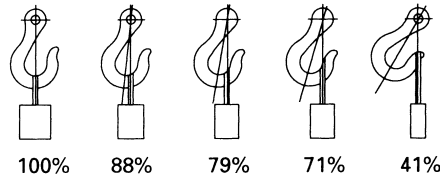
- 1) Use the rope that has the enough capacity and select the corresponding hanging up rope according to the weight of the component:

Hanging Up Rope		
(Adopt the un-galvanized "Z" type or "S" type standard braided rope)		
Diameter of Rope	Allowable Bearing Force	
	mm	t
10	9.8	1.0
11.2	13.7	1.4
12.5	15.7	1.6
14	21.6	2.2
16	27.5	2.8
18	35.3	3.6
20	43.1	4.4
22.4	54.9	5.6
30	98.1	10.0
40	176.5	18.0
50	274.6	28.0
60	392.2	40.0

★ Allowable value of bearing force is about 1/6 or 1/7 of break strength of rope.

2) The rope should be in the middle of the hook.

The rope in the edge of hook is very dangerous, which can cause the rope to slide and result in the accident when lifting. The lifting strength is maximum when the rope in the middle of the hook.

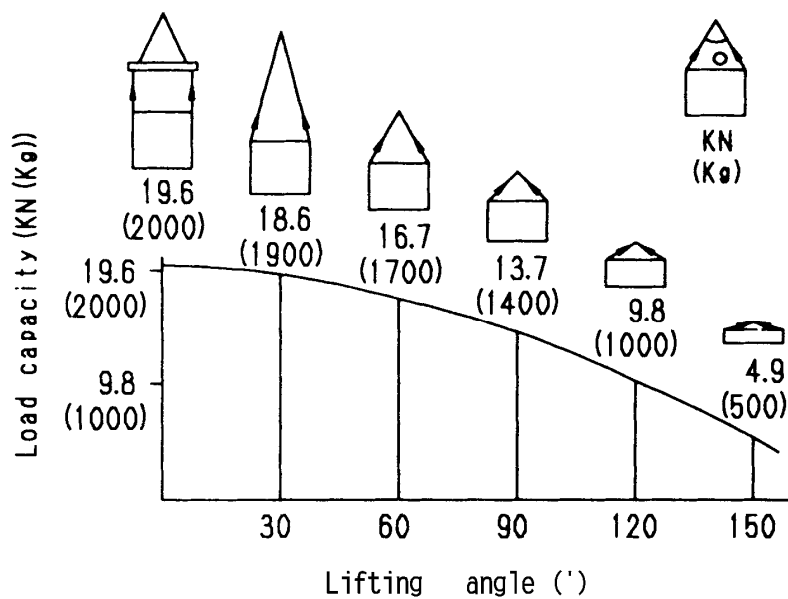


3) Hanging up the heavy with single rope is prohibited. Use two or more ropes wound on the heavy symmetrically when hanging up.

▲ Use the single rope to lift may cause the heavy rotate when hanging up, which will cause the rope rotate in counterclockwise or slide from the original position and result in the accident.

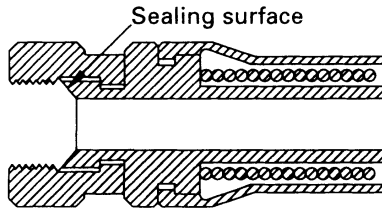
4) The angle of rope should not be too large. The bearing force on each rope will increase with the angle when hanging up with several ropes. The illustration below describes the allowable variation of bearing force on each rope when hanging up with two ropes. The allowable vertical lifting forces on each rope are all 9.8 kN (1000 kg).

When hanging up the heavy vertically with two ropes, the two ropes can hang up the load of 19.6 kN (2000 kg). The weight variation is 9.8 kN (1000 kg) when the angle of two ropes is of 120°. On the other hand, if lift the load of 19.6 kN (2000 kg) and the angle of two ropes is of 150° and lift the same load, the load variation of the two ropes is 39.2 kN (4000 kg).



# Tightening Torque

Tightening torque of horn type connecting nut  
(Use the torque wrench)



SAD00483

Screw Diameter	Subtense Width	Tightening Torque	
		Nm	kgm
14	19	24.5±4.9	2.5±0.5
18	24	49±19.6	5±2
22	27	78.5±19.6	8±2
24	32	137.3±29.4	14±3
30	36	176.5±29.4	18±3
33	41	196.1±49	20±5
36	46	245.2±49	25±5
42	55	294.2±49	30±5



# Engine

## Specification and Maintenance

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Fix the engine on the flat position and check the safety pin and locating disc prior to check, adjust or search the faults. Make proper signal and only allow the approved persons to access the engine during conduct the connection operation. When check the remain water level, first cool the engine and then move the radiator to avoid scald by the spilling out hot water. Avoid contacting the rotating components, such as fan, etc.

ENGINE	
	HG220
Model	6CTA8.3-C215
Type	Vertical, in-line, water-cooled, 4 strokes
Aspiration	turbocharged aftercooling
No. of cylinders	6
Bore	114 mm
Stroke	135 mm
Piston displacement	8.3 L
Horsepower - Gross	160kW/2,200rpm
Maximum torque	908Nm/1,500rpm
Torque rise	31%
Air cleaner	Dry type
Electrical	28V, 70A
Battery	12V*2 : 900cca

TRANSMISSION AND TORQUE CONVERTER	
	HG220
Speed (at rated engine speed)	Forward / Reverse (km/h)
1st	6.88/6.88
2nd	11.85/15.65
3rd	15.65/33.45
4th	26.68
5th	33.45
6th	52.74

TANDEM DRIVE		
	HG220	
Oscillating welded box section	614*225 mm	
Side wall thickness	Inner	22 mm
	Outer	22 mm
Wheel axle spacing	1,535.4 mm	
Tandem oscillation	±13 °	

FRONT AXLE	
	HG220
Type	Solid bar construction welded steel sections
Ground clearance at pivot	610 mm
Wheel lean angle, right or left	±17 °
Oscillation, total	32 °

REAR AXLE	
Alloy steel, heat treated, full floating axle with lock/unlock differential	NO-SPIN differential

STEERING	
	HG220
Hydraulic power steering providing stopped engine steering meeting ISO 5010	Hydraulic power steering
Minimum turning radius	7.3 mm
Maximum steering range, right or left	49 °
Articulation	±26 °

BRAKES	
	HG220
Service brake	Foot operated, hydraulically actuated on four tandem wheels, 3,613 <sup>cm<sup>2</sup></sup> total braking surface
Parking brake	Flexible shaft control, drum brake

FRAME	
	HG220
Height	302 mm
Width	280 mm
Side	22 mm
Upper, Lower	25 mm

DRAWBAR	
	HG220
	A-shaped, u-section press formed and welded construction for maximum strength with a replaceable drawbar ball
Drawbar frame	210*16 mm

CIRCLE	
	HG220
	Four circle support shoes with replaceable wear surface. Circle teeth hardened on front 180° of circle
Diameter (outside)	1,410 mm
Circle reversing control hydraulic rotation	360 °

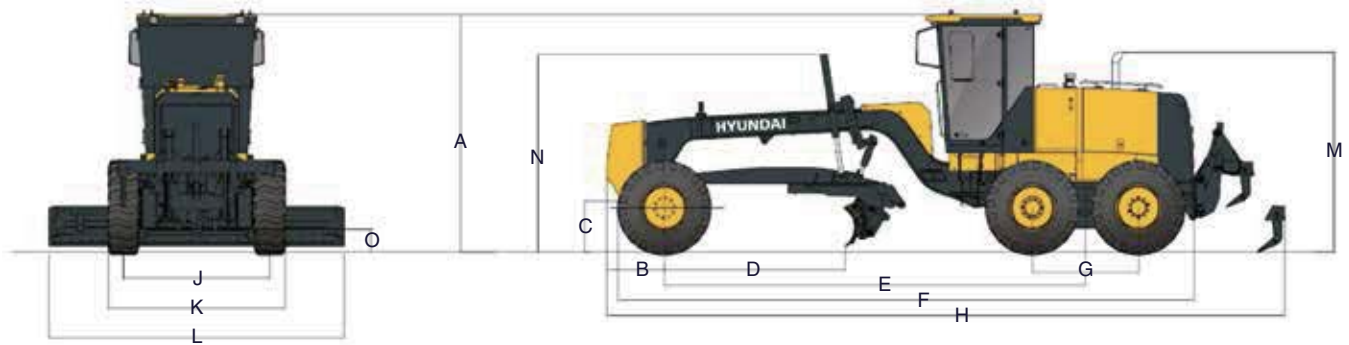
MOLDBOARD	
	HG220
	Replaceable metal wear inserts, cutting edge and bits. Cutting edge and end bits are hardened.
Dimensions	4,320*580*22 mm
Arc radius	329 mm
Cutting edge	152*16 mm

BLADE RANGE		
		HG220
Circle center shift	Right	525 mm
	Left	530 mm
Moldboard side shift	Right	965 mm
	Left	965 mm
Maximum shoulder reach outside rear tire (frame straight)	Right	2,367 mm
	Left	2,372 mm
Maximum lift above ground		450 mm
Maximum cutting depth		535 mm
Maximum blade angle, right or left		90 °
Blade tip angle		29-77 °

HYDRAULICS	
	HG220
	Hydraulic system of double pump and double multi way valve. Priority braking and steering. There are hydraulic locks on the scraper lifting, front wheel tilting, traction frame tilting, power tilting, frame articulation and other oil circuits
Output (at engine rated prm)	99 L/min
Maximum system pressure	17.5 MPa

INSTRUMENT		
		HG220
Gauge	Standard	Engine coolant temperature, fuel level, torque converter oil temperature
Warning lights / indicator	Standard	Battery charge, directional indicator, engine oil pressure, parking brake
CAPACITIES (REFILLING)		
		HG220
Fuel tank		370 L
Cooling system		36.5 L
Crank case		27 L
Transmission		28 L
Final drive		18 L
Tandem housing (each)		45*2 L
Hydraulic system		65 L
Circle reverse housing		4 L
OPERATING WEIGHT (APPROXIMATE)		
		HG220
Includes lubricants, coolant, full fuel tank	Total	15,800 kg
	On rear wheels	11,060 kg
	On front wheels	4,740 kg
With front mounted scarifier	Total	16,450 kg
	On rear wheels	11,060 kg
	On front wheels	5,390 kg
With rear mounted ripper and front push plate	Total	15,800 kg
	On rear wheels	11,060 kg
	On front wheels	4,740 kg
SCARIFIER (OPTIONAL)		
		HG220
Middle, V-type	Working width	1,325 mm
	Scarifying depth, maximum	210 mm
	Scarifier shank holders	11
	Scarifier shank holders spacing	130 mm
Rear	Working width	2,161 mm
	Scarifying depth, maximum	249 mm
	Scarifier shank holders	9
	Scarifier shank holders spacing	267 mm
RIPPER (OPTIONAL)		
		HG220
Ripping depth, maximum		436 mm
Ripper shank holders		3-teeth (standard) 5-teeth (optional)
Ripper shank holder spacing		534 mm
Machine length increase, beam raised		1,000 mm

## DIMENSIONS



Item	Description	HG220
A	Height to Top of Non-ROPS Cabin	3,420 mm
	Height to Top of ROPS Frame	3,604 mm
B	Center of Front Axle to counterweight	963 mm
C	Ground Clearance to Center Front Axle	714 mm
D	Length of Front Axle to Moldboard	2,600 mm
E	Length of Front Axle to Mid Tandem	6,100 mm
F	Length of Front Tire to Rear of Machine	8,653 mm
G	Length of Between Tandem Axles	1,535 mm
H	Length of Between Counterweight to Ripper	8,653 mm
J	Width of Tire Center Lines	2,120 mm
K	Width of Outside Tires	2,565 mm
L	Width of Moldboard	4,320 mm
M	Height to Exhaust Stack	2,747 mm
N	Height to Top of Cylinders	2,908 mm
O	Ground Clearance to Trans. Case	339 mm

## Change of Engine Oil and Engine Oil Cartridge

- The engine oil will become dirt and the engine oil additive will reduce after the engine is used.

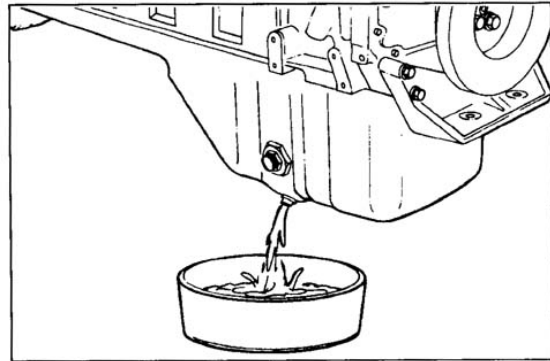
The content of pollutant is in direct proportion to the total loss of fuel and engine oil.

- ★ The period of changing the engine oil, in any case, should not exceed 8000 km, 250 hours or above three months for the engine under normal operation.

- Change the engine oil and engine oil cartridge to remove the impurities suspended inside the engine oil.

- ★ Discharging the oil when the engine oil is hot and the pollutant is under suspension status.

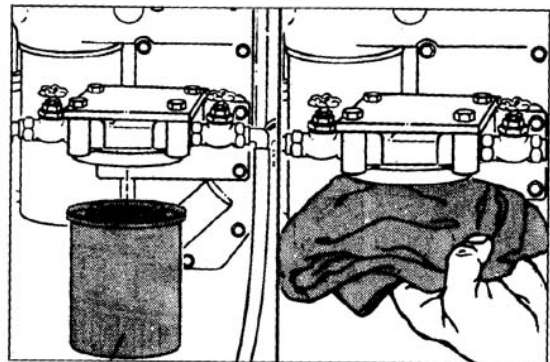
- Stop the machine when the engine running until the water temperature is reaches to 60 °C and dismantle the discharging oil screw plug.



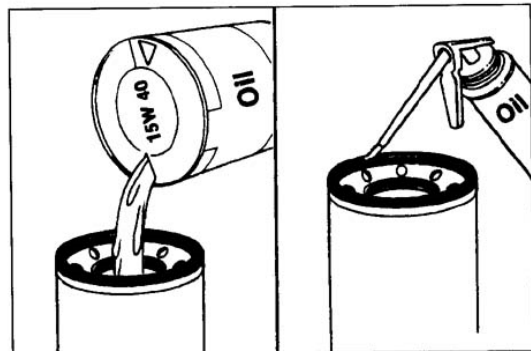
- ⚠ Hot engine oil will result in hurt to persons.

- Clean the around head of the engine oil cartridge. Dismantle the cartridge. Clean the surface of washer on he head of cartridge.

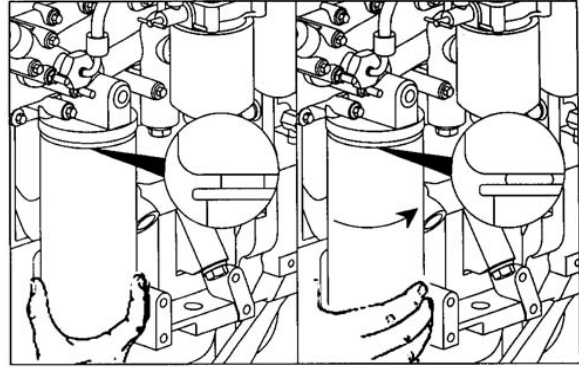
- ★ O sealing ring will clog into the head of the cartridge, so it should be removed.



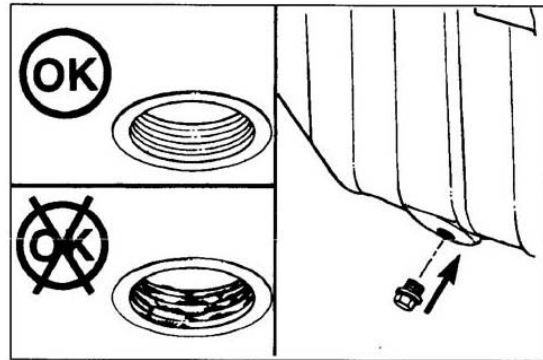
- Apply one thin layer of engine oil on the sealing surface of washer before assemble the cartridge.



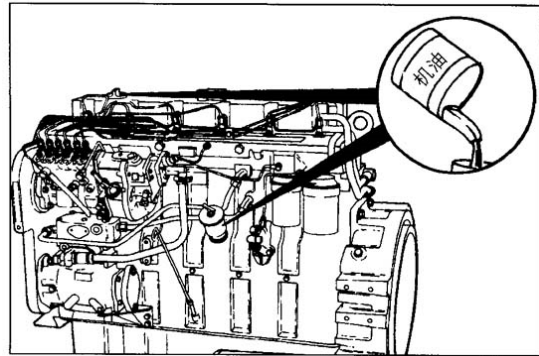
- ★ When mount the engine oil cartridge, after the sealing ring has contacted, then tight 3/4 ~ 1 circle. Over tight the cartridge will cause the screw to distort or damage the sealing ring of cartridge.



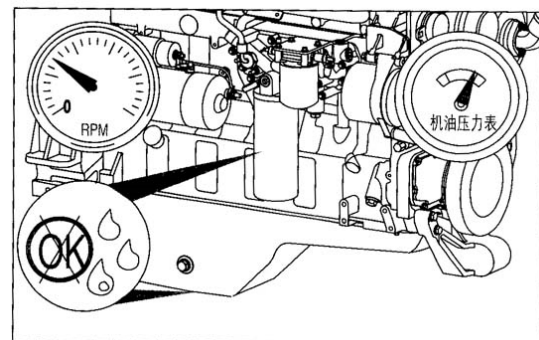
- Check and clean the discharging oil screw plug and sealing surface, and install the discharging oil screw plug.



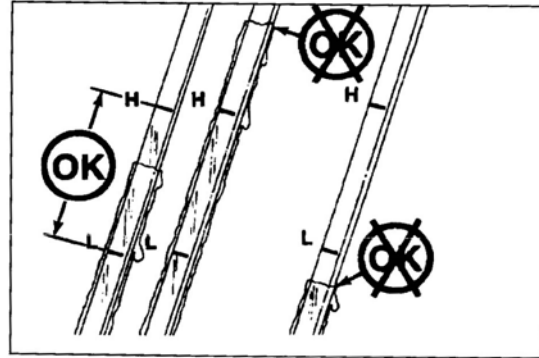
- Fill the clean engine oil into the engine until reach proper height of oil level. The capacity of the entire lubricating system, including the cartridge, is 27 L.



- Run the engine under idle speed and check if the cartridge and discharging oil screw plug leakage.

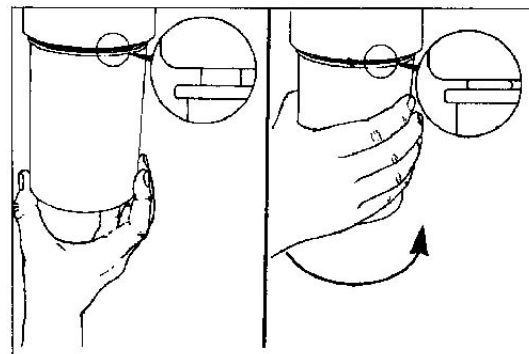
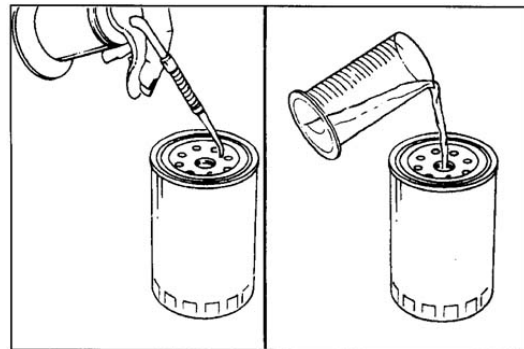


After stop the machine, flow the engine oil into the oil stray from the top components about in 5 minutes, and then check the height of oil level. If necessary, refill the engine oil to the level where the “H” mark of dipstick is shown.



### Change of Fuel Cartridge

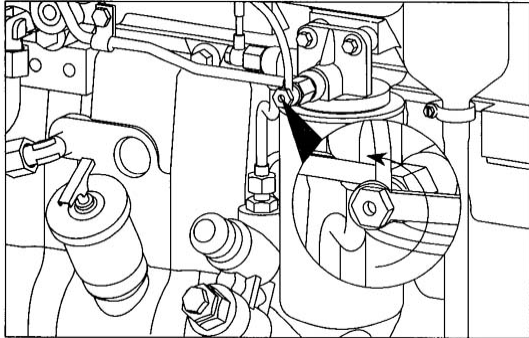
- Clean the around head of the fuel cartridge. Dismantle the cartridge. Clean the surface of washer on he head of cartridge. Change the O sealing ring.
- Fill the clean diesel oil into the new fuel cartridge and lubricate the O sealing ring with clean engine oil.
- ★ When mount the engine oil cartridge, after the sealing ring has contacted, then tight 3/4 ~ 1 circle. Over tight the cartridge will cause the screw to distort or damage the sealing ring of cartridge.



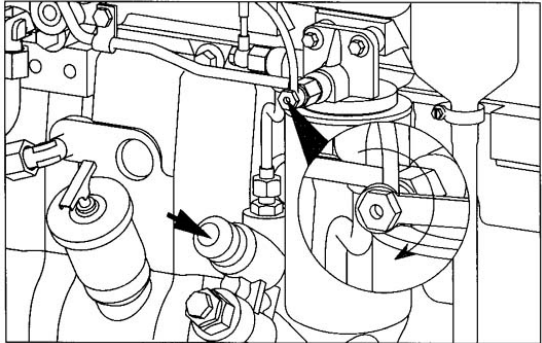


# Exhaust of Fuel System

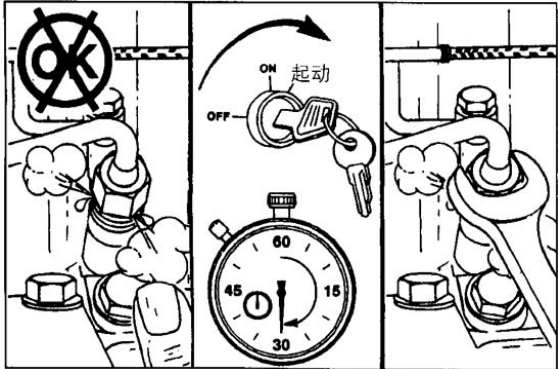
- Loose the exhaust screws
- Press the plug of oil transit pump until the oil flowing from the connecting area has no air.



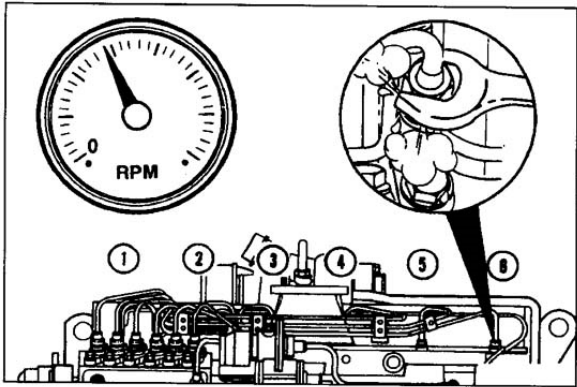
- Loose the connecting nut on the oil sprayer and drive the diesel by using of starting motor to exhaust the air inside the high-pressure oil pipes and tight the connecting nut.



- Start the diesel. Exhaust the air inside high-pressure oil pipe for one time until the diesel runs smoothly.



The diesel oil pressure inside the high-pressure oil pipe is enough to penetrate the skin and result in serious damage.

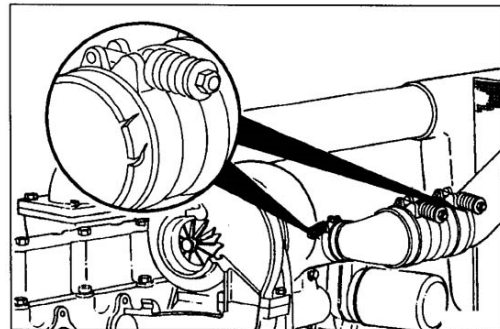


## Maintenance of Air Filter Element

★ The diesel used for engineering machinery always working in the badly condition that the dust content in the air is very high. So it is require high filtering efficiency of air filter elements and high sealing of the air inlet system. The insufficiency of air inlet volume will not only directly affect the output power of engine, but also result in the carbon accumulation dramatically inside the combustion chamber and air cylinder sleeve, consequently quicken the wear of piston ring and cylinder sleeve until them were damaged. The quality of the inlet air is not good, will also result in the early wear of cylinder sleeve and piston assembly, and consequently reduce the service life of engine.

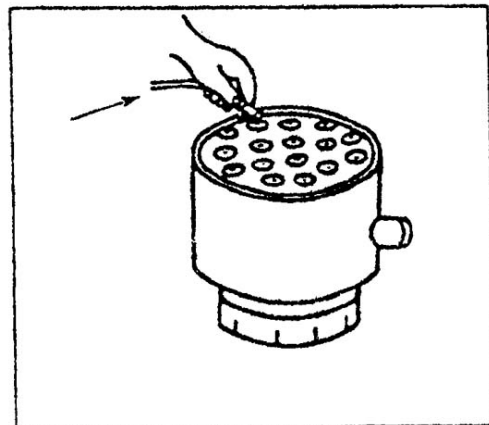
- Check the air inlet system

Check if the hose of the air inlet system has crack, if the clamp has loosen or perforated. Tight or change component when it is necessary to ensure there has no air leakage in the air inlet system.



### Air filter

The maximum air inlet resistance of this kind of air filter is 6.2 kPa. The maximum air inlet resistance must be checked when the supercharged diesel runs under rated full load. Clean the dusts inside the dust collection chamber every 100 hours' operation. Remove the main paper filter element and knock the both ends of main filter element or use the compressed air that the pressure is not over 0.5 MPa to clean it every 100~200 hours (it can be adjusted properly depends on the dust content in the workplace environment).



First blow air from the interior to the exterior along the paper fold, then blow air from outside to the inside, finally blow air from inside to outside to remove the dust. Use the same method in the maintenance condition above to maintain the safety filter elements.

★ No use the oil or water to clean the filter element is allowed.

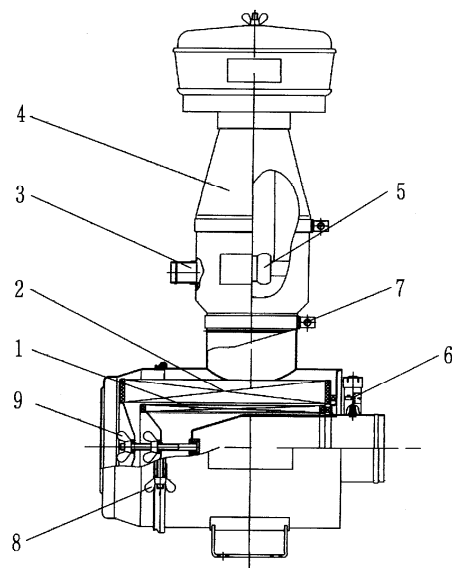
★ It is need to change it if the damaged filter element is found or it is hard to remove the dirt.

★ Conduct above maintenance every 50~100 hours' operation in the working condition that has severe powder.

★ The outlet end of air filter is equipped with KBZ-1 type air filter maintenance indicator. The operator should maintain the air filter when the air filter is blocked.

The disassembly of cyclone paper air filter

- 1) Loose the clamp (7) and remove the coarse filter (4). Loose the clamp (8) and remove the cover and butterfly nut (9) and remove the paper main filter element (2) and safety filter element (1).
  - 2) Conduct the maintenance as the method abovementioned.
  - 3) The assembly of air filter is conducted as per the reverse sequence.
- ★ Avoid damaging the filter element when dismantle the filter element. When assemble the paper filter element and safety filter element, both end surfaces of them must be sealed reliable and should have no leakage. Prohibit starting and using the engine without the air filter.



**Cyclone Paper Air Filter**

1. Filter Element
2. Paper Main Filter Element
3. Connection of Exhaust Tube
4. Coarse Filter
5. Dust Collection Chamber
6. Alarm
7. Clamp
8. Clamp
9. Butterfly Nut

## Lubricant and Recommended Specification of Fuel

### Lubricant for diesel

It is better to use the CD Class 15W/40 diesel oil produced by China Petrochemical General Company or use the APICCC/CD Class 15W-40 thickened engine oil of America Petroleum Association. The sulphate content in the oil should not exceed 1.85%. Attention: When the ambient temperature is keeping below  $-5^{\circ}\text{C}$ , use the light weight CD Class 5W-30 engine oil will facilitate the start. Continuously use the low viscosity engine oil will increase the wear of engine.

### Use in the hyperborean area:

If one engine is always runs under the ambient temperature of below  $-23^{\circ}\text{C}$  and there has no warming measures when it is under non-running status, the use of CS Class engine oil should meet the additional requirements below:

Parameters (Test Method)	Description
Viscosity	Under $-35^{\circ}\text{C}$ , max. 10,000 Mpa·S Under $100^{\circ}\text{C}$ , min. 5.6 mm <sup>2</sup> /s
Freezing point (American Society of Testing Materials: ASTM D-97)	At least lower $5^{\circ}\text{C}$ than the expected minimum ambient temperature

The suitable engine oil will include comprehensive composition and it should in conformity with the product of 5W-20 or 5W-30.

### Fuel:

Warning: Mix the gasoline or alcohol with diesel oil is prohibited and such mixture will cause the explosion.

It is suggest using the light diesel oil from China Petrochemical General Company. To adopt such fuel will make the property of diesel under the optimal status. When the working temperature is below  $0^{\circ}\text{C}$ , select the suitable grade of light diesel oil based on the specific local air temperature. According to the air temperature, the lower-temperature light diesels that can select to use are RC-10, RC-20, RC-30, etc.

The viscosity of oil should be kept over 1.3 centipoises to supply sufficient lubrication with the fuel system.

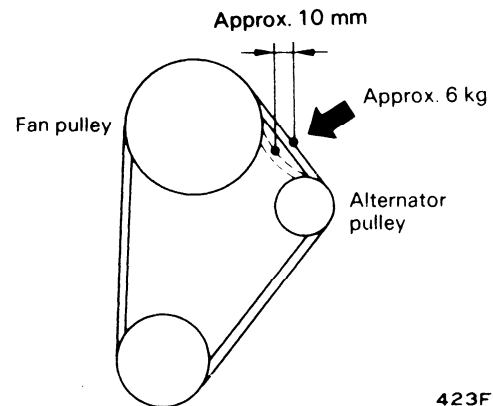
## The commissioning of the tension of pulley of belt of fan

### Check the tension of belt of fan

Apply force of 6 kg into the middle area between the pulley wheel of fan and pulley wheel of alternator to check tension.

### Measuring Process

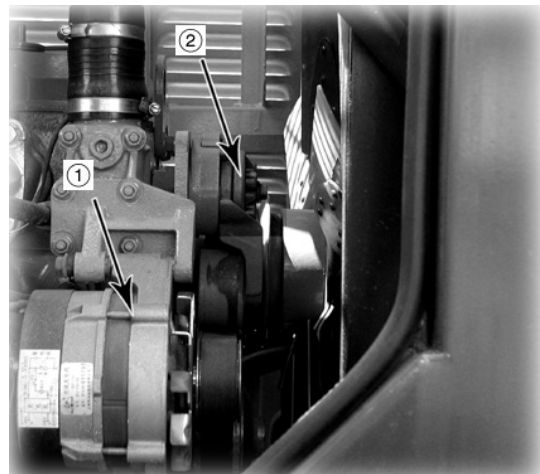
1. Apply force of 6 kg into the middle point between the alternator and pulley wheel of fan, press the V type belt and measure the deflection dimension of V type belt with ruler.



423F303

### Adjustment Process

1. Loose the bolt (1) of alternator and bolt (2) of the adjusting plate.
  2. Insert one pole or support into the area between the bolt of alternator and cylinder body, then lift the alternator.
- ▲ If handle the alternator with hand, please care the fingers.
3. Adjust the tension of belt and tight temporarily the bolt.
  4. Check. Tight completely the bolt when the tension of belt is moderate.

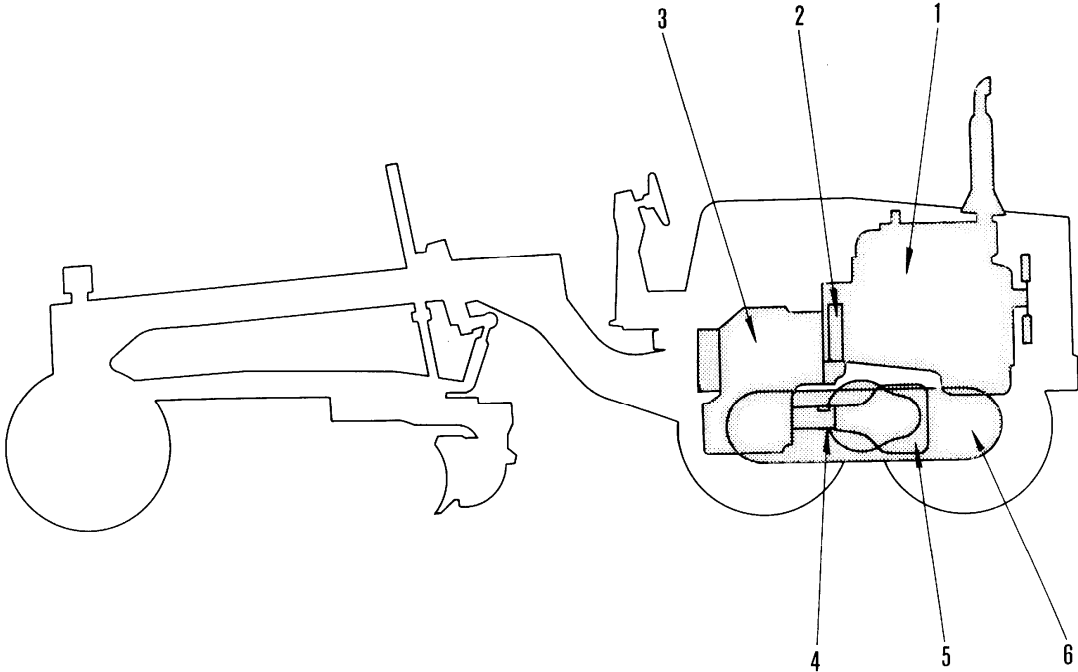


# Transmission System

## 1. Structures and Function

General Description -----	20-20
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Hydraulic Diagram of Gear-box -----	20-24
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Gear-box -----	20-27
Clutch -----	20-29
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Rear Transaxle -----	20-45
Balanced Housing -----	20-48

# General Description

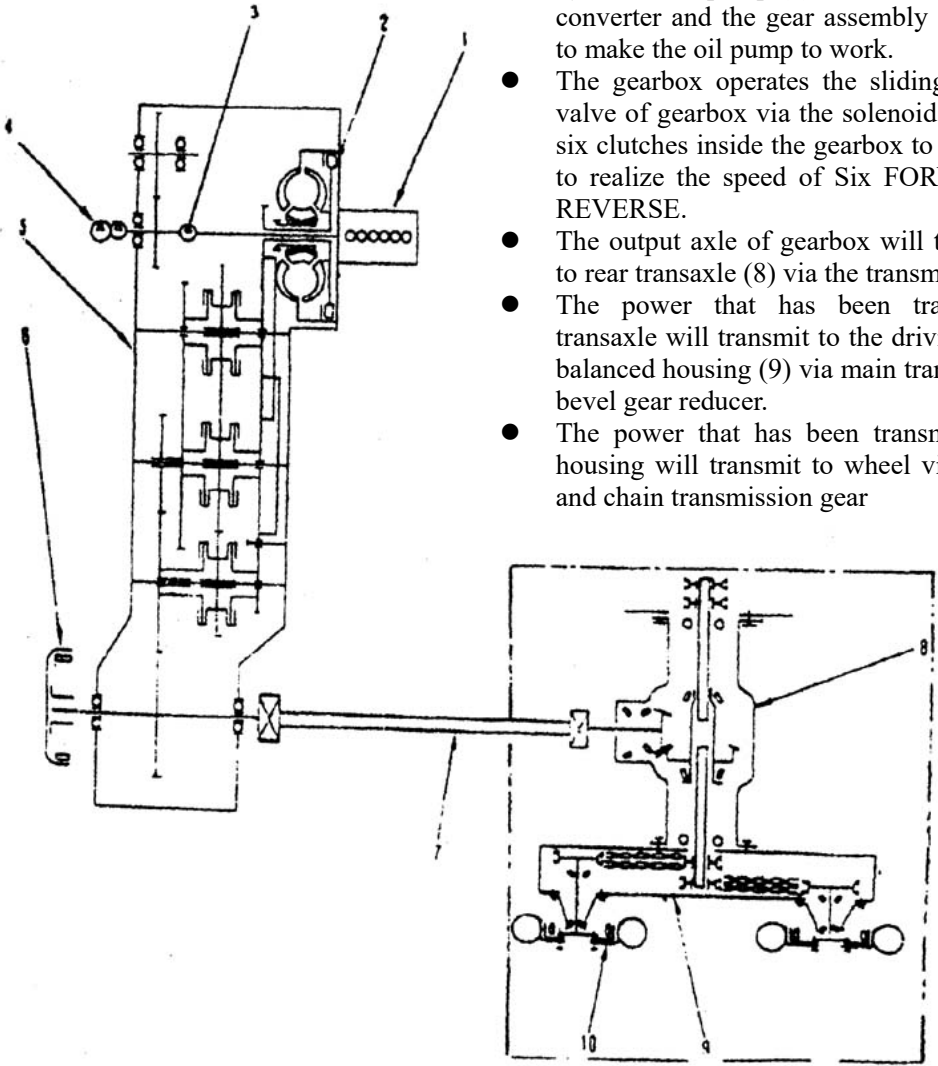


- 1. Engine
- 2. Connecting Plate
- 3. Torque Converter
- 4. Rear Transmission Shaft
- 5. Rear Transaxle
- 6. Balanced Housing

- The power of engine (1) transmits to torque converter and power gearshift gearbox inside the hydrodynamic transmission (3) through the connecting plate (2). It will realize the speed at each shift of FORWARD/REVERSE through the selection of clutch to adapt the exterior load.
- The power was transmitted to rear transaxle (5), to right and left balanced housing (6) through the rear transmission shaft (4), then the power drives the chains of chain wheel and the power was transmitted to the wheels.

# Transmission System

- The power of engine (1) was transmitted to torque converter via the flywheel, connecting plate (2) of flywheel and elastic connecting plate.
- The torque converter takes the oil as medium. The torque converter will convert the transmitted torque based on the variation of load, and then the torque was transmitted to the driving gear of gearbox.
- In additional, the power of engine was transmitted to hydraulic oil pump (4) via the axle inside the torque converter and the gear assembly inside the gearbox to make the oil pump to work.
- The gearbox operates the sliding valve of control valve of gearbox via the solenoid valve to make the six clutches inside the gearbox to work, respectively to realize the speed of Six FORWARD and Three REVERSE.
- The output axle of gearbox will transmit the power to rear transaxle (8) via the transmission shaft (7).
- The power that has been transmitted to rear transaxle will transmit to the driving chain wheel of balanced housing (9) via main transmission gear and bevel gear reducer.
- The power that has been transmitted to balanced housing will transmit to wheel via the chain wheel and chain transmission gear

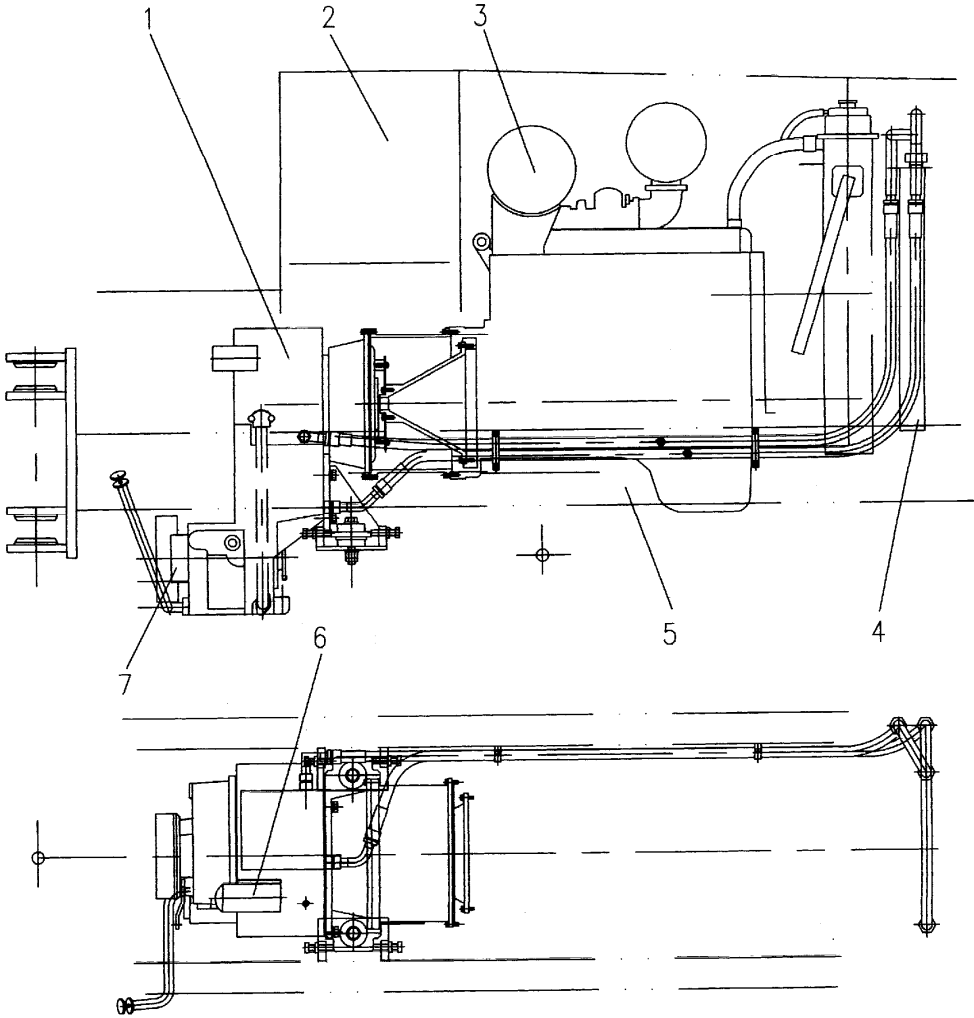


1.Engine      2. Connecting Plate      3. Variable Pump      4. Steering and      5. Torque Converter Hydraulic Pump

6. Parking Brake      7. Drive Shaft      8. Rear Transaxle      9. Balanced Housing      10. Driving Brake



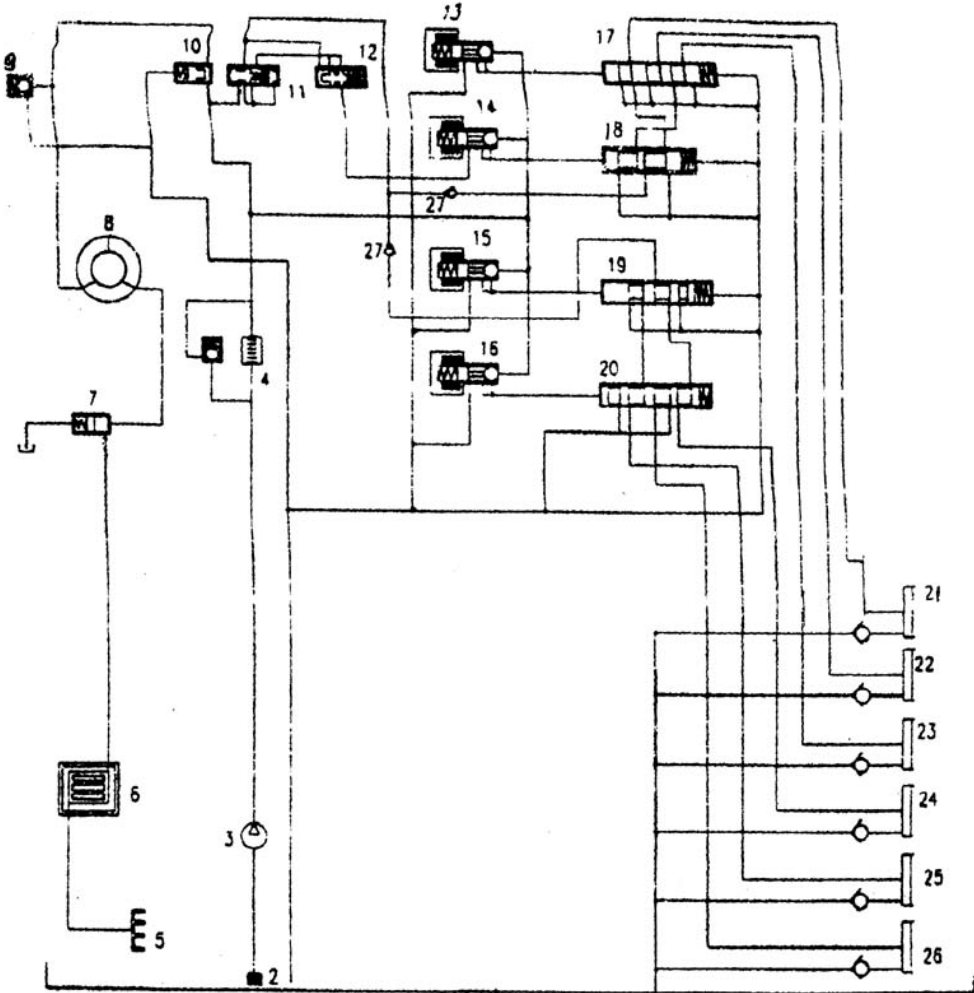
# Pipeline of Hydrodynamic Transmission



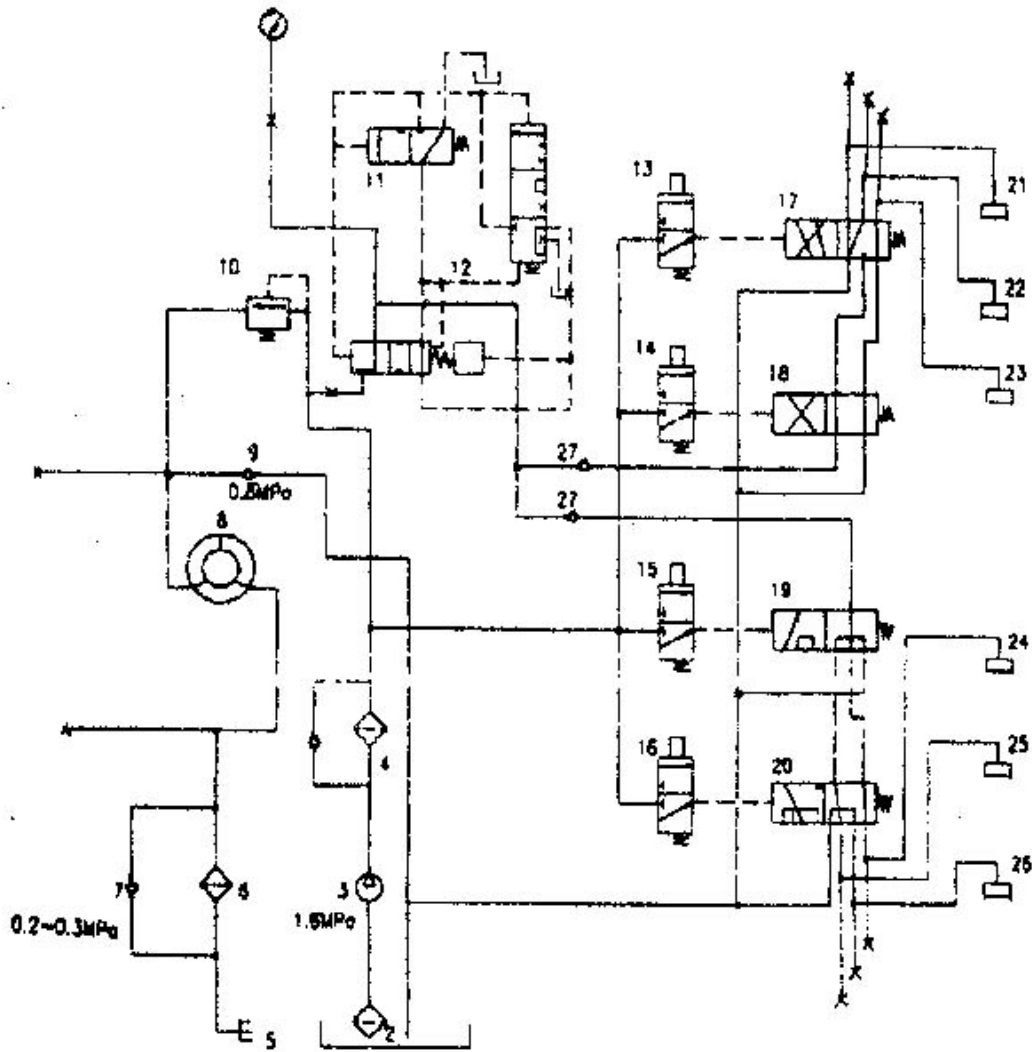
- Transmission pump (inside the transmission gear) sucks the oil from the transmission gear (1) via the filter.
  - The oil from transmission pump was transmitted to control valve of transmission gear via transmission oil filter (6).
  - Then the oil was cooled by the radiator (4), and the cooled oil will cool and lubricate the transmission gear.
1. Transmission Gear
  2. Hydraulic Oil Tank
  3. Engine
  4. Radiator
  5. Carriage
  6. Transmission Oil Filter
  7. Parking Brake

# Hydraulic Oil Pipe Diagram of Gearbox

(The engine is under flameout status)

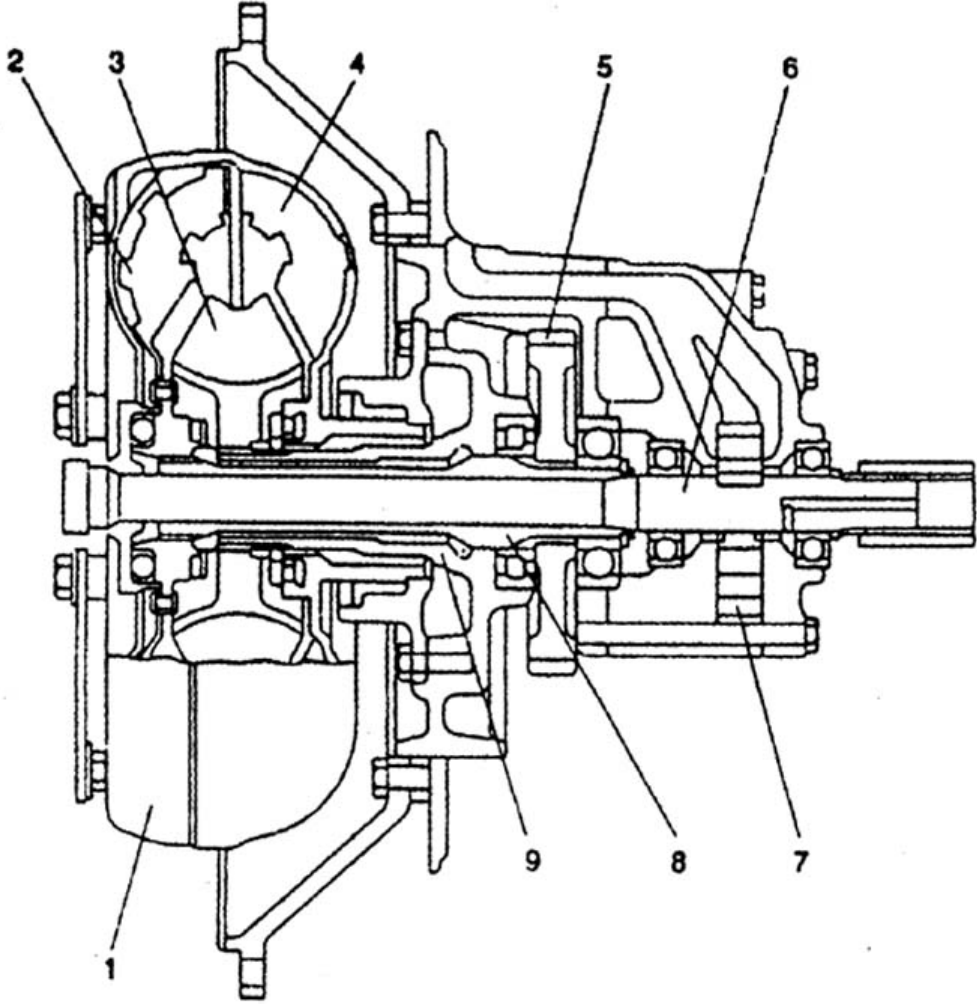


# Hydraulic Diagram of Gearbox



- |   |                                 |                   |
|---|---------------------------------|-------------------|
| 1. Gearbox                                  | 10. Main Control Pressure Valve | 19. Shift Valve   |
| 2. Coarse Filter                            | 11. Reset Valve                 | 20. Shift Valve   |
| 3. Transmission Pump                        | 12. Regulator Valve             | 21. KV Clutch     |
| 4. Oil Filter                               | 13. Solenoid Valve (M3)         | 22. KR Clutch     |
| 5. Lubrication Device of Gearbox            | 14. Solenoid Valve (M1)         | 23. K4 Clutch     |
| 6. Oil Cooler                               | 15. Solenoid Valve (M4)         | 24. K3 Clutch     |
| 7. Pressure Compensator of Torque Converter | 16. Solenoid Valve (M2)         | 25. K2 Clutch     |
| 8. Torque Converter                         | 17. Shift Valve                 | 26. K1 Clutch     |
| 9. Bypass Valve of Torque Converter         | 18. Shift Valve                 | 27. One Way Valve |

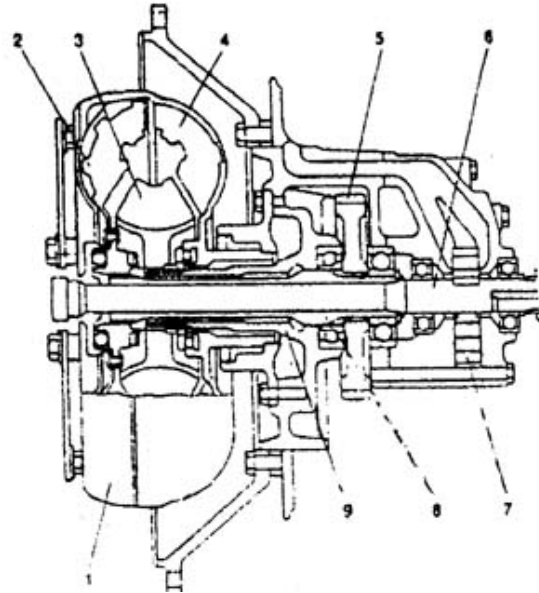
# Torque Converter



- 1. Pump Casing
- 2. Turbine
- 3. Guide Wheel
- 4. Pump Wheel
- 5. Driving Gear
- 6. Pump Wheel Axle
- 7. Transmission Oil Pump
- 8. Turbine Shaft
- 9. Guide Wheel Stand

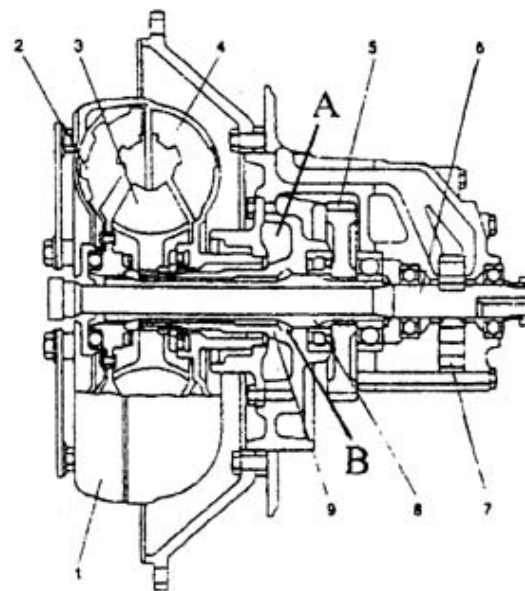
## Power Channel

- The torque converter is mounted between the engine and gearbox. The power from engine was transmitted to pump casing (1) via flywheel, connecting plate of flywheel and elastic connecting plate.
- The pump casing (1) and pump wheel (4) are connected and fixed by using of bolt and the pump casing (1) and pump wheel axle are connected by spine, which will rotate depend directly on the running of engine. The power of pump wheel (4) takes the oil as medium to drive the turbine (2) to run and transmit the power to the driving gear (5) inside the gearbox. The power of pump casing drives the hydraulic pump via the pump wheel axle.

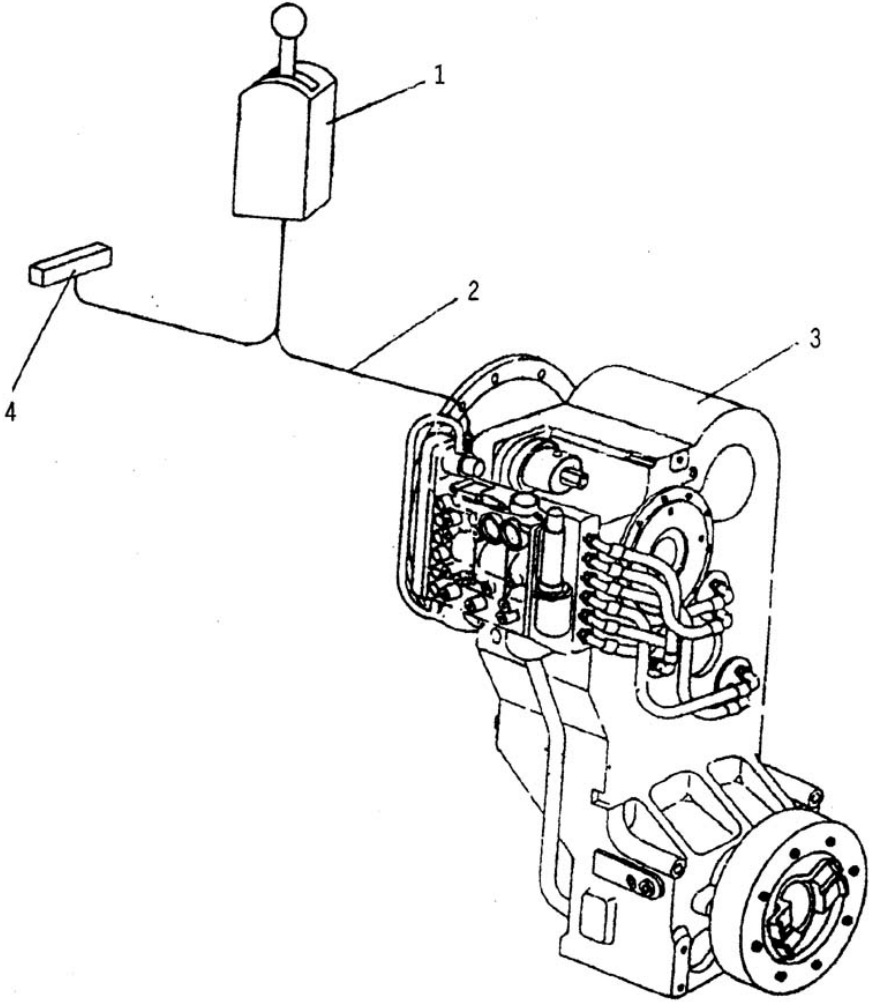


## Flow Direction of Oil

- The oil the transmission pump (7) supplied with torque converter enters into inlet A via the oil channel of guide wheel stand (9), then flows to pump wheel (4). The rotation of pump wheel (4) make the oil produces impact and the oil enters into turbine (2) and the energy of oil was transmitted to turbine (2). The turbine (2) is connected with driving gear (5) of gearbox by using of spine, so the power was transmitted to the driving gear of gearbox. The oil from turbine (2) was transmitted to guide wheel (3) and re-enters into pump wheel (4). However, some oil flows to the oil cooler to cool via the oil outlet B through the guide wheel (3)



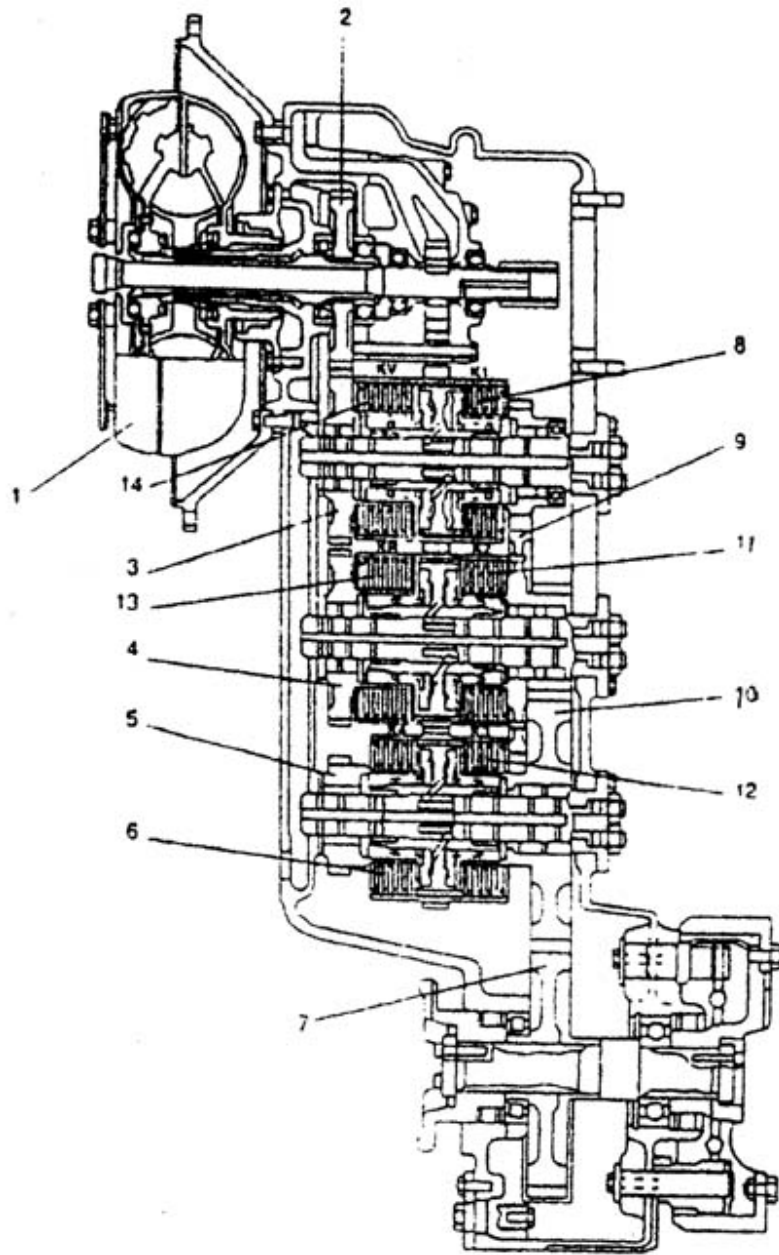
# Gearbox



- 1. SG6 Shift Selector
- 2. Shift Solenoid Cable
- 3. Gearbox
- 4. Output Cable of Power Supply

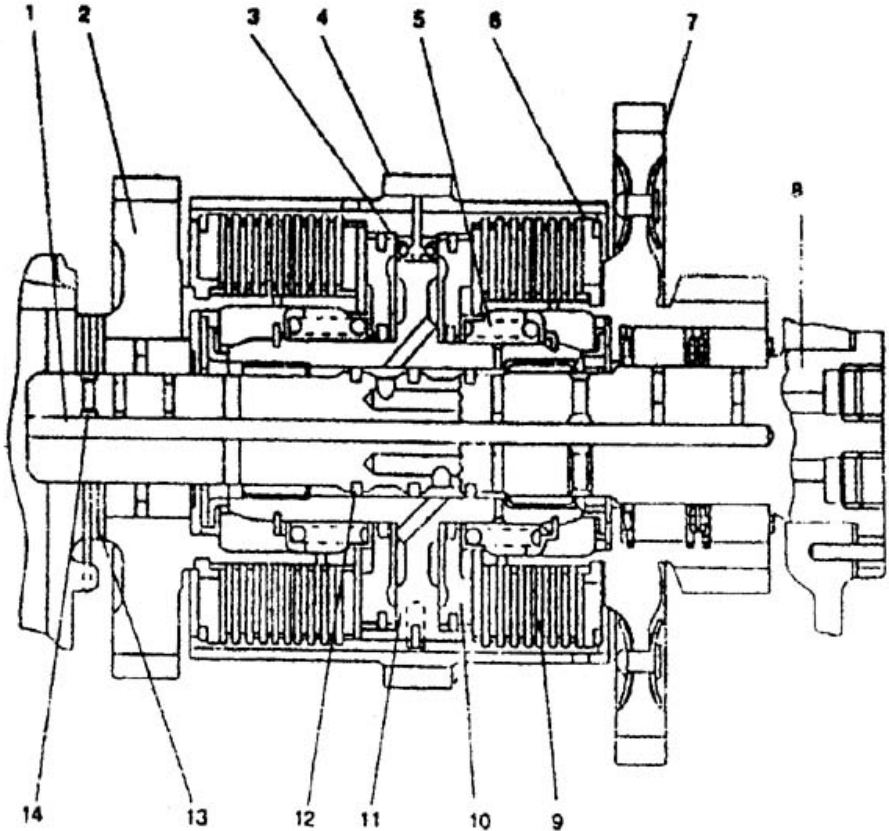
## General Description

- The gearbox is mounted in the back of torque converter. The power from converter enters into the gearbox through the driving gear of gearbox.
- The gearbox use the combination of clutches of FORWARD/REVERSE and four speed clutches to shift of forward one~six shift or reverse one~three shift and transmit the power to the output shaft.



- |                                 |                                 |                                 |
|---------------------------------|---------------------------------|---------------------------------|
| 1. Converter                    | 2. Driving Gear                 | 3. Forward Clutch Gear          |
| 4. Reverse Clutch Gear          | 5. 4 <sup>th</sup> Clutch Gear  | 6. 4 <sup>th</sup> Clutch (K4)  |
| 7. Output Gear                  | 8. 1 <sup>st</sup> Clutch (K1)  | 9. 2 <sup>nd</sup> Clutch Gear  |
| 10. 3 <sup>rd</sup> Clutch Gear | 11. 2 <sup>nd</sup> Clutch (K2) | 12. 3 <sup>rd</sup> Clutch (K3) |
| 13. Reverse Clutch (KR)         | 14. Forward Clutch (KV)         |                                 |

# Clutch



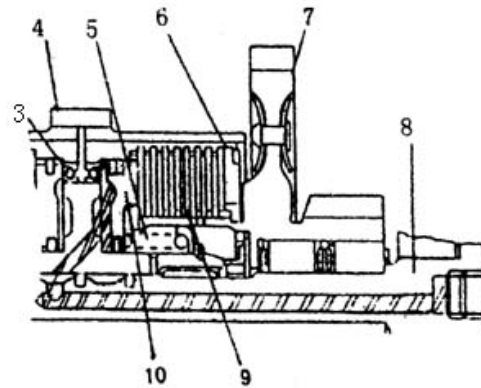
- |                             |                           |                               |
|-----------------------------|---------------------------|-------------------------------|
| 1. Lubricant Channel        | 2. Gear                   | 3. Discharging Oil Steel Ball |
| 4. Drum Wheel (Clutch Case) | 5. Reset Spring           | 6. Bearing Plate              |
| 7. Gear                     | 8. Auxiliary Shaft        | 9. Friction disc              |
| 10. Piston                  | 11. Clutch Cylinder Block | 12. Sealing Ring              |
| 13. Washer                  | 14. Lubricant Opening     |                               |



## The Operation of Clutch

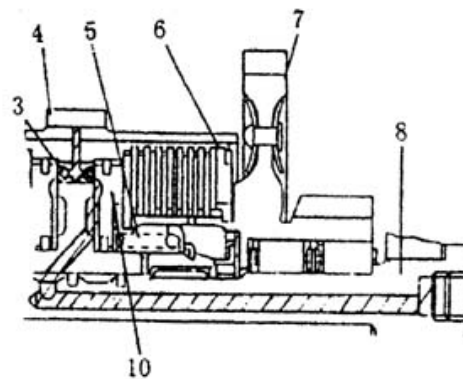
When engaged:

- The oil flows into the clutch cylinder block from the control valve of gearbox via the oil hole inside the shaft to push the piston (10).
- The main and auxiliary friction disc are engaged when pushing the piston, which make the clutch case (4) and clutch gear (7) to form one integer to transmit the power.

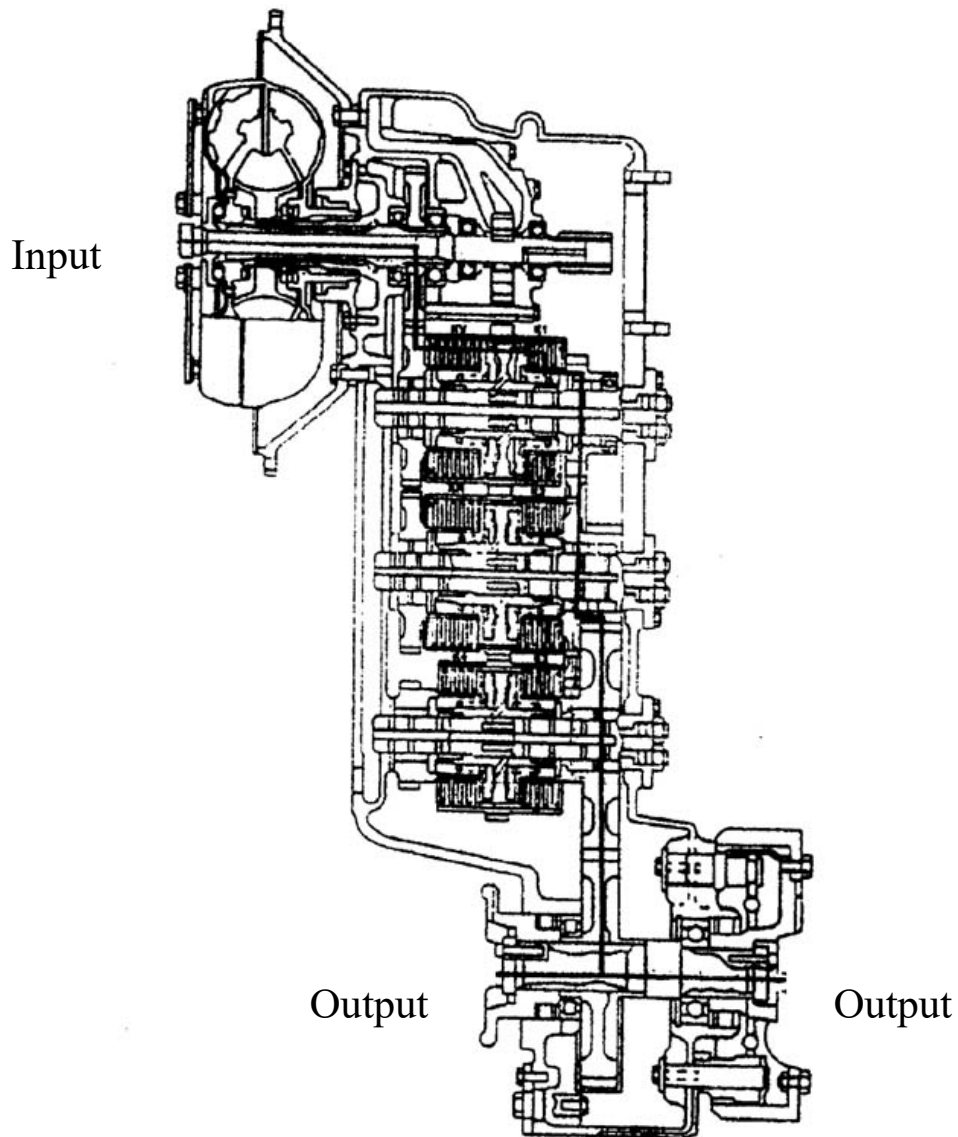


When disengaged:

- The oil pressure applied into the piston (10) is reduced when the control valve of gearbox cut the oil supplied to the clutch.
- The piston returns to the original position via the spring (5), which separate the clutch case (4) from clutch gear (7).
- When the clutch is disengaged, the oil inside the cylinder block is drained by the centrifugal force via the discharging oil opening to prevent the separation of clutch is not complete.



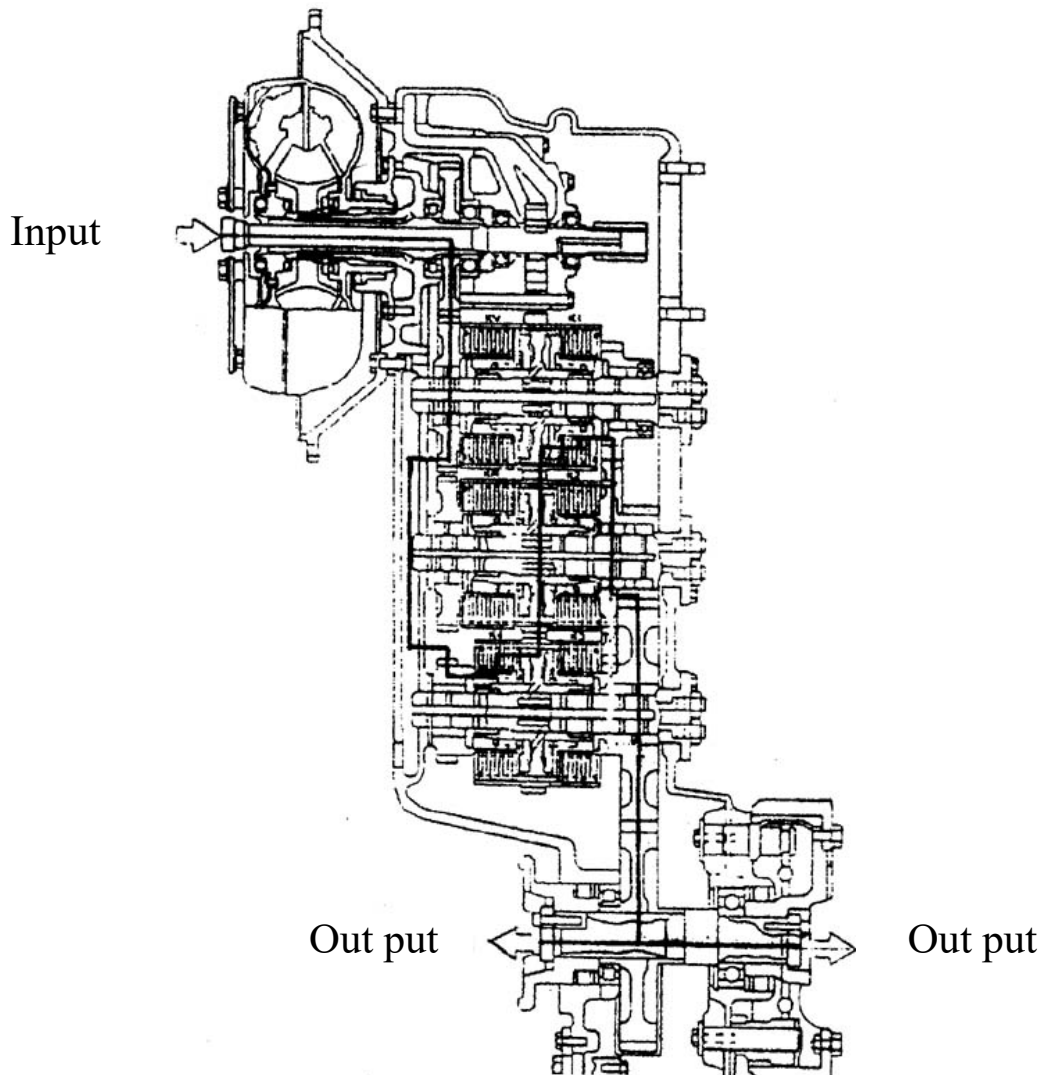
## Forward 1<sup>st</sup> Shift



### Operation

- When conduct the operation of forwarding 1<sup>st</sup> shift, KV and K1 clutches are engaged. The power transmitted from torque converter to driving gear was transmitted to the output shaft.
- The main and auxiliary friction discs inside the KV shift and K1 shift clutches are compacted by the oil pressure applied into their cylinder block via the piston.
- The power from torque converter is transmitted from driving gear to KV, K1 clutch case via the KV shift clutch.
- Because the K1 shift clutch is engaged, so the power transmitted to the KV, K1 clutch case is transmitted from K1 clutch gear to K2 clutch gear, K3 clutch gear and output shaft gear via the K1 shift clutch, then is transmitted to output shaft.

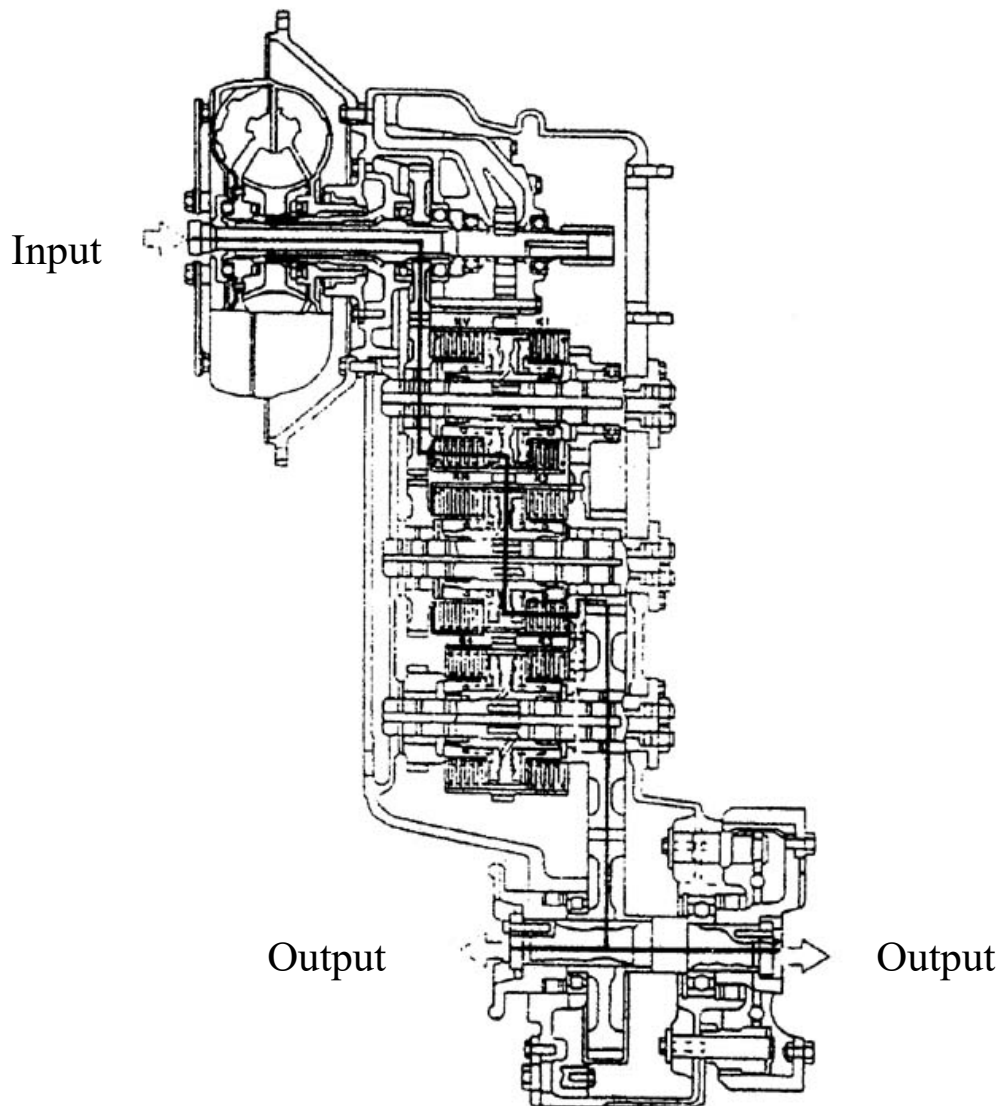
## Forward No.2 Shift



### Operation

- When conduct the operation of forwarding No.2 shift, K4 and K1 clutches are engaged. The power transmitted from torque converter to driving gear was transmitted to the output shaft.
- The main and auxiliary friction discs inside the K4 shift and K1 shift clutches are compacted by the oil pressure applied into their cylinder block via the piston.
- The power from torque converter is transmitted from driving gear to K4, clutch gear via the KV shift clutch gear and counter gear, the power is then transmitted from driving gear to KV, K1shift clutch case through K4 clutch via K4, K3 clutch case and KR, K2 clutch case.
- Because the K1 shift clutch is engaged, so the power transmitted to the KV, K1 shift clutch case is transmitted from K1 clutch gear to K2 clutch gear, K3 clutch gear and output shaft gear via the K1 shift clutch, then is transmitted to output shaft.

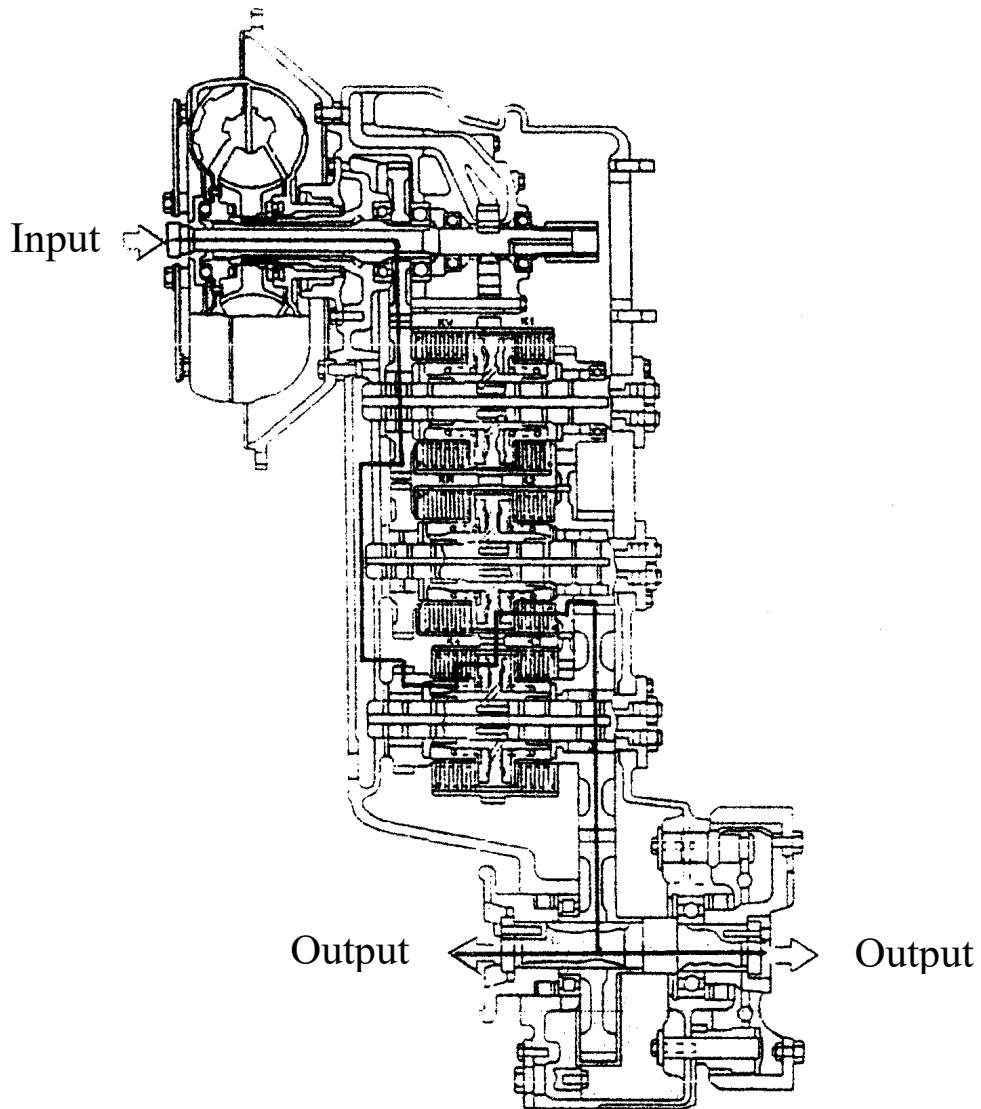
## Forward No.3 Shift



### Operation

- When conducting the operation of forwarding No.3 shift, KV and K2 clutches are engaged. The power transmitted from torque converter to driving gear is transmitted to the output shaft.
- The main and auxiliary friction discs inside the KV shift and K2 shift clutches are compacted by the oil pressure applied into their cylinder block via the piston.
- The power from torque converter is transmitted from driving gear to KV, K1 clutch case and KR, K2 clutch case via the forward shift clutch.
- Because the K2 shift clutch is engaged, so the power transmitted to the K2 clutch case is transmitted from K2 clutch gear to K3 clutch gear and output shaft gear via the K2 shift clutch, then is transmitted to output shaft.

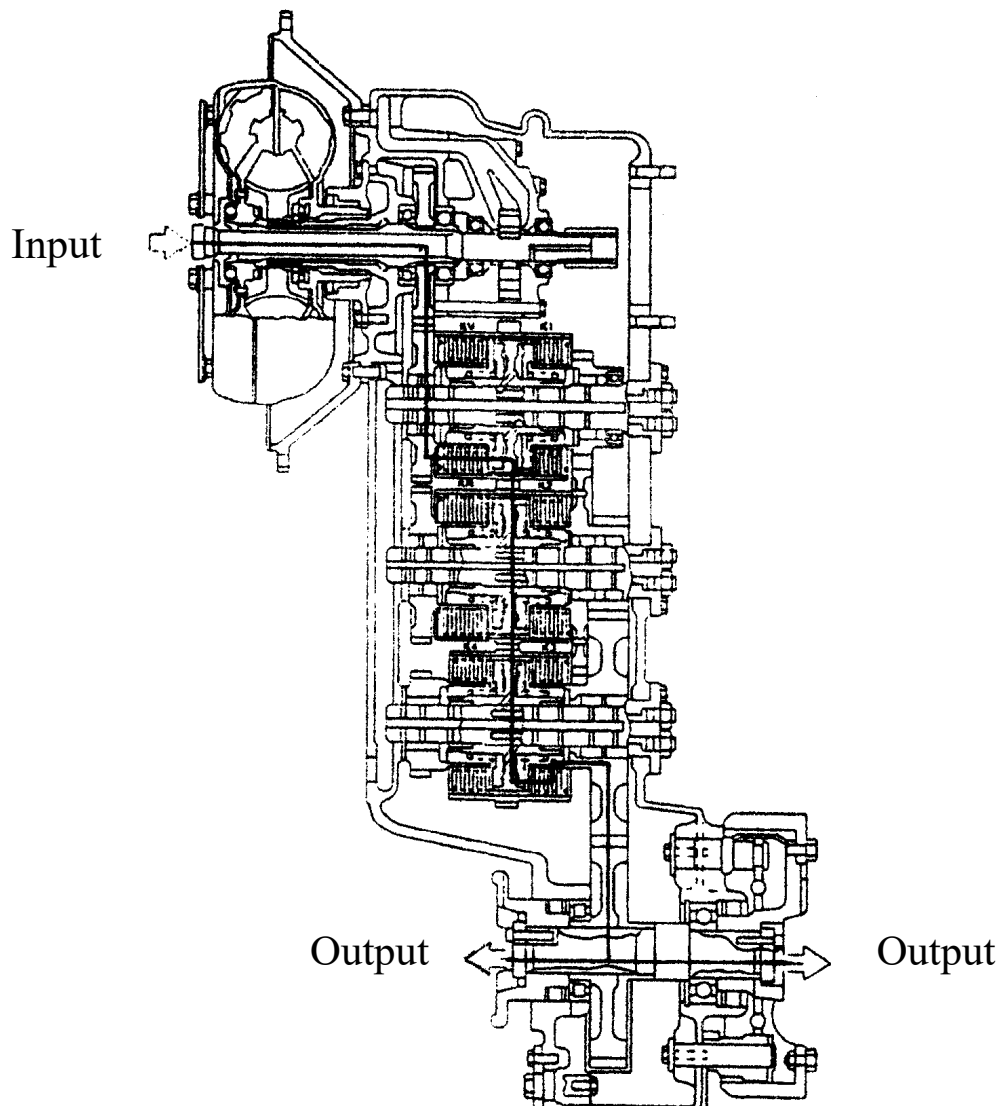
## Forward No.4 Shift



### Operation

- When conducting the operation of forwarding No.4 shift, K4 and K2 clutches are engaged. The power transmitted from torque converter to driving gear is transmitted to the output shaft.
- The main and auxiliary friction discs inside the K4 shift and K2 shift clutches are compacted by the oil pressure applied into their cylinder block via the piston.
- The power from torque converter is transmitted from driving gear to K4 clutch gear via the KV shift clutch gear and counter gear, then is transmitted to KR, K2 clutch case through K4 clutch via K4, K3 clutch case.
- Because the K2 shift clutch is engaged, so the power transmitted to the K2 clutch case is transmitted from K2 clutch gear to K3 clutch gear and output shaft gear via the K2 shift clutch, then is transmitted to output shaft.

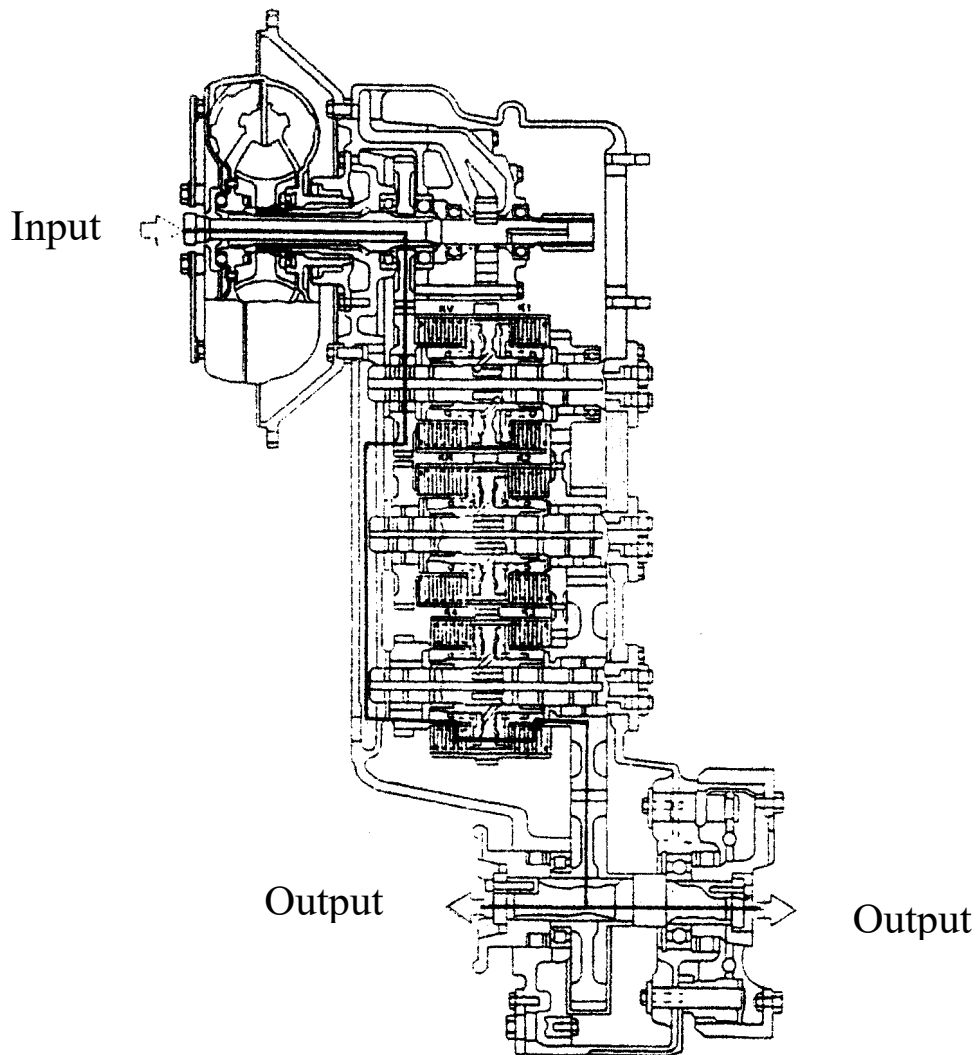
## Forward No.5 Shift



### Operation

- When conduct the operation of forwarding No.5 shift, KV and K3 clutches are engaged. The power transmitted from torque converter to driving gear was transmitted to the output shaft.
- The main and auxiliary friction discs inside the KV shift and K3 shift clutches are compacted by the oil pressure applied into their cylinder block via the piston.
- The power from torque converter is transmitted from driving gear to K4, K3 clutch case through the forward shift clutch via the KV, K1 shift clutch case and KR, K2 clutch case.
- Because the K3 shift clutch is engaged, so the power transmitted to the K3 clutch case is transmitted to K3 clutch gear and output shaft gear via the K3 shift clutch, then is transmitted to output shaft.

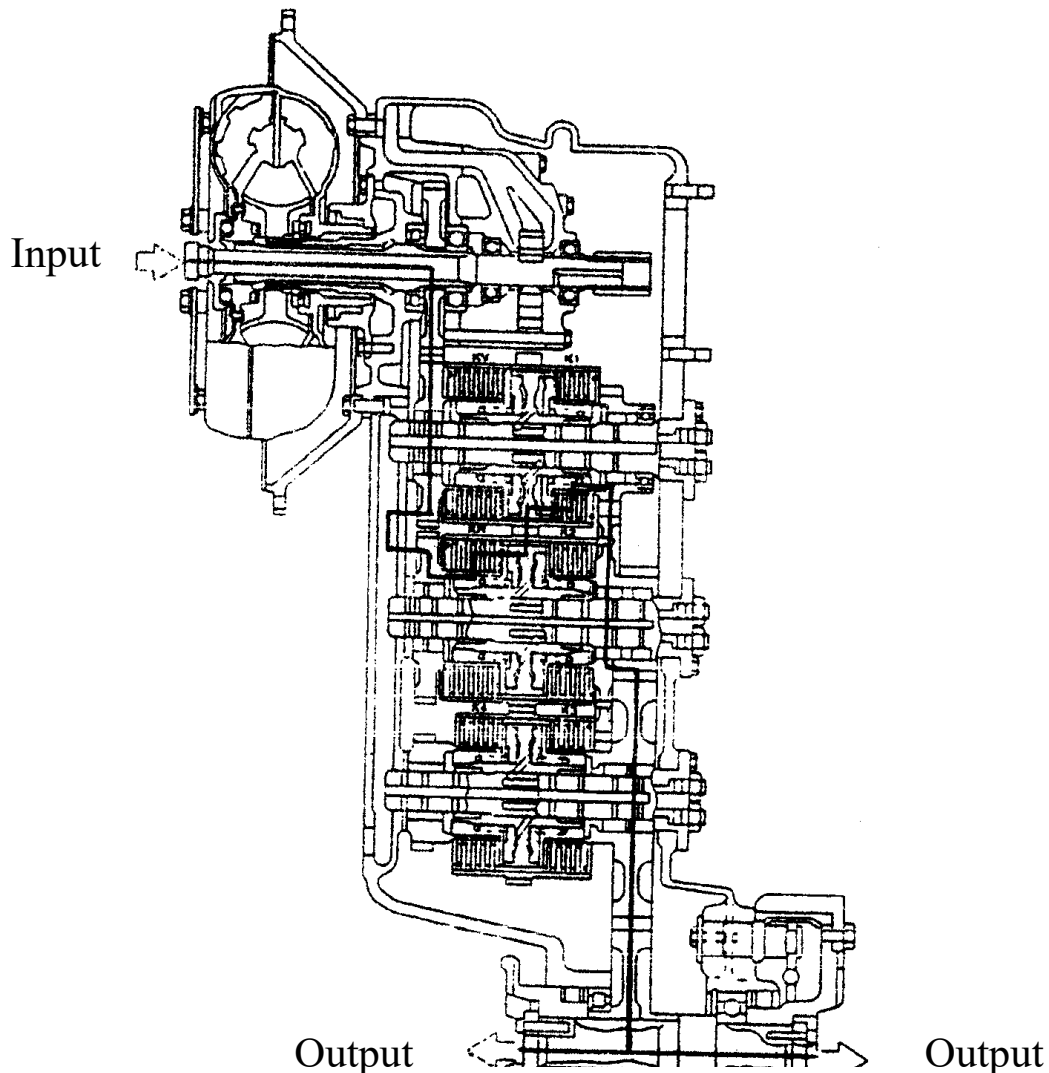
## Forward No.6 Shift



### Operation

- When conduct the operation of forwarding No.6 shift, K4 and K3 clutches are engaged. The power transmitted from torque converter to driving gear was transmitted to the output shaft.
- The main and auxiliary friction discs inside the K4 shift and K3 shift clutches are compacted by the oil pressure applied into their cylinder block via the piston.
- The power from torque converter is transmitted from driving gear to K4 clutch gear via the KV shift clutch gear and counter gear, then is transmitted to K4, K3 clutch case via K4 clutch.
- Because the K3 shift clutch is engaged, so the power transmitted to the K3 clutch case is transmitted to K3 clutch gear and output shaft gear via the K3 shift clutch, then is transmitted to output shaft.

## Reverse No.1 Shift

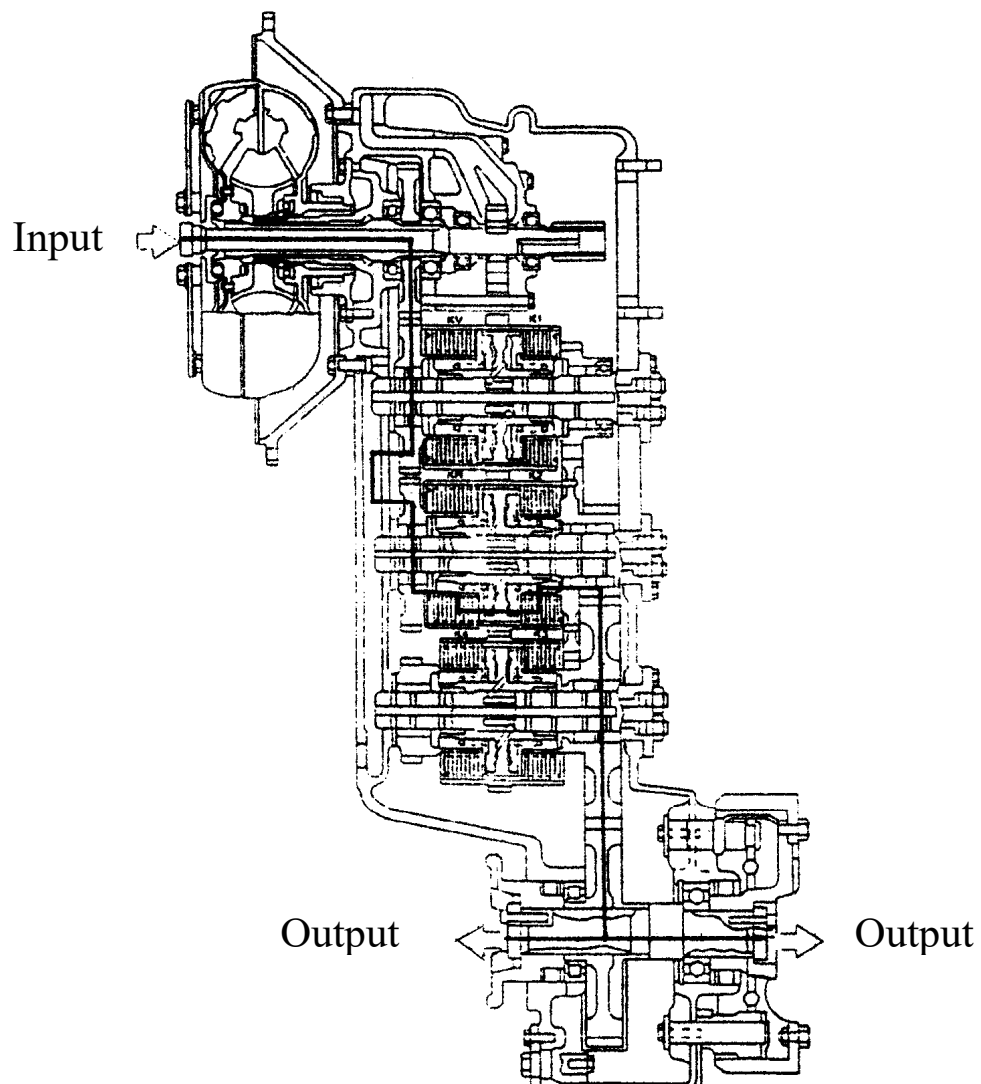


### Operation

- When conduct the operation of reversing No.1 shift, KR and K1 clutches are engaged. The power transmitted from torque converter to driving gear is transmitted to the output shaft.
- The main and auxiliary friction discs inside the KR shift and K1 shift clutches are compacted by the oil pressure applied into their cylinder block via the piston.
- The power from torque converter is transmitted from driving gear to KR, K2 clutch case and KV, K1 clutch case via the KV shift clutch gear and KR clutch gear through KR clutch.
- Because the K1 shift clutch is engaged, so the power transmitted to the forward KV, K1 clutch case is transmitted from K1 clutch gear to K2 clutch gear, K3 clutch gear and output shaft gear via the K1 shift clutch, then is transmitted to output shaft.



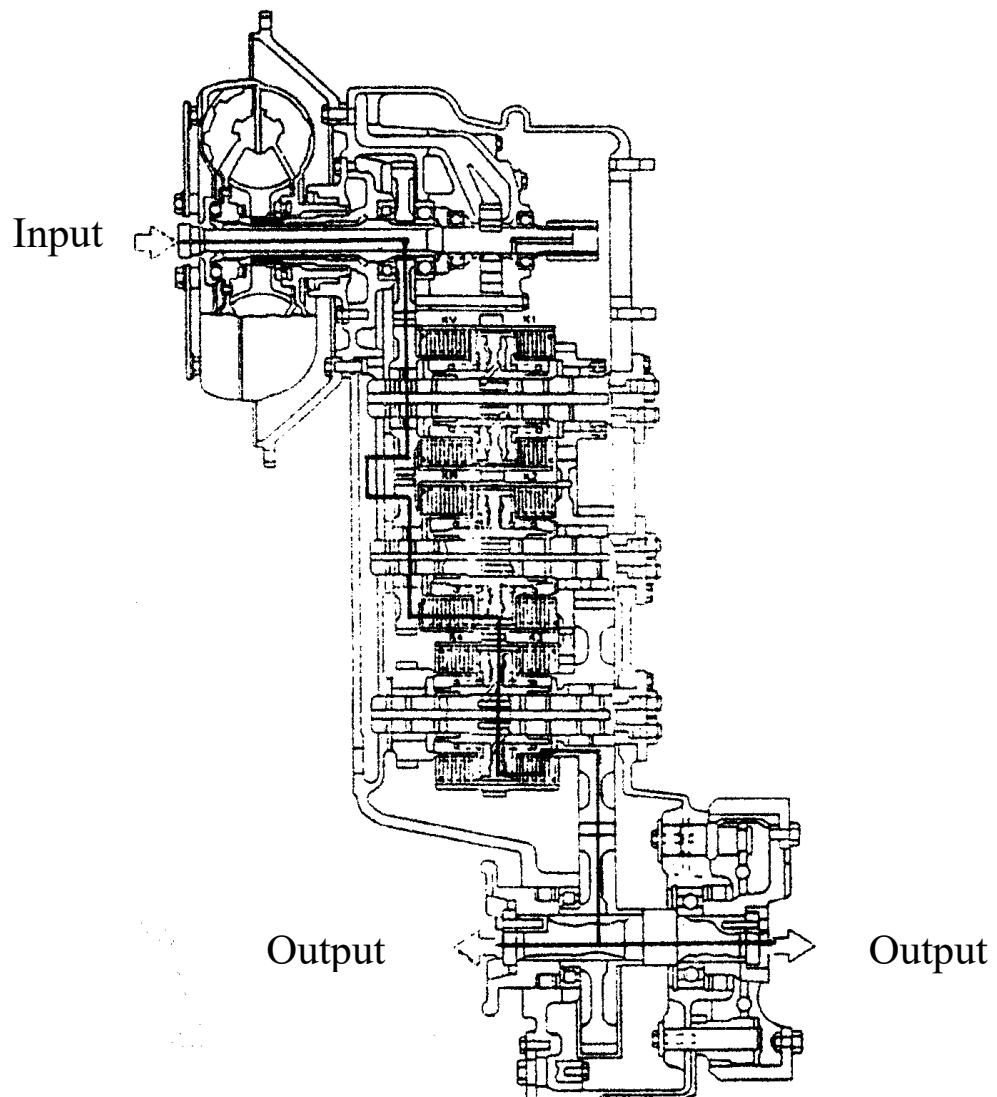
## Reverse No.2 Shift



### Operation

- When conduct the operation of reversing No.2 shift, KR and K2 clutches are engaged. The power transmitted from torque converter to driving gear is transmitted to the output shaft.
- The main and auxiliary friction discs inside the KR shift and K2 clutches are compacted by the oil pressure applied into their cylinder block via the piston.
- The power from torque converter is transmitted from driving gear to KR, K2 clutch case via the KV shift clutch gear and KR clutch gear through KR clutch.
- Because the K2 shift clutch is engaged, so the power transmitted to the forward K2 clutch case is transmitted from K2 clutch gear to K3 clutch gear and output shaft gear via the K2 shift clutch, and then is transmitted to output shaft.

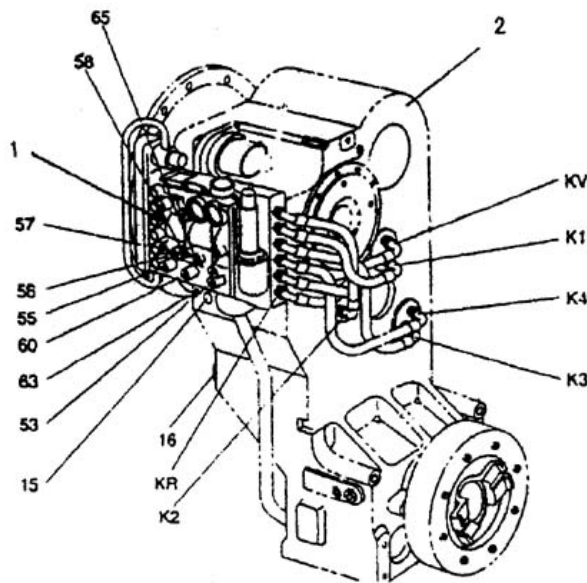
## Reverse No.3 Shift



### Operation

- When conduct the operation of reversing No.3 shift, KR and K3 clutches are engaged. The power transmitted from torque converter to driving gear is transmitted to the output shaft.
- The main and auxiliary friction discs inside the KR and K3 clutches are compacted by the oil pressure applied into their cylinder block via the piston.
- The power from torque converter is transmitted from driving gear to KR, K2 clutch case and K4, K3 clutch case via the KV shift clutch gear and KR clutch gear through KR clutch.
- Because the K3 shift clutch is engaged, so the power transmitted to the forward K3 clutch case is transmitted to K3 clutch gear and output shaft gear via the K3 shift clutch, and then is transmitted to output shaft.

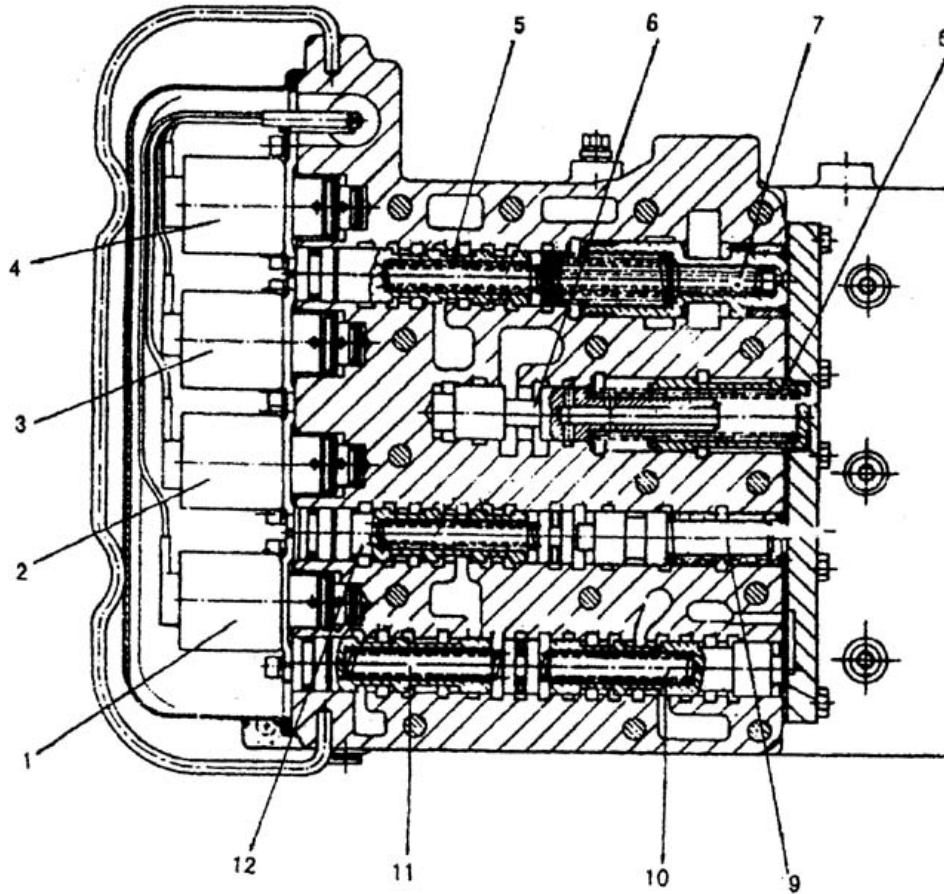
## Control Valve of Gearbox



1. Control Valve of Gearbox	15. To Connection of Oil Radiator	57. Pressure Test Port of 2 <sup>nd</sup> Clutch (K2)
2. Gearbox	16. From To Connection of Oil Radiator	58. Pressure Test Port of 3 <sup>rd</sup> Clutch (K3)
	53. Pressure Test Port of Forward Clutch (KV)	60. Pressure Test Port of 4 <sup>th</sup> Clutch (K4)
	55. Pressure Test Port of Reverse Clutch (KR)	63. Temperature Port of Torque Converter Outlet
	56. Pressure Test Port of 1 <sup>st</sup> Clutch (K1)	65. Pressure Test Port of Main Pressure Control

### General Description

- The oil from pump enters into the gearbox control valve through the oil filter. The oil is distributed through the main pressure control valve, then flows into the solenoid valve manipulator loop and clutch manipulator loop, respectively.
- The oil pressure flows into the solenoid valve loop is regulated by the main pressure control valve, that is when the solenoid valve switches on and switches off, it will control the oil pressure of each shift slid valve.
- The increase of pressure of oil that flows into clutch manipulator loop through main pressure control valve is regulated by the regulator valve. The oil is use to manipulate the clutch. The oil releases from the main pressure control valve will supply the torque converter.
- Through the action of quick return valve and accumulator, the regulator valve smoothly increase the oil pressure of clutch when the switch of shift, so reduce the impact during the switch of shift.



1. Solenoid Valve (M1)  
 2. Solenoid Valve (M2)  
 3. Solenoid Valve (M3)  
 4. Solenoid Valve (M4)

5. Shift Valve  
 6. Regulator Valve  
 7. Main Pressure Control Valve  
 8. Accumulator

9. Quick Return Valve  
 10. Shift Valve  
 11. Shift Valve  
 12. Shift Valve

## Gearbox Solenoid Valve

### Function

- When operate the transmission manipulator handle to conduct forward and reverse each shift, the electric signal is sent to the four solenoid valves mounted on the gearbox control valve to control the slid valve of each shift according to the open and close solenoid combination.

### Operation

#### 1. Solenoid Valve Switch Off

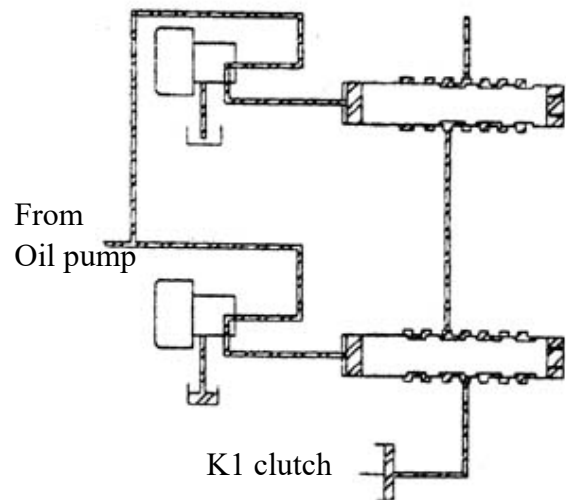
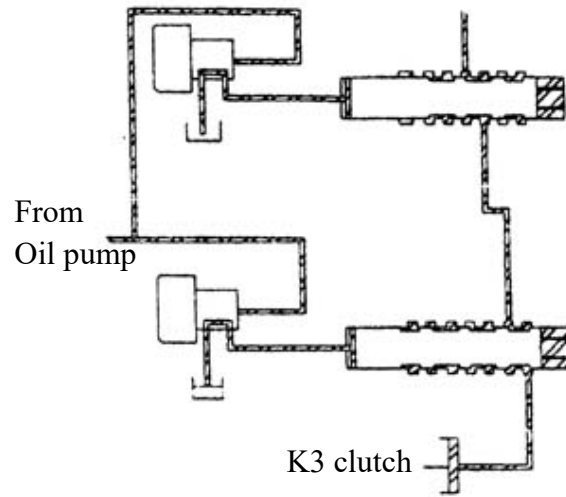
The oil from oil pump is blocked by the solenoid valve, which make the shift slid valve is moved to left side under the action of spring force, consequently the oil at the port E flows into the K3 clutch.

#### 2. Solenoid Valve Switch On

When operate the transmission manipulator handle, the solenoid valve will block the drain port and switch on the oil from oil pump to port A and B of shift slid valve, the slid valve is moved to right side due to the action of oil pressure overcomes the spring force, consequently the oil from oil pump is flowed to the K1 clutch.

**Operation Chart of Solenoid Valve and Clutch**  
 ● : Current Action

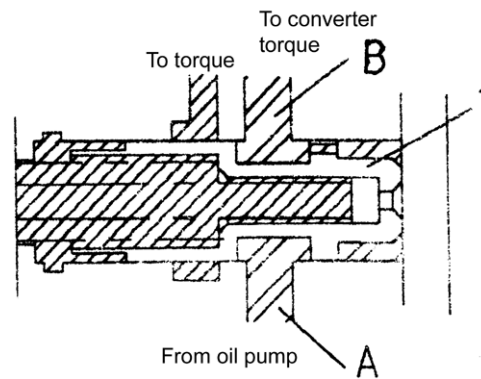
Shifts	Solenoid Valve			
	M1	M2	M3	M4
Forward 1 <sup>st</sup> Shift		●	●	●
Forward 2 <sup>nd</sup> Shift	●	●		●
Forward 3 <sup>rd</sup> Shift			●	●
Forward 4 <sup>th</sup> Shift	●			●
Forward 5 <sup>th</sup> Shift			●	
Forward 6 <sup>th</sup> Shift	●			
Neutral				
Reverse 1 <sup>st</sup> Shift	●	●	●	●
Reverse 2 <sup>nd</sup> Shift	●		●	●
Reverse 3 <sup>rd</sup> Shift	●		●	



## Main Pressure Control Valve

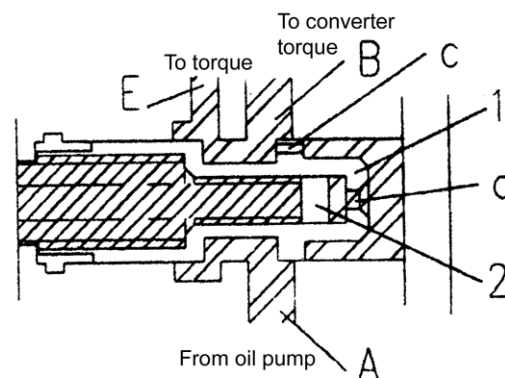
### Function

- The main pressure control valve regulates the oil pressure flowed to the clutch loop and solenoid valve loop and distributes the oil flow between the clutch loop and torque converter.



### Operation

1. The oil comes from the oil pump enters into the main pressure control valve, the oil will pass through the port A and port B and flow to the shift valve when the oil pressure is lower than the specified pressure of main pressure control valve (1).
2. If the oil pressure is higher than the specified value, the oil passing through the throttle port c and d of main pressure control valve (1) will push the valve cartridge (1) to left and release the oil to port E and keep the pressure under specified value. The oil releases from port E will flows to torque converter.



## Quick Return Valve and Regulator Valve

### General:

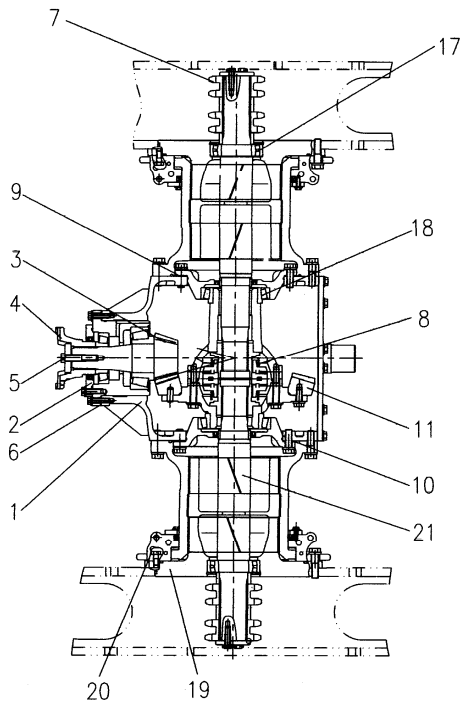
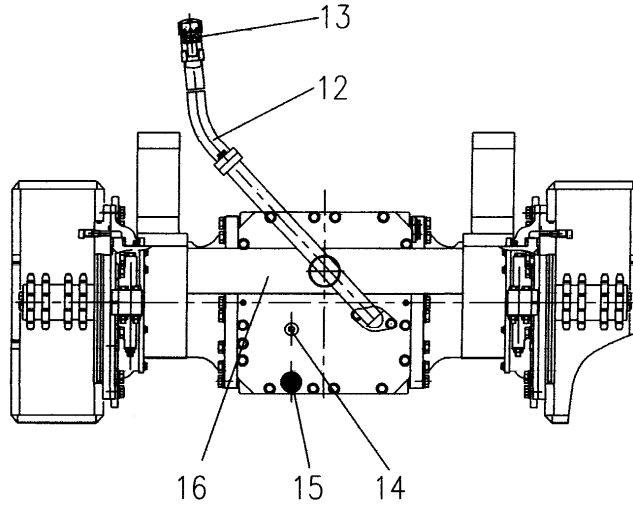
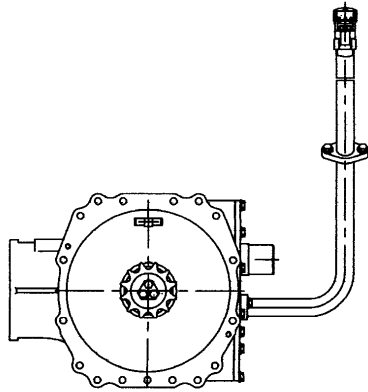
- The purpose of quick return valve is to make the regulator valve smoothly increase the pressure of clutch. Quickly reset to transmit the pressure inside the accumulator to apply into the pressure regulator valve. When the gearbox switches the shift, the loop will be drained instantaneously.

The regulator valve is mainly composed of pressure regulator valve and accumulator.

When shift operation changes the speed, the clutch is compacted by the piston. If the oil pressure is suddenly increased, the piston makes the clutch engaged abruptly and wheel is started suddenly, which adds extra impact and the installation of quick return valve and regulator valve avoid such situation. When the manipulator shift changes the speed, the pressure on the piston is increased gradually until reach the setting pressure. When starting, the purpose of such device is to make the clutch engage smoothly and avoid impact, which not only increase the durability of gearbox, but also make the operator more comfortable.

# Rear Transaxle

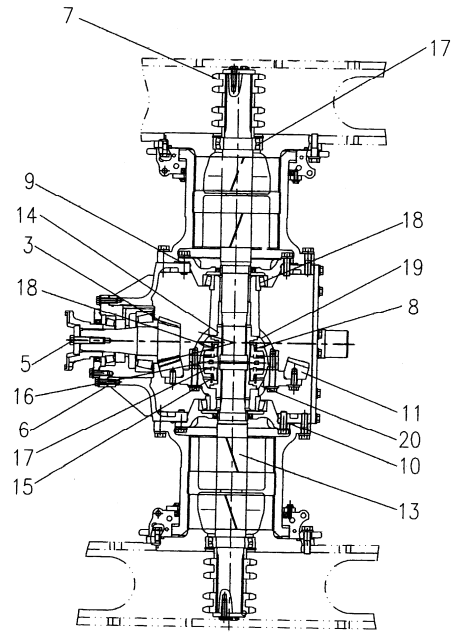
## Anti-slid Differential



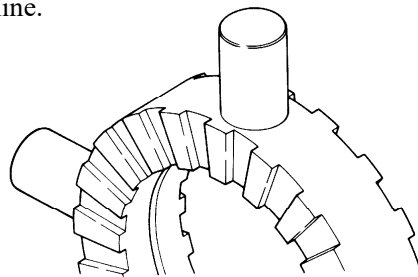
1. Transaxle Housing
2. Cover
3. Main Screw Bevel Gear
4. Joint
5. Bolt
6. Washer
7. Chain Wheel
8. Anti-slip Device
9. Shim
10. Shim
11. Large Bevel Gear
12. Oil Pipe
13. Vent Valve
14. Oil Level Plug
15. Drain Plug
16. Swing Frame
17. Bearing
18. Bearing
19. Flange
20. Transaxle Case
21. Halfshaft



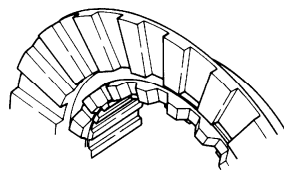
- The power passes through engine → Joint → gearbox, then passes through the main screw bevel gear (3) and large bevel gear at proper angle, then transmit to drive differential case (19) and (20). When the differential case (19), (20) was driven, the cross (8) is moved and drive halfshaft (13) and (12). Use the bolt (5) to adjust the preload of main screw bevel gear (3). The gear surface contact length, clearance and preload of large screw bevel gear (11) can be adjusted by using of the adjusting shims (6), (9) and (10). For the vehicle equipped with such differential lock device, when change the driving direction of vehicle, one side of vehicle rotate quickly and other side rotate slowly. For example, if turning left, the right wheel should rotate faster than the left wheel; otherwise the vehicle can't turn smoothly. Meanwhile, due to the installation of differential device, it will ensure the wheel will automatic adjust the rotation speed of right and left wheel according to different resistance on the ground. In such way, the vehicle can turn left smoothly.
- The differential lock device is composed of the following parts: cross (8) with gear is mounted at left and right end, the middle engaging wheel is mounted in the middle as one integer; gears on both surfaces, one surface is engaged with driven clutch (18) and other surface is engaged with cross, they all are connected together through the side gear and spline.



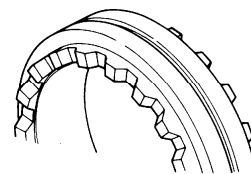
Cross holder



Driven clutch



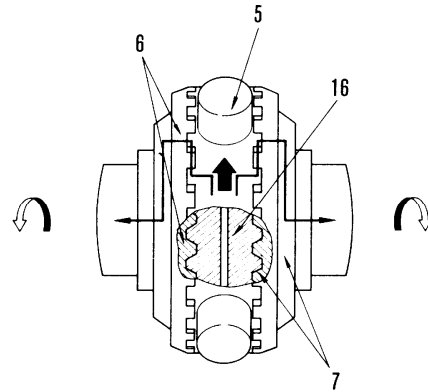
Intermediate gear



## Working Principle of Differential Device

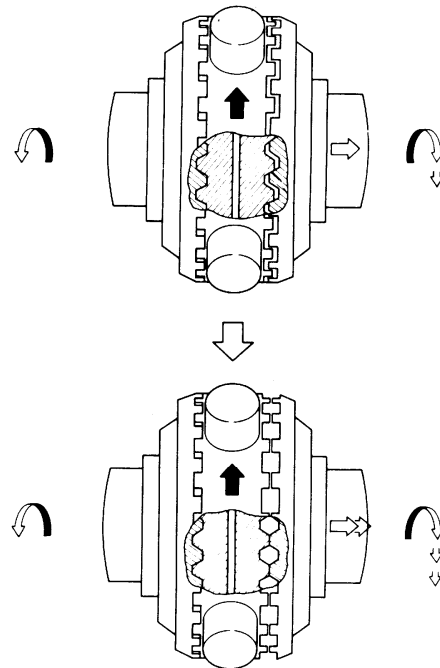
### 1. Straightly Drive:

- The left and right driven clutches (6) and (7) engage with cross (5) and middle engaging wheel (16). The power is transmitted to cross through main screw bevel gear and transmitted to left and right wheels through the side wheel to keep the same speed of left and right wheels.
- The engaging gear is engaged with driven clutch without clearance, meanwhile, the interior gears on the driven clutch keeping gear side clearance with the gears on the cross.

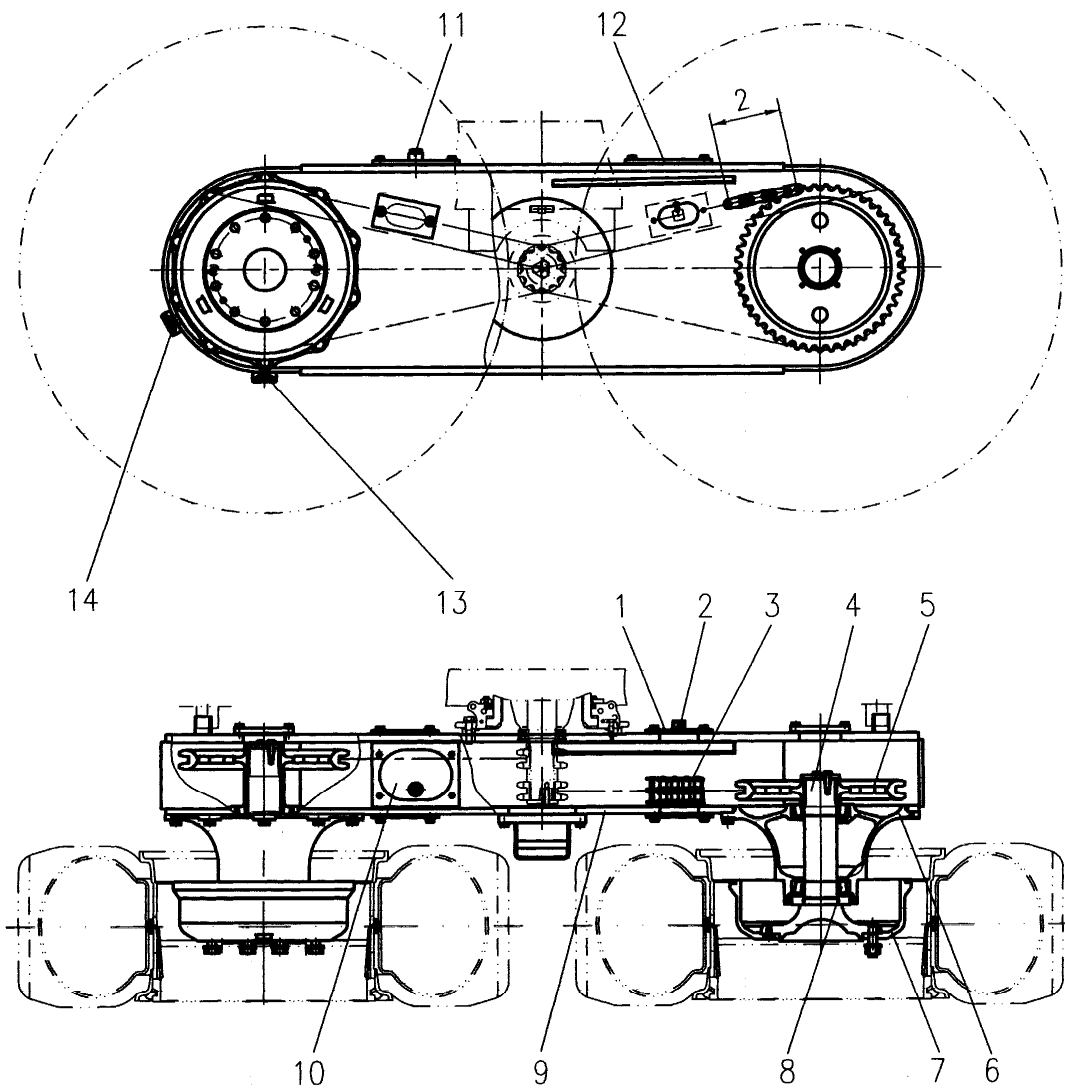


### 2. Non-straightly drive (e.g. turn left)

- When the vehicle turning, the outside (right side wheel) wheel must rotate faster than the inside wheel (left side wheel), at that time, the left and right wheels (driven clutch) need keep different rotation speed due to the effect of ground resistance.
- Left and right driven clutches (6) and (7) are engaged with cross (5) through large gear side clearance. The driven clutch (6) is affected by the ground resistance and the gear side clearance, so it ensures the driven clutch rotates with the different rotation speed with the cross. The ground resistance simultaneously applies into middle engaging wheel (16) and driven clutch wheel gear, this wheel gear slid and push the driven clutch forward outside. When this wheel gear stop slid and fix on two sides of wheel gear, the clutch gear will separate completely and the right drive clutch will freely rotate.
- So, the outside wheel will freely rotate when drive along curve and the power only just transmits to inside wheel.



# Balanced Housing



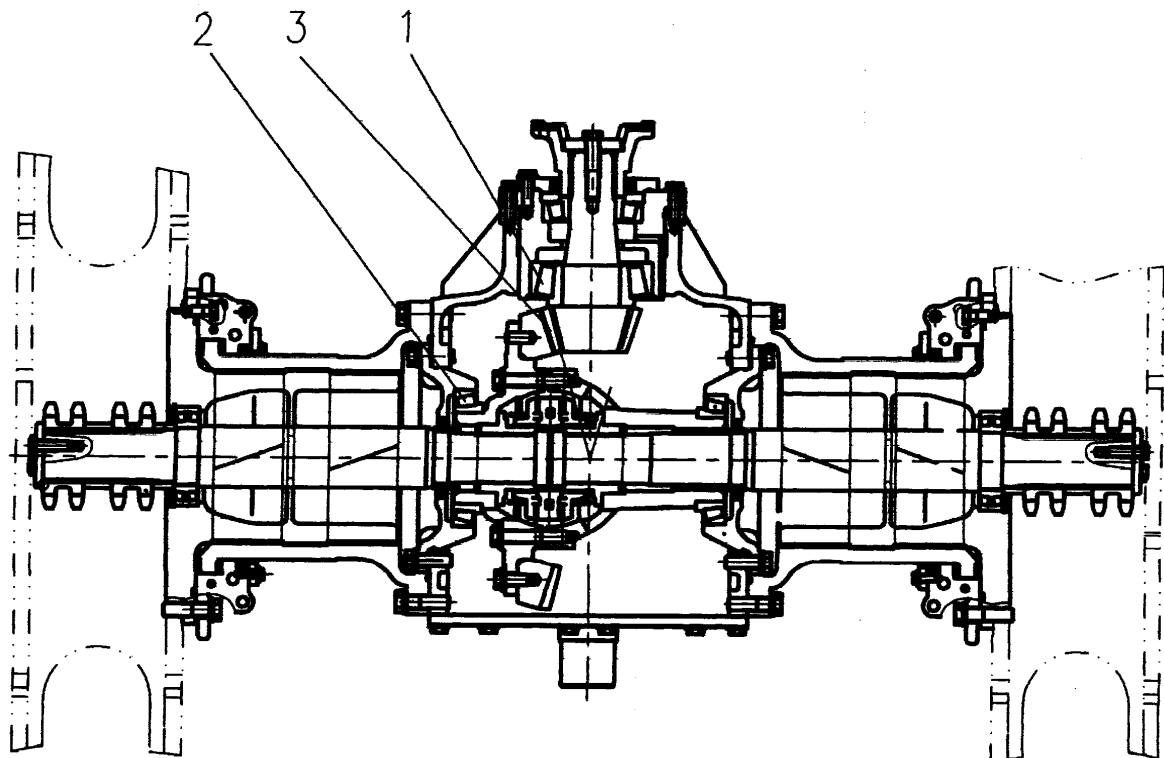
- 1. Cover
- 2. Vent Valve
- 3. Chain
- 4. Hub Axle
- 5. Chain Wheel
- 6. Casing
- 7. Brake Drum
- 8. Bearing
- 9. Balance Housing
- 10. Cover
- 11. Refill Port
- 12. Cover
- 13. Drain Plug
- 14. Oil Level Plug

# **Transmission System**

## **2. Maintenance Standard**

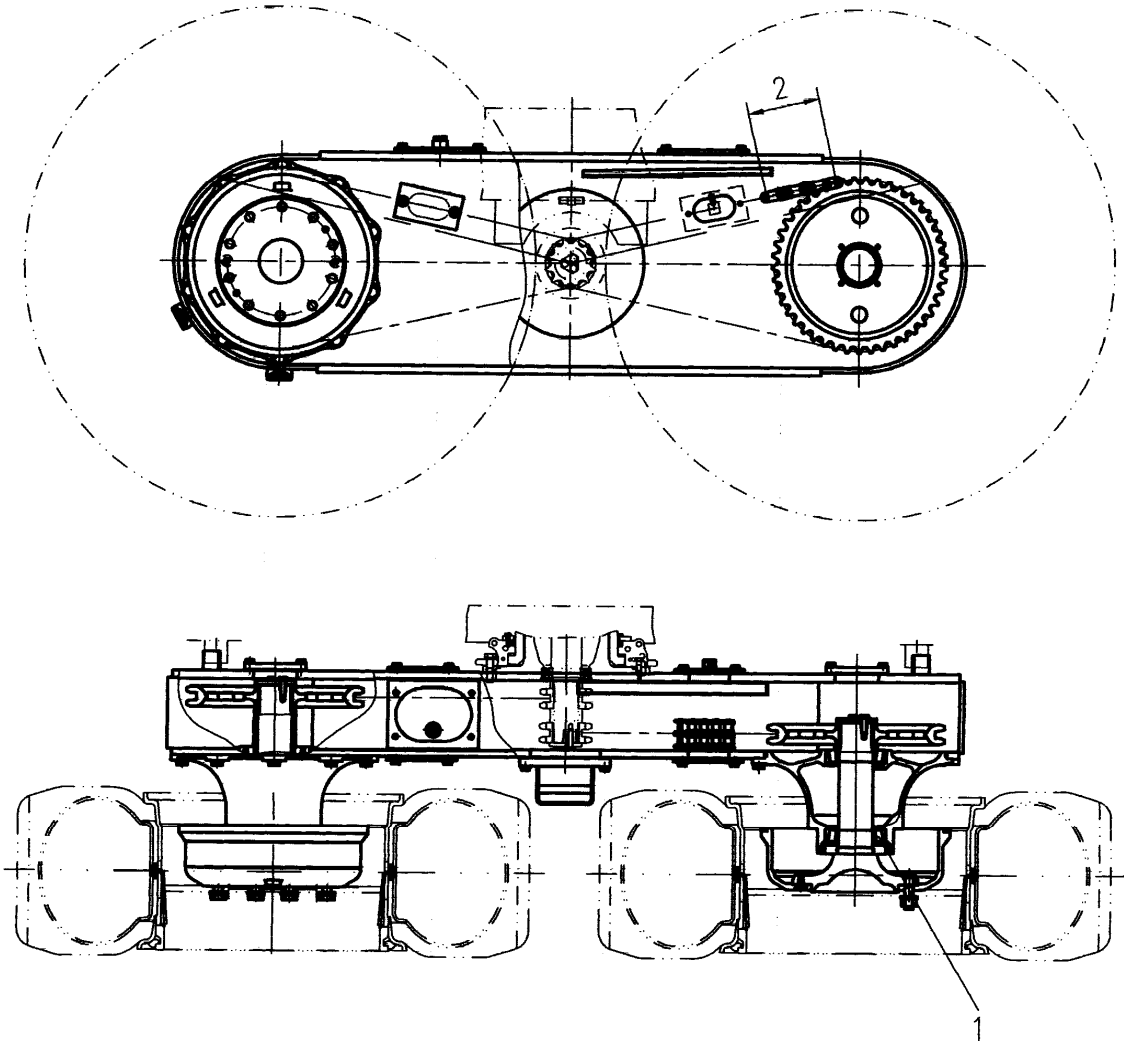
Rear Transaxle -----	20-50
Balanced Housing -----	20-51

## Rear Transaxle



Serial No.	Inspection Items	Requirements		Action
1	Preload of main screw bevel gear bearing	Starting torque: 8.8~11.8 N·m		Adjustment
2	Preload of large screw bevel gear bearing	Turn the main screw bevel gear and matching gear, adjust bearing, measuring the starting torque 9.6~13.4 N·m		
3	Tooth clearance between the large screw bevel gear and main screw bevel gear	Tolerance	Repair Limit	
		0.25~0.33	1.3	

# Balanced Housing



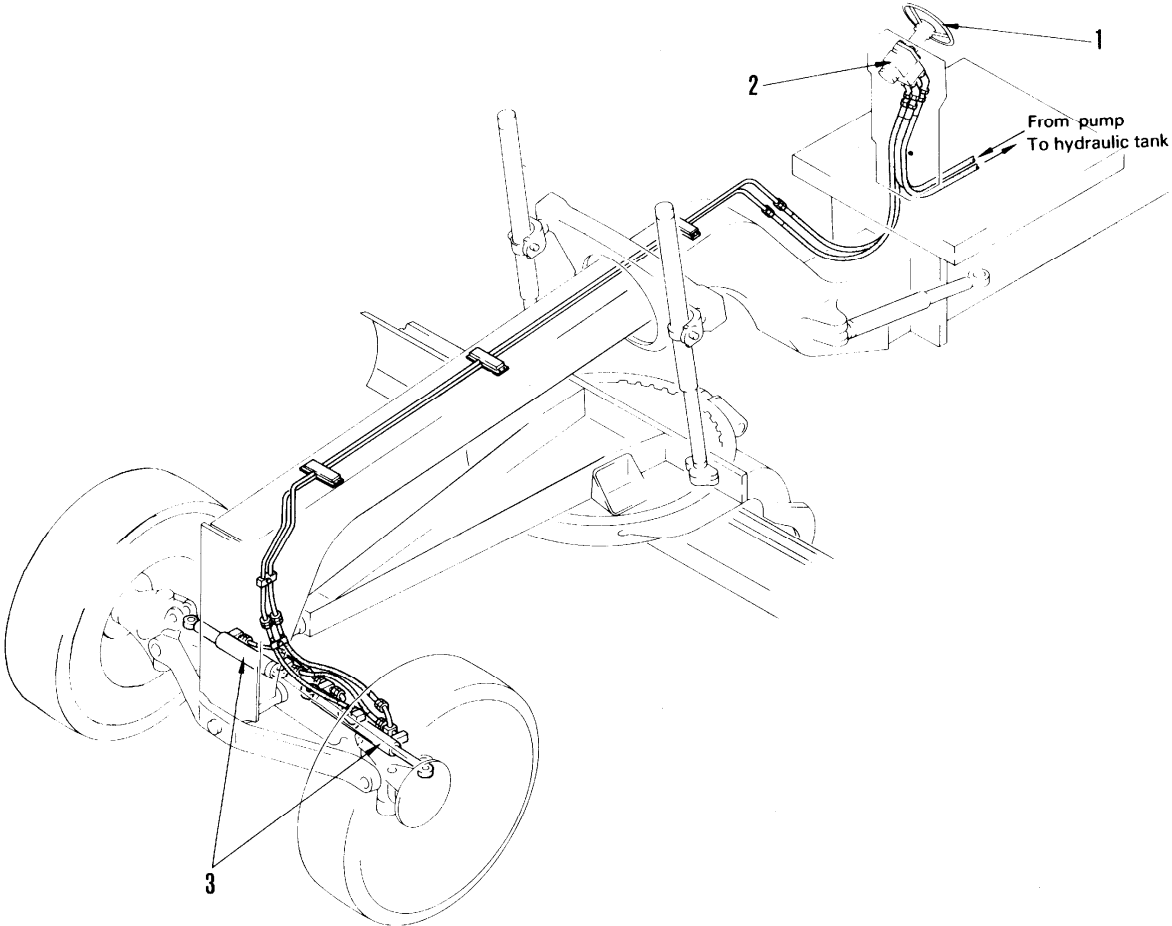
Serial No.	Inspection Items	Requirements		Action
1	Preload of hub bearing	Rotation torque: 11.5~16.5 N·m		Adjustment
2	The extension of chains (10 knots)	Standard Dimension	Repair Limit	Replacement
		317.5	322.3	

# Steering System

## 1. Structure and Function

Steering Pipeline -----	20-53
Steering Principle Diagram -----	20-54
Front Axle -----	20-60
Steering Cylinder -----	20-63
Tire -----	20-64

# Steering Pipeline

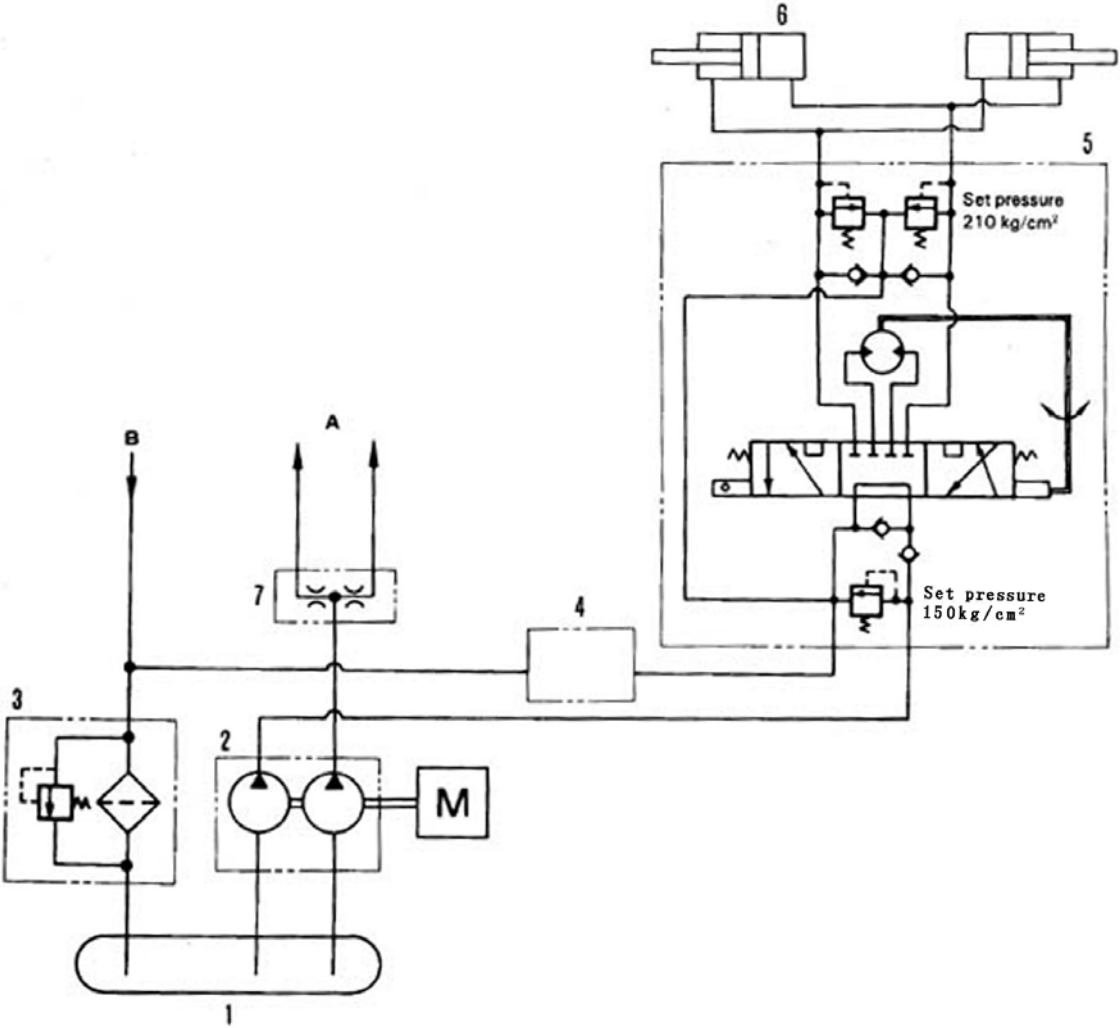


The grader adopts the hydraulic control steering system. The pressure oil is enters into cylinder (3) through the steering gear (2) when the steering wheel turning and the working hydraulic oil is also used to steering system.

- 1. Steering Wheel
- 2. Steering Gear
- 3. Steering Cylinder

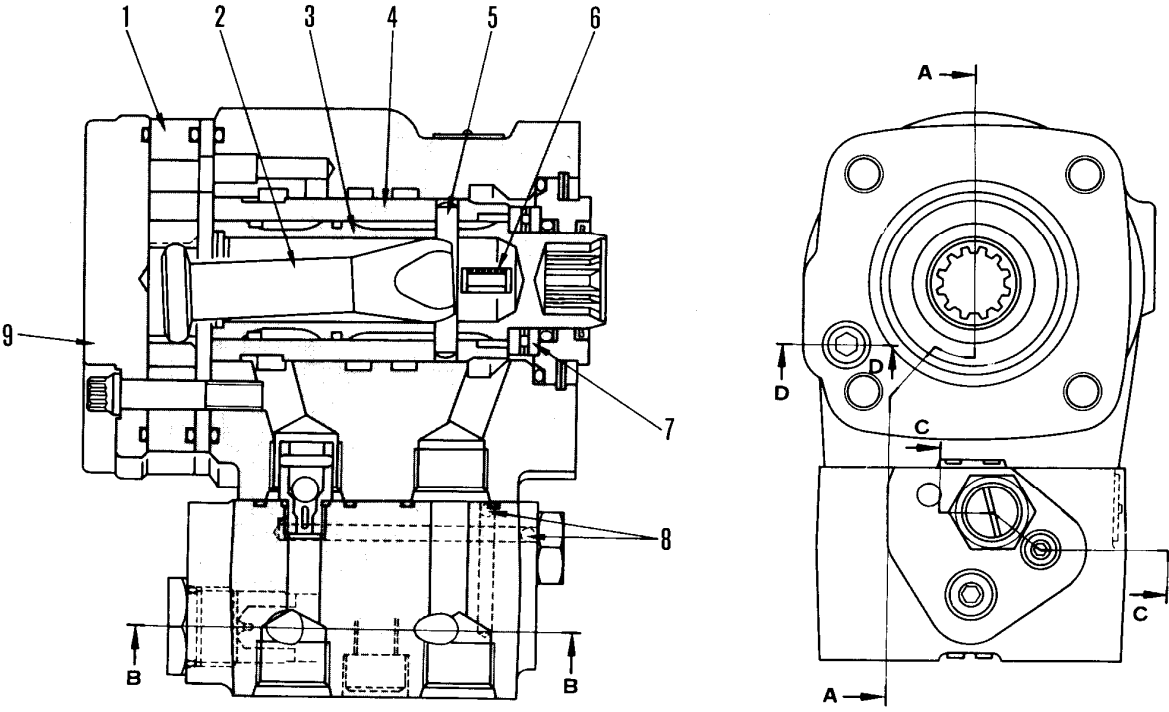


# Steering Principle Diagram



- 1. Hydraulic Oil Tank
- 2. Hydraulic Steering Pump
- 3. Hydraulic Oil Filter
- 4. Main Force Loader
- 5. Steering Gear
- 6. Steering Cylinder
- 7. Dividing Valve
- A. To Hydraulic Oil Loop
- B. From Hydraulic Oil Loop

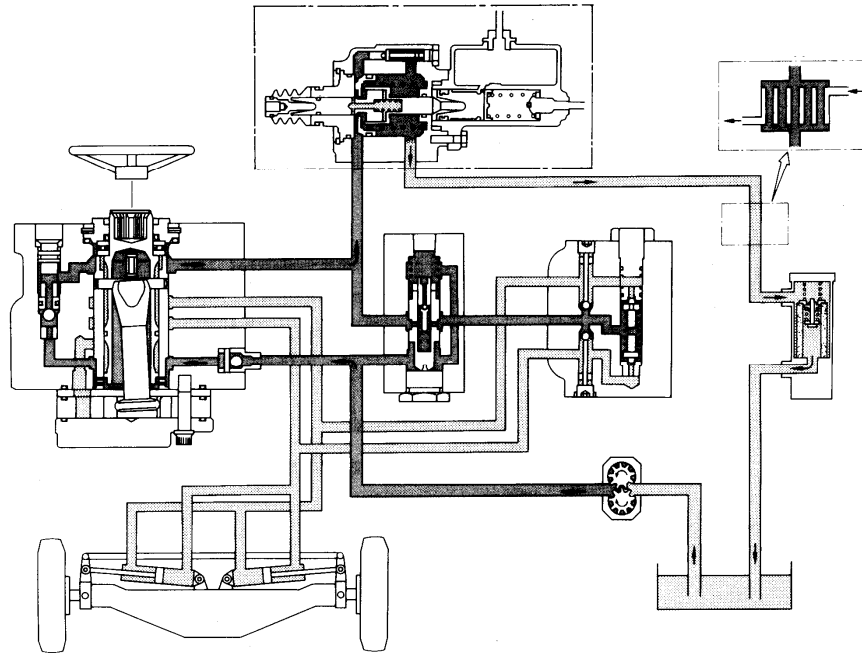
# Steering Gear



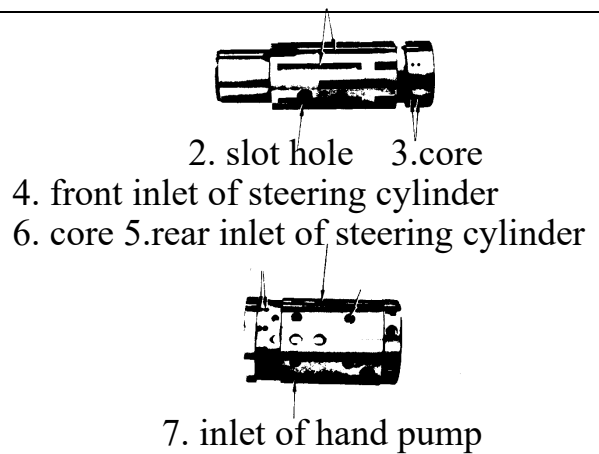
- |                      |                      |                   |
|----------------------|----------------------|-------------------|
| 1. Rotor Assembly    | 4. Valve Sleeve      | 7. Roller Bearing |
| 2. Interactive Shaft | 5. Pawl Pin          | 8. Check Valve    |
| 3. Valve Cartridge   | 6. Spring Lamination | 9. Rear Cover     |

## Operation

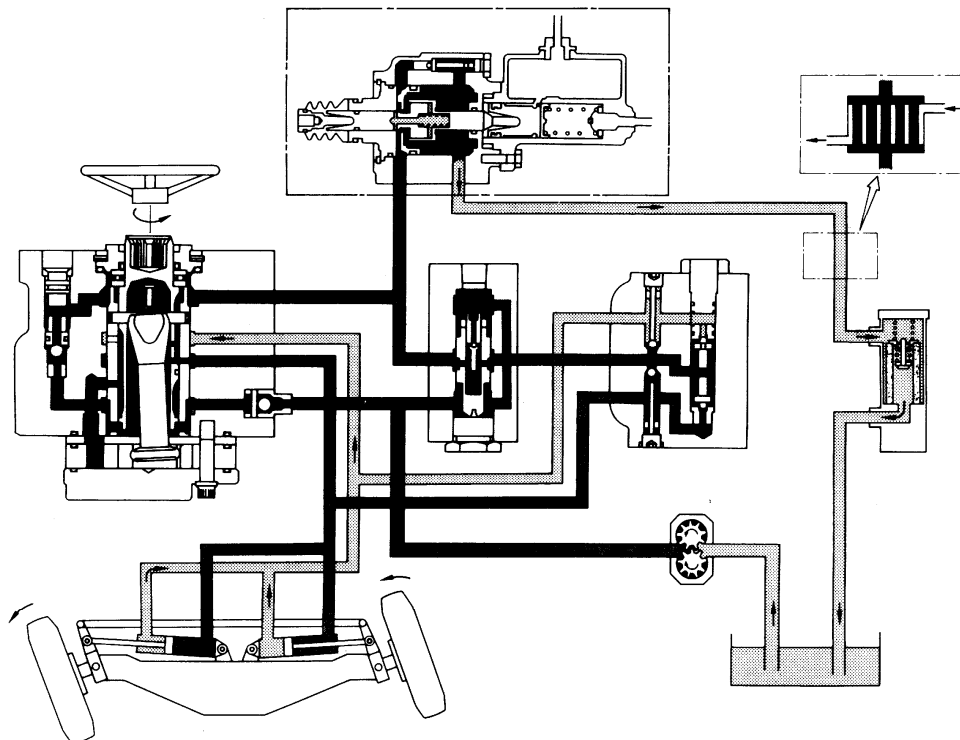
When doesn't turn the steering wheel:



When the steering wheel doesn't turn, the spring lamination makes the valve cartridge and valve sleeve stop at the central position of slot of valve cartridge that its pawl pin was fixed. In such case, the oil ports that connecting valve sleeve with steering cylinder and manual pump are all isolated with the longitudinal slots of valve cartridge, meanwhile, the little holes in the bottom of valve cartridge are corresponding with the holes in the valve sleeve (totaling 24 holes distributing with equal-space in the 12 double-hole plates of surfaces of valve cartridge or valve sleeve). The oil enters into intake port of steering gear from steering pump, and flows to the inside of valve cartridge through the valve cartridge and valve sleeve. After the oil is circulated, it flows outlet port of steering gear from the slot of valve cartridge and return to oil tank.

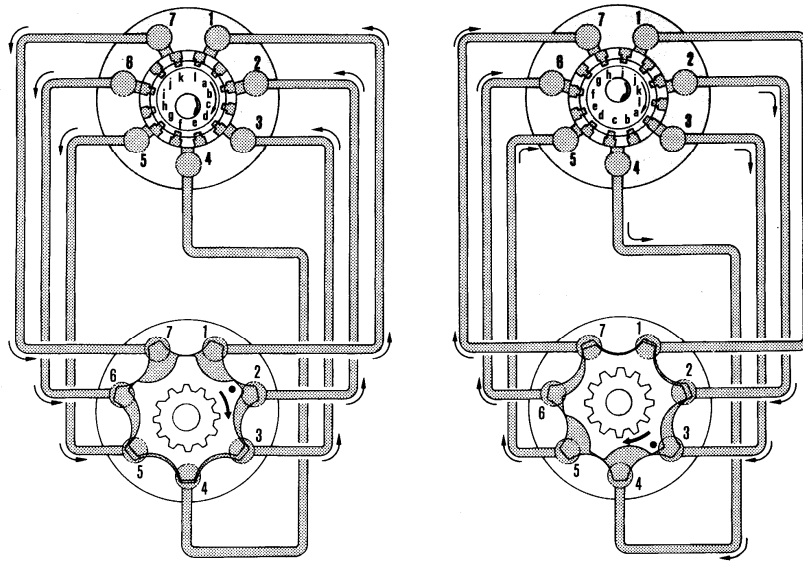


## When the steering wheel turning (turn left)



- When the steering wheel turns left, the turning bring the match of spline, cause the steering shaft also turns left. Because the valve sleeve is connected with valve cartridge by using of spring laminations, the valve cartridge compact the spring laminations, bring about the turning angle difference between the valve sleeve and valve cartridge, which make all holes in the valve sleeve are all connected with slots of valve cartridge.
- In such case, the manual pump oil port of valve sleeve is connects with steering cylinder oil port (at left steering side) in the direction of valve cartridge through the valve cartridge, and the steering cylinder oil port (at the right steering side) of valve sleeve is connected with valve outlet port of valve sleeve.
- The oil enters into the manual pump from oil pump through steering gear inlet port and returns to the valve sleeve. After the oil is circulated, it flows into steering cylinder from valve cartridge slot through the oil port of steering cylinder inside the valve sleeve, meanwhile, the oil come from steering cylinder is compressed back to oil tank through valve sleeve oil hole and valve cartridge slot.
- Under the above situation, the hydraulic oil inside the oil pump rotates the manual pump, which is similar to an oil motor, to reduce the manipulation force of steering wheel. When the steering wheel stops rotation, the rebound force of spring lamination make the rotation angle difference between the valve sleeve and valve cartridge to change. The case of “Steering wheel doesn’t turn” abovementioned is same.

## Connect the manual pump oil port to valve sleeve oil port



- The connecting diagram of manual pump oil port (seven holes) to valve sleeve oil hole (12 holes) is illustrated. When the steering wheel turns right side, the oil holes a, c, e, g, i and k are connected with pump through the valve cartridge slot. In the same way, the oil holes b, d, f, h, j and l are connected with steering cylinder.
- Under the situation shown in Figure 1, the manual pumps 1, 2 and 3 are under the status of oil output, at that time, such oil ports are just connect with valve sleeve oil ports 1, b and d, respectively. The oil is transmitted to the oil cylinder through these oil ports. In additionally, manual pump oil ports 5, 6 and 7 are under the status of oil intake, they are just connecting with valve sleeve oil ports g, i and k, respectively. The oil come from steering pump is intakes through these oil ports. When the steering wheel turns 90° as per the direction shown in Figure 1, the connecting diagram 2 illustrates the connection between the manual pump oil port and steering oil port, under such case, the manual pump oil ports 1, 2 and 3 are just connect to the valve sleeve oil ports i, k and a in which the oil is under the status of intake. At the same time, the manual pump oil ports 5, 6 and 7 are just connecting to the valve sleeve oil ports d, f and h in which the oil is under the status of output.



Inlet and outlet

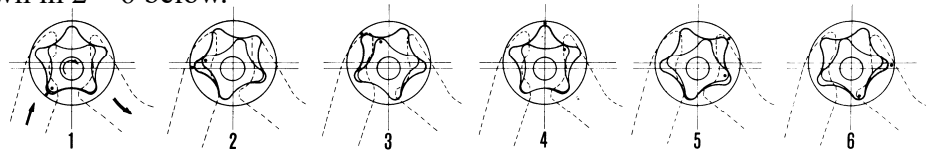


- As abovementioned, the manual pump oil ports that under oil output status are connect to the valve sleeve oil ports that flow to steering cylinder, respectively; at the same time, the manual pump oil ports that are under the status of oil intake are connect to valve sleeve oil ports that flow to steering oil pump, respectively. When the faults of engine or oil pump result in the output of steering oil pump stop, the manual pump is intakes oil from oil tank due to the pressure and transmit the oil to steering cylinder that manipulate the steering operation, in such way, the necessary steering operation can still be maintained.

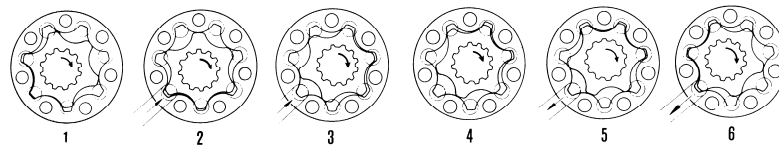
- The other function of manual pump is regulating the output oil during operation period. In fact, the oil come from the steering oil pump must pass through the manual pump, because the steering wheel of interior gear of manual pump will forward one teeth when it rotate  $1/7$  circle, the interior gear push to output the corresponding oil, the oil output flow is direct proportion to the steering angle of steering wheel. When faults occurred in the engine or steering cylinder, the manual pump still has such function, so the normal oil output can still be maintained.

### The comparison between cycloidal pump and steering gear manual pump

- The intake oil ports and the output oil ports are independent in the cycloidal pump. When the oil pump shaft turns to the position shown in the figure below, the oil pumps will intake oil from intake oil port and output oil from output port. The operation sequence is shown in 2~6 below.

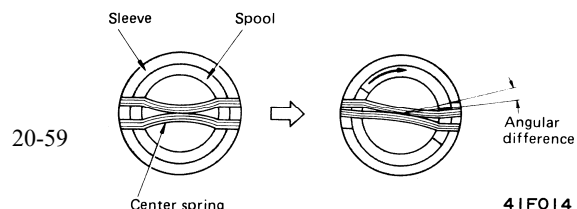


- In manual pump, the input/output ports of oil pump are distributed in the gear tooth of interior gear. When the oil pump rotates, the oil port shown in figure below will connect to steering oil pump according to the step 2 and step 3 and connect to steering cylinder according to the step 5 and step 6, which will transmit the oil to oil cylinder and the 7 holes independently and uniformly intake and output oil.

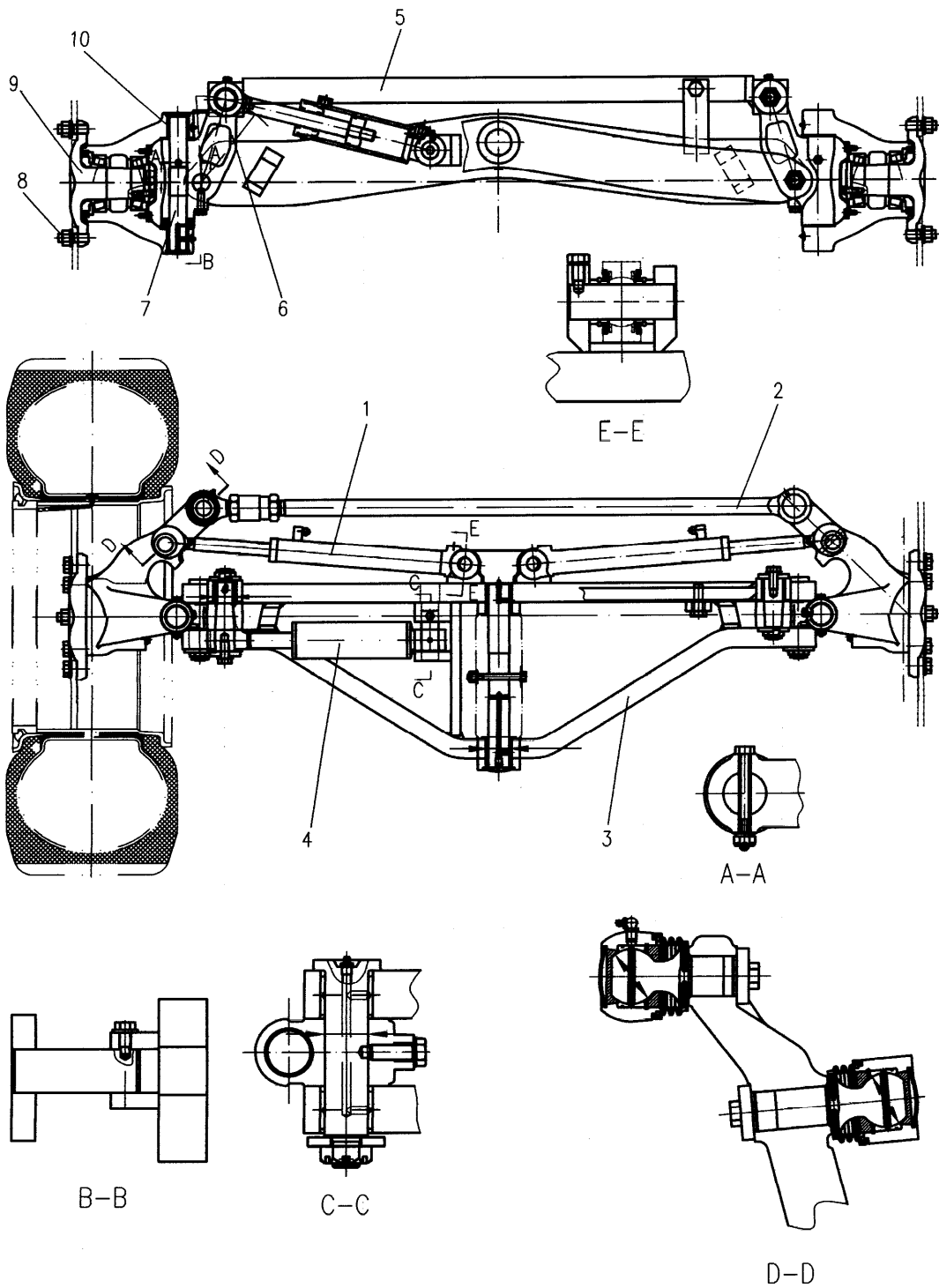


### The function of spring lamination

- X type spring lamination is composed of three-leaf spring, which is shown in figure below. The X type spring lamination installed in the valve sleeve and valve cartridge. When the steering wheel turns to another side, the valve cartridge compresses the spring lamination. Because the X type spring lamination increase the angle difference between the valve sleeve and valve cartridge, which make the valve sleeve oil port connects to valve cartridge oil port, so the oil will pass through oil port and flow into steering cylinder. When the steering wheel stops turn, the manual pump will also stop turn, so the oil channel that flows to steering cylinder is closed and the oil pressure increases until the main overflow valve opens and the oil is output. To avoid the oil pressure increase unnecessarily, the spring lamination returns to original status, which make there has no angle difference between the valve cartridge and valve sleeve, then the same situation has mentioned in the “When the steering wheel doesn’t turn”.



# Front Axle



Inward Incline:  $5.0 \pm 1.0$  mm  
 Outward Incline:  $0^\circ$   
 Main Pin Incline Angle:  $0^\circ$

- |                      |                           |
|----------------------|---------------------------|
| 1. Steering Cylinder | 6. Support                |
| 2. Link Rod          | 7. Central Vertical Shaft |
| 3. Front Axle        | 8. Hub Nut                |
| 4. Incline Cylinder  | 9. Hub Axle               |
| 5. Incline Rod       | 10. Sleeve                |

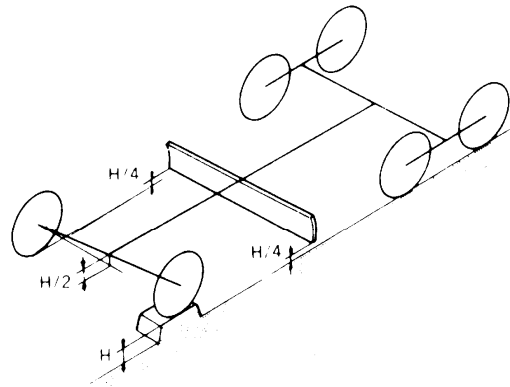
## Function of Front Axle

### 1. Steering

Please see “Steering System”.

### 2. Reduce the angle of scraper blade and the variation of ascend and descend displacement

The front axle is installed in the center of frame, so it can swing 16 degrees. As the swing of balanced housing, when front wheel gets across one object or falls into one pit, the front axle can limit the ascend and descend displacement variation of scraper blade to minimum. Please see the figure. When the front wheel gets across one object (Height =  $H$ ), the middle point of front axle increases by  $2/H$ . due to the swing of front axle, the scraper blade just increases by  $4/H$  while keeping flat. Just because the front axle can swing from left to right ( $16^\circ$ ), then the scraper blade can be kept in stable status.

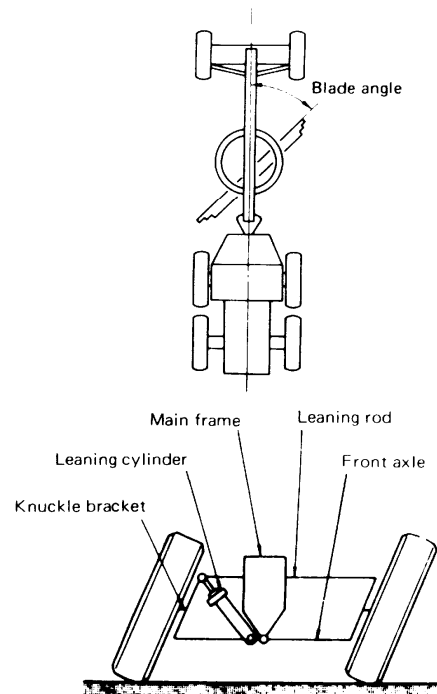


### 3. Prevent the front wheel from side sliding (Side Incline System)

The front wheel can incline left and right, namely the incline system, which can protect the front wheel from sliding to side and reducing the turning radius. Use the operation of scraper blade with propulsive angle is the often practice in the operation of grader. The side slid force result from the propulsive angle applies into the scraper blade, which will result in the side sliding.

The ratio of distributed weight in the front and rear axle is about 3:7. When the scraper blade cuts into the ground, the load of front wheel increases, which is easy to result in the side slid of front wheel.

To react such side slid, the side incline of front wheel makes them more rigid. The change of load center of front axle and center of gravity of machine can prevent the side sliding.





## The calibration of front wheel

The two front wheels make the vehicle to turn. Use the special method to assemble the wheel to make the steering easy, stable and accurate. Such special assemble is called as calibration, which has great influence on the operation of steering wheel.

### 1. Outward Incline

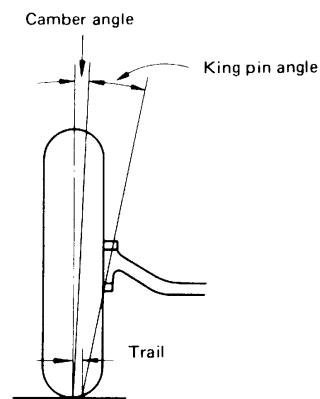
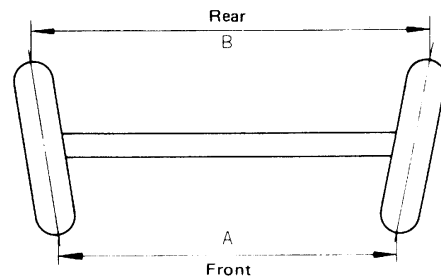
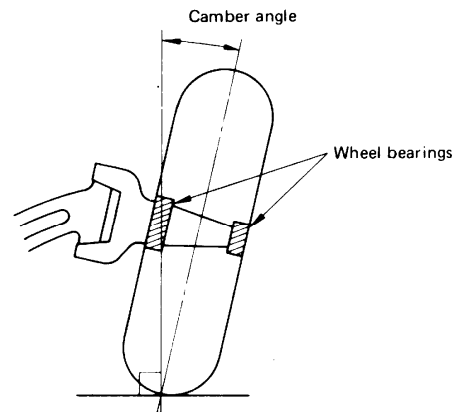
When assemble front wheel, the distance between the tops of the two wheels is far than the distance between the bottoms of the two wheels. Such incline is called as outward incline.

### 2. Inward Incline

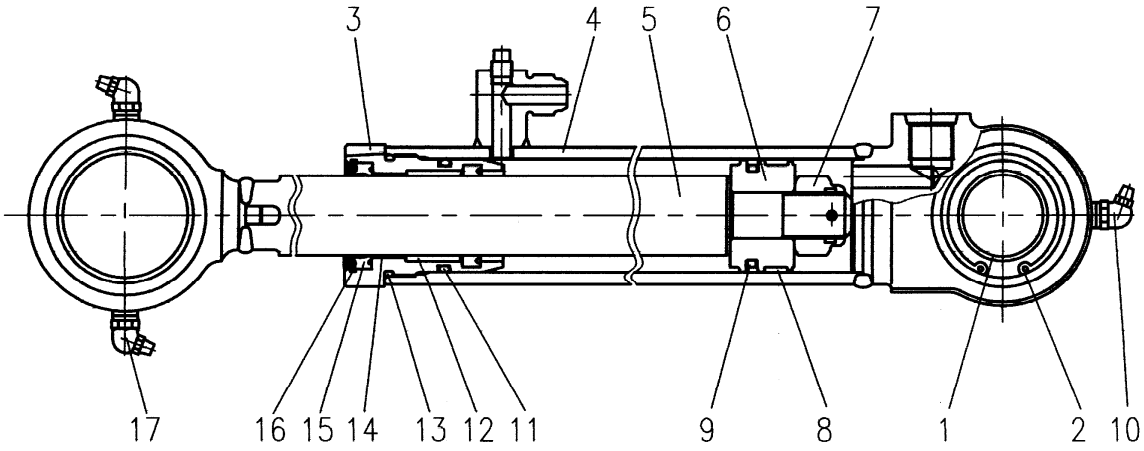
Same with the abovementioned, the distance A between the front ends of front wheel is little slightly than the distance B between the rear ends. Such incline is called as inward incline. When vehicle drives with outward incline, the power is intend to push front wheel, which outward increase the ground resistance to wheels and result in the driving is unstable and larger tire wear. When the wheel is assembled with slightly inward incline, such bad tendency will reduce to minimum. The difference of 4 ~ 6 mm between A and B is called inward incline value.

### 3. The incline of central vertical axle

When the incline is inward slightly, the central vertical axle is not vertical absolutely and such angle is called the incline of central vertical axle, combined with the outward incline, such incline reduces the swing track of steering wheel. Because when the central vertical axle as the central axle to makes the front wheel to turn, the front wheel is tend to increase, meanwhile, such action is accompanied the reaction of the wheel returns to previous position. When the gear turn a little and the vehicle forwards straightly, the release of the steering wheel will produce reaction to return the steering wheel to the previous position, such angle is always about  $5^{\circ} \sim 8^{\circ}$ .

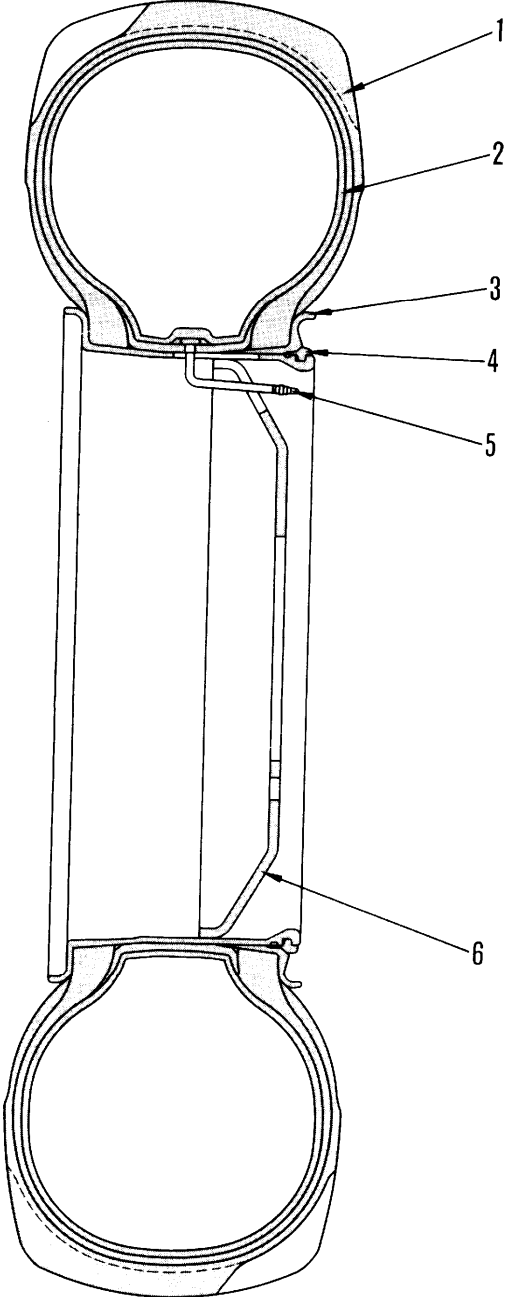


# Steering Cylinder



- |                  |                             |                    |
|------------------|-----------------------------|--------------------|
| 1. Sleeve        | 7. Nut                      | 13. O Ring         |
| 2. Retainer Ring | 8. Bearing Ring             | 14. Bearing Ring   |
| 3. Cylinder Head | 9. Piston Sealing Ring      | 15. Dustproof Seal |
| 4. Cylinder Body | 10. Oil Cup                 | 16. Retainer Ring  |
| 5. Piston Rod    | 11. O Ring                  | 17. Oil Cup        |
| 6. Piston        | 12. Piston Rod Sealing Ring |                    |

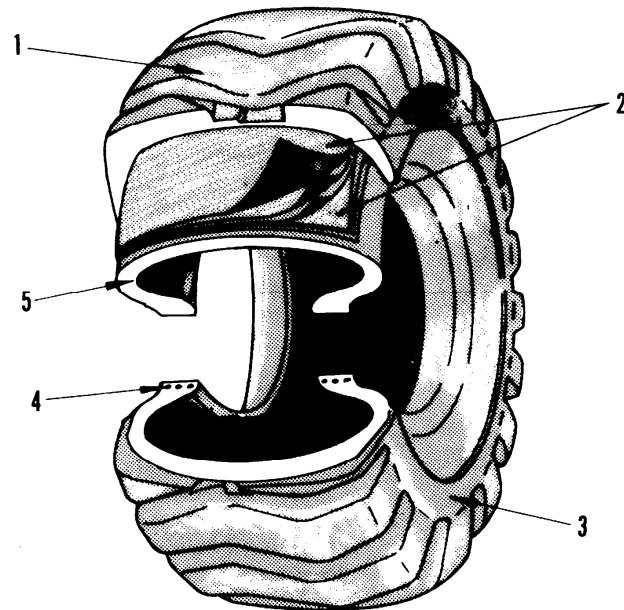
# Tire



- 1. Tire
- 2. Inner Tire
- 3. Side Ring
- 4. Lock Ring
- 5. Air Inlet
- 6. Spoke

Tire Size	17.5-25-14PR L-2
Air Pressure	3.0kgf /C m <sup>2</sup>

## Structure



1. Tread
2. Damper Lamination
3. Tire Wall
4. Tire Steel Wire
5. Outside Tire Body, Tire Shell

Engineering machinery use different types of tires, which extensively apply into various environments. So, unlike the car tire, the tires of engineering machinery are various. In the nowadays that the engineering machineries are extensively applied, the service life and cost of tire produced by engineering machinery tire manufacturer will relevant to the engineering efficiency factor. The research result from such issues is that the property of engineering vehicles requires the corresponding tires. The Wider Tire was standardized in 1956.

Many engineering vehicles operated in the sand, mud or rock environment, it is hard to realize the high-speed drive. Under the environment of rock ground, sand and mud floors, the driving speed is normally lower. Driving on the rock ground, the tires will be cut and penetrated. Under the sand and mud floor condition, the tire that reduced inner pressure and increased buoyancy can avoid the tire from trapping into sand and mud. In other words, it is very important to select different tire based on the different work.

<p><b>1. Tread</b> Tire tread is the outer layer of tire, and its main purpose is to protect the interior wear and ablation to minimum. The contact area between the tread and ground is rim, and such part is made of different types and slots to suit to the different environment the tire uses.</p> <p><b>2. Damper Laminations</b> This part lie in between the tire tread and tire shell, which absorbs the vibration of tire to protect the tread from being penetrated.</p> <p><b>3. Tire Wall</b> It will protect the tire shell from continuously expanding both inside and outside during driving.</p> <p><b>4. Tire Steel Wire</b> It is made of copper and wire to protect tire rim. The airtightness is very important when tire steel wire is in the tire without inner tube.</p> <p><b>5. Tire Shell</b> Tire shell absorbs the load and vibration applied to the tire. It is made under inner pressure with special core material. In other words, this part is the framework of tire.</p> <p><b>6. Layer</b> It is in the interior tire and this part is composed of tough nylon core.</p>	<p><b>Traction and Adhesion</b> The adhesion will increase through the reduction in the contact pressure of ground.</p> <ol style="list-style-type: none"> <li>(1) Try to reduce air pressure</li> <li>(2) Use the wider tire, if possible</li> <li>(3) If the load is given, try to increase the contact length and width between the tire and ground.</li> <li>(4) Use wider steel wire tire</li> <li>(5) Reduce the machine's load</li> </ol> <p><b>Increase Traction</b></p> <ol style="list-style-type: none"> <li>(1) Increase machine's load</li> <li>(2) Use the tire that the tread will well engage with ground</li> <li>(3) Use the larger dimension tire to keep free rotation.</li> <li>(4) Select the most suitable driving ground based on the ground condition.</li> </ol> <p><b>Driving on the soft land</b></p> <ol style="list-style-type: none"> <li>(1) Increase air pressure (reduce the contact area with ground and reduce rotation resistance)</li> <li>(2) Select larger outer diameter tire (to keep free rotation)</li> <li>(3) Reduce Load.</li> </ol>
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# Steering System

## 2. Test and Adjustment

Standard Value Table for Judgment -----	20-69
Testing Tools List -----	20-70
Check Steering Wheel -----	20-71
Check Radial Eccentricity of Tire -----	20-72
Check Inward Incline Angle-----	20-73

### Standard Value Table for Judgment

Item	Condition	Unit	Standard Value	Allowable Value
<b>Travel</b>				
Steering angle of steering wheel	At end of travel	Circle	5-5.8	
Incline Rod		mm	55-65	
Hinge Bar		mm	65-75	
<b>Manipulation Force</b>				
Steering Wheel	Engine idle rotate with low speed	N	Max. 30	Max. 50
Incline Rod	Max. value before arriving the termination of travel		Max. 36	Max. 51
Hinge Bar			Max. 30	Max. 345
<b>Wheel</b>				
Tire Radial Eccentricity	Tile surface	mm	Max. 7.0	Max. 7.0
Air Pressure		MPa	0.30	0.30±0.02
Outward Incline Angle		°	0	Max. 0±0.5
Inward Incline Angle		mm	5	5±1
Incline Angle		°	19.5	-
Neutral Travel of Steering Wheel		mm	10-12	Max. 35



## Testing Tools List

Serial No.	Test Items	Tools	Range
1	Steering Wheel Manipulation Force	Pull-push Weight	0-250 N
2	Steering Wheel Manipulation Demonstration	Disc Ruler	2 m
3	Tire Radial Eccentricity	Measuring Gauge	0.1-10 mm
4	Tire Expansion Pressure	Tire Pressure Meter	0-1 MPa
5	Outward Incline Angle	Outward Incline Angle Meter	

- ▲ When start test, adjust or maintain, put the machine stops on the flat ground, set the safety lock between the front and rear frame, the work equipment is lowered to lower position and flameout the engine. Apply the parking brake and block the tire.
- ▲ When set or cancel the instruments, remove slowly the oil filter cover to release the pressure of hydraulic oil tank, then manipulate the control rod for several times to release the remaining pressure in the hydraulic pipeline.
- ▲ The person who doesn't familiar with this machine accesses this machine is not allowed when the test is conducting.
- ▲ The oil in the circular oil pipeline is hot, so you should pay care to prevent from scalding.

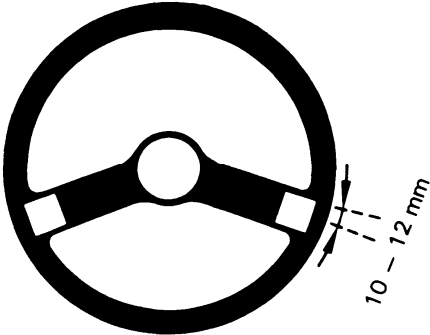
# Check Steering Wheel

## Special Tools

Serial No.	Part Description	Quantity
1	Push-and-pull Balance	1
2	Tape	1

## Steering Wheel Neutral Travel

When the travel of steering wheel is over the standard value, or steering wheel produces vibration, or the steering wheel bumps hands, please reassemble (replace) the steering gear assembly.



## Manipulation Force

Use the push-and-pull balance A to measure the manipulation force of steering wheel. Measure the manipulation force when the engine is idle and all tires have contacted the ground.



## Check Tire Radial Eccentricity

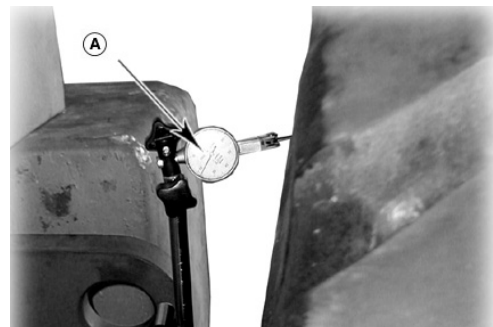
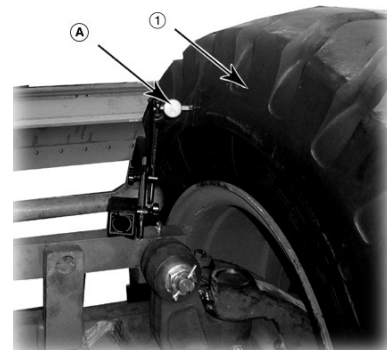
### Special Tool

### Standard Measuring Gauge

Serial No.	Part Description	Quantity
A	Standard Measuring Gauge	1
	Tire Air Pressure Meter	1

### Inspection of Front Wheel

- 1) Start the engine and make the front wheel (1) off ground by using of the scraper blade as the jack.
  - 2) Raise the rear wheel end of machine and put the lower part of the machine on a support.
  - 3) Use the standard gauge A to measure the tire eccentricity through rotating tire by hand.
- ▲ Conduct measuring after engine is stopped.



### Check the tire's expansion pressure

Use the tire air pressure meter B to measure the expansion pressure of front and rear tires.



# Check Inward Incline Angle

## Special Tool

Serial No.	Part Description	Quantity
1	Round Tape	1

### Inspection:

1. Make the steering rod and incline rod of front wheel lie in the middle position and stop the grader on the flat ground.
- ★ When parking the vehicle, drives the whole machine along the forward direction for sever meters and then stop it.
2. Measure with tape the height from the tire tread (ground) to the center of axle.
3. Make one marks on each width center of right and left tires at the abovementioned height.
4. Measure with tape the distance A between two marks of left and right tires.
5. Forward slowly the vehicle and make the mark on the front part of tire turns to the rear part of tire. Stop the vehicle when the height between such mark and ground is the same with the height shown in item 2.
6. Re-measure with tape the distance B between two marks of left and right tires.
7. Standard Inward Incline Angle:  $B - A = 5.0 \pm 1.0 \text{mm}$

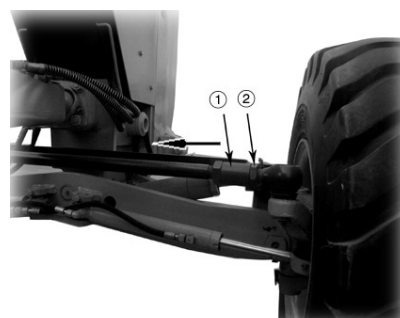


### Adjustment

- ★ Adjustment should be conducted as per the following procedure when the inward incline angle is over the standard value.

Loose the locking nut (1)

- ★ When rotate the screw connection (2) as per the arrow direction, the inward incline angle will increase. If rotate it in the reverse direction, the inward incline angle will reduce (one circle: 18 mm).
- ★ The front axle should be kept stable and no any incline is allowed when conduct the adjustment.



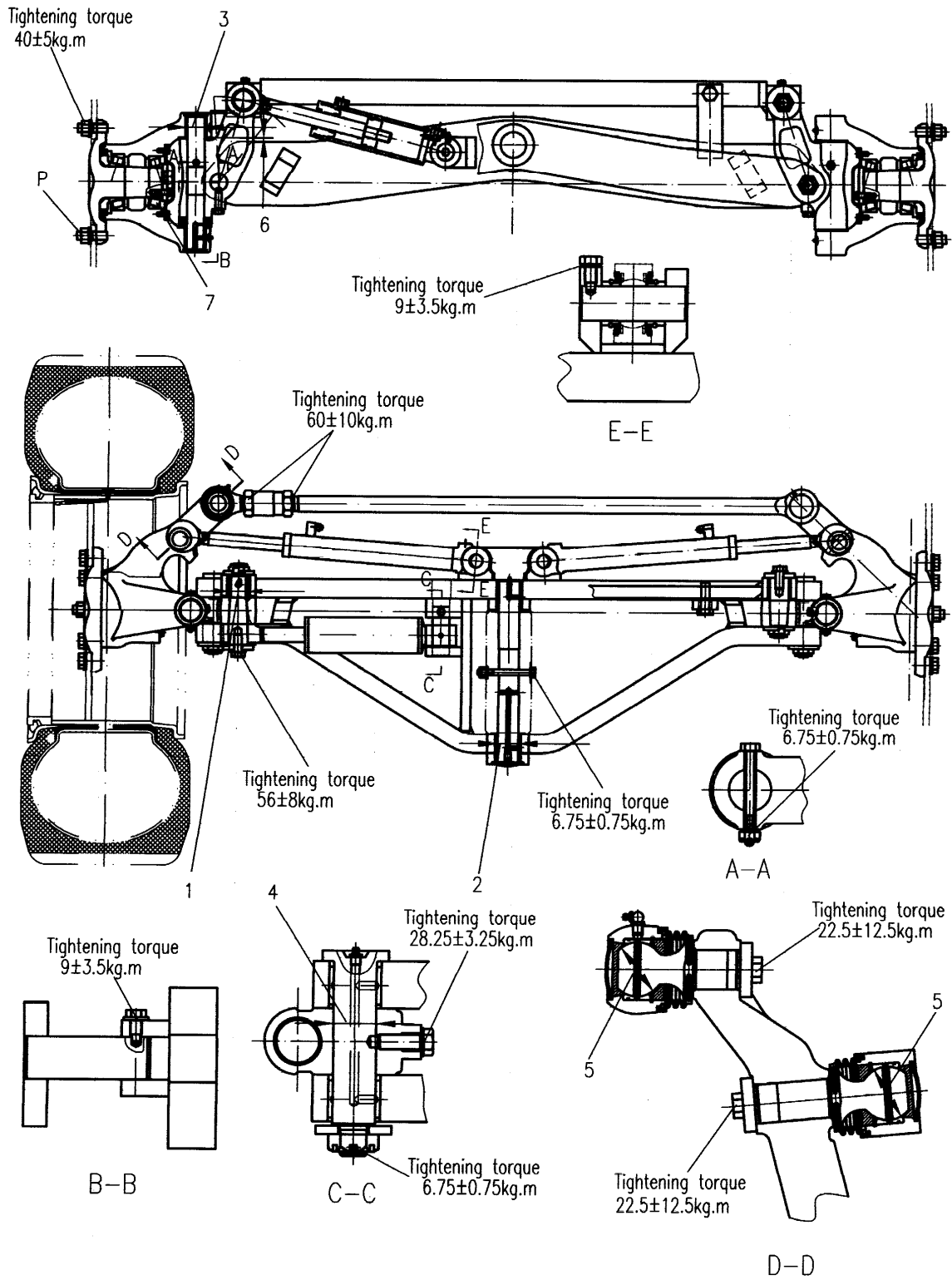
# Steering System

## 3. Maintenance Standard

Front Axle ----- 20-75

Steering Cylinder ----- 20-77

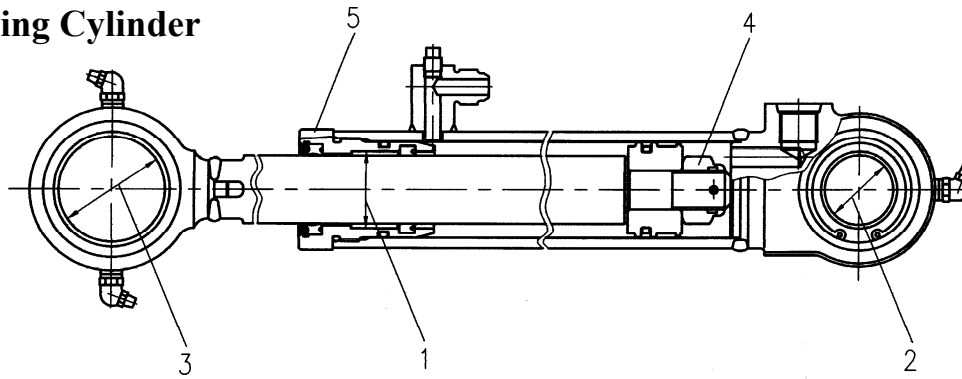
# Front Axle



Unit: mm

Serial No.	Items to be inspected	Requirement					Remarks
		Standard Value	Tolerance		Standard Clearance	Allowable Clearance	
	Axle		Hole				
1	Clearance between incline pin and incline rod sleeve	50	-0.025 -0.064	+0.142 +0.080	0.125- 0.206	2.0	Reassemble Sleeve
2	Clearance between main pin and sleeve	55	-0.030 -0.076	+0.174 +0.100	0.130- 0.250	2.0	
3	Clearance between incline pin and sleeve	45	-0.025 -0.064	+0.142 +0.080	0.105- 0.206	2.0	
4	Clearance between axle end pin and sleeve	45	-0.025 -0.064	+0.142 +0.080	0.105- 0.206	2.0	
5	Clearance between ball joint and sleeve	55	0 -0.02	+0.02 0	0.02 -0.04	1.0	
6	Clearance between support and sleeve	Standard Clearance		Clearance Limit			
		0.12~0.852		2.0			
7	Preload of hub bearing	Initial Rotation: 8-12 kg (at P point of hub bolt)				Adjust	

## Steering Cylinder



Serial No.	Items to be inspected	Requirement				Remarks	
		Standard Value	Tolerance		Standard Clearance		Allowable Clearance
1	Clearance between piston rod and bearing ring	35	-0.080 -0.142	+0.132 +0.006	0.086- 0.274	0.6	Reassemble Sleeve
2	Clearance between cylinder pin axle and sleeve	35	-0.025 -0.064	0 -0.012	0.013- 0.064	1.0	
3	Clearance between cylinder rod sleeve and installation pin	35	-0.06 -0.09	+0.02 0	0.06- 0.11	1.0	
4	Tightening torque of piston nut	250±25 N·m				Re-tight	
5	Tightening torque of cylinder head	400±40 N·m					

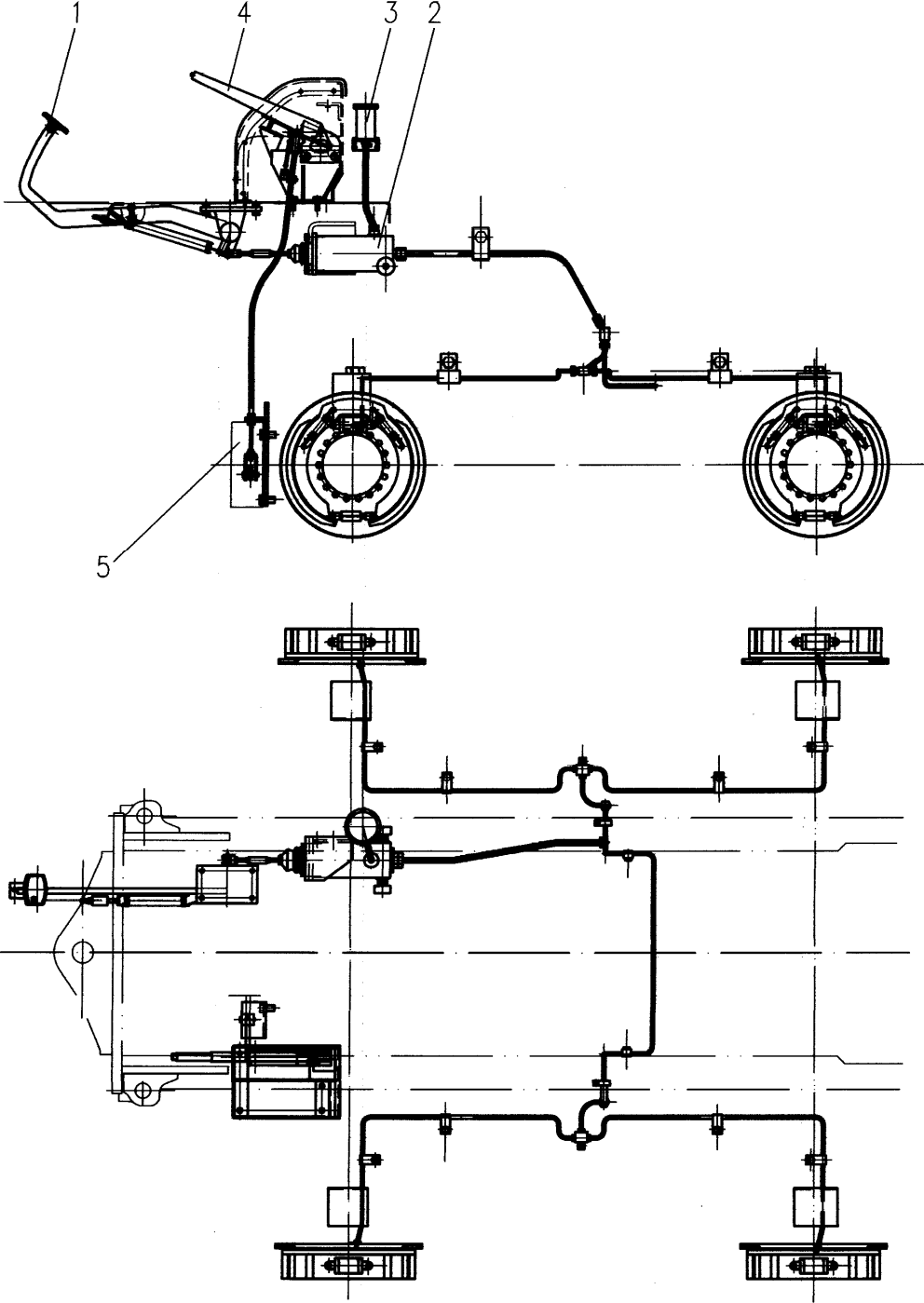


# **Brake System**

## **1. Structure and Functions**

Brake Pipeline -----	20-81
Brake Circuit -----	20-82
Booster -----	20-83
Wheel Cylinder Brake -----	20-86
Parking Brake -----	20-87

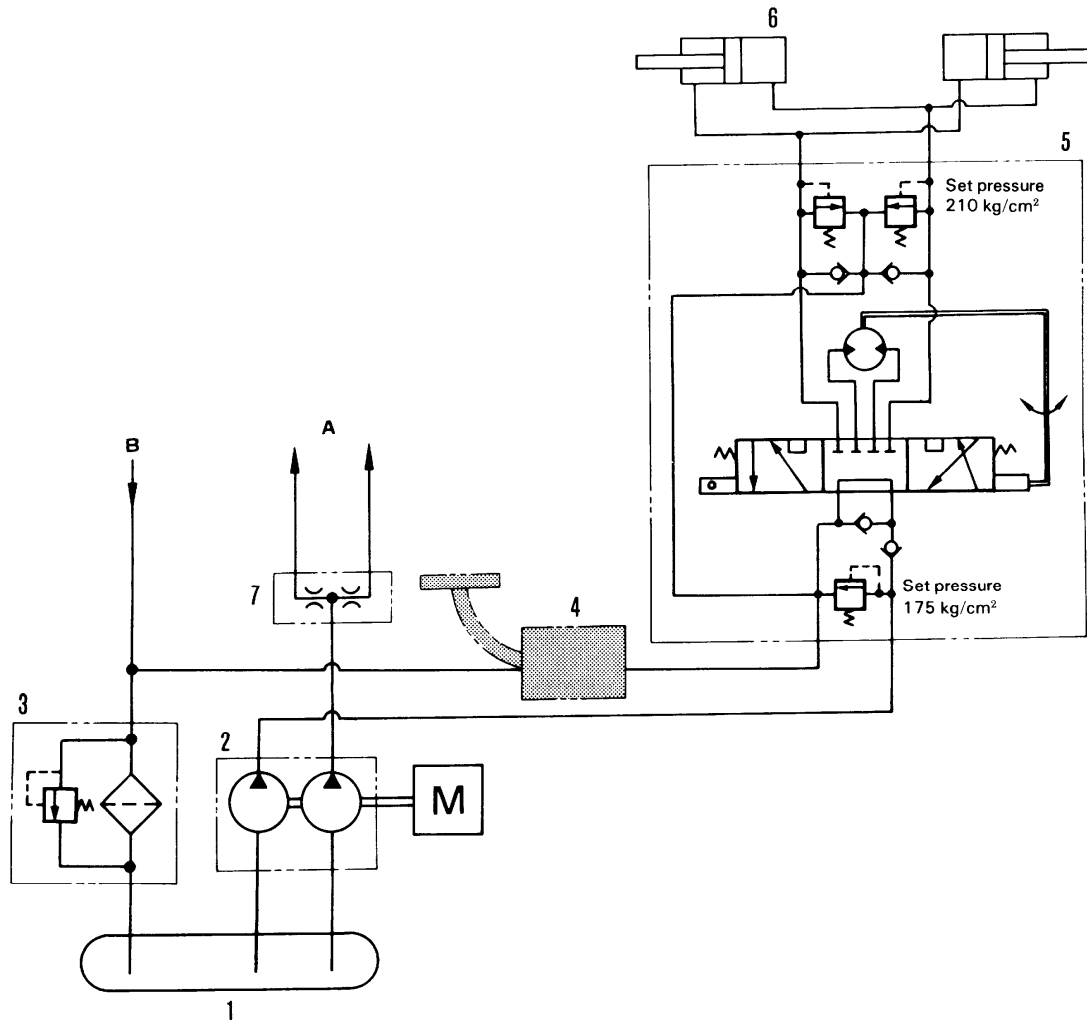
# Brake Pipeline



- 1. Brake Pedal
- 2. Brake Booster
- 3. Master Cylinder
- 4. Parking Brake Rod
- 5. Parking Brake

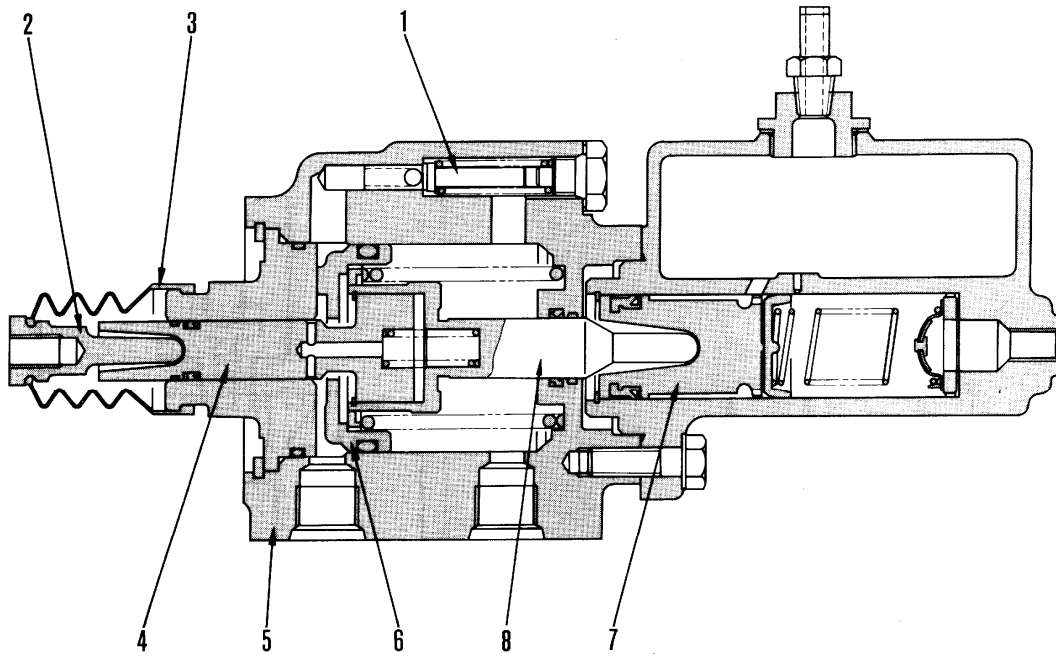
### 3. Reservoirs

## Brake Circuit



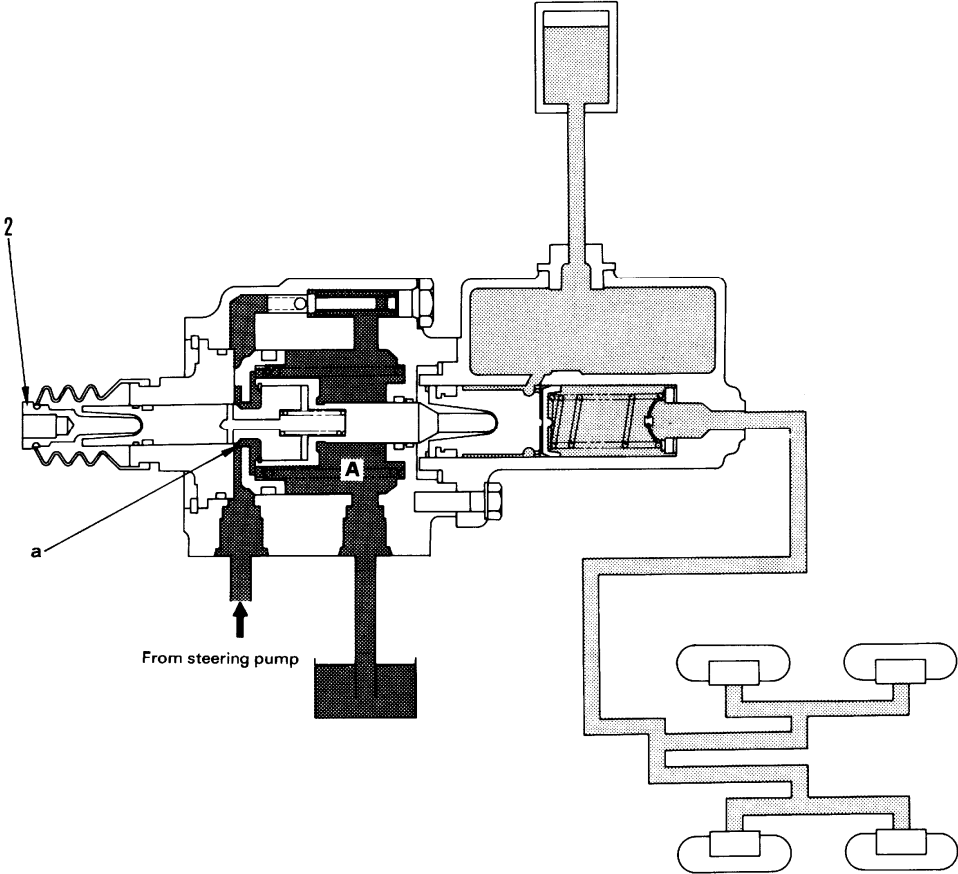
1. Hydraulic Oil Tank
2. Hydraulic Pressure and Steering Pump
3. Hydraulic Oil Filter
4. Booster
5. Steering Control Valve
6. Steering Cylinder
- A. To hydraulic Circuit
- B. From Hydraulic Circuit

## Booster



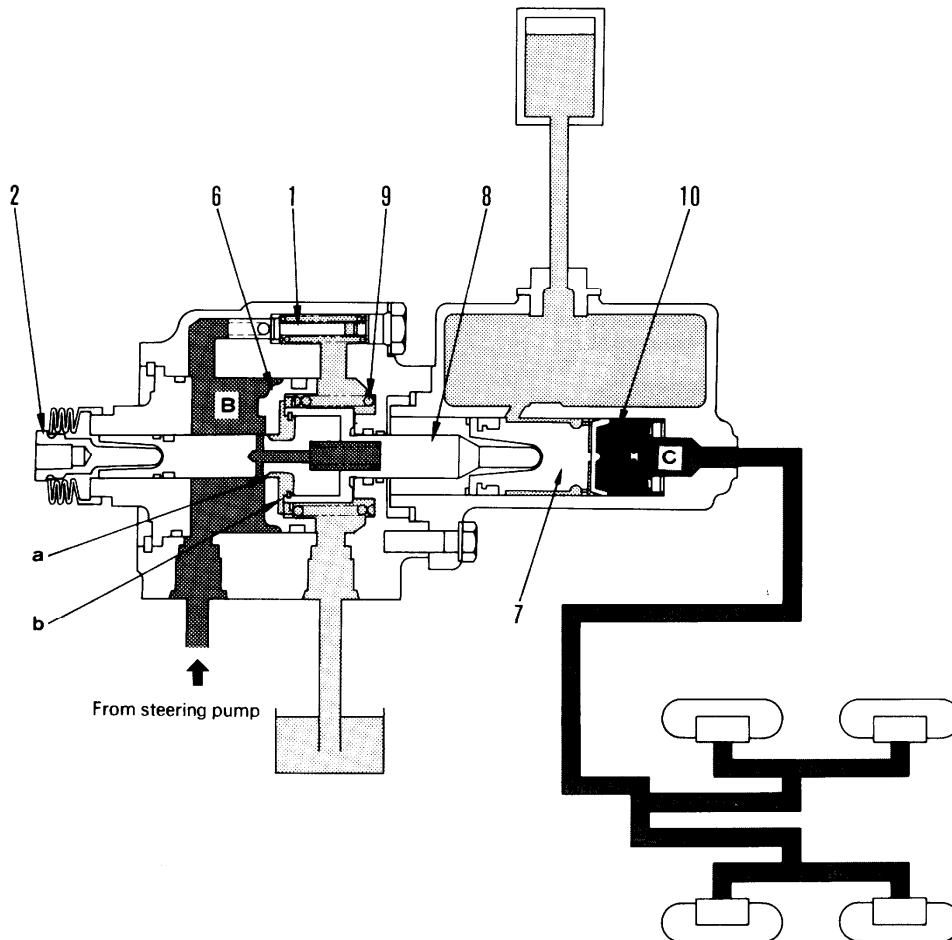
- This booster is the hydraulic operation booster. Depress the brake pedal, the oil comes from steering pump applies into booster piston (6) and the hydraulic force in the piston (7) will increase.
1. Unloading Valve
  2. Slid Valve
  3. Boot
  4. Master Piston
  5. Shell
  6. Booster Piston
  7. Piston
  8. Slid Valve

# Release the Brake



- The slid valve (2) doesn't act when the brake pedal isn't depressed.
- The oil comes from oil pump enters into booster through steering circuit.
- The oil enters into booster via "a" point and flows into A chamber and is drained.

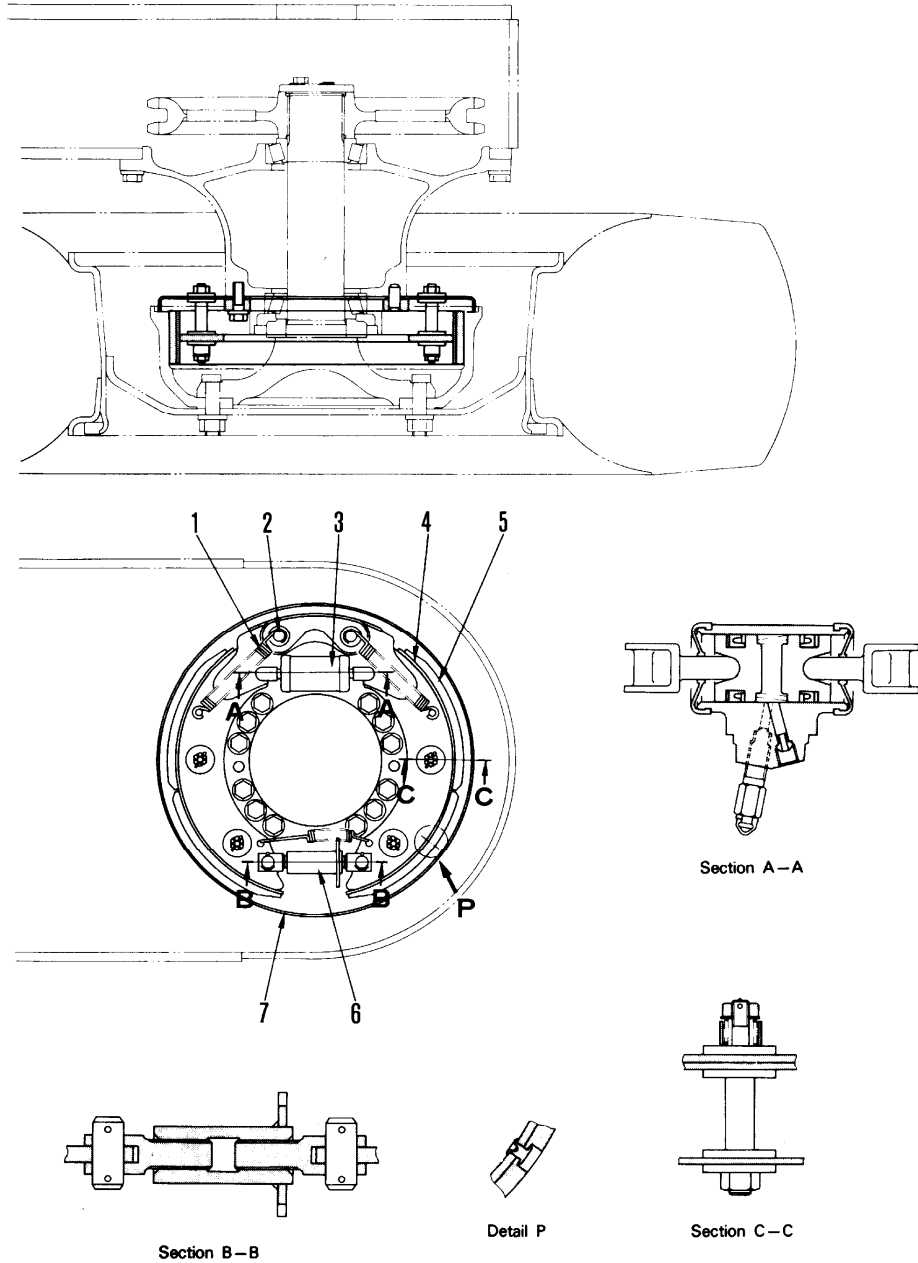
## Brake Operation



- Depress the brake pedal, the slid valve (2) move to right and “a” is blocked and the pressure of B chamber is increased.
- When the pressure of B chamber increases, the booster piston is moved to right and contacts with “b” position of slid valve (8) and the slid valve is pushed.
- When the slid valve (8) is pushed to right side, the piston (7) is pushed to right and the brake oil is compressed out from C
- Depress foot brake, the slid valve (2) pushes booster piston (6) and “a” point is closed. When the pressure of B chamber is increased to 20 kg/cm<sup>2</sup>, the overflow valve (1) is open and the oil is drained.
- Release the pedal, the return spring (9) and (10) intake the brake oil back to oil tank.

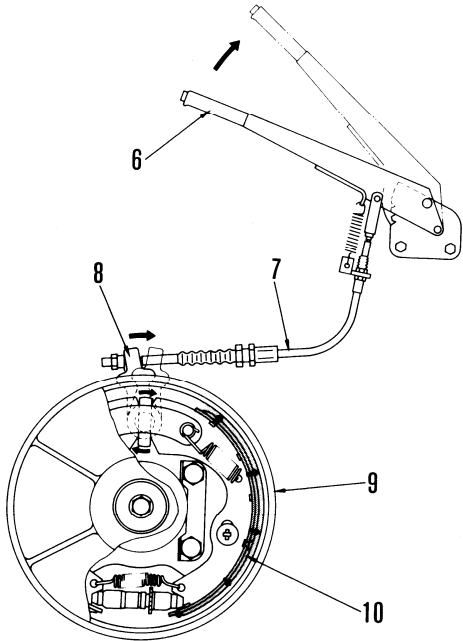
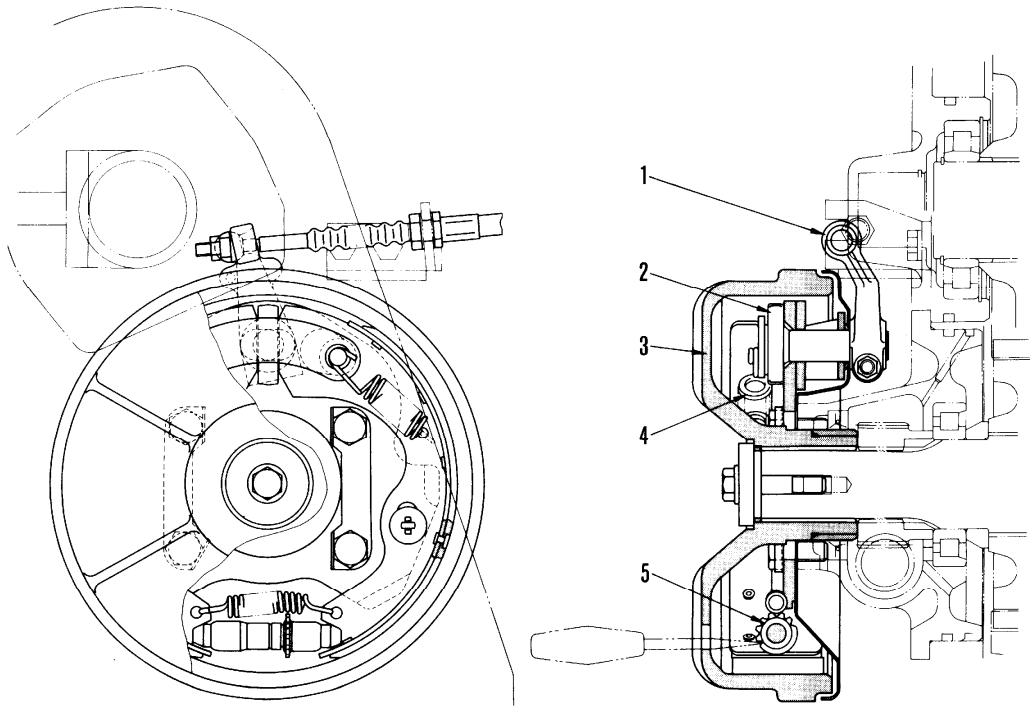
chamber.

## Wheel Cylinder Brake Drum Brake



- |                   |               |
|-------------------|---------------|
| 1. Return Spring  | 5. Sleeve Pad |
| 2. Fixed Pin      | 6. Regulator  |
| 3. Wheel Cylinder | 7. Brake Drum |
| 4. Brake          |               |

# Parking Brake



- 1. Connecting Rod
- 2. Anchor Plate
- 3. Brake Drum
- 4. Return Spring
- 5. Regulator
- 6. Operation Rod
- 7. Soft Axle
- 8. Connecting Rod
- 9. Brake Drum
- 10. Brake Hoof

Parking brake is inner expansion type brake applies into the counter shaft of gearbox.



# **Brake System**

## **2. Test and Adjustment**

Standard Value Table for Judgment -----	20-87
Test and Adjustment Tools List -----	20-87
Check Brake Pedal -----	20-88
Exhaust of Brake Pipeline -----	20-90
Check Parking Brake Operation Rod -----	20-91

## Standard Value Table for Judgment

Item	Condition	Unit	Standard Value	Allowable Value
<b>Pedal Brake (Foot Brake)</b>				
<b>Height</b> Neutral Travel	Engine's Rotation Speed: Stop	mm	160±5 10±5	160±15 10±10
<b>Travel</b> Operation Force	Engine's Rotation Speed: Low Speed Running	mm N	80±10 Max. 450	80±20 Max. 650
<b>Brake Property</b>	Ground: Flat, Dry and Straight Brake Speed: 30 km/h	m	Max. 13	Max. 13
<b>Parking Brake Operation Rod</b>	Keep the capability of stopping machine on the gradient of 15%			
<b>Operation Force</b>	Engine's Rotation Speed: Stop	N	Max. 300	Max. 500
<b>Travel</b>			Within 2-3 tooth	Max. 6 tooth

## Testing and Adjustment Tools List

Serial No.	Test Items	Tools	Range
1	Brake pedal operation force	Depress meter	0-1000 N
2	Brake's Travel	Tape	30 m
3	Clearance of brake hoof	Measuring Clearance Gauge	0.1-3.0 mm
4	Pedal's travel	Disc Tape	2 m
5	Operation force	Push-and-pull balance	0-500 N

▲ When conduct test, adjustment or maintenance, put the machine stops on the flat ground, set the safety lock on the frame, and put the scraper blade on the ground and then stop the machine.

Pull the parking brake and block the tires.

▲ The person who doesn't obtained permission accesses this machine is not allowed when the one team is conducting operation.

# Check Brake Pedal

## Special Tools

Serial No.	Part Number	Part Description	Quantity
A	Common Use Tools	Tape	1
B		Vernier caliper	1

### 1. Height Adjustment

Measure with tape the distance from bottom plate to center of fixed bolt of pedal (1).

Adjust the height from pedal brake bolt (20 to fixed pedal.

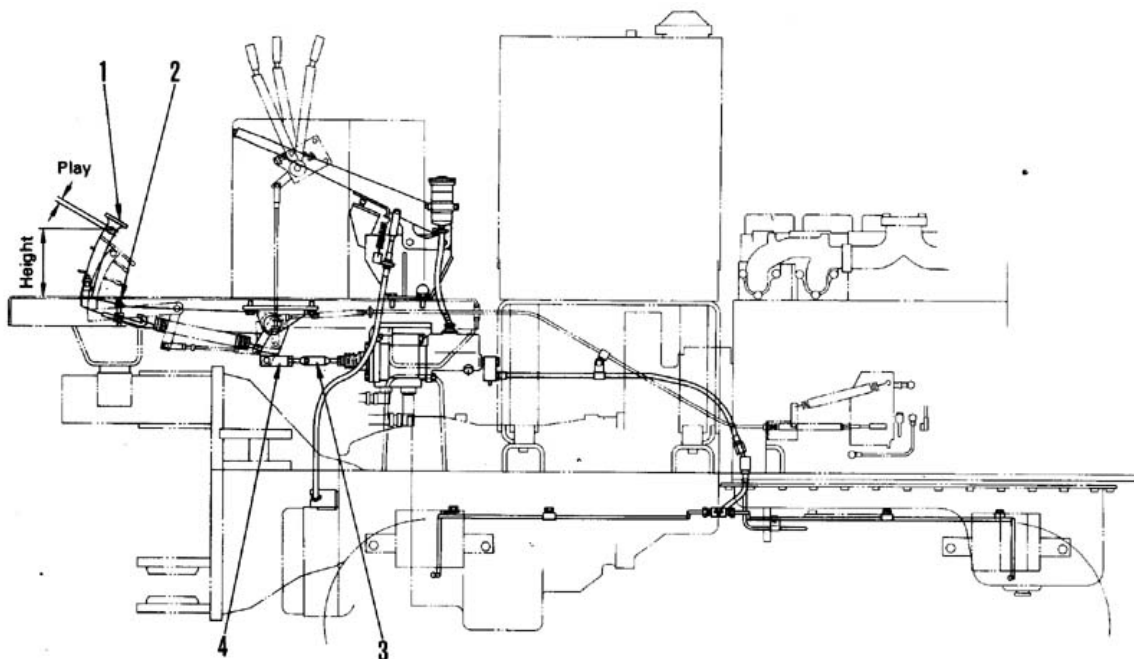
### 2. Adjustment of Neutral Travel

Measure with tape A along the action direction of pedal.

★ The engine should be flameout when conducting the measurement.

Adjust fork rod and connecting rod until the standard value is reached.

★ Bend the split pin to ensure the safety.

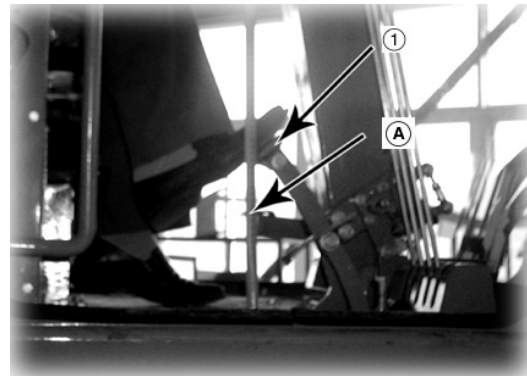


### 3. Travel

- ▲ Confirm the shift operation rod is in the middle position and pull parking brake operation rod up forwardly.

Start engine, depress pedal (1), and measure with tape A the distance from center of installing bolt of pedal to the bottom frame plane.

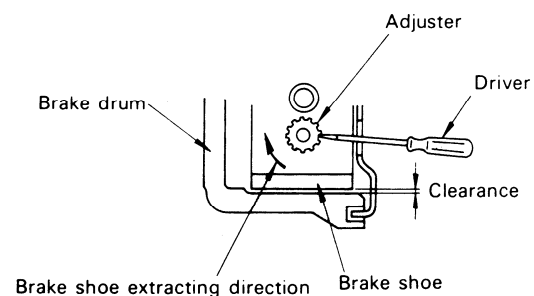
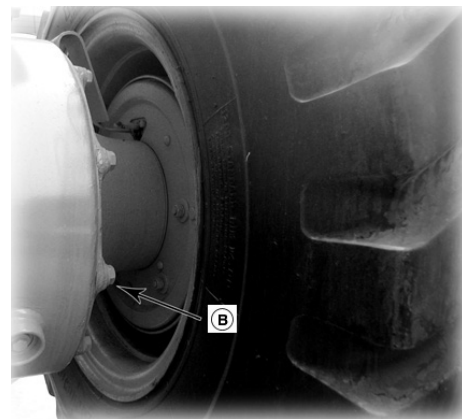
- ★ Conduct the measurement when the engine is idle.
- ★ If the travel is over standard value when the pedal is depressed or the brake efficiency is bad, please refer to “Brake Drum Adjustment”.



#### Brake Drum Adjustment

- ▲ The engine should be stopped when conduct adjustment.

1. Disassemble the rubber cover on the outside end cover and insert the screwdriver into the adjusting hole. Rotate the adjusting gear until the pad and brake drum contact closely.
2. Next step is to rotate the adjusting gear for 6~8 tooth.
3. Disassemble the rubber cover, insert the 0.6 mm thickness shim B into one of inspection opening and inspect the clearance of other side and the clearance should less than 0.4 mm.
4. If the measured clearance in the 3<sup>rd</sup> step above is not within the tolerance, please refer to the 1<sup>st</sup> step to tight the brake hoof and adjust the shaft (6), make there have no clearance between four inspection openings.
5. Readjust according to 2<sup>nd</sup> and 3<sup>rd</sup> step after the adjustment.
6. After adjustment, depress the brake pedal and the compressed height of pedal should be ensured within standard scope.
7. After adjustment, drive the vehicle for 500 m to check the temperature of four brake drums. Ensure there have no slid.
8. After adjustment, the brake distance under initial speed of 30 km/h should be within standard range.



## 4. Operation Force

### Special Tool

Serial No.	Part Description	Quantity
1	Tape	1

Depress the pressure meter with foot to measure its maximum operation force.

- ★ Conduct measurement when the engine is under idle speed.

### Exhaust of Brake Pipeline

- ★ The exhaust operation should be conducted by two persons, one refills the brake fluid and the other exhausts air.

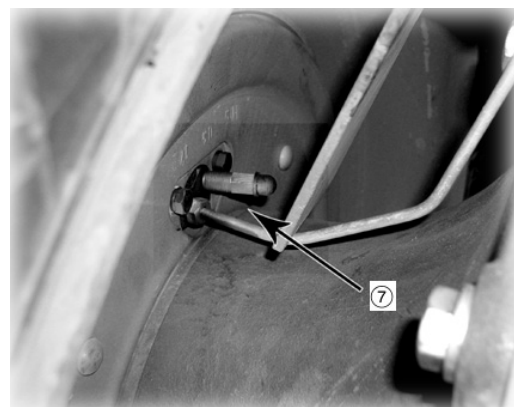
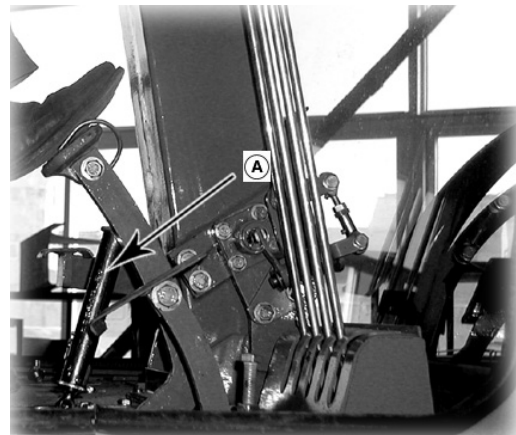
- ★ Prepare some extra brake fluid to prevent the brake fluid from using out during operation.

- ▲ The engine should be stopped when exhaust the air.

1) Install one plastic tube on the exhaust outlet and the other end of plastic tube insert into the reservoir. The reservoir should maintain half fluid.

2) Depress the brake pedal for several times. Loose the exhaust screws when the pedal is depressed and tight the exhaust screw before the pressure in the cylinder is reduced. Repeat the process above until the air is exhausted completely.

- ★ Depress the brake pedal for one time every 3 seconds.



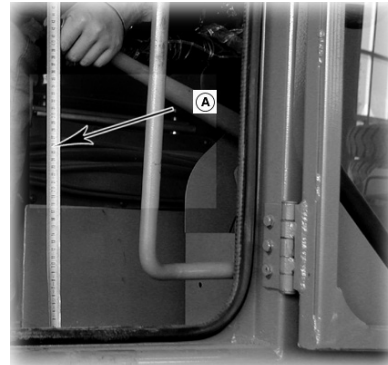
## Check Parking Brake Operation Rod

### Special Tools

Serial No.	Part Number	Part Description	Quantity
A	Common Use Tools	Tape	1
B		Pressure Meter	1

### Travel Inspection

Measure with tape the travel distance from top to bottom of parking operation rod.



### Travel Adjustment

▲ The engine should be stopped when conduct adjustment.

1. Insert the screwdriver into the adjusting hole of brake drum and rotate the adjusting gear as per the arrow direction until the lining is contact closely with brake drum, then return to the clearance between the adjusting lining and brake drum.
2. After the clearance between lining and brake drum has been adjusted, pull the operation rod and adjust the soft shaft and make its travel at the ratchet wheel is within 2-3 teeth.
3. After adjusted, the machine can park on the gradient of 15% and will not slid.



### Operation Force Inspection

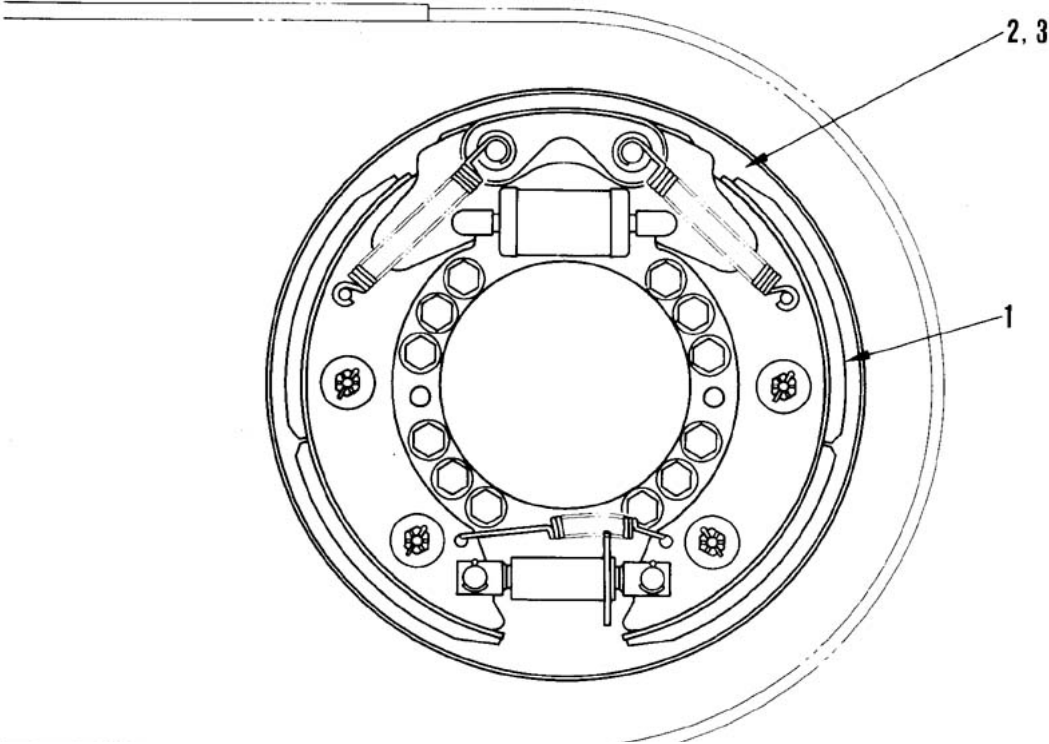
Inspect with pressure meter B the operation force.

# **Brake System**

## **3. Maintenance Standard**

Wheel Rim Brake -----	20-93
Booster -----	20-94

**Wheel Rim Brake  
Drum Brake**

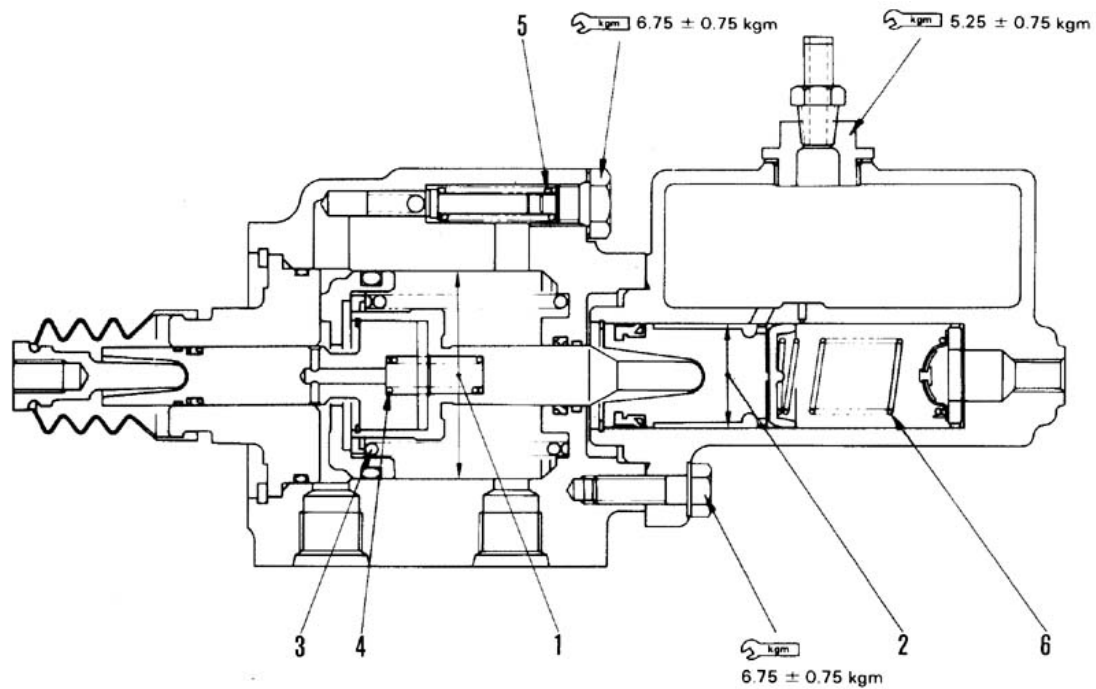


Unit: mm

Serial No.	Items to be inspected	Judgment		Action
1	Wear of Lining	Clearance between the rivet head and lining surface: Max. 0.5		Change lining
2	Inner surface wear of brake drum	Standard Dimension	Repairing Limit	Replace the brake drum
		438.2	441.2	
3	Over tolerance of roughness of inner surface of brake drum	Repairing limit: 0.2		Turn the angle of replace



# Booster



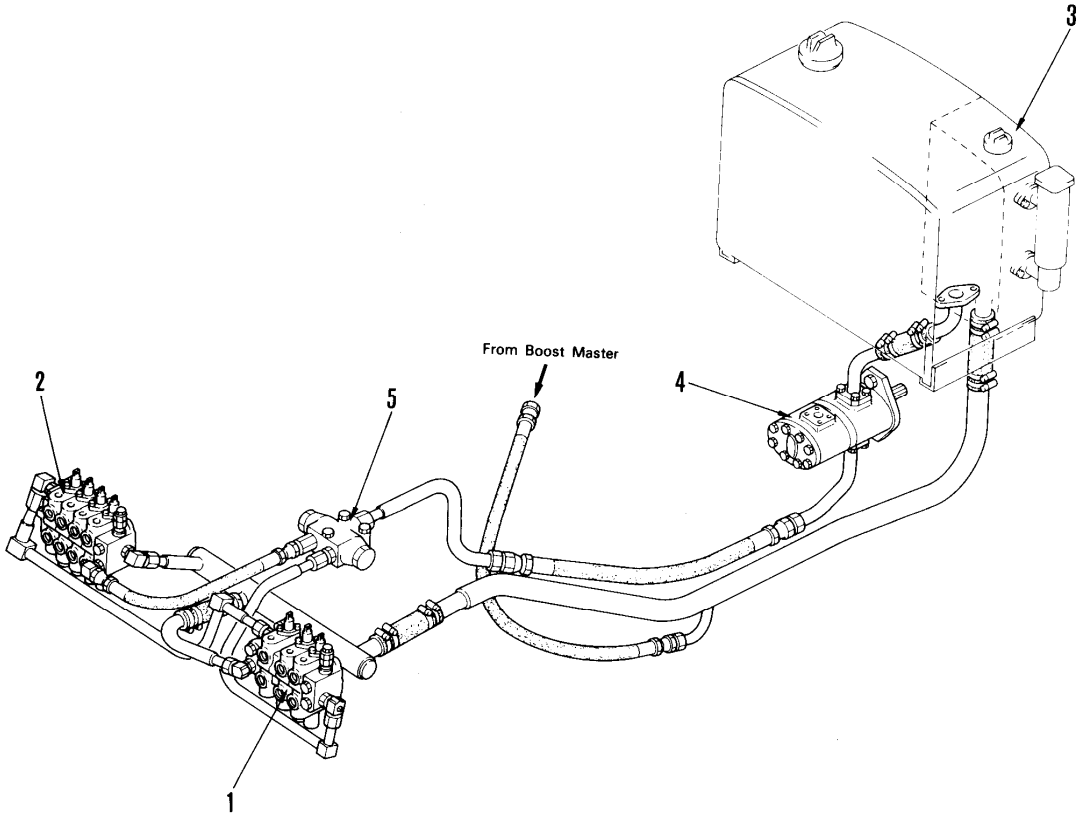
Serial No.	Items to be inspected	Judgment					Action
		Standard Dimension	Tolerance		Standard Clearance	Clearance Limit	
1	Clearance between booster casing and piston	76.2	-0.2 -0.25	+0.074 0	0.200- 0.324	0.35	Replacement
2	Clearance between piston and cylinder	38.1	-0.050 0.089	+0.068 0	0.050- 0.151	0.20	
3	Return Spring	Standard Dimension			Repairing Limit		
		Free Length	Installed Length	Installed Load	Free Length	Installed Load	
		123	73	40 kg	-	33 kg	
4	Selector Spring	41	36	11.8 kg	-	9 kg	
5	Overflow Spring	48.5	42.5	11.9 kg	-	10.5 kg	
6	Master Spring	126	58	6.8 kg	-	5.5 kg	

# Hydraulic System

## 1. Structure and Functions

Hydraulic Pipeline -----	20-96
Hydraulic Operation -----	20-104
The Principle of Hydraulic System -----	20-105
Oil Pump -----	20-106
Turning Motor -----	20-107
Control Valve -----	20-108
Distributing Valve -----	20-110
Hydraulic-control Check Valve -----	20-111
Hydraulic Cylinder -----	20-113

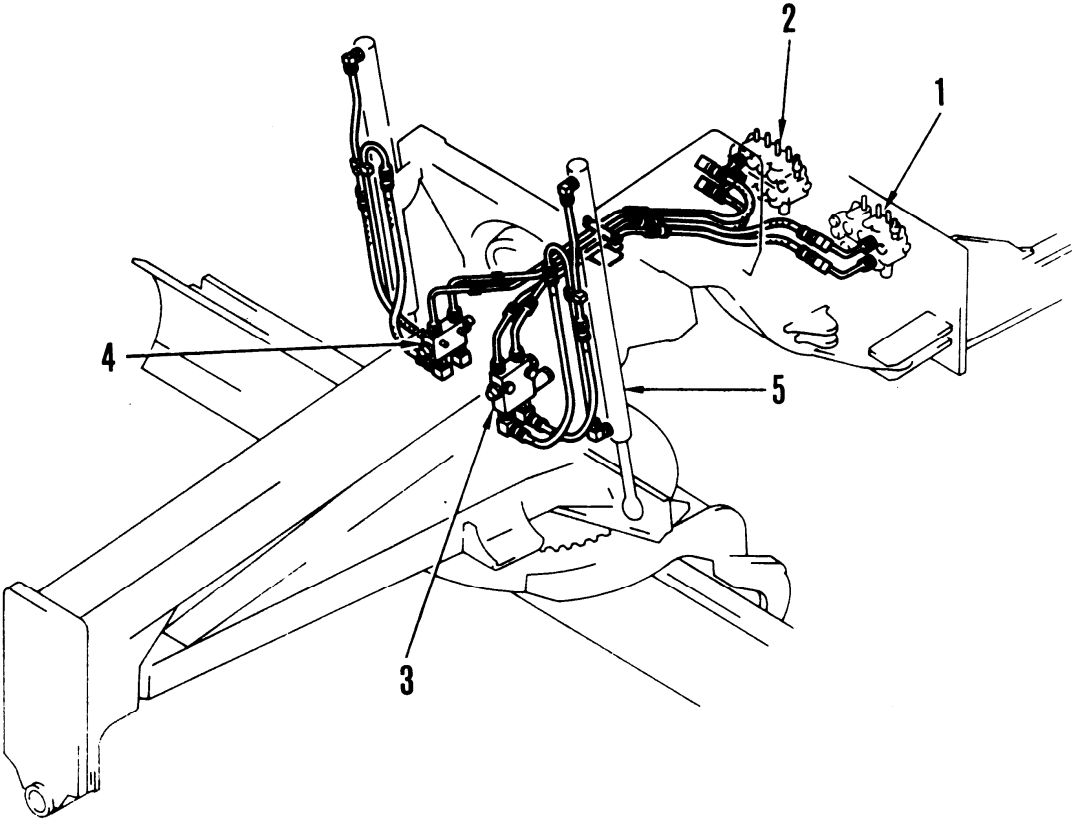
# Hydraulic Pipeline



The hydraulic control part of operation work equipment is composed of hydraulic oil tank (3), oil pump (4), distributing valve (5) and high-pressure pipeline. The control valve, oil cylinder and hydraulic motor are connected together with high-pressure pipeline.

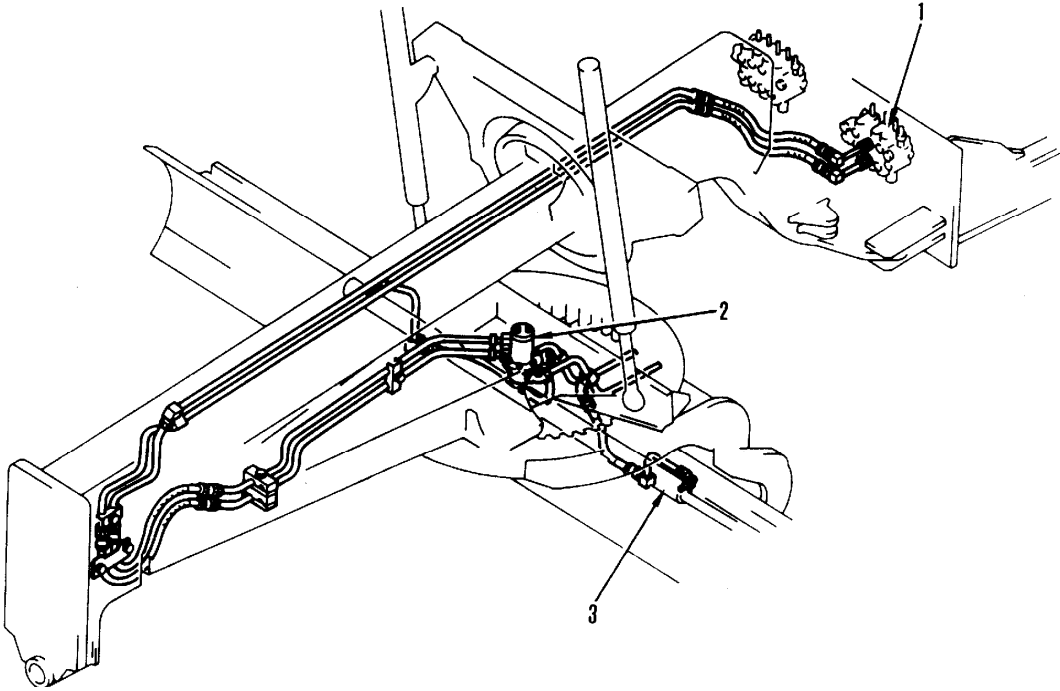
- 1. Left Control Valve (4 ways)
- 2. Right Control Valve (4 ways)
- 3. Hydraulic Oil Tank
- 4. Hydraulic Oil Pump
- 5. Distributing Valve

# Scraper Blade Lifting Control Pipeline



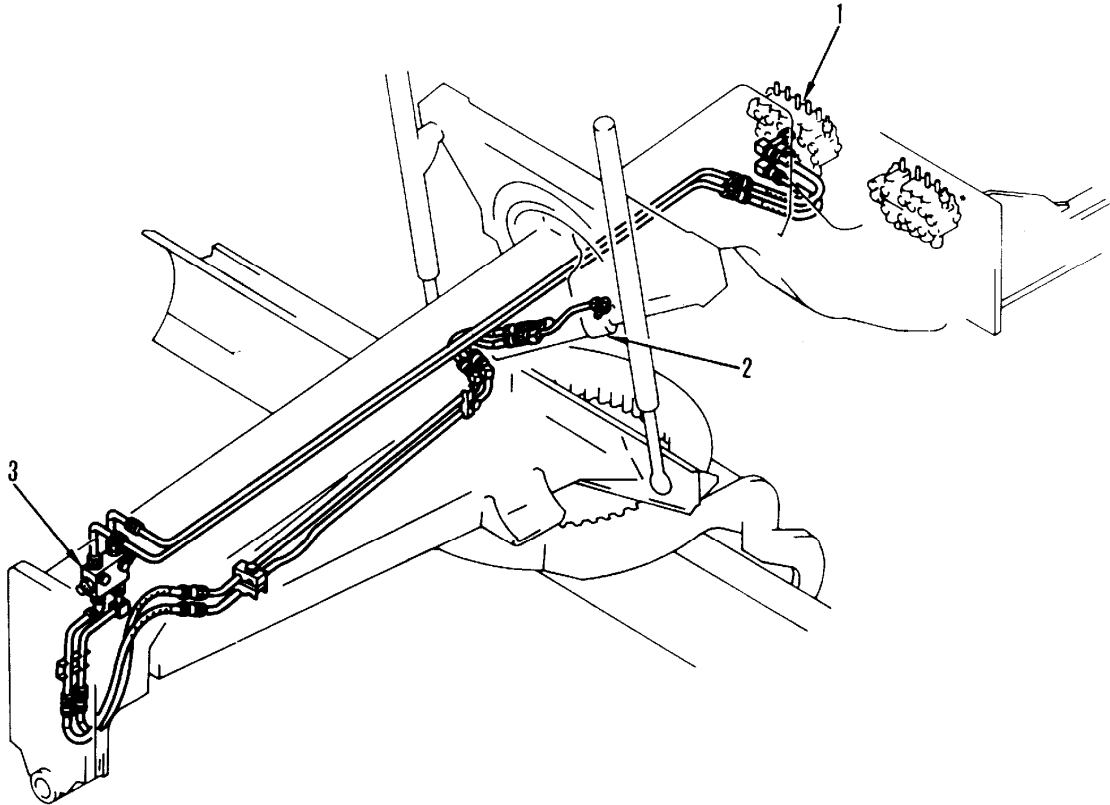
- 1. Left Control Valve (4 ways)
- 2. Right Control Valve (4 ways)
- 3. Left Hydraulic Control Check Valve (For Lifting)
- 4. Right Hydraulic Control Check Valve (For Lifting)
- 5. Scraper Blade Lifting Cylinder

# Scraper Blade Side Moving Control Pipeline



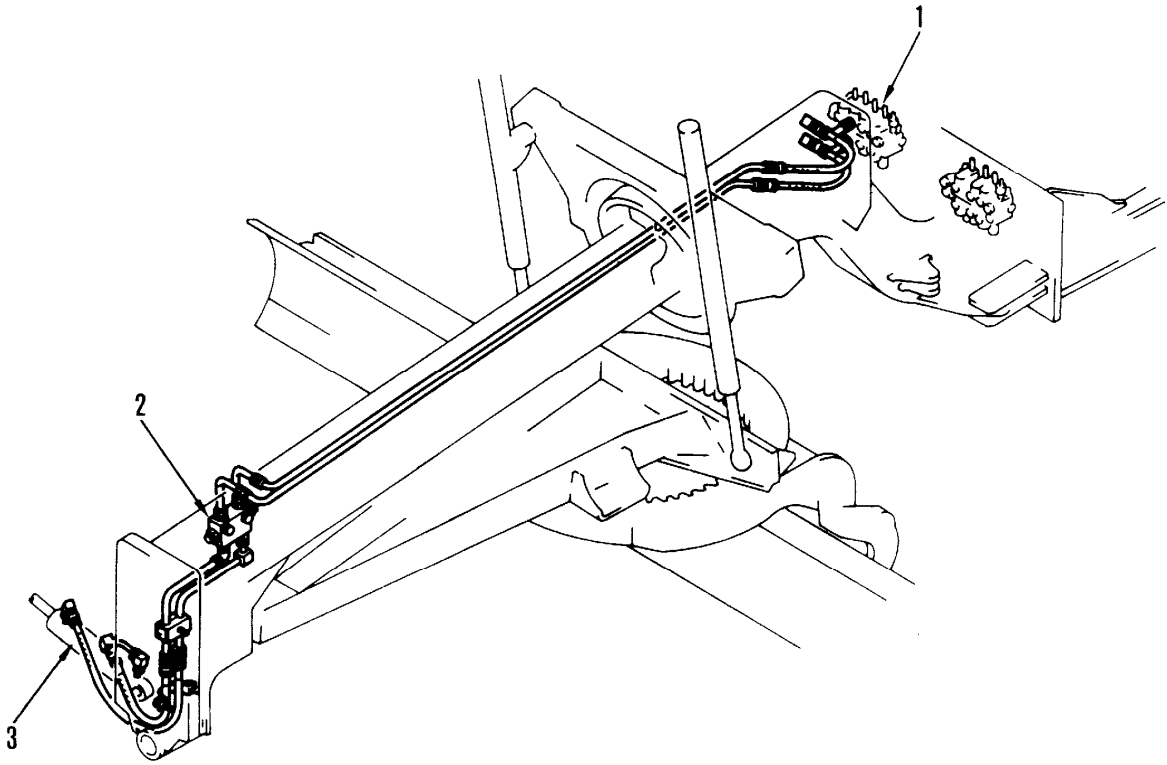
- 1. Left Control Valve (4 ways)
- 2. Rotary Joint
- 3. Scraper Blade Side Moving Cylinder

**Traction Frame Side Swing Control Pipeline**



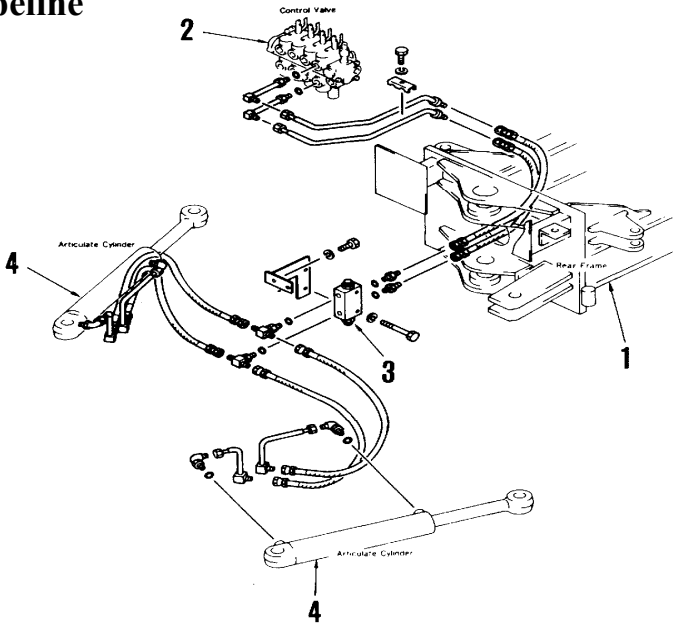
- 1. Right Control Valve (4 ways)
- 2. Traction Frame Side Swing Cylinder
- 3. Hydraulic-control Check Valve  
(For Traction Frame Side Swing)

# Front Wheel Incline Control Pipeline



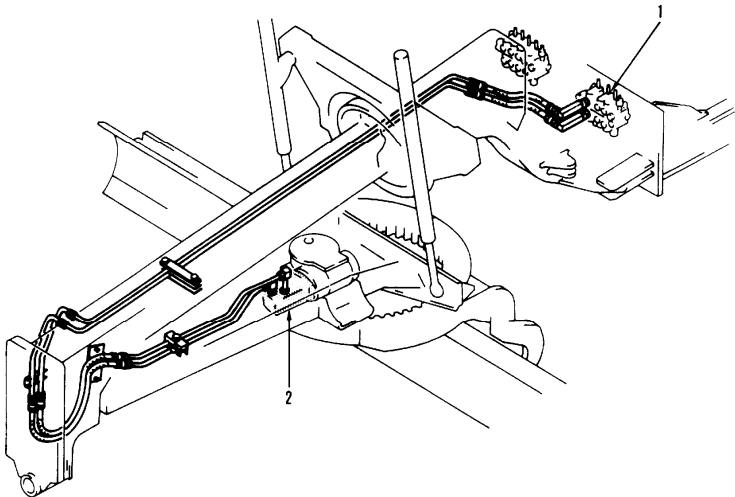
- 1. Right Control Valve (4 ways)
- 2. Hydraulic-control Check Valve  
(For Front Wheel Incline)
- 3. Incline Cylinder

# Hinge Control Pipeline



- 1. Rear Frame
- 2. Right Control Valve (4 Ways)
- 3. Hydraulic-control Check Valve
- 4. Hinge Cylinder

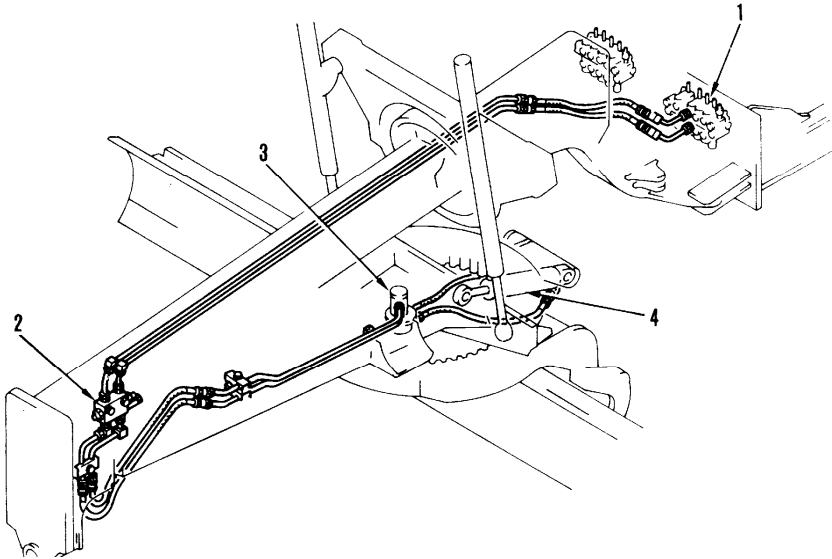
# Turning Control Pipeline



- 1. Right Control Valve (4 Ways)
- 2. Turning Motor

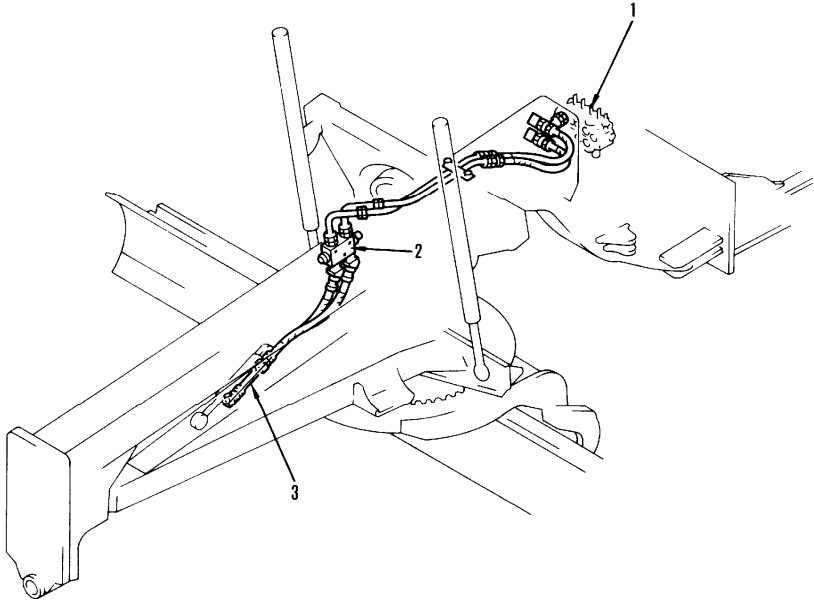


# Power Incline Control Pipeline



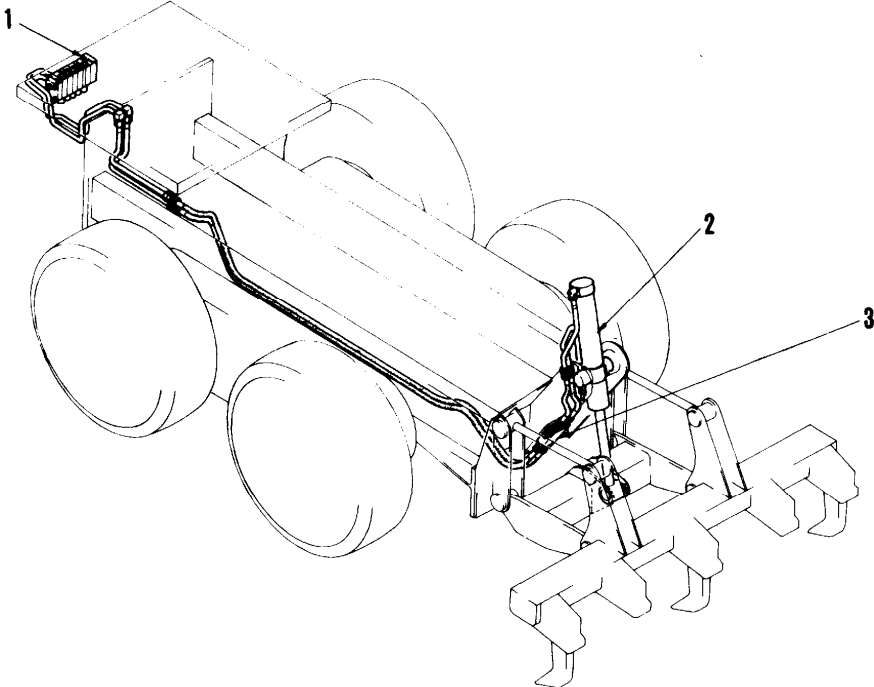
- 1. Left Control Valve (4 Ways)
- 2. Hydraulic-control Check Valve (For Power Incline)
- 3. Rotary Joint
- 4. Power Incline Cylinder

# Front Scarifier Control Pipeline (Optional)



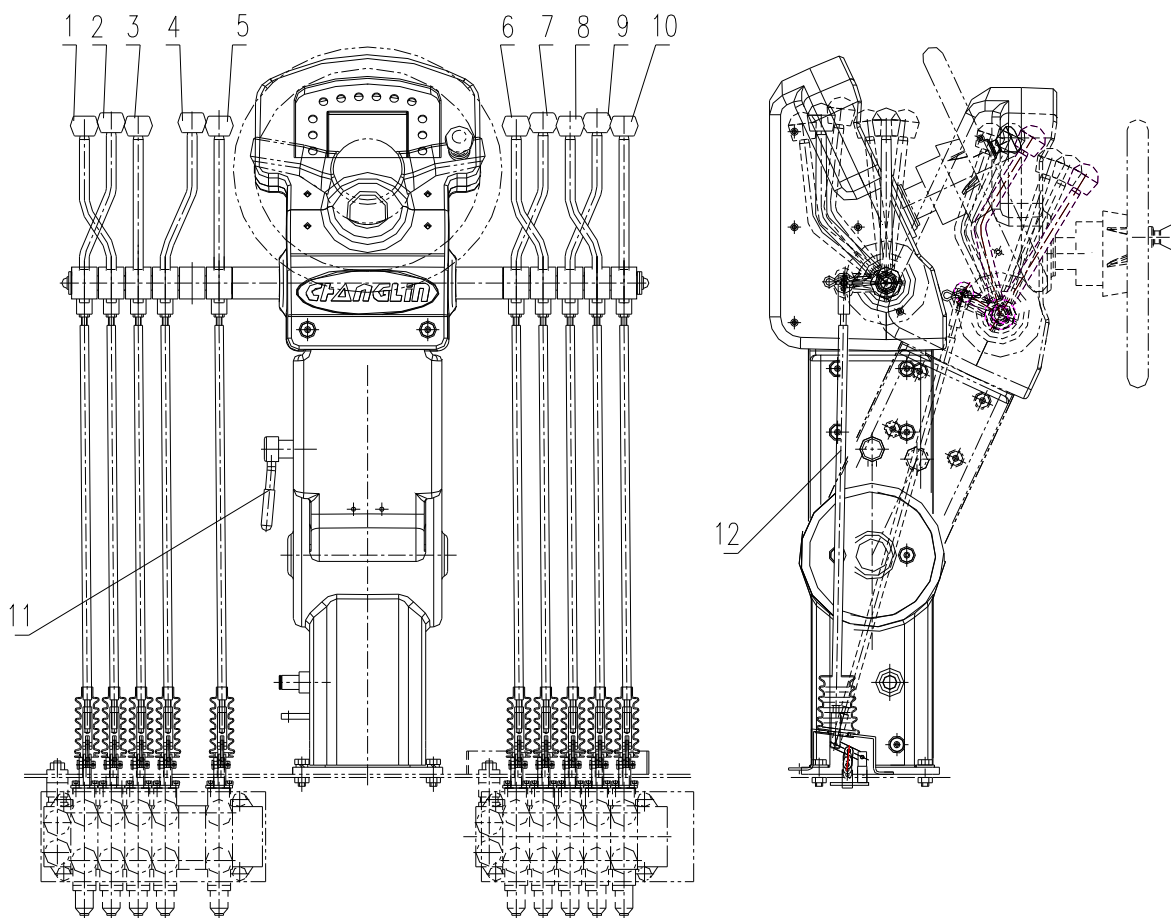
- 1. Right Control Valve
- 2. Hydraulic-control Check Valve (For Front Scarifier)
- 3. Scarifier Cylinder

# Rear Ripper Control Pipeline (Optional)



- 1. Left Control Valve
- 2. Rear Ripper Cylinder
- 3. Hydraulic-control Check Valve (For Rear Ripper)

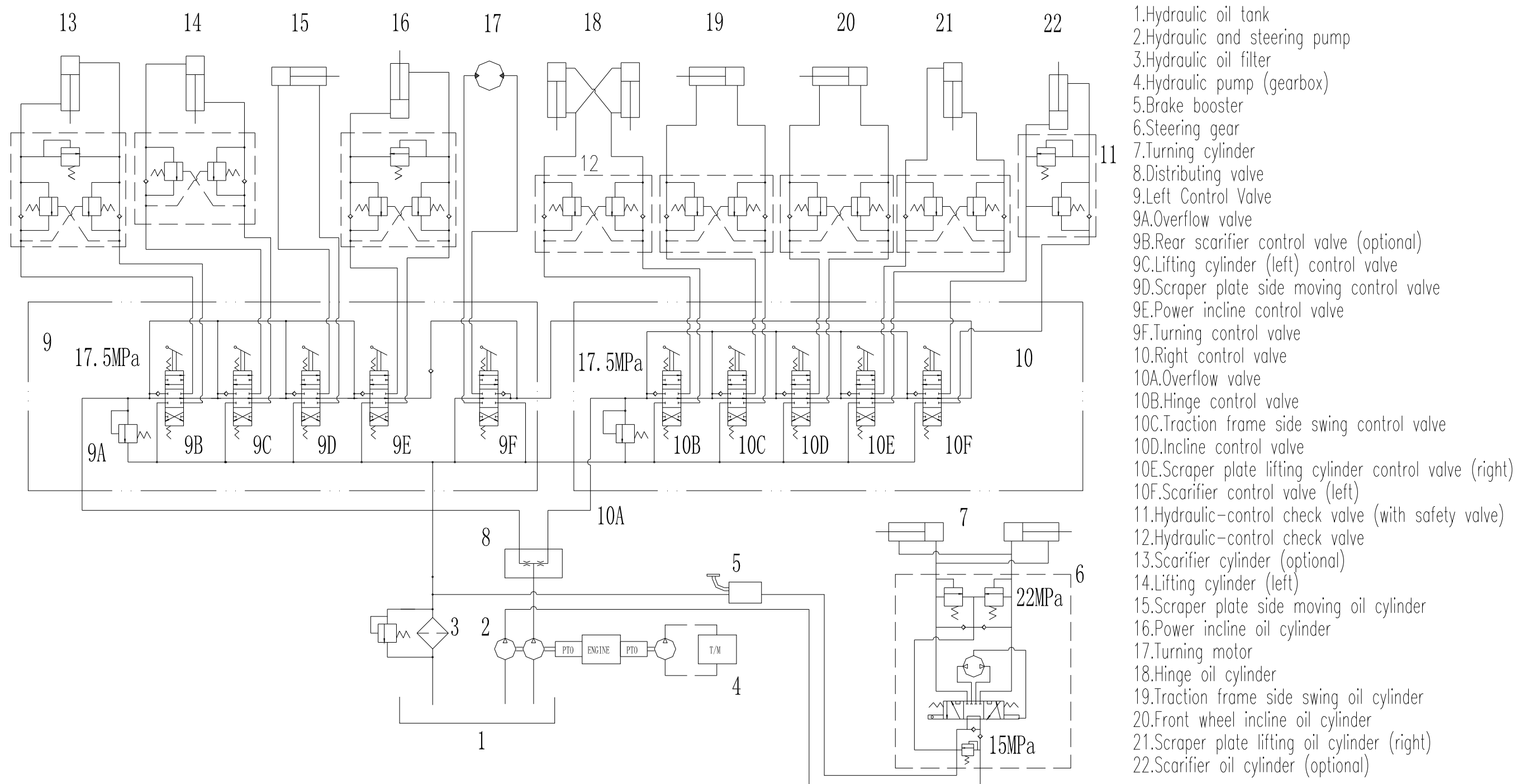
## Hydraulic Operation



The angular regulating handle in the control board can adjust the angle between control board and baseboard, and the control board can be leaned towards the seat except for in vertical position. So, the operator will obtain comfortable operation under stand and seating status.

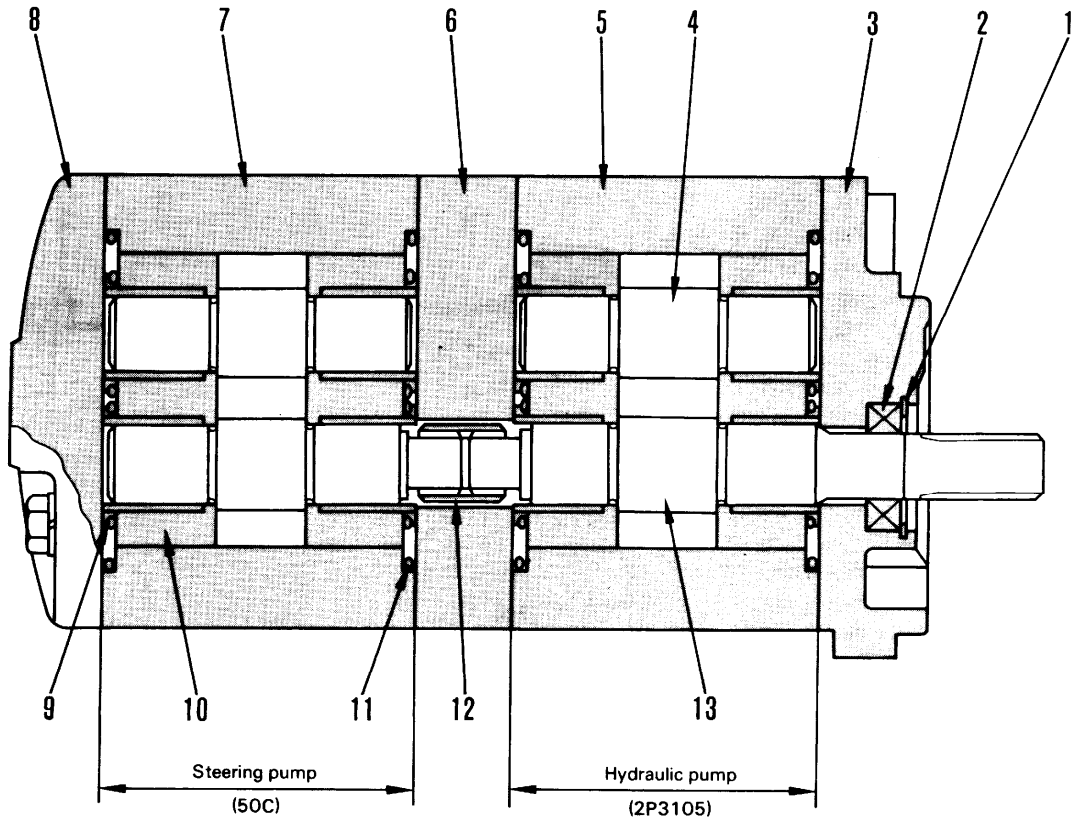
1. Scraper blade lifting operation rod (left side)
2. Ripper operation rod (optional)
3. Scraper blade side moving operation rod
4. Power incline operation rod
5. Turning Rod
6. Traction frame side swing operation rod
7. Hinge operation rod
8. Scraper lifting operation rod (right side)
9. Incline operation rod
10. Front scraper blade operation rod (optional)
11. Control board angular regulating handle
12. Rod

## The principle of hydraulic system



1. Hydraulic oil tank
2. Hydraulic and steering pump
3. Hydraulic oil filter
4. Hydraulic pump (gearbox)
5. Brake booster
6. Steering gear
7. Turning cylinder
8. Distributing valve
9. Left Control Valve
- 9A. Overflow valve
- 9B. Rear scarifier control valve (optional)
- 9C. Lifting cylinder (left) control valve
- 9D. Scraper plate side moving control valve
- 9E. Power incline control valve
- 9F. Turning control valve
10. Right control valve
- 10A. Overflow valve
- 10B. Hinge control valve
- 10C. Traction frame side swing control valve
- 10D. Incline control valve
- 10E. Scraper plate lifting cylinder control valve (right)
- 10F. Scarifier control valve (left)
11. Hydraulic-control check valve (with safety valve)
12. Hydraulic-control check valve
13. Scarifier cylinder (optional)
14. Lifting cylinder (left)
15. Scraper plate side moving oil cylinder
16. Power incline oil cylinder
17. Turning motor
18. Hinge oil cylinder
19. Traction frame side swing oil cylinder
20. Front wheel incline oil cylinder
21. Scraper plate lifting oil cylinder (right)
22. Scarifier oil cylinder (optional)

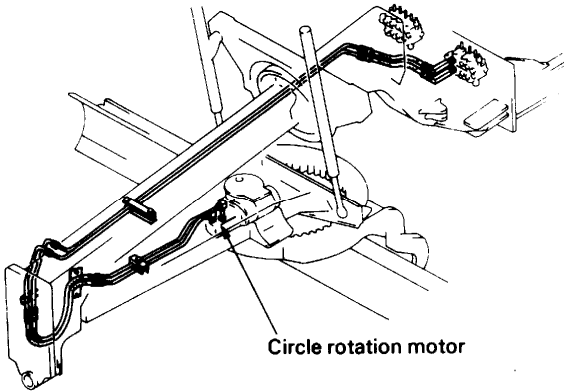
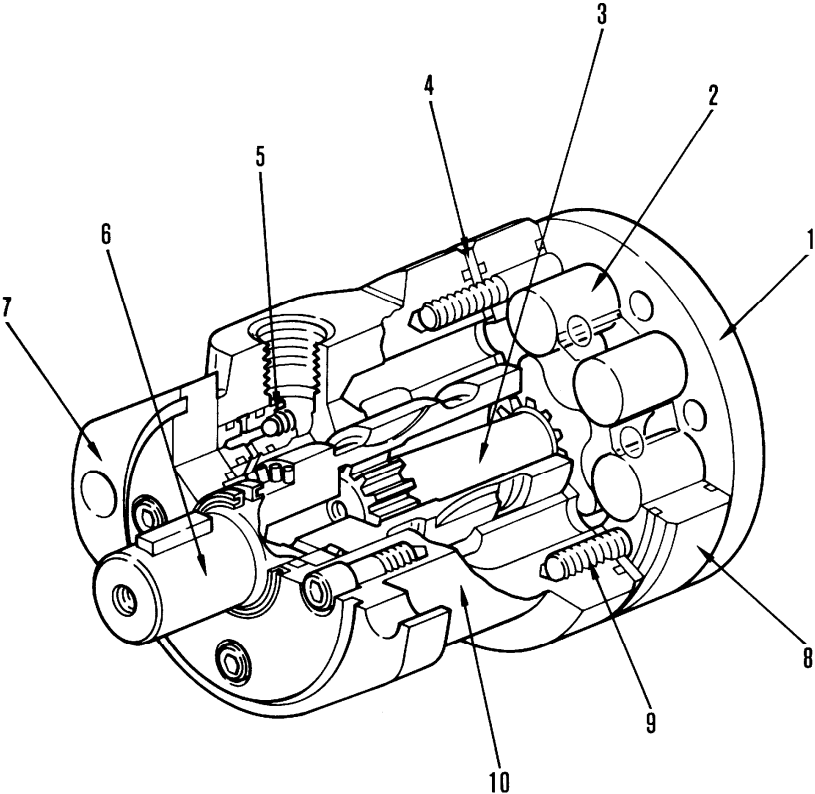
# Oil Pump



Theoretic Exhaust Volume: 25 ml/r      45 ml/r  
 Maximum Pressure: 17.5 MPa      20 MPa

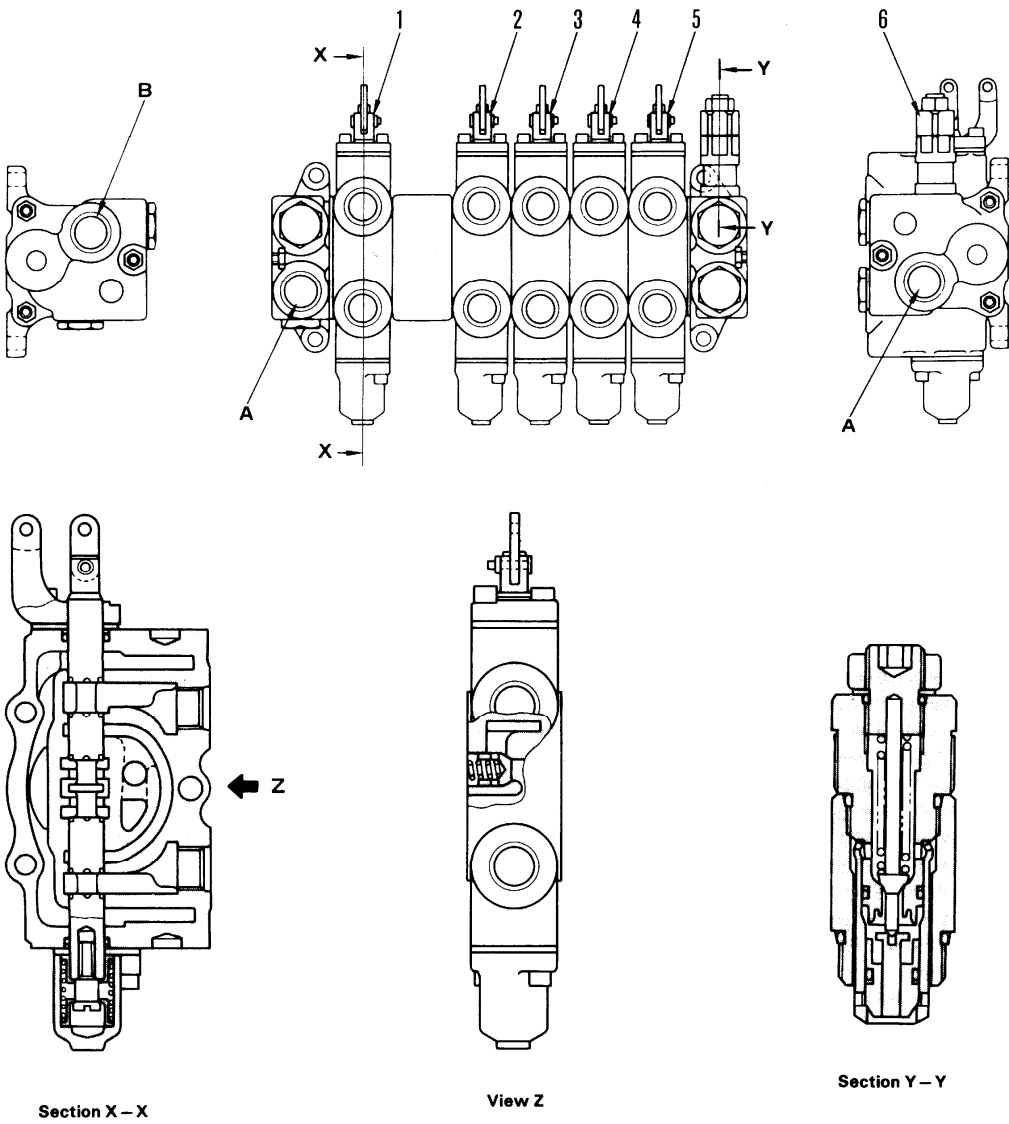
1. Retainer Ring
2. Oil Seal
3. Flange for Installation
4. Driven Gear
5. Pump Body
6. Middle Connecting Plate
7. Pump Body
8. Cover
9. Washer
10. Sleeve
11. Sealing Parts
12. Connector
13. Drive Gear

# Turning Motor



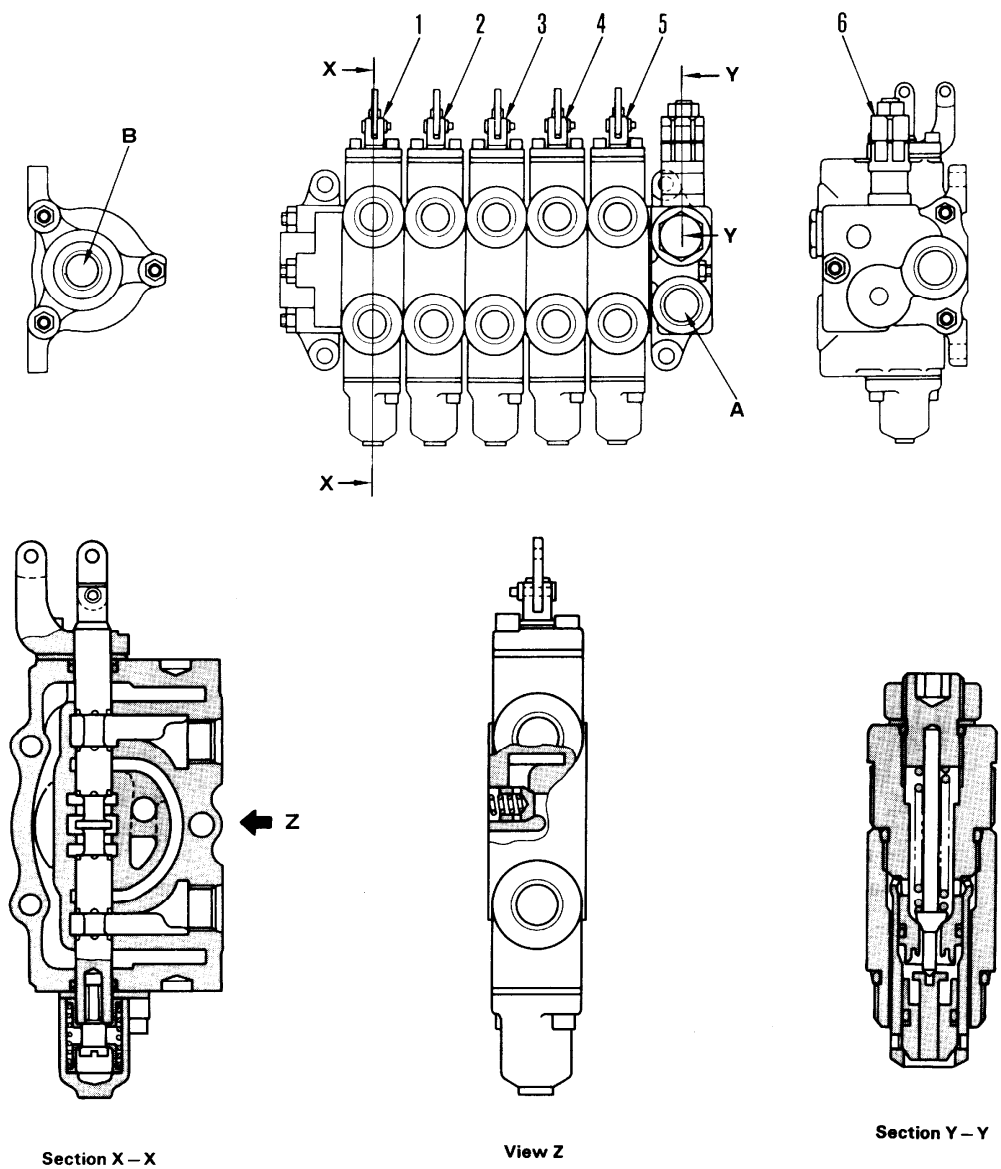
- 1. Bottom Cover
- 2. Stator Bushing
- 3. Drive Shaft
- 4. Valve Plate
- 5. Check Valve
- 6. Output Shaft
- 7. Flange
- 8. Stator
- 9. Screw Rod
- 10. Sleeve

**Control Valve**  
**Left Control Valve**



1. Turning Control Valve
  2. Power Incline Control Valve
  3. Scraper Blade Side Moving Control Valve
  4. Scraper Blade Lifting (Left) Control Valve
  5. Rear Ripper Control Valve (Optional)
  6. Overflow Valve
- A. Oil Inlet  
 B. Oil Return

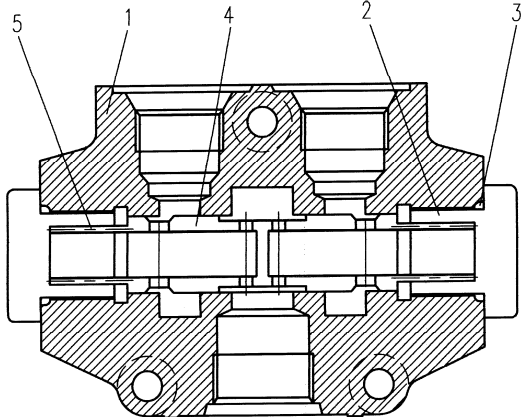
# Right Control Valve



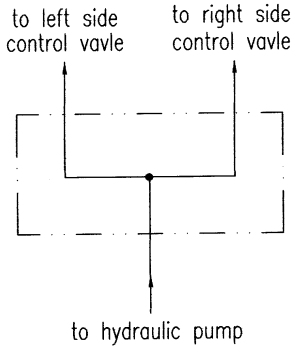
- 1. Scarifier Control Valve (Optional)
- 2. Scraper Blade Lifting (Right) Control Valve
- 3. Front Incline Control Valve
- 4. Traction Frame Side Swing Control Valve
- 5. Hinge Control Valve
- 6. Overflow Valve
- A. Oil Inlet
- B. Oil Return



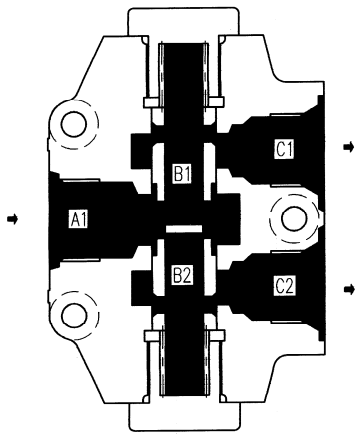
# Distributing Valve



- 1. Valve Body
- 2. Screw Plug
- 3. O Ring
- 4. Valve Sleeve
- 5. Spring

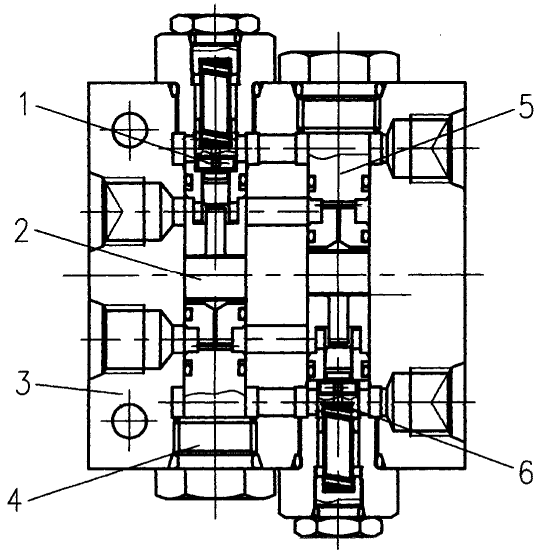


Oil enters A chamber from oil pump and is distributed at constant speed. One strand of oil flows to B<sub>1</sub> chamber and C<sub>1</sub> chamber; another strand of oil flows to B<sub>2</sub> chamber and C<sub>2</sub> chamber and these oil will flow to master control valve, respectively.

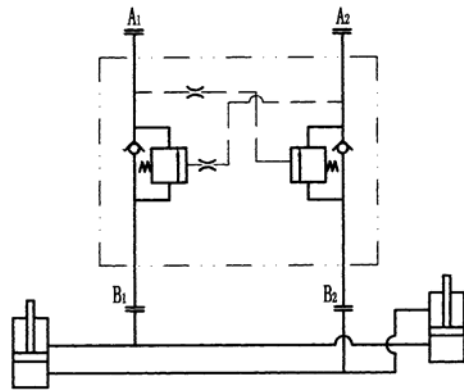


## Hydraulic-control Check Valve

(For left and right lifting, hinge, front wheel incline and traction frame side swing)

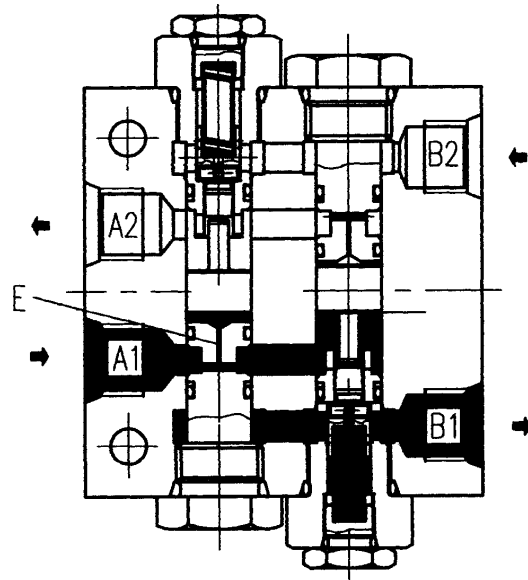


1. Check Valve
2. Piston
3. Valve Body
4. Screw Plug
5. Screw Plug
6. Check Valve



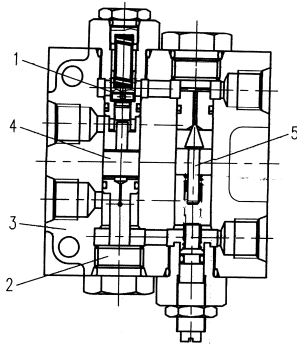
### Operation

When operate the control valve, oil enters A<sub>1</sub> chamber from oil pump and check valve (6) is opened and oil flows to B<sub>1</sub> chamber. When the pressure is produced, oil pushes piston (2) from throttle E and opens the check valve (1). In such way, oil connects the B<sub>2</sub> chamber and A<sub>2</sub> chamber and flows to oil outlet. Because the pressure variation between cylinder head end and cylinder head bottom is consistent with the switch of check valve (1), so the swing is occurred, however, because the damper of the throttle E, so the check valve (1) will not closed immediately even the pressure in A<sub>1</sub> chamber is lowered.



## Hydraulic-control Check Valve (with safety valve)

(For front scarifier (optional))



1. Check Valve
2. Screw Plug
3. Valve Body
4. Piston
5. Overflow Valve

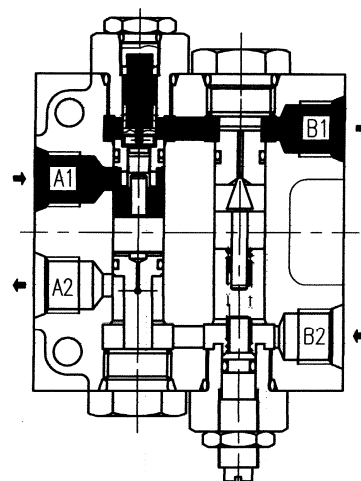
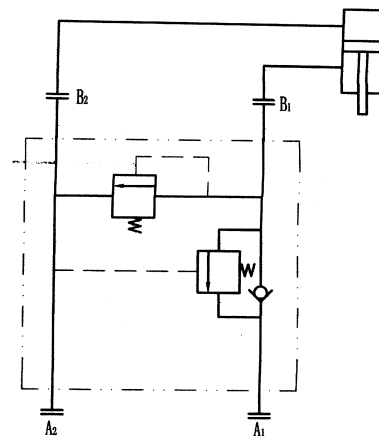
The hydraulic-control check valve with safety valve is mainly prevent the pressure variation of hydraulic cylinder and protect hydraulic cylinder from occurring abnormal pressure due to the foreign force.

When the scraper plate is lifted to max. position, the traction frame is moved to end. When traction frame has been in place and lifting limit is realized, the hydraulic-control check valve with safety valve installed on the lifting oil cylinder (left) of scraper plate is mainly prevent the work equipment from damaging due to the contact and collision.

### Operation

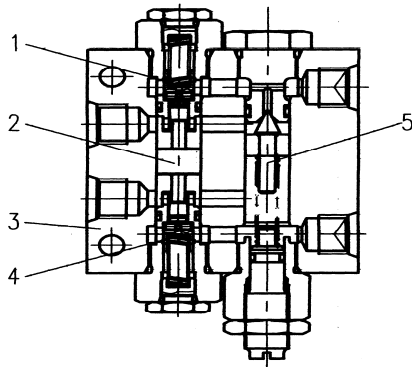
When operate the operation rod to retract the oil cylinder, the oil enters into A1 chamber from oil pump and pushes the check valve (1) and the oil flows to the top piston inside chamber on the head of oil cylinder through B1 chamber. The oil on the bottom of oil cylinder flows from B2 chamber to A2 chamber and back to oil tank.

When operate the operation rod to extend the oil cylinder, the oil flows into the bottom of oil cylinder through B2 chamber. When the pressure of A2 chamber and B2 chamber is increased, the piston (4) is pushed and pushes the check valve (1) to open. The oil on the head of oil cylinder flows to the throttle of check valve (1) from B1 chamber and back to oil tank from A1 chamber. When encounters any impact and vibration and the pressure of B1 chamber is increased to abnormal value of  $250 \text{ kg/cm}^2$  or more during the operation of machine, the overflow valve (5) is opened and oil flows to B2 chamber and back to oil tank, which avoid the impact.



## Hydraulic-control Check Valve

(For power incline, rear ripper (optional), front scraper blade (optional))



1. Check Valve
2. Piston
3. Shell Body
4. Check Valve
5. Overflow Valve

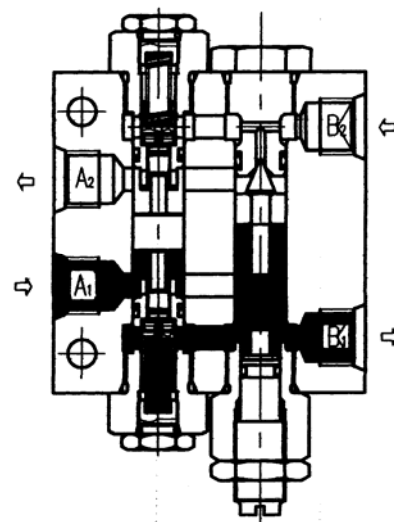
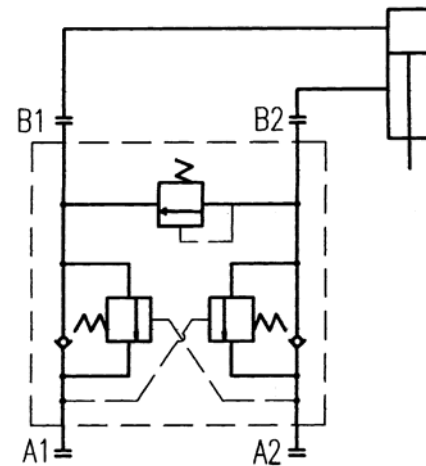
The hydraulic-control check valve with safety valve is mainly prevent the pressure variation of hydraulic cylinder and protect hydraulic cylinder from occurring abnormal pressure due to the foreign force.

### Operation

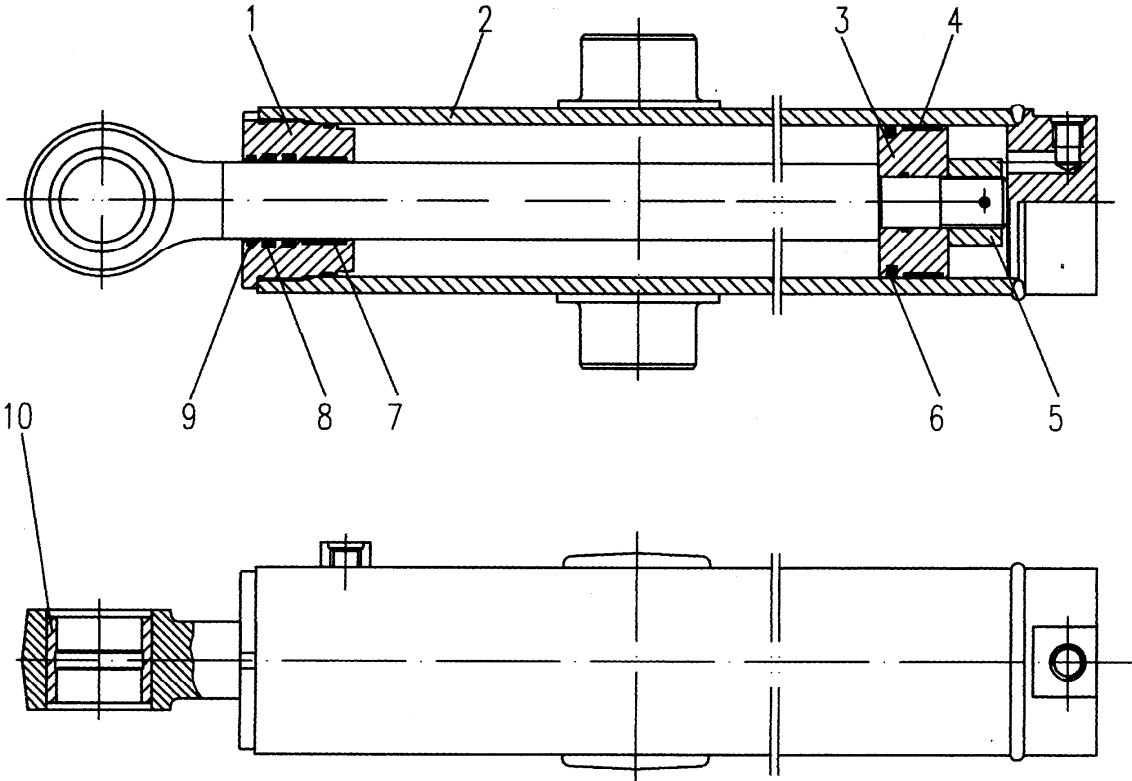
When operate the operation rod to extend the oil cylinder, the oil enters into A<sub>1</sub> chamber from oil pump and pushes the piston (2) and the check valve (4), then the oil flows to the bottom of hydraulic cylinder through B<sub>1</sub> chamber. The oil on the head of oil cylinder back to oil tank from B<sub>2</sub> chamber and A<sub>2</sub> chamber.

When operate the operation rod to retract the oil cylinder, the oil enters into A<sub>2</sub> chamber from oil pump. When the pressure of A<sub>2</sub> chamber is increased, the check valve (1) is pushed and opens the check valve (1). The oil flows to the head of hydraulic cylinder from B<sub>2</sub> chamber.

When the pressure of B<sub>2</sub> chamber is increased to abnormal value of 250 kg/cm<sup>2</sup> or more due to the impact, the overflow valve will be opened and oil flows from B<sub>2</sub> chamber to B<sub>1</sub> chamber, which reduce the impact.



**Rear Ripper Oil Cylinder (Optional)**



- 1. Cylinder Head
- 2. Cylinder Body
- 3. Piston
- 4. Bearing Ring
- 5. Locking Nut
- 6. Piston Ring
- 7. Sealing Ring
- 8. Bearing Ring
- 9. Dustproof Ring
- 10. Sleeve

# Hydraulic System

## 2. Test and Adjustment

Exhaust the air in the hydraulic circuit-----	20-116
Troubleshooting (Turning Motor) -----	20-117

## ▲ Exhaust the air in the hydraulic circuit

When replace the hydraulic pump or replace the hard pipe and hose near the pump, or replace the hard pipe and hose of the working system or steering system, exhaust the air in the working system and steering system according to the following methods:

- (1) Open the cap of oil refill hole on the hydraulic oil tank;
- (2) Start the engine;
- (3) Make the engine running under idle speed, and extend and retract all cylinders of working system and steering system starting from the bottom of travel for 2~3 times (about 50~60 mm) .
- (4) Run the engine with high speed and extend and retract all cylinders of working system and steering system under full travel for 3~5 times to exhaust the air in the pipeline.
- (5) After exhaust the air, set the machine and work equipment on the standard position (park the wheels in line, the front and rear frame is in the same line, the scraper blade and frame is of 90° and put them on the ground and drop the ripper to approach the ground), then check the oil volume and tight the cap of oil refill hole;
- (6) Stop the engine and check the hard pipe and hose for leakage.
- (7) Notes during exhaust the air

- 7.1) When exhaust the air of steering oil cylinder, the scraper should be dropped and support the front frame to lift the front wheel off the ground;
- 7.2) When exhaust the air in the such hydraulic system as scraper blade turning, scraper side moving and scraper incline, the scraper blade should be raised;
- 7.3) When exhaust the air in the traction frame side incline system, the scraper should be dropped slightly;
- 7.4) When exhaust the air in the hinge steering system, the shift should be in Neutral position;
- 7.5) When the scraper is lifted and the oil cylinder of ripper is extended, the machine has been off ground. Care should be paid when conduct this operation.

## Troubleshooting (Turning Motor)

Fault	Cause	Troubleshooting
Motor doesn't run	<ol style="list-style-type: none"> <li>1. Dust or the oil is too dirty, radial load of shaft and shaft sleeve is too large and motor is clogged.</li> <li>2. No pressure.</li> <li>3. Motor internal leak.</li> </ol>	<ol style="list-style-type: none"> <li>1. Turn the motor and test the oil pressure.</li> <li>2. Check the pumps and valves in the entire circuit.</li> <li>3. Exchange the motor</li> </ol>
The rotation speed of motor is different with the setting value	<ol style="list-style-type: none"> <li>1. The oil of motor is not enough.</li> <li>2. The axle temperature increases and hydraulic oil leaks and the viscosity reduce.</li> </ol>	<ol style="list-style-type: none"> <li>1. Check the flow rate of pump and motor, check the output volum in idling condition and check the drain flow of valves.</li> <li>2. Use the oil with normal viscosity or use the normal oil temperature to drive.</li> </ol>
The rotation speed of motor is deviated	<ol style="list-style-type: none"> <li>1. Pipeline is wrong.</li> <li>2. Speed adjusting is wrong.</li> </ol>	<ol style="list-style-type: none"> <li>1. Adjust pipeline</li> <li>2. Change speed adjusting (means the re-installed items)</li> </ol>
Shaft seal leaks	<ol style="list-style-type: none"> <li>1. Sealing elements were worn or damaged</li> </ol>	<ol style="list-style-type: none"> <li>1. Change sealing elements.</li> </ol>
Leak between flange and flange surface	<ol style="list-style-type: none"> <li>1. The flange connection is too loose.</li> <li>2. The O ring between flange and flange surface is damaged or the flange is damaged.</li> <li>3. The connection seal leaks oil.</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-tight (tightening torque: 26-32 N·m)</li> <li>2. Check O-ring for scratch or bur and check the working surface of O-ring on the flange surface.</li> <li>3. Change O-ring.</li> </ol>
Leak from rear cover	<ol style="list-style-type: none"> <li>1. The bolt of bottom cover has loosened.</li> <li>2. The O-ring is worn or damaged.</li> <li>3. Contacting area has dirt.</li> <li>4. Contacting area has concave slot or crack.</li> </ol>	<ol style="list-style-type: none"> <li>1. Tight 7 bolts (Tightening torque: 32-35 N·m);</li> <li>2. Replace O-ring;</li> <li>3. Clean and reassemble it.</li> <li>4. Grind the contacting area with 6# sand paper to smooth it.</li> </ol>
The installed flange have crack (4 bolted flanges)	<ol style="list-style-type: none"> <li>1. Result from the installation method</li> </ol>	<ol style="list-style-type: none"> <li>1. Change flange or use the normal bolt to tight.</li> </ol>
Holes leak	<ol style="list-style-type: none"> <li>1. Improper connection</li> <li>2. Screw is damaged</li> <li>3. Flange surface has crack</li> </ol>	<ol style="list-style-type: none"> <li>1. Re-connect</li> <li>2. Change flange surface.</li> </ol>
Abnormal sound	<ol style="list-style-type: none"> <li>1. The axle is installed wrongly;</li> <li>2. Air in the pipeline or motor;</li> <li>3. Pump has clearance</li> <li>4. Motor has clearance</li> <li>5. Air in the oil inlet pipe</li> </ol>	<ol style="list-style-type: none"> <li>1. Reinstall</li> <li>2. Exhaust</li> <li>3. Exchange pump</li> <li>4. Exchange motor</li> <li>5. Exhaust</li> </ol>
Abnormal temperature raise	<ol style="list-style-type: none"> <li>1. Cooling system is abnormal;</li> <li>2. The capacity of oil tank is not enough</li> <li>3. The pressure is too high</li> <li>4. Using swing mechanism frequently</li> </ol>	<ol style="list-style-type: none"> <li>1. Check and repair cooler;</li> <li>2. Increase capacity or cooler</li> <li>3. Adjust the overflow valve to normal pressure.</li> </ol>

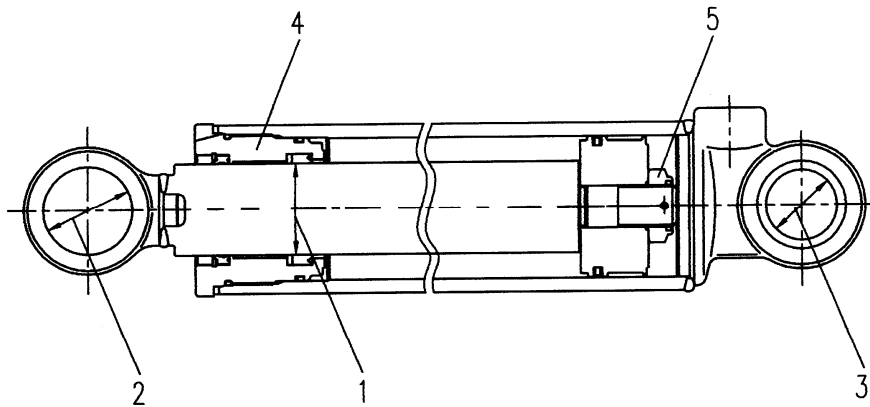


# **Hydraulic System**

## **3. Maintenance Standard**

Hydraulic Oil Cylinder ----- 20-119

# Hydraulic Oil Cylinder



Serial No.	Items to be inspected	Judgment					Action	
		Standard Dimension	Tolerance		Standard Clearance	Minimum Clearance		
			Axle	Hole				
1	Clearance between piston rod and sleeve	Scraper blade lifting	50	-0.080 -0.142	+0.164 +0.007	0.087~ 0.036	0.6	Re-install sleeve
		Scraper blade side moving	50	-0.080 -0.142	+0.164 +0.007	0.087~ 0.036	0.6	
		Traction frame side swing	45	-0.080 -0.142	+0.152 +0.007	0.087~ 0.036	0.6	
		Front wheel incline	35	-0.080 -0.142	+0.132 +0.006	0.087~ 0.036	0.6	
		Hinge turning	45	-0.080 -0.142	+0.152 +0.007	0.087~ 0.036	0.6	
		Power incline turning	40	-0.080 -0.142	+0.132 +0.006	0.087~ 0.036	0.6	
		Scarifier (optional)	50	-0.080 -0.142	+0.164 +0.007	0.087~ 0.036	0.6	
		Rear ripper (optional)	50	-0.080 -0.142	+0.164 +0.007	0.087~ 0.036	0.6	
2	Clearance between piston rod support and sleeve	Scraper blade lifting	80	-	-	-	-	Re-install sleeve
		Scraper blade side moving	40	-0.025 -0.064	+0.142 +0.080	0.105~ 0.206	1	
		Traction frame side swing	80	-	-	-	-	
		Front wheel incline	45	-0.025 -0.064	+0.142 +0.080	0.105~ 0.206	1	
		Hinge turning	45	-0.025 -0.064	+0.142 +0.080	0.105~ 0.206	1	
		Power incline turning	40	-0.025 -0.064	0 -0.012	0.105~ 0.206	1	
		Scarifier (optional)	50	-0.025 -0.064	+0.142 +0.080	0.105~ 0.206	1	
		Rear ripper (optional)	50	-0.025 -0.064	+0.142 +0.080	0.105~ 0.206	1	

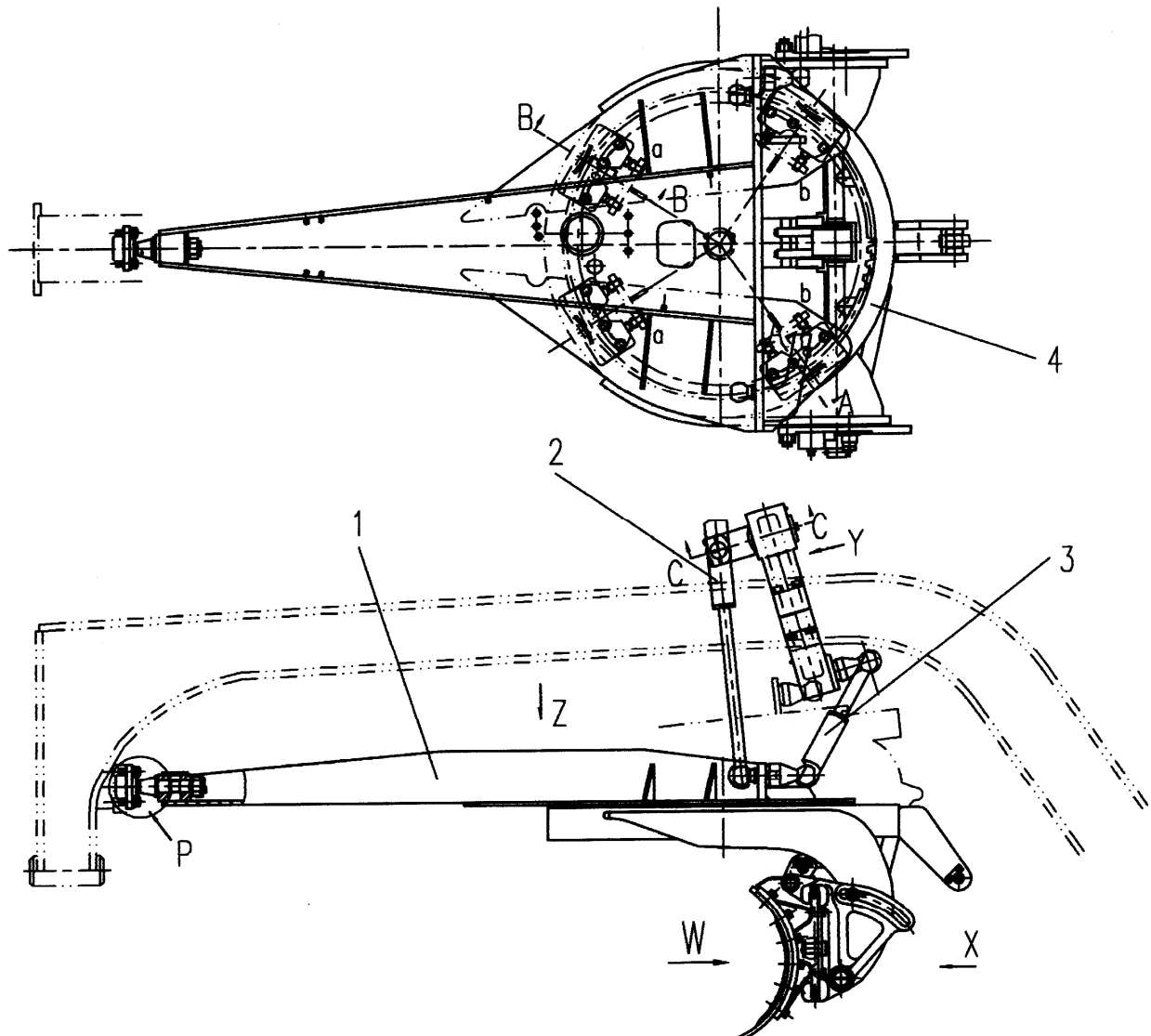
Serial No.	Items to be inspected	Judgment					Action	
		Standard Dimension	Tolerance		Standard Clearance	Minimum Clearance		
	Axle		Hole					
3	Clearance between oil cylinder base (support, bearing ball joint and support) and sleeve	Scraper blade lifting	45	-0.080 -0.142	+0.062 0	0.087~ 0.204	1	Re-install sleeve
		Scraper blade side moving	40	-0.025 -0.064	+0.142 +0.080	0.105~ 0.206	1	
		Traction frame side swing	80	-	-	-	-	
		Incline	40	-0.025 -0.064	+0.142 +0.080	0.105~ 0.206	1	
		Hinge	45	-0.025 -0.064	+0.142 +0.080	0.105~ 0.206	1	
		Power incline turning	40	-0.025 -0.064	0 -0.012	0.013~ 0.064	1	
		Scarifier (optional)	50	-0.025 -0.064	+0.142 +0.080	0.105~ 0.206	1	
		Rear ripper (optional)	75	-0.100 -0.174	+0.174 +0.100	0.200~ 0.348	1	
		4	Tightening torque of oil cylinder head	Scraper blade lifting	600±60 N·m			
Scraper blade side moving	600±60 N·m							
Traction frame side swing	600±60 N·m							
Incline	550±55 N·m							
Hinge	600±60 N·m							
Power incline turning	690±69 N·m							
Scarifier (optional)	690±69 N·m							
Rear ripper (optional)	860±86 N·m							
5	Tightening torque of piston nut	Scraper blade lifting	630±63 N·m					Re-tight
		Scraper blade side moving	630±63 N·m					
		Traction frame side swing	630±63 N·m					
		Incline	420±42 N·m					
		Hinge	630±63 N·m					
		Power incline turning	630±63 N·m					
		Scarifier (optional)	800±80 N·m					
		Rear ripper (optional)	1100±110 N·m					

# **Work Equipments**

## **1. Structure and Functions**

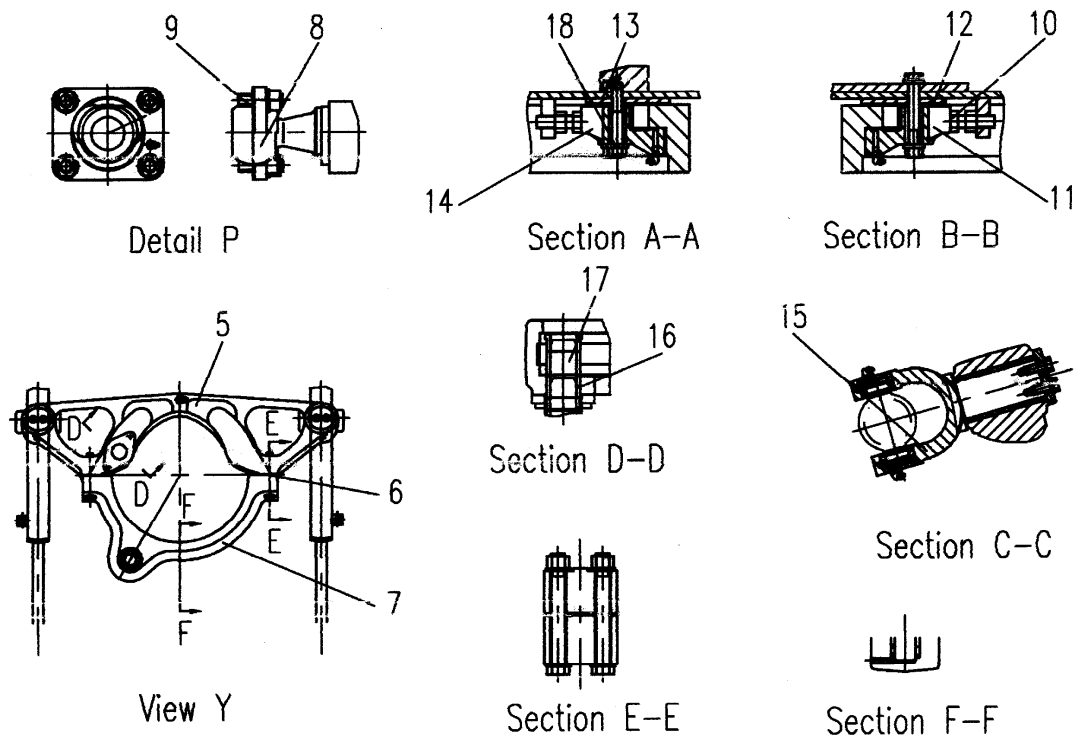
Traction Frame and Lifter -----	20-122
Scraper Blade -----	20-125
Turning Gear -----	20-126
Frame -----	20-127
Front Scarifier (Optional) -----	20-128
Rear Ripper (Optional) -----	20-129

## Traction Frame and Lifter



Traction frame is important equipment for supporting turning gear ring and scraper blade. When the ball joint (8) is worn, the shim (9) is used to adjust the clearance at connecting area to ensure the clearance is not too much. When rotate the guide frames (11) and (14) and make them contact with turning gear ring at (a) and (b) points. The shim (12) and (13) as well as adjusting bolt are used to adjust the clearance of connecting elements.

1. Traction Frame
2. Scraper Blade Lifting Oil Cylinder
3. Traction Frame Side Moving Oil Cylinder
4. Turning Gear Ring



The oil cylinder is mounted on lifter to move the scraper blade device.

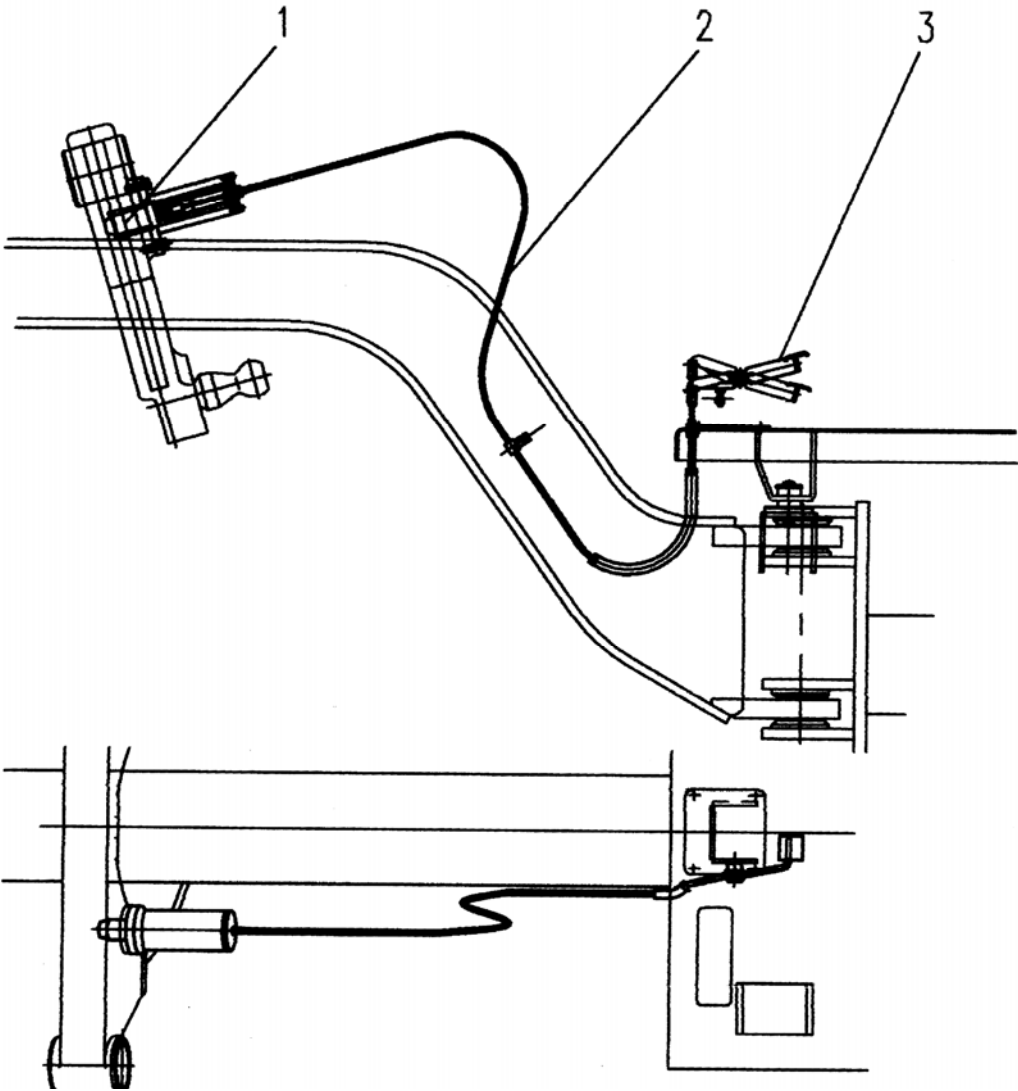
Connecting frames (5) and (7) are mounted guide plate that is welding on front frame. The connecting frame can be turned when remove the control pin at the left side of instrument column.

There are 3 holes that pins can insert into to prevent turning. Holes (d) and (c) are used to scrape the gradient to left or to right for scraper.

Hole (e) is used more frequent than other holes. The sleeve (16) is used to adjust the clearance between pin and hole to make the clearance reach to minimum value (such clearance can increase the move of scraper to top and to bottom). In additionally, the clearance between connecting frame and the guide plate that is welding on the frame can be adjusted with shim.

- 5. Lift Connecting Frame (Top)
- 6. Shim
- 7. Lift Connecting Frame (Bottom)
- 8. Ball Hinge Joint
- 9. Shim
- 10. Adjusting Bolt
- 11. Guide Frame
- 12. Shim
- 13. Shim
- 14. Guide Frame
- 15. Ball Hinge Joint
- 16. Sleeve
- 17. Pin
- 18. Bolt

# Lifter Connecting Frame Control



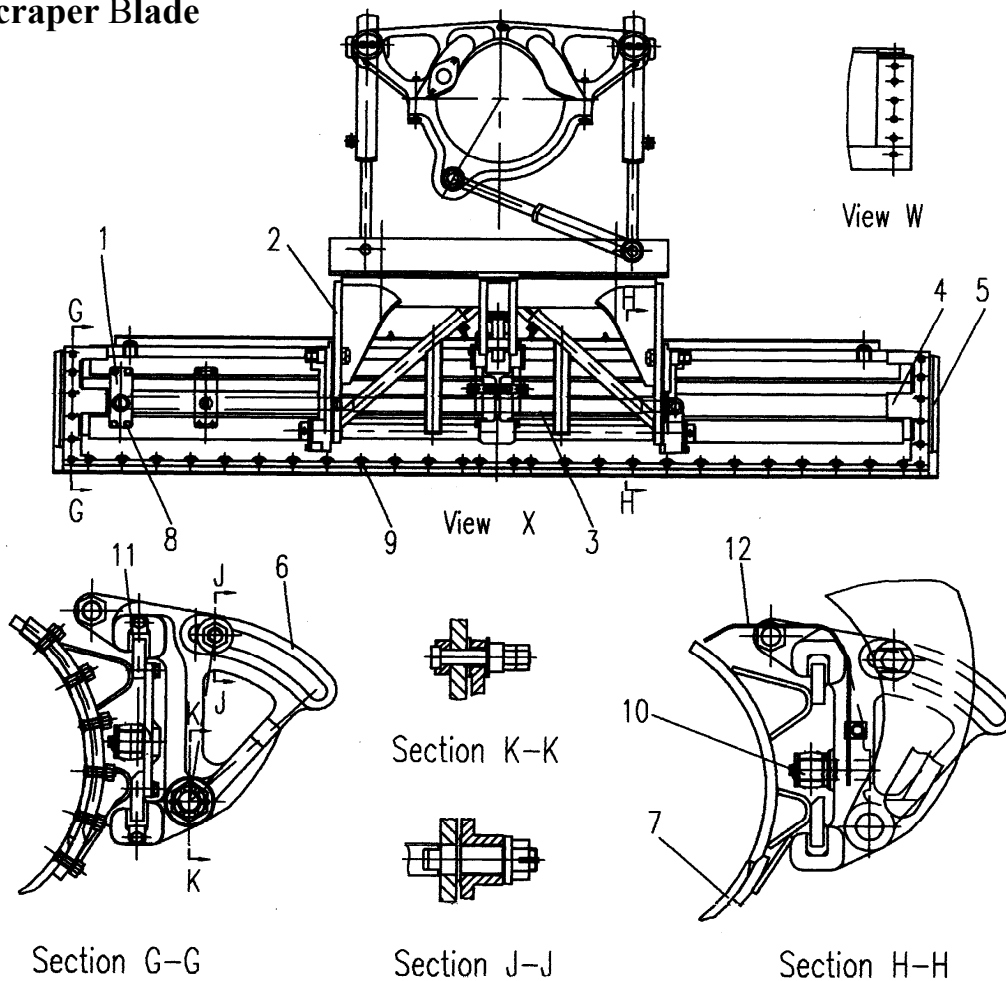
The connecting frame of lifter is fixed on the guide plate on the support of front frame lifter through pin. When conduct scraping gradient operation, depress the pedal (3) and remove pin and turn the connecting frame of lifter.

1. Pin

2. Soft Shaft

3. Pedal

## Scraper Blade



The adjusting frame (6) is used to adjust the cutting angle of scraper blade. When the scraper blade is move to edge, the sliding frame is corresponds with the sleeve of sliding elements. When the clearance between the sliding frame and sliding elements is too much and the operation accuracy cannot be obtained, change the sliding frame.

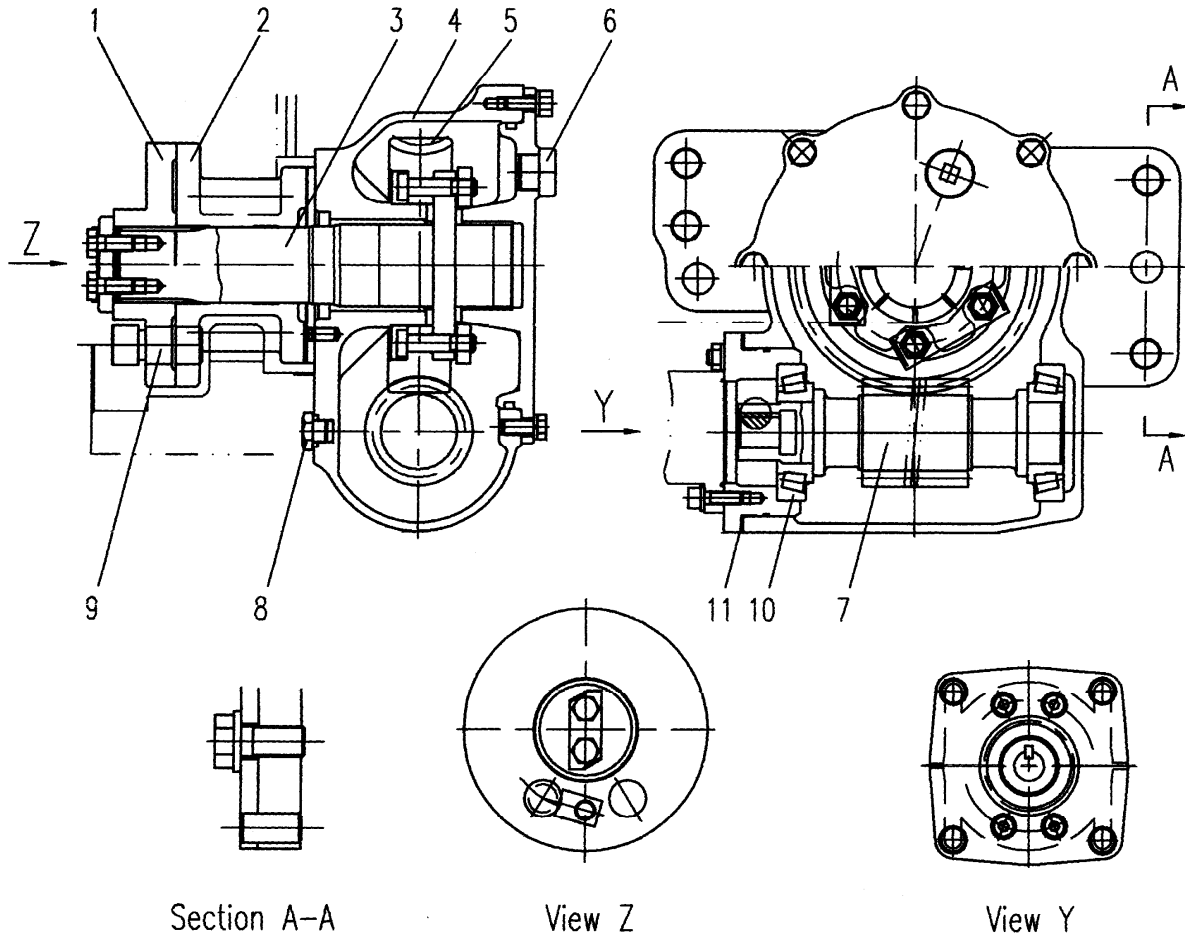
Cover plate (12) is used to prevent some problems from occurring, such as the slide is affected or the oil cylinder piston rod is damaged due to the dust and sand on the scraper blade sliding part and side moving oil cylinder.

The side moving of scraper blade can be adjusted through the sliding position or support (1).

1. Support
2. Support frame
3. Scraper Blade Side Moving Oil Cylinder
4. Scraper Blade
5. Edge Blade Plate
6. Adjusting Frame
7. Cutting Edge
8. Bolt
9. Nut
10. Shaft
11. Sliding Frame
12. Cover Plate



## Turning Gear

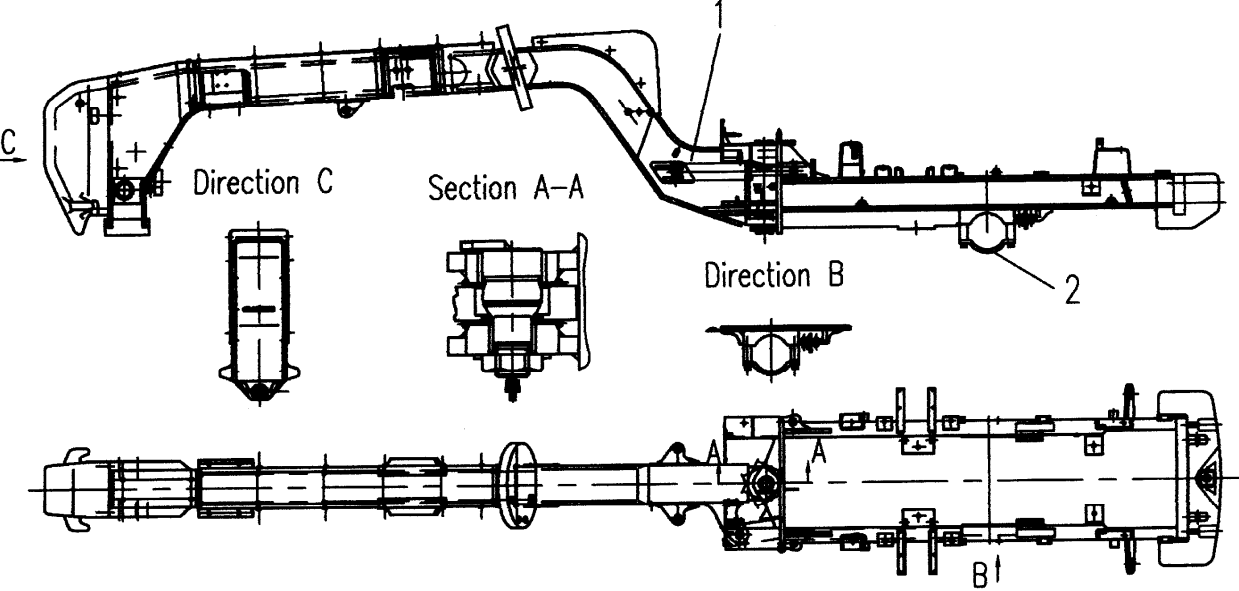


The turning gear is driven by motor through the splineway on the worm shaft (7).

The connector (1) and gear (2) is connected through the safety pin (9). If abnormal torque is transmitted from the scraper blade, the safety pin (9) will be sheared to prevent the scraper blade system from cracking due to overload.

1. Connector
2. Pinion
3. Shaft
4. Housing
5. Worm Wheel
6. Screw Plug
7. Worm
8. Drain Plug
9. Safety Pin
10. Bearing
11. Shim

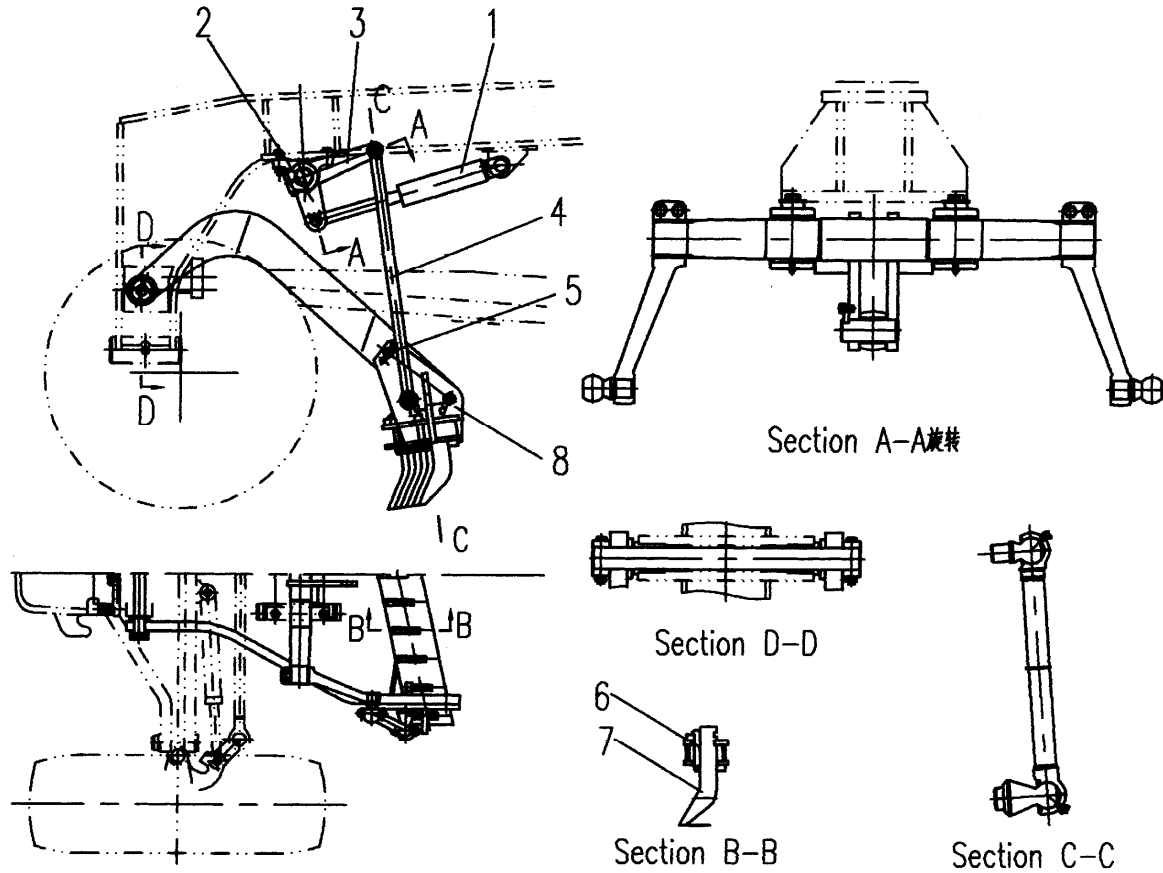
# Frame



The front frame can turn 26° to left or to right (the turning limit block is located on left and right sides of frame) through the hinge oil cylinder. When conduct moving operation, leaving the mud operation or operate on the corner, the hinge structure is benefit to reduce the turning radius. In additionally, the operation view is good due to the front frame is an integer.

- 1. Frame
- 2. Press Cover

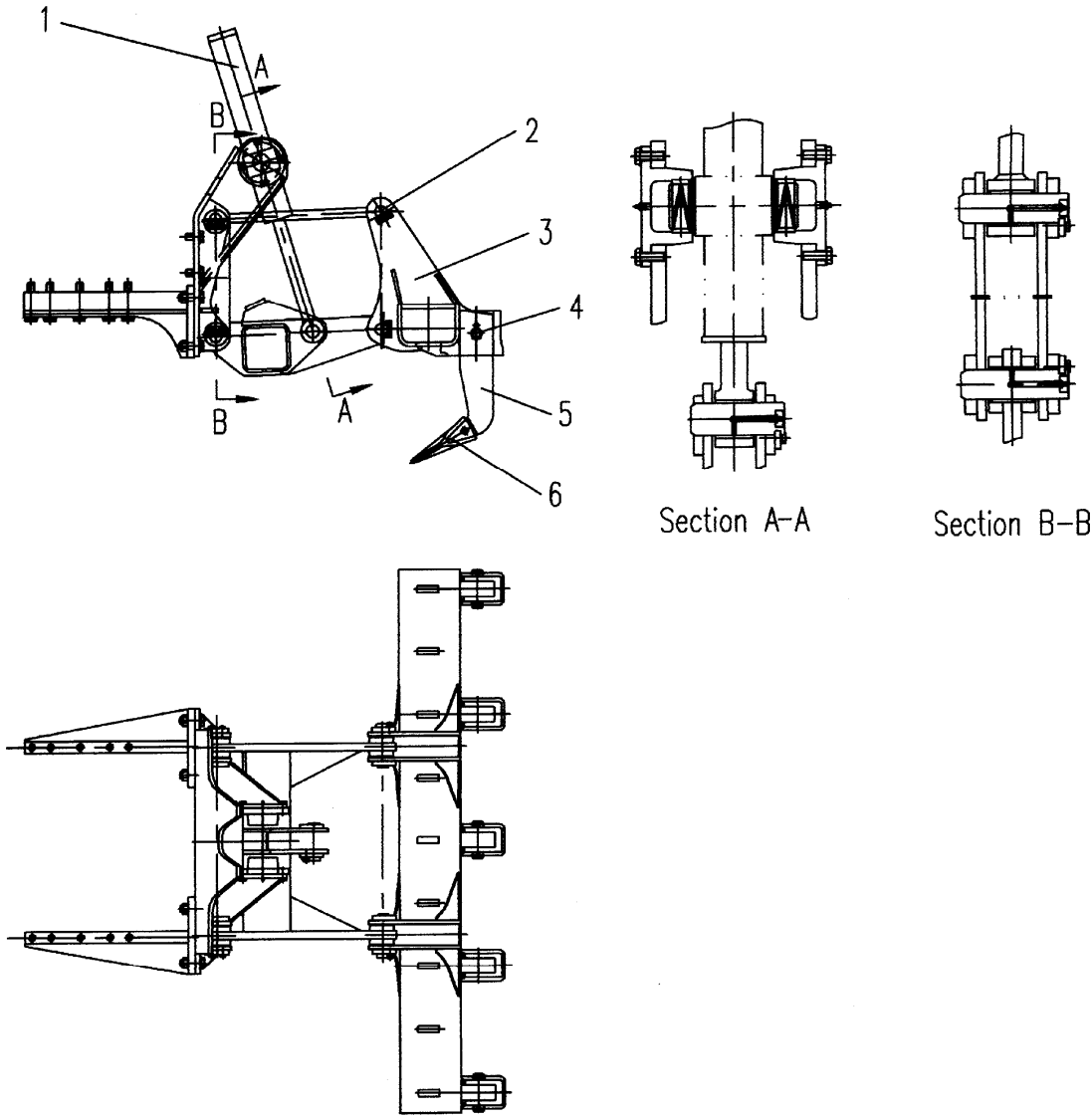
# Front Scarifier (Optional)



When remove the bolt (5) between holes (a) and (b) on the support (8), the cutting angle of teeth, lifting height and cutting depth of scarifier can be changed.

- 1. Scarifier Oil Cylinder
- 2. Arm
- 3. Scarifier Oil Cylinder Arm
- 4. Rod
- 5. Bolt
- 6. Tooth
- 7. Wedge Block
- 8. Support

### Rear Ripper (Optional)



The lifting height and digging depth of ripper are adjusted through the hydraulic oil cylinder (1). The tooth tip cuts into the ground by using of the load produced by the self-weight of ripper, so the rear ripper can conduct difficult digging operations that common ripper cannot operate. Two kinds of teeth tips are used respectively to: short teeth suits to heavy load digging and long teeth suits to common operation.

- 1. Ripper Oil Cylinder
- 2. Pin
- 3. Support
- 4. Split Pin
- 5. Digger
- 6. Teeth Tip

# Work Equipments

## 2. Test and Adjustment

Judgment Standard Table -----	20-131
Adjusting Tools List -----	20-133
Check Control Rod -----	20-134
Check Hydraulic Oil Temperature -----	20-135
Hydraulic Sedimentation -----	20-137

### Judgment Standard Table

Items	Status	Unit	Standard Value	Allowable Value
<b>Operation Rod</b> <b>Moving</b> Scraper blade right lifting Scraper blade left lifting Scraper blade side moving Traction frame side moving Turning Power Incline Front scraper blade Rear ripper	Engine is stop and travel is on the termination.	Mm	55-65 45-55 45-55 55-65 45-55 55-65 65-75 55-65	50-70 40-60 40-60 50-70 40-60 50-70 60-80 50-70
<b>Operation Force</b> Scraper blade left & right lifting Scraper blade side moving Traction frame side moving Turning Power Incline Front scraper blade Rear ripper	Engine is stop, the travel is in the middle point of handle and it will reach maximum value before arriving the travel termination.	N	Max. 36 Max. 36 Max. 36 Max. 36 Max. 30 Max. 30 Max. 30	Max. 51 Max. 51 Max. 51 Max. 51 Max. 45 Max. 45 Max. 45
<b>Operation Speed</b> 1. Scraper blade lifting speed (Ascending) (Descending)	Oil temperature: 40±5 °C . Engine is under rated rotation speed status, the height of bottom edge of scraper blade is of 100 mm.	mm/sec.	225 135	202 121
2. Traction frame side moving speed (Left) (Right)	Oil temperature: 40±5 °C . Engine is under rated rotation speed status, the height of bottom edge of scraper blade is of 100 mm.		135 190	121 171
3. Scraper blade side moving speed (Left) (Right)	Oil temperature: 40±5 °C . Engine is under rated rotation speed status, the height of bottom edge of scraper blade is of 100 mm.		225 135	202 121
4. Turning speed	Oil temperature: 40±5 °C . Engine is under turning speed of maximum rotation speed.	Degree/se c	11	9.9
5. Scarifier lifting speed (Ascending) (Descending)	Oil temperature: 40±5°C. The ascending speed and descending speed when the center teeth tip of scarifier off ground of 50~150 mm.	mm/sec.	250 175	225 157

6. Rear ripper lifting speed (Ascending) (Descending)	Oil temperature: 40±5°C. The ascending speed and descending speed when the center teeth tip of ripper off ground of 50~150 mm under the rated rotation speed of engine.	mm/sec	220	198
			170	153
7. Front scraper blade lifting speed (Ascending) (Descending)	Oil temperature: 40±5°C. The ascending speed and descending speed when the bottom edge of scraper blade off ground of 50~150 mm under the rated rotation speed of engine.	mm/sec	200	180
			150	135
<b>Hydraulic Sedimentation</b> 1. Scraper blade oil cylinder extend	Oil temperature: 40±5°C. The scraper blade suspense vertically with regard to the machine. Record the extend value of oil cylinder.	mm/10 min.	Max. 10	Max. 20
2. Scraper blade oil cylinder retract	Oil temperature: 40±5°C. The lower edge of scraper blade contacts with ground and front wheel is raised. Record the retract value of oil cylinder.		Max. 20	Max. 40
3. Rear ripper oil cylinder extend	Oil temperature: 40±5°C. The ripper suspense. Record the extend value of oil cylinder.		Max. 10	Max. 20
4. Rear ripper oil cylinder retract	Oil temperature: 40±5°C. The lower teeth of rear ripper contact with ground and front wheel is raised. Record the retract value of oil cylinder.		Max. 30	Max. 50
Setting pressure of master overflow valve Right valve Left valve	Oil temperature: 40±5°C. Engine's speed: High-speed idle.	MPa	20 <sub>0</sub> <sup>+0.5</sup> 20 <sub>0</sub> <sup>+0.5</sup>	18.5 18.5

## Adjustment Tools List

<b>Serial No.</b>	<b>Test Items</b>	<b>Tools</b>	<b>Range</b>
1	Hydraulic pressure	Pressure meter	0-40 MPa
2	Oil temperature	Thermosensor	-50°C -120°C
3	Engine's speed	Tachometer	Digital Readout
4	Operation force of work equipment operation rod	Push-and-pull balance	0-250 N 0-500 N
5	Test travel	Tape	2 m

▲ When finish test, adjustment or maintenance, stop the machine on the flat ground, set the safety lock on the frame, and put the scraper blade on the ground and then flameout the engine.

Conduct parking brake and block the tires.

- ▲ The person who doesn't obtained permission accesses this machine is not allowed.
- ▲ When test the speed of engine, one person sits on the seat to operate and one conducts the test. Check the operation for safety and use the recognized signal.
- ▲ Carefully conduct all operations and avoid contacting the rotating components.



## Check Operation Rod Special Tools

Serial No.	Description	Quantity
A	Tape	1
B	Push-and-pull Balance	1

### Travel

Use the steel tape to measure the operation length at the center of handle of rod (1).

- ★ Conduct the measurement when the engine is stop.
- ★ The travel of work equipment operation rod is determined by the travel of slid valve of control valve, however, the centering position of handle is adjusted by individual rod.



### Operation Force

Use the push-and-pull balance to measure the maximum value of tip of rod (1) before arriving the travel termination.

- ★ Conduct the measurement when the engine is stop.
- ★ The spring force of slid valve at one side of control valve decides the operation force of work equipment operation rod. When the operation force is over the standard value, check the moving condition of tie rod. If it is normal, disassemble the control valve and check the movement of slid valve.

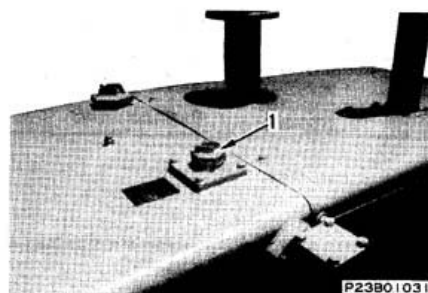


## Check Hydraulic Oil Temperature

### Special Tools

Serial No.	Description	Quantity
A	Thermosensor	1

1. Remove the cap of hydraulic oil tank and remove filter. Please slowly loose when remove the cap to release the pressure in the hydraulic oil tank.
2. Insert the thermosensor into oil hole and measure the oil temperature with main body of thermosensor A.



### Check Hydraulic Oil Pressure

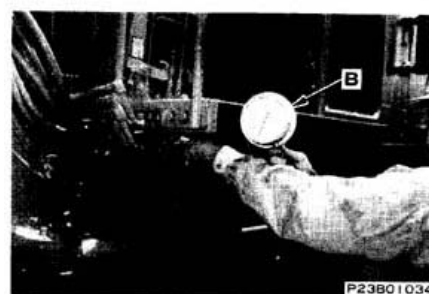
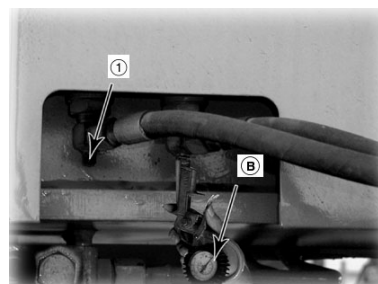
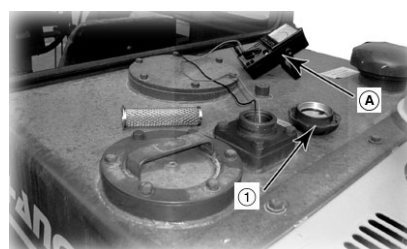
Serial No.	Description	Quantity
A	Pressure Meter	1

- ▲ The cap of hydraulic pressure oil tank can be loosed only after the engine is stopped and release the interior pressure.

1. Remove the screw plug (1) and install oil pressure meter B (about 40 MPa).

- ★ Remove the screw plug after operate the operation control rod to avoid the oil from spraying.

2. Start the engine and operate the operation rod of the measured circuit to measure the overflow pressure when hydraulic oil temperature is within range of 35°C ~ 45°C.



## Adjust the hydraulic oil pressure

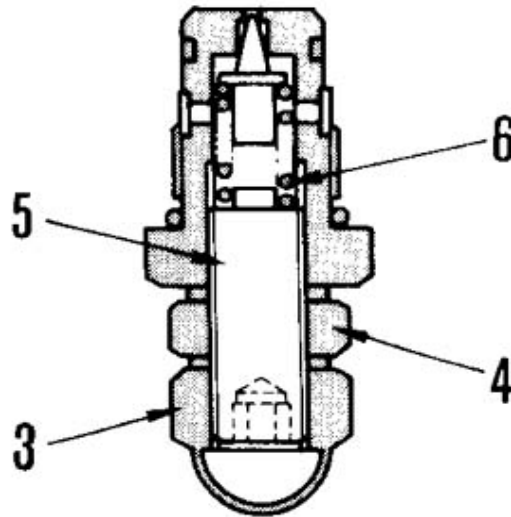
★ Adjust according to the steps below if the hydraulic oil pressure can't reach to standard value (20 MPa)

1. Remove cover (3), loose nut (4), and turn adjusting screw (5) to adjust the pressure of interior spring (6).

★ Clockwise turn for increasing oil pressure.

★ Counterclockwise turn for decreasing oil pressure.

2. After finish the adjustment, repeat commissioning and check if it has reached the standard value.

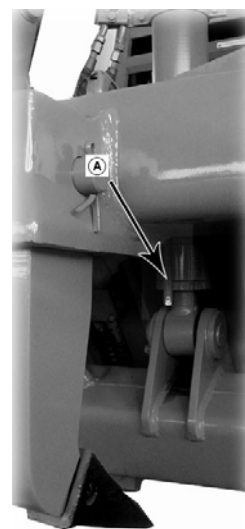


## Hydraulic Sedimentation

### Special Tool

Serial No.	Description	Quantity
A	Tape	1

1. Scraper blade oil cylinder extends
  - 1) Start engine after test the pressure and increase the hydraulic oil temperature to such range of  $40\pm 5^{\circ}\text{C}$ .
  - 2) Put the bottom edge of scraper blade on the ground and push oil cylinder to leave the front wheel from the ground for 300 mm.
  - 3) Stop engine for 10 minutes and use the disc tape to measure shrink value of oil cylinder and piston rod.
2. Scraper blade oil cylinder retracts
  - 1) Start engine after test the pressure and increase the hydraulic oil temperature to such range of  $40\pm 5^{\circ}\text{C}$ .
  - 2) Put the bottom edge of scraper blade on the ground and push oil cylinder to leave the front wheel from the ground for 300 mm.
  - 3) Stop engine for 10 minutes and use the disc tape to measure shrink value of oil cylinder and piston rod.
3. Scarifier oil cylinder extends (optional)
  - ★ Use the same method with “Scraper blade oil cylinder extends” to measure.
4. Scarifier oil cylinder retracts (optional)
  - ★ Use the same method with “Scraper blade oil cylinder retracts” to measure.
5. Rear ripper oil cylinder extends (optional)
  - ★ Use the same method with “Scraper blade oil cylinder extends” to measure.
6. Rear ripper oil cylinder retracts (optional)
  - ★ Use the same method with “Scraper blade oil cylinder retracts” to measure.

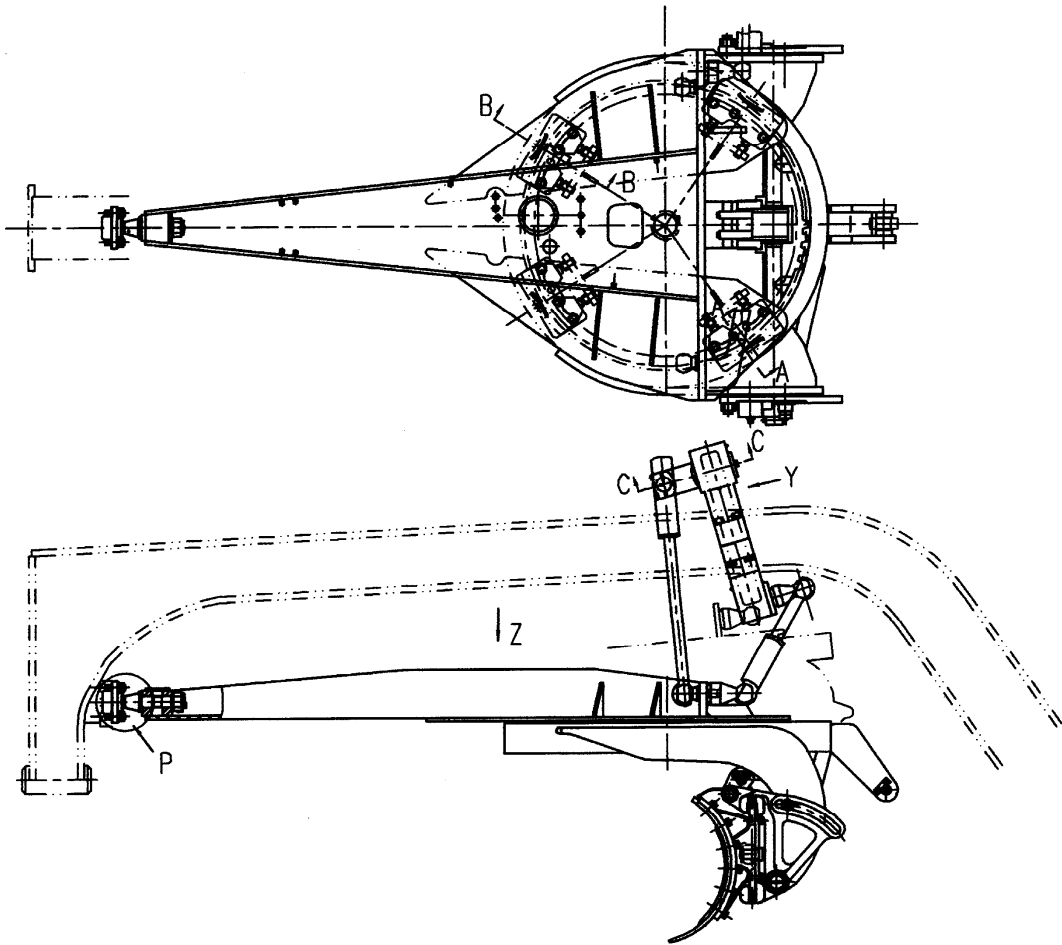


# **Work Equipments**

## **3. Maintenance Standard**

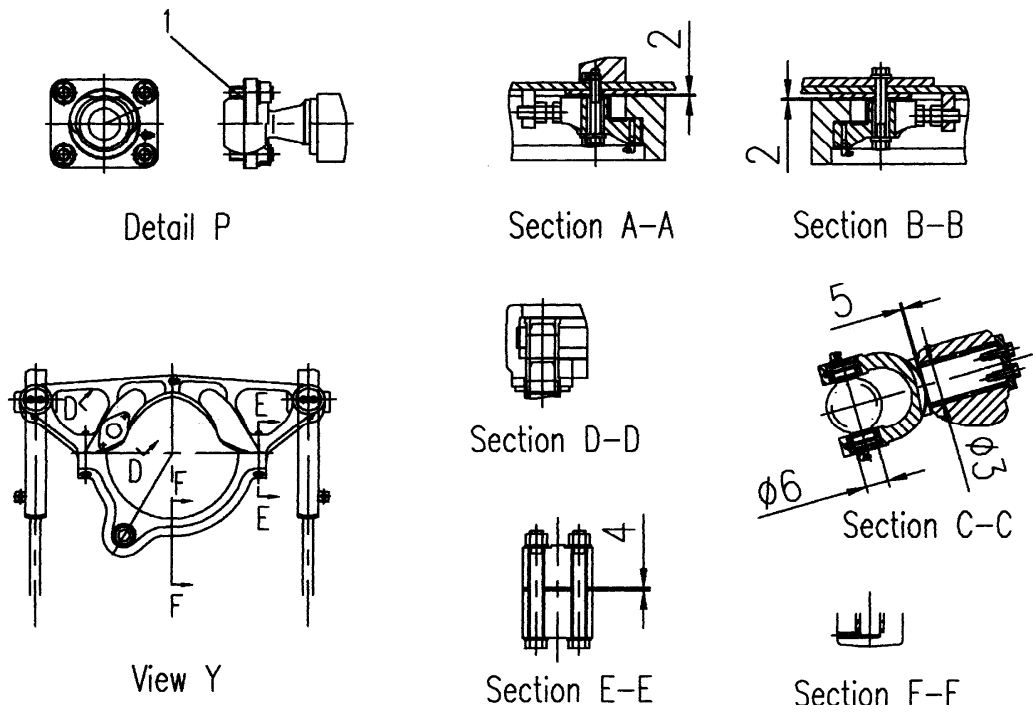
Traction Frame and Lifter -----	20-139
Scraper Blade -----	20-141
Turning Gear -----	20-142
Front Scarifier (Optional) -----	20-143
Rear Ripper (Optional) -----	20-144

## Traction Frame and Lifter



Unit: mm

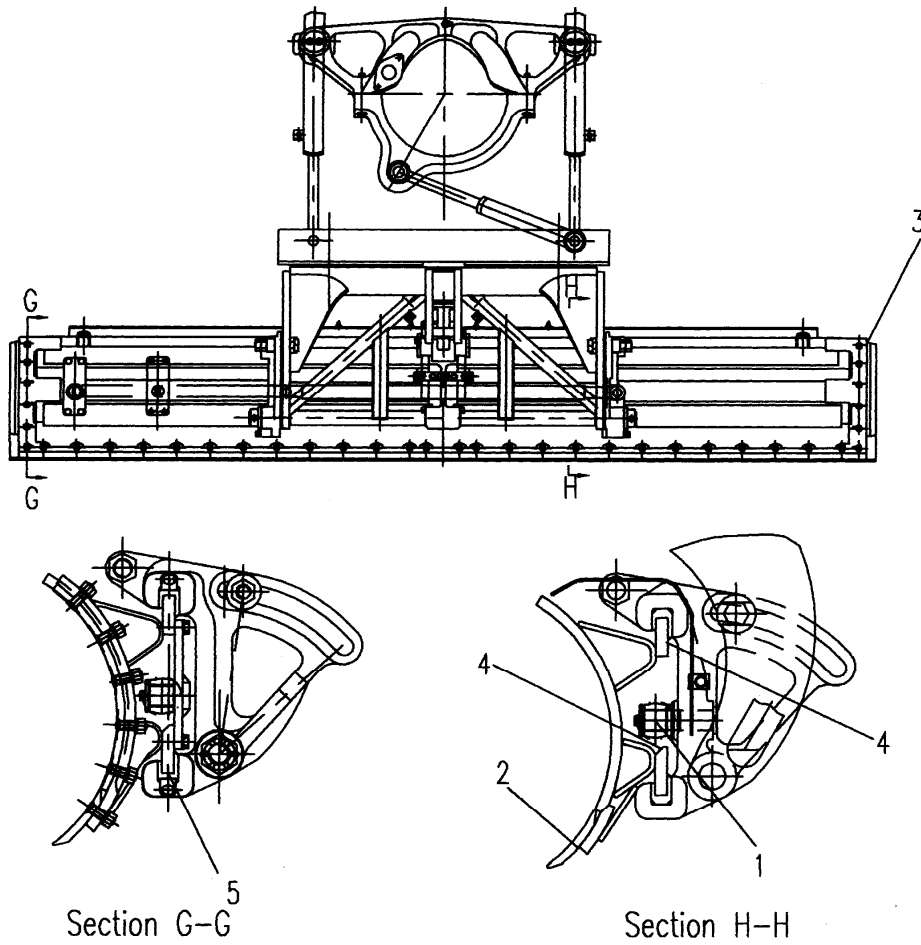
Serial No.	Items to be inspected	Judgment				Action
		Standard Dimension	Tolerance		Standard Clearance	
1	Wear of traction ball hinge joint	120	Axle	Hole	0.120 0.447	-
			-0.120	+0.180 0		
2	Clearance between gear ring and traction frame	Standard Clearance		Clearance Limit		Adjustment
		1.5		1.0-2.0		



Unit: mm

Serial No.	Items to be inspected	Judgment					Action
		Standard Dimension	Tolerance		Standard Clearance	Clearance Limit	
3	Clearance between support and sleeve	75	-0.030 -0.076	+0.22 +0.16	0.190 0.296	0.6	Replace
4	Wear of Lifter	Standard Shim Thickness: 2					Change
5	Axial Clearance of Support	Standard Clearance 0.8-1.3		Clearance Limit 2.0			Replace
6	Clearance between the scraper blade side incline cylinder bottom side support and sleeve	Standard Dimension	Tolerance		Standard Clearance	Clearance Limit	Replace
		45	-0.080 -0.142	+0.062 0	0.080- 0.204	0.5	

# Scraper Blade

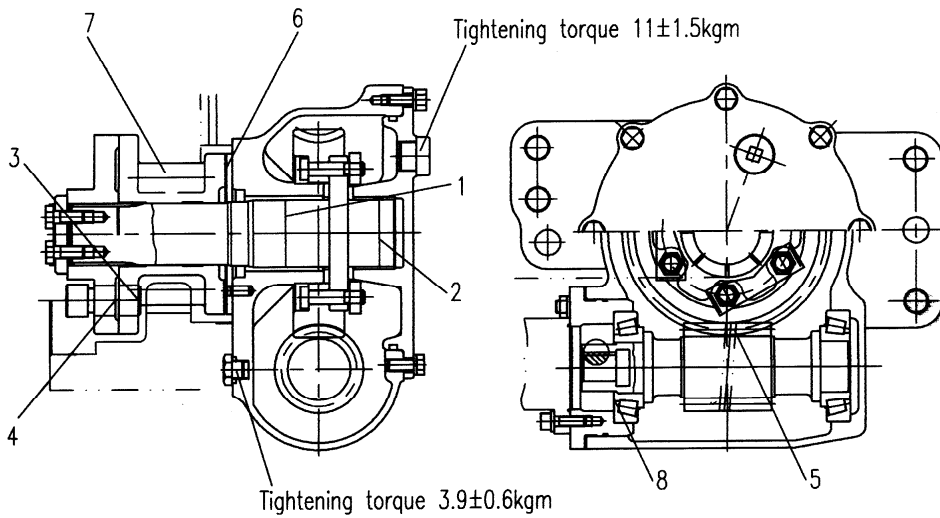


Unit: mm

Serial No.	Items to be inspected	Judgment				Action
		Standard Dimension	Tolerance		Standard Clearance	
1	Clearance between scraper side moving cylinder shaft and regulator	120	-0.025 -0.064	+0.142 +0.080	0.105- 0.206	Replace Sleeve
2	Wear of cutting edge	Maximum 10 mm (to edge of base)				Replacement
3	Wear of side blade	Allowable limit: Side: 25 Maximum 10 mm (to edge of base)				
4	Wear of Guide	Repairing Limit: Height: 364 Thickness: 21				
5	Wear of Guide Block of Scraper Blade	Repairing Limit: Height: 14 Thickness: 33				



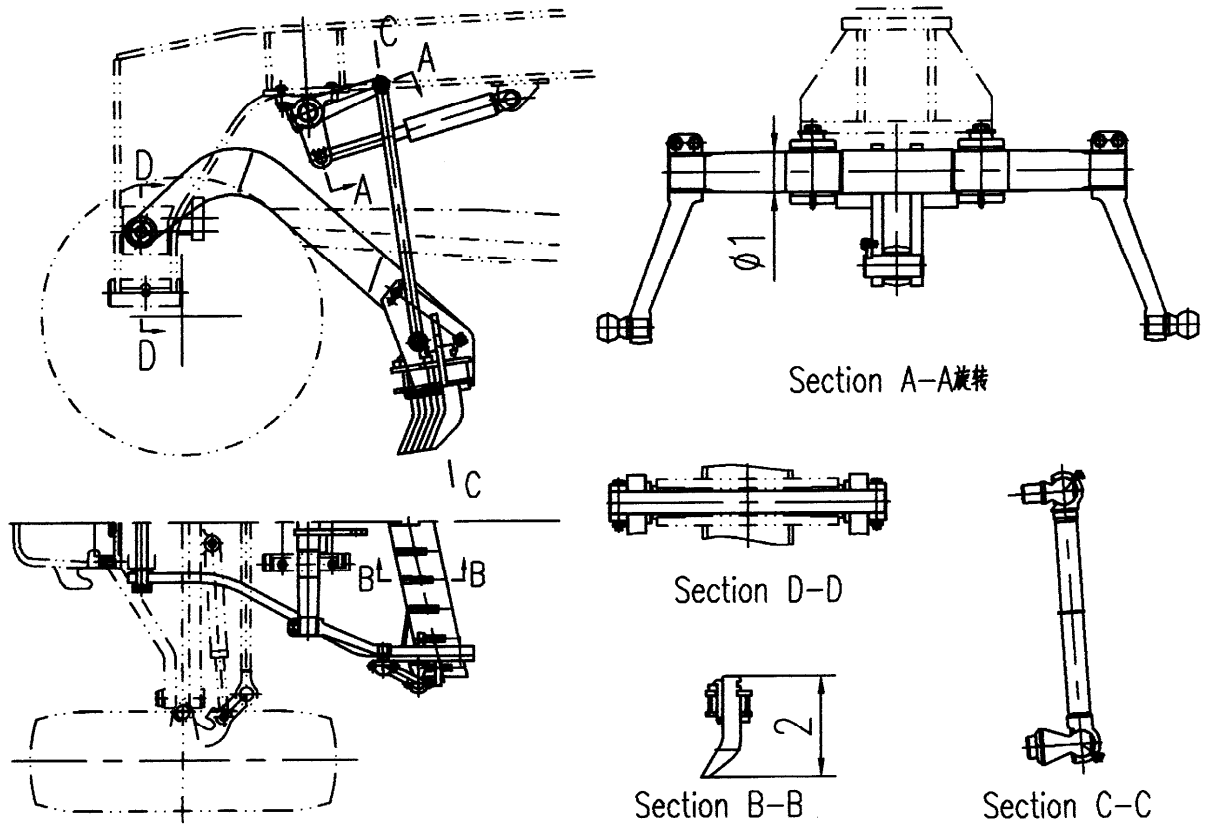
# Turning Gear



Unit: mm

Serial No.	Items to be inspected	Judgment					Action
		Standard Dimension	Tolerance		Standard Clearance	Clearance Limit	
			Axle	Hole			
1	Clearance between worm shaft and sleeve	65	-0.030 -0.076	+0.057 +0.010	0.0440- 0.117	0.5	Replacement
2	Clearance between worm shaft and sleeve	65	+0.035 +0.035	+0.226 +0.069	0.034- 0.221	0.5	
3	Clearance between pinion and shearing pin	30	0 -0.021	+0.080 0	0- 0.101	1.0	
4	Clearance between connector and shearing pin	30	0 -0.021	+0.080 0	0- 0.101	1.0	
5	Gear clearance between worm and turbine	Standard Clearance		Standard Limit		Change	
		0.3-0.4		2.0			
6	Clearance between pinion and friction plate	0.1-0.5		0.6		Adjust	
7	Pinion's wear	Standard Dimension		Repairing Limit		Replace	
		25		20			
8	Preload of worm shaft bearing	0.03-0.08 N·m					Adjust

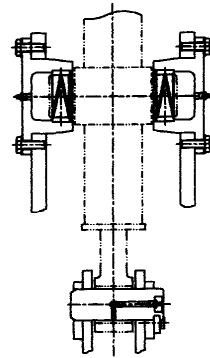
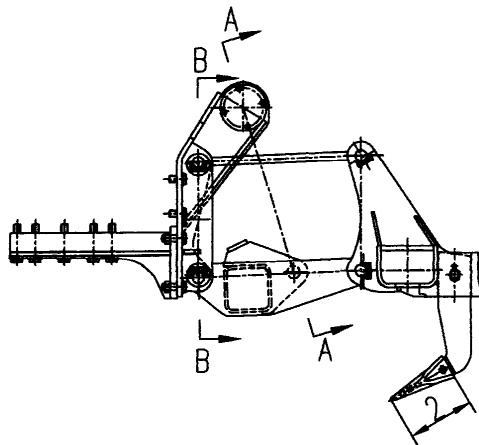
## Front Scarifier (Optional)



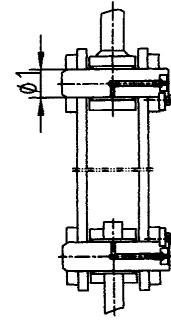
Unit: mm

Serial No.	Items to be inspected	Judgment				Action	
		Standard Value	Tolerance		Standard Clearance		Clearance Limit
Axle	Hole						
1	Clearance between axle and sleeve	110	-0.036 -0.090	+0.207 +0.120	0.025- 0.103	3	Replace Sleeve
2	Gear Tip Wear	Standard Clearance		Repairing Limit		Replace Gear	
		450		330			

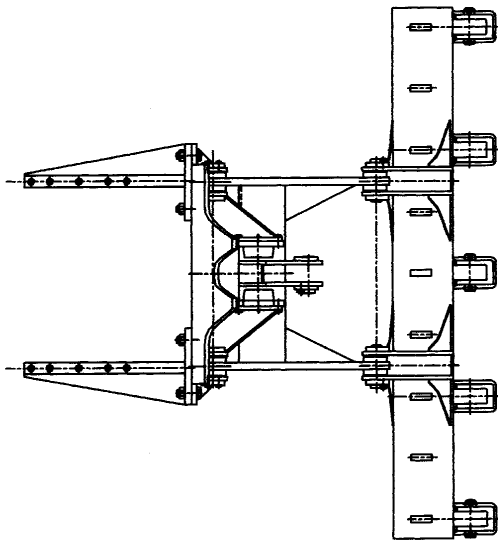
## Rear Ripper (Optional)



Section A-A



Section B-B



Unit: mm

Serial No.	Items to be inspected	Judgment				Action	
		Standard Value	Tolerance		Standard Clearance		Clearance Limit
1	Clearance between pin and sleeve	50	-0.025	+0.039	0.025-0.103	0.5	Replace
			-0.064	0			
2	Gear Tip Wear	Standard Clearance		Repairing Limit		Replace Gear	
		290		150			

# Electrical Circuit Diagram(HG220)

