



# **LG936L Training Material**

# Section I Overall Structure and Overview

## Section I Overall Structure and Overview

- Overall structure
- Meaning of loader model
- Meaning of ordering number for loader
- Performance characteristics of LG936L (E3613115A39)

## Section II Product configuration

- Optional equipment
- Optional attachments
- Overall parameters

## Section I Overall Structure and Overview

### I. Overall structure and overview

The LG936L loader is a medium multipurpose engineering machinery which mainly for loading loose material , it apply to mining, capital construction, road construction , enterprise, freight yard, ports etc.



## Section I Overall Structure and Overview

### I. Overall structure and overview

LG936L loaders mainly engaged in loose soil, sand, gravel, coal, garbage and other bulk material loading shovel, far transfer operations, but also for traction, leveling ground, pushing set , stack transfer and other operations.

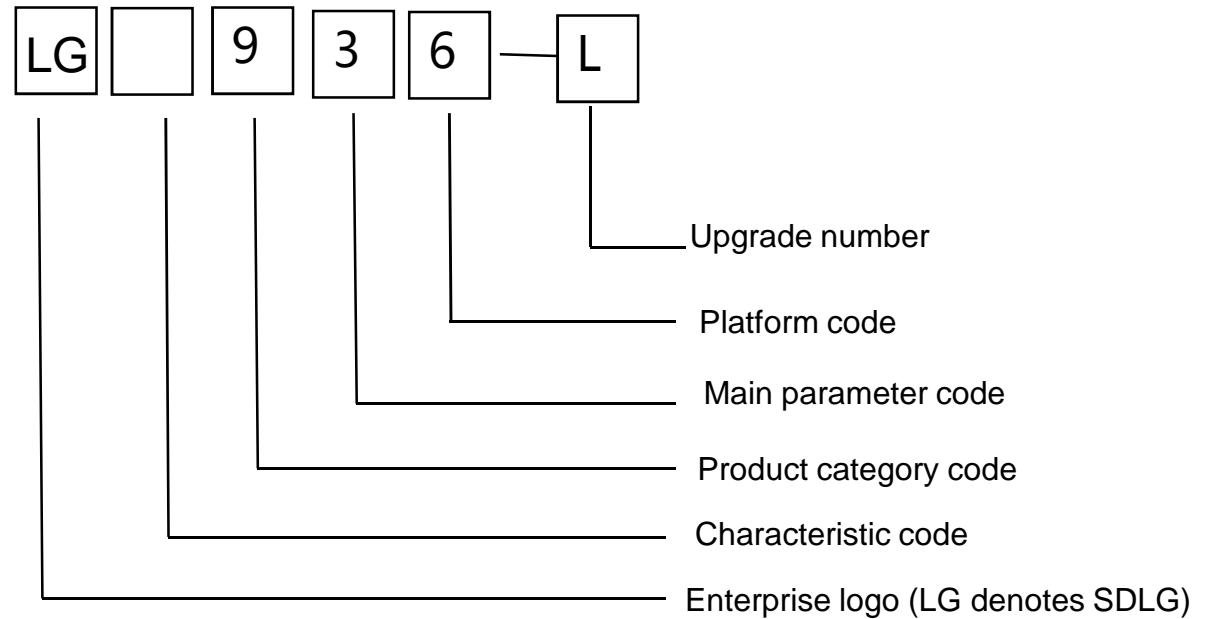


## Section I Overall Structure and Overview

### II. Meaning of loader model

#### 1. Numbering principle for loader model

The product model is composed of enterprise logo, characteristic code, product category code, main parameter code, platform code, and upgrade number.



## Section I Overall Structure and Overview

### (1)Characteristic code

The characteristic code is expressed by 1~3 digits of Latin capital letters.

Product Category	Characteristic name	Characteristic code
Earth-moving machinery	Articulated steering wheel loader	
	Track loader	C
	Skid steering wheel loader	S



Track loader



Articulated steering wheel loader



Skid steering wheel loader

## Section I Overall Structure and Overview

### (2) Product category code



9 denotes earth-moving machinery.



6 denotes excavating machinery.



8 denotes road machinery.



7 denotes mining truck.

## Section I Overall Structure and Overview

### (3) Main parameter code

The main parameter code of the product is expressed by the Arabic numbers and shall be chosen as per the following regulations:



The loaders with rated carrying capacity no less than 2 tons are expressed by rounded value of rated carrying capacity. For instance, the rated carrying capacity of LG936L is 3 tons and therefore the main parameter code is 3.



The loaders with rated carrying capacity less than 2 tons are expressed by rounded number of rated carrying capacity (unit: ton) multiplied by 10. If the value obtained is only one digit, suffix "0" to the value obtained. For instance, the rated carrying capacity of LG918 is 1.8 tons and therefore the main parameter code is 18.



## Section I Overall Structure and Overview

### (4) Platform code

The product platform is determined depending on the product status, technical specification, and main structural configuration. Generally, the product platform is classified into 5 levels, namely economic level, medium level, medium and high level, and high level, which are expressed by number 2, 3, 6, 8, or 9.

No platform code is used for the loaders less than 2 tons, in which case a letter is used to denote the drive mode. M denotes mechanical drive mode, H denotes static hydraulic drive mode, and no letter is used for hydraulic drive mode.



## Section I Overall Structure and Overview

### (5) Upgrade number

In event of major change in product structure or performance, which requires the redesign, prototype build, or authentication, the upgrade code shall be given. The upgrade code is expressed by Arabic number in succession. The “-“ after the main parameter code shall be removed if no upgrade code is available.

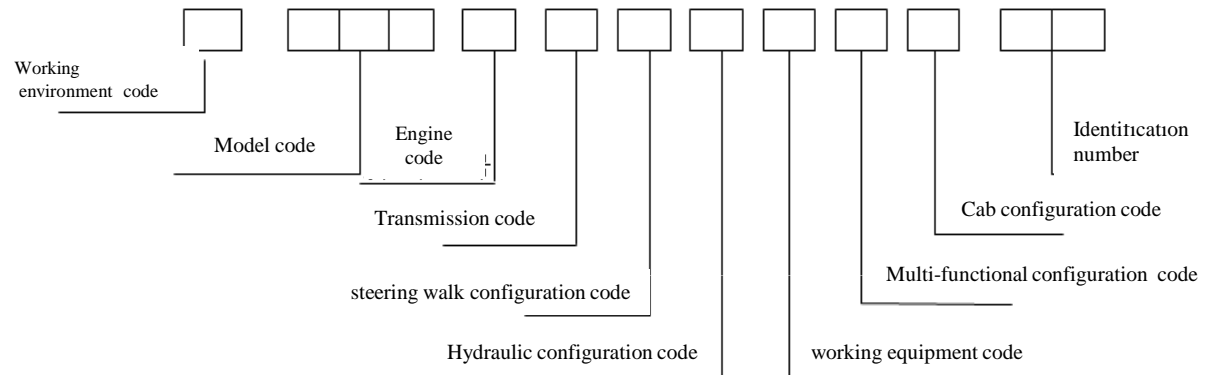


## Section I Overall Structure and Overview

### III. Meaning of ordering number

The format and the composition of the ordering number for wheel loader are as below:

- (1) Working environment code
- (2) Model code
- (3) Engine code
- (4) Transmission code
- (5) steering walk configuration code
- (6) Hydraulic configuration code
- (7) working equipment code
- (8) Multi-functional configuration code
- (9) Cab configuration code
- (10) Identification number



## Section I Overall Structure and Overview

### (1) Working environment code

The first letter denotes the working environment code.

environment code	working environmental conditions
E	Export model
C	In accordance with the EU directive export models, EC designated area
T	Tunnel model
None	Domestic regular model
F	Forest
H	High altitude
L	Cold
M	Mine
R	Environmental sanitation
W	Humid, Wetlands
X	hot air (With the furnace environment)



Export model



CE model



Tunnel model



Domestic model

## Section I Overall Structure and Overview

### (2) Model code

The 1<sup>st</sup> and 2<sup>nd</sup> numbers denote the main parameter. For instance, 18 denotes LG918 and 36 denotes LG936.



## Section I Overall Structure and Overview

### (3) Engine code

The 4<sup>th</sup> number denotes engine model.

Engine code	The loader rated load (t)		
	≤1.5t	1.6-2.5t	3.0t
1	Deutz	Shangchai	YuchaiYC6108G
2		Steyr	—
3		Weichai	Weichai Deutz WP6G125
4	Dongfeng Cummins	Dongfeng Cummins	—
5	Yuchai	Yuchai	Dongfeng Cummins
6		Dalian Deutz	Deutz 2013
7	Perkins	Weichai Deutz	Perkins
8	Yanmar	Volvo	Yuchai 6J125G
9	Cummins	Cummins	Cummins
A			
B		Import Deutz	Import Deutz

## Section I Overall Structure and Overview

### (3) Engine code

The 4<sup>th</sup> number denotes engine model.

Engine code	The loader rated load (t)		
	4.0t	5.0t	≥6.0t
1	Shangchai	—	Shangchai C6121
2	Steyr	Steyr	Steyr
3	Deutz	Shangchai C6121	—
4	Dongfeng Cummins	Dongfeng Cummins	Dongfeng Cummins
5	—	Shangchai D6114	—
6	—	Deutz	Dalian Deutz
7	Yuchai	Yuchai	—
8	Volvo	Shangchai D9	Volvo
9	Cummins	Cummins 6CTAA8.3	Cummins
A		Cummins QSB6.7	—
B	Import Deutz	Import Deutz	Import Deutz

## Section I Overall Structure and Overview

### (4) Transmission model

The 5<sup>th</sup> number denotes transmission model.

	1	2
1.6-2.0t	—	Shantui transmission
3.0t	SDLG transmission	Hangchi /Shantui/ ZF transmission
4.5t	SDLG transmission	—
5.0t	SDLG transmission	VRT200/ ZF transmission
6.0t	—	VRT201/ ZF transmission
7.0t	—	VOLVO transmission
8.0t	—	VOLVO transmission



SDLG transmission



ZF transmission



VRT200 transmission



Hangchi transmission



Shantui transmission

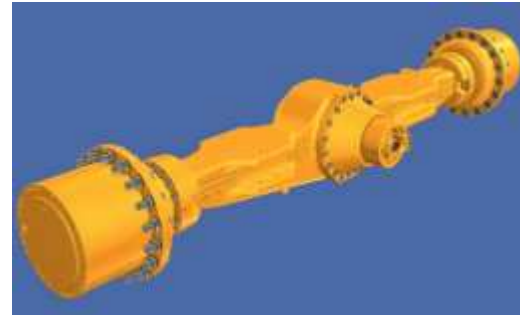


## Section I Overall Structure and Overview

### (5) Drive axle code

The 6<sup>th</sup> number denotes drive axle.

	1.6-2.0t	3.0t	4.5t	5.0t	6.0t	7.0t	8.0t
1	SDLG axle Feichen g axle	SDL G axle	SDL G axle	SDL G axle	SDL G axle	SDL G axle	SDL G axle
2	—	—	—	—	—	ZF axle	ZF axle



ZF axle



SDLG axle



Feicheng axle

## Section I Overall Structure and Overview

### (6) Hydraulic configuration code

The 7<sup>th</sup> number denotes the configuration of hydraulic system.

°



Pilot control



Mechanical control

	1.6-2.0t	3.0t	4.5t	5.0t	6.0t	7.0t	8.0t
0	—	—	—	Dual rocker mechanical control Constant flow by single stabilizer valve	—	—	—
1	—	—	—	Mechanical control Constant flow by single stabilizer valve	—	—	—
2	—	—	—	—	—	—	—
3	—	—	—	—	Pilot control Flow amplifying	—	—
4	Mechanical control Load-sensing	Mechanical control Load- sensing	Mechanical control Load-sensing	Mechanical control Load-sensing	—	—	—
5	Pilot control Load-sensing	Pilot control Load- sensing	Pilot control Load-sensing	Pilot control Load-sensing	Pilot control Load-sensing	Pilot control Load-sensing	Pilot control Load-sensing

## Section I Overall Structure and Overview

### (7) Working equipment code

The 8<sup>th</sup> number denotes the boom type.

	1.6-2.0t	3.0t	4.5t	5.0t	6.0t	7.0t	8.0t
A	Standard model	Standard model	Standard model	Standard model	Standard model	Standard model	Standard model
G	Long-wheelbase model	Long-wheelbase model	Long-wheelbase model	Long-wheelbase model	Long-wheelbase model	—	—
Q	Ultra-long-wheelbase model	—	—	Ultra-long-wheelbase model	—	—	—
R	—	—	—	Short boom and dual rocker	Short boom	—	—



Standard model



Ultra-long-wheelbase model



Long-wheelbase model

## Section I Overall Structure and Overview

### (8) Multi-functional configuration code

The 9<sup>th</sup> number denotes the multi-functional configuration code.

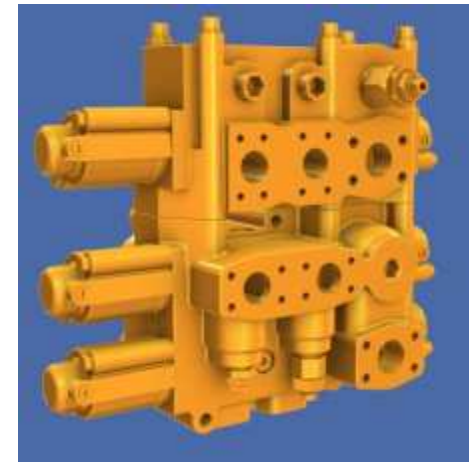
	1.6-2.0t	3.0t	4.5t	5.0t	6.0t	7.0t	8.0t
2	Duple x valve	Duple x valve	Duple x valve	Duplex valve	Duplex valve	Duplex valve	Duplex valve
3	Triple valve	Triple valve	Triple valve	Triple valve	Triple valve	Triple valve	—
k	Quick change device	Quick change device	—	Quick change device	—	—	—



Quick- change device



Duplex valve



Triple valve

## Section I Overall Structure and Overview

### (9 ) Cab configuration code

The 10<sup>th</sup> number denotes the cab model

Cab code	Cab Type
0	Cab shed
5	None cab or Cab shed
6	FOPS&ROPS
9	Standard

Cab generally with the basic configuration of product design requirements, namely, the standard model. On the basic of standard type, in accordance with the needs of users choose cab shed, FOPS & ROPS cab etc.



Tunnel cab



Standard cab

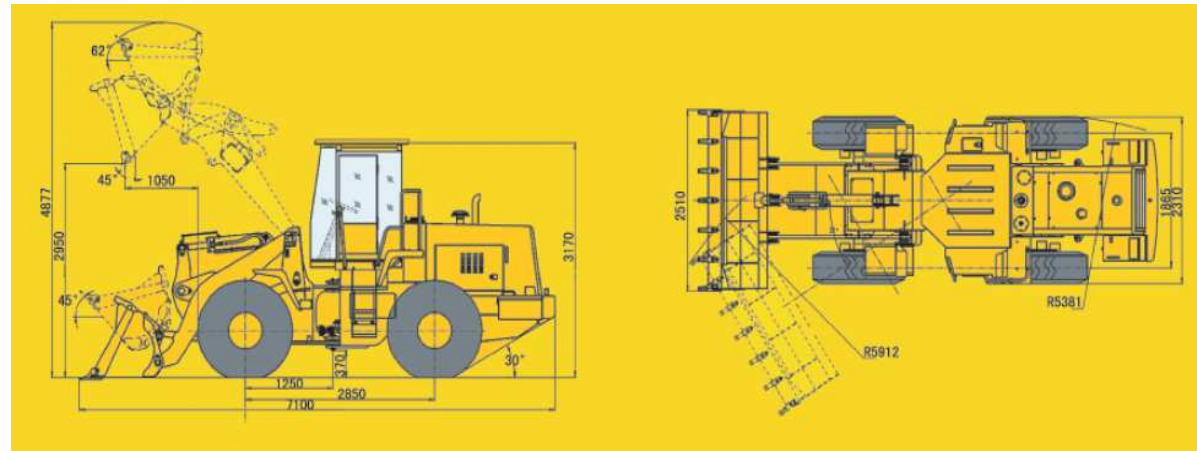


ROPS cab

## Section I Overall Structure and Overview

### IV Performance characteristics of LG936L ( E3613115A39 )

1 .small turning radius , High efficiency, The overall sizes are 7100 × 2510 × 3170mm.



## Section I Overall Structure and Overview

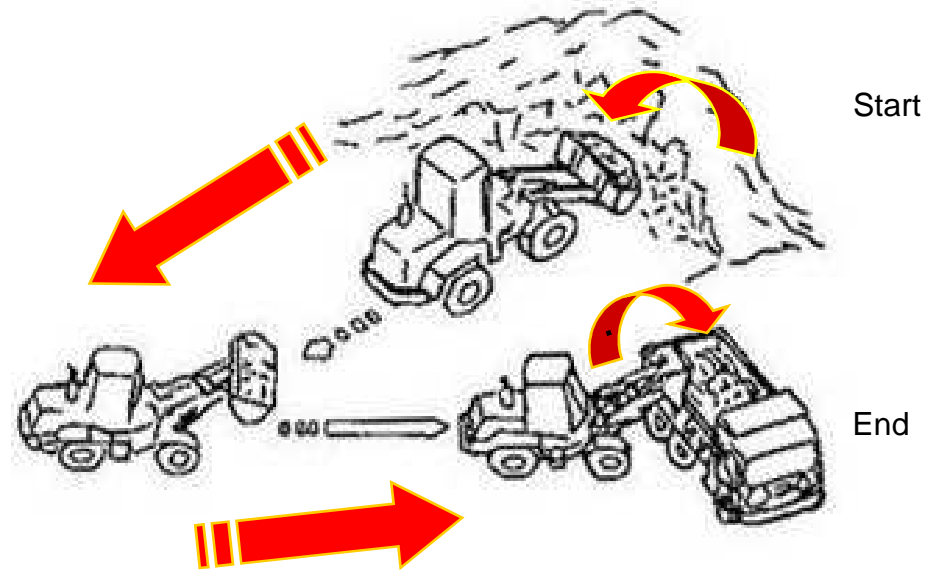
2 .The 2,850mm wheelbase is longer than the products of same class so that the small-sized models feature outstanding overall stability to enhance the working safety index.



2850mm

## Section I Overall Structure and Overview

3 .Bucket lifting time (fully loaded)  
 $\leq 5.3$  s , Bucket falling time (empty  
bucket) $\leq 2.9$  s , Bucket dumping time  
(empty bucket) $\leq 1.0$  s , total time  $\leq$   
9.2s, the operating cycle time is short.





## Section I Overall Structure and Overview

4 .Large retraction angle of bucket achieves high loading coefficient, solving the industry's common existed problem of incomplete loading of bucket.



## Section I Overall Structure and Overview

5. The standard 1.8m<sup>3</sup> bucket (1690200067) is higher than the products of same class in terms of the material loading volume, featuring highest transport efficiency within same period.



## Section I Overall Structure and Overview

6 .The Wenchai Deutz WP6G125E22 engine features low fuel consumption, low noise, high power, long service life, high reliability, and high market volume



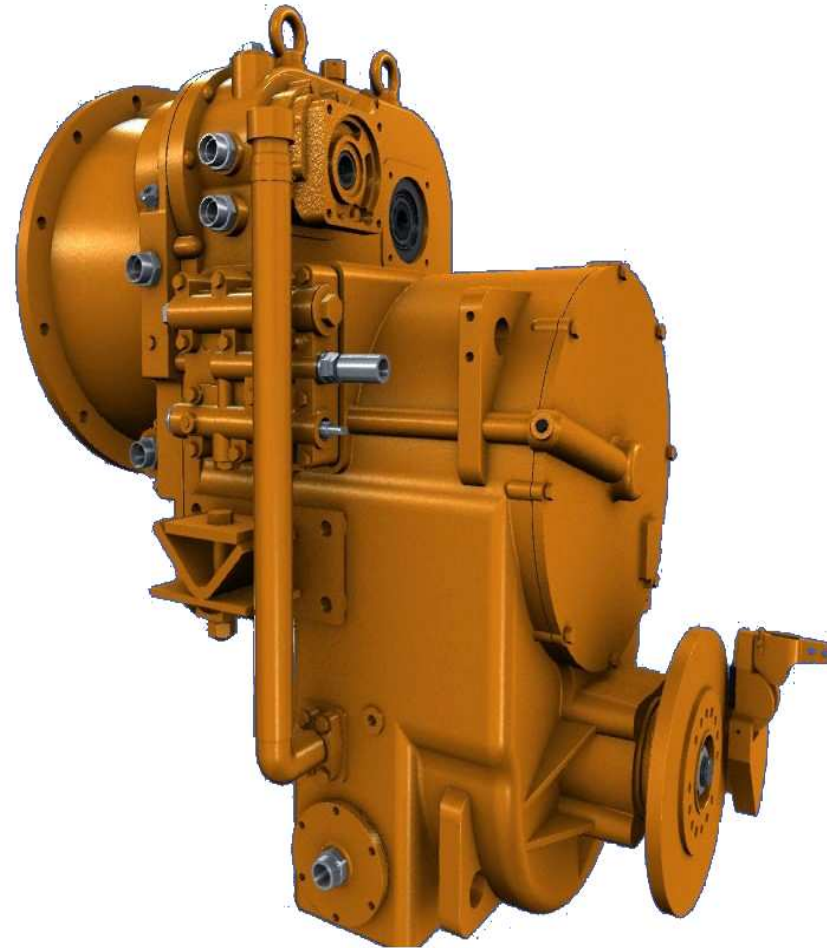
## Section I Overall Structure and Overview

7 .SDLG drive axle with caliper brake is proved by the market and features high reliability and easy maintenances.



## Section I Overall Structure and Overview

8 .Equipped with LG 50 power shift planetary gearbox, the hydraulic torque converter with the single-stage ,two turbines and four elements can make full use of engine power, increased torque, so that machine has greater traction, more compact structure, high transmission efficiency ,fast speed, long service life.



## Section I Overall Structure and Overview

9 .The cab has fine extensive vision and equipped with rearview mirror, it is convenient to observe the surrounding environment at working.



## Section II Product configuration

### I. Optional product configuration

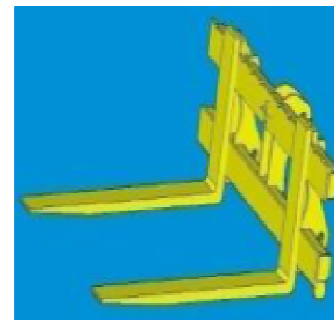
Ordering number	Engine	Transmission	Operation control	Cab	Quick-change device	Bucket capacity
E3613115A36	Weichai Deutz ZWP6G125E2 2	SDLG Transmission  SDLGdrive axle	1.Single pilot lever 2.Load-sensing system 3. Triple valve 4. Double brake pedal	ROPS cab	\	Standard bucket1.8m <sup>3</sup> Strengthen bucket2.0m <sup>3</sup> Oversize bucket 2.2m <sup>3</sup> Oversize bucket2.5m <sup>3</sup> Rock bucket1.5m <sup>3</sup> Pallet fork Timber fork Bale fork Snow removal device Multi-function bucket 1.8m <sup>3</sup>
E3613115A39				Conventional cab	\	
E3613115A3901				Conventional cab	\	
E3613115AK6				ROPS cab	Stand ard	
E3613115AK9				Conventional cab	Stand ard	
E3616115AK6	Dalian Deutz ZWP6G125E2 2 BF6M2012			ROPS cab	Stand ard	Quick -change multi- function bucket 1.8m <sup>3</sup> Quick -change pallet1.2m <sup>3</sup> Quick- change pallet1.5m <sup>3</sup>
E3616115A39				Conventional cab	\	

## Section II Product configuration

### II. Optional attachments



Oversize bucket 2.2m<sup>3</sup>



Pallet fork



Multi-function 1.8m<sup>3</sup>



## Section II Product configuration

### III. Machine Technical Parameters

#### 1 .Main parameters

Item	Parameter
Rated bucket capacity (m3)	1.8m <sup>3</sup>
Rated load (kg)	3000
Overall operating weight(kg)	10700
Length × Width × Height (mm)	7100 × 2510 × 3170

Item	Parameter
Tipping load (kN)	≥66
Maximum tractive force (kN)	≥105
Maximum breakout force (kN)	≥96
Maximum gradeability (°)	30

## Section II Product configuration

### III. Machine Technical Parameters

#### 2 .Main parameters – Running speed

Item	Parameter	
	Forward	Reverse
1 <sup>st</sup> gear (km/h)	0~13	0~17
2 <sup>nd</sup> gear (km/h)	0~38	\

## Section II Product configuration

### III. Machine Technical Parameters

#### 3 .Main parameters - Engine

Item	Parameter
Brand	Weichai Deutz
Model	WP6G125E22
Type	Inline, water-cooled, turbocharged, direct injection
Rated power (kW)	92
Rated speed (r/min)	2200

Item	Parameter
Number of cylinders	6
Cylinder bore / Stroke (mm)	105/120
The lowest fuel consumption rate(g/kW.h)	215
Max torque (N.m)	500N·m
Emission Standard	Chinese Stage-II

## Section II Product configuration

### III. Machine Technical Parameters

#### 4 .Main parameters – Torque converter

Item	Parameter
Type	Single-stage four-element hydraulic torque converter
Torque ratio	4.56
Oil cooling mode	Recirculating water cooled
Torque converter inlet pressure (MPa)	0.45~0.55 MPa
Torque converter outlet pressure (MPa)	0.15~0.25 MPa

## Section II Product configuration

### III. Machine Technical Parameters

#### 5 .Main parameters – Transmission

Item	Parameter
Model	SDLG
Type	Planetary power shift gearbox,
Number of gears	Two forward and one reverse
Model of variable pump	CBGj2063/2040
Working pressure of transmission (MPa)	1.1~1.5 MPa

## Section II Product configuration

### III. Machine Technical Parameters

#### 6 .Main parameters – Drive axle

Item	Parameter
Type	Full-time 4-wheel drive
Tire specification	17.5—20
Pressure of front tires (MPa)	0.333~0.353 MPa
Pressure of rear tires (MPa)	0.275~0.294 MPa
Wheel reducer type	One-stage planetary reducer
Wheel reduction ratio	3.12
Main drive reduction ratio	6.167

## Section II Product configuration

### III. Machine Technical Parameters

#### 7 .Main parameters - Brake

Item	Parameter
Service brake type	Air-assisted hydraulic caliper brake
Braking pressure (MPa)	0.784
Parking brake type	Electric air control caliper disc

## Section II Product configuration

### III. Machine Technical Parameters

#### 8 .Main parameters – Steering hydraulic system

Item	Parameter
Type	Load sensing fully hydraulic articulated steering
Priority valve	VLE-150
Steering pump	CBGj2063/2040
Steering gear	BZZ5-500
Steering angle (°)	38°
Steering pressure (MPa)	12



## Section II Product configuration

### III. Machine Technical Parameters

#### 9. Main parameters – Working hydraulic system

Item	Parameter
Type	Hydraulic piloted control
Working pump	CBGj3100/1010-XF
Model of multi-way valve	D32A-16
Total cycling time (s)	≤9.2 s
System working pressure (MPa)	16 MPa

## Section II Product configuration

### III. Machine Technical Parameters

#### 10 .Main parameters – Oil capacities

Item	Parameter
Hydraulic oil (L)	128L
Fuel (L)	140L
Drive axle (L) (The main drive & Final drive)	2X18L
Engine (L)	13L
Transmission (L)	45L
Brake system (L)	4L

# Chapter II Operations, Maintenance, and Testing of Complete Machine

## Section I Operation Specification of Complete Machine

- Applied working condition
- Prestart preparations
- Basic operation specification and requirements
- Combination switch
- Starter switch
- Steering wheel
- Rocker switches
- Gearshift operating lever
- Working operating lever
- Parking brake lever
- Flameout operating flexible shaft
- A/C panel

## Section II Maintenance Specification of Complete Machine

- Maintenance of complete machine
- Checking of oil/fluid levels
- Replacement of oils/fluids

## Section III Testing Specification of Complete Machine

- List of complete machine testing tools
- Pressure testing of working hydraulic system
- Pressure testing of steering hydraulic system
- Operation and testing of battery tester
- Operation and testing of multimeter
- Operation and testing of tachometer
- Operation and testing of infrared thermometer
- Testing of tire pressure

### I、 Applied Working Condition:

Wheel loader is a multi-purpose large construction machine mainly used for bulk materials. It is widely used in mineral yards, construction, roads, freight yards and ports. It can be used for dragging, to flatten the ground, piling and stacking of bulk soil, sand, sand stone, coal and garbage. It can chuck wood, fork grass, clean snow and chuck box-liked material with proper work equipment.



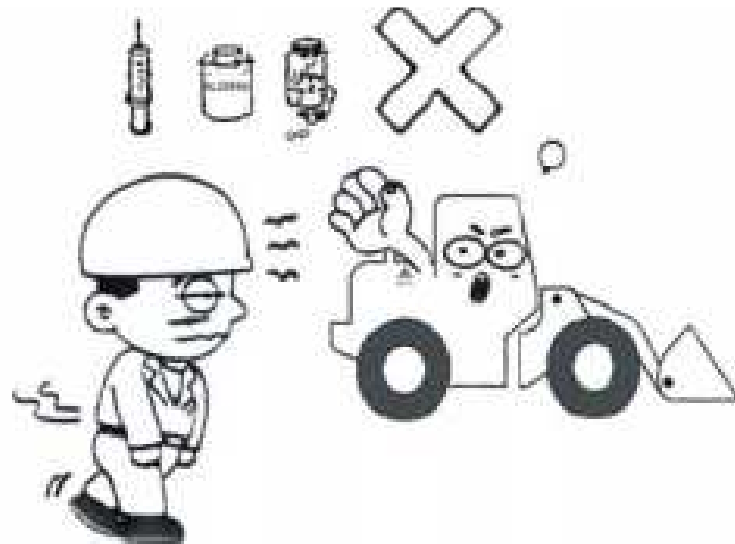
## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

1. Get familiar with and master safety operation practice of loader

(1) Only the specially trained and approved personnel can operate and maintain the machine.

(2) Operate and maintain the machine under good physical state.



## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

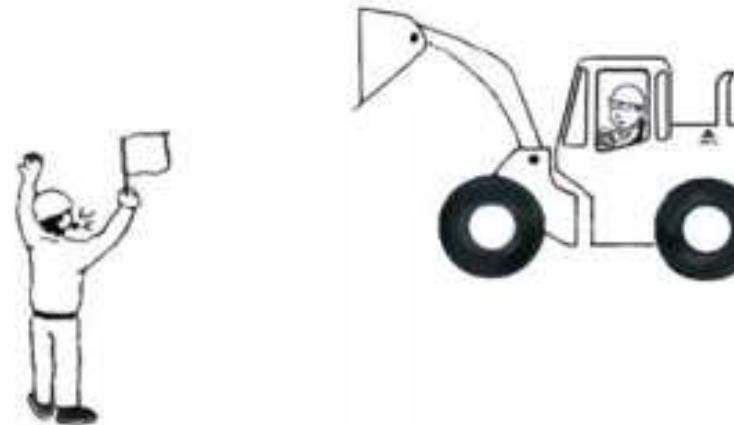
1. Get familiar with and master safety operation practice of loader

(3) Properly wear all labor protection appliances.

(4) Abide by the instructions and cooperate with each other.

#### Caution:

Refer to the “Operation and Maintenance Manual” for other safety practices.



## Section I Operation Specification of Complete Machine

### II、Preparations before Start

2. Get familiar with the safety signs of complete vehicle

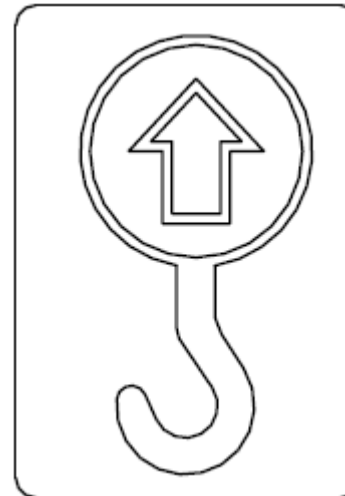
(1) Starter switch warning sign, located above the starter switch.

(2) Hoisting sign, located at hoisting position of frame.



停车后钥匙打在中位位置上

The key should be on the mid position after the vehicle stops.



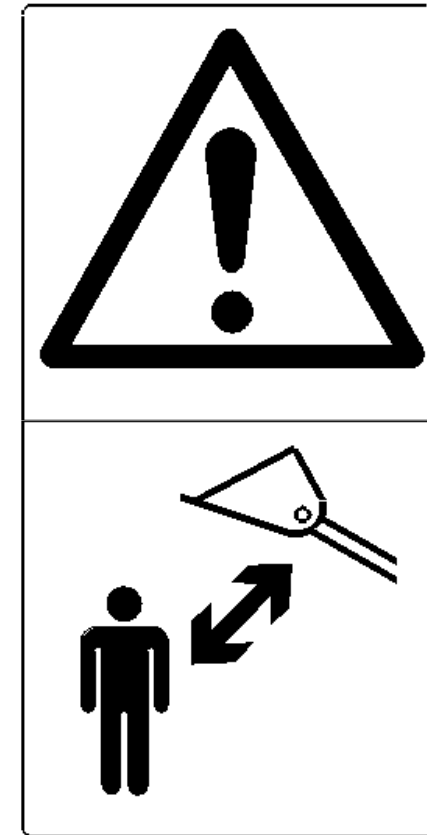
## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

2. Get familiar with the safety signs of complete vehicle

(3) Lifting boom safety sign, located on both sides of boom.

(4) Under-boom danger sign, located on both sides of boom





## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

2.Get familiar with the safety signs of complete vehicle

(5) There is injury danger at articulations during steering. The sign is located at front and rear frame articulations.



## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

2. Get familiar with the safety signs of complete vehicle

(6) Antifreeze sign  
Located on the left door of cab and at the water tank filler port of engine hood.

Coolant (-35#) has been added in the machine

- Notice : the coolant is glycol engine cooling liquor.
- Please do according to the circumstance and the illustration when reinfusing, otherwise the effect will be reduced.
- Selecting range is advised as below:
  - 25# is used in the temperature of  $\geq -15^{\circ}\text{C}$
  - 35# is used in the temperature of  $\geq -25^{\circ}\text{C}$
  - 45# is used in the temperature of  $\geq -35^{\circ}\text{C}$

(When -35# antifreeze is used)

Coolant (-45 #) has been added in the machine

- Notice : the coolant is glycol engine cooling liquor.
- Please do according to the circumstance and the illustration when reinfusing, otherwise the effect will be reduced.
- Selecting range is advised as below:
  - 25# is used in the temperature of  $\geq -15^{\circ}\text{C}$
  - 35# is used in the temperature of  $\geq -25^{\circ}\text{C}$
  - 45# is used in the temperature of  $\geq -35^{\circ}\text{C}$

(When -45# antifreeze is used)

## Section I Operation Specification of Complete Machine

### II、Preparations before Start

2. Get familiar with the safety signs of complete vehicle

(7) Hydraulic oil tank sign, located on hydraulic oil tank.

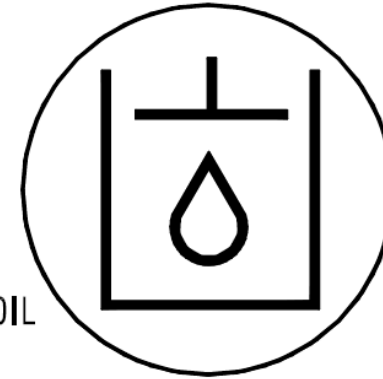
(8) Cab door caution sign, located on left side of cab door.

**Caution: Please refer to “Operation and Maintenance Manual” for other safety signs.**

### 液 压 油 箱 HYDRAULIC OIL TANK

• 推荐选用范围:

• 环境温度	液压油牌号
AMBIENT T.	HYDRAULIC OIL
-10°C ~ 40°C	L-HM46
-30°C ~ 40°C	L-HV46



1. 小心挤手。

Take care not to be squeezed.

2. 行车时须将门关好  
或固定。

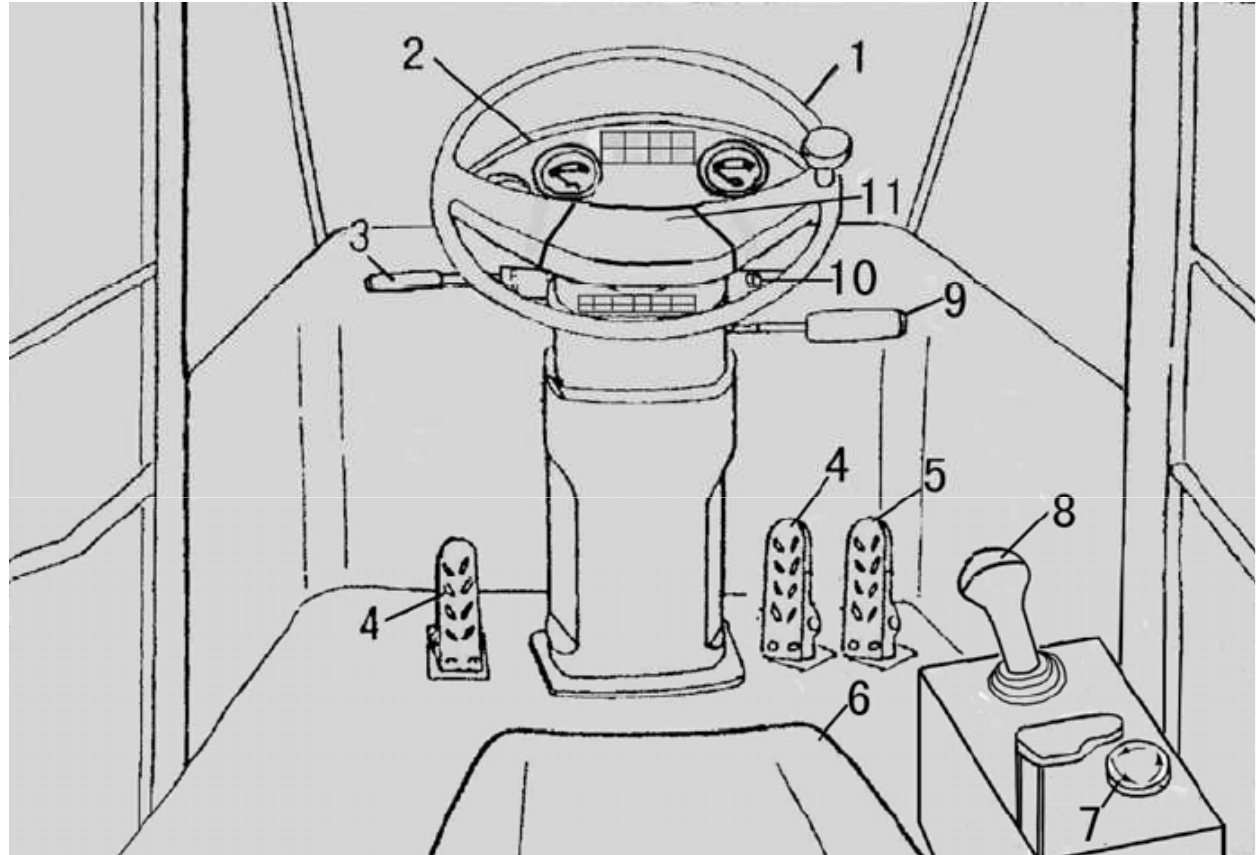
The door must be fixed when driving.

## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

3. Get familiar with information of instrument panel

- (1) Steering wheel
- (2) Instrument panel
- (3) Gearshift operating lever
- (4) Brake pedal (one each on the left and right sides)
- (5) Throttle pedal
- (6) Seat
- (7) Parking brake switch
- (8) Equipment control lever
- (9) Combination switch
- (10) Starter switch
- (11) Horn button

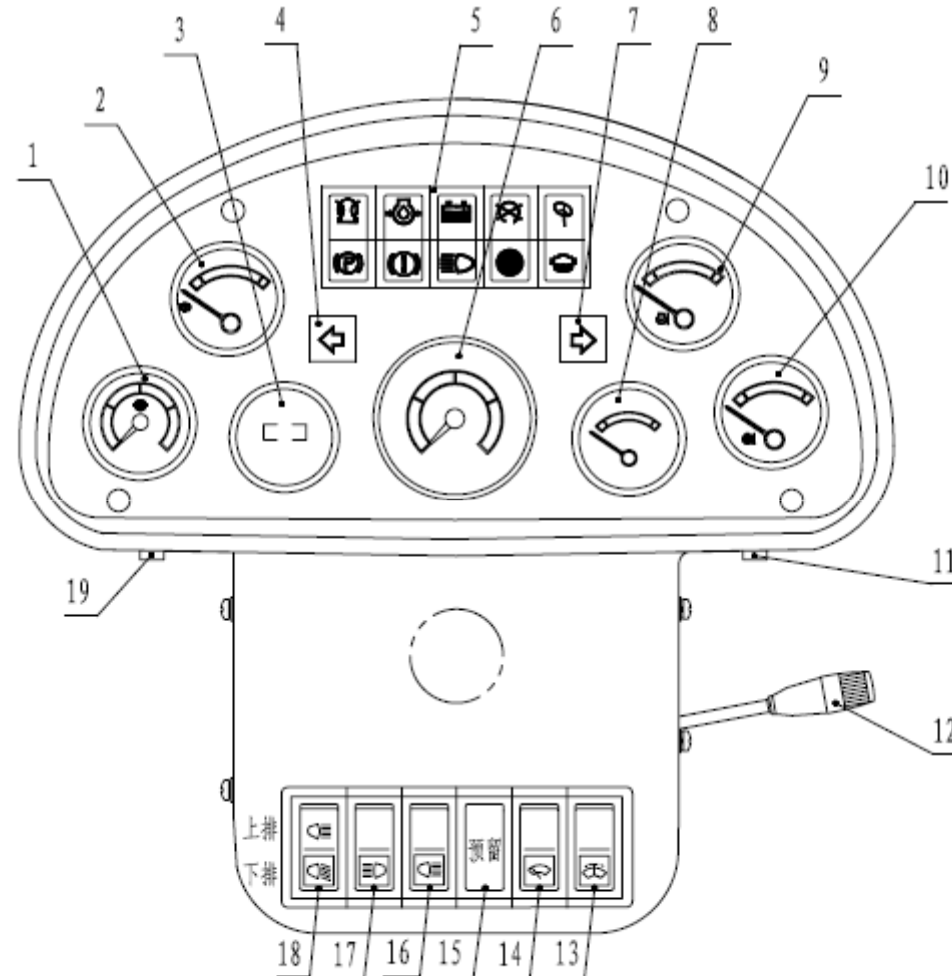


## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

3. Get familiar with information of instrument panel

- (1) Transmission pressure gauge
- (2) Air pressure gauge
- (3) Working hourmeter
- (4) Left turn indicator lamp
- (5) Indicator subassembly
- (6) Tachometer
- (7) Right turn indicator lamp
- (8) Oil level gauge
- (9) Engine water temperature gauge
- (10) Torque converter oil temperature gauge:
- (11) Starter switch
- (12) Combination switch
- (13) Water spray switch
- (14) Wiper switch
- (15) Cover plate
- (16) Tail illuminator switch
- (17) Headlamp switch
- (18) Rear lamp switch
- (19) Hazard warning switch



## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

3. Get familiar with information of instrument panel

- **Engine water temperature gauge**

This gauge indicates the temperature of engine coolant.

The water temperature is normal if the pointer of the water temperature gauge is within the green zone (60°C~100°C).

- **Torque converter oil temperature gauge**

This gauge indicates the temperature of torque converter transmission oil.

The oil temperature is normal if the pointer of the oil temperature gauge is within the green zone (60°C~110°C).

**Caution:**

**If the pointer of oil temperature gauge is within red zone, stop the machine for checking.**



## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

3. Get familiar with information of instrument panel

- **Working hourmeter**

This hourmeter indicates the working hours of the engine, which can be taken as the basis for maintenance.

- **Gearshift pressure gauge**

This gauge indicates the pressure of gearshift operating system.

The oil pressure is normal if the pointer is within the green zone (1.1~1.5MPa). If out of the green zone, please stop the machine for checking.



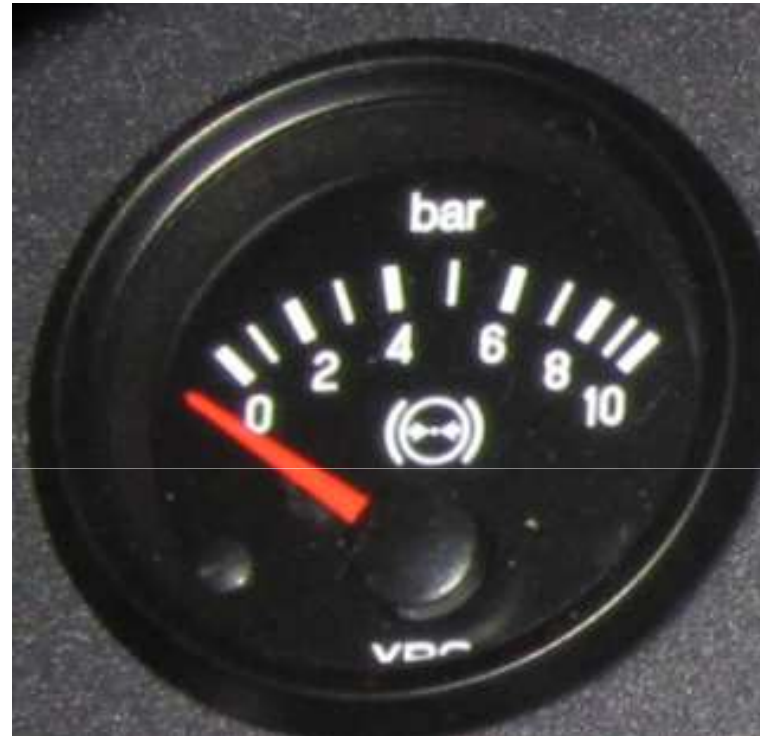
## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

3. Get familiar with information of instrument panel

- **Brake air pressure gauge**

The reading of this gauge indicates the air pressure in the brake system. The air pressure is normal if the reading is within 6~8bar. If out of above range, stop the machine for checking.





## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

3. Get familiar with information of instrument panel

- **Oil level gauge**

This gauge indicates the ratio of the fuel lever in the fuel tank to the volume of the tank

- **Tachometer**

This gauge indicates the engine speed.



## Section I Operation Specification of Complete Machine

### II、Preparations before Start

3. Get familiar with information of instrument panel

(1) Left turn indicator lamp

This indicator lamp lights up while making a left turn.

(2) Parking brake indicator lamp

This red indicator lamp lights up when the parking brake is set.

(3) Low air pressure warning indicator lamp. This red indicator lamp lights up when the air pressure in the air reservoir is less than 0.4MPa.

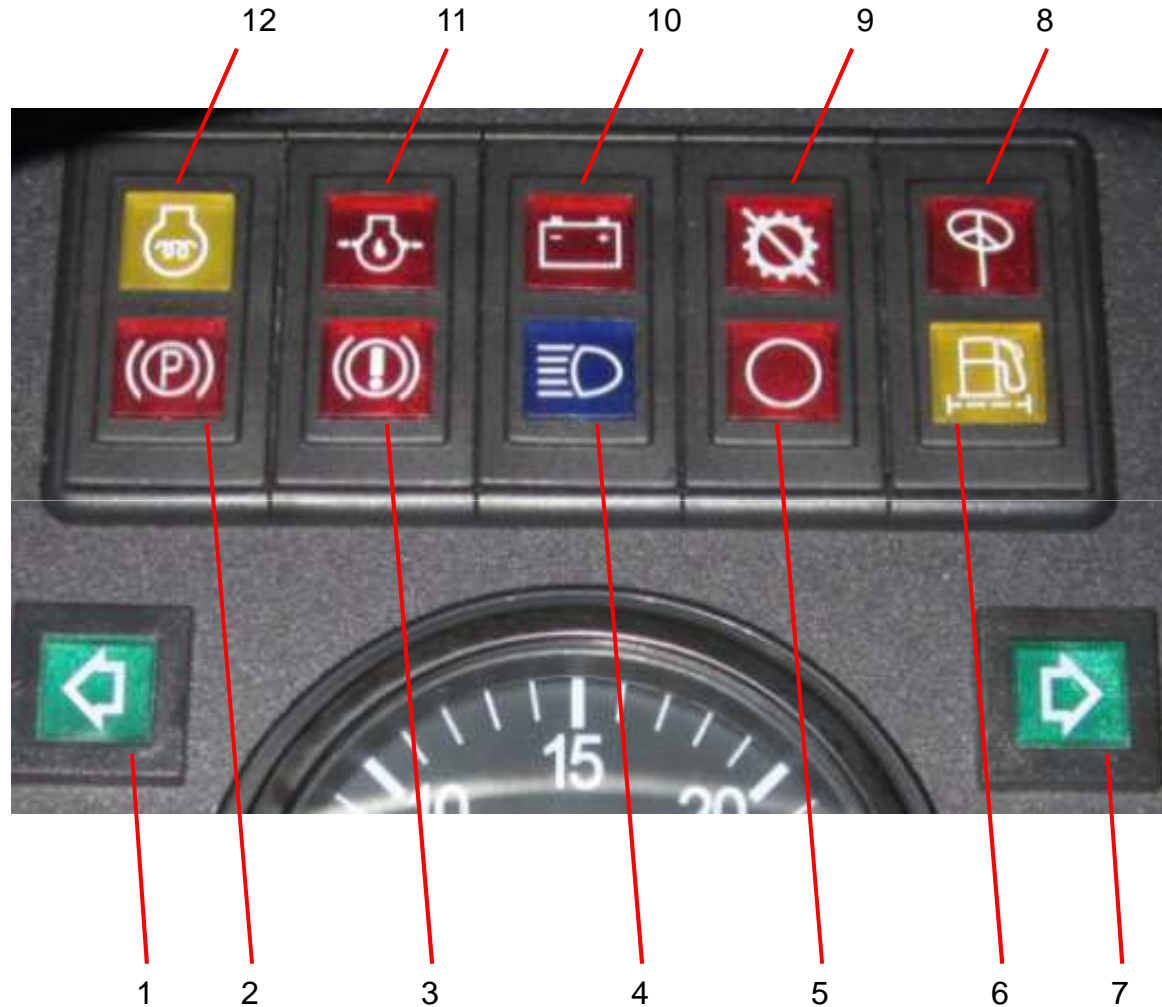
(4) Headlamp high beam indicator lamp. This indicator lamp lights up when the headlamp high beam is turned on.

(5) Electric control box working indicator lamp. This indicator lamp lights up when the electric control box is working normally. (reserved).

(6) Fuel strainer warning indicator lamp (reserved)

(7) Right turn indicator lamp

This indicator lamp lights up while making a right turn.



## Section I Operation Specification of Complete Machine

### II、 Preparations before Start

3. Get familiar with information of instrument panel

(8) Emergency turn indicator lamp (reserved)

(9) Power cutoff indicator lamp (reserved)

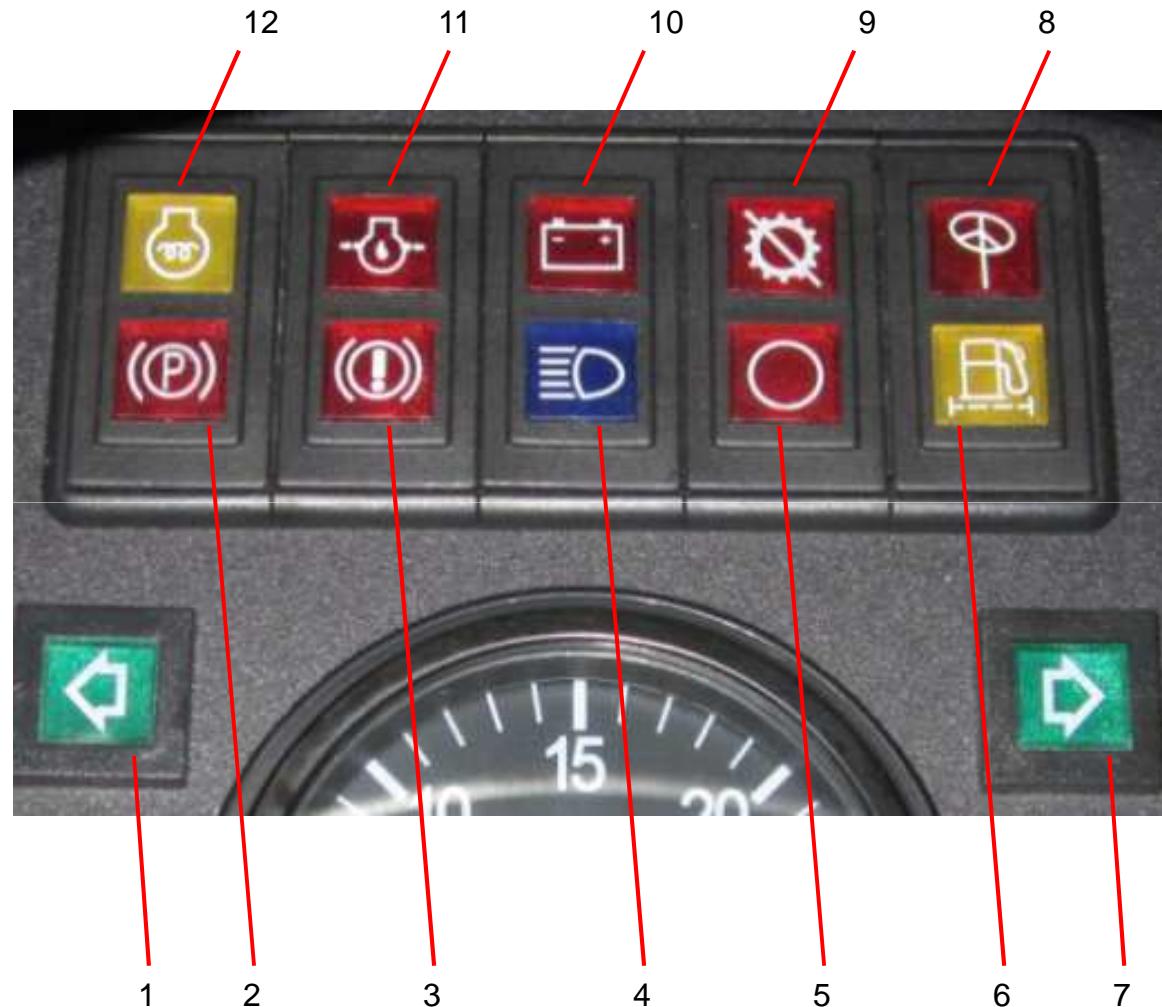
(10) Charging indicator lamp

This indicator lamp lights up after the starter switch is turned and goes out after the engine is started. Otherwise, it indicates that the battery charging system is malfunctioned and shall be checked and repaired.

(11) Low engine oil pressure warning indicator lamp

This indicator lamp lights up immediately after the starter switch is turned on and goes out immediately after the engine is started. Otherwise, it indicates that the engine oil level is too low or the lubrication system is malfunctioned. In such case, stop the engine and check the engine.

(12)Preheating indicator (reserved)



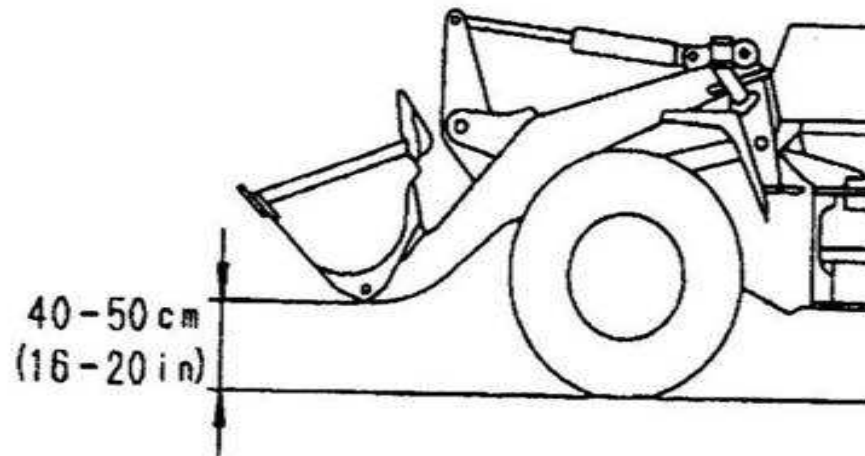
## Section I Operation Specification of Complete Machine

### III、 Operation Specification

#### 1、 Startup

(1) To prevent accidents, ensure that there is no irrelevant person on the loader or in the vicinity of the loader and keep the loader away from the obstacles, high voltage wires, and cables before the traveling.

(2) Lift the boom, tilt backward the bucket, and maintain the traveling state. The lower articulated point of boom shall be 400~500mm off the ground ;



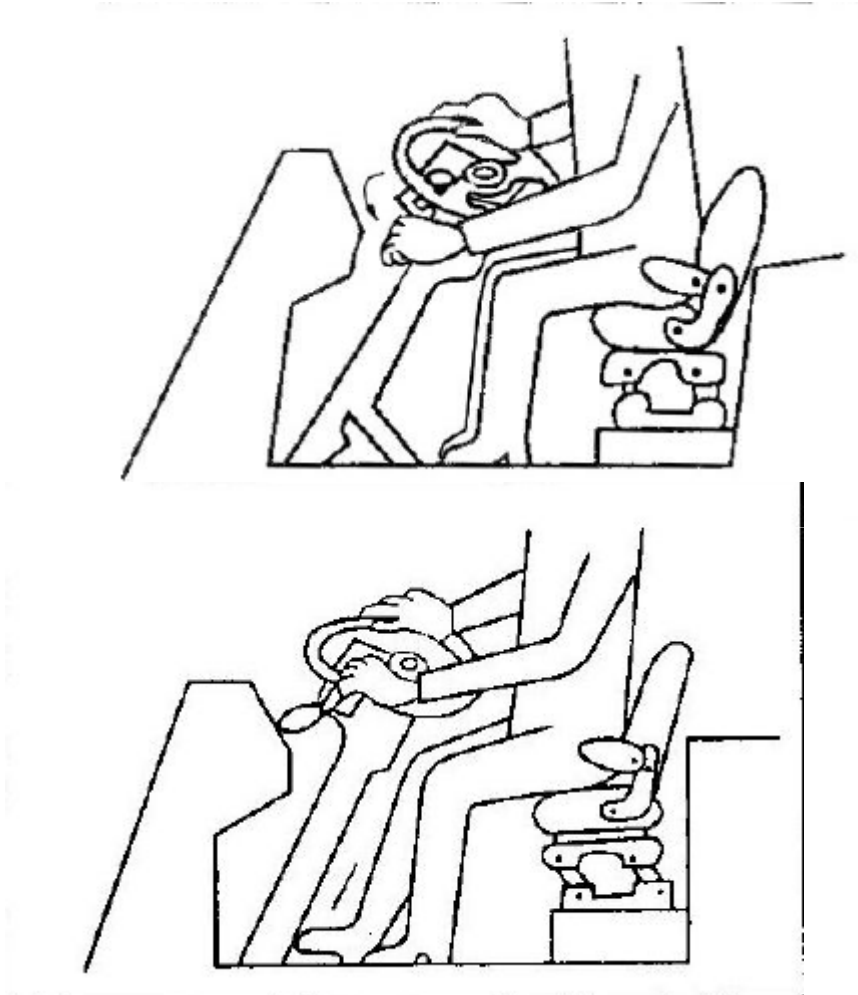
## Section I Operation Specification of Complete Machine

### III、 Operation Specification

#### 1、 Startup

(3) Shift the gearshift operating lever to 1<sup>st</sup> forward gear or 1<sup>st</sup> reverse gear, depress the brake pedal, and lightly rotate the parking brake switch to pop up to release the parking brake.

(4) Release the brake pedal and slowly depress the throttle pedal to drive forward or backward the loader.

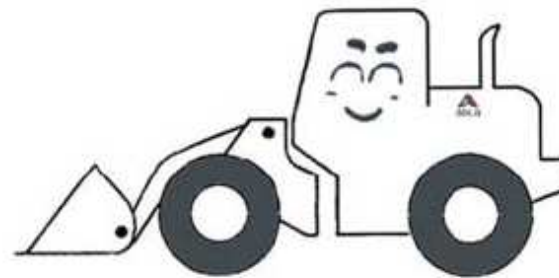
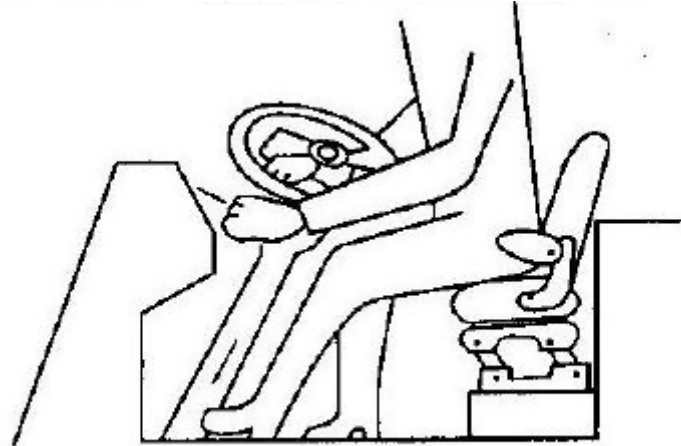


## Section I Operation Specification of Complete Machine

### III、 Operation Specification

#### 2、 Stop

- (1) Release the throttle pedal, depress the brake pedal to stop steadily the loader, and shift the gearshift operating lever to neutral position
- (2) Push down the parking brake switch
- (3) Lower the bucket or other working device onto the ground ;
- (4) Idle run the engine for approximate 5min, pull the flameout cable or rotate the starter key to position OFF to stop the engine, and withdraw and properly preserve the key.



## Section I Operation Specification of Complete Machine

### III、 Operation Specification

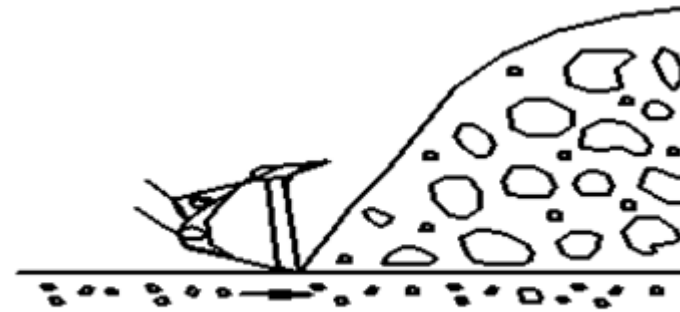
#### 3、 Operation Method

(1) To load the rock material, the bucket shall have a downward tilting angle. To load the earthwork, the bucket shall place horizontally onto the ground and shovel straightly perpendicular to the material.

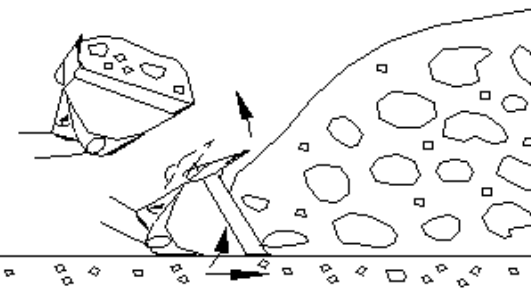
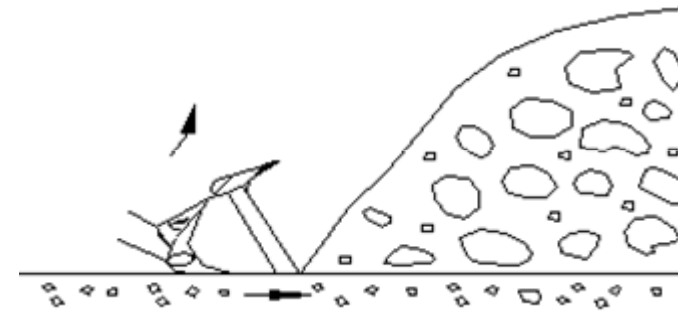
(2) After the bucket is fully loaded, make sure to retract the bucket before lifting the boom

(3) Do not lower the boom at the position "FLOAT".

(4) After unload the, make sure to retract the bucket before lifting the boom or it will damage the cylinder.



岩石堆料



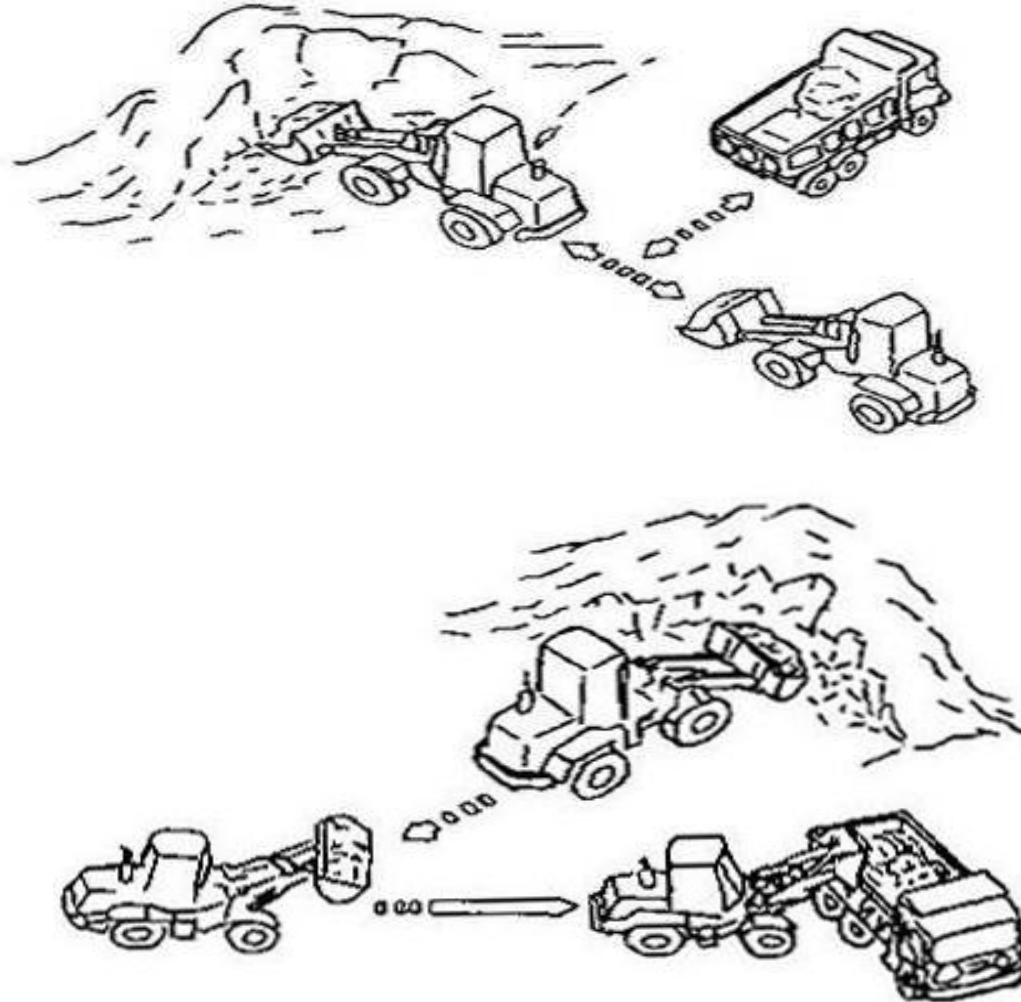
## Section I Operation Specification of Complete Machine

### III、 Operation Specification

#### 4、 Loading and Unloading Method

(1) Cross loading/unloading  
Align the loader with the stockpile, load the material, and travel rearward. Then, the dump truck drives in between the loader and the stockpile. This loading/unloading method features shortest cycle time.

(2) V-shaped loading/unloading  
Position the dump truck so that the dump truck forms an approximate 60° angle with the backward direction of the loader. After the bucket is fully loaded with material, the loader travels backward, steers for certain angle, and drives towards the dump truck. The smaller the V-shape angle is, the higher the working efficiency of the loader is.





## Section I Operation Specification of Complete Machine

### III、 OPERATION SPECIFICATION

#### 5、 Safety Precautions

(1) It's prohibited to load or unload the material during steering.

(2) It's prohibited to lift the boom without retracting the bucket during the loading of material.



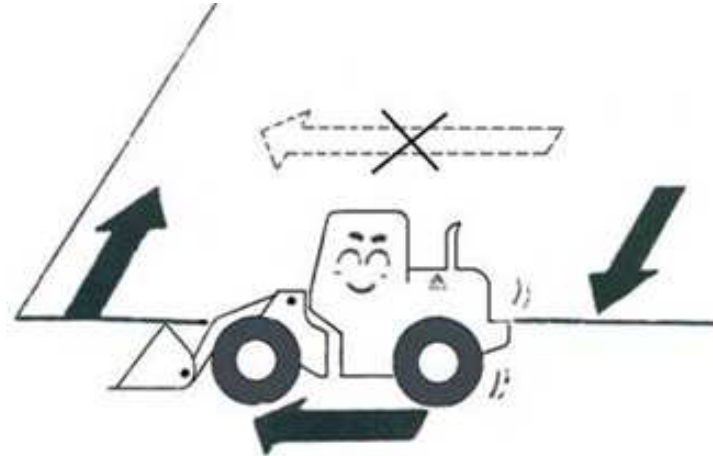
## Section I Operation Specification of Complete Machine

### III、 Operation Specification

#### 5、 Safety Precautions

(3) It's prohibited to travel laterally on a slope. Travel slowly to drive down a slope. It's prohibited to coast with engine stopped. While traveling down a slope under heavily loaded condition, travel the loader under backup mode.

(4) The maximum water depth shall not reach the drive axle housing and brake disc.



## Section I Operation Specification of Complete Machine

### III、 Operation Specification

#### 5、 Safety Precautions

( 5 ) Make sure to keep good ventilation during compartment (and underground) operations. The engine must be fitted with exhaust gas treatment device.


( 6 ) Do not operate the operating lever further after the cylinder reaches limit position and operate slowly at uniform speed during unloading.




## Section I Operation Specification of Complete Machine

### IV、Combination switch

#### •Clearance lamp

Provided that the starter switch is at position ON, when the combination switch is rotated to “OFF” position, pull upward this switch to turn on the headlamp high beam. When the combination is rotated to position “”, the clearance lamps on both the front combination lamp and rear lamp are turned on. Pull upward this switch to turn on the headlamp high beam.

#### •Operations of headlamp high beam and low beam

Provided that the starter switch is at position ON, the headlamp low beam is turned on when the combination switch is rotated to position “” and the headlamp high beam is turned on when this switch is pushed downward.

#### •Operation of turn lamps

Push forward this switch to turn on the left turn lamp and pull backward this switch to turn on the right turn lamp.



## Section I Operation Specification of Complete Machine

### V. Starter switch

- **Position HEAT**

This position is the engine preheating position of the cold start system and is an optional device.

- **Position OFF**

At this position the key can be inserted or withdrawn. Rotate the key to this position to turn off the circuit.

- **Position ON**

Turn on the electric system of the complete machine. Please keep the key at position ON during the running of the engine.

- **Position START**

This is the position to start the engine. Hold the key at this position at the instant of the engine start. After the engine is started, the key will automatically return to position ON upon release of the key.



## Section I Operation Specification of Complete Machine

### VI. Steering wheel

- The steering wheel is connected with the steering gear through steering column. Rotate the steering wheel clockwise to turn the machine right and rotate counter-clockwise to turn the machine left.
- The rotation angle of the steering wheel is not equal to the steering angle of the machine. When the steering wheel is rotated continually, the steering angle of the machine is increased, till the required steering position is reached.
- The faster the rotation speed of the steering wheel is, the faster the steering speed of the machine is.
- The steering wheel will not automatically return after the steering so that the steering angle of the machine remains unchanged. Therefore, at completion of the machine steering, rotate the steering wheel in opposite direction to drive the machine linearly.



## Section I Operation Specification of Complete Machine

### VII. Rocker switches

1. Rear lamp high beam and low beam

Push down the lower end of switch to turn on the rear lamp low beam on the engine hood and push down the upper end to turn on the rear lamp high beam on the engine hood.

2. Headlamp

Push down the lower end of switch to turn on the headlamp on the cab and push down the upper end to turn off the headlamp.

3. Rear illuminator

Push down the lower end of switch to turn on the rear illuminator on the cab and push down the upper end to turn off the rear illuminator.

4. Wiper

Push down the lower end of switch to run the wiper and push down the upper end to stop the wiper.

5. Water spray switch

Push down the lower end of switch to run the wiper and push down the upper end to stop the wiper.



## Section I Operation Specification of Complete Machine

### VIII、 Gearshift operating lever

The transmission equipped on LG936L adopts two forward gears and one reverse gear.

- This lever can control the traveling direction and speed of the machine.
- when the lever is in “N” position , neutral gear. When the lever is in “1” position , first gear ,wheel loader will move slowly. When the lever is in “2” position , second gear ,wheel loader will move fast. When the lever is in “R” position, wheel loader will retreat.





## Section I Operation Specification of Complete Machine

### IX. Working device operating levers

- **Operations of boom**

Push backward the working device operating lever to lift, push downward to lower, push further forward to float, and push to neutral position for automatic return.

- **Operations of bucket**

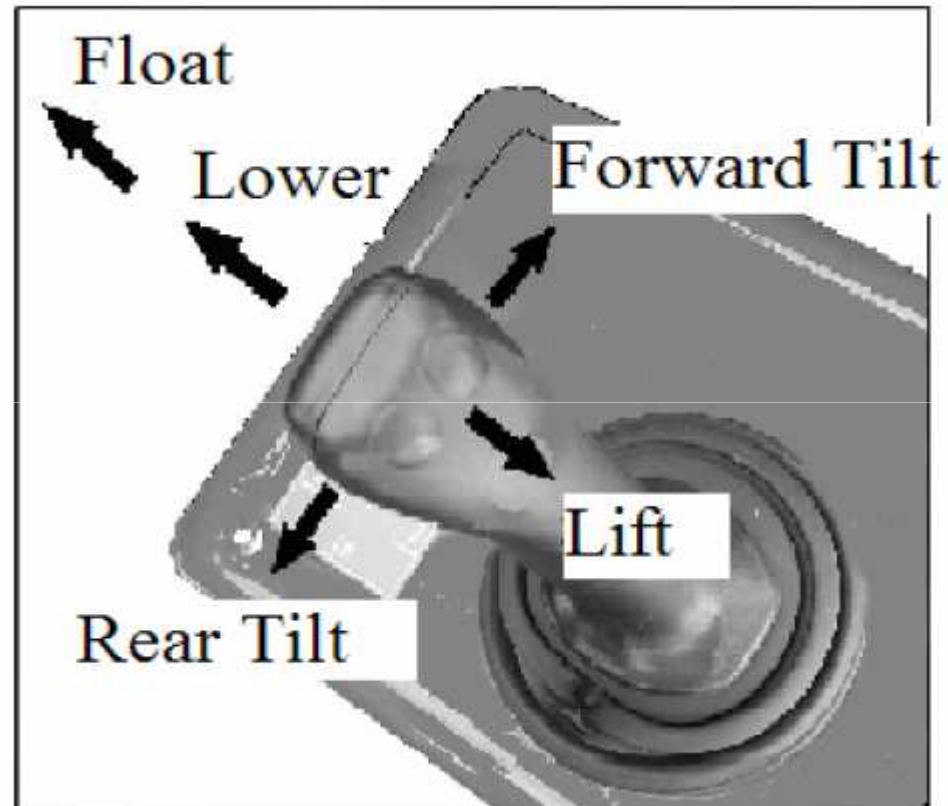
Push leftward to retract the bucket, push rightward to unload the material, and push to neutral position for automatic return.

- **Automatic lock function**

During the ground leveling or scraping of the loader, shift the operating lever to position FLOAT so that the operating lever is electromagnetically locked to realize the automatic lock function of boom. To shift the operating lever to neutral position, pull back manually.

- **Bucket automatic leveling function**

After the unloading of material, retract to the bucket to the limit so that the operating lever is electromagnetically locked, the bucket returns to level position, and the lever automatically returns to neutral position.



## Section I Operation Specification of Complete Machine

### X、Parking brake switch

The parking brake switch is located on the right side of the seat. Press the switch to brake the machine. Turn the switch clockwise until it springs back to release the brake.



## Section I Operation Specification of Complete Machine

### XI. Flameout operating flexible shaft

This flexible shaft is located on the rear end of the heater cover on the right side of the driver seat. Pull up this flexible shaft and hold for several seconds to stop the engine.

### XII. A/C panel

The airflow switch is on the left, of which the L, M, and H denote different airflow levels.

The temperature control switch is on the right. Once turned on, the indicator lamp lights up and the air conditioner starts refrigeration.



Flameout control knot



## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

#### 1. Every 50h maintenance

- (1) Replace the engine oil 12liters.
- (2) Replace the engine oil filter element.



Engine oil filter

## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

#### 2. Every 100h maintenance

- (1) Replace hydraulic transmission oil 49liters.
- (2) Replace gear oil 2×18liters
- (3) Replace transmission oil filter element.



Transmission oil filter element

## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

#### 3. Every 250h maintenance

- (1) Replace the engine oil 12liters.
- (2) Replace the engine oil filter element.
- (3) Replace engine air strainer.
- (4) Replace fuel filter.

• Recurrence period:  $(2n-1)250$ , except the multiple of 750, of which  $n=1, 2, 3...$



Fuel filter

## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

#### 4. Every 500h maintenance

- (1) Replace the engine oil.
- (2) Replace the engine oil filter element.
- (3) Replace engine air strainer.
- (4) Replace fuel filter.
- (5) Replace fuel strainer element.
- (6) Replace pilot filter element.
- (7) Replace hydraulic oil return filter element
- (8) Replace the brake fluid 2liters.
- (9). Replace transmission oil 49 liters.
- (10). Replace transmission oil filter element.

Pilot hydraulic oil filter



Pilot filter element



## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

#### 5. Every 750h maintenance

- (1) Replace the engine oil 12liters.
- (2) Replace the engine oil filter element.
- (3) Replace engine air strainer.
- (4) Replace fuel filter.

•Recurrence period:  $(2n-1)*750$ , of which  $n=1, 2, 3...$





## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

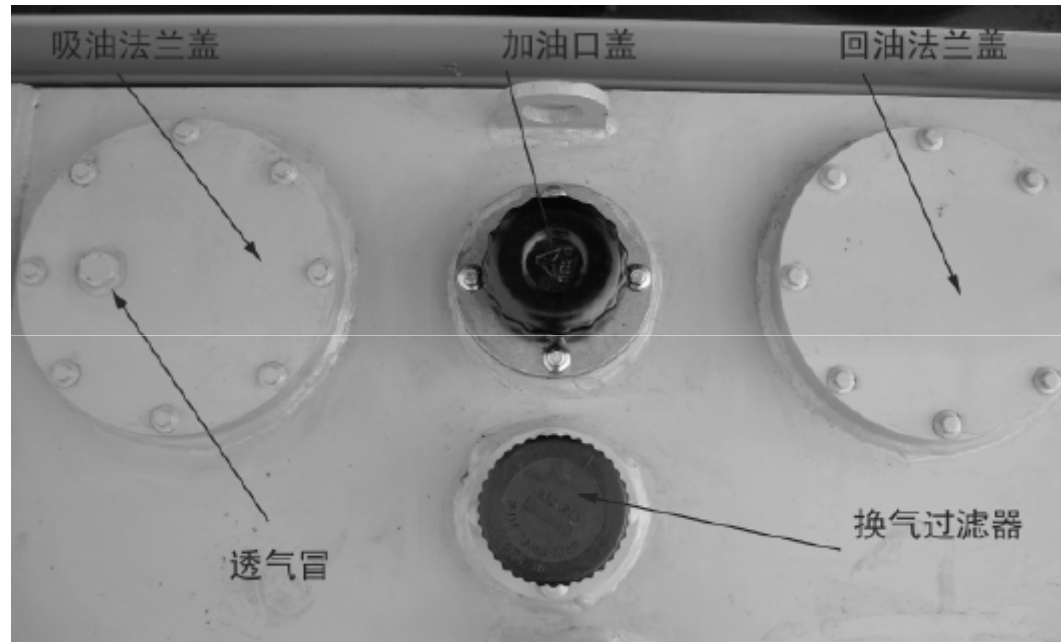
#### 6. Every 1,000h maintenance

- (1) Replace the engine oil 12 liters.
- (2) Replace the engine oil filter element.
- (3) Replace engine air strainer.
- (4) Replace fuel filter.
- (5) Replace fuel strainer element.
- (6) Replace transmission oil 49 liters.
- (7) Replace transmission oil filter element.
- (8) Replace hydraulic oil 123liters.
- (9) Replace pilot filter element.
- (10) Replace hydraulic oil return filter element
- (11) Replace gear oil 2×18liters
- (12) Replace the brake fluid.

Oil suction flange cap

Hydraulic Oil filler cap

Oil return flange cap



Breath cap

Vent filter

## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

#### 7. Every 1,500h maintenance

- (1) Replace the engine oil 12liters
- (2) Replace the engine oil filter element.
- (3) Replace fuel strainer element.
- (4) Replace fuel filter.
- (5) Replace engine air strainer.
- (6) Replace engine air cleaner element.
- (7). Replace transmission oil 49 liters
- (8). Replace transmission oil filter element.

•Recurrence period:  $(2n+1)*500$ , of which  $n=1, 2, 3...$



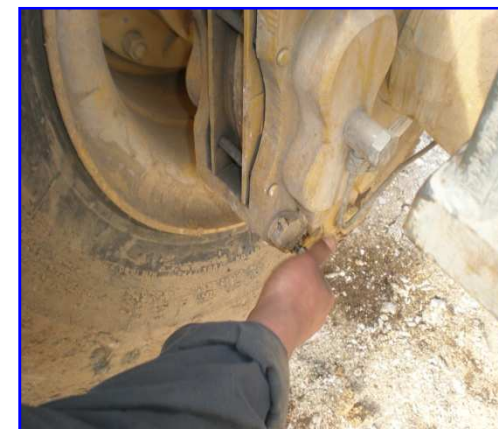
## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

#### 8. Every 2,000h maintenance

- (1) Replace the engine oil 12liters.
- (2) Replace the engine oil filter element.
- (3) Replace engine air strainer.
- (4) Replace engine air refined strainer
- (5) Replace fuel filter.
- (6) Replace fuel strainer element.
- (7) Replace hydraulic transmission oil 49 liters.
- (8) Replace transmission oil filter element.
- (9) Replace hydraulic oil 123liters.
- (10) Replace pilot filter element.
- (11) Replace hydraulic oil return filter element
- (12) Replace drive axle gear oil 2×18 liters.
- (13) Replace the brake fluid 2 liters.
- (14) Replace antifreeze 34kg.

• Recurrence period:  $n \times 2000$ , of which  $n=1, 2, 3 \dots$



## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

#### 9. Every 2,500h maintenance

- (1) Replace the engine oil 12 liters.
- (2) Replace the engine oil filter element.
- (3) Replace engine air strainer.
- (4) Replace fuel filter.
- (5) Replace fuel strainer element.
- (6). Replace transmission oil 49 liters
- (7). Replace transmission oil filter element.

• Recurrence period:  $(n+1) * 1000 + 500$ , of which  $n = 1, 2, 3...$  In event of coincidence with recurrence period of every 1,000h maintenance, the every 1,000h maintenance shall prevail.

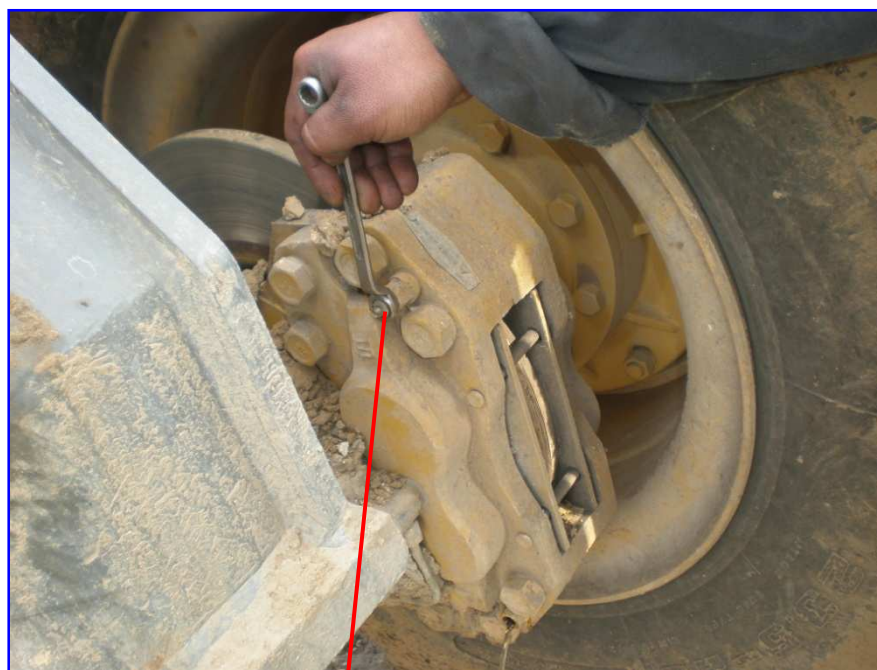


## Section II Maintenance of Complete Machine

### I. Maintenance of complete machine

#### 10. Every 3,000h maintenance

- (1) Replace the engine oil 12 liters.
  - (2) Replace the engine oil filter element.
  - (3) Replace engine air strainer.
  - (4) Replace engine air cleaner element.
  - (5) Replace fuel filter.
  - (6) Replace fuel strainer element.
  - (7) Replace hydraulic transmission oil 49 liters.
  - (8) Replace transmission oil filter element.
  - (9) Replace pilot filter element.
  - (10) Replace hydraulic oil return filter element
  - (11) Replace drive axle gear oil 2×18 liters.
  - (12) Replace the brake fluid 2 liters.
- **Recurrence period:  $(2n+1)*1000$ , of which  $n=1, 2, 3...$**



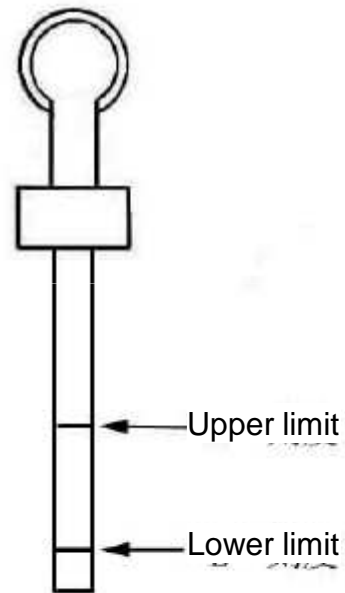
Brake caliper  
bleeding valve

## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

#### 1. Checking of engine oil level

- Park the loader on a level ground, shift the gearshift operating lever to neutral position, pull up the parking brake lever to set the parking brake of the machine, and place blocks before and after the tires.
- Open the engine hood side gate on the left side of the engine hood.
- Withdraw the oil dipstick, wipe clean, reinsert, and then withdraw again for checking (for at least two times).
- If the oil level is below the lower limit, add oil through oil filler port. If the oil level is above the upper limit, find out and resolve the cause. If the oil level is between the upper limit and lower limit, the oil level is appropriate. Insert the oil dipstick and close the engine hood side gate.
- Caution: The checking of oil level must be conducted before the working or 15min after the stop of the engine.**

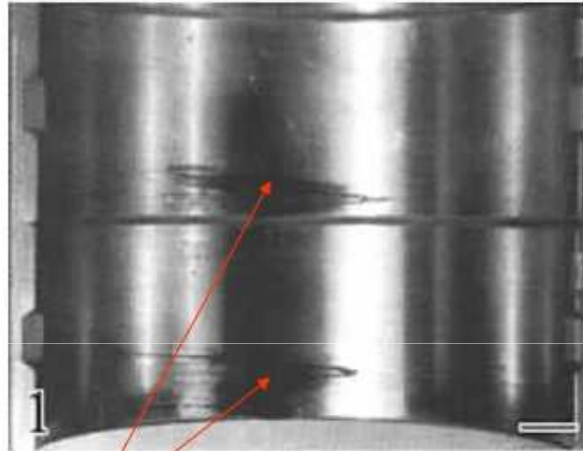


## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

#### 1. Checking of engine oil level

•Caution: If the engine is short of lubricating oil, the poor lubricating oil is used, or the lubricating oil is not replaced for a long period, it will probably lead to seizure of bushing or scuffing of cylinder.



Seizure of bushing



Scuffing of cylinder

## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

#### 2. Checking of coolant level

- (1) Open the water tank cap under cold state of engine.
- (2) Observe the coolant amount within radiator and ensure that the radiator is full of coolant. If insufficient, add coolant timely.
- (3) Install the water tank cap.

**Coolant level: the height between coolant and water tank is less than 20mm**





## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

#### 3. Checking of brake fluid level

- (1) Open the access cap of booster pump assembly oil cup.
- (2) Observe the brake fluid amount in the oil cup. The fluid amount shall be 3/4 of oil cup capacity. Add brake fluid if insufficient.
- (3) Observe the oil cup filter screen for presence of impurity and clean if any.
- (4) Install the oil cup cap.



## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

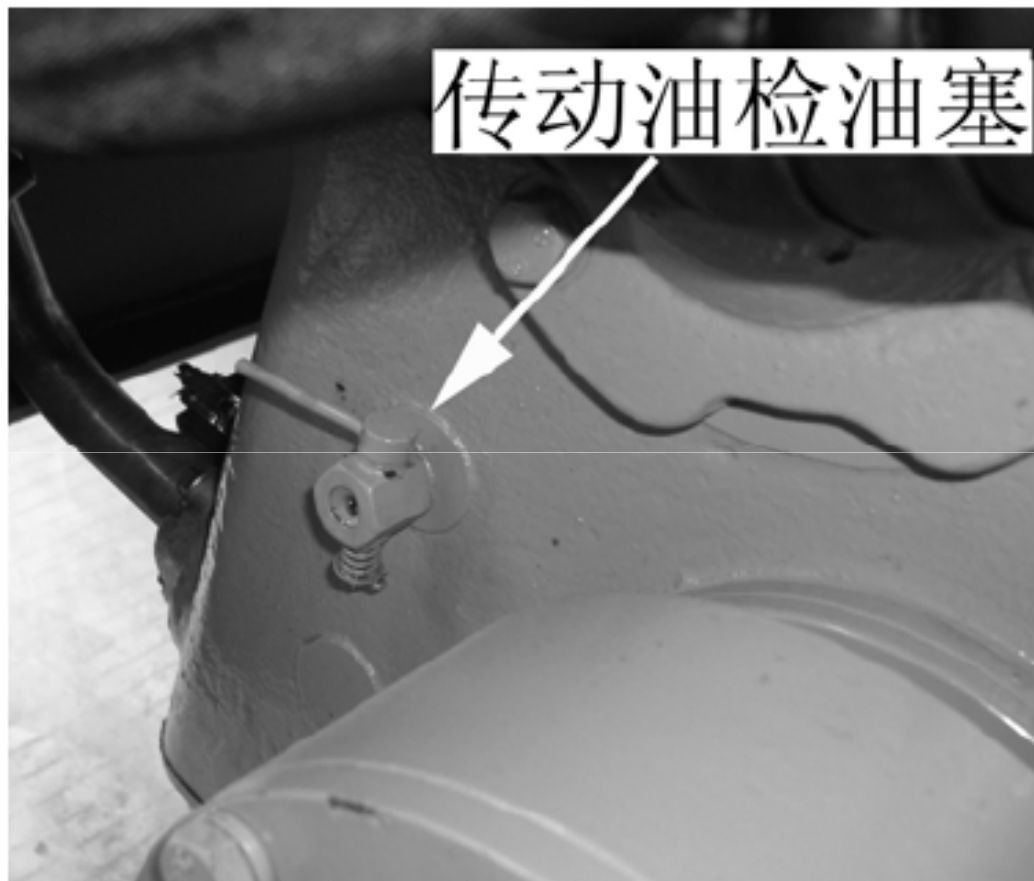
#### 4. Checking of transmission oil level

(1) Park the machine on a level ground, shift the gearshift operating lever to neutral position, pull up the parking brake lever to set the parking brake of the machine, and place blocks before and after the tires.

(2) After the engine idles for 5min at 1000r/min, open the oil check plug to check the oil level during idling. If there is an outflow of transmission oil, the oil level is normal.

(3) If insufficient, add the oil.

Transmission oil access plug



## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

#### 5. Checking of drive axle oil level

(1) Park the loader on a level ground, shift the gearshift operating lever to neutral position, pull up the parking brake lever to set the parking brake of the machine, and place blocks before and after the tires.

(2) Screw off the oil filler plug on the center of front and rear drive axle housings. If the oil level is at the lower edge of oil filler port, the oil level is appropriate. Otherwise, add the specified gear oil. After adding the oil, observe for approximate 5min. If the oil level remains stable, screw in the oil filler plug.

**(3) Oil filling standard: move the loader slowly until wheel filling port and Axle housing filling port are at the same horizontal position. Fill the gear oil until it drains.**

(4) Fill Axle housing gear oil until it drains



## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

#### 6. Checking of hydraulic oil level

(1) Park the loader on a level ground, lower the bucket level onto the ground, and align the front and rear frames straightly without any angle.

(2) Check the oil level of the hydraulic oil tank on the left side of the machine. The oil level is normal if the lever gauge is at a range of  $\pm 2$  from the middle level. If the level gauge is lower than the scale -2 of the middle scale please fill the hydraulic oil

Hydraulic oil level gauge



## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

#### 7. Checking of lubrication status at lubricating points

• Check the lubrication status at lubricating points and timely add the lubricating grease. The adding method of lubricating method is as below:

(1) Remove oil dirt from vicinity of lubricating points.

(2) Connect grease gun to the grease nipple and operate the grease gun to add the lubricating grease. Observe the articulated surfaces, till the used grease is completely squeezed out and the new grease just overflows.

(3) Remove over-flown used grease and properly protect the grease nipple with a small amount of new grease.



## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels 8. Checking of battery

- (1) Remove foreign material from the top of battery and observe the battery for presence of damage or leakage.
- (2) Check the battery charge indicator. It indicates good battery if the indicator is green. If the indicator is black, it's necessary to charge the battery. If white, it's necessary to replace battery.
- (3) Check the connection of wiring posts. In event of looseness, timely tighten.



## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

#### 9. Checking of tire air pressure

(1) Screw off the tire valve protective cap and check the intactness of tire valve. Remove the impurity and dirt from the vicinity of the valve, connect the pressure gauge to the tire valve, and observe the reading of pressure gauge.

(2) The air pressure shall be 0.33~0.35MPa for front tires and 0.27~0.29MPa for rear tires. If out of above ranges, inflate or deflate the tires.

(3) At completion of checking, properly preserve the pressure gauge and install the valve protective cap.

Caution: While checking the air pressure and inflating the tire, do not face your body towards straightly to the tire and pressure gauge.



## Section II Maintenance of Complete Machine

### II. Checking of oil/fluid levels

#### 10. Checking of tire air pressure

(1) While the loader is traveling with over-high tire pressure, the contact area of the tire crown is reduced and the partial load is increased, which will accelerate the wear and lead to tire burst under worse cases.

(2) While the loader is traveling with under-low tire pressure, the wear is accelerated and the overheating is caused for the tire shoulder, which will lead to separation between sidewall rubber and cord ply and lead to burst under worse cases.



Over-high pressure



Under-low pressure



## Section II Maintenance of Complete Machine

### III. Replacement of Oils/Fluids

#### 1. Replacement of engine oil

(1) Park the loader on a level ground, shift the gearshift operating lever to neutral position, pull up the parking brake, place the blocks before and after the tires, and start the engine for idling. After the oil temperature reaches 20°C~40°C, stop the engine.

(2) Screw off the oil drainage plug on the bottom of the engine, drain the oil and catch with a container, and replace the engine oil filter.

(3) Fully drain the used oil and reinstall the oil drainage plug.

(4) Open the left gate of engine hood and add specified engine oil through engine oil filler port.

(5) Idle run the engine and check the engine oil filter and oil drainage plug for presence of oil leakage.

(6) After the stop of engine, wait for approximate 15min to enable the engine oil to fully return to oil pan, and check the engine oil level again.

Engine oil filler



Engine oil dipstick

## Section II Maintenance of Complete Machine

### III. Replacement of Oils/Fluids

#### 2. Replacement of transmission oil

(1) Park the machine on a level ground, shift the gearshift operating lever to neutral position, stop the engine, pull up the parking brake lever to set the parking brake of the machine, and place blocks before and after the tires.

(2) While the transmission is at working temperature, screw off the oil drainage plug on the right bottom of the transmission and catch the oil with a container.

**Caution: While draining the oil, fully drain the oil from the transmission as well as from the torque converter and radiator.**

Oil drainage plug



Oil checking plug

## Section II Maintenance of Complete Machine

### III. Replacement of Oils/Fluids

#### 3. Replacement of transmission oil

(1) Fully drain the used oil, thoroughly remove the dirt from the oil drainage plug, sealing surface of housing, and transmission body, and reinstall above parts.

(2) Screw off the transmission oil filler cap at the right articulation of the loader and add specified hydraulic transmission oil.

(3) Start and idle run the engine. The oil level shall be above the access plug.

(4) Shift to every gear for once.

(5) Check the oil level again and add oil if necessary.

#### Caution:

- Make sure to replace the filter at the replacement of oil each time.
- After opening the access plug to check the oil level each time, make sure to close the access plug.

Transmission oil filler



## Section II Maintenance of Complete Machine

### III. Replacement of Oils/Fluids

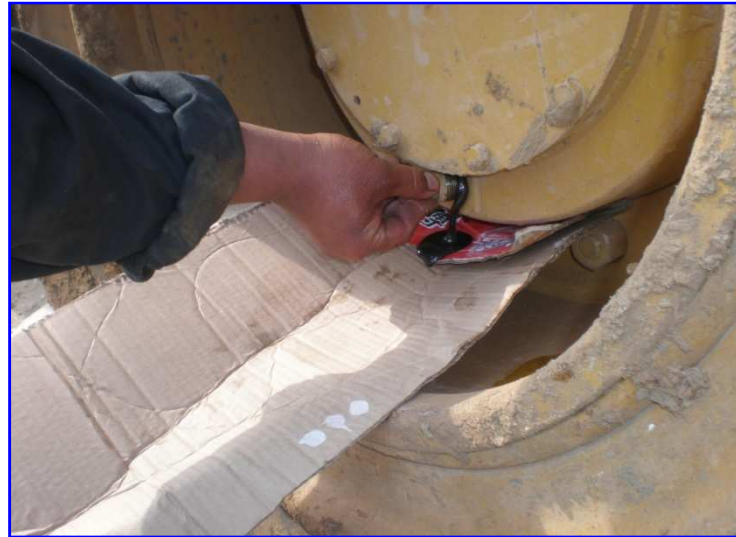
#### 4. Replacement of drive axle oil

(1) Drive the loader to a level ground, idle run for approximate 10min, and slowly drive the loader under small throttle opening extent, till the oil drainage plug on the wheel end face of front drive axle at the lowest position.

(2) Stop the engine, shift the gearshift operating lever to neutral position, pull up the parking brake lever to set the parking brake of machine, and place the blocks before and after the tires.

(3) Screw off the oil drainage plugs on side faces of two wheels and on the central bottom of axle housing to drain the oil and catch with a container.

(4) Fully drain the used oil and screw on the oil drainage plug on the central bottom of the axle housing.



## Section II Maintenance of Complete Machine

### III. Replacement of Oils/Fluids

#### 5. Replacement of drive axle oil

(1) Start the engine, release the parking brake, and drive the loader slowly under small throttle opening extent, till the oil drainage port on the side faces of wheels is at the horizontal axis level of the tire.

(2) Stop the engine, shift the gearshift operating lever to neutral position, and pull up the parking brake lever to set the parking brake of machine.

(3) Add specified gear oil through oil drainage port on side faces of two wheels of front drive axle and through the oil filler port on the center of axle housing and check the oil level again.

(4) Reinstall the oil drainage plug on the side faces of two wheels of front drive axle and the oil drainage plug on the center of axle housing.

(5) Replace the gear oil of rear drive axle as per above-mentioned procedure.



## Section II Maintenance of Complete Machine

### III. Replacement of Oils/Fluids

#### 6. Replacement of hydraulic oil

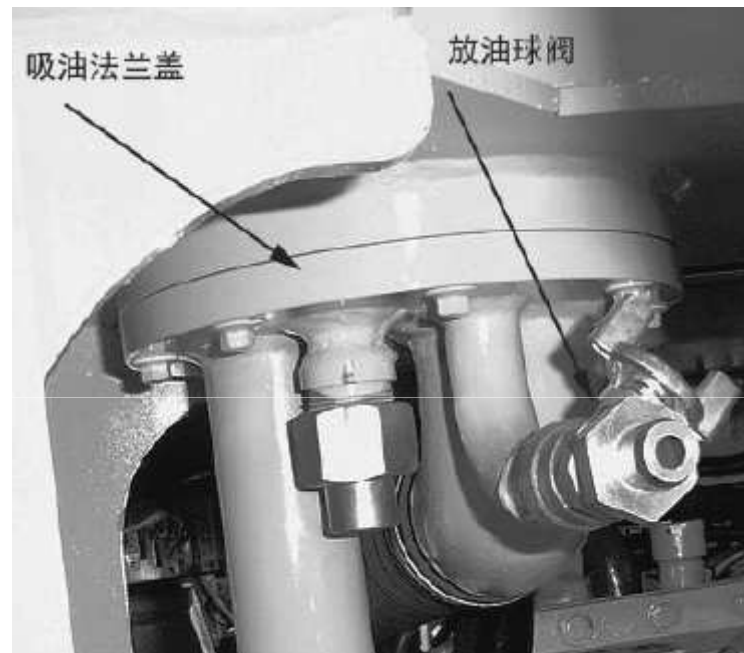
(1) Fully remove the impurities from the bucket, park the loader on a level and spacious ground, shift the gearshift operating lever to neutral position, pull up the parking brake lever to set the parking brake of machine, start the engine, idle run for 10min, and then operate the lifting and lowering of boom and the forward and backward tilting of bucket repeatedly for several times.

(2) Lift the boom to the highest position, tilt backward the bucket to maximum position, and then stop the engine.

(3) Push forward the bucket operating lever to tilt forward the bucket under the action of dead weight and drain the oil from the bucket cylinder. After the bucket is rotated in place, push forward the boom operating lever to lower the boom under the action of dead weight and drain the oil from the boom cylinder.

Oil suction flange cap

Oil drain ball valve



## Section II Maintenance of Complete Machine

### III. Replacement of Oils/Fluids 6. Replacement of hydraulic oil

(4) Disassemble the oil drainage plug on the bottom of hydraulic oil tank to drain the used oil and catch with a container. At the same time, screw off the oil filler cap to speed up the oil drainage.

(5) Disassemble the flange cap on the bottom of the oil tank and clean the inside of oil tank.

(6) Disassemble the top flange cap of the oil tank, clean the oil suction port, oil return port, and filler port filter element and replace filter element if damaged.

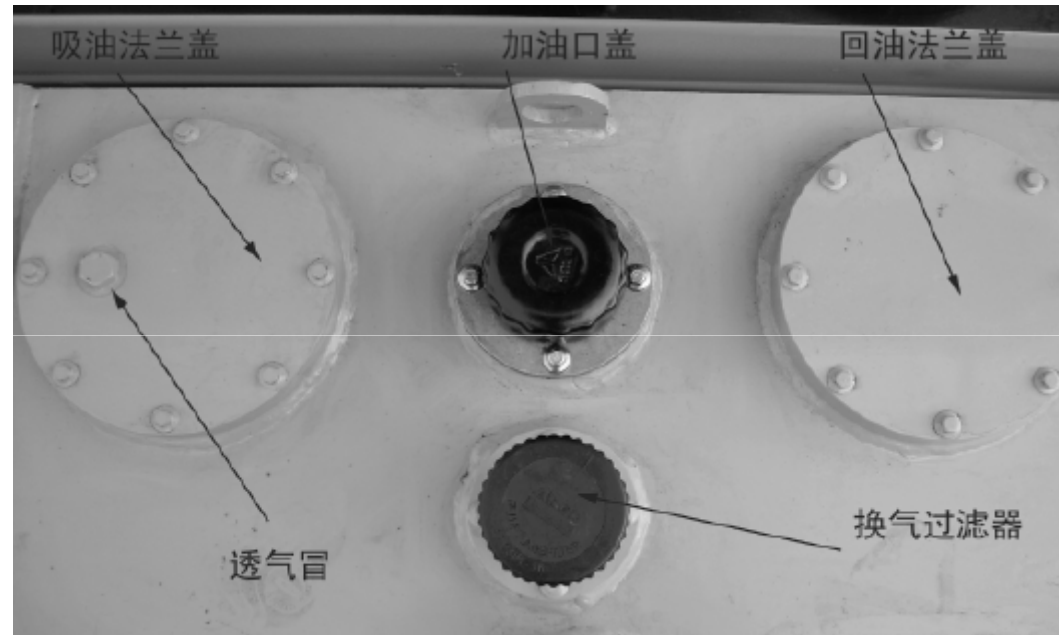
(7) Re-tighten the flange cap and oil drainage plug.

(8) Add specified hydraulic oil through the top filler port of the oil tank, till the oil level reaches the middle marking of the level gauge, and tighten the oil filler cap. It's prohibited to remove the filler port filter element and directly add oil to the oil tank.

Oil return flange cap

Oil filler cap

Oil suction flange cap



Breath cap

Vent filter

## Section II Maintenance of Complete Machine

### III. Replacement of Oils/Fluids 6. Replacement of hydraulic oil

(9) Start the engine and operate the lifting and lowering of boom, forward and backward tilting of the bucket, and left and right steering to the maximum angle for 2~3 times to fully fill the cylinders and oil pipes with hydraulic oil. Next, idle run the engine for 5min to help bleed the air from the system.

(10) Stop the engine, check the oil level, and add if necessary.

Hydraulic oil tank level gauge

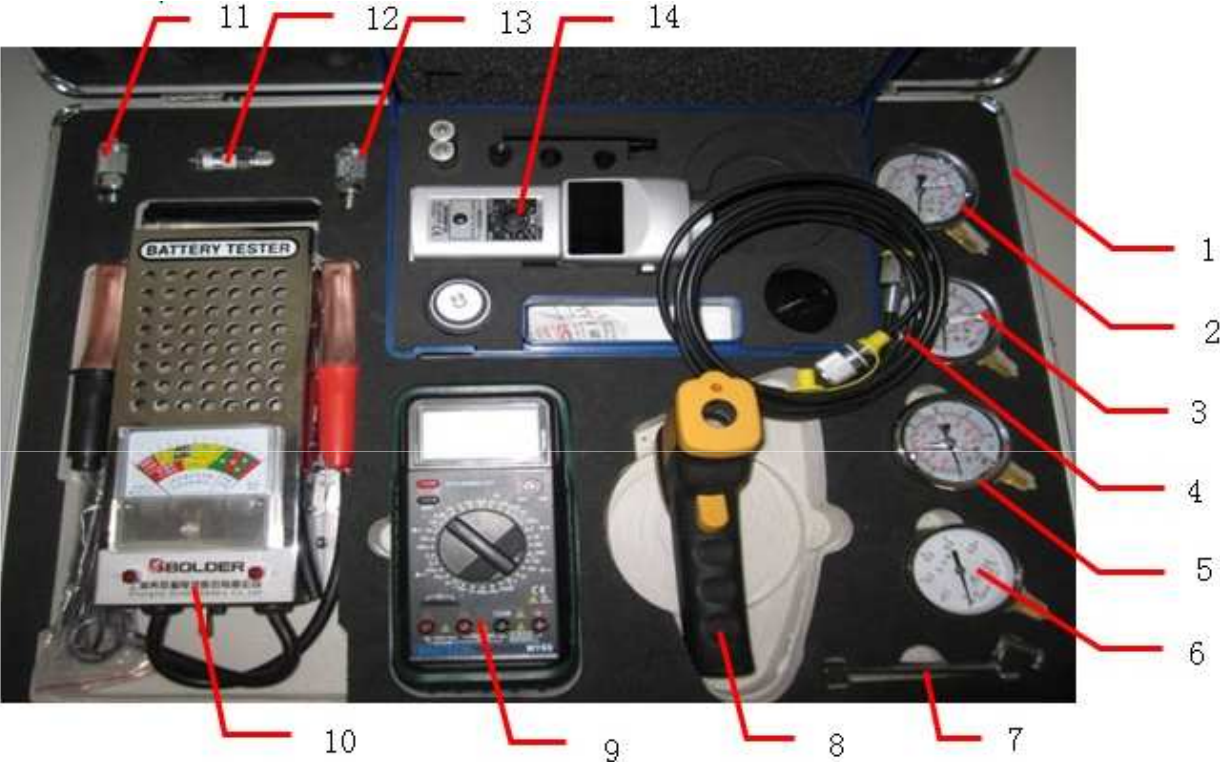




# Section III Testing of Complete Machine

## I. List of testing tools

Note: The actual storage places of the testing connectors and pressure gauges within the toolbox may differ from the places shown in the figure. Please carefully observe at the choice of testing tools, in order to prevent the use of wrong tool.



### Section III List of Complete Machine Testing Tools

No.	Code	Name	Specification and model	Application
1	6900000436	One-off packing carton	Packing carton	
2	4030000369	Pressure gauge 213.53.063/60G1/4	0—6MPa	For measurement of pilot pressure and gearshift pressure
3	4030000370	Pressure gauge 213.53.063/400G1/4	0—40MPa	For measurement of system pressure (working/steering)
4	4030000368	Testing hose SMS20/M1/4-3000A		Assorted with pressure gauge
5	6430000379	Pressure gauge	213.53.063/600G1/4	For measurement of road roller vibration pressure
6	6430000205	Tire pressure gauge	0—0.6MPa	For measurement of tire pressure
7	6430000423	Tire pressure gauge extension rod		Assorted with tire pressure gauge
8	6430000204	Infrared thermometer	Infrared thermometer	Non-contact infrared thermometer
9	6430000206	Multimeter.		For measurement of all kinds of electric units and circuits
10	6430000203	Battery tester	HBV200	For measurement of battery voltage and discharging
11	6410004204	Measuring connector smk20-m14*1.5-PE	smk20-m14*1.5-PE	Assorted with pressure gauge
12	6410003035	Measuring connector smk20-m14*1.5-pc	smk20-m14*1.5-pc	Assorted with pressure gauge
13	4120002381	Testing connector SMK20-G1/4-PC	smk20-G1/4-PC	Assorted with pressure gauge
14	6430000556	Tachometer	DT-207L	For measurement of engine speed or related speeds

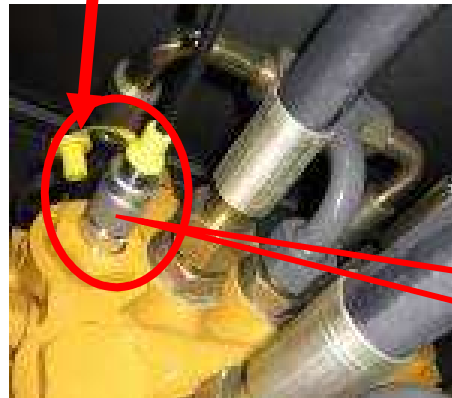
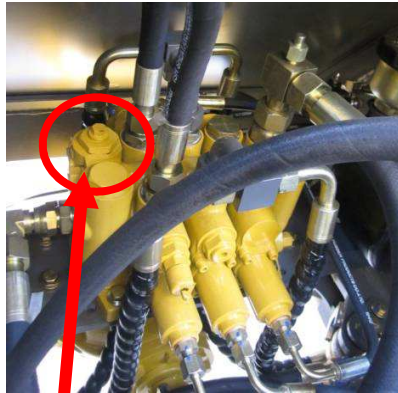
## Section III Testing of Complete Machine

### II. Pressure testing of working hydraulic system

(1) After the oil is fully drained, connect the testing pipeline, on which the pressure gauge is connected, to the pressure measurement port. Choose the pressure gauge with a measuring range of 40MPa (the rated pressure of the working hydraulic system of LG918 is 17.5MPa).

(2) Start the engine, operate the boom cylinder in such manner that the boom cylinder reaches the end of rodless chamber and the system is relieving, operate the throttle pedal to run the engine at rated speed (alternatively, operate the boom cylinder to the end of rod chamber and operate the bucket cylinder to the end of either rod chamber or rodless chamber), and read the reading of pressure gauge.

**Caution: The system pressure can be measured at the steel pipe of rodless chamber of the bucket cylinder.**



LG936 Test Result

Test Joint  
smk20-m14\*1.5-PE

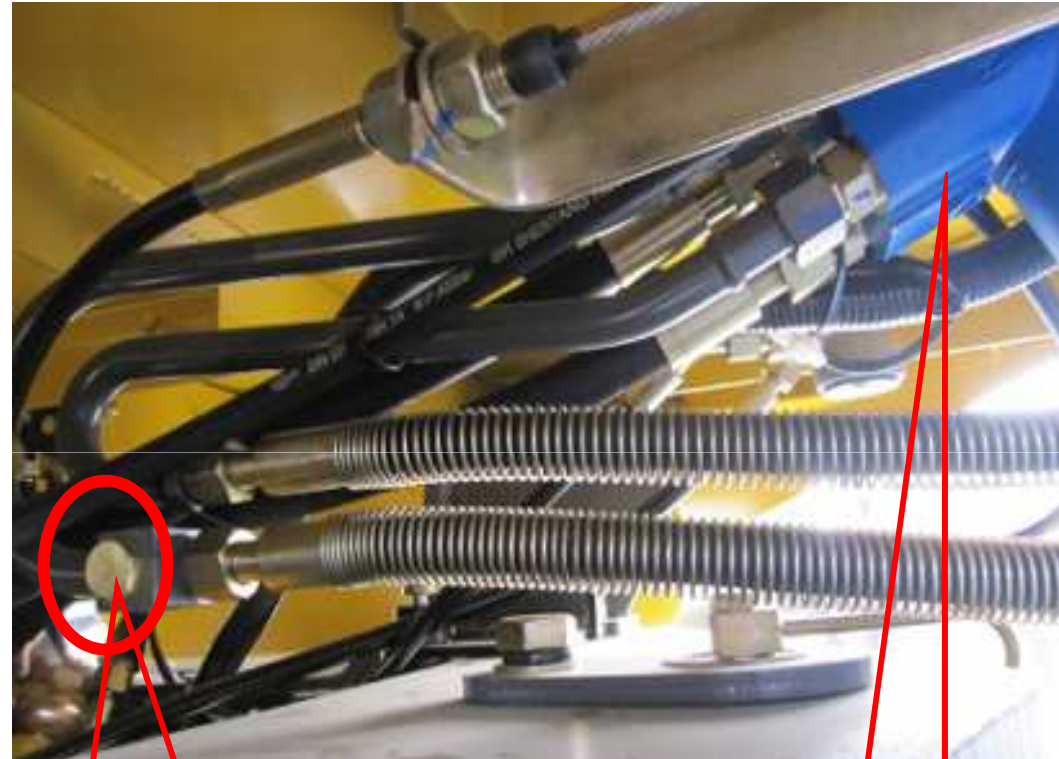
## Section III Testing of Complete Machine

### III. Pressure testing of steering hydraulic system

(1) After the stop of the engine, rotate the steering wheel leftward and rightward for several times for fully unloading of oil.

(2) Connect the pressure testing pipeline, on which the pressure gauge is connected, to the pressure measurement port. Choose the pressure gauge with a measuring range of 40MPa (The rated pressure for the steering hydraulic system of LG918 is 14MPa). At the time of connection, firstly loosen the pressure measurement port to relieve the pressure.

(3) After the start of the machine, rotate the steering wheel to one limit position. In such case, the reading on the pressure gauge is the pressure of steering system.



Pressure Test Port

Steering valve

### Section III Testing of Complete Machine

#### IV. Operation and testing of battery tester

Test the battery.

(1) Clamp the testing clamps to the wiring posts of the battery. If the surface indicator lights up, it indicates the positive pole. The test may be conducted disregarding the positive and negative poles. If the indicator fails to light up, check whether the clamps are securely connected.

(2) Depress the load switch, till the pointer is stable. The testing time is not allowed to last for 10s. Observe the surface pointer and the test result is good if within green zone, low if within red zone, and weak if within yellow zone.

**Caution: Measure the open-circuit voltage of battery before the testing. If the voltage is  $\geq 12.4V$ , the test can be conducted. If the voltage is  $< 12.4V$ , charge the battery firstly and then conduct the testing and judgment.**

**The loading time of battery shall not exceed 10s.**



Load switch

## Section III Testing of Complete Machine

### IV. Operation and testing of battery tester

Test the charging system

- (1) Connect the tester as per the method for measurement of battery.
- (2) Start the engine and run the engine, till the normal working temperature is reached.
- (3) Increase the engine speed to 1,200~1,500r/min. Pay attention to keep clean the engine and at the same time do not depress the load switch.
- (4) If the pointer is within red zone, it indicates that the charging system is malfunctioned and the battery will be insufficiently charged. If the pointer is within green zone, it indicates that the charging system is normal and the battery can be charged.



Load switch

## Section III Testing of Complete Machine

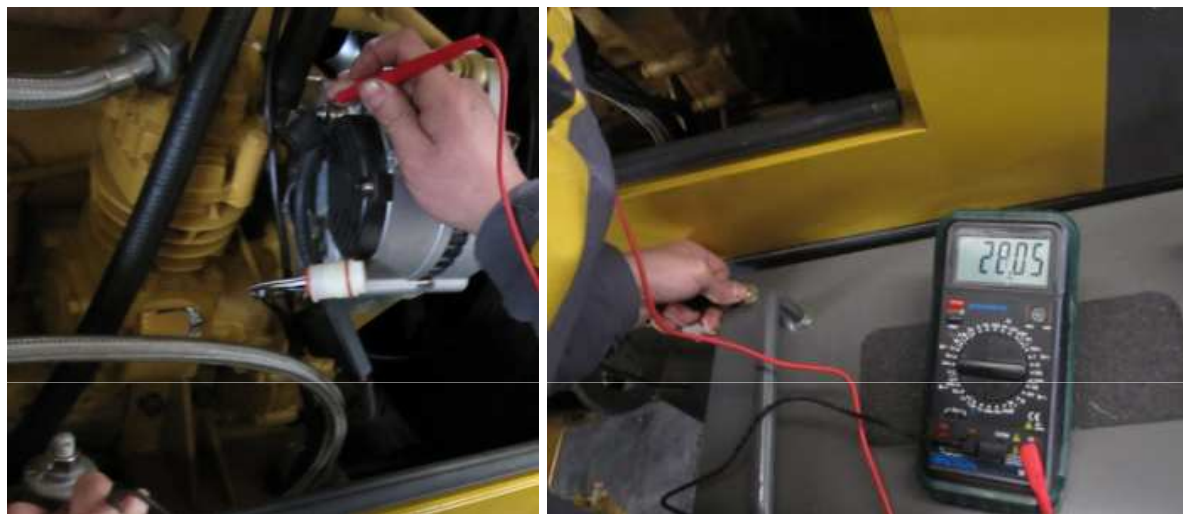
### V. Operation and testing of multimeter

Measurement method of DC voltage  
(1) Place the measuring range switch to required voltage range (As the system voltage of this machine is generally DC 12V or 24V, generally the DC 200V measuring range is adopted).

(2) Connect the black measuring probe to the jack "COM" and red measuring probe to jack "VΩ".

(3) Connect the red measuring probe to the measuring point and earth the black measuring probe. To measure the alternator voltage, after the start of the engine, connect the red measuring probe of multimeter to B+ and earth the black measuring probe.

(4) The reading is the voltage at the measuring point.



## Section III Testing of Complete Machine

### V. Operation and testing of multimeter

Measurement method of resistance:

(5) Connect the black measuring probe to the jack "COM" and red measuring probe to jack "V $\Omega$ ".

(6) Rotate the measuring range switch to required resistance measuring range and connect the probes to two sides of the resistor to be measured respectively.

(7) The reading is the resistance of the resistor being measured.





## Section III Testing of Complete Machine

### VI. Operation and testing of infrared thermometer

(1) Power-on – Press the “measure” key. The infrared thermometer powers on for self examination and automatically measures and displays the temperature.

(2) Measurement – Point the probe to the target and press the “Measure” key for single measurement or press and hold the “Measure” key for continual measurement (Note: At the time of measurement, press and hold the “Measure” key for no less than approximate 0.8s)

(3) Power-off – After powered on, the infrared thermometer will automatically power off if no operation is made for more than 15s.

(4) Auxiliary function – Press the key “C” to display the temperature in “°C”. Press the key “F” to display the temperature in “°F”. Press the key “Backlight” to turn on/off the display backlight. Press the key “Laser” to turn on/off the aiming of laser.



激光照射点

Laser irradiation point

温度显示器

Temperature sensor



测温仪测量键

Measure key of infrared thermometer

## Section III Testing of Complete Machine

### VII. Operation and testing of tachometer

(1) Place a small piece of reflective tape to the shaft to be tested or the part in speed as same as the crankshaft (such as disc).

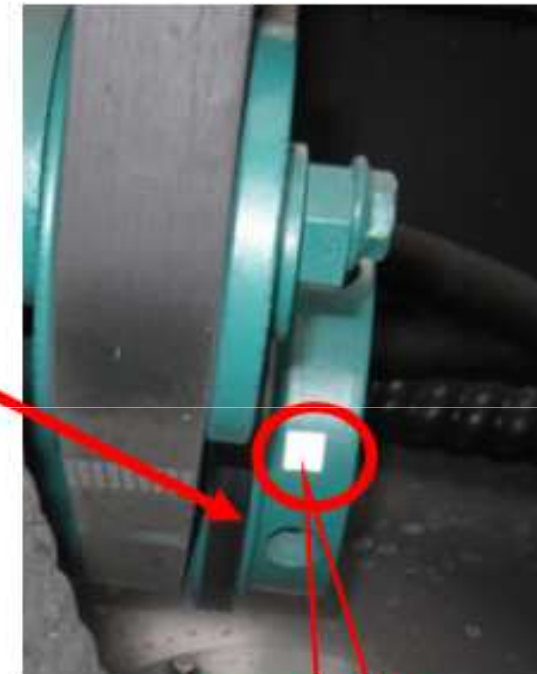
(2) Align the tachometer with the position of reflective tape, press and hold the power switch for several seconds, and observe the display screen. The tachometer indicates the rotation speed by testing the number of reflective ray of the reflective tape.

(3) Before the speedometer detaches from the testing position, loosen the power switch to keep the reading at completion of observation.

(4) The last reading can be displayed for 5min. Press the key "Save" to display for further 5min. The key "Save" can be pressed repeatedly.



Measure the engine speed



Reflective tape

## Section III Testing of Complete Machine

### VIII. Testing of tire pressure

(1) Measurement method: Stop the vehicle and wait for the tire temperature to drop to ambient temperature before the measurement.

(2) Application in malfunction judgment: The abnormal wear in the middle of tire tread is caused by over-high tire pressure. The overheating of tire, ply separation of tire shoulder, or even tire burst is caused by under-low tire pressure or overloaded operations.

(3) Standard air pressure:

Front tires: 0.333~0.353MPa

Rear tires: 0.275~0.294MPa



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## Section one Engine Overview

### Model introduction

WP6G125E22

WP	Weichai	6	Displacement code
G	Construction machinery	125	<b>The power is 125 horsepower</b>
E2	<b>Conform to China national emission standard level 2</b>	2	Variant code

## Section one Overview

Weichai Deutz WP6G125E22 is in-line, four-stroke, water-cooled, turbocharged six-cylinder diesel engine, with following characteristics:

### 1、 High reliability

Reasonable design, fine workmanship, all the system configurations and components are designed with sufficient safety factor and reliability factor.

### 2、 Dynamic models, large torque backup

The torque reserve can reach above 30%, can meet all kinds of construction machinery demand fort power and torque.

### 3、 Good economical efficiency

Through optimization design, the diesel engine has lower fuel consumption and oil consumption in a wide range of road and speed.

### 4、 Low emission, low pollution, low noise, meet with Euro emission standard level II



## Section one Overview

5、 Excellent starting performance at low temperature

The engine can start smoothly at  $-10^{\circ}\text{C}$  without the low temperature starting equipment, and can start smoothly below  $-35^{\circ}\text{C}$  with the aid of the equipment.

6、 Reasonable structure, convenient to operate and repair

The single type cylinder head has small volume, public good, strong interchangeability. The main sealing adopts the non liner technology to completely solve the "three leakage" problem. Parts reduces maintenance costs with a high degree of universal, standardized, serialized.



## Section 2. Crank and connecting rod mechanism

The crank and connecting rod mechanism mainly consists of three parts: the body component, crankshaft flywheel component, piston and connecting rod component.

### 1、 The cylinder block assembly

#### (1) Cylinder block

##### ① Function

The cylinder block is installation basis of each mechanism and system of the engine, and can keep the accurate positional relationship between each moving parts of the engine. The cylinder block and crankcase is usually cast in one piece, called the cylinder body crankcase.



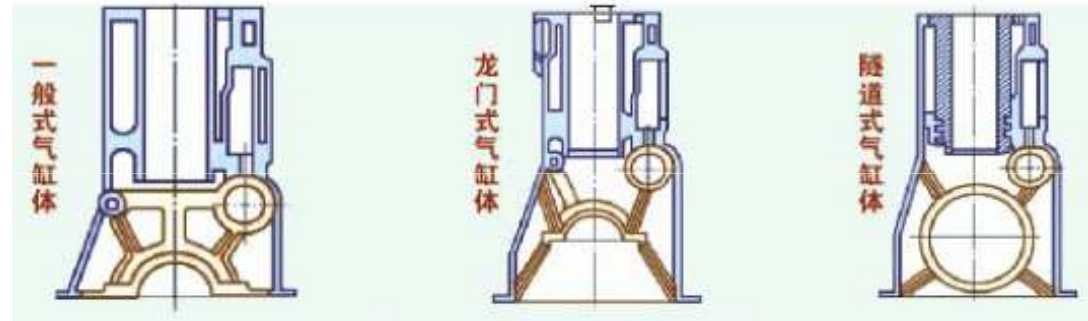


## Section 2. Crank and connecting rod mechanism

### ② Structural style

According to the cylinder block and oil pan different installation location, the cylinder body is usually divided into three types: general type, Longmen type crankcase and tunnel crankcase.

Weichai DEUTZ engine use the Longmen crankcase with a simple and reliable sealing, the structure has good performance of anti bending, torsional stiffness, and convenient disassembly.



## Section 2. Crank and connecting rod mechanism

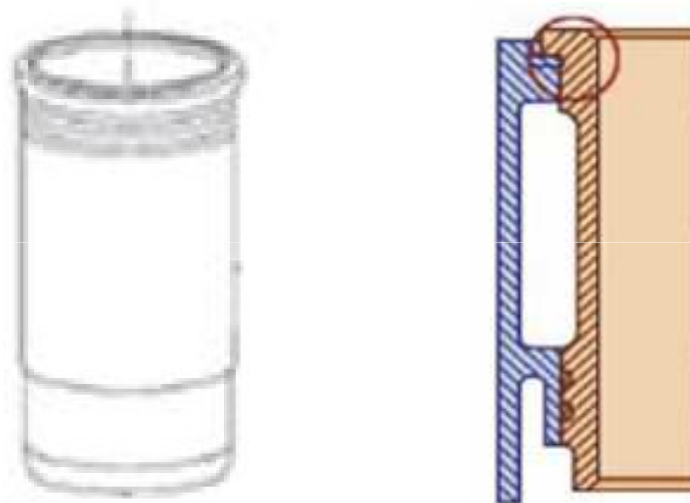
### (2) Cylinder liner

#### ① Function

The function of the cylinder liner is to guide the piston direction and seal the gas inside the cylinder.

② There are two types of cylinder liner: Dry cylinder liner and wet cylinder liner, the dry cylinder liner is not directly in contact with the cooling liquid, but the wet cylinder is just the opposite.

Weichai Deutz engine uses wet cylinder liner with high effect of cooling, but the requirement for sealing is also very high.



## Section 2. Crank and connecting rod mechanism

### (3) Cylinder head

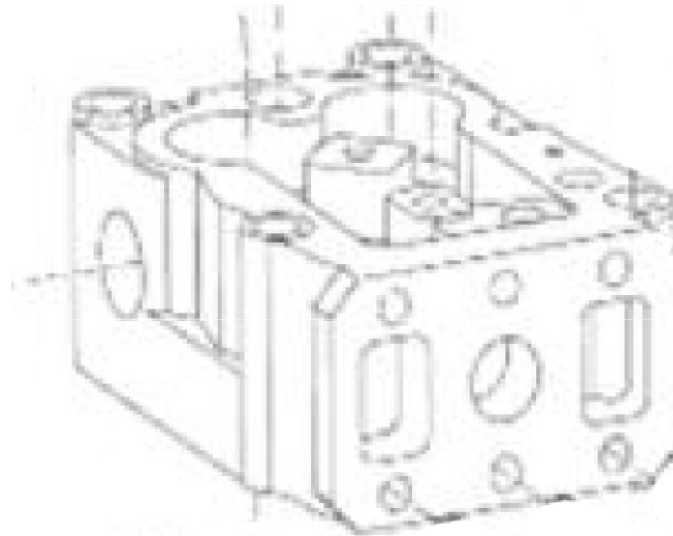
#### ① Function

The function of the cylinder head is to close the upper part of the cylinder and form a combustion chamber with piston crown and cylinder wall.

#### ② Cylinder head type

Cylinder head has usual types of integral-type, single-cylinder split type and double cylinder split type.

Weichai Deutz using split for easy maintenance.

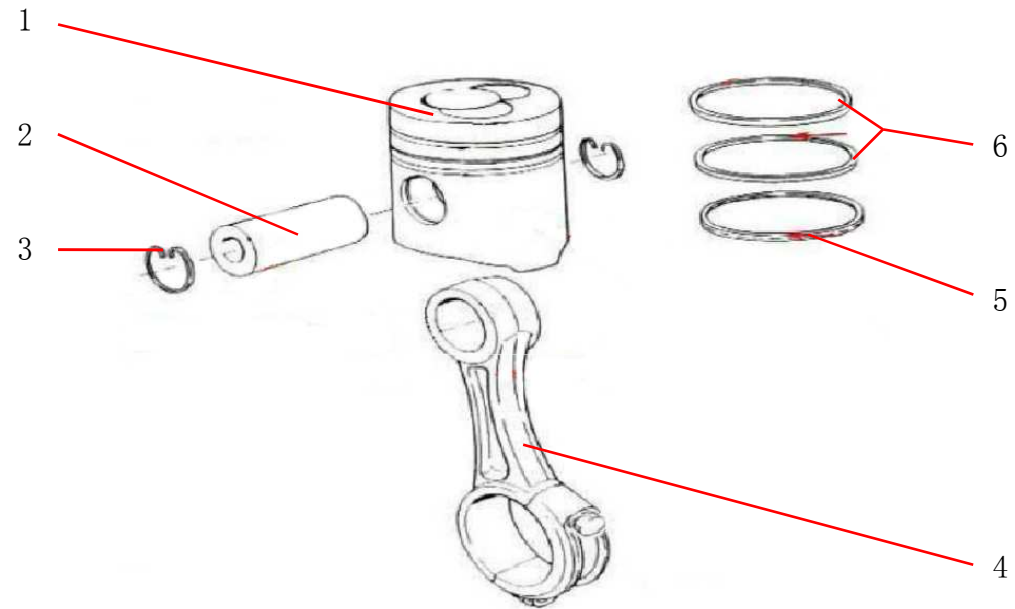


## Section 2. Crank and connecting rod mechanism

### 2、Piston and connecting rod assembly

The Piston and connecting rod assembly mainly composed of pistons, piston rings, connecting rod, piston pin and other mechanical components.

- 1- piston
- 2- piston pin
- 3- piston pin snap ring
- 4- connecting rod
- 5- oil ring
- 6- gas ring



## Section 2. Crank and connecting rod mechanism

### (1) Piston

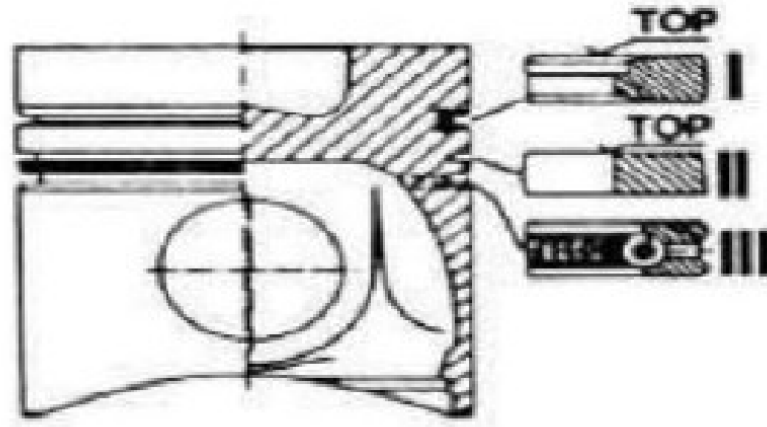
#### ① Piston function

The piston function is form a combustion chamber with cylinder head and cylinder sleeve, accept the gas pressure, and send it to the connecting rod, etc.

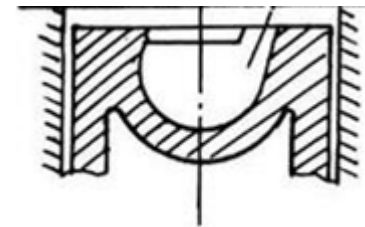
#### ② Combustion chamber

The combustion chamber is a confined space sealed by the piston crown, cylinder liner, cylinder head and piston ring, engineering machinery engine usually uses the unified type combustion chamber.

The unified type combustion chamber is divided into two types, namely spherical combustion chamber and  $\omega$  combustion chamber. Weichai DEUTZ engine uses  $\omega$  combustion chamber to form air swirling movement in conjunction with the helical air inlet, which makes the oil and air mixed more fully and uniformly.



$\omega$  型



球形

## Section 2. Crank and connecting rod mechanism

### (2) Piston ring

#### ① Classification

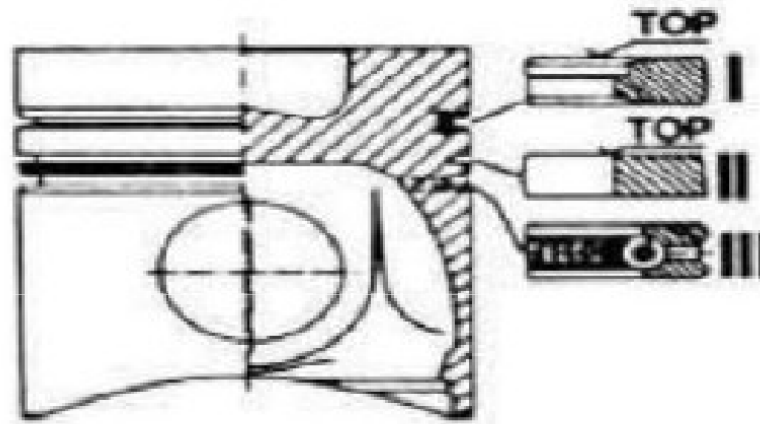
Piston ring is divided into gas ring and oil ring in terms of function.

#### ② Gas ring function

The first and the second ring are gas rings, which function is to ensure the tight seal between the cylinder and the piston, prevent the gas leakage, and transfer most of the heat absorbed from the piston crown to the cylinder wall.

#### ③ Oil ring function

The third ring is oil ring, which function is to distribute oil, scrape oil, reduce the friction resistance and assist the sealing.



## Section 2. Crank and connecting rod mechanism

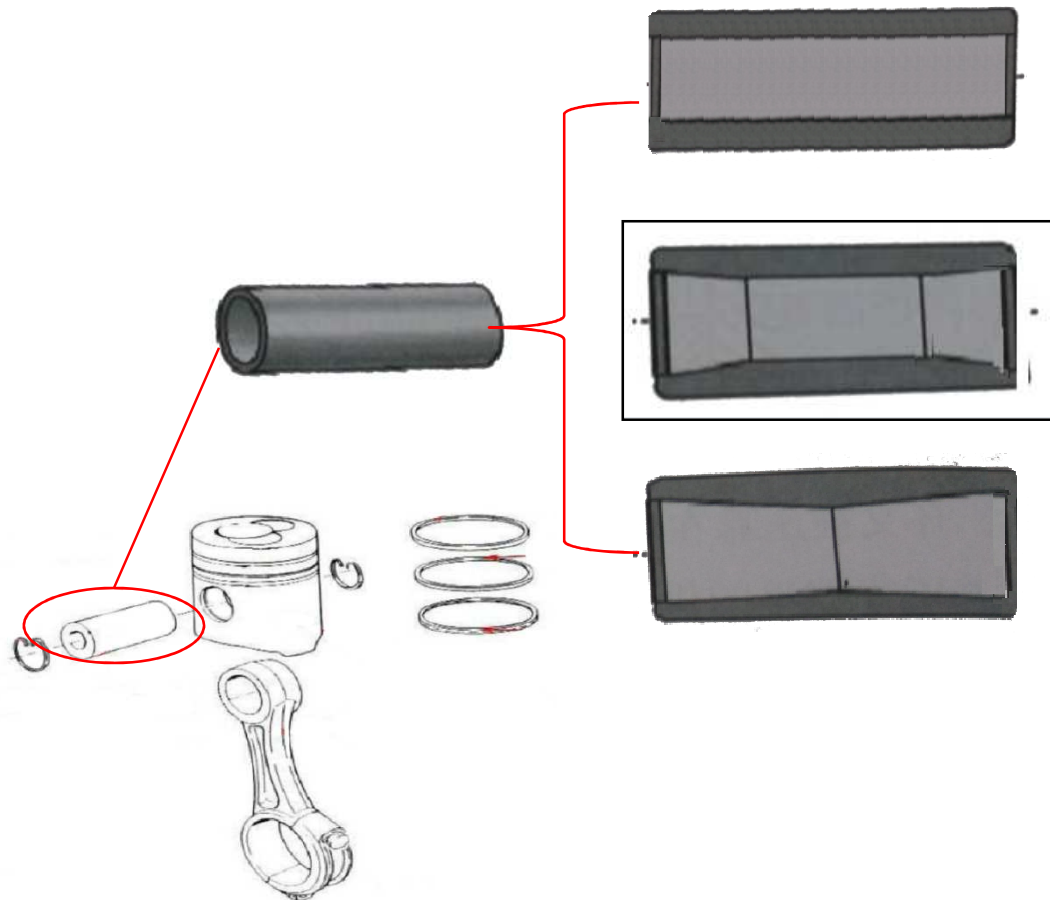
### (3) Piston pin

#### ① Function

The piston pin joins the piston to connecting rod, and transmit the force from piston to connecting rod.

#### ② Structural style

Hollow cylinder, such as cylindrical internal hole, conical internal hole, combined internal hole. Weichai DEUTZ engine uses the cylindrical internal hole.



## Section 2. Crank and connecting rod mechanism

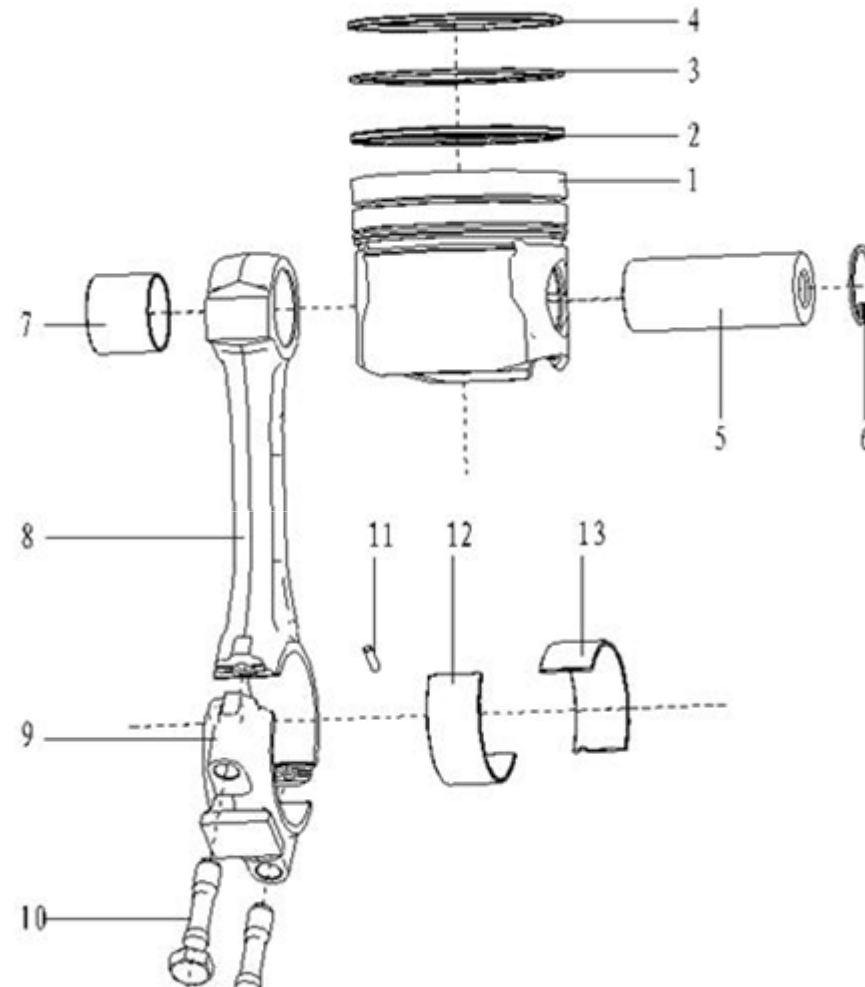
### (4) Connecting rod

#### ① Composition

The connecting rod is composed of connecting rod small end, shaft, connecting rod big end, screw and connecting rod cap, etc.

#### ② Function

Connecting rod joins the connecting rod to the crankshaft, transmit the force from piston to connecting rod, and transfer the reciprocating movement of the piston into the rotary motion of the crankshaft.





## Section 2. Crank and connecting rod mechanism

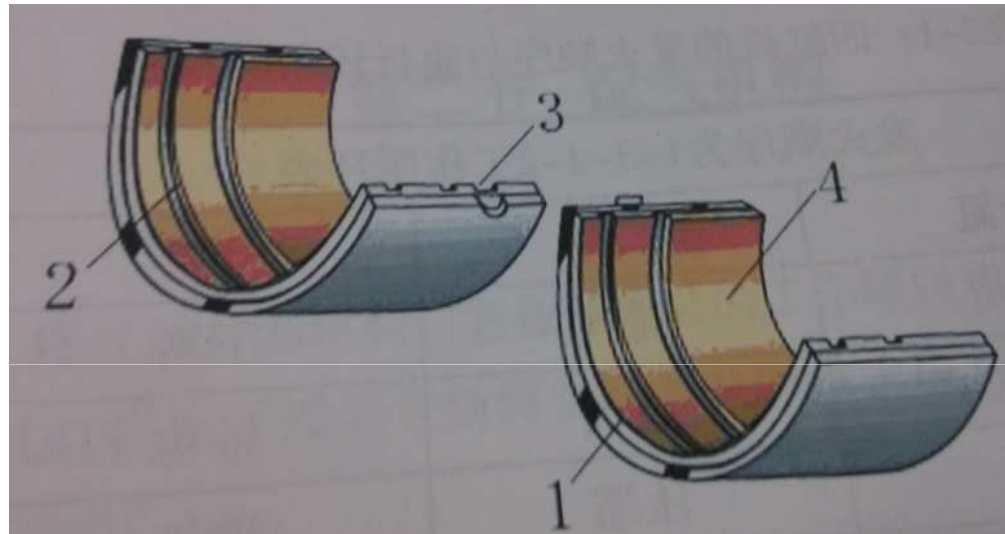
(5) Bearing bushing

1- Steel back

2- Oil groove

3- Positioning convex key

4- Antifriction alloy



## Section 2. Crank and connecting rod mechanism

### 3、The crankshaft and flywheel assembly

Mainly consists of crankshaft, flywheel, and other accessories.

#### (1) Crankshaft

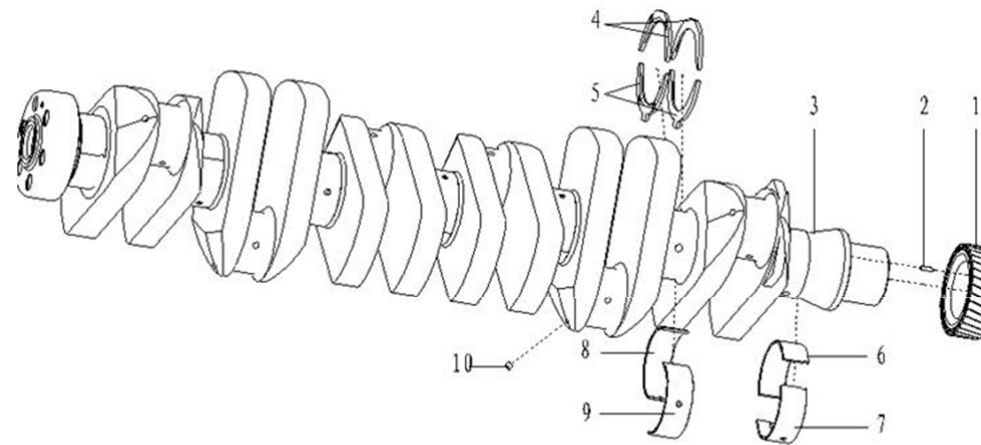
##### ① Composition

The crankshaft is composed of main journal, connecting rod shaft neck, crank, counterbalance, front-end and back-end, etc.

A connecting rod shaft neck and a crankshaft constitute a crank.

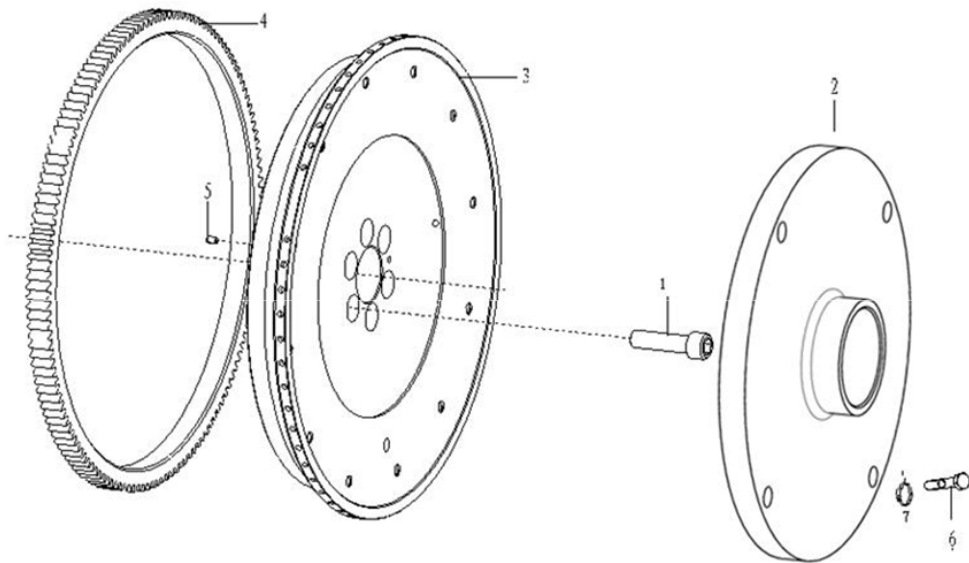
##### ② Function

The crankshaft interacts closely with the connecting rod to change the gas pressure into rotation power, transmit the power to the transmission mechanism, and drive the valve mechanism and other auxiliary devices.



## Section 2. Crank and connecting rod mechanism

(2) Flywheel



### Section 3. The valve mechanism

#### 1. Overview

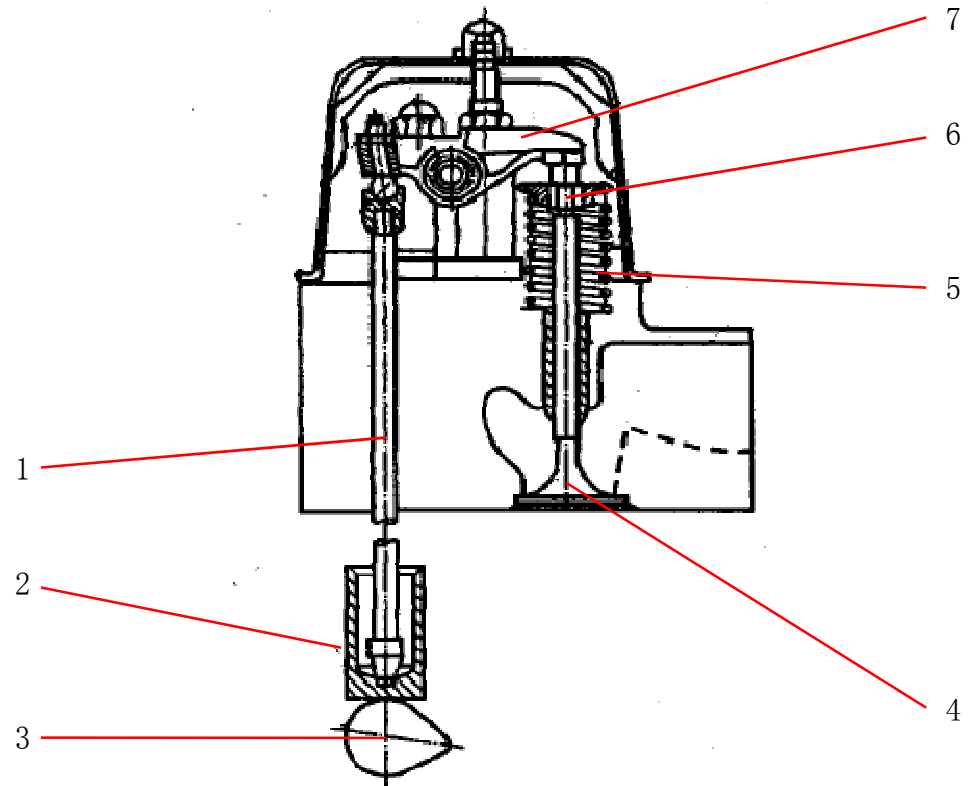
The function of valve mechanism is to control the air inlet and outlet, which regularly control the opening and closing of the intake and exhaust valve, supply mixture fresh air to the cylinder and timely draw used air out, according to the requirement of the cylinder working order and working process. In addition, it can ensure cylinder seal when the inlet and outlet valve

When the engine works, the camshaft is driven by the crankshaft through the timing gear, the cam pushes the tappet and rod and pass the action to the rocker arm which around an axis to overcome the spring force to open the valve. When the camshaft needs to rotate and cross the maximum pushing process, the valves return to the original position and close the valve.

1- push rod    2-tappet    3-camshaft

4-valve    5-valve spring

6-locking plate    7- rocker arm



## Section 3. The valve mechanism

The valve mechanism mainly consists of Valve assembly and valve transmission assembly.

### 2、 Valve assembly

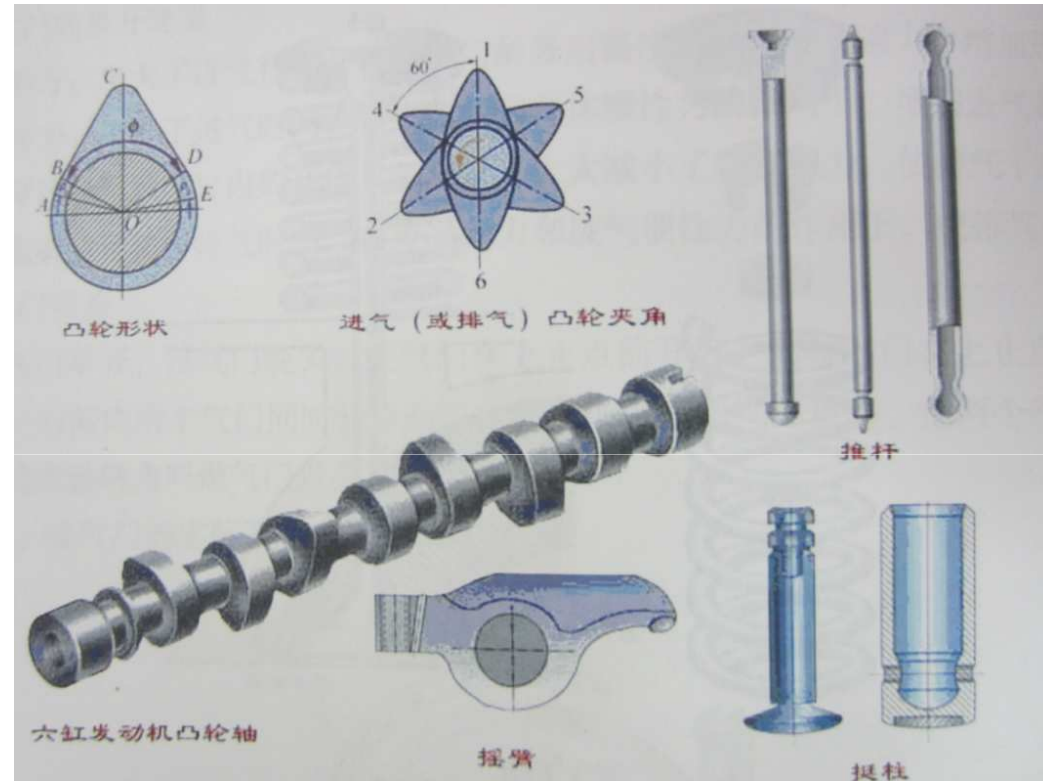
The valve assembly includes valves, valve seats, valve guides, valve springs, locking plate and retainer.

#### (1) Valve

The function of valve is to control the opening and closing of the inlet and outlet valve, resist high temperature, high pressure and impact, which requires the valve to have the following characteristic: sufficient stiffness, strength, wear resistance, high temperature resistance, corrosion resistance, impact resistance.

#### (2) Valve guide

Its function is to guide the valve, ensure the valves do straight reciprocating motion, it also has the heat transfer function, pass heat from the valve head to the rod shaft, and spread out to the outside through the cylinder head.



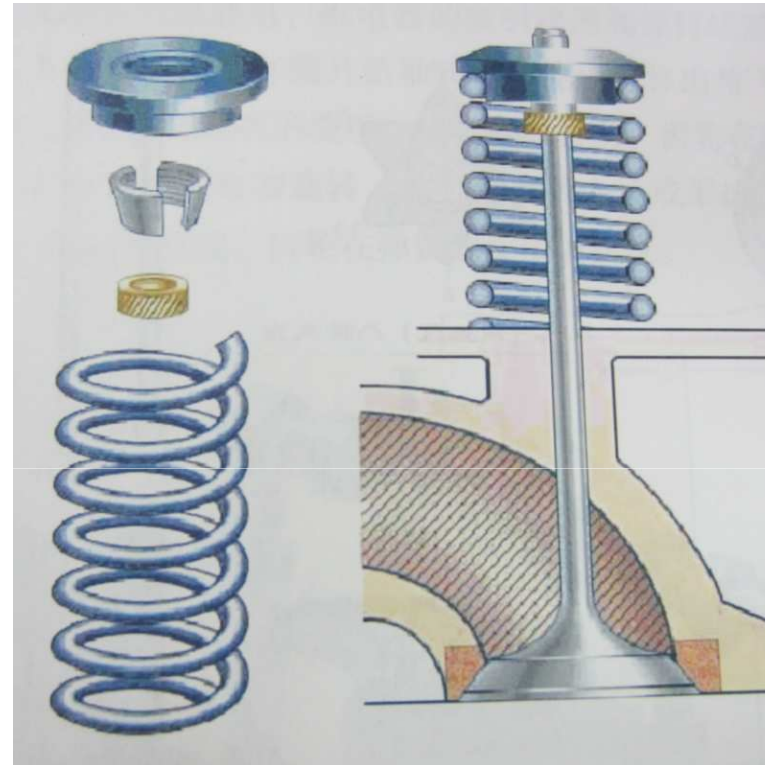
### Section 3. The valve mechanism

#### (3) Valve seat

The valve seat interacts closely with the valve head sealing conical surface to seal the cylinder, and the heat from the valve head can be released to the outside through the valve seat.

#### (4) Valve spring

The function of the valve spring is to ensure the valve's return, prevent the transmission parts detachment during movement. When the valve closed, the valve spring should ensure the sealing between valve and valve seat. when the valve opened, it should ensure the valve can't be separated from the cam for the inertial force created during the movement. The valve spring is a cylindrical spiral spring, which one end is supported on the cylinder head and the other end is pressed against the spring seat at the end of the valve rod, the spring seat is fixed to the end of the valve rod with a locking plate.



## Section 3. The valve mechanism

### 3、 Valve transmission assembly

The valve transmission assembly transfers movement between camshaft and valve, which includes camshaft, tappet, push rod, rocker arm, valve clearance adjusting screw and other components.

#### (1) Camshaft

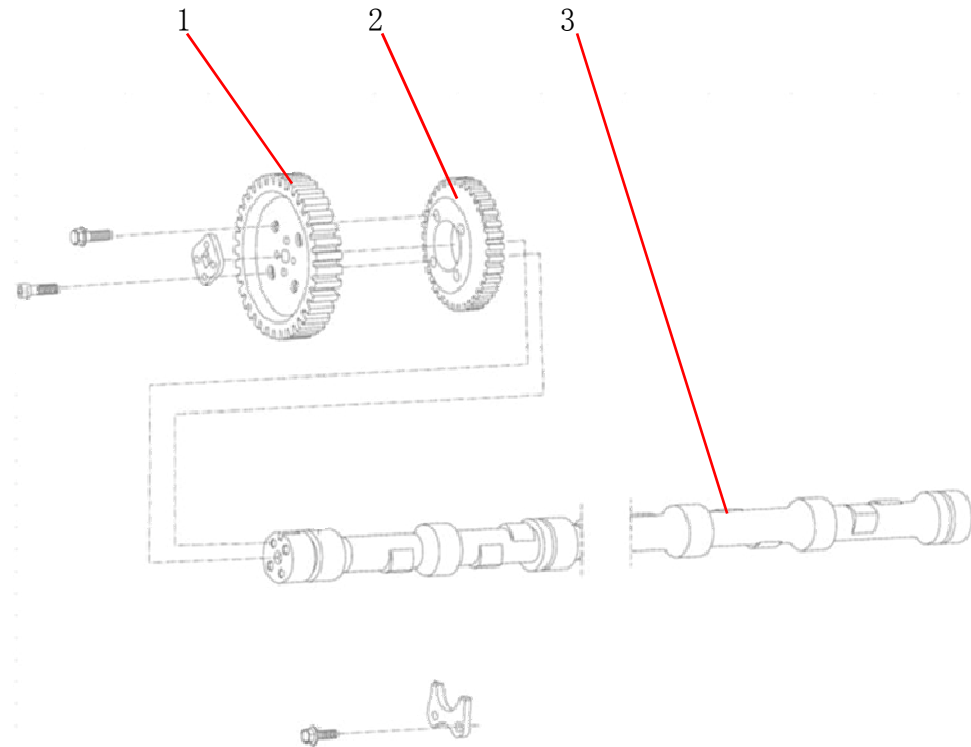
The camshaft controls the opening and closing of the valve, each intake valve and exhaust valve respectively has corresponding intake cam and exhaust cam, the valve opening and closing time and height can be influenced by the rotation of the cam, the cam arrangement can influence the valve opening and closing time and working order

Right picture is the camshaft assembly

1- Camshaft gear

2- Gear(drive fuel pump)

3- Camshaft



### Section 3. The valve mechanism

#### (2) Tappet

The function of the cam tappet is to pass the push force from the cam to the push rod and bear the lateral force exerted by the rotation of the camshaft.

#### (3) Push rod

The function of the push rod is to pass the push force from the camshaft to the rocker arm, which is the most easily bent parts of the gas distribution mechanism

#### (4) Rocker arm and Rocker arm seat

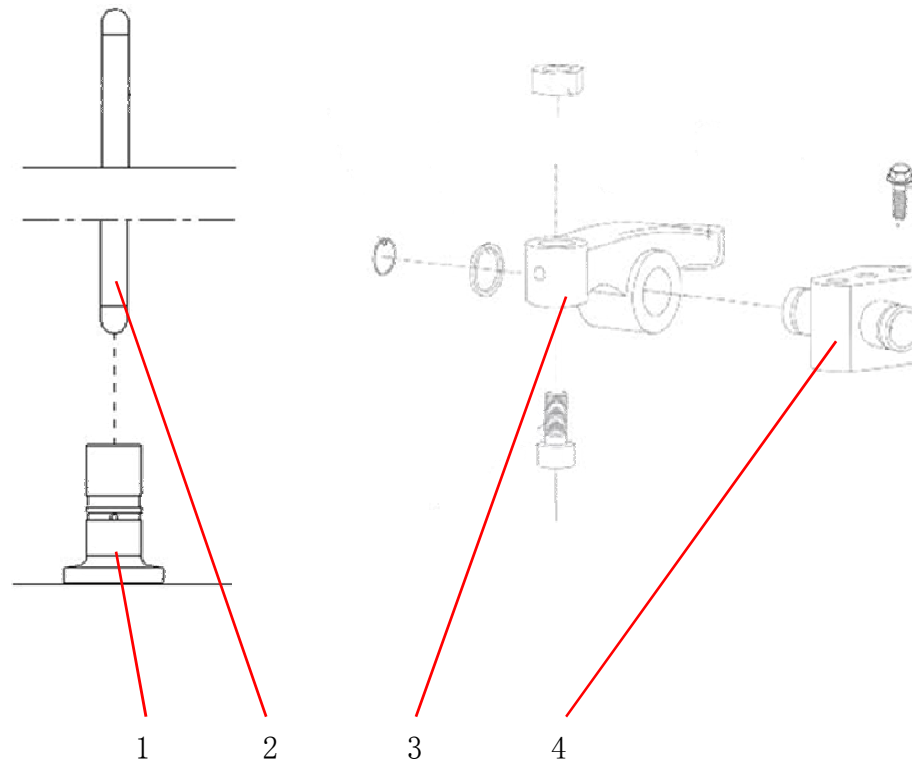
The function is to pass the thrust of the tappets and push rod to the rocker arm, through the swing of the rocker arm to open and close the valve.

1-tappet

2-push rod

3-rocker arm

4-rocker arm seat





### Section 3. The valve mechanism

#### 4. Valve clearance

Valve clearance means the clearance between the end of the valve rod and rocker arm or tappet when the valve is completely closed under the cold condition, which function is to compensate for the amount of expansion after the valve is heated.

Valve clearance is too large or too small will cause certain harms: If the valve clearance is too large, which will cause the inlet and exhaust valve open delayed, the exhaust time shortened, the valve opening height reduced, and will change the normal gas distribution phase, resulting in insufficient air intake and incompletely air exhaust, parts of the gas distribution mechanism impact increased and wear accelerated. If the valve clearance is too small, when the parts heated and expand, which will push the valve open, cause the valve can not be tightly closed, reduce the engine power, lead to the valve sealing surface serious carbon deposit or burnt, and even bring about the valve strike the piston.

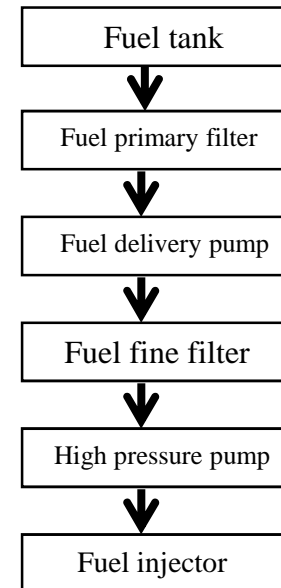
intake valve	exhaust valve
0.2mm	0.3mm

## Section 4. Fuel supply system

### 1. Overview

The main function of fuel supply system is to continuously feed the engine with filtrated clean fuel, and inject certain amount of diesel into combustion chamber as certain pressure and quality according to different engine performance requirements, which will mix and burn with the air rapidly .

Fuel supply system consists of fuel injection pump, governor, Fuel delivery pump, fuel filter, fuel injector, high pressure oil pipe, low pressure oil pipe and accessories.



## Section 4. Fuel supply system

### 2. Fuel filter



## Section 4. Fuel supply system

### 3. Fuel injection pump

#### Function

The main function of the fuel injection pump is to provide certain amount of high pressure fuel in regulation time to the injector, while at the same time accomplishing the engine rotary speed control.

1- Fuel pump drive gear

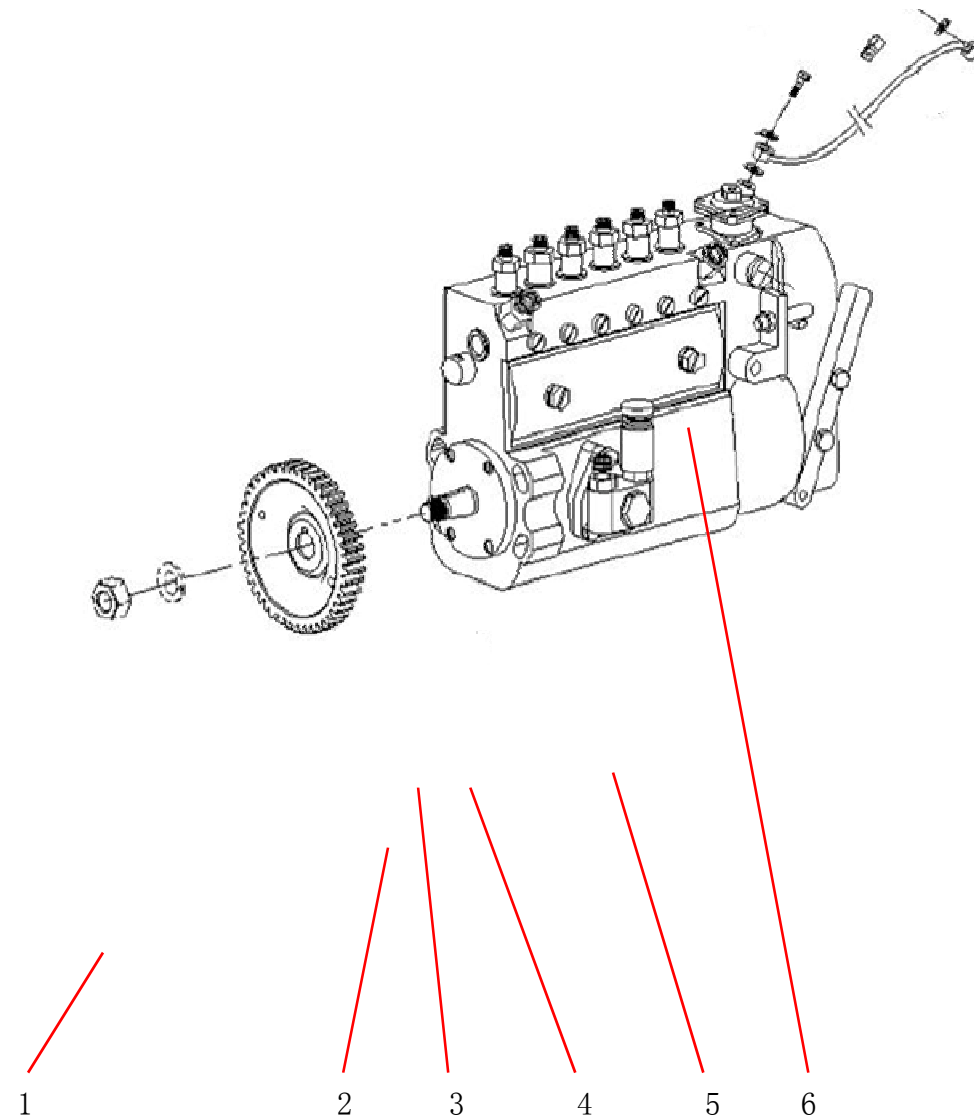
2- Fuel feed pump

3- Manual fuel pump

4- High pressure oil pump

5- Governor

6- The hollow pipe smoke limiter



## Section 4. Fuel supply system

### Operating theory

#### (1) The suction process

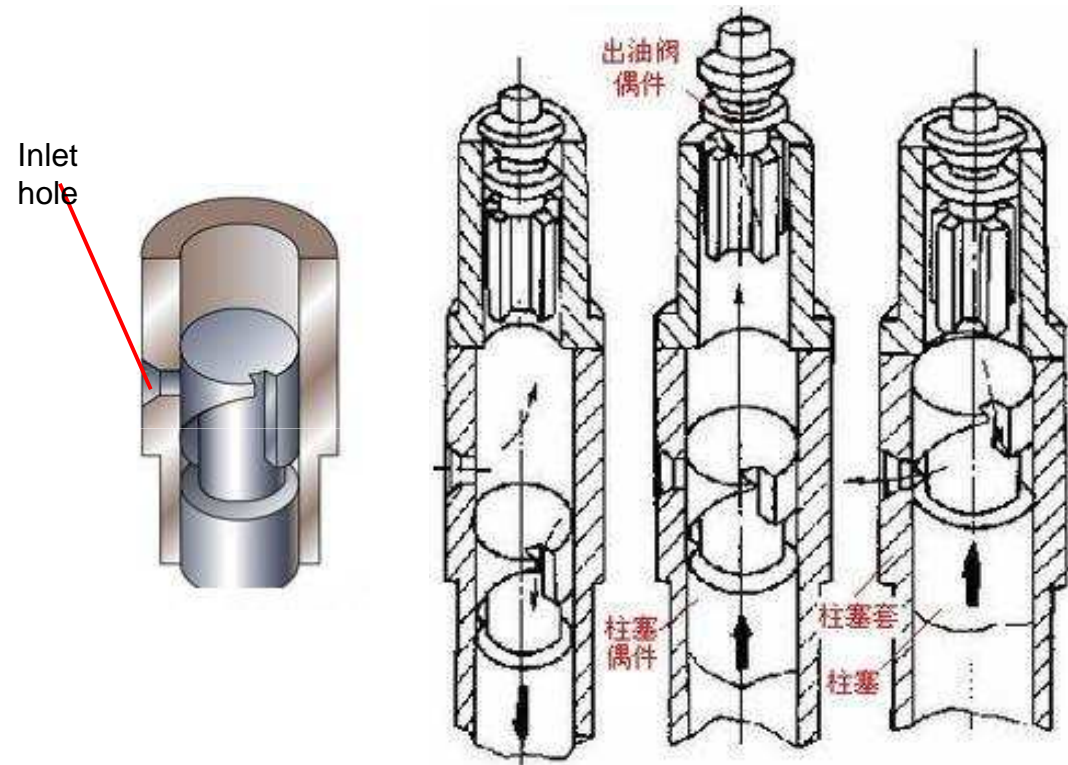
As the plunger moving downwards and top surface of the plunger is below the inlet hole, the fuel will come into the plunger chamber.

#### (2) By-pass process

As the plunger moving upwards and the top surface of the plunger is still below the inlet hole, fuel in the plunger chamber will return to the low-voltage circuit.

#### (3) Injection process

As the plunger moving upwards and the top surface of the plunger is above the inlet hole, the fuel is compressed, and when the fuel pressure is higher than fuel injector opening pressure, the fuel is injected into the cylinder, burn and supply power .

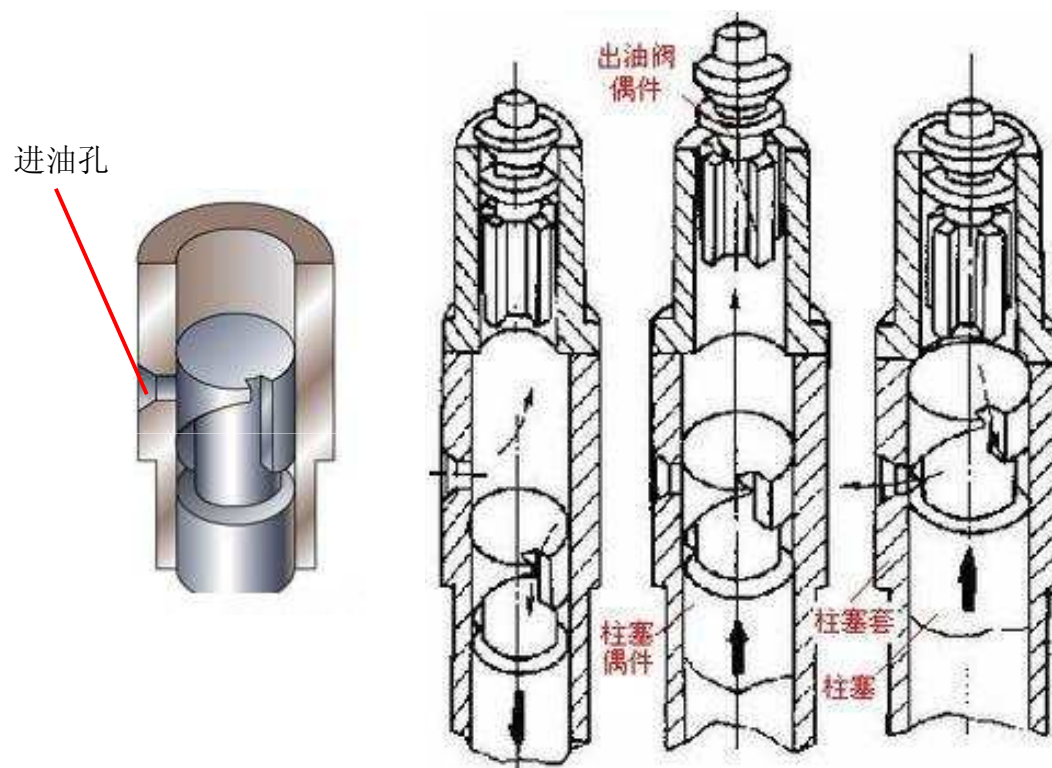


## Section 4. Fuel supply system

### (4) Unloading process

As the plunger continues to move upwards and the fuel inlet hole in plunger connects with the discharging hole, the plunger chamber is connected to the low-voltage circuit, the pressure of high-pressure fuel in plunger chamber drops, and the fuel injector closes, the fuel injection process is completed.

**The speed control theory:** By rotating the plunger, control the connection time of discharging hole and inlet hole while the plunger moving upwards, such to control time of the injection process, and realize engine speed control.



## Section 4. Fuel supply system

### 5. Fuel injection advance angle adjustment method

Slowly rotating the crankshaft along the engine working direction until it reaches the required flywheel engraved line. Rotating the fuel injection pump camshaft to make the cylinder of the pump, which near the gear, at the fuel supply starting point(When there is a little fluctuation on the right of the oil outlet ). Install the fuel pump gear and make sure it engaged with the intermediate gear, ensure the four screw hole on the fuel injection pump hub align with the middle of the long hole on the gear. Install the gear cover plate and fastening bolts of the injection pump gear.



## Section 4. Fuel supply system

### 4. Fuel injector





## Section 4. Fuel supply system

Remove the outlet valve on the fuel pump at the gear end, install overflow pipe.

Push the handle of the fuel pump until no fuel bubble in the overflow pipe.

Use the socket wrench to rotate the fuel pump shaft end hexagon nuts in a clockwise direction.

In order to increase advance angle of fuel supply (counter-clockwise is to reduce advance angle fuel supply), please press the fuel supply pump until the fuel falls from the overflow pipe drop by drop(a drop every 4-5 seconds), after the adjustment finished, tighten the fastening bolts of the four gears.

Counter-rotating the crankshaft and then change the direction until the oil falls from the overflow pipe drop by drop(a drop every 4-5 seconds), the fuel supply advance angle can be ensured by observing the engraved line on the flywheel through the inspection window on the flywheel shell. The angle should be within the specified range, or the advance angle of the fuel supply should be adjusted.



## Section 5. Lubrication system

### 1. Overview

The function of lubrication system is to continuously supply certain amount of clean lubricating oil to the surface of the parts which are doing relative movements, such as to get liquid friction, reduce friction force, reduce mechanical grinding, and clean and cool the part surface. Summarized as follows:

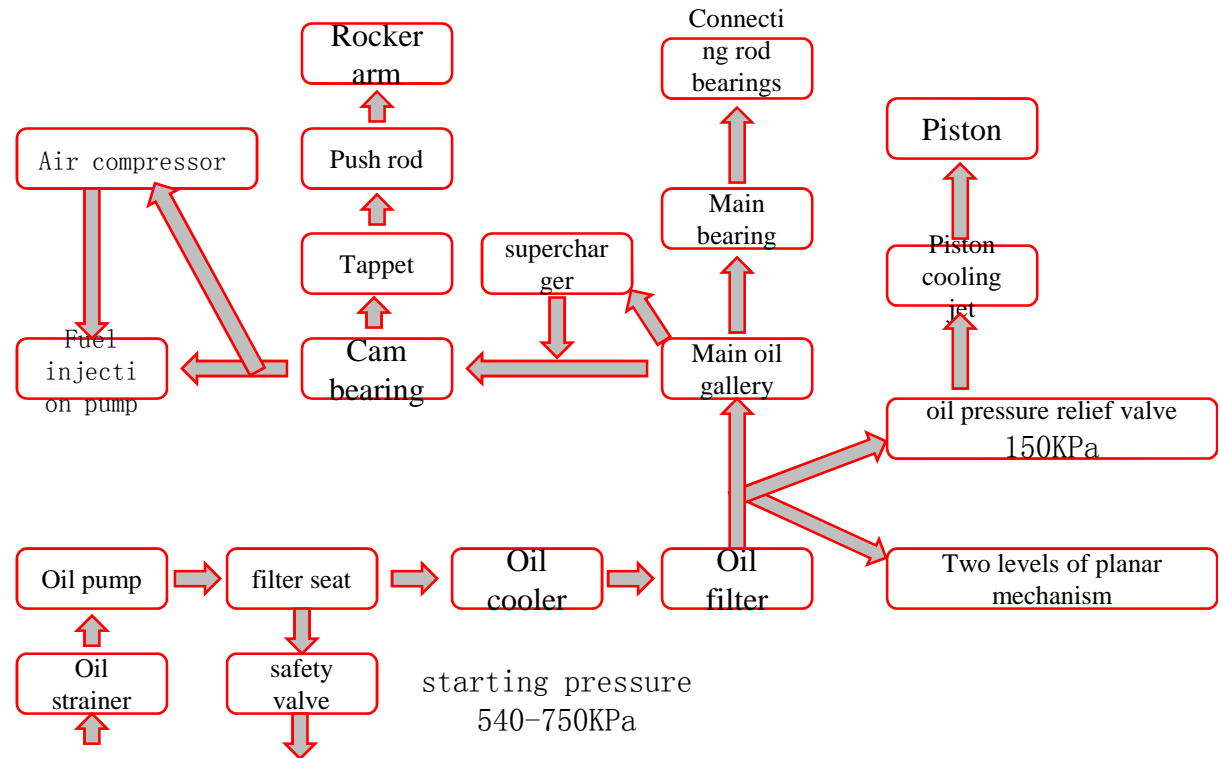
**Lubrication function:** lubricate parts surface, reduce wear, reduce the consumption of engine power.

**Cleaning function:** clean the friction surface, remove abrasive dust and some other foreign matter.

**Cooling function:** oil can take away the heat generated by the friction when circulates in the lubrication system.

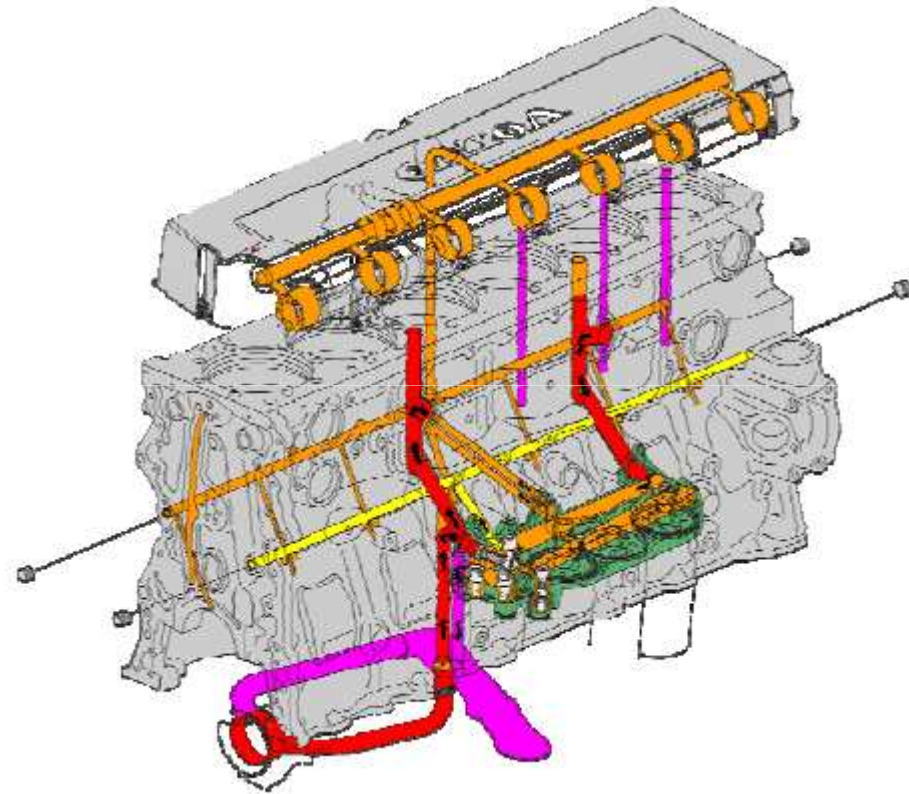
**Sealing function:** Form an oil film between parts to improve their sealing, prevent leakage of gas and oil.

**Anti-corrosion function:** form an oil film on the surface of the part to prevent rust corrosion.



## Section 5. Lubrication system

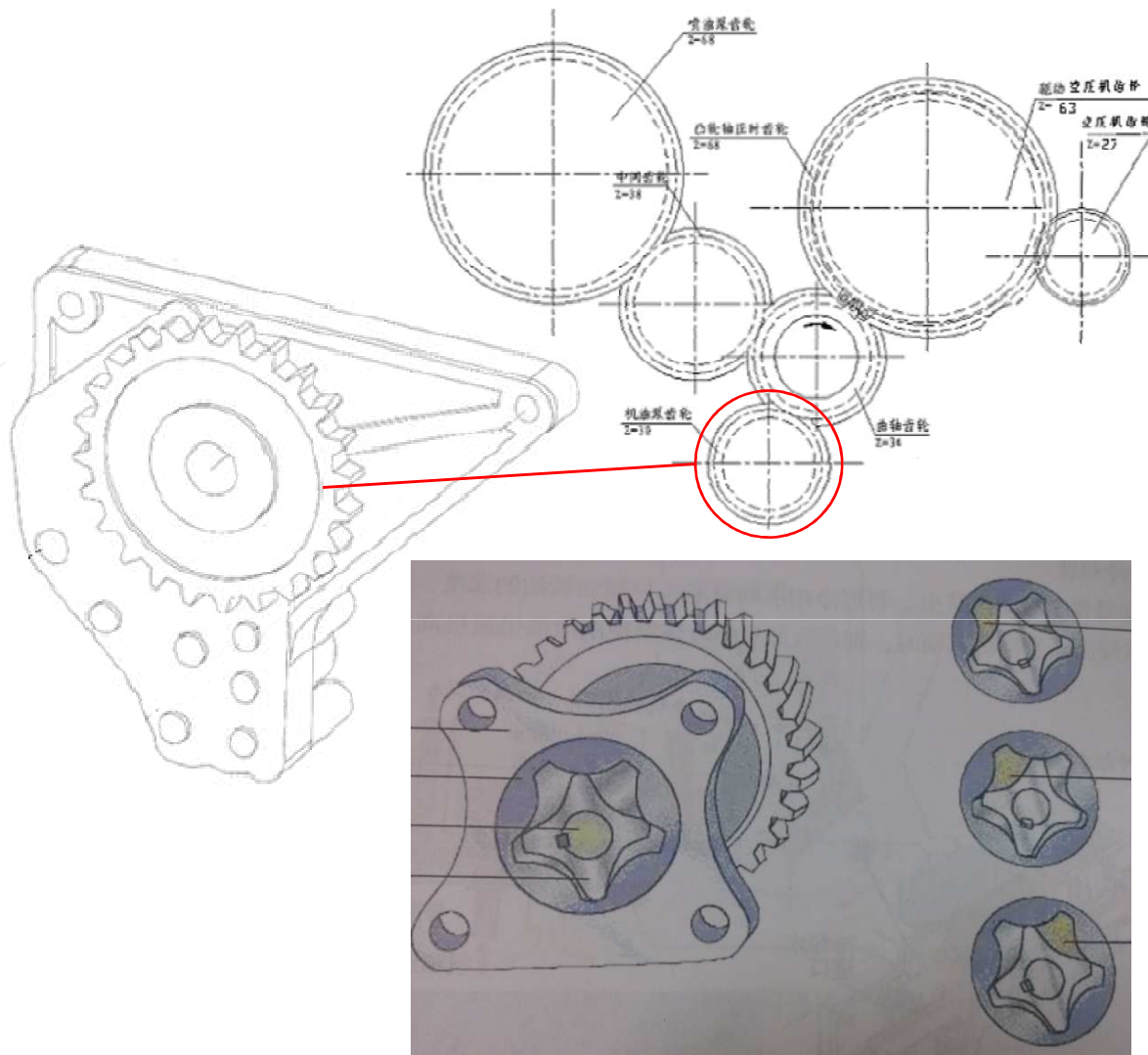
The lubrication system mainly consists of oil pump, oil filter, various valves, oil radiator, etc.



## Section 5. Lubrication system

### 2. Oil pump

Rotor pump consists of casing, inner rotor, outer rotor and a pump cover, etc.



## Section 5. Lubrication system

### 3. Oil filter and oil cooler

#### Oil filter

The upper cover of the filter has a bypass valve, when it was blocked, the by pass valve would be opened by the oil pressure, and the lubricating oil would directly flow into the main oil pipe without going throught the filter to ensure the oil supply could not be interrupted.

#### Oil cooler

The oil cooler is placed in the coolant pipe, use the coolant temperature to control the temperature of lubricatng oil. When the lubricating oil temperature is high, it depends on the coolant to lower the temperature. When the engine starts, heat absorbed from the coolant can quickly increase the temperature of the lubricating oil.

1- Oil cooler pipe

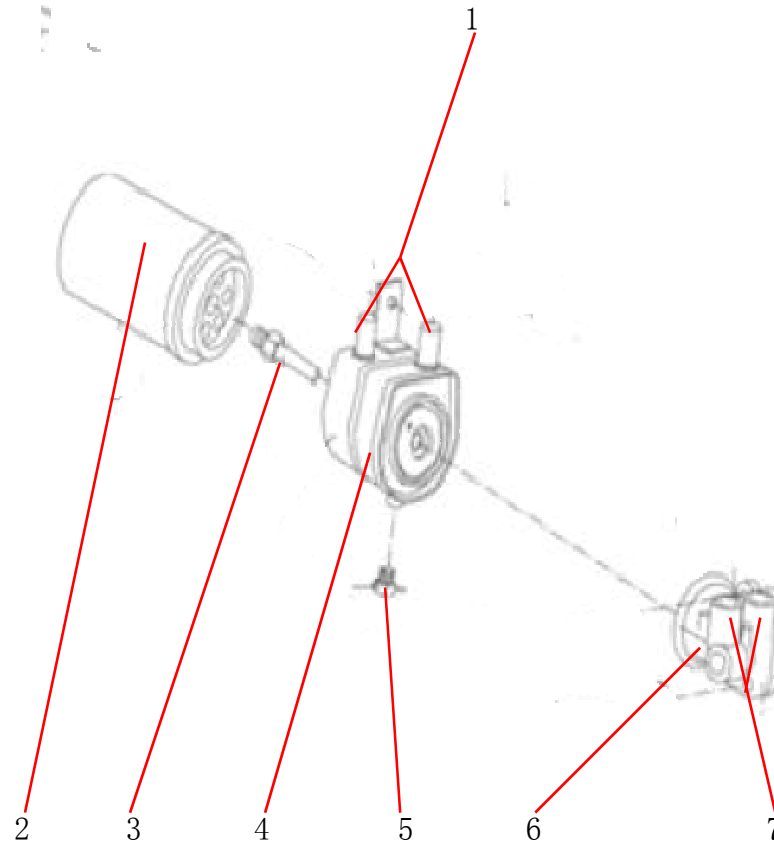
2- Oil filter

3- connecting screw rod

4- Oil cooler 5- Drain plug

6- Oil cooler seat

7- Oil filter oil port

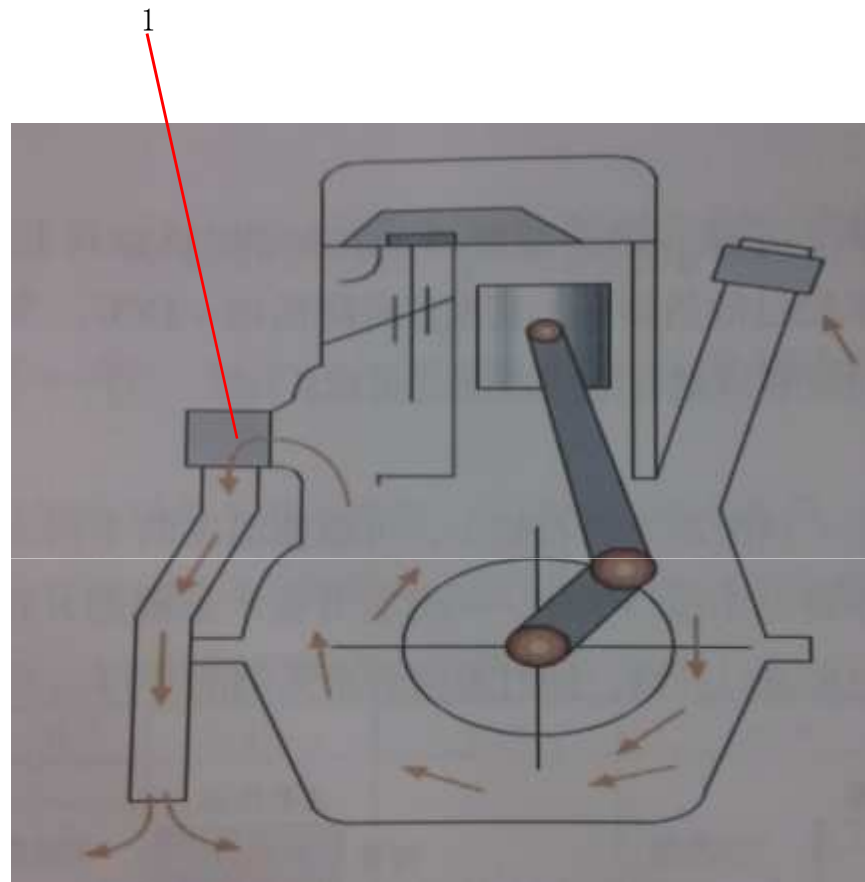


## Section 5. Lubrication system

### 4. Crankcase ventilation

When the engine works, part of the combustible gas mixture and the exhaust gas leak into the crankcase through the piston rings. After being congealed in the crankcase, the leaked fuel will dilute the lubricating oil. At the same time, the high temperature of the exhaust gas, the acidic substances in the exhaust gas and the water vapor will erode the parts, and spoil the lubricating oil. In addition, since the gas mixture and exhaust air into the crankcase, the crankcase pressure will be increased, the temperature will be raised, and it will be easy for the oil to leak to the outside through the oil seal, gasket, etc.

1- Water separator



## Section 6. Cooling system

### 1. Overview

#### Function

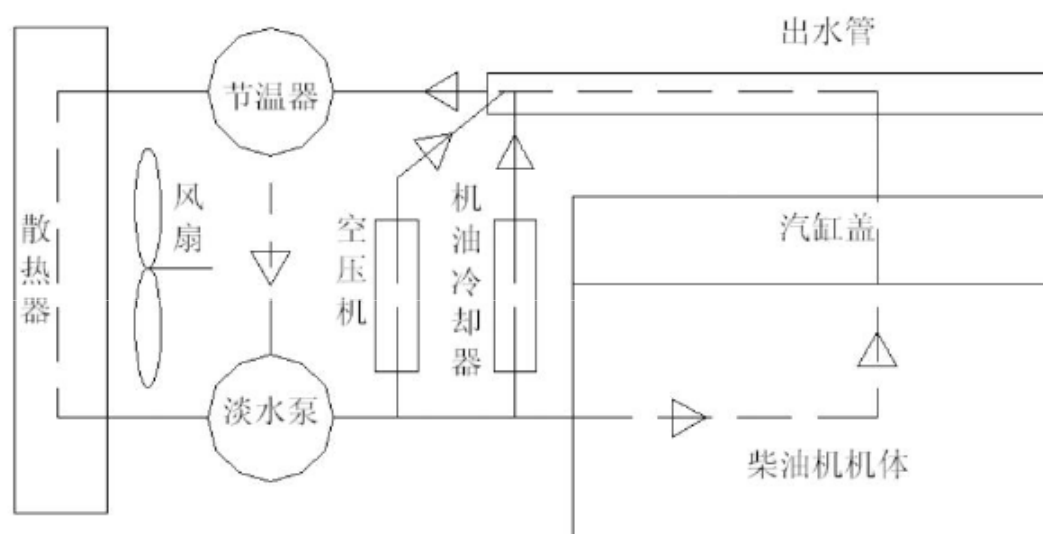
The function of the cooling system is to timely release the heat absorbed by the heated parts to the outside to ensure that the engine works in the most suitable temperature conditions.

#### Classification

The cooling system, according to the different cooling methods, can be divided into air-cooled and water-cooled.

#### Composition

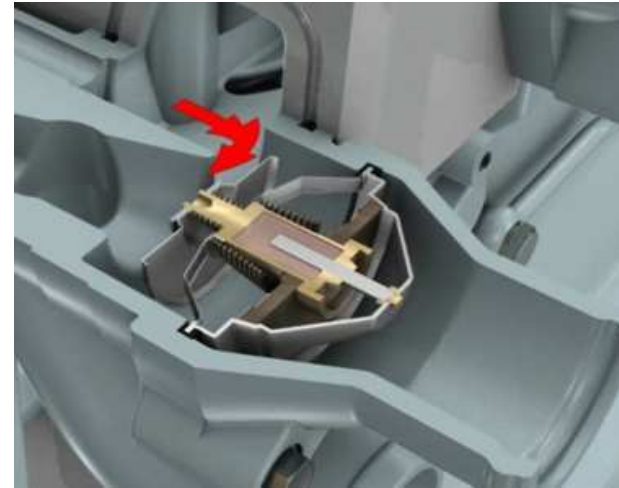
The cooling system consists of radiator, water pump, fan, cooling bushing, Cooling system consists of radiator, water pump, fan, cooling water jacket and thermostat, etc.



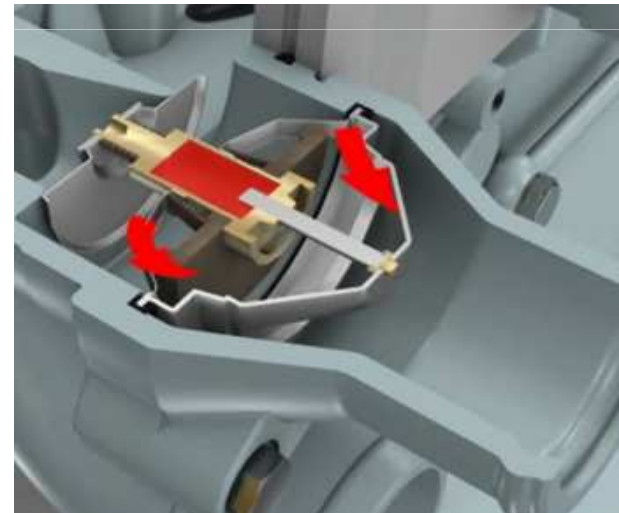
## Section 6. Cooling system

### 2. Thermostat

When the coolant temperature is below the set value, the refined paraffin in thermostats temperature sensor is solid, the thermostat valve will close connection between the engine and radiator with the spring function, coolant will enter the engine through water pump, and the engine is in small recirculation (State 1); when the coolant temperature reaches the set value, the paraffin starts to melt and gradually becomes to liquid, the volume grows and oppres the push rods, the anti-force of push rods to the valve will open the valve, and then the coolant enters the radiator for the big loop (State 2).



状态1



状态2

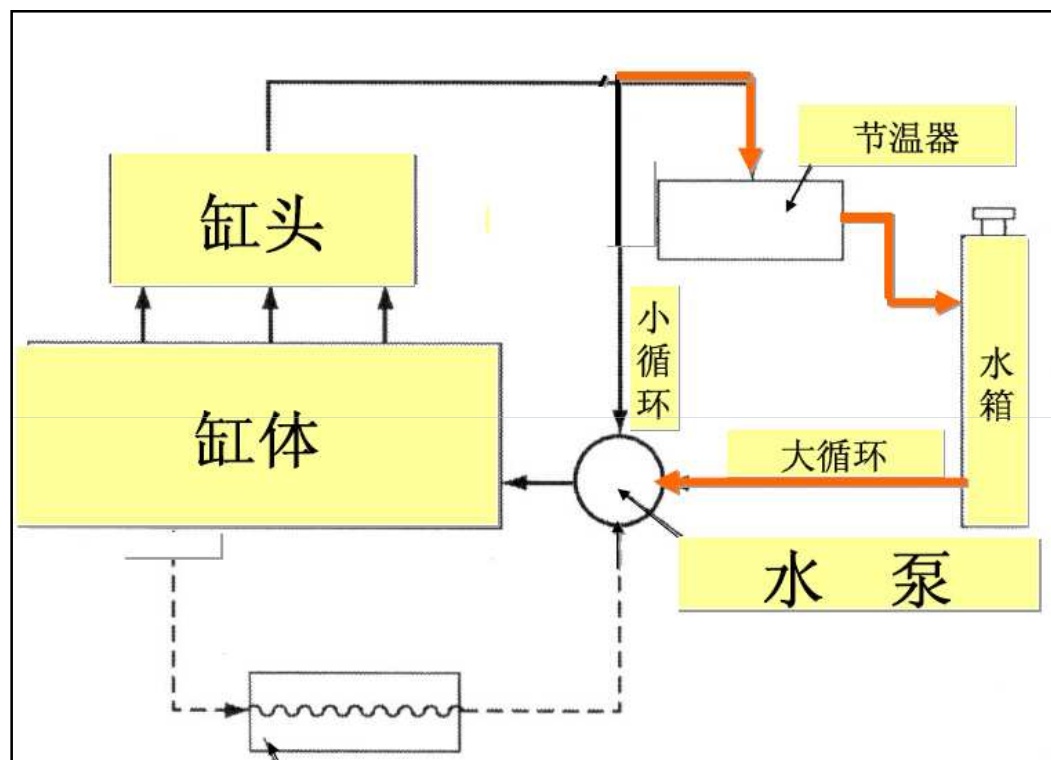


## Section 6. Cooling system

### 3. Coolant recirculation

The coolant circulation can be divided into small circulation and big circulation which are two kinds of circulatory states of the coolant circulation.

When the temperature is below 75 °C, the cooling capacity is weak, which will cause the water temperature rose rapidly, so as to ensure the engine components heat up quickly or avoid engine to be too cold. Because the circulation line is short and the coolant flow is small, so called the samll circulation.. Path: thermostat - water pump - oil cooler - water jacket - thermostat.



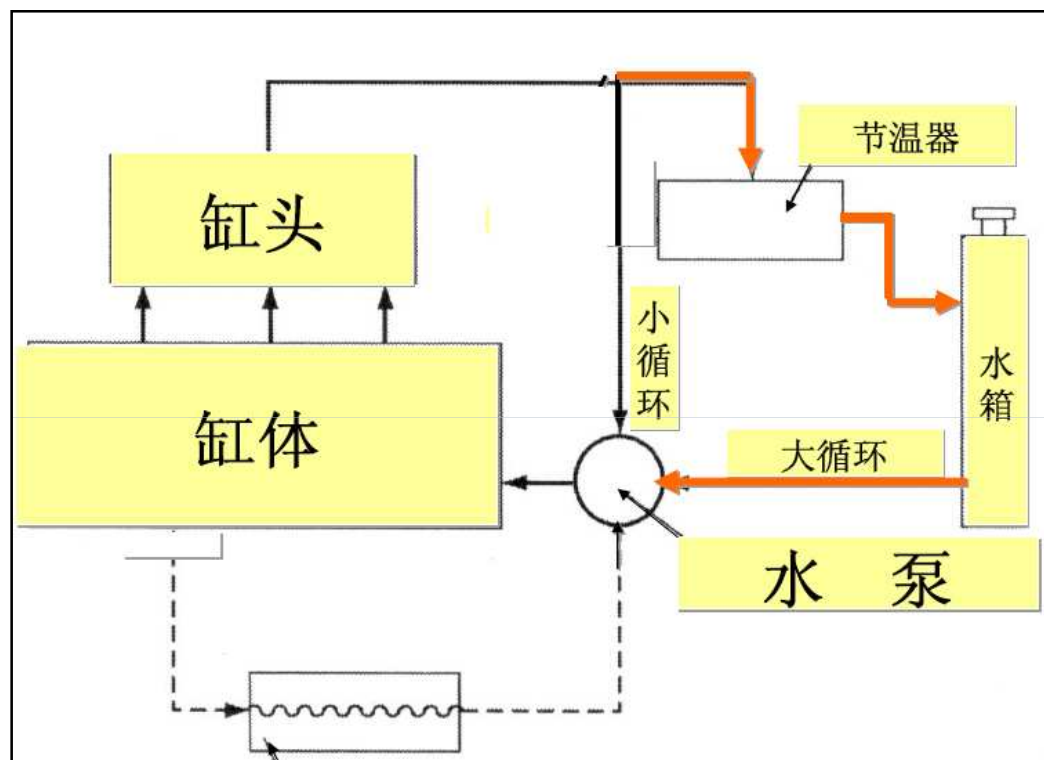
## Section 6. Cooling system

### 3. Coolant recirculation

When the temperature is higher than 95 °C, the cooling capacity is strong, which will cause the water temperature drop, so as to ensure the temperature is not too high, in this case the circulation line is long and the coolant flow is large, so called the big circulation. Path:

Thermostat - Water Pump - Oil cooler - water jacket - Radiator - Thermostat.

When the temperature between 75-95 °C, it is mixed circulation, which means the big and small circulation work at the same time.



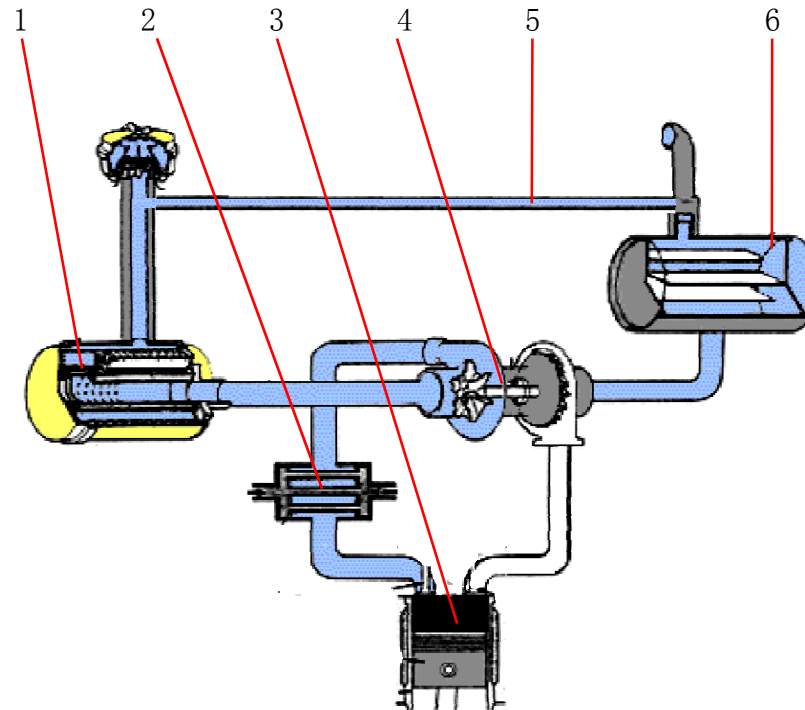
## Section 7. The air intake and exhaust system

### 1. Overview

#### Function

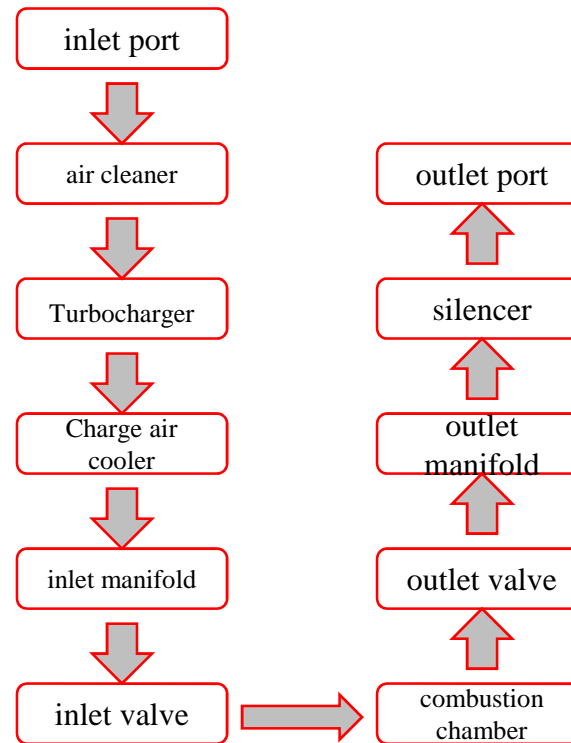
The function of the intake and exhaust system is to suck the air into the cylinder, mix and burn the air with fuel, then discharge the exhaust air into the air.

- 1- Air cleaner
- 2- Charge air cooler
- 3- Piston
- 4- Turbocharger
- 5- Gas path connecting hose
- 6- Silencer



## Section 7. The air intake and exhaust system

Gas path



## Section 7. The air intake and exhaust system

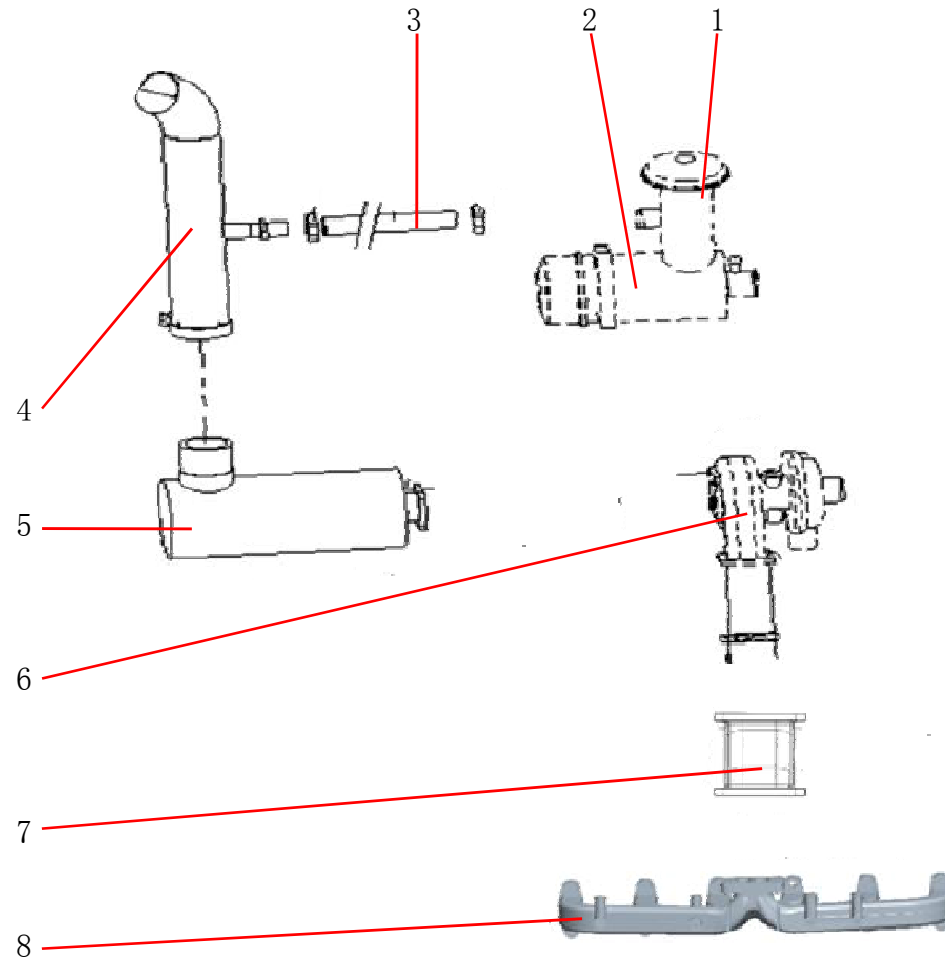
**Air cleaner:** Its function is to filter the air, there are two filters in the housing: primary filter and fine filter.

**Gas connection hose:** use the negative pressure of both ends to remove the dust from the fresh air, absorb into the exhaust pipe, and discharge to the outside.

**Silencer:** Reduce the noise.

**Turbocharger:** Use the exhaust gas flow to drive the turbine rotate, so as to increase the air inlet air pressure and volume.

**Charge air cooler:** Reduce the temperature of the fresh air, and increase the air inlet volume by decreasing the air pressure.



## Section 8. Common malfunction

### 1. Engine does not start

Serial number	Cause of malfunction	Repairing method
1	Starter motor speed is too low	Check the starting system, cranking speed shall not be less than 110 r/min.
2	Air in fuel supply system	1. Check fuel pipe connector for loose. Release bleed screw on the fuel filter, and use hand pump to pump fuel, until the overflow of fuel without air bubbles. 2. Release high pressure fuel pipe connection on injector, and use hand pump to pump fuel, until the overflow of fuel without air bubbles.
3	Fuel line blocked	Check fuel supply lines for unobstructed.
4	Fuel filter blocked	Replace the spin-on filter element of fuel filter assembly.
5	The delivery pump can not feed fuel or feed intermittently	Check the fuel inlet lines for leaks and fuel delivery pump for malfunction.
6	Fuel injection less, no injection or injection pressure low	1. Check the injector spray condition; 2. whether the injection pump plunger and the outlet valve is worn or stuck, whether the plunger spring and outlet valve spring is broken.
7	Starting system circuit wiring error or poor contact	Check the wiring is correct and reliable.
8	The battery power insufficient	Charge the battery.
9	Starter motor carbon brushes and commutator contact poor	Repair or replace the electric brush; clean the commutator surface by abrasive paper and blow it clean.
10	Low compression pressure low due to piston ring excessive wear or valve leaks	Check valve clearance, valve spring, valve guides and sealing of valve seat, it is necessary to grinding valve seats if the sealing is poor.
11	Fuel shut-off solenoid connector may be loose or dirty, corroded	Tighten, clean or replace.
12	Fuel injection timing is not assembled correctly	Check and adjust.

## Section 8. Common malfunction

### 2. Engine lack of power

Serial number	Cause of malfunction	Repairing method
1	Air intake blocked	Check the air filter and air intake, clean or replace the air filter element.
2	Exhaust back pressure is too high	Check valve timing, adjust if necessary; clean exhaust pipes.
3	Fuel lines leaking or blocked	Check sealing conditions of fuel lines and fittings, check fuel filter for blocked, replace spin-on filter element, check injection pump sealing.
4	Fuel injection pump plunger excessive wear	Check and replace the plunger and barrel assembly.
5	Fuel injector poor atomization	Check fuel injection pressure, clean up the carbon deposit, adjust and repair.
6	Fuel injection advance angle is smaller or larger than normal	Check and adjust.
7	The air phase is error	Check and adjust valve timing and valve clearance.
8	Cylinder head gasket air leaks	Tighten the cylinder head bolts in sequence in accordance with specified torque or replace cylinder head gasket.
9	Valve sealing poor	Grind or replace to regrind.
10	Piston rings is worn excessively	Replace piston rings.

## Section 8. Common malfunction

### 3. Exhaust black smoke

Serial number	Cause of malfunction	Repairing method
1	Air intake blocked	Check the air filter and air intake pipes and clean-up.
2	Poor fuel quality	Use fuel up to specification
3	Fuel injector poor atomization	Check, repair, or replace.
4	<i>Valve clearance is excessive</i>	<i>Adjust valve clearance in accordance with the standard</i>



## Section 8. Common malfunction

### 4. Exhaust white smoke, blue smoke

Serial number	Cause of malfunction	Repairing method
1	Poor fuel quality, with excessive water in fuel	Replace fuel up to specification.
2	Compression pressure is low, incomplete combustion	Check piston ring and cylinder head gasket and replace it.
3	Air supply or fuel feed timing is not correct	The specialized staff to check and adjust.
4	Compression pressure is low, incomplete combustion	Check piston ring and cylinder head gasket and replace it.

## Section 8. Common malfunction

### 5. Oil pressure is too low

Serial number	Cause of malfunction	Repairing method
1	Oil thin, or use improper oil	Select appropriate oil according to specification
2	The oil pump rotor is worn or assembly clearance is too large	Replace the pump
3	Oil filter pressure regulator valve failure	Repair
4	The pump inlet pipe cracks	Repair, replace
5	The pump inlet pipe mounting bolts loose	tighten to specified torque
6	Shaft bearing clearance is too large	Check and replace

## Section 8. Common malfunction

**6. Oil pressure is too high**

Serial number	Cause of malfunction	Repairing method
1	Temperature is too low, the oil viscosity is large	Choose specified type of oil, it is required to run at slow speed after start, check wheel the oil temperature is normal
2	Pressure relief valve blocked	Check, clean

## Section 8. Common malfunction

### 7. Excessive oil consumption

Serial number	Cause of malfunction	Repairing method
1	External oil line leaks	Check and repair
2	Diesel engine is overload	Reduce the load
3	The type of oil is improperly	Use as required
4	The piston is stuck or excessively worn	Check, repair, and replace if necessary
5	Cylinder bore is worn excessively	Cylinder boring for increased piston or installing the repair-using cylinder liner
6	Valve guide is worn, valve stem sealing failure	Check and replace

## Section 8. Common malfunction

### 8. High coolant temperature

Serial number	Cause of malfunction	Repairing method
1	Insufficient cooling water, the water flow is too small	Check whether the cooling water is sufficient and add if necessary
2	Whether the belt is too loose	Adjust
3	Water pump leakage	Repair in time
4	Thermostat is failure or damaged	Check and replace
5	Water temperature sensor is damaged, the water temperature sensor failure	Check whether the actual temperature is identical to the gauge indicating value; if not, replace the temperature sensor or the temperature gauge
6	The cylinder head gasket is blow-out	Check and replace

# Chapter 4 Torque converter & gearbox

## Section 1 Torque converter overview

## Section 2 Torque converter

- Torque converter formation
- Torque converter operating theory
- YJSW315 torque converter parameters and advantages
- Hydraulic converter assembling positioning

## Section 3 Gearbox

- Gearbox overview
- Gearbox function
- Gearbox operating theory
- Gearbox formation
- Drive line

## Section 4 Oil passage system

- Oil passage system formation
- Variable speed oil-way
- Torque converter oil-way

## Section 5 Adjustment and measurement of assembly space

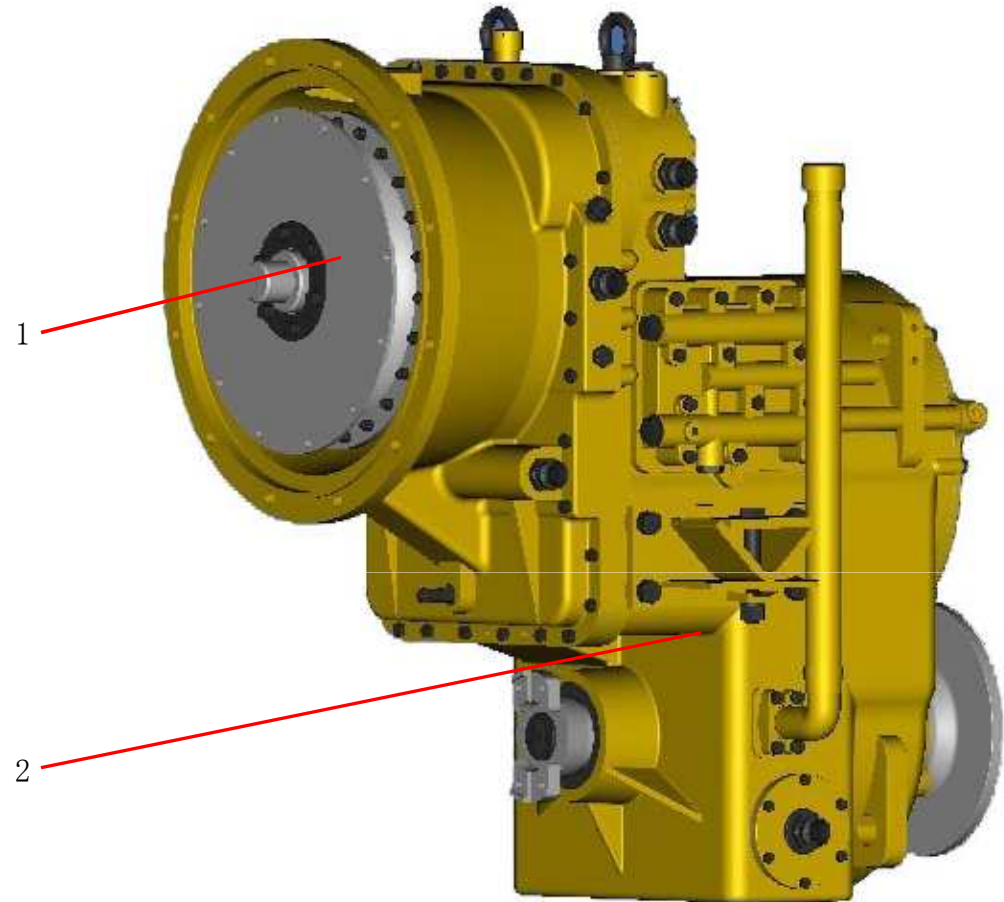
## Section 6 Common faults and troubleshooting

## Section 1 Overview

- LG936L is equipped with YJSW315-2A torque converter and A303 SDLG gearbox.
- YJSW315-2A-type hydraulic torque converter is the single-stage two-phase centripetal hydraulic torque converter with two turbines and four elements.
- A303 SDLG gearbox is planetary gearbox with 2 forward gears and 1 reverse gear.

1-Torque converter assembly  
2-Gearbox assembly

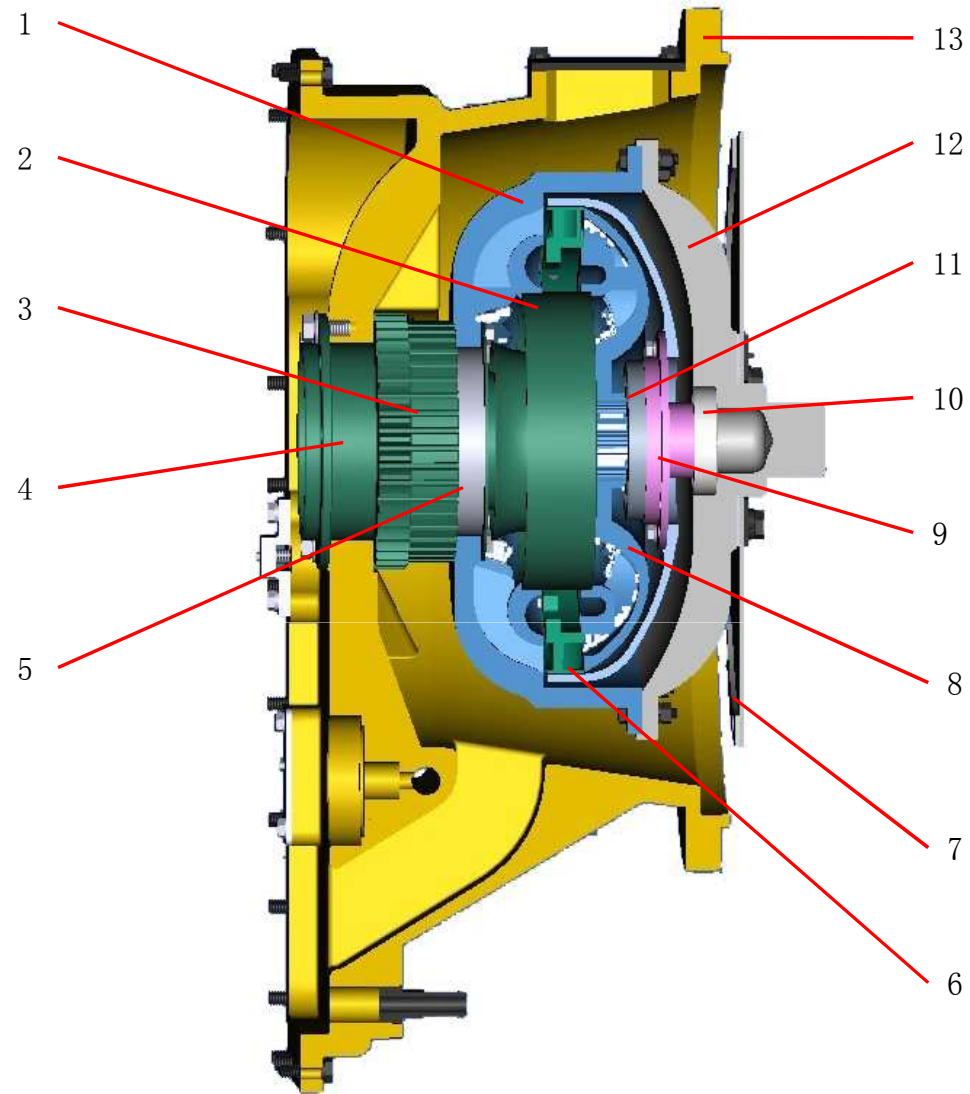
- Explanation :  
Single stage: The torque converter with no or only one rigidly connected turbine in circulation circle is called single-stage hydraulic torque converter.  
Two phases: The function variation number of elements in the torque converter is called phase, e.g. two phases stand for two functions.



## Section 2 Torque converter

### 1. Torque converter formation

• The torque converter is mainly made up of first stage turbine 6, second turbine 8, guide wheel 2 and pump impeller 1, and the sealed annular working chamber formed by these components is the circulation passage of the working fluid. The shape of the working chamber within the cross section cut by revolving axis is called a circulation circle. The largest diameter of the portion passed by the working fluid in the circulation circle is called the effective diameter of the circulation circle. The number combination 315 among YJSW315-2A stands for the effective diameter of circulation circle. 1-pump impeller, 2-guide wheel, 3-transfer gear, 4-guide wheel seat, 5.10.11-bearing, 6-first-stage turbine, 7-spring plate, 8-second-stage turbine, 9-first-stage turbine hub, 12-cap wheel, 13-shell of torque converter.





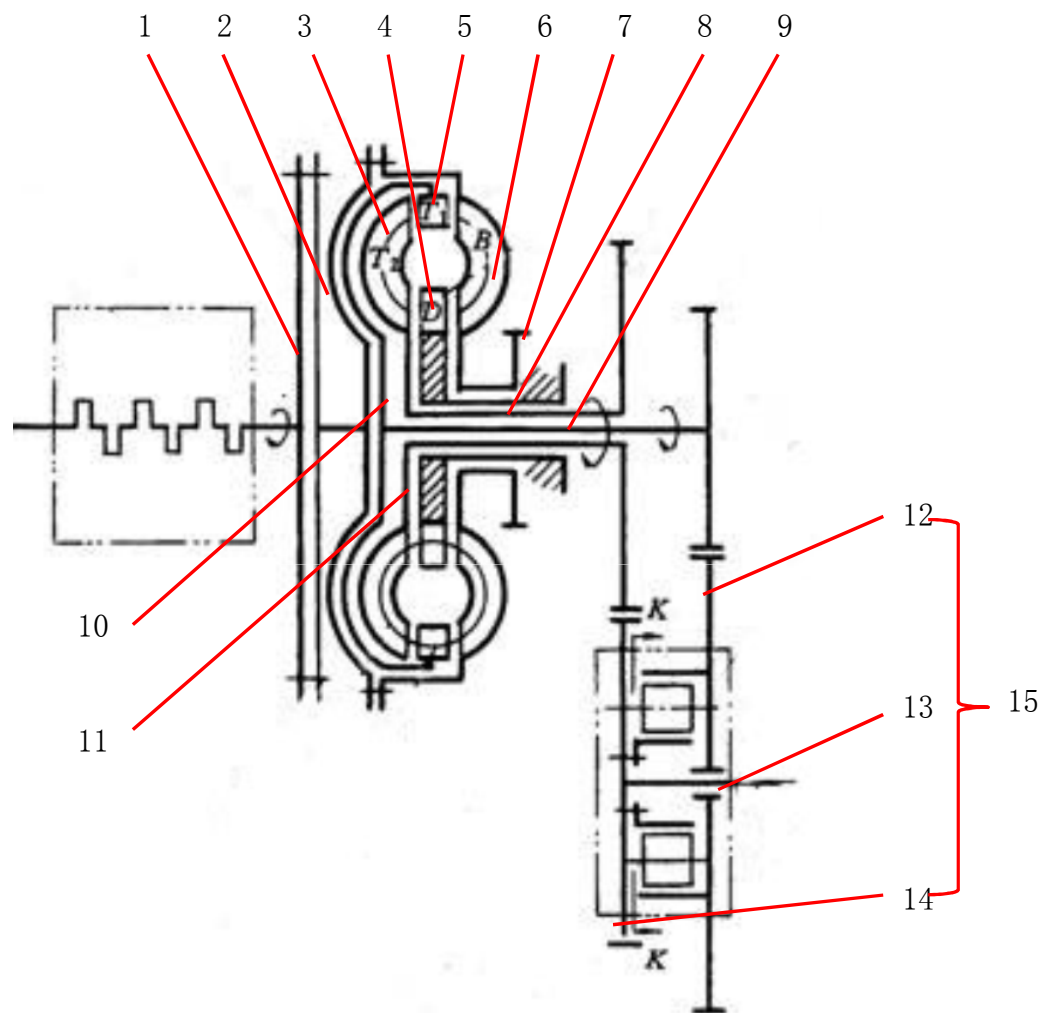
## Section 2 Torque converter

### 1. Torque converter formation

- The input section of torque converter is composed of spring plate 1, cap wheel 2 and pump impeller.
- The output of the torque converter is relatively more complicated, it is different in following two conditions.

(1) When the loader works in the low-speed and heavy load conditions, the output section is composed of first-stage turbine 5, first-stage turbine hub 10, output shaft of first-stage turbine 9, second-stage turbine 3, second-stage turbine hub 11, output shaft of second-stage hub 8. At this time, inner ring cam and outer ring gear of overrun clutch are connected tightly.

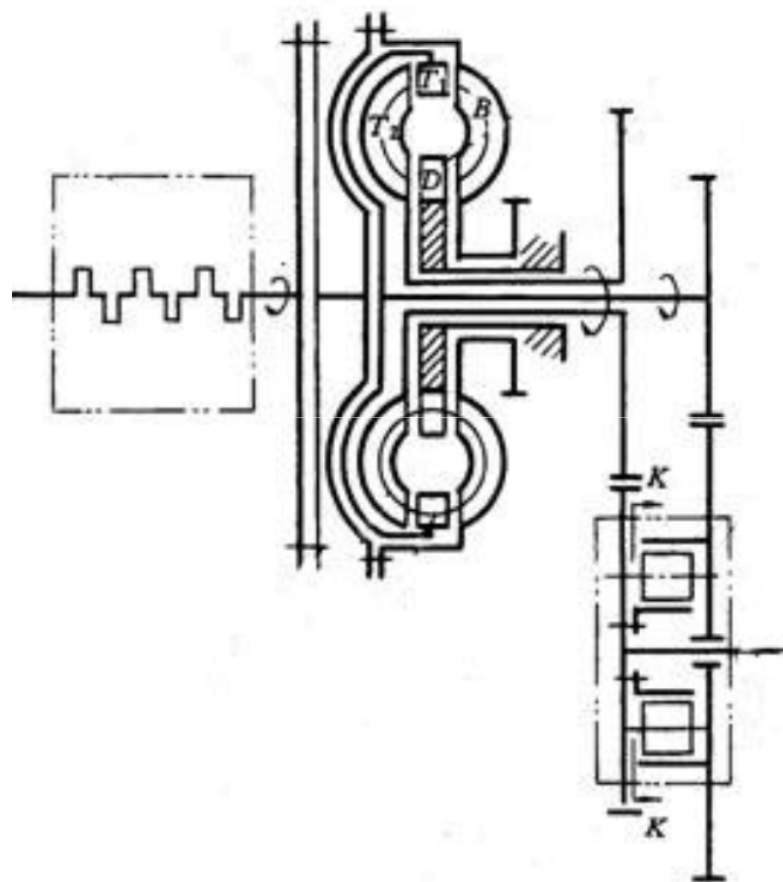
(2) when the loader works in the high-speed and light load, the output section is composed of second-stage turbine 3, second-stage turbine hub 11, output shaft of second-stage turbine 8. At this time, first-stage turbine is idling, and only second-stage turbine outputs power.



## Section 2 Torque converter

### 2. Operating theory of torque converter

• When the engine drives the pump impeller to rotate, the working fluid in the pump impeller is driven to rotate by the blades of the pump impeller during rotation. Under the action of centrifugal force, the working fluid executes relative motion from the inner edge of blades to the outer edge along the passage among the blades, making it accelerated, so as to convert the generated mechanical energy into fluid energy of working fluid. As a result of the liquid impact on the blade, the turbine is driven to rotate, so part of the fluid energy transforms to mechanical energy of the turbine to output, at this time, the working fluid executes from outer edge of blades of the turbine to inner edge, and hits the blades of guide wheel and flows among the blades of the guide wheel, and then takes part in the next circulation or flows back to tank.



## Section 2 Torque converter

### 3.YJSW315 torque converter parameter and advantages

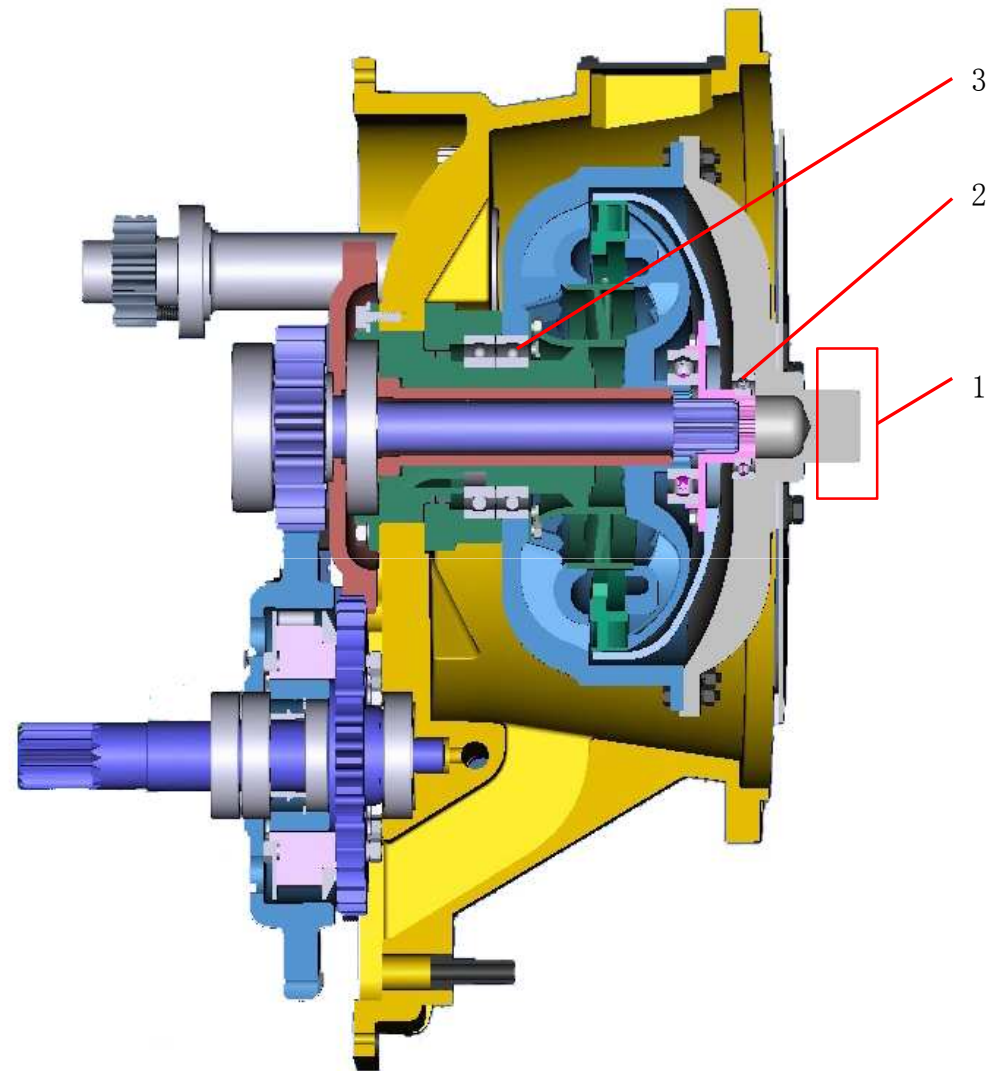
- As a result of function of automatic torque converting of the torque converter, the machine has a good adaptive performance on external sudden load avoiding the engine shutting down due to sudden increase of external load and meeting willingly the need of the machine in traction condition .
- As working medium is liquid, it can absorb and reduce vibration and shock, and improve service life of the loader. According to statistic, the service life of engine can improved by 47%, the gearbox by 400%.
- Improve mobility of loader.
- Simplify operation and improve operation comfortableness.

Item	value	unit
Circulation circle diameter	315	mm
Nominal torque when no power output (MBg0)	57.5	N.m
Nominal torque at high effective situation (MBgη)	58.8	N.m
torque ratio when no power output (K0)	4.56	
Max. effectiveness (ηmax)	86%	
Rated input rotary speed	2200	rpm
weight	179	千克
Overview inch	470x530x530	毫米

## Section 2 Torque converter

### 4. Assembling and positioning of torque converter

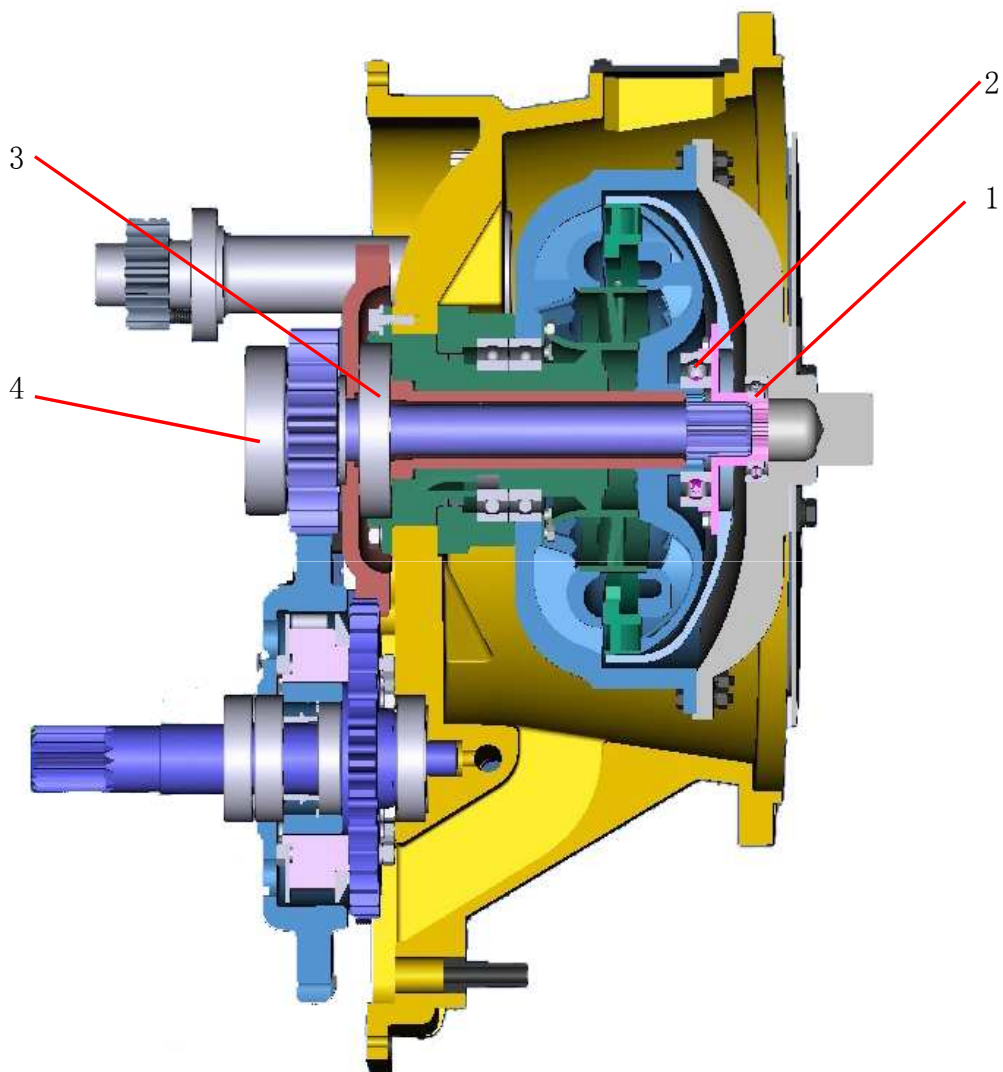
- The output of motive power of torque converter has 3 supporting points. The first one is a fixed spot, the end of the cap wheel inserts the center hole of the flywheel, so the engine supports the torque converter, meanwhile concentricity between torque converter and crankshaft gets ensured, prevent radial movement of working wheel of torque converter, and bear certain radial load.
- The second spot is that cap wheel is supported on the guide wheel via two rows of bearing.
- The third spot is that there is a bearing between cap wheel and the hub of the first-stage turbine to support them. Maybe it is spare for the pump impeller system, but it's necessary for the first-stage and second-stage turbine,



## Section 2 Torque converter

### 4、Assembling and positioning of torque converter

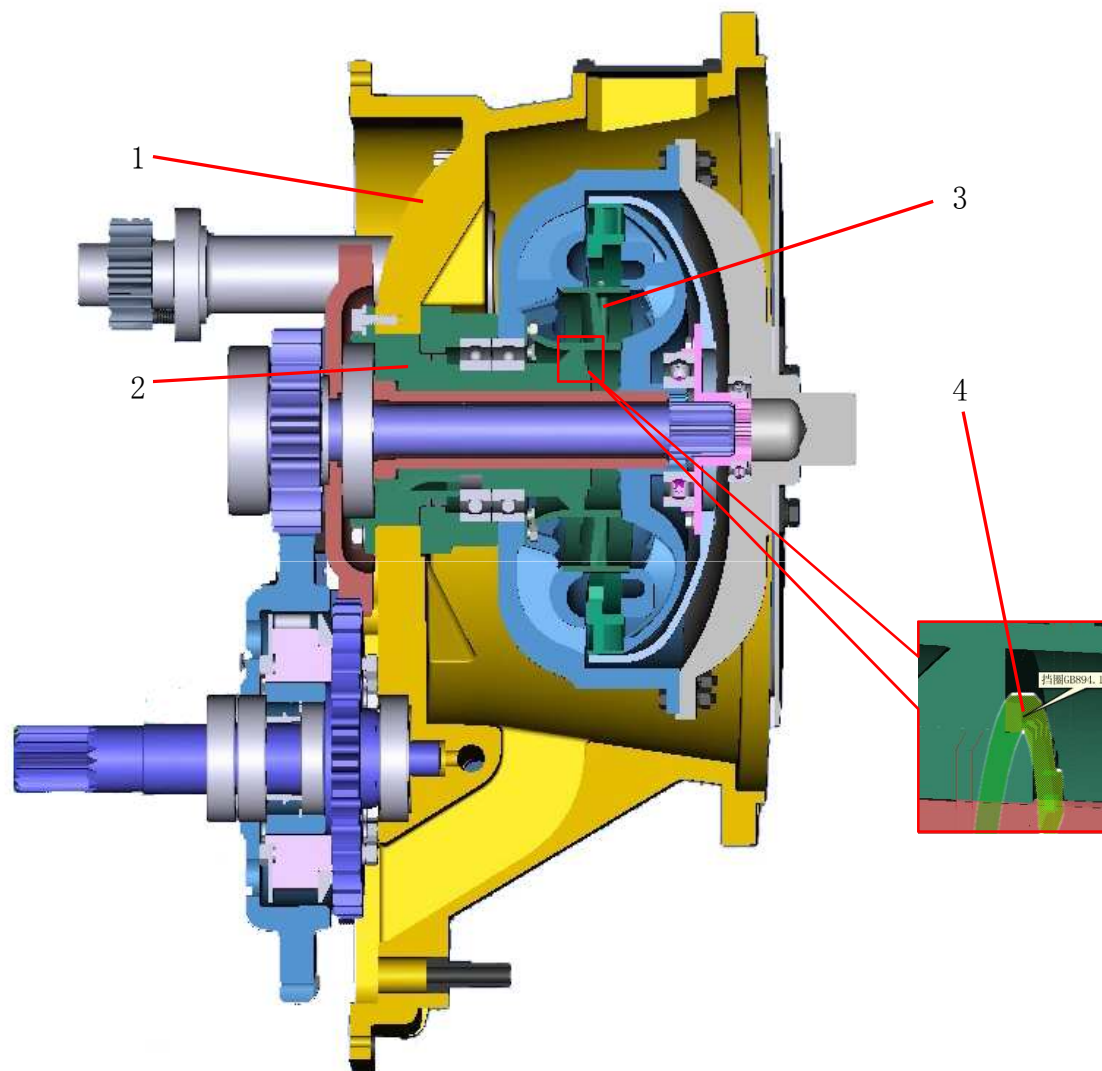
- The output shaft of the first-stage turbine is supported by two ball-bearings, the right one is fixed in the bearing seat bore of the cap wheel and another fixed in the bearing seat bore of the shell of torque converter. The output shaft of the second-stage turbine is supported by two ball-bearing too, the right one is pressed into the hub of the second-stage turbine and supported on the hub of the first-stage turbine, and another fixed in the bearing seat bore of the guide wheel seat.



## Section 2 Torque converter

### 4、Assembling and positioning of torque converter

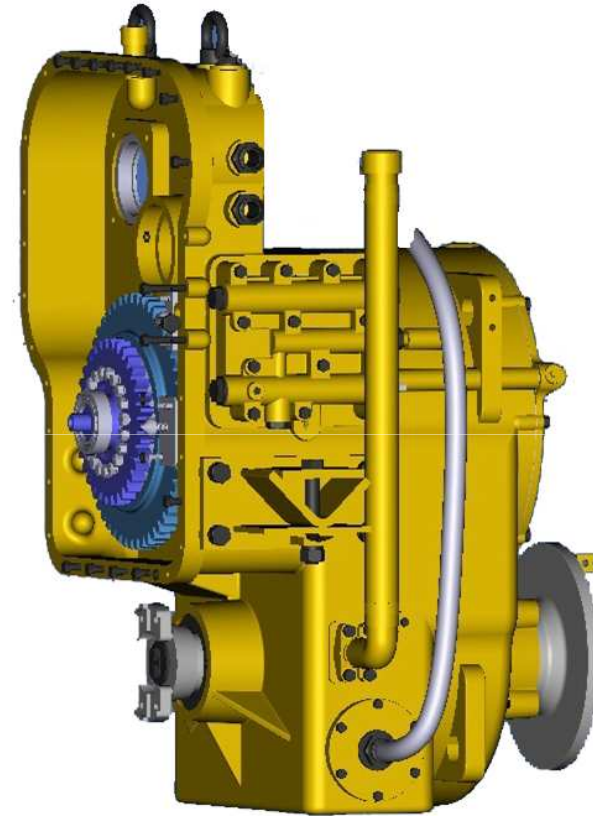
- Fixing and supporting of guide wheel seat:
- Guide wheel is a fixed wheel in torque converter. The attachment between guide wheel and shell of torque converter is: guide wheel 3 → guide wheel seat 2 → shell of torque converter 1.
- Guide wheel and guide wheel join through spines. And in order to prevent axial travel of turbine, a retaining ring (4) is applied on the right of the guide wheel. Guide wheel seat is fixed in the shell of torque converter using bolts.



## Section 3 Gearbox

### —.Overview

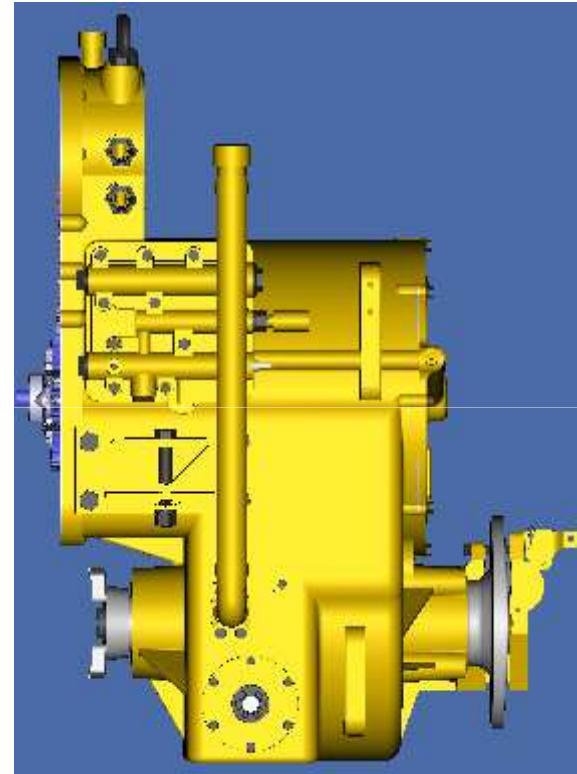
- LG936L adopts Lingong A303 planetary and power shifting gearbox. It has 2 forward gears and 1 reverse gear. Its characters are: easy gear shift, stable combination, simple and compact structure , high transmission efficiency, reliable work, long service life and so on.



## Section 3 Gearbox

### 2.Function of gearbox

- 1、 Change the running speed and traction force of the loader by modifying transmission ratio between diesel engine and wheels so as to adapt the operating and running requirements of the loaders.
- 2、 Enable loader backward movement.
- 3、 Cut off the power transmitted to the running gear so that prevent the power from diesel engine transmitting to the running gear at the operation state,





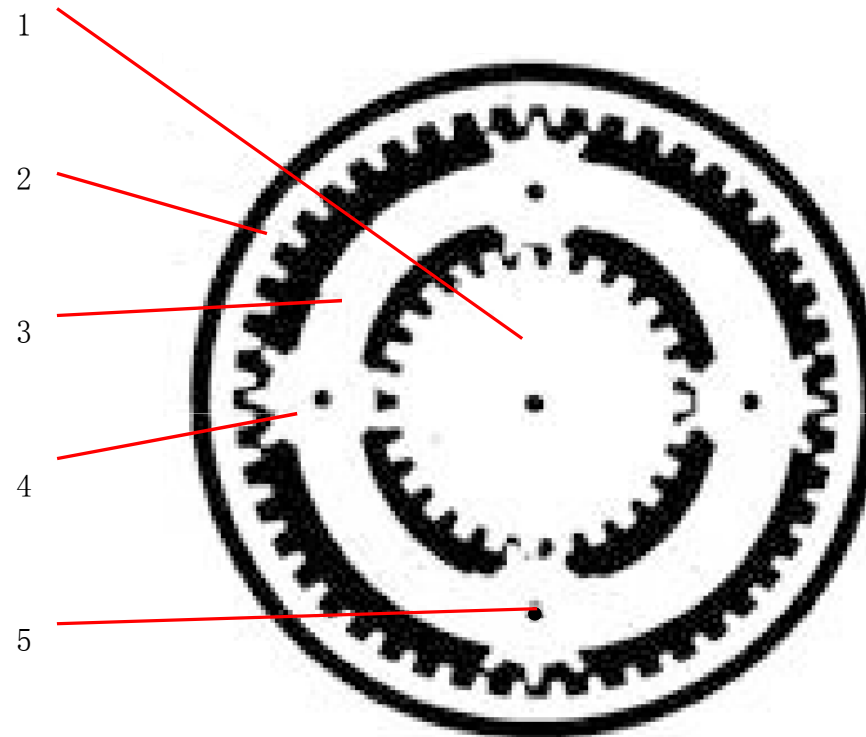
## Section 3 Gearbox

### 3. Working principle of gearbox

- The planetary gearbox is composed of basic planet rows. The right drawing is the structure of the basic planet row, it shows that the basic planet row is composed of sun gear 1, planet gear 4, planet carrier 3 (include planet gear shaft 5), gear ring 2.

- Planet gear is arranged on the planet carrier and is difficult to be connected with the external part and just plays the role of the idle gear for transmitting motion without having direct relation with the transmission ratio. Therefore, in the planetary gearbox, the basic planet row only has three elements (sun gear, planet carrier and gear ring) what can connect with external part.

1-Sun gear      2-gear ring  
3-Planet carrier    4-Planet gear  
5-Planet gear shaft



## Section 3 Gearbox

- The planetary gearbox only has two solutions for the power of the planet row is totally input from the sun gear, these are: planet carrier is fixed and gear ring takes as output, gear ring is fixed and planet carrier takes as output.

(1) When the sun gear is taken as input, planet carrier as output, and gear ring is fixed, it is forward gear I (as shown in Figure 1).

(2) When the sun gear is taken as input, gear ring as output, and the planet carrier is fixed, it is backward gear (I) (as shown in Figure 2).

Note: the forward gear II of the gearbox of the loader directly transmits the power from the sun gear to output gear through clutch of gear II, thus it also can be called direct gear.

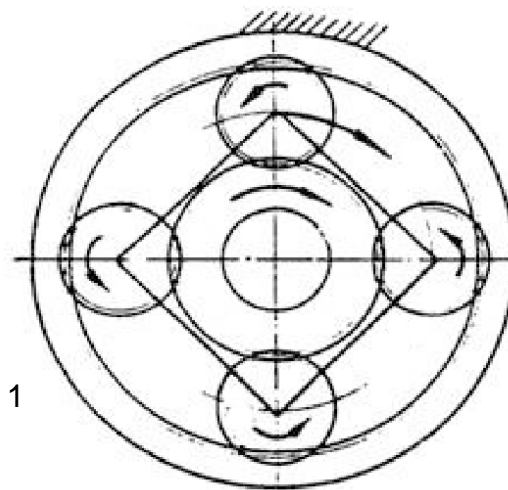


Figure 1

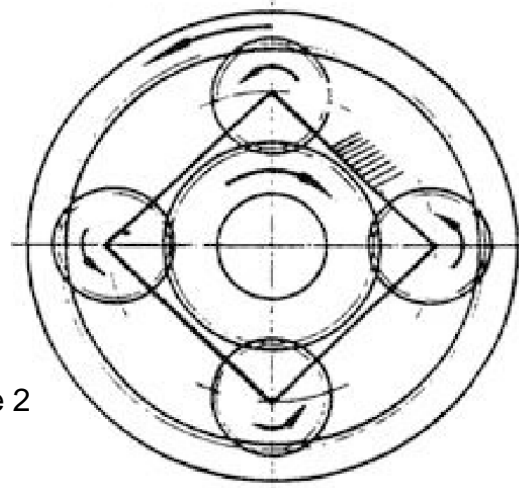
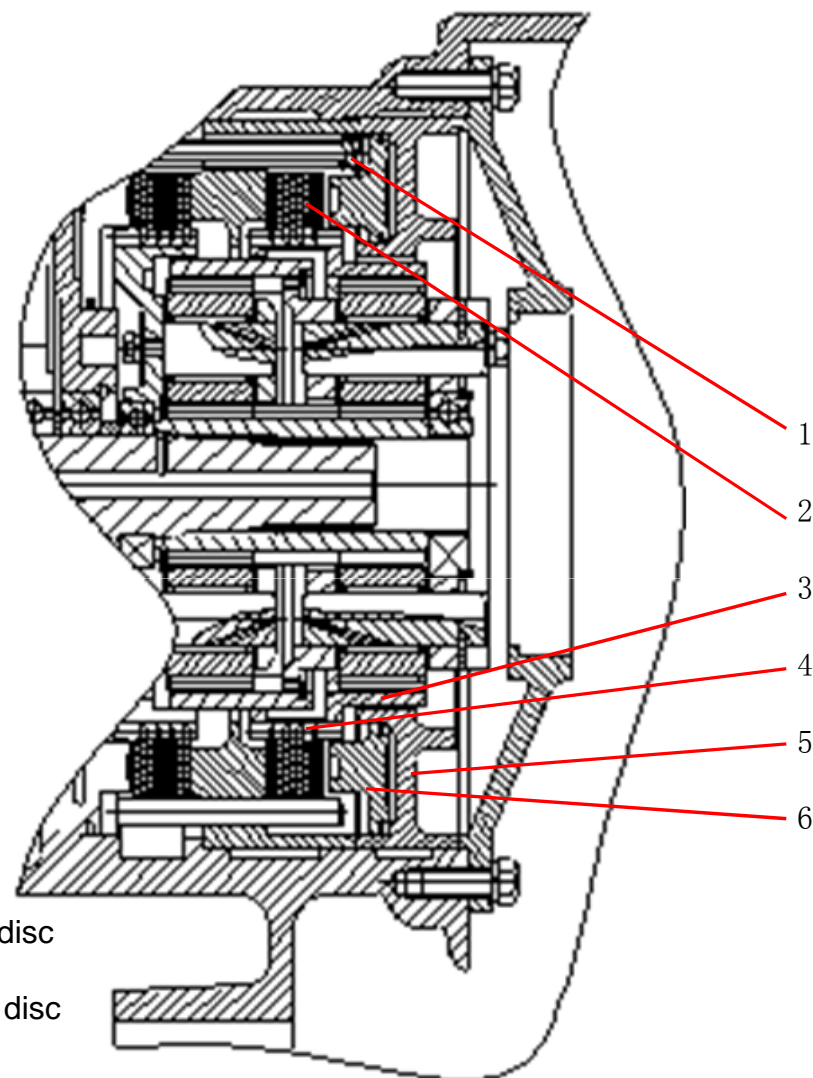


Figure 2

## Section 3 Gearbox

### (2) Principle of clutch

- When the rod of the speed-shifting control valve is arranged in the gear I position, for example, the pressure oil enters the cylinder of gear I from the control valve, and pushes piston of gear I leftwards so as to laminate the driving friction disc of the gear I with the driven friction disc fixed on the gearbox body. According to transmission principle, it follows forward I transmission route.
- When the rod of the speed-shifting control valve is arranged in the other position, under the action of return spring, the gear I piston press the pressure oil out of the cylinder, meanwhile, friction discs are released.
- There are some difference for forward gear II , one thing is friction disc transmits power, another thing is the force make the piston return comes from spring ring.



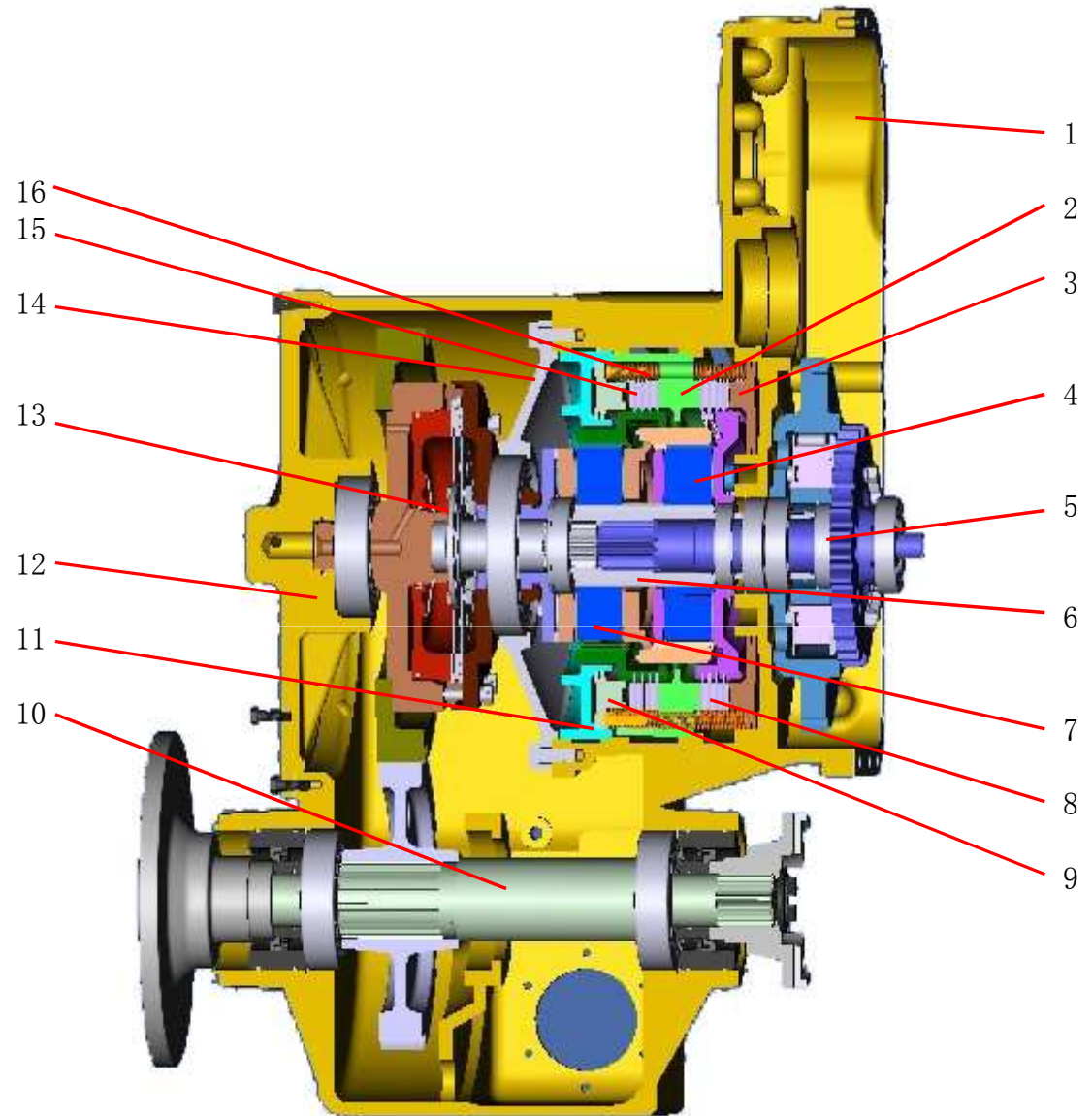
- 1-spring
- 2-driven friction disc
- 3-gear ring
- 4-driving friction disc
- 5-cylinder
- 6-piston

## Section 3 Gearbox

### 4. Formation

- Main parts of the gearbox:

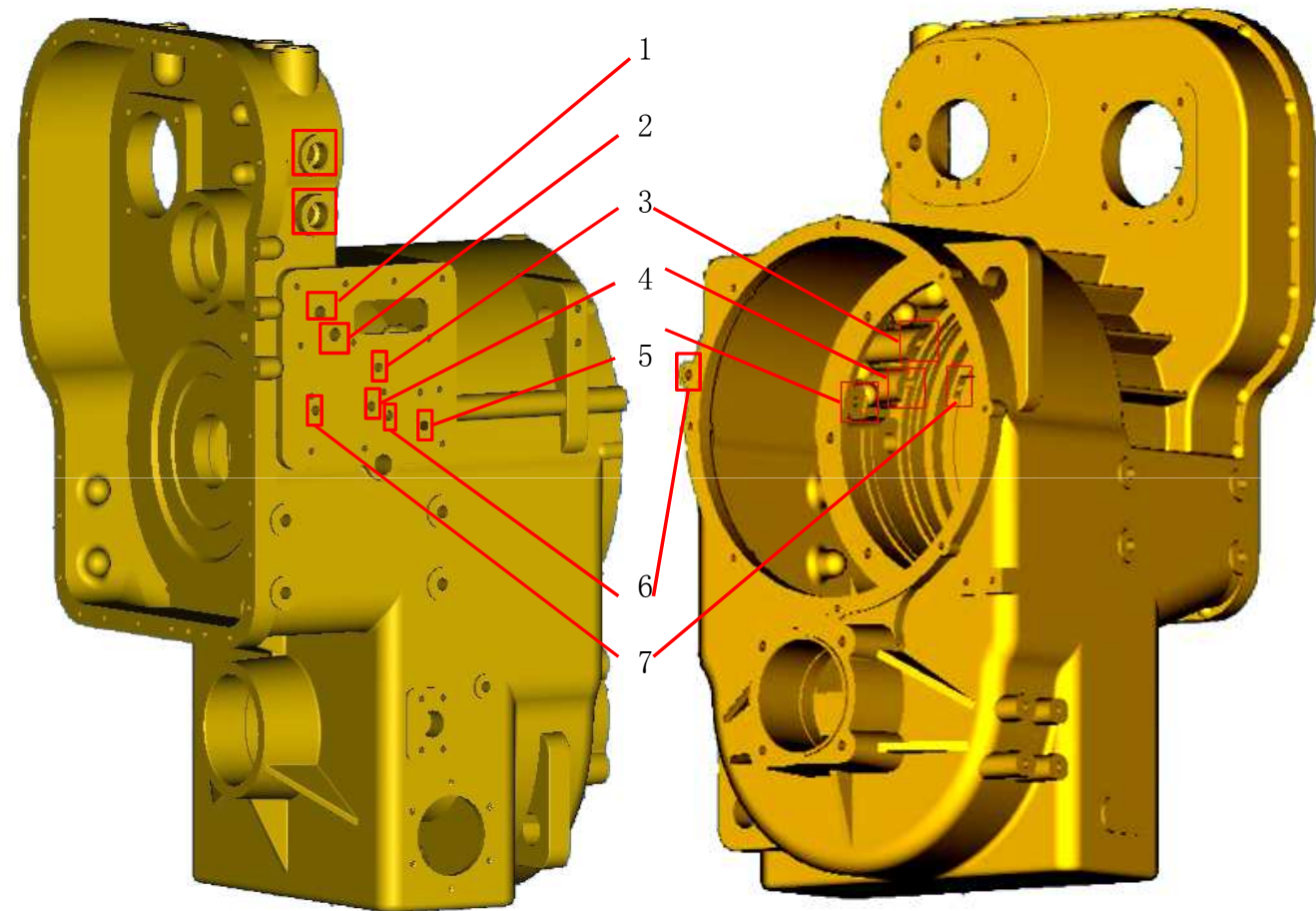
- 1-shell
- 2-separator
- 3-piston of backward gear
- 4-backward gear assembly
- 5-overrun clutch
- 6-sun gear
- 7-forward gear I assembly
- 8-friction disc of forward gear I
- 9-piston of forward gear I
- 10-output shaft assembly
- 11-cylinder of forward gear I
- 12-end plate
- 13-forward gear II assembly
- 14-cover
- 15-friction disc of forward gear I
- 16-spring



## Section 3 Gearbox

(1) Shell

1-oil feed hole of speed-shifting control valve  
2-oil feed hole of torque converter  
3、4-port for returning oil  
5-oil passage of gear I  
6-oil passage of gear II  
7-oil passage of reverse gear

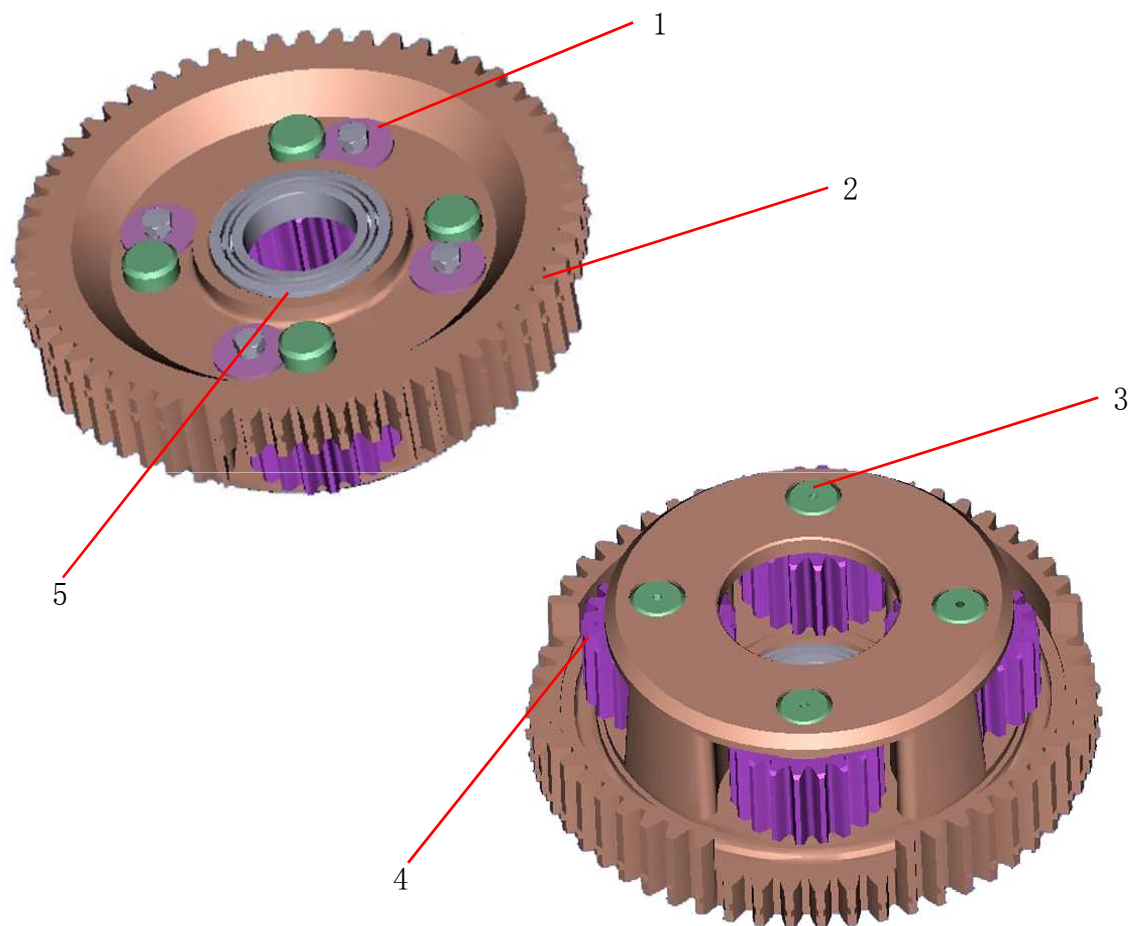


## Section 3 Gearbox

### (2) Reverse gear assembly

•The cylinder of reverse gear is in the shell of the gearbox, and there are 8 piece of friction disc in reverse gear assembly, 4 pieces are driving disc, and others driven disc. The piston restores under the action of the release spring arranged along the circumference when the clutch releases.

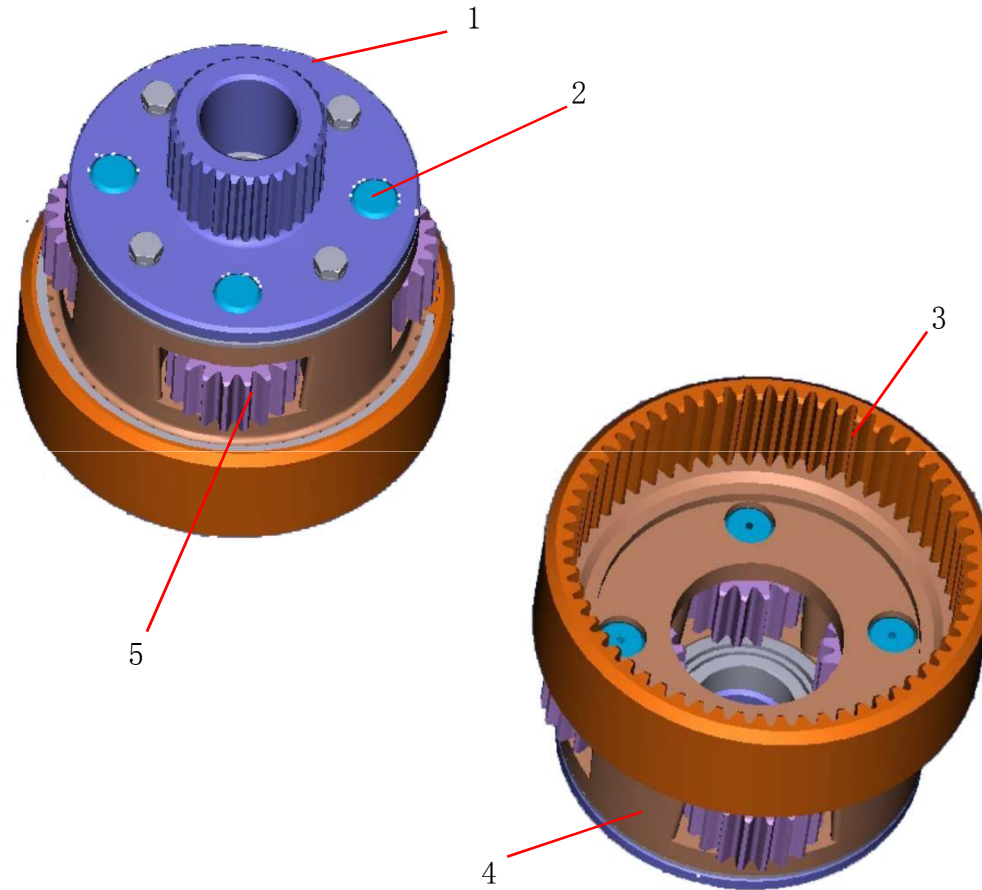
- 1-shim
- 2-planet carrier
- 3-planet gear shaft
- 4-planet gear
- 5-bearing



## Section 3 Gearbox

### (3) Gear I assembly

- 1- connecting flange
- 2-planet gear shaft
- 3-gear ring of reverse gear
- 4-planet carrier
- 5-planet gear

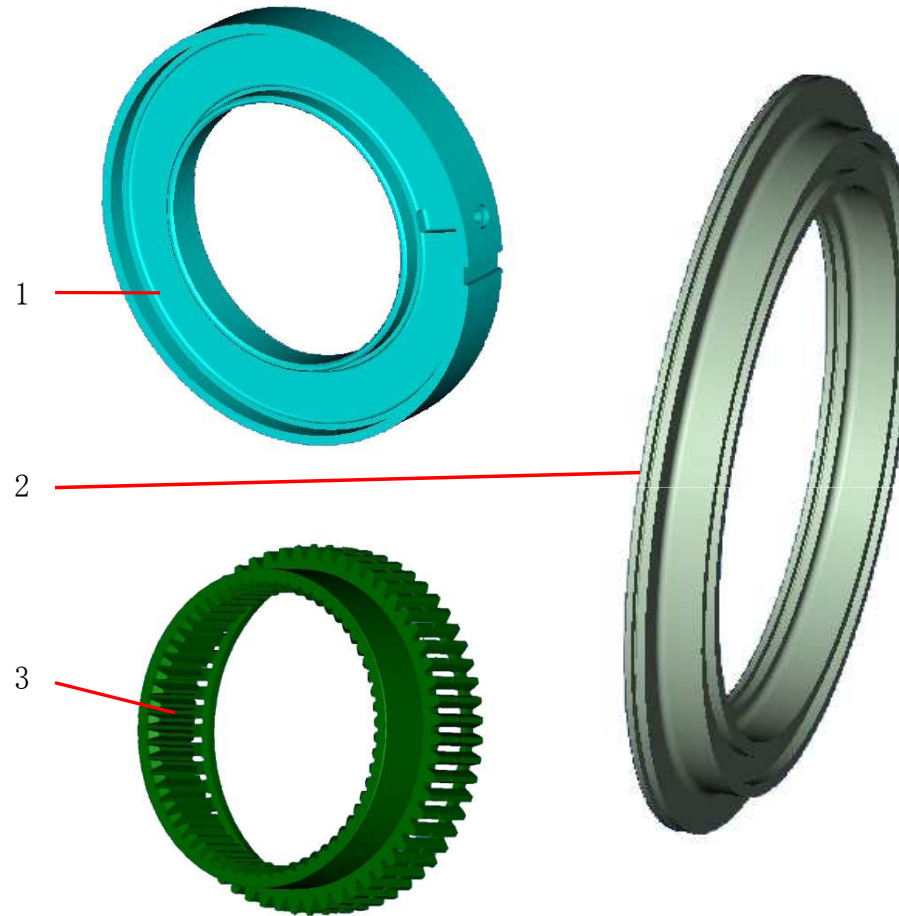


### Section 3 Gearbox

(3) Other parts of gear I

•Cylinder of gear I is fixed on the shell of the gearbox, there are 8 pieces of friction discs in the gear ring, 4 pieces are driving disc and others driven discs, The piston restores under the action of the release spring arranged along the circumference when the clutch releases.

1-cylinder  
2-piston  
3-gear ring





## Section 3 Gearbox

### (4) Gear II assembly

• There are 3 pieces of friction discs in gear II assembly, 2 pieces are driving discs and other is driven disc. the piston restores under the action of the release spring arranged along the circumference when the clutch releases.

1- Intermediate input shaft

2-cylinder

3-bearing

4- release spring

5-piston

6-driving disc

7- gear II compressed disc

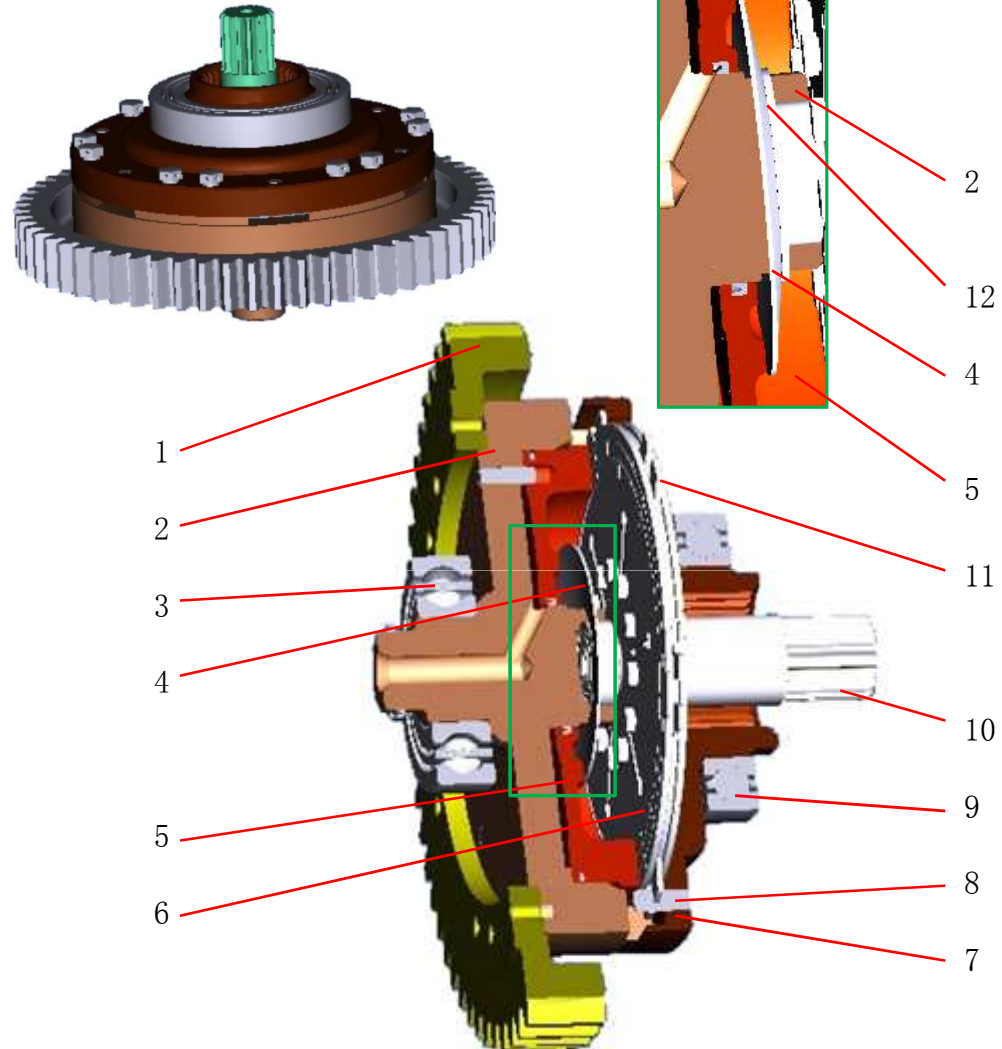
8-pin

9-bearing

10- direct gear shaft

11-driven disc

12-ring



## Section 3 Gearbox

### (5) Overrun clutch

● Overrun clutch is an element of input parts, it can adjust its input type according to external load.

1-ring

2、5、6-bearing

3- spacer sleeve

4-internal ring

7-inner race cam

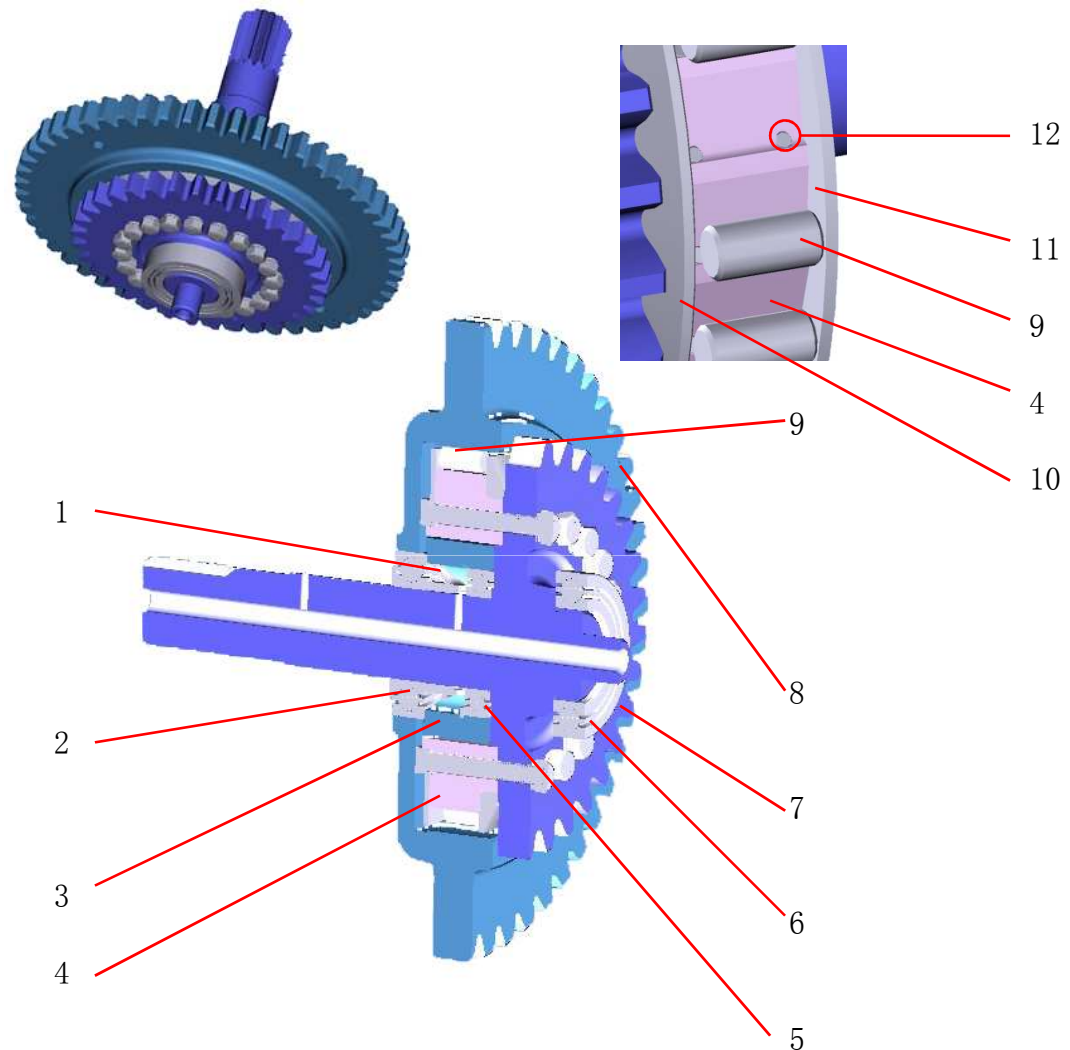
8-gear

9- needle roller

10-left baffle

11-right baffle

12-spring



## Section 3 Gearbox

### (5) Overrun clutch

- When rotary speed of gear(W1) is higher than the rotary speed of inner race cam(W2), springs are prolonged, under the action of springs and rollers, the gear and inner race cam connect strongly, and transmit power together.

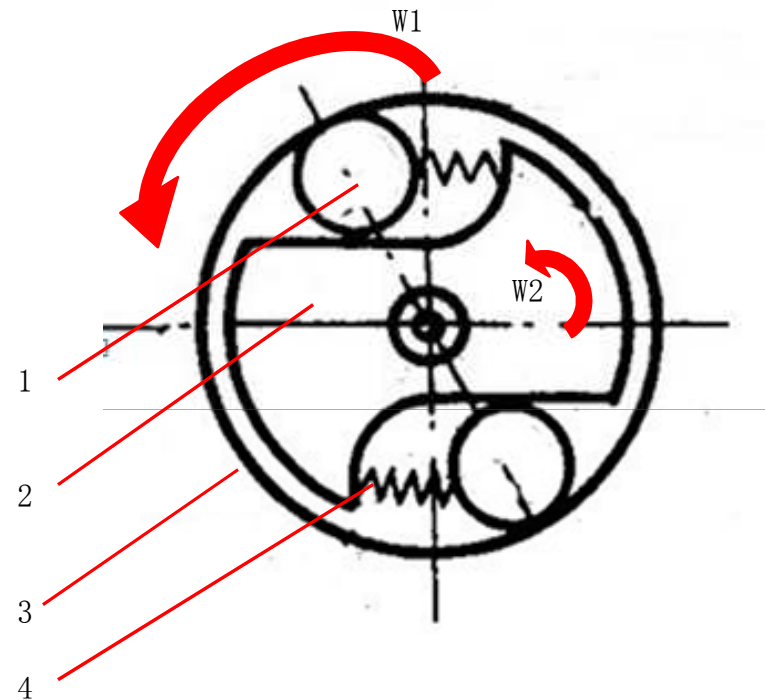
- When rotary speed of gear(W1) is lower than the rotary speed of inner race cam(W2), springs are compressed, the gear and inner race cam are in separating situation, their motion state don't affect each other, only inner race cam transmit power.

1-roller

2-inner race cam

3-gear

4-spring

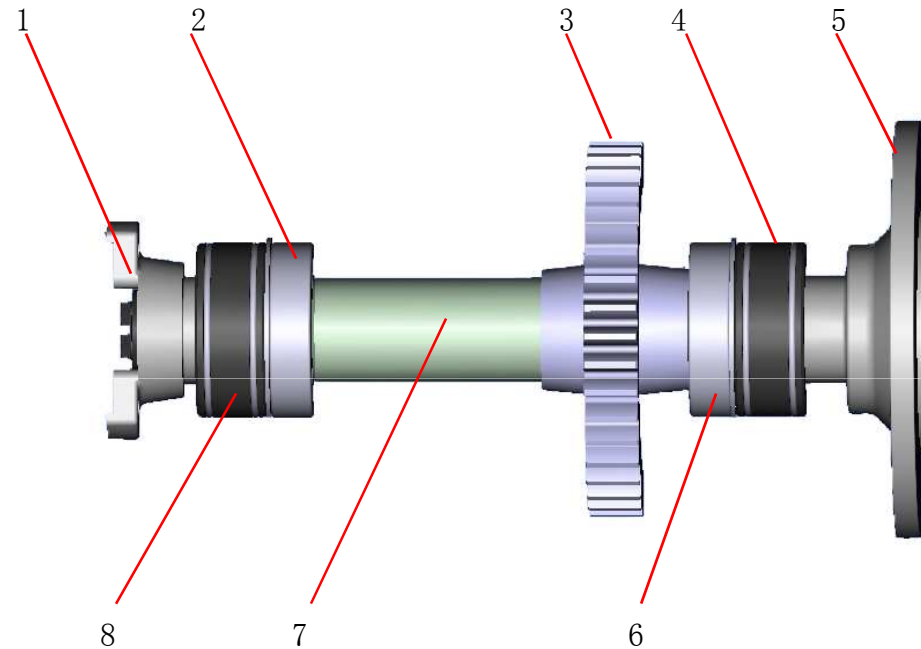


## Section 3 Gearbox

### (6) output shaft assembly

- Gear 3 meshes with intermediate gear of direct gear assembly, and transmit the power from intermediate gear to output shaft.

- 1-rear connecting flange
- 2、 6-bearing
- 3-output gear
- 4、 8-sealing
- 5-front connecting flange
- 7-output shaft

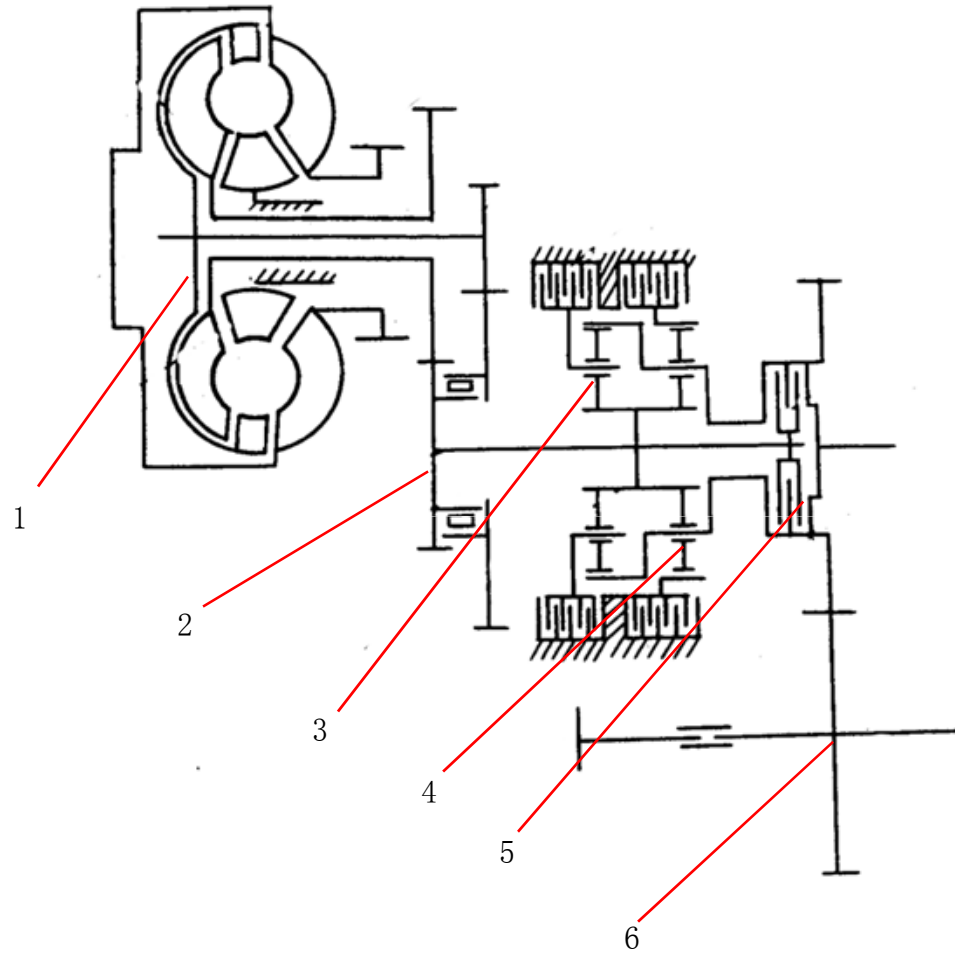


## Section 3 Gearbox

### 5. Driving line

• The sketch of C&T assembly is shown in the right.

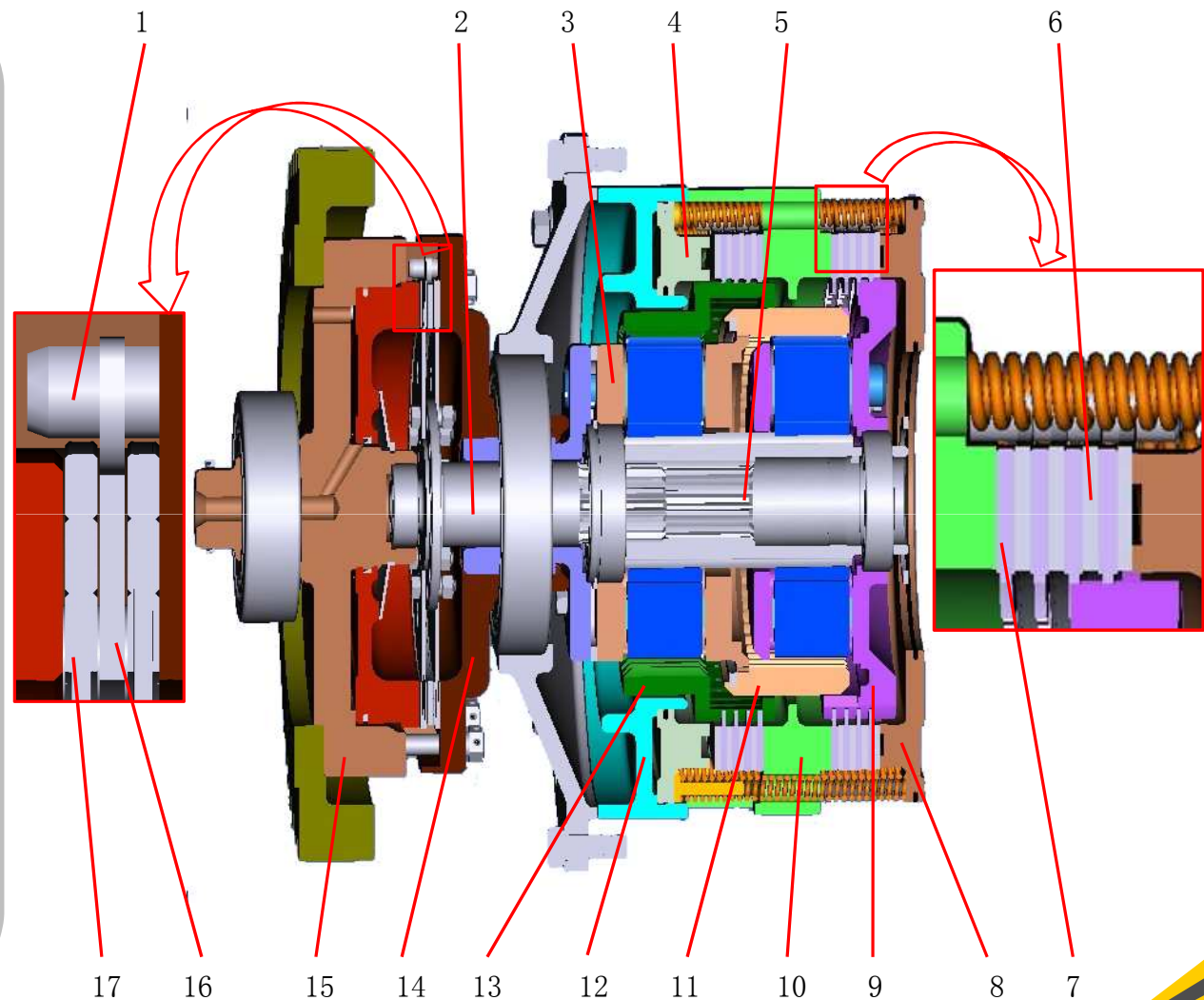
- 1-torque converter assembly
- 2-overnun clutch assembly
- 3-reverse gear assembly
- 4-gear I assembly
- 5-gear II assembly
- 6-output shaft assembly



## Section 3 Gearbox

### 5. Driving line

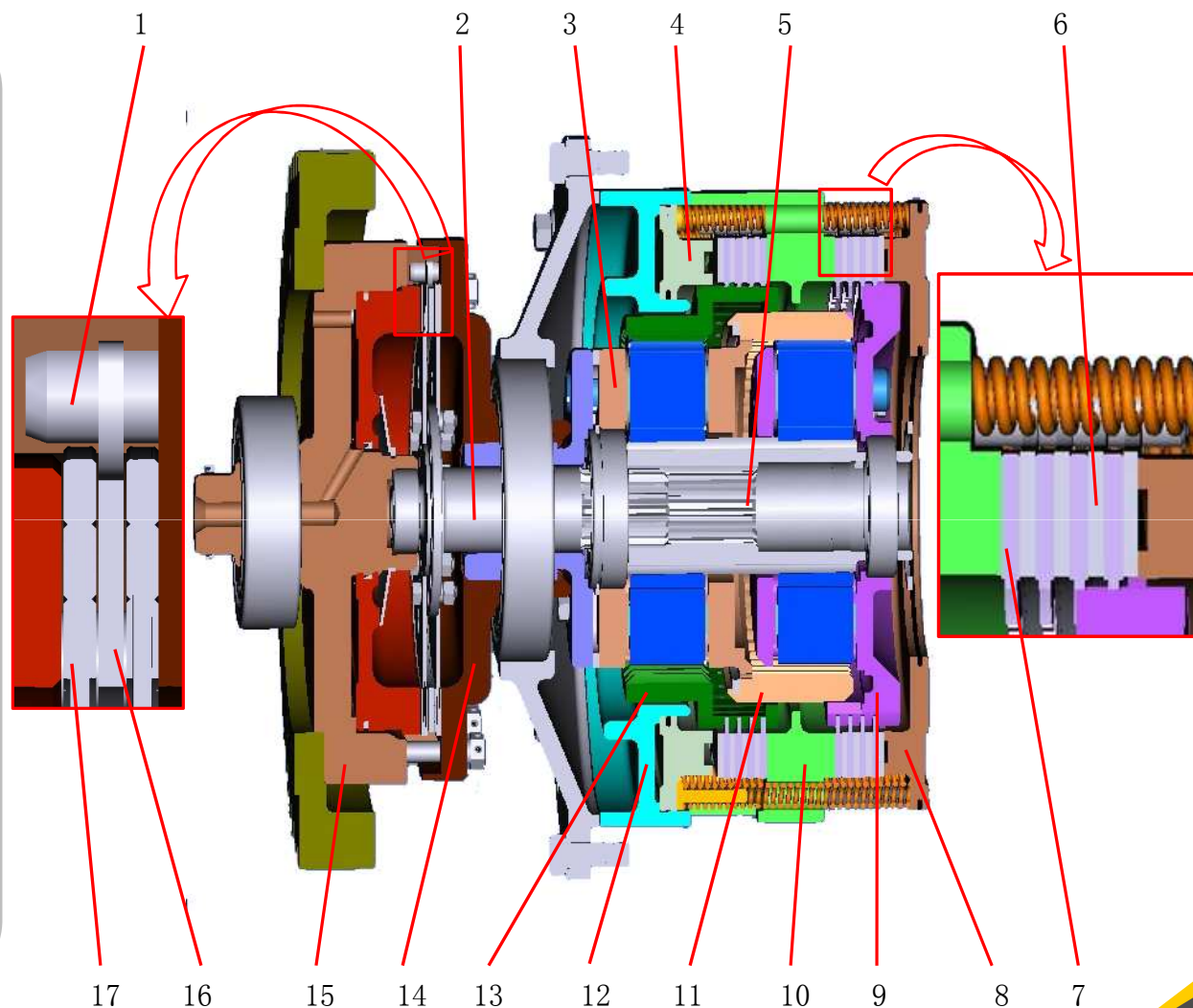
- The planet shifting portion comprises two planet rows which have identical teeth number of sun gears, planet gears and gear rings, and have integrated sun gears connected with input shaft through spline and further connected with the input shaft of gear II (direct gear shaft) through spline.
- Gear ring 11 of reverse planet row, planet carrier 3 of planet row of gear I and compressed disc 14 of direct gear are integrally connected through spline teeth, which form the power output device of the planet speed shifting portion.



## Section 3 Gearbox

### 5. Driving line

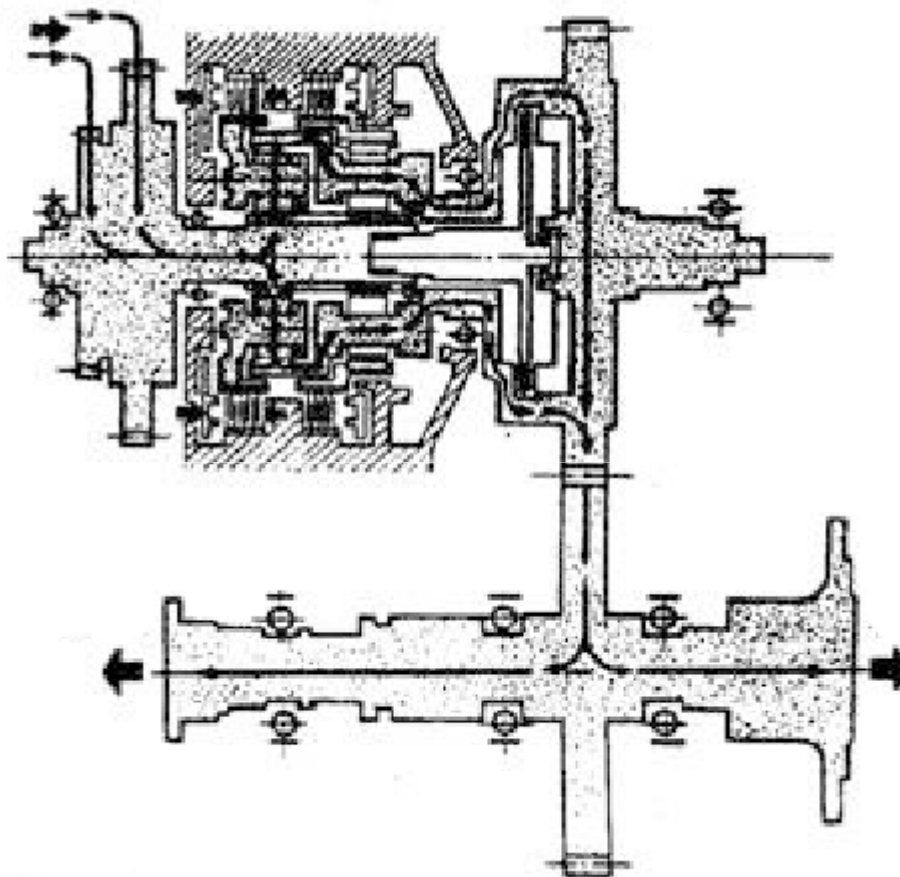
- Clutches arranged on the planet carrier 41 of the reverse planet row and the gear ring 31 of the planet row of gear I are connected with the driving friction disc of the clutch through spline. The driven friction disc of the clutch is guided by the cylinder pin of isolating tray fixed to the shell and transmits the force to shell.
- The clutch of the direct gear has two slices of driving friction discs which are connected with the drive shaft of the clutch (input shaft of gear II) through screws, and has only slice of driven friction disc which transmits force to the compressed disc of the gear II through the guiding of the cylinder pin.



## Section 3 Gearbox

### (1) Transmission Route of Reverse Gear

- When the rod of the speed-shifting control valve is arranged in the reverse gear position, the pressure oil enters the reverse oil intake hole on the gearbox from the control valve, flows into the reverse gear cylinder (on the gearbox) and pushes the reverse gear piston rightwards so as to laminate the driving friction disc of the reverse gear with the driven friction disc fixed on the gearbox body. So the planet carrier is fixed, and the power from the sun gear is yielded through the inner reverse gear ring via the planet gear.
- The reverse gear transmission route is as follows: intermediate input shaft - sun gear - reverse planet gear - inner reverse gear ring - gear I planet carrier - gear II compressed disc - output shaft gear - output shaft.

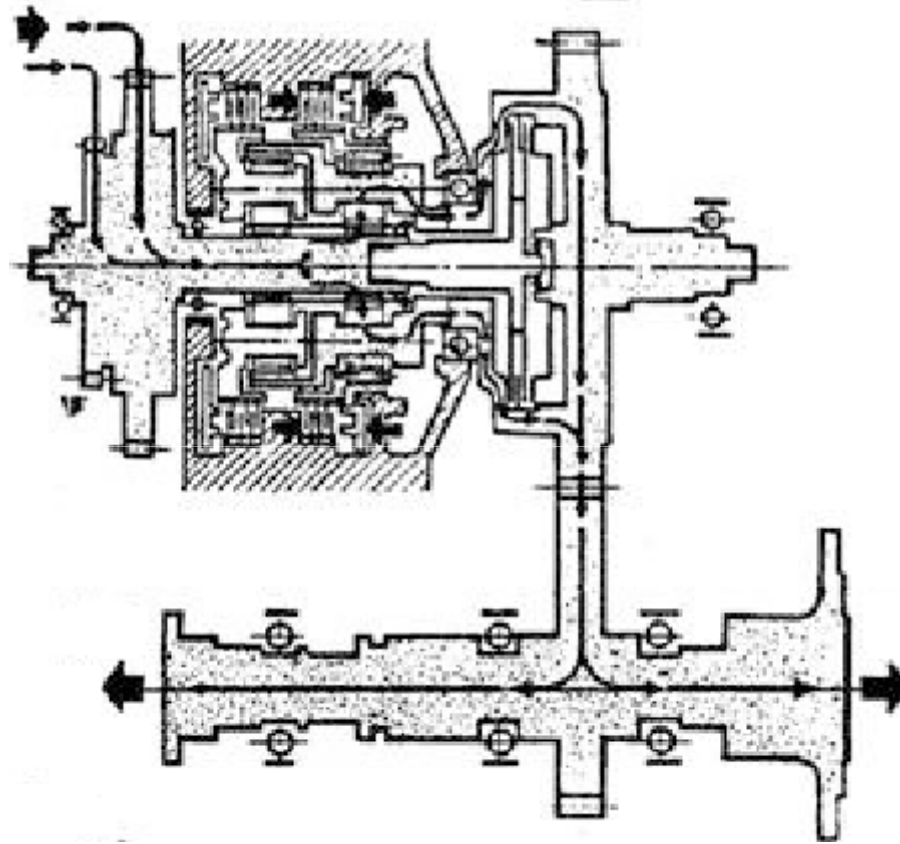




## Section 3 Gearbox

### (2) Transmission Route of gear I

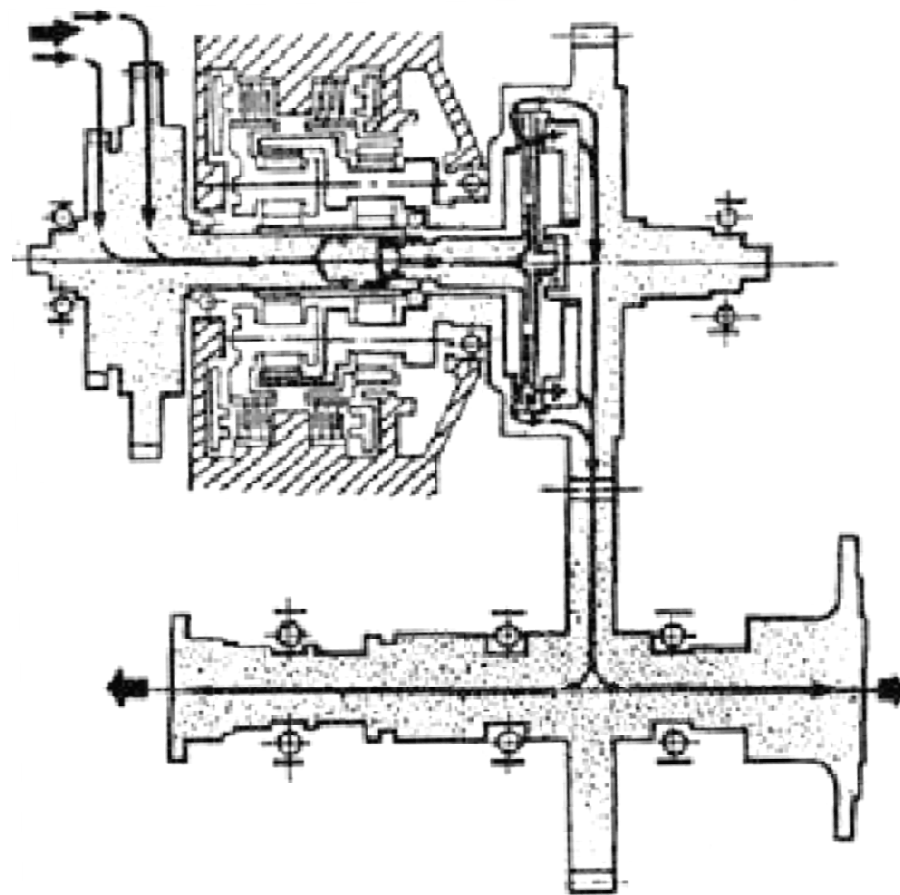
- When the rod of the speed-shifting control valve is arranged in the gear I position, the pressure oil enters the cylinder of gear I from the control valve, and pushes piston of gear I leftwards so as to laminate the driving friction disc of the gear I with the driven friction disc fixed on the gearbox body. So the gear ring of the gear I is fixed and the planet carrier takes as output element.
- The transmission route of gear I is as follows: intermediate input shaft - sun gear - planet gear of gear I - planet carrier of gear I - compressed disc of direct gear - intermediate output gear - output shaft gear - output shaft.



## Section 3 Gearbox

### (3) Transmission Route of gear II

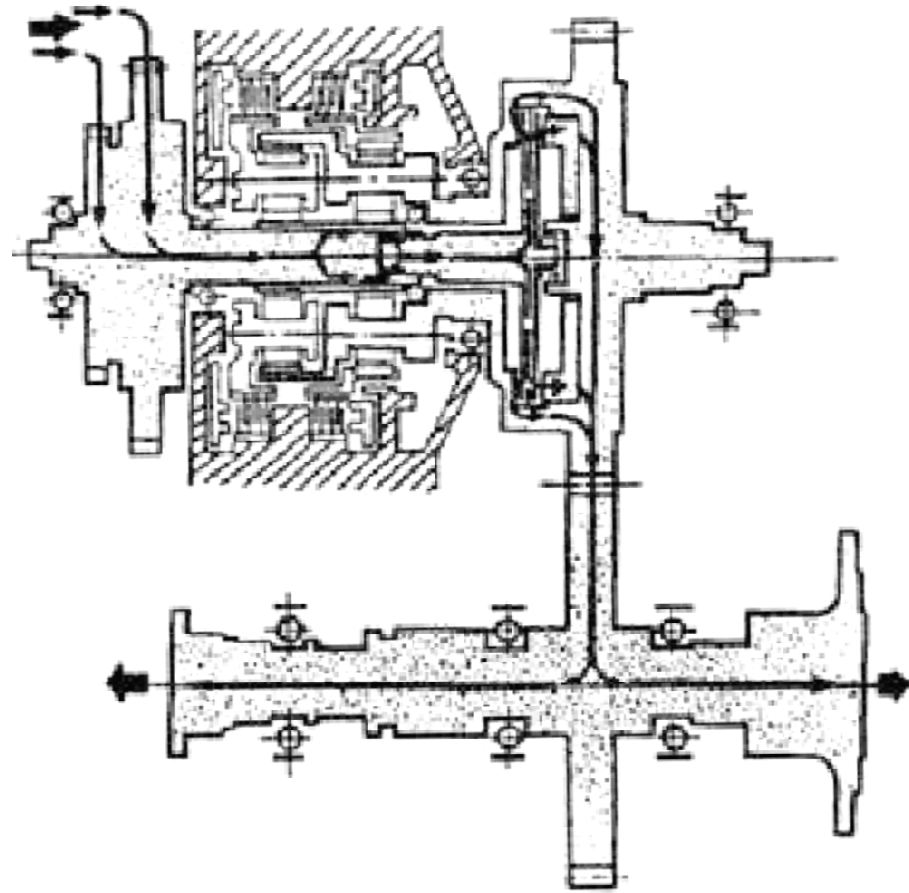
- When the rod of the speed-shifting control valve is arranged in the gear II position, the pressure oil enters oil intake hole of the gear II of the gearbox body, flows into the cylinder of direct gear and pushes piston of direct gear leftwards so as to laminate the driving friction disc of the direct gear with the driven friction disc. Since the driving friction disc of the gear II is connected with the input shaft thereof, and the driven friction disc, the driven friction disc is connected with the compressed disc of the direct gear through the cylinder pin, and the said compressed is connected with the gear of the intermediate output shaft, the power input by the sun gear is transmitted to the driving friction disc of gear II, and transmitted to the compressed disc through the driven friction disc of the direct gear, and finally is yielded through the output gear ring.



## Section 3 Gearbox

(3) Transmission Route of gear II

- The transmission route of direct gear is as follows: intermediate input shaft - sun gear - direct gear shaft - friction disc of direct gear - intermediate output gear - output shaft gear - output shaft.

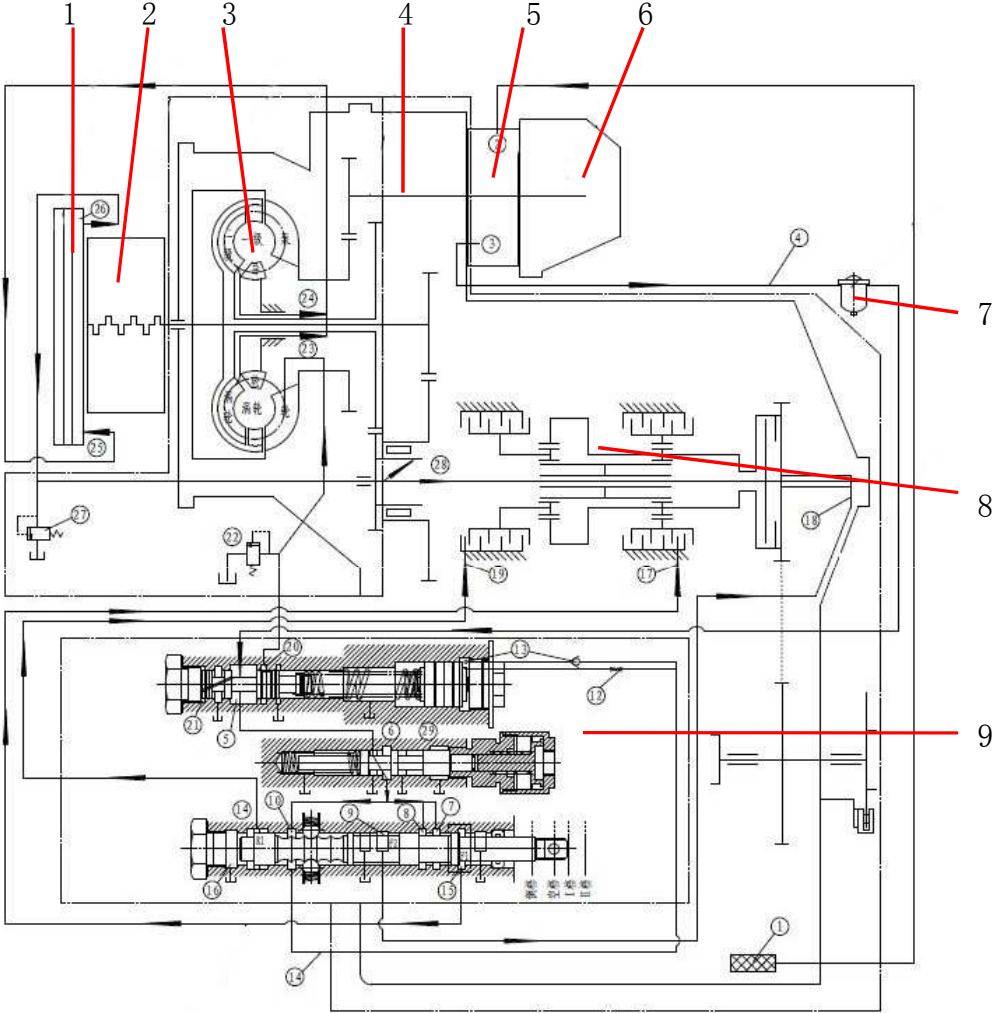


# Section 4 Oil passage system

## 1. Composition of Oil Supply System

•Oil supply system is mainly composed of oil pan 3, control valve 2, gear pump 1, oil filter, radiator, torque converter, cylinders of three gears and oil pipelines.

- 1-radiator
- 2-engine
- 3-torque converter
- 4- transfer gear
- 5-gear pump
- 6- Working pump
- 7-oil filter
- 8-gearbox
- 9-speed-control valve

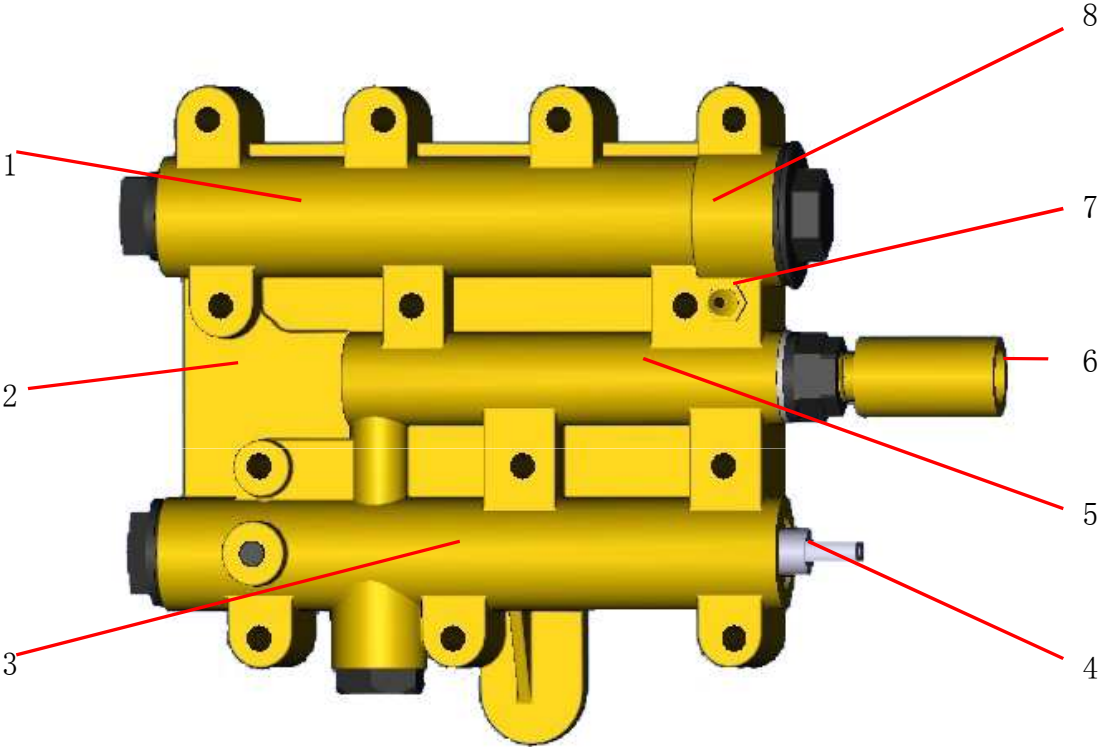


### Section 4 Oil passage system

(1) Control valve

•The picture on the right is external figure of the control valve:

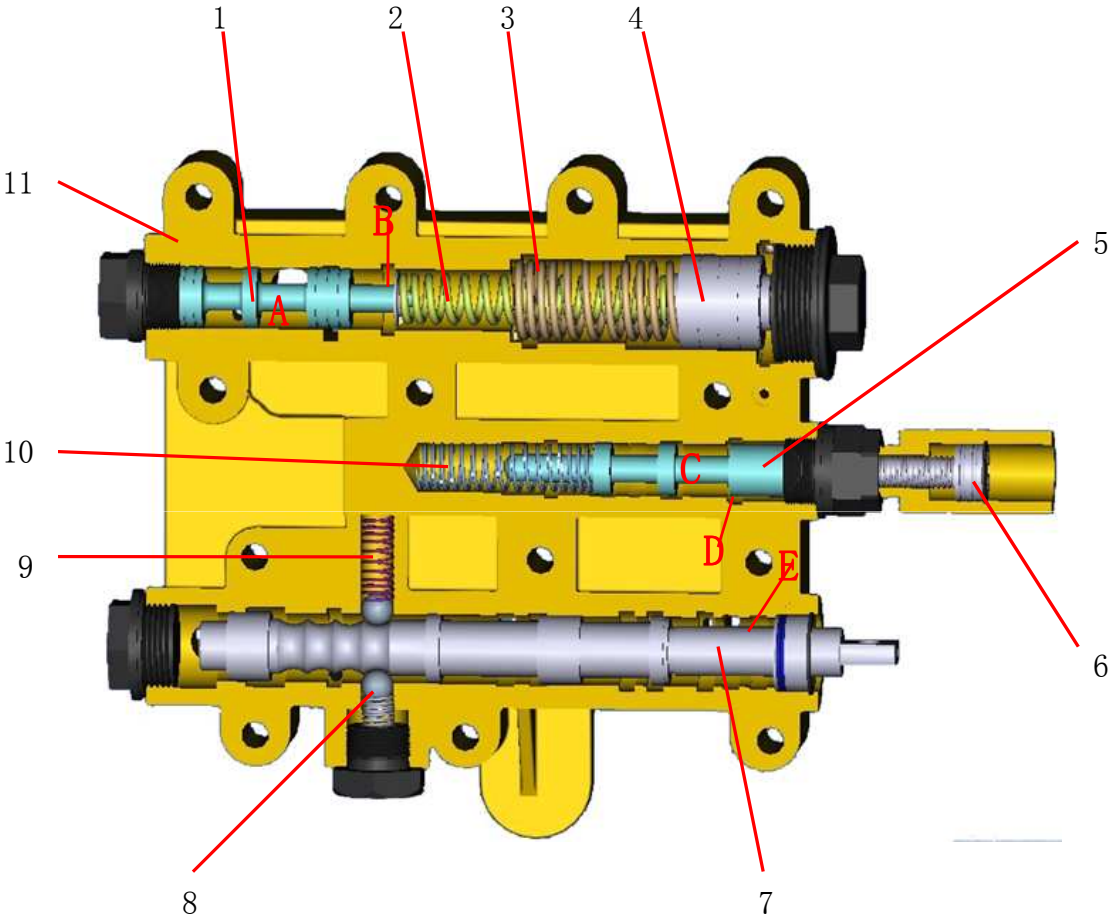
- 1-reducing valve
- 2-valve body
- 3-speed-control valve
- 4-rod of speed-control valve
- 5-cutting valve
- 6-air valve
- 7-port for pressure sensor
- 8- accumulator



### Section 4 Oil passage system

•The picture on the right is the profile of the control valve.

- 1-rod of reducing valve
- 2-spring
- 3-spring
- 4-slide block
- 5-rod of cutting valve
- 6-rod of air valve
- 7-rod of speed-control valve
- 8-steel ball
- 9-spring
- 10-spring
- 11-valve block

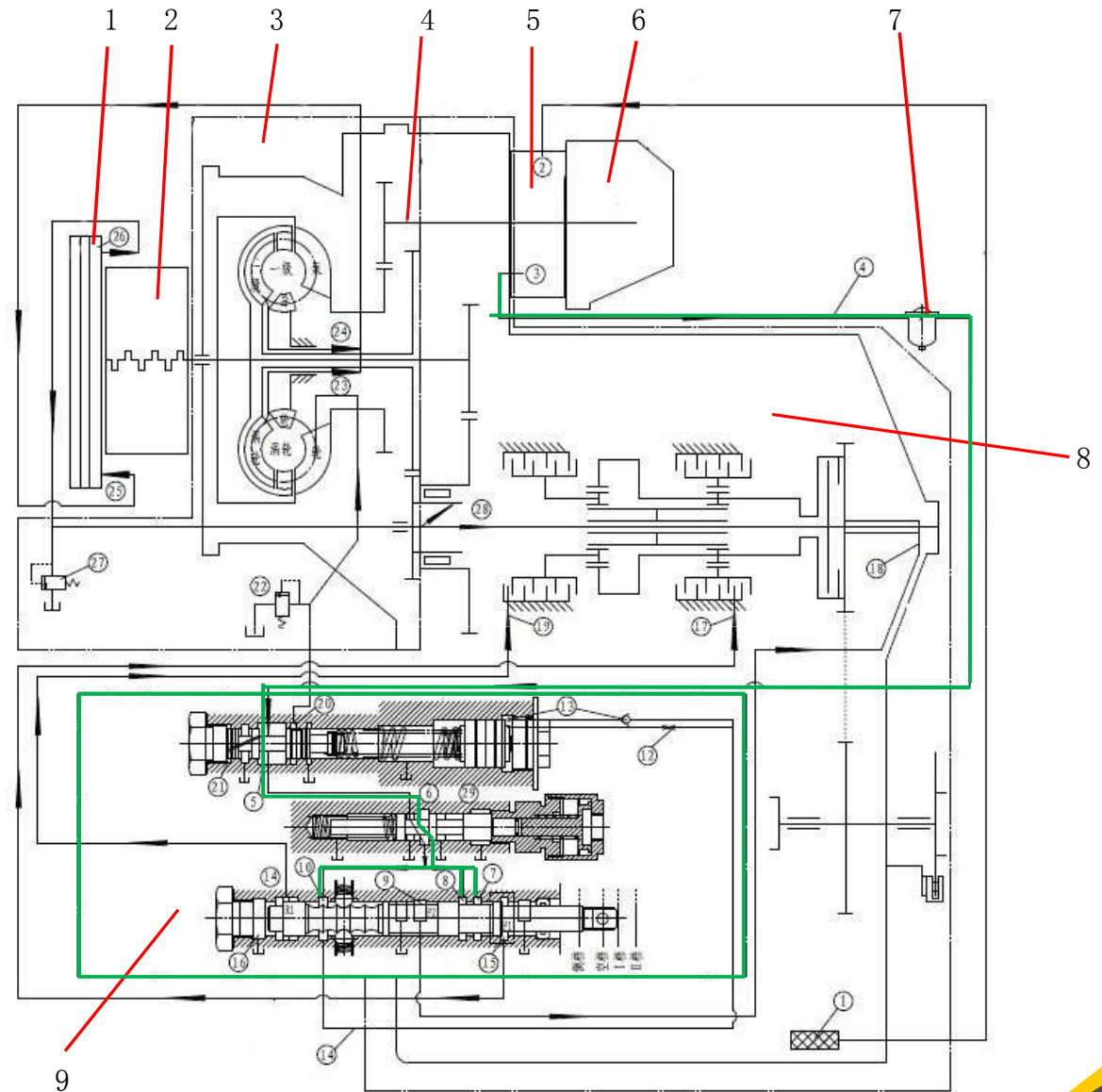


## Section 4 Oil passage system

### 2.Speed-control oil passage

•The hydraulic transmission oil is yielded from the gearshift pump, filtered by oil filter and then is supplied to the speed-shifting control valve (or reducing valve). The working oil enters the speed-shifting control oil passage of the speed-shifting control valve first to meet the speed shift requirement, and then part of the oil enters the torque converter.

- 1-radiator
- 2-engine
- 3-torque converter
- 4- transfer gear
- 5-gear pump
- 6- Working pump
- 7-oil filter
- 8-gearbox
- 9-speed-control valve



## Section 4 Oil passage system

(1) Oil passage (or port) of the speed-control valve

1-This port communicates with chamber C

2、3-They communicate with each other when cutting valve doesn't work.

4-Communicates with chamber with a spring.

5、11、22-oil returning chamber

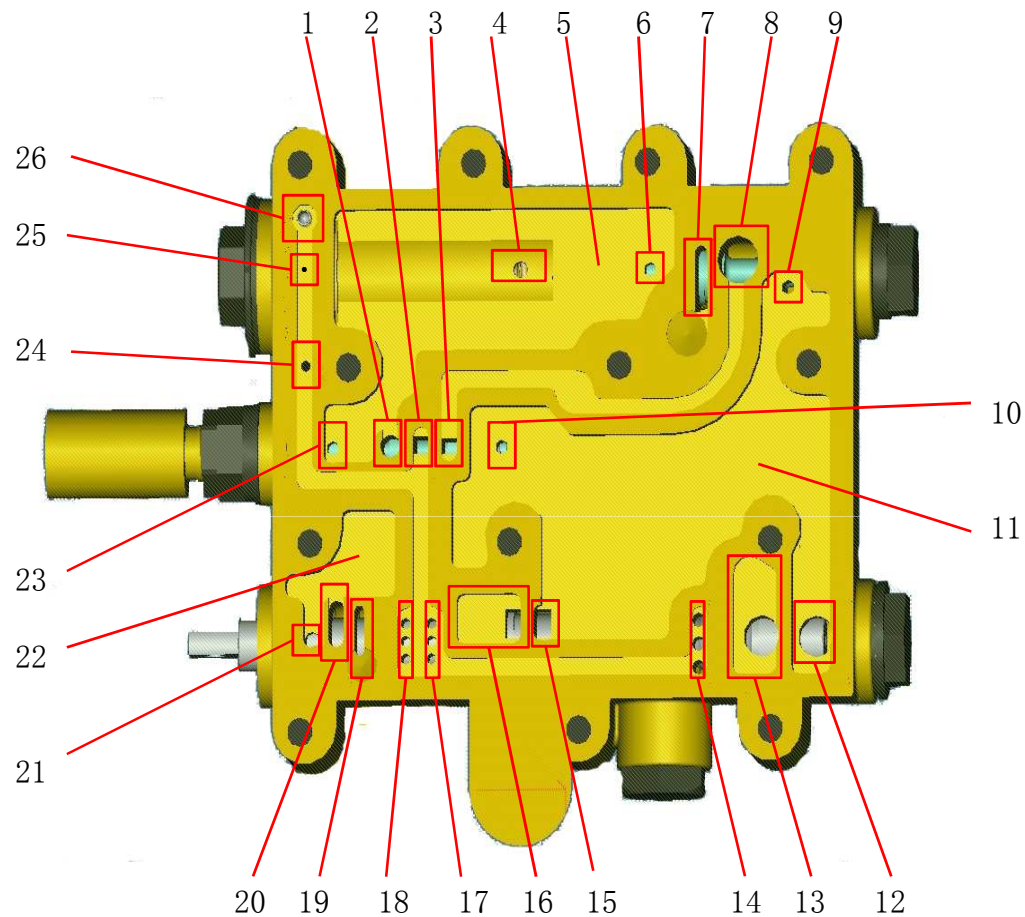
6-Communicates with chamber B.

7-oil inlet of torque converter

8-Communicates with filter

9-returning port

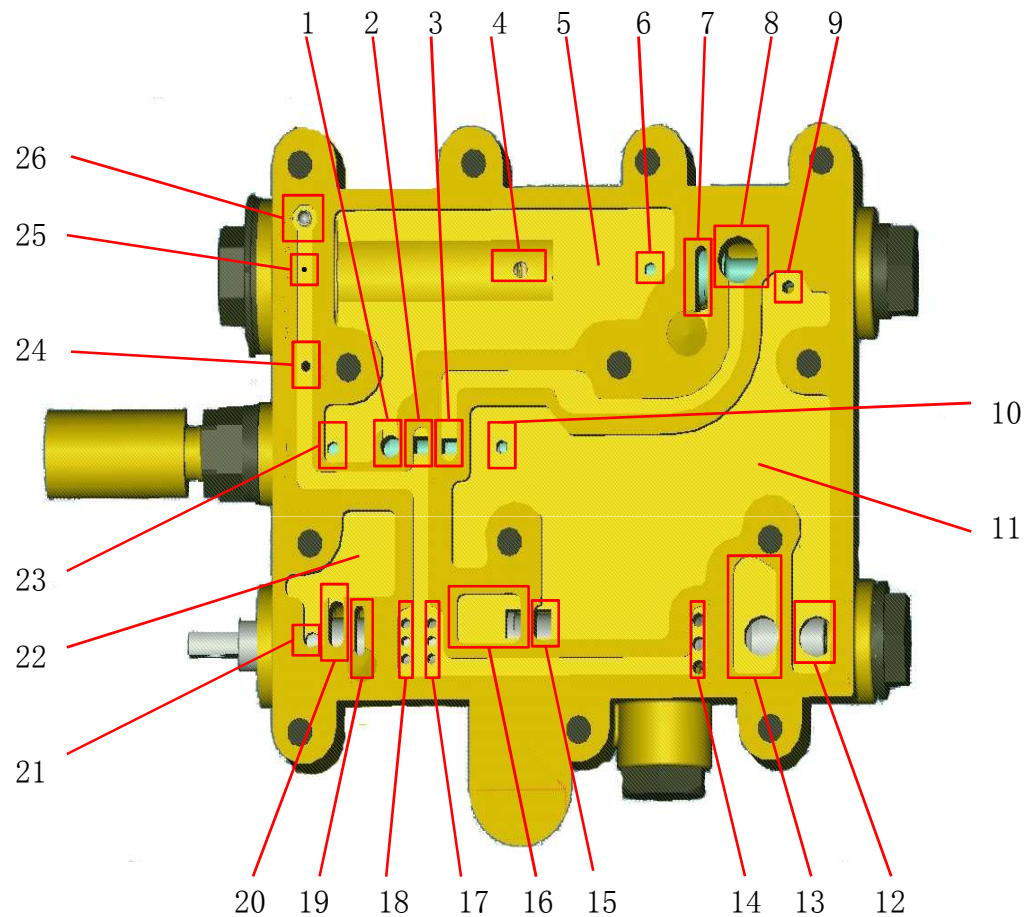
10-Communicates with the chamber with spring of cutting valve





## Section 4 Oil passage system

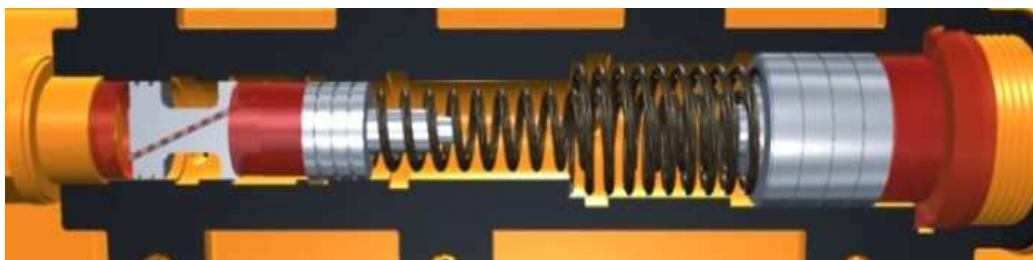
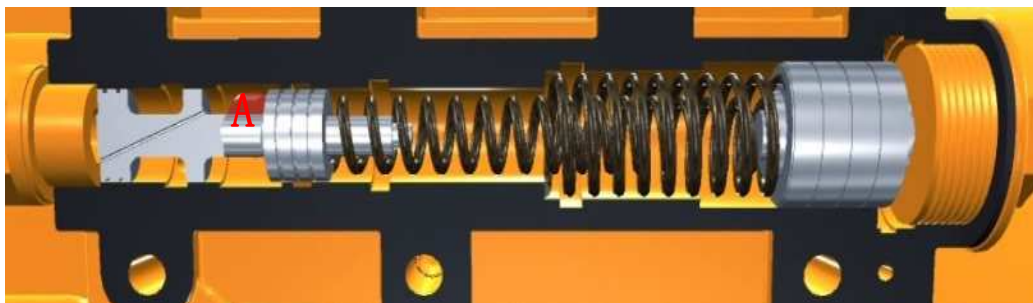
- (1) Oil passage (or port) of the speed-control valve
- 12-Returning port of reverse gear.
- 13-Cylinder port of reverse gear.
- 14-Oil inlet of reverse gear. 15-Cylinder port of gear II
- 16-Returning port of gear II
- 17-Oil inlet of gear II
- 18-Oil inlet of gear I
- 19-Cylinder port of gear I
- 20-Returning port of gear I
- 21-Communicates with chamber E
- 23-Communicates with chamber D
- 24-Communicates with chamber pressure sensor
- 25-orifice
- 26-one-way valve



## Section 4 Oil passage system

### (2) Working principles of the reducing valve

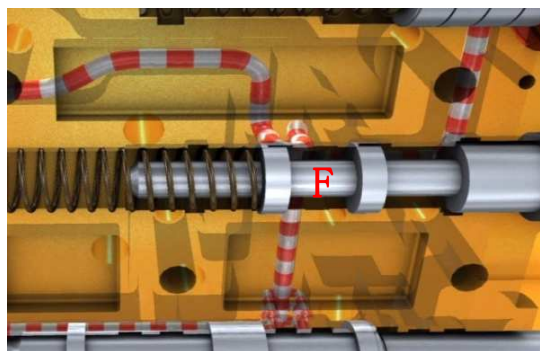
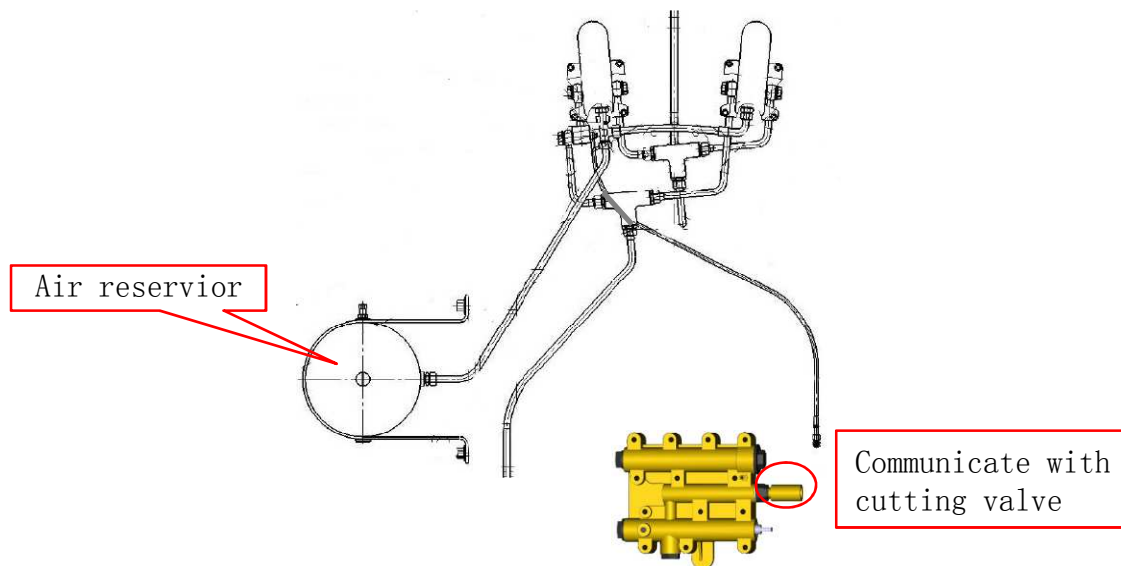
- Oil from the filter enters chamber A and reaches cylinder ports of the three gears along oil-passage, with the pressure rising in the cylinder ports, pressure oil enters the sealed cavity on the left through the orifice in the valve rod of the reducing valve, and pushes the rod to move to the right. Meanwhile, oil in the channel flows into the sealed cavity on the right of the slide block through the orifice in the slide block, and pushes the slide block to move to the left. When the oil's pressure is in the range 1.08 Mpa and 1.47 Mpa, the rod of the reducing valve moves to the left to make chamber A communicate with the passage communicating with the torque converter, and at that time the slide block presses on the valve block. If the pressure continue rising, the rod of the reducing valve continues to the right until the chamber communicates with the returning port.



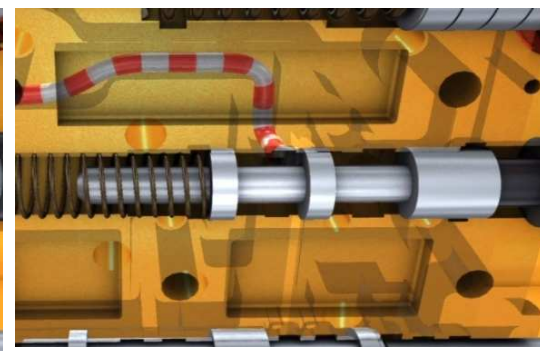
## Section 4 Oil passage system

(3) Working principles of the cutting valve

- As shown in the right picture(Picture 1), the foot brake pedal is not pressed, pressure oil flows into chamber F from speed-control channel, and flows out of chamber F and into another speed-control channel.
- When the left foot brake pedal is pressed, pressure air flows out of the air reservoir and into the cutting valve through left brake valve, and pushes the rod to move, at this time, the oil-passage is cutted off to realize power-off (as shown in Picture 2).



Picture 1

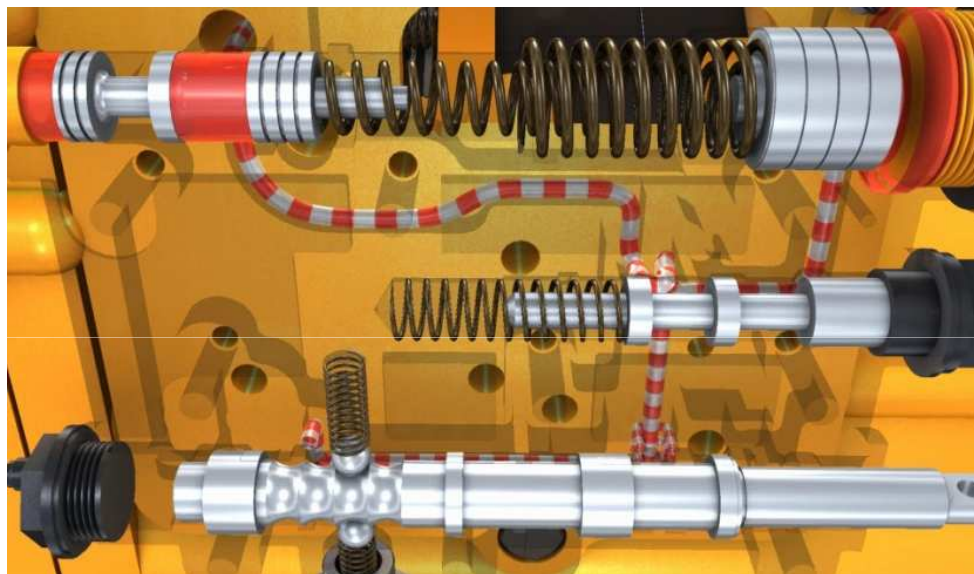


Picture 2

## Section 4 Oil passage system

### (4) Working principles of speed-control valve

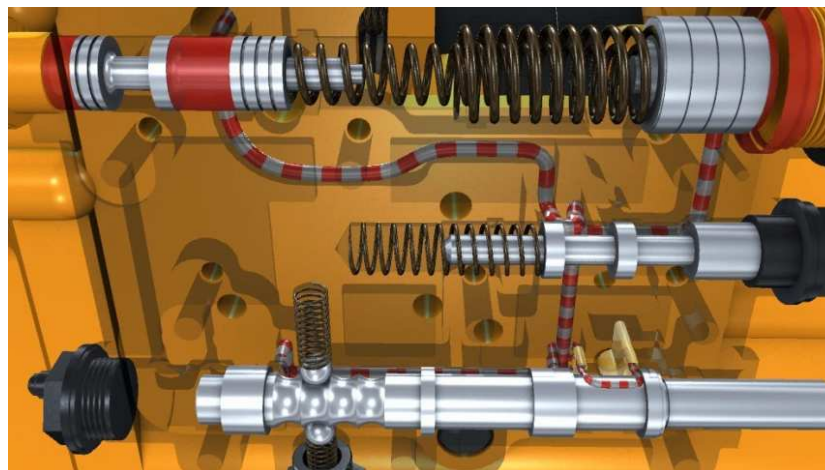
- When the speed-control valve rod is placed in the neutral position, the rod cuts off the channel between cylinder ports and oil inlets, and cylinder ports are connected to returning port. Pressure oil can't flow into cylinders, clutches can't work, so the gearbox is no power input. This time, part of pressure oil flows into torque converter, part relieves from overflow valve in the torque converter, and other flows into tank through the returning port of reducing valve.



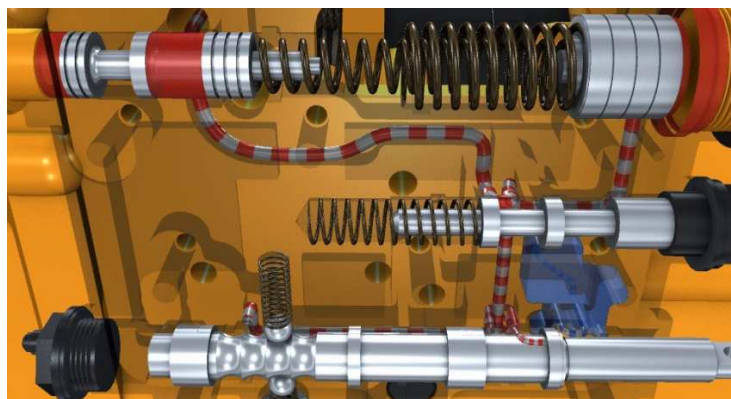
## Section 4 Oil passage system

(4) Principle of speed-control valve

- When the rod of speed-control valve is placed in the position of gear I, oil inlet of gear I is connected to cylinder port of gear I, pressure oil flows into cylinder of gear I. At this time, oil inlet of gear II and reverse gear continue being cut off (refer to picture 1).
- When the rod of speed-control valve is back to neutral, the rod cuts off the passage between oil inlet of gear I and cylinder port of gear I, and cylinder port of gear I is connected to returning port (refer to picture 2).
- Under the action of springs, the oil in the cylinder of gear I flows to oil tank through speed-control valve (refer to picture 3).



图一



图二

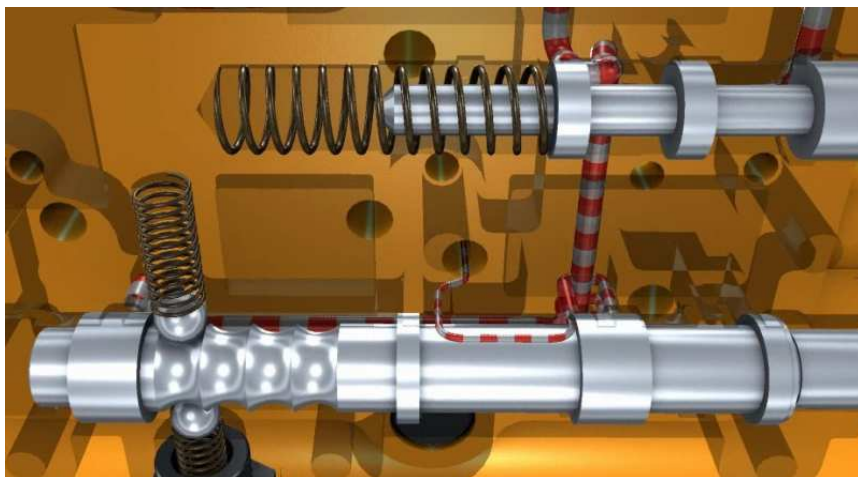


图三

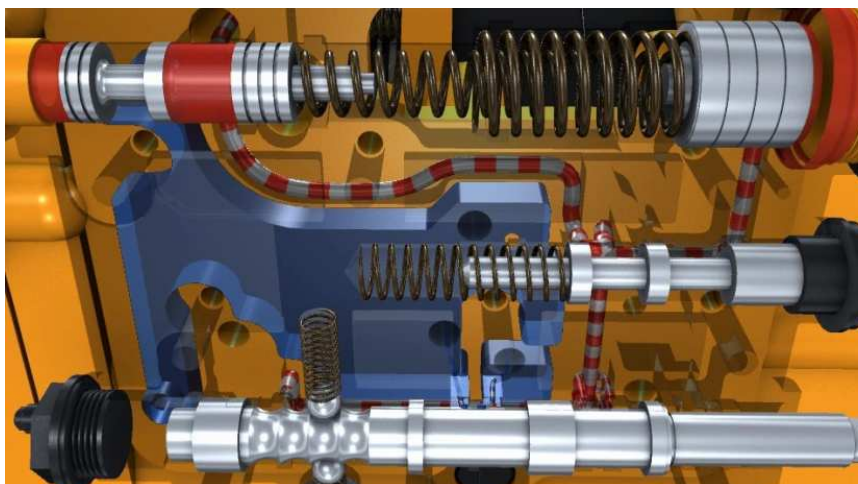
## Section 4 Oil passage system

(4) Principle of speed-control valve

- When the rod of speed-control valve is placed in the position of gear II, oil inlet of gear II is connected to cylinder port of gear II, pressure oil flows into cylinder of gear II. At this time, oil inlet of gear I and reverse gear continue being cut off (refer to picture 1).
- When the rod of speed-control valve is back to neutral, the rod cuts off the passage between oil inlet of gear II and cylinder port of gear II, and cylinder port of gear II is connected to returning port (refer to picture 2).
- Under the action of coiled spring, piston of gear II returns, and compress the oil in the cylinder of gear II out.



图一

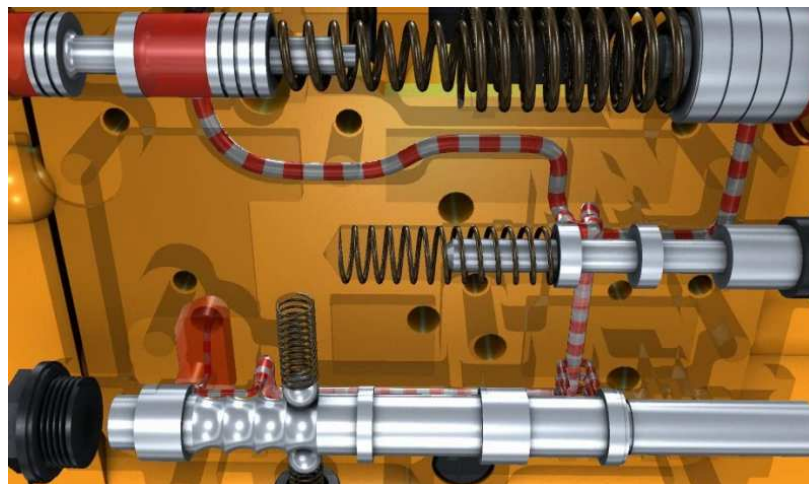


图二

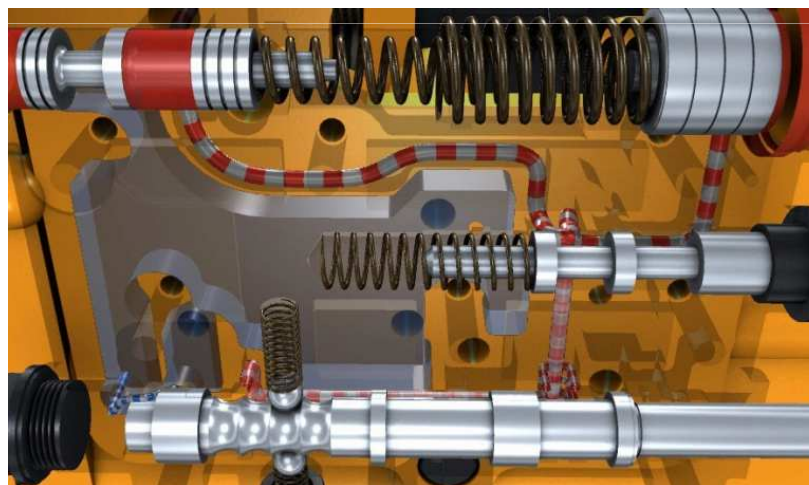
## Section 4 Oil passage system

(4) Principle of speed-control valve

- When the rod of speed-control valve is placed in the position of reverse gear, oil inlet of reverse gear is connected to cylinder port of reverse gear, pressure oil flows into cylinder of reverse gear. At this time, oil inlet of gear II and gear I continue being cut off (refer to picture 3).
- When the rod of speed-control valve is back to neutral, the rod cuts off the passage between oil inlet of reverse gear and cylinder port of reverse gear, and cylinder port of reverse gear is connected to returning port (refer to picture 4).



图三



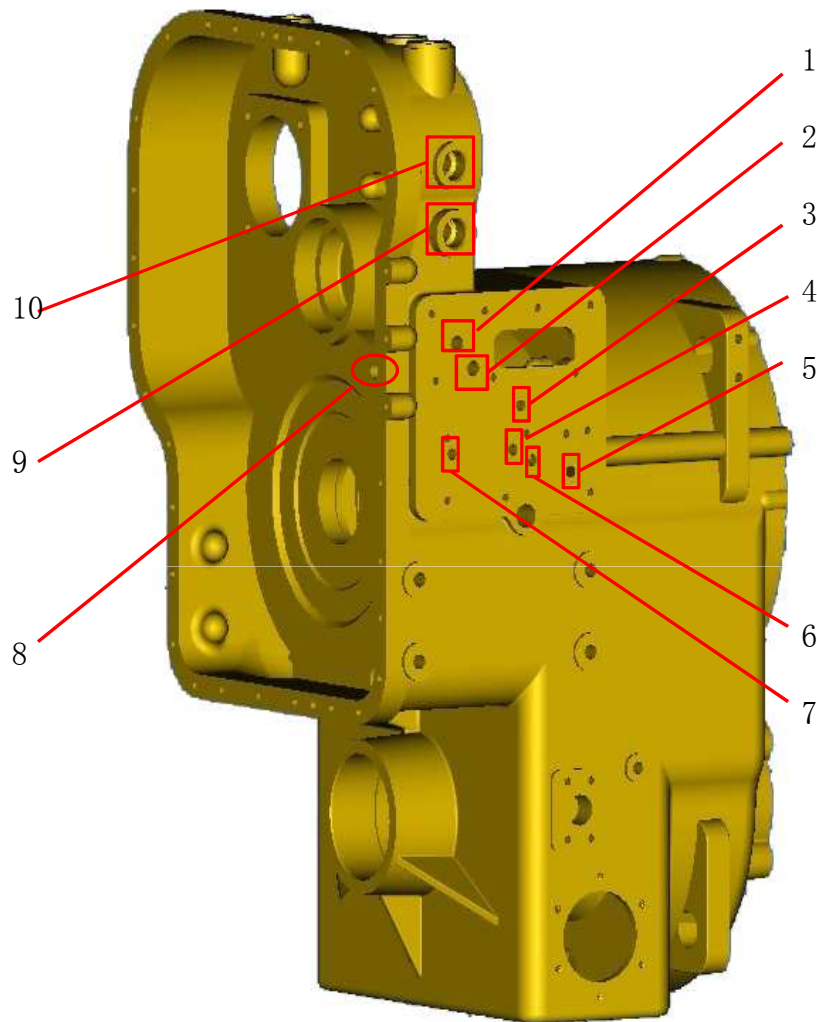
图四

## Section 4 Oil passage system

(5) oil passage of speed-control valve

• Oil from cylinders of three gears return to gearbox through hole 3 and 4, spraying on clutch and other parts to lubricate and cool them, then to oil tank.

1-oil inlet of speed-control valve  
2-oil inlet of torque converter 3,4-  
returning port of gearbox  
5-channel of gear I  
6-channel of gear II  
7-channel of reverse gear  
8-connecting with hole 2 9-  
connecting with hole 1  
10-oil outlet of speed-control pump



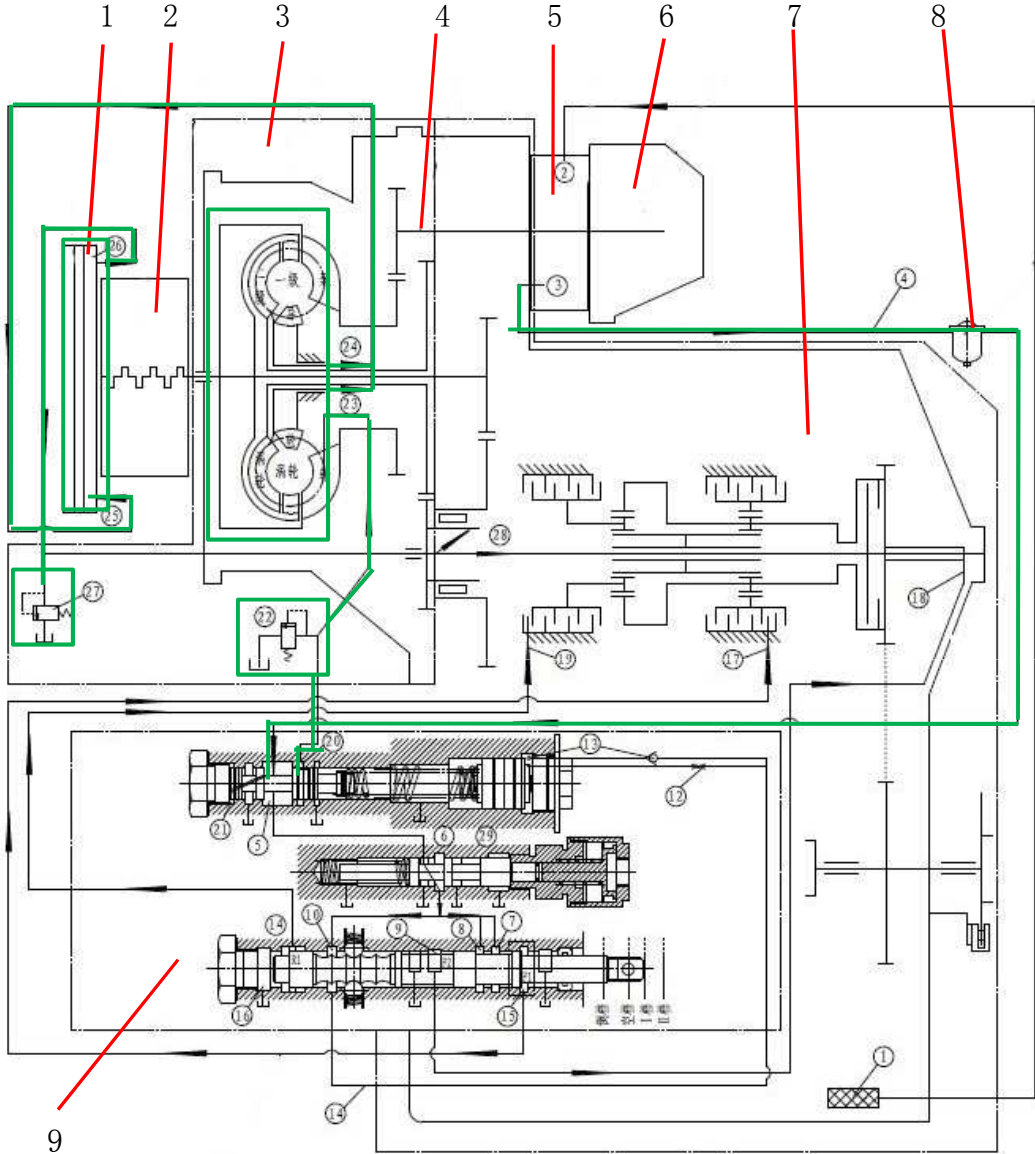


## Section 4 Oil passage system

### 3.Oil passage of torque converter

●When cylinder ports are full of pressure oil, pressure oil starts to flow into torque converter, and to keep Certain pressure in the working chamber of the torque converter during operation.

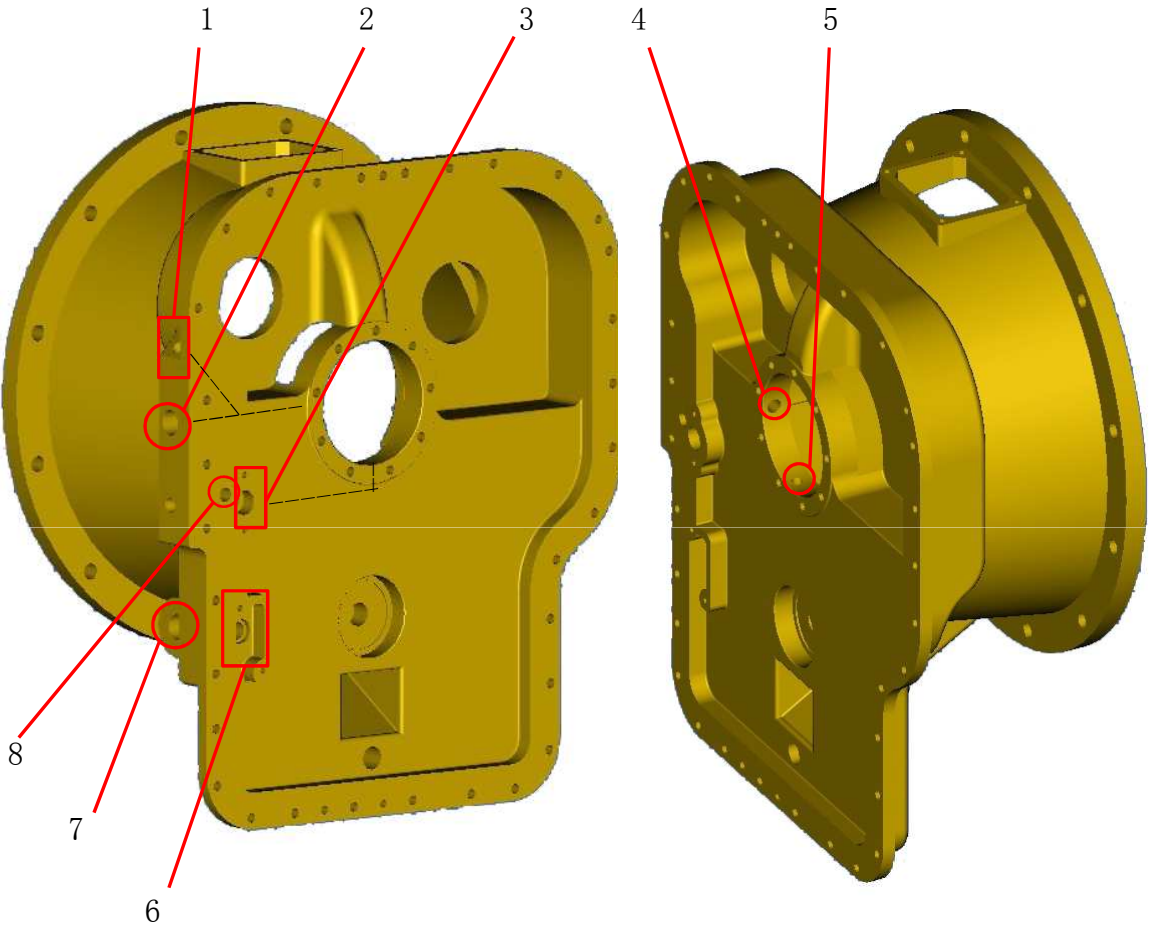
- 1-radiator
- 2-engine
- 3-torque converter
- 4- working wheel
- 5-speed-control pump
- 6-working pump
- 7-oil filter
- 8-gearbox
- 9-speed-control valve



### Section 4 Oil passage system

(1) Ports in shell of torque converter

- 1-fix temperature sensor
- 2-returning port of torque converter, connecting with radiator
- 3-fix pressure regulating valve
- 4-connecting with 2
- 5-connecting with 8
- 6-fix counter pressure valve
- 7-connecting with returning port of radiator
- 8-oil inlet of torque converter

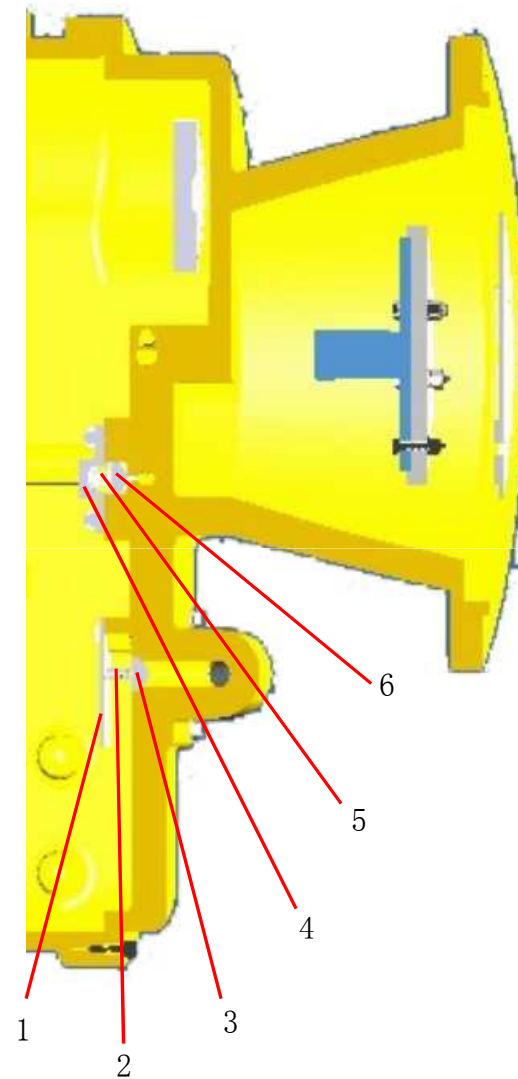


## Section 4 Oil passage system

(2) pressure-control in the torque converter

- Certain pressure should be kept in the working chamber of the torque converter during operation; normally, the pressure at the oil inlet should be 0.45-0.55 Mpa and be adjusted by the oil regulating valve of the converter. Oil regulating valve is composed of cover plate 4, spring 5 and valve rod 6.

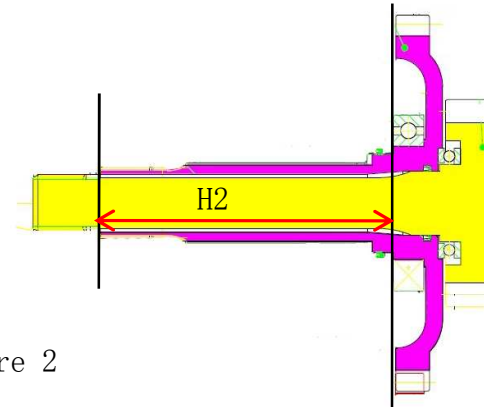
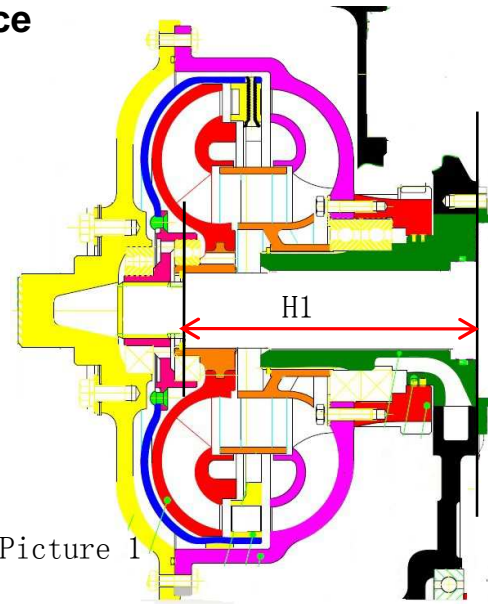
- The excessively low oil pressure will result in cavitation inside the converter and decrease the transmission efficiency; on the contrary, excessively high pressure may reduce seal performance, increase leakage risk and even damage the engine component. the pressure at the oil outlet should be 0.15-0.25 Mpa. Counter pressure valve is composed of cover plate 1, spring 2, and valve rod 3.



## Section 5 Measuring and adjusting of fitting clearance

(1) Gap between second-stage input shaft and retaining ring

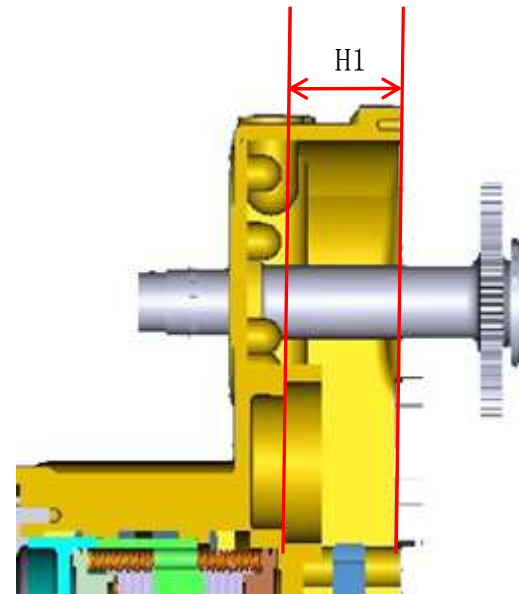
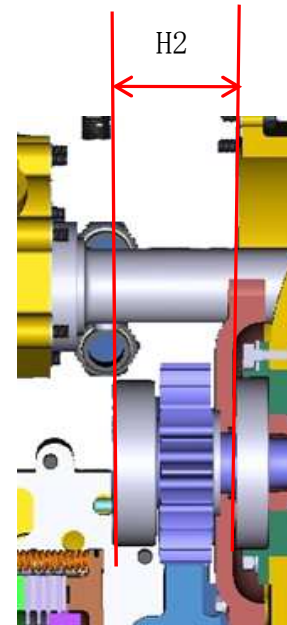
- Measure the depth H1 between guide wheel and second-stage turbine retaining ring as shown in picture 1.
- Measure the length H2 between the end of bearing and the end of second-stage input shaft, as shown in picture 2.
- Select and assemble right spline shim to keep the difference between H1 and H2 in the range of 0.3mm and 0.7mm.



## Section 5 Measuring and adjusting of fitting clearance

(2) Gap between bearing of the first-stage input gear and shell of gearbox.

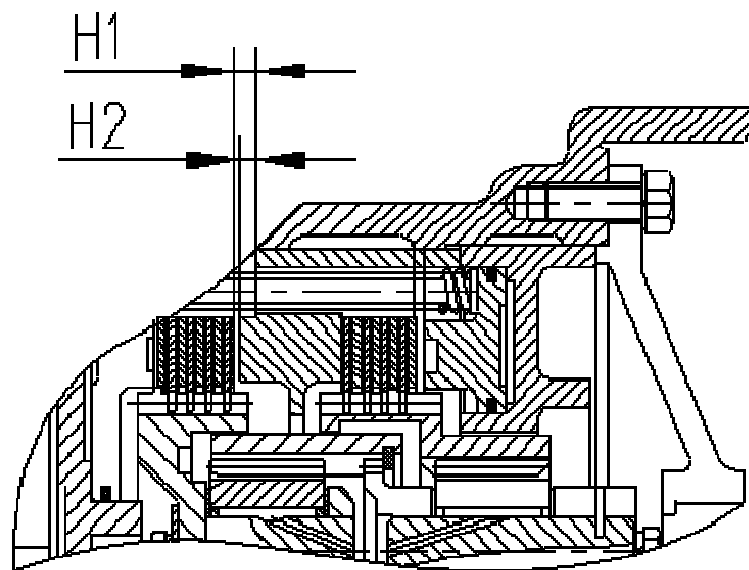
- Measure the length H1 between the section of the gearbox and the section of the bearing seat which is for the bearing of the first-stage input shaft.
- Measure the length H2 between the section of the shell of the torque converter and external section of the bearing of the first-stage input gear.
- The thickness of the shim is decided by the difference between H1 and H2, select and assemble right gasket combined surface of gearbox and torque converter, to keep the difference between H1 and H2 in the range of 0.3mm and 0.7mm.



## Section 5 Measuring and adjusting of fitting clearance

(3) Clearance between discs of reverse gear

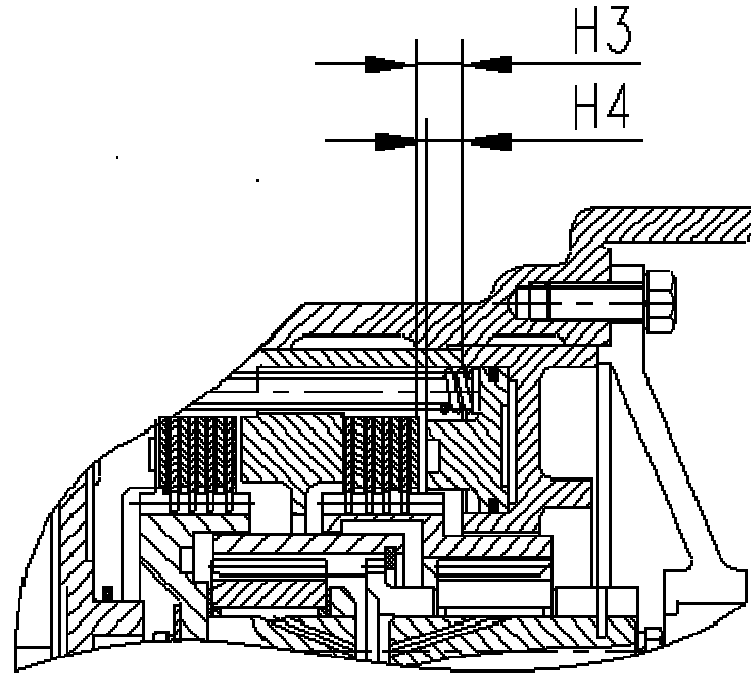
- Measure the length H1 between the last disc and the combined surface of shell and isolated bracket.
- Measure height H2 of the bulge of isolated bracket.
- The difference should be in the range of 0.9mm and 2.8mm.



## Section 5 Measuring and adjusting of fitting clearance

(4) Clearance between discs of gear I

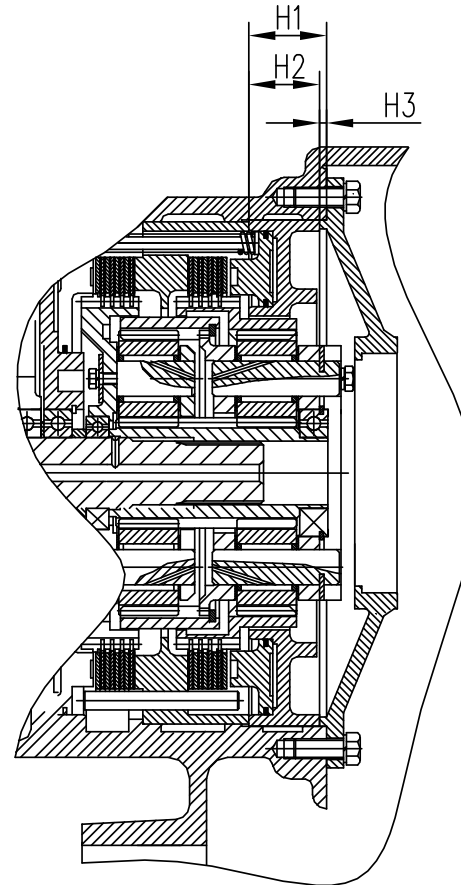
- Measure the length H3 between the last disc and left section of isolated bracket.
- Measure the length H4 between the left section of the piston of gear I and the left section of the cylinder of gear I .
- The difference between H3 and H4 should be kept in the range of 1.4mm and 2.8mm.



## Section 5 Measuring and adjusting of fitting clearance

(5) Clearance between cylinder of gear I and middle cover

- Measure the length H1 between the cylinder of gear I and the combined surface of shell and middle cover.
- Measure the axial length H2 of cylinder of gear I .
- Measure the height H3 of the bulge of the middle cover.
- To keep this formula  $(H1 - H2 - H3 < 0.1\text{mm})$  correct.

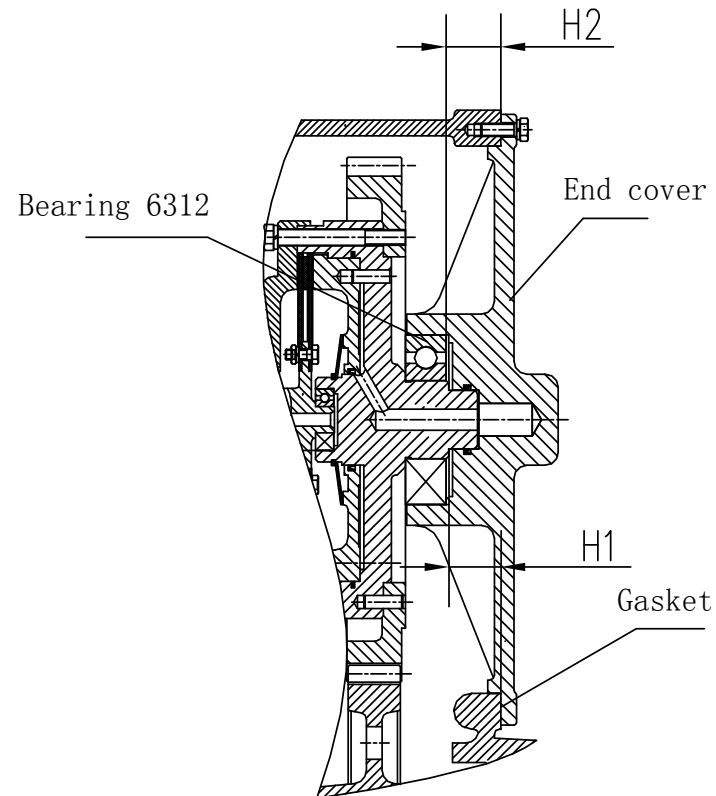




## Section 5 Measuring and adjusting of fitting clearance

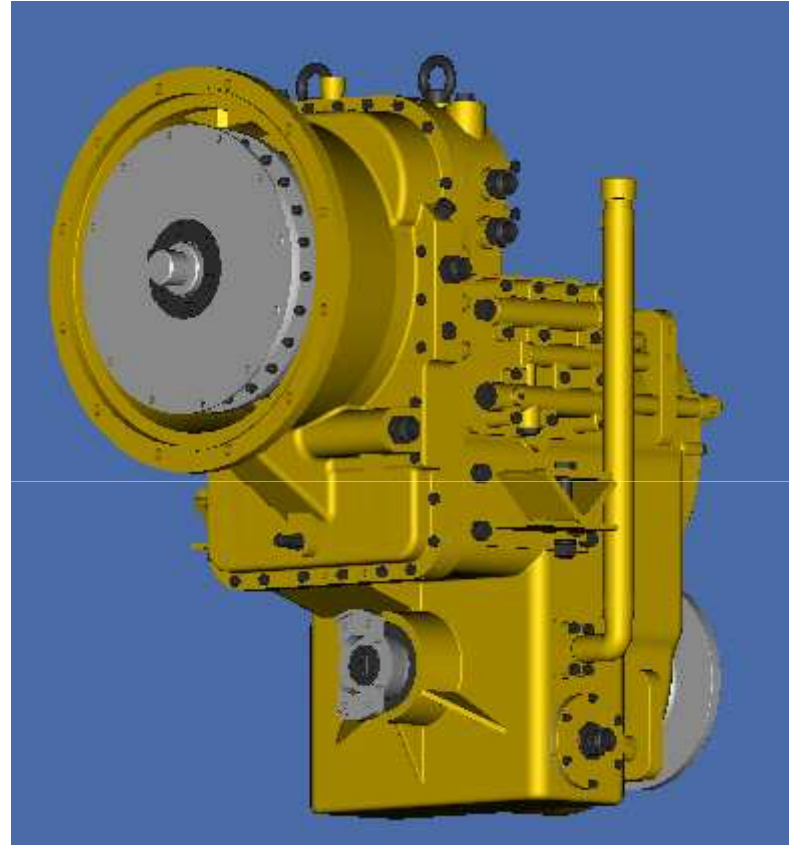
(6) axial clearance of the bearing of gear II cylinder.

- Measure the length H1 between the upper section of the bearing of gear II cylinder and section of gearbox shell.
- Measure the length H2 between undersurface in bearing seat in the end cover and the combined surface of end cover and gearbox shell.
- Select the gasket according to the difference of H1 and H2, and assemble this gasket between the combined surface, to keep axial clearance in the range of 0.3mm and 1mm.



## Section 6 Typical troubleshooting

- Failure symptoms: oil in oil pan of gearbox rises automatically .
- Causes to such a failure: The oil seal of the steering pump or working pump has been damaged, and the oil of the hydraulic system flows into the oil pan through the gearbox of the torque converter which results in the oil increase, therefore, the oil seal should be replaced with a new one according to needs.



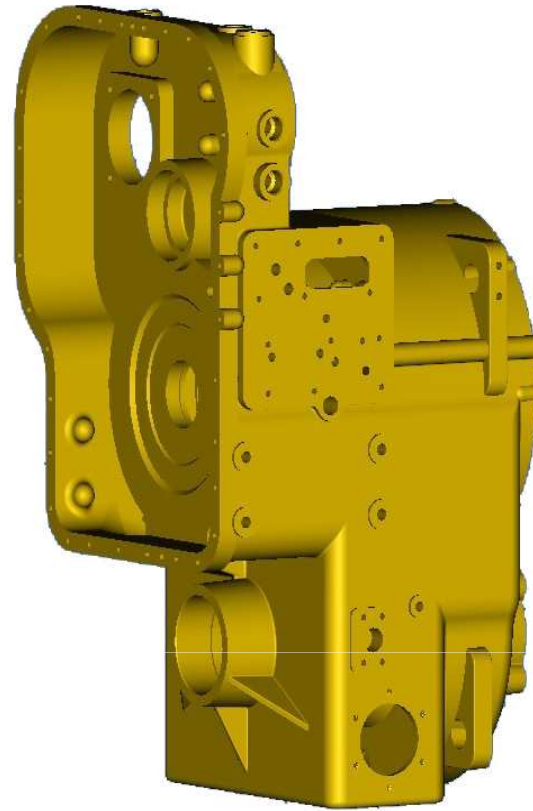
## Section 6 Typical troubleshooting

- Failure symptoms: plenty of aluminum swarf or metal swarf exists on oil pan of gearbox and the oil temperature increases.
- Causes to such a failure:
  - (1) Large amount of aluminum swarf contained in the oil indicates the friction between the working wheels, meanwhile, the transmission efficiency reduces accompanying with working oil heating.
  - (2) Large amount of copper swarf contained in the oil indicates the dry grind or slip between the active and driven friction discs. Check whether the hydraulic oil level and the speed shifting pressure are normal or not, if yes, it indicates the improper installation of the active and driven friction discs or the deformation thereof.
  - (3) Large amount of iron swarf contained in the oil indicates the slip of the overrun clutch, thus the overrun clutch should be detached and inspected.



## Section 6 Typical troubleshooting

- Failure symptoms: gear II has normal pressure but gear I and reverse gear fail to boost
- Causes to such a failure: firstly check whether the connecting bolt of the middle cover and the box is broken; secondly, check whether the axial play between the middle cover and hydraulic cylinder is controlled in the range of 0.1 to 0.3 mm.
- Failure symptoms: gear I and gear II have normal pressure but reverse gear fails to boost
- Causes to such a failure: It is needed to check whether the reverse position of the gearbox has cracks, for said failure may occur under the condition of high system pressure.



## Section 6 Typical troubleshooting

- Failure symptoms: gear II and reverse gear have normal pressure but gear I fails to boost

- Causes to such a failure:

- (1) The oil seal of the piston of gear I is damaged.
- (2) The piston of the gear I has sand hole.

- Failure symptoms: gear I and reverse gear have normal pressure but gear II fails to boost.

- Causes to such a failure:

- (1) the rotary oil seal at the matching portion of the middle cover of the rear cover of the gearbox and the hydraulic cylinder of gear II is damaged or lacked.
- (2) the O-shaped ring at the oil passage outlet of the gear II at the connecting part of the box and the rear cover is damaged.
- (3) the three piston guide pins in the hydraulic cylinder of gear II drop.



# Chapter V Drive Axle System

## Section I Overview of Drive Axle

- Composition of drive axle system
- Functions of drive axle

## Section II Structural Principle of Main Drive

- Structure of main drive
- Functions of main drive

## Section III Structural Principle of Differential

- Structure of differential
- Working principle of differential
- Functions of differential

## Section IV Half Shaft

## Section V Structural Principle of Wheel Reducer

- Structure of wheel reducer
- Working principle of wheel reducer
- Functions of wheel reducer

## Section VI Power Transmission Route of Drive Axle

## Section VII Drive Shaft

## Section VIII Universal Joint

- Structure
- Maintenance

## Section IX Tires

## Section X Gap Adjustment of Drive Axle

- Measurement of bearing rotation torque
- Adjustment of engagement status for spiral bevel gears
- Measurement method of engagement contact area
- Adjustment method for engagement contact area
- Differences between front and rear drive axles

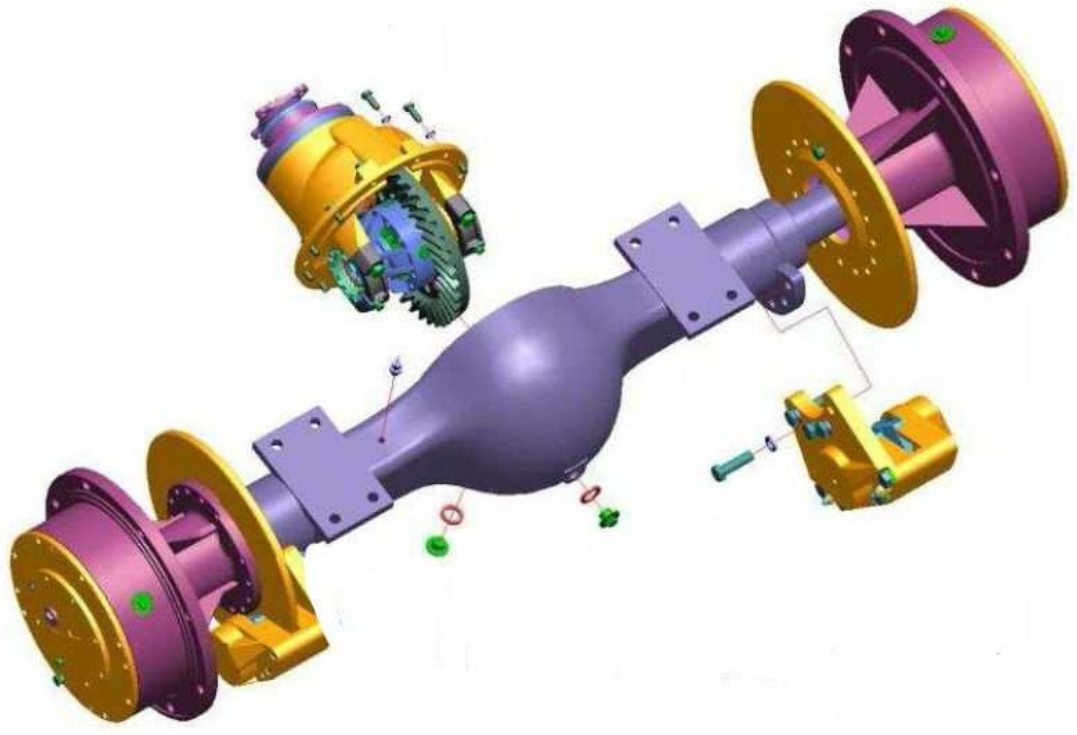
## Section XI Judgment of Common Malfunctions

- Abnormal wear of spiral bevel gears
- Noise of differential
- Noise of wheel reducer
- Oil permeation of brake disc
- Oil leakage of main drive

# Section I Drive Axle Assembly

## I. System composition

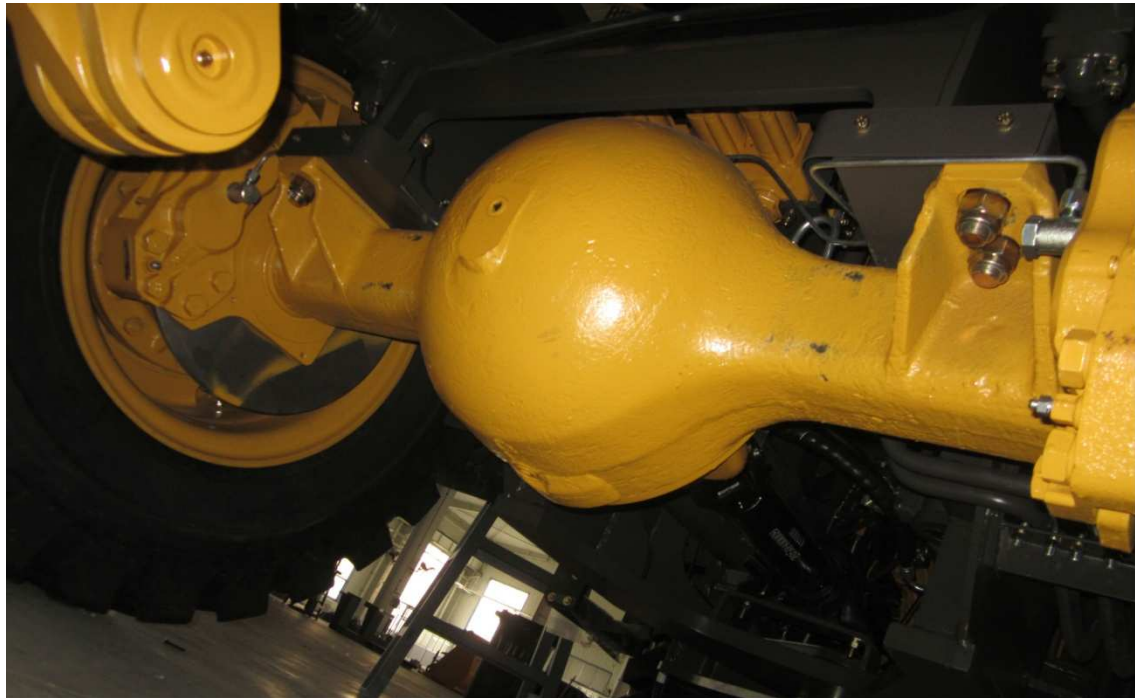
- The drive axle is located at the end of the transmission system and is the general term for all transmission mechanism between the drive shaft and the drive wheels.
- The drive axle of the loader is mainly composed of axle housing, main drive (including differential), half shaft, wheel reducer, and tire and wheel rim assemblies.
- The drive axle is installed on the frame to carry the load transmitted from the frame and convey to the wheels. The housing of the drive axle is the mounting carrier for main drive, half shaft, and wheel reducer.



# Section I Drive Axle Assembly

## II. Functions

- The drive axle is mainly functioned to transmit the torque from the drive shaft to the drive wheels.
- It further reduces the speed and increases the torque for the power transmitted from the transmission, alters the rotating axis of input shaft by 90°, and transmits to the wheel reducer via differential and half shaft.
- The speed ratio of the main drive is 4.625, the speed ratio of wheel reducer is 4.875, and the total speed ratio is 22.55.
- The drive axle further reduces the output speed of transmission, increases the output torque, and realizes different speeds between drive wheels on two sides for steering purpose.
- In addition, the housing of the drive axle can carry the load.

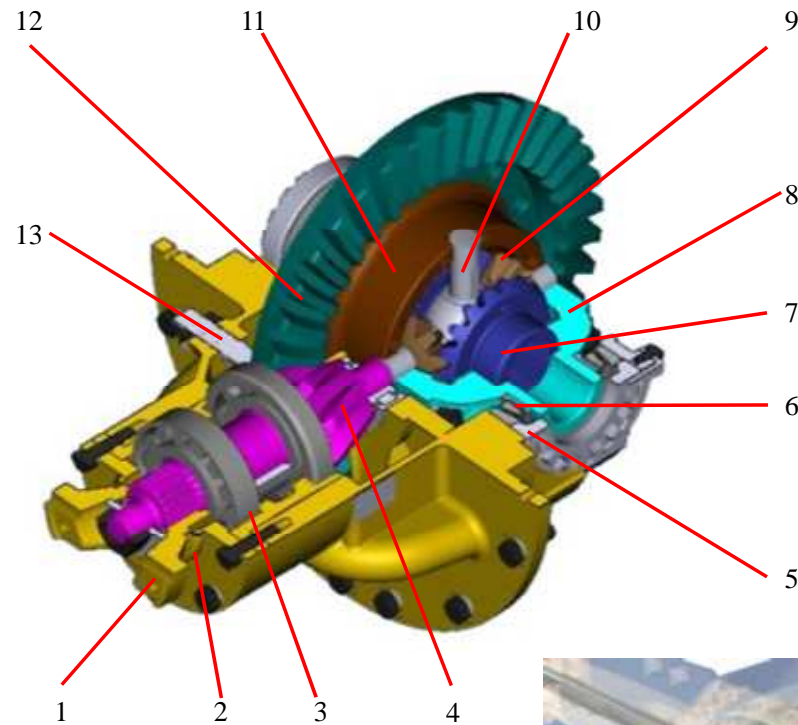




## Section II Main Drive

### I. Structure

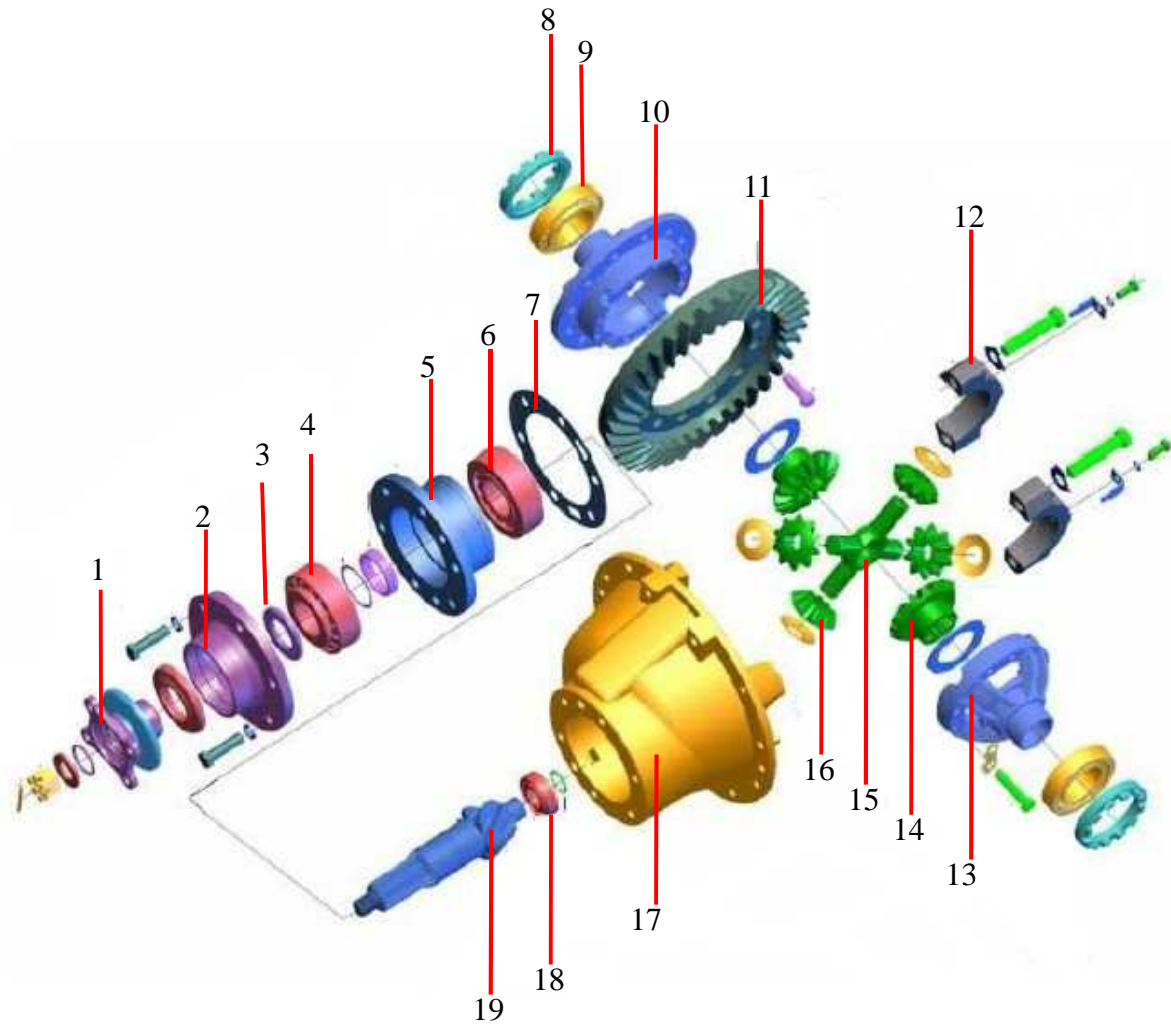
- The main drive mainly includes the drive spiral bevel gear, driven spiral bevel gear, crossing shaft, left and right differential housings, half shaft, and half shaft gear.
- 1 – Input flange
- 2 – Oil seal base
- 3 - Oil seal
- 4 – Drive spiral bevel gear
- 5 - Adjustment nut
- 6 - Tapered roller bearing
- 7 - Half shaft gear
- 8 – Right differential housing
- 9 - Planetary gear
- 10 - Crossing shaft
- 11 – Left differential housing
- 12 – Driven spiral bevel gear
- 13 - Thrust bolt



# Section II Main Drive

## I. Structure

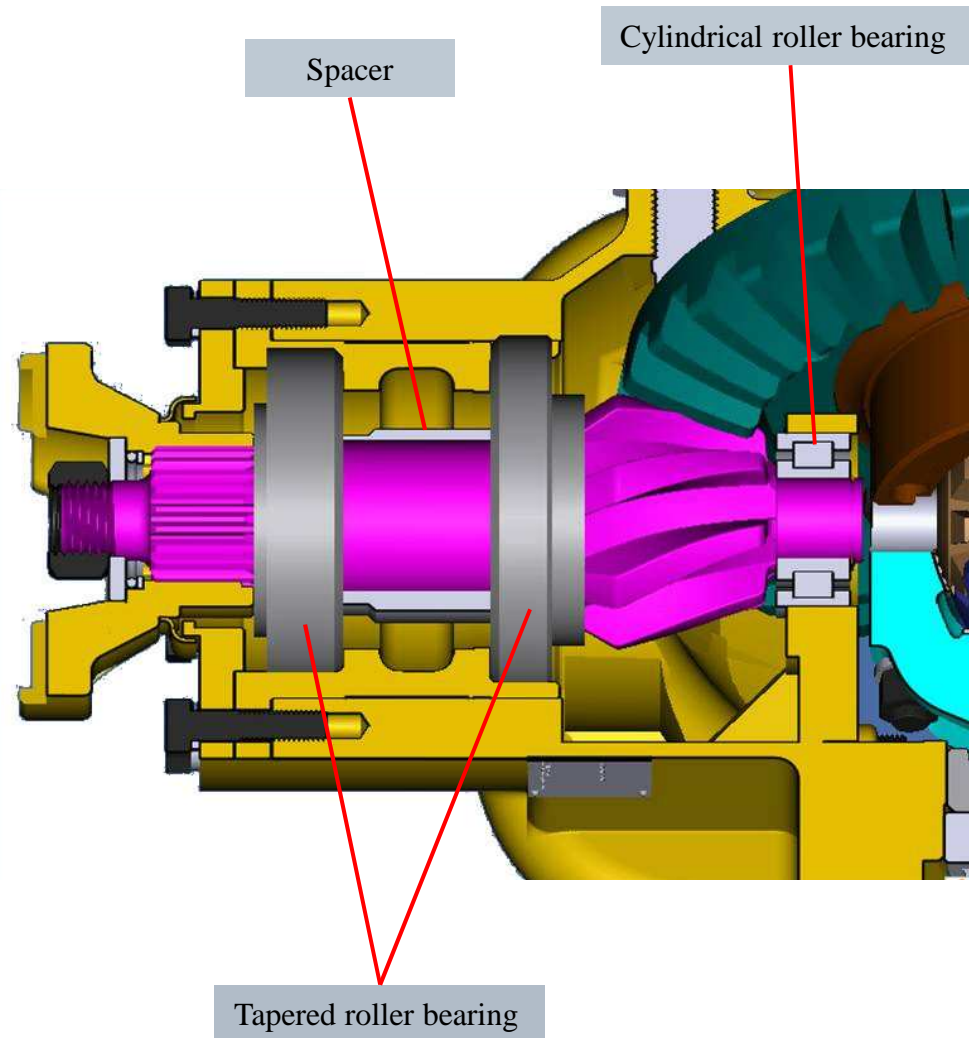
- The structure of main drive becomes clearer and more definite through the explosive view of the main drive.
- 1 – Input flange
- 2 - Bearing cap
- 3 – Thrust washer
- 4 - Bearing
- 5 – Bearing sleeve
- 6 - Bearing
- 7 - Adjustment gasket
- 8 - Adjustment nut
- 9 - Tapered roller bearing
- 10 – Left differential housing
- 11 – Driven spiral bevel gear
- 12 - Differential bearing cap
- 13 – Right differential housing
- 14 - Half shaft gear
- 15 - Crossing shaft
- 16 – Planetary gear
- 17 – Main drive housing
- 18 - Rolling bearing
- 19 – Driven spiral bevel gear



## Section II Main Drive

### I. Structure

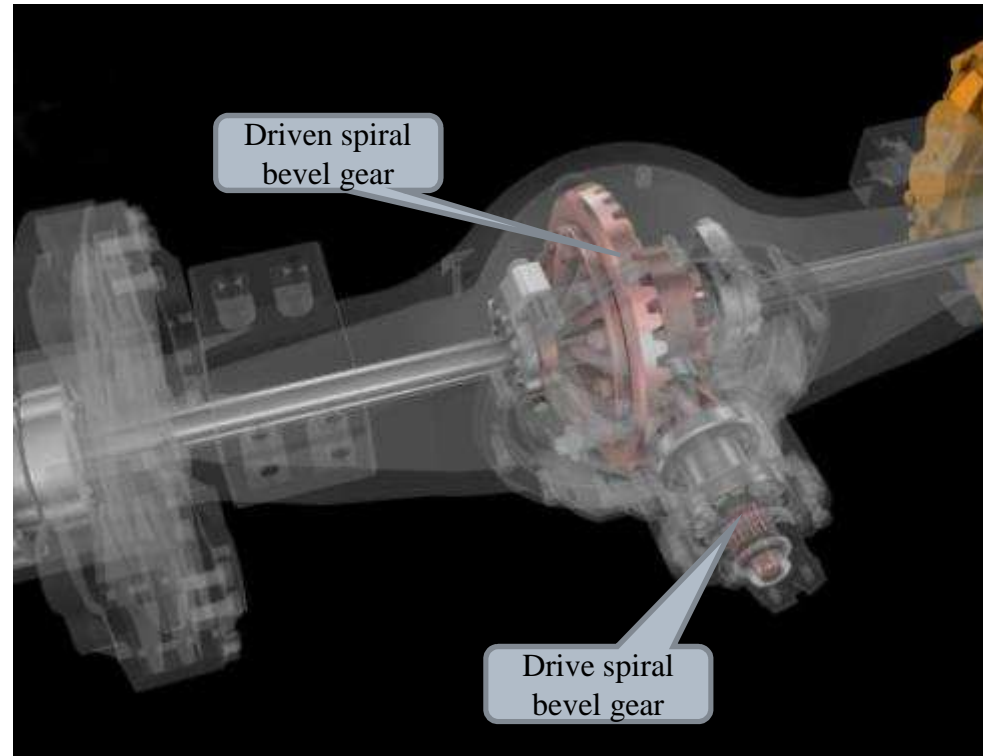
- To ensure sufficient carrying rigidity of the drive spiral bevel gear, the drive spiral bevel gear is integrated with the shaft. Its front support is on two tapered roller bearings that come into close contact by small ends and its rear support is on the cylindrical roller bearing to form transversal support.
- While assembling the main reducer, the tapered roller bearings shall have certain assembly preload, namely the tapered roller bearings shall be applied with certain preload on the basis of eliminating the bearing gap. To adjust the preload of tapered roller bearings, the adjustment washer is installed on one end of the spacer bushing between the bearing inner races. If too tight, increase the total thickness of washer. If too tight, increase the total thickness of washer. Otherwise, reduce the total thickness of washer.



## Section II Main Drive

### II. Functions

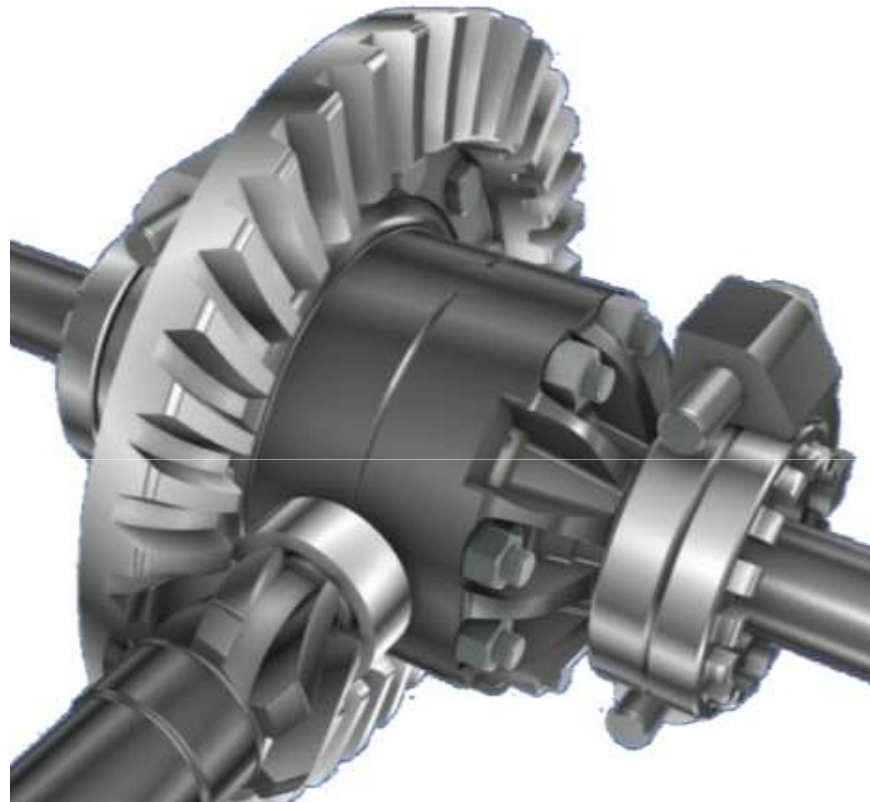
- The main drive is functioned to further reduce the speed and increase the torque for the power transmitted from the transmission and alters the rotating axis of input shaft by 90° and transmits to the wheel reducer via differential and half shaft.



## Section III Differential

### ● I. Structure

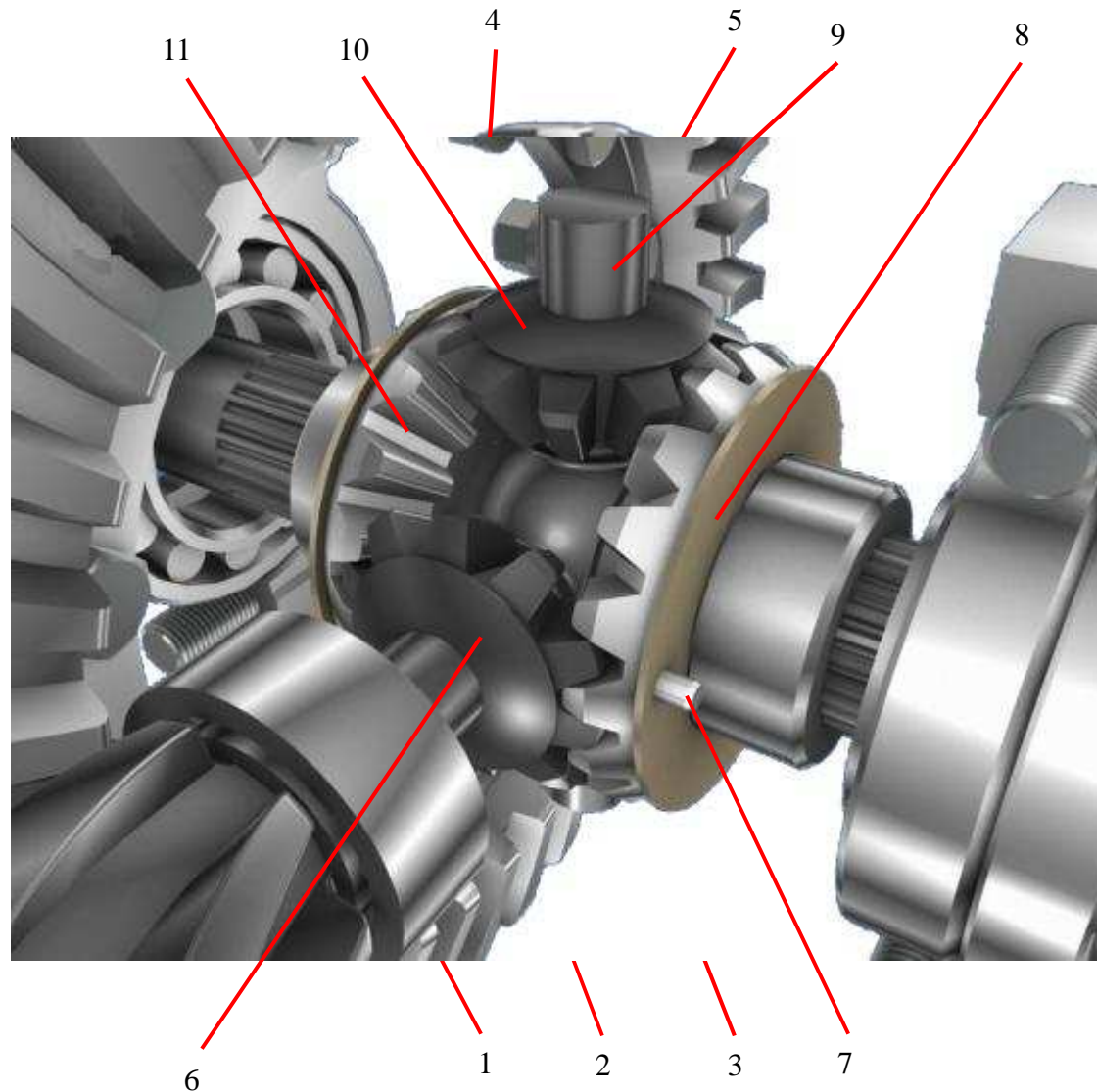
- The differential for the drive axle of the loader adopts symmetric bevel gear differential structure and is mainly composed of bevel gears, left/right differential housings, crossing shaft, and half shaft gears.
- The left and right differential housings are fitted by bolts. The driven spiral bevel gear of the main drive is fixed on the flange of right differential housing by bolts.
- The journal of the cross shaft is embedded in the bore formed by corresponding slots on the parting surface between left and right housings. Each journal is attached with a straight bevel gear (planetary gear) under floating state, which is engaged with two straight bevel half shaft gears.
- The journals of two half shaft gears are supported in corresponding left and right seat bores of the differential housings respectively and are connected with half shaft via inner spline.



# Section III Differential

## I. Structure

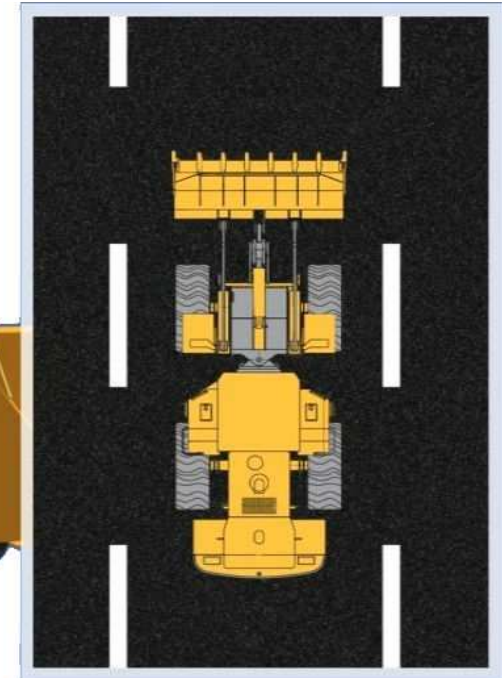
- The structure of the differential becomes clearer through the comparison between the statuses before and after the differential housings are disassembled.
- 1 – Drive spiral bevel gear
- 2 - Cylindrical roller bearing
- 3 – Right differential housing
- 4 – Driven spiral bevel gear
- 5 – Left differential housing
- 6 – Planetary gear
- 7 - Locating pin
- 8 – Planar friction-reduction gasket
- 9 - Crossing shaft
- 10 – Spherical friction-reduction gasket
- 11 - Half shaft gear



# Section III Differential

## II. Working principle – Motion characteristics

- The symmetric bevel gear differential adopted by the drive axle of wheel loader is a planetary gear mechanism. The differential housings and planetary gear shaft (cross shaft) are integrated to form the planetary carrier. In addition, the differential is functioned as a drive part as the differential housings are rigidly connected with the driven spiral bevel gear of the main drive.
- The power is transmitted from the drive spiral bevel gear of main reducer to the driven spiral bevel gear and is transmitted to the drive wheels in turn through differential housings, cross shaft, planetary gear, half shaft gear, and half shaft.
- During the linear traveling of the vehicle, the wheels on two sides rotate at same speed and the acting forces applied onto the half shaft gears are equal. In such case, the planetary gears of the differential remain still and the engaged half shaft gears are locked so that the differential housing drives the crossing shaft and the planetary gear rotates around the axis of the half shaft. In such case, the half shafts on two sides maintain same output speeds to realize linear traveling.



Linear traveling

## Section III Differential

### II. Working principle – Motion characteristics

- While the machine is making a turn, due to different rolling distances between the outer wheels and the inner wheels, two additional forces in opposite directions are generated on the wheels on two sides to drive the planetary gears for revolution as well as for auto-rotation around own axis. In such case, the speed of the outer half shaft gears is increased on the basis of the speed of differential housing so that the speed of the outer wheels is increased and the speed of the inner wheels is reduced.



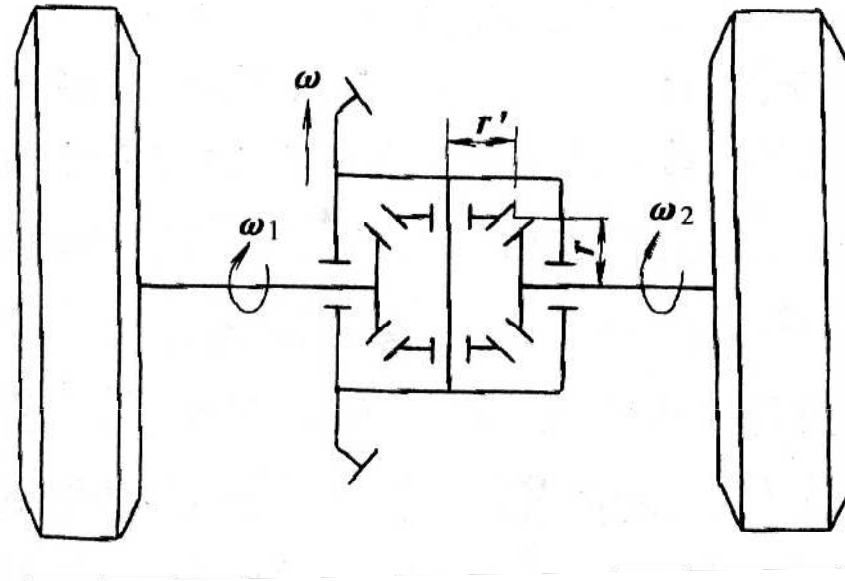
Making a turn



## Section III Differential

### II. Working principle – Motion characteristics

- Assuming that the rotating angular speed is  $\omega$  ( $n_0$  in revolution per minute) and the angular speeds of half shaft gears are  $\omega_1$  and  $\omega_2$  respectively ( $n_1$  and  $n_2$  in revolution per minute respectively), then the following equation is established:
  - $2\omega = \omega_1 + \omega_2$
  - $2n_0 = n_1 + n_2$
  - The above equation is the motion characteristic equation of the differential, which indicates that:
    - ① When the speed of half shaft gear on one side is zero, the speed of the half shaft gear on the other side is two times of the differential housing speed.
    - ② The sum from the speeds of left and right half shaft gears is equal to two times of the speed of the differential housing and is relevant to the speed of planetary gear.
    - ③ When the speed of differential housing is zero, if the half shaft gear on one side is rotating under the application of other external torque, the half shaft gear on the other side will rotate same speed in opposite direction.

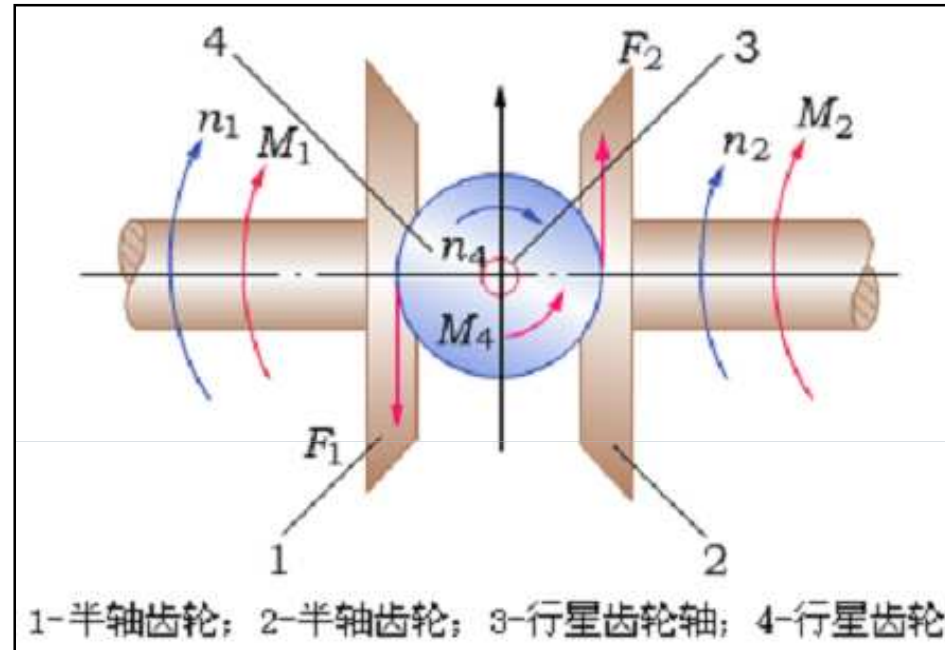


*Working schematic diagram of conventional bevel gear type differential*

## Section III Differential

### II. Working principle – Torque characteristic

- For symmetric type bevel gear differential, assuming that the torque from the main reducer is  $M_0$ , the torques distributed to the inner and outer half shafts by the differential are  $M_2$  and  $M_1$  respectively, and the friction resistance torque within differential is  $M_R$ , then:
  - $M_2 + M_1 = M_0$
  - $M_2 - M_1 = M_R$
- ① The sum of torques applied onto two half shafts is equal to the torque applied onto the differential.
- ② The symmetric bevel gear differential features really low friction torque  $M_R$ , which can be ignored. The torque is always uniformly distributed, no matter whether the left and right drive wheels are under same speed or not.
- It can be obtained the transmission characteristic of "different speeds without different torques" for conventional differential from above analysis.
- This characteristic can meet the traveling and operating needs of loader on common roads. However, when the loader is operating under extremely poor ground, it will seriously impair the trafficability of the loader.



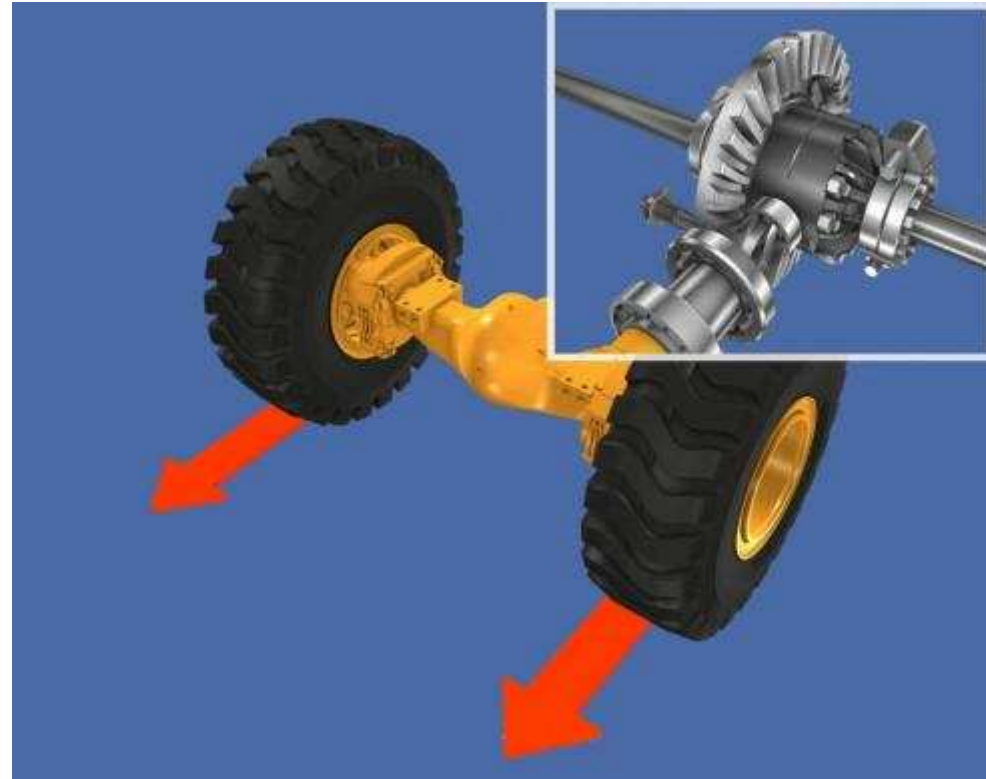
**Diagram for torque distribution of differential**

1 – Half shaft gear 2 – Half shaft gear 3 – Planetary gear shaft 4 – Planetary gear

# Section III Differential

## III. Functions

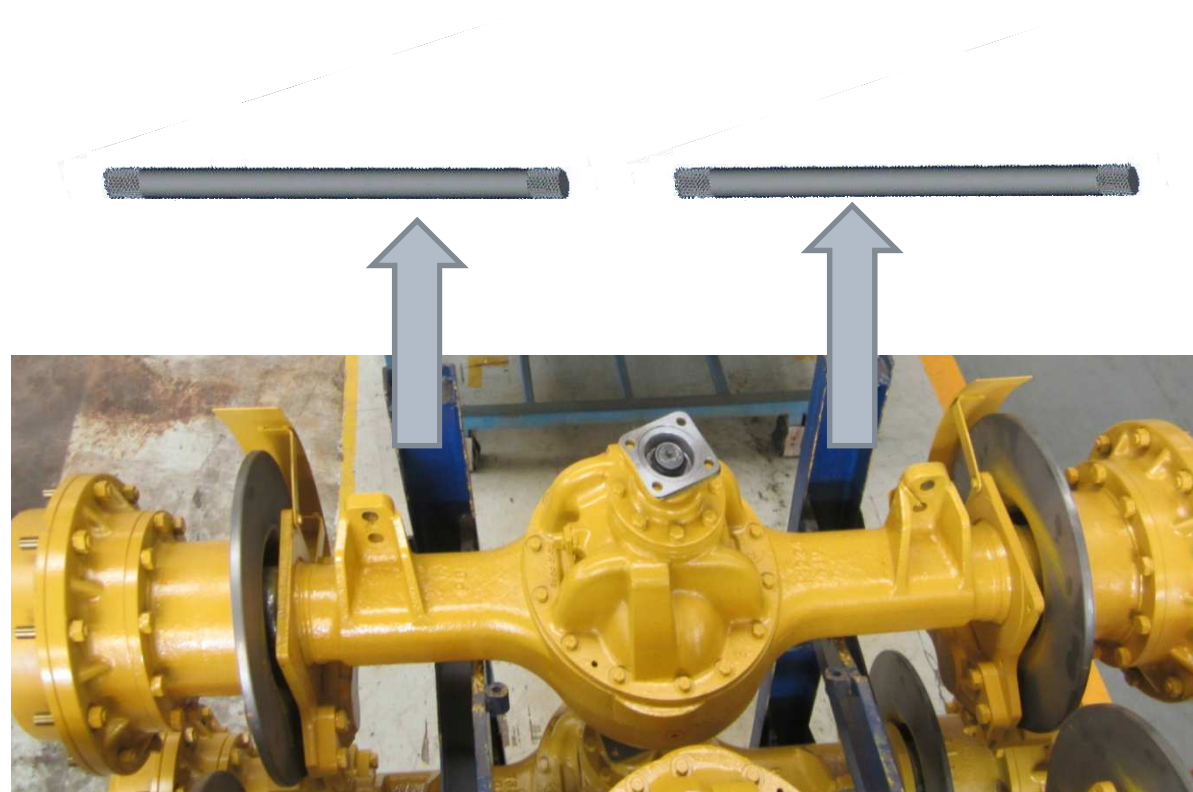
- The structure of the differential becomes clearer through the comparison between the statuses before and after the differential housings are disassembled.
- The differential is mainly functioned for differential function against the unequal speed between left and right wheels, in order to reduce the wear of tires.
- While traveling linearly under same road condition, there is no relative movement between planetary gear and half shaft gear and two shaft shafts rotate under same speed. The differential starts to act under the following conditions:
  - While traveling on rough road.
  - While making a turn: The inner and outer wheels on one same axle have different traveled distances and speeds and the left and right half shafts rotate under different speeds. In such case, there is a relative rotation between planetary gear and half shaft gear to adapt to two unequal rotation speeds.
  - While changing the rotation travels of left and right wheels under unequal air pressure between left and right wheels.



## Section IV Half Shaft

- **Functions**

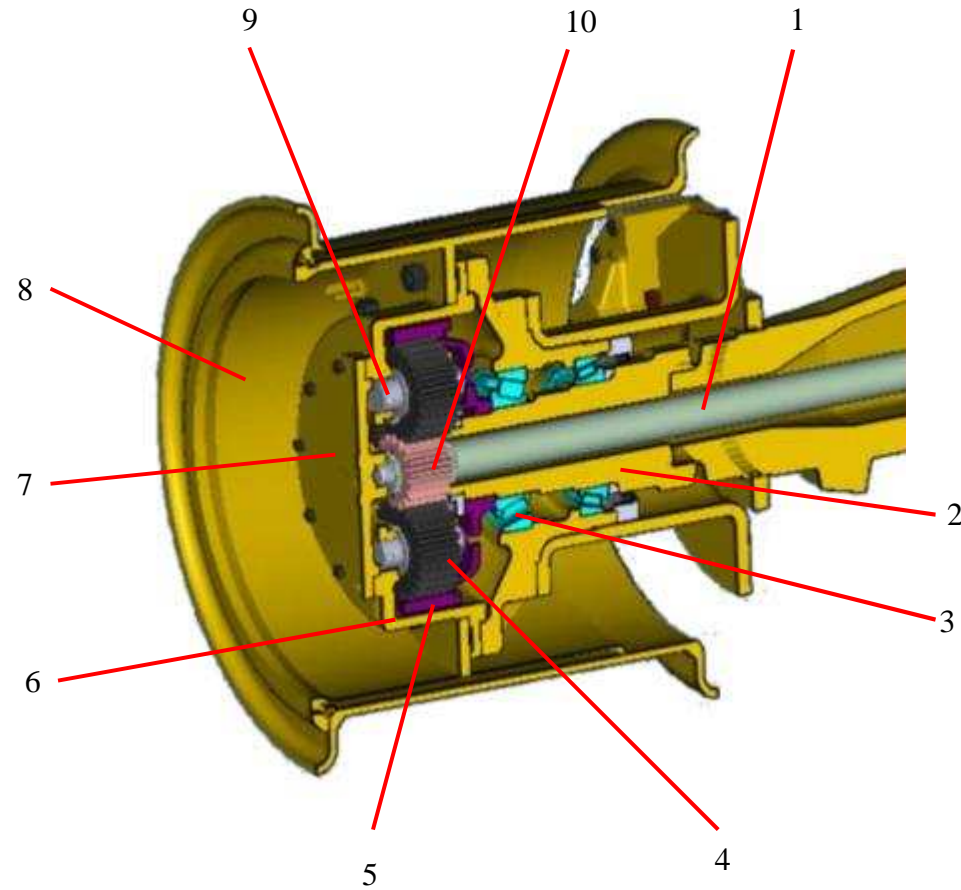
- The half shaft is the solid shaft for transmission of power between differential and wheel reducer. Its inner end is connected with the half shaft gear of differential via spline and its outer end is connected with the sun gear of wheel reducer via spline and retainer. The left and right half shafts of the loader drive axle adopt full floating structure. This structure enables two ends of half shaft to carry only the torque, without any counterforce or bending torque.
- To prevent the axial play of half shaft under the application of the lateral force, the engagement end with the sun gear of wheel reducer is limited by pillar (or steel ball).
- The torque and movement from the main drive is transmitted to the half shaft via differential and then is transmitted to the wheel reducer via half shaft.



# Section V Wheel Reducer

## I. Structure

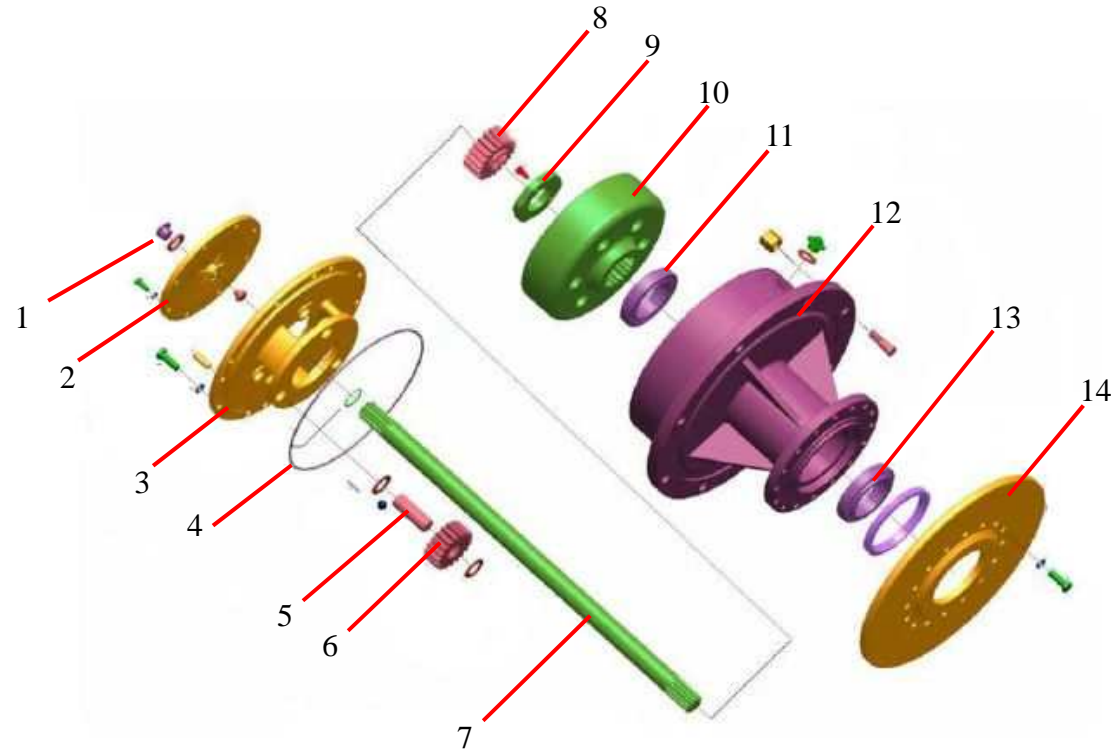
- 1 – Half shaft
- 2 – Balance shaft
- 3 - Tapered roller bearing
- 4 - Planetary gear
- 5 – Inner gear ring
- 6 - Planetary carrier
- 7 – End cap
- I. 8 – Wheel rim assembly
- 9 - Planetary gear shaft
- 10 - Sun gear



# Section V Wheel Reducer

## I. Structure

- The structure of wheel reducer becomes clearer through the explosive view of the wheel reducer.
- 1 - Screw plug
- 2 - End cap
- 3 - Planetary carrier
- 4 - O-ring
- 5 - Planetary gear shaft
- 6 - Planetary gear
- I. 7 - Half shaft
- 8 - Sun gear
- 9 - Lock nut
- 10 - Inner gear ring
- 11 - Rolling bearing
- 12 - Hub
- 13 - Rolling bearing
- 14 - Brake disc



# Section V Wheel Reducer

## II. Working Principle

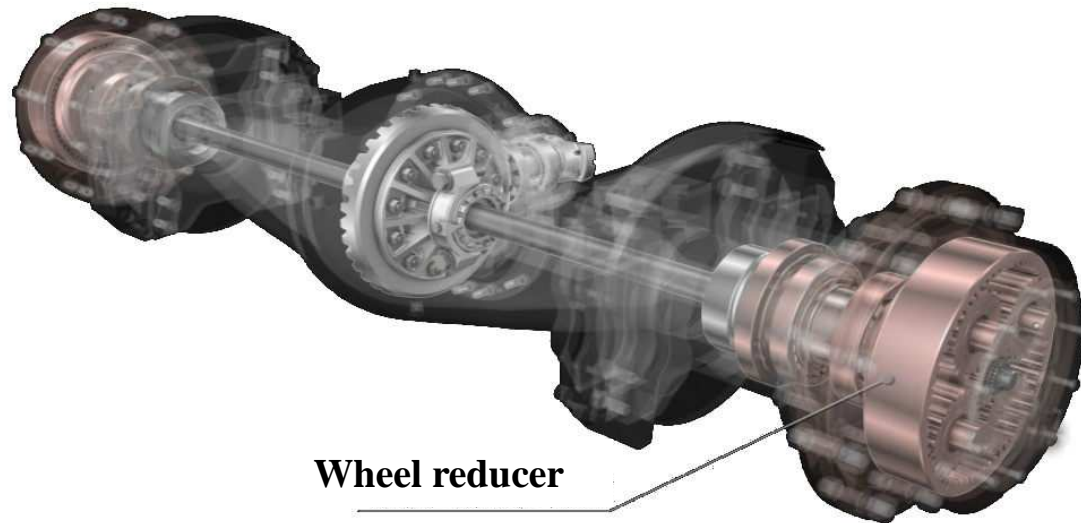
- The sun gear and half shaft are connected together by spline. The gear ring is fixed on the wheel support on two ends of the drive axle housing via spline and it's stationary. The planetary gear that engages with the sun gear and gear ring is installed on the planetary carrier via roller bearing and planetary gear shaft. The planetary carrier and wheel rim are fixed together by wheel rim bolts and therefore the wheel rim rotates along with the planetary carrier.
- The power from the main drive is transmitted to planetary gear via half shaft and sun gear so that the planetary gear rolls along the stationary inner gear ring and drives the rotation of planetary carrier and drive wheels.



# Section V Wheel Reducer

### III. Functions

- The wheel reducer is the final torque enhancement and speed reduction mechanism in the transmission system. It can increase the reduction ratio of transmission to meet the traveling and working requirements of the complete machine. In addition, as it can accordingly reduce the speed ratios of main drive and transmission, it reduces the transmitted torques of these parts and reduces their structural sizes.
- The wheel reducer adopts planetary transmission mechanism. The whole structure is composed of drive sun gear, fixed gear ring, and driven planetary carrier and planetary gear.



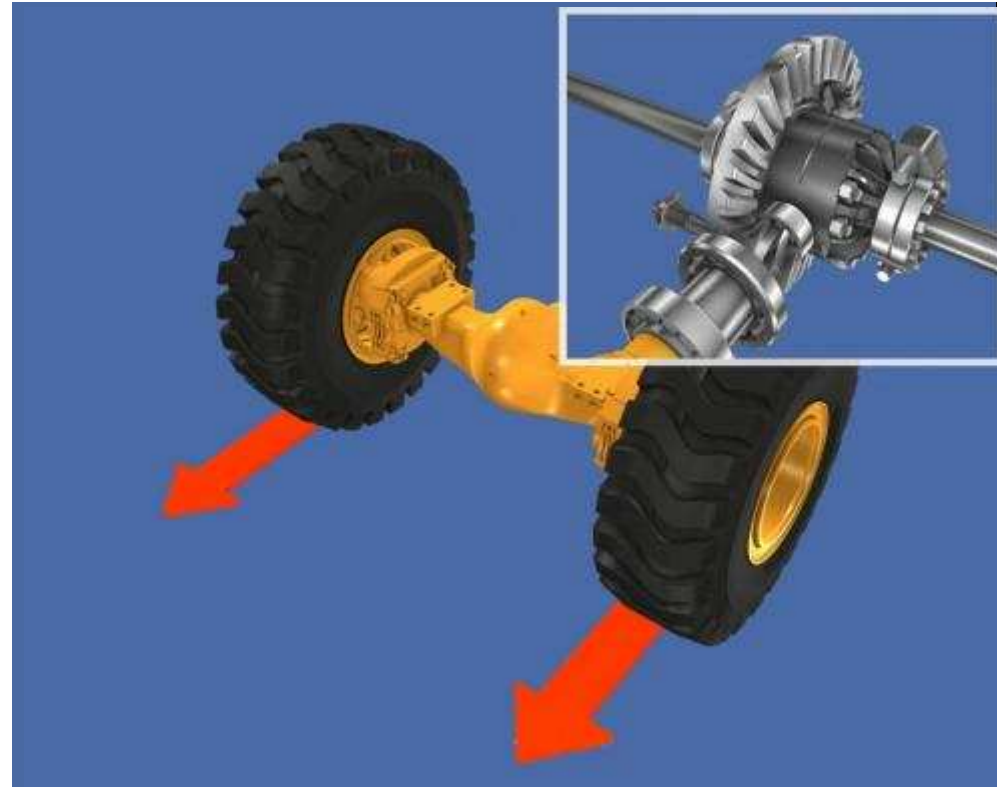


# Section VI Drive Axle Assembly

- **Power transmission route**

Input flange

- Main drive
- Drive spiral bevel gear
- Driven spiral bevel gear
- Differential housing assembly
- Crossing shaft
- Planetary bevel gear
- Half shaft bevel gear
- Half shaft
- Wheel reducer
- Wheel sun gear
- Wheel planetary gear
- Wheel planetary carrier
- Wheel rim assembly
- Tires



## Section VII Drive Shaft

### ● Functions

- The drive shaft is a kind of mechanism in rotation motion for torque transmission and is commonly used as the connection between the transmission and drive axles. The drive shaft is generally composed of pipe yoke assembly, universal joint yoke, and spline shaft assembly.
- During the running of the loader, the relative position between the transmission and drive axle is under frequent change. To prevent the motion interference, the drive shaft is fitted with the sliding spline connector composed of sliding fork and spline shaft, in order to realize the length change of the drive shaft.
- To reduce the wear, the drive shaft is fitted with oil cup containing lubricating grease, oil seal, and spline sleeve, in order to ensure the lubrication of spline shaft within the pipe yoke and prevent the ingress of water and dust into the sliding spline.



Rear drive shaft: for connecting rear drive axle with SDLG transmission



Front drive shaft: for connecting SDLG transmission with front drive axle

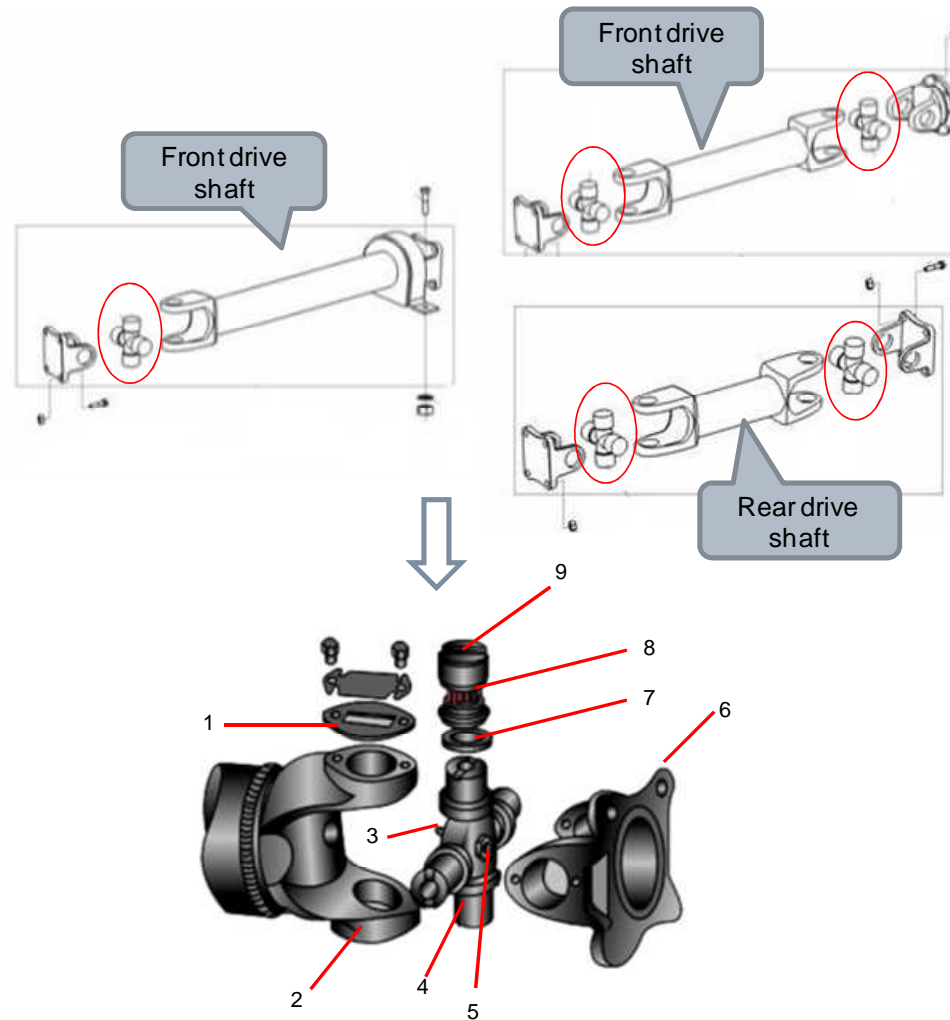
# Section VIII Universal Joint

## ●Structure

●The crossing shaft type rigid universal joint is an extensively applied non-uniform speed universal joint, which allows the maximum angle of 15°~20° between two neighboring shafts. The crossing shaft type universal joint is composed of a crossing shaft, two universal joint yokes, and four needle bearings.

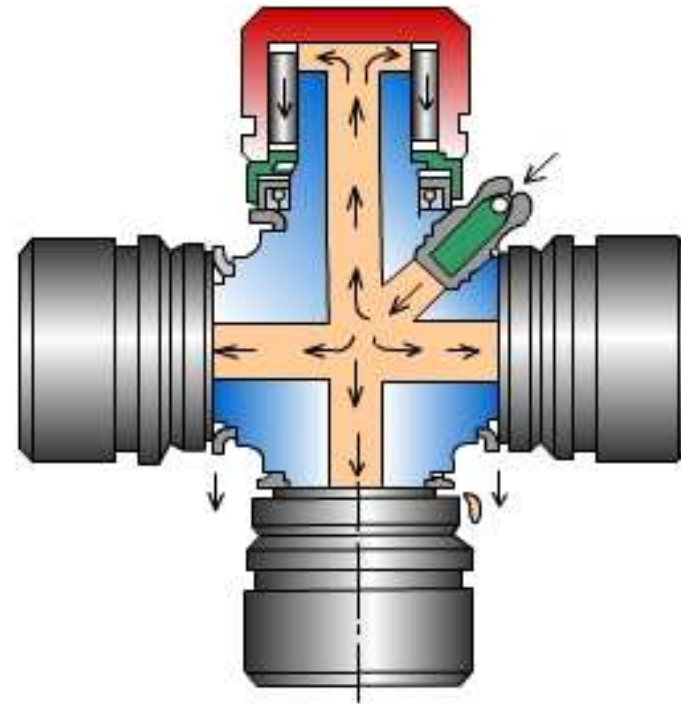
●The bores on two universal joint yokes are attached onto two pairs of crossing shaft journals respectively. In such case, when the drive shaft is rotating, the driven shaft can rotate as well and can swing in any direction around the center of crossing shaft. The needle bearings are fitted between the crossing shaft journal and universal joint yoke bore and the outer rings of the needle bearings are axially located by the circlips.

- 1 - Bearing cap
- 2 - Universal joint yoke
- 3 - Oil nipple
- 4 - Crossing shaft
- 5 - Safety valve
- 6 - Universal joint yoke
- 7 - Oil seal
- 8 - Needle
- 9 - Sleeve



## Section VIII Universal Joint

- **Maintenance**
- To lubricate the bearings, the crossing shaft is generally fitted with oil nipple and oil line that is led to the journal. The lubricating oil can be injected through the oil nipple to the needle bearing at the crossing shaft journal.

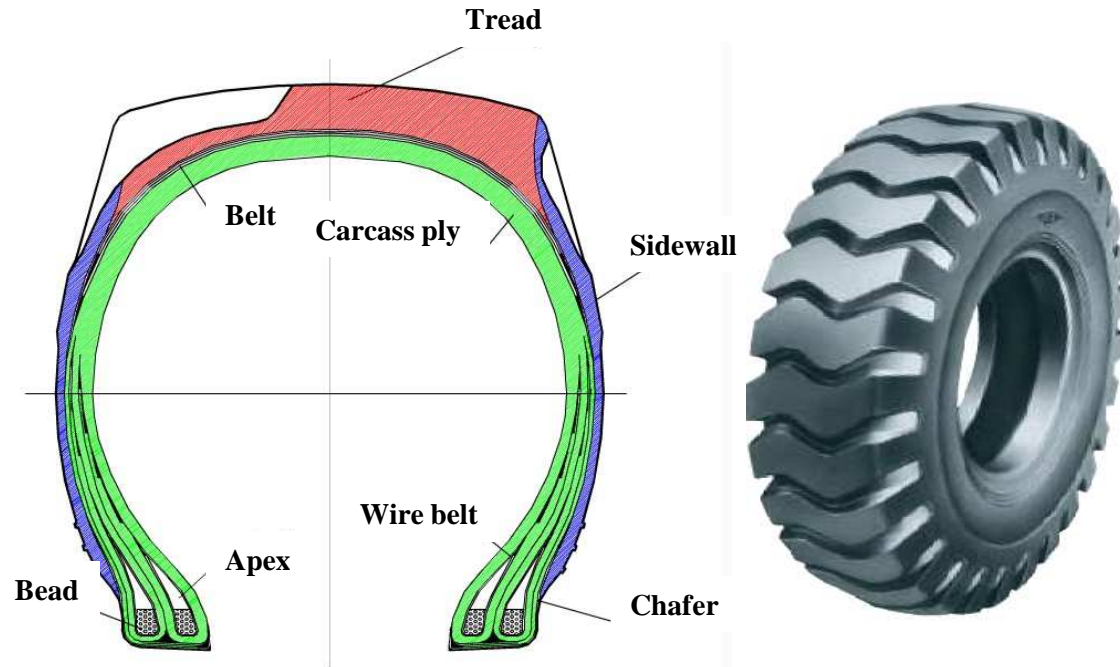


# Section IX Tires

● **Functions**

- The tire assemblies are the main traveling parts and are functioned to carry the weight of complete machine, relieve the impact force from the ground, and generate drive force and braking force by means of the adhesion between tires and road.
- The wheel loader generally adopts low pressure wide tires, featuring large sectional size, good elasticity, and low ground pressure. While traveling or operating on soft foundation, the tire features low sink, high adhesion, and good traction and trafficability. While traveling or operating on rough road, the tire can ensure the good damping and shock absorption performance of the loader.
- Meaning of tire specification (The specification of tires for LG936L is shown below)
- GB2980—17.5—20

Nominal diameter of wheel rim  
 Bias structure code  
 Nominal section width  
 Standard designation

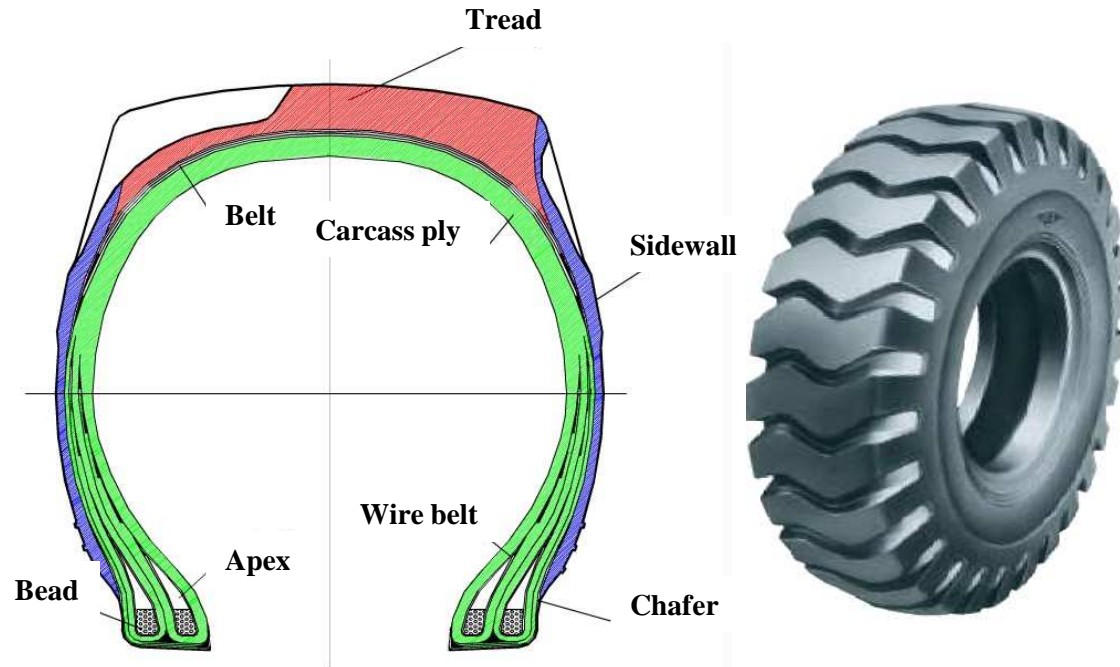
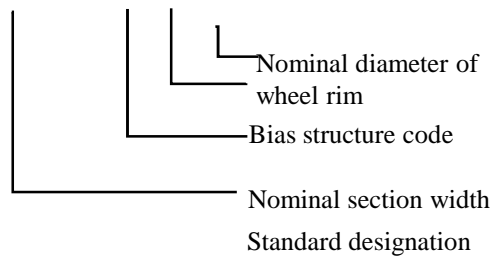


# Section IX Tires

## ●Functions

- The tire assemblies are the main traveling parts and are functioned to carry the weight of complete machine, relieve the impact force from the ground, and generate drive force and braking force by means of the adhesion between tires and road.
- The wheel loader generally adopts low pressure wide tires, featuring large sectional size, good elasticity, and low ground pressure. While traveling or operating on soft foundation, the tire features low sink, high adhesion, and good traction and trafficability. While traveling or operating on rough road, the tire can ensure the good damping and shock absorption performance of the loader.
- Meaning of tire specification (The specification of tires for LG936L is shown below)

●GB2980—17.5—20

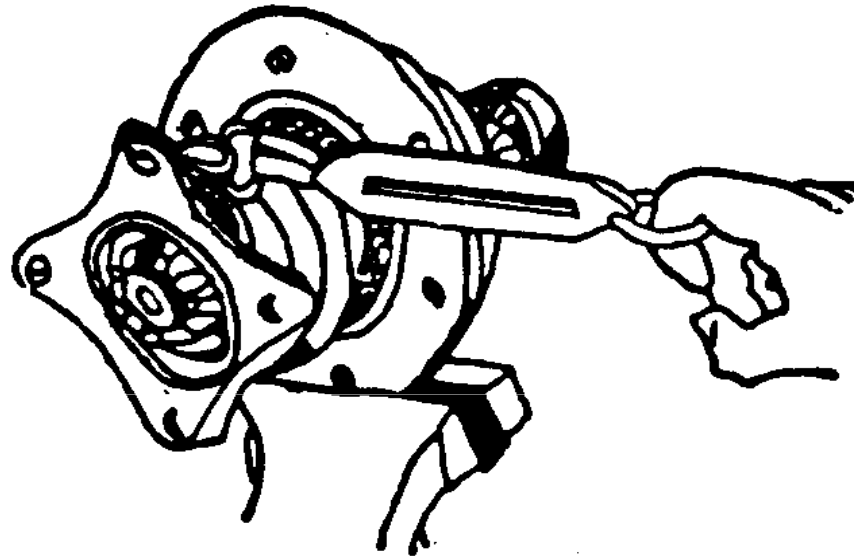


## Section X Gap Adjustment of Drive Axle

- **Measurement of bearing rotation torque**

- To reduce the axial displacement of gear shaft due to axial force generated during the transmission of bevel gears to improve the support rigidity of the shaft and guarantee the normal engagement of gear pairs, it's necessary to measure the rotation torque of bearings during the assembly. However, the gear shaft can't be too tight, or it will easily accelerate the wear of tapered roller bearing.

- The pre-torque of the tapered roller bearing can be obtained by measuring the rotating torque of the drive bevel gear. Generally, the rotating torque is 1.5~2.6N.m.

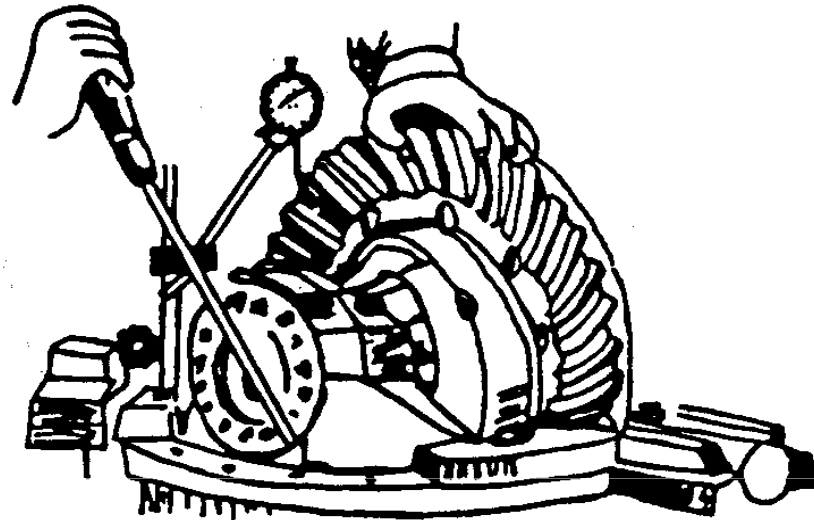


Measurement of bearing rotation torque

## Section X Gap Adjustment of Drive Axle

### II. Adjustment of engagement status for spiral bevel gears

- The adjustment of engagement status for spiral bevel gear refers to the adjustment of backlash and engagement contact area.
- While adjusting the backlash of spiral bevel gear pair, press the probe of dial gauge against the tooth face at large end edge of driven spiral bevel gear and then rotate the driven spiral bevel gear to directly measure the backlash, as shown in the figure.
- Specific measurement method of backlash:
- Fix the stand of dial gauge on the bracket, place the probe of dial gauge perpendicular to the tooth face of driven spiral bevel gear, rotate the driven spiral bevel gear back and forth with hand, and observe the variation amplitude of the dial gauge, which is the measured backlash. Generally, it's required to measure at 3~4 different places along the circumference. The backlash shall be 0.20~0.35mm. If the backlash can't be adjusted to the specified value and is above 0.75mm, make sure to replace the bevel gear pair.



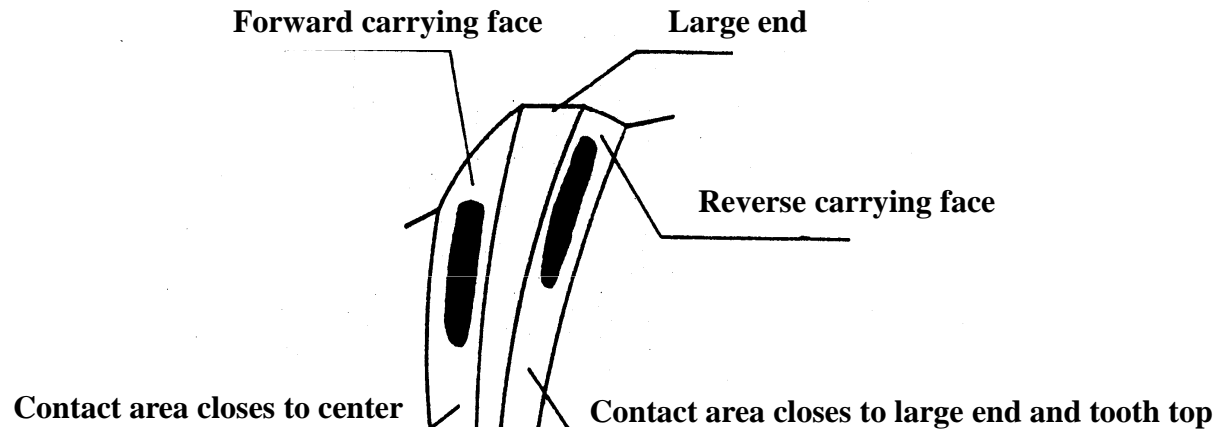
- Adjustment of backlash:
- The backlash is adjusted by rotating the adjustment nut to change the position of driven spiral bevel gear (when necessary, adjust by moving the drive spiral bevel gear assembly).
- If the gap is above the specified value, close the driven spiral bevel gear towards the drive spiral bevel gear. Otherwise, move it away from the drive spiral bevel gear.
- To maintain the properly adjusted preload for the differential tapered roller bearings, the number of turns the adjustment nut on one end is screwed in shall be equal to the number of the turns the adjustment nut on the other end is screwed out.



# Section X Gap Adjustment of Drive Axle

### III. Measurement method of engagement contact area

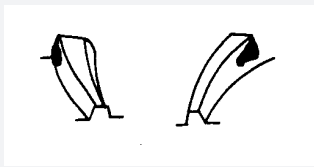
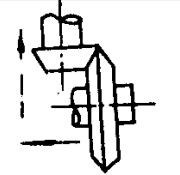
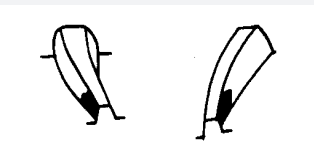
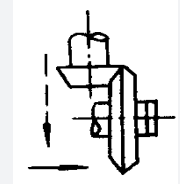
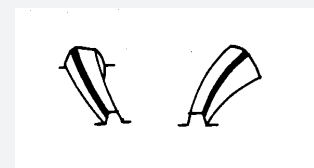
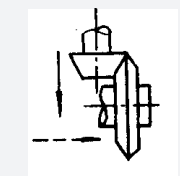
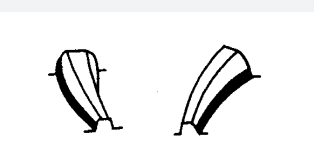
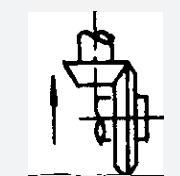
- While measuring the engagement contact area of bevel gear pair, firstly apply red paint (such as red lead) to the teeth (generally three teeth) of the driven spiral bevel gear, rotate the driven spiral bevel gear repeatedly with hand, and check the contact trace.
- The correct engagement status is as below: The contact area shall be no less than 60% in both tooth length and tooth height directions and the engagement trace shall be in the middle with slight offset towards small end in tooth height direction and shall slightly close to the small end in tooth length direction.



# Section X Gap Adjustment of Drive Axle

## IV. Adjustment method for engagement contact area:

- a. When the engagement trace closes to the large end or small end of the gear, firstly move the axial position of driven spiral bevel gear. If there is no change of backlash, adjust the axial mounting position of the drive spiral bevel gear.
  - b. When the engagement trace closes to the tooth top or tooth root of the gear, firstly move the axial position of drive spiral bevel gear. If there is no change of backlash, adjust the axial mounting position of the driven spiral bevel gear.
- The position of drive spiral bevel gear is changed by adjusting the thickness of adjustment washer.
  - The position of driven spiral bevel gear is changed by moving the adjustment nut. To prevent impairing the tension of the tapered roller bearings on two ends of differential, the number of turns the adjustment nut on one end is screwed out shall be equal to the number of the turns the adjustment nut on the other end is screwed in.

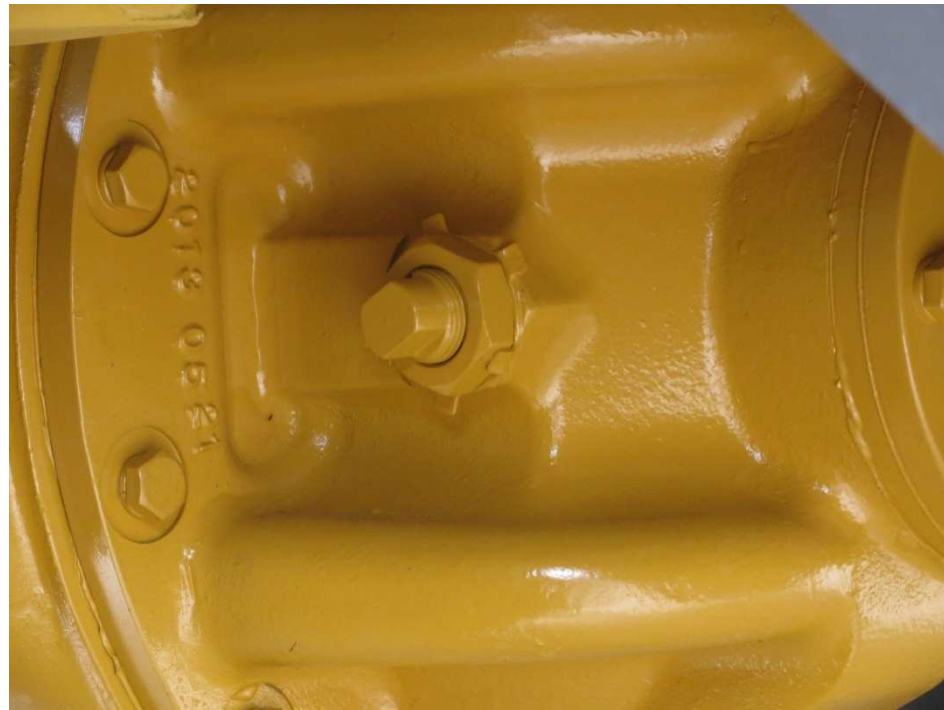
Contact area of driven bevel gear tooth face	Adjustment Method	Movement direction of gear
	Move the driven gear towards drive gear. If the backlash is too small, move outward the drive gear.	
	Move the driven gear away from drive gear. If the backlash is too large, move inward the drive gear.	
	Move the drive gear towards driven gear. If the backlash is too small, move outward the driven gear.	
	Move the drive gear away from driven gear. If the backlash is too large, move inward the driven gear.	

## Section X Gap Adjustment of Drive Axle

### V. Gap adjustment of thrust bolt

To ensure the driven bevel gear has enough support stiffness, install thrust bolt on the back of the driven spiral bevel gear to limit the driven spiral bevel gear deformation, prevent the driven spiral bevel gear from excessive deformation gear affect the normal work;

Should be paid attention to in the process of assembling and debugging: adjust the gap of drive spiral bevel gear back to thrust bolt to 0.25 ~ 0.40 mm (millimeter) in general.



# Section X Gap Adjustment of Drive Axle

## VI. Difference between front and rear axles

### 1. Different installation modes

- The front axle is fixed on the front frame and the rear axle is fixed on the subframe of the rear frame. The subframe can swing vertically with respect to the rear frame. It's functioned to, while the whole machine is driving on rough road, four wheels of the machine can touch the ground stably, in order to improve the trafficability of the loader.

### 2. Different directions of spiral gears

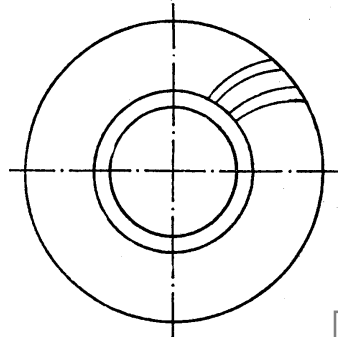
- Front axle: The drive spiral bevel gear is of left-handed and the driven spiral bevel gear is of right-handed.

- Rear axle: The drive spiral bevel gear is of right-handed and the driven spiral bevel gear is of left-handed.

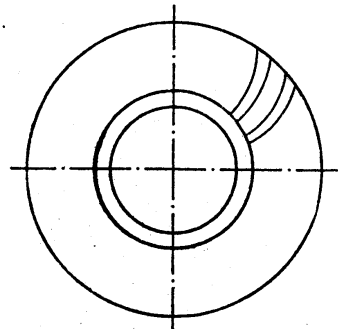
- The drive spiral bevel gears and the driven spiral bevel gears must be used in pair and must be replaced in pair in event of malfunction.

### 3. Judgment method for left-handed and right-handed spiral bevel gears:

- Facing towards the front face of gear, the right-handed means that the spiral teeth extend from small end to large end in clockwise direction. On the contrary, the left-handed means that the spiral teeth extend from small end to large end in counter-clockwise direction.



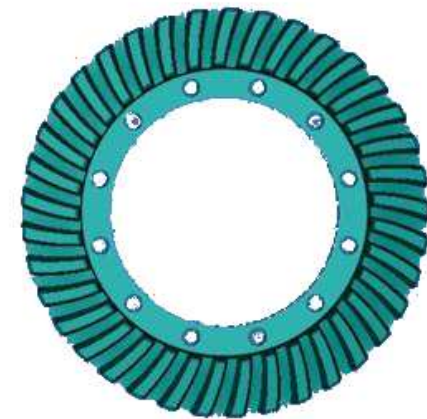
**Right-handed**



**Left-handed**



Front axle drive spiral bevel gear, left-handed



Front axle driven spiral bevel gear, right-handed



Rear axle drive spiral bevel gear, right-handed



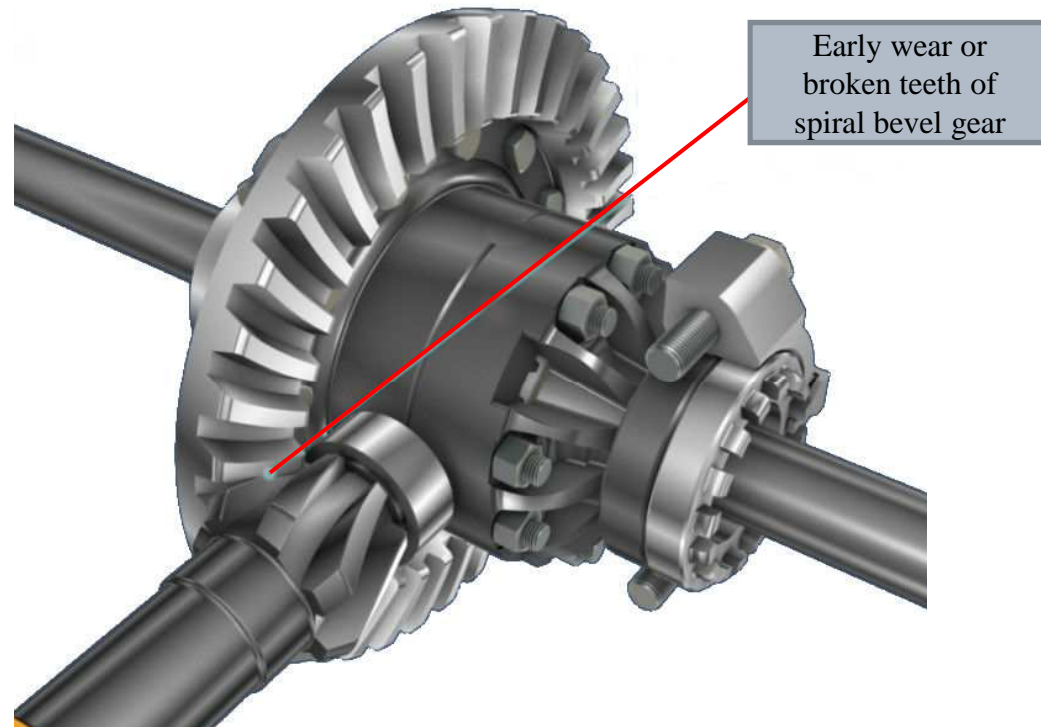
Rear axle driven spiral bevel gear, left-handed

# Section XI Common Malfunctions of Drive Axle

## I. Early wear or broken teeth of spiral bevel gear

- Fault cause analysis:

1. Improper gap adjustment of thrust bolt, leading to excessive deformation of driven spiral bevel gears and poor engagement of spiral bevel gear pair.
2. Noise due to improper backlash adjustment between drive and driven spiral bevel gears. The excessive backlash will lead to impact between teeth of gears. The under-size backlash will lead to squeezing between teeth of gears, accelerate the wear, and cause heating of drive axle.
3. Incorrect operations. If the insertion angle of the bucket is too high during the working, the front wheels will be off the ground and the rear axle main drive will be easily damaged. If the bucket load is too high, the rear wheels will be off the ground and the front axle main drive will be easily damaged. Once the gears are damaged, it will generate abnormal sound.
4. Deteriorated gear oil or insufficient gear oil of drive axle.

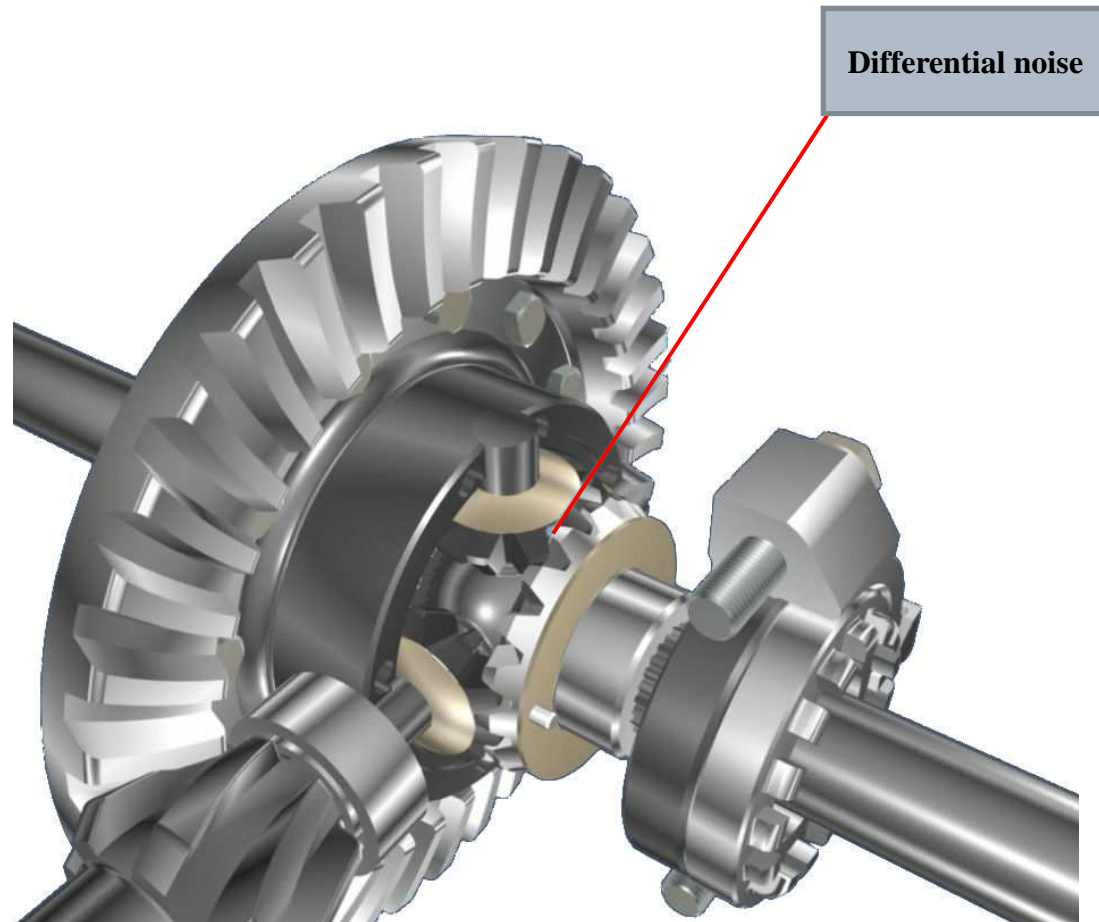


# Section XI Common Malfunctions of Drive Axle

## II. Differential noise

- Fault cause analysis:

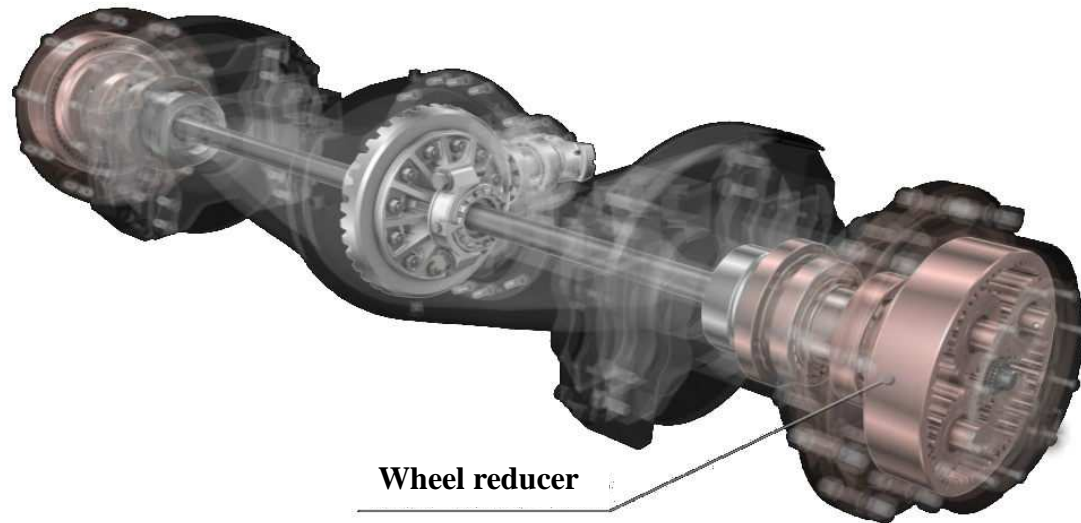
1. The stagnation of differential planetary gear and cross shaft and the wear of adjustment washer will lead to excessive backlash of bevel gears and cause noise.
2. Wear or broken teeth of internal gears of differential.
3. Excessive gap of half shaft gear gasket or planetary gear gasket.



# Section XI Common Malfunctions of Drive Axle

## III. Noise of wheel reducer

- Fault cause analysis:
  1. Breakage of planetary carrier
  2. Wear of internal gears
  3. Broken teeth of planetary gear or sun gear
  4. Pop-out of planetary gear shaft ball



## Section XI Common Malfunctions of Drive Axle

### IV. Oil permeation of drive axle brake disc

- Fault cause analysis:

The oil permeation of the brake disc is generally caused by the damaged dual-lip framework oil seal at the final drive, which causes external leakage of gear oil and oil contamination on brake disc and impairs the braking effects. This is really dangerous. Timely disassemble the tires, planetary carrier, and wheel hub for repair or replacement.



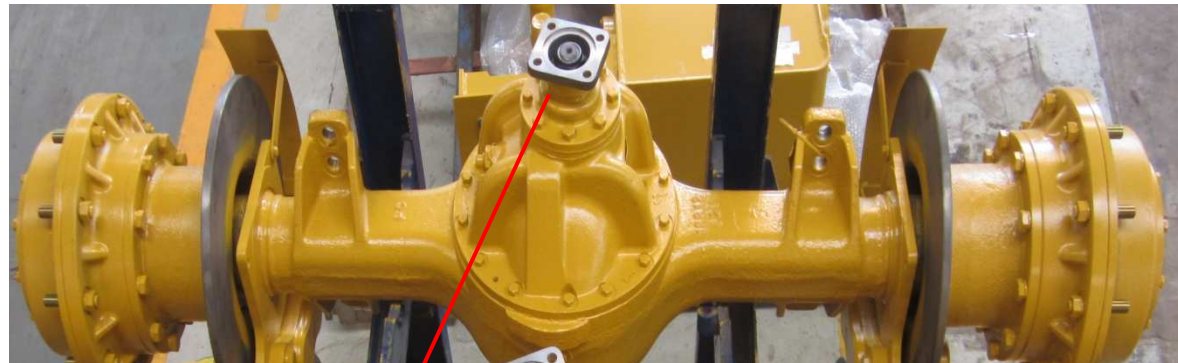
Oil permeation of drive axle brake disc



# Section XI Common Malfunctions of Drive Axle

## V. Oil leakage of main drive

- Fault cause analysis:
- Aging, cracking, and damage of oil seal.
- During the disassembly, do not enlarge the oil seal fiercely, in order to prevent plastic deformation. Heat the oil seal by immersing into a fluid at a temperature as close to the working fluid as possible before installation. Use the special tools.



Oil leakage at main drive oil seal

# CHAPTER 6 HYDRAULIC SYSTEM

## Section 1: GENERAL

- Brief
- Advantages of hydraulic system

## Section 2: STEERING HYDRAULIC SYSTEM

- Brief
- Steering pump
- Common faults of steering pump
- Priority valve
- Common faults of priority valve
- Steering gear
- Common faults of steering gear
- Steering cylinder
- Common faults of steering cylinder
- Oil tank

## Section 3: WORKING HYDRAULIC SYSTEM

- Brief
- Working pump
- Pilot pump
- Control valve
- Common faults of control valve
- Pressure selection valve
- Common faults of pressure selection valve
- Pilot valve
- Common faults of pilot valve
- Lift arm cylinder
- Bucket cylinder

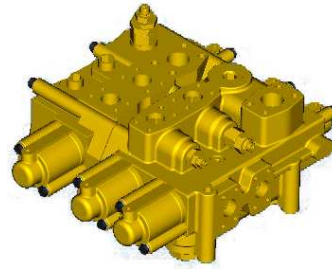
## Section 4: THE THIRD FUNCTION

- Control valve

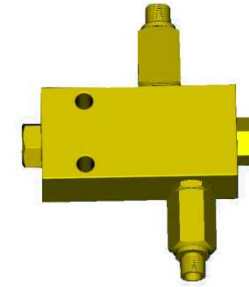
## SECTION 1 GENERAL

### •BRIEF

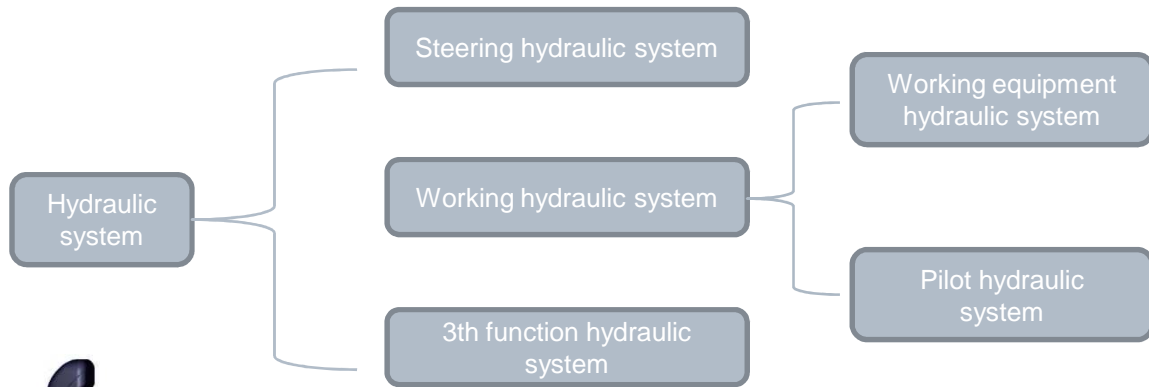
•The hydraulic system can be divided into 3 simple systems, like the working hydraulic system, the steering hydraulic system, and the 3th function hydraulic system. what's more, the working hydraulic system is composed of the working equipment hydraulic system and the pilot hydraulic system.



多路阀



压力选择阀



先导阀



动臂油缸



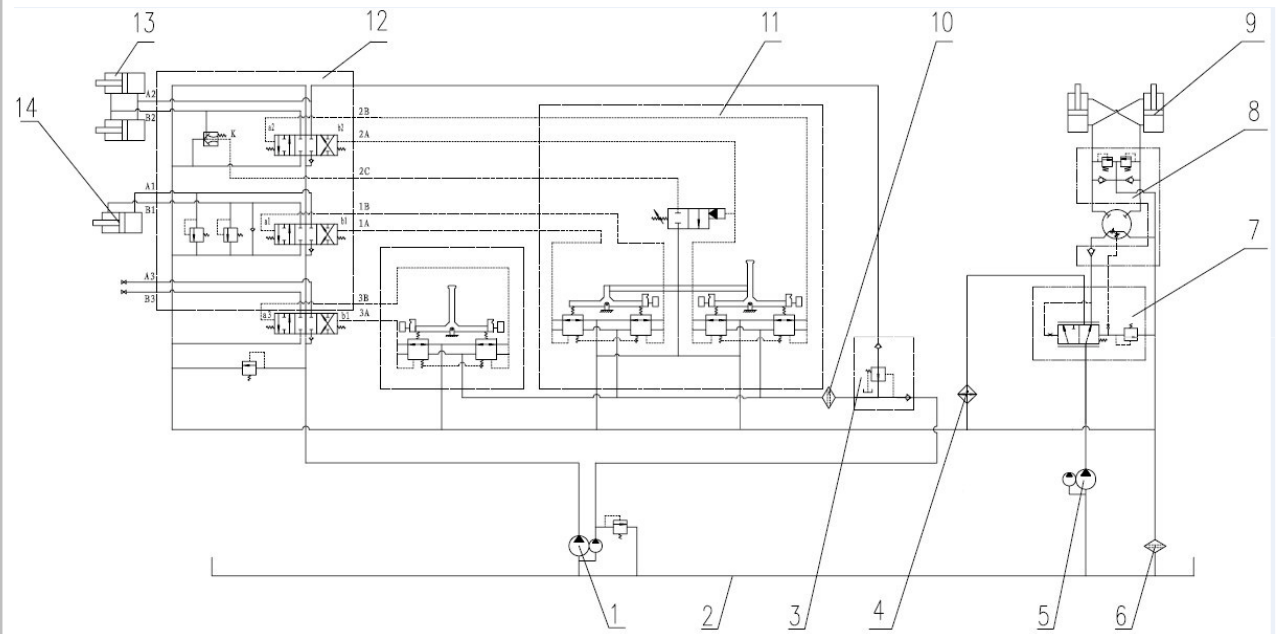
优先阀

## SECTION 1 GENERAL

### ● ADVANTAGES OF HYDRAULIC SYSTEM

- Compared with the mechanical control ones, this can reduce the impaction.
- Simplification of operation.
- Promotion of the working efficiency
- energy saving for the optimized combination of hydraulic components

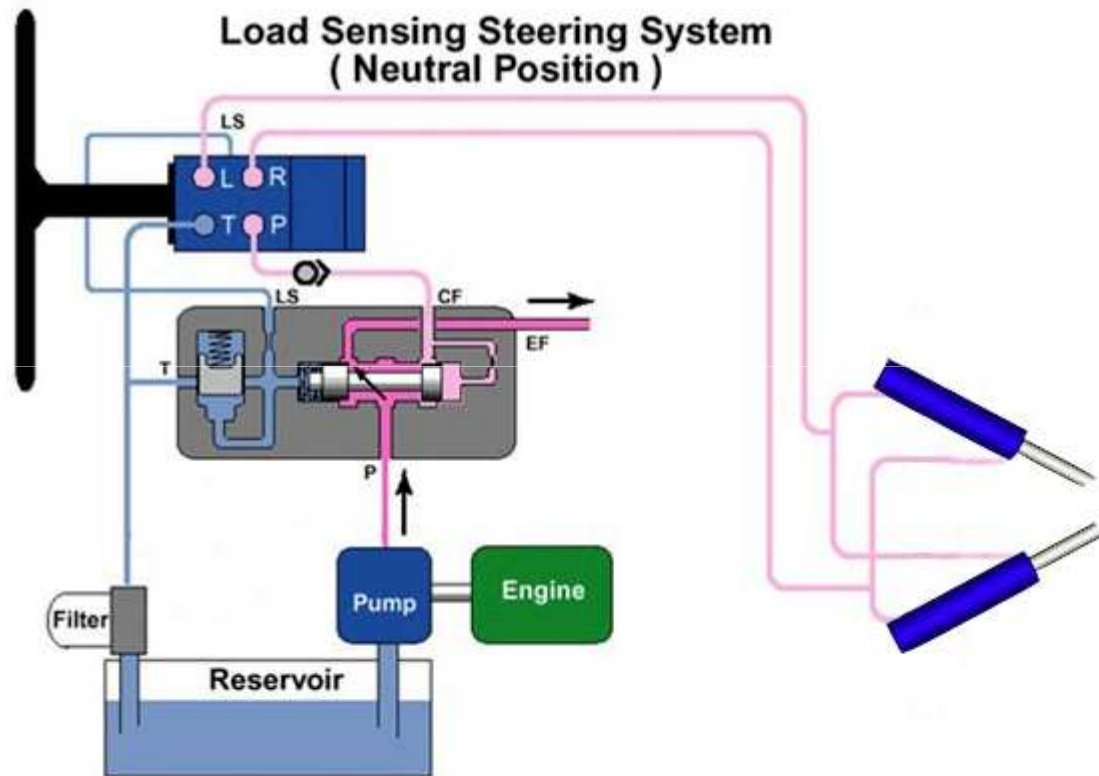
- 1. Dual pump
- 2. Oil tank
- 3. Pressure selection valve
- 4. Radiator assembly
- 5. Dual pump
- 6. Drain filter
- 7. Priority valve
- 8. Steering gear
- 9. Steering cylinder
- 10. Pilot oil filter
- 11. Pilot valve
- 12. Control valve
- 13. Lift arm cylinder
- 14. Bucket cylinder



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •BRIEF

- The steering hydraulic system is composed of oil tank, steering pump, priority valve, steering gear, steering cylinders and hoses.
- The pressure of the steering hydraulic system is 12MPa.
- When you turn the steering wheel, the steering pump sucks the oil from the oil tank, and exhausts the oil to the priority valve through the hose. Then the oil will go into the steering gear and then to the steering cylinders to pull the front frame to turn left or right.



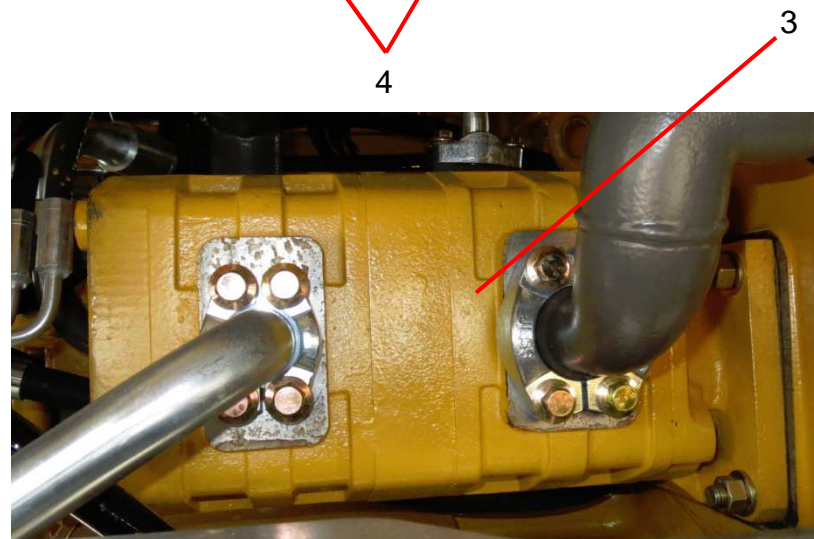
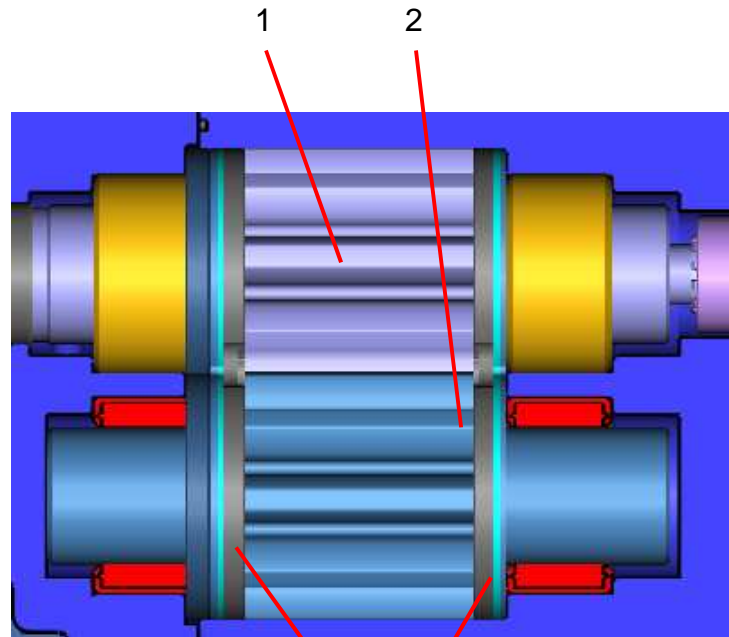
## SECTION 2 STEERING HYDRAULIC SYSTEM

### •STEERING PUMP

•The steering pump is a gear pump. The dual pump is composed of the steering pump and the gear shifting pump, the one that besides the transmission is the steering pump.

•The output volume is 63ml/r, the rated rotate speed is 2200r/min and the rated pressure is 20MPa.

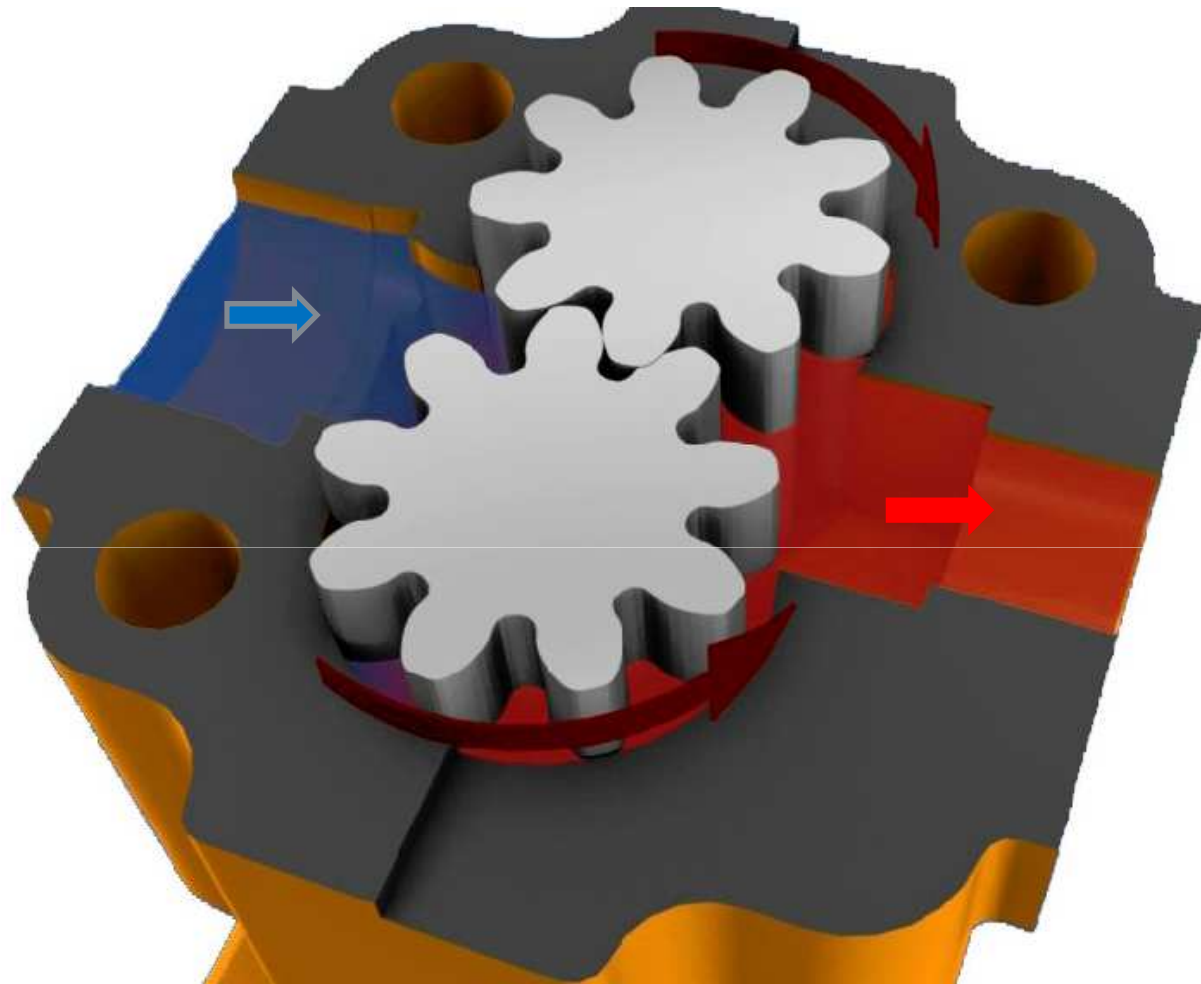
- 1.Driving gear
- 2.Driven gear
- 3.Pump body
- 4.Side plate



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •STEERING PUMP

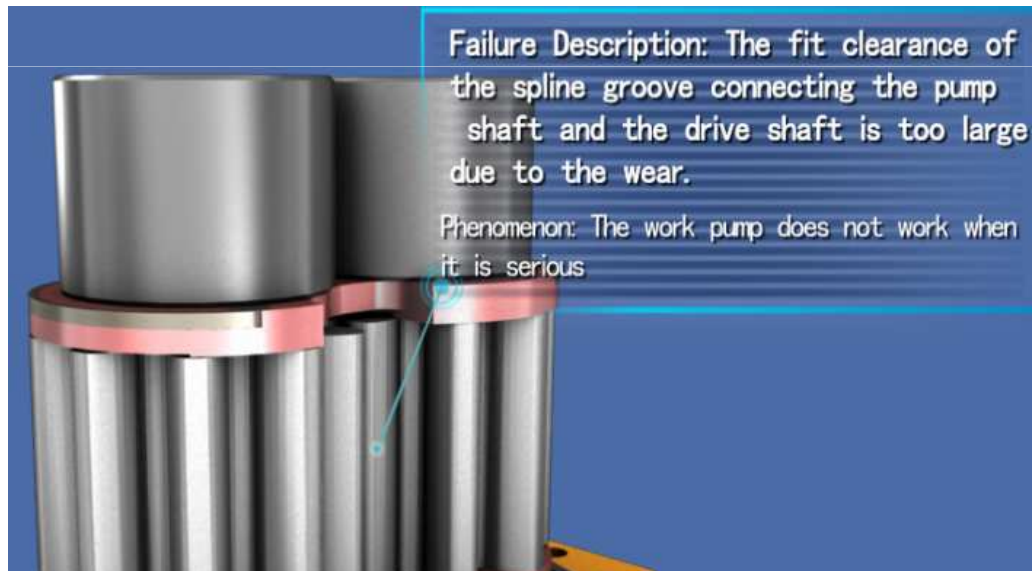
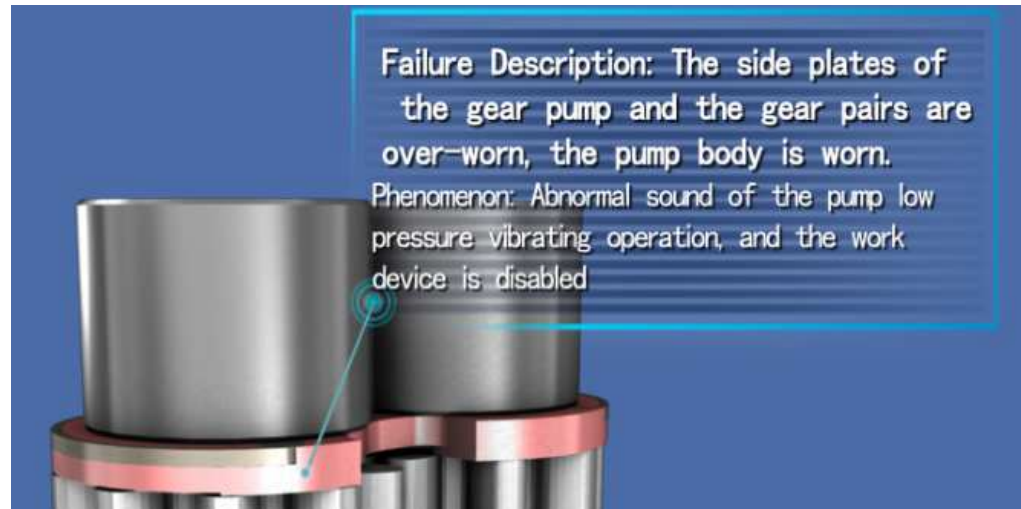
- The steering pump is a three-element gear pump, of which the three elements refer to the front and rear end caps and pump body. A pair of engaged gears is installed within the pump body. Driven by the power takeoff output shaft, the drive gear engages with the driven gear and rotates. In such case, the oil will be sucked from the input port and exhausted from the output port. The changes of the volume of the input and output chamber can account for this. When the volume of the chamber enlarged with the rotating of the 2 gears, the pressure of the chamber will decrease rapidly, the oil will be pulled into this chamber by the force of the atmosphere. While the oil in the chamber whose volume will be decreased will be pulled out by the high pressure in the chamber.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •COMMON FAULTS OF STEERING PUMP

- Phenomenon: Abnormal sound of the pump, low output pressure, and the work device is disabled.
- Failure cause: The side plates of the gear pump are over-worn, the gears are over-worn or the pump body is over-worn.
- Phenomenon: The pump does not work.
- Failure cause: the fit clearance of the spline groove connecting the pump and the drive shaft is too large due to the wear.





## SECTION 2 STEERING HYDRAULIC SYSTEM

### •COMMON FAULTS OF STEERING PUMP

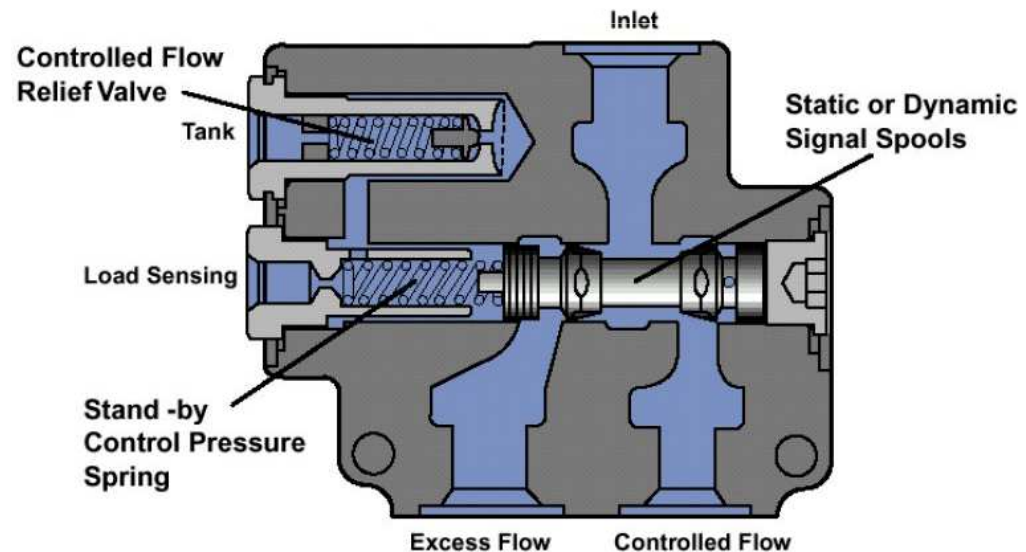
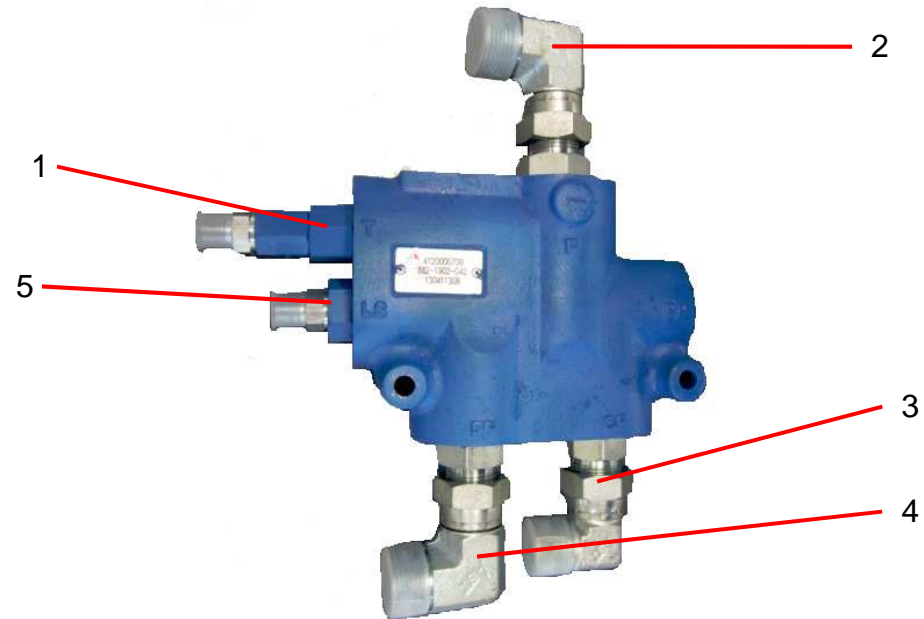
- Phenomenon: The transmission oil is drifting to the hydraulic system or the hydraulic oil enters the transmission system.
- Failure cause: The input shaft oil seal of the working & steering pump is damaged or the seal ring of the pump oil outlet end is damaged.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •PRIORITY VALVE

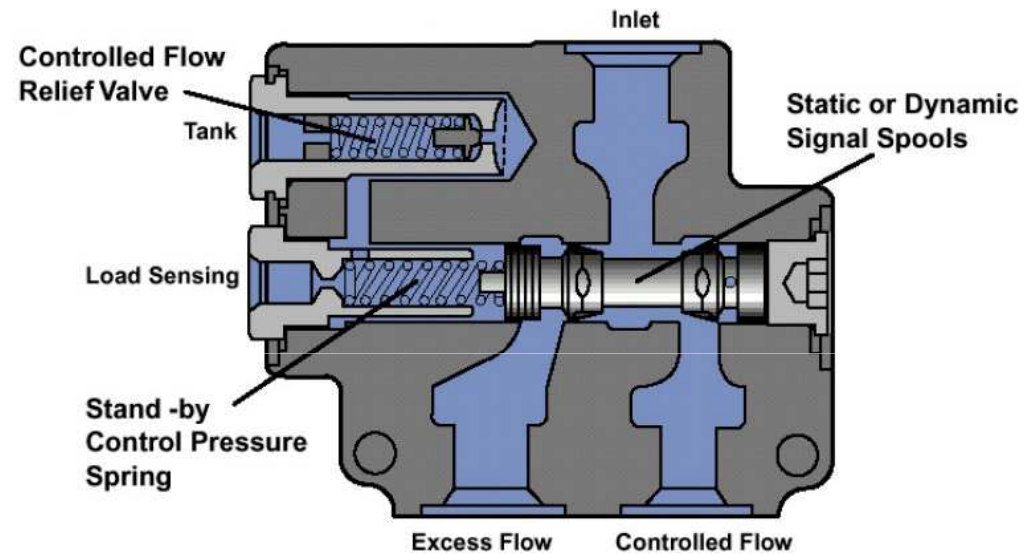
- The load sensor steering system is made up of the priority valve and the BZZ5 steering gear.
- When you turning the steering wheel, the priority valve can ensure the oil flow demanded by the steering gear and the rest will flow to the working hydraulic system.
- The spring in T port is used to control the pressure of CF chamber. You can adjust the steering pressure through adjusting this spring.
- 1.T port for oil drain
- 2.P port for oil inlet
- 3.CF port connected with the inlet port of steering gear
- 4.EF port connected with the working hydraulic system
- 5.LS port connected with the LS orifice of the steering gear



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •PRIORITY VALVE

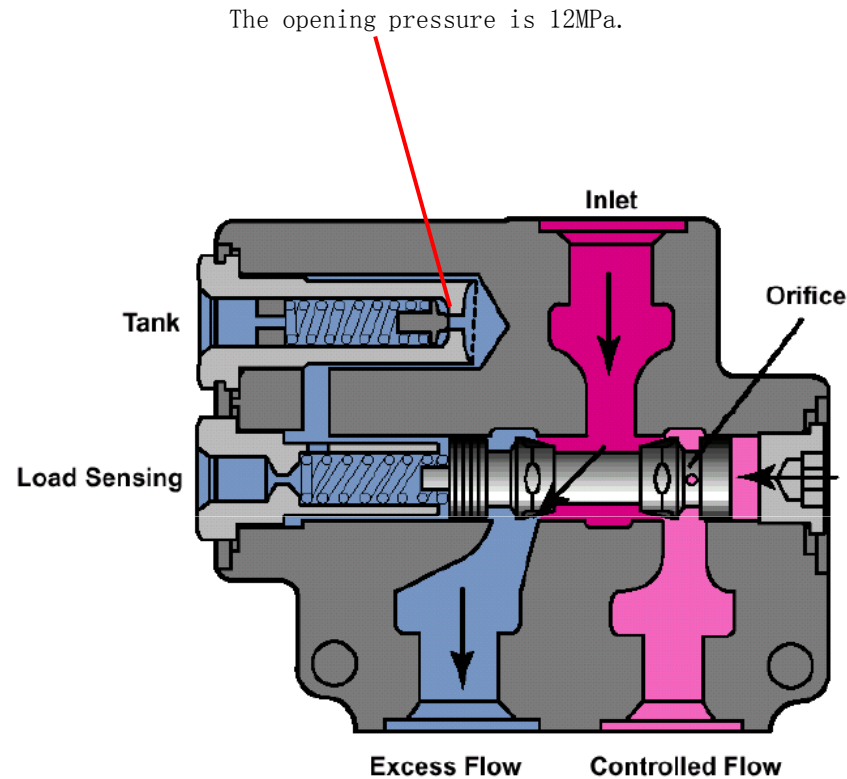
•When the engine is off, the spring will push the spool to the right side. The inlet port is connected to the CF port.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### ●PRIORITY VALVE

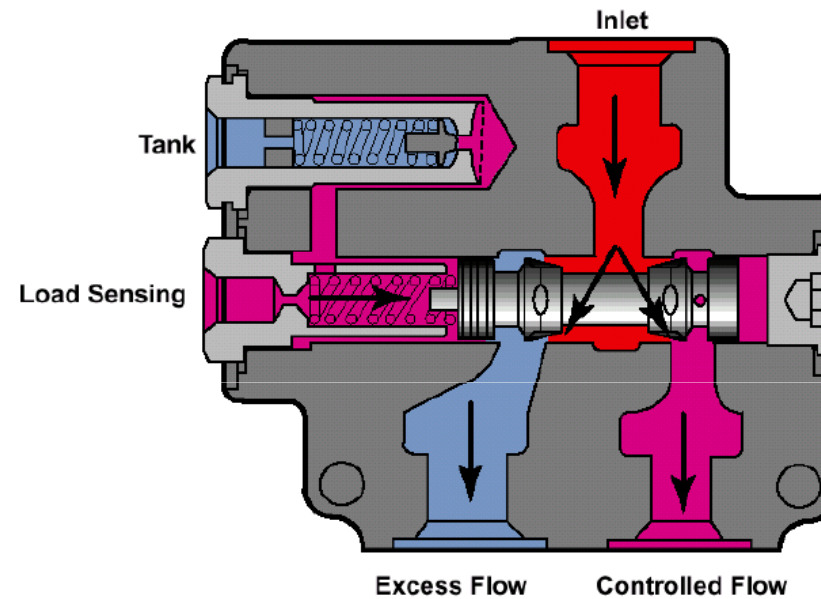
●Start the diesel engine. When the steering wheel is still at neutral position, the working/steering pump sucks oil from the hydraulic oil tank and inputs to the priority valve through pipeline. The priority valve core is at the rightmost position. In such case, the inlet of priority valve is connected with the chamber CF and the high pressure oil enters into steering gear through port CF. As the steering gear is at neutral position, the pressure in the chamber CF increases continually and the high pressure oil enters into the right chamber of valve core through orifice. When the pressure reaches certain value to overcome the spring force and push the leftward movement of valve core, the oil inlet is connected with the chamber EF. The high pressure oil enters into working hydraulic system through port EF to provide high pressure oil for the working hydraulic system.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •PRIORITY VALVE

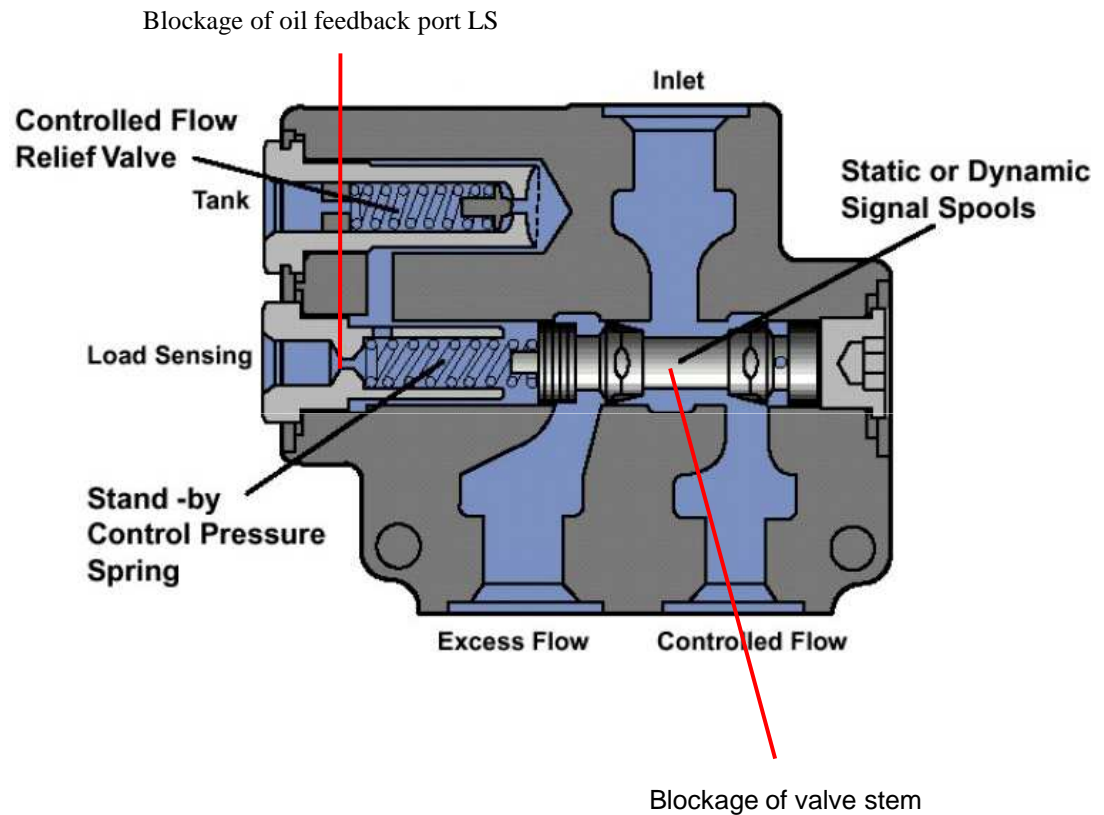
•When the steering wheel is rotating, the pressure at the oil inlet of steering gear is reduced and the pressure difference between port CF and port LS is reduced (in such case, the pressure difference between port CF and port LS is really small). Under the joint action of the hydraulic oil pressure and spring force, the priority valve core moves rightward to connect the oil inlet with port CF. At the same time, the connection between the oil inlet and port EF is reduced and the amount of high pressure oil entering into the working hydraulic system is reduced. The high pressure oil enters into the steering cylinder through steering gear to realize steering.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •COMMON FAULTS OF PRIORITY VALVE

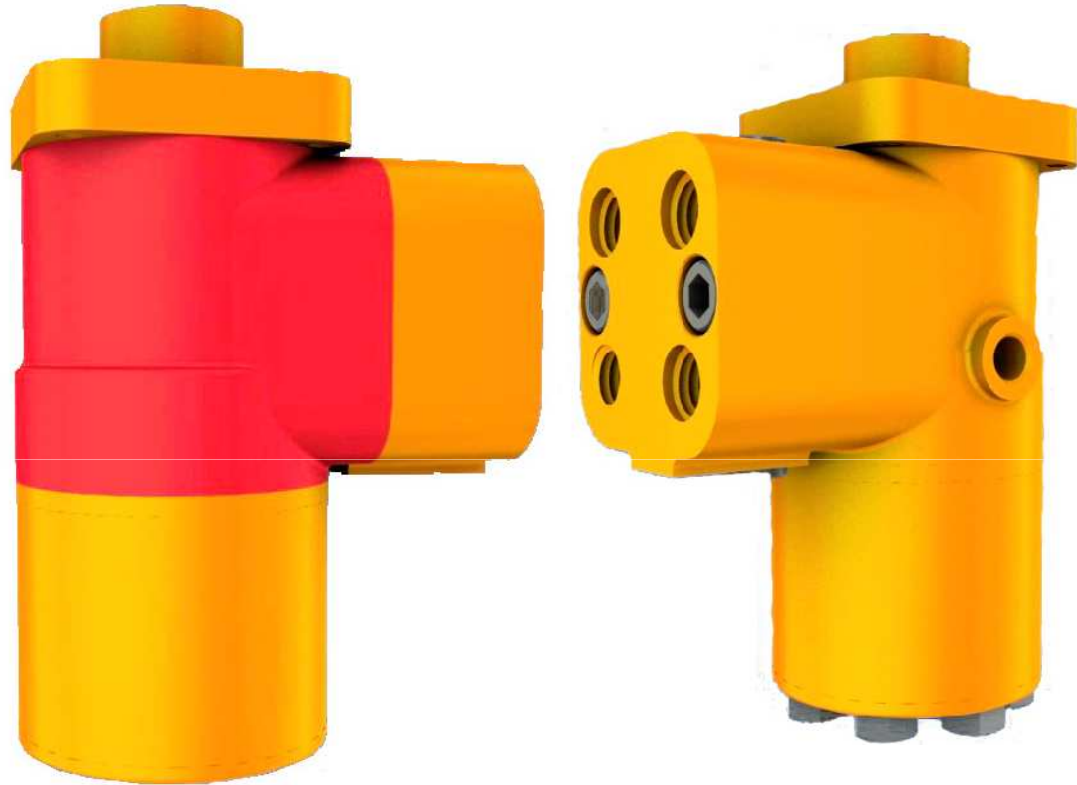
- Phenomenon: Heavy steering or steering failure.
- Failure cause: Blockage of oil feedback port LS or blockage of valve stem.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •STEERING GEAR

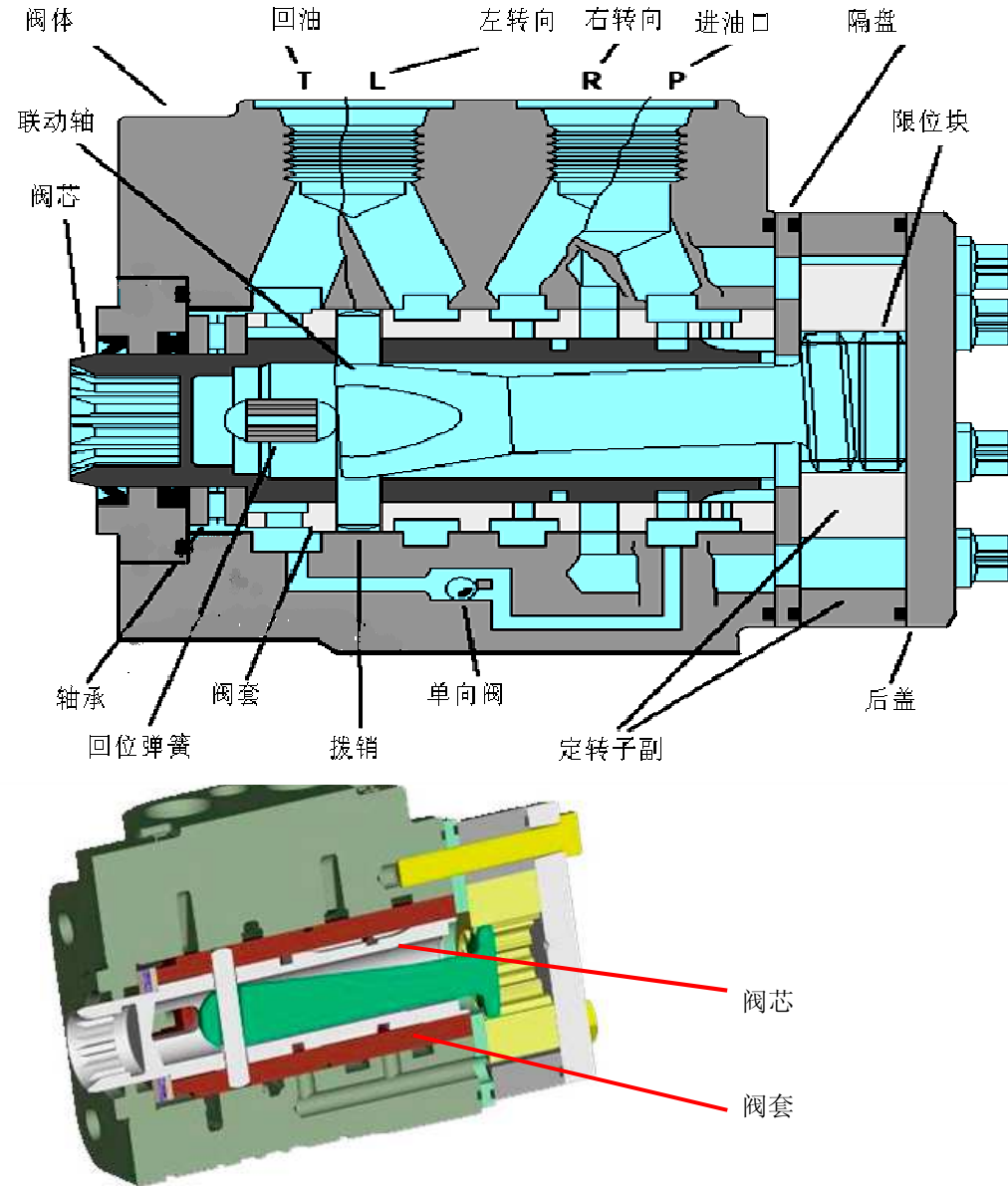
•BZZ5 hydraulic steering gear is a kind of cycloid rotary valve type hydraulic steering gear composed of follow-up valve and cycloid pin gear pair, which is the most popular steering unit applied both at home and abroad nowadays. It features flexible operations, labor-saving, compact structure, reliable working, easy installation and layout, and capability of manual steering when the engine stops.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### ●STEERING GEAR

●The BZZ5 load-sensing hydraulic gear is mainly composed of follow-up valve, metering motor, and combination valve block. Among those, the follow-up valve includes valve core, valve sleeve, and valve body. The metering motor includes rotor and stator.

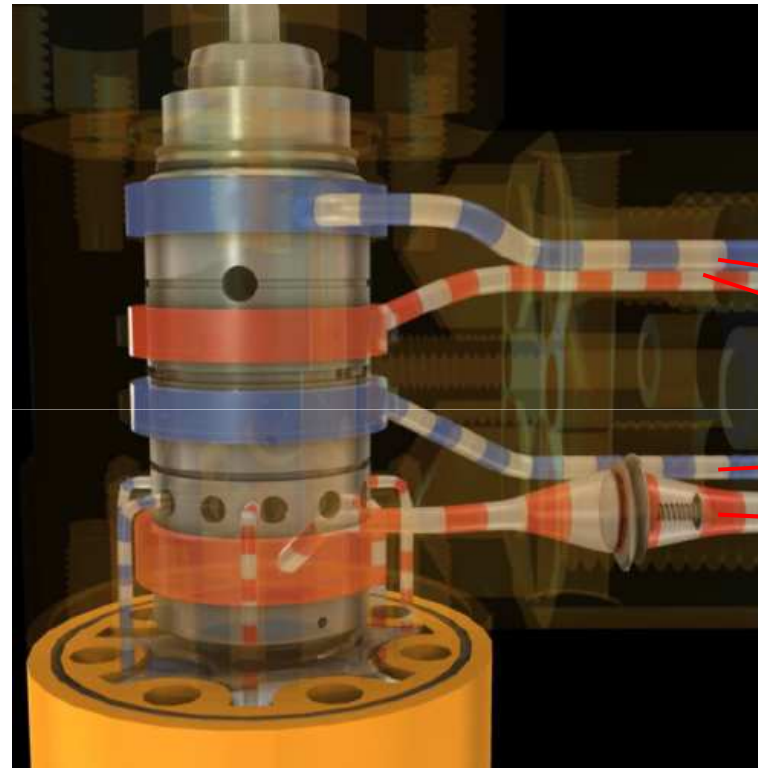




## SECTION 2 STEERING HYDRAULIC SYSTEM

### •STEERING GEAR

- 1.Oil return
- 2.Turning left
- 3.Turning right
- 4.Oil inlet
- When the steering wheel is still, the valve core and valve sleeve are at neutral position under the force of centering spring and the hydraulic oil from the priority valve flows through valve core and valve sleeve and returns to oil tank through port T. The loader travels at the preset direction.
- When the steering wheel is rotating, there is a relative rotation between valve core and valve sleeve and the rotor rotates as well. The oil enters into the metering motor through valve sleeve and valve core and then enters into the left turn or right turn oil channel through oil distribution pan to drive the movement of steering cylinders and realize the steering of loader.



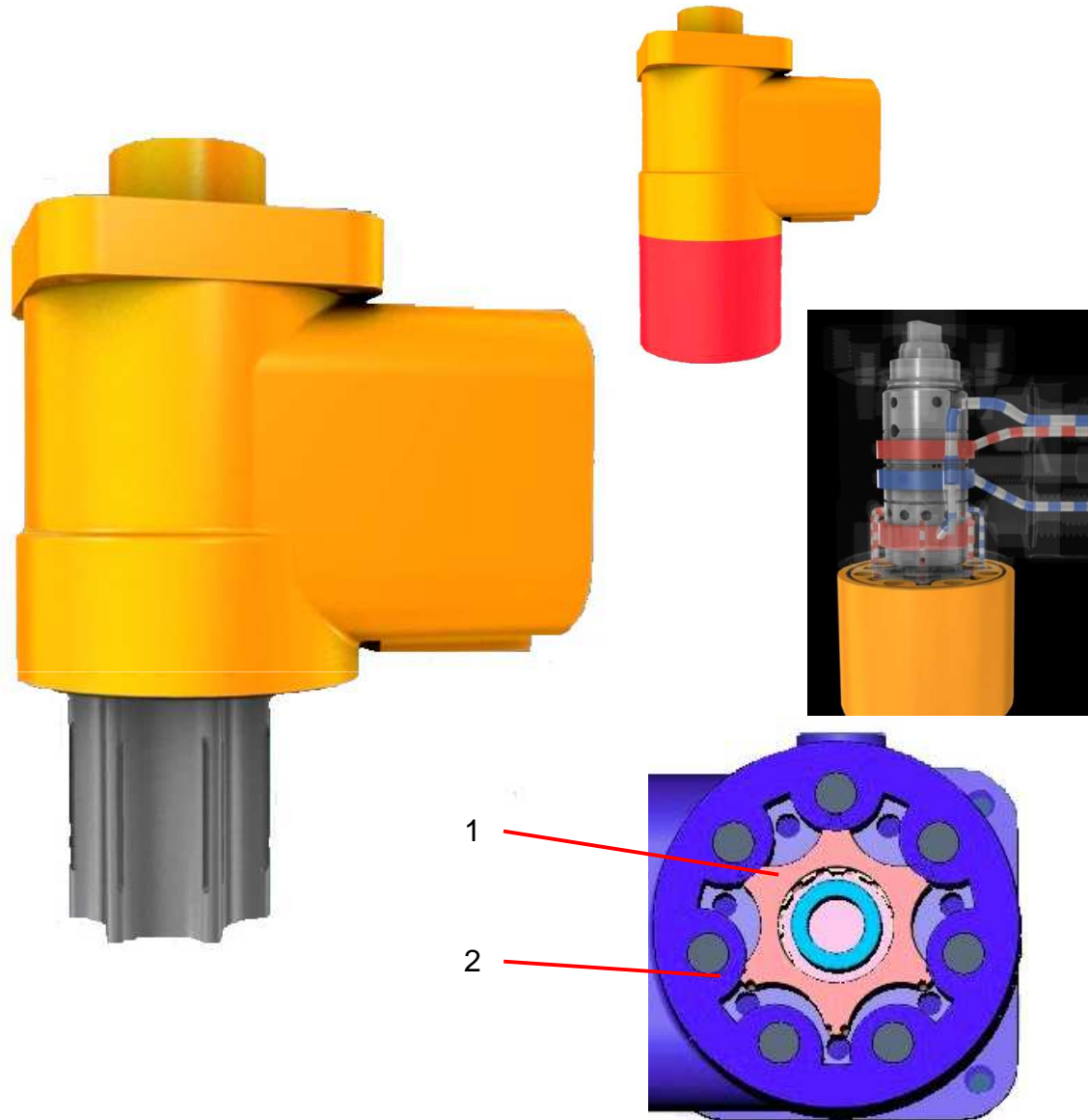
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4

## SECTION 2 STEERING HYDRAULIC SYSTEM

### •STEERING GEAR

•After the stop of engine, when the steering wheel is rotating, the shifting pin drives the rotation of valve sleeve, coupler shaft, and rotor. In such case, the rotor and stator exert the functionality of the pump. The rotation of rotor sucks out the oil and inputs into the oil inlet chamber of rotor pump through check valve, valve sleeve, and valve core. It generates pressure for the hydraulic oil of steering gear and inputs into the steering cylinder to realize the steering of loader.

- 1 Rotor
- 2 Stator



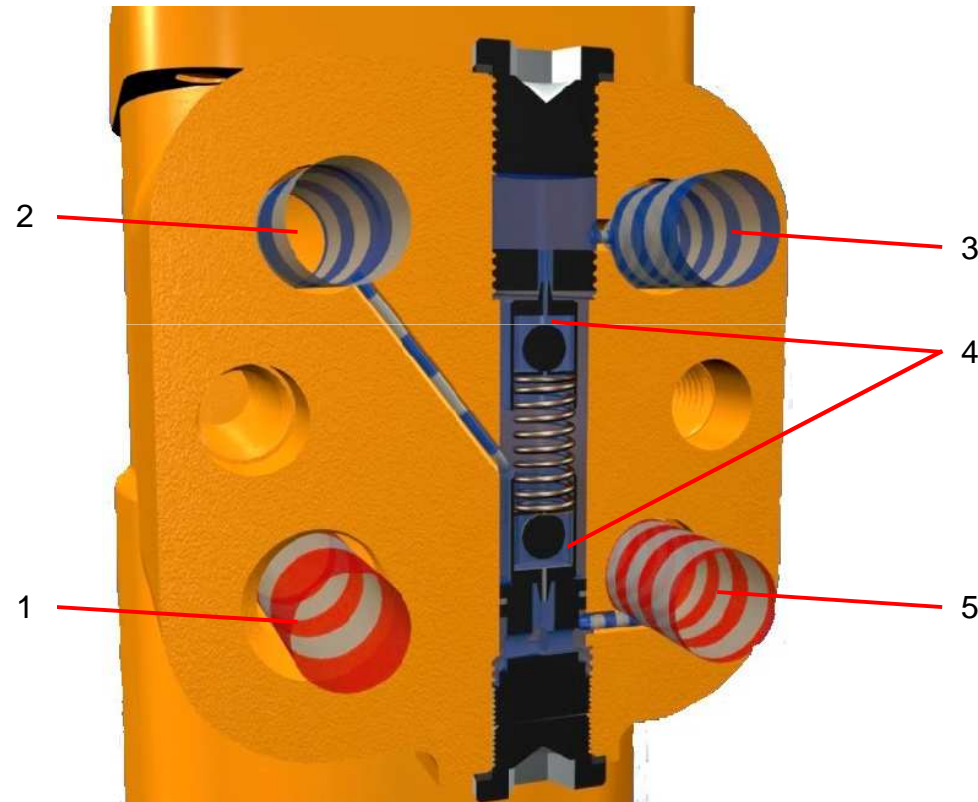
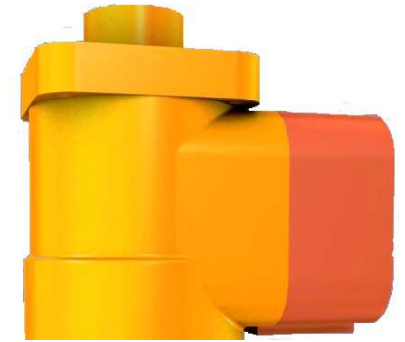
## SECTION 2 STEERING HYDRAULIC SYSTEM

### •STEERING GEAR

•When the steering of the machine is forced by an external force, the pressure increased sharply in two chambers of the steering cylinders and the pressure in the other two chambers reduced rapidly. The oil in the high pressure chamber pushes open the check valve of combination valve block and drain back to the tank. And the negative pressure chamber pull the check valve of combination valve block open to realize oil refilling.

•The opening pressure for the check valve is 20MPa

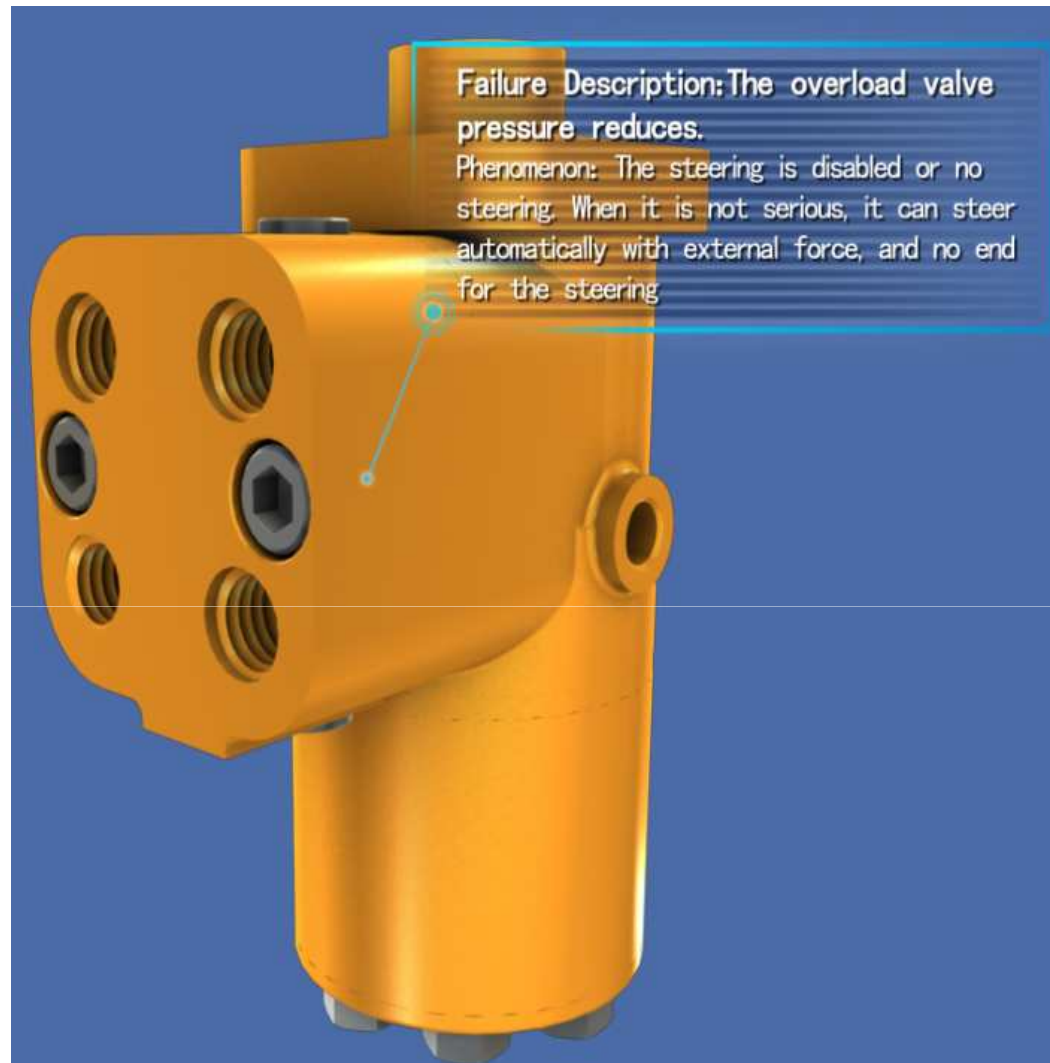
- 1.P port for oil inlet
- 2.T port for oil drainage
- 3.L port for turning left
- 4.Check valve
- 5.R port for turning right



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •COMMON FAULTS OF STEERING GEAR

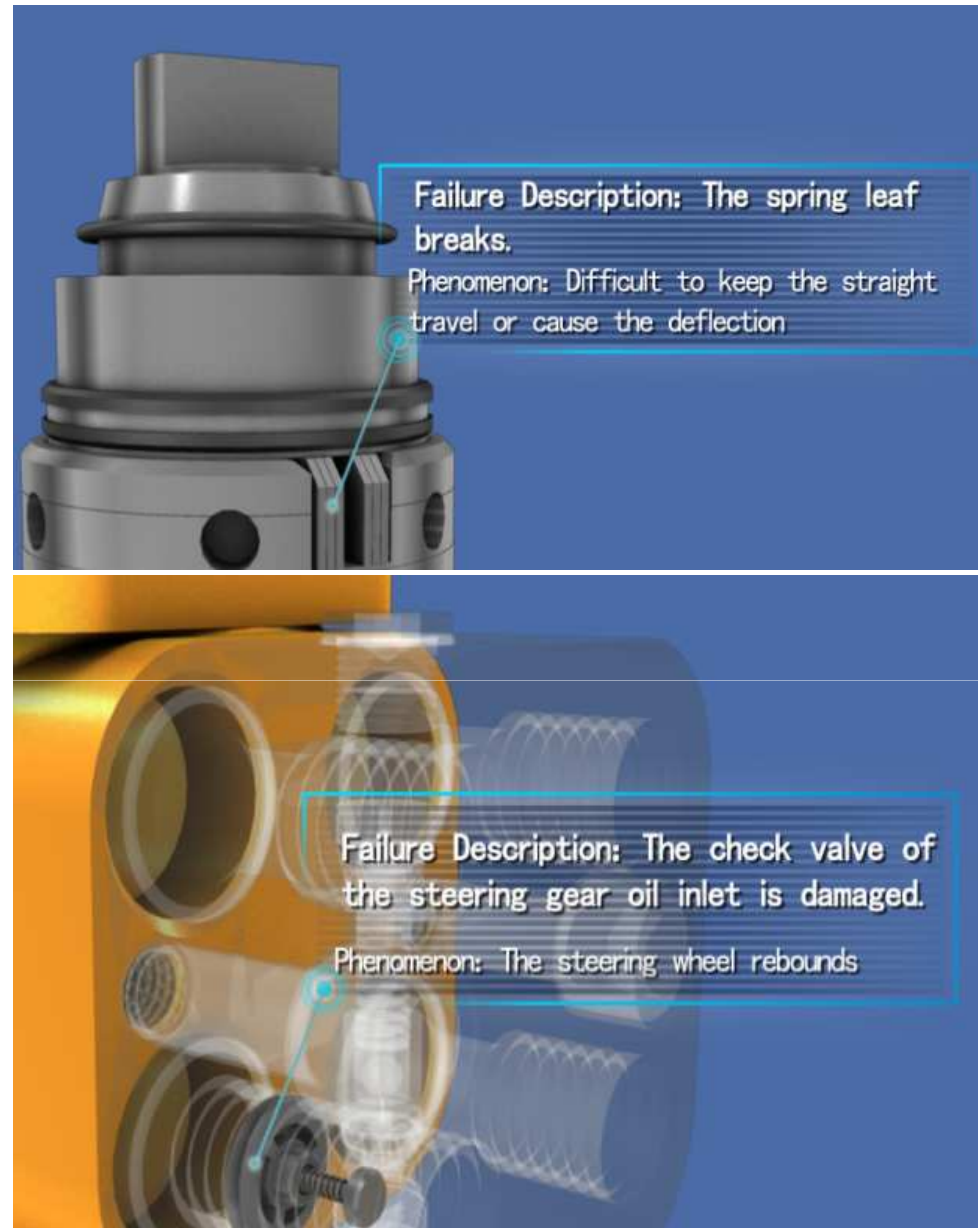
- Phenomenon: The steering is disabled or no steering. When it is not serious, it can steer automatically with external force, and no end for the steering.
- Failure cause: The overload valve pressure reduces.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### ●COMMON FAULTS OF STEERING GEAR

- Phenomenon: Difficult to keep the straight travel or cause the deflection.
- Failure cause: The spring leaf breaks.
- Phenomenon: The steering wheel rebounds.
- Failure cause: The check valve of the steering gear oil inlet is damaged.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •COMMON FAULTS OF STEERING GEAR

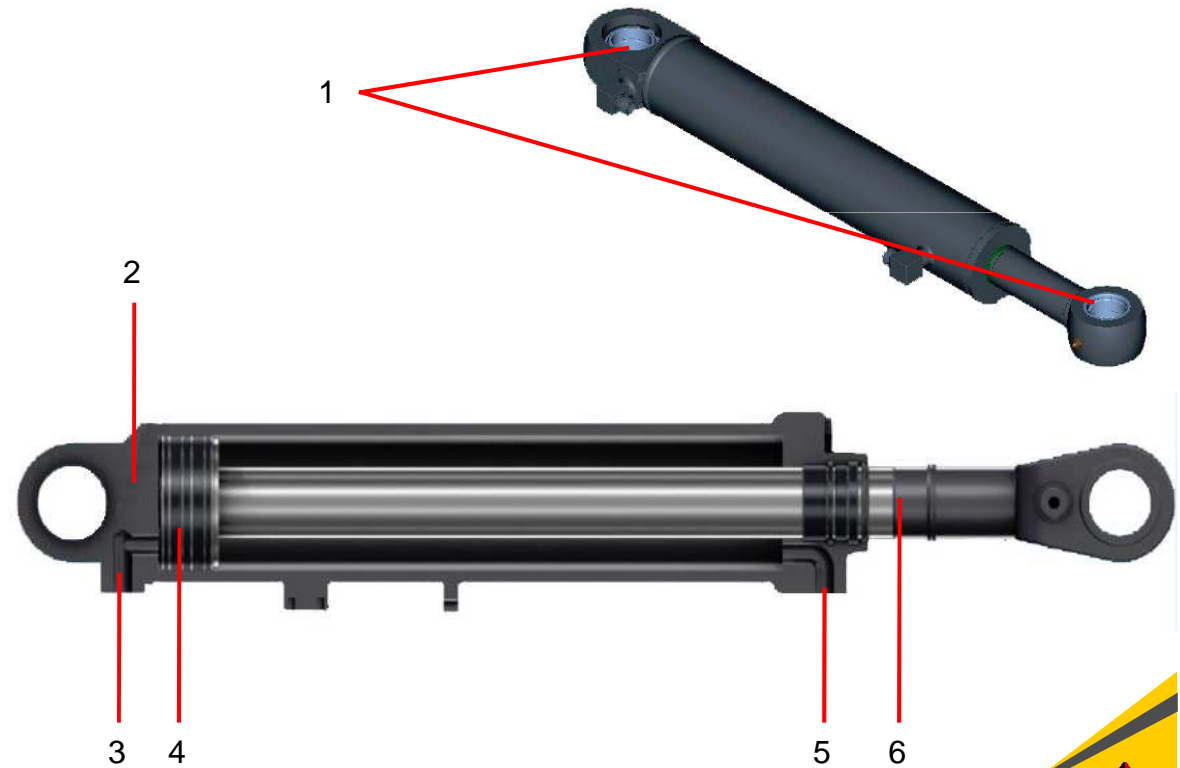
- Phenomenon: Heavy steering.
- Failure cause: The ball check valve of the steering gear fails.
- Phenomenon: Heavy steering
- Failure cause: The steering gear inner bearing is damaged.



## SECTION 2 STEERING HYDRAULIC SYSTEM

### •STEERING CYLINDER

- 1. Shaft sleeve
- 2. Cylinder body
- 3. Big chamber oil port
- 4. Piston
- 5. Small chamber oil port
- 6. Cylinder rod



## SECTION 2 STEERING HYDRAULIC SYSTEM

### ●COMMON FAULTS OF STEERING CYLINDER

- Phenomenon: Weak steering or steering failure.
- Failure cause: Internal leakage due to damage of steering cylinder seals.
- Phenomenon: Internal leakage of cylinder and weak operation.
- Failure cause: Wear of piston, scuffing of cylinder block, or damage of oil seal.
- Phenomenon: Oil leakage of cylinder head.
- Failure cause: Failure of cylinder head oil seal and wear of guide sleeve.

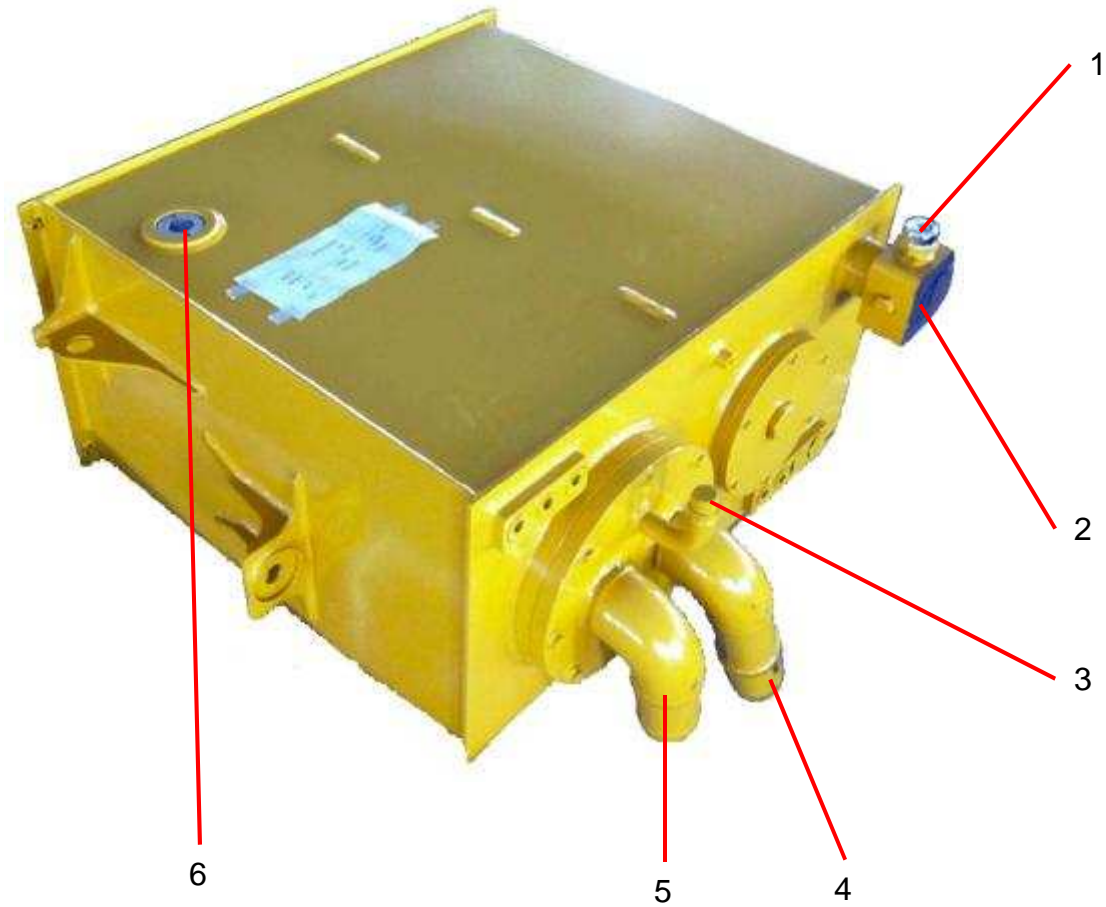




## SECTION 2 STEERING HYDRAULIC SYSTEM

### •OIL TANK

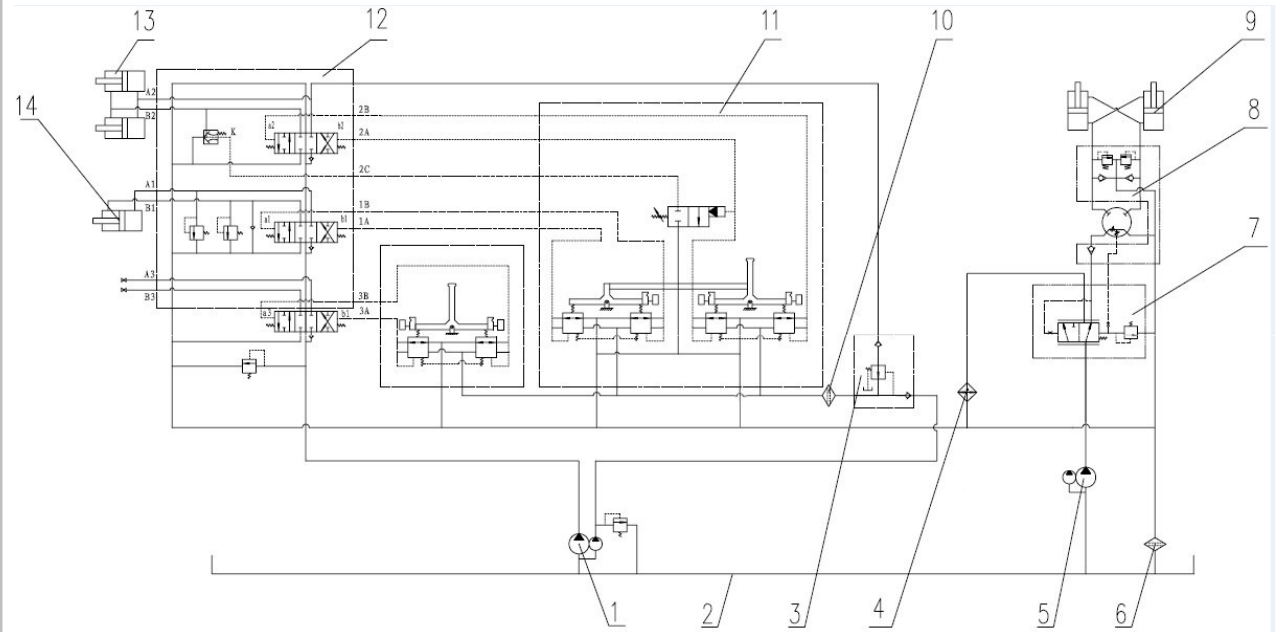
- 1.Oil return port
- 2.Oil return ort
- 3.Drain port
- 4.Oil suck port
- 5.Oil suck port
- 6.Inspection window



## SECTION 3 WORKING HYDRAULIC SYSTEM

### •BRIEF

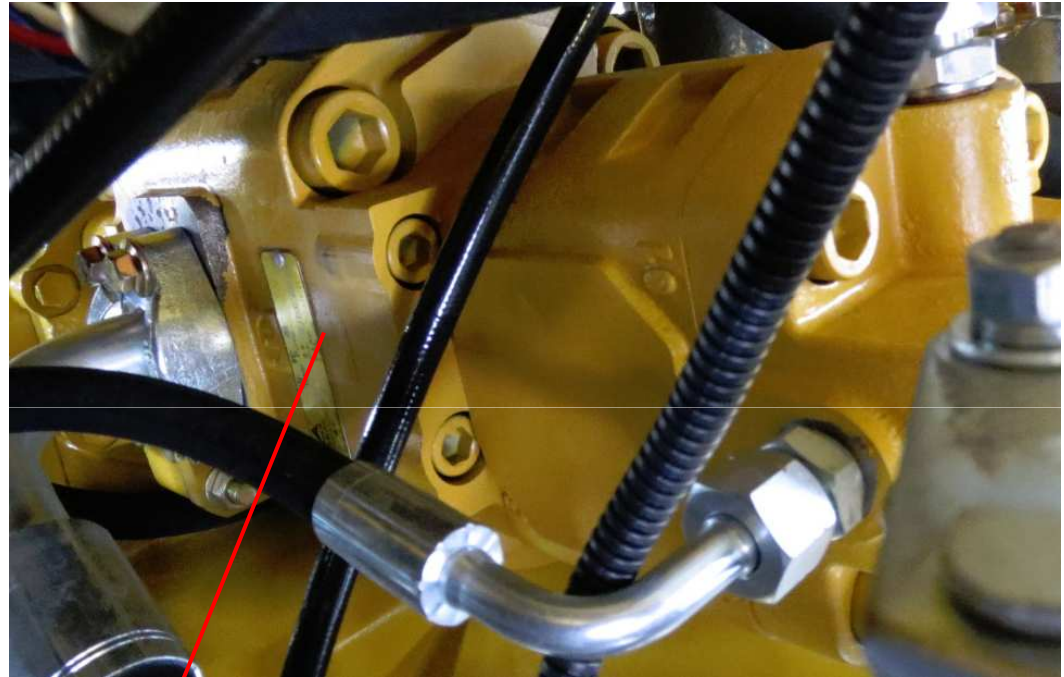
- The working hydraulic system includes working device hydraulic system and pilot hydraulic system.
- The working hydraulic system is mainly composed of working pump, control valve, lift arm cylinder, bucket cylinder and pipeline. The pilot hydraulic system is mainly composed of pilot pump, pressure selection valve, pilot valve and pipeline.
- The regulated pressure for the relief valve of working hydraulic system is 16MPa, the overload pressure for rodless chamber of bucket cylinder is 18MPa, and the overload pressure for rod chamber of bucket cylinder is 12MPa.
- The rated working pressure of pilot hydraulic system is 0.5-2.5MPa.



## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●WORKING PUMP

- The working pump and the steering pump share one same dual pump. Please refer to the part of steering pump for the working principle and common faults.
- The displacement of the working pump is 100ml/r, the rated speed is 2,200r/min.

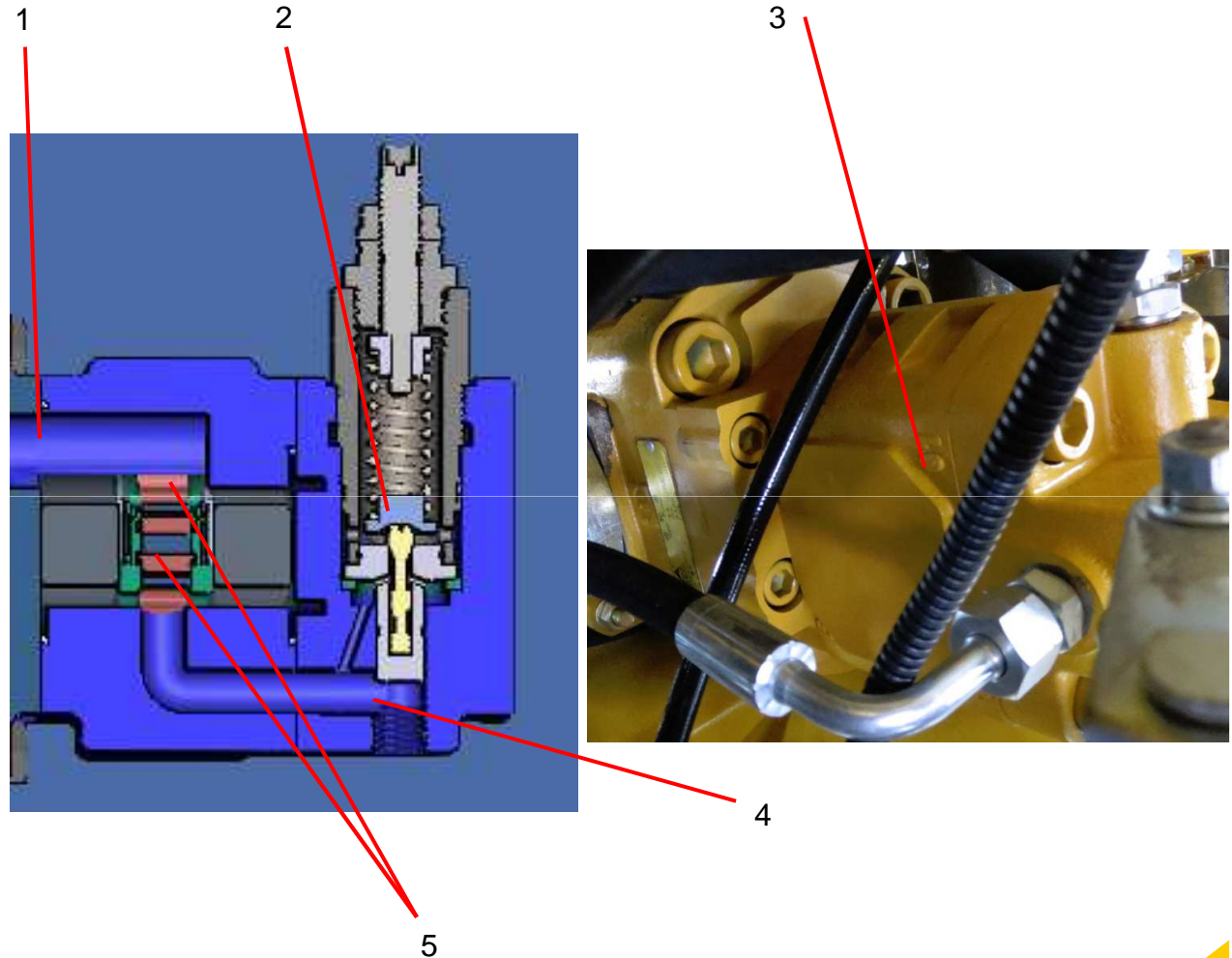


工作泵

## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●PILOT PUMP

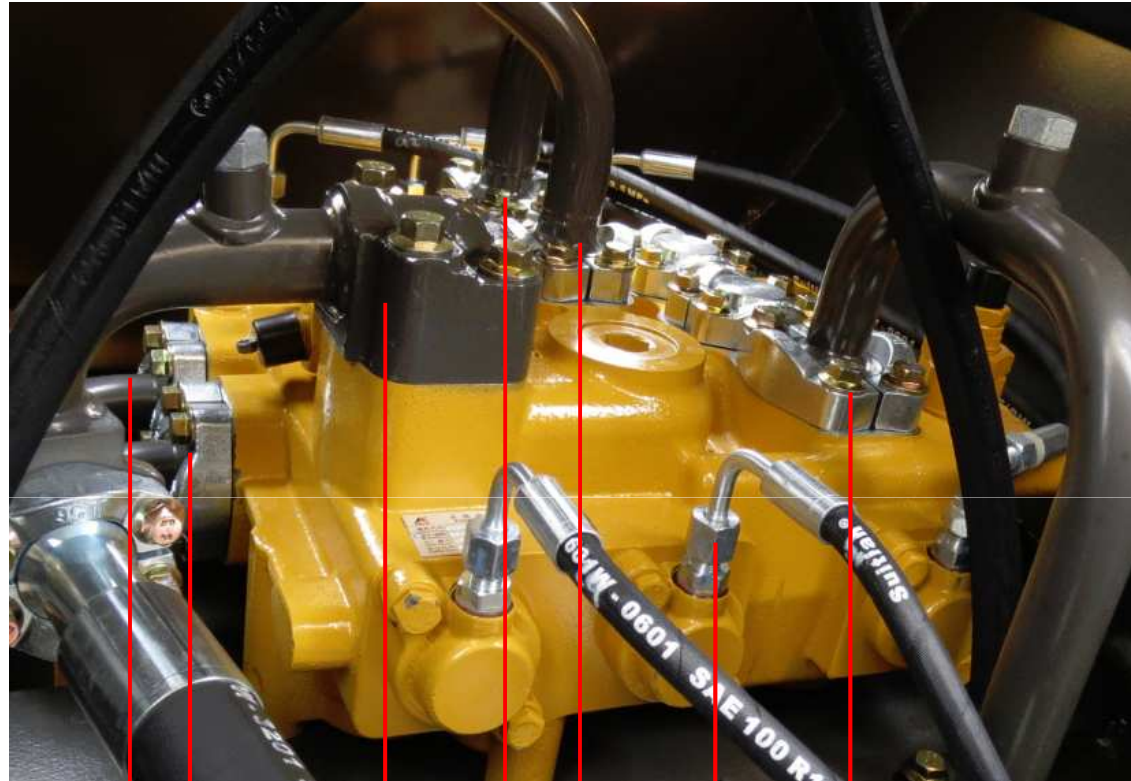
- The working pump and the steering pump share one same dual pump. The pilot pump is also a gear pump.
- The displacement of the pilot pump is 10ml/r, the rated speed is 2,200r/min, and the relief pressure is 3.5MPa.
- 1.Oil inlet port
- 2.Relief valve
- 3.Pilot pump
- 4.Oil outlet port
- 5.Engaging gears



## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●CONTROL VALVE

- The control valve is mainly composed of valve body, boom circuit slide valve, bucket circuit slide valve, return spring, check valve, relief valve, overload refilling valve, and seals.
- The control valve is used to control the motion directions of bucket cylinder and boom cylinder by changing the flow direction of oil or hold the bucket and boom at certain positions, in order to meet all kinds of working needs of the loader.
- 1.To big chamber of lift arm cylinder
- 2.To small chamber of lift arm cylinder
- 3.Oil return port
- 4.To big chamber of bucket cylinder
- 5.To small chamber of bucket cylinder
- 6.Pilot oil port
- 7.Oil inlet port



1 2 3 4 5 6 7

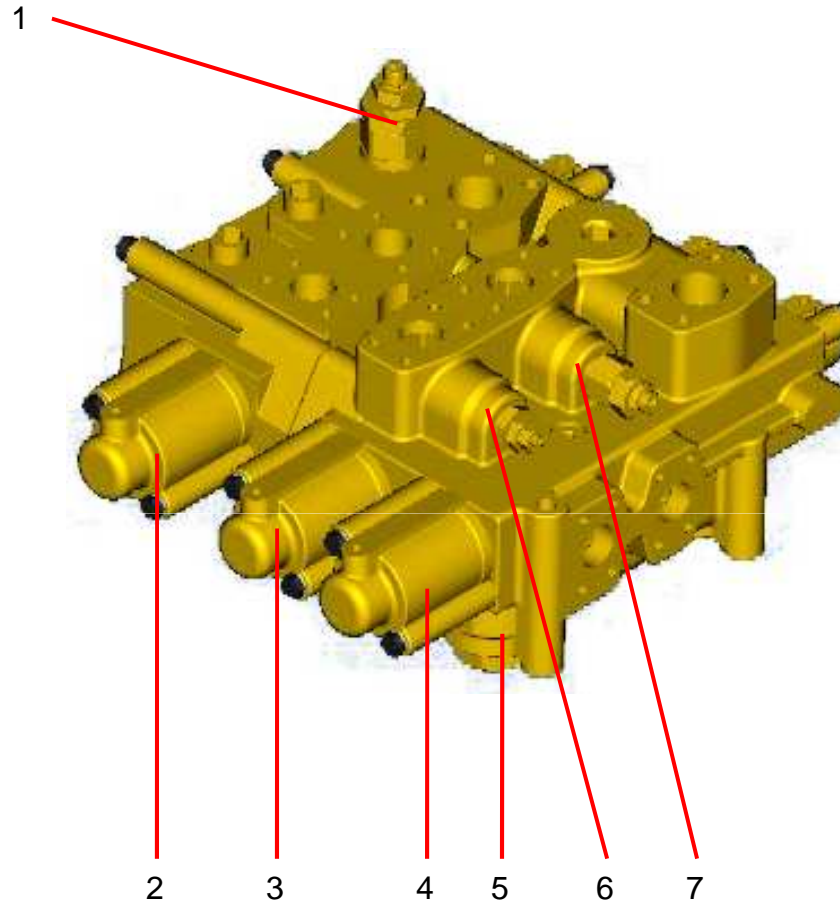
## SECTION 3 WORKING HYDRAULIC SYSTEM

### •CONTROL VALVE

- 1.Relief valve
- 2.The third function
- 3.Bucket circuit
- 4.Lift arm circuit
- 5.Logic valve
- 6.Relief valve
- 7.Oil refill valve

•When the pilot valve is at neutral position, all slide valves of control valve have no action and the hydraulic oil enters into the control valve through oil inlet or returns to oil tank directly through oil return port.

•The rated working pressure of control valve is 16MPa.



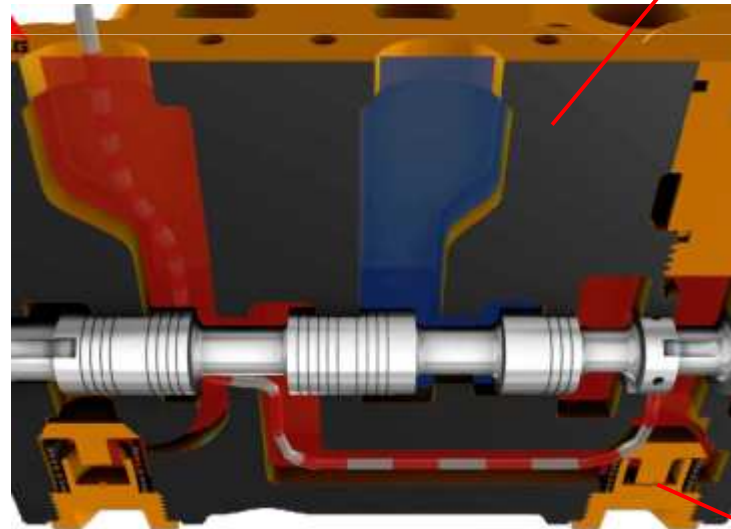
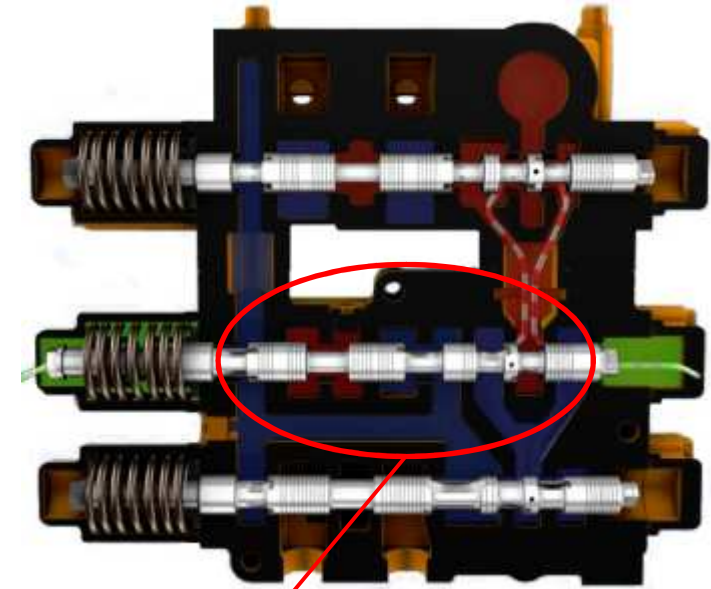
## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●CONTROL VALVE

#### ●Unloading

●When the pilot valve is at unloading position, the pilot oil enters into the bucket circuit to move the bucket circuit slide valve to one end. The rod chamber of bucket cylinder is connected with main oil line and the rodless chamber of bucket cylinder is connected with oil return line. The pressure oil enters into rod chamber of bucket cylinder to retract the cylinder rod and realize the unloading action.

#### ●1.Check valve



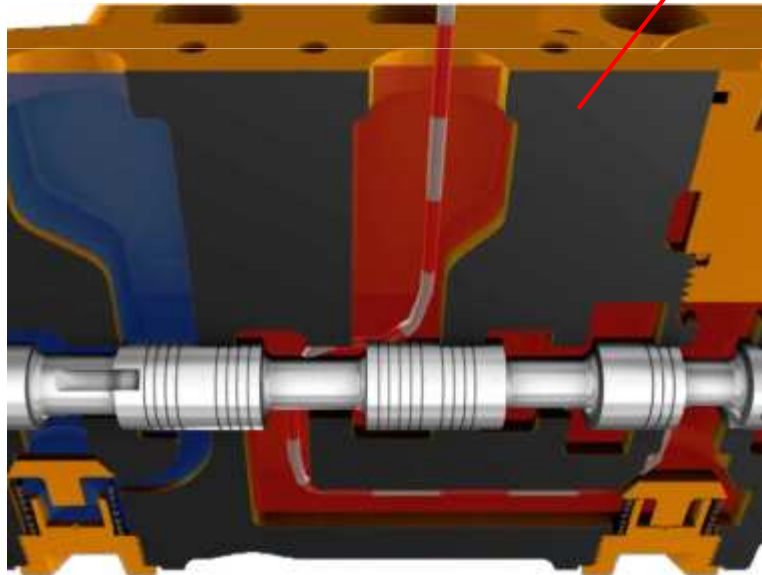
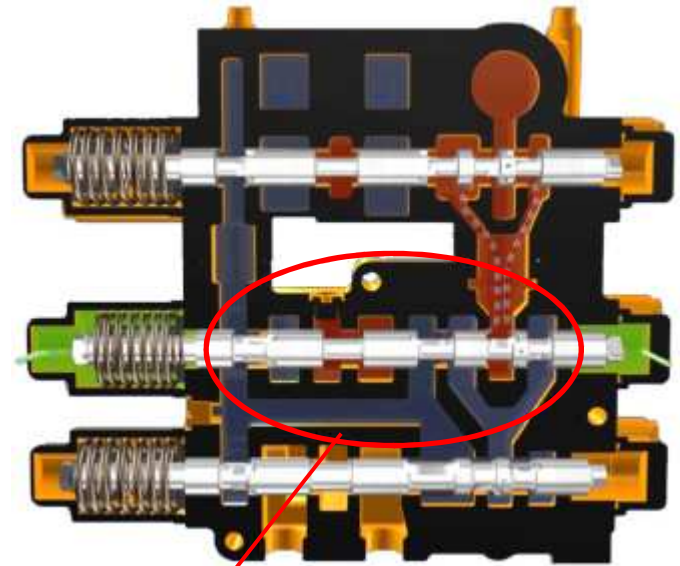
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## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●CONTROL VALVE

#### ●Bucket retraction

●When the pilot valve is at bucket retraction position, the pilot oil enters into the bucket circuit to push the bucket circuit slide valve to the other end. The rodless chamber of bucket cylinder is connected with main oil channel and the rod chamber of bucket cylinder is connected with oil return channel. The high pressured oil enters into rodless chamber of bucket cylinder to extend the cylinder rod and realize the bucket retraction action.



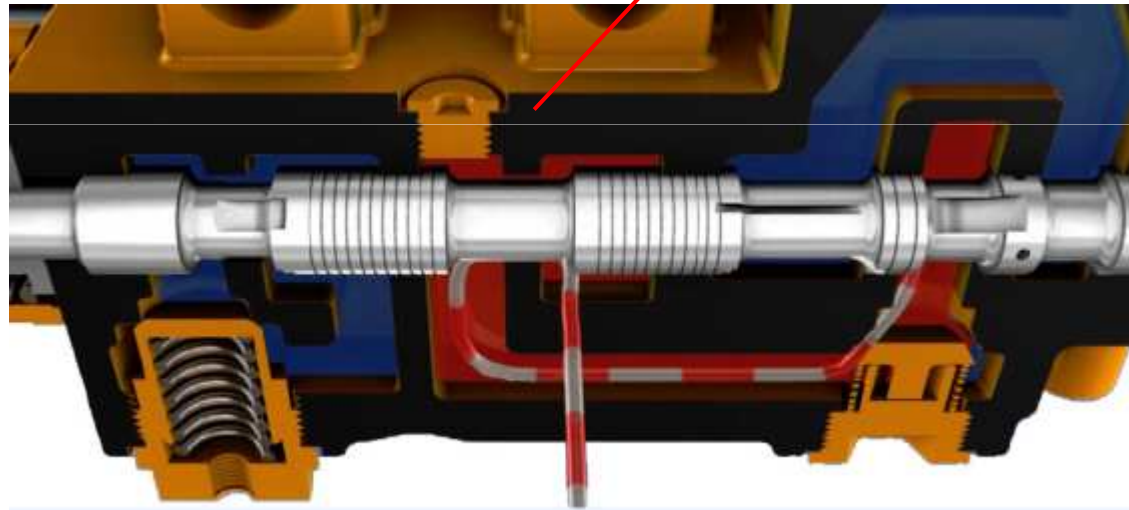
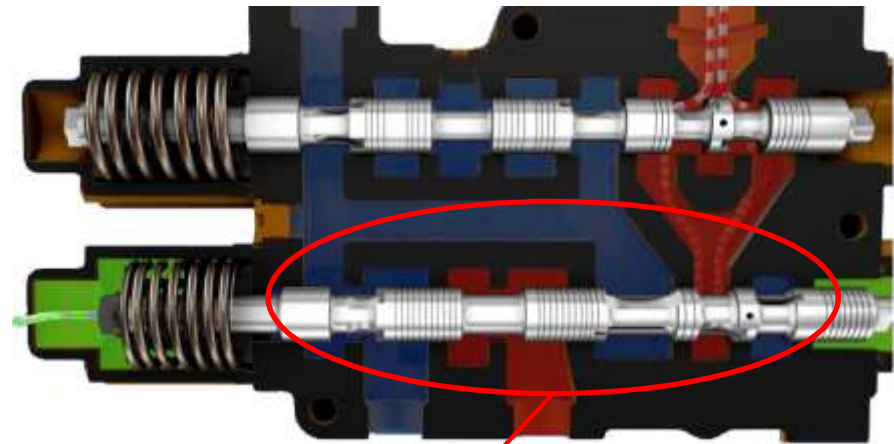


## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●CONTROL VALVE

#### ●Lifting of lift arm

●When the pilot valve is at lift arm lifting position, the pilot oil enters into the lift arm circuit to drive the movement of boom slide valve. The rodless chamber of boom cylinder is connected with main oil channel and the rod chamber of boom cylinder is connected with oil return channel. The high pressured oil from main oil channel enters into the rodless chamber of lift arm cylinder to extend the boom cylinder rod and realize the lifting of boom.

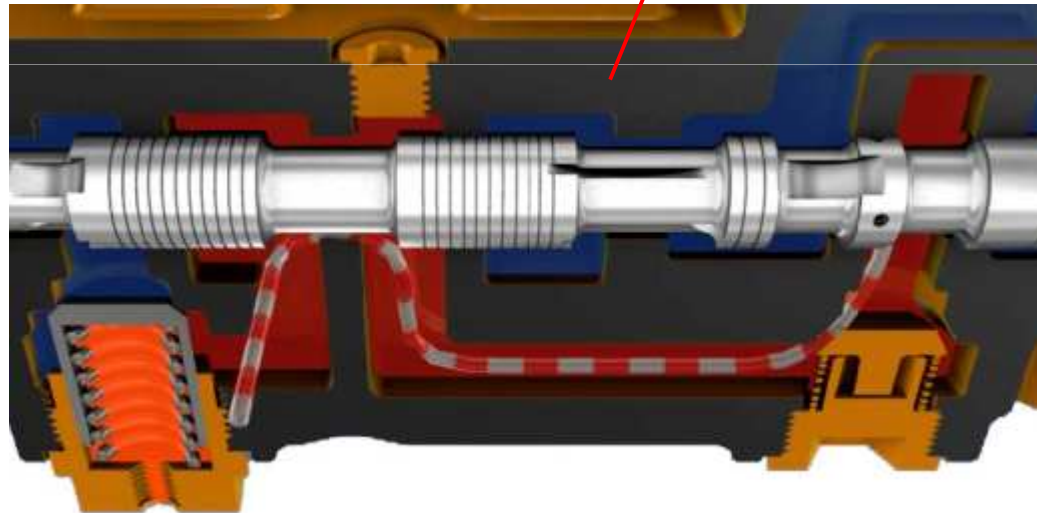
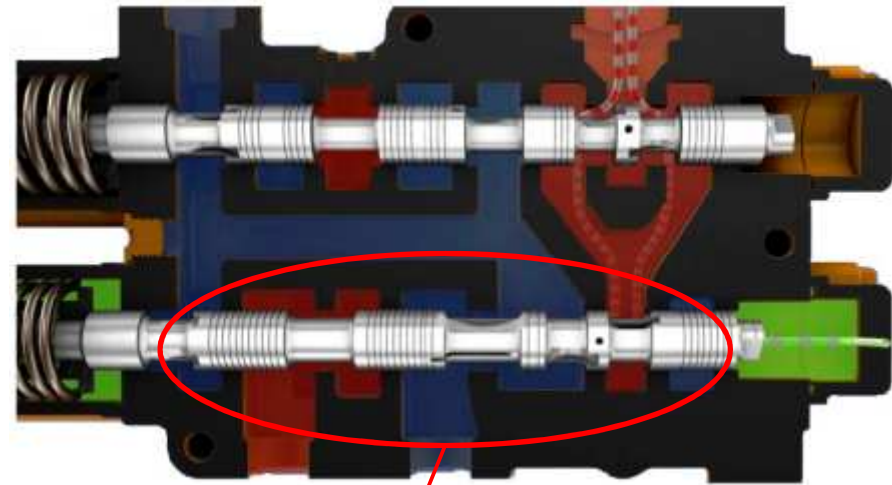


## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●CONTROL VALVE

#### ●Lowering of lift arm

●When the pilot valve is at lift arm lowering position, the pilot oil enters into the lift arm circuit to drive the movement of lift arm circuit. The rod chamber of boom cylinder is connected with main oil channel and the rodless chamber of boom cylinder is connected with oil return channel. The high pressured oil enters the rod chamber of lift arm cylinder to retract the boom cylinder rod and realize the lowering of lift arm.



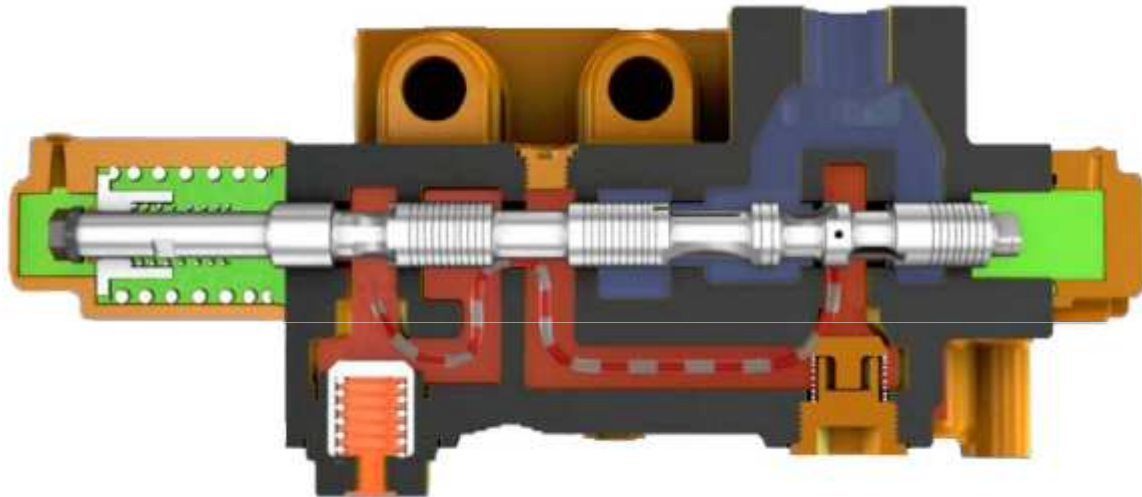
## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●CONTROL VALVE

#### ●Floating of lift arm

●When the pilot valve is at lift arm floating position, the pilot oil enters into the lift arm circuit to drive the valve core to lift arm floating position. The rodless and rod chambers of lift arm cylinder are connected together with the oil return channel. At the same time, the flow that the main oil channel to the lift arm cylinder is cut off.

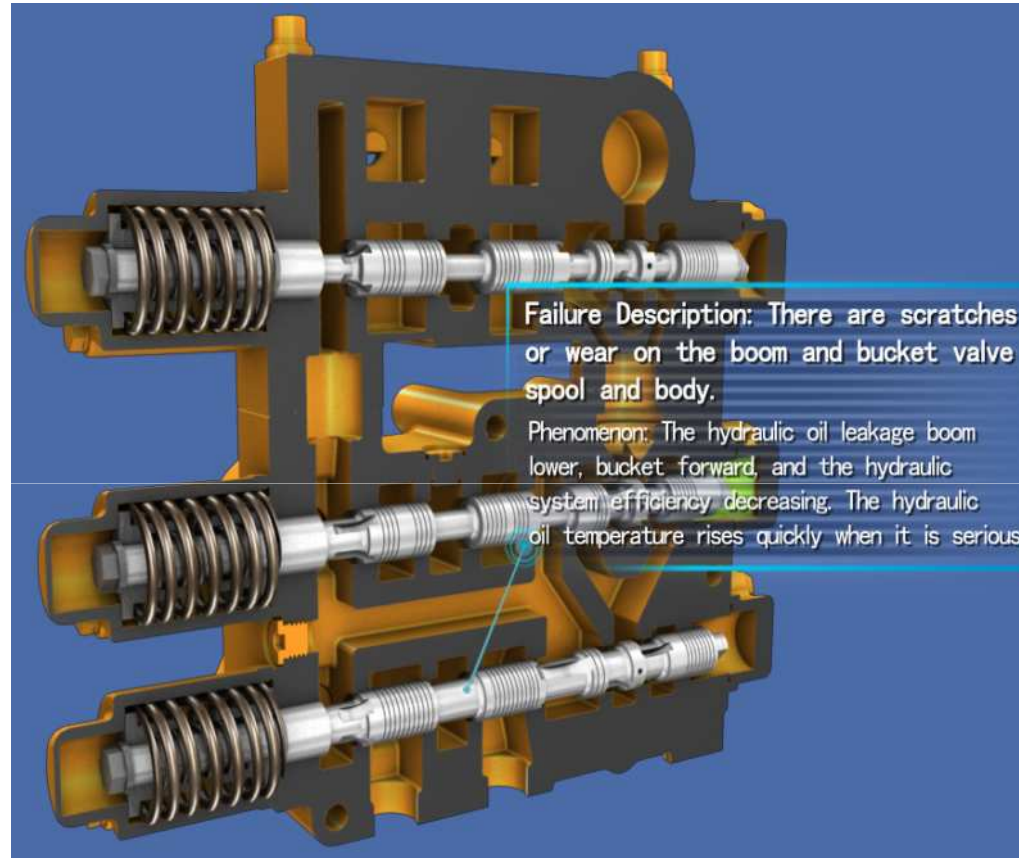
●When the bucket is rotated forcibly by external force, the main oil channel realizes the unloading of high pressured chamber of bucket cylinder and the oil refilling of low pressure chamber under the effect of the overload refilling valve. In addition, under the rapid downward rotation of the bucket, it requires the overload refilling valve for oil refilling.



## SECTION 3 WORKING HYDRAULIC SYSTEM

### •COMMON FAULTS OF CONTROL VALVE

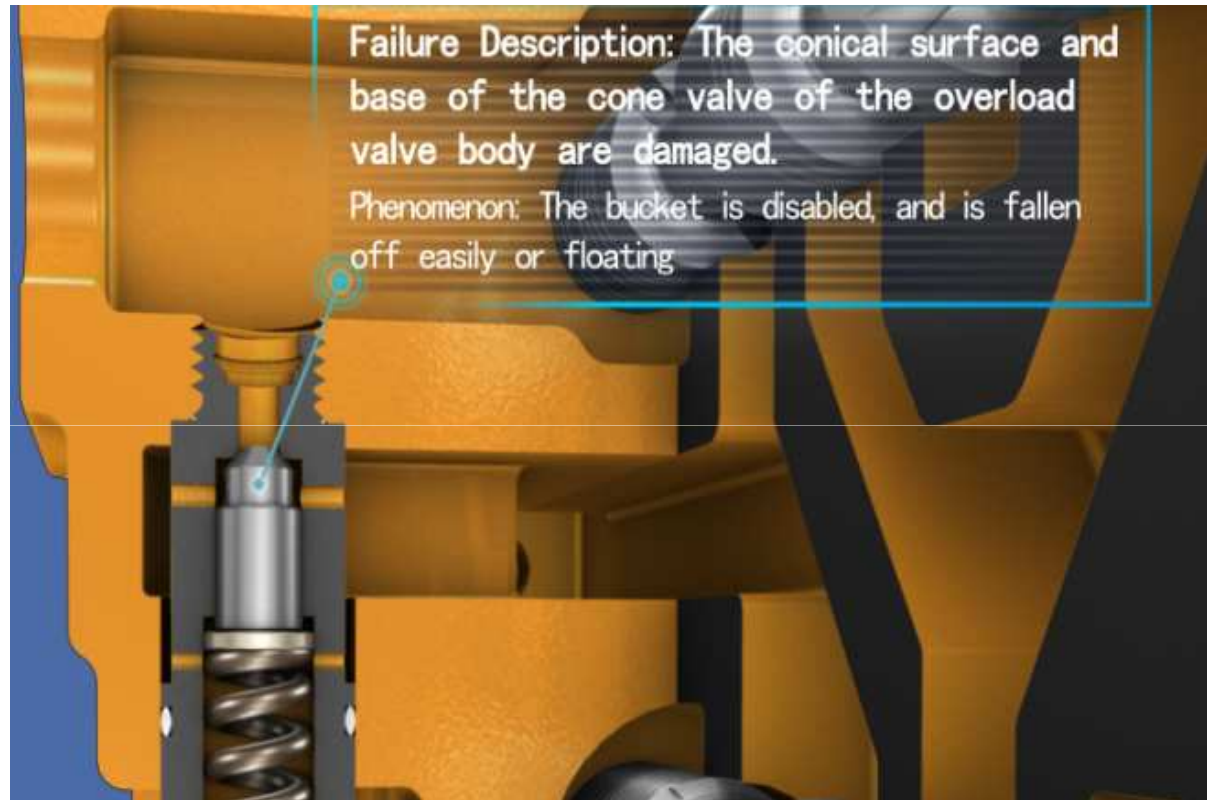
- Phenomenon: The hydraulic oil leakage boom lower, bucket forward, and the hydraulic system efficiency decreasing. The hydraulic oil temperature rises quickly when it is serious.
- Failure cause: There are scratches or wear on the boom and bucket valve spool and body.



## SECTION 3 WORKING HYDRAULIC SYSTEM

### •COMMON FAULTS OF CONTROL VALVE

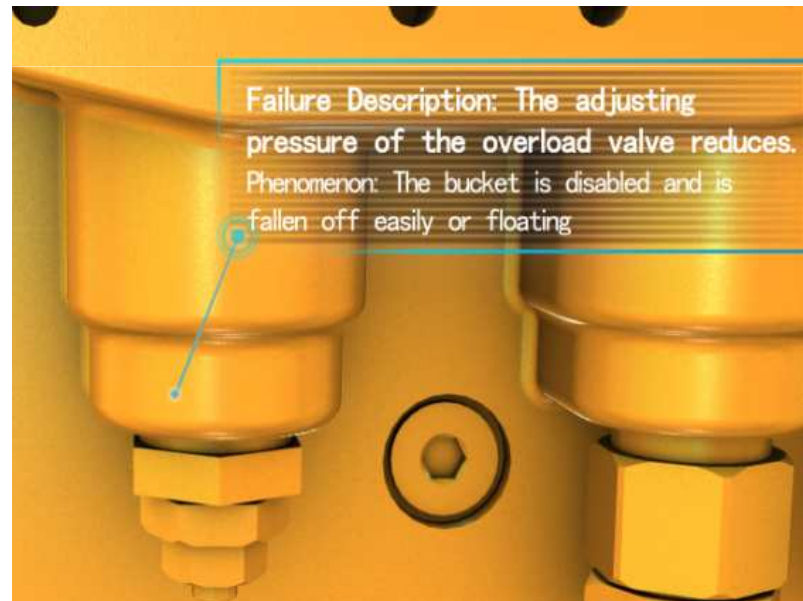
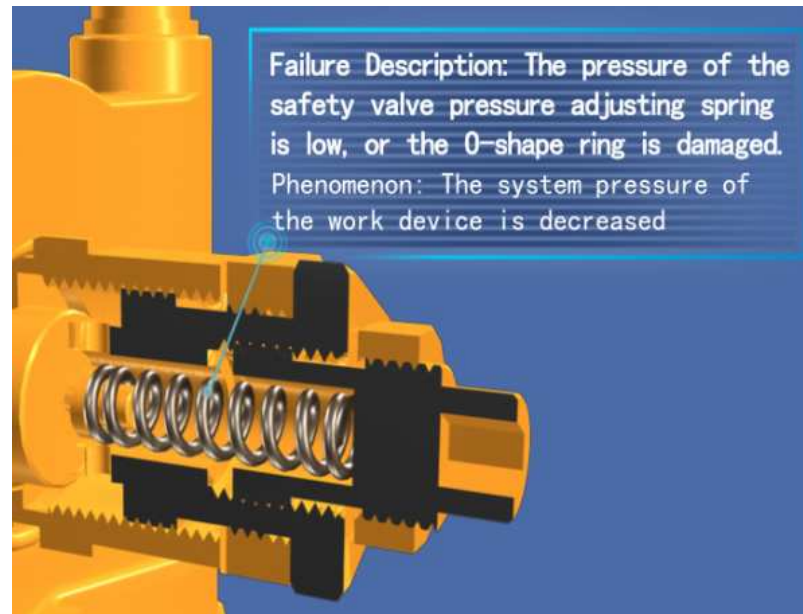
- Phenomenon: The bucket is disabled and is fallen off easily or floating.
- Failure cause: The conical surface and base of the cone valve of the overload valve body are damaged.



## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●COMMON FAULTS OF CONTROL VALVE

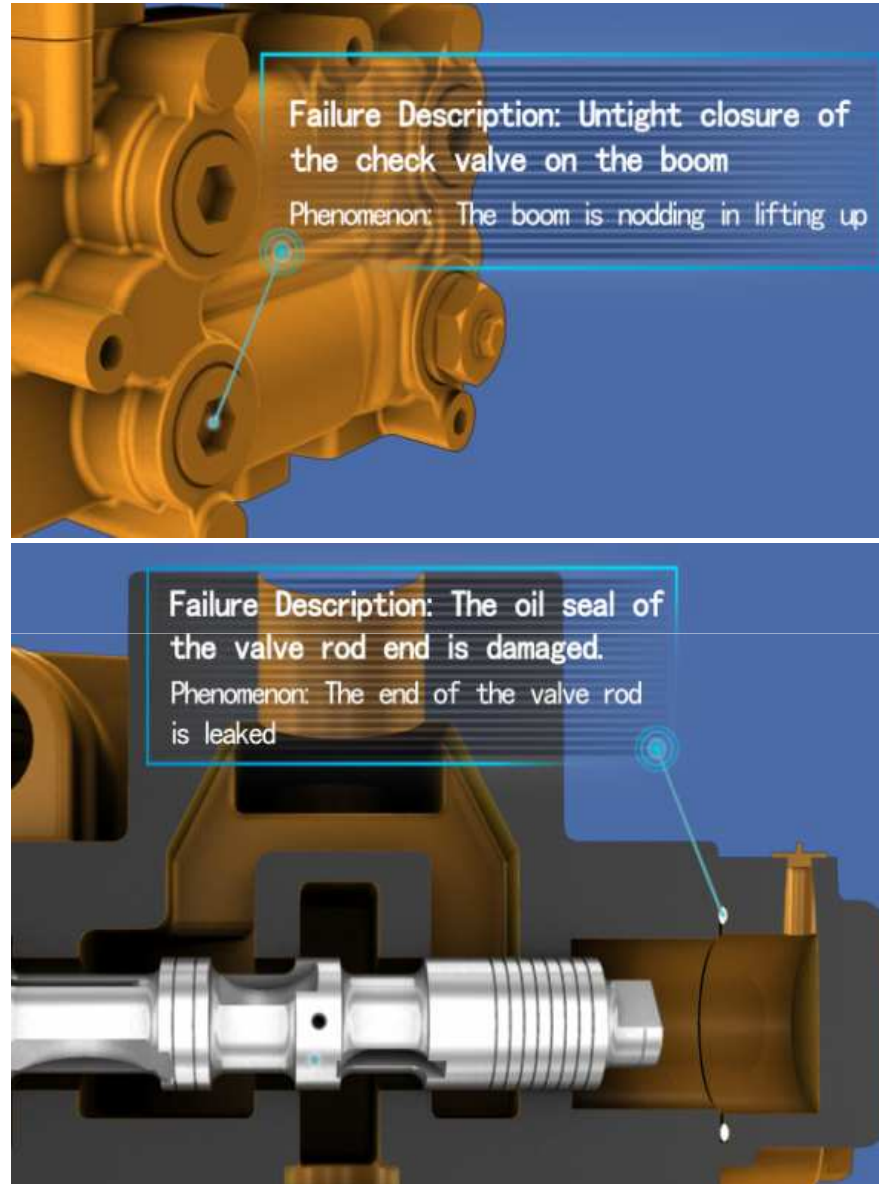
- Phenomenon: The pressure of the working hydraulic system decreased.
- Failure cause: The pressure of the safety valve pressure adjusting spring is low, or the O-ring is damaged.
- Phenomenon: The bucket is disabled and is fallen off easily or floating.
- Failure cause: The adjusting pressure of the overload valve reduces.



## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●COMMON FAULTS OF CONTROL VALVE

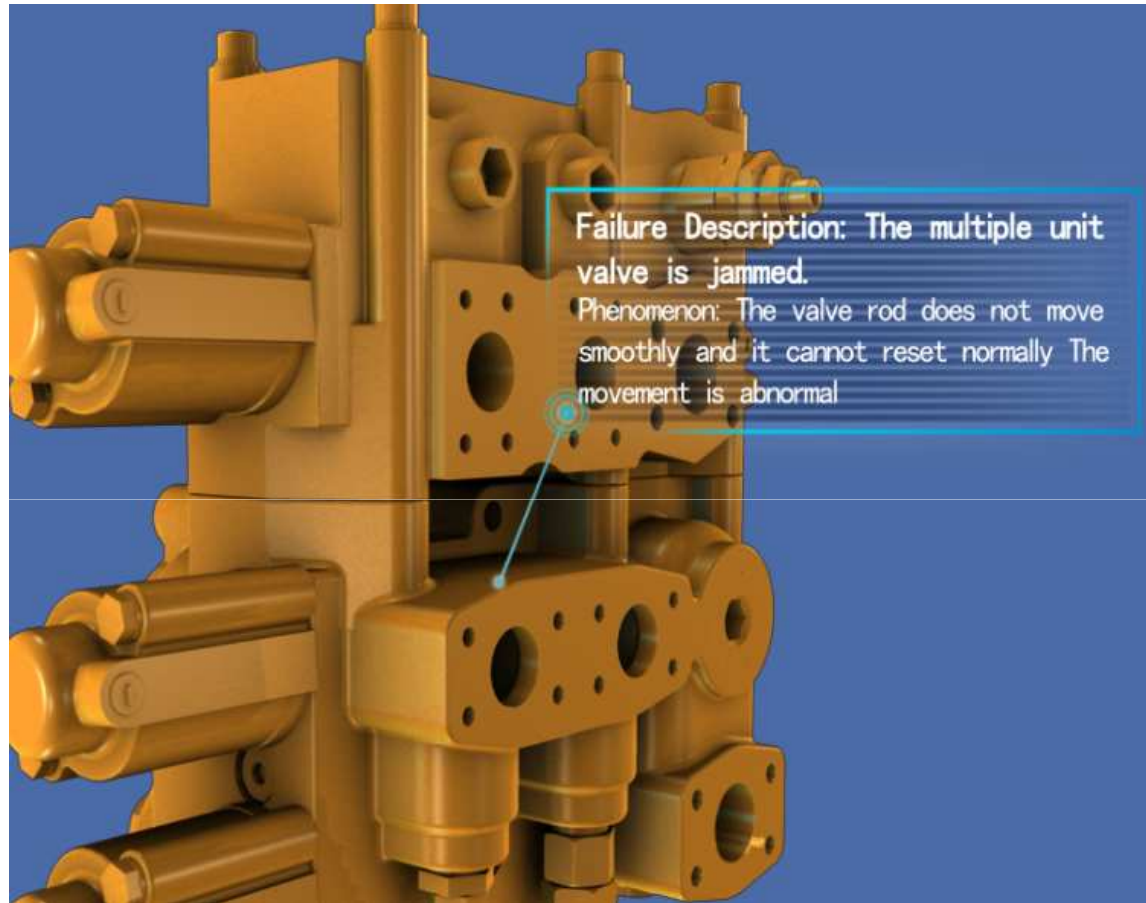
- Phenomenon: The boom nodding when lifting up.
- Failure cause: Un-tight closure of the check valve on the boom
- Phenomenon: The end of the valve rod is leaked
- Failure cause: The oil seal of the valve rod end is damaged.



## SECTION 3 WORKING HYDRAULIC SYSTEM

### •COMMON FAULTS OF CONTROL VALVE

- Phenomenon: The valve rod does not move smoothly and it cannot reset normally. The movement is abnormal.
- Failure cause: The control valve is jammed.





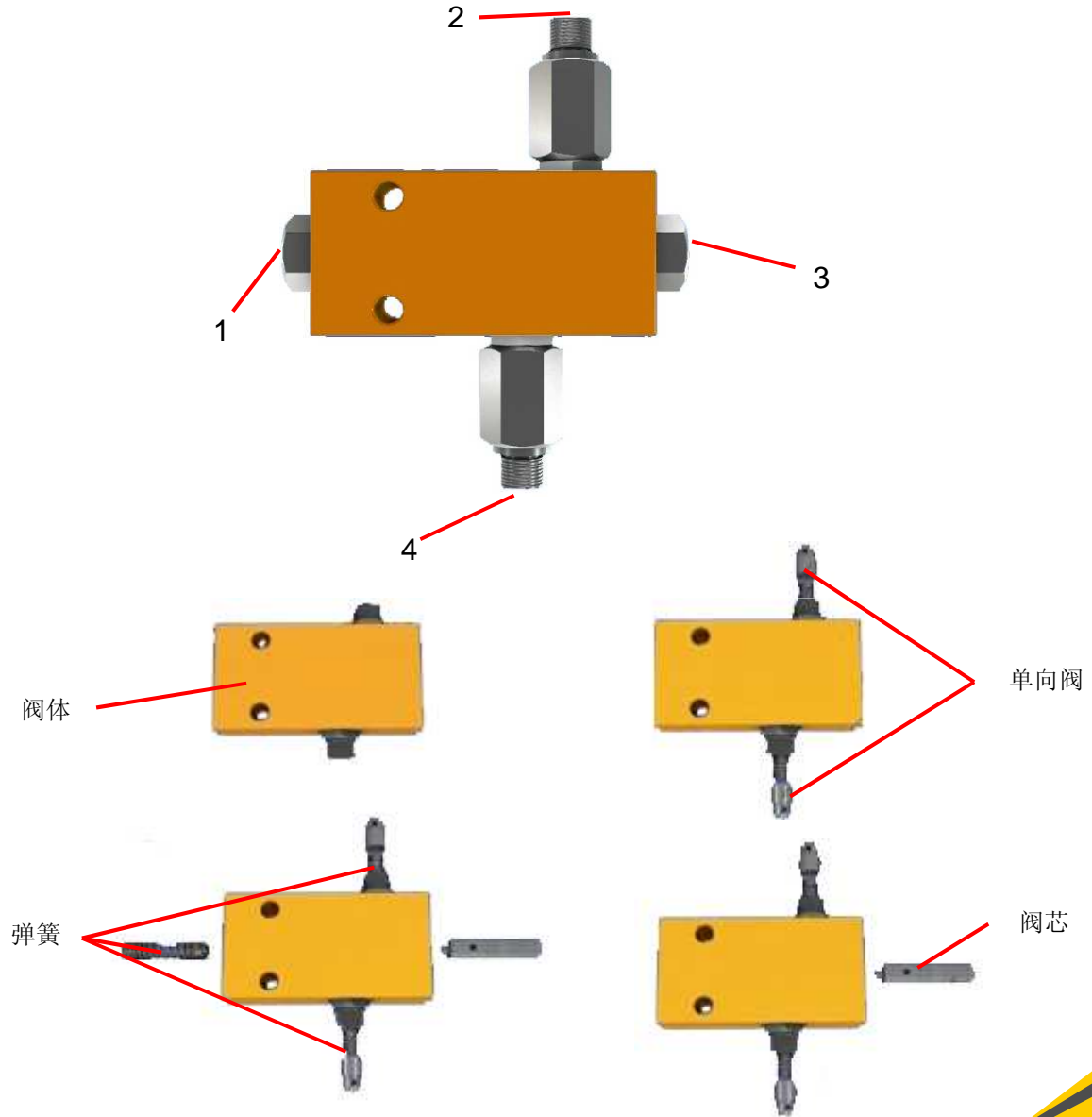
## SECTION 3 WORKING HYDRAULIC SYSTEM

### •PRESSURE SELECTOR VALVE

•The pressure selector valve is mainly composed of valve body, valve core, check valve, and spring.

•The pressure selector valve is functioned to provide pressure oil at certain pressure to the pilot valve and ensure that the lift arm can be lowered onto the ground after the engine is stopped.

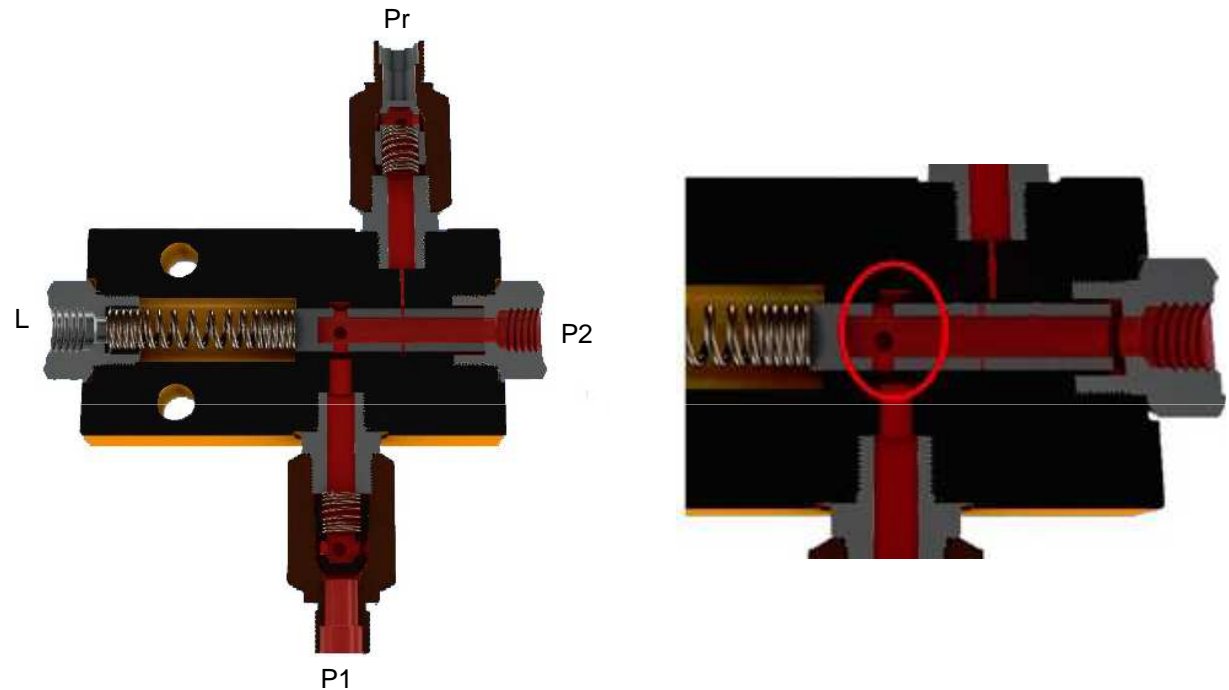
- 1.L port for oil return
- 2.Pr port to big chamber of the lift arm
- 3.P2 port to pilot valve
- 4.P1 port to pilot pump



## SECTION 3 WORKING HYDRAULIC SYSTEM

### •PRESSURE SELECTOR VALVE

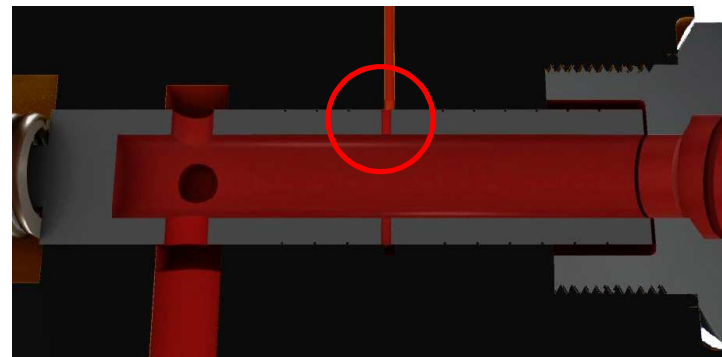
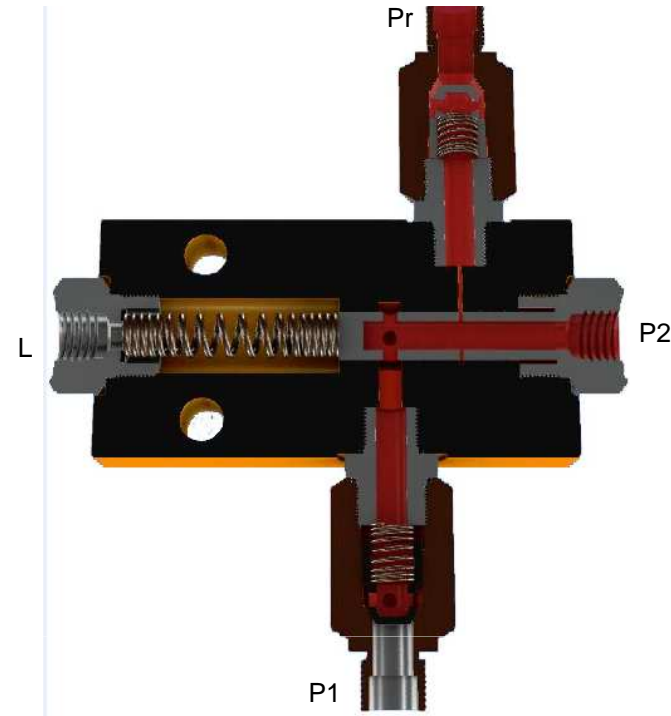
•When the pressure of pilot system is low, the oil inlet port is fully connected with the valve core and the pilot pressure increases gradually. At the same time, under the action of pilot pressure, the valve core gradually moves leftward, till the opening of valve core is completely staggered from the oil inlet port. In such case, the pilot oil line reaches the maximum pressure. When the pilot pressure is reduces during the movement of pilot valve, the valve core moves gradually rightward under the action of spring force and the opening of valve core is gradually connected with the oil inlet port to avoid the pressure drop of pilot system and ensure that the pilot oil pressure is maintained at approximate 2.5MPa.



## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●PRESSURE SELECTOR VALVE

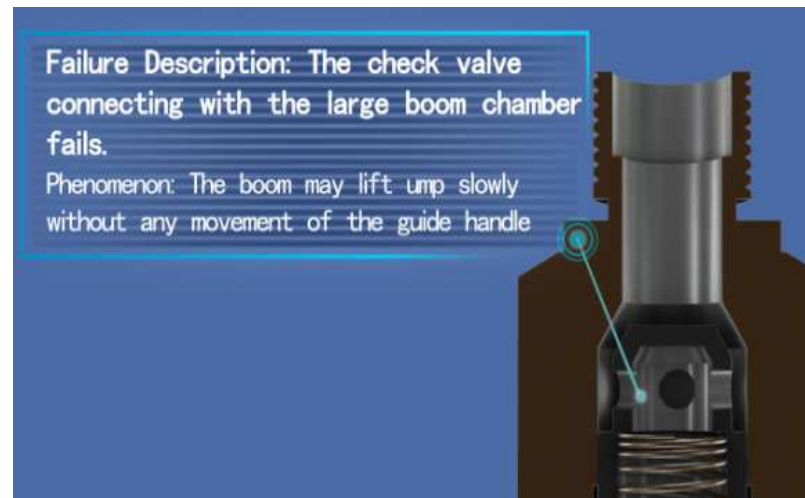
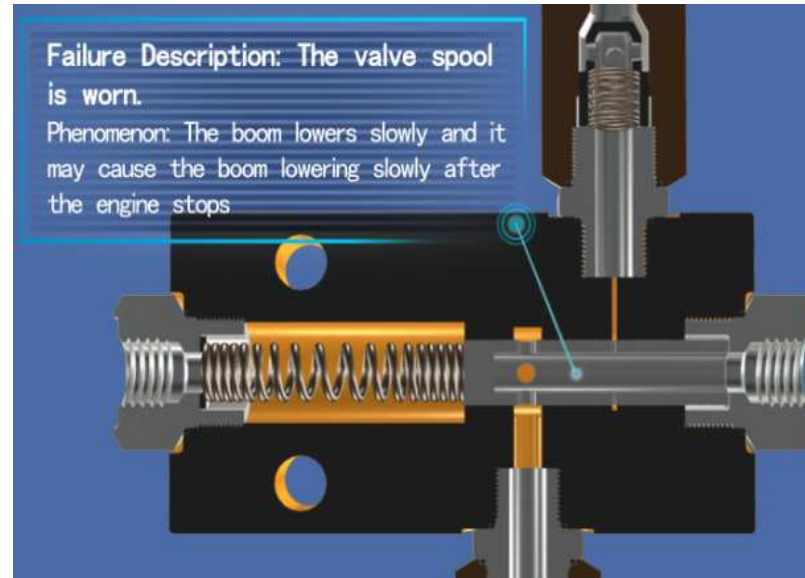
●After the engine is stopped, the rodless chamber of boom maintains high pressure under the gravity force of the working device. Place the pilot valve at lift arm lowering position. The hydraulic oil from the rodless chamber of lift arm cylinders push the check valve open and enters into pilot hydraulic system through valve core. When the pressure of pilot oil line increases gradually, the valve core moves leftward gradually so that the small opening on the top of the valve core is gradually staggered from the oil port Pr. The opening/closing extent between the port Pr and valve core is jointly controlled by the spring force and pilot oil pressure to realize the control on the pilot system pressure.



## SECTION 3 WORKING HYDRAULIC SYSTEM

### • COMMON FAULTS OF PRESSURE SELECTOR VALVE

- Phenomenon: The lift arm lowers slowly and it may cause the lift arm lowering slowly after the engine stops.
- Failure cause: The valve spool is worn.
- Phenomenon: The lift arm may lift up slowly without any movement of the guide handle.
- Failure cause: The check valve connecting with the large chamber of the lift arm fails.



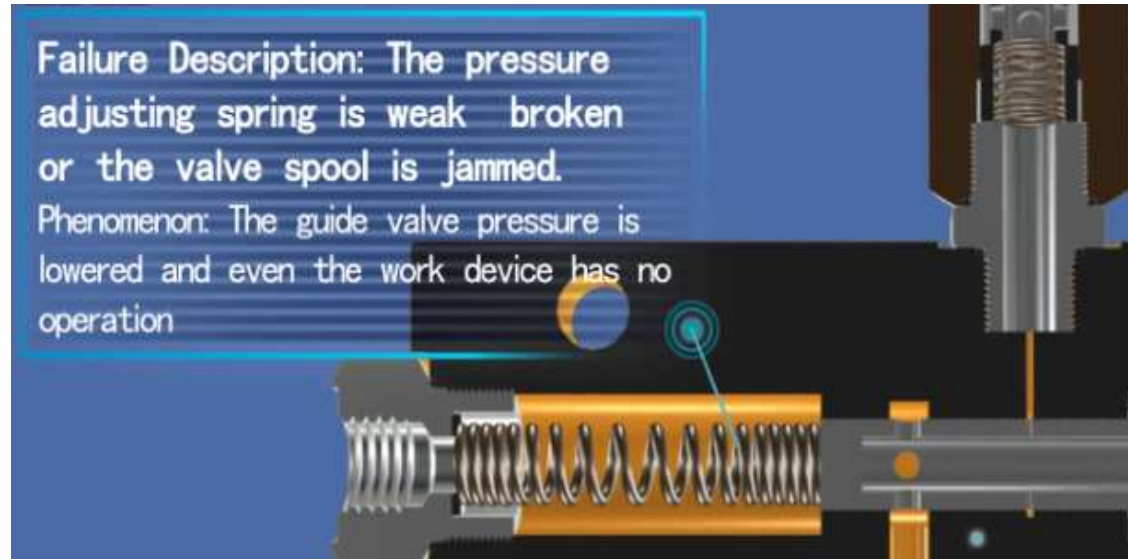
## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●COMMON FAULTS OF PRESSURE SELECTOR VALVE

- Phenomenon: The guide valve pressure is lowered and even the work device has no operation.
- Failure cause: The pressure adjusting spring is weak, broken or the valve spool is jammed
- Phenomenon: The oil flowing to the guide pump, and the lift arm lowers slowly after the engine stops.
- Failure cause: The check valve connecting with the pilot pump fails.

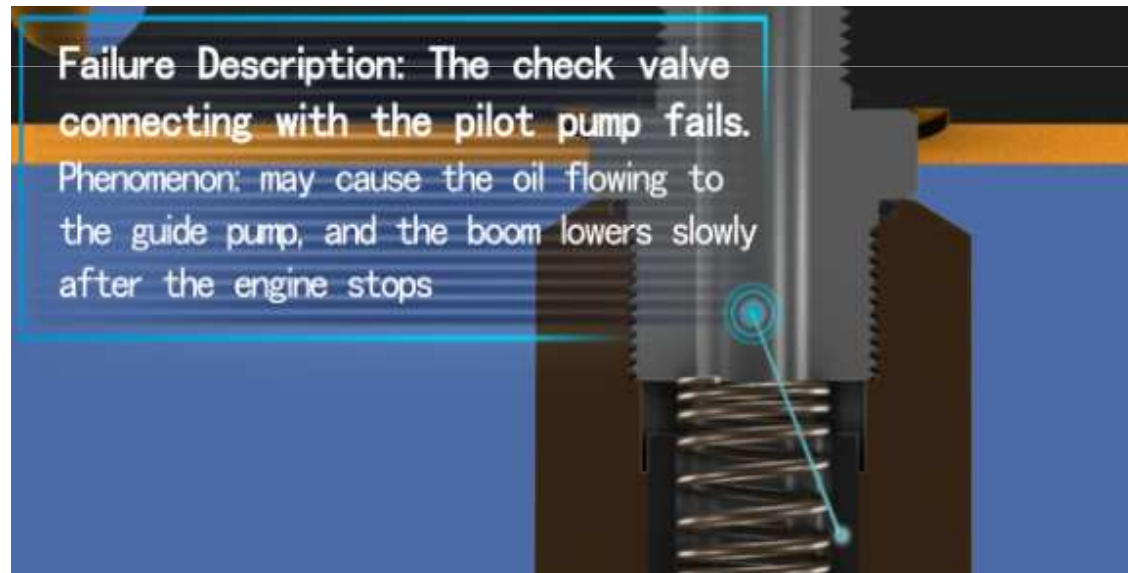
**Failure Description:** The pressure adjusting spring is weak broken or the valve spool is jammed.

**Phenomenon:** The guide valve pressure is lowered and even the work device has no operation



**Failure Description:** The check valve connecting with the pilot pump fails.

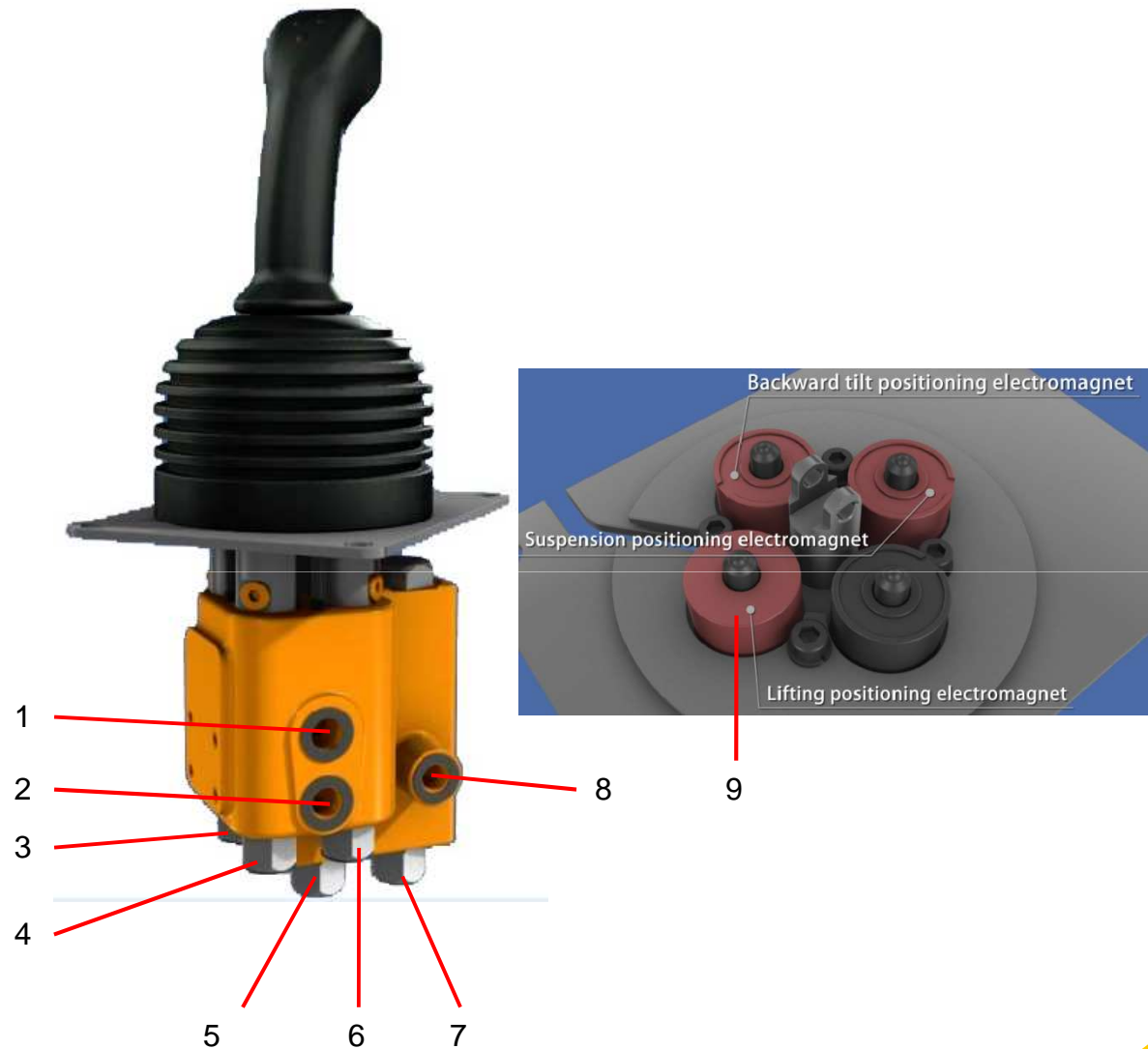
**Phenomenon:** may cause the oil flowing to the guide pump, and the boom lowers slowly after the engine stops



## SECTION 3 WORKING HYDRAULIC SYSTEM

### PILOT VALVE

- The pilot valve is mainly composed of valve body, valve core, spring, and electromagnet.
  - The pilot valve controls the actions of working device. The boom has four actions, namely lifting, neutral, lowering, and floating, and the bucket has three actions, namely neutral, forward tilting, and backward tilting.
- 1.Oil return port
  - 2.Oil inlet port
  - 3.Oil port for backward tilting
  - 4.Oil port for lift arm lifting
  - 5.Oil port for lift arm lowering
  - 6.Oil port for forward tilting
  - 7.For spare use
  - 8.Oil port for lift arm floating
  - 9.Electromagnet



## SECTION 3 WORKING HYDRAULIC SYSTEM

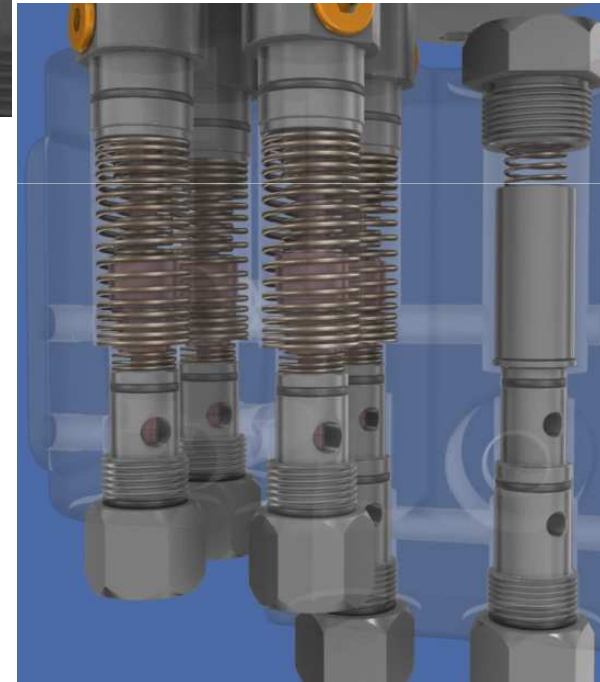
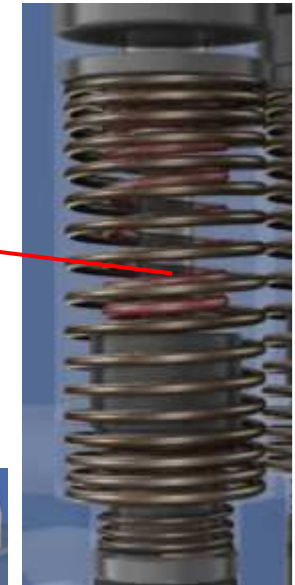
### PILOT VALVE

While shifting the operating lever to a certain position, the pressure pin drives the downward movement of the pressure rod so that the metering valve core moves downward to cut off the passage between control chamber and oil return chamber and connect the control oil chamber with oil inlet chamber. The pilot pressure oil reaches one end of control valve to drive the movement of control valve slide valve and realize corresponding reversing action. At the same time, the oil pressure of the control chamber is applied to the lower end of metering valve core, which is balanced with the metering spring force. When the operating lever is maintained at certain position, both the spring force and the corresponding pressure of control chamber are constant values, which is similar to the actions of fixed value reducing valve. The spring force varies along with the variation of the operating lever swing angle: High swing angle brings about high spring force, high pressure of control chamber, and accordingly increased push force onto the control valve core, namely the travel of main valve core is proportional to the swing angle of pilot valve operating lever, in order to realize the proportional pilot control.



计量阀芯

计量弹簧



## SECTION 3 WORKING HYDRAULIC SYSTEM

### •PILOT VALVE

- When the pilot operating lever is pushed downward further, the pilot valve is locked by electromagnet. The pressure of the control oil increases, and the logic valve is pushed open. Thus the both the big chamber and the small chamber of the lift arm are connected with the oil tank. And this is the floating condition.





## SECTION 3 WORKING HYDRAULIC SYSTEM

### •COMMON FAULTS OF PILOT VALVE

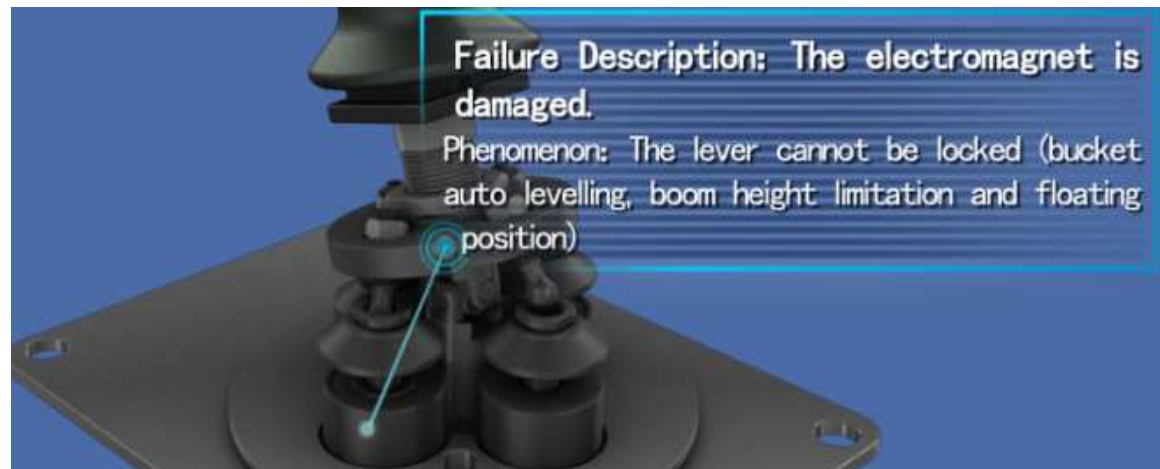
- Phenomenon: The operation is rude without final movement, and it may cause the accident when it is serious.
- Failure cause: The measuring spring fails of breaks.



## SECTION 3 WORKING HYDRAULIC SYSTEM

### ●COMMON FAULTS OF PRESSURE SELECTOR VALVE

- Phenomenon: The work device has no movement or moves slowly.
- Failure cause: The pilot valve spool is jammed.
- Phenomenon: The lever cannot be locked (bucket auto leveling, lift arm limitation and floating position).
- Failure cause: The electromagnet is damaged.



## SECTION 3 WORKING HYDRAULIC SYSTEM

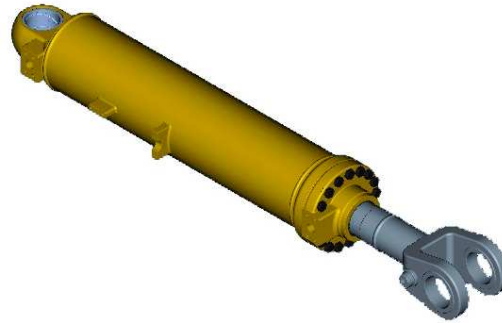
### •LIFT ARM CYLINDER

- The lift arm cylinder is composed of cylinder block, shaft sleeve, piston, cylinder rod, and seals.

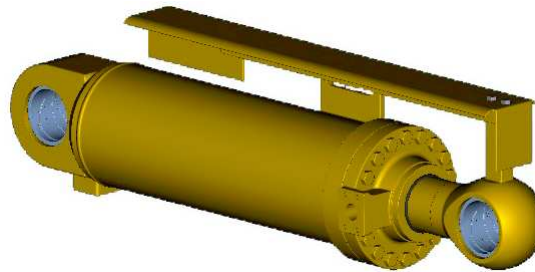
### •BUCKET CYLINDER

- The bucket cylinder is composed of cylinder block, shaft sleeve, piston, cylinder rod, and seals.

- Refer to the steering cylinder for the common faults of the lift arm cylinders and the bucket cylinders.



动臂油缸



转斗油缸

## SECTION 4 THE THIRD FUNCTION

### •CONTROL VALVE

- As one circuit of control valve, the third function is generally functioned as reserve circuit.
- The third circuit can be used for controlling diversified attachments, such as multi-functional bucket as shown in the picture.



# Chapter VII Electric System

## Section I Brief

- Electrical System Introduction

## Section II Power supply

- Generator
- Battery

## Section III Boot device

- Start circuit
- Starter motor
- Power switch

## Section IV Lighting signaling equipment

- Lighting system
- Electric horn system

## Section V Instrument testing equipment

- Dashboard
- Sensor wiring
- Temperature sensor
- Brake pressure sensor
- Fuel level sensor
- Alarm Pressure Switch

## Section VI Auxiliary equipment

- Air conditioner system
- Spray cleaning system
- Front and rear wipers
- Quick-change system
- Fan system

## Section I Review

### 一. Electrical System Introduction

- The electric system is an important part of the loader and is mainly functioned for start and control of diesel engine and fulfillment of the operations including lighting, signal indicators, and instrument monitoring. The quality of electric system directly influences the working reliability and the traveling and operation safety of the loader.



## Section I Review

### —.Composition of Electric system

●The electric system of loader is mainly composed of the following 5 parts :

- Power Part
- Start Part
- Lighting and signaling part
- Instrument
- Accessory Part



1.Power part: Including the battery and alternator assembly.



2.Start part: Mainly including starter, starter relay, and electric lock, which are functioned to start the diesel engine.



3.Lighting and signaling part: Mainly including all kinds of lighting and signal lamps and horns and buzzers, which are functioned to ensure the safety of human and machine and the successful implementation of operations under all kinds of operation conditions.



4.Instrument monitoring part: Including pressure gauges, pressure sensors, temperature gauges, temperature sensors, and low pressure alarms.



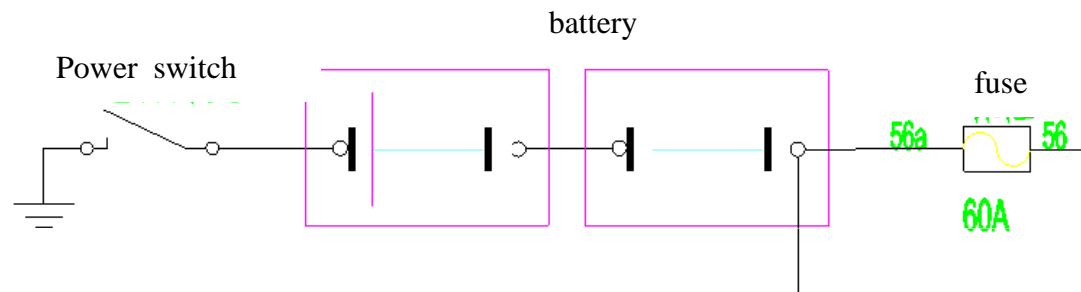
6.Accessory part: Including the electric wiper, heater, and A/C system.

## Section I Review

### — Characteristics of Electric System

#### • Characteristics of Electric System :

1. Low voltage : 24V
2. DC : Battery-powered, DC .
3. Single-wire system : All appliances in parallel, using the "negative ground" .





## Section II Power part

### 一. Generator

#### 1. Working principle of generator

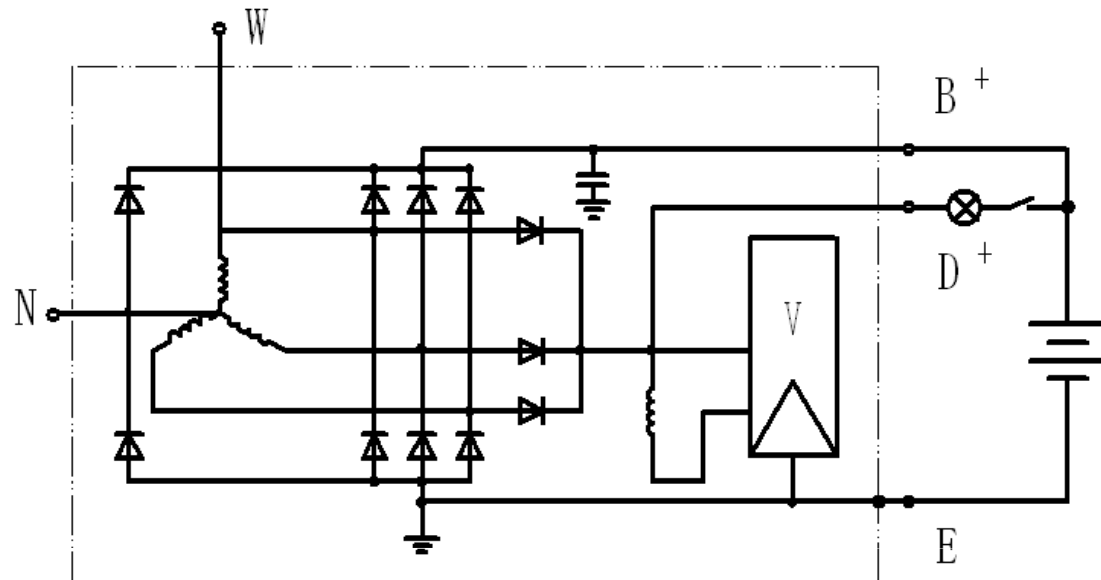
- The **generator** is composed of rotor, stator, drive pulley, fan, front and rear end caps, and electric brush. The excitation winding is generally wound on the rotor and the stator adopts Y-shaped connection mode. The rectifier is generally a 6-tube bridge full wave rectifier.
- When a DC voltage is applied on two ends of excitation winding, the current will generate a magnetic field. Driven by the engine, the magnetic field rotates along with the rotor and the three-phase symmetric winding of the stator will, under the application of rotating magnetic field, generate three-phase sine electromotive force with same frequency and same amplitude in spacing of 120°.



## Section II Power part

### Generator

- The unidirectional conduction performance of silicon diode is utilized for rectification. At any moment, only the positive diode connected with the winding of the phase with highest potential is on. In same way, the negative diode connected with the winding of the phase with lowest potential is on. Through the sequential turn-on of six diodes repeatedly, one relatively stable pulsed DC voltage is obtained at two sides of the load.
- The terminal voltage of alternator is proportional to the speed of the alternator. Due to high speed variation range of the engine, the terminal voltage of alternator will also vary within a high range and the output of terminal voltage can't meet the operation requirements of the loader's electric devices for constant voltage. Therefore, the voltage regulator must be set.



- The voltage regulator utilizes the on/off of switching tube to change the size of excitation current so as to change the intensity of magnetic field to stabilize the voltage of the generator.
- The filter capacitor is mainly functioned to filter away the peak pulse and high frequency interference issued by the generator.

## Section II Power part

### —Generator

#### 2. Wiring method of generator

The generator is generally an assorted part of diesel engine and has three lead terminals, as shown in the Figure 10-4, which are respectively:

B+: generator power output terminal

D+: Charging indicator signal

W+: Phase output terminal, which can be functioned as timer signal as well as speedometer signal.

- The generator is in parallel connection with battery set to power the electric devices of whole loader. The electric devices are powered by the battery before the start of the loader and are powered by the generator after the start of loader. At the same time, the generator also charges the battery set.



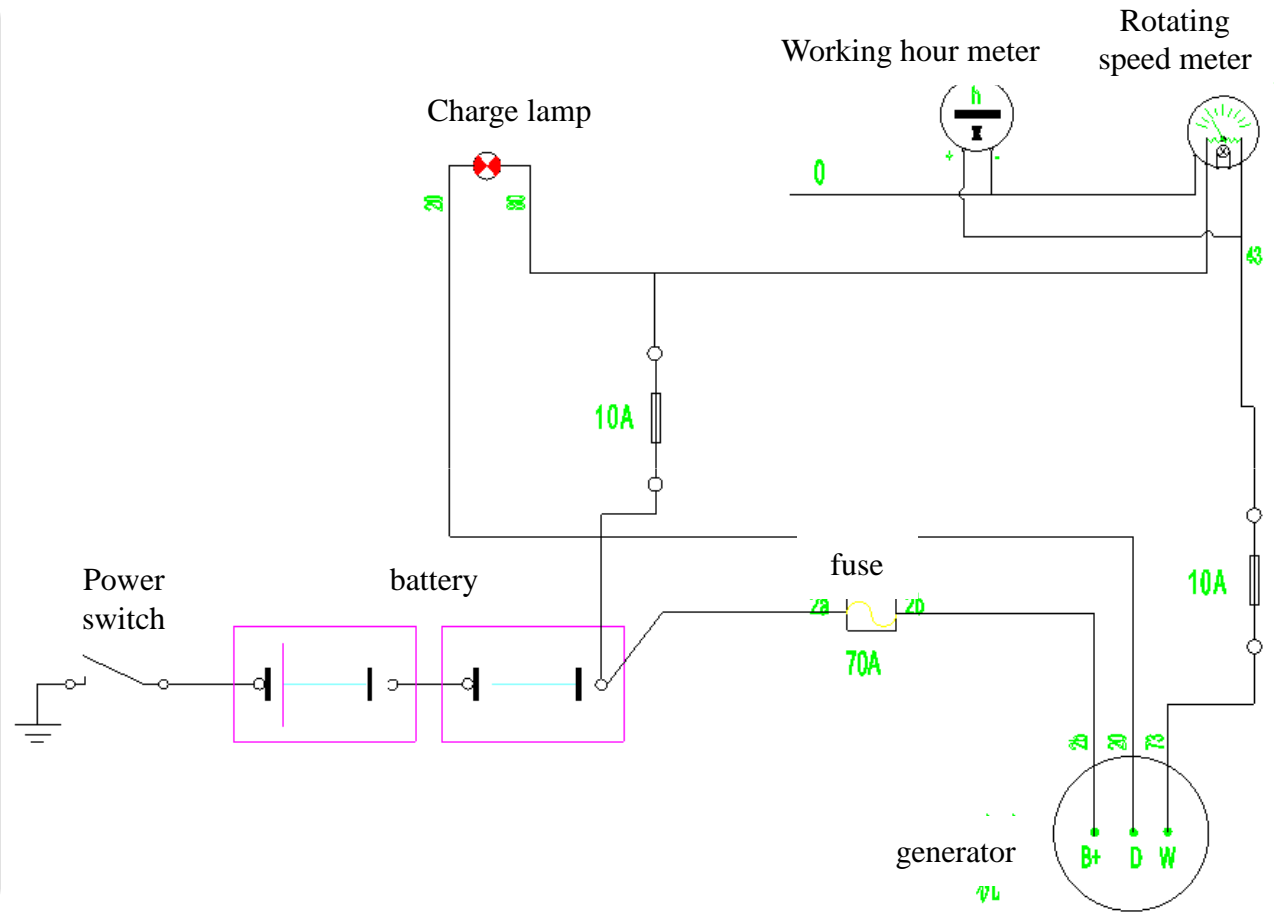
**Warning:** It's strictly prohibited for the generator to independently power the electric devices without the battery.

**Warning:** It's prohibited to check the power generation of generator by instantly short-circuiting the positive and negative posts of alternator for generation of spark, in order to prevent burning the diode and impairing the regulator.

## Section II Power part

### 一. Generator

- Total wiring schematic diagram generator



## Section II Power part

### 一。 Generator

- Common Malfunctions of Generator
- Phenomenon : generator does not generate electricity .
- Fault detection and judgment: Check with DC 200V measuring range of universal meter . Turn on the electric lock, measure the terminal voltage of alternator (connect red probe to terminal D+ of alternator and connect black probe to grounding), and record the reading of universal meter (This reading is actually the terminal voltage of battery and is generally less than 26V). Start the machine, measure the terminal voltage of alternator again, and record the reading of universal meter (If the alternator is generating power normally, this reading shall be approximate 28V).



## Section II Power Part

### 一. Generator

#### ● Troubleshooting :

1 First, check the alternator drive belt is too loose.

2 off power locks, power generator with a wrench checking the connection terminals are correct, fastening, and reliable.

3 Check the generator grounding reliability.



## Section II Power Part

### 二. Battery

- Battery Type : 6-QW-120B
- Rated voltage : 12V
- Rated Capacity : 120A·h

The overall machine adopts 2 batteries in series connection. The battery is one invertible DC power supply and is parallel connected with alternator to power the electric devices. A single battery can supply 200A~600A start current to the starter motor within a short period (5~10s). The battery is also equivalent to a large capacitor, which can absorb the over-voltage that may occur any time in the circuit, in order to protect the electric devices against puncture.

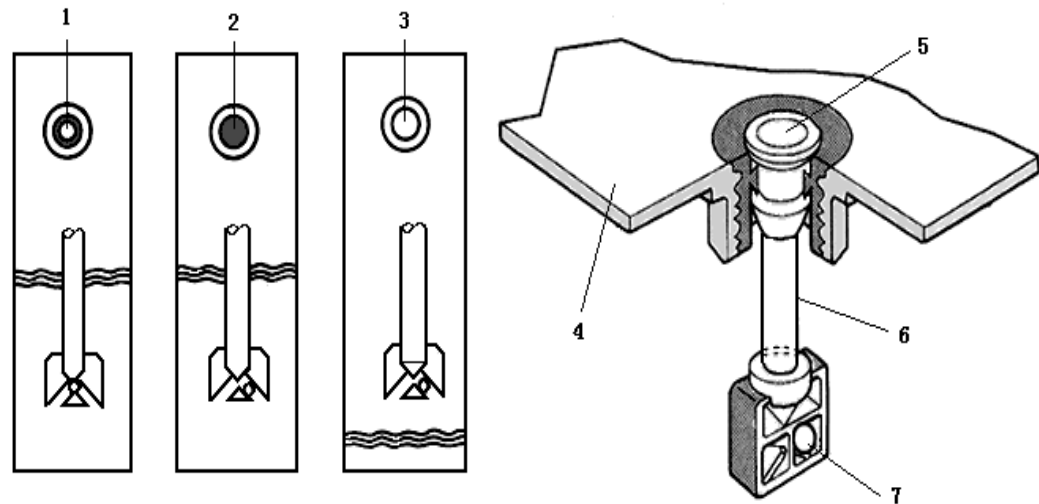


## Section II Power Part

### 二. Battery

● Figure 10-1 Structure and color of charge indicator

Color of charge indicator	Electric quantity
green	The electric quantity is above 65% and the battery is normal
dark	The electric quantity is less than 65% and the charging is required.
Light yellow	The battery is over-charged and shall be replaced with new one.



1 - green 2 - dark 3 - Light yellow  
 4 - Battery cap 5 - Observation 6 - Optic charge indicator 7 - Green small ball





## Section III Power Part

### 二. Battery

- Battery Common Troubleshooting.
- Symptom: can not start .
- Cause: Battery power is low or damaged .
- Check method :
  - First check the battery power and the battery cable connections are reliable or not
  - Check the voltage of battery . Check with DC 200V measuring range of multimeter. Connect the red probe to the output cable end of the positive post of battery and connect the black probe to the negative post of the battery. The reading of the multimeter is the terminal voltage of the battery (generally at 24V~26V). .



## Section III Power Part

### 三. Battery Relay

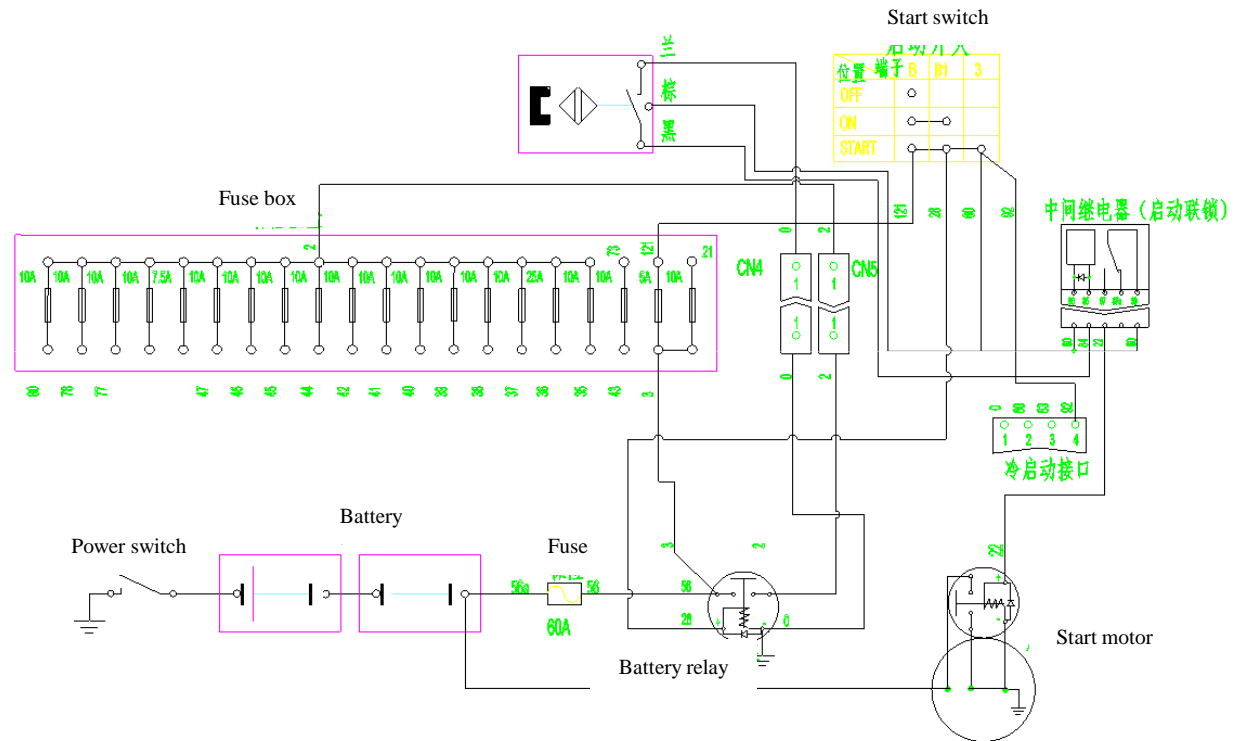
- When the electric lock key is turned to the ON position, the wires 28# and 0# are turned on to supply power to the whole machine.



## Section III Start Part

### 一. Start Circuit

- Composition of the start circuit.
- Start circuit is mainly composed of the battery, the power switch, battery delay relay, starter relay, starter motor, wires and other components.

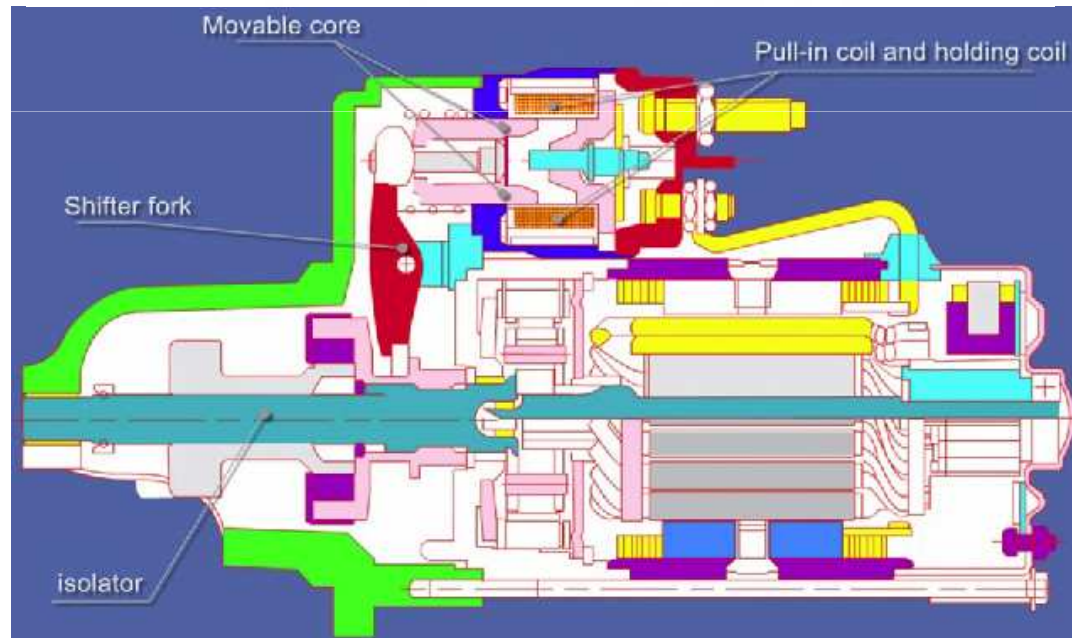
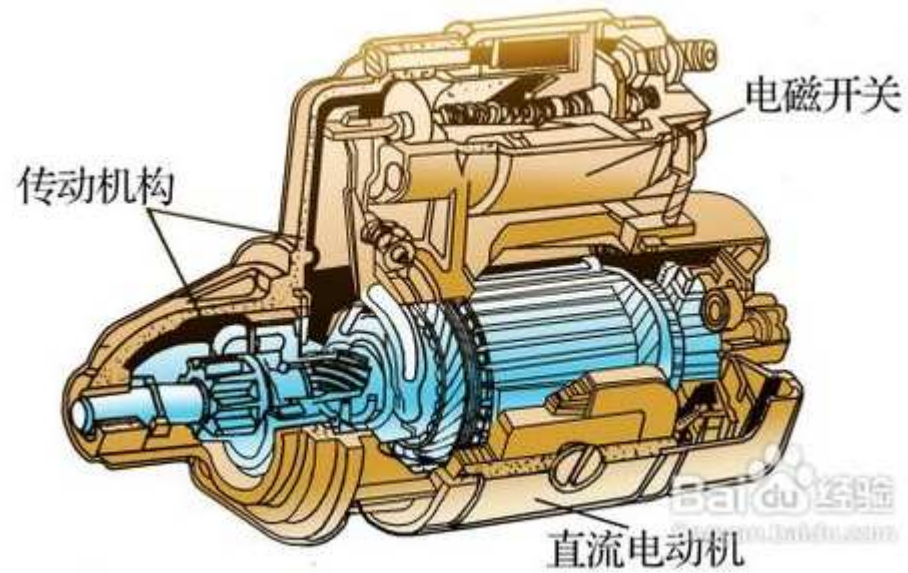


## Section III Start Part

### 二. Structure of starter motor

The starter motor is an assorted unit of diesel engine. It is mainly composed of electromagnetic switch, DC motor, shifting fork, and drive gear. The starter motor converts the electric energy of the battery to mechanical energy through DC motor and drives the engine flywheel through drive gear to realize the start of engine.

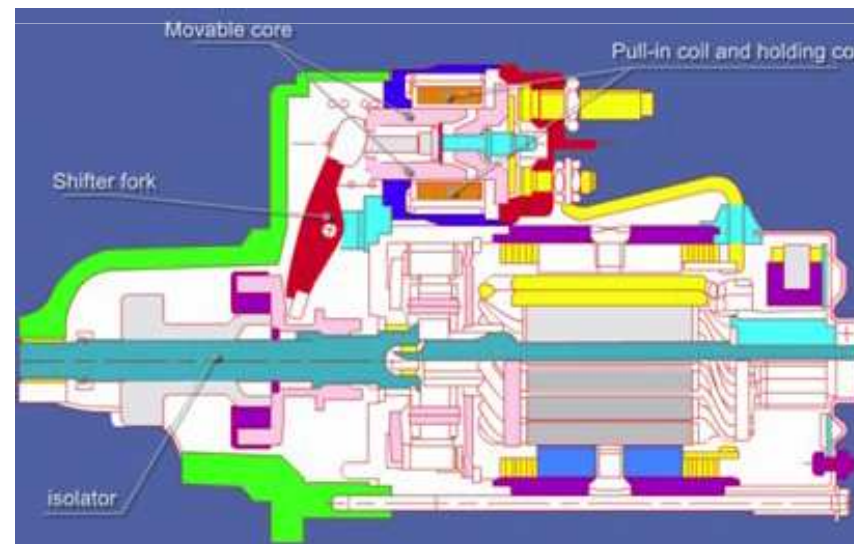
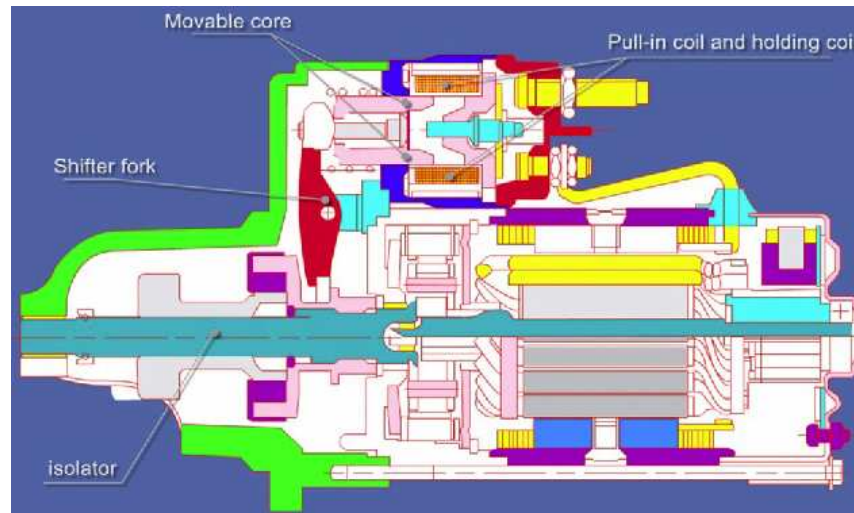
••



## Section III Start Part

### 二. Starter Motor

When the power switch is turned on, the 24V terminal voltage of the battery is applied onto the starter motor via the contact of starter relay. At the moment when the electric lock is rotated to position "START", two coils of the electromagnetic switch of the starter motor are powered and actuated. The electromagnetic resultant force generated by above two coils drives the movement of movable contact disc so that two contacts of the electromagnetic switch are engaged and the current is inputted to the DC motor coil from the battery for form the circuit via the housing of starter motor. In such case, the DC motor starts the rotation. At the same time, the iron core moves to drive the shifting fork to engage the drive gear with the engine flywheel gear ring. The DC motor drives the rotation of the flywheel and the engine start is initiated.



## Section III Start Part

### 二.Starter Motor

- After a successful start, the driver release the electric lock key, power locks automatically reset to "ON" file, the solenoid power, the core under the action of the spring force is reset to the initial position. First gear is also reset to the initial position, and the starter motor stops.



## Section III Start Part

### 二.Starter Motor

- Common fault of Starter motor 。
- Fault description: closed negative switching, self-starting motor running 。
- Reason : This situation is generally due to start relays, power locks or electromagnetic switch contacts due to sintering.
- Approach: re-polished contacts with the movable contact plate or replace the solenoid switch or replace the starter motor.



## Section III Start Part

### 二.Starter Motor

- Malfunctions: No reaction of starter motor at the time of start. ◦
- Handling method: While rotating the electric lock to position “START”, check the wire voltage at the electromagnetic switch of pneumatic motor. If no voltage is detected, check the electric lock, starter relay, and battery (For instance, check the battery set connecting circuit, negative switch, and grounding wire for reliable connections), or it can be determined as the malfunction of starter motor that leads to start failure.



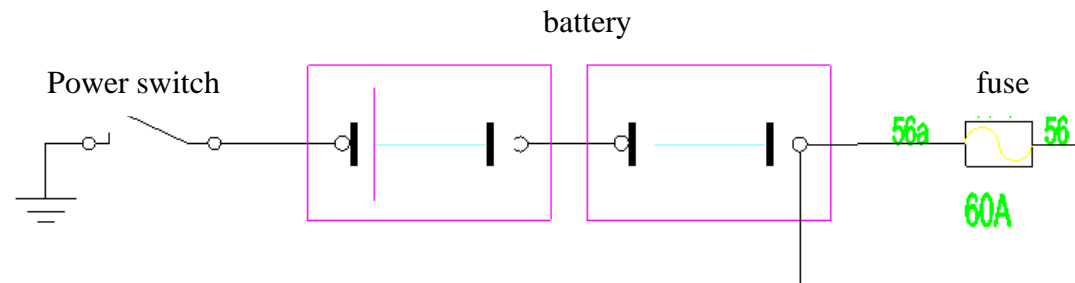


## Section III Start Part

### 三. Power Switch

•The power switch controls the connection and disconnection between battery negative post and frame (grounding). Turn on the power switch to connect the negative post of battery with frame. Turn on the electric lock to power on the electric loads of overall machine. Turn off the power switch to cut off the negative post of battery from frame so that no loop is formed in the circuits of the overall machine. Even when the electric lock is turned on, the overall machine can't be powered on nor started.

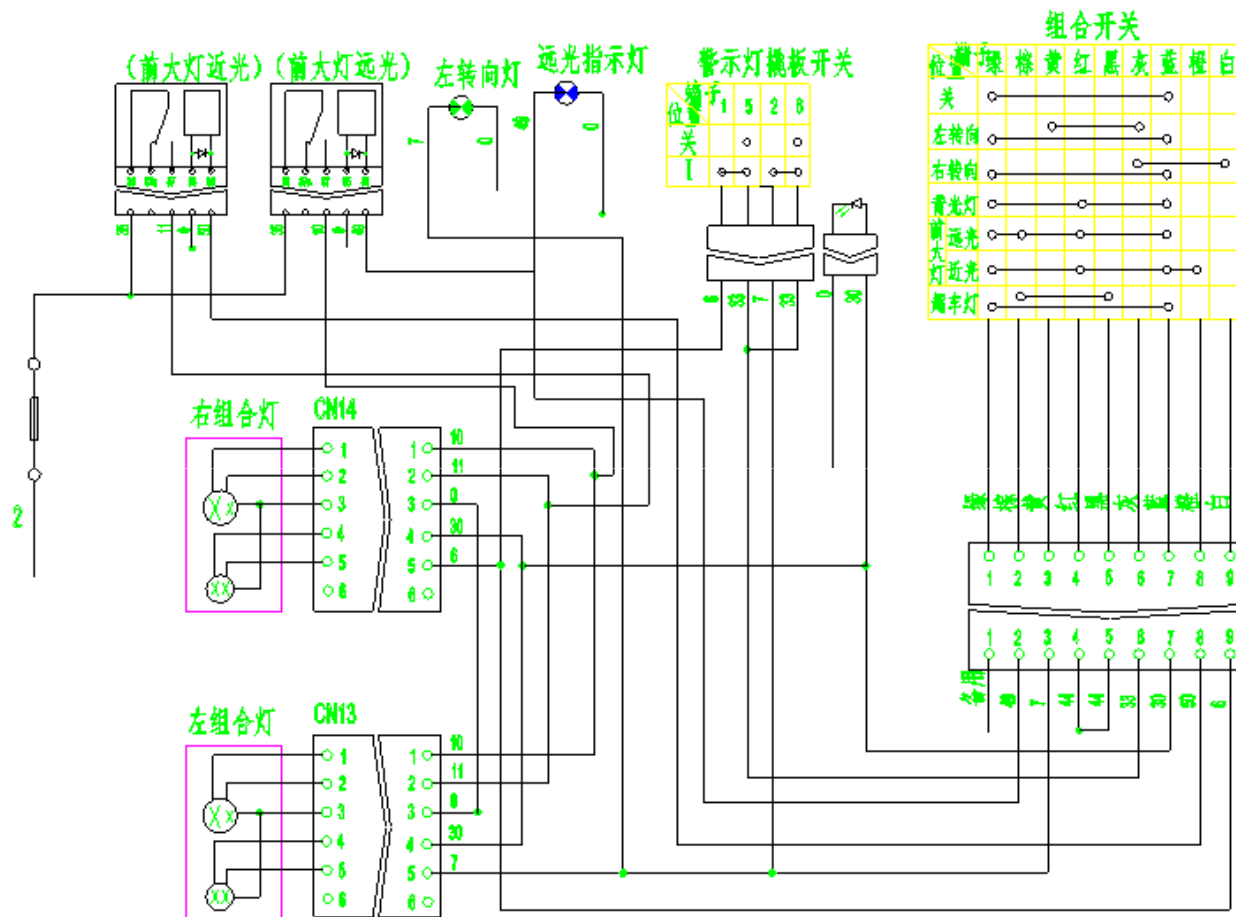
**Warning: When the loader is parked for a long time, please ensure to turn off the power switch, in order to prevent electric leakage and other accidents. Before connecting the battery cables, re-tightening the battery cables, or disconnecting the connecting wires of battery, please make sure to turn off this switch for the purpose of safety.**



## Section IV Lighting signaling equipment

### 一. Lighting System

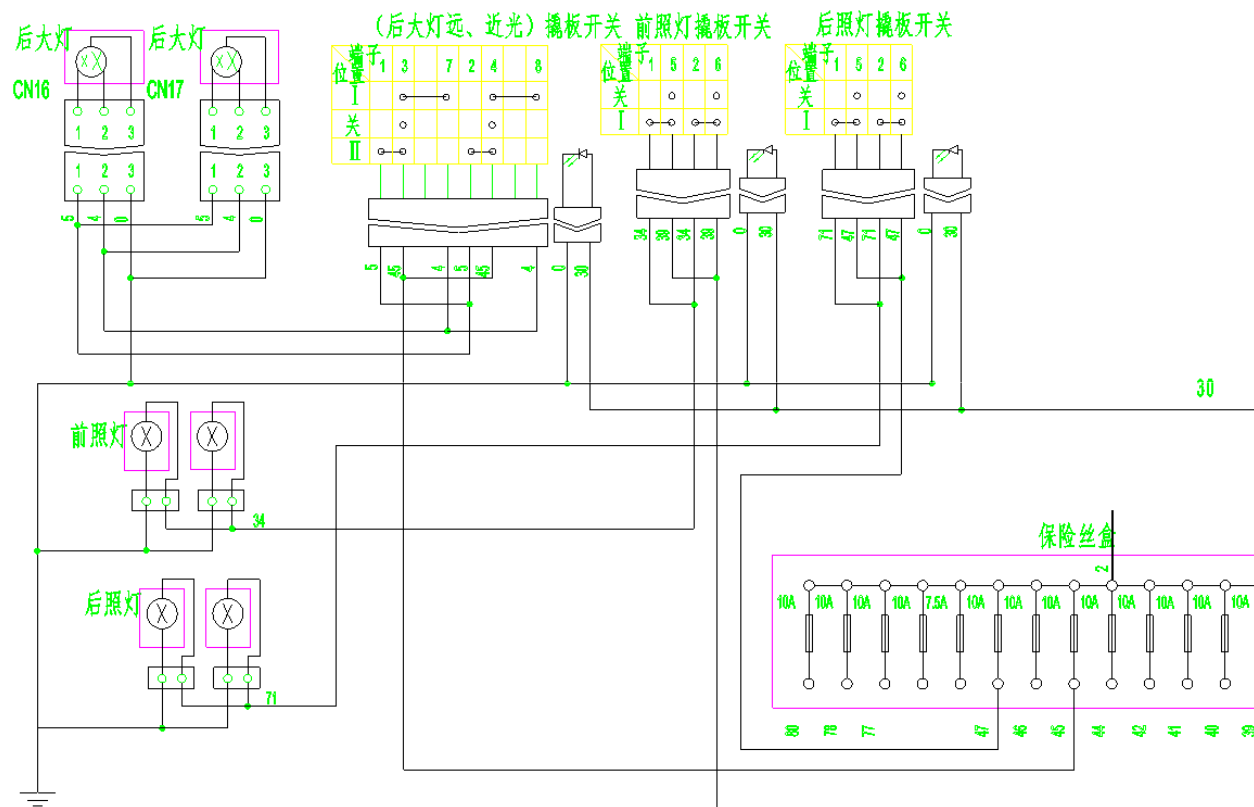
- Lighting system components .
- Lighting system consists of front combination lamp circuit, turn signal lines, warning lights lines, work light line, headlights and interior lights line lines and other components. Shown combination lamp circuit .
- Main circuit from the power supply line 35, the control circuit from the supply line 44. Conversion combination switch, the corresponding indicator on the control panel or the corresponding light-emitting diodes in the control circuit current under the action of light.



## Section IV Lighting signaling equipment

### 一. Lighting System

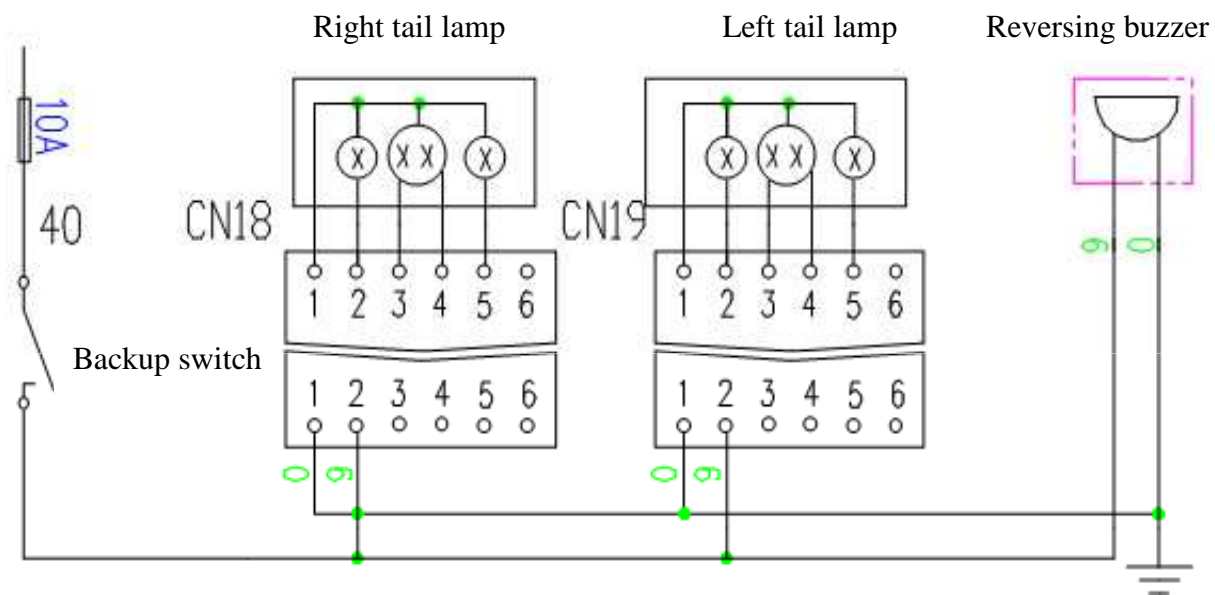
●Icon for the post Headlight and back light circuit. Its working principle is, battery-powered via two wires into the fuse box, and then split, each circuit is fused with the corresponding rocker switch followed by General Electric circuit with the electrical work. Corresponding function .



## Section IV Lighting signaling equipment

### 一. Lighting System

• Icon for the backup alarm system, reversing switch 40 is closed and the 9th line circuit line circuit is switched on. At this point, reversing lights lit around taillights and reverse buzzer circuit turns, reversing buzzer .



## Section IV Lighting signaling equipment

### 一. Lighting System

- Reversing alarm system common troubleshooting and exclusion
- Phenomenon: The backup warning buzzer fails to sound when the electric lock is turned on and the reverse gear is engaged
- **Analysis of Malfunctions :** After the electric lock is turned on, the backup warning buzzer sounds constantly no matter which gear is engaged. This problem is generally caused by the bonded contact of backup switch. In few cases, it's caused by the short-circuit between wire 9# and certain power wire. ◦

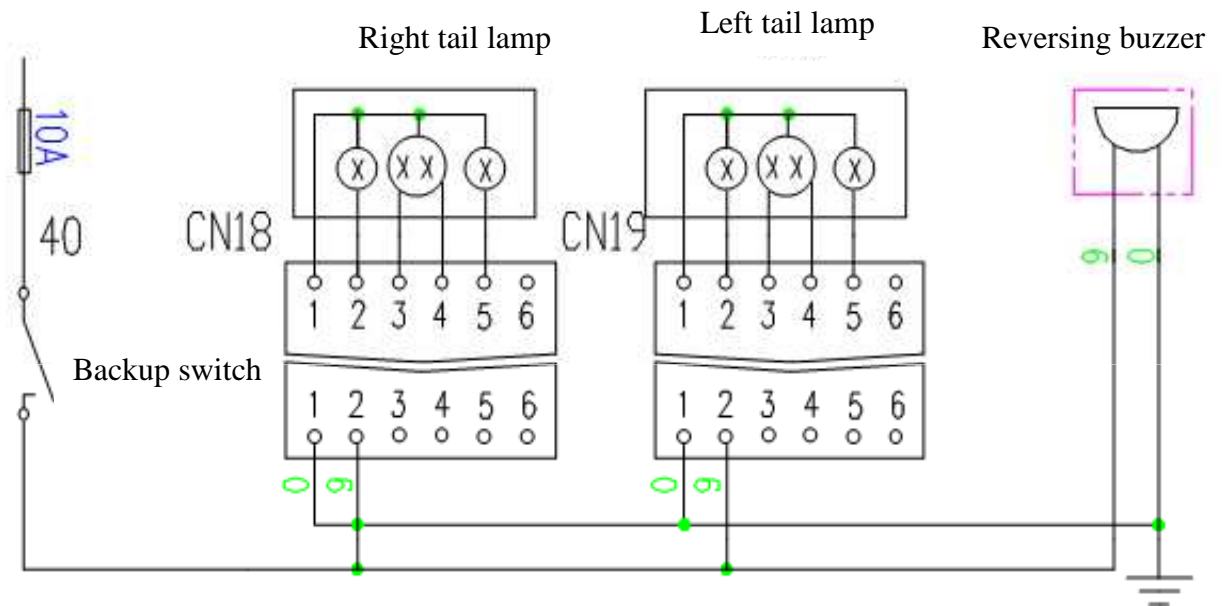


## Section IV Lighting signaling equipment

### 一. Lighting System

#### ●Malfunction exclusion :

1. Check the 10A backup warning buzzer fuse for burnout .
2. Check the connectors and wires for secure and reliable connections. Generally, the loose connector or worn harness will lead to middle open-circuit of wire 9#.
3. Check the backup switch for damage. If normal, two wires of the backup switch are connected when the reverse gear is engaged .
4. If no problem is detected in above checking items, check the voltage of wire 9# at the backup warning buzzer. If the voltage is normal (24V), it indicates that the backup warning buzzer is damaged and shall be replaced. If no voltage is detected, generally the connector is loose or the harness is worn .

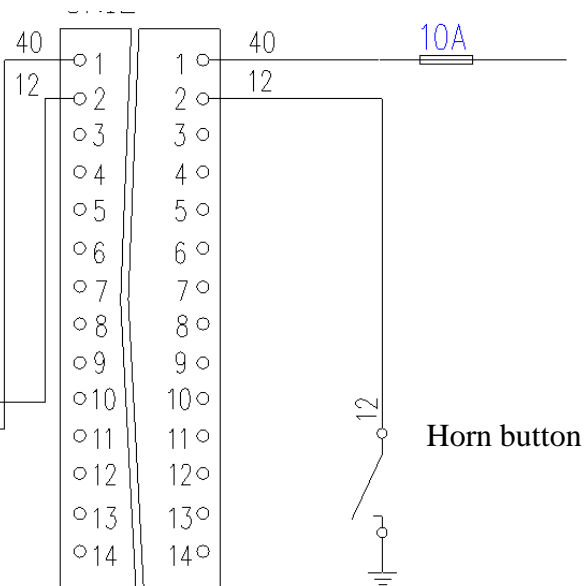
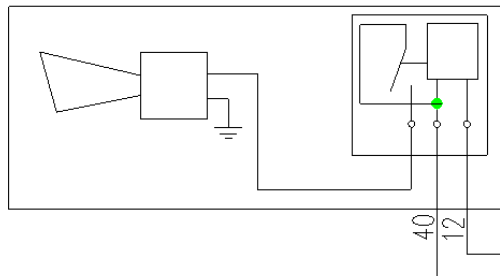


## Section IV Lighting signaling equipment

### 二. Electric Horn

• Supply line through the fuse to 40, press the horn button, line 40, line 12 is switched on. Meanwhile, the 40 lines for power and speaker assembly connected, loud speakers, played the role of whistle warning .

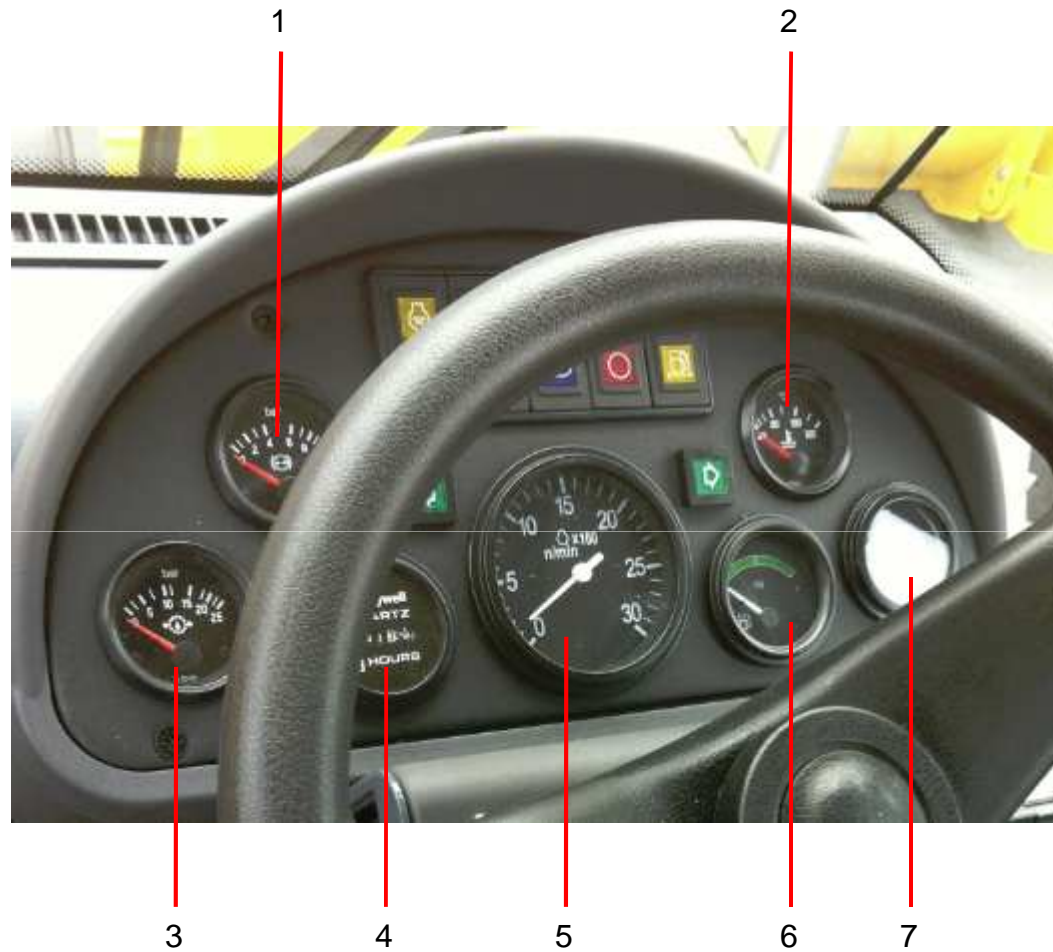
Horn assembly



## Section V Instrument testing equipment

### —Instrument panel

- Brief of instrument panel
- 1.Brake pressure gauge
- 2.Engine water temperature gauge
- 3.Transmission oil pressure gauge
- 4.Hour meter
- 5.Speedometer
- 6.oil level gauge
- 7.Torque converter oil temperature gauge

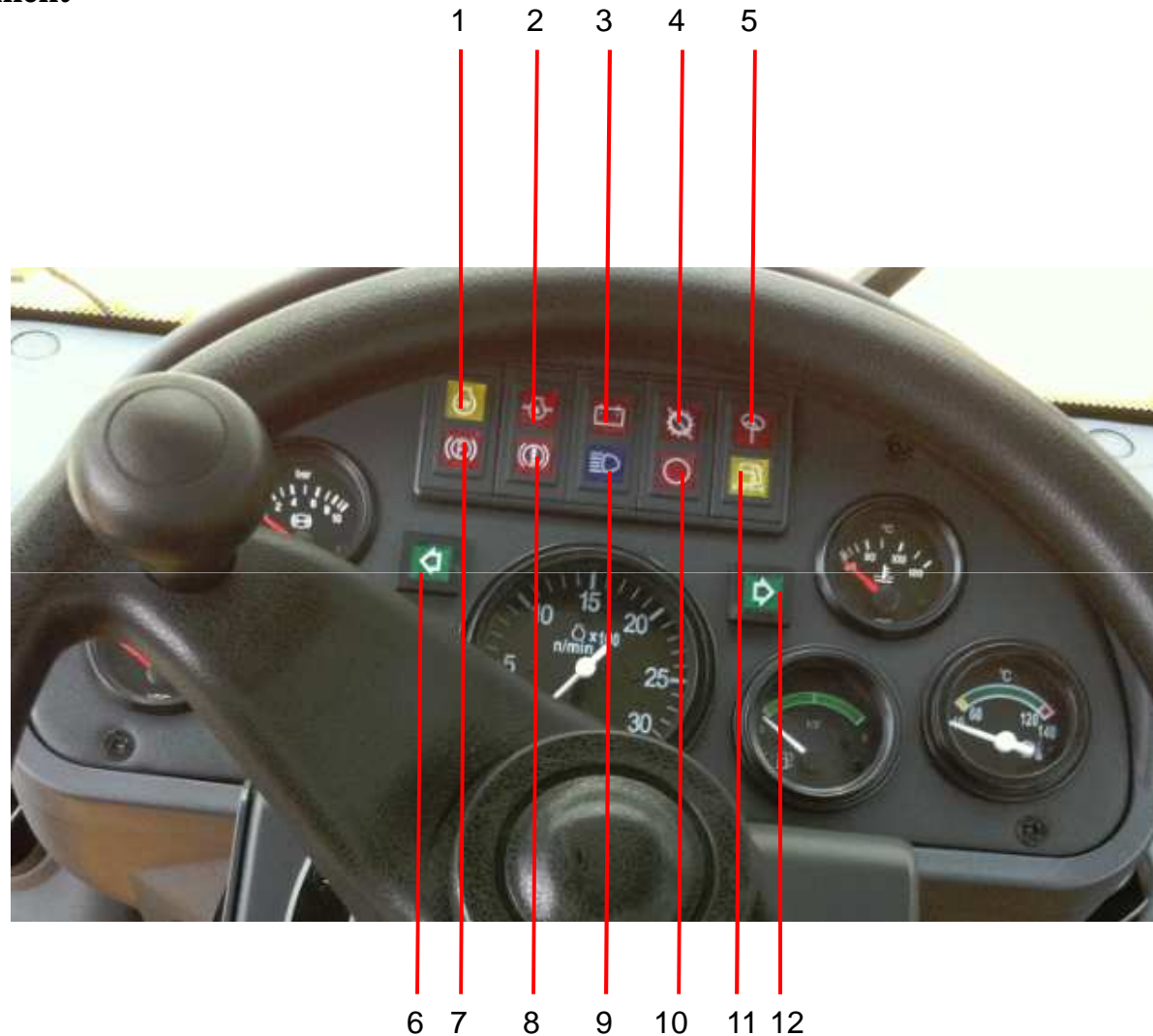


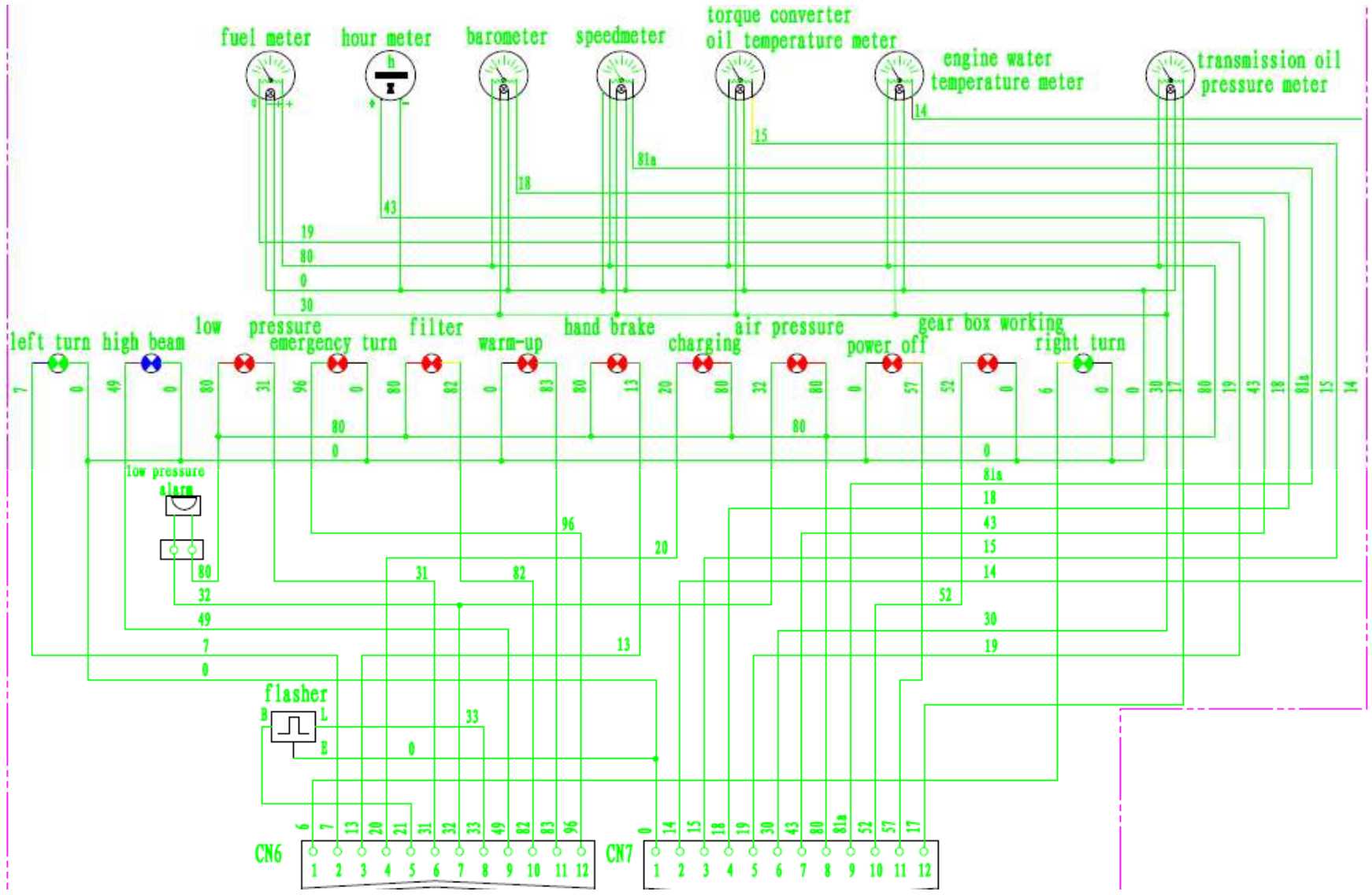


## Section V Instrument testing equipment

### 一. Instrument panel

- Brief of instrument panel
- 1. Preheating indicator lamp
- 2. Engine oil pressure alarm indicator lamp
- 3. Charging indicator lamp
- 4. Power cutoff indicator lamp
- 5. Emergency turn signal indicator lamp
- 6. Left turn signal indicator lamp
- 7. Parking brake indicator lamp
- 8. Low brake pressure alarm indicator lamp
- 9. High beam indicator lamp
- 10. Work indicator lamp of power case
- 11. Fuel strainer alarm indicator lamp
- 12. Right turn signal indicator lamp

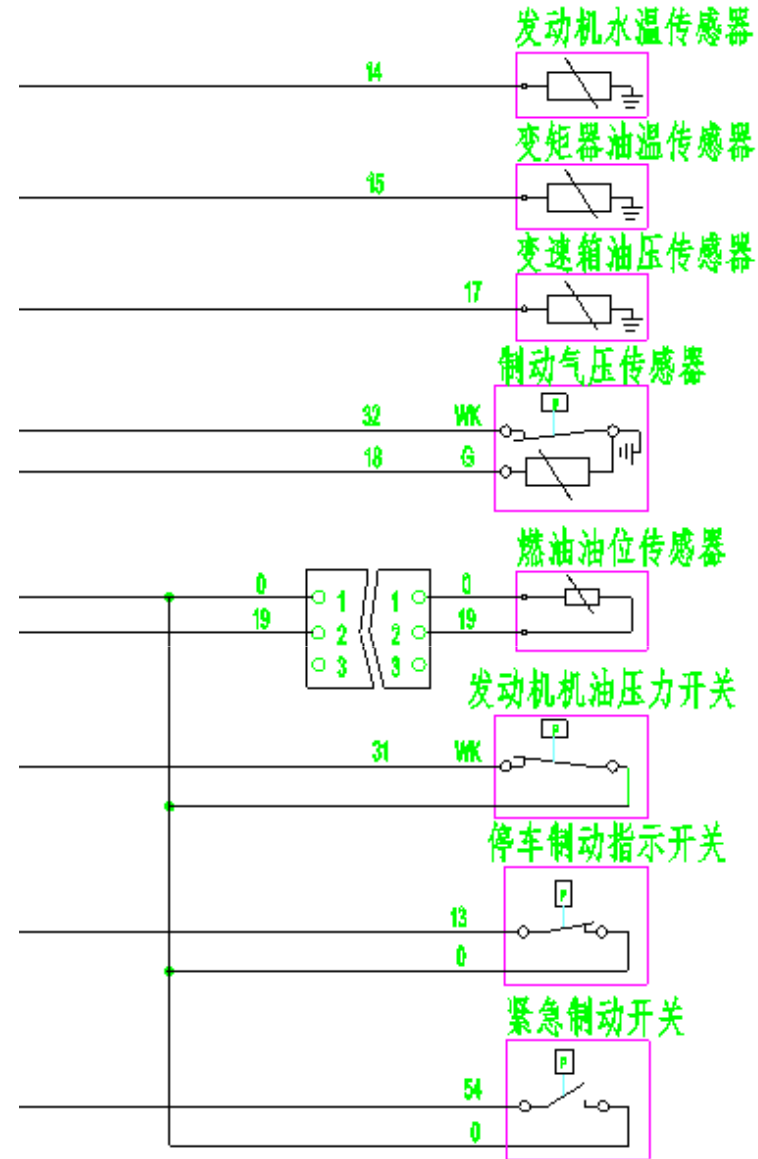




## Section V Instrument testing equipment

### 二. Sensor route

•The role of sensor is to convert pressure, temperature and other physic signal to electric signal according to certain rules, and output it to meet information transmission, processing, storage, display, record and control requirements 。 It is the primary link of the automatic detection and control.



## Section V Instrument testing equipment

### 三. Temperature sensor

- LG936 is fitted with two temperature sensors to monitor the torque converter oil temperature and engine water temperature. The temperature sensor is equivalent to a thermistor, of which the resistance is reduced along with the increasing of temperature. (226Ohm at 26°C ambient temperature and 26.4Ohm at 115°C) 。



## Section V Instrument testing equipment

### 三. Temperature Sensor

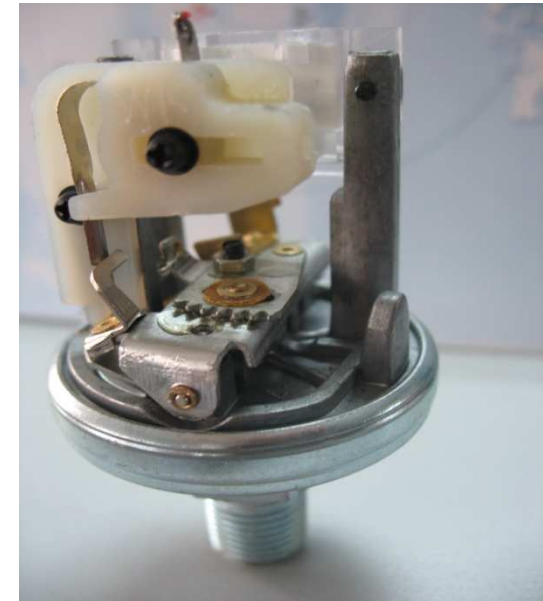
- Common malfunctions of temperature sensor.
- Phenomenon : Thermometer indicates abnormal .
- Handling Method : Disassemble the sensing wire from the temperature sensor. If the instrument indicates full measuring range when the sensing wire is grounded and indicates minimum reading when the sensing wire is hung in the air, it indicates that the instrument and circuit are normal and the sensor is damaged. Replace the sensor. Otherwise, check the circuit. If the circuit is normal, the instrument is malfunctioned.



## Section V Instrument testing equipment

### 四. Brake air pressure sensor

- By pressure change, the deformation of beryllium bronze diaphragm will occur, causing the slide of resistor pointer within the sensor, and the resistance will change the current, so that the swing of the instrument pointer is achieved.



## Section V Instrument testing equipment

### 五. Fuel level sensor

- The fuel level sensor is actually a discrete slide resistor, of which the resistance is reduced along with the increasing of fuel level. It's installed on the fuel tank.



## Section V Instrument testing equipment

### 五. Fuel level sensor

- Common malfunctions of fuel level sensor .
- Phenomenon : Fuel level indicates abnormal.
- Handling Method : Disassemble the sensing wire from the fuel level sensor. If the instrument indicates full measuring range when the sensing wire is grounded and indicates minimum reading when the sensing wire is hung in the air, it indicates that the instrument and circuit are normal and the sensor is damaged. Replace the sensor. Otherwise, check the circuit. If the circuit is normal, the instrument is malfunctioned.





## Section V Instrument testing equipment

### 六. Pressure alarm switch

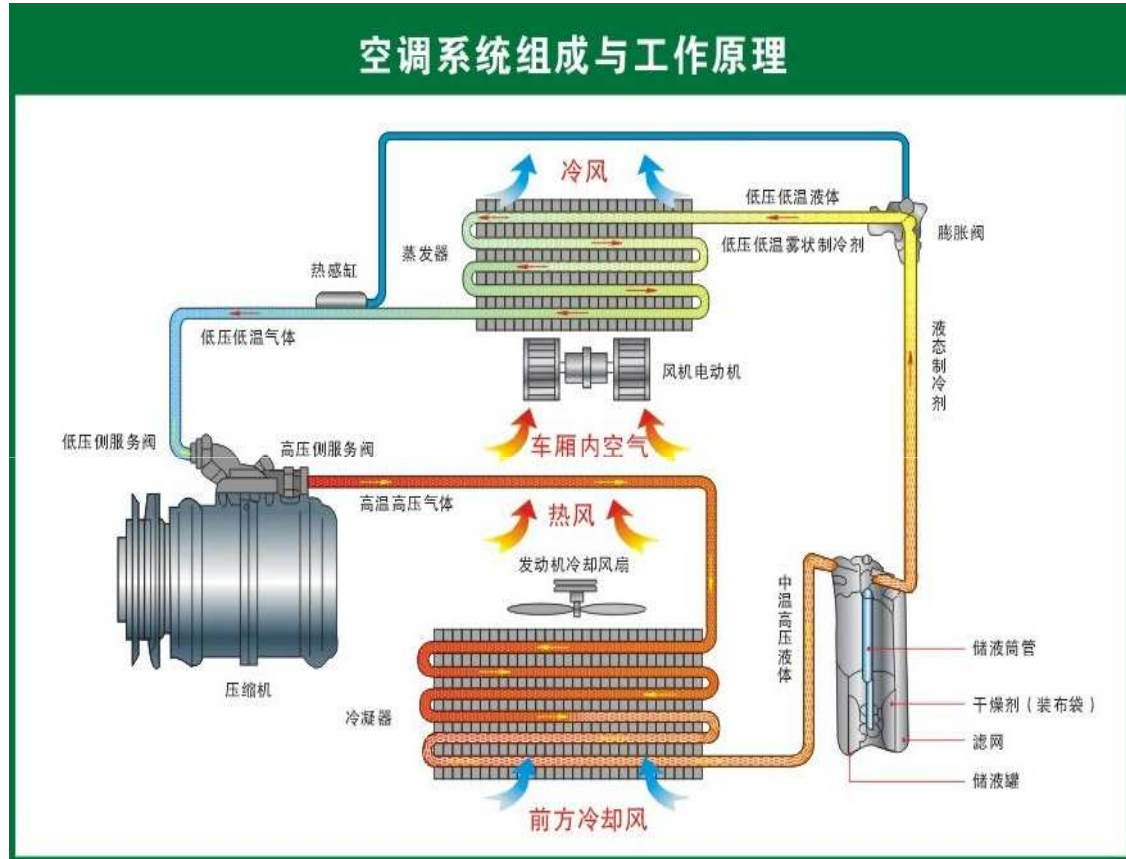
- The overall machine is fitted with two pressure switches, namely the low braking pressure alarm switch and the low engine oil pressure alarm switch;
- The alarm indicator lamp will alarm when the braking air pressure is less than 0.45MPa or the engine oil pressure is less than 0.08MPa.



## Section V Instrument testing equipment

### 一. A/C System

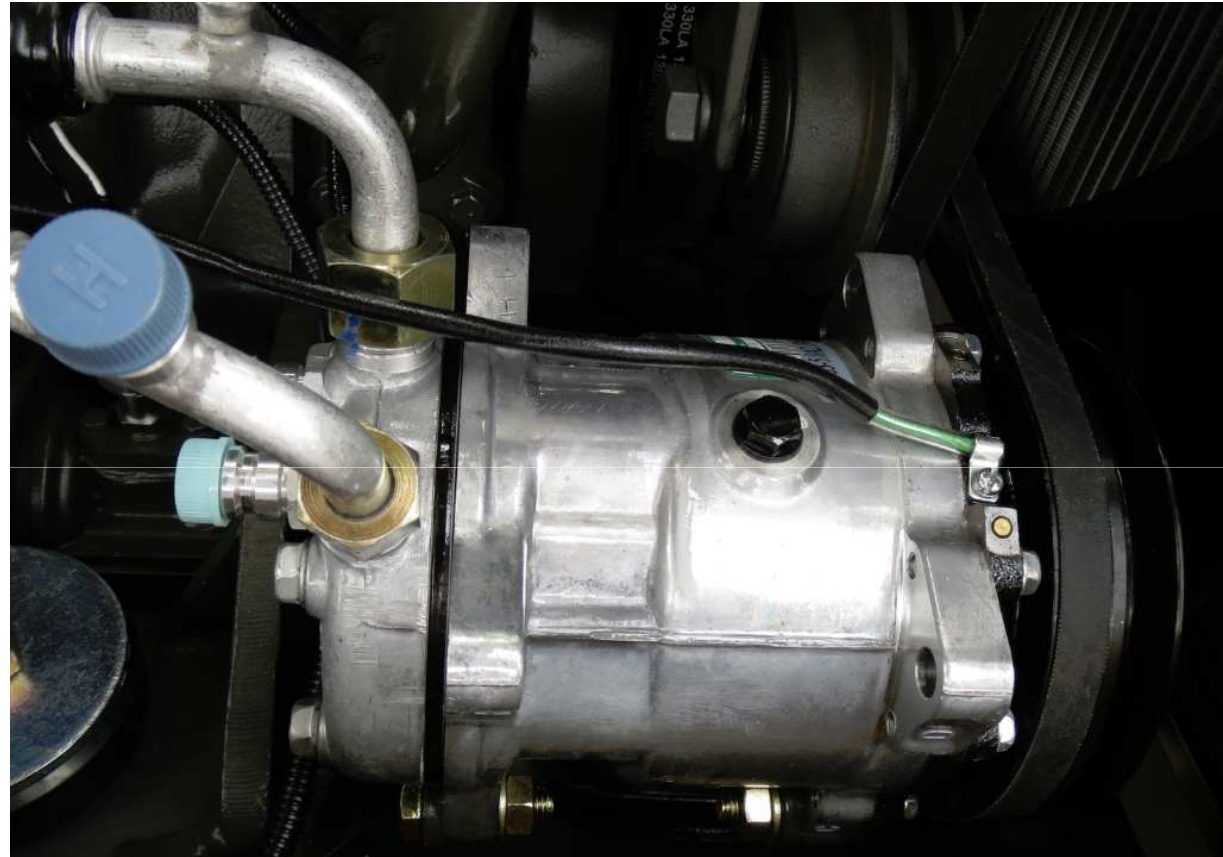
- A/C system is composed of A/C compressor, evaporator, condenser, fluid reservoir, pipeline and others.
- Compressor suck in lower pressure refrigerating steam from evaporator, and make its pressure rise, then send it to condenser, in which be evaporated to higher pressure liquid, throttled by the throttling valve, be sent to evaporator, in which absorbing heat, evaporating and become low-pressure steam, thereby complete the refrigeration cycle.



## Section V Instrument testing equipment

### — A/C System

- The role of A/C compressor is compression, refrigeration and driving in A/C refrigeration circuit, its principle is similar with piston pump.
- A/C compressor suck in gaseous refrigeration at low temperature and pressure, through compressed, output gaseous refrigeration at low temperature and pressure.



## Section V Instrument testing equipment

### —, A/C System

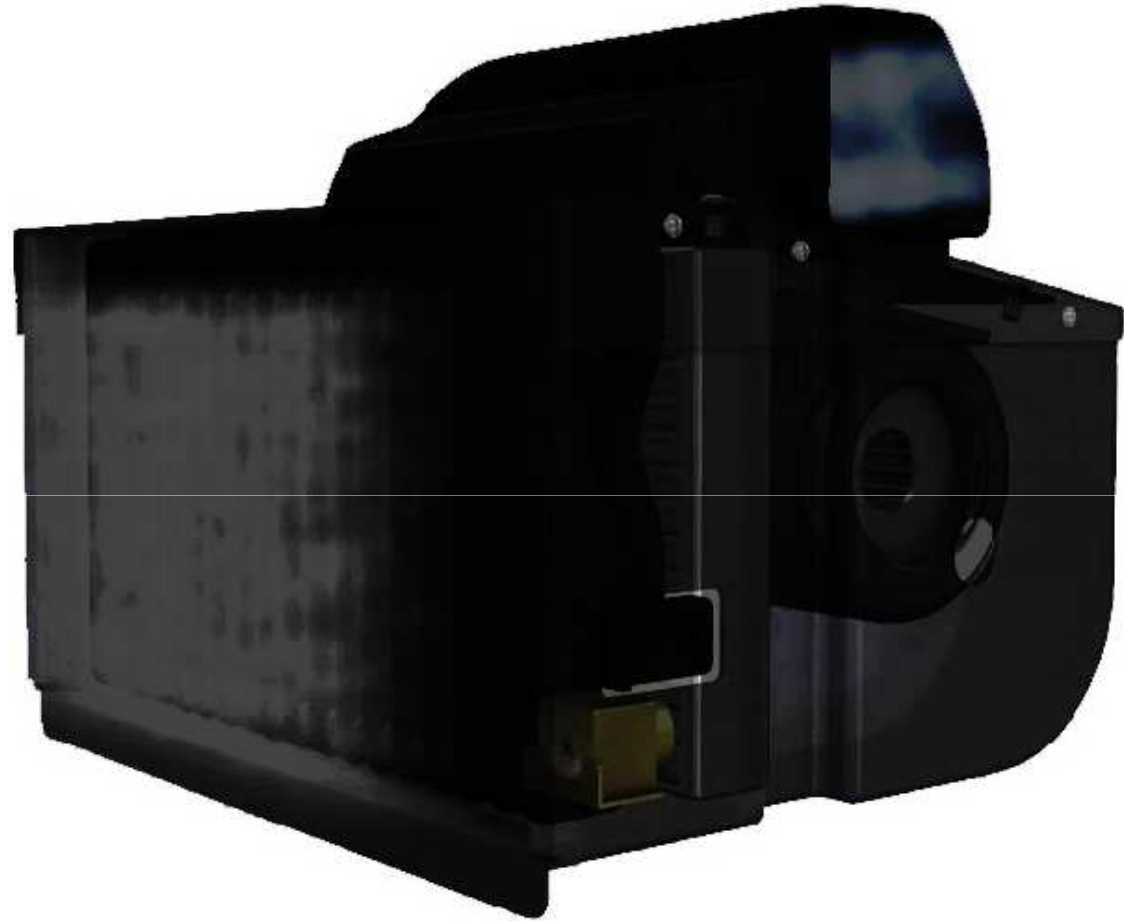
- The condenser is used for refrigerating high-temperature refrigerating steam ,which is compressed by the compressor and make it liquefaction, it is heated exchanger.
- Its principle is similar with radiator.



## Section VI Auxiliary equipment

### — A/C System

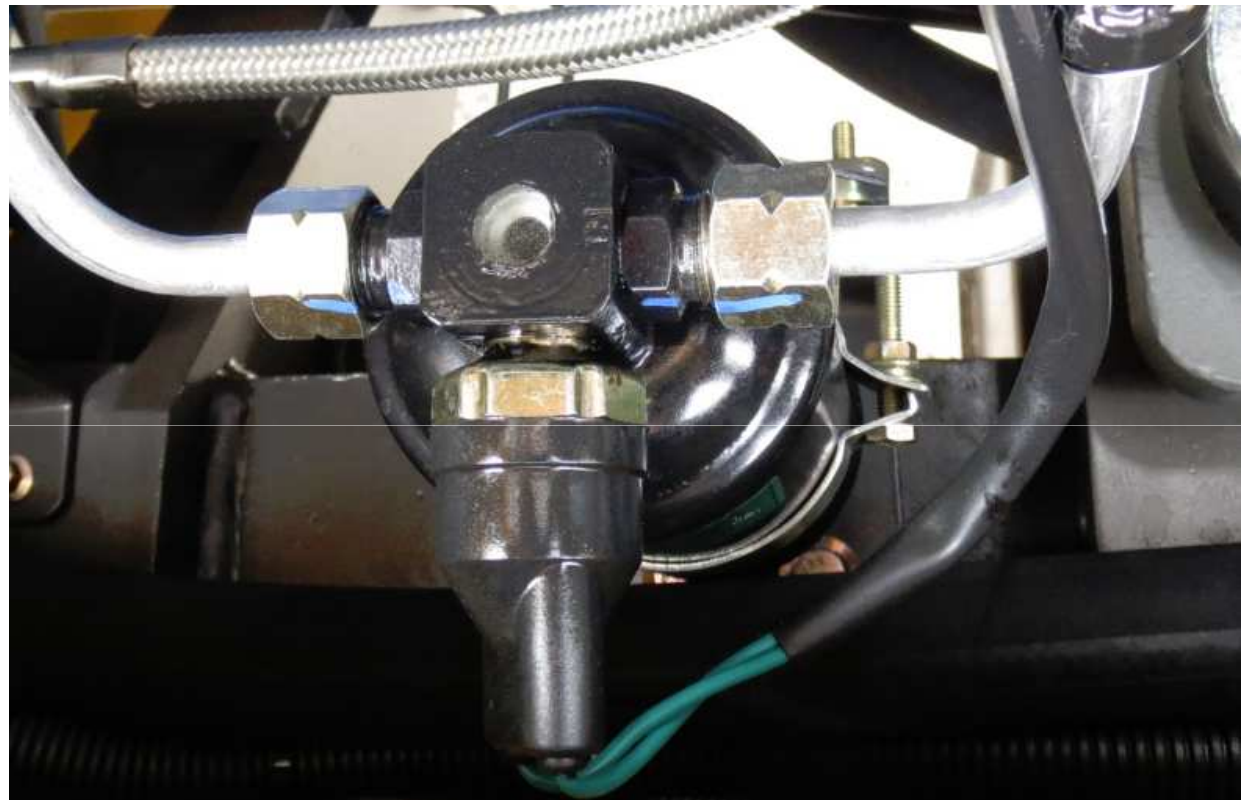
- Evaporator is an important part of the four big refrigerating parts, low temperature condensation liquid ,through evaporator , exchange heat with outside air, gasify and absorb heat, achieve refrigerating effect.



## Section VI Auxiliary equipment

### 一. A/C System

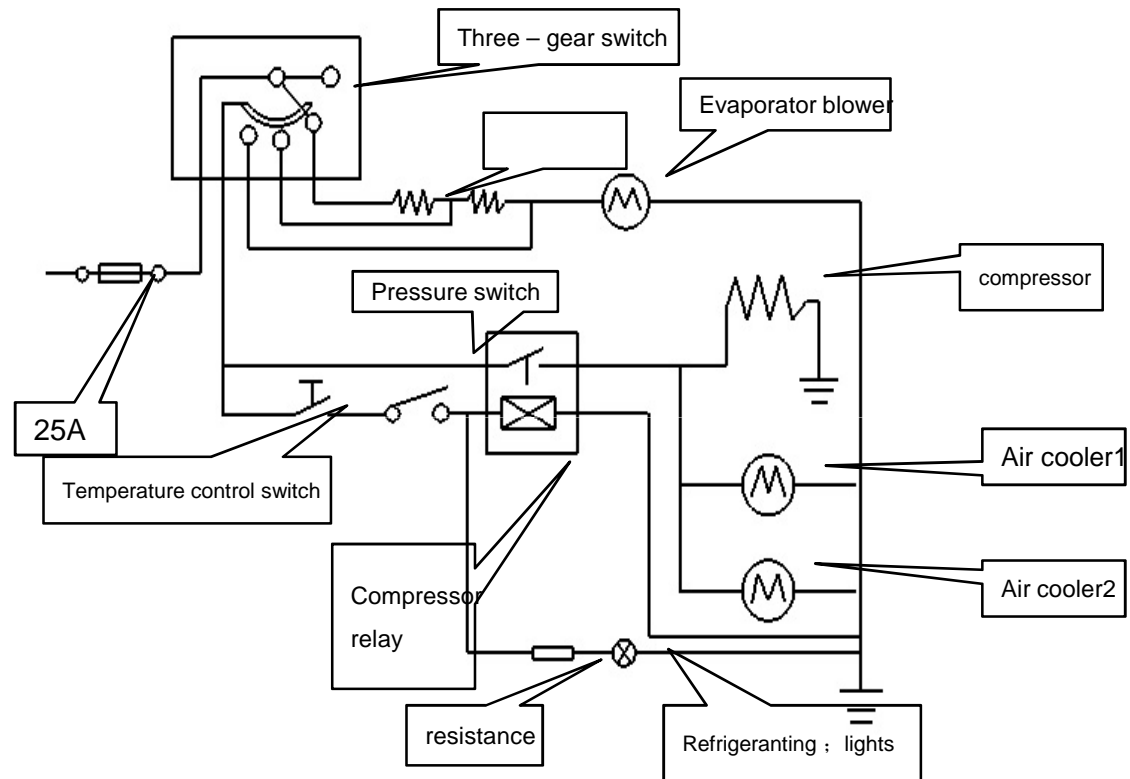
- The reservoir has a pressure switch, when the reservoir pressure is within a certain range, the pressure switch is turned on, or the pressure switch is turned off to stop refrigerating.
- The pressure switch on the general scope of 0.23Mpa-2.55Mpa. Namely pressure is lower than 0.23Mpa or higher than 2.55Mpa, pressure switch will turn off.



## Section VI Auxiliary equipment

### — A/C System

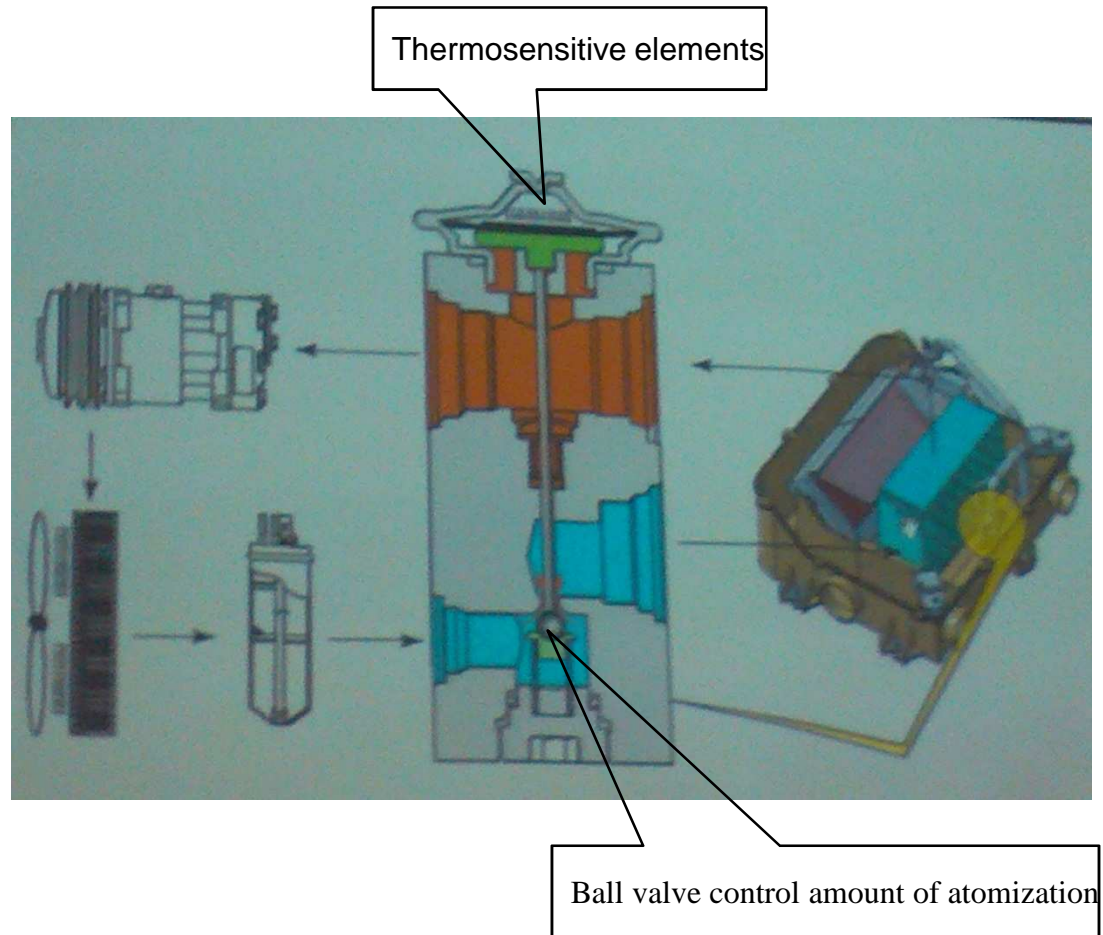
• The electric principle of A/C system is as shown of the chart, the main circuit is mainly controlled by the 3-speed switch, thermostat and pressure switch. When the cab temperature is higher than the set temperature, the thermostat switch is closed, can refrigerate. When the cab temperature is gradually decreasing to the set temperature, the thermostat switch turns off, stopping refrigerating, in order to make the cab constant temperature; meanwhile thermostat switch also prevents evaporator from frosting.



## Section VI Auxiliary equipment

### 一. A/C System

- Expansion valve is installed between the evaporator and fluid reservoir, Generally fixed to the evaporator.
- The expansion valve make middle temperature high-pressure liquid refrigerant through the throttling be transmitted into low temperature low-pressure wet steam, and then the refrigerant absorbs heat in the evaporator to achieve the refrigerating effect, the expansion valve through the overheat change at the end of evaporator to control flow of valve port, to prevent evaporator area utilized and knock phenomenon.
- It plays a role of throttling, dropping pressure and regulating the flow. meanwhile it also can prevent wet compression and liquid strike, prevent abnormal overheating.





## Section VI Auxiliary equipment

### —. A/C System

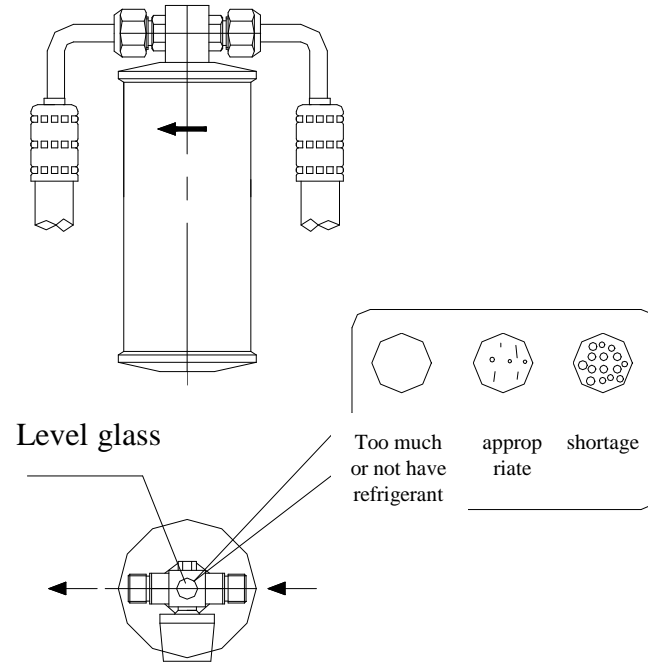
- Common Malfunctions of A/C System

- Phenomenon : no refrigeration

- Cause: 1. Evaporator fan does not rotate:

It may be the fuse blows, the internal switch is disconnected and so on.

2.Evaporator fan rotate : the compressor rotate or not, belt is loose or not, there is refrigerant or not, pipeline blocks or not.



## Section VI Auxiliary equipment

### —. A/C System

- Common malfunctions of A/C system
- Phenomenon : Poor refrigeration
- Cause:
  - 1. The refrigerant flow of the expansion valve outlet decreases, on the high pressure side 、 low pressure side of the refrigeration unit, temperature is too high or pressure is too low .
  - 2. lack of refrigerant.
  - 3. compressor belt is too loose, and slipping.
- Phenomenon : abnormal noise
- Cause: Normally, mechanical faults, such as loose fasteners, moving parts wear over the limit or poor lubrication.

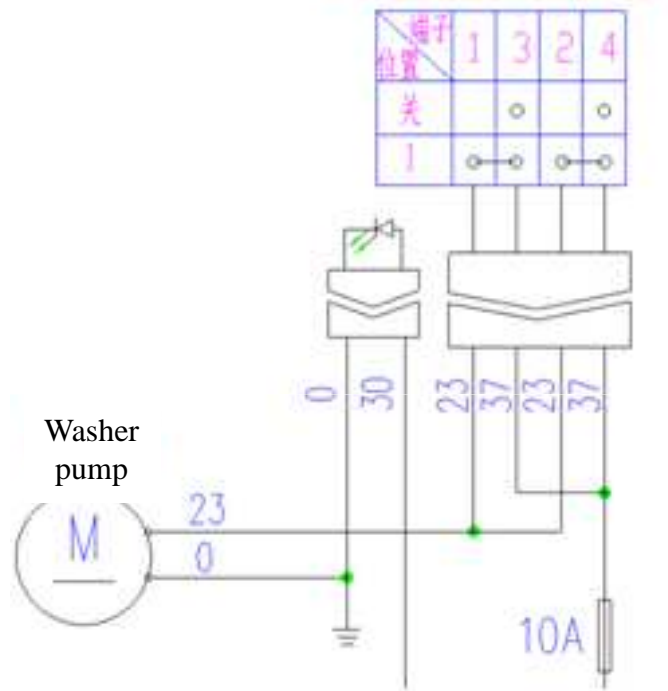


## Section VI Auxiliary equipment

### 二. Spray cleaning system

- Spray cleaning system is supplied power by supply power and connected with 37-line after going through 10A fuse, when pressing the spray bottle rocker switch, 37-line connects with 23-line, water motor is supplied by 23-line, water motor turns and realize cleaning.

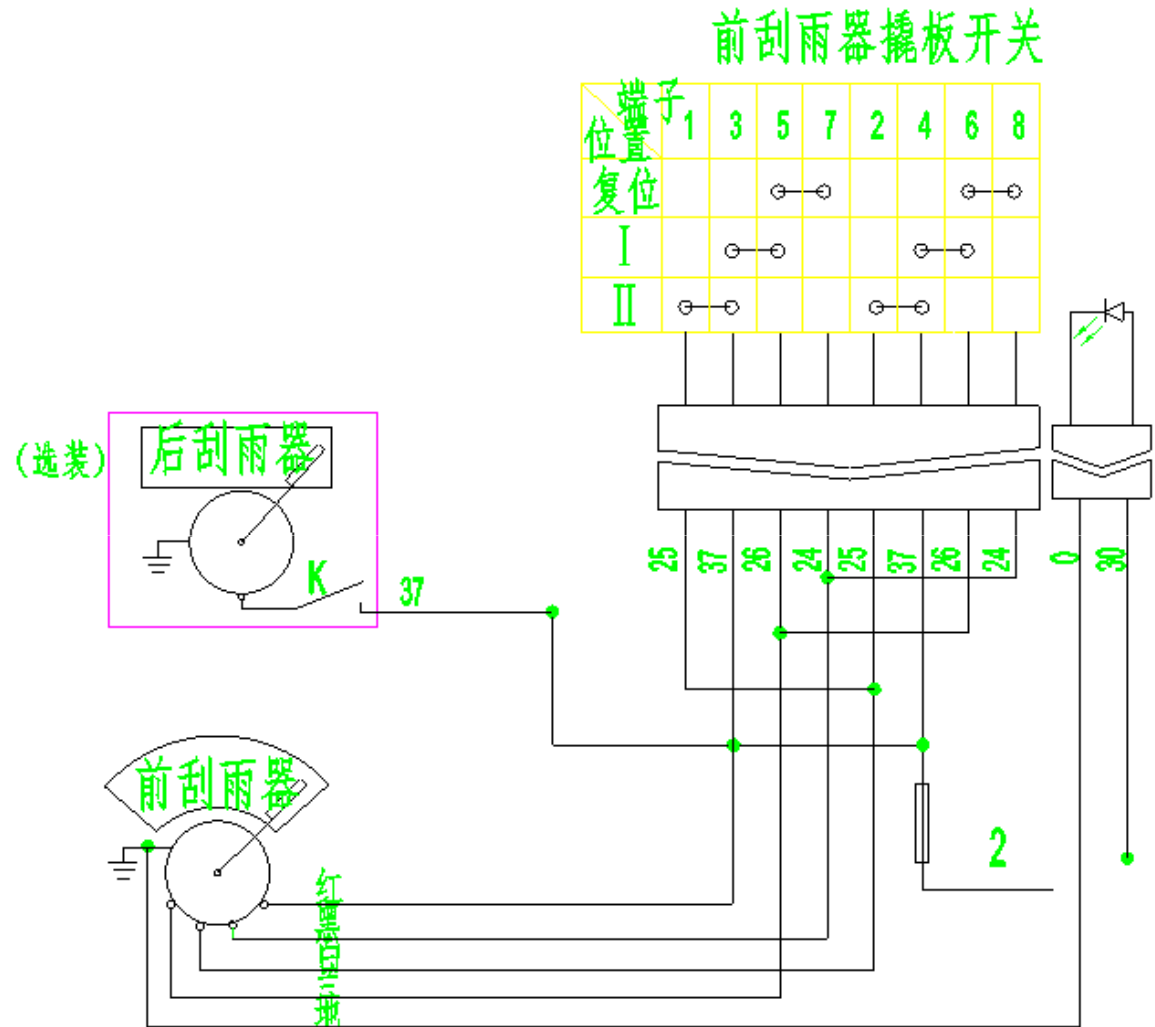
Sprinkling rocker switch (with reset)



## Section VI Auxiliary equipment

### 三. Front and Rear Wiper

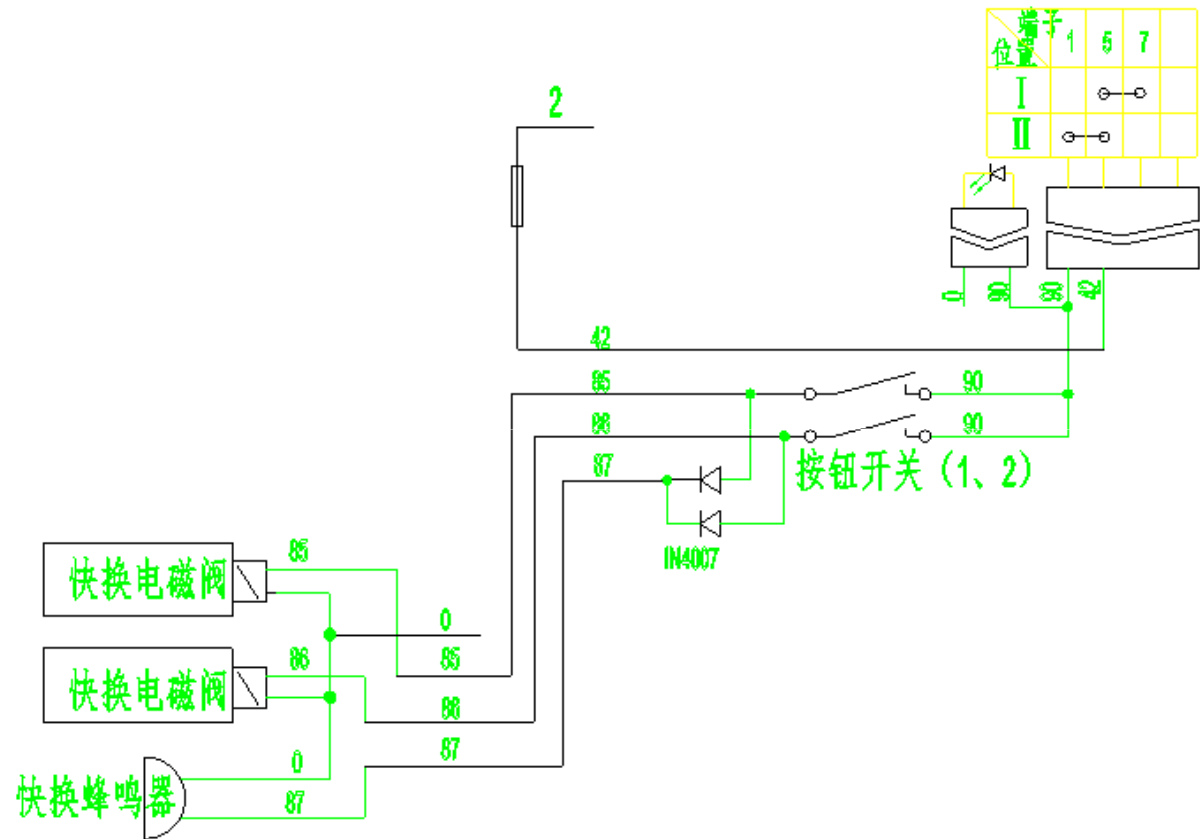
• Front and rear wipers are supplied power by 2-line and connected with 37-line after going through 10A fuse, when pressing rear wiper button, rear wipers motor is supplied power , rear wiper works . Adjust position of the front wiper rocker switch, make front wiper be connected with different lines , so that front wiper can work at different speed.



## Section VI Auxiliary equipment

### 四. Quick-change system

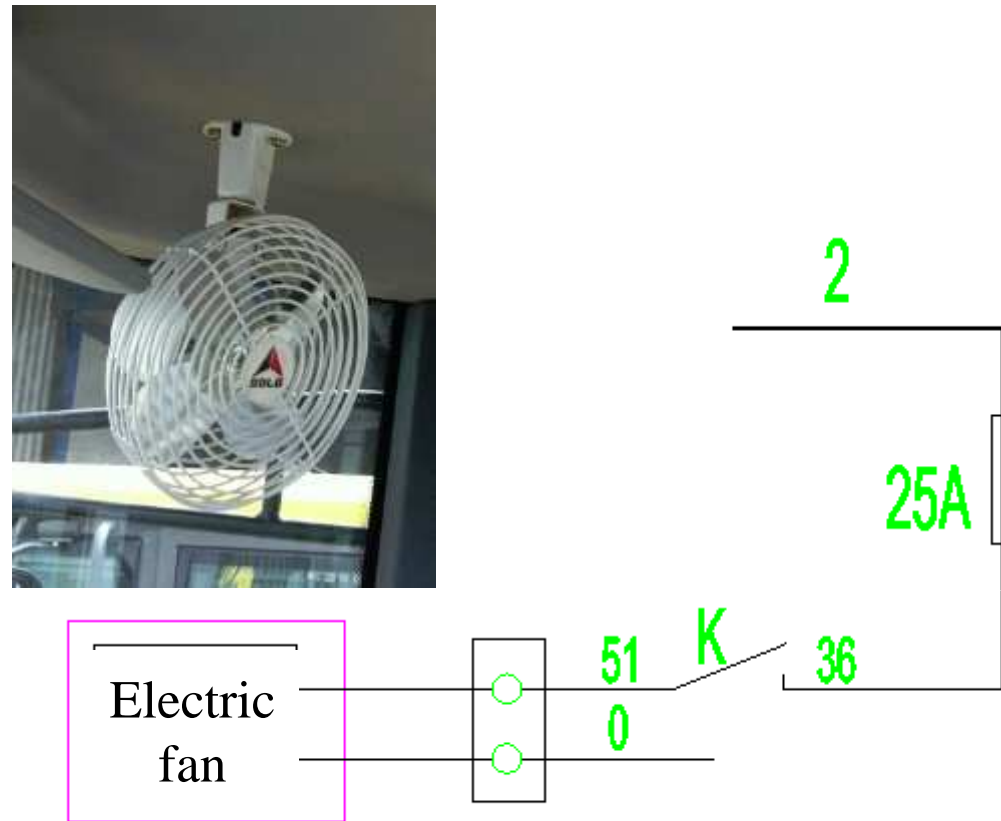
• Front and rear wipers are supplied power by 2-line and connected with 37-line after going through 10A fuse, when pressing rear wiper button, rear wipers motor is supplied power , rear wiper works . Adjust position of the front wiper rocker switch, make front wiper be connected with different lines , so that front wiper can work at different speed.



## Section VI Auxiliary equipment

### 五. Fan System

- Electric fan is supplied power by 2-line, be connected with 36-line through 25A fuse, adjust the fan switch button, then the fan turns.



# Chapter 8 Brake system

## Section I Service brake system overview

### Section II Air compressor

- Air compressor overview
- Air compressor structure
- Air compressor function
- Air compressors operating process
- General failure

### Section III Oil-water separator combination valve

- Oil-water separator combination valve function
- Oil-water separator combination valve structure
- Oil-water separator combination valve operating principle
- Operation precautions
- General failure

### Section IV Air reservoir

- Air reservoir function
- Air reservoir structure
- Air reservoir service

### Section V Air brake valve

- Air brake valve function
- Air brake valve structure
- Air brake valve operating process
- General failure

### Section VI 3-way shuttle valve

- 3-way shuttle valve function
- 3-way shuttle valve structure

### Section VII Air booster pump

- Air booster pump function
- Air booster pump structure
- Air booster pump operating process
- General failure

### Section VIII Brake caliper

- Brake caliper function
- Brake caliper structure
- Brake caliper operating process
- General failure

### Section IX Parking brake system

- The parking brake system formation
- The brake structure
- Brake operating process

### Section X Brake fluid use, replacement and precautions

### Section XI Brake system general failure and troubleshooting

# Section I Service brake system

- **System composition**

- It is used to reduce the vehicle travelling speed and park, controlled by the driver through the brake pedal

- LG936L brake system is dual-line service brake circuit, and the brake type is caliper dry-brake, mainly composed of air compressors, oil-water separator, air booster pump, brake caliper, air reservoir and pipelines, etc.

1-Front axle disk brake caliper

2-Front Axle brake Disk

3-Rear Axle brake Disk

4-Rear axle disk brake caliper

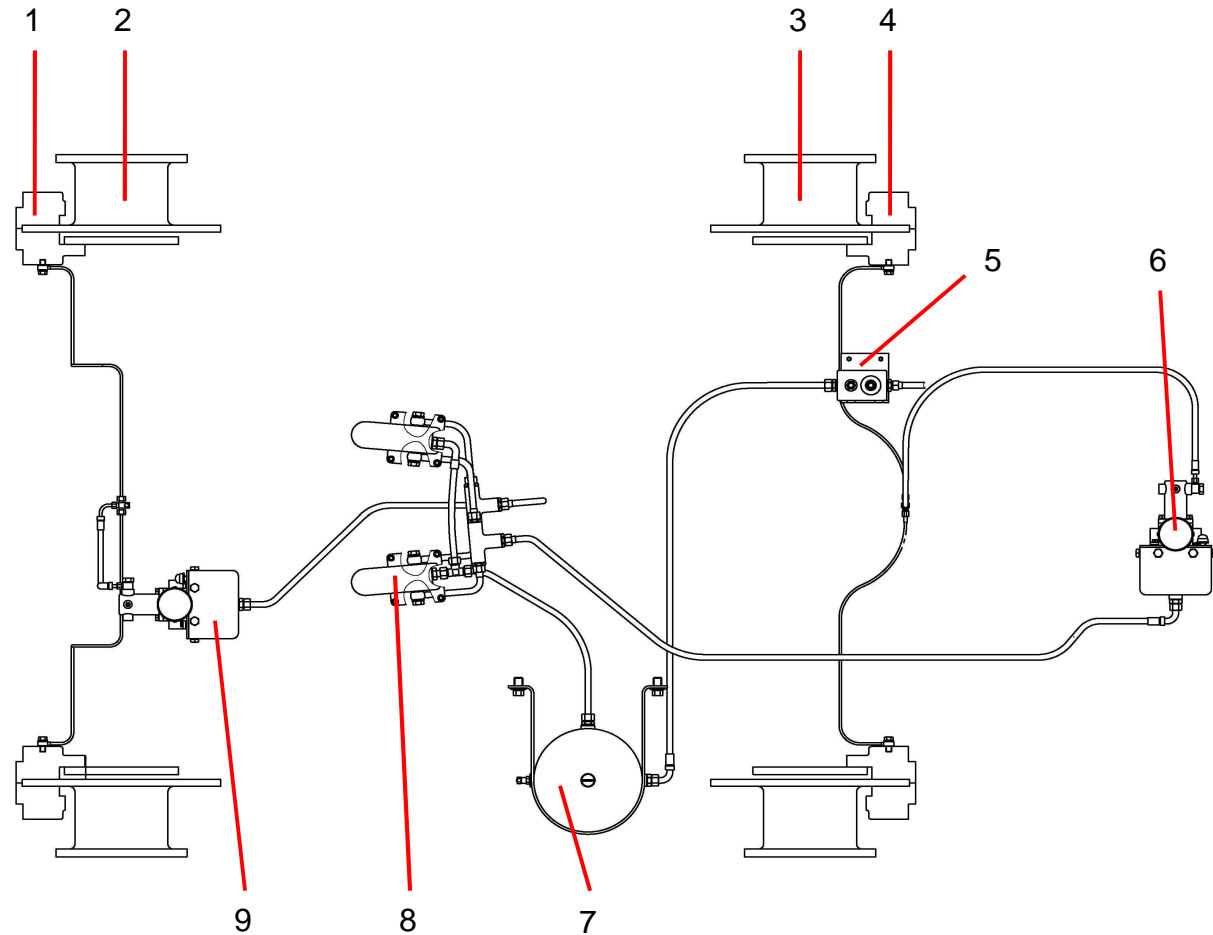
5-Oil-water separator (connect with air compressors)

6-Rear air booster pump

7-Air reservoir

8-Left brake valve

9-Front air booster pump





## Section II Air compressor

### I . Overview

- Power:  
Air compressor is installed in one side of the engine, driven by the belt of the engine:  
Pressure lubricating oil comes from auxiliary oil channel of the engine, enters into the air compressor to lubricate its bearings through the oil pipe fixed on cylinder block, and provides splash lubrication to the cylinder liner, and returns to the oil sump through timing gear chamber in the end.
- Air source:  
The inlet air must flow through the air filter. After air flowing through the filter and before entering the turbocharger, there is a piece of air pipe, connecting to the air compressor's inlet port.
- Cooling:  
Share a water circulation cooling system with the engine.

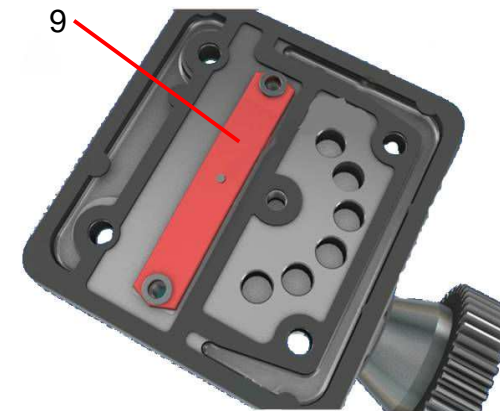
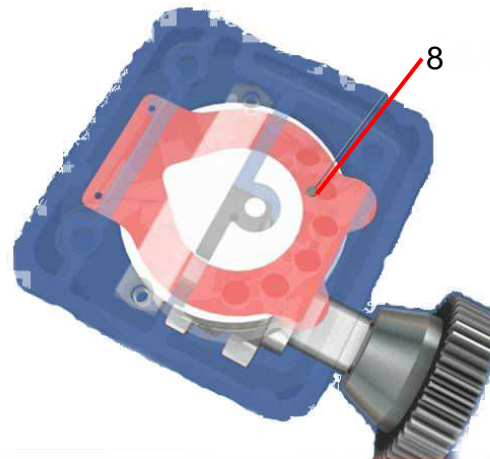
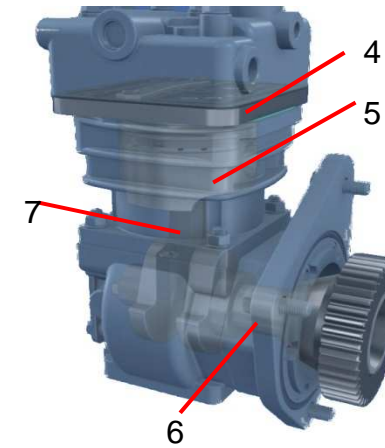
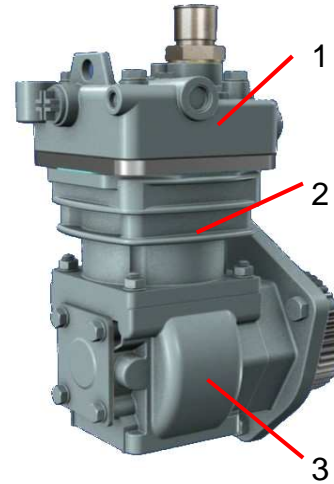


## Section II Air compressor

### II. Structure

- The air compressor is mounted on the engine, and its component parts includes: inlet pipe, exhaust pipe, cylinder head, cylinder block, crank case, crankshaft, connecting rod, piston, and piston rings, piston pin, inlet valve and exhaust valve

- 1-Cylinder head
- 2-Cylinder block
- 3-Crankcase
- 4-Valve mount
- 5-Piston
- 6-Crankshaft
- 7-Connecting rod
- 8-Air inlet valve
- 9-Air exhaust valve



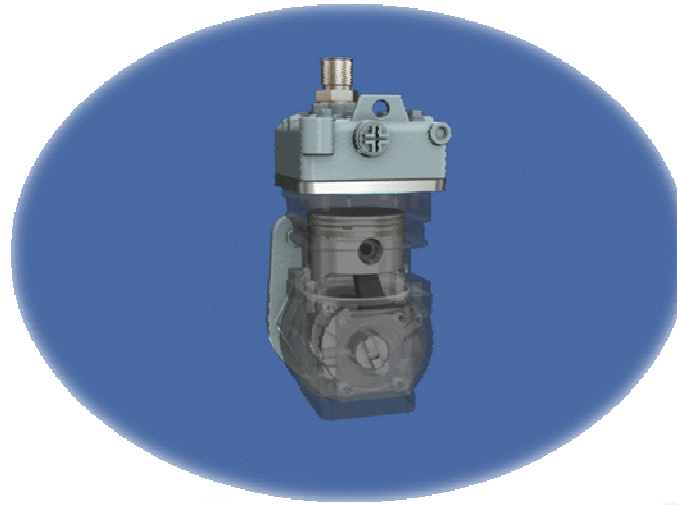
## Section II Air compressor

### III. Function.

- Air compressor function is to supply compressed air to the brake system, providing an aid for vehicle brake;

### IV. The operating process

- Air is cleaned by the filter before entering air pressure inlet pipe, and the connecting rod is driven by the crankshaft to drive the piston to move downwards. And then the inlet valve open.



The air is filtrated through the filter then enters air compressor air inlet pipe



The connecting rod drives the piston to move downwards, and the inlet valve opens

## Section II Air compressor

### IV. The operating process

- The connecting rod drives the piston to move upwards, the inlet valve will close and the exhaust valve opens;
- The compressed air discharges from the air compressor exhaust port, providing the system with power;
- The air compressor repeats this process continuously to perform suction and exhaust.



The piston moves upwards, the inlet valve will close and the exhaust valve will open;

The compressed air discharges from the air compressor exhaust port, providing the system with power;

## Section II Air compressor

### V. Common failure

#### 1. The symptoms: air compressor position noise

- Analysis of reasons:

Air compressor main bearing journals and bearings, connecting rod journals and bearings, connecting rod small pin hole with piston pin clearance too large or worn;

#### 2. The symptoms: air compressor can not produce pressure

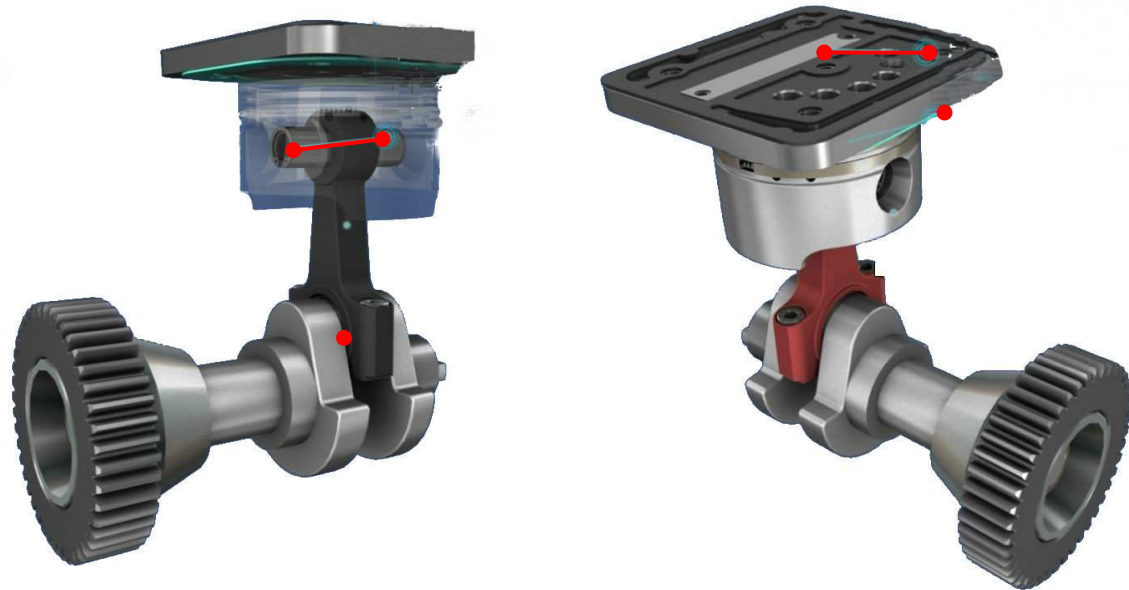
- Analysis of reason:

Air compressor exhaust valve has failed or is not sealed tightly, air compressor cylinder head cracks result in gasket being blown out and air leakage;

#### 3. The symptoms: air compressor burns oil

- Analysis of reason:

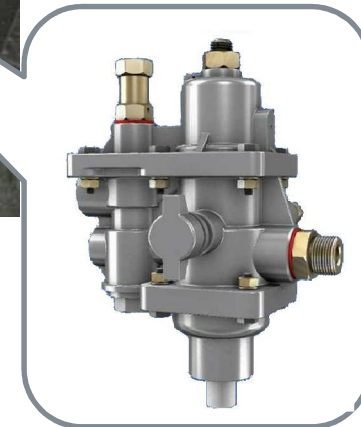
Air filter has not been replaced for a long time, the air being drawn into with dust and debris to make the piston, piston ring wear abnormally



## Section III Oil-water separator combination valve

### I . Function

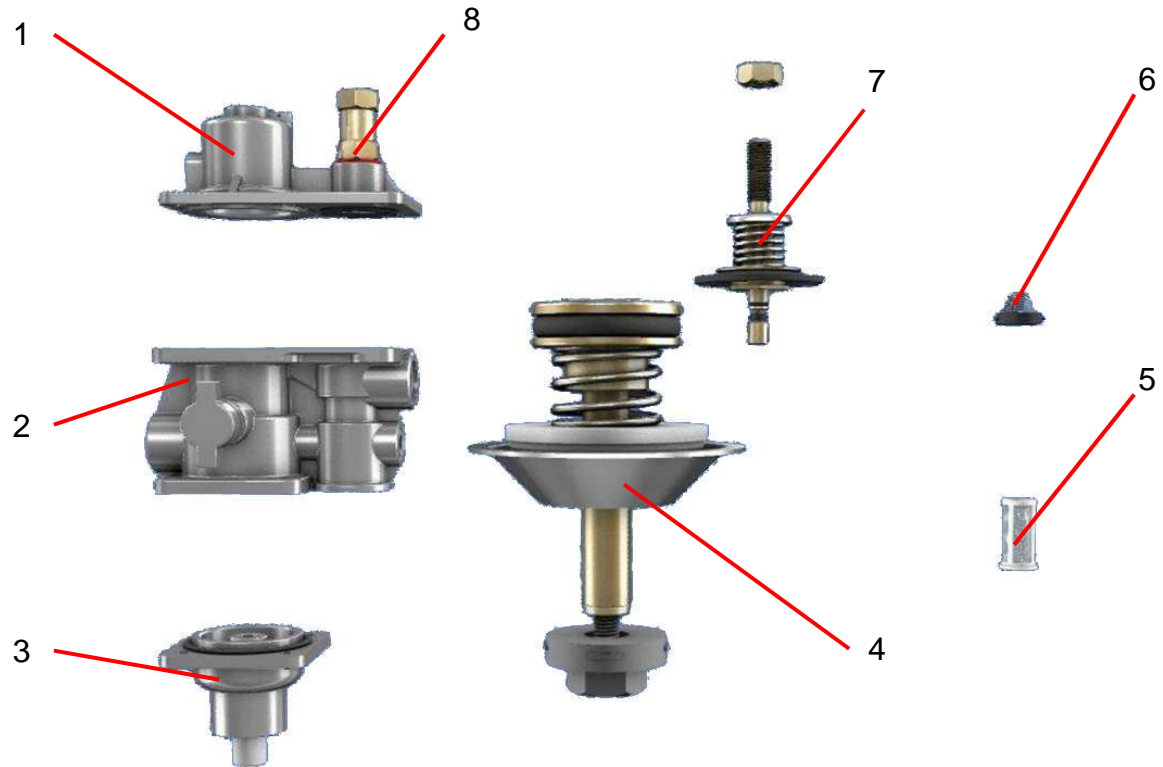
- Oil-water separator combination valve is a combination valve composed of the water separator and air pressure regulator, its function is:
- Automatically adjust the brake system operating air pressure .
- Ensure the loader brake system security;
- Separate oil, water and other impurities from the compressed air, and discharge through the unloading unit.
- Unscrew the wing nut to inflate the tire, etc.



# Section III Oil-water separator combination valve

## II. Structure formation

- Water separator combination valve is mainly consists of the middle body, the top and bottom cover and internal separated oil and water separating chamber, filter element, check valve, pressure relief valve assembly, as well as air pressure conditioning components and gas-liquid drain valve components, and so on.
  - As shown in the right water separator exploded figure
- 1-Top cover
  - 2-Middle body
  - 3-Bottom cover
  - 4-Gas-liquid drain valve component
  - 5-Filter element
  - 6-Check valve
  - 7-Air pressure conditioning components
  - 8-Relief valve assembly

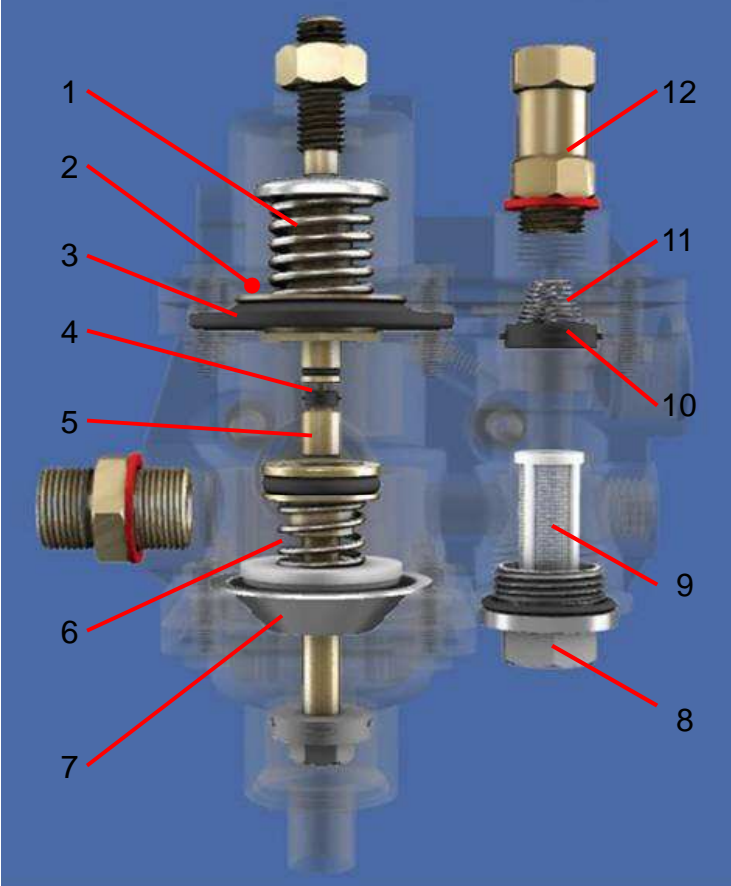


# Section III Oil-water separator combination valve

## II. Structure formation

- The air pressure controlling group of water separator combination valve consists of the control piston, regulating valve, adjusting spring and the tympanic membrane, etc.;
- The gas-liquid drain valve is mainly consists of air bleeding piston assembly, oil collector, valve seat, as well as the housing, spring etc.

- 1-Adjusting spring
- 2-Control piston
- 3-Tympanic membrane
- 4-Adjusting valve
- 5-Valve seat
- 6- Return spring
- 7-Oil collector
- 8-Plug
- 9-Filter element assembly
- 10-Check valve
- 11-Spring
- 12-Relief valve assembly



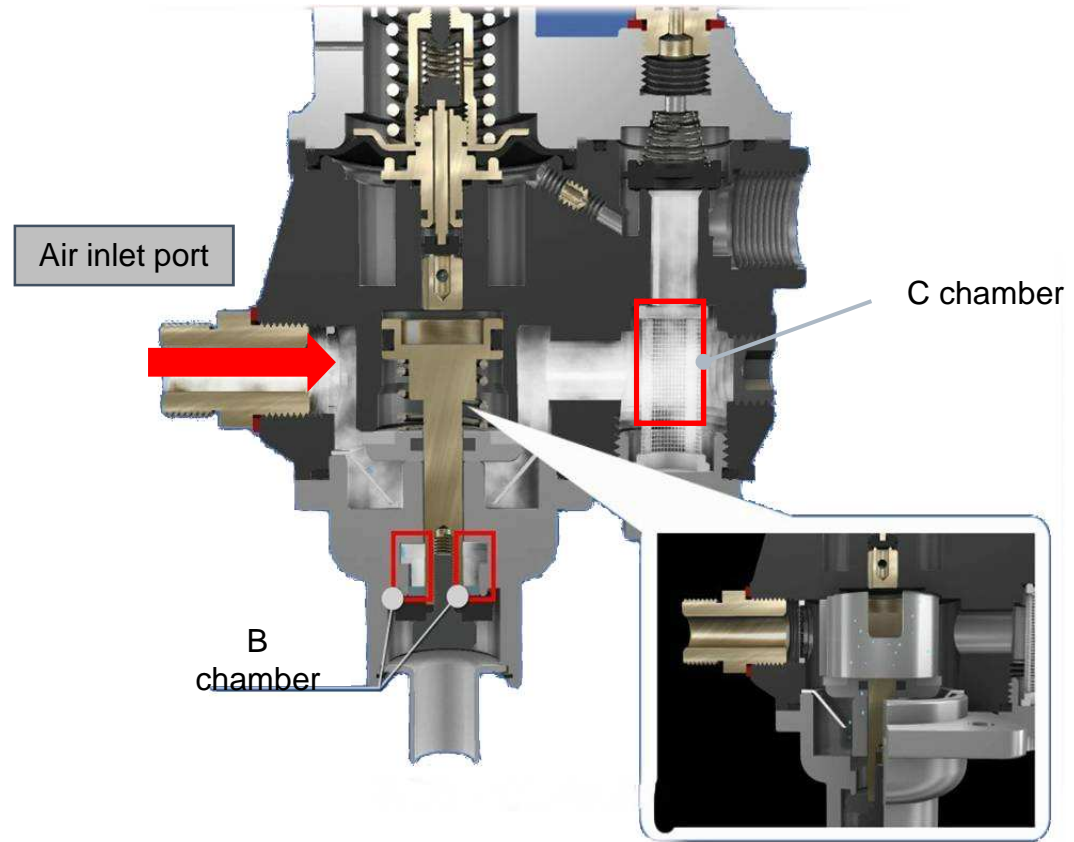


## Section III Oil-water separator combination valve

### III. Operating principle

#### ①. Separate water and oil from air

- Air from compressor goes through the air inlet to water separator combination valve. Air flow impacts the combination valve internal shell surface, the gas flow direction and speed changes, the oil and water whose density is greater than the gas, is separated by the inertia force, and concentrate on the water separator combination valve lower housing chamber wall, and flows down along the wall, and flow through the oil collector into the chamber B.
- The compressed air free of oil and water through the filter element assembly enters chamber C, push the one-way valve open to enter the air tank. The oil and water concentrated in chamber B will be discharged automatically as the air pressure reaches the rated value.

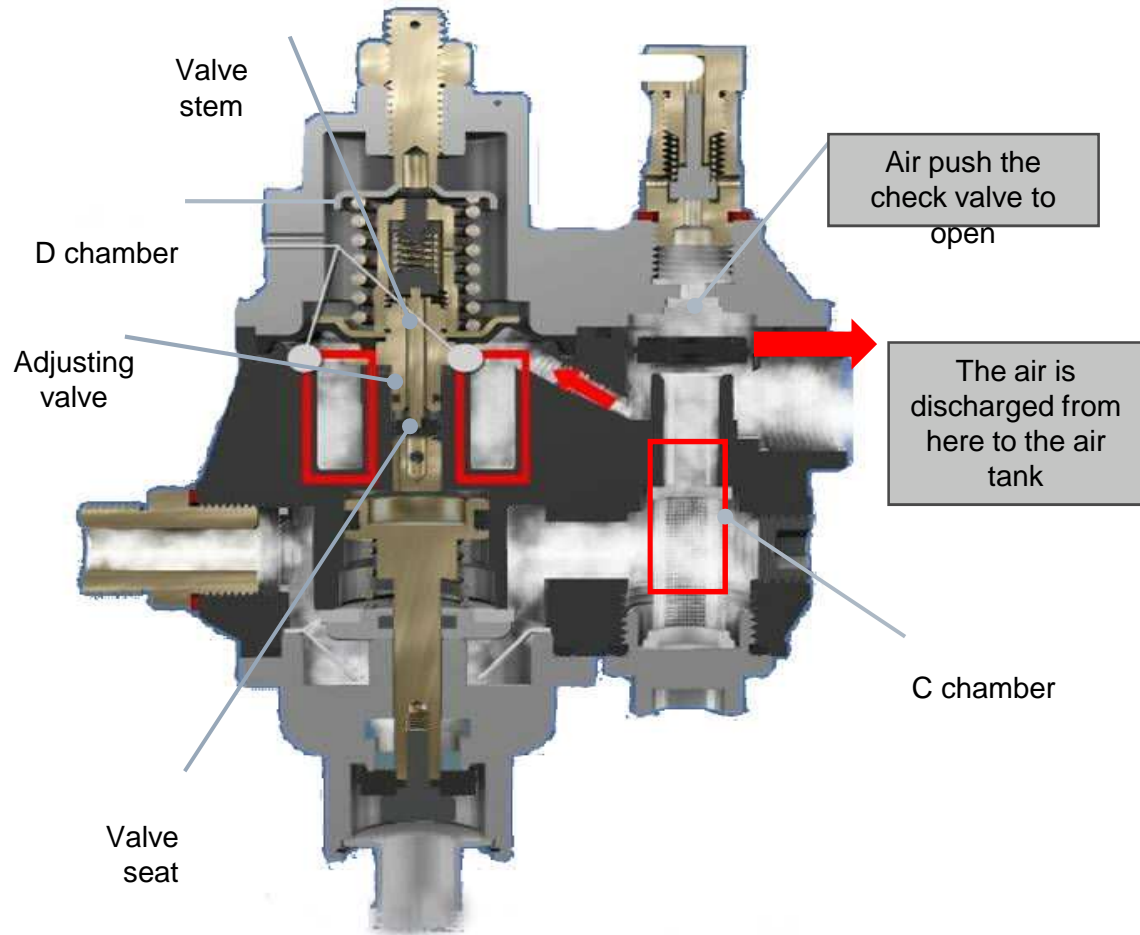


# Section III Oil-water separator combination valve

## III. Operating principle

### ②. Adjusting air pressure function

- The compressed air free of oil and water enters chamber C through the filter element assembly, push the check valve open to enter the air reservoir, the air flow is divided into two-way after pushing open the check valve: one way enters into the air reservoir, and the other goes into chamber D through the orifice plug. The chamber D is connected with chamber C.
- When the air tank pressure is less than the set pressure( system set pressure is normally 0.784Mpa), the control piston does not move, the adjust valve is pressed by valve stem onto the valve seat, the valve is in off state. Because the air pressure of chamber D is insufficient to overcome the adjusting spring force at this time.

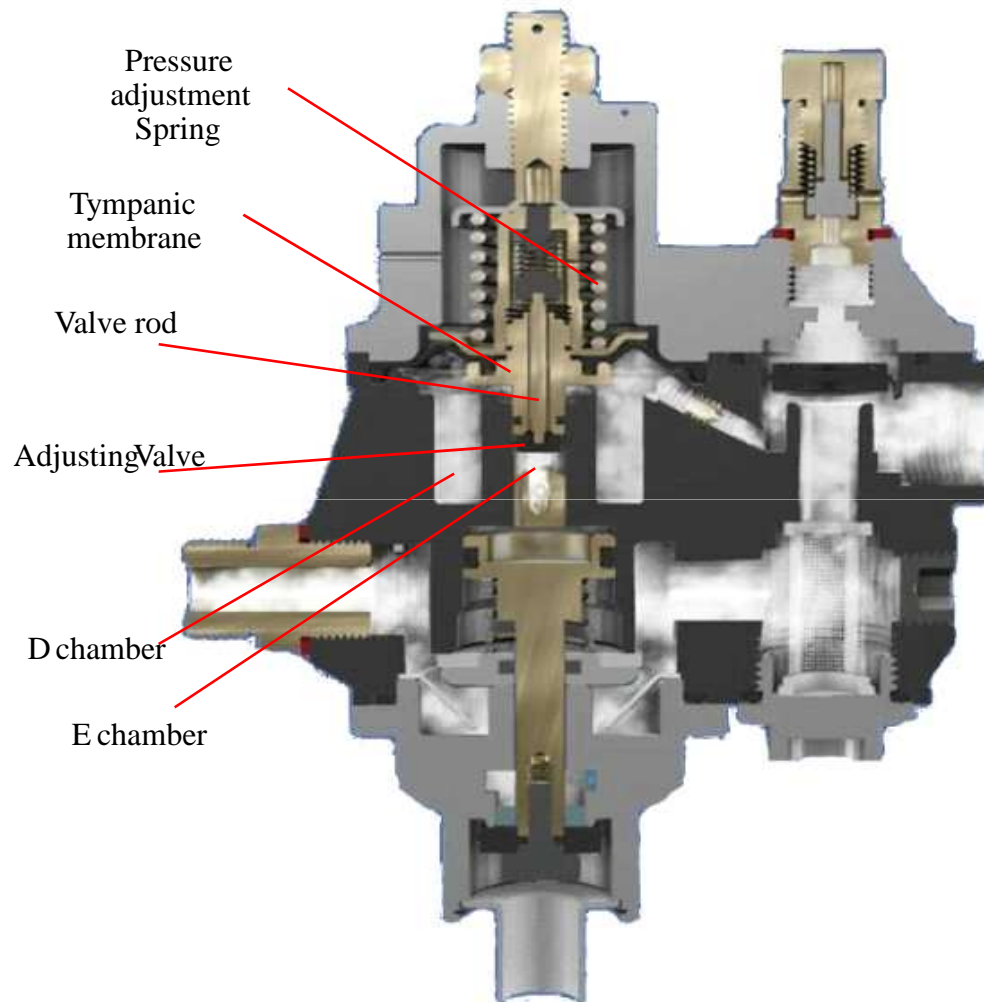


## Section III Oil-water separator combination valve

### III. Operating principle

#### ②. Adjusting air pressure function

- When the air reservoir pressure (equal to the D chamber pressure) is higher than the set pressure 0.784Mpa, the compressed air force will overcome the spring tension force, driving the tympanic membrane to move upwards. The tympanic membrane drives control piston to move up, and the valve rod floats. The compressed air goes through D chamber to E chamber, which will open the adjusting valve and valve rod.

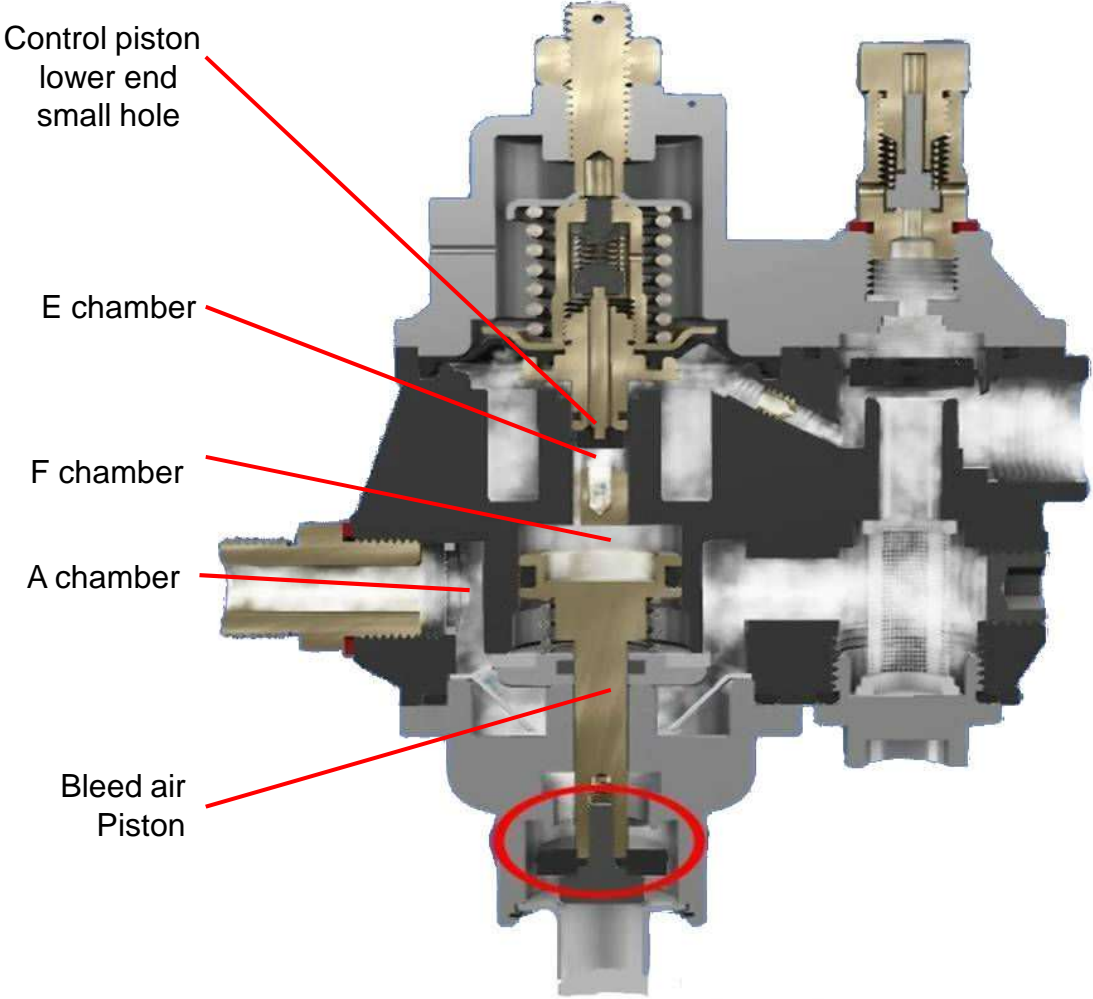


# Section III Oil-water separator combination valve

## III. Operating principle

### ②. Adjusting air pressure function

- As the adjusting valve moving upwards, it will close the small hole on lower end of the control piston. The air of the E chamber enters into F chamber, which will push the bleeding piston to move downwards and open the exhaust valve. Then the air of A chamber which comes from the air compressor will go directly to atmosphere, realize the air compressor unloading;

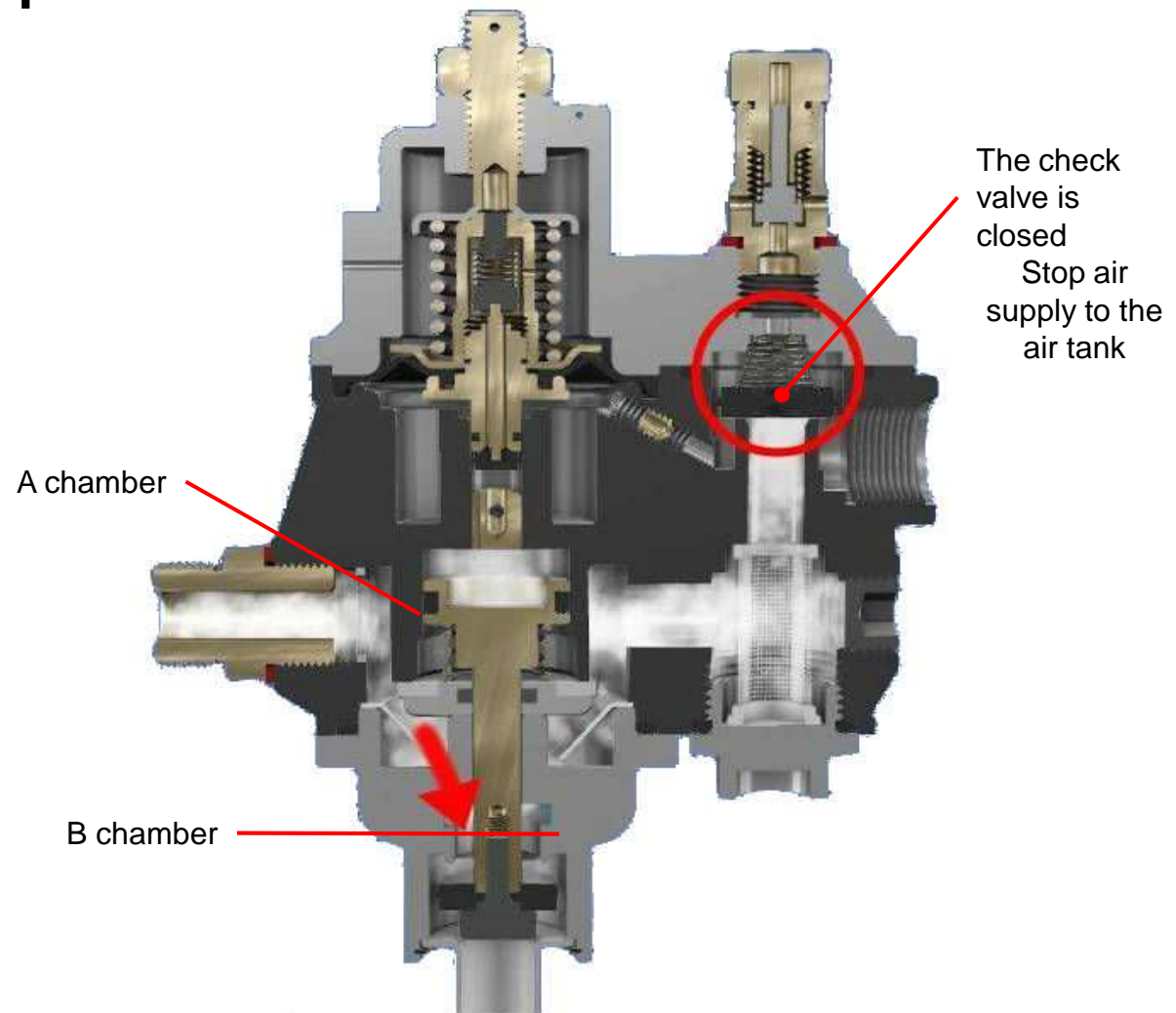


## Section III Oil-water separator combination valve

### III. Operating principle

#### ②. Adjusting air pressure function

- The accumulated oil, water and other impurities in B chamber, which are separated from the air, are discharged with the compressed air. Then the check valve closes, stopping air supply to the air reservoir;

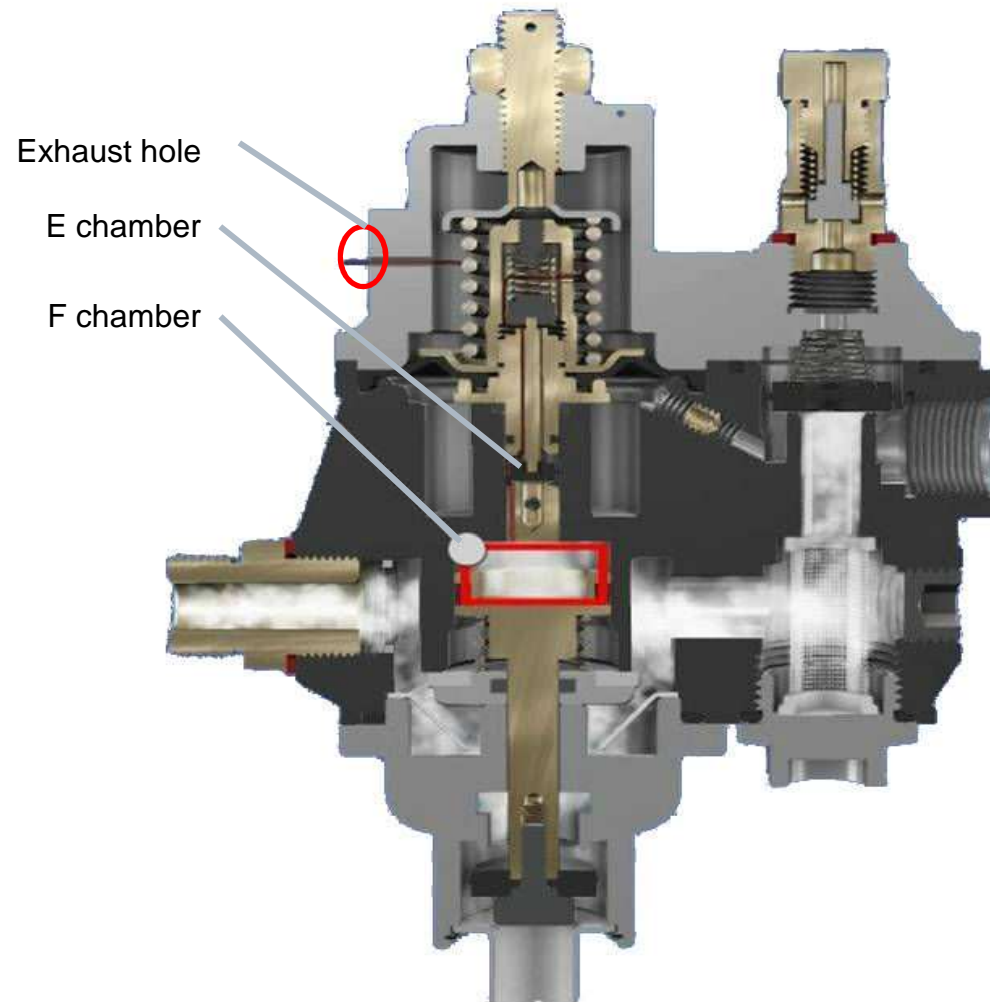


## Section III Oil-water separator combination valve

### III. Operating principle

#### ②. Adjusting air pressure function

- When the air tank pressure is below 0.686Mpa, the control piston assembly will return by the pressure-regulating spring. The valve rod will push the adjust valve downwards, closing the air channel from E chamber to F chamber.
- Meanwhile the channel from F chamber to the atmosphere is connected through the clearance of the control piston and valve rod. Air in F chamber is discharged to atmosphere rapidly. The bleeding piston assembly quickly move upwards, turning off the lower bleeding valve. So the air compressor supplies air to the air reservoir again.

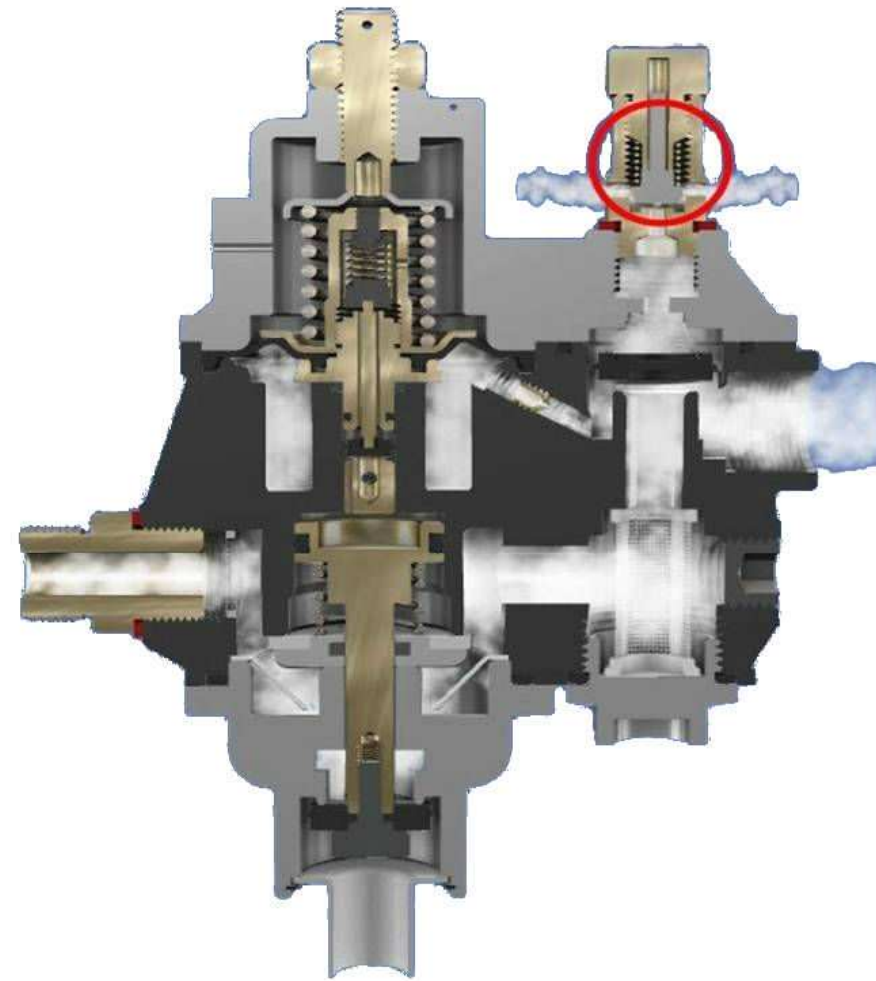


## Section III Oil-water separator combination valve

### III. Operating principle

#### ③. Security protection function

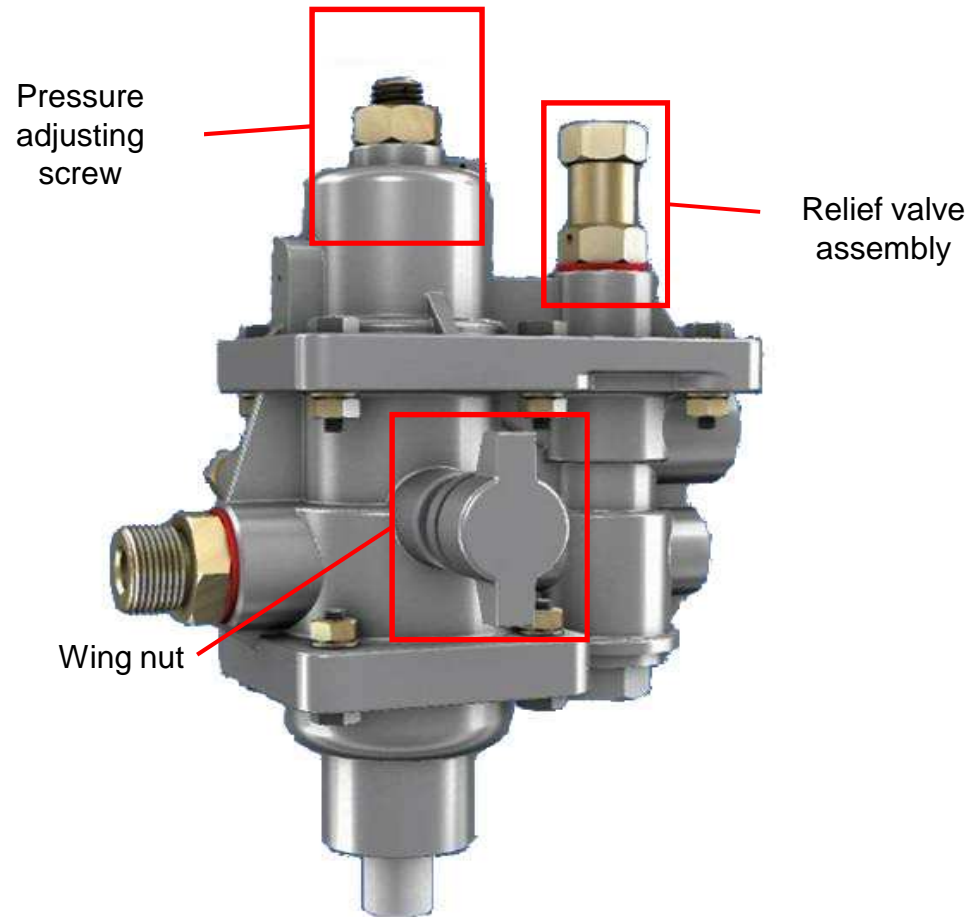
- If the air pressure adjustment function of oil water separator combination valve fails, the air pressure rises to 0.882Mpa. At this time, the relief valve assembly is pushed to open. The compressed air will go into the atmosphere through here to protect the brake system for security.



## Section III Oil-water separator combination valve

### IV. Operating precautions

- Pressure adjusting screw, relief valve assembly, and other key parts and components have been adjusted at the factory by the manufacturer. In general do not change it so as to avoid damages to the brake system .It can be dangerous for driving safety if changed;
- If it is necessary to adjust, the relief valve assembly should be adjusted firstly, and the pressure-regulating valve should be adjusted later, which ensure that the adjusted system pressure should not be too high.
- Unscrew the wing nut (as shown in the figure), connect the inflation pipe, the filtered compressed air may inflate the tire.

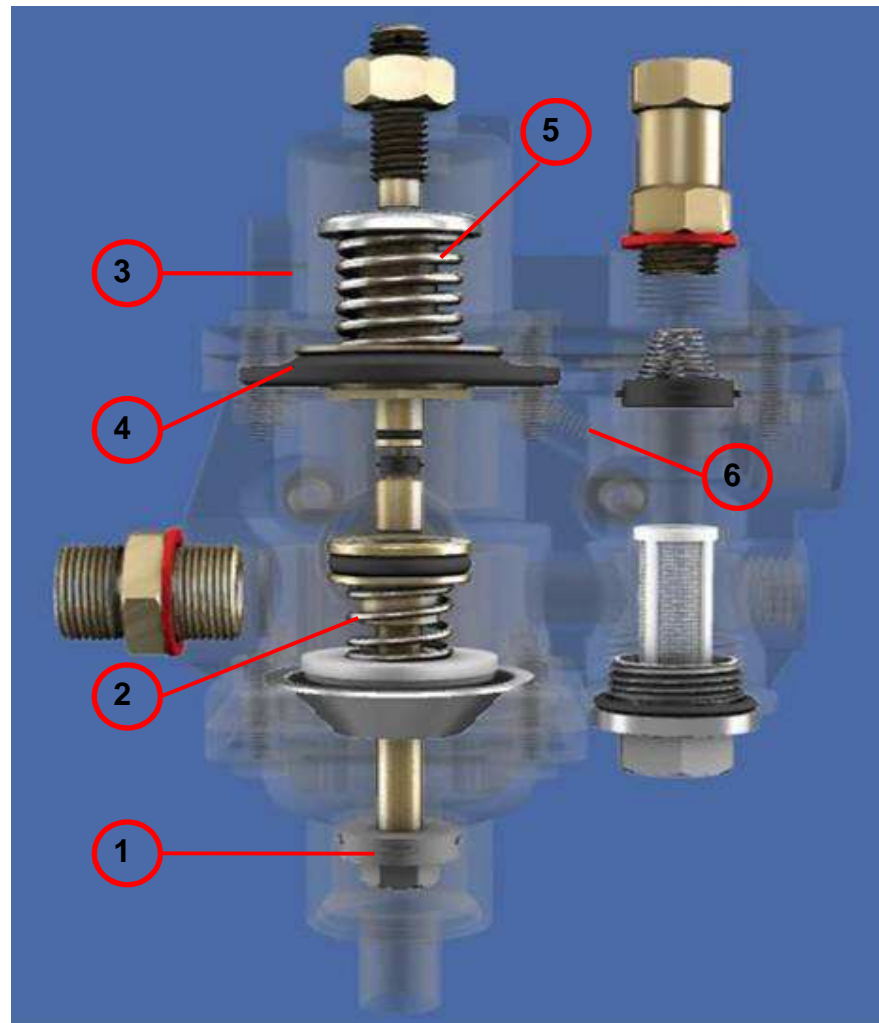




## Section III Oil-water separator combination valve

### V. Common failure

1. When the bleeding valve sealing ring under the exhaust air piston is damaged or stuck, the valve can not close tightly, which will lead to air leaks.
2. When the bleeding piston return spring failures or bleeding piston is stuck, the valve can not close tightly, which will lead to air leaks.
3. When the air channel from the housing to atmospheric is blocked, the bleeding piston can not return effectively, the valve can not close tightly, which will lead to air leaks.
4. When the tympanic membrane ruptures, the pressure will be low, the compressed air will leak from the top cover vent;
5. After working for a long time, the pressure adjusting spring force is reduced, which will make the system pressure too low.
6. When the orifice from C chamber to D chamber is blocked, the pressure adjusting spring, piston assembly is stuck, and part of the pressure adjust function fails. When the air pressure is more than 0.882Mpa, compressed air is applied to the relief valve, will open the valve and the air will exhaust to atmosphere.



# Section IV Air reservoir

## I . Function

- LG936L loader air reservoir is mounted on the left of bench, mainly used for compressed air storage, and provide air source for the brake system;
- When the compressor is not working, the compressed air in air reservoir can ensure braking normally for a certain number of times.
- Provide installation support for relief valve, pressure sensor, valve, inflating valve, water exhaust valve and pressure switch;
- When the driver depresses the brake pedal or operates the parking brake solenoid valve, compressed air enter the brake or the operating air chamber through the control valve, achieve service brake or parking brake.



# Section IV Air reservoir

## II. Structure

### 1 - Safety valve

●When the safety control valve of the oil-water separator combination valve is failed, it protects the brake system. The pressure setting is 0.85~0.9MPa and the safety valve opens to exhaust the air when the pressure setting is exceeded.

### 2. Air pressure sensor

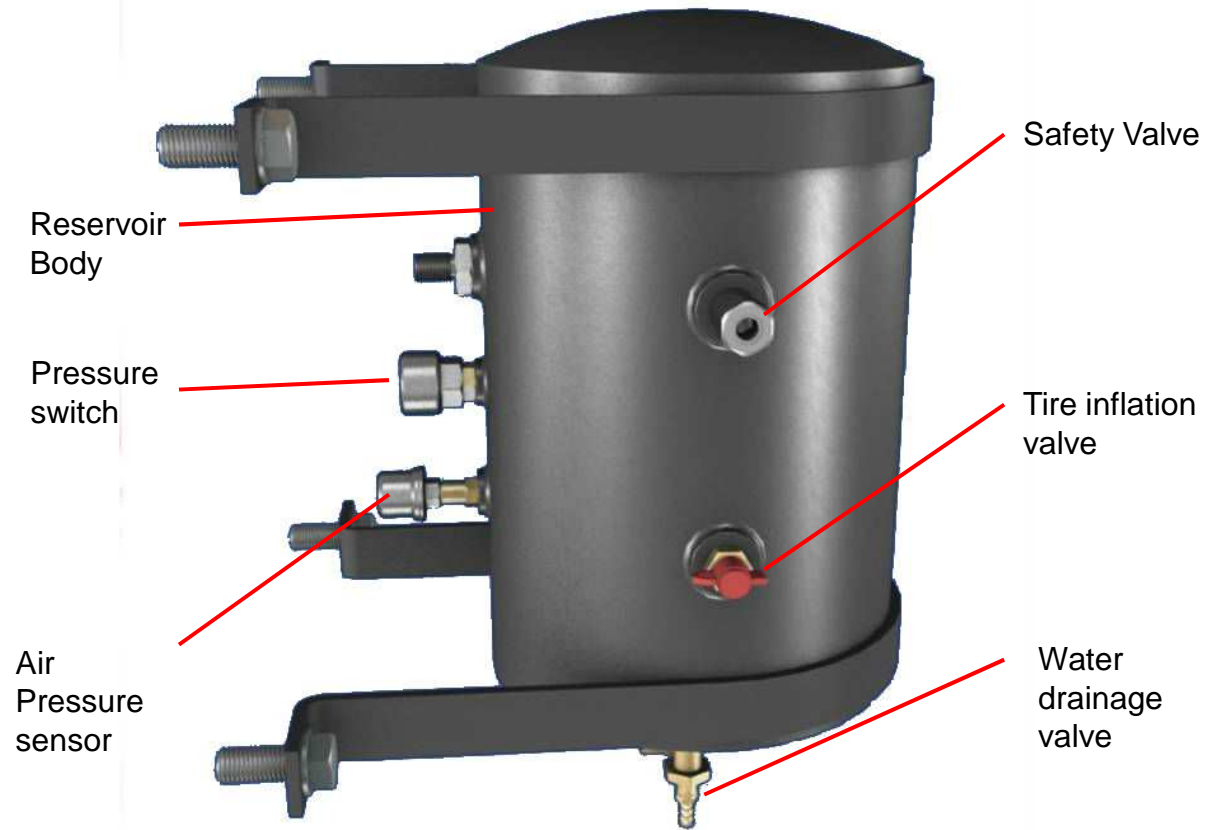
●It provides the pressure value for the air pressure gauge so that the driver can correctly judge the braking state and the good air circuit performance.

### 3. Water drainage valve

●When the water content accumulated in the air sinks to the bottom of the reservoir, loosen the water drainage valve to drain the accumulated water.

### 4. Pressure switch

●When the brake air pressure is less than 0.4MPa, the pressure switch cuts off the power supply to the brake solenoid valve to cut off the solenoid valve and realize emergency braking.



# Section IV Air reservoir

## III. Operation service

- **Water deposition in air reservoir**
- While the compressor supplies air to air reservoir, because of temperature difference between the air and external surroundings, water vapour will be produced by the temperature difference, the vapours will turn into water drops and deposit in bottom of the air tank;
- **Hazards of water deposition in air reservoir**
- If the water deposition accumulates too much and has not been drained in time, the water and iron rust, impurities will flow into the brake valve and interior of the booster pump through the air lines, thus lead to pollution of the brake valve and interior of booster pump, which makes lubrication bad, and produce rust, sealing worn, piston blocked or other failures;
- Water deposition in air reservoir is a major cause of brake parts failures, the user should drain the water in time according to the operation and service manual.

Accumulated water in the air reservoir entered the brake valve, causing piston blockage and sealing performance degradation

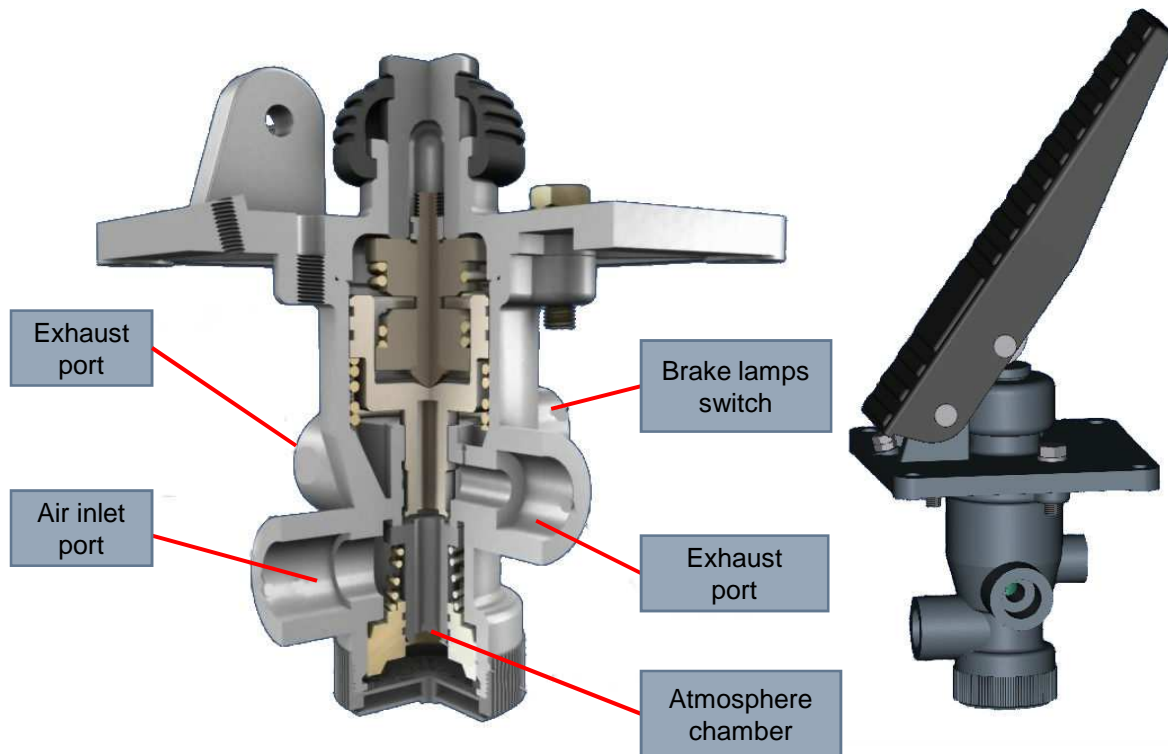


Accumulated water in the air reservoir entered the booster pump, causing cylinder corrosion, piston blockage and seals wear.

# Section V Air brake valve

## I . Function

- The air brake valve is used to control compressed air volume which enters the booster pump as braking, that is controlling the air pressure of the pump, to get different brake effect, and bring "sensitive road condition " to the driver, the driver may feel the vehicle brake condition according to the brake pedal travel and manipulating force.
- The brake valve is an equipment driven by the brake pedal, to brake the wheels or release it;
- The inlet port of brake valve is connected with the air reservoir, and the exhaust port is connected with the 3-way shuttle valve. A power cut-off switch is installed on the brake valve, to cut off power to transmission as the brake valve is actuated.

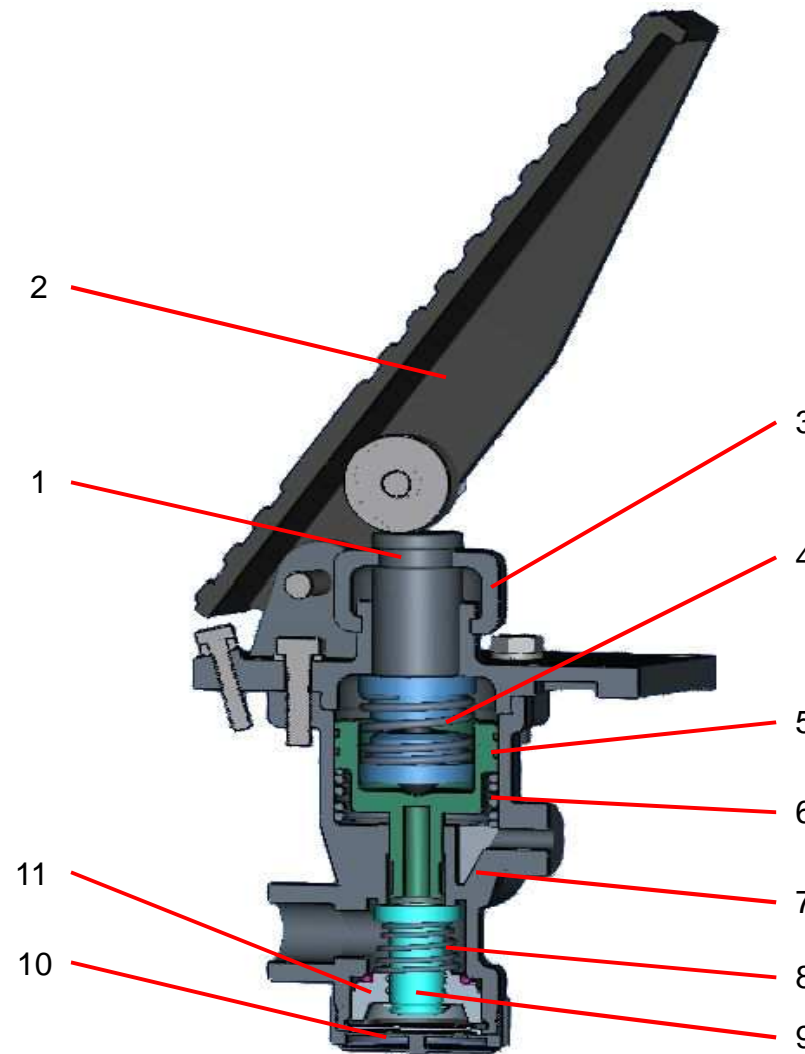


# Section V Air brake valve

## II. Structure formation

- It is composed of the pedal, top cover, lower valve body and tappet in valve body, piston balance spring, air inlet valve and return spring etc;

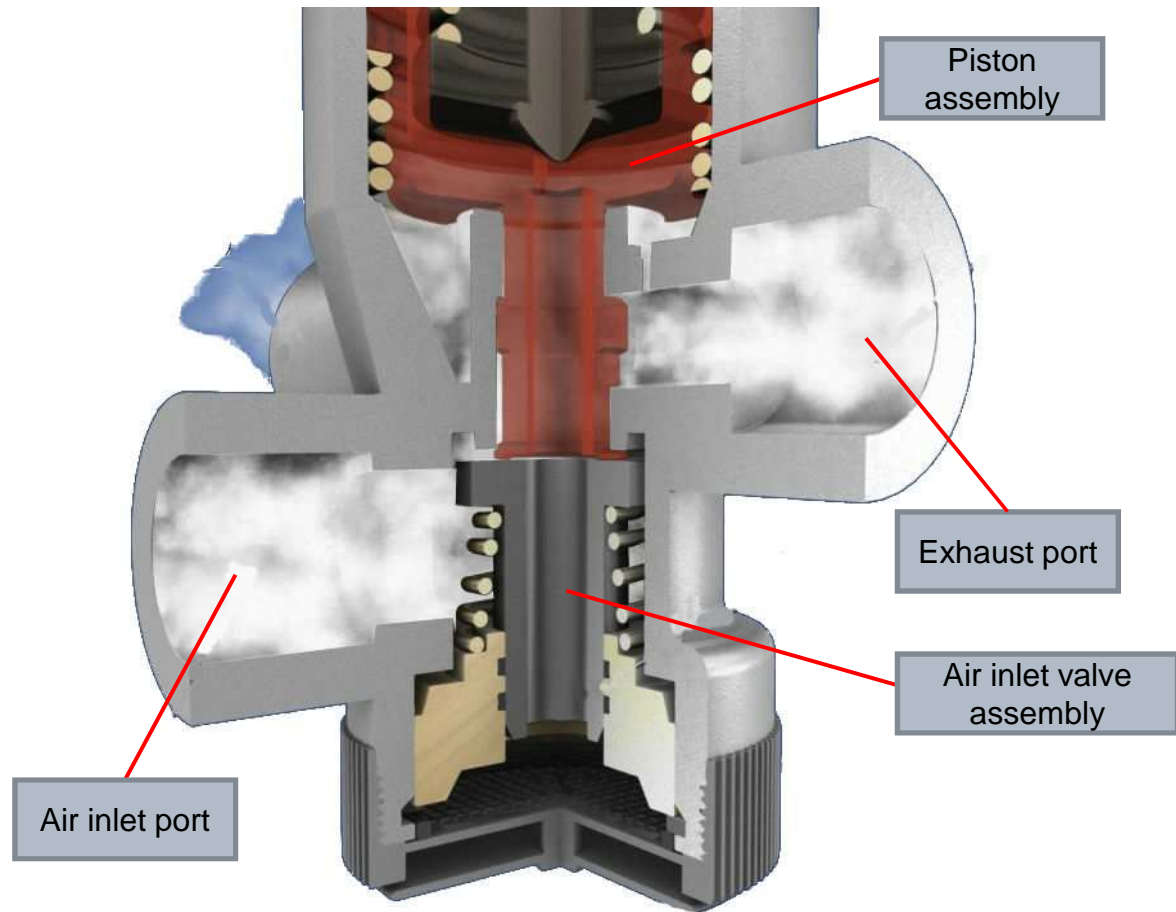
- 1.Carrier Rod
- 2.Service brake pedal assembly
- 3.Dust cover
- 4.Balance spring assembly
- 5.Piston assembly
- 6.Piston return spring
- 7.Valve body
- 8.Air inlet valve assembly
- 10.Air exhaust valve assembly
- 11.Valve assembly



## Section V Air brake valve

### III. Operating principle—application of the brake function

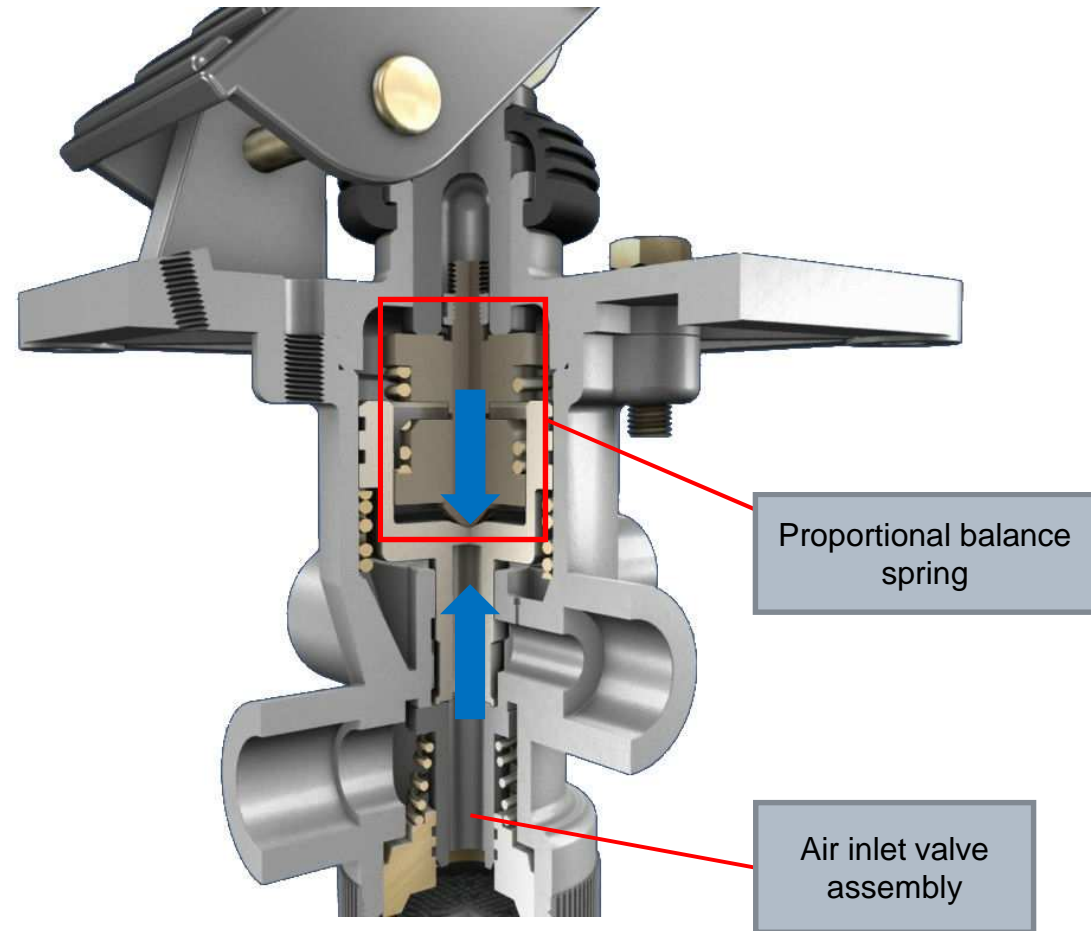
- As the driver depressing the brake pedal, the carrier rod is driven by the pedal to apply specified pressure to the balance spring. Then the pressure pushes the piston move downwards. Thus close the channel between air port and atmosphere, and open the air inlet valve assembly;
- The compressed air form air reservoir enters the booster pump or power cut-off switch to apply braking effect through the inlet port, air inlet valve assembly and exhaust port .



## Section V Air brake valve

### III. Operating principle—balance proportioning control

- During braking conditions, exhaust port output air pressure and brake pedal application force the increases and decreases proportionally, which is realized by the balance spring.
- As application force of brake pedal is constant, the force between carrier rod and balance spring is also constant. Then the air valve opens. When the force of lower piston cavity, which applying on piston, exceeds the balance spring force, the balance spring is depressed, and the piston moves upwards until the inlet port is closed.
- Now the force of air pressure applying to piston is balance with the force of brake pedal applying to balance spring. The output pressure of exhaust port C is a constant value.

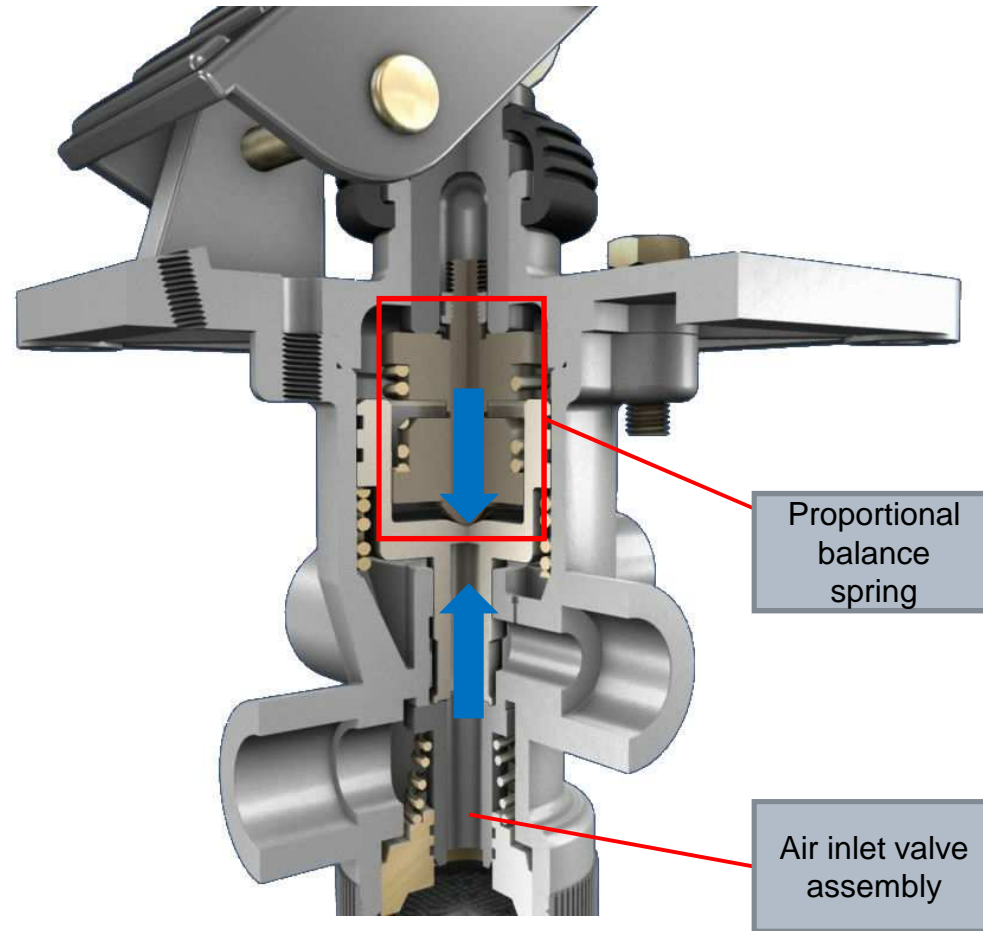




## Section V Air brake valve

### III. Operating principle—balance proportioning control

- As the force of brake pedal applying to balance spring increases, the piston moves downwards again and re-open the inlet valve. As the air pressure of lower piston cavity increases to a certain value, the force on piston is balance with force of brake pedal applying to balance spring, the inlet valve is close again and the output air pressure of exhaust port C will keep constant and be higher than the previous value.
- That is to say, the output air pressure of exhaust port is proportional to the depressed travel of balance spring, and is also proportional to brake pedal travel;
- As releasing the brake pedal, the piston assembly 5 is pushed to the highest position by return spring 6, and the inlet valve is closed by the return spring. Then the brake process is finished



## Section V Air brake valve

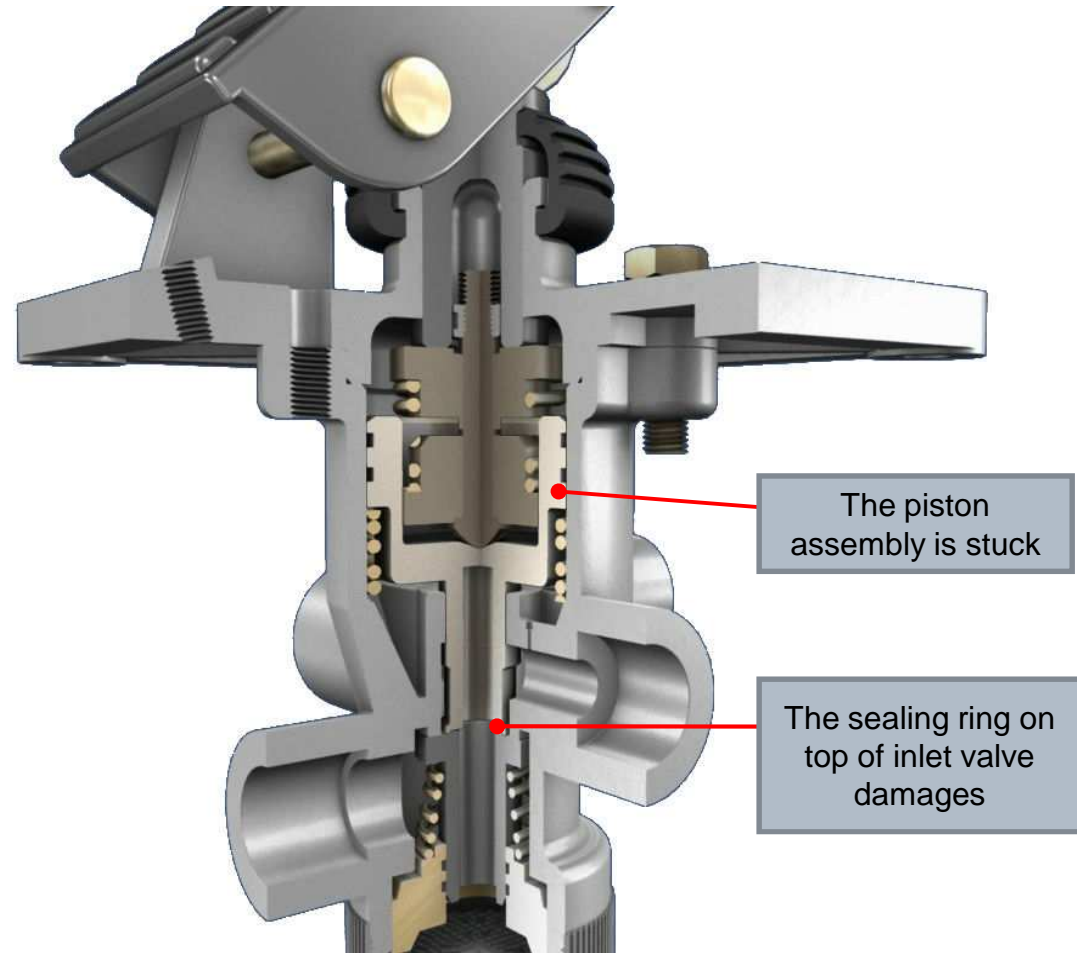
### IV. Common failure

#### 1. Insufficient braking torque

- Analysis of reason:
- The piston assembly is stuck, that it can not effectively push the inlet valve move downwards to open the air inlet port;
- The sealing ring on top of inlet valve damages or there are impurities, leading to air leaks from the inlet valve;

#### 2. The brake is put off

- Analysis of reason:
- The valve spool returning is stuck or broken



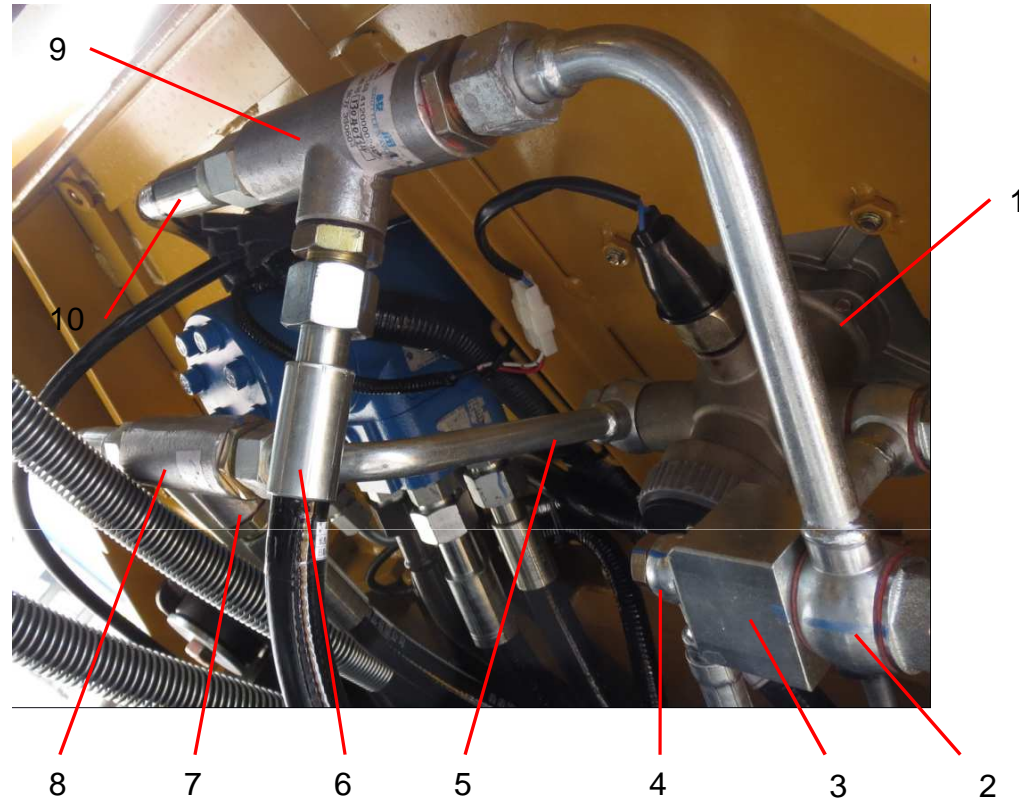
# Section VI 3-way shuttle valve

## I . Function

1. The 3-way shuttle valve is installed under the cab, connecting with left and right air brake valve and air booster pump. There is a spool in the shuttle valve, the spool moves to left and right side according to pressure difference between left and right brake valve. Thus only one of the two brake valves may operate at the same time to supply compressed air to booster pump;

## 2. Security protection

- The two brake valves are connected in parallel, if one of them fails suddenly, the other one may operates to brake normally, providing security protection;

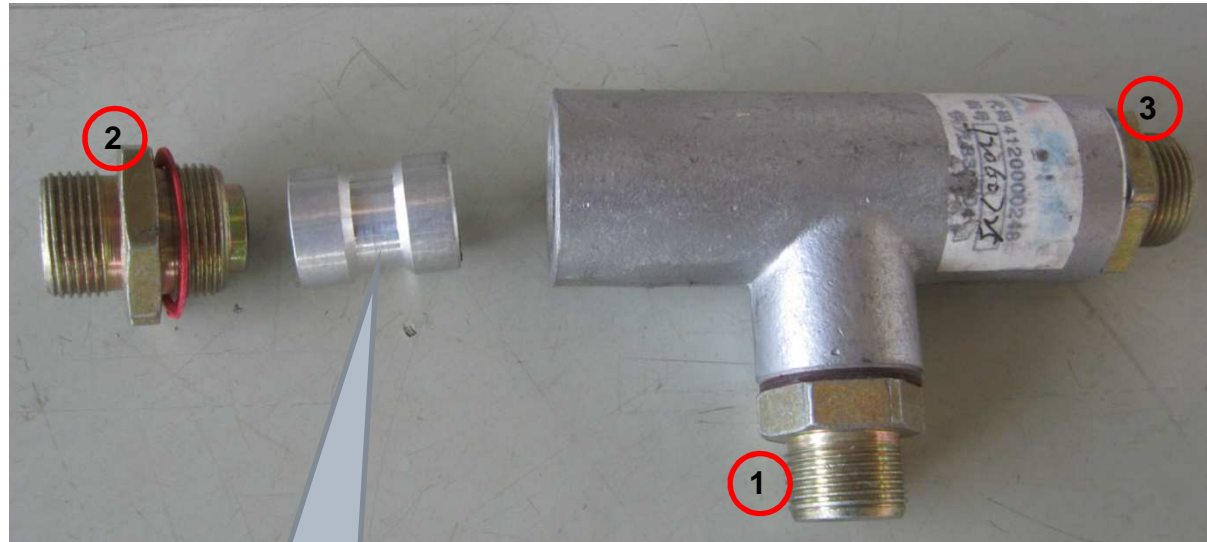


- |   |  |
|---|--|
| 1. Left brake valve                             | 2. Pipe(Connect with Left 3-way shuttle valve) |
| 3. 3-way block                                  | 4. Power cut-off pipe                          |
| 5. Pipe(Connect with right 3-way shuttle valve) |  |
| 6. Pipe(Connect with booster pump)              |  |
| 7. Pipe(Connect with booster pump)              | 8. Right 3-way shuttle valve                   |
| 9. Left 3-way shuttle valve                     | 10. Connect with right brake valve             |

## Section VI 3-way shuttle valve

### II. Structure

- The structure of the 3-way shuttle valve is simple, it mainly consists of spool, valve body, three unions thus in total 5 parts, as shown in the right figure:
- Both ends of the spool is sealed, it is driven by the air pressure to move left and right, ensure that only one union, the union 2 or union 3, is connected with union 1 at the same time.



# Section VII Air booster pump

## I . Function

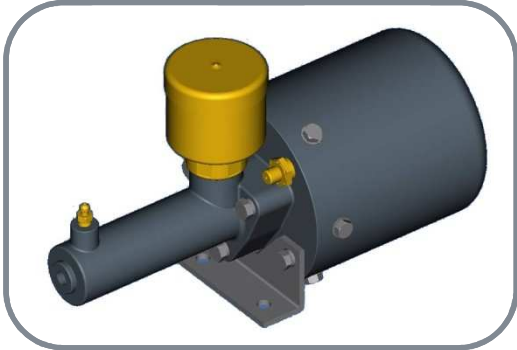
- LG936L loader is equipped with two air booster pump, locating on right side of front frame and at the end of rear frame.
- The function of booster pump is mainly to increase pressure of the brake fluid in master brake cylinder, to drive piston of brake caliper on front and rear driving axle, realizing brake of the loader.



Front Booster Pump Position



Rear booster pump position

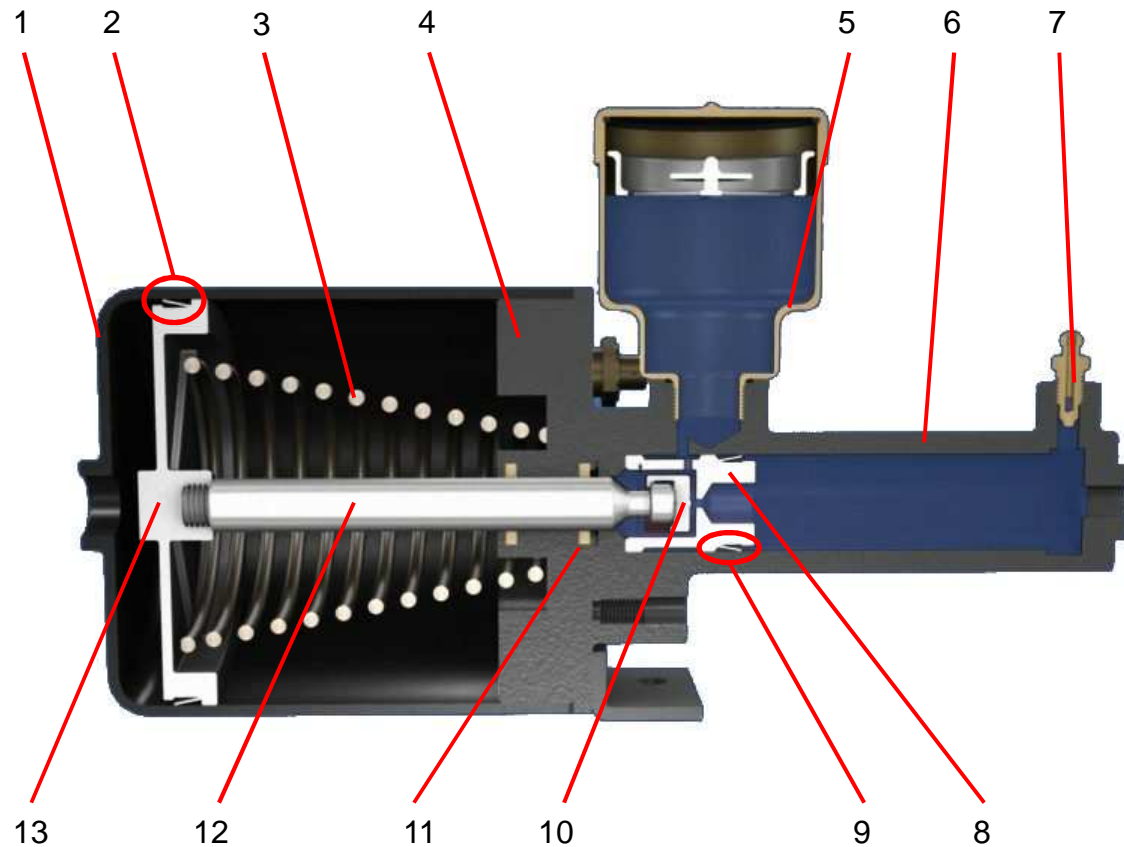


# Section VII Air booster pump

## II. Structure

● The booster pump is mainly composed of booster cylinder block, brake cylinder block, oil pressure piston, air chamber piston, push rod, push rod seat end cover, return spring, oil reservoir cup and sealing. The structure of air booster pump is shown in the right figure

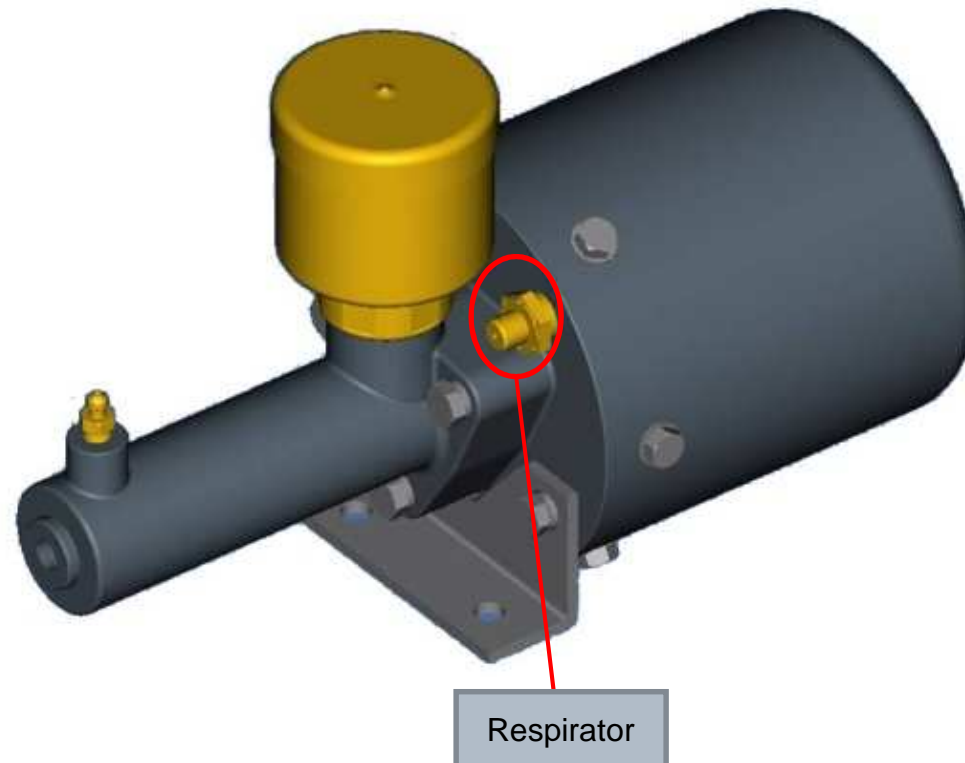
- 1.Booster cylinder block
- 2.Sealing ring
- 3-Return spring
- 4.End cover
- 5.Oil reservoir cup
- 6.Brake cylinder block
- 7.Bleed screw
- 8.Oil pressure piston
- 9.Sealing ring
- 10.Master cylinder rubber cup
- 11.Sealing ring
- 12.Push rod
- 13.Brake piston



## Section VII Air booster pump

### II . Structure: Respirator

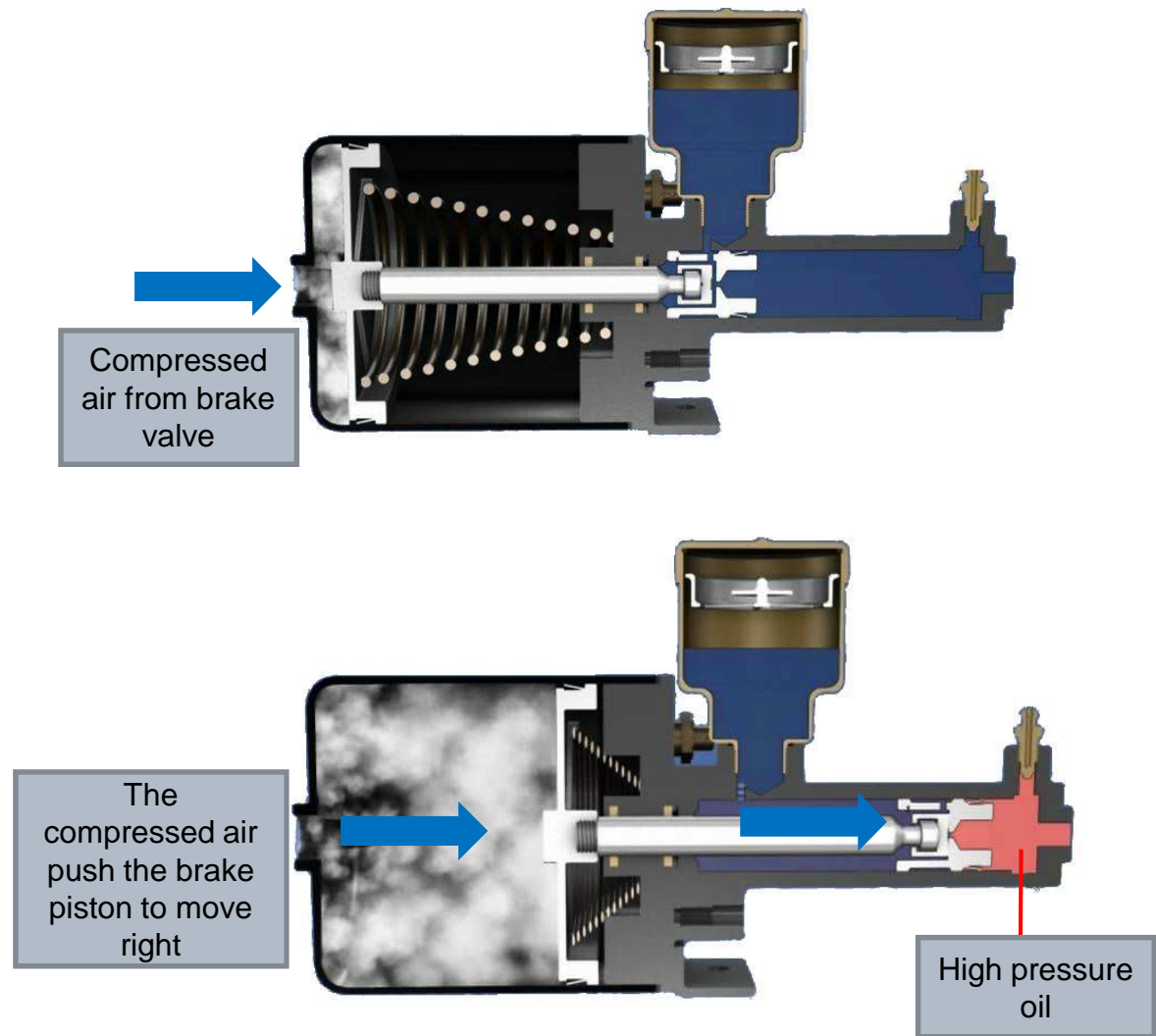
- The Respirator is located on end cover of the booster pump, with which the pump cylinder spring chamber is connected with atmosphere. When braking, the compressed air drives the cylinder piston to move forwards, the cylinder spring chamber exhausts air from this position, make the piston move quickly. As releasing the brake, the spring chamber may breathe in air from the respirator, which makes the air piston return in position quickly by the spring. Thus the brake is released;
- Strainer of the respirator may filtrate impurities in suction or exhaust as applying brake or releasing brake. The respirator should be replaced regularly to prevent it from being blocked, which may result in insufficient brake. If the breather is broken, the sucked impurities may damage the pump.



## Section VII Air booster pump

### III. Operating process-brake process

1. As depressing the brake pedal to brake the loader, compressed air from the brake valve will pass through the inlet union to enter booster cylinder block and push the brake piston overcome the force of return spring to move right. Because the push and the brake piston are connected together, the Oil pressure piston also moves toward right. which will seal oil in cylinder block, and make brake fluid in brake master cylinder produce high pressure (in general, the ratio of brake pressure and oil pressure in outlet port is 1:18X90%), high pressure brake fluid enters the disc brake through the pipelines, to brake the wheels.

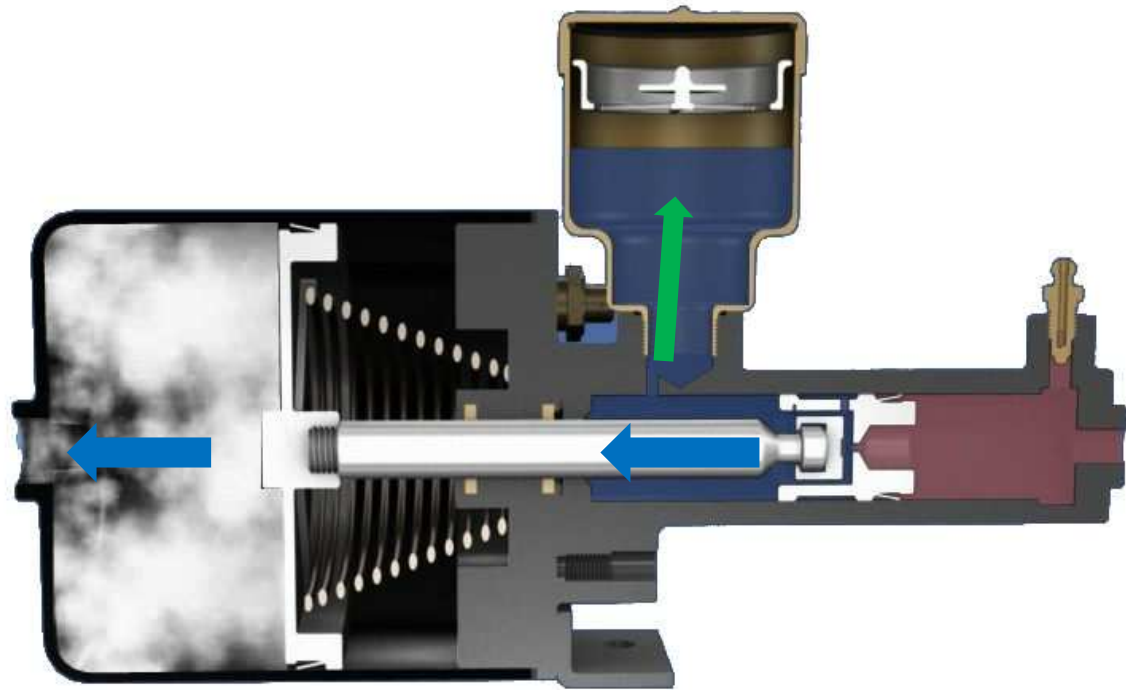




## Section VII Air booster pump

### III. Operating process-release brake process

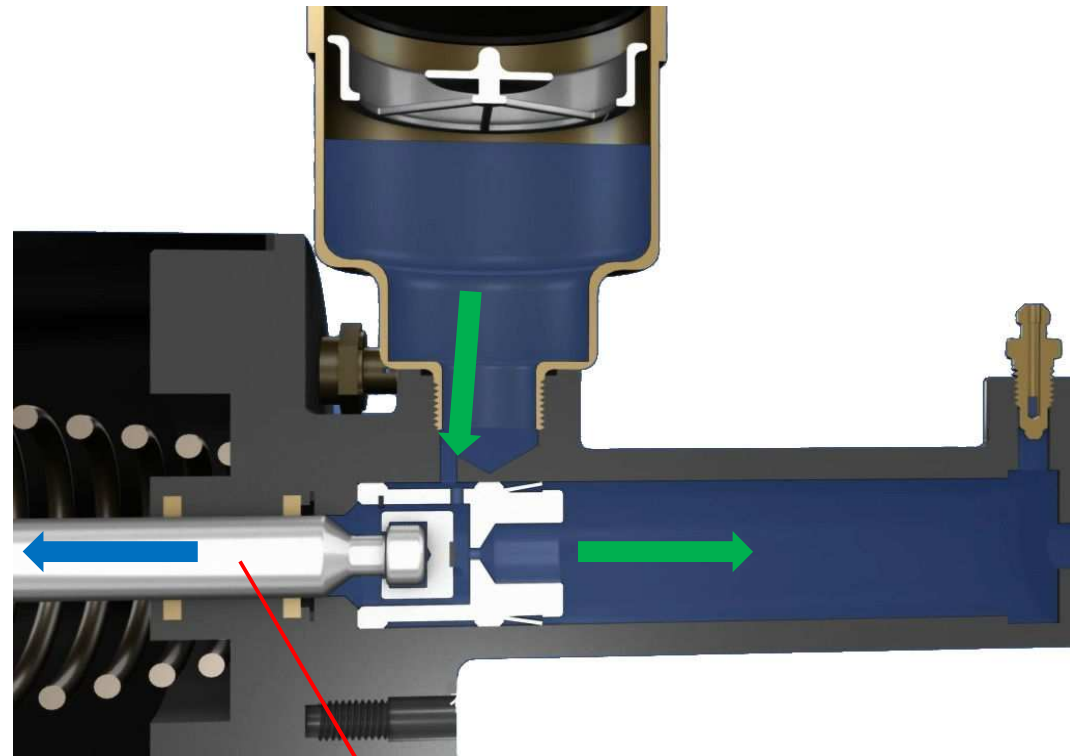
2. As the brake pedal is released, the brake piston is driven by the return spring to move left. The compressed air will return to brake valve through the booster union, and exhaust to atmosphere through the brake valve. At the same time, the push rod pushes the seat assembly to move left, and the oil pressure piston moves left. The high pressure brake fluid in brake parts returns to brake cylinder block through the oil pipes. Thus the brake is released.



## Section VII Air booster pump

### III. Operating process-release brake process

3. Because the brake fluid in brake pump can not return with the piston in time when the brake pedal is released quickly, a low pressure will be produced in the brake cylinder. Then the brake fluid in oil reservoir cup will be driven to the pump body by barometric pressure through clearance between the push rod seat assembly and oil pressure piston. Now if depressing the brake pedal again, the brake effectiveness will be better.

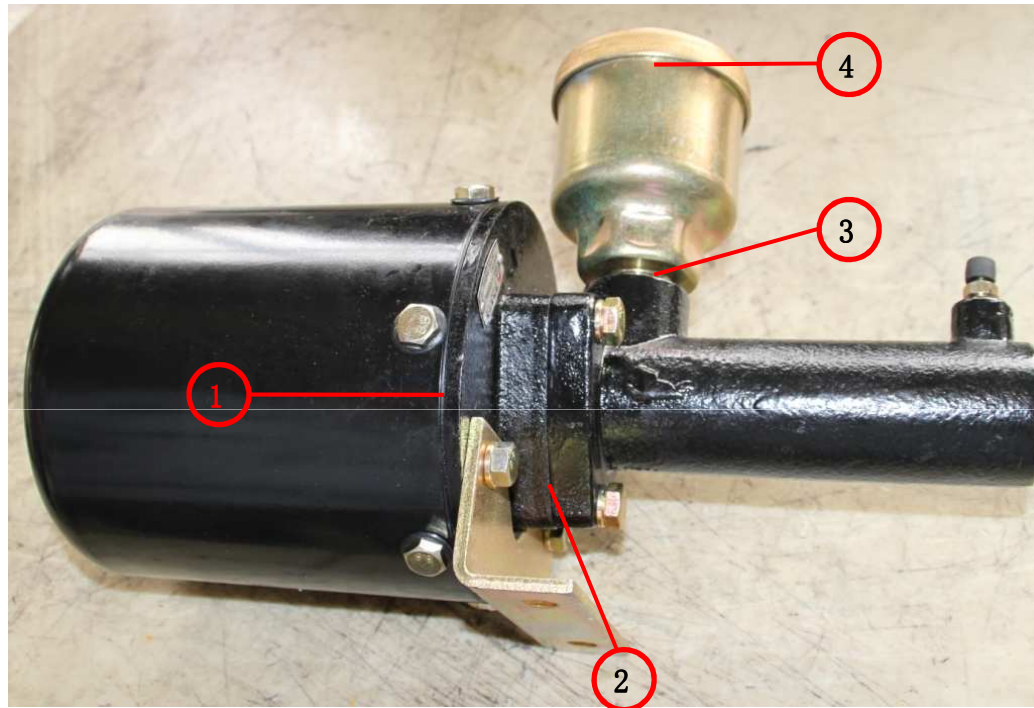


If the brake pedal is released quickly, the push rod will drive the oil pressure piston to return quickly

## Section VII Air booster pump

### IV. Common failure

- **Booster leakage:** Spark the loader steadily and put the gear in neutral, the brake air pressure will be at specified value. Depress the brake pedal and keep, obvious air exhaust will be observed at the pump respirator if there is serious leaks of booster pump cylinder sealing. If there is serious leakage from the booster pump cylinder seal, there should be obvious fluctuation or gas bubbles rising from bottom of the cup when you observe brake fluid in oil reservoir cup at this time. If the booster pump centre sealing ring leaks, it can be judged by observing brake fluid from the cylinder and end cover connection part;
- **External leakage:** leakage between oil reservoir cup and end cover, oil cylinder block and end cover joints. The reasons should be booster pump sealing loosen, which resulting in the oil leakage ;  
As shown in the right figure, the common leakage points of air booster pump.



## Section VIII Brake caliper

### I . Function

- LG936L loader brake system is equipped with caliper disc brake. The brake caliper is a pliers with friction block, catching the rotating brake disc from both sides to brake it. The both end surfaces is operating surface of the driving axle, and it is fixed on the wheel and rotates with the wheel. It is combination of internal and external callipers, easy to maintain and service.
- The compressed brake fluid is applied to the brake caliper piston to drive the brake linings to catch the brake disc from both sides, thus to provide brake.

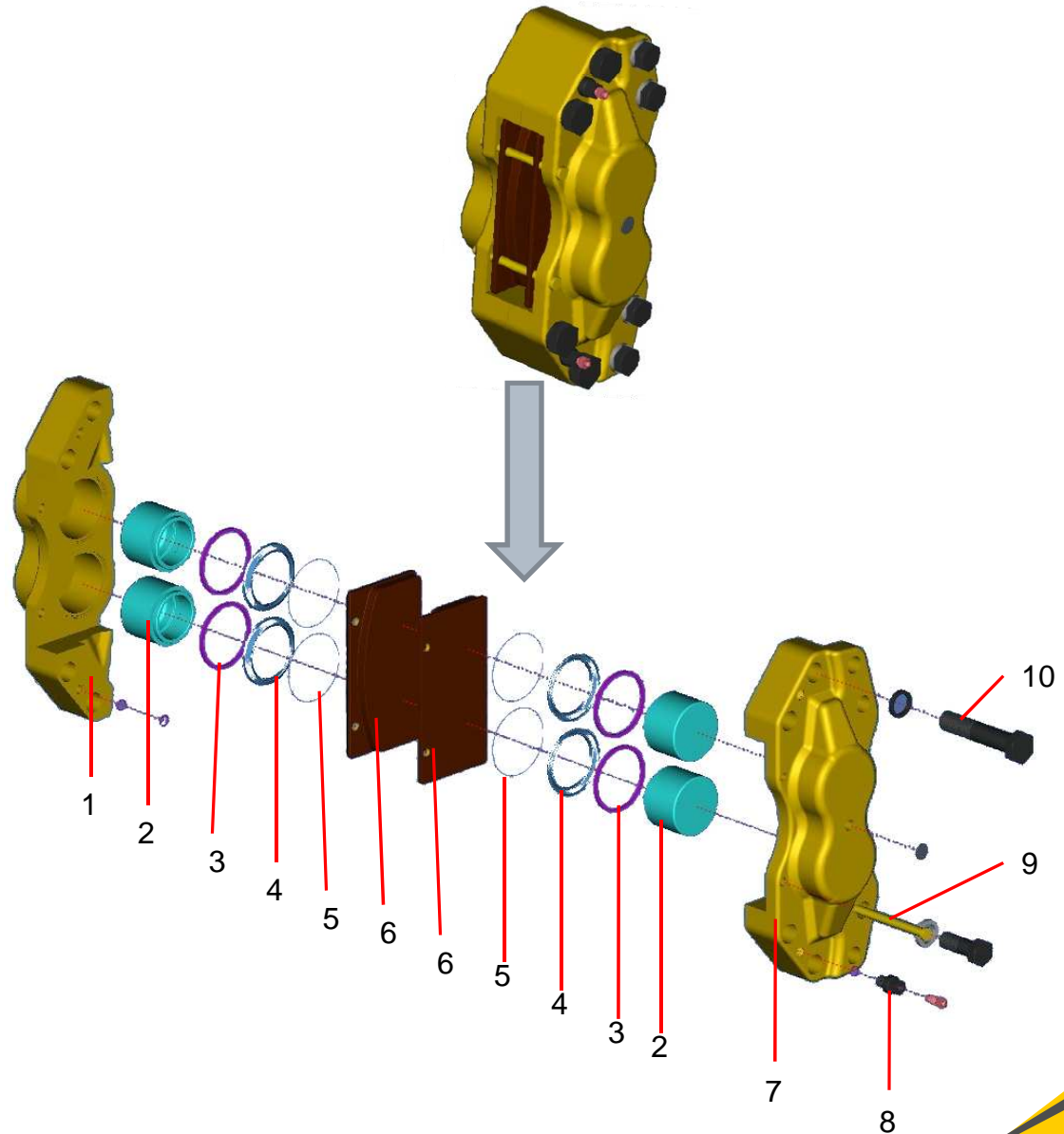


# Section VIII Brake caliper

## II. Structure

- The disc-brake caliper is mainly composed of inner caliper, outer caliper, seal ring, piston, rectangular seal ring, and dust cover.
- The pressurized brake fluid is applied on the piston of brake caliper to drive the brake friction plate to clamp the rotating brake disc from both sides for braking purpose.

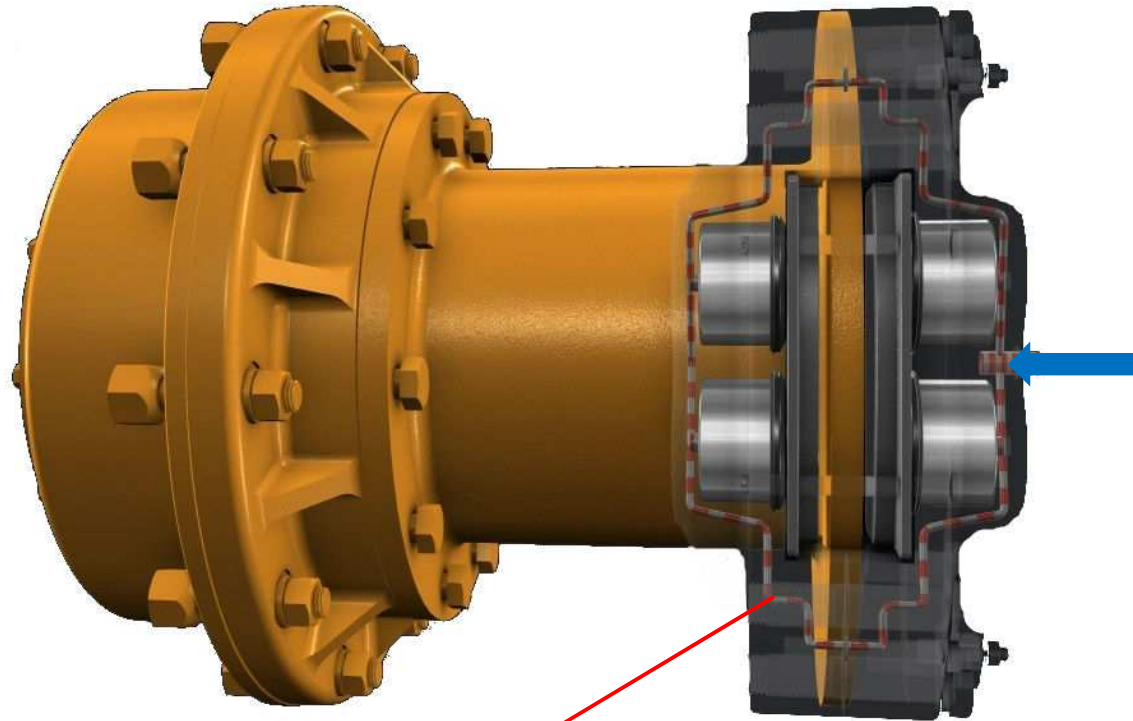
- 1.Outer Caliper
- 2.Brake Piston
3. Rectangular Seal Ring
- 4.Dust Cover
- 5.Seal Ring
6. Friction plate
7. Inner Caliper
8. Bleed Screw
9. Mount Pin of friction plate
- 10.Bolt



## Section VIII Brake caliper

### III. Operating process

- When the brakes are applied, high pressure brake fluid from booster pump enters each slave cylinder oil cylinder, drives the symmetrical arrangement piston to move inwards, and the oil push the brake linings to clamp the brake disc so as to reduce the wheel speed to stop.

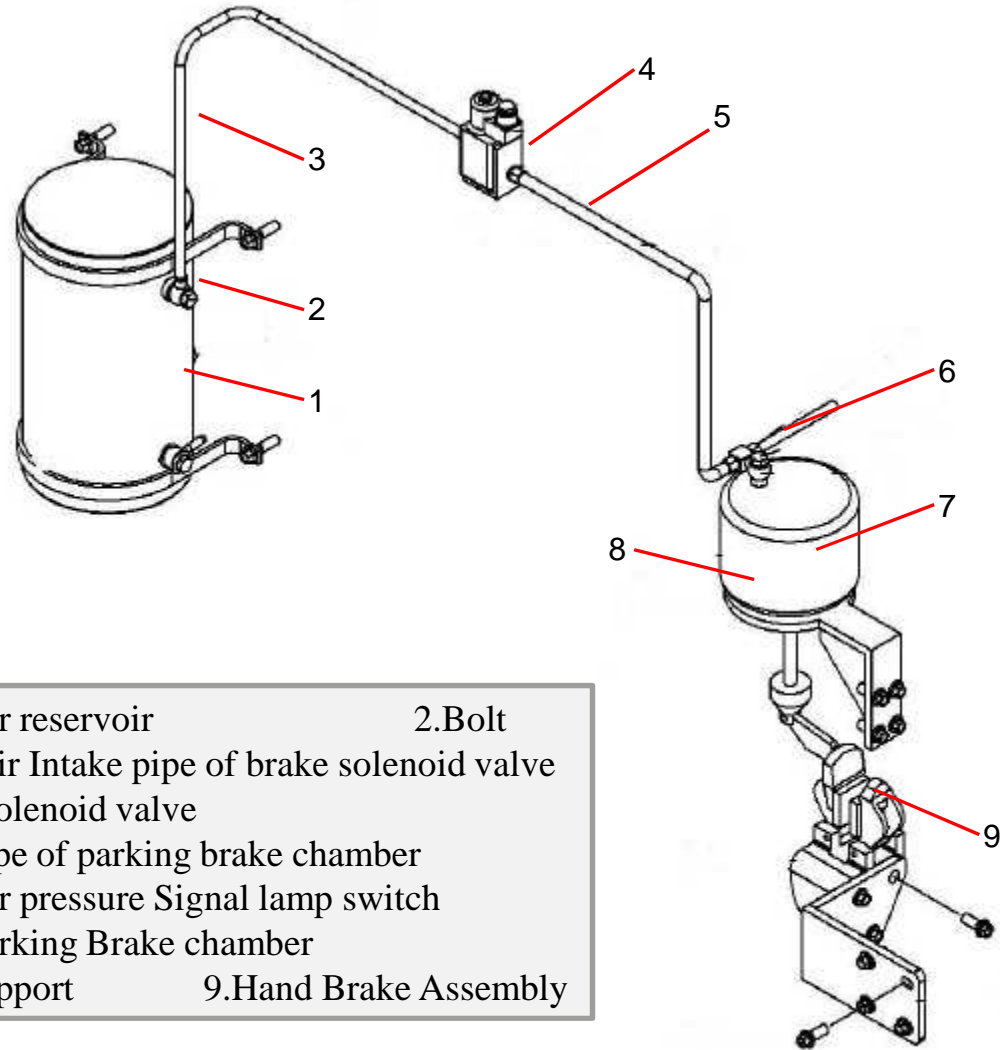


High-pressure fluid through the lines to the brake caliper, so that the two side symmetrical piston move inwards, to clamp the brake discs to brake

# Section IX Parking Brake System

## I . Structure formation

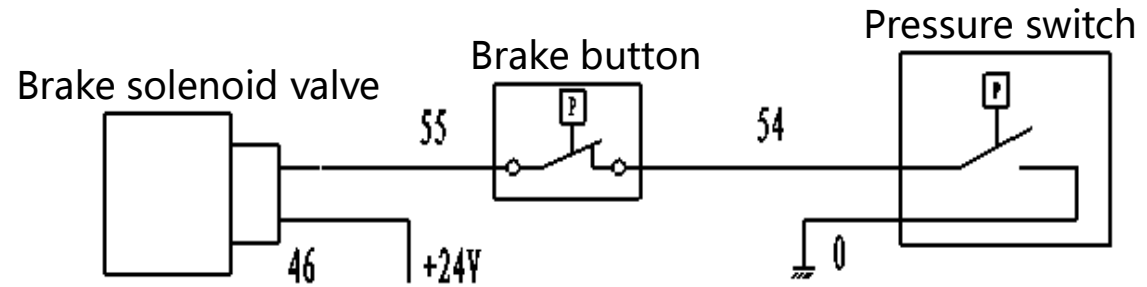
- The brake system, which is used to keep the loader in the original position, is named parking brake system.
- It is used to brake in case of an emergency during the operation of the loader, and keep the loader at the original position after parking in order not to move due to the road slope or other external forces. It can also protect for brake safety in case the pressure of service brake is too low
- LG936L is electric pneumatic pliers disc parking brake system. It is mainly composed of caliper disc brake, parking brake chamber, hand brake valve, air reservoir, pipelines, etc.
- The brake of the parking brake system are always installed on the front output shaft of the gearbox on the loader. Through manual or chamber control, the brake disc is clapped to achieve parking brake.



# Section IX Parking Brake System

## II. Operating principle

- Manual release and operate parking brake
- When the pressure of compressed air in the brake system is within normal working range, rotate the brake operating button on the right control box of the cab. The button will spring automatically to provide a electric signal (the wires 54 and 55 are connected) to the brake solenoid valve so that the compressed air from air reservoir enters into the parking brake chamber via brake solenoid valve and then the piston compresses the spring to release the caliper brake and release the parking brake.



Brake operating button

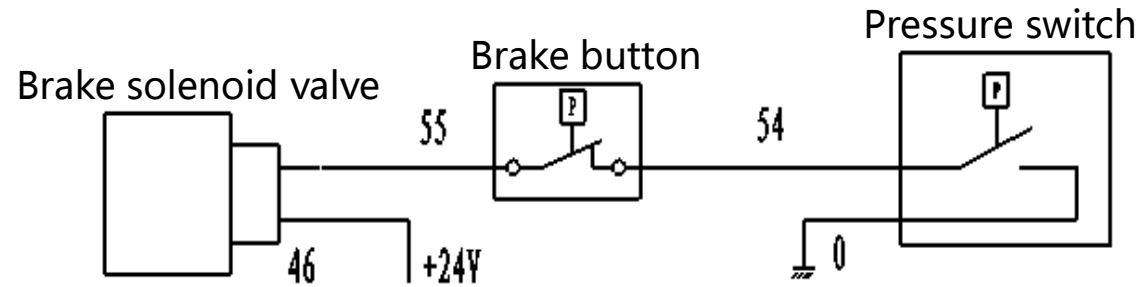
- ① Rotate: connect the wire 54 with wire 55 so that the solenoid valve is powered on to release the parking brake.
- ② Push down: disconnect the wire 54 from wire 55 so that the solenoid valve is cut off to set the parking brake



# Section IX Parking Brake System

## II. Operating principle

- Manual release and operate parking brake
- In event of emergency braking or parking, push down the operating button of the brake solenoid valve to cut off the solenoid valve. In such case, the compressed air in the parking brake chamber is drained to the open air via brake solenoid valve so that the brake is pulled for braking purpose under the action of the spring force. At the same time, the air pressure signal is outputted to control the light-up of parking brake indicator, in order to alert the operator that the complete machine is under braked state.



Brake operating button

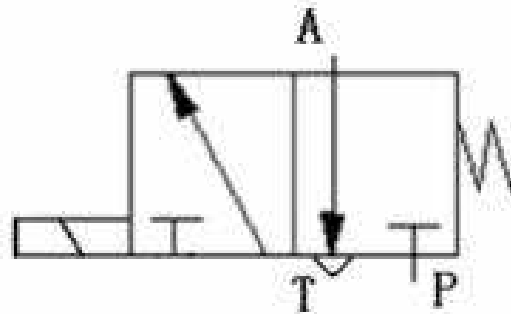
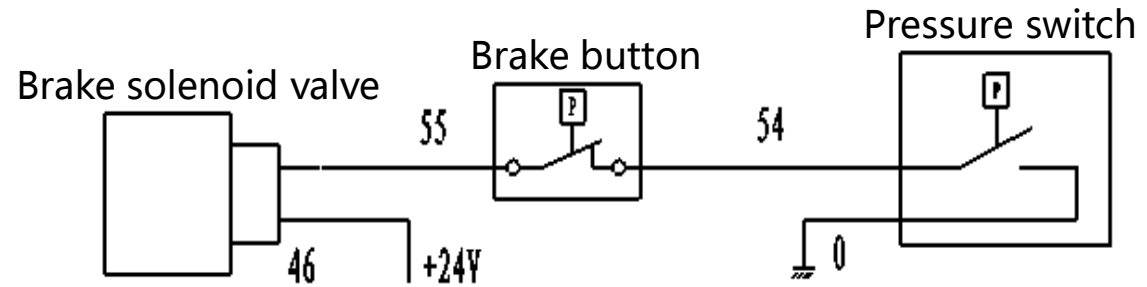
- ① Rotate: connect the wire 54 with wire 55 so that the solenoid valve is powered on to release the parking brake.
- ② Push down: disconnect the wire 54 from wire 55 so that the solenoid valve is cut off to set the parking brake

# Section IX Parking Brake System

## III. Brake solenoid valve

• The brake solenoid valve is used in the parking brake system, of which the intake port is connected with the compressed air from the air reservoir, the outlet port is connected with the parking brake chamber, and the exhaust port is connected with the open air.

- 1. When the control button is released, the power of solenoid valve is on so that the solenoid valve core is actuated to open the air passage to the parking brake chamber. The air pressure overcomes the spring force of the brake chamber spring to release the parking brake.
- 2. When the control button is pushed down or the brake pressure is less than 0.4MPa, the brake solenoid valve is cut off so that the valve core closes the air passage to the brake chamber. At the same time, it opens the passage of brake chamber to the open air to engage the brake.



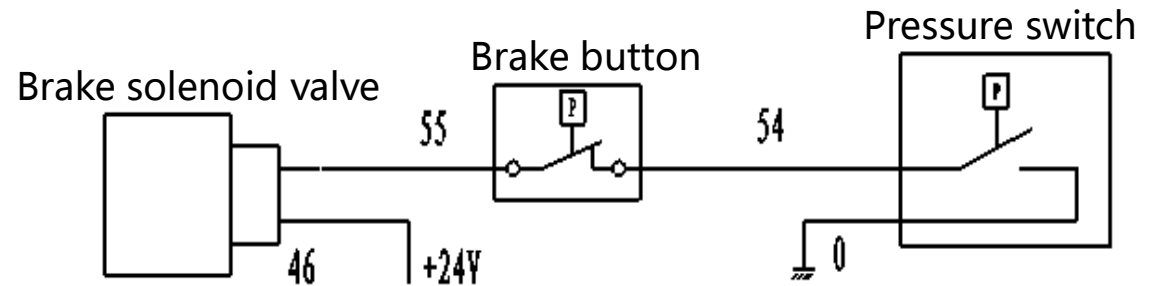
P. Connected with air reservoir  
A. Connected with brake air chamber  
T. Connected with the atmosphere



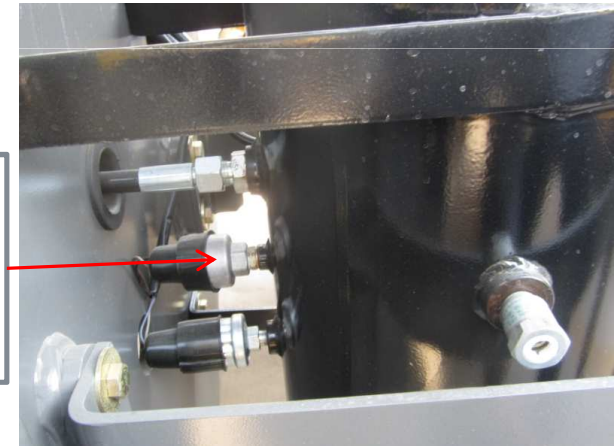
# Section IX Parking Brake System

## IV. Air pressure automatic protection

- During the operations of the loader, if the air pressure of the air reservoir is less than the specified safety pressure (0.4MPa) due to system leakage, the brake pressure switch cuts off the brake solenoid valve automatically so that the spring of the brake chamber returns to apply emergency braking, in order to guarantee operation safety.
- In event of similar situation during operations, stop the machine, check the air circuits, and resolve the malfunction before startup again



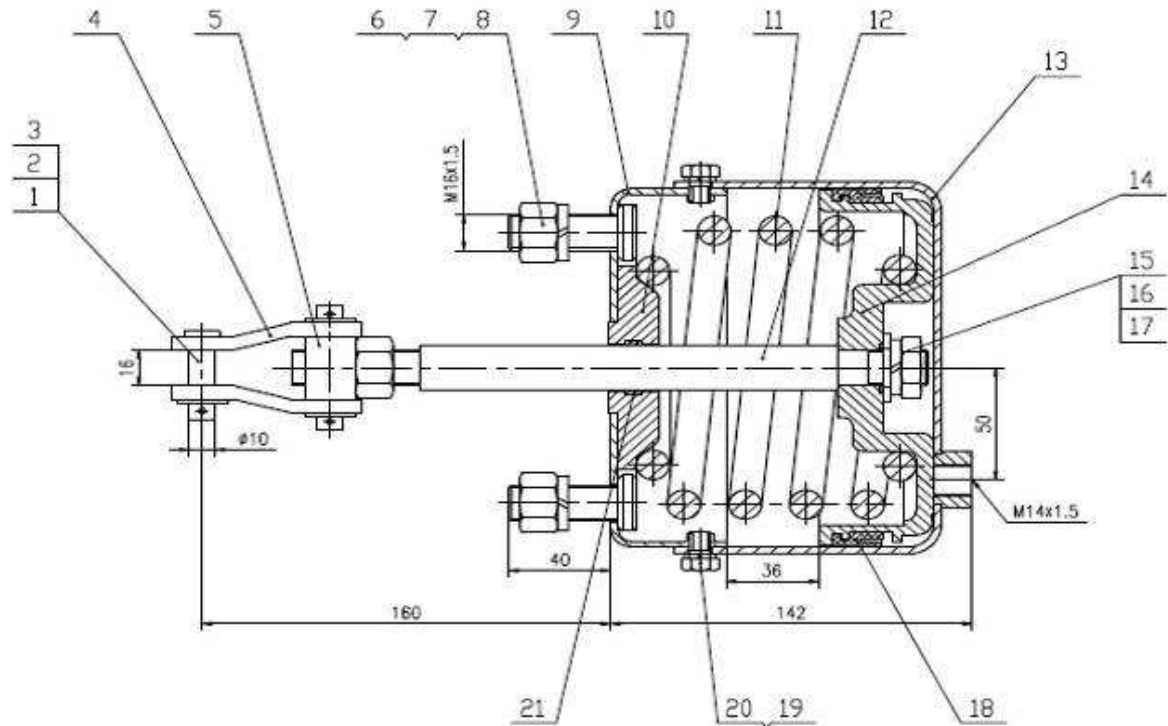
The pressure switch cuts off circuit to realize emergency braking when the air pressure is less than 0.4MPa.



# Section IX Parking Brake System

## • V. Parking Brake Chamber

- The engagement and disengagement of the emergency brake and parking brake are fulfilled by the brake chamber.
- When the air pressure overcomes the spring force of the brake chamber spring, the parking brake is released.
- When the air source is cut off or brake air pressure is less than the specified value, the air chamber spring returns to engage the brake.



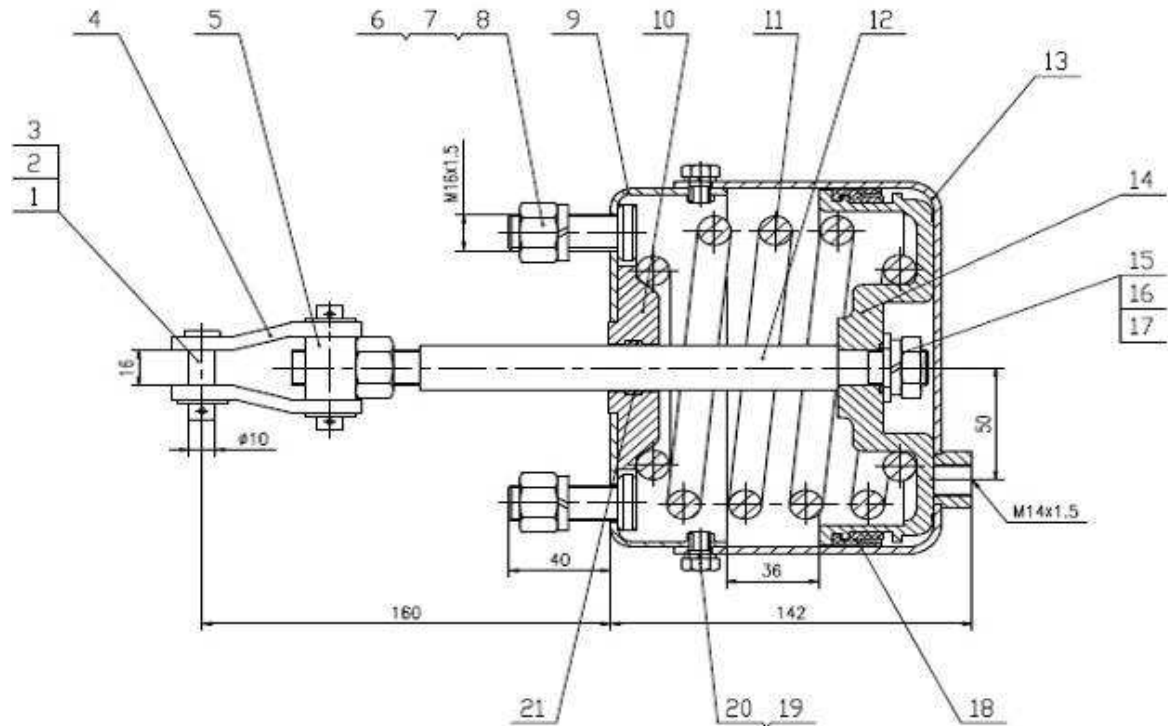
- |                        |              |            |                     |               |              |
|------------------------|--------------|------------|---------------------|---------------|--------------|
| 1. Hinge pin           | 2. Split pin | 3. Washer  | 4. Connecting plate | 5. Connector  | 6. Nut       |
| 7. Washer              | 8. Bolt      | 9. Cap     | 10. Base plate      | 11. Spring    | 12. Push rod |
| 13. Housing            | 14. Piston   | 15. Nut    | 16. Washer          | 17. Seal ring |              |
| 18. Piston rubber ring | 19. Bolt     | 20. Washer | 21. Guide ring      |               |              |

# Section IX Parking Brake System

## • V. Parking Brake Chamber

• The brake air chamber is fixed on the frame and the brake push rod is connected with the cam handle of the brake. The structure of the parking brake chamber is shown in pic.

• When the air pressure drops to 0.4MPa, the brake solenoid valve closes the valve port automatically to prevent the input of compressed air into right chamber of brake air chamber. The spring force of the spring 11 drives the piston 14 to the right end of brake air chamber and the push rod port moves rightward to drive the cam lever of brake and engage the brake.



- |                        |              |            |                     |               |              |
|------------------------|--------------|------------|---------------------|---------------|--------------|
| 1. Hinge pin           | 2. Split pin | 3. Washer  | 4. Connecting plate | 5. Connector  | 6. Nut       |
| 7. Washer              | 8. Bolt      | 9. Cap     | 10. Base plate      | 11. Spring    | 12. Push rod |
| 13. Housing            | 14. Piston   | 15. Nut    | 16. Washer          | 17. Seal ring |              |
| 18. Piston rubber ring | 19. Bolt     | 20. Washer | 21. Guide ring      |               |              |

## Section IX Parking Brake System

### • V. Parking Brake Chamber

- The compression force of the brake spring within the parking brake air chamber is really high and shall not be disassembled. In event of malfunction, replace the assembly, in order to prevent safety accidents.
- When it's necessary to tow the machine in event of causes such as machine malfunction, make sure to release the air chamber push rod and brake handle before towing, in order to prevent the damage of machine.



1.Cylinder body 2.End Cover 3.Piston  
4.Air Chamber Apron 5.Push Rod 6.Return Spring

# Section X Brake fluid

## I . Brake fluid types

- There are mainly three types of brake fluid: alcoholic, mineral oil, and synthetic. The alcoholic and mineral oil types are now used less. the synthetic brake fluid is main application brake fluid .
1. Synthetic brake fluid
    - This brake fluid uses the synthetic liquid as base solution, adding with a variety of addition agent.
  2. The noted method
    - Such as HZY3, the H, Z Y , respectively for synthetic, brake, and liquid. The number 3 as a mark of this series of standards, no specific meaning.
    - At present the LG936L loader service brake system use HZY 3 (DOT 3) synthetic brake fluid



Brake Fluid: specified designed for SDLG

# Section X Brake fluid

## II. Brake fluid application

1. Do not mix different brands of brake fluid, so as to avoid hierarchical fluid and loss of braking.
  2. The brake fluid container must be dedicated, to prevent other oil from blend or reaction to fail;
  3. The container with brake fluid must be clean, being covered closely, to prevent mechanical impurities and water from being mixed.
- If dust or debris is found on the fluid surface, do not stir before cleaning it off, using clean dedicated tools to add brake fluid.

## III. Brake fluid replacement

1. When the brake fluid is mixed with mineral oils such as gasoline, diesel; and when the vehicle travelling normally, the brake is suddenly light or heavy;
2. When the brake fluid is less. There are cloudy colour or containing much impurities, and sediment , when inspecting the fluid.



Brake Fluid: specified designed for SDLG



# Section X Brake fluid

## IV. Brake fluid replacement precautions

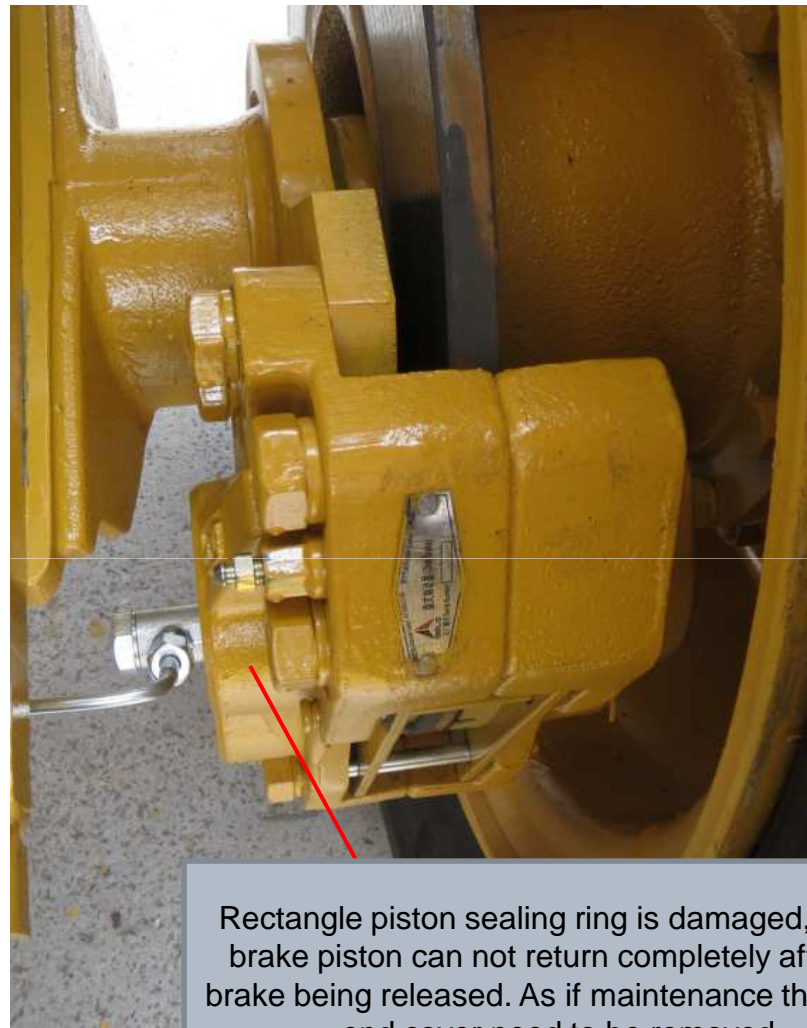
1. Must apply brake fluid of specified trademark;
2. To replace the brake fluid, the residual liquid in brake system must be cleaned clearly, and check the new brake fluid carefully.
3. As replacing the brake fluid, minimize the contact time between brake fluid and the atmosphere as possible as one can, so as to avoid brake fluid absorbing water and degrading performance.
4. Before replacing the brake fluid, it is better to clean the brake system with the alcohol thoroughly.
5. **Bleed air of the brake system**  
Air in the brake pipelines will affect brake effect, and result in brake failure. Therefore after replacing parts, clean brake system and replace brake fluid, it is necessary to bleed air of the brake system

### Bleed air as follows:

- 1, Fill the booster pump reservoir cup with brake fluid;
- 2, Unscrew the booster pump air bleed screw, waiting for the continuous liquid flow, then tighten the air bleed screw;
- 3, Start the engine, and the air pressure is rising to a specified value (0.68MPa), depress the brake pedal for several times to fill the brake pipelines and brake caliper with brake fluid. Hold the brake pedal in depressed status, release the brake caliper bleed screw to bleed the air, and quickly tighten the bleed screw. Then repeat the above steps until no bubbles out of the brake caliper until the continuous flow of brake fluid appears. Stop bleeding and tighten the bleed screw;
- 4, As bleeding air, add brake fluid to the brake fluid cup continually to prevent air re-mix;
- 5, After bleeding air, add brake fluid so that level of the reservoir cup is above 2 / 3, tighten lid of the cup.

## Section XI Brake system general failure and troubleshooting

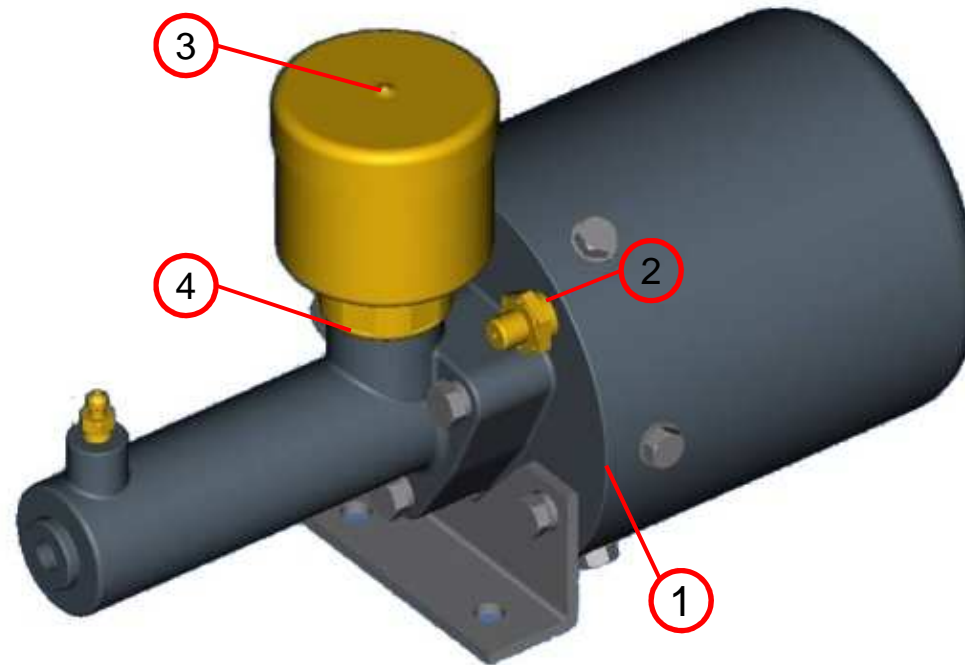
- **Symptom: The loader brake dragging**
- Brakes dragging definition: When the brake is released, there is a separation failure of the caliper. So that the caliper transfers part of the brake torque in a non-braking state.
- Possible causes:
- There is air in the brake system or in the pipelines, the air volume will decrease as being pressed, which resulting in braking hysteresis. The compressed air in brake pipelines will increase as the brake being released, thus the brake fluid can not return completely, leading to hysteresis;
- Check whether the front and rear axle both are clamped:
- Brake caliper failure; the rectangle oil seal damage. The brake caliper piston can not return smoothly, or the inner piston rust result in brake valve failure, the inner piston moving sluggish.
- The booster pump fails, booster pump air chamber piston is worn seriously, and return sluggish.



Rectangle piston sealing ring is damaged, so the brake piston can not return completely after the brake being released. As if maintenance the piston end cover need to be removed.

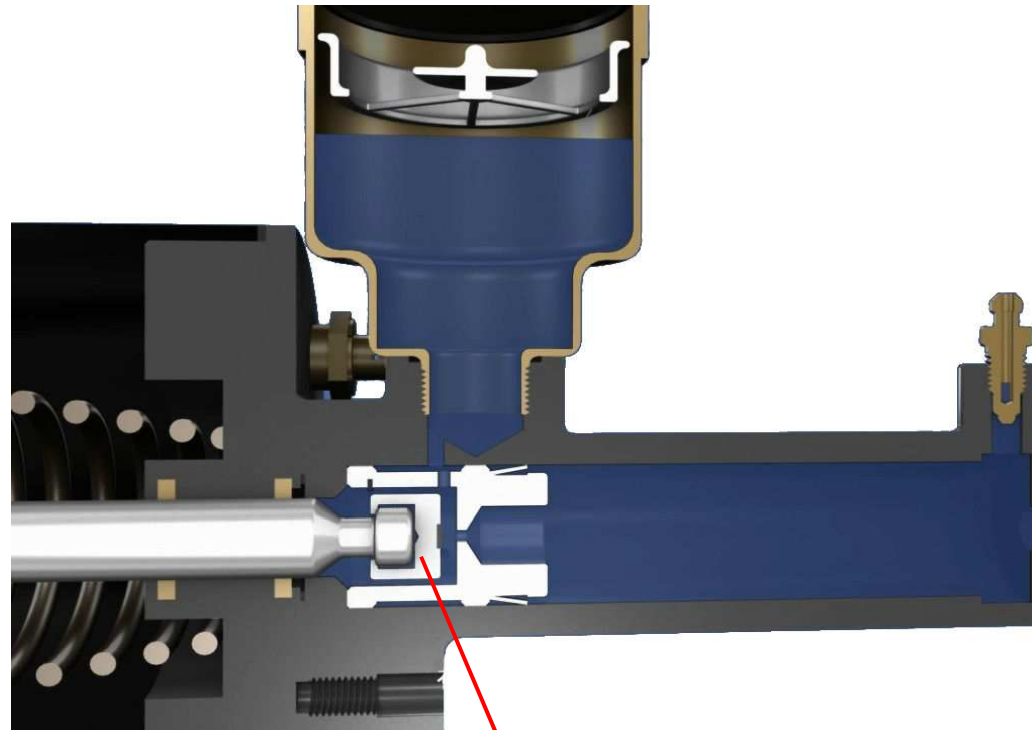
## Section XI Brake system general failure and troubleshooting

- **Symptoms: Booster pump brake fluid leaks**
- Possible causes:
- Firstly observe where the brake fluid is come from, distinguish the internal leaks and external leaks;
- Leaking from the Respirator or the 2 connection, leak out, internal leaks for push rod guide seals damaged;
- Pump body and end cap connection 1, external leaks for the sealing ring here damaged;
- Oil reservoir cup and end cap connection 4, external leaks for the sealing ring here damaged;
- Oil reservoir cup port oil spilling 3, brake pump seal damages and brake fluid in high-pressure cavity returns to the low-pressure cavity;
- The damage of push rod seat sealing support may also leading to oil spilling from the reservoir cup.



## Section XI Brake system general failure and troubleshooting

- **Symptoms: suddenly "no brake"**
- Why "no brake" suddenly as the loader travelling? How to take emergency measures?
- Possible causes:
- If the pressure of air reservoir and oil level in the cup are in normal range, a sudden "no brake" may be due to the following reasons:
- Master pump seal of the rubber collar inversion or broken in air chamber of the booster pump, the compressed air flow into the low-pressure chamber through the sealing.
- The seal cup of brake master cylinder lip suddenly turns over or worn, brake fluid in high-pressure cavity flow into the low-pressure cavity;
- The air brake valve piston assembly is stuck suddenly, that it can not effectively push the inlet spool to move downwards to open the air inlet port;
- In the case of an emergency, when suddenly no brake, you can immediately put the bucket on ground, and apply pressure downwards or reverse brake.



Push rod brake master pump seal cup broken, will result in high and low pressure cavity oil leaking, lead to brake oil pressure is decreased, and produce a sudden "no brake"

## Section XI Brake system general failure and troubleshooting

- **Symptom: the loader running off tracking as braking**
- Possible causes:
- The direct reason of running off tracking is that the torque of left and right wheel brake is not equal.
- Brake caliper on one side of the wheel "Locked ", it is difficult to disengage. That's because the rectangular sealing ring function to return in caliper is damaged.
- Depress the foot brake pedal, the brake caliper on one side brakes, the other one can not produce a equal brake torque due to internal leakage. The oil pipelines obstruction or brake caliper piston corrosion, and the brake fluid does not enter the caliper, which lead to running off tracking



# Chapter VII Structural Parts and Covering Parts System

## Section I Frame System

- Overview
- Rear and front frames
- Subframe
- Ballast

## Section II Covering Parts System

- Cab overview
- Engine hood
- Left and right stands

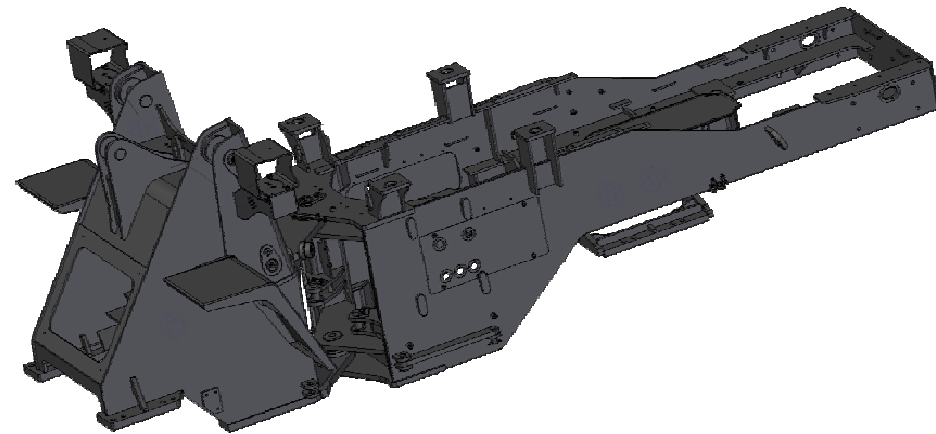
## Section III Working Device

- Brief of working device
- Boom
- Rocker
- Connecting rod
- Attachments

# Section I Frame System

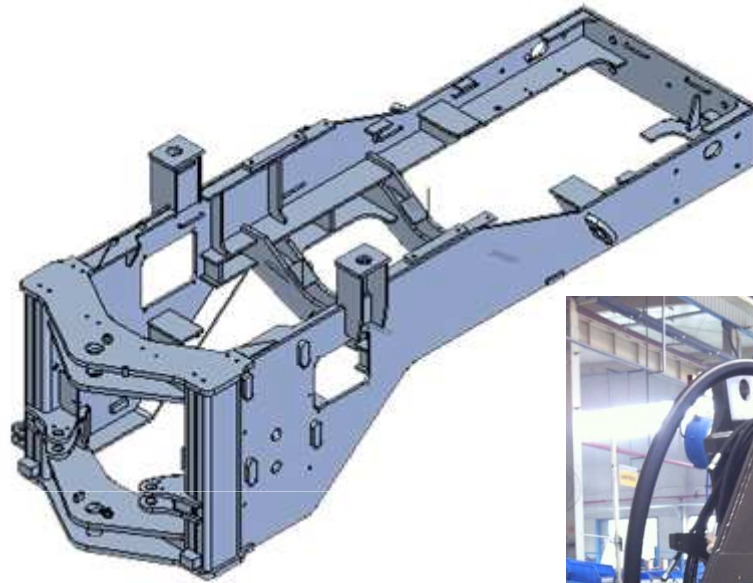
## OVERVIEW OF FRAME SYSTEM

- The frame is composed of front frame and rear frame. The articulation pin is used to connect the front and rear frames. By means of the telescoping action of the steering cylinder, a relative rotation around the articulation pin is achieved between the front and rear frames to realize steering.



# Section I Frame System

The front frame adopts 4-plate box type structure ,The rear frame adopts single plate .They have hing carrying capacity and long working life.





# Section I Frame System

- **Subframe**

- The rear frame is fitted with subframe or swing axle bracket so that the rear axle can swing vertically around the rear frame within a certain range (generally  $10^{\circ}\sim 15^{\circ}$ ).

# Section I Frame System

- **Ballast**

- The ballast is used to balance the front and rear weights of the whole vehicle to ensure the safety of the machine during the working.



## Section II Covering Parts System

- Cab
- The cab features reasonable structure, high safety and durability, spaciousness and brightness, beautiful upholstery, reasonable layout, and comfortable driving and riding, with standard A/C system and pilot control.



## Section II Covering Parts System

- **Engine hood**
- The large opening design is adopted for the engine hood on both sides and for the rear window lattice, in order to ease the maintenance and repair.



# Section II Covering Parts System

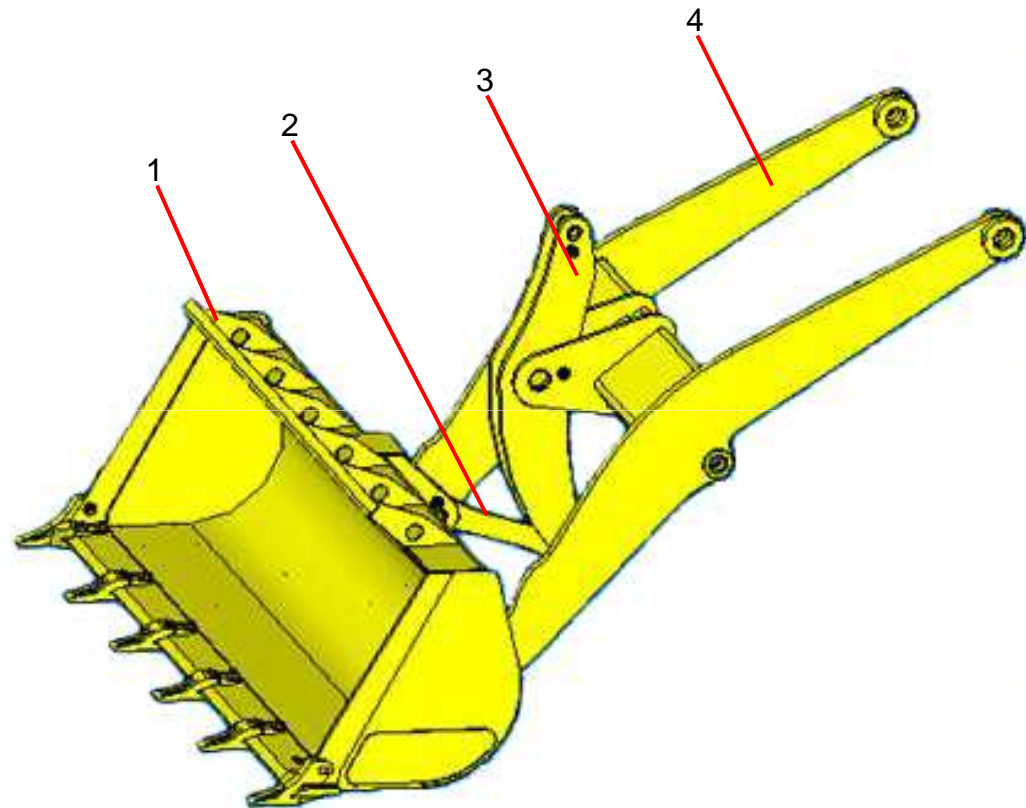
Left and right stands assembly



## Section III Working Device

### Brief of working device

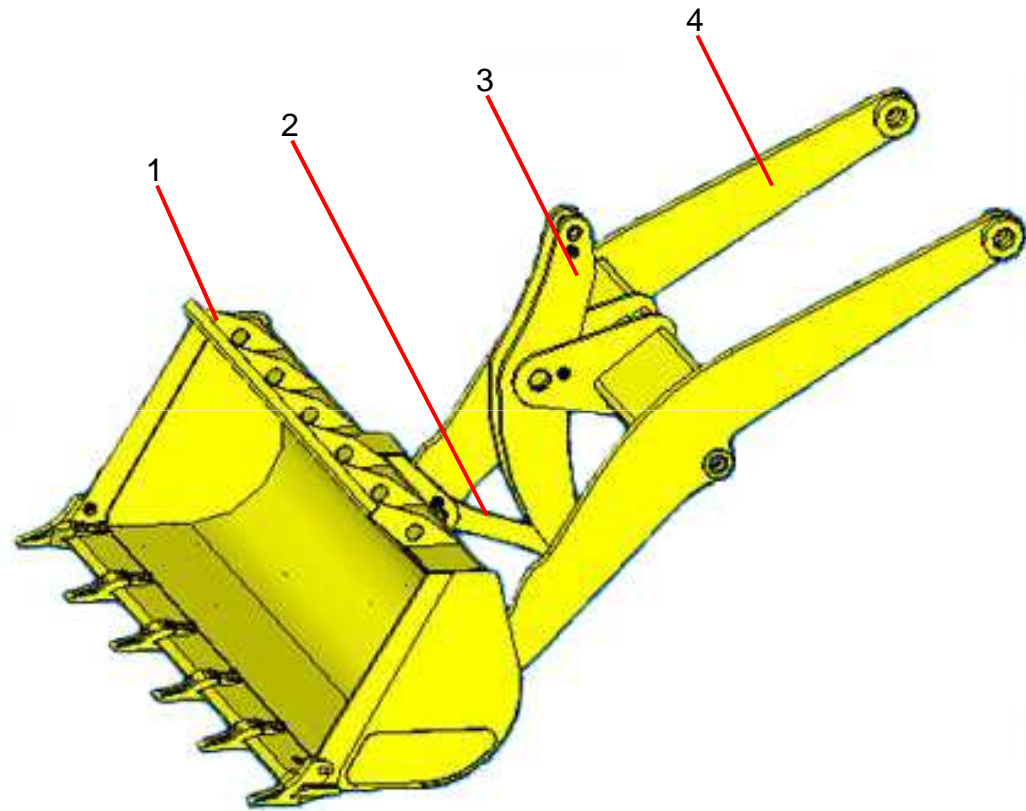
- The working device of our wheel loader adopts reverse link mechanism.
- Main structure:
  - 1-Bucket
  - 2-Connecting Rod
  - 3-Rocker
  - 4-Boom
- The main performance characteristics include:
  - 1. During the excavating operations of the loader, the retraction force of the bucket is provided by the rear chamber (rodless chamber) of the bucket cylinder so that it can generate high breakout force and improve the working performance of loader.



## Section III Working Device

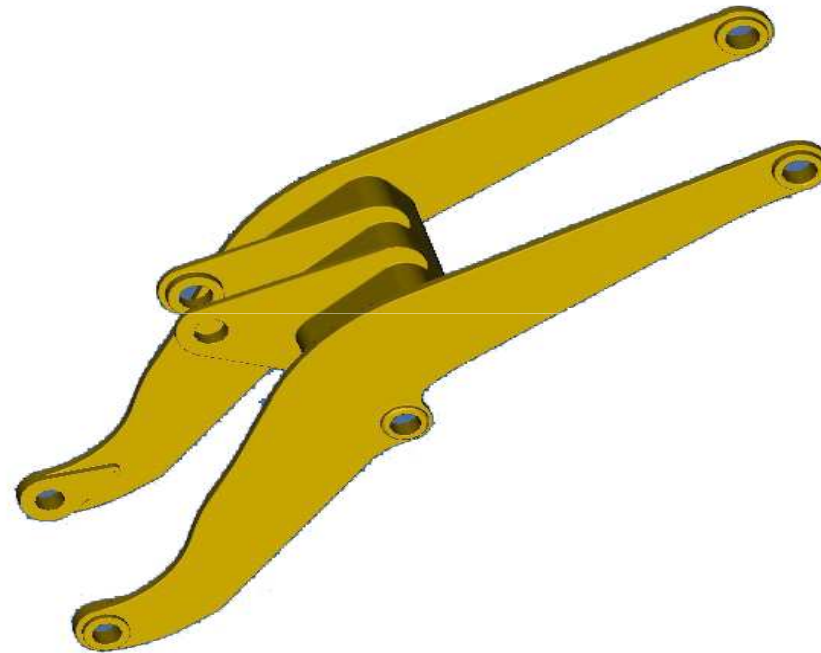
### ● Brief of working device

- 2. During the lifting and lowering of the boom, the bucket retraction angle changes rarely so that the bucket retraction angle of the boom at the lower portion is increased without increasing the bucket retraction angle of boom at the highest position, which can improve the loading extent of the bucket during the excavating operations of the loader and reduce the material spillage during the transport of the material.
- 3. Low bucket angle during the unloading can help control the unloading speed and relieve the unloading impact.
- 4. When the bucket is lowered onto the ground from the top unloading position, the bucket can automatically return to the excavating position under the action of own link mechanism, without operating the bucket cylinder, which simplifies the operations and improves the efficiency.



## Section III Working Device

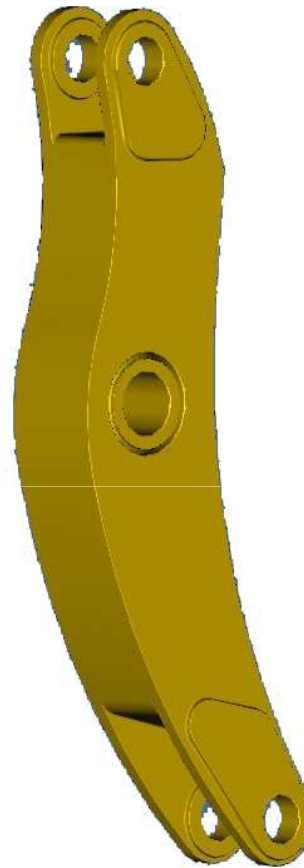
- **Standard boom**
  - Technical Parameter  
Boom length: 2.51m
- **Lengthened boom**
  - Technical Parameter  
Boom length: 2.8m





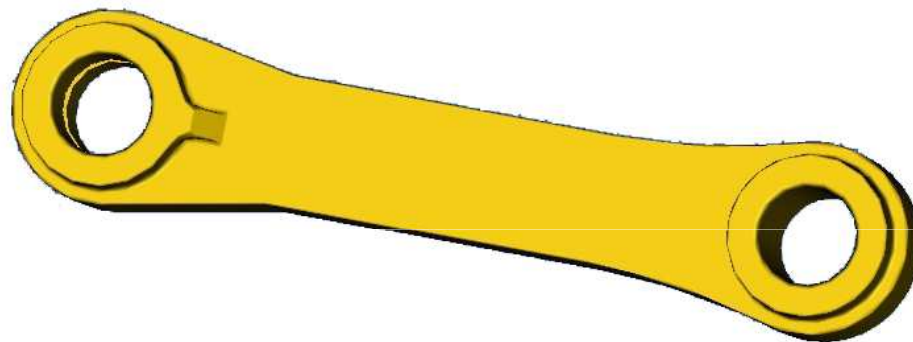
# Section III Working Device

● Rocker



## Section III Working Device

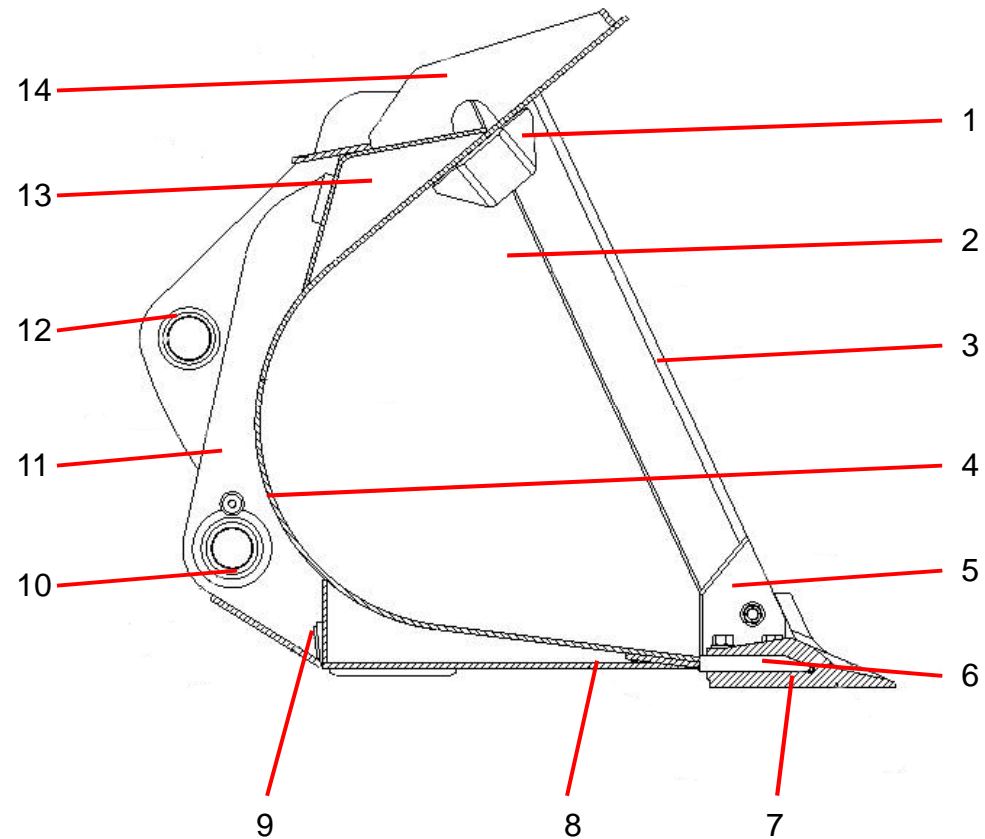
- Connecting rod



## Section III Working Device

### ● Bucket

- 1: Reinforcement plate
- 2: Side plate
- 3: Side cutting plate
- 4: Bucket wall
- 5: Auxiliary cutting plate
- 6: Main cutting plate
- 7: Bucket teeth
- 8: Reinforcement underplate
- 9: Lower limit block
- 10: Lower hinge base
- 11: Support plate
- 12: Upper hinge base
- 13: Reinforcement angle block
- 14: Lifting eye



## Section III Working Device

- **Standard bucket**
- Capacity: 1.8/1.6m<sup>3</sup>
- Applicable working condition:  
Earth-moving
- Ordering number:  
E3613115A36  
E3613115A39  
E3613115A3901  
E3616115A39



## Section III Working Device

- **Enlarged bucket**

- Capacity: 2.2/2.5m<sup>3</sup>

- Applicable working conditions:  
Earth-moving

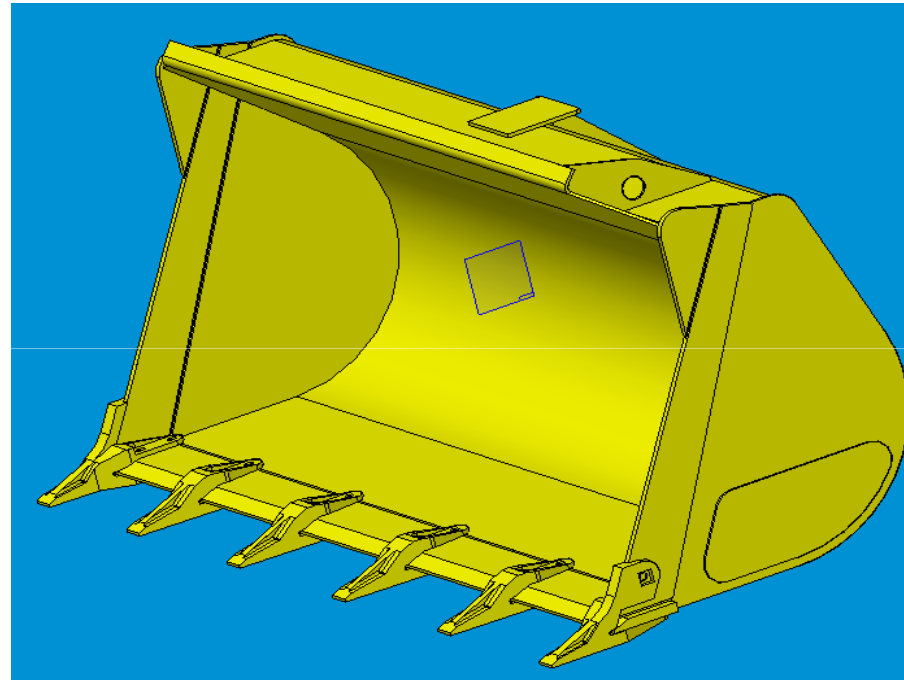
- Ordering number:

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## Section III Working Device

- **Multi-functional bucket**

- **Functional brief**

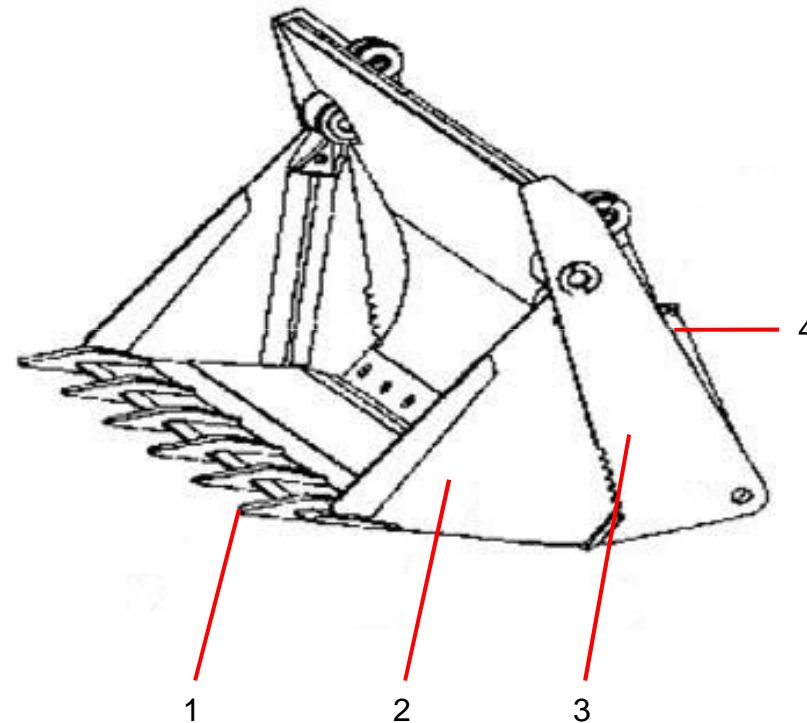
The bucket gate is connected with the bucket body via articulation hinge. One end of the hydraulic cylinder is connected with the bucket gate via articulation hinge and another end is connected with the bucket body via articulation hinge. Through the telescoping of hydraulic cylinder, the relative rotation of bucket gate around the bucket body is realized. In combination with the actions of the boom cylinder and bucket cylinder, the multiple functions (such as excavating, bulldozing, scraping, clamping, and high unloading) are realized.

1: Bucket teeth

2: Bucket gate

3: Bucket body

4: Cylinder



## Section III Working Device

- **Multi-functional bucket**

- Bucket capacity: 1.8m<sup>3</sup>

- Bucket width: 2,510mm

- Applications

1. Function as conventional bucket.

2. Clamp a small amount of rod material.

3. Simple bulldozing and excavating.

4. Function for high unloading.  
Unloading height: 3,027mm.

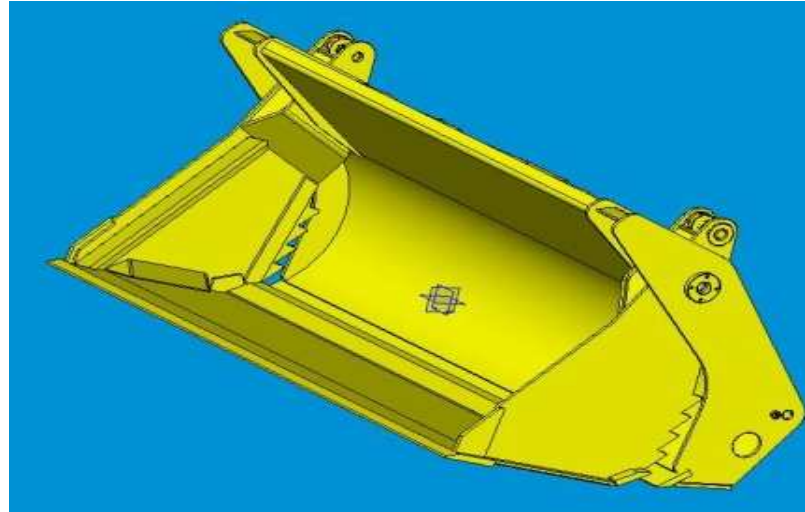
- Ordering number:

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E3613115A39

E3613115A3901

E3616115A39



## Section III Working Device

- **Rock bucket**

- Capacity: 1.5m<sup>3</sup>

- Applicable working conditions:

Rock

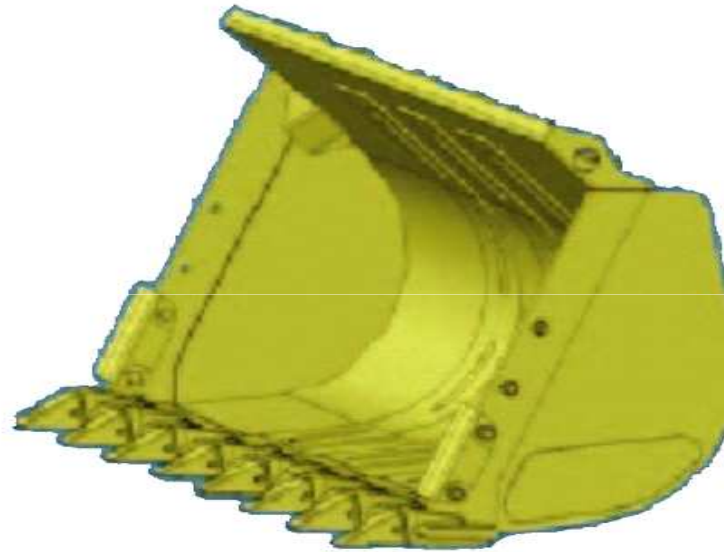
- Ordering number:

E3613115A36

E3613115A39

E3613115A3901

E3616115A39





## Section III Working Device

- **Side dumping bucket**

- Capacity: 1.4m<sup>3</sup>

- Applicable working conditions:

  - Earth-moving

- Ordering number:

  - E3613115A36

  - E3613115A39

  - E3613115A3901

  - E3616115A39



## Section III Working Device

- **Flat fork**

- **Functional brief**

The flat fork is an attachment of fork functionality, which is interchangeable with the front unloading bucket of the loader.

- **Description**

Effective length of fork: 1,000mm.

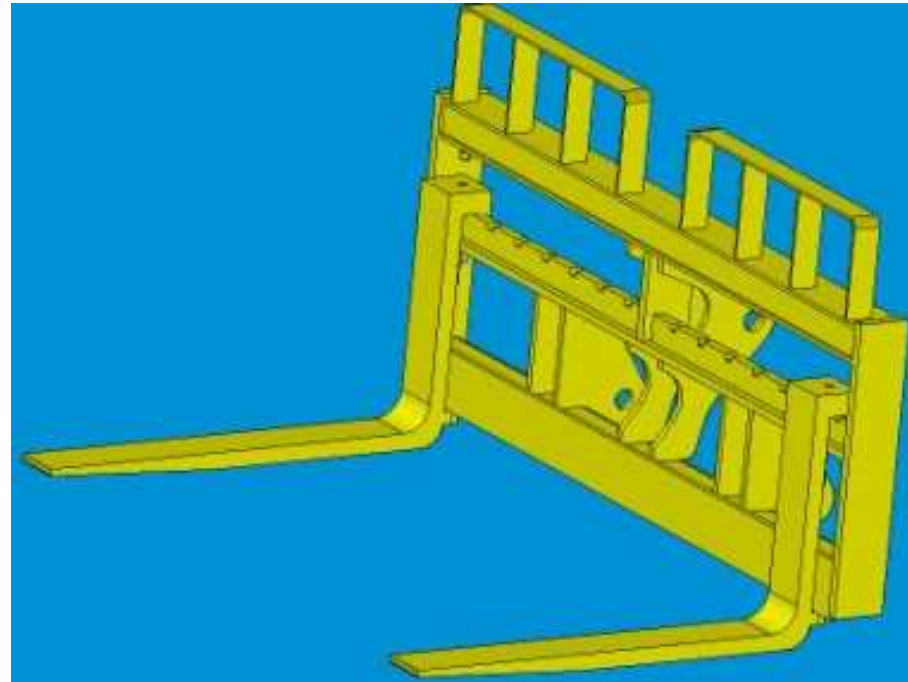
Adjustable width between two forks.

- **Applicable working conditions**

It's mainly applicable for the handling, transport, and stacking of containers and cubic materials in the construction sites such as freight yards, docks, and ports.

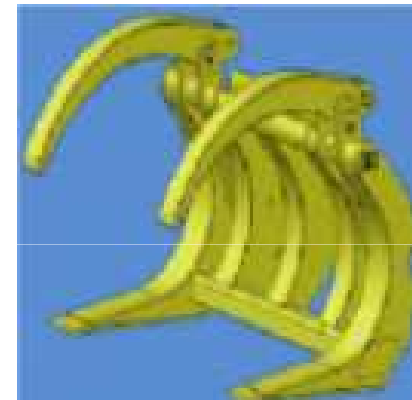
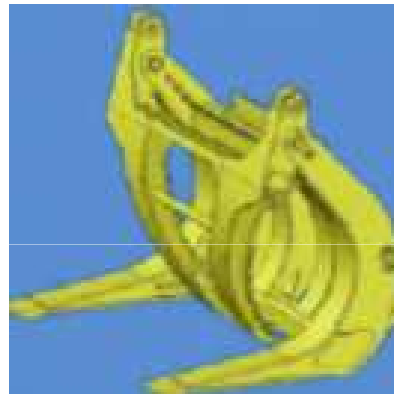
- **Ordering number: E1805215A39 (optional)**

E1805215A36 (optional)



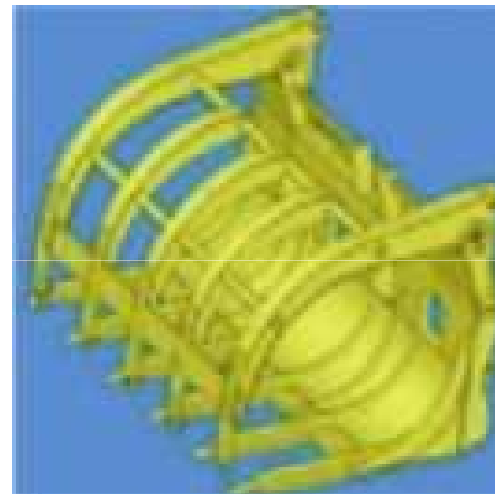
## Section III Working Device

- **Log grapple(one tooth or two tooth above)**
- Rated load: 2.5t
- Applicabl working conditions:  
Round log
- Ordering number:  
E3613115A36  
E3613115A39  
E3613115A3901  
E3616115A39



## Section III Working Device

- **Grass grapple**
- Rated load: 3.0t
- Applicabl working conditions:  
Grass
- Ordering number:  
E3613115A36  
E3613115A39  
E3613115A3901  
E3616115A39



## Section III Working Device

- **Light/snow ploughing**

- **Applicable working conditions:**

Snow

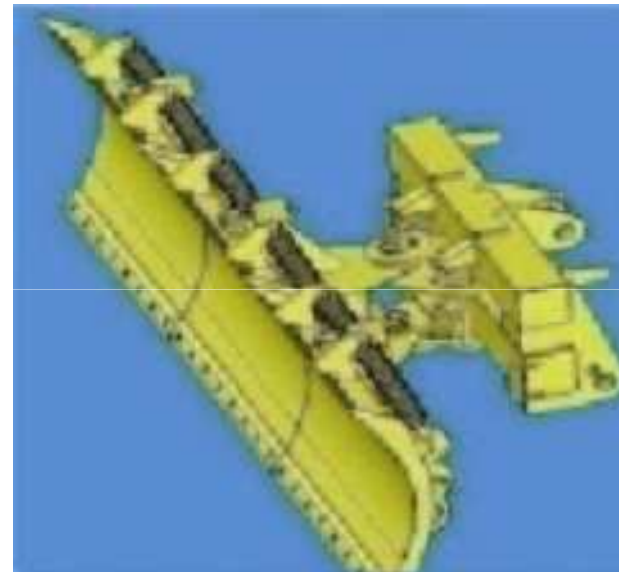
- **Ordering number:**

E3613115A36

E3613115A39

E3613115A3901

E3616115A39



## Section III Working Device

### Quick change device

- The quick change refers to the mechanism in which, provided that the main structural parts of the working device of the loader are basically unchanged, the original connection between the original bucket and boom is changed from two individual hinges to the two hinges connected by two piston rod ends of the quick change cylinder. This change of hinges is realized by the telescoping of quick change hydraulic cylinder piston from the original manual operations, in order to reduce the change time and improve the working efficiency.

- Ordering number:

E3613115AK6

E3613115AK9

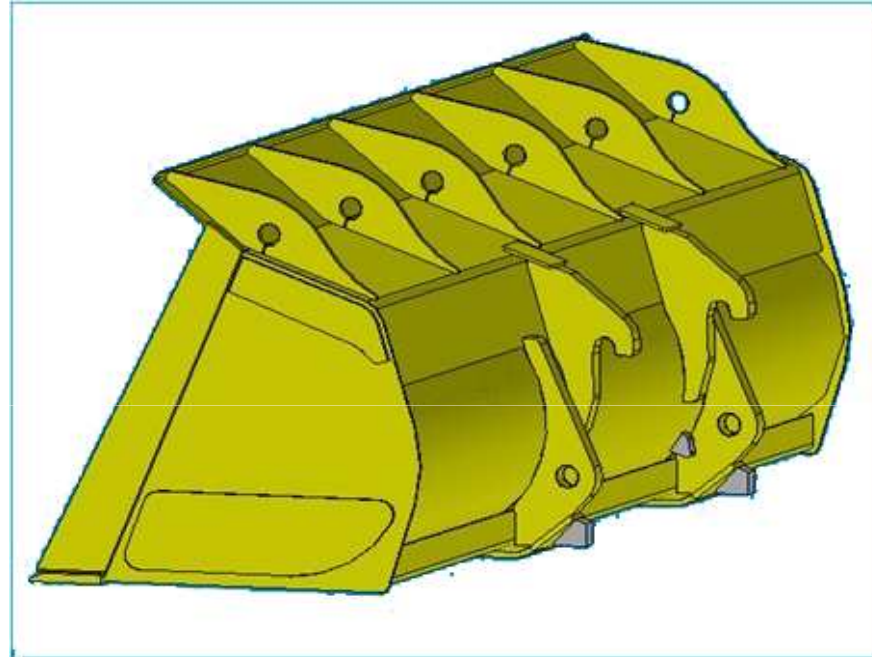
E3616115AK6



## Section III Working Device

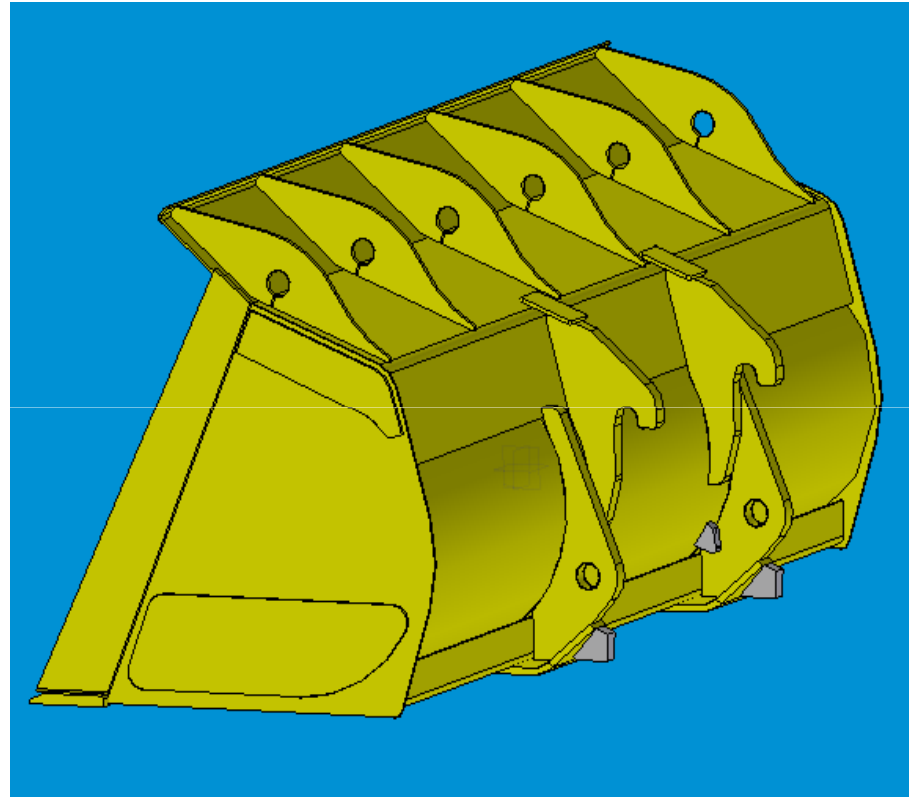
### Quick change standard bucket

- Bucket capacity: 1.8/1.6m<sup>3</sup>
- Applicabl working conditions:  
Earth-moving
- Ordering number:  
  
E3613115AK6  
  
E3613115AK9  
  
E3616115AK6



## Section III Working Device

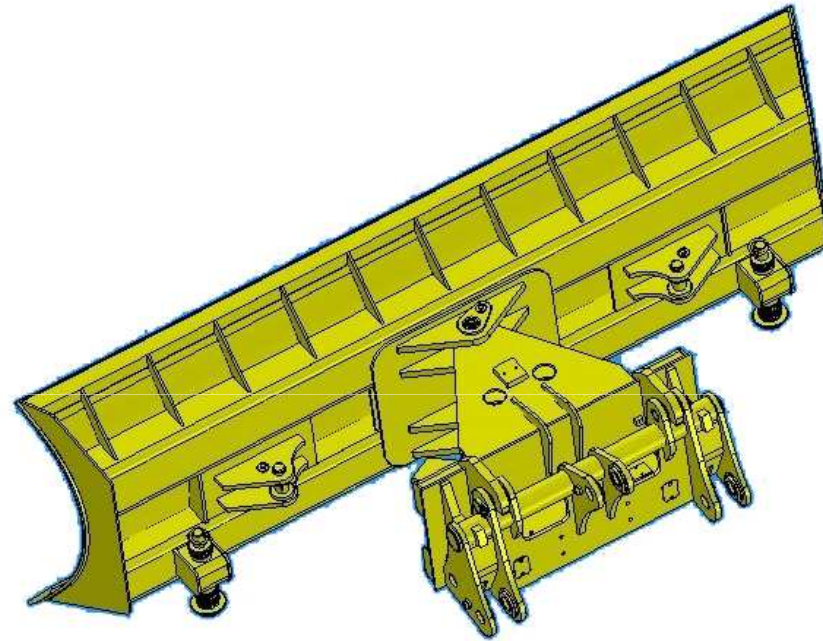
- **Quick change Log grapple**
- Specification: 1814mm width, 1619mm length.
- Applicable working conditions:
- Round log
- Ordering number:  
E3613115AK6  
E3613115AK9  
E3616115AK6





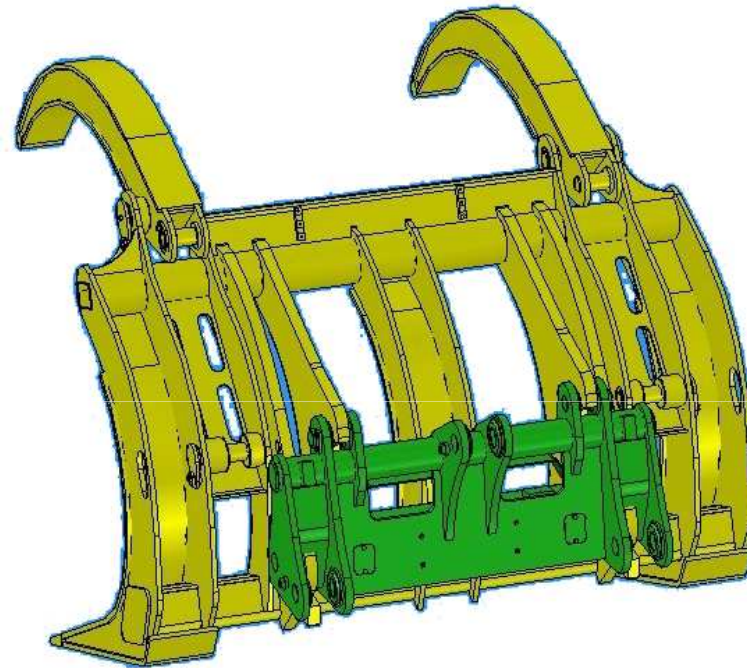
## Section III Working Device

- **Quick change light/snow ploughing**
- **Applicable working conditions:**  
Snow
- **Ordering number:**  
E3613115AK6  
E3613115AK9  
E3616115AK6



## Section III Working Device

- **Quick chang light/snow ploughing**
- **Applicabl working conditions:**  
Snow
- **Ordering number:**  
E3613115AK6  
E3613115AK9  
E3616115AK6



## Section III Working Device

- **Multi-functional bucket**

- Bucket capacity: 1.8m<sup>3</sup>

- Bucket width: 2,510mm

- Applications

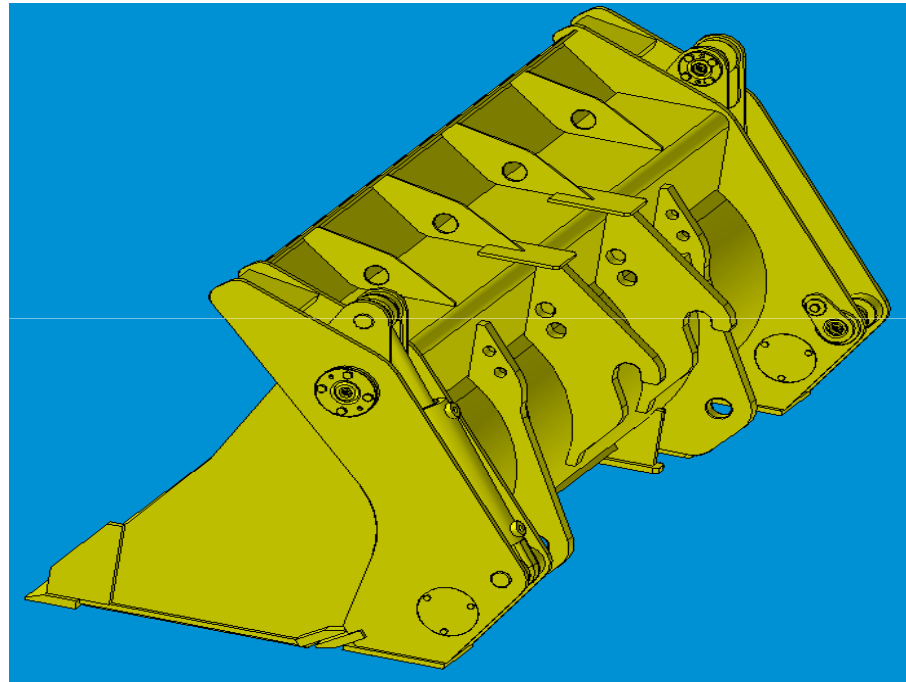
1. Function as conventional bucket.
2. Clamp a small amount of rod material.
3. Simple bulldozing and excavating.
4. Function for high unloading.  
Unloading height: 3,027mm.

- Ordering number:

E3613115AK6

E3613115AK9

E3616115AK6



# Vision & Mission

## Our Vision

To become the No.1 Chinese construction equipment brand for reliability, customer satisfaction and Brand image in the construction machinery industry.

## Our Mission

To provide highly reliable products and services in order to maximize our value in the eyes of the customer.

## Brand Promotion Slogan

Reliability in Action

