

### **Introduction**

This manual main introduces the items in the aspects of performance, structure, and operation, as well as maintenance and service, etc of the rough-terrain forklift trucks, so that the operators are able for a correct use and maintenance.

During the user operating process, the operators and equipment management personal involved shall carefully follow the relevant regulations of this manual, for the forklift truck to maintain its good technical conditions.

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## I. Forklift Truck Main Technical Parameters

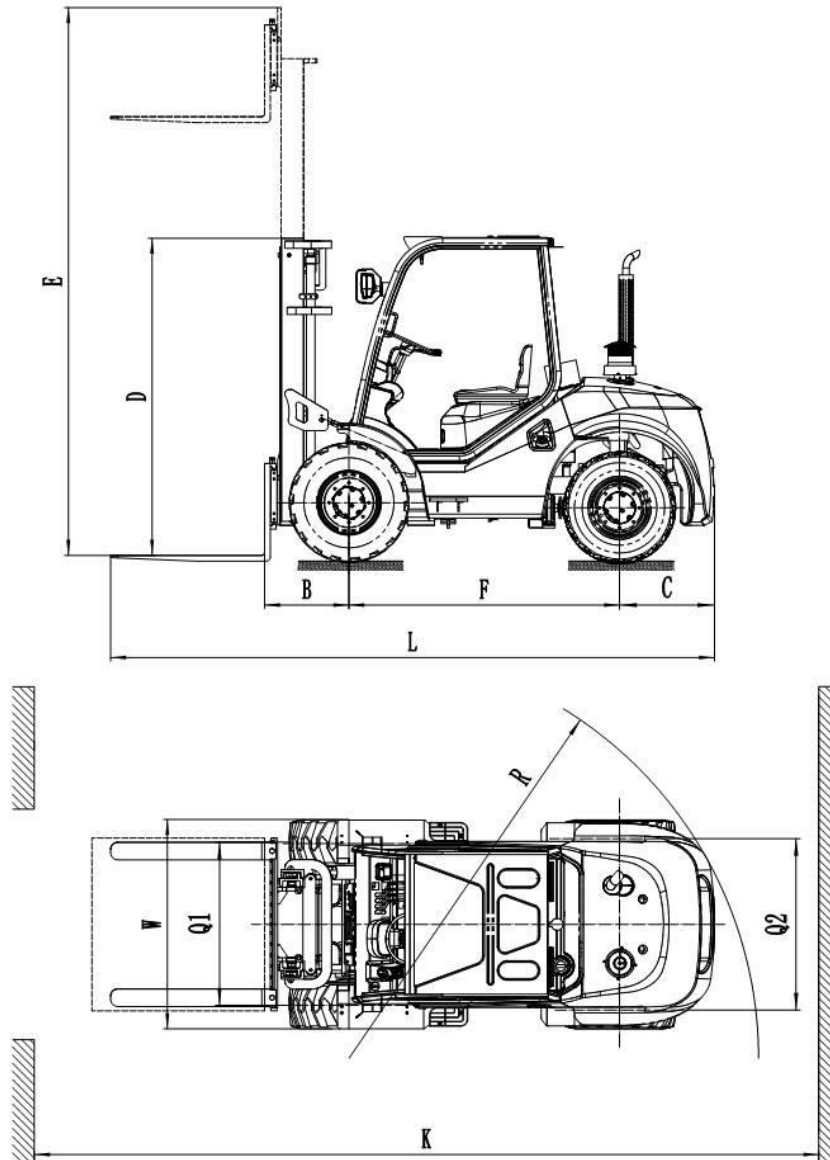


Table 1

| Model<br>Parameter            |                                                 |                       | FD18T-<br>C4WE3 | FD18T-<br>C4WV3 | FD25T-<br>C4WE3 | FD25T-<br>C4WV3 | FD35T-<br>C4WE3 | FD35T-<br>C4WV3 |
|-------------------------------|-------------------------------------------------|-----------------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| Performance<br>Parameter      | Rated Load<br>kg                                |                       | 1800            |                 | 2500            |                 | 3500            |                 |
|                               | Load Center<br>mm                               |                       | 500             |                 |                 |                 |                 |                 |
|                               | Lifting Height<br>mm                            |                       | 3000            |                 |                 |                 |                 |                 |
|                               | Free Lifting Height<br>mm                       |                       | 105             |                 | 160             |                 | 165             |                 |
|                               | Mast Tilt Angle<br>Front/Rear                   |                       | 10/12°          |                 |                 |                 |                 |                 |
|                               | Lifting<br>Speed<br>mm/s                        | Full-Load/No<br>-Load | 610/630         | 590/610         | 570/600         | 480/510         | 485/510         | 385/415         |
|                               | Running<br>Speed km/h                           | Forward               | 17/18           | 17/18           | 18/18           | 17/18           | 19/19           | 17/18           |
|                               |                                                 | Back                  | 9/9             | 9/9             | 9/9             | 9/9             | 9/9             | 9/9             |
|                               | Max Traction Force<br>(Full-Load/No-Lo<br>ad) N |                       | 35000/25<br>000 | 31000/27<br>000 | 35000/29<br>000 | 31000/27<br>000 | 35000/35<br>000 | 31000/31<br>000 |
|                               | Gradeability<br>(Full-Load/No-Lo<br>ad) %       |                       | 50/60           | 50/60           | 50/60           | 48/60           | 45/55           | 30/45           |
|                               | Efficiency of<br>differential lock%             |                       | 45              |                 |                 |                 |                 |                 |
|                               | Minimum turning<br>radius R mm                  |                       | 3140            |                 |                 |                 |                 |                 |
| Min Turning<br>Radius K<br>mm |                                                 | 5050                  |                 | 5125            |                 | 5140            |                 |                 |

Table 2

| Model<br><br>Parameter     |                                             |                       | FD18T-<br>C4W(6)<br>3 | FD18T-<br>C4W(9<br>A)3 | FD25T-<br>C4W(6)<br>3 | FD25T-<br>C4W(9<br>A)3 | FD35T-<br>C4W(6)<br>3 | FD35T-<br>C4W(9<br>A)3 |
|----------------------------|---------------------------------------------|-----------------------|-----------------------|------------------------|-----------------------|------------------------|-----------------------|------------------------|
|                            |                                             |                       |                       |                        |                       |                        |                       |                        |
| Performance parameter      | Rated Load<br>kg                            |                       | 1800                  |                        | 2500                  |                        | 3500                  |                        |
|                            | Load Center<br>mm                           |                       | 500                   |                        |                       |                        |                       |                        |
|                            | Lifting Height<br>mm                        |                       | 3000                  |                        |                       |                        |                       |                        |
|                            | Free Lifting Height<br>mm                   |                       | 105                   |                        | 160                   |                        | 165                   |                        |
|                            | Mast Tilt Angle<br>Front/Rear               |                       | 10/12°                |                        |                       |                        |                       |                        |
|                            | Lifting Speed<br>mm/s                       | Full-Load/No-<br>Load | 590/610               | 610/630                | 480/510               | 550/580                | 385/415               | 430/460                |
|                            | Running Speed km/h                          | Forward               | 17/18                 | 19/18                  | 17/18                 | 19/19                  | 17/18                 | 19/19                  |
|                            |                                             | Back                  | 9/9                   | 9/9                    | 9/9                   | 9/9                    | 9/9                   | 9/9                    |
|                            | Max Traction Force<br>(Full-Load/No-Load) N |                       | 32000/2<br>4000       | 35000/3<br>5000        | 31000/2<br>7000       | 35000/3<br>5000        | 31000/3<br>1000       | 35000/3<br>5000        |
|                            | Gradeability<br>(Full-Load/No-Load) %       |                       | 45/55                 | 45/55                  | 40/50                 | 40/50                  | 30/45                 | 42/42                  |
|                            | Efficiency of differential<br>lock %        |                       | 45                    |                        |                       |                        |                       |                        |
|                            | Minimum turning radius R<br>mm              |                       | 3140                  |                        |                       |                        |                       |                        |
| Min Turning Radius K<br>mm |                                             | 5050                  |                       | 5125                   |                       | 5140                   |                       |                        |

Table 3

| Model<br>Parameter    |                                                   | 1.8T           | 2.5T     | 3.5T     |          |
|-----------------------|---------------------------------------------------|----------------|----------|----------|----------|
| Performance parameter | Whole Length L<br>(Without Fork)<br>mm            | 2990           | 3126     | 3141     |          |
|                       | Whole Width W<br>mm                               | 1450           |          | 1600     |          |
|                       | Whole Height D<br>(Mast Retracted)<br>mm          | 2256           | 2256     | 2330     |          |
|                       | Whole Height E<br>(Mast Extended with<br>rack) mm | 4150           | 4175     | 4305     |          |
|                       | Wheelbase F<br>mm                                 | 1880           |          |          |          |
|                       | Wheelbase                                         | Front Q1<br>mm | 1123     | 1250     |          |
|                       |                                                   | Rear Q2<br>mm  | 1190     |          |          |
|                       | Front Clearance B<br>mm                           |                | 510      | 585      | 600      |
|                       | Rear Clearance C<br>mm                            |                | 600      | 660      | 660      |
|                       | Fork Dimension                                    | Length<br>mm   | 1070     | 1070     | 1070     |
|                       |                                                   | Width<br>mm    | 100      | 122      | 125      |
|                       |                                                   | Height<br>mm   | 35       | 40       | 45       |
|                       | Fork Horizontal<br>Adjustment Quantity<br>mm      |                | 200-1315 | 250-1310 | 250-1500 |
|                       | Ground Clearance<br>(in the Place of<br>Mast) mm  |                | 270      | 270      | 270      |
|                       | Self weight<br>kg                                 |                | 4255     | 4830     | 5550     |

## II. Description about Forklift Truck Main Parts

Power System ——— Gearbox ——— Drive Axle ——— Steering system ——— Braking  
system ——— Hydraulic System ——— Lifting System ——— Electrical System

### III. Structure, Principle, Adjustment, and Maintenance of Forklift Truck

In order for operators to use, service, and maintain the forklift truck in a better way, the items of such aspects as the structure, principle, adjustment, disassembly and assembly, maintenance, and failure removal, etc related to the forklift truck are now introduced one by one, respectively.

#### 1. Power System

##### 1.1 Engine Overview

At present, the diesel engine used by 1.8-3.5t ordinary rough-terrain forklift is shown in Table 4.

Table 4

| Model<br>Parameter                           |                                                        | 4TNE98                                                    |
|----------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------|
| Type                                         |                                                        | 4-Stroke, Water-Cooling, Straight-Line, and Valve in Head |
| Cylinder                                     | Number of Cylinders –<br>Cylinder Diameter ×<br>Stroke | 4-98×110                                                  |
|                                              | Total Displacement                                     | 3.319                                                     |
|                                              | Compression Ratio                                      | 21.3                                                      |
| Rated Power/Speed                            |                                                        | 42.1kw/2300rpm                                            |
| Max Torque/Speed                             |                                                        | 206N.m/1700rpm                                            |
| No-Load Min Speed                            |                                                        | 750rpm                                                    |
| Min Fuel Specific Consumption                |                                                        | 265 g/kw.h                                                |
| Movement Direction                           |                                                        | In Clockwise Direction Looking from the End of Fan        |
| Whole Length × Whole Width<br>× Whole Height |                                                        | 728×526×707                                               |
| Weight                                       |                                                        | 225kg                                                     |
| Working Sequence of Cylinder                 |                                                        | 1-3-4-2                                                   |
| Cooling System                               |                                                        | Forced Circulation Water Cooling                          |
| Lubricating System                           |                                                        | Forced Lubrication                                        |
| Main Part                                    | Injection pump                                         | Distributed Type                                          |
|                                              | Oil atomizer                                           | Throttling Type                                           |
|                                              | Air filter                                             | Paper Filtration                                          |
|                                              | Oil pump                                               | Cycloid Pump                                              |
|                                              | Water pump                                             | Eddy Current Type                                         |
|                                              | Thermostat                                             | Wax Pellet Type                                           |
|                                              | Generator                                              | Voltage                                                   |
|                                              |                                                        | Current                                                   |
|                                              |                                                        | Method of power generation                                |
|                                              | Starter                                                | Voltage                                                   |
|                                              |                                                        | Output Power                                              |
|                                              | Battery                                                |                                                           |

| Model                                        |                                                        | S4S-455                                                   |                   |                                          |
|----------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------|-------------------|------------------------------------------|
| Parameter                                    |                                                        |                                                           |                   |                                          |
| Type                                         |                                                        | 4-Stroke, Water-Cooling, Straight-Line, and Valve in Head |                   |                                          |
| Cylinder                                     | Number of Cylinders –<br>Cylinder Diameter ×<br>Stroke | 4-94×120                                                  |                   |                                          |
|                                              | Total Displacement                                     | 3.331                                                     |                   |                                          |
|                                              | Compression Ratio                                      | 22                                                        |                   |                                          |
| Rated Power/Speed                            |                                                        | 42.1kw/2300rpm                                            |                   |                                          |
| Max Torque/Speed                             |                                                        | 206N.m/1700rpm                                            |                   |                                          |
| No-Load Min Speed                            |                                                        | 750rpm                                                    |                   |                                          |
| Min Fuel Specific Consumption                |                                                        | 265 g/kw.h                                                |                   |                                          |
| Movement Direction                           |                                                        | In Clockwise Direction Looking from the End of Fan        |                   |                                          |
| Whole Length × Whole Width<br>× Whole Height |                                                        | 741×559×724                                               |                   |                                          |
| Weight                                       |                                                        | 245kg                                                     |                   |                                          |
| Working Sequence of Cylinder                 |                                                        | 1-3-4-2                                                   |                   |                                          |
| Cooling System                               |                                                        | Forced Circulation Water Cooling                          |                   |                                          |
| Lubricating System                           |                                                        | Forced Lubrication                                        |                   |                                          |
| Main Part                                    | Injection pump                                         |                                                           | Distributed Type  |                                          |
|                                              | Oil atomizer                                           |                                                           | Throttling Type   |                                          |
|                                              | Air filter                                             |                                                           | Paper Filtration  |                                          |
|                                              | Oil pump                                               |                                                           | Cycloid Pump      |                                          |
|                                              | Water pump                                             |                                                           | Eddy Current Type |                                          |
|                                              | Thermostat                                             |                                                           | Wax Pellet Type   |                                          |
|                                              | Generator                                              | Voltage                                                   |                   | 12V                                      |
|                                              |                                                        | Current                                                   |                   | 50A                                      |
|                                              |                                                        | Method of power generation                                |                   | AC Generation, and Silicon Rectification |
|                                              | Starter                                                | Voltage                                                   |                   | 12V                                      |
|                                              |                                                        | Output Power                                              |                   | 2.2kw                                    |
|                                              | Battery                                                |                                                           | 12V/90Ah          |                                          |

| Model                                        |                                                        | Mitsubishi D04EG                                          |                  |                                          |
|----------------------------------------------|--------------------------------------------------------|-----------------------------------------------------------|------------------|------------------------------------------|
| Parameter                                    |                                                        |                                                           |                  |                                          |
| Type                                         |                                                        | 4-Stroke, Water-Cooling, Straight-Line, and Valve in Head |                  |                                          |
| Cylinder                                     | Number of Cylinders –<br>Cylinder Diameter ×<br>Stroke | 4-94×120                                                  |                  |                                          |
|                                              | Total Displacement                                     | 3.331                                                     |                  |                                          |
|                                              | Compression Ratio                                      | 17.5                                                      |                  |                                          |
| Rated Power/Speed                            |                                                        | 42.1kw/2300rpm                                            |                  |                                          |
| Max Torque/Speed                             |                                                        | 206N.m/1700rpm                                            |                  |                                          |
| No-Load Min Speed                            |                                                        | 750rpm                                                    |                  |                                          |
| Min Fuel Specific Consumption                |                                                        | 265 g/kw.h                                                |                  |                                          |
| Movement Direction                           |                                                        | In Clockwise Direction Looking from the End of Fan        |                  |                                          |
| Whole Length × Whole Width<br>× Whole Height |                                                        | 761×577×734                                               |                  |                                          |
| Weight                                       |                                                        | 260Kg                                                     |                  |                                          |
| Working Sequence of Cylinder                 |                                                        | 1-3-4-2-1                                                 |                  |                                          |
| Cooling System                               |                                                        | Forced Circulation Water Cooling                          |                  |                                          |
| Lubricating System                           |                                                        | Forced Lubrication                                        |                  |                                          |
| Main Part                                    | Injection pump                                         |                                                           | Distributed Type |                                          |
|                                              | Oil atomizer                                           |                                                           | Throttling Type  |                                          |
|                                              | Air filter                                             |                                                           | Paper Filtration |                                          |
|                                              | Oil pump                                               |                                                           | Cycloid Pump     |                                          |
|                                              | Water pump                                             |                                                           | Centrifugal pump |                                          |
|                                              | Thermostat                                             |                                                           | Wax Pellet Type  |                                          |
|                                              | Generator                                              | Voltage                                                   |                  | 12V                                      |
|                                              |                                                        | Current                                                   |                  | 50A                                      |
|                                              |                                                        | Method of power generation                                |                  | AC Generation, and Silicon Rectification |
|                                              | Starter                                                | Voltage                                                   |                  | 12V                                      |
|                                              |                                                        | Output Power                                              |                  | 2.2kw                                    |
|                                              | Battery                                                |                                                           | 12V/90Ah         |                                          |

| Parameter \ Model                            |                                                        | V2403                                                    |
|----------------------------------------------|--------------------------------------------------------|----------------------------------------------------------|
| Type                                         |                                                        | 4-Stroke, Water-Cooling, Straight-Line, Direct injection |
| Cylinder                                     | Number of Cylinders –<br>Cylinder Diameter ×<br>Stroke | 4-87.0×102.4                                             |
|                                              | Total Displacement                                     | 2.43                                                     |
|                                              | Compression Ratio                                      | 18.1                                                     |
| Rated Power/Speed                            |                                                        | 42.1kw/2300rpm                                           |
| Max Torque/Speed                             |                                                        | 206N.m/1700rpm                                           |
| No-Load Min Speed                            |                                                        | 750rpm                                                   |
| Min Fuel Specific Consumption                |                                                        | 265 g/kw.h                                               |
| Movement Direction                           |                                                        | In Clockwise Direction Looking from the End of Fan       |
| Whole Length × Whole Width<br>× Whole Height |                                                        | 842×540×735                                              |
| Weight                                       |                                                        | 233Kg                                                    |
| Working Sequence of Cylinder                 |                                                        | 1-3-4-2-1                                                |
| Cooling System                               |                                                        | Forced Circulation Water Cooling                         |
| Lubricating System                           |                                                        | Forced Lubrication                                       |
| Main Part                                    | Injection pump                                         | Electronically controlled VE pump                        |
|                                              | Oil atomizer                                           | P type mouth                                             |
|                                              | Air filter                                             | Paper Filtration                                         |
|                                              | Oil pump                                               | Cycloid Pump                                             |
|                                              | Water pump                                             | Eddy Current Type                                        |
|                                              | Thermostat                                             | Wax Pellet Type                                          |
|                                              | Generator                                              | Voltage                                                  |
|                                              |                                                        | Current                                                  |
|                                              |                                                        | Method of power generation                               |
|                                              | Starter                                                | Voltage                                                  |
|                                              |                                                        | Output Power                                             |
|                                              | Battery                                                |                                                          |

Refer to their respective engine operation and maintenance manuals for the introduction about homemade engines used for 1.8-3.5t ordinary rough-terrain forklift trucks.

The Power of the Engine is passed onto transmission system mainly by flywheel through Clutch and Torque Converter.

## 1.2 Engine Adjustment

It is required to adjust the rotating speed of engine as it produces influence over operating efficiency with both running speed and lifting speed of forklift truck, and the rotating speed of engine shall be adjusted according to the undermentioned methods, if it fails to reach the specified value.

### (1) Adjusting idle speed (used for diesel engine)

The speed of diesel engine is controlled by speed limiter of fuel injection pump, and the latter has been properly adjusted on test bed in general, while it can no longer be adjusted after engine is mounted. The steps for adjustment using test bed are given as follows (for reference):



Fig 1-1

a) Control the zero adjustment of gear rack, mount the control rack for measurement device onto the end face of control rack for oil injection pump, and align the zero position of control rack for measurement device with the zero position of graduated scale.

b) Fully tilt the control rod in the direction for fuel to be increased, and ensure that the control rack extends by more than 15mm. Then fully tilt the control rod in the direction for fuel to be stopped, and ensure that the control rack on the graduated scale is less than 1mm.

c) Adjust the oil injection timing and injection speed.

d) Adjust the pressure from the minimum negative pressure.

(2) Examining whether or not air leak exists, by making use of adjusting rack to adjust the negative pressure of oil injection pump in reference to Fig 1-2.

(3) Adjusting the limit of smoke by making use of adjusting screw for limit of smoke, while the operators shall pay attention that please never adjust it for imported engines, when they are basically under normal operating conditions.

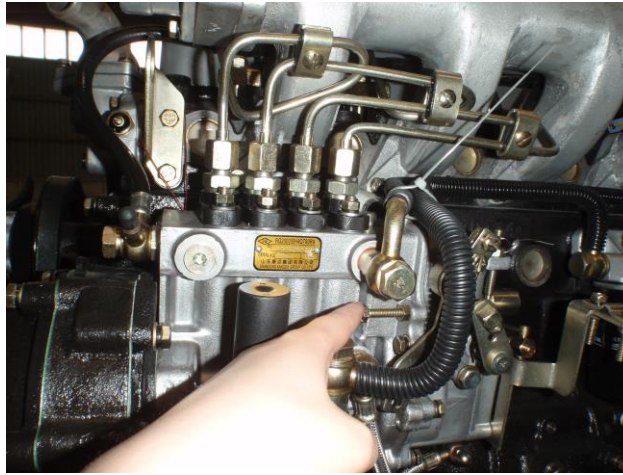


Fig 1-2

### 1.3 Fuel System

Fuel system is composed of fuel tank, oil quantity sensor, and oil quantity indicator (Fig 1-3)

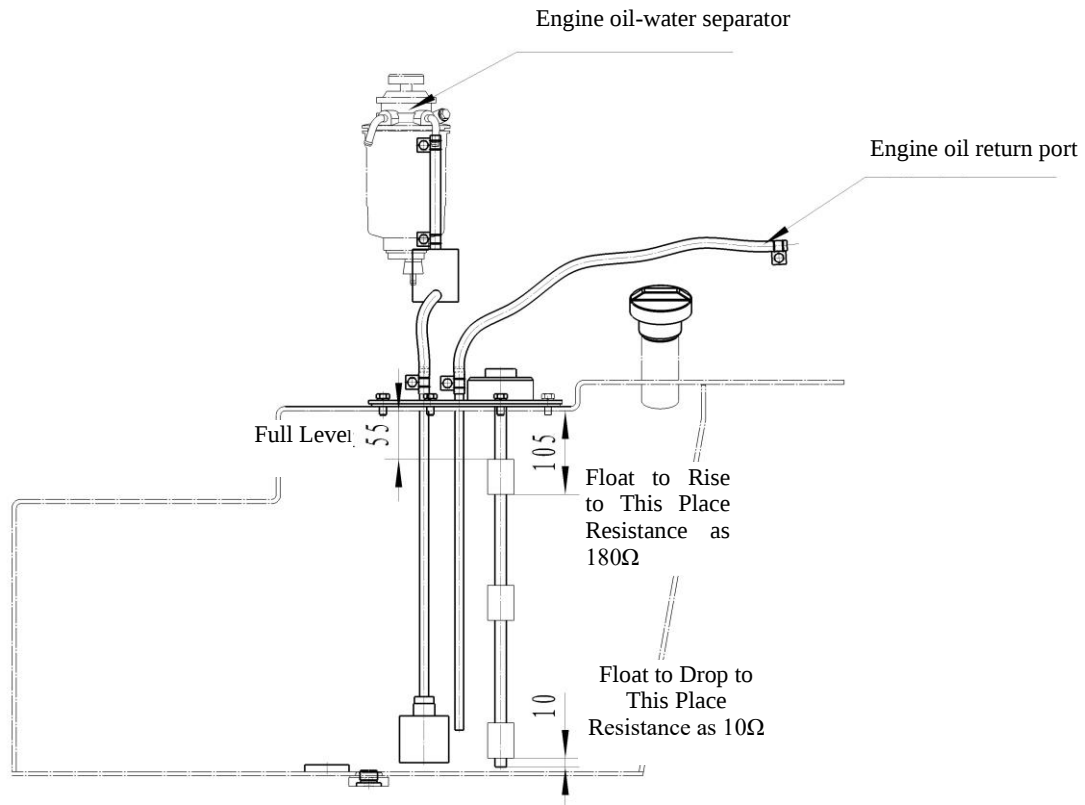


Fig 1-3 Fuel Tank

#### 1.3.1 Fuel Tank

Fuel tank is an integrated welded structure connected with vehicle chassis into a whole, located on the left side of vehicle chassis. The capacity of 1.8-3.5t ordinary rough-terrain forklift is 55.5L and the fuel quantity sensor is fitted on the tank cover of fuel tank to detect the fuel level.

#### 1.3.2 Fuel Quantity Sensor

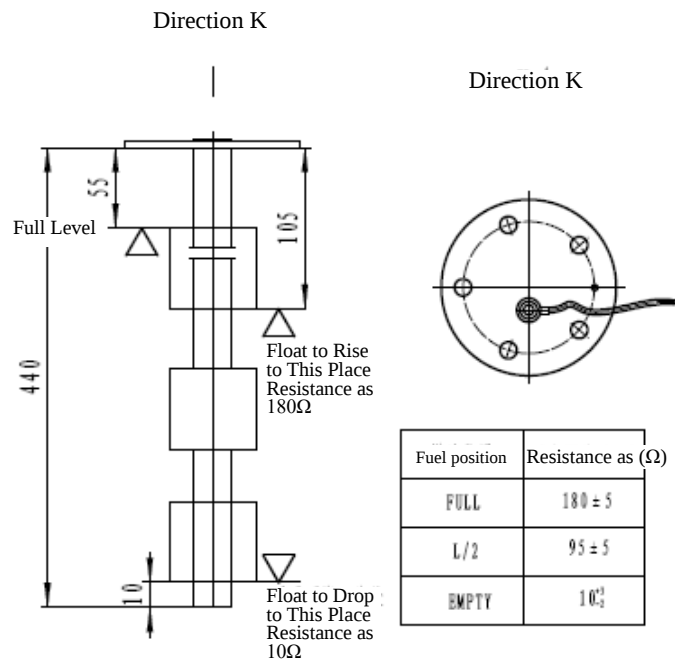


Fig 1-4 Fuel Quantity Sensor

The fuel quantity sensor is used to convert the remaining fuel quantity in fuel tank into voltage, and refer to Fig 1-4. The value of resistance will change, when float moves upward and downward, by making use of alloy steel wire to be fabricated into slide resistance connected with float, and the storage fuel quantity inside fuel tank can be read out from the instrument panel through electromagnetic fuel gauge.

### 1.3.3 Maintenance of Fuel System

The fuel system is to be maintained and serviced once for every work of 100 hours, with the following method, and the fuel tank shall be cleaned once for every work of 600 hours.

#### (1) Fuel Filter

Fuel filter is used for remove dust and impurity in fuel, and this fuel filter is located between the fuel tank and oil injection pump .

#### (2) Service of Diesel Engine Fuel Filter

This filter is in cylindrical type (Refer to Fig 1-5), not detachable generally, and it shall be replaced in complete set if required.

- a) For every work of 100 hours, dismount the cylindrical shell using special tools, and take out the filter core.
- b) For every work of 600 hours, the entire filter shall be replaced.
- c) It is required to pay attention to examining as to whether or not fuel leak exists after reassembly.
- d) Pay attention to examining the working status of Part 1 overflow valve.

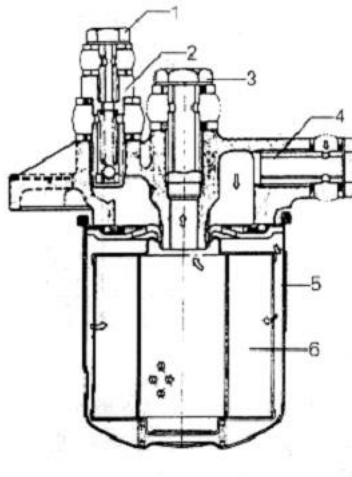


Fig 1-5

### (3) Fuel-Water Separator (Sediment Bowl)

As VE oil injection pump is lubricated with fuel internally, water content in fuel must be separated, and therefore sediment bowl is used. If indicator light of fuel-water separator turns on, water shall be drained. (Fig 1-6)

#### a) Water Drain

Loosen off the fuel drain plug and allow fuel drain plug to drain water manually. Then tighten the fuel drain pump and start the pump for multiple times. It shall be ensured that no fuel leak exists, engine is started, and warning light is turned off. Firmly tighten the fuel drain plug.

#### b) Air Exhaust

Loosen off the air exhaust plug (overflow valve) of oil injection pump, and press the main pump until no air emits. It shall be ensured that no fuel leak exists.

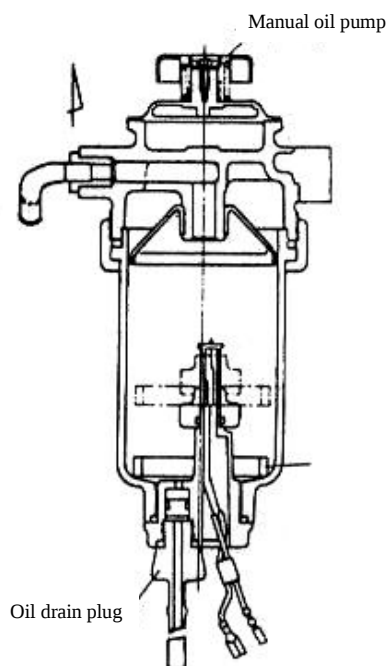


Fig. 1-6

#### (4) Cleaning of Fuel Tank

The fuel tank is to be cleaned once for working every 600 hours.

### 1.4 Notes for starting and running of Mitsubishi Engine (only applicable to Mitsubishi S4S engine).

## The Operation of Mitsubishi Diesel Engine

❶ Use only specified fuel (&MHI Genuine fuel filter) ,engine oil (&MHI Genuine oil filter) and LLC in the OM manual.

❷ Wear proper work clothes and protective gears

#### ❸ Never Break the Seals

To ensure the proper engine operation, the fuel injection pump, governor, handle and fuel control link are provided with seals.

(If the engine is operated with the seal tampered, no guarantee will be provided)

#### ❹ Perform engine break-in

To break in a new engine,operate the engine at a speed lower than rated speed under light load during the first 50 hours of operation.

( Please change immediately engine oil and oil filter after the first 50 hours )

| Break-in operate |                          |            |          |           |
|------------------|--------------------------|------------|----------|-----------|
|                  | Rotational speed ( rpm ) |            | Load(PS) | Time(min) |
| 1                | Low speed                | 600~900    | No-load  | 20        |
| 2                | Medium speed             | 1000~1200  | No-load  | 10        |
| 3                | High speed               | 1400~rated | No-load  | 10        |
| 4                | Rated speed              |            | 25%      | 20        |
| 5                |                          |            | 50%      | 20        |
| 6                |                          |            | 75%      | 30        |
| 7                |                          |            | 100%     | 20        |

#### ❺ Warming up engine first

After starting the engine,run it at a low idle speed for warming-up.Start the work after the coolant temp is rasied.Don't continue the warm-up operate for a longer time. Long warm-up operation causes carbon deposits in the cylinders, and may lead to incomplete combustion.

#### ❻ Cool down the engine before stopping

Cool down the engine at a low idling for five to six minutes before stopping it.

(The turbocharged engine must perform this operation)

#### ❼ Never operate engine under overload condition

If the engine shows an overload condition such as back exhaust someke,reduce the load immediately and operate the engine at appropriate output and load.

#### ❽ Prohibition of continuous low-load operation

Low load continuous operation(less than 30%)must be limited within one hour after a continuous low load operation, run the engine at a load of 50% or higher for 30 minutes or more to prevent carbon from accumulating.

#### ❾ Do not operate starter for continuously

Do not use the starter for more than 10 seconds at a time.If the engine doesn't start,wait for at least 30 seconds before cranking again.

## 2. Gear box

### 2.1 Overview

FSDT25/35 rough-terrain forklift truck power transmission system belongs to a new four-wheel drive rough-terrain forklift truck power transmission system, and is mainly composed of FSDT35Igearbox (25/35 universal), FSDT25/35 II transmission box, FSDT25/35 III front main reduction box, and FSDT25/35 IV rear main reduction box, with 2 front and 1 rear gears; the time-sharing four-wheel drive can be realized according to actual needs. The torque converter for FSDT35Igearbox is a single stage, two phase, three work wheels integrated hydraulic torque converter, so that the gearbox is provided with automatic adaptability to hydraulic transmission output, and the output torque and rotational speed can be changed with the change in external load correspondingly; also, it can absorb and eliminate impact vibration onto the transmission system from the engine and external load; an electro-hydraulic shift with inching valve and buffer valve is adopted to make the manipulation simple, convenient and stable while starting, significantly reducing the fatigue strength of operation. The off-axle mechanism is controlled by solenoid valve, and the transformation between two-wheel drive and four-wheel drive is achieved through the hydraulic clutch. FSDT25/35 III front main reduction box and FSDT25/35 IV rear speed reduction box are equipped with differential lock, and can be under automatic control according to the road conditions, greatly improving the off-road capability of the forklift.

### 2.2 Main technical parameters

| Model                                                 |         | FSDT25                                                                 | FSDT35 |
|-------------------------------------------------------|---------|------------------------------------------------------------------------|--------|
| Rated power of matching engine Kw                     |         | 33~40                                                                  | 40~48  |
| Rated speed of matching engine r/min                  |         | 2000~2650                                                              |        |
| Input direction of rotation (for input end)           |         | Clockwise                                                              |        |
| Front axle end                                        | F1 gear | 8.2011                                                                 | 9.0212 |
|                                                       | F2 gear | 3.1278                                                                 | 3.4405 |
|                                                       | R gear  | 6.3951                                                                 | 7.0346 |
| Rear axle end                                         | F1 gear | 7.7040                                                                 | 7.6543 |
|                                                       | F2 gear | 2.9382                                                                 | 2.9193 |
|                                                       | R gear  | 6.0075                                                                 | 5.9688 |
| Model of torque converter                             |         | YJH265                                                                 |        |
| Gearbox working oil                                   |         | L-TSA32GB11120 steam turbine oil /No.6 or 8 hydraulic transmission oil |        |
| Transmission box and main reducer box lubricating oil |         | 85W/90 heavy load gear oil                                             |        |

## 2.3 Notes to installation and use

2.3.1 The main oil pressure of the gearbox is 1.1 ~ 1.4 MPa, the oil inlet pressure of the torque converter is 0.4 ~ 0.6 MPa, and the return oil pressure is 0.1 ~ 0.3 MPa.

2.3.2 The working oil temperature of normal oil is 70°C ~ 90°C, the highest working oil temperature does not exceed 120°C, and the duration is not more than 5 minutes.

2.3.3 The working oil should be kept clean, and can not contain impurities; the working oil should be changed after 100 hours of initial work at the normal oil temperature; then, new oil should be changed every 1000 hours or when using after a long time of being discontinued.

2.3.4 The gearbox's working oil level height is checked after 3 minutes since the engine is started, and the oil level height should be within the scope of the oil dipstick; the lubrication oil level height of the transmission case is based on the oil plug in the case; the lubricating oil level height of the front and rear main reduction box will be subject to the axle oil plug.

2.3.5 Before the vehicle is shifted, the inching valve should be shut down; before braking, the inching valve must be shut down at first, **in order to prevent damage to the clutch**.

## 2.4 Fault and elimination

| Fault item                                           | Reason for fault and elimination method                                                                                                                                                                                                                                                                                                                                                                                       |
|------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Efficiency decreases and oil temperature is too high | 1 The friction plate is jammed or worn. Check whether the friction plate is glued, with non-uniform contact or warp.<br>2 The torque converter is short of oil supply. Check whether the oil pump is worn and whether the oil level is on the normal position.<br>3 The bearing is damaged. Replace the bearing.<br>4 Check whether the lubricating oil pipe is blocked.<br>5 The torque converter's one-way wheel is jammed. |
| Oil leakage                                          | 1 The sealing gasket is broken. Replace the sealing gasket.<br>2 Rubber parts are aged or damaged. Replace the parts.<br>3 Some parts are damaged and crack. Replace.                                                                                                                                                                                                                                                         |
| Clutch pressure is low and the swing is too big      | 1 The oil level is low. Check the oil level and add oil to normal oil level.<br>2 The sealing ring of input shaft assembly and piston are worn or the wedge is tight at the time of inlet assembly. Attention should be paid to when replacing the sealing ring and assembling.<br>3. The oil pump is worn. Replace the oil pump.<br>4 Check whether the inching valve rod is reset.                                          |

## 2.5 Dimensional drawing of shape connection

### 2.5.1 Power transmission system box of FSĐT35 rough-terrain forklift truck

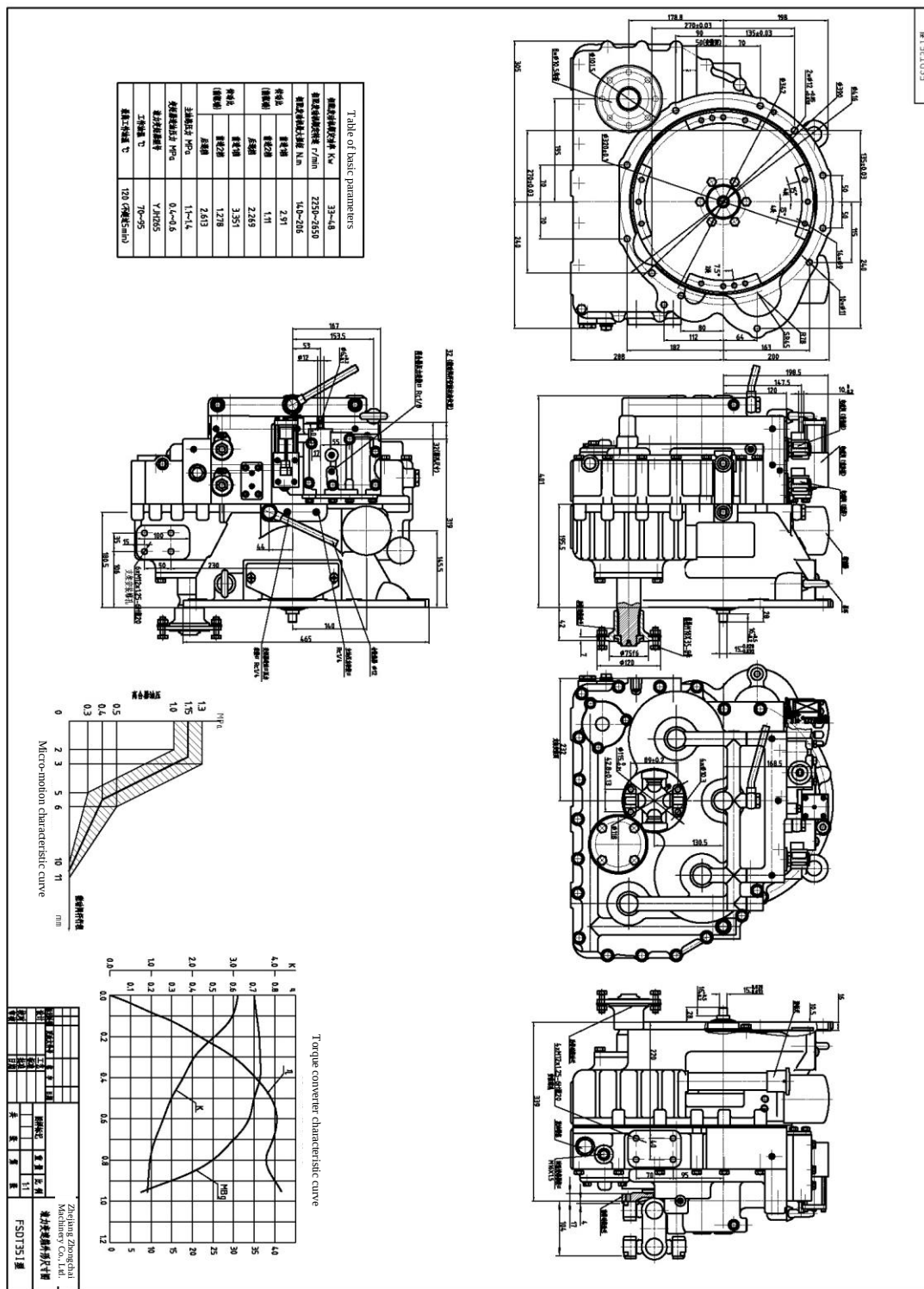


Fig. 2-1 FSĐT35I transmission (4TNE98)

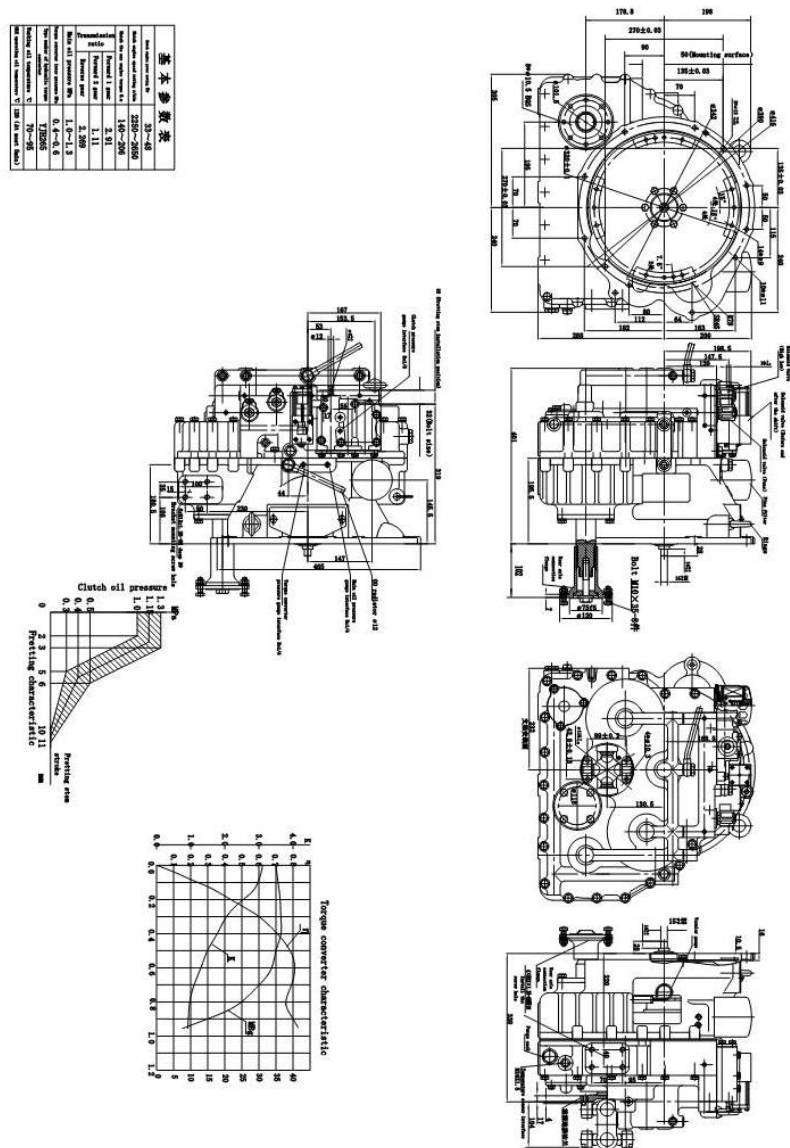


Fig. 2-2 FSDT35I-1 transmission (Mitsubishi、Kubota)

## 2.5.2 Power transmission system gearbox of FSDT35 rough-terrain forklift truck

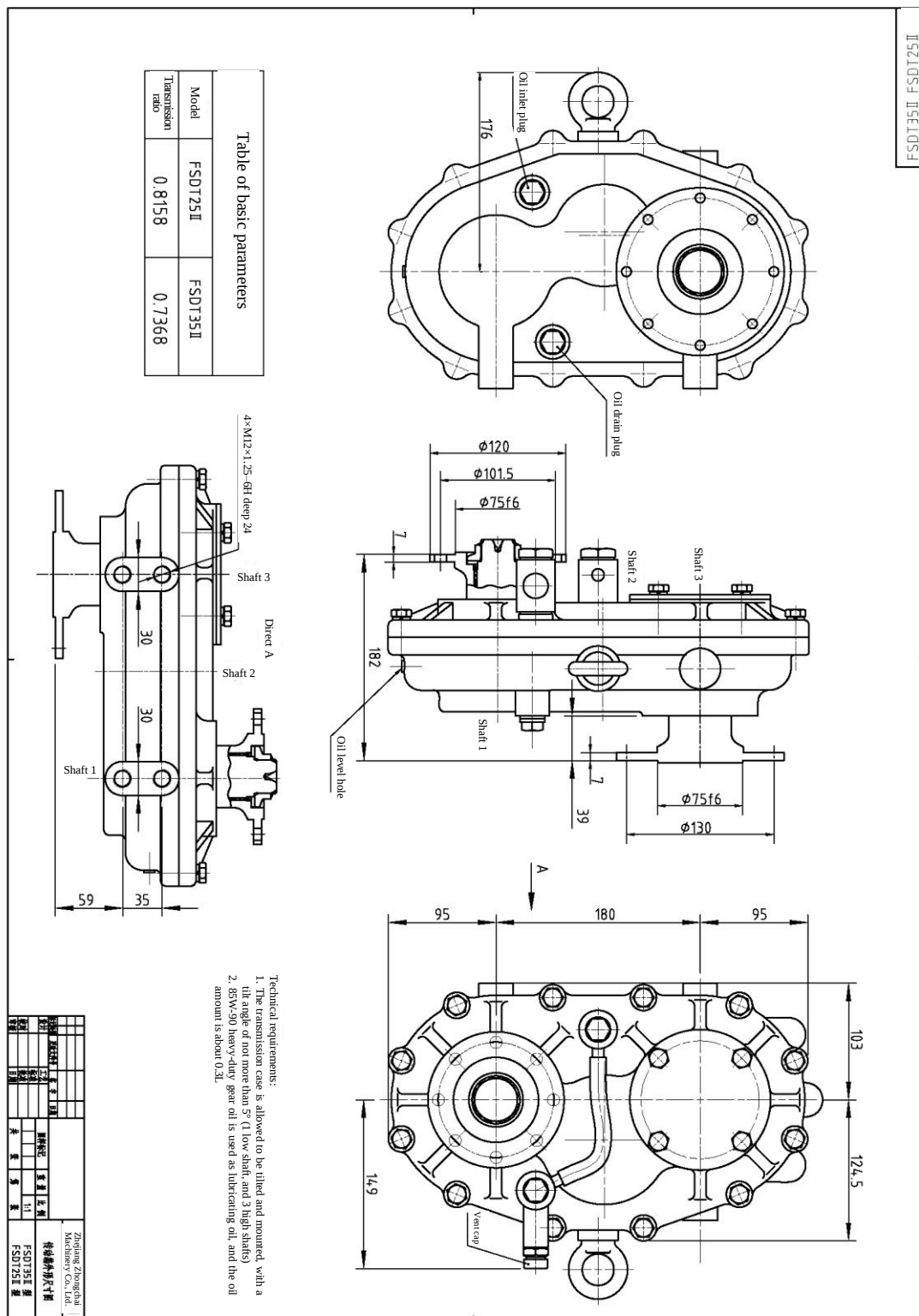


Fig. 2-3 FSDT25II/ FSDT35II Driving hosing

### 2.5.3 Power transmission system front main reducer of FSDT35 rough-terrain forklift truck

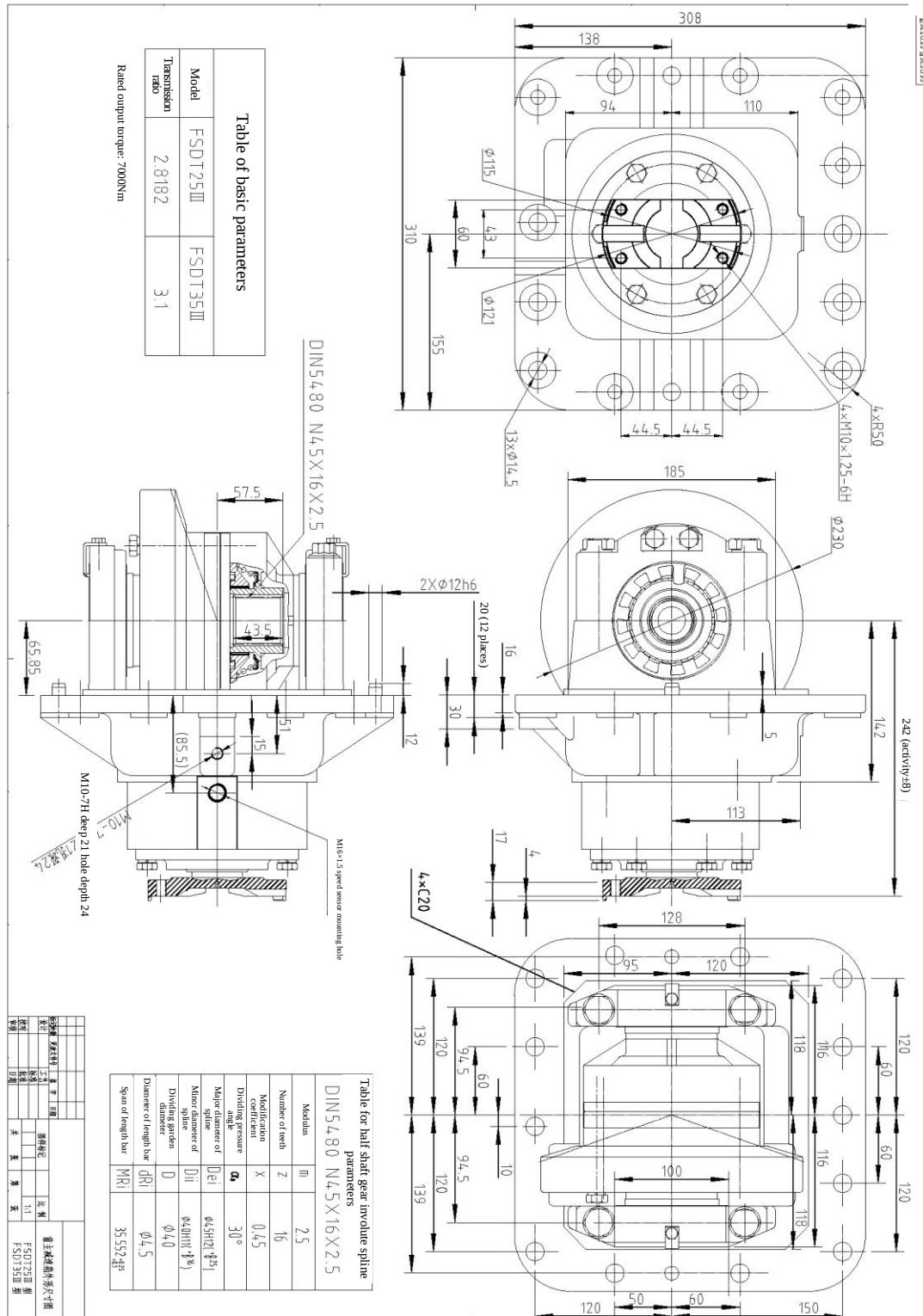


Fig.2-4 FSDT25III/ FSDT35III Front main reducer

## 2.5.4 Rear main reducer of FSDT35 rough-terrain forklift truck power transmission system

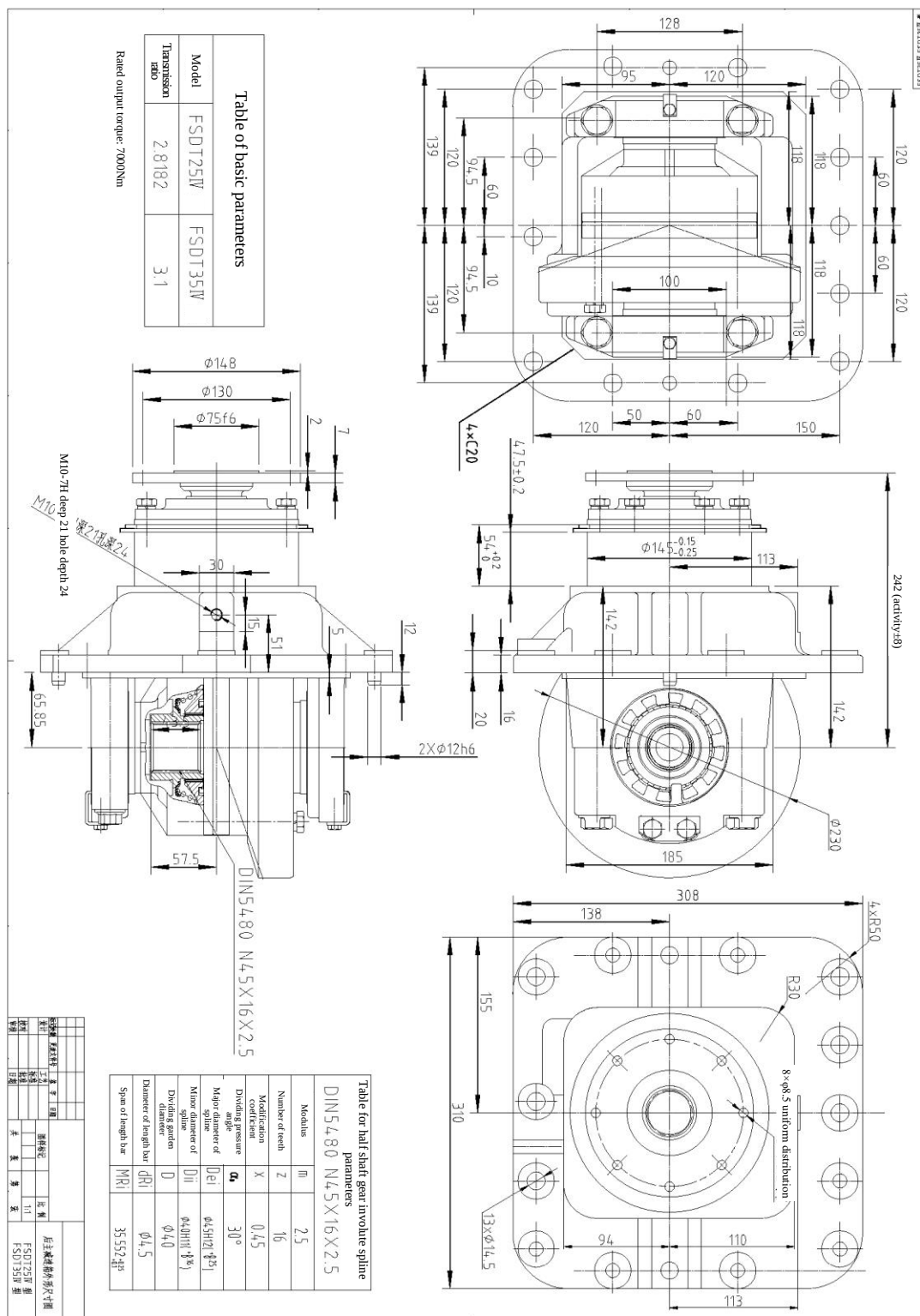


Fig 2-5 FSDT25IV/ FSDT35IV Rear main reducer

## 2.6 Parts catalog

## Transmission parts List (I)

| No. | Figure number or code | Name                            | Qty. | Remark         |
|-----|-----------------------|---------------------------------|------|----------------|
| 1   | GB/T5783              | Bolt M10*25                     | 4    |                |
| 2   | FSDT35-01004          | Idler shaft end cover           | 1    |                |
| 3   | FSDT35-01015          | Idler shaft end cover liner     | 1    |                |
| 4   | FSDT35-05009          | Idler wheel spacer              | AR   |                |
| 5   | GB/T276               | Bearing 6206                    | 1    |                |
| 6   | GB/T5782              | Bolt M10*110                    | 6    |                |
| 7   | FSDT35-05004          | Idler shaft                     | 1    |                |
| 8   | SV08-40-V-12-DL       | Plug-in solenoid valve          | 1    |                |
| 9   | SV08-33-V-12-DL       | Plug-in solenoid valve          | 1    |                |
| 10  | JB/T982               | Combined sealing washer 20C     | 1    |                |
| 11  | SDT30-01021           | Oil port plug screw             | 1    |                |
| 12  | GB/T5783              | Bolt M10*30                     | 1    |                |
| 13  | GB/T5783              | Bolt M10*45                     | 3    |                |
| 14  | GB/T276               | Bearing 6210                    | 1    |                |
| 15  | GB/T894.1             | Retaining ring for shaft 50     | 1    |                |
| 16  | JDS45-04012           | Oil seal 50*70*10               | 1    |                |
| 17  | GB1235                | O ring 100*3.1                  | 1    |                |
| 18  | FSDT35-01003          | Off-axle shaft end cover        | 1    |                |
| 19  | GB/T5783              | Bolt M10*25                     | 6    |                |
| 20  | FSDT35-06003          | Off-axle flange                 | 1    | 4TNE9<br>8     |
| -   | FSDT35-06003-1        | Off-axle flange                 | 1    | S4S 、<br>V2403 |
| 21  | FSDT35-06004          | Locknut                         | 1    | 4TNE9<br>8     |
| S22 | GB/T893.1             | Retaining ring for hole 72      | 1    |                |
| 23  | FSDT35-01008          | Oil sealing end cover           | 1    |                |
| 24  | GB1235                | O ring 70*3.1                   | 1    |                |
| 25  | GB/T894.1             | Retaining ring for shaft 30     | 1    |                |
| 26  | FSDT35-05007          | Limit baffle ring               | 1    |                |
| 27  | FSDT35-05006          | Semicircle baffle ring          | 2    |                |
| 28  | GB/T5782              | Bolt M10*80                     | 2    |                |
| 29  | SDT30-05003           | Oil supply pump liner           | 1    |                |
| 30  | SDT30-05000           | Oil supply pump assembly        | 1    |                |
| 31  | SDT30-06000-1         | Torque converter assembly       | 1    |                |
| 32  | GB/T825               | Lifting bolt M12                | 1    |                |
| 33  | SDT30-01024           | Torque converter shell cover    | 1    |                |
| 34  | GB/T818               | Screw M8*10                     | 2    |                |
| 35  | SDT30-07200           | Electro-hydraulic control valve | 1    |                |

|    |               | body                                   |    |           |
|----|---------------|----------------------------------------|----|-----------|
| 36 | Y30H-07020    | Filter screen                          | 1  |           |
| 37 | GB/T5789      | Bolt M8*30                             | 2  |           |
| 38 | FSDT35-01014  | Transition block liner                 | 1  |           |
| 39 | GB/T70.1      | Screw M6*35                            | 4  |           |
| 40 | FSDT35-01005  | Transition block                       | 1  |           |
| 41 | Y30H-07010    | Filter (II)                            | 1  |           |
| 42 | Y30H-07002    | Pipe joint                             | 1  |           |
| 43 | Y30H-D07300   | Solenoid valve                         | 1  |           |
| 44 | GB/T5789      | Bolt M8*60                             | 6  |           |
| 45 | Y30H-01007    | Refuelling filler cap                  | 1  |           |
| 46 | SDT30-01016-1 | Dipstick seat                          | 1  |           |
| 47 | SDT30-07015   | Electro-hydraulic control valve gasket | 1  |           |
| 48 | SDT30-01018   | Hinged Bolt                            | 2  |           |
| 49 | SDT30-01019-2 | Cooling output pipe component          | 2  |           |
| 50 | JB/ZQ4446     | Plug Rc1/8                             | 18 |           |
| 51 | JB/T982       | Combined sealing washer 16C            | 6  |           |
| 52 | Y30H-01011    | Oil outlet plug screw                  | 2  |           |
| 53 | GB/T5287      | washer 6                               | 1  |           |
| 54 | Y30H-01102    | Filter screen assembly                 | 1  |           |
| 55 | GB/T5782      | Bolt M10*100                           | 9  |           |
| 56 | SDT30-01007   | Stud                                   | 1  |           |
| 57 | GB/T283       | Bearing 6009                           | 1  |           |
| 58 | SDT30-01005   | Coarse filter liner                    | 1  |           |
| 59 | SDT30-03003-1 | Oil seal 45*68*12                      | 2  |           |
| 60 | SDT30-01004   | Coarse filter shell                    | 1  |           |
| 61 | GB/T5789      | Bolt M8*16                             | 3  |           |
| 62 | FSDT35-05001  | Output flange                          | 1  |           |
| 63 | GB/T6170      | Nut 6                                  | 2  |           |
| 64 | GB/T93        | washer 10                              | 24 |           |
| 65 | JB/ZQ4446     | Plug Rc1/2                             | 3  |           |
| 66 | FSDT35-01016  | Felt                                   | 1  |           |
| 67 | GB/T5782      | Bolt M8*40                             | 3  |           |
| 68 | GB/T5782      | Bolt M8*50                             | 3  |           |
| 69 | Y30H-07007    | Bolt liner                             | 6  |           |
| 70 | GB3452.1      | O ring 8.75*1.8                        | 2  |           |
| 71 | GB/T93        | washer 6                               | 4  |           |
| 72 | GB/T70.1      | Screw M5*45                            | 4  |           |
| 73 | GB3452.1      | O ring 30*1.8                          | 1  |           |
| 74 | GB/T825       | Lifting bolt M10                       | 1  |           |
| 75 | FSDT35-06006  | Dummy plate                            | 1  | S4S、V2403 |

|    |              |           |   |               |
|----|--------------|-----------|---|---------------|
| 76 | GB/T93       | washer 14 | 1 | S4S、<br>V2403 |
| 77 | FSDT35-06007 | Bolt      | 1 | S4S、<br>V2403 |

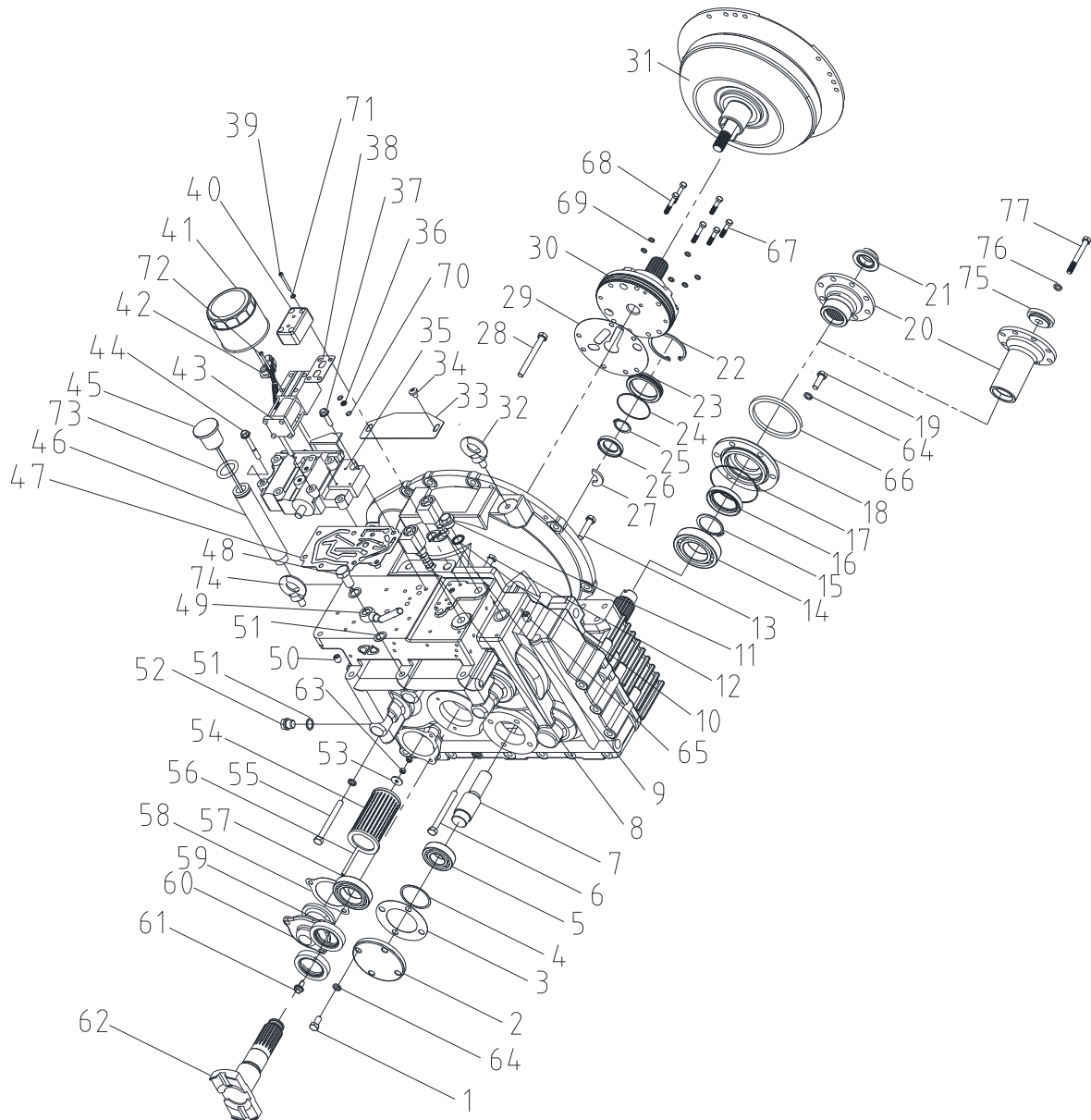


Fig.2-6 FSDT35I/ FSDT35I-1 Transmission parts (One)

| Transmission parts List (II) |                       |                                    |          |        |
|------------------------------|-----------------------|------------------------------------|----------|--------|
| No.                          | Figure number or code | Name                               | Qty.     | Remark |
| 1                            | <b>FSDT35-01001A</b>  | Box body                           | 1        |        |
| 2                            | FSDT35-01006          | Torque converter housing gasket    | 1        |        |
| 3                            | FSDT35-06000          | Off-axle clutch assembly           | 1        |        |
| 4                            | FSDT35-05003          | Output gear                        | 1        |        |
| 5                            | FSDT35-05002          | Output transmission gear           | 1        |        |
| 6                            | GB/T893.1             | Retaining ring for hole 24         | 1        |        |
| 7                            | FSDT35-05008          | Key C14*28*9                       | 4        |        |
| 8                            | FSDT35-05005          | Idle wheel                         | 1        |        |
| 9                            | GB/T276               | Bearing 6012                       | 1        |        |
| 10                           | GB/T283               | Bearing NF207                      | 1        |        |
| 11                           | GB/T119.1             | Cylindrical pin 12*20              | 2        |        |
| 12                           | GB1235                | O ring 28*2.4                      | 1        |        |
| 13                           | <b>FSDT35-01002A</b>  | Torque converter housing           | 1        |        |
| 14                           | GB1235                | O ring 15*2.4                      | 2        |        |
| 15                           | SDT30-01010           | Overflow valve element             | 1        |        |
| 16                           | SDT30-01013           | Safety valve element               | 1        |        |
| 17                           | SDT30-01011A          | Overflow valve spring              | 1        |        |
| 18                           | SDT30-01014           | Safety valve spring                | 1        |        |
| 19                           | GB/T5287              | <b>Flat washer 6</b>               | <b>2</b> |        |
| 20                           | SDT30-01015           | Safety valve pad                   | 1        |        |
| 21                           | GB/T893.1             | Retaining ring for hole 22         | 1        |        |
| 22                           | GB/T893.1             | Retaining ring for hole 18         | 1        |        |
| 23                           | FSDT35-03000          | Low-speed clutch assembly          | 1        |        |
| 24                           | GB/T894.1             | Retaining ring for shaft 60        | 1        |        |
| 25                           | <b>FSDT35-04000</b>   | <b>High-speed clutch assembly</b>  | <b>1</b> |        |
| 26                           | <b>FSDT35-02000</b>   | <b>Input shaft clutch assembly</b> | <b>1</b> |        |

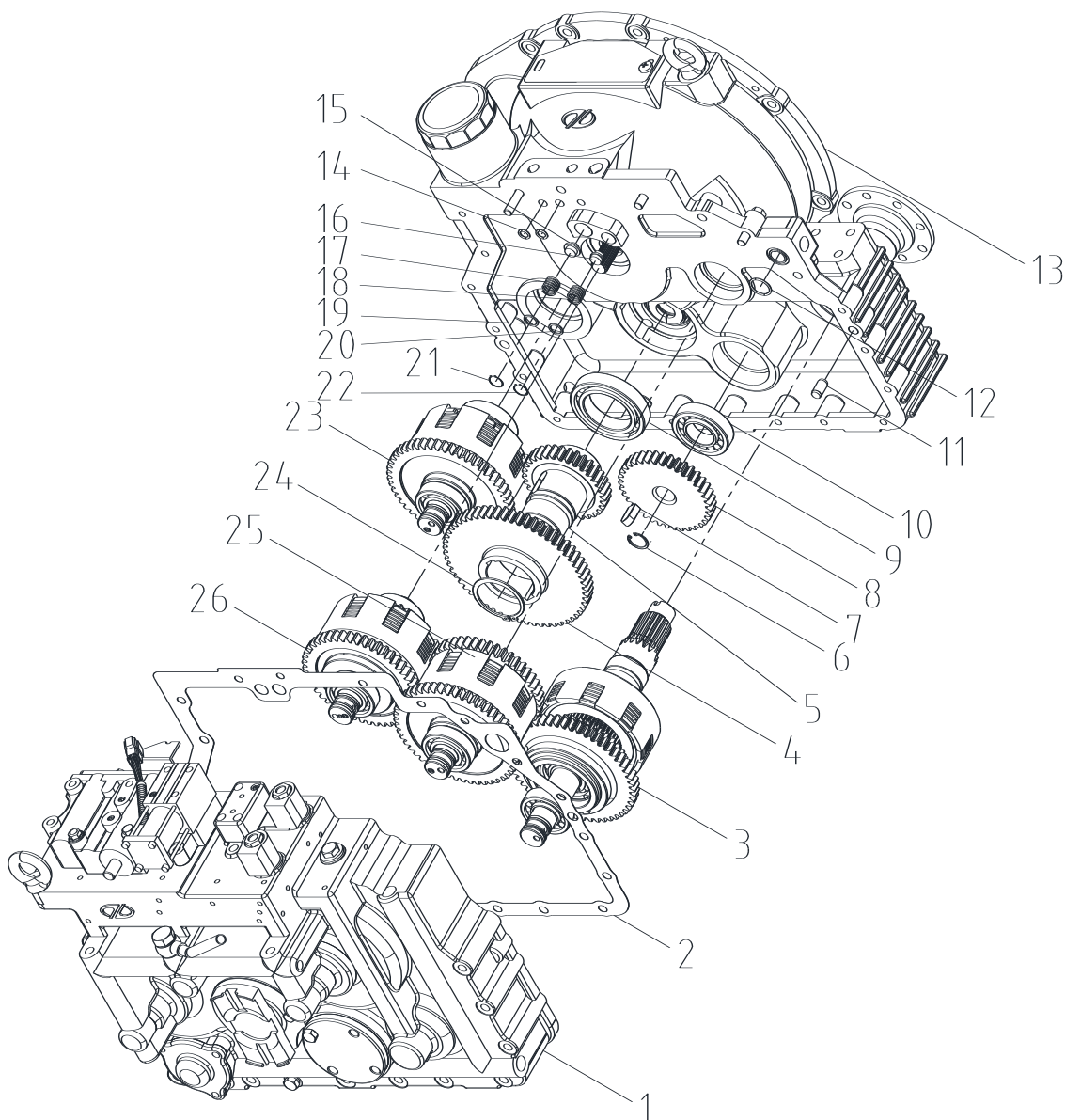


Fig.2-7 FSDT35I/ FSDT35I-1 Transmission parts (Two)

List of high speed shaft parts (Fig. 2-8)

| No. | Figure number or code | Name                            | Qty. | Remark   |
|-----|-----------------------|---------------------------------|------|----------|
| 1   | GB/T78                | Screw M8*8                      | 1    |          |
| 2   | Y30H-02009            | Sealing ring (A)                | 2    | Imported |
| 3   | GB/T276               | Deep groove ball bearing 6206   | 2    | NTN      |
| 4   | Y30H-02006            | Thrust ring (B)                 | 2    |          |
| 5   | SDT30-02004           | Driven transmission gear        | 2    |          |
| 6   | FSDT35-03001          | Key C14*22*9                    | 1    |          |
| 7   | SDT30-04100           | Countershaft assembly           | 1    |          |
| 8   | Y30H-02010            | Sealing ring (B)                | 1    |          |
| 9   | GB1235                | O sealing ring 40*3.5           | 1    |          |
| 10  | SDT30-02200           | Piston assembly                 | 1    |          |
| 11  | SDT30-02003           | Return spring                   | 1    |          |
| 12  | Y30H-02004            | Spring seat                     | 1    |          |
| 13  | GB/T894.1             | Retainer ring 40                | 1    |          |
| 14  | Y30H-02008            | Spacer                          | 5    |          |
| 15  | Y30H-02007            | Friction plate                  | 5    | Imported |
| 16  | Y30H-02012            | End plate                       | 1    |          |
| 17  | Y30H-02011A           | Snap ring                       | 1    |          |
| 18  | Y30H-02005A           | Thrust ring (A)                 | 1    |          |
| 19  | JB/T7918              | Needle roller bearing K35*42*20 | 1    |          |
| 20  | FSDT35-04002          | High speed gear                 | 1    |          |
| 21  | Y30H-02013            | Belleville spring               | 1    |          |

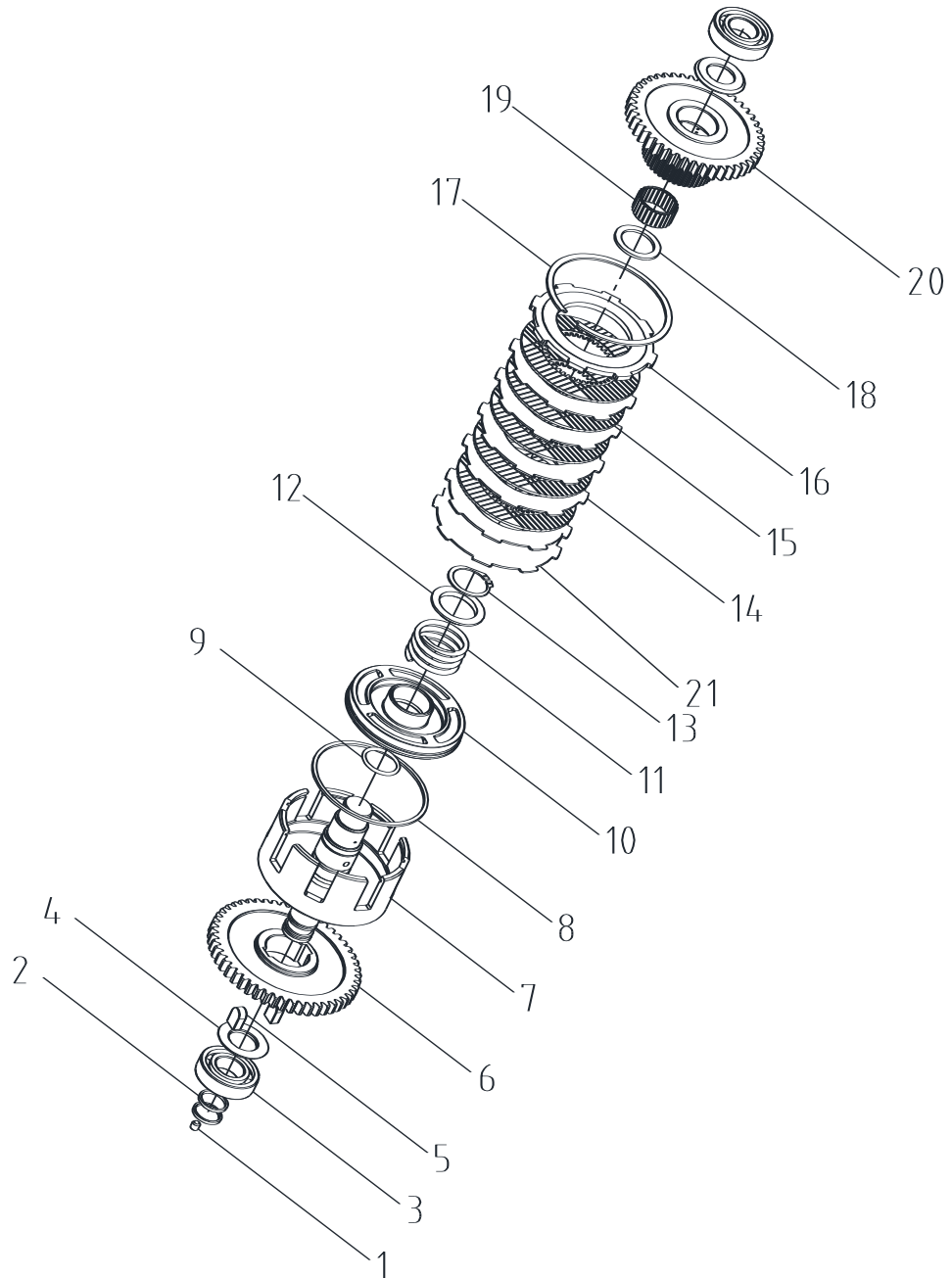


Fig.2-8 High speed shaft parts

Input shaft clutch components (Fig.2-9)

| No. | Figure number or code | Name                            | Qty. | Remark   |
|-----|-----------------------|---------------------------------|------|----------|
| 1   | GB/T78                | Screw M8*8                      | 1    |          |
| 2   | Y30H-02009            | Sealing ring (A)                | 3    | Imported |
| 3   | GB/T276               | Deep groove ball bearing 6206   | 2    | NTN      |
| 4   | Y30H-02006            | Thrust ring (B)                 | 2    |          |
| 5   | FSDT35-02001          | Driving transmission gear       | 1    |          |
| 6   | SDT30-02004           | Key C14*22*9                    | 2    |          |
| 7   | SDT30-02100           | Input shaft assembly            | 1    |          |
| 8   | Y30H-02010            | Sealing ring (B)                | 1    |          |
| 9   | GB1235                | O sealing ring 40*3.5           | 1    |          |
| 10  | SDT30-02200           | Piston assembly                 | 1    |          |
| 11  | SDT30-02003           | Return spring                   | 1    |          |
| 12  | Y30H-02004            | Spring seat                     | 1    |          |
| 13  | GB/T894.1             | Retainer ring 40                | 1    |          |
| 14  | Y30H-02008            | Spacer                          | 5    |          |
| 15  | Y30H-02007            | friction plate                  | 5    | Imported |
| 16  | Y30H-02012            | End plate                       | 1    |          |
| 17  | Y30H-02011A           | Snap ring                       | 1    |          |
| 18  | Y30H-02005A           | Thrust plate (A)                | 1    |          |
| 19  | JB/T7918              | Needle roller bearing K35*42*20 | 1    |          |
| 20  | FSDT35-02002          | Backward gear                   | 1    |          |
| 21  | Y30H-02013            | Belleville spring               | 1    |          |

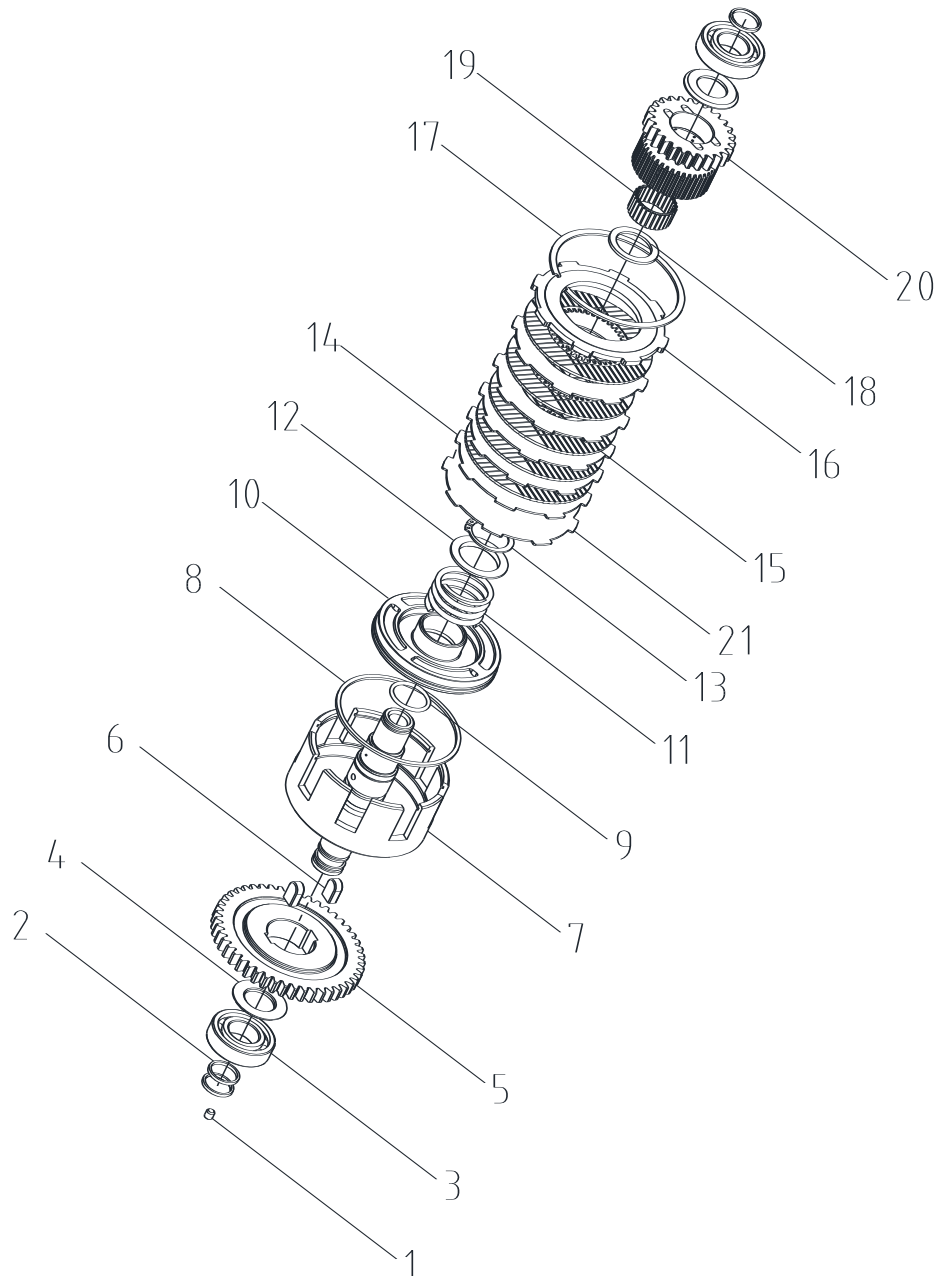


Fig 2-9 Input shaft clutch components

Off-axle shaft parts (Fig.2-10)

| No. | Figure number or code | Name                             | Qty. | Remark   |
|-----|-----------------------|----------------------------------|------|----------|
| 1   | FSDT35-06100          | Off-axle shaft assembly          | 1    |          |
| 2   | Y30H-02010            | Sealing ring (B)                 | 1    |          |
| 3   | GB1235                | O sealing ring 40*3.5            | 1    |          |
| 4   | SDT30-02200           | Piston assembly                  | 1    |          |
| 5   | SDT30-02003           | Return spring                    | 1    |          |
| 6   | Y30H-02004            | Spring seat                      | 1    |          |
| 7   | GB/T894.1             | Retainer ring 40                 | 1    |          |
| 8   | Y30H-02008            | Spacer                           | 6    |          |
| 9   | Y30H-02007            | friction plate                   | 6    | NTN      |
| 10  | Y30H-02012            | End plate                        | 1    |          |
| 11  | Y30H-02011A           | Snap ring                        | 1    |          |
| 12  | FSDT35-06002          | Off-axle gear                    | 1    |          |
| 13  | GB/T276               | Deep groove ball bearing 6207    | 2    |          |
| 14  | FSDT35-05008          | Key C14*28*9                     | 2    |          |
| 15  | FSDT35-06005-1        | Gasket                           | 1    | Imported |
| 16  | FSDT35-06001          | High speed transmission gear     | 1    |          |
| 17  | GB/T894.1             | Retaining ring for shaft 35      | 1    |          |
| 18  | GB/T893.1             | Retaining ring for hole 72       | 1    |          |
| 19  | GB/T894.1             | Retaining ring for shaft 90      | 1    |          |
| 20  | GB/T283               | Cylindrical roller bearing NJ206 | 1    |          |
| 21  | Y30H-02009            | Sealing ring (A)                 | 2    | Imported |
| 22  | GB/T78                | Screw M8*8                       | 1    |          |

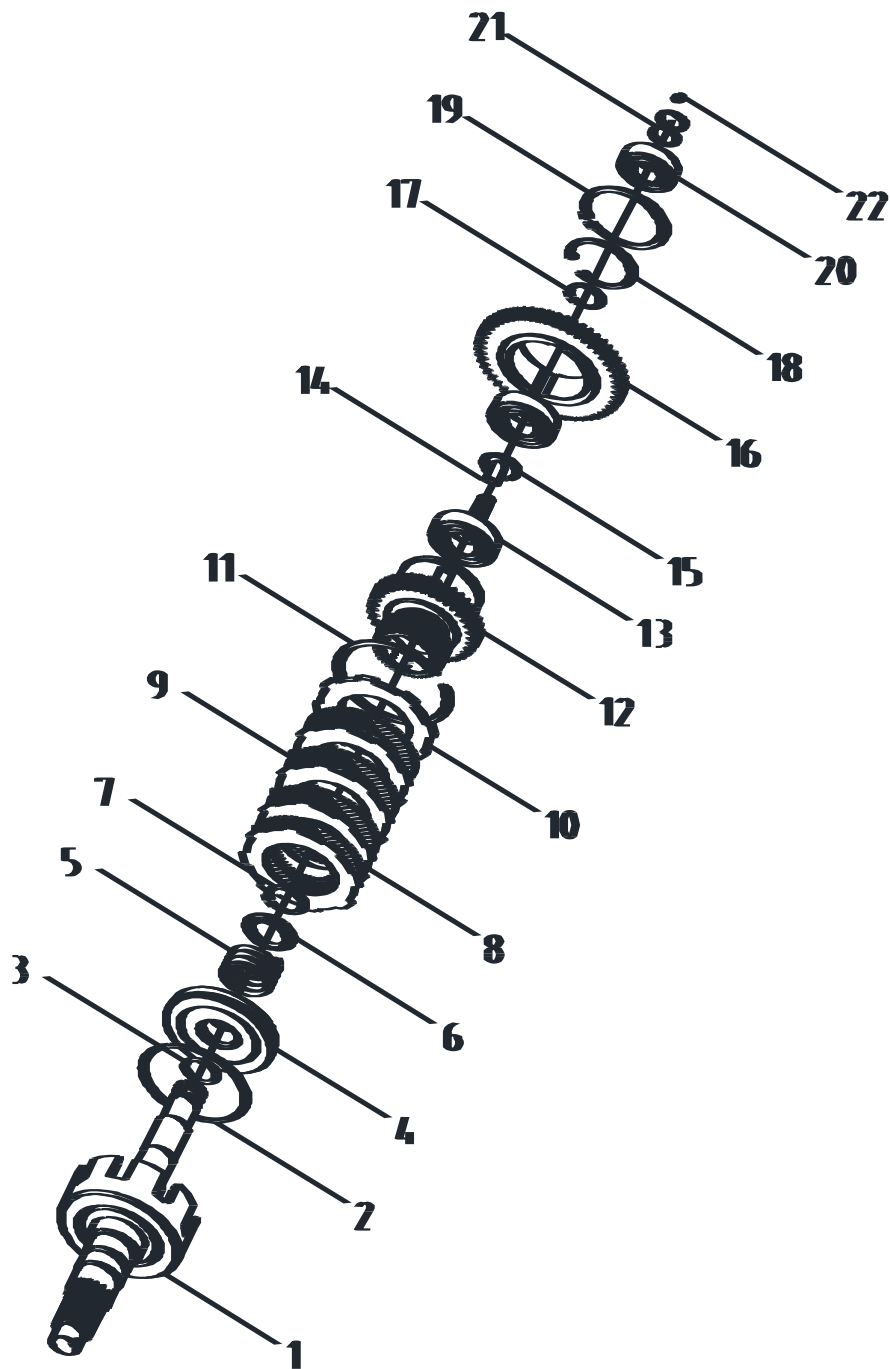


Fig.2-10 Off-axle shaft parts

Low speed shaft parts (Fig.2-11)

| No. | Figure number or code | Name                            | Qty. | Remark   |
|-----|-----------------------|---------------------------------|------|----------|
| 1   | GB/T78                | Screw M8*8                      | 1    |          |
| 2   | Y30H-02009            | Sealing ring (A)                | 2    | Imported |
| 3   | GB/T276               | Deep groove ball bearing 6206   | 1    | NTN      |
| 4   | Y30H-02006            | Thrust ring (B)                 | 1    |          |
| 5   | FSDT35-03001          | Driven transmission gear        | 1    |          |
| 6   | SDT30-02004           | Key C14*22*9                    | 2    |          |
| 7   | SDT30-04100           | Countershaft assembly           | 1    |          |
| 8   | Y30H-02010            | Sealing ring (B)                | 1    |          |
| 9   | GB1235                | O sealing ring 40*3.5           | 1    |          |
| 10  | SDT30-02200           | Piston assembly                 | 1    |          |
| 11  | SDT30-02003           | Return spring                   | 1    |          |
| 12  | Y30H-02004            | Spring seat                     | 1    |          |
| 13  | GB/T894.1             | Retainer ring 40                | 1    |          |
| 14  | Y30H-02008            | Spacer                          | 5    |          |
| 15  | Y30H-02007            | Friction plate                  | 5    | Imported |
| 16  | Y30H-02012            | End plate                       | 1    |          |
| 17  | Y30H-02005A           | Thrust plate (A)                | 1    |          |
| 18  | Y30H-02011A           | Needle roller bearing K35*42*20 | 1    |          |
| 19  | JB/T7918              | Snap ring                       | 1    |          |
| 20  | FSDT35-03002          | Low speed gear                  | 1    |          |
| 21  | FSDT35-03003          | Thrust ring                     | 1    |          |
| 22  | GB/T276               | Deep groove ball bearing 6306   | 1    | NTN      |
| 23  | Y30H-02013            | Belleville spring               | 1    |          |

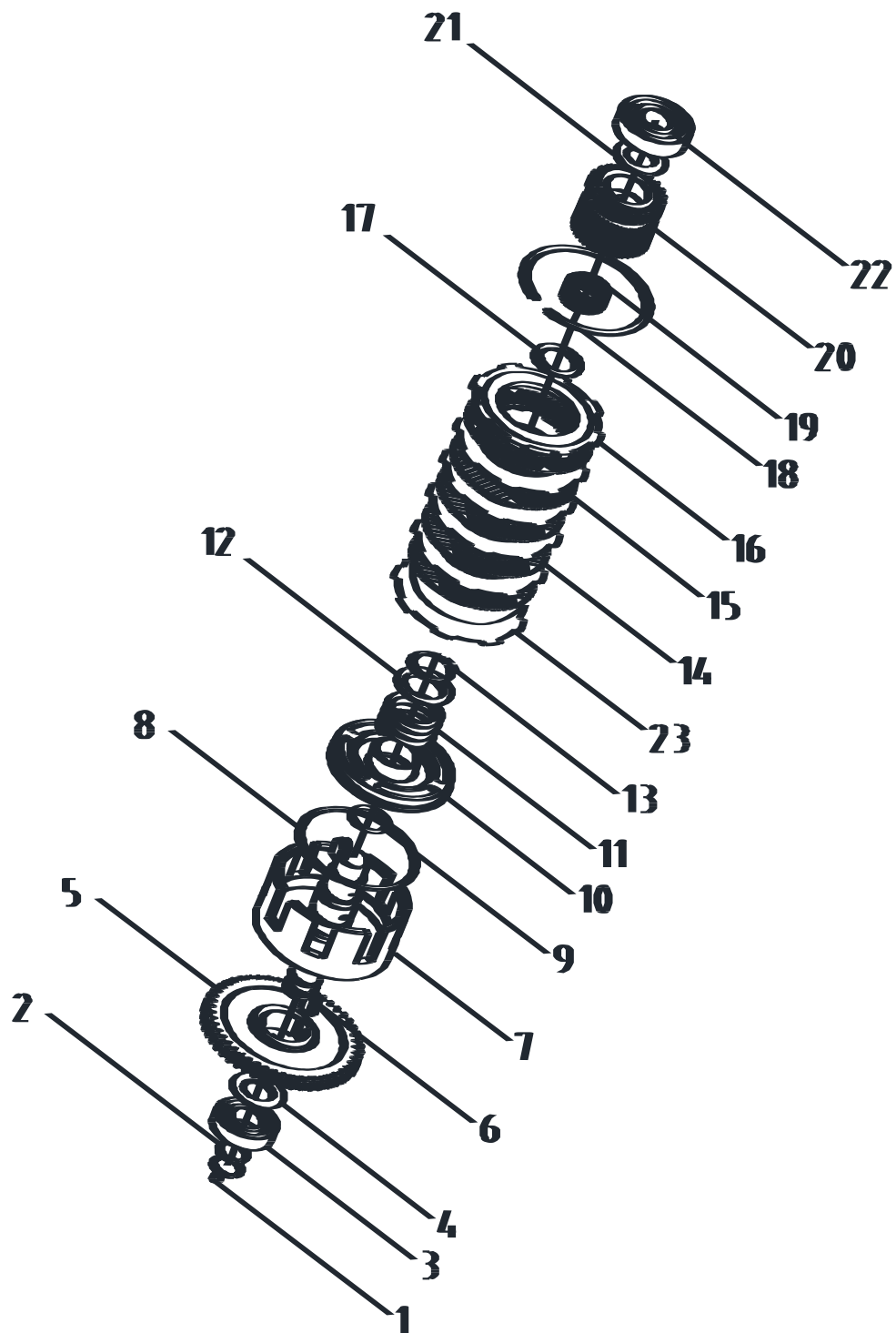


Fig.2-11 Low speed shaft parts

List of transmission parts(Fig.2-12)

| No. | Drawing No. (Code) | Name                            | Qty. | Remark         |
|-----|--------------------|---------------------------------|------|----------------|
| 1   | FSDT35-07007       | Transmission case output flange | 1    |                |
| 2   | Y30H-01011         | Oil outlet plug screw           | 2    |                |
| 3   | FSDT35-07012       | Dust cover                      | 2    |                |
| 4   | GB/T276            | Deep groove ball bearing 6208   | 2    |                |
| 5   | GB/T276            | Deep groove ball bearing 6209   | 2    |                |
| 6   | FSDT35-07005       | Transmission case output gear   | 1    |                |
| 7   | FSDT35-07002       | Transmission case housing       | 1    | With FSDT 35II |
| -   | FSDT25-07002       | Transmission case housing       | 1    | With FSDT25II  |
| 8   | GB/T93             | Spring washer 6                 | 6    |                |
| 9   | GB/T5783           | Bolt M6*16                      | 6    |                |
| 10  | FSDT35-07010       | Hinged ventilation block        | 1    |                |
| 11  | FSDT35-06003       | Off-axle flange                 | 1    |                |
| 12  | FSDT35-07013       | Ventilation plug assembly       | 2    |                |
| 13  | FSDT35-06005       | Gasket                          | 1    |                |
| 14  | GB/T3452.1         | O ring 34.5*3.55                | 1    |                |
| 15  | FSDT35-06004       | Locknut                         | 1    |                |
| 16  | FSDT35-07010-1     | Hinged ventilation block        | 1    |                |
| 17  | JB/T982            | Combined gasket 16C             | 6    |                |
| 18  | FSDT35-07011       | Hinged Bolt                     | 2    |                |
| 19  | d16 JB/T8870       | Hoop                            | 2    |                |
| 20  | FSDT35-07015       | Braided oil resistant hose      | 1    |                |
| 21  | GB/T5783           | Bolt M10*20                     | 6    |                |
| 22  | GB/T93             | Spring washer 10                | 18   |                |
| 23  | FSDT35-07003       | Transmission case cover         | 1    |                |
| 24  | GB/T5783           | Bolt M10*35                     | 12   |                |
| 25  | GB1235             | O ring 80*3.1                   | 1    |                |
| 26  | FSDT35-07014       | Vent cap                        | 1    |                |
| 27  | GB/T5789           | Bolt M12*1.25*30-10.9           | 1    | Sizing         |
| 28  | SDT30-10003        | Clapboard                       | 1    |                |
| 29  | FSDT35-07008       | Transmission case output gear   | 1    | With FSDT35II  |
| -   | FSDT25-07008       | Transmission case output gear   | 1    | With FSDT25II  |
| 30  | FSDT35-07006       | transmission case Idle wheel    | 1    |                |
| 31  | GB/T119.1          | Cylindrical pin 10*24           | 2    |                |

|    |               |                                  |   |                  |
|----|---------------|----------------------------------|---|------------------|
| 32 | GB/T283       | Cylindrical roller bearing NJ206 | 2 |                  |
| 33 | JB/ZQ4446     | Plug screw Rc1/4                 | 1 |                  |
| 34 | FSDT35-07001  | Transmission case body           | 1 | With<br>FSDT35II |
| -  | FSDT25-07001  | Transmission case body           | 1 | With<br>FSDT25II |
| 35 | GB/T825       | Lifting bolt M12                 | 1 |                  |
| 36 | SDT30-10004-1 | Oil seal 55*78*12                | 2 |                  |
| 37 | SDT30-10004   | Oil seal 55*78*10                | 2 |                  |

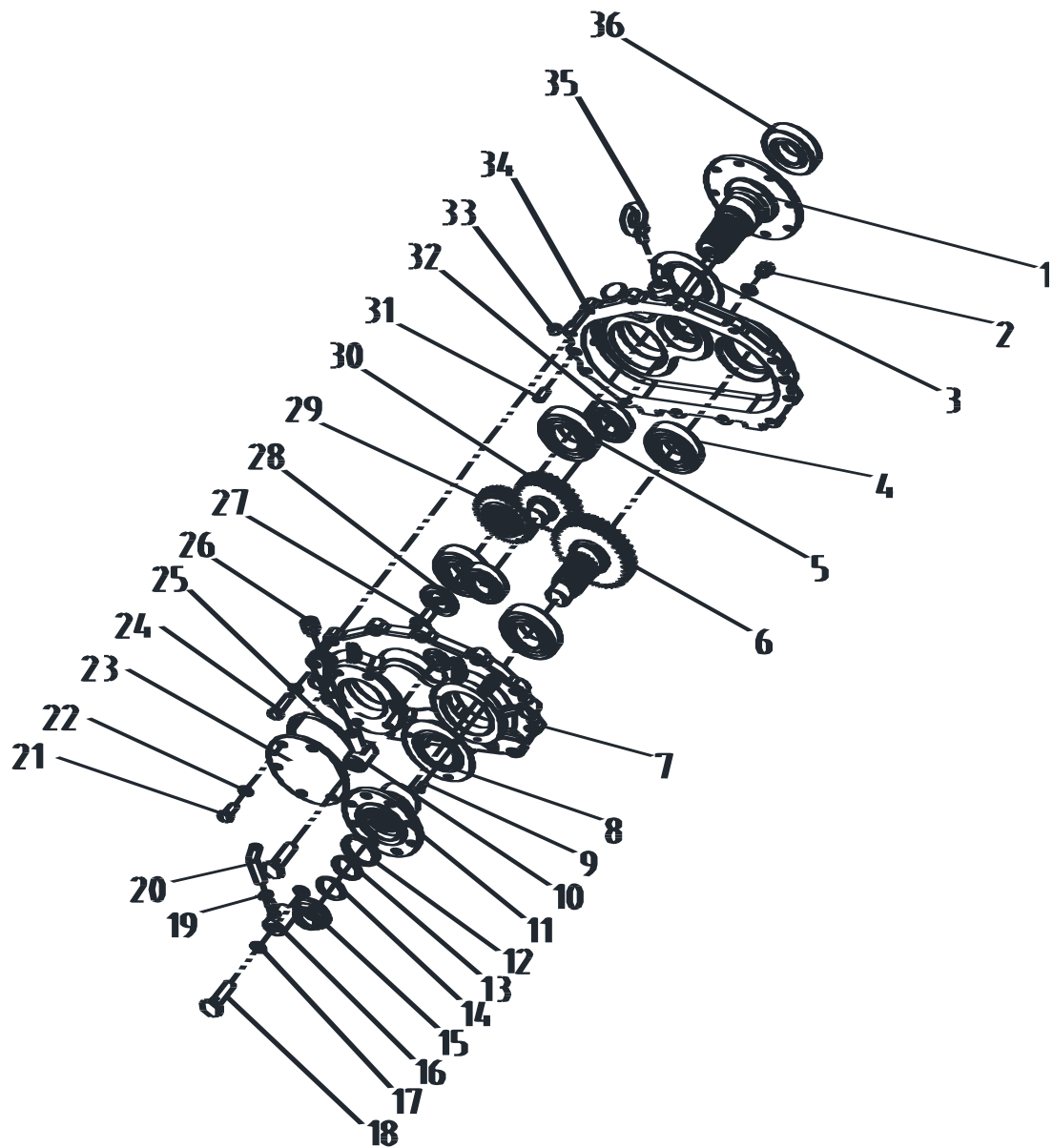


Fig.2-12 List of transmission parts

List of front main reducer parts (Fig.2-13)

| No. | Drawing No. (Code) | Name                         | Qty.       | Remark         |
|-----|--------------------|------------------------------|------------|----------------|
| 1   | FSDT35-08004       | Adjusting nut                | 2          |                |
| 2   | GB/T297            | Tapered roller bearing 32013 | 2          |                |
| 3   | FSDT35-09005       | Bearing block bolt           | 12         |                |
| 4   | FSDT35-09006       | Bearing block lock           | 6          |                |
| 5   | FSDT35-09004       | Bearing block locking plate  | 1          | With FSDT35III |
| -   | FSDT25-09004       | Bearing block locking plate  | 1          | With FSDT25III |
| 6   | FSDT35-09002-1     | Left differential housing    | 1          |                |
| 7   | FSDT35-09024       | Spacers                      | 8          |                |
| 8   | FSDT35-09025       | Friction plate               | 6          |                |
| 9   | FSDT35-09026       | Friction plate               | 2          | Thickness      |
| 10  | FSDT35-09022       | Planetary washer             | 4          |                |
| 11  | FSDT35-09021       | Planetary gear               | 4          |                |
| 12  | FSDT35-08003       | Bearing                      | 2          |                |
| 13  | FSDT35-08005       | Stopplate                    | 2          |                |
| 14  | GB/T93             | Washer 6                     | 2          |                |
| 15  | GB/5783            | Bolt M6*12                   | 2          |                |
| 16  | Y30H-01010         | Bearing seat bolts           | 4          |                |
| 17  | Y30H-01008         | Lock plate for bearing seat  | 4          |                |
| 18  | FSDT35-09001-1     | Right differential housing   | 1          |                |
| 19  | FSDT35-09023       | Half shaft gear              | 2          |                |
| 20  | FSDT35-09020       | Cross shaft                  | 1          |                |
| 21  | FSDT35-09003       | Output shaft                 | 1          | With FSDT35III |
| -   | FSDT25-09003       | Output shaft                 | 1          | With FSDT25III |
| 22  | GB/T297            | Tapered roller bearing 32012 | 2          |                |
| 23  | FSDT35-09008       | Output shaft gasket          | On dem and |                |
| 24  | FSDT35-08001       | Before the main reduction    | 1          |                |
| 25  | FSDT35-09011       | Speed gear                   | 1          |                |
| 26  | GB1235             | O ring 105*3.1               | 1          |                |
| 27  | SDT30-10004-1      | Oil seal                     | 1          | 55*78*10       |
| 28  | FSDT35-09009       | Locknut                      | 1          |                |
| 29  | FSDT35-08002       | Main minus end cap           | 1          |                |
| 30  | GB/T93             | Washer 10                    | 6          |                |
| 31  | GB/5783            | Bolt M10*25                  | 6          |                |

|    |                     |                       |          |  |
|----|---------------------|-----------------------|----------|--|
| 32 | SDT30-03002         | Output flange         | 1        |  |
| 33 | <b>FSDT35-07013</b> | Transmission box felt | <b>1</b> |  |

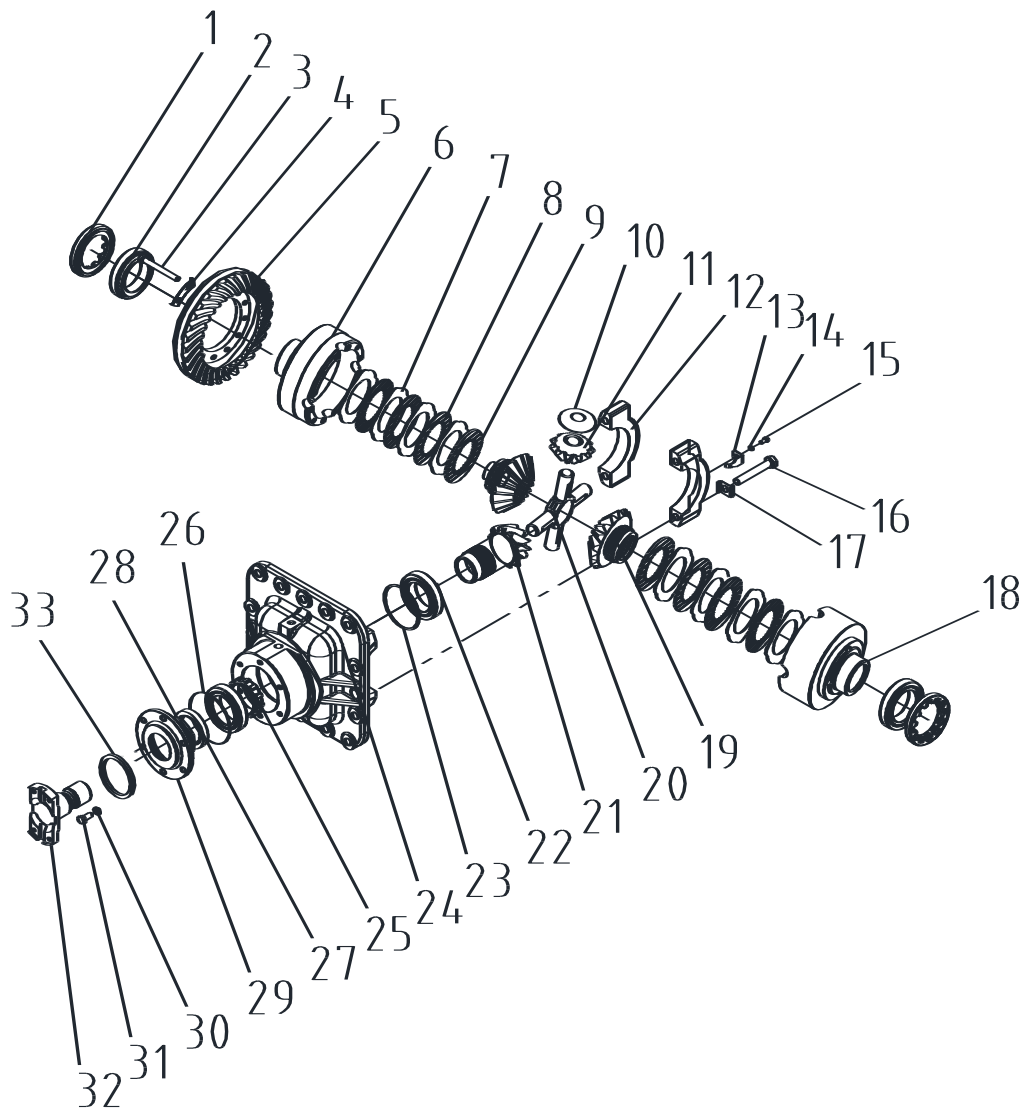


Fig.2-13 List of front main reducer parts

| List of rear main reducer parts (2-14) |                    |                                 |           |               |
|----------------------------------------|--------------------|---------------------------------|-----------|---------------|
| No.                                    | Drawing No. (Code) | Name                            | Qty.      | Remark        |
| 1                                      | FSDT35-08004       | Adjusting nut                   | 2         |               |
| 2                                      | GB/T297            | Tapered roller bearing 32013    | 2         |               |
| 3                                      | FSDT35-09005       | Differential case bolt          | 12        |               |
| 4                                      | FSDT35-09006       | Differential case locking plate | 6         |               |
| 5                                      | FSDT35-09004       | Spiral bevel gear               | 1         | With FSDT35IV |
|                                        | FSDT25-09004       | Spiral bevel gear               | 1         | With FSDT25IV |
| 6                                      | FSDT35-09002-1     | Left differential housing       | 1         |               |
| 7                                      | FSDT35-09024       | spacers                         | 8         |               |
| 8                                      | FSDT35-09025       | Friction plate                  | 6         | Thick         |
| 9                                      | FSDT35-09026       | Friction plate                  | 2         |               |
| 10                                     | FSDT35-09022       | Planetary washer                | 4         |               |
| 11                                     | FSDT35-09021       | Planetary gear                  | 4         |               |
| 12                                     | FSDT35-08003       | Bearing block                   | 2         |               |
| 13                                     | FSDT35-08005       | Stop piece                      | 2         |               |
| 14                                     | GB/T93             | Washer 6                        | 2         |               |
| 15                                     | GB/5783            | Bolt M6*12                      | 2         |               |
| 16                                     | Y30H-01010         | Bearing seat bolts              | 4         |               |
| 17                                     | Y30H-01008         | Lock plate for bearing seat     | 4         |               |
| 18                                     | FSDT35-09001-1     | Right differential housing      | 1         |               |
| 19                                     | FSDT35-09023       | Half shaft gear                 | 2         |               |
| 20                                     | FSDT35-09020       | Spider                          | 1         |               |
| 21                                     | FSDT35-09003       | Output shaft                    | 1         | With FSDT35IV |
|                                        | FSDT25-09003       | Output shaft                    | 1         | With FSDT25IV |
| 22                                     | GB/T297            | Tapered roller bearing 32012    | 2         |               |
| 23                                     | FSDT35-09008       | Output shaft gasket             | On demand |               |
| 24                                     | FSDT35-08007       | Rear reducer seat               | 1         |               |
| 25                                     | GB1235             | O ring 105*3.1                  | 1         |               |
| 26                                     | SDT30-10004-1      | Oil seal                        | 1         | 55*78*10      |
| 27                                     | FSDT35-09009       | Locknut                         | 1         |               |
| 28                                     | FSDT35-08002       | Main reducer end cover          | 1         |               |
| 29                                     | GB/T93             | Washer 10                       | 6         |               |
| 30                                     | GB/5783            | Bolt M10*25                     | 6         |               |
| 31                                     | FSDT35-09007       | Rear main minus input flange    | 1         |               |
| 32                                     | FSDT35-07013       | Transmission box felt           | 1         |               |

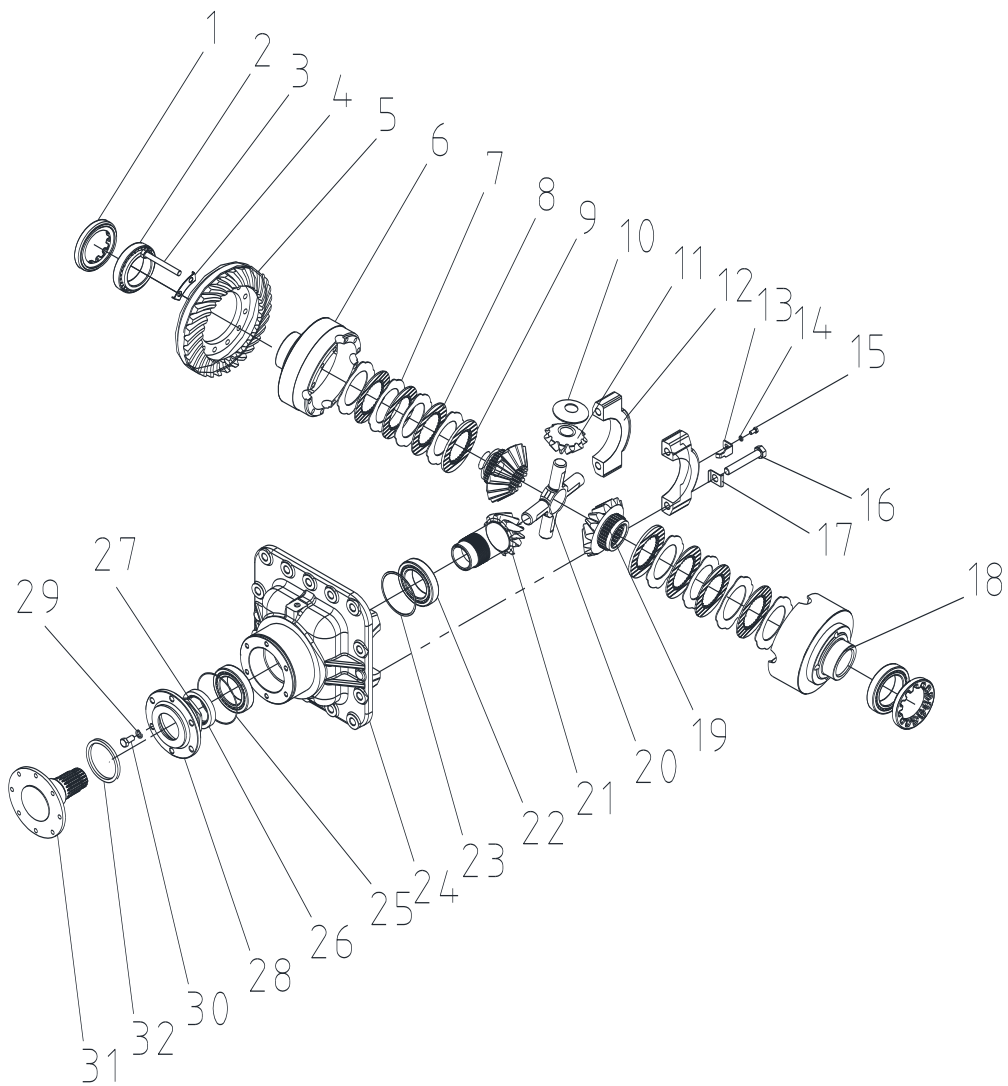


Fig.2-14 List of rear main reducer parts

### 3. Drive Axle

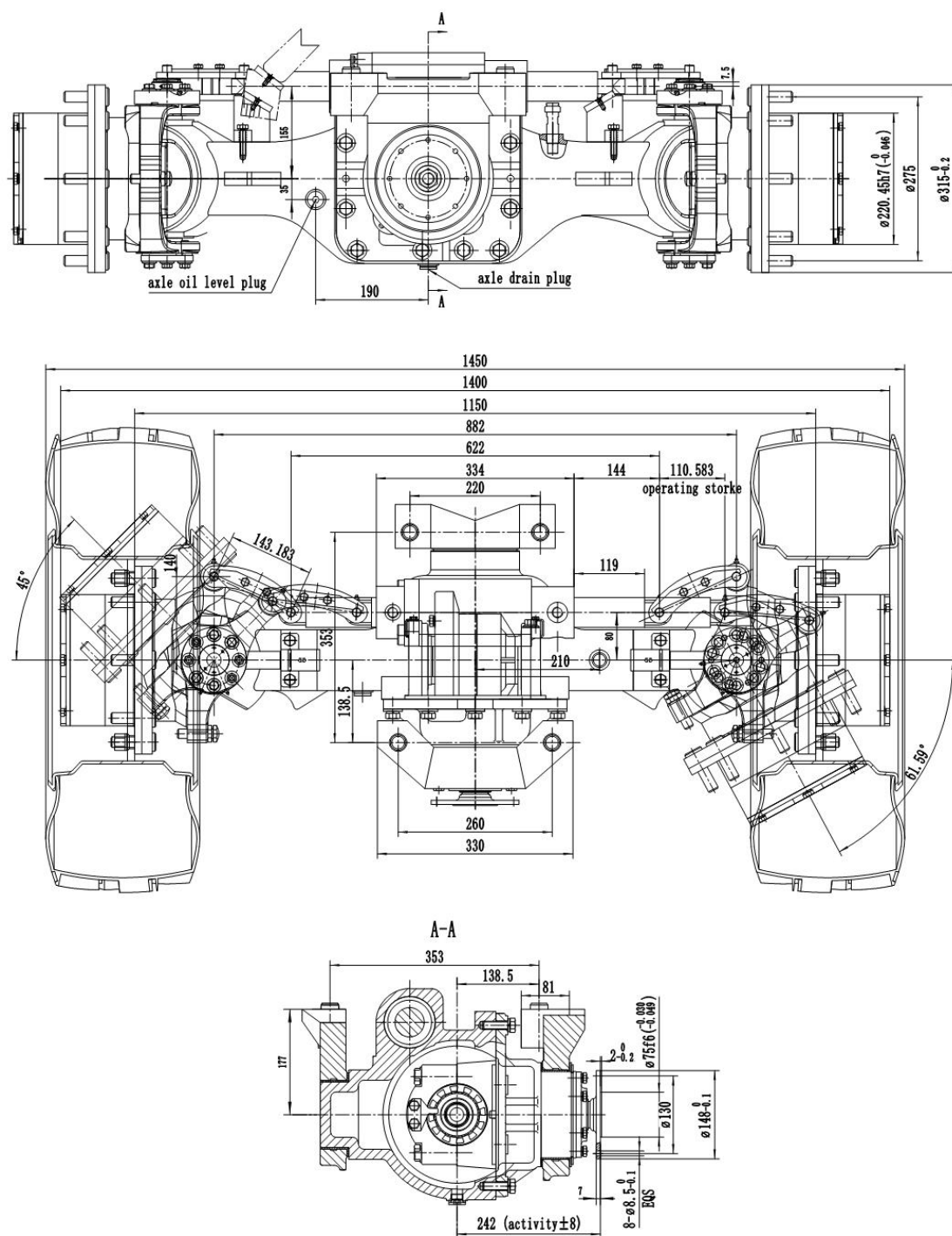
#### 3.1 SQH35000000B rear steering drive axle

##### 3.1.1 Main technical parameters

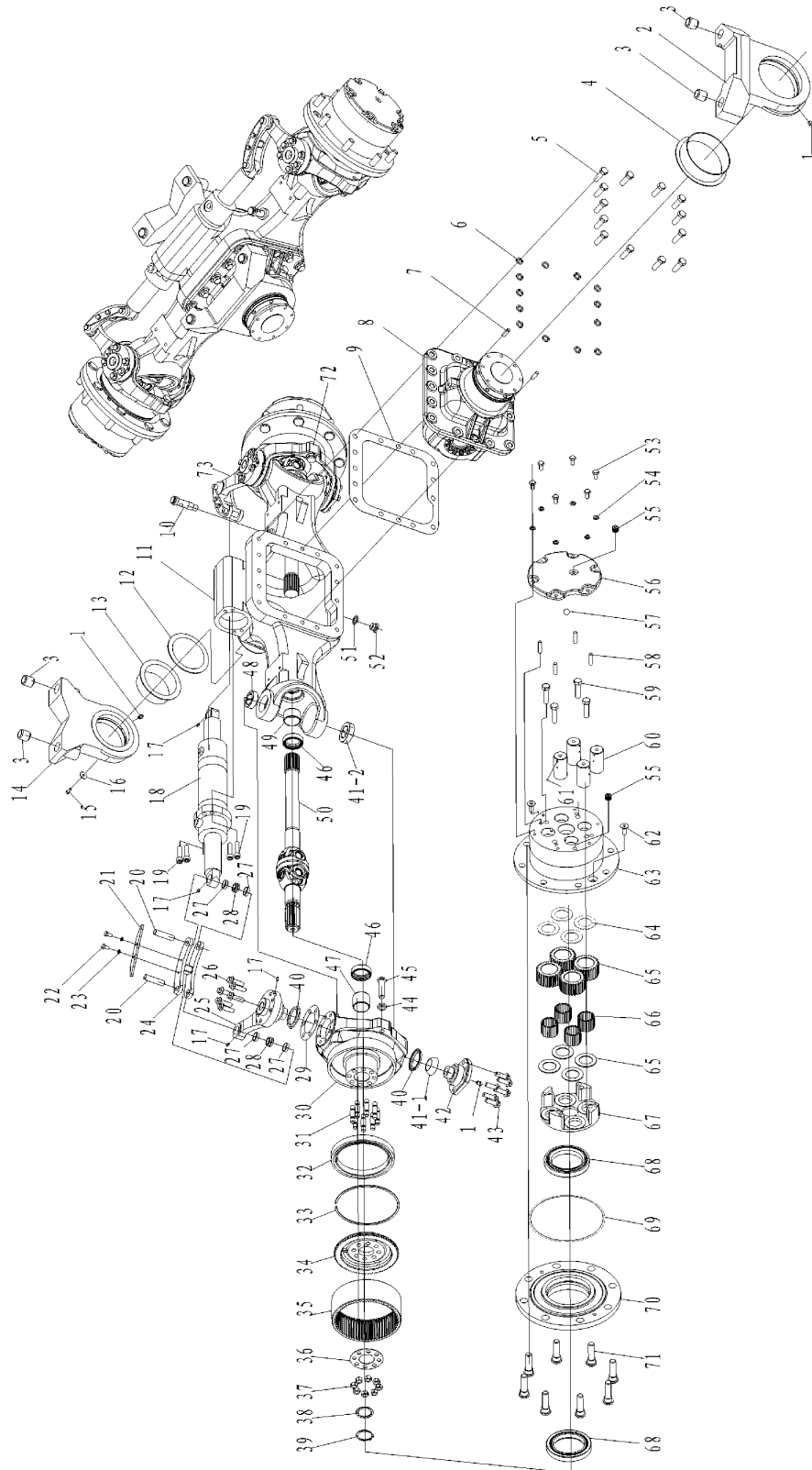
|                                                |                           |                                                                     |
|------------------------------------------------|---------------------------|---------------------------------------------------------------------|
| Max. input torque (N.m)                        |                           | ≤1200                                                               |
| Drive ratio                                    |                           | Total drive ratio 18.6, hub reduction ratio 6, main drive ratio 3.1 |
| Rear axle transmission shaft                   |                           | Middle drive shaft                                                  |
| Input end parameters                           |                           | (Convex seam allowance) 2×Ø75× (pitch circle Ø115×X8×Ø8.5EQS)       |
| Hub and spoke plate connecting bolt            |                           | 8-M18X1.5-6g (seam allowance Ø220.5×pitch circle Ø275mm)            |
| Spoke spacing (mm)                             |                           | 1150                                                                |
| Front wheel alignment                          | Front wheel camber angle  | 0°                                                                  |
|                                                | Kingpin inclination angle | 0°                                                                  |
|                                                | Kingpin caster angle      | 0°                                                                  |
|                                                | Front wheel toe-in        | 0—2mm                                                               |
|                                                | Type of steering          | Hydraulic steering                                                  |
| Tilt angle of rear shaft (axle)                |                           | 8° (each side)                                                      |
| Maximum turning angle                          |                           | Internal gear corner 61.59°, external gear corner 45°               |
| Diameter of steering cylinder /piston rod (mm) |                           | Ø75/Ø50                                                             |
| Number of steering cylinder                    |                           | 1                                                                   |
| Steering cylinder stroke (mm)                  |                           | 111                                                                 |
| Rated load (kg)                                |                           | 4500                                                                |
| Dead weight (kg)                               |                           | 320                                                                 |

### 3.1.2 Outline drawing, structural form and characteristics

### 3.1.2.1 Outline drawing and sizes



### 3.1.2.2 Structural form and characteristics



## 3.1.3 List of SQH35000000B rear steering drive axle parts

| No. | Code                 | Name                                            | Qty   | No. | Code             | Name                                         | Qty |
|-----|----------------------|-------------------------------------------------|-------|-----|------------------|----------------------------------------------|-----|
| 1   | JB/T7940.1-1995      | Straight forced filling oil cupM10X1            | 4     | 38  | SQH35000027      | Stub shaft outer baffle ring                 | 2   |
| 2   | SQH35070001B         | Front pedestal                                  | 1     | 39  | SQH35000026A     | Retaining ring for shaft                     | 2   |
| 3   | SQH35000007          | Support locating sleeve                         | 4     | 40  | SQH35000004      | Dust Ring                                    | 4   |
| 4   | SQH35070002B         | Support bushing                                 | 1     | 41  | GAC35S           | Angular-contact articulated bearing 35X62X18 | 2   |
| 5   | GB/T5783-2000        | Hexagonal head bolt M14X1.5X45/10.9 level       | 13    | 42  | SQH35000002      | Lower backing pin                            | 2   |
| 6   | GB/T93-1987          | Spring washer 14                                | 13    | 43  | SQH350000029     | Hexagon flange bolt M12X1.25X35/10.9 level   | 12  |
| 7   | GB/T 119.2-2000      | Cylindrical pin D12X32                          | 2     | 44  | GB/T 6172.1-2000 | Hexagon thin nut M16                         | 2   |
| 8   | FSDT35IV             | rear main reduction box assembly                | 1     | 45  | SQH35020002B     | Stop boltM16X70/10.9 level                   | 2   |
| -   | FSDT25IV             | rear main reduction box assembly                | 1     | 46  | CFW              | SIMRIT combination oil seal 45X60X16         | 4   |
| 9   | SQQ35000004B         | Main reducer gasket                             | 1     | 47  | SQH35020003B     | sliding bearing 45x50x40                     | 2   |
| 10  | Q30LD100             | Long ventilation plug (R2)1/2                   | 1     | 48  | SQH35000017      | bushing 35X52X16.5                           | 2   |
| 11  | SQH35030001B         | axle housing                                    | 1     | 49  | SQH35000008      | Sliding bearing 45X50X30                     | 2   |
| 12  | SQH35000012B/13B/14B | Adjusting washer                                | 1 set | 50  | SQH35010000B     | Axle shaft assembly                          | 2   |
| 13  | SQH35000006          | Support bushing                                 | 1     | 51  | JB/T 982-2000    | Combined washer 20                           | 2   |
| 14  | SQH35060001B         | Rear support                                    | 1     | 52  | SQQ35000006B     | Plug screw M20x1.5                           | 2   |
| 15  | GB/T 5783-2000       | Hexagonal head bolt M6X16/8.8 level             | 1     | 53  | GB/5783-2000     | Bolt M10x20                                  | 12  |
| 16  | SQH35000030          | Gasket                                          | 1     | 54  | GB/T93-2000      | Spring washer 10                             | 12  |
| 17  | JB/T 7940.1-1995     | Straight forced filling oil cupM6               | 6     | 55  | Q30LD006         | Plug R2-1/2                                  | 4   |
| 18  | SQH35050000B         | steering cylinder assembly                      | 1     | 56  | SQQ35000002B     | Bottom cap                                   | 2   |
| 19  | GB/T 70.1-2000       | hexagon socket head cap screw M12X45/10.9 level | 4     | 57  | GB/T308-2000     | Steel ball 11/16"                            | 2   |
| 20  | SQH35000005B         | Connecting rod pin                              | 4     | 58  | GB/T119.2-2000   | Pin 10(m6)*40                                | 8   |

|    |                         |                                                   |          |    |                     |                                            |     |
|----|-------------------------|---------------------------------------------------|----------|----|---------------------|--------------------------------------------|-----|
| 21 | SQH3500000<br>6B        | Baffle                                            | 2        | 59 | GB/T<br>5786-2000   | Bolt M14*1.5*55                            | 8   |
| 22 | GB/T5781-20<br>00       | Bolt M8x16                                        | 4        | 60 | SQH35040005         | Gear shaft                                 | 8   |
| 23 | GB/T93-1987             | Spring washer8                                    | 4        | 61 | GB/T308-2002        | Steel ball 15/64                           | 8   |
| 24 | SQH3500000<br>7B        | Connecting rod                                    | 2        | 62 | SQH35000025         | Screw M12*30                               | 4   |
| 25 | SQH3500000<br>8B        | Left steering knuckle<br>arm                      | 1        | 63 | SQQ35040001<br>A    | Planet gear breaket                        | 2   |
| 26 | SQH3500000<br>9B        | Hexagon flange bolt<br>M12X1.25X40/10.9<br>level  | 12       | 64 | SQH35040006         | Snap ring                                  | 16  |
| 27 | SQH3500000<br>4B        | bushing                                           | 8        | 65 | SQH35040002<br>A    | Planet gear                                | 8   |
| 28 | H24C4-3206<br>1(GE16ES) | Articulated bearing<br>(ES)                       | 4        | 66 | GB/T309-84          | Needle 5*39.8                              | 224 |
| 29 | SQH3500001<br>0B/11B    | Adjusting washer                                  | 1<br>set | 67 | SQQ35040002         | Bracket                                    | 2   |
| 30 | SQH3502000<br>1B        | Left steering knuckle                             | 1        | 68 | TIMKEN              | Bearing<br>JL819349/JL8193<br>10/95*135*20 | 4   |
| 31 | SQH3500001<br>0         | Double end stud                                   | 16       | 69 | GB/T3452.1-19<br>92 | O-ring 223*2.65                            | 2   |
| 32 | CFW                     | SIMRIT<br>combination oil seal<br>155X190X17.5/19 | 2        | 70 | SQH35070001         | Hub                                        | 2   |
| 33 | SQH3505000<br>3         | Gear ring baffle ring                             | 2        | 71 | SQH35070002         | Bolt                                       | 16  |
| 34 | SQH3505000<br>1         | support for tooth ring                            | 2        | 72 | SQH35040001<br>B    | Knuckle ass'y<br>(right)                   | 1   |
| 35 | SQH3505000<br>2A        | Gear ring                                         | 2        | 73 | SQH35000003<br>B    | Lever                                      | 1   |
| 36 | SQH3500002<br>4         | Internal shield ring of<br>external half shaft    | 16       |    |                     |                                            |     |
| 37 | GB/T<br>6176-2000       | 2 hexagon nut<br>M12X1.25                         | 2        |    |                     |                                            |     |

### 3.1.4 Use, maintenance and repair

#### (I) Prior to use of new axle

1. Before a new axle is used, sulfur phosphorus 90 heavy load gear oil (GL - 5) is added from the bridge packet oil filling port to the main reducer until there is oil overflowing from the bridge packet oil hole (about 8L); the oil filling and drain hole of the hub reducer is transferred to the vertical position, in the face of the hub reducer end cover, the oil filling and drain hole of the hub reducer is set in the top, and sulfur phosphorus 90 heavy load gear oil (GL - 5) is filled from the oil filling and drain hole until there is oil overflowing from the hub side (the oil amount of single hub reducer is about 0.85 L).

2. Inject adequate 2# lithium base lubricating grease to each grease nipple

(II) After the new axle is mounted, the vehicle runs in for 1500 km, and there is a need to check the pre-tightening torque of each part fastener.

#### (III) Axle maintenance

1. Often clear the dirt and dust on the ventilation plug in the rear axle housing.

2. Regularly check the oil filling port plug screw and oil drain plug screw, and if oil leakage is found, they should be tightened in time, or the end face sealing gasket is changed.

3. Every running for 2000km, inject 2# lithium base lubricating grease to each grease nipple, and clean the ventilation plug; check the oil surface height of the axle housing, and hub gear (open the oil level plug screw for inspection).

4. Every running for 8000-10000km, check the fasteners; check the clearance of hub bearing; check the quality of gear oil inside the axle housing, and in case of discoloration, thinning and metamorphism, new oil should be replaced in a timely manner. The mileage for the first oil change is 2000 km, and there is a need to change the gear oil once per 24000 km.

#### (IV) Major maintenance standards of main parts

##### 1. Tightening torque of main bolts and nuts (N·m)

|                                                                |         |
|----------------------------------------------------------------|---------|
| Fastening bolt of rear main reduction box assembly (No. 5)     | 180-220 |
| Fastening bolt of steering cylinder assembly (No. 19)          | 115-140 |
| Baffle fastening bolt (No. 22)                                 | 20-25   |
| Fastening bolt of left and right steering knuckle arm (No. 26) | 125-150 |
| Fastening bolt of lower backing pin (No. 43)                   | 125-150 |
| Fastening bolt of support for tooth ring (No. 37)              | 85-100  |
| Fastening nut of steering stop bolt (No. 44)                   | 140-150 |
| Oil inlet and outlet plug screw of main reducer (No. 53)       | 40-50   |
| End cover fastening bolt (No. 54)                              | 45-55   |
| Hub oil inlet and outlet plug screw (No. 56)                   | 25-30   |
| Planet carriersupport fastening bolt (No.61)                   | 180-220 |
| Planet carrierconnecting bolt (No.64)                          | 80-90   |

##### 2. Major maintenance standard

| Item                               | Maintenance standard | Remark                                             |
|------------------------------------|----------------------|----------------------------------------------------|
| Starting force of rear hub         | 30-55N               | Measure along the tangential direction of hub bolt |
| Starting force of steering knuckle | < 10N                | Measure along the tangential direction of stud     |

### 3.1.5 Assembly and adjustment

#### (I) Dismantling of assembly

##### 1. Dismantling of planet carrier assembly

- (1) At first, release the gear oil in the wheel side.
- (2) Use an internal hexagonal wrench to dismantle the hexagon socket countersunk head screw (No.34).
- (3) Slightly turn the planet carrier, pull with force outward, tap on the planet carrier with force at the same time, to shake and loosen the planet carrier, and after the planet carrier becomes loose, remove the planet carrier, but attention should be also paid to the assembly that is heavy, not causing hurt or injury.

The installation of the planet carrier assembly is opposite to the process above in order, but attention must be paid to the tightening torque of hexagon socket countersunk head screw.

##### 2. Disassembling method of hub assembly

- (1) Take the retaining ring for shaft (No. 39) out of the axle shaft assembly with reversible circlip pliers.
- (2) Take down the stub shaft outer baffle ring (No. 38).
- (3) Use a wrench to take down the hexagon nut (No. 37).
- (4) Take down the internal shield ring of external half shaft (No. 36).
- (5) Take out the ring gear assembly (Gear ring baffle ring (No. 33), support for tooth ring (No.34) and gear ring (No. 35) with pull code.
- (6) Turn the wheel hub assembly slightly, and make an effort to pull outward, while tapping on hub to shake and loosen the outer bearing inner ring. After the outer bearing inner ring is loose, remove the wheel hub assembly, but attention should be also paid to the hub assembly that is heavy, the not causing hurt or injury, and keep careful not to break the outer bearing inner ring at the same time.

The installation of the hub assembly is opposite to the process above in order, but attention must be paid to the tightening torque and bearing pre-tightening force of hexagon nut (No. 37).

##### 3. Disassembling method of steering knuckle assembly

- (1) Use a wrench to take down the hexagon bolt (No. 22).
- (2) Take down the baffle (No. 21).
- (3) Take out the connecting rod pin (No. 20).
- (4) Take down the connecting rod (No. 24).
- (5) Use a wrench to take down the Hexagon flange bolt (No. 26 and No. 43).

(6) Take out the left steering knuckle arm (No. 25), right steering knuckle arm (No. 75) and lower backing pin (No. 42).

(7) Hold the axle shaft assembly (No. 51), pull the left steering knuckle (No. 30) and right steering knuckle (No. 74) outward with force, but attention should be also paid to the axle shaft assembly not taken out, and the steering knuckle assembly is heavy, not causing hurt or injury.

The installation of the left and right steering knuckle assembly is opposite to the process above in order. But attention should be also paid to the outer axle shaft that does not damage the oil seal port in the left and right steering knuckle, and to the tightening torque of hexagon flange bolt (No. 26 and No. 43) and hexagon bolt (No. 22).

#### 4. Disassembling method of steering cylinder assembly

(1) Use a wrench to take down the hexagonal head bolt (No. 5).

(2) Pull the steering cylinder assembly (No. 18) outward with force, but attention should be also paid to the steering cylinder assembly that is heavy, not causing hurt or injury.

The installation of the steering cylinder assembly is opposite to the process above in order, but attention must be paid to the tightening torque of hexagon socket head cap screw (No. 19).

#### 5. Disassembling method of rear main reduction box assembly

(1) Pull the axle shaft assembly (No. 51) outward with force, but attention should be also paid to the inner axle shaft that does not damage the oil seal port in the axle housing, and attention should be also paid to the axle shaft assembly that is heavy, not causing hurt or injury.

(2) Use a wrench to take down the Hexagonal head bolt (No. 5).

(3) Use two hexagonal head bolts (No. 5) to jack up the rear main reduction box assembly (No.8).

(4) Pull the rear main reduction box assembly (No. 8) outward with force, but attention should be also paid to the rear main reduction box assembly that is heavy, not causing hurt or injury.

The installation of the rear main reduction box assembly is opposite to the process above in order, but attention must be paid to the tightening torque of hexagonal head bolt (No. 5), and screw the positioning pin (No. 7).

### (II) Adjustment of the axle

#### 1. Gap adjustment of rear axle body and steering knuckle

(1) Install the axle shaft assembly into the axle body at first.

(2) Cover the left and right steering knuckle (No. 30 and No. 75) onto the axle shaft assembly and rear axle body (No. 11).

(3) Press the inner ring of angular-contact articulated bearing (No. 41-1) into the lower backing pin (No. 42).

(4) cover the dust trap into the lower backing pin, coat the ball surface on the articulated bearing inner ring (convex) with a thin layer of lubricating grease, align bolt holes and mount the backing pin and rear axle body into the steering knuckle, and tighten the hex flange bolt (No. 43).

(5) Select the appropriate adjustment sheet (No. 29) to set into the left and right steering knuckle arm to adjust the clearance, and thus to guarantee clearance within 0.1.

(6) Coat the outside surface of left and right steering knuckle arm with a thin layer of lubricating grease, align and install the left and right steering knuckle arm bolt holes into the steering knuckle and rear axle body, and tighten the hex flang bolt (No.26).

(7) Measure the starting force of steering knuckle along the tangential direction of steering knuckle stud, and left and right measurement should be measured separately and the starting force should be less than 30N, as shown in Figure 1

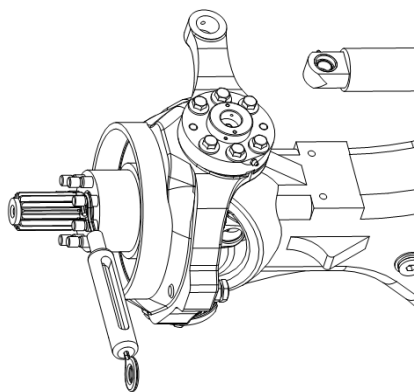


Figure 1

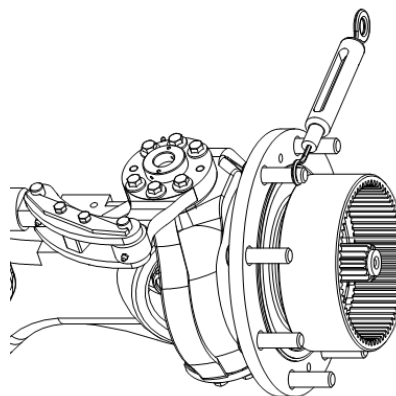


Figure 2

## 2. Adjustment of the pre - tightening force of rear axle hub bearing

- (1) Install the rear axle hub assembly into steering knuckle.
- (2) Turn the hub for 2-3 laps, and make the bearing in place correctly
- (3) Install the ring gear assembly into the steering knuckle.
- (4) Mount the internal shield ring of external half shaft (No. 36) into the steering knuckle.
- (5) Coat the double end stud (No. 31) with screw fastening adhesive, and then tighten the hex nut with 100N. m torque (No. 37).
- (6) Turn the hub for 2-3 laps, and measure the starting force of the hub along the tangential direction of the hub bolt; the starting force of the hub should be 20 to 55 N as shown in Figure 2

## 3. Adjustment of steering angle

- (1) Adjust the stop bolt of the steering angle (No. 45) to make the largest angle of inner wheel 61.59 °.
- (2) After the stop bolt is adjusted, tighten the lock nut (No. 44).
- (3)When the maximum rotation angle fo the inner wheels exceeds 30 degrees, the 4 WHEEL DRIVE is not recommended.

## 3.1.6 Common faults and elimination in use

| Fault form                                                                                                                | Reason analysis                                                                  | Elimination method                                |
|---------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------|
| The hub bearing feels sluggish                                                                                            | 1. The bearing lacks of lubrication or the use of lubricating oil is not correct | Add gear oil or replace gear oil                  |
|                                                                                                                           | 2. The bearing is dirtied by dust                                                | Clean or enhance lubrication                      |
| The steering operation is heavy and shimmy<br>The rear drive axle may fail and the problem of shimmy steering is excluded | 1. The clearance between the steering knuckle arm and bushing is too large       | Inspect and replace parts to adjust the clearance |
|                                                                                                                           | 2. The articulated bearing on the lower backing pin is worn or damaged           | Check and replace                                 |
|                                                                                                                           | 3. The connecting rod pin is worn or damaged                                     | Replace                                           |
|                                                                                                                           | 4. The articulated bearing on the connecting rod pin is worn or damaged.         | Replace                                           |
|                                                                                                                           | 5. Rear steering drive axle parts lack of lubrication                            | Add lubricating grease                            |
|                                                                                                                           | 6. Tire pressure is too low                                                      | Add to the specified pressure                     |
|                                                                                                                           | 7. The tyre is worn too much                                                     | Replace the tires                                 |
|                                                                                                                           | 8. The hub bearing is worn                                                       | Replace the bearing                               |
|                                                                                                                           | 9. Steering cylinder leaks oil                                                   | Replace the steering cylinder                     |
|                                                                                                                           | 10. The steering cylinder oil pressure is too low                                | Regulate the hydraulic pressure                   |
|                                                                                                                           | 11. The ring gear assembly pressure stud is loose                                | Tighten the stud                                  |
|                                                                                                                           | 12. The ring gear assembly gland nut is loose                                    | Tighten the gland nut                             |

## 3.1.7 List of wearing parts

| No. | Code         | Description                                          | Qty | Remark   |
|-----|--------------|------------------------------------------------------|-----|----------|
| 1   | H24C4-32061  | Articulated bearing                                  | 4   | (No. 28) |
| 2   | CFW          | SIMRIT combination oil seal 155×190×17.5/19          | 2   | (No. 32) |
| 3   | SQH35000004  | Dust Ring                                            | 4   | (No. 40) |
| 4   | GAC35S       | Angular-contact articulated bearing 35×62×18         | 2   | (No. 41) |
| 5   | CFW          | SIMRIT combination oil seal 45×60×16                 | 4   | (No. 46) |
| 6   | SQH35020003B | sliding bearing 45×50×40                             | 2   | (No. 47) |
| 7   | SQH35000017  | Bushing 35×52×16.5                                   | 2   | (No. 49) |
| 8   | SQH35000008  | Sliding bearing 45×50×30                             | 2   | (No. 50) |
| 9   | TIMKEN       | Tapered roller bearing JL819349/JL819310 (95×135×20) | 4   | (No. 70) |

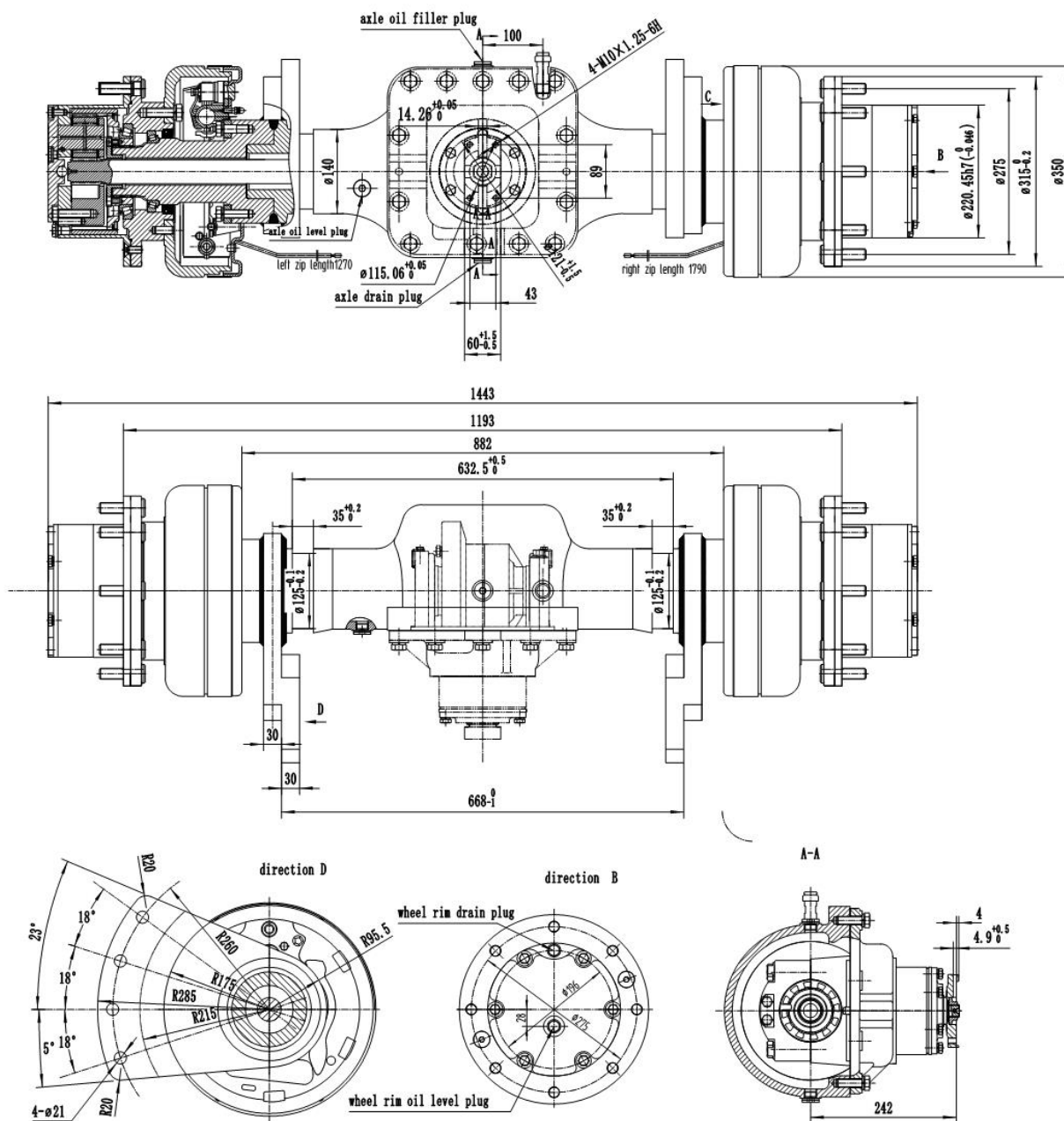
### 3.2 Direction for use of SQQ35000000B front drive axle

#### 3.2.1 Main technical parameters

|                                     |                                                                     |
|-------------------------------------|---------------------------------------------------------------------|
| Max. input torque (N.m)             | ≤1200                                                               |
| Drive ratio                         | Total drive ratio 18.6, hub reduction ratio 6, main drive ratio 3.1 |
| Front axle propeller shaft          | Middle drive shaft                                                  |
| Input end parameters                | (concave seam allowance)4×Ø115×(pitch row 89×43×4×M10×1.25)         |
| Hub and spoke plate connecting bolt | 8-M18×1.5-6g (seam allowance Ø220.5× pitch circle Ø275mm)           |
| Spoke spacing (mm)                  | 1193                                                                |
| Brake specification                 | Φ313×76                                                             |
| Maximum braking moment              | 2× 7046N.m                                                          |
| Mast installation size              | Φ125×35×632.5                                                       |
| Frame installation size             | 4×Φ21×(3X18°) ×R260×668                                             |
| Rated load (kg)                     | 7500                                                                |
| Dead weight (kg)                    | 366                                                                 |

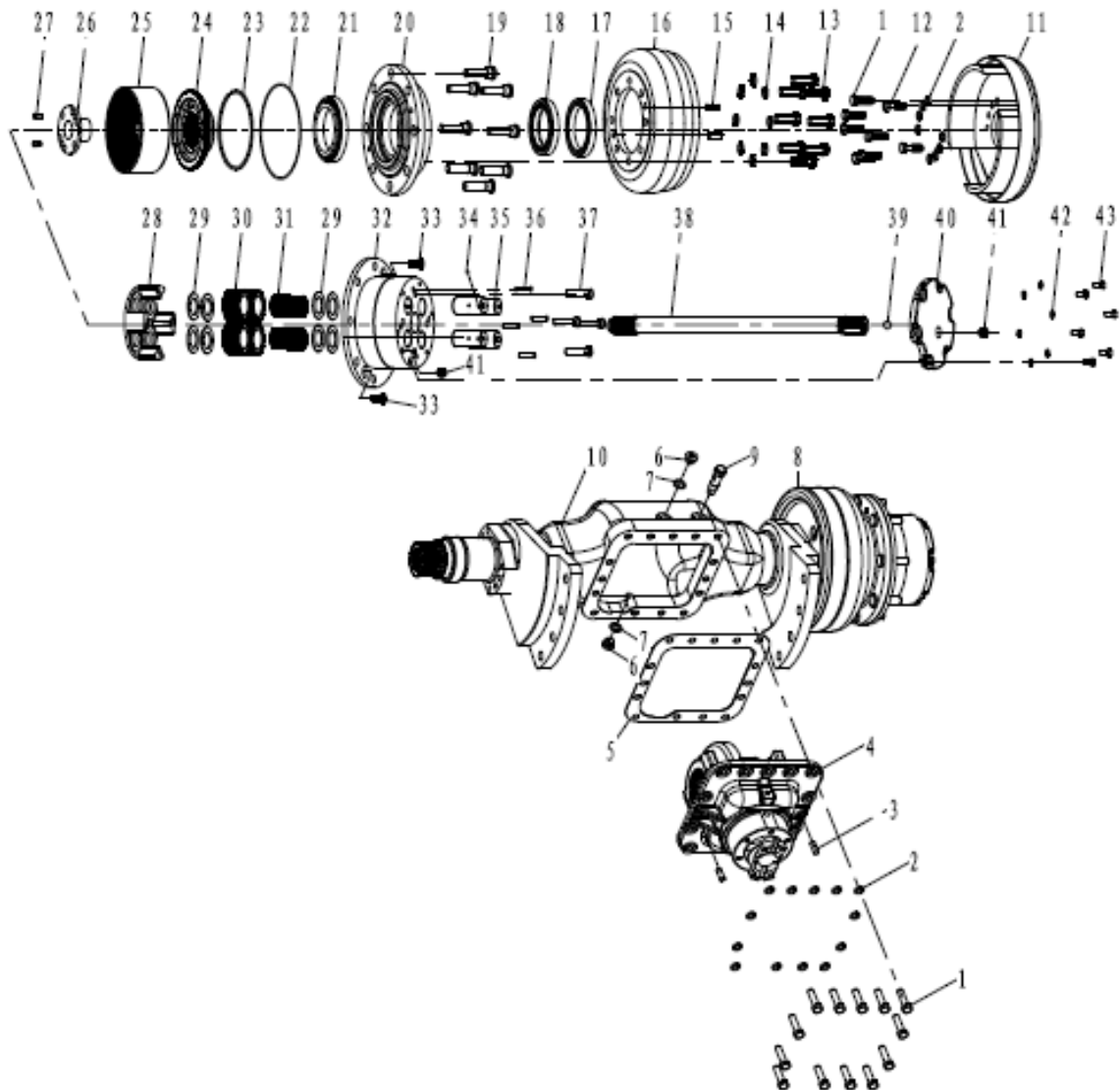
### 3.2.2 Outline drawing, structural form and characteristics

### 3.2.2.1 Outline drawing and sizes



### 3.2.2.2 Structural form and characteristics

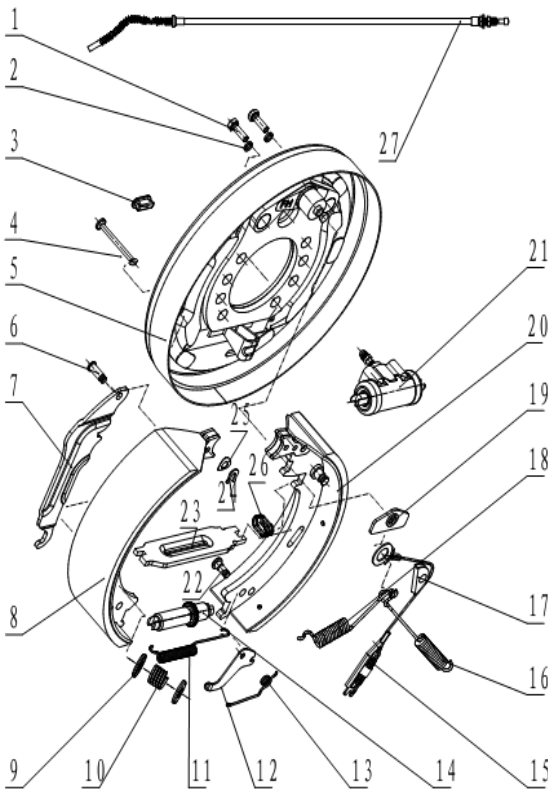
List of SQQ3500000B front drive axle parts



| No. | Code                 | Description               | Qty | Remark    |
|-----|----------------------|---------------------------|-----|-----------|
| 1   | GB/T5786-M14*1.5*45- | Bolt M14*1.5*45           | 29  |           |
| 2   | GB/T93-14            | Washer 14                 | 29  |           |
| 3   | GB/T119.2-12*32      | Pin 12*32                 | 2   |           |
| 4   | 25BY16-03000         | Reduction housing         | 1   | 1.8t、2.5t |
| -   | 35BY16-03000         | Reduction housing         | 1   | 3.5t      |
| 5   | SQQ35000004B         | Washer                    | 1   |           |
| 6   | SQQ35000006B         | Plug M20*1.5              | 2   |           |
| 7   | JB/T982-20           | Combination washer 20     | 2   |           |
| 8   | Q30LD003             | Wheel brake ass'y         | 1   |           |
| 9   | Q30LD100             | Breather plug             | 1   |           |
| 10  | SQQ35030000B         | Axle body                 | 1   |           |
| 11  | Q30LD002             | Wheel brake ass'y (L.H)   | 1   |           |
| 12  | SQQ35000005B         | Bolt M14*1.5*45           | 4   |           |
| 13  | GB/T5786-M16*1.5*50- | Bolt M16*1.5*50           | 16  |           |
| 14  | GB/T93-16            | Washer 16                 | 16  |           |
| 15  | GB/T119.2-12*32      | Pin 12*32                 | 4   |           |
| 16  | SQQ35020002B         | Brake drum                | 2   |           |
| 17  | 110*140*14.5/16      | Oil seal 110*140*14.5/16  | 2   |           |
| 18  | TIMKEN               | Bearing JL819349/JL819310 | 2   |           |
| 19  | SQH35070002          | Bolt                      | 16  |           |
| 20  | SQQ35020001B         | Hub                       | 2   |           |
| 21  | TIMKEN               | Bearing 37431A/37625      | 2   |           |
| 22  | GB/T3452.1-223*2.65  | O-ring 223*2.65           | 2   |           |
| 23  | SQH35050003          | Ring                      | 2   |           |
| 24  | SQH35050001          | Bracket                   | 2   |           |
| 25  | SQH35050002A         | Gear ring                 | 2   |           |
| 26  | SQQ35000007B         | Nut                       | 2   |           |
| 27  | GB/T70.1-M8*12-8.8J  | Screw M8*12               | 4   |           |
| 28  | SQQ35040002          | Bracket                   | 2   |           |
| 29  | SQH35040006          | Snap ring                 | 16  |           |
| 30  | SQH35040002A         | Planet gear               | 8   |           |
| 31  | GB/T309-5*39.8       | Needle 5*39.8             | 224 |           |
| 32  | SQQ35040001A         | Planet gear breaket       | 2   |           |
| 33  | SQH350000025         | Screw M12*30              | 4   |           |
| 34  | GB/T308-15/64        | Steel ball 15/64          | 8   |           |
| 35  | SQH35040005          | Gear shaft                | 8   |           |
| 36  | GB/T119.2-10(M6)*40  | Pin M10(m6)*40            | 8   |           |
| 37  | GB/T5786-2000-M14*1. | Bolt M14*1.5*55           | 8   |           |
| 38  | SQQ35000003B         | Half axle                 | 2   |           |
| 39  | GB/T308-11/16        | Steel ball 11/16          | 2   |           |
| 40  | SQQ35000002B         | Bottom cap                | 2   |           |
| 41  | Q30LD006             | Plug R2-1/2               | 4   |           |
| 42  | GB/T93-10            | Washer 10                 | 12  |           |
| 43  | GB/T5783-M10*20-8.8J | Bolt M10*20               | 12  |           |

## 3.2.2.3 Structural form and characteristics of Q30LD002 Left brake assembly

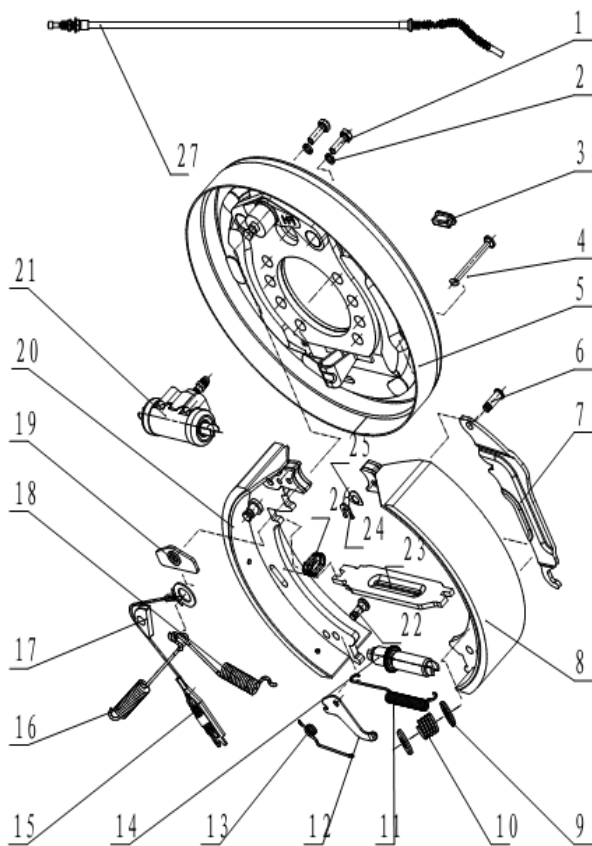
List of Q30LD002 left brake assembly parts



| No. | Code           | Description                                            | Qty |
|-----|----------------|--------------------------------------------------------|-----|
| 1   | GB/T5782-2000  | Bolt M8×1.25×25-6g                                     | 2   |
| 2   | GB/T93-1987    | Spring washer                                          | 2   |
| 3   | 24433-70040G   | Glue                                                   | 1   |
| 4   | 24433-70010G   | Compression spring rod                                 | 2   |
| 5   | 24433-72000G-L | Left brake baseplate assembly                          | 1   |
| 6   | 24433-70150G   | Dowel                                                  | 1   |
| 7   | 24433-70140G-L | Left hand brake lever                                  | 1   |
| 8   | 24433-75000G   | Brake shoe friction plate assembly                     | 1   |
| 9   | 24433-70020G   | Compression spring seat                                | 4   |
| 10  | 24433-70030G   | Compression spring                                     | 2   |
| 11  | 24433-70050G   | Tension spring                                         | 1   |
| 12  | 24433-70100G-L | Left pawl                                              | 1   |
| 13  | 24433-70090G-L | Left torsional spring                                  | 1   |
| 14  | 24433-74000G-L | Left clearance adjuster assembly                       | 1   |
| 15  | 24433-73000G   | Spring anchoring device                                | 1   |
| 16  | 24433-70071G-L | Left return spring (Rear)                              | 1   |
| 17  | 24433-70081G   | Guide block                                            | 1   |
| 18  | 24433-70070G-L | Left return spring (front)                             | 1   |
| 19  | 24433-70060G   | Guide plate                                            | 1   |
| 20  | 24433-71001G-L | Left brake shoe friction plate and spring pin assembly | 1   |
| 21  | 24433-76000G   | Brake cylinder assembly                                | 1   |
| 22  | 24433-70110G   | Dowel                                                  | 1   |
| 23  | 24433-70120G-L | Left hand brake push rod                               | 1   |
| 24  | 24433-70170G   | Lever pin retainer ring                                | 1   |
| 25  | 24433-70160G   | Resilient pad                                          | 1   |
| 26  | 24433-70130G   | Spring                                                 | 1   |
| 27  | OC11246-14603  | Brake cable assembly (left)                            | 1   |

## 3.2.2.4 Q30LD003Right brake assemblyStructural form and characteristics

List of Q30LD003Right brake assembly parts



| No. | Code           | Description                                             | Qty |
|-----|----------------|---------------------------------------------------------|-----|
| 1   | GB/T5782-2000  | Bolt M8×1.25×25-6g                                      | 2   |
| 2   | GB/T93-1987    | Spring washer                                           | 2   |
| 3   | 24433-70040G   | Glue                                                    | 1   |
| 4   | 24433-70010G   | Compression spring rod                                  | 2   |
| 5   | 24433-72000G-R | Right brake baseplate assembly                          | 1   |
| 6   | 24433-70150G   | Dowel                                                   | 1   |
| 7   | 24433-70140G-R | Right hand brake lever                                  | 1   |
| 8   | 24433-75000G   | Brake shoe friction plate assembly                      | 1   |
| 9   | 24433-70020G   | Compression spring seat                                 | 4   |
| 10  | 24433-70030G   | Compression spring                                      | 2   |
| 11  | 24433-70050G   | Tension spring                                          | 1   |
| 12  | 24433-70100G-R | Right pawl                                              | 1   |
| 13  | 24433-70090G-R | Right torsional spring                                  | 1   |
| 14  | 24433-74000G-R | Right clearance adjuster assembly                       | 1   |
| 15  | 24433-73000G   | Spring anchoring device                                 | 1   |
| 16  | 24433-70071G-R | Right return spring (rear)                              | 1   |
| 17  | 24433-70081G   | Guide block                                             | 1   |
| 18  | 24433-70070G-R | Right return spring (front)                             | 1   |
| 19  | 24433-70060G   | Guide plate                                             | 1   |
| 20  | 24433-71001G-R | Right brake shoe friction plate and spring pin assembly | 1   |
| 21  | 24433-76000G   | Brake cylinder assembly                                 | 1   |
| 22  | 24433-70110G   | Dowel                                                   | 1   |
| 23  | 24433-70120G-R | Right hand brake push rod                               | 1   |
| 24  | 24433-70170G   | Rod pin retainer ring                                   | 1   |
| 25  | 24433-70160G   | Resilient pad                                           | 1   |
| 26  | 24433-70130G   | Spring                                                  | 1   |
| 27  | OC11246-24603  | Brake cable assembly (right)                            | 1   |

### 3.2.3 Use, maintenance and repair

#### (I) Prior to use of new axle

Before a new axle is used, sulfur phosphorus 90 heavy load gear oil (GL - 5) is added from the bridge packet oil filling port to the main reducer until there is oil overflowing from the bridge packet oil hole (about 8L); the oil filling and drain hole of the hub reducer is transferred to the vertical position, in the face of the hub reducer end cover, the oil filling and drain hole of the hub reducer is set in the top, and sulfur phosphorus 90 heavy load gear oil (GL - 5) is filled from the oil filling and drain hole until there is oil overflowing from the hub side (the oil amount of single hub reducer is about 0.85 L).

(II) After the new axle is mounted, the vehicle runs in for 1500 km, and there is a need to check the pre-tightening torque of each part fastener, and re-adjust the brake clearance.

#### (III) Axle maintenance

1. Often clear the dirt and dust on the ventilation plug in the rear axle housing.

2. Regularly check the oil filling port plug screw and oil drain plug screw, and if oil leakage is found, they should be tightened in time, or the end face sealing gasket is changed.

3. Every running for 2000km, inject 2# lithium base lubricating grease to each grease nipple, and clean the ventilation plug; check the oil surface height of the axle housing, and hub gear (open the oil level plug screw for inspection).

4. Every running for 8000-10000km, check the fasteners; check the clearance of hub bearing; check the quality of gear oil inside the axle housing, and in case of discoloration, thinning and metamorphism, new oil should be replaced in a timely manner. The mileage for the first oil change is 2000 km, and there is a need to change the gear oil once per 24000 km.

### 3.2.4 Major maintenance standards of main parts

#### 1. Tightening torque of main bolts and nuts (N·m)

|                                                            |         |
|------------------------------------------------------------|---------|
| Fastening bolt of front main reduction box assembly (No.1) | 180-220 |
| Fastening bolt of front and right brake (No.12 and No.13)  | 200-240 |
| Round nut retaining screw (No.28)                          | 20-25   |
| Main reducer oil inlet and outlet plug screw (No.6)        | 40-50   |
| End cover fastening bolt (No.45)                           | 45-55   |
| Hub oil inlet and outlet plug screw (No.43)                | 25-30   |
| Planet carriersupport fastening bolt (No.38)               | 180-220 |
| Planet carrierconnecting bolt (No.34)                      | 80-90   |

#### 2. Major maintenance standard

| Item                        | Maintenance standard | Remark                                             |
|-----------------------------|----------------------|----------------------------------------------------|
| Starting force of front hub | 30-55N               | Measure along the tangential direction of hub bolt |

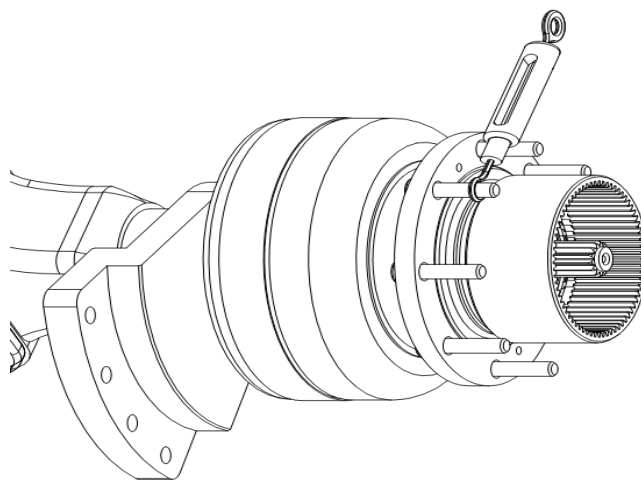


Figure 1

### 3.2.5 Assembly and adjustment

#### (I) Dismantling of assembly

##### 1. Dismantling of planet carrier assembly

- (1) At first, release the gear oil in the wheel side.
- (2) Use an internal hexagonal wrench to dismantle the hexagon socket countersunk head screw (No. 34).
- (3) Slightly turn the planet carrier, pull with force outward, tap on the planet carrier with force at the same time, to shake and loosen the planet carrier, and after the planet carrier becomes loose, remove the planet carrier, but attention should be also paid to the assembly that is heavy, not causing hurt or injury.

The installation of the planet carrier assembly is opposite to the process above in order, but attention must be paid to the tightening torque of the hexagon socket countersunk head screw.

##### 2. Disassembling method of front axle wheel drum brake assembly

- (1) Pull out the half shaft (No. 39) gently.
- (2) Use the internal hexagonal wrench to remove the hexagon socket head cap screw (No. 28).
- (3) Use a special wrench to take down the round nut (No. 27).
- (4) Pull the ring gear assembly (gear ring baffle ring (No. 24), support for tooth ring (No. 25), and ring gear (No. 26) outward with force, take down the ring gear assembly, and knock the ring gear assembly gently.
- (5) Rotate the hub drum brake assembly slightly, and make an effort to pull out, while tapping on the drum brake; after the hub drum brake assembly is loose, take down the hub drum brake, but attention should be also paid to the assembly that is heavy, not causing hurt or injury. At the same time, pay attention to the outer bearing inner ring not to be damaged.

The installation of the rear hub drum brake assembly is opposite to the process above in order, but attention must be paid to the tightening torque of round nut (No. 27) and the adjustment of bearing pre-tightening force.

### 3. Disassembling method of brake assembly

(1) Use a wrench to take down the Positioning bolt (No. 12) and hex bolt (No. 13).

(2) Pull the left brake assembly (No. 11) and right brake assembly (No. 8) with force outward.

The installation of the left and right brake assembly is opposite to the process above in order, but attention must be paid to the tightening torque of bolts, the gap adjustment of friction plate and the left and right sides of brake assembly, and the hand brake cable of the left brake assembly is shorter than that of the right brake assembly.

### 4. Disassembling method of front main reduction box assembly

(1) Use a wrench to take down the hexagonal head bolt (No. 1).

(2) Use two hexagonal head bolts (No. 5) to jack up the front main reduction box assembly (No. 4).

(3) Pull the front main reduction box assembly (No. 5) with force outward, but attention should be also paid to the front main reduction box assembly the assembly that is heavy, not causing hurt or injury.

The installation of the front main reduction box assembly is opposite to the process above in order, but attention must be paid to the tightening torque of hexagonal head bolt (No. 1), and screw the positioning pin (No. 3).

### (II) Adjustment of the axle

#### 1. Adjustment of brake clearance

In case that the gap between the brake block and drum brake is too big or too small, it will affect the braking performance of the vehicle, so the gap of brake ratchet wheel is adjusted to 0.25-0.4mm with a screwdriver.

#### 2. Adjustment of the hub bearing pre-tightening force

Use an internal hexagonal wrench to take down the hexagon socket head cap screw (No. 28) at first, adjust the clearance between the brake block and drum brake to a maximum, fasten the round nut (No. 27) with a special spanner, and the tightening torque shall be not less than 200 nm. Then, rotate the drum brake for 2-3 laps, make the bearing in place rightly, and fasten it with no less than 200Nm of torque. Next reverse the round nut for 1/4-1/6 laps, turn the drum brake for 2-3 laps, measure the starting force along the tangent direction of hub bolt with spring balance, and the value shall be the 30 to 55N, as shown in figure 1. Finally, twist on the hexagon socket head cap screw (No.28).

## 3.2.6 Common faults and elimination in use

| Fault form                                    | Reason analysis                                                                         | Elimination method                                                                   |
|-----------------------------------------------|-----------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| Main drive<br>With<br>abnormal<br>noise       | 1. The differential gear clearance is improper                                          | Replace the gasket or gear                                                           |
|                                               | 2. The gap between the driving gear and driven gear is too large                        | Replace the gasket or gear                                                           |
|                                               | 3. The pre - tightening force of the driving gear bearing is too small                  | Adjust the pre-tightening force                                                      |
|                                               | 4. The axle shaft gear, planet gear, universal be pin thrust washer are worn or damaged | Correct or replace the faulty parts                                                  |
|                                               | 5. Too low oil level                                                                    | Add lubricating oil fully                                                            |
| Lubricating<br>oil leakage                    | 1. The oil seal is worn and loose or damaged                                            | Replace oil seal                                                                     |
|                                               | 2. The reducer fastening bolt is loose or the sealant is damaged                        | In accordance with the provided torque screw down the bolt and re-paint sealant      |
|                                               | 3. Bearing block fastening bolt is loose                                                | In accordance with the provided torque screw down the bolt                           |
|                                               | 4. Oil outlet plug screw is loose or the liner is damaged                               | In accordance with the provided torque, tighten the plug screw, or replace the liner |
|                                               | 5. The axle housing is deformed due to overload                                         | Correct or replace the axle housing                                                  |
|                                               | 6. Ventilation plug is stuck or damaged                                                 | Clean or replace the ventilation plug                                                |
| Stagnant hub<br>bearing                       | 1. The pre - tightening force of hub bearing is too large                               | Adjust the pre-tightening force                                                      |
|                                               | 2. The bearing lacks of lubrication or the use of lubricating grease is not correct     | Strengthen the lubrication or replace lubricating grease                             |
|                                               | 3. The bearing is dirtied by dust                                                       | Clean or enhance lubrication                                                         |
| Braking<br>force of<br>brake is not<br>enough | 1. The brake pump is damaged                                                            | Replace the brake pump                                                               |
|                                               | 2. Braking pressure is not enough                                                       | Check the pipeline and brake master cylinder                                         |
|                                               | 3. The braking friction plate overheats or deteriorates                                 | Replace the friction plate                                                           |
|                                               | 4. The clearance between brake friction plate and drum brake is too large               | Check and adjust the clearance between friction plate and drum brake                 |
|                                               | 5. The braking friction plate joint is improper                                         | Correct the friction plate joint position or bond                                    |
|                                               | 6. The friction plate or drum brake has lubricating oil                                 | Clean oil stains and replace friction plate                                          |
|                                               | 7. Water flows into the drum brake                                                      | Step gently on the pedal in the driving process, to drain water out                  |
|                                               | 8. Brake connecting bolt is loose or damaged                                            | Tighten the brake connecting bolt or replace connecting bolt                         |

## 3.2.7 List of wearing parts

| No. | Code   | Description                              | Qty | Remark   |
|-----|--------|------------------------------------------|-----|----------|
| 1   | SIMRIT | CFW combination oil seal 110X140X14.5/16 | 2   | (No. 18) |
| 2   | TIMKEN | Tapered roller bearing JL819349/JL819310 | 2   | (No. 19) |
| 3   | TIMKEN | Tapered roller bearing 37431A/37625      | 1   | (No. 22) |

#### 4. Steering System

| Type of Steering System            |                                  | Rear Wheel Steering with Power Steering |            |
|------------------------------------|----------------------------------|-----------------------------------------|------------|
| Power Steering                     |                                  |                                         |            |
| Forklift Truck Tonnage             |                                  | 1.8t                                    | 2.5t, 3.5t |
| Cycloid Full Hydraulic Orbitrol    |                                  | BZZ7-100                                | BZZ7-125   |
| Steering<br>Cylinder               | Cylinder Diameter      mm        | Φ75                                     |            |
|                                    | Diameter of Piston Rod   mm      | Φ50                                     |            |
|                                    | Stroke                        mm | 111 (total travel)                      |            |
| Diameter of Steering Wheel      mm |                                  | Φ360                                    |            |

##### 4.1 Overview

Steering system is mainly composed of fully hydraulic steering gear and steering cylinder.

##### (1) Fully Hydraulic Steering Gear Assembly (Fig 4-1)

It mainly includes cycloid fully hydraulic gear, (Refer to Fig 4-2), steering column and steering wheel. The steering column and the steering wheel are able to rotate both forwards and backwards by  $5^{\circ}$ - $15^{\circ}$ , in order to adapt to driver's needs.

Fully hydraulic steering gear is able to transmit the pressure oil from bypass valve to steering cylinder through pipeline according to the size measurement for the rotation of steering wheel. When engine is turned off, oil pump cannot feed oil, steering can be achieved manually.

##### (2) Steering Cylinder (Fig 4-3)

Steering cylinder is in dual-action through type. The two ends of piston rod are connected with steering knuckle through link. Pressure oil from fully hydraulic orbitrol enables the piston rod to move leftward or rightward through steering cylinder, thus to achieve leftward or rightward steering.

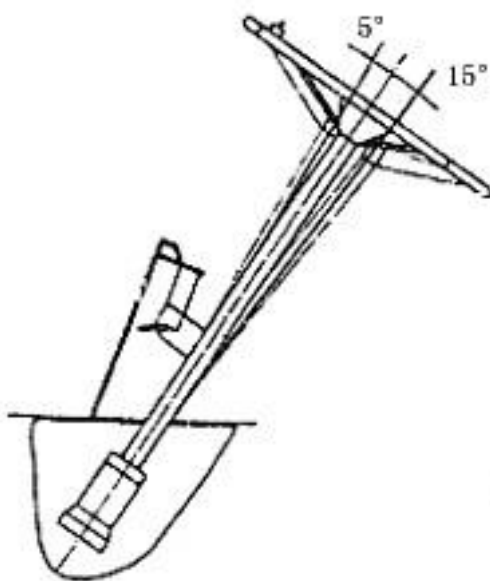


Fig 4-1 Orbitrol

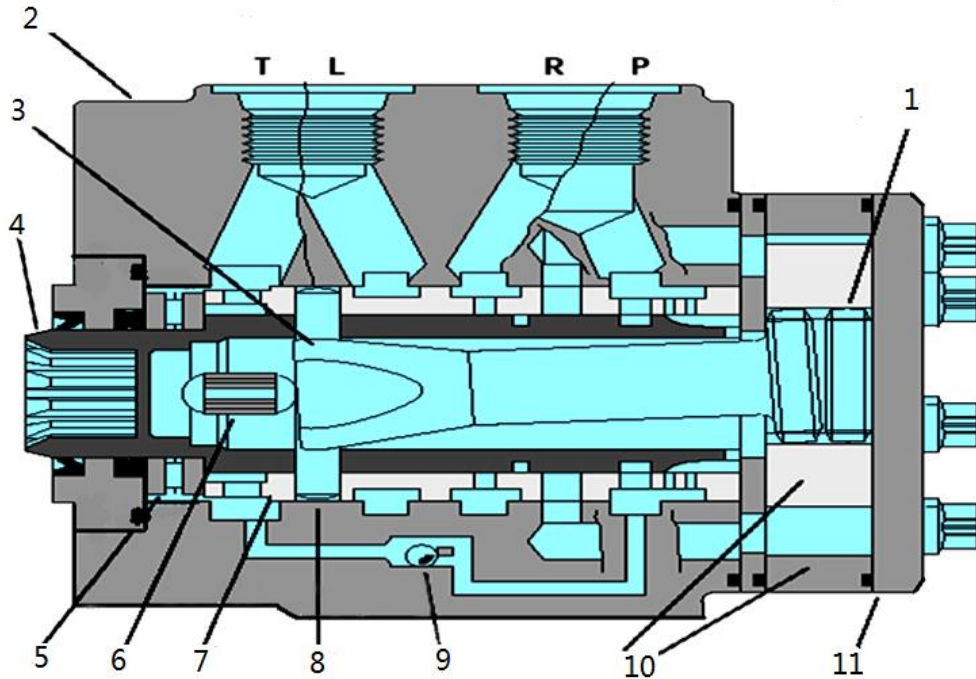


Figure 4-2 Cycloid Fully Hydraulic Steering Gear

- |                            |                     |                  |
|----------------------------|---------------------|------------------|
| 1. Positioning Plate       | 5. Bearing          | 9. One-way Valve |
| 2. Valve Body              | 6. Returning Spring | 10. Stator       |
| 3. Universal Driving Shaft | 7. Valve Sleeve     | 11. Rear Cap     |
| 4. Valve Core              | 8. Pin              |                  |

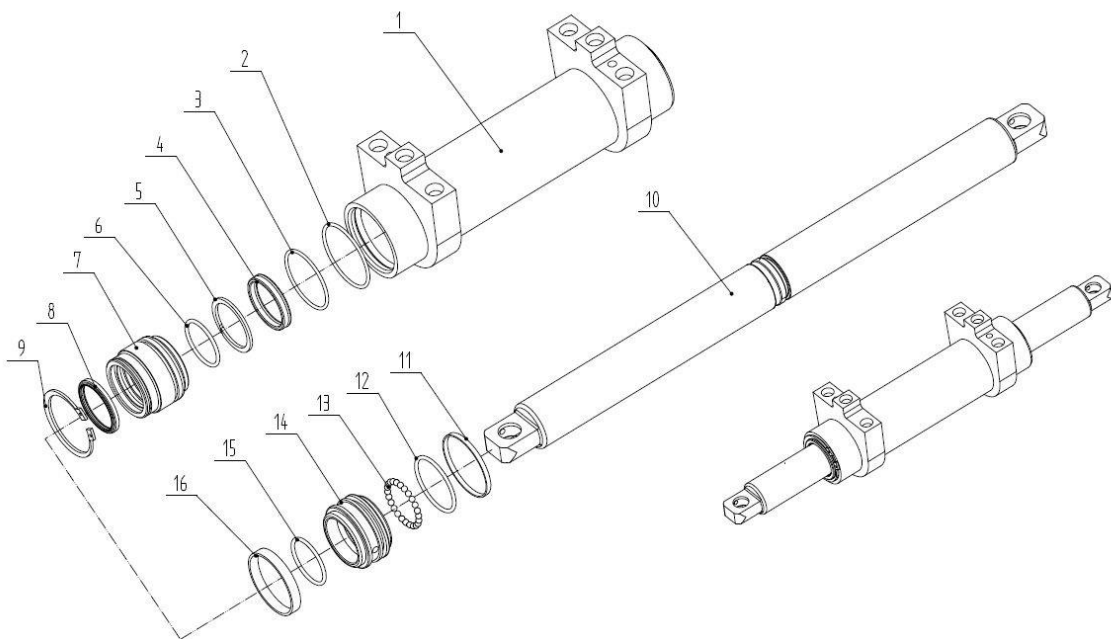


Fig 4-3 Steering Cylinder

- |                     |                           |                    |
|---------------------|---------------------------|--------------------|
| 1. Cylinder Assy    | 6.O-Seal Ring             | 11.Supporting Ring |
| 2.Orifice Snap Ring | 7.Horizontal Cylinder Cap | 12. O-Seal Ring    |
| 3.O-Ring            | 8.Dustproof Ring          | 13. Steel Ball     |
| 4.Axis Seal Ring    | 9. Snap ring              | 14. Piston         |
| 5. Baffle           | 10.Piston Rod             | 15. O-Seal Ring    |
| 16. Suporting Ring  |                           |                    |

#### 4.2 Examination after Reassembly of Steering System

(1) Turn the steering wheel leftward and rightward thoroughly to see whether or not left and right force applications are uniform, and whether or not rotation is steady.

(2) Examine whether or not oil pressure pipeline is correctly arranged, and whether or not the left and right steering are reversely assembled.

(3) Jack up the rear wheels, and slowly turn the steering wheel leftward and rightward. Repeat it for several times, and remove the air in the hydraulic pipeline and the cylinder.

#### 4.3 Failure Removal for Steering System

| Problem                                     | Analysis Cause of Generation                                                                      | Removal Method                      |
|---------------------------------------------|---------------------------------------------------------------------------------------------------|-------------------------------------|
| Steering Wheel<br>Fixed                     | Oil pump damaged or out of action                                                                 | To be replaced                      |
|                                             | Bypass valve blocked or damaged                                                                   | To be cleaned or replaced           |
|                                             | Rubber hose joint damaged or pipeline blocked                                                     | To be replaced or cleaned           |
| Steering<br>Operation<br>Toilsome           | Bypass valve pressure too low                                                                     | Pressure to be adjusted             |
|                                             | Air present in oil circuit                                                                        | Air to be removed                   |
|                                             | Reset of orbitrol out of operation, and positioning leaf spring broken or elasticity insufficient | Leaf spring to be replaced          |
|                                             | Excessive internal leak of steering cylinder                                                      | Sealing of piston to be examined    |
| Forklift Truck<br>Serpentine or<br>Swinging | Excessive steering flow                                                                           | Flow of bypass valve to be adjusted |
| Abnormal<br>Noise                           | Oil tank level low                                                                                | Oil to be added                     |
|                                             | Suction pipe or oil filter blocked                                                                | To be cleaned or replaced           |
| Oil Leak                                    | Sealing of steering cylinder guide sleeve damaged or pipeline or joint damaged                    | To be replaced                      |

## 5. Brake System

|                                |                                                                |
|--------------------------------|----------------------------------------------------------------|
| Type                           | Front Twin Wheel Brake, Internal Expansion, Hydraulic          |
| Pedal Lever Ratio              | 5.66                                                           |
| Master Cylinder Diameter       | 19.05mm                                                        |
| Wheel Brake                    | ZC35-5L、ZC35-5R                                                |
| Type                           | Dual Servo Type with Parking Brake                             |
| Wheel Cylinder Diameter        | 28.58mm                                                        |
| Size of Brake Shoe (L × W × T) | 348×76×8mm                                                     |
| Area of Brake Shoe             | 264 cm <sup>2</sup> ×4                                         |
| Inner Diameter of Brake Drum   | 314mm                                                          |
| Parking Brake                  | Front Twin Wheel Brake, Internal Expansion, and Hydraulic Type |

### 5.1 Overview

Brake system is in a front double-wheel brake type, and it is composed of brake master cylinder, brake, and brake pedal mechanism.

### 5.2 Brake master cylinder

Brake master cylinder includes one valve seat, one one-way valve, and one return spring, as well as rubber cup, piston, and auxiliary rubber cup. The end part is fixed using thrust washer and stop steel wire, while and external part is protected through rubber dust cap. The master cylinder piston acts through push rod through operating brake pedal. When brake pedal is pushed down, the push rod pushes forward the piston, and the brake fluid in the cylinder body flows back to oil tank through return oil port, until the main rubber cup blocks the return oil hole. After main rubber cup has pushed the return oil port, the brake fluid in front cavity of master cylinder is compressed and opens the one-way valve, thus to flow to the wheel cylinder through bypass pipeline. In this way, the pistons of respective wheel cylinders extend outwards, for the friction plate of brake shoe and the brake drum to get into contact with each other, to achieve the effect of deceleration or brake. At this point, the rear cavity of piston is supplemented with the brake fluid from return oil port and oil inlet port. When brake pedal is loosened, the piston is pressed by return spring, and at the same time the brake fluid in respective brake cylinders are likewise compressed by return spring of brake shoe, for brake fluid to return to the master cylinder (the front cavity of piston) through one-way valve. The piston will return to original place, the brake fluid in master cylinder will flow back to oil tank through return oil port, and the pressure of one-way valve is adjusted to certain proportion to the remaining pressure in brake cylinders, so that the rubber cup of wheel cylinder is correctly placed to prevent oil leak, and to eliminate the effect of choke that may possibly arise during emergency brake.

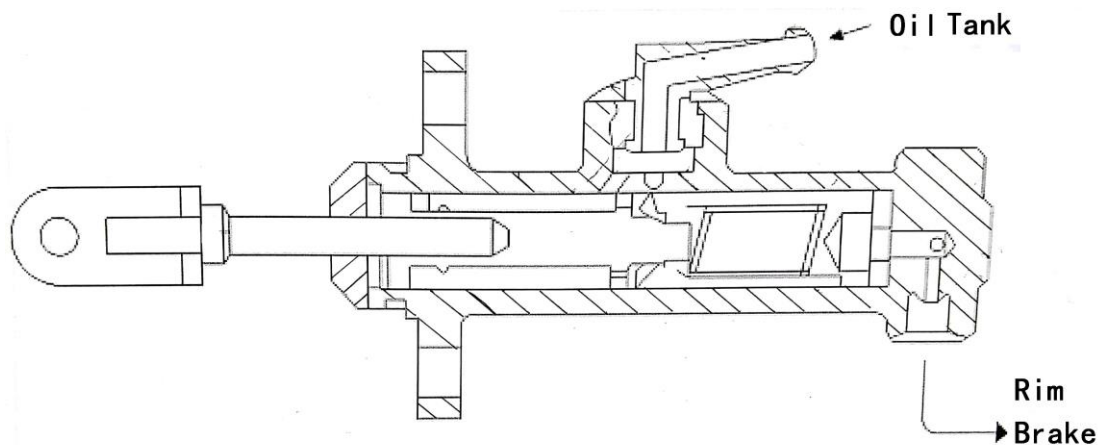


Fig 5-1 Brake Master Cylinder

### 5.3 Wheel Brake

Wheel brake is in an internal expansion and hydraulic type, and it is composed of brake shoe, spring, wheel cylinder, adjuster, and bottom plate. The two brakes are respectively mounted on the two ends of front axle. One end of brake shoe is connected with support pin, while the other end is connected with clearance adjuster, and bears down onto the bottom plate by spring and tension spring pull rod. Lever L H Brake is mounted on primary brake shoe, while adjustment pull rod for automatic clearance adjuster is fitted on secondary brake shoe. Refer to Fig 5-2.

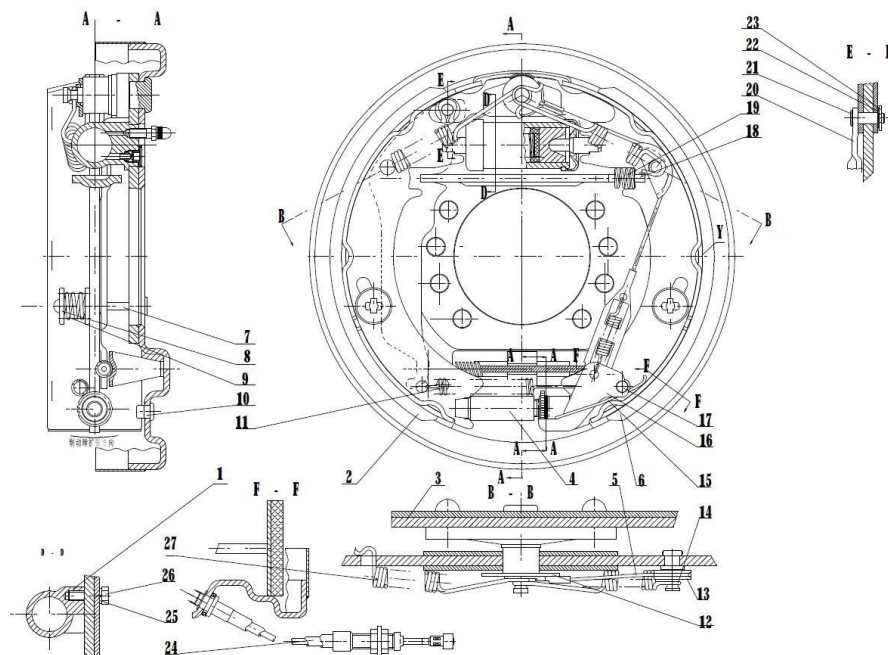


Figure 5-2 Wheel brake

1. Brake cylinder assy   2. Brake shoe and friction plate assy   3. Brake bottom plate assy
4. Clearance adjuster assy   5. Spring cable device   6. Brake shoe and friction plate
7. Spring pull rod   8. Spring seat   9. Tension spring   10. Plug   11. Tension spring
12. Guiding plate   13. Guiding block   14. Return Spring (rear)   15. Twist spring
16. Pawl   17. Pin   18. Left hand brake push rod   19. Spring   20. Hand brake pull rod

21. Pin 22. Spring gasket 23. Lever-pin ring 24. Brake cable assy 25. Washer  
26. Bolt 27. Return Spring

The brake action in forward movement is as follows (as indicated in Fig5-3). Through operating brake wheel cylinder, the primary brake shoe and the secondary brake shoe are effected by two forces of equal size but reverse directions, respectively, for brake shoe and brake drum to get into contact with each other, while the primary brake shoe is pressed onto the adjuster with support of friction force between brake shoe and brake drum, thereby for clearance adjuster to generate a larger force used to operate the wheel cylinder to push the secondary brake shoe, and to force the upper end of secondary brake shoe to bear down on the support pin, thus to get a relatively large brake force. In another connection, the reversing brake action is performed in reverse direction, but the brake force is the same as that during forward movement.

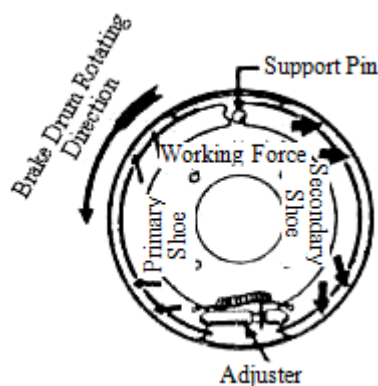


Fig 5-3 Brake Actions during Forward Running Process



Fig 5-4 Brake Actions during Reversing Process

#### 5.4 Automatic Clearance Regulator

The automatic clearance adjuster is able to automatically maintain the clearance between brake shoe and brake drum between 0.25-0.4mm. However this adjuster only acts during reversing brake. During reverse movement, the brake shoe will disengage once the brake pedal is pushed down, thereby, the secondary and the primarily brake shoes will begin to get into contact with brake drum for rotation together, until the upper end of primarily brake shoe begins to get into contact with support pin.

Meanwhile when secondary brake shoe is released from the support ping, the A part of adjusting lever (Refer to Fig 6-5.) is relatively in tension, thus for adjusting lever to rotate around the B part, for C part to lower, and the D part of adjuster to rotate leftward, so as to achieve the objective of automatic adjustment. When brake pedal is further pushed down, the pressure applied to both ends of adjust is larger, which has increased the resistance to thread rotation, for the force of adjusting lever to be unable to actuate rotation of part D.

### 5.5 Parking Brake

Parking brake adopts a hand-pull flexible shaft body; together with the foot brake, it uses an automatic power shoe brake that acts on the front wheels. Only when the forklift truck has parked, the park brake can be used.

Before adjusting the park brake, decide whether the drive axle braking system functions properly. 1) Adjust the nut B, so the length is equal to 68mm, and then tighten the lock nut B. 2) Screw and adjust the nut A to adjust the manual brake's pulling force. The pulling force is 147-196N on the P point in the Q direction of the locking handle. 3) After the manual brake lever is correctly adjusted, release the manual brake lever, to ensure the brake is fully released. 4) Ensure that the manual brake works properly through the above adjustments.

Note: coat appropriate amount of lithium base grease onto the guide rail C and keep regular painting.

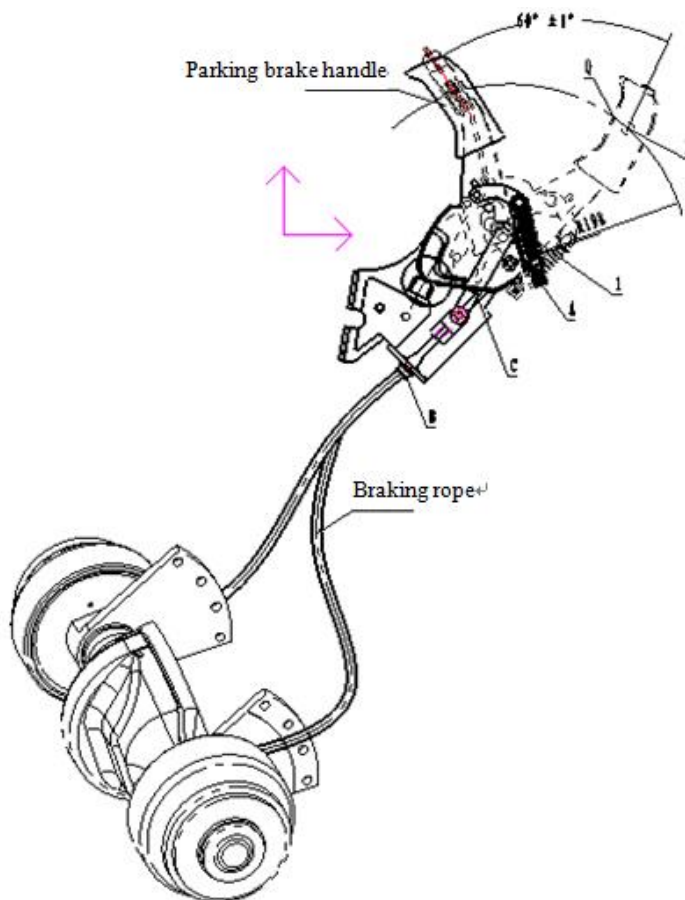


Fig 5-5 Parking Brake Device

## 5.6 Adjustment of Brake Pedal

Adjust the limit bolt, Make the pedal position as shown below, with distance 113mm, from the front floor and the free travel of the pedal 20mm, tight the limit bolt to ensure the normal operation of the foot brake device.

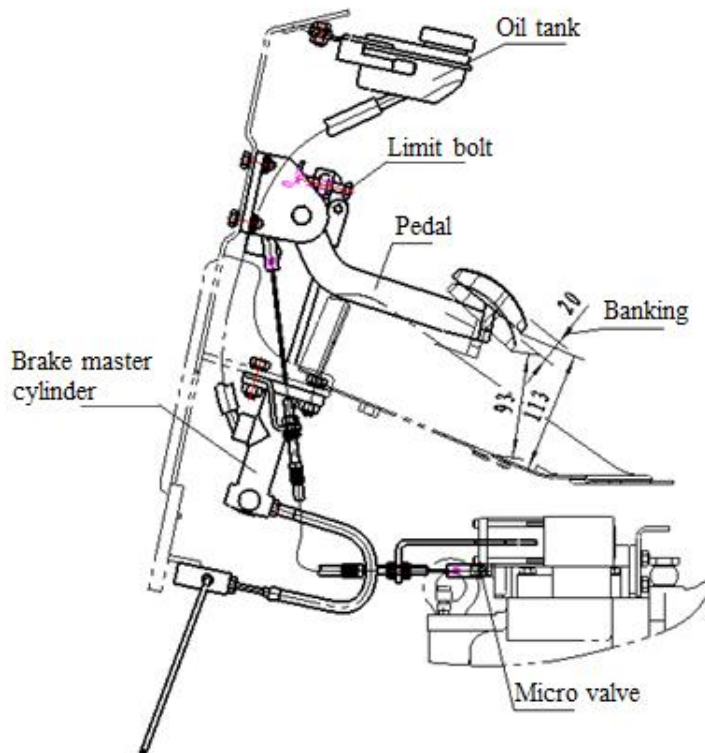


Fig 5-6 Adjustment of Brake Pedal

## 5.7 Maintenance

This section covers brake disassembly, reassembly, and adjustment

### 5.7.1 Disassembly of Wheel Brake

(1) Remove the fixed spring of secondary brake shoe, and take off the adjusting lever, top lever, and the top lever return spring (Fig 5-7).



Figure 5-7

- (2) Remove the return springs for the two brake shoes (Fig 5-8)



Fig 5-8

- (3) Remove the other three fixed springs (Fig 5-9).



Fig 5-9

- (4) Remove the primary brake shoe and the secondary brake shoe, and at the same time remove the spring for adjuster. (Fig 5-10)



Fig 5-10

(5) Demount the brake oil pipe on the wheel Cylinder, then remove the mounting bolts of wheel cylinder, and separate the wheel cylinder from the bottom plate (Fig 5-11).



Fig 5-11

(6) Remove the E-shaped retainer ring that fastens the brake cable onto the bolts on bottom plate, and detach the bottom plate from the axle. (Fig 5-12)

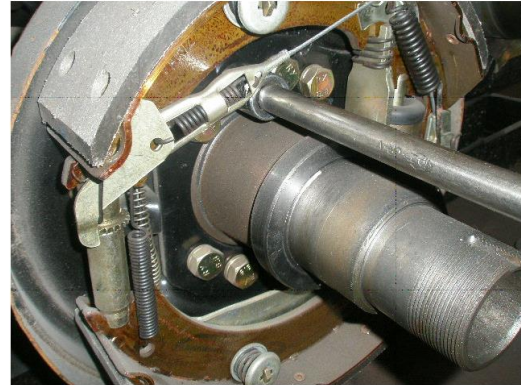


Fig 5-12

(7) Remove the shield for wheel cylinder, and push out all the parts inside the cylinder (Fig 5-13).



Fig 5-13

### 5.7.2 Examination of Wheel Brake

Examine all the parts as to whether or not any of them is worn or damaged, and it shall be repaired or replaced, if incompliant.

(1) Examine whether or not the inner surface of wheel cylinder body and the surface of piston column are rusted, and then measure the clearance between piston and cylinder body.

Specified Value: : 0.065mm-0.150mm;

Maximum Value: 0.15

(2)Visually check whether or not the pump rubber cup is damaged or distorted, and replace it if incompliant.

Outer Diameter of Rubber Cup:  $\Phi 30.1_{-0.2}$

The standard value for interference of rubber cup is 1.52, and the minimum value is 0.42

(3) Examine the free length of wheel cylinder spring, and replace it is improper.

It is specified that the free lengths of wheel cylinder springs for 3t, and 3.5t forklift trucks as well as 2t forklift truck are respectively 58mm and 60mm.

(4) Examine the thickness of brake shoe, and replace it if it is found to be excessively worn out.

Specified Thickness: 8.8mm

Minimum Thickness: 5mm

(5) Examine the status of inner surface of brake drum, and it shall be rehabilitated or replaced, if it is found to be excessively worn out.

Standard Value: 314mm

Maximum Value after Rehabilitation: 316mm

(6) Measure the free length and installation load of return spring for brake shoe (Fig 5-14).

Free Length:L=115.1mm

Installation Length: 122mm

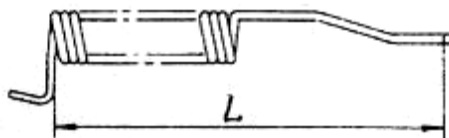


Fig 5-14

Installation Load: 225N

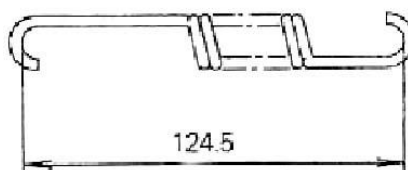


Fig 5-15

(7) Measure the free length and installation load of return spring for top rod (Fig 5-15).

|                        |          |
|------------------------|----------|
| Free Length            | 124.5mm  |
| Installation Length    | 130mm    |
| Installation Load      | 245N     |
| Forklift Truck Tonnage | 1.8-3.5T |

(8) Measure the free length and installation load of adjuster spring (Fig 5-16).

Free Length: 121mm

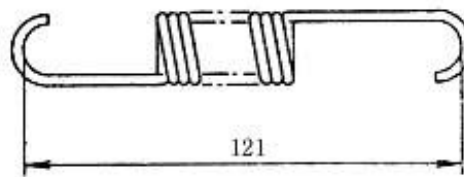


Fig 5-16

Installation Length: 137mm (3t,4t)

Installation Load: 71.5N (3t,4t)

(9) Measure free length and installation load of ratchet spring (Fig 5-17). Installation Load: 14.7N

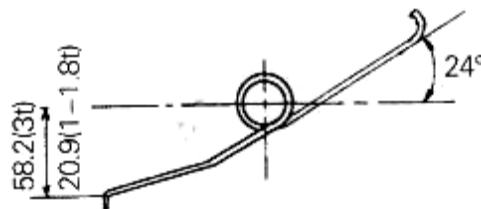


Fig 5-17

(10) Examine whether or not the adjusting mechanism is damaged, how the operating status is, and also examine whether or not the contact of adjusting lever is out of order, and replace it when necessary.

### 6.7.3 Reassembly of Wheel Brake

(1) Firstly dip the wheel cylinder rubber cup and the piston with brake fluid, and then assemble spring, rubber cup, piston, and shield in turn.

(2) Mount the wheel cylinder on bottom plate.

Attention: Ensure that respective parts are all at the correct position during installation, and the bolt tightening torques are 17.6-26.5N.m.

(3) Mount the bottom plate onto the front axle.

Bolt Tightening Torque: 120-140N.m

(4) Add #2 calcium base lubricating grease at a, b, c, d respective lubricating pints as

indicated in Fig 5-18, and be careful not to allow this grease to be adhibited on brake shoe.

- (a) Support Face of Bottom Plate    (b) Support Pin of Lever L H Brake
- (c) Support Pin    (d) Adjuster Thread and Other Rotating Parts
- (e) Contact Face of Brake Shoe and Washer,Cup

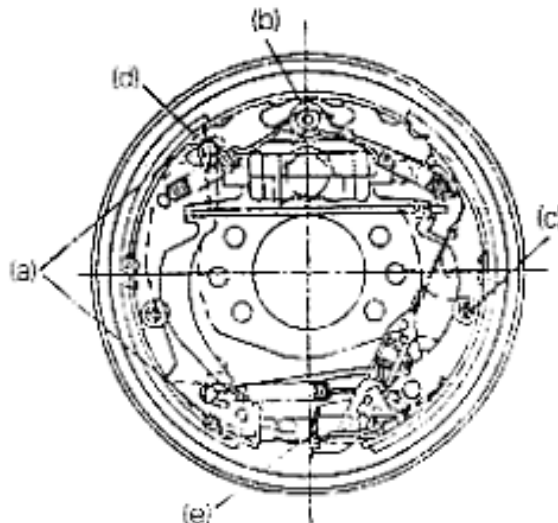


Fig 5-18 1.8t-3.5t Forklift Truck

(5) Mount the brake cable assembly onto the bottom plate using E-shaped retainer ring.

(6) Mount the brake shoe onto the bottom plate using fixing spring, but the bottom part of secondary brake shoe shall be mounted with fixing spring after the washer, cup and the adjusting lever have been properly installed, to ensure that the pressure seat is fitted in the holes of brake shoe and adjusting lever(Fig 5-19).



Fig 5-19

(7) Mount the compressed spring onto the hand brake push rod, and then install the push rod onto the brake shoe.

(8) Mount the guide plate of brake shoe onto the support pin, and then install the return spring of brake shoe (Fig 5-20)



Fig 5-20

(9) Install adjuster, adjuster spring, top rod, and return spring for top rod (Fig 5-21).



Fig 5-21

Pay attention to the following respective items:

a) Adjuster thread direction and its installation direction (left-hand thread is used for left brake, while right-hand thread is used for right brake.)

b) Adjuster spring direction (It is not allowed for the tooth part of adjuster to contact the spring.)

c) Top rod return spring direction (At the end of support pin, the spring hook shall be fixed on the opposite side of top rod.)

d) Top rod and top rod return spring shall be fixed inside the sloth of support pin.

e) Make sure that the lower end of adjusting lever shall be in contact with the tooth part of adjuster.

(10) Connect the brake oil pip onto the wheel cylinder.

(11) Measure the inner diameter of brake drum, and adjust the adjuster for the differences between the inner diameter of brake drum and the friction plate of brake shoe to be: 0.5-0.8mm.

#### 5.8 Operating Test on Automatic Clearance Regulator

(1) Firstly allow the diameter of brake shoe to approach the installation size, and pull the adjusting lever with hand in the direction as indicated by the arrow in Fig 5-22 for adjust to rotate. When hand is released, the adjusting lever returns to its original place, while the gear of adjuster will not rotate.

Attention: Even if when hand is released, and the adjuster gear and the adjusting lever return together, the adjuster is still able for normal work after being assembled.

(2) In the case when adjusting lever is pulled, and the adjuster cannot do the abovementioned action, the following items shall be examined:

a) Mount the adjusting lever, the top rod, the top rod spring, and the washer, cup firmly.

b) Examine whether or not the relationship in arrangement between adjusting lever and adjusting gear is correct. Refer to Fig 5-23 and replace the parts if not satisfactory. In addition, examine whether or not lever and gear are in contact with each other.

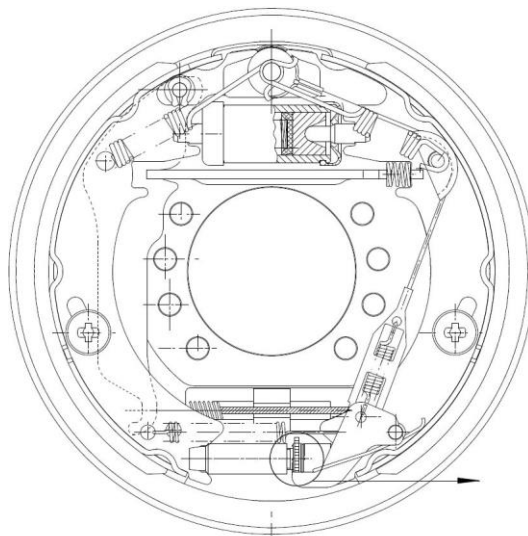


Fig 5-22

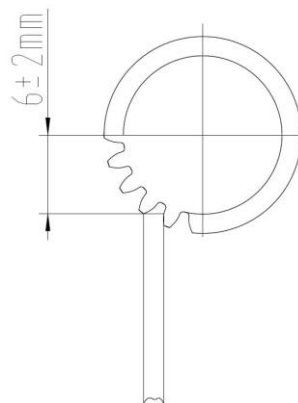


Fig 5-23

c) Examine whether or not the return spring of top rod and the spring for adjuster are damaged, and then examine the rotating status of adjuster gear and whether or not its engaged part is excessively worn out or damaged.

## 5.9 Failure Removal for Wheel Brake

| Problem                    | Analysis for Cause of Generation                                                                                                                                                                                                                                                                               | Removal Method                                                                                                                                                                        |
|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Brake under Poor Condition | 1. Oil Leak with Brake System<br>2. Clearance of Brake Shoe Not Properly Adjusted<br>3. Brake too Hot<br>4. Contact between Brake Drum and Brake Shoe under Poor Condition<br>5. Impurity Attached on Brake Shoe<br>6. Impurity Blended into Brake Fluid<br>7. Brake Pedal (Inching Valve) Improperly Adjusted | To be Repaired<br>Adjuster to be Adjusted<br>Examine Whether or not Skidding Exists<br>To be Readjusted<br>To be Repaired or Replaced<br>Brake Fluid to be Examined<br>To be Adjusted |
| Noise Present with Brake   | 1. Surface of Brake Shoe Hardened or Impurity Attached on It<br>2. Bottom Plate Distorted or Bolt Loosened<br>3. Brake Shoe Distorted or Installation Incorrect<br>4. Brake Shoe Worn<br>5. Bearing of Wheel Loosened                                                                                          | To be Repaired or Replaced<br>To be Repaired or Replaced<br>To be Repaired or Replaced<br>To be Replaced<br>To be Repaired                                                            |
| Brake Un-uniform           | 1. Oil Stain Present on Surface of Brake Shoe<br>2. Clearance of Brake Shoe Not Properly Adjusted<br>3. Wheel Cylinder Out of Operation<br>4. Brake Shoe Return Spring Damaged<br>5. Brake Drum Deflected                                                                                                      | To be Repaired or Replaced<br>Adjuster to be Adjusted<br>To be Repaired or Replaced<br>To be Replaced<br>To be Repaired or Replaced                                                   |
| Brake Weak                 | 1. Oil Leak with Brake System<br>2. Clearance of Brake Shoe Not Properly Adjusted<br>3. Air Blended into Brake System<br>4. Adjustment of Brake Pedal Incorrect                                                                                                                                                | To be Repaired or Replaced<br>Adjuster to be Adjusted<br>Air to be Bled<br>To be Readjusted                                                                                           |

Note: When forklift is not used for a long period of time, it is suggested to lift the cylinder to the top 2-3 times for lubrication maintenance less than every ten days.

## 6. Hydraulic System

| Forklift Truck<br>Tonnage |                         | 1.8T                                                                                                             |                                    |                   | 2.5T                      |                                    |                   | 3.5T                |                                    |                   |  |
|---------------------------|-------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------|---------------------------|------------------------------------|-------------------|---------------------|------------------------------------|-------------------|--|
| Equipped Engine           |                         | 4TNE98                                                                                                           | MitsubishiS4S-455/Mitsubishi D04EG | Kubota V2403      | 4TNE98                    | MitsubishiS4S-455/Mitsubishi D04EG | Kubota V2403      | 4TNE98              | MitsubishiS4S-455/Mitsubishi D04EG | Kubota V2403      |  |
| Main Pump                 | Model                   | SGP1A28.2D2H9-L093C                                                                                              | SGP1A28.2D2H1-L707D                | SGP1A27D2H9-R432T | SGP1A28.2D2H9-L093C       | SGP1A28.2D2H1-L707D                | SGP1A27D2H9-R432T | SGP1A28.2D2H9-L093C | SGP1A28.2D2H1-L707D                | SGP1A27D2H9-R432T |  |
|                           | Type                    | Gear Type                                                                                                        |                                    |                   |                           |                                    |                   |                     |                                    |                   |  |
|                           | Driving                 | Driving with Engine Power Output Gear                                                                            |                                    |                   |                           |                                    |                   |                     |                                    |                   |  |
| Multi-way Valve           | Model                   | CDB3-F15YM3-02<br>(1.8T)                                                                                         |                                    |                   | CDB3-F15YM3-02 (2.5-3.5t) |                                    |                   |                     |                                    |                   |  |
|                           | Type                    | Double Spool Valve, with Overflow Valve, Bypass Valve, and Inclined autolocking Valve, Pilot valve load feedback |                                    |                   |                           |                                    |                   |                     |                                    |                   |  |
|                           | Adjusting Pressure      | 16.5Mpa (1.8T)                                                                                                   |                                    |                   | 20MPa (2.5-3.5t)          |                                    |                   |                     |                                    |                   |  |
|                           | Bypass Valve            | Press<br>ure                                                                                                     | 12 MPa                             |                   |                           |                                    |                   |                     |                                    |                   |  |
|                           |                         | Flow<br>Rate                                                                                                     | 11 L/Min                           |                   |                           |                                    |                   |                     |                                    |                   |  |
| Lift Cylinder             | Type                    | Single Act Piston Type, with Shutoff Valve, one-way valve and lower buffer                                       |                                    |                   |                           |                                    |                   |                     |                                    |                   |  |
|                           | Cylinder Inner Diameter | 1.8t: Φ45mm                                                                                                      |                                    |                   | 2.5t: Φ50mm               |                                    |                   | 3.5t: Φ56mm         |                                    |                   |  |
|                           | Stroke                  | (2nd-grade Standard Mast at 3m Lifting Height) 1495mm<br>(Varying along with Type of Mast and Lifting Height)    |                                    |                   |                           |                                    |                   |                     |                                    |                   |  |
| Tilt Cylinder             | Type                    | Double-acting                                                                                                    |                                    |                   |                           |                                    |                   |                     |                                    |                   |  |
|                           | Cylinder Inner Diameter | 1.8t: Φ63mm                                                                                                      |                                    |                   | 2.5t: Φ70mm               |                                    |                   | 3.5t: Φ80mm         |                                    |                   |  |
|                           | Diameter of piston rod  | 1.8t: Φ30mm                                                                                                      |                                    |                   | 2.5t: Φ32mm               |                                    |                   | 3.5t: Φ35mm         |                                    |                   |  |
|                           | Stroke                  | 1.8t: 174.5 mm                                                                                                   |                                    |                   | 2.5t: 174.5 mm            |                                    |                   | 3.5t: 174.5 mm      |                                    |                   |  |

## 6.1 Overview

Hydraulic system is composed of main oil pump, multi-way valve, lift cylinder, tilt cylinder, and oil pipeline, as well as the direct transmission oil pump of engine power-take-off (P.T.O).

## 6.2 Main Oil Pump

The main oil pump is a gear pump, mainly composed of pump body, pump cover, one pair of gears, bearing, and seal ring. Load balanced bearing and special lubricating method are applied to main oil pump, for the end face of gear to gain the minimum clearance.

As pump body and pump cover are light and firm, as they are made of alloy aluminum. The two shafts respectively provided for driving gear and driven gear are separately installed on the bearing of pump body. These bearings are made of special material, to bear the radial load of gear shaft on one hand, and to serve as the baffle seat for the end face of gear on another.

On the side of drive shaft, one oil seal is pressed and fitted on the pump body, to ensure the sealing property. The sealing between pump body and cover is ensured with seal ring in special shape mounted.

## 6.3 Multi-way Valve and Bypass Valve (Fig 6-1)

The 2-disk multi-way valve consists of four-plate valve body, two spool valves, one safety overflow valve, and one bypass valve. The four-plate valve body is assembled using three stub bolts and nuts, and the inclined spool valves are mounted with inclined autolocking valve.

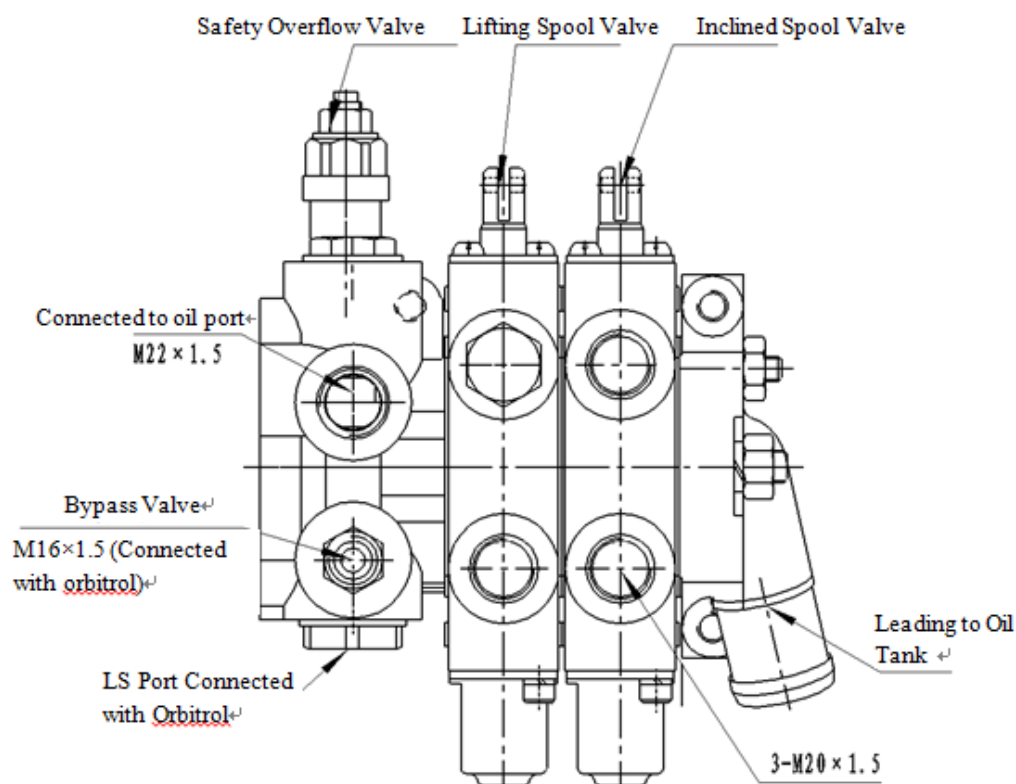


Fig 6-1 Multi-way Valve

### 6.3.1 Operation of Spool Valve (Taking inclined Spool Valve as example)

#### (1) Neutral Position (Fig 6-2)

At this point the High-pressure oil drained from oil pump returns to oil tank through neutral position.

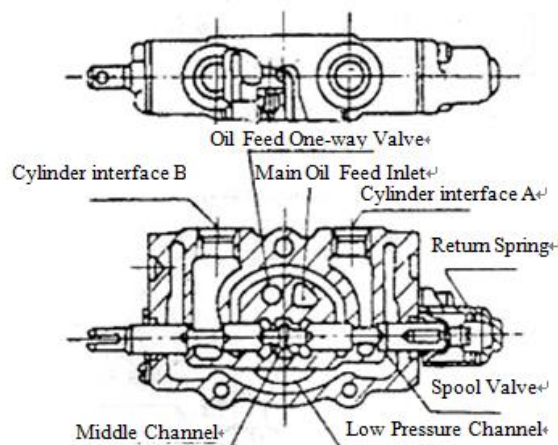


Fig 6-2

(2) Push-in Spool Valve (Fig 6-3):

At this point middle channel is closed, the oil from oil inlet port opens the one-way valve and flows to the interface B of cylinder, while the oil from cylinder interface A flows to oil tank through low-pressure channel. By virtue of return spring, it may allow the spool valve to return to neutral position.

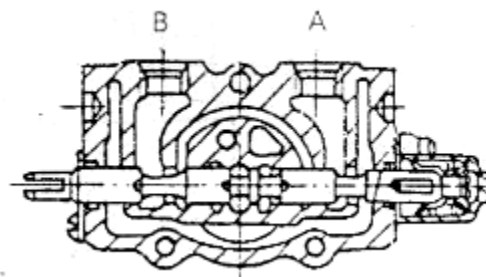


Fig 6-3

(3) Pull-out Spool Valve (Fig 6-4)

At this point when neutral position is closed, the oil from the oil inlet port opens the one-way valve and flows to the cylinder interface A, while the oil from cylinder interface B flows to the oil tank through low-pressure channel. By virtue of return spring, it may allow the spool valve to return to neutral position.

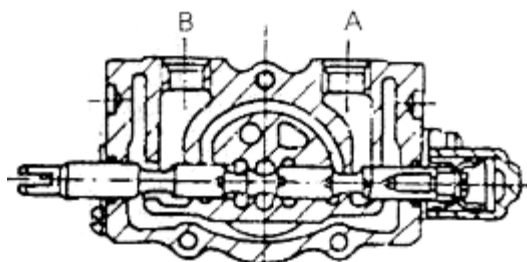


Fig 6-4

6.3.2 Main Safety Overflow Valve and Bypass Safety Valve (Fig 6-5)

The main safety overflow valve is composed of the two parts including main valve A and pilot valve B. When multi-way valve is reserved, the high-pressure oils in cavity C and working mechanisms (such as lift cylinder and tilt cylinder) are connected, the pressure oil acts on the pilot valve B, through the fixed throttle holes D and E. When system pressure is larger than the system regulated pressure, the pilot valve B is opens, for the pressure in cavity F to drop. The valve core of the entire main valve A moves rightwards, for the pressure oil to be directly connected with

low-pressure channel G, for cavity C to be relieved, in order to ensure the stability of system pressure. Adjusting screw H may be used to adjust the stable pressure value of the system.

The bypass safety valve is in a relatively simple structure, as a direct-acting type of overflow, to get a stable pressure value for steering system by making use of the principle for direct balance of liquid pressure with spring force. When operating wheel is operated, the oil cavity M is connected with high-pressure oil circuit. When system pressure is larger than spring pressure, the valve core N moves rightwards, and pressure oil is connected with low-pressure oil circuit through cavity T, for cavity M to be relieved, in order to ensure the stability for the pressure of steering system. Adjusting screw K may be used to adjust the stable pressure value of the system.

L valve is a balanced spool valve, and the spool valve L moves leftwards and rightwards through continuous change in flow and pressure to change the openness in the two places of R and S, to ensure that the flows to working cavity Q and outlet PS to fully hydraulic orbitrol are automatically balanced, and to be passed by steadily according to proportion. a, b, and c are the fixed throttle holes.

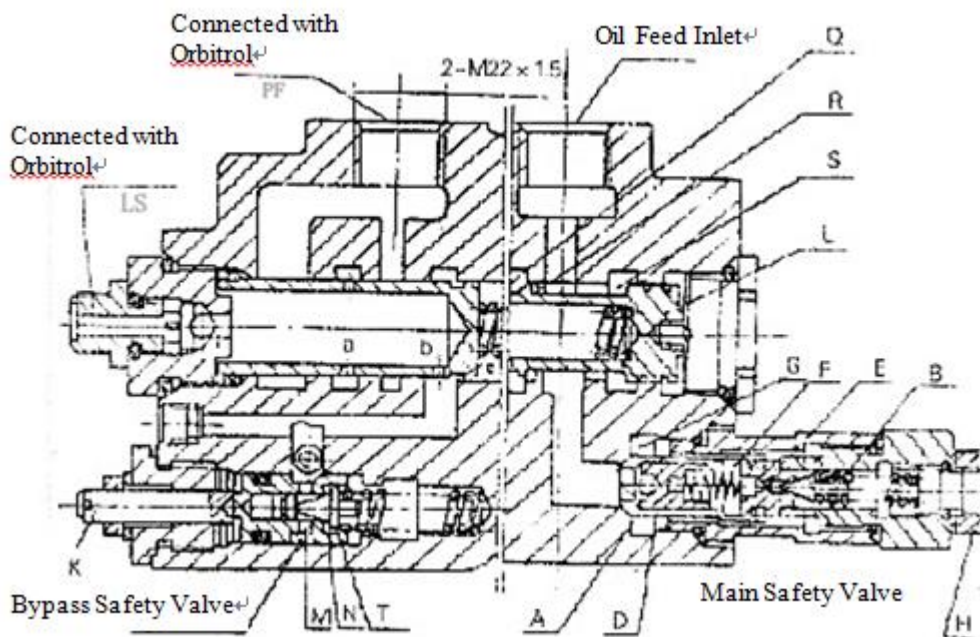


Fig 6-5

### 6.3.3 Action of Inclined Autolock Valve

The inclined spool valve is mounted with autolock valve, mainly used to prevent vibration possibly arisen from internal negative pressure of tilting cylinder, and avoid severe aftereffect caused by misoperation. For general conventional structure, the inclined spool valve can still be operated for it to tip forward after engine is turned off. However, when this tilt autolock valve is used, it cannot make the mast tip forward, even if the valve is operate with a big push, in the case when engine is turned off. Refer to Fig 6-6 for its structure.

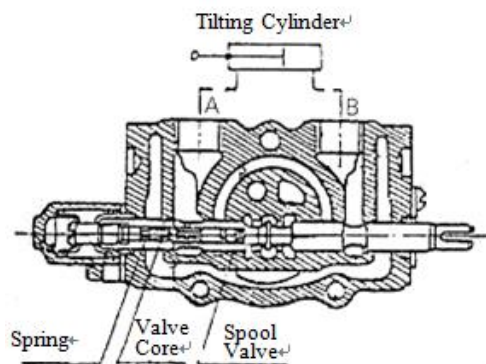


Fig 6-6

The interfaces “A” and “B” of valve body are respectively connected to the front and rear cavities of piston for tilting cylinder. When spool valve is pulled out, the high-pressure oil (P) enters into interface “A”, while the oil in the rear cavity returns from “B” to oil tank (T), and at this point the mast is under the back-tip status.

When inclined spool valve is pushed, the high-pressure oil enters into interface “B”, to allow the autolock valve in spool valve to act by virtue of high-pressure oil, while “A” is connected with low pressure. When engine turns off or stop rotation, there is no high-pressure oil for autolock inside the spool valve to act, hence the interface “A” cannot be connected with low pressure, the mast will not tip forward, and negative pressure can neither be formed in tilt cylinder.

#### 6.4 Oil Circuit of Hydraulic System (Main Oil Circuit)

As in Fig 6-7, The high-pressure oil from the main oil pump reaches the multi-way pump, divided into two parts via multi-way valve and through the bypass valve therein: One part for high-pressure oil to be divided into lifting cylinder or tilt cylinder, and the other part is divided at an invariable flow rate into orbitrol (with pilot valve load feedback), to control the steering cylinder. When lift and tilt two spool valves are at the neutral position, the high-pressure oil returns to oil tank directly through channel. When lift spool valve is pulled, the high-pressure oil passes through the throttle valve, and then pushes the piston rod upwards from downward of lift cylinder piston. When lift spool valve is pushed, the lower part of lifting cylinder piston is connected with low pressure, for piston rod to drop depending on self weight and cargo weight. AT this point the oil flowing out from lifting cylinder passes through the throttle valve for the dropping speed to be controlled. When tilt spool valve is operated, the high-pressure oil may flow into the front cavity of tilting cylinder, while the other side is connected with low pressure, for the mast to achieve the back tip or front tip action.

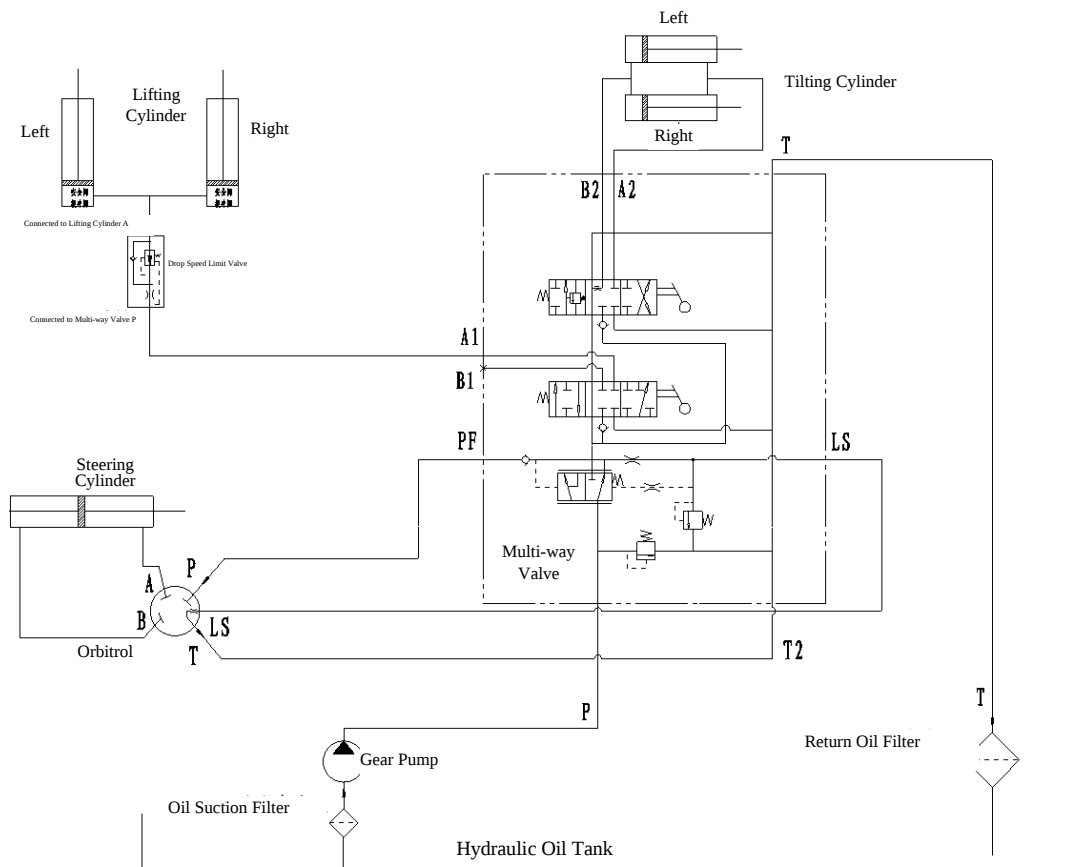


Fig 6-7 Oil Circuit of Hydraulic System

### 6.5 Lifting Cylinder

As in Fig 6-8, Two single-acting lifting cylinders are fixed on the rear side of channel steel for the outer mast, and the bottom part of cylinder is fixed on the fork carriage of lift cylinder on the outer mast using pins and bolts, while the top part of cylinder (namely the top part of piston rod) is connected with active beam. The piston strokes for the two cylinders shall be adjusted to be consistent, for the two cylinders to lift synchronously, and the part 29 may be adjusted to achieve the synchronization, if they are still not synchronized.

The lifting cylinder is mainly composed of cylinder body, piston, piston rod, cylinder cover, cylinder bottom and sealing parts. One oil port is available in the lower part of cylinder body, The piston is fastened onto the piston rod using slot nut and cotter pine, and one YX seal ring, retainer ring and wear ring are fitted on the outer edge of piston. This piston moves along the inner surface of cylinder body under the action of high-pressure oil. Shaft sleeve and dust ring pressed and matched are mounted in the inner hold of cylinder cover, and this shaft sleeve supports the piston rod, while the dust ring is able for cylinder body to resist dust. The stroke of piston may be adjusted by making use of cylinder cover.

When the lift spool valve of multi-way valve is pulled backwards, the high-pressure oil enters through the bottom part of lift cylinder, to push the piston and the piston rod, for fork and inner mast to lift by virtue of lift chain. When lift spool valve is pushed forward, the piston of lift cylinder drops under the effect of piston rod, fork carriage, fork and cargo weight, for the oil under the piston to flow out. The oil drained out from lift cylinder is controlled by throttle valve, and returns to oil tank through multi-way valve.

- |                   |                      |
|-------------------|----------------------|
| 1. Active Beam    | 16. Pin              |
| 2. Dust Ring      | 17. Spool Valve      |
| 3. Shaft Cap      | 18. Spring           |
| 4. Cylinder Cover | 19. Joint            |
| 5. O-Ring         | 20. O-Ring           |
| 6. Piston Rod     | 21. Hoisting Chain   |
| 7. Cylinder Body  | 22. Plug             |
| 8. O-Ring         | 23. Screw            |
| 9. Piston         | 24. Retainer Ring    |
| 10. Wear Ring     | 25. Sheave           |
| 11. Retainer Ring | 26. Plug             |
| 12. Yx Seal Ring  | 27. Chuck Plate      |
| 13. Nut           | 28. Bolt             |
| 14. Cotter Pin    | 29. Adjusting Washer |
| 15. Bolt          |                      |

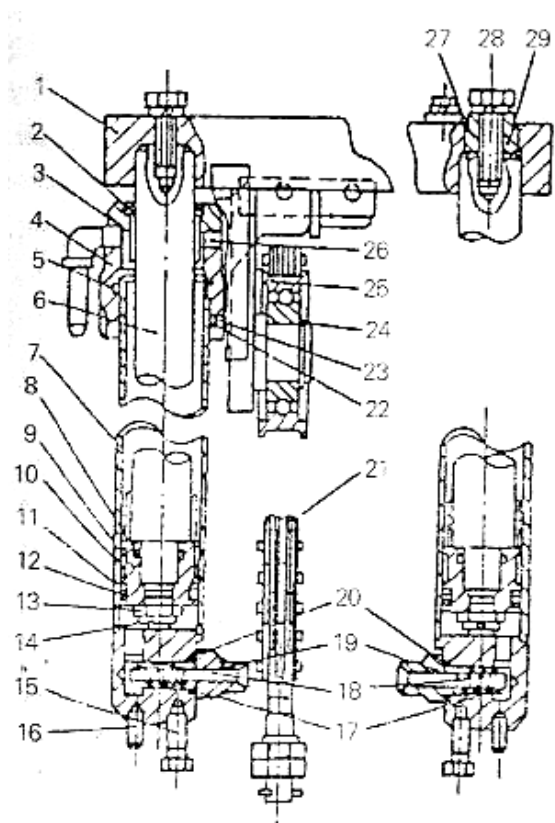


Fig 6-8 Lifting Cylinder

There is one shut-off valve on the bottom of lift cylinder, (Refer to Fig 6-9), to prevent cargo from abrupt drop, when high-pressure rubber hose is suddenly cracked. The oil from lift cylinder passes through the spool valve of shut-off valve, and the oil holes around the spool valve allow the two rubber hoses to generate pressure difference. When this pressure difference is smaller than the spring force, the spool valve will not act. If the high-pressure rubber hose is cracked, a very huge pressure difference is formed, for the spool valve to move and block up its surrounding oil holes, only to allow a small amount of oil to flow through the pores on the end part of spool valve, for fork to slowly drop.

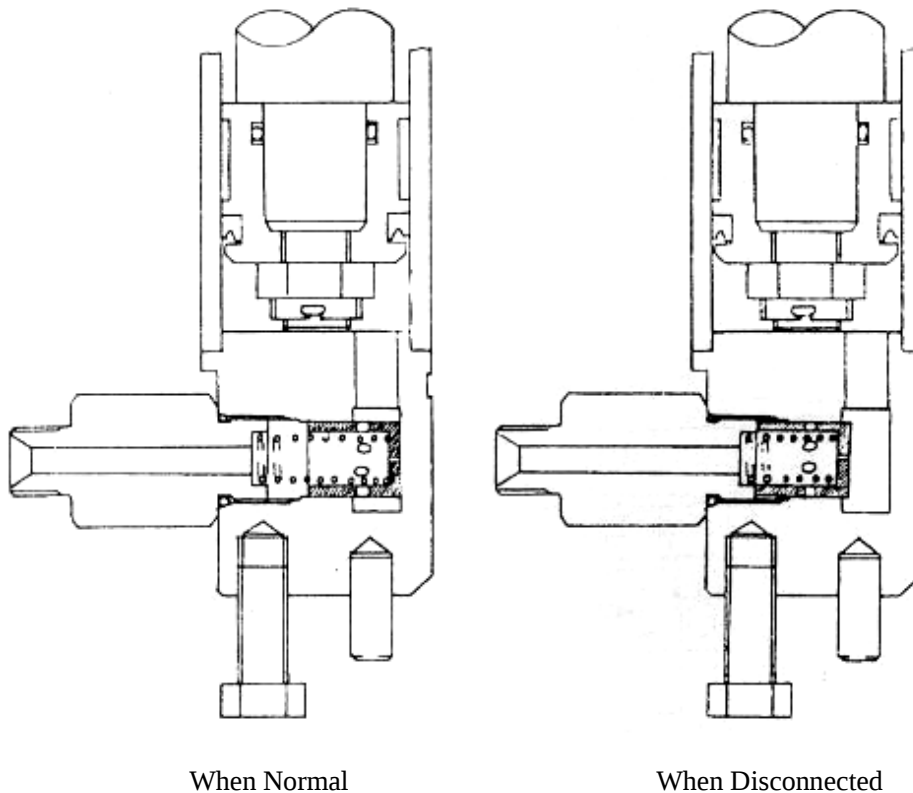
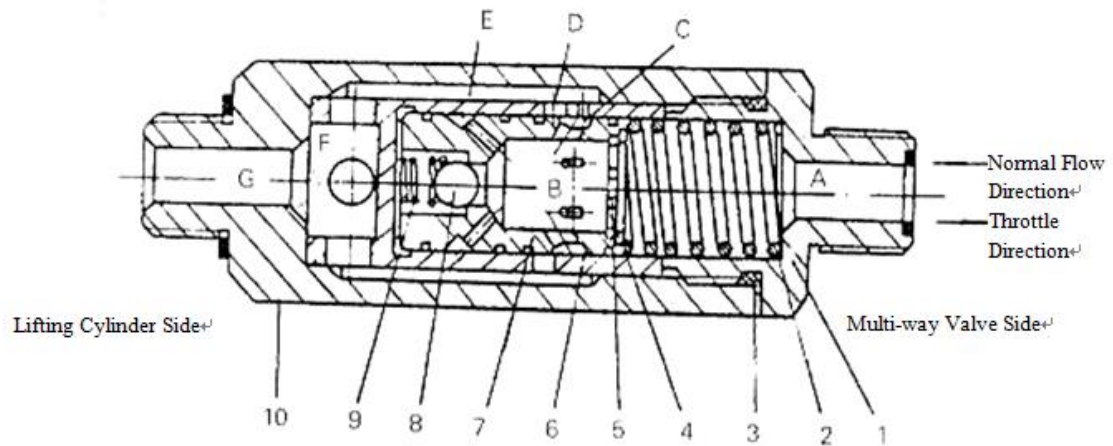


Fig 6-9

#### 6.6 Limiting Valve

Speed limiting valve (namely throttle valve) is mounted in the oil circuit of lift cylinder, to restrain the dropping speed when fork carries a heavy load, and its structure is indicated as in Fig 6-10. When spool valve of multi-way valve is at the “Lift” position, the high-pressure oil from multi-way valve passes through cavities A and B as well as holes C, D, E, and F, and cavity G under the condition when it is not throttled, and then flows into the lift cylinder. When spool valve of multi-way valve is at the “Drop” position, the oil from lift cylinder passes cavity G, oil holes F, E, D, and C, as well as cavities B and A through the entire valve. At this point, pressure difference is generated between cavity A and cavity B, and opens the ball valve (Part 8). When pressure difference exceeds the spring force of spring 2, the valve core 7 moves rightwards, for the flow quantity of oil to drop for diminish of D and C holes, which has also reduced the flow quantity through the throttle hole.



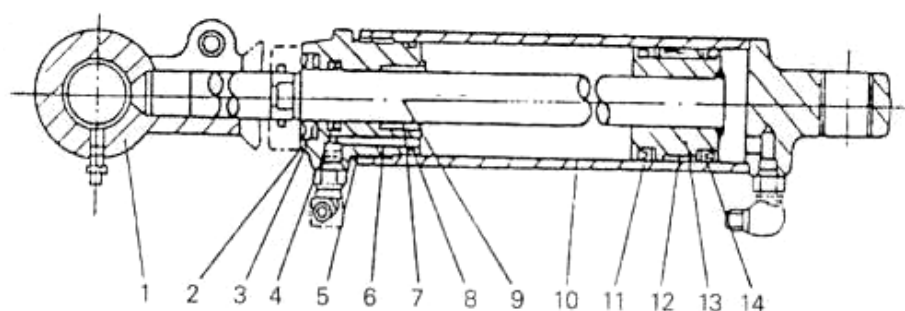
- |           |                  |                   |               |                |
|-----------|------------------|-------------------|---------------|----------------|
| 1. Joint  | 3. O-Ring        | 5. Throttle Plate | 7. Valve Core | 9. Spring      |
| 2. Spring | 4. Retainer Ring | 6. Valve Sleeve   | 8. Nylon Ball | 10. Valve Body |

Fig 6-10 Limiting Valve

#### 6.7 Tilting Cylinder (Fig 6-11)

Tilting cylinder is in a double-acting type, mounted on the two sides of mast. Its end of piston rod is connected with mast, and the bottom of tilt cylinder is connected with truck frame using pins.

The tilting cylinder assembly comprises of piston, piston rod, cylinder body, cylinder bottom, guide sleeve, and sealing parts. Welded structure is applied to piston and piston rod. One wear ring and two Yx seal rings are mounted on the outer edge of piston, while Yx seal ring, retainer ring, and dust ring are fitted in the inner hold of guide sleeve, pressed and matched with shaft sleeve. This shaft sleeve supports the piston rod, while the seal ring, retainer ring, and dust ring are able to prevent oil leak and dust, screwed onto the cylinder body together with O-ring.



- |               |                   |                  |                 |
|---------------|-------------------|------------------|-----------------|
| 1. Clevis     | 2. Dust Ring      | 3. Baffle Ring   | 4. Yx Seal Ring |
| 5. O-Ring     | 6. Guide Sleeve   | 7. Bearing       | 8. O-Ring       |
| 9. Piston Rod | 10. Cylinder Body | 11. Yx Seal Ring | 12. Wear Ring   |
| 13. Piston    | 14. Yx Seal Ring  |                  |                 |

Fig 6-11 Tilting Cylinder

When tilt spool valve is pushed forward, the high-pressure oil enters from the bottom of cylinder, thus to push forward the piston for mast to tip forward by  $6^{\circ}$ , and when spool valve is pulled backwards, the high-pressure oil enters from the front end of cylinder body, to push backward the piston, until the mast tips backwards by  $12^{\circ}$ .

## 6.8 Maintenance of Main Oil Pump

### 6.8.1 Disassembly

(Refer to Fig 6-18 and 6-19 for Imported Main Oil Pump in combination.)

(1) Clamp the pump gently on the vice stand after cleaning, and firstly remove the bolt 12.

(2) Detach pump cover 1 and seal rings 8, 9, 10, and 11.

(3) Remove the front-end cover 7, and 8, 9, 10, and 11.

(4) Demount bearings 3 and 4, as well as gears 5 and 6 from pump body 2, and bearings may be dismounted through pressing the gears, if it is difficult to disassemble them.

It is the best to make arrangement according to the sequences in Fig 6-18 and Fig 6-19, in order to facilitate examination.

### 6.8.2 Examination and Repair

The parts that have been disassembled, except rubber, shall be cleaned firstly with oil, and examined, repaired, or replaces according to following steps.

#### (1) Examination of Pump Body

High-efficiency gear pump is designed into that the crest of gear rotates along the inner surface of pump body through slight press and touch, and the trace of scratch will be generated around the inner surface of the crest and the pump body. Under normal situation, its trace shall not exceed a length  $1/3$  of the inner edge of the pump body, and if it reaches  $1/2$  length, it indicates that the bearing and gear shaft are severely worn out. In Fig 6-12, when size X exceeds 39.180mm, or the trace of scratch on inner edge exceeds one half, it is required to replace the pump body.

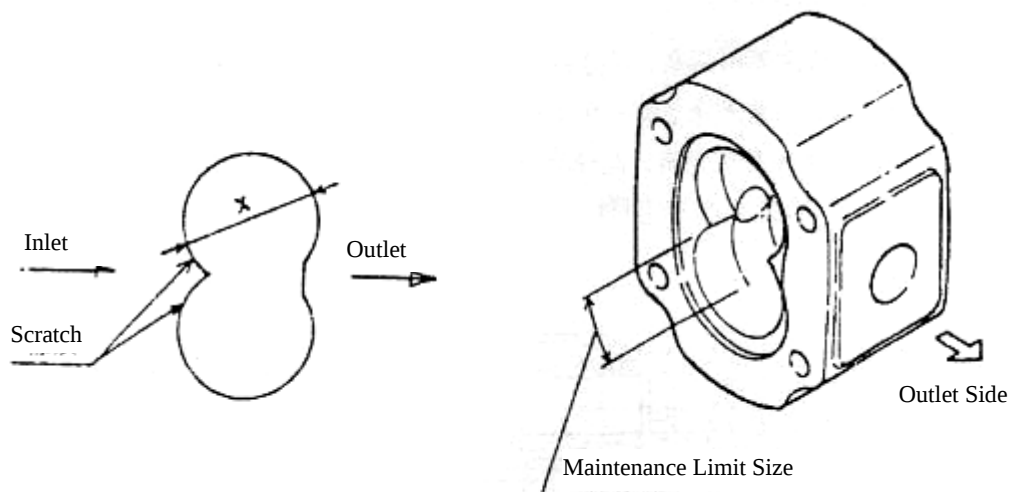


Fig. 6-12

## (2) Examination of Bearing (Fig 6-13 and Fig 6-14)

The ideal situation is to require that the inner surface of bearing is not coarse, and the contact surface with brightness is shown at the position about 1/2 at the inlet side. The bearing shall be replaced, if any of the undermentioned cases occurs.

a) The trace of contact appears on the entire slide inner surface, and a feeling of obvious coarseness exists when it is scraped with finger nail.

b) Crack appears around the end face, and a severe coarseness is felt when it is scraped with finger nail.

c) The bonding trace with other extraneous substance appears on the internal slide surface and the end face.

Most cases of abovementioned failures are aroused by un-cleaned hydraulic oil. At this point the whole oil circuit may be cleaned or the oil may be replaced. Some individual cases are attributed to overloaded safety valve, air corrosion, or too high temperature, or too low viscosity. In the case when the abovementioned failures occur, leading to coarseness or severe wear on the gear shaft or the end face of gear, the gear and bearing shall be replaced. The limit size for bearing maintenance is:

Inner Diameter—19.123mm (Fig 6-14)

Total Length—26.411mm

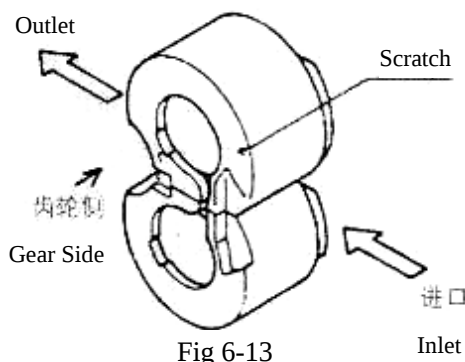


Fig 6-13

## (3) Examination of Gear

So long as clean hydraulic oil is used, generally speaking, gear shaft and gear end face will not be damaged. In the case when a coarseness to a certain degree is felt when it is scraped with finger nail on the end face of bearing and gear, or crack occurs on the gear end face, or severe un-uniform wear is present on the gear end face, the gear shall be replaced at this point. When gear surface is worn or discolored, it indicates that failure has also occurred with bearing or pump body, and it shall be examined. The limit size for the axial diameter of gear shaft is 18.935mm (as indicated in Fig 6-15).

## (4) Examination of Oil Seal

a) Oil Seal 14: (Refer to Figs 6-18 and 6-19) Oil seal 14 is a combination seal, and the lip at inner side of the pump shaft plays the sealing function, while the lip at the outer side is mainly for dust resistance (as in Fig 6-16). It is mainly required to examine whether or not crack, wear, or distortion exists with oil seal, and it is also required to examine whether or not the elasticity of rubber is enough, and it shall be replaced once it is out of order.

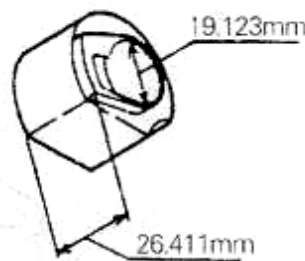


Fig 6-14

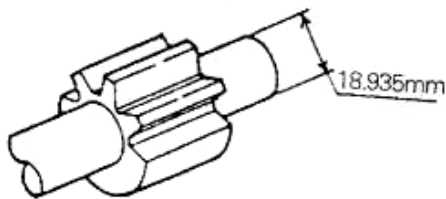


Fig 6-15

b) Seal Rings 8 and 9;

Seal ring 8 for pump body and seal ring 9 for bearing shall be replaced with new ones, when pump body is reassembled.

c) Seal Rings 10 and 11: Examine whether or not they are worn and damaged.

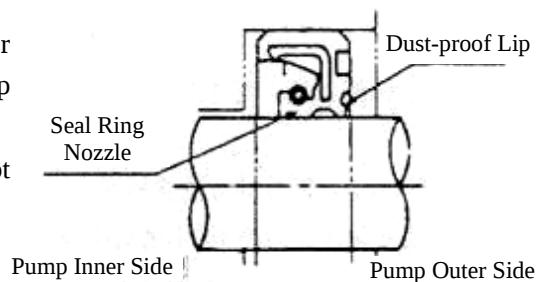


Fig 6-16

### 6.8.3 Reassembly (Fig 6-17)

(1) Clean the disassembled parts.

(2) Coat a thin layer of clean grease on the lips of oil seals 8, 9, 10, 11, and 14.

(3) Place the pump body 2 and the pump cover 1 on a flat stand, and coat the inner surface of pump body with clean hydraulic oil.

(4) Put bearings 3 and 4 into the pump body, and pay attention not to misplace their mutual positions. Place the bearing at correct position, and it may be taken out for reassembly, in the case of difficulty. It is never allowed to knock it gently or press it in forcibly.

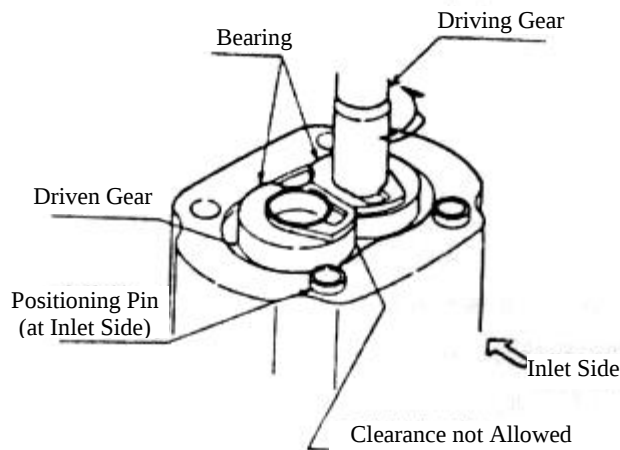


Fig. 6-17

(5) Turn over the pump body, put the driving and driven gears 5 and 6 into the pump body, and allow the engaged teeth to be at the same engagement positions prior to disassembly.

(6) Mount the bearings 3 and 4 on one side of the front end cover using the same method as in Step (4).

(7) Mount the seal ring for pump body 8, the seal ring for bearing 9, and seal rings 10 and 11, and pay attention not to allow the seal rings to be overlaid in the middle.

(8) Assemble the front end cover 7, and in this case, wrap the band around the end of driving gear, to avoid damage of oil ring lip, and don't forget removing such band after the front end cover is mounted.

(9) When pump body is turned over to mount end cover, pay attention to prevent the slide of seal rings installed during step (7).

(10) Mount seal rings 8, 9, 10, and 11, with the same method as in step (7).

(11) Put on the end cover 1.

(12) Mount spring washer 13 and bolt 12, and tighten the bolt with a torque of  $47^{+0.25}_0$  N.m

( $4.7^{+0.26}_0$  kgm).

Examine the gear pump as to whether or not it is assembled completely and properly. Place the driving shaft into the vice stand, the turn this pump, and the rotation of this pump shall be quite light. It is required to reexamine the pump, in the case when it is difficult to rotate.

Before this pump is assembled onto the machine, it is required to examine for a second time whether or not the assembly of the hydraulic pump is correct, and whether or not the rotating direction is correct.

Attention shall be paid to the following items when the pump is assembled:

a) Examine whether or not the lower part based on centerline is damaged or present with dust.

b) Examine whether or not the flange face of pipeline is damaged or present with dirt.

Mount O-ring, after the abovementioned has been examined (pipeline flange).

#### 6.8.4 Test Run

Operation shall be carried out after assembly. Observe whether or not the pump has the specified performance after reassembly, and do running-in. It is required for test run to be performed when pump is assembled on forklift truck, and test run shall be conducted according to the following method. If pump is blocked or its internal part is excessively worn out, oil shall be replaced and filter shall be replaced or cleaned.

(1) Install pressure gauge on high-pressure pipeline near the pump.

(2) Place the control valve at neutral gear, for pump to run at a speed of 500-1000rpm. As this valve is at neutral gear, the reading of pressure gauge shall be slightly lower than 1MPa (10kg/cm), and keep the pump running for 10 minutes under such status.

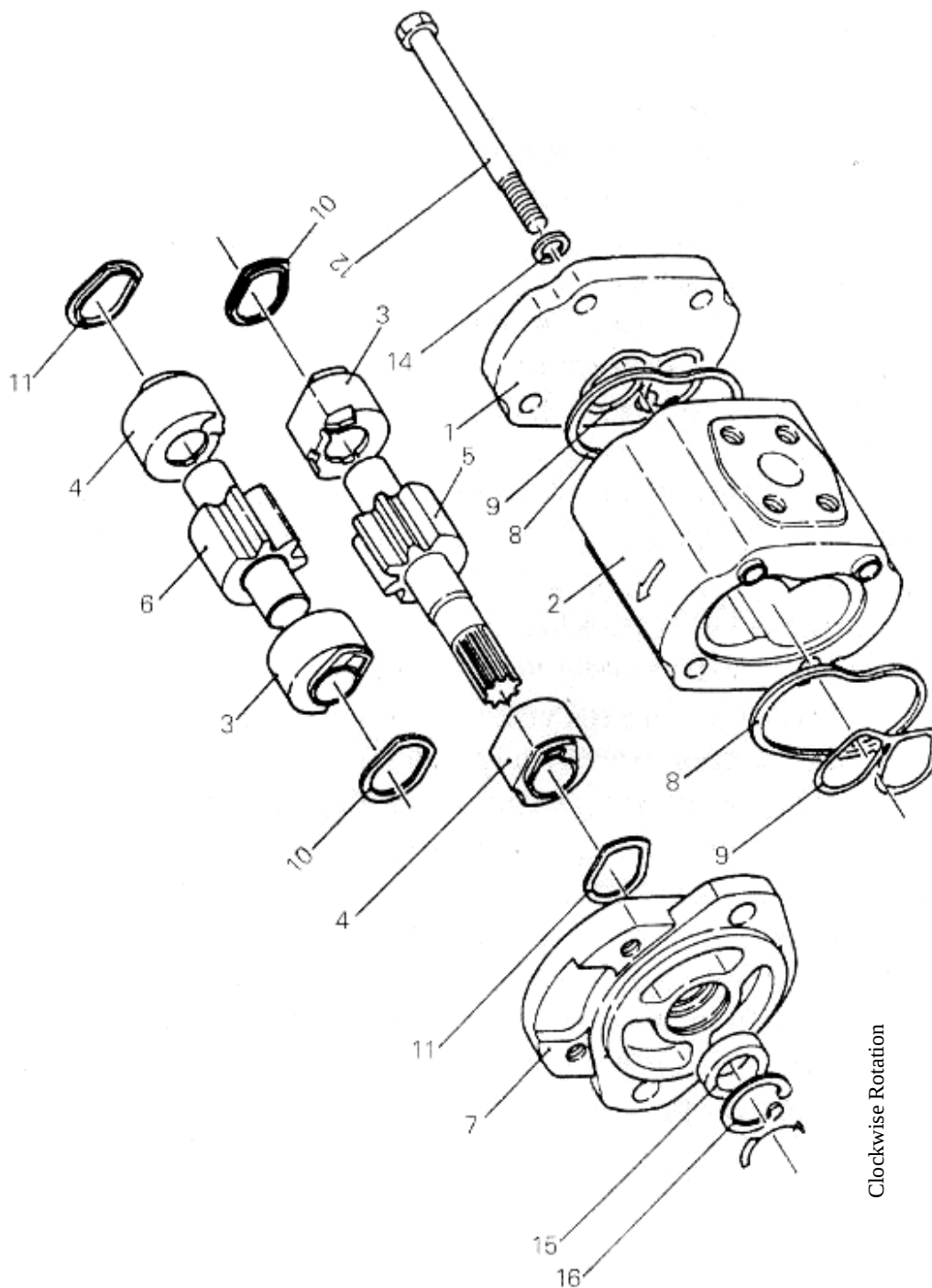
(3) Increase its rotating speed to 1500-2000rpm, and allow it to be idle for 10 minutes.

(4) Keep the rotating speed at Step (3) unchanged, increase the pressure to 2-3MPa (20-30kg/cm) for a further operation for 5 minutes, and repeat such operation until maximum pressure is reached. During this process, use overflow valve to increase load so as to adjust pressure. Allow each oil circuit to work for 5 minutes, and replace or clean the filter core of return oil filter. When pressure is boosted, attention shall be paid to oil temperature, as well as the surface temperature and working sound of pump body. IF oil temperature or pump temperature is too high, the pump shall be unloaded immediately to lower the temperature, and then this process is to be repeated.

(5) After the above procedure is completed, readjust the overflow valve to the original working condition and perform unloading test.

(6) No matter it is loading or not loaded, unloading test shall be made in either cases, to ensure that this device has a proper speed.

Fig 7-18 and Fig 7-19 respectively indicate the lateral views for structure of gear oil pump in clockwise and counterclockwise rotations, and Fig 7-20 represents the schematic diagram of hydraulic pipeline, for your information.



1. End Cover 2. Pump Body 3. Bearing 4. Bearing 5. Driving Gear  
6. Driven Gear 7. Front End Cover 8. Seal Ring 9. Seal Ring 10. Seal Ring  
11. Seal Ring 12. Bolt 13. Lock Washer 14. Oil Seal 15. Locking Collar

Fig 6-18 Clockwise Rotation of Gear Pump (1.9-3.5t Gasoline Forklift Trucks)

1. End Cover
2. Pump Body
3. Bearing
4. Bearing
5. Driving Gear
6. Driven Gear
7. Front End Cover
8. Seal Ring
9. Seal Ring
10. Seal Ring
11. Seal Ring
12. Bolt
13. Lock Washer
14. Oil Seal
15. Locking Collar

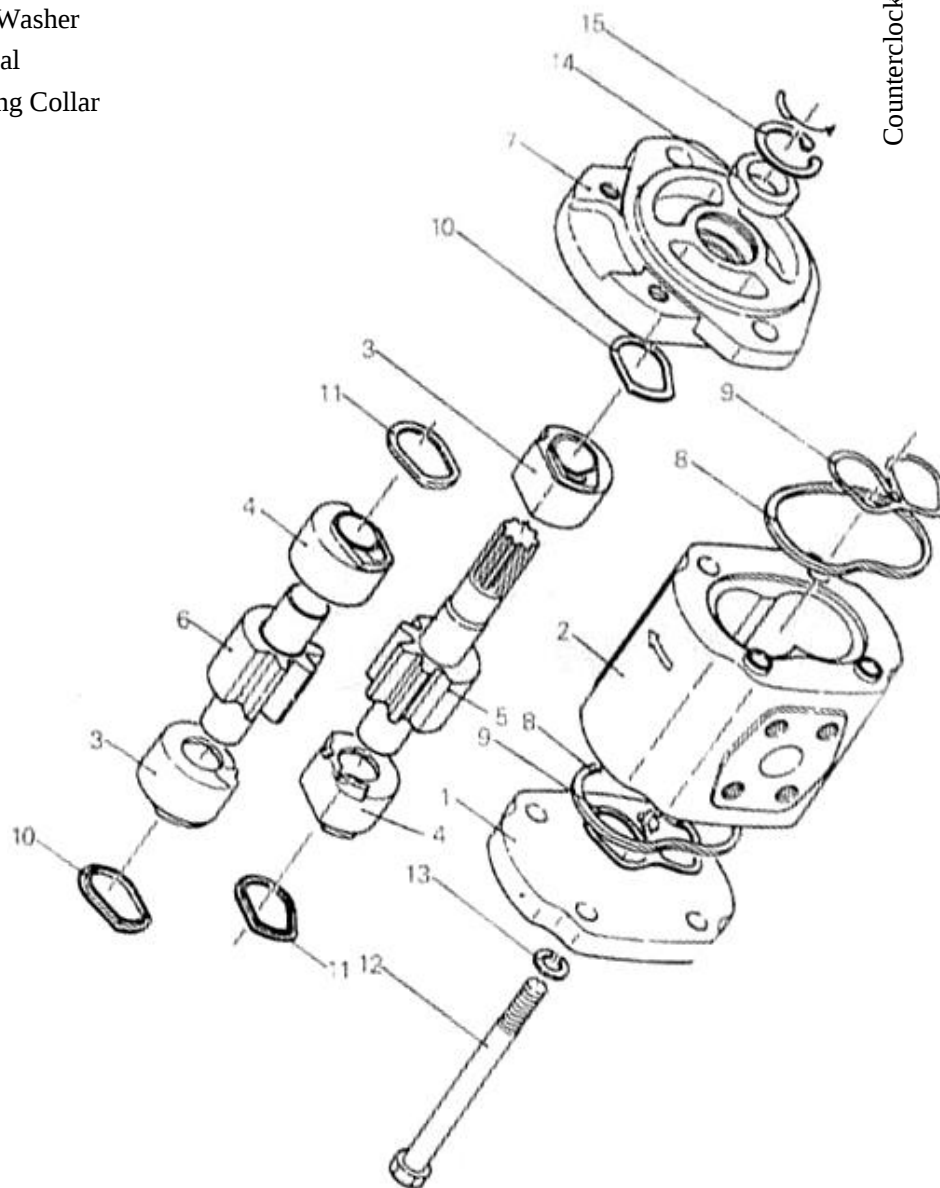


Fig 6-19 Counterclockwise Rotation of Gear Pump (1.8-3.5t Diesel Forklift Truck)

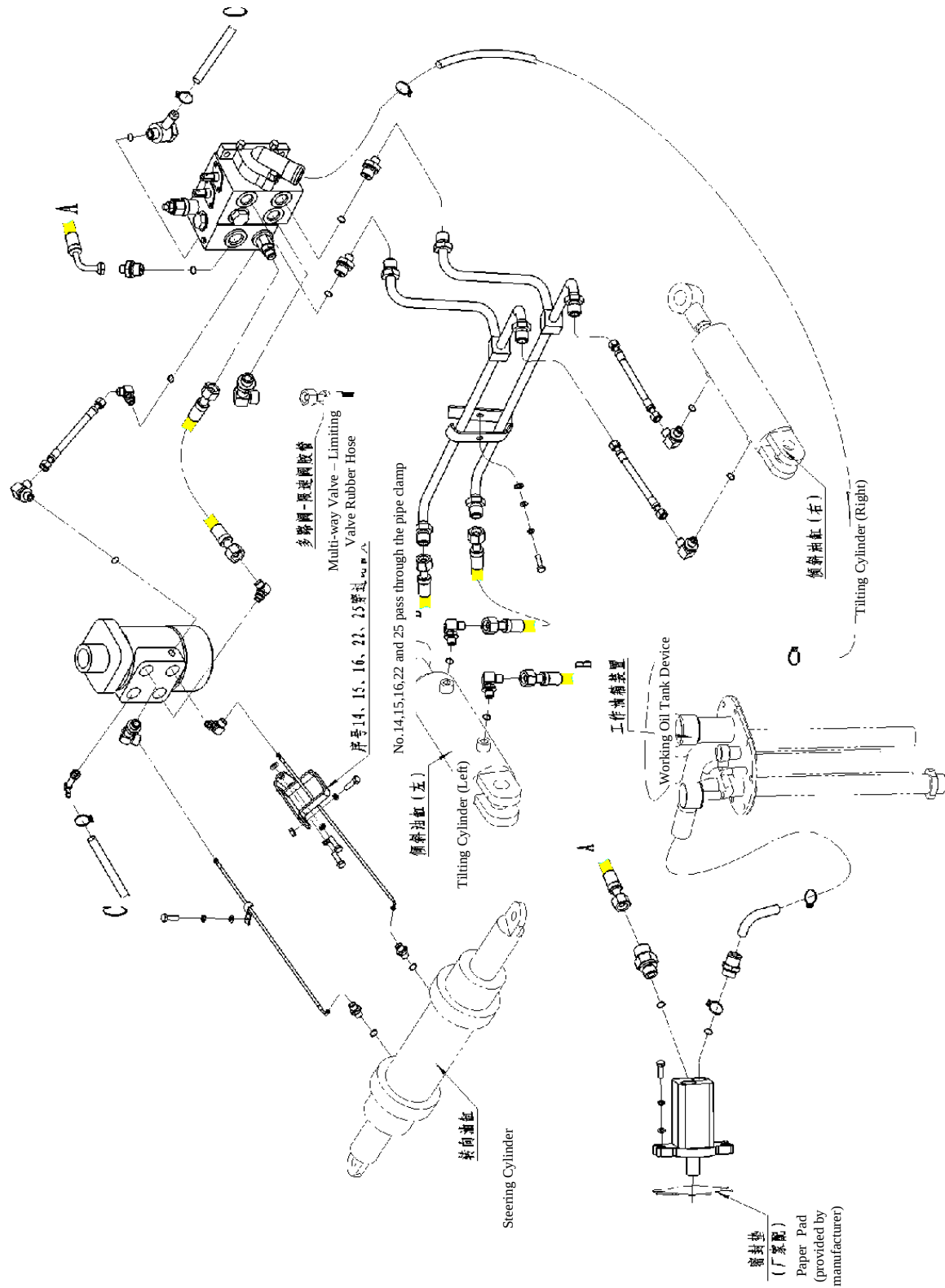


Fig 6-20 Schematic Drawing of Hydraulic Pipeline (Diesel Forklift Trucks)

## 6.8.5 Failure Removal

| Problem                                    | Possible Cause                                                                                                   | Removal Method                                                                                                                                                                                                            |
|--------------------------------------------|------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Oil of Oil Pump<br>Staying away            | Oil level in oil tank to the low end                                                                             | Oil to be filled to the specified oil level                                                                                                                                                                               |
|                                            | <b>Pump suction hose or oil filter<br/>blocked</b>                                                               | To be cleaned, and oil to be replaced if<br>it is dirty                                                                                                                                                                   |
| Failure of Gear<br>Pump for<br>Supercharge | Bearings 3 and 4 worn, and bearing<br>seal ring 9 or filler seal rings 10<br>and 11 at fault                     | To be replaced                                                                                                                                                                                                            |
|                                            | Overflow valve misadjusted                                                                                       | Pressure to be raised based by virtue of<br>pressure gauge                                                                                                                                                                |
|                                            | Air blended into pump                                                                                            | (1) Loosened joint at suction pipe side<br>to be re-tightened<br>(2) Oil to be added into oil tank<br>(3) Oil seal of pump to be examined<br>(4) Pump to be started only until there<br>is no more air bubble in oil tank |
| Noise of Gear<br>Pump Loud                 | Oil suction side hose twisted, or<br>cavity aroused by blockage of oil<br>filter                                 | Oil filter to be cleaned and hose to be<br>adjusted                                                                                                                                                                       |
|                                            | Air sucked inside due to loosening<br>of oil suction side joint                                                  | Each joint to be re-tightened                                                                                                                                                                                             |
|                                            | Cavity aroused due to excessive<br>viscosity                                                                     | (1) Oil of proper viscosity to be used<br>(2) Work to be started only when oil<br>temperature is normal                                                                                                                   |
|                                            | Non-concentric                                                                                                   | To be concentric                                                                                                                                                                                                          |
|                                            | Air bubble present in hydraulic oil                                                                              | Cause for generation of air bubble to<br>be examined and to be repaired                                                                                                                                                   |
| Oil Leak with<br>Pump                      | (1) Oil seal and seal ring 8 of pump<br>at fault<br>(2) Sliding face worn (for internal<br>leak to be increased) | To be replaced                                                                                                                                                                                                            |

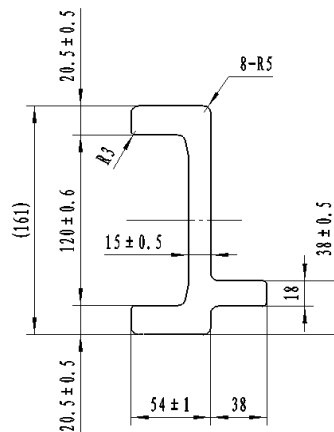
## 7. Lifting System

Note: this vehicle is strictly prohibited to tilt forward where the system's lifting load is more than 300 mm

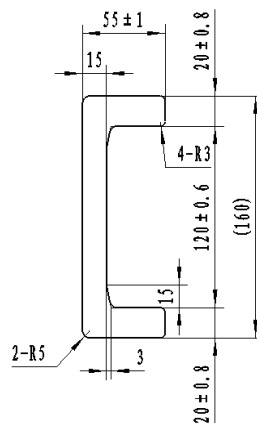
2-3.5t Type

Roller type, "J"-shaped inner mast, "C"-shaped outer mast with free lifting, two-stage telescopic mast

End Face of Inner mast:



End Face of Outer mast:

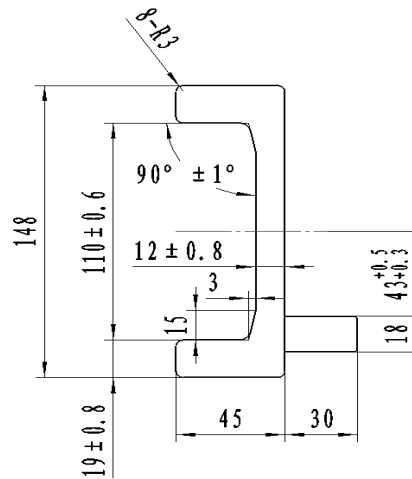


### 1.8t Type

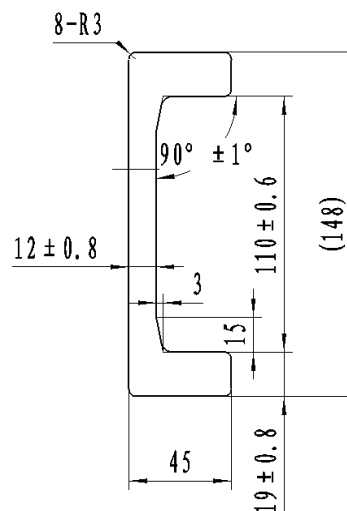
Roller type, “J”-shaped inner mast, “C”-shaped outer mast with free lifting, two-stage telescopic mast

outer

End Face of Inner mast:



End Face of Outer mast:



## 7.1 Overview

Lifting system is a two-stage rolling telescopic mast, with the outer mast typical of a “C” shaped end face, and the inner mast in a “J” shaped end face. The fork and the fork carriage comply with the international standard, with a free lift of about 160mm during operation.

## 7.2 Inside and Outer masts

The mast assembly is composed of inside and outer masts. The lower part of the outer mast is connected with drive axle, with weight mainly supported on axle housing. The fork carriage of tilt cylinder on the outer side in the middle of outer mast is connected with piston rod of tilt cylinder. The mast is able to tip forward for 10° and backward for 12° through operating the inclined spool valve of multi-way valve. The inside and outer masts are welded parts, to bear the longitudinal and traverse loads through rollers and side rollers, and to allow the inner mast to rise and fall steadily.

## 7.3 Fork carriage

The fork carriage is also in a structure of welded part, to allow the fork carriage to move upward and downward steadily along the inner edges of the channel steel for the inner mast and to bear the longitudinal and traverse loads through composite roller and single roller with clearance adjustable. As for 1.8-3.5t forklift truck frame, each side has two groups of composite rollers and a group of single roller, a total of four groups of composite rollers and two groups of single rollers make the forklift frame move on the portal frame channel steel from up to down smoothly. When the fork rises to the maximum height, one pair of main rollers on left and right on top will extend to the upper edge of the inner mast.

The fork is locked inside the groove on the fork carriage using lock pins, and the spacing of fork may be adjusted on the left or right manual. International standard (ISO) is applied to fork and fork carriage, to facilitate common use and interchange.

## 7.4 Adjustment of Lifting System

(1) Drop the fork to the ground, and adjust the lift chain, to ensure that the distance between the lower roller center of fork carriage and the lower edge of inner mast is 15-20mm.

(2) Tip back the mast and adjust the tensioning force of lift chain, for the tensioning degrees of lift chain at places b to be equivalent (Fig 8-1).

(3) The strokes of left and right lift cylinders shall be equivalent, and their strokes may be adjusted using cylinder cover 4 (Refer to Fig 7-8.).

(4) Adjust the error of position for the height of left and right lift cylinders by making use of the adjusting bolt on the upper end of right lift cylinder as indicated in Fig 8-2.

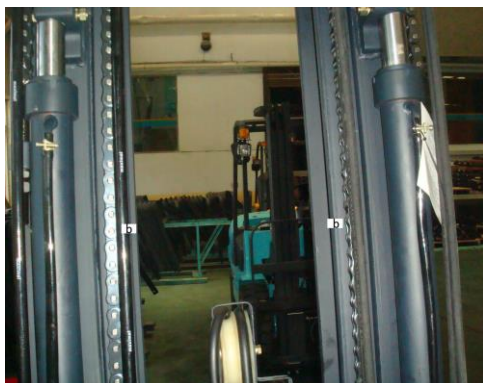


Fig. 8-1

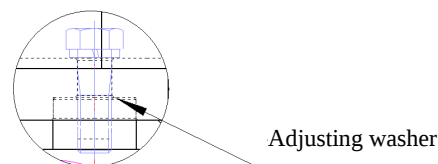


Fig. 8-2

## 8. Electrical System

### 8.1 Overview

The electrical system of the series models is a single-line electrical system with anode bonding, and it's like a forklift truck's "nervous system" to ensure that the forklift truck is working properly. The electrical equipment is mainly composed of following several systems:

#### 1. Power supply system

Power supply system mainly consists of battery, generator, charging indicator light and other components, and supplies power to the electric equipment of the forklift truck. The battery provides power before starting the forklift; the generator provides power when the forklift runs, and at the same time charges the battery, and the charging indicator light is used to display the charging status.

#### 2. Starting System

Starting system is mainly composed of heater plug, key switch, neutral switch, and starter lamp; its function is to start the engine. After the key switch is turned on, the heater plug works, make sure the preheating has completed and the heater plug has stopped working before starting. The starting system has neutral protection function; only if the shift lever is at the neutral position, the engine starts correctly; it can not start.

#### 3. Stop control system

Stop control system is mainly composed of key switch and fuel solenoid valve. When downtime is needed, rotate the key switch to OFF, cut off the power supply of the fuel solenoid valve, and the fuel solenoid valve cuts off oil supply and the engine stops automatically.

#### 4. Instrument system

Instrument system is primarily composed of intelligent instrument, water temperature sensor, oil temperature sensor, fuel sensor, oil pressure switch, oil-water separation switch and other components. Its function is to detect the operation of the forklift truck and displays it through the dashboard, allowing operators to get a good understanding of the state of the forklift.

#### 5. Lighting and sound and light alarm system

The system includes a variety of lighting equipment, signal lights, horn, reversing buzzer, etc.

Front combination lamp: a front combination lamp consists of lights (55W), width lamp (5W) and turn signal (21W) three parts;

Tri-color taillight: a tri-color taillight consists of turn signal (21W), width lamp (5W), stop lamp (21W) and reversing lamp (10W) four parts;

Rear light (55W);

Warning light (2W).

Description of operations:

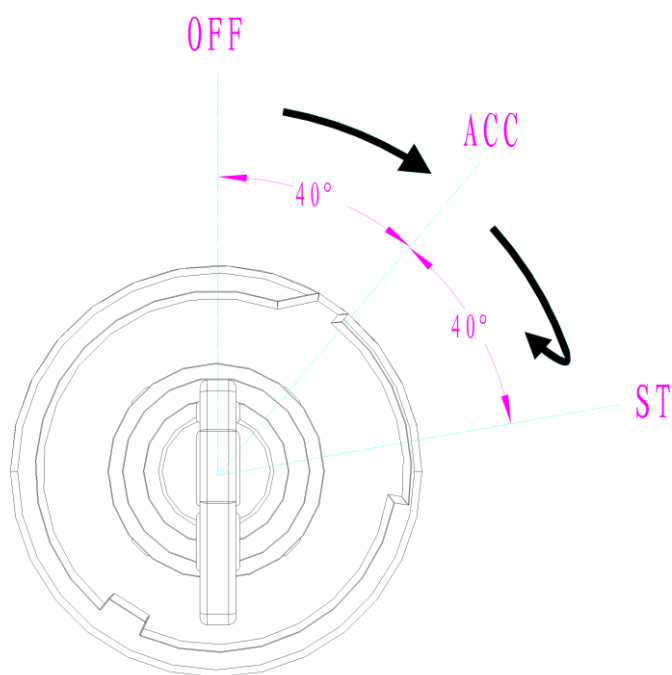
##### 1. Start and stop

Before the engine starts, you should first ensure that the gear control lever is at the neutral position, in which case the meter displays neutral (N), or else the engine will not start. This is

because the forklift has a function of starting protection, to prevent danger.

When the key switch is OFF, you can insert/remove the key; in case that the engine has started, return the key switch to OFF, and the engine will automatically stop.

Rotate the key switch clockwise to the ACC gear, and the forklift is powered on and the preheating system works automatically to heat the air; the preheating indicator light is on, indicating the state of the preheating system. After 8~12S, the preheating is completed, and the preheating system stops automatically, then rotate the key switch clockwise to ST gear, and start the engine. After the engine starts, release the key switch, and reset the key switch to ACC.



Note:

1. After the engine has stopped, do not place the key switch to ACC gear, so as to avoid the power loss to the battery;
2. When the engine is running, do not start rotate the key switch to ST gear, to prevent damage to the motor;
3. When starting, the one-time start time should not exceed 5S, and the twice starting interval is above 120S; if it is impossible to start the engine after starting three times in a row, you should first find out the cause before you start it.

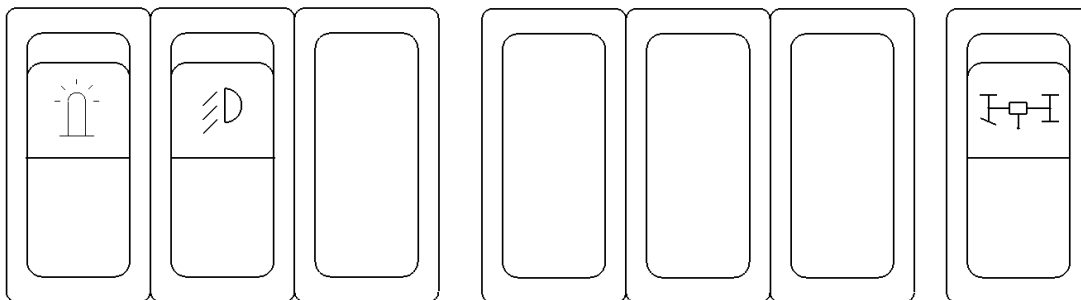
## 8.2 Forklift running

After the engine starts, push the gear shift lever forward, switch the gearbox to the forward gear, and the forklift moves forward and the forward speed of the forklift is controlled by controlling the gas pedal; dial the gear shift lever backward, switch the gearbox to the back speed, and the forklift returns and the backward speed of the forklift is controlled by controlling the gas pedal.

### (1)Rocker switch

Forklift rocker switch group is used to control electrical parts of the forklift. **1** It is used to control the warning light: open the warning light and it is flashing, shut off the warning light

and it goes out; **2** It is used to control the condition of the rear working light: after opening, when the shift lever is situated at the reverse gear, the rear working light is on, and after it is shut down, it will not be off in any conditions; **3** There is a reserved switch. **4** There is a reserved switch. **5** There is a reserved switch. **6**. There is a reserved switch. **7** It is used to control the switching of four-wheel drive and two-wheel drive, and the solenoid valve block is controlled through the electrical signal of the switch; when the switch is open, the solenoid valve coil is electrified, so that the valve element is sucked in and the oil path is smooth, and the oil path is used to control the rear drive of vehicle to run, thus to achieve the effect of driving four-wheel drive at the same time.



#### (2) Horn button

Horn button is positioned at the center of the steering wheel, and the horn sounds after you press it.

#### (3) Direction switch and signal

Direction control and signal: move forward once if the direction switch is pushed ahead forward, and move forward twice if it is pushed ahead forward twice: it is neutral when the direction switch is in the middle, when the neutral indicator light on the instrument is on, indicating that the starter can start, or else the starter can't work; move backward once if the direction switch is returned once, and move backward twice if it is returned twice; when the direction switch is in reverse position, the backup light and warning light are on, and the reversing buzzer sounds.

#### (4) Light control

Rotate the light switch to the first gear, and the front and rear width lamp work; rotate it to the second gear, and the headlight works, in which case the width lamp still works.

#### (5) Turn signal

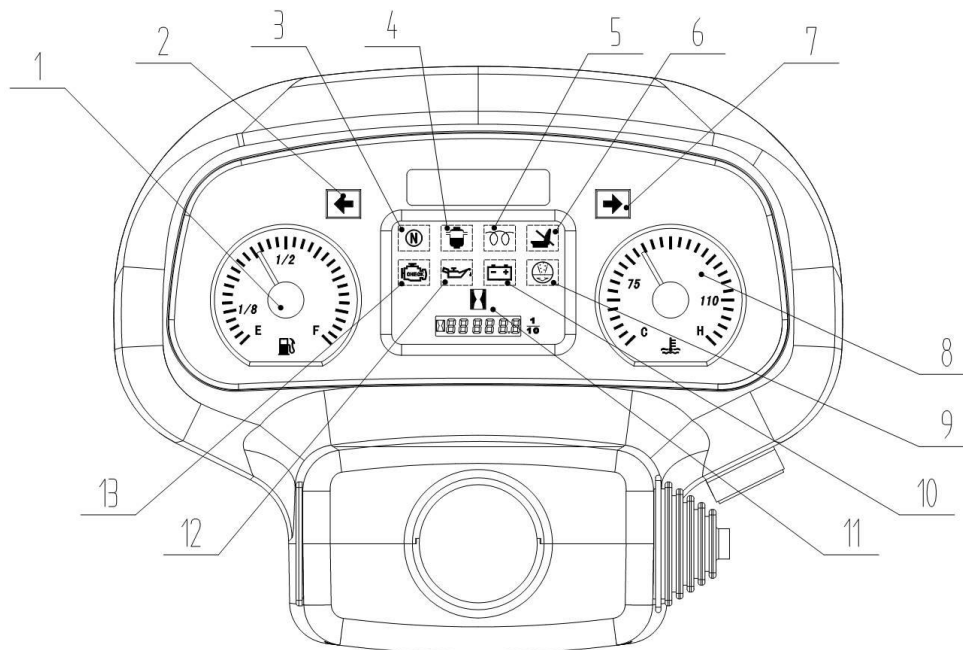
Push the steering switch forward, and the forklift is ready to turn left and the forklift's left turn signal is flashing at a certain frequency; pull the turn switch backward, and the forklift is ready to turn right and the forklift's right turn signal is flashing at a certain frequency.

#### (6) Braking signal

When the forklift needs to be braked, step on the brake pedal, and the brake light works and the forklift is in the braking state.

### 8.3 Introduction to instrument

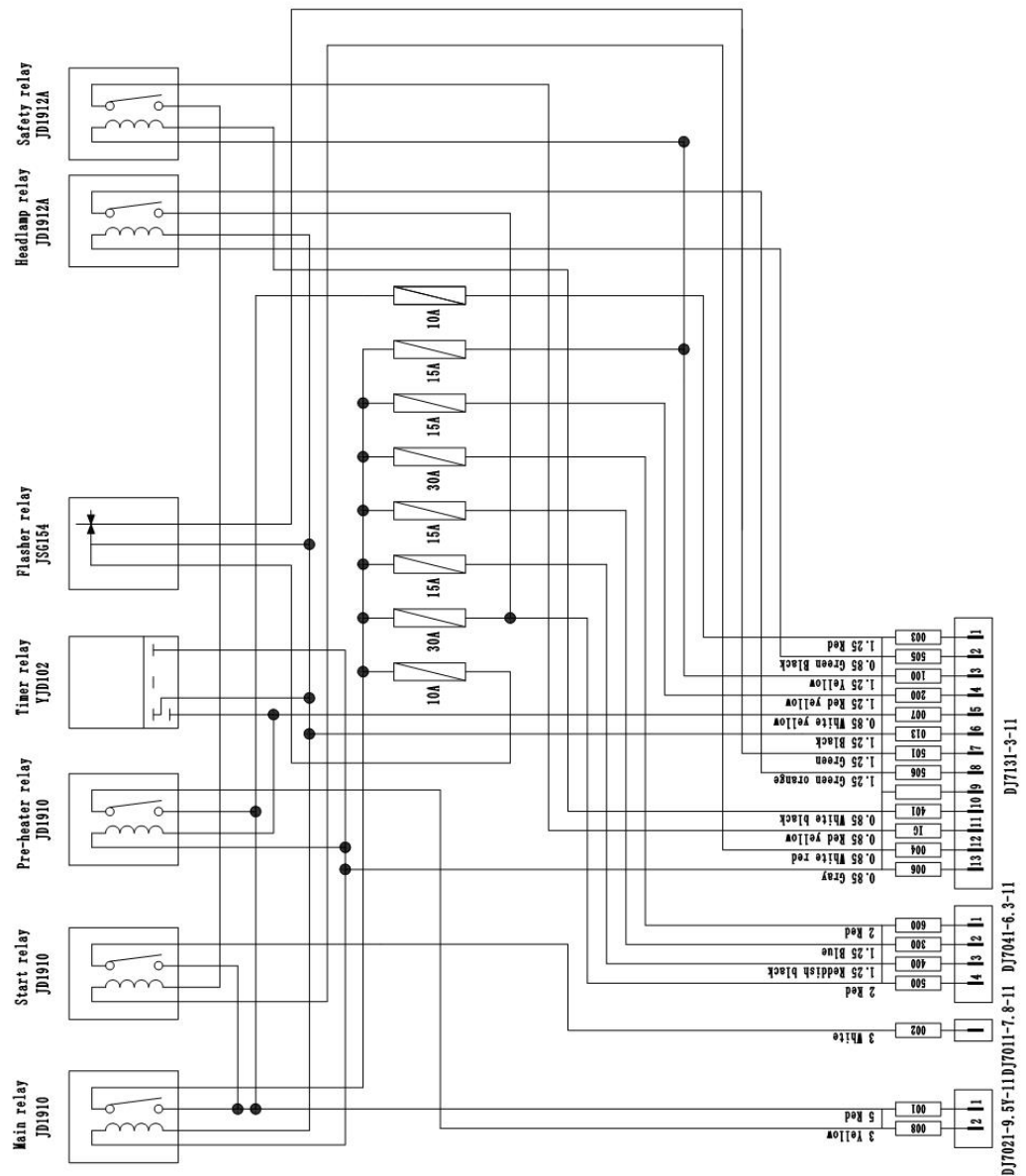
The instrument is used to indicate the working conditions of various critical systems of the forklift, and operators can quickly determine system failure prior to maintenance.



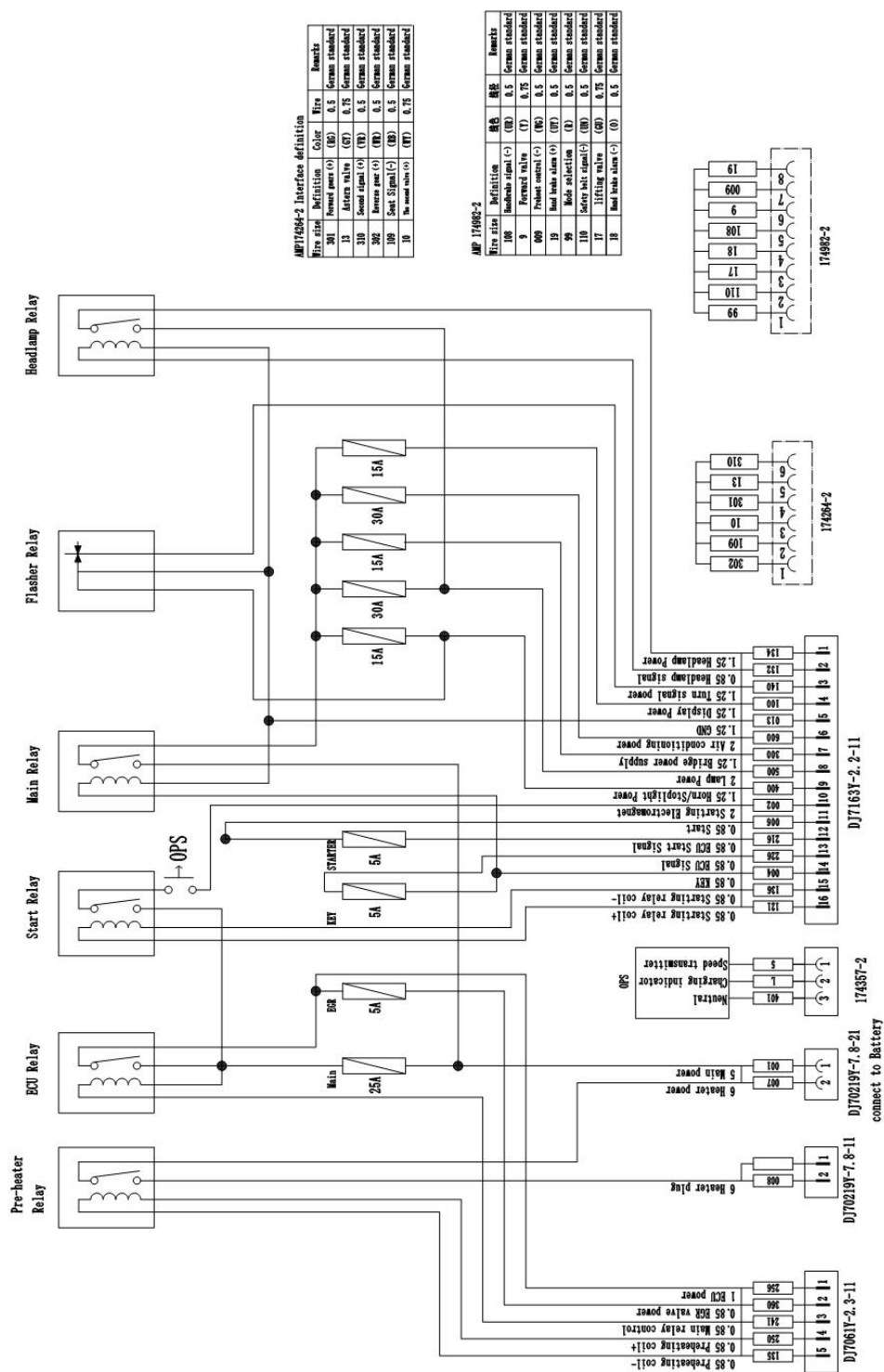
- 1: oil gauge: shows the amount of remaining oil in the fuel tank.
- 2: left-turn indicator light: when lit, it means forklift left-turn indicator light is working;
- 3: neutral indication: N indicates neutral when lit;
- 4: oil-water separation indicator light: when lit, it means that the water content in the oil-water separator is too high, and manual drainage is needed;
- 5: preheating indicator: when lit, it means that engine intake preheating is underway;
- 6: seat indicator: when lit, it means that the person is not in the seat;
- 7: right turn indicator light: when lit, it means forklift right turn indicator light is working;
- 8: water temperature meter: display the water temperature of forklift engine;
- 9: air filter blockage indicator light: on the air filter blockage;
- 10: charging indicator light: when it is on, the generator does not charge the battery;
- 11: timer: cumulative engine working time;
- 12: low oil pressure indicator light: when lit, the engine oil pressure is low;
- 13: fault indicator light: after starting, it indicates that the engine is faulty;

#### 8.4 Introduction to electrical box:

The electrical box is used to install a chip fuse and relay. The chip fuse is used to protect the circuits to prevent electrical appliances and wire being burnt due to short circuit. The relay is used to expand the switch capacity, making the small-capacity switch can control high-power electrical appliances.



YANMAR、S4S



V2403

#### Battery:

The following matters should be paid attention to when the battery is used:

- 1) The battery can produce flammable gases, so there is a danger of explosion. Therefore you should avoid short circuit and sparks, and firework is strictly prohibited, to prevent the occurrence of fire or explosion.
- 2) The battery's electrolyte is dilute sulfuric acid, and it is very dangerous where it is exposed to the skin or eyes, because it can cause burning or blindness. When the electrolyte comes into contact with the skin, rinse immediately with plenty of water, and when it contacts with the eyes, rinse immediately with plenty of water and seek medical advice in a timely manner.
- 3) The battery has self-discharge phenomenon; when the forklift truck is not used for a long time, the battery should be well maintained, and it should be charged on a regular basis.

#### (8) Common faults and instructions

##### Truck unable to start

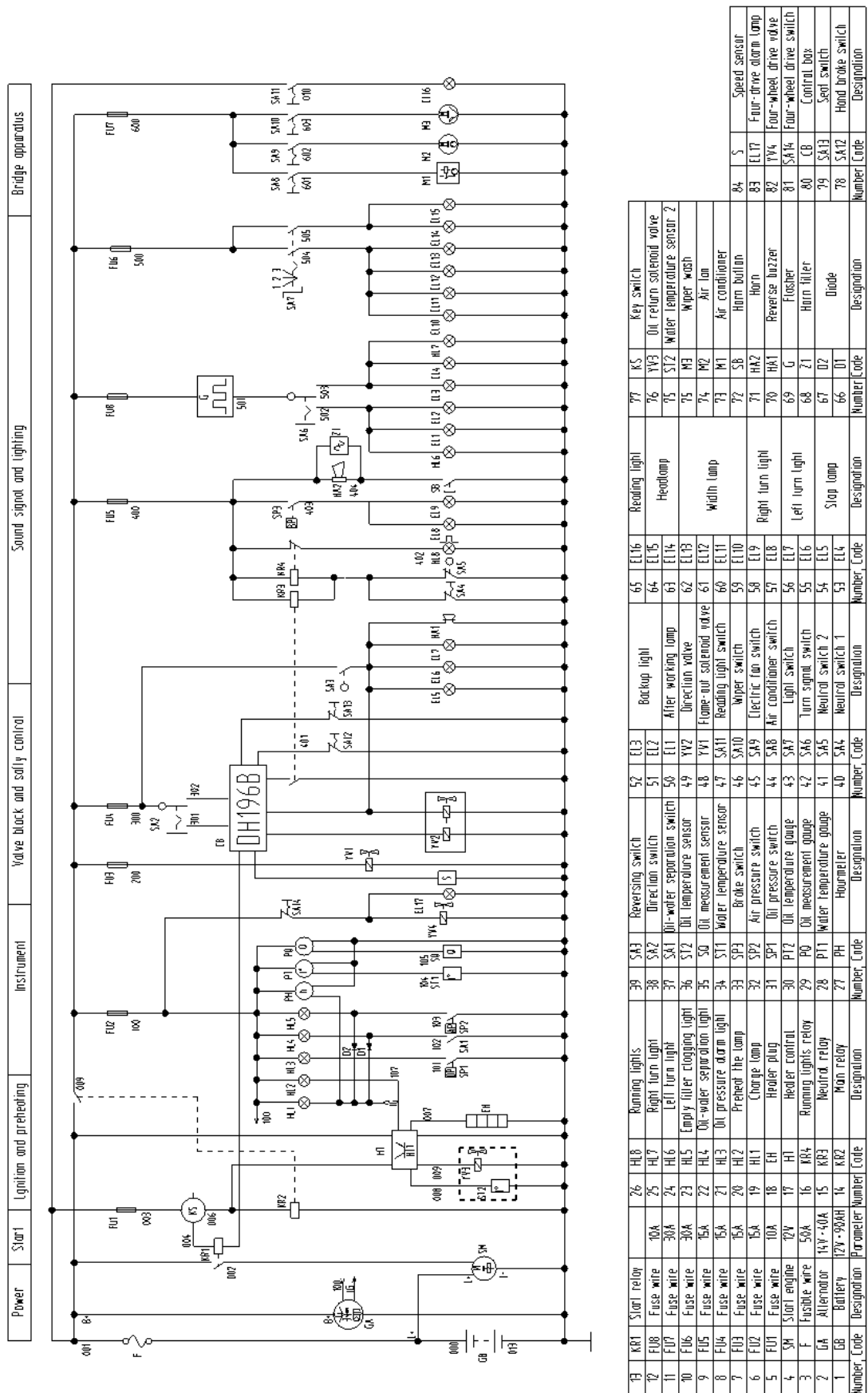
- ① Check the wiring of the battery and whether it is energized.
- ② Check whether the ignition line of the key switch has power output and wiring is correct.
- ③ Check starter wiring is correct.
- ④ Whether the fuse is damaged or disconnected.
- ⑤ Check whether the diesel、gasoline、oil、liquefied gas、oil suction pump、tubing、and oil circuit have been added and connected correctly.
- ⑥ Whether the hand brake has been pulled down、whether the seat belt is fastened and whether the gear is in neutral.

##### Truck cannot walk

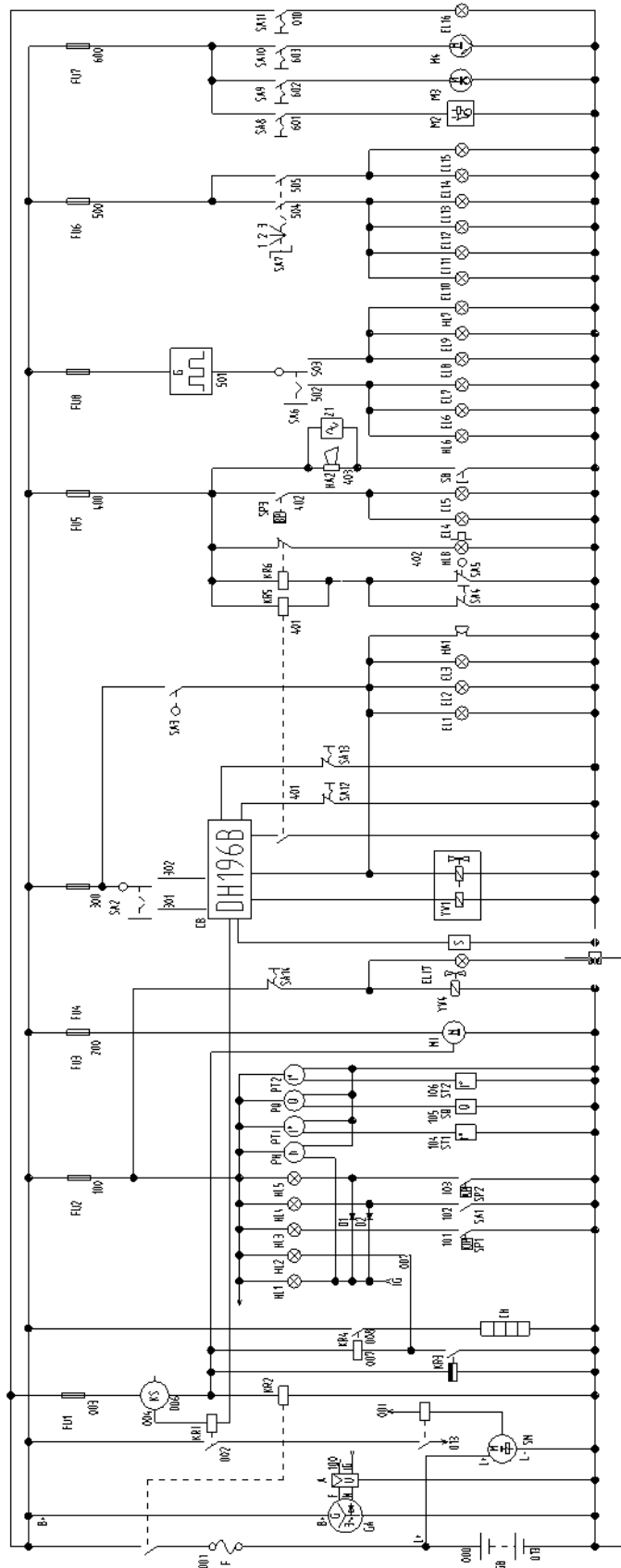
- ① Check the direction switch forward and back for power output.
- ② Transmission direction valve connection is correct、without power input.
- ③ Whether the electric liquid commutation box is damaged and the wiring is correct.
- ④ Check the throttle and the accelerator pedal.
- ⑤ Whether the hand brake is unfastened、the seat belt is fastened.

#### 8.5 Electric System Schematic Drawing

The schematic drawing of different engines differ from each other mainly on the starting system and on the sensor. It is suggested to refer to the specific drawing and real condition of the truck first when carrying out repair.

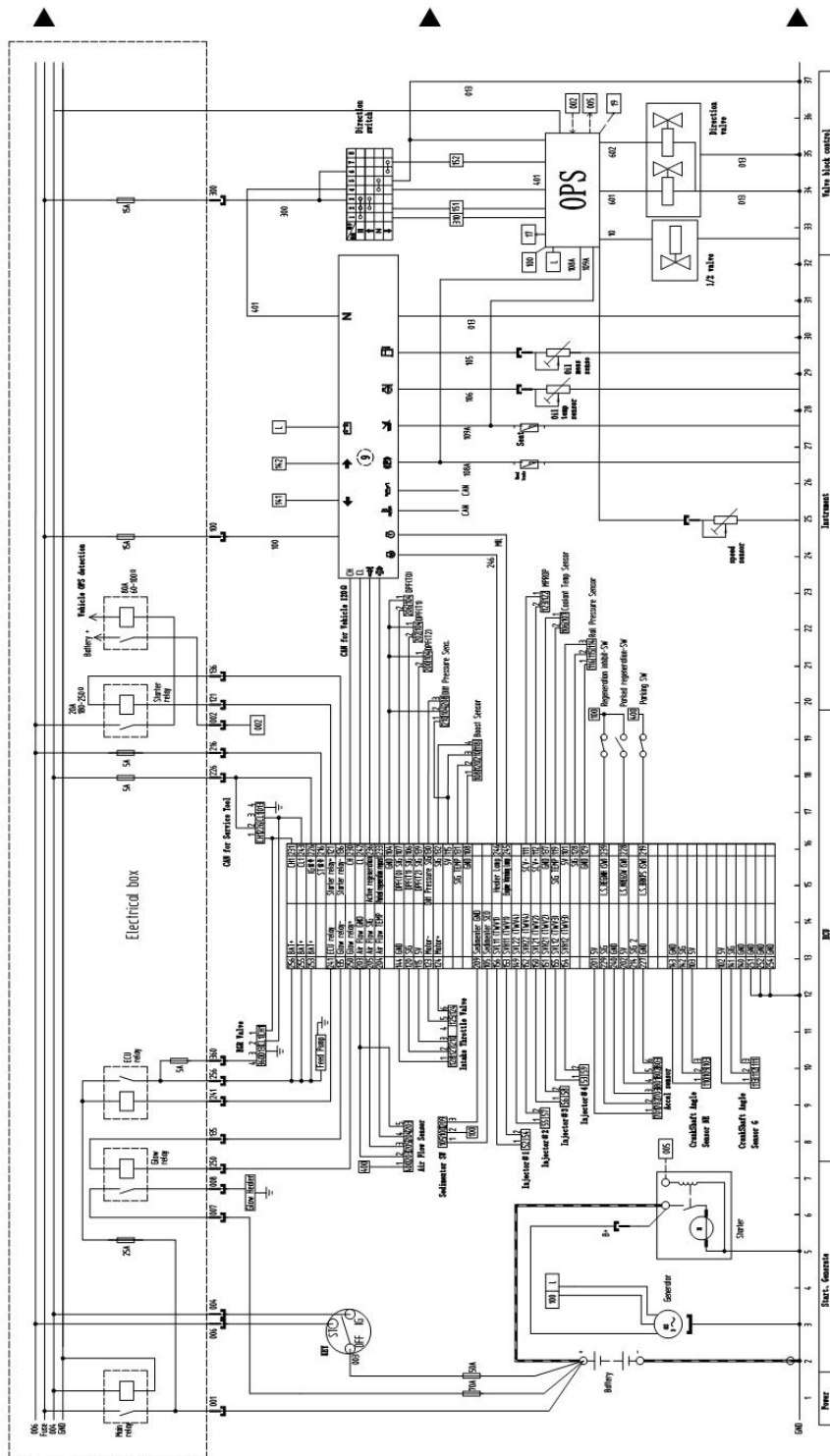


Power Start Ignition and preheating Instrument Valve block and safety control Sound signal and lighting Bridge apparatus

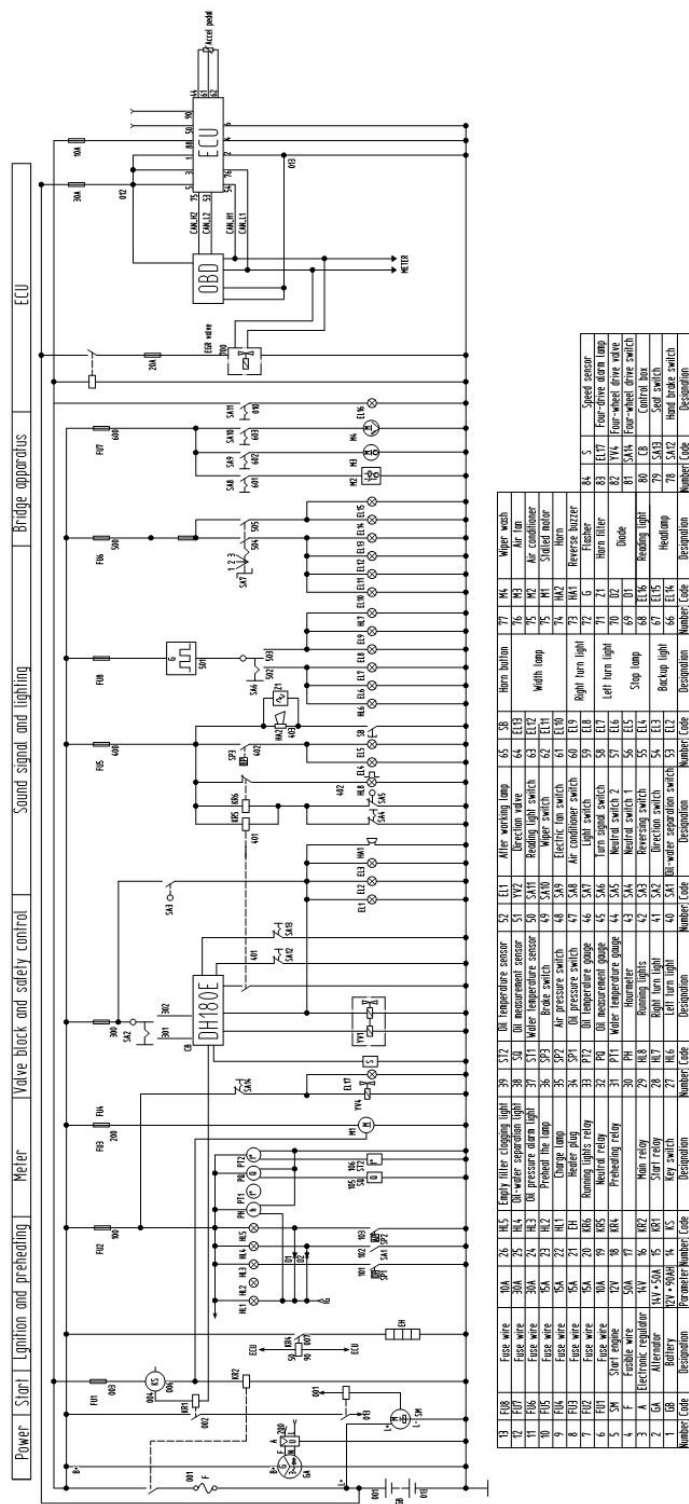


|        |      |                      |           |        |      |                             |        |      |                          |        |      |                             |        |      |             |        |      |                             |
|--------|------|----------------------|-----------|--------|------|-----------------------------|--------|------|--------------------------|--------|------|-----------------------------|--------|------|-------------|--------|------|-----------------------------|
| 13     | F08  | Fuse wire            | 10A       | 26     | H05  | Empty filter clogging light | 39     | S02  | Oil temperature sensor   | 52     | EL1  | After working lamp          | 65     | S0   | Horn button | 77     | M4   | Wiper wash                  |
| 12     | F07  | Fuse wire            | 30A       | 25     | H04  | Oil-water separation light  | 38     | S01  | Oil measurement sensor   | 51     | Y02  | Direction valve             | 64     | EL19 | M3          | 76     | M3   | Air fan                     |
| 11     | F06  | Fuse wire            | 30A       | 24     | H03  | Oil pressure alarm light    | 37     | S11  | Water temperature sensor | 50     | S411 | Reading light switch        | 63     | EL12 | M2          | 75     | M2   | Air conditioner             |
| 10     | F05  | Fuse wire            | 15A       | 23     | H02  | Preheat line lamp           | 36     | S03  | Brake switch             | 49     | S410 | Wiper switch                | 62     | EL11 | M1          | 74     | M1   | Slotted motor               |
| 9      | F04  | Fuse wire            | 15A       | 22     | H01  | Charge lamp                 | 35     | S02  | Air pressure switch      | 48     | S409 | Electric fan switch         | 61     | EL10 | HA2         | 73     | HA1  | Horn                        |
| 8      | F03  | Fuse wire            | 15A       | 21     | FH   | Heater plug                 | 34     | S01  | Oil pressure switch      | 47     | S408 | Air conditioner switch      | 60     | EL9  | HA1         | 72     | G    | Reverse buzzer              |
| 7      | F02  | Fuse wire            | 15A       | 20     | K06  | Running lights relay        | 33     | P02  | Oil temperature gauge    | 46     | S407 | Light switch                | 59     | EL8  | HA1         | 71     | Z1   | Flasher                     |
| 6      | F01  | Fuse wire            | 10A       | 19     | K05  | Preheating relay            | 32     | P01  | Oil measurement gauge    | 45     | S406 | Turn signal switch          | 58     | EL7  | HA1         | 70     | D2   | Horn filler                 |
| 5      | S04  | Start engine         | 12V       | 18     | K04  | Neutral relay               | 31     | P01  | Oil measurement gauge    | 44     | S405 | Neutral switch 2            | 57     | EL6  | HA1         | 69     | D1   | Drone                       |
| 4      | F    | Fusible wire         | 50A       | 17     | K03  | Timer relay                 | 30     | PH   | Hourmeter                | 43     | S404 | Neutral switch 1            | 56     | EL5  | HA1         | 68     | EL16 | Reading light               |
| 3      | A    | Electronic regulator | 14V       | 16     | K02  | Main relay                  | 29     | H08  | Running lights           | 42     | S403 | Reversing switch            | 55     | EL4  | HA1         | 67     | EL15 | Headlamp                    |
| 2      | GA   | Alternator           | 14V-50A   | 15     | K01  | Start relay                 | 28     | H07  | Right turn light         | 41     | S402 | Direction switch            | 54     | EL3  | HA1         | 66     | EL14 | Backup light                |
| 1      | GB   | Battery              | 12V-90AH  | 14     | K5   | Key switch                  | 27     | H06  | Left turn light          | 40     | S401 | Oil-water separation switch | 53     | EL2  | HA1         | 65     | EL13 | Oil-water separation switch |
| Number | Code | Designation          | Parameter | Number | Code | Designation                 | Number | Code | Designation              | Number | Code | Designation                 | Number | Code | Designation | Number | Code | Designation                 |

Electrical schematic diagram(S4S engine)



Electrical schematic diagram(V2403 engine)



Electrical schematic diagram(D04EG engine)

## 8.6 DPF regeneration control - only for KUBOTA V2403 engines

### 8.6.1 DPF state

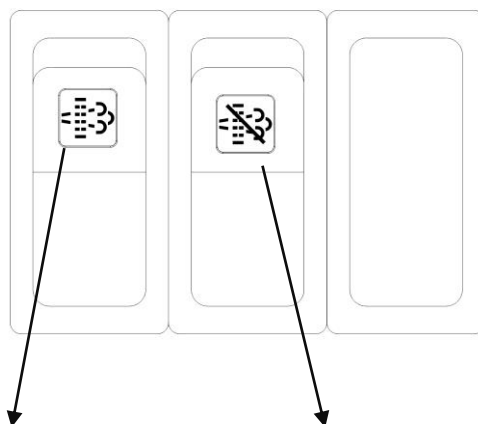
| NO. | DPFstate                               | Level | Note                                                                                                                                                                                                                                                                                                                                                  |
|-----|----------------------------------------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1   | You don't need to regenerate           | 0、1   | No need for parking active regeneration.Operator unable to initiate parking active regeneration.(Parking active regeneration switch is not activated)                                                                                                                                                                                                 |
| 2   | Required regeneration - Request level  | 2     | If DPF does not return to a certain level after 1800 seconds, active regeneration is required.Machine cannot be operated during parking active regeneration.<br>The following safety conditions need to be met during parking active regeneration.<br>- Accelerator pedal position = 0 %<br>- Neutral position switch = on<br>- Parking switch = open |
| 3   | Need to regenerate. - Warning level    | 3     | To protect the DPF, the engine power output is reduced.Active parking regeneration is required.                                                                                                                                                                                                                                                       |
| 4   | Need regeneration. - Maintenance level | 4     | Active parking regeneration can only be performed with maintenance tools.Engine power output decreases.                                                                                                                                                                                                                                               |
| 5   | Need to regenerate - stop level        | 5     | Active regeneration cannot be performed even through maintenance tools.Engine power output is significantly reduced.DPF must be removed and cleaned                                                                                                                                                                                                   |

### 8.6.2 Operator instructions

1: In the process of regeneration, the heavy exhaust temperature will be very high, we should pay attention to avoid close and contact.

2: to protect DPF from dust overload, it is necessary to find an open and smoke-free area for regeneration.

3: before active regeneration, ensure that the handbrake is pulled up, the accelerator pedal has no signal, the gear is in neutral, and the diesel is sufficient. Confirm that there is no problem, and press the automatic regeneration switch.

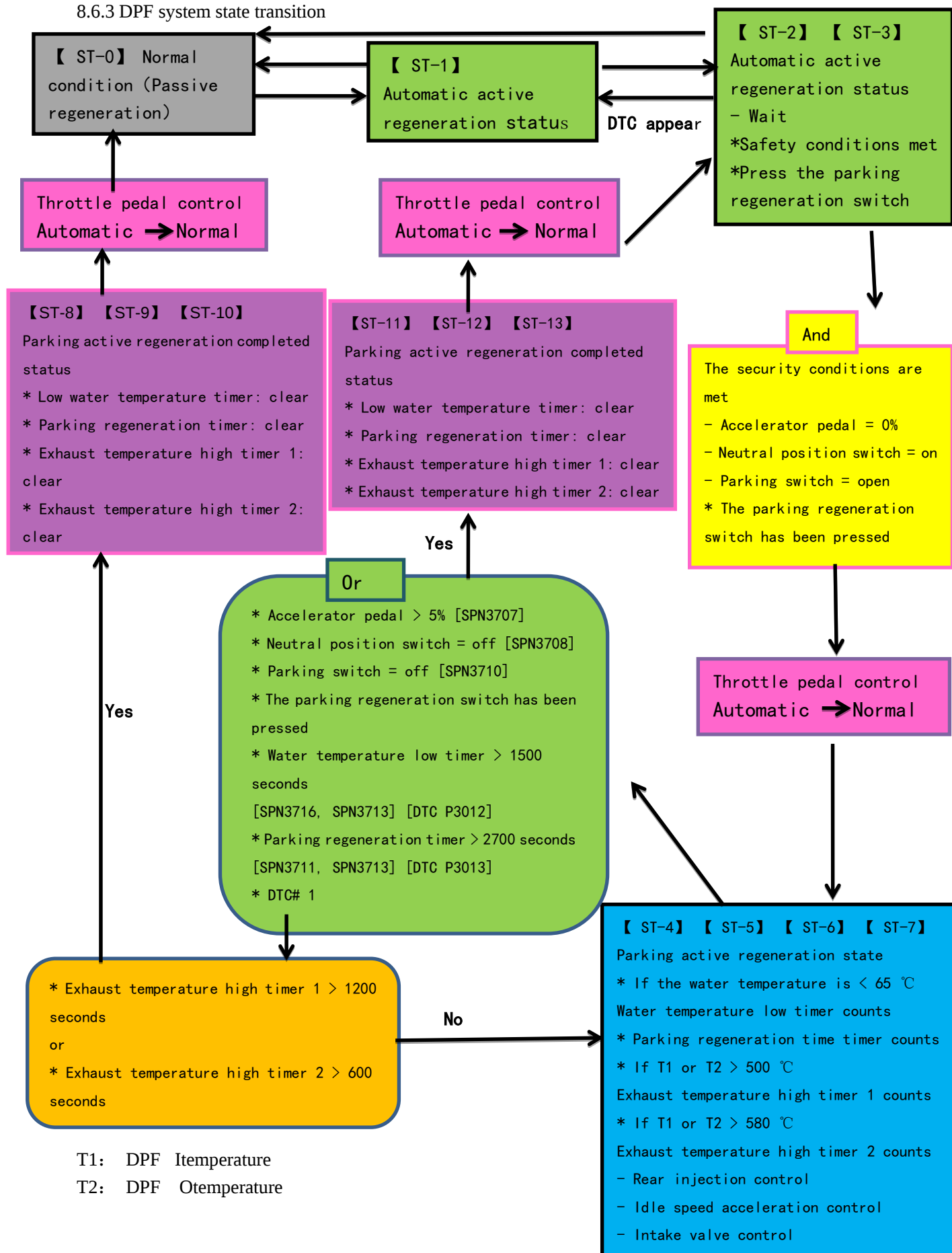


Regeneration of the switch

Regenerative inhibition switch

- 4: Regeneration inhibition switch: the customer does not want to regenerate (for example, in an indoor or flammable warehouse, the customer can press the inhibition switch so that the DPF cannot regenerate)

### 8.6.3 DPF system state transition



## 8.6.4 Indicator status



Inhibition of



Active regenerative finger lamp



Need regeneration/request light



Trouble light

**level0: Passive regeneration only**

|                          |       |       |       |       |
|--------------------------|-------|-------|-------|-------|
| Don't need to regenerate | Open  | Close | Close | Close |
| Don't need to regenerate | Close | Close | Close | Close |

**Level 1: Automatic regeneration**

|                                  |       |             |             |       |
|----------------------------------|-------|-------------|-------------|-------|
| Need to regenerate automatically | Open  | Close       | Normally on | Close |
| It's being regenerated           | Close | Normally on | Normally on | Close |

**Level 2: Automatic or parking regeneration**

|                                                                        |       |             |             |       |
|------------------------------------------------------------------------|-------|-------------|-------------|-------|
| Need to regenerate automatically<br>Need to park for regeneration      | Open  | Close       | Flashing    | Close |
| Automatic regeneration in progress<br>Parking regeneration in progress | Close | Normally on | Normally on | Close |

**Level 3: Reduced function or speed**

|                                  |       |             |             |      |
|----------------------------------|-------|-------------|-------------|------|
| Need to park for regeneration    | Open  | Close       | Flashing    | Open |
| Parking regeneration in progress | Close | Normally on | Normally on | Open |

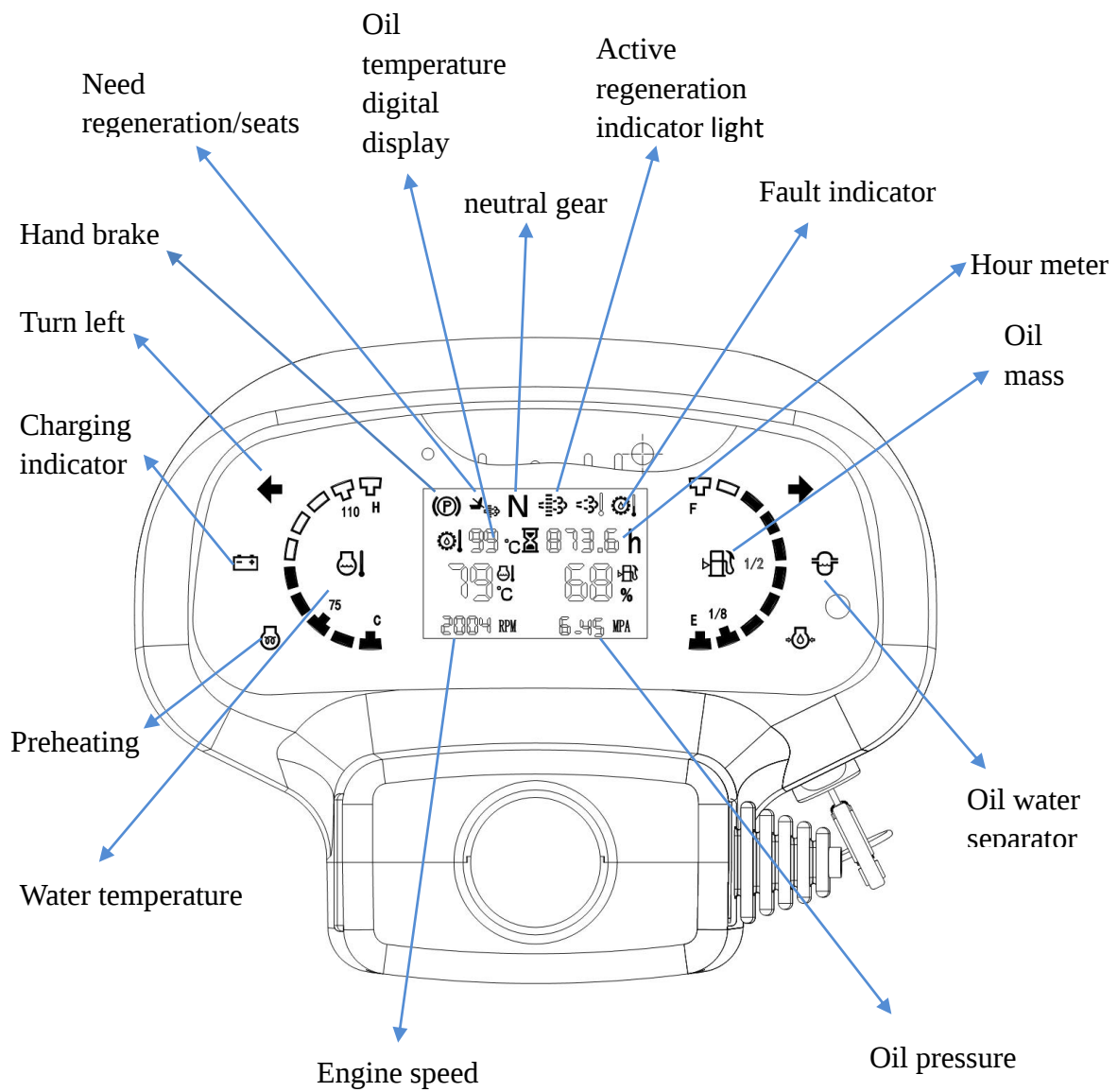
**Level 4: Reduced function or speed**

|                                                                |       |             |             |      |
|----------------------------------------------------------------|-------|-------------|-------------|------|
| Maintenance tools are required to perform parking regeneration | Open  | Close       | Flashing    | Open |
| Perform parking regeneration through maintenance tools         | Close | Normally on | Normally on | Open |

**Level 5: Engine out**

|                                                                               |       |       |          |      |
|-------------------------------------------------------------------------------|-------|-------|----------|------|
| DPF repair and cleaning required (active and parking regeneration prohibited) | Open  | Close | Flashing | Open |
|                                                                               | Close | Close | Flashing | Open |

### 8.6.5 Instrument



## 8.6.6 Kubota engine failure code

| DTC                                                                                     | J1939-73 |         | SPN Name<br>SAE J1939                        | Detection item                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------|----------|---------|----------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                         | SPN      | FM<br>I |                                              |                                                                                                                                                                                                                                                    |
| NE-G phase shift<br>NE: Crankshaft<br>position sensor<br>G: Camshaft<br>position sensor | 636      | 7       | Engine Position Sensor                       | Large phase shift between<br>NE pulse and G pulse                                                                                                                                                                                                  |
| Pressure limiter<br>emergency open                                                      | 633      | 7       | Engine Fuel Actuator 1<br>Control Command    | Pressure limiter<br>emergency open                                                                                                                                                                                                                 |
| High rail pressure                                                                      | 157      | 0       | Engine Injector Metering<br>Rail 1 Pressure  | Actual pressure exceeds<br>the command pressure                                                                                                                                                                                                    |
| SCV (MPROP) stuck                                                                       | 1347     | 7       | Engine Fuel Pump<br>Pressurizing Assembly #1 | SCV stuck at open<br>position<br>(Actual rail pressure<br>continuously exceeds the<br>command rail pressure)                                                                                                                                       |
| Fuel leak (in high<br>pressured fuel<br>system)                                         | 1239     | 1       | Engine Fuel Leakage 1                        | Fuel leak from high<br>pressured fuel system<br>(Fuel consumption is<br>calculated from the<br>difference of fuel pressure<br>of before and after the<br>injection, and the error<br>will be detected when<br>excess fuel consumption<br>is found) |
| Intake air temp. error:<br>Low                                                          | 172      | 4       | Engine Air Inlet<br>Temperature              | Ground short circuit of<br>sensor or harness                                                                                                                                                                                                       |
| Intake air temp. error:<br>High                                                         | 172      | 3       | Engine Air Inlet<br>Temperature              | Open circuit or +B short<br>circuit of sensor or<br>harness                                                                                                                                                                                        |
| Coolant temperature<br>sensor: Low                                                      | 110      | 4       | Engine Coolant Temperature                   | Ground short circuit of<br>sensor or harness                                                                                                                                                                                                       |
| Coolant temperature<br>sensor: High                                                     | 110      | 3       | Engine Coolant Temperature                   | Open circuit or +B short<br>circuit of sensor or<br>harness                                                                                                                                                                                        |
| Rail pressure sensor:<br>Low                                                            | 157      | 4       | Engine Injector Metering<br>Rail 1 Pressure  | Ground short circuit of<br>sensor or harness<br>Failure of sensor                                                                                                                                                                                  |

|                                                                |        |   |                                             |                                                                                  |
|----------------------------------------------------------------|--------|---|---------------------------------------------|----------------------------------------------------------------------------------|
| Rail pressure sensor:<br>High                                  | 157    | 3 | Engine Injector Metering<br>Rail 1 Pressure | Open circuit or +B short<br>circuit of sensor or<br>harness<br>Failure of sensor |
| Injector charge<br>voltage: High                               | 523535 | 0 | proprietary                                 | Injector charge voltage:<br>High                                                 |
| Open circuit of<br>harness or coil in 1st<br>cylinder injector | 651    | 3 | Engine Injector Cylinder #01                | Open circuit of harness<br>Open circuit of injector<br>coil                      |
| Open circuit of<br>harness or coil in 3rd<br>cylinder injector | 653    | 3 | Engine Injector Cylinder #03                | Open circuit of harness<br>Open circuit of injector<br>coil                      |
| Open circuit of<br>harness or coil in 4th<br>cylinder injector | 654    | 3 | Engine Injector Cylinder #04                | Open circuit of harness<br>Open circuit of injector<br>coil                      |
| Open circuit of<br>harness or coil in 2nd<br>cylinder injector | 652    | 3 | Engine Injector Cylinder #02                | Open circuit of harness<br>Open circuit of injector<br>coil                      |
| Engine overheat                                                | 110    | 0 | Engine Coolant Temperature                  | Overheat of engine<br>coolant temperature                                        |
| Engine overrun                                                 | 190    | 0 | Engine Speed                                | Engine speed exceeds<br>threshold speed                                          |
| Boost pressure<br>sensor: Low                                  | 102    | 4 | Engine Intake Manifold #1<br>Pressure       | Ground short circuit of<br>sensor or harness<br>Failure of sensor                |
| Boost pressure<br>sensor: High                                 | 102    | 3 | Engine Intake Manifold #1<br>Pressure       | Open circuit or +B short<br>circuit of sensor or<br>harness<br>Failure of sensor |
| No input of NE<br>sensor (Crank<br>position sensor) pulse      | 636    | 8 | Engine Position Sensor                      | Open circuit or short<br>circuit of sensor or<br>harness<br>Failure of sensor    |
| NE sensor (Crank<br>position sensor) pulse<br>number error     | 636    | 2 | Engine Position Sensor                      | Open circuit or short<br>circuit of sensor or<br>harness<br>Failure of sensor    |
| No input of G sensor<br>(Camshaft position<br>sensor) pulse    | 723    | 8 | Engine Speed 2                              | Open circuit or short<br>circuit of sensor or<br>harness<br>Failure of sensor    |

|                                                        |        |   |                                           |                                                                         |
|--------------------------------------------------------|--------|---|-------------------------------------------|-------------------------------------------------------------------------|
| G-sensor (Camshaft position sensor) pulse number error | 723    | 2 | Engine Speed 2                            | Open circuit or short circuit of sensor or harness<br>Failure of sensor |
| Open circuit of glow relay driving circuit             | 676    | 5 | Engine Glow Plug Relay                    | Open circuit of glow relay                                              |
| +B short of glow relay driving circuit                 | 523544 | 3 | proprietary                               | +B short of glow relay driving circuit                                  |
| Ground short of glow relay driving circuit             | 523544 | 4 | proprietary                               | Ground short of glow relay driving circuit                              |
| Glow heater relay driving circuit overheat             | 676    | 0 | Engine Glow Plug Relay                    | Overheat of glow plug driving circuit                                   |
| Oil pressure error                                     | 100    | 1 | Engine Oil Pressure                       | Oil pressure switch                                                     |
| Battery voltage: Low                                   | 168    | 4 | Battery Potential / Power Input 1         | Open circuit, short circuit or damage of harness<br>Failure of battery  |
| Battery voltage: High                                  | 168    | 3 | Battery Potential / Power Input 1         | Open circuit, short circuit or damage of harness<br>Failure of battery  |
| QR (IQA) data error                                    | 523538 | 2 | proprietary                               | QR data read error                                                      |
| No QR (IQA) data                                       | 523538 | 7 | proprietary                               | QR data is unwritten                                                    |
| ECU FLASH ROM error                                    | 628    | 2 | Program Memory                            | FLASH ROM error                                                         |
| ECU CPU (Main IC) error                                | 1077   | 2 | Engine Fuel Injection Pump Controller     | Failure of CPU and/or IC                                                |
| ECU CPU (Monitoring IC) error                          | 523527 | 2 | proprietary                               | Failure of monitoring IC of CPU                                         |
| Injector charge voltage: Low                           | 523525 | 1 | proprietary                               | Injector charge voltage: Low<br>Failure of charge circuit of ECU        |
| Open circuit of SCV (MPROP)                            | 1347   | 5 | Engine Fuel Pump Pressurizing Assembly #1 | Open circuit of SCV (MPROP)                                             |
| SCV (MPROP) drive system error                         | 1347   | 4 | Engine Fuel Pump Pressurizing Assembly #1 | Ground short circuit of SCV (MPROP)                                     |
| +B short circuit of SCV (MPROP)                        | 1347   | 3 | Engine Fuel Pump Pressurizing Assembly #1 | +B short circuit of SCV (MPROP)                                         |

|                                               |        |    |                                       |                                                                                                                     |
|-----------------------------------------------|--------|----|---------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| Injector drive IC error or Open circuit       | 1077   | 12 | Engine Fuel Injection Pump Controller | Injector drive IC error or Open circuit of No.1 & 4 cylinder injector or Open circuit of No.2 & 3 cylinder injector |
| Internal injector drive circuit short         | 523605 | 6  | proprietary                           | Short circuit in Injector driver IC                                                                                 |
| Sensor supply voltage 1: Low                  | 3509   | 4  | Sensor supply voltage 1               | Sensor supply voltage 1 error or recognition error                                                                  |
| Sensor supply voltage 1: High                 | 3509   | 3  | Sensor supply voltage 1               | Sensor supply voltage 1 error or recognition error                                                                  |
| Sensor supply voltage 2: Low                  | 3510   | 4  | Sensor supply voltage 2               | Sensor supply voltage 2 error or recognition error                                                                  |
| Sensor supply voltage 2: High                 | 3510   | 3  | Sensor supply voltage 2               | Sensor supply voltage 2 error or recognition error                                                                  |
| Sensor supply voltage 3: Low                  | 3511   | 4  | Sensor supply voltage 3               | Sensor supply voltage 3 error or recognition error                                                                  |
| Sensor supply voltage 3: High                 | 3511   | 3  | Sensor supply voltage 3               | Sensor supply voltage 3 error or recognition error                                                                  |
| Main relay is locked in closed position       | 1485   | 2  | ECM Main Relay                        | Failure of main relay                                                                                               |
| Ground short of Starter relay driving circuit | 677    | 4  | Engine Starter Motor Relay            | Ground short of Starter relay driving circuit                                                                       |
| Accelerator position sensor 1: Low            | 91     | 4  | Accelerator Pedal Position 1          | Ground short circuit or open circuit of sensor or harness                                                           |
| Accelerator position sensor 1: High           | 91     | 3  | Accelerator Pedal Position 1          | +B short circuit of sensor or harness                                                                               |
| Accelerator position sensor 2: Low            | 29     | 4  | Accelerator Pedal Position 2          | Ground short circuit or open circuit of sensor or harness                                                           |
| Accelerator position sensor 2: High           | 29     | 3  | Accelerator Pedal Position 2          | +B short circuit of sensor or harness                                                                               |
| Accelerator position sensor error (CAN)       | 523543 | 2  | proprietary                           | Accelerator position sensor signal error (sensor or harness open circuit, ground short circuit etc.)                |
| No.1 & 4 cylinder injector short to +B or GND | 523523 | 3  | proprietary                           | Wiring harness short to +B or Wiring harness short to ground                                                        |

|                                                   |        |    |                                 |                                                                                                           |
|---------------------------------------------------|--------|----|---------------------------------|-----------------------------------------------------------------------------------------------------------|
| No. 2 & 3cylinder injector short to +B or GND     | 523524 | 3  | proprietary                     | Wiring harness short to +B or<br>Wiring harness short to ground                                           |
| Barometric pressure sensor error (Low side)       | 108    | 4  | Barometric Pressure             | Sensor or ECU internal circuit short to ground                                                            |
| Barometric pressure sensor error (High side)      | 108    | 3  | Barometric Pressure             | Sensor or ECU internal circuit short to +B                                                                |
| Pressure limiter not open                         | 679    | 7  | Pressure relief valve           | Rail pressure value is sticking<br>or too low engine power not to open PL valve forcibly                  |
| Rail pressure failure after pressure limiter open | 679    | 16 | Pressure relief valve           | Rail pressure value is too high or low despite the existence of response that the pressure limiter opened |
| CAN2 Bus off                                      | 523547 | 2  | proprietary                     | CAN2 +B or GND short circuit or high traffic error                                                        |
| CAN1 Bus off                                      | 523604 | 2  | proprietary                     | CAN1 +B or GND short circuit or high traffic error                                                        |
| CAN-KBT Frame error                               | 523548 | 2  | proprietary                     | CAN-KBT original frame open circuit error                                                                 |
| DTC Code LIST (After treatment related)           |        |    |                                 |                                                                                                           |
| Intake air temp. built-in MAF sensor: Low         | 171    | 4  | Ambient Air Temperature         | Ground short circuit of sensor or harness                                                                 |
| Intake air temp. built-in MAF sensor: High        | 171    | 3  | Ambient Air Temperature         | Open circuit or +B short circuit of sensor or harness                                                     |
| Intake air volume: Low                            | 132    | 1  | Engine Inlet Air Mass Flow Rate | Engine inlet air mass flow rate lacking (Disconnect turbo blower intake hose)                             |
| MAF sensor: Low Removal of MAF sensor (NCD)       | 132    | 4  | Engine Inlet Air Mass Flow Rate | Open circuit or ground short circuit of sensor or harness                                                 |
| MAF sensor: High                                  | 132    | 3  | Engine Inlet Air Mass Flow Rate | +B short circuit of sensor or harness                                                                     |
| EGR actuator open circuit                         | 523574 | 3  | proprietary                     | EGR actuator open circuit                                                                                 |

|                                               |        |    |                                                                   |                                                       |
|-----------------------------------------------|--------|----|-------------------------------------------------------------------|-------------------------------------------------------|
| EGR actuator coil short                       | 523574 | 4  | proprietary                                                       | EGR actuator coil short                               |
| EGR position sensor failure                   | 523572 | 4  | proprietary                                                       | EGR position sensor failure                           |
| Exhaust gas temperature sensor 1: Low         | 3242   | 4  | Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature | Ground short circuit of sensor or harness             |
| Exhaust gas temperature sensor 1: High        | 3242   | 3  | Aftertreatment 1 Diesel Particulate Filter Intake Gas Temperature | Open circuit or +B short circuit of sensor or harness |
| Exhaust gas temperature sensor 0: Low         | 4765   | 4  | Aftertreatment 1 Diesel Oxidation Catalyst Intake Gas Temperature | Ground short circuit of sensor or harness             |
| Exhaust gas temperature sensor 0: High        | 4765   | 3  | Aftertreatment 1 Diesel Oxidation Catalyst Intake Gas Temperature | Open circuit or +B short circuit of sensor or harness |
| EEPROM check sum error                        | 523700 | 13 | proprietary                                                       | KBT-EEPROM check sum error                            |
| Removal of DPF system (PCD)                   | 3936   | 7  | Aftertreatment Diesel Particulate Filter System                   | Removal of DPF                                        |
| Intake throttle feedback error                | 523580 | 2  | proprietary                                                       | Intake throttle feedback error                        |
| Accelerator position sensor correlation error | 91     | 2  | Accel Pedal Sensor 1                                              | Deviation from designed correlation in two sensors    |
| EGR actuator valve stuck                      | 523575 | 7  | proprietary                                                       | EGR actuator valve stuck                              |
| EGR (DC motor) overheat                       | 523576 | 2  | proprietary                                                       | EGR (DC motor) overheat                               |
| EGR (DC motor) temp. sensor failure           | 523577 | 2  | proprietary                                                       | EGR (DC motor) temp. sensor failure                   |
| Exhaust gas temperature sensor 2: Low         | 3246   | 4  | Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature | Ground short circuit of sensor or harness             |
| Exhaust gas temperature sensor 2: High        | 3246   | 3  | Aftertreatment 1 Diesel Particulate Filter Outlet Gas Temperature | Open circuit or +B short circuit of sensor or harness |
| Differential pressure sensor 1: Low           | 3251   | 4  | Aftertreatment 1 Diesel Particulate Filter Differential Pressure  | Ground short circuit of sensor or harness             |

|                                                                   |        |    |                                                                  |                                                                                                   |
|-------------------------------------------------------------------|--------|----|------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Differential pressure sensor 1: High Failures of PCD system (PCD) | 3251   | 3  | Aftertreatment 1 Diesel Particulate Filter Differential Pressure | Open circuit or +B short circuit of sensor or harness                                             |
| Intake throttle lift sensor: Low                                  | 523582 | 4  | proprietary                                                      | Intake throttle lift sensor: Low                                                                  |
| Intake throttle lift sensor: High                                 | 523582 | 3  | proprietary                                                      | Intake throttle lift sensor: High                                                                 |
| Emission deterioration                                            | 3252   | 0  | Aftertreatment 1 Exhaust Gas Temperature 2 Preliminary FMI       | DOC is heated up due to unburned fuel                                                             |
| Emergency Exhaust gas temperature sensor 0: High                  | 4765   | 0  | Aftertreatment 1 Exhaust Gas Temperature 1 Preliminary FMI       | DOC inlet temp. (T0): High                                                                        |
| Emergency Exhaust gas temperature sensor 1: High                  | 3242   | 0  | Aftertreatment 1 Exhaust Gas Temperature 2 Preliminary FMI       | DPF inlet temp. (T1): High                                                                        |
| Emergency Exhaust gas temperature sensor 2: High                  | 3246   | 0  | Aftertreatment 1 Exhaust Gas Temperature 3 Preliminary FMI       | DPF outlet temp. (T2): High                                                                       |
| Excessive PM3                                                     | 3701   | 15 | Diesel Particulate Filter Status                                 | PM accumulation level 3                                                                           |
| Excessive PM4                                                     | 3701   | 16 | Diesel Particulate Filter Status                                 | PM accumulation level 4                                                                           |
| Excessive PM5                                                     | 3701   | 0  | Diesel Particulate Filter Status                                 | PM accumulation level 5                                                                           |
| Boost pressure: Low                                               | 132    | 15 | Engine Inlet Air Mass Flow Rate                                  | Disconnect the hose between the turbo blower out and intake flange<br>Boost pressure sensor error |
| Low coolant temp. in parked regeneration                          | 523589 | 17 | proprietary                                                      | During regeneration mode, Engine warm-up condition is not satisfied (coolant temp. is low)        |
| Parked regeneration time out                                      | 523590 | 16 | proprietary                                                      | Time out error: regeneration incomplete due to low temperature of DPF                             |
| Loss of Function of DPF (PCD)                                     | 3936   | 2  | Aftertreatment Diesel Particulate Filter System                  | Loss of function of DPF                                                                           |

|                                                          |        |    |             |                                                                       |
|----------------------------------------------------------|--------|----|-------------|-----------------------------------------------------------------------|
| All exhaust temp. sensor failure                         | 523599 | 0  | proprietary | All exhaust temp. sensor failure simultaneously                       |
| High exhaust gas temp. after emergency high temp. DTC    | 523601 | 0  | proprietary | Exhaust gas temperature sensor 0, 1, 2 output                         |
| High frequency of regeneration                           | 523602 | 0  | proprietary | Time interval from the end time to the start time of the regeneration |
| Over heat pre-caution                                    | 523603 | 15 | proprietary | Coolant temp.                                                         |
| No communication with EGR<br>Removal of EGR system (NCD) | 523578 | 2  | proprietary | No communication with EGR                                             |
| CAN CCVS (Parking SW and Vehicle speed) frame error      | 523591 | 2  | proprietary | CAN_CCVS communication stopping                                       |
| CAN CM1 (Regen SW) frame error                           | 523592 | 2  | proprietary | CAN_CM1 communication stopping                                        |
| CAN ETC5 (Neutral SW) frame error                        | 523595 | 2  | proprietary | CAN_ETC5 communication stopping                                       |
| CAN TSC1 frame error                                     | 523596 | 2  | proprietary | CAN_TSC1 communication stopping                                       |
| CAN EBC1 frame error                                     | 523598 | 2  | proprietary | CAN_EBC1 communication stopping                                       |

#### IV. Drive, Operation, and Routine Maintenance of Forklift Truck

The forklift drivers and management personnel must bear in mind “Safety First”, and perform safety operation and standard operation according to the forklift truck operation and maintenance manual as well as driver manual.

##### 1. Conveyance of Forklift Truck

Attention must be paid to following items when container or motor vehicle is used to convey forklift trucks:

(1) Trigger the parking brake.

(2) It is required to fasten properly the front part and the rear part of the mast and the counter weight using steel wire, and to wedge up properly the corresponding positions of front and rear wheels using wedge blocks.

(3) Do as the Drivers' Manual states during lifting operation.

##### 2. Storage of Forklift Truck

(1) Drain the fuel completely (Cooling water is not to be drained if it is the antirust and anti-freezing fluid.).

(2) Coat antirust oil on the surface of un-painted parts, and coat lubricating oil on the lift chain.

(3) Drop the door to the lowest position.

(4) Trigger the parking brake.

(5) Fill the front and rear wheels properly using wedge blocks.

##### 3. Preparation prior to Operation

(1) Avoid examining fuel, oil leak, and oil level as well as examining electrical instrument in the place with open fire, and avoid adding fuel during operation.

(2) Examine air pressure of tyres.

(3) The handle for forward and reversing gear shall be placed at the middle position (the position of part).

(4) Don't smoke when fuel system is work and when battery is examined.

(5) Examine the status of respective handles and pedals.

(6) Get well prepared prior to start.

(7) Loosen the parking brake.

(8) Perform the test actions for lift and drop, forward and backward tip of mast as well as steering and brake of forklift truck.

(9) The degree for contamination of hydraulic oil is larger than Grade 12, and the NAS1638 “Requirement for Cleanliness of Parts with Hydraulic System” is to be followed as test standard.

##### 4. Operation of Forklift Truck

(1) The forklift truck must be driven by drivers who have been trained and hold driving license.

(2) The operators shall wear shoes, helmet, clothes, and gloves usable for safety protection during operation.

(3) Examine respective controls and warning devices before truck is driven, and it is required to operate the truck after repair in the case when any damage or defect is found.

(4) Load shall not exceed the specified values during conveyance. Fork must be completely

inserted under the cargo, and cargo shall be uniformly placed on the fork. It is not allowed to pick up cargo using single fork tip.

(5) Smoothly perform start, turning, driving, brake, and stop. Slow down at turning, on wet or smooth pavements.

(6) It is required to place cargo as low as possible, and to keep the mast tilt backwards, when cargo is load for driving.

(7) It is required to be careful during driving on a ramp. It is required to drive forward during upgrade and drive reversely during downgrade, when the truck is driven on a ramp larger than 1/10. Turning shall be avoided by all means, and please never perform loading-unloading operation when forklift truck is running downgrade.

(8) It is required to pay attention to passengers, obstacles, and low-lying pavements, and pay attention to the clearance above the forklift truck, during driving.

(9) It is not allowed for anyone to stand on fork and it is not allowed for anyone to be carried on truck.

(10) It is not allowed for anyone to stand under the fork, or to walk under the fork.

(11) It is not allowed to control the truck and spreaders at any position other than the driver seat.

(12) It is required to pay attention to the fall of cargo from above, for any high lift forklift trucks with a lifting height larger than 3m, and protective measures must be taken, when necessary.

(13) Try as much as possible to tip backward the mast for high-lift forklift trucks during work, and it is required to perform front or back tip within the minimum range during loading-unloading operation.

(14) It is required to take a doubled care, and to drive slowly, during running on dock or on temporary planks.

(15) Driver shall not stay on the truck, when fuel is added, and the engine shall be turned off. Ignition is to be avoided when battery or level of oil tank is examined.

(16) The forklift trucks with spreaders shall be operated as loaded forklift trucks during empty-load operation.

(17) Don't convey unfixed or loosely stacked cargo, and take care when cargo of relatively large size is conveyed.

(18) Drop the fork onto the ground, and put the handle for gear position to neutral gear, and turn off the engine or disconnect the power supply when driver leaves the truck. Pull the parking brake device properly when truck is parked on a ramp, while wedge blocks must be used to fill up the wheels when the truck is to be parked there for a long time.

(19) It is not allowed to open water tank cover carelessly, under the condition when engine is very hot.

(20) The pressures of multi-way valve and safety valve have been properly adjusted before delivery of forklift truck from factory, and users shall not adjust them at discretion during use, to avoid damage of entire hydraulic system and hydraulic components due to excessively high adjustment.

(21) The value of air pressure specified on the label plate of "Tyre Air Pressure" shall be followed for tyre air charge.

(22) The maximum noise outside the forklift truck is not to be larger than 104 dB (A), and

JB/T3300 shall be followed as test method.

(23) The forklift with a self-locking function, turn speed must not be greater than 5KM/h.

(24) Heavy-lifting height exceeding 1200, not leaning forward.

## 5. Notices for application of Cooling System

(1) When forklift truck is being used, in the case when radiator is overheated or temperature of coolant is excessively high, try as much as possible not to open the radiator cover immediately. Examine the liquid level, in order to find the overheating cause. When cover has to be opened, it is required to drop engine to medium speed. Turn the radiator cover slowly and loosen off the cover after waiting for a while, to avoid scald of operator by splash of coolant.

Make sure to screw the radiator cover properly in place, when it is tightened up, and otherwise it is difficult to build up a specified pressure system.

(2) Regarding the radiator with coolant used as cleaning water, the water in radiator shall be drained out, only when truck is parked in cold weather and risk exists for water to be frozen. The radiator shall be detached, after it has worked for a period of time, and shall be cleaned in the boiled soda solution, to remove the scale or sediment formed on respective inner surfaces of radiator.

(3) Regarding radiator with long-acting antirust and anti-freezing fluid (model as FD-2 type -35°C) used for coolant, it is strictly prohibited to randomly add water and anti-freezing fluid of different models. The antirust and anti-freezing fluid of the same model shall be supplemented after anti-freezing fluid is leaked or evaporated.

Anti-freezing fluid is generally used both in winter and summer, not changed for four seasons. It shall be drained out for filtration and purification treatment after use for one year in general, to be then further used.

(4) According to different work conditions, the smudge on the outer surface of radiator shall be periodically cleaned and removed, either to be soak cleaned using detergent, or to be flushed using compressed air or high-pressure water (pressure not larger than 40kg/cm).

## 6. Oils Used for Forklift Truck

| Name                | Brand or Code (Domestic)                                                                                                                                                                       |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Gasoline            | 93#                                                                                                                                                                                            |
| Diesel Oil          | To be selected and used according to diesel engine operation and maintenance manual, or according to GB252-2015 Light Diesel Oil.<br>Summer 0# Winter -10~ -35#                                |
| Engine Oil          | To be selected and used according to engine operation and maintenance manual, or according to Diesel Engine: GB11121-2006 standard requirements and the tough degree of its working conditions |
| Hydraulic Oil       | L-HM32                                                                                                                                                                                         |
| Hydraulic Drive Oil | 6# Hydraulic Drive Oil                                                                                                                                                                         |
| Gear Oil            | 85W/90                                                                                                                                                                                         |
| Brake Fluid         | ZSM207 DOT3 Synthetic Brake Fluid                                                                                                                                                              |
| Lubricating Oil     | 3# Lithium Base Lubricating Grease Drop Point 170                                                                                                                                              |

## 7. Drawing of Lubricating System

