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Vehicle code

For the convenient maintenance of your trucd, please enter the correct and complete Vehicle code :

Vehicle Model: _____

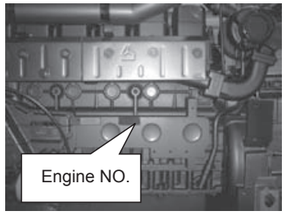
VIN NO.: _____

Engine NO: _____

Purchase Date: _____

Note;

1. Nameplate of the Vehicale Model located at the first Staircase on the co-driver side.(The door should be open)
2. VIN No .printed on the place where the center line of front axle crosses at the inner plate of right side member .
3. Engine No. located on the leftside of the engine body.(Along the driving direction)



Foreword

SINOTRUK HOWO series heavy trucks are manufactured by China National Heavy Truck Corporation(SINOTRUK). The manual is intended to familialize you with the technical details of your truck and to acquaint you with the operation and maintenance.This instruction manual should therefore be kept by the driver and always carried in the vehicle.

We ask the owner to read this through again and again before putting the vehicle into service and also later on,and to closely follow the instructions for the operation and maintenance.This will increase the useful service life of the vehicle and ensure its profitable use.

Should a fault develop,please turn to one of the service center appointed by SINOTRUK,where your vehicle will be serviced conscientiously by the trained mechanics equipped with the necessary special tools. This ensures that the only original spares will be used, moreover the affer-sale deparment of SINOTRUK is always ready to offer advice and assistance.

This manual is only for the guidance as the operation and maintenance book, parts and components in this book may be different form those you bought; please check according to your order. We remain the right of changing without notice.

We wish you every success and the best of luck on your way.

China National Heavy Duty Truck Group Co., Ltd.

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Warming :

1. Before tilting up the cab ,open the cab cover first .
2. When perfoming electric welding in or near the vehicle ,turn off the battery power and unplug any connector connecting with electronic device (main control unit ,control board ,dashboard and ECU of ABS, ect .)!
3. Inspection and maintenance the vehicle regularly.
4. Customer is Strictly prohibited to disassemble or replace the ECU of the engine, or else will result in the breakdown of the vehicle.
5. Shut down the engine and the main power switch also the parking break should be used in case of accident, at a longterm parking.

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PART ONE

Vehicle Operation

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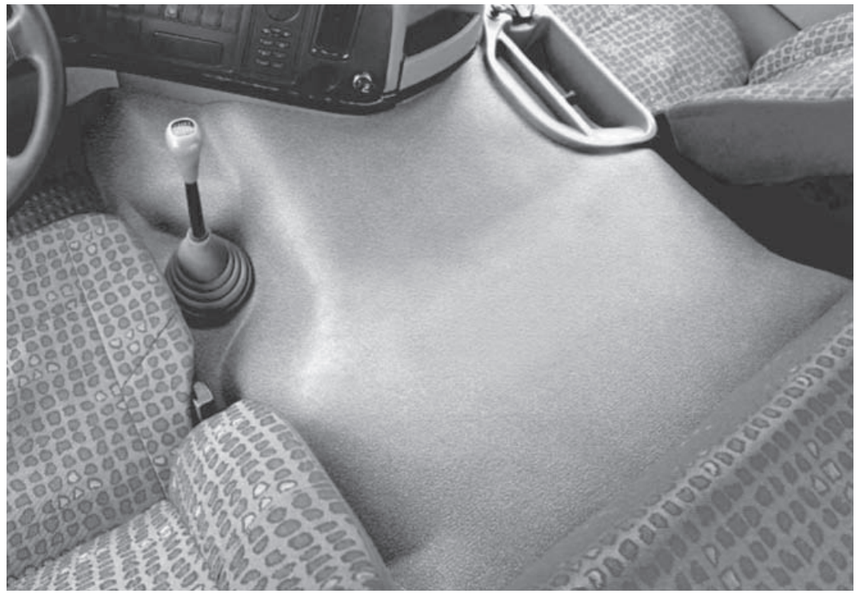
1.Driver’s Cab – interior devices



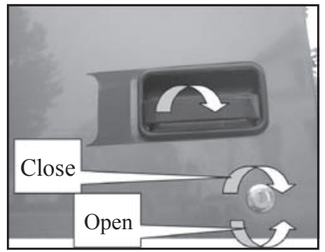
1.1Door Operation

⚠ Warning: Don’t drive away unless the doors are properly closed !

1.1.1Operate the door switch from outside

Open the door: If the door is unlocked, press down the handle and then pull it outward, the door can be opened.

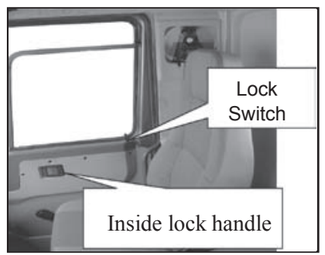
Close the door: Insert the key and turn 180 clockwise, take out the key, the door is locked. At that time even if press down the outside handle, the door cannot be opened.



1.1.2Operate the door switch from inside

Open the door: Turn the inside lock handle at an angle, then push it outward, the door can be opened.

Closed the door: Close the door with power. At that time if press down the door knob, the door cannot be opened from outside.



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1.2 Dashboard

1 Tachometer 2.Information screen 3.Fuel gauge 4. Water temperature gauge 5.Speedometer 6.Air pressure gauge 1 7.Signal indicator 8.Knob 9. Air pressure gauge 2

Switch panel

1.Hand brake handle 2. Trailer hand brake handle 3.Rocker switches 4. Air conditioner control panel and display 5.Horm switch 6. Steering wheel 7. Gearshift lever handle 8. Cigarette lighter

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1.3 Signal indicator symbols summary

No	1	2	3	4	5	6	7	8	9	10	11
Symbol											
color	Red									Blue	Flashing green
No	12	13	14	15	16	17	18	19	20	21	22
Symbol											
color	Flahing green		Red	Yellow				Green			
No	23	24	25	26	27	28	29	30	31	32	33
Symbol											
color	Green		Yellow						Red	Yellow	Green
No	34	35									
Symbol											
color	Yellow		Spare								

1. Seat belt lock
2. Battery charge
3. ater temperature
4. Steering oil level
5. Parking warning
6. Cab lock
7. Brake air pressure 2
8. Brake air pressure 1
9. Oil pressure
10. High beam
11. Left turn
12. Right turn
13. Trailer turn
14. Parking brake
15. Air filter blocking
16. Common warning
17. Front fog light
18. Rear fog light
19. PTO
20. Wheel differential lock
21. Axle differential lock
22. All wheel drive
23. Low range gears
24. High range gears
25. ABS – tractor
26. ABS- trailer
27. Air suspension
28. Lifting trailing axle
29. ASR
30. Low fuel level
31. Aux. air
32. Exhaust brake
33. Retarder
34. EDC fault
35. Flame preheating

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Signal indicator symbols and description

N0	Name	Remark
1	Seat belt indicator	It will go out after fastening the seat belt
2	Battery charge indicator	It will go out after starting the engine
3	Water temperature indicator	water temperatuer warning
4	Steering oil level indicator	Steering oil level warning
5	Parking warning indicator	five kinds of failure including over speeding
6	Cab lock indicator	Cab lock checking
7	Brake pressure 2 indicator	brake pressure 2 warning
8	Brake pressure 1 indicator	brake pressure 1warning
9	Engine oil pressure indicator	oil pressure warning
10	High beam indicator	High beam lamp will light up
11	Left turn indicator - tractor	It will flash with left turn lamp
12	Right turn indicator – tractor	It will flash with right turn lamp
13	Turn indicator – trailer	It will flash wish left or right turn indicator when coupling with trailer
14	Parking brake indicator	It will light up when the handbrake handle is pulled down
15	Air filter blocking indicator	air filter blocking warning

N0	Name	Remark
16	Common warning indicator	It will light up when common failure occurs
17	Front fog lamp indicator	Front fog lamps light
18	Rear fog lamp indicator	Rear fog lamps light
19	PTO indicator	PTO in operation
20	Wheel differential lock indicator	wheel differential lock in operation
21	Axle differential lock indicator	axle diffenential lock in operation
22	All – wheel drive indicator	all – wheel drive in operation
23	Low range gear indicator	in low range gears
24	High range gear indicator	in high range gears
25	ABS indicator – tractor	ABS – trcator in operation
26	ABS indicator- trailer	ABS –trailer in operation
27	Air suspension indicator	air suspension
28	Trailling axle indicator	lifting
29	ASR indicato	It will light up when ASR system operates
30	Low fuel level indicator	Please fill the fuel in time
31	Aux . air indicator	low pressure in the aux . air circuit

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N0	Name	Remark
32	Exhaust brake indicator	engine exhaust brake in operation
33	Retatder indicator	retarder in operation
34	EDC failure indicator	EDC failure
35	Flame preheating indicator	flame priheating working

Signal Switches and their function (excluding rocker switches)

N0	Name	Remark
1	Wiper (combination switch 31B)	When switched on (with #15) ,it indicates wiper in operation
2	Washing pump (combination switch 56)	When switched on (with #15) ,it indicates washing pump in operation
3	Key in position 4 (startup signal)	When switched on (with #15) ,it indicates startup
4	D+sigal,indicating engine in operation	high level (>12V) is regarded as effective
5	S9 exhaust buake switch	When switched on (equal to group connection), it's regarded as effective
6	S30 parking break break switch	When switched on (equal to group connection), indicator in the dashboard will ligh up
7	S31 air pressure switch	When switched on (equal to group connection), aux air indicator in the dashboard will light up
8	S51 water temperature warning switch	When switched on (equal to group connection), indicator in the dashboard will ligh up
9	S69 steering oil level switch	When switched on (equal to group connection), indicator in the dashboard will ligh up

N0	Name	Remark
10	S27 Cab lock switch	When switched on (equal to group connection), indicator in the deshboard will light up
11	S28/1 Brake air pressure 1signal switch	When switched on (equal to group connection), indicator in the deshboard will light up
12	S28/2 Brake air pressure 2signal switch	When switched on (equal to group connection), indicator in the deshboard will light up
13	S32 Oil pressure warning switch	When switched on (equal to group connection), indicator in the deshboard will light up
14	S29 Air filter blocking switch	When switched on (equal to group connection), indicator in the deshboard will light up
15	S10 Brake lamp switch	When switched on (with #15), it indicates the function enable
16	S15 reverse gear switch	When switched on (equal to group connection), it indicator in reverse gear
17	S24 PTO access switch	When switched on (equal to group connection), the corresponding indicator in the dashboard will change from flashing to full brightness
18	S20/21 Wheel differential access switch	When switched on (equal to group connection), the corresponding indicator in the dashboard will change from flashing to full brightness
19	S22 axle differential access switch	When switched on (equal to group connection), the corresponding indicator in the dashboard will change from flashing to full brightness
20	All- wheel drive access switch	When switched on (equal to group connection), the corresponding indicator in the dashboard will change from flashing to full brightness
21	S33 front – mounted splitter group switch	When switched on (equal to group connection), high range gears indicator in the dashboard will light up
22	S26 crawler gear switch	When switched on (equal to group connection), low range gears indicator in the dashboard will light up
23	S48/49 horm switch	When switched on (equal to group connection), the horn (electrical horm or air horm) will light up
24	S14 neutral gear switch	When switched on (equal to group connection), it indicates in neutral gear
25	ABS- 1 sigal	When switched on (equal to group connection),ABS- tractor indicator in the dashboard will light up

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N0	Name	Remark
26	ABS- 2 signal	When switched on (equal to group connection), ABS- trailer indicator in the dashboard will light up
27	Cab door open signal	When switched on (equal to group connection), it indicates effective
28	ECAS1	When switched on (equal to group connection), it indicates in operation
29	ECAS2	When switched on (equal to group connection), it indicates in operation
30	High beam (combina switch S3- 56a)	When switched on (equal to group connection), it indicates in operation
31	Low beam (combina switch S3- 56b)	When switched on (equal to group connection), it ind icates in operation
32	Left turn (combina switch S3- 6)	When switched on (equal to group connection), it ind icates in operation
33	Right turn (combina switch S3- 7)	When switched on (equal to group connection), it ind icates in operation
34	Support axle mode switch	When switched on (equal to group connection), it ind icates in operation
35	Trailing axle mode switch	When switched on (equal to group connection), it ind icates in operation

Note : For the definitions of the alphabetic symbols in the colum, of “signal function” , please refer to the requirement in the electrical principle diagrams in PART FOUR .

1.4 Rocker switch symbols summary

NO.	1	2	3	4	5	6	7	8	9
Name	Light switch	Front lamp switch	Rear lamp switch	Emergency warning switch	Horn conversion switch	Working lamp switch	Cold-start switch	PTO neutral switch	PTO switch
Symbol									
Color	green	green	yellow	red	green	green	green	yellow	red

NO.	10	11	12	13	14	15	16	17	18
Name	Wheel differential switch	Axle differential switch	All-wheel drive switch	ABS checking switch	Trailing axle go-up switch	Trailing axle go-down switch	Transfer case neutral switch	Transfer case switch	Lifting axle swicth
Symbol									
Color	yellow	yellow	green	yellow	yellow	yellow	green	yellow	green

NO.	19	20	21	22	23	24	25	26	27
Name	ECU inspection switch	Engine heating machine switch	Warning light switch	Main & auxiliary oil tank shift switch	PTO switch	Vice-brake switch	Engine retarder switch	Engine retarder inspection switch	Power switch
Symbol									
Color	yellow	yellow	yellow	green	yellow	green	green	yellow	red

NO.	28	29	30	31	32	33	34	35	36
Name	Second PTO switch	Emergency warning switch	Spare switch	No-load operation switch	Brake temperature decrease switch	No-load operation switch	Electrically operated fuel pump switch	PTO switch	GRD Geared switch
Symbol									
Color	red	red	yellow	yellow	yellow	yellow	green	yellow	red

NO.	37	38	39	40	41	42	43	44	45
Name	Ball valve heating switch	Pot water leakage switch	Self-preservation switch	Hand throttle attached switch					
Symbol									
Color	red	green	green	yellow					

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Rocker switchdes and their function description(including indicators.Except for special description,key switch in position 1 is ineffective)

No	Name	State	Function	Remark
1	Light switch	0	Head lamp and position lamp both off	
		1	Position lamp on/head lamp off	When in position 2 and 3,instrument light effective,high beam flashing ineffective
		2	Position lamp on/head lamp both on	High beam flashing effective,high and low beam combination switch effective
2	Front fog lamp switch	0	Off	
		1	Open	Precondition:light switch position 1 open
3	Rear fog lamp switch	0	Off	
		1	Open	Precondition:(1)light switch position 1 open,front fog lamp open (2)light switch position 2 open
4	Emergency warning switch	0	Off	
		1	Open	Effective when key switch is in position 1,2,3 and 4.See the following description of its detailed functions
5	Horn conversion switch	0	Electrical horn	Press horn button on the steering wheel
		1	Air horn	Press horn button on the steering wheel
6	Working lamp switch	0	off	
		1	open	Working lamp in operation

No	Name	State	Function	Remark
7	Cold - start switch	0	Off	
		1	Open	When ignition switch is effective,ether electric injection pump is in operation during the start - up.This function will automatically cease to be effective after the engine starts up
8	POT neural switch	0	Off	
		1	Open	When PTO toggle switch is on,PTO solenoid is in operation,and PTO access switch reaches its proper position,PTO neutral valve will be in operation
9	PTO switch	0	Off	
		1	Open	PTO solenoid is in operation,the corresponding indicator will flash when PTO access switch doesn't reach position up when it reaches position
10	Wheel differ-ential	0	Off	
		1	Open	Wheel differential solenoid is in operation,the corresponding indicator will flash when wheel differential access switch doesn't reach position and light up when it reaches position
11	Axle differe-ntial switch	0	Off	
		1	Open**	Axle differential solenoid is in operation,the corresponding indicator will flash when axle differential access switch doesn't reach position and light up when it reaches position
12	All - wheel drive switch	0	Off	
		1	Open	All - wheel drive solenoid is in operation,the corresponding indicator will flash when all - wheel drive access switch doesn't reach position and light up when it reaches position

Note: ** When axle differential switch is pressed down,axle differential indicator will flash.If there is feedback signal from the axle differential switch in 5s,axle differential indicator will light up.If there is no feedback signal,check output of axle differential solenoid valve.If output is normal,axle differential indicator will light up.

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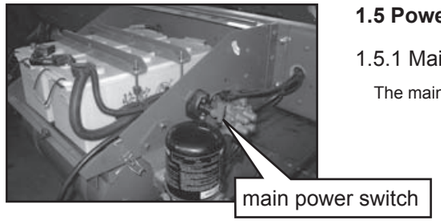
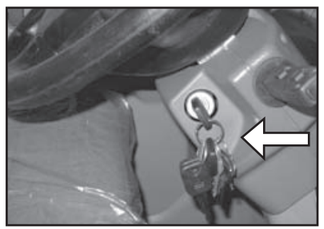


1.5 Power switch

1.5.1 Main power switch

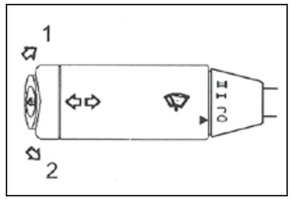
The main power switch is located outside the battery housing on the right side member.



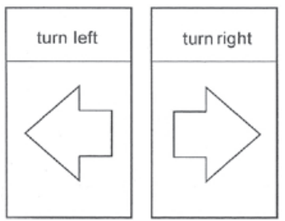
1.5.2 Key switch

The key switch is on the steering column.

Position	Function	Remark
1	When vehicle stands still, turn on the electrical device	
2	Turn off power	Key may be withdrawn
3	Driving position	
4	Starting the engine	Return to position 3 automatically



1-turn right
2-turn left



1.6 Combination switch

1.6.1 Operation of steering lamp

Note: When steering lamp works, turn indicator in the dashboard will flash in the same time (if coupling with trailer, the trailer turn lamp will flash together).If some steering lamp bulb is damaged (all bulb power decreases by 21W), flashing frequency will speed up(in double frequency),and turn indicator also will give a hint at double frequency. In the meantime, corresponding failure information will be displayed on the dashboard information screen.

1.6.2 Emergency warning

Turn on main power switch, press down emergency warning switch, all the turn lamps and turn indicators will flash.

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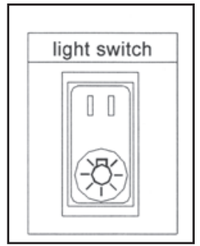
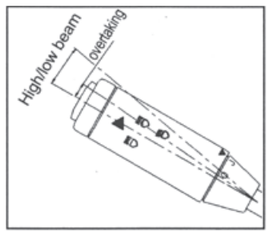
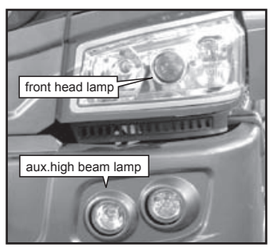






1.6.3 Operation of front head lamp

When putting the handle of combination switch in middle position, key switch in position 3, light switch in position 2, high or low beam lamp lights up. Turn the handle of combination switch up to 4° both the high and low beam lamp light, they can be used as temporary light for overtaking or meeting vehicles at night. Continue to turn it up to 10°.The brightness can be changed, that is, high beam can be changed to low beam, and low beam to high beam. After releasing, the handle can return to its initiate position automatically.

When overtaking or meeting vehicles at day time, turn the handle up to 4°, high beam lamp lights up, Release the handle, it can return to its initiate place automatically.

1.6.4 Operation of windscreen wiper

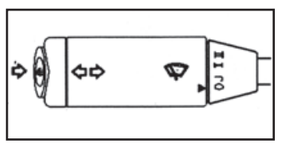
O – “off” position

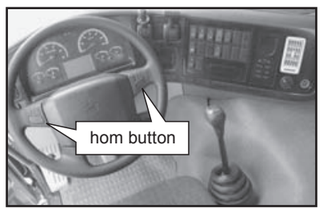
J – windscreen wiper – intermediate

I – windscreen wiper – slow

II – windscreen wiper – fast

Press – windscreen washing system





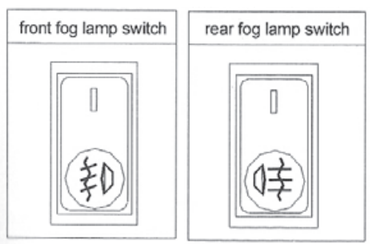
1.6.5Horn button

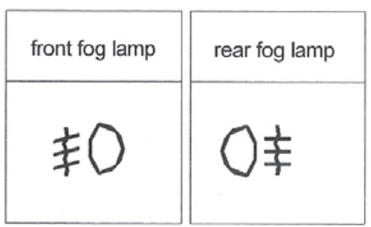
Two kinds of horn: electrical horn, electrical – controlled air horn. The conversion between them is realized by horn conversion switch.

Horn button is the steering wheel. When operating electrical – controlled horn, press down horn conversion switch (rocker switch) and then press horn button on the steering wheel.

1.7 Operation of fog lamp and interior lighting

Note: The front and rear fog lamp can only operated after turning on the light switch.





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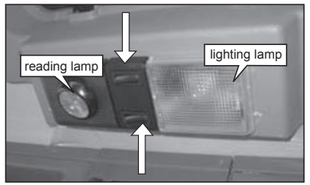


1.7.1 Operation of front fog lamp

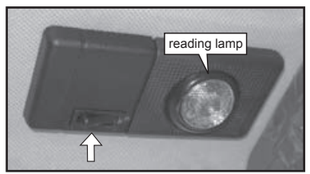
Turn on light switch in the position 1.

Press down front fog lamp switch, the front fog lamp will switch on. In the mean time, front fog lamp indicator in the dashboard will light up.

1.7.2 Operation of rear fog lamp

Turn on light switch in the position 1, or switch on front fog lamp.

Press down rear fog lamp switch, the rear fog lamp will switch on. In the mean time, rear fog lamp indicator in the dashboard will light up.



1.7.3 Interior lighting lamp

(1) Turn on interior lighting lamp switch

Press down the left side of interior lighting lamp switch, the interior lighting system can light up automatically when the door is opened.

(2) Continuous lighting

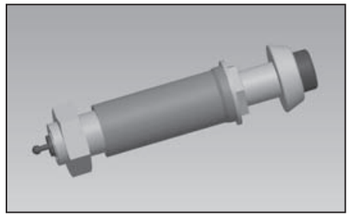
Only press down the right side of interior lighting lamp switch.

(3) Turn off interior lighting lamp switch

Only put interior lighting lamp switch in the middle position.

1.8 Operation of hand throttle

The hand throttle assembly is installed on the cab switch panel. In process of driving, keep the hand throttle at a certain position to make the truck move smoothly，that can help reducing the driver fatigue，for who need not to keep on stepping accelerator pedal. When emergence occurs the hand throttle will stop the oil supply for driving security.

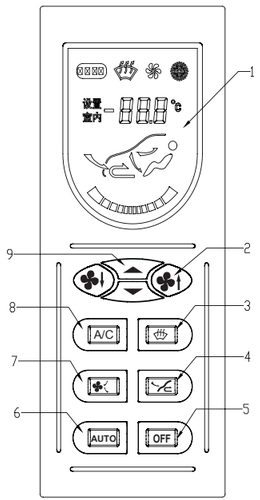


1.9 Operation of air-conditioning and warm air

1.9.1Controller assembly

1.9.1.1 Introduction to panel:

1. Display
2. Regulating button of wind flow
3. Selection button for air outtake mode of defroster button: divided into four modes of cycle options, blowing towards the head, blowing towards the feet, blowing towards the feet and defrosting, and defrosting
4. Selection button for air intake modes: cycle options
5. Power-off button
6. Automation button
7. Selection button for air outtake mode: divided into four modes of cycle options, blowing towards the head, blowing towards the feet, blowing towards the feet and defrosting, and defrosting
8. Refrigeration button
9. Button for temperature setting



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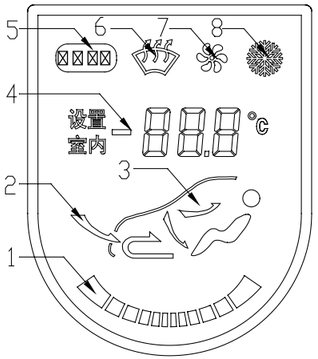
1.9.1.2 Introduction to the displayed contents



1. Signs for levels of wind flow
2. Signs for air intake modes
3. Signs for air outtake status
4. Display of setting temperature and ambient temperature
5. Sign for AUTO function
6. Defrosting sign
7. Wind blowing sign
8. Refrigeration sign

1.9.2 Operating instructions

1.9.2.1 Setting the interior temperature you required

Adjust the button of Temperature Setting to the interior temperature you expect. The temperature setting ranges from LO to 18℃-29℃ and HI. If you want to make it even cooler, you can set the temperature at the position of LO; if you want to make it warmer, just set the temperature at the position of HI.

Reminder：22℃--26℃ is proper for general environment conditions.

1.9.2.2 Setting wind flow: In normal cases, the system can automatically adjust in accordance with the temperature you set, or individually set the wind flow you required.

Reminder: The wind flow has nine levels, which will be gradually adjusted after you press the button of Wind Flow.

1.9.2.3 se of night vision function

Turn on the power switch of small lamps, the button symbols will be simultaneously displayed with other instrument symbols.

1.9.2.4 Selection of air outtake modes

Four air outtake modes can be selected through Selection Button for Air Outtake Modes and Defrosting Button.

1.9.2.5 Selection of air intake modes

The air intake modes by internal air cycle can be used in a short period of time in the following environment:

To rapidly lower the interior temperature when it is warmer;

To rapidly improve the interior temperature when it is colder;

Poor air quality outside the car, such as too much dust and peculiar smells.

1.9.3 Usage precautions

1.9.3.1 You are required to conduct regular servicing and maintenance on the air conditioning system.

1.9.3.2 If the panel becomes dirty, use soft dry cloth to gently wipe the panel surface. Wet cloth or dry, hard things are forbidden to use because they may damage the panel, buttons or display.

1.9.3.3 Do not touch the display with fingers, oil absorbing materials or dry, hard things; otherwise, it will cause the display’s vagueness, lack of segments or damage.

1.9.3.4 The fillers for refrigerant are on air compressor and ducts. Contact the professionals for filling refrigerant if it is inadequate and consequently causes poor refrigeration. When the refrigerant is inadequate, white foam can be seen through the sight glass on the top of liquid storage tank. On the contrary, colorless liquid can be seen.

1.9.3.5 In the event of any system failure identified, please go to the designated service station and ask the professional service personnel to examine and repair it.

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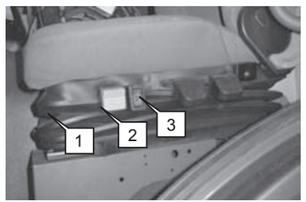
1.10 Seat

HOWO new - type seat has added seat back heating device, waist back support and double lock slide rail. The seat back consists of two adjustable sections.

The waist support adopts an adjustable air bag to provide driver's waist with good support by operating control valve to adjust air amount.

The electrical heating device uses carbon fiber as heating material. The heating cushion is as soft as cotton, and has the advantages of adjustable temperature and power, safety, rapid temperature increase and even heating. Thus the driver will feel more comfortable.

The luxurious high seat back consists of upper and bottom section. The rake of seat back can be adjusted to give a good support to driver's shoulder and thus reduce his fatigue.



1.10.1 Specification

Width: 490mm Height: 935mm Height adjusting range:0~65mm

Fore and aft travel adjustment range: 0±75mm

Take of seat back adjustment range:0。~41.4。(backward in relation to vertical line) ,0。~60。(forward in relation to vertical line)

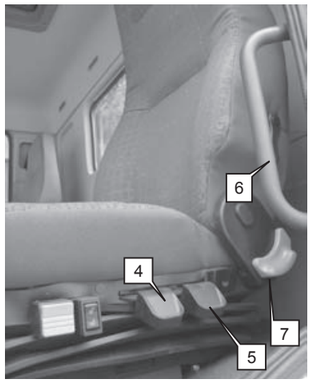
1.10.2 Operation

(1) Fore and aft travel adjustment

Hold the handle up, move the seat forward and backward to the desired position, Then release the handle.

(2)Air bag waist back support

Press down the bottom end of control valve, air bag will begin to inflate. Press down the upper end of control valve, it will begin to deflate. Release in the desired position.



(3) Electrical heating control

Press down the upper end of control switch, electrical heating device will increase rapidly to its designed temperature. Press down the bottom end of control switch, it will maintain the temperature. The middle position is off.

(4)Front height adjustment

Hold handle up smoothly, apply a proper downward (or upward) force on the front end of seat cushion, adjust the front end down (or up) to the desired position, and release the handle.

(5)Rear height adjustment

Hold handle up smoothly, apply a proper downward (or upward) force on the rear end of seat cushion, adjust the rear end down (or up) to the desired position, and release the handle.

(6)Small seat back adjustment handle

Turn the handle to adjust small seat back to the desired position, then release the handle and lock the position.

(7)Seat back rake adjustment

Hold the handle up with power, turn seat back to the desired position, then release the handle and lock the position.

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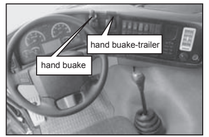
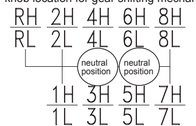
1.11 Gearbox shift lever

Short lever is convenient to operate and can greatly reduce driver's labor strength. It is set on the cab, difficult to come off gear position and takes effect on the cab tilting.



1.11.1Operating mechanism

HW series transmissions belong to remote-control type, in which HW 20716 transmission and HW 18709 transmission offer both single-lever double-H control type and double-lever double-H control type, and HW 18710 transmission offers both single-lever single-H control type and double-lever single-H control type. HW series main transmissions adopt manual operation and pneumatic operation for front and rear auxiliary transmissions. See Figure 1, 3 and 4 for schematic diagram of gears and see Figure 2 for schematic diagram of shift knob. The shift knob location for gear shifting mechanism of HW 20716 is shown in Figure 2 and 3; the shift knob location for gear shifting mechanism of HW18709 is shown in Figure 4 and the shift knob location for gear shifting mechanism of HW 18710 is shown in Figure 1 and 2.



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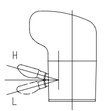

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3

1.12 Hand break (spring parking brake)

Hand brake is in the left side of the dashboard (The figure shows brake lever in "off" position).

Only after the handbrake warning light goes out, the pressure is over 0.65Mpa, can the spring brake fully be released and the vehicle ready to drive.

Warning: Don't drive away before this warning light goes out!

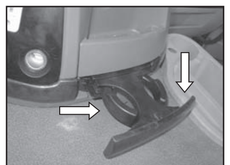
After the warning light goes out, all the aux. operation system (such as clutch booster, gearshift of splitter group, etc.) is ready to work. The vehicle can't get to the complete running order until a reservoir pressure of 0.7Mpa (reading on the pressure gauge) is reached. The specified braking performance can only be reached, when the reservoir pressure is above 0.7Mpa.

Note: The tractor adopts a trailer handbrake to brake the trailer separately during its driving condition. The trailer handbrake can return to its initiate position automatically, but cannot be used for parking brake.

1.13 Other interior devices

1.13.1 Glove compartment

(1)Standard and extended cab (shown by the arrow in the figures, the right figure shows the position of cop support)



(2)High – roof cab (shown by the arrow in the figure)

A portable electric thermal container (optional) can be placed in the position shown by the right arrow.

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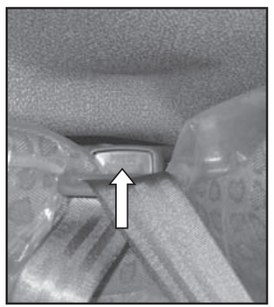


1.13.2 Seat belt

Every seat has a seat belt

(1) Fasten the seat belt

Hold the latch, pass the seat belt around the shoulder, and insert tongue into the latch till engagement sound is heard.

(2) Release the seat belt

Press down the red button on the latch in the arrow direction, pull out the tongue, and the seat belt will return to its initiate position automatically.

Note: Please fasten the set belt before driving away! The condition and function of the set belt should be checked every day.

1.13.3 Sleeping bed

HOWO extended cab and high-roof cab are equipped with sleeping bed. the top one can be raised up to an arbitrary angle.

1.13.4 Radio with USB Interface

Notes:

1. Tune the radio so that it couldn't hinder you from hearing the traffic information (e.g. hooters, alarm whistles, etc.).
2. Do not connect the cathode of vehicle battery until the machine is installed and connected completely to prevent the short circuit.

1.13.4.1.Introduction of panel (figures included)

(1).Power switch (2).Program search button for radio, track search button for USB play

(4).SEL button, selection of sound effect modes

(5).6、7、9、10、11 preset button

(8).USB interface

(12).Preset button for DSP audio source

(13).AUX button

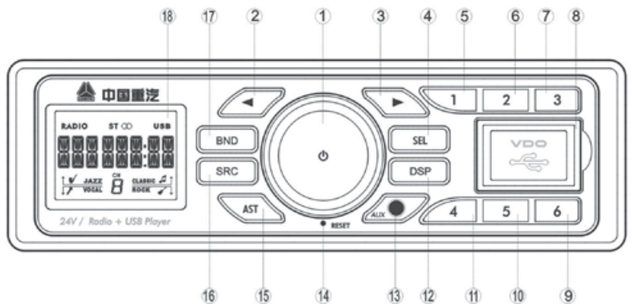
(14).Reset button

(15).AST button for automatic search and storage

(16).SRC button, USB/AUX switch button

(17).FM/AM BND, audio source switches to FM/AM

(18).LCD display



1.13.4.2.Acoustics adjustment

Power-on/power-off – press the power switch button 1 to turn on or turn off the radio;

Volume tuning – press the power switch button 1 to tune up and down;

Adjustment of acoustics/sound effect mode – press SEL button (4) to enter the mode of sound effect setting, turn the switch button for selection setting.

Notes: This operation should be adjusted within 2 seconds of the selected mode, otherwise it will return to the mode of volume control.

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1.13.4.3.Reception of radio

Wave band control button, BND – press button 14 to switch FM-AM wave band.

Automatic search – short press the program search button 2 or 3 to automatically search the radio station until it is found; short press again to continue searching the next radio station;

- Long press the program search button 2 or 3 (for at least 2 seconds) to switch to manual search. A frequency point happens for each press. It will automatically return to the status of short press in three seconds' idle operation.

Automatic storage of radio stations (AST) – press AST button 15 to enter automatic storage, and the radio stations are stored in the preset buttons 1-6.

Preset radio stations (1-6) – turn to the ratio station expected, press the corresponding preset button for at least two seconds to store the radio station.

1.13.4.4.Play of USB mode

Equipment connection – insert the U flash disk; if the contact is good, press the SRC button 16 to switch to USB mode.

File types supported - audio file (*.mp3); partitioned storage methods (FAT16 and FAT32); 8-320kbps bit-rate

Quick track selection – quick press any figure or a group of figures (1-6) and automatically plays in three seconds;

Short press any figure (e.g. 2) among 1-6 to play the second track;

Press program search button (2 or 3) to select previous or next track.

Notes: Do not pull out the U flash disk without disconnection when playing the files in U flash disk. Pull out after the machine is closed.

1.13.5 Drive Recorder(Optional)

1.13.5.1 Operating method of data recorde

Power-on of data recorder

The data recorder will automatically start as long as the voltage is above 9V between the wire and earth of data recorder. No switch is needed. The range of supply voltage suitable for data recorder is 9-36V.

1.13.5.2.Operation and display of data recorder

At normal conditions, the data recorder displays the current real-time clock and current speed.

There are 4 buttons on the data recorder, which are Menu, Up, Down and Print. The Menu button is mainly used for page roll of display. UP and Down are used for the information that exceeds one page. Print button is used for print purpose.

Press Menu button, the average speed of 15 minutes prior to the parking will be displayed on the screen. Press Up and Down to roll and view relevant data. The following data can be obtained one by one:

1.Current real-time clock and current speed

2.Average speed of 15 minutes prior to the parking

3.Record of fatigue driving

4.Driver code

5.No. of driving license

6.Speed when overspeed alarm

7.Vehicle characteristic coefficients

8.Current accumulated mileage and sectional mileage

9.Record index and parking index

10.Serial number and software version of data recorde

Print of data recorder

At parking conditions, press the Print button and operate according to the displayed contents, and the printer will export print data.

Notes:

1. Do not operate the Print button at driving conditions.

2.The print content will not change according to different drivers and only current driver's date will be printed.

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1.13.5.3 Setting of relevant parameters

IC card is used for driver's identity authentication and setting of data recorders.

Notes: Please ensure that the chip is placed upwards when inserting the IC card into data recorder. In the meantime, insert and pull out the IC card quickly.

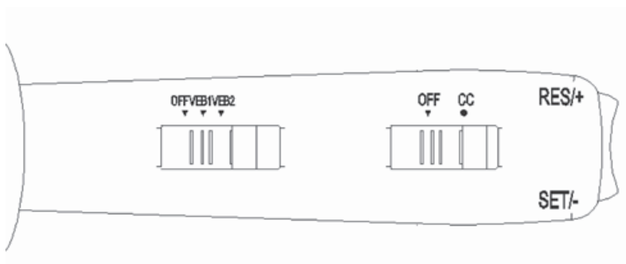
Setting of vehicle characteristic coefficients: Insert the IC card into data recorder, the data recorder will display Setting Vehicle Coefficients: 624. Then press the UP or Down button on the panel to increase or decrease the numerical value. Draw the IC card when the expected numerical value is met. The data recorder will keep the current data in its internal storage.

Similarly, the settings for speed of overspeed alarm and clock can be carried out.

1.14 Operation of Combined cruise switch(optional)

Notes: The cruising combined switch is solely installed on the vehicles with National III engines!

The shape of cruising combined switch is illustrated below and it has two functions: cruising operation and auxiliary brake operation of engines (when equipped with auxiliary brake system).



1.14.1.Cruising operation

There are three cruising operation switches, CC, RES/+ and SET/-. The detailed operations are as follows:

CC switch is the primary cruising (self-return) switch. Operate the switch, select the cruising function and enter the cruising status. At this time, CC symbol on the display of combined instrument panel will flash at 90 Hz.

The driver can change the vehicle speed by operating the accelerator pedal. Release the accelerator when attaining the target engine RPM (e.g. 60 km/hour). Press SET/- to enter the cruising mode and CC symbol on the display of combined instrument panel goes on.

Under the cruising mode, stepping on brake pedal or stepping on clutch pedal can temporarily retreat from the cruising mode. At this time, the CC symbol on the display of combined instrument panel will flash at 90Hz. Just press RES/+ if you want to re-enter the cruising mode after temporary exit.

Two methods can be used to improve the target engine RPM: step on the accelerator to reach the new target engine RPM and press SET/-, or repeatedly operate RES/+ (1 km/hour is increased for each press). Also two ways for reducing the target engine RPM: step on the brake pedal to reach the new target engine RPM and press SET/-, or repeatedly operate SET/- (1 km/hour is reduced for each press).

Notes:

(1).The vehicle speed set by cruising ranges from 35km/hour to 105km/hour, the car will automatically retreat from the cruising status when the vehicle speed is lower than 35 km/hour or higher than 105 km/hour;

(2).The period for pressing RES/+ or SET/- must not exceed 559ms, otherwise the engine will report Failure 26 and 43. Failure 43 must be eliminated after the engine is stopped, while Failure 26 can be eliminated by releasing the switch only without stopping the engine.

1.14.2 Auxiliary engine braking

The engine's auxiliary bake may be used to improve the braking effects. First turn the cruising combined switch to VEB1 or VEB2, and then step on the exhaust braking switch to realize the engine's auxiliary brake.

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2. Preparation before driving

⚠ Warning: keeping the truck in good condition is always important!

2.1 Regular check before driving

2.1.1 Turn on main power switch

2.1.2 Check the working condition of the entire electric circuit system (system self- check)

In order to check the driving conditions of all the signal indicators and lamps quickly, quick check and display pattern are set.

(1)Enter check pattern

Check when key is in position 3,gearshift lever is in neutral position, all the toggle switches are turn off ,brake pedal is not depressed ,washing pump is not in operation ,cab door is open ,hold down high beam lamp flashing switch for about 8 seconds (High beam lamp lights up at this time).

(2)Check procedure

The relevant lamp will light up in turn: position lamp- break lamp/reverse lamp- rear fog lamp/ working lamp- front fog lamp/high beam lamp … this process will go round and begin again. In the meantime, all the indicators in the dashboard will light up in turn and points in 6 gauges will sway from zero to maximum repeatedly, and “running screen”, “input information screen “and” output information screen” will be displayed on the information screen repeatedly.

If any fault takes place, the relevant fault information will be displayed on the screen (If there several faults taking place at the same time, fault information will be displayed on the screen one by one repeatedly).

(3) Exit check pattern

Turn off key switch, close the cab door or start the engine, any of the three operation will exit check pattern.

2.1.3 Check coolant level, refill coolant

Open the cover of radiator, check coolant level of the coolant tank. If the coolant level is too low, please refill it with the specified coolant, till the coolant, till the coolant level raises to the specified mark.

Note:

(1)Because the coolant tank is set on the engine, the cab must be tipped up when filling the coolant.

(2)Before tipping the cab, open the cover of radiator at first!(shown as the figure)

Check if relief valve can maintain a certain pressure in cooling system as compared with the open air, so it raise the boiling point of coolant. it’s very important for the vehicle to run in the highland, so the relief valve cannot be damaged or changed at will.

When the engine is hot, fill the coolant in two steps:

The first step: unload the high pressure slowly from the filling hole.

The second step: open the cap of filling hole, fill the coolant when the engine is running at the idle speed.

⚠ Warning: Don’t add coolant when the engine is hot!

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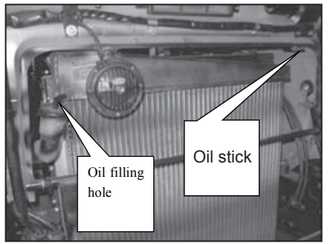


(1)Check fuel level

Turn on key switch and read fuel level on the fuel gauge. If the reading is not correct, please check fuel gauge and sensor.

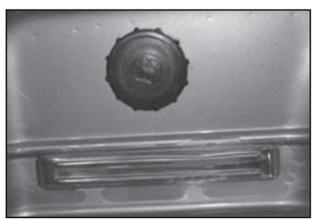
(2)Check oil level

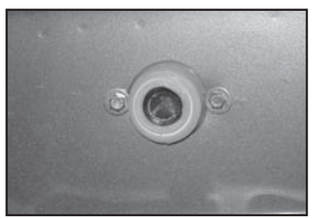
When the vehicle stands still and the engine is cool, draw out the oil stick, oil level should be located between top and bottom mark of the oil stick(the oil amout between top and bottom mark is about 3l).if oil level is below the bottom mark, please refill it with specified engine oil from the filling hole till the oil level raise to the specified mark, and then close the cap of filling hole tightly.

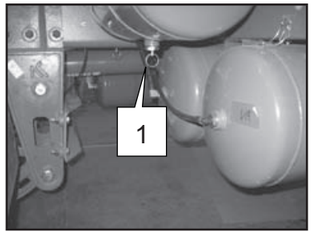
(3)Washing Liquids refilling

The filling hole is on the second class pedal of the cab's left side.

Turn off the cover,pull the hole out and turn it to a proper position as the figure shows, and then refill it .







2.1.4 Check and release water from brake air reservoir

When the vehicle stands still, pull down or push up the water exhaust valve 1 to drain out water from the reservoir. if you find that the water released from the reservoir is mixed with oil , it shows the air filter is failure . replace the new cartridge immediately.

2.1.5 Check tire pressure, charge air with charging joint on the air reservoir if

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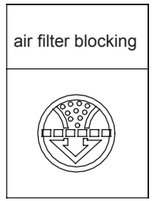
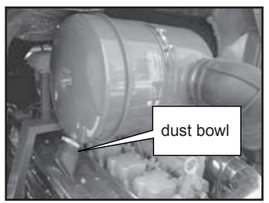




cab tipping

necessary.

2.1.6 Check leakage of lubricating oil , coolant and air line.

2.1.7 Check air filter

Under severe winter or dusty operating conditions, empty and clean the dust bowls (three in total) daily. Otherwise, engine and turbocharger will wear out early.

If air filter is blocked, the air filter blocking indicator will light up. In normal condition, if the indicator lights up, clean or replace the filter cartridge.

2.1.8 Check if the cab is locked

⚠ Warning: when running, the cab must be locked.

If the cab is not locked, cab lock indicator will light up .please lock the cab.

After locking, check the position of cab lifting cylinder. Lock and see if the piston rod returns to its original place .if it cannot place in the original position steadily, readjust it; otherwise, the cab will be damaged.

Before starting to drive the truck, check if there is any people or obstacle around the vehicle.

2.2 Starting the engine

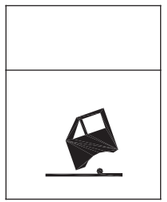
2.2.1 Turn on main power switch, turn key switch to position 4, start the engine.

Note: when running, don't turn off the key switch (that is ,in position 3).

2.2.2 Starting procedure

Operate hand brake. Put the gearshift lever in neutral position. Turn the key and start the engine. After starting the engine, battery charge indicator goes out.

Notes:



1. If the engine cannot be started at the first time, reset the key switch in position 2, and then star again.

2. Starting time is no more than 15 seconds for every time. The time interval between two starts is not less than 30 seconds.

2.2.3 Oil pressure after starting

After starting the engine, read the pressure value on the oil pressure gauge. At the same time, the oil pressure indicator should go out.

2.2.4 Turbocharger operation

Turbocharger is on the top rear side of the engine, which consists of turbine wheel and pump wheel. The turbine wheel is acted by the exhaust air from the engine, makes pump wheel on the same shaft run at high rev, send the compressed air into engine inlet pipe, increase air pressure and thus increase the engine power.

The rotor of the turbocharger turns with very high speed (about 7000~10000r/m) and its lubrication is the forced lubrication. it is supplied with the forced lubricant from the main oil passage of the engine. After stopping the engine, the oil supply stops too.

Cautions on operation:

1. After starting the engine, the engine must run at speed for 3~5 minutes. Don't depress the accelerator violently, only after the pressure and temperature raise to the normal condition. The load can be added (especially in winter). Otherwise the bearings and sealing rings of the turbocharger will wear out early because of lack in oil.

2. After the engine is out of ignition, the engine must run at idle speed for 3~5

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minutes, and then stop it. Don't depress the accelerator violently before stooping ignition. Otherwise it will speed up engine rev suddenly because of depressing the accelerator violently, the turbocharger will speed up too, at that time if the engine stops ignition, the oil pump will stop delivering oil . as the turbocharger rotor continues to run at a high speed because of inertia ,rotor shaft, bearing sand seal rings will wear out very soon in short of oil .

3. Before starting an engine which has been out of operation for a long time, the turbocharger must be pre-lubricated, fill the clean lubricant through inlet port by dismounting the turbocharger inlet pipe. Otherwise it will produce earlier wear because of lack in oil.

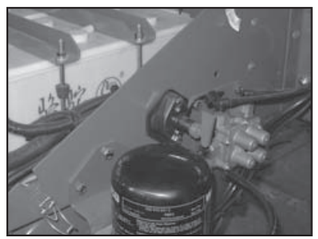
2.3 Stopping the engine

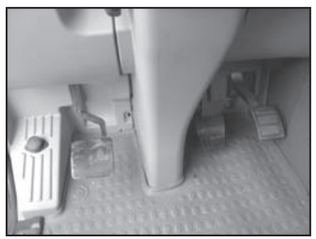
1. Depress the button 1 of the exhaust brake, stop the engine. Then turn off the key switch and main power switch.

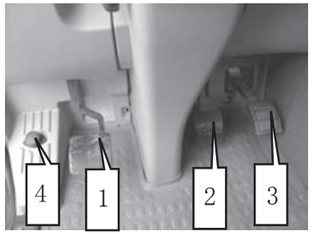
2. EGR engine stopping operation.

Depress the button 1 of the exhaust brake, stop the engine. Then turn off the key switch and main power switch.

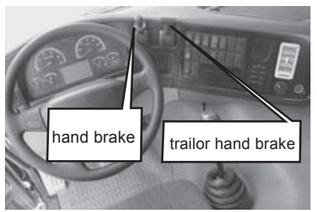
⚠ Warning：If the engine is hot after working hard, allow it to cool down at idle speed for 3~5 minutes before stopping







1.clutch pedal
2.brake pedal
3.accelertor
4.exhaust brake button



3 Driving and shift gear

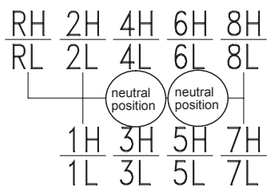
3.1 Driving

After starting the engine .if low pressure warning light lights up and buzzer sounds, the vehicle can't drive. Only after the inflation pressure is more than 0.55mpa (5.5bar). The warning light goes out and buzzing, can release the hand brake handles and get to drive. The vehicle can't get to the complete running order until a reservoir pressure of 0.7mpa (reading on the pressure gauge) is reached. The specified braking performance can only be reached, when the reservoir pressure is above 0.7mpa.

3.2 Gears and operation

Shifting handle location of gearbox HW18709 refer to figure 3 .

For the detail, please refer to "gearbox control and operation instruction" in PART TWO



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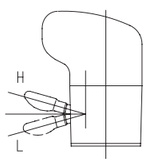

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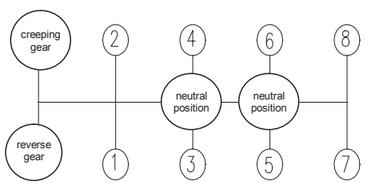

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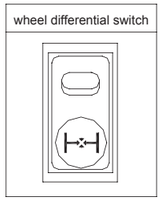

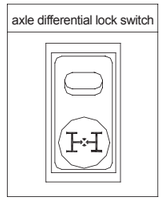

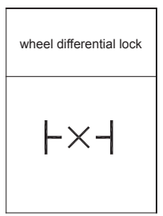

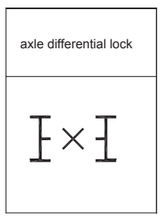

3.3 Operation of differential locks

The drive axle is equipped with differential lock, which improves the driving ability of the vehicle when it goes into a sild or sinks into mud pit.the differential lock consists of the wheel differential lock and axle differential lock. There is only wheel differential lock on single axle.

Note: there is no wheel differential lock on HOWO rear axle!

3.3.1Wheel differential lock operation on 4x2 and 6x2 vehicle

⚠Warning: wheel differential lock can only be used when the vehicle drives in a straight line!

(1)Differential lock engagement: the differential lock may only be engaged when the vehicle stands still or drives at low speed (equal to walking pace) in a straight line. Press down wheel differential switch, the wheel differential indicator in the dashboard will light up after the differential lock has been engaged.

⚠Warning: when the vehicle is running, the clutch must be disengaged before engaging the differential lock.

(2)Differential lock disengagement: Release the accelerator, depress clutch pedal, and then press the upper end of wheel differential switch. The wheel differential indicator in the dashboard will go out after the differential lock has been disengaged.

3.3.2Differential lock operations on 6x4, 6x6 and 8x4 vehicle

Operation principle: the axle differential lock must be engaged first before the wheel Differential lock.

(1)Axle Differential lock

The axle differential lock is used to lock the axle differential case between the first and the second drive axle.

a.Axle differential lock engagement: the differential lock may only be engaged when the vehicle stands still or drives at low speed (equal to walking pace) in astraight line. Press down axle differential switch, the axle differential indicator in the dashboard will light up after the differential lock has been engaged.

⚠ Warning: when the vehicle is running, the clutch must be disengaged before engaging the differential lock!

b. Differential lock disengagement: Release the accelerator, depress clutch pedal, and then press the axle differential switch. The axle Differential indicator in the dashboard will go out after the differential lock has been disengaged.

(2) Wheel Differential lock

The wheel differential lock is used to lock the wheel differential case between the first and the second drive axle.

⚠ Warning: wheel differential lock can only be used when the vehicle drives in a straight line!

The operation of wheel differential lock is the same as that on 4x2 and 6x2 vehicle.

Notes:

1.When the wheel differential lock indicator still lights up , the vehicle cannot turn direction or run at high speed .

2.When traveling across country, disengage the differential immediately , release the accelerator, depress clutch pedal ,and return the differential lock switch to its ignition position. The function of differential lock will be cancelled immediately after the switch indicator and that in the danshboard go out.

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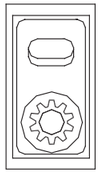
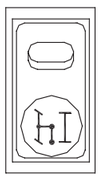
PTO neutral switch



PTO switch



PTO

3.4 PTO Operation

Note: PTO can only operated in low range gears.

3.4.1 PTO engagement

Depress clutch pedal, press down PTO switch and engage the PTO,at this time, the indicator in the dashboard will light up . change gear, release clutch ,the PTO will only function after engaging gear speed.

3.4.2 PTO disengagement

Depress clutch pedal, press down PTO switch, after about three seconds, release clutch pedal and the PTO will be disengaged. At the same time, the indicator in the dashboard will go out.

3.4.3 PTO neutral switch operation

PTO neutral switch is gearshift locking device,which is intended to prevent the vehicle from driving again after PTO engagement.

(1)Turn on PTO neutral switch

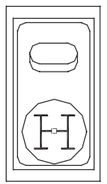
If operating PTO when the vehicle stands still, use PTO neutral switch.

⚠ Warning: the gearshift lever must be put into low range gears when using PTO neutral switch!

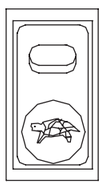
●Engage low range gears and press down the PTO switch .

●Press down PTO neutral switch, the gearshift lever will be forced into neutral position by compressed air (At this time, there is no output from the splitter group, but the main gear box can change gear) to make the vehicle stand still. In the meantime, the indicator in the dashboard will light up. Engage the PTO and get power output.

transfer case neutual switch



transfer case switch



(2)Turn off PTO neutral switch

●Engage neutral gear.

●Press down the upper end of PTO neutral switch .the indicator in the dashboard will go out.

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

3.5 Transfer case (for all- wheel drive vehicle)

The transfer case has high and low gear. When the rocker switch is off, the high gear of transfer case is engaged .the lowgear of transfer case may only be engaged when the vehicle stands still or runs it a walking pace.

Note: The clutch must be disengaged first and then couple with the front axle when getting into the low gear of transfer case (that is, press sown the all – wheel drive switch first).

3.5.1 Transfer case switch operation

(1) Turn on the switch Press down transfer case switch, the electrical air control an switch on with transfer case, and in the meantime, the indicator in the dashboard will light up.

(2) Turn off the switch

Press down the upper end of transfer case switch, and in the meantime, the indicator in the dashboard will go out .

3.5.2 Transfer case neutral switch operation

(1) Turn on the switch

Warning: the gearshift lever must be put into low range gears when using transfer case neutral switch!

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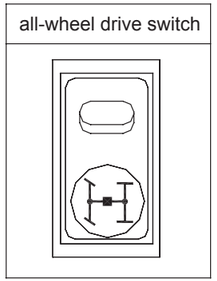
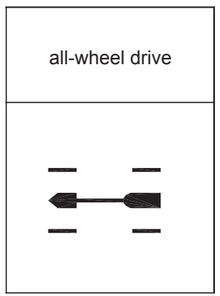




3.6 All- wheel drive vehicle

Turn on the switch : press down the all- wheel drive switch , electrical air control can switch on with the front drive axle ,and at the same time the indicator in the dashboard will light up.

Turn off the switch : press down the upper end of the all- wheel drive ,and at the same time the indicator in the dashboard will go out .

Note: the front drive axle can also be engaged when the vehicle is running. but the clutch must be disengaged or the vehicle must drive at low speed before the engagement.

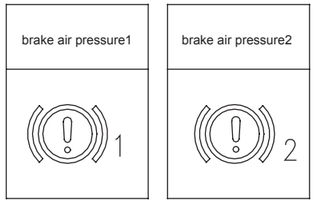
Driving with all –wheel drive only used in the following situations:

-when traveling across country

-on slippery or icy surface

-on steep gradients uphill or downhill

Driving with all –wheel drive should be avoided on firm ground with good grip, except on steep gradients uphill or downhill.



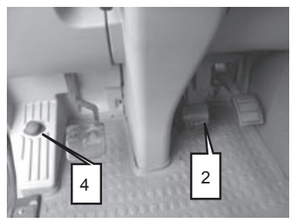
4 Brake system

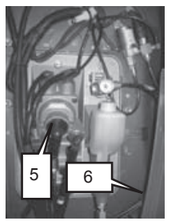
Brake system consists of four brake units: service brake (footbrake),auxiliary brake (engine exhaust brake), emergency and parking brake (handbrake)as well as trailer brake (for tractor).

4.1 Service brake

Dual –circuit compressed air brake is operated by pedal. operating pressure 75mpa, regulating valve cut-off pressure 0.85mpa .the first brake circuit acts on the rear drive axle or dual rear drive axle wheels while the second one acts on the front axle wheels. If the reservoir pressure in one of the two brake circuits drops below 0.55mpa, the air pressure indicator in the dashboard will light up. When this happens, the vehicle must be stopped immediately and the cause of pressure loss ascertained, the pressure can fall below 0.55mpa as a result of a rapid of a rapid succession of full applications of the brake.

Pressure loss test: with engine stopped and parking brake applied, the maximum pressure drop within two hours is 0.05mpa while the maximum within 30minutes is 0.01mpa.





2、Brake pedal 4、 Exhaust brake button 5、The main brake valve 6、Cab front wall

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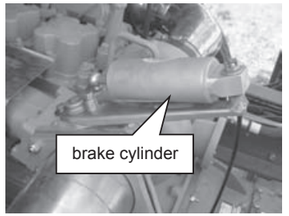
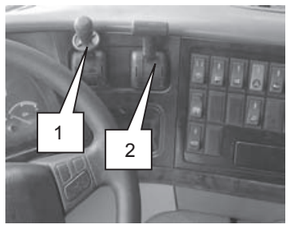
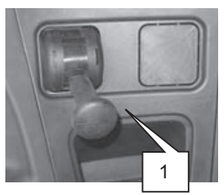




release position
1. handbrake handle
2. trailer handbrake handle



brake position

4.2 Auxiliary brake

Exhaust brake and stopping ignition switch are on the same unit. When operating, depress the exhaust brake switch 1 to stop the engine .At that time, the running vehicle uses engine as auxiliary brake.

When driving downhill for a long distance, the exhaust brake must be uzilized. when driving on icy, snow or muddy road ,the utilization of the exhaust brake can be reduce side-wise skidding .when meeting a vehicle or driving on cross- country road, utilization of the exhaust brake can reduce speed in advance.

Utilization of the exhaust brake will reduce opereation frequency of service brake, reduce wear of tire and wheel brake, prolong its operating life,decrease fuel consumption and improve driving safety.

Note: when gearbox is in neutral gear, the exhaust brake is inoperative. When gearbox is in low range, the exhaust brake efficiency is higher than that in high range.

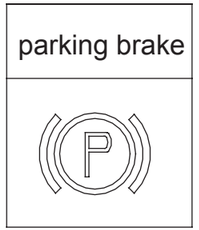
4.3 Emergency and parking brake

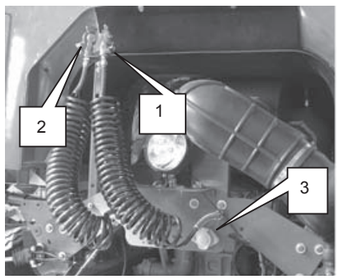
The handbrake acts as both emergency brake and parking brake through spring brake cylinders on the rear axles. the parking brake is realized by operating handbrake handle.

When afault occurs in brake system, the emergency brake will be realized by the compressed spring automatically.

The braking effect of the spring brake is only be cancelled when brake system pressure is above 0.55mpa and after the handbrake indicator goes out.

When operating handbrake, just pull down the handle, in the meantime, the indicator in the dashboard will light up.





Notes:

1.when the vehicles stands still, the handbrake must be used!

2.Before starting the engine, ensure that the handbrake handle is in the brake position .Otherwise the pressure rises in the brake system and the original parking brake effect will be cancelled.

4.4 Trailer brake (for tractor)

The trailer brake is used to brake trailer or semi-trailer, independent from the brake system in the tractor.

When releasing the trailer handbrake handle, it will return to its original position (shown in the figure).

1.dual circuit air reservoir joint (red).

2.dual circuit brake connector (yellow)

3.7-hole socket

4.5 ABS operation

When the ABS check indicator lights up, it indicates ABS fault. for ABS check, repair and maintenance, please refer to the technical material distributed with the vehicle sale by ABS manufacturer.

4.6 Cautions for the brake system

4.6.1 Emergency release of the spring brake cylinders

In case of leakage in the lines to the spring brake cylinders, the brake can be acted by it self . after screwing out the bolts on the cylinders. the brake can be released.

Notes:

(1) Before releasing the spring brake cylinder, engage the gear speed, and check service brake (foot brake).

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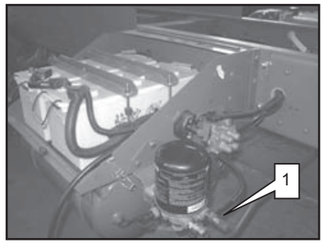
(2) When releasing the spring brake cylinder on a gradient road, the wheels must be blocked for preventing them from sidewise skidding.

1.release position

2.normal driving position

4.6.2 Inflation connector operation

Pressure regulator is integrated with the air dryer. the inflation connector 1 is set on the air reservoir.



After screwing inflation hose onto the inflation connector, it can not only charge the tires, but also air line in the vehicle from outside air source.

4.6.3 Brake line maintenance

When welding, cutting and drilling near the brake plastic hose, please pay attention to the following specifications:

●pre-release the pressure in the brake line

●the hoses must be covered fully in order to prevent them from damages by sparks flame or hot cutting scraps.

●Permissible heating of non- pressurized hoses: max .130°C max. duration 60 minutes.

⚠ Warning: Turn off the battery and unplug any connector connecting with electronic device (main control unit, control board, dashboard and ECU of ABS, etc.)!

5 Winter operation

5.1 Cooling system

The cooling system is filled with long –life antifreeze coolant (frost proof above -35°),if the vehicle is dirving under the condition below -35°,please raise the concentration of the coolant properly.

Note:

Mixing two different brands of coolant is not allowed. when filling different kind of coolant, please clean the cooling system thoroughly.

5.2 Brake unit

Drain condensate from the air reservoir in time order to prevent it from freezingh, check the working conditions of air dryer can be used for two years. replace the drying dgent if there is dirty water drained from the air reservoir ,because the drying agent has lost effect.

5.3 Battery

Check electrolytic solution level and specific density every three months. Electrolytic solution level should be 10 ~15 mm higher than the electrode plate, the specific density more than 1.24/cm3

Take off the battery from the vehicle and put it in a warm room if the vehicle is out of service for a long time or in very low temperature.

Check if the clamp between battery terminal and conducting wire is loose and the working conditions of the battery is normal for every 500km.

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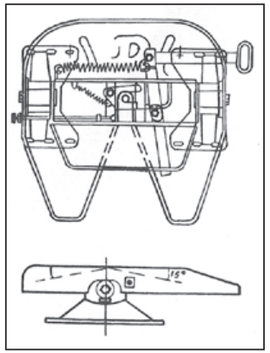
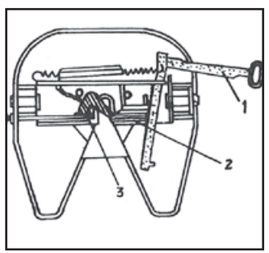




6 Tractor and trailer

6.1 Coupling the trailer

6.1.1semi- trailer

The coupling of tractor and semi- trailer is realized by a fifth wheel.

Coupling procedure:

(1) Secure the semi- trailer against rolling.

(2) Lift up the hand lever 1 on the fifth wheel, put the lever to the upper eye and pull it out until the position slot locks housing. At that time. the fifth wheel is ready to couple.

(3) Coupling during the reverse

After putting drawbar pin to the connevting jaw in the fifth wheel, coupling hook 3 and edge rest block 2 lock the coupling jaw antomatically and finish the coupling operation. at the same time the lever returns its initiate position. it means the operations is correct.

6.2 Uncoupling the trailer

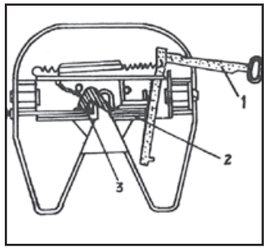
6.2.1 Secure semi –trailer or trailer against rolling.

6.2.2 Uncoupl ing the semi- trailer or trailer with dual circuit brake system

First uncouple the reservoir line (red) and then the brake line (yellow).it is essential to adhere to this aequence, since otherwise the trailer brake will be released.

6.2.3 Unconpling the trailer

Put forward the hand lever a 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 initiate position if the trailer shall not be coupled with for a long time .



6.2.4 Unconpling 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 tractor, turn the drawbar, release the drawbar pin, and finish the uncoupling operation. return the hand lever 1 of the fifth wheel to its initiate position if the semi- trailer shall not be coupled with for along time .

6.3 Cautions

(1) when connecting compressed air lines and electric cables, ensure that no stress, kinking or abrasion can occur when the vehicle turns or rebounds.

(2) After connecting the compressed air lines, adjust the load-sensing pressure regulator (if fitted) on the trailer in accordance with the requirements of the trailer manufacture.

(3) With the dual circuit brake system, the connectors are connected red to red (on the right) and yellow to yellow (on the left).

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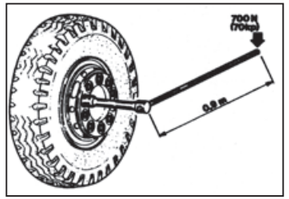

7 Changing the wheel

(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 contact face of the wheel nut is bright and free from dirt and grease.

(4) Before putting on the wheel, clean the rim matching with wheel locating hole and wheel redactor 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.in the later time retighten the tire nuts every 1000km.

8 Running –in of the new truck

Running-inmileage:2000~4000km

Before running in, check the truck regularly , ensure the truck in good working condition.

Attentions for the running – in

1.After starting, do not speed up the engine while still cold. The engine speed may only raised after the operating temperature is reached.

2.During the running –in period, the tuck should run on the good road.

3.Change gear in time, engage the clutch smoothly, do not speed up suddenly, and prevents the tuck from operating the emergency brake.

4.Change to low range gears in time before going uphill and do not allow the engine to run at very low speed.

5.Do not drive the new truck with full load in high speed .check all the indicators and warning lights!

6.Check and control engine oil pressure and coolant temperature. Often pay attention to the temperature of gearbox, front/rear axle, wheel hub and brake drum. If severely hot , find out the reason and adjust or repair at once.

7.After the first 50km of after changing a wheel, the wheel nuts must be retightened with specified torque.

After running – in, check and maintenance according to the requirements specified in “the first check” in this operation instructions.

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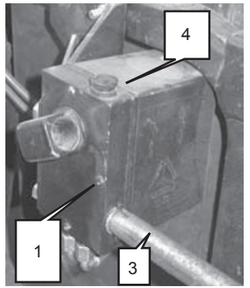


fig.1

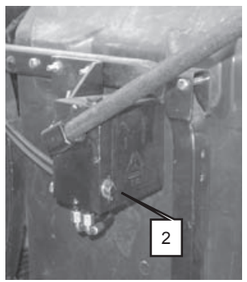


fig.2

1.hydraulic oil pump

2.Tipping hand lever

3.Crowbar

4.Oil plug

9 Cab tilting and suspension

9.1 cab tiling system

9.1.1 Tiling operation

(1) Before tilting , remove all the loose articles from the cab.

(2) Before tilting , open the radiator cover first (fig3)

(3) When tilting , anybody cannot stand in the near front of the cab (fig4)

(4) Turn the tilting hand lever of the tilting oil pump to "↑"position ,tip up the cab with hand pump.

(5) Turn the tilting hand 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 40~100mm, the cab will fall back automatically.

1.1 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 dirt out .

1.2 During the period when the cab is falling.

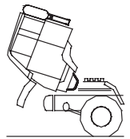


fig.3

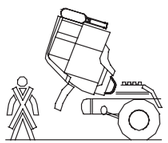


fig.4

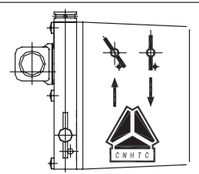
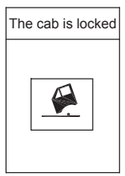


fig.5



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.

1.3 Finally check cab lock indicator in the dashboard. If the cab is not locked, the cab lock indicator will light up .

Note: when tilting, the cab must be tipped forward beyond the top die point, otherwise you cannot continue the next operation procedures.

During the tilting period, nobody is allowed to enter the cab.

9.1.2 Filling oil and releasing air of the tilting system, only after the cab returning to its original position

About 0.4l HVN32 low temperature hydraulic oil should be used, before filling, ensure that the hydraulic oil is clean and in accordance with the specification.

Filling procedure:

1.Open the oil plug and fill up the specified hydraulic oil.

2.While tilting up the cab slowly with hand pump, fill the oil continuously.

3.Tip down the cab and drain the superfluous oil at the same time.

4.Tip up and down the cab again with hand pump, after tilting down the cab to its original position, check and fill up the oil again.

5.Finally, screw the oil plug.

9.1.3 Check function of the tilting system

(1) Tip 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 .

(2) When tilting the cab to 30 The cab can be kept in this position for 20 minutes without sinking.

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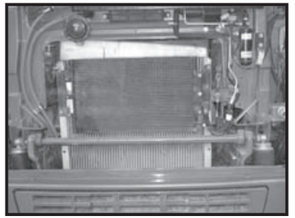
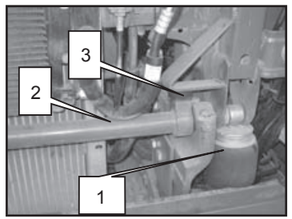




9.2 Cab suspension

9.2.1 Front suspension

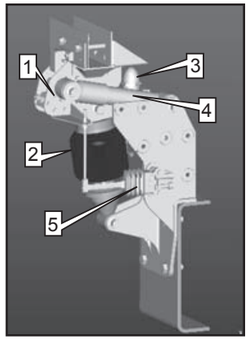
1. air spring of front suspension
2. height control valve
3. rocker arm

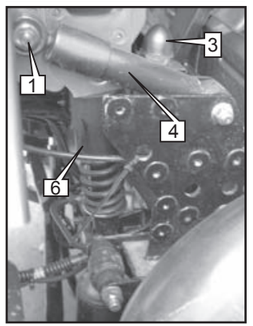
Before assembling the rocker arm, check if grease has been filled, after assembling, check if the washer is locked.

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.

9.2.2 Front shock absorber and stop block

1. front shock absorber
2. stop block





9.2.3 Rear suspension

1.hydraulic lock

2.shock absorber (air bag) of rear suspension

3.stop block

4.stabilizer bar

5.height control valve

6.shock absorber (coil spring) of rear suspension.

The hydraulic lock and the lock shaft should be coated with lithium-baaed 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±2mm.

Note: if front and rear suspension are both air bag type suspension, when the air bag is stained with grease during its application and repair, clean the air bag in time to prevent it from aging.

9.2.4 Check suspension

After the cab has been mounted on the frame, tip up and down the cab.

(1) Check if the air bag of front and rear suspension inflates and deflates normally and if the front rocker arm turns flexibly.

(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).

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10 Operating Instructions of Oil Bath Air Filter

Sinotruk has developed and produced the dual inlet vortex filtering device and oil bath air filtering device successfully and put forward optimized configuration for different trucks: dual inlet vortex filtering device + ordinary air filter for ordinary road trucks, and dual inlet vortex filtering device + oil bath air filtering device + ordinary air filter for engineering dump trucks.

Below are the usage, removal, inspection and cleaning procedures of the oil bath air filter.

10.1. Usage

1. The new trucks are not filled with lubricant in factory.

2. The new trucks shall be filled with lubricant before being put into operation. The grade of the lubricant filled shall be identical with that of lubricant added to the engine.

3. Before adding lubricant, the lubricant in the filter shall not exceed 30mm in depth or 5L in volume. Overlubricating is not allowed.

4. If the lubricant does not flow when shaking the bottom shell, it is necessary to clean the filter core and replace the lubricant.

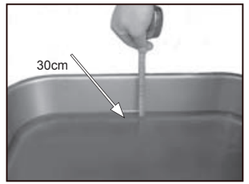
Under extremely severe conditions, checks shall be performed on a daily basis. Generally, it can be used continuously for 80-150 hours. The filter core can be used for a long period of time and need not be replaced.

5. Upon receipt of new trucks each day, check if the bolts or hooks connecting the shell or bottom shell are loose. If so, tighten them.

10.2 Removal, Inspection and Cleaning Procedures

1. Oil bath air filter assembly

2. Open the upper and lower shell locking device



3. Oiling

Remove the oil bottom shell, add lubricant to 5L in volume or 30mm in depth.

4. Clean the lower filter core assembly

Clean the fan blade surface and filter core with diesel until there is no oil sludge on the filter core and fan blade upon visual inspection.

5. Clean the upper filter core assembly in the same manner as cleaning the lower filter core.

6. Assemble the filter core assembly. Install the upper filter core first and then the lower filter core, and finally tighten with rubber pad, flat pad and wing nut.

7. Assemble the lower housing. Fasten the lower housing to which oil is added with hook firmly.

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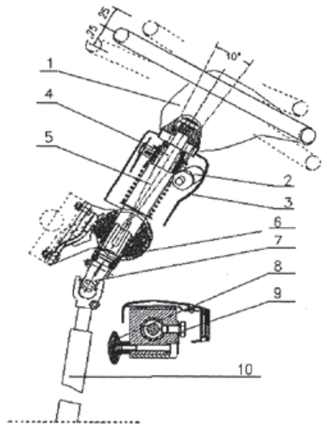
PART TWO

Operation and maintenance

1 Steering system

Steering system consists of steering wheel, steering shaft , universal joint and steering column.

Hydraulic steering system and steering operation mechanism



1. steering wheel 2.ignition lock 3. steering column cover 4. steering column sleeve 6. steering column guide sleeve 7.universal joint 8.adjustment handle 9.travel limit screw 10. steering telescopic shaft

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The power steering gear ZF8098 or ZF8095 is a kind of integral hydraulic steering gear with rotary valve type control valve. The ZF8098 steering gear adopts variable speed ratio transfer and self-adjustable hydraulic steering limit valve. Its built- in pressure relief valve has adjustment pressure of 130+13bar, thus can efficiently protect the steering pump and steering system, and extend service life of the steering system components.

1.1 Operation and adjustment of the steering operation mechanism

1.1.1 I t can be adjusted.

Steering adjustment range :±25mm.angle : ±5

Release the adjustment handle 8 shown in the figure, adjust Steering wheel 1 to position and then adjustment handle 8.

1.1.2 For double Steering front axle, wheel alignment instrument should be used to make front axle wheels in straight running position .then assemble the Steering drag rod and make the rocker arm perpendicular to the ground .the skewness of front axle wheels should be no more than 1mm/m and in the same direction.

Notes :

1.The Steering gear cannot rotate to its left and right limit angle before connecting with the drag rod. When pre-assembling the Steering rocker arm, try to make contact against the middle position and prevent it from moving.

2.If it's impossible to fix the rocker arm during repair, screw off the limit screw in the bottom of the housing ,and retighten it after completing the assemble of the rocker arm.

1.2 Steering system maintenance

1.2.1 Check hydraulic oil level. First clean oil reservoir and its surroundings to keep dirt out. Take care of the oil stick mark .The oil level should agree with oil stick when the engine operates; it should be a bit higher when the engine doesn't operate.

1.2.2 For the new vehicle , replace hydraulic oil and clean cartridge in the reservoir after the first 2500km. in the laster time, replace hydraulic oil after every 50000km(or one year).

1.2.3 Check oil level and cleanness every month.

1.2.4 The procedure for changing oil is as following:

(1)Put up the front axle.

(2)Open reservoir cap, screw off the return pipe on the steering gear.

(3)Start the engine, run at idle speed for about ten seconds, and turn the steering wheel to its left and right limit position so as to drain oil from inside the oil reservoir, booster pump and ateering gear.

(4)Retighten the return pipe(Take care to keep it clean and keep dirt out of the oil circuit), clean oil reservoir, oil filter and cartridge. You'd better renew cartridge every tome when changing oil.

(5)After filling up hydraulic oil, run the engine at idle speed, turn left and right the steering wheel repeatedly, and in the meantime fill oil continuously till oil level no longer reduces and no bubble occurs. The oil level should be within the specified range.

Note: Please replace with specified oil (HVN32 low temperature hydraulic oil).

1.2.5In the first-grade service, check the clearance of every rotary component such as steering tie rod and drag rod joint. If the clearance shows too big, the component should be replaced. And grease should be added on all the components in the first-grade service.

1.3 Specifications

mode&data	ZF8098	ZF8095
Suitable front axle load(Kg)	6500～8000	6000
Max pressure（Mpa）	18．3	18
Oil Pump current capacity(L/min)	16~20	16
Ratio	22.2~26.2	15.7~18.5
Steering plate max turn	6.2	4.4

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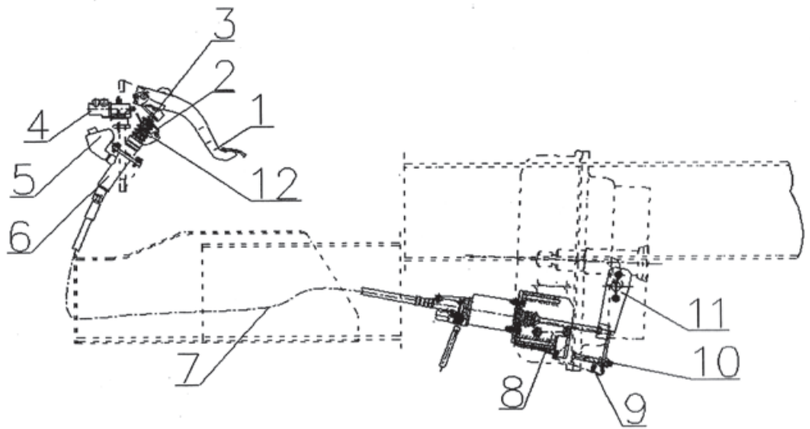
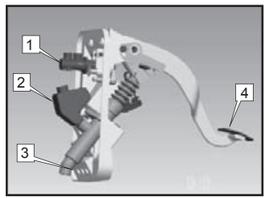
2 Clutch operation system

2.1 Introduction



1.clutch pedal 2.return pipe 3.main cylinder pushrod 4.clutch brake control valve 5.oil reservoir 6.main cylinder 7.high pressure oil pipe 8.booster cylinder bracket 9.return pipe 10.limit bolt 11.release rocker arm 12.spring bracket



1.clutch brake control valve
2.clutch main cylinder
3.oil reservoir
4.clutch pedal

cylinder. On one hand, the brake fluid into the hydraulic control chamber of the booster cylinder. On one hand, the brake fluid acts on the piston as the working pressure, on the other hand it regulates the inlet valve of air chamber in the booster cylinder as controlling pressure. Compressed air enters the air chamber, pushed the piston to make pushrod move forward. Then the release rocker arm and release fork swing forth to push the release bearing, making the clutch disengaged.

The main cylinder and oil reservoir, etc. are all located on the front plate of the cab (shown in the figure). The drive cylinder is connected with the booster cylinder through high pressure hose. The clutch and its brake control part share a bracket, which is aluminum alloy forged and has the characteristics of low weight and high rigidness. The oil reservoir is directly mounted on the main cylinder, making its assembling and brake fluid filling more convenient. During the clutch operation, the driver's feet don't need to leave the floor. After the operation, the driver can put his left foot on the left side boss of the pedal, thus the driver can reduce fatigue and accurately operate the clutch.

2.2 Specification

Working medium: air, brake fluid

Working pressure: brake fluid: 4Mpa air: 0.85Mpa

Temperature:-40C~80C

Brake fluid: in compliance with JG3 or DOT standard

2.3 Adjustment of clutch operation system

2.3.1 Check and adjust the clearance between main cylinder pushed and piston

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When adjusting, push the pedal with hand smoothly till main cylinder pushrod contacts against the piston. Adjust the height of limit bracket. ensure that the gap between limit bracket and clutch pedal is about 1mm. Then tighten the nut of limit bracket, ensure that the gap between pushrod and piston is 0.5mm~1mm. This gap may not be over 1mm, otherwise it will reduce the effective travel of main cylinder and also the effect of declutching.

2.3.2 Adjust clutch brake control valve

Depress 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 depressed fully). This can prevent the brake control valve from coming off the pedal bracket.

2.3.3Check and adjust the clearance of release bearing (excluding pull-type diaphragm spring clutch)

The clearance of the release bearing should be 2mm~3mm so that the release bearing will not be damaged because of long-time service before next maintenance interval. During assembling and adjustment of release bearing, push it with hand in the direction of declutching is 5mm~8mm,and then tighten the nut. If the bolt cap can not reach its limit position after driving the vehicle, adjust hook position of the return spring, ensure that there is always a gap of 2mm~3mm for the release bearing. In result, the service life of releasing bearing will be extended.

2.3.4 Release air in hydraulic system

Air in hydraulic system can reduce the effective travel of booster cylinder pushrod, and the clutch can’t be disengaged thoroughly, thus changing gear becomes difficult.

When assembling and disassembling the oil tube, be sure to release the exhaust valve of booster cylinder. Fill the specified oil to the reservoir. At the same time depress the clutch pedal and release air from the exhaust valve, then tighten it. After depressing 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.

2.4 Attentions:

2.4.1 During releasing air, only after the exhaust valve or union nut is tightened, can the pedal release, otherwise the air will get into the system again. Lift the pedal to max. height in order to get brake fluid into the cylinder chamber from reservoir. Ensure the air is released from the clutch hydraulic system, the effective travel of booster cylinder is 25mm, if it is less than 20mm,release air again till the specified pressure reaches.

2.4.2 When maintenance the newly bought vehicle, readjust the clearance again. Readjust the clearance every 12000Km for the second grade maintenance. When operating the first grade maintenance (that is for every 4000Km), check and adjust the clearance. During readjusting, push the clutch rocker arm with hand, there should be gap for the limit bolt cap.

2.4.3 The working medium of hydraulic system should adopt DOT3 brake fluid. During mounting and dismounting the oil tube, seal the union nut and tube connector with Loctite 572.

2.4.4 When changing brake fluid, drain the remaining fluid out of the system thoroughly; replace the specified brand brake fluid manufactured in the same batch.

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2.5 Troubleshooting of Common Failures

Failure	Reason	Elimination method
Clutch slipping	1.Friction disc is contaminated with grease	1.Clean the grease on clutch pressure plate, driven plate and flywheel
	2. The friction disc of clutch driven plate becomes thinner due to serious abrasion and the clutch lever contact rises backwards. When the upwarping exceeds the free travel, the clutch lever is compressed to offset part of pressure that retains the spring. Thus the clutch can't engage completely although the pedal is fully released.	1.Adjust the free travel of pedal according to the rules. 2.In the event of any abrasion of friction disc, adjust the effective length of pedal stopper. If the adjustment fails, replace the friction disc.
Failed disengagement of clutch	1.The free travel of clutch pedal is too long, and the working stroke is inadequate.	1.Adjust the free travel of pedal according to the rules.
	2.Improper adjustment or distortion of clutch lever causes the deflection of pressure plate and partial damage of friction disc.	1.Align the clutch lever and replace it if necessary. 2.Check the abrasion of fraction disc, repair or replace it according to actual conditions.

3. Operation, Use and Maintenance of Transmission

⚠ Warning:

◆ Operate the transmission in accordance with the specified procedures to avoid individual injury, equipment malfunctions or damages;

◆ Before the vehicle is started, the driver should sit on the driver seat, moving the gearshift lever into neutral position and using grip brake;

◆ Leave the cab before the vehicle commences to work or the engine runs, move the gearshift lever into neutral position and use grip brake to lock up the wheels;

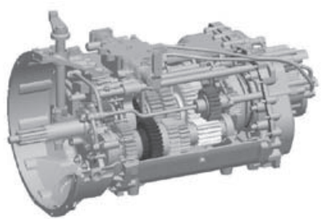
◆ Move the gearshift lever into neutral position and use grip brake when parking the vehicle or leaving the cab;

◆ Do not release the grip brake to shift gears before the vehicle's air pressure rises to a proper level;

◆ Sliding on a downgrade is strictly prohibited when the transmission is located at neutral position;

◆ When operating by power take-off, immediately press the clutch pedal to the floor for a while after pressing the switch and then release the pedal after the power take-off works normally;

◆ When the vehicle needs to be dragged, you may draw the half axle, disconnect the drive shaft or have the driving wheel lifted off the ground.



3.1 Introduction to HW series transmissions

HW series transmissions belong to new-generation transmissions specially designed for heavy-duty trucks, with all intellectual property rights owned by China National Heavy Duty Truck Group Co., Ltd. Its main transmission adopts twin countershaft structure and auxiliary transmission adopts planetary deceleration structure, ensuring the stronger carrying capacity and more reliable structures. The interlocked mechanism for main transmission and auxiliary transmission effectively protects the synchronizer of auxiliary transmission, and the forced lubrication system enables the transmission to be suitable for various road conditions. The integrated design of small cover ensures the clear gears and flexible gear shifting.

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This series transmissions shall apply to the engines used for heavy-duty trucks, whose power ranges 336~460 HP. They are the top choice for domestic heavy-duty trucks.

3.2 Main parameters for transmissions

Main parameters for HW series transmissions

Model No.		Gears													Max. Torque Nm	Max. Engine Speed rpm	Fuel Capacity L
		C	1	2	3	4	5	6	7	8	9	10	R1	R2			
HW18709		12.68	8.46	6.26	4.64	3.38	2.5	1.85	1.37	1				11.63	1,800	2,600	12
HW18710			14.58	10.94	8.1	5.998	4.375	3.33	2.5	1.852	1.371	1	15.04	3.437	1,800	2,600	12
HW20716	L		15.59	10.89	7.48	5.195	3.56	2.488	1.71	1.187				14.29	2,000	2,600	14
	H		13.12	9.17	6.3	4.375	3	2.095	1.44	1				12.03			

3.3 Transmission structure

1.Operating mechanism

HW series transmissions belong to remote-control type, in which HW 20716 transmission and HW 18709 transmission offer both single-lever double-H control type and double-lever double-H control type, and HW 18710 transmission offers both single-lever single-H control type and double-lever single-H control type. HW series main transmissions adopt manual operation and pneumatic operation for front and rear auxiliary transmissions. See Figure 1, 3 and 4 for schematic diagram of gears and see Figure 2 for schematic diagram of shift knob. The shift knob location for gear shifting mechanism of HW 20716 is shown in Figure 2 and 3; the shift knob location for gear shifting mechanism of HW18709 is shown in Figure 4 and the shift knob location for gear shifting mechanism of HW 18710 is shown in Figure 1 and 2.

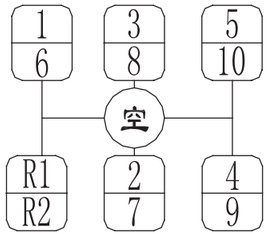

Figure 1

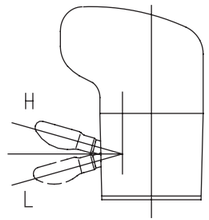

Figure 2

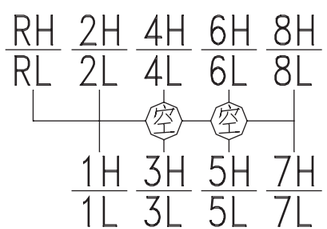

Figure 3

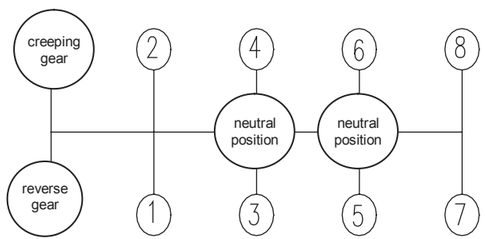

Figure 4

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2.Pneumatic operation system

Air is supplied by the compressed air (0.7~0.8Mpa) of the vehicle. Front and rear auxiliary transmissions for HW 20716 adopt pneumatic operation and the gear shifting for front auxiliary transmission is realized through the switch of preselector valve on the shift knob, see Figure 5 (Schematic Diagram for Gas Pipeline of Free Gearshifting Transmission) - when the switching valve is located at H zone, the air flows from opening 1 through opening 2 of two positions five way valve into upper opening of free gearshifting cylinder; when the switching valve is located at L zone, the air flows from opening 1 through opening 4 of two positions five way valve into lower opening of free gearshifting cylinder; HW 18709 has no free gearshifting cylinder. In the above two transmissions, the gear shifting for rear auxiliary transmission is realized by double-H operation mechanism, see Figure 6 for their gas pipeline schematic diagram - opening P is the air intake of double-H valve, opening A is to be connected to the upper opening of sequential gearshifting cylinder and opening B is to be connected to the lower opening of sequential gearshifting cylinder.

Main transmission for HW 18710 transmission adopts manual operation and pneumatic operation for rear auxiliary transmission.

Notes: The air outtake of double-H valve must be mounted downwards.

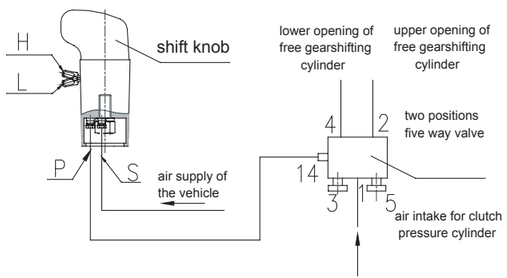

Figure 5 Schematic Diagram for Gas Pipeline of Free Gearshifting Transmission

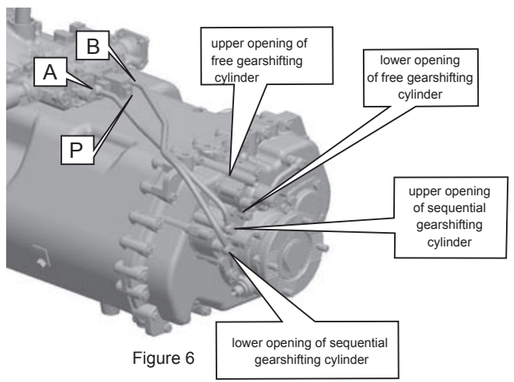

Figure 6

Transmission Model	Transmission Speed Ratio	Output Speed Ratio for Power Take-off	Power Take-off Equipped
HW20716	1.1875	0.739	HW50
HW18709	1.25	0.924	HW50
HW18710	1.25	0.924	HW50
HW20716	1.1875	0.9	HW70
HW18709	1.25	0.95	HW70
HW18710	1.25	0.95	HW70

4. Interlocked mechanism for main and auxiliary transmissions

HW series transmissions employ the interlocked mechanism for main and auxiliary transmissions: when the shift fork shaft for sequential gearshifting of auxiliary transmission does not move to the right place, the interlock plate will be perfectly in the groove of shift fork shaft of main transmission under the effect of spring, which makes the shift fork shaft of main transmission locked up at neutral position. When the shift fork shaft of sequential gearshifting moves to the right place, it will push the interlock plate to rotate and unlock the shift fork shaft of main transmission. As a result, this can prevent the main transmission from being put into gear when the auxiliary transmission does not move into a proper gear, during the switching of high and low gears, effectively protecting the synchronizer of auxiliary transmission.

5. Lubricating system

The lubricating method adopts the combination of forced lubrication and gear splash lubrication. High-flow forced lubricating pump will enable the lubricant flow to each part, such as planetary deceleration mechanism, idler shaft, input and power take-off. This kind of combinational lubricating method ensures the full lubrication and cooling of synchronizer, bearings and gears.

6.Small cover

Interlock, self-lock, reverse gear lock, double-H drive, neutral position sensor and reverse gear sensor are all integrated into the small cover, which is featured with compact size, clear gears, flexible gear change and more reliable performance than ever. It can realize the operation by single or double levers.

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7.Speed ratio

Both large speed ratio range (HW18709: 1~12.68, HW20716: 1~15.59, HW18710: 1~14.583) and forced lubricating system enhance the gradeability of this series of transmissions, offering an excellent performance in demanding environments. In the meantime, the rational gears layout and small speed ratio difference (HW18709 and HW18710:1.35, HW20716: 1.19) enable the vehicle to achieve expected vehicle speed when the engine runs at the most economical speed, improving the fuel efficiency.

3.4 Installation and adjustment of cable shifting system

1.When the cable is mounted on the vehicle, its bend radius must be less than 300mm, and its working temperature ranges -40℃~+100℃.

2.The connection between cable, gear shifting and outer select rocker arm should meet the following requirements:

(1).The angle between cable and rocker arm has better be 90°;

(2).The cable's pilot sleeve, jacket joint and pull-push rod must be located in one straight line.

3.Separately install the gear selection cable and gear shifting cable on the operator.

Notes: The ball joint thread for two cables should be completely screwed.

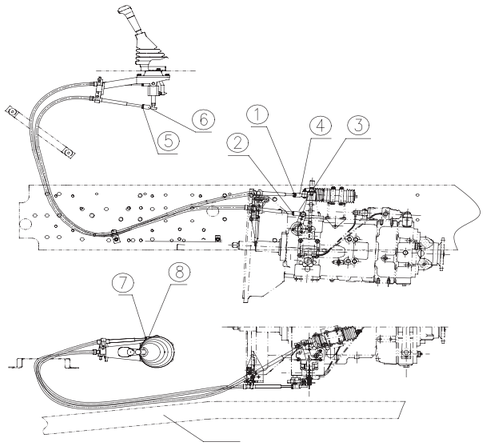
4.After the installation, move the jaw stick to the neutral position, measure if the cable size at the transmission end have met relevant requirements. If not, adjust the connecting length of cable ball joint and rod thread to align the cable's installation size.

5.After the installation finished, conduct the operations of gear selection and shifting to check if all the gears have been selected. If the gears on one side are found to have difficulties in gear selection and shifting, refer to the above paragraph to check and adjust the installation size of gear selection cable at the transmission end.

6.The detailed adjustments for the cables are as follows: (Figure 7)

(1).After the assembly is completed, if the front-row gears are found to have difficulties in moving to the right position during the trial run, unscrew ① nut (or ⑤ nut), rotate ④ ball joint (or ⑥ ball joint) anticlockwise properly (to increase the length). On the contrary, if the rear-row gears are found to have difficulties in moving to the right position, unscrew ① nut (or ⑤ nut), rotate ④ ball joint (or ⑥ ball joint) clockwise properly (to

reduce the length). Repeat the above steps and adjust the length until all the gear can move to the right positions smoothly.



(2).After the assembly is completed, if the low gears are found to have difficulties in moving to the right position during the trial run, unscrew ② nut (⑦ nut), rotate ③ ball joint (or ⑧ ball joint) anticlockwise properly (to increase the length). On the contrary, if the high gears are found to have difficulties in moving to the right position during the trial run, unscrew ② nut (⑦ nut), rotate ③ ball joint (or ⑧ ball joint) clockwise properly (to reduce the length). Repeat the above steps and adjust the length until all the gear can be found.

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3.5 Maintenance and precautions of transmission

1.Requirements for use

It is suggested that we operate and use the transmission properly and rationally, implementing regular servicing and maintenance, which is crucial to the vehicle's reliable driving and the transmission's long life expectancy. Please adhere to the following use requirements:

1.1Lubricant brand

Please fill and inject 85W/90GL-5 vehicle gear oil in the transmutation.

1.2 Proper oil level

Please make sure that the oil level is leveled with the observation slit of oil level. Check the oil level through the observation slit on box flank until the oil level reaches the slit and spillage happens. The oil injection volume is about 12L for HW18709 transmission and HW18710 transmission (12.5L with power take-off added), and 14L for HW20716 transmission (14.5L with power take-off added).

1.3 Inspection of oil level

Regular inspection should be made to the oil level. The car should be parked on the flat road surface 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.

1.5 Cycle for lubricant replacement

Discharge the used lubricant in the transmission first 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 can 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 not be below -40°C.

The lubricant will discompose and shorten the transmission's lifetime 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 a vehicle speed <32km/h.

<2> High engine speed.

<3> High ambient temperature.

<4> Transmission surrounded by eddy current.

<5> Exhaust system is too close to the transmission.

<6> High-power overspeed running.

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 Drag or 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

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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, you may draw the half axle out, disconnect the drive shaft or have the driving wheel dragged over the ground.

1.9 Operating methods for gear shifting

For switching free gearshifting of HW20716, first press the switch on shift knob (see Figure 3), the operating steps from 1L to 1H are: first turn the switch valve from position L to position H, then step on the clutch pedal (to the floor), release the clutch and the gear shifting is completed (no operations for shift knob are required in this process). Operating steps from 1H to 2L: first turn the switch valve from position H to position L, then step on the clutch pedal, move the shift knob to neutral position and then to second gear, release the clutch and the gear shifting is completed. Similarly, repeat the same operations until the shift knob is moved to 8H. It is same to shift gears down. The gears will not shifted if you just step on the clutch pedal, release the clutch and turn the switch on shift knob.

For HW20710 transmission, when shifting from low gears to high gears (vice versa), first put the handle valve in position H (L) and then move to neutral position, wait for a little while and move to sixth gear (fifth gear). Do not skip for shifting, or it will influence the lifetime of synchronizer of auxiliary transmission. When the handle is at a certain gear, you can switch H-L of handle valve but can't shift between high and low gears, because any shifting must be implemented through neutral position.

2 Precautions

2.1 The clutch must be completely disconnected and the gearshift lever should be moved into relevant positions when shifting.

2.2 Both HW20716 transmission and HW18709 transmission have two neutral positions for high gears and low gears respectively, i.e. gear 5-6 neutral position for high gears and gear 3-4 neutral position for low gears. HW 18710 transmission has one neutral poison, i.e. gear2-3 neutral position. When parking a car, the gearshift lever should be moved into neutral position for low gears.

2.3 When the vehicles equipped with HW series transmissions shift into low gear (creeping gear) or reverse gear, they must be first parked and then shift into relevant gear to prevent the parts inside the transmission from being damaged. When shifting into reverse gear (creeping gear), bigger gear selection force must be used to overcome the resistance of reverse gear (creeping gear) lock.

2.4 When the transmission shifts from low gears to high gears (vice versa), do not skip for shifting, or it will influence the lifetime of synchronizer for auxiliary transmission.

2.5 When the vehicle drives down the hill, no shifting between high and low gears is permitted.

2.6 Shift to first gear or second gear to start the vehicle in accordance with the road conditions.

2.7 Release the brake before the vehicle starts. For the vehicles that employ 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 In 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 gearshifting

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cylinder and its gas pipeline to ensure that auxiliary transmission has shifted into relevant gear.

2.10 Do not detach or assemble the transmission within “Three Promises” warranty period.

3.6 Specifications of optional gearbox

1. Fashite series

Model No.	Torque N.m	Shift and Speed Ratio										Fuel Capacity (L)
		Creeping Gear	1st Gear	2nd Gear	3rd Gear	4th Gear	5th Gear	6th Gear	7th Gear	8th Gear	Reverse Gear	
8JS100TB-B	1,000		11.40	7.94	5.63	4.06	2.81	1.96	1.39	1.00	11.35	12.5
9JS119	1,190	12.11	8.80	5.93	4.42	3.36	2.41	1.76	1.32	1.00	12.66	13
RT11509C	1,490	12.42	8.29	6.08	4.53	3.36	2.47	1.81	1.35	1.00	12.99	
RT11509G	1,650	12.57	8.39	6.15	4.59	3.40	2.47	1.81	1.35	1.00	13.14	
9JS180	1,800	12.65	8.38	6.22	4.57	3.40	2.46	1.83	1.34	1.00	13.22	

Model No.	Torque N.m	Gear and Speed Ratio														Fuel Capacity (L)
		1st Gear	2nd Gear	3rd Gear	4th Gear	5th Gear	6th Gear	7th Gear	8th Gear	9 Gear	10th Gear	11 Gear	12th Gear	1st Reverse Gear	2nd Reverse Gear	
12JS160T	1,600	15.53	12.08	9.39	7.33	5.73	4.46	3.48	2.71	2.10	1.64	1.28	1.00	14.86	3.33	14.5
12TS180T	1,800	15.53	12.08	9.39	7.33	5.73	4.46	3.48	2.71	2.10	1.64	1.28	1.00	14.86	3.33	14.5
RT-18110B	1,830	14.73	11	8.17	6	4.46	3.3	2.46	1.8	1.34	1			15.1	3.38	

2.Qijiang gear transmission series

Model No.	Torque N.m		Gear and Speed Ratio										Fuel Capacity (L)
			Creeping Gear	1st Gear	2nd Gear	3rd Gear	4th Gear	5th Gear	6th Gear	7th Gear	8th Gear	Reverse Gear	
6S-120	Direct Gear	1,200		9.01	5.24	3.20	2.20	1.50	1.00			8.30	11
	Overdrive Gear	1,200		7.03	4.09	2.45	1.50	1.00	0.81			6.48	
5S-150GP	Direct Gear	1,500	13.04	8.48	6.04	4.38	3.43	2.47	1.76	1.28	1.00	11.77	13
	Overdrive Gear	1,500	9.73	6.38	4.65	3.43	2.50	1.85	1.36	1.00	0.73	11.77	

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4 HOWO front steering axle

4.1 Structure and data

4.1.1 Structure

Forged I – shaped beam, Elliott steering knuckle, S brake cam, drum brake (optional: disc brake),diaphragm-type brake chamber, ASA and ABS.

4.1.2 Data

Rating axle load		7000	Wheel stud & B. C.	10xΦ335
Wheel track	11.00R20	2046	Wheel	8.0-20
	12.00R20	2027		8.5-20
	12.00R24			8.5-24
Kingpin center distance		1790	Wheel stud specification	20xM22x1.5
Leaf spring center distance		850	Inside/outside wheel turning angle	45/33
Toe-in	radial ply tire	0±1	Brake	Φ420x160
	diagonal tire	3±1	Brake drum service life	Φ422±0.1
Kingpin inclination angle		3°		
Kingpin camber angle		1°		
Wheel camber angle		1°		

4.2 Assemble and adjust brake and ASA

(1) Put brake chamber pushrod in its original position, coat splined end of cam shaft with grease, then assemble locating bracket of the adjustment arm on the cam shaft bracket by bolts. Make sure that at this time the bolts should not be tightened and the locating bracket can rotate freely on the boss of can shaft bracket.

(2) Assemble the adjustment arm on the cam shaft. Make sure that the arrow direction on the housing should be the same as brake direction, that is, the direction of brake chamber pushrod pushing adjustment arm outward.

(3) Use SW12 spanner to rotate worm hex end of the adjustment arm in clockwise direction (Note: don't use electric spanner and pneumatic drill), making its hole align naturally with the U-fork pinhole of the brake chamber pushrod. Then insert the cylindrical pin into U-fork hole and lock the split pin.

(4) Fix the adjustment arm on the cam shaft by bolts, shims or retainers. At this time, ensure the axial clearance of adjustment arm is 0.5-2mm. Then push its control arm in the brake direction(as shown by an arrow on the control arm) to the end. The aforementioned operations are intended to maintain the specified clearance between friction disc and brake drum. Thereafter fix the locating bracket and control arm.

(5) Adjust brake clearance. Rotate worm hex end of adjustment arm in clockwise direction to the end by spanner (till friction disc contacts brake drum), then rotate it in counterclockwise direction for 3/4 turn. Note: don't use electric spanner and pneumatic drill.

(6) Brake the vehicle several times, the brake clearance will be automatically adjusted to its normal range. The adjustment function can be observed through the automatic rotation of worm hex end in clockwise just before the vehicle brake ends.

(7) Check brake clearance and pushrod travel. Maximum air pressure is necessary to operate the brake chamber in the check. After correct adjustment of the brake, free travel of the pushrod should be no more than 15mm.

4.3 Adjustment of Wheel hub bearing

(1) While rotating wheel hub, tighten grooved hexagonal nut by a torque of 280Nm at the same time to ensure all the bearing surfaces contact.

(2) Screw back the grooved hexagonal nut a bit to make its groove align with the small hole on the steering knuckle, loosen wheel hub to make it rotate freely, and adjust to the rotating torque of 6-10Nm when oil seal, grease and brake drum exist.

(3) Assemble split pin and lock up the grooved hexagonal nut.

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4.4 Tightening torques of the main fasteners

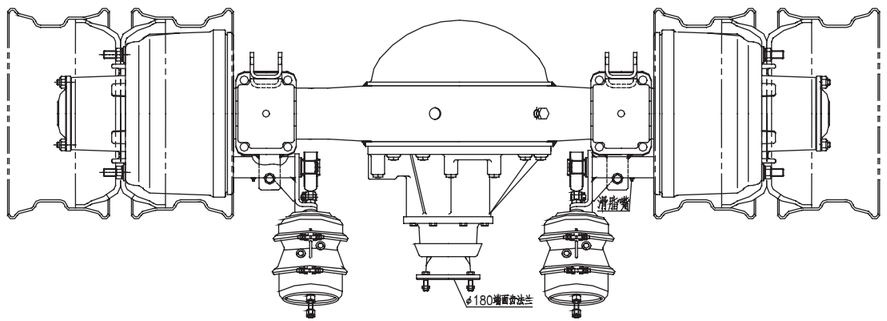
Name	Tightening torque(Nm)
Steering arm nut	280-350
Steering tie rod nut	280-350
Wheel nut	550-600
Wedge locking pin nut	45-70
Steering stop bolt retaining nut	70-90
Ball pin nut of steering tie rod arm	180-280
Tie rod clamp nut	40-60
Steering arm nut	280-350
Steering tie rod nut	280-350
Wheel nut	550-600
Wedge locking pin nut	45-70
Steering stop bolt retaining nut	70-90
Ball pin nut of steering tie rod arm	180-280
Tie rod clamp nut	40-60

5 Operation and maintenance of HOWO rear axle

5.1 Structure and data

5.1.1 Structure

Central single reduction final drive, pressed axle housing, finish forged differential gear, full — floating axle shaft, reinforced wheel reduction, steel pressed brake, friction lining with different thickness. It has S cam drum brake with double diaphragm brake chamber, Can be assembled with both ABS and ASR, optionally with automatic or mechanical brake clearance adjustment arm. HOWO rear axle has such advantages as simple and reliable structure, long service life, low noise, light mass, high efficiency and convenient operation and maintenance, etc.



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5.1.2 Data

Model	Single rear axle	Tandem axle	
		Intermediate axle	Rear axle
Structure	Central single reduction, full-floating axle shaft,	steel pressed axle	housing
Rating axle load	13000	13000	13000
Maximum input torque	29945	35000	35000
Ratio	4.22	4.22	4.22
Spring center distance	1010	1020	1020
Input flange	DIN 165/DIN 180 XS 165/XS 180	DIN 165/DIN 180 XS 165/XS 180	DIN 165/DIN 180 XS 165/XS 180
Standard wheel track	1830mm(wheel rim thickness:12mm)		
Brake type and dimension	S cam drum brake		
Brake chamber	Double	Double	
Service brake torque	32000Nm(brake friction coefficient 0.42, Brake pressure0.6MPa)		
Spring brake torque	32000Nm(brake friction coefficient 0.42,)		
Wheel rim type	8.5-20	8.5-20 12.00-20/12.00R20 11.00-20/11.00R20	
Tire type	12.00-20/12.00R20 11.00-20/11.00R20		
Wheel rim alignment	Center alignment, wheel stud 10-M22x1.5		

5.2 Operation and adjustment

5.2.1 Operation of new axle

(1) Before operation, fill GL5 EP 80W-90 (temperature= -26°) or GL5EP 85W-140(temperature= -12°)heavy load gear oil in final drive from the filling hole in the rear cover of axle housing till oil level reaches filling hole. When assembled with 12.00-20 tire, about 25L for intermediate axle and about 22L for rear axle.

(2) Before operation, fill enough 2# lithium based grease in each grease fittings.

(3) After operation, the vehicle must experience a breaking-in of 1500Km. It can only put into service after checking fasteners (except for bolt coated with glue) again.

5.2.2 Adjustment of axle

(1) Bearing pre-tightening force and gear clearance

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Item	Data
Pre-tightening force of wheel hub bearing	10-12Nm
Clearance between axle shaft gear and planetary gear	Standard gear clearance0.20-0.30mm
	Repair limit0.5mm
Clearance between brake shoe and brake drum	0.2-0.5mm
Clearance between planetary year and cross spider	Standard gear clearance0.10-0.14mm
	Repair limit0.3mm
Oil seat bearing clearance	⩽0.03mm
Planetary year clearance of axle differential	Standard gear clearance0.15-0.25mm
	Repair limit0.45mm
Master driven bevel gear clearance	Standard gear clear0.30-0.40mmance
	Repair limit0.6mm
Clearance between axle shaft gear boss and differential	Standard gear clearance0.21-0.31mm
	Repair limit0.6mm
Clearance between fork and geared sleeve	Standard gear clearance0.10-0.18mm
	Repair limit1.0mm

(2) Attentions when assemble:

a. Differential case housing assembling: assemble right housing on the left one after the assemble marks are matched.

b. Oil bath shim adjustment: the clearance between oil bath and gear should be 1.5 – 4.5mm when assembling the shim

c. Bearing cap assemble: when assembling the cap, it's necessary to match the marks made before dismantling in order to avoid wrong assemble.

(3) Axle adjustment

Pre – tightening force adjustment of wheel hub bearing:

a. Dismantle the locking plate, and then tighten the adjusting nut by a special spanner. The tightening torque should be more than 500Nm.

b. Rotate brake drum for 2 ~ 3 turns to make the bearing fall on correct position. Then tighten it by a torque of no less than 500Nm.

c. Rotate the adjusting nut for 1/4~ 1/6 turn and brake drum for 2 ~ 3 turns. Measure the starting power on the hub bolt by a spring balance. The reading is 30 ~ 65N.

d. Assemble the locking plate and tightening its fastening screw.

5.3 Lubrication and maintenance

5.3.1 Lubricant and filling-up volume:

Location	Lubricant(grease)	Volume
Final drive	GL-5,80W/90 heavy load gear oil	About 22L
Hub bearing	GL-5,80W/90 heavy load gear oil	About 2L
Brake clearance adjustment arm and shaft	No.1 automotive universal lithium-based grease GB7324	Fill the grease till it overflows

Notes:1. The maintenance can be performed in accordance with chassis maintenance interval

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2. The lubrication chambers of final drive and hub bearing are connected with each other, and they share a filling hole on the rear cap of axle housing. After fill more than 15L, tilt the axle leftward and rightward several times in order to ensure the lubricant flow into hub chamber, providing hub bearing good with lubrication.

3.When driving the vehicle in an ambient temperature of no less than-15℃, it is recommended to use GL-5,85W/140 heavy load gear oil.

5.3.2 Add and change lubricant:

Replace lubricant filled during assemble after 5000Km. Check oil level every 5000Km or each month.

Change lubricant every 150,000Km or each year.

Replace grease of brake adjustment arm and cam shaft every 150,000Km or each year.

5.3.3 Axle maintenance:

a. Often clean dirt and dust from the breather plug on rear axle housing.

b. Often check filling hole plug and drain hole plug. If there is any leakage, tighten or replace seal washer immediately.

c. Because the torque transferred by axle shaft flange is very big and also has impact load, the fastening condition of axle shaft bolt Must be often checked to prevent it from loosening and possible bleak.

d. For every 2000km, fill2# lithium based grease in each grease fitting, clean breather plug check gear oil level inside axle housing.

e. For every 5000km, check brake clearance.

f. For every 8000-10000km, check the fastening condition of brake bottom plate, loosening condition of hub bearing and friction disc wear. If wear exceeds hold – down notch, friction disc must be replaced. Check quality of gear oil inside the axle housing, if oil becomes bad or thinner, it should be changed in time. The first oil change interval is 8000km, and gear oil should be replaced for every 24000km later.

5.3.4 Check and maintenance

Item	Interval	(dependent on	Distance or time	Interval Which is first reached)
	First check	Regular check and maintenance		
Regular check	**After 1500Km After one month**	**Every 15000Km Every 3 months**	**Every 60000Km Every 6 months**	**Every120000Km Every year**
Running parts wear, seal damage, running friction disc wear, cam shaft return, function of adjustment arm, function and sealing property of brake chamber	○	○	○	○
Safety check(every day)				
Brake adjustment	○	○	○	○
Brake operation	○	○	○	○
Maintenance				
Tighten bolts again by specified torque				
Clean brake	○			○
Coat brake				○
Coat brake shoe anchor pin and roller with “Loctite” antiseize agent agent				○
Check rotation of hub bearing, adjust or replace It if necessary	○			○

Note:1.when driving the vehicle in bad working condition, its maintain interval shold be shortened accordingly.

2.After assembling or changing wheel,tighten wheel nuts by specified torque after 50km,and tighten them again by specified torque after 150km.

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5.4 Tightening torques of main fasteners

No.	Location	Tightening torque (Nm)
1	Retaining bolt of bevel gear differential left and right case	220-280
2	Flange retaining bolt	130-180
3	Driven gear retaining bolt	600-700
4	Oil filling plug and drain plug	130-150
5	Bearing cap retaining bolt	400-500
6	Redactor retaining bolt and nut	130-180
7	Grooved hexagonal nut on the master cone	500-600
8	Brake mounting bolt	260-300
9	Grooved hexagonal nut for retaining the idler gear system	400-500
10	Retaining nut of hub bolt	380-400
11	Bearing seat retaining nut on the master cone	140-200
12	Stop plate retaining bolt	36-63
13	Retaining bolt of cylindrical gear cover	80-100
14	Axle shaft retaining bolt	270-310
15	Bearing seat retaining bolt in the position of master cylindrical gear	105-120
16	Tandem axle assembly retaining bolt	80-100
17	Retaining nut of axle differential front and rear housing	130-180
18	Retaining bolt at the end of tandem axle	350-400
19	Retaining nut of oil sealing seat	75-90
20	Drive axle bolt	130-160

5.5 Common faults and solutions

Troubleshooting	Reasons	Solution
Exceptional noise of transmission	1、differential device gear clearance dose not suitable	To replace stops pushes the filling piece or the gear
	2、The main driven gear gap is oversized	To replace stops pushes the filling piece or the gear
	3、The main drive gear bearing pretightening force is too small	Adjustment pretightening force
	4、Attrition of half shaft gear, planet gear or cross axle filling piece and so on	To adjustment or replace the breakdown components
	5、The oil level is excessively low	Add enough lubricating oil
Lubricating oil leakage	1、Attrition, loosing or damage of oil seal	Replace oil seal
	2、The loosing of reduction gear tie bolt	tight according to the pretightening force
	3、Seal packing collar damage	Spreads the sealant again
	4、The loosing of bearing seat tie bolt	ight according to the pretightening force
	5、loosing of the oil discharge bolt or the liner damage	ight according to the pretightening force or replace the liner
	6、The overload causes the bridge shell distortion	Adjustment or replace the bridge shell
	7、The air plug is stopped up or damaged	Clean or replace the air plug
Bush bearing detention	1、The bush bearing pretightening force is oversized	Adjust pretightening force
	2、The bearing lacks the lubrication or the lubricant is not correct	Add or replace lubricant
	3、The bearing stains the dust	Clean and add lubricant
Not enough braking force	1、The cam rotation of axis does not work	Inspection cam shaft working condition
	2、The brake air chamber throwout lever stroke adjustment does not work well	Adjust traveling schedule
	3、Brake lining plate overheated or deterioration	Replace friction plate
	4、The brake lining plate does not fit	Adjust friction plate fitting position
	5、The brake drum enters water	steps on the pedal lightly, to make the water out
	6、having lubricant on the friction plate and the brake drum	Clean or replace friction plate
	7、The brake pressure insufficient or air insufficient	inspects the air operated pipeline and various air valves
Exceptional noise when braking	1、The friction plate attrition causes the bolt to protrude	Replace friction plate
	2、Friction plate surface hardening or deterioration	Replace friction plate
	3、The brake drum non-uniform attrition or the installment are not firm	Adjusts the brake drum or tightening the bolt
	4、The brake shoe and the friction plate contact is not close	Tighten all the bolts
	5、The brake shoe set pin loosing	Tighten the bolt
	6、Bush bearing attrition	Replace bush bearing
	7、Brake drum distortion	Adjust or replace the brake drum
the brake not stably	1、The brake shoe installment does not well	tighten the set pin locking bolt
	2、damage of return spring	Replace the return spring
	3、The friction plate has oil or deterioration	Clean or replace friction plate
	4、Brake shield plate damage	Replace Brake shield plate
The wheel becomes rough	The cam shaft insufficient lubrication or adjusts the arm not to return to the position	Adjust the trouble location
	2、The brake shoe or the air chamber return spring break off or weary.	Replace the failed part

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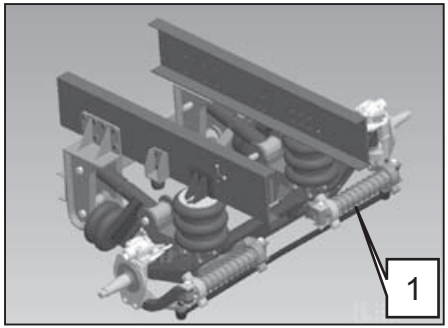
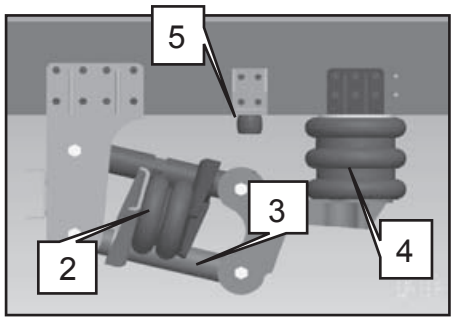
6 Idler trailing axle

6.1 Operation instruction



The idler trailing axle is based on Steyr front steering axle on which air suspension and operation system are assembled. The assembling of idler trailing axle will efficiently improve vehicle load capacity, reasonably adjust axle load distribution and reduce tire wear.

Generally, the vehicle assembled with idler trailing axle drives on high road.



1.Steering damper assembly
2.Lifting airbag
3.Four-bar linkage mechanism
4.Loading airbag
5.Stopper

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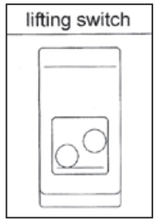


6.1.1 User instructions

When the servo steering support axle needs to be lifted, you just need to give a flip in the cab. No operation is needed because it can automatically lift when reversing a vehicle.

(1) Lift bridge falls

Press the lifting rocker arm, supply electricity to solenoid valve and discharge the lifting airbag. Loading airbag is inflated through pressure sensing control valve to lower the lift bridge.

(2) Lift bridge rises

A. Restore the lifting rocker arm, solenoid valve is cut off, lift airbag is inflated, discharge the loading airbag through pressure sensing control valve to lift the bridge.

B. To avoid the tire abrasion of servo steering support axle when reversing, the function of automatic lift for servo steering support axle is specially designed for the hoisting system.

Notes:

1. If you reverse a vehicle after pressing the rocker arm (i.e. servo steering support axle falls), the servo steering support axle will still rise after the vehicle shift out of reverse gear. If you want the servo steering support axle to fall, restore and reset the rocker arm to lower the servo steering support axle.

2. When the vehicle has no load or only half load, you may lift servo steering support axle to leave the ground surface.

3. You had better operate the rise/fall of servo steering support axle when the vehicle is parked, to avoid any abnormal abrasion of tires.

6.1.2 Data

Lifting heighe:150mm(full load0/220mm(without load)

Kingpin caster angle:6。

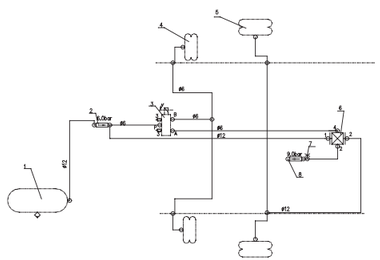
Mass:7000Kg (full load)/1000Kg(without load)

Model		Lifting air bag	Load-carrying air bag
		FD200-25(made in Germany)	FD300-29(made in Germany)
Installation height (mm)	Full load	200	264
	Without load		304
Working pressure	Full load		6-7
	Without load	6-7	6-7

6.2 Working principle

6.2.1 For the electric principle of lift-up operation, please refer to PART FOUR Electrical principles

6.2.2 Pneumatic principle diagram for lift-up operation



1.Pressure reservoir
2.Bleeding valve
3.Solenoid valve
4.Life airbag
5.Loading airbag
6.Sensing proportioning valve
7.esting joint
8.Safety valve

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6.2.3 Instructions of control principles

The pressure reservoir supplies air to loading airbag and lift airbag of air suspension system by bleeding valve and 2-position, five way solenoid valve. The bleeding pressure for bleeding valve is 6bar, which can ensure that the air pressure for vehicle brake system will not be below safe pressure due to frequent charge and discharge of airbag. The air pressure for safety valve warranty system will not be above 9bar. The air pressure of loading airbag is adjusted through pressure sensing control valve.

6.2.4 Key points for adjustment of pressure sensing control valve

1.When lifting shaft descends, the air pressure inside loading airbag is controlled by angle of control rod of pressure sensing control valve

2.Adjustment methods

1)The vehicle is unloaded. Operate the rocker arm and make the lifting shaft descend;

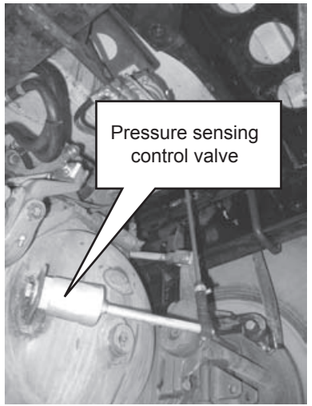
2)Connect air gauge to testing joint of safety valve;

3)The initial angle of control rod of pressure sensing control valve should be 15º below sea level. Adjust the securing location at upper tube, make the air pressure inside loading airbag remain 2bar, finally screw and tighten the bolt.

6.3 Repair and maintenance

This system needs zero maintenance or servicing. Please replace the assembly in a timely manner if any damage.

The airbag belongs to a rubber part, please clean it to avoid rubber aging if it is contaminated with grease or solvent during its use and maintenance.

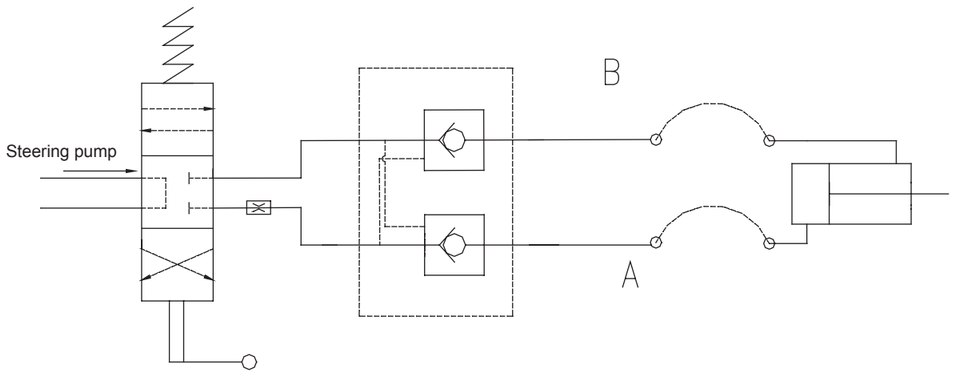


7 Working principle and operation instruction of 6x2 trailing axle

⚠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 controlled by the control cylinder through hydraulic valve. The hydraulic working principle shown in the figure.



Hydraulic working principle

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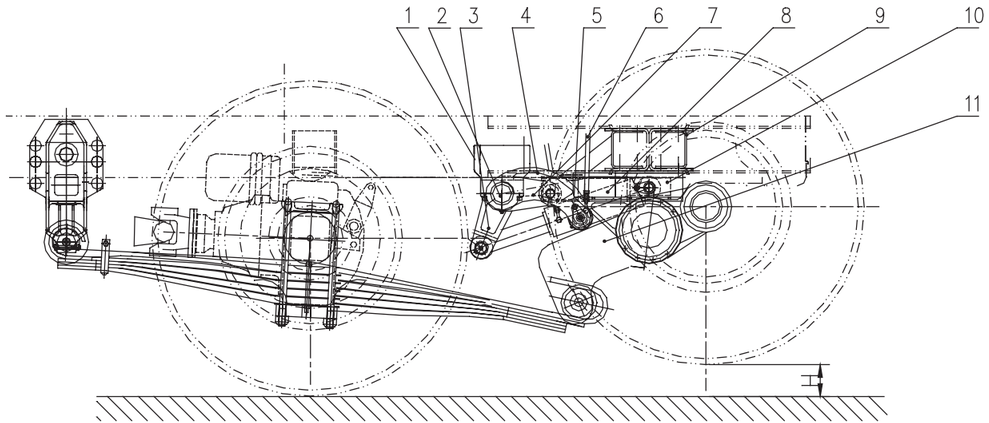
Lifting operation

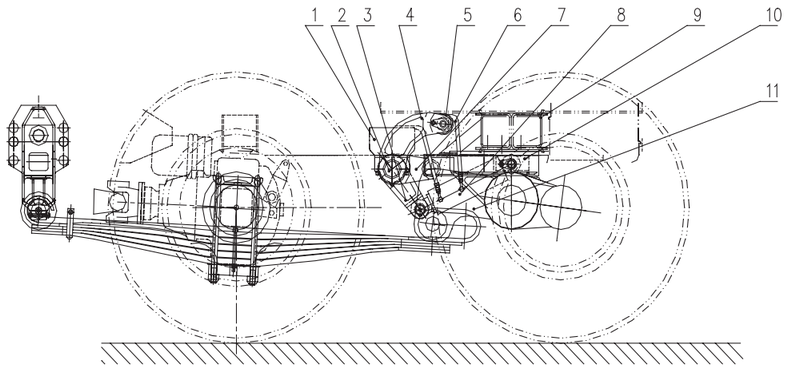
When the vehicle stands still, engine runs at idle speed, open the protection unit of the hydraulic controlled valve, lift the lever to the lifting position, the pressure oil enters to lower chamber of the cylinder through high pressure tube, piston rod stretches out and pushes and turns the pushing arm of hydraulic cylinder on the swiveling shaft, and brings the swiveling shaft2 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; 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.



After the rear axle is lifted up

Lowing 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 burn, the axle is lowed 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 lowing the axle to the ground is realized. Locke the lever.



The dropping position of rear axle

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

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8 Operation and maintenance of rear axle

Structure: central single reduction with planetary wheel redactor, pressed axle housing with wheel differential and axle differential

8.1 Data

Item	Data			
Rating axle load (kg)	13000x2			
Max. input speed(r/min)	3500			
Max. input torque(Nm)	25560	23540	19620	17170
Ratio	4.42	4.8	5.73	6.72
Service brake(mm)	420x185			
Brake type	Pneumatic chamber cam brake			
Bake chamber	24" Diaphragm type			
Brake torque(Nm)	29400			
Rating brake pressure(bar)	6			
Friction disc coefficient	0.38			
Total weight(kg)	Intermediate axle860; rear axle770			
Lubricant filling amount(L)	Final drive16.5;Intermediate axle redactor 19.7; wheel redactor3			

8.2 Operation and maintenance of rear axle

8.2.1 Maintain lubricant amount, often check oil amount of wheel redactor and final drive.

Lack in oil may lead to early wear of running components and even cause burning damage. But this is not to say, more lubricant means better, because excessive lubricant may result in high temperature and even oil leakage.

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.

For new vehicle's initial maintenance, when replacing lubricant of the wheel redactor, 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 old 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 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.

The final drive and wheel redactor in rear axle use API GL-5, SAE 85W/90 gear oil. Generally, oil amount is 6L for the axle housing and 2L for each wheel redactor.

The oil change interval for rear axle gear oil is 5000Km or one year. Gear oil should be replaced for the first 2000-3000Km compulsory maintenance.

8.2.2 Correct operation of differential lock

The wheel differential in rear axle is used to automatically realize speed difference between left and right wheel when the vehicle turns comer 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.

Note: After the vehicle drives away from the trouble road, disengage the differential lock immediately, or it will result in tire wear and differential damage.

8.2.3 Avoid serious overload

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The designed load capacity of rear axle is 13 ton. Serious overload and load concentration will result in axle housing deforming and break. Therefore, the load capacity specified in accordance with driving condition should be complied with.

8.2.4 If the connection fittings of differential gear and driven gear, etc need to be reassembled during the repair coat the coupling threads with Loctite 262 thread setting glue, and tighten the coupling bolt specified torque.

During operation, don't drive the vehicle if you hear abnormal sound. Check and repair immediately.

8.3 Main bearing pre-tightening forces and gear clearances

Clearance between differential planetary gear and axle shaft gear	0.1-0.2mm
Pre-tightening force of driven bevel gear bearing	3-4Nm
Pre-tightening force of drive bevel gear bearing	1-2Nm
Engaging clearance between drive gear and driven gear	0.2-0.3mm
Hub bearing pre-tightening force	7-9Nm
Fitting clearance between cam shaft and sleeve	0.015-0.208mm
Wear limit of shaft and sleeve	0.35mm
Brake shoe min. thickness no less than	6mm
Tightening force of axle end nut	300-400N
Tightening force of hollow spline shaft	300N
Wheel nut	550-600Nm
Retaining nut of differential gear housing	195Nm
Retaining nut differential gear housing and driven bevel gear	325Nm

8.4 Rear driving axle FAQ Troubleshooting

1. Oil leak

There are several obvious parts of rear driving axle leaking. Leaking at center reducer is frequently happens on the input shaft, which normally arise from broken or worn out of oil seal of the input shaft (initiative gear) or loosing of oil seal spring. When maintenance should notice that if the outer ring of oil seal leaks which shows the outer ring of oil seal and the shell connection loosing. When reassembly should wash the outer ring and the shell seal hole clean, and use LOCTITE603 solid glue to the outer ring and put the seal into the seal hole. If the seal is intact, but it still leaks badly, then should go check the axle shell ventilation devices (which should be checked frequently). If the ventilate valve is blocked the heat that brought from movement of axle, makes the pressure goes up, which makes the lubricating oil leaks out. This problem is usually not noticed.

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 hole and axle tube shell, 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 airproof, which is connected without mat, we can disassembly them and wash the end head and wheel reducer shell clean, then use LOCTITE587 to reassemble them. When gluing the glue bar should be never judges.

If find out the blowhole of axle shell leaks and the wheel reducer lack oil very often that commonly means the 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.

2 .over heat of hub

Over heat of hub commonly arise from excessive pretightening force of hub bearing, which commonly occurs after maintenance. If haven't tighten the axle head nut according to regulate during maintenance, and the pretightening force is excessive, can cause over heat of hub. The hub should be reassembled according to regulation. Certainly, distortion and broken down of hub bearing also can arise over heat of hub.

3.over heat of brake drum

There are many factors for over heat of brake drum. May problems arose from mechanical brake parts or brake control gas path system. Firstly should check out whether the servo-brake back to place quickly after braking. If the servo-brake can not back to place quickly or back to place

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slowly, may remove the handspike of servo-brake and the brake adjusting arm to check whether the servo-brake back to place quickly, if not, which means failure of servo-brake and brake control gas path. And if the servo-brake back to place quickly after removing the handspike of servo-brake and the brake adjusting arm, then should check whether the brake camshaft running neatly.

Bending deflection of the brake camshaft, lacking oil of muff or deflection and dislocation of camshaft bearing, can all make the failure of servo-brake back to place to cause the over heat of brake drum.

The brake off or loosing of brake shoe return spring can cause over heat of brake drum and make frictional noise. When normal driving, between the braking friction plate and the brake drum should have a certain gap (generally 0.2 millimeters), if the gap is too big may affect the braking effect, and if too small will arise overheating. The heat dissipation of brake drum is not good, frequent braking will soon make the brake drum overheating, seriously can even burning tire valve and arise flat tire. So if vehicles traveling downhill in a long-distance frequently should use engine exhaust braking to avoid frequent use of brakes, to prevent overheating of brake drum.

4. Abnormal noise from central drive

If there is sudden abnormal noise coming from the rear axel housing while driving, stop the vehicle immediately for inspection. Generally, this kind of 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 or pit corrosion of the tooth surface. If the noise is not significant when driving, but it is significant 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 significant noise when the vehicle is normally traveling in a straight line, but there is abnormal noise when the vehicle is turning a corner, it is obviously 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 the 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.

The deformation of axle housing can also cause the abnormal noise from the real axle, which should be attended to during inspection.

In case of abnormal noise from the rear axel, do not drive the vehicle forcibly. Remove and check the rear axel 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.

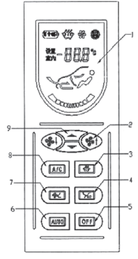
5.The fail of differential lock

When need to put up the differential lock, push the switch for it 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 shoots out, but does not in place that means the head of mating gear tooth mated with the head of gear peak but not in place. When move the truck front and back the differential lock will work naturally. If the differential cylinder does not work that shows the electricity, gas control system of electromagnetic valve has some problem. May loosen the outlet connection of electromagnetic valve to observe whether some compressed air output, if not that shows the problem from circuit control system of electromagnetic valve or electromagnetic valve itself; if yes that shows the problem come from the differential cylinder.

When finding the push rod puts the differential lock in place, but the signal light does 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 abrade tyre

There is a few reasons for abrading tyre: the distortion of tyre steel ring, loosing of hub bearing and alternating of rear axle. The reason for alternating of rear axle is commonly the break of snail of center armor plate.



9 Operation and maintenance of air conditioning system

9.1 Introduction

The system consists of radiator, compressor, condenser, expansion valve, receiver-dryer, evaporator and blower. It is connected as a closed system by pipes. Radiator uses circulation water as the heating source, compressor is operated by the belt of the engine, the solenoid clutch is operated by the electrical power supplied by the vehicle, the condenser is cooled by the radiator. The cooling medium is R134 fluorine free.

9.1.1 Controller assembly

Control panel:

(1) display screen

(2) wind power adjustment button

(3) defrost button

four modes: upstream blow, downstream blow, downstream defrost, defrost

(4) inlet wind select button

(5) power off button

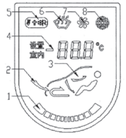
(6) AUTO function button

(7) outlet wind select button

four modes: upstream blow, downstream blow, downstream defrost, defrost

(8) cooling button

(9)temperature setting button



9.1.2 Display information

(1) wind power scale

(2) inlet wind mode

(3) outlet wind mode

(4) temperature setting and ambient temperature display

(5) AUTO function

(6) Defrost

(7) Wind blow

(8) Cooling

9.1.3 Data

Model		KQZN-4.9
Cooling power		423Kcal/h(4.9W)
Coolant		R134a
Compressor	Model	SE5H14
	Voltage	D.C 24V
	Exhaust amount	138cc/r
Clutch	Power	50W
	Belt groove	Double groove
	Belt pitch diameter	F120
Evaporator	Cartridge	Parallel-flow type 630*490*20mm
	Windward area	0.31m²
	Cartridge	Tube type 420*210*70mm
	Windward area	0.08m²
Expansion valve		"H" \ 1.5T

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9.2 Operation instructions

9.2.1 Set your desirable temperature inside the vehicle

Adjust temperature setting button and Set your desirable temperature inside the vehicle. Range: “LO”,18℃~29℃, “HI”. You’ll fell cooler in the position “LO” and warmer in the position “HI”.

Note: In general environment condition, it is more suitable to set in the range of 22℃~26℃.

9.2.2 Set wind power

In general condition, wind power can be automatically adjusted by the system in accordance with the temperature setting, but also can be adjusted separately.

Note: The wind power has nine scale. Push the wind power button, wind power will be adjusted slowly.

9.2.3 Night-vision function

Open the power switch of night-vision light, the button signal will be displayed simultaneously with other instrument signals.

9.2.4 Outlet blow mode

Four outlet blow modes can be selected by outlet wind select button and defrost button respectively.

9.2.5 Inlet blow mode

In the following environments, the interior circulation inlet mode can be used in a short time:

- in order to decrease interior temperature when the weather is rather hot;
- in order to increase interior temperature when the weather is rather cold;
- when air quality outside the vehicle is bad, such as dusty, bad smell, etc.

9.3 Attentions:

(1)Please perform regular check and maintenance.

(2)If the panel is dirty, clean its surface with soft and dry cloth. Never clean it with wet cloth or hard dry thing, otherwise it’s easier to damage the panel, buttons or display screen.

(3)Don’t touch the display screen with finger, oily or hard thing, otherwise the display may be not clear and the display screen may be damaged.

(4)The filling hole for cooling medium is on the compressor and its pipe. if cooling medium is not enough and cooling efficiency is not satisfactory, please contact with professionals. If cooling medium is not enough, white foam can be seen from the window on top of the receiver. If cooling medium is enough, it is colorless. If the system fails, please contact the special service shop and seek the help of professionals.

9.4 Maintenance and repair

Item	Content		Check period				
			Every week	Every month	Every two month	Every season	Every year
	Coolant amount	Check coolant level	+				
Air conditioning unit	Coolant leakage	Check leakage with halogen checker			+		
	Hose and pipe	Check cracks and damage			+		-
		Check leakage of connectors and tightening of clamps					-
		Replace desiccant and filter					
	Coolant	Refill with specified coolant	+				
Compressor	Shaft seal	Check leakage trace with white paper	+		-		
	Belt	Check tightness of belt pulley and check wear			+		
	Bolt	Check tightness, check and check change all of them, if necessary	+				
Evaporator Condenser	Evaporator cartridge	Check dirt, clean if necessary	+				+
	Wind motor	Check running condition					
	Expansion valve	Check running condition, remove filter gauze and clean it	+				
	Condenser cartridge	Check dirt, clean if necessary	+				
Electrical component	Connector and plug	Check looseness of wire clamp plug		+			
	Heat sensitive resistance switch	Check action				+	
	Solenoid clutch	Check if specified requirements has been met				+	
	Solenoid clutch bearing	If it can’t turn steadily, please replace it					+

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9.5 Troubleshooting and solutions

Trouble		solution
1.High pressure too low	System leakage	Check leakage and repair
	Expansion Valve fault	Replace
	Air return valve closed	Open
	Short of coolant	Add coolant
	Receiver-dryer blocking	Replace
	Compressor air return valve leakage	Replace
	Compressor leaf valve damaged	Replace
2.High pressure too high	There is air in the system	Refill coolant
	Condenser blocking	Clean condenser
	Exhaust valve closed	Open
	There is excessive coolant in the system	Drain out excessive coolant
3.Air return pressure low	Short of coolant	Add coolant
	Compressor piston wear	Repair
	Compressor cylinder gasket leakage	Replace
	Hose twisted or squeezed	Replace
	Compressor air return valve leakage	Replace
	There is moist in the system	Replace dryer
	Expansion valve filter gauze blocking	Clean and replace dryer
	Expansion valve temperature sensor loose	Tighten temperature sensor clamp

Trouble		solution
4.Air return pressure high	There is excessive coolant in the system	Drain out excessive coolant
	Expansion valve cannot be closed	Replace
	Compressor leaf valve damaged	Replace
	Compressor cylinder gasket leakage	Replace
5.Compressor doesn't work	Drive belt damage	Replace
	Clutch conducting wire damaged	Replace
	Compressor piston damaged	Replace compressor
	Constant temperature switch failure	Replace
	Clutch coil damaged	Replace
6.Low cooling efficiency	Coil pipe frozen, temperature setting too high	Screw down constant temperature switch to defrost
	Hot air infiltrates into the cab	Close hot air valve
	Receive-dryer blocking	Replace
	Short of coolant	Add coolant
	High pressure too high	Refer to 2
	Air return pressure low	Refer to 3
	Air return pressure high	Refer to 4
	Dryer blocking	Replace
	Expansion valve failure	Replace
	Constant temperature switch failure	Replace

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Trouble		solution
7. Evaporator coil pipe frozen	Improper adjustment of constant temperature switch	Adjust to the working condition
	Not enough air through the evaporator	Check evaporator blower
8. Belt failure	Not centered	Adjust the axial position of belt pulley
	Belt too tight or too loose	Adjust
	Wrong belt dimensions	Replace
	Idler bearing damaged	Replace bearing
9. Fan doesn't work	Fan fuse burnt	Replace
	Control switch failure	Replace
	Fan motor voltage too low	Replace
	Electyic motor voltage too low	Check conducting wire
10.Fan speed too low	Loose contact	Check and repair
	Conducting wire loose or short circuit	Remove trouble
	Rotor shaft bent	Replace
	Controller resistance burnt	Replace resistance
	Not enough voltage	Check generator
	Check fan blade retaining screw	Tighten the screw
11. Hose or joint leakage	Joint leakage	Repair or replace
	Hose leakage	Replace

10. Vehicle Frame and Suspension

10.1Vehicle frame

HOWO series vehicle frames adopt high-strength alloy materials, with wide front body and narrow rear body, front 1,000mm and rear 850mm

Both vehicle battery and tire rack are mounted on the right side, while muffler and large aluminum alloy fuel tank are mounted on the left side

Capacity of fuel tank (L): 300 and 400 for square tanks; 260, 350 and 400 for D-type. Refer to actual assembly of fuel tank for real capacity.

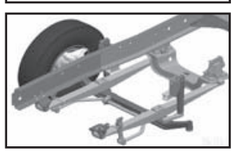
10.2 Front suspension

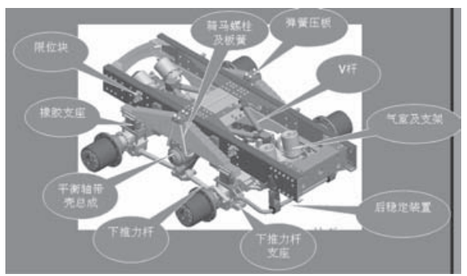
Basic type for front suspension: vertically mounted leaf springs (containing parabolic leaf springs), equipped with cylindrical vibration damper and anti-roll bar

10.3 Rear suspension (N0-07 new balanced suspension)

NS-07 new balanced suspension consists of elastic module, V-type track bar, lower track bar, track bar bracket, balance shaft and case assembly, limiting stopper and rear stabilizer.

1.U-bolt and plate spring
2.Spring pressure plate
3.V-type track bar
4.Chamber and bracket
5.Rear stabilizer
6.Lower track bar bracket
7.Lower track bar
8.Balance shaft and case assembly
9.Rubber bracket
10.Limiting stopper





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Notes:

1.Try to design a crossbeam at the subframe over the balance shaft when refitting;

2.The bolt used in refitting should try to avoid contacting any movable parts, such as spring pressure plate, plate spring clips and rubber racket, in order not to interfere with each other. If not, the bolt head should be mounted outwards with the nut inside it;

3.The crossbeam location of subframe should be identical with the crossbeam of vehicle frame. If the blank space between the subframe over middle and rear axles and the crossbeam adopts X-type reinforced ribs, a certain space must be reserved for disassembling the V-type track bar;

4.To meet the run-out of rear drive axle, do not arrange the crossbeam over rear axle chamber.

10.4 Rubber suspension (RS850)

1.Hanger assembly of vehicle frame

2.Vertical track bar

3.Load-carrying rubber spring

4.Saddle assembly

5.Balance beam assembly

6.dapter nut

Warning: When the hanger of vehicle frame has cracks, ruptures and serious rust, do not operate the vehicle. The hanger of vehicle frame with cracks, ruptures or serious rust may make the components apart and cause vehicles to lose control, leading to individual injury or property loss.

Check the lower edges of these bush rubber for any ruptures or rips, at lease once a year. Please make sure that these concave gaskets are mounted with sharp lip downwards. The protective cap secured by vertical bush is movable and convenient for inspection.

Do not use cutting blowpipe to remove any affiliated fasteners and rubber components.

Lubricants and grease are strictly forbidden to be used on any part of rubber suspension system, especially on rubber parts.

Notes:

Do not unscrew the nut to install split pin, which may reduce the tightening torque below the standard value.

⚠ Warning:

Inadequate tightening torque may cause earlier abrasion and damage to the leg and hole of axle bracket and/or connecting parts at the end of balance beam.

Standard of Tightening Torque

Description	Part No. of Hendrickson CNHTC	Thread Level	Recommended Torque (N·m)
Lock nut with vertical drive pin	25151-000	1.5”-12UNF-2B, GRADE B	238-306
Lock stud with vertical-bush retaining ring	97289-001 AZ9725525021	M16X2, CLASS 10.9	75-88.4
Lock nut with vertical-bush retaining ring	97287-001 Q33216T13F2	M16X2, CLASS 10	136-170
Saddle bottom-cover studs	97290-001 AZ9725525022	M27X3, CLASS 10.9	75-88.4
Lock nut with saddle bottom-cover studs	97288-001 AZ9725525017	M27X3, CLASS 10	306-374
Adapter nut	17491-022 AZ9725525030	1.875-12UNF-2B, GRADE C	2720-3400

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10.5 Air suspension (single axle, four airbags)

10.5.1 Requirements for use

1) The vehicle is not allowed to overload and its maximum load for single axle must not exceed 16 tons. It will have to drive on good road surfaces of expressways and level 1 highway;

2) Lubricants and grease are strictly forbidden to be used on any part of air suspension system, especially on rubber parts;

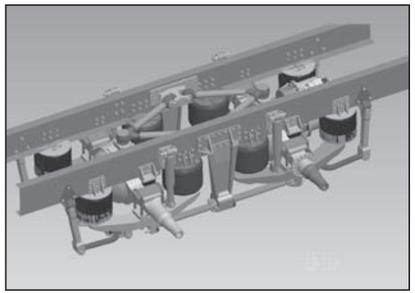
3) Ensure normal air supply pressure, which should be kept at 8.5 bar or so for air suspension system;

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.

10.5.2 Characteristics of air suspension system:

1) Adjustment through height control valve, whatever the load is, i.e. automatically adjust the height when load changes to make the vehicle height remain.

2) Manual control of rotary slide valve can realize vehicle body's rise/fall when the vehicle is static. The height range falls under the working scope of airbags to meet the users' special applications and legal requirements.



PART THREE

Maintenance of the vehicle

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1 .Maintenance Groups

The graded truck maintenance system provides for three maintenance groups according to different uses, driving conditions, expected annual mileage.

Maintenance Group 1:

Bad operation condition(severe winter, hot summer, sandy, cross-country), Vehicles for short distance

Average annual mileage: up to 20000Km

Maintenance Group2:

Vehicles in short and medium distance service

Average annual mileage: up to 60000Km

Maintenance Group 3:

Vehicles in long distance service

Average annual mileage: over 60000Km

2. Routine inspection and maintenance intervals

For routine inspection and maintenance in various operation conditions, see table 1.

3. Oil change interval

3.1 Under normal conditions (see table 2)

3.2 Under normal conditions (see table3)

The severe conditions include the follwing:

1 in tropics or frigid zone (temperature higher than + 30℃ or less than – 10℃)

2 fuel sulfur conten:0.5-1.0%

3 fuel sulfur conten:1.0-1.5%

Table 1 **Unit: 100km**

Group	Routine Inspection	First- grade service	Routine Inspection	Second-grade service	Routine Inspection	First- grade service	Routine Inspection	Third-grade service	Routine Inspection	First- grade service	Routine Inspection	Second-grade service	Routine Inspection	First- grade service	Routine Inspection	Fourth-grade service
I	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80
	85	90	95	100	105	110	115	120	125	130	135	140	145	150	155	160
	165	170	175	180	185	190	195	200	205	210	215	220	225	230	235	240
	245	250	255	260	265	270	275	280	285	290	295	300	305	310	315	320
II	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160
	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320
	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480
	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640
III	15	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160
	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320
	330	340	350	360	370	380	390	400	410	420	430	440	450	460	470	480
	490	500	510	520	530	540	550	560	570	580	590	600	610	620	630	640

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Table 2

●**Changing Oil Mark**

Type	Engine (Turbocharged)	Gearbox Transfer box	Fore axle/rear axle	Remark
First checking	●	●	●	Driving 2000~4000km
Routine inspection	●			
First-grade service	●			
Second-grade service	●	●	●	
Third-grade service	●	●	●	
Fourth-grade service	●	●	●	

Table 3

Operation Condition	Maintenance Group	Naturally Aspirated Engine	Turbocharged Engine
Severe condition(1)	Ⅰ Ⅱ Ⅲ	every 5000km	every 5000km
Severe condition(2)	Ⅰ Ⅱ Ⅲ	5000km 5000km 10000km	5000km 5000km 10000km
Severe condition(3)	Ⅰ Ⅱ Ⅲ	10000km	5000km
Severe condition(1+2)	Ⅰ Ⅱ Ⅲ	7500km 7500km 7500km	5000km
Severe condition(1+3)	Ⅰ Ⅱ Ⅲ	5000km	2500km

4.Maintenance tasks

4.1 Regular maintenance tasks

(1) Check handbrake and footbrake

(2) Check illuminating lamps , single lamps and indication lamps (oil pressure ,pressure in air reservoir , air filter maintenance indicator and battery charge indicator , ect.)

(3) Check the working mode of starter , alternator and battery.

(4) Check tire pressure and condition.

(5) Check the level of engine oil , coolant and steering hydraulic oil.

(6)Drain water form air reservoir.

4.2 Graded maintenance tasks (see table 4)

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Table 4-1

● Maintenance tasks include changing oil , checking and adjustment

Engine	1 st Inspection	Routine Inspection	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th –grade Service
Change engine oil	●	●	●	●	●	●
Replace oil filter	●	Every time changing oil				
Check and adjust vale clearance	●		●	●	●	●
Check injection nozzle pressure					●	●
Replace fuel filter cartridge			●	●	●	●
Replace fuel pre-filter cartridge			●	●	●	●
Check coolant level and add coolant	●	●	●	●	●	●
Replace coolant		Once every 24 months				
Tighten cooling system pipe clamp	●					
Tighten air inlet pipe and flanged joint			●	●	●	●
Check air filter indicator			●	●	●	●
Check dust bowl		●	●	●	●	●
Check air filter main cartridge		Clean every day				
Replace air filter main cartridge		When main cartridge damaged				

Table 4-2

Engine	1 st Inspection	Routine Inspection	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th –grade Service
Replace air filter safety cartridge	When main cartridge damaged					
Check and tighten V-belt	●	●	●	●	●	●
Check booster bearing clearance					●	●
Check injection pump						●
Check and adjust clutch travel and steel rope	●	●	●	●	●	●
Adjust idle speed	●					
Gearbox and transfer box						
Check gearbox oil level			●			
Replace gearbox lubricant (at least once a year)	●			●	●	●
Clean pressure reducer cartridge (FAST gearbox)				●	●	●
Replace gearbox transfer box ventilation device				●	●	●
Check oil level of transfer box			●			
Check lubricant (at least once a year) of transfer box	●			●	●	●
Check and tighten transfer box suspension if necessary				●	●	●

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Table 4-3

Front Axle	1 st Inspection	Routine Inspection	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th –grade Service
Check oil level of final drive and wheel reductor			●			
Replace oil for drive and wheel redactor(at least once a year)	●			●	●	●
Clean front axle ventilation device			●	●	●	●
Check and adjust taper bearing clearance of non-drive axle	The first 2 nd-grade service					
Change wheel hub grease(non-drive axle)	●				●	●
Rear axle						
Check oil level of final drive and wheel reductor			●			
Replace oil for final drive and wheel redactor (at least once a year)	●			●	●	●
Clean ventilation device			●	●	●	●
Check and adjust hub cone bearing clearance	The first 2 nd-grade service					
Check balancing shaft oil level(1491-1891 and 2891) Replace balancing shaft lubricant	●		●	●	●	●
Transmission shaft						
Retighten bolts of transmission shaft	●					
Visual check for connection and wear of transmission shaft				●	●	●

Table 4-4

Cab	1 st Inspection	Routine Inspection	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th –grade Service
Check wiper action	●	●	●	●	●	●
Retighten locking handle on driver’s cab	●			●	●	●
Retighten engine radiator’s cover	●					
Check oil level of cab tipping hand pump				●	●	●
Check lifting cylinder	●		●	●	●	●
Chassis						
Check fixation and action of draw hook	●		●	●	●	●
Retighten 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 fixation wheel nuts	●		●	●	●	●
Check battery fixation				●	●	●
Check fixation fuel tank				●	●	●

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Table 4-5

Brake System	1 st Inspection	Routine Inspection	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th –grade Service
Drain water from air reservoir	●	●	●	●	●	●
Check leakproofness of air pressure system(with barometer)	●		●	●	●	●
Check brake lining thickness and adjust brake clearance				●	●	●
Check wheel brake					●	●
Check pinch bar of load-sensing valve (optional unit)for wear				●	●	●
Check brake line and brake hose	●			●	●	●
Check brake chamber			●	●	●	●
Check footbrake , handbrake and exhaust brake action(when braking-in)	●		●	●	●	●
Check and adjust load-sensing valve(optional unit) on vehicle	●					

Table 4-6

Electrical System	1 st Inspection	Routine Inspection	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th –grade Service
Check electrical system (indicator , headlamp , width indicator , wiper , heating and ventilation)	●	●	●	●	●	●
Check electrolyte level , specific density and cell voltage	●		●	●	●	●
Check fixation of battery terminal , coat electrode with grease	●		●	●	●	●
Check electric tachometer and speed accuracy	●	●	●	●	●	●
Steering system						
Replace steering oil (20000~25000km)	●					
Check and adjust front wheel alignment	●					
Check oil level of steering reservoir	●		●	●	●	●
Replace filter cartridge of steering reservoir					●	●
Check steering system performance					●	●
Check steering linkage clearance				●	●	●
Check bolts , joints and locking device of steering linkage	●					
Vehicle						
Short distance breaking-in (including brake test)	●		●	●	●	●
Visual check for leakage	●	●	●	●	●	●
Check and tighten cargo bod	●	●	●	●	●	●

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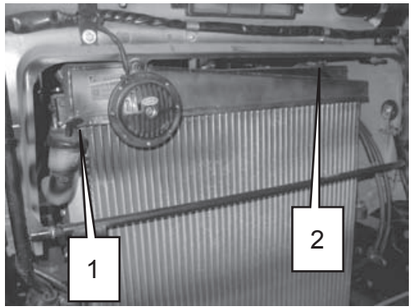
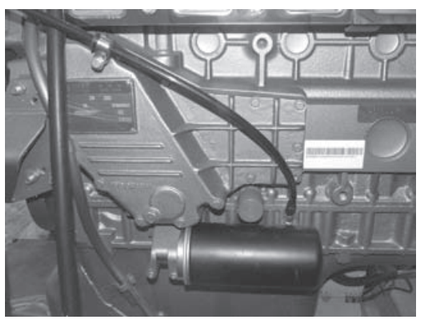
Table 4-7

Lubrication	1 st Inspection	Routine Inspection	1 st -grade Service	2 nd -grade Service	3 rd -grade Service	4 th –grade Service
Water pump	●	●	●	●	●	●
Clutch release shaft(FAST gearbox)	●	●	●	●	●	●
Clutch pedal shaft	●	●	●	●	●	●
Clutch release bearing	●	●	●	●	●	●
Clutch release cable and rocker arm	●	at least once every four weeks				
Universal joint and intermediate support of transmission shaft	●	●	●	●	●	●
Steering knuckle 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	●	●	●	●	●	●
Drawbar 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 ,once a week for the vehicle operated on construction site.



1.oil filing hole
2.oil dipstick



Change engine oil

Note : change engine oil only when engine is hot .

When draining oil , check if oil color is normal and if there is impurity in order to find potential fault . After draining oil , clean oil drain plug , tighten it and replace new oil filter cartridge . Fill new oil into the upper mark in dipstick . In order to prevent engine start-up without lubrication , turn the key switch to start-up position (position 4) when high pressure pump is cut off oil supply . After running at idle speed for a while , start the engine again at low speed . Check leakage of the oil filter . Five minutes after stopping the engine , check and add oil to the upper oil to the upper mark on dipstick .

Change oil filter cartridge

When changing oil , the two oil filter in parallel connection must be replaced at the same time . Apply a thin coat of oil on gasket and tighten the filter .

Oil filter cartridge assembly No.:6100070005

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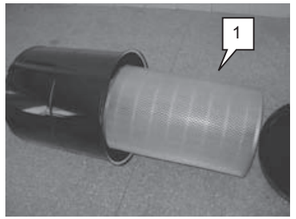
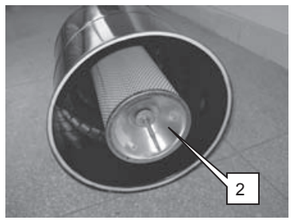




1.Outer filter

2.Safety filter

Air filter maintenance

For the convenience of dust emission , the dust exhaust should be kept vertical .

●After 250 hours operation , the outer filter should be cleaned . The method is as following:

1.Knock the filter cap lightly to remove dust .

2.Clean filter surface from inside toward outside by compressed dry air . Air pressure ≤0.5Mpa

Warning : It's not allowed to clean outer filter with oil or water!

●The filter should be replaced under the following conditions:

The safety cannot be cleaned and should be replaced along with the outer filter at the same time .

1.The outer filter is damaged;

2.The engine exhausts black smoke and has to enough power .

3.The outer filter has been cleaned five times .

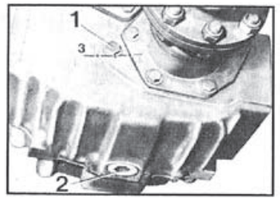
Outer filter 1 part No.:KLQ73-300

Safety filter 2part No.:KLQ73-200

Gearbox oil level check and oil change

1 - oil level checking and filing plug

2 - oil lecel

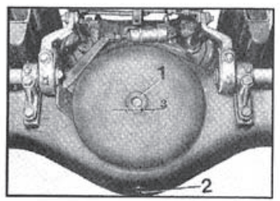


Check tranfer box oil level

1-oil filing plug

2-oil drain plug

3-oil level



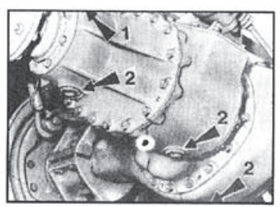
Check front and rear axle oil level

Front drive axle with planetary hub redactor , rear axle on 4×2,6×2 truck , the second rear axle on 6×4,6×6,8×4 truck

1-oil filing plug

2-oil drain plug

3-oil level



The first rear axle on 6×4,6×6,8×4 truck

1-oil filing plug

2-oil drain plug

3-oil level(see the figure up)

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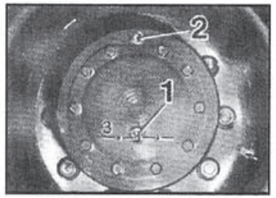


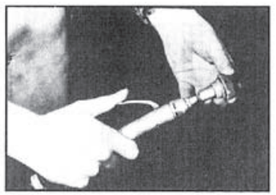
Planetary hub reductor on front and rear axle

1 - oil filling plug

2 - oil level

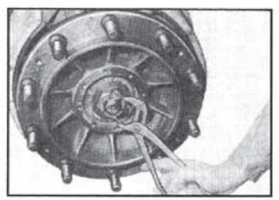
3 - change oil (when oil is hot)

Turn the hub and let the oil drain plug to the lower position . Drain oil from the hub redactor, refill oil in this position 1 . Turn the hub to the position shown in the figure and drain the excessive oil .



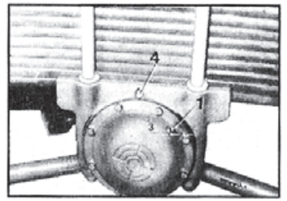
Clean ventilation unit of the axle

Screw down all the ventilation plugs on the front and rear drive axle hub and clean them with compressed air .



Rigid front axle

Replace wheel hub grease .

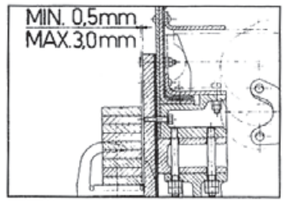


Balancing shaft bearing support

Check oil level at filling plug 1 .

3-oil level

Screw down the ventilation plug 4 while filling oil .



Balancing suspension

Check slide rail wear . If gap is greater than 3mm,fit adjusting plate or replace slide rail .

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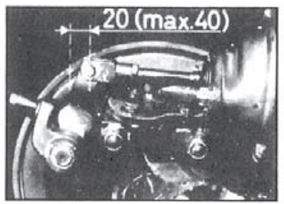
Check brake lining thickness

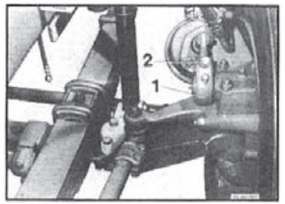
The minimum thickness of brake lining must not be thinner than 6mm .



Adjust wheel brake clearance

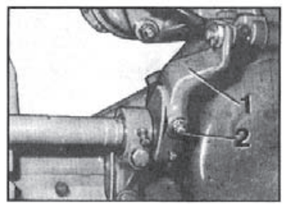
1.Adjust front wheel brake clearance: The brake must be adjusted as soon as the stroke of brake cylinder(piston rod stroke) exceeds 30mm . adjustment us unnecessary with the auto adjuster .

Adjustment sequence : Turn inward the screw on the clearance adjustment arm till the wheel locks , and then turn back the adjusting screw for 2.5 turns .



2.Adjust front axle brake clearance

Turn the hex . Bolt 2 on the end worm shaft till the wheel locks , and then turn back till hearing three sounds .



3.Adjust rear axle brake clearance

The adjustment of rear axle brake is the same as that of the front axle brake .

Before making any adjustment , release the hand brake , jack up the vehicle . After the adjustment , drive the vehicle to check if brake disalignment occurs .

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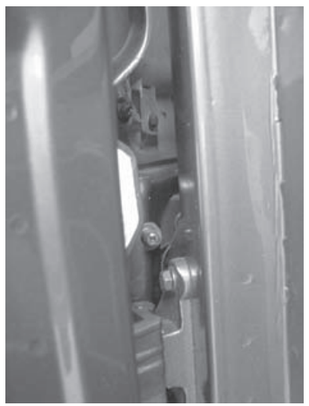
When repairing headlamp and changing bulb , the dismantling operation, of headlamp assembly is as following:

1.Remove headlamp cover .



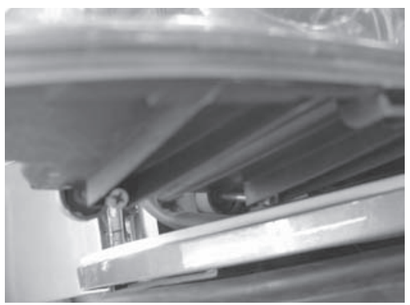
2.Open the door on the same side , and loosen the retaining bolt of headlamp (shown by the arrow in the figure).

3.Draw out the headlamp lightly .

Adjust light beam

1. Remove headlamp cover .

Adjust the two screws as shown in the figure .



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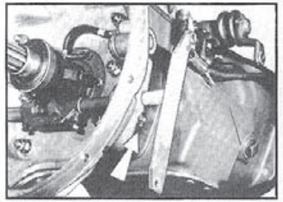
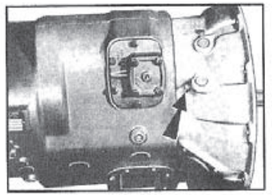
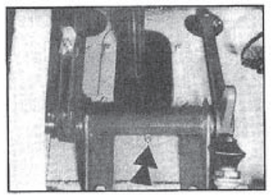


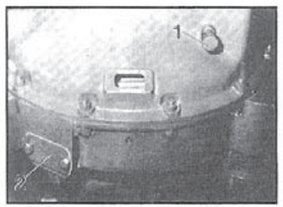
Lubricate clutch release shaft

Lubricate left and right bearing of the clutch release shaft .



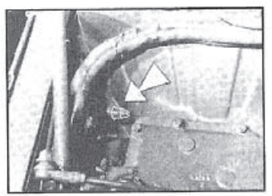
Lubricate clutch pedal shaft .

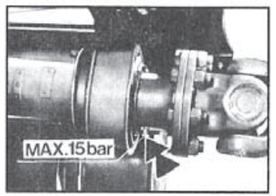


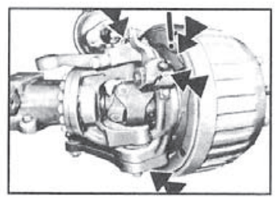


Lubricate clutch release bearing

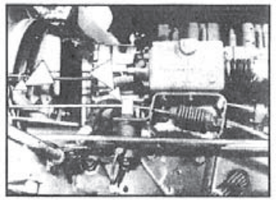
FSAT gearbox QJ gearbox



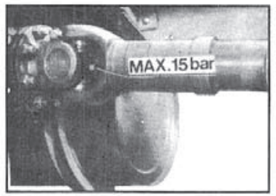




Lubricate clutch rocker arm

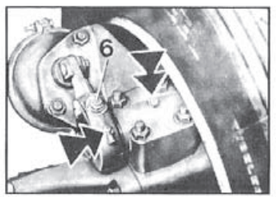


Lubricate universal joint and intermediate support of transmission shaft .



Lubricate steering knuckle pin , brake arm and camshaft .

Front drive axle Rigid front axle



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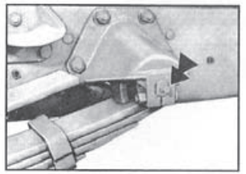
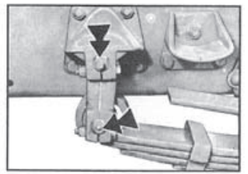
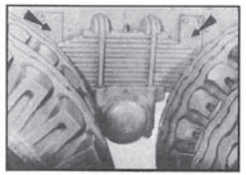
Lubricate shock absorber mounting .



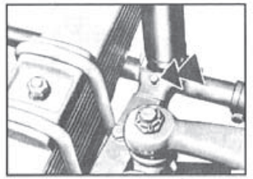
Lubricate gearshift lever bracket .



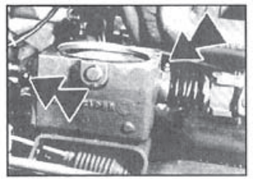
Lubricate rear axle brake arm and cam shaft .



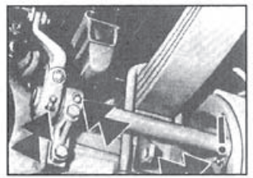
Lubricate shock absorber mounting .



Lubricate gearshift lever bracket .



Lubricate rear axle brake arm and cam shaft .



PART FOUR

Intelligent Control System of Electric Appliances

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1.Overview of intelligent control system

● The engine adopts electronically controlled common-rail fuel injection system developed by Japan, which tests the actual status of engine mainly through various sensors and switches, and implements best control of volume, duration and pressure of fuel injection by calculation and treatment, achieving best performance in both power and emission;

●The instrument adopts internationally popular digital CAN instrument, featuring step motor drive and display of large screen LCD. It can display failures, alarms, input/output signals, etc. and conduct CAN communication with some electronically controlled units (ECU), such as engine and ABS.

2.Operation process and instructions of reminders and alarms

(1)Alarm buzzer

After the engine is started, the alarm buzzer will produce an alarm sound if any signal including Brake Pressure 1, Brake Pressure 2, Oil Pressure Alarm and Cab Lock alarms.

(2)Operation process, reminders and alarms

2.1 Connect the power master switch before inserting the key and turning on all rocker switches; an alarm sound can be heard and, at the same time, we can notice all signal indicator lights inside the instrument and lighting indicator lights in rocker switches go on for about one second (the rocker switch is not required to be in a certain position in advance, soit is suggested that some rocker switches not be turned on);

2.2 Only Parking Lights and Emergency Alarms function are well before inserting the key, and the parking lights will go on when Lighting Switch is turned on and in position 1; all the turning lamps will flash when turning on Emergency Alarm and, at the same time, the corresponding signal indicator lights on instrument panel will also flash. (the flash frequency will be doubled if the bulb is damaged.);

2.3 Turn the key from position “3” to position “4” to start the engine when the transmission is in “neutral position”;

2.4 After the engine works, the alarm buzzer will produce continues alarm sound before Oil Pressure Switch, Brake Pressure 1, Brake Pressure 2 and Cab Lock Switch are all confirmed for compliance. Moreover, Warning Parking Lights will go on to warn the driver that he can’t drive at the moment! Only when all conditions are confirmed and the alarm buzzer stops producing alarm sounds will the Warning Parking Light go off;

2.5 When turning lamp works, the trailer’s turning lamp will also flash; when the bulb of turning lamp is damaged, the flash frequency of working turning lamp will be increased (when the trailer exists, its turning lamp will not flash), i.e. frequency doubling. Meanwhile, the instrument indicator lights in cab will also offer reminders of frequency doubling;

2.6 Insert the key, turn the key from position “2” to position “3”. In normal conditions, the consequent response is just the same as that of Clause 2.1 and, at the same time, the on-off status of all signals for the vehicle will be displayed on the instrument panel. During this process, the control panel will test relevant driving branch circuits. In the event of any short circuit failure in certain branch circuit, there should be relevant reminders on instrument panel.

3.System self-check and instructions of screen scrolling:

To check the driving conditions of all signal indicator lights and lamps fast, fast check/demo mode is set.

(1) System self-check

The engine is stopped; the vehicle is parked; all rocker switches are turned off; no step on brake pedal; open the door; inching main beam for 8 seconds.

(2) Testing process

Relevant lights will be driven one by one, i.e. parking lights - stop lamp/reversing lamp goes on – rear fog lamp/working lamp goes on – front fog lamp/low beam goes on… In the meantime, all the signal indicator lights on instrument panel will flash in turn and six digital watches, from zero to the maximum number, swing over and over. The switching between Trip Display Screen, Information Input Screen and Information Output Screen will repeatedly be shown on the display screen.

(3) Exit from check mode

Any of closed key switch, closed cab door and started engine will exit from the check mode.

(4) Conditions for screen scrolling

Conditions for screen scrolling and small odometer reset: parked vehicle; operation instructions: turn the knob (anticlockwise) to the left to

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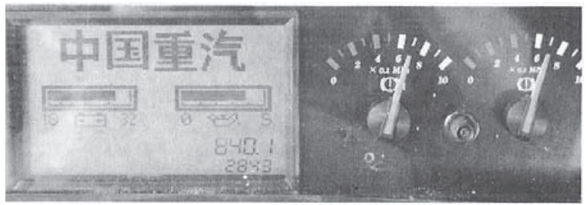
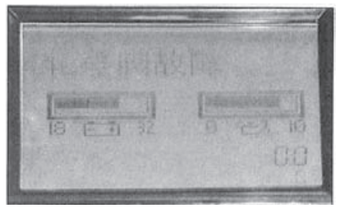
display LCD screen scrolling. Scroll the screen once for every knob turning and repeatedly switch between Trip Display Screen, Information Input Screen and Information Output Screen, accompanied with voice reminders.

Under the status of Trip Display Screen, turn the knob to the right (clockwise) and clear the mileage data. Under the status of Input/Output Screen, Input/Output Screen should be kept for 10 minutes.





4. Dashboard information screen

4.1 Running screen (normal information screen)

●In the top of screen is “中国重汽”（China National Heavy Truck Corporation）

●If any fault tasks place, “中国重汽”will fade out and the relevant fault information will be displayed on the screen (if there are several faults taking place at the same time, fault information will be displayed on the screen on by one repeatedly).

●The next line is two graphic columns which displayed “power voltage” and “oil pressure” respectively.

●The last lines is sub-mileage total mileage (The sub-mileage characters are larger). During the running screen display, the value of “sub-mileage” can be removed by turning the knob and hold it for about two seconds.

4.2Input information screen(table1)

When the engine dose’t operate and the gearshift lever is in neutral position, turn the knob in counterclockwise direction and hold it for about two seconds, the running screen can change over to input information screen, turn the knob in clockwise direction within three seconds, this screen can be kept for minutes (When turning the knob, the buzzer will buzz in a short)

and quick sound), Otherwise, it will return to the running screen.

For the content of input information screen, please refer to table1 (“1”-effective, “0”-ineffective).

4.3 Output information screen (table 1)

Turn the knob in clockwise direction and hold it for about two seconds, the input information screen can change over to output information screen. After changing to this screen, press the knob within three seconds, this screen can be kept for ten minutes(When pressing the knob, the buzz in a short and quick sound).

For the content of output information screen, please refer to table 2(“1”-in operation, “0”-not in operation).

(The next several lines on the output information for the manufacturer.)

4.4 Fault information screen

Switch on with #15 power (Turn on the key)

● When no relevant driving takes place, if “××× fault” screen prompts, the relevant relay circuit package may have been cut off.

● When the relevant driving takes place, if “××× fault” screen prompts, the relevant relay contact point may have been cut off, or relay circuit package driving abnormal.

● If the fault information is displayed occasionally, the relevant parts may be have been in bad contact.

4.5 Display data description

×××××.×→Engine operation time with mileage

××××.×→Engine operation time without mileage

××××→Mileage pulse number K

315→Speed ratio

Note:1.Information screen input and output can only operated during vehicle check and maintenance.

2.Please not turn the knob during normal driving condition.

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Table 1 Input information screen

1. Display the input information screen

When the gearshift lever is in neutral position, turn left the knob and hold it for about two seconds, the LCD screen will scroll. Turn the knob once, the screen will scroll a page. While “input” is shown in the bottom of the screen, the input information screen appears. Turn right the knob, display content can be more than ten minutes.

2. Displayed content

The display content is a combination of “0” and “1” characters. “1” represents some is certain while “0” represents uncertain. We regard one of the characters as a digit and encode them as the first digit, the second digit, etc. from left to right and from top to bottom. The coding sequence is as following:

Row/line	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
3	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
4	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
5	65	66	67	68	69	70	70	72	73	74	75	76	77	78	79	80
6	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
7	97	98	99	100	101	102	103	104	105	106						

For the definition of each digit, please refer to the following table.

3.Digit definition table

No	Name	Description
1	KEY-3	Turn key on (15#)
2	K1	Position switch
3	K2	Front fog lamp switch
4	K3	Rear fog lamp switch
5	K4	Light switch
6	K5	Emergency warning switch
7	K6	Horn conversion switch
8	K7	PTO switch
9	K8	PTO neutral switch
10	K9	Wheel differential switch
11	K10	Axle differential switch
12	K11	All-wheel drive switch
13	K12	Working lamp switch
14	K13	Cold-start switch
15	K14	Spare toggle switch

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No	Name	Description
16	K15	Spare toggle switch
17	K16	Spare toggle switch
18	56A	High beam lamp switch
19	56B	Low beam lamp switch
20	Combination S3-6	Right turn switch
21	Combination S3-7	Left turn switch
22	S31	Air pressure signal switch
23	S10	Brake lamp switch
24	S30	Spring switch
25	S28/1	Air pressure brake switch 1
26	S28/2	Air pressure brake switch 2
27	S48/S49	Horn switch
28	S69	Exhaust brake switch
29	S9	Exhaust brake switch
30	Spare 2	Without definition
31	Trailing axle mode conversion	Trailing axle mode conversion

No	Name	Description
32	Support shaft mode conversion	Support shaft mode cinversion
33	Spare 5	Without definition
34	Spare 6	Without definition
35	Spare 7	Without definition
36	Spare 8	Without definition
37	Without definition	
38	Without definition	
39	Wrong communication with control board	Wrong communication with control board
40	Instrument buzzer in operation	In accordance with control board
41	U2 state digit	“0” normal, “1” wrong
42	U3 state digit	“0” normal, “1” wrong
43	D+ input	“1”The engine has started up
44	IN_XDB	“1”Washing pump in operation
45	IN_JXYG	“1”Windsceen wiper in operation
46	KEY_4	“1”Startup signal input
47	ASR signal	“1”ASR indicator lights up

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No	Name	Description
48	Retarder signal	“1”Retarder indicator lights up
49	Spare	Without definition
50	Water temperature warning signal	“1”Water temperature warning lamp lights up
51	Reverse switch signal	“1”In reverse gear
52	Crawler switch signal	“1”In low range gears
53	Front mounted splitter group signal	“1”In high range gears
54	Air filter blocking signal	“1”Cab door is opened
55	cab door open	“1”Cab in lock position
56	Cab lock	“1”Oil pressure warning indicator lights up
57	Oil pressure warning signal	“1”In neutral position
58	Neutral switch signal	“1” Access
59	Axle differential access signal	“1” Access
60	Wheel differential access signal	“1” Access
61	PTO access signal	“1” Access
62	All_wheel drive access signal	“1” Access
63	ABS_tractor	“1”ABS 1 indicator lights up

No	Name	Description
64	ABS_tralier	“1”ABS 2 indicator lights up
65	ECAS_2	“1” Relevant digit set
66	ECAS_1	“1” Relevant digit set
67	/J7 Overcurrent signal	“0”Branch circuit overcurrent
68	/J2 Overcurrent signal	“0”Branch circuit overcurrent
69	/J8 Overcurrent signal	“0”Branch circuit overcurrent
70	/J3 Overcurrent signal	“0”Branch circuit overcurrent
71	/J9 Overcurrent signal	“0”Branch circuit overcurrent
72	/J4 Overcurrent signal	“0”Branch circuit overcurrent
73	/J5 Overcurrent signal	“0”Branch circuit overcurrent
74	/J10 Overcurrent signal	“0”Branch circuit overcurrent
75	Flash lamp overcurrent	“1”Flash lamp branch circuit overcurrent
76	Trailer lamp signal	“1”Coupling with trailer
77	The four_circuit protection valve overcurrent signal	“1”Abnormal in the four- circuit protection valve
78	Flash lamp share signal	“1”Flash lamp lights up, “0”Flash lamp goes out
79	Reverse lamp abnormal	“1”Branch circuit abnormal

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No	Name	Description
80	Rear fog lamp abnormal	“1”Branch circuit abnormal
81	Brake lamp abnormal	“1”Branch circuit abnormal
82	Ether electric injection pump	“1”Branch circuit abnormal
83	U23_2abnormal	“1”Branch circuit abnormal
84	U23_1abnormal	“1”Branch circuit abnormal
85	U22_2abnormal	“1”Branch circuit abnormal
86	U22_1abnormal	“1”Branch circuit abnormal
87	U21_2abnormal	“1”Branch circuit abnormal
88	U21_1abnormal	“1”Branch circuit abnormal
89	U20_2abnormal	“1”Branch circuit abnormal
90	U20_1abnormal	“1”Branch circuit abnormal
91	J2 abnormal	“1”Branch circuit abnormal
92	J3 abnormal	“1”Branch circuit abnormal
93	J4 abnormal	“1”Branch circuit abnormal
94	J5 abnormal	“1”Branch circuit abnormal
95	J7 abnormal	“1”Branch circuit abnormal

No	Name	Description
96	J8 abnormal	“1”Branch circuit abnormal
97	J9 abnormal	“1”Branch circuit abnormal
98	J10 abnormal	“1”Branch circuit abnormal
99	Without definition	
100	Without definition	
101	Without definition	
102	Without definition	
103	Without definition	
104	U2 state digit	“0”Normal, “1”Wrong
105	U5 state digit	“0”Normal, “1”Wrong
106	Without definition	

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Table 2 Output information screen

1.Display the output information screen

When the gearshift lever is in neutral position,turn left the knob and hold it for about two seconds, the LCD screen will scroll. Turn the knob once, the screen will scroll a page. While “output” is shown in the bottom of the screen, the output information screen appears. Turn right the knob, display content can be kept more than ten minutes.

2.Display content

The display content is a combination of “o” and ”1” characters. “1” represents some state doesn’t take place while “o” represents some state has appeared. We regard one of the characters as a digit and encode them as the first digit, the second digit, etc. from left to right and from top to bottom. The coding sequence is as following:

row Line	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
2	17	18	19	20	21	22	23	24	25	26	27	28	29			

For the definition of each digit, please refer to the following table.

3.Digit definition table

No	Name	No	Name
1	PTO solenoid	16	Reverse lamp in operation
2	PTO neutral solenoid	17	Rear fog lamp in operation
3	All-wheel drive solenoid	18	Ether electric injection pump in operation
4	Wheel differential solenoid	19	Left flash lamp in operation
5	Axle differential solenoid	20	Right flash lamp in operation
6	Working lamp	21	15# Aux. relay
7	Exhaust brake valve	22	Windscreen wiper relay
8	Lift valve in operation	23	High power relay of air conditioner
9	Low power 2 in operation	24	High beam lamp relay
10	Low power 3 in operation	25	Low beam lamp relay
11	Low power 4 in operation	26	Front fog lamp relay
12	Low power 4 in operation	27	D + Aux. relay
13	Electrical horn in operation	28	Position lamp relay
14	Air horn in operation	29	
15	Brake lamp in operation		

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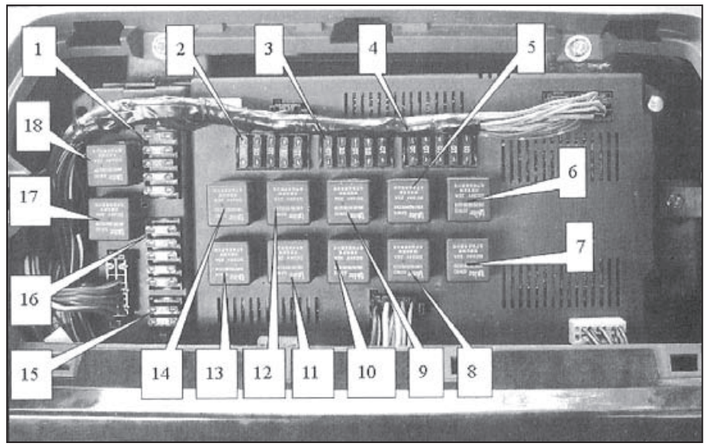
5 Control board



1. Fs fuse 2. F4 fuse 3. F5 fuse 4. F6 fuse 5.J4 relay 6.J5 relay 7. J10 relay 8. J9 relay 9. J3 relay 10. J8 relay 11. J7 relay 12. J2 relay 13. J6 relay 14. J1 relay 15. F1 fuse 16. F2 fuse 17. J12 relay 18. J11 relay

Power relay code description

Code	Relay name
J1	Right turn lamp
J2	15# Aux. electric source
J3	Air conditioner electric source
J4	Headlamp (high beam)
J5	Front fog lamp
J6	Left turn lamp
J7	Windscreen wiper
J8	Headlamp (low beam)
J9	Front fog lamp
J10	D + electric source
J11	Spare
J12	Spare

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Fuse and relevant relay used by control board

Fuse No.	Capacity	Relevant relay	Use
F1-1	15A	-	Seat cushion adjustment/air dryer/rear mirror heating
F1-2	15A	-	Key switch (30#)
F1-3	15A	-	ABS – trailer (30# electric source)
F1-4	15A	-	Left cigarette lighter
F1-5	15A	-	Right cigarette lighter
F2-1	15A	-	ECAS (30# electric source)
F2-2	15A	-	ABS (30# electric source)
F2-3	15A	-	ABS (30# electric source)
F2-4	15A	-	Left power window
F2-5	15A	-	Right power window
F3-1	15A	-	Spare relay - 2
F3-2	15A	-	Spare relay - 1
F3-3	15A	-	ABS (15# power source)
F3-4	15A	-	ECAS(15# power source)
F3-5	15A	-	15# electric source

F4-1	15A	J1, J6	Turn lamp fuse
F4-2	25A	-	Intelligent power IC electric source fuse (30# electric source)
F4-3	10A		15# Aux. electric source
F4-4	10A	J2	15# Aux. electric source
F4-5	10A		15# Aux. electric source
F5-1	10A	-	30# (Combination instrument, left module)
F5-2	10A	J7	Windscreen wiper
F5-3	25A	J3	Air conditioner electric source
F5-4	10A	J8	Headlamp (low beam)
F5-5	25A	J4	Headlamp (high beam)
F6-1	25A	J9	Position lamp
F6-2	15A	J10	D + electric source
F6-3	10A	J5	Front fog lamp
F6-4	15A	J11	Spare
F6-5	10A	J12	Spare

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6 Electrical principle diagram

The vehicle electric circuit adopts single – line system, minus earth, rating voltage 24V.

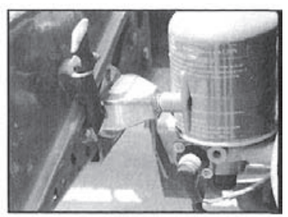
The electric wire color in the diagram is represented by an English capital letter.

Letter	A	B	C	D	E	F	G	H	I	K	L	M	N
Color	red	black	white	yellow	grey	green	violet	orange	dark blue	light blue	brown	ground	pink

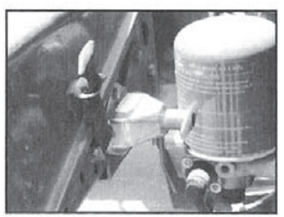
7 Cautions for electric welding operation

If it's necessary to perform electric welding when the vehicles is repaired or retrofitted, dismount the HOWO intelligent control system first!

7.1 Turn off the battery switch as shown in fig.

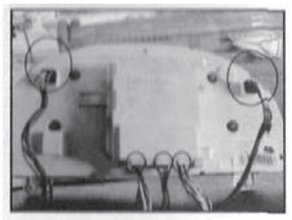


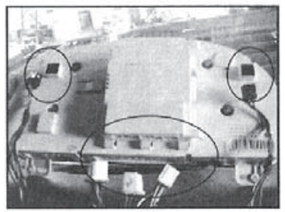
Switch on



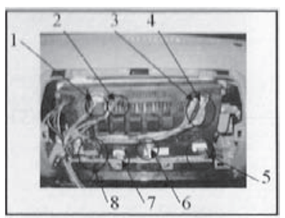
switch off

7.2 Dismount the dashboard and turn it over in the cab. The connecting conditions of each plug which must be cut off is shown in fig. Dismount all the five plugs as shown in fig.





7.3 After opening the cover of control board in the cab, the connecting conditions of each plug which must be cut off is shown in fig (There are eight plugs in total, including power plug). The eight plugs are required to be completely separated from their sockets as shown in fig.



7.4 After performing the electrid welding, restore each plug to its original condition.

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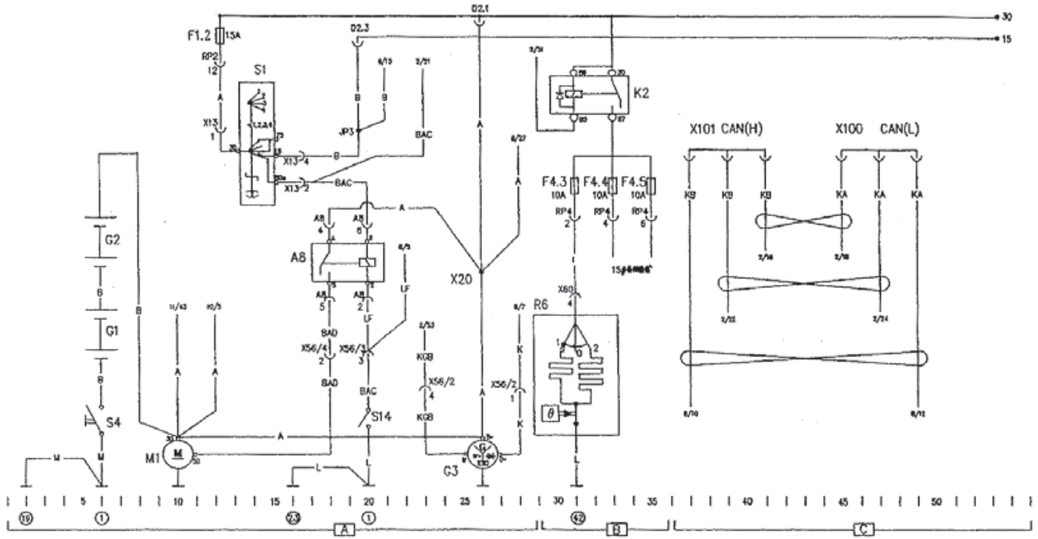
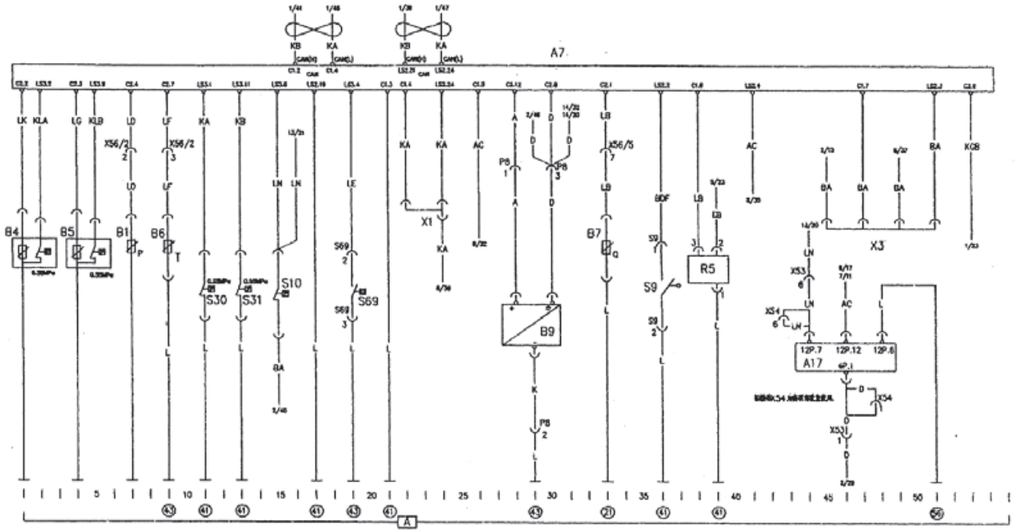


A8 Starting relay
G1, G2 Battery
G3 Alternator
M1 Starter
F1.2 Key switch fuse
S1 Key switch
S4 Mechanical power switch
S14 Gearbox neutral switch
X20 Distribution box
JP3 Junction box
R6 electric heating seat
X100 Junction box of CAN signal line
X101 Junction box of CAN signal line
K2 15# electric source relay J2
F4.3 Seat heating fuse
F4.4 15# electric source spare fuse
F4.5 15# electric source spare fuse

1. Gearbox earth point
19. Frame right side member earth point, middle front
23. Frame right side member earth point, rear
42. Cab earth point, middle

A. Power system
B. Electric heating seat
C. Junction box of CAN signal line



A7 Instrument cluster and left control module
B1 Oil pressure sensor
B4 Brake air pressure I sensor
B5 Brake air pressure II sensor
B6 Water temperature sensor
B7 Fuel sensor
B9 Speed sensor
S10 Brake lamp switch
S30 Spring brake switch
S31 Aux. air switch
S9 Exhaust brake switch
S69 Steering oil level switch
R5 Instrument lighting switch
A17 Trip recorder

21. Solenoid earth point
41.Cab earth point, left
42. Cab earth point, middle
43. Cab earth point, right
56. Roof earth point, right
A.Signal switch and instrument sensor

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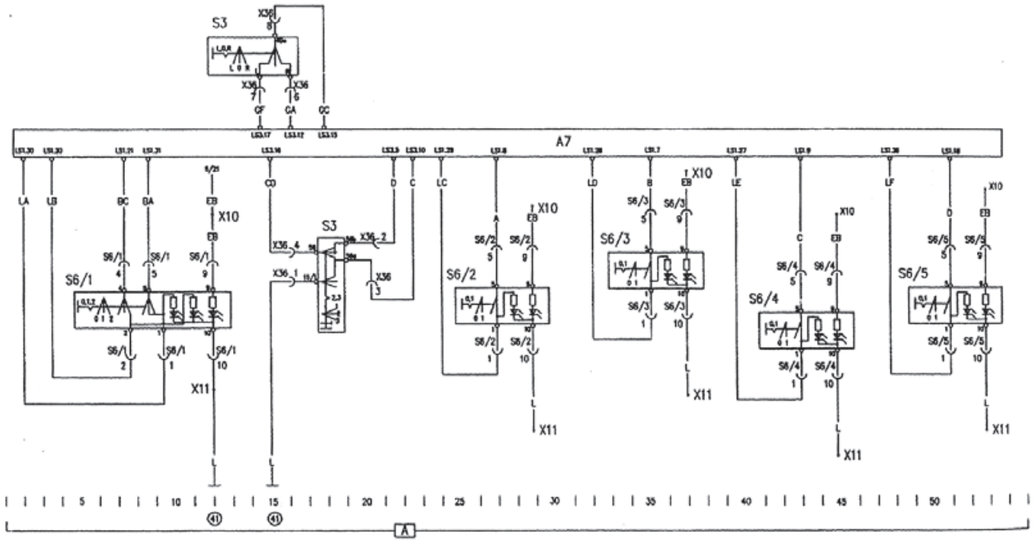
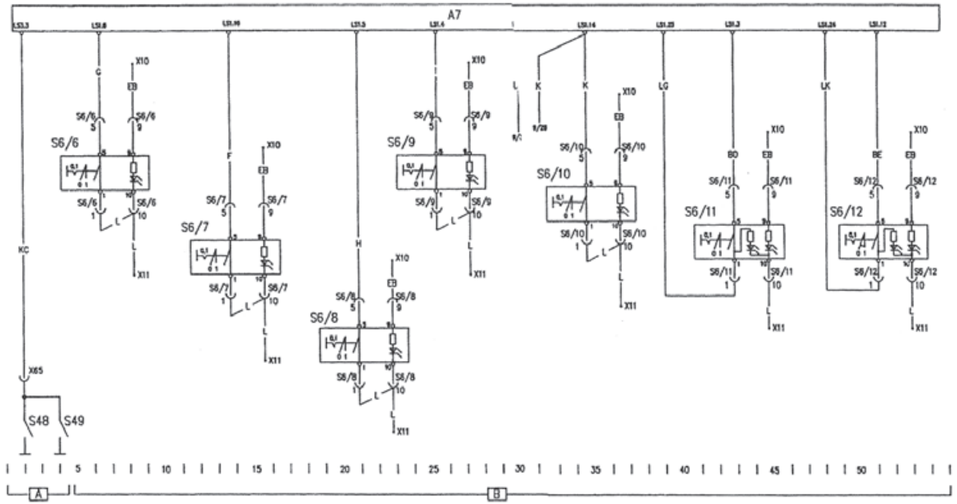


A7 Instrument cluster and left control module
S3 Combination switch
S6/1 Light switch
S6/2 Front fog lamp switch
S6/3 Rear fog lamp switch
S6/4 Emergency warning switch
S6/5 Horn conversion switch
X10 Toggle switch lighting anode junction box
X11 Toggle switch lighting cathode junction box
41. Cab earth point, left
A.Combination switch and toggle switch



A7 Instrument cluster and left control module
S48 Horn button on the steering wheel
S49 Horn button on the steering wheel
S6/6 PTO switch
S6/7 PTO neutral switch
S6/8 Wheel differential switch
S6/9 Axle differential switch
S6/10 All-wheel drive switch
S6/11 Working lamp switch
S6/12 Cord-start switch
X10 Toggle switch lighting anode junction box
X11 Toggle switch lighting cathode junction box
A.Horn button on the steering wheel
B.Toggle switch

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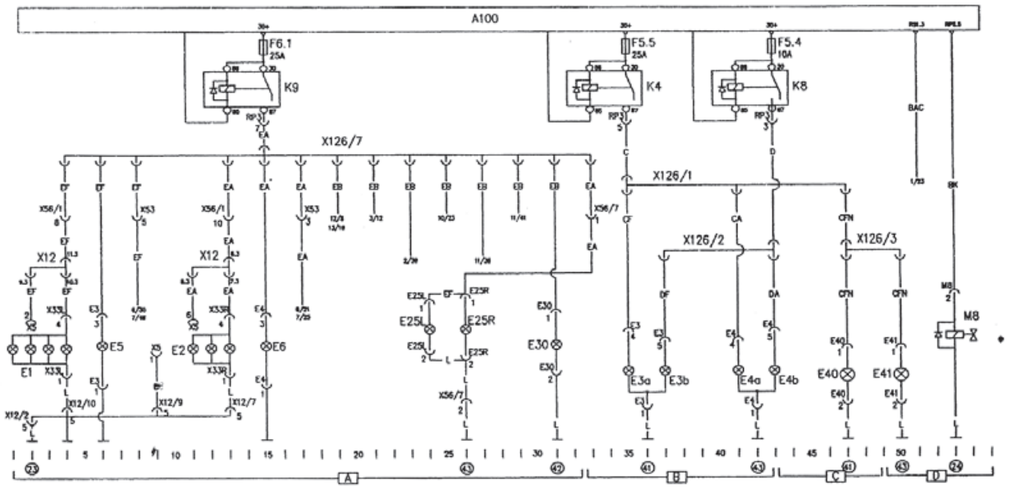
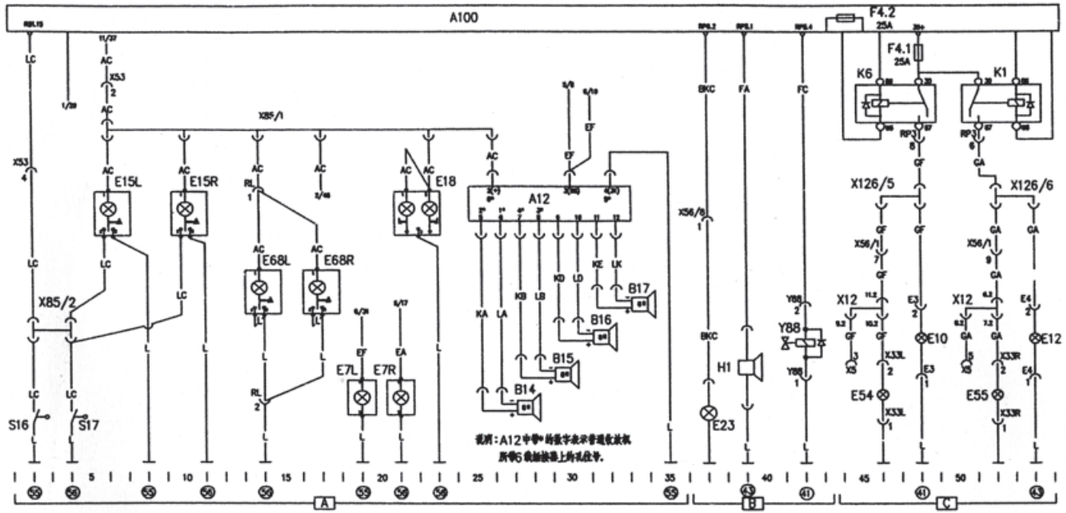


A100 Right control module
E1 Rear position lamp – left, license lamp
E2 Rear position lamp, right
E3a Headlamp high beam, left
E3b Headlamp low beam, left
E4a Headlamp high beam, right
E4b Headlamp low beam, right
E5 Front position lamp, left
E6 Front position lamp, right
E25L.R Side marker lamp, tractor
E30 Ash tray lighting lamp
E40 Aux. high beam lamp, left
E41 Aux. high beam lamp, right
F6.1 Position lamp fuse
K9 Position lamp relay J9
F5.4 Low beam lamp fuse
K8 Low beam lamp relay J8
F5.5 High beam lamp fuse
K4 High beam lamp relay J4
M8 Ether cold – start solenoid
23. Frame right side member earth point, rear
24. Eher tank installation site earth point on right side member, front
42. Cab earth point, middle
43.Cab earth point, right
55. Roof earth point, left
56. Roof earth point, right
A.Position lamp
B.Headlamp
C. Aux. high beam lamp
D. Ether cold – start device



A100 Right control module
E15L, R Interior lighting lamp, left and right
E18 Interior lighting lamp, middle
E7L, R Front width lamp, left and right
E68L, R Sleeping bed reading lamp, left and right
X85/1,2 Junction box
S16,S17 Door lamp switch, left and right
A12 Radio & tape player
B14 Front loudspeaker, left
B15 Front loudspeaker, right
B16 Rear loudspeaker, left
B17 Rear loudspeaker, right
H1 Electric horn
Y88 Air horn solenoid
S48,S49 Horn button
E23 Working lamp
E10, E12 Front turn lamp, left and right
E54,E55 Rear turn lamp, left and right
F4.1 Turn lamp fuse
K1 Right turn lamp relay J1
K6 Left turn lamp relay J6
F4.2 30# power IC electric source fuse
43. Cab earth point, right
41. Cab earth point, left
43. Cab earth point, right
55.Roof earth point, left
56. Roof earth point, right
A.Electric appliance of standard cab
B.Working lamp, horn
C.Turn lamp

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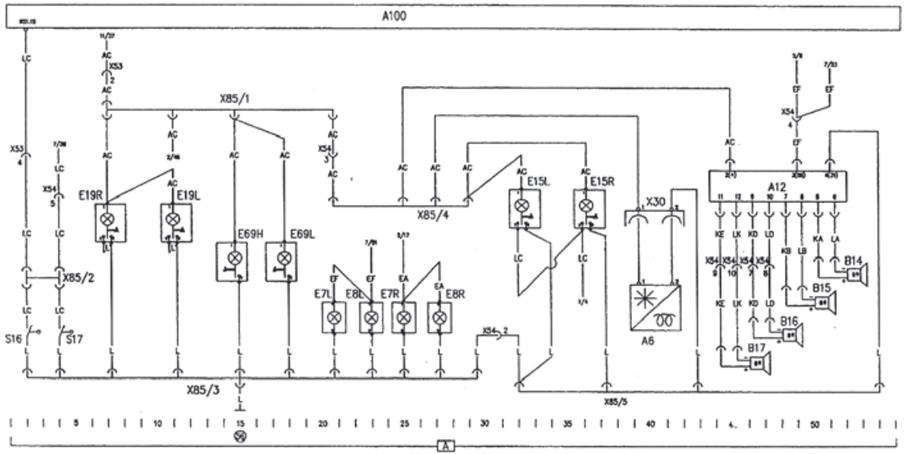
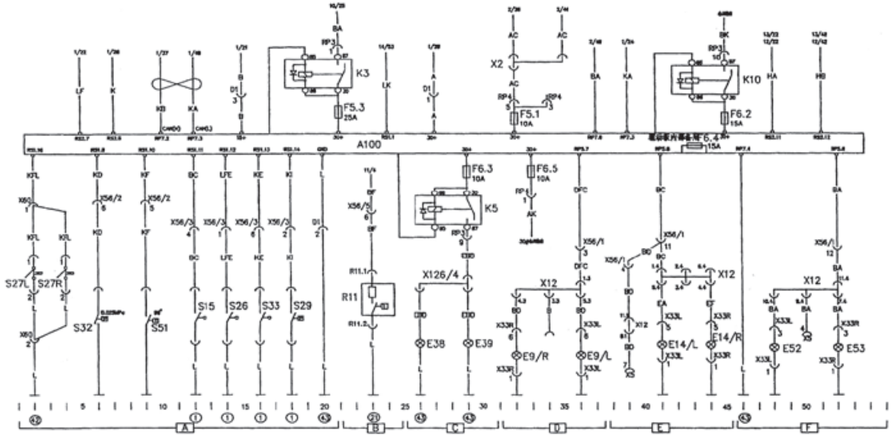


A100 Cab control module, right
A6 Thermal container
E15L Interior lighting lamp, left
E15R Interior lighting lamp, right
E69H Reading lamp of upper berth
E69L Reading lamp of lower berth

E19L Interior lighting lamp of left roof
E19R Interior lighting lamp of right roof
E7L Front width lamp,left
E7R Front width lamp, right
X85/3 14- line junction box
X85/1,2,4,5 4- line junction box

X30 Cigarette lighter socket
S16 Door lamp switch, left
S17 Door lamp switch, right
A12 Radio & tape player
B14 Front loudspeaker, left
B15 Front loudspeaker, right

B16 Rear loudspeaker, left
B17 Rear loudspeaker, right
56. Roof earth point, right
A.Electric appliance of high – roof cab



A100 Cab control module, right
S15 Reverse switch
S26 Low range gear switch
S27L Cab lock switch, left
S27R Cab lock switch, right
S33 High range gears switch
S29 Air filter blocking switch
S32 Oil pressure warning switch

S51 Water temperature warning switch
R11 Air dryer
E38, E39 Front fog lamp, left and right
E52,E53 Brake lamp, left and right
E9/L, R Rear fog lamp, left and right
E14/L, R Reverse lamp, left and right
F6.3 Front fog lamp fuse
K5 Front fog lamp relay J3

F6.2D + Electric source fuse
K10 D + Relay J10
F5.1 Instrument, left control 30# electric source
1. Gearbox earth point
21. Solenoid earth point
43.Cab earth point, right

A. Switch signal input
B. Air dryer
B.Front fog lamp
D. Rear fog lamp
E. Reverse lamp
F. Brake lamp

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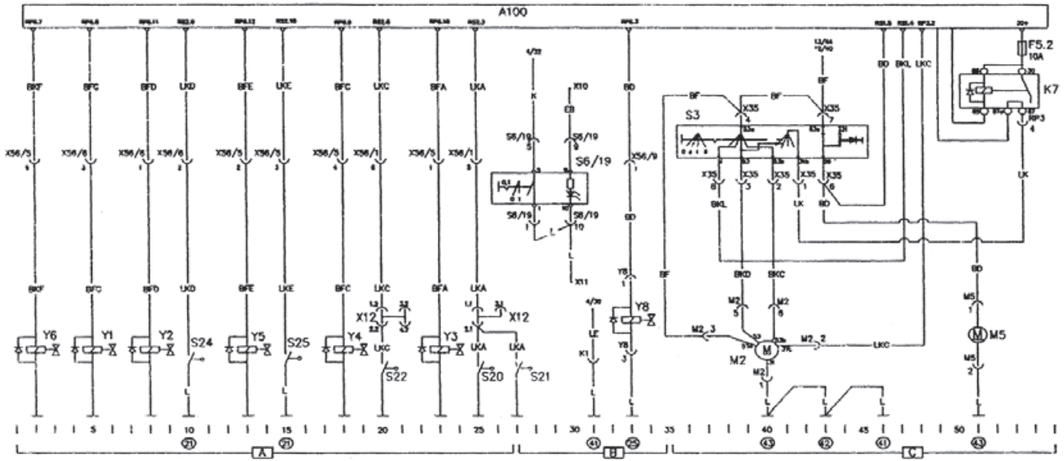
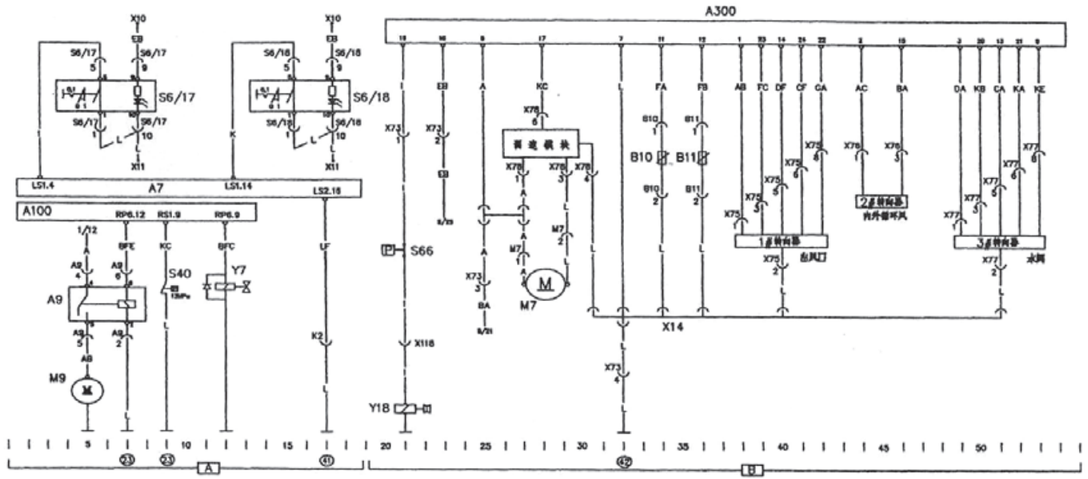


A100 Cab control module, S3 Combination switch
M2 Wiper motor M5 Washing pump moto
S20 Wheel differential switch of intermediate axle
S21 Wheel differential switch of rear axle
S22 Axle differential switch
S24 PTO switch S25 All – wheel drive switch
Y1 PTO neutral solenoid Y2 PTO solenoid
Y3 Wheel differential solenoid]
Y4 Axle differential solenoid
Y5 All – wheel drive solenoid
Y6 Exhaust brake solenoid
Y8 Trailing axle lifting solenoid
S6/19 Trailing axle lifting switch
X5 7 – hole socket in the trailer
F5.2 Wiper fuse
K7 Wiper relay J7

Description on the lifting function of trailing axle

When connecting with the connector K7, LE line is connected with earth line, the position of all – wheel drive switch will also be used as axle lifting switch S6/19. When S6/19 switches on, the solenoid will be driven and the trailing axle will drop down; If reverse switch is on , Y8 drive will be cancelled, the trailing axle will lift up. Y8 can only be driven again till S6/19 returns to its initial position and switches on. The reverse switch has the priority. When the trailing axle is in lifting condition, the trailing axle indicator on the instrument cluster will light up.

A.Differential lock and PTO system
B.Trailing axle lifting
C.Windscreen wiper, washing pump



A7 Instrument cluster and left control module
A9 Support shaft lifting relay A100 Right control module
A300 Air conditioning control module
S6/17 Support shaft go – down switch
S6/18 Support shaft go –up switch
M9 Support shaft lifting motor S40 Hydraulic switch
Y7 Change solenoid M7 Wind moto
B10 Interior temperature sensor
B11 Evaporator temperature sensor X14 14 – line junction box
X118 Air conditioning cable connector Y18 Solenoid clutch

Description on the lifting operation of support shaft

1.When connecting with the connector K7, the position of axle differential switch will also be used as support shaft go – down switch S6/17, and the position of all – wheel drive switch will also be used as support shaft go –up switch S6/18. The go – up switch is interlocked with the go –down switch. When opening the go – down switch, the change valve Y7 will be driven and stop operating after 40 seconds; when opening the go –up or go –down switch, the coil A9 will be driven and switch of after 40 seconds. If the pressure of hydraulic line reaches 13Mpa within 40 seconds, the switch S40 will switch off. The coil A9 will switch off immediately. Pressure has the priority.

2. When the suppor shaft is in lifting condition, the support shaft indicator on the instrument cluster will light up.

23. Frame right side member earth point, rear
41. Cab earth point, left 42. Cab earth point, middle
A. Lifting control of support shaft
B. Intelligent controlled air donditioning system

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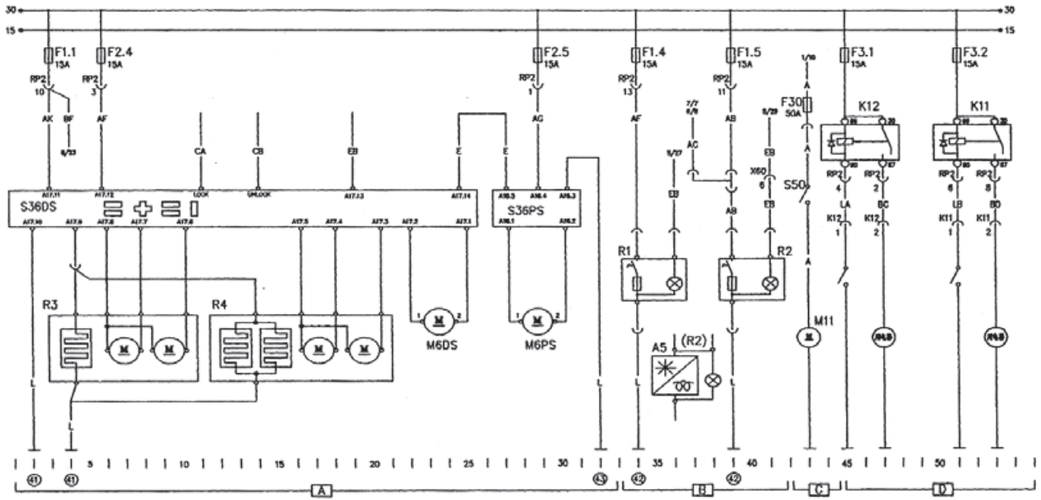
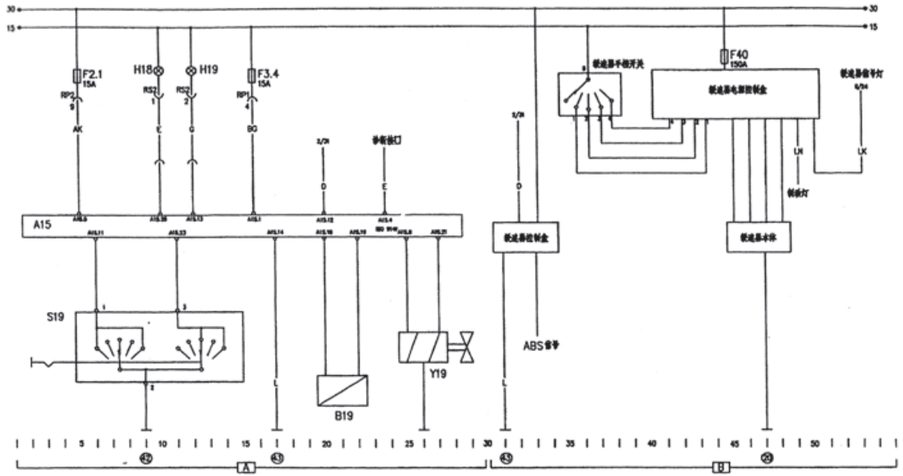


S36DS Driver's side door switch
S36PS Co – driver's side door switch
M6DS Driver's side window glass regulator
M6PS Passenger's side window glass regulator
R3, R4 Rear mirror, left and right
R1, R2 Cigarette lighter, left and right
F2.4 Power window fuse, left F2.5 Power window fuse, right
F1.1 Electric adjusting and heating rear mirror, air dryer fuse
F1.4 Cigarette lighter fuse, left F1.5 Cigarette lighter fuse, right
F30 Cab electric lifting fuse S50 Cab lifting button
M11 Cab tipping motor A5 Electric cup
F3.1 Spare relay K12 fuse F3.2 Spare relay K11 fuse
K11 Spare relay J11 K12 Spare relay J12
1.Gearbox earth point 41. Cab earth point, left
42.Cab earth point, middle Description on function area B
If the cigarette lighter R2 on the side of the co – driver is not used, the electric cup A5 can be plugged directly in the socket R2 to get electricity.
A.Electric controlled unit of cab door
B.Cigarette lighter
C.Cab electric lifting
D.Spare relay



A13 ECU of the ABS/ASR
S6/13 ABS check switch
Y11 Front solenoid, left
B13 Front wheel sensor, left
Y12 Front solenoid, right
B14 Front wheel sensor, right
Y13 Front solenoid, left
B15 Rear wheel sensor, left
Y14 Rear solenoid, right
B16 Rear wheel sensor, right
F2.2 ABS 30# fuse
F3.3 ABS 15# fuse
X6 ABS 7 – hole socket in the trailer
X14 ECU 14 – hole connector
X18 ECU 18 – hole connector
F1.3 ABS 30# electric source fuse, trailer
F3.5 ABS 15# electric source fuse, trailer
41. Cab earth point, left
42. Cab earth point, middle
43. Cab earth point, right
A: ABS D – VERSION BASIC
4S/4M WABCO

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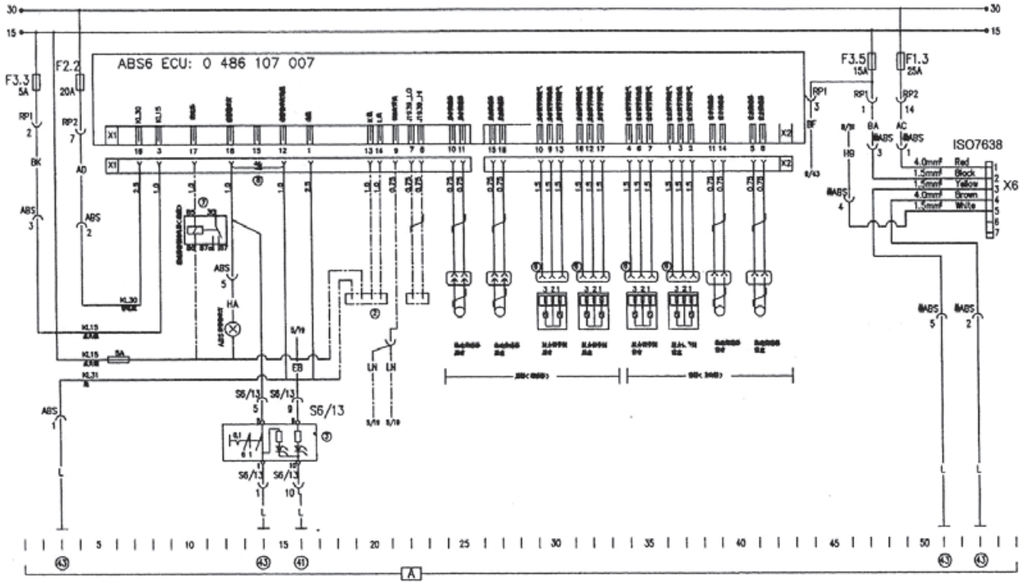
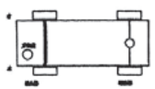
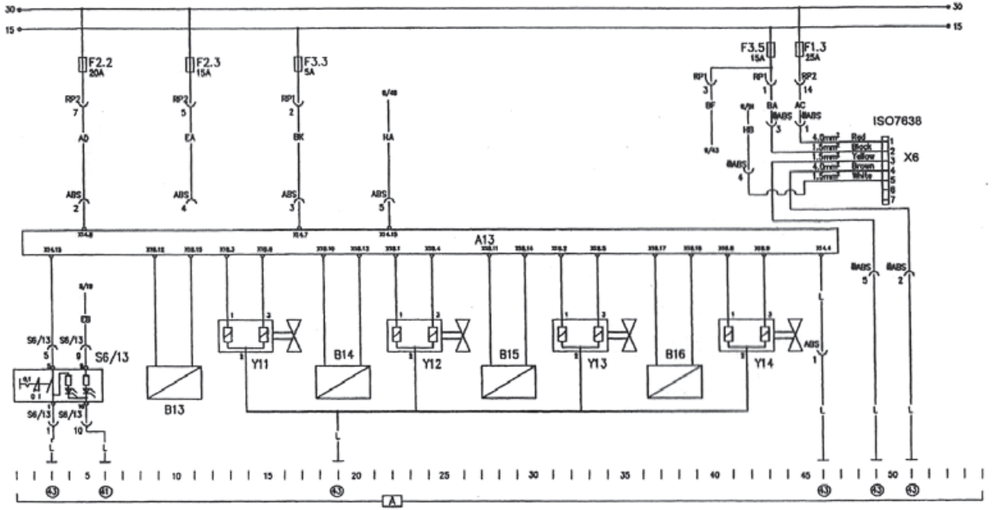




41.Cab earth point, left
43.Cab earth point, right

A: ABS6 ECU standard 4S/4M KNORR



A15 ECU of the single – point control ECAS
H18 Abnormal height indicator (yellow)
H19 Fault indicator (red)
B19 Height sensor

Y19 Solenoid
S19 ECAS remote – control unit
F3.4 ECAS 15# electric source fuse
F2.1 ECAS 30# electric source fuse

F40 Eddy current retarder fuse
42. Cab earth point, middle
43. Cab earth point, right
A. Single – point control air suspension
B. Eddy current retarder

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PART FIVE

Engine

1. Use and Maintenance of WD615 Series of E-control common-rail engine

⚠ Cautions!

High-quality lubrication-oil, oil filter and anti-freeze coolant shall be regularly used and replaced according to User's Manual. Natural water can't be used directly.

High-quality diesel oil shall be used and diesel oil filter shall be regularly maintained and replaced according to User's Manual. Water and precipitate in oil-water separator shall be dropped out everyday. The cleanliness of fuel tank must be regularly checked.

Liquid level of oil and coolant, and sealing of intake system shall be checked before engine is started daily.

When engine is started, running at idle shall last for 3 to 5 minutes to warm it up. The engine shall be started when water temperature reaches 60℃. Running at idle shall also last for 3 to 5 minutes before the vehicle is shutdown.

Use, inspection, maintenance and repair shall be undertaken according to User's Manual. Repair work shall be carried out by qualified people. Maintenance and repair work shall be done in authorized service station as much as possible.

Fuel injection system of E-control diesel engine shall produce high voltage (110V) during the running of diesel engine, so don't touch fuel injector solenoid valve wire or components to avoid electric shock during this period.

E-control high-pressure common-rail diesel engine makes high injection pressure (160Mpa). Both the oil rail and fuel in fuel injection pipe have very high pressure.. Therefore, when fuel leakage happens, please stop the vehicle with diesel engine and repair it after pressure in fuel pipe decreases to avoid personal injury.

In order to avoid harness short-circuit, it is forbidden to flush the harness of diesel engine with water. If there is any water on the harness, start the diesel engine only after it is dried by cool air.

Other unaccounted questions, please refer to instructions of “ Use and maintenance instruction of WD615 EuroⅢ series of diesel engine”, which is attached with the vehicle.

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1.1 Main system parameters and specifications of WD615 series of E-control common-rail engine

WD615 series of engine adopts E-control common-rail injection system, four-valve structure and electronically controlled leakage braking system of Japanese Denso Company. The maximum common-rail pressure could be up to 180Mpa. According to engine rotating speed, temperature, loads, water temperature, boost pressure and vehicle running situation, engine ECU could precisely adjust fuel injection amount, fuel injection times, common-rail pressure and advance angle, which will make engine emission, noise, power performance, economical performance, stable performance, low-temperature starting performance and vehicle operation performance at best situation.

1.1.1 Common abbreviation and definition

CRS Common-rail system

ECU Electronically controlled unit

PCV Pump pressure control valve

TWV Two way solenoid valve

1.1.2 Main system technical parameters and accessory specification of WD615 Series of Euro Ⅲ diesel engine

1.1.2.1.Lubrication system

a) Lubrication oil type: CF-4 15W/40

b) Lubrication oil addition amount

Oil adding time	（L） Oil addition amount
When new engine is added with oil for first time	31
When changing the oil and filter core	28
When changing the oil	27

c) Oil pressure range while normally running (oil temperature≥80℃): 100～600kpa

1.1.2. 2 E-controlled high-pressure common-rail fuel system

a)ECU type: R61540090002 Manufacturer: DENSO, Japan

b)Fuel injecting pump type: HPO Manufacturer: DENSO, Japan

c)Fuel injector type: 670* 9(with QR) Manufacturer: DENSO, Japan

Injection pressure: 40～160Mpa（MAX）

d)Requirement for diesel oil: Light diesel oil in according to GB17691-2005 standard

e)Oil coarse filter (with oil-water separator, optional oil heater): drawing No. WG1540080211

Filter core change interval: 2000km (reference value， standard oil)

f)Oil filter: drawing No. WG1540080110

Filter core change interval: 3000km

1.1.2.3 Cooling system

Fan: Φ590、Φ640、Φ704 ring type fan (silicone oil)

Coolant volume in diesel engine: 21.5L

1.1.2.4Low temperature starting device: (Option for customers)

——Air inlet with intake air preheating device. Parameters of heater: 24V, 2.4Kw. Engine can be started when temperature is between -25～-30℃.

——Manufacturer: Philips

——Without intake air preheating device. Engine can be started when temperature is between -5～-10℃.

1.1.2.5 Starting system

Starter: ISKRA，24V、7.5kW

Generator: 28V55A 1540W

Battery: 2×12V135Ah

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1.1.2.7 Air compressor

Type: Dual cylinder piston type, water-cooling

Cylinder bore×stroke 85×56mm

Displacement: 636mL

Working pressure: 10bar

Maximum pressure: 12.5bar

1.1.2.8 Air distribution timing (1 mm clearance) (See Fig 5-1)

Intake valve open Top dead center

Intake valve close 18° after bottom dead center

Exhaust valve open 37° before bottom dead center

Exhaust valve close 3° before top dead center

Cold valve clearance Intake 0.30mm

Exhaust 0.40mm

2.13 Electronically controlled exhaust & discharge braking (Optional for customers)

Braking power: 160kW (rated 2200r/min)

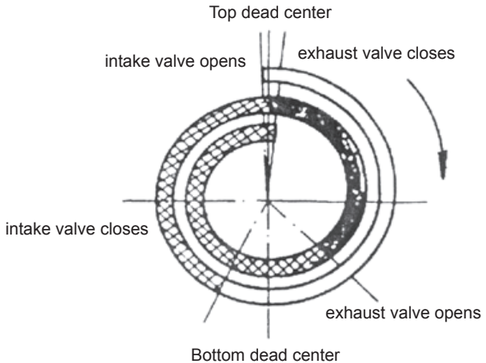

Fig 5-1

1.2 Electrical system of WD615 series of engine E-control common-rail

The electric system is composed of ECU, sensor, switch, relay, actuator (fuel feed pump solenoid valve, fuel injector solenoid valve, exhaust braking valve, leakage braking valve), lights, communication data connection and DC24V power device.

1.2.1 Sensor

Sensors installed on the engine are as following: (provided by engine supplier, see Figure 5-3)

(1)Rotating speed sensor

(2)Cylinder discrimination sensor

(3)Coolant temperature sensor

(4)Inlet air temperature sensor

(5)Return oil temperature sensor

(6) Inlet air pressure sensor

(7) Common-rail pressure sensor

(8) Oil pressure sensor

(9) Diesel oil moisture alarming sensor

(installed in the diesel oil coarse filter element) (Optional for customers)

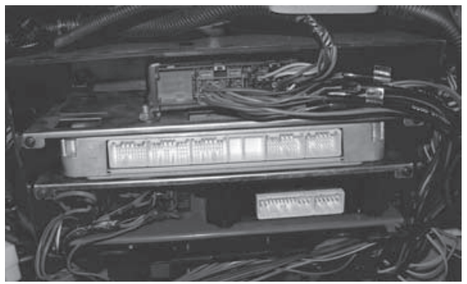

Fig5-2

Sensors installed in vehicles are as following: (supplied by vehicle factory)

(1)、Acceleration pedal sensor 1, 2

(2)、Vehicle speed sensor

(3)、Power output acceleration sensor

(4) 、Idle speed control variable sensor

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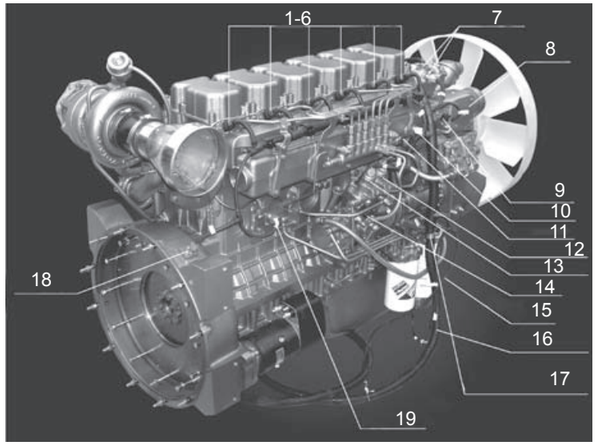

Figure 5-3 Sensors on engine

1-6 cylinder fuel injector, leakage braking device, four core connector
7.Outlet water temperature sensor
8.Inlet air heater
9.Inlet air pressure sensor
10.Inlet air temperature sensor
11.Common-rail pressure sensor
12.PCV1 fuel feed pump solenoid valve
13.PCV2 fuel feed pump solenoid valve
14.Cylinder discrimination sensor
15. Engine below vehicle/stop switch wire
16. Wiring harness assembly (Connecting ECU in vehicles)
17. Fixed point of engine wiring harness; the length connecting with ECU shall be calculated from this point
18. NE rotating speed sensor
19.Oil return temperature sensor

1.2.2 Switch

(1) Key switch; (2) Starting switch;

(3) Exhaust braking switch; (4) Clutch switch;

(5) Braking switch; (6) Neutral switch;

(7) Diagnosis switch; (8) Air-conditioner switch;

(9) Cruise main switch; (10) Cruise setup switch;

(11)Cruise reset switch; (12) Warm-up switch;

(13) Trailer switch; (14) Power output switch;

(15) Engine stop switch;(16)Reverse gear switch

1.2.3 Rela(provided by vehicle factory)

(1) Air heating relay

(2) Main relay

(3) Fuel feed pump pressure control valve relay

(4) Starting valve

(5) Exhaust braking relay

(6) Leakage braking relay (Option)

(7) Braking relay (for getting the signal of braking indicator)

1.2.4 Actuator

(1) PCV fuel feed pump pressure control solenoid valve: 2 pieces

(2) Fuel injector solenoid valve: 6 pieces

(3) Exhaust braking valve

(4) Leakage braking solenoid valve (Optional for engine): 6 pieces, DC24V, 0.78A/pieces

1.2.5 Indicator

(1)Exhaust braking indicator

(2)Diagnosis indicator

(3)Pre-heating indicator

Oil-water separator indicator

1.2.6 Communication data connection

(1) Port CAN1 is used for connecting diagnosis tools and SOB data input

(2) Port CAN2 is used for connection of ECU and other electronically control units

(3) (SINK) TAC2 is the signal output of ECU rotating speed sensor

1.2.7 Exhaust-leakage braking device (Optional)

The engine is equipped with exhaust-leakage braking device made by Jacons, USA. It can work simultaneously with exhaust braking. When engine is at 2200r/min, the braking power can be no less than 160kW, which obviously improves the braking performance and safety performance of vehicles. For exhaust-leakage braking device, please see Figure 5-4.

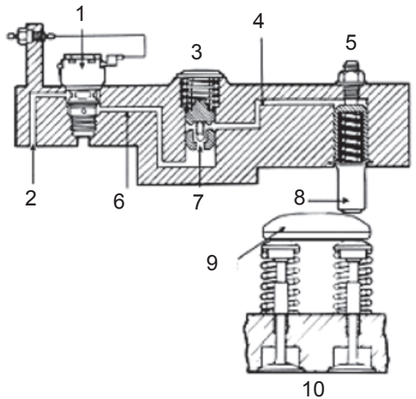

Figure 5-4

1. solenoid valve
2. oil inlet
3. control valve
4. high-pressure oil
5. adjusting screw
6. low-pressure oil
7. ball valve
8. piston
9. cross connector
10. exhaust valve

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1.2.8 Electronically controlled heating device

Resistance type air pre-heating device can preheat under the control of electronically controlled system before the startup of the engine. After engine rotates, heating keeps for some time automatically according to rotating speed of engine, and it will largely improve cold starting performance of engine and reduce white smoke of unburned diesel under low-temperature starting, which is difficult to avoid for traditional diesel engines.

1.2.9 Engine fault flash code

Serial No.	Fault code	Fault conditions	Fault flash code
1	P0122	Acceleration pedal 1. Too low signal	22
2	P0123	Acceleration pedal 1. Too high signal	22
3	P0222	Acceleration pedal 2. Too low signal	22
4	P0223	Acceleration pedal 2. Too high signal	22
5	P0121	Acceleration pedal 1. It can’t be closed.	22
6	P0221	Acceleration pedal 2. It can’t be closed.	22
7	P0120	Acceleration pedal 1. It can’t be closed.	22
8	P0220	Acceleration pedal 2. It can’t be closed.	22
9	P2120	Double acceleration pedal. Invalid signal	22
10	P2163	Idle speed switch is open	42
11	P2109	Idle speed switch is closed	42
12	P0238	Inlet air pressure sensor. Too high signal	37
13	P0237	Inlet air pressure sensor. Too low signal	37
14	P0236	Inlet pressure sensor. Invalid property	37
15	P0227	PTO pedal. Too low signal	23

Serial No.	Fault code	Fault conditions	Fault flash code
16	P0228	pedal. Too high signal	23
17	P0193	Common-rail pressure sensor. Too high signal	67
18	P0192	Common-rail pressure sensor. Too low signal	67
19	P0191	Common-rail pressure sensor. Signal keeps for the medium range	67
20	P0563	Vehicle voltage. Too high voltage	26
21	P0562	Vehicle voltage. Too low voltage	26
22	P0118	Cool water temperature sensor. Too high temperature	11
23	P0117	Cool water temperature sensor. Too low temperature	11
24	P0183	Fuel water temperature sensor. Too high signal	14
25	P0182	Fuel water temperature sensor. Too low signal	14
26	P0113	Inlet air temperature sensor. Too high signal	16
27	P0112	Inlet air temperature sensor. Too low signal	16
28	P2229	Air pressure sensor. Too high signal	15
29	P2228	Air pressure sensor. Too low signal	15
30	P1143	Idle speed potentiometer. Too high signal	44
31	P1142	Idle speed potentiometer. Too low signal	44
32	P0617	Starting switch. Short-circuit of battery	45
33	P0337	NE sensor. Impulse-free	13
34	P0342	G sensor. Impulse-free	12
35	P0385	NE and G. Impulse-free	13

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Serial No.	Fault code	Fault conditions	Fault flash code
36	P0503	Vehicle speed sensor. Too high frequency	21
37	P0502	Vehicle speed sensor. Output open circuit. Short-circuit	21
38	P0501	Vehicle speed sensor. Signal fault	21
39	P1681	Exhaust braking output. Open circuit. Short-circuit of ground	28
40	P1682	Exhaust braking output. Short-circuit of battery	28
41	P2148	Fuel injector COM1. Output short-circuit of battery	57
42	P2147	Fuel injector COM1. Output short-circuit of ground	57
43	P2146	Fuel injector COM1. Output load open circuit; TWV1、3、5 load open circuit	57
44	P2151	Fuel injector COM2. Short-circuit to battery; TWV2、4、6 output short-circuit to battery	58
45	P2150	Fuel injector COM2. Short-circuit to ground; TWV2、4、6 output short-circuit to ground	58
46	P2149	Fuel injector COM2. Output load open circuit; TWV2、4、6 load open circuit	58
47	P0201	Fuel injector TWV1 output open circuit; fuel injector coil is disconnected	51
48	P0205	Fuel injector TWV2 output open circuit; fuel injector coil is disconnected	55
49	P0203	Fuel injector TWV3 output open circuit; fuel injector coil is disconnected	53
50	P0206	Fuel injector TWV4 output open circuit; fuel injector coil is disconnected	56
51	P0202	Fuel injector TWV5 output open circuit; fuel injector coil is disconnected	52
52	P0204	Fuel injector TWV6 output open circuit; fuel injector coil is disconnected	54
53	P0611	Capacitor charging circuit; fault	59
54	P0200	Capacitor charging circuit; fault	59
55	P0629	PCV1 output short-circuit; short-circuit to battery	71
56	P2634	PCV2 output short-circuit; short-circuit to battery	72
57	P0629	PCV1 and PCV2 short-circuit to battery	73
58	P0628	PCV1 output open circuit; short-circuit to ground	71
59	P2633	PCV2 output open circuit; short-circuit to ground	72

Serial No.	Fault code	Fault conditions	Fault flash code
60	P0628	PCV1 and PCV2 output open circuit; short-circuit to ground	73
61	P2635	Fuel feed pump; overload of controlling	76
62	P1088	Fuel feed pump; over voltage of controlling	76
63	P1266	Fuel feed pump; no load of controlling	77
64	P0093	Fuel feed pump; no load of controlling, including fuel leakage	78
65	P1089	Common-rail pressure; exceeding upper limit	69
66	P0088	Common-rail pressure; exceeding ultra-high upper limit	68
67	P0301	Cylinder 1 fuel system; fault	61
68	P0302	Cylinder 2 fuel system; fault	65
69	P0303	Cylinder 3 fuel system; fault	63
70	P0304	Cylinder 4 fuel system; fault	66
71	P0305	Cylinder 5 fuel system; fault	62
72	P0306	Cylinder 6 fuel system; fault	64
73	P0219	Engine; overrun	7
74	P0541	Pre-heat the relay; output short-circuit to ground	25
75	P0542	Pre-heat the relay; output open circuit; short-circuit to battery	25
76	P1530	Engine stop switch; it is blocked and stopped	46
77	P0217	Cool water temperature overruns; exceeding upper limit	6
78	P0234	Inlet air pressure sensor; exceeding upper limit	39
79	P0299	Inlet air pressure sensor; exceeding lower limit	39
80	P1676	Reverse switch; open circuit, short-circuit to ground	48

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Serial No.	Fault code	Fault conditions	Fault flash code
81	P1677	Reverse switch; short-circuit to battery	48
82	U0073	CAN1 node failure	8
83	U1001	CAN2 node failure	9
84	P0704	Clutch switch; circuit fault (manual transmission only)	41
85	P0850	Neutral switch; circuit fault (manual transmission only)	47
86	P0263	1# flowing damper works	61
87	P0275	2# flowing damper works	65
88	P0269	3# flowing damper works	63
89	P0278	4# flowing damper works	66
90	P0266	5# flowing damper works	62
91	P0272	6# flowing damper works	64
92	U0121	CAN BUS wire is disconnected from ABS	9
93	U0155	CAN BUS wire is disconnected from instrument	9
94	P0686	Main relay diagnosis; main relay is disconnected	5
95	P1565	Cruise switch; circuit fault	43
96	P1602	QR code data; no input	2
97	P0602	QR code data; error	2
98	P1601	QR code data; definition error (definition of QR code modification is incorrect)	2
99	P0607	CPU failure; detect integrated circuit failure	3
100	P0606	CPU failure; main CPU failure	3
101	P0601	Flash memory area-inspection and error	3
102	P0523	Fuel pressure sensor; too high signal	17
103	P0522	Fuel pressure sensor; too low signal	17
104	P0524	Fuel pressure is low	17
105	P1683	Exhaust braking auxiliary output; short-circuit of ground	1
106	P1684	Exhaust braking auxiliary output; short-circuit of battery	1

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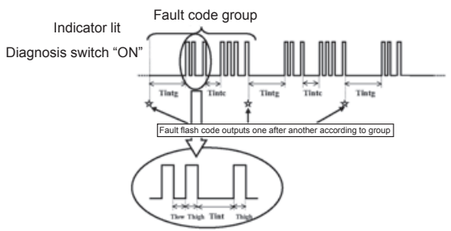
1.2.10 Graphic illustration of fault diagnosis flash code(See Figure 5-5)

When the diesel engine shuts down and diagnosis switch is on “ON”, if fault diagnosis indicator is lit, it shows the indicator works well, otherwise repair work shall be carried out. If the diesel engine is starting or running, fault diagnosis indicator shall be off, otherwise electronically controlled system fault occurrs. When the diesel engine is starting or running and diagnosis switch is on “ON”, fault diagnosis indicator uniformly flashes, flash and interval time TN=288ms. It is shown as following figure:

When fault occurs during diesel engine starting or running, diagnosis indicator is lit, turn diagnosis switch to “ON”, fault diagnosis indicator flashes the output according to fault flash code.

The following figure is the output of flash code 21 and 31.



In above-mentioned figure, diagnosis indicator flash time and interval time is as following:

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

1.3 Operation and maintenance of WD615(EGR) series of Euro Ⅲ diesel engine

1.3.1 Operation attentions

Before running the diesel engine, the height of cooling level, fuel and oil level, and diesel level shall be checked, and moisture of fuel coarse filter shall be discharged.

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

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

During running-in period (3000km), it is suitable for diesel engine to run only under medium load, and the vehicle shall be used without trailer.

Diesel engine oil level check: check must be carried out after engine shuts down 5 minutes. Oil level can’t exceed standard height (it is not allowed to add more oil), otherwise it will cause faults of engine fuel injection and insufficient power. For the engine working with load, load and speed must be reduced before shutdown. Idle speed running must last for no less than 5 minutes.

1.3.2 Maintenance rules

Table 2-1 Three service conditions of automobile accessories

WG Ⅰ	WG Ⅱ	WGⅢ
Poor conditions (severe cold or hot climate, high dust content, used in construction site or bus, municipal engineering vehicle, snow sweeper, fire-fighting engine) or vehicles with annual mileage less than 2×10^4km or with running hours less than 600h	Vehicles with annual mileage less than 到6×10^4km, medium-short distance transportation (for delivery)	Vehicles with annual mileage over 6×10^4km, long distance transportation

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Table 2-2 First-time check, routine check and cycle of maintenance

Service conditions Item	WG Ⅰ	WG Ⅱ	WGⅢ
First-time check	After running 1000～1500km After running 30～50h	After running 1500～2000km	After running 1500～2000km
Routine check (P)	Every 5000km Every 150h	Every 1×10⁴km	Every
Grade 1 maintenance (WD1)	Every 1×10⁴km Every 300h	Every 2×10⁴km	Every 3×10⁴km
Grade 2 maintenance (WD2)	Every 2×10⁴km Every 600h	Every 4×10⁴km	Every 6×10⁴km
Grade 3 maintenance (WD3)	Every 4×10⁴km Every 1200h	Every 8×10⁴km	Every 12×10⁴km
Grade 4 maintenance (WD4)	Every 8×10⁴km Every 2400h	Every 16×10⁴km	Every 24×10⁴km

Table 2-3 Oil change interval of diesel engine in maintenance rules

Service conditions Item	WG Ⅰ	WG Ⅱ	WGⅢ
	Annual mileage less than 2×10⁴km	Annual mileage less than 6×10⁴km	Annual mileage more than 6×10⁴km
First-time check	After running 1000～1500km	After running 1500～2000km	After running 1500～2000km
Routine check (P)	Every 500km	Every 1×10⁴km	Every 1.5×10⁴km
Grade 1 maintenance (WD1)	Every 1×10⁴km	Every 2×10⁴km	Every 3×10⁴km
Grade 2 maintenance (WD2)	Every 2×10⁴km	Every 4×10⁴km	Every 6×10⁴km
Grade 3 maintenance (WD3)	Every 4×10⁴km	Every 8×10⁴km	Every 12×10⁴km
Grade 4 maintenance (WD4)	Every 8×10⁴km	Every 8×10⁴km	Every 24×10⁴km

Table 2-4 Maintenance cretiria of Diesel engine

Diesel engine maintenance items	First-time check	P	WD1	WD2	WD3	WD4
Replace diesel oil (at least once a year)	●	●	●	●	●	●
Replace fuel filter or filter element	●	Every time change diesel oil				
Check and adjust valve clearance	●		●	●	●	●
Check and adjust fuel injector starting pressure					●	●
Replace fuel filter core			●	●	●	●
Clean rough fuel filter or replace filter core			●	●	●	●
Check coolant volume and add it to full	●	●	●	●	●	●
Replace coolant	According to 3.1.3					
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 lightens or it indicates red					
Replace safety filter core of air filter	After cleaning main filter core for five times					
Check and fasten multi-wedge belt	●	●	●	●	●	●

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Check bearing clearance of turbocharger						●
Check and adjust fuel injector on test-bed					●	●
Check, adjust clutch stroke and wire rope conditions	●	●	●	●	●	●
Adjust idle-speed rotation speed	●					
Electric components and electronically controlled system wiring harness	Check it every 250 hours					
Note: ●The mark means maintenance is needed.						

1.3.3 Common faults and solutions

1.3.3.1Diagnosis tools and communication link failure of ECU

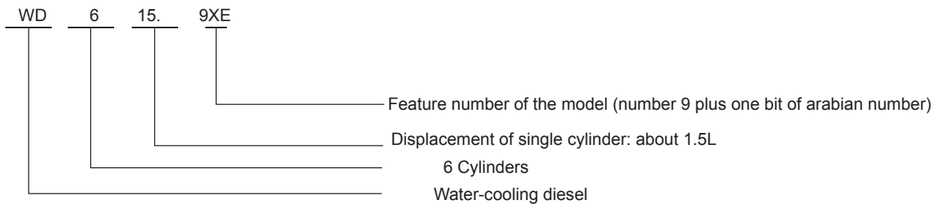
Fault Reason	Elimination Method
Vehicle key switch is on “OFF”	Turn vehicle key switch to ‘ON”
Battery voltage of engine wiring harness connection parts is low or none (lower than 16V)	Check voltage at engine wiring harness connection parts
No voltage on electronically control unit ECU (lower than 16V)	Check voltage at electronically controlled connection parts
Engine wiring harness fuse is broken	Replace fuse of engine electronically controlled system
Fault of data interface	Check voltage and polarity of data interface circuit

1.3.3.2 Other common faults and elimination methods of engine, please refere to relative instructions of“ Use and maintenance instructions of WD615 Euro 3 series of diesel engine”, which is attached with vehicle.

2. Use and Maintenance of WD615 EURO III (EGR) Series of Diesel Engine

WD615 ERO III (EGR) series of diesel engine can fully meet the requirement for power of heavy duty truck and requirement for multi purposes of construction machine. Based on Euro II diesel engine, this series is added with EGR control device, adopts fuel injection pump whose oil feed is controlled electronically, and the connection with the whole vehicle is consistent with Euro II. The only change is the outlet of the thermostat. The engine owns such features as compact structure, good rigidness, reliable operation, long lifetime, excellent performance and economics.

Basic model designation of WD615 series of EURO III diesel engine



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2.1 Main technical data of WD615 State III (EGR) series of diesel engine

Model	WD615.92E	WD615.93E	WD615.95E	WD615.96E	WD615.99E
Type	4strokes, water cooling, in-line, direct injection, dry type cylinder sleeve, EGR				
Number of cylinder	6				
Bore × stroke （mm×mm）	126×130				
Displacement （L）	9.726				
Rated power/rotating speed (kW/r/min)	196/2200	213/2200	247/2200	276/2200	302/2200
Max.torque/rotating speed （N·m/ r/min）	1100 /1100～1600	1160 /1100～1600	1350 /1100～1600	1500 /1100～1600	1700 /1100～1600
Min. fuel consumption (g/kW.h)	195				
Torque reservation rate (%)	29.3	25.5	25.9	25.2	29.7
Compression ratio	17.5：1				
Ignition order	1-5-3-6-2-4				
Cold clearance of valve （mm）	intake 0.30 exhaust 0.40				
Distribution phase （1mm clearance）	intake valve open upper dead center intake valve close 18° behind lower dead center exhaust valve open 37° before lower dead center exhaust valve close 3°before upper dead center				
Advance angle（°）	5	7	9	9	10
Max. unload speed (r/min)	2480+50				
Stable speed at idle (r/min)	600+50				
Emission level	ERO III				

2.2 Structure of WD615 ERO III (EGR) series of diesel engine

2.2.1Body

Improved wide body. There is a joint face where injection pump bracket is installed in the middle of left side of the body. After the bracket is installed, oil feed pump bracket should not be dismantled after parts are machined, and should keep as a whole. The injection pump is just fixed on it.

2.2.2Cylinder head

Cylinder head is special one which is made of NiCr pearlite alloy casting iron, one head for one cylinder, intake and exhaust system of 4 valves, 2 for intake and 2 for exhaust. On the cylinder head, intake and exhaust channels are oriented at both sides. Intake channel generates swirl according to the requirement of direct injection combustion system.

There are four main M16 bolts on each cylinder head and 3 M12 stud bolts shared with contigeous cylinders.

On the cylinder head, mosaic injector bushing structure is adopted, which is good for improving the nozzle radiation and enhancing the reliability of the nozzle. After flowing into cylinder head, the cooling water goes through the water cavity of bridge of the nose, then passes by injector bushing into discharge pipe.

Injector is installed in the middle of intake and exhaust valves.

2.2.3 E-control H pump

WD615 ERO III (EGR) series of diesel engine adopts fuel injection pump of e-control oil supply rate and controls pre-stroke of injection pump by ECU. The customer is not allowed to repair the e-control pump by himself. The regulator is of RQV-K full-stroke.

There is a smoke limiter installed on injection pump which is for improving low rotating speed of waste air turbo at low speed, low pressure at outlet of presser, fewer intake air could cause bad combustion to increase smoke concentration. Pressure compensator senses the pressure in intake pipe by air pipe and control oil supply to make the diesel engine’s smoke concentration at idle. The diesel engine has been adjusted before leaving the factory, so the customer don’t need to adjust it anymore.

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Advance angle adjustment of diesel engine

Adjusting steps as following: align the scale values on the flywheel with the marks on flywheel housing according to advance angle values in the Fuel Matching Table to align the pointer of injection pump with scale line on the connecting flange, then tighten the tensioning bolt of angle adjustment plate with a tightening torque of 280N.m for M16×1.5 and 230N.m for M14×1.5. In case of no monitoring of the computer, don't align the advance angle by watching oil drainage of 1st cylinder.

Injector assembly:

P type multi-hole injector is adopted with an opening pressure of 33MPa.

2.2.4Thermostat

The thermostat is installed at the end of drain pipe, the function of which is to automatically adjust water volume into the radiator according to cooling water temperature and changes circulating range of water to adjust radiation capability of cooling system to guarantee the engine works within proper temperature range.

In order to ensure normal work of the engine, the thermostat must be kept in good technical status and inspected periodically. In case of clogging or poor closing, the thermostat should be dismantled for cleaning or repair, otherwise it will affect the normal work of the engine seriously. It's suggested that thermostat core should be changed after used for one year.

When replacing the thermostat, you only need to open EGR drain elbow to take out of thermostat core. When replacing the core, pay attention to the direction of installation and ensure the direction of vent holes. Keep it at right position and in good sealing condition when installing.

2.2.5EGR intake and exhaust system

EGR waste air recirculation control system cools a part of waste air in exhaust pipe by EGR heat exchanger, conducts it into fresh mixed air in the intake pipe to lower oxygen density and highest combustion temperature in the cylinder to control the generation of harmful NOx, in this way to realize the goal of reducing emission. The device can control waste air recirculation according to engine's working condition by controlling the opening and closing of EGR valve by ECU. It can realize precise control for EGR valve.

EGR valve is usually closed under conditions below: 1. intake air temperature below 10℃; 2. intake air temperature above 70℃; 3. cooling water temperature above 95℃; 4. during changing process of engine working condition; 5. Engine in braking status.

Supercharger: WD615 ERO III (EGR) series diesel engine supercharger is radial waste air turbocharger with release valve which effectively improves medium & low speed performance and reduces emission. Oil for lubricating and cooling the supercharger is conducted out of the rear end of the main oil channel of the engine to return to the crankshaft case directly.

2.2.6 ECU and Sensor

E-control unit of EGR engine is mainly composed of ECU, harness, stepper motor of H pump, sensors, solenoid controlling EGR valve, generator, starter, flame pre-heating device etc.

Sensor

Sensors installed on the engine:(supplied by the engine manufacturer)

(1) Rotating speed sensor

(2) Water temperature sensor

(3)Air temperature & pressure sensor

(4)Pre-stroke sensor

(5)Throttle position sensor

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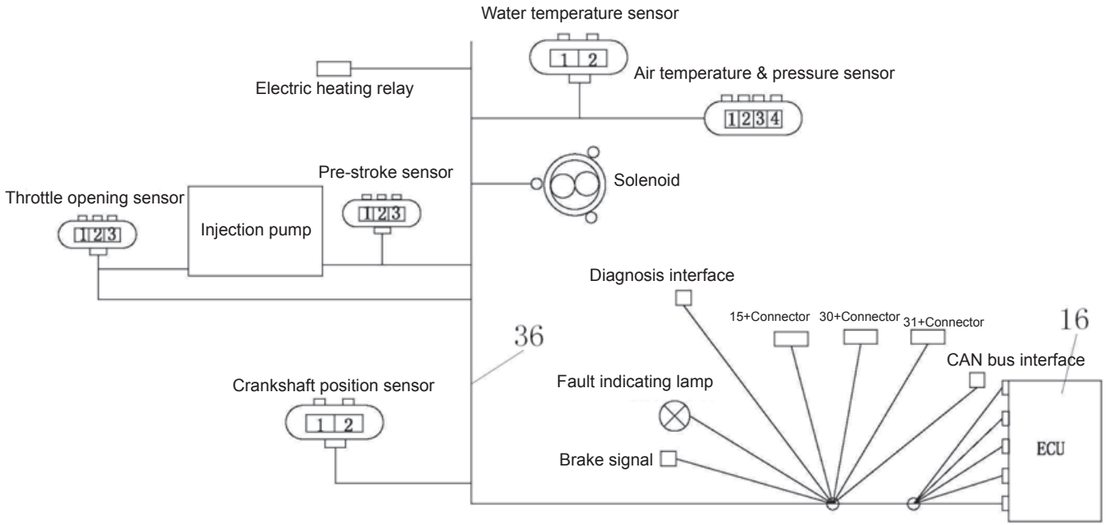
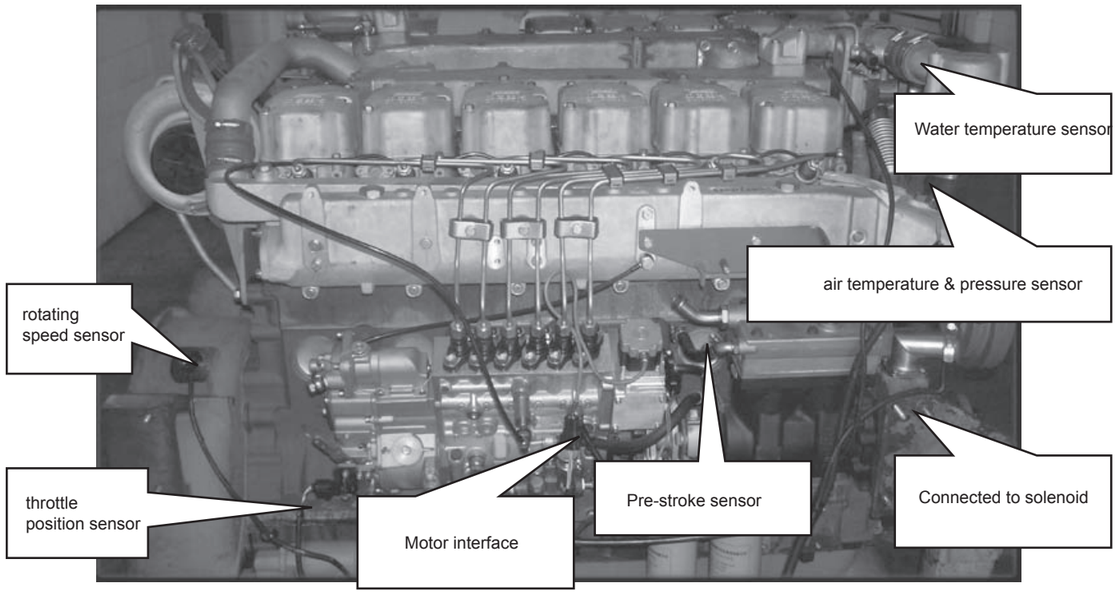


Figure Circuit of ECU and sensor and solenoid



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EGR is the core of engine e-control system and all control is realized by it. ECU controls the opening of EGR at right time according to such signals as engine rotating speed, load, intake air temperature & pressure, cooling water temperature and so on. A small part of waste air enters intake system through EGR valve, mixes with mixed air, and then enters the cylinder to take part in combustion.

When the engine is running at idle, low speed, small load and cooling, ECU controls waste air not taking part in recirculation (i.e. EGR valve closed) to prevent the engine performance from being effected; when the engine exceeds certain rotating speed, load and temperature, ECU control a small part of waste air taking part in recirculation (i.e. EGR valve open).

Water temperature sensor is used to measure the temperature of cooling water of the engine.

Air intake temperature & pressure sensor installed on intake pipe is used to measure the temperature and pressure of intake air.

Pre-stroke sensor is installed on stepper motor of injection pump to inspect pre-stroke, and is sent to ECU as feedback signal of stepper motor controlled by ECU.

Throttle position sensor is installed near the throttle drag link of injection pump to inspect its position to obtain load signal.

Crankshaft rotating speed sensor is installed on housing of flywheel to measure the rotating speed of the engine.

2.2.7 Dual-cylinder air compressor

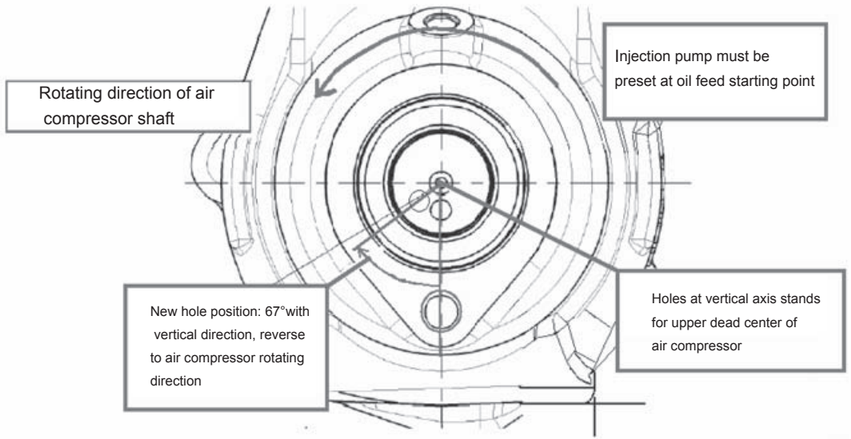
Dual-cylinder air conpressor is driven by injection pump gear. Lubricate it like this: lubricant enters air compressor through main channel by a pipe fixed on cylinder body, lubricates the bearing, then returns to oil sump through gear chamber.

After air at the inlet of dual-cylinder air compressor is filtrated by a filter, there is a pipe to dual-cylinder air compressor before air enters supercharger.

About cooling of dual-cylinder air compressor, a pipe is connected to the compressor cylinder head from cylinder body, and then connected to the entrance at the side of water pump of diesel engine after water comes out of cylinder head.

Drive ratio of dual-cylinder air compressor and engine is 0.5. No need to install propeller shaft. Pay attention to its timing relation with injection pump when installing. Before injection pump gear is installed, other gears of the engine must be at required oil feed advance angle, and air compressor crankshaft must be at the right timing position as the figure requires below.

Timing of injection pump and air compressor



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2.3 Use and maintenance of WD615 EURO III (EGR) series of diesel engine

2.3.1 Selection of oil brand

select oil and diesel of right brand according to present ambient working temperature of the engine. The stipulation of selecting oil and diesel brands can be seen in the table below.

Selection of oil

Ambient temperature	⩾-10℃	<-10℃
Oil brand to be selected	15W/40	5W/30

Selection of diesel

Ambient temperature ℃	≥0	0~-10	-10~-20	-20~-30
Diesel brand to be selected	0#	-10#	-20#	-35#

2.3.2 Anti-freeze fluid

Coolant of WD615 ERO III (EGR) series diesel engine must be anti-freeze fluid. Anti-freezing fluid has four functions:

① anti-freeze; ②anti-scaling; ③anti-canvitation of cooling system parts; ④Anti-corrosion of cooling system parts.

2.3.3Maintenance of diesel engine

Check if the coolant, fuel, oil and diesel levels are in accordance with the requirement before starting the diesel engine.

If the diesel engine cannot be started in 15s, restart it in 2min. After starting, make the diesel engine run 2～3min at idle. Oil pressure should

be above 100kPa. Don't make it run at high speed suddenly before the cooling water reaches 60℃, otherwise wearability and reliability of the engine will be effected.

Within running-in period, the diesel engine is only appropriate to work under medium load. Inspection of oil level: it must be checked in 5min after the engine is shutdown. For the engine working with load, load and speed must be reduced before shutdown. Idle speed running must last for no less than 5 minutes.

2.3.4Maintenance rules

Table 1 Three service conditions of automotive accessories

WG Ⅰ	WG Ⅱ	WGⅢ
Poor conditions (severe cold or hot climate, high dust content, used in construction site or bus, municipal engineering vehicle, snow sweeper, fire-fighting engine) or vehicles with annual mileage less than 2×10^4km or with running hours less than 600h	Annual mileage less than 6×10^4km, short and medium distance transportation (used for cargo delivery)	Annual mileage more than 6×10^4km, long-distance transportation

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Table 2 First-time inspection, routin inspection and period of maintenance

Service condition / Item	WG Ⅰ	WG Ⅱ	WGⅢ
1st-time check	After running 1000～1500km After running 30～50h	After running 1500～2000km	After running 1500～2000km
Routin check (P)	Every 5000km Every 150h	Every 1×10^4km	Every 1.5×10^4km
Grade 1 maintenance (WD1)	Every 1×10^4km Evrey 300h	Every 2×10^4km	Every 3×10^4km
Grade 2 maintenance (WD2)	Every 2×10^4km Every 600h	Every 4×10^4km	Every 6×10^4km
Grade 3maintenance (WD3)	Every 4×10^4km Every 1200h	Every 8×10^4km	Every 12×10^4km
Grade 4 maintenance (WD4)	Every 8×10^4km Every 2400h	Every 16×10^4km	Every 24×10^4km

Table 3 Oil change interval in heavy truck maintenance

Service condition	WG Ⅰ	WG Ⅱ	WGⅢ
Item	Anual mileage less than 2×10^4km	Anual mileage less than 6×10^4km	Anual mileage less than 6×10^4km
check	After running 1000～1500km	After running 1500～2000k m	After running 1500～2000k m
check(P)	Every 5000km	Every 1×10^4km	Every 1.5×10^4km
1 maintenance (WD1)	Every 1×10^4km	Every 2×10^4km	Every 3×10^4km
2 maintenance (WD2)	Every 2×10^4km	Every 4×10^4km	Every 6×10^4km
3maintenance (WD3)	Every 4×10^4km	Every 8×10^4km	Every 12×10^4km
4 maintenance (WD4)	Every 8×10^4km	Every 16×10^4km	Every 24×10^4km

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Table 4 Oil change interval as oil usage condition requires (different according to oil consumption)

Normal condition (normal oil consumption)		Poor condition (high oil consumption)	
Ambient temperature Fuel with sulfur content below 0.5% (mass)		A	Tropical or frigid climate(temperature usually above +30℃ or under -10℃)
		B	Fuel with sulfur content between 0.5%-1.0%
		C	Fuel with sulfur content between 1.0%-1.5%
Oil usage condition	Service condition		
Normal condition	WG Ⅰ WG Ⅱ WGⅢ	5000 Every 10000 km 15000	
Poor condition A	WG Ⅰ WG Ⅱ WGⅢ	5000 Every 5000 km 5000	
Poor condition B	WG Ⅰ WG Ⅱ WGⅢ	5000 Every 5000 km 10000	
Poor condition C	WG Ⅰ WG Ⅱ WGⅢ	5000 Every 5000 km 5000	
Poor condition A+B	WG Ⅰ WG Ⅱ WGⅢ	5000 Every 5000 km 5000	
Poor condition A+C	WG Ⅰ WG Ⅱ WGⅢ	2500 Every 2500 km 2500	

Table 5 Maintenance of Diesel Engine

Maintenance item	1st-time check	P	WD1	WD2	WD3	WD4
Replace oil (once a year at least)	●	●	●	●	●	●
Replace oil filter or element	●	When replacing diesel engine oil each time				
Check and adjust valve clearance	●		●	●	●	●
Check and adjust nozzle open pressure					●	●
Replace fuel filter element			●	●	●	●
Clean fuel coarse filter or element			●	●	●	●
Check coolant capacity and replenish	●	●	●	●	●	●
Replace coolant	According to the requirement of table 4-5					
Tighten cooling pipe clamp	●					
Tighten intake pipe, hose and flange coupler	●		●	●	●	●
Check air filter maintenance indicator or lamp			●	●	●	●
Clean dust collector of air filter (excluding auto clean type)		●	●	●	●	●

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Clean main element of air filter	When indicating lamp on					
Replace main element of air filter	Refer to specifications in the instruction manual					
Replace safety element of air filter	After cleaning main filter element five times					
Check and tighten multi-wedge belt	●	●	●	●	●	●
Check supercharger bearing clearance						●
Check and adjust injection pump on the test table					●	●
Check and adjust clutch journey and wire	●	●	●	●	●	●
Adjust rotating speed at idle	●					
Note: ● The mark means maintenance is needed.						

2.4 Troubleshooting of E-Control system

2.4.1 Fault light inspection method:

2.4.1.1

When ECU power supply is switched on, the system works normally and the fault light is off. When the system works abnormally, the fault light is always on.

2.4.1.2

When the diagnosis switch is on, the fault light turns off after 1-1 if the system is all right. If the system is not all right, the fault light turns on after finishing fault display by flashing according to Fault Light Flashing Code Table.

2.4.1. 3

Fault Flash Code designation

E.g. for the output of fault light flash code 2-1 and 3-1, if the light flashes twice first (0.5s each time), then turns on once in 2s, the fault flash code is 2-1; if a new code is formed in 4s, and the light flashes three times and turns on once, the fault flash code is 3-1; in another 4s, the light is always on.

2. 4.2 Fault light flash code definition table

Fault light flash code	Meaning of flash code		Fault light flash code	Meaning of flash code
1-1	No fault		3-1	Throttle sensor short-circuit to ground or open circuit to power supply
2-1	Open circuit to engine rotating speed sensor		3-2	Throttle sensor open circuit to ground or short-circuit to power supply
2-2	Short-circuit to intake temperature sensor		3-3	Pre-stroke sensor short-circuit to ground or open circuit to power supply
2-3	Open circuit to intake temperature sensor		3-4	Pre-stroke sensor open circuit to ground or short-circuit to power supply
2-4	Short-circuit to water temperature sensor		3-5	Power supply voltage overhigh
2-5	Open circuit to water temperature sensor		3-6	Power supply voltage overlow
2-6	Intake pressure sensor short-circuit to ground or open circuit to power supply		3-7	Worm gear gets stuck or pre-stroke sensor harness has fault
2-7	Intake pressure sensor open circuit to ground or short-circuit to power supply		3-8	Reverse connection of motor drive line

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2.5 Common faults and solutions

Many reasons can cause faults of diesel engine. One reason can make the engine show many abnormalities and similarly one fault can be caused by many reasons. Usually, faults can be checked and justified by looking, listening, touching, smelling etc, from the simple to the complicated and from the surface to the inside. When toubleshootings are carried out, the property of the fault shall be justified according to its features and comprehensive analysis on all symptoms should be done to find their relation. For those faults whose reasons cannot be found immediately, run the diesel engine at low speed and find the reason under the premise that no big accidents will happen.

Now we will introduce some specific faults and troubleshootings on WD615 ERO III (EGR) series of diesel engine.

Fault 1: Vibrating at idle

1. EGR valve cannot be closed completely. Check and replace the assembly.
2. Fault code is shown.(Look over Fault code table and find solution.)

Fault 2: Poor acceleratinon performance

1. EGR valve cannot be closed completely. Check and replace the assembly.
2. Fault code is shown (Look over Fault Code Table and find solution)
3. ECU calibration error(calibrate again)
4. Air intake pressure sensor doesn't work (check or replace it)

Fault 3: Deficient power

1. EGR intake and exhaust pipes leak. Check and change.
2. Fault code is shown (Look over Fault Code Table and find solution)
3. Air intake pressure sensor doesn’t work (check or replace it)

Fault 4: Black smoke from exhaust pipe

1. EGR valve cannot be closed completely. Check and replace the assembly.
2. EGR intake and exhaust pipes leak. Check and replace it.

Fault 5: Idle shutdown

1. EGR valve cannot be closed completely. Check and change the assembly.

2. Fault code is shown (Look over Fault Code Table and find solution)

Fault 6: Vapor from exhaust pipe

1. EGR cooling pipe leaks. Check and change EGR cooler assembly.

Fault 7: Oil level rises in oil sump

This is usually caused when diesel runs into oil sump.

1. Return pipe washer of the injector is installed wrongly (replace and re-install)

2.6 Other Common Technical Data

Matching clearance and wear limit among main parts of WD615 ERO III (EGR) series of diesel engine

Sequence No.	Item	Theoretical value	Wear limit
1	Main bearing clearance	0.095～0.163	0.17
2	Con rod bearing clearance	0.059～0.127	0.16
3	Axial clearance of crankshaft	0.102～0.305	0.35
4	Axial clearance of con rod plane	0.15～0.35	
5	Clearance between con rod bushing and piston pin	0.04～0.061	0.1
6	Clearance between piston pin boss and piston pin	0.005～0.018	
7	Working clearance of piston ring open incold status: 1st ring 2nd ring Oil ring	0.35～0.55 0.40～0.60 0.20～0.40	1～1.2 1～1.2 1～1.2

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8	End face clearance of piston ring open incold status: 1st ring 2nd ring Oil ring	0.08～0.115 0.04～0.075	0.28 0.26
9	Clearance between intake valve rod and valve duct	0.03～0.06	0.11
10	Clearance between exhaust valve rod and valve duct	0.05～0.08	0.12
11	Value of air valve bottom inside cylinder head plane exhaust/intake	0.075～1.15/1～1.4	1.8
12	Value of cylinder sleeve top higher than upper plane of the body	0.05～0.10	
13	Axial clearance of camshaft	0.1～0.4	
14	Clearance between camshaft bearings	0.04～0.12	
15	Clearance between lifter and lifter hole	0.025～0.089	
16	Surplus and clearance between outer diameter of cylinder sleeve and cylinder sleeve hole of the body	-0.02～0.023	
17	Clearance rocker arm bushing and rocker arm shaft	0.012～0.066	
18	Valve clearance intake/exhaust(cold)	0.3/0.4	
19	Side clearance of gears	0.15～0.33	

Tightening torque and angle of main bolts and nuts of diesel engine

Name	Thread specification（mm）	Tightening torque（N·m）+ once more turning angle	Permissible times to use
Main bearing bolt	M18	250^{+30}_{0}（follow tightening order），Lubricating	
Con rod bolt	M14×1.5	120＋(90°±5°)， Lubricating (up to 170～250N·m at the same time)	1
Main bolt of cylinder head	M16	200^{+10}_{0}＋2×(90°±5°)， Lubricating (up to 300～400N·m at the same time)	2
Accessory nut of cylinder head	M12	90^{+10}_{0}＋2×(90°±5°)， Lubricating (up to 130～170N·m at the same time)	2
Flywheel bolt	M14×1.5	60^{+20}_{0}＋2×(90°±5°)， Lubricating (up to 230～280N·m at the same time)	2
Flywheel housing bolt	M12	40^{+20}_{0} ＋(120°±5°)， Lubricating (up to 110～140N·m at the same time)	2
机油泵惰轮轴螺栓	M10	60^{+5}_{0}， Loctite 242 anti-loosing	
Camshaft gear bolt	M8	32， Loctite 242 anti-loosing	
Middle gear tightening bolt	M10	(60±5)＋90°，Loctite 242 anti-loosing	
press bolt of crankshaft belt wheel	M10	60^{+5}_{0}	
Injector press plate bolt	M8	26～29	
High pressure pipe press nut	M14×1.5	39.2～49	
Exhaust pipe bolt	M10	50～70+ (90°±5°)， Loctite, anti seizing	
Rocker arm seat bolt	M12	100^{+10}_{0}	

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Press nut of injection pump gear	M24×1.5	350， Loctite 242 anti-loosing	
Tension wheel bolt	M12	110	
Oil pump drive shaft bearing cover plate bolt	M8	25	
Tightening bolt for angle adjustment plate	M16×1.5	280， Loctite 242 anti-loosing	
	M14×1.5	230， Loctite 242 anti-loosing	
Connecting bolt of elastic connecting slice of coupler	M12	110， Loctite 242 anti-loosing	

Notes: ① Value on angle code is permissible tolerance range.
② Angle value is the torsional angle after turning to specified torque.
③ The value before the angle value is the times of torsion.
④ There are requirements for the strength grade of all bolts and nuts on all parts of the engine. Bolts and nuts of the same specification but different strength grades cannot be exchanged and mis-installed. More than permissible usage times is not allowed, otherwise serious consequence could be caused.

The application of glue and accessories for WD615 ERO III (EGR) series diesel engine

Glue brand	Color	Function	Application area
Loctite 242	Sky blue	Anti-loosing	Timing gear chamber bolt Camshaft thrust washer bolt Middle gear bolt Front oil seal base bolt Filter base bolt Oil cooler bolt Injection pump coupling bolt Air compressor bolt nut Angle adjusting plate bolt Suction filter bolt Main oil channel pressure limit valve tread Oil cooler by-pass valve Injecction pump driven gear nut
Loctite 262	Red	Anti-loosing	Cylinder head stud bolt
Loctite 271	Red	Anti-loosing and fastening	bowl shape pisten Oil pump pressure limit valve
Loctite 272	Red	Anti-loosing and fastening	Hexagon lobular socket countersunk head screw of installation valve Hexagon socket head screw of installation valve

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Glue brand	Color	Function	Application area
Loctite 609	Green	Fastening	Connecting pipe for warm air on water drain pipe；Connecting part of pipe connector and water pipe；Connector of oil return pipe of supercharger
Loctite 510	Red or green or light yellow	Sealing	Joint face of cylinder body and crankshaft case；Front and back end face of cylinder body；Joint face of air compressor and gear chamber；Joint face of filter base and crankshaft case
Anti-Seize	Grey	Anti-seize	Exhaust pipe bolt, supercharger bolt
MoS2	Grey black	Lubricating	Joint face of cylinder sleeve and body
High & low temperature grease	Grey	Anti-seize	Joint face of EGR cooling pipe assembly and rubber O-ring

3. Main technical data of D12 series of diesel engine

Model		D12.42	D12.38
Type		In-line, water colling, 4 strokes, charging & intercooling, direct injection	
Number of cylinder		6	
Bore × stroke mm×mm		126×155	
Displacement L		11.596	
Rated power/rotating speed (kW/r/min)		309/2000	279/2000
Max. torque/rotating speed (N·m/r/min)		1820 /1100~1500	1650 /1100~1500
Gross power min. fuel consumption rate (g/kW·h)		192	
Compression ratio		17：1	
Ignition order		1-5-3-6-2-4	
Fuel supply advance angle °CA		12±1	14±1
Valve cold clrearance (mm)	Intake	0.40±0.03	
	Exhaust	0.50±0.03	
Max. unload rotating speed (r/min)		2300±50	
Stable rotating speed at idle (r/min)		650±50	
Noise LwdB（A）		≤97	
Dimension (mm)		1575/1646×825×1090	

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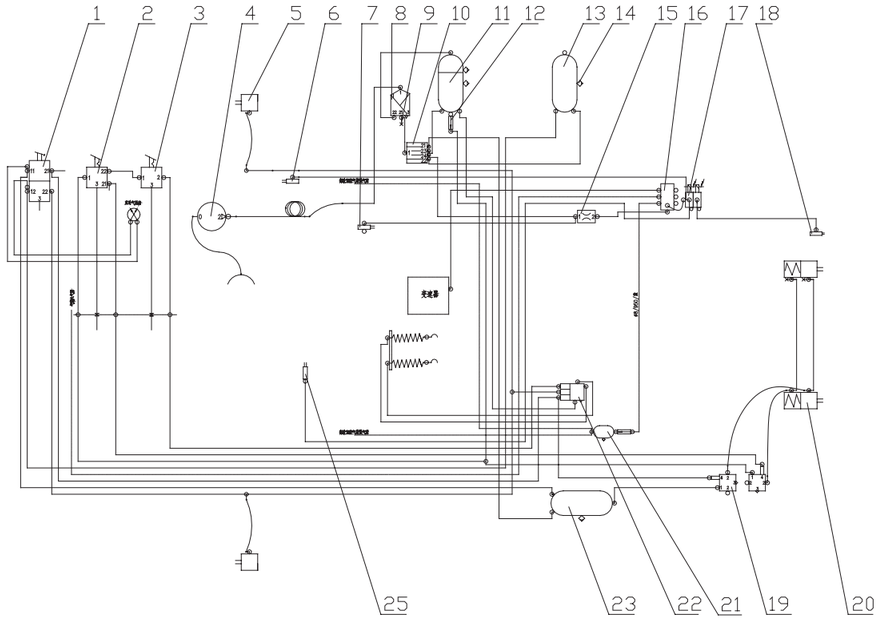
PART SIX

Others

1.Brake principle diagram

1.1 Brake principle diagram on 4x2 vehicle (with ABS)



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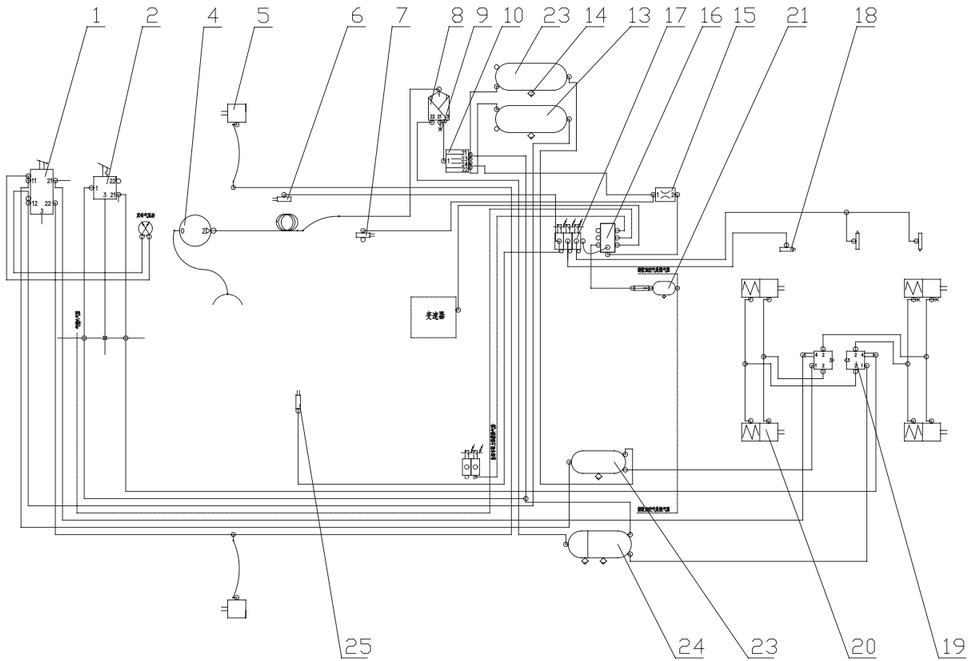
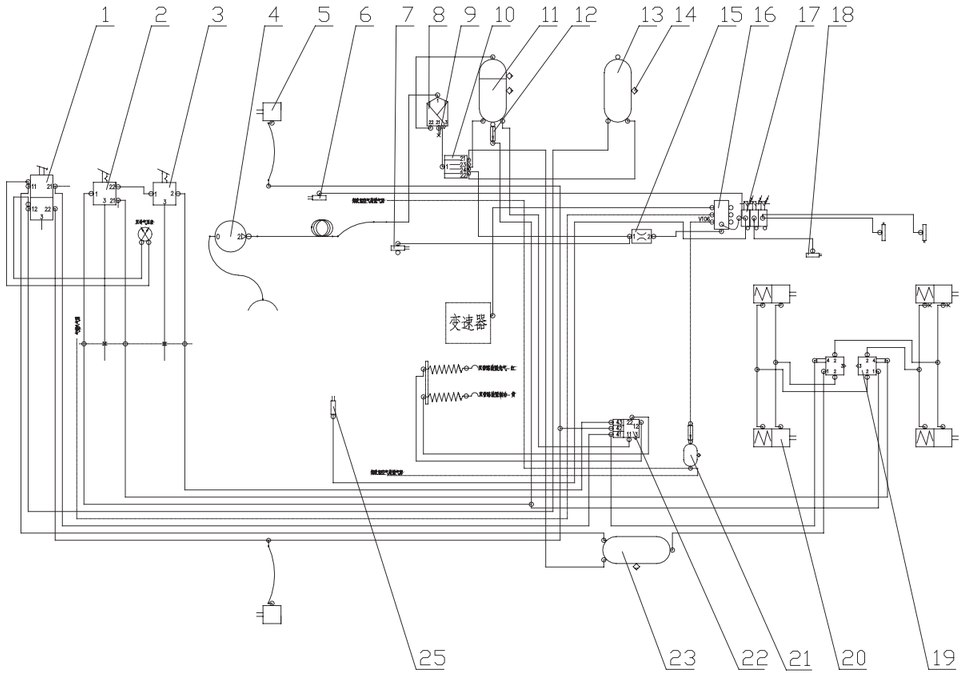
1.2 Brake principle diagram on 6x4 vehicle (with ABS)



1.3



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1.4 Brake principle diagram on 8x4 vehicle (with ABS)

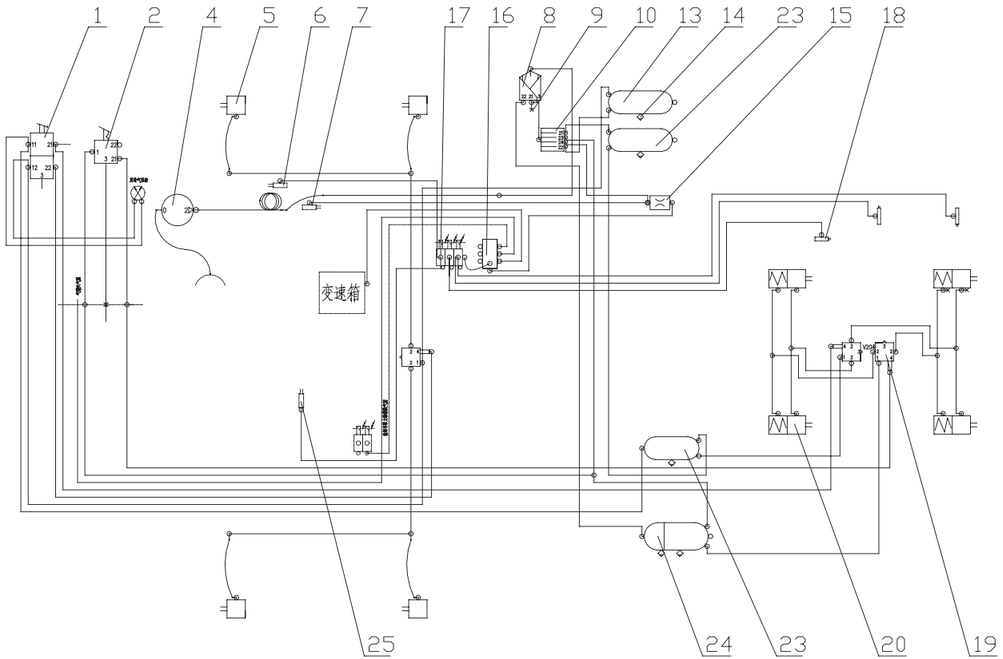

Diagram description

1.Main brake cylinder 2. Hand brake valve – trailer 3. Hand brake valve 4. Air compressor 5. ABS solenoid (WABCO/KNORR) 6. Front axle brake chamber 7. Parking oil cylinder 8. Air dryer 9. Four – circuit protection valve 10. check valve 11. 10L air reservoir 12. 30L air reservoir 13. Test connector 14. Drain valve 15. 20L air reservoir 16. Solenoid 17. Rear axle brake chamber 18. Differential lock air cylinder 19. 40L air reservoir 20. Relay valve 21. Control valve – trailer 22. Two – way check valve 23. Booster cylinder operated by gearbox cable 24. Engine exhaust brake assembly

Remark of interface:

1/11/12 – Inlet port

2/21/22/23/24 – Outlet port

3 – Exhaust port

4/41/42/43 – Control port

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2.Lamp bulb table

Lamp name		type of lamp bulb	Power of lamp bulb	Qty/truck
Headlamp (high/low beam)		H1 P14.5S	70W	4
Aux. high beam lamp		H3 PK22S	70W	2
Front fog lamp		H3 PK22S	70W	2
Direction lamp (Front)		P21W BA15S	21W	2
Height indication lamp		R5W BA15S	5W	2
Combined lamps (rear)	Direction lamp	P21W BA15S	21W	2
	Position lamp	R5W BA15S	5W	2
	Brake lamp	P21W BA15S	21W	2
	Reverse lamp	P21W BA15S	21W	2
	Rear fog lamp	P21W BA15S	21W	2
	Position lamp (side)	R10W BA15S	10W	2
	License lamp (left)	R5W BA15S	5W	1
Interior lamp		R10W BA15S	10W	If necessary

3 Operation data in summary

Capacity data

Assembly	Name		Specification	Capacity (L)
Fuel tank(L)	Fuel	Freezing point in summer ≤℃	GB 252 high – grade 0# diesel GB 252 high – grade 20# diesel	350 or 220
		Freezing point in winter		
Cooling system (L)	Long life antifreeze and antirust coolant		Long life antifreeze and antirust coolant for Heavy loading vehicle (all rear aroud)	40
Lubricating system (L)	Engine oil		15W – 40 CD or CF grade	21
Gearbox (L)	Heavy loading vehicle gear oil		85W /90 GL – 5	13
Clutch (L)	Brake fluid		SAE 116 /DOT3	1
Power steering gear (L)	Hydraulic oil		ATF – III	3.5
HOWO Rear axle final drive and hub shaft (L)	Heavy loading vehicle gear oil		80W (85W) /90 GL – 5 80W/140 (for low temperature)	23
Cab tipping system (L)	Hydraulic oil		HVN32 low temperature hydraulic oil	0.4

	spring leaf saving		
	location	specification(Number x thickness x width)mm	remark
4×2	front	4×22×90	
6×4	cargo, tractor the left and right front is the same with 4x2		
	rear	(5×38) ×89	cargo, tractor, Sitaier axle
8×4	front	4×20×90	
double front axle	front	the same with 8X4	

4.Adjustment data

assembly	oil		trademark	capacity
fuel tank capacity（L）	diesel	summer solidifying point<0°C	top class quality	400 or 300③
		winter solidifying point <-20°C	GB252 top class quality-20 mark light diesel	
cooling sysytem（L）	long lasting freeze and corrode resistant coolant		heavy load four season long lasting freeze and corrode resistant coolant	40
lubricating system	engine diesel oil		15W-40 CD class ①	27
transmission（L）	heavy load vehicle gear oil		85W/90 GL-5	13
clutch（L）	brake liquid		SAE 116/ DOT3②	about 1 liter
drive redirector（L）	hydraulic oil		HVN32 microtherm hydraulic oil	3．5
rear axle main reducer and hub bearing（L）	heavy load vehicle gear oil		GL-5EP 80W/90 or GL-5EP 85W/140	23
rear axle main reducer and hub bearing（Sitaer series rear axle）（L）	heavy load vehicle gear oil		GL-5EP 80W/90 or GL-5EP 85W/140	
cab upturn setup（L）	hydraulic oil		HVN32 microtherm hydraulic oil	0．4

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Note ①、oil for engines with CRDI system, please according to the explanation for engine.

②、brake liquid should be "莱可"(lai ke) brand DOT3 made by Rongzhong petroleum company Nan'an city Fujian province.

③、the practice capacity depends on the vehicle assembly.

clutch pedal journey（mm）		pedal area		40	
brake shoe slice clearance （mm）				0．6~1	
brake chamber handspike journey（mm）				57（min）	
tyre pressure（kpa）	model	9．00-20	10．00-20	11．00-20	12．00-20
	single tyre	700	740	740	740
	double tyre	770	810	810	810

5.Breif Introduction of the main structure

5.1 Engine : SINITRUK brand. It meets Euro II or Euro III Emission standard.

5.2 Rear axle: single reduction rear axle with wheel differential lock, steel plate pressed axle housing. Optional: Rear axle with central single reduction and wheel redactor.

5.3 Suspension: front suspension: longitudinal parabolic leaf spring suspension with shock absorber and stabilizer;

Rear suspension: mail and auxiliary spring suspension (4x2) or balancing suspension.

5.4 Steering gear: ZF8098 hydraulic steering gear, recirculating ball – rack and sector type, ratio 22.2 ~26.2.

5.5 Clutch: single disc dry clutch, hydraulic air – controlled. Diameter 420 for coil spring., 430 for diaphragm spring.

5.6 Braking system: dual circuit air brake system, service brake (foot brake), aux. brake(engine exhaust brake), emergency and parking brake (hand brake), and trailer brake. Working pressure 0.75Mpa. Main brake cylinder operated by depressing pedal directly.

5.7 Electrical system: single circuit system, 24V, minus earth. Alternator: integrated silicon rectifying alternator, 28V, 35A, 1000W. Starter: 24V, 8.1kw, with friction clutch. Battery: 2x12V, 135A (optional: 165A).

5.8 Driver's cab: forward cab, manual hydraulic tipping unit. Three types: standard, extended and high – roof cab.

NOTE

Vehicle Technical Data Supplied With Vehicle