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## PREFACE

This manual introduces a new type of internal combustion counter-balanced forklift truck with front axle drive. The KB(G)15/20 (D+) forklift trucks are featured by a wide-vision mast system, full hydraulic steering unit, automatic servo brake, new stepless speed regulator, pedaled parking braking device, integrated overhead guard and high quality large screen combination instrument. So they have a lot of advantages such as excellent performance, easy operation, wide vision, flexible steering, reliable braking, strong power, low noise, no pollution and aesthetic appearance. These trucks are applicable to loading, handling and stacking in factories, mines, stations, ports, freight yards, warehouses, food processing and light industries. They are the ideal equipment of loading and unloading mechanization. The forklift trucks equipped with various attachments, such as bucket, clamp, hanger and so on, will be used wider.

This manual briefly introduces technical parameters of KB(G)15/20 (D+) internal combustion counter-balanced forklift truck, structure, working principle, operation, maintenance and service of key parts. Read the manual Carefully before operation. Strictly follow the rules and notices in this manual as correct and safe operation enables your trucks under the best working state for a long period and exerts the maximum efficiency.

Information in this manual is subjected to changes without prior notice as part and device are continuously improving.

If you have any other questions or opinions on the forklift trucks, please consult forklift dealer. Welcome you to ask questions, Suggestions and criticisms. Thank you for your trust to baoli forklift.

Sincerely wish you a good mood and everything goes well in the process of using the forklift.

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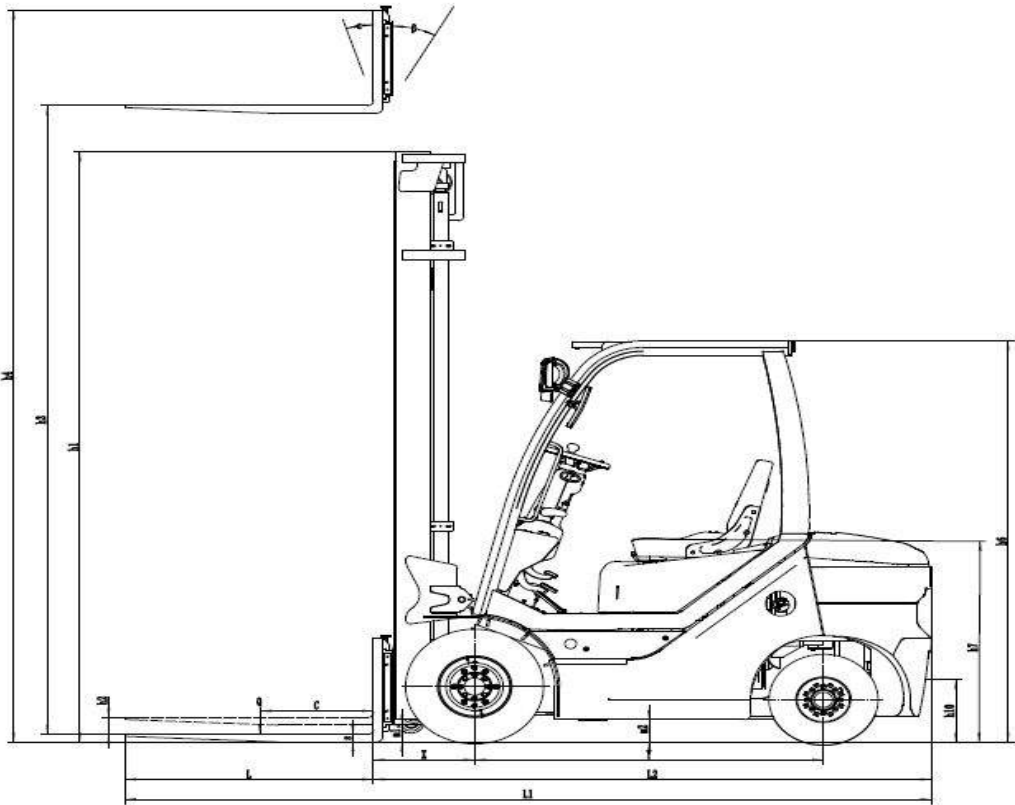
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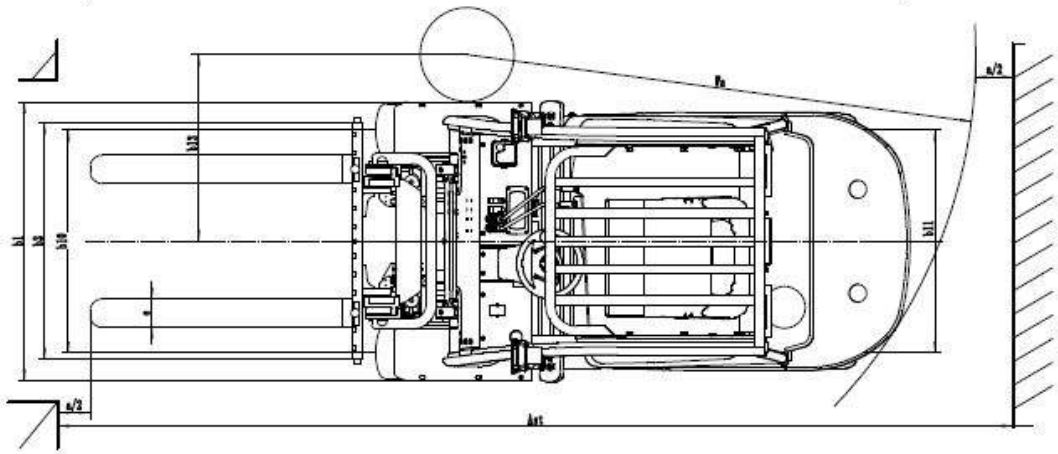
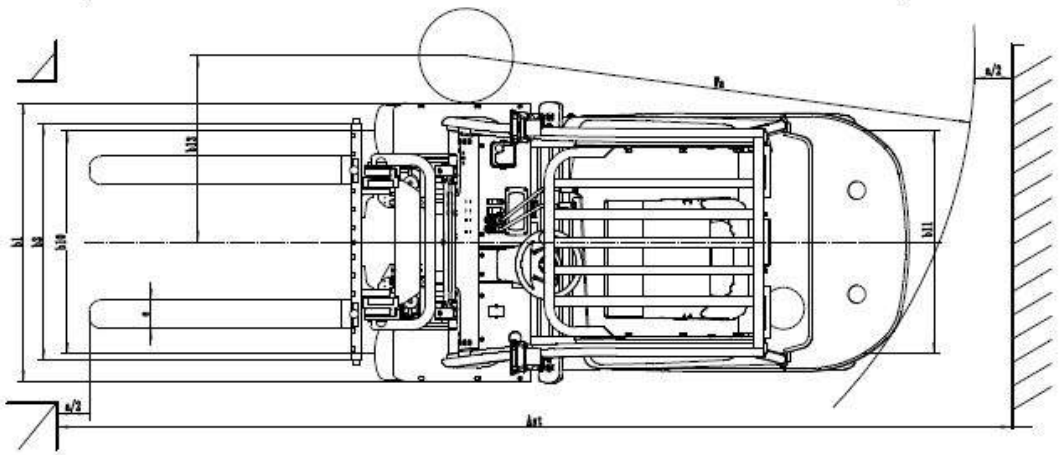
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## **I. About forklift truck**

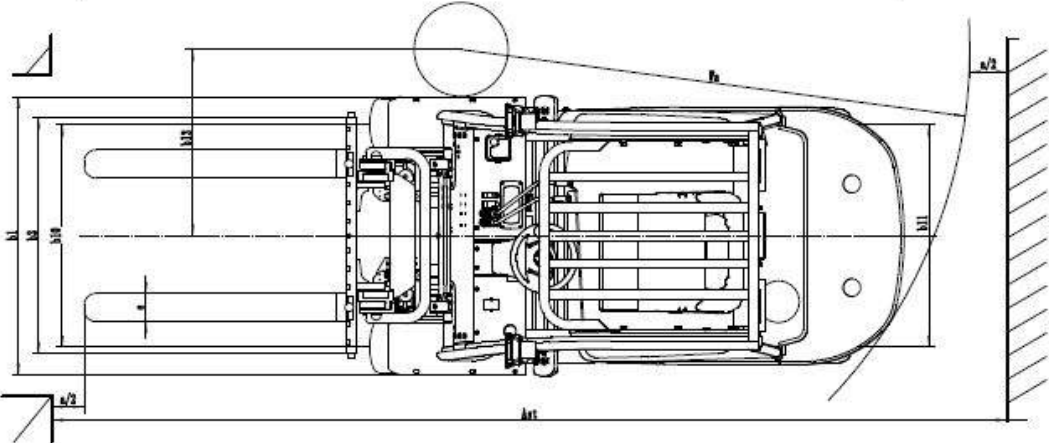
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## 1. Outside View





## 2. Technical Parameters

| POS   | ITEM DESCRIPTION   | UNIT  | DESIGN VALUE |               |               |
|---|--|---|--------------|---------------|---------------|
|   |  |   | KBG15        | KBG18         |               |
| Spec<br>ificat<br>ion                                 | 1.1  | Manufacturer  |              | KION Baoli    | KION Baoli    |
|   | 1.2  | Model designation   |              | KBG15         | KBG18         |
|   | 1.3  | Type of drive:<br>Electric-Diesel-Petrol-LPG-Network<br>Power(Electric) |              | Gasoline      | Gasoline      |
|   | 1.4  | Operation Type:Hand-stand on-Driver<br>seated                           |              | Driver seated | Driver seated |
|   | 1.5  | Load Capacity   | Q(kg)        | 1500          | 1800          |
|   | 1.6  | Load Barycenter Distance  | C(mm)        | 500           | 500           |
|   | 1.8  | Axle centre to fork face  | X(mm)        | 435           | 435           |
|   | 1.9  | Wheel Base  | Y(mm)        | 1500          | 1500          |
| Wei<br>ght  | 2.1  | Service Weight  | kg           | 2960          | 3108          |
|   | 2.2  | Axle weight with Rated Load front/rear                                  | kg           | 4014/446      | 4417/491      |
|   | 2.3  | Axle weight without Load front/rear                                     | kg           | 1184/1776     | 1243/1865     |
| 3.1   | Tyres:SE-Super elastic PN-Pneumatic  |   | PN           | PN            |               |
| wh<br>eels<br>and<br>tyres                            |  |   |              |               |               |
| Dime<br>nsio<br>ns<br>and<br>Over<br>all<br>Size<br>s |  |   |              |               |               |

|      |  |           |             |             |
|------|--|-----------|-------------|-------------|
| 4.7  | Overhead Guard Height                                      | h6(mm)    | 2065        | 2065        |
| 4.8  | Seat Height  | h7(mm)    | 1010        | 1010        |
| 4.12 | Drawbar Height   | h10(mm)   | 220         | 220         |
| 4.19 | Overall Length (including forks arms 1000mm)               | L1(mm)    | 3432        | 3466        |
| 4.20 | Lenght to Face of Forks                                    | L2(mm)    | 2362        | 2396        |
| 4.21 | Overall Width  | b1(mm)    | 1177        | 1177        |
| 4.22 | Fork Arms Dimensions                                       | s/e/L(mm) | 35/120/1070 | 35/120/1070 |
| 4.23 | Fork Carriage in Compliance with ISO 2328 Class/Form A,B   |           | A           | A           |
| 4.24 | Fork Carriage Width  | b3(mm)    |             | 1100        |
| 4.31 | Ground Clearance below Mast(with load)                     | m1(mm)    | 110         | 110         |
| 4.32 | Ground Clearance Centre of Wheelbase(with load)            | m2(mm)    | 105         | 105         |
| 4.33 | Aisle Width with pallet 1000×1200 and Fork Arms Pitch 1200 | Ast(mm)   | 3795        | 3815        |
| 4.35 | Turning Radius   | Wa(mm)    | 2160        | 2180        |
| 4.36 | Turning Point Minimum Distance from the Truck Center Line  | b13(mm)   |             |             |

| POS         |     | ITEM DESCRIPTION |   | DESIGN VALUE |             |             |
|-------------|-----|------------------|---|--------------|-------------|-------------|
| KBG15       |     | KBG18            |   | KBG20        |             |             |
| Performance | 5.1 | UNIT             | Drive Speed with/without load                             | km/h         | 16.1/16.1   | 15.7/16.5   |
|             | 5.2 |                  | Lifting Speed with/without load                           | mm/s         | 461.5/699.3 | 655/694.1   |
|             | 5.3 |                  | Lowering Speed with/without load                          | mm/s         | 381.7/421.2 | 519.9/531.9 |
|             | 5.5 |                  | Drawbar Pull Tractive Effort (at 2km/h) with/without load | N            | 20/10       | 20/8        |
|             | 5.7 |                  | Gradeability (at 2km/h)                                   | %            | 20          | 20          |



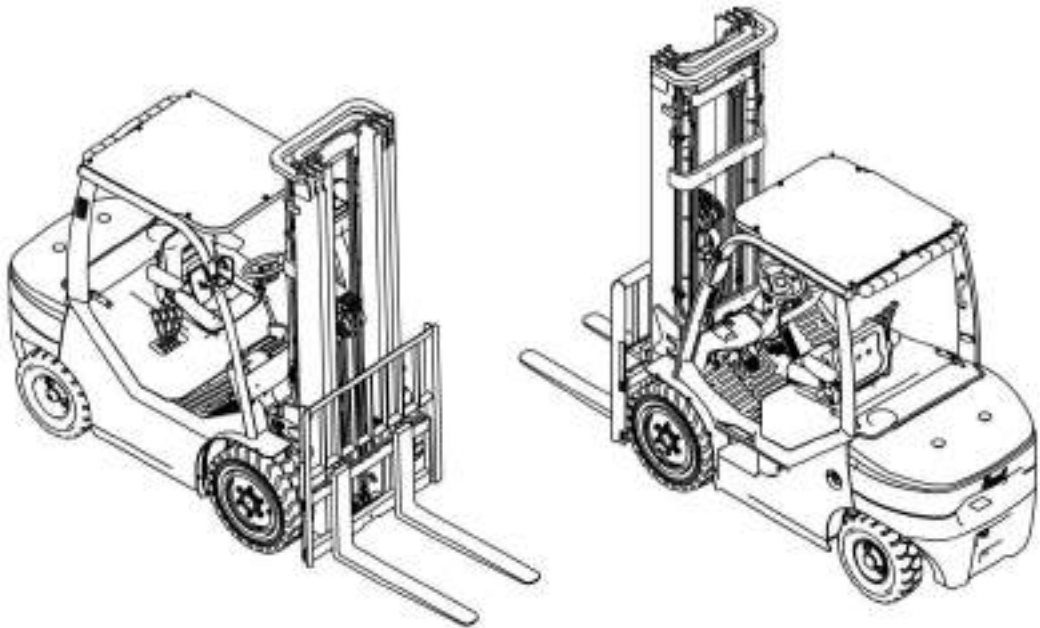
|        |      |   |                 |                             |                             |
|--------|------|---|-----------------|-----------------------------|-----------------------------|
|        |      | with/without load                             |                 |                             |                             |
|        | 5.10 | Service Brake                                 |                 | Mechanical/hydraulic        | Mechanical/hydraulic        |
| Engine | 7.1  | Engine Manufacturer/Engine Type               |                 | Nissan K21                  | Nissan K21                  |
|        | 7.2  | Engine Power in compliance with ISO 1585      | kw              | 32.3                        | 32.3                        |
|        | 7.3  | Rated Number of Revolutions                   | /min            | 2400                        | 2400                        |
|        | 7.4  | Cylinder Number/Displacement                  | cm <sup>3</sup> | 4/2095                      | 4/2095                      |
|        | 7.5  | Fuel Consumption in compliance with VDI-Cycle | l/h             | 4.1L/h                      | 4.21L/h                     |
| Others | 8.1  | Drive Control Type                            |                 | Mechanical torque converter | Mechanical torque converter |
|        | 8.2  | Service Pressure for Attachments              | bar             | -                           | -                           |
|        | 8.3  | Oil Flow rate for (max.available)             | l/min           | -                           | -                           |
|        | 8.4  | Noise at Operator's Ear                       | dB(A)           | 105                         | 105                         |
|        | 8.5  | Drawbar,model/Type DIN                        |                 | Pin                         | Pin                         |

| POS           | ITEM DESCRIPTION | UNIT   | DESIGN VALUE |               |               |
|---------------|------------------|--|--------------|---------------|---------------|
|               |                  |  | KB15         | KB18          |               |
| Specification | 1.1              | Manufacturer   |              | KION Baoli    | KION Baoli    |
|               | 1.2              | Model designation  |              | KB15          | KB18          |
|               | 1.3              | Type of drive:<br>Electric-Diesel-Petrol-LPG-Network Power(Electric) |              | Diesel        | Diesel        |
|               | 1.4              | Operation Type:Hand-stand on-Driver seated                           |              | Driver seated | Driver seated |
|               | 1.5              | Load Capacity  | Q(kg)        | 1500          | 1800          |
|               | 1.6              | Load Barycenter Distance   | C(mm)        | 500           | 500           |
|               | 1.8              | Axle centre to fork face   | X(mm)        | 435           | 435           |

|                              |   |  |                       |              |              |           |
|------------------------------|---|--|-----------------------|--------------|--------------|-----------|
|                              | 1.9   | Wheel Base   | Y(mm)                 | 1500         | 1500         |           |
| Weight                       | 2.1   | Service Weight   | kg                    | 3060         | 3210         |           |
|                              | 2.2   | Axle weight with Rated Load front/rear                     | kg                    | 3840/700     | 4330/680     |           |
|                              | 2.3   | Axle weight without Load front/rear                        | kg                    | 1380/1660    | 1340/1870    |           |
| wheels and tyres             | 3.1   | Tyres:SE-Super elastic PN-Pneumatic                        |                       | PN           | PN           |           |
|                              | 3.2   | Front Tyres Size   |                       | 6.50-10-14PR | 6.50-10-14PR |           |
|                              | 3.3   | Rear Tyres Size  |                       | 5.00-8-10PR  | 5.00-8-10PR  |           |
|                              | 3.6   | Front Track Width  | b10 (mm)              | 940          | 940          |           |
|                              | 3.7   | Rear Track Width   | b11 (mm)              | 920          | 920          |           |
| Dimensions and Overall Sizes | 4.1   | Mast lift,forward/backward                                 | $\alpha/\beta$ (Grad) | 6°/12°       | 6°/12°       |           |
|                              | 4.2   | Mast Minimum Overall Height                                | h1(mm)                | 2002         | 2002         |           |
|                              | 4.3   | Free lift  | h2(mm)                | 128          | 128          |           |
|                              | 4.4   | Lift height  | h3(mm)                | 3000         | 3000         |           |
|                              | 4.5   | Mast Maximum Overall Height                                | h4(mm)                | 4040         | 4040         |           |
|                              | 4.7   | Overhead Guard Height                                      | h6(mm)                | 2065         | 2065         |           |
|                              | 4.8   | Seat Height  | h7(mm)                | 1010         | 1010         |           |
|                              | 4.12  | Drawbar Height   | h10(mm)               | 220          | 220          |           |
|                              | 4.19  | Overall Length (including forks arms 1000mm)               | L1(mm)                | 3432         | 3466         |           |
|                              | 4.20  | Lenght to Face of Forks                                    | L2(mm)                | 2362         | 2396         |           |
|                              | 4.21  | Overall Width  | b1(mm)                | 1177         | 1177         |           |
|                              | 4.22  | Fork Arms Dimensions                                       | s/e/L(mm)             | 35/120/1070  | 35/120/1070  |           |
|                              | 4.23  | Fork Carriage in Compliance with ISO 2328 Class/Form A,B   |                       | A            | A            |           |
|                              | 4.24  | Fork Carriage Width  | b3(mm)                | 1040         | 1040         |           |
|                              | 4.31  | Ground Clearance below Mast(with load)                     | m1(mm)                | 110          | 110          |           |
|                              | 4.32  | Ground Clearance Centre of Wheelbase(with load)            | m2(mm)                | 105          | 105          |           |
|                              | 4.33  | Aisle Width with pallet 1000×1200 and Fork Arms Pitch 1200 | Ast(mm)               | 3795         | 3815         |           |
|                              | 4.35  | Turning Radius   | Wa(mm)                | 2160         | 2180         |           |
| 4.36                         | Turning Point Minimum Distance from the Truck Center Line | b13(mm)  |                       |              |              |           |
| POS                          |   | ITEM DESCRIPTION   | UNIT                  | DESIGN VALUE |              |           |
| KB15                         | KB18  |  |                       | KB20         |              |           |
| Performance                  |   | 5.1  | Drive Speed           | km/h         | 16.3/16.3    | 15.7/15.9 |

|        |      |   |  |       |                                   |                                   |
|--------|------|---|--|-------|-----------------------------------|-----------------------------------|
|        |      |   | h/<br>wit<br>ho<br>ut<br>lo<br>ad  |       |                                   |                                   |
|        | 5.2  |   | Lif<br>tin<br>g<br>Sp<br>ee<br>d<br>wit<br>h/<br>wit<br>ho<br>ut<br>lo<br>ad | mm/s  | 505.05/716.56                     | 445.1/726.98                      |
|        | 5.3  | Lowering Speed<br>with/without<br>load                                |  | mm/s  | 375.78/396.48                     | 405.04/416.28                     |
|        | 5.5  | Drawbar Pull<br>Tractive Effort<br>(at 2km/h)<br>with/without<br>load |  | N     | 11.5/10.7                         | 11.5/10.7                         |
|        | 5.7  | Gradeability (at<br>2km/h)<br>with/without<br>load                    |  | %     | 20                                | 20                                |
|        | 5.10 | Service Brake   |  |       | Mechanical/hyd<br>raulic          | Mechanical/hyd<br>raulic          |
| Engine | 7.1  | Engine<br>Manufacturer/E<br>ngine Type                                |  |       | ISUZU C240                        | ISUZU C240                        |
|        | 7.2  | Engine Power in<br>compliance with<br>ISO 1585                        |  | kw    | 35.4                              | 35.4                              |
|        | 7.3  | Rated Number of<br>Revolutions  |  | /min  | 2500                              | 2500                              |
|        | 7.4  | Cylinder<br>Number/Displac<br>ement                                   |  | cm³   | 4/2369                            | 4/2369                            |
|        | 7.5  | Fuel<br>Consumption in<br>compliance with<br>VDI-Cycle                |  | l/h   | 7.14L/h                           | 7.14L/h                           |
| Others | 8.1  | Drive Control<br>Type   |  |       | Mechanical<br>torque<br>converter | Mechanical<br>torque<br>converter |
|        | 8.2  | Service<br>Pressure for<br>Attachments                                |  | bar   | -                                 | -                                 |
|        | 8.3  | Oil Flow rate for<br>(max.available)                                  |  | l/min | -                                 | -                                 |
|        | 8.4  | Noise at<br>Operator's Ear  |  | dB(A) | 107                               | 107                               |
|        | 8.5  | Drawbar,model/<br>Type DIN  |  |       | Pin                               | Pin                               |

### 3. Performance Characteristics



tr:  
easy and flexible steering, safety and reliability.

(2) The braking system adopts hydraulic brake, which guarantees easy operation and reliable braking.

(3) The truck adopts wide vision and retractable mast, the mast has broad vision with high intensity. The mast adopts series design which can be customized upon user's requirements to mount 2-stage or 3-stage full free mast of different lifting height with various optional attachments equipped.

(4) The truck which is equipped with hydraulic torque converter and drive device consisting of electron transmission box has the following advantages:

- Hydraulic torque converter can realize automatic stepless speed regulation and output torque makes the forklift truck have good tractive characteristics.
- The inching device makes it easy for the drivers to align goods allocation.
- Realizing smooth shift during operation is configured to improve working efficiency, simplify operation, release the driver's labor intensity and lower requirement of proficiency of the driver's operation for those trucks which need frequent starting and shifting.

(5) The forklift truck can select mast or cab of different height according to the operating into container or out container.

(6) The whole truck adopts streamline design, unique appearance, wider operating vision and larger driving space as well as a lot of advantages such as low

noise, vibration damping, dustproof, comfortable operation, safety and reliability.

#### 4. Description of Main Systems

| No. | Name                | Contents  |
|-----|---------------------|---|
| 1   | Power system        | engine mounting, fuel, exhaust and cooling system(inc. torque converter oil cooler) etc.            |
| 2   | Transmission system | torque converter, gear box, transmission shaft, gearshift etc.                                      |
| 3   | Drive axle          | axle housing, half shaft, brake, front wheel etc.   |
| 4   | Brake system        | wheel brake and parking brake etc.  |
| 5   | Steering system     | steering wheel, cycloid gear type powered steering unit etc.  |
| 6   | Hydraulic system    | pump, valve, HP oil pipe, LP oil pipe, connectors etc.  |
| 7   | Electric system     | lamps and lanterns, battery, meter, harness etc.  |
| 8   | Lifting system      | mast, fork, lift bracket, load backrest, tilt cylinder, lift cylinder, lift chain, mast roller etc. |

• **List of outline dimensions of main removable parts & lift parameters:**

|                                      | Max. outline dimension (mm) | Min. lift capacity (Kg) |
|--------------------------------------|-----------------------------|-------------------------|
| Counter weight                       | 1094×552×951                | 1185                    |
| Standard mast                        | 1140×1900×2002              | 720                     |
| Lift bracket<br>(with load backrest) | 580×181×1040                | 83.85                   |
| Fork                                 | 122×40×1070                 | 52.65                   |

**Notice:**

Weight values in the above table is for reference only when disassembly which may be different from actual ones because of different configurations or technology optimization.

## **II . Safe driving and operation of forklift truck**

---

It is important for drivers and managers of forklift truck to follow the principle of “safety first”. Please read this manual thoroughly before the first operation, which will help you well understand Baoli forklift truck and operate correctly and safely.

### **1. Instructions for a new forklift truck**

The performance and service life of the forklift truck have close relation with maintenance during the break-in period since the use of the new truck. During this period, pay special attention to the following items:

(1) Always warm up your vehicle before operation; Don't run engine at high speed with no load; Operate the vehicle under the light load and low speed without sudden acceleration or braking during operation.

(2) Replace gear oil in the differential and reducer after the new forklift truck has worked for 100 hours.

(3) Replace the lubrication oil in engine oil pan, transmission box, driving axle and hydraulic oil in hydraulic oil tank; check and readjust the clearance between the driving gear and driven gear in the reducer after the new forklift truck has worked for 200 hours.

## 2. Inspection before operation

Complete inspections before operation to guarantee safety, high efficiency and long service life of the forklift truck.



(1) The forklift truck adopts imported engine, of which use and maintenance refer to manual of the engine enclosed.

(2) Check air pressure of the tyre, if not enough, inflate in time. Check the bolts of all wheels for tightness.

(3) Add oil in hydraulic oil tank by regulations and add lubrication oil for lubricated parts. The oil level should be in the middle of scale marks of oil level meter. The contamination level of the hydraulic oil should be lower than grade 12.

(4) Check the radiator, and add antifreeze if necessary.

(5) Check if any leakage of hydraulic oil and brake fluid. Check if any leakage or damage of oil pipes, water hoses, vent-pipes and the piping joints, pumps and valves etc.

(6) Check if all the connectors and plugs of electric system are reliable. Check if the meters, lamps and switches work well.

(7) Check free stroke of every pedal and check if the levers is reset naturally. Test lifting and forward/backward tilting actions to ensure fork bracket and mast can lift and tilt smoothly. Test steering and braking actions to ensure flexible and reliable braking and steering.

(8) Check the traveling brake: the free stroke of brake pedal is 4-8 mm, when effective brake, the clearance between the front baseboard and the pedal should be more than 20mm.

(9) Check the parking brake: the unloaded truck can park on 20% slope, when the parking brake is locked.

(10) Check all exposed connectors and fasteners for looseness.

## 3. Start and stop of the engine

### (1) Start of the engine

(a) First switch the shift lever at the neutral position and the parking brake level at the braking position.

(b) When starting, insert the key into the preheat starting switch, turn clockwise to I (ON) position, preheating system of engine automatically preheats for 10-15 seconds, after preheating indicator lamp is off, turn clockwise to "START" position and then starting motor starts. When hand releases the key, it automatically returns to "ON" position under the action of spring force. Every starting time can't be more than 15 seconds and restart after 30 seconds. If engine doesn't work after starting for several times, check and remove the trouble, do not keep the starting motor continuously start for a long time.

(c) After the start of the engine, the engine shall run for five minutes with no load.

Full load operation isn't allowed until water temperature of the engine rises above 60°C.

**Notice:**

When the engine runs with no load, check if readings and alarms on water thermometer, oil manometer, ammeter and fuel measurer meet the specification, check each pedal for free stroke, check parking braking and pedal braking systems, test mast lifting, tilting forward/backward, steering and braking actions. If no problem, release parking brake for operation .

**(2) Stop of the engine**

Engine runs for five minutes with no load to cool the engine gradually, and shift the ignition switch to OFF position, then the engine stops.

**Notice:**

- While the engine is running, do not turn the preheat starting switch to "START" position, otherwise it may damage starting motor.
- Do not keep the preheating start switch at the "ON" position while the engine is shut down, which may result in battery discharge.

#### **4. Handling, loading, lifting and towing of forklift truck**

**(1) Handling**

(a) Apply the parking brake when shipping the forklift trucks by container or freight car.

(b) Fix the mast and the balance weight with steel wire and use jacks to prevent the forklift trucks from moving in the cabin.

(c) Pay attention to the overall length, width and height when loading, unloading and shipping on road and follow relevant regulations.

(d) Mast and balance weight can be disassembled for separately transportation if necessary.

**(2) Loading**

(a) Use the lap plate with proper length, width and strength.

(b) Pull the parking brake to effectively stop the wheel.

(c) Fasten the lap plate in the center of the cabin, there shall be no grease on the plate.

(d) The left and right heights of the plate are the same to make the truck run stably when loading and unloading.

(e) Don't change the direction or move transversely on the plate to prevent the danger.

(f) Reverse the truck slowly when loading the forklift truck on the freight car to keep left and right tyres synchronous.

**(3) Sling the forklift truck**

(a) Only the specially trained personnel can lift the truck.

(b) Lift at the position indicated on "lift sign" on the truck when lifting.

(c) The slinging cable shall have enough bearing force.

(d) Disassembled parts of forklift truck also have specified lifting positions.







Fig. 1 Sling the forklift truck

### Basic mast and Counterweight Lifting capacity

|       |                           |                          |   |
|-------|---------------------------|--------------------------|---|
| Model | Basic mast                |                          | C<br>o<br>u<br>n<br>t<br>e<br>r<br>w<br>e<br>i<br>g<br>h<br>t |
|       | Overall dimension<br>(mm) | Lifting capacity<br>(kg) | Overall dimension<br>(mm)                                     |
| 1.5T  | 1885×1040×430             | > 7000                   | 1094×500×900  |
| 2.0T  | 1885×1040×430             | > 7000                   | 1094×540×942  |

#### (4) Towing

(a) The draw bar beneath the counter weight is used for towing vehicles. When operating the draw bar, pull out it, fasten with steel wire and then install the draw bar.

(b) When towing the forklift truck, release the parking brake.

(c) The draw bar is only used for truck transportation or breakout when the truck can't drive any more.

(d) Don't tie towing wire to unspecified position.

(e) Don't apply capacity abruptly when towing the truck.

#### (5) Repair of broken-down truck

If broken-down suddenly during operation, drag it away and repair in time to avoid hindering other vehicles or workers.

### 5. Parking and storage

#### (1) Safe parking

(a) Park your forklift truck on a flat ground preferably in a wide area. If parking on

a slope is unavoidable, press down the parking brake device and block the wheels with wedge to prevent accidental sliding. The truck is forbidden parking on a steep slope.

(b) Park your forklift truck in the specified area or anywhere which is permitted by traffic conditions. If necessary, put a signpost or signal lights around the truck.

(c) Park your forklift truck on solid ground. Avoid parking on soft ground, deep mud or slippery floor.

(d) If you can not lower the forks on the ground due to break-down of the lifting system, hang a warning flag at the end of the fork and park the truck in an area which is permitted by traffic conditions.

## **(2) Storage**

### **• Before storage**

Before storage , clean your forklift truck thoroughly and inspect as the following procedures:

(a) Wipe away grease and oil adhering to the body of the truck with cloth and water,if necessary.

(b) While washing the body of the truck, check general condition of the truck. Especially check if any pression or damage, if tyres are worn and if any nail or stone in the tread.

(c) Fill the oil tank up with the specified fuel.

(d) Check if any oil leakage.

(e) Apply grease where necessary.

(f) Check for looseness of matching face between hub nut and cylinder piston rod. Check if any scratch or cinch mark on surface of piston rod.

(g) Check if mast rollers rotates smoothly.

(h) Lift up lift cylinder and fill oil.

(i) In winter or cold season, don't drain long-acting antifreeze, while cooling water shall be drained.

### **• Daily storage**

(a) Park the forklift truck at a specified place and block the wheels with wedges.

(b) Switch the shift lever in the neutral position and press the parking brake pedal.

(c) Put the key switch in "OFF" position and turn off the engine, operate the lever of the control valve several times and release the residual pressure in the cylinder or pipes.

(d) Remove the key and keep it in a secure place.

### **• Long-term storage**

Perform the following services and checks in addition to the "Daily storage"service:

(a) Taking the rainy season into consideration, park the truck at a higher and harder ground.

(b) Avoid parking on soft ground such as asphalted road in summer.

(c) Coat antirust oil on the exposed parts such as piston rods and shafts which tends to rust.

(d) Cover components which may be caught with humidity.

(e) The truck should be started at least once a week. Fill cooling water, if cooling water is discharged. Remove grease from the piston rods and shafts. Start the engine and warm up thoroughly. Move the truck slowly forwards and backwards. Operate the hydraulic control for several times.

### **• Operate the forklift truck after long-term storage**

(a) Remove antirust oil from the exposed parts.

(b) Discharge the engine oil in crankshaft case of the engine, discharge the gear oil or hydraulic transmission oil in differential and gear box, after cleaning up then

replace oil.

- (c) Discharge foreign matter and water from the hydraulic oil tank and fuel tank.
- (d) Remove the cylinder cap where necessary, check the valves and the rocker shafts and confirm if the clearance between valves is normal
- (e) Add cooling fluid upto specified level.
- (f) Carefully inspect before starting.
- (g) Warm up the forklift truck.



#### **WARNING**

If at any time your lift truck is found to be in need of repair, defective, or in any way unsafe, the condition should be reported to be supervisor, and the truck should be taken out of service until it has been restored to safe operating condition.

## **6. Informations for safety operation**

(1) The forklift truck is special equipment. Only trained and authorized operator with proper license can drive the truck; and only trained and authorized operator can maintain the truck to ensure normal use of the truck.

(2) Wear the safety guards, such as clothing, shoes, helmet and gloves while operating the truck.

(3) Be familiar with follow all signs on the truck. The signs must be replaced if lost or damaged.

(4) Daily inspection should be carried out before or after using the truck; never operate the truck with fault. In case any abnormality during the operation of the truck, stop and check and continue operation till such fault is eliminated.

(5) When the distance between the gravity center of loads and the fork arms is 500mm, the max. capacity is the rated capacity, load during handling can't exceed specified value. When the distance exceeds 500mm, the capacity shall be reduced according to the load chart. Overloading is strictly prohibited.

(6) Operate your forklift truck on flat and solid ground. When operating on other ground, the lift capacity and travel speed must be duly decreased. Wipe off the oil and grease from the floor.

(7) Customized forklift truck equipped with attachment makes its application wider, but it will reduce its effective load and stability The attachment and special device can't be used for any other purpose. Please read our additional instructions and operate the truck according to requirements. Any reconstruction is forbidden.

(8) Users select "Lengthened fork" to carry super-wide loads. Pay attention that: bearing force of the lengthened forks shall strictly comply with capacity chart and be controlled within capacity center, its bearing capacity is the same as standard fork, reduce load when capacity center moves forward; forbid stirring up or collide cargoes and pay special attention when driving or turning.

(9) The unloaded forklift truck with attachment should be operated as a loaded truck.

(10) Before operation, connect the power and turn on the key switch, select the position of direction switch, check if the truck turns well by turning steering wheel, press the accelerator pedal slowly to keep proper acceleration.

(11 ) During operation, pay attention to the performance and condition of the mechanical, hydraulic and electrical systems.

(12) When operating one lever, pay attention not to shift another lever. Don't operate the lever at any position out of the driver's seat.

(13) The shift distance of control valve lever can control the speed of the lifting or descending of the goods. When the goods are lifted or descended, the initial speed can't be too fast in either case.

(14) When tilting the mast forward or backward to the limit position or lifting the fork to the maximum height, return the directional lever to neutral.

(15) The starting, turning, driving, braking and stopping of the truck should be carried out smoothly. When turning on the humid or slippery road, the truck should be decelerated.

(16) Because the forklift truck turns by the rear wheels, the end may swing widely when turning. Use carefully in narrow aisles or other workplaces.

(17) Avoid sudden stop, acceleration, stop or turn. Improper operation, may lead the truck turn over. In this case, the driver must keep calm, don't jump off the truck. The driver must hold tightly the steering wheel with two hands; meanwhile, his body must incline in the opposite direction to truck's turning-over.

(18) Drive carefully on slope, turning, transverse or deflective traveling is forbidden, otherwise the truck may turn over; On a slope, drive the truck with load forward to ascend and backward to descend. When the truck goes down on a slope, drive slowly with the brakes on. Make sure that the engine should not be shut down when traveling on a slope.

(19) The stability of the truck is greatly influenced by the wind-force during outdoor operation, you must pay special attention.

(20) Be careful and slowly drive on a dock or temporary paving slab.

(21) Adjust distance of fork according to the dimension of goods. Make the loads distributed on two forks evenly to avoid tilt and slide of goods.

(22) Don't pick the loads up with single fork. Fork can not be used to pull out any embedded goods, if necessary, the pulling force should be calculated first.

(23) Don't handle unfixed or loose goods. Be careful to handle bulky goods. To prevent the collapse of stacked goods, tighten them before handling. Forbid handling loose or little volume goods without pallet.

(24) When loading the goods, lower the forks to the floor. After the fork is inserted into stacked goods, the fork arms shall be in contact with the goods. Drive the truck with mast tilting back. Before traveling, raise the forks for 200mm-300mm from the floor.

(25) When handling bulky loads which block your sight, operate the forklift truck in reverse.

(26) While mast's lifting and lowering, anyone is absolutely prohibited from standing under the lift bracket or being lifted with forks. Never permit anyone to stand or walk under upraised forks.

(27) When lifting the load, according to the weight of the load, accelerate properly and then pull the lifting lever.

(28) The load descends due to the gravity, in this case, the engine must be in idle position, and the lever must be pulled slowly to prevent the load from sudden falling.

(29) When loading and unloading goods, keep the mast vertical and the truck is in braking state.

(30) Height of load should be controlled under height of load backrest as load with the height exceeding the load backrest may fall against operation, which may lead to serious accident.

(31) When travelling with load, don't tilt mast forward, don't carry out handling, or don't brake abruptly to prevent goods from slipping off the forks.

(32) It is necessary to brake before tilting the mast forward or backward. It's also necessary to decelerate and tilt forward slowly so as to prevent the goods from slipping off the forks.

(33) Don't make a sudden braking when the truck travels with loads.

(34) Drive the forklift truck to the stacked goods at a low speed, at the same time, pay much attention to observe if any sharp and hard objects near the goods, otherwise the tyres will be pricked.

(35) Pay attention to pedestrian, obstacle and bumpy road when driving. Pay attention to the clearance above the forklift truck.

(36) Keep your head, hands, arms, feet and legs within the confines of the cab. Never allow other persons loaded on the forklift truck.

(37) Tilt the mast of the high lift forklift truck as backward as possible when operating the truck. Use minimum forward and backward tilt when loading and unloading. It is dangerous to travel or turn when lifting the goods at height.

(38) It is noted that the goods will fall down in case the forks of the truck with lifting height more than 3m lift, take the protection measures if necessary.

(39) Before the truck decelerates and stops safely, don't change gear to reverse shift to prevent damaging components or guarantee safe loading.

(40) When the truck stops and the engine is on idle position, the mast must be tilted backward. You can't leave the truck with idling engine or hanged goods unattended.

(41) When adding fuel, make the driver leave the truck and the engine is flamed out. Don't ignite when checking the level of fuel tank.

(42) Don't open the water tank cover when the engine is very hot.

(43) After one day's working, the fuel tank should be added oil to prevent the humidity in the fuel tank from becoming the blob and then interfusing the fluid.

(44) When leaving, engage the parking brake, lower the forks on the ground and let the shift lever switched to neutral, make the engine flamed out or cut down the electric supply. If parking on a slope with smaller gradient, apply the parking brake and block the wheels with wedges. The truck is forbidden parking on a slope with bigger gradient.

(45) Don't adjust the control valve and relief valve at will to prevent the damage of hydraulic system and its components due to over-pressure.

(46) Tyres should be inflated according to the pressure value specified in the sign of "Tyre Pressure".

(47) Check the chains periodically to make sure that good lubrication condition exists between the chain elements, the degree of tightness between left and right chains is identical. If any abrasion of chains during operation or the variation value of the chain pitch exceeds 2% of standard value, replace chains immediately to guarantee safe loading.

(48) The overhead guard is main part to protect the operator from falling materials. Loose installation, reuse after dismantling, and use after reconstruction are very dangerous which may lead to serious accident.

(49) A load backrest is main part to prevent load on fork from sliding to operator. Loose installation, reuse after dismantling, and use after reconstruction are very dangerous which may lead to serious accident.

(50) Any change or addition of the truck without written approval of our company is forbidden otherwise it may affect rated capacity or safety operation.

(51) Pay special attention to safety when maintenance at height.

(52) The forklift truck must be operated under the following environment: below an elevation of 1000 meters and temperature between -15°C and 35°C , relative humidity is 95%. Carefully use under other adverse circumstances.

(53) Exhaust emission of forklift truck shall comply with national regulations: smoke intensity of domestic diesel engine  $\leq 5$ Bosch while content of CO of domestic gasoline engine  $\leq 5\%$  and content of HC  $\leq 2500$ PPm; if imported diesel engine is

used, exhaust emission shall satisfy Europe standard (Class II). Harm of exhaust emission against human body is inevitable, so forbid using the forklift truck in a closed space as exhaust of the truck may cause you asphyxia.

(54) According to the Directive 2000/14/EC and EN12 053 standard, test lifting, driving and idling, promised sound power level: LWA=107dB(A); however, when operating the truck, additional noises may be increased due to different operations and influences of external environment, so higher or lower noise level may be occurred.

(55) To prevent the fire, accident or other unpredictable events, prepare the fire extinguishers in advance and operate them according to the instructions.

(56) The driver feels the vibration of the forklift truck when operating and driving the forklift truck. According to ISO3691 and EN13059 standard, during operation of the truck, total vibration value of the forklift truck transmitted to the operator shall be no more than 2.5m/s<sup>2</sup>, however vibration frequency felt by the driver depends on the working condition (etc. Road status, operation mode), so the actual vibration frequency must be determined by site condition when necessary.




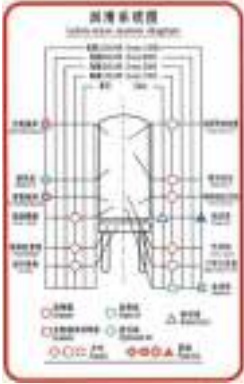
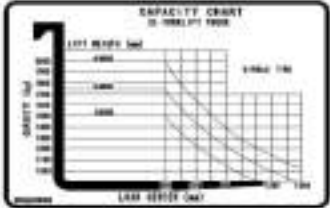
#### **Vibration Frequency Characteristic**


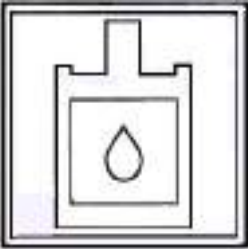

| Model | The noise pressure level at the operator's position | The measured Sound power level | The guaranteed sound power level | The vertical direction acceleration mean value from the seat to the operator |
|-------|---|--------------------------------|----------------------------------|--|
|       | EN12053   | EN12053                        | 2000/14/EC                       |  |
| KBG15 | 87 dB(A)  | 105 dB(A)                      | 107 dB(A)                        | 0.91 (m/s <sup>2</sup> )   |
| KBG20 | 86 dB(A)  | 104 dB(A)                      | 107 dB(A)                        | 0.84 (m/s <sup>2</sup> )   |

## **7. Warning signs**



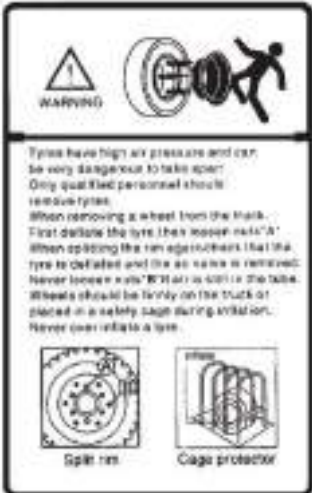
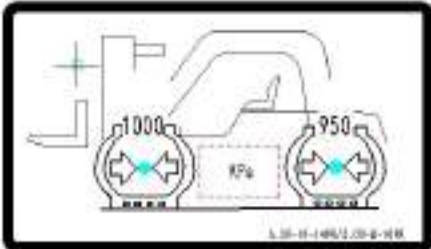

The warning signs attached to the vehicle indicate the operating method and instructions. Before driving it, read them thoroughly. If the warning sign drops, stick it again. After maintenance, check if the warning sign is complete and legible, if






necessary, please replace them.



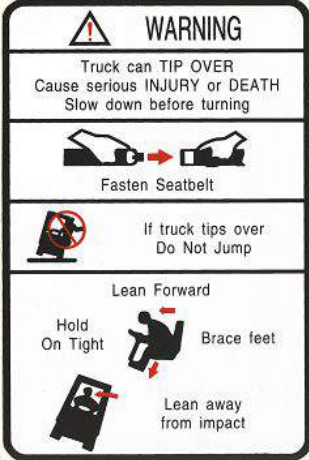

| Name   | Warning signs  |
|--|--|
| (1) Forbidden anyone stand on or beneath the fork. |     |
| (2) Operating notices                              |     |
| (3) Nameplate of forklift truck                    |   |
| (4) Diagram of lubrication system                  |   |
| (5) Capacity chart                                 |  |

|   |   |
|---|---|
|   |   |
| <p><b>(6) Inspections before starting</b></p> | <div data-bbox="738 253 1023 697" style="border: 1px solid black; border-radius: 15px; padding: 10px;"> <p style="text-align: center;">Inspections before starting</p> <p>On inspections before starting the truck:</p> <ol style="list-style-type: none"> <li>1. Hydraulic oil level: The liquid level should be in the middle position of up and down marks of oil level indicator;</li> <li>2. Check the pipes, joints and pump valves for leakage and damage;</li> <li>3. Check the driving brake:             <ul style="list-style-type: none"> <li>(I) The virtual travel of brake pedal should be between 0-10mm;</li> <li>(II) The clearance between front backing plate and metal shell should be larger than 3mm;</li> </ul> </li> <li>4. Check the parking brake frequently and make sure that the truck with full load can stop on the ramp with 10% slope when pulling the lever to the bottom;</li> <li>5. Check if meters, lamps, switches and electronic devices are working normally.</li> </ol> </div> |
| <p><b>(7) Adjust parking brake</b></p>        | <div data-bbox="755 722 1020 983" style="border: 1px solid black; border-radius: 15px; padding: 10px;"> <p style="text-align: center;">ADJUSTMENT OF PARKING BRAKE</p> <div style="text-align: center;">  <p>- Brake force reduce</p> <p>+ Brake force increase</p> </div> </div>  |
| <p><b>(8) Add hydraulic oil</b></p>           | <div data-bbox="769 1016 1016 1261" style="border: 1px solid black; border-radius: 15px; padding: 10px;">  </div>   |
| <p><b>(9) Add fuel (gasoline)</b></p>         | <div data-bbox="779 1300 1009 1561" style="border: 1px solid black; border-radius: 15px; padding: 10px;">  </div>   |



|  |   |
|--|---|
| <p>(10) Add fuel</p>                       |   |
| <p>(11) Add antifreeze</p>                 |   |
| <p>(12) Tyre safety (pneumatic tyre)</p>   |  <p>WARNING</p> <p>Tyres have high air pressure and can be very dangerous to take apart. Only qualified personnel should remove tyres.</p> <p>When removing a wheel from the truck:</p> <ul style="list-style-type: none"> <li>First deflate the tyre (then loosen nuts)</li> <li>When splitting the rim edge protectors flat the tyre to deflate and the air valve is removed.</li> <li>Never loosen nuts when air is still in the tube.</li> <li>Wheels should be firmly on the truck or placed in a safety cage during inflation.</li> <li>Never over inflate a tyre.</li> </ul> <p>Split rim      Cage protector</p> |
| <p>(13) Tyre pressure (pneumatic tyre)</p> |  <p>1000      950      kPa</p>  |
| <p>(14) Indication of lifting point</p>    |   |

|   |  |
|---|--|
| <p>(15) Lift sign</p>                             |    |
| <p>(16) Forbid entering space behind the mast</p> |    |
| <p>(17) Forbid carrying person</p>                |   |
| <p>(18) Warning sign: injury to hand</p>          |  |
| <p>(19) Fan hurting hand</p>                      |  |

|   |  |
|---|--|
| <p><b>(20) Hood crushing hand</b></p>                   |    |
| <p><b>(21) Belt pulley thumb hand</b></p>               |    |
| <p><b>(22) Prevent turnover</b></p>                     |   |
| <p><b>(23) Instructions for using parking brake</b></p> |  |

## 8. Using LP Gas

### Operating LP Gas powered trucks

 **WARNING**

Compressed LP gas can cause injury or death if mis-handled.  
Only trained, authorized personnel should fill or exchange LP gas tanks.  
Protective clothing such as a face shield, long sleeves, and long gloves (covering the wrist) should be worn.

Do not refill removable LP gas tanks while they are mounted on the truck.  
Do not refuel or park LP gas-powered lift trucks in confined areas or near underground entrances, elevator shafts, or other places where LP gas could collect and cause potential danger of an explosion. Ensure that the area around any LP gas-powered truck is well ventilated before switching on the electrical system or starting the engine.  
Do not leave the lift truck, for even a short time, near equipment that generates high temperatures. Ovens and furnaces are examples. The heat may raise the pressure of the LP gas in the tank to a dangerous level.  
Close the hand wheel valve on the tank when LP gas-powered lift trucks are parked overnight or stored for long periods indoors with the fuel tank in place. Close valves on empty tanks.

 **WARNING**

LP gas is extremely flammable.  
Never use an open flame to check the liquid level in the fuel tank or to check for leaks in the LP gas lines or connection fittings. Use a soap solution whenever checking for leaks.

 **WARNING**

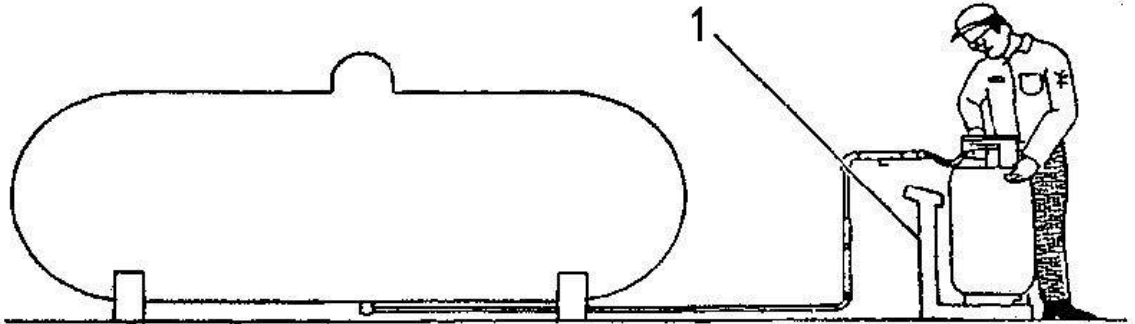
Damaged or dirty LP gas tanks can leak or explode under pressure.  
Examine LP gas tanks before filling and before reuse. Look for damage to the valve, liquid gauge, fittings and hand wheels. Check for dents, scrapes or other damage to the pressure vessel and for dirt or debris in the openings.

## **WARNING**

Leaking LP gas is a fire hazard.

Use a soap solution to inspect LP gas lines and connection fittings for leakage after the tank is changed or the lines have disconnected/ reconnected for any other reason. All defective or damaged components must be repaired or replaced before using the truck.

### **Refilling LP Gas Tanks**



The weight scale method of filling LP gas tanks is highly recommended. This method utilizes a scale (1) to allow precise filling and therefore reduce the chances of overfilling. Accidental discharge of LP gas from overfilling presents a fire hazard and damages the environment.

- Only trained, authorized personnel should fill or exchange LP gas tanks. Protective clothing such as a face shield, long sleeves, and long gloves (covering the wrist) should be worn.
- Do not refill removable LP gas cylinders while they are mounted on the truck.
- Make sure you know and understand the proper procedure for refilling an LP Gas tank.
- Know all fire codes in your area.
- If you have any questions regarding refueling LP gas tanks, ask your supervisor.
- If problems with filling occur, call the LP gas supplier.
- Store both full and empty tanks according to local fire codes.
- Always observe the law or regulations in your country, state, or province when filling LP gas tanks.

## **III. Periodic inspection and maintenance**

---

During operating the forklift truck, it is necessary to operate carefully, serve and maintain periodically to keep the forklift truck in good condition.

### **1. General rules on inspection and maintenance**

(1) Only use genuine parts from Baoli to protect vehicle when replacing critical parts.

(2) Only use genuine or recommended grease when replacing or adding oil.

(3) Clean oil inlet and grease inlet with a brush or waste cloth before adding oil or grease.

(4) Check oil level and add oil when the truck is parked on a level ground.

(5) Regularly prevent, maintain and service and pay attention not to injure yourself.

(6) In case any damage or fault, report to manager, forbid using this truck before repair.

#### **• Regular inspection**

(1) Check the tightness and the reliability of the hydraulic system.

(2) Check the reliability of the steering and braking systems.

(3) Check the reliability of connection of mast, driving axle, steering axle and frame.

(4) Check all wheels for tightness.

#### **• Irregular inspection**

- (1) Check the reliability of each welding joints of the mast and frame.
- (2) Check the reliability of connecting joints of steering cylinder, joint plate and gimbal etc.
- (3) Check all pipes and hoses for any leakage and breakage.
- (4) Check if the performance of the traveling brake and the parking brake satisfies standards.

**▲ CAUTION**

- . Only trained and authorized serviceman shall be permitted to service and repair the truck.
- . When checking and maintaining the forklift truck, do not use the mast or the load backrest instead of a ladder, these actions will lead to a dangerous condition unexpectedly.

## 2. Inspection and Maintenance

### 2.1 Around inspection

#### 2.1.1 Vehicle uprightness

Does the vehicle lean to one side or the other? If so, check if a tyre is broken or if any problem of travelling system.

#### 2.1.2 Beneath the vehicle

Check for any oil or water leakage on the ground where the vehicle was parked. Check for loose parts or damage.

If any abnormality, ask professional serviceman to inspect the vehicle.

#### 2.1.3 Tyre inspection

Check condition of tires. Low air pressure reduces tire service life and increase fuel consumption. Unevenness of air pressure between right and left tires or unevenly worn or badly damaged tires will cause uneven steering forces.



#### Tyre infl

1. Use a  are. Adjust it to the proper level.

The standard tyre pressures are indicated on the decal at the front left side of the hood.

2. After the adjustment, check if air is leaked from the valve.



### Damage, crack and wear

Check the tyres for damage, cracks, and wear. Check the rims for bending. If the tyres are damaged, or there is a marked difference in the wearing of tyres between the front and rear or between the left and right is perceived, or bent rims are found, ask a professional serviceman for inspection.

#### ▲ CAUTION

Check the forklift truck needs tire that have a high inflation pressure to carry heavy loads, even a small bending of rims or damage at the tread surface could cause an accident.

#### ⚠ WARNING

1. All nuts and bolts should be properly installed and torqued before inflating tire and rim assembly. An inflated tire contains potentially explosive energy.

**DON'T OVERINFLATE.**

2. When using an air compressor, first adjust the air pressure of the compressor. Failure to do so will cause a serious accident, since the compressor delivers the maximum pressure.

### 2.1.4 Hub nut inspection

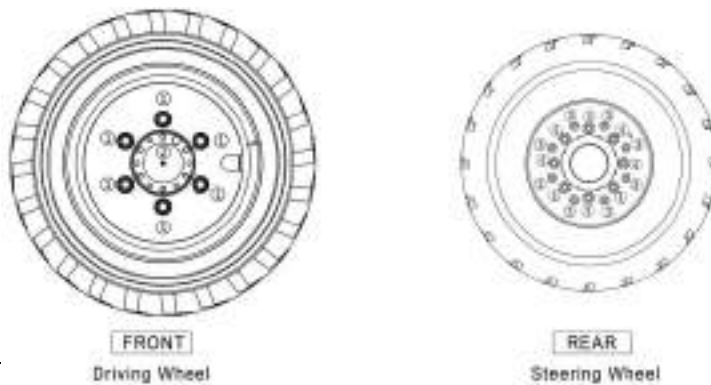
Check the tightness of the hub nuts.

Check hub nuts for correct torque. Avoid uneven torque and tighten all nuts uniformly. All hub nuts should be tightened to the specified torque securely. Refer to the corresponding section for proper torque.



- ① Hub nut
- ② Divided rim bolt
- ③ Drive shaft bolt
- ④ Hub nut
- ⑤ Divided rim bolt





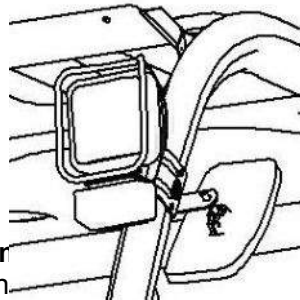
**▲ CAUTION**

Do not dismantle divided rim bolt ② and ⑤ when detaching hub nut ① and ④.

**2.1.5 Lamp inspection**

Are the filaments complete? Is any lens damaged?

Actuate each light or lamp switch to be certain that the respective light or lamp comes on properly. Always keep the lenses clean to insure proper forward vision.



• **Rear combination lamp**

Check rear combination lamp (pull up) for damage or contamination.

• **Head lights & front combination lamps**

Check for dirty or damaged lens.

• **Turn signal check**

Make sure that the turn signal operates properly by moving the turn signal lever.

• **Back-up lamp operation**

The back-up lamp comes on when the shift lever or directional control lever is placed in reverse position.

**2.1.6 Check fuel tank**

Check fuel tank, tank covering, fuel inlet, and drain valve for fuel leakage according to the following procedures.

- (1). Try to smell if there is leakage.
- (2). Look for leakage.
- (3). Touch and confirm if there is leakage.

Drive to the nearest Baoli dealer and ask for repairing oil tank immediately if any leakage.

**2.1.7 Overhead guard check**

The overhead guard is for your protection. Make certain that it is securely mounted and all structural members are secure.

## 2.2 Engine compar

### 2.2.1 Leakage insp

Check the engine compartment for any oil or fuel leakage.

Check the radiator if it is clogged and check if there are any foreign objects attached to grill of the radiator, such as paper or others.

### 2.2.2 Check level of engine coolant and add



(1) Reservoir tank

Level check and addition of engine coolant shall be performed while the coolant is cool.

1. With the engine off, open the engine hood and check the engine coolant level in the reservoir tank.

#### **Note:**

The reservoir tank equipped to the radiator will automatically add the engine coolant to upper limit when the coolant in the radiator becomes insufficient.

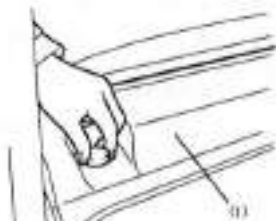
2. The coolant level is proper if it is in the middle of the upper and lower limits. If the level is lower than the lower limit, add coolant to the upper limit.

3. The concentration of the long-life coolant (LLC) in the engine coolant must be higher than 30% (or 50% in a frigid zone.)

#### **Note:**

If no engine coolant remains in the reservoir tank, be sure to check the coolant level in the radiator, too.

### 2.2.3 Check the engine coolant level in radiator



(1) Ra

1. Remove the radiator cover.

2. Remove the cap and check the coolant level from the filler port.

3. If the engine coolant is not visible through the filler port, fill appropriately diluted coolant (LLC) to the port.

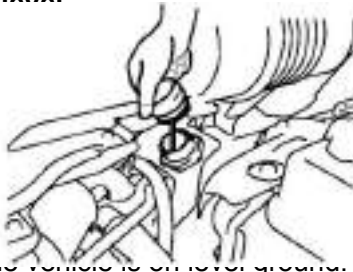


**Note:**

To close and tighten the radiator cap, match the pawl on the reverse side of the cap with the notch on the filler port and turn the cap fully clockwise while applying a downward force.

**⚠ WARNING**

Use extreme care when removing the radiator pressure cap. In pressure system, the sudden release of pressure can cause a steam flash which would cause a serious personal injury. Loosen cap slowly to allow steam to escape. After that, tighten cap securely. It is good practice to use thick waste cloth or the like when removing the cap. Avoid putting on gloves, since you may get burnt at your hand if hot water splashes on it.

**2.2.4 Check hydraulic oil level**

Always stop the engine and park the vehicle on a level ground before checking the level of the hydraulic oil, while the vehicle is on level ground.

1. Open the engine hood and remove the hydraulic oil cap.
2. Wipe the level gauge attached to the oil cap with clean cloth, insert it again into the tank and screw tightly.

**Note:**

Inspect the oil level with level gauge from oil supply inlet, without screwing the hydraulic oil cap tightly.

3. Take out the level gauge gently and check if the hydraulic oil is above the oil level.
4. If the hydraulic oil is insufficient, add oil. Spilled and splashed oil must be wiped off thoroughly.

**▲ CAUTION**

The oil level check should be done with engine shut down, forks on the ground or floor, and the truck itself on a level surface.

**2.2.5 Engine oil inspection**

1. Park the vehicle on a flat ground. If the vehicle is inclined, the the reading may have any deviation.
2. The oil level must be checked before starting the engine or at least 3 minutes after the engine is closed.
3. Take out the oil level gauge and wipe it with clean cloth. Insert it again and check if the oil level is between the F and L levels.
4. If the oil level is lower than the L line, add oil to the F line.



### 2.2.6 Add engine oil

1. To add oil, remove the filler cap and pour oil through the filler port. Never let the oil level exceed the F line.

2. The oil added must be appropriate for the season.

SAE40 Ambient temperature : higher than 30°C

SAE30 Ambient temperature : 0°C to 30°C

SAE20 Ambient temperature : -10°C to 0°C



#### ▲ CAUTION

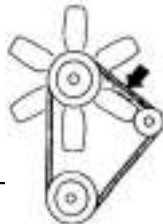
Always use the same brand of oil if possible.

Select the brand number of the engine oil according to the requirements of the engine or the corresponding section of the manual.

### 2.2.7 Fan belt inspection

Inspect the fan belt for cracks, fraying and tension. Pushed the midway between the water pump and the generator by the thumb.

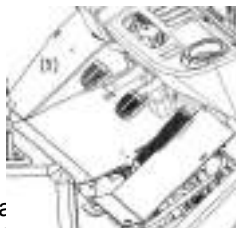
If any abnormality, entrust professional serviceman to replace or adjust the belt.



#### WARNING

Fan belt deflection check should be made with engine shut down.

### 2.2.8 Torque converter oil inspection



(1) Toe board

1. Park the vehicle on flat and solid ground, and stop the engine.

2. Open the engine hood and remove the toe board.

3. Take out the level gauge and wipe it with clean cloth.

4. Insert the level gauge back, and take it out again to check if the oil level.

### ▲ CAUTION

Inspect if parking brake pedal works well and if fork is lowered to the ground.

## 2.3 On board vehicle inspection

### 2.3.1 Brake fluid inspection



(1) Reservo

With the engine on, check the level of the brake fluid in the reservoir tank. The level shall be within the range as shown in the fig.

If the level is lower than the lower limit, add brake fluid up to the proper level. If brake fluid is consumed rapidly, the brake system may have leakage. Ask a professional serviceman for inspection as early as possible.

### ⚠ WARNING

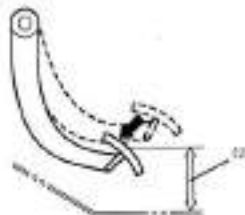
- Never use any oil other than brake fluid.
- Do not allow dirt to get into the reservoir tank. Even a small amount of dirt in the brake fluid may affect normal braking.
- Check the small vent hole in the reservoir tank frequently to make sure that it is not clogged with dirt.

### 2.3.2 Instrument inspection

Start the engine and confirm that instrument works well.

The hour meter, water-thermometer and fuel level gauge are provided to inform the operator of the operating condition of the truck during operation.

### 2.3.3 Brake pedal inspection



(1) Brake pedal

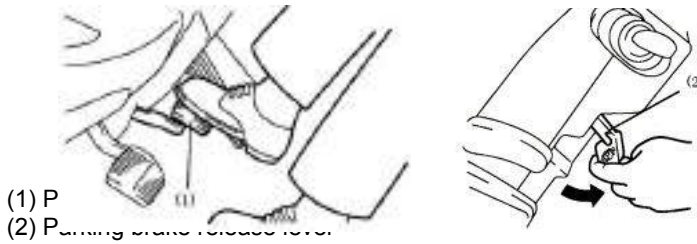
(2) Brake pedal floor clearance

1. Depress the brake pedal fully, and check the floor clearance (clearance between the pedal and floor) Floor clearance  $\geq 110$ mm
2. Make sure that the pedal does not slide down under breaking state.
3. Also check that no abnormality during pedal depression and return.
4. Manually depress the brake pedal to check free stroke till a resistance is felt.  
Free stroke of brake pedal: 5 mm to 8 mm.

### ▲ CAUTION

Ask a professional serviceman for inspection if free stroke is too large, pedal movement is abnormal or brake performance is improper.

### 2.3.4 Parking brake inspection



1. Fully press down the parking brake pedal and check if the brake is functioning normally.
2. After fully pressing the parking brake pedal, pull the parking brake release lever toward you and confirm that the parking brake is released.

#### ▲ CAUTION

Ask a professional serviceman for inspection if any abnormality is found.

### 2.3.5 Engine inspection



Start the engine and \

1. Check each meter \ firm there is no abnormality.
2. Check if the engine is generating abnormal noise or vibration.
3. Check if color of exhaust gas color to is normal.

Colorless or light blue exhaust indicates complete combustion; black exhaust, incomplete combustion; and white exhaust, engine oil is sucked into the cylinders for mixing with fuel.

#### ⚠ WARNING

- The exhaust gas is poisonous. If you must start the engine inside a building or enclosure, insure sufficient ventilation.
- The gasoline engine carburetor is equipped with the automatic chock that keeps the engine running at a relatively high speed a while.  
Do not be bothered, however, because the engine returns to a normal speed upon warming enough.

### 2.3.6 Inching and brake pedal Inspection



- (1) Inching and brake pedal
1. Manually depress the inching and brake pedal to check the free stroke until a resistance is felt.  
The free stroke of inching and brake pedal: 5~8 mm
  2. Depress the inching and brake pedal and check if there is any depression or abnormal resistance.

**▲ CAUTION**

Ask a professional serviceman for inspection if any abnormality is found.

**2.3.7 Loading handling system**

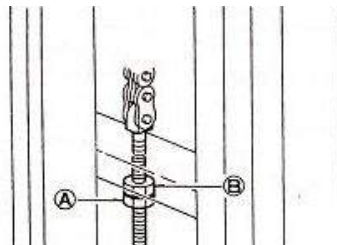


1. Check the installation of the mast and fork for slack or bending.
2. Check fork stoppers.
3. Check for mast distortion, chain tension and oil leakage from cylinders and piping.
4. Operate the lift and tilt levers to check their operating state.
5. Check for loose mounting bolts of the load backrest. Retighten where needed.
6. Sound horn, and actuate the lift and tilt levers to be certain that the carriage moves up and down properly and the mast can be tilted smoothly. Make certain that the relief valve operates accompanying its relieving sound when each cylinder piston reaches the stroke end.

Pay attention to system operating sound.

7. Check the tension and abnormality of the lift chains.

To check the tension, raise the fork about 5cm above the ground and push the middle of the chain with the thumb. Make certain the tension for the right and left chains is even. If uneven tension is found, loosen the lock nut (A) of anchor pin and adjust the chain, turning the adjusting nut (B) of the chain anchor one.



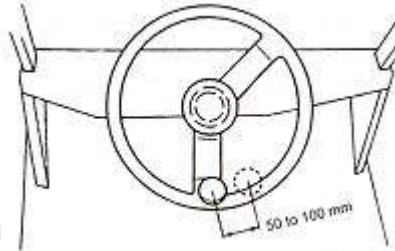
**NOTE:**

Don't use "Grease" but use "Machine Oil (ex. Hydraulic Oil)" only for lift chain lubrication.

**▲ CAUTION**

If any abnormality is found, ask professional serviceman for inspection.

### 2.3.8 Steering wheel inspection



Perform the following i

1. Check free stroke of the steering wheel with the rear wheel set in the straight traveling direction.

The free stroke of steering wheel when idling: 50-100mm

2. Turn the steering wheel in the circumferential direction and also move it up and down to check if there is any looseness.

3. Press the horn button to check if the horn sounds normally.

4. If any abnormality is found, ask a professional serviceman for inspection.

### 2.3.9 Horn button operation check

Press the horn button to make certain the horn sounds.

### 2.3.10 Drivers' seat adjustment

Make sure the driver's seat is properly located. If not properly, shift the adjusting lever to the right and move the driver's seat to a position which provides easy access to all foot and hand controls. After adjustment, shake the driver's seat a little to be sure that it is securely locked.

### 2.3.11 Shift lever(s) check

Check the shift lever(s) for looseness and operation.

## 2.4 When driving slowly

### 2.4.1 Brake effect

Inspect if there is anything abnormality when the brake pedal is pressed or if the brakes only work on one side.

Use the parking brake and ensure that the vehicle stops and maintains a parking state.

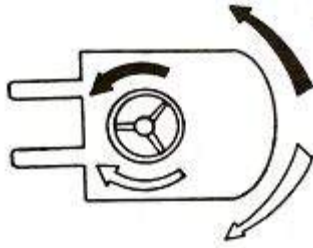
Caution:

If any abnormality, stop vehicle immediately and ask a professional serviceman for inspection.

### 2.4.2 Direction inspection

Turn the steering wheel traveling slowly to see that the steering forces are equal in right and left or that any abnormality does not exist.





## 2.5 Before garaging th

Remove dirt from inspections.

and then perform the following

1. Inspect if any oil or water leakage.
2. Inspect each component for distortions, scratches, dents or cracks.
3. Clean the air filter element and lubricate parts where necessary.
4. Lift the forks all the way up and down to lubricate lift cylinder.

Caution:

Even a small abnormality may cause a serious accident.

Do not operate the vehicle until repairs have been completed.

If you feel anything unusual during operation, notify the supervisor.

## 2.6 Self-repair & maintenance

### 2.6 .1 Replace or repair tyre

Tyres have high air pressure and can be very dangerous to take apart. Only qualified personnel should remove tyres.

Prepare tools and jack necessary for replacing or repairing tyres.

#### Front wheel

·Park the vehicle on solid floor and shut down the engine. All loads should be unloaded from the vehicle.

·Press the parking brake pedal and block the wheels with wedges. Put the jack under the vehicle frame.

·Jack up the vehicle to the extent that the tyre still remains on the ground. Loosen the hub nuts. Do not remove them.

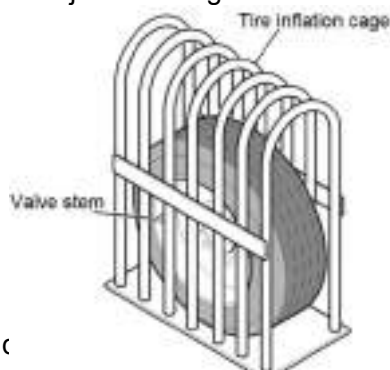
·Again jack up the truck until the tyre leaves off the ground. Remove the hub nuts, and detach the wheel.

·The wheel should be reinstalled in the reverse order: the hub nuts should be tightened in the diagonal order evenly.

·After reinstallation, check the tyre for pressure and make it achieve standard value.

#### Rear wheel

Use the same manner as with the front wheel tyre for repair or replacement except for the position of the jack which goes under the counterweight.



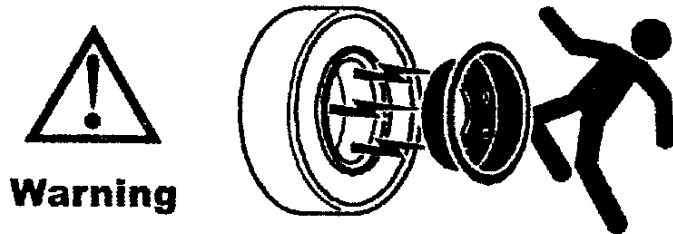
#### Notice:

- When inflating or c cage or barrier shall be used.
- Always check for .... damage before inflating .... Do not add air to tires with cracked or damaged rims. Adding air to tires with damaged rims can cause the rim to

break with explosive force. If a damaged rim is discovered, have the wheel removed and repaired by trained and qualified personnel before using the truck.

- When checking tire pressure, place your body in front of the tread face of the tire. Do not check from the side face of the tire.
- Always inflate tires to the correct pressure. Incorrect tire pressure can cause premature wear or explosive separation of multi-piece rim sets.
- Always wear safety glasses when inflating tires to avoid possible eye injury from dust or dirt.
- Only properly trained personnel should replace pneumatic tires on multi-piece rim sets.
- Always use correct procedures when servicing or replacing pneumatic tires on multi-piece rim sets. Failure to use proper procedures can result in explosive separation of the tire and rim set and cause severe injury or death.
- OSHA safety procedures must always be followed. Refer to OSHA 1910.177.
- Do not mix different sizes or tire types, this could affect stability.
- If the procedures listed above are not followed the result could be death or serious injury.

**Warning:**



The tire inflation pressure on a forklift truck is several times higher than the pressure on an automobile. Also, multi-piece rim sets can present the hazard of explosive disassembly if not handled properly.

When working with wheels or tires, always observe the following safety rules. Failure to observe these rules could result in severe injury or death.

## **2.6.2 Clean air filter**

### **Clean filter element**

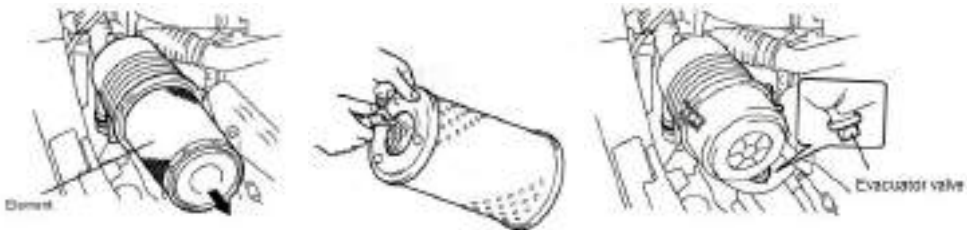
(1). Beat up the filter element or paper lightly without causing any damage or blow dust off with compressed air (7kg/cm<sup>2</sup> or less) from inside.

a. Dip the element in water containing neutral detergent for approximately 30 minutes and then wash. Pay attention not to scratch the filter paper.

b. After washing, rinse the element with clean water (water pressure less than 2.8 kg/cm<sup>2</sup>).

c. Allow to dry naturally or use a dryer (cold air). Never use compressed air or flame.

(2). After cleaning the element, remove any dust in the evacuator valve (optional).



**Notice:**

- Always replace the element if the filter paper is torn or damaged.
- Wash the element if heavily contaminated.
- The element should be replaced after washing for six times or used for one year.

**2.6.3 Retighten bolts and nuts**

Retighten each bolt and nut on the chassis and load handling system.

**2.6.4 Add antifreeze**

If the vehicle is parked at a place where the temperature is less than 0 °C, the cooling water will freeze and may damage the radiator and/or cylinder. In this cases, antifreeze coolant must be used.

When long-life coolant (LLC) is used, it must be replaced once every two years. Freezing temperature varies by amount of antifreeze added.

|                                   |     |     |     |     |
|-----------------------------------|-----|-----|-----|-----|
| Freeze protection temperature(°C) | -12 | -15 | -24 | -35 |
| Antifreeze (%)                    | 25  | 30  | 40  | 50  |

**Caution:**

The antifreeze fluid is flammable, so be particularly careful to avoid flame. Before adding antifreeze, inspect the radiator, water pump, piping and cylinder block for leakage.

The procedures for adding antifreeze are as follows.

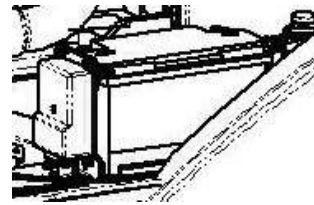
- (1). Remove the radiator cap. Loosen the drain cock on the radiator and cylinder and drain the cooling water.
- (2). Flush out the radiator and cylinder by adding clean water through the radiator inlet.
- (3). After the water has drained out of the radiator and cylinder block, tighten the radiator and engine drain cocks.
- (4). Add the proper amount of antifreeze to the radiator inlet and fill up the remaining space with clean water.
- (5). When temperature raises and there is no longer any danger of freezing, drain the cooling water containing the antifreeze (except LLC, LLC is replaced every 2 years).

Flush out the radiator and engine cylinder and fill with clean water.

**2.6.5 Fuse replacement**

If a lamp isn't on or an electrical device does not function, the corresponding fuse may be burnt. Check the fuse for each device.

The lighting location on the fuse box is the burnt fuse when electrified. The fuse box is located in the front left of the opened engine hood.



The fuse is checked and replaced as the following procedures:

- (1). Set the ignition switch to the OFF position.
- (2). Remove the fuse box cover and check the fuse.
- (3). If the fuse is burnt, replace it with a spare fuse.

|             |          |        |            |       |        |        |               |
|-------------|----------|--------|------------|-------|--------|--------|---------------|
| Light color | Brown    | Yellow | Red        | Green | Yellow | Red    | Red           |
| Current     | 7.5A     | 5A     | 10A        | 30A   | 5A     | 10A    | 10A           |
| Component   | Headlamp | Horn   | Small Lamp | ECU   | Meter  | Switch | Control Power |

**▲ CAUTION**

Use the fuse of the same specification as the original one. on or fire.

Notice:

The datial information of use box refers to Service Manual.

**2.6.6 Clean the radiator fin**

Clean the radiator and radiator fin, if foreign matters therein, it may cause over-heating.

**Caution:**

- After stopping the engine, confirm that the engine has been sufficiently cooled down before cleaning. Taking inadequate precautions may result in scald.
- When cleaning the radiator fin, take care not to cause it become deformed.
- When performing cleaning, always wear safety goggles and dust mask.

**2.6.7 Maintain battery**

**Terminals:**

(1). A loose or corrosive terminal may cause poor connection. In case any white powder on the terminal, dissolve it with hot water and then lubricate the terminal with grease.



(2). If terminal is seriously corrosive, take it off from the battery to remove the corrosion substance with a wire brush or sandpaper. Then connect the terminal tightly to the battery and grease the terminal.

**Notice:**

Remove the negative terminal (-) first, then replace the other terminals in the same manner.

**Caution:**

- Stop the engine when attempt to maintain the battery and terminals.
- Be careful not permitting any foreign matter to come into the battery by means of putting the lids tightly in place.
- Be careful to cause neither a short circuit on the battery nor nearing fire, because the battery-emitted gas is inflammable.

·Be careful enough not to contact the battery electrolyte. When it comes into contact with an eye or skin, wash it off immediately with a plenty of water and then see a doctor.

·Charge the battery with the lids off in a well-ventilated area.

·When battery electrolyte is spilt, be certain to wash it off with water thoroughly at the spot and adjacent area.

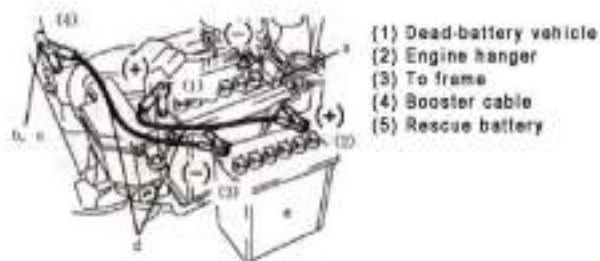
#### **When the battery is discharged**

When a booster cable is available, it is possible to start the engine with the battery of another vehicle.

Connect the booster cable as the matter shown in figure.

Make sure of (+) and ( - ) terminals of the cable when connecting.

#### **Caution:**



·Connection (1): The (+) terminal of discharged battery.

·Connection (4): Use a frame apart from the battery.

·Do not directly connect batteries to avoid a danger of explosion.

(An inflammable gas generated from batteries may cause fire.)

### **2.6.8 Torque converter inspection**

#### **<High oil temperature>**

When the oil temperature is too high, you should immediately stop the forklift, let the engine idle running, and check the cooling system and water tank. If the cooling system is normal, check if the oil level is between the F and L levels. If the oil level meets the requirements, after adjusting machine working condition, check the temperature of the tubing. If the temperature is low, remove tubing to remove sediment.

#### **<Low oil pressure>**

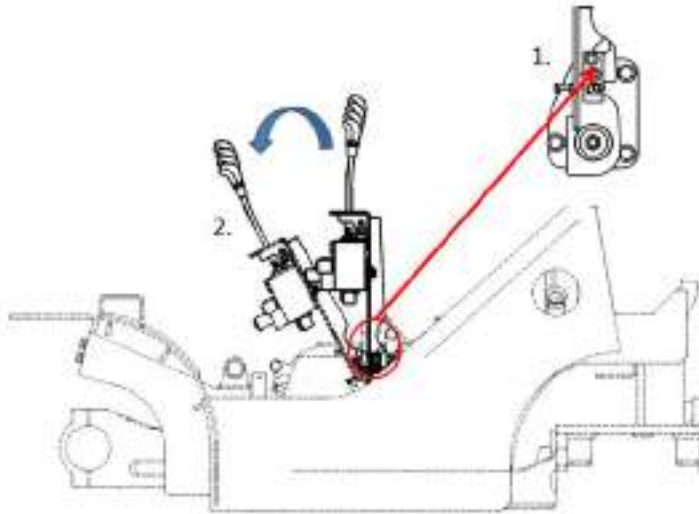
If the oil pressure is too low, check the oil level. If the oil level is lower than the lowest scale, add oil. If the oil level is normal, check [inlet tube](#) and [outlet tube](#) whether there is a leak.

### **2.6.9 Clean air filter (side control)**

1. Open Multitandem valve support

(1).Open lock catch

(2).Rotate Multitandem valve support(According to the direction of photo)



2. Clean filter element

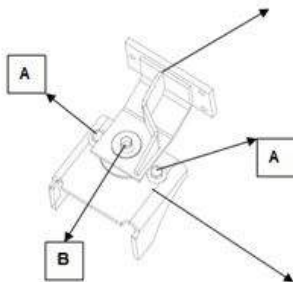
Reference 2.6.2

### 2.6.10 Check the engine mounts and screws

< Torque >

When the engines is working ,the vehicle will produce vibration ,need to check torque every 200h ,Detail of the following:

A, B=44.1N.m



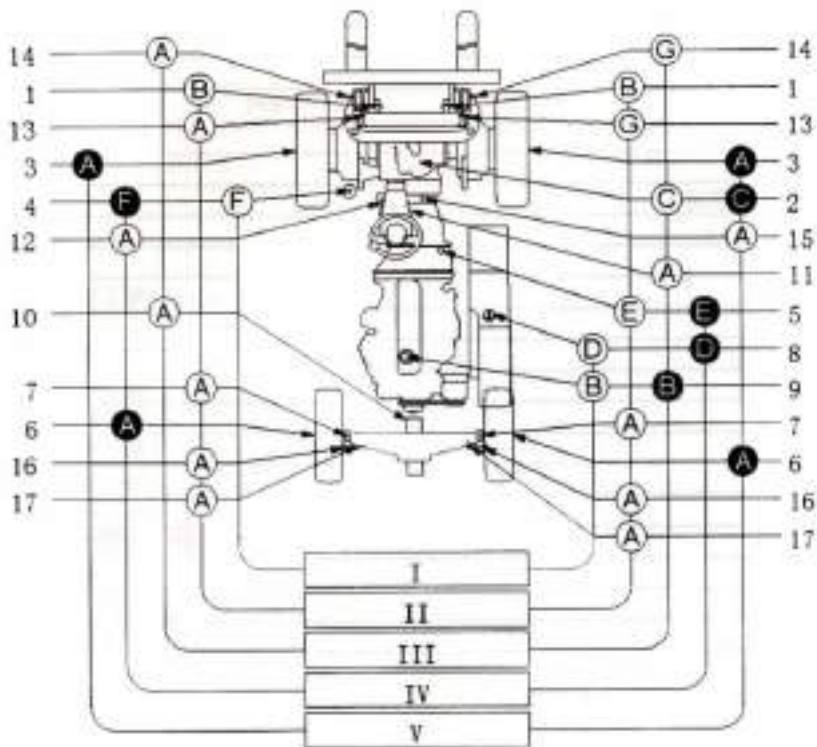
### 3. Periodic replacement table

| Replacement period (Accumulate hours of operation or monthly periods of operation, whichever comes sooner.) | Every 6Weeks | 3   | 6    | 12   | Months |
|---|--------------|-----|------|------|--------|
|   | Every 250    | 500 | 1000 | 2000 | Hours  |
| Engine oil  | •            |     | ←    | ←    | ←      |
| Engine oil filter   | •            |     | •    | ←    | ←      |

|   |                             |
|---|-----------------------------|
| Cooling water<br>(except LLC, LLC is every 2 years) | • ← ←                       |
| Air cleaner element                                 | •                           |
| Fuel filter   | • ←                         |
| Torque converter oil                                | • ←                         |
| Torque converter oil filter                         | • ←                         |
| Manual transmission oil                             | •                           |
| Differential gear oil                               | •                           |
| Hydraulic oil                                       | • ←                         |
| Hydraulic oil filter                                | • • ←                       |
| Wheel bearing grease                                | •                           |
| Spark plugs   | • ←                         |
| Master cylinder, wheel cylinder cap<br>and seals    | •                           |
| Brake fluid   | • ←                         |
| Power steering hose                                 | Every 2 years               |
| Power steering rubber parts                         | Every 2 years               |
| Hydraulic hose                                      | Every 2 years               |
| Fuel hose   | Every 2 years               |
| Torque converter rubber hose                        | Every 2 years               |
| Chain<br>Hydraulic                                  | Every 3 years               |
| Hydraulic oil pump seal                             | Every 3 years or 6000 hours |

**Note:** In case of the busy operating condition, the recommended service interval is 170 hours or 1 month .

#### 4. Diagram of regular maintenance & lubrication



- |  |   |
|--|---|
| 1. Ct                                  | II) Inspect every 40 hours (weekly)     |
| 2. Differential gear                   | III) Inspect every 250 hours (6 weeks)  |
| 3. Front wheel bearing                 | IV) Inspect every 1000 hours (6 months) |
| 4. Brake fluid cup                     | V) Inspect every 2000 hours (annually)  |
| 5. Transmission case                   | ○ : Inspect and service                 |
| 6. Rear wheel bearing                  | ● : Replace                             |
| 7. Steering knuckle king pin           | A) MP grease                            |
| 8. Oil tank                            | B) Engine oil                           |
| 9. Engine crankcase                    | C) Hypoid gear oil                      |
| 10. Pump transmission device           | D) Hydraulic oil                        |
| 11. Foot operating assy                | E) Hydraulic transmission oil           |
| 12. Direction column locking mechanism | F) Brake fluid                          |
| 13. Mast support bushing               |   |
| 14. Tilt cylinder pin                  |   |
| 15. Propeller shaft                    |   |
| 16. Tie rod end pin                    |   |
| 17. Steering cylinder rear pin         |   |

**Note:** In case of the busy operating condition, the recommended service interval is 170 hours or 1 month



## **5. Recommended oil, grease and antifreeze for forklift truck**

The oil level listed in following table is approximation, the detailed value when operating shall be confirmed according to the instrument or corresponding gauge.

Adding oil, grease and antifreeze shall follow relevant automobile standard. The above oil shall be disposed by relevant laws and regulations. Improper disposal may pollute water, soil or air, etc.

It is necessary to wear safety protective devices such as safety goggles and thick gloves to avoid direct contact with human body when adding oil. Once the oil stain adheres on the skin, wash it with clean water and soap, it is forbidden to wash with gasoline or kerosene.

**Recommended oil, grease and antifreeze for forklift truck**

| Brand / Product              | General standard                | Recommended temperature                                      | Viscosity              | Domestic  | Caltex                           | Mobil                              | Shell                     | Esso                        | Oil level |
|------------------------------|---------------------------------|--|------------------------|---|----------------------------------|------------------------------------|---------------------------|-----------------------------|-----------|
| Engine oil                   | Gasoline<br>API SG<br>API SJ    | Asses "Viscosity Grade" according to environment temperature | SAE 5W-30              | SF  | RPM Delo 400 oil                 | Mobil super 5                      | Shell X100                | Esso extra motor oil        |           |
|                              |                                 |  | SAE 10W-30             | SG  |                                  |                                    | Shell Helix               |                             |           |
|                              | Diesel<br>API CF-4<br>API CH-4  | -10°C - +30°C  | SAE 15W-40             | SJ  |                                  |                                    |                           | Esso Superflo               |           |
|                              |                                 |  |                        | CD  | Shell Rimula C Diesel engine oil | Essolube XT ID                     |                           |                             |           |
|                              |                                 | -25°C - +30°C  | SAE 10W-30             | CF-4  | RPM Delo 400 oil                 | Mobil Delvac Super 1300            | Essolube XT2              |                             |           |
|                              |                                 | -20°C - +40°C  | SAE 15W-40             | CH-4  |                                  | Mobil Delvac MX Diesel engine oil  | Essolube XT5              |                             |           |
| Hydraulic fluid              | ISO 6743/4 L-HM<br>DIN 51524 II | ≥-10°C   | ISO VG32               | Antwear hydraulic fluid L-HM32                  | Rando oil 32                     | Mobil DTE24                        | Shell tellus oil 32       | Nuto H32                    | 45L       |
|                              |                                 |  | ISO VG68               | Antwear hydraulic fluid L-HM68                  |                                  |                                    | Shell tellus oil 46       | Nuto H 46                   |           |
|                              | ISO 6743/4 L-HV                 | ≥-20°C   |                        | Low temperature antiwear hydraulic fluid L-HV32 |                                  |                                    | Shell tellus oil 32       | Univas N32                  |           |
|                              |                                 |  |                        | Low pour point antiwear hydraulic fluid L-HS32  |                                  |                                    |                           |                             |           |
|                              | ISO 6743/4 L-HS                 | 2-40°C   |                        |   | Rando HDZ 32                     | Mobil DTE 13M                      | Shell tellus T32          |                             |           |
| Automatic transmission fluid | GM Dexron III                   |  |                        | 8# Transmission fluid                           | Texmatic fluid 1888              | Mobile ATF                         | Shell ATF III             | Esso ATF                    | 20L       |
| Brake fluid                  | FMVSS 116-DOT3                  |  |                        | JG-3  |                                  | Mobil super heavy duty brake fluid | Shell dotax B             | Esso brake fluid (DOT-4)    | 0.6L      |
| Grease                       | MP                              | -20°C - +120°C   |                        | 3# General lithium grease                       | Marik all purpose 2,3            | Mobil grease                       | Shell retinax grease      | Esso multipurpose grease H  |           |
|                              |                                 |  |                        | MoS <sub>2</sub> EP lithium grease              | Marik multipurpose 2,3           | Mobil grease Xi-P 222 special      | Shell avrania HDX2 grease |                             |           |
| Coolant fluid                | LLC                             | ≥-25°C<br>≥-35°C<br>≥-40°C                                   |                        | FD-II<br>FD-2A<br>FD-III                        |                                  | Mobil coolant                      | Shell freeze guard        | Esso coolant                | Filled    |
| Automotive gear oil          | API GL-5 or MIL-L-2105D         | -15°C - +48°C<br>-25°C - +48°C                               | SAE85W/90<br>SAE80W/90 | Heavy duty automotive gear oil 85W/90GL-5       | Thuban EP (80W-90,90)            | Mobil HD 85W/90GL-5                | Shell spirax A gear oil   | Esso gear oil Gx 85W/90GL-5 | 18L       |

## **IV. Structure, principle, adjustment and maintenance of forklift truck**

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In order to always keep your forklift under the best condition, you shall well understand structure, principle, adjustment and maintenance of the forklift truck. Any fault of the truck shall be repaired by professional and qualified serviceman and genuine parts of Baoli shall be used for replacement.

### **1. Power system**

#### **1.1 General description of engine**

Power system mainly consists of the engine, fuel system, intake system, cooling system and exhaust system. The engine is mounted on the frame by rubber cushion to reduce vibration. The engine is integrated with torque converter, transmission case, drive shaft and drive axle as a whole.

More details related to structure and adjustment of the engine refer to the operation and maintenance manual of engine.

#### **1.2 Engine parameters and appropriate truck model**

| Engine model |            | Rated output /Speed<br>Kw/r.p.m | Rated torque /<br>Speed<br>N.m/r.p.m | Cylinder<br>number<br>-Bore×Stroke<br>mm | Total<br>displacem<br>ent<br>L |       |
|--------------|------------|---------------------------------|--------------------------------------|--|--------------------------------|-------|
| 柴油<br>机      | Xinchang   | BPG490                          | 37/2650                              | 148/1900                                 | 4-90×100                       | 2.54  |
|              |            | BPG495                          | 42/2650                              | 174/1800                                 | 4-98×105                       | 2.98  |
|              |            | BPG498                          | 45/2500                              | 191/1600                                 | 4-98×105                       | 3.168 |
|              | ISUZU      | C240PKJ                         | 34.5/2500                            | 139/1800                                 | 4-86×102                       | 2.369 |
|              |            | 4JG2PE                          | 44.9/2450                            | 186.3/1600                               | 4-95.4×107                     | 3.059 |
|              | Yanmar     | 4TNE92                          | 32.8/2450                            | 149/1600                                 | 4-92×100                       | 2.659 |
| 4TNE98       |            | 44.3/2300                       | 206/1700                             | 4-98×110                                 | 3.319                          |       |
| 汽油<br>机      | Mitsubishi | 4G64-31ZG                       | 37/2500                              | 161/1600                                 | 4-86.5×100                     | 2.350 |
|              | Nissan     | K21                             | 31.2/2250                            | 143/1600                                 | 4-89×83                        | 2.065 |
|              |            | K25                             | 37.4/2300                            | 176/1600                                 | 4-89×100                       | 2.488 |

Corresponding engine and forklift model refers to the table below and affixed with CE label:

| Engine model       | The<br>guaranteed<br>Sound power<br>level LwA(dB)<br>2000/14/EC | Exhausting<br>2004/26/EC | CECONFOR<br>MITY<br>2006/42/EC | Truck model |     |
|--------------------|---|--------------------------|--------------------------------|-------------|-----|
| diesel<br>engine   | ISUZU   | C240PKJ                  | 106                            | StageIIIA   | yes |
| 4TNE98             | Yanmar  | 4TNE92                   | 107                            | StageIIIA   | yes |
|                    |   | 107                      | StageIIIA                      | yes         |     |
| gasoline<br>engine |   | Mitsubishi               | 4G64<br>-31ZG                  | 105         |     |
|                    | Nissan  | K21                      | 105                            |             | yes |
| K25                |   | 105                      |                                | yes         |     |

**Note:** The sound power level LWA executes 2000/14/EC standard and exhausting executes 2004/26/EC standard. 2004/26/EC is not applicable to forklift truck with gasoline engine.

### 1.3 Inspection and adjustment of engine

In order to keep your truck under good condition, you shall carry out periodic inspection and adjustment of power system.

- (1) Regularly clear the dust of element of air filter.
- (2) Regularly replace oil filter and fuel filter.
- (3) Check and add the coolant periodically.
- (4) Periodic inspection of air valve of engine and ignition time of injection pump.
- (5) Regularly adjust fan belt and all fasteners.

**Note:** Always check the exhaust emission of the engine during using the forklift truck. Especially after repair and maintenance of the engine, it's necessary to verify the emission index to ensure that emission value satisfies the national standard so as to minimum damage to the human body and environment.

### 1.4 Fuel tank

Fuel tank is welded together and assembles truck body into an organic whole. It locates in the left side of the frame. Tank cover plate is located in tank above. Cover plate is equipped with fuel sensor which is used for monitoring oil flow. The structure of Gasoline engine fork truck is same with diesel engine fork truck, just the former is suction pipe and the latter is return tube.

#### 1.4.1 Oil flow sensor

The function of oil flow sensor is put the oil in the oil tank into the current value, see Figure 4.1.

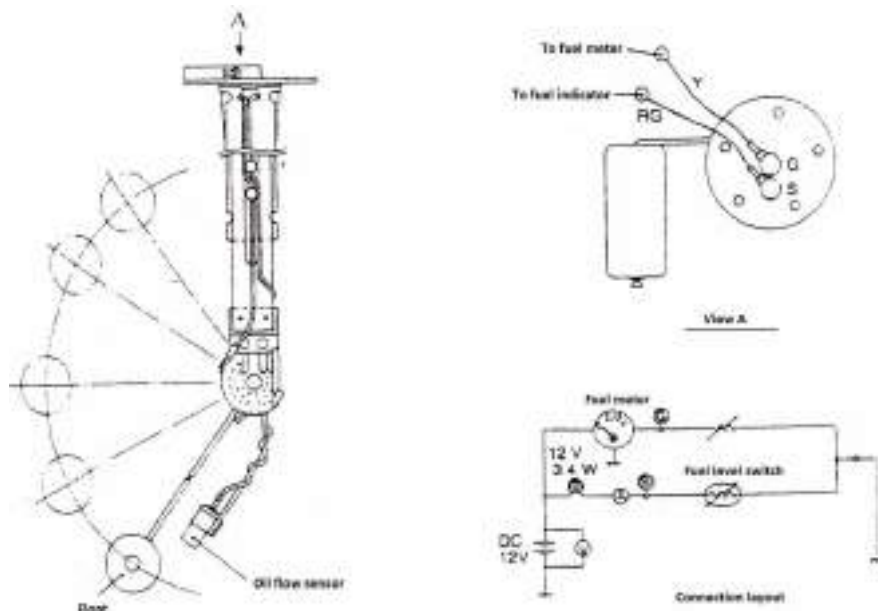


Figure 4.1 Oil flow sensor

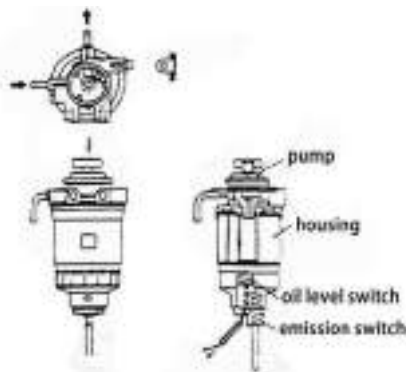
#### 1.4.2 Maintenance of fuel system

Make a maintenance and service to the fuel system maintenance every 100 hours

of work, according to the following method. Do a cleaning of the fuel tank every 600 hours of work.

(1) Oil filter

The fuel installed in the fuel pump ( Diesel engine ) is used for filter which is supplied for engine.



▲ Diesel engine

- (a) Replace air filter every 600 hours of work;
- (b) Along the new filter sealing ring around a few drops of fuel injection, and then put on. Seal come into contact with the oil filter, and then turned into two thirds.
- (c) When the oil filter warning lights, loosen the drain switch water purification

**Note:** After draining, Ensure the water shut-off.

(2) Clean fuel tank

Clean the fuel tank every 600 hours of work. To forklift truck with gasoline engine, it's important to pay attention to fire prevention when cleaning.

**1.5 Instructions for using cooling system**

(1) When using the forklift truck, if radiator is boiled or the temperature of coolant is too high, don't open the cap of the radiator immediately. If the cap is opened for finding out reasons for boiling, reduce speed of the engine to medium speed to fully cool its cooling system till idling, slowly rotate radiator cap and dismantle it after a while to avoid scalding operators due to splashed coolant. When tightening the cap, tighten it in place otherwise it will be difficult to rebuilt the specified pressure system.

(2) If shrinkage compensation can is mounted on the left side of the engine, the can shall be marked with FULL and LOW, level of antifreeze shall be in the middle of the two marks. After leakage and evaporation of the antifreeze, add anti-rust antifreeze of the same modle. The antifreeze can be used all over the year without replacement. Usually, antifreeze which is used for one year shall be discharged for filtration and purification before reuse.

(3) Antifreeze is poisonous, which shall be identified as "dangerous substance" during storage and placed at a safe place. If swallowed by accident, take the emergency first aid and consult a physician immediately.

(4) According to different working conditions, regularly clean dirt on the surface of the radiator with detergent or wash with compressed air or high pressure water (pressure less than 4kg/cm<sup>2</sup>) .

**2. Tor-con drive unit**

**Hydraulic drive unit**

|        |      |  |
|--------|------|--|
| Torque | Type | Three elements, single stage, two phases |
|--------|------|--|

|                        |                              |                               |
|------------------------|------------------------------|-------------------------------|
| converter              | Torque ratio                 | 3                             |
|                        | Set pressure                 | 0.5 ~ 0.68 MPa                |
| Charging pump          | Type                         | Inner-mesh gear pump          |
|                        | Flow rate                    | 27 L/min ( 2000rpm,1.5MPa )   |
| Hydraulic transmission | Type                         | Power shifted                 |
|                        | Speed ration (FWD/BWD)       | 1.35/1.35                     |
| Hydraulic clutch       | Friction piece: O.D.×I.D.×T. | Φ125×Φ80×2.7 (mm)             |
|                        | Friction area                | 71cm <sup>2</sup>             |
|                        | Set pressure                 | 1.1 ~ 1.4 MPa                 |
| Weight                 |                              | 165kg                         |
| Oil amount             |                              | 7 L                           |
| Oil type               |                              | 6# or 8# Torque converter oil |

## 2.1 General description

Hydraulic transmission type forklift truck is provided with a drive unit including a torque converter and an electron gear-shifting transmission case (See Figure4.4), which is featured by:

(1) With an inching valve, the inching operation can be carried out when the engine runs at both high and low speeds.

(2) Hydraulic clutch is provided with three pairs of steel plates and high quality friction pieces after special processing, which improves the durability of friction surface.

(3) One-way overrun clutch in the torque converter improves the efficiency of power transmission.

(4) High quality filter in torque converter improves cleanliness of oil and the service life of the torque converter.

## 2.2 Torque converter

The torque converter mainly consists of pump impeller, turbine and an guide wheel and its structure refers to Figure 4.5.

Impeller driven by an input shaft, liquid, is jetted along cascade of pump impeller to cascade of turbine under the action of centrifugal force (at this moment, mechanical energy is transferred to dynamic energy), torque is transmitted to output shaft, fluid which leaves the turbine changes direction under the action of guide wheel, thus a portion of fluid returns to the pump impeller at a certain angle. At this moment, reacted torque to push the guide wheel is produced, so output torque is a reacted torque value more than input torque, when rotating speed of turbine is increased by input speed, angle of fluid flow reduces and torque of output shaft reduces. Finally, the fluid flows in cascade of guide wheel along a reverse direction, original reacted torque acts reversely, so torque of output shaft is less than torque of output shaft. To prevent the occurrence of such case, one-way clutch in guide wheel makes the guide wheel freely rotate under the reaction of reacted torque.

Such torque conversion method can guarantee efficient and stable operation.

The torque converter of drive system is connected with flywheel of engine via

elastic plate and rotates as the rotation of engine, which is filled with the torque converter oil. Main gear is connected with pump impeller with two jaws to drive fuel feed pump to supply torque converter and hydraulic transmission box. Turbine is connected to turbine shaft via multiple key and power is transmitted to the transmission box through a turbine shaft.

### 2.3 Fuel system of torque converter (See Figure 4.6)

After the engine is started, the fuel feed pump inhales the oil from the oil tank (i.e. Shell bottom of transmission box), which flows through control valve. The pressure oil from the pump is divided into two parts via the valve: one for hydraulic clutch and the other for fuel feed of torque converter.

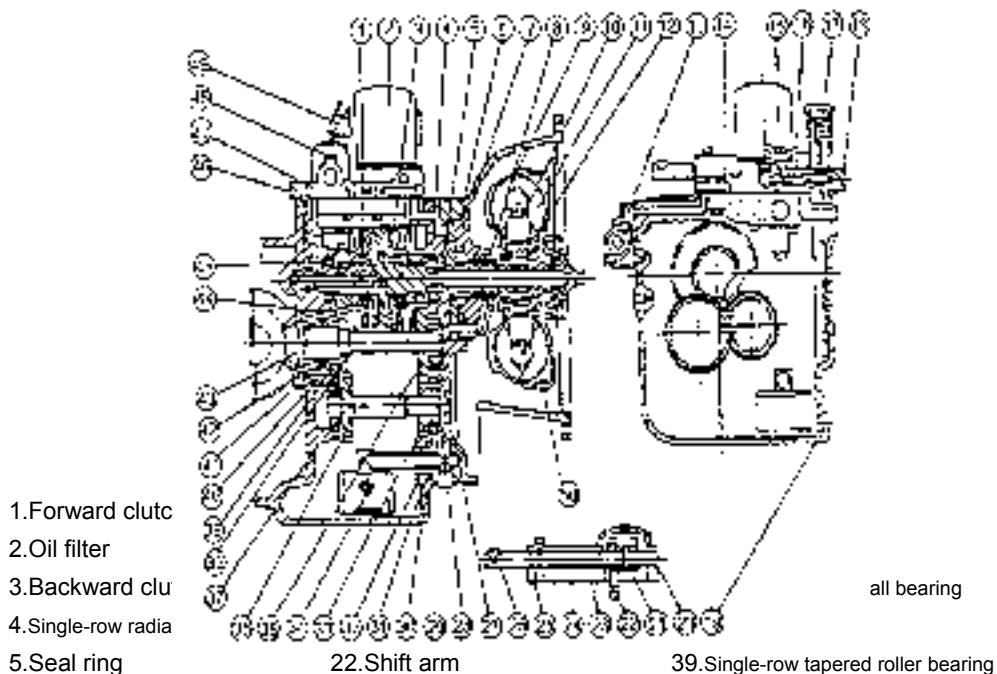
The oil necessary for operation of the hydraulic clutch flows into constant pressure valve (pressure set at 1.1-1.4MPa), on one hand, oil from the constant pressure valve further flows to inching valve and slide valve; on the other hand, the oil feeds cascade of torque converter via relief valve (pressure set at 0.5-0.7MPa), oil from the torque converter is cooled by an oil radiator, lubricate the hydraulic clutch and finally returns to the oil tank.

In the neutral position, the fuel pipe from the slide valve to the clutch is closed, at this moment, constant pressure valve is open, oil flows into the torque converter via relief valve. When the slide valve lies at its forward or backward position, the fuel pipes from the slide valve to forward clutch are connected to have all clutches act: when a clutch is at work, spacer and friction piece in another clutch are under separated condition, lubricated and cooled. When the inching valve is operated through stressing the inching pedal, a portion of the majority of oil introduced in clutches flows into the oil tank through the inching valve rod. The oil circulation for the torque converter then is the same as that in the neutral.

### 2.4 Towing disabled truck

After hydraulic drive type truck is damaged which need towing by other vehicles, pay attention to:

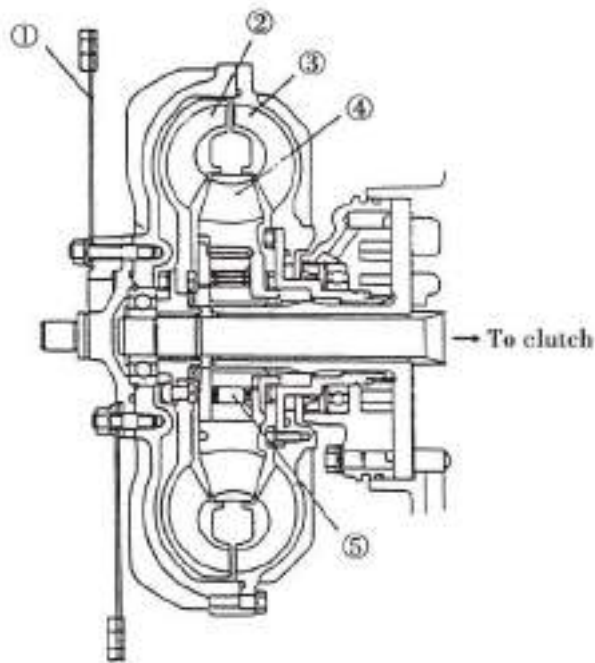
- (1) Remove the half-shaft from the front wheel.
- (2) Electron shift should be placed in the neutral.





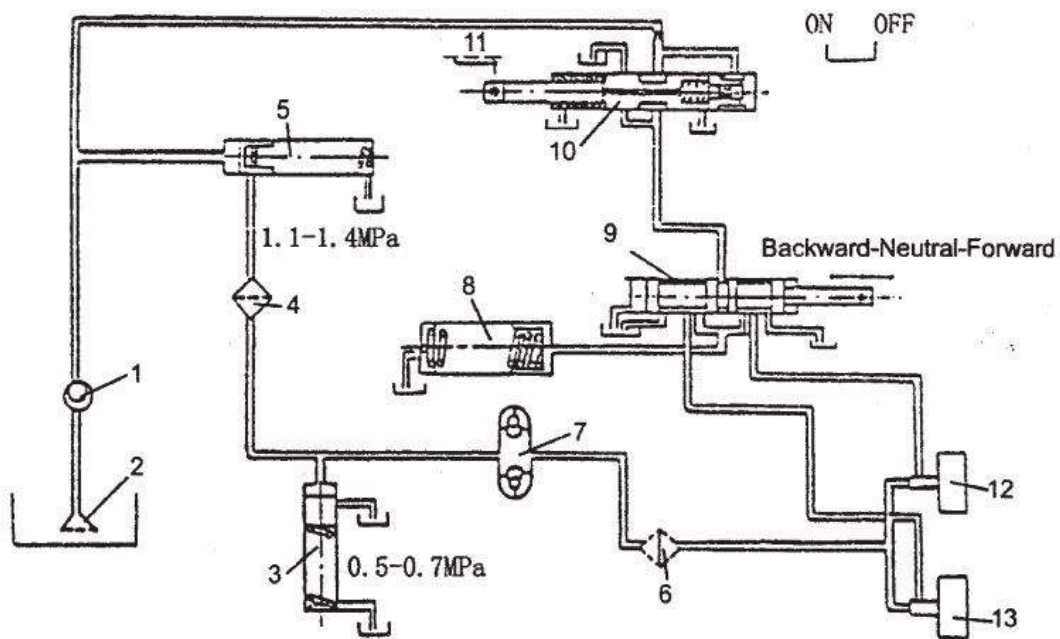
- |                    |                                   |                                      |
|--------------------|-----------------------------------|--------------------------------------|
| 6.O-ring           | 23.Transmission case cover        | 40.O-ring                            |
| 7.Charging pump    | 24.Shift shaft                    | 41.Oil seal                          |
| 8.Oil seal         | 25.O-ring                         | 42.Single-row tapered roller bearing |
| 9.Impeller         | 26.Haft-round key                 | 43.Output shaft                      |
| 10.Guide wheel     | 27.Clip ring for hole             | 44.Supporting piece                  |
| 11.Turbine         | 28.Single-row radial ball bearing | 45.Single-row radial ball bearing    |
| 12.Spring plate    | 29.Single-row radial ball bearing | 46.Inner-hexagon plug                |
| 13.Inching valve   | 30.O-ring                         | 47.Cover                             |
| 14.Control valve   | 31.Snap ring                      | 48.Bolt                              |
| 15.Piston          | 32.O-ring                         | 49.Switch, reverse lamp              |
| 16.Spring          | 33.Idler                          | 50.Drain plug                        |
| 17.Oil inlet cover | 34.Oil filter                     |                                      |

Figure 4.4 Hydraulic drive unit



- |                 |                   |             |
|-----------------|-------------------|-------------|
| 1. Spring       | 2. Turbine        | 3. Impeller |
| 4. Idler pulley | 5. One-way clutch |             |

Figure 4.5 Torque converter



- |                     |                    |                     |
|---------------------|--------------------|---------------------|
| 1. Charging pump    | 2. Oil filter      | 3. Relief valve     |
| 4. Oil filter       | 5. Pressure valve  | 6. Oil radiator     |
| 7. Torque converter | 8. Adjusting valve | 9. Slide valve      |
| 10. Inching valve   | 11. Switch         | 12. Backward clutch |
| 13. Forward clutch  |                    |                     |

Figure 4.6 Hydraulic circuit

## 2.5 Trouble shooting

(1) Insufficient power

| <b>Parts</b>     | <b>Problem</b>  | <b>Possible cause and remedy</b>   |
|------------------|---|--|
| Torque converter | A. Too low oil pressure                                 |  |
|                  | 1. Lower oil level                                      | Check oil level and add oil  |
|                  | 2. Air entering in resulting from loose connections     | Check connection or oil pipe. Retighten each connection or replace seal. |
|                  | 3. Blocked oil filter                                   | Check, clean or replace.   |
|                  | 4. Oil can not be pumped out                            | Check and replace  |
|                  | 5. Deformed spring of relief valve                      | Check tension of spring  |
|                  | 6. Seal ring or O-ring seal damaged                     | Check and replace  |
|                  | B. Fly wheel damaged                                    | Check oil, if have dirt, replace it.                                     |
| Gear Box         | A .Unsuitable oil or air bubble in oil                  | Check oil  |
|                  | 1. Air entering in resulting from loose connections     | Check connection or oil pipe. Retighten each connection or replace seal. |
|                  | 2. Too low oil pressure or air bubble in oil            | Measure and adjust pressure  |
|                  | B. Slipped clutch                                       |  |
|                  | 1. Oil pressure lower                                   | Measure and adjust pressure  |
|                  | 2. Seal ring damaged                                    | Check and replace  |
|                  | 3. Piston ring of the clutch damaged                    | Check and replace  |
|                  | 4. Worn friction piece or deformed steel piece          | Replace  |
|                  | C. Incorrect position between inching rod and shift rod | Check and adjust   |
| Engine           | Insufficient engine power                               | Adjust or repair engine  |

(2) Higher oil temperature

| <b>Parts</b>     | <b>Problem</b>                                      | <b>Possible cause and remedy</b>   |
|------------------|---|--|
| Torque converter | 1. Lower oil level                                  | Check oil level and add oil  |
|                  | 2. Blocked oil filter                               | Check, clean or replace.   |
|                  | 3. Fly wheel bump against other parts               | Check oil, if have dirt, replace it.                                     |
|                  | 4. Air entering in resulting from loose connections | Check connection or oil pipe. Retighten each connection or replace seal. |

|          |                         |                                  |
|----------|-------------------------|----------------------------------|
|          | 5. Water mixed into oil | Check and replace oil            |
|          | 6. Lower oil flow       | Check pipe and replace           |
|          | 7. Worn bearing         | Check and replace                |
| Gear box | 1. Slipped clutch       | Replace friction piece of clutch |
|          | 2. Worn bearing         | Check and replace                |

### (3) High noisy of gear box

| Parts            | Problem                       | Possible cause and remedy                 |
|------------------|-------------------------------|---|
| Torque converter | 1. Elasticity plate is broken | Check noise and replace elasticity plate. |
|                  | 2. Damaged or worn bearing    | Check or replace                          |
|                  | 3. Gear is broken             | Check or replace                          |
|                  | 4. Spline is worn             | Check or replace                          |
|                  | 5. Noisy main pump            | Check or replace                          |
|                  | 6. Loosen bolt                | Check, tighten or replace.                |
| Gear box         | 1. Bearing is worn            | Check or replace                          |
|                  | 2. Gear is broken             | Check or replace                          |
|                  | 3. Spline is worn             | Check or replace                          |
|                  | 4. Loosen bolt                | Check, tighten or replace.                |

### (4) Low transmission efficiency

| Parts            | Problem                                   | Possible cause and remedy        |
|------------------|---|----------------------------------|
| Torque converter | 1. Elasticity plate is broken             | Check noise and replace          |
|                  | 2. Lower oil amount                       | Check oil level and add oil      |
|                  | 3. Ineffective driving system of oil pump | Check and replace                |
|                  | 4. Shaft is broken                        | Check and replace                |
|                  | 5. Too low oil pressure                   | Check oil pump for suction pipe  |
| Gear box         | 1. Lower oil amount                       | Check oil level and add oil      |
|                  | 2. Seal ring is worn                      | Check and replace                |
|                  | 3. Slipped clutch                         | Check oil pressure of the clutch |
|                  | 4. Shaft is broken                        | Check and replace                |
|                  | 5. Clutch cap is broken                   | Check and replace                |

|  |  |                          |
|--|--|--------------------------|
|  | 6. Retainer ring of clutch cap is broken | Check and replace        |
|  | 7. Foreign matter mixed in oil tank      | Check, clean or replace. |
|  | 8. Spline of shaft is worn               | Check and replace        |

### (5) Oil leakage

| Parts                        | Problem                         | Possible cause and remedy                  |
|------------------------------|---------------------------------|--|
| Torque converter or gear box | 1. Worn seal ring               | Check and replace seal ring                |
|                              | 2. Incorrect connection of case | Check, tighten or replace.                 |
|                              | 3. Loose connector and oil pipe | Check, tighten or replace.                 |
|                              | 4. Loose drain plug             | Check, tighten or replace.                 |
|                              | 5. Oil spray from vent hole     | Check connector, air hole or replace pipe. |
|                              | 6. Much oil                     | Check oil level and drain surplus oil      |

## 3. Drive system

### Drive system technical parameters

|                |   |              |
|----------------|---|--------------|
| Type           | Front wheel drive, axle body and frame fastened together, fully floating type |              |
| Forklift truck | 3t  | 3.5t         |
|                | Single tyre( 2) Double tyre ( 4)  |              |
| Tyre size      | 28×9-15-12PR  | 28×9-15-14PR |
| Rim size       | 7.00WFB-15  | 7.00WFB-15   |
| Tyre pressure  | 0.80Mpa   |              |

**Notice:** Due to different manufacturers' standards, normal tyre inflation pressure refers to actual configurations and requirements of tyres.

### 3.1 General description

The drive axle mainly consists of the housing, the wheel hub, the half shaft and the brake unit. The housing is an integral casting structure. The tyre with the rim is fixed to the hub with studs and nuts. The power is transmitted to the half shaft through the differential and drives the front wheels through the hubs. Each hub is fixed on the axle housing with two tapered roller bearings, so that the half shaft only bears torque transmitted to the hubs. Oil seal is mounted inside wheel hub to prevent water and dust from entering inside the hub and oil leakage.

The structure of drive axle refers to figure 4.10.

### 3.2 Assembly of wheel hub

(1) Fill about 100 cc lithium base grease in wheel hub with, then fit the hub on the shaft. (Figure 4.11)

2) Screw down the adjusting nut with a torque of about 1kg.m and then loosen it for 1/2 turn.

(3) Hang the spring balance on the bolt to measure the hubs' starting torque. When the starting torque arrives the specified value, lock the nuts slowly.

Starting torque: 5 to 15 kg.m (Figure 4.12)

(4) Install the lock plates and lock nuts, after that pull the lock plates up to lock the bolts.

(5) Assemble wheel (Figure 4.13)

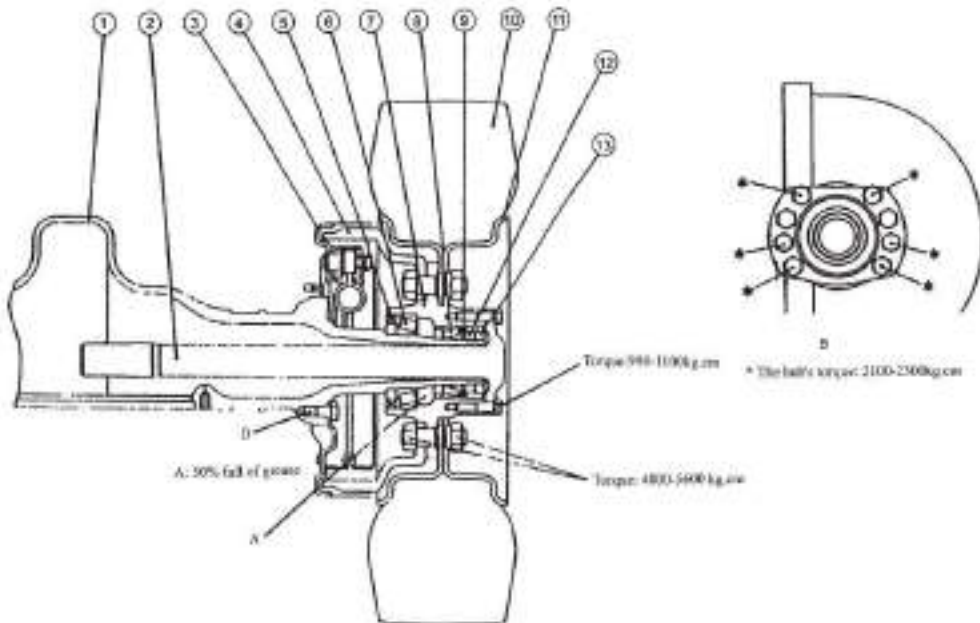
Install the inner rim and gasket inside the outer rim and assemble the outer rim and inner rim. Pay attention to the following items:

(a) Put the air valve nozzle outside, in the notch of the rim.

(b) Make the tops of the rim face outside when installing mounting bolts of the rim.

(c) Don't stand near the tyre when inflating air.

(d) When the tyre pressure reaches 98KPa (1kgf/cm<sup>2</sup>), knock the tyre lightly to make the inner tyre and gasket enter the rim.



|               |                          |                 |
|---------------|--------------------------|-----------------|
| 1 Housing     | 6 Tapered roller bearing | 1 Rim           |
| 2 Half-shaft  | 7 Wheel hub              | 2 Adjusting nut |
| 3 Wheel brake | 8 Tapered roller bearing | 3 Lock nut      |
| 4 Brake drum  | 9 Oil seal               |                 |
| 5 Oil seal    | 0 Tyre                   |                 |

Figure 4.10 Drive axle

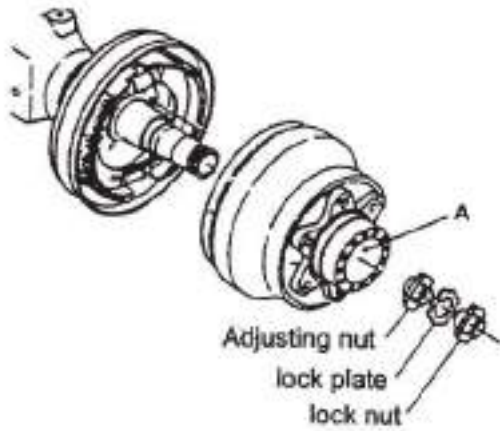


Figure 4.11 Add grease

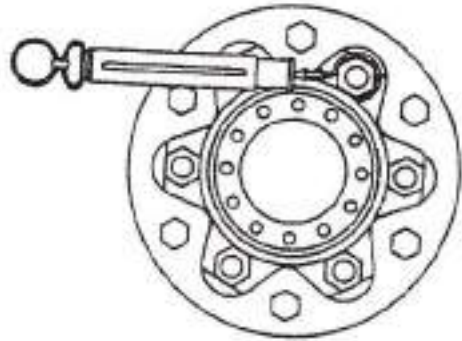
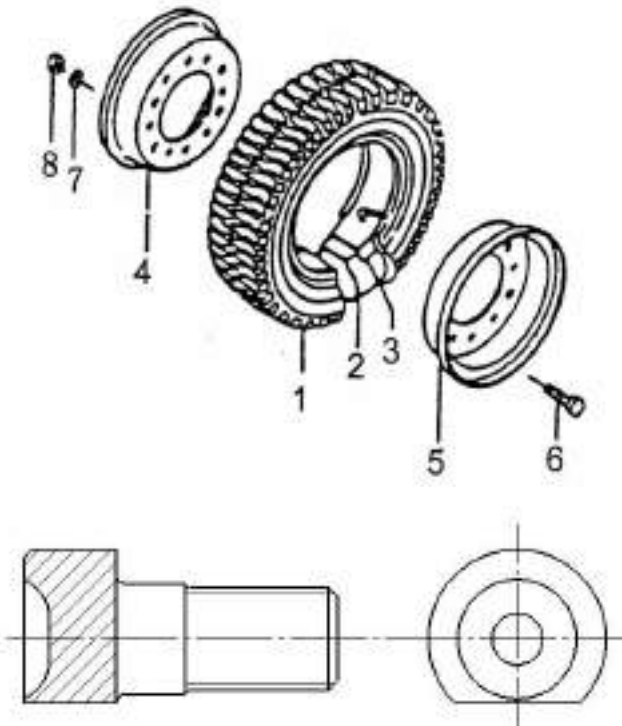


Figure 4.12 Measure starting torque



Structure of rim bolt

- |              |              |                  |
|--------------|--------------|------------------|
| 1. Tyre      | 4. Inner rim | 7. Spring washer |
| 2. Air valve | 5. Outer rim | 8. Nut, rim      |
| 3. Bushing   | 6. Rim bolt  |                  |

Figure 4.13 Wheel assembly

### 3.3 Troubleshooting

| Problem | Probable cause | Remedy |
|---------|----------------|--------|
|---------|----------------|--------|

|                                 |   |                    |
|---------------------------------|---|--------------------|
| Oil leaks from the reducer case | Connecting bolt of reducer is loose or worn shim                          | Tighten or replace |
|                                 | Blocked air hole  | Clean or replace   |
|                                 | Worn or damaged oil seal  | Replace            |
| Noisy differential              | Worn or damaged gear  | Replace            |
|                                 | Worn or damaged bearing   | Replace            |
|                                 | Misadjusted gear clearance  | Adjust             |
|                                 | Interference fit of spline connecting with half shaft gear and half shaft | Replace parts      |
|                                 | Insufficient gear oil   | Add oil            |

## 4. Brake system

**Table 4.5 Brake system technical parameters**

|                               |   |
|-------------------------------|---|
| Type of brake system          | Front two-wheel braking, internal expansion, hydraulic type |
| Pedal ratio                   | 5.66  |
| Master cylinder bore          | 19.05mm   |
| Wheel brake                   | 3t, 3.5t  |
| Type                          | Duo-servo type with parking brake                           |
| Operating cylinder bore       | 28.58mm   |
| Size, friction pieces (L×W×T) | 348×76×8 (mm)   |
| Area, friction pieces         | 264cm <sup>2</sup> ×4                                       |
| Inner diameter of brake drum  | 314mm   |
| Parking brake                 | Front two-wheel braking, internal expansion, hydraulic type |

### 4.1 General description

The brake system is the front double-wheel braking type, consisting of master cylinder, brake and brake pedal mechanism.

### 4.2 Master cylinder

The cylinder contains a valve seat, a check valve, a return spring as well as primary cup, piston and secondary cup, of which the end is fixed by stop washer and stop wire, external part protected from dust by means of a rubber dust cover and piston is actuated through the push rod under the operation of the brake pedal. When the brake pedal is pressed, the push rod pushes the piston downward, brake fluid in the cylinder flows back to the reserve tank through the return port until primary cup blocks up the return port, after the primary cup passes through the return port, the brake fluid in the lower cavity of the cylinder is pressurized and opens the check valve, and then flows through the brake pipeline to brake cylinder, in this case, all pistons of brach cylinders extend outwards, which makes friction pieces on the brake shoes



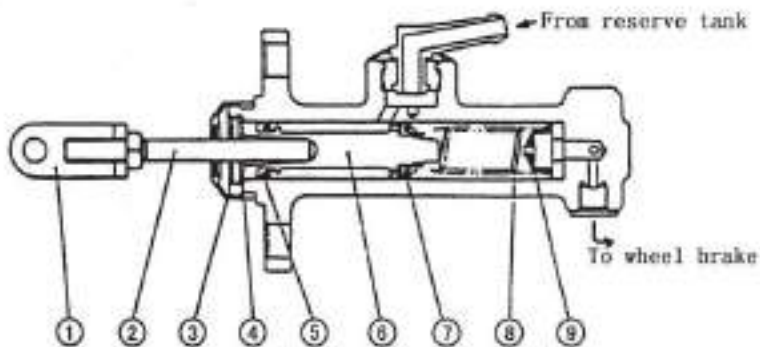
come into contact with the brake drum to slow or stop the truck, at this moment, the cavity behind the piston is compensated by brake fluid through the return port and inlet port. When the brake pedal is released, the piston is forced back by the return spring, meanwhile, the brake fluid in all brake cylinders is pressurized by the return spring, returning into the master cylinder through the check valve, with the piston back to its original position, the brake fluid in the master cylinder flows into the reserve tank through the return port., pressure of check valve is adjusted to form a certain proportion against residual pressure in brake pipelines and brake cylinder, which makes piston cup of brake cylinder is correctly installed to prevent oil leakage and eliminate a possibility of air locking when the truck is sharply braked.

The structure of master cylinder refers to Figure 4.14.

### 4.3 Wheel brake

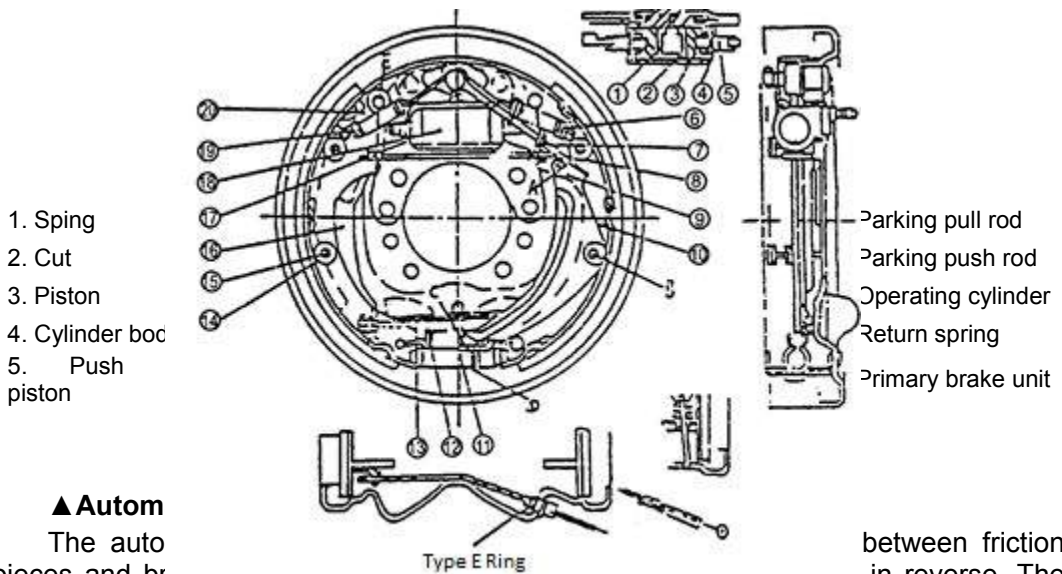
The wheel brake is the internal expansion hydraulic type, consisting of brake shoes, spring, brake cylinder, adjuster and backing plates. Two wheel brakes are mounted on both ends of the front axle. One end of the brake shoe is connected to the anchor pin and the other is connected to the adjuster and stressed on the backing plate by the spring and spring pull rod. The primary brake shoe is provided with the manual parking pull rod while the secondary brake shoe is provided with the adjusting lever of the automatic clearance adjuster.

The structure of wheel brake refers to Figure 5.2.



- |               |                  |                |
|---------------|------------------|----------------|
| 1. Link rod   | 4. Snap ring     | 7. Primary cup |
| 2. Push rod   | 5. Secondary cup | 8. Spring      |
| 3. Dust cover | 6. Piston        | 9. Check valve |

Figure 4.14 Master cylinder



- 1. Spring
- 2. Cut
- 3. Piston
- 4. Cylinder boc
- 5. Push piston

**▲ Autom**

The auto pieces and br

secondary brake shoe contacts with the brake drum and rotates together, the pull rod turns right around the point A so that the point B of the rod raises (Figure 4.3). After release the brake pedal, the pull rod turns left under the action of the spring force so that the point B of the rod lowers.(Figure 4.16)

When the clearance between the friction pieces and the brake drum increases, the vertical distance of the pawl rotating at point B increases. When the clearance is more than 0.4mm, one tooth of the adjuster is dialed and the adjusting lever becomes longer, so that the clearance decreases.

Clearance adjusting range: Within 0.4 to 0.45mm.

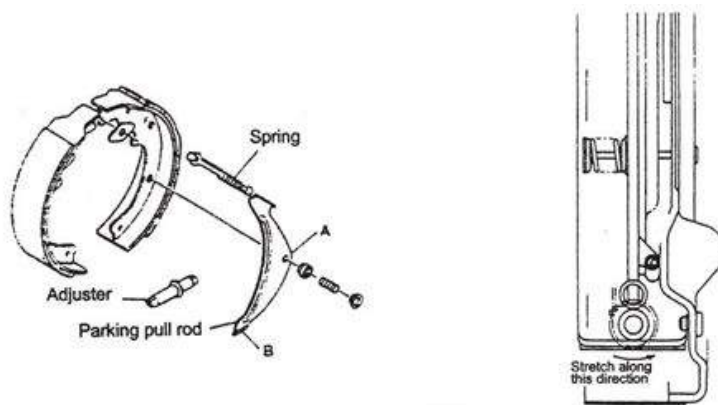


Figure 4.16 Automatic clearance adjuster

**4.4 Operating device of parking brake**

The parking brake is lever type. Open the second cap on the right of the instrument bracket covering, adjuster is visible, the brake force can be adjusted with the parallel-driver.

Brake force adjustment:

When you turn the adjuster clockwise, the force increases;, when you turn the adjuster counterclockwise, the force decreases.

Pressure: 50kg

Operating method: Turn off the key, press the parking brake pedal with left foot

until a sound “ka--” is heard, then release it. When release the parking brake, pull the blue lever (release switch) under the combination lamp to the release position, then the parking brake can be released.

The structure of parking brake refers to Figure 4.17.

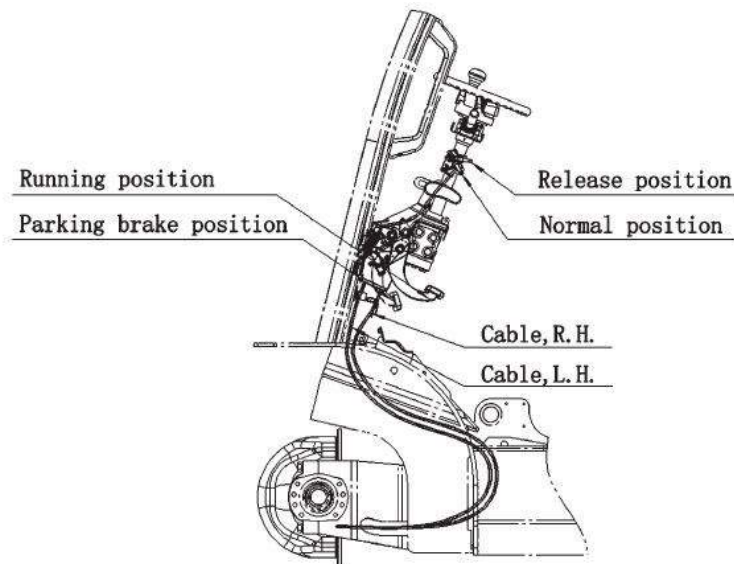


Figure 4.17 Parking brake

#### 4.5 Inspection of wheel brake

Inspect all parts to make sure if there're any abrasion or damage. If necessary, repair or replace with new ones.

(1) Check the inner surface of brake cylinder and surface of the piston for rusting. Then, measure the clearance between the piston and cylinder body:

Specified clearance: 0.03 to 0.10 mm

Limit: 0.15mm

(2) Visually check the primary cup of the brake cylinder for damage or deformation. If necessary, replace it.

(3) Check the brake cylinder spring for free length. If necessary, replace it.

(4) Check the friction piece for thickness, if it is excessively worn replace it.

Unit : mm

|                    |      |          |
|--------------------|------|----------|
|                    | 1.5t | 1.8t、 2t |
| Standard thickness | 7.2  | 8        |
| Max. thickness     | 5.0  | 6        |

(5) Check the inner surface of brake drum for damage and excessive Abrasion. If necessary, repair or replace it.

Unit : mm

|                    |      |          |
|--------------------|------|----------|
|                    | 1.5t | 1.8t、 2t |
| Standard dimension | 310  | 314      |
| Max. dimension     | 312  | 316      |

(6) Measure the free length and the installation load of the brake shoe return spring.

(7) Check the adjuster for damage, check the operation condition, and the contact point between the lever and gear for defect. Replace it if necessary.

#### 4.6 Troubleshooting

| Problem        | Probable cause  | Remedy              |
|----------------|---|---------------------|
| Poor braking   | 1.Fluid leaks from brake system                                   | Repair              |
|                | 2.Maladjustment of brake shoe clearance                           | Adjust the adjuster |
|                | 3.Brake overheating   | Check for dragging  |
|                | 4.Poor contact between brake drum and friction piece              | Readjust            |
|                | 5.Foreign matter adhered on friction piece                        | Repair or replace   |
|                | 6.Foreign matter mixed in brake fluid                             | Check brake fluid   |
|                | 7.Maladjustment of brake pedal (inching valve)                    | Adjust              |
| Noisy brake    | 1.Hardened friction piece surface or foreign matter adhered on it | Repair or replace   |
|                | 2.Deformed backing plate or loose bolts                           | Repair or replace   |
|                | 3.Deformed shoe or incorrect installation                         | Repair or replace   |
|                | 4.Worn friction piece   | Replace             |
|                | 5.Loose wheel bearing   | Repair              |
| Uneven braking | 1.Oil-contaminated friction piece                                 | Repair or replace   |
|                | 2.Maladjustment of brake shoe clearance                           | Adjust the adjuster |
|                | 3.Malfunction operating cylinder                                  | Repair or replace   |
|                | 4.Return spring of brake shoe deteriorated                        | Replace             |
|                | 5.Deflected drum  | Repair or replace   |
| Soft braking   | 1.Brake fluid leaks from system                                   | Repair or replace   |
|                | 2.Maladjustment of brake shoe clearance                           | Adjust the adjuster |
|                | 3.Air mixed in brake system                                       | Bleed air           |
|                | 4.Maladjustment of brake pedal                                    | Readjust            |

### 5. Steering system

|                       | 1.5t                                    | 1.8t | 2t |
|-----------------------|---|------|----|
| Steering system       | Rear wheel powered steering             |      |    |
| Type of steering unit | Cycloid gear type powered steering unit |      |    |

|                                |                           |                                 |   |  |
|--------------------------------|---------------------------|---------------------------------|---|--|
| Model of steering unit         |                           | BZZ1-100 (sealed by taper ring) |   |  |
| Steering cylinder              | Double-action piston type | Double-action piston type       |   |  |
|                                | Cylinder bore mm          | φ70                             |   |  |
|                                | Diameter of piston rod mm | φ50                             |   |  |
|                                | Stroke mm                 | 160                             |   |  |
| Rated pressure Mpa             | 5                         | 6.5                             | 7 |  |
| Diameter of handwheel mm       | φ380                      |                                 |   |  |
| Pressure of steering wheel Mpa | 0.84                      | 0.76                            |   |  |

The steering system mainly consists of steering wheel, steering shaft and steering unit. The steering shaft is directly connected with the steering unit. The steering column can be tilted forward or backward to a proper position. ( See Figure 4.18 )

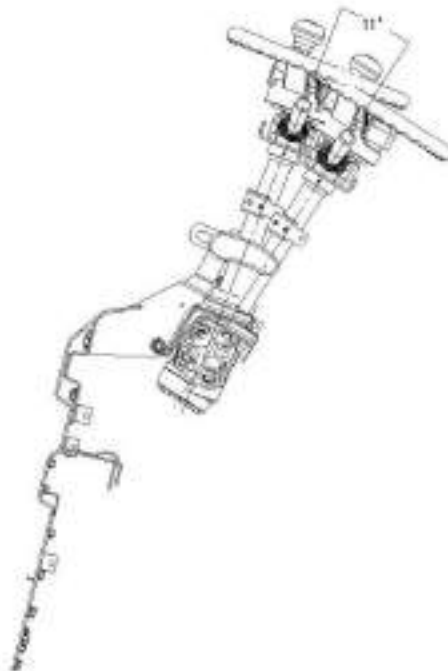
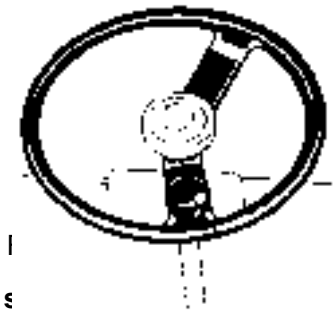


Figure 4.18 Steering operation device

### 5.1 Steering wheel

Steering wheel is operated in the same way as normal vehicles, that is to say, when turning the steering wheel right, the truck will turn right. When turning the steering wheel left, the truck will turn left. Steering wheel is mounted at the back of the forklift truck, which makes the tail section of the truck swing out when turning.



### 5.2 Cycloidal hydraulic steering unit

The hydraulic steering unit (Figure 4.20) can transmit the pressure oil from the flow divider by pipes to the steering cylinder in terms of the rotating angle of the steering wheel. When the engine stops running, the oil pump can't supply oil, in this case a manual steering should be adopted.

1. Spacing sleeve
2. Valve body
3. Valve body
4. Interlock shaft
5. Spring piece
6. Joint sleeve
7. Rotor
8. Stator
9. Valve sleeve

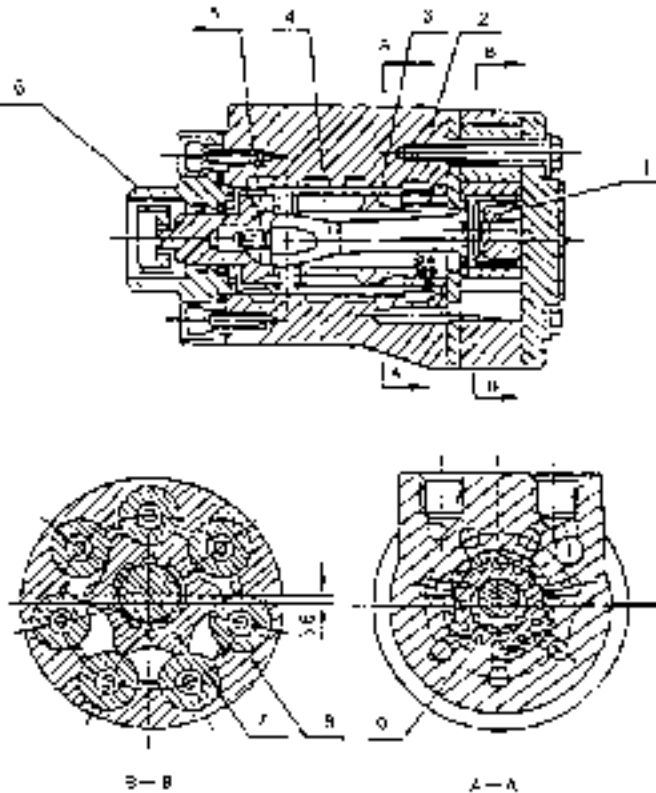


Figure 4.20 Cycloid gear type powered steering unit

### 5.3 Inspection after reassembling the steering system

(1) Check if the force is evenly applied and rotation is stable when turning the steering wheel right and left until it can't be turned any more

(2) Check if hydraulic pipeline is correctly laid and if the turning direction is correctly installed.

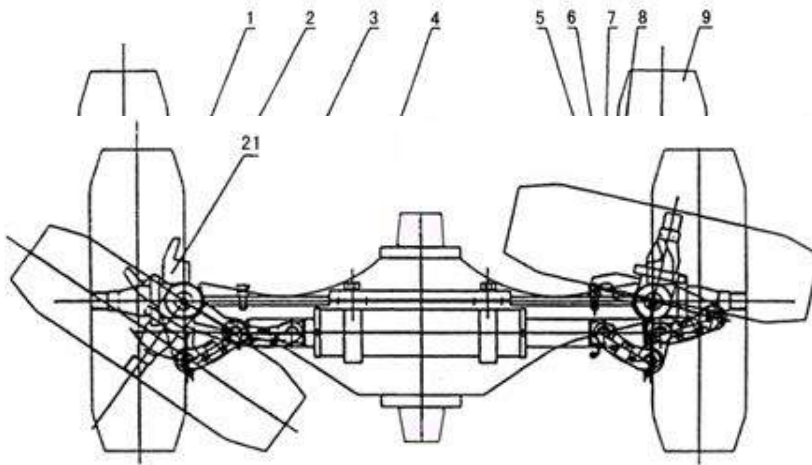
(3) Lift up the rear wheels and slowly turn the steering wheel left and right several times to drain the air in the hydraulic pipelines and the cylinder.

#### 5.4 Troubleshooting

| Problem                                   | Analysis of trouble   | Remedy                            |
|---|---|-----------------------------------|
| Fail to turn handwheel                    | Oil pump damaged  | Replace                           |
|   | Flow-divider blocked or damaged   | Clean or replace                  |
|   | Hose or joint damaged or pipeline blocked   | Clean or replace                  |
| Difficult to turn handwheel               | Too low oil pressure from flow-divider  | Adjust pressure                   |
|   | Air in steering oil circuit   | Exhaust air                       |
|   | Steering unit fail to reposition due to spring piece damaged or insufficient elasticity | Replace spring piece              |
|   | Excessive inner-leakage in steering cylinder  | Check piston seals                |
| Truck's naking or moving with oscillation | Excessive flow rate for steering  | Adjust flow divider for flow rate |
|   | Spring damaged or elasticity insufficient   | Replace                           |
| Excessive noise                           | Too low oil level in oil tank   | Refill oil                        |
|   | Suction pipeline or oil filter blocked  | Clean or replace                  |
| Oil leakage                               | Seals of guide sleeve, pipeline or joint damaged  | Replace                           |

#### 5.5 Steering axle

The steering axle is box cross-sectional welded structure (Fig5.3), consisting of axle body, steering cylinder, tie rod, steering knuckles and steering wheels. The steering axle adopts crank block mechanism, pressure oil is transmitted to steering knuckle by cylinder piston rod via tie rod, which makes steering wheel deviate and realize steering. The steering axle is connected to the rear frame by the buffer.

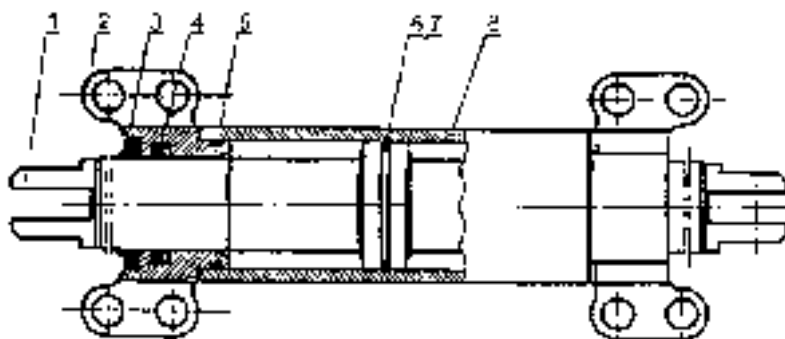


- |   |                       |     |                        |     |                    |
|---|-----------------------|-----|------------------------|-----|--------------------|
| 1 | Axle body             | 9.  | Tyre                   | 17. | Oil seal           |
| 2 | Tie rod               | 10. | Oil seal               | 18. | O-ring             |
| 3 | Steering cylinder     | 11. | Tapered roller bearing | 19. | Bushing            |
| 4 | Damper, steering axle | 12. | Tapered roller bearing | 20. | Dust sleeve        |
| 5 | Knuckle assy, R.H.    | 13. | Hub cover              | 21. | Knuckle assy, L.H. |
| 6 | Thrust bearing        | 14. | Hub                    |     |                    |
| 7 | Needle bearing        | 15. | Hub bolt               |     |                    |
| 8 | King pin              | 16. | Hub nut                |     |                    |

Figure 4.21 Steering axle

### 5.5.1 Steering cylinder

The steering cylinder is double-acting piston type. The seal unit of the piston adopts combination seal of supporting ring and O-ring, seal between cylinder cover and piston rod adopts Yx-ring. The cylinder is fixed on the steering axle through cylinder covers on both sides.



- |   |        |     |    |         |   |                 |
|---|--------|-----|----|---------|---|-----------------|
| 1 | Piston | rod | 4. | Yx-ring | 7 | Supporting ring |
| . | assy   |     | .  |         | . |                 |



- |   |                |    |        |   |               |
|---|----------------|----|--------|---|---------------|
| 2 | Cylinder cover | 5. | O-ring | 8 | Cylinder body |
| 3 | Dust ring      | 6. | O-ring |   |               |

Figure 4.22 Steering cylinder

### 5.5.2 Rear wheel bearing pre-load adjustment

(1) As shown in Figure 4.23, fill grease in the chamber formed by wheel hubs, wheel hub bearing and wheel hub covers. Coat the lips of the oil seals with lubricating grease.

(2) Fix the bearing race to the hub and mount the hub on the knuckle shaft.

(3) Fit a flat washer and tighten a castle nut with torque of 206~235N.m and loosen it and then tighten it again with torque of 9.8N.m.

(4) slightly knock at it with a wooden hammer and rotate the hub for 3~4 turns to ensure no looseness of the hub;

(5) Tighten the castle nut and align one of its notches with a hole drilled in the steering knuckle.

(6) Again slightly knock at the hub with a wooden hammer and manually rotate the hub for 3~4 turns to ensure its smooth rotation with a specified torque of 2.94~7.8N.m.

(7) If the rotating torque is higher than the specified value, screw out the castle nut for 1/6 turn and measure the torque value then.

(8) When the torque value measured is up to the specified one, lock the castle nut with a cotter pin.

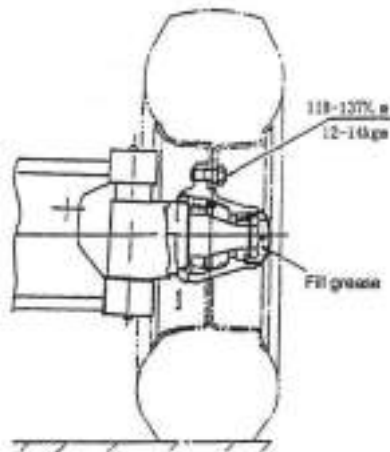


Figure 4.23 Pre-load adjustment

## 6. Hydraulic system

|                |     |                   |  |
|----------------|-----|-------------------|--|
| Hydraulic pump | oil | Type              | Gear pump  |
|                |     | Displacement      | 35.7 ml/r  |
| Control valve  |     | Type              | Two-pool type with relief valve, flow divider and tilt valve |
|                |     | Setting pressure  | 17.5MPa  |
|                |     | Dividing pressure | 9Mpa(3t) / 10.5MPa(3.5t)                                     |
|                |     | Flow rate         | 13L/min(3t、3.5t)   |
| Lift cylinder  |     | Type              | Single-action piston type, with cut-off valve                |

|                      |           |                                  |
|----------------------|-----------|----------------------------------|
|                      | Bore Dia. | Φ56mm                            |
|                      | Stroke    | 1495mm (Only for 3m lift height) |
| Tilt cylinder        | Type      | Double-action piston type        |
|                      | Bore Dia. | Φ80mm                            |
|                      | Stroke    | 136mm                            |
| Hydraulic oil amount |           | 42L                              |

## 6.1 General description

The hydraulic system consists of hydraulic pump, control valve, lift cylinder, tilt cylinder, and oil pipelines, etc. The oil tank is installed on the right side of the truck.

### 6.2 Hydraulic oil pump (Figure 4.24)

The hydraulic oil pump is a gear pump, which is driven directly by the power output device of the engine. The oil in the oil tank flows to the control valve through master pump.

The hydraulic oil pump consists of pump body, a pair of gears, lining plate and snap rings. The pressure-balance method may lead the lining plate press on the side face of gear due to outleting oil between the lining plate and pump body. This pump uses pressure-balance type bearings and a special lubrication method to minimum the gear clearance.

### 6.3 Control valve & flow divider (Figure 4.25)

The control valve (two slide valve) consists of four valve housings, two slide valves, one relief valve and one flow divider. The four valve housings are assembled together with three studs and nuts. The tilt slide valve is provided with a tilt lock valve.

- |              |
|--------------|
| 1.Pump bo    |
| 2.Driving ge |
| 3.Driven ge  |
| 4.Front cov  |
| 5.Rear cov   |
| 6.Lining pla |
| 7.Seal ring  |
| 8.Ring       |
| 9.Oil seal   |
| 10.Snap rin  |

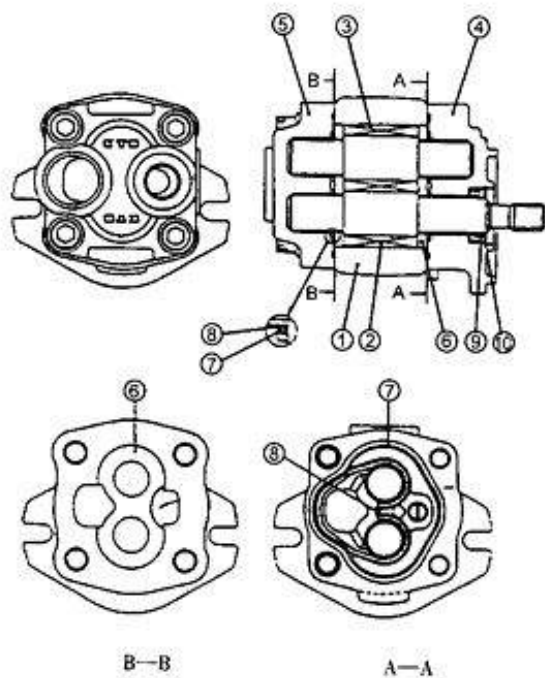
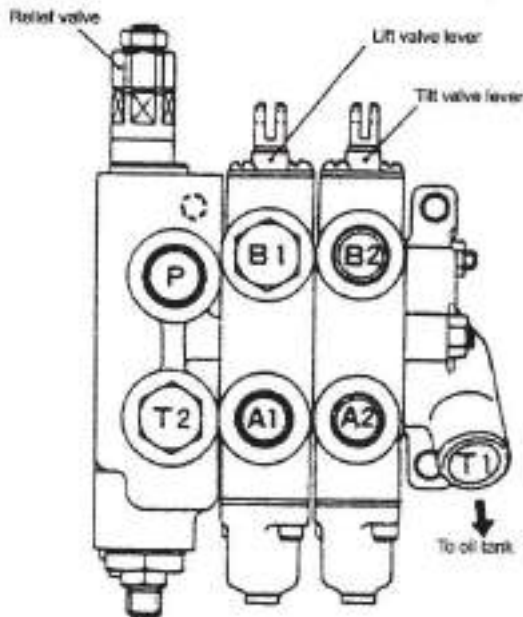


Figure 4.24 Hydraulic pump

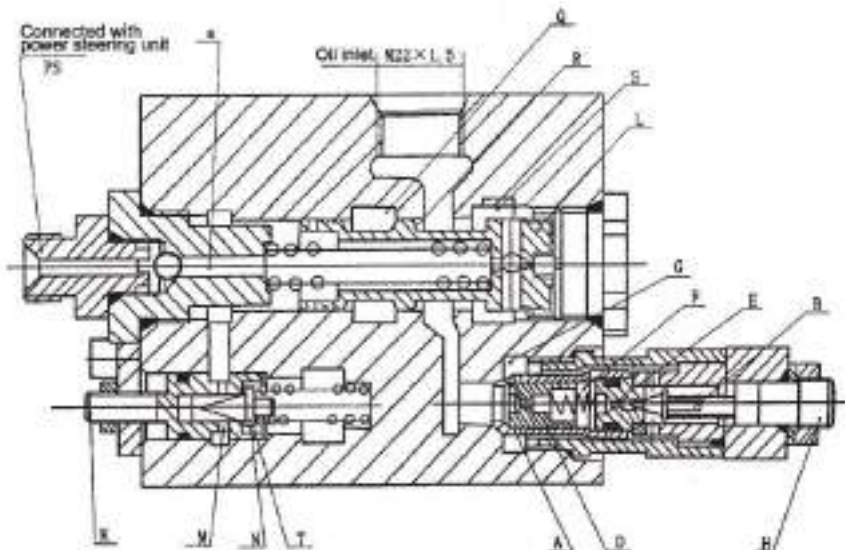


Structure of relief valve and flow divider refers to Figure 4.26.

The relief valve consists of main valve A and pilot valve B. When the control valve changes direction, chamber Q is connected with high pressure oil in working mechanism (e.g. Lift cylinder, tilt cylinder). The high pressure oil affects the pilot valve B through throttle holes D and E. If the system pressure is higher than the setting pressure, the pilot valve B is open to reduce the pressure in chamber F and thus spool of the main valve A moves right, then the oil may directly flow to low-pressure passage G and load off. In this way, the system pressure may keep stable. The adjusting screw H can be used to adjust stable pressure of the system.

The structure of the flow divider is more simple. It is direct overflow type, which can obtain stable pressure value of the steering system under the principle that hydraulic pressure is directly balanced with spring force. When operating steering wheel, oil chamber M is connected with the high pressure passage. If the system pressure is higher than the spring force, the valve core N moves right, the pressure oil flow directly to the low-pressure passage via Chamber T and load chamber M off to ensure stable pressure of steering system. The adjusting screw K can be used to adjust stable pressure of the system.

Valve L is a balance slide valve, slide L moves right or left according to the change of the oil flow and pressure to change the opening of chamber R and S and ensure automatic balance between oil flowing working chamber Q and ports P and S and oil flowing to steering unit to achieve stable throttle by proportions. Hole a is a fixed throttle hole.



### ▲ Pressure adjustment of relief valve (Figure 4.27)

The pressure of the relief valve has been set before delivery. User can't adjust the pressure at will, otherwise it will bring dangers to system and safety of the vehicle. If the oil pressure is different from standard value, specialized servicemen adjust the pressure as the following procedures according to the measure method specified in JB/T3300:

(a) Screw out the measured hole plug from the inlet port of control valve and install the oil-pressure gauge (20MPa) on it.

(b) Operate the tilt lever, measure the pressure when the stroke is to the bottom.

(c) When the set pressure of relief valve can't match with the lift capacity of the forklift truck, loosen the lock nut of the overflow valve, screw the adjusting screw left and right to achieve the specified value. Turn the screw left when pressure is high, and turn right when it is low.

(d) After adjustment, tighten the lock nut.

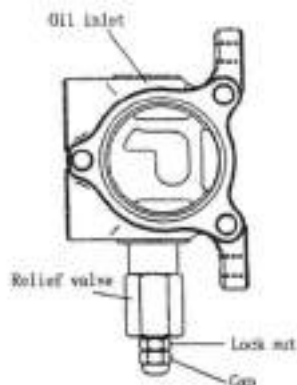


Figure 4.27 Pressure adjustment of the relief valve

### 6.4 Hydraulic oil circuit( Figure 4.28)

The high pressure oil from the hydraulic pump reaches control valve first, which is divided by the flow divider into two parts: one is transmitted to lift cylinder or tilt cylinder, and the other is transmitted to steering unit at constant flow rate to control the steering cylinder. When lifting and tilting slide valves are located in neutral position, the high pressure oil directly returns to the tank through the passage. When the lifting slide

valve is pulled, the high pressure oil flows through the flow divider and pushes the piston rod up from the lower part of the lift cylinder. When pushing the lifting slide valve, the lower part of the lift cylinder is connected with low pressure and the piston rod begins to descend due to the weight of the load. In this case, falling speed of the oil from lift cylinder is controlled. When the tilt lever is operated, the high pressure oil can flow in the front chamber of the tilt cylinder, while the other side is connected with low pressure, which makes the mast then tilt forward or backward.

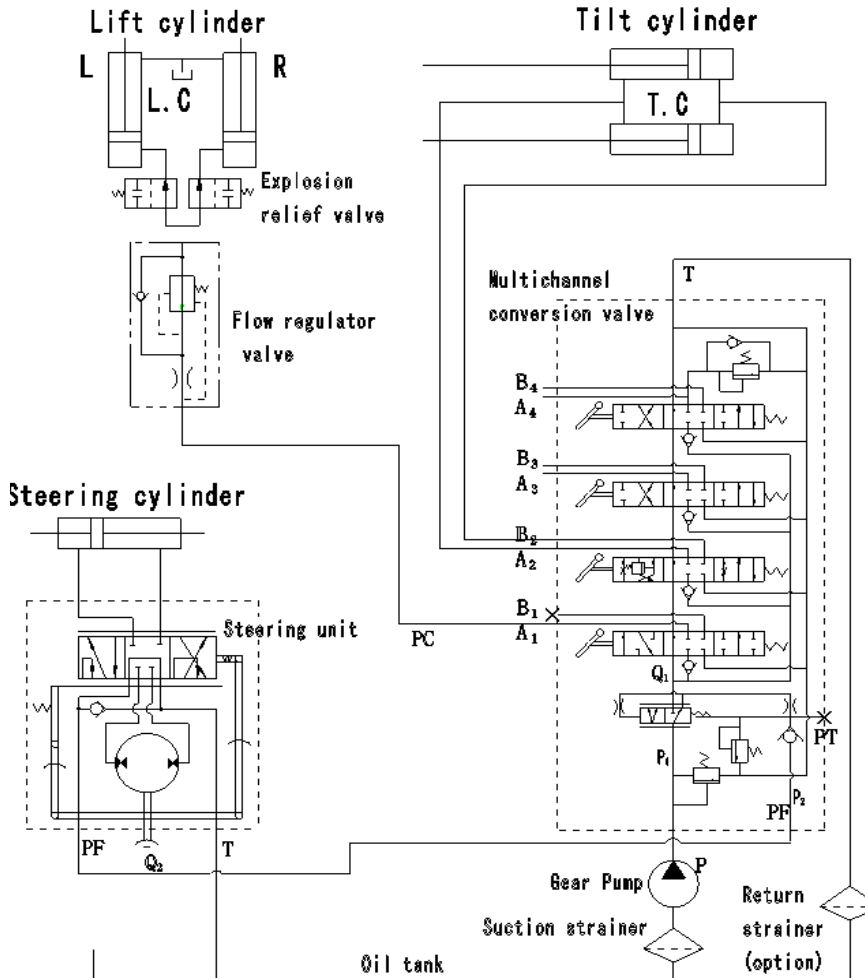


Figure 4.28 Hydraulic oil circuit

### Hydraulic oil circuit technical parameters

|                                       |       |         |    |
|---------------------------------------|-------|---------|----|
| Ton                                   | t     | 1.5-1.8 | 2  |
| Flow, control valve Q1                | L/min | 65      | 65 |
| Flow, steering unit Q2                | L/min | 13      | 13 |
| Primary pressure, hydraulic system P1 | Mpa   | 17.5    | 19 |

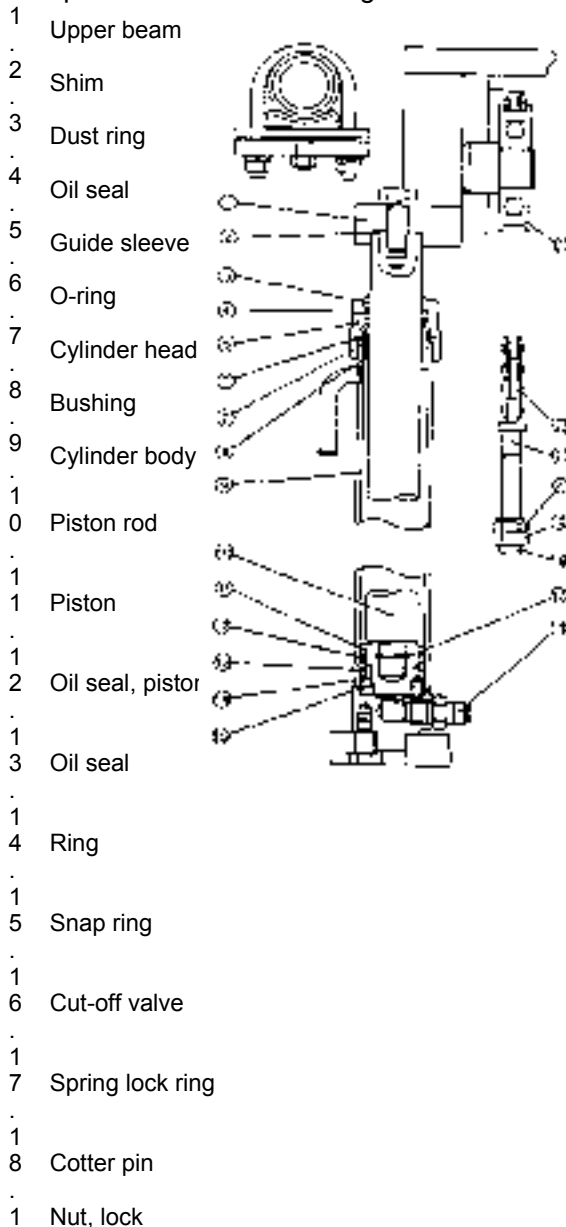
### 6.5 Lift cylinder

The lift cylinder is single-action piston type, consisting of cylinder body, piston rod, piston and cylinder head etc. The bottom of the cylinder is connected with the cylinder supporter of the outer mast by bolts and pins, while its top (i.e. piston rod head) is connected with the upper beam of the outer mast.

The piston, fastened to the piston rod with elastic wire is fitted with oil seals and support rings on its outer periphery.

At the bottom of the lift cylinder, there is a stop valve, which protects safety when the high-pressure hose bursts for any reason when mast raises.

Bushing and oil seal are assembled on the cylinder head to support the piston and prevent dirt from entering.



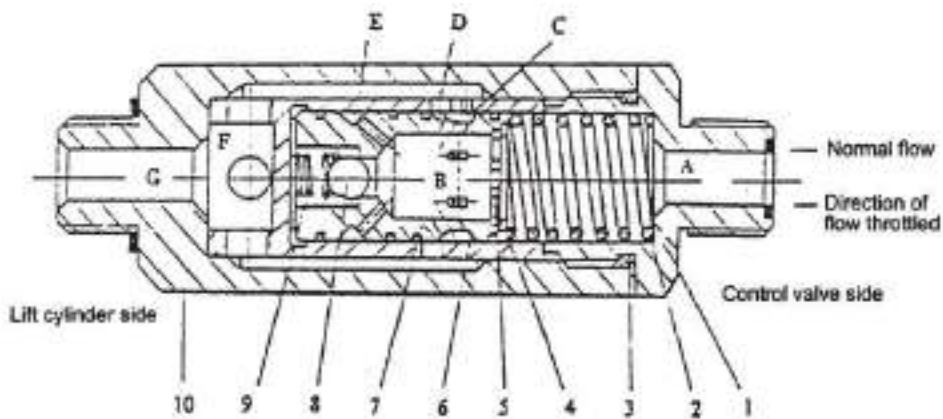
- 9
- .
- 2
- 0 Adjust nut
- .
- 2
- 1 Joint
- .
- 2
- 2 Chain
- .
- 2
- 3 Sheave
- .

Figure 4.29 Lift cylinder

### 6.6 Throttle valve

The throttle valve mounted in oil pipe of the lift cylinder to limit the descending speed of loaded forks and its structure is shown in Figure 4.30.

When control valve and slide valve are placed in the “lift” position, the pressure oil from the control valve flows through the oil chambers A and B, oil holes C, D, E and F, and the chamber G to the lift cylinder without any throttle. When the lift valve and slide valve are placed in the “down” position, the oil from lift cylinder flows in the reverse position. At this moment, a pressure difference is formed between Chamber A and B. Open ball valve (8), when pressure difference exceeds spring force of spring (2), valve core (7) right, thus the oil flow is decreased by narrowing of the holes D and C, and reduces the oil flow passing through the throttle hole. In addition to control of deceleration speed of load, the throttle valve also serves as a safety device, i.e. Rubber rose between the control valve and the lift cylinder is damaged due to some reason, at this moment, the throttle valve functions as a safety device to prevent damager caused by abrupt falling of the load.



- 1 Joint
- 2 Spring
- 3 O-ring
- 4 Snap ring
- 5 Throttle plate
- 6 Valve sleeve
- 7 Valve core
- 8 Ball
- 9 Spring
- Valve body

Figure 4.30 Flow regulator valve

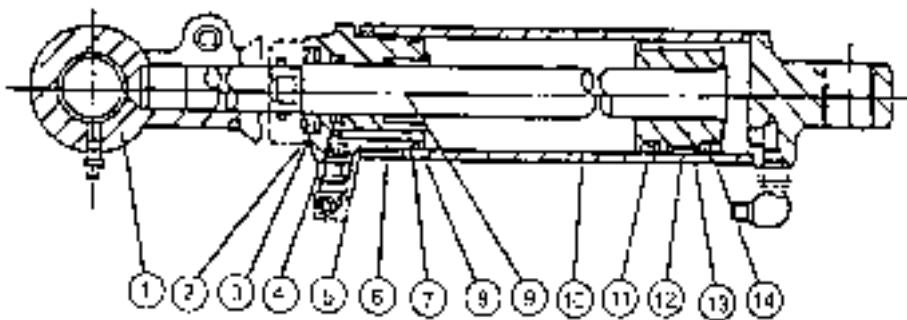
### 6.7 Tilt cylinder (Figure 4.31)

The tilt cylinder is double-acting type, which is installed on both sides of the mast,



end of its piston rod is connected with mast and base of the tilt cylinder is connected with frame via pins.

The tilt cylinder assembly consists of piston, piston rod, cylinder body, cylinder base, guide sleeve and seals. The piston and piston rod adopt welded structure. One support ring and two Yx seal rings are mounted on outer edge of piston. Bushing, Yx seal ring, snap ring and dust proof ring are press-fitted to the inner side of the guide sleeve. This bushing supports piston rod, Yx seal ring, snap ring and dust proof ring can prevent oil leakage and dust proof, which are screwed into the cylinder body together with O-ring. When the tilt lever is pushed forward, the high-pressure oil enters the cylinder body from the cylinder base, to move the piston forward and causing the mast to tilt forward until 6 degree. When the tilt lever is pulled backward, high-pressure oil enters the cylinder body from the guide sleeve and moves the piston backward, tilting the mast backward until 11 degrees.



|   |           |    |               |   |           |
|---|-----------|----|---------------|---|-----------|
| 1 | Joint     | 6. | Guide sleeve  | 1 | Yx-ring   |
| . | .         | .  | .             | 1 | .         |
| 2 | Dust ring | 7. | Bearing       | 1 | Wear ring |
| . | .         | .  | .             | 2 | .         |
| 3 | Snap ring | 8. | O-ring        | 1 | Piston    |
| . | .         | .  | .             | 3 | .         |
| 4 | Yx-ring   | 9. | Piston rod    | 1 | Yx-ring   |
| . | .         | .  | .             | 4 | .         |
| 5 | O-ring    | 1  | Cylinder body | . | .         |
| . | .         | 0. | .             | . | .         |

Figure 4.31 Tilt cylinder

## 6.8 Hydraulic pipelines

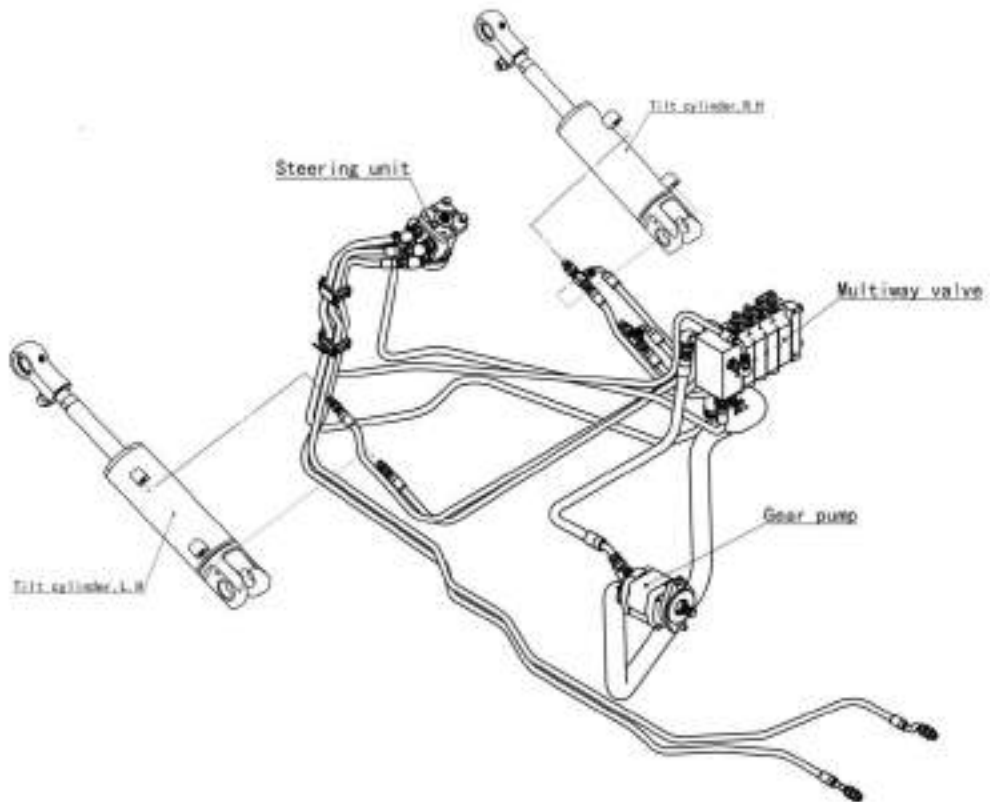


Figure 4.32 Hydraulic pipelines

## 6.9 Trouble shooting

If any fault is found on hydraulic system, find out causes and take proper remedies according to the following table.

(1) Control valve

| Problem   | Possible cause           | Remedy                 |
|---|--------------------------|------------------------|
| Lower oil pressure and lower oil amount of the steering oil circuit | Spool is held up         | Disassembly and clean, |
|   | Slide surface broke down | Replace spool          |
|   | Spring is broken         | Replace spring         |
|   | Oil hole is blocked      | Disassembly and clean  |
|   | Misadjusted relief valve | Adjust relief valve    |
| Lower oil pressure of the lifting                                   | Spool is held up         | Disassembly and clean  |

|   |                              |                                |
|---|------------------------------|--------------------------------|
| oil circuit   | Oil hole is blocked          | Disassembly and clean          |
| Vibrate and the oil pressure rises slowly                                     | Spool is held up             | Disassembly and clean          |
|   | Exhaust is inadequate        | Exhaust fully                  |
| The oil pressure of the steering oil circuit is more than the specified value | Spool is held up             | Disassembly and clean          |
|   | Oil hole is blocked          | Disassembly and clean          |
| Lower oil amount  | Misadjusted relief valve     | Adjust                         |
| Noisy control valve   | Misadjusted relief valve     | Adjust                         |
|   | Slide surface worn           | Replace relief valve           |
| Oil leakage (outside)   | O-ring seal broken down      | Replace O-ring seal            |
| Adjusting pressure lower  | Spring is worsen             | Replace spring                 |
|   | Valve seat surface is worsen | Adjust or replace relief valve |
| Oil leakage (inside)  | Valve seat surface is worsen | Correct valve seat surface     |
| Adjusting pressure higher   | Valve is held up             | Disassembly and clean          |

## (2) Hydraulic oil pump

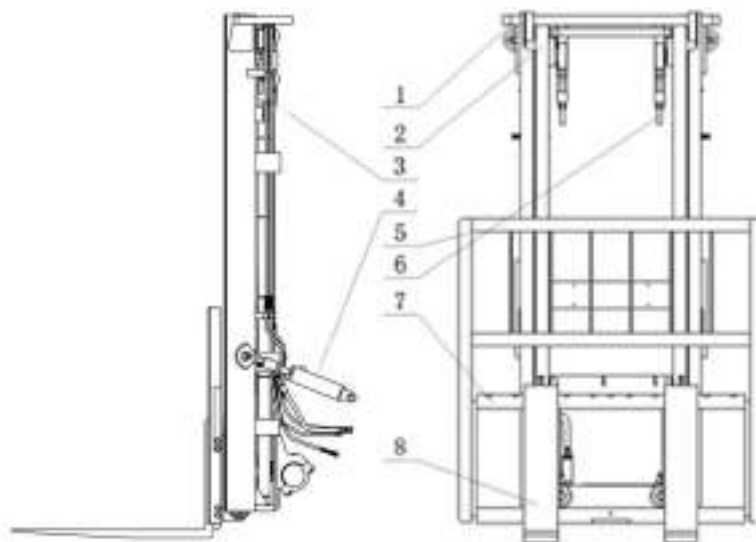
| <b>Problem</b>                | <b>Possible cause</b>                       | <b>Possible cause</b>              |
|-------------------------------|---|------------------------------------|
| Oil can't be pumped out       | Lower oil level in oil tank                 | Add oil up to specified oil        |
|                               | Blocked pipe-line or oil filter             | Clean or replace oil if necessary  |
| Oil leakage                   | Oil seal or seal ring in pump broken down   | Replace                            |
|                               | Pump broken down                            | Replace                            |
| Oil pump can't be pressurized | Lining plate broken down                    | Replace                            |
|                               | Wearing broken down                         |                                    |
|                               | Seal ring, bushing or snap ring broken down |                                    |
|                               | Misadjusted relief valve                    | Adjust pressure to specified value |
|                               | Air entering into the pump                  |                                    |
|                               |   | Add oil into oil tank              |
|                               |   | Replace oil seal                   |
| Noisy oil pump                | Worn suction pipe or blocked oil filter     | Correct pipe or repair filter      |

|  |  |                                 |
|--|--|---------------------------------|
|  | Air entering in resulting from loose suction connections | Retighten the connection        |
|  | Too high oil stickiness                                  | Use oil with proper stickiness  |
|  | Air bubble in oil  | Find out cause and correct them |

## 7. Lifting system

### 7.1 General description

The lifting system is two-stage roller vertical descending type, which consists of the inner mast, the outer mast and the lift bracket.



- |                 |                 |                |
|-----------------|-----------------|----------------|
| 1 Outer mast    | 4 Tilt cylinder | 7 Lift bracket |
| 2 Inner mast    | 5 Load backrest | 8 Fork         |
| 3 Lift cylinder | 6 Lift chain    |                |

Figure 4.33 Mast

### 7.1 Inner and outer masts

The inner and outer masts are welded parts. The base of outer mast is mounted on drive axle through supporting. The middle of outer mast is connected with the frame by the tilt cylinder. The mast can be tilt forward and backward under the action of the tilt cylinder. The outer mast is made of C-shaped channel steel and main rollers and side rollers are assembled on the upper part. The inner mast is made of J-shaped channel steel and main rollers and side rollers are mounted at the bottom.

**Notice:** Maintenance and service of main rollers and side rollers on outer mast are maintenance at height. Pay special attention to safety.

### 7.2 Fork bracket

The fork bracket rolls in inner mast by the main rollers. The main rollers are mounted on the main roller shafts and blocked by elastic snap rings. The main roller shafts are welded on the fork bracket. The side rollers are fixed on the fork bracket with bolts. They roll along the flank plate of the inner mast and rolling clearance can be adjusted with shims. The main rollers sustain the longitudinal loads, when fork raises up to the top, the upper rolls expose from the top of the mast, the side rollers sustain the transverse loads.

### 7.3 Fork

The fork is fastened in beam groove on the fork bracket with pins, the fork clearance can be adjusted manually. The forks and fork brackets are manufactured according to the international standard for replacement.

The fork pin fastens the fork within the definite position. When adjusting the clearance of the fork, pull the fork pin up and turn 1/4 circle, the fork clearance must be adjusted according to the loaded goods.

### 7.4 Roller position

There are two kinds of rollers, main roller and side roller. They are respectively mounted on the outer mast, inner mast and fork bracket. The main rollers sustain the loads from front and rear directions and the side rollers sustain the side loads, which makes the inner mast and fork bracket move freely.

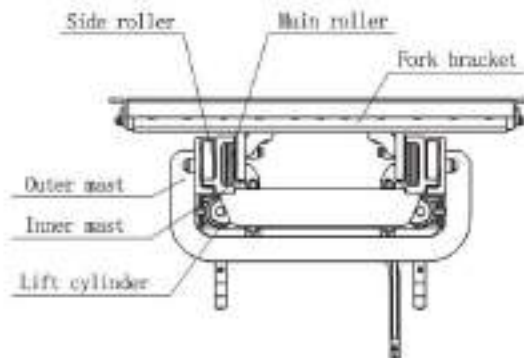


Figure 4.34 Roller position

#### Notice:

(a) Adjust the side roller clearance for 0.5mm.

(b) Apply lubricating grease on the surface of main roller and contact face of mast.

### 7.5 Maintenance and adjustment

#### 7.5.1 Adjustment of lift cylinder (Figure 4.35)

When replacing the lift cylinder, inner mast or outer mast, we shall readjust the stroke of the lift cylinder as follows:

(1) Install the piston rod in the upper beam of the inner mast without shims.

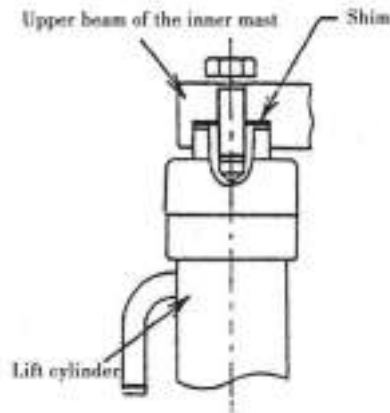
(2) Lift the mast slowly to the max. stroke of the cylinder and check if the two cylinders are synchronous or not.

(3) Install shims between the top of the piston rod of the cylinder which stops first and the upper beam of the inner mast. The thickness of the shim is 0.2mm or 0.5mm.

(4) Adjust the tightness of chains.

Notice: Adjustment of lift cylinder is maintenance at height. Pay attention to safety.

- 7.5.2 Adjustment of**
- (1) Let the truck park
  - (2) Lower the forks (
- chain and maintain a dist:



ie the mast vertical.  
end nipple of the upper  
ie fork bracket.

| Capacity | A mm  |
|----------|-------|
| 1.5T     | 20-25 |
| 2T       | 15-20 |

Figure 4.36

(3) Make the fork down to the ground and tilt backward in place. Adjust the adjusting nut at the end nipple of the upper chain and make tightness of the two chain is the same.

**7.5.3 Replace rollers of the fork bracket**

- (1) Place a pallet on the forks and let the truck parking on the horizontal ground.
- (2) Fall the forks and the pallet down to the ground.
- (3) Disassemble the upper end nipple of the upper chain and take the chain off from the sheave.
- (4) Lift the inner mast ( See Figure 4.37 ① ) 。
- (5) Make the truck back-up if the lift bracket is fully separated from the outer mast. ( See Figure 4.37 ② ) 。
- (6) Replace the main rollers
  - Disassemble all snap rings and take out the main rollers with a drawing tool except the adjusting shims.
  - Ensure the new rollers have the same types as the replaced rollers. Install the new rollers inside the fork bracket and fasten them with elastic snap rings.

**7.5.4 Replace rollers of masts ( Figure 4.38 )**

- (1) Disassemble the fork bracket from the inner mast in the same way as replacing rollers of fork bracket.
- (2) Let the truck parking on the horizontal ground and wedge up the front wheels

for 250mm to 300mm.

(3) Apply the parking brake and wedge up the rear wheels.

(4) Disassemble the bolts which fasten the lift cylinder and the inner mast. Lift the inner mast, pay attention not to lose the shims of the piston rod heads.

(5) Disassemble the connecting bolts for the lift cylinder and the base of the outer mast. Disassemble the lift cylinders and the oil pipes between the two cylinders without loosening the oil pipe joints.

(6) Lower inner mast and disassemble main rollers at the bottom of the inner mast. Main rollers on the upper outer mast will be exposed on the top of the inner mast.

(7) Replace the main rollers.

·Disassemble the upper main rollers with a drawing tool, don't lose the adjust shims.

·Install the new rollers and the shims disassembled before.

(8) Lift the inner mast till all rollers enter the mast.

(9) Reassemble the lift cylinder and the fork bracket in the opposite procedures against disassembly.



Figure 4.37

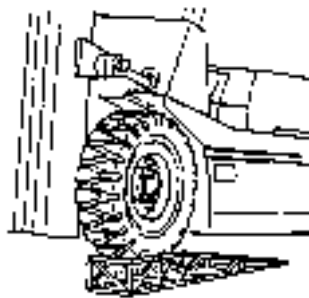


Figure 4.38

## 8. Electric system

### 8.1 General description

The electric system is single wire system with minus earth. It mainly consists of the following systems:

(1) Charging system

This system contains generator, battery, charging indicator, etc. It supplies power for all electric appliances.

Voltage: DC 12V

(2) Starting system

This system mainly consists of automatic pre-heating unit (only for diesel engine), starting switch, starting protection circuit, starting motor, etc. The function of this system is to start the engine.

(3) Instrument

The numeric combination instrument (Figure 4-39) for this internal combustion forklift truck adopts advanced electronic technologies and achievements, which

conducts highprecision digital processing of input signals.. It consists of a pointer instrument driven by two imported stepping motors and an hour meter composed by a LCD screen. The stepping motor meter has high reliability, accuracy and visibility, which can display important parameters of vehicle. The LCD can display the working hours and working state of vehicle clearly. This instrument overcomes the disadvantages of traditional instrument such as poor precision, low stability, difficult parameter revision and expansion, more heat-productivity, more electricity consumption, easy damage and poor openness, etc.

(4) Lighting and signal devices

Including lightings, signal lamps, horns and buzzers, etc.

Headlight: 55W

Front combination lamp (turning/signal): 21W/5W

Rear combination lamp (turning/brake/signal/backing):

21W (yellow)/21W (red)/5W (red)/10W (white)

Warning lamp (optional): 21W

## **8.2 Brief instructions for operation**

### (1) Starting

There is a starting protection circuit in the control box for the safety of the forklift truck. You must shift the direction switch at the neutral position before starting the engine. Otherwise, you can not start the engine.

Turn the key switch clockwise to the I (ON) position (power position), the instrument and the ignition circuit is ready for work. For diesel engine, the automatic pre-heating begins to work and the pre-heating indicator is on. The pre-heating time is controlled by a time relay automatically for 13.5 seconds, then the pre-heating indicator automatically goes out.

Turn the starting switch clockwise to the II (ON) position (starting position), the engine is started.

After engine is started, push the direction switch forward (that is forward shift), then pedal the accelerator, the forklift truck will travel or work quickly. When pull the direction switch backward (that is in reverse shift), the backing lamps light and the back buzzers sound.

### (2) Turning handle switch

Pull the turning handle switch to the I (ON) position, the front and rear combination lamps (clearance & tail) is on. Pull the turning handle switch to the II (ON) position, the head lamps is on, at this time the clearance and tail lamps are on.

### (3) Turning signal

Pull the turning switch backward, the left front and rear turning lamps flash. Push the turning switch forward, the right front and rear turning lamps flash.

### (4) Brake signal

When parking the truck, the brake lamps (red) in the rear combination lamps are on.

### (5) Backing signal

When reversing the forklift truck, pull the direction switch backward and the shift gear is at the reversing position. Then the backing lamps (white) in the rear combination lamps are on and the buzzer sounds.

### (6) No charging signal

Before starting the engine, put the staring switch to the I (ON) position and the charging lamp is on. After engine starting, the charging lamp is automatically off. If the charging lamp is on while the engine is working, it means something is wrong with the charging circuit and you must stop working and check as soon as possible.

### (7) Oil pressure signal



Before starting the engine, put the starting switch to the I (ON) position and the oil pressure warning lamp is on. After engine starting, the oil pressure warning lamp is automatically off. If this lamp lights while the engine is working, it indicates low engine oil pressure and you must stop working and check as soon as possible.

(8) Oil-water separator signal

Before starting the engine, put the starting switch to the I (ON) position, the meter will check automatically and the oil-water separator warning lamp is on. After 1-2s, the lamp is off automatically. If this lamp becomes on while the engine is working, it means too much water has been accumulated in the oil-water separator. After pushing the handle of the water separator to get rid of the water, this lamp will become off.

(9) Fuel meter

It indicates how much fuel is left in the fuel tank. If the indicating needle is near E position, it means there is little fuel in the fuel tank. You should add the fuel tank as soon as possible.

(10) Water temperature meter

It indicates the temperature of the coolant for the engine.

(11) Hour meter

It records the working hours of the engine.

**8.3 Diagram of instrument panel and Instructions of operation**

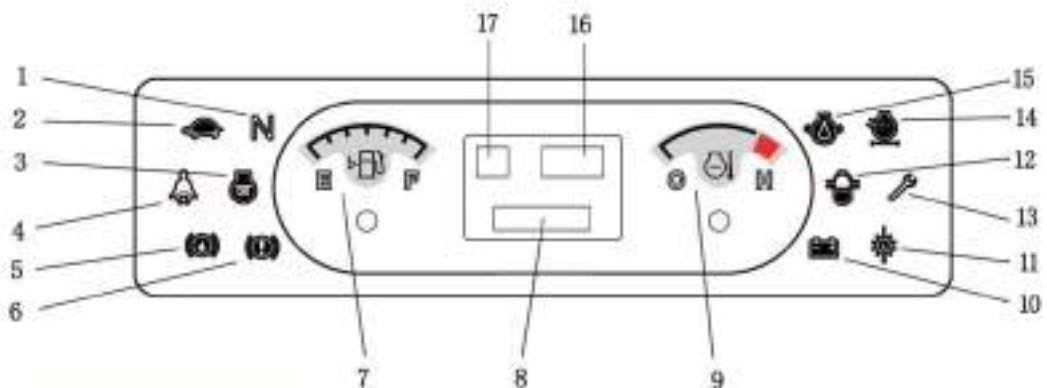


Figure 4.39 Numeric combination instrument

General instructions for meter:







(1) After connecting the power for 2 seconds, the instrument will carry out self-check automatically, the indicating lamps will light, the hand will replace to primary position immediately and then run to corresponding working position.

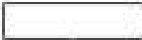



(2) When the meter is during self-check, the LCD displays Baoli welcome.







When running normally, the LCD displays running well.

When there is error, the LCD displays Running error.

| Symbol   | Name                        | Description  |
|----------|-----------------------------|--|
| <b>N</b> | (1) Indicator,neutral shift | When the shift switch is on neutral position, the indicator lights, then the truck can be started. |

|   |   |  |
|---|---|--|
|    | (2) Indicator, slow speed                       | <p>When the slow speed button is pressed, the slow speed indicator lights, at this time the engine runs with slow speed. The function applies to the electric-control type engine.</p>   |
|    | (3) Indicator, preheating                       | <p>When the ignition switch is turned on, the lamp lights and preheating starts. The lamp goes out automatically when preheating is over. The engine will start easily.</p> <p><b>Caution:</b><br/>If the indicator does not go out or it lights during engine running, the preheating intake heater may be defective. Please ask a Baoli dealer for inspection or repair.</p>                                   |
|    | (4) Safety seat switch ( option )               | <p>With safety seat switch open, meter indicates seat symbol, main contactor can't be connected and truck can't travel until seat switch closes.</p>   |
|   | 5) Warning lamp, low brake fluid level (option) | <p>If the brake fluid is not enough, the warning lamp will light to remind the operator and the buzzer sounds.</p> <p>If the warning lamp is still on after complementing the brake fluid, please contact with Baoli dealer for inspection.</p>  |
|  | (6) Warning lamp, parking brake (option)        | <p>The warning lamp will light when the parking brake unit is engaged. Check if the warning lamp is failed when releasing the brake unit and running the truck.</p>  |
|  | (7) Fuel gauge                                  | <p>a. Indicate the remaining fuel in the tank, total with 6 scales.</p> <p>b. Switch on the meter, the fuel indicating needle will return to E position, then it will run to corresponding position with fuel capacity, and stop turning until cutting off the power.</p> <p><b>Caution:</b><br/>After adding oil or turning on the ignition switch, the indicating needle will stop turning after a moment.</p> |

|   |   |  |
|---|---|--|
|   |   | <p><b>Caution:</b></p> <ul style="list-style-type: none"> <li>. If the road is not level, attention must be paid because the correct level may not be indicated.</li> <li>. Especially of diesel engine, be sure to refuel it before it stops running, once the engine cutting out, it is necessary to bleed air from the fuel system.</li> </ul>  |
|    | (8) Timing area   | <p>After connecting the ignition switch, the meter will indicate the working hours. It will begin to time after starting the engine.<br/>The unit of the number on the right is 1/10 hour.<br/>Master the periodic maintenance hours with the time meter, and record the working hours.</p>  |
|   | (9) Water temperature gauge                                     | <p>a. Indicate the temperature of engine cooling water.</p> <p>b. When the needle points to C, the water temperature is less than or equal 60 °C . If the water temperature is higher than or equal 11 0°C (red frame position), the buzzer will sound to remind the operator.</p> <p>c. The water leakage, less engine refrigerant, loose fan belt, dirty radiator belt or other abnormalities in cooling system may lead temporary over-heating. Check the cooling system.</p> |
|  | (10) Indicator, charge  | <p>a. Lighting lamp indicates an abnormality of the charging system while the engine is running.</p> <p>b. If normal, the lamp lights when the ignition switch is turned on and goes out when the engine starts.</p> <p>c. If the lamp lights while the engine is running, stop the operation immediately, inspect the fan belt for fracture or loosening, after adjust it then restart the engine.</p>  |
|  | (11) Warning lamp, temperature of torque converter oil (option) | <p>Switch on the meter, the initial condition of torque converter oil temperature (begin from 65 °C ) will be displayed in the upper left of LCD.</p>  |
|   | (12) Warning lamp, water separator                              | <p>Before starting the engine, put the key switch to the I ( ON ) position, the meter will do the check automatically and the water separator warning lamp is on. After 1-2s, the lamp is automatically off. If this lamp becomes on while the engine is working, it</p>   |

|   |   |   |
|---|---|---|
|    |   | means too much water has been accumulated in the water separator. After pushing the handle of the water separator to get rid of the water, this lamp will become off.   |
|    | (13) Trouble light (option)                                 | When the meter is switched on, the indicator will light, after starting the engine, the indicator will go out. If the controller measures abnormal condition, the trouble light will flash regularly, the error code can be checked out according to the flashing. The function applies to the electric-control type engine.  |
|    | (14) Warning lamp, air cleaner (option)                     | <p>a. This lamp lights when the air cleaner element gets clogged during engine running.</p> <p>b. If normal, the lamp lights when the ignition switch is turned on and goes out when the engine starts.</p> <p>c. If the lamp lights while the engine is running, stop the engine and clean the element and dust guard. For the cleaning method, refer to the Weekly Maintenance Section.</p>   |
|   | (15) Warning lamp, engine oil pressure                      | <p>Lighting lamp indicates low engine pressure while the engine is running.</p> <p>a. If normal, the lamp lights when the ignition switch is turned on and goes out when the engine starts.</p> <p>b. If the lamp lights while the engine is running, maybe the engine oil is insufficient or the lubrication system is faulty. Stop the operation immediately and ask a Baoli dealer for inspection and repair.</p> <p><b>Note:</b><br/>The “warning lamp of engine oil pressure” does not indicate the oil level. Check the oil level using the oil level gauge before starting work.</p> |
|  | 16) Indicator, running state                                | Indicate realtime temperature of torque converter oil.  |
|  | 17) Indicator, temperature of torque converter oil (option) | Indicate realtime temperature of torque converter oil.  |

### 8.3.1 Working environment

- (1) Elevation is lower than 1200 meters.
- (2) Ambient temperature is between -25°C and +40°C .
- (3) Relative humidity is not larger than 95%.

### 8.3.2 Cautions

- (1) Forbid wetting the instrument. When washing the truck, don't let water spraying or splashing into the instrument, if so, clean it with dry cloth.
- (2) Don't pull the plug of the instrument and harness regularly to avoid poor contact.
- (3) Forbid impacting or scratching the meter strongly.
- (4) When the instrument works abnormally, contact with our company for maintenance.

## **8.4 Principle diagram of electrical system**

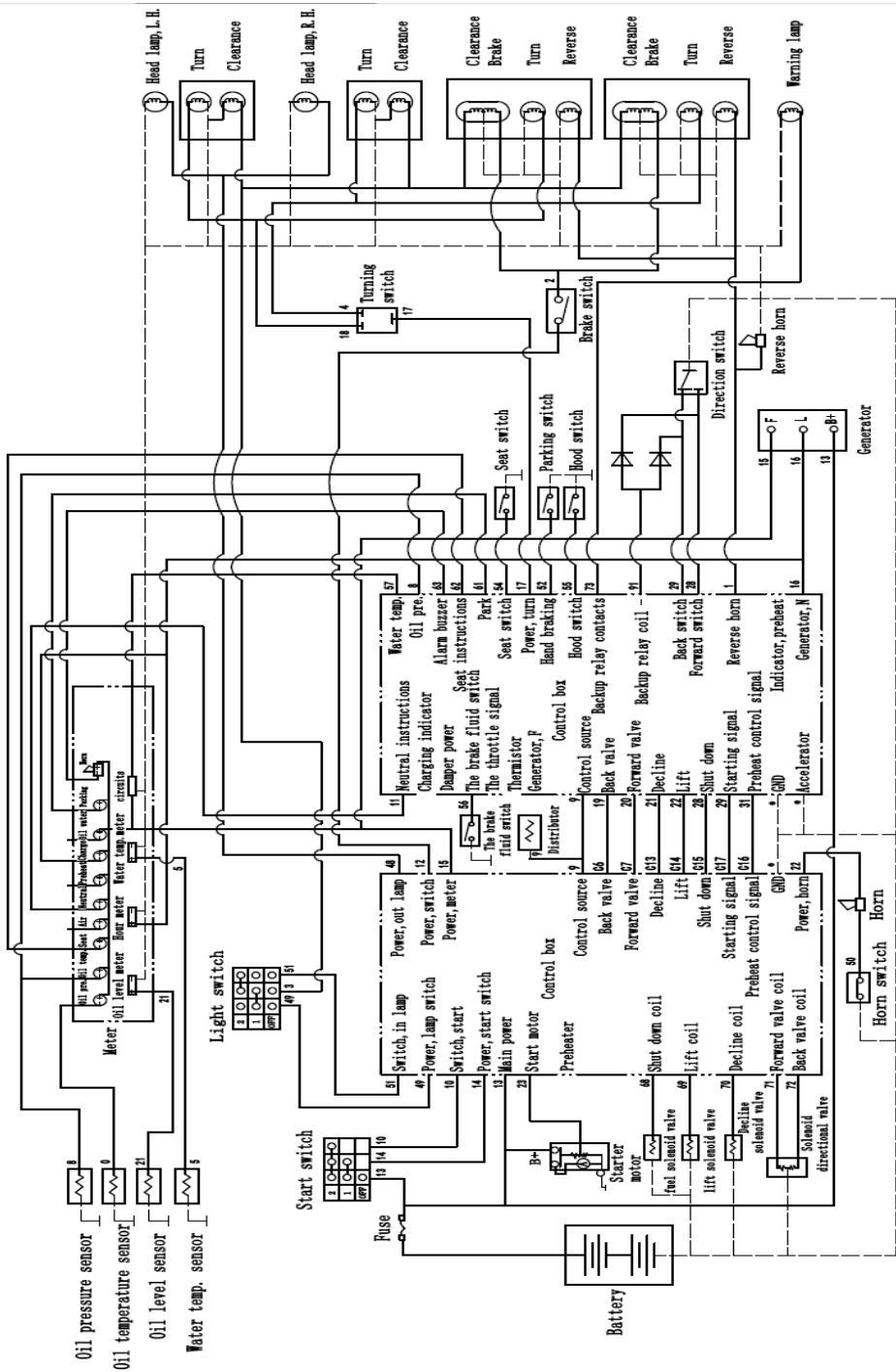
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