

Operator's Manual for HOWO Series Truck



SINOTRUK IMPORT & EXPORT CO., LTD.

October, 2011

Dear customers:

Many thanks for choosing HOWO trucks! Please read this manual carefully before the new vehicles run into operation. And hope you could enjoy your driving experience.

This manual is about operation and maintenance of HOWO series heavy duty trucks. It contains the technical information of HOWO trucks such as operation/performance and structure/maintenance/adjustment and so on. You can find the related assembly information and attentions according to the specific configuration of your vehicles.

To ensure the normal life of vehicles and obtain the good economic benefit, all the instructions of the operation and maintenance requirements mentioned in this manual need strictly to be followed.

Pure fuel in accordance with the quality requirement is required to be used during the vehicle's running. All chosen oil, lubricating oil, hydraulic oil etc. for vehicles shall be consistent with the grades provided by this manual.

When the vehicles break down, please contact the authorized service station by SINOTRUK immediately, and we will supply the timely and effective services to you.

This manual is the latest edition for vehicle's operation and maintenance and we reserve the rights of technical alteration and upgrades for better improvement without prior notice.

SINOTRUK IMPORT & EXPORT CO., LTD

Vehicle No.

In order to maintain your vehicle conveniently, please fill the Vehicle No. accurately and completely:

Vehicle Model: _____

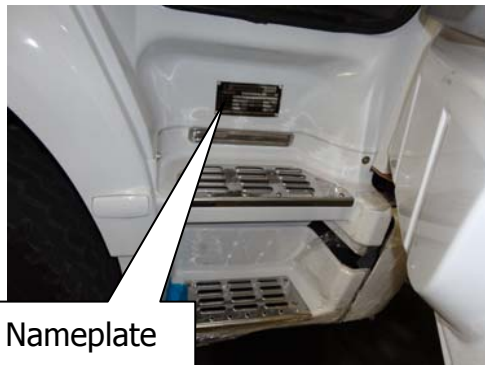
VIN: _____

Engine Code: _____

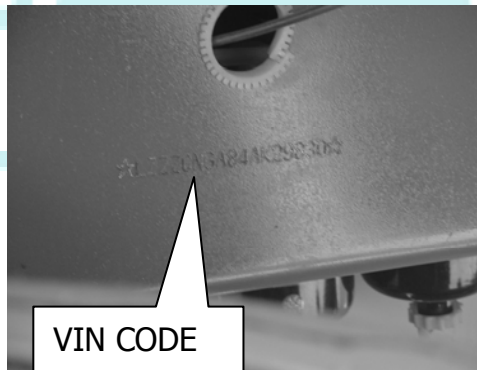
Purchasing Date: _____

ATTENTION:

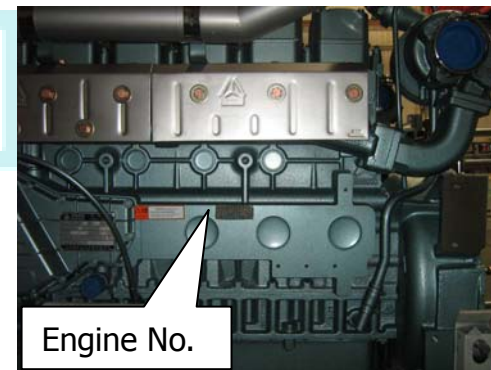
1. Nameplate marked with vehicle model is on the first footplate on the co-driver's side (Open the door.)
2. VIN code is punched on the ventral shield of right longeron of frame and stands at the centerline of front-axle.
3. Engine No. is punched on the left block of the engine (Check it along the direction of driving).



Nameplate



VIN CODE



Engine No.

ATTENTIONS:

1. When driving downhill, do not sliding out of gear, use the main brake, in the meantime use the exhaust brake as much as possible to assist deceleration, also open EVB (exhaust valve brake) to assist deceleration when heavy loaded.
2. Turn off the engine, main power switch and use the parking brake service in order to avoid accident, when parking the vehicle for a long time.
3. Unauthorized modification and installation of various devices is prohibited, especially for electronics, brakes, steering and other systems related to the safety of the vehicle, or it may affect the service and safety performance of vehicle and result in accident, fire or damage to vehicle, and our company will not be responsible for the consequences. Disassembling or replacing the ECU of engine is strictly prohibited, or the vehicle may break down.
4. The radiator mask must be opened before tilting the cab.
5. When there is welding work in or near the vehicle, it is necessary to cut the battery power and unplug all electronic components (CBCU, instrument panel, and ECU of engine, ABS etc.) connectors.
6. It is forbidden to flush engine, because this can lead to short circuit of electric system and damage of ECU.
7. Keep a good driving habit. Avoid continual or sudden stepping on the gas, otherwise it will affect service life and fuel economy of vehicle.
8. Regular inspection and maintenance is important to the vehicle. We supply maintenance of different periods for our company's vehicle, and it's free for the first-time maintenance. Maintenance above mentioned is very essential for the safe use of your vehicle and to keep the vehicle in good condition. If the specified maintenance in this manual is not executed, our company will not assume warranty obligations.

9. *Do It Yourself* of this manual is to introduce the user which they can do, please use the parts CNHTC provided (Short for: original parts) and go to dealers authorized by CNHTC to buy original parts. CNHTC will not be responsible for any direct or indirect losses caused by the use of unoriginal parts.

Before starting to read this manual, please pay attention to the following symbols:



Specification:

Content with this symbol is additional information.



Notice:

This symbol is for instructing the important information how to operate the vehicle correctly or which may damage the vehicle.



Warning:

This symbol is for instructing the risks of accident or injury that may happen.

Content

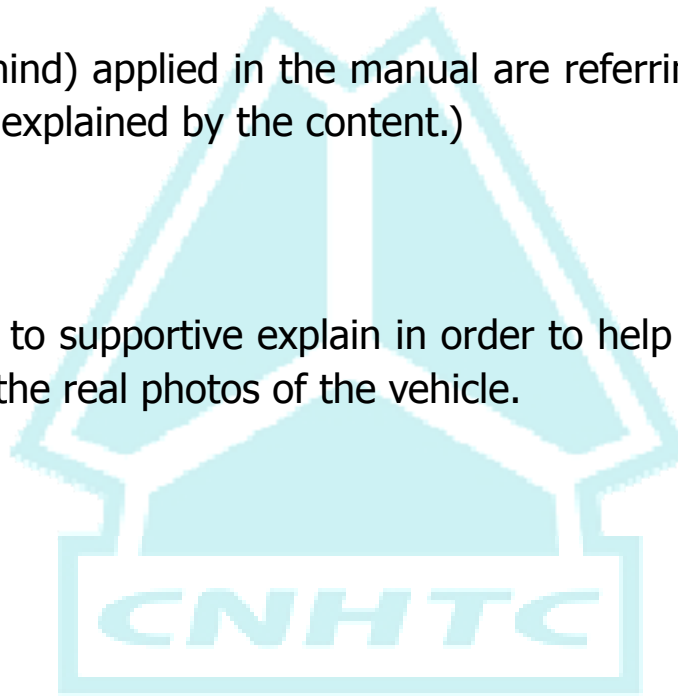
It will show you the content of this manual with the list of all the titles on the next page.

Directions Explanation

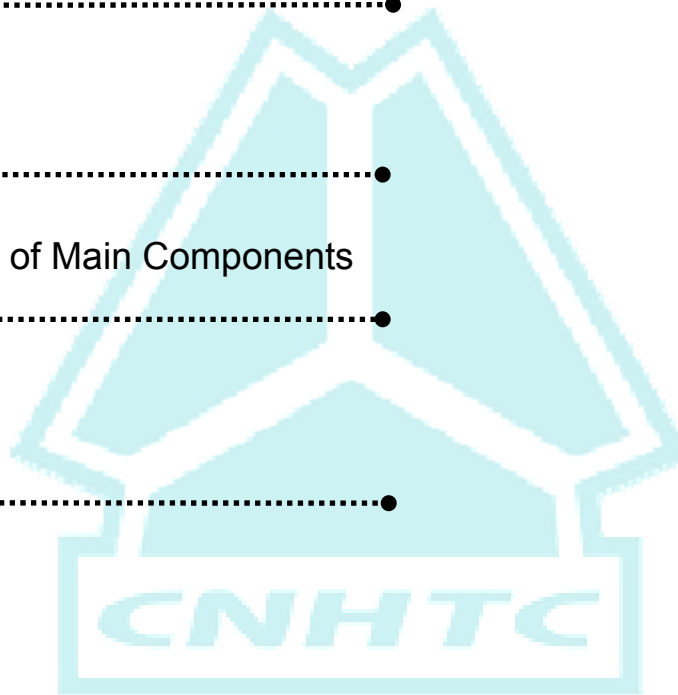
All the directions (left/right/front/behind) applied in the manual are referring to the forwarding direction of the vehicle. (Exception: Other directions explained by the content.)

Pictures Explanation

The pictures in the manual are used to supportive explain in order to help the customers to understand. Some pictures are only for illustration, not the real photos of the vehicle.



-  1 Familiar with Vehicle and Operation
-  2 Vehicle Maintenance
-  3 Operation and Maintenance of Main Components
-  4 Do it by yourself



Section 1

Familiar with Vehicle and Operation



Overview



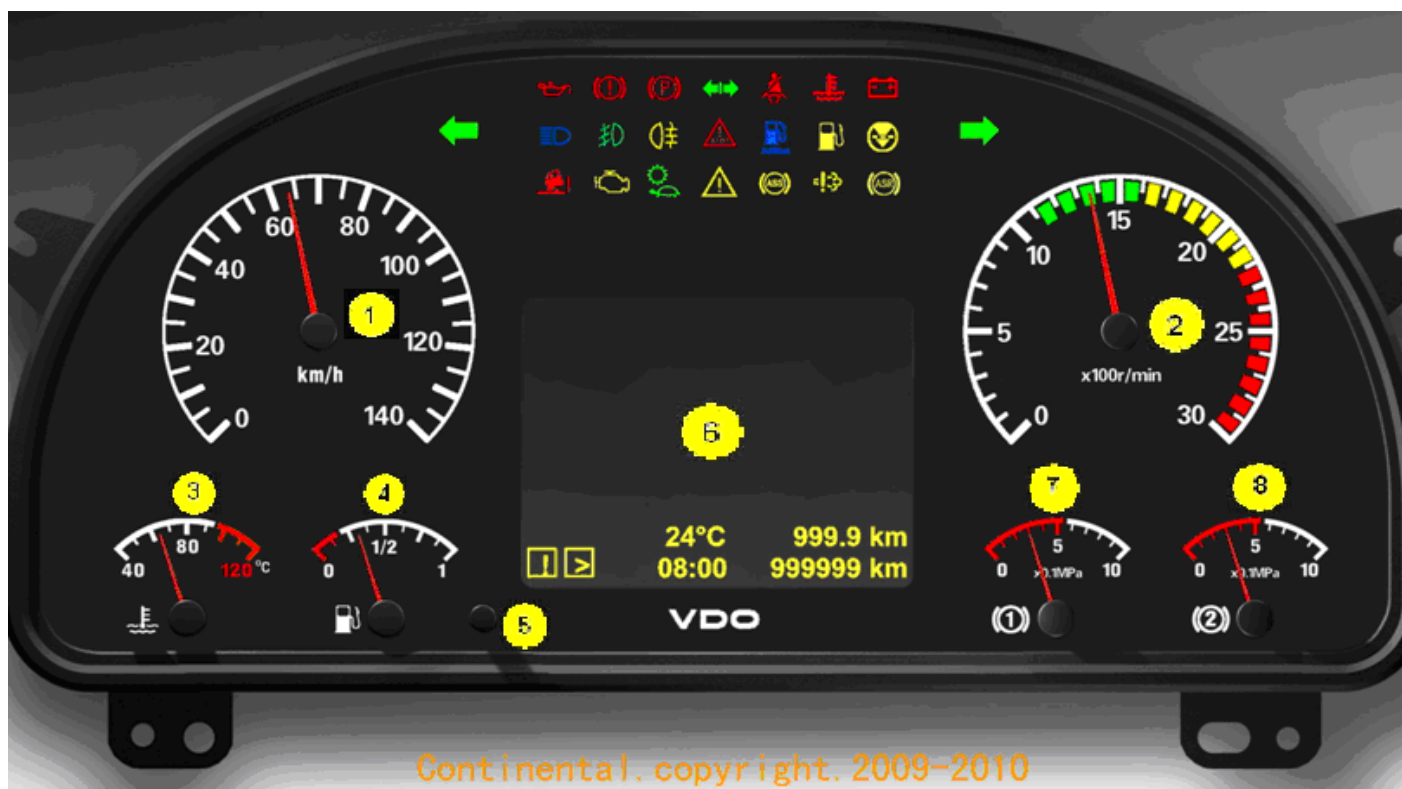
Overview

The general overview helps you to know instrument panels and control equipments.

Item	Description	Item	Description
1	Warm air outlet	8	Transmission shift handle
2	Horn button	9	Rocker switch control panel
3	Steering wheel	10	Ashtray
4	Combination instrument (CMIC)	11	Air conditioner control panel and LCD
5	Cruise control switch(only for Euro3 optional)	12	Cigar lighter
6	Handle of hand brake valve	13	Cup seat
7	Handle of trailer hand brake valve		



Combination Instrument (CMIC)



Item	Description	Page No.	Item	Description	Page No.
1	Speedometer	4	5	Trip distance/Trip fuel consumption reset button	5
2	Engine tachometer	4	6	LCD	5
3	Engine coolant temperature gauge	4	7	Air pressure gauge of brake circuit 1	34
4	Fuel level gauge	5	8	Air pressure gauge of brake circuit 2	34

Combination Instrument(CMIC)

Combination Instrument Function Instruction

1. Speedometer

The speedometer displays vehicle's running speed.

The speed will be zero if error occurs in the communication between tachograph and CBCU, meanwhile the error indicating message will be displayed on the combination instrument screen.

The vehicle's total mileage and phase mileage information will be displayed on the lower right corner of screen.

2. Engine Tachometer

The engine tachometer displays engine rotating speed.

The needle will stay at the position which is +5° exceeding maximum when engine rotating speed is over scale range.

3. Engine Water Temperature Gauge

It displays the temperature of engine cooling water.

The alarm indicator of engine cooling water temperature will light up when temperature is over 95℃, meanwhile the serious alarm indicator flashes and buzzer gives an alarm.



Notice:

In this case, stop and check the vehicle at once, otherwise it will cause loss of life and property!

4. Fuel Gauge

The fuel gauge displays fuel quantity in the fuel tank.

The fuel alarm indicator will light up when the fuel quantity is less than 1/8 of total fuel capacity in the fuel tank.

Combination Instrument(CMIC)

5. Trip Mileage/Trip Mileage Fuel Consumption Reset Button

When vehicle is parking, press the button continuously more than 2 seconds, which is used to reset trip mileage/trip mileage fuel consumption.

6. LCD

It displays many kinds of information, such as accumulative total mileage, trip mileage, time and so on. All the information is dispatched from CBCU to CMIC(combination instrument) through data bus and displayed on LCD.

According to display sequence and detail functions on LCD, the displayed contents of each page is introduced as follows:

6.1 Logo

The logo "CNHTC" will be displayed within 1.5 second after key switch turns on. Please refer to picture 6.1.

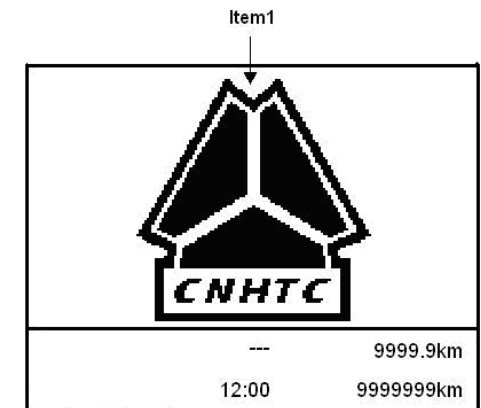
6.2. Normal Driving Information

Display vehicle information under normal driving, refer to picture 6.2

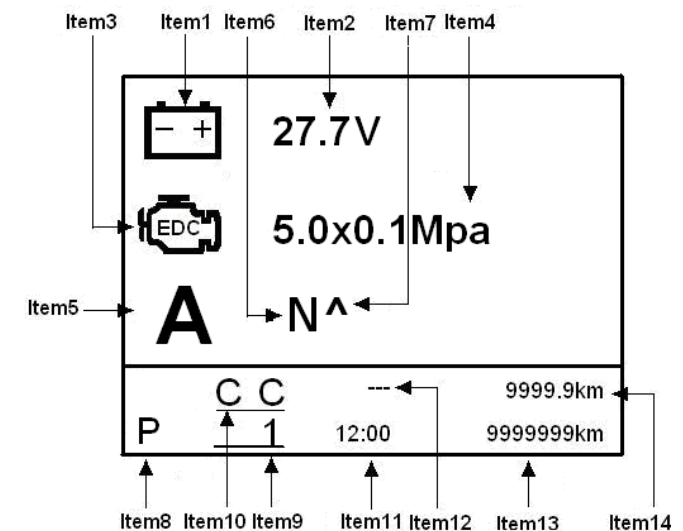
The contents are displayed as follows:

◆ Electric Source Voltage (Item 1, Item 2 in Picture 6.2)

Display electric source voltage in the form of figure on LCD, range: 0–32 V.



Pic. 6.1



Pic. 6.2

Combination Instrument(CMIC)

◆ Oil Pressure of Engine (Item 3, item 4 in Picture 6.2)

Display oil pressure in the form of figure on LCD as well.

◆ Transmission Gears Information (Item 5 and item 6 in Picture 6.2)

When vehicle is installed with manual transmission, it shows N, R and blank on the Item 6 position which means neutral, reverse gear and forward gear.

◆ Cruise Working Indicator (only for Euro3 vehicle, Item 10 in Picture 6.2)

When vehicle is driven in cruise mode, it displays "CC".

◆ Time (Item 11 in Picture 6.2)

Time displaying: The time will show tachograph's time if system connects with tachograph of VDO which connects chassis CPU through CAN bus.

If tachograph of VDO is not equipped, the displayed time should be set by customer after system electrifying.

◆ Accumulative Total Mileage of Vehicle (Item 13 in Pic. 6.2)

Display range: 0~99999999km.

Combination Instrument (CMIC)

◆ Trip Mileage (Item 14 in Picture 6.2)

Display range: 0~9999.9km.

If accumulative mileage exceeds displaying range or press trip mileage/trip mileage fuel consumption reset button for 2 seconds, trip mileage and trip mileage fuel consumption will be reset.



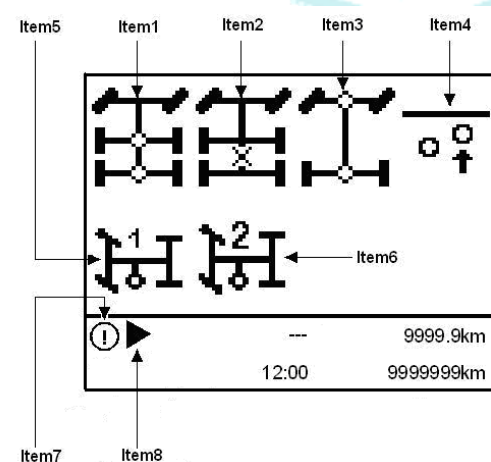
Notice:

It is prohibited to disconnect battery with chassis CPU directly without turning off the key, otherwise the data of trip mileage will be lost.

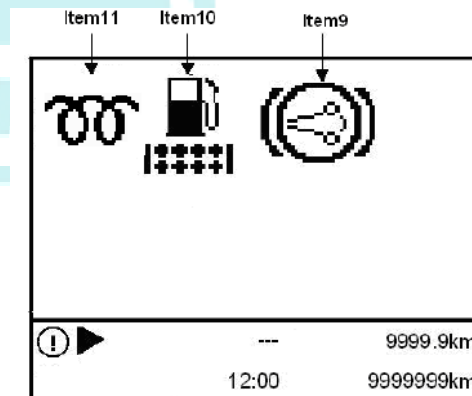
6.3. Displaying Page of Working Information

It is used for displaying some working information of vehicle, such as working indication of differential lock, all-wheel driving, lifting axle, PTO and EVB, ect.

There are nine indication symbols displayed on the LCD, which is divided to display on two screens. Displaying pages refer to picture 6.3 and picture 6.4:



Pic. 6.3



Pic. 6.4

Combination Instrument (CMIC)

Indicators Description in Illustration:

Item 1: Working indicator of interwheel differential lock

When interwheel differential lock is at the right place, this indicator symbol hushes on the LCD; otherwise, this indicator symbol will flash.

Item 2: Working indicator of interaxle differential lock

When interaxle differential lock is at the right place, this indicator symbol hushes on the LCD. Otherwise, this indicator symbol will flash.

Item 3: Working indicator of all-wheel driving

When all-wheel driving differential lock is at the right place, this indicator symbol hushes on the LCD. Otherwise, this indicator symbol will flash.



Notice:

When any indicator of Item 1-3 is displayed on LCD, that shows, when the switch of interwheel differential lock, interaxle differential lock or all-wheel driving are closed, the LCD will stay on this page.

Item 4: Working indicator symbol of lifting axle

When lifting axle works, this indicator symbol will display on LCD.

Item 5: Working indicator of PTO

After PTO switch is closed at right position, this indicator symbol hushes on the LCD. Otherwise, this indicator symbol will flash.

Item 6: Working indicator of PTO on neutral

When PTO neutral gear solenoid valve works, this indicator symbol will be displayed on the LCD.

Combination Instrument (CMIC)

Item 7: Working information indicator

The indicator symbol  will be displayed on LCD, when differential lock, all-wheel driving, PTO, PTO neutral gear and exhaust brake valve works.

Item 8: Turn page indicator

When the contents of information are more than one page, this indicator symbol will be displayed on LCD, They can be browsed by turning the MCS knob.

When current page is shown as picture 6.3 and some information is needed to be displayed on LCD as picture 6.4, this indicator will flash. **Turn the MCS knob** and come to next screen.

When current page is shown as picture 6.4 and some information is needed to be displayed on LCD as picture 6.3, this indicator will appear and keep hushing. **Turn the MCS knob back** and return to the former screen.

Item 9: Working indicator of exhaust brake

This indicator symbol will be displayed on LCD when exhaust brake works.

Item 10: Alarm indicator of fuel-water separator.

This indicator symbol will be displayed on LCD when there is too much water in fuel and the signal switch is closed for warning.

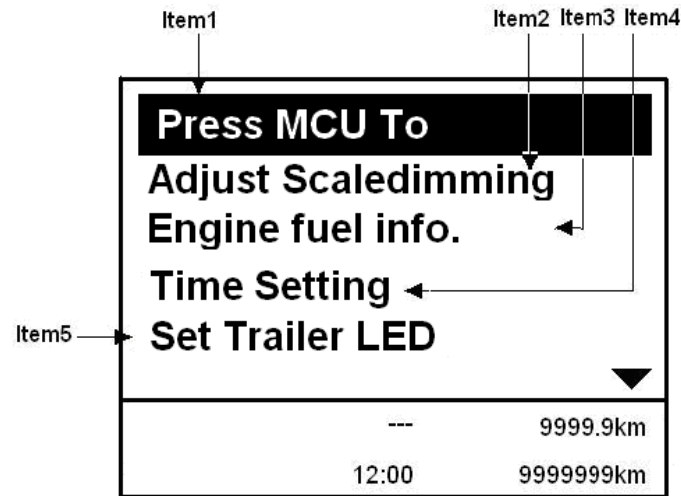
Item 11: Engine preheating indicator

This indicator symbol will be displayed on LCD when engine air-intake electric preheater works.

Combination Instrument (CMIC)

6.4. Vehicle Status Adjustment/ Checking Page

It is used for entering vehicle status adjustment/ checking page layout, as picture 6.5:



Pic. 6.5 Vehicle status adjustment/checking page

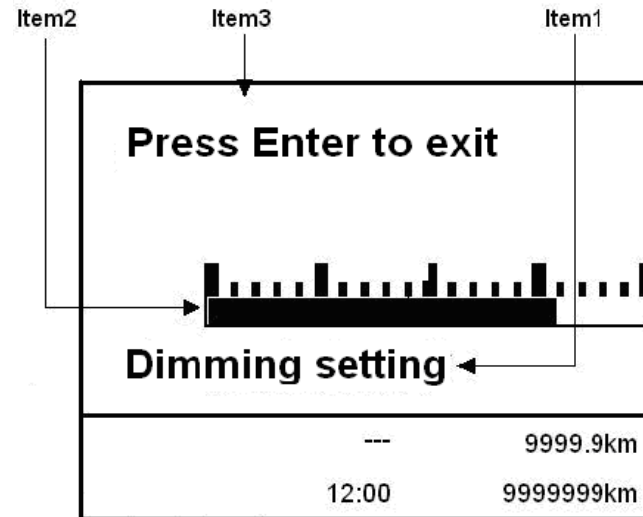
Procedure:

- 1). Press the menu button and enter (as item 1 of picture 6.5):
- 2). Brightness adjustment of LCD (as item 2 of picture 6.5)
- 3). Fuel consumption situation (only for Euro3 vehicle, refer to item 3 of picture 6.5)
- 4). Time adjustment (Refer to item 4 of picture 6.5)

● Brightness Adjustment of LCD

Turn MCU knob left/right until the background color of **Adjust Scale dimming of LCD** turns to yellow, and then press MCU button to enter **Dimming Adjustment** page (shown as Item1 in picture 6.6).

Combination Instrument (CMIC)



Pic. 6.6 Brightness Adjustment of LCD

The Brightness and columnar bar (Item 2) will increase or decrease while turning MCU knob to left or right and the brightness will reach the maximum when the columnar bar is full.

When getting favorite brightness, press MCU to exit dimming adjustment (Item3). In this case, the interface returns to the page shown in picture 6.5, and the chosen brightness will be saved in EEPROM.

The brightness shown on LCD will not change before next scale dimming adjustment.

When the small lamp lights up, adjust not only the brightness of LCD, but also illumination of scale and switch.

Brightness adjustment mode would be cancelled if any switch of differential or all-wheel driving turns on, and the current brightness will be saved in EEPROM.

Combination Instrument (CMIC)

● Fuel Consumption Situation (Picture 6.7)

It is used for displaying fuel consumption situation of Euro3 vehicle with common rail engine only. It will not display this interface for vehicles without common rail engine.

Item 1: Trip mileage fuel consumption (Qtrip) display:

Display format: XX.X L, the unit is "L" – Liter; accuracy 0.5L

Press the reset button of trip mileage /trip mileage fuel consumption on the combination instrument more than two seconds, the Qtrip will be reset to zero.

Item 2: Total fuel consumption (Qtotal) display:

Display format: XXXX L, the unit is "L" – Liter; accuracy 1L

Item 3: Hour fuel consumption display (Qinst)

Display format: XX.X L/h, the unit is "L/h" – Liter/hour

Item 4: Fuel consumption per 100km display (Q100km):

Display format: XX.X L/100km, the unit is "L/100km" – Liter/100kilometer

When the value of Q100km is beyond 150 L/100 km, LCD will not display Q100km.

● Time Setting

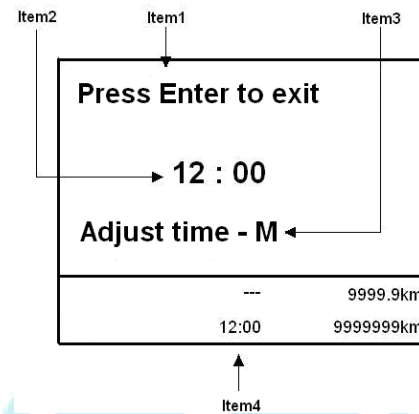
This function is only for vehicles not connected with VDO tachograph. You can enter time setting menu via MCU operation.

Turn MCU left / right until the color of "time setting" bar changes into yellow, press MCU to enter time setting (Refer to picture 6.8).

Item1	→ Qtrip	2.5	L
Item2	→ Qtotal	600	L
Item3	→ Qinst	20.1	L/h
Item4	→ Q100km	0.0	L/100km
		---	9999.9km
		12:00	9999999km

Pic. 6.7

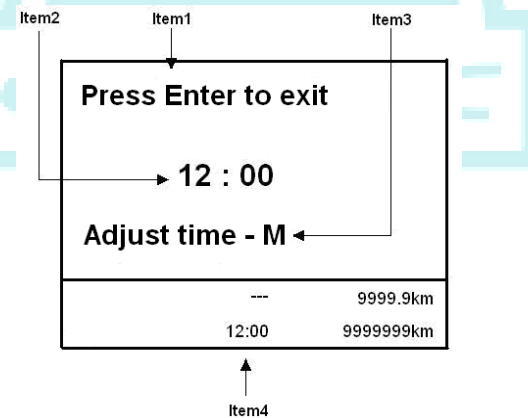
Combination Instrument (CMIC)



Pic. 6.8

Press MCU knob once to enter hour setting menu, and the hour position starts flashing. Turn left to decrease and turn right to increase. The adjustment range is displayed circularly within 0-23.

Press MCU knob once as soon as the right hour is set, it will enter minute adjustment mode which is as same as hour's. It is circled within 0-59. After confirming the set minute, save it and exit time setting mode through pressing MCU knob (refer to Picture 6.9)



Pic. 6.9

Combination Instrument (CMIC)



Notice:

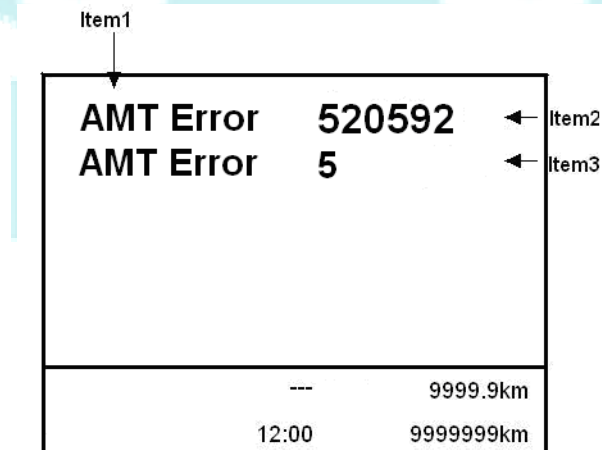
System will exit time setting mode if any switch of differential locks or all-wheel driving turns on during the setting process, and the current time will be saved in the system.

The time setting interface will not be displayed if the VDO tachograph is installed and connected with CAN bus.

6.5. System Errors Information

The errors information will be displayed on the LCD when the system errors occur, such as sensor connecting error, lower brake air pressure and overtime of CAN communication of engine, ABS (Refer to picture 6.10).

When new error occurs, it will displayed on LCD automatically.



AMT Error 520592	
AMT Error 5	
--- 9999.9km	
12:00 9999999km	

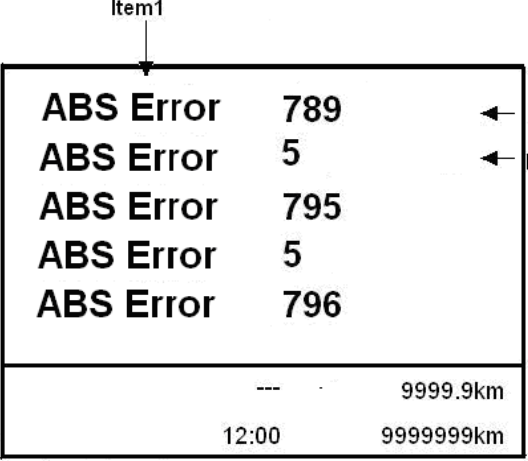
Pic. 6.10 System error information

Combination Instrument (CMIC)

● Code Display Mode

For the system in support of CAN-DIM diagnosis function, the SPN code and FMI code of error information of AMT and ABS systems will be displayed on the interface.

For the error information shown on the LCD, find out error source according to annex A "ABS (WABCO) error code table".



ABS Error	789	← Item1
ABS Error	5	← Item2
ABS Error	795	
ABS Error	5	
ABS Error	796	
---		9999.9km
12:00		9999999km

Pic. 6.11 ABS Error Code Display

Above picture 6.11 is the interface displaying ABS errors, when ABS errors occur.

Take the case of ABS, above displayed information shows that:

Item 1 ----ABS error: error source is ABS system;

Item 2 ----789: SPN code, error position will be sensor of left front wheel as per Agreement J1939;

Item 3 ---- 5: FMI code, error position will be lower electricity than requirement or open circuit as per Agreement.

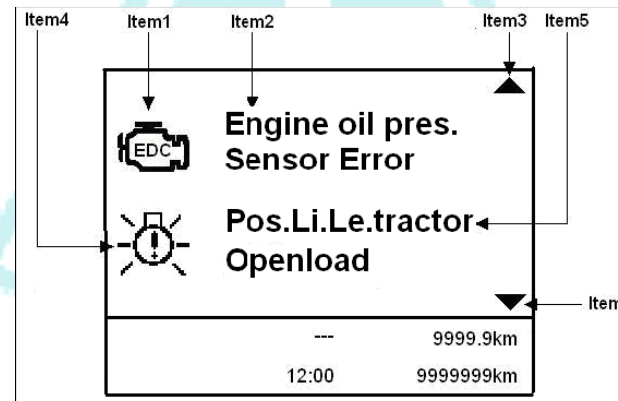
Combination Instrument (CMIC)

● Words Displaying Mode (Picture 6.12)

The error information excepting for getting by DMI diagnosis of CAN system will be displayed on interface in the form of words.

All displaying error information will be ranked as per priority level, if many errors happen, the errors with high priority will be displayed firstly such as the errors of brake, body safety and engine safety.

As per error information shown on LCD, find out error source and removing methods according to annex B “*System error information and exit methods*”.



Pic. 6.12 Words displaying Mode

Item 1: The first error symbol;

Item 2: The text description of the first error. And it will be displaying on two rows if the information more than one row.

Item 3: The arrowhead of page up;

Item 4: The second error symbol;

Item 5: The text description of the second error. And it will be displaying on two rows if the information more than one row.

Combination Instrument (CMIC)

Item 6: The arrowhead of page down;

Item 3 will be displayed on the interface if the error information can not displayed on one page fully and not displayed on the first page as well;

Item 6 will be displayed on the interface if the error information can not displayed on one page fully and not displayed on the last page as well;

Item 3 and *Item 6* will be displayed on the interface at one time if the error information displays on many pages and not displayed on the first page or last page;

If error occurred is very serious, the serious error alarm indicator  (red) will light up, and the buzzer alarms continuously when engine is working.



Notice:

For this case, please stop and check the vehicle at once! Restart to drive after errors being solved, or it will cause loss of life and property!

Press down menu knob, the buzzer alarm sound will close for a while, but it will restart to alarm one minute later or new serious error happened within one minute later on.

When common error happens, the alarm indicator  (**yellow**) lights up. Meanwhile, if the following error happens with engine operating, the buzzer alarm ten times in the form of one time per second.

After removing all errors, the buzzer will be silent, and symbols of all error information will disappear.

The alarm interface will return back to normal driving interface.

Combination Instrument (CMIC)

6.6. System Operation

Sleep mode means that the CBCU is under power saving status, and system does not work.

Operating mode means that CBCU is under working status, the program and all connectors are working.

There are three waken methods, different signal with different waken object, details as following:

Signals	Waking objects			
	CBCU	CMIC	VDR/MTCO	MCU
Key switch	√	√	√	√
Emergency alarm switch	√	√	X	X
Lighting switch	√	√	X	X

● Key Switch Wake-up

In this case, all the system will be activated, electrify to self-check and LCD lights up.

All the system starts to work, the communication connections between them will be established and the vehicle enters driving status if connected with ABS or common rail engine.

● Emergency Alarm Switch Wake-up

Under the condition that the key switch close and the emergency alarm switch turn on only, body central computer will be waken up partly and the LCD of instrument does not work, in this case, the emergency alarm, that is, steering lamps light up.

Combination Instrument (CMIC)

● Lighting Switch Wake-up

When the key switch is off and lighting switch is on, function of CBCU will be wakened partly, and the lamps controlled by lighting switch are working such as position lamp, height lamp, side indicator, instrument backlighting and switch indicator.

Turn-on and turn-off voltages of emergency alarm switch wake-up and lighting switch wake-up can be defined by program.

Key switch delays 1 second after closed, the system will return to sleeping status which makes sure all systems exit working status safely.

6.7. System Electrify and Self-checking

When the key switch is at the *ON* position, that is, bus system will self-check after KL15 turning on. After that, all parts will operate as following:

All instruments: Every instrument finger starts from mechanism terminal, and rotate to scale span within 2 seconds. Later on, the odometer and engine tachometer return to zero position, and air pressure gauge, fuel gauge and water temperature gauge show the real value of current system.

All indicators: All indicators will light up for one second, and then return to real condition.

LCD: Interval of two seconds, it displays CNHTC logo firstly and then displays normal driving interface (displays voltage and oil pressure).

After self-checking, if any switch of interaxle differential, interwheel differential lock switch and all-wheel driving switch is on, the differential lock indicator interface will be displayed;

Combination Instrument (CMIC)

If above mentioned differential locks are not engaged and error happens, the interface will enter into error information page;

If the two situations above mentioned do not exist, but the working indicator symbols of other indicator interface is working, the system will switch to indicator interface.

If above mentioned three situations do not appear, the system will stay on normal driving interface.

6.8. System Turn-off

If the system is activated by emergency alarm switch or lighting switch, it will return to sleeping status after switch is off.

Disconnect switch, the system will delay for one second to return to sleeping status.

In this case, all working loads are off, and the instrument fingers go back to zero position, the instrument backlighting will be off.



Notice:

It is strictly prohibited to cut off electric circuit connection between battery and body center computer under unclosing key switch or other input power with wake-up function!

Otherwise, all components including the system control units, wire harness and electronic components of whole vehicle may be damaged, and system data may be lost and down to cause vehicle unavailable!

Combination Instrument (CMIC)

6.9. LCD Menu and Interface Operation

Only one menu is displayed on the LCD every time. But the needed content is more than one item, so it is needed to switch between them.

Turn the menu knob to right to browse downwards;

Turn the menu knob to left to browse upwards;

When the displayed differential lock information is more than one screen, press down menu knob to display next information, all information can be displayed in turns.

If the screen is not enough to display needed error information, turn menu knob to right or left to display more information.



Notice:

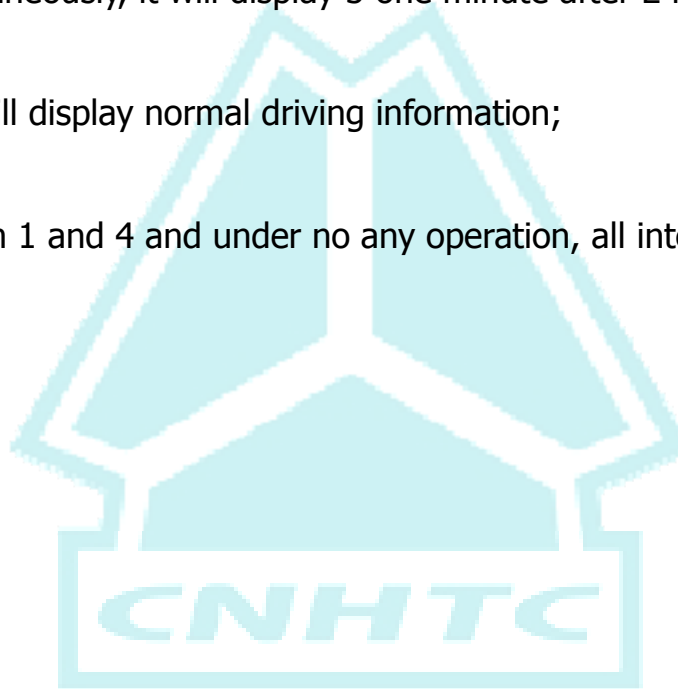
When entering error information interface and other information interfaces, it will display from the very beginning every time.

After system electrifying and self-checking, interface displays in priority order.

- 1) Display differential lock information as long as differential lock starts to work, and other interface will exit immediately including error information, backlighting adjustment, time adjustment mode and so on;
- 2) If it is not under the first status, and new error happened, the error information will be displayed on the interface immediately after ending of lighting adjustment or time adjustment (if it is under this status);

Combination Instrument (CMIC)

- 3) If it is not under the first and second statuses, and new working information happened, the working information will display on the interface immediately after ending of lighting adjustment or time adjustment (if it is under this status);
- 4) If the second and third happens simultaneously, it will display 3 one minute after 2 is displayed.
- 5) If above mentioned does not exist, it will display normal driving information;
- 6) Excepting description mentioned in item 1 and 4 and under no any operation, all interfaces will return to normal driving interface after delaying one minute.



Combination Instrument (CMIC)

System Error Information Displayed on LCD and Trouble Shooting

(If some errors are shown on LCD while driving, please refer to the list below for fixing the problem.)

Error Source	Display Content on LCD		Error Cause and Failure Recovery Methods
	Symbol	Wording Information	
Brake Circuit 1		Air pressure in brake circuit 1 is low	The air pressure of air reservoir is lower than 5.5x 0.1MPa (5.5bar).
Brake Circuit 2		Air pressure in brake circuit 2 is low	
Auxiliary Air Circuit		Air pressure in auxiliary air reservoir is low	
Engine Coolant Temperature		Engine coolant temperature is high	Coolant temperature is higher than 95℃ when engine is running. Please check the sensor, sensor circuit and cooling system.
Engine Oil Pressure		Engine oil pressure of is low	When engine is working, the engine oil circuit pressure is less than 0.6 x 0.1MPa (0.6bar).
Engine Overspeed		Engine overspeed	Engine speed is over 2600rpm for more than three seconds.
Fuel Level		Low fuel level in fuel tank	The rest fuel in fuel tank is less than 1/8 of total capacity.
Air Filter		Air filter is blocked	Air filter is blocked, please check and maintain warning switch/circuit/air filter.
Battery And Generator		Generator can not charge.	The voltage at "D+" terminal is lower than 23.5V for more than 3 seconds when engine operates. Failure reasons: generator error or connection error.
Cab		Cab is unlocked	Cab is unlocked. The cause is that cab is unlocked or wire harness error.

Combination Instrument (CMIC)

Cab Unlocking		Cab door is unlocked	Cab door is not locked while vehicle is running (speed more than 15km/h).
Air Pressure Sensor (Brake Circuit 1)		Air pressure sensor error in brake circuit 1	The numerical value of resistance for sensor on brake circuit 1 is over defined range (open circuit) or connection error. Please measure sensor resistance and check connection.
Air Pressure Sensor (Brake Circuit 2)		Air pressure sensor error in brake circuit 2	The numerical value of resistance for sensor on brake circuit 2 is over defined range (open circuit) or connection error. Please measure sensor resistance and check connection.
Coolant Temperature Sensor		Engine coolant temperature sensor error	The numerical value of resistance for coolant temperature sensor on engine is over defined range (open circuit) or connection error. Please measure sensor resistance and check connection.
Oil Pressure Sensor		Engine oil pressure sensor error	The numerical value of resistance for oil pressure sensor on engine is over defined range (open circuit) or connection error. Please measure sensor resistance and check connection.
Fuel Level Sensor		Fuel level sensor error	Resistance for fuel level sensor is over defined value (open circuit) or wrong connection. Please check the sensor and wire harness.
Engine Communication Error(only for Euro3 vehicle)		Engine communication error	If the communication between engine and CBCU is interrupted, this error information will be displayed on LCD. Check CAN line and ECU of engine.
ABS Communication Error		ABS communication error	If the communication between ABS and CBCU is interrupted, this error will be displayed on LCD. Check CAN line and ECU of ABS.
Tachograph		Tachograph error	If the communication between tachograph and CBCU is interrupted, this error will be displayed on LCD. Check CAN line and tachograph.
System Voltage of Whole Vehicle		voltage is high	The voltage is higher than 30V during continuous period (3s), It maybe damage electricity components. Please check generator, charging circuit and battery.

Combination Instrument (CMIC)

		Voltage is low	The voltage is lower than 19V during continuous period (3s), which maybe cause some system can not work normally. Please check generator, charging circuit and battery.
Voltage Error of the Sixth Group		G6 power error (CBCU power)	The voltage of the sixth group is lower than system voltage. Check the circuit connecting between the 2 nd hole of connector 1 (total 9 holes) of CBCU and power and fuse. Note: when error occurs, the load connected with this group power will be affected and unavailable.
Voltage Error Of The Fifth Group		G5 power error (CBCU power)	The voltage of the fifth group is lower than system voltage. Check the circuit connecting between the 8th hole of connector 1 (total 9 holes) of CBCU and power and fuse. Note: when error occurs, the load connected with this group power will be affected and unavailable.
Voltage Error of The Fourth Group		G4 power error and menu knob disabled	The voltage of the fourth group is lower than system voltage. Check the circuit connecting between the eighth hole of connector 5 (total nine holes) of CBCU and power and fuse. Note: when error occurs, the load connected with this group power will be affected and unavailable.
Voltage Error of The Third Group		G3 power error (CBCU power)	The voltage of the third group is lower than system voltage. Check the circuit connecting between the second hole of connector 5 (total nine holes) of CBCU and power and fuse. Note: when error occurs, the load connected with this group power will be affected and unavailable.
Voltage Error of The Second Group		G2 power error (CBCU power)	The voltage of the second group is lower than system voltage. Check the circuit connecting between the sixth hole of connector 6 (total fifteen holes) of CBCU and power and fuse. Note: when error occurs, the load connected with this group power will be affected and unavailable.

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Voltage Error of The First Group		G1 power error (CBCU power)	The voltage of the first group is lower than system voltage. Check the circuit connecting the tenth hole of connector 6 (total fifteen holes) of CBCU and power and fuse. Note: when error occurs, the load connected with this group power will be affected and unavailable.
Washer Motor		Washer motor error	Conducting wire from CBCU to washer motor is open/short circuit to the ground, please check the circuit.
Brake Lamp of Tractor Truck		Brake lamp is short circuit to the ground	Step on brake pedal, if brake lamp does not light and this error information is displayed on LCD, it means short circuit. Check the circuit connected this lamp.
		Brake lamp overload	Step on brake pedal, if the braking lamp lights and this error information is displayed on LCD, it means the power of brake lamp is over permitted range (30-55W). Check the lamp and examine whether the power meets requirement or not.
		Brake lamp is open circuit.	Step on brake pedal, if this error information is displayed on LCD, it means that the power of lamp is not within permitted range. Check lamp and circuit, examine whether the power meets requirement and connection is good or not.
Brake Lamp of Trailer		Brake lamp is short circuit to the ground	After connecting trailer, step on brake pedal, if the lamp does not light and this error information is displayed on LCD, it means short circuit. Check the circuit connected this lamp.
		Brake lamp overload	After connecting trailer, step on brake pedal, if the brake lamp lights and this error information is displayed on LCD, it means the power of brake lamp is over permitted range (30-80W). Check the lamp and examine whether the power meets requirement or not.

Combination Instrument (CMIC)

		Brake lamp is open circuit.	After connecting trailer, step on brake pedal, if this error information is displayed on LCD, it means that the power of lamp is not within permitted range. Check the lamp and circuit, examine whether power meets requirement and connection is good or not.
Left-front And Left-rear Steering Lamps of Tractor Truck		Left-front and left-rear steering lamps are short circuit to the ground.	Turn on left steering switch or emergency alarm switch and this error information is displayed on LCD, it means short circuit. Please check circuit and lamp.
Left-front And Left-rear Steering Lamps of Tractor Truck		Left-front and left-rear steering lamps overload	Turn on left steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means the power of lamp is over permitted range (26-56W). Examine whether the power meets requirement or not.
		Left-front and left-rear steering lamps are open circuit.	Turn on left steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means that the power of lamp connected is lower than permitted range (26-56W). Check whether the lamp power and connections meet requirement or not.
Left-middle Steering Lamp Of Main Vehicle		Left-middle steering lamp is short circuit to the ground.	Turn on left steering switch or emergency alarm switch, if this error information is displayed on LCD, it means short circuit. Please check the circuit and lamp.
		Left-middle steering lamp overloads	Turn on the left steering or emergency alarm switch, if steering lamp lights up and this error information is displayed on LCD, it means that the power of lamp connected exceeds permitted range (2-30W). Check whether the lamp power meets regulated value or not.
		Left-middle steering lamp is open circuit	Turn on the left steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means that the power of lamp is lower than permitted range (2-30W). Check the lamp and circuit, examine whether the power meets regulated Value and connections are good or not.

Combination Instrument (CMIC)

Left-side Steering Lamp Of Trailer		Trailer left-side steering lamp is short circuit to the ground.	Turn on left steering switch or emergency alarm switch and this error information is displayed on LCD, it means short circuit. Please check the circuit and lamp.
		Trailer left-side steering lamp overloads	Turn on the left steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means the power of lamp exceeds permitted range (15-180W). Check whether the lamp power meets regulated value or not.
Left-side Steering Lamp Of Trailer		Trailer left-side steering lamp is open circuit.	Turn on the left steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means that the power of lamp is lower than permitted range (15-180W). Check the lamp and circuit, examine whether the power meets regulated value and connections are good or not.
Right-front And Right-rear Steering Lamps of Tractor Truck		Right-front and right-rear steering lamps are short circuit to the ground.	Turn on right steering switch or emergency alarm switch, if this error information is displayed on LCD, it means short circuit. Please check the circuit and lamp.
		Right-front and right-rear steering lamps overload.	Turn on the right steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means the power of lamp exceeds permitted range (26-56W). Check whether the lamp power meets regulated value or not.
		Right-front and right-rear steering lamps are open circuit.	Turn on the right steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means the power of lamp is lower than permitted range (26-56W). Check whether the power meets regulated value and connections are good or not.
Right-middle Steering Lamp of Tractor Truck		Right-middle steering lamp is short circuit to the ground.	Turn on right steering switch or emergency alarm switch and this error information is displayed on LCD, it means short circuit. Please check the circuit and lamp.

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		Right-middle steering lamp overloads	Turn on the right steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means the power of lamp exceeds permitted range (2-30W). Check whether the lamp power meets regulated value or not.
		Right-middle steering lamp is open circuit	Turn on the right steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means that the power of lamp is lower than permitted range (2-30W). Check the lamp and circuit, examine whether the power meets regulated value and connections are good or not.
Right-side Steering Lamp of Trailer		Trailer right-side steering lamp is short circuit to the ground.	Turn on right steering switch or emergency alarm switch, if this error information is displayed on LCD, it means short circuit. Please check the circuit and lamp.
Right-side Steering Lamp of Trailer		Trailer right-side steering lamp overloads	Turn on the right steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means the power of lamp exceeds permitted range (15-180w). Check whether the lamp power meets regulated value or not.
		Trailer right-side steering lamp is open circuit.	Turn on the right steering switch or emergency alarm switch, if steering lamp lights and this error information is displayed on LCD, it means that the power of lamp is less than permitted range (15-180w). Check the lamp and circuit, examine whether the power meets regulated value and connections are good or not.
Rear Fog Lamp of Tractor Truck		Rear fog lamp is short circuit to the ground	Turn on the switch of small lamp, front fog lamp and rear fog lamp switch, if the lamps can not light and this error information is displayed on LCD, it means short circuit. Check the circuit connected to the lamp.
		Rear fog lamp overload	Turn on the switch of small lamp, front fog lamp and rear fog lamp switch, if the lamps light and this error information is displayed on LCD, it means that the power of lamp is over permitted range (34-56W). Check the lamp and examine whether the power meets requirement or not.

Combination Instrument (CMIC)

		Rear fog lamp is open circuit.	Turn on the switch of small lamp, front fog lamp and rear fog lamp switch, if this error information is displayed on LCD, it means that the power of lamp is not within permitted range. Check the lamps and connections, examine whether the power meets requirement and connections are good or not.
Front Fog Lamp of Tractor Truck		Front fog lamp is short circuit to the ground.	Turn on the switch of small lamp and front fog lamp switch, if the lamp can not light and this error information is displayed on LCD, it means short circuit. Check the circuit connected to the lamp.
		Front fog lamp overloads.	Turn on the switch of small lamp and front fog lamps switch; if the lamp lights and this error information is displayed on LCD, it means that the power of the connected lamp is beyond permitted range (98-182w). Check the lamp and examine whether the power meets requirement or not.
Front Fog Lamp of Tractor Truck		Front fog lamp is open circuit.	Turn on the switch of small lamp and front fog lamp switch, if this error information is displayed on LCD, it means that the power of lamp is not within permitted range. Check the lamps and connections, examine whether the power meets requirement and connections are good or not.
Rear Fog Lamp of Trailer		Rear fog lamp of trailer is short circuit to the ground.	Turn on the switch of small lamp, front and rear fog lamps switch, if the lamps can not light and this error information is displayed on LCD, it means short circuit. Check the circuit connected to the lamps.
		Trailer rear fog lamp overloads.	Turn on the switch of small lamp, front and rear fog lamps switch, if the lamps light this error information is displayed on LCD, it means the power of the connected lamps is beyond permitted range (34-70W). Check the lamps and examine whether the power meets requirement or not.

Combination Instrument (CMIC)

		Trailer rear fog lamp is open circuit.	Turn on the switch of small lamp, front and rear fog lamps switch, if this error information is displayed on LCD, it means that the power of lamps is not within permitted range. Check the lamps and connections, examine whether the power meets requirement and connections are good or not.
High Beam Headlamp		Relay of high-beam headlamp is short circuit to the ground.	Turn on the switch of high-beam headlamp, if this error information is displayed on LCD, it means short circuit between CBCU and relay. Check the circuit and relay.
Low Beam Headlamp		Low beam headlamp is short circuit to the ground.	Turn on the light switch with II gear and the light locates low beam light position, the lamp can not light and this error information is displayed on LCD, it means short circuit. Check circuit connected to lamp and lamp.
		Low beam headlamp overloads.	Turn on the light switch with II gear and the light locate low beam light position, the lamp lights and this error information is displayed on LCD, it means the power of lamp is beyond permitted range (80-240W) . Check the lamp, examine whether the power meets requirement or not.
Low Beam Headlamp		Low beam headlamp is open circuit.	Turn on the light switch with II gear and the switch locates low beam light position, and this error information is displayed on LCD, it means the power of lamp is not within permitted range. Check the lamp and circuit, examine whether the power meets requirement and connections are good or not.
Reversing Lamp of Tractor Truck		Reversing lamp is short circuit to the ground.	Turn on the key switch and shift to reversing gear, if the reversing lamp can not light and this error information is displayed on LCD, it means short circuit. Check the lamp and circuit connected it.
		Reversing lamp overloads.	Turn on the key switch and shift to reversing gear, if the reversing lamp lights and this error information is displayed on LCD, it means that the power of lamp is beyond permitted range (30-55W). Check the lamp, examine whether the power meets requirement or not.

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		Reversing lamp is open circuit.	Turn on the key switch and shift to reversing gear, if this error information is displayed on LCD, it means that the power of lamp is not within permitted range. Check the lamp and circuit, examine whether the power meets requirement and connections are good or not.
Reversing Lamp of Trailer		Reversing lamp of trailer is short circuit to the ground.	Turn on the key switch and shift to reversing gear when the trailer connected, if the reversing lamp of trailer can not light and this error information is displayed on LCD, it means short circuit. Check the lamp and circuit connected the lamp.
		Trailer reversing lamp overloads.	Turn on the key switch and shift to reversing gear when the trailer connected, if the reversing lamp lights and this error information is displayed on LCD, it means that the power of lamp is beyond permitted range (34-56W). Check the lamp, examine whether the power meets requirement or not.
		Trailer lamp is open circuit	Turn on the key switch and shift to reversing gear when the trailer connected, if this error information is displayed on LCD, it means that the power of lamp is not within permitted range. Check the lamp and circuit, examine whether the power meets requirement and connections are good or not.
Illumination of Small Lamp Switch		Switch lamp is short circuit to the ground.	Turn on the key switch and the switch of small lamp, if switch lamp can not light and this error information is displayed on LCD, it means short circuit. Check the lamp and circuit connected the lamp.
Left Position Lamp of Tractor Truck		Left-side position lamp is short circuit to the ground.	Turn on the key switch and the switch of small lamp, if left-side position lamp (including marker lamp, height lamp, position lamp and license plate lamp) can not light and this error information is displayed on LCD, it means short circuit. Check the lamp and circuit connected the lamp.

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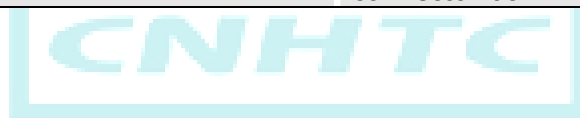
		Left-side position lamp overloads.	Turn on the key switch and the switch of small lamp, if left-side position lamp (including marker lamp, height lamp, position lamp and license plate lamp) light and this error information is displayed on LCD, it means that the power of lamp is beyond permitted range(15-70W). Check lamp, examine whether the power meets requirement or not.
		Left-side position lamp is open circuit.	Turn on the key switch and the switch of small lamp, if this error information is displayed on LCD, it means that the power of lamp is not in permitted range. Check the lamp and circuit, examine whether the power meets requirement and connections are good or not.
Right Position Lamp of Tractor Truck		Right-side position lamp is short circuit to the ground	Turn on the key switch and the switch of small lamp, if right-side position lamp (including marker lamp, height lamp, position lamp and license plate lamp) can not light and this error information is displayed on LCD, it means short circuit. Check the lamp and circuit connected the lamp.
		Right-side position lamp overloads.	Turn on the key switch and the switch of small lamp, if right-side position lamp (including marker lamp, height lamp, position lamp and license plate lamp) light and this error information is displayed on LCD, it means that the power of lamp is beyond permitted range (15-70W). Check lamp, examine whether the power meets requirement or not.
		Right-side position lamp is open circuit.	Turn on the key switch and the switch of small lamp, if this error information is displayed on LCD, it means that the power of lamp is not in permitted range. Check the lamp and circuit, examine whether the power meets requirement and connections are in good condition.
Position Lamp Reply of Trailer		Position lamp relay of trailer is short circuit to the ground.	When this error information is displayed on LCD, check the circuit and relay.

Combination Instrument (CMIC)

Lights of Trailer do not Work			Everytime turn on the keys, light switches or emergency alarming switch, CBCU will check the status of reverse lights and brake lights of the trailer. If any of them has power greater than 15W, CBCU will take as the trailer has been connected. Then, outputs of the trailer will work under the operation of corresponding switches. Considering that some customers will assemble LED trailer lights(This is because the power of LED is too small for CBCU to detect the trailer) , on the program version released at March 2009, we have added option for trailer tail lights on LCD. The default choice is bulb lights. If customer chooses LED lights, the CBCU will force the trailer output.
Unable to download program/EOL			Check the wire between C04 pin of CBCU and the diagnosis node and also the power supply at the diagnosis node.
Air conditioner relay not work/turn on and off intermittently			When turning on the key, the air conditioner relay will connect if battery voltage B+ is higher than 27V; and it will disconnect if battery voltage is lower than 23V during continuous period(3s). When the engine stops (i.e. engine speed less than 350rpm), the relay will disconnect.
Inaccurate engine speed gauge/vehicle speed			Mistake in writing K value or alternator speed ratio when the vehicle is offline.
Engine speed gauge not work			Pls. check the wire between the generator and CBCU.
Vehicle speed gauge not work			Pls. check the wire between the generator vehicle speed sensor and CBCU.

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CMIC not work			Check the fuse supplying power for CMIC on connecting box. Check the power supply of CMIC connectors. Check the ICAN wire between CIMC and CBCU.
Oil pressure warning when turning on the front beams/front fog lights.			This problem is caused by the way of oil pressure sensor connects to GND. To solve this problem, the value from sensor needs to be compensated when turning on the front beams/ front fog lights. Meanwhile, only use the oil pressure warning pin as the source of oil pressure warning function.
Engine error indicator is ON			When this indicator is on, it means there is error in the engine. Please first get rid of the engine error.
Lights not work			Please check the bulbs; Please check if the wire is open load. Please check if there is short-circuit. Because when CBCU detects short-circuit, it will cut off the output automatically. Please check the 6 fuse for CBCU power supply on the electrical connector box.



Combination Instrument (CMIC)

Error analysis for CMIC, CBCU and CAN system between CMIC and CBCU:

1. If the CAN bus connection is interrupted suddenly (KL15 on), the information on LCD would last for 3s,  (red) would keep flashing for 3min, all CMIC background will light up.
2. If instrument can not light when KL15 is on, but other parts (lighting, wiper etc.) can work normally. Please check CAN bus connection between the cluster and CBCU, then the CBCU.
3. If all inputs or outputs of CBCU don't work and wire connection is ok, check CBCU power supply first. And then check the input of KL15/ small light switch/ emergency alarming switch.
4. If the KL30 of instrument is suddenly interrupted when KL15 on, all gauges will stay in the position at the moment power is cut off. When KL30 is recovered, the CMIC will perform a power-on-reset cycle after KL15 is (re)connected. Gauges will indicate the current value after the self-test is over.
7. Air pressure gauge of brake circle 1
8. Air pressure gauge of brake circle 2

It is used for display air pressure value of brake circle 1 and brake circle 2.

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When any alarm switch of air pressure circles connects (the air pressure of brake circle less than 5.5x0.1 MPa), the lower air pressure alarm indicator will light up, in the meanwhile, the serious alarm indicator lights up as well, and the buzzer will alarm during running.



Notice:

In this case, stop and check the vehicle at once, otherwise it will cause loss of life and property!

9. CMIC Indicators

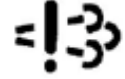


Combination Instrument (CMIC)

Function list of indicators

No.	Description	Symbol	Color	No.	Description	Symbol	Color
1	Left steering indicator		Green	13	Serious alarm indicator		Red
2	Right steering indicator		Green	14	AdBlue indicator		Blue
3	Low oil pressure alarm indicator		Red	15	Fuel lower level alarm indicator		Yellow
4	Low air pressure alarm indicator		Red	16	Air filter block alarm indicator		Yellow
No.	Description	Symbol	Color	No.	Description	Symbol	Color
5	Parking brake indicator		Red	17	Cab unlocking alarm indicator		Red
6	Trailer steering indicator		Green	18	Engine error indicator		Yellow
7	Safety belt alarm indicator		Red	19	Transmission lower gear range indicator		Green
8	High coolant temperature alarm indicator		Red	20	Common alarm indicator		Yellow
9	Charging indicator		Red	21	Tractor truck ABS indicator		Yellow

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10	High beam indicator		blue	22	Engine emission indicator		Yellow
11	Front fog lamp indicator		Green	23	ASR indicator		Yellow
12	Rear fog lamp indicator		Yellow				



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1. Left steering indicator

2. Right steering indicator

Left-side or right-side steering indicator will flash according to steering signal, the flash frequency of indicator will be around two times than normal situation if one of steering lamp meets errors. All the steering lamps and left/right side indicators will flash when press down alarm indicator switch.

3. Lower oil pressure alarm indicator

This lamp will light up when the engine oil pressure is low. In this case, stop the vehicle and engine, check immediately or contact with local service station to maintain if it is necessary.

4. Lower air pressure alarm indicator

This lamp will light up when the brake air pressure is lower. Contact with local service station to maintain if it is necessary.

5. Parking brake indicator

This lamp will light up when the vehicle stops and turn on the hand brake switch.

6. Trailer steering indicator

The green lamp will light up when turn on trailer steering indicator; this lamp will display with continuously flash as long as the lamp meets errors.

7. Safety belt alarm indicator

This lamp will light up with alarm, if driver does not fasten safety belt after starting.

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8. Higher water temperature alarm indicator

This lamp will light up when the water temperature is high, for the time being, stop the vehicle and check water level of engine. Contact with local service station to maintain if it is necessary.

9. Charging indicator

When the generator works with normal situation, the lamp is off; when the generator meets errors, the lamp will light up.

10. High beam indicator

This lamp will light up when turn on the headlamp switch and distance lamp switch.

11. Front fog lamp indicator

The green lamp will flash when turn on the front fog lamp indicator; this lamp will display with continuously flash as long as the lamps meet errors.

12. Rear fog lamp indicator

The yellow lamp will flash when turn on the front fog lamp indicator; this lamp will display with continuously flash as long as the lamps meet errors.

13. Serious alarm indicator

This lamp will light up when the vehicle meets serious errors. For the time being, stop vehicle and check, contact with local service station to maintain if it is necessary.

14. AdBlue level alarm indicator(only for Euro4 vehicle)

This is a standby indicator for Euro4 vehicle. When AdBlue level is low, DCU will send message to CBCU, then this indicator will

Combination Instrument (CMIC)

light up on LCD. In this case, supply AdBlue to tank immediately.

15. Low fuel level alarm indicator

This lamp will light up when the fuel level of fuel tank is low. In this case, supply the fuel to fuel tank.

16. Air filter blocked alarm indicator

The lamp will light up when too much dust in filter leads to air intake blocked. Clean the filter or change it.

17. Cab unlocking alarm indicator

This lamp will light up when the door unlock. In this case, lock the door again.

18. Engine error indicator

This lamp will light up when engine meets errors. In this case, stop the vehicle and check, contact with the local service station to maintain if it is necessary.

19. Transmission lower speed range indicator

This lamp will light up when the transmission is on lower speed range (1~4 gear).

20. Common alarm indicator

This lamp will light up when the vehicle meets common errors. In this case, stop the vehicle and check, contact with the local service station to maintain if it is necessary.

21. Tractor truck ABS indicator

The ABS system will operate when the tractor truck brakes. This lamp will light up when ABS system meets errors.

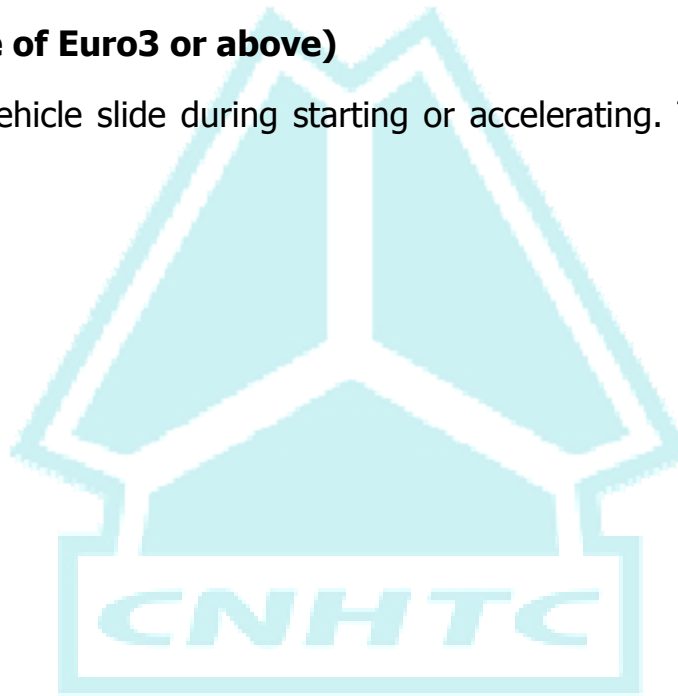
Combination Instrument (CMIC)

22. Engine emission alarm indicator(for vehicle of Euro3 or above)

When fuel and AdBlue level is low, DCU will send message to CBCU, then this indicator lights up on LCD to warn low emission. In this case, supply or change fuel to fuel tank or AdBlue to AdBlue tank immediately.

23. ASR indicator(optional for vehicle of Euro3 or above)

The ASR system will operate when the vehicle slide during starting or accelerating. This lamp will light up when ASR system meets errors.



Rocker Switch



Rocker Switch

Rocker switches and function description

(Including indicators. It is invalid when the key switch is on 1 gear, unless specified description)

Item	Description	Status	Function	Remarks
1	Lamp Switch	0	Both Position Lamp and Headlamp Off	
		1	Position Lamp On/Headlamp Off	Instrument lamp works at Shift 2 and Shift 3, headlights will not work
		2	Both Position Lamp and Headlamp On	headlights will work, the combination switch work
2	Interwheel Differential	0	Off	
		1	On	Interwheel differential magnetic valve will work, and the indicator will flash until interwheel differential switch put in right place, then the indicator lights completely.
3	Front Fog Lamp Switch	0	Off	
		1	On	Precondition: Shift 1 of lamp switch has been turned on.
4	Interaxle Differential	0	Off	
		1	On	Interaxle differential magnetic valve will work, and the indicator will flash until interaxle differential switch put in right place, then the indicator lights completely.
5	Rear Fog Lamp Switch	0	Off	
		1	On	Precondition: (1) Shift 1 of lamp switch has been turned on, front fog lamp has also been turned on; or (2) Shift 2 of lamp switch has been turned on.
6	Working Lamp Switch	0	Off	
		1	On	Working lamp lights.
7	Serious Alarm Switch	0	Off	
		1	On	Shift 1,2,3,4 of key switch are available.

Rocker Switch

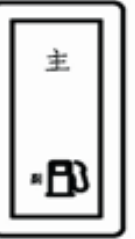
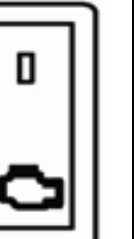
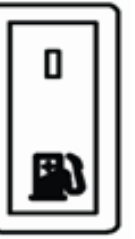
8	ECU diagnostic switch	0	Off	
		1	On	
9	Horn transferring switch	0	Electric horn	Press horn button on the steering wheel
		1	Air horn	Press horn button on the steering wheel
10	ABS Checking switch	0		
		1		
11	Screen adjustment Button(MCS)		Adjust parameters of LCD	There 3 operation ways: turn clockwise, turn anticlockwise, press.
12	Exhaust brake switch(Euro2)	0	Off	
		1	On	Solenoid valve of exhaust brake will work while clutch being engaged, transmission being not at neutral and engine speed more than 1100rpm.



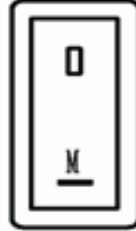
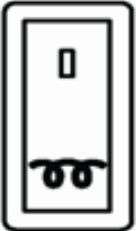
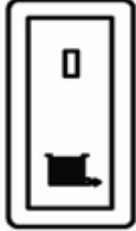
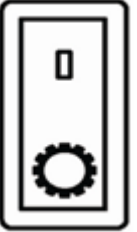
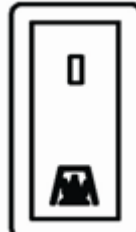
Notice:

After pushing the interaxle diff-lock switch, the lamp will flash, if there is feedback signal from interaxle diff-lock switch within 5 seconds, the lamp for interaxle diff-lock will be on; if there is no feedback signal, check driving output of interaxle diff-lock magnetic valve, and if the output is normal, the lamp will be on.

Rocker Switch

No.	1	2	3	4	5	6	7	8	9
Name	Cold-start switch	ABS checking	Warmer/preheating	Trailing axle lifting	Trailing axle descending	PTO neutral	PTO	Interwheel differential	Interaxle differential
Switch Symbol									
No.	10	11	12	13	14	15	16	17	18
Name	All-wheel drive	Lifting axle lifting&descending	Power	Transfer case neutral	Off-road / Highway	Main & auxiliary fuel tank shifting	Alarm	Working lamp	ECU diagnosing
Switch Symbol									
No.	19	20	21	22	23	24	25	26	27
Name	Warning light	Vice-brake	Engine retarder	Front working lamp	Engine retarder inspection	No-load operation	PTO	Second PTO	Brake cooling
Switch Symbol									

Rocker Switch

No.	28	29	30	31	32	33	34	35	36
Name	PTO	Emergency warning light	Standby switch	No-load operation	Electrically operated fuel pump	Ball valve heating	Reservoir water drain	Indoor power control	Outdoor power control
Switch Symbol									
No.	37	38	39	40	41	42	43	44	45
Name	Self-preservation	Hand throttle attached	Gearbox diagnosing	Power	Driving & Working shifting	Instrument & CAN shifting	Double contacts PTO	Rearview mirror strengthen	Light
Switch Symbol									
No.	46	47	48	49	50	51	52		
Name	Front fog lamp switch	Rear fog lamp switch	Centralization lubrication	Hom conversion	Heater(upper red/lower green)	ABS off-road switch	Engine braking switch		
Switch Symbol									

Master Power Switch

The master power switch is at outside of battery box on right side member.



Notice:

Switch off the master power switch if vehicle is out of using for long time to avoid accident.



1- Master power switch

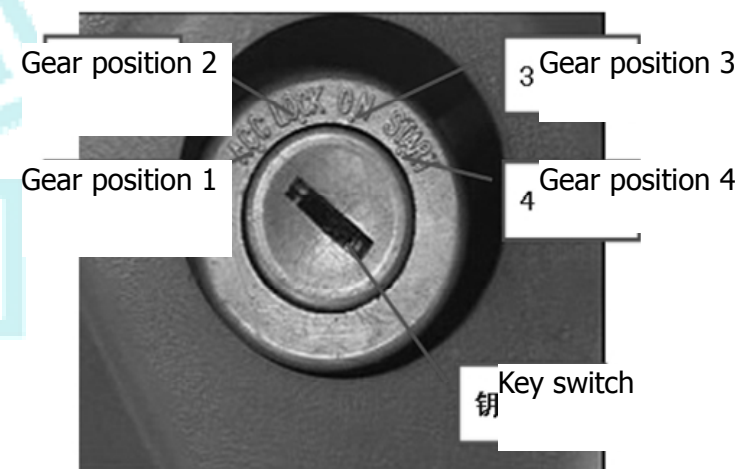
Key Switch

The key is on the steering column. Function of each position is shown as follows.

Position	Purpose	Remarks
1 (ACC)	Launch the facilities of parking	
2 (LOCK)	Power cut	Key may be removed
3 (ON)	Driving	
4 (START)	Start engine	Return to position 3 automatically



Key Switch



Working Positions of Key Switch

Unlock/Lock Vehicle Door with Key

Operation of Door



Warning:

Driving without door locked is forbidden!

Use the Door Lock from Outside

Open the door: When the door is not locked, pull down the handle to open the door; if the door is locked, insert the key and turn 180° anticlockwise, then pull the handle to open.

Lock the door: Insert the key and turn 180° clockwise, the door will be locked.



① Lock ② Unlock



① Locking handle
② Locking switch

Use the Door Lock from Inside

Open the door: Pull the handle (as ① shown in right picture) and push the door to open.

Lock the door: Press the lock switch (as ② shown in right picture), the door can not be opened from outside.

Manual Glass Lifter

Turn the handle clockwise or anticlockwise to lift or decline the glass of door.



Radio with USB Connection



Radio with USB Connection



Notice:

1. Adjust volume not to disturb your hearing others' horn.
2. To avoid short circuit, please connect cathode of battery after connecting the equipment.

Radio with USB Connection

Panel Instruction

- ① Power supply switch
- ②, ③ Channel search, USB playing chooser
- ④ SEL button, sound mode
- ⑤, ⑥, ⑦, ⑨, ⑩, ⑪ Settings
- ⑧ USB socket
- ⑫ DSP sound resource setting
- ⑬ AUX button
- ⑭ Reset
- ⑮ AST auto searching and saving
- ⑯ SRC USB/AUX shifting
- ⑰ BND change to FM/AM
- ⑱ LCD screen

Sound Adjustment

On/Off	Button 1
Volume	Button 1
Sound and EQ mode	Button 4



Notice:

Operate within 2 seconds after chosen the mode, or it will turn back to volume control.

Radio

BND, button 14, shift between FM and AM

Auto searching: Press button 2 or 3 till channel received. Press again for next searching.

Radio with USB Connection

Auto searching—pressing button 2 or 3 more than 2 seconds (at least two seconds) will shift to manual searching. Change one frequency point with one press, and it will change to short pressing mode with no operation during 3 seconds.

Auto channel saving (AST)—Button 15. Channels will be saved by setting button 1-6.

Settings buttons (1-6)—Turn to the wanted channel and press relevant setting button at least two seconds to save the channel.

USB Playing

Connection—Insert flash memory and press SRC 16 button to shift to USB mode.

File Type —Sound file is *.mp3; Storage type is FAT16 and FAT32 in segments; bit speed is 8—320kbps.

Quick choosing—Press one combination of 1-6 or any one of them quickly, it will play automatically after 3 seconds;

Shortly press any one of 1-6, for instance 2, it will play the second song; press channel button 2 or 3, you can choose previous or next song.



Notice:

Please remove the flash memory after turning off.

Tachograph(Model Number: VDO MTCO1324)

Tachograph is optional device for HOWO vehicles.

Main Technical Parameters:

Max. speed range: 125km/h;

Effective pulse range: 4000-25000imp/km.



Main Functions:

MTCO1324 tachograph can record the time of driving, rest, preparation, working, and different operation conditions, etc.

The fault code can also be stored by tachograph.

Vehicle speed will be recorded in ROM as system parameters after its signal has been processed by CMOS chip.

Operation and Displaying

• Contents on the panel includes:

Communication interface: located at left and upper of panel, and used to connect standardization device.

LCD: displays date, time, mileage, driver's information, initial configuration, fault code, and so on.

- Button 1, 2: press them to select driver.
- Button M: used to select information displayed and set.
- Button +, -: used to adjust time, date, page up and page down.
- Button $\triangle$: to open paper tray.
- Paper tray is under panel and includes two layers: the upper layer is used to place recorder paper for first driver, the lower layer is for the second driver.

Tachograph(Model Number: VDO MTC01324)

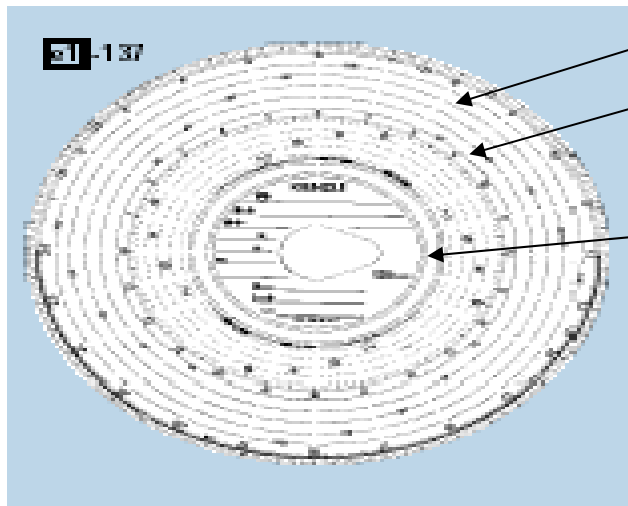
- The nameplate is pasted in paper tray.

User mode or servicing mode can be performed by operating the buttons on panel: press the button M shortly to enter user mode; press the button M while switching on the ignition key to enter servicing mode.

Press 'menu' button, the screen will show the average speed within 15 mins before parking, press upward and downward, you can check successively:

- | | |
|-----------------------------------|--|
| 1. Real Time and Speed | 2. Average Speed Within 15 Mins Before Parking |
| 3. Fatigue Driving Record | 4. Driver'S Code |
| 5. Driving License Number | 6. Excessive Alarm Speed |
| 7. Vehicle Character Coefficient | 8. Total Mileage And Trip Mileage |
| 9. Record Index and Parking Index | 10. Serial No. Of Tachograph and Software Version. |

Paper Recorder: record and print the information as vehicle speed, mileage, etc.



Time displaying area

Status displaying area: driving, rest, preparation, working

Vehicle speed curve displaying area: speed shown at radial direction, and time shown along circumference.

Mileage recorder area: mileage is recorded by curve. Once up or once down means 5km.

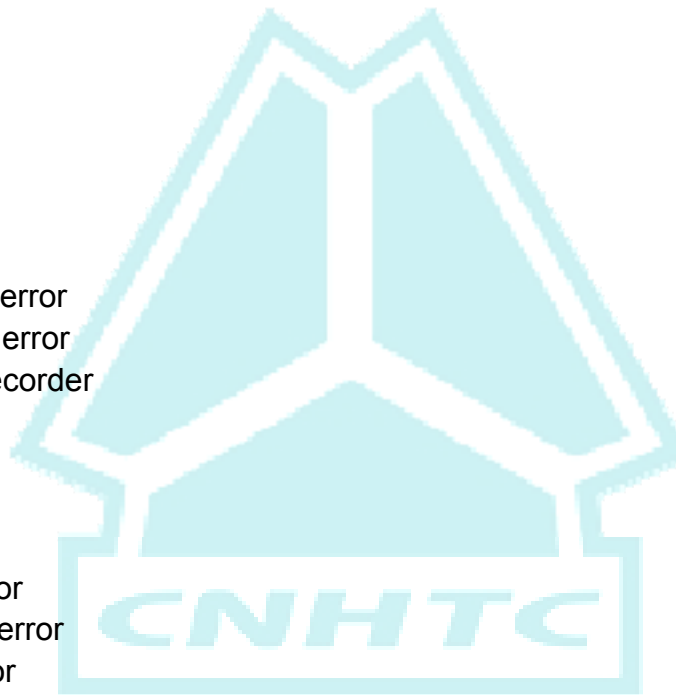
Tachograph(Model Number: VDO MTC01324)

Maintenance

Do not need additional maintenance except for daily cleaning. When faults occur, it is suggested to change the complete device or relevant parts. Use clean and soft cloth while cleaning the tachograph, at the same time, make sure no corrosive chemical can be used, and no water enter the interior of it.

Fault Codes and Fault Reasons:

Fault code	Fault reason
A00C	Inside error
A400	No power
A822	Sensor error
A423	Sensor communication error
A411	System communication error
A051	Driving without paper recorder
900B	CAN wire disconnected
900A	Other CAN errors
9430	Speed output error
9010	LCD error
9060	Paper tray function error
9061	Vehicle speed system error
9063	Paper tray bracket error
9064	Paper tray triggering error
900F	Button error
9051	Without first driver's paper recorder
9052	Without second driver's paper recorder
9053	Update setting of paper tray mechanism



Tachograph(Model Number: VDO MTC01324)

Printing

Park the vehicle, then press 'print' button to print data according to operation instruction shown on screen.



Notice:

- 1. No printing when driving.**
- 2. It always prints data of current driver and no recognition of drivers.**

Specification Settings

IC card is for recognizing drivers and position of tachograph.

Notes: when inserting the IC card, make the CMOS chip upward and quickly insert or remove.

Vehicle character coefficient settings: insert the IC card and the screen will show 'vehicle coefficient settings: 624', then press 'upward' and 'downward' to adjust the value. Remove the IC card when coming to the needed value and the settings will be saved. Excessive speed and time can be set as well in the time way.

Air Conditioner

1. Controller

1.1 Panel:

- ① Screen
- ② Wind power adjuster
- ③ Defrost wind directions
- ④ Air inlet mode select: circulatory selecting
- ⑤ Power off
- ⑥ Auto mode
- ⑦ Wind mode select:
Blowing head, foot, etc.
- ⑧ Cooling
- ⑨ Temperature settings: press "▲" ("▼")one time
to increasing (decrease) indoor temperature 1℃.

1.2 Information Shown on Screen

- ① Wind power
- ② Air inlet
- ③ Wind mode
- ④ Set temperature and real temperature
- ⑤ Blower operating mark
- ⑥ Cooling state(compressor operating)



Air Conditioner

2. Instruction

2.1 Set Needed Inside Temperature

Adjust the button to your needed indoor temperature with scope "LO, 18°C--29°C, HI". Set at "LO" to make cooler and "HI" to make warmer.

Notes: Normally 22°C~26°C is comfortable.

2.2 Wind Power Setting

Wind power can be adjusted manually or automatically according to temperature being set.



Notice:

There are nine (9) grades of wind power totally and it can be changed slowly while pressing the adjust button.

2.3 Night Vision Function

Turn on small lamp switch, the buttons' symbol can be shown with other symbols on instrument.

2.4 Wind Mode Selecting

Four (4) modes can be selected by wind mode button and defrost button.

Air Conditioner

2.5 Air inlet mode selecting

Inside and outside air inlet circulation mode can be selected by selecting button.

Inside circulation can be adopted within short time in following cases:

- In hot weather, quickly reduces temperature inside.
- In cold weather, quickly rises temperature inside.
- Bad air outside, for instance dusty or smelly.

3. Notice

3.1 Regularly maintain A/C.

3.2 Clean the panel with soft and dry cloth when it is dirty. Wet cloth and hard thing may cause damages to panel, buttons and screen.

3.3 Do not touch the screen with finger, hard or grease things, because they can cause the screen to display unclearly.

3.4 Refrigerant filling port is on compressor and pipe. Please contact technician of designated service station if the refrigerant is insufficient. When refrigerant is insufficient, white foam can be seen through the window on fluid reservoir; when refrigerant is sufficient, colorless liquid can be seen.

3.5 If defect occurs to the system, please contact with technician of designated service station.

Overvoltage Warning Device

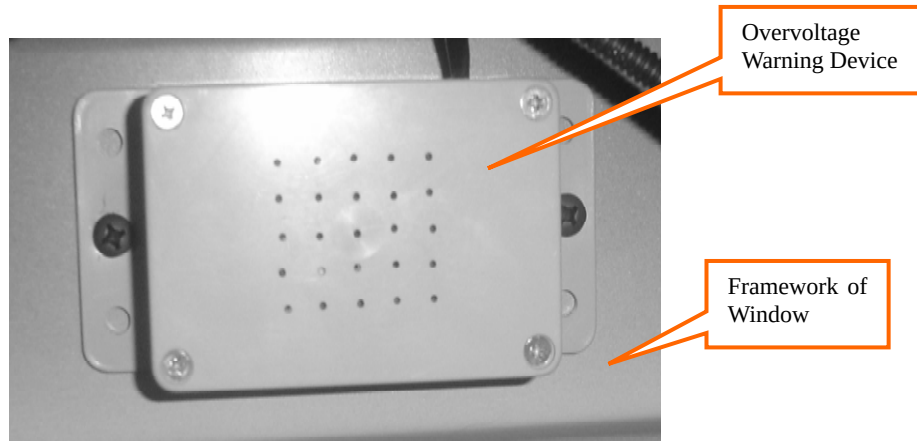


Figure : Overvoltage Warning Device

When system voltage is over $30.5 \pm 0.5V$, overvoltage warning device will utter voice instruction: "alternator voltage is higher, please lower the alternator speed and go to the service station to maintain as soon as possible". When system voltage is over $31.5 \pm 0.5V$, overvoltage warning device will utter voice instruction: engine voltage is highest, please disconnect the engine wire and go to the service station to maintain as quickly as possible.



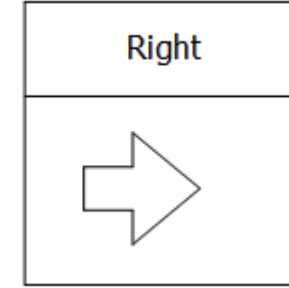
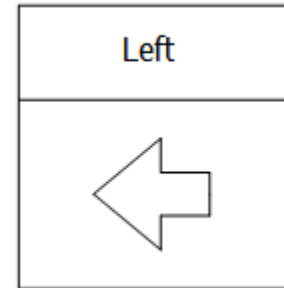
Steering Indicator and Alarm

1. Steering Indicator:



① Turn right

② Turn left

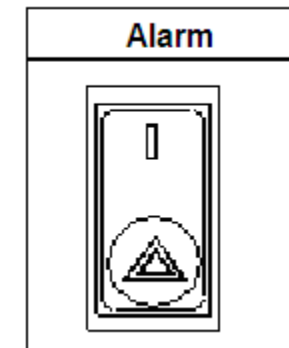


Notice:

When the steering lights on, the indicating lamp on the instrument panel will flash (indicators on trailers will also flash). If some bulb of indicating lamp is damaged, the flash of indicating lamp will be more frequent (frequent doubling); defect notice will be shown on information screen at the same time.

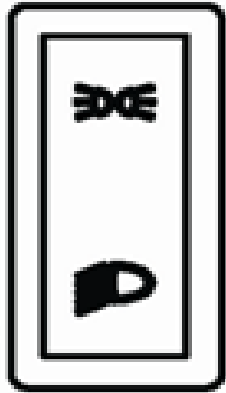
2. Alarm

Power on and press alarm switch, then all the steering indicators and indicating lamps will be on.

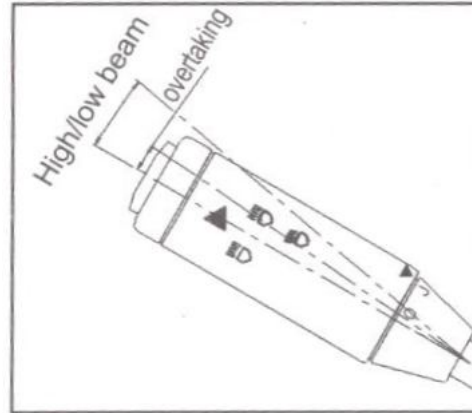


Head Lamp

Operation of Head Lamp:



Lamp Switch



Combination Switch Handle

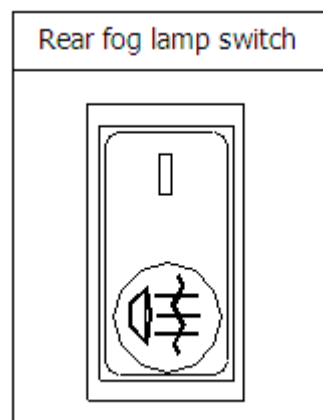
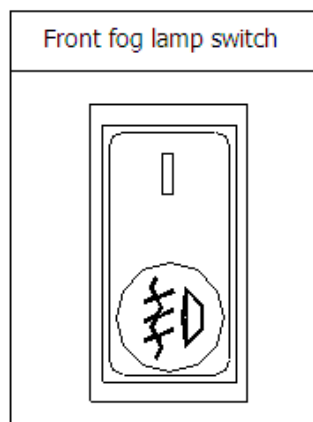


① Front lamp ② Assist high beam

While combination switch handle is at middle position, the key switch is at position 3 and lamp switch is at shift 2, the low or high beam will light on. Then lift the handle by 4°, both the low and high beam will light on. Lift the handle to 10 degree, the low or high beam will change to the other. The handle can reposition itself.

When overtaking/passing or meeting vehicles at day time, lift the handle by 4 degrees to turn on high beam, then the handle will reposition after your action.

Fog Lamp and Inside Lamp



① Front fog lamp



Notice:

Fog lamps can be operated only when the lamp switch is on.

1) Operation of front fog lamp

While lamp switch is at position 1, press front fog lamp switch, the front fog lamp will be on and corresponding indicator on the instrument panel will also be on.

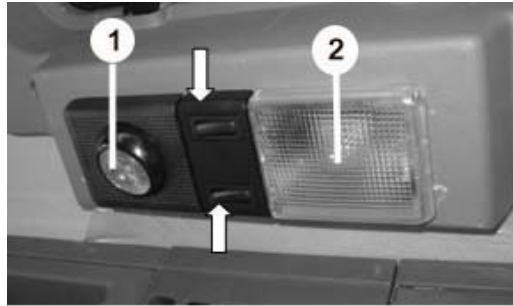
2) Operation of rear fog lamp

While lamp switch is at position 2 or the front fog lamp is on, press rear fog lamp switch, the rear fog lamp will be on and corresponding indicator on the instrument panel will also be on.

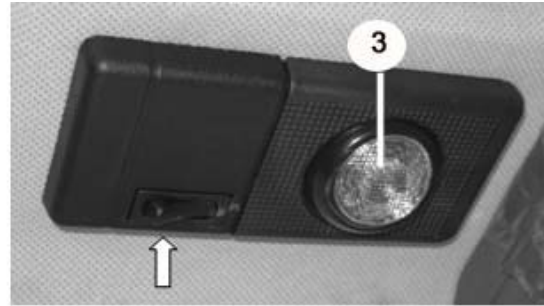
Fog Lamp and Inside Lamp

3. Inside Lamps

The inside lamps include reading lamp, illuminating lamp and sleeper lamp.



① Reading lamp ② Illuminating lamp



③ Inside lamp



Sleeper lamp

3.1 Turn on inside lamps

When the door opens, press left of inside lamp switch, the inside lamp system will automatically be on.

3.2 Continuous illuminating

Press right side of inside lamp switch, the illuminating lamp will be on continuously.

3.3 Turn off inside lamps

Turn the switch to the middle position, the inside lamps will be off.

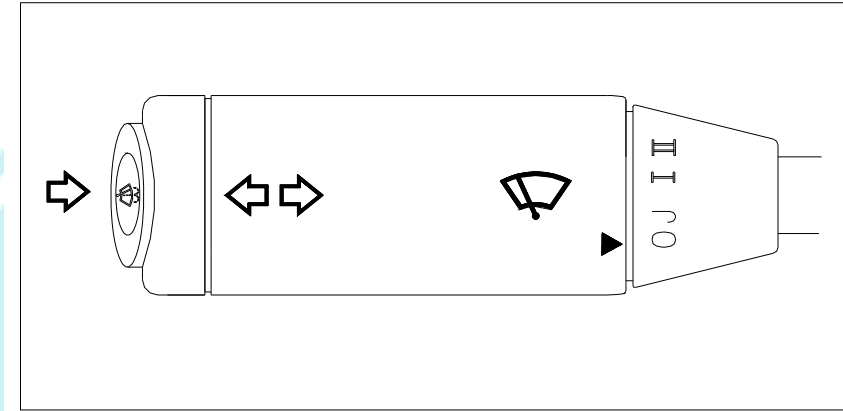
Inner Sun Visor



Inner sun visors are pulled down

While driving in strong sunlight, pulling down the inner sun visor to avoid the glare of sun and prevent accidents.

Windscreen Wiper and Cleaner



Operation of Wiper	
0	Off
J	Intermission
I	Low
II	High
Press	Windscreen cleaner

Operation of windscreen cleaner: press button at the direction of left arrowhead to start the windscreen cleaner, and turn the handle to "0" position to switch off. Different working mode and speed can be set when turn handle to "J", "I" and "II".

Rearview Mirror



Operation of rearview mirrors:

1. Ensure driver's seat has been adjusted at right position.
2. Check the view field of mirrors, adjust mirrors depending on drive conditions and environment.
3. Clean the surface of mirrors immediately if they are misty or dirty.

Horn Controlling



Horn Conversion Switch



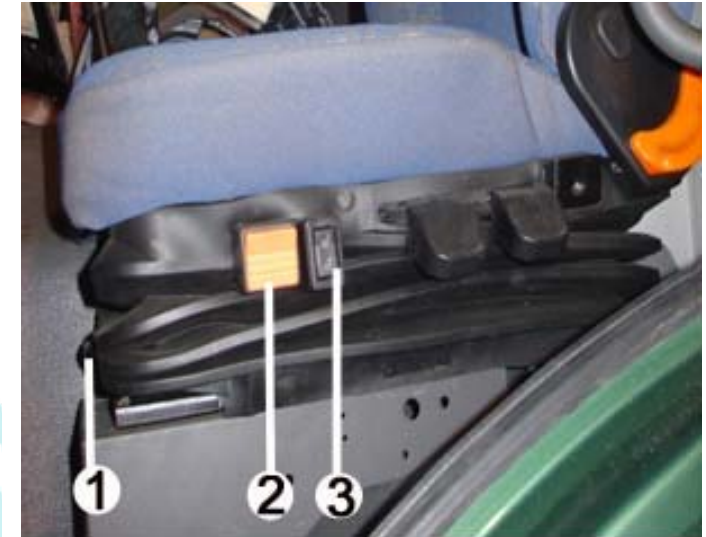
Horn Button

There two kinds of horn equipped on HOWO truck-electrical horn and electrical controlled air horn. The conversion between them can be realized by horn conversion switch. When operating the electrical controlled air horn, first turn on the horn conversion switch (rocker switch), then press horn button on steering wheel.

Seat

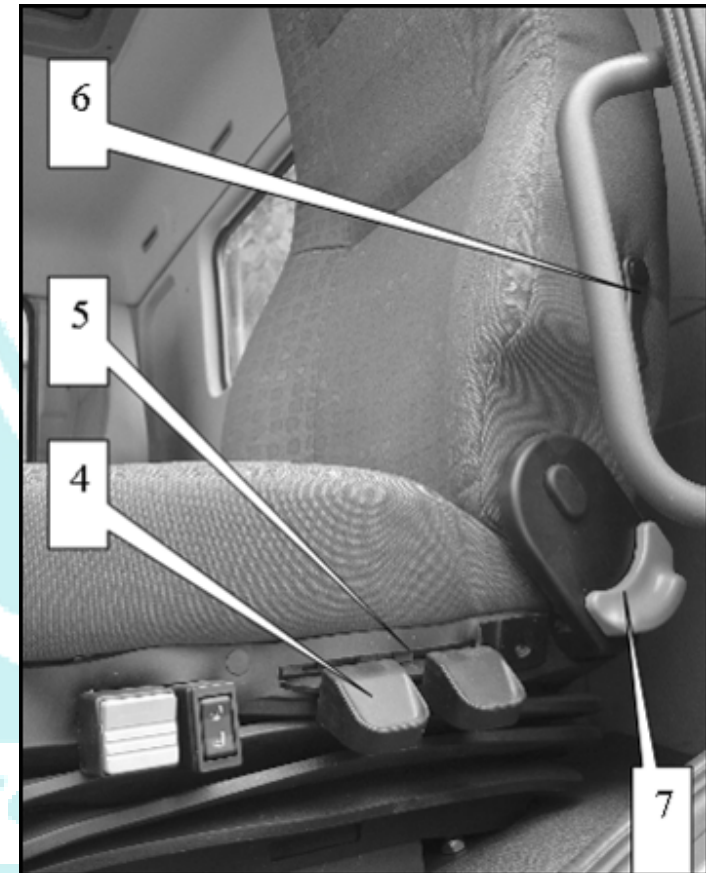
1. Instruction

- ① Forward and backward adjustment
Lift the handle and adjust the seat forward and backward to needed position, then release the handle to fix the seat.
- ② Waist support
Press lower end of controlling valve, air charging begins; press upper end of the valve, deflation begins.
- ③ Heating(optional)
Press upper end of switch, the temperature will rise up to the value set on; press lower end of switch, the temperature will be kept; press the middle to cut off.



Seat

- ④ Front height adjustment
Lightly lift the handle and force the front of seat upward or downward to adjust the front height of seat. Free the handle when the position is all right.
- ⑤ Rear height adjustment
Lightly lift the handle and force the rear of seat upward or downward to adjust the rear height of seat. Free the handle when the position is all right.
- ⑥ Adjusting handle for backrest
Turn the handle to adjust the backrest to right position.
- ⑦ Backrest elevation adjustment
Lift the handle to adjust the elevation of backrest to required degree, then release the handle to lock.

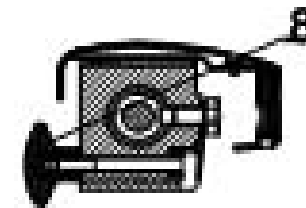
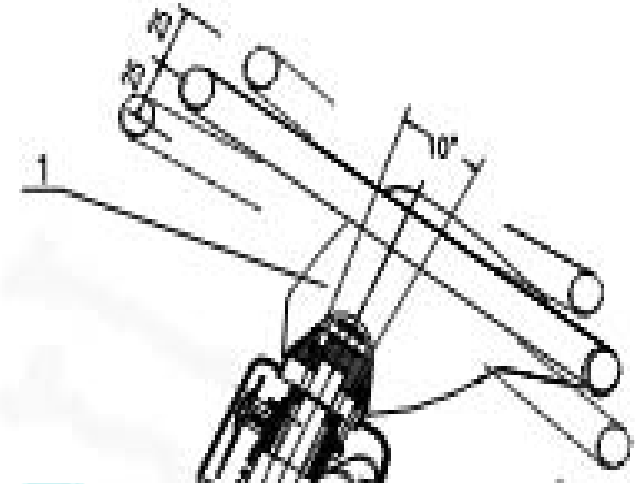
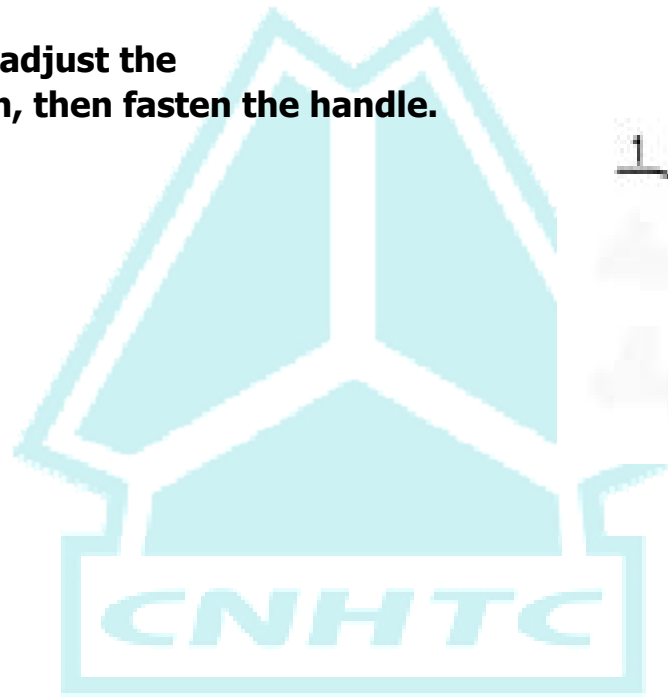


Adjusting Steering Wheel

The steering wheel is adjustable in the scope of ± 25 mm in height and $\pm 5^\circ$ in degree forward and backward.

Instruction:

Loosen the adjustment handle 8 and adjust the steering wheel to the needed position, then fasten the handle.



Sleeper

HW76 long cab and HW79 high roof cab have sleepers. For high roof cab, there are 2 sleepers and the upper one can be folded to any position. HW76 long cab has only one sleeper.



Ashtray

Pull the ashtray outside when need (open state shown in the following picture).

Ensure the cigarette butt is extinguished completely to avoid fire accident.



Cup Holder

Open and using states are shown in following pictures.



Tool Box

For long and high-roof cab, a tool box is set behind the left door (open state shown as picture below).



Cigar Lighter

Operation for cigar lighter:

Battery main power switch is on, key switch is at gear I or gear II.

Press the cigar lighter button until hear the sound of locked.

The cigar lighter will flick out while heating part become red.

The socket of cigar lighter can also applied as power supply for electric devices the power of which is not over 240W(24V/10A).



Cigar Lighter

Sundries Box

There are upper sundries boxes in cab to store some portable personal belongings such as clothing, books and so on.

For high-roof cab, one portable refrigerator can be equipped (for customer's option).



Refrigerator box(big one)



Sundries Boxes

Cigar Lighter



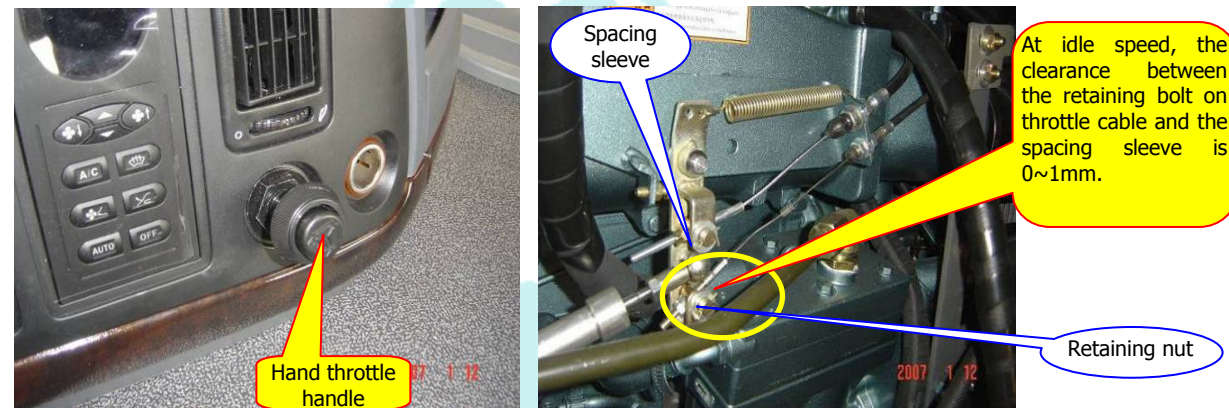
1. Hold the handle of cigar lighter while using it because the heated cigar lighter can cause scalding.
2. The cigar lighter should be taken from socket if there children in cab. They can get burnt themselves or cause fire accident when they play heated cigar lighter.
3. The cigar lighter can be used only under the conditions of traffic permitting and safety driving.



Hand Throttle

Operation instruction of hand throttle (for Euro2 tractor)

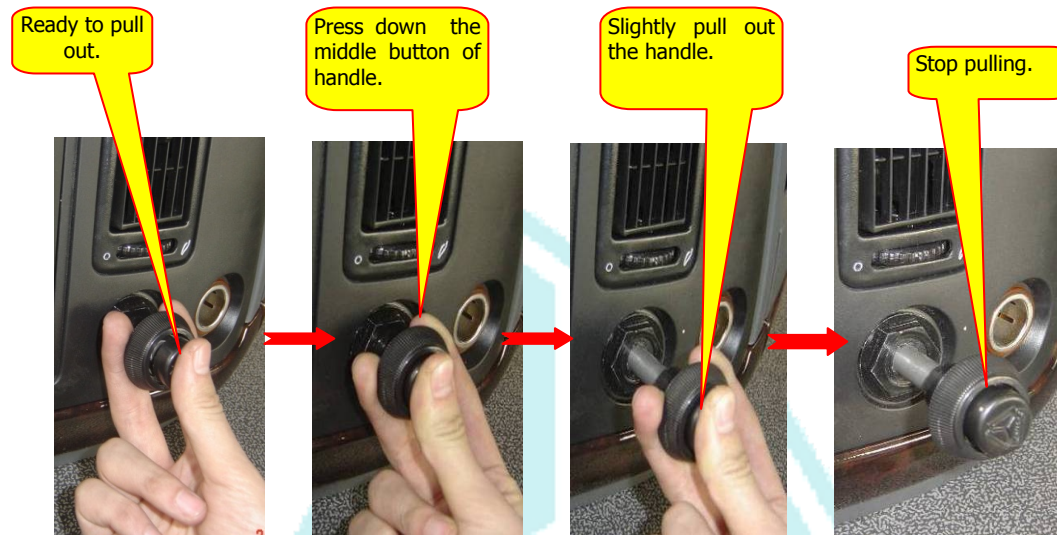
The hand throttle is set on the switch panel of cabin. During driving after starting vehicle, keep the hand throttle at one position and make vehicle drive smoothly. It is unnecessary for the driver to always keep foot on accelerator pedal, thereby alleviating the driver's fatigue.



Operation of hand throttle:

1. Step the accelerator pedal to a position for appropriate rotating speed of engine, pull out the throttle handle slowly while pressing the middle button until the resistance is suddenly increased, then stop pulling.
2. Rotating speed of engine can be slightly adjusted by turning the end cover of hand throttle handle (rotating speed of engine will increase when turning cover anticlockwise, otherwise speed will slow down);
3. When shifting gear, the throttle should be reset at original position

Hand Throttle



Notice:

1. At idle speed, the clearance between the retaining nut on throttle cable and the spacing sleeve is 0~1mm.
2. On parking state, the engine rotation controlled by the hand throttle is required to be at 2150~2200r/min as appropriate.
3. To avoid the cable break, it is inappropriate to continuously increase the rotation on high rotating speed range.



Warning: In case of emergency, the hand throttle must be reset on initial position immediately.

The distance of running-in is 2000~4000km. Check the vehicle before running-in, and make sure the vehicle be in normal working conditions.

New Vehicle Running-in

Running-in notice:

1. After the engine being started, do not accelerate immediately; increase the engine speed slowly only when reaching normal using temperature.
2. During running-in period, drive the vehicle on flat road. Load for vehicle should be 50-80 percent of rating load, at the same time, vehicle speed should not exceed 80 percent of maximum speed.
3. Shift gear timely, make the clutch be smoothly engaged, and avoid to sudden accelerate or brake.
4. Shift into low-gear before uphill; do not let the engine work at a very low speed.
5. Do not drive the new vehicle at high speed when full-loaded. Pay attention to every indicating signal and warning light!
6. Examine and control the normal temperature of cooling fluid and oil pressure. Pay attention to the temperature of gearbox, wheel-hubs and brake drums of front and rear axle. If serious overheated occurs, find the reason and adjust or repair the fault part immediately.
7. After the first 50 km running or after changing wheels, tighten the wheel nuts according to set torque.

After running-in, check and maintain the vehicle according to the contents of maintenance requirements 'First time check' item of "Maintenance tasks" in Section 2.

Preparation before Driving



Make sure the vehicle be in normal conditions and no defect before driving!

Preparation includes: duty check before driving, ignition and flameout of engine.

Duty Check before Driving

1. Turn on the main electrical power switch to electrify power supply of vehicle.
2. Check electrical system (system check automatically)
Please refer to content 6.7 of 'electric instruments and controlling system'?????????
3. Check coolant level. Fill the specified coolant to scale if it is insufficient.



Under Mounted Expansion Tank



Open Front Cover



Rear Mounted Expansion Tank

Preparation before Driving



Notice: 1. For expansion mounted under cab, tilt the cab to check coolant level or fill coolant.

2. Open the front cover of radiator before tilting the cab.

3. For rear-mounted expansion tank (optional, fixed behind of cab), don't need tilt cab and can inspect the coolant level or fill coolant directly.

Relief valve on expansion can raise boiling point of coolant by keeping inner higher pressure than atmospheric pressure outside. It is not permitted to change or damage the valve at random. It is especially important in tableland area.

When the temperature of engine is still high, fill the coolant by two steps: first, release high pressure slowly from the filling port; second, open the filling port cover, and fill coolant during idle speed.



Warning:

Filling coolant in high engine temperature is forbidden!

3.1 Check fuel quantity

Turn on the key switch to check fuel level through fuel gauge on instrument.
If it shows incorrectly, please check fuel gauge and sensor.



① Engine oil filling opening



② Oil dipstick

3.2 Check engine oil

Park the truck on horizontal road. After the engine cools down, pull out oil dipstick, the level should be between upper and lower scales (about 3L). Fill specified engine oil complying with the stipulated filling quantity if it is insufficient.

Preparation before Driving

3.3 Fill windscreen cleaning liquid

The filling opening of cleaning liquid is at the second left foot step of cab. After removing the lid, pull out the opening and fill liquid.



① Lid of filling opening



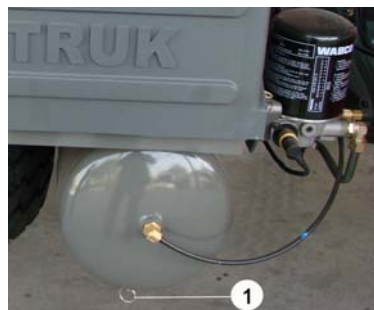
② Filling opening



③ Pull out filling opening

4. Check and drain the water in brake air reservoir

When the vehicle is parked, pull or push the drain valve ① to drain water from air reservoir. If the water mixed with oil, it means the air dryer is invalid. It is necessary to change a new one at once.



Drainage valve



Air dryer

Preparation before Driving

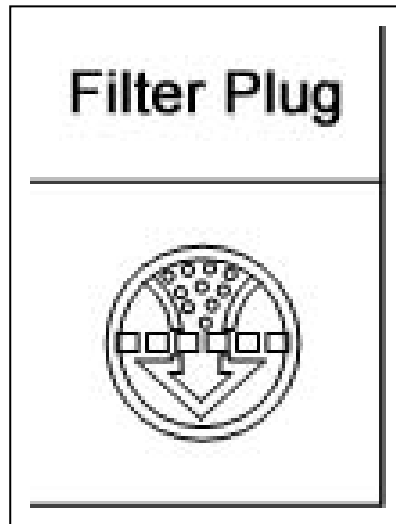
5. Check air pressure of tyres.

Tyres can be inflated through the check connector on air reservoir in an emergency.

6. Check leakage of lubricant, coolant and air.

7. Check air filter.

In winter or dusty condition, the dust bags should be emptied and cleaned everyday. If dust bags are broken or lost, change them immediately, or it might cause early damage to engine and turbo-charger.



① Dust bag

Signal lamp on instrument will be on if the air filter is blocked. Air filter core must be changed if blocking warning signal lamp is on.

Preparation before Diving

8. Check if the cab is locked

 **Warning: Cab must be locked during driving.**

Indicating lamp will be on if the cab is not locked. Then you must stop the vehicle and lock the cab at once.



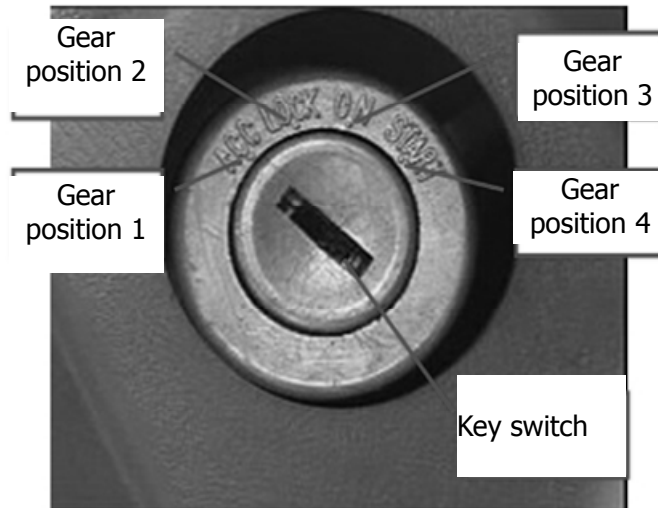
After the cab is locked, check if the cab lifting cylinder is in right position by watching whether the piston rod is in initial position or not. If not, you should adjust it, or the cab may be damaged.

Make sure that no person or other obstacles near the vehicle before starting it.

Start the Engine

Start the engine

1. Turn on the main power switch and turn the key to position 4 (STRAT), the engine will be started.



Notice: When driving, do not turn off the key switch. The key should be at position 3 (ON) when driving.

Start the Engine

2. Starting

Engage hand brake and shift into neutral gear and turn the key to start engine. After the alternator is started, the charging indicator lamp will be off.



Notice: 1) If failed to start engine at the first time, turn the key to position 2 and start again.
2) Every start should be least than 15 seconds and at least 30 seconds interval between two times of starting.

3. Check engine oil pressure

After engine is started, watch the engine oil pressure value. The signal lamp on instrument for oil pressure should be off if the oil pressure is normal.



Notice: The engine should never work with high speed while it is cold! Check and repair the vehicle immediately if no oil pressure value is shown on instrument after starting the engine.

4. Turbo-charger

There different places of turbo-charger for different series engines. For WD615 series engine (Euro2), the turbo-charger is at top-back of the engine. For D12 series engine (Euro2 and Euro3), the turbo-charger is at right middle of engine. For D10 series engine (Euro3), the turbo-charger is at left middle of engine. Turbo-charger is composed of turbo parts and pump wheel parts. The exhaust gas goes into the turbocharger and makes the pump wheel rotate with high speed, then press the compressed air into the air inlet pipe of the engine to enlarge air pressure and enhance the engine power

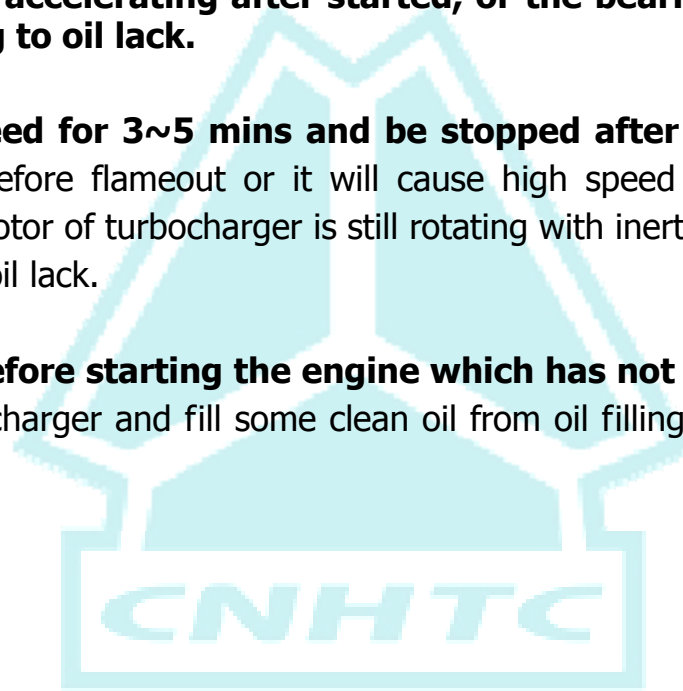
The rotor of turbo-charger has very high speed (80000~105000 rpm). The rotor bearing is lubricated by enforcement and the lubricant oil is supplied through main oil pipeline of engine. Lubricant oil supply will stop with flameout of engine.

Start the Engine



Notice:

- 1) Before oil pressure and temperature is normal (especially in cold weather), the engine should work in idle speed for 3~5 mins without hard accelerating after started, or the bearing and sealing ring of turbo-charger will be damaged in advance owing to oil lack.
- 2) The engine should run in idle speed for 3~5 mins and be stopped after the rotation speed of turbo-charger goes down. No hard accelerating before flameout or it will cause high speed of turbocharger. The oil pump will stop immediately after flameout while the rotor of turbocharger is still rotating with inertia, the rotor axis, bearing and sealing ring will be damaged in advance owing to oil lack.
- 3) Pre-lubricate the turbo-charger before starting the engine which has not been started for a long time. You may remove the oil inlet pipe of the turbo-charger and fill some clean oil from oil filling opening to avoid the turbo-charger from being damaged.



Turn Off the Engine

Flameout

Turn the key to 'LOCK' position (position2) and the engine will stop, then turn off the main power switch and remove the key from key switch.



Main Power Switch



Warning: After working with heavy load, the engine should stop after running at idle speed for 3~5 minutes.

Start and Turn Off Engine Outside Cab (Optional)

 **Be careful and don't get injured**

When the cab is tilted and the engine is at working status, do not get close or touch the parts moving or with high temperature on engine, such as exhaust manifold, driving belt, fan, etc.

 **Special tips:** If the transmission is engaged (rather than at "Neutral"), starting button ① can not be activated.

Operation methods:

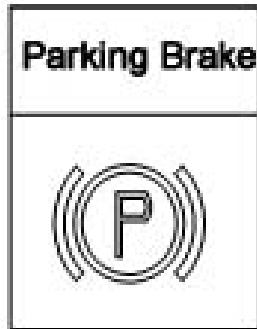
- After tilting the cab, two buttons will be found as following:
 - ① Starting button (green)
 - ② Shutting down button (red)
- Starting the engine: Press and hold the button ① until the engine is started.
- Shutting down engine: Press the shutting down button ② and the engine flameout will be performed.
- Meanwhile, press and hold the starting button ① and shutting down button ②, the starter will turn the engine, but the engine won't be started.



Parking Brake

Hand Brake Valve (Parking brake of energy-storing with spring)

The hand brake valve is at right side of instrument panel. (⑤ in picture is at 'brake' position).
Only when the hand brake signal lamp is off and the air pressure is over 0.55 MPa (5.5 bar), the hand brake can be released completely, then the vehicle can start.



⑤ Hand brake valve ⑥ Trailer hand brake valve



Specification: Trailer hand brake valve is located on dashboard of tractors. The trailer hand brake valve will reposition automatically and can not be used for parking brake.

Parking Brake



Warning: Do not drive the vehicle before the signal lamp is off!

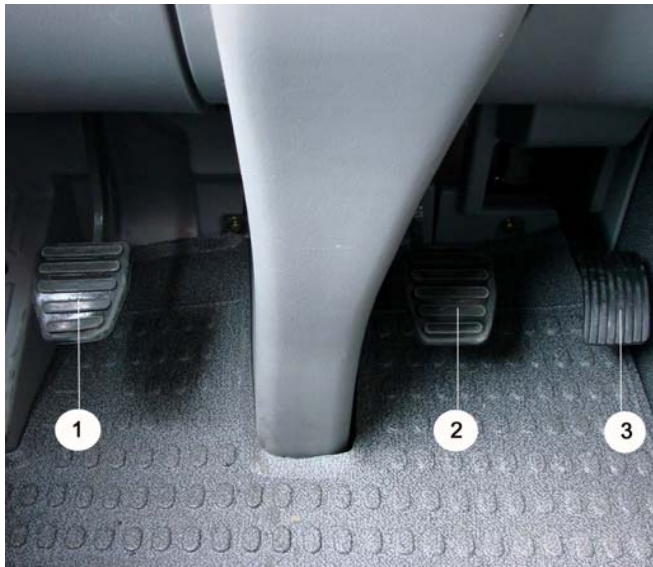
After the signal lamp is off, air-assisting systems (clutch, shifting and so on) can be operated. Only when the air pressure in air reservoir is more than 0.7MPa (7 bar), the brake system can reach standard performance and the vehicle can be suitable for driving.



Starting and Shift

Starting

After starting the engine, the vehicle can still not be driven if low air pressure warning lamp and alarm is on. After the air pressure reaches 0.55MPa (5.5 bar) and warning lamp or alarm is off, release the hand brake to drive the vehicle.



- ① Clutch pedal
- ② Service Brake pedal
- ③ Accelerating pedal

Start and Shift

Gears and Operation of Gearbox

1. Shifting System

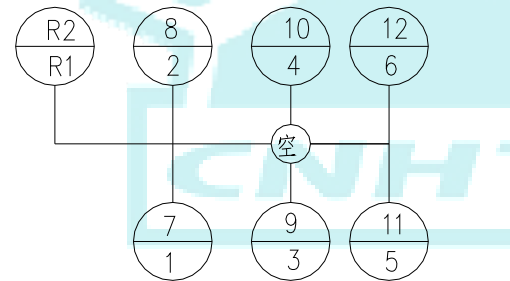
Pic.1 and pic.2 show gears arrangement for different types of gearbox and shifting handle. The picture A shows gears arrangement for transmission with 10 gears, such as HW13710, HW15710, HW19710 and HW19710T series. When the preselective valve switch on shifting handle is at L, 1st, 2nd, 3rd, 4th, 5th and R1 gears are available, when the switch is at H, 6th, 7th, 8th, 9th, 10th and R2 gears are available.

The picture B shows gears arrangement for transmission with 12 gears, such as HW19712 series. When the preselective valve switch on shifting handle is at L, 1st, 2nd, 3rd, 4th, 5th, 6th and R1 gears are available, when the switch is at H, 7th, 8th, 9th, 10th, 11th, 12th and R2 gears are available.

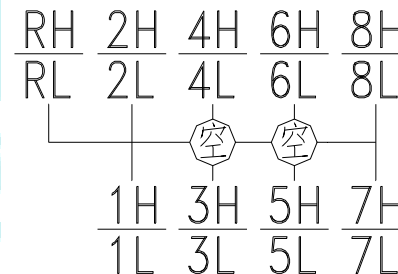
The picture C shows gears arrangement for transmission with 16 gears, such as HW20716 series. When the preselective valve switch on shifting handle is at L, 1L, 2L, 3L, 4L, 5L, 6L, 7L, 8L and RL gears are available, when the switch is at H, 1H, 2H, 3H, 4H, 5H, 6H, 7H, 8H and RH gears are available.



A

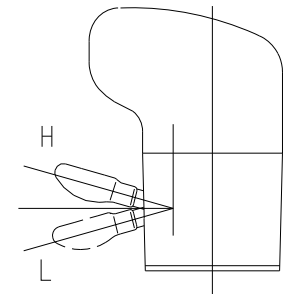


B



C

Pic.1 Gears Arrangement



Pic.2 Shifting handle

Start and Shift

2. Air control system

Remote operation system is equipped for all of HW series transmissions, which have two kinds of structure-single lever controlling and double lever controlling. Manual operation is for main box and air control for auxiliary box. The air resource is compressed air of 0.7-0.8MPa supplied by the vehicle.

Attention: Only when transmission is in neutral position, can the conversion operation of high and low gear on shift handle work.

3. Start operation

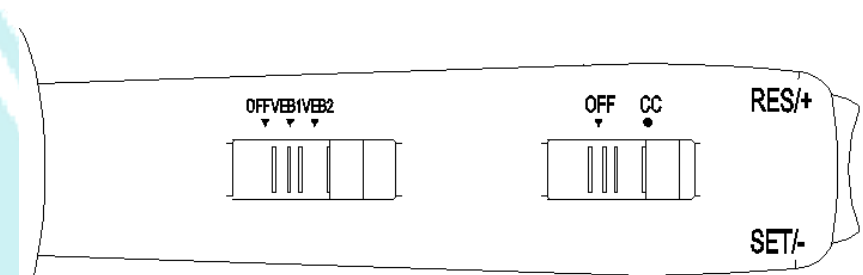
To drive vehicle smoothly, turn the preselective valve switch to L and shift to 1st or 2nd gear to drive forward or R1 to reverse.



Cruise Driving and EVB Control(for Euro3 vehicle)

Operation of Cruise Combination Switch

Functions: cruise and exhaust brake.



1. Cruise

There are 3 cruise switches: CC, RES/+ and SET/-:

'CC' is the main cruise switch and can reset automatically. Switch on and enter cruise function. Now the symbol of CC on instrument will flash by frequency of 1.5HZ (90times per minute). The drive speed may be change by stepping the accelerator pedal. When vehicle reaches expected speed, release the accelerator pedal and press the SET/- button to enter cruise mode, and then the symbol "CC" on LCD of instrument keeps being on all the while.

During cruise driving, stepping brake or clutch pedal will cancel cruise mode and the symbol of CC flashes again by frequency of 1.5HZ (90times per minute). Press RES/+ to exit temporarily and re-enter cruise mode.

Cruise Driving and EVB Control(for Euro3 vehicle)

There are two ways for increasing the target speed: press the SET/+ button after reaching the new targeted speed or repeats the operation of pressing RES/+ (1km/h will be increased by one press).

There are also two ways available for decreasing the target speed: step brake pedal slightly and press the SET/- button after reaching the new targeted speed or repeats the operation of pressing RES/-(1km/h will be decreased by one press).



Cautions:

- 1) The cruise mode is available within speed range of 10km/h-120km/h, otherwise it will be cancelled automatically.
- 2) Duration of pressing RES/+ and SET/- button should not exceed 559 ms, otherwise the engine error number 26 and 43 will occur. Error number 43 only can be eliminated after the engine being shut down; Error number 26 can be eliminated by releasing the button.
- 3) When engine failure occurs, the vehicle will automatically exit from cruise mode.

2. Operation of Engine Exhaust Valve Brake(only for Euro3)

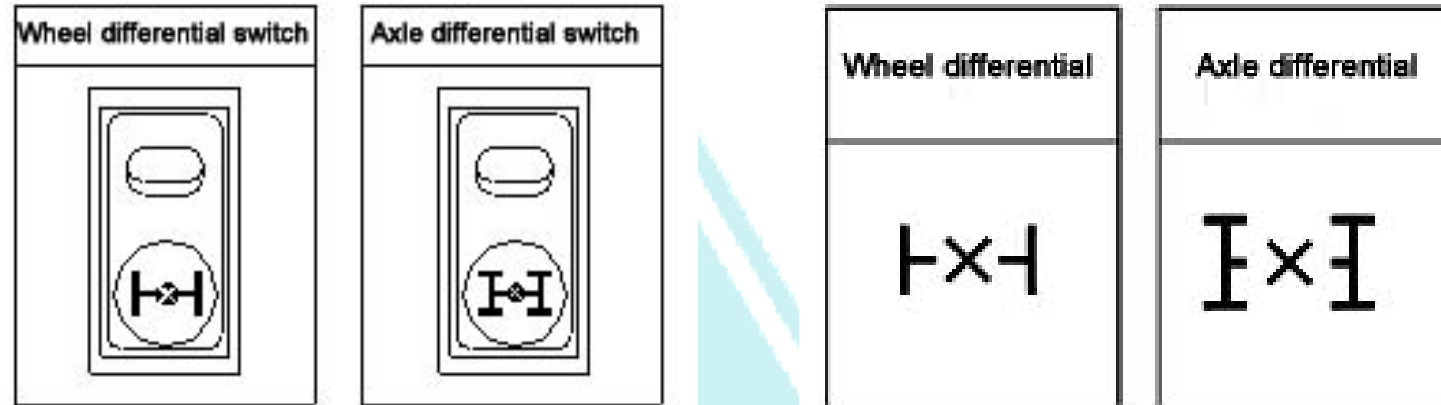
Engine exhaust valve brake (EVB) can help vehicle to gain better braking performance through operating the VEB1 and VEB2 switch on cruise combination switch. Push the cruise switch to VEB1 or VEB2 to operate exhaust brake by applying engine's power.

3. Operation conditions for Exhaust Valve Brake of Euro3 common rail Engine

Release the clutch and accelerator pedal, don't shift in neutral gear, and engine revolving speed is more than 1050rpm.

Differential Lock Operation

Operation of Diff-lock



The driving axles are equipped with differential locks, which include inter-wheel differential lock and inter-axle differential lock. There is only inter-wheel differential lock for single driving axle. When the wheels are sliding or getting bogged in mud, to use the diff-lock can gain more trafficability.



Notice:

No inter-wheel diff-lock for HW series single reduction driving axle.

1. Operation for single driving axle vehicle

Differential Lock Operation

2. Operation for Inter-wheel Diff-lock of Single Driving Axle(4×2 and 6×2 vehicles)



Warning: Inter-wheel diff-lock can only be used when vehicle is going straightly.

1.1 Engage: only when the vehicle is in halted state or driven in straight line under low speed (equivalent to walking speed), can the inter-wheel differential lock be engaged.

Press the rocker switch for inter-wheel diff-lock and the indicating lamp will be on after inter-wheel diff-lock being engaged.



Warning: During driving, release the clutch before engaging!

1.2 Release: stop accelerating and release the clutch, then press top of the rocker switch. The indicating lamp will be off after the lock is released.

2. Operation for Differential Lock of Tandem Driving Axles (6×4, 6×6 and 8×4 Vehicles)

Operation Principle: First engage inter-axle diff-lock, then for inter wheel diff-lock.

2.1 Inter-axle diff-lock: Inter-axle diff-lock is for locking the differential between the first and second rear driving axles.

2.1.1 Engage: Only when the vehicle is halted state or driven straightly under low speed (equivalent to walking speed), can the inter-axle differential lock be engaged.

Press the rocker switch for inter-axle diff-lock and the indicating lamp will be on after the diff-lock being engaged.



Warning: During driving, release the clutch before engaging!

2.1.2 Release: Stop accelerating and release the clutch, then press top of the rocker switch. The indicating lamp will be off After the inter-axle diff-lock is released.

Differential Lock Control

2.2 Inter-wheel diff-lock

Operation for inter-wheel diff-lock of the tandem rear driving axles is same as the single driving axle in Item 1.

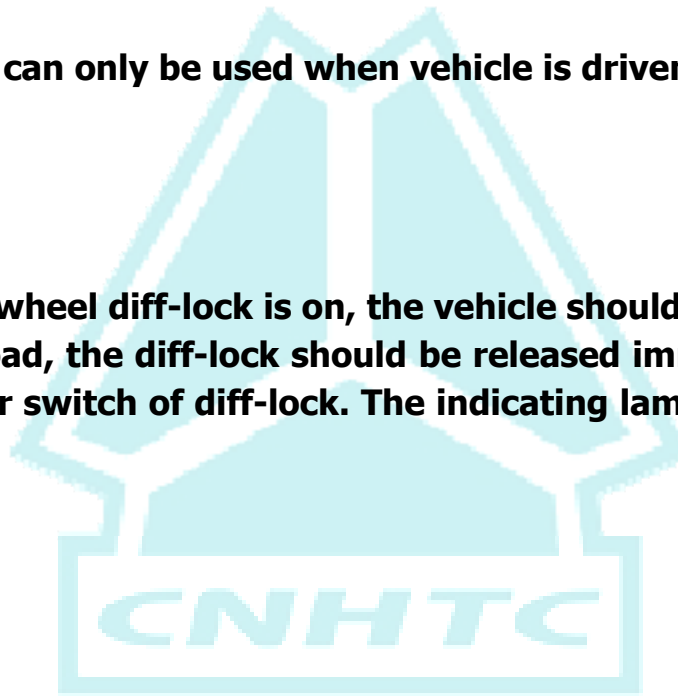


Warning: Inter-wheel diff-lock can only be used when vehicle is driven in straight line.



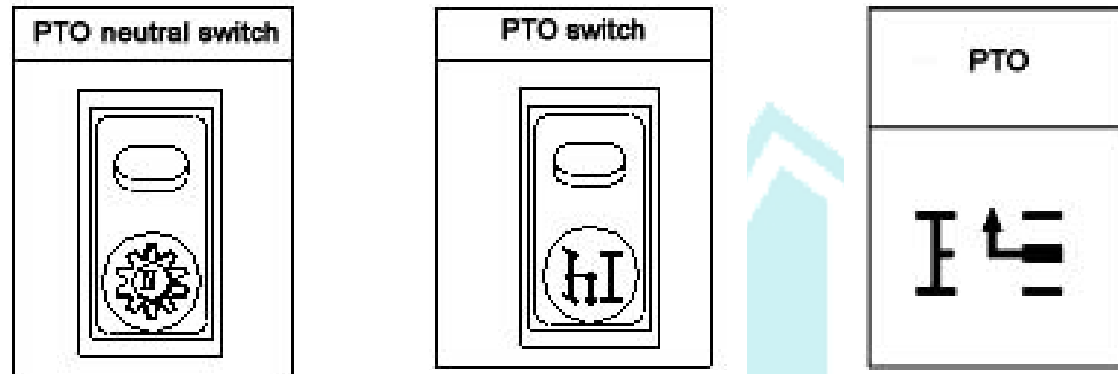
Caution:

- 1. When the indicating lamp of inter-wheel diff-lock is on, the vehicle should not turn or drive in high speed.**
- 2. After getting through the rough road, the diff-lock should be released immediately. Stop accelerating, release the clutch and reposition the rocker switch of diff-lock. The indicating lamp will be off after the diff-lock will is released .**



PTO Control

Operation of PTO (Take PTO rear mounted on gearbox for instance)



Caution: PTO can only be used when transmission shifted into low gears.

1. Engage for PTO:

Release the clutch and press the PTO switch, the indicating lamp on instrument panel will be on, then shift gear and engage the clutch. The PTO works only when the gear is engaged.

2. Release for PTO:

Release the clutch and press the PTO switch, engage the clutch after 3 seconds around and PTO will be released. The indicating lamp on instrument panel will be off.

3. Operation for PTO neutral switch

The PTO neutral switch is a shifting-locking device for transmission, to prevent the vehicle from running after PTO is engaged. The vehicle can not be driven when the PTO is working.

PTO Control

3.1 Use of PTO neutral switch

PTO should be used during the vehicle is parking by applying PTO neutral switch.



Warning: Shift transmission into low gears firstly before using PTO!

- Shift transmission into low gears and press PTO switch.
- Press PTO neutral switch, compressed air will force the gear of transmission to neutral (there is no output from sub box of transmission at this moment, but the main box is able to be shifted), the vehicle will be in halted state. In the meanwhile, the indicating lamp on instrument panel will be on. Engage the PTO and power will be outputed.

3.2 Release PTO neutral switch

- Shift transmission to neutral gear and press top of PTO switch, PTO will be released. The indicating lamp on instrument panel will be off at the same time.



Warning: Shift transmission into neutral before releasing PTO!

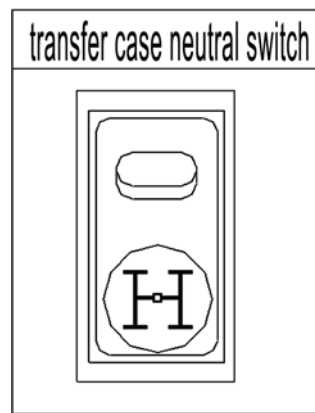
Operation for Transfer Case (for all-wheel drive vehicle)

The transfer box has high and low gear. When the rocker switch is off, the high gear of transfer case will be engaged. The low gear of transfer case can only be engaged when the vehicle stands still or runs at a walking speed.

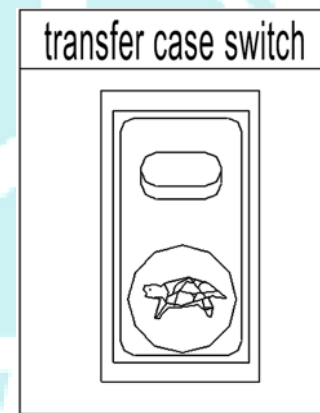


Notice: Before getting into the low gear of transfer case, the clutch must be disengaged first and then couple transfer case with the front axle (that is, press the all-wheel driving switch).

1. Transfer case switch operation



Transfer case neutral switch



Transfer case switch

1.1 Turn on the switch:

Press transfer case switch, then electrical control air operating system can switch on the transfer case, and the indicator on instrument panel will light.

1.2 Turn off the switch:

Press the upper end of transfer case switch, and the indicator on instrument panel will go out.

Operation for Transfer Case (for all-wheel drive vehicle)

2. Transfer case neutral switch operation

Transfer case neutral switch is a gearshifting lock device of transfer case to stop vehicle and apply PTO of transfer case.

2.1 Turn on the switch



Warning: The transmission must be engaged into low range gears when using transfer case neutral switch!

2.1.1 Engage transmission into low range gears.

2.1.2 Press transfer case neutral switch, the transfer case will be engaged into neutral position by compressed air to make the vehicle stop running. In the meantime, the indicator on instrument panel will light.

2.1.3 Then press PTO switch, engage the PTO and get power output.

2.2 Turn off the switch

Engage transmission into neutral gear. Press the upper end of transfer case neutral switch, the indicator on instrument panel will go out.



Warning: Before the switch is turned off, the gearshift lever must be put into neutral position!

Operation for All-Wheel Driving

Turn on the switch: press the all-wheel drive switch, electrical control air operating system can switch on transfer case with the front drive axle, and at the same time the indicator on instrument panel will light.

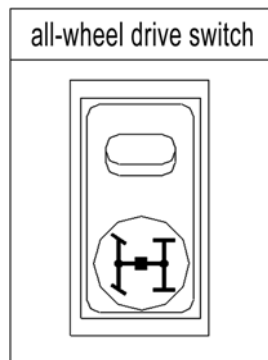
Turn off the switch: press the upper end of the all-wheel drive switch, the indicator on instrument panel will go out.



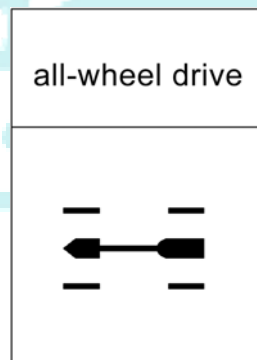
Notice: The front driving axle can also be engaged when the vehicle is running, but the clutch must be disengaged or the vehicle must run at low speed before the engagement.

All-wheel driving is only useful in the following situations:

- ① When traveling on cross-country road;
- ② While driving on slippery or icy road;
- ③ While driving along steep gradients uphill or downhill. Except for this, driving with all-wheel drive should be avoided on firm ground with good adhesion ability for tyre.



All-wheel drive switch



All-wheel drive

Operation in Winter

Cooling system

The anti-freeze and anti-corrosion coolant liquid applied by the coolant system can be prevented from freezing above -35°C . If the truck runs under the conditions of temperature being lower than -35°C , the coolant concentration may be appropriately increased.

Attention: It is not allowed to use the coolant combined with different types or brands of products.

The coolant system should be thoroughly cleaned up before replacing coolant of different types or brands.

Brake system

The water condensed in the air reservoir should be drained in time to prevent from freezing. Be careful to check the performance of air dryer.

Under normal conditions, the service life of drying agent is two years. If there is dirty water drained from the air reservoir, it shows that the drying agent is out of operation and must be replaced immediately.

Battery

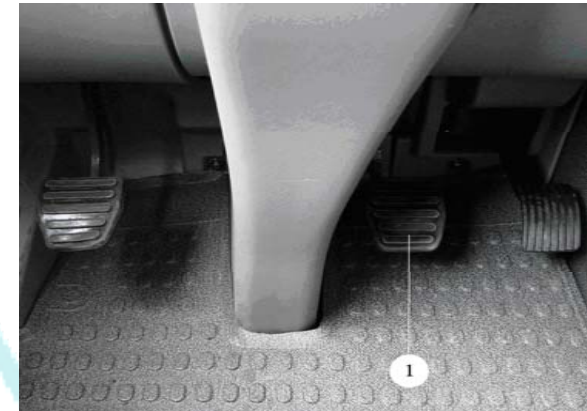
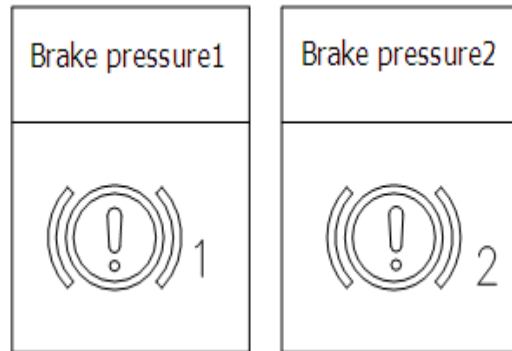
The level and specific gravity of battery electrolytic are to be checked monthly. The level should be 10-15mm higher than the electrode plate, the specific gravity is above $1.24\text{g}/\text{cm}^3$. If vehicle will be out of service and stored under very low temperature for a long time, it is suggested to take out the battery from vehicle and store it in a warm room.

Every 500km driving, check if the clamp between battery terminal and conducting wire is loose, and the performance of battery is normal. Replace them immediately once fault occurs.

Service Brake

There are four brake devices for brake system: Service brake (Foot brake), Auxiliary brake (Engine exhaust brake, exhaust valve brake or both installed), emergency brake and parking brake (Hand brake) and trailer brake (for tractor truck).

1. Service Brake



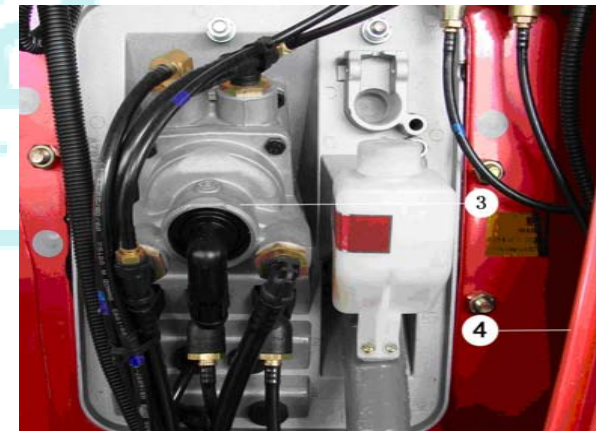
1. Service brake pedal



2-1. Exhaust brake switch(Euro 3)



2-2. Rocker switch for exhaust brake(Euro2)



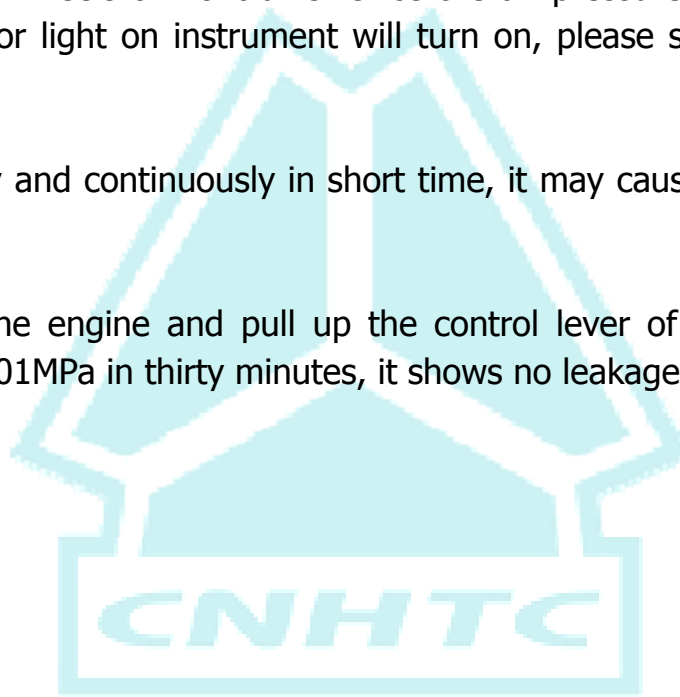
3. Service brake valve 4. Front wall of cab

Service Brake

Pedal controlling, dual circuit compressed air brake, the working pressure is 0.75 MPa(7.5Bar) and the cutting pressure of pressure regulating valve is 0.85 MPa (8.5Bar). The first circuit works on the wheels of rear driving axle or rear tandem driving axle; and the second circuit works on the wheels of front axle. Once the air pressure of one air reservoir in the two circuits is lower than 0.55MPa, the pressure indicator light on instrument will turn on, please stop the vehicle immediately and find the reason of pressure leakage.

Do the full application of brake repeatedly and continuously in short time, it may cause air pressure to be lower than 0.55 MPa (5.5 Bar).

Examination of pressure leakage: Stop the engine and pull up the control lever of hand brake, if the air pressure reduces 0.05MPa at most in 2 hours, or reduces 0.01MPa in thirty minutes, it shows no leakage occurs in air pipes.



Auxiliary Brake

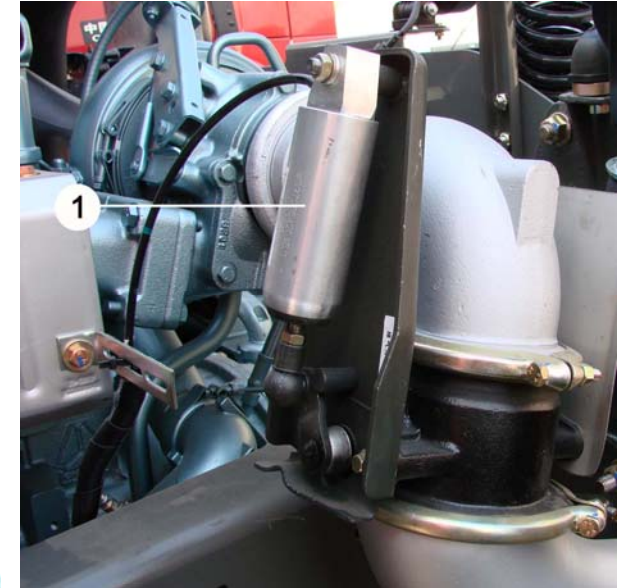
2. Auxiliary Brake

2.1 Exhaust brake:

When using auxiliary brake, press the exhaust brake rocker switch 2 and release the accelerating pedal, then the vehicle can use the energy of engine to do the auxiliary brake.

The exhaust brake must be used when driving on the long downhill way; and it also can be used on the snowy and muddy road to reduce the possibilities of sideslip; when meeting and on the rough road the exhaust brake also can be used to slow down in advance.

Using the exhaust brake can reduce the times of using service brake, and decrease the abrasion and heat of the wheel and wheel brake, extend their service life, reduce the fuel consumption and improve drive security.



1-Exhaust Brake Cylinder



Notice: When the gearbox is in neutral gear, the auxiliary brake doesn't work.

When the gearbox is shifted at lower gear, the efficiency of exhaust brake is higher.

2.2 EVB Brake:

EVB is Exhaust Valve Brake, which can help driver to reduce the speed and control the vehicle. One exhaust brake valve (DC24V, 0.78A) is equipped for each cylinder, and installed under the valve cover of engine. It is standard configuration for Euro 3 common rail engines and optional for Euro 2 engines. It can observably raise brake performance when it works with exhaust

Auxiliary Brake

brake at the same time, and improve drive security.

Exhaust brake increase the intake and exhaust power consumption by keeping exhaust valve open, leaking the compressed mixed air in the cylinder during compressing stroke and with the backpressure brought by exhaust brake, so as to promote brake power. So that there is hardly energy returns to piston in the process of expansion stroke. During engine's repeatedly functioning, the forward momentum of vehicle is consumed and the speed is also cut down.

2.3 Operation of EVB:

When the exhaust brake is adopted, release the clutch and accelerator pedal, press down the rocker switch of exhaust brake, then the exhaust brake and Exhaust Valve Brake will function at the same time. The exhaust brake will stop automatically when you step down the clutch pedal or accelerator pedal. The exhaust brake will also stop by itself when the engine running speed is under 1000 r/min. Under the premise of less than governed engine speed, shifting gear-box in the lowest gear will make vehicle get the maximum decelerator power.

2.4 The working conditions of EVB:

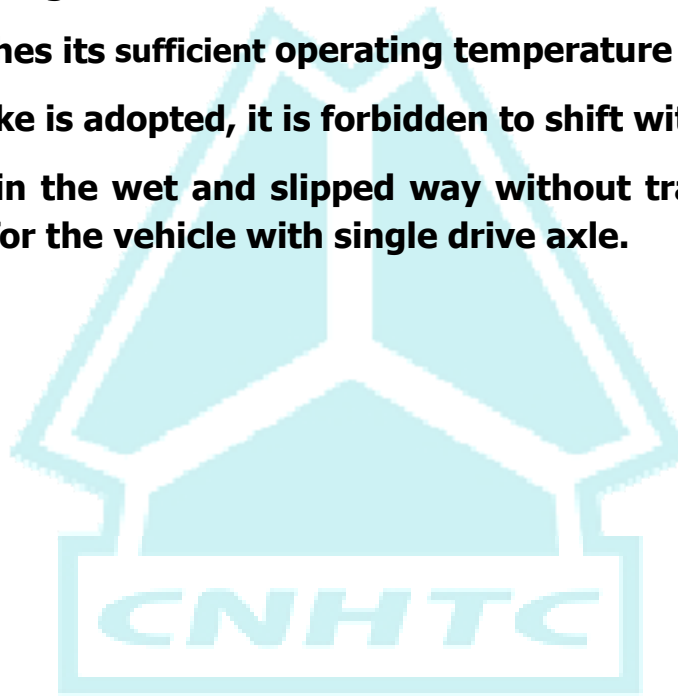
1. For Euro III common rail engine: the rotary speed of engine is more than 1050rpm and transmission is not shifted in neutral gear, don't step accelerator and clutch pedal at the same time.
2. For the Euro II engine: the rotary speed of engine is more than 1100rpm and transmission is not shifted in neutral gear, don't step accelerator and clutch pedal at the same time.

Auxiliary Brake



Notice:

1. EVB is a kind of vehicle retarder device instead of parking device. Service brake is the only way to stop vehicle completely, which is braking.
2. Make sure the engine reaches its sufficient operating temperature before starting the exhaust brake.
3. As long as the exhaust brake is adopted, it is forbidden to shift without releasing the clutch.
4. When the vehicle driving in the wet and slipped way without trailer or the trailer is empty, it is not allowed to use EVB device, specially for the vehicle with single drive axle.



Emergency and Parking Brake

3. Emergency and Parking Brake

Hand brake can be used as emergency and parking brake, it works through energy-stored spring brake cylinder of rear driving axle. And parking brake operates through controlling the handle of hand brake valve.

When there are any errors in brake system, emergency brake operates automatically by pushing of the energy-stored spring.

Only when the air pressure of brake system is higher than 0.55MPa and the signal light of hand brake is off, can the emergency brake can be removed completely.

The usage of hand brake: pull down the handle. At the same time, the signal light on the instrument will be on.

Releasing of hand brake: lift the handle and it will return to the releasing position automatically.(Refer to the picture). The signal light on the instrument will be off at the same time.



Release Position
① Handle of hand brake valve for tractor
② Handle of trailer hand brake valve



Brake Position
② Handle of trailer hand brake valve



Notice:

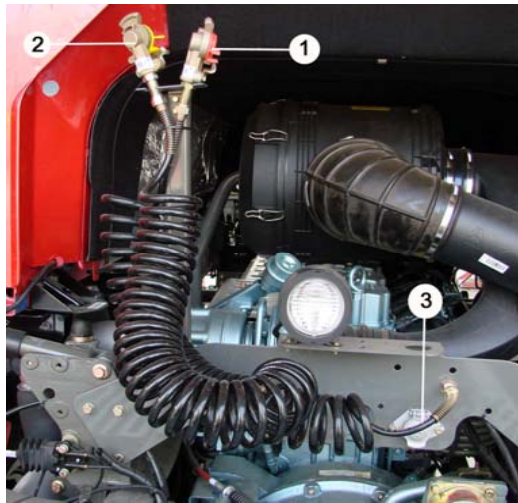
1. Hand brake must be pulled down when the vehicle stops.
2. Before starting the engine, put the handle of hand brake valve at brake position; if not, the air pressure of brake system will be raised and all the parking brake will be removed.



Trailer Brake

Trailer hand brake is used for brake of the trailer or semi-trailer, and separated from the brake system of tractor truck.

When loosing the hand brake valve handle of trailer, it will rebound back to the initial position (The initial position is as the above picture).



1. Connector of dual circuit of air reservoir (red)
2. Connector of dual circuit of brake (yellow)
3. Seven-hole electric socket for trailer

ABS System

When the indicating light of ABS testing is on, it expresses ABS failure. Please go to service station immediately to repair and maintain.

ABS (Anti-lock braking system) is an electrical controlling system which monitors and controls vehicle speed during brake period. Its function is avoiding the wheels being locked due to larger brake force (especially on the slippery road). Even though the full brake is acted on, the transverse traction force can be kept to ensure the driving and turning stability of vehicle and the best brake synergetic effect between tractor and trailer. Meanwhile, ABS can also keep the effective brake friction between tyre and road surface, as well as the optimization of deceleration and brake distance of vehicle. ABS works through normal brake system and can improve the initiative safety of vehicle.

Advantages of ABS

- (1) Keep steering yarage of vehicle during emergency brake.
- (2) Shorten and optimize brake distance. The brake distance will be shortened over 10% on the road surface of low adhesion. Keep the best use efficiency of road surface adhesion factor, i.e. best brake distance.
- (3) Decrease the driver's mental burden and reduce traffic accident.
- (4) Reduce tyre abrasion and save maintenance cost.

ABS System

Composition of ABS

ABS is made of lots of components, mainly includes: ECU, gear ring, sensor, electromagnetic valve, sensor and electromagnetic valve wire, ABS indicator light, switch (optional at the main manufacturing factory), relay for retarder controlling (for retarder fitted vehicle), power supply grounding wires with fuses. If added ASR function, the following components need to be gained: one ASR indicator light, one switch or button for ASR, one differential brake valve, one dual way check valve, engine controlling interface, etc. For trailer ABS, it must be equipped with ISO7638 power supply, which is also called: power supply of trailer ABS. it also be added indicator light of trailer ABS in the cab.

ABS Working Principle

The working principle of ABS is gear ring and sensor corporately produces signal of induced voltage, and the signal is transported to ECU. ECU receives and deals with the signal form sensor, and send signal to electromagnetic valve. Electromagnetic valve adjusts the brake pressure of brake air chamber according to the instruction made by ECU. ABS indicator light is used to remind of the driver whether the ABS is normal working or not. Therefore, the entire system installation includes air channel, electrical circuit, axle and cab wiring harness.

Identification Method of ABS Normal Working

(1) Observing ABS Indicator Light

The function of ABS indicator is warning the driver to understand the situation of ABS and displaying the diagnosis flash code.

Working condition of ABS indicator is as following:

Table 1: Working Condition of ABS Indicator Light

Put on Igniting Switch	ABS Indicator Light Instantly is Illuminated (about 3 Seconds) then Gone out	ABS Normal
	ABS Indicator Light is Constant Illuminated	If indicator light goes out when vehicle speed is more than 7km/h, the ABS is on the normal condition. If indicator light does not go out when vehicle speed is more than 7km/h, the ABS is on the abnormal condition.

ABS System

Notice: ABS indicator light will be gone out after the vehicle speed is more than 7km/h when the vehicle is firstly started-up or after system diagnosis (if system is normal function). The condition of indicator light will be as the abovementioned since the second ignition switch is opened.

(2) Emergency Brake

Emergency brake shall be executed on the wide and smooth road at more than 40km/h speed, and observe the brake trace. If there is not brake trace on the road surface, it shows that ABS plays its role. If there are drag marks of all wheels or drag mark of one of wheels, and meanwhile, the ABS indicator light is illuminated, it shows that ABS does not play its role or not play its role on one of wheels. At this condition, ABS or ABS of one of wheels shall be carried out diagnosis and maintenance.

(3) ABS Working Identification

Put on the ignition switch and wait for the ABS indicator light gone out, then listen to the recycle sound of ABS electromagnetic valve. For the 4S/4M basic model of E version, there are four self-examining sounds of electromagnetic valve.

Sound recycling of ABS electromagnetic valve is totally sounds as 1-2-3-4.

1-right front wheel

2-left rear wheel

3-left front wheel

4-right rear wheel

Diagnosis Method of ABS

WABCO provides several diagnosis methods for troubleshooting of ABS, such as apparatus diagnosis, PC diagnosis, portable apparatus and flash code diagnosis's. Apparatus and PC diagnosis are suitable for the offline of complete vehicle and reinforced service station for malfunction identification. Potable apparatus and flash code diagnosis are suitable for service station or consumer self-examine to its system.

ABS System

ABS Error Information Displayed on LCD and Failure Cause

Failure Component	SPN	FMI	Fault
ABS sensor on left wheel of front axle	789	1	Air gap of sensor
	789	2	Incorrect tyre
	789	3	Short circuit to battery
	789	4	Short circuit to Ground
	789	5	Open circuit
	789	6	Short circuit
	789	7	Incorrect gear wheel
	789	8	Sensor loose
	789	9	Wires mismatched
	789	10	Speed drop-out
	789	11	Abnormal speed(chatter)
	789	12	Frequency too high
ABS sensor on right wheel of front axle	790	1	Air gap of sensor
	790	2	Incorrect tyre
	790	3	Short circuit to battery
	790	4	Short circuit to Ground
	790	5	Open circuit
	790	6	Short circuit
	790	7	Incorrect gear wheel
	790	8	Sensor loose
	790	9	Wires mismatched
	790	10	Speed drop-out

ABS System

ABS Error Information Displayed on LCD and Failure Cause

	790	11	Abnormal speed(chatter)
	790	12	Frequency too high
ABS sensor on left wheel of rear axle	791	1	Air gap of sensor
	791	2	Incorrect tyre
	791	3	Short circuit to battery
	791	4	Short circuit to Ground
	791	5	Open circuit
	791	6	Short circuit
	791	7	Incorrect gear wheel
	791	8	Sensor loose
	791	9	Wires mismatched
	791	10	Speed drop-out
	791	11	Abnormal speed(chatter)
	791	12	Frequency too high
ABS sensor on right wheel of rear axle	792	1	Air gap of sensor
	792	2	Incorrect tyre
	792	3	Short circuit to battery
	792	4	Short circuit to Ground
	792	5	Open circuit
	792	6	Short circuit
	792	7	Incorrect gear wheel
	792	8	Sensor loose
	792	9	Wires mismatched
	792	10	Speed drop-out
	792	11	Abnormal speed(chatter)
	792	12	Frequency too high

ABS System

ABS Error Information Displayed on LCD and Failure Cause

ABS sensor on left wheel of the 3rd axle	793	1	Air gap of sensor
	793	2	Incorrect tyre
	793	3	Short circuit to battery
	793	4	Short circuit to Ground
	793	5	Open circuit
	793	6	Short circuit
	793	7	Incorrect gear wheel
	793	8	Sensor loose
	793	9	Wires mismatched
	793	10	Speed drop-out
	793	11	Abnormal speed(chatter)
	793	12	Frequency too high
ABS sensor on right wheel of the 3rd axle	794	1	Air gap of sensor
	794	2	Incorrect tyre
	794	3	Short circuit to battery
	794	4	Short circuit to Ground
	794	5	Open circuit
	794	6	Short circuit
	794	7	Incorrect gear wheel
	794	8	Sensor loose
	794	9	Wires mismatched
	794	10	Speed drop-out
	794	11	Abnormal speed(chatter)
	794	12	Frequency too high
Solenoid for left wheel of front axle	795	3	Short circuit to battery
	795	5	Open circuit
	795	6	Short circuit to Ground

ABS System

ABS Error Information Displayed on LCD and Failure Cause

Solenoid for right wheel of front axle	796	3	Short circuit to battery
	796	5	Open circuit
	796	6	Short circuit to Ground
Solenoid for left wheel of rear axle	797	3	Short circuit to battery
	797	5	Open circuit
	797	6	Short circuit to Ground
Solenoid for right wheel of rear axle	798	3	Short circuit to battery
	798	5	Open circuit
	798	6	Short circuit to Ground
Solenoid for left wheel of the 3rd axle	799	3	Short circuit to battery
	799	5	Open circuit
	799	6	Short circuit to Ground
Solenoid for right wheel of the 3rd axle	800	3	Short circuit to battery
	800	5	Open circuit
	800	6	Short circuit to Ground
DBR, retarder	801	3	Short circuit to battery
	801	5	Open circuit
	801	6	Short circuit to Ground
Relay for diagonal 1	802	4	Low voltage/open circuit in electric supply of 1 st axle, 2nd axle and Diff.
	802	5	GND 2 Open circuit
	802	7	Electric supply of 1 st axle, 2 nd axle and Diff. Internal Relay does not open

Brake Cautions

1. Urgently Loosing of Spring Brake Cylinder

When the spring brake cylinder is braking self-powered because of leakage of connecting pipe, loosen the bolt of cylinder to the released position and the brake will be released.



Notice:

(1) Before loosing the spring brake cylinder, shift transmission into first gear and examine if the service brake (foot braking) is normal.

(2) When loosing the spring brake cylinder on the uphill/downhill road, please block the wheel to prevent vehicle from sliding.

2. Usage of Charging Connector

Because the combined air dryer is applied, the adjusting valve is combined with the air dryer together, charging connector is equipped on the air reservoir. By screwing charging pipe on the charging connector, tyres can be inflated and the air reservoir can also be inflated from the air source outside.

3. Maintenance of Braking Line

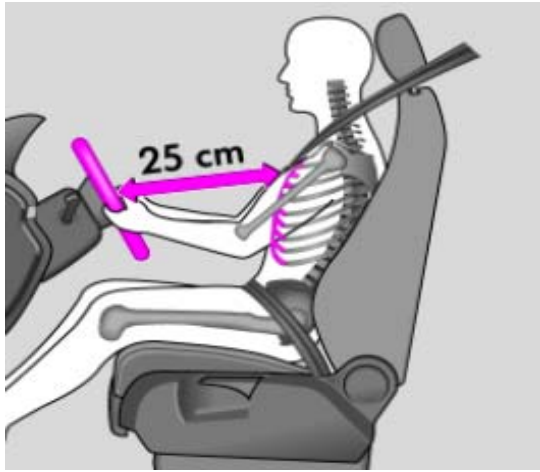
When welding, cutting and drilling near the plastic pipe for braking, it should be subject to the following provisions:

- a) Let out the air in the pipe;
- b) Cover the pipe in order to avoid to be damaged by the spark, fire and glowed chip;
- c) The permitted highest temperature without any pressure pipe is 130°C, the duration is one hour.

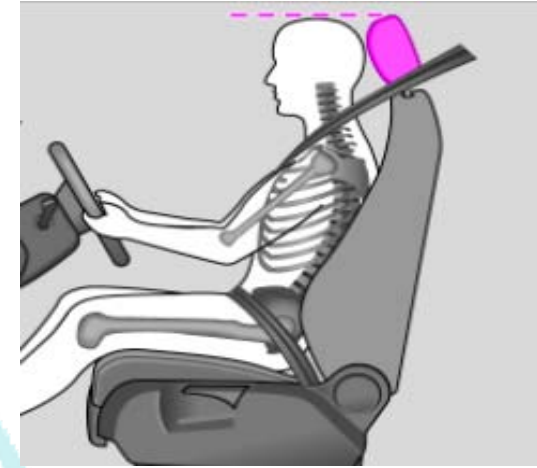


Warning: Battery and other electrical parts connected with the electronic device (CMIC, ECU, CBCU etc.) should be cut off or pull out!

Driver's Sitting Position



Pic. 1



pic. 2

Correct driver sitting position is of much importance to the safety and comfort driving.

For driver's safety and reducing the damage of the accident, the following adjusting process is strongly suggested:

- 1) Adjusting the steering wheel: The distance between the steering wheel and breast is less than 25 cm (Referring to the above picture 1);
- 2) Adjusting the driver's seat forward and backward to make the driver to step on the accelerator, brake and clutch to the end under the case of slight bowlegs.
- 3) Adjusting headrest: Upper edge of headrest is flush to the top of head (Referring to the picture 2).
- 4) Seat back is at the upright position, and the back should be fully fit in the seat back.
- 5) Fasten the safety belt correctly (Referring to safety belt instructions).
- 6) Putting the foot at the foot space, and make the vehicle to be the driver's control.
- 7) Adjusting the driver's seat manually.

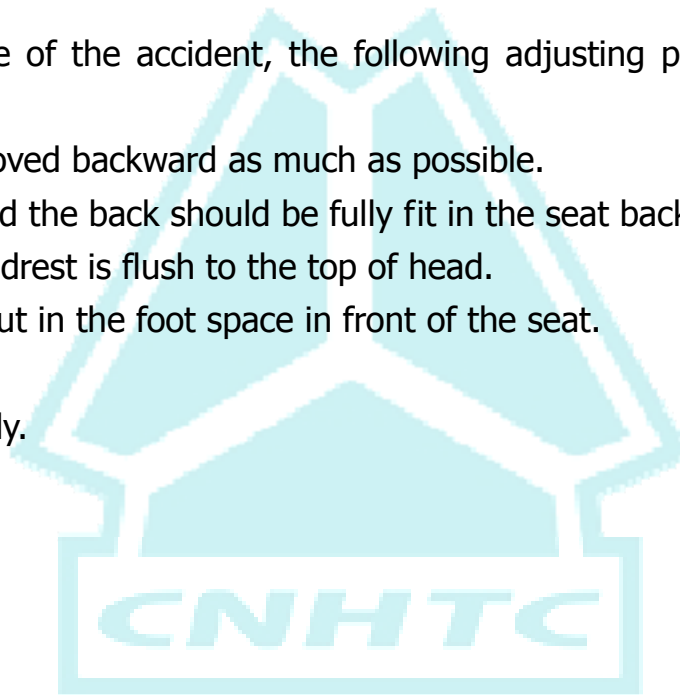
Driver's Sitting Position

Front Passengers' Sitting Position:

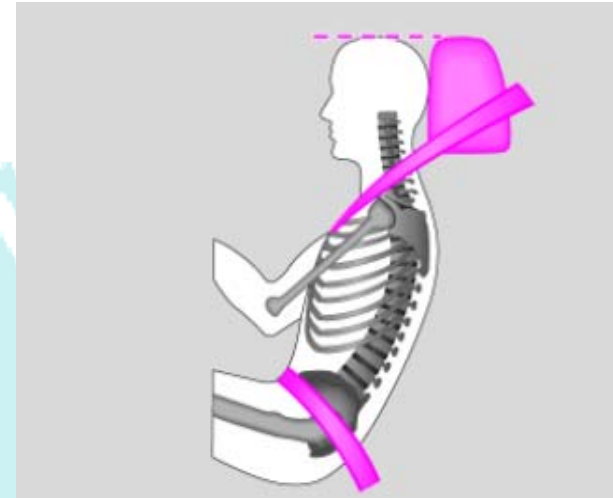
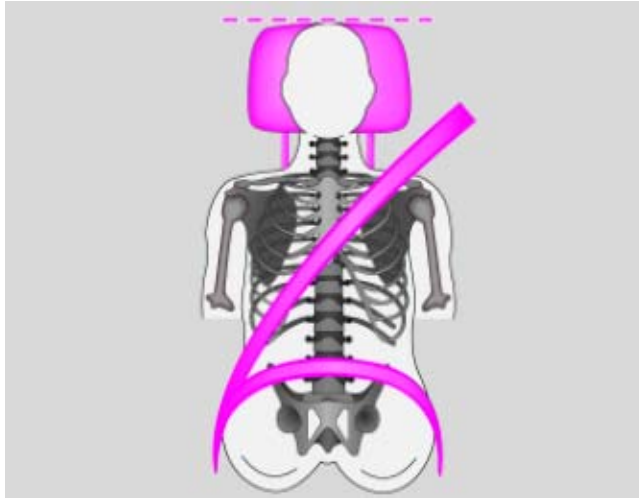
The distance between dashboard and front passenger is not less than 25 cm.

For your safety and reducing the damage of the accident, the following adjusting process is strongly suggested to the front passenger:

- 1) The front passenger seat should be moved backward as much as possible.
- 2) Seat back is at the upright position, and the back should be fully fit in the seat back.
- 3) Adjusting headrest: Upper edge of headrest is flush to the top of head.
- 4) The front passengers' feet should be put in the foot space in front of the seat.
- 5) Fasten the safety belt correctly.
- 6) Adjusting the passenger's seat manually.



Headrest



The Headrests Adjusting:

The headrest adjusting is very important to protect the passengers, and it can reduce the hurt risk when accident occurs.

The headrest must be adjusted correctly to gain the best protection.

Adjusting headrest: Upper edge of headrest is flush to the top of head as much as possible.

Warning!

- 1. Removing or wrong position of the headrest may increase the hurt risk.**
- 2. Wrong position of the headrest may cause serious damage even death in the accident.**
- 3. Wrong position of the headrest may increase the hurt risk in the sudden driving conditions or brakes.**
- 4. Headrest should be properly adjusted according to driver or passenger's height.**

Safety Belt

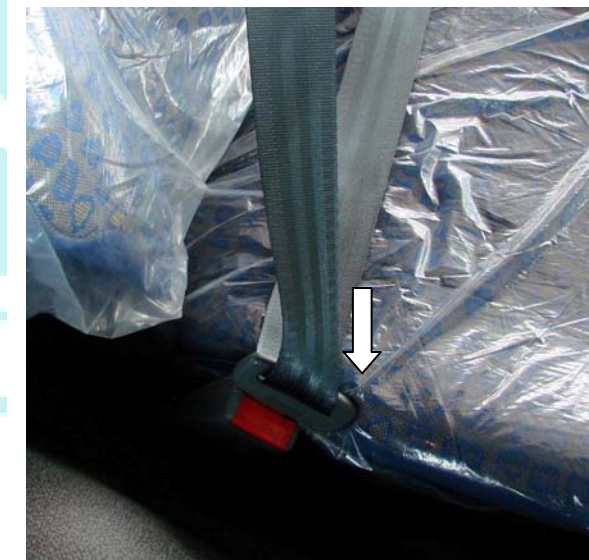
Every seat has been equipped one safety belt in cabin.

1. Fasten Safety Belt

Pull the seat belt lock, make belt around the shoulder and insert the latch into the socket until you hear the voice of meshing.

2. Releasing Safety Belt

Press the red button on the safety belt socket according to the direction of the arrow, pull out the latch, the safety belts will roll back to the original position automatically.



Safety Belt

3. Safety Belt Alarm Instruction

- 3.1 Switch the key to the driving position, if the safety belts are engaged, the safety belt lock signal lamp on instrument does not flash; if not, signal lamp will keep on without alarm buzzer.
- 3.2 After starting the engine, if the belt is not engaged, safety belt locking signal lamp lights up, and buzzer alarm in low frequency and stop after 6 seconds; after inserting the safety belt well, the lamp is off and buzzer stop to alarm at the same time.
- 3.3 If pull out the safety belt is pulled out when the engine is working, the signal lamp is on and the buzzer alarms in low frequency for 6 seconds.



Notice:

- 1. Please fasten the safety belt well before driving every time!**
- 2. Check the performance and functions of the safety belt everyday.**

Pedal Area



①Clutch pedal ②Brake pedal ③Accelerator pedal

Pedal:

- All staff and pedal pad should not affect the operation and movement of pedals.
- To ensure the pedals of accelerator, brake and clutch are able to be stepped down to the end without a hitch at any time.
- To ensure the pedal can bounce back to the original position without a hitch.
- The pedal pad does not affect the pedal area, and fixed in the foot space.
- When the brake air circuit encounters error, the brake pedal needs the longer pedal travel to stop the vehicle.
- Wearing proper shoes. The shoes should make foot to hold up well in order to have good pedal feeling.



Warning:

- 1. If the pedal could not make trouble-free operation, it may lead to dangerous driving conditions.**
- 2. Do not put anything in the driver's foot space. The staff may slide to the pedal area to prevent pedal operations and result in no brake, operating the clutch or accelerator in the sudden driving or braking**

Pedal Area



Driver's side pedal pad:

- The pedal pad must be fixed in the foot space without affecting the pedal's movement.
- Ensure the pedal pad immovable and no affecting the movement of the pedal when driving. And pay attention to the warning.
- The pedal pad should not roll in the pedal area or slide. Fixing parts of the pedal pad must be fixed in the foot area.

Warning:

- 1. If the pedal could not make trouble-free operation, it may lead to dangerous driving conditions.**
- 2. To ensure the pedal pad immovable.**
- 3. Do not put any other pedal pads on the fixed pedal pad, because it can reduce the pedal area and affect the pedal movement.-Danger!**

Sundries Box



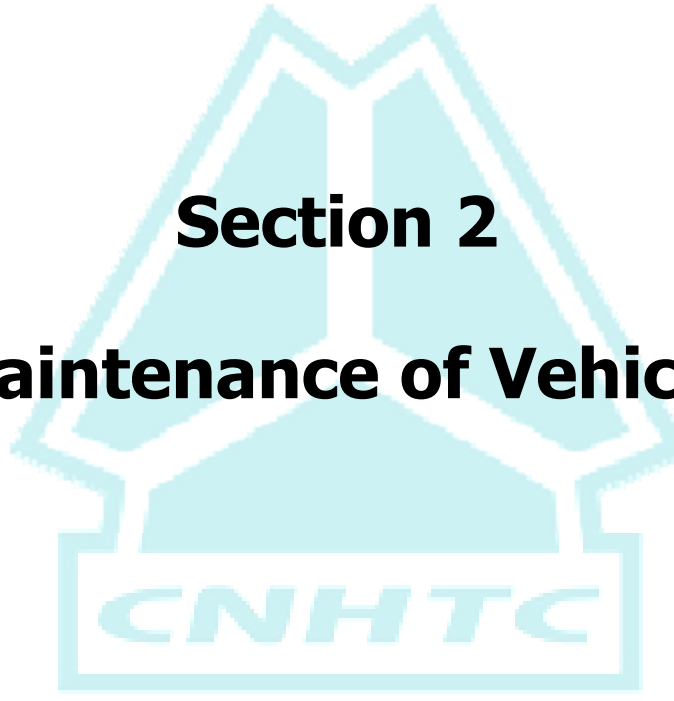
Warning:

1. Only soft articles or staff can be put in the sundries box.
2. Incompact articles loaded may lead to the serious damage.
3. All the articles must be put in the sundries box and fixed well.
4. When the sudden driving or accident occurred, hard and heavy object splashing may lead to the serious damage if the incompact articles are loaded.

Fire Extinguisher (Optional)



Fire extinguisher is optional according to customer's requirement. It is installed at left side of driver's seat in order that driver can take out and operate it conveniently in case of fire.



Section 2

Maintenance of Vehicle

Vehicle Service Conditions

Table 1 Service Conditions of Vehicle

WG I	WG II	WGIII
Operating condition is very bad (very hot or cold weather, high dust, close transportation construction site etc.) Mileage per year less than 2×10^4 km or working duration not more than 600h.	Mileage per year more than 2×10^4 km and less than 6×10^4 km, i.e. close and middle distance transportation.	Mileage per year more than 6×10^4 km, i.e. long distance transportation.

The working conditions of Euro III vehicle

Normal Condition	Bad Condition			
A	B	C	D	E
Good condition and long distance transport, Sulfur content of fuel is less than 0.05%	Short distance transport, engineering truck, bus, etc.	Off-road, mountain and rugged road	Hot or cold region (temperature always above 30°C or below -10°C)	Sulfur content of fuel more than 0.05%

The working conditions of Euro II vehicle

Normal Condition	Bad Condition		
In normal temperature and S content of fuel is less than 0.5%	A	B	C
	In tropics or frigid zone (the temperature is usually more than $+30^{\circ}\text{C}$ or -10°C)	The S content of the fuel is 0.5%-1.0%	The S content of the fuel is 1.0%-1.5%

Cycle of Maintenance

Table 2 Cycle of Maintenance

Service Conditions Items	WG I	WG II	WGIII
First-time Check	After running 1000~1500km Or After running 30~50h	After running 1500~2000km	After running 1500~2000km
Routine Check (P)	Every 5000km or Every 150h	Every 1×10^4 km	Every 1.5×10^4 km
1st-Grade Service (WD1)	Every 1×10^4 km or Every 300h	Every 2×10^4 km	Every 3×10^4 km
2nd-Grade Service (WD2)	Every 2×10^4 km or Every 600h	Every 4×10^4 km	Every 6×10^4 km
3rd-Grade Service (WD3)	Every 4×10^4 km or Every 1200h	Every 8×10^4 km	Every 12×10^4 km
4th-Grade Service (WD4)	Every 8×10^4 km or Every 2400h	Every 16×10^4 km	Every 24×10^4 km

Maintenance Items

1. Regular Maintenance Items

- 1.1 Check hand brake and service brake;
- 1.2 Check illuminating lamps, signal lamps and indication lamps (oil pressure, air pressure, air filter indicator and battery charge indicator, etc.);
- 1.3 Check the working mode of starter, alternator and battery;
- 1.4 Check tyre pressure and condition;
- 1.5 Check the level of engine oil, coolant and steering hydraulic oil;
- 1.6 Drain water from air reservoir.

2. Maintenance Tasks of Every Grade

Please refer to the third part "Operation and Maintenance of Main Components" for the checking and maintenance of engine, clutch, transmission, front and rear axles, steering system, etc.

Table 3 Maintenance Tasks of Every Grade

• Maintenance items include changing oil, examining and adjustment

Cab	First-time Check	Routine Check	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th -grade Service
Check the wiper	•	•	•	•	•	•
Re-tighten locking handle on driver's cab	•			•	•	•
Re-tighten engine radiator's cover	•					
Check oil level of cab tipping hand pump				•	•	•
Check lifting cylinder	•		•	•	•	•

Maintenance Items

Table 3 Maintenance Tasks of Every Grade

• Maintenance items include changing oil, examining and adjustment.

Chassis	First-time Check	Routine Check	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th -grade Service
Check fixation and action of towing hook	•		•	•	•	•
Re-tighten the bolts on cross member of the frame	•					
Tighten front and rear leaf spring bolts and brackets	•			•	•	•
Check spare tire fixing device				•	•	•
Check and adjust slide rail clearance of leaf spring				•	•	•
Check the fixation of wheel nuts	•		•	•	•	•
Check the fixation of battery				•	•	•
Check the fixation of fuel tank				•	•	•
Electrical System	First-time Check	Routine Check	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th -grade Service
Check the working condition of electrical system (Instrument, lamps, wiper, and air conditioner).	•	•	•	•	•	•
Check electrolyte level and cell voltage	•		•	•	•	•
Check the fixation of battery terminal, coat electrode with grease	•		•	•	•	•
Check electric tachometer and speed accuracy	•	•	•	•	•	•

Maintenance Items

Table 3 Maintenance Tasks of Every Grade

• Maintenance items include changing oil, examining and adjustment.

Brake System	First-time Check	Routine Check	1st-grade Service	2nd-grade Service	3rd-grade Service	4th-grade Service
Drain water from air reservoir	•	•	•	•	•	•
Check leakproofness of air pressure system (With barometer)	•		•	•	•	•
Check brake lining thickness and adjust brake clearance				•	•	•
Clean wheel brake					•	•
Check vulnerability of brake pipeline and hoses	•			•	•	•
Check brake chamber			•	•	•	•
Check footbrake, handbrake and exhaust brake action (When do the trial running)	•		•	•	•	•
Check ABS	•		•	•	•	•
Vehicle	First-time Check	Routine Check	1st-grade Service	2nd-grade Service	3rd-grade Service	4th-grade Service
Short distance trial running (Including braking test)	•		•	•	•	•
Visual check for leakage	•	•	•	•	•	•
Check and tighten cargo body	•	•	•	•	•	•

Maintenance Items

Table 3 Maintenance Tasks of Every Grade

• Maintenance items include changing oil, examining and adjustment.

Lubrication	First-time Check	Routine Check	1st-grade Service	2nd-grade Service	3rd-grade Service	4th-grade Service
Water pump	•	•	•	•	•	•
Clutch release shaft	•	•	•	•	•	•
Clutch pedal shaft	•	•	•	•	•	•
Clutch release bearing	•	•	•	•	•	•
Universal joint and intermediate support of transmission shaft	•	•	•	•	•	•
Steering knuckle and front axle	•		•	•	•	•
Leaf spring pin	•	At least once every four weeks				
Check leaf spring slide rail clearance of suspension	•	•	•	•	•	•
Shock absorber mounting	•	•	•	•	•	•
Gearshift lever bracket		•	•	•	•	•
Brake camshaft and brake arm	•	•	•	•	•	•
Towing hook	•	•	•	•	•	•
Fifth wheel	•	•	•	•	•	•
Cab door hinge			•	•	•	•
Perform rust-proofing treatment of driver's cab again according to schedule		Once every 12 months				

Note: After cleaning the vehicle, re-lubricate all the parts which need lubricant at once, it should be acted once a week for the vehicle operated on construction site.

Mandatory Maintenance

1. Purpose

Remove and clean the particles, burrs and other harmful impurities caused during the initial operation of vehicle, solve the connections loosening problems resulting from the initial operation, carrying out a mandatory running-in maintenance, to improve the reliability, so that make the vehicle in the best working condition to extend the service life of vehicle.

2. Implementation

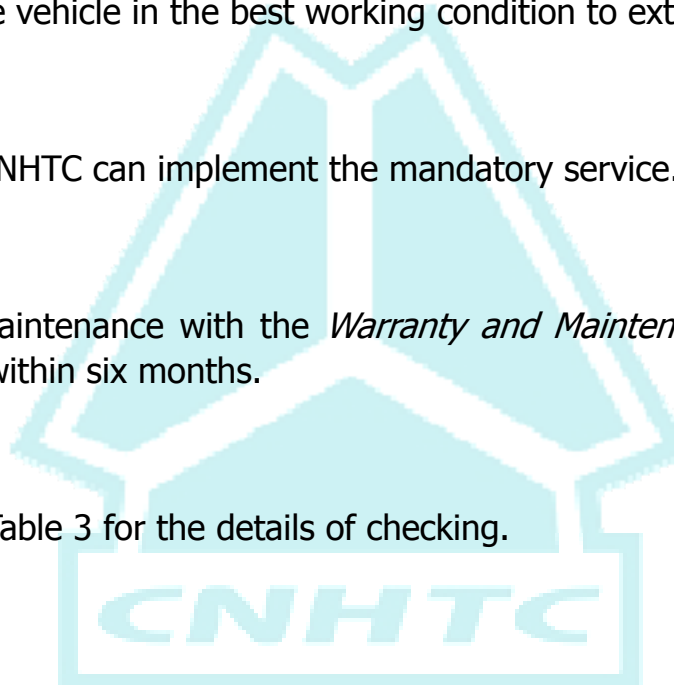
Special service stations authorized by CNHTC can implement the mandatory service.

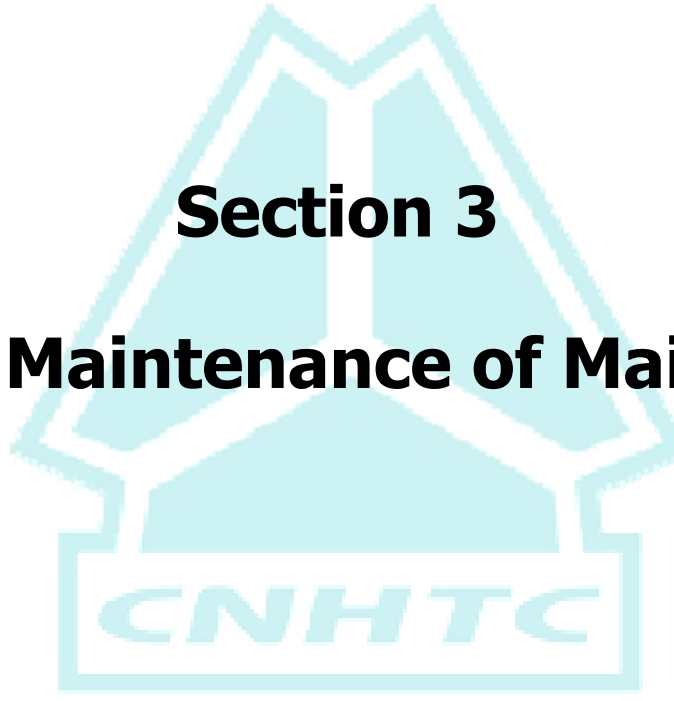
3. Mileage Requirement

The vehicle can enjoy a mandatory maintenance with the *Warranty and Maintenance Manual* of CNHTC, if the mileage is between 2000 to 4000 kilometers and within six months.

4. Content

Please refer to the First-time Check of Table 3 for the details of checking.





Section 3

Operation and Maintenance of Main Components

Euro III Engine

1. Main system parameters and specifications of WD615 series Euro III Electronic Control Common Rail Engine

The WD615 series Euro III engine adopts the Japanese Denso Company's electronic control common rail injection system, four valves structure and electronic control air bleed brake system. The top common rail pressure can reach to 180 MPa. The engine ECU can accurately adjust fuel injection amount, injection times, common rail pressure and ignition advance angle by engine speed, temperature, load, water temperature, boost pressure and vehicle running condition; the engine emission, noise, power performance, economy, stability, starting performance in cold and steering performance are perfectly matched.

(1) Common abbreviations and definitions

CRS Electronic high pressure common rail system

ECU Electronic Control Unit

PCV Oil pump pressure control valve

TWV

Two way Injector solenoid valve

(2) WD615 series Euro III diesel engine main system technical parameters and accessory specifications

① Lubricating system;

a) Lubrication oil model: CH-4 grade, 15W/40

b) Lubrication oil filling amount

Filling Time	Oil Filling Amount (L)
First filling of new vehicle	25
Replacing oil and filter	24
Replacing oil	23

Euro III Engine

c) The oil pressure range in normal operation: (Oil temperature $\geq$ 80℃): 100~600kPa

② Electronic control common rail fuel system

- a) ECU model: R61540090002 Manufacturer: Japan DENSO Company
- b) Fuel injection pump model:HP0 Manufacturer: Japan DENSO Company
- c) Fuel injector model; 670*(with QR code) Manufacturer: Japan DENSO Company, fuel injection pressure; 40~160MPa (MAX)
- d) Diesel requirement: light diesel that meets standard of GB17691-2005
- e) Fuel coarse strainer (with fuel and oil separation, can select fuel heater), filter replacing time is about 20000km.
- f) Fuel filter, filter replacing time is about 30000km.

③ Cooling system

- a) Fan: annular fan
- b) Diesel inner coolant liquid volume: 21.5L

④ Cold starting device (options)

Air intake with electronic control electrical heating cold starting device, heater parameter 24V, 2.4kW,

Euro III Engine

can start in temperature of $-25\sim-30^{\circ}\text{C}$.

Manufacture: Philips Company

Without electrical heating cold starting device, can start in temperature of $-5\sim-10^{\circ}\text{C}$.

⑤ Starting system

Starter: 24V、7.5kW Generator: 28V55A 1540W Battery: 2×12V135Ah

⑥ Air compressor

Type: Double cylinder piston type, water cooling Bore×Stroke: $\Phi 85\times 56\text{mm}$

Displacement: 636mL Working pressure: 1000kPa

⑦ Valve Timing (with 1 mm clearance) (see Figure 1)

Intake valve open: top dead center Intake valve close: bottom dead center rear 18°

Exhaust valve open: bottom dead center front 37° Exhaust valve close: top dead center front 3°

Valve clearance in cold: intake valve 0.30mm Exhaust valve 0.40mm

Euro III Engine

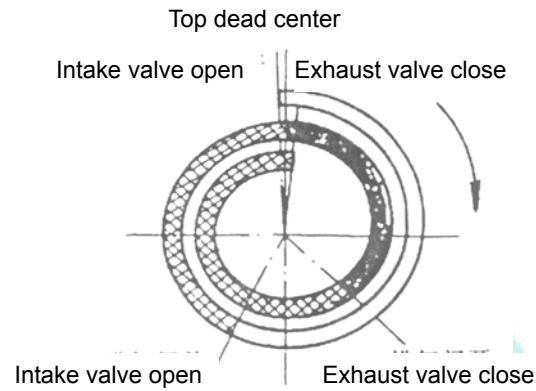


Fig. 1 Valve Sketch Figure

⑧ Electric exhaust brake (for options)

Brake power: 160kW (in rated speed 2200r/min)

Euro III Engine

2. The electronic control common rail system of WD615 series engine

The electrical system is composed of ECU, sensor, switch, relay, actuator (oil supply solenoid valve, fuel injector solenoid valve, exhaust brake valve, exhaust brake device solenoid valve), lamp, communication data connection and DC24V power, etc.

(1) Sensor

The sensor mounted on engine: (provided by engine manufacture, see figure 2)

- ① Ne speed sensor; ② G cylinder judging sensor; ③ Coolant temperature sensor; ④ Air intake temperature sensor;
- ⑤ Returned fuel temperature sensor; ⑥ Air intake pressure sensor; ⑦ Common rail pressure sensor; ⑧ Oil pressure sensor;
- ⑨ Diesel water warring sensor (mounted on diesel strainer) (for selection)

Euro III Engine

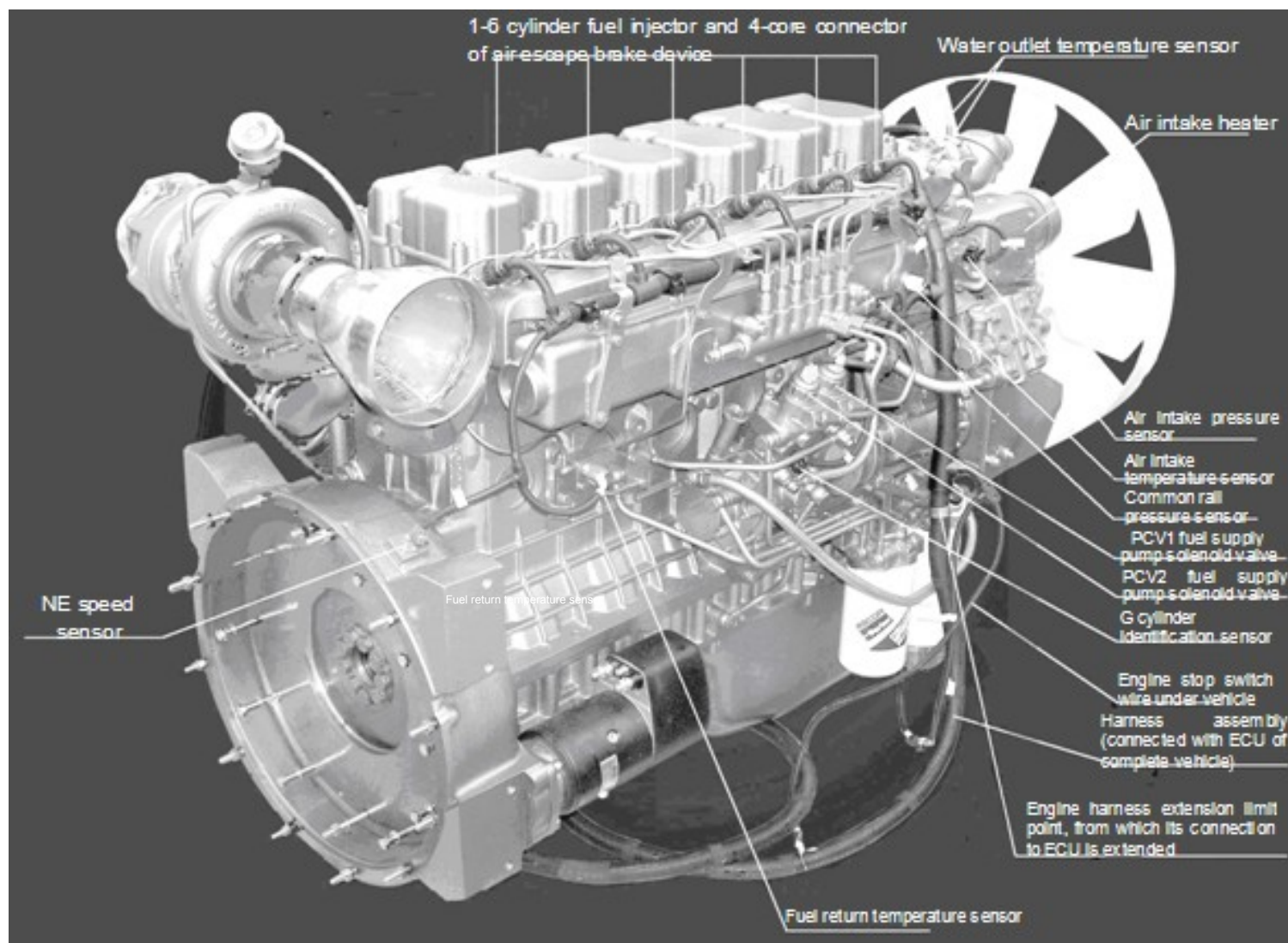


Fig. 2 Engine Sensors

Euro III Engine

The followings are the sensors installed on a completed vehicle (supplied by the complete vehicle factory):

- ① Accelerator pedal sensors 1 and 2 (Fig.3); ② Speed sensor; ③ Power output acceleration sensor;
- ④ Idle control sensor

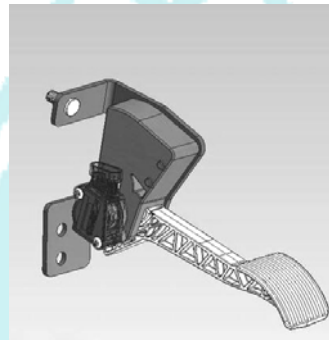


Fig. 3 Accelerator Pedal

(2) Switches (supplied by the complete vehicle factory)

- ① Key switch; ② Master power supply switch; ③ Exhaust brake switch; ④ Clutch switch; ⑤ Brake switch;
- ⑥ Neutral position switch; ⑦ Engine diagnosis switch; ⑧ Air conditioner switch; ⑨ Heater switch; ⑩ Power output switch; ⑪ Reversing switch;

(3) Relays (supplied by the complete vehicle factory)

- ① Air heating relay; ② Main relay; ③ Fuel pump pressure control valve relay; ④ Starting relay; ⑤ Exhaust brake relay

Euro III Engine

(4) Actuators

- ① 2 Fuel pump pressure control solenoid valves; ② 6 Fuel injector solenoid valves; ③ Exhaust brake valve;

(5) Indicator Lamps

- ① Exhaust brake indicator lamp; ② Diagnosis lamp; ③ Heater indicator lamp;

(6) Communication Data Connection

- ① CAN1 port for connecting with diagnosis tool and SOB data writing; ② CAN2 port for connecting ECU sensor with complete vehicle's instrument; ③ (SINK) TAC2 is the signal output of ECU speed sensor.

(7) Exhaust Valve Brake (EVB)

EVB is the abbreviation of "Exhaust Valve Brake". As a retarder of diesel engine, EVB can further enhance the brake efficiency of engine on the basis of the traditional butterfly valve exhaust-assisted brake device, and it is helpful for the deceleration and control of vehicle. The reasonable application of EVB can increase the brake torque produced by diesel engine and continuously reduce or stabilize the speed, which enhances the controllability of vehicle without using the brake system, lowers the using frequency of brake system, and reduces the abrasion of brake system and the wastage of tyres due to braking, as well as prolongs the replacement period of brake shoe, thus minimizing the operating cost of the complete vehicle. EVB is an assistant brake device rather than a vehicle stopping device. It can be used in place of service brake system, which must be used for stopping a vehicle. If the engine brake is used for deceleration purpose properly, the service brake can keep cool and thus provide maximum braking ability quickly.

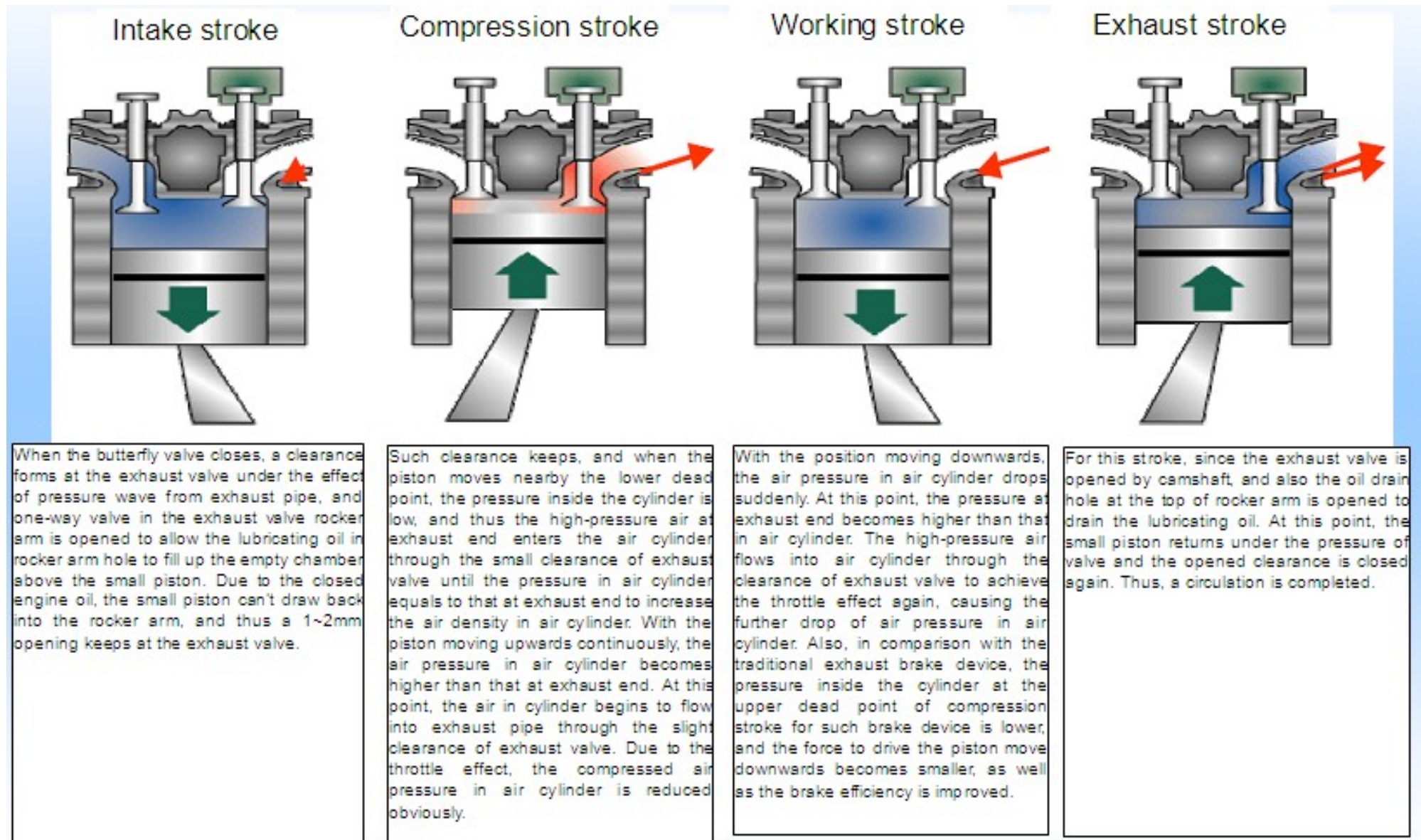
Euro III Engine

EVb system consists of such two parts as the butterfly valve exhaust-assisted brake device and the EVb of diesel engine. Both are interconnected and can be used simultaneously for braking purpose.

Working Principle of EVb System is shown as the following figure on the next page.



Euro III Engine



Euro III Engine

(8) Exhaust/Air Escape Brake Device (Optional)

The engine is equipped with the exhaust/air escape brake device which works with exhaust brake. It can achieve a brake power not less than 160kW at an engine speed of 2200r/min, which enhances the braking performance of vehicle greatly and improves the security of vehicle. See Fig. 4 for details.

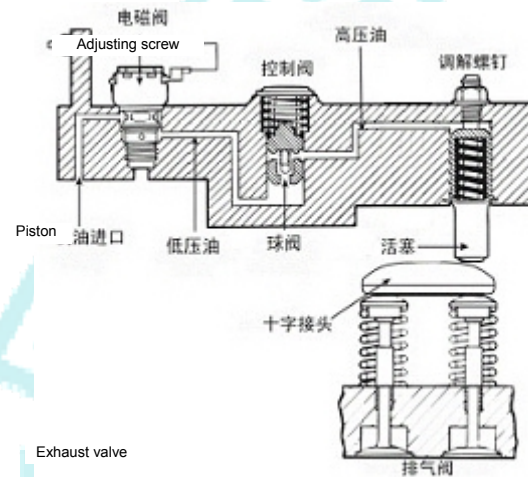


Fig. 4 Exhaust/Air Escape Brake Device

(9) Electric Control Heating Device (Optional)

Under the control of electric control system, the resistance preheating device functions to heat the engine before the startup of engine, and to automatically and continuously heat for a period according to the engine speed after the engine begins to work, which greatly improves the cold starting performance and reduces the white smoke emission due to unburned diesel in cold starting, which is an unavoidable problem for traditional diesel engines.

Euro III Engine

3. Operation and Maintenance of WD615 Series Euro III Common Rail Engine

Before starting the diesel engine, check whether the coolant, fuel, engine oil and diesel levels are in accordance with the required levels, and remove the water in coarse fuel filter.

If the diesel engine can't be started within 15s, restart it under an interval of 2 minutes.

After the engine is started, make it run idle for 2~3 minutes. Note that the engine oil pressure shall be greater than 100kPa. Don't keep the engine run suddenly at high speed with high load before the cooling water reaches up to 60°C; or else, the wearability and reliability of engine may be affected.

During the running-in period of diesel engine (2000km traveling), always make the engine operate under medium load, and no trailer is allowed.

The engine oil level of diesel engine shall be checked 5 minutes after it is stopped. The engine oil level shall not exceed the limit, or else such failures as oil injection or insufficient power may occur. Before stopping a diesel engine working with load, reduce its load and speed first, and keep it idle for at least 5 minutes.

The fuel injection system of electric control diesel engine may generate high voltage (110V) during operation. So, don't touch any wire or component of fuel injector solenoid valve to avoid electric shock.

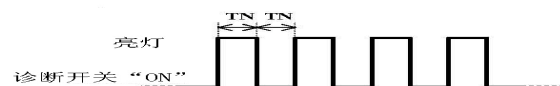
The fuel injection pressure of electric control high-pressure common-rail diesel engine is very high (160MPa), and high fuel pressure exists both in common rail and high-pressure fuel pipe. So, in case of fuel leakage, stop the diesel engine and repair it after the pressure in pipeline drops, so as to avoid any injury. In order to avoid the short circuit of harness, no flushing is allowed for partial harness of diesel engine. If any water is found on partial harness, only after the harness is dried can the diesel engine be started.

Euro III Engine

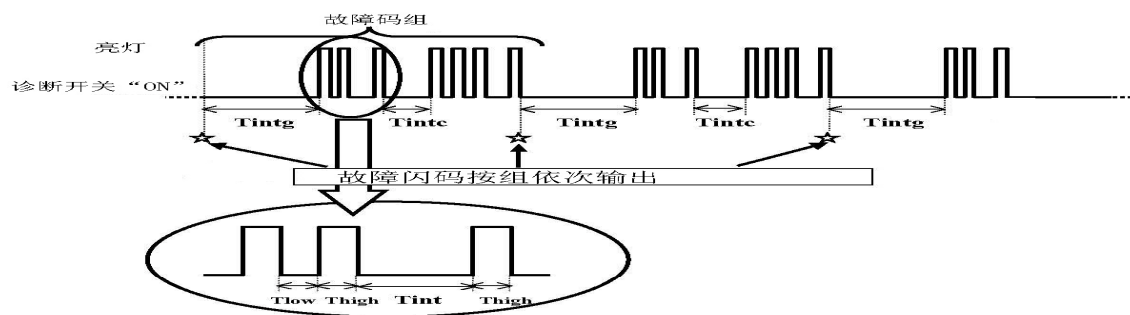
4. Common failures and Troubleshooting for WD615 Series of Euro III Common Rail Engine

(1) Illustration of Malfunction Diagnosis Flash Codes

在柴油机停机时，诊断开关打在“ON”位置时，如果故障诊断灯亮，则说明故障诊断灯工作正常，否则，需要对之进行维修。如果柴油机处于启动或运行状态，故障诊断灯应该熄灭，否则，就是电控系统产生了故障。当柴油机处于正常启动或运行状态，诊断开关打在“ON”位置时，故障诊断灯均匀闪烁，闪烁及间隔时间 $T_N=288\text{ms}$ ，如下图所示。



当柴油机处于启动或运行状态产生故障时，诊断灯亮，将诊断开关打在“ON”位置，故障诊断灯按故障闪码闪烁输出：
下图为故障码21和31的输出：



上图中诊断灯闪烁持续时间及间隔时间长短如下：

Thigh	480 ms
Tlow	480 ms
Tint	1440 ms
Tintc	2400 ms
Tintg	4320 ms

Fig. 5 malfunction Codes

Euro III Engine

(2) Engine Malfunction Flash Codes

No.	Malfunction Code	Description	Flash Code
1	P0122	Too low signal level of accelerator pedal 1	22
2	P0123	Too high signal level of accelerator pedal 1	22
3	P0222	Too low signal level of accelerator pedal 2	22
4	P0223	Too high signal level of accelerator pedal 2	22
5	P0121	Accelerator pedal 1 fails to stop.	22
6	P0221	Accelerator pedal 2 fails to stop.	22
7	P0120	Accelerator pedal 1 fails to close.	22
8	P0220	Accelerator pedal 2 fails to close.	22
9	P2120	Invalid signal of double accelerator pedal	22
10	P2163	Open circuit of idle switch	42
11	P2109	Closed idle switch	42
12	P0238	Too high signal level of air intake pressure sensor	37
13	P0237	Too low signal level of air intake pressure sensor	37
14	P0236	Invalid performance of air intake pressure sensor	37
15	P0227	Too low signal level of PTO pedal	23
16	P0228	Too high signal level of PTO pedal	23
17	P0193	Too high signal level of common rail pressure sensor	67
18	P0192	Too low signal level of common rail pressure sensor	67
19	P0191	Signal of common rail pressure sensor within medium range	67
20	P0563	Too high vehicle voltage	26
21	P0562	Too low vehicle voltage	26
22	P0118	Too high signal level of cooling water temperature sensor	11
23	P0117	Too low signal level of cooling water temperature sensor	11
24	P0183	Too high signal level of fuel water temperature sensor	14

No.	Malfunction Code	Description	Flash Code
25	P0182	Too low signal level of fuel water temperature sensor	14
26	P0113	Too high signal level of air intake temperature sensor	16
27	P0112	Too low signal level of air intake temperature sensor	16
28	P2229	Too high signal level of barometric pressure sensor	15
29	P2228	Too low signal level of barometric pressure sensor	15
30	P1143	Too high signal level of idle speed potentiometer	44
31	P1142	Too low signal level of idle speed potentiometer	44
32	P0617	Short circuit to battery of starting switch	45
33	P0337	NE sensor without pulse	13
34	P0342	G sensor without pulse	12
35	P0385	Both NE and G sensors without pulse	13
36	P0503	Too high frequency of speed sensor	21
37	P0502	Broken/short circuit of speed sensor input	21
38	P0501	Signal malfunction of speed sensor	21
39	P1681	Broken/short circuit to earth of exhaust brake output	28
40	P1682	Short circuit to battery of exhaust brake output	28
41	P2148	Short circuit to battery of fuel injector COM1 output	57
42	P2147	Short circuit to earth of fuel injector COM1 output	57
43	P2146	Broken circuit of fuel injector COM1 output load and TWV1, 3, 5 loads	57
44	P2151	Short circuit to battery of fuel injector COM2 and TWV2, 4, 6 outputs	58
45	P2150	Short circuit to earth of fuel injector COM2 and TWV2, 4, 6 outputs	58
46	P2149	Broken circuit of fuel injector COM2 output load and TWV2, 4, 6 loads	58
47	P0201	Broken circuit of fuel injector TWV1 output, and broken coil of fuel injector	51
48	P0205	Broken circuit of fuel injector TWV2 output, and broken coil of fuel injector	55
49	P0203	Broken circuit of fuel injector TWV3 output, and broken coil of fuel injector	53
50	P0206	Broken circuit of fuel injector TWV4 output, and broken coil of fuel injector	56
51	P0202	Broken circuit of fuel injector TWV5 output, and broken coil of fuel injector	52
52	P0204	Broken circuit of fuel injector TWV6 output, and broken coil of fuel injector	54

No.	Malfunction Code	Description	Flash Code
53	P0611	Malfunction in capacitor charging circuit	59
54	P0200	Malfunction in capacitor charging circuit	59
55	P0629	Short circuit or that to battery of PCV1 output	71
56	P2634	Short circuit or that to battery of PCV2 output	72
57	P0629	Short circuit to battery of PCV1 and PCV2	73
58	P0628	Broken or short circuit to earth of PCV1 output	71
59	P2633	Broken or short circuit to earth of PCV2 output	72
60	P0628	Broken or short circuit to earth of PCV1 and PCV2 outputs	73
61	P2635	Overload of fuel pump control	76
62	P1088	Overvoltage of fuel pump control	76
63	P1266	No load of fuel pump control	77
64	P0093	No load of fuel pump control, including fuel leakage	78
65	P1089	Common rail pressure beyond upper limit	69
66	P0088	Common rail pressure beyond super upper limit	68
67	P0301	Malfunction in fuel system of cylinder 1	61
68	P0302	Malfunction in fuel system of cylinder 2	65
69	P0303	Malfunction in fuel system of cylinder 3	63
70	P0304	Malfunction in fuel system of cylinder 4	66
71	P0305	Malfunction in fuel system of cylinder 5	62
72	P0306	Malfunction in fuel system of cylinder 6	64
73	P0219	Engine beyond limit	7
74	P0541	Short circuit to earth of preheating relay output	25
75	P0542	Broken or short circuit to battery of preheating relay output	25
76	P1530	Engine stop switch seized and closed	46
77	P0217	Cooling water temperature beyond upper limit	6
78	P0234	Air intake pressure sensor beyond upper limit	39
79	P0299	Air intake pressure sensor beyond lower limit	39
80	P1676	Broken/short circuit to earth of reversing switch	48

No.	Malfunction Code	Description	Flash Code
81	P1677	Short circuit to battery of reversing switch	48
82	U0073	Error in CAN1 node	8
83	U1001	Error in CAN2 node	9
84	P0704	Circuit malfunction in clutch switch (only manual transfer is available)	41
85	P0850	Circuit malfunction of neutral switch (only manual transfer is available)	47
86	P0263	1# flow damper works.	61
87	P0275	2# flow damper works.	65
88	P0269	3# flow damper works.	63
89	P0278	4# flow damper works.	66
90	P0266	5# flow damper works.	62
91	P0272	6# flow damper works.	64
92	U0121	CAN BUS disconnected from ABS	9
93	U0155	CAN BUS disconnected from instrument	9
94	P0686	Main relay disconnected	5
95	P1565	Circuit malfunction of cruise switch	43
96	P1602	No writing of QR code data	2
97	P0602	Error in QR code data	2
98	P1601	Wrong definition of QR code data (wrong modification of definition QR code)	2
99	P0607	Malfunction of CPU monitoring integrated circuit	3
100	P0606	Main CPU malfunction	3
101	P0601	Inspection and error in flash memory area	3
102	P0523	Too high signal level of engine oil pressure sensor	17
103	P0522	Too low signal level of engine oil pressure sensor	17
104	P0524	Low pressure of engine oil	17
105	P1683	Short circuit to earth of assistant exhaust brake output	1
106	P1684	Short circuit to battery of assistant exhaust brake output	1

Euro III Engine

(3) Common Malfunctions and Troubleshooting

① Diagnosis tools fail to communicate with ECU

Cause	Troubleshooting
1. Key switch set at "OFF" position	1. Set the key switch to "ON" position.
2. Low or no voltage at engine harness connector (lower than 16V)	2. Check the voltage at engine harness connector.
3. No voltage on ECU (lower than 16V)	3. Check the voltage at ECU connector.
4. Blowout of engine wire harness fuse	4. Replace fuse for electric control system of engine.
5. Malfunction in data interface connector	5. Check the voltage and polarity of data interface line

② For other common malfunctions and troubleshooting of engine, please refer to the descriptions in relevant sections of *Use & Maintenance Manual for WD615 Series Euro III Common Rail Diesel Engine* provided together with your vehicle.

Euro II Engine

1. General

WD615 series diesel engines ,it is featured by compact structure, fine rigidity, reliable operation, long service life, good performance and well economical efficiency, it suit to series of road transporting and tipper truck.

The structure features of diesel engine are summarized as follows:

- a. One cylinder head matches with one cylinder, which is good for reliable operation and convenient removal.
- b. The oil injection pump is set at the left side (seem from the free end of engine), which is good for arrangement on vehicle.
- c. The built-in oil cooler is applied, working safely and reliably.
- d. The turbocharger is rear mounted, the arrangement is compact and the difference between overall dimensions of engine models of this series is small.
- e. All engines of this series are six-cylinder in-line engines, which are highly interchangeable and convenient for complete vehicle assembly.

Euro II Engine

2. Main Technical Parameters of WD615 Euro II Series of Diesel Engine

Model	WD615.62	WD615.87	WD615.69	WD615.47
Type	Four-stroke, water-cooled, in-line, direct-injection, dry cylinder sleeve			
Number of cylinders	6			
Bore×stroke (mm×mm)	126×130			
Total displacement of engine (L)	9.726			
Rated power/rotation speed (kW/r/min)	196/2,200	213/2,200	247/2,200	273/2,200
Max. torque/rotation speed (N·m/ r/min)	1,100 /1,100~1,600	1,160 /1,100~1,600	1,350 /1,100~1,600	1,460 /1,100~1,600
Compression ratio	17:1			
Ignition order	1-5-3-6-2-4			
Valve cold clearance (mm)	Intake 0.30; Exhaust 0.40			

Euro II Engine

3. Structural Characteristics of WD615 Euro II Series of Diesel Engine

(1) Engine Body

Based on the improvement of wide engine body design, the engine body has a junction surface at the middle part of its left side for installation of fuel injection pump support. In general, after installation of the support, the fuel supply pump bracket shall not be removed after the sub-assembly machining but be kept as a whole, and the fuel injection pump is fixed just above it.

(2) Cylinder Head

Each cylinder has a special cylinder head adopts four-valve intake & exhaust system (two intake valves and two exhaust valves). The intake & exhaust ducts on cylinder head are arranged on both sides, and certain rotational flow will be generated in the intake duct according to the requirements of direct-injection combustion system.

Each cylinder has four main bolts of cylinder head (M16) and three studs (M12) shared with the adjacent cylinder.

The cylinder head is equipped with insertion of fuel injector bushing, which is very helpful for improving the heat radiation and operating reliability of fuel injection nozzle. All cooling water flow, after entering into the cylinder head, passes through the water chamber in the nose bridge area, then sweeps the fuel injector bushing, and enters into the water outlet pipe at last.

The fuel injector is installed between the intake valve and exhaust valve.

Euro II Engine

(3) Fuel injection pump

All the engines in WD615 family use PS8500 pumps. The governor is all-speed RQV-K governor.

Recommended fuel

Ambient temperature °C	≥0	0~-10	-10~-20	-20~-30
The number of the fuel	No.0	No.-10	No.-20	No.-35

Fuel filter:

Double-stage filter with filtering capability of 3~5 μ m.

(4) Thermostat:

The thermostat, installed at the rear end of water outlet pipe, is used to adjust the water volume entering into the radiator automatically, according to the temperature of cooling water, to change the circulation range of water so as to adjust the radiating capability of cooling system and ensure that the engine can operate within a proper temperature range.

For ensuring normal engine operation, it is necessary to keep the thermostat in good technical condition. Therefore, the thermostat must be checked periodically. In case the thermostat appears jamming or improper closure, it shall be removed for cleaning or repair, and makeshift use is not allowed; otherwise, it will influence the normal engine operation badly. Generally, it is recommended that the thermostat filter be replaced in time after being used for one year.

Euro II Engine

When replacing thermostat, you can take out its filter only by opening the water outlet pipe. When replacing the thermostat filter, please pay attention to the installation direction to ensure the direction of ventilation hole. Furthermore, the thermostat shall be installed rightly, with good seal.

(5) Intake & Exhaust System

Aftercooler: The after-cooler is of a tube and air-to-air type, its inlet port is at its bottom and its outlet port at its upper part.

Cold starting device: The flame type intake air preheating device, enables the engine to be started at the temperature of $-25\sim-30^{\circ}\text{C}$. The engine without the cold starting device can be started at $-5\sim-10^{\circ}\text{C}$.

Supercharger: the supercharger in the WD615 Euro II series diesel engine is a radial-flow exhaust gas turbo-supercharger with exhaust valve, which can improve the medium-and-low-speed performance and reduce emission effectively. The engine oil for lubricating and cooling supercharger is drawn out from the rear end of main oil duct of engine and returns to the lower part of crankshaft case directly.

(6) Double-cylinder Air Compressor

The double-cylinder air compressor, driven by the gear of fuel injection pump, is lubricated as follows: The lubricating oil enters into the air compressor from the main oil duct through an oil pipe fixed on the cylinder body to lubricate its bearing and then the oil return reaches oil pan after passing through the gear chamber.

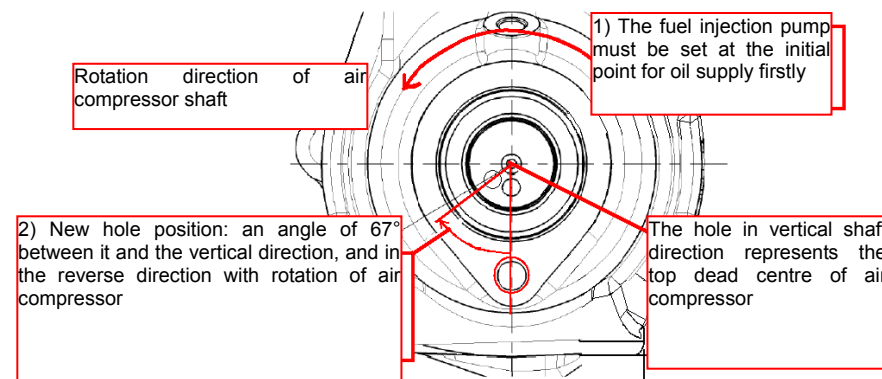
The inlet air of double-cylinder air compressor has been filtered by air cleaner. After passing through the air cleaner and before entering into the supercharger, the air enters into the double-cylinder air compressor through a branch pipe.

Euro II Engine

Connect a pipe from the cylinder body to the cylinder head of double-cylinder air compressor and then, after the water flows out from the cylinder head, to the side inlet of water pump of diesel engine, by which the double-cylinder air compressor is cooled.

As the transmission ratio of double-cylinder air compressor to engine is 0.5, there is no need to install drive shaft. During installation, the timing relation with fuel injection pump needs your attention. Before installation of gear of fuel injection pump, the other gears of engine must be set at the position with required oil supply advance angle and the crankshaft of air compressor must be set at the correct timing position complying with the requirements of the following figure. Only after the above conditions are met, can the gear of fuel injection pump be installed.

Timing of Fuel Injection Pump and Air Compressor



4. Use and Maintenance of WD615 Euro II Series of Diesel Engine

- (1) Selection of oil and fuel: select engine oil and diesel with correct grades according to the operating temperature at that time. The selection of engine oil and diesel grades is specified as follows.

Euro II Engine

Selection of Engine Oil

Operating temperature	$\geq -10^{\circ}\text{C}$	$< -10^{\circ}\text{C}$
Engine oil grade to be selected	15W/40, CF-4	5W/30, CF-4

Selection of Diesel

Operating temperature ($^{\circ}\text{C}$)	≥ 0	0~-10	-10~-20	-20~-30
Diesel grade to be selected	No. 0	No. -10	No. -20	No. -35

- (2) Anti-freezing Liquid: the anti-freezing liquid must be applied to the coolant of WD615 Euro II Series diesel engine as specified. The anti-freezing liquid has four functions:
- a. anti-freezing; b. preventing formation of scale deposit; c. preventing gas etching of parts of cooling system; d. preventing corrosion of parts of cooling system.

(3) Maintenance of Diesel Engine

It is necessary to check the level of coolant, fuel, engine oil and diesel for compliance before start of diesel engine.

When starting diesel engine, if it can't be started within 15s, it shall be restarted after 2 min. After start of diesel engine, run it at idle speed for 2-3 min. and the engine oil pressure shall exceed 100kPa at this time. Don't run it with heavy load and at high speed quickly all of a sudden before the cooling water temperature exceeds 60°C ; otherwise, it will affect the wearing resistance and reliability of engine.

Euro II Engine

Within the running-in period (3,000km), the diesel engine shall only operate with load below average. The engine oil level must be based on the check conducted 5 min. later after shutdown. Before stopping, the diesel engine operating with load must be subject to load and speed reduction, with the time of idling not less than 5 min.

5. Troubleshooting of Common Malfunctions

There are various causes leading to malfunctions of diesel engine. A single cause will lead to multiple abnormalities of diesel engine and a single malfunction may be resulted from multiple causes. Generally, the malfunction shall be checked and judged by seeing, listening, touching, smelling, etc. from the simple to the complex and from the outside to the inside. During troubleshooting, it is necessary to judge the malfunction property according to the malfunction characteristic and find out the correlation between each malfunction based on comprehensive analysis. For the malfunction whose cause can't be found out immediately, run the diesel engine at low speed on the premise that ensure the major accident stands no chance, and then conduct observation and analysis to find out the cause.

5.1 Failure of starting

- (1)Circuit Problems: check the insufficient electricity of battery or looseness of joints, the start circuit is connected correctly, see the starter or starting solenoid valve are working normally;
- (2)Fuel System: check the viscosity of engine oil, there is air in the fuel circuit;
- (3)Advance Angle: check the running-off of advance angle when initially supplying oil;
- (4)The Exhaust Butterfly Valves: check the exhaust butterfly valve is not closed normally.

Euro II Engine

5.2 Abnormal Sound from Engine

- (1) Stop the vehicle, check the position of abnormal sound and connect to service station.

5.3 Too Low Pressure of Engine Oil

- (1) Check the position of leakage engine oil;
- (2) Use standard engine oil grade and ensure its quality;
- (3) Check the engine oil pressure gauge is normal.

5.4 Power Deficiency

- (1) Problem of Oil Circuit: check there is air in the fuel circuit, the quality of fuel, the injection pump or injector is working normally;
- (2) Intake and Exhaust System: check the blockage of air filter, the exhaust butterfly valve close abnormally;
- (3) Complete Vehicle System: check the position of fuel pump handle, the handle of fuel pump can not get the maximum place when the throttle pedal is stepped to the end.

5.5 High Water Temperature in Engine

- (1) Check whether the cooling water in water tank is deficient;
- (2) Check whether the water pump belt slip or too loose;

Euro II Engine

- (3) Check whether the water pump working normally;
- (4) Damage of the cylinder head gasket, check whether there is water spots around the cylinder head.

5.6 Water Return of Engine

- (1) Excessive water is added into expansion water tank or loss of water tank cover;
- (2) Water return is false because thermostat exhaust pipe in expansion water tank is so long that it goes under the water level.

5.7 Black Smokes

- (1) Check the blockage of air filter, lead to the insufficient intake air;
- (2) The fuel injection pump supplies too much fuel or the injector poor atomization;
- (3) The diesel engine is running at an overload.

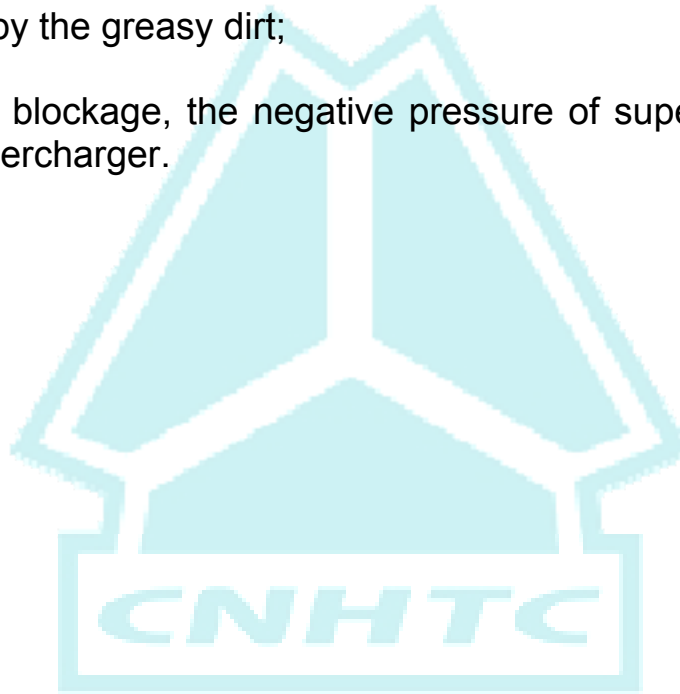
5.8 White Smokes

- (1) The quality of diesel is bad with much water in it;
- (2) Check whether the air temperature or cooling water temperature is too low;
- (3) The valve clearance is too small, so that the exhaust valve is opened too early.

Euro II Engine

5.9 Blue Smokes

- (1)The oil level of oil pan is too high, the engine oil jumps up;
- (2)The gas-oil separator is blocked by the greasy dirt;
- (3)As the air filter pipe is in serious blockage, the negative pressure of supercharger compressor is strong, which makes engine oil be inhaled into supercharger.



Operation and Maintenance of Engine

1. Operation Attentions and Maintenance

For driving safety, the engine must be carried out routine inspections of each component. If somewhere is abnormal, the vehicle should be sent to the repairing service station for maintenance.

Before starting the diesel engine, the height of cooling level, oil level, and diesel level must be checked.

When starting the diesel engine is started, if it doesn't work within 15 seconds, restart it after 2 minutes.

After diesel engine is started, idle speed running will last for 2-3 minutes. Oil pressure will exceed 100,000Pa. When cooling water temperature is lower than 60°C, do not run the engine at high-speed and heavy load at once, otherwise its wear resistance and reliability will be affected.

In the case that the engine works with load, load and speed must be reduced before shutdown. Idle speed running must last for no less than 5 minutes.

During running-in period (within 3000km), it is suitable for diesel engine to run only under medium load.

2. Routine Inspection and Maintenance

2.1 Oil Level Check

Check must be carried out after engine being shut down for 5 minutes with the vehicle parked on ground. When the engine is running or the vehicle is tilting, the oil level could not be measured accurately.

Operation and Maintenance of Engine

Checking Methods:

1. Pull out the oil gauge, clean the oil.
2. Re-insert the oil gauge completely, and then pull it out again, check the oil level. If the oil level is in the grid region between "High" and "Low" (As shown in Figure 6), it indicates that it is normal.

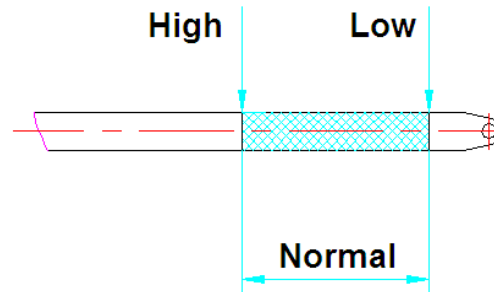


Fig. 6 Oil level check

3. If the oil is too low, please fill oil. When refilling, do not exceed the "High" of oil gauge.
4. After filling oil, re-insert the oil gauge correctly. Do not let the oil spill all around during refilling. Prevent oil spilling on the other components of the engine to avoid danger.

2.2 Coolant Level

Check whether the coolant water level is adequate or not (According to the method of "Preparation Before Driving").

Check the coolant level and add the coolant after the engine is cool.

Operation and Maintenance of Engine

The reason of sudden dropping of coolant level may be the leak of cooling system, please drive to service station for maintenance and changing at once.

2.3 Engine Status

Start the engine and check whether the exhaust gas, shaking and starting is normal, and check if there is abnormal noise when the engine is at idle speed. If there are abnormal starting, black smoke, abnormal shaking or noise happened, please drive to service station for checking and maintenance.

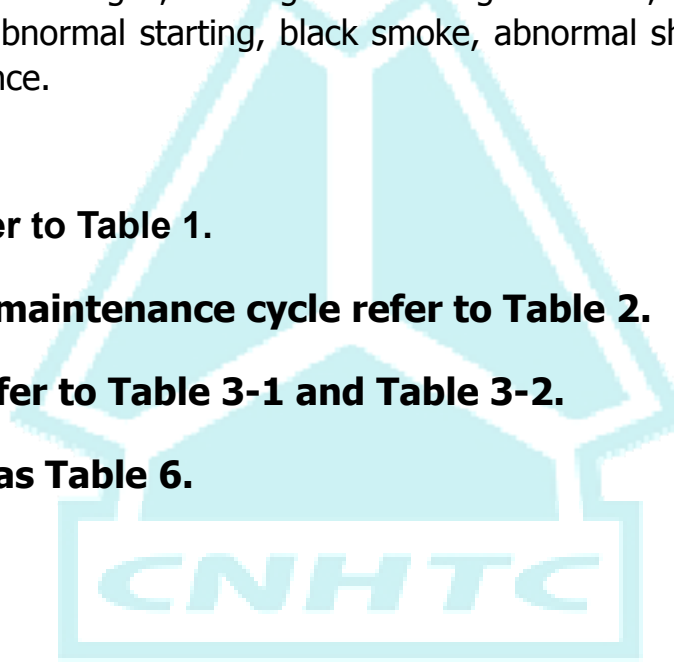
3. Maintenance Rules

3.1 Service conditions of vehicle refer to Table 1.

3.2 First check, routine check and maintenance cycle refer to Table 2.

3.3 Changing cycle of engine oil refer to Table 3-1 and Table 3-2.

3.4 Engine Maintenance Standard as Table 6.


CNHTC

Operation and Maintenance of Engine

Table 3-1 Changing Cycle of CH-4 Oil in Different Conditions for Euro3 Engine

Service Conditions Changing Interval	WG I	WG II	WG III
A	—————	15000km	20000km
B	5000km/4 months/service time 200h	10000km /6 months/service time 500h	—————
C	5000km /4 months/service time 200h	10000km	15000km
D	5000km /4 months/service time 200h	10000km	15000km
E	5000km /4 months/service time 200h	10000km	15000km
1. For vehicles serves in various bad condition or always over-loads, interval of oil changing shall be shorten. 2. Ensure two times of oil changing per year under whatever conditions.			

Operation and Maintenance of Engine

Table 3-2 Changing Cycle of CH-4 Oil in Different Conditions for Euro2 Engine

Service Conditions Changing Interval	WG I	WG II	WG III
Normal conditions	5000km	Every 10000km	15000km
A	5000km	Every 5000km	5000km
B	5000km	Every 5000km	10000km
C	5000km	Every 5000km	5000km
A & B	5000km	Every 5000km	5000km
A & C	25000km	Every 25000km	25000km
1. For vehicles serves in various bad condition or always over-loads, interval of oil changing shall be shorten. 2. Ensure two times of oil changing per year under whatever conditions.			

Operation and Maintenance of Engine

Table 3-3 Maintenance Range of Diesel Engine

Diesel Engine Maintenance Items	First-time Check	P	WD1	WD2	WD3	WD4
Replace oil	●	Oil changing cycle as per different conditions				
Replace oil filter or filter element	●	When changing oil				
Check and adjust valve clearance	●		●	●	●	●
Replace fuel filter element			●	●	●	●
Clean primary fuel filter or replace filter element			●	●	●	●
Check coolant volume and add it to full	●	●	●	●	●	●
Replace coolant	According to 4.4					
Fasten cooling pipe clamp	●					
Fasten inlet air pipe, soft tube, and flange connection parts	●		●	●	●	●
Check air filter maintenance indicating light or indicator			●	●	●	●
Clean dust cup of air filter (Excluding automatic exhausting type)		●	●	●	●	●
Clean main filter element of air filter	When indicator light or it indicates red					
Replace safety filter core of air filter	After cleaning main filter core for five times					
Check bearing clearance of turbocharger						●
Check and adjust clutch travel and clearance	●	●	●	●	●	●
Electric components and electronically controlled system wiring harness	Check it every 250 hours					
Note: The mark “● ” means that the maintenance is needed.						

Operation and Maintenance of Engine

Table 3-3 Maintenance Range of Diesel Engine

Diesel Engine Maintenance Items	First-time Check	P	WD1	WD2	WD3	WD4
Check and tighten belts	•	•	•	•	•	•
Check and adjust opening pressure of nozzle(for Euro2 engine)					•	•
Check and adjust injection pump on test bench(for Euro2 engine)					•	•
Adjust idle speed(for Euro2 engine)	•					
Note: The mark "•" means that the maintenance is needed.						



Operation and Maintenance of Engine

4. Fuel, Lubricating Oil, Coolant and Auxiliary Materials Used in Engine:

4.1 Fuel

Summer: diesel which apply to the local market in summer.

Winter: diesel which apply to the local market in winter.

4.2 Lubricating Oil

4.2.1 Grade CF—4 engine oil should be used for Euro2 engine. Grade CH—4 engine oil should be used for Euro3 common rail engine. SAE 15W/40 grade oil is recommended when local temperature is above -10℃.

4.2.2 High-grade oil is allowed to replace lower-grade oil.

Before starting the engine, check the height of the oil level in the oil pan.

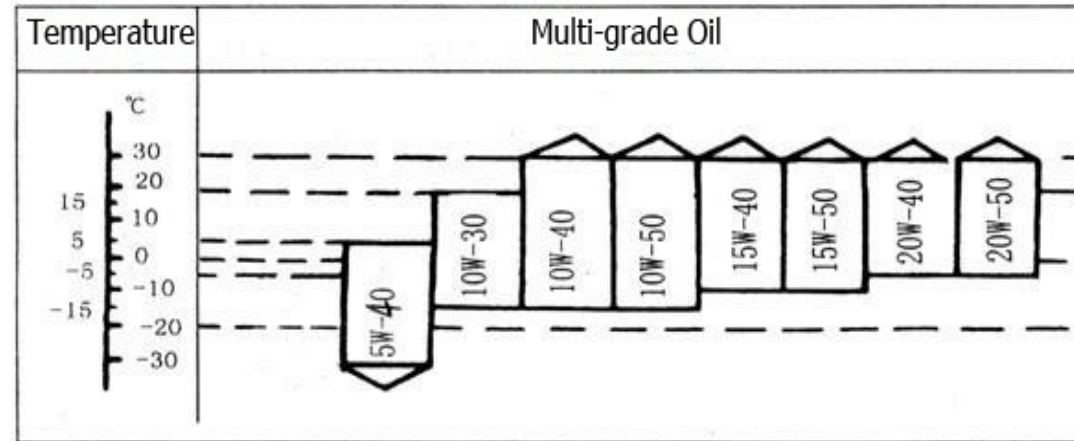


Warning:

- 1. Do not check the height of lubricating oil level when the engine is running.**
- 2. It is not allowed to mix-use the different grade oils.**

Operation and Maintenance of Engine

Table 3-4 Selection of Oil Brand



As the multi-grade oil with a flat viscosity curve, between the range of lubricating low temperature and high temperature, it has good lubricating characteristic, so we recommend use multi-level lubricant.

Changing Engine Oil:

Check whether the oil color is normal and extraneous matter is mixed in oil or not when discharging the used oil, so as to detect hidden errors. After the oil is to be drained completely, clean the drain plug and then tighten it; replace with new oil filter element, the new oil should be added into the engine to the upper limit of oil ruler. In order to prevent the case that starting the engine without lubrication, turn the key switch to the starting position (Position 4) when the high-pressure oil pump is in the off position, empty running for a while, and then start the engine and operate in low speed. Check oil filter if there is any leaks, shut down five minutes later, check and add oil to the upper limit.



Notice: Do not replace the engine oil when it is hot.

Operation and Maintenance of Engine

4.3 Grease

Inject the general lithium grease into the oil cup of water pump in line with the requirements of the local market.

4.4 Coolant

Cooling system should be added with the long-acting cooling fluid, this fluid has capability of antifreeze rust. Please refer to the ratio of long-acting coolant antifreeze instructions.

Brand	Applicable Min. Temperature℃
JFL-318	-10
JFL-336	-26
JFL-345	-35



Warning:

- 1. When temperature is below 0℃, you should check the antifreeze concentration regularly.**
- 2. Vehicles perennial running at areas above 0℃, water which has been treated with anti-rust and anti-scaling could be used as the coolant; it is prohibited using untreated water as the engine coolant.**

Operation and Maintenance of Engine

4.5 Driving Belt

Check the driving belt. The working surface of the driving belt shall be free from any vertical cracks. Damaged, oil dipped or polished belts must be changed immediately.



Warning: Some fine cross cracks may be found with the driving belt after normal running for about 5000 to 10000km (3000 to 6000 miles). If only such fine cross cracks are found, there is no any for changing.

Changing driving belt requires certain professional know-hows. Diving belt needs to be changed with qualified service facilities.

5. Operation notice

5.1 EURO III Series Diesel Engine

- 1) In order to protect legitimate right and interests of users, it is not permitted to change the data of ECU without our permission.
- 2) Once the data of ECU has been changed, the warranty ceases to be in effect.
- 3) The pump, injector and rail of CR are contraptions. It is not permitted that the pump, injectors and rail dismantled by users.
- 4) Rotating parts of turbocharger are precision high speed parts, dismantling or impacting is not permitted, or the effectiveness of the warranty will no longer exist.
- 5) There are strict requirements on tightening torque and turning angle of main bearing bolts, cylinder head bolts and connecting rod bolts, loosening or dismantling is not permitted, or the warranty ceases to be in effect.
- 6) Before starting the diesel engine, check whether the coolant and lubricating oil are fully filled.
- 7) Connecting rod bolts can be used once only.

5.2 EURO II Series Diesel Engine

- 1) In order to protect legitimate right and interests of users, it is forbidden to dismantle fuel quality lead sealing of injection pump privately.
- 2) Once injection pump is adjusted or lead sealing is dismantled, the guarantee ceases to be in effect.

Operation and Maintenance of Engine

- 3) Injection pump is precision parts, it is forbidden to dismantle by user, or the guarantee ceases to be in effect.
- 4) Rotating parts of turbocharger are precision high speed parts, dismantling or impacting is not permitted, or the guarantee ceases to be in effect.
- 5) There are strict requirements on tightening torque and turning angle of main bearing bolts, cylinder head bolts and connecting rod bolts, loosening or dismantling is not permitted, or the warranty ceases to be in effect.
- 6) Before starting the diesel engine, check whether the coolant and lubricating oil are fully filled.
- 7) Connecting rod bolts can be used once only.

6. Change engine oil

Notice: Change engine oil when hot.

During oil drain, carefully check engine oil for normal color and presence of foreign materials so as to find potential failures. After oil is discharged completely, clear the drain plug of foreign materials and then tighten it; replace with a new oil filter element and fill the engine with fresh engine oil until the upper limit on the oil dipstick. To prevent starting the engine without lubrication, turn the key switch to start position (position 4) with the high pressure oil pump in oil cut-off position, idle for a while, then start the engine and allow it to run at low speed. Check the oil filter for leakage, shut down the engine and wait 5 minutes, and then check and refill engine oil until the oil level reaches the upper limit on the oil dipstick.

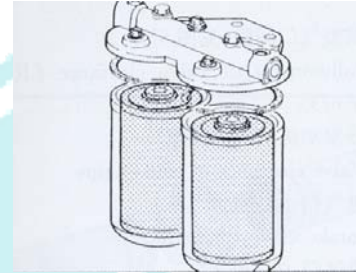
● **Replace oil filter element**

When changing engine oil, replace the 2 shunt oil filters at the same time. Apply a thin layer of oil on the gasket and then tighten the filter.

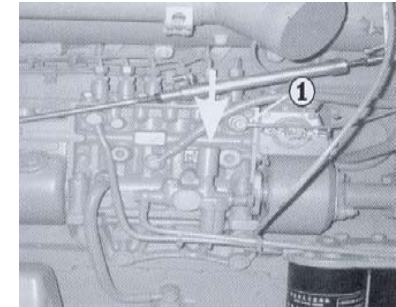
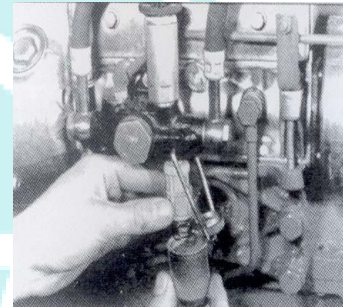
Operation and Maintenance of Engine

Fuel filter

Replace the 2 filter elements at the same time.



- Clean the prefilter at the fuel transfer pump
- Bleeding high pressure fuel pump



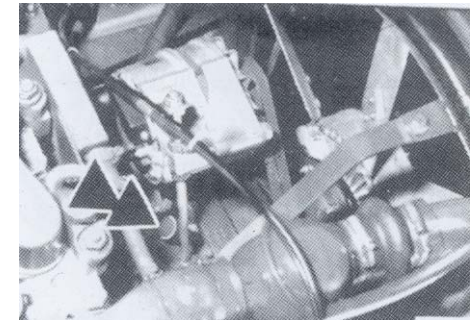
Set the hand throttle to fuel cutoff position, and then pump fuel using manual fuel pump until no bubbles exist in the fuel flowing out of the bleeder plug 1. Loosen the fuel pipe at the nozzle bracket, set throttle to full open position, and then operate the starter until no bubbles exist in the fuel ejected.

Operation and Maintenance of Engine

- (1) Anti-freezing Liquid: the anti-freezing liquid must be applied to the coolant of WD615 Euro II Series of diesel engine as specified. The anti-freezing liquid has four functions:
- a. anti-freezing; b. preventing formation of scale deposit; c. preventing gas etching of parts of cooling system; d. preventing corrosion of parts of cooling system.

Lubricate water pump bearing

Fill the water pump bearing chamber from the grease fitting on the water pump.



(2) Maintenance of Diesel Engine

It is necessary to check the level of coolant, fuel, engine oil and diesel for compliance before start of diesel engine.

When starting diesel engine, if it can't be started within 15s, it shall be restarted after 2 min. After start of diesel engine, run it at idle speed for 2-3 min. and the engine oil pressure shall exceed 100 kPa at this time. Don't run it with heavy load and at high speed quickly all of a sudden before the cooling water temperature exceeds 60°C; otherwise, it will affect the wearing resistance and reliability of engine.

Within the running-in period (3,000 km), the diesel engine shall only operate with load below average. The engine oil level must be based on the check conducted 5 min. later after shutdown. Before stopping, the diesel engine operating with load must be subject to load and speed reduction, with the time of idling not less than 5 min.

Clutch

1. Main Composing of Clutch System

Clutch system is composed mainly by Clutch platen assembly (figure 1), driven disc assembly (figure 2), master pump and booster cylinder (figure 3 and 4).

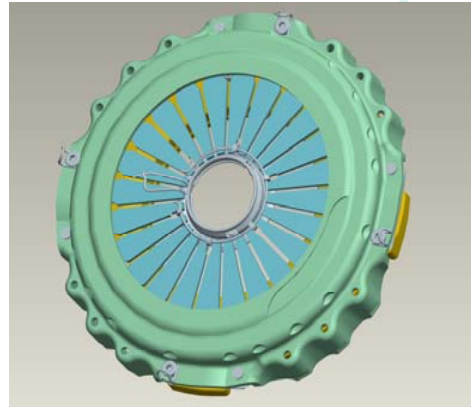


Fig.1 Clutch Platen Assembly

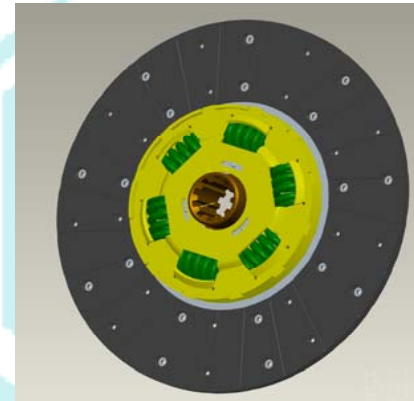


Fig.2 Driven Disc Assembly

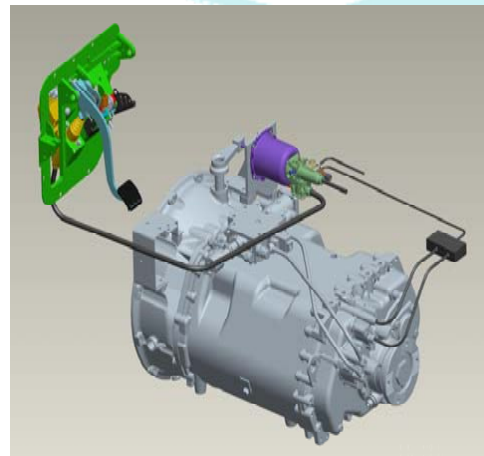


Fig. 3 Master Pump

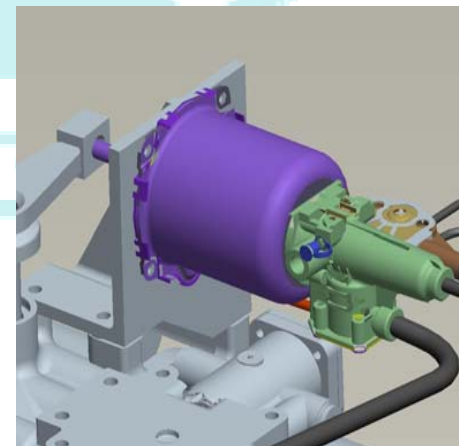


Fig.4 Booster Cylinder.

Clutch

2. Main Function of Clutch System

- 1). When vehicle startup, it smoothly connects engine and transmission system and ensure the vehicle steadily startup.
- 2). When gear shifting, it separates engine from transmission, and reduces the impact among shift gears of transmission.
- 3). It limits the largest torque supported by driven system, and prevents each parts of driven system to be damaged due to over-load.
- 4). Effectively reduce the vibration and noise of driven system.

3. Basic Requirements of Clutch System

- 1). Under any driving conditions, it can transfer the largest torque of engine.
- 2). Smooth and soft connection ensures vehicle startup without tremble and impact.
- 3). Rapidly and completely separate.
- 4). Small rotating amount of driven parts; reduce the impact among transmission gears when gear shifting.
- 5). Have great decalescence and airing and heat dissemination; ensure the use life of clutch.
- 6). Have abilities of vibration absorbing, impact softening to avoid driven system causing torsion resonance.
- 7). Light and precise operation.
- 8). Pressure acted on the driven disc and friction factor of friction material shall try to be smaller during applying period; ensure it has steadily working feature.
- 9). Have enough strength and better moving balance.
- 10). Have features of brief and compact structure, better manufacturing techniques and easy maintenance and service and others.

4. Operation System of Clutch

4.1. Introduce of Operation System of Clutch.

Operation system of pull-typed clutch is the clutch separates the force from the engine direction. Compared with the traditional

Clutch

push-typed clutch, pull-typed operation need not adjust clearance of separating bearing during application. It not only reduces the working amount of vehicle maintenance, but also totally avoids clutch damaging due to forget adjusting the clearance of bearing. Operation of clutch and brake share the same bracket, which adopts aluminum alloy and has features of lighter and better rigidity. Clutch pedal adopts pendant type pedal which is more suitable for human-machine engineering due to larger foot space and increases the comfortable operation; adopting module structure has great feature of seal with cab (see Fig. 5). Clutch driven cylinder, oil reservoir tank of clutch, pedal assembly of clutch and others are all deployed in the front of cab; driven cylinder connects with auxiliary cylinder of clutch on the chassis by soft pipe; oil reservoir tank directly connects with driven cylinder of clutch (see Fig 6).

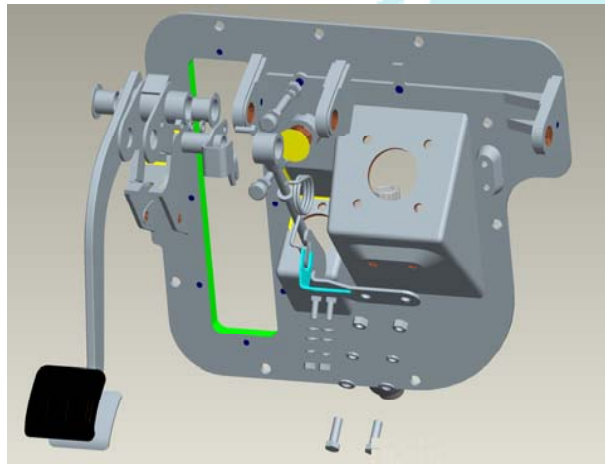


Fig. 5 Structure of Pedal Part.

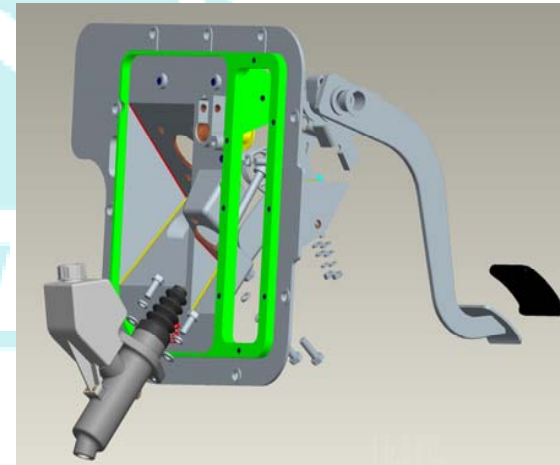


Fig. 6. Structure of Driven Cylinder Part.

Clutch

4.2. Operation Principle of Clutch Operation System.

Clutch operation system adopts hydraulic operation and air force aiding structure.

When press down clutch pedal, push rod of driven cylinder will push piston to forward move, then push brake liquid to enter hydraulic control chamber of clutch aid cylinder along the oil pipe. On the one hand, brake liquid acts on the piston as working pressure, and on the other hand, it acts as control pressure of air chamber of aid cylinder. When compressed air enters air chamber of aid cylinder, it will produce aid air force. They push together piston to make push rod of aid cylinder moving, and separating swing arm rotating. Then, it separates fork to drive separating bearing make forwards (pull-style) or backwards (push-style) movements, and then clutch separates.

5. Operation Parameters of Clutch Operation System.

- (1) Working medium: compressed air, brake liquid.
- (2) Largest working pressure: brake liquid is 4MPa, and compressed air is 0.85MPa.
- (3) Working temperature: $-40^{\circ}\text{C} \sim +80^{\circ}\text{C}$.
- (4) Brake Liquid: meets DOT3, DOT4 or SAEJ1703 standards. (Notice: brake liquid has a certain erosion).
- (5) Pedal journey: largest journey is 185mm.
- (6) Pedal force: 150 with air aiding force.

Clutch

Operation System of Pull-type Clutch.

Operation system of pull-typed clutch is the clutch separates the force from the engine direction. Compared with the traditional push-typed clutch, pull-typed operation need not adjust clearance of separating bearing during application. It not only reduces the working amount of vehicle maintenance, but also totally avoids clutch damaging due to forget adjusting the clearance of bearing. Its structure is shown as figure 7.

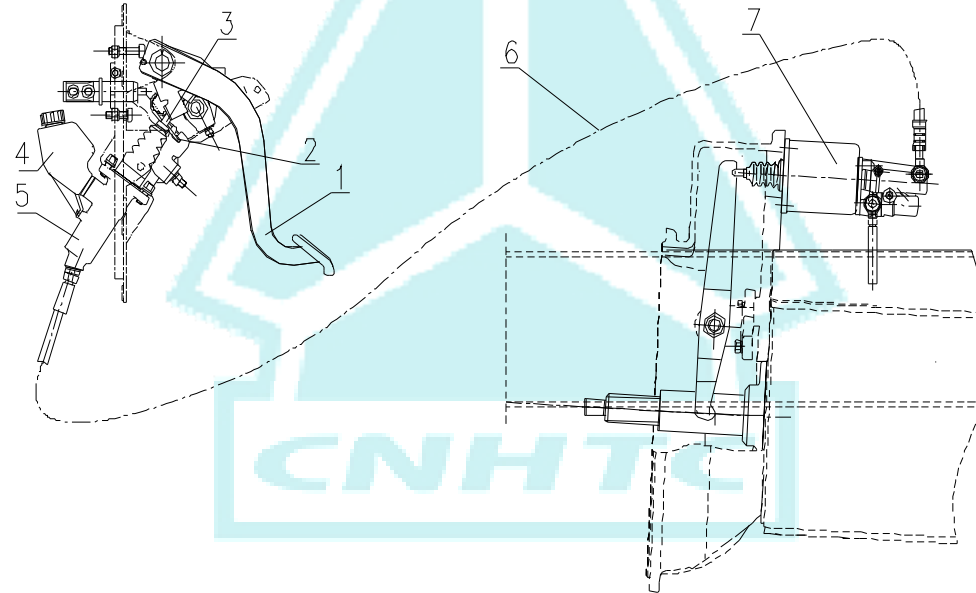


Fig. 7: Assembly Drawing of Pull-type Clutch Operation System

1. Clutch Pedal Assembly. 2. Back Spring. 3. Push Rod of Clutch Driven Cylinder. 4. Clutch Oil Reservoir Tank. 5. Clutch Driven Cylinder.
6. High Pressure Oil Pipe. 7. Clutch Auxiliary Cylinder.

Clutch

Adjustment of Clutch Operation System

1. Check and Adjust the Clearance between Master Cylinder Pushrod and Piston:

When adjusting, push the pedal with hand smoothly till the main cylinder pushrod contacts against the piston, then adjust the limit bracket until the clearance between limit bracket and pedal is about 1mm. Tighten the limit bracket nut. Ensure there is 0.5mm~1mm clearance between the pushrod and piston, this clearance should not exceed 1mm, or it will reduce the effective travel and influent the effect of clutch.

2. Adjust Clutch Brake Control Valve:

Step on the clutch pedal fully, at this time the working travel of main cylinder pushrod should not be less than 32mm, and the clutch pedal should have control valve to move 3~5mm. Fix the brake control valve, tighten the bolt, and then adjust the limit screw of the pedal bracket, making the screw cap contact against the clutch against the clutch pedal (when the clutch pedal is stepped down fully). This can prevent the brake control valve from coming off the pedal bracket.

3. Release the Air in Hydraulic System Thoroughly:

Air in hydraulic system can reduce the effective travel of booster cylinder pushrod, and the clutch can't be released thoroughly, thus shifting becomes difficult.

When assembling and disassembling oil tube, be sure to release the exhaust valve of booster cylinder first. Fill the specified oil to the reservoir. At the same time step on the clutch pedal and release air from the exhaust valve, then tighten it. After stepping on the clutch pedal rapidly for several times, hold the pedal tightly, release the exhaust valve till no air comes out, then tighten the exhaust valve.

Repeat the afore-mentioned steps for 2~3 times, air in hydraulic system will be released completely.

Clutch

Attentions:

1. During the exhaust process, relax the pedal after the exhaust valve or an associated tube nut is tightened, so as to avoid inhalation of air, lifting the pedal to the maximum height in order to add the brake fluid inside the tank to the master cylinder fluid anvil cell.
2. Re-adjust the clearance when you maintain the new vehicle for the first time. Check the vehicle for second grade maintenance every 12,000km and for first grade maintenance every 4,000km. Push the clutch rocker arm with hand, there should be gap in the head of limit bolt.
3. You must adopt DOT3, DOT4 or SAE J1703 brake fluid as actuating medium in hydraulic system. When mounting and dismounting the pipeline, you can use the Loctite572 to seal the union nut and connector.
4. When changing brake fluid, drain the remaining fluid out of the system thoroughly, and change to the specified brand fluid manufactured in the same batch.
5. Brake fluid is corrosive. Avoid brake fluid splashed on the human body and the paint surface of the vehicle during the exhaust process.

Transmission

1. Overview of HW Series Transmission

The HW series transmission of China National Heavy Duty Truck Group Corp. (Sinotruk) is a new generation transmission for heavy-duty vehicles, which enjoys the completely independent intellectual property rights. Its main gear box is of a dual counter shaft structure while its auxiliary gear box is of a planetary reduction structure, which makes its bearing capacity higher and construction more reliable. Its main and auxiliary gear box interlock mechanism effectively protects the auxiliary gear box synchronizer, and its forced lubrication system adapts it to various kinds of road conditions. Besides, the design of its integrated small cover makes for clear gear position and flexible gear shift.

2. Main Performance Parameters of HW Series Transmission

Transmission Model	Torque (Nm)	Rated speed (Rpm)	Weight (Kg)	Oil quantity	Structural features	Length(from Clutch S.A. to output flange)
HW13710	1390	2600	337	13	Main box double counter shaft Accessory box planetary gears	859
HW13710C	1500	2600	337	13	Main box double counter shaft Accessory box planetary gears	859
HW15710	1500	2600	342	12		859
HW15710C	1650	2600	342	12		843
HW19710	1900	2600	363	12		843
HW19710C	2100	2600	363	12	Main box double counter shaft Accessory box planetary gears	843
HW19710T	1900	2600	430	18	Main box single shaft, Synchronizer, Accessory box planetary gears	1030
HW19710TC	2100	2600	430	18		
HW19712	1900	2600	393	13	Main box double counter shaft Accessory box planetary gears	915
HW19712C	2100	2600	393	13		
HW20716	2000	2600	397	14		
HW20716C	2200	2600	397	14		

Transmission

HW series transmission speed ratio

Transmission Model	1	2	3	4	5	6	7	8	9	10	11	12	R1	R2
HW13710	14.08	10.47	7.82	5.82	4.35	3.24	2.41	1.80	1.34	1.00			12.67	2.91
HW13710C	10.52	7.83	5.85	4.35	3.25	2.42	1.80	1.34	1.00	0.75			9.47	2.18
HW15710	14.28	10.62	7.87	5.88	4.38	3.27	2.43	1.80	1.34	1.00			13.91	3.18
HW15710C	10.73	7.98	5.91	4.38	3.29	2.45	1.82	1.35	1.00	0.75			10.49	2.39
HW19710	14.28	10.62	7.87	5.88	4.38	3.27	2.43	1.80	1.34	1.00			13.91	3.18
HW19710C	10.73	7.98	5.91	4.38	3.29	2.45	1.82	1.35	1.00	0.75			10.45	2.39
HW19710T	14.36	10.66	7.88	5.82	4.38	3.28	2.44	1.80	1.33	1.00			14.01	3.20
HW19710TC	10.79	8.01	5.92	4.38	3.29	2.47	1.83	1.35	1.00	0.75			10.53	2.41
HW19712	15.01	11.67	9.03	7.14	5.57	4.38	3.43	2.67	2.06	1.63	1.27	1.00	13.81	3.16
HW19712C	11.80	9.17	7.10	5.61	4.38	3.44	2.70	2.10	1.62	1.28	1.00	0.79	10.85	2.48
HW20716	L	15.59	10.89	7.48	5.2	3.56	2.49	1.71	1.19				14.29	
	H	13.12	9.17	6.3	4.38	3	2.1	1.44	1				12.03	
HW20716C	L	13.12	9.17	6.3	4.38	3	2.1	1.44	1				12.03	
	H	11.05	7.72	5.3	3.68	2.52	1.76	1.21	0.84				10.1	

Transmission

3. Structural Characteristics of HW Series Transmission

(1) Control Mechanism

The HW series transmissions are all remotely controlled. The HW20716 transmission comes in two types, the single-lever dual-H valve control and the dual-lever dual-H valve control; the HW15710/19710 transmission is of the single/dual-lever single-H valve control. The main gear box of HW transmission is manually controlled while its front and rear auxiliary gear boxes are pneumatically controlled. Fig. 1 and 3 are the schematic diagrams for the gear positions while Fig. 2 is the schematic diagram for the handle. For HW20716 and HW15710/19710 transmissions, their gear shift handle positions are as shown in Fig. 2 and 3, and Fig. 1 and 2 respectively.

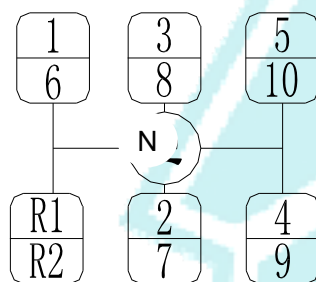


Fig. 1

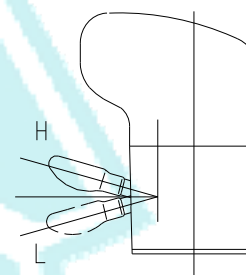


Fig. 2

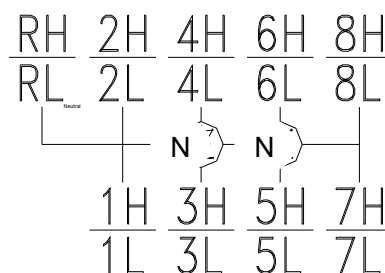


Fig. 3

Transmission

(2) Pneumatically Controlled System

The air source is the 0.7~0.8Mpa compressed air from the complete vehicle. Both the front and the rear auxiliary gear boxes of the HW20716 transmission are pneumatically controlled. The shift between the high and the low gears of its front auxiliary gear box is achieved by means of the preselector valve switch on the handle. Fig. 5 is the schematic diagram for the pipelines (transmission split air pipelines). When the switch valve is in the H range, air enters the upper port of the split gear cylinder through port 1 via port 2 of the two-position five-way valve. When the switch valve is in the L range, air enters the lower port of the split gear cylinder through port 1 via port 4 of the two-position five-way valve. The shift between the high and the low gears of the rear auxiliary gear boxes of the transmissions is achieved in the dual-H valve control mechanism. Fig. 6 is the schematic diagram for the air passage: port P is the inlet port of the dual-H valve; port A is connected to the upper port of the range gear cylinder while port B is connected to the lower port of the range gear cylinder.

The main gear box of the HW19710 transmission is manually controlled while its rear auxiliary gear box is pneumatically controlled.

Note: The exhaust port of the dual-H valve shall be mounted facing down.

Transmission

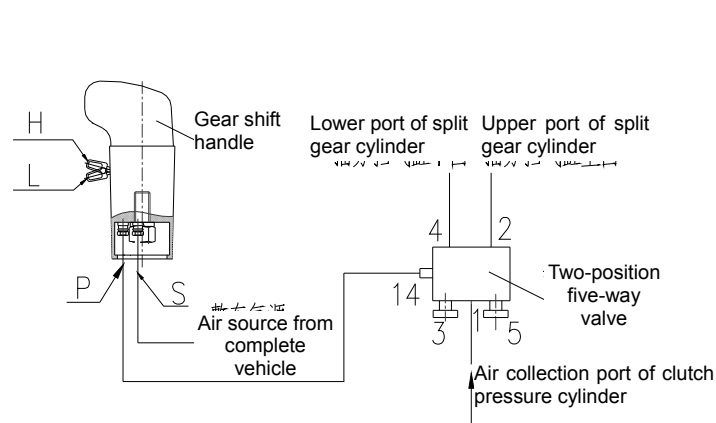


Fig. 4 Schematic Diagram for Transmission Split Air Pipeline

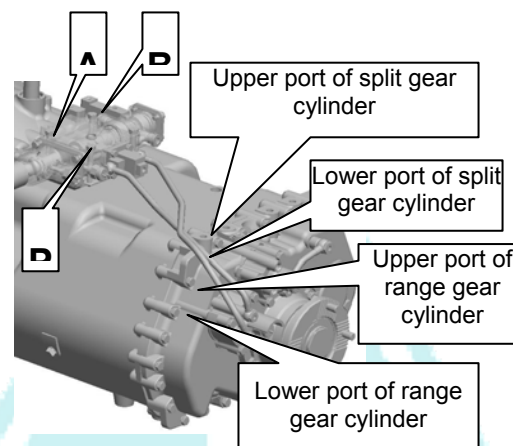


Fig. 5

(3) Power Take-off

To meet the demand of some special vehicles, a power take-off can be mounted at the right back of the HW series transmission. The power take-off comes in two types, HW50 and HW70. Since it takes power directly from the right counter shaft of the main gear box, it is able to take power when the gear is in the neutral position and its direction of rotation is the same as that of the engine. The gear ratio of the HW50 power take-off itself is 0.739 while that of the HW70 itself is 0.76. The output speed ratios of the power take-offs are as shown in the table below:

Type of Transmission	Speed Ratio of Transmission	Output Speed Ratio of Power Take-off	Power Take-off Equipped
HW20716	1.1875	0.739	HW50
HW15710/19710	1.25	0.924	HW50
HW20716	1.1875	0.9	HW70
HW15710/19710	1.25	0.95	HW70

Transmission

(4) Main and Auxiliary Gear Box Interlock Mechanism

The HW series transmission is equipped with a main and auxiliary gear box interlock mechanism. When the fork shaft of the range gear of the auxiliary gear box is not in position, the interlocking plate will be just in the fork shaft groove of the main gear box by the action of the spring, locking the fork shaft of the main gear box in the neutral position. When the fork shaft of the range gear reaches the proper position, it will push the interlocking plate to rotate, thereby unlocking the fork shaft of the main gear box. In this way, during the shift between the high and low gears, the gears of the main gear box can be prevented from being engaged when the gears of the auxiliary gear box are not engaged properly. Thus, the synchronizer of the auxiliary gear box can be effectively protected.

(6) Small Cover

The interlock, the self-lock, the reverse gear lock, the dual-H valve drive, the neutral gear sensor and the reverse gear sensor are all integrated on the small cover, which form a smart structure, clear gear positions, flexible gear shift and reliable operation. In addition, both the single-lever and the dual-lever operations can be realized.

(7) Speed Ratio

With a wide range of speed ratios (HW20716: 1~15.59, HW15710/19710: 1~14.28) and a forced lubrication

system, this series of transmissions enjoys good gradeability and strong adaptability to various complex road conditions. Meanwhile, its rational gear arrangement and small speed ratio difference (HW15710/19710: 1.35, HW20716: 1.19) enables the vehicle to attain the expected speed when its engine runs at the most economical rate, therefore helping achieve an excellent fuel economy.

Operation and Maintenance of Transmission

1. Usage Requirements

Operate the transmission properly, and implement regular servicing and maintenance, which is crucial for vehicle's reliable driving and the transmission's long life expectancy. Please comply with the following requirements for use:

1.1 Lubricant Brand

Please fill and inject 85W/91GL-5 vehicle gear oil in the transmission.

1.2 Proper Oil Level

Please make sure that the oil level is abreast with the observation opening of oil level. Check the oil level through the observation opening on box flank until the oil level reached the opening and spillage happens.

1.3 Inspection of Oil Level

Regular inspection should be made to the oil level. The truck should be parked on flat road when checking the oil level. Considering the inflation of hot oil, do not immediately check the vehicle that is just parked, and only when the oil level is stabilized and the oil temperature comes close to the ambient temperature can we check the oil level, to prevent the inaccurate measurement.

1.4 Re-supply of Lubricant

To prevent the chemical reaction of different kinds of lubricants, the re-supplied lubricant should be identical with the former lubricant brand and specifications in item 1.1.

Operation and Maintenance of Transmission

1.5 Cycle for Lubricant Replacement

Discharge the used lubricant in the transmission and then rinse the strainer assembly when replacing the lubricant for transmission.

The lubricant in the new transmission must be replaced between 2,000~5,000km.

For each 10,000km, the lubricant must be checked for its oil level and leakage. It should be supplemented and the strainer can also be rinsed at any time if necessary.

For each 50,000km, the lubricant must be replaced.

1.6 Working Temperature

The maximum temperature for transmission during the continuous working period must not exceed 120°C and its minimum temperature must be below -40°C.

The lubricant will decompose and reduce the lifetime of transmission if the working temperature exceeds 120°C.

Any of the following conditions can cause the transmission's working temperature to exceed 120°C.

- ① Continuous driving at the speed not more than 32Km/h.
- ② Engine speed is too high.
- ③ Ambient temperature is too high.
- ④ Transmission is surrounded by eddy current.
- ⑤ Exhaust system is too close to the transmission.
- ⑥ Running at high-power and over-speed rotating.

Operation and Maintenance of Transmission

1.7 Working Inclination Angle

The working inclination angle for transmission must not exceed 15° , otherwise, it may not be fully lubricated (the working inclination angle is equal to transmission's installation angle on the chassis plus slope angle).

1.8 Draging and Sliding

When the transmission works, its countershaft rotates and drives the oil pump to run, plus splash lubrication, which can fully lubricate the transmission. When the vehicle is dragged with rear wheels touching the ground and transmission system connected, the main shaft rotates comparing to main shaft gear and the planetary mechanism also rotates, although the countershaft gear and main shaft gear for main transmission do not rotate. This will cause great damage to the transmission's planetary mechanism and localization elements of main shaft due to insufficient lubrication.

Pay attention to the following points to prevent this kind of phenomena:

Do not step on the clutch pedal to let the vehicle slid on neutral position.

When the vehicle needs to be dragged, draw the half axle out or disconnect the drive shaft, or have the driving wheel dragged liftoff the ground.

2. Precautions

2.1 The clutch must be completely released and the gear shaft lever should be moved into relevant positions when shifting.

2.2 When parking, the gear shaft lever should be moved into neutral position in low gears area.

Operation and Maintenance of Transmission

- 2.3 When shift into low gear (Creeping gear) or reverse gear, it must be stopped first and then shift into relevant gear to prevent the parts inside the transmission from being damaged.
- 2.4 When the transmission shifts from low gears to high gears (vice versa), do not skip gears, or it will influence the lifetime of auxiliary gearbox's synchronizer.
- 2.5 When driving downhill, shifting between high and low gears is prohibited.
- 2.6 Shift to first gear or second gear to move in accordance with the road conditions.
- 2.7 Release the brake before the vehicle starts. For the vehicle is equipped with air cut-off brake, do not shift to relevant gear and start until their brake valves are connected and the air pressure reaches the level required to release the brake.
- 2.8 On the event of any unusual phenomenon, such as abnormal sound or heavy operation during the use of transmission, the vehicle must be parked immediately to check for any failure. Do not continue driving until the failure is eliminated.
- 2.9 The transmission is featured with interlocked mechanism for main and auxiliary transmission. The gear shifting for main transmission is locked up before the auxiliary transmission shifts into relevant gear. In the event any failed shifting, it may be affected by the interlock of main and auxiliary transmission. Check the sequential gear shifting cylinder and its gas pipeline to ensure that auxiliary transmission has shifted into relevant gear.
- 2.10 Privately disassembly/knock down or assemble the transmission is strictly prohibited within warranty period.

Operation and Maintenance of Transmission

3. HW Series Mechanical Gear box of Sinotruk

3.1 Overview of HW Series Transmission

The HW series transmission of China National Heavy Duty Truck Group Corp. (Sinotruk) is a new generation transmission for heavy-duty vehicles, which enjoys the completely independent intellectual property rights. Its main gear box is of a dual counter shaft structure while its auxiliary gear box is of a planetary reduction structure, which makes its bearing capacity higher and construction more reliable. Its main and auxiliary gear box interlock mechanism effectively protects the auxiliary gear box synchronizer, and its forced lubrication system adapts it to various kinds of road conditions. Besides, the design of its integrated small cover makes for clear gear position and flexible gear shift.

3.2 Main Performance Parameters of HW Series Transmission

Type	Max. Torque (Nm)	Max. Speed (Rpm)	weight (Kg)	Oil Filling Volume (L)
HW15710	1500	2600	342	12
HW15710C	1650	2600	342	12
HW19710	1900	2600	363	12
HW19710C	2100	2600	363	12
HW19712	1900	2600	393	14
HW19712C	2150	2600	393	14

3.3 Installation and Adjustment of Flexible Shaft Control System

- (1) The flexible shaft shall be arranged on the complete vehicle with a bend radius not less than 300mm. Its operating temperature ranges between -40℃ and +100℃.

Transmission for use

(2) The flexible shaft shall be connected with the gear shift rocker arm and the gear select rocker arm in the following way:

- a. The flexible shaft shall form a right angle with the rocker arm as possible as it can;
- b. The spatial positions of the guide sleeve, the protecting pipe joint and the push-and-pull rod of the flexible shaft shall be in a line.

(3) Install the gear select flexible shaft and the gear shift flexible shaft onto the control mechanism separately.

Caution: The spherical hinge threads of the two flexible shafts shall be screwed down.

- (4) After the installation, place the gear shift lever in the neutral position and measure if the dimensions of flexible shaft at the transmission end comply with the requirements. If not, adjust the connection length of the flexible shaft spherical hinge and the push rod tread so as to adjust the installation dimensions of the flexible shaft.
- (5) Then select and shift the gears to check if all the gears can be engaged. If a gear is difficult to be selected and shifted, check and adjust the installation dimensions of the gear select flexible shaft at the transmission end in accordance with the previous point.
- (6) The specific adjustment of the flexible shaft is as shown in Fig. 7:

Operation and Maintenance of Transmission

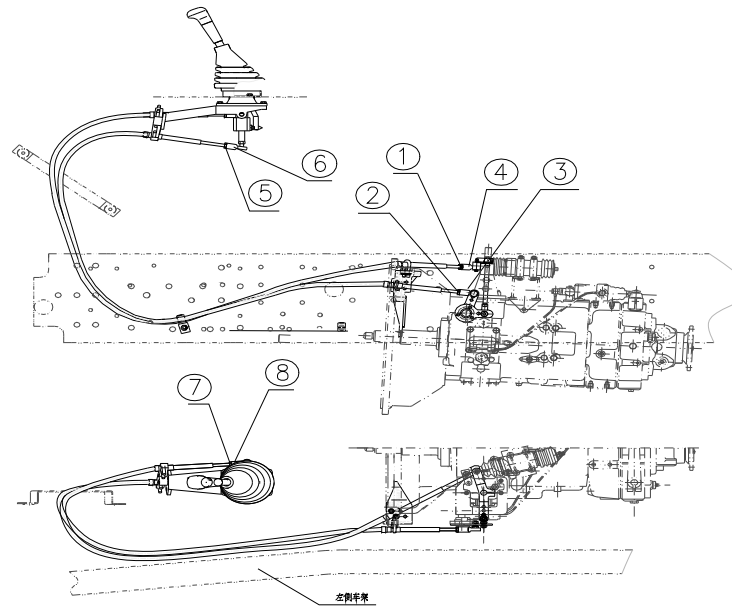


Fig. 7

- a. After the assembly, if the front row gears cannot be engaged in the test drive, unscrew nut ① (or nut ⑤) and properly rotate spherical hinge ④ (or spherical hinge ⑥) counterclockwise (to extend it). On the contrary, if the rear row gears cannot be engaged, unscrew nut ① (or nut ⑤) and properly rotate spherical hinge ④ (or spherical hinge ⑥) clockwise (to shorten it). Repeat the above procedures to make adjustment until all the gears can be engaged.
- b. After the assembly, if the low range gears cannot be engaged in the test drive, unscrew nut ② (or nut ⑦) and properly rotate spherical hinge ③ (or spherical hinge ⑧) counterclockwise (to extend it). On the contrary, if the high range gears cannot be engaged, unscrew nut ② (or nut ⑦) and properly rotate spherical hinge ③ (or spherical hinge ⑧) clockwise (to shorten it). Repeat the above procedures to make adjustment until all the gears can be engaged.

Operation and Maintenance of Transmission

3.4 Operation, Maintenance and Precautions for HW Series Transmission

(1) Operation requirements

To ensure the safe and reliable driving of the vehicle and prolong the service life of the transmission, it is critical to operate the transmission properly and maintain it regularly. Please follow the operation requirements below:

a. Lubricating oil Grade

The transmission shall be filled with the 85W/90GL-5 grade vehicle gear oil.

b. Correct Oil Level

The oil level shall be flush with the oil level viewing port. Check the oil level from the viewing port on the side of the transmission case. Fill in the oil until it reaches above the viewing port. The oil filling volume for HW18710 transmissions is 12L (12.5L when the power take-off equipped) while that for the HW20716 transmission is 14L (14.5L when the power take-off equipped).

c. Oil Level Check

The oil level shall be checked at a regular interval. To do this check, park the vehicle on a level road. Since oil expands in volume when hot, Do not check its level immediately after parking so as to avoid false measurement. Only when the oil level stabilizes and the oil temperature is close to the normal temperature, can this check be done.

Operation and Maintenance of Transmission

d. Add Lubricating Oil

To avoid the chemical reaction between different types of lubricating oil, the added lubricating oil shall be of the same grade with the old one.

e. Oil Change Cycle

To change the lubricating oil in the transmission, oil remaining in the transmission shall be first drained and the screen assembly be cleaned.

For a new transmission, change the lubricating oil on completion of the first 2000~5000km.

Check the level and the leakage of the lubricating oil for every 10,000 km, add it from time to time and clean the screen.

Change the lubricating oil for every 50,000 km.

f. Working Temperature

When the transmission is working continuously, its temperature shall be not more than 120°C and not less than -40°C.

If the working temperature exceeds 120°C, the lubricating oil will decompose and the service life of the transmission will shorten.

The working temperature of transmission will exceed 120°C in any one of the following conditions:

Operation and Maintenance of Transmission

- <1> Keep the transmission running when the vehicle speed is below 32Km/h.
- <2> The engine speed is high.
- <3> The ambient temperature is high.
- <4> The eddy flow surrounds the transmission.
- <5> The exhaust system is too close to the transmission.
- <6> The engine overspeeds with a high power.

g. Working Inclination Angle

When the inclination angle of the transmission is greater than 15°, lubrication may be insufficient (the working inclination angle equals to the mounting angle of the transmission on the chassis plus the slope angle).

h. Towing or sliding

When the transmission is working, its counter shaft rotates to drive the lubricating oil pump to run. This, together with the splash lubrication, can provide sufficient lubrication for the transmission. However, when the vehicle is being towed with its rear wheels touching ground and its power train connected, the counter shaft gears and the main shaft gears of the main gear box are not rotating. But the main shaft is rotating in relation to its gears and the planetary mechanism is also rotating, which will cause severe damage to the planetary mechanism and the main shaft positioning element of the transmission due to lack of lubrication.

To prevent this from happening, note that:

Operation and Maintenance of Transmission

When the vehicle is sliding in neutral, never depress the clutch pedal.

When the vehicle needs towing, it is permissible to draw out the half shaft or disengage the drive axle, or to lift the drive wheels from the ground for towing.

i. Gear Shift Operation

To shift the split gear of the HW20716 transmission, first shift the switch on the gear shift handle (see Fig. 3). To shift from 1L to 1H: first shift the switch valve from position L to position H, then depress the clutch (note that the clutch shall be fully depressed) and release the clutch before completing the gear shifting (this process does not involve operating the handle). To shift from 1H to 2L: first shift the switch valve from position H to position L, then depress the clutch, return the handle to the neutral position, engage gear 2 and release the clutch before completing the gear shifting. Continue shifting in the same way until gear 8H is engaged. For the shift-down, the same operation applies. Note the gears will not shift if the clutch pedal is first depressed and then released, and then the switch on the handle is shifted.

To shift from the low range gears to the high range gears (vice versa) of the HW14710/18710 transmission, first place the handle valve in position H (L) and then return it to the neutral position. Wait for some moment before engaging gear 6 (gear 5). Never jump over any gears, or the service life of the synchronizer of the auxiliary gear box will be affected. When the handle is in a gear position, shifting the handle valve between H and L will not achieve high and low gear shifting. Only when the handle is in the neutral position, can gear shifting be realized.

(2) Precautions

- a. To shift the gears, the clutch shall be disengaged completely and the gear lever be placed in position.
- b. For the HW20716 transmissions, each gear lever has two neutral positions: one between gear 5 and 6 in the

Operation and Maintenance of Transmission

- high range and the other between gear 3 and 4 in the low range. For the HW18710 transmission, the gear lever has one neutral position between gear 2 and 3. To park the vehicle, place the gear lever in the neutral position in the low range.
- c. To engage a low gear (the climbing gear) or the reverse gear in a vehicle fitted with the HW series transmission, first stop the vehicle and then engage the gear so as not to damage the parts in the transmission. To engage the reverse gear (the climbing gear), exert a large gear select force to overcome the resistance of the reverse gear (the climbing gear) lock.
 - d. To shift from the low range gears to the high range gears (vice versa), Never jump over any gears, or the service life of the synchronizer of the auxiliary gear box will be affected.
 - e. To drive the vehicle downslope, Never shift between the low and the high range gears.
 - f. Start the vehicle in first or second gear, depending on the road condition.
 - g. To start the vehicle, release the brake first. For a vehicle equipped with an air cutoff brake, after the brake valve has been energized, wait for the air pressure to increase to the level required for the brake release before engaging the gear for starting.
 - h. During the operation, if the transmission gives out abnormal sounds, feels heavy to operate or shows other abnormalities, stop the vehicle immediately for an inspection. Eliminate all the abnormalities before continuing to drive.
 - i. This transmission is fitted with a main and auxiliary gear box interlock mechanism. When the auxiliary gear box is not placed in the proper gear position, the main gear box will be locked. Therefore, if a gear cannot be engaged

Operation and Maintenance of Transmission

during shifting, it may be due to the effect of the main and auxiliary gear box interlock. Please check the range gear cylinder and its air passage first to ensure that the auxiliary gear box is placed in the proper gear position.

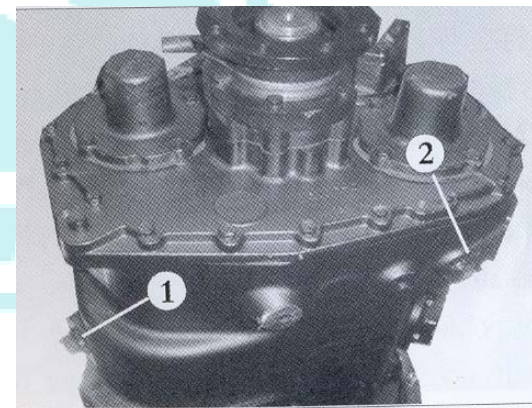
g. During the period of warranty, the transmission shall not be removed and assembled without authorization.

h. Oil Level Check

The oil level shall be checked at a regular interval. To do this check, park the vehicle on a level road. Since oil expands in volume when hot, Do not check its level immediately after parking so as to avoid false measurement. Only when the oil level stabilizes and the oil temperature is close to the normal temperature, can this check be done.

1-Oil level check and fill plug

2-Drain bolt (view from bottom of transmission)



Front Axle

1. Regular maintenance and care of front axle every 15,000km or every six months.
2. Check rotation of wheel bearings, replace grease, and check whether the wheel bearings can continue to use, adjust or replace it if necessary; the grease used in wheel hub bearings, brake camshaft and the main pin, tie rod ball pins, brake gap adjustment arm, etc. is for motor vehicles through the lithium-based grease.
3. Grease Volume:
 - 3.1 Volume of grease for each wheel: at a total of about 0.6kg for wheel hub cavity and two bearings;
 - 3.2 Grease volume for each brake camshaft and kingpin is approximately 0.2kg, adding to the bracket with the oil gun until overflow from the holes;
 - 3.3 Tie rod ball pins, brake slack adjuster arm should be filled with grease.

4. Overview of HF7 and HF9 Front Axle

HF7 front axle is the highway vehicle special front axle and newly developed by SINOTRUK, its load capacity is better than other domestic vehicles of same type, good stability and steering operating is sensitive and the new processing technology lowers its dead weight and enhances its reliability. HF9 front axle is the one of highest load capacity performance in domestic market, many tests proved that its handling and reliability are in perfect condition. The HF7 and HF9 front axle are well equipped and both the drum type or disc type brake can be mounted.

Front Axle

Main Specifications:

- ◆ Kingpin inclination angle: disc type is 6° and drum type is 3°
- ◆ Kingpin caster angle: 0°
- ◆ Camber angle: 1°
- ◆ Toe-in (measure on the diameter of $\phi 648$ at wheel inner edge) (mm):
 - 0 $\pm$ 1 (Meridian tire)
 - 3 $\pm$ 1 (Bias tire)
- ◆ Track (mm):
 - 2041 (11.00-20 tire) /2022 (12.00-20 tire)
- ◆ King pin central distance (mm): 1790
- ◆ Leaf spring central distance (mm): 850
- ◆ Wheel model: 8.5-20
- ◆ Wheel bolt holes amount and distribution circle: 10 $\times$ ϕ 335
- ◆ Wheel bolt specification: M22 $\times$ 1.5

Front Axle

- ◆ Maximum torsion angle of inner/outer wheel: 45°/33°
- ◆ Brake type: floating brake caliper, disc type brake
- ◆ Brake chamber specification: 24" diaphragm type
- ◆ Brake chamber joint: M22×1.5

5. Brief introduction of the disc brake

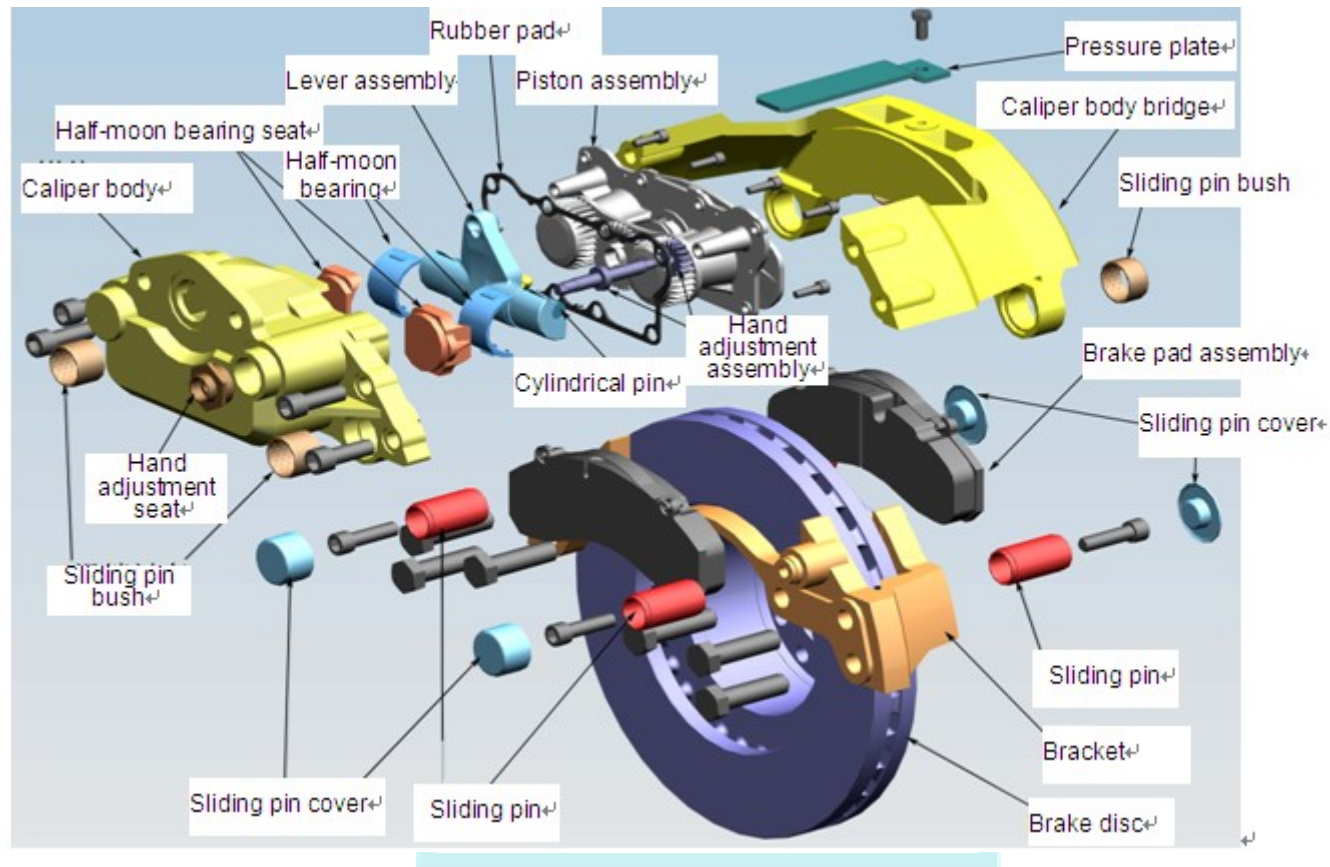
The disc brake is a patented product that China National Heavy Duty Truck Group Co., Ltd. possesses independent intellectual property. Compact structure, lightweight, automatically adjustable brake clearance, high braking efficiency, good head emission conditions, and the advanced techniques that can reduce occurrence of tire burst together with use of large kingpin inclination installation design and advanced lever/push rod and double push plate structures render stable brake moment output and make braking smooth so that driving sway during braking and braking deviation of the vehicle have been cleared effectively and vehicle braking becomes safe and reliable while use cost is reduced.

5.1. Requirements to installation of disc brake front axle

Check that the brake disc can rotate freely. Turn the hexagon head on the hand adjustment shaft clockwise with a ratchet wrench until the brake lining comes into contact with the brake disc, and then reverse to loosen the head 1/3-1/2 turn to finish the setting.

Subsequently, subject the brake to 10~15 noload applications simply and then the clearance between the brake lining and the brake disc will be adjusted automatically to the normal value (0.8mm~1.0mm).

Front Axle



5.2 Maintenance and servicing of the disc front axle

(1) Items in periodic inspection

Check the following items periodically at least every 3 months. The recommended inspection period is the minimum

Front Axle

requirement. The braking system may require more frequent checks depending on service conditions of vehicles.

Table of Periodic Inspection Items of the Disc Front Axle

Inspection object	Testing parameter	Specified requirement
Brake lining (wear limit)	Minimum brake lining thickness	3 mm 11 mm (with bottom plate)
	Maximum amount of uneven wear	1 mm
Brake disc (wear limit)	Minimum thickness	37 mm
	Maximum wear-away thickness at each side	4 mm
Horizontal slip of brake caliper relative to bracket	Maximum resistance	100N

Wear condition of the brake lining must be visually checked periodically. For example, check the brake lining each time you check tire pressure or check it every 3 months.

Check wear limits of the brake disc and lining periodically.

When the brake disc and lining have been worn so that they reach the specified minimum thicknesses, their braking efficiencies will drop and then you must replace them immediately. If the brake lining is scorched or contaminated by oil, it must be replaced immediately.

The brake linings must be replaced as a set per axle. Single lining replacement is not allowed. You must use the brake linings produced by the manufacturers appointed by China National Heavy Duty Truck Group Co., Ltd. If you fail to observe this point, China National Heavy Duty Truck Group Co., Ltd. will terminate warranty for your vehicle.

Front Axle

(2) Brake lining inspection

Before the inspection and maintenance service, please confirm that the service (foot) brake, the parking (hand) brake, and the provisional parking brake for buses are not applied. In addition, fix your vehicle properly to immobilize its wheels.

Remove the sealing cap and turn the bolt counterclockwise to adjust with a ratchet wrench until the brake lining loosens. After the brake lining is removed, measure the distance from the brake pad bottom surface (including bottom plate) to the friction surface as shown in the figure. The minimum permissible thickness (including bottom plate) is 11 mm. It is required that you measure at 4 different points evenly distributed circumferentially and selected using a vernier caliper, in addition, avoid burrs and seriously worn places.

At the same time, check if the brake lining is worn evenly. The maximum permissible amount of unevenness is 1 mm (measure at 8 points). It is required that you measure at 8 different points evenly distributed circumferentially and selected using a vernier caliper, in addition, avoid burrs and seriously worn places.

In the case of uneven wear, check if the brake caliper can slide normally on the sliding pin, if dust exists between the brake lining bottom plate and the one-piece push plate, and if the clearance regulation of the automatic adjustment is normal.

When replacing the brake lining, replace all brake linings of the two brakes on one and the same axle at the same time. In addition, the new brake linings selected as substitutes must be the original spare parts appointed by China National Heavy Duty Truck Group Co., Ltd.

Front Axle



Picture of Brake Pad Assembly Brake Lining Inspection

Note: The inner brake lining may be worn more seriously than the outer one due to light braking.

(3) Brake disc dimension inspection

A=Brake disc thickness

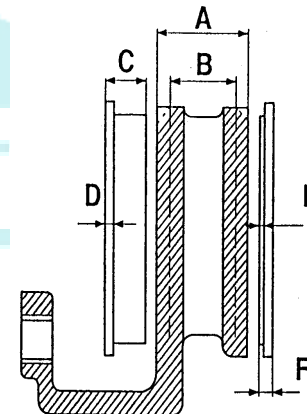
For a new disc, A=45mm

When B = 37mm (after wearout), it must be replaced.

C=Total thickness of brake lining (new), 30mm

D=Bottom plate, 8mm

E=Minimum thickness of friction material, 3mm



Front Axle

F=Minimum permissible total thickness of friction material and bottom plate: for a 8mm bottom plate, F=11mm.

If A is not greater than 39mm, it is recommended that you replace with new brake lining and disc. When its thickness is less than 37mm, the brake disc must be replaced.

Measure the thickness at the thinnest place of brake disc. Avoid measuring thickness at edge of the brake disc because burrs may exist there.

(4) Brake disc surface crack inspection (Fig. a)

Each time you replace a brake lining, check the corresponding brake disc for grooves and cracks.

a=Contact area of brake lining

A1=Flecks distributed on the surface (In such a case, use is allowed.)

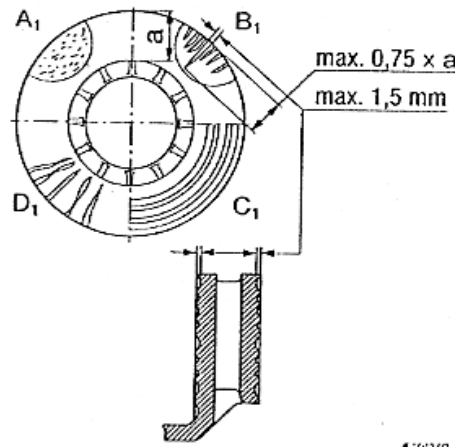
B1=Cracks distributed radially with both depths and widths less than 1.5 mm and lengths less than 3/4 width of the contact zone of the brake lining (In such a case, use is allowed.)

C1=Ring-shaped grooves with depths less than 1.5 mm (In such a case, use is allowed.)

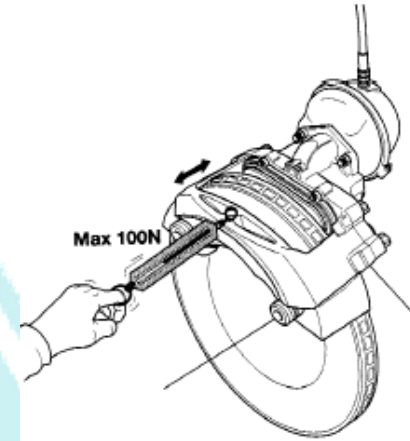
D1=Cracks penetrating into the ventilating and cooling passage of the disc or running through from inside to outside (radially) of the contact zone (a) of the brake lining (This situation is not allowed.) Then, the brake disc must be replaced. In the cases of A1, B1 and C1, the brake disc can continue to be used until the limit thickness of wear (37mm) is reached. The brake disc is maintenance-free. In addition, you need not to polish its surface when replacing a brake lining, but polishing is preferable. For example, after severe grooves appear on friction surface of a brake disc, polishing can increase contact area between the brake lining and the brake disc. To meet safety needs, the minimum thickness of the brake disc

Front Axle

polished must be greater than 39mm.



a. Classification of Surface Cracks on Brake Disc



b. Sliding Function Inspection for Brake Caliper

(5) Sliding function inspection for brake caliper (Fig. b)

As shown in the figure, check if the maximum sliding resistance of the brake caliper exceeds 100N and if dust and foreign materials that hamper sliding of the brake caliper exist.

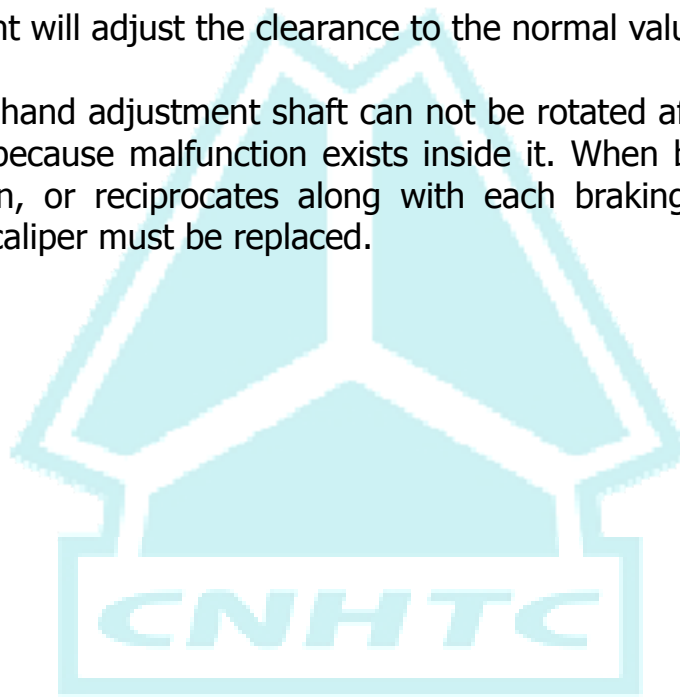
(6) Clearance adjustment

Push the brake caliper towards inside along the guide pin. Use a suitable tool to detach the one-piece push plate from the inner brake pad. Measure the clearance between the push plate and the inner brake pad back plate (the value should be within the range of 0.7~1.0 mm). If the clearance is too large or small, the automatic adjustment will not be able to work normally, and then you should perform the following inspection.

Front Axle

Open the rubber cap, and then twist the hexagon head on the hand adjustment shaft counterclockwise with a wrench until a clearance between the brake pad and the brake disc appears. Put a wrench on the hexagon head on the hand adjustment shaft and perform 5 brake applications (approx. 2bar). If the automatic adjustment works normally, the wrench should turn a small stretch clockwise (the rotation distance will decrease as number of brake applications increases). After several brake applications, the automatic adjustment will adjust the clearance to the normal value.

Notice: If the hexagon head on the hand adjustment shaft can not be rotated after a 16N force is applied on the wrench, the brake caliper must be replaced because malfunction exists inside it. When braking, if the wrench keeps still, or only rotates at the first brake application, or reciprocates along with each braking action, it indicates that this automatic adjustment has failed and the brake caliper must be replaced.



Front Axle

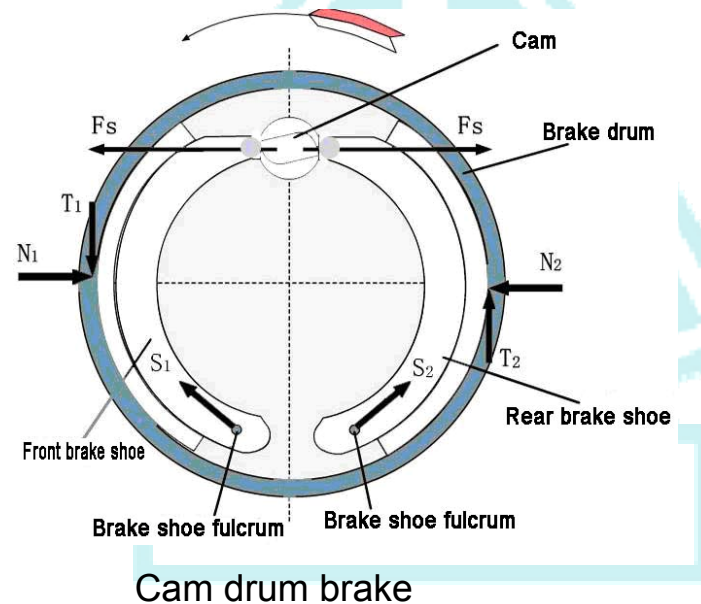
5.3 Analysis of common faults of the disc front axle

Trouble	Cause	Measure
Braking deviation	One side of brake lining burnished?	Replace the brake lining.
	Clearance between braking lining and brake disc abnormal.	Check initial clearance adjustment and automatic adjustment functions.
	Brake lining unable to slide freely on bracket	Clean the brake lining, sliding pin and bracket.
	Pressures in air chambers at both sides of axle nonuniform (measure pressure at each side with an air pressure gauge).	Service the brake chambers and valves.
Braking force lack	One side of brake lining burnished?	Replace the brake lining.
	Clearance between braking lining and brake disc abnormal.	Check initial clearance adjustment and automatic adjustment functions.
	Brake disc failed.	Replace the brake disc.
	Pressure in brake chamber abnormal (measure pressure in air chamber with an air pressure gauge).	Check the air circuit and valves for such situations as air leak and failure.
Brake can not be released completely	Clearance between braking lining and brake disc abnormal.	Check initial clearance adjustment and automatic adjustment functions.
	Brake lining unable to slide freely on bracket	Clean the brake lining, sliding pin and bracket.
	Compressed air in brake chamber during brake release.	Service the brake chambers and valves.
	Sliding function of brake caliper normal?	Replace with a new sliding pin and bushing.
Braking deviation	One side of brake lining burnished?	Replace the brake lining.
	Clearance between braking lining and brake disc abnormal.	Check initial clearance adjustment and automatic adjustment functions.
	Brake lining unable to slide freely on bracket	Clean the brake lining, sliding pin and bracket.
	Pressures in air chambers at both sides of axle nonuniform (measure pressure at each side with an air pressure gauge).	Service the brake chambers and valves.

Front Axle

6 Drum brake front axle

All drum brakes in SINOTRUK are cam collar after shoe brake. The figure shows the drum brake, brake drum as a rotating component is fixed at wheel hub flange. Brake shoes as a fixed component may rotate around fixed fulcrum (brake shoe supporting pin fixed at brake bottom plate) respectively.

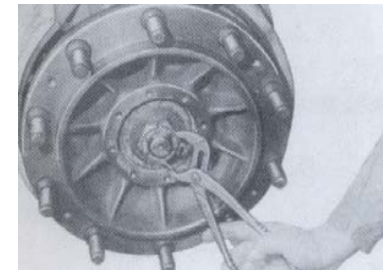
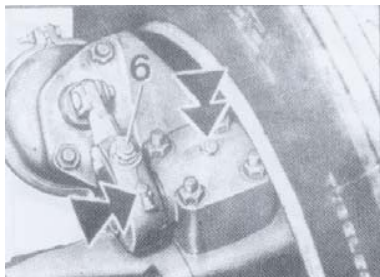


7 The main points of front axle's using and maintenance

- (1) Starting and parking should smoothly, avoiding the emergency braking and steering excessively, it should slipping brake, with the wheel keeping upright. It should little using the emergency brake, low speed when you driving on the poor road, preventing shocking the front axle, making the early break of front suspension.

Front Axle

- (2) Retain the normal tire air pressure, front tire: (235 ± 19.6) kPa; rear tire (314 ± 19.6) kPa. Too high tire air pressure will increase the jumping frequency of tire, too low tire air pressure will increase the resistance to rolling and side force.
- (3) It should be routine attention and routine maintenance, check the ball joints of the tie rod arm and tie rod. If you find the ball joints wearing and loosen, you must replace it. You should check spare component's quality when you replace it. If you assemble the bad spare components, not only the short service life, but also the early wearing of others parts.
- (4) Dismantle and assemble the tire should use special tool, avoiding to the rim deformation. The tire should check balance regularly, avoiding to the diameter run-out and moving by uneven quality.
- (5) Install the lower arm should replace the ball joint dust cover, add the grease in the dust cover. The head of the ball joints mustn't daub any lubricating oil and grease.
- (6) Adjust the toe-in should check the absorber working normally, fixing fastness whether or not, coil spring breaking whether or not, the spring between both side balance whether or not.
- (7) Change the grease in the wheel hub.
- (8) Lubricate steering knuckle kingpin, brake arm and brake camshaft



Front Axle

8 Drum brake front axle common troubleshooting

8.1 Heavy Steering

- (1) All including poor lubrication, corrosion and damage of king pin and thrust roller bearing;
- (2) That too tight of adjusting gasket for steering knuckle;
- (3) Insufficient tire air pressure.

8.2 Front Wheel Deflection

- (1) Incorrect toe-in adjustment;
- (2) Deformed front beam, steering knuckle and steel ring;

8.3 Front Wheel Swing

- (1) Looseness of front wheel hub bearing and ellipse of brake drum;
- (2) All including unbalanced wheel assembly as well as non-concentric assembly of brake drum, hub and steel ring;
- (3) All including large clearance between king pin and bushing, loose drag link head, and damaged thrust roller bearing;
- (4) All including deformed front axle and frame can change front axle positioning parameters so as to form front axle swing.;
- (5) All including loose steel plate spring or dislocation, inconsistent front steel plate spring deflection or number.

Rear Axle

8.4 Abnormal and Heating of Front Wheel Assembly

- (1) All including damaged front axle hub bearing, thrust roller bearing and knuckle bushing;
- (2) Oil lack of hub bearing;

8.5 Direction Deviation

- (1) That horizontal steering and drag link has been bent or deformed;
- (2) The air pressure difference of front wheel left/right tires is larger;
- (3) Front axle or wheel deformation;
- (4) Left/right front spring stretch is larger.

Pay Attention to the Following Points in the Use and Maintenance of the Rear Axle:

1. Maintain Lubricant Volume, and Frequently Check Oil Volume of Wheel Reductor and Main Retarder.

Oil lacking may lead to early wear of running components and even cause burning damage. While, more lubricant does not mean that it will provide better performance, because excessive lubricant may result in high temperature and even oil leakage.

For new vehicle's initial maintenance, when replacing lubricant of the wheel reductor, rotate the wheel till drain plug is in the lowest position while filling plug is in the position near half height of the axle housing. Open the drain plug to drain out used oil, screw it back and open the filling plug to fill lubricant to its height, and then screw back the filling plug. Rotate the wheel for

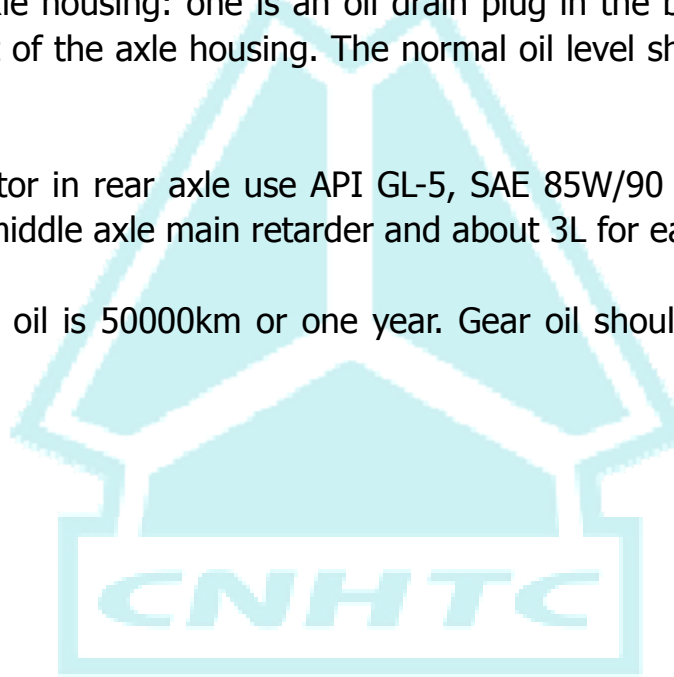
Rear Axle

several times, locate it in the position where drain plug is in the highest position while filling plug is in the position near half height of the axle housing. Open the filling plug to drain out excessive lubricant till oil level is kept in the height of filling plug, and then screw it back.

There are two screw plugs on the rear axle housing: one is an oil drain plug in the bottom of axle housing, the other is an oil filling plug in the position near half height of the axle housing. The normal oil level should be maintained in the height of filling plug.

The main reducing gear and wheel reductor in rear axle use API GL-5, SAE 85W/90 gear oil. Generally, oil volume is 16.5L for rear driving axle main retarder, 19.7L for middle axle main retarder and about 3L for each wheel reductor.

The oil change interval for rear axle gear oil is 50000km or one year. Gear oil should be replaced for the first 2000-3000 km compulsory maintenance.



Rear Axle

2. Operation of Differential Lock

The interwheel differential in rear axle is used to automatically realize speed difference between left and right wheel when the vehicle turns corner so as to avoid tire wear and mechanical damage. Engage the differential lock when the vehicle wheels on one side skids on smooth or muddy road, at this time the left and right axle shaft become one rigidly coupled shaft, thus the vehicle will drive away from the trouble road.



Notice:

After the vehicle driving out of rough road, disengage the differential lock immediately, or it will result in tire worn and differential damaged.

3. Avoiding Serious Overloading

Serious overloading and loading concentration will result in axle housing deforming and break. Therefore, the loading capacity shall be complied with the specified loading in accordance with certain driving conditions.

4. Other Precautions

If the connection fittings such as differential gear and driven gear, etc. need to be reassembled during repairing, smear the coupling threads with LOCTITE 262 thread setting glue, and tighten the coupling bolt according to the specified torque.

If abnormal sound is heard during operation, do not drive the vehicle, check and repair immediately.

5. Use and Maintenance of the HW1249 and HW1279 Axles

5.1 Structure overview

Rear Axle

The structure form of the HW1249 and HW1279 axles features central single-stage final drive, reinforced stamping-welded axle housing, finish forged differential gear, full-floating half axle, reinforced hub structure, steel plate stamping-welded brake, and friction lining of unequal thickness, etc. The brake is of involute S-shaped cam drum type which is provided with a double-diaphragm brake chamber. An automatic or manual brake clearance adjusting arm can be installed on it for adjustment. The brake can also be equipped with ABS and ASR. The HW1249 and HW1279 axles have such advantages as simple and reliable construction, long life, low noise, light mass, high efficiency, and use and maintenance convenience.

5.2 Technical parameters

Model	Single rear axle	Tandem axle	
		Intermediate axle	Rear axle
Construction	Central single reduction, full-floating half axle, steel plate stamping-welded axle housing		
Rated axle load (Kg)	13 000	13 000	13 000
Speed ratio	5.833, 4.875, 4.3, 3.91	5.833, 4.875, 4.3, 3.91	5.833, 4.875, 4.3, 3.91
Leaf spring center distance mm	1010	1020	1020
Input flange	XS180	XS180	XS180
Standard wheel track	1850 mm		
Type and size of brake	S-shaped cam drum brake $\Phi 420 \times 185$		
Brake chamber	24"/24" double-cavity air chamber		
Service brake moment	32000N.m (when braking friction coefficient is 0.42 and brake pressure is 0.6MPa)		
Spring brake moment	32000N.m (when braking friction coefficient is 0.42)		
Type of rim	8.5-20		
Type of tire	12.00-20/12.00R20		
	11.00-20/11.00R20		
Location mode of rim	Rim centered, wheel bolt 10-M22 $\times$ 1.5, distribution circle $\Phi 335$		

Rear Axle

5.3 Use and adjustment

(1) Use of a new axle

- ① Before using the new axle, fill the final drive with GL5 EP 80W-90 (for applications when air temperature is equal to or above -26℃) or GL5 EP 85W-140 (for applications when air temperature is equal to or above -12℃) heavy duty gear oil from the filler hole on the rear cover of the axle housing until oil is flush with the hole (with 12.00-20 tires installed, the oil capacity of the intermediate axle is approx. 22L and that of the rear axle is approx. 20.5L).
- ② Before using the new axle, fill each grease fitting with adequate 2# lithium base grease.
- ③ After you start to use the new axle, do not put the vehicle into regular operation until it has gone through a 1,500Km running-in and fasteners (except sealant coated bolts) have been rechecked.

(2) Axle adjustment

① Bearing pre-tightening force and gear clearance

Item	Parameter
Wheel hub bearing pre-tightening force	10~12Nm
Clearance between half axle gear and planetary gear	Standard backlash: 0.20~0.30
	Repair limit: 0.5 mm
Clearance between brake shoe and brake drum	0.2~0.5mm
Clearance between planetary gear and spider	Standard backlash: 0.10~0.14
	Repair limit: 0.3 mm
Oil seal seat bearing clearance	≤0.03mm
Inter-axle differential planetary gear clearance	Standard backlash: 0.15~0.25
	Repair limit: 0.45 mm
Clearance between driving and driven bevel gears	Standard backlash: 0.30~0.40
	Repair limit: 0.6 mm
Clearance between half axle gear boss and differential	Standard backlash: 0.21~0.31
	Repair limit: 0.6 mm
Clearance between shifting fork and engaging sleeve	Standard backlash: 0.10~0.18
	Repair limit: 1.0 mm

Rear Axle

Tightening torques for major fasteners

SN	Tightening location	Tightening torque (N·m)
1、	Bolt fastening bevel gear differential left and right carriers	220~280
2、	Flange fastening bolt	130~180
3、	Driven gear fastening bolt	600~700
4、	Fill plug and drain plug	130~150
5、	Bearing cap fastening bolt	400~500
6、	Nut and bolt fastening reducer	130~180
7、	Hexagon slotted nut on main cone	500~600
8、	Brake assembling bolt	260~300
9、	Hexagon slotted nut fastening idler system	400~500
10、	Fastening nut of wheel hub bolt	380~400
11、	Bearing seat fastening bolt on main cone	140~200
12、	Brake block fastening bolt	36~63
13、	Cylindrical gear cover fastening bolt	80~100
14、	Half axle fastening bolt	270~310
15、	Bearing seat fastening bolt at driving cylindrical gear	105~120
16、	Through shaft assembly fastening bolt	80~100
17、	Nut fastening inter-axial differential front and rear carriers	130~180
18、	Through shaft end fastening bolt	350~400
19、	Oil seal seat fastening nut	75~90
20、	Drive shaft bolt	130~160

② Notices for assembly

- 1) Assembly of differential carriers: After aligning the assembly marks, put the right carrier on the left one.

Rear Axle

- 2) Adjustment of oil bath shim: When assembling shim (s), it is advisable that the gap between the oil bath and the gear be 1.5~4.5.
- 3) Assembly method for bearing cap: When reinstalling a bearing cap, align the marks made before removal properly to avoid misplacement.

③ Axle adjustment

Adjustment of wheel hub bearing pre-tightening force:

- 1) Remove the locking plate first, and then tighten the adjusting nut using the special wrench (tightening torque should be greater than 500N.m).
- 2) Rotate the brake drum 2~3 turns to seat the bearing correctly. Then, tighten using a moment not less than 500N.m.
- 3) Reverse the adjusting nut 1/4~1/6 turn and rotate the brake drum 2~3 turns. Measure starting force on a wheel hub bolt with a spring balance. The value measured should be 30~65N.
- 4) Install the locking plate and then tighten its fastening screw.

5.4 Lubrication and maintenance

(1) Lubricant and its fill capacity:

Oil site	Lubricant (grease)	Amount
Final drive	GL-5, 80W/90 heavy-duty automobile gear oil	Approx. 22L
Wheel hub bearing	GL-5, 80W/90 heavy-duty automobile gear oil	Approx. 2L
Brake clearance adjusting arm and camshaft	1# General purpose lithium base grease for automobile-GB7324	Add until oil spills from the overflow hole.

Rear Axle

Instructions:

- ① Perform maintenance according to maintenance period of the chassis.
- ② The lubricant cavities of the final drive and wheel hub bearing communicate with each other and they share a filler hole on the rear cover of the axle housing. To ensure that lubricant can flow into the wheel hub chamber during oil fill, tilt the axle to the left and right for several runs when oil volume reaches above 15L so that the wheel hub bearing can be lubricated well.
- ③ When the vehicle is used with the lowest ambient temperature equal to or above -15°C , it is recommended that you use GL-5, 85W/140 heavy-duty automobile gear oil.

Note: Quality of gear oil affects life and performance of the axle greatly. Therefore, we recommend that you select best quality lubricant.

(2) Oil fill and change:

After 5,000 km travel, change the lubricant added at assembly and check oil level every 5,000 km travel or monthly;

change lubricant every 50,000 km travel or yearly;

change grease on the brake adjusting arm and camshaft every 150,000 km travel or yearly.

Rear Axle

(3) Axle maintenance

- ① Clear the rear axle housing breather plug of dirt and dust on a regular basis.
- ② Check the filler hole plug and the drain hole plug on a regular basis. If oil seepage and leakage is found, tighten or replace the seal washers without delay.
- ③ As the half axle flange transmits large torques and is under the action of impact loads, you must check tightening of the half axle bolts on a regular basis to prevent looseness and half axle bolt fracture caused thereby.
- ④ Every 2,000 km travel, fill each grease fitting with 2# lithium base grease, clean the breather plug, and check the gear oil level in the axle housing (open the fill plug on the rear cover of the axle housing to check).
- ⑤ Every 5,000 km travel, check brake clearance.
- ⑥ Every 8,000~10,000 km, check tightening of brake bottom plate, check wheel hub bearing for looseness, check brake block for wear (replace when it has been worn so that the limit pit is exceeded), check quality of the gear oil in the axle housing and immediately renew if signs of deterioration, thinning, etc. are found.

Rear Axle

5.5 Analysis of common faults

Symptom	Cause analysis	Handling method
Abnormal sound from drivetrain	1. Differential gear clearance improper.	Replace the thrust plate or gear.
	2. Clearance between driving and driven gears too large.	Replace the thrust plate or gear.
	3. Pre-tightening force of driving gear bearing too small.	Adjust the pre-tightening force.
	4. Half axle gear, planetary gear, and spider shim etc. worn.	Correct or replace faulty parts.
	5. Oil level too low.	Refill lubricant.
Lubricant leakage	1. Oil seal worn, loose or damaged.	Replace the oil seal.
	2. Reducer fastening bolt loose.	Tighten to the pre-tightening torque.
	3. Seal ring damaged.	Reapply sealant.
	4. Bearing seat fastening bolt loose.	Tighten to the specified torque.
	5. Drain plug loose or pad damaged.	Tighten the plug to the specified torque or replace the pad.
	6. Axle housing deformed due to overloading.	Correct or replace the axle housing.
	7. Breather plug clogged or damaged.	Clean or replace the breather plug.
Slow wheel hub bearing	1. Pre-tightening force of wheel hub bearing too large.	Adjust the pre-tightening force.
	2. Bearing lubrication lack or grease incorrect.	Fill or change the grease.
	3. Bearing stained with dust.	Clean and fill grease.
Braking force lack	1. Camshaft rotates dully.	Check operation of the camshaft.
	2. Stroke of brake chamber push rod adjusted improperly.	Adjust the stroke.
	3. Brake lining overheat or deterioration.	Replace the brake lining.
	4. Brake lining attached improperly.	Correct attaching position of the brake lining.
	5. Water in brake drum.	During travel, depress the pedal gently to drain water.

Rear Axle

	6. Grease on brake lining and brake drum.	Clear the grease or replace the brake lining.
	7. Brake pressure or air quantity insufficient.	Check the pneumatic line and all air valves.
Abnormal sound is heard during braking	1. Bolt exposed due to wear of brake lining.	Replace the brake lining.
	2. Brake lining surface hardening or deteriorating.	Replace the brake lining.
	3. Brake drum worn unevenly or installed infirmly.	Correct the brake drum or tighten the bolt.
	4. Brake shoe and brake lining contact loosely.	Tighten bolts.
	5. Brake shoe anchor pin loose.	Tighten the anchor pin lock bolt.
	6. Wheel hub bearing worn.	Replace the wheel hub bearing.
	7. Brake drum deformed.	Correct or replace the brake drum.
Braking judder	1. Brake shoe installed improperly.	Tighten the anchor pin lock bolt.
	2. Return spring damaged.	Replace the return spring.
	3. Brake lining oil stained or deteriorating.	Clean or replace the brake lining.
	4. Brake bottom plate damaged.	Replace the brake bottom plate.
Wheel is seized.	1. Camshaft lubricated poorly or adjusting arm not returned.	Correct the faulty places.
	2. Brake shoe or air chamber return spring broken or fatigued.	Replace faulty components.

Rear Axle

6.Use and Maintenance of the ST series Rear Drive Axle

6.1 Overview

The Steyr rear drive axle is a double-stage drive axle comprising central one-stage reduction and hub planetary reduction. This type of axles is further divided into tandem drive axle and rear drive axle according to drive form. The steel plate stamped or cast axle housing is provided with inter-wheel differential and differential lock. Three tonnages (10, 13 and 16) for rated axle load are available according to wall thickness of axle housing. At present, the drive axles with axle housing wall thickness of 16 mm and rated axle load tonnage of 13 are used mostly.

7.2 Main technical parameters

Item	Parameter	
	ST13	ST16
Model	ST13	ST16
Rated axle load (kg)	13,000	16000
Maximum input speed (r/min)	2600	
Speed ratio	5.73, 4.8, 4.42, 3.93	
Brake size(mm)	Φ420×220	
Type of wheel braking	Pneumatic chamber cam braking type	
Brake chamber	24" diaphragm type	
Brake moment (N.m)	29,400	
Rated brake pressure (bar)	6	
Friction coefficient of brake lining	0.38	
Gross weight of axle (Kg)	For intermediate axle, approx. 860; for rear axle, approx. 770.	
Fill volume of lubricant (L)	For rear axle final drive, 16.5; for intermediate axle final drive, 19.7; for hub reducer, 3.	

Rear Axle

Major bearing pre-tightening forces and gear clearances

Clearance between differential pinion and half axle gear	0.18-0.22 mm
Pre-tightening torque of driven bevel gear bearing	3-4 N.m
Pre-tightening torque of driving bevel gear bearing	1-2 N.m
Meshing clearance between driving and driven bevel gears	0.3-0.4 mm
Wheel hub bearing pre-tightening torque	7-9 N.m
Fit clearance between camshaft and	0.015-0.208 mm
Wear limit of camshaft and bush	0.35 mm
Minimum thickness of brake shoe should not be less than	6 mm
Tightening torque for shaft head nut	300-400 N.m
Tightening torque for hollow spline shaft	300 N
Tightening torque for wheel nut	550-600 N.m
Differential carrier fastening nut	195 N.m
Nut fastening differential carrier to driven bevel gear	325 N.m

6.3 Use and maintenance

Pay attention to the following points when using and maintaining the rear drive axle:

- (1) Maintain lubricant volume. During use, check oil levels in hub reducer and final drive of the axle on a regular basis.

Oil starvation will cause premature wear of moving parts and, if serious, result in burn through. However, “the more the better” does not apply to lubricant because lubricant excess will cause high temperature even result in oil leak.

When changing hub reducer lubricant at initial maintenance of a new car, it is required that you should rotate the wheel until the drain plug is at its lowest position while the fill plug is at upside of the other half and open the

Rear Axle

drain plug to drain used oil during fresh oil fill, and then install the drain plug properly, open the fill plug, add lubricant until this high liquid level, and finally screw in the fill plug. Rotate the wheel repeatedly for several turns. Then position the wheel until the drain plug is at its highest position while the fill plug is on the smaller half, and open the fill plug to allow redundant lubricant to flow out until the liquid level is kept at the position of the fill plug. Finally, install the fill plug properly.

There are two screw plugs on the rear axle housing: A drain plug at bottom of the bowl and a fill plug at approx. half height of the bowl. The normal liquid level should always keep at the height of the fill plug.

The rear axle final drive and the hub reducer use APIGL-4 class gear oil with viscosity grade of SAE85W/90. Oil capacity in a common bowl: for rear axle final drive, 16.5L; for intermediate axle final drive, 19L, for each hub reducer, approx. 2L.

The change period of the gear oil in the rear drive axle is 50,000 km travel or 1 year. During the compulsory maintenance after the first 2,000-4,000 km travel, change the gear oil.

(2) Correct use of the differential lock.

The inter-wheel differential lock on the rear drive axle enables automatic differential speeds on left and right wheels when the car is cornering so as to avoid tire wear and mechanical failure. When the wheels on single side of the car drive in a slippery or muddy road surface and slip there so that the car can not pull out, engage the differential lock and then the left and right half axles will become a rigid coupling shaft. Thus, the car can pull out of the faulty road surface certainly.

Note: After the car pulls out of the faulty road surface, pick off the differential lock immediately; otherwise, such serious accidents as heavy tire wear and differential bash will occur.

Rear Axle

- (3) Avoid badly overloading.

The design bearing capacity of the Steyr rear drive axle is 13t and the axle housing wall thickness of common vehicles is 16 mm. Both badly overloading and load concentration will result in axle housing deformation and fracture. During use, be sure to lade your vehicle according to the load specified in the driving conditions.

- (4) If you reassemble such connectors and differential and driven gear during maintenance, be sure to smear Loctite 262 thread locking sealant on the connection thread and tighten to the specified torque to ensure locking of the attachment bolt.

If abnormal sound is heard during use, do not continue to drive forcedly. Instead, disassemble to check and repair immediately.

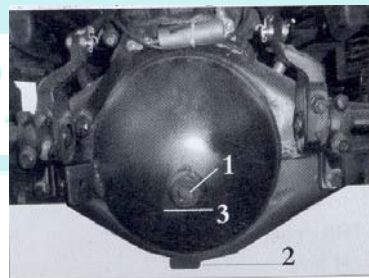
- (5) Maintain lubricant volume. During use, check oil levels in hub reducer and final drive of the axle on a regular basis.

Check oil level in rear drive axle

1-Fill plug

2-Drain plug

3-Oil level



Oil starvation will cause premature wear of moving parts and, if serious, result in burn through. However, “the more the better” does not apply to lubricant because lubricant excess will cause high temperature even result in oil leak.

Rear Axle

When changing hub reducer lubricant at initial maintenance of a new car, it is required that you should rotate the wheel until the drain plug is at its lowest position while the fill plug is at upside of the other half and open the drain plug to drain used oil during fresh oil fill, and then install the drain plug properly, open the fill plug, add lubricant until this high liquid level, and finally screw in the fill plug. Rotate the wheel repeatedly for several turns. Then position the wheel until the drain plug is at its highest position while the fill plug is on the smaller half, and open the fill plug to allow redundant lubricant to flow out until the liquid level is kept at the position of the fill plug. Finally, install the fill plug properly.

There are two screw plugs on the rear axle housing: A drain plug at bottom of the bowl and a fill plug at approx. half height of the bowl. The normal liquid level should always keep at the height of the fill plug.

The rear axle final drive and the hub reducer use API GL-4 class gear oil with viscosity grade of SAE85W/90. Oil capacity in a common bowl: for rear axle final drive, 16.5L; for intermediate axle final drive, 19L, for each hub reducer, approx. 2L.

The change period of the gear oil in the rear drive axle is 50,000 km travel or 1 year. During the compulsory maintenance after the first 2,000-4,000 km travel, change the gear oil.

6.4 Common faults and troubleshooting

6.4.1. Oil leak

On the rear drive axle, oil leak will occur at several distinct places. On the central reducer, oil leak often occurs at the input shaft. This is generally due to input shaft (driving gear shaft) oil seal damage or wear or slack oil seal spring. During maintenance, note that outward leak from outer ring of the oil seal indicates that the outer ring fits with the housing loosely. When reassembling, clean up the outer ring of the oil seal and the oil seal seat hole on

Rear Axle

the housing, then smear Loctite 603 retaining compound on the outer ring and drive it into the oil seal seat hole. If the oil seal is intact but heavy oil leak still occurs, check the breather on the axle housing (check on a regular basis). If the air vent is clogged by oil stains, the heat generated on the axle housing during running will make air pressure rise to force lubricant to discharge. This is a problem that sometimes is ignored by people.

If oil is splashed from the wheel hub, check the following three places: the O-ring between the wheel hub and the hub reducer housing, the O-ring between the wheel hub oil seal seat and the axle tube on the axle housing, and the wheel hub oil seal. Generally, oil leak from the wheel hub oil seal is more likely to occur. Pay attention to the following when reinstalling the wheel hub oil seal: There are two oil seals of same size but in different materials on the wheel hub. Generally, install the oil seal having a yellow mark or an impression at inner side and the other one at outer side. If the oil seal outer ring and the wheel hub oil seal seat hole are fitted loosely, you can smear Loctite 603 cylinder retaining compound on the outer ring.

If outward leak occurs at the shaft head end cover, it indicates that the contact surface between the end cover and the planet carrier is not sealed. The end cover and the hub reducer housing end face are connected without pad, so you can clean them up after disassembly and then smear Loctite 587 sealant and reassemble. During sealant application, smear a continuous sealant bar on the connection surface.

If outward leak is found frequently at the vent hole on the axle housing and the hub reducer is always short of oil, generally, it indicates that the half axle oil seal is installed in opposite direction or damaged.

Oil splash from the shaft head sometimes will make the brake lining and brake drum to be stained with oil traces, which will result in brake failure.

Rear Axle

6.4.2. Wheel hub heat up

Wheel hub heat up is generally due to too large wheel hub bearing pre-tightening force and usually occurs after maintenance. This is resulted from too large bearing pre-tightening force caused by your failure to tighten the clamp nut on the shaft head as required causing too large tightening torque on the nut. Then, the wheel hub should be reassembled as required. Deformation and damage of the wheel hub bearing will naturally cause wheel axle overheat.

6.4.3. Brake drum heat up

Many factors can cause brake drum overheat. This is due to the problems in mechanical part and braking control air circuit system.

First, carefully check if the brake chamber can return rapidly after brake application. If the brake chamber can not return or just return slowly, you can detach the chamber push rod from the brake adjusting arm and then recheck if the brake chamber can return rapidly. If the chamber still return slowly, it is obvious that the brake chamber and the braking control air circuit are malfunctioning. If return of the chamber becomes obviously smooth after it is detached from the adjusting arm, check if the brake camshaft can rotate smartly. Both brake camshaft bending deformation and serious oil starvation of shaft sleeve or deformation and dislocation of brake camshaft bracket will cause unsmooth brake return which will then result in brake drum overheat.

Broken or slack brake shoe return spring will not only cause brake drum to overheat but also result in frictional noise.

During normal travel, a certain clearance should exist between brake lining and brake drum (generally, 0.2 mm). Too large clearance will affect brake effect while too small clearance will cause overheat.

Rear Axle

As the heat emission conditions of the brake drum itself are comparatively poor, frequent brake application will make it overheat rapidly, and, when serious, tire valve even could be burned to cause tire leakage. Therefore, when a car that often travels in mountainous areas is going down a long-distance slope, it is advocated that engine exhaust brake be used to decelerate and frequent application of service brake be avoided as far as possible. These measures can prevent brake drum overheat.

6.4.4. Abnormal sound from central drive

If abnormal sound from the rear axle bowl is heard abruptly during travel, stop your car immediately to check because this kind of sound is sometimes a symptom of machine member damage.

Falling apart of differential supporting bearing, severe pitting or wear on bearing, loose or falling off driven gear retaining bolt, loose differential lock engaging sleeve, and tooth strike on drive gear or differential gear will cause serious abnormal sound.

If a continuous sound caused by gear wear is heard and the sound becomes louder and louder as vehicle speed increases, this is generally resulted from bearing pitting, drive gear wear or tooth flank scuffing and pitting. If no clear sound is heard during normal travel but obvious noise is heard instead when you decelerate and reduce fuel supply, this is generally caused by drive gear tooth back scoring and pitting.

When no clear noise from your car is heard during normal straight driving and abnormal sound is made obviously during cornering, this is apparently caused by differential gear damage or burning or looseness and play of differential lock engaging sleeve.

If continuous noise is heard after replacement with new driving and driven gears and the noise becomes louder as vehicle speed increases, check if the meshing clearance between the driving and driven gears and the contact marks on them are acceptable. Especially observe if the driving and driven gears are assembled suitably.

Rear Axle

Axle housing deformation will also make abnormal sound from rear axle, which should be paid attention to during inspection.

When abnormal sound from rear axle is heard, do not continue to drive forcedly. Instead, disassemble to check immediately because falling apart of bearing, looseness of retaining bolt, and gear damage will bring more severe consequences if not repaired duly.

6.4.5.Failure to engage differential lock

When you need to engage the differential lock, depress the differential lock switch (the engagement indicator light will not come on). First, check if the piston push rod in the differential lock working cylinder will act when the switch is depressed. When you find that the differential lock can not be engaged in place though the working cylinder push rod has extended, it indicates that crest-crest butting occurs on the engaging sleeve causing the differential lock to fail to engage in place. Then, you can move the car forward and backward once and engagement will succeed naturally. If the working cylinder does not respond at all, obviously, the electric and pneumatic control systems of the solenoid valve are malfunctioning. You can loosen the air output joint of the solenoid valve and then observe for output of compressed air. If not seen, apparently, circuit control part of the solenoid valve or the solenoid valve itself is malfunctioning. If output of compressed air is seen, obviously, the working cylinder itself is malfunctioning.

If the working cylinder push rod can engage the differential lock in place clearly after the differential lock switch is depressed but the indicator light in the switch does not come on, obviously, the differential lock indicator light switch or the bulb is malfunctioning. So, it is easy for you to troubleshoot and judge using a test lamp.

6.4.6.Tire wear on rear wheel

This trouble has several causes including tire rim deformation, loose wheel hub bearing, and rear axle dislocation. In addition, rear axle dislocation is generally caused by broken center screw on steel plate.

Rear Axle

7. Use and Maintenance of the HC16 Cast Housing Hub Reduction Axle

7.1. Construction features

The HC16 heavy-duty cast drive axle is one developed and manufactured elaborately by China National Heavy Duty Truck Group Co., Ltd. by fully borrowing ideas from and absorbing the design concepts of the cast drive axles on the heavy-duty trucks of the international brands such as VOLVO, BENZ and MAN while adopting advanced design means and superior manufacturing techniques.

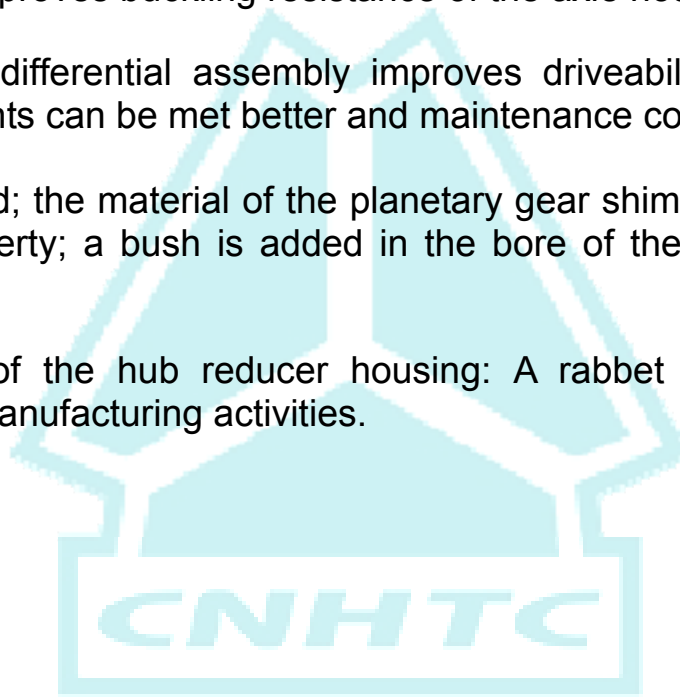
The advantages of this axle include stronger bearing capacity, better resistance to bending deformation, higher reliability, low noise, and wider adaptability to such service conditions as severe road condition, large shock, and serious overloading. Strict bench tests and road tests have proved that the performance of this product has approached to the advanced world standard.

- (1) The advanced three-section cast rigid axle housing structural design brings higher rigidity and strength while giving stronger bearing capacity.
- (2) The leaf spring seat, brake bottom plate flange, rear cover, etc. are cast together with the axle housing integrally so that wall thickness is optimized, stress distribution becomes more appropriate, bearing capacity and resistance to bending deformation are enhanced, and working is more reliable.
- (3) The enhancement in supporting rigidity of the final drive improves working conditions of the driving and driven bevel gears, cut failure rate of the final drive effectively, and reduce noise from the whole axle and occurrences of oil leak.
- (4) The material of the cast axle housing is unique. Tests have proved that it has not only many excellent characteristics of plain cast iron, e.g. good castability and vibration absorbing property, low notch sensitivity,

Rear Axle

and higher impact toughness but also the mechanical properties comparable with steel. Use of this material makes the axle housing more adaptable to such severe operating conditions as overloading and strong shock.

- (5) The increased section design improves buckling resistance of the axle housing effectively.
- (6) The reinforced design for the differential assembly improves driveability and use reliability greatly so that customers' operating requirements can be met better and maintenance cost is reduced.
- (7) The spider diameter is increased; the material of the planetary gear shim is changed to composite type in order to increase wear resistant property; a bush is added in the bore of the planetary gear to improve lubrication conditions of the differential.
- (8) Improvement on construction of the hub reducer housing: A rabbet notch is added to meet the special requirements for customers' remanufacturing activities.



Rear Axle

7.2 HC16 axle main technical parameters

Project	Parameter		
Rated load (kg)	16000×2		
Max.rotated speed (r/min)	2600		
Speed ratio	4.42	4.8	5.73
Service brake mechanism (mm)	Φ420×220		
Wheel braking style	Cam roller braking style		
Braking chamble	24" diaphragm		
Braking torque (N.m)	29400		
Specified braking air pressure (bar)	6		
Brake plate friction factor	0.38		
Weight (kg)	First axle 860 ; Second axle 770		
Oil quantity (L)	Second axle final drive 16.5; first axle final drive 19; wheel reduction 2		

Rear Axle

7.3. Use and maintenance

Please refer to instructions on related parts of the ST rear axle for use and maintenance and troubleshooting of common fault of the St rear axle.



Rear Axle

8. Use and Maintenance of AC16 Cast Axle

The AC16 rear drive axle is a double-stage drive axle comprising central one-stage reduction and hub planetary reduction. Now the style only have tandem drive axle with cast housing, inter-axle, inter-wheel differences and differences lock. The rated load is 16 tons.

8.1 AC16 driving axle main technique parameter

Project	Parameter		
Rated load (kg)	16000×2		
Max.rotated speed (r/min)	3500		
Max input torque(N.m)	25560	23540	19620
Speed ratio	4.77	5.45	6.5
Service brake mechanism (mm)	Φ420×220		
Wheel braking style	Cam roller braking style		
Braking chamble	24" diaphragm		
Braking torque (N.m)	29400		
Specified braking air pressure (bar)	6		
Brake plate friction factor	0.38		
Weight (kg)	First axle 920 ; Second axle 807		
Oil quantity (L)	Second axle final drive 13.5; first axle final drive 17.5; wheel reduction 2		

Rear Axle

8.2 Use and maintenance

Pay attention to the following points when using and maintaining the rear drive axle:

- (1) Maintain lubricant volume. During use, check oil levels in hub reducer and final drive of the axle on a regular basis.

Oil starvation will cause premature wear of moving parts and, if serious, result in burn through. However, “the more the better” does not apply to lubricant because lubricant excess will cause high temperature even result in oil leak.

When changing hub reducer lubricant at initial maintenance of a new car, it is required that you should rotate the wheel until the drain plug is at its lowest position while the fill plug is at upside of the other half and open the drain plug to drain used oil during fresh oil fill, and then install the drain plug properly, open the fill plug, add lubricant until this high liquid level, and finally screw in the fill plug. Rotate the wheel repeatedly for several turns. Then position the wheel until the drain plug is at its highest position while the fill plug is on the smaller half, and open the fill plug to allow redundant lubricant to flow out until the liquid level is kept at the position of the fill plug. Finally, install the fill plug properly.

There are two screw plugs on the rear axle housing: A drain plug at bottom of the bowl and a fill plug at approx. half height of the bowl. The normal liquid level should always keep at the height of the fill plug.

The rear axle final drive and the hub reducer use APIGL-4 class gear oil with viscosity grade of SAE85W/90. Oil capacity in a common bowl: for rear axle final drive, 14.5L; for intermediate axle final drive, 17L, for each hub reducer, approx. 2L.

The change period of the gear oil in the rear drive axle is 50,000 km travel or 1 year. During the compulsory maintenance after the first 2,000-4,000 km travel, change the gear oil.

Rear Axle

(2) Correct use of the differential lock.

The inter-wheel differential lock on the rear drive axle enables automatic differential speeds on left and right wheels when the car is cornering so as to avoid tire wear and mechanical failure. When the wheels on single side of the car drive in a slippery or muddy road surface and slip there so that the car can not pull out, engage the differential lock and then the left and right half axles will become a rigid coupling shaft. Thus, the car can pull out of the faulty road surface certainly.

Note: After the car pulls out of the faulty road surface, pick off the differential lock immediately; otherwise, such serious accidents as heavy tire wear and differential bash will occur.

(3) Avoid badly overloading.

The design bearing capacity of the Steyr rear drive axle is 13t and the axle housing wall thickness of common vehicles is 16 mm. Both badly overloading and load concentration will result in axle housing deformation and fracture. During use, be sure to lade your vehicle according to the load specified in the driving conditions.

(4) If you reassemble such connectors and differential and driven gear during maintenance, be sure to smear Loctite 262 thread locking sealant on the connection thread and tighten to the specified torque to ensure locking of the attachment bolt.

If abnormal sound is heard during use, do not continue to drive forcedly. Instead, disassemble to check and repair immediately.

Frames and Suspensions

1. HOWO series frames

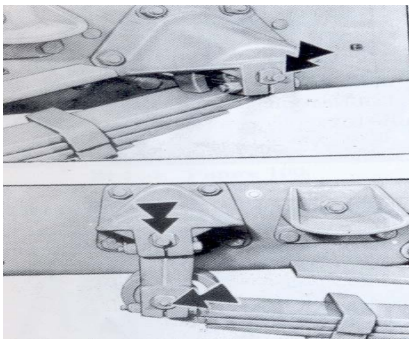
The HOWO series frames are made of hard alloy materials which are high strength. Their structure type features wider front (1000 mm) and narrower rear (850 mm).

2. Front suspensions

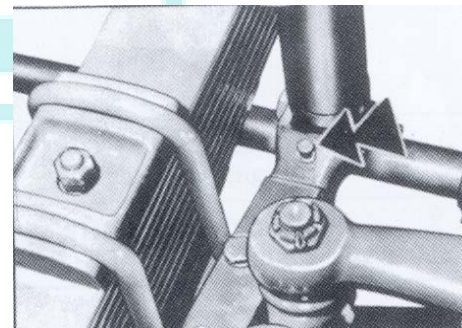
The basic type of the HOWO series automotive front suspensions comprises longitudinally set leaf spring with telescopic shock absorber.

The longitudinally set front leaf spring consists of 9 spring sheets of unequal lengths which forms the leaf spring assembly and are fastened together by center bolt while secured on the front shaft by U-bolts. The front spring eye is connected with the frame through bracket pin and front bracket to form a fixed hinged support while the rear spring eye is connected with the frame through lifting eye pin, lifting eye and lifting eye bracket to enable free swing. Thus, it is ensured that the distance between the 2 spring eyes can vary a little with camber of the spring.

Lubricate leaf spring pin



Lubricate lower bracket of shock absorber

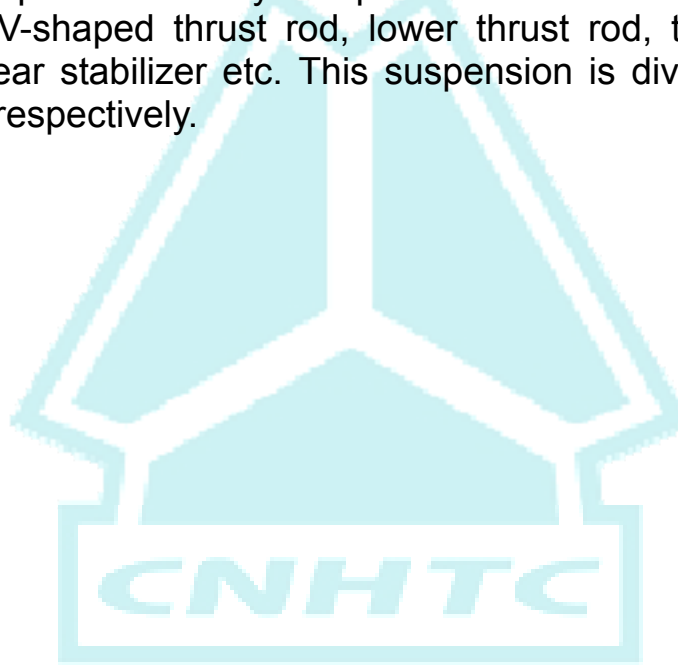


Frames and Suspensions

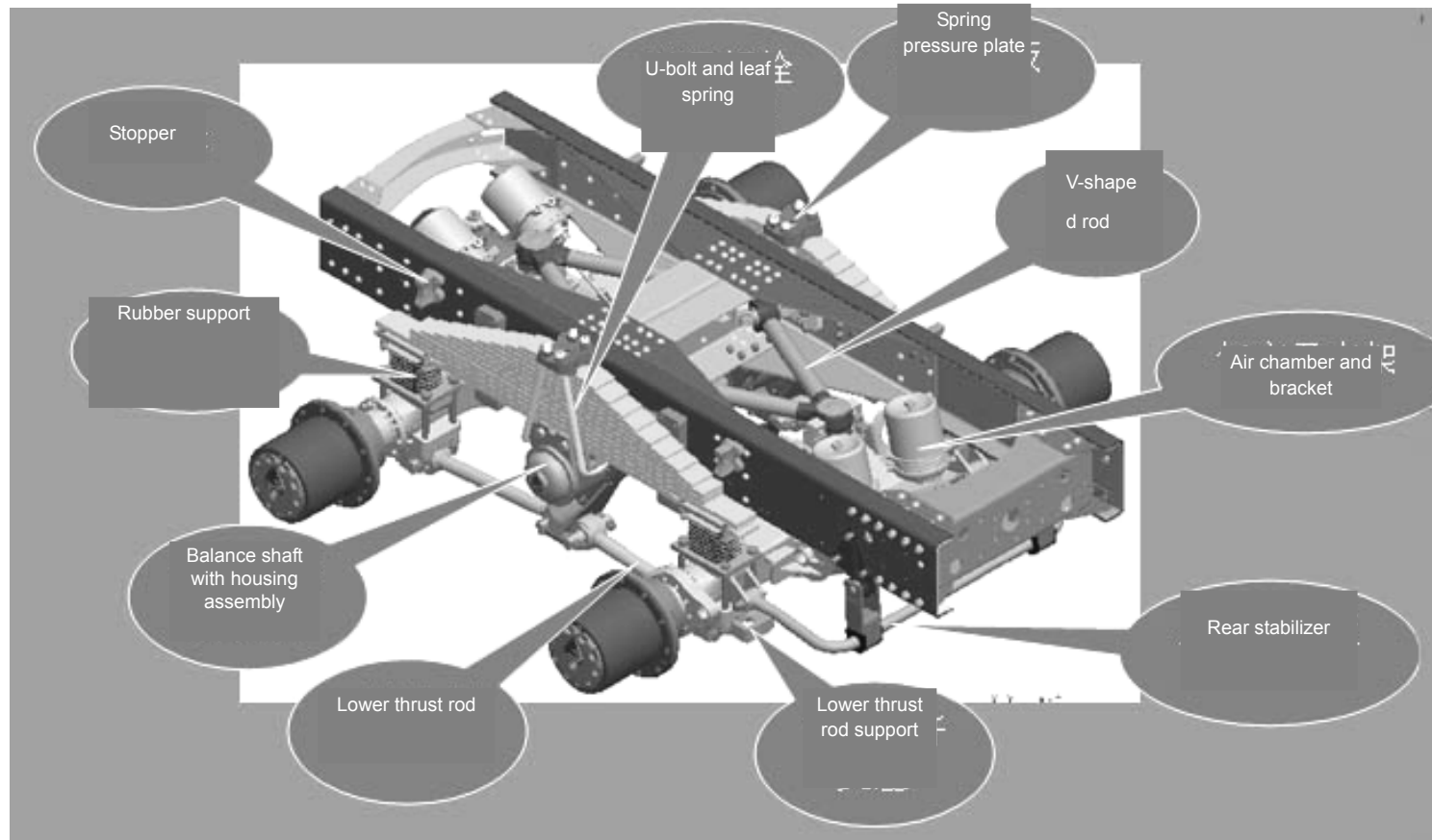
3. Rear suspensions

(1) NS-07 new type balanced suspension

The NS-07 new type balanced suspension mainly comprises elastic module (leaf spring, rubber support, U-bolt, nut, leaf spring pressure block), V-shaped thrust rod, lower thrust rod, thrust rod support, balance shaft with housing assembly, stopper, and rear stabilizer etc. This suspension is divided into 2 forms which apply to road vehicles and engineering vehicles respectively.

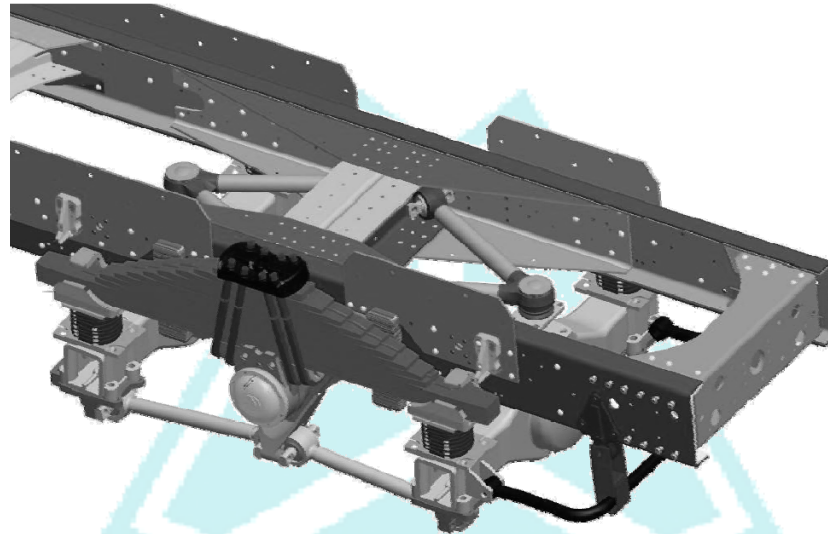


Frames and Suspensions



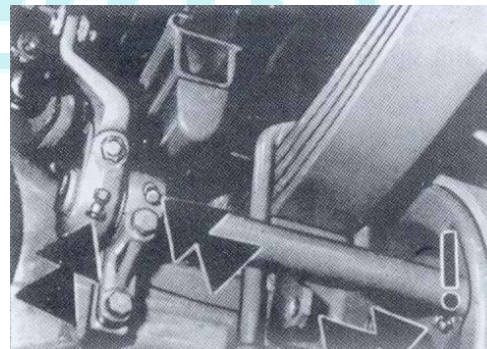
Balanced Suspension for Road Vehicles

Frames and Suspensions



Balanced Suspension for Engineering Vehicles

Lubricate rear axle brake arm and camshaft



Rear Lifting Axle for 6×2 vehicle

Working principle and operation instruction of 6×2 trailing axle

Warning:

1. The trailing axle can only be lifted up when the vehicle has no load.
2. The trailing axle mechanism can only be operated when the vehicle stands still without load.
3. During lifting operation, the axle must be lifted up to the position of limit block.
4. During lowing operation, the roller must be lifted up to the highest point.
5. After operation, lock the lever.

The lifting and lowing of rear axle is operated by high pressure oil supplied by steering pump and controlled by the control cylinder through hydraulic valve. The hydraulic working principle is shown in the figure.

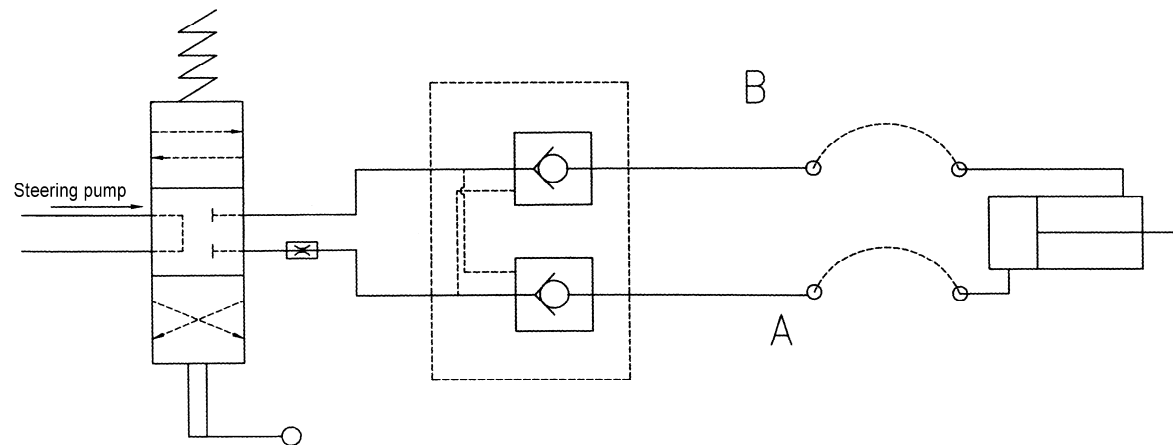


Fig.1: Hydraulic working principle

Rear Lifting Axle for 6×2 vehicle

Lifting operation:

When the vehicle stands still, engine runs at idle speed, open the protection unit of the hydraulic controlled valve, lift the lever to the lifting position, the pressure oil enters to lower chamber of the cylinder through high pressure tube, piston rod stretches out and pushes and turns the pushing arm of hydraulic cylinder on the swiveling shaft, and brings the swiveling shaft 2 and pushing arm 4 to turn. When certain travel is reached, the roller 5 on the pushing arm presses against the end of the balance rocker arm 11. If cylinder stretches out continuously, and the load on the trailing axle reduces, the leaf spring of rear suspension is deformed; when the load on the trailing axle reduces to zero, leaf spring will stop deforming; hydraulic cylinder 8 continues to stretch out, the balance rocker arm 11 turns round balance shaft, the trailing shaft is lifting up. Because the leaf spring stop deforming, the vehicle frame begins to rise; after the trailing axle reaches limit block, release the lever, the lever return to the middle position automatically. The hydraulic cylinder is locked by hydraulic lock, the rear axle is lifted up at last. Lock the lever.

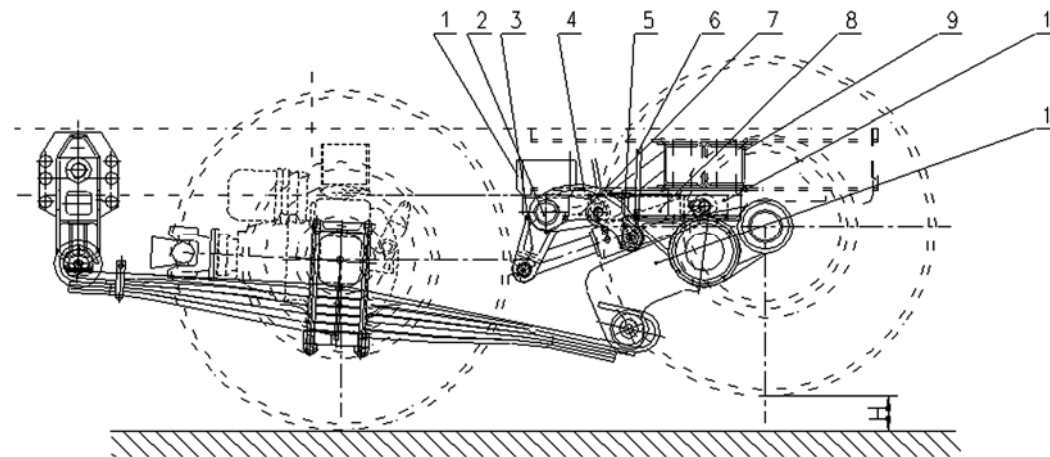


Fig.2: After the rear axle is lifted up

Rear Lifting Axle for 6×2 vehicle

Lowring operation:

When the vehicle stands still, engine runs at idle speed, open the protection unit of the hydraulic controlled valve, press down the lever to the dropping position, the pressure oil enters to upper chamber of the cylinder through high pressure tube, piston rod withdraws and brings the swiveling shaft 2 and pushing arm 4 to turn, the axle is lowered down because of its own weight. When the axle has dropped down to the ground, the piston rod continues to withdraw to its limit position, pushes pushing arm 4 and roller 5 to continue to rise up to the highest point, at a distance of about 60mm from balance rocker arm 11. After releasing the lever, the lever returns to the middle position automatically. The hydraulic cylinder is locked by hydraulic lock. Thus the task of lowring the axle to the ground is realized. Lock the lever.

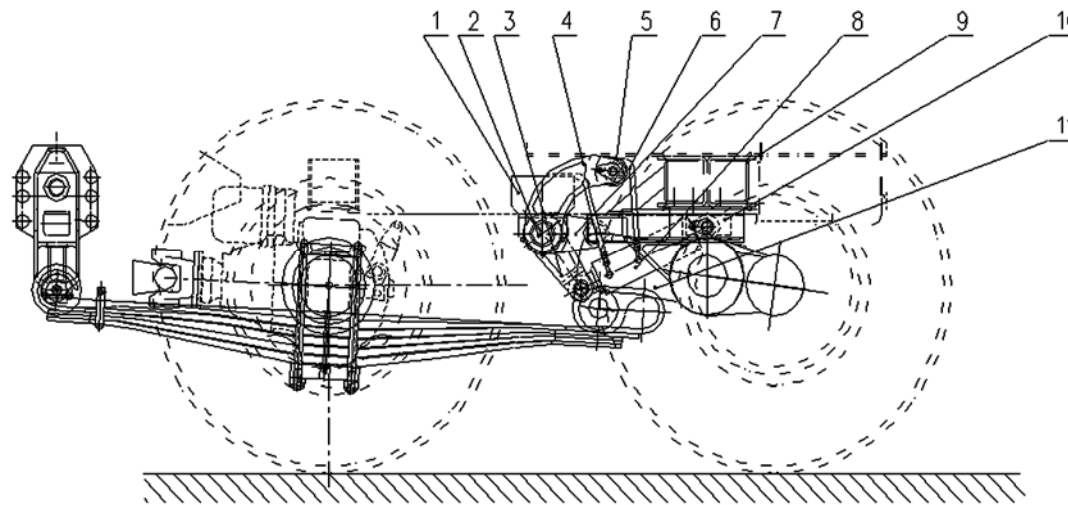


Fig.3: The dropping position of rear axle

Rear Lifting Axle for 6×2 vehicle

Explanation of fig 2 and fig 3:

1. swiveling shaft bracket assembly
2. swiveling shaft
3. pushing arm of hydraulic cylinder
4. pushing arm
5. roller
6. high pressure pipe
7. support arm
8. hydraulic cylinder
9. frame reinforced parts
10. hydraulic cylinder bracket assembly
11. balance rocker arm

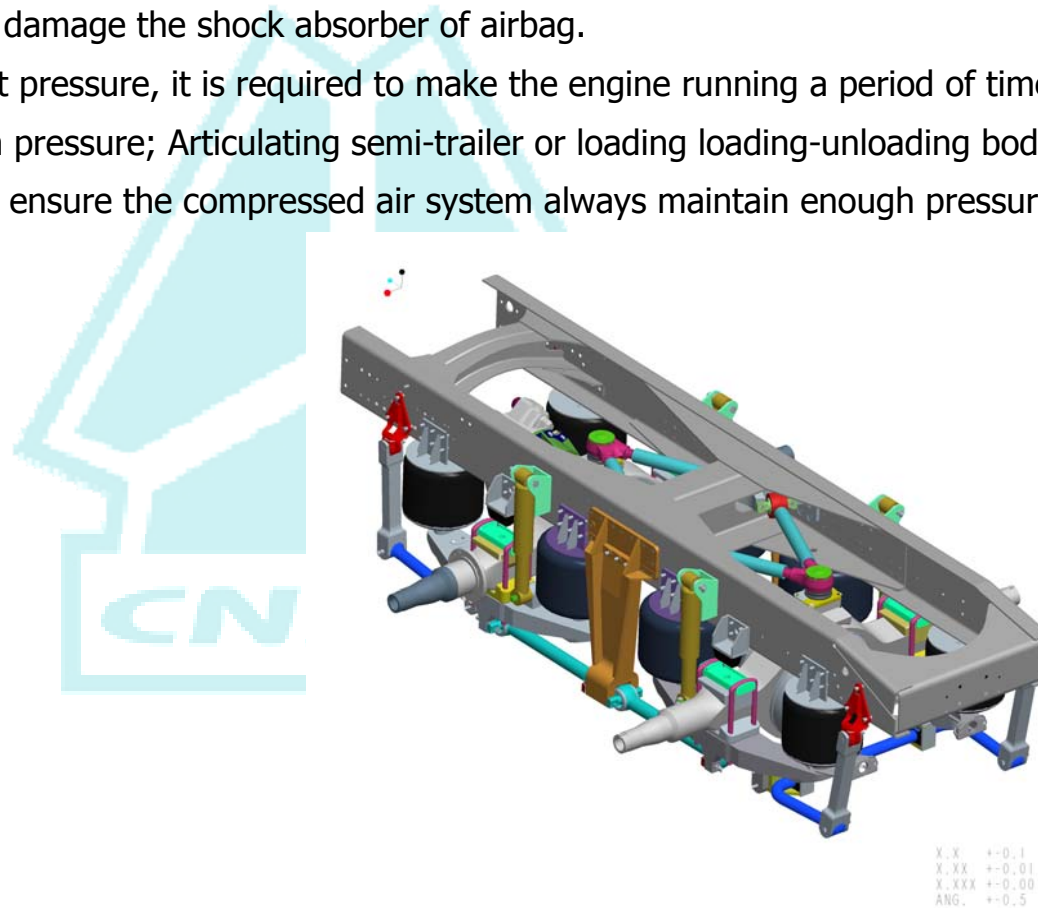


Air Suspension(Optional)

The vehicle of driving axle equipped air spring suspension can raise or lower the height of the rear frame through controlling the height valve.

Before loading loading-unloading body or cans, you should lower the position of chassis, otherwise, the chassis might suddenly play up after exchanging bodies, this may damage the shock absorber of airbag.

If the compressed air system is insufficient pressure, it is required to make the engine running a period of time, make the compressed air system to build up enough pressure; Articulating semi-trailer or loading loading-unloading body or container, make the engine keep running, this would ensure the compressed air system always maintain enough pressure.



Air Suspension(Optional)

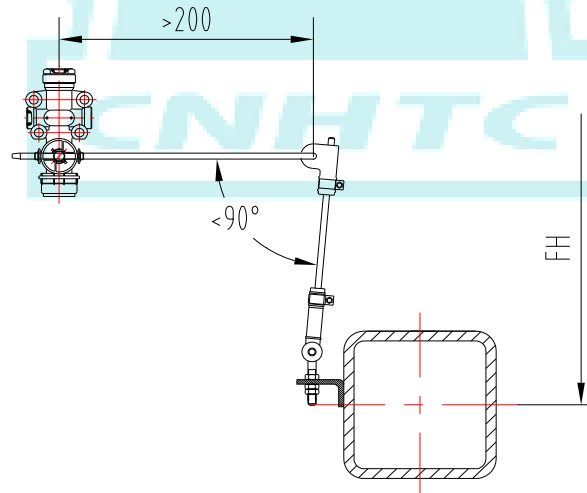
1. Characteristics of air suspension system:

- 1) Adjustment of suspension through height control valve can make the vehicle keep at the preset height when load changes.
- 2) Manual control of rotary slide valve can realize vehicle body's rising or falling when the vehicle is static. The height range falls under the working scope of airbags to meet the users' special applications and legal requirements.

2. Requirements for use:

- 1) The vehicle is not allowed to overload and maximum load for each axle must not exceed 16 tons. It is suggested that the vehicle should run on high level highway or good road.
- 2) Lubricants and grease are strictly forbidden to be used on any part of air suspension system, especially on rubber parts.
- 3) Ensure normal air supply pressure, which should be kept at 8.5 bar or so for air suspension system.
- 4) Daily and routine inspection and maintenance, including visual inspection of air spring for adequate and balanced inflation, normal suspension height, no system leakage, no oil leakage or damage for vibration damage, and smooth working.

3. The installation of air suspension height control valves



Air Suspension(Optional)

Attention: a、 The effective length of Height valve swinging rod should be more than 200 mm;

b、 At the height of the valve swinging rod horizontal position, the Angle between the rod and should be a little less than 90° ;

c、 The installation position must be easy to the high control valve of inspection, repair and maintenance

d、 Installation swinging rod, insert from high valve with a ">" side

e、 Adjust the FH value through the height control valve, FH equals to design value theory at the height of the valve swinging rod level. (FH value is the distance from the center of a wheel to the frame under wing)



HUV Rubber Suspension(Optional for tandem axle)

This suspension has the following advantages:

a. Simple structure:

The simple structure facilitates installation, reduces assembly time, improves working efficiency, cuts cost, and increases benefit.

b. Light dead weight:

c. Lubrication free:

With such features as maintenance and lubrication free, the rubber suspension will also bring customers better economic benefits while saving their costs and time.

d. Good trafficability:

The rubber suspension has good trafficability so that tire wear is reduced while tire service life is extended and maintenance cost is cut while maintenance expense is saved effectively to bring customers good economic benefits.

e. Excellent comfort:

With the variable rigidity feature, the rubber suspension can provide your vehicle with excellent comfort, reduce the vibration caused by rugged road surfaces to the maximum extent, mitigate driver's fatigue, protect integrity of vehicle components and goods, and extend lives of on-vehicle components, whether the vehicle is in noload or full load condition.

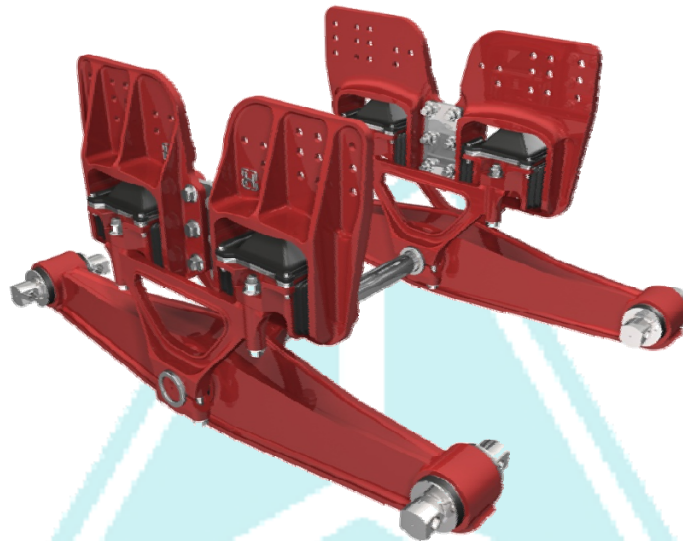
f. Damage of elastic components will not affect travel of the vehicle:

When a conventional leaf spring structure is used, once the leaf spring is damaged, the vehicle will be unable to run and you can not but replace the leaf spring with a new one. For a vehicle equipped with rubber suspension, if any of its elastic components is damaged when the vehicle is running, its travel will not be affected, so you can replace the component after you have sent the goods to your destination thus avoiding the customer's direct or indirect loss.

g. Tire wear can be reduced greatly:

When the vehicle is running, tire bounce will cause wear. Because the rubber suspension improves running smoothness greatly, tire wear can be reduced significantly.

HUV Rubber Suspension(Optional for tandem axle)



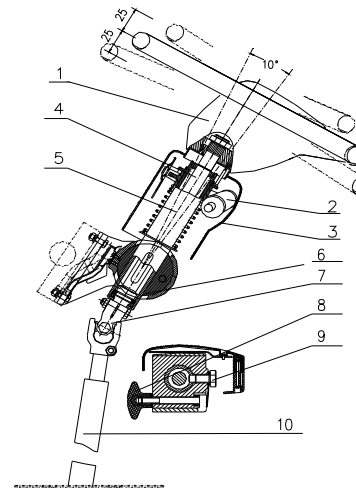
HUV270 Rubber Suspension



Steering System

1. Structure description of the steering system

The steering operation system consists of steering wheel, steering shaft, universal joint and steering column assembly. Diameter of steering wheel: $\Phi 450$ mm.



Drawing of the Hydraulic Power Steering System and the Steering Control Device

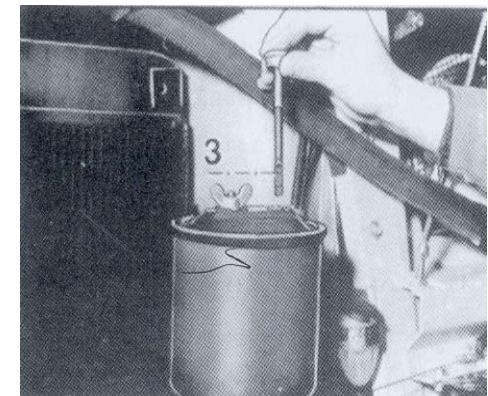
- | | | | | |
|-------------------|---------------------------------|-------------------------------|---------------------|---------------------------|
| 1. Steering wheel | 2. Ignition lock assembly | 3. Steering column cover | 4. Steering column | 5. Steering column sleeve |
| | 6. Steering column guide sleeve | 7. Universal joint | 8. Adjusting handle | |
| | 9. Stroke limiting screw | 10. Steering telescopic shaft | | |

Steering System

2. Technical parameters of steering gear

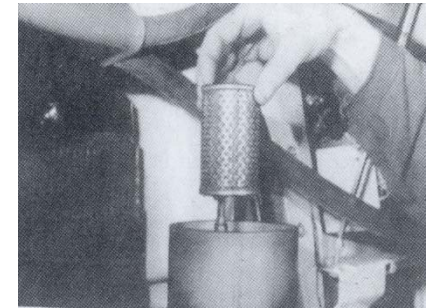
Parameter \ Model	ZF8098
Applicable front shaft load (kg)	6,500~8,000
Maximum pressure (Mpa)	18.3
Flow rate of oil pump (L/min)	16~20
Drive ratio	22.2~26.2
Maximum number of turns of steering wheel	6.2

3. Check hydraulic oil level inside the tank. First, clean oil reservoir and its surroundings to keep dirt out. Pay attention to the oil stick mark when checking, the oil level should be the same as the oil stick when the engine operates; the oil level should be a bit higher when the engine does not work.
4. The hydraulic oil of new vehicle needs to be replaced, and clean filter in the reservoir after the first 2,500km, and then each subsequent 20,000km (or half a year) the vehicle needs to replace the hydraulic oil.
5. Check the oil surface height once a month, and check the cleanliness of hydraulic oil.
6. The procedure for changing oil as following:
 - 6.1 Put up the front axle.
 - 6.2 Open the cover of oil tank; screw off the return pipe on the steering gear.



Steering System

- 6.3 Start the engine, idle running about 10 seconds, and turn the steering wheel to its right and left limit position several times, so as to drain oil inside the oil reservoir, booster pumps, steering gear.
- 6.4 Re-tighten the return pipe (keep it clean and keep dirt out of the oil circuit), clean oil reservoir, oil filters and filter elements. It is best to renew filter element every time when changing oil.
- 6.5 After filling up hydraulic oil, run the engine at idle speed, turn left and right the steering wheel repeatedly, at the same time, fill oil continuously till oil level no longer reduces and no bubble occurs.



Notice: Please replace with the specified hydraulic oil (HVN32 Low Temperature Hydraulic Oil).

7. In the first-grade service, check the clearance of every rotary component such as steering tie rod and drag rod joint. If the clearance is huge, the component should be replaced, and grease should be added on all the components in the first-grade service.

Air Conditioner

1. System Brief Introduction

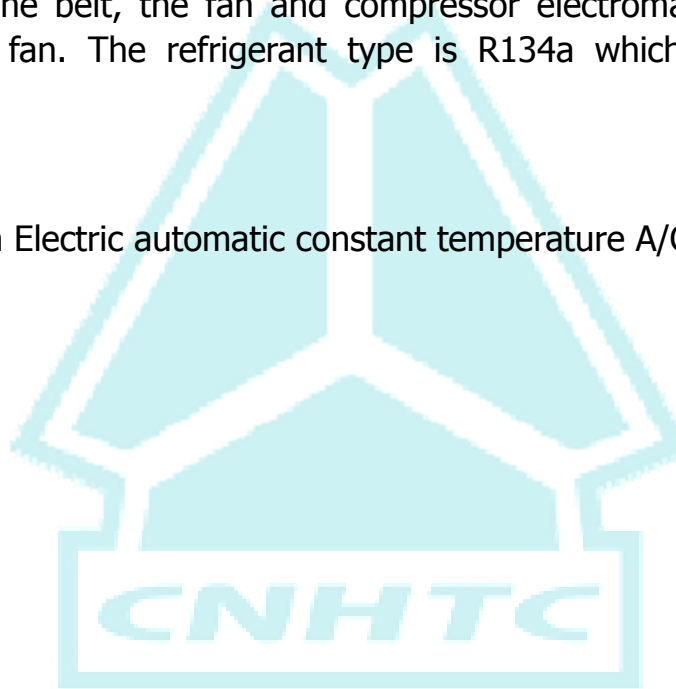
The system is composed by radiator, compressor, condenser, expansion valve, receiver drier, evaporator and fan and they are connected with pipes and form one closed system. The radiator takes engine circulating water as heat source, the compressor is driven by engine belt, the fan and compressor electromagnetic clutch is powered by vehicle and condenser is cooled by radiator fan. The refrigerant type is R134a which is green environmental protection and freon-free.

2. Operating Instruction

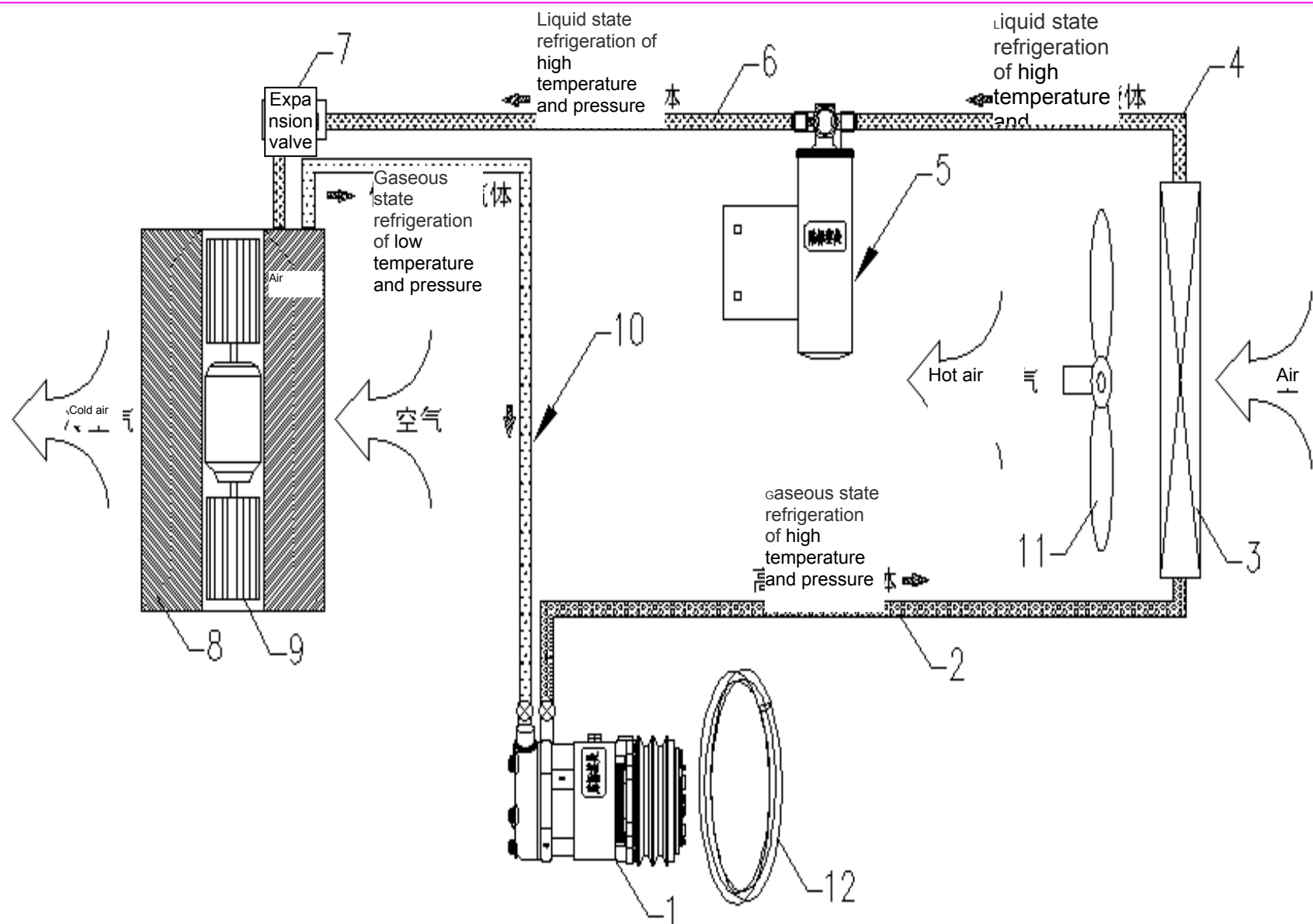
HOWO series vehicle can be mounted with Electric automatic constant temperature A/C.

A/C refrigeration theory

The figure of A/C refrigeration theory.



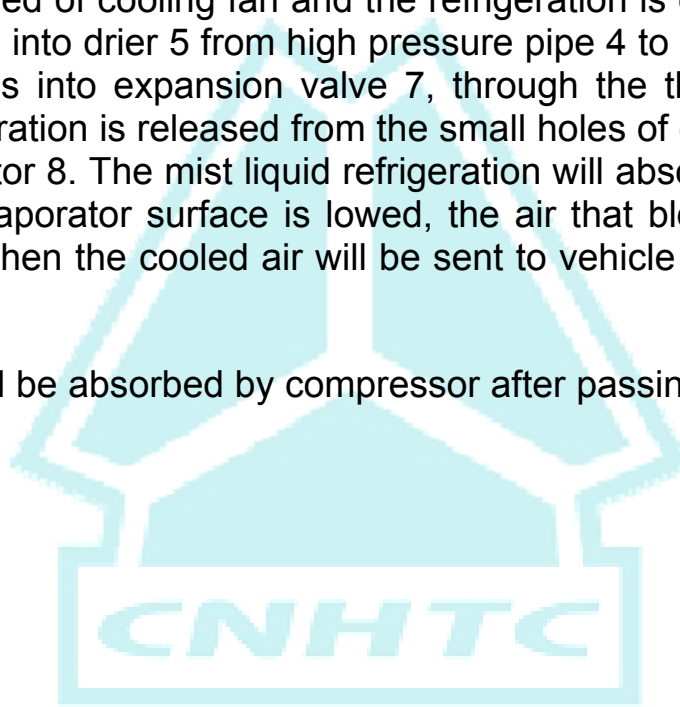
Air Conditioner



Air Conditioner

The compressor 1 is driven by the transmission belt 12 which is driven by engine, absorbs the gaseous state refrigeration of low temperature and pressure in evaporator 8 from low pressure pipe 10 and releases them under condition of high temperature and pressure. The gaseous state refrigeration passes the high pressure pipe 2 and goes into condenser 3 where got forced cooled of cooling fan and the refrigeration is changed from gaseous state into liquid state. Then the liquid refrigeration goes into drier 5 from high pressure pipe 4 to remove water and impurity. And then it passes high pressure pipe 6 and goes into expansion valve 7, through the throttle of expansion valve, the middle temperature and pressure liquid refrigeration is released from the small holes of expansion valve and changed into mist of low pressure and flows into evaporator 8. The mist liquid refrigeration will absorb heat in evaporator and be changed into liquid, then the temperature of evaporator surface is lowed, the air that blown by blowing fan 9 will pass by the surface of evaporator and get cooled, then the cooled air will be sent to vehicle interior to reduce the temperature and effect cooling performance.

The gaseous state refrigeration will be absorbed by compressor after passing the evaporator; the cycle goes round and round to low temperature.



Air Conditioner

3. Main Technical Parameter

A/C System	Refrigerating output	4.8-4.9KW
	Refrigerant	R134a
Compressor	Model	SE5H14
Compressor	Engine displacement	138cc/r
Compressor	Working voltage	DC24V
Compressor	Belt	Triangle seat belt (dual A) 17-420
Compressor	Electromagnetic clutch power	50W
Compressor	Weight	5.1kg
Compressor	Refrigerator oil	RENISO PAG 100 refrigerant oil
Condenser	Structure	Parallel flow
	Core	650×380×20
	Front face area	0.24m ²
Radiator	Structure	Gilled tube
	Core	369×204×64
	Front face area	0.07m ²
Expansion Valve	Type	Inner balance thermal expansion valve 1.5T
System Protection	Pressure protection	0.21MPa<P<3.14MPa

4. Precautions

- Not professional personnel are not allowed to disassemble or repair A/C system. The A/C system is always in pressure condition, the heating to the refrigeration filled system is prohibited.
- The direct touch of human body and liquid refrigeration will cause frostbite; hand, face and other exposed body are not allowed to be close with refrigeration. Before the filling of refrigeration, please identify the refrigeration R134a for the A/C system, any other refrigeration is not allowed to fill in.

Air Conditioner

- The drier shall be connected to system in the last step to avoid the absorbing of water in air and affect the water absorbing performance.
- The refrigerant oil needed in system is usually supplied by the refrigerant oil of compressor and not need to fill it any more. But it shall be filled if the refrigerant oil is lacked and caused by system leakage.
- In the seasons that not to use A/C, start the A/C cooling system by 2-3 times for 10 minutes every time in every month to avoid damage of evaporator, condenser or compressor.

5. Repair and Maintenance

Maintenance Parts	Maintenance Contents	Maintenance Period
Refrigeration	Obverse by level glass to check if refrigerant is enough, otherwise add in.	Every day
Receiver drier	Lowed water absorption performance, replace.	Every year
Rubber pipe	If it is aged or chapped, replace if necessary.	Every month
Pipe joint	If it has leakage or oil, tightening.	Every month
Expansion valve	Check if it is normal, otherwise make adjustment or replace.	Every year
Refrigerant oil	If it is enough or dirty, fill in or replace.	Every half year
Belt	Rate of tension, if it wore, replace if necessary.	Every month
Tightening bolt	If it is loosen or damaged, disassembly or remounting if necessary.	Every week
Evaporator	Cleaning	Every half year
Condenser	Cleaning	Every week
A/C outer cycle filter	Cleaning	Every week
A/C wiring harness	If the connector is firmly connected	Every month

Air Conditioner

6. Trouble Diagnosis and Shooting List

Trouble Phenomena	Possible Reason	Solution
1. High pressure is lower	System leakage	Check leakage and repair
	High pressure valve trouble	Change
	Return valve is closed	Open it
	Lacks refrigerant	Fill in refrigerant
	Receiver drier is blocked	Replace
	Compressor return air valve leakage	Change valve
	Damage of compressor reed valve	Replace
2. High pressure is higher	Air exist in system	Refill the refrigerant
	Condenser is blocked	Clean condenser
	Exhaust valve is closed	Open it
	Refrigerant is exceed in system	Exhaust more refrigerant
3. Returned air pressure is low	Lack of refrigerant	Fill refrigerant
	Compressor piston wore	Repair
	Compressor cylinder head gasket leakage	Replace cylinder head gasket leakage
	Hose twist or flat	Replace hose
3. Returned air pressure is low	Compressor return air valve leakage	Replace air valve
	System is wetly	Replace drier
	Expansion valve filter is blocked	Clean and replace drier
	Compressor reed valve is damaged	Replace
4. Returned air pressure is high	Expansion valve temperature sensor is loosen	Tighten the temperature sensor fixing clip
	Refrigerant is exceed in system	Exhaust more refrigerant
	Expansion valve can only open but can not close	Replace expansion valve
	Compressor reed is damaged	Replace reed valve

	Compressor cylinder head gasket leakage	Replace cylinder head gasket
5. Compressor is not working	Driven belt is broken	Replace belt
	Clutch cable is damaged	Replace cable
	Compressor piston cost long time	Replace compressor
	Constant temperature switch	Replace constant temperature
	Clutch coil is damaged	Replace coil
	Pressure valve has trouble	Replace pressure valve
6. Poor cooling performance	Gilled tube is frozen, temperature setting is too high	Rotate the constant switch downwards, defrost
	Can not fully close hot water valve	Close hot water valve
	Receiver drier is blocked	Replace
6. Poor cooling performance	Lack of refrigerant	Fill in refrigerant
	Defrost temperature sensor trouble	Replace
	High pressure is too high	Refer to 2
	The pressure of return air is low	Refer to 3
	The pressure of return air is high	Refer to 4
	Drier is blocked	Clean, replace drier
	Expansion valve is trouble	Replace expansion
	Constant temperature switch can not work	Replace constant switch
7. Evaporator gilled tube is frozen	Improper adjustment of constant temperature	Adjust to working condition
	Not enough air is passing evaporator	Check the evaporating fan
8. Belt trouble	Pulley can not match	Adjust pulley bearing position
	Belt is too tight or looseness	Proper adjustment
	Belt size is not correct	Replace
	Idle gear is damaged	Replace bearing
9. Hose or joint leakage	Leakage of joint	Repair or replace
	Leakage of hose	Replace hose

Battery

Check the surface and proportion of liquid electrolyte every three months. The surface is 10~15mm higher than the electrode plate; the proportion is more than 1.24 g per cm³.

Take off the battery into the warmer room when the vehicle does not run for a long period and the temperature is low.

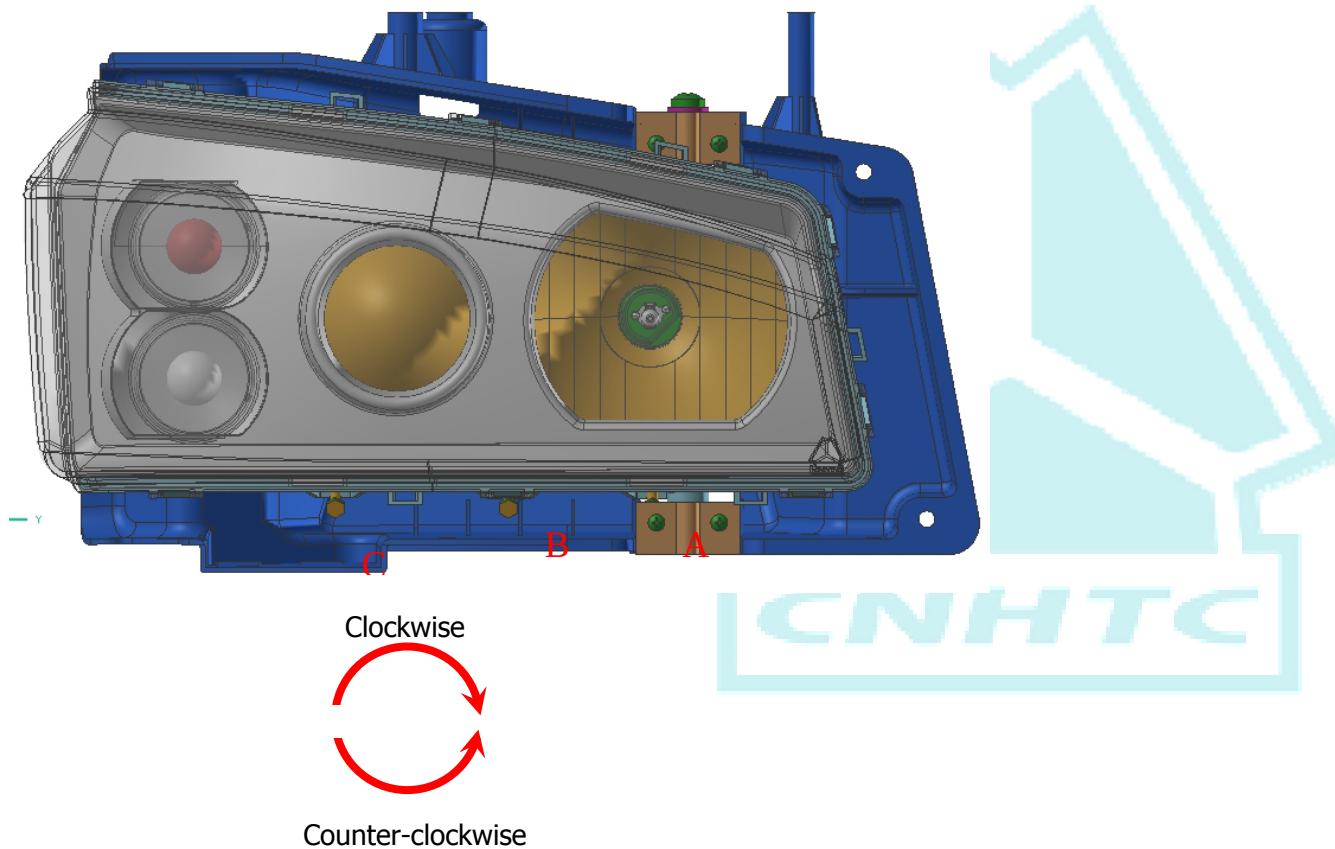
Check whether the battery electrode pile and wire connection clip is loose and the battery conditions are normal or not when the vehicle runs for each 500 km.



Adjustment Guidance for Headlamp

Adjustment of Headlamp

Vertical and horizontal adjustment method for high & low beam of HOWO headlamp as follows:



Clockwise and anti-clockwise as observed from the front of lights.

Adjustment Guidance for Headlamp

The first step—Remove the outside decorative ring.

The second step—Adjust the reflector direction as the following steps:

1. High beam vertical adjustment method

Turn screw A clockwise, the high beam will move down.

Turn screw A counterclockwise, the high beam will move up.

2. Adjust low beam up and down

Turn screw B&C clockwise, the low beam will move down.

Turn screw B&C counterclockwise, the low beam will move up.

3. Low beam horizontal adjustment method (right lamp)

Turn screw B clockwise, at the same time, turn screw C withershins, the center of low beam will move left.

Turn screw B withershins, at the same time, turn screw C clockwise, the center of low beam will move right.

4. Low beam horizontal adjustment method (left lamp)

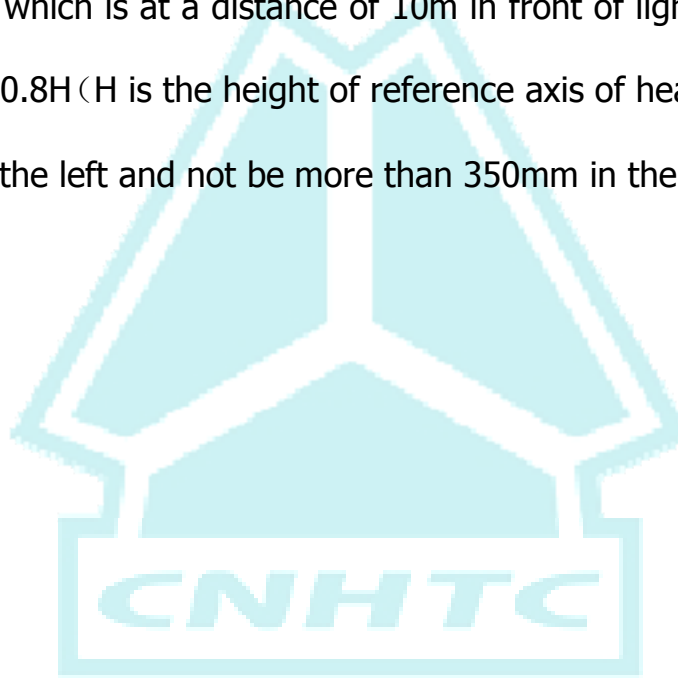
Turn screw B clockwise, at the same time, turn screw C withershins, the center of low beam will move right.

Adjustment Guidance for Headlamp

Turn screw B withershins, at the same time, turn screw C clockwise, the center of low beam will move left.

The irradiation position of headlight low beam:

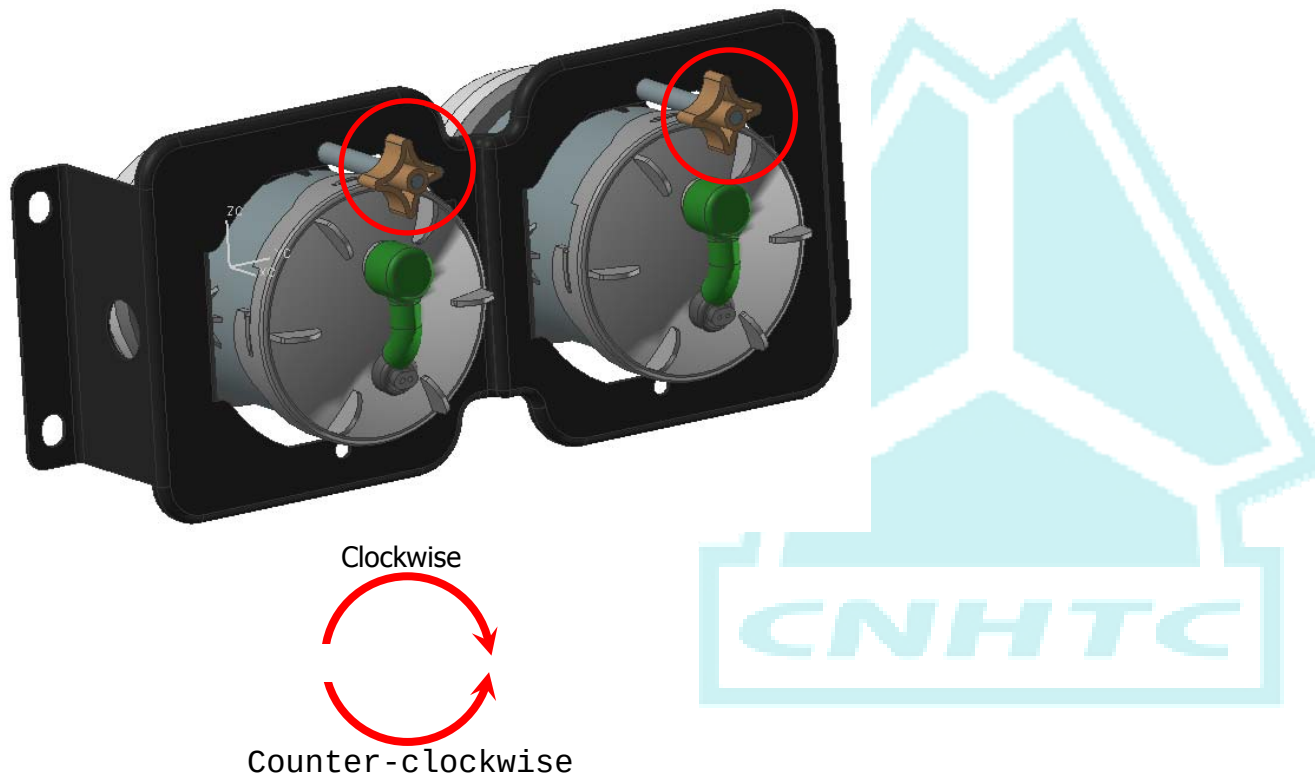
When the low beam project to the screen which is at a distance of 10m in front of light, the height of the corner of cut-off line or the height of midpoint should be $0.6H \sim 0.8H$ (H is the height of reference axis of headlight, the same as follows), and, the low beam should not be more than 170mm in the left and not be more than 350mm in the right in the horizontal direction.



Adjustment Guidance for Headlamp

Adjustment Guidance of Fog and High Beam Combination Lamp

Vertical adjustment method for HOWO front combination lamp as follows:



Clockwise and anti-clockwise as observed from the back of light.

Adjustment Guidance for Headlamp

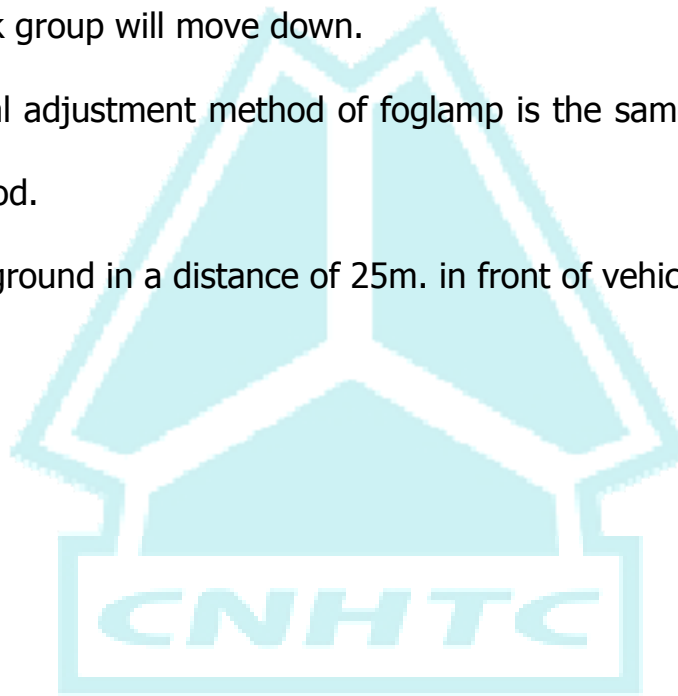
Vertical adjustment method:

Turn handwheel clockwise, the lampwick group will move up.

Turn handwheel withershins, the lampwick group will move down.

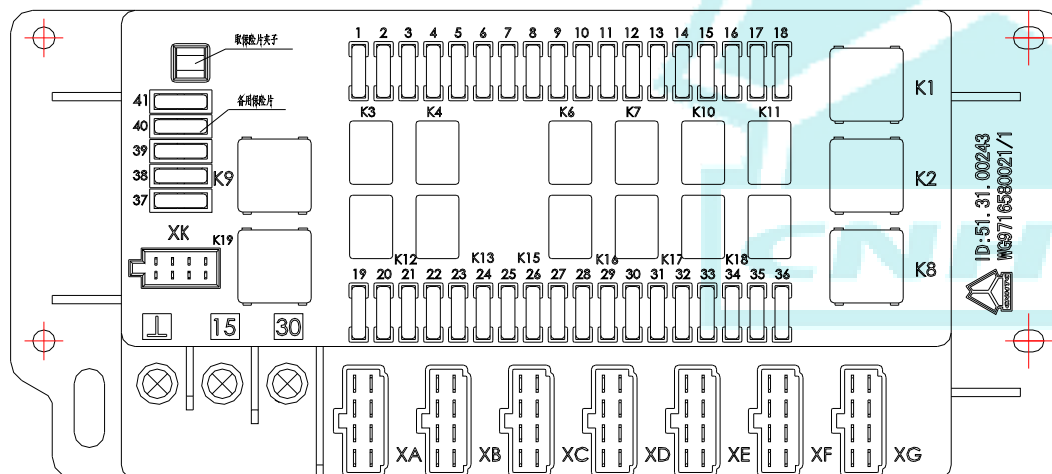
The HOWO front combination light vertical adjustment method of foglamp is the same as high beam lamp, and is the same as left lamp and right lamp adjustment method.

The center of fog lights should fall to the ground in a distance of 25m. in front of vehicle.



Instructions for Electric Connector Box

The central electrical connection box is located in the electrical case under the dashboard of co-driver's side.



Central electrical connection box

Instructions for Electric Connector Box

1. Open the cover of electrical case under the dashboard.

- By the right direction, open the cover of electrical case forcedly and then draw it out from the slot.

2. Close the cover of electrical case under the dashboard.

- Insert the cover into the slot.
- By the direction against opening, press down the cover of electrical case.



Notice: Before changing fuse, turn off all electrical devices and take away the wiring clip from the negative end of battery.

3. Check/change fuse:

All electrical circuits of vehicle are equipped with fuse. If any of the circuits is in failure, turn off relevant electrical device and check whether fuse is burned out or not. Change fuse at once if failure happens.

4. Fuse clamp/spare fuse

While changing the damaged fuse, use the fuse clamp in the central electrical connection box to take the spare fuse.

Instructions for Electric Connector Box

5. Instruction for parts of electrical connection box

取保险片夹子

备用保险

20: 二极管电阻组件

K3: D+

K4: 挂车左位置灯

K6: 电喇叭

K7: 左远光灯

K10: 雨刮间歇

K11: 排气制动

K1: PCV

K9: 15#电源

K12: 工作灯

K13: 挂车右位置灯

K15: 气喇叭

K16: 右远光灯

K17: ECU15H电源

K18: 备用

K2: ECU

K19: 15#电源2

K8: 空调电源

说明: K3, K17为ADR车型专用5脚继电器

F1	F2	F3	F4	F5	F6	F7	F8	F9	F10	F11	F12	F13	F14	F15	F16	F17	F18
5A	5A	15A	15A	10A	10A	10A	15A	15A	25A	10A	10A	20A	10A	15A	5A	5A	20A
P线 C V K1	翘等 板15 开电 关源	工 作 灯 K12	挂 位 置 车 灯 K4、K13	K9空 气之 干燥 器	K9座 椅之 加热 后热	K915 #之 备用	电 气 喇叭 喇叭 K6 K15	主 A B 车S	挂 A B 车S	左 远 光 灯 K7	右 远 光 灯 K16	P电 C V 源 K1	雨 刮 间 歇 K10	挂 座 车 电 插 源	排 气 制 动 K11	E17 C U 脚	E电 C U 源 K2
F19	F20	F21	F22	F23	F24	F25	F26	F27	F28	F29	F30	F31	F32	F33	F34	F35	F36
5A	5A	15A	15A	10A	5A	10A	10A	15A	15A	15A	20A	20A	20A	15A	15A	10A	25A
主 A B 车S	挂 A B 车S	组 合 开 关	里 传 程 感 表 器	V电 D R 源	C电 M I C 源	C电 M I C 源	点 烟 器	C B C U	C B C U	C B C U	C B C U	C B C U	C B C U	30# 备 用	钥 匙 开 关	内 V 收 照 明 灯R	空 调 电 源 K8

Instructions for Electric Connector Box

6. Fuse specifications and relevant application

Fuse No.	Capacity	Application	Fuse No.	Capacity	Application
F1	5A	PCV Coil(K1)—for Euro3 vehicle	F22	15A	Speedometer sensor
F2	5A	15# electric source of rocker switch and so on	F23	10A	Electric source of VDR
F3	15A	Working lamp (K12)	F24	5A	Electric source of CMIC
F4	15A	Trailer position lamp (K4, K13)	F25	10A	Electric source of CMIC
F5	10A	Air dryer(K9)	F26	10A	Cigar lighter
F6	10A	Seat heater(K9)	F27	15A	G1 of CBCU
F7	10A	15# standby	F28	15A	G2 of CBCU
F8	15A	Electric horn(K6), Air horn(K15)	F29	15A	G3 of CBCU
F9	15A	ABS—tractor	F30	20A	G4 of CBCU
F10	25A	ABS—trailer	F31	20A	G5 of CBCU
F11	10A	Left high beam lamp(K7)	F32	20A	G6 of CBCU
F12	10A	Right high beam lamp(K16)	F33	15A	30# standby
F13	20A	PCV electric source(K1)	F34	15A	Key switch
F14	10A	Wiper intermission(K10)	F35	10A	Interior light/VDR/radio
F15	15A	Trailer socket electric source	F36	25A	Electric source of air conditioner
F16	5A	Exhaust brake(K11)	F37		Standby
F17	5A	17 th pin of ECU	F38		Standby
F18	20A	Electric source of ECU (K2)	F39		Standby
F19	5A	ABS—tractor	F40		Standby
F20	5A	ABS—trailer	F41		Standby
F21	15A	Combination switch			

Air Intake System

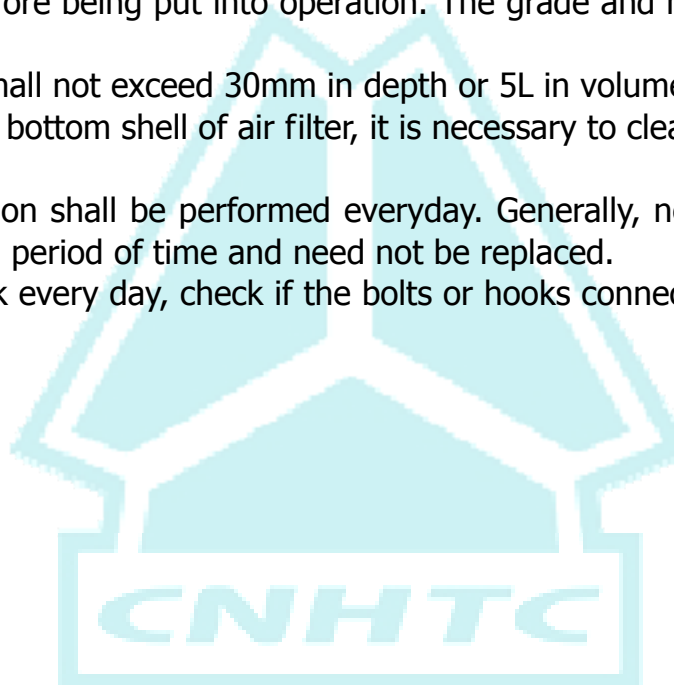
1. Oil bath air cleaner

1.1、Attention for use

- ① The new trucks are not filled with oil when they are delivered.
- ② The new trucks shall be filled with oil before being put into operation. The grade and model of oil filled shall be identical with that of lubricant oil for engine.
- ③ While filling oil, oil quantity in the filter shall not exceed 30mm in depth or 5L in volume. Over-filling is not allowed.
- ④ If the oil does not flow when shaking the bottom shell of air filter, it is necessary to clean the filter core and replace the oil.

Under extremely severe conditions, inspection shall be performed everyday. Generally, new oil can be used continuously for 80-150 hours. The filter core can be used for a long period of time and need not be replaced.

- ⑤ When parking vehicle after stopping work every day, check if the bolts or hooks connecting the shell and bottom shell are loose. If so, tighten them.



Air Intake System

1.2、Removal, Inspection and Cleaning Procedures

(1) Oil bath air cleaner assembly.



(2) Open the locking device of the housing upper and lower halves.



(3) Fill oil.

Remove the oil pan, add 5L oil or until the oil layer depth reaches 30 mm.

measuring tape
immersed below oil
level for about 30 mm



(4) Clean the lower filter element assembly.

Clean the fan blade surface and filter element with diesel oil until no oil sludge is found on the filter element and fan blade through visual examination.



Air Intake System

(5) Clean the upper filter element assembly. Use the same procedure as that for lower filter element.



(6) Fit the filter element assembly. Install the upper filter element first and then the lower one. Finally, tighten them using rubber pad, plain washer and wing nut.



(7) Assemble the housing lower half. Fix the housing lower half filled with oil firmly using draw hooks.



(8) The assembly is completed.

Air Intake System

2. Operation instructions for general-purpose and desert-application air cleaners

2.1. Air cleaner service indicator light check

Tilt the cab, cover the air intake briefly with the engine running, and the service indicator light should come on immediately.

2.2. Maintenance of general-purpose and desert-application air cleaners

- (1) Perform maintenance for general-purpose air cleaners periodically. The maintenance period for prefilters is 800-1,200h depending on working environment. For newly installed ones, check their filter elements daily during use to prevent unexpected situations.
- (2) Perform maintenance for desert-application air cleaners periodically. The maintenance period of prefilters is 600-1,000h (in dusty environment, 200-300h). The maintenance period of fine filter paper elements is 500-100h depending on working environment. During prefilter maintenance, use corresponding maintenance method according to different structures. When bodies of prefilter and fine filter are connected in H form, during prefilter maintenance, you can simply open the upper and lower (or left and right) end covers, blow off the dust and sand and deposit in the breather pipe using compressed air repeatedly, and then reinstall the cover plate and seal ring properly. When bodies of prefilter and fine filter are connected in T form, take out the fine filter paper element and safety cartridge first, and then blow off the dust and sand and deposit in the breather pipe up and down using compressed air repeatedly. Maintain the fine filter paper element using the routine method simply. For newly installed ones, check their paper filter elements daily during use to prevent unexpected situations.

Air Intake System

(3) Maintenance notices for air cleaners:

- ① During maintenance of an air cleaner, remove the engine intake duct or plug the air outlet duct of the fine filter using gauze first to prevent dust and sand from being blown into the engine intake duct directly to cause serious consequence.
- ② During construction in saline alkali areas, dust and sand may cement inside the prefilter body. In such a case, flushing the prefilter body with main water is allowed, but you should note that the seal ring and end cover can be attached only after moisture has been air dried.

2.3. The installation methods for desert-application air cleaners:

- (1) Double-stage desert-application air cleaners are generally installed directly by the auto makers as self-contained components at delivery. Their installation methods and dimensions are designed elaborately and matched. Auto users can also choose and purchase according to models of their cars and then install by themselves.
- (2) Single-stage prefilters are used when improving original intake systems of cars. Namely, add a prefilter on the original intake duct. As a result, filtration efficiency of the intake system is increased greatly and premature wear of engine is avoided. Generally, there are 3 installation methods for it:

- ① The method for installation on front panel of carriage:

Design and make a bracket. Fix the bracket on the front panel first, and then secure the air cleaner to the bracket using clips with the air outlet of the air cleaner connected with the air inlet of the original fine filter using hose simply.

Air Intake System

- ② The method for installation on upper part of cab back wall.
- ③ The method for installation on girder of car.

Naturally, other installation methods are also available and customers can design and install by themselves according to different models.



Picture of a desert-application air cleaner



Picture of a general-purpose air cleaner



Section 4

Do it by yourself

Changing and Replacing Parts

Your vehicle is designed based on the latest technical knowledge of security, so it provides excellent active and passive safety. In order to maintain this state, it is forbidden to change parts arbitrarily. So if the vehicle must be added other accessories, carry out technical improvement or replace parts, pay attention to the following instructions:

1. Before purchasing the accessories and parts for replacement or technical improvement, ask for the CNHTC sales agencies's advice first.
2. CNHTC sales agency provides original accessories, parts and components, and professional installation services.
3. We suggest using original accessories and parts only, and installing them at CNHTC service agency. Due to the damage caused by violation of operation, CNHTC service agency does not provide quality assurance.
4. If the additional installation of the accessories which will directly affect the driver's control of the vehicle, such as speed control devices, these devices must get CE (European Community recognized mark) or "CCC" mark which approve equipment can be installed in your models.
5. If the connected electrical equipment does not directly control the vehicle, such as refrigerators, horns, or fan, CE (European Community recognized mark), or "CCC" mark should be attached to them.
6. If your vehicle needs technical modification, please note our principles, that is, do not modify the vehicle without our permission; do not perform to damage the vehicle; the transportation safety and operating reliability should be ensured. CNHTC service agency will provide professional service or introduce professional state under particular cases.

Changing and Replacing Parts



Notice:

1. Reliability, security and acceptability of the original accessories and parts have the approval and is suitable for the vehicle.
2. For other brand parts and components, we could not provide quality warranty, even if they have official approval from the technical inspection supervision authorities' acceptance.
3. For unauthorized vehicles modification and the adverse consequences caused by the modification, no warranty will be provided.



Driver's Tools and Spare Tire

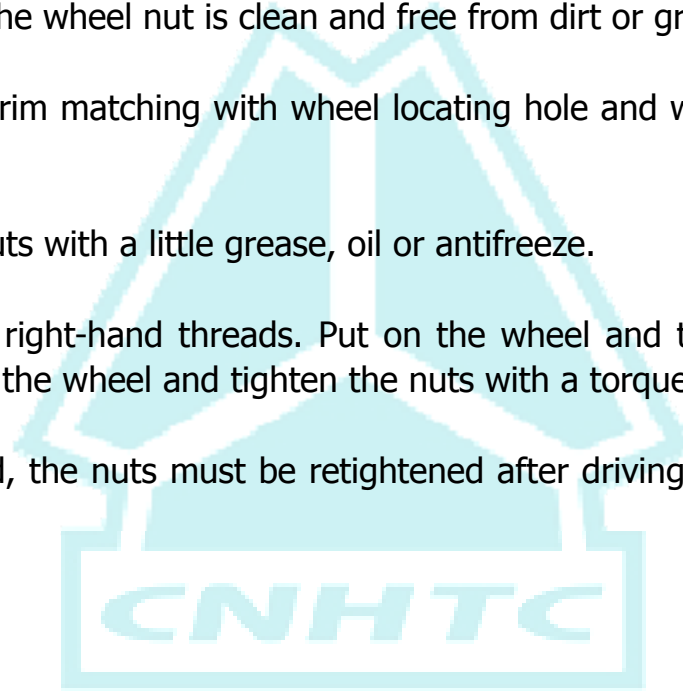


Notice:

1. Ensure that the driver's tools and spare wheel are firmly fixed, in order to avoid loosen in accidents and sudden braking situations.
2. The vehicle must not be started when it is lifted.
3. Ensure the vehicle is lifted by appropriate support block if you work under the truck.
4. The jack must be screwed completely before putting back to toolbox, and make the crank handle firmly resisted the side of the jack.

Changing Wheels

1. When changing a wheel, take care not to damage the stud threads.
2. The matching surface between the brake drum and rim must be absolutely free from paint, grease or dirt.
3. It is essential that the contact face of the wheel nut is clean and free from dirt or grease.
4. Before installation of wheel, clean the rim matching with wheel locating hole and wheel reductor housing, and coat it with a little grease.
5. Coat threads of the wheel studs and nuts with a little grease, oil or antifreeze.
6. All the threads of the wheel nuts are right-hand threads. Put on the wheel and tighten the wheel nuts in cross sequence while the wheel is still raised, then low the wheel and tighten the nuts with a torque of 550~600Nm.
7. Every time when the wheel is changed, the nuts must be retightened after driving 50Km. And later on, retighten the wheel nuts every 1000Km.



Coupling Trailer with Tractor



1. Coupling the Trailer

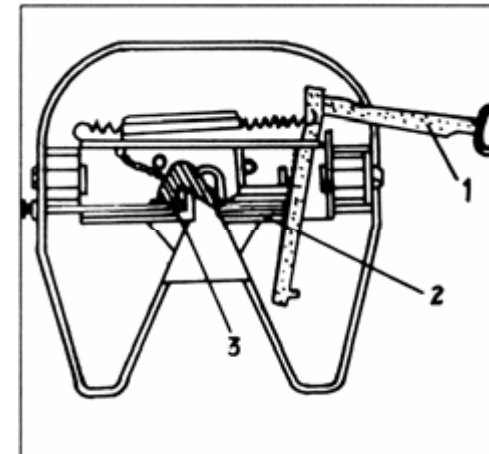
Semi-trailer:

The coupling of tractor truck and trailer is conducted by fifth wheel. Coupling procedure:

1.1 Secure the semi-trailer stands still.

1.2 Lift the hand lever 1 on the fifth wheel, put the lever to the upper long eye and pull it out until the position slot locks housing. At that time, the fifth wheel is ready to couple.

1.3 Coupling during the tractor's backing, after putting drawbar pin to the connecting jaw in the fifth wheel, coupling hook 3 and wedge block 2 lock the coupling jaw automatically and complete the coupling. At the same time the lever returns to its original position. It means the operation is correct.



Coupling Trailer with Tractor

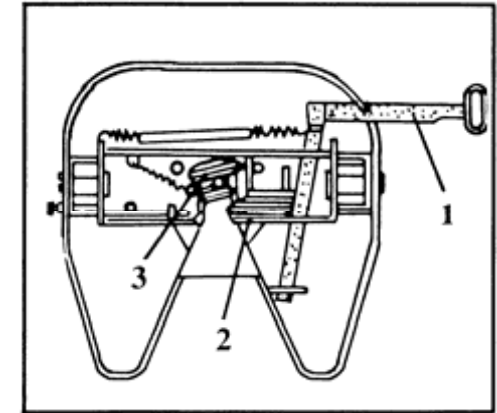
2. Uncoupling the Trailer

2.1 Secure semi-trailer or trailer stand still.

2.2 Uncoupling the semi-trailer with dual circuit brake system, first uncoupling the reservoir line (red) and then the brake line (yellow). It is essential to adhere to this order, otherwise the trailer brake will be released.

2.3 Uncoupling the trailer: Put forward the hand lever 1 of the automatic locking mechanism (in the travel direction of the truck) until the coupling jaw is unlocked. Drive forward the tractor to finish the uncoupling operation. Return the hand lever to its original position if the trailer will not be coupled with for a long period.

2.4 Uncoupling the semi-trailer: Put out the hand lever of the fifth wheel until the position slot locks housing, the edge block 2 will uncouple hook 3. Drive forward the vehicle, turn the drawbar, release the drawbar pin, and finish the uncoupling operation. Return the hand lever 1 of the fifth wheel to its original position if the semi-trailer will not be coupled with for a long period.



3. Cautions

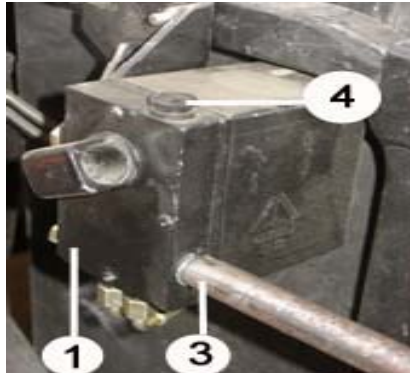
3.1 While connecting compressed air lines and electric cables, please ensure there is no stress, kinking or abrasion could occur when the vehicle turns or rebounds.

3.2 After connecting the compressed air lines, adjust the load-sensing pressure regulator (if fitted) on the trailer in accordance with requirements of the trailer manufacturer.

3.3 With the dual circuit brake system, the connectors are connected red to red (on the right) and yellow to yellow (on the left).

Tilting System and Suspension of Cab

Tilting and lifting system of cab



Pic.1



Pic. 2

- ① Manual hydraulic oil pump
- ② Transfer handle
- ③ Lever
- ④ Oil plug

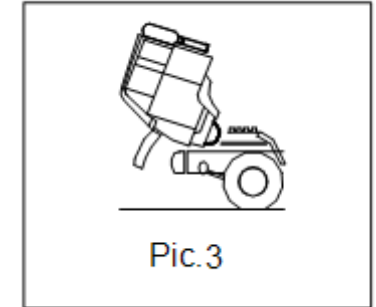
1. Tilting operation

- 1.1 Before tilting, remove all the loose articles from the cab.
- 1.2 Before tilting, open the radiator cover first (Pic. 3).
- 1.3 When tilting, nobody should stand near the front of the cab (Pic. 4).
- 1.4 Turn the tilting hand lever of the tilting oil pump to "↑" position, tip up the cab with hand pump (Pic. 5).
- 1.5 Turn the tilting hand lever to "↓" position, tip down the cab to its original position with hand pump.

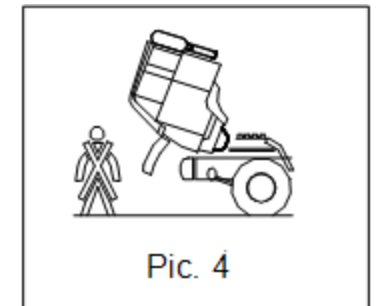


Warning:

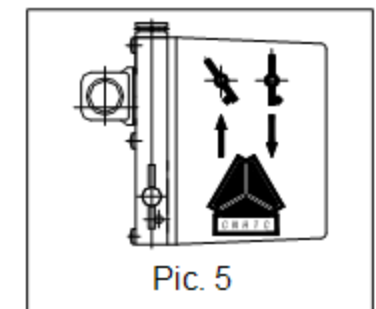
Because the oil cylinder can fall back automatically at the top die point, when the distance between the lock pin and the lock catch is 40~100 mm, the cab will fall back automatically.



Pic.3



Pic. 4



Pic. 5

Tilting System and Suspension of Cab

- 1.6 After the cab has fallen back, the rubber bellows connecting with the top intake duct must cling to the bottom intake duct so as to keep the dust outside.
- 1.7 During the period when the cab is falling down, check if the guide pad of the front air bag is aligned. After the cab has completely fallen back, check if the front air bag is upright, if not aligned, tip up and down the cab again.
- 1.8 Finally check cab lock indicator on the instrument. If the cab is unlocked, the cab lock indicator will light up.



Notice:

When titling, the cab must be tipped forward beyond the top die point, otherwise the next operation procedure could not be continued.

2. Filling Oil and Releasing Air of the Titling System

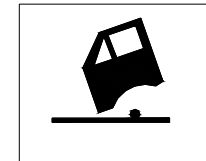
Filling oil and releasing air of tilting system only after the cab returning to its original position.

About 0.41 HVN32 low temperatures hydraulic oil should be used, to ensure that the hydraulic oil is clean and in accordance with the specification before filling.

Filling procedures:

- ① Open the oil plug and fill up the specified hydraulic oil.
- ② While titling up the cab slowly with hand pump, fill the oil continuously.
- ③ Tilt down the cab and drain the superfluous oil at the same time.
- ④ Tilt up and down the cab again with hand pump, after titling down the cab to its original position, check and fill up the oil again.
- ⑤ Finally, screw the oil plug.

Air filter clogged



Tilting System and Suspension of Cab

3. Check Function of the Tilting System

3.1 Tilt the cab forward to top die point, check the working condition during tilting down. If the system is working in good condition, the cab will tip down slowly with resistance rather than strike down.

3.2 When tilting the cab to 30°, the cab can be kept in this position for 20 minutes without sinking.

Cab suspension

1. Front suspension: (Pic. 6)

Before assembling the rocker arm, check if grease has been filled, after

Assembling, check if the washer is locked.

After tipping down the cab, the air spring of front suspension still has a Pressure of 1~2kg. Before the cab returns to its original position, check air bag pressure. If necessary, adjust the track bar with hand to ensure the air bag pressure. After the cab returns, check air bag to ensure that it will not fold or deflect, otherwise tip up and down the cab again.



Pic. 6 Coil spring of front suspension (or air spring)



Warning:

When adjusting, pressure of air bag should not be over 2kg.

Tilting System and Suspension of Cab

2. Rear suspension: (Pic. 7)

With air springs:

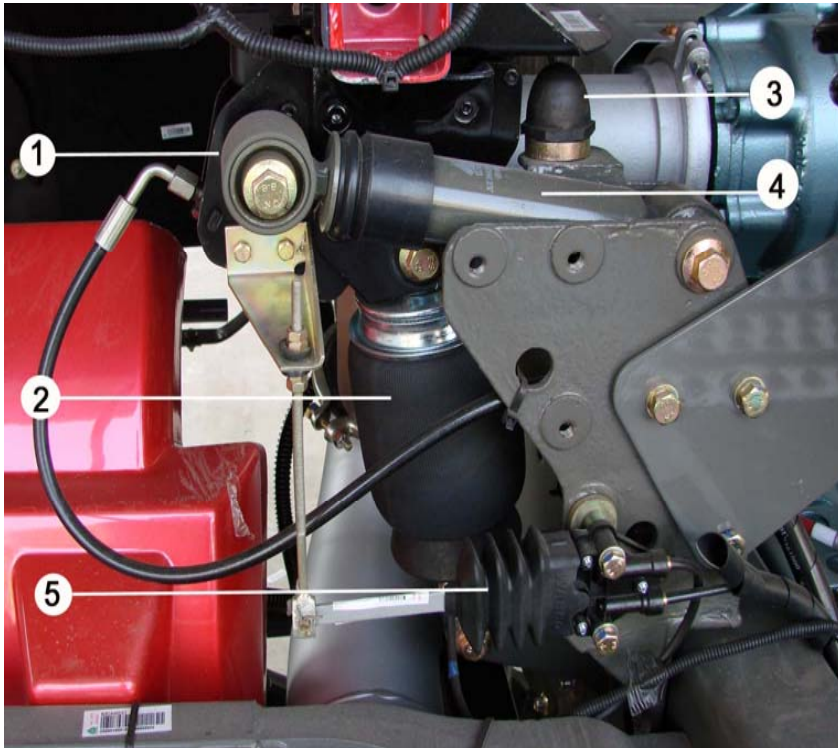


Fig 7

The hydraulic lock and the lock shaft should be coated with lithium-based grease.

The height of left and right shock absorber of rear suspension should be the same. Adjust track bar nut to change their height to $270 \pm 2\text{mm}$.



Notice:

If front and rear suspension is both air suspensions, when the air bag is stained with grease during its application and repair, clean the air bag in time to prevent it from aging.

1. Hydraulic lock
2. Shock absorber (air bag) of rear suspension
3. Limiting block
4. Stabilizer bar
5. Height control valve
6. Shock absorber (coil spring may be adopted according to working conditions) of rear suspension

Tilting System and Suspension of Cab

3. Check the Suspension System

After the cab has been mounted on the frame, tilt up and down the cab.

3.1 Check if the air bags of front and rear suspension inflates and deflates normally and if the front rocker arm turns flexibly.

3.2 Check if the hydraulic lock engages and disengages normally, and at the same time, check the working condition of hydraulic lock indicator (in normal condition, the indicator will go out when the hydraulic lock locks up, and it will light up when the lock releases).



Notice:

Vehicle lighting is highly important for safety. Therefore, always keep all lights work normally.

When changing bulb, do not work when the hands are dirty with oil or damp. Only cloth free of cotton shall be used to hold the bulb.

Check if the touches are corrosive or not; when it's necessary, clean up.

Check seals to see if they are installed correctly. Change damaged seals.

If new light is still not lighted after changing, check the lighting system at qualified service facilities. Be careful and don't get injured.

Change Bulbs



Notice: Be careful of scald

·The bulb may be very hot. Therefore, when changing the bulb front, close the lighting to make the bulb cooled off. Be careful and not get burned.

Some bulbs are pressure-proof and heat-proof. Be careful not to get burned or injured in case the bulb explodes.

Only sealed bulb for the purpose can be used. Change bulb of the same type.

Never use bulbs which have been fallen off or scratched. The bulb may explode.

Don't touch the bulb without wearing gloves. When it's necessary, use cloth free of cotton should be dipped in alcohol or denatured alcohol to wipe and wash the glass bulb.

Only use the bulb with correct voltage.

Prevent humidity during use. Do not make it get in touch with liquid.

When changing the bulb, you have to wear protective glasses and anti-skid gloves to prevent getting hurt.

Place the bulb where the child can not reach.

Periodically check the front illumination system.

Common Errors and Solutions

Front Axle

Errors	Error Source	Solutions
Heavy Steering	Steering knuckle is not flexible	Lubricate the kingpin of steering knuckle, check the clearance between steering knuckle and front axle.
	Inadequate lubrication	Lubricate the kingpin of steering knuckle and track-rod ball pin.
	Improper toe-in adjustment	Re-adjust toe-in
Flexible Steering	Improper pre-tightening of hub bearings	Re-adjust the pre-tightening force of hub bearings.
	Ball pin of tie-bar flexible and worn-down	Tight or replace the ball pin
	Steering knuckle bush worn-out	Replace steering knuckle bush
Wheel Flutter	Improper pre-tightening of hub bearings	Re-adjust the pre-tightening force of hub bearings
	Ball pin of tie-bar flexible and worn-down	Tight or replace the ball pin
	Steering knuckle bush worn-down	Replace steering knuckle bush
	Clearance between steering knuckle and front axle is too large	Re-adjust the clearance
Brake Side-slipping	Whether one side of friction block is polished or not	Replace the friction block
	Clearance between friction block and retarding disc	Initial adjustment and function check
	Whether friction block can move freely within the fixed base plate or not.	Remove the brake pads, clean the brake pads, fixed base plate and brake calipers
	Whether the air pressure on both sides of brake chamber of axles are the same or not (with barometer measuring the pressure)	Refer to the vehicle manual.
	Remove the air relief plug or not	Remove the air relief plug of brake chamber

Common Errors and Solutions

Front Axle

Errors	Error Source	Solutions
Braking Drag	When the brakes are released, whether there are compressed air in brake chamber or not.	Refer to the vehicle manual
	When parking braking is released, whether all the spring braking are released in the brake chamber or not.	Refer to the vehicle manual
	Check the clearance between the brake pads and retarding disc is right or not	Initial adjustment and function check
	Whether brake pads can move freely within the fixed base plate or not.	Remove the brake pads, clean the brake pads, fixed base plate and brake calipers
	Sliding function of brake caliper is normal or not	Change sliding pin and bush
	Remove the air relief plug of brake chamber or not	Remove the air relief plug of brake chamber
No or inferior Braking Effect	Whether the brake pads are polished or not	Replace the brake pads
	Check the clearance between the brake pads and retarding disc is right or not	Initial adjustment and function check
	Retarding disc is in good working condition or not	Replace the retarding disc
	Whether the air pressure on both sides of brake chamber of axles are normal or not (with barometer measuring the pressure)	According to the vehicle use requirements, implement the remedial measures

Common Errors and Solutions

Rear Driving Axle FAQ Troubleshooting

1. Oil Leak

There are several leaking places of rear driving axle. Oil leaking place of final gear is always at the input shaft. It is usually because of damage of worn-out oil seal of the input shaft (driving gear shaft) , or loosen of oil seal spring. When maintaining it should be noticed that if oil leaks from outside of oil seal, it shows the outside of oil seal and housing are matched loosely. When reassemble the outside of oil seal and oil seal seat hole on the housing should be cleaned, and apply LOCTITE603 solid glue to the outside of oil seal and punch the seal into the oil seal seat hole. If the oil seal is intact, but oil still leaks heavily, check the axle housing ventilation devices(which should be checked frequently). If the ventilate port is jammed, the heat brought from movement of axle may push the lubricant outside by accumulated pressure. This may usually be ignored.

There are three parts should be checked when the hub leaks, the O type ring between the hub and wheel reducer's shell, the O type ring between the hub oil seal seat and axis tube of axle housing, the seal of hub. Normally the seal of hub leaks more often. When reassemble the hub seal should notice that the hub has two seals of the same dimension but materials, normally put the one with yellow mark or engraved mark to the inside, while the other one to outside. If the outer ring of oil seal and the shell connection loosing, use LOCTITE603 solid glue to the outer ring of oil seal.

If the axle head leaks that shows the end cover and planet carrier contact surface is not airtight, which is connected without mat, we can disassembly them and clean the end cover and wheel reductor housing flange, then use LOCTITE587 to reassemble them. Glue trail should be continuous.

If find out the blowhole of axle shell leaks and the wheel reductor leak oil very often that commonly means the oil seal of half shaft has installed in a wrong way or has broken down.

If the axle head leaks, there would be oil stain on brake lining and brake drum, which can cause failure of brake.

Common Errors and Solutions

2. Overheat of Hub

Overheat of hub commonly arises from excessive pre-tightening force of hub bearing, which commonly occurs after maintenance. If haven't tighten the axle head nuts according to regulation during maintenance, the pre-tightening force is excessive, which will cause over heat of hub. The hub should be reassembled according to regulation. Certainly, distortion and broke down of hub bearing also can arise over heat of hub.

3. Overheat of Brake Drum

There are many factors for overheat of brake drum, some are resulted from mechanical brake parts and some are resulted from brake control air path system.

Firstly, check out whether the brake chamber back to place quickly after braking. If the brake chamber can not back to place quickly or back to place slowly, driver may remove the handspike of brake chamber and the brake adjusting arm to check whether the brake chamber back to place quickly, if not, it means failure of brake chamber and brake control air path. And if the brake chamber back to place quickly after removing the handspike of brake chamber and the brake adjusting arm, then should check whether the brake camshaft running neatly.

Deformation of the brake camshaft, lacking oil of axis bush or deformation/dislocation of camshaft bearing, can all make the failure of brake chamber back to place to cause the over heat of brake drum.

Broken or loosing of brake shoe return spring may cause overheat of brake drum or make frictional noise.

During the normal driving, there should have a certain gap between the braking friction plate and the brake drum (normally 0.2 mm), if the gap is too large, it may affect the braking effect; and if too small, it will arise overheating.

Common Errors and Solutions

The heat dissipation of brake drum is not good condition, frequently braking action will make the brake drum overheating very soon, which will seriously even burn tire valve and cause air leakage of tire. So if vehicles traveling downhill in a long-distance, using engine exhaust braking is highly recommended instead of using service brake frequently, in order to prevent overheating of brake drum.

4. Abnormal Noise from Central Powertrain

If there is sudden abnormal noise coming from the rear axle housing while driving, stop the vehicle immediately for inspection. Generally, this abnormal noise indicates parts have been damaged.

The falling apart of the supporting bearing for the differential, the serious pit corrosion or abrasion of the bearing, the loosening or falling off of the set bolt of the driven gear, the loosening of the engaging sleeve for the differential lock as well as the tooth breaking of the differential gear may cause serious abnormal noise.

If the noise due to gear abrasion is continuous and the level of such noise increases with the increase of vehicle speed, it is generally caused by the pit corrosion of the bearing, abrasion of driving gear or the scratch pit corrosion of the tooth surface. If the noise is not obvious when driving, but high noise when slowing the vehicle down by withdrawing fuel, it is generally caused by the drag mark or pit corrosion of the tooth back of the driving gear.

If there is no obvious noise when the vehicle is normally traveling in a straight line, but abnormal noise when the vehicle is turning at the corner, it is apparently caused by the damage or burning of the differential gear, or by the moving of differential lock's loosened engaging sleeve.

If there is continuous noise after replacing the driving and driven gears and the level of such noise increases with increase of the vehicle speed, check whether the backlash of the driving and driven gears and the contact trace of tooth surfaces are qualified, and pay special attention to whether the driving and driven gears are assembled as a matched set.

Common Errors and Solutions

Rear Driving Axle FAQ Troubleshooting

The deformation of axle housing can also cause the abnormal noise from the rear axle, which should be attended to during inspection. In case of abnormal noise from the rear axle, do not drive the vehicle forcibly. Remove and check the rear axle immediately. The falling apart of the bearing, the loosening of the set bolt and damage of the gear may, if not repaired in time, result in more serious consequences.

5. The Failure of Differential Lock

When the differential lock is needed to put up, push the switch but the signal light does not on. The first thing you should do is to check out whether the push rod of differential cylinder moves. When finding the push rod could shoot out, however, not in right position, that means the head of mating gear tooth mated with the head of gear peak but not in the right position. When move the truck front and back the differential lock will work naturally. If the differential cylinder doesn't work, it indicates some problems is the electricity, air control system of electromagnetic valve. Then, just loosen the outlet connection of magnetic valve to observe whether some compressed air output, if not that shows the problem from circuit control system of magnetic valve or magnetic valve itself; if yes, that indicates the problem comes from the working cylinder.

If pushing rod puts the differential lock in right position after pressing the differential lock switch, however, the signal light is not on, obviously the problem is from the switch of signal light or signal light itself, which is easy to check out by using the test lamp.

6. Rear Wheel Abrading Tire

There may be several possibilities for rear wheel abrading tire: the distortion of tyre steel ring, loosening of hub bearing and malposition of rear axle. The reason for malposition of rear axle is commonly the cracking of screw of center armor plate.

Common Errors and Solutions

Clutch

Errors	Reasons	Solutions
Clutch Slipping	There is no release bearing clearance, and clutch is half-releasing.	Adjust the release bearing clearance as specified.
	Clutch plate lining has been worn down to a dangerous level.	Replace friction plates
Clutch Incomplete Releasing	Release bearing clearance is too wide, and effective separate distance are not enough.	Adjust the release bearing clearance as specified.
	The air went into the clutch hydraulic system, and effective separate distance become smaller.	Remove all the air in the clutch hydraulic system.



Common Errors and Solutions

Air-Conditioner Error Diagnosis and Resolution Table

Errors	Possible Reasons	Solutions
1. High pressure is low	Leak	Leak checking and repair
	Expansion valve error	Replacement
	Return-air valve closed	Turn on
	Lack of freezing medium	Liquid charging
	Drier blocked	Replacement
	Compressor return-air valve leak	Replacing the valve
	Compressor reed valve damaged	Replacement
2. High pressure is high	Air in the system	Re-inject freezing medium
	Condenser blocked	Clear the condenser
	Exhaust valve was closed	Open the exhaust valve
	Freezing medium overcapacity	Discharge redundant freezing medium
3. Back pressure is low	Lack of freezing medium	Add the freezing medium
	Compressor piston worn-out	Repair
	Compressor head gasket leak	Replace head gasket
	Tube jammed or squeezed	Replace tubes
	Compressor return-air valve leak	Replace the valve plate
	Moisture in the system	Replace drier
	Expansion valve trap valve blocked	Clean and replace the drier
4. Back pressure is high	Expansion valve sensing bulb flexible	Tightening the sensing bulb retaining clip
	Freezing medium overcapacity	Exhaust redundant freezing medium
	Expansion valve can not be closed	Replace expansion valve
	Compressor reed valve damaged	Replace reed valve
	Compressor head gasket leak	Replace air cylinder gasket

Common Errors and Solutions

Air-Conditioner Error Diagnosis and Resolution Table

5. Compressor doesn't work	Driving belt damaged	Replace belt
	Clutch wire damaged	Replace wire
	Compressor piston damaged	Replace compressor
	Thermostat switch failure	Replace thermostat switch
	Clutch coil damaged	Replace coil
6. Poor cooling effect	Coil freezing, the temperature adjusted overvaluation	Tighten down the thermostat switch, and defrosting
	Hot air infiltrates into cab	Turn off heat source valve
	Drier clogged	Replace the drier
	Lack of freezing medium	Add the freezing medium
	High pressure is a little high	Refer to 2
	Return pressure is a little low	Refer to 3
	Return pressure is a little high	Refer to 4
	Drier blocked	Clear and replace the drier
	Expansion valve error	Replace expansion valve
	Thermostat switch failure	Replace thermostat switch
7. Evaporator coil freeze	Thermostat switch improper adjustment	Adjust to the working condition
	Insufficient air capacity going through evaporator	Examine evaporator fan

Common Errors and Solutions

Air-Conditioner Error Diagnosis and Resolution Table

8. Trouble in Belts	Misalignment belt pulley	Adjust the belt pulley axial location
	Too tight or too loose	Right adjustment
	Improper specification	Replacement
	Damaged idler bearings	Replace the bearing
9. The fan doesn't work	Fuse is burned down	Replacement
	Pilot switch failure	Replacement
	Injured motor of fans	Replacement
	Motor voltage is low	Check the wires
	Contact unreliable	Examination
10. The fan runs too slow	Wires become flexible or short circuit	Troubleshooting
	Crooked rotor spindle	Replacement
	Controller resistance is burned down	Replace the resistance
	Low voltage	Examine the engine
	Screws used to fix the blades	Tightening the screws
11. Leak of hose or connectors	Connectors leaking	Repair or Replacement
	Hose leaking	Replace the hose

Frequently-Used Vehicle Data

Reference Value for Lubricant Oil and Operating Fluid

Lubricant Oil for Power Components

Power Component		Filling Condition	Oil Type and Model	Filling Volume(L)	Remark
Engine		New engine or after overhauling	Euro3: CH-4 15W/40;	WD615 and D10 series: 25; D12 series: 38	
		After changing oil and filter while duty maintenance	Euro2: CF-4 15W/40	WD615 and D10 series: 24; D12 series: 37	
Transmission		Under normal conditions	GL-5 85W/90	HW19710/HW15710: 12; HW19710T: 18; HW19712/HW13710: 13; HW20716: 14	Additional 0.5L oil should be filled while equipped with PTO
		Under cold zone environment(such as Russia)	GL-5 75W/90		
Drive Axle	ST16/HC16		GL-5 80W/90	Central reduction of rear axle:16.5; Central reduction of middle axle:19; Hub reduction: 2	
	AC16			Central reduction of rear axle:13.5; Central reduction of middle axle:17.5; Hub reduction: 2	
	HW16			Central reduction of rear axle:22; Central reduction of middle axle:25	
	HW12			Central reduction of rear axle:20.5; Central reduction of middle axle:22	
	ST13			Central reduction of rear axle:14.5; Central reduction of middle axle:17; Hub reduction: 2	
	ST16 Front Drive Axle			Central reduction:6; Hub reduction: 2	

Frequently-Used Vehicle Data

Filling Volume of Operating Fluids

Filled Component	Petroleum Product	Fluid Type and Model	Filling Volume(L)
Fuel tank	Diesel	Depended on engine emission standard and local working temperature	As per tank selected by costumer
Engine Cooling system	Long-lasting antifreeze anti-corrosion coolant	Heavy duty long-lasting antifreeze anti-corrosion coolant used in four seasons	40-45(for WD615 and D10 engine), 45-50(for D12 engine)
Clutch Operating System	Brake fluid	SAEJ1703/ DOT3	About 1
Steering System	Hydraulic liquid	HVN32 Low temperature hydraulic liquid	5(Single Steering), 6(Dual Steering)
Cab tilting system	Hydraulic liquid	HVN32 Low temperature hydraulic liquid	0.4



Notice: The values listed above are only for reference and actual filling volume is subject to the specific configuration. Please check the scale mark on the relevant tank and gauge.

Data for Adjusting

Travel of clutch pedal (Free travel)(mm)							40		
Brake Shoe Clearance (mm)							0.6~1		
Travel of brake chamber push-rod (Travel of piston rod)(mm)							57 (minimum)		
Tyre Specification	Type		11.00-20	12.00-20	11.00R20	12.00R20	12R22.5	295/80R22.5	315/80R22.5
	Ply Rating		16	18	16	18	16	18	18
	Air pressure (kPa)	Single tyre	740	740	770	770	830	850	830
		Dual tyre	810	810	840	840	830	850	830
	Max. Payload (kg)	Single tyre	3270	3730	3270	3730	3350	3550	3750
		Dual tyre	2870	3270	2870	3270	3075	3150	3450

Frequently-Used Vehicle Data

Light Bulb Specification of HOWO Vehicle

Light Name		Bulb Model	Voltage & Power	Quantity For One Truck
Headlamp(High Beam, Low Beam)		H1 P14.5s	24V 70W	4
Front Steering Light		PY21W BAU15s	24V 21W	2
Front Parking Light		R5W BA15s	24V 5W	2
Auxiliary High Beam		H1 P14.5s	24V 70W	2
Front fog Light		H3 PK22s	24V 70W	2
Side Steering Lamp		P21W BA15s	24V 21W	2
Front Outline Marker Lamp		R10W BA15s	24V 10W	2
		Or: W5W W2.1×9.5d	Or: 24V 5W	2
Rear Outline Marker Lamp		W5W W2.1×9.5d	24V 5W	According to need
Side Marker Lamp		W5W W2.1×9.5d	24V 5W	According to need
Rear Combination Light	Steering Light	P21W BA15s	24V 21W	2
	Parking light	R5W BA15s	24V 5W	4
	Brake Light	P21W BA15s	24V 21W	2
	Reverse Light	P21W BA15s	24V 21W	2
	Rear Fog Light	P21W BA15s	24V 21W	2
	Rear Outline Marker/Side Marker Lamp	R10W BA15s	24V 10W	2
	License Light	R10W BA15s	24V 5W	1
Interior Illuminating Light		R10W BA15s	24V 10W	According to need