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LiuGong 柳工

201812000

CLG4180D
MOTOR GRADER

SERVICE MANUAL

Applicable type and model: CLG4180D (Shangchai Engine III + ZF Gearbox + Tai'an Lutong)

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Contents

General Information **1-1**
Power System **2-1**
Power Train System **3-1**
Hydraulic System **4-1**
Air Conditioning System **5-1**
Cab and Covering Parts **6-1**
Structure **7-1**
Electrical appliance **8-1**
Appendix **9-1**

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General Information

How to Use the Manual **1-3**
Safety Description **1-3**
Identification of Manual and System **1-4**
Engine Identification **1-5**
Cable Identification Methods **1-6**
Coating Materials **1-8**
Weight Table **1-10**
Unit Conversion Table **1-11**
Standard Torque Table **1-12**
Oil Specification List and Maintenance Details List **1-16**
Technical Specification of the Complete Machine **1-20**
Complete Machine Inspection Table **1-27**

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How to Use the Manual

This manual is used by service personnel. Basic tools required in specific maintenance work are addressed in the manual and recommended to be used.

Safety warning symbols/mark will appear on the important safety information from the machine, safety sign, manual or any other places. If the symbol appears, you should follow the instruction in the safety information and be alert to the possibility of personal injury or death.

Technical manual is divided into several parts: Maintenance and test. The chapter for maintenance tells us how to repair parts, and the chapter for test can help you quickly discern majority of conventional breakdown.

The information is set for various components that need instructions on maintenance. The beginning of every system module is the summary list for all applicable basic tools and equipment, and other materials, service spare parts, technical parameters, tolerance and torque required in this work.

Technical manual is rough guide to specific machines, only including important information required in the diagnosis, analysis, test and repair.

Basic service information can be obtained from other sources, including basic operation theory, basic principles of troubleshooting, general maintenance, common faults and its causes.

Other reference manuals

- Parts Manual of Grader
- Operation & Maintenance Manual of Grader
- Use and maintenance manual of the engine
- Torque Transmission Overhaul Manual

User's guidance

- Because the influences to the machine from area or processing are different, it shall confirm which machine is applicable, and what work implements it has.
- Some accessories and optional parts in the Manual may not be transported to relevant areas, and consult your local LiuGong dealer if required.
- The materials and technical specifications in the Manual are changed with variation of products, and all information, diagrams and specifications in the Manual are the latest product information obtained at the time of publication. LiuGong reserves the right to make modification without any notice. If it needs to obtain the latest technical information, please consult the dealer of LiuGong in local area or Service Department of LiuGong Loader Marketing Co., Ltd.

Safety Description

Most accidents related to product operation, maintenance and repair are resulted from neglecting of basic safety rules or protective measures. Before accidents happening, if enough attention can be attached to potential hazards, the accidents can be avoided. The relevant personnel shall be familiar with the potential accident hazards, and accept necessary training to obtain certain troubleshooting skills by using tools.

Incorrect operation, lubrication, maintenance and repair are of great danger, and personnel death may be incurred when it is severe.

Before reading and fully understanding the contents on operation, lubrication, maintenance and repair, no operation, lubrication, maintenance or repair is permitted on the machine.

The safety precautions and warnings are all listed in this manual and on the product. If such warnings are ignored, the death of relative personnel may be incurred.

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Any hazard is identified with "Safety warning symbols" followed by "signal terminology", such as "Danger", "Warning" and "Notice" and so on. "Warning" identification for safety is as follows:

⚠WARNING

The meaning of the safety warning symbol is as follows:

Notice! Be careful! For your safety!

The content of danger is interpreted with text or diagram under warning sign.

Such operations possibly leading to damages of the machine all have "Caution" or "Warning" marked on the machine and in this manual.

It is impossible for LiuGong to predict every dangerous working environment, so the warnings in this manual and on the product are somewhat not exhaustive. If any tool, procedure, method or technique not specifically recommended by LiuGong is applied, you should make sure of your own or others' safety, and that no operation, lubrication, maintenance or repair program you have selected would make the machine damaged or endangered.

The instructions, numerical values and illustrations in this manual are prepared according to the currently latest available data. Due to the continuous improvement on the design of this machine, the details may have changes possibly unavailable in this manual. For the machine-related latest information or any doubt on the data in this manual, please contact LiuGong or its dealers.

Article 65 of California Suggestions

California considers that exhaust from diesel engines and some of its ingredients can lead to cancer, and cause birth defects or other harms on reproduction.

Battery posts, battery electrodes and relevant accessories contain lead and lead compounds, which require washing hands after touch.

Identification of Manual and System

Significance: Only use corresponding manual that which is designed for your specified machine. If incorrect manual is chosen, incorrect service may happen. When the manual is chosen, product identification number (PIN) and engine number.

Choose correct corresponding manual

Motor-graders from LiuGong will be sold in different markets according to different machine configurations which different market demands offer. There are different corresponding manuals for different machine configurations.

If necessary, product serial number and engine number will be listed on the cover of grader manual. These numbers are used for recognizing correctly corresponding manual of your machine.

Product series number identification

The nameplate of product identification number (PIN) lies on the left of the front frame, and in the front of left-side multi-way valve, as shown in the figure 1. There is a 17-digit coding on the nameplate and the bottom of the nameplate for every machine, and the last 6-digit character of the coding shows product identification number of the machine.

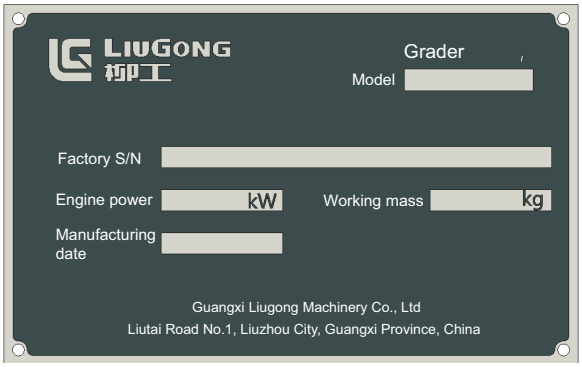
Position for product identification number nameplate



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Product identification number nameplate

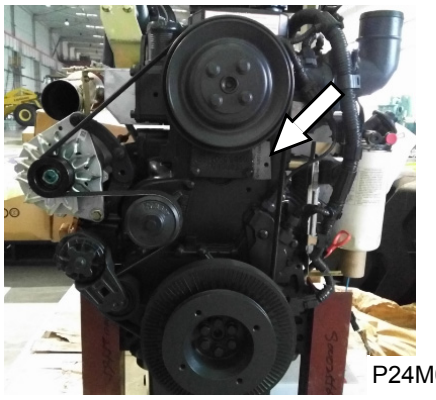


P24M00002

Engine Identification

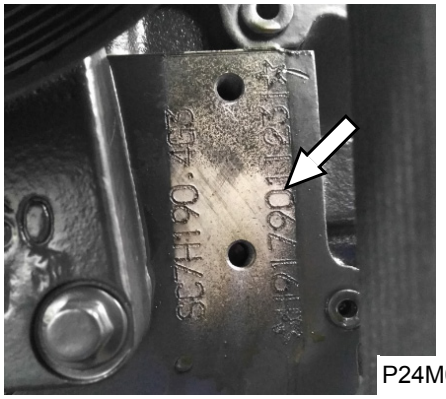
Engine identification number lies in the front end of the engine, as shown in the figure 3 and figure 4, on which engine model and its assembly line number are engraved.

Place of engine identification number



P24M00003

Engine identification number

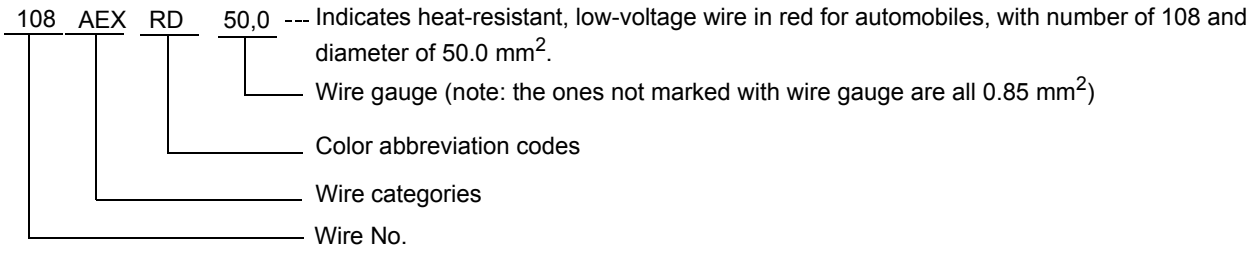


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Cable Identification Methods

The wire in circuit diagram is marked in combination with wire No., wire categories, color abbreviation codes and wire gauge for maintenance. For example,



Wire No.

Wire No. is digital code for marking wire with three Arabic numbers in accordance with certain rules.

Wire categories

The wire categories selected for engineering machinery are AEX, AV, AVS, AVSS, and QVR in general. For applicable range of ambient temperature of various wires, see following table.

No.	Wire type	Wire name	Description	Heat resistance
1	QVR	Low-voltage wire for road vehicles	70°C heat-resisting, copper core PVC-insulated	≤70°C
2	AVSS	Thin-wall insulated low-voltage wire for vehicles	The thickness of insulation layer is 0.30~0.40mm	≤80°C
3	AVS	Thin-wall insulated low-voltage wire for vehicles	The thickness of insulation layer is 0.50~0.70mm	≤80°C
4	AV	Insulated low voltage wire for vehicles	The thickness of insulation layer is 0.60~2.0mm	≤80°C
5	AEX	Heat-resisting low voltage wire for vehicles	Heat resistance and cross-linking polyethylene	≤110°C

Color abbreviation codes

Color	Abbreviation	Color	Abbreviation
BLACK	BK	BLUE	BU
GREY	GY	GREEN	GN
RED	RD	YELLOW	YL
BROWN	BR	PINK	PK
VIOLET	VT	ORANGE	OR
WHITE	WH	LIGHT BLUE	LTBU
RED/GREEN	RD/GN	YELLOW/BLUE	YL/BU

Remark: the code composed of two colors indicates double-color wire
For example: "RD/GN" shows red-green wire.

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Wire specifications

Allowable current and voltage drop of AV wire, and approximate performances of AVS, AVSS and QVR shall be executed uniformly according to following table.

Ambient temperature		30°C		40°C		50°C		60°C		70°C	
Allowable current/voltage drop		A	mV/m	A	mV/m	A	mV/m	A	mV/m	A	mV/m
Nominal sectional area (mm²)	0.85	18	463	16	412	14	360	11	283	8	206
	1.25	23	407	21	372	18	319	14	248	10	177
	2	31	338	28	305	24	262	20	218	14	153
	3	42	291	38	263	33	228	27	187	19	132
	5	57	248	51	222	44	192	36	157	25	109
	8	74	213	66	190	57	164	47	135	33	95
	15	103	176	92	157	30	137	65	111	46	79
	20	135	148	121	133	105	116	85	94	60	66
	30	188	121	168	108	146	94	119	77	84	54
	40	210	112	188	110	163	87	133	71	94	50
	50	246	103	220	92	190	60	155	65	110	46
	60	272	97	243	87	211	75	172	62	121	43
	85	335	90	300	80	260	70	212	57	150	40
	100	399	83	356	74	309	65	252	53	178	37

Circuit type and color abbreviation code

For general corresponding rules between circuit type and wire color, see the following table.

Circuit type	Color abbreviation codes
Power line	OR,RD
Signal line	WH
Grounding	BK,GY
Communication line	RD/GN,YL/BU

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Coating Materials

Name	Specifications	Main features and purposes
1277 Thread locker sealants	1277	• Features: anaerobic and fast air drying • Purposes: used for parts not frequently removed
1243 Thread locker sealants	1243	Used for removable parts (speed sensor in general)
Long-term anti-rust agent	LONG#2 light yellow	• Feature: rust protection for a long time • Purpose: used for mounting face of pump, sensor, hydraulic fitting, etc
High efficient detergent 1755	1755	• Feature: strong ability of cleaning • Purpose: used for pump and motor
Anaerobic pipe thread sealant	1567	• Feature: it has features of high-temperature resistance, self-lubrication and medium resistance and is used for sealing medium (oil, air, vapor, water) pipeline cone/ taper thread • Purpose: used for water temperature sensor and engine oil pressure sensor
Cleaning agent for electromechanical equipment	HD-10	Used for cleaning oil pipe joints, etc
Diesel engine sealant	1515	Used for mounting face of diesel engine flange
Polyurethane sealant	1924	Used for waterproof of starter motor and assembling clearance
Mobilux EP	None	Used for rust protection of rear cover hinge

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Paint standard:

There are two main kinds of colors that applied to 4180D:

Yellow: matte (65-75%) RAL1006 yellow

Gray: matte (35-45%) RAL7021 gray

The standard of paint quality is as follows (for more information, see QJ/LG08.44-2013):

No.	Item	Indicator	Testing method	Remarks
1	Paint film appearance	Paint film shall be uniform color, and no blistering, crack, wrinkle, under screen, rust, damage, dirt and so on	Visual inspection	Refer to the requirements at all levels of surface for details of allowable defects
2	Paint film gloss	Meet the minimum requirements of paint film gloss at all levels of surface	Visual inspection/gloss meter	For details, see the requirements at all levels of surface. For matte paint, refer to the special requirements
3	Paint film thickness	Meet the minimum requirements of paint film gloss at all levels of surface	Thickness gauge of paint film	For details, please see the requirements at all levels of surface
4	Adhesion of paint film	Good adhesion and no peeling in detection of paint film	Use single cutting edge or scriber to perform the cross cut on the paint film with five horizontal and vertical lines. The distance between the scribing lines is 1mm~1.5mm and the depth can reach the steel plate substrate. Then stick the transparent adhesive tape and compact, then tear off the tape	Approval standard: No whole piece of grid film drops. Little film drop along the scribing lines is allowed
5	Color difference	There is no paint contamination, mechanical impurity, rust and dirts	Visual inspection/color difference meter	For details, please see the requirements at all levels of surface
6	Shield	Meet the minimum requirements of paint film gloss at all levels of surface	Visual inspection	
7	Decal	The decal should be correct, complete, decorous, firm, smooth and no popping	Visual inspection	

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Weight Table

The following table indicates the reference value of the weight of each component. When using the hoisting equipment , please refer to the following table to select the sling.

Components	Weight kg
Engine (excluding oil)	600
Radiator assembly (with shroud and bracket)	145
Water radiator	21
Torque converter oil radiator	15
Intercooler	14
Auxiliary tank	5
Hydraulic oil radiator	10
Fuel tank	195
Front axle assembly	457
Rear axle assembly (with oil)	2607
Speed changer - torque converter assembly (with oil)	491
Drive shaft	17
Tire & rim assembly	216
Worm gear case	95
Front frame assembly	2014
Rear frame assembly	940
Swing seat assembly	263
Working device assembly	2204
Traction frame	510
Swing bearing (bearing)	204
Swing circle support frame	470
Blade assembly	780
Front counterweight	570
Rear counterweight	1180

Components	Weight kg
Working pump	28
Hydraulic oil tank (without support)	155
Multi-way valve	22
Metering pump	10
Blade lifting oil cylinder	75
Traction frame swing oil cylinder	36
Blade lead-out cylinder	68
Blade angle cylinder	36
Hitch steer cylinder	46
Front wheel steering cylinder	12
Front wheel tilt cylinder	18
Latch cylinder	11
Motor	16
Swivel joint	18
Cab (with roll-over protection)	465
Cab platform	90
Seat	39
Platform	40
Control box	8
Evaporator assembly	18
A/C Compressor	7
Rear cover	123
Battery (single)	18
Front floodlight bracket	8

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Unit Conversion Table

The Manual uses ISO International System of Units, and ISO international units are converted into British units as shown in following figure:

Parameters	Metric unit	British unit	Multiple
Length	mm	In	0.03937
	mm	ft	0.003281
Capacity	L	US gal	0.2642
	L	US qt	1.057
	m^3	Yd3	1.308
Weight	kg	lb	2.205
Intensity	N	kgf	0.10197
	N	lbf	0.2248
Torque	Nm	kgf·m	0.1020
	Nm	lbf·ft	0.7375
Pressure	MPa	kgf/cm^3	10.197
	MPa	psi	145.0
Power	kW	PS	1.360
	kW	HP	1.341
Temperature	°C	°F	°C×1.8+32
Speed	km/h	mph	0.6214
	min^{-1}	rpm	1.0
Flow	L/min	US gpm	0.2642
	mL/rev	cc/rev	1.0

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Standard Torque Table

Torque Specification – Metric System

Under the condition of no special requirement, torque specification is subject to the following torques.

These values apply to coarse threaded fasteners obtained from suppliers, for the surface with plating or without plating or being coated with the engine oil. These values don’t apply to places with graphite or molybdenum lithium base grease or the place for using grease.

Grade 8.8 of bolt, nut and stud		
Specifications	**N.m**	**lbf·ft**
M6	7.7±1.1	5.67875±0.81125
M8	19±2.9	14.0125±2.13875
M10	38±5	28.025±3.6875
M12	66±9	48.675±6.6375
M14	107±15	78.9125±11.0625
M16	166±26	122.425±19.175
M18	229±33	168.8875±24.3375
M20	302±37	222.725±27.2875
M22	443±59	326.7125±43.5125
M24	561±74	413.7375±54.575
M27	811±111	598.1125±81.8625
M30	1106±148	815.675±109.15
M33	1512±221	1115.1±162.9875
M36	1955±258	1441.813±42.775

Grade 10.9/12.9 of bolt, nut and stud		
Specifications	**N.m**	**lbf·ft**
M10	72±6	53.1±4.425
M12	120±10	88.5±7.375
M14	195±15	143.8125±11.0625
M16	305±25	224.9375±18.4375
M18	415±35	306.0625±25.8125
M20	600±50	442.5±36.875
M22	800±70	590±51.625
M24	1020±100	752.25±73.75
M27	1500±100	1106.25±73.75
M30	1850±150	1364.375±110.625
M33	2900±400	2138.75±295
M36	3100±250	2286.25±184.375

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Tightening torque of 24°cone with O-ring sealed pipe fittings

Series	Thread size	Hose inner diameter mm	Tightening torque	
			N.m	kgf.m
Light-type	M12×1.5	5	16±1	1.6±0.1
	M14×1.5	6.3	16±1	1.6±0.1
	M16×1.5	8	26±2	2.7±0.2
	M18×1.5	10	37±2	3.8±0.2
	M22×1.5	12.5	47±2	4.8±0.2
	M26×1.5	16	89±4	9.1±0.4
	M30×2	19	116±5	11.8±0.5
	M36×2	25	137±6	14.0±0.6
	M45×2	31.5	226±11	23.1±1.1
	M52×2	38	347±16	35.4±1.6
Heavy-type	M14×1.5	5	26±2	2.7±0.2
	M16×1.5	6.3	42±2	4.3±0.2
	M18×1.5	6.3	53±2	5.4±0.2
	M20×1.5	8	63±3	6.4±0.3
	M22×1.5	10	79±4	8.1±0.4
	M24×1.5	12.5	84±4	8.6±0.4
	M30×2	16	126±6	12.9±0.6
	M36×2	19	179±8	18.3±0.8
	M42×2	25	263±12	26.8±1.2
	M52×2	31.5	368±17	37.6±1.7

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Tightening torque of flange seal pipe joint bolt

Series	Bolt	Bolt performance level	Tightening torque	
			N.m	kgf.m
Light-type	M8	8.8	25.2±1.2	2.57±0.12
	M10		52.5±2.5	5.35±0.25
	M12		96.6±4.6	9.85±0.47
	M16		220±10	22.5±1.07
	M8	10.9	33.6±1.6	3.42±0.16
	M10		73.5±3.5	7.5±0.35
	M12		136±6	12.8±0.6
	M16		310±15	31.6±1.5
Heavy-type	M8	8.8	25.2±1.2	2.57±0.12
	M10		52.5±2.5	5.35±0.25
	M12		96.6±4.6	9.85±0.47
	M16		220±10	22.5±1.07
	M20		420±20	42.8±2.0
	M8	10.9	33.6±1.6	3.42±0.16
	M10		73.5±3.5	7.5±0.35
	M12		136±6	12.8±0.6
	M16		310±15	31.6±1.5
	M20		577±27	58.9±2.8

Tightening torque of thread angle type sealed hose connector

Material of fastenings	Carbon steel and alloy steel		Aluminum product	
Thread size	Tightening torque		Tightening torque	
	N.m	kgf.m	N.m	kgf.m
G1/8	8.75±1.25	0.90±0.12	/	/
G1/4	36±2	3.67±0.2	29.3±2.2	3.0±0.2
G3/8	73.5±4.5	7.5±0.46	49±3	5.0±0.3
G1/2	110±10	11.2±1.0	55±5	5.6±0.5
G3/4	165±15	16.8±1.5	734±4	7.5±0.4
G1	225±25	23.0±2.55	/	/
G1-1/4	275±25	28.0±2.55	/	/
G1-1/2	285±15	29.1±1.5	/	/

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Connector tightening torque

Thread size	Tightening torque	
	N.m	kgf.m
M12	24±2	2.4±0.2
M14	30±2	3.1±0.2
M16	30±2	3.1±0.2
M18	30±2	3.1±0.2

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Oil Specification List and Maintenance Details List

Oil specification list

Category		Name	Capacity	Application locations	Remarks
Engine oil	≥-15°C	★ SAE15W/40CH-4	18L	Diesel engine oil sump tank	
	<-15°C	SAE 5W/40 CH-4			
Engine fuel	≥-15°C	★ 0# Diesel oil	348L	Fuel tank	
	<-15°C	-20# Diesel oil			
Hydraulic oil	-15~40°C	★ HM-46 Anti-wear hydraulic oil	110L	Hydraulic oil tank	Total volume of the hydraulic system is about 165L (including cylinder, pipeline and so on)
	-25~40°C	HV-46 low-temperature anti-wear hydraulic oil			
Torque converter oil	≥-15°C	★ Mobil Delvac 15W-40	33L	Torque torque converter transmission assembly	
	<-15°C	Mobil ATF220			
Gear oil	≥-15°C	★ 85W-90GL-5 heavy-duty gear oil	26L	Middle section of the rear axle	
			36	Left Tandem	
			36	Right tandem	
			1.5	Worm gear case	
	<-15°C	80W-90GL-5 Low-temperature heavy-load gear oil	26L	Middle section of the rear axle	
			36	Left tandem	
			36	Right tandem	
			1.5	Worm gear case	
Refrigerant		★ R134a	1Kg	Air conditioner	
Grease	Manual lubrication	★ 2# Molybdenum disulfide lithium grease	2KG	Moving parts for swing pin, hinge, bearing, transmission and so on	
Coolant		★ Shell Anti-freeze	40L	Auxiliary tank	Choose corresponding specification for anti-freeze according to local temperature

★ Refers to the standard configuration

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⚠CAUTION

Oil in the engine, transmission and rear axle can't be exchanged each other, which will cause the damage of parts.

For selection of the fuel in the winter, please consult your local dealers; if the temperature of the fuel is lower than ignition temperature, it will cause that the engine loses power or the engine can't be started.

Low-sulfur fuel shall be used, using fuel mistakingly will cause the damage of the engine.

List of Maintenance details

Maintenance contents	Maintenance interval*						
	10h or every day	50h or every week	100h or every two weeks	250h or every month	500h or every three months	1000h or every six months	2000h or every year
Check battery disconnect switch	●						
Check engine oil level	●						
Check coolant level	●						
Check the fuel level	●						
Check hydraulic oil level	●						
Check engine belt	●						
Check the fan	●						
Check instruments	●						
Check lamps	●						
Remove the water and impurities from pre-filter	●						
Check service indicator of the air filter	●						
Check the air pressure and damage of tires	●						
Check backup alarm	●						
Tour inspections**	●						
Check the transmission fluid level		●					
Clean strainer of the A/C evaporator		●					
Check the A/C compressor belt		●					
Clean the condenser		●					
Clean the battery, and apply Vaseline on the wiring terminal		●					
Fill grease into all moving parts		●					
Check the nitrogen pre-charging pressure of the accumulator		○		●			

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Maintenance contents	Maintenance interval*						
	10h or every day	50h or every week	100h or every two weeks	250h or every month	500h or every three months	1000h or every six months	2000h or every year
Check brake friction plate is worn		○		●			
Replace the transmission fluid & secondary filter, and clean the filter inside the oil sump tank.			○			●	
Replace drive axle gear oil			○			●	
Cleaning the engine cylinder head			●				
Clean the radiator			●				
Clean and wash the fuel filling filter screen of the fuel tank			●				
Operate rotation of the swing arm for one time, and make sure there is the lubrication on the contact surface			●				
Check the rail bushing of the blade.			●				
Check all the coupling bolts of all drive shafts.				●			
Check the rim captive bolts				●			
Check the mounting bolts of the transmission				●			
Check mounting bolts of the engine				●			
Check mounting bolt of the worm box				●			
Check the force welding seams and bolts of work implement and frames				●			
Check engine harness				●			
Check the air intake system of the engine				●			
Replace the engine oil and engine oil filter				●			
Replace air filter element				●			
Check drive axle, Tandem and the level of worm tank				●			
Check the refrigerant in the A/C refrigerant reservoir				●			
Check the service brake system				●			
Check parking brake system				●			
Check the concentration of anti-freeze and the coolant additive					●		
Replace fuel prefilter and filter element					●		
Check the captive bolts of the frame hinge pin					●		
Adjust valve clearance of the engine					●		

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Maintenance contents	Maintenance interval*						
	10h or every day	50h or every week	100h or every two weeks	250h or every month	500h or every three months	1000h or every six months	2000h or every year
Check engine belt tension pully						●	
Replace gear oil of the Tandem and the worm tank						●	
Replace the filter element of the returning oil filter of the hydraulic system						●	
Clean the fuel tank						●	
Screw up the captive bolts of the battery and clean the top of the battery						●	
Check the fan bearing							●
Check the turbocharger							●
Check shock absorber of the crank pulley							●
Replace the coolant and clean the cooling system							●
Clean oil tank and replace hydraulic oil							●
Check natural settlement of the cylinder							●
Check cooling tube, water pipes, connector and clamp of A/C							●
Check the flexibility of the steering system							●
Clean and washing the cooling system of the engine, and replace coolant liquid							●

Symbol descriptions: ○ stands for maintenance for the first time, ● standards for maintenance interval. Check and find problems which shall be repaired in time, otherwise, it may cause the damage of the machine.
*Cautions for maintenance interval:
(1) The maintenance work must be conducted according to the time cycle that firstly expire in the working timer or the calendar (day, week, month, etc.);
(2) In the working environment of extreme coldness, excessive dust or humidity, there should be more lubrication maintenance stipulated in "regular maintenance;
(3) During the maintenance, it is better to repeat the maintenance items listed in original maintenance items. For example, when conducting the maintenance for every 500 working hours or 3 months, there should be the maintenance for 250 working hours or 1month,50 working hours or every week and every 10 working hour or every day.
**Refer to details about the"Tour Inspections" in the "Important Maintenance Programs".

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Technical Specification of the Complete Machine



P24M00005

Overview

This grader is a kind of construction machinery used to heavily level road surface and reshape road embankment sections. It is used to level roads, squares, etc.

This grader is a common construction machine, therefore it is not used in the presence of flammable and explosive hazard, excessive dust and toxic gas.

Working environment requirements

1. Altitude: ≤4500m
2. Ambient temperature: -15°C ~ 40°C
3. Fording depth: ≤850mm

⚠WARNING

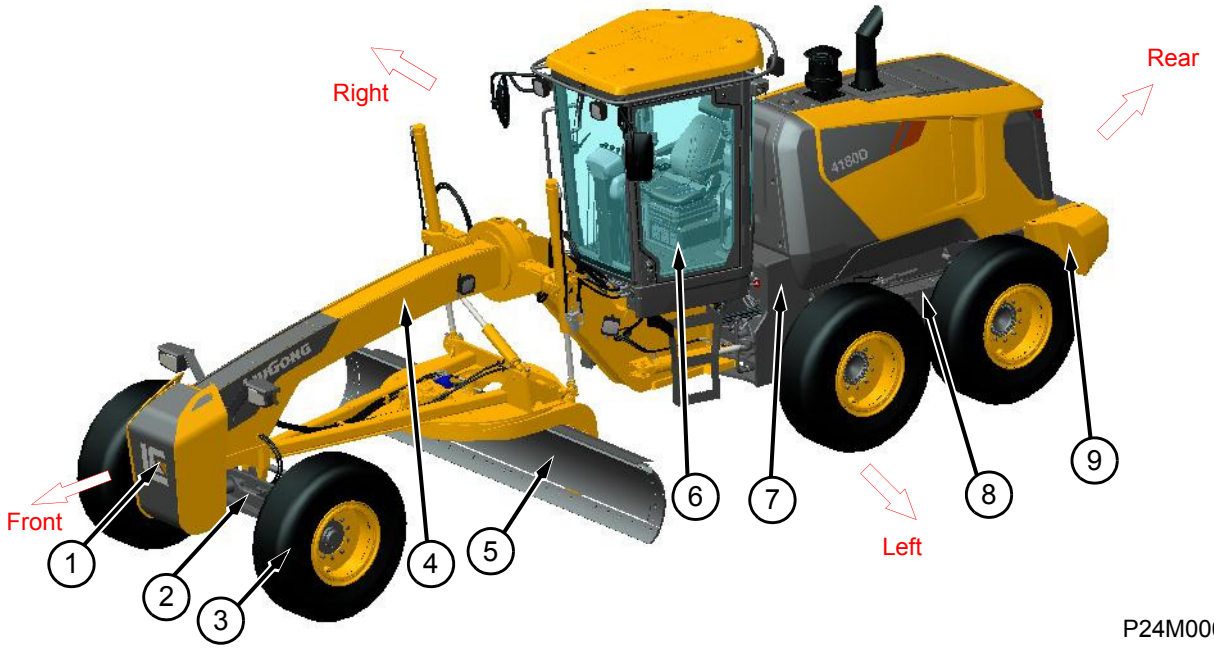
Please don’t operate the machine under the working condition of there being risks of rolls or falling-object.

⚠CAUTION

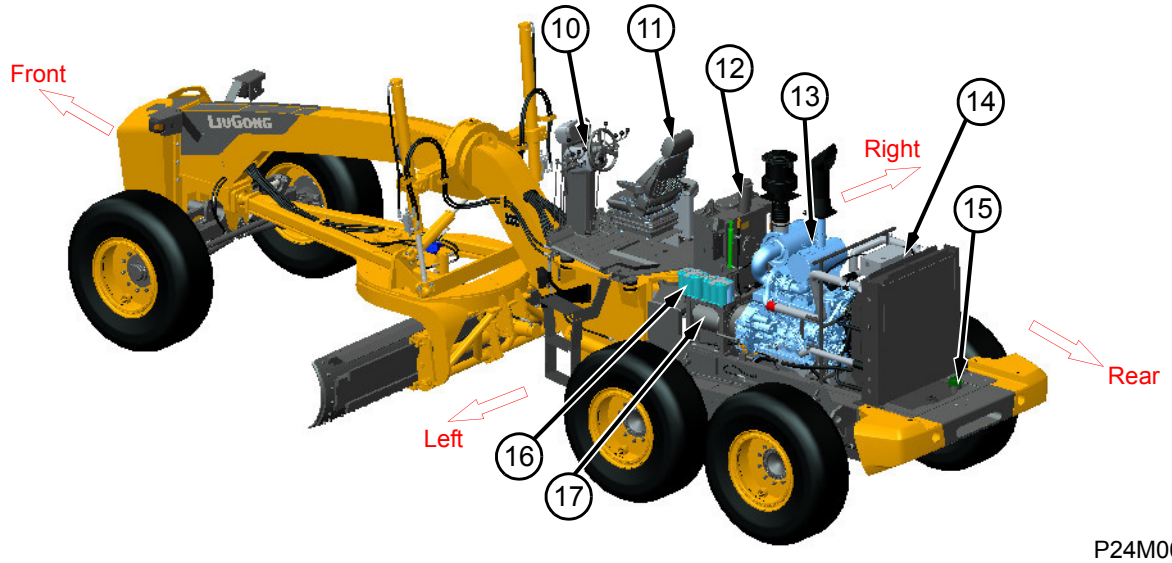
Preventive measures, maintenance and safety regulations listed in this manual only apply to applicable machines which conform to the regulation. If application range is exceeded to use the machine, Guangxi Liugong Machinery Co., Ltd. will assume no safety responsibility, and all safety responsibilities in such operations will be assumed by user. Under no circumstance, operations prohibited in this manual shall be used.

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Main Components of the Complete Machine



P24M00006



P24M00007

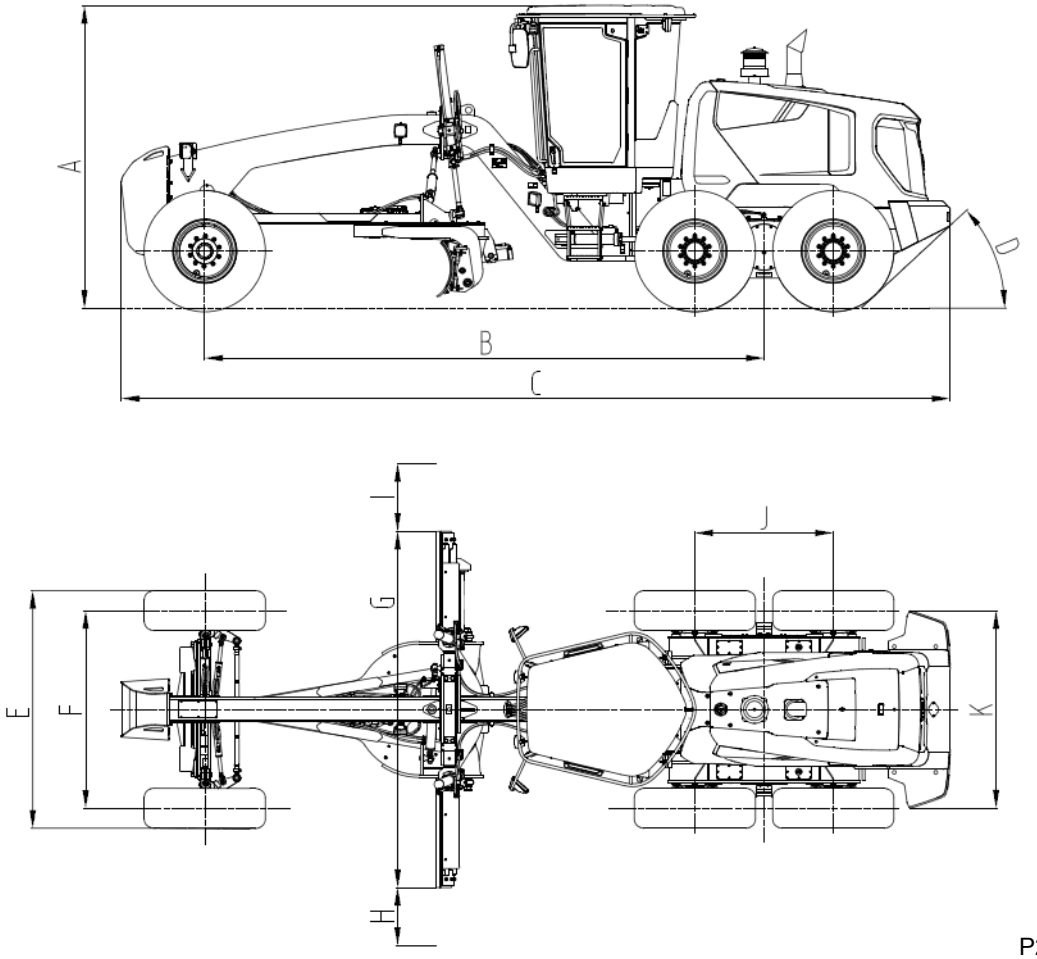
1. Front counterweight
2. Front axle
3. Rim tire
4. Front frame
5. Work implement
6. Cab
7. Rear frame
8. Rear axle assembly
9. Rear counterweight
10. Operation device
11. Driver Seat
12. Hydraulic oil tank
13. Diesel engine
14. Radiator group
15. Fuel tank
16. Battery
17. Torque transmission

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Technical parameters of the complete machine

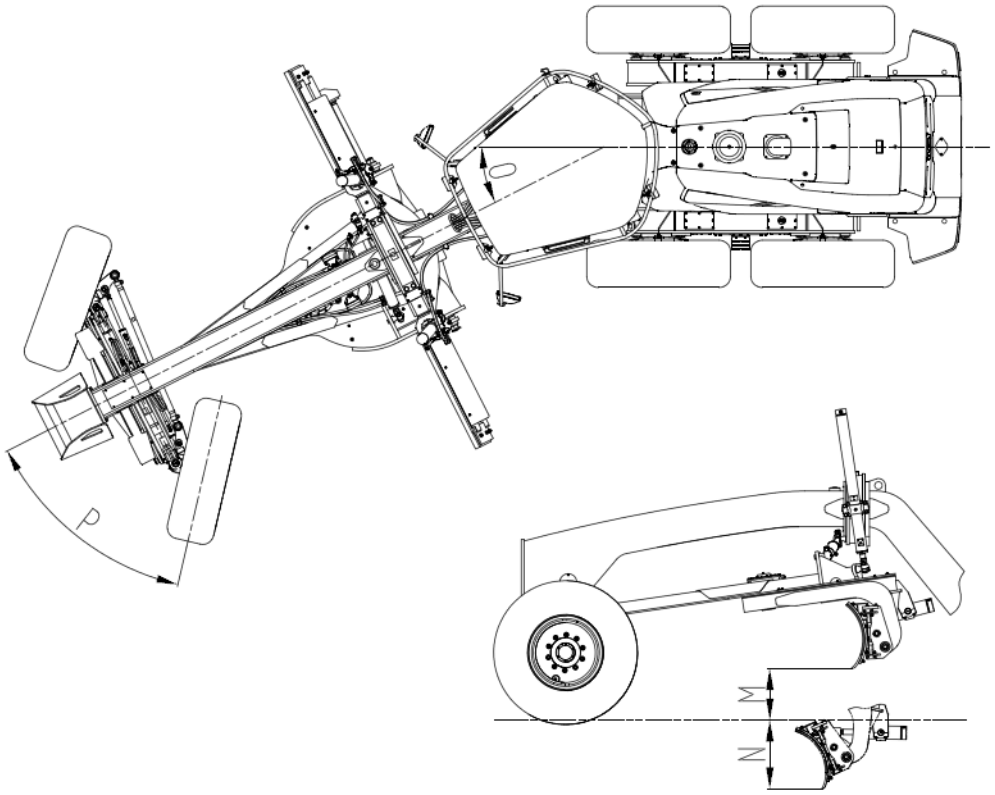
All rated operations of the machine are obtained when the machine operates on a hard and horizontal supporting surface. If the working ambient conditions of the machine differ from the above standard conditions (for example, working on soft or uneven ground or slopes), the operator shall consider these conditions.

Geometric figure



P24M00008

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P24M00009

Geometric parameters

A: Height of the complete machine	mm	3380
B: Wheel base of front and rear axle	mm	6230
C: Length of the complete machine (Standard configuration)	mm	9090
D: Departure angle	°	43
E: Width of the complete machine (Outer side of the wheel)	mm	2600
F: Wheel track	mm	2200±20
G: Width of the blade	mm	3960
Height of the blade	mm	610
Thickness of the blade	mm#	19
H: Maximum side shift distance of the blade (left)	mm	645
I: Maximum side shift distance of the blade (right)	mm	755
J: Wheel base of rear axle	mm	1553
K: Width of rear counterweight	mm	2196
M: Maximum lifting height of the blade	mm	600
N: Maximum digging depth of the blade	mm	680
Minimum chip angle of the blade	°	28
Maximum chip angle of the blade	°	74
Maximum tilt angle of the blade	°	90

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Maximum swing angle of the blade	º	360
O: Hinge angle of the frame	º	27
Swing angle of the rear axle	º	15
Minimum ground clearance	mm	430
Ground clearance of the front axle	mm	602
Tilt angle of the front wheel	º	18
Swing angle of the front axle	º	16
P: Steering angle of the front wheel	º	50

Technical parameters

Weight of the complete machine (standard configuration)	kg	15500
Maximum traction force kN (f=0.75)	kN	80
Minimum turning radius	mm	7200
Maximum gradeability	% / °	47%(25°)
Forward gear 1 speed	km/h	6.2
Forward gear 2 speed	km/h	10.7
Forward gear 3 speed	km/h	12.4
Forward gear 4 speed	km/h	21.2
Forward gear 5 speed	km/h	26.2
Forward gear 6 speed	km/h	≥40
Reverse gear 1 speed	km/h	6.2
Reverse gear 2 speed	km/h	12.4
Reverse gear 3 speed	km/h	26.2
Ground pressure of the blade	kg	7600
Rated power	kW	140
Rated speed	r/min	2200
Lifting speed of the blade	mm/s	≥150
Lowering speed of the blade	mm/s	≥100
Electrical system voltage	V	24

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Performance parameter of main parts

Part/ System	Item	Unit(s)	Parameters
Diesel engine	Manufacturer	/	SDEC
	Model	/	SC7H190
	Type	/	Electric control and high-pressure common rail
	Air intake mode	/	Turbo charging + air-air intercooler
	Layout mode and number of air cylinders	/	Inline six-cylinder
	Total displacement of pistons	L	6.44
	Emission standard	/	Guo III
	Rated power	kW	140
	Rated speed	r/min	2200
	Maximum torque	N.m	820
	Maximum torque rotate speed	r/min	1200~1500
	Idling speed	r/min	800
	Maximum idling speed	r/min	≤2376
	Oil/fuel consumption ratio	%	≤0.4%
	Engine power	kW	2
	Starter motor power	kW	6
Torque transmission	Manufacturer	/	ZF
	Torque converter model	/	W340
	Torque ratio	/	2.14
	Transmission model	/	6WG200
	Working pressure of variable-speed pump	Mpa	1.6~1.8
	Number of forward/reverse gear	/	F6/R3
	Speed-variable mode	/	Counter shaft power shift
Rear axle	Manufacturer	/	TAIAN LUTONG
	Model	/	PY180.39-LX(LiuGong)C
	Type	/	Three-stage whole-type full-floating bearing
	Wheel base	mm	1542.2~1564.2
	Service brake type	/	Overall hydraulic disk brake
	Differential type	/	NOSPIN
	Final drive type	/	Sprocket drive
	Swing angle of the rear axle	°	15
Tire rim	Tire size	/	17.5-25
	Rim specifications	/	25-14.00/1.5
	Tire ply rating	/	12
	Tread pattern type	/	L-3
	Tire inflation pressure	Mpa	0.32

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Part/ System	Item	Unit(s)	Parameters
Work Hydraulic System	Type of the pump	/	Gear pump
	Pump model	/	HPT2-30/30/Y210
	Pump displacement	ml/r	30+30
	Maximum flow	L/min	132
	Rated speed flow	L/min	122
	System pressure	Mpa	20±0.5
	Multiple way valve type	/	AX31849-1
	Multiple way valve flow	l/s	70
	Lifting speed of the blade	mm/s	≥150
	Lowering speed of the blade	mm/s	≥100
Steering system	Type of the pump	/	Gear pump
	Pump model	/	HPT2-30/30/Y210
	Maximum flow	/	66
	Rated speed flow	/	61
	System pressure	/	16.7±0.5
Brake System	Type of the pump	/	Gear pump
	Pump model	/	HPT2-30/30/Y210
	Maximum flow	L/min	66
	Rated speed flow	L/min	61
	System pressure	Mpa	12.8~15.9
	Service brake type	/	Full-hydraulic shoe brake
	Service brake oil pressure	MPa	10.3±0.3
	Parking brake and emergent brake type	/	Manual electric disc type
	Parking brake oil pressure	MPa	12.8~15.9
	Charge pressure	MPa	12.8~15.9
	Precharge pressure of the accumulator	MPa	9.2
Air condition system	Air condition type	/	Heat pump type
	Compressor model	/	GY5H-14
	Refrigerating capacity	w	4600
	Heating capacity	w	5000
	Compressor power	w	3000
	Chip fuse type	/	ANS
Electrical system	Electrical system voltage	V	24
	Battery type	/	6-SPB-50C
	Battery capacity	Ah	55
	The contact current of main power relay	A	100A
	Chip fuse type	/	ATS
	Main fuse type	/	ANS
	Alternator rated power	W	2000

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Complete Machine Inspection Table

Inspection item	No.	Inspection method and acceptance criteria
Inspection before test run	1	**Complete machine information:** visually check the complete machine number for compliance with description of model;
	2	**Fastening bolt:** visual check whether the mounting bolts of the frame hinge are tightened;
	3	**Fastening bolt:** visual check whether the mounting bolts of the engine are tightened;
	4	**Fastening bolt:** visual check whether the mounting bolts of transmission are tightened;
	5	**Fastening bolt:** visual check whether the mounting bolts of rear axle are tightened;
	6	**Fastening bolt:** visually check whether mounting bolts of tire & rim are tightened;
	7	**Water level:** anti-freeze level shall be over the middle line in the level window of expansion tank;
	8	**Engine oil:** pull out the oil dipstick and the engine oil level shall be between the MIN and MAX marks of the dipstick, and the oil is not in white;
	9	**Hydraulic oil:** visually check whether the oil level of the hydraulic oil tank is within the green scale and the oil is not in white;
	10	**Transmission fluid:** when the engine is idling and the transmission fluid temperature does not exceed 40°C, check that the level shall be between cold fluid MAX and MIN marks. Then, put the shift lever to 4th gear and depress the brake, then the accelerator to run the transmission for 5~8min resulting in the transmission fluid temperature reaching 100~110°C. Release the accelerator and put the shift lever to neutral gear, then check that the level is between hot oil MAX and MIN marks when the transmission fluid reaches a temperature more than 80°C;
	11	**Air-tightness:** visual check each hydraulic line, cylinder, transmission, axle, oil tank, radiator, diesel engine for no leakage during inspection;
Climbing up the cab	1	Open and close the left and right doors of cab, and no seizing or abnormal sound should occur;
	2	Shake the interior of the cab by hand and no looseness should occur;
	3	Turn on/off the dome light, radio and tape player, sunshade, cigarette lighter, and they should function normally;
	4	**Seat adjustment:** the height and front & rear adjustment distance of the seat is obvious; adjustment angle of left and right backrest armrest is obvious; move upward the handle at the front of suspension, the suspension rises, otherwise goes down;
	5	**Turning on the electric lock:** turn on the front floodlight, work light, warning lamp, parking light orderly and get off the vehicle to check if they function normally;
	6	**Starting the complete machine:** depress the accelerator pedal and visually check the corresponding change to the speed of the tachometer on the instrument panel;
	7	**Starting the complete machine:** operate the switch of LCD to switch the voltage and timing display;
	8	**Visually check:** timer display and record the time;
	9	**Steering wheel:** Steering gear can be adjusted front and rear normally; no looseness after locking. Lift the steering wheel upwards by hand and no axial runout occurs (≤3mm);
	10	**Horn:** press the horn button on the combination lever/steering wheel and listen for the horn, no abnormal sound and failure shall occur;
Air condition system	1	The air volume switch, temperature mode switch on the A/C panel functions normally and is indicated; the air outlet shall be operated normally;

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Inspection item	No.	Inspection method and acceptance criteria
Driving test	1	**Start the complete machine:** it is started normally, and no abnormal sound is heard from the engine and air filter, and it turns off normally without delay; observe the engine under the diesel engine idling and top speed, it shall not stall;
	2	**Start the complete machine:** adjust the complete machine operating idle speed to a level of more than 950 rpm, and under the working condition of the blade pressing the ground, the engine does not stall;
	3	**Starting the complete machine:** visually check that no trouble code appears on the LCD of instrument panel, and no indicating identification, no alarm flashing or constant lighting appears on the instrument panel;
	4	Control lever: there is no seizing and interference with other parts when operating the lever;
	5	**Inspection of work implement operation:** no abnormal sound shall occur during cylinder lifting; no abnormal sound shall occur during the rotation process of the swing circle;
	6	**Visual check and listening:** visually check that there is no interference between front and rear frame when turning to the maximum left and right steering angle; there is no interference and pulling between hydraulic line&electrical circuit when the steer action occurs for the hinge;
	7	**Gear inspection:** Operate the shift lever, and all the gears shall be available freely for the complete machine;
	8	**Backup alarm:** when the shift lever is placed at reverse gear, the backup alarm begins to perform buzzing alarm immediately;
	9	Drive the vehicle for 10 laps, during which depress the brake pedal and the complete machine is braked, two times per lap; no seizing shall be felt when depressing the accelerator and brake pedal during driving;
	10	**Fault alarm inspection:** observe that no alarm indicator on instrument panel indicates alarm during driving; visually check that oil and water temperature of the torque converter are displayed at green area;
	11	**Steering during driving:** no seizing, heavy or floating is felt when turning to the left and right during driving;
	12	**Power train system inspection:** listen to the diesel engine operation for abnormal sound during driving; front and rear axles have no abnormal sound; transmission & torque converter assembly has no abnormal sound;
	13	**Emergency brake:** apply hand brake after climbing 15% of slope, and then release the brake valve, the complete vehicle shall stay for 5 seconds and remain stationary;
	14	**Pressure maintaining of hydraulic system:** work implements are lifted to the maximum, visually check dropping off doesn’t occur during lifting the cylinder;

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Inspection item	No.	Inspection method and acceptance criteria
Static check	1	**Touch:** there is no oil leakage for fuel pipe joints from front wheel steering cylinder, front wheel tilt cylinder, traction frame swing oil cylinder, frame hinge steer cylinder, blade lead-out cylinder and blade angle cylinder;
	2	**Touch:** there is no oil leakage for fuel pipe joints from hydraulic pump, multiple-way valve, worm box drive motor and swing joint;
	3	**Touch:** there is no oil leakage for joints from the accumulator, the brake steel tube and the brake;
	4	**Touch:** there is no oil leakage for flanges, plugs, dipstick and fuel pipe joint in the hydraulic oil tank;
	5	**Touch:** there is no oil leakage for joints from blade cylinder (if configured), ripper cylinder (if configured) and latch cylinder (if configured);
	6	**Touch:** there is no oil leakage at diesel tank and outlet pipe joint, diesel tank body and flange, plug;
	7	**Visual check:** rear cover with lifting mechanism is raised smoothly during which there is no interference with other parts; there is no interference between lifting jack and frame, radiator; there is no oil leakage at lifting cylinder joint;
	8	**Visual check:** rear cover is symmetrical at left and right sides; bottom of rear cover is attached with counterweight, rear frame, left and right plate;
	9	**Visual check:** diesel engine mounting bolt is fastened and there is no oil leakage at parts on diesel engine and oil pan;
	10	**Visual check+touch:** there is no water leakage at upper and lower water pipe, cool and warm water pipe and water valve; there is no oil leakage at pipe joints of filter, high pressure oil pump, flywheel housing cover;
	11	**Visual check:** A/C pipe runs smoothly and is not interfered with other components, diesel engine high temperature area and the exposed A/C aluminum pipe is not interfered with other components;
	12	**Visual check:** the pulley belt is not twisted and peeled off; and the A/C compressor pulley is in the same horizontal plane with diesel engine pulley;
	13	**Visual check:** clearance between engine fan and shroud is ≥10mm, clearance between the engine and the fan guard is ≥15mm;
	14	**Visual check + touch:** there is no water and oil leakage at radiator assembly and its radiator pipe joint;

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Power System

General Information 2-3
Safety 2-3
Universal Tool and Tooling List 2-5
Introduction of Power System 2-6
Composition and Layout of Power System 2-6
Main Technical Parameters of Power System 2-8
Structure and Function 2-9
Engine System 2-9
Overview 2-9
Diesel Engine Mounting Assembly 2-12
Air Filter 2-22
Muffler 2-23
Cooling System 2-23
Radiator Group 2-28
Fan 2-29
Fuel Tank Assembly 2-30
Test and Adjustment 2-31
Adjust the Valve Lash 2-31
Measurement of Blow-by of Crankcase 2-34
Removal and Installation 2-42
Removal and Installation of Diesel Engine 2-42
Removal, Installation, Disassembly and Assembly of Radiator Group 2-48
Removal and Installation of Fan 2-58
Removal and Installation of Fuel Tank Assembly 2-59
Fault Diagnosis and Troubleshooting Methods 2-64
Precautions for Fault Diagnosis 2-64
Common Fault Code and Troubleshooting 2-64

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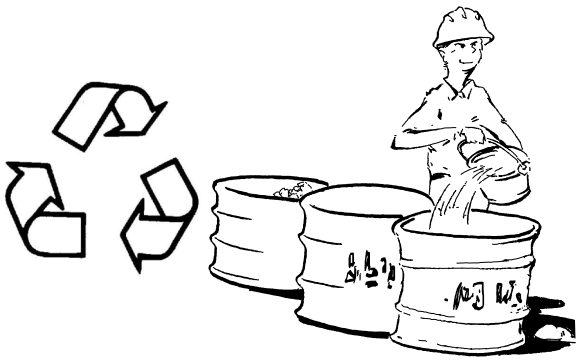
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General Information

Safety

Safe Disposal of Waste Liquid

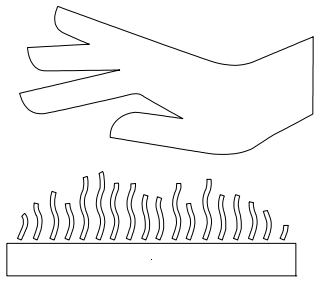
- Improper treatment of waste engine oil, waste diesel fuel and waste DEF is harmful to environment and ecosystem. Treatment shall conform with the local laws and regulations.
- It is necessary to contain and place the liquid spattering during the inspection, maintenance, test, adjustment and repair of machine with vessel. Proper containers shall be prepared well before opening any fluid cavity or disassembling the parts containing liquid. Use proper container when draining liquid.
- Do not use the food or drink containers because they may be drunk by others by mistake.



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Prevent Burn

After running for some time, parts of the machine will be hot, such as engine, DPF (Diesel Particle Filter) and inter-cooler tube which can be inspected or repaired only after being cooled down.

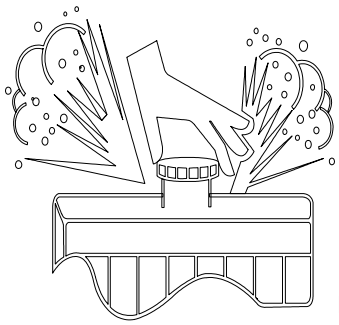


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Coolant

At working temperature, the engine coolant is at high temperature and has pressure. The radiator and all the pipes connected to the radiator contain hot water or vapor, if you touch them, serious burn would occur.

- When checking the coolant level, the engine shall be shut off and the filler cap shall be cooled to the extent that it can be opened by bare hands. Slowly loosen the filler cap of cooling system to release the pressure.
- Coolant contains alkali which may causing injury and do not let it contact your skin, eyes and mouth.

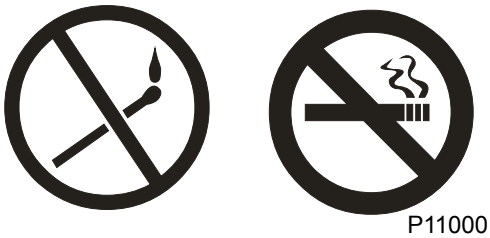


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Safeguard from Fire and Explosion

- All fuel, most lubricant and some refrigerant mixtures are flammables.
- Fuel leaking onto the hot surface or electrical elements may cause fire.
- Do not smoke when refilling or within refiling area, and in the place storing flammables.



P11000157

- Store the fuel, lubricant into containers with relevant marks to avoid use by non-working personnel.
- Put the cleaning cloth or other combustible materials with oil soaked into protective container, and set it at a safe place.
- Do not perform welding or flame cutting onto the pipe containing flammable liquid. Before welding or cutting, flammable liquid shall be cleaned completely.
- Accumulated flammable materials such as fuel, lubricant or other scattered materials on the machine shall be cleaned up.
- Diethyl ether (Warning: Do not use diethyl ether to start the engine).
- Any attempts to start the engine by using diethyl ether may cause serious damage to engine or casualties.



P11000158

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Universal Tool and Tooling List

Name	Specifications
Open-end wrench	7#, 8#, 10#, 11#, 12#, 13#, 16#, 18#, 19#, 20#, 22#, 24#, 30#
Ratchet wrench and socket	Ratchet wrench, 10#, 11#, 12#, 13#, 16#, 18#, 19#, 20#, 22#, 24#, 30# socket
Torque wrench	120±6N.m, 1020±6N.m
Traveling crane	More than 2t
Wire rope with hooks	Load bearing over 840Kg
Steel ruler	Steel ruler
Straight screwdriver	
Cross screwdriver	T25
Lifting eye	
Plastic sealing membrane	
Waste oil tank	
Remarks:	

Precautions on removal and installation:

1. Removal and installation shall be carried out when engine is cool. In general, open engine hood after engine is shut down, and wait for 15 minutes before the engine is cooled down;
2. Measurement equipment and tools such as torque wrench shall have compliance certificates issued by metrological department;
3. Because many other related components on the complete machine are concerned during the removal and installation of each component, removed components (especially standard parts) shall be reasonably placed to avoid wrong installation, neglected installation, part missing, etc. during reassembly;
4. When other components are involved in the removal and installation of each component, please refer to the list of tools for removing and installing other components from/on the complete machine, these tools will not be listed in the tool list of this component;
5. If the expected effect can be reached in the ways of using open-end wrench, blower gun and socket as well as ratchet wrench and socket to remove and install, anyone can be chosen.

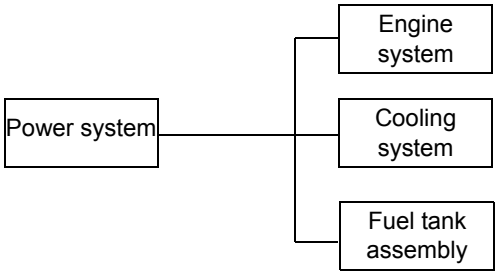
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Introduction of Power System

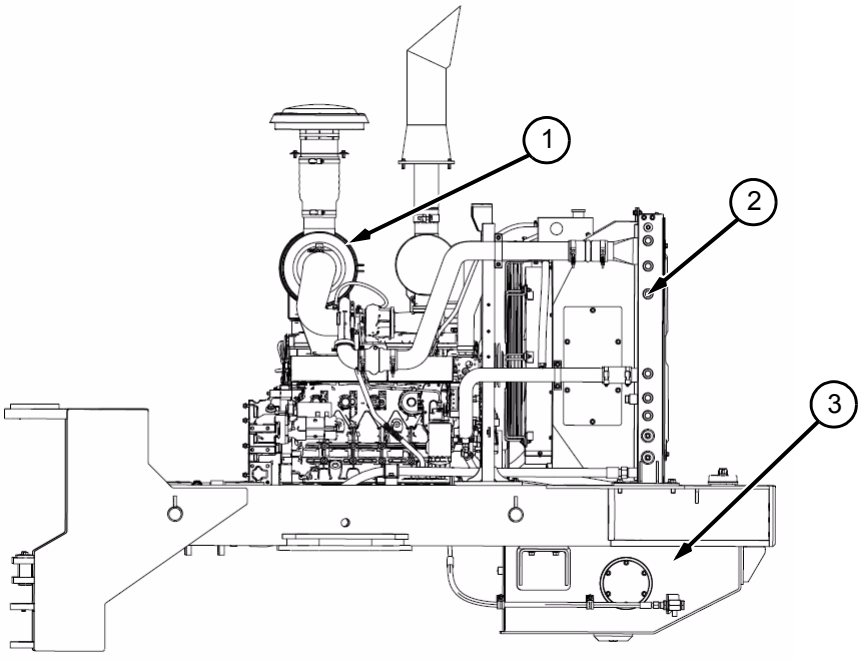
Composition and Layout of Power System

The function of the power system is: supplying the machine with the mechanical energy converted from the chemical energy of fuel. Power system includes: engine system, cooling system and fuel tank assembly.

Module structure of power system



Location of power system on the complete machine

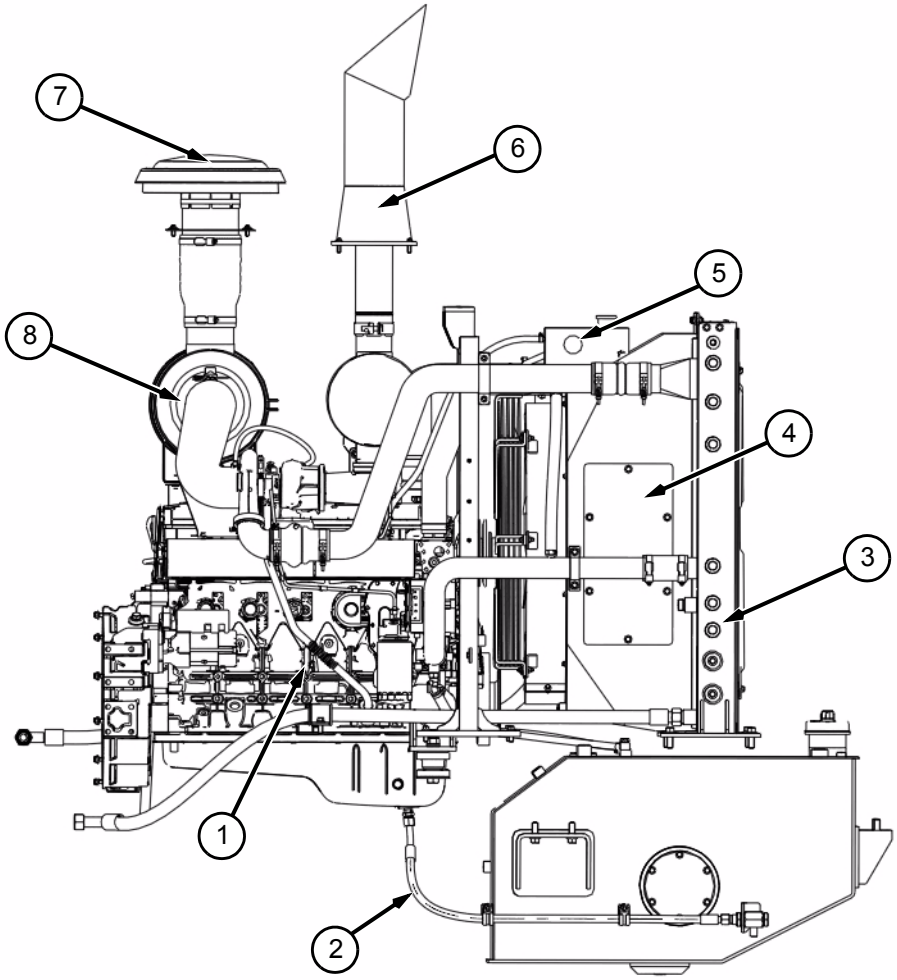


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1. Engine system
2. Cooling system
3. Fuel tank assembly

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Components of power system



P24P00002

1. Diesel engine
2. Oil drain device
3. Radiator group
4. Shroud
5. Auxiliary tank
6. Exhaust pipe
7. Air pre-filter
8. Air filter

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Main Technical Parameters of Power System

Engine	Model	SDEC SC7H190.4G3
	Type	Six-cylinder in-line, four-stroke, turbocharged
	Emission	Guo III
	* Rated power	140kW/2200r/min
	* Maximum idling speed	≤2376r/min
	* Minimum idling speed	800±50r/min
	Engine oil level	18L
	Oil filter	Full flow type and replaceable (filter can rotate)
	Thermostat	Opening temperature: 82°C and full open temperature: 95°C
	Preheating method	Grid heater
	Rotation direction	Clockwise (viewed from the fan end to flywheel housing end)
Cooling system	Fan	Diameter of 760mm, 9 pieces of blades, air blow type
Water radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	880mm X 447mm X 85mm
Torque converter oil radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	880mm X 230mm X 85mm
Hydraulic oil radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	880mm X 144mm X 85mm
Air-air intercooler	Core type	Plate-fin type
	Core size (height × width × thickness)	880mm X 223mm X 85mm
Fuel tank assembly	Total tank volume	348L

Note: Data marked with * is based on engine with fuel system and water pump under intake resistance of 380 mm H_2O (3.72kPa) and exhaust resistance of 160.5 mm Hg (21kPa) but not including alternator, fan, optional configurations and drive components.

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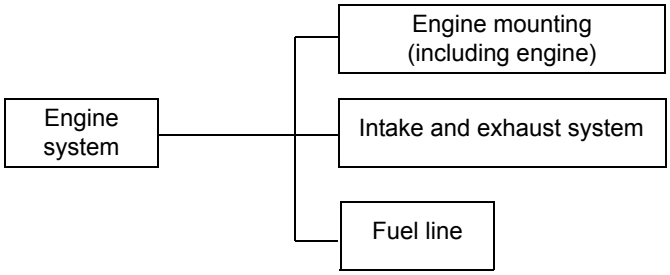
Structure and Function

Engine System

Overview

Components and Layout of Engine System

Engine system consists of engine mounting, intake and exhaust system and fuel line.



Parameters of Engine System

Engine model	SC7H190.4G3
Type	In-line, four stroke, turbocharged & air-air intercooler
Number of cylinder	6
Displacement	6.44
Rated power	140X(1±5%)
Rated speed (r/min)	2200
Maximum no-load speed (r/min)	≤2376
Minimum no-load speed (r/min)	800±50
Oil/fuel consumption ratio	≤0.4%
Net weight of diesel engine (kg)	600X(1+5%)
Fan pulley speed ratio(Fan speed ratio/diesel engine speed)	0.87: 1
Distance from fan center to crankshaft center (mm)	394.5
Alternator specification	28V/70A
Maximum power and rated voltage of starter motor	6KW/24V

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Working Principle of Engine System

Engine sucks fuel from fuel tank, and the fuel enters into fuel common-rail pipe of the engine via fuel line, then common-rail pipe connects with injector of which injection time and quantity are controlled by engine ECM. Engine pumps air from atmosphere, which enters into cylinder by air filter filtering, then the air mixes into inflammable mixture with fuel injected into cylinder. Air mixture is compressed dramatically when piston rises to approximate top dead center, its temperature increases to ignition point and it burns severely, and gives out a large number of energy to drive piston to move. Piston links up with crankshaft via piston rod, and piston goes on circular movement by piston up-and-down motion driving crankshaft. Crankshaft outputs energy via flywheel. Burnt exhaust gas enters into exhaust manifold, and gathers to turbocharger driving turbocharger rotation. Then, the exhaust gas enters into the muffler from the exhaust pipe and is exhausted into atmosphere from exhaust pipe.

Inspection and Test of Engine System

Daily inspection of engine

Check the diesel engine periphery before starting it every day as follows:

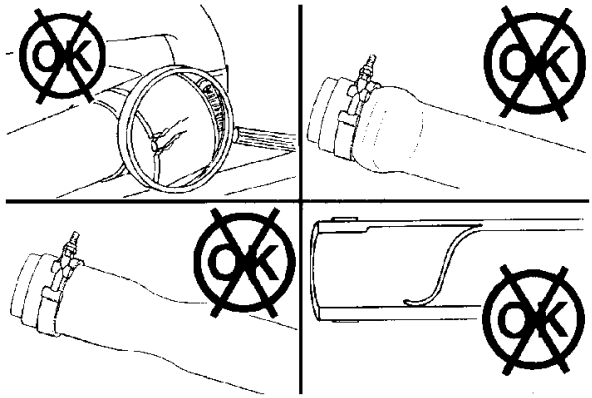
- Check whether there is rag, scrap wire, pipe clamp, screw and other foreign matters on the diesel engine and the radiator which shall be kept clean and tidy.
- Check whether each joint and mating surface of the fuel system, the cooling system and the lubrication system are in leakage.
- Check the fastening conditions of accessories.
- Check whether the fan connection and safety cover are safe and reliable.
- Check whether the electrical circuit connector is loose and whether the wire is good.
- Check whether the drive belt is good.

Intake line

Check daily whether the intake line is worn and damaged whether the clamp is loose and has small holes, which may cause damage to the engine.

If necessary, replace the damaged pipe and tighten the loose clamp to avoid leakage of air system.

For torque specifications, please refer to the equipment manufacturers maintenance information. Check whether the intake pipe clamp and hose are corroded. If any, the corrosive stuff and dirt will enter into the air intake system. If necessary, disassemble and clean it.



P24P00003

Check the engine oil level

Check daily the engine oil level before the vehicle started or at stop state (at least 5 minutes after the vehicle is stopped so that there is enough time for the oil returning to the oil pan). The oil level shall be between "ADD" and "FULL" on the oil dipstick. If oil is insufficient, please fill it.



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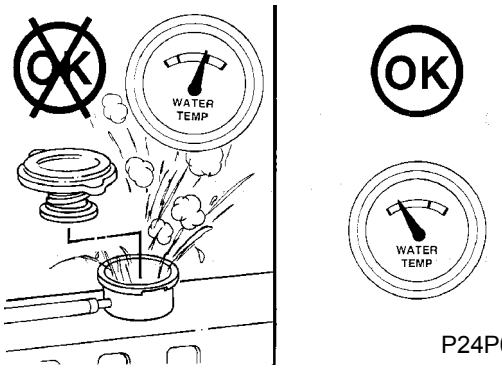
⚠CAUTION

Do not operate the diesel engine as the oil level is lower than "ADD" scale, otherwise, the performance of the diesel engine will become poor, or even, the diesel engine will be damaged. However, the oil level shall not be high than "FULL" scale.

Inspection of coolant level

⚠WARNING

Do not open the pressure cover on hot engine. The pressure cover can not be opened until the coolant temperature is lowered below 50°C [120°F]. Otherwise, the ejected high-temperature coolant or vapor may cause personal injury!



P24P00004

⚠WARNING

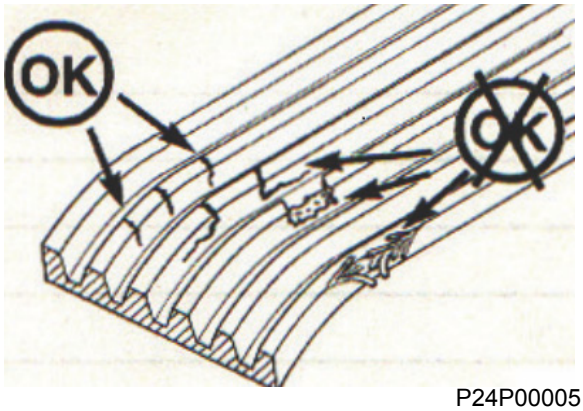
The skin and eye shall not contact the coolant of which the anti-rust agent contains alkaline to avoid being injured.

⚠CAUTION

Do not prevent leakage of the cooling system using the sealing additive. Otherwise, the cooling system will be blocked and the coolant will not flow smoothly so that the engine will be overheated.

Check the transmission belt

Visually and daily check the drive belt. Check whether the belt has crossbas crack. The transverse crack along with the belt width is permitted. Rather than the longitudinal (along with the belt length) and transversal crack. Replace the belt if it is worn or its material is peeled off.



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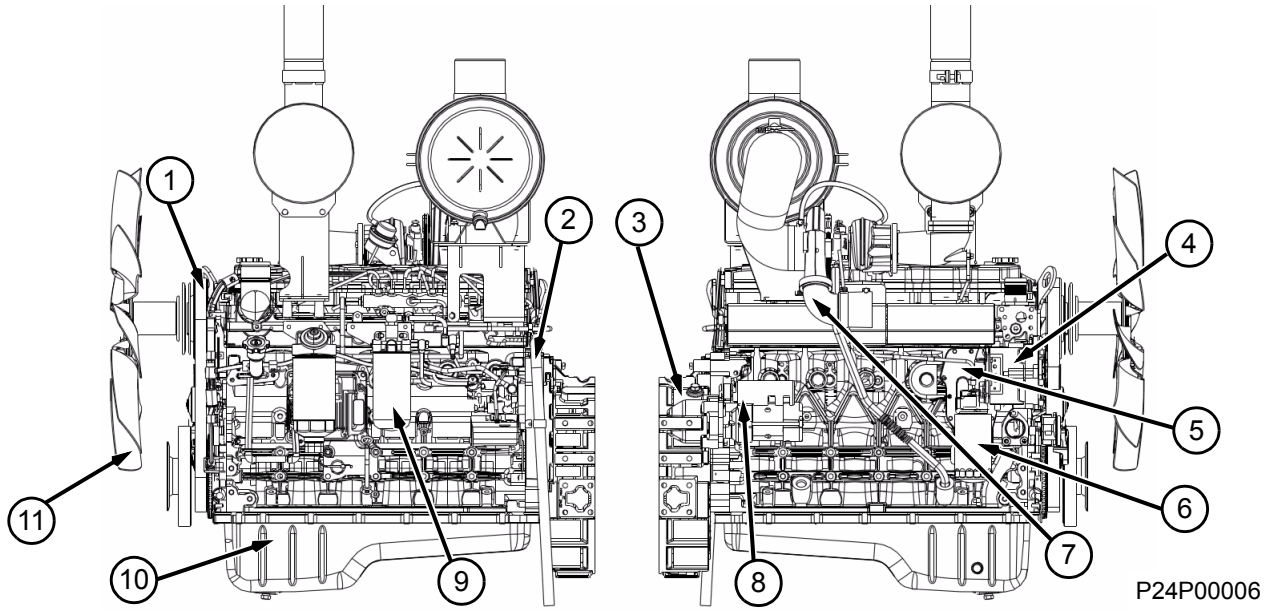
Diesel Engine Mounting Assembly

Parameters of Diesel Engine

Model	SDEC SC7H190.4G3
Number of cylinder	6
Bore	105 mm
Stroke	124 mm
Displacement	6.44L
Suction mode	Turbocharged inter-cooled
* Rated power	140kW/2200r/min
* Maximum idling speed	≤2376r/min
* Minimum idling speed	800±50r/min

Structure of Diesel Engine Component and Working Principle of System

Outside view of SDEC engine SC7H190.4G3

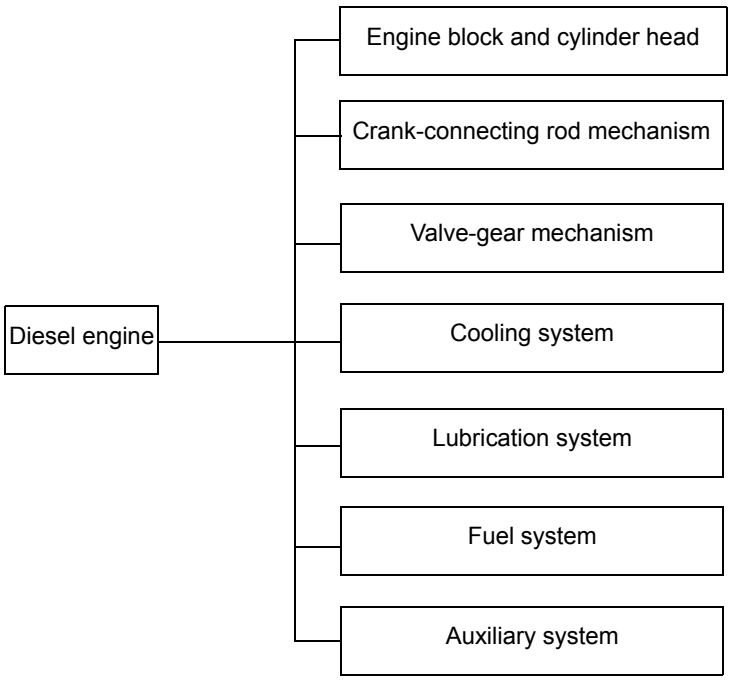


1. Belt pulley system
2. Crankcase ventilating pipe
3. Flywheel housing
4. Alternator
5. Oil cooler
6. Oil filter
7. Turbocharger
8. Starter motor
9. Fuel filter
10. Oil sump
11. Fan

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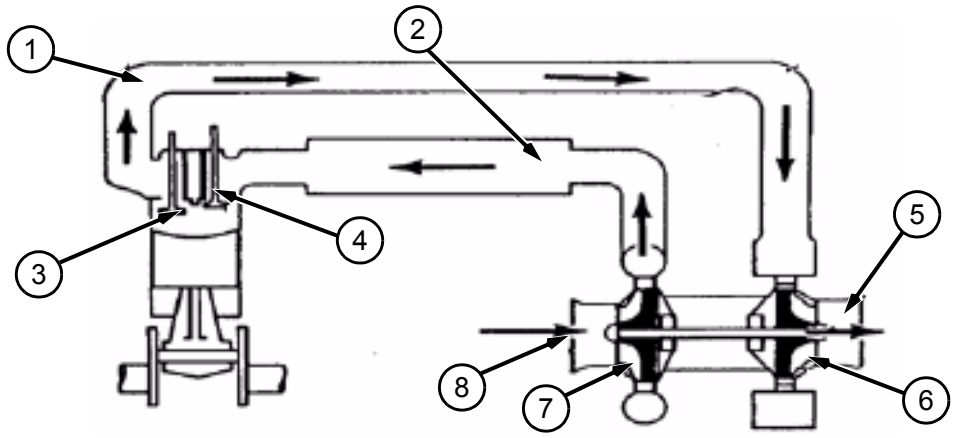
The diesel engine is generally composed of two major mechanisms and four systems:

Module structure of power system



The working principles of diesel engine main systems are as follows:

1) Intake and exhaust system



P24P00007

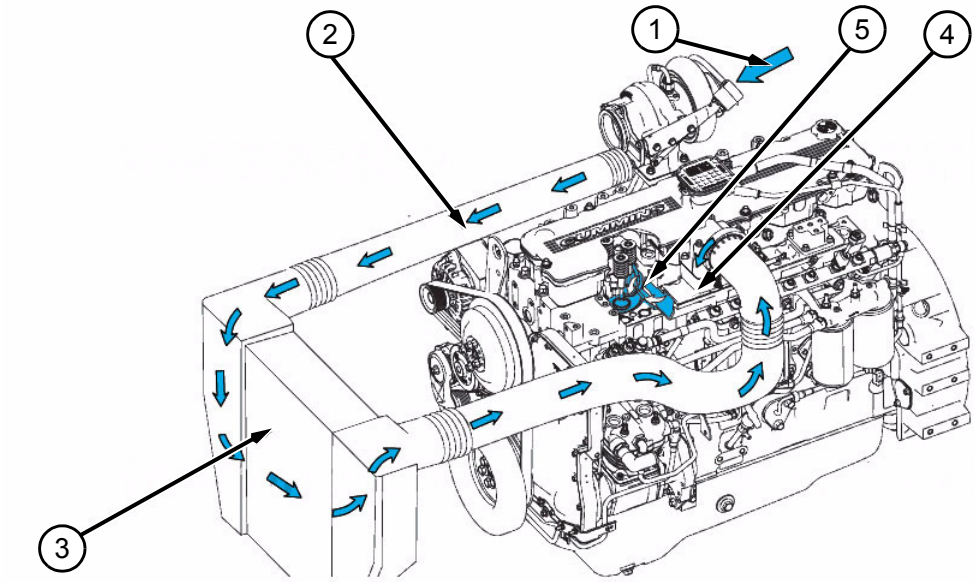
1. Exhaust pipe
2. Intercooler and intake pipe
3. Exhaust valve
4. Intake valve
5. Exhaust vent
6. Exhaust turbine
7. Intake compressor
8. Air inlet via air filter

Intake and exhaust system mainly consists of air filter, intake compressor, intercooler, intake pipe, cylinder head, intake valve, engine block combustion chamber, exhaust valve, exhaust pipe, exhaust turbine (turbocharger) and muffler.

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Air intake started from the air filter enters the compressor 7 via its inlet 8. Air after being compressed is cooled by the intercooler and then enters the combustion chamber (via the intake pipe 2 and air inlet in the cylinder head) in which the air is mixed and combusted with injected fuel so as to push the piston to work. When the exhaust valve 3 is open, the exhaust gas after being combusted in the cylinder enters the exhaust turbine 6 (turbocharger) via exhaust pipe 1 and drives the turbine shaft to rotate. The exhaust gas is discharged from the muffler and the rotating turbine shaft provides compressed power for the turbo compressor. Adopt the turbocharging intercooling technology to improve the engine performance better. Set an air-air intercooler between the compressor outlet of the turbocharger and the air inlet of the cylinder head to cool the air from the compressor before delivering it to the cylinder.

Air intake system flow chart

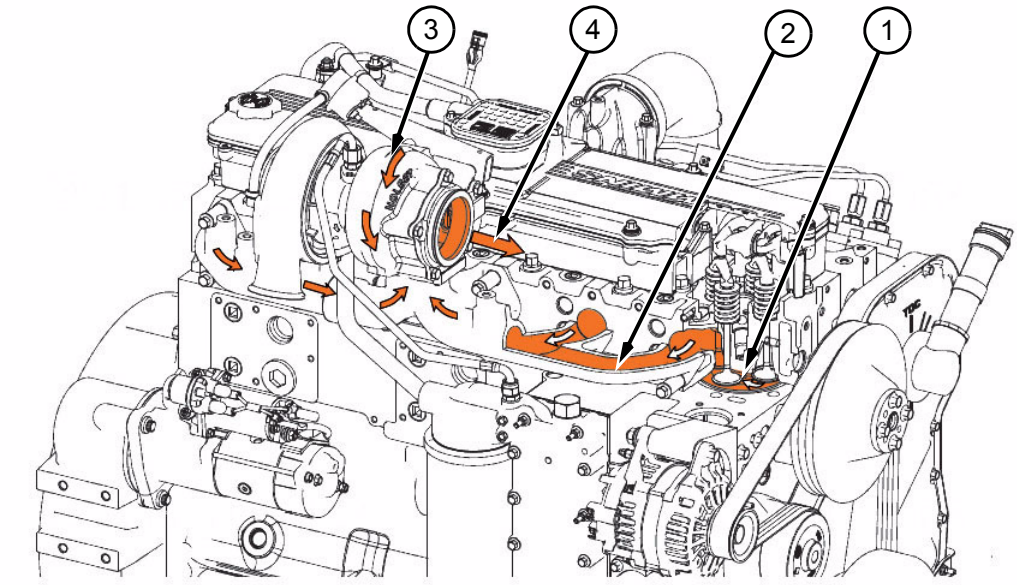


P24P00008

1. To the air inlet of the turbocharger
2. Air from the turbocharger to air-air intercooler
3. Air-air intercooler
4. Intake manifold (integrated with the cylinder head)
5. Intake valve

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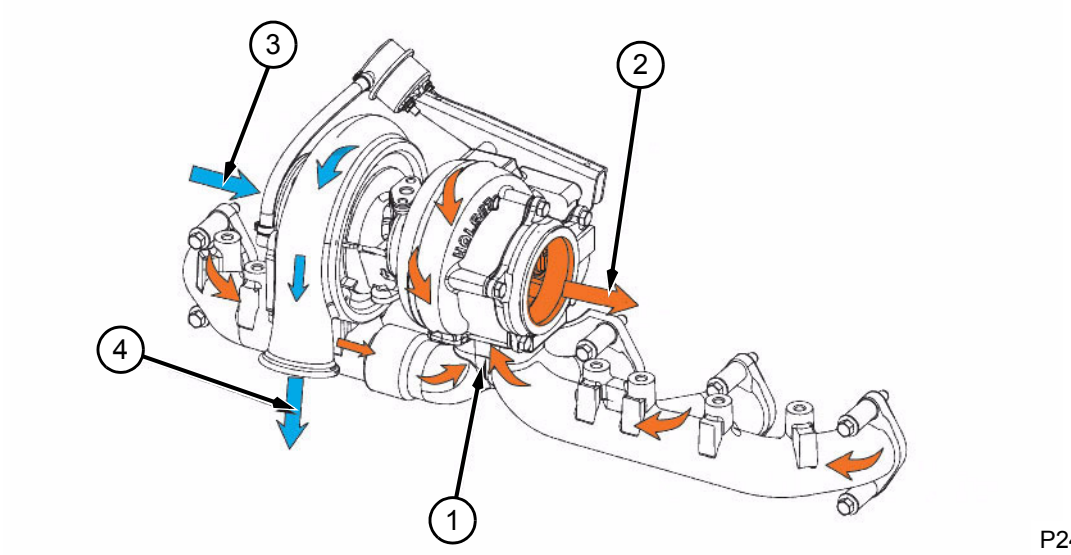
Exhaust system flow chart



P24P00009

1. Exhaust flow from the cylinder
2. Exhaust manifold (pulse type)
3. Dual inlet turbocharger
4. Exhaust flow from the turbine housing

Chart for air in the turbocharger



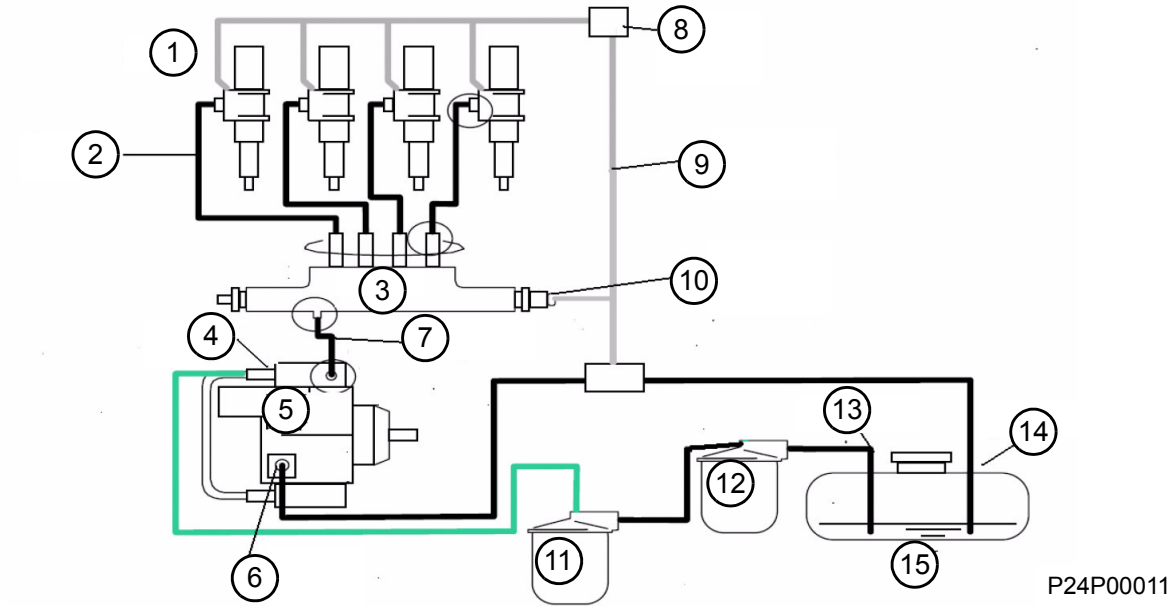
P24P00010

1. The exhaust into the turbocharger turbine housing
2. The exhaust discharged from the turbine housing
3. Air into the turbocharger compressor housing
4. Air discharged from the compressor housing

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2) Fuel system

Engine fuel system diagram



1. Injector
2. High pressure fuel pipe inner diameter 3
3. Common rail pipe
4. Fuel pump inlet
5. Fuel pump components
6. Fuel pump return port M10X1
7. Common rail oil inlet pipe inner diameter 3
8. Injector return pipe joint M12X1.25
9. Injector return pipe inner diameter 8
10. Common rail pipe oil return port
11. Final filter
12. Primary filter
13. Fuel outlet
14. Fuel return port
15. Tank

When the engine works, fuel in the fuel tank via the primary filter is firstly filtered by final fuel filter, and then flows to the fuel injection pump in which the fuel is pressed to high-pressure common rail pipe. The common rail supplies high pressure fuel for the injector which injects the fuel to the combustion chamber so as to provide the fuel power for engine working. Structural parts of fuel feed pump, high-pressure common rail and injector have the pressure relief valve. When the fuel pressure exceeds the setting value, fuel will overflows from the pressure relief valve to fuel tank.

Description:

1. The final fuel filter is equipped with fuel pressure sensor which has switch type and semiconductor type. In general, two-wire system is the switch type and three wire is the semiconductor type. It is used to determine whether the oil inlet pressure is normal and the alarm limit. Whether the sensor is installed depending on the configuration.
2. For the electronic control engine, SDEC 7H engine is equipped with HP3 fuel pump. The fuel feed pump is lubricated and cooled by the fuel. The return joint on the pump is only for the flow of lubricated and cooled fuel. The step valve in the fuel pump controls the fuel entering pressure when fuel enters SCV valve so that the fuel quantity is free from the pressure fluctuation.
3. The pressure limiter is not open during the normal work of engine (the fuel pressure is within the normal range), that is, there is no fuel return.
4. The cylinder head is engraved with forwards and backwards fuel return passage.
5. The injector is the separate type, the fuel pipe and injector body are sealed coordinately under the squeezing action of fuel pipe sphere and the injector body cone surface.

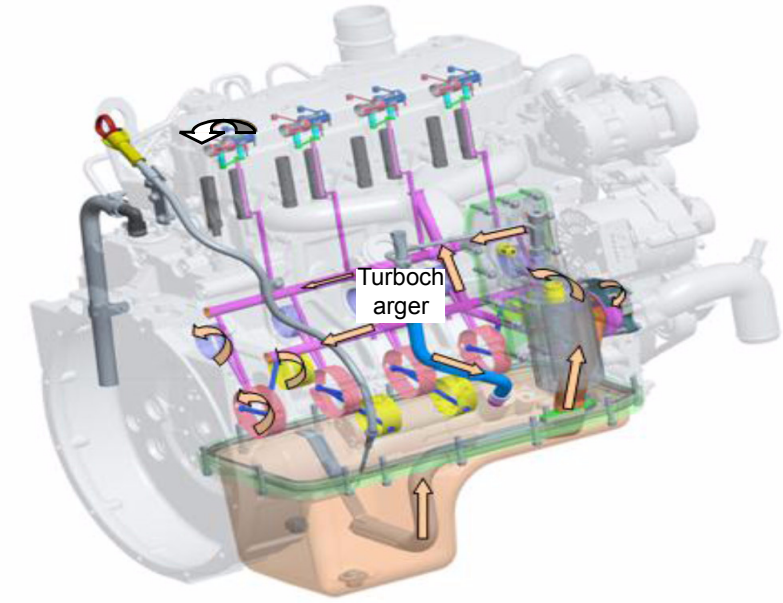
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⚠CAUTION

Replace the fuel filter at regular interval, otherwise, the diesel engine power will decrease, even serious fault of fuel injection pump and injector will be caused.

3) Lubrication system

Engine lubrication system oil flow diagram

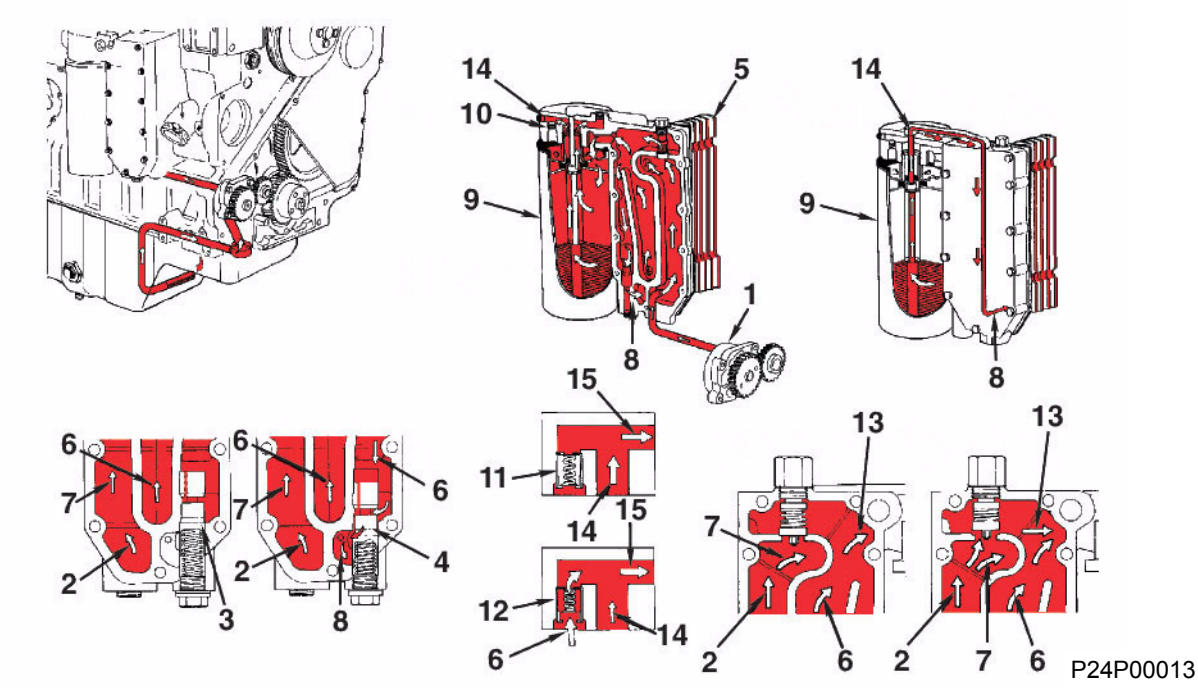


P24P00012

The oil flow in the lubrication system starts from oil pump. Oil pump will pump the oil from oil sump pump via the oil suction pipe to the oil cooler. After being cooled, oil enters into the oil filter for being filtered, then enters main oil passage of the engine and flows to crankshaft, main bearing, camshaft, piston, connecting rod, valve-gear mechanism, gear and other positions trough various oil passages for the functions of lubrication, cooling and cleaning and finally flows back to oil sump. If the oil filter is blocked, the oil will directly enter main oil passage via the bypass valve. Oil in the other oil line will directly flow from the oil filter base passage via the turbocharger oil inlet line to the turbocharger impeller shaft and bearing, and returns to the oil sump via the turbocharger return pipe after lubricating, cooling and cleaning the impeller shaft and bearing.

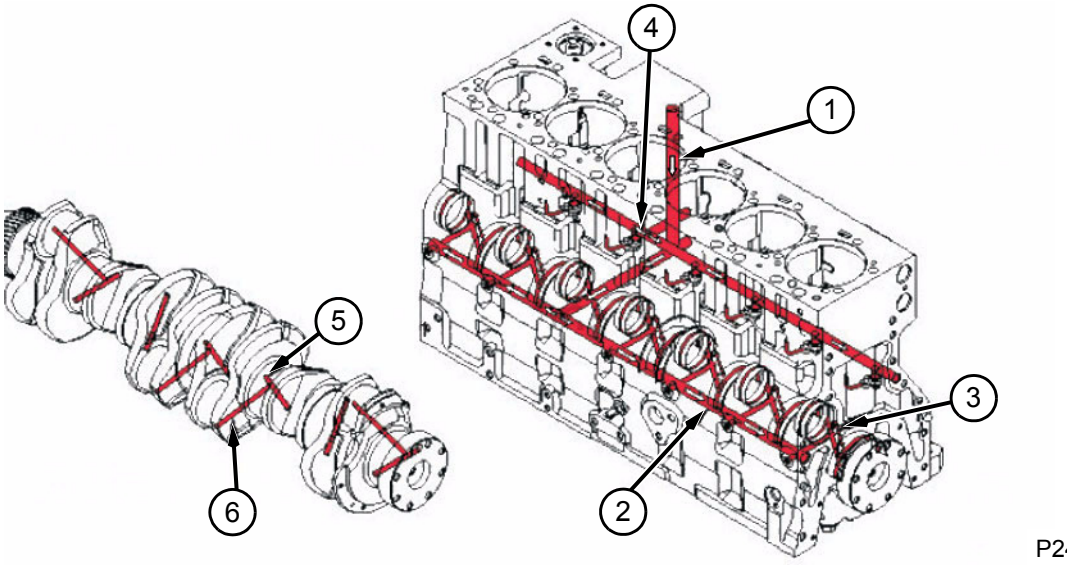
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Oil cooler fluid flow



1. Internal gear oil pump
2. From oil pump
3. Pressure regulating valve close
4. Pressure regulating valve open
5. Oil cooler
6. From oil cooler
7. To oil cooler
8. To oil sump
9. Full-flow oil filter
10. Filter bypass valve
11. Filter bypass valve close
12. Filter bypass valve open
13. To oil filter
14. From oil filter
15. To main oil passage

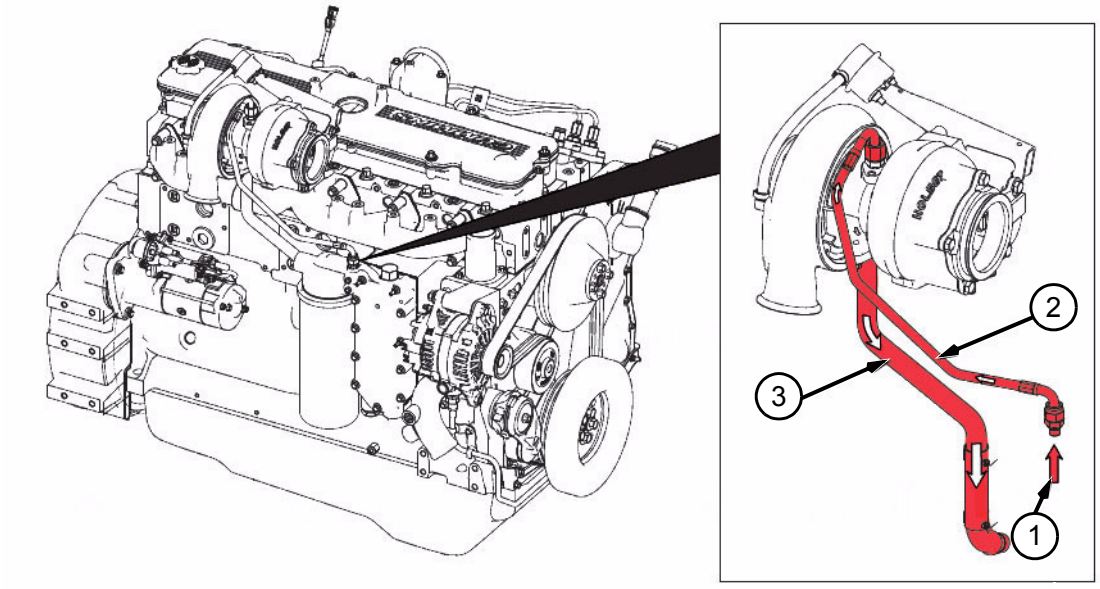
Lubrication of working components



1. From oil filter
2. Main oil gallery
3. To camshaft
4. To piston cooling nozzle
5. From main oil passage
6. To connecting rod bearing

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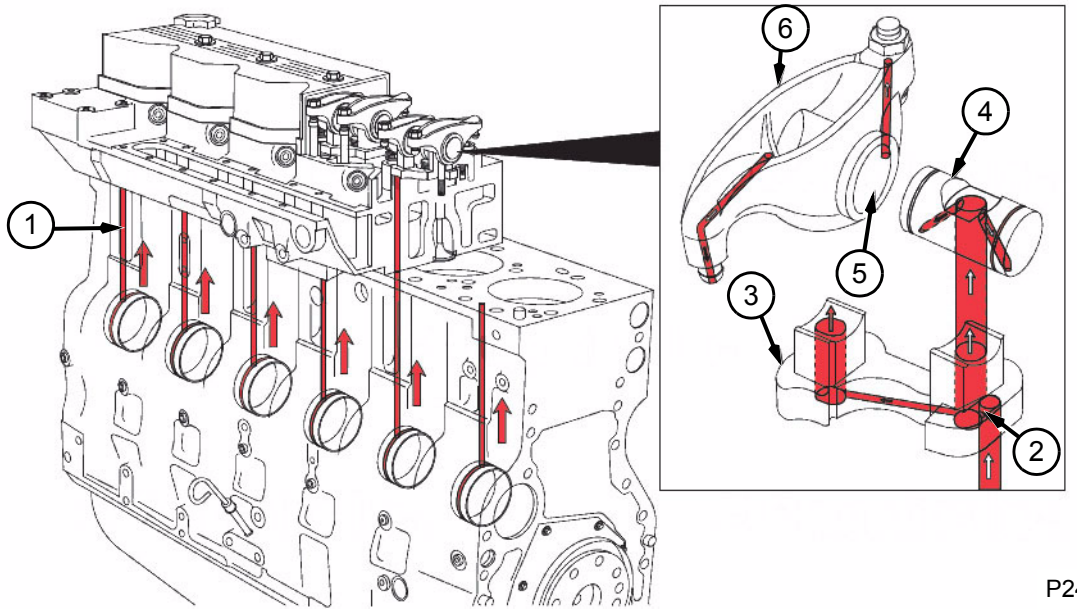
Lubrication of turbocharger



P24P00015

1. Oil supply from oil filter base
2. Oil supply for turbocharger
3. Oil return from turbocharger

Lubrication of top-mounted mechanism



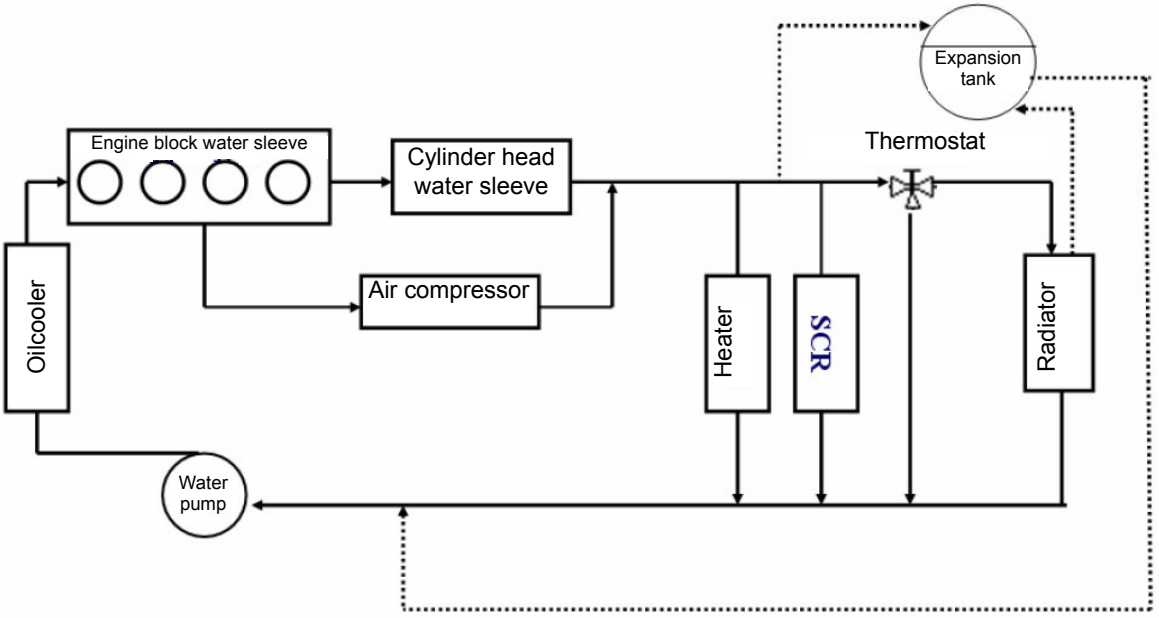
P24P00016

1. From camshaft bush
2. Oil transfer slot
3. Rocker arm support
4. Rockshaft
5. Rocker arm bore
6. Rocker arm

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4) Cooling system

Engine cooling system diagram



P24P00017

Main function of the cooling system is to remove the heat produced by the diesel engine, engine oil and its load parts. Other heats not being removed by cooling system will be removed by exhaust or will radiate to the atmosphere. Engine coolant via the water pump enters the oil cooler water cavity for cooling the oil, and then enters the engine block water sleeve and cylinder head water sleeve in sequence, after cooling the engine, it enters the thermostat which is located at water outlet of the cylinder head water sleeve. When the engine coolant temperature does not reach the opening temperature of the thermostat, the coolant flows directly to the inlet of water pump; if the engine coolant temperature reaches the opening temperature of the thermostat, the coolant enters water tank for cooling, and then flows into the inlet of water pump.

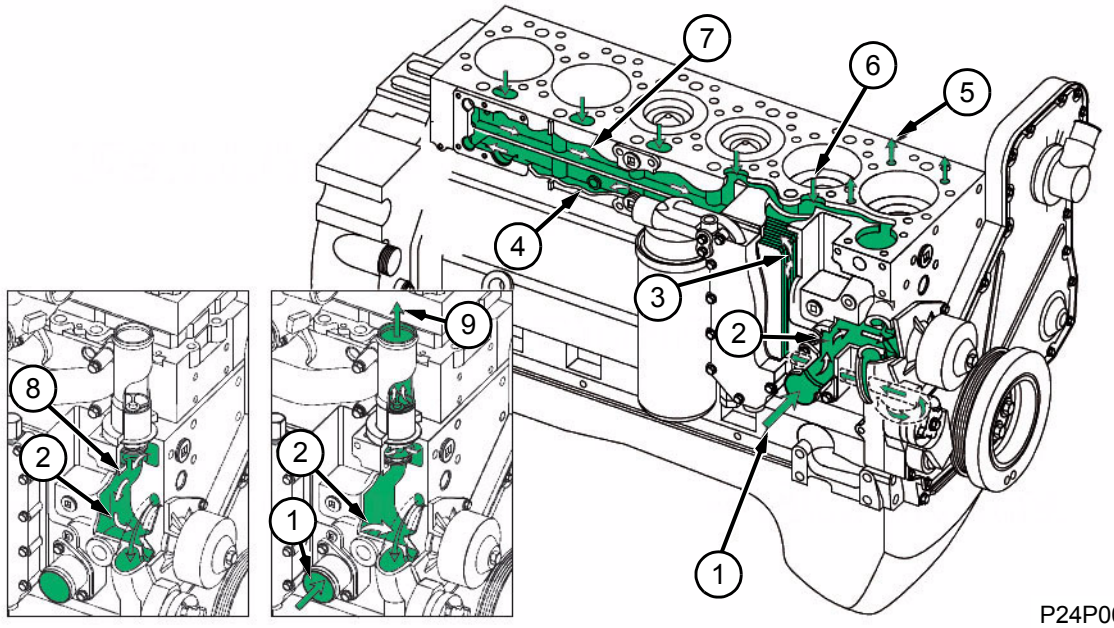
Path for coolant of engine block and cylinder head: water inlet of engine block → water pump volute chamber → oil cooler cavity → engine block water sleeve → cylinder gasket → lower water sleeve of cylinder head → upper water sleeve of cylinder head → cylinder head water outlet pipe.

Description:

1. The cylinder head has the function of water distribution.
2. SCR (Guo IV) system is heated either by the heating wire or by coolant. The heating wire is used when the engine temperature is still low before and after the engine is started; while the coolant heating is working after the engine temperature is normal.
3. Working range of thermostat: 82±2°C≤THW≤95°C and lift range L≥ 8mm.

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Coolant flow diagram



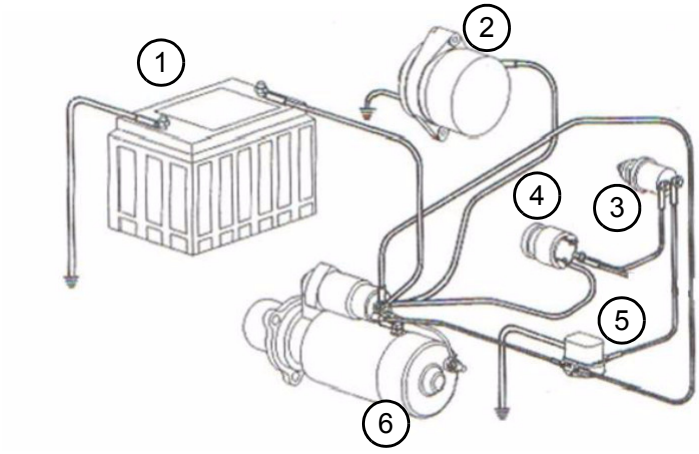
P24P00018

1. Coolant from the radiator
2. Water pump suction pipe
3. Coolant flowing through oil cooler
4. Lower water manifold of cylinder block (to cylinder)
5. Coolant flow to the cylinder head
6. Coolant returning from the cylinder head
7. Upper water manifold of cylinder block
8. Thermostat bypass
9. Coolant returning to the radiator

5) Electrical starting system

Main components of electrical starting system are the battery, the starter motor, the alternator, etc. Its diagram is shown as follows. If the electrical starting system is controlled by ECU, the starting operation is related with ECU.

Electrical starting system diagram



P24P00019

1. Battery
2. Alternator
3. Start button
4. Key switch
5. Start Relay
6. Starter Motor

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Brief introduction to working principle: when the engine starts, the battery supplies power for the starter motor; after the engine starts, the pulley drives the alternator to run for power generation, the alternator charges the battery and the battery supplies power for other systems (such as lamp and audio) when the engine is stopped.

Air Filter

Parameters of Air Filter

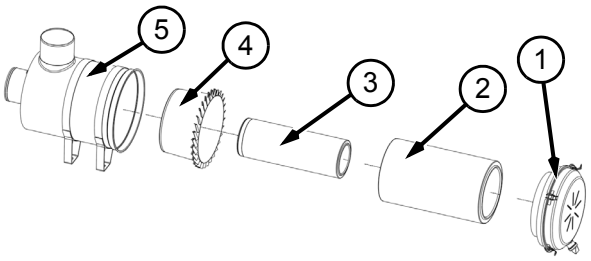
Flow	800m³/h

Structure and Principle of Air Filter

The air filter is composed of housing, main filter element, safety filter element and end cover.

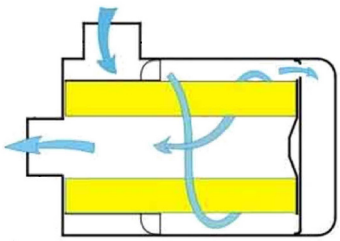
Air filter, through main filter element and safety filter element, ensures that clean and dry air enters engine.

When the engine operates, the air enters the air filter through the rain cap, and is filtered by the main filter element and is then secondarily filtered by safety filter element, as shown in figure below:



P24P00020

1. End cover
2. Main filter element
3. Safety filter element
4. Twisted leaf
5. Housing



P24P00021

Intake air filter alert of this machine is the electronic induction type. When the filter works for a period of time, much dust is accumulated on filter element, and resistance of air through filter increases. When circulating air resistance is more than 6.2KPa, intake air filter alert sensor installed between air filter and turbocharger will transmit signal to intake air filter alert indicator on instrument panel. When the indicator goes on, air filter shall be maintained.



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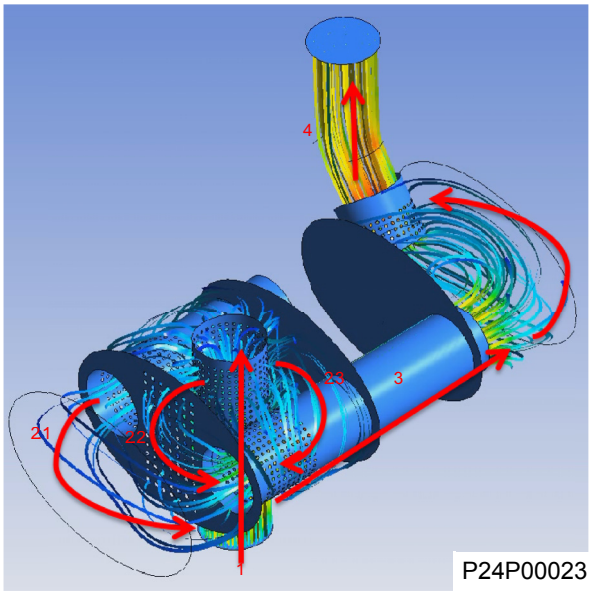
Muffler

Parameters of Muffler

Exhaust back pressure	5kPa
Flow	1785m³/h
Insertion loss	15.5dB

Structure and Principle of Muffler

As shown in figure below, hot gas 1 exhausted from the engine enters the muffler, the gas after being muffled by internal cellular network of the muffler reaches the air outlet 4 of muffler via the internal line 3 for being exhausted to the atmosphere.



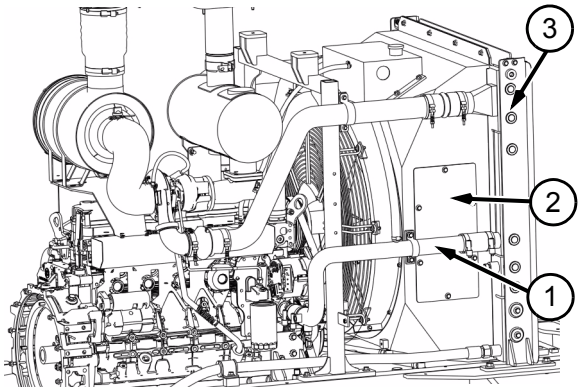
P24P00023

Cooling System

Components and Layout of Cooling System

The cooling system consists of radiator group, radiator line, fan, baffle and other parts and components.

Lubrication of working components



P24P00024

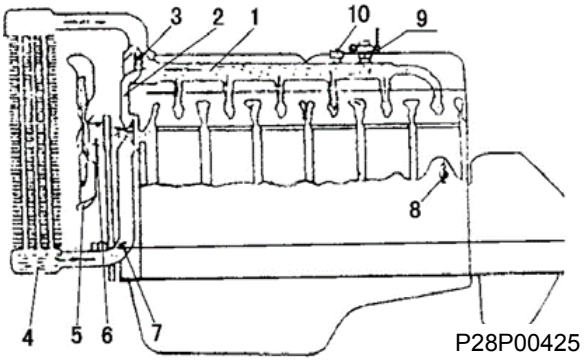
1. Radiator line
2. Shroud Assembly
3. Radiator group

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Working Principle of Cooling System

Cooling system comprises radiators and corresponding connecting lines and the radiators are composed of water radiator, air-air intercooler, hydraulic oil radiator and torque converter oil radiator. Its function is to radiate heat produced by each component (or system) into the air along with cooling air in order to ensure each component works properly in appropriate temperature range.

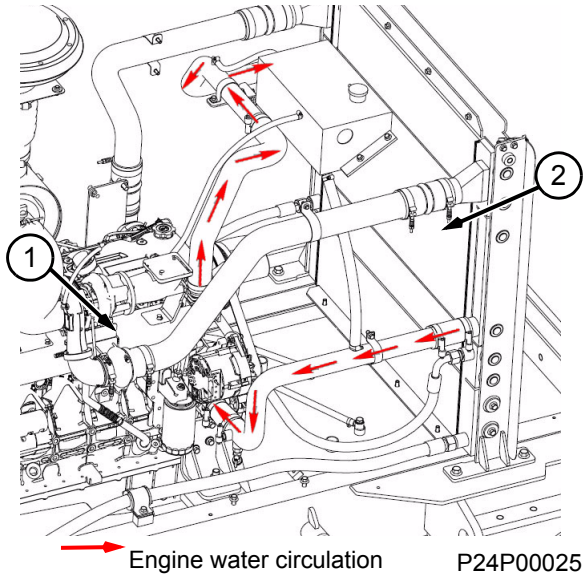
As shown in the figure below, diesel engine cooling system mainly comprises a radiator (water tank), a water pump, a fan, a thermostat, an oil cooler, water inlet and outlet pipes, etc.



P28P00425

1. Water outlet pipe assembly
2. Small circulation
3. Thermostat
4. Radiator
5. Fan
6. Water pump
7. Oil cooler
8. Drain valve
9. Heating valve
10. Water temperature sensor

Cooling system of this machine adopts engine to drive fan and air-blow mode to cool. The system adopts forced closed circulating water cooling system. Working principle of system is as follows: water outlet at lower part of radiator is connected with water inlet of oil cooler via the water hose. Water outlet of oil cooler is connected with water pump via the water hose. Water pump pumps coolant into the cylinder block water passage. Coolant firstly cools cylinder through water sleeve inside cylinder block, then flows up to cool cylinder head, and is collected by the water outlet header pipe to reach thermostat. When coolant temperature is lower than 82°C, thermostat is closed, and all coolant is bypassed to water pump inlet. At the moment, the coolant is only circulating between cylinder block and head, so that warm-up can be quickly realized. When coolant temperature reaches 82°C, thermostat starts to be opened, part of coolant flows to water inlet at upper part of radiator and enters radiator and is cooled by radiator fan. When coolant temperature is above 95°C, thermostat is fully opened, bypass hole is closed, and all coolant is cooled by the radiator. The coolant flowing direction at the moment is shown in the figure.



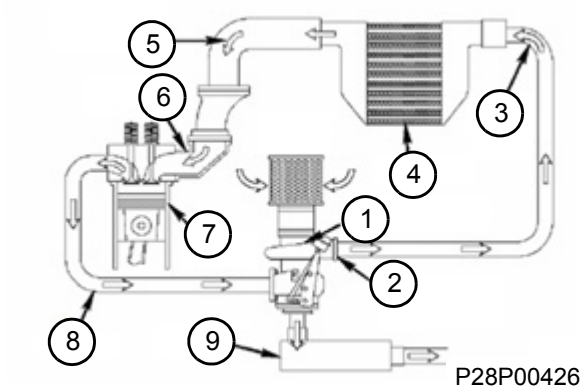
P24P00025

1. Engine
2. Water radiator

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Air-air intercooler radiator

Air-air intercooler radiator has the main function of cooling high-temperature and high-pressure gas via turbocharger, reducing temperature of gas entering engine combustion chamber to increase air density. Its working principle is shown in the figure below. After air is pressurized by turbocharger, its temperature rises up sharply and its pressure is increased. The air flows into air-air intercooler from left air pipe and passes through core of air-air intercooler. External cooling air flows by outside the core to bring away heat of air inside so as to reduce its temperature to be less than 80°C, and then, the air flows into engine intake manifold and cylinder from right air pipe of air-air intercooler.

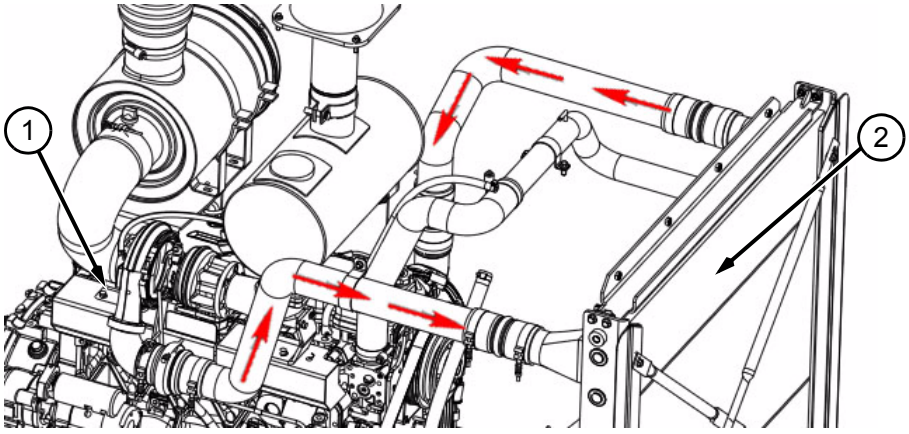


P28P00426

1. Turbocharger air inlet
2. Turbocharger air outlet
3. Pressurized hot air
4. Air-air intercooler radiator
5. Pressurized cold air
6. Intake manifold
7. Cylinder
8. Exhaust gas
9. Muffler

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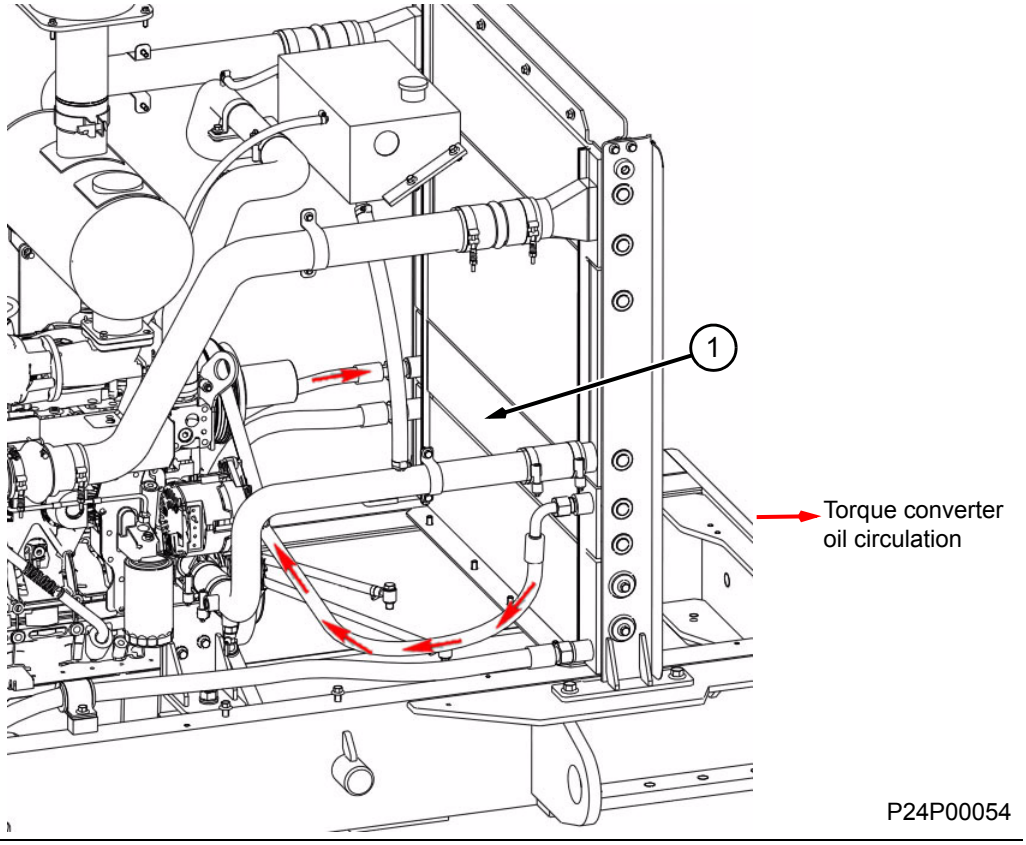
The air-air intercooler cooling system of the machine is arranged as shown in the figure below.



1. Turbocharger
2. Air-air intercooler

Hydraulic oil radiator

Hydraulic oil radiator has the main function of radiating heat generated by hydraulic oil during the working of hydraulic system to avoid temperature of hydraulic oil line from being too high.

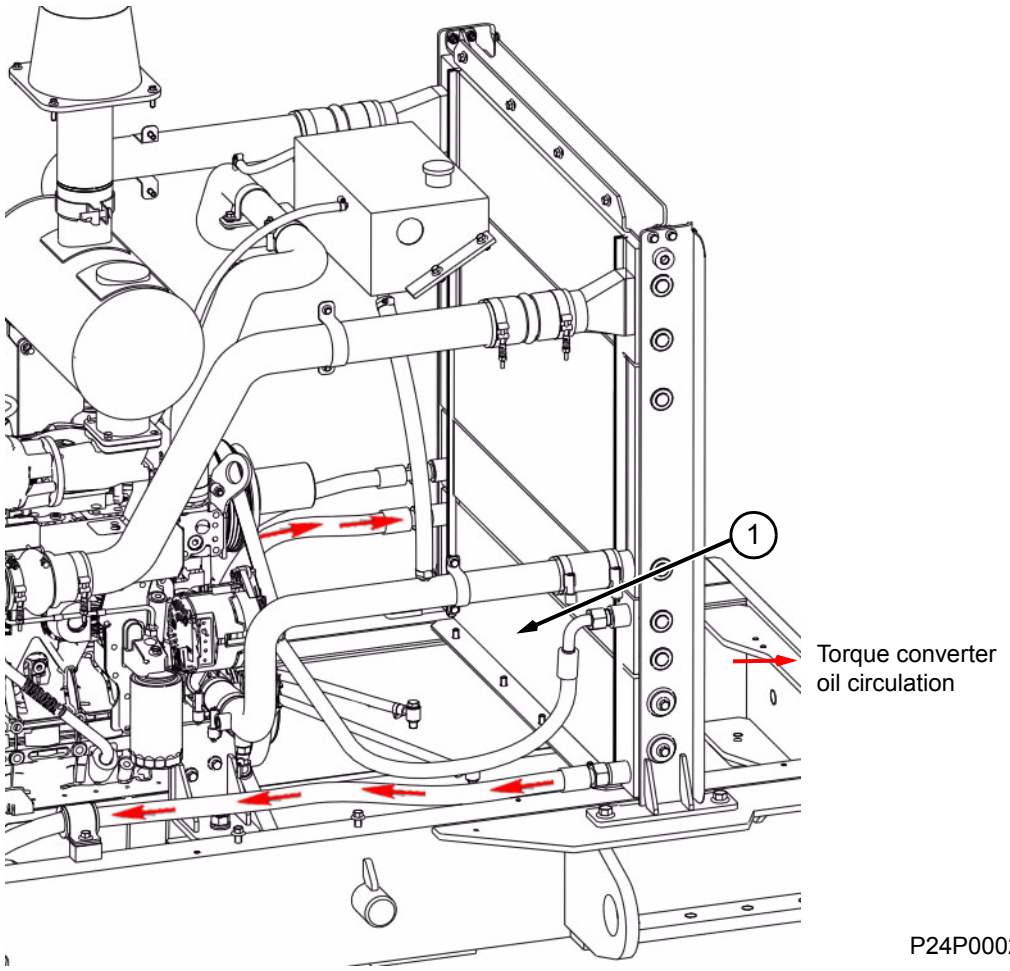


1. Hydraulic oil radiator

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Torque converter oil radiator

Torque converter oil radiator has the main function of radiating heat generated by torque converter oil during the working of transmission and torque converter to avoid temperature of torque converter and transmission from being too high and ensure normal working of machine.



1. Torque converter oil radiator

Inspection of Cooling System

Check

Check the radiator passage wall for cracks, and if any, it is necessary to perform the repair welding and replace the radiator.

Check the radiator fin, and if the fin is bent for a large area so that the passage is blocked, it is necessary to flat the fin by the wind direction or replace the radiator.

Check whether the radiator passage is blocked by debris or impurities, and if any, it is necessary to blow and clean it with compressed air. Please notice that the direction of compressed air shall be inverse with that of air which passes through the radiator during normal operation of the machine.

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Radiator Group

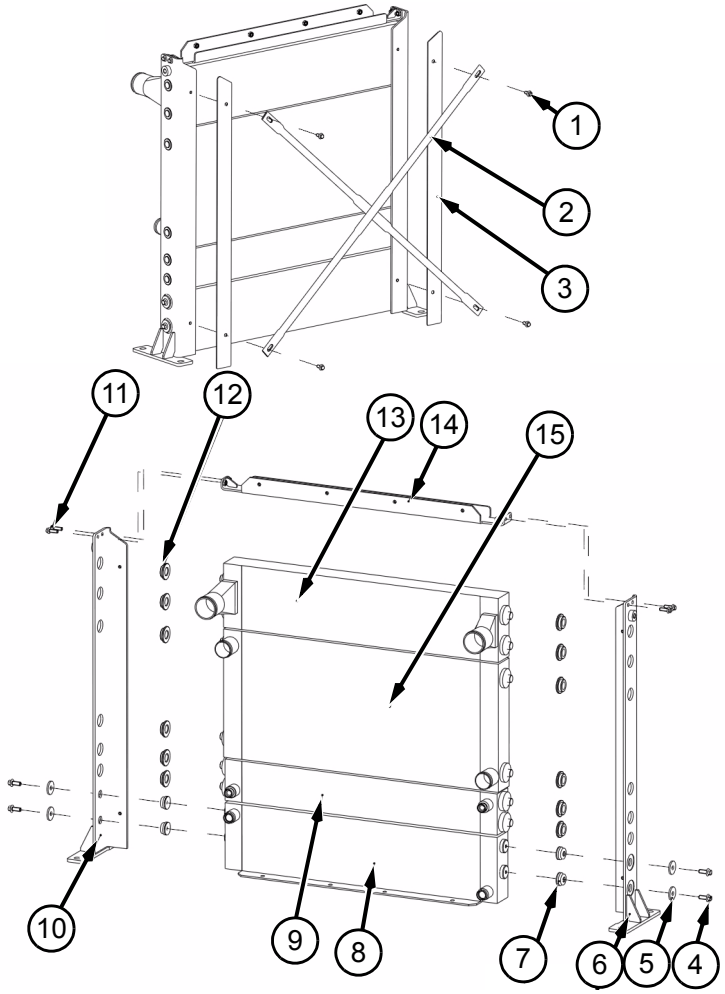
Parameters of Radiator Group

Water radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	880mm X 447mm X85mm
Torque converter oil radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	880mm X 230mm X85mm
Hydraulic oil radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	880mm X 144mm X85mm
Air-air intercooler	Core type	Plate-fin type
	Core size (height × width × thickness)	880mm X 223mm X85mm

Structure of Radiator Group

Radiator group consists of water radiator, air-air intercooler, torque converter oil radiator, hydraulic oil radiator and support plate bracket, etc

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P24P00028

1. Rib
2. Bolt (M10X20)
3. Plate
4. Bolt (M12X30)
5. Pressure plate
6. Left support
7. Shock absorber
8. Torque converter oil radiator
9. Hydraulic oil radiator
10. Right support
11. Bolt (M10X30)
12. Shock absorber
13. Air-air intercooler
14. Support
15. Water radiator

Fan

Technical Parameters of Fan

	Number of vane	Diameter	Form
Fan	9	760mm	Air-blow

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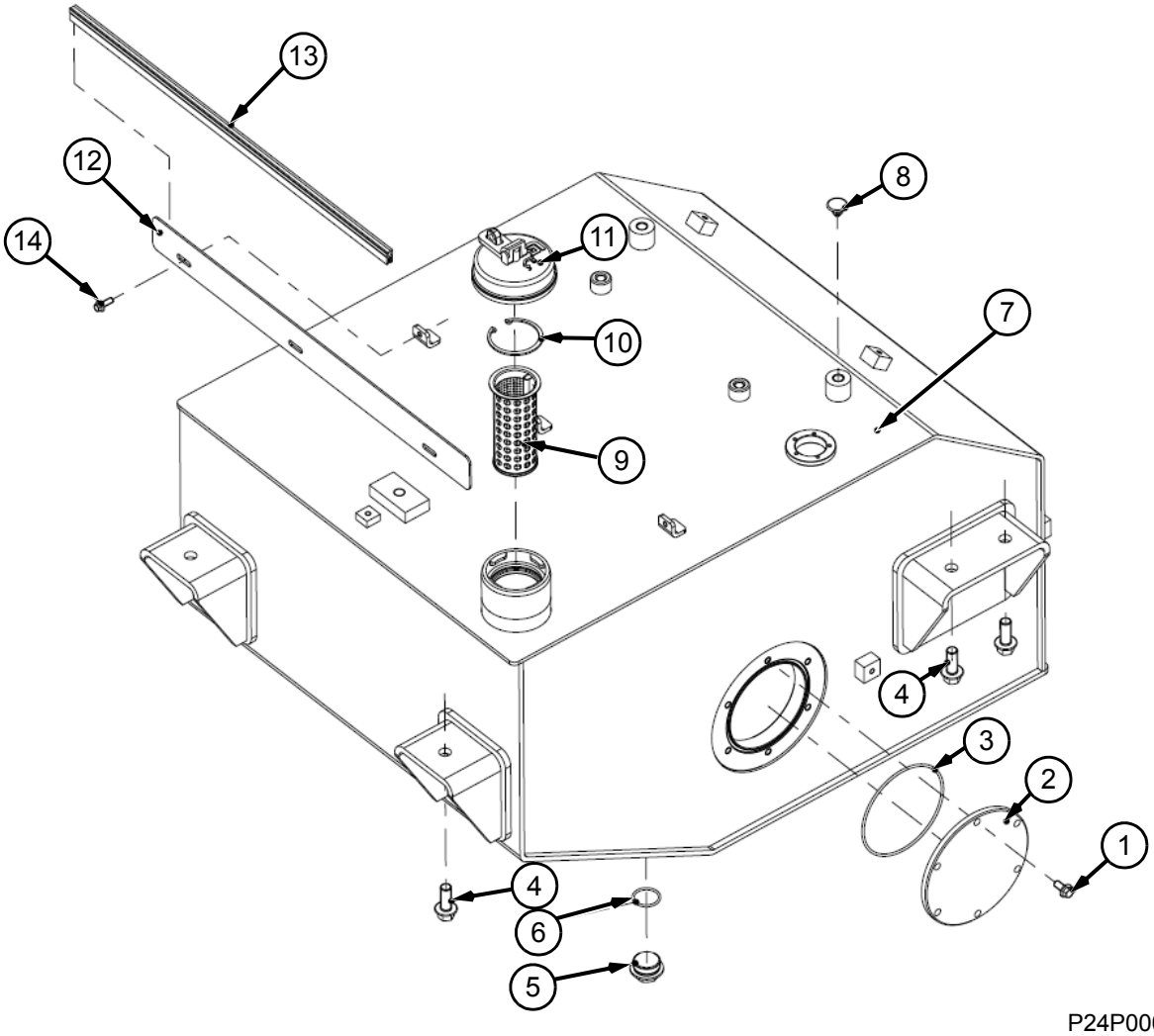
Fuel Tank Assembly

Technical Parameters of Fuel Tank Assembly

Total tank volume	348L

Components and Layout of Fuel Tank Assembly

The fuel tank assembly is mainly composed of fuel tank, filler pipe, fuel tank cover and other parts and components.



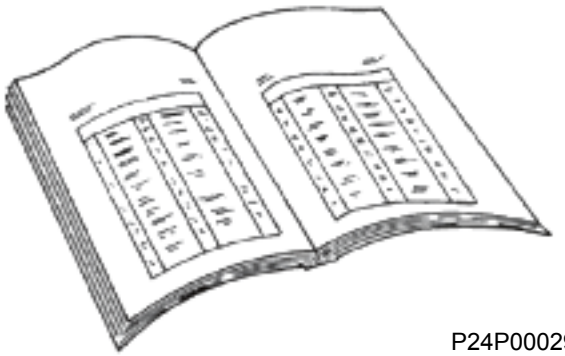
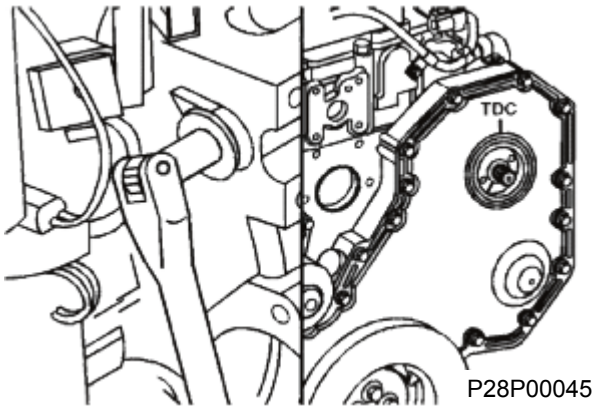
P24P00033

1. Bolt (M10X20)
2. Flange cover
3. O-ring
4. Bolt (M16X40)
5. Plug
6. O-ring
7. Fuel tank
8. Rubber plug
9. Strainer
10. Retainer
11. Tank cover assembly
12. Plate
13. Seal
14. Bolt (M8X20)

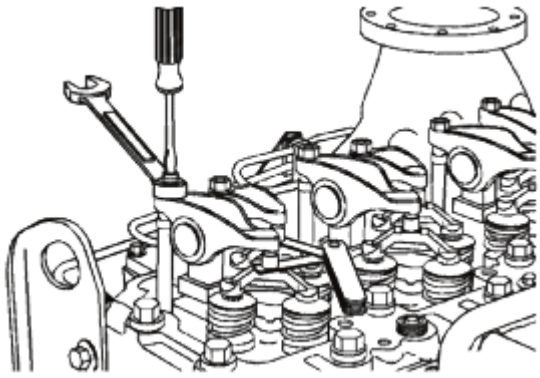
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Test and Adjustment

Adjust the Valve Lash

Figure	Procedure
 P24P00029	**Preparation steps** **Warning: Explosive gas may leak from the battery. To avoid personal injury, the engine compartment must be with good ventilation before the maintenance of the battery. To avoid the arc, firstly remove the negative terminal (-) cable of battery and finally connect the negative terminal(-) cable of battery.**
 P28P00045	**Adjustment** **Notice: The engine coolant temperature shall be less than 60°C [140°F].** Use the jigger tool (part No. 3824591) or equivalent. Rotate the crankshaft and align with the top dead center marks on gear chamber cover and fuel pump gear.

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Figure	Procedure
 P28P00046	When the engine is at this position, it is possible to check the valve lash for following rocker arms: 1I, 1E, 2I, 3E, 4I and 5E.

Limit value of the lash inspection	mm		in
Intake	0.08	Minimum	0.003
	0.25	Maximum	0.01
Exhaust	0.08	Minimum	0.003
	0.5	Maximum	0.02

Note: The lash inspection is a part of failure diagnosis; as long as the lash measurement value is within the range of above limit values, it needs no reset during inspection.

Lift the rocker arm end upward and insert the filler gage between the ball joint for bridging pressure plate and rocker arm rod and the bearing seat to measure the lash. If the lash measurement value is beyond the technical specification, loosen the locknut, and adjust the lash to the nominal technical specification.

Technical specification for lash reset

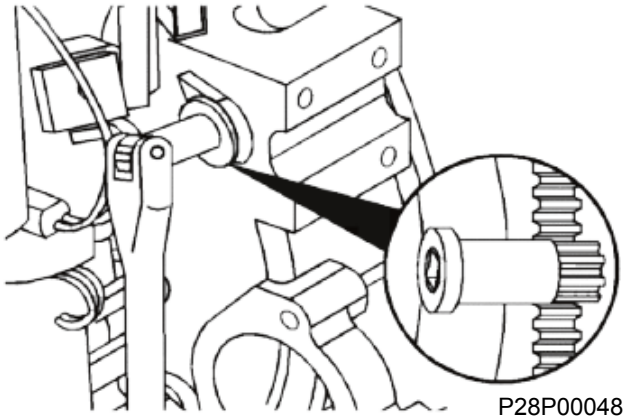
	mm		in
Intake	0.25	Nominal	0.01
Exhaust	0.5	Nominal	0.02

Note: Only when measuring and detecting that the lash exceeds the technical specifications, or the engine maintenance leads to the removal of rocker arm and/or looseness of adjusting screw, the lash will be reset according to the intervals specified in related maintenance procedures.

Tighten the lock nut and then measure again.

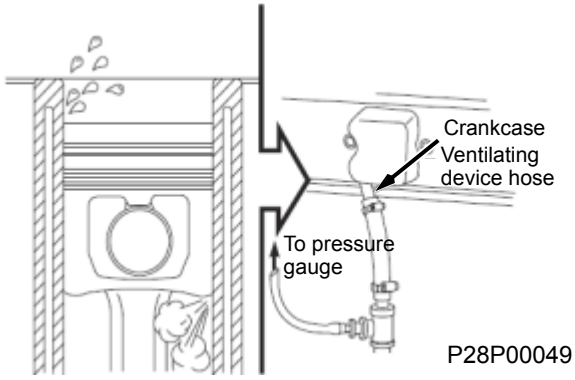
Nm Torque value: 39--47 N.m

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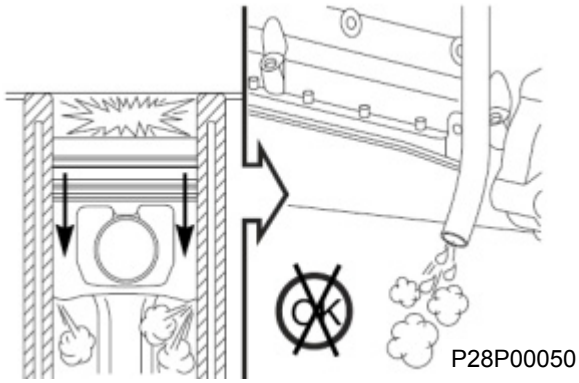
Figure	Procedure
 P28P00048	Use the jigger tool (part No. 3824591) or equivalent to rotate the crankshaft for 360 degrees and measure the lashes of rocker arms 2E, 3I, 4E, 5I, 6I and 6E. If the lash exceeds the technical specification, reset it.

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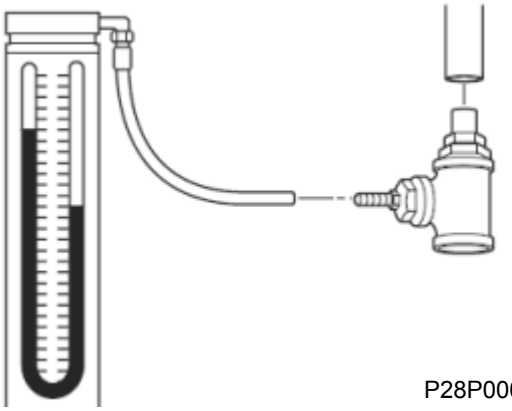
Measurement of Blow-by of Crankcase

Figure	Procedure
 P28P00049	**Note:** The actual engine configurations are not showed in some graphs in this step. However, the steps are the same. If crankcase blow-by volume is too much, it indicates that fault occurs in the engine or its related components, and consequently burning gas or air leaks into the crankcase. The result is that the generated pressure exceeds normal crankcase pressure, and therefore the blow-by level is increased. How to measure the crankcase blow-by and how to determine the fault components are described in this step. **The general purpose of blow-by measurement lies in:** ● Check the running-in of engine after re-installation ● For the open crankcase ventilating system, conduct fault diagnosis and troubleshooting when excess engine oil overflows from the crankcase respirator pipes (generally also known as oil carry-out) ● For closed type crankcase ventilating system, carry out fault diagnosis and troubleshooting for the oil ingress into the intake system; for the engine equipped with crankcase pressure sensor, carry out the fault diagnosis and troubleshooting for the high pressure in crankcase; perform fault diagnosis and troubleshooting for possible internal damages of the engine, such as damaged piston ring, valve rod sealing part or duct, turbocharger and air compressor These steps provide the general guideline about measurement of air blow-by related to above conditions.

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Figure	Procedure
 P28P00050	**It is worth noticing that the two terms about "blow-by" and "carry-out (engine oil overflows from the respirator pipe)" are usually equivalent.** The engine oil quantity will directly affect the measurement results of blow-by if excess engine oil overflows from the respirator pipes when measuring blow-by. The blow-by measurement results may also be affected by the engine oil collected on the metering holes of blow-by measurement and maintenance tools. This reduces the sizes of metering holes, and therefore, the measurement results always exceed the actual blow-by measurement values. If so, the following measures shall be taken: ● Find different measuring positions on the engine to measure the air glow-by (engine oil filler, engine oil filler cover, drainage position of unused turbocharger, etc.). ● Clean the residual engine oil on the respirator before measuring blow-by, and dry it completely. ● Confirm whether there are some factors making the respirator be full with engine oil, for example: 1) Engine oil level is incorrect 2) Vehicle operation (excessive incline, excessive all-round rotation of the engine) 3) The failure of engine inner component leads to oil flow deflection to the ventilation unit cavity (piston cooling nozzle, auxiliary oil exhaust pipe and etc.) ● Confirm whether there is another respirator option for the engine being repaired.

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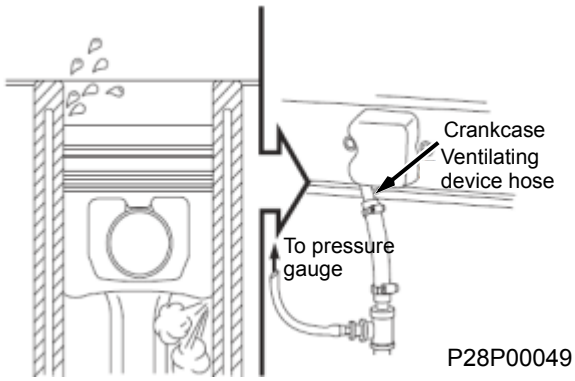
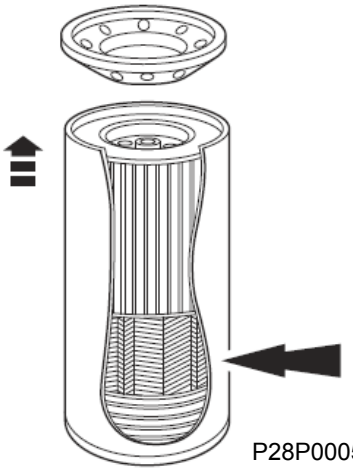
Figure	Procedure
 P28P00051	The tools used for measuring blow-by are generally similar in the structure. The sizes of metering holes are their main distinctions. Different sizes of metering holes are designed for accurately measuring blow-by, which can also meet the needs for various engine configurations and rated power. Because the engine blow-by depends on the volume of air intake. For example: If the measurement of blow-by is conducted on two engines with the same configurations and sizes, but with different rated horsepowers and rated speeds, the measured maximum blow-by values will be different. The air inflow of engine with high rated horsepower and high rated speed is relatively high, therefore the blow-by value will be higher. That is to say, if the small metering hole blow-by tool is used to measure the engine with high horsepower and high rated speed, the measurement will exceed the limit of pressure measurement tool. Part number of blow-by tool: 3822566 Size of metering hole: 7.67 mm [0.302 in] Connect the water pressure gauge (part No. ST1111-3) or equivalent device, pressure gauge or sensor on the blow-by measurement and maintenance tools when measuring the crankcase blow-by pressure. **Note:** Water pressure gauge (part No. ST1111-3) or equivalent devices can measure at most 944 mm [36 in] water column.

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The relationship between measured pressure value of orifice with 7.67-mm [0.302-in] diameters and flow velocity is shown in the following table.

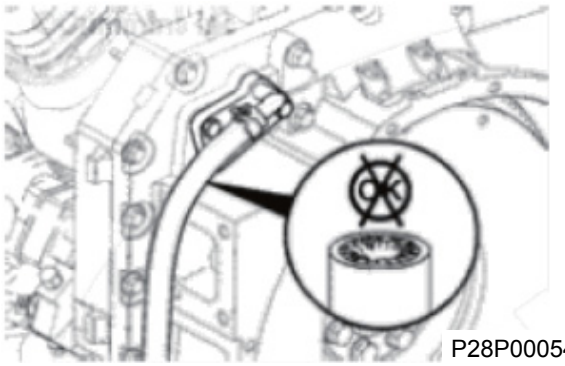
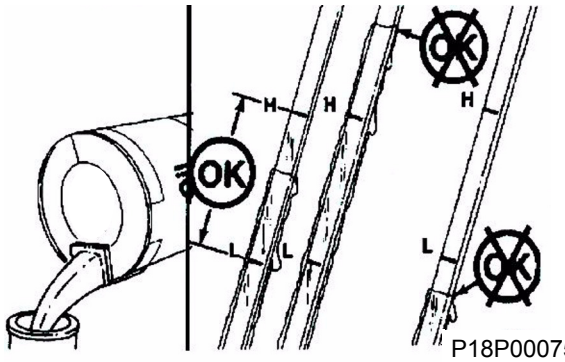
The blow-by conversion table for the orifice with 7.67 mm [0.302 in] diameters and blow-by	
mm H_2O [in H_2O]	liter [cfm] / minute
25.4 [1]	50 [1.766]
50.8 [2]	84 [2.966]
76.2 [3]	103 [3.637]
101.6 [4]	119 [4.202]
127 [5]	133 [4.697]
152.4 [6]	145 [5.121]
177.8 [7]	155 [5.474]
203.2 [8]	164 [5.792]
228.6 [9]	172 [6.074]
254 [10]	180 [6.357]
279.4 [11]	187 [6.604]
304.8 [12]	193 [6.816]
330.2 [13]	200 [7.063]
355.6 [14]	206 [7.275]
381 [15]	211 [7.451]
406.4 [16]	217 [7.663]
431.8 [17]	222 [7.840]
457.2 [18]	226 [7.981]
482.6 [19]	229 [8.087]
508 [20]	235 [8.299]
533.4 [21]	239 [8.440]
558.8 [22]	242 [8.546]
584.2 [23]	246 [8.687]
609.6 [24]	248 [8.758]

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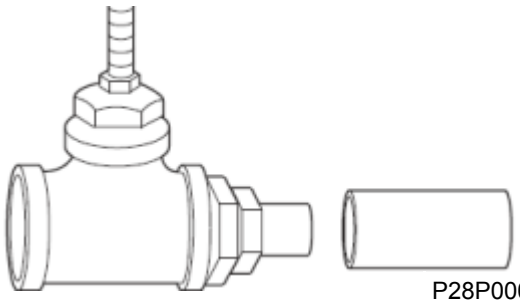
Figure	Procedure
 P28P00049	**Note:** Other steps can be adopted to verify the doubt that the internal faults of the engine cause excess blow-by. Blow-by measurement shall be considered only when the running-in of engine after overhaul is confirmed or other symptoms appear. Emerging symptoms include: ● Excess engine oil carry-out (the engine oil is carried-out from the crankcase respirator pipes) ● Excess crankcase pressure (for the engine equipped with crankcase pressure sensor) ● Low power ● Engine oil consumption ● Exhaust smoking It is not necessary to measure the blow-by if there are no other symptoms.
 P28P00053	Other steps can be adopted to verify the doubt that the internal faults of the engine cause excess blow-by. These steps include: ● Confirm the maintenance procedures of engine. ● Cut the engine oil filter and check whether there are chippings. ● Get an engine oil sample and check whether there are pollutions.

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Initial inspection

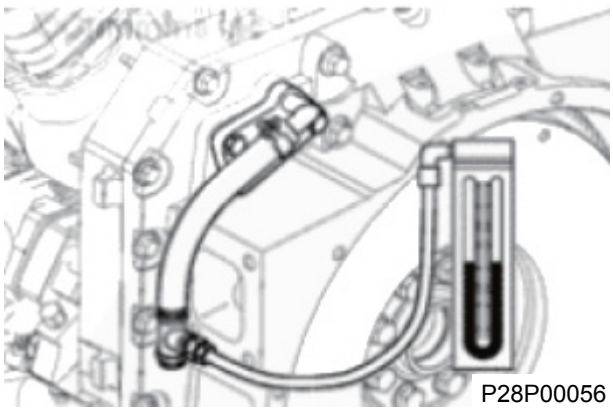
Figure	Procedure
 P28P00054	**Note:** The locations and types of crankcase respirators will change depending on the differences of engine configurations (front gear power train or rear gear power train) and/or engine applications. Check whether the crankcase respirator pipes are blocked before measuring the blow-by pressure. If troubleshooting for excess engine oil overflowing from the respirator pipe is carried out, the respirator components shall be removed prior to blow-by measurement in order to clean and clear all collected engine oil away.
 P18P00075	Check the engine oil level; if necessary, correctly calibrate the oil dipstick. If the oil level is too high, the blow-by pressure will exceed normal level and/or excess engine oil will be carried out.

Measurement

Figure	Procedure
 P28P00055	Select correct blow-by measurement maintenance tool for the engine maintained. Part number of blow-by tool: 3822566 Size of metering hole: 7.67mm[0.302in]

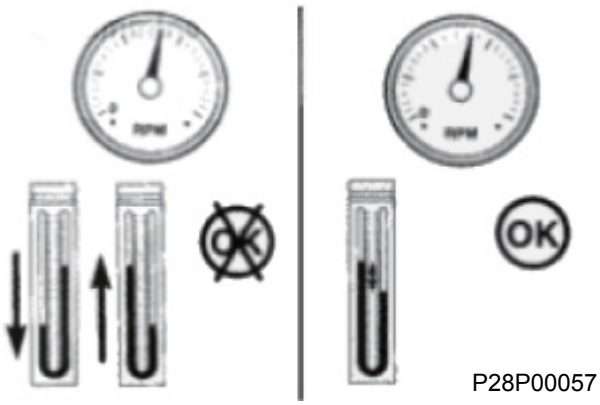
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Measurement

Figure	Procedure
 P28P00056	Connect the water pressure gauge (the part number is ST1111-3), pressure gauge or sensor on the blow-by measurement and maintenance tools when measuring the blow-by pressure of crankcase. **Note:** The locations of crankcase respirator pipes may change along with the engine configurations and/or its specific applications. Installation of applicable blow-by maintenance tools: For the typical open crankcase respirator/ ventilating system, connect applicable blow-by maintenance tools at the end of crankcase respirator pipes. Connect a water pressure gauge, pressure gauge or sensor on the blow-by maintenance tools. For the engine with closed crankcase ventilating system (without crankcase ventilation filter), disconnect the respirator pipe and plug the intake manifold or turbocharger compressor housing port. Connect proper blow-by maintenance tool to the end of crankcase respirator pipe. Connect a water pressure gauge, pressure gauge or sensor on the blow-by maintenance tools. For the engine equipped with external fuel-moisture coagulation type respirator core (CM871, CM876, CM2250, CM2150 and the engine equipped with Enviroguard™ filter), connect related blow-by maintenance tool to the crankcase respirator pipe at inlet side of fuel-moisture coagulation type respirator housing.

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Measurement

Figure	Procedure
 P28P00057	**Notice: Excess engine oil overflows from the respirator pipes during the blow-by measurement. So the engine oil volume also directly affects the blow-by measurement results.** Operate the engine with rated speed and full load until stable values are obtained. **Note:** During the blow-by measurement, a "peak" shall appear initially in numerical values when the engine achieves peak power and rated speed. Start to read the readings after the blow-by measured value is stable. **Note:** For engine running-in, if the blow-by increases suddenly, or if the blow-by exceeds the maximum allowance at any running-in phase, return the previous step and continue running-in. If the blow-by does not reach the acceptable level, stop running-in and confirm the cause. Record the blow-by measured values in steady state. Remove the engine blow-by maintenance tools and the water pressure gauge or pressure gauge if blow-by is within the technical specifications. The blow-by volume limit value of SDEC engine for CLG4180D is 115L/min.

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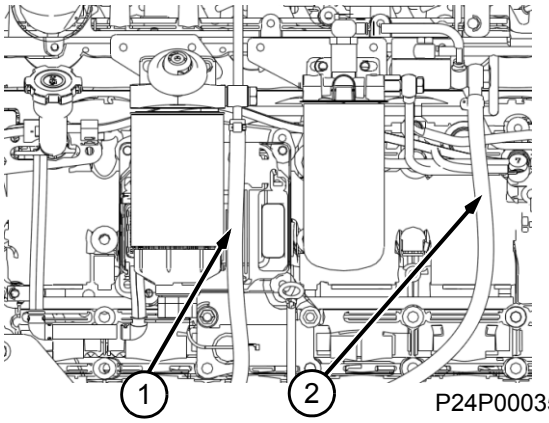
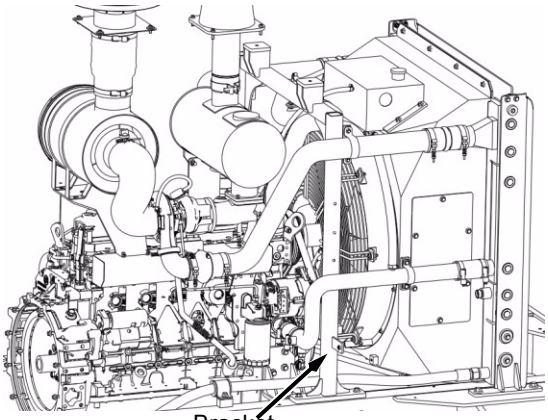
Removal and Installation

Removal and Installation of Diesel Engine

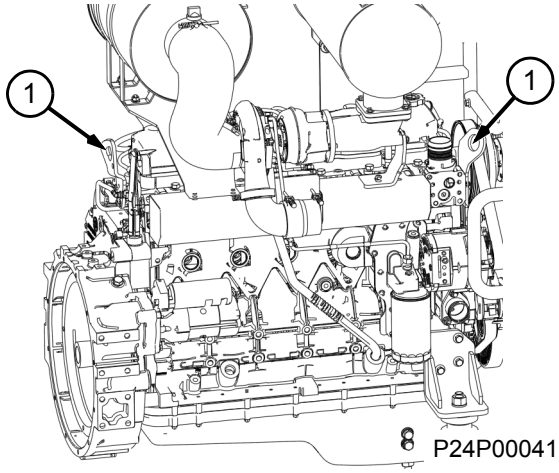
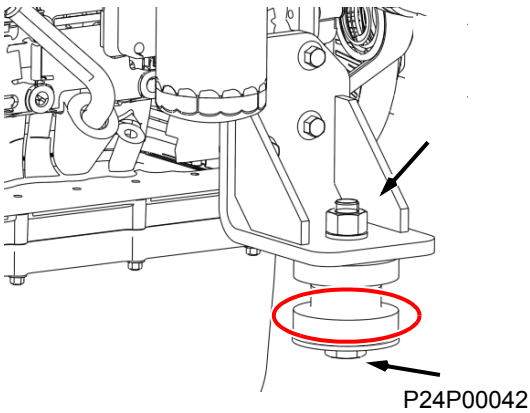
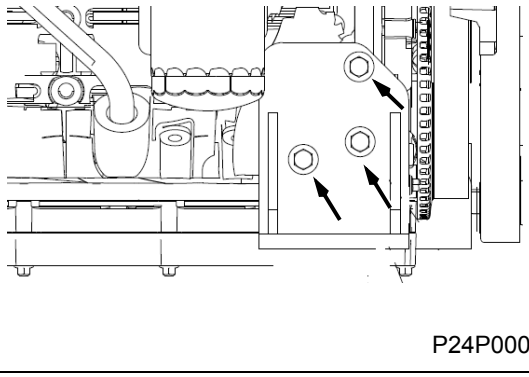
Removal of Diesel Engine

Figure	Operation steps	Tool(s)
 P24P00034  P11000175	1. Turn off the negative electrode switch, and hang on a "No operating" warning board.	
	2. Remove and place the rain cap, exhaust pipe and engine hood according to the "Removal of Engine Hood" Chapter.	Plastic sealing membrane
	3. Drain completely oil and coolant in the engine and collect them separately using oil collecting basin and classify them. 4. Remove the electrical connectors and circuits on the engine, air filter and oil-water separator.	Plastic sealing membrane Oil collecting basin

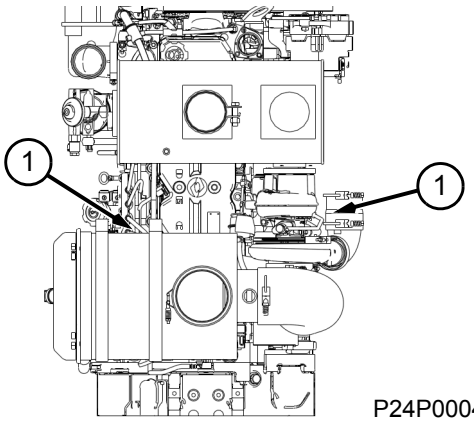
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Figure	Operation steps	Tool(s)
	5. Remove A/C compressor, A/C pipe and warm air hose from the engine according to requirements and steps for "Removal and Installation of Compressor Line and Compressor", and seal every ports with plastic sealing membrane as required.	Plastic sealing membrane
 P24P00035	6. Remove the engine oil inlet/ return pipe: a. Remove the screws of oil inlet pipe (1). b. Remove the joint of oil return pipe (2). c. Pack the removed screw, union with plastic sealing bag d. Mask the fuel pipe joint with sealing membrane.	Open-end wrench 19# Monkey spanner Plastic sealing bag Plastic sealing membrane
	7. Remove the fan and radiator group by referring to the "Radiator Group Removal" Chapter.	
 P24P00036	8. Remove the hydraulic oil tank assembly before the engine by referring to the requirements and steps of the "Hydraulic Oil Tank Assembly Removal" Chapter. 9. Unscrew the mounting screws of the bracket to remove the bracket.	Open-end wrench 8#, 10#, 15#

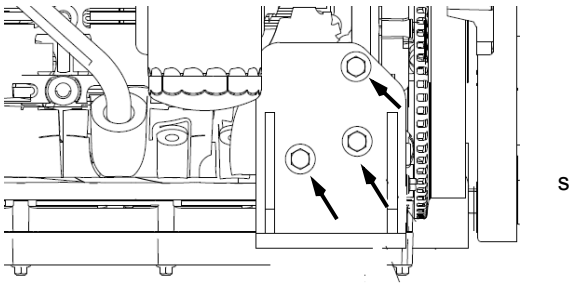
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Figure	Operation steps	Tool(s)
 1. Lifting eye	10. Slowly operate traveling crane, hang lifting eye on engine with hook on wire rope, and tauten wire rope without lifting engine.	Traveling crane Wire rope with hooks
	11. Remove captive bolts in connecting surface of engine and torque converter according to requirements and steps for "Removal of Torque Converter & Transmission Assembly".	
	12. Hold fixing nut of engine with an open-end wrench, and remove captive bolt of engine under engine mounting support with a blower gun, a rod and a socket and take down lower part of shock absorber from the frame.	Open-end wrench 30# Socket 30#
	13. Loosen captive bolt of engine mounting support with an open-end wrench and take it out, then take down engine mounting support.	Open-end wrench 15#

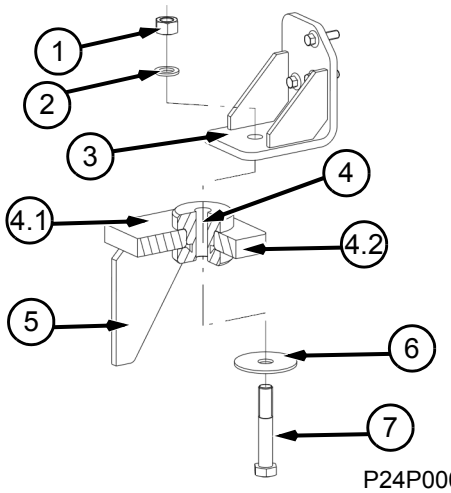
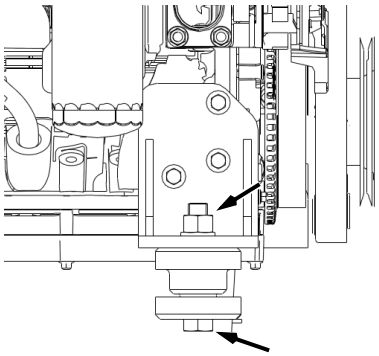
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Figure	Operation steps	Tool(s)
 P24P00043 1. Hold	14. Operate wire rope with hook on traveling crane to pass hook through lifting hole at pulley side of engine and hold both sides of engine and lift engine as slowly as possible in order to ensure that engine is slowly and steadily lifted out of complete machine and will not collide with other parts of complete machine. Place the engine onto the special tooling for placing.	Traveling crane Wire rope with hooks Special engine tooling

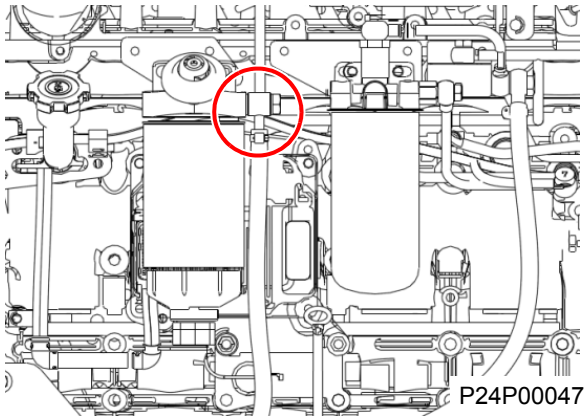
Installation of Diesel Engine

Figure	Operation steps	Tool(s)
 P24P00044	1. Install engine mounting support on engine with captive bolt for engine mounting support, and pre-tighten captive bolt with a wrench. 2. Tighten captive bolt of engine mounting support using a torque wrench with torque of 132 ±10N·m.	Open-end wrench 15#, 120±6N.m torque wrench

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Figure	Operation steps	Tool(s)
 P24P00045 1. Locknut 2. Hard washer 3. Engine mounting support 4. Shock absorber 4.1 Upper part of shock absorber 4.2 Lower part of shock absorber 5. Rear frame support 6. Shim 7. Bolt	3. Put the upper part of shock absorber (4.1) above rear frame support (5), operate the traveling crane to lower the engine as slowly as possible so that the engine mounting support (3) is located as close as possible to the upper part of shock absorber (4.1) and the support hole is concentric with shock absorber hole; put the lower part of shock absorber (4.2) under rear frame support (5), pass in sequence the bolt (7) through the shim (6), the shock absorber (4), engine mounting support (3), and assemble it together with the hard washer (2) and locknut (1) and loosen the hook.	
 P24P00046	4. Hold nut with the wrench, and pre-tighten the captive bolt of engine from under rear frame support with a blower gun, a rod and a socket. 5. Tighten the captive bolt of transmission with a torque wrench according to requirements and steps for "Installation of Transmission & Torque Converter Assembly". 6. Tighten captive bolt of engine using the torque wrench with torque of 600 ±55N·m.	Open-end wrench 30# Socket 30# 1020±6 N·m torque wrench

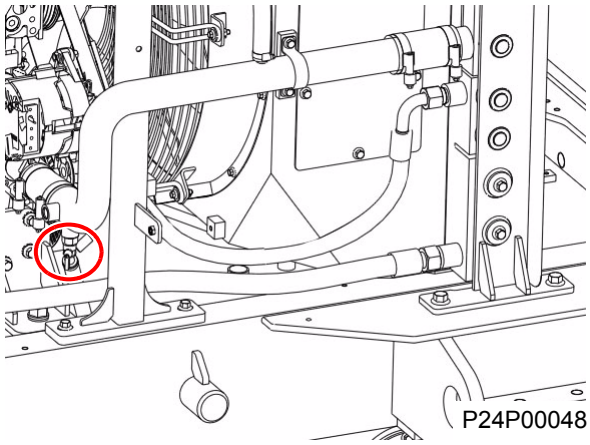
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Figure	Operation steps	Tool(s)
 P24P00047	7. Install the screw and joint on the primary fuel filter using the wrench and keep properly them in a plastic sealing bag. Mask the fuel pipe joint with sealing membrane.	Open-end wrench 19#
	8. Install A/C compressor, A/C pipe and warm air hose on the engine according to requirements and steps for "Removal and Installation of Compressor Line and Compressor". 9. Install the electrical connectors and circuits on the engine, air filter and oil-water separator. 10. Install the engine hood, rain cap and exhaust pipe according to requirements and steps specified in the "Installation of Engine Hood" Chapter. 11. Install the engine fan and radiator group according to the requirements and steps specified in the "Installation of Radiator" Chapter. 12. Close the engine hood and take down the warning board "No operating".	

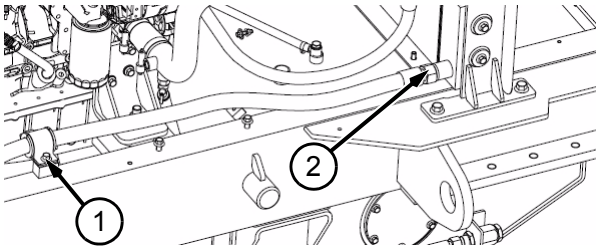
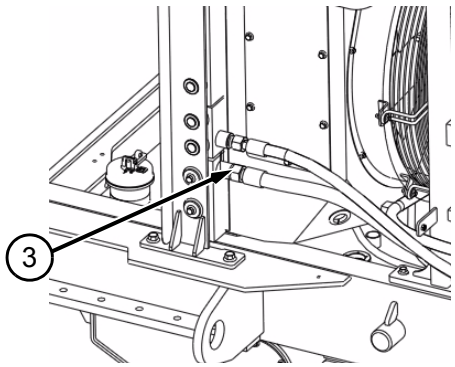
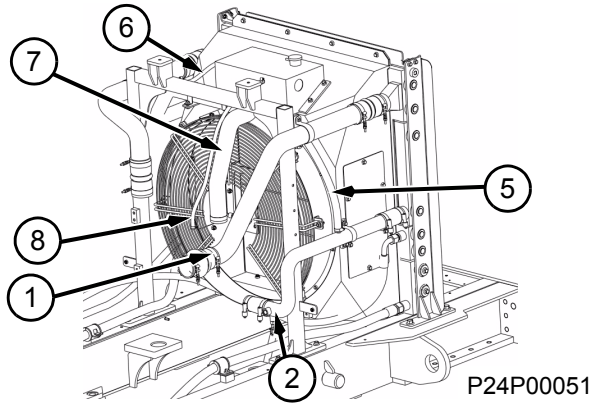
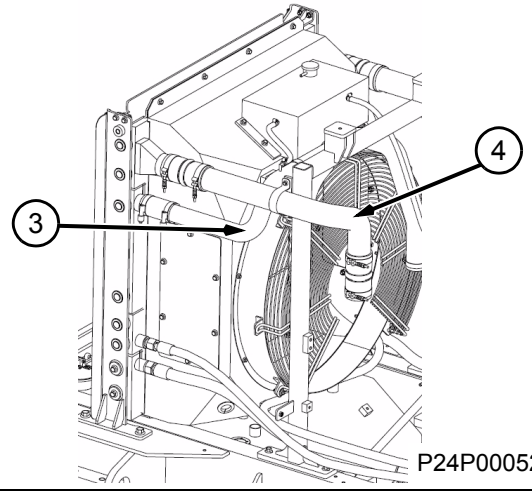
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Removal, Installation, Disassembly and Assembly of Radiator Group

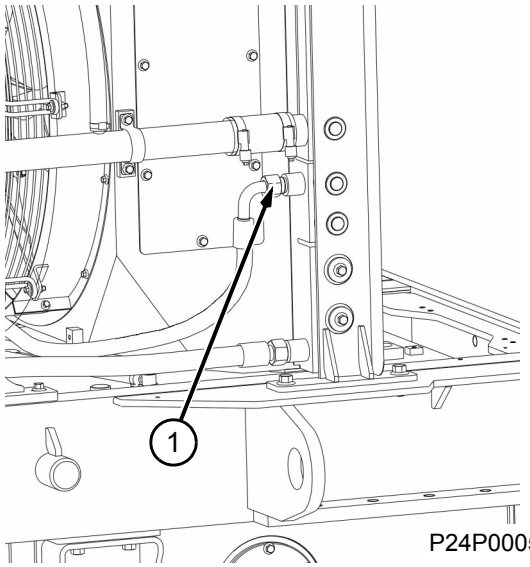
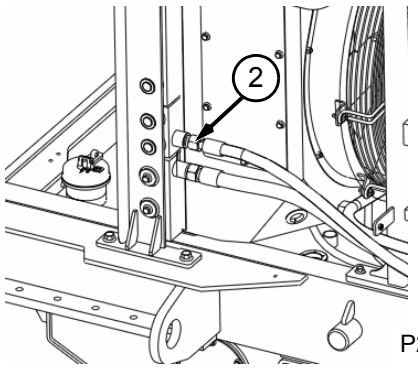
Removal of Radiator Group

Figure	Operation steps	Tool(s)
 P24P00034  P11000175	1. Turn off the negative electrode switch, and hang on a "No operating" warning board.	
	2. Remove the rain cap, exhaust pipe and engine hood according to "Removal of Engine Hood".	
 P24P00048	3. Open the drain valve for draining completely the coolant in the radiator and its lines and collect the coolant using the oil collecting basin for uniform disposal.	Oil collecting basin

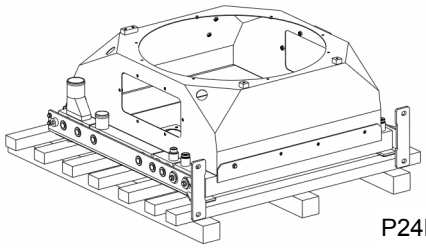
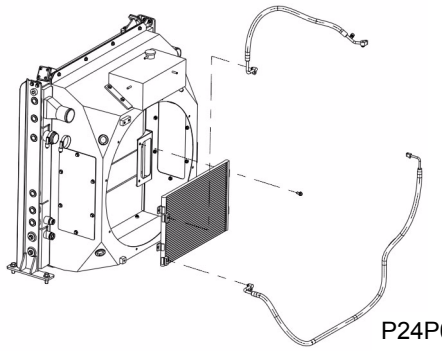
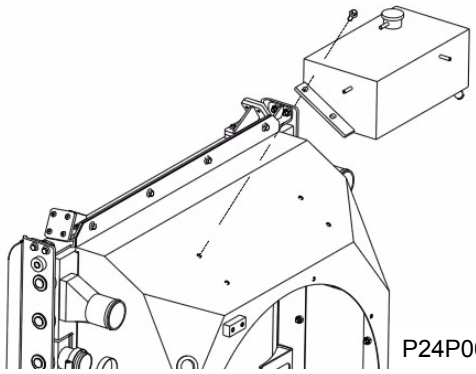
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Figure	Operation steps	Tool(s)
 P24P00049  P24P00050	4. Remove the torque converter oil pipe: a. Refer to "Removal of Transmission and Torque Converter Assembly" for draining the torque converter oil; b. Loosen the torque converter oil pipe clamp (1); c. Loosen the torque converter oil pipes (2) and (3) joint and remove the oil pipes; d. Mask the fuel pipe joint with sealing membrane.	Open-end wrench 15# Monkey spanner Sealing membrane
 P24P00051  P24P00052	5. Remove the line: a. Remove the inter-cooler tubes (1) and (4); b. Remove water refilling hose (5) and steam hoses (6) and (8); c. Remove upper hose (7), lower tube (2) and upper tube (3); d. Mask the fuel pipe joint with sealing membrane.	Open-end wrench: 8#, 10#, 12#, 13# Straight screwdriver Sealing membrane

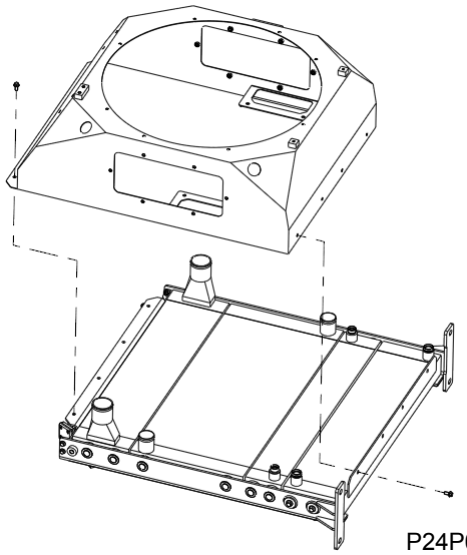
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Figure	Operation steps	Tool(s)
 P24P00053  P24P00050	6. Remove the hydraulic oil pipe. a. Drain out the hydraulic oil by referring to the "Hydraulic System - Removal and Installation - Working Hydraulic System" Chapter. b. Unplug the joint of hydraulic oil pipe (1) and (2) to remove the oil pipe c. Mask the fuel pipe joint with sealing membrane	Monkey spanner Sealing membrane
	7. Refer to “Removal of Fan” for removing the fan.	
	8. Operating the steps 1-3 “Removal and Replacement of Refrigerant Reservoir”.	

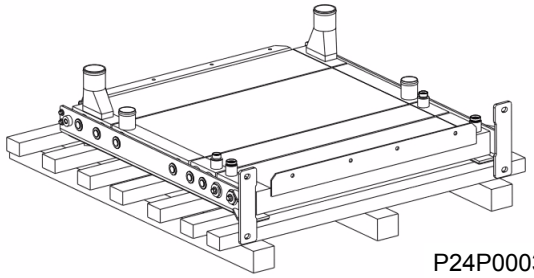
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Figure	Operation steps	Tool(s)
 P24P00057  P24P00058	9. Tighten the lifting eye to the lifting lugs of the radiator group and screw for at least three turns. Hang the lifting eye with hook on wire rope. Slowly operate traveling crane, and tauten wire rope without lifting the radiator.	Traveling crane Wire rope Lifting eye
 P24P00031	10. Unscrew the radiator mounting bolts, and lower the radiator group and lay down on its back onto the block (with each radiator inlet/outlet facing upwards)	Socket 12# Blower gun Traveling crane Block
 P24P00032	11. Remove the condenser and connecting pipelines, and seal the open connectors of the condenser with plastic bags and adhesive tapes.	Open-end wrench 7#, 10# Plastic bag Adhesive tapes
 P24P00037	12. Remove the upper tank	Open-end wrench 10#

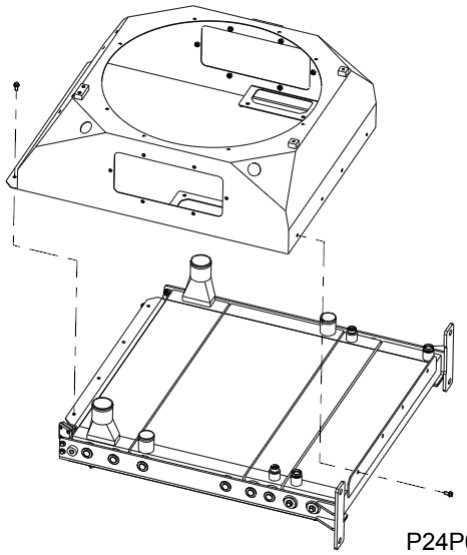
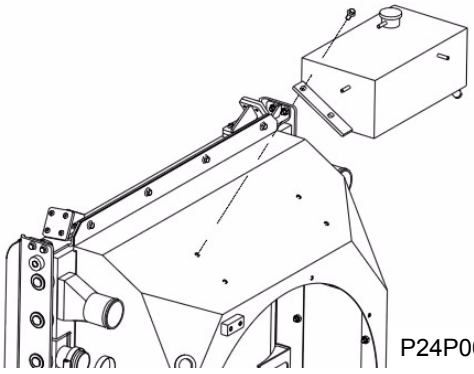
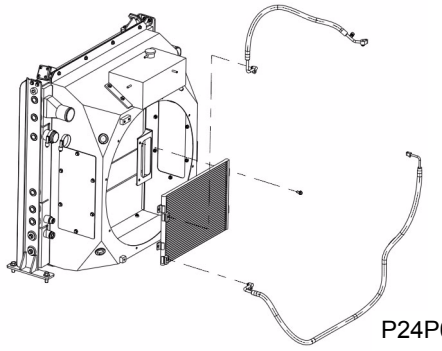
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Figure	Operation steps	Tool(s)
 P24P00038	13. Remove the shroud assembly	Open-end wrench 13# Traveling crane

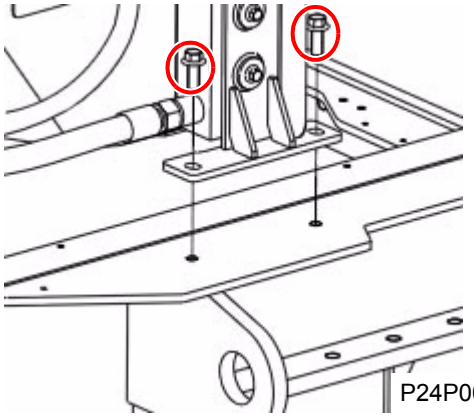
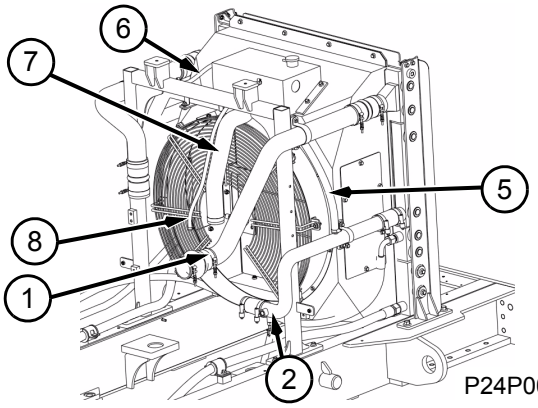
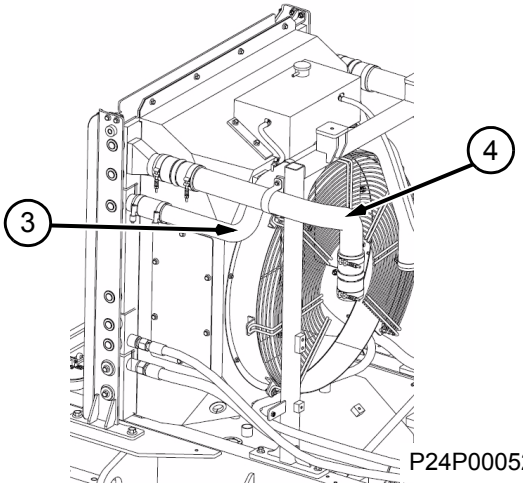
Installation of the Radiator Group

Figure	Operation steps	Tool(s)
 P24P00057  P24P00058	1. Tighten the lifting eye to the lifting lugs of the radiator group and screw for at least three turns. Hang the lifting eye with hook on wire rope. Slowly operate the traveling crane to lift the radiator.	Traveling crane Wire rope Lifting eye
 P24P00039	2. Slowly operate the traveling crane, fix the radiator group on the tooling using bolts or put upwards the radiator group on the block (with each radiator inlet/outlet facing upwards).	Traveling crane Block

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Figure	Operation steps	Tool(s)
 P24P00038	3. Fix the shroud assembly on the radiator group	Open-end wrench 13# Traveling crane
 P24P00037	4. Install the upper tank on the shroud assembly	Open-end wrench 10#
 P24P00032	5. Install the condenser and its connecting pipelines on the shroud assembly	Open-end wrench 7#, 10# Plastic bag Adhesive tapes

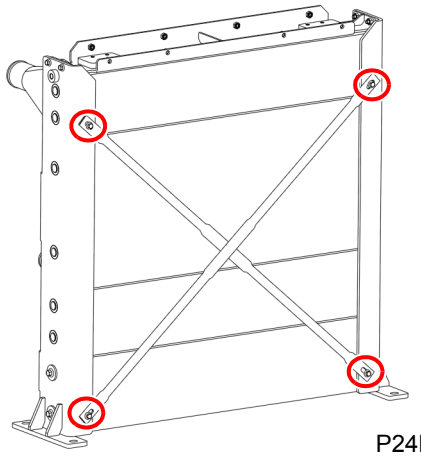
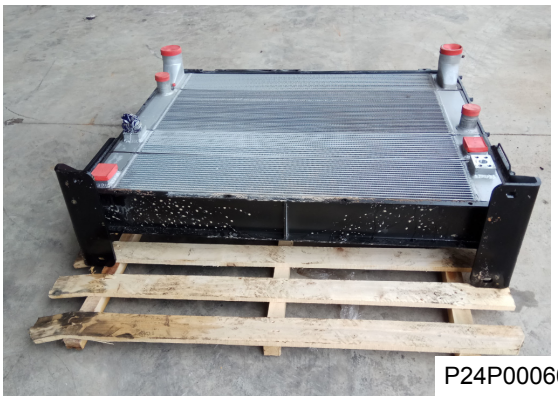
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Figure	Operation steps	Tool(s)
 P24P00061	6. Lift the radiator group on the frame using the traveling crane and tighten the radiator mounting bolts with tightening torque of 248±25N·m.Remove the lifting eye.	Socket 21# Traveling crane Torque wrench
	7. Refer to "Removal of Fan" for installing the fan.	
 P24P00051  P24P00052	8. Install the lines: a. Install the inter-cooler tubes (1) and (4); b. Install water refilling hose (5) and steam hoses (6) and (8); c. Install upper hose (7), lower tube (2) and upper tube (3).	Open-end wrench: 8#, 10#, 12#, 13# Straight screwdriver
	9. Install the oil pipe and hydraulic oil pipe of torque converter.	Open-end wrench 15# Monkey spanner

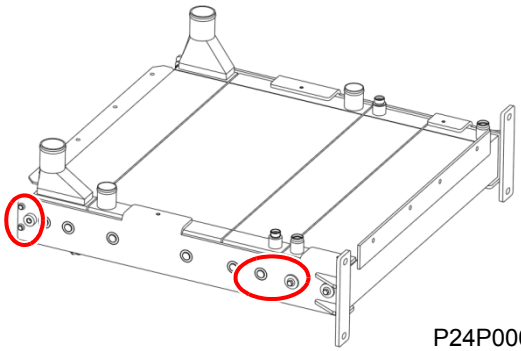
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Figure	Operation steps	Tool(s)
	10. Install the engine hood, air filter cap and exhaust pipe according to steps for "Installation of Engine Hood". 11. Close the engine hood and take down the warning board "No operating".	

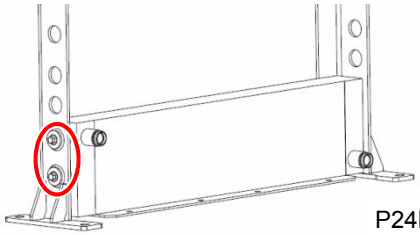
Disassembly of Radiator Group

Figure	Operation steps	Tool(s)
 P24P00040	1. Place the radiator upright on a smooth floor, and unscrew the mounting bolts of radiator group ribs to remove the ribs and pressure plate. **⚠ Notice: When performing the above operation, the radiator group shall be held by someone's hands or corresponding stabilizing equipment to prevent tilting.**	Traveling crane Wire rope Lifting eye Open-end wrench 13#
 P24P00060	2. Put upwards the radiator group on the carrier with each radiator inlet/outlet facing upwards to remove the lifting eye.	Traveling crane Wire rope

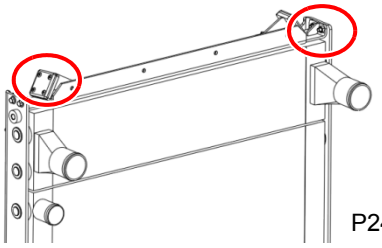
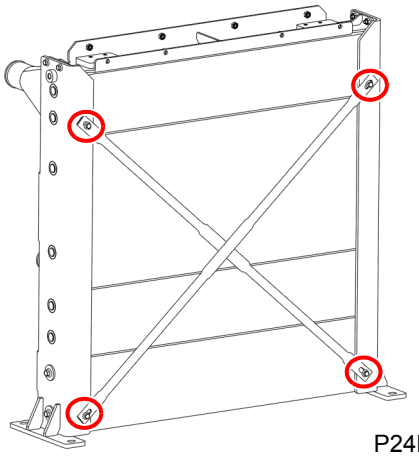
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Figure	Operation steps	Tool(s)
 P24P00062	3. Unscrew 8 captive bolts at left and right sides and remove the bolts and upper connecting plate.	Open-end wrench 13#, 15#
	4. Split left and right supports by a certain distance with the aid of straight screwdriver so that each radiator is disconnected with left and right supports fixing hole, and collect sponge and shock absorber.	Straight screwdriver

Assembly of Radiator Group

Figure	Operation steps	Tool(s)
 P24P00063	1. Horizontally put left and right supports on the carrier.	
 P24P00064	2. Install the shock absorber to the both ends of torque converter oil radiator and then glue the sponge on left and right supports. Insert the lugs both ends of radiator into the two holes of the left and right supports. Install fastening bolts of torque converter oil radiator, but do not tighten them. Perform the same assembly method for the other radiators.	Open-end wrench 15#

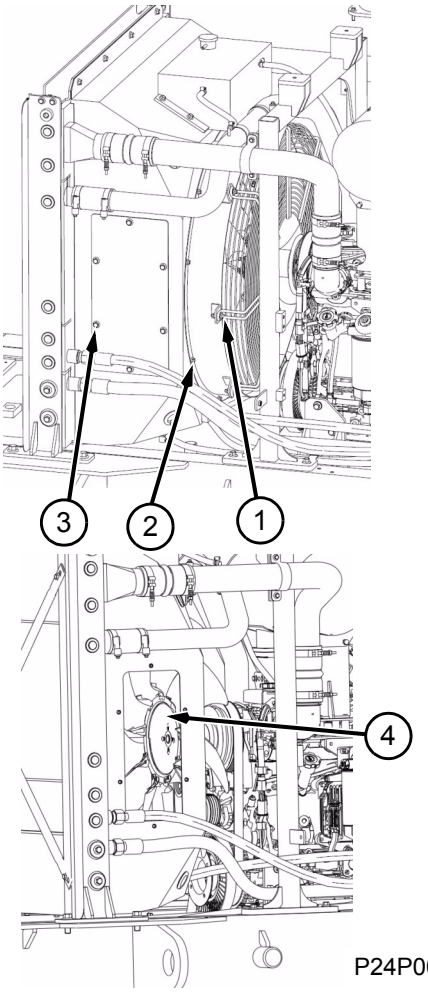
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Figure	Operation steps	Tool(s)
 P24P00065	3. Install the upper connecting plate at the top of radiator and tighten it with bolts. 4. Tighten the captive bolts of torque converter oil radiator.	Open-end wrench 13#, 15#
 P24P00057  P24P00058	5. Tighten the lifting eye to the lifting lugs of the radiator group and screw it for at least three turns. Hang the lifting eye with hook on wire rope. Slowly operates the traveling crane to lift the radiator in upright.	Traveling crane Wire rope Lifting eye
 P24P00040	6. Install the pressure plate and radiator ribs. **⚠ Notice: The radiator group shall be held by someone's hands or corresponding stabilizing equipment to prevent tilting when above 5 and 6 operations are carried out.**	Open-end wrench 10#

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Removal and Installation of Fan

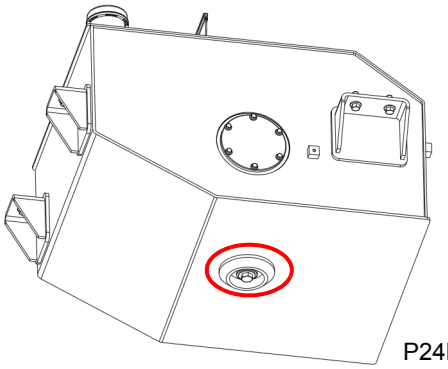
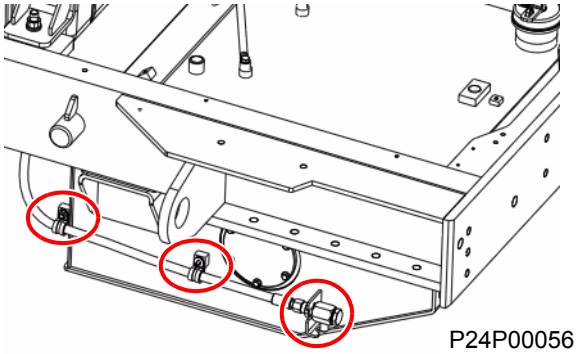
Removal of Fan

Figure	Operation steps	Tool(s)
	a. Unscrew the fan cover (1) bolt to remove the shield; b. Unscrew the shroud (2) mounting bolt to remove the shroud; c. Unscrew the mounting bolt on the shroud side plate (3) to remove the shroud side plate; d. Unscrew the fan (4) mounting bolt to remove the fan.	Open-end wrench: 8#, 10#;

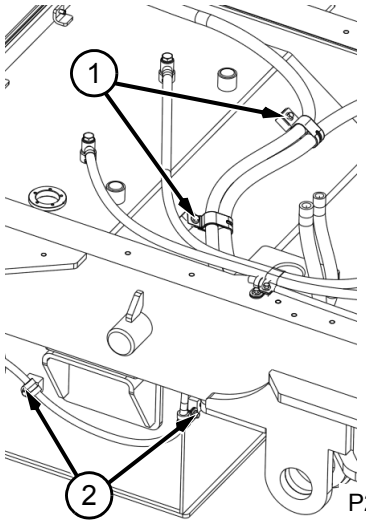
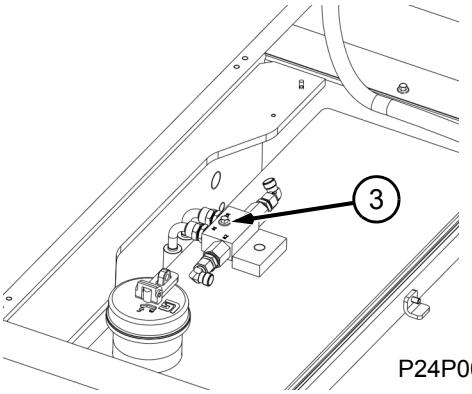
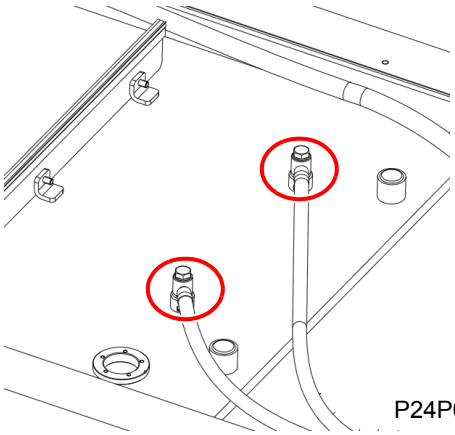
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Removal and Installation of Fuel Tank Assembly

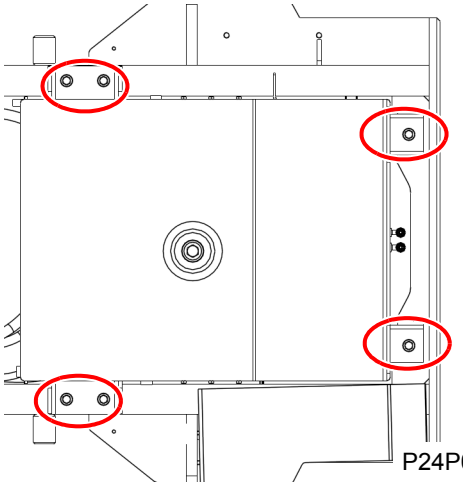
Removal of Fuel Tank Assembly

Figure	Operation steps	Tool(s)
 P24P00055	1. Drainage of diesel fuel: Clean drain hole of fuel tank, place a clean oil container under the fuel tank, and unscrew drain plug. After fuel is drained, fix drain plug back to fuel tank. Drained fuel should be strictly sealed for preservation to prevent pollution to fuel.	24# socket, socket wrench and fuel tank
 P24P00056	2. Remove the oil drain device: a. Unscrew the drain plug of the oil drain device for draining the oil of the engine oil pan and collect the oil using the oil collecting basin for uniform disposal. b. Remove the drain joint from the fuel tank fixing plate, loosen the clamp of drain device, remove the drain pipe, seal each port with sealing membrane and fix the drain joint at the vehicle frame with strapping tape and do not drop it to the ground.	Open-end wrench 10#, 27# Monkey spanner Sealing membrane Oil collecting basin

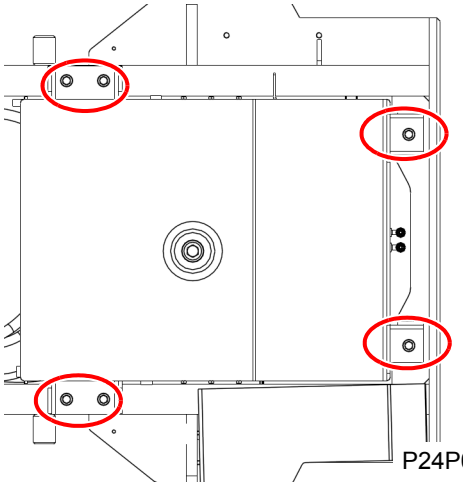
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Figure	Operation steps	Tool(s)
 P24P00059  P24P00067	3. Remove the pipe clamp/bolts: a. Remove A/C pipe clamp (1); b. Remove the lifting system pipe clamp (2); c. Remove the mounting bolts (3) of hydraulic lock.	Open-end wrench 10#
 P24P00068	4. Remove the fuel lines of suction and return port: Remove screw of fuel hose at fuel tank end, take down fuel hose of that end, and fix the screw back to fuel return hole. Mask the fuel hose with a clean plastic bag.	Open-end wrench 19# Clean plastic bag

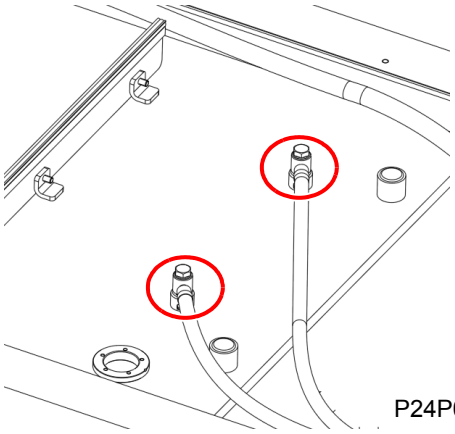
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Figure	Operation steps	Tool(s)
 P24P00069	5. Removal of fuel sensor wire harness: Unplug fuel sensor wire harness connector of fuel tank.	
 P24P00070	6. Remove the fuel tank: Remove mounting bolts of the fuel tank. **⚠ Notice: Fuel tank is connected to frame through bolts and nuts in four mounting points. After mounting bolts are loosened, fuel tank will separate from frame. Before removal, use a reliable tool (e.g., forklift) with sufficient bearing capacity to support fuel tank.** **⚠ Notice: Before step 6, make sure steps 2~5 have been done; otherwise, corresponding parts will be damaged, and even a safety accident will occur.**	Open-end wrench 21#, carrier tool or tooling

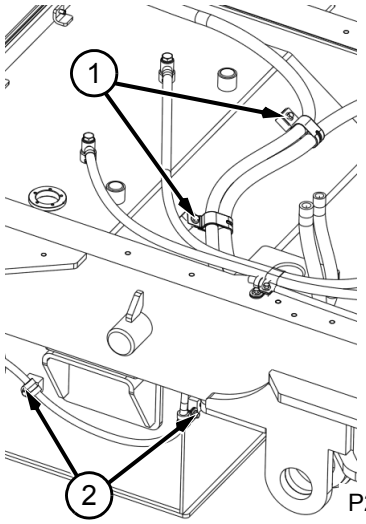
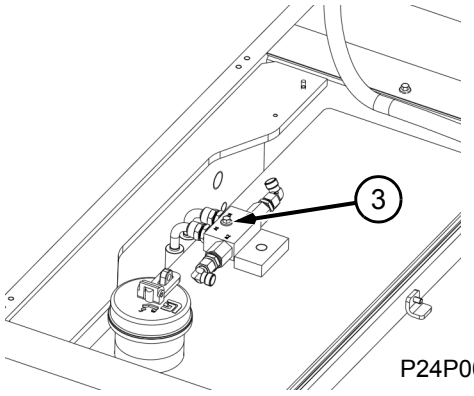
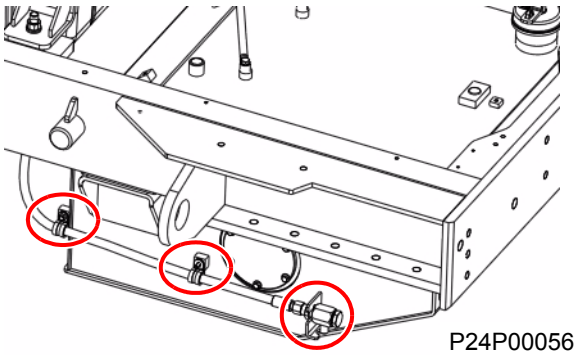
Installation of Fuel Tank Assembly

Figure	Operation steps	Tool(s)
 P24P00070	1. Transfer the diesel fuel tank to the position under the rear frame with carrier tool to align the hole of diesel fuel tank with the diesel fuel tank mounting hole on the rear frame. Fix the fuel tank on rear frame using bolts with the tightening torque of fuel tank mounting bolts 248±25N·m.	Open-end wrench 21# Carrier tool or tooling

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Figure	Operation steps	Tool(s)
 P24P00069	2. Connect the fuel level sensor harness connector to the complete machine harness.	
 P24P00068	3. Install the fuel pipe to the flange of the diesel fuel tank with screw, seal gasket.	Open-end wrench 19#

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Figure	Operation steps	Tool(s)
 P24P00059  P24P00067	4. Fix the pipe clamp/bolts: a. Fix A/C pipe clamp (1); b. Fix the lifting system pipe clamp (2); c. Fix the mounting bolts (3) of hydraulic lock.	Open-end wrench 10#
 P24P00056	5. Install the drain joint, drain pipe and pipe clamp of oil drain device.	Open-end wrench 10#, 27# Monkey spanner
	6. Fill fuel and oil.	

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Fault Diagnosis and Troubleshooting Methods

Precautions for Fault Diagnosis

Park the machine on the flat ground, check whether the locking pin, block and parking brake are fixed firmly.

When two or more workers operate the machine, follow the agreed signal strictly, and any unauthorized people are not allowed to get close to the machine.

If the radiator cover is removed when the engine is still hot, the hot coolant may spray out which will cause scald. Therefore, start the fault diagnosis when the engine is cooled.

Specially notice that do not touch any hot components or avoid being jammed by any rotating components.

When disconnecting the wire, be sure to disconnect the negative pole (-) of the battery firstly.

Be sure to release the inner pressure first when removing the plug or cover where the oil pressure, water pressure or air pressure may exist. When installing the measuring device, make sure that it is connected correctly.

Common Fault Code and Troubleshooting

Fault modes, possible causes and troubleshooting for the diesel engine

The following table shows several simple and typical fault modes, possible causes and troubleshooting during operation of the diesel engine. Any symptom occurs during operation of diesel engine, the user shall take proper measures for troubleshooting, otherwise, big accident of the diesel engine may appear. The user may find the causes according to the instructions in the following table to eliminate simple faults. In case of complex faults, please feel free to contact SDEC service call center (400-820-5656) to obtain the technical guidance or professional maintenance service.

No.	Fault mode	No.	Fault mode
1	Diagnostic tool fails to communicate with ECU	17	Diesel engine runs roughly at idling
2	Fault code indicator fails to work	18	The vibration of diesel engine is over large
3	Fault code indicator goes on constantly without obvious problems	19	Diesel engine knock
4	The alternator fails to be charged or is charged insufficiently	20	The diesel engine has too large noise
5	The starting system is faulty	21	The diesel engine emits black smoke
6	The diesel engine fails to be started or is started difficultly	22	The diesel engine emits white smoke
7	The diesel engine can be started, but fails to run constantly	23	The diesel engine emits blue smoke
8	The diesel engine is ignited poorly or the speed is not steady	24	Excessive fuel consumption

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No.	Fault mode	No.	Fault mode
9	The diesel engine is shut down easily at low speed	25	The coolant temperature is higher than that under normal condition - the diesel engine is overheated gradually
10	The diesel engine is in rough working or misfire	26	The coolant temperature is higher than that under normal condition - the diesel engine is overheated abruptly
11	Underpowered diesel engine	27	The coolant temperature is less than that under normal condition
12	The diesel engine with load fails to reach the rated speed	28	Coolant is contaminated
13	The diesel engine stops accidentally or is shut down at deceleration	29	Oil pressure too high
14	Poor acceleration performance of the diesel engine	30	Oil pressure too low
15	The diesel engine fails to stop	31	Excessive oil consumption
16	The diesel engine with unsteady idling or hunting	32	Oil is contaminated

Fault mode 1: Diagnostic tool fails to communicate with ECU

Possible cause	Troubleshooting
The start key switch is at "OFF" position	Turn the start key switch to "ON" position
Please contact SDEC service call center (400-820-5656)	

Fault mode 2: Fault code indicator fails to work

Possible cause	Troubleshooting
Fault indicator is blown	Replace the bulb
The battery fails to supply power or the key switch is faulty	Refer to Vehicle or Equipment Manufacturer Operation Manual for inspection of battery voltage and key switch circuit
Please contact SDEC service call center (400-820-5656)	

Fault mode 3: Fault code indicator goes on constantly without obvious problems

Possible cause	Troubleshooting
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)
Electronic control system runs improperly	Stop the diesel engine, turn off all powers, and then start the diesel engine again
Please contact SDEC service call center (400-820-5656)	

Fault mode 4: The alternator fails to be charged or is charged insufficiently

Possible cause	Troubleshooting
Instrument or indicator fails	Check/replace the instrument or indicator
The battery connector is loose or corroded	Clean/tighten the battery connector

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Possible cause	Troubleshooting
The drive belt is slipped or the tension pulley fails	Check whether the belt tension pulley works normally
Connectors on the alternator or the alternator voltage regulator are in poor connection	Tighten all connectors on the alternator or the voltage regulator
Please contact SDEC service call center (400-820-5656)	

Fault mode 5: The starting system is faulty

Possible cause	Troubleshooting
Starting circuit connector is loose or corroded and the battery wire or connector is loose, disconnected or corroded	Check and clean the wire and connector and tighten the connector
Insufficient battery power	Use the battery with sufficient power or add the battery for being used in parallel
Starter motor fault	Check the starting system circuit, if necessary, contact SDEC service call center (400-820-5656)
Please contact SDEC service call center (400-820-5656)	

Fault mode 6: The diesel engine fails to be started or is started difficultly

Possible cause	Troubleshooting
ECU connector is unplugged	Plug the ECU connector
ECU without voltage	Check the malfunction indicator light to judge whether ECU has voltage
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)
ECU connector is in poor connection	Readjust the connection of connector
Starting method is wrong	Refer to Vehicle or Equipment Operation Manual
Starting time is about 2-3s	It is normal with no need to be adjusted
The drive unit is engaged	Disengage the drive unit
Starting speed is too low (minimum starting speed 100 rpm)	Check the battery voltage and whether the starter motor and circuit connector are loose or corroded
Insufficient fuel in the fuel tank	Refill fuel
There is air in the fuel system	Check the leakage source, if necessary, tighten fuel joint, fuel pipe clamp or replace fuel joint and fuel pipe, and then pump fuel and exhaust the air for the fuel system
Fuel low pressure pipe joint is loose	Check the fuel low pressure pipe and tighten all low pressure pipe joints
Fuel filter or fuel suction pipe is blocked	Replace the fuel filter or fuel suction pipe
Fuel is in wax precipitation due to cold weather	Select the proper fuel specified in the Manual according to the environment
Resistance in the air intake system exceeds the specified value	Check the air intake system and replace the air filter element if necessary

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Possible cause	Troubleshooting
Resistance in the exhaust system does not comply with the requirements	Check the exhaust system
The rotation of crankshaft is stuck	Turn the diesel engine and check the stuck condition of the crankshaft, if necessary, contact SDEC service call center (400-820-5656)
Adjustment of intake and exhaust valve lash is not correct	Adjust the intake and exhaust valve lash
Please contact SDEC service call center (400-820-5656)	

Fault mode 7: The diesel engine can be started, but fails to run constantly

Possible cause	Troubleshooting
The diesel engine and driven unit are engaged	Disengage the diesel engine and driven unit
Fuel is in wax precipitation due to cold weather	Select the proper fuel specified in the Manual according to the environment
There is air in the fuel system	Check the leakage source, if necessary, tighten fuel joint, fuel pipe clamp or replace fuel joint and fuel pipe, and then pump fuel and exhaust the air for the fuel system
Fuel filter or fuel suction pipe is blocked	Replace the fuel filter or fuel suction pipe
Resistance in the air intake system exceeds the specified value	Check the air intake system and replace the air filter element if necessary
Resistance in the exhaust system does not comply with the requirements	Check the exhaust system, if necessary, contact SDEC service call center (400-820-5656)
Poor fuel quality	Please use fuel specified in the Manual and drive the vehicle for validation using the temporary fuel tank for holding fuel with good quality
Please contact SDEC service call center (400-820-5656)	

Fault mode 8: The diesel engine is ignited poorly or the speed is not steady

Possible cause	Troubleshooting
Less fuel in the fuel tank	Refill fuel
Air enters into the fuel system	Check the leakage source, if necessary, tighten fuel joint, fuel pipe clamp or replace fuel joint and fuel pipe, and then pump fuel and exhaust the air for the fuel system
Low fuel pressure	Check whether the fuel tank has fuel, whether the fuel pipe from fuel tank to fuel transfer pump is in fuel leakage, seriously deformed, bent or blocked by dirt and whether there are bubbles in the pipe. If necessary, please contact SDEC service call center (400-820-5656)
High pressure fuel pipe joint is in fuel leakage	Tighten the joint. If the joint thread has been damaged, replace the related parts
Valve lash is incorrect	Check and adjust the valve lash
Please contact SDEC service call center (400-820-5656)	

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Fault mode 9: The diesel engine is shut down easily at low speed

Possible cause	Troubleshooting
Less diesel fuel in the fuel tank	Refill diesel fuel
Air in low pressure fuel line	Check fuel level in the fuel tank and check whether the connection between fuel tank and fuel transfer pump is in fuel leakage, whether the fuel pipe is deformed and bent, troubleshoot the leakage source, and then pump fuel and exhaust air for fuel system
Please contact SDEC service call center (400-820-5656)	

Fault mode 10: The diesel engine is in rough working or misfire

Possible cause	Troubleshooting
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)
Occur only at idling	Refer to fault diagnosis "diesel engine is in rough working at idling"
The diesel engine runs at low temperature	Refer to fault diagnosis "The coolant temperature is less than that under normal condition"
Valve lash is not correct	Check and adjust the valve lash
Please contact SDEC service call center (400-820-5656)	

Fault mode 11: Underpowered diesel engine

Possible cause	Troubleshooting
Ask the driver	Obtain all information related to the problem
Overload running	Reduce the load to allowable range
The vehicle runs on the plateau exceeding the specification	The vehicle runs on the specified plateau with the power decrease as the altitude increases
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)
The replaced drive system of the diesel engine fails to match with the diesel engine	Check whether the gear drive of the drive system matches with the diesel engine
The accelerator pedal is not depressed thoroughly	Check whether movement of the accelerator pedal is stuck
Oil level exceeds the specified value	Check and adjust the oil level to the specified range
The load of drive attachment is too large	Check the running conditions of the diesel engine cooling fan and check whether the vehicle brake has friction
There is air in the fuel system	Check the leakage source, if necessary, tighten fuel joint, fuel pipe clamp or replace fuel joint and fuel pipe, and then pump fuel and exhaust the air for the fuel system
Fuel inlet temperature is high	Refill fuel in the fuel tank, if necessary, please contact SDEC service call center (400-820-5656)
Fuel supply is blocked	Check the fuel inlet resistance, if necessary, replace the primary fuel filter and final fuel filter

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Possible cause	Troubleshooting
Exhaust manifold or turbocharger is in air exhaust leakage	Check the exhaust pipe and the boost pressure and troubleshoot the leakage source
Resistance in the exhaust system does not comply with the specification	Check the resistance in the exhaust system, if necessary, contact SDEC service call center (400-820-5656)
Air intake system is in leakage	Check whether the intake pipe, intercooler and their lines are in loose connection or leakage
Resistance in the air intake system exceeds the specified value	Check resistance in the air intake system, if necessary, replace the air filter element
Turbocharger fault	Check the turbocharger, if necessary, please contact SDEC service call center (400-820-5656)
The fuel specification does not comply with the requirements or the fuel quality is poor	Please use fuel specified in the Manual and drive the vehicle for validation using the temporary fuel tank for holding fuel with good quality
The intake valve or exhaust valve is adjusted incorrectly	Check and adjust the valve lash
Please contact SDEC service call center (400-820-5656)	

Fault mode 12: The diesel engine with load fails to reach the rated speed

Possible cause	Troubleshooting
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)
Load is too large	Reduce the vehicle load or shift to low gear
The vehicle drive system is changed so that it fails to match with the diesel engine	Check whether the drive system matches with the diesel engine
The tachometer is faulty	Check the tachometer
Fuel inlet resistance is large	Check the fuel filter and fuel suction pipe, if necessary, replace the filter
Turbocharger fault	Check the turbocharger, if necessary, please contact SDEC service call center (400-820-5656)
Air intake system is in leakage	Check whether the intake pipe, intercooler and their lines are in loose connection or leakage
Resistance in the air intake system exceeds the specified value	Check resistance in the air intake system, if necessary, replace the air filter element
The fuel specification does not comply with the requirements or the fuel quality is poor	Please use fuel specified in the Manual and drive the vehicle for validation using the temporary fuel tank for holding fuel with good quality
Please contact SDEC service call center (400-820-5656)	

Fault mode 13: The diesel engine stops accidentally or is shut down at deceleration

Possible cause	Troubleshooting
Due to the protection system of the vehicle or equipment	Contact the vehicle or equipment manufacturer
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)

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Possible cause	Troubleshooting
Air enters into the fuel system	Check the leakage source, if necessary, tighten fuel joint, fuel pipe clamp or replace fuel joint and fuel pipe, and then pump fuel and exhaust the air for the fuel system
Fuel is contaminate	Replace with clean and qualified fuel
Please contact SDEC service call center (400-820-5656)	

Fault mode 14: Poor acceleration performance of the diesel engine

Possible cause	Troubleshooting
Ask the driver	Obtain all details related to the problem
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)
The vehicle drive system is changed so that it fails to match with the diesel engine	Check whether the drive system matches with the diesel engine
The load of attachment is too large	Check whether the resistance in the cooling fan, air conditioner and vehicle brake system is too large and reduce the load of drive attachment
Movement of the accelerator pedal is stuck	Check the stuck condition of the accelerator pedal, if necessary, contact SDEC service call center (400-820-5656)
Air intake system is in air leakage	Check whether the intake pipe, intercooler and their lines are in air leakage
Air intake system or exhaust system is stuck	Check the resistance in the air intake system and exhaust system, if necessary, contact SDEC service call center (400-820-5656)
Intake and exhaust valve lash are not correct	Check and adjust the valve lash
Please contact SDEC service call center (400-820-5656)	

Fault mode 15: The diesel engine fails to stop

Possible cause	Troubleshooting
The key switch circuit is faulty	Refer to Vehicle or Equipment Manufacturer Operation Manual for inspection of key switch circuit
The diesel engine sucks into fuel mist	Check the diesel engine intake pipe and separate it from the fuel mist source
External power supply voltage	Check and make sure that no external voltage circuit is connected with the vehicle power supply circuit
Turbocharger is in poor oil sealing and oil leakage	Check whether the compressor air outlet and air pipe have oil trace
Please contact SDEC service call center (400-820-5656)	

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Fault mode 16: The diesel engine with unsteady idling or hunting

Possible cause	Troubleshooting
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)
There is air in the fuel system	Check the low pressure pipe and troubleshoot the leakage source, if necessary, tighten or replace joint and low pressure fuel pipe, and then pump fuel and exhaust the air for the fuel system
Please contact SDEC service call center (400-820-5656)	

Fault mode 17: The diesel engine is in rough working at idling

Possible cause	Troubleshooting
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)
Diesel engine temperature is too low	Improve the diesel engine temperature
Idling load is too large (more than 50hp)	Reduce the idling load
The intercooler or its line is in leakage	Check the intercooler and its line
The intake pipe is in air leakage	Check the intake pipe
The diesel engine support has problem	Check the diesel engine support and cushion
Valve lash is incorrect	Adjust the valve lash
Please contact SDEC service call center (400-820-5656)	

Fault mode 18: The vibration of diesel engine is over large

Possible cause	Troubleshooting
The diesel engine is in unsteady running	Refer to "The diesel engine is in rough running or misfire"
The captive bolts or screw caps of drive belt tensioner or shock absorber are loose	Tighten the bolts or screw caps
The fan is in unbalanced rotation	Loosen or remove the fan belt and run the diesel engine for a short time at the speed as the vibration occurred. If no vibration occurs, the fan, fan hub or fan drive bearing shall be replaced
The fan is damaged or the attachment is faulty	Check/replace the faulty parts
Shock absorber is damaged	Check/replace the shock absorber
The diesel engine support has problem	Check the diesel engine support and cushion, if necessary, replace the related parts
Please contact SDEC service call center (400-820-5656)	

Fault mode 19: Diesel engine knock

Possible cause	Troubleshooting
Air enters into the fuel system	Check whether the fuel suction pipe is in leakage and pump fuel and exhaust the air for the fuel system

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Possible cause	Troubleshooting
Poor fuel quality	Please use fuel specified in the Manual and drive the vehicle for validation using the temporary fuel tank for holding fuel with good quality
Please contact SDEC service call center (400-820-5656)	

Fault mode 20: The diesel engine has too large noise

Possible cause	Troubleshooting
The drive belt tension is insufficient or load is too large	Check the working condition of the tension pulley, if necessary, replace it; check whether each pulley can rotate freely
Leakage in air intake and exhaust	Check the leakage condition of air intake system and exhaust system, tighten the loose parts and components, if necessary, replace the related parts and components
Turbocharger has noise	Check whether the impeller and the turbine collide with the housing
Intake and exhaust valve lash are too large	Check and adjust the valve lash
Please contact SDEC service call center (400-820-5656)	

Fault mode 21: The diesel engine emits black smoke

Possible cause	Troubleshooting
Overloading of diesel engine	Shift to low gear or reduce the equipment load
Resistance in the air intake system exceeds the specified value	Check resistance in the air intake system, if necessary, replace the air filter element
Intake or exhaust valve lash is not correct	Adjust the valve lash
The fuel does not comply with the requirements or the fuel quality is poor	Please use fuel specified in the Manual and drive the vehicle for validation using the temporary fuel tank for holding fuel with good quality
Please contact SDEC service call center (400-820-5656)	

Fault mode 22: The diesel engine emits white smoke

Possible cause	Troubleshooting
The diesel engine is in cold state	Warm up the diesel engine
There is water in the fuel system	Check the fuel water separator, if necessary, replace it. Meanwhile, drain completely the water in the fuel system
The fuel does not comply with the requirements or the fuel quality is poor	Please use fuel specified in the Manual and drive the vehicle for validation using the temporary fuel tank for holding fuel with good quality
Please contact SDEC service call center (400-820-5656)	

Fault mode 23: The diesel engine emits blue smoke

Possible cause	Troubleshooting
It runs at low load for a long time (below 40% of rated power), the piston and cylinder liner have larger clearance so that it is easy for oil to enter into combustion chamber	Properly improve the load; select the proper power at matching

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Possible cause	Troubleshooting
Excessive oil refilled in the oil pan	Fill oil according to oil dipstick scale
Oil seal of turbocharger is damaged and oil enters into the intake manifold	Check whether the intake manifold has oil, if necessary, check or replace the turbocharger
Please contact SDEC service call center (400-820-5656)	

Fault mode 24: Excessive fuel consumption

Possible cause	Troubleshooting
Operating skills of the driver	Check the driver for operation of gear shifting, deceleration and idling
The display shows fault code	Refer to "Engine Fault Code and Flash Code" for finding the causes, if necessary, contact SDEC service call center (400-820-5656)
The odometer shows incorrectly	Adjust the odometer
The drive system and the diesel engine are in incorrect matching	Check the vehicle gear and make sure that the diesel engine and the drive system parts have no mistake
Fuel leakage	Check the airtightness of the fuel system line, if loose, tighten it
Air intake or exhaust resistance is too large	Check the air intake system and exhaust system, especially the air filter and exhaust muffler, if necessary, contact SDEC service call center (400-820-5656)
Oil level is too high	Check the oil level and adjust the oil quantity
Intake valve or exhaust valve has poor sealing	Check and adjust the valve lash
Fuel quality is poor	Please use fuel specified in the Manual and drive the vehicle for validation using the temporary fuel tank for holding fuel with good quality
Please contact SDEC service call center (400-820-5656)	

Fault mode 25: The coolant temperature is higher than that under normal condition - the diesel engine is overheated gradually

Possible cause	Troubleshooting
The diesel engine runs with overload	Reduce the load for the engine running
Coolant level is too low	Check the coolant level and leakage condition, troubleshoot the leakage and refill the coolant to the specified range
Oil level is too high or too low	Check the oil level and adjust it to the specified range
Radiator shutters are stuck or damaged	Check the radiator shutters, if necessary, repair or replace them
Coolant hose is deflated and is in leakage	Check the hose, if necessary, replace the hose
Drive belt is loose	Check the belt, if necessary, replace it
Radiator pressure cap is faulty and the calibrated pressure is low	Check the function of the pressure cap, if necessary, please contact SDEC service call center (400-820-5656)
Temperature gauge is faulty	Check the temperature gauge and replace it if necessary
Thermostat is faulty	Check the thermostat, and replace it if necessary

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Possible cause	Troubleshooting
Air enters into the cooling system	Check the leakage condition of the joint at the suction end of water pump
Water pump is faulty	Check the water pump and replace it if necessary
Please contact SDEC service call center (400-820-5656)	

Fault mode 26: The coolant temperature is higher than that under normal condition - the diesel engine is overheated abruptly

Possible cause	Troubleshooting
Coolant level is too low	Check the coolant leakage condition, troubleshoot the leakage source, and then refill the coolant to the specified range
Cooling system hose is deflated and is in leakage	Check the hose, tighten the loose clamp and replace the hose if necessary
Drive belt cracks	Check the belt, if necessary, replace it
Coolant temperature gauge is faulty	Check the temperature gauge and replace it if necessary
Please contact SDEC service call center (400-820-5656)	

Fault mode 27: The coolant temperature is less than that under normal condition

Possible cause	Troubleshooting
The radiator shutter is stuck in the maximum opening	Check the shutter, if necessary, replace it
Excessive cold air flows trough the radiator	Visually check the running condition of the fan and the fan clutch (if equipped), if necessary, please contact SDEC service call center (400-820-5656)
The diesel engine is working under low temperature	Take measures to improve the air intake temperature
Coolant temperature gauge is faulty	Check the temperature gauge and replace it if necessary
Please contact SDEC service call center (400-820-5656)	

Fault mode 28: Coolant is contaminated

Possible cause	Troubleshooting
Improper coolant medium is selected	Choose the coolant specified in the Manual
Replacement interval of coolant is too long	Replace the coolant as per the specified interval
Please contact SDEC service call center (400-820-5656)	

Fault mode 29: Oil pressure too high

Possible cause	Troubleshooting
The diesel engine runs at too low temperature and oil is of high viscosity	Refer to fault diagnosis "The coolant temperature is less than that under normal condition"
Oil pressure gauge is faulty	Check the oil pressure gauge, if necessary, replace it
The lubricant specification does not comply with the requirements	Replace with the lubricant specified in the Manual, and replace the oil filter
Please contact SDEC service call center (400-820-5656)	

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Fault mode 30: Oil pressure too low

Possible cause	Troubleshooting
Oil level is too low	Check the oil level and adjust it to the specified range
The oil line is in leakage	Check the oil line and troubleshoot the leakage source
Oil temperature is higher than the specified value	Refer to fault diagnosis "The coolant temperature is higher than that under normal condition"
Oil pressure gauge is faulty	Check the oil pressure gauge, if necessary, replace it
Water in oil	Check whether the filler cap or dipstick is lost, replace oil or oil filter
Oil filter is blocked	Replace oil and oil filter
The oil specification does not comply with the requirements and has low viscosity	Check the oil specification, if necessary, replace oil and oil filter
Hydraulic oil in the engine oil	Check and repair the leakage part of hydraulic oil, replace oil or oil filter
Please contact SDEC service call center (400-820-5656)	

Fault mode 31: Excessive oil consumption

Possible cause	Troubleshooting
Idling time is too long	Shorten the idling time
Oil level is too high	Check the oil level, adjust it if necessary
The diesel engine is in external leakage	Check whether the external lines, sealing gaskets and oil seals of the diesel engine are in leakage and replace the damaged parts and components
Turbocharger oil leaks into the air intake system or exhaust system	Check whether the compressor inlet, air pipe and turbine outlet have oil
Crankcase pressure is too high and compress the oil out of oil-gas separator	Check whether there is oil trace around the oil-gas separator, if necessary, please contact SDEC service call center (400-820-5656)
Air compressor pumps oil	Check whether there is oil trace at the air compressor outlet, if necessary, replace the air compressor
The oil quality specification does not comply with the requirements	Check the oil quality specification. Choose oil with correct specification and replace oil and oil filter
Please contact SDEC service call center (400-820-5656)	

Fault mode 32: Oil is contaminated

Possible cause	Troubleshooting
The diesel engine is in extremely cold running so that the diesel engine runs below the normal temperature and condensed fuel enters into the oil pan	Check whether the diesel engine runs at idling for a long time and shorten the idling running time
Please contact SDEC service call center (400-820-5656)	

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Engine Fault Code and Flash Code

When the engine has fault, its fault code is shown on the instrument panel in the cab, SDEC engine fault code is shown: PXXXX (X represents the number). When the engine has fault, the diagnostic switch on the control box in the cab shall be cooperated

No.	P code	Description	SVS (flash code)
1	P0563	Battery voltage too high	26
2	P0562	Battery voltage too low	26
3	P0642	Sensor supply circuit 1 voltage too low	24
4	P0643	Sensor supply circuit 1 voltage too high	24
5	P0652	Sensor supply circuit 2 voltage too low	24
6	P0653	Sensor supply circuit 2 voltage too high	24
7	P0118	Coolant temperature sensor signal too high	11
8	P0117	Coolant temperature sensor signal too low	11
9	P0116	Coolant temperature sensor invalid	11
10	P0113	Intake temperature sensor signal too high	16
11	P0112	Intake temperature sensor signal too low	16
12	P0073	Ambient temperature sensor signal too high	17
13	P0072	Ambient temperature sensor signal too low	17
14	P0183	Fuel temperature sensor signal too high	14
15	P0182	Fuel temperature sensor signal too low	14
16	P0193	Common rail pressure sensor signal too high	67
17	P0192	Common rail pressure sensor signal too low	67
18	P0191	Common rail pressure sensor signal constant	67
19	P2229	Atmospheric pressure sensor signal too high	15
20	P2228	Atmospheric pressure sensor signal too low	15
21	P2227	Atmospheric pressure sensor invalid	15
22	P0238	Intake pressure sensor signal too high	37
23	P0237	Intake pressure sensor signal too low	37
24	P0236	Intake pressure sensor invalid	37
25	P0122	Accelerator pedal sensor #1 signal too low	22
26	P0123	Accelerator pedal sensor #1 signal too high	22
27	P0222	Accelerator pedal sensor #2 signal too low	22
28	P0223	Accelerator pedal sensor #2 signal too high	22
29	P0121	Accelerator pedal sensor #1 always on	22
30	P0221	Accelerator pedal sensor #2 always on	22
31	P0120	Accelerator pedal sensor #1 always off	22
32	P0220	Accelerator pedal sensor #2 always off	22
33	P2120	Accelerator pedal sensor #1 and #2 signal invalid	22
34	P0227	PTO pedal sensor signal too low	23

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No.	P code	Description	SVS (flash code)
35	P0228	PTO pedal sensor signal too high	23
36	P0103	Air flow sensor signal too high	17
37	P0102	Air flow sensor signal too low	17
38	P0101	Air flow sensor invalid	17
39	P1143	Idle quantity signal too high	44
40	P1142	Idle quantity signal too low	44
41	P0523	Oil pressure sensor signal too high	18
42	P0522	Oil pressure sensor signal too low	18
43	P2542	Fuel filter pressure sensor signal too high	95
44	P2541	Fuel filter pressure sensor signal too low	95
45	P1681	Exhaust brake valve output open or short to GND	28
46	P1682	Exhaust brake valve output short to power supply	28
47	P1683	In-cylinder brake #2 solenoid output open or short to GND	29
48	P1684	In-cylinder brake #1 solenoid output short to power supply	29
49	P1685	In-cylinder brake #2 solenoid output open or short to GND	29
50	P1686	In-cylinder brake #2 solenoid output short to power supply	29
51	P1687	Transmission retarder solenoid open or short to GND	85
52	P1688	Transmission retarder solenoid short to power supply	85
53	P0541	Preheating relay short to GND	25
54	P0542	Preheating relay open or short to power supply	25
55	P0616	Starter relay short to GND	4
56	P0615	Starter relay output open or short to power supply	4
57	P2148	Fuel injector common port COM1 short to power supply	57
58	P2147	Fuel injector common port COM1 short to GND	57
59	P2146	Fuel injector common port COM1 open	57
60	P2151	Fuel injector common port COM2 short to power supply	58
61	P2150	Fuel injector common port COM2 short to GND	58
62	P2149	Fuel injector common port COM2 open	58
63	P0201	No. 1 cylinder fuel injector solenoid coil open	51
64	P0205	No. 5 cylinder fuel injector solenoid coil open	55
65	P0203	No. 3 cylinder fuel injector solenoid coil open	53
66	P0206	No. 6 cylinder fuel injector solenoid coil open	56
67	P0202	No. 2 cylinder fuel injector solenoid coil open	52
68	P0204	No. 4 cylinder fuel injector solenoid coil open	54
69	P0611	Capacitor charging circuit is invalid due to undercharge	59
70	P0200	Capacitor charging circuit is invalid due to overcharge	59
71	P0263	No. 1 cylinder oil supply slack device activated	61
72	P0275	No. 5 cylinder oil supply slack device activated	65
73	P0269	No. 3 cylinder oil supply slack device activated	63

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No.	P code	Description	SVS (flash code)
74	P0278	No. 6 cylinder oil supply slack device activated	66
75	P0266	No. 2 cylinder oil supply slack device activated	62
76	P0272	No. 4 cylinder oil supply slack device activated	64
77	P1602	QR code not written	2
78	P0602	QR code error	2
79	P1601	QR code definition error	2
80	P0629	SCV output short to power supply	74
81	P0627	SCV output open or short to GND	75
82	P1190	Fuel feed pump control valve (fuel suction control valve) viscosity	75
83	P0093	Common rail pressure sensor performance invalid (including oil leak)	78
84	P2293	Fuel feed pump protection	79
85	P1217	Fuel feed pump replacement	79
86	P1218	Fuel feed pump invalid (insufficient flow)	77
87	P1219	Pressure limiter is opened	77
88	P1089	Common rail pressure exceeds the upper limit value	69
89	P0088	Common rail pressure exceeds the maximum limit	68
90	P1221	Common rail pressure is less than the minimum limit of target value	93
91	P0607	CPU error	3
92	P0606	Main CPU error	3
93	P0601	FLASH calibration and error	3
94	P0336	Crank angle sensor pulse number error	13
95	P0337	Crank angle sensor no pulse signal	13
96	P0342	Cam angle sensor no pulse signal	12
97	P0341	Camshaft angle sensor pulse number error	13
98	P0385	Cam angle and crank angle sensors no pulse signal	13
99	P0503	Vehicle speed sensor signal frequency too high	21
100	P0502	Vehicle speed sensor signal frequency short or open	21
101	P0501	Vehicle speed sensor signal invalid	21
102	P2163	Idle switch viscosity alway on	42
103	P2109	Idle switch viscosity alway off	42
104	P0617	Starter switch short to power supply	45
105	P1530	Engine stop switch viscosity always on	46
106	P1565	Cruise switch circuit failure	43
107	P0850	Neutral switch circuit failure	47
108	P0704	Clutch switch circuit failure	41
109	P1676	Reverse switch open or short to GND	48
110	P1677	Reverse switch short to power supply	48
111	P0686	Main relay viscosity always off	5
112	P0219	Engine overspeed	7

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No.	P code	Description	SVS (flash code)
113	P0217	Coolant temperature exceeding the upper limit	6
114	P0234	Intake pressure exceeding the upper limit	39
115	P0299	Intake pressure lower than lower limit	39
116	P0524	Oil pressure too low	18
117	P253F	Oil quality poor	81
118	P0521	Oil quality sensor fault	81
119	P2560	Coolant level too low	49
120	P2269	Level in oil-water separator too high	19
121	P0480	Electronic fan open or short to GND	84
122	P0481	Electronic fan short to power supply	84
123	P0482	Electronic fan control fault	84
124	P1222	Oil pump negative pressure exceeding the limit value at Level 1	96
125	P1223	Oil pump negative pressure exceeding the limit value at Level 2	97
126	P1D17	General faults of diesel particle filter system	82
127	P1D18	Serious faults of diesel particle filter system	82
128	U0073	CAN#1 node error	9
129	U1001	CAN#2 node error	9
130	U0101	CAN bus connecting with AT open	9
131	U0121	CAN bus connecting with ABS open	9
132	U0155	CAN bus connecting with instrument open	9
133	U1200	CAN bus connecting with VNT open	9
134	U1155	CAN bus connecting with DCU open	9
135	U0140	CAN bus connecting with body controller open	9
136	U1201	CAN buss connecting with oil quality sensor open	9
137	U1162	GPS fault	99
138	U1163	GPS fault for the second time	99

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Technical Requirements for Engine Fastener Torque

If the engine is overhauled, tighten the fastening bolts with tightening torque in strict accordance with the requirements of engine manufacturer. CLG4180D is equipped with SDEC 7H engine, the tightening torque specifications of which crucial bolts are shown in the following table:

No.	Name	Thread specification	Final tightening torque reference (Nm)	Process tightening methods
1	Main bearing cap bolt	M14*1.5	Sampling a set of data range: 238~262Nm. Take: 260Nm	Step 1: 120 Nm Step 2: Unscrew completely Step 3: 60±5 Nm Step 4: 95±5 Nm Step 5 turn: 150°±5°
2	Cylinder cover bolt	M12*1.75	Take: 180Nm	Step 1: 90Nm Step 2: Unscrew completely Step 3: 90Nm Step 4 turn: 120°±5°
3	Connecting rod bolts	M11×1.25	Sampling a set of data range: 113~125Nm. Take: 125Nm	Step 1: 30±5 Nm Step 2: 60±5 Nm Step 3 turn: 60°±3°
4	Flywheel screw	M12×1.25		Tighten it alternately in twice The first time: 30±5Nm The second time: 60°±3°
5	Crankshaft pulley (with signal panel, with/ without rubber shock absorber is applicable)	M12*1.25		Step 1: 50±5 Nm Step 2: Turn by 90°±3°

The tightening torque specifications of SDEC 7H engine crucial bolts are shown in the following table:

No.	Name	Thread specification	Final tightening torque (Nm)	Tightening methods
1	Mounting bolts of cooling nozzle	M8×1.25	15N.m	
2	Fastening nuts of injection pump transmission gear	M14×1.5	64±5 Nm	
3	Fastening bolts of camshaft gear		36 Nm	
4	Thrust bolts of camshaft		24 Nm	
5	Fastening nuts of injection pump flange	M8	24±3 Nm	
6	Fastening bolts of oil pump		24 Nm	Step 1: 8 Nm Step 2: 24Nm
7	High pressure fuel joint nuts Fastening bolts of injector clamp High pressure fuel joint nuts		15 Nm 30±3Nm 50 Nm	Tighten high pressure fuel pipe joint nuts in two steps and tighten the injector nuts between two steps
8	Fastening nuts of injector wire harness		1.5 Nm	

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No.	Name	Thread specification	Final tightening torque (Nm)	Tightening methods
9	High pressure fuel pipe nuts		39 Nm (fuel rail to fuel joint)	
			44 Nm (injection pump to fuel rail)	
11	Fastening bolts of engine block reinforcing plate		43 Nm	
12	Fastening bolts of intake manifold cover plate		24 Nm	
13	Front gear housing bolts		24 Nm	
14	Fastening bolts of flywheel housing	M10 M12	49 Nm 85 Nm	
15	Speed sensor bolts		5 Nm	
16	Camshaft phase sensor		4 Nm	
17	Fastening bolts of exhaust pipe and turbocharger	M10	43±4 Nm	
18	Fuel filter		Turn for 3/4 turns after contact	
19	Fuel filter base		90 Nm	
20	Oil pan drain plug		60±4 Nm	
21	Fastening bolts of oil pan		28 Nm	
22	Mounting bolts of valve rocker arm block		36 Nm	
23	Mounting bolts of intermediate enclosure and cylinder head cover		24 Nm	
24	Tightening torque of rear gear chamber mounting bolts	M8 M10 M12	24 Nm 47 Nm 50 Nm	
25	Tightening torque of oil suction pipe mounting bolts		24 Nm	
26	Engine rear underframe		77 Nm	
27	Fastening bolts of engine front underframe (Grade 10.9)		115 Nm	
28	Fastening nuts of air compressor drive gear	M18×1.5	170 Nm	
29	Front hanger plate bolts	M10 M12	60±5Nm 90±5Nm	
30	Rear hanger plate bolts	M10	60±5Nm	

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Power Train System

General Information 3-3
Safety 3-3
Universal Tool and Tooling List 3-3
Special Tool and Tooling 3-3
Introduction of Power Train System 3-4
Composition and Position of Power Train System 3-4
Technical Parameters of Brake System 3-4
Working Principle of Power Train System 3-5
Overview of Power Train System Fluid 3-7
Maintenance and Replacement of Transmission and Drive Axle Oil 3-8
Structure and Function 3-10
Torque Converter & Transmission System 3-10
Rear Axle Assembly 3-21
Front Axle Assembly 3-23
Drive Shaft System 3-25
Tire&Rim System 3-26
Test and Adjustment 3-27
System Test of Power Train System 3-27
System Test of Drive Axle System Test 3-29
Drive Shaft System 3-29
Test Requirements 3-29
Removal and Installation 3-30
Removal and Installation of Torque Converter & Transmission System 3-30
Disassembly and Assembly of Torque Converter & Transmission Assembly 3-35
Removal and Installation of Rear Axle Assembly 3-36
Disassembly and Assembly of the Drive Axle 3-42
Removal and Installation of Front Axle Assembly 3-43
Removal and Installation of Drive Shaft System 3-53
Fault Diagnosis and Troubleshooting Methods 3-55
Precautions for Fault Diagnosis 3-55
Common Faults and Troubleshooting 3-55

https://truckmanualshub.com/

Common Failure Modes of Tire and Reasons 3-59

https://truckmanualshub.com/

General Information

Safety

Many accidents in operation, maintenance, repair and other aspects are caused by failing to observe the basic safety rules and precautions. If the case of potential risk is fully aware in advance, these accidents usually can be avoided. The operators must pay attention to these potential risks, and be trained for relevant skills before properly and safely operating, maintaining and repairing the machine.

Any improper operation, maintenance and repair method may lead to hazardous conditions, and may cause personal injury and even death.

Be sure to read and understand the relevant security measures and precautions before operating, maintaining and repairing the machine.

Please strictly obey the safety warning information listed in this Manual and on the machine during operating, maintaining and repairing the machine, otherwise heavy casualties will occur.

Safety warning information in the Manual is indicated by the following symbols:

⚠ DANGER

This word means danger will occurred immediately, and if no avoidance, it may cause death or serious personal injury.

⚠WARNING

This word means existing potential danger, and if no avoidance, it may cause death or serious personal injury.

⚠CAUTION

This word means existing potential danger, and if no avoidance, it may cause slight or medium personal injury.

"Caution" is also used for reminding the relevant safety attentions of unsafe operation possibly causing personal injury. "Danger" represents the worst dangerous conditions. Safety sign of "danger" or "warning" is an attachment set at the specific dangerous location. General precautions are listed on the safety sign of "Caution".

In addition, please carefully follow the "Cautions" listed in this Manual, otherwise, it may result in great damage to the machine. We are unable to enumerate all the possible risks (including potential dangers), and the warnings in the Manual and product do not cover all the risks and dangers. If the tools, operation procedures, methods or techniques are not specially recommended by our company, it is necessary to ensure the personal safety of every one, and protect the machine against any damage.

The contents herein are provided based on the status of the machine at the time when the Manual was written, whereas, all products are updating, and this machine is no exception. Any modification will influence the operation, maintenance and repair of the machine, therefore, please contact the LiuGong dealers for latest and most comprehensive service information before operating, maintaining and repairing the machine.

Universal Tool and Tooling List

For the universal tools, tooling list, please see the universal tools, tooling list of this manual for details.

Special Tool and Tooling

For the special tool, tooling list, please see "ZF Box Overhaul Manual" and "Rear Axle Overhaul Manual of Grader from Tai'an, Jincheng" for details.

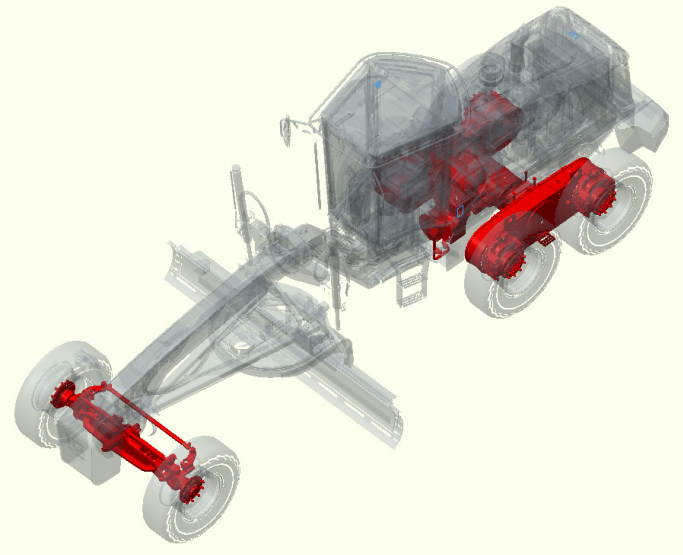
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Introduction of Power Train System

Composition and Position of Power Train System

The power train system is a critical part of a grader, like a heart, and it is located at portion between the engine and tire, as shown in red in the figure below. It mainly consists of four major components: transmission, drive shaft, drive axle and steering axle.

Position diagram for power train system of the grader



P24T00002

Technical Parameters of Brake System

Main technical parameters of power train system are listed in table below.

Main technical parameters of power train system

System components	Item	Parameters	Remarks
Transmission	Model	ZF 6WG200	
	Type	Counter shaft power shift	
	Control mode	Manually directly change to corresponding gears	
Torque converter	Type	Single-turbo, three-element	
Drive axle	Drive mode	Main drive spiral gear level-1 reduction, wheel planetary gear reduction, finally drive mode is chain drive	
	Differential mode	No-spin toothed antiskid differential	
	Brake mode	Tai'an Lutong Axle: caliper-disc brake Xuzhou Meichi Axle: shoe brake	

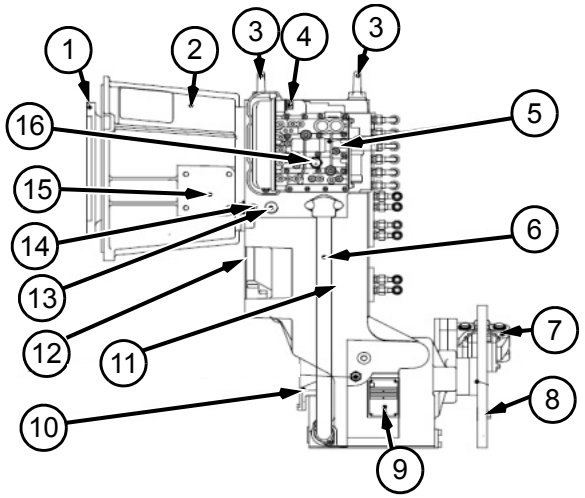
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System components	Item	Parameters	Remarks
Tire	Tire structure	Bias tire	
	Specifications	17.5-25-12/L-3/TT	
	Level	12	
	Tread pattern type	L-3	Ordinary block
Rim	Specifications	25-14.00/1.5	

Working Principle of Power Train System

The torque converter-transmission assembly equipped in this machine is ZF 6WG200 power shift transmission, and the drive axle is PY 180 caliper-disc dry brake axle from Tai'an Lutong or shoe brake axle from Xuzhou Meichi.

Diagram for transmission assembly composition

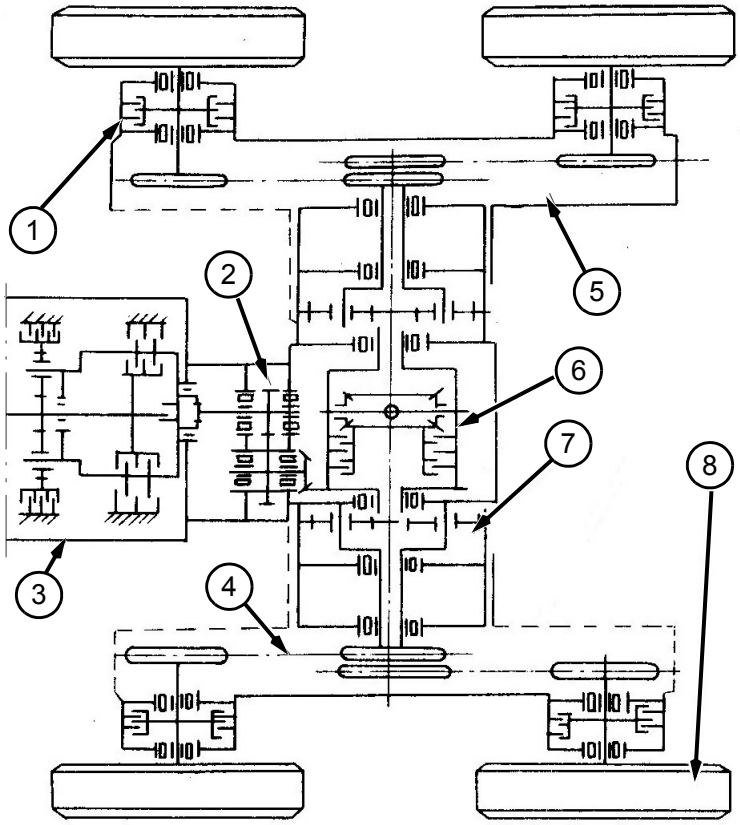


P24T00003

1. Coupling device (torque converter and elastic plate)
2. Torque converter housing
3. Lifting eye
4. Control harness interface
5. Electro-hydraulic shift control valve
6. Suction tube
7. Brake
8. Brake disc
9. Nameplate
10. Output flange
11. Transmission output speed sensor
12. Inlet port of torque converter
13. Oil outlet of torque converter
14. Torque converter outlet oil temperature sensor
15. Cover plate
16. System pressure sensor of shift control valve

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Structure diagram for drive axle assembly



P24T00004

1. Hub support and brake
2. One-level reduction
3. Multiple-gear transmission
4. Drive chain
5. Tandem
6. Main drive and limited slip differential (or differential lock)
7. Planetary reducer
8. Tire

As shown in the above two figures, the engine is coupled with the torque converter of the torque converter & transmission assembly, a part of engine power is used to drive the torque converter to work and another part is used to drive the hydraulic pump so as to provide power for the hydraulic system.

When the engine works together with torque converter, the engine output power is input into the transmission after being torqued by the torque converter. Under the control of its electro-hydraulic shift control valve, the transmission can output power and speed at different positions with gear shafts and clutches.

The power output from the transmission is transmitted to the bevel gear of drive axle via the drive shaft, and transmitted to wheel reducer by left and right half shafts via bevel gear differential, then transmitted to tandem link drive and further to tire rim assembly by decelerating and increasing torsion, thus finally to drive the grader to travel and work.

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Overview of Power Train System Fluid

The oil product used for the power train system of the grader is divided into four categories, i.e. the lubricant, grease, brake fluid and fuel, each of which can play a different role in the use of grader.

The lubricant, used in the grader, has two effects, one is to lubricate the parts and reduce the pressure, so as to prolong the service life of parts; the other is to dissipate the heat of parts produced by friction, so as to make the parts work normally. The lubricant is based on the petroleum base and added with various additives. The lubricant used by the grader covers four categories, i.e, diesel engine oil, gear oil, hydraulic transmission oil and hydraulic oil. The applications of the lubricant used in the power train system of this machine are shown in the table below:

Application locations	Ambient temperature	Recommended lubricant oil brand	The grade of lubricant oil
Torque converter & transmission assembly	≥-15°C	Mobil Black Overlord 1300 hydraulic transmission oil	SAE/CF 15W-40
	≤-15°C	Mobil ATF220 hydraulic transmission oil	SAE/CF 10W-30
Middle section of the rear axle, tandem	≥-15°C	Heavy-load wheel gear oil from Liuzhou, Gaorun	SAE 85W-90 GL-5
	≤-15°C	Low-temperature heavy-load wheel gear oil from Liuzhou, Gaorun	SAE 80W-90 GL-5
Rear axle brake	≥-15°C	Anti-wear hydraulic oil	HM-46
	≤-15°C	Low-temperature antiwear hydraulic oil	HV-46

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Maintenance and Replacement of Transmission and Drive Axle Oil

Maintenance and Replacement of Transmission Oil

The oil product added in the torque converter & transmission assembly must be consistent with oil list TE-ML 03 as recommended by ZF, the oil level shall be checked once every week by the following methods:

1) Park the machine on level ground.
2) Turn the gear of the transmission in the neutral position, and press the parking brake button to prevent the machine from moving.
3) Torque converter & transmission oil is at 80-95°C.
4) Engine operates at idle speed.
5) Observe the oil level gauge of transmission and it shall be in the "HOT" hot-oil level zone.

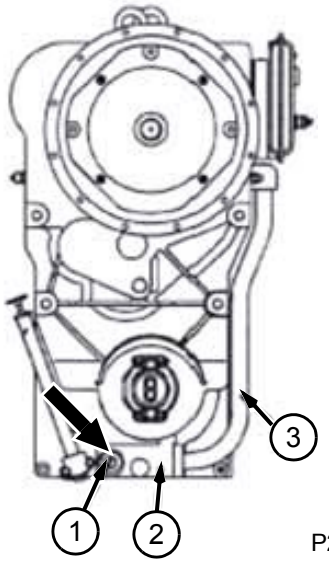
After the torque converter & transmission assembly co-work for the first 100h, the oil shall be replaced every 1000h or at least once a year. Oil shall be replaced by the methods as below:

1) Unscrew the drain plug on the torque converter & transmission assembly to drain the oil.

⚠CAUTION

The waste oil shall be collected in a container during oil drainage, in order to avoid environmental contamination; The oil shall be fully cooled before oil drainage, in order to avoid personal injury due to hot oil splashing onto the body.

Transmission drain plug



1. Drain plug
2. Transmission coarse filter
3. Suction tube

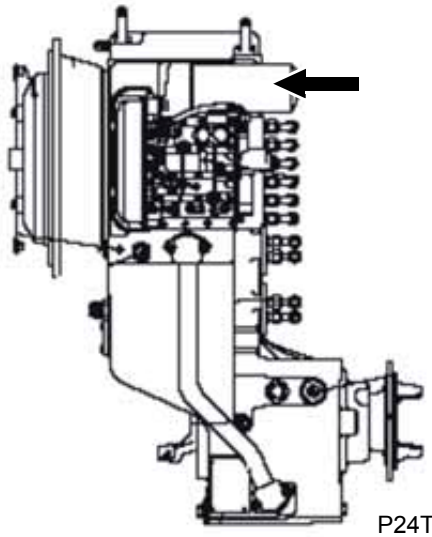
2) After the Oil sump tank of the transmission completely gets empty, wipe clean the mating surface on drain plug and transmission housing that contacting with O ring of the oil drain plug. After the O-ring of the oil drain plug is replaced, reassemble and tighten it.
3) Add the oil in accordance with the oil list TE-ML 03 as recommended by ZF.
4) Check the oil level by the method as specified for transmission.

The fine oil filter is also replaced every time the oil change is done for the transmission, as shown in the following figure. The oil filter shall be installed by the following methods:

1) Apply a small amount of the transmission oil on the oil seal of oil filter.
2) The oil filter is screwed in until the oil seal of oil filter contacts the filter head, tighten it 1/3 to 1/2 turn by hand.

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Replace transmission oil fine filter



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Maintenance and Replacement of Drive Axle Oil

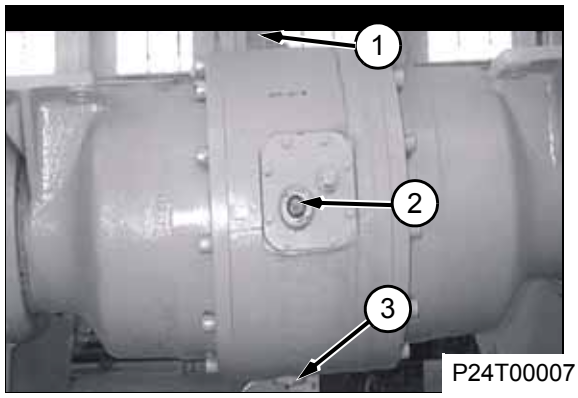
The oil product added in the drive axle must be in accordance with the oil list of 85W-90 heavy-load wheel gear oil (GL-5) recommended by LiuGong. Check and filling method for The middle section of Jincheng PY180 rear axle and the oil level of the tandem are as follows:

1) Park the machine at flat ground, and place it horizontally. Clean any part required to be refilled prior to inspection.

2) Turn the gear of the transmission in the neutral position, and press the parking brake button to prevent the machine from moving.

3) Screw out the middle section of oil level plug, observe the oil level for the middle part of drive axle middle section, and that oil overflows from the screw hole shall be seen,otherwise, the capacity will be insufficient. Replace and fill oil to the middle section, drain oil from the bottom of the oil drain port, fill oil from the top of the oil filler, filling oil are subject to that oil is overflowed from the oil level port, as shown in the following figure.

Check, drain oil and fill oil for the oil level of rear axle middle section

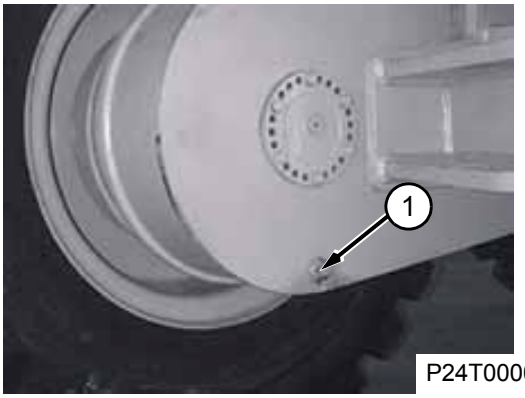


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1. Filler plug
2. Oil level hole
3. Drain plug

4) For replacing gear oil for tandem, firstly, unscrew the drain plug of the inner side of tandem as shown in figure below (drain plug or located at the bottom of the tandem) to drain and connect the oil with the container. After oil is drained out, tighten the drain plug. Refill the clean gear oil through the oil filler on the tandem top cover until fluid level reached the location between lower visible part and the middle position of the tandem oil window.

Drain plug from the inner side of the tandem



P24T00008

1. Drain plug

5) The first time for replacing lubricant oil: after the first month or after the first work for 250 hours; the period for replacing lubricant oil: every six month or every 1000 hours.

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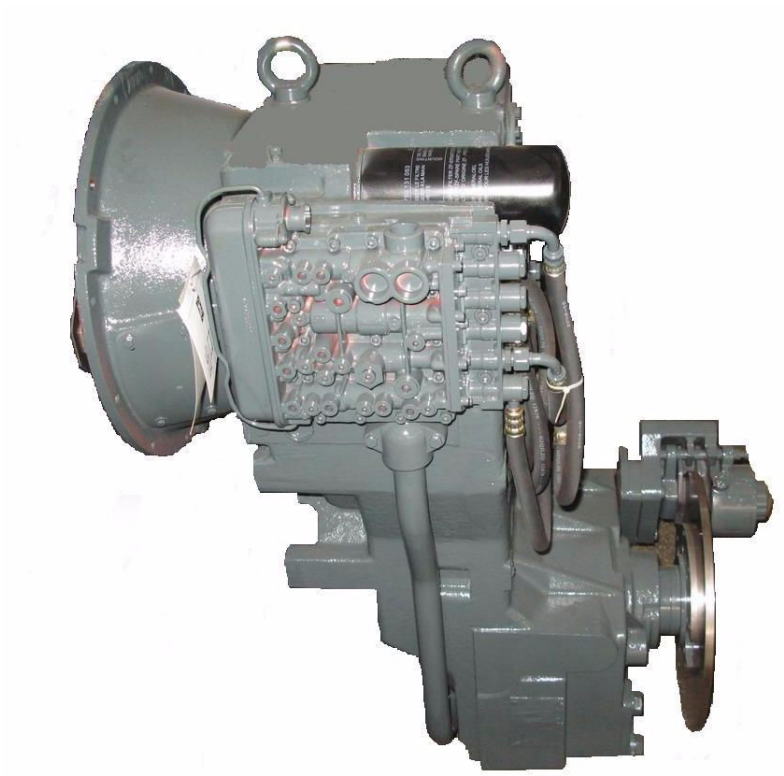
Structure and Function

Torque Converter & Transmission System

System Position and Composition

The torque converter & transmission system equipped with CLG4180D grader is ZF 6WG200 electro hydraulic control system, which consists of three-element, single-turbine torque converter, mechanical transmission with six forward gears, three reverse gears and electro hydraulic shift control system, as shown below:

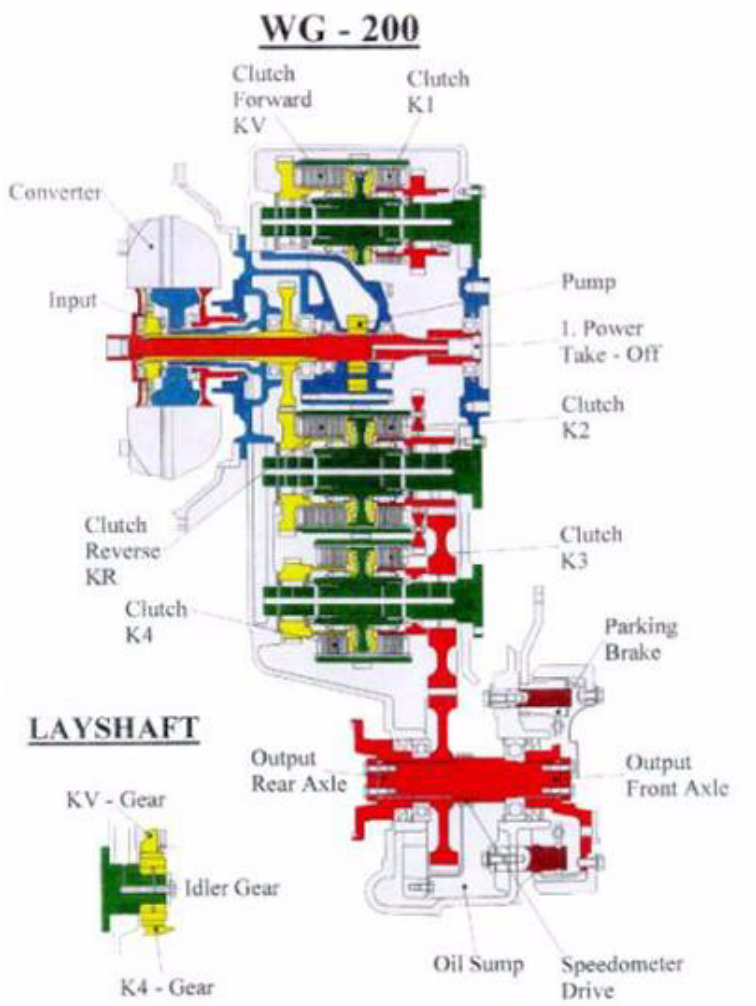
External view of torque converter & transmission assembly



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Structural schematic diagram of torque converter & transmission assembly



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Technical Parameters of System

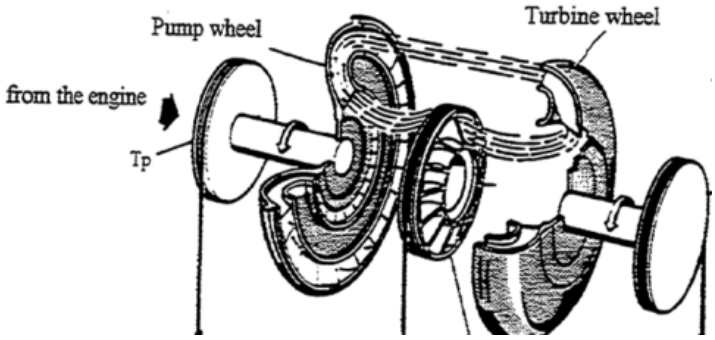
The technical parameters of ZF 6WG200 torque converter & transmission assembly in CLG4180D grader are listed in following table.

Technical parameter table of torque converter & transmission assembly

Components	Item	Parameters	Remarks
Transmission	Model	ZF 6WG200	
	Type	Fixed shaft type	
	Gears	Six forward gears, three reverse gears	
	Torque converter & transmission assembly Quality (oil not included) /kg	435	
	Mode of emergence parking brake	Disc brake	
Torque converter	Type	Single-turbo, three-element	
	Circulation circle diameter of torque converter/mm	340	
	Inlet pressure of torque converter/MPa	0.55~0.85	
	Outlet pressure of torque converter/MPa	0.50~0.55	
Shift Control System	System voltage /V	24	
	Shift control mode	Semi-auto electro hydraulic power gearshift (manually direct gearshift mode)	
	System working pressure /MPa	1.6~1.8	

System Schematic Diagram and Working Principle Description

Structure diagram for torque converter

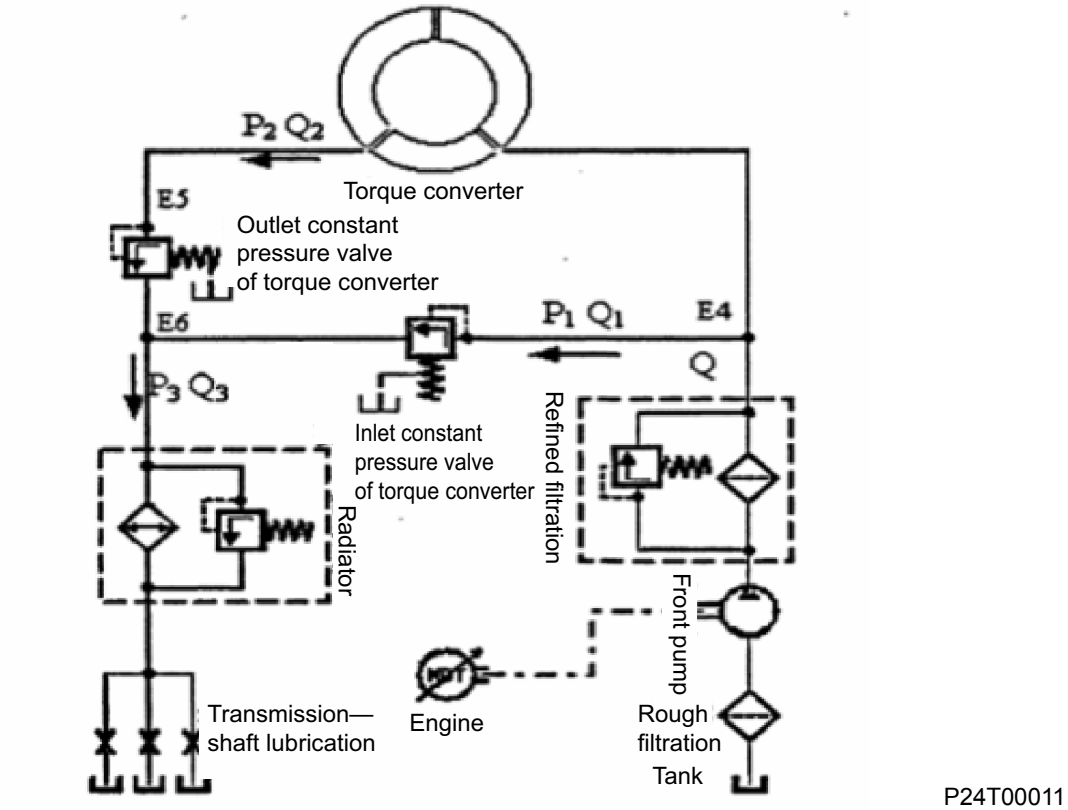


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The torque converter of this system is a three-element with single-turbo structure, and the diagram for its structure and working principle is as follows:

Hydraulic schematic diagram for torque converter

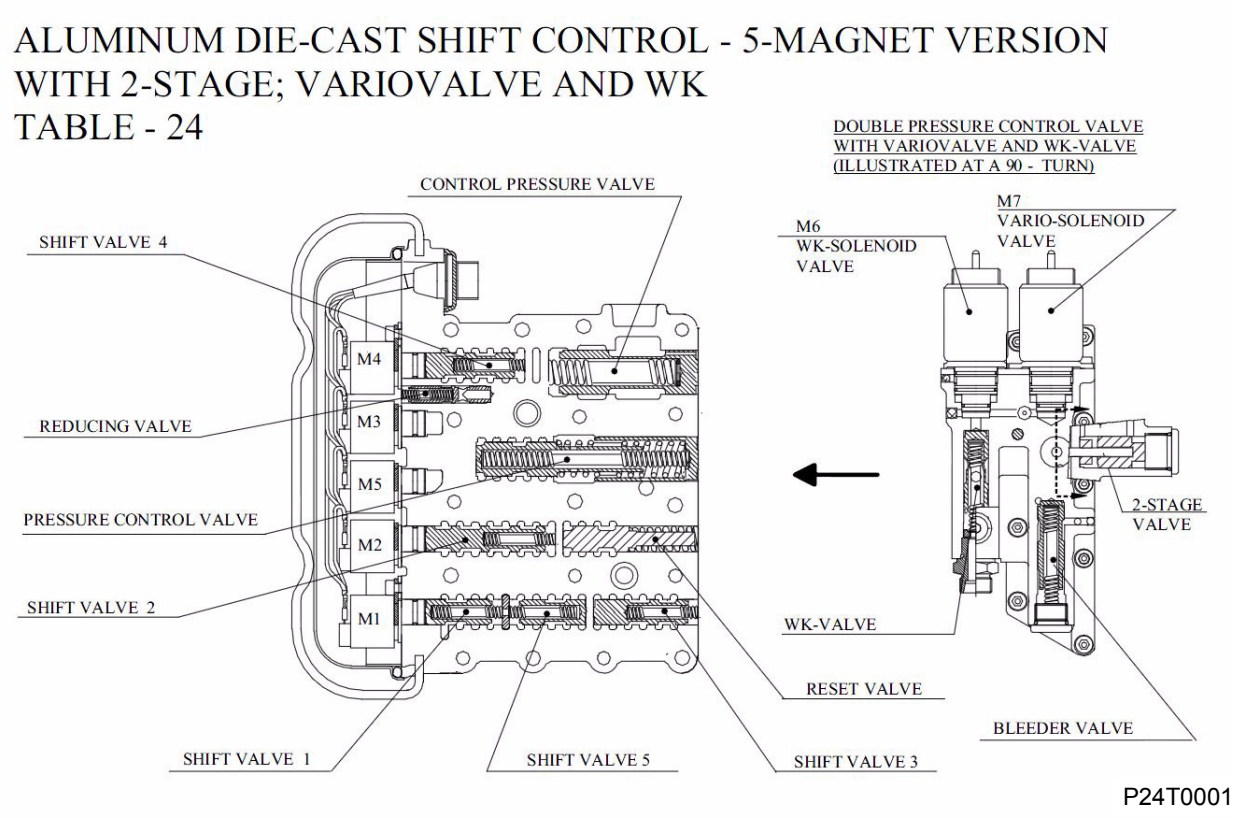


We can see from structure diagram for torque converter, a three-element, single-turbo torque converter mainly consists of pump gear, leading wheel and turbine. As the pump wheel of torque converter is directly coupled with and driven by the engine, the hydrodynamic drive oil between pump wheel and turbine forms complex flow in torque converter under rotation of pump wheel. The mechanical energy is converted into kinetic energy of oil fluid. The fluid flow with kinetic energy strikes against the turbine at a high speed. The turbine absorbs its kinetic energy and restores it to mechanical energy for transmission. The leading wheel is stationary. When the fluid flow (which is from the turbine and has some kinetic energy) passes through the curved blade of the leading wheel, the torque formed by the impact force and counterforce produced on the blade acts on the fixed base, and equivalent to the sum of increased torque of turbine from counterforce and reduced input torque of pump gear from impact force. It is possible that the output torque of turbine is greater than input torque of pump gear, based on which, the torque converter is variable.

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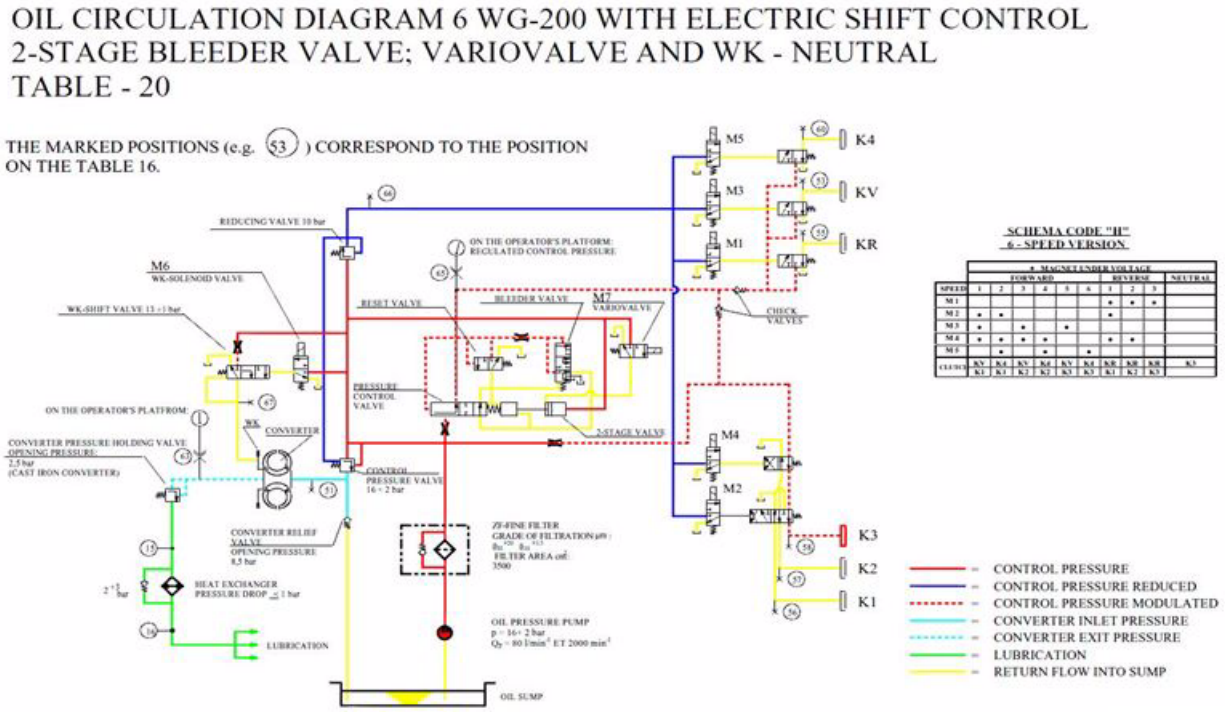
The working oil of torque converter is imported into the torque converter after the coarse and fine filtering from the oil tank by the gear shift pump in transmission. There is a constant pressure valve (safety valve) set at the inlet port of torque converter, whose main role is to avoid excessive pressure in the torque converter to damage the parts inside torque converter. There is an another constant pressure valve (back pressure valve) at the outlet port of torque converter, whose main role is to ensure the torque converter is full of working oil in order to avoid cavitation appeared during operation and impact on the performance of torque converter. An electro-hydraulic shift control valve is installed on the transmission assembly, see the following figure for the structure composition and operating hydraulic schematic diagram:

Diagram for structure and composition of electro-hydraulic shift control valve



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Hydraulic schematic diagram of torque converter & transmission assembly



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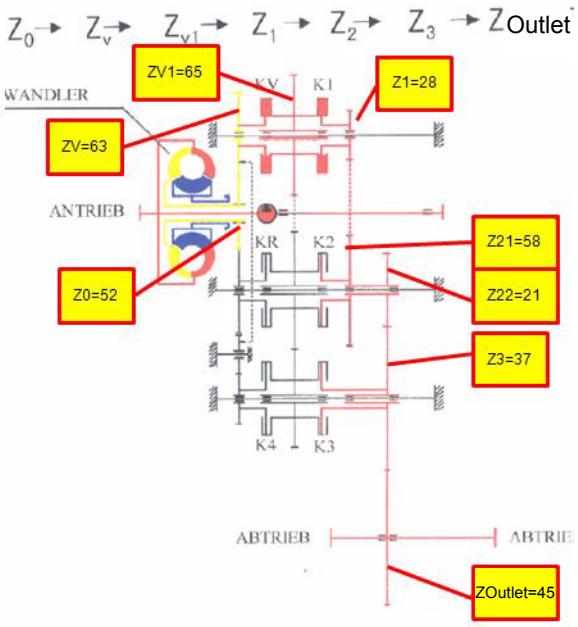
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Logical relations between gear states and working conditions of shift solenoid control valve

Solenoid valve	Electric condition of the solenoid valve									
	Forward gear						Reverse gear			Neutral gear
	1	2	3	4	5	6	1	2	3	
M1							●	●	●	
M2	●	●					●			
M3	●		●		●					
M4	●	●	●	●			●	●		
M5		●		●		●				
Clutch	KV	K4	KV	K4	KV	K4	KR	KR	KR	K3
Clutch	K1	K1	K2	K2	K3	K3	K1	K2	K3	

The electro-hydraulic shift control valve consists of solenoid valves M1, M2, M3, M4, M5, valve stem and body. When the electro-hydraulic shift control valve is operating, the fluid flow direction in the valve stem oil passage is controlled by the power of solenoid valves, which finally control the engagement and disengagement of gear clutch in the transmission so that the transmission outputs different gears. Under conditions of the transmission in different gears, for the power transferring line and gear engagement, please see the figure of the power transferring line for each gear as the following figure:

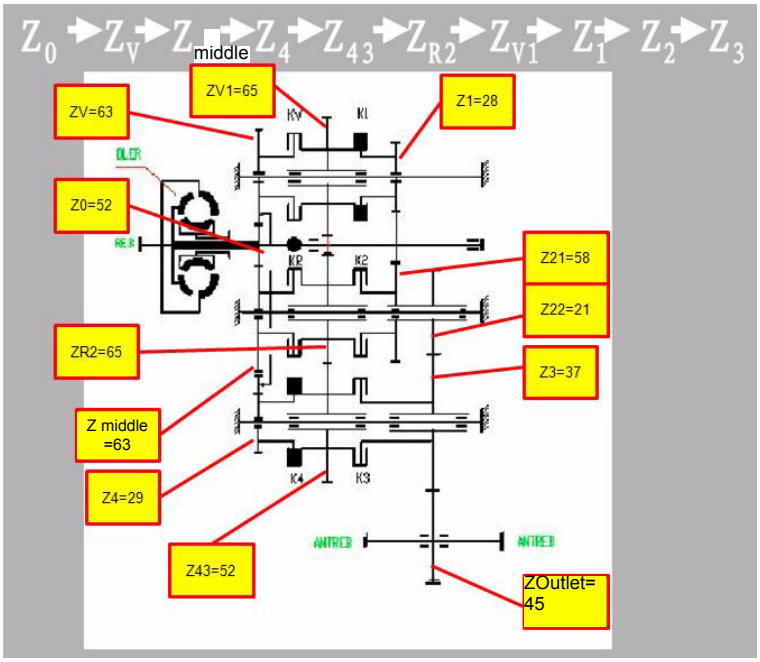
Drive line of forward gear 1



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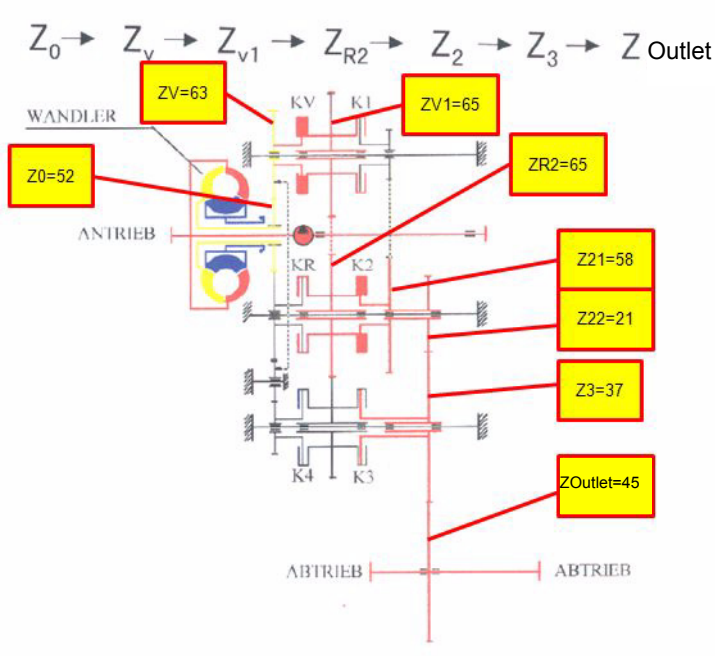
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Drive line of forward gear 2



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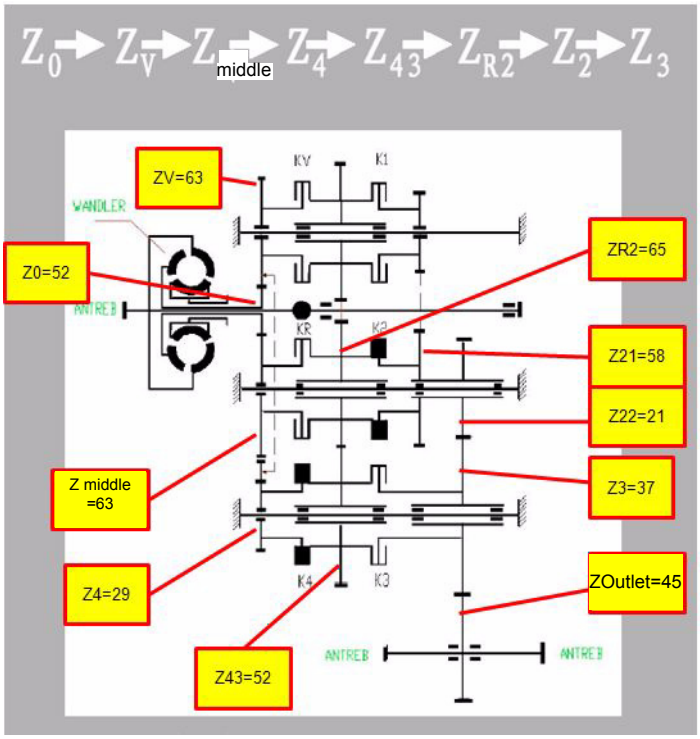
Drive line of forward gear 3



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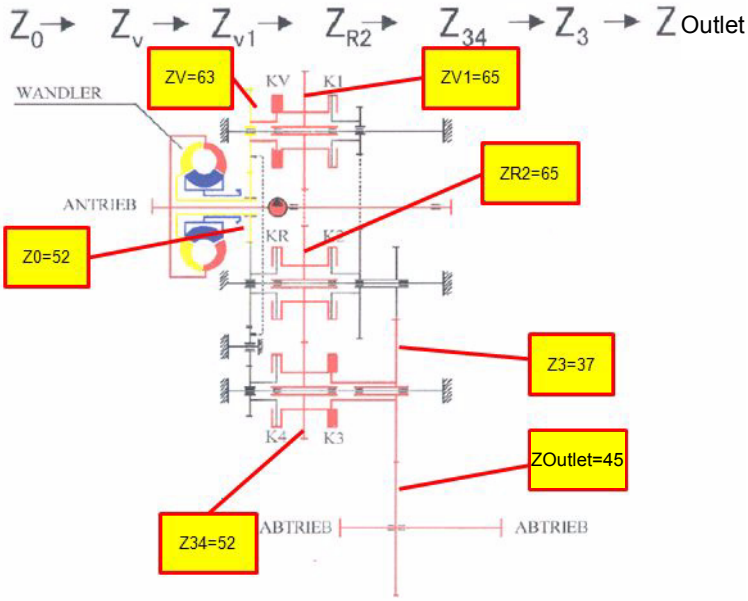
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Drive line of forward gear 4



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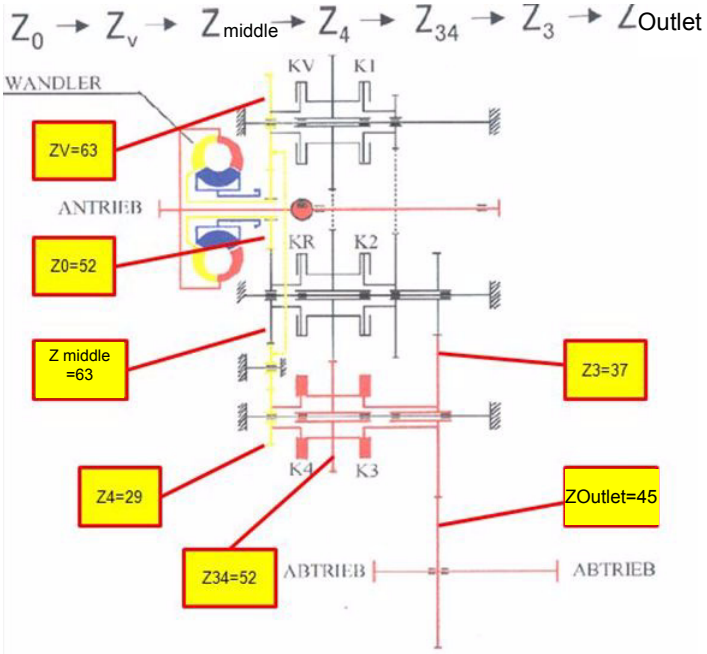
Drive line of forward gear 5



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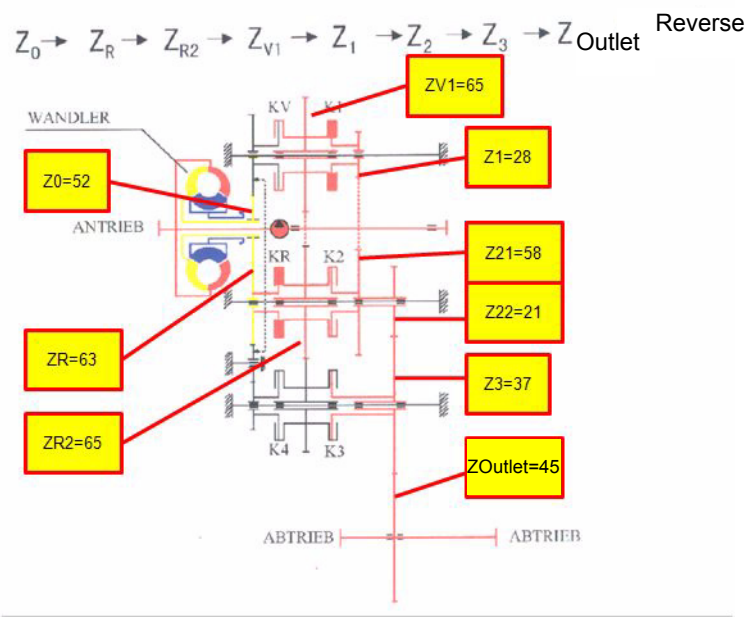
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Drive line of forward gear 6



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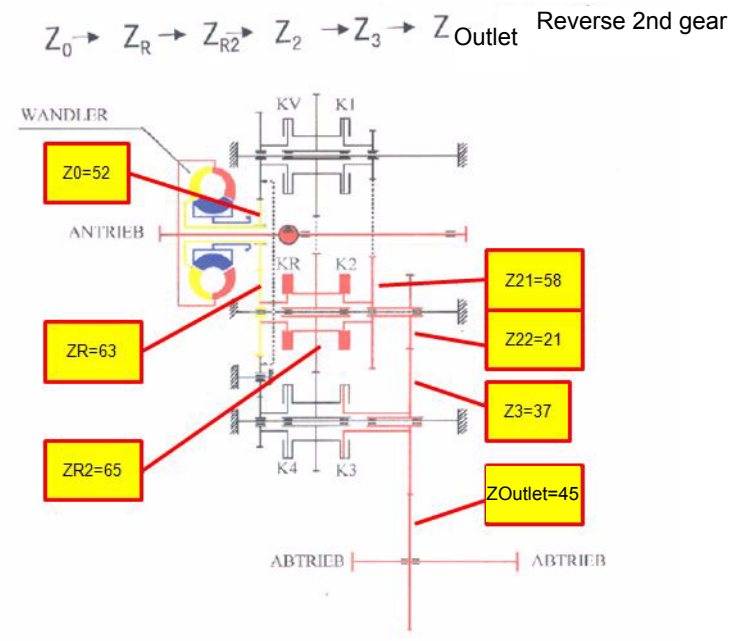
Drive line of reverse gear 1



P24T00020

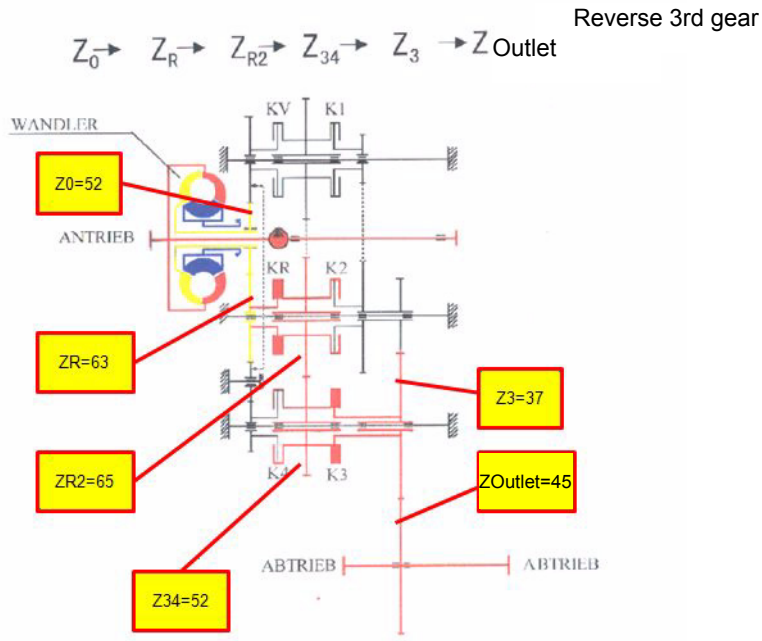
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Drive line of reverse gear 2



P24T00021

Drive line of reverse gear 3



P24T00022

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Rear Axle Assembly

Composition and Working Principle

Composition: drive axle mode of this machine mainly refers to rear axle assembly, including rear axle, mounting bolt, lubrication lines and brake lines.

Working principle: Firstly, via bevel gear, planetary reduction and chain drive, reduce the rotate speed that is input from the transmission, improve the torque, and rotate by driving sprocket to meet requirements of driving, operating speed and traction of main machine. Secondly, the differential function between left and right tires is achieved by No-spin differential to make sure that the machine can travel normally even the driving resistances on both sides are different. Thirdly, match the limit block of rear frame, left and right tandems can swing up and down by 15° and make sure the flatness of the operation from the grader. Fourthly, Match hydraulic brake system, provide the function of service brake.

In addition to basic functions of drive axle for the drive axle, it is also a load-bearing device for complete machine, a support device for travel wheel and mounting & support device for service brake.

Technical Parameters

The drive axle system of this machine mainly refers to rear axle assembly, major technical parameters are listed in following table.

Technical parameters table of the drive axle assembly

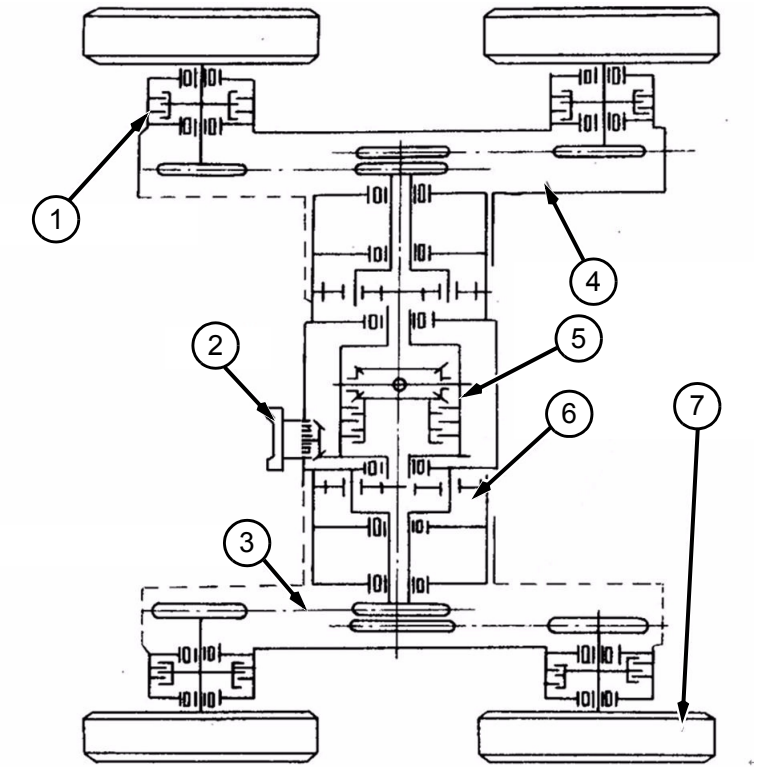
System components	Item	Parameters	Remarks
Rear axle	Drive mode	Main drive spiral gear level-1 reduction, wheel planetary gear reduction, finally drive mode is chain drive	
	Differential mode	No-spin toothed antiskid differential	
	Brake mode	Tai’an Lutong Axle: caliper-disc brake Xuzhou Meichi Axle: shoe brake	
	Brake pressure (MPa)	10	

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Structure and Schematic

The drive axle of the machine is rear axle assembly, consisting of main (including antiskid differential), wheel reducer (planetary reduction) and tandem (chain drive, caliper-disc brake or shoe brake). the structure diagram is as shown in the following figure.

Structure diagram of rear axle



P24T00023

1. Hub support and brake
2. 7C flange
3. Drive chain
4. Tandem
5. Main drive and limited slip differential (or differential lock)
6. Planetary reducer
7. Tire

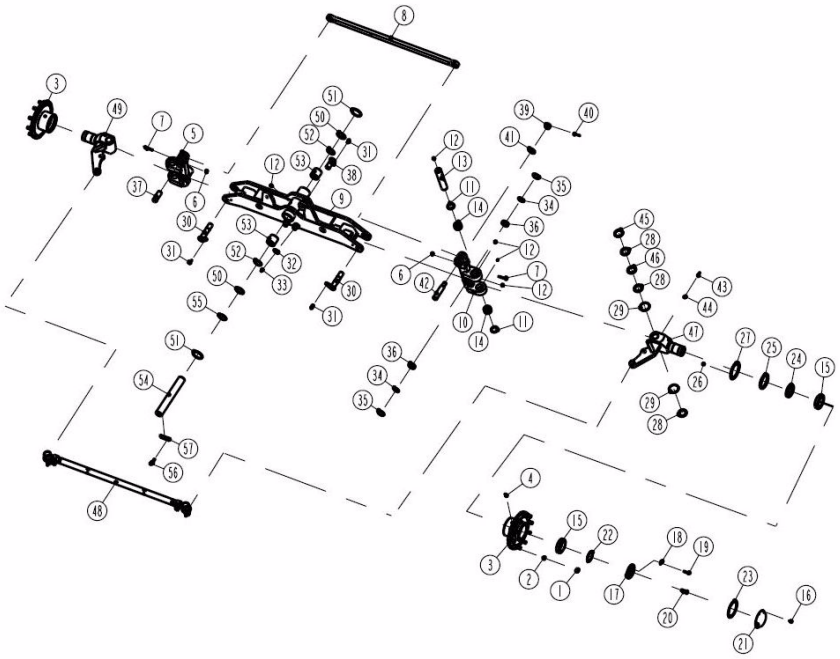
Working principle: the transmission transfers power through drive shaft, and then transfers to drive wheels through 7C flange, main reducer (main drive, differential), half shaft gear, half shaft, Reducer (planetary reducer), double-row sprocket wheel, chain and sprocket for simplex chain to achieve mechanical driving. Rear axle is equipped with service brake, and provides power through hydraulic brake system. During the course of driving, necessary service brake is executed.

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Front Axle Assembly

Composition and Position of Front Axle Assembly

CLG4180D front assembly is installed on the front frame by being connected with the front frame via a pin, which makes function for carrying the weight on the complete machine and complete swing function of the front axle; in the meantime, when complete machine is driving or working, via the applied force of steering cylinder installed on front axle assembly, make steering knuckle on the front axle assembly complete the steering function; via the applied force of tilt cylinder installed on front axle assembly, make tilt knuckle on the front axle assembly complete the tilt function. The composition of front axle assembly is as shown in the figure below:

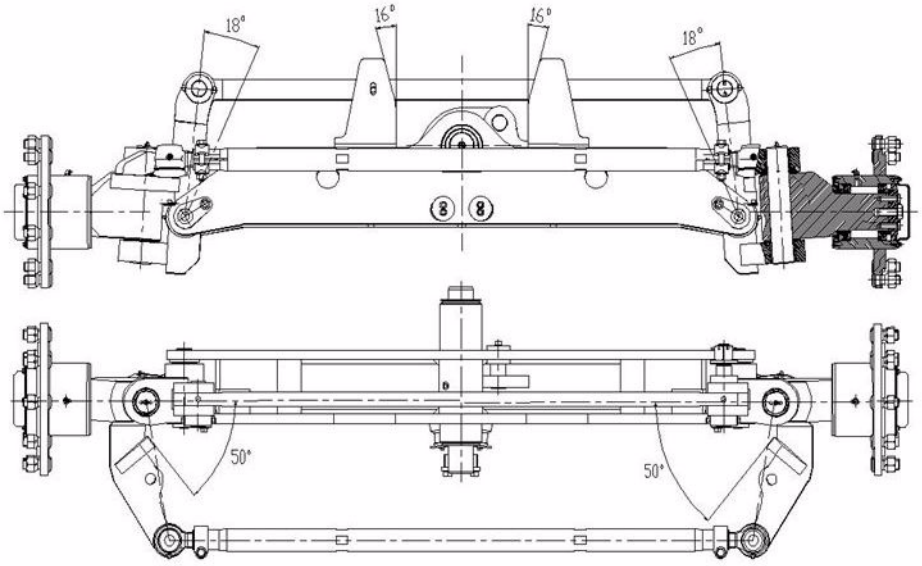


P24T00024

1. Nut
2. Washer
3. Front wheel hub
4. Grease fitting
5. Lean-joint
6. Nut
7. Bolt
8. Wheel tilt linkage assembly
9. Front axle frame
10. Lean-joint
11. Dust ring
12. Grease fitting
13. Steering pin
14. Bushing
15. Tapered roller bearing
16. Bolt
17. End cover
18. Lock plate
19. Bolt
20. Bolt
21. End cover
22. Adjusting shim
23. Seal ring
24. Bushing
25. Oil seal
26. Screw
27. Snap ring
28. Thrust washer
29. V-ring
30. Pin shaft
31. Bolt
32. Disk
33. Bolt
34. Thrust washer
35. V-ring
36. Angular-contact knuckle bearing
37. Pin shaft
38. Pin shaft
39. Nut
40. Pin
41. Washer
42. Pin shaft
43. Screw
44. Nut
45. Adjusting shim
46. Thrust roller needle bearing
47. Steering knuckle
48. Steering linkage
49. Steering knuckle
50. Thrust washer
51. V-ring
52. Dust ring
53. Steel sleeve
54. Pin shaft
55. Adjusting shim
56. Bolt
57. Baffle

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Technical Parameters of the Drive Axle Assembly



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Main Technical Parameters of the Drive Axle Assembly:

Inside steering angle of the steering knuckle: 50°±2

Inside tilt angle of the tilt knuckle: 18°±2°

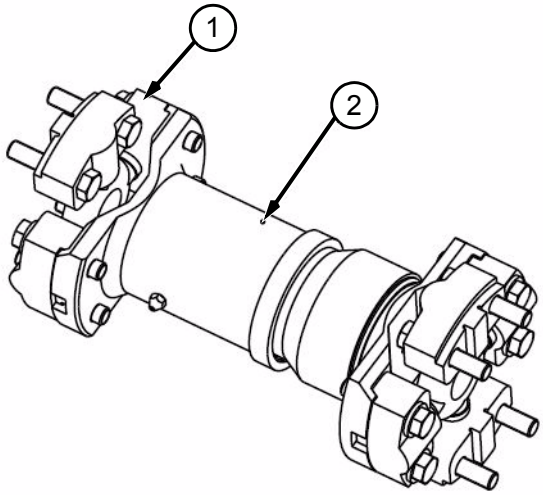
Relative front frame swing angle of front axle assembly: 16°±2°

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Drive Shaft System

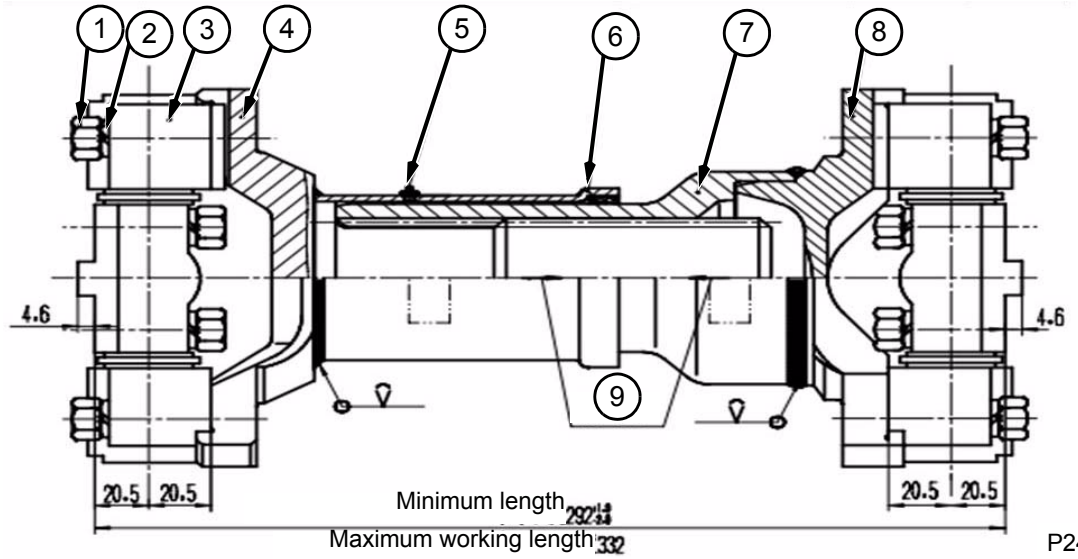
Composition and Position of System Components

Drive shaft system coupling of CLG4180D grader is installed on between torque converter & transmission assembly output flange and tandem input flange, mainly used for transmitting torque and rotate speed output by the engine, and torque converter & transmission assembly changing the torque and speed, and then inputting the tandem via drive shaft system.



P24T00026

1. Bolt 1/2 〃 -20UNF
2. Drive shaft assembly



P24T00027

1. Bolt
2. Washer
3. Spider assembly
4. Shaft fork
5. Oil cup
6. Dust cover
7. Sliding sleeve
8. Joint fork
9. Arrow mark

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Technical Parameter for Drive Shaft System.

1. Working mounting length of the drive shaft assembly: 310 mm, min mounting length: 292 mm, and max mounting length: 332 mm;
2. Rated working torque of drive shaft assembly: 3500N.m;
3. Center lines of the universal joints shall be in the same surface, and the difference shall be no greater than 3°;
4. Coupling types of the input terminal and the output terminal are 7C flange.

Tire&Rim System

System Components and Position

Tyre & rim system mainly consists of the tyre and rim assembly, and a certain amount of inert gas shall be filled. They are fixed on the front axle and the rear axle of a grader with the hub bolts and nuts. They have the functions of carrying the load of the grader, drawing the grader to drive, absorbing shock to keep comfort for the vehicle, etc.

Technical Parameters of System

The technical parameters for the tire & rim system equipped in this machine are listed in the table below.

Technical parameters of tire & rim system

System components	Item	Parameters	Remarks
Tire	Tire structure	Bias tire with an inner tube	Tubeless bias tire and radial tires can be equipped
	Specifications	17.5-25 PR12/TT L-3	
	Level	12	
	Tread pattern type	L-3	Ordinary block
	Tire pressure (MPa)	0.32-0.35	
Rim	Specifications	25-14.00/1.5	

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Test and Adjustment

System Test of Power Train System

Leakage Inspection

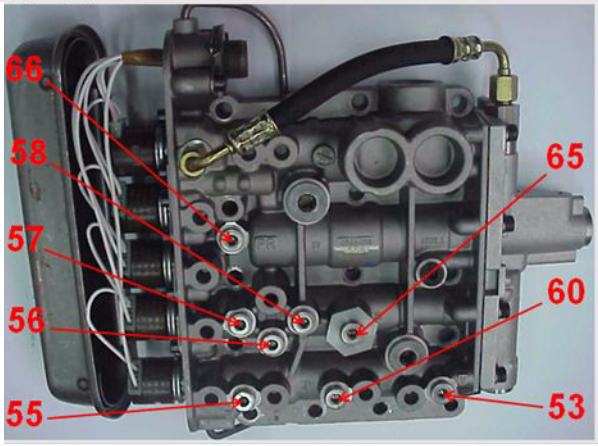
Start the machine and operate it for several minutes, observe whether there is sign of leakage from each hose assembly coupled with transmission assembly, if any, re-tighten it.

Test of Transmission Shift Pressure

Power on the machine, the transmission oil pressure warning light flashes on the instrument, and after start of machine, the warning light shall go off, if not, check the transmission oil level again.

Pressure Testing Port and Value for Shift Control Valve

Pressure testing port for control valve



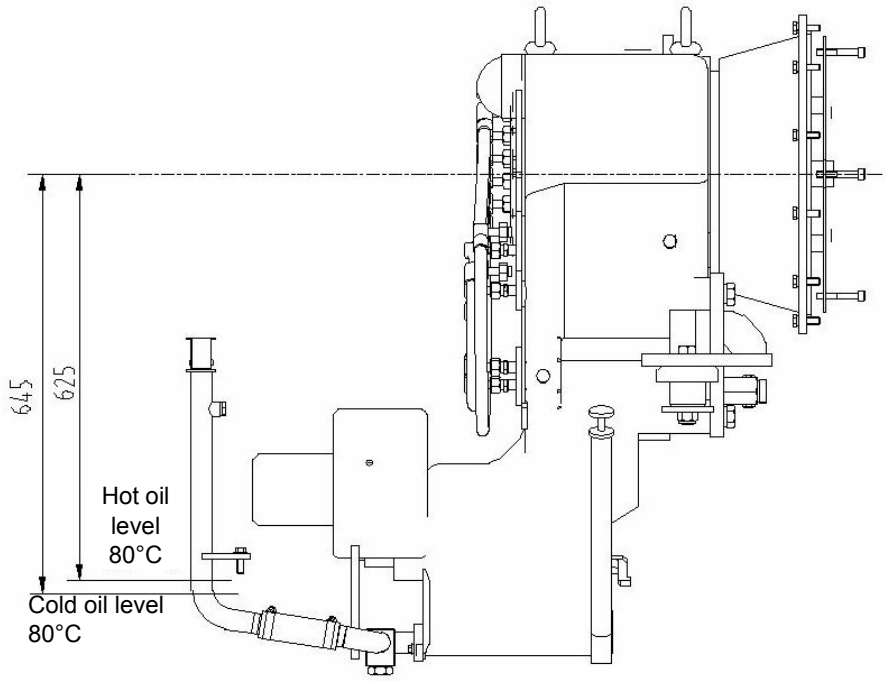
53	=	Clutch Forward	16 +2 bar	KV	M10x1
55	=	Clutch Reverse	16 +2 bar	KR	M10x1
56	=	Clutch	16 +2 bar	K1	M10x1
57	=	Clutch	16 +2 bar	K2	M10x1
58	=	Clutch	16 +2 bar	K3	M10x1
60	=	Clutch	16 +2 bar	K4	M10x1
63	=	Behind the converter			M14x1,5
		Temperature 100° C, short-time 120° C			
65	=	System pressure	16 +2 bar		M10x1
		Measuring points for delivery rates:			

P24T00028

53. Forward gear KV
55. Backward gear KR
56. 1st gear K1
57. 2nd gear K2
58. 3rd gear K3
60. 4th gear K4
65. System pressure 16+2 bar
66. Reduced pressure 10 bar

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Inspection for the Value of Torque Converter & Transmission System Oil Level



P24T00029

When the rotate speed of the engine is 1000rpm, under the state of cold oil (the oil temperature doesn’t exceed 40°C), the oil level shall be in the cold oil level zone, and under the state of hot oil (the temperature is between 80°C and 100°C), the oil level shall be in hot oil level zone.

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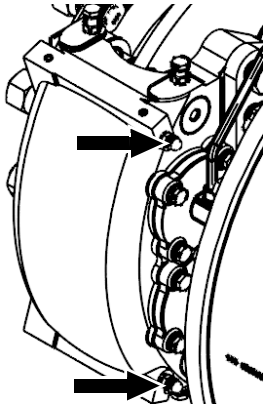
System Test of Drive Axle System Test

Leakage Inspection

Start the machine, depress the service brake pedal for several times after the air pressure of accumulator gets normal, observe whether there is sign of leakage at the joint of steel pipe of rear axle brake and service brake hose.

Air bleeding

Rear-axle air-bleeder plug (Tai'an Lutong Axle)

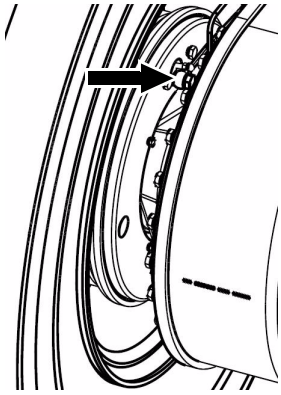


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Exhaust

1. Loose the exhaust plug on the brake clamp. (Each clamp has exhaust plug).
2. Start the machine and depress the service brake pedal until the oil overflows from the ventilation plug.
3. Tighten the ventilation plug.

Rear-axle air-bleeder plug (Tai'an Lutong Axle)



P24T00001

1. Unscrew the air-bleeder plug. (existing on each hub, which is located on the upper part of the brake steel pipe joint)
2. Start up the machine and depress the service brake pedal until the oil flows out of the air-bleeder plug.
3. Start up the machine and depress the service brake pedal until the oil flows out of the air-bleeder plug.

Drive Shaft System

Test Requirements

Testing Dynamic Unbalance Value

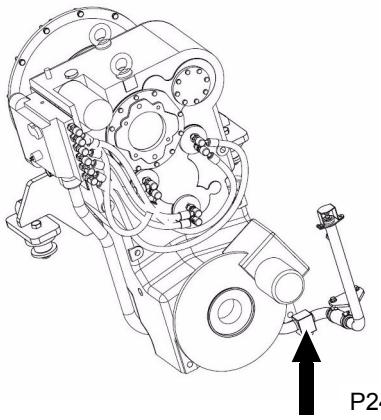
After the drive shaft is repaired, a professional dynamic unbalance test must be performed.

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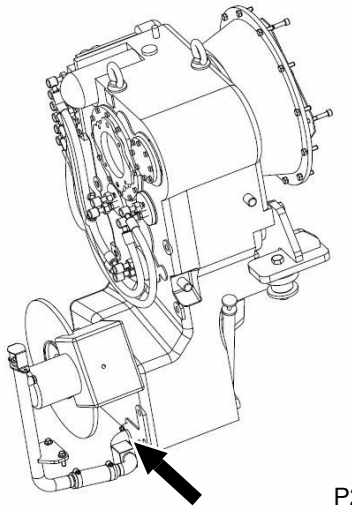
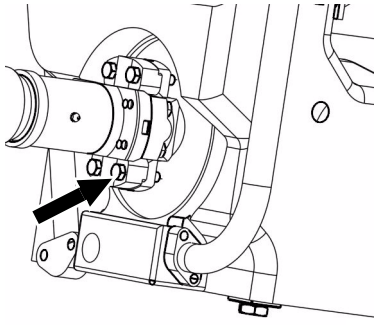
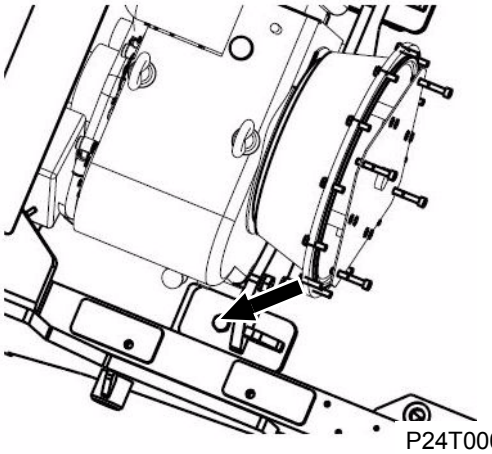
Removal and Installation

Removal and Installation of Torque Converter & Transmission System

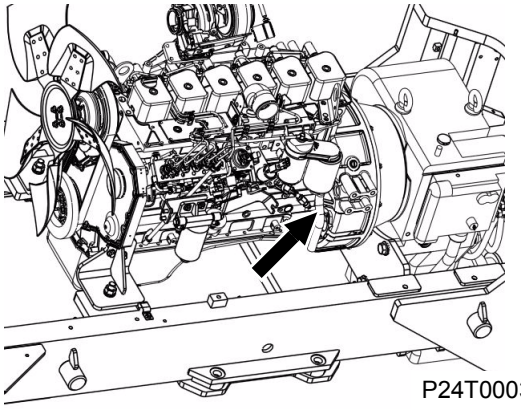
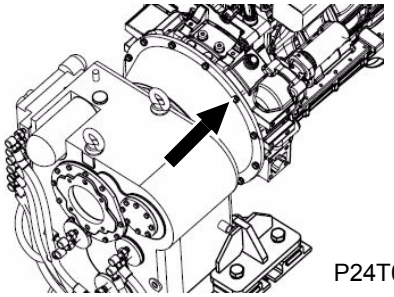
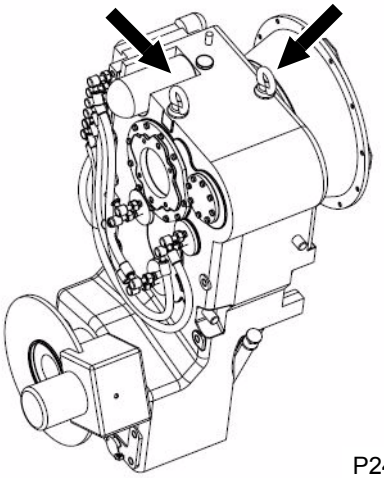
Removal of Torque Converter & Transmission System

Figure	Operation steps	Tool(s)
	1. Stop the machine on a level ground, put the blade of the work implement on the ground, and pull up the emergency parking brake lever. 2. Turn off the engine and remove the key.	
 P24T00032	3. Remove the drain plug on the filler pipe assembly of transmission & torque converter system to drain the oil from the transmission assembly. After the oil is drained out, remove the circuit, cooling hose and brake hose on that system, respectively. **⚠ Notice: The waste oil shall be collected in a container during removal to avoid environmental pollution.** **⚠ Danger: Make sure that pressure inside the hose assembly which is connected to transmission & torque converter system is fully drained out and the oil is cooled sufficiently before the system, so as to avoid personal injury caused by hose pressure and hot oil during removal.**	34# socket, 13# socket and pneumatic impact wrench
	4. Remove engine hood assembly of the grader, and refer to the Chapter of Removal of Engine Hood for removal procedures.	

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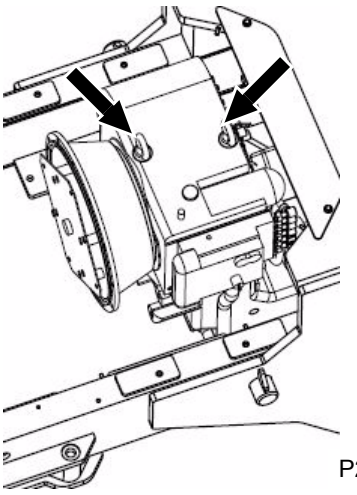
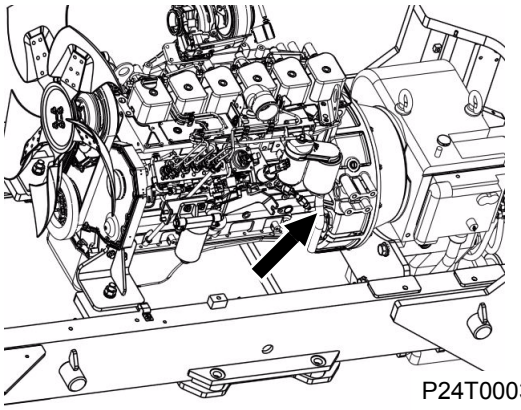
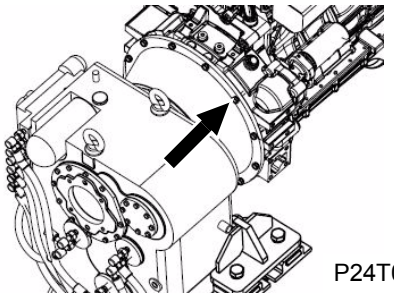
Figure	Operation steps	Tool(s)
 P24T00033	5. Remove the filler pipe assembly connecting the transmission with the wrench. **⚠ Notice:The waste oil shall be recycled in filler pipe assembly during removal, in order to avoid environmental contamination.** Filler pipe assembly which has been removed shall be masked to prevent parts from the contamination.	13# Wrench
 P24T00034	6. Remove the tightening bolt which is connected to rear drive shaft assembly and rear output flange of transmission assembly. **⚠ Notice: Rear drive shaft assembly is composed of slidable spline sleeve, spline shaft and so on; please take care to avoid personal injury caused by the parts of drive shaft sliding and falling off during removal.**	18# Wrench
 P24T00035	7. Remove the bolts and washer for tightening the transmission mounting bracket and the frame with an air gun.	46# wrench, 46# socket, pneumatic impact wrench

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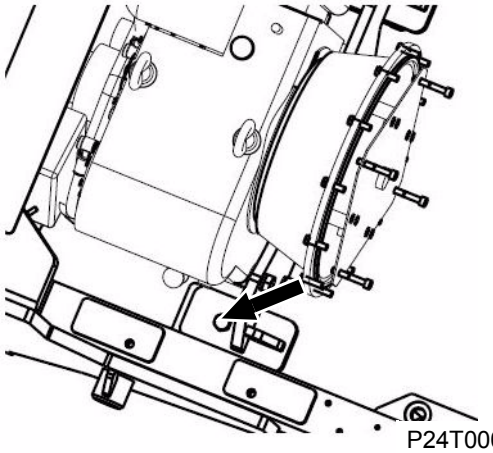
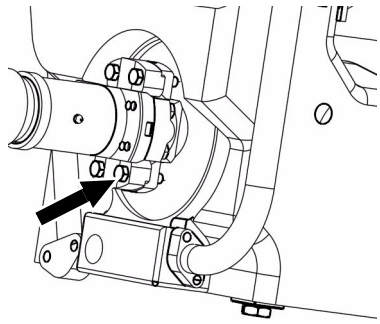
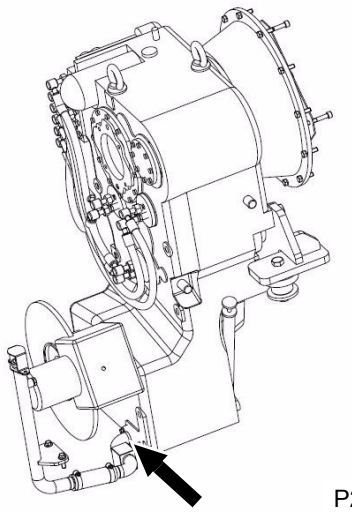
Figure	Operation steps	Tool(s)
 P24T00036	8. Clockwise rotate the engine fan wheel to make the mating bolts turning to the engine inspection window, and then remove the mounting bolt which is connected to the engine flywheel on the transmission assembly from fitting end of the engine with inner hexagon wrench.	6#Hexagon wrench
 P24T00037	9. Remove the fastening bolts connecting the transmission assembly - torque converter housing with the engine housing using an air gun and socket.	16# socket, pneumatic impact wrench
 P24T00038	10. Supporting the engine by the bracket, lift up the transmission assembly from the machine through the lifting eye with the hoisting device and ropes and place it in a safe area. (During hoisting, the transmission assembly is not allowed to collide with the frame, engine and other parts)	Sling (2 tons)

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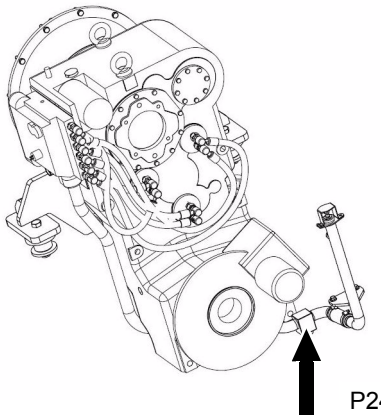
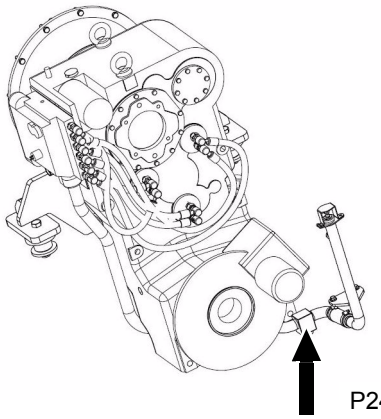
Installation of Torque Converter & Transmission System

Figure	Operation steps	Tool(s)
 P24T00039	1. Lift the transmission assembly from safety zone to place on the corresponding position of the rear frame through lifting eye of transmission assembly with the hoisting equipment and ropes.	Sling (2 tons)
 P24T00036	2. Clockwise rotate the engine fan wheel to make the mating bolts turning to the engine inspection window, and then install the engine flywheel on the torque converter-transmission assembly passing through the bolt linkage from engine fitting end with inner hexagon wrench, tightening torque of the bolt: 90±10 N.m.	6#Hexagon wrench
 P24T00037	3. Tighten bolts connecting the transmission assembly - torque converter housing with the engine housing with an air gun and socket: tightening torque: 72±6N.m.	16# socket, pneumatic impact wrench

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Figure	Operation steps	Tool(s)
 P24T00035	4. Tighten the bolt and the nut connecting transmission mounting support to rear frame with a blower gun, tightening torque: 415±35N.m.	46# wrench, 46# socket, pneumatic impact wrench
 P24T00034	5. Rear drive shaft shall be connected and installed on the torque converter & transmission assembly output flange, tightening torque of the bolt: 120±10N.m.	18# Wrench
 P24T00033	6. Install filler pipe on transmission - torque converter assembly by the bolt with the wrench, tightening torque of the bolt: 26±4N.m.	13# Wrench

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Figure	Operation steps	Tool(s)
 P24T00032	7. Screw the drain plug on the filler pipe assembly into the filler pipe assembly with the wrench and tighten it, tightening torque: 630±70N.m.	34# socket, 13# socket and pneumatic impact wrench
 P24T00032	8. Through oil filler of filler pipe assembly, 45L, SAE15W-40 Mobil Black Overlord 1300 engine oil is injected into the transmission - torque converter assembly, and check whether there is no oil leakage for filler pipe assembly of transmission & torque converter assembly system.	

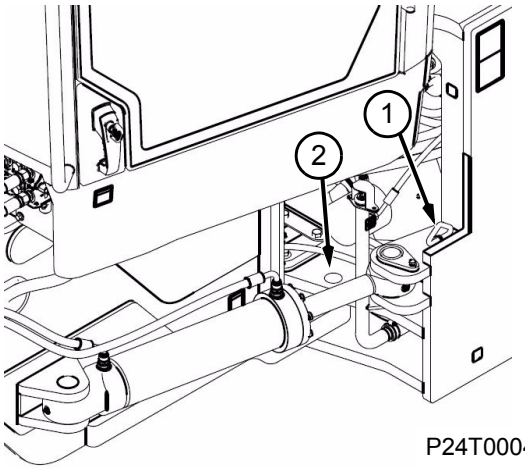
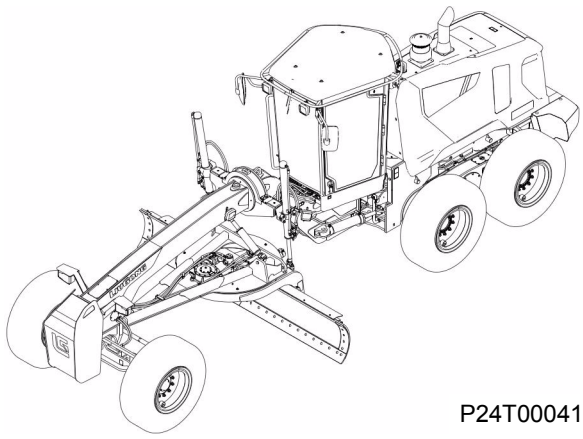
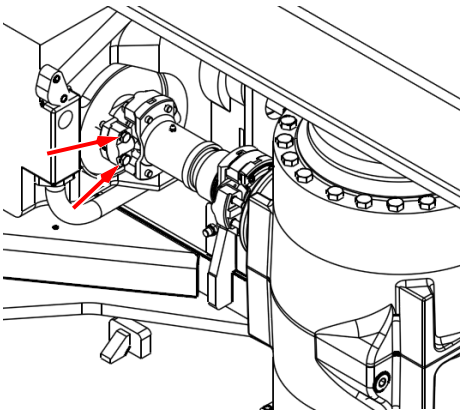
Disassembly and Assembly of Torque Converter & Transmission Assembly

For disassembly and assembly of torque converter & transmission assembly in CLG4180D grader, refer to "ZF transmission Overhaul Manual".

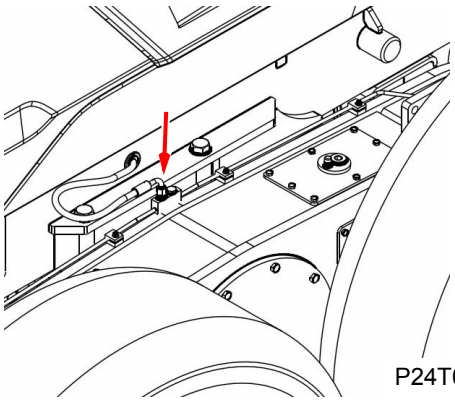
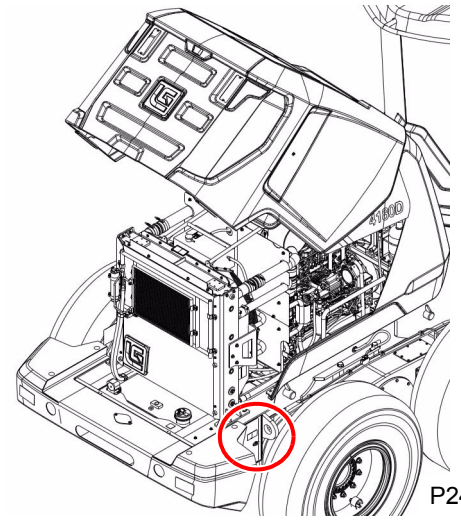
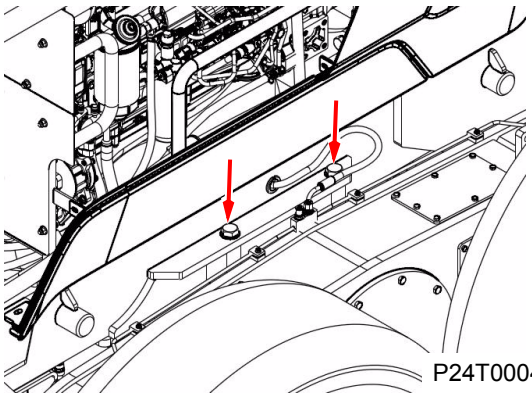
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Removal and Installation of Rear Axle Assembly

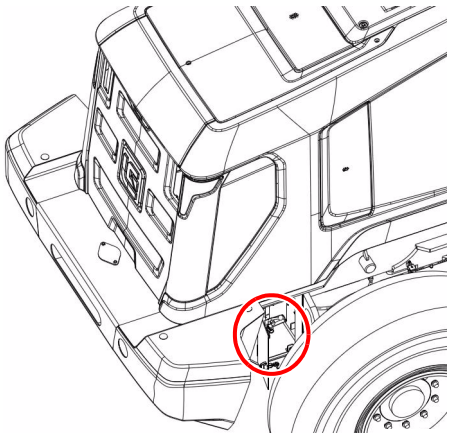
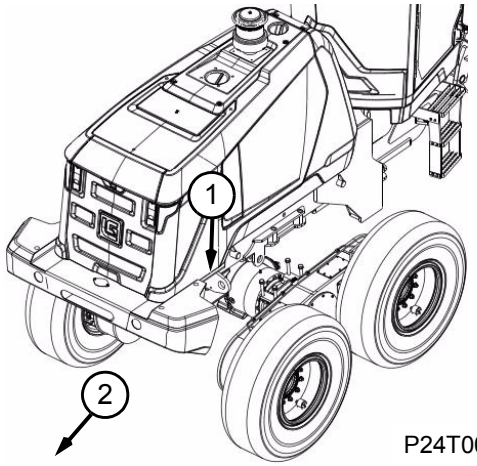
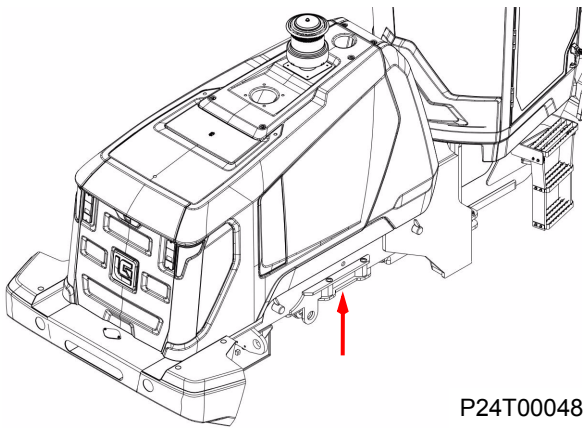
Removal of Rear Axle Assembly

Figure	Operation steps	Tool(s)
 P24T00040	1. Park the machine on the horizontal ground, adjust hitch steer cylinder to align front and rear frame, and from the bottom of the cab, take out the pin from position (1) and put it into the hole of the pin (2) (one respectively on the left and right), and then lock front and rear frame.	
 P24T00041	2. Place lower edge of the blade onto the ground and locate at the middle position. If the machine is equipped with ripper and blade, lift ripper and blade to the highest position above the ground. Pull up emergence parking brake button. 3. Cut off the engine, depress the service brake pedal for 15~20 times, so as to completely release brake system pressure.	
 P24T00042	4. Remove bolts of rear drive shaft and transmission to separate rear drive shaft and transmission.	18# Socket, fixed torque wrench

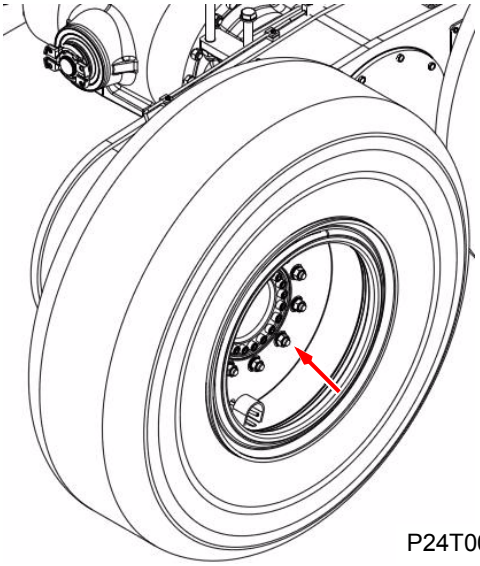
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Figure	Operation steps	Tool(s)
 P24T00043	5. Remove the hose assembly from the rear axle connecting to the service brake system. **⚠ Notice: The waste oil shall be recovered in a container during removal, in order to avoid environmental contamination. Shield the removed hose to prevent the parts from being contaminated.** **⚠ Danger: Make sure that the hose pressure is fully discharged and the oil is cooled sufficiently before removing the hose, so as to avoid personal injury caused by hose pressure and hot oil during removal.**	19# wrench, plug M16X1.5 (24° inside the taper, external thread)
 P24T00044	6. By hood lift system, open the hood to the largest position. Operation for details sees "Opening of Engine Hood".	
 P24T00045	7. Remove connecting bolt and nut from rear axle and rear frame.	36# open-end wrench, pneumatic impact wrench, 36# socket

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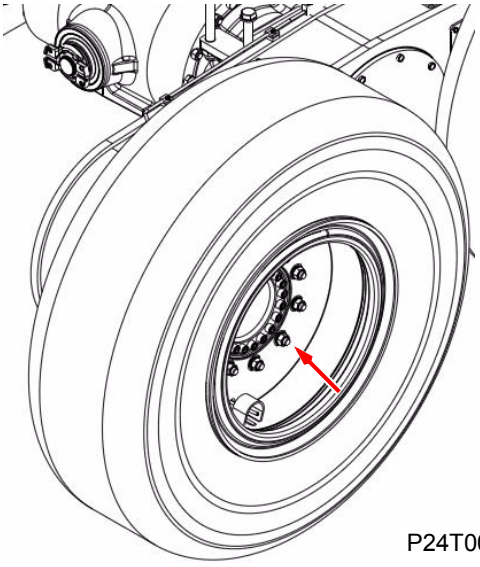
Figure	Operation steps	Tool(s)
 P24T00046	8. By hood lift system, put down the hood. Operation for details sees "Closing of Engine Hood".	
 P24T00047	9. Thread the lifting hole (1) (one respectively on the left and right) of rear frame with sling, and lock it. **⚠ Notice: The sling doesn't scratch the engine hood.** 10. Lift the complete machine slowly until the lowest point of rear counterweight (or ripper) is 100 mm higher than the tire and keep the machine in static state. 11. Push rear axle and tyre & rim system out along the direction (2), and lift it up to proper place with traveling crane to carry out follow-up removal and maintenance.	Sling (15 tons), traveling crane or hoisting equipment (greater than 15 tons)
 P24T00048	12. With rear frame, place equal-height supports (one respectively on the left and right), and slow down the machine to keep the complete machine at the height when rear axle is not removed.	

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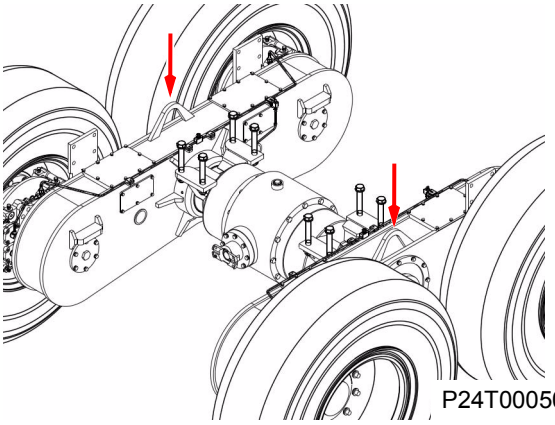
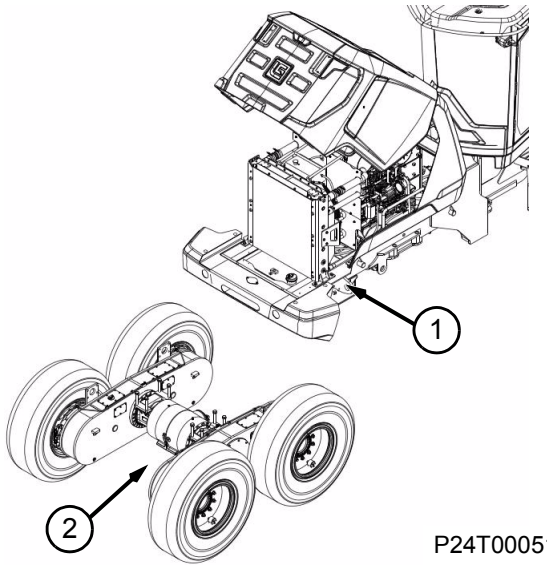
Figure	Operation steps	Tool(s)
 P24T00049	13. Hoist up removed rear axle and tyre & rim system to appliance for rear axle assembly and make tyres above the ground. 14. Pre-lift up the tires with a sling, and remove the mounting nuts of the tyre & rim system. 15. Hoist tyre & rim system away rear axle and place them in a safe zone. 16. Repeat steps for (14) and (15), and remove other three groups of tyre & rim system installed on rear axle. 17. Repair and maintenance for follow-up rear axle assembly, see "Drive Axle Service Manual of the grader".	Sling (5 tons), traveling crane (5 tons), 34# socket, pneumatic impact wrench

Note: If that faults appears in the "tandem" is judged, there is no need to remove rear axle assembly from complete machine, and directly carry out repair on the complete machine.

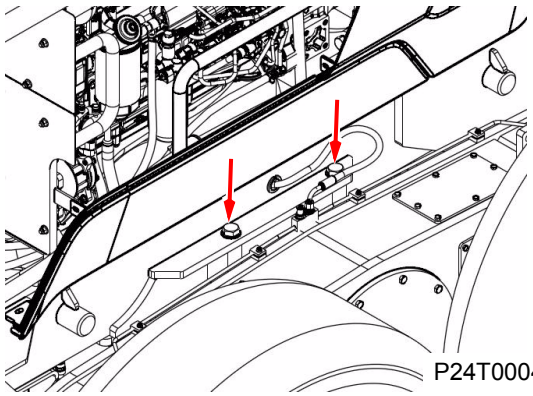
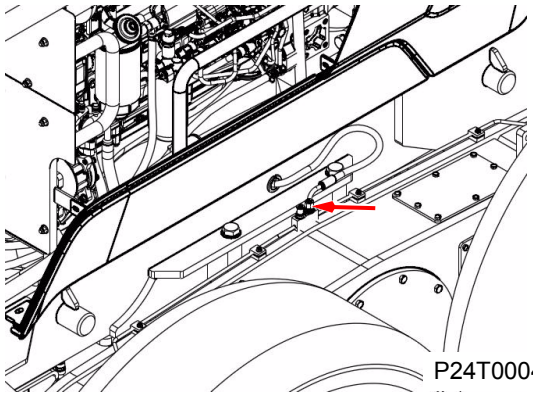
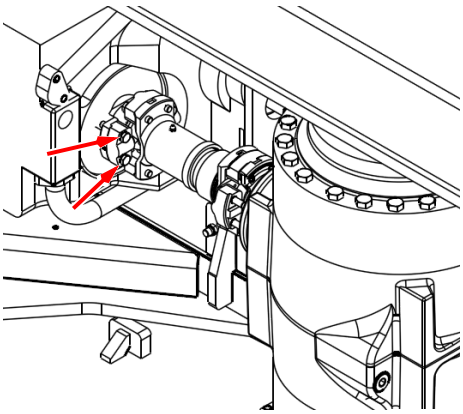
Installation of Rear Axle Assembly

Figure	Operation steps	Tool(s)
 P24T00049	1. Lift up the tire & rim system (4 groups) with lifting device and install it onto the axle, and then install the rim nut, the tightening torque is 800±80N.m.	Sling (2 tons) 34# socket, pneumatic impact wrench

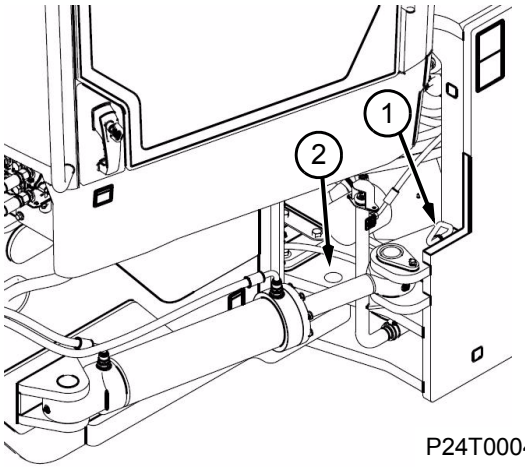
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Figure	Operation steps	Tool(s)
 P24T00050	2. Hoist up rear axle assembly and tyre & rim system which has been assembled with hoisting equipment to open space rear to align tyre and front tyre of the complete machine with one end of the drive shaft facing the direction for driving.	Sling (5 tons), traveling crane (5 tons)
 P24T00051	3. By hood lift system, open the hood to the largest position. Operation for details sees "Opening of Engine Hood". 4. Thread the lifting hole (1) (one respectively on the left and right) of rear frame with sling, and lock it. **⚠ Notice: The sling doesn't scratch the engine hood.** 5. Lift the complete machine slowly until the lowest point of rear counterweight (or ripper) is 100mm higher than the tire and keep the machine in static state. 6. Push rear axle and tyre & rim system into along the direction (2) to proper place. 7. Put down the complete machine slowly, during the process, notice align the mounting hole.	Sling(15 tons), traveling crane or hoisting equipment (greater than 15 tons)

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Figure	Operation steps	Tool(s)
 P24T00045	8. Install the mounting bolts, washers and nuts of rear axle assembly and tighten them with an blower gun, the tightening torque is 800±80N.m.	36# open-end wrench, pneumatic impact wrench, 36# socket
 P24T00045	9. Connect hose between the rear axle and service brake line.	19# Wrench
 P24T00042	10. Install bolts connecting drive shaft and transmission. Apply thread locker for bolts, tightening torque is 120±10N.m.	Socket 18#, fixed torque wrench and thread locker

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Figure	Operation steps	Tool(s)
 P24T00040	11. For the bottom of the cab, take out the pin from position (2), and put into the hole of the pin from position (1) (one respectively on the left and right), and remove the locking of front and rear frame. 12. Check whether there is the leakage for the brake lines. 13. For exhaust of service brake pipe, operation for details sees "Rear Assembly System Test".	

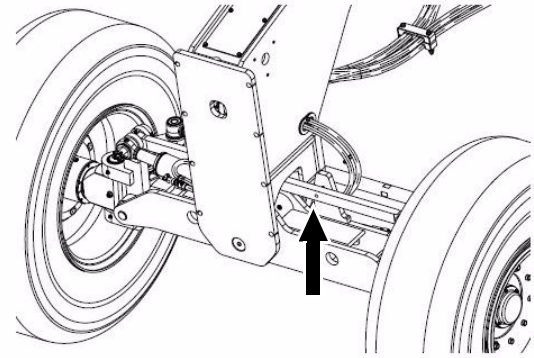
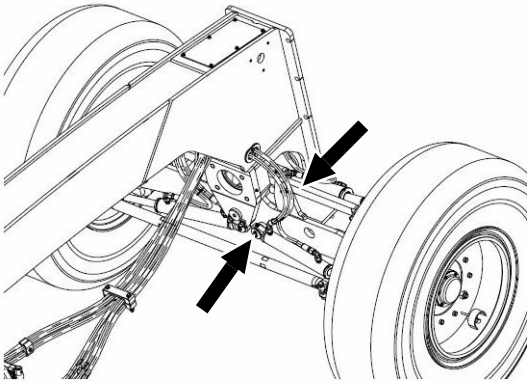
Disassembly and Assembly of the Drive Axle

For disassembly and assembly of the drive axle in this machine, see "Drive Axle Service Manual of the Grader" for details.

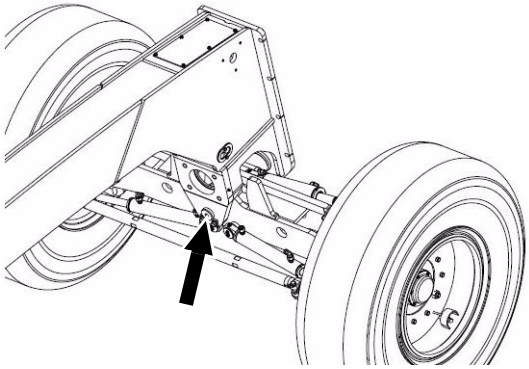
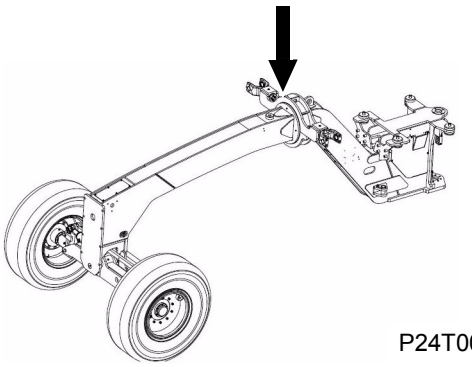
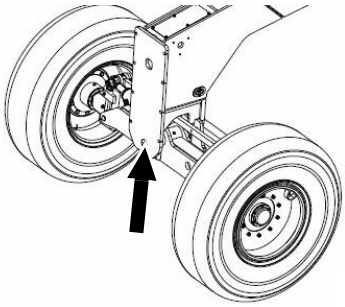
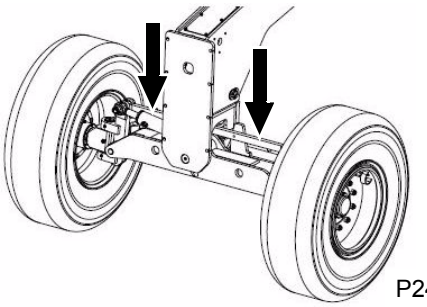
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Removal and Installation of Front Axle Assembly

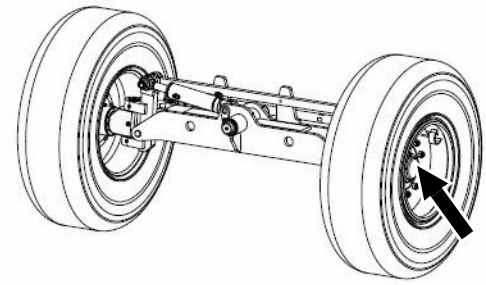
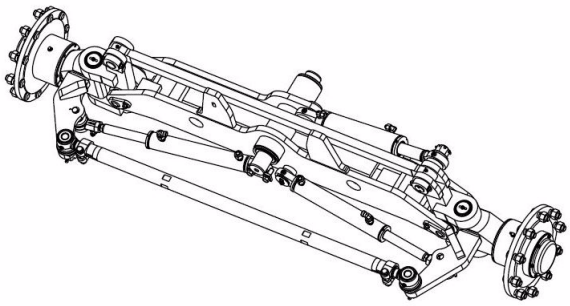
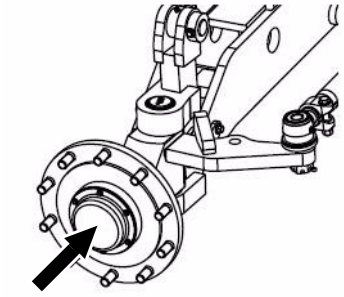
Removal of Front Axle Assembly

Figure	Operation steps	Tool(s)
 P24T00052	1. Stop the machine on a level ground, put the blade of the work implement on the ground, and pull up the emergency parking brake lever. 2. In the middle position of axle frame and tilt linkage, use bolts for M12 and the length being longer than 95, and tighten it with the nut M12 to prevent tilt knuckle from potential risk occurring during the process of removal.	18# Wrench
 P24T00053	3. Firstly, loose 2~3 circles for coupling nuts of the hose assembly from steering cylinder and tilt cylinder with the wrench to release the pressure inside the hose, otherwise, hydraulic oil will be erupted; and then completely loose and remove every hose assembly. **⚠ Notice: The waste oil shall be recovered in a container during removal, in order to avoid environmental contamination. Shield the removed hose assemblies to prevent the parts from being contaminated.**	28# Wrench

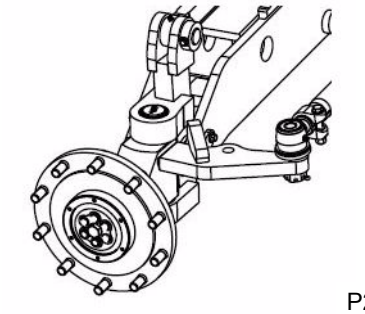
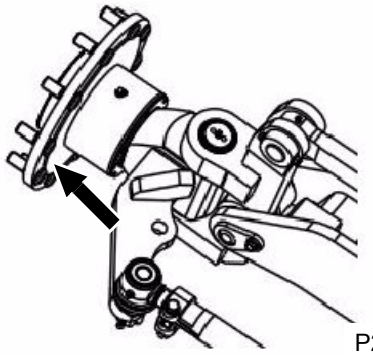
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Figure	Operation steps	Tool(s)
 P24T00054	4. Remove stop plate captive bolts on the front axle assembly and front frame coupling chain link with the wrench, and then remove the stop plate.	22# Wrench
 P24T00055	5. Hoist up the front frame with a wire rope to make the tires lifted off the ground.	Sling (greater than 10 tons)
 P24T00056	6. For the complete machine equipped with front counterweight or bulldozing blade, firstly remove the front counterweight or the blade, and then knock the iron bar with a hammer to knock out the pin that connecting with the front axle assembly and the front frame.	Iron bar, hammer
 P24T00057	7. Lift out front axle assembly from the mounting position of front frame with sling and move them to safe zone.	Sling (greater than 2 tons)

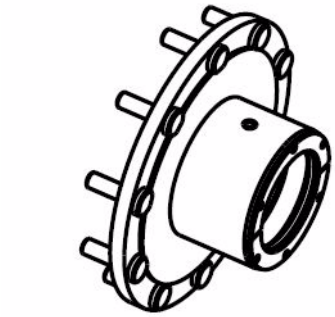
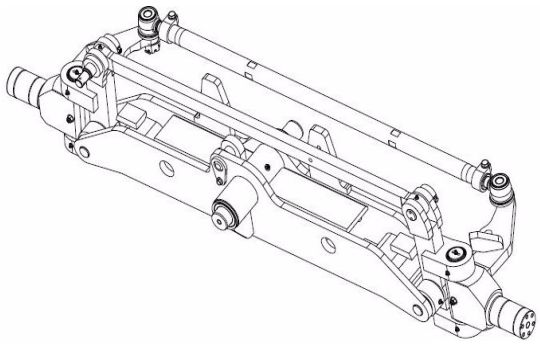
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Figure	Operation steps	Tool(s)
 P24T00058	8. Continue lifting up front axle assembly with sling and make tyres off the ground. 9. Loosen the top nut from one side of tyres, but do not screw them out; remove the other 9 fastening nuts on the tires; remove the fastening nuts on the other side by the above steps. 10. Remove the top nuts on the both sides of tyres from axle assembly to detach the tires from the front axle. **⚠ Notice: During detachment, nobody is allowed to stand within 1.5m from the tires; otherwise, there is potential safety hazard that the tires may hit people.**	Sling (greater than 2 tons), 33# socket, pneumatic impact wrench and 33# wrench
 P24T00059	11. Remove steering cylinder and tilt cylinder on the front axle assembly, and the steps for removal refers to ("Removal of Front Wheel Tilt Cylinder" Chapter).	
 P24T00060	12. Screw off fastening bolts of the end cover on the hub with the wrench, and then respectively remove end cover and seal ring.	10# Wrench

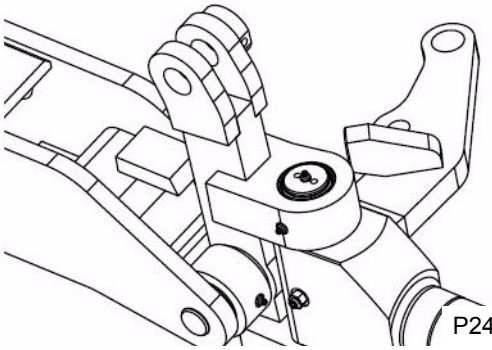
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Figure	Operation steps	Tool(s)
 P24T00061	13. Remove 3 lock plates with a straight screwdriver and a hammer. 14. Screw fastening bolts on the end cover with the wrench respectively. 15. Then respectively remove end cover and shim.	Straight screwdriver, hammer, 20# wrench and 30# wrench
 P24T00062	16. Remove the bolts from the hub and remove the retainer ring from the hub end-face by using a wrench, and then knock the circumference of the inner side of the hub uniformly with a copper bar (rotate and knock the hub simultaneously) till the hub is removed. ⚠ **Note: the port of oil seal lip is not allowed to be scratched or damaged during removal.**	Copper bar, hammer
 P24T00063	17. Remove the bearing cone from the wheel bearing with a puller and wrench. Specific steps: Adjust the puller, fix the screw rod of the puller in the threaded holes of the M20 bolts (arrange a washer on the threaded end of the puller to protect the threads from damage), fix the pulling end of the puller on the snap ring, and pull out the bearing cone and the snap ring by rotating the screw rod on the puller with a wrench.	Puller, wrench

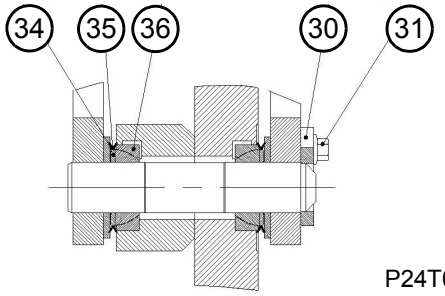
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Figure	Operation steps	Tool(s)
 P24T00064	18. Remove the skeleton oil seal with a screwdriver. ⚠ **Note: the port of oil seal lip is not allowed to be scratched or damaged during removal.**	Cross screwdriver
 P24T00065	19. Connect the edge of the copper bar with the bearing cup, knock the copper bar with the hammer (change the position of the copper bar at the symmetry point of the circumference of the bearing cup, till the bearing cup is completely detached from the hub cone.	Copper bar, hammer
 P24T00066	20. Respectively remove captive nuts of steering linkage and tilt linkage with the wrench; 21. Slowly knock ball joint shaft from both ends of steering linkage with the hammer to make steering linkage completely detached from steering arm; 22. Knock copper bar with the hammer, and the pin is detached from tilt knuckle by the copper bar knocking the pin, and remove the tilt linkage.	18#Wrench, 46#wrench, copper bar and hammer

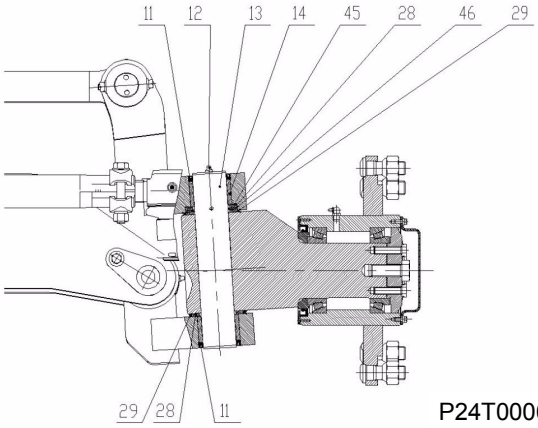
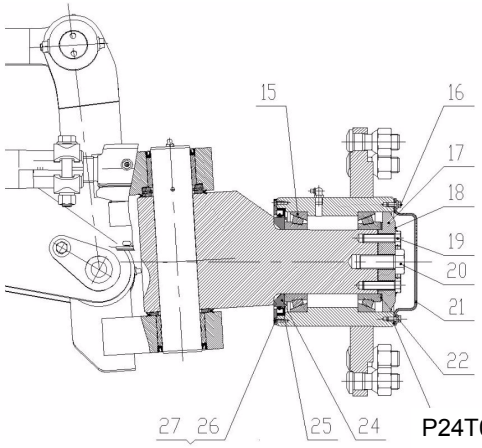
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Figure	Operation steps	Tool(s)
 P24T00067	23. Remove the bolts and screws on the steering knuckle with a wrench, and knock the copper bar with the hammer till the pin is completely detached from the steering knuckle and tilt knuckle; 24. Remove the nut of the pin lock-plate from the tilt knuckle with a wrench, and then knock the copper bar with a hammer till the pin is completely detached from the axle frame; 25. Check each shaft sleeve and inner surface of the oscillating bearing for scratches and abrasions.	18#Wrench, 46#wrench, copper bar and hammer

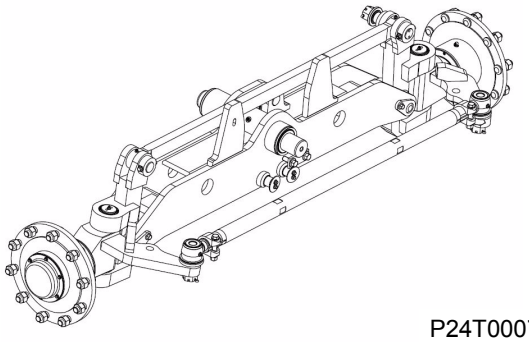
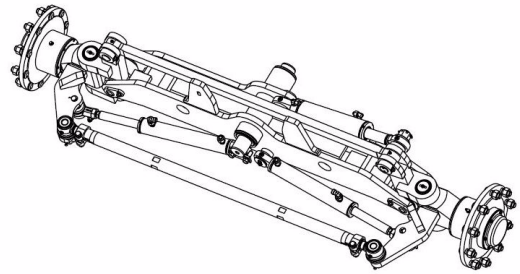
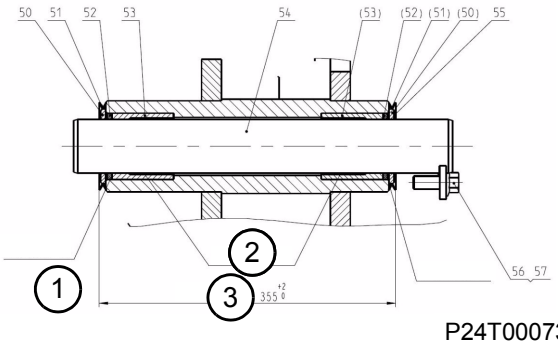
Installation of Front Axle Assembly

Figure	Operation steps	Tool(s)
 P24T00068	1. As shown in the left-side figure, install tilt knuckle coupling from left and right sides on the front axle respectively via pins, nuts, washers, angular contact knuckle bearing, pin shaft, V-seal ring and thrust shim; 2. When fastening nuts on the pin shaft are tightened with the wrench, pre-tightening torque of the angular contact knuckle bearing from both sides is 0.5~0.6N.m.	46# Wrench

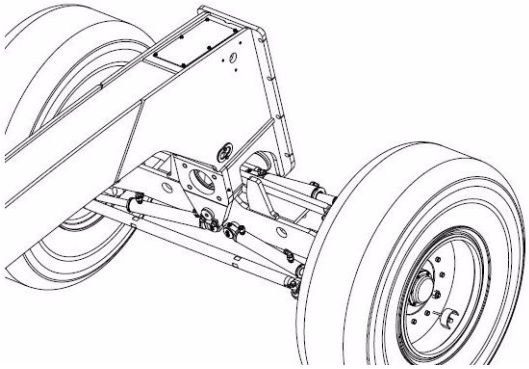
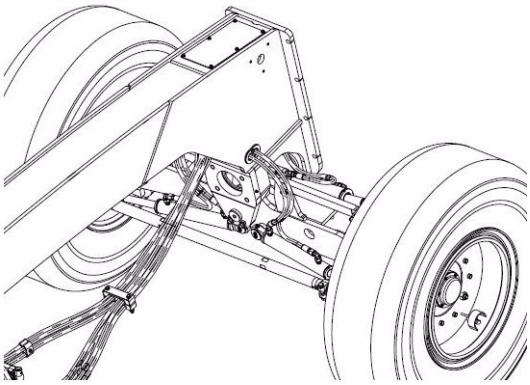
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Figure	Operation steps	Tool(s)
 P24T00069	3. As shown in the left-side figure, install steering knuckle from left and right sides on corresponding tilt knuckle respectively via steering pin, slide bearing, shim, thrust needle bearing, thrust washer, dust ring, screws and nuts. 4. After installation, max clearance of allowable shim is 0.2mm.	18#Wrench, hammer, copper bar
 P24T00070	5. As shown in the left-side figure, install the hub of front wheels on the steering knuckle respectively via tapered roller bearing, shim, end cover, lock plate, bolts, seal gasket, bushing, oil seal, snap ring and screw; 6. When assembled, under conditions of no oil seal being assembled and no grease being filled, allow that pre--tightening torque of tapered roller bearing is 7.5~9N.m; 7. When No.25 oil seal is assembled, the grease shall be applied on the lip; 8. Fill the grease into the cavity between two mounting bearing from the hub of front wheels until there is grease leakage at No.17 end cover; 9. Tightening torque of No.20 bolt: 600±50N.m, tightening torque of No.19 bolt: 90±12 N.m; 10. When No.23 seal gasket is assembled, the flange sealant shall be applied on both sides.	18#Wrench, 20#wrench, 32# wrench, hammer, copper bar

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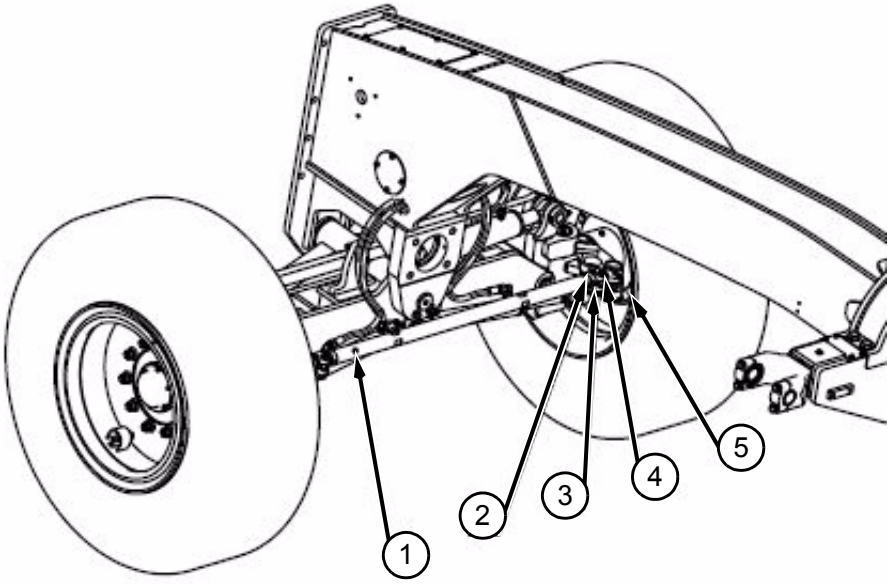
Figure	Operation steps	Tool(s)
 P24T00071	11. Respectively assembly and fix steering linkage and tilt linkage on the front axle assembly; 12. In the middle position of axle frame and tilt linkage, use bolts for M12 and the length being longer than 95, and tighten it with the nut M12.	18#Wrench, 46# wrench, hammer, copper bar
 P24T00059	13. Respectively assemble and fix steering cylinder and tilt cylinder via pin, bolts, nuts, etc on the front axle assembly.	18#Wrench, 46# wrench, hammer, copper bar
 P24T00073 1. Parts of opening for dust ring lips are outward 2. Oil port is inward, and vertically place straight oil tank 3. Frame opening dimensions	14. Lift up front axle assembly with the sling, and fix front axle assembly on the front frame via pin, steel sleeve, dust ring, thrust shim, adjusting shim, the baffle and bolt coupling; 15. After No.55 adjusting shim is installed, allow that the axial clearance between front axle assembly and front frame is 0.2~0.5mm; 16. Tightening torque of No.56 bolt: 225±35N.m.	18#Wrench, 46# wrench, hammer, copper bar

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Figure	Operation steps	Tool(s)
 P24T00054	17. Lift up the tyre with the sling to install it on the hub of front axle assembly, and tighten nuts with torque wrench, tightening torque of the nut is 500±30 N.m.	Sling (2 tons) 33# socket, pneumatic impact wrench, 33# wrench, torque wrench
 P24T00053	18. Respectively connect hydraulic lines with steering cylinder and tilt cylinder using a wrench, referring to the Hydraulic Schematic Diagram; 19. Loose the sling on the front frame to make tyres on the front axle assembly land down the ground steadily.	

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Adjustment of Front Axle Steering Linkage



P24T00031

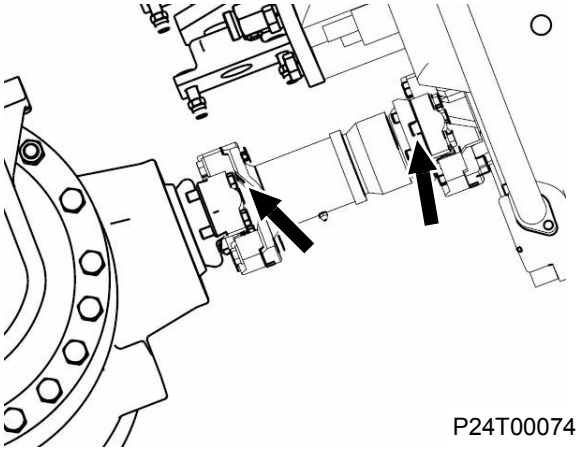
1. Tension bar
2. Snap ring
3. Nut
4. Bolt
5. Ball joint assembly

1. Start the machine, control actions of the steering cylinder and the tilt cylinder, swing the carrier and rotate the tires. The front axle assembly is placed horizontally. Measure the distance between installation points of the steering linkages on the right steering knuckle and the left steering knuckle from the front axle assembly with the tape or tape measure and keep a record;
2. Theoretical value for the distance between installation points of the steering linkages on the right steering knuckle and the left steering knuckle from the front axle assembly is 1524±5mm;
3. Toe-in requirements of the front axle assembly is 5~10mm;
4. Judge whether the measured distance between installation points of the steering linkages on the right steering knuckle and the left steering knuckle from the front axle assembly is within the range of the design theoretical value. If the measured value exceeds the design theoretical value, it is necessary to make adjustments;
5. Adjustment method of the steering linkage distance: Slightly unscrew the nuts (3) on the snap ring (2) at both ends of the linkage (1), seize the catching part on the linkage (1) with the wrench, and slowly rotate the linkage (1) forwards or backwards till the distance between installation points of the steering linkages on the right steering knuckle and the left steering knuckle from the front axle assembly reaches toe-in requirements; screw the nuts (3) and the bolts (4) on the snap ring (2).

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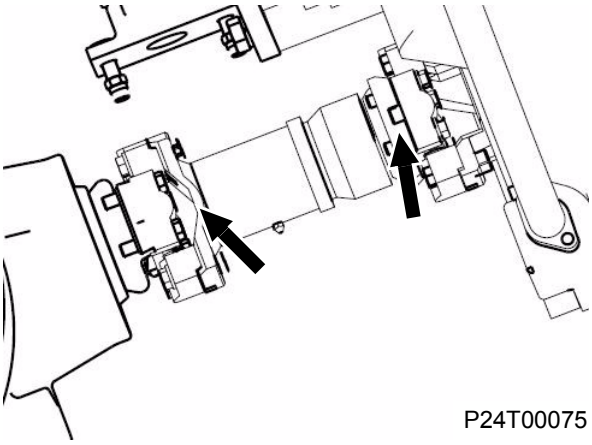
Removal and Installation of Drive Shaft System

Removal of Drive Shaft System

Figure	Operation steps	Tool(s)
	1. Park the grader on a level ground, turn off the engine, and place the transmission handle in neutral position, pull up the emergency parking brake handle.	
 P24T00074	2. Respectively remove bolts connected to torque converter & transmission assembly output flange and tandem input flange on the drive shaft system; 3. Place the drive shaft assembly to a safe area. **⚠ Notice: Drive shaft assembly is composed of slidable spline sleeve, spline shaft and so on; please take care to avoid personal injury caused by the parts of drive shaft sliding and falling off during removal.**	18# Wrench

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Installation of Drive Shaft System

Figure	Operation steps	Tool(s)
	1. Before drive shaft assembly is assembled, firstly, respectively wipe up the end faces of torque converter & transmission assembly output flange and tandem input flange and installation end face of drive shaft assembly on both sides.	Clean duster cloth
 P24T00075	2. Lift up drive shaft assembly, one side of end face and hole site respectively align the mounting end faces of torque converter & transmission assembly output flange and the mounting hole; 3. When coupling bolts from both ends of the drive shaft system are assembled, thread locker shall be applied on the thread, tightening torque of the bolt: 120±10 N.m; 4. The grease shall be filled up inside the spline. **⚠ Notice: During the assembly, two arrows marked on the drive shaft assembly in opposite direction shall be aligned.**	18# wrench or open-end 18# fixed torque spanner

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Fault Diagnosis and Troubleshooting Methods

Precautions for Fault Diagnosis

- Park the machine on the flat ground, check whether the locking pin, block and parking brake are fixed firmly.
- When two or more personnels operate the machine, follow the agreed signal strictly, and any unauthorized people are not allowed to get close to the machine.
- If the radiator cover is removed when the engine is still hot, the hot coolant may spray out which will cause scald. Therefore, start the fault diagnosis when the engine is cooled.
- Specially notice that do not touch any hot components or avoid being jammed by any rotating components.
- When disconnecting the wire, be sure to disconnect the negative pole (—) of the battery firstly.
- Be sure to release the inner pressure first when removing the plug or cover where the oil pressure, water pressure or air pressure may exist. When installing the measuring device, make sure that it is connected correctly.

Common Faults and Troubleshooting

Some common faults (abnormal phenomena) and corresponding easy troubleshooting for WG-series of transmissions are as follows. Some faults are troubleshooted by uses by oneself; if faults of the transmission refer to repair or overhauling, please ask for specialized persons or under the guidance of them, carry out the troubleshooting. If faults or abnormal phenomena not involved in the list or not analyzed in the list are come across, specialized persons shall be asked for to carry out analysis on site and ensure corresponding measures.

No.	Fault features	Main reasons	Fault inspection and troubleshooting
1	The machine can not be started	1. The pressure is over low. 2. No pressure of speed change or low pressure. 3. Brake system is locked.	1. Check gas path and recover normal pressure. 2. Replace oil seal or shift control valve. 3. Repair the brake system.
2	The engine can not be started	1. Start circuit of the base machine (such as power voltage, electric lock, start relay and start motor) has faults. 2. The lever is not at the neutral position. 3. The fuse to the control circuit on the base machine is burnt. 4. Poor contact of handle plug or the handle is failed. 5. Poor contact of controller plug or the controller is failed.	1. Check the circuit of the base machine. 2. Shift the lever to neutral position. 3. Replace the fuse. 4. Organize the plugs. 5. Organize the plugs.

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No.	Fault features	Main reasons	Fault inspection and troubleshooting
3	The engine runs normally, but doesn't drive	1. The gear is not engaged. 2. Oil level in the transmission is too low. 3. Oil pump is damaged or the leakage causes insufficient oil supply.	1. Check circuit of shift selector and the accuracy of gear shifts. 2. Fill new oil according to requirements. 3. Replace new parts and check sealing surface and oil seal.
4	The machine is powerless, and driving force is insufficient	1. Oil quantity of the transmission is insufficient; and the pressure of oil inlet for the torque converter is low. 2. Main pressure is too low. Gear shift pressure is low. 3. The filter of the engine is blocked. 4. Output power of engine is insufficient. 5. Clutch slipping. 6. Turbine group of the torque converter is damaged. 7. There is air leakage for oil inlet pipe of the variable-speed pump. 8. Transmission oil filter is blocked. 9. The abrasion of friction plate group is too high. 10. The oil leakage volume of the torque converter is too high.	1. Check the oil level of the transmission; replace or clean filter or primary strainer; check whether pressure control valve of the control valve and control pressure valve is normal. 2. Check the pressure of the transmission system, and the normal value is 1.6~1.8MPa. Replace oil seal or shift control valve. 3. Replace filter of the engine. 4. Check the engine and replace the engine or replace the power. 5. Check oil pressure for clutches and oil seal of the piston; check whether there is no overload. 6. Replace turbine group of the torque converter. 7. Replace the seal or oil inlet pipe. 8. Replace transmission oil filter. 9. Replace the friction plate group. 10. Replace the oil seal.
5	Control pressure (main pressure) is low, unstable or the meter is tripped	1. The valve element of the control valve is out of nimbleness. 2. The suction empty for the oil pump. 3. Oil pump is invalid. 4. There is serious oil leakage for oil seal of the clutch piston.	1. Clean or replace the control valve. 2. Check there is blocking phenomenon for oil level, oil passage and strainer; after reasons are confirmed, make corresponding processing methods. 3. Replace it with a new one. 4. Replace the oil seal.
6	The shift pressure of all gears are low	1. Oil pressure gauge is failed. 2. Insufficient tightening torque for bolt of shift control valve. 3. Spring of main pressure valve is broken. 4. Variable-speed pump is worn. 5. There is air leakage for oil inlet pipe of the variable-speed pump. 6. Fragments enter into shift control valve or the valve is stuck. 7. Shift control valve is damaged. 8. Transmission oil filter is blocked. 9. Insufficient oil mass in the transmission.	1. Replace the oil pressure gauge. 2. Tightening torque for M8-8.8 bolt of shift control valve is 26 N.m. 3. Replace spring of main pressure valve. 4. Replace the variable-speed pump. 5. Replace the seal or oil inlet pipe. 6. Replace the filter, and clean the control valve. 7. Replace shift control valve. 8. Replace transmission oil filter. 9. Oil is filled to the stipulated oil volume.
7	Too short shifting time at all gears	1. O-ring in throttle plug is damaged. 2. The tightening torque of pressure control valve bolts is out of specified range.	1. Replace O-ring. 2. Tightening torque for M8-8.8 bolt of shift control valve is 26 N.m.

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No.	Fault features	Main reasons	Fault inspection and troubleshooting
8	Too long shifting time at all gears	1. Throttle plug is blocked. 2. Pressure control valve is stuck.	1. Clean and dredge. 2. Wash and check.
9	Only some gear	1. The gear of the clutch is sintered. 2. Oil seals from other gears are damaged. 3. The tooth forms of the friction plates from other gears are shaved.	1. Check the clutch and replace friction plate group. 2. Replace the oil seal. 3. Replace the friction plate group.
10	Gear shift pressure for some gear is low	1. Piston seal of this gear is damaged 2. Oil seal in the oil passage of the gear is damaged. 3. Some part is damaged or there is oil leakage for the oil passage of the gear.	1. Replace the oil seal for the piston of the gear. 2. Replace oil seal in the oil passage of the gear. 3. Replace the part.
11	Vehicle does not move at any gear	1. Insufficient oil level. 2. Elastic plate connecting engine and torque converter is torn, or power connection from torque converter to transmission input gear has faults. 3. The complete machine circuit is faulty. 4. Shift pressure is too low. 5. Solenoid valve is damaged. 6. Shift lever is damaged. 7. Controller is damaged.	1. Check oil level and fill the oil by following the correct operation. 2. Replace the elastic plate or replace the related damaged parts. 3. Check whether the power voltage is normal and whether the cable is damaged. 4. Refer to the troubleshooting above. 5. Check if the rated current of solenoid valve is 830 mA. 6. Refer to the troubleshooting for lever. Replacement. 7. Refer to the troubleshooting method of controller. Replacement.
12	Shift selector doesn’t work, there is incorrect gear shifts, trip stop or losing gears.	1. The fuse of the selector is in poor connection. 2. The sockets for cables is in poor connection. 3. Internal faults of the shift selector. 4. Electrical system faults of the vehicle or unstable voltage. 5. The valve element in the control valve is out of nimbleness.	1. Check and replace the fuse. 2. Check connection conditions for sockets. 3. Repair or replace the shift selector. 4. Check electrical system of the vehicle, and measure the voltage (theoretical value is 24 V). 5. Clean or replace the control valve.

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No.	Fault features	Main reasons	Fault inspection and troubleshooting
13	The oil temperature of the torque converter is high	1. Oil temperature sensor is failed. 2. Oil temperature gauge is failed. 3. Oil level is too high or too low. 4. Air found in torque converter oil radiator. 5. Oil line from torque converter to radiator is blocked. Radiator is dirty. 6. Poor cooling capability of radiator. 7. Counterbalance valve of torque converter stuck. 8. Oil quality is incorrect or ageing. 9. Transmission oil pressure is too low, and the clutch slips for a long time.	1. Replace the part. 2. Replace the part. 3. Check oil level following the correct method. 4. Exhaust. 5. Check oil pipe from radiator to transmission and radiator for blockage. Clean the radiator. 6. Check whether cooling capability is sufficient, such as checking the degree of tightness for engine fan belt and dirt attached to outer surface of radiator. 7. Check the hose joint from transmission to radiator. If the hose joint sticks into the box too deep and against the counterbalance valve spool, the valve will be stuck and cause the oil line blocked. 8. Replace designated trade mark for the oil. 9. Replace oil seal or shift control valve or the clutch.
14	Numbers of transmission oil appears inside the flywheel housing	1. Oil seal is damaged between stator support and gear.	1. Replace the oil seal.
15	The oil level of the transmission rises up abnormally	1. Seal ring from power take-off port of the external oil pump (working pump, steering pump,etc) is damaged.	1. Replace seal ring from power take-off port of the external oil pump (working pump, steering pump,etc).

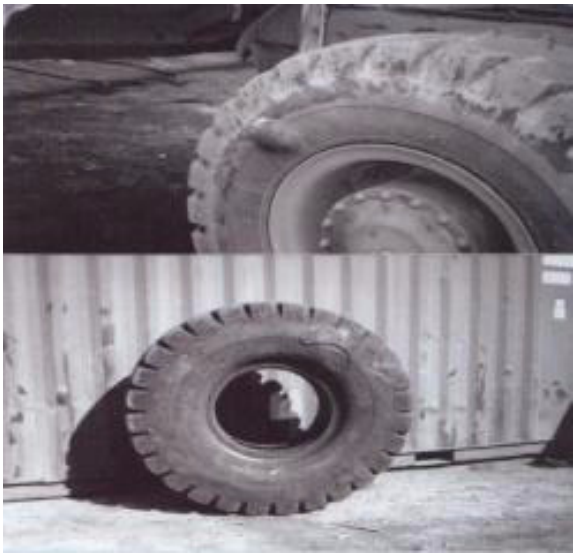
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Common Failure Modes of Tire and Reasons

Common failure modes and reasons of tire are as follows:

Failure mode	Typical pictures	Main reasons
Delaminating of tire crown	 P28T00060	1. Manufacture: there is impurities, oil stains or water in the tread rubber or cord ply or not firmly compressed when being molded, or gasoline does not fully volatilize. 2. Usage: speed is too fast (beyond specified speed), and directive pattern is traveling in reverse direction.
Shoulder delamination blasting	 P28T00061	1. Manufacture: there is impurities, oil stains or water in sidewall rubber or cord ply or not firmly compressed, or gasoline does not fully volatilize. 2. Traveling with insufficient air will intensify wear of tire shoulders and cause excessive heat, which will separate sidewall rubber from cord ply and cause an explosion when problem gets worse.

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Failure mode	Typical pictures	Main reasons
Delaminating of tire side wall	 P28T00062	1. Manufacture: there is impurities, oil stains or water in sidewall rubber or cord ply or not firmly compressed when being molded or gasoline does not fully volatilize. 2. Traveling on uneven road with insufficient air or overload or operating in severe working conditions will cause tire body to deform badly and cause excessive heat in partial sidewall so that sidewall peels off or explodes.
Double skin	 P28T00063	Major reasons: mixing of extruded tread compound is uneven, surfaces of semi-finished product have impurities, vulcanization mold has oil stains, and isolating agent is unevenly applied.

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Failure mode	Typical pictures	Main reasons
Wearing of tire crown	 P28T00064	Major reasons: traveling with too high pressure will cause earthed area reduction of tire crown, local load increase and wear intensify.
Trauma	 P28T00065	Major reasons: during traveling, outer tube is scratched by pointed objects or is stabbed evenly by pointed objects.
Side trauma	 P28T00066	Major causes: the vehicle speeds up when steering, the tire side wall rubs the roadside obstacles; and installed tire is stuck with hard objects; the machine is damaged during transportation or installation.

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Hydraulic System

General Information 4-5

Safety Precautions for Hydraulic System 4-5
Overview of Hydraulic System 4-8
Technical Parameters of Hydraulic System 4-11
Schematic Diagram of Hydraulic System 4-13
Universal Tools and Tooling for Hydraulic Maintenance 4-14
Special Tools and Tooling for Hydraulic Maintenance 4-14
Hydraulic Oil 4-18

Structure and Function 4-20

Work Hydraulic System 4-20
- Hydraulic Oil Tank 4-22
- Working Pump 4-24
- Left Multi-way Valve 4-26
- Right Multi-way Valve 4-28
- Swing Motor 4-31
- Swivel Joint 4-34
- Lift blade Lift Cylinder 4-36
- Left Blade Lift Cylinder Balanced Valve 4-38
- Right Blade Lift Cylinder 4-40
- Right Blade Lift Cylinder Balanced Valve 4-40
- Circle Sideshift Cylinder 4-42
- Circle Sideshift Cylinder Hydraulic Lock 4-43
- Front Wheel Tilt Cylinder 4-45
- Front Wheel Tilt Cylinder Hydraulic Lock 4-46
- Hitch Steer Cylinder 4-47
- Hitch Steer Cylinder Balanced Valve 4-49
- Blade Pitch Cylinder 4-51
- Blade Pitch Cylinder Balanced Valve 4-52
- Blade Lead-out Cylinder 4-53

Steering Hydraulic System 4-54
- Gear Pump 4-55
- Metering Pump 4-55

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Priority Valve 4-59
Steering Cylinder 4-60
Brake System 4-61
Gear Pump 4-63
Brake Valve 4-63
Charge Valve 4-64
Accumulator 4-65
Emergency & Parking Brake System 4-65
Maintenance of Brake System 4-66
Latch Hydraulic System 4-68
Latch Cylinder 4-69
Solenoid Directional Valve 4-71

Test and Adjustment 4-72

Steering Hydraulic System Test 4-72
Brake System Test 4-73

Removal and Installation 4-75

Work Hydraulic System 4-75
Removal and Installation of Hydraulic Oil Tank Assembly 4-75
Removal and Installation of Working Pump Assembly 4-83
Removal and Installation of Left Multiple-way Valve 4-88
Removal and Installation of Right Multiple-way Valve 4-90
Removal and Installation of Swing Motor 4-90
Removal and Installation of Swivel Joint Assembly 4-91
Removal and Installation of Left Blade Lift Cylinder 4-93
Removal and Installation of Left Blade Lift Cylinder Balanced Valve 4-97
Removal of Right Blade Lift Cylinder 4-98
Removal of Right Blade Lift Cylinder Balanced Valve 4-98
Removal and Installation of Circle Sideshift Cylinder 4-98
Removal and Installation of Circle Sideshift Cylinder Hydraulic Lock 4-101
Removal and Installation of Front Wheel Tilt Cylinder 4-103
Removal and Installation of Front Wheel Tilt Cylinder Hydraulic Lock 4-105
Removal and Installation of Hitch Steering Cylinder 4-107
Removal and Installation of Hitch Steering Cylinder Balanced Valve 4-110
Removal and Installation of Blade Pitch Cylinder 4-111
Removal and Installation of Blade Pitch Cylinder Balanced Valve 4-113

https://truckmanualshub.com/

Removal of Blade Lead-out Cylinder 4-114
Steering Hydraulic System 4-115
Removal of Quantitative Gear Pump Assembly 4-115
Removal, Disassembly and Assembly of Metering Pump 4-115
Removal, Disassembly and Assembly of Priority Valve 4-129
Brake System 4-139
Disassembly and Assembly of Brake Valve 4-139
Disassembly and Assembly of Charge Valve 4-144
Disassembly and Assembly of Accumulator 4-149
Latch Hydraulic System 4-153
Disassembly and Assembly of Latch Cylinder 4-153
Disassembly and Assembly of Solenoid Directional Valve 4-156

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General Information

Safety Precautions for Hydraulic System

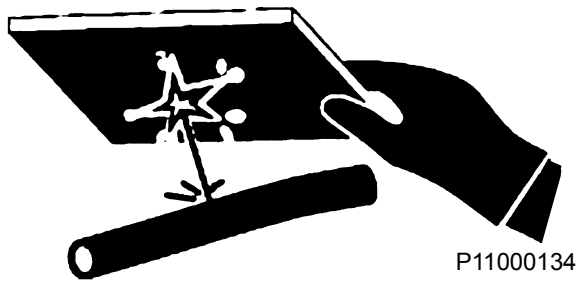
Compressed air

Compressed air may cause personal injury. When using the compressed air for cleaning, wear the mask, protection suits and shoes. Do not point the compressed air at yourself or anyone. The compressed air may penetrate the skin and lead to severe injury or even death. The maximum pressure of the compressed air for cleaning should be lower than 0.2 Mpa.

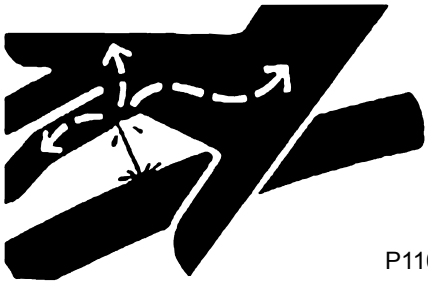
High pressure solution

Warning:

- Prevent from being scalded by high-pressure oil. When overhauling or replacing the pipes of hydraulic system, check whether the pressure of system has been released. Hydraulic oil under pressure spattering on skin will cause serious harm to the skin.
- Be careful to remove the hydraulic pipelines or joints. When the oil spouts, the released high pressure oil may lead to the continuous movement of the hoses.
- Please wear safety goggles and leather gloves when checking for leakages. Do not use bare hands to check the leakage, but use plate or paper plate to check the leakage.



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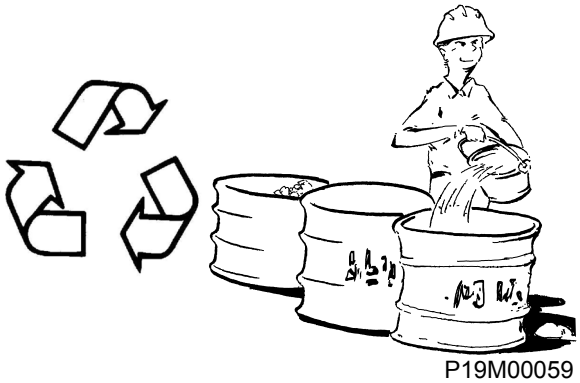


P11000204

- Even if the pressured liquid is leaked as small as a pin hole, it may also penetrate the muscles and cause personal injury. If shot by the spouted high pressure oil, please contact a doctor and take a treatment immediately.

Safe disposal of waste liquid

- Inappropriate disposal of waste liquid will endanger environment and ecology. Please observe local laws and regulations when disposing the waste liquid.
- It is necessary to contain and place the liquid spattering during the inspection, maintenance, test, adjustment and repair of machine with vessel. Proper containers shall be prepared well before opening any fluid cavity or disassembling the parts containing liquid. Use proper container when draining liquid.
- Do not use the food or drink containers because they may be drunk by others by mistake.

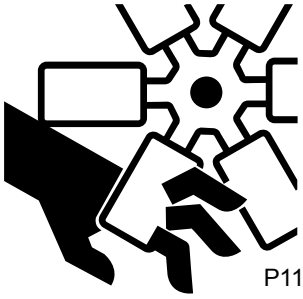


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Precautions for accumulator application

- The accumulator with the high-pressure nitrogen is the dangerous article, therefore, read the following requirements and properly use the accumulator.
- The accumulator shall be checked before charge of nitrogen. It is prohibited to charge the accumulator with gas if the accumulator does not have a nameplate, or the words on the nameplate are missed so that its type can not be identified, or if the steel seal marks are incomplete or cannot be read clearly, or if there are defects on the housing and therefore safe use cannot be ensured.
- The accumulator can only be charged with nitrogen, and it is prohibited to charge with oxygen, compressed air or other inflammable gas to avoid explosion.
- Slowly charge the nitrogen into the accumulator so as to avoid the breakage of the rubber bag.



P11000190

- The air valve of the accumulator should be installed upward vertically. The accumulator shall be stably fixed on the bracket without being welded.
- Do not drill any hole on the accumulator or carry open fire or heat sources close to the accumulator.
- Do not conduct any welding operation on the accumulator.
- Since the accumulator is a high-pressure container, it shall be replaced and repaired by professional operators.
- Release the air before discarding the accumulator.

Keep off extruding or cutting off

- Do not have your hands, arms or any other limbs placed between movable components. For example, between work implement and cylinder, between machine and work implement.
- Support the equipment properly when working under the work implement. Do not support the work implement depending on hydraulic cylinder. If control mechanism moves or hydraulic oil line leaks, work implement will drop. If it is necessary to remove the shield during the maintenance, then install the shield after the maintenance.
- Unless otherwise stated, any adjustment is not permitted to be performed when machine or engine is running. If the maintenance procedure must be performed when machine is running, do not let the machine stay in an unattended status. Arrange one person to seat in the operator seat and to prepare to shut down the engine at any time.
- Do not use twisted or worn wire rope. Wear gloves during operation and moving.
- When forcing to extrude the block pin, make sure there is no one around. Wear safety goggles in order to protect your eyes.

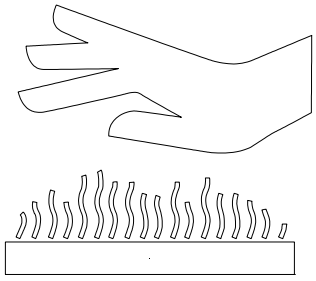
  When knocking objects with hammer, please make sure the flying debris will not hurt any person.

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Oil

Hot oil and parts will cause injury to person, and do not let the hot oil and components contact your skin.

- Under working temperature, the hydraulic oil tank is hot and contains pressure. When opening oil filler cap of hydraulic oil tank, shut off the engine and cool the filler cap down until it can be opened by bare hands. Remove the tank cover slowly to release the pressure of hydraulic oil tank so as to prevent from being scalded by hot oil.



P11000148

- Release pressure of the system before disassembling all pipes, joints, or relevant parts.

Pipeline, pipe and hose

- Do not warp or knock the high-pressure pipeline, and do not install the abnormally warped or broken pipes or hoses onto the machine.
- Repair the loose or damaged pipelines of fuel and lubricant and pipes and hoses of hydraulic system in time. Leakage will cause fire hazard, and if repair or replacement is necessary, please contact the authorized dealer by LiuGong Machinery Co., Ltd.
- If following problems occur, replacement should be necessary.

  Damage or leakage of joint.
  The outer layer of hose is worn or cracked, and reinforced steel wires are exposed.
  Partial bulge of hose.
  The hose is twisted or flattened.
  The hose reinforcement steel has embedded to the outer layer.
  Misplacement of the end joints.

Make sure all clamps, guards and heat shields are installed correctly to avoid shaking or overheating by friction with other parts.

Otherwise, it will generate toxic gas resulting in poisoning.

Precautions for accessories

It should be installed and commissioned by qualified personnel; the operator should be trained, and his/her operation and maintenance shall be performed strictly according to the operation instructions for accessories.

When installing and using the spare accessories, please read related instructions, manuals and informations about the accessories.

Incorrect installation or purchase of accessories will not only cause safety issues, but also have the negative effect on service life and operation of the machine.

Do not use the accessories unauthorized by LiuGong. Using unauthorized accessories will cause safety issues, do harm on the normal operation of machine and influence its service life.

It is forbidden to make any refit on the accessories without permissions; otherwise you shall bear the responsibility.

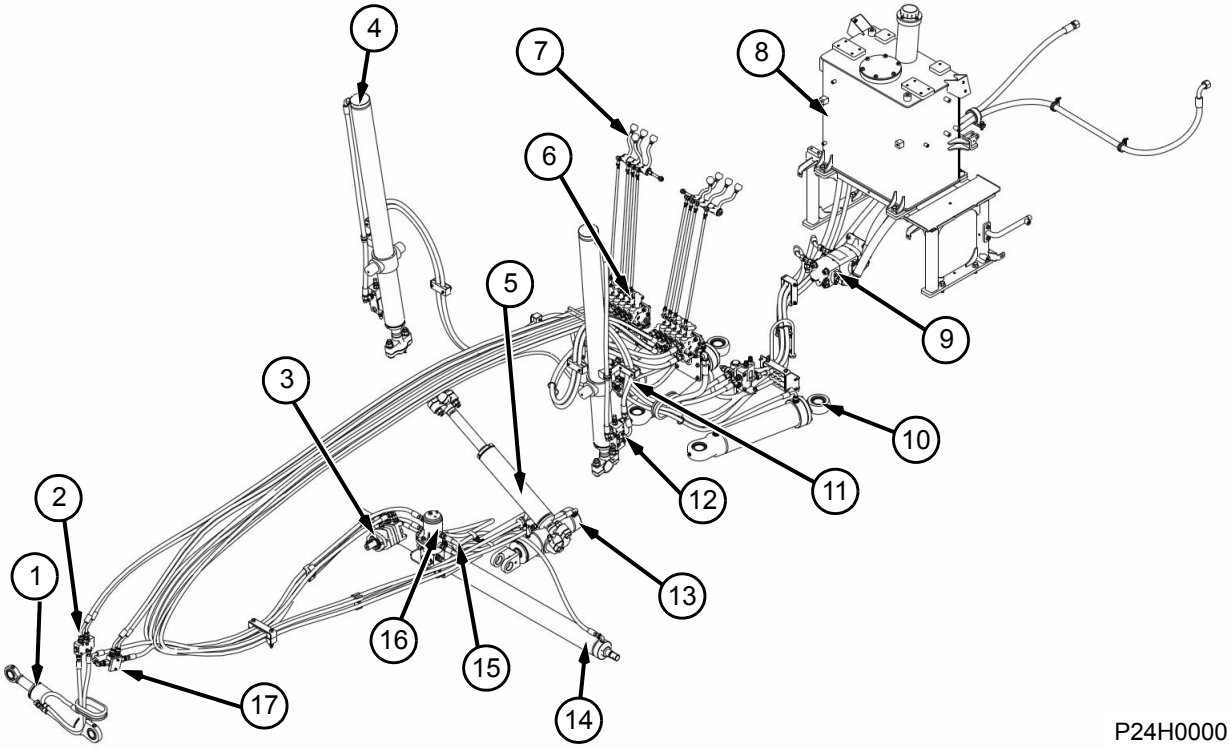
LiuGong Machinery Co., Ltd will not be responsible for the injury, accident and damage of machine due to using unauthorized accessories.

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Overview of Hydraulic System

The hydraulic system is the actuator of the grader and mainly composed of four functional modules, i.e. work implement hydraulic system, steering hydraulic system, brake system and latch hydraulic system. Among them, steering hydraulic system gives priority to oil supply to the steering circuit through the priority valve to ensure the steering function; brake system gives priority to oil supply to the brake circuit and the accumulator through the charge valve to ensure functions of service brake and parking brake; work implement hydraulic system controls the coordinated actions of various cylinders and motors through the control valve to meet the need of grader for adapting to different operating conditions; the latch hydraulic system mainly implements functions of Track frame and work implement positioning. Layout of CLG4180D-T3 hydraulic system is as follows:

CLG4180D-T3 Work hydraulic system

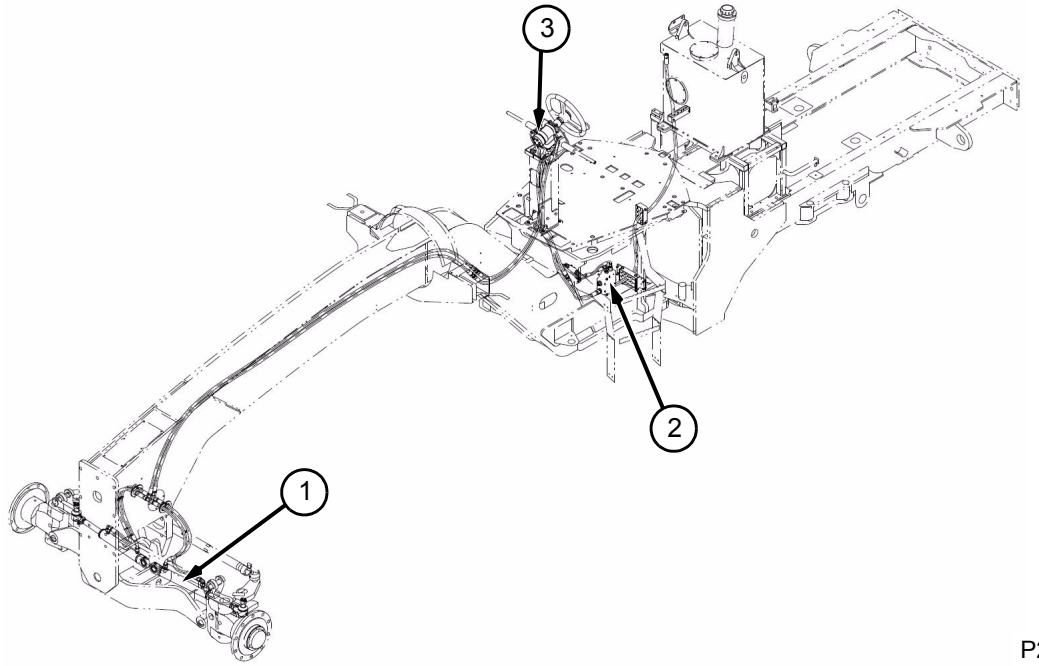


P24H00001

1. Front wheel tilt cylinder
2. Tilt hydraulic lock
3. Swing motor
4. Blade lift cylinder
5. Circle sideshift cylinder
6. Multi-way valve
7. Control lever as
8. Hydraulic oil tank
9. Tandem working pump
10. Hitch steer cylinder
11. Hitch steer balanced valve
12. Blade lift balanced valve
13. Blade pitch cylinder
14. Blade sideshift cylinder
15. Blade pitch balanced valve
16. Swivel joint
17. Circle sideshift hydraulic lock

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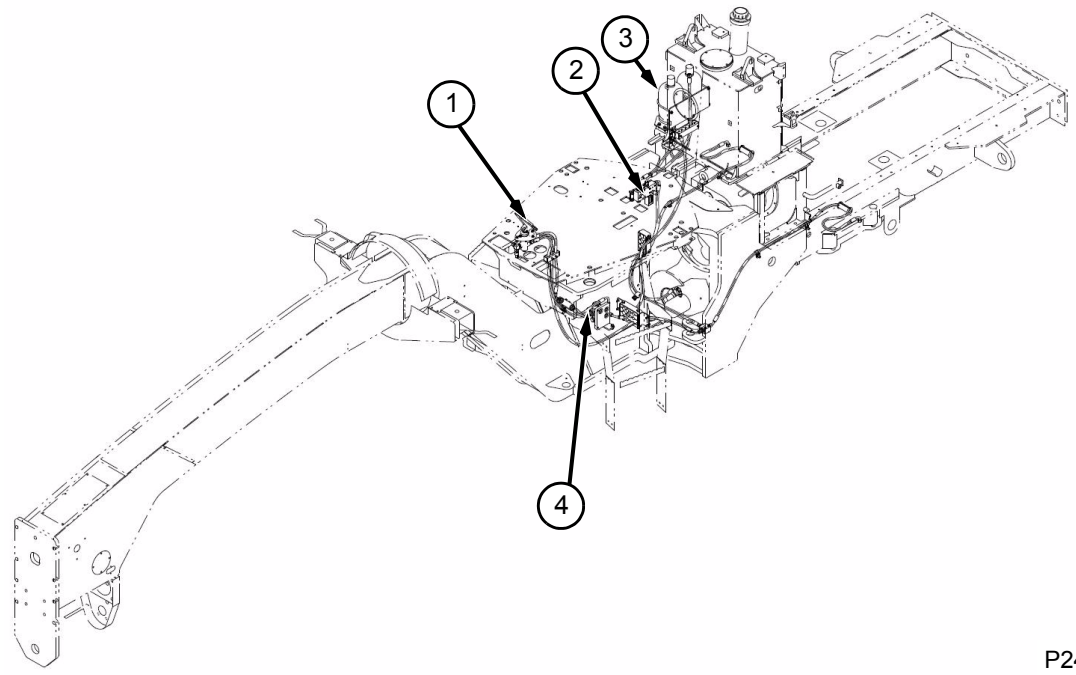
CLG4180D-T3 Steering hydraulic system



P24H00002

1. Front wheel steering cylinder
2. Priority valve
3. Metering pump

CLG4180D-T3 Brake system

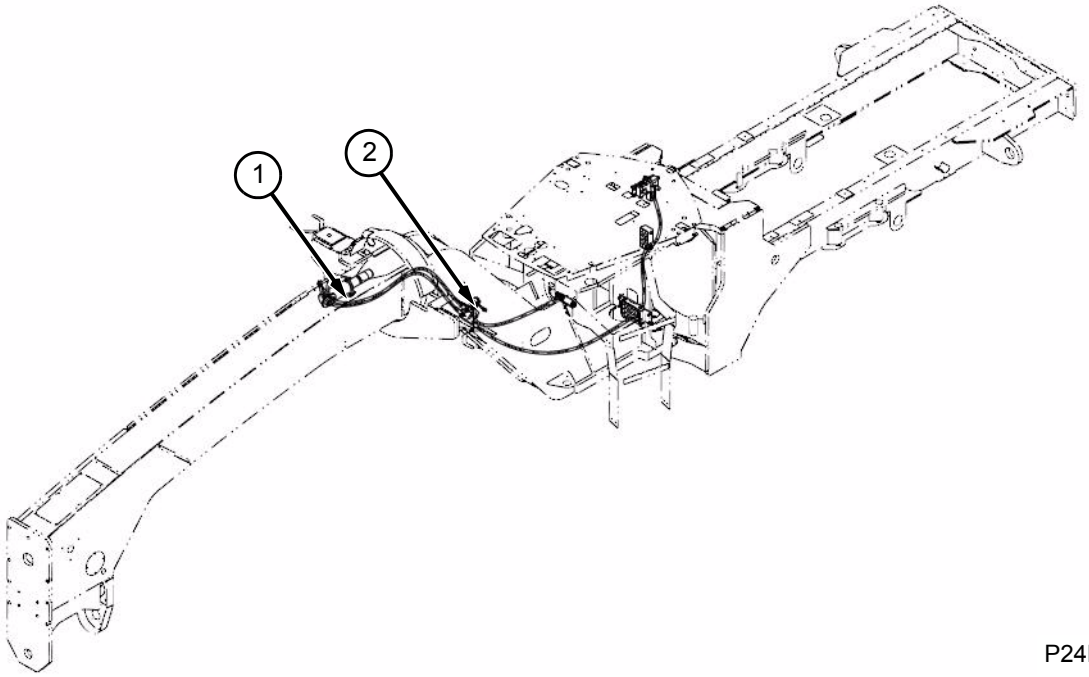


P24H00003

1. Service brake valve
2. Parking brake valve
3. Accumulator
4. Charge valve

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CLG4180D-T3 Latch hydraulic system



P24H00004

1. Latch cylinder
2. Latch control valve

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Technical Parameters of Hydraulic System

Main technical parameters of CLG4180D-T3 hydraulic system

	Item	Unit(s)	
Work Hydraulic System	Type	/	Open-quantitative pump hydraulic system
	Maximum working pressure of the system	MPa	20± 0.5
	Displacement of working pump	ml/r	30/30
	Rated speed of the working pump	r/min	2200
	Rated flow of multi-way flow	L/min	70
	Maximum system flow of the system	L/min	122L@2200r/min
	Blade lift cylinder (cylinder No. -- cylinder bore × stroke)	mm	2-Φ80× 1255
	Circle sideshift cylinder (cylinder number -- cylinder bore × stroke)	mm	1-Φ80× 295
	Blade sideshift cylinder (cylinder No. -- cylinder bore × stroke)	mm	1-Φ80× 1400
	Blade pitch cylinder (cylinder No. -- cylinder bore × stroke)	mm	1-Φ100×195
	Front wheel tilt cylinder (cylinder No. - cylinder bore × stroke)	mm	1- Φ 80 × 193
	Hitch steer cylinder (cylinder number -- cylinder bore × stroke)	mm	2-Φ100× 375
	Swing motor displacement	ml/r	100
Steering Hydraulic System	Type	/	Swing front axle, fully hydraulic steering system
	System working pressure	MPa	16.7± 0.5
	Steering pump displacement (share with rear pump of working pump)	ml/r	30
	Rated speed of steering pump	r/min	2200
	Metering pump	ml/r	200
	Steering angle	°	50°± 1°
	Steering cylinder (cylinder number -- cylinder bore × stroke)	mm	2- Φ50× 290

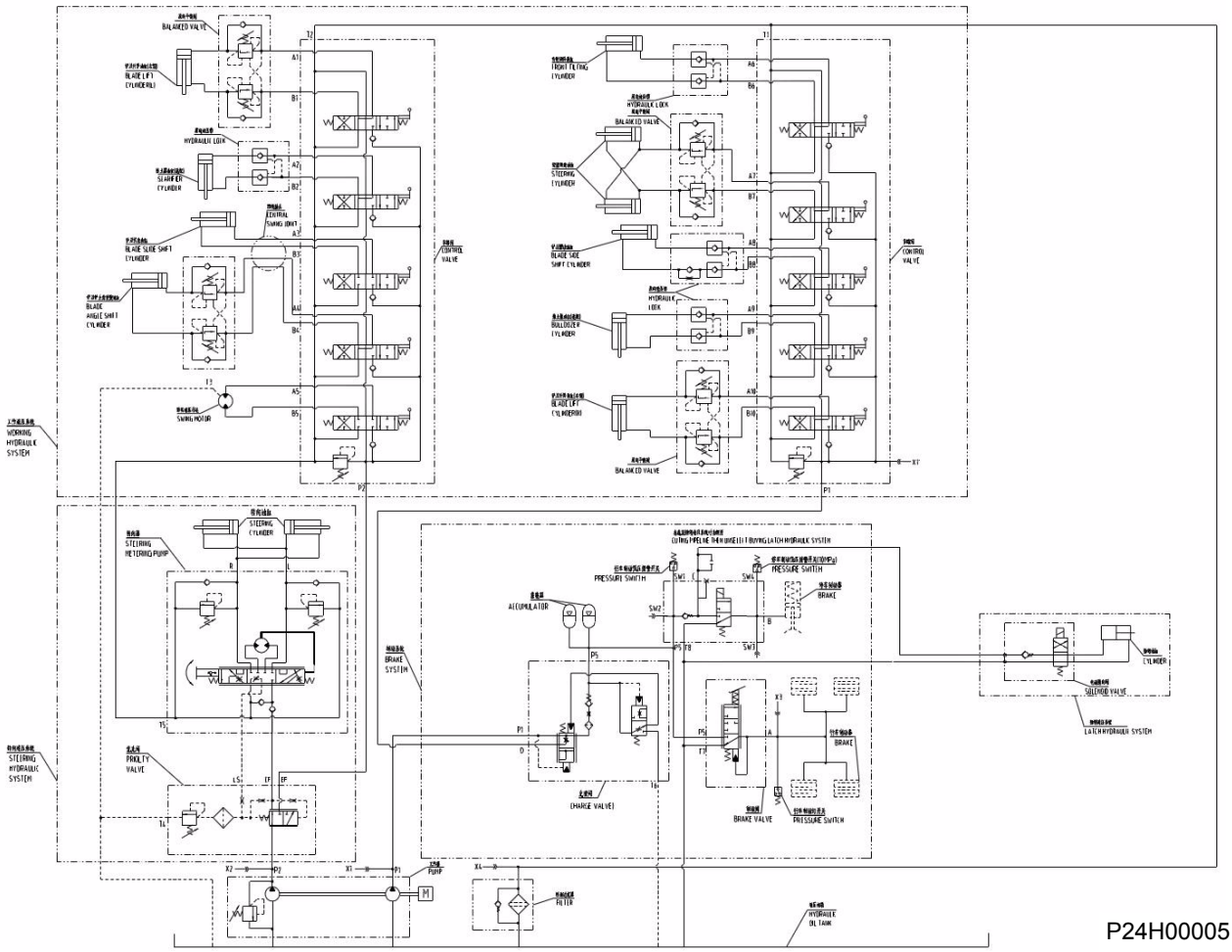
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	Item	Unit(s)	
Brake System	Type	/	Single-way full hydraulic service brake and electronic control parking brake
	Brake pump displacement (share with front pump of working pump)	ml/r	30
	Maximum pressure of service brake	MPa	10.3 ± 0.35
	Opening pressure of charge valve	MPa	12.8 ± 0.35
	Shut-off pressure of charge valve	MPa	15.9 ± 0.35
	Low pressure alarm pressure of service braking	MPa	10
	Air pre-charging pressure of the accumulator	MPa	9.2± 0.3
	Accumulator volume (quantity × volume)	L	2×1.6
	Low pressure alarm pressure of parking brake	MPa	10
	Charge flow	L/min	10.2±1.9
Latch hydraulic system	Type	/	Electronic hydraulic pull pin
	Latch cylinder (cylinder number -- cylinder bore × stroke)	mm	1-Φ63× 47
Working medium	Hydraulic oil	L	165
	Cleanliness	NAS 1638	≤ Grade 9

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Schematic Diagram of Hydraulic System

CLG4180D-T3 Hydraulic schematic diagram



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Universal Tools and Tooling for Hydraulic Maintenance

Common tools table

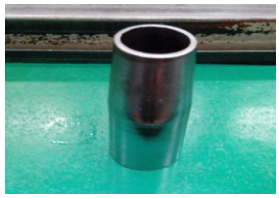
Name	Specifications (Qty.)
Open-end wrench	8#,10#,13#,15#,17#,19#,21#,22#,24#,27#,30#,32#,36#,41#, 44#,46#
Straight screwdriver	
Cross screwdriver	
Plier	
Torque wrench	20~100N.m, 90~300N.m, 160~680N.m
Inner hexagon wrench	One set in metric standard and one set in imperial standard
Hoisting equipment	2t
Sling	2t
⚠ Notice: The removed standard parts should be placed with relevant material together to avoid being mixed.	

Special Tools and Tooling for Hydraulic Maintenance

Special tools and tooling list for tooling device cylinder

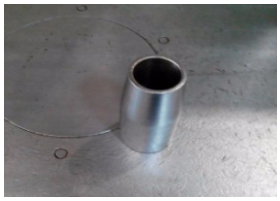
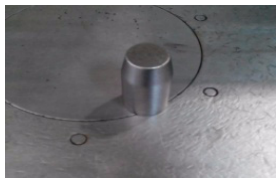
No.	Liugong No.	Tool description	Figure	Purpose	Quantity for full-time service dealers
1	SP130702	Pry bar		For hydraulic parts assembling auxiliary tools	1
2	SP129313	Rubber hammer		For assembling dust ring of cylinder head	1
3	SP130917	Tooling for compressing dust ring		For compressing dust ring of cylinder head	1

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No.	Liugong No.	Tool description	Figure	Purpose	Quantity for full-time service dealers
4	SP130915	Guide sleeve		For assembling the O-ring of piston rod	1
5	SP130700	Guide sleeve		For assembling cylinder head group onto piston rod	1
6	SP129308	Positioning tool		For aligning flange bolt hole with cylinder head through hole	1
7	SP130698	Dowel pin		For aligning flange bolt hole with cylinder head through hole	1
8	SP133205	Blower gun		For pre-tightening bolt	1
9	SP129309	Socket		For tightening bolt	1
10	SP130929	Steel wire scissors		For retaining ring of cylinder head	1

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Special tools and tooling list for steering cylinder:

No.	Liugong No.	Tool description	Figure	Purpose	Quantity for full-time service dealers
1	SP130702	Pressing and fitting tooling for friction ring		For pressing and fitting the friction ring onto piston	1
2	SP129313	Compressing tooling for friction ring		For compressing the friction ring	1
3	SP130917	Guide sleeve		For assembling cylinder head group onto piston rod	1
4	SP130915	Guide sleeve		For assembling the O-ring of piston rod	1
5	SP130700	Pressing and fitting tooling for bushing		For assembling the bushing onto cylinder block	1
6	SP129308	Cylinder block support		For supporting the cylinder block and pressing the bushing on the cylinder block	1

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No.	Liugong No.	Tool description	Figure	Purpose	Quantity for full-time service dealers
7	SP130698	Bushing detection		For detecting the size of bushing assembled onto the cylinder block	1
8	SP133205	Blower gun		For tightening the nylon locknut	1
9	SP129309	Copper bar		For pressing the piston rod into the cylinder block	1
10	SP130929	Hook spanner		For pre-tightening the cylinder head group	1
11	SP129306	Socket		For locking the cylinder head group	1

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Hydraulic Oil

Hydraulic oil is the working medium for delivering energy in the hydraulic system, and it also has the functions of lubrication, sealing, cooling, rust protection, etc. In the CLG4180D-T3 grader hydraulic system, due to variation in pressure, speed and temperature within a wide range, the applied hydraulic oil can adapt to this variation and maintain stable performance as required in order to guarantee the stability of operating state but not likely to cause great changes or damages due to changes in external conditions, we have the following requirements for the technical parameters of hydraulic oil:

Main technical parameters of CLG4180D-T3 hydraulic oil			
Hydraulic oil	Brand	Summer: HM46 antiwear hydraulic oil Winter: HV46 antiwear hydraulic oil	LiuGong Gaorun
	Oil quantity	L	165
	Cleanliness	NAS 1638	≤9
	Change interval	H	2000

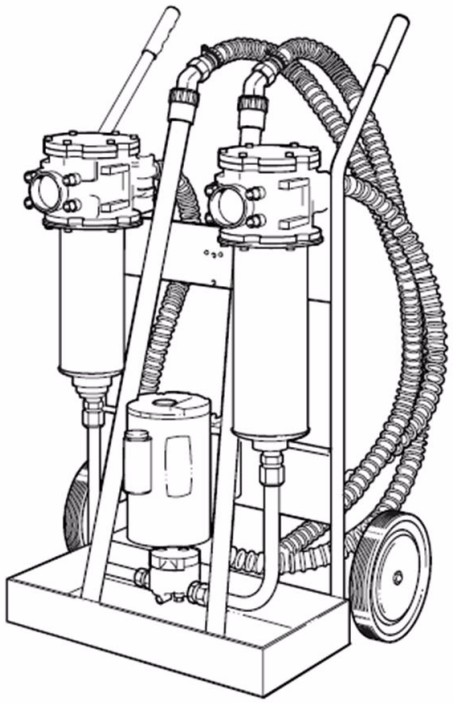
⚠CAUTION

Hydraulic oils of the same brand and different specifications cannot be mixed, and hydraulic oils of the same specification and different brands cannot be mixed, either. If you must use hydraulic oil of another brand for some reason, please clean up the system first. For details, please refer to the Maintenance Manual.

In addition, whether the hydraulic oil is or not clean directly affects the working performance of the hydraulic system and the service life of hydraulic elements. According to statistics, at least 75% of faults of the hydraulic system are due to the cleanliness of hydraulic oil not up to standard. Therefore, precautions for hydraulic oil pollution is necessary. For grader, we shall firstly prevent pollutants from entering the hydraulic system from the source: We recommend to filter the oil products with the oil filter vehicle in the process of refueling or renewing of fuel to ensure that the oil products entering the hydraulic system can meet the standard required by us: ≤NAS 1638 9th-level standard.

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Oil filter vehicle



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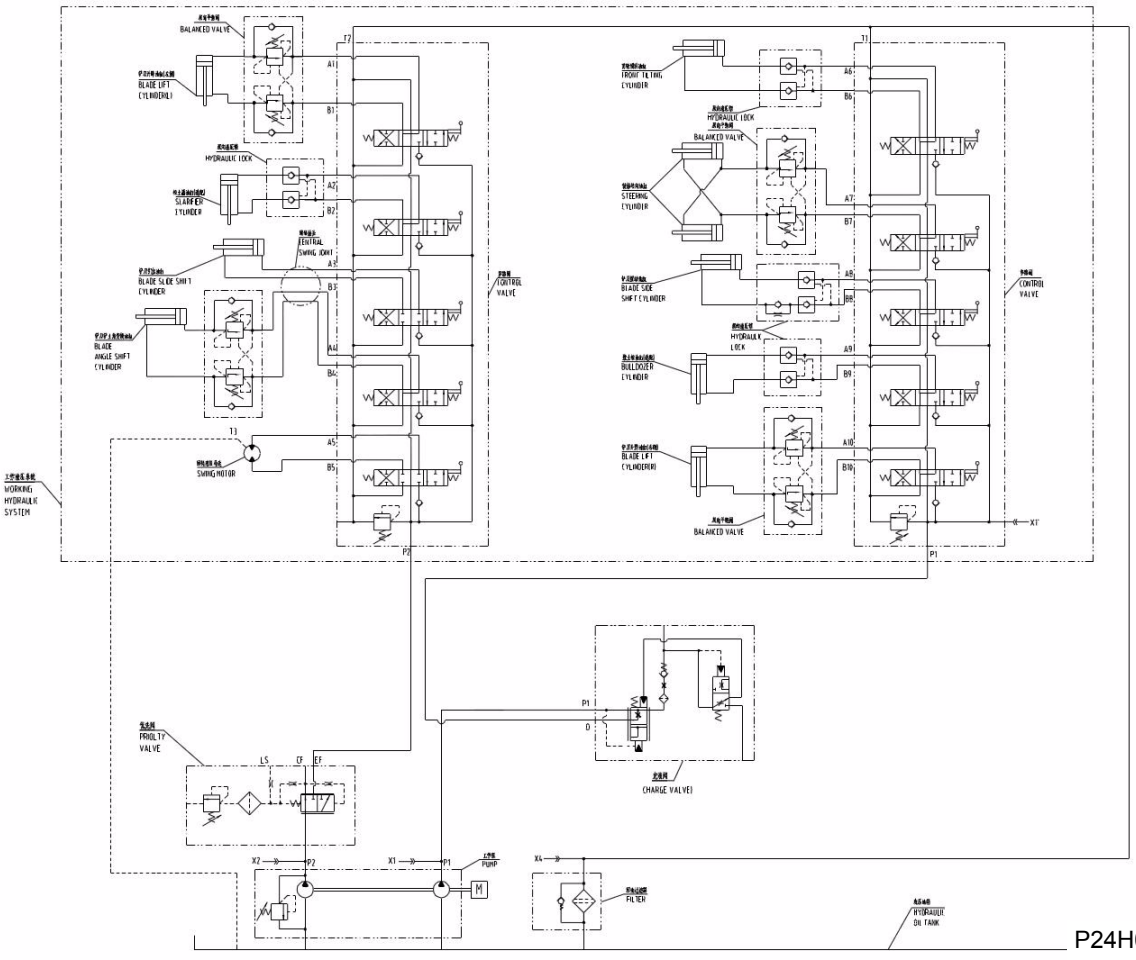
Structure and Function

Work Hydraulic System

A: Overview - components and position

The work implement hydraulic system is used to control the movement of various work implements (blade, ripper, dozer, etc.) of grader, including blade lifting and lowering to the left/right, blade rotation, blade sideshift relative to or along with the circle, change of blade cutting angle, circle rotation, contraction & release of ripper and dozer, etc. The system is a dual-pump and double-circuit hydraulic system (see work hydraulic system Schematic). It consists of fuel tank and duplex hydraulic gear pump, two sets of five-linked multi-way valve, as well as hydraulic cylinder, motor, hydraulic lock, line, etc. of each working device. Each circuit has its own hydraulic pump, but hydraulic oil is from the same tank, hydraulic oil for work is absorbed from the fuel tank by two pumps, pumped oil is supplied to two circuits, respectively, and the coordinated actions of various cylinders and motors are controlled through the multi-way valve to meet the operational requirements of grader for adapting to different operating conditions. CLG4180D-T3 grader work hydraulic system schematic and layout drawing are as follows:

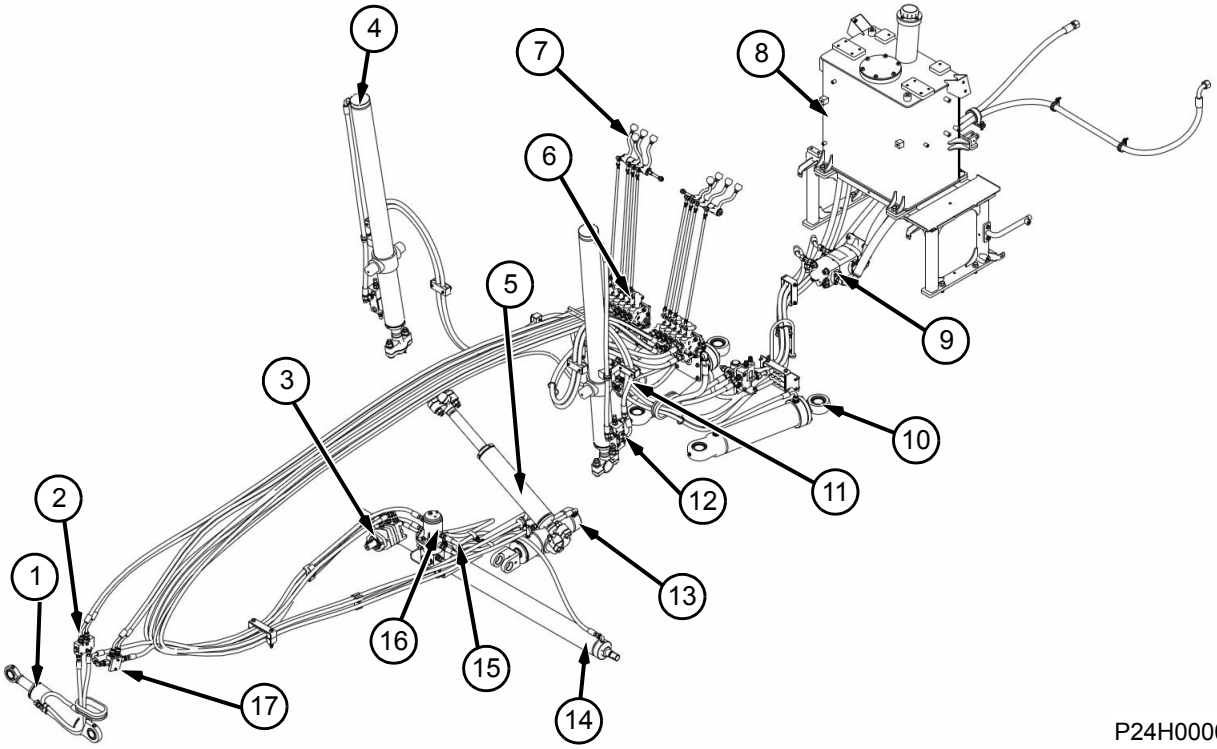
Hydraulic schematic diagram of CLG4180D-T3 Work hydraulic system



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Layout diagram of CLG4180D-T3 work hydraulic system



1. Front wheel tilt cylinder
2. Tilt hydraulic lock
3. Swing motor
4. Blade lift cylinder
5. Circle sideshift cylinder
6. Multi-way valve
7. Control lever as
8. Hydraulic oil tank
9. Tandem working pump
10. Hitch steer cylinder
11. Hitch steer balanced valve
12. Blade lift balanced valve
13. Blade pitch cylinder
14. Blade sideshift cylinder
15. Blade pitch balanced valve
16. Swivel joint
17. Circle sideshift hydraulic lock

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(1) When the work system has no action, that is, the control valve is in the neutral position, working pump will suction and pump out the oils from the hydraulic oil tank, passing through the priority valve, filling valve, left and right Multi-way valves and return oil filter, respectively, back to the oil tank, forming a circulation circuit.

(2) When pulling one or more levers, hydraulic oil opens the check valve in the control valve and enters corresponding hydraulic cylinder or hydraulic motor to work. The role of the check valve is to restrict oil in the working device to flow to the oil tank to ensure normal operation of the hydraulic system.

(3) The bidirectional hydraulic lock or balanced valve installed to the blade tilt circuit and two blade lift circuits can prevent displacement due to the weight and load of work implement itself, and it ensures driving safety of the grader and working range and working precision of the blade.

(4) Because the two lift cylinders at left and right is supplied by two isoflow circuits, the lifting and lowering of both lift cylinders are fundamentally synchronized at the same speed, so the working performance of grader is improved.

(5) The safety valve integrated on the left & right Multi-way valves are mainly playing a role in overload protection for the hydraulic system.

B: Overview - technical parameters of work hydraulic system

Item	Parameters
System pressure	20±0.5MPa
System flow	122L/min@2200r/min
Blade pitch balanced valve pressure	21±0.5MPa
Blade lift balanced valve pressure	28±0.5MPa
Hitch steer balanced valve pressure	31±0.5MPa
Work pump integrated safety valve pressure	21±0.5MPa

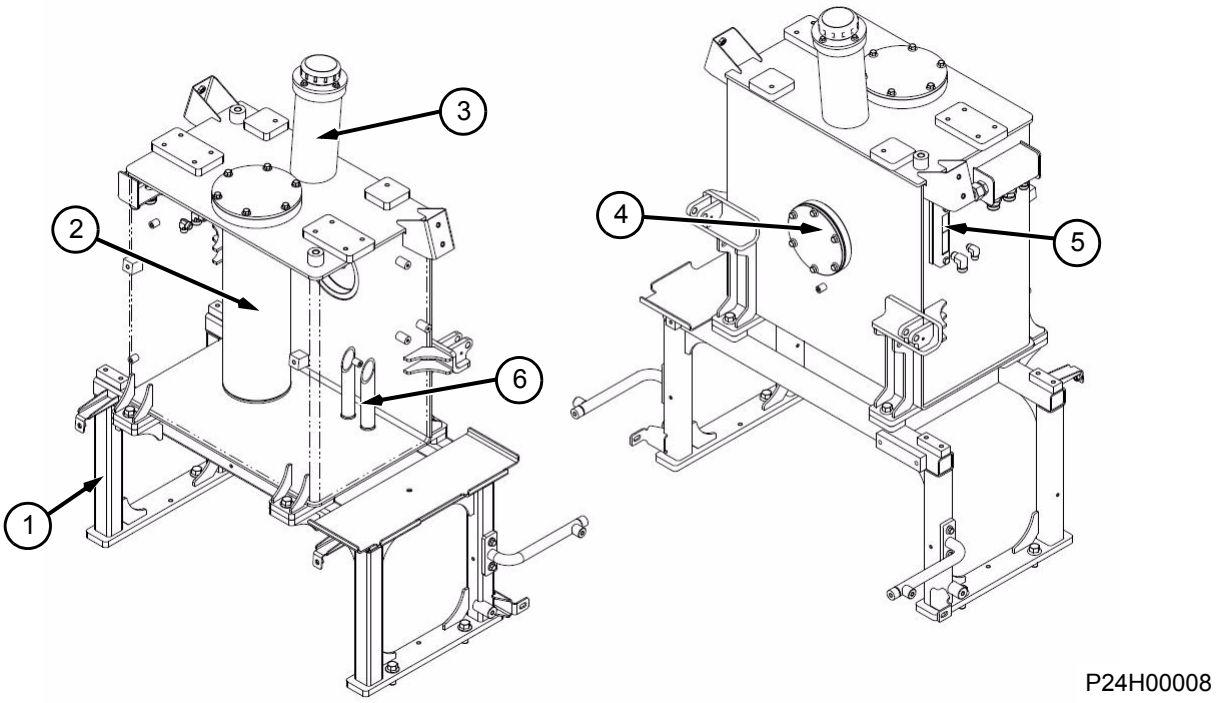
Hydraulic Oil Tank

Installation Position and Functional Structure of Hydraulic Oil Tank

The hydraulic oil tank is top-mounted type, which is located inside the engine compartment, and installed on the rear frame in the middle of a machine. The function is to store the hydraulic oil required for work of the hydraulic system and precipitate the pollutant of oil in hydraulic oil tank, separate the air from oil and cool the hydraulic oil. A return oil filter has been set in the oil tank to filter the pollutant in oil lines of the hydraulic system so as to guarantee the cleanliness of hydraulic oil. Structural diagram of hydraulic oil tank is as follows:

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Structural diagram of hydraulic oil tank



P24H00008

1. Bracket
2. Return oil filter
3. Strainer assembly and oil filler
4. Washing port
5. Level gauge
6. Suction pipe

In which, the oil return cavity is used to temporarily store the hydraulic oil that returns from the system to effectively reduce the back-flow velocity so as to avoid bubbles produced in the hydraulic oil tank resulted from too fast oil returning. The return oil filter mainly filters the oil returning to the hydraulic oil tank to prevent pollutant from entering into the system through the oil tank to cause pollution again. Washing port is used to clean the dirt in the oil tank through the position. Oil drain pipe is used to drain fluid out of oil tank when replacing oil or cleaning oil tank. Hydraulic oil is filled from the oil filler after filtration by the oil filter vehicle. Oil filler filter element is used to prevent large particles from entering into oil tank when replacing and filling hydraulic oil. Strainer assembly has the function of the respirator at the same time, the respirator sucks air from atmosphere to fill the air space when the air pressure in oil tank is negative and that exhaust extra air to realize the protection function when the air pressure in oil tank is out of limit. Oil level gauge is used to observe the oil level of oil tank. Oil suction port is used to supply oil for hydraulic pump.

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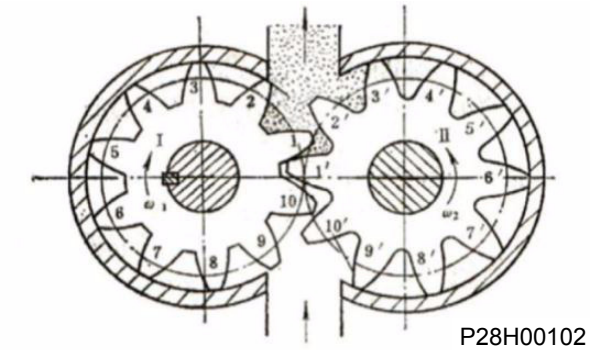
Working Pump

Main Technical Parameters

Item	Parameters
Rated pressure MPa	23/21
Displacement mm/r	30/30
Direction of rotation	Left rotation
Rated speed rpm	2200
Operating fluid	Anti-wear hydraulic oil
Weight kg	26

Structure and Working Principle of Working Pump

Schematic diagram of working pump



P28H00102

The gear pump works using the meshing movement of a pair of gears and causing volume changes in the suction and draining cavities. It is the suction port with a closed volume always in a growing state, and it is the outlet with a closed volume always in a reducing state. Generally, the side with larger port is the suction port, and the side with smaller port is the outlet.

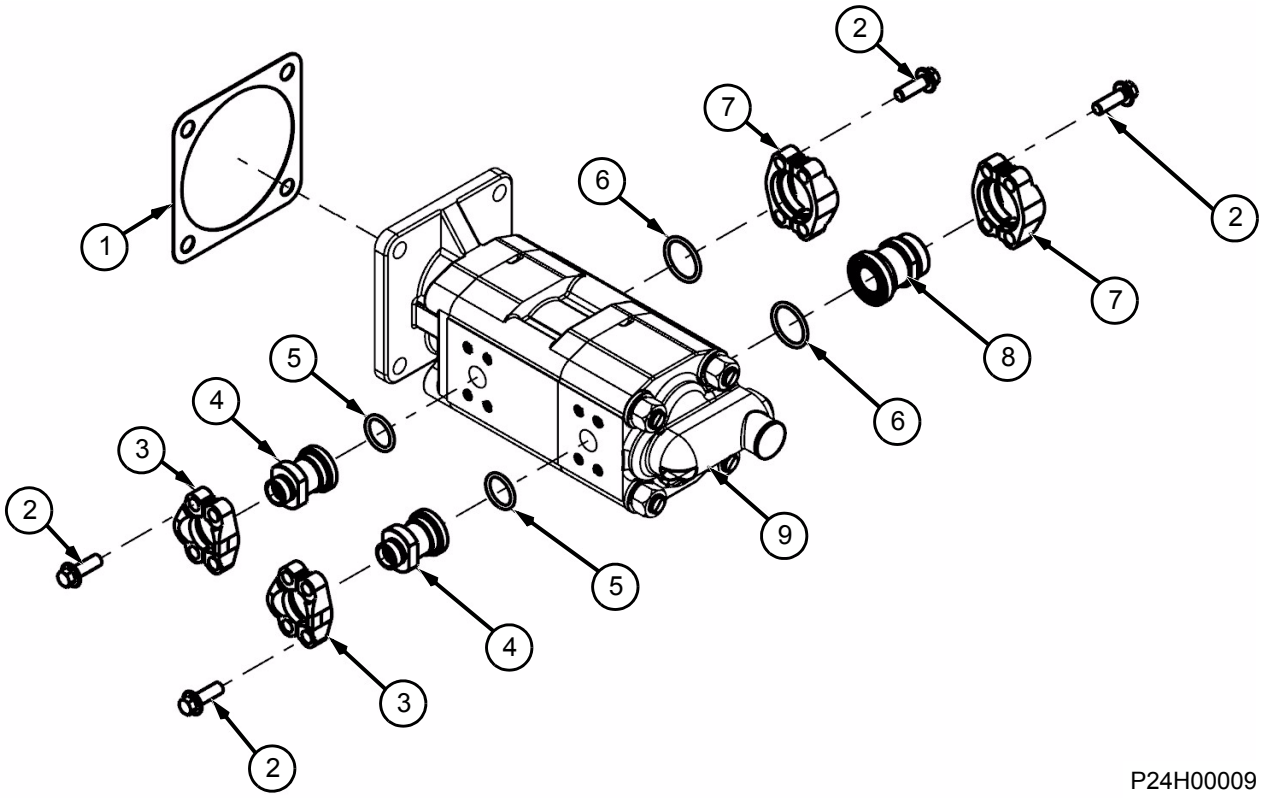
https://truckmanualshub.com/

Mounting Position and Functional Structure of the Working Pump Assembly

Directly install working pump assembly on the transmission, and fix the assembly with bolts, studs and nuts.

Structure of working pump assembly

Structure diagram of working pump assembly



1. Seal gasket
2. Bolt
3. Pressure plate
4. Flanged joint
5. O-ring
6. O-ring
7. Pressure plate
8. Connector
9. Tandem pump

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Left Multi-way Valve

Mounting Position and Functional Structure of Multi-Way Valve assembly on the Left Side

The multi-way valve on the left side is installed on front-left side of the cab platform, and is a five-linked mechanical control valve mainly used to control the oil transformation and on-off of branch circuits in the work hydraulic system, having features as follows:

The first link circuit controls the left blade lift cylinder action, and the valve plate in this link is next to return opening T2;

The second link circuit controls the ripper cylinder action, this feature is optional, and its valve plate is next to the first link valve;

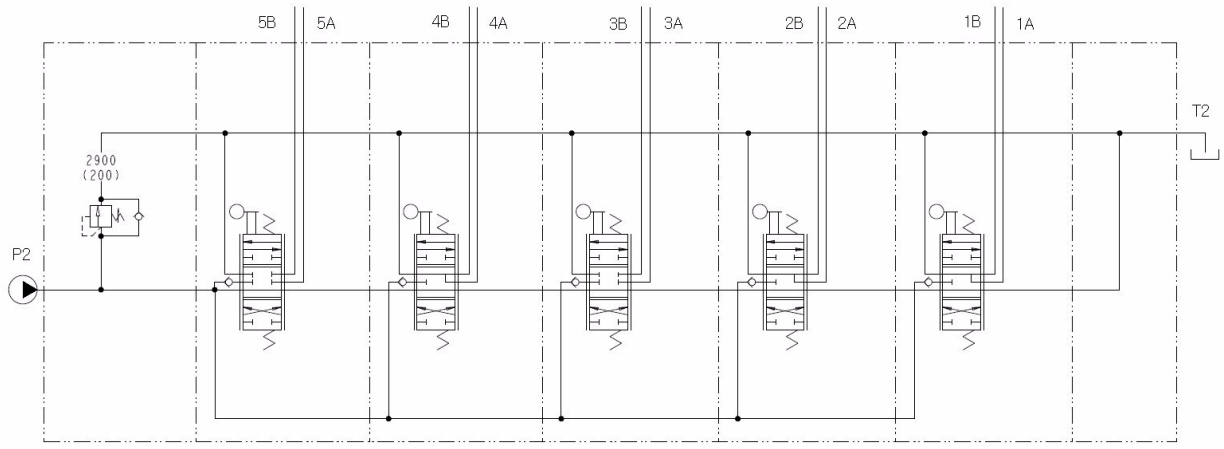
The third link circuit controls the blade lead-out cylinder action, and the valve plate in this link is next to the second link valve;

The fourth link circuit controls the blade angle transformation cylinder action, and the valve plate in this link is next to the third link valve;

The fifth link circuit controls the swing motor action, and the valve plate in this link is next to the fourth link valve and inlet P2.

Of which the safety valve integrated in the multi-way valve is for system overpressure protection, with set value of 20 MPa at delivery, and the check valve is used to prevent oil from flowing backward and avoid affecting the working pump.

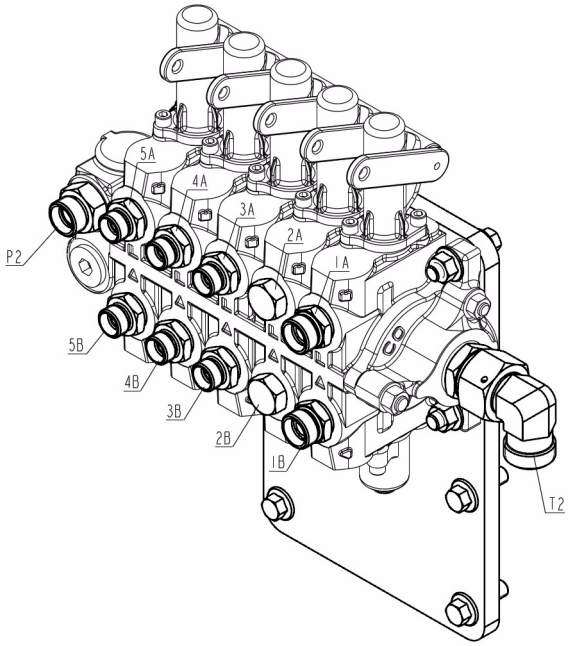
Schematic diagram of left control valve hydraulic



P24H00010

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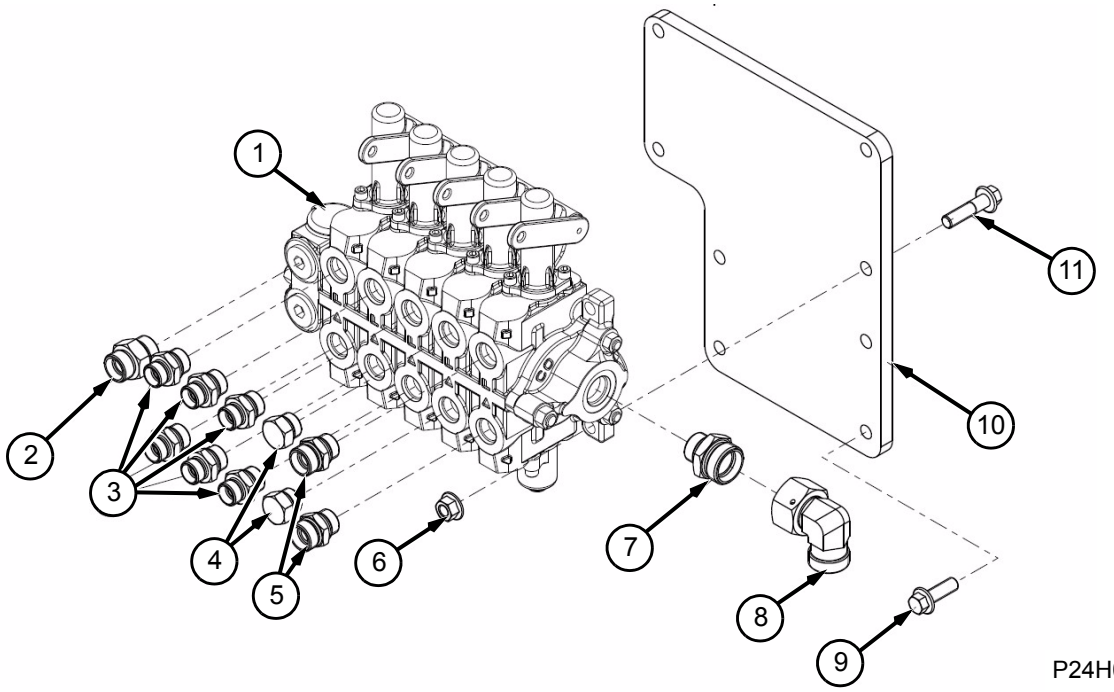
Diagram of multiple-way valve oil port on the left side



P24H00011

Multiple-Way Valve Assembly on the Left Side:

Schematic diagram of multiple-way valve assembly on the left side:



P24H00012

1. Control valve as
2. Joint
3. Joint
4. Plug
5. Joint
6. Nut
7. Joint
8. Transition joint
9. Bolt
10. Plate
11. Bolt

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Right Multi-way Valve

Mounting Position and Functional Structure of Multi-Way Valve assembly on the Right Side

RH multiple unit valve is installed at the right front below the cab platform, and is a five-linked mechanical control valve mainly used to control the oil transformation and on-off of branch circuits in the work hydraulic system, having features as follows:

The first link circuit controls the blade swing cylinder action, and the valve plate in this link is next to return opening T1;

The second link circuit controls the hitch steer cylinder action, and its valve plate is next to the first link valve;

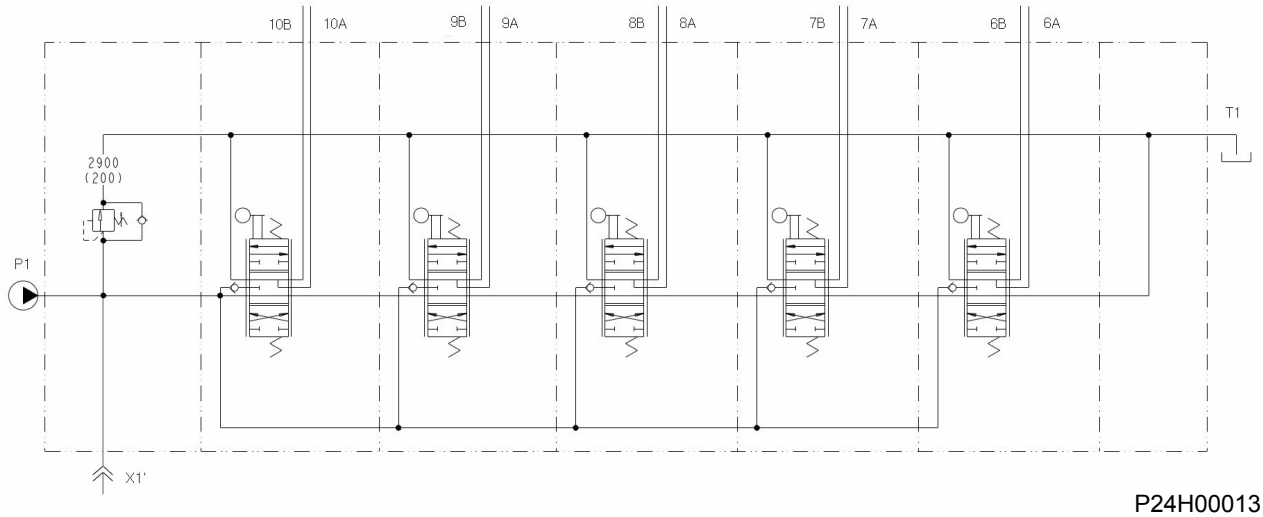
The third link circuit controls the front wheel tilt cylinder action, and the valve plate in this link is next to the second link valve;

The fourth link circuit controls the blade cylinder action, this feature is optional, and its valve plate is next to the third link valve;

The fifth link circuit controls the blade lift cylinder-rh action, and the valve plate in this link is next to the fourth link valve and inlet P1.

Of which the safety valve integrated in the multi-way valve is for system overpressure protection, with set value of 20 MPa at delivery, and the check valve is used to prevent oil from flowing backward and avoid affecting the working pump.

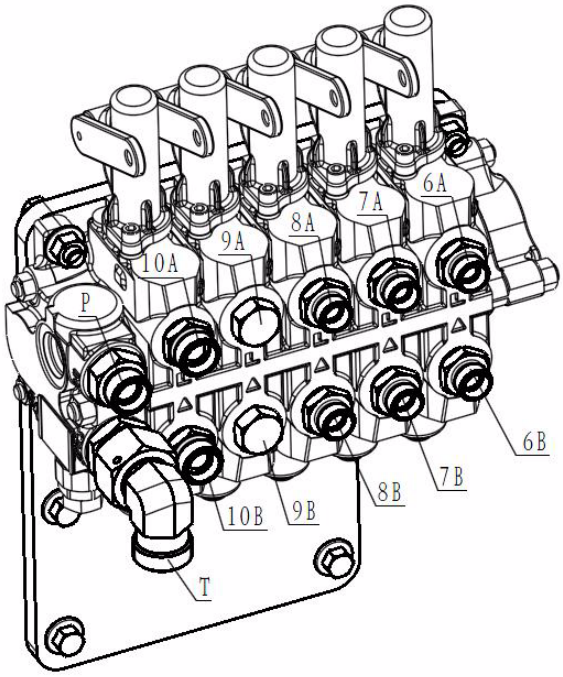
Schematic diagram of right control valve hydraulic



P24H00013

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Diagram of multiple-way valve oil port on the right side

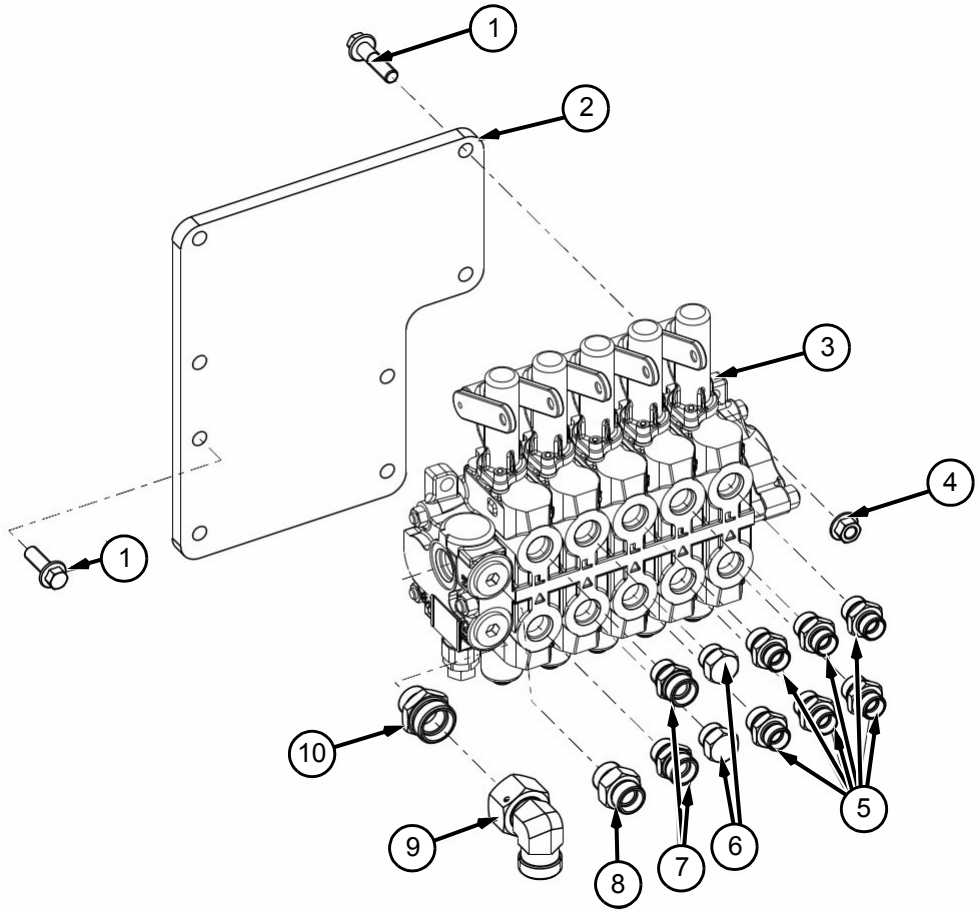


P24H00014

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Multiple-way Valve Assembly on the Right Side:

Schematic diagram of multiple-way valve assembly on the right side



1. Bolt
2. Plate
3. Control valve as
4. Nut
5. Joint
6. Plug
7. Joint
8. Joint
9. Elbow
10. Transition joint
11. Bolt

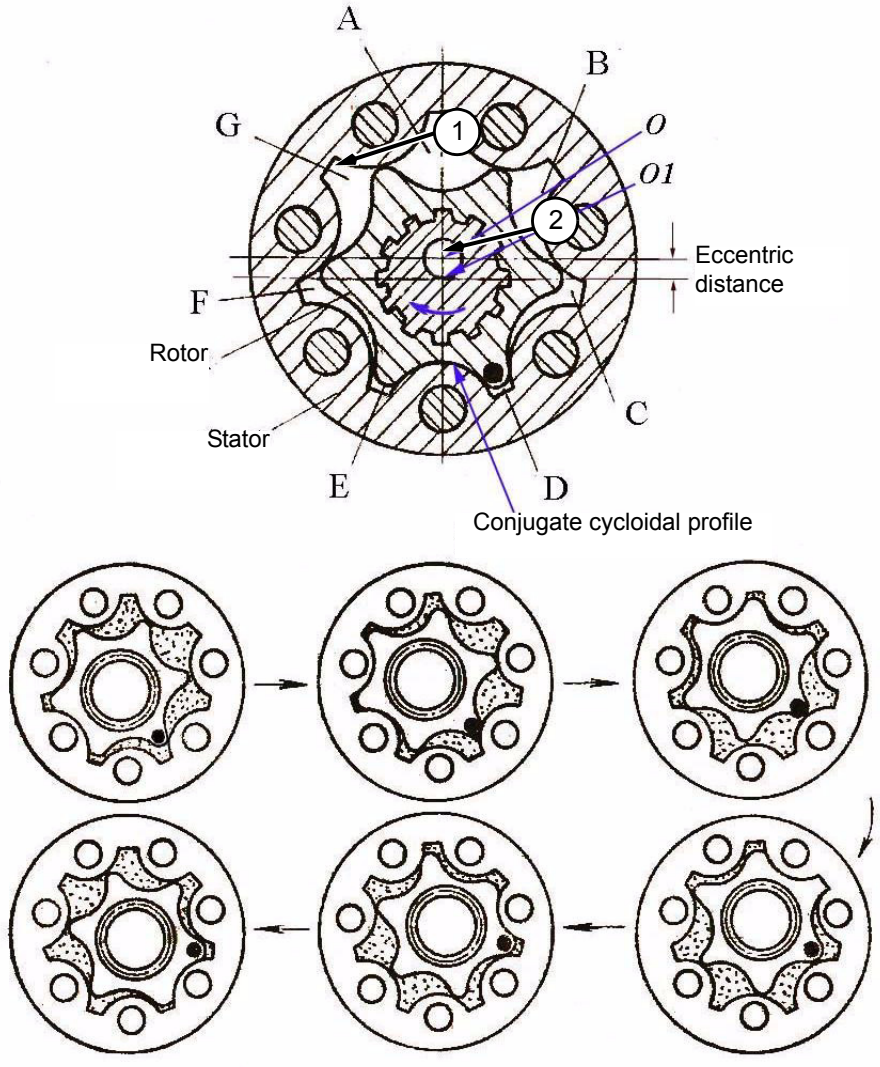
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Swing Motor

Functional Principle of Swing Motor

The swing motor is a gear-within-gear cycloid motor, usually consisting of a pair of meshed gear pairs, spline shaft, output shaft and flow distribution shaft. There is one more teeth of stationary stator (external gear) than cycloidal rotor (internal gear), one end of the spline shaft is connected with the ring gear, the other end is connected with the output shaft to play the role of transmitting actions of both. On one hand, the cycloidal rotor revolves on its axis O1 during meshing, and on the other hand, it makes reverse orbit action at high speed around stator axis O. After orbit action for a circle, the working volume sealed between teeth completes oil feeding and discharge once, at the same time, the cycloidal rotor revolves on its axis by one tooth.

Working principle diagram of swing motor



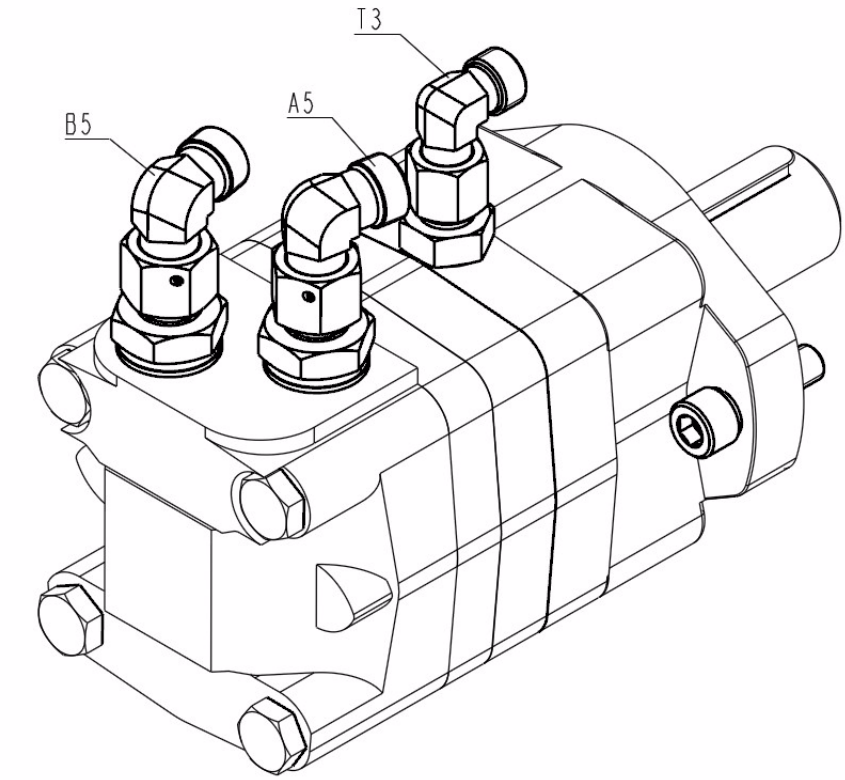
P24H00016

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Mounting Location and Functional Principle of Swing Motor

The swing motor is located above the circle of work implement, having the main function of driving the worm gear case and circle to rotate to adapt to different operating conditions for grader.

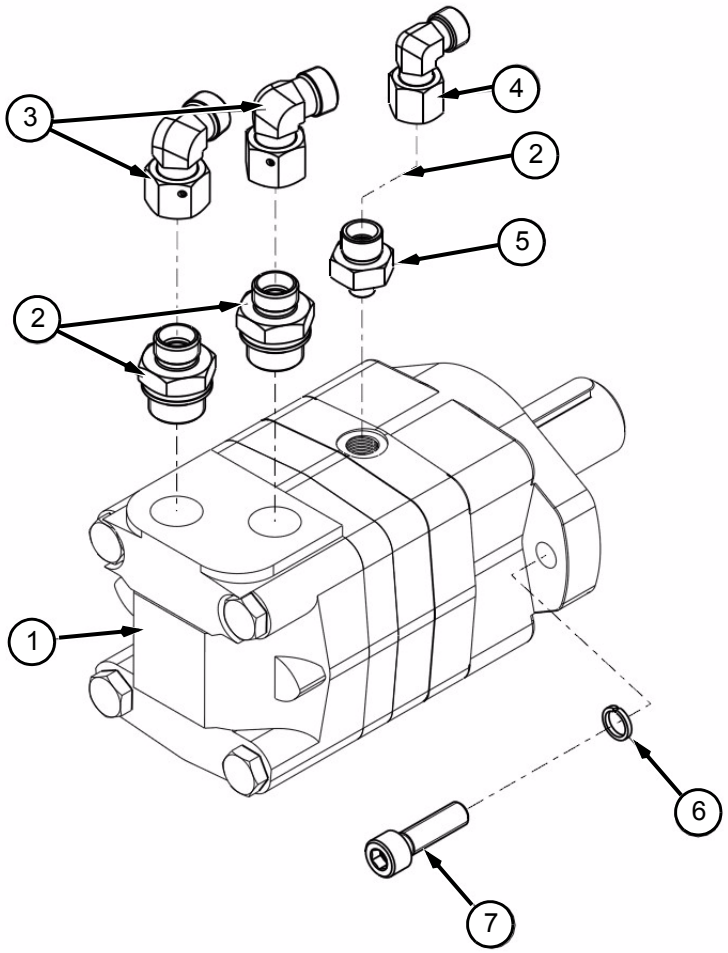
Diagram of swing motor oil port



P24H00017

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Structure diagram of swing motor



P24H00018

1. Swing motor
2. Straight connector
3. Elbow
4. Joint
5. Joint
6. Hard washer
7. Screw

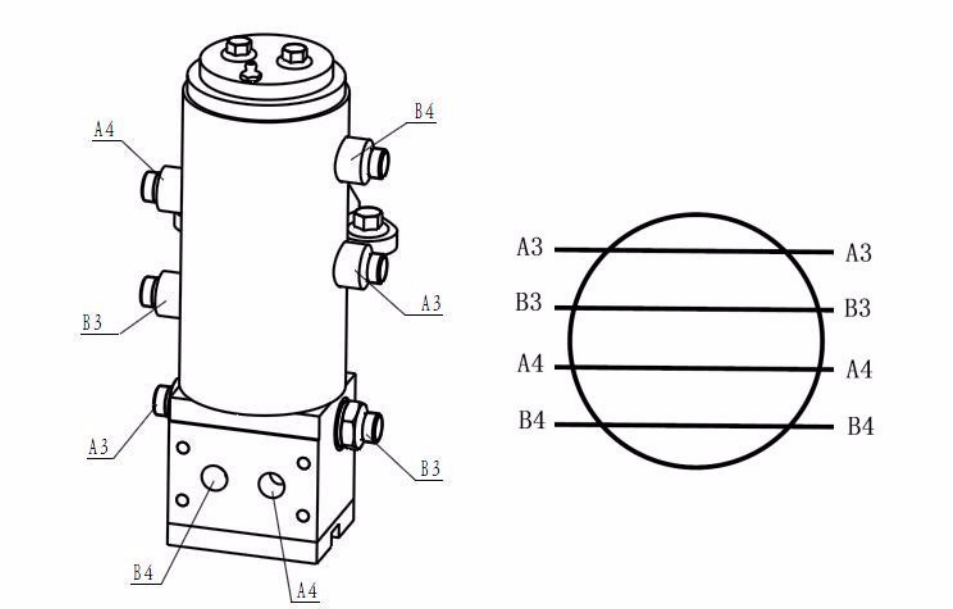
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Swivel Joint

Mounting Location and Functional Principle of Swivel Joint Assembly

The swivel joint is located in the center of the circle of work implement, mainly used to connect the grader work implement fixed part with the hydraulic system line of the rotating part, making the upper and lower parts of system line have relative rotational action at 360° without interference.

Hydraulic schematic of swivel joint and diagram of oil port

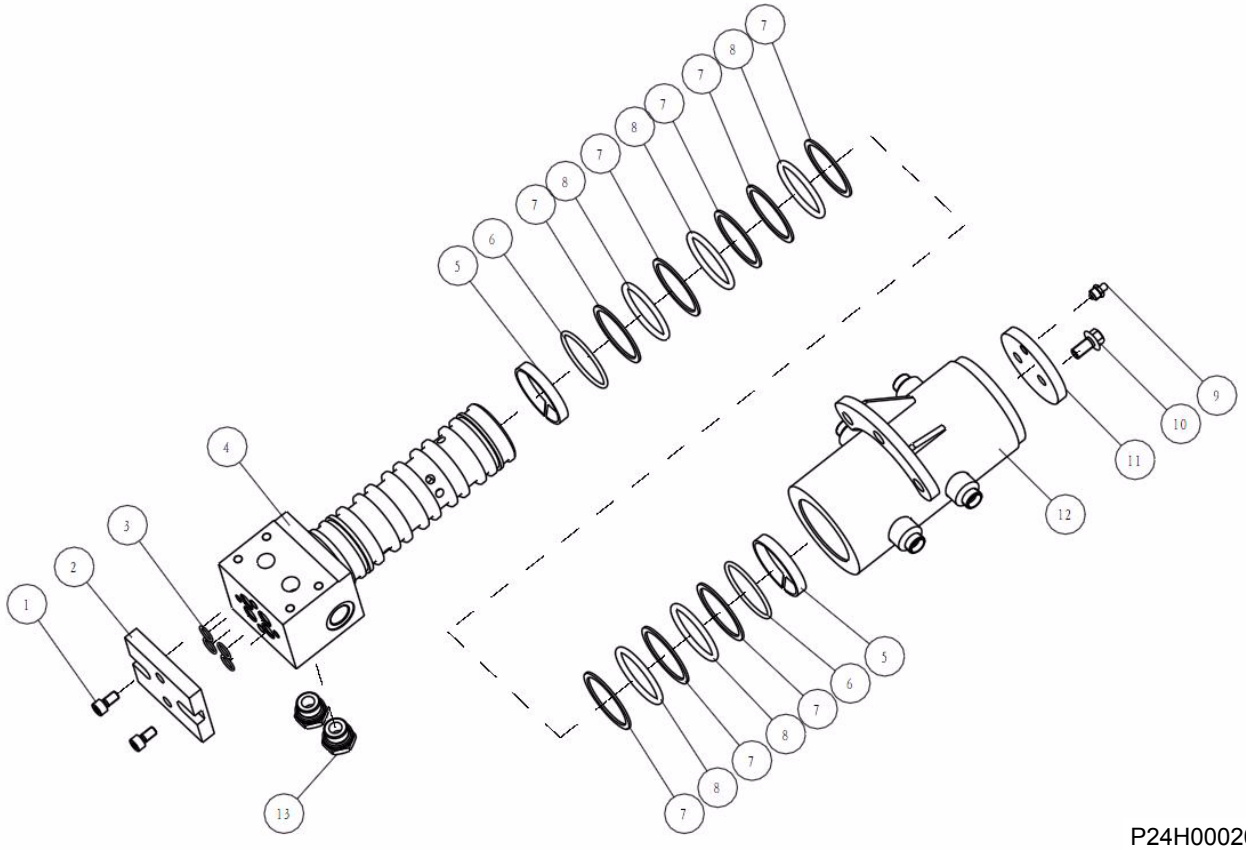


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Functional Structure of Swivel Joint

Structural diagram of swivel joint

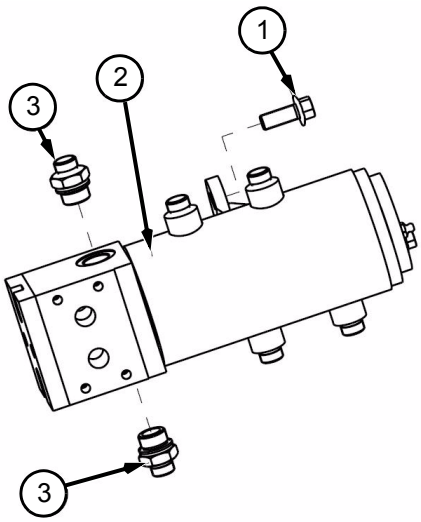


1. Screw
2. Cover plate
3. O-ring
4. Revolving shaft
5. Support ring
6. O-ring
7. Retainer
8. O-ring
9. Oil cup
10. Bolt
11. Baffle
12. Cylinder block
13. Plug

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Functional Structure of Swivel Joint Assembly

Structural diagram of swivel joint assembly



P24H00021

1. Bolt
2. Swivel joint
3. Connector

Lift blade Lift Cylinder

Main Technical Parameters

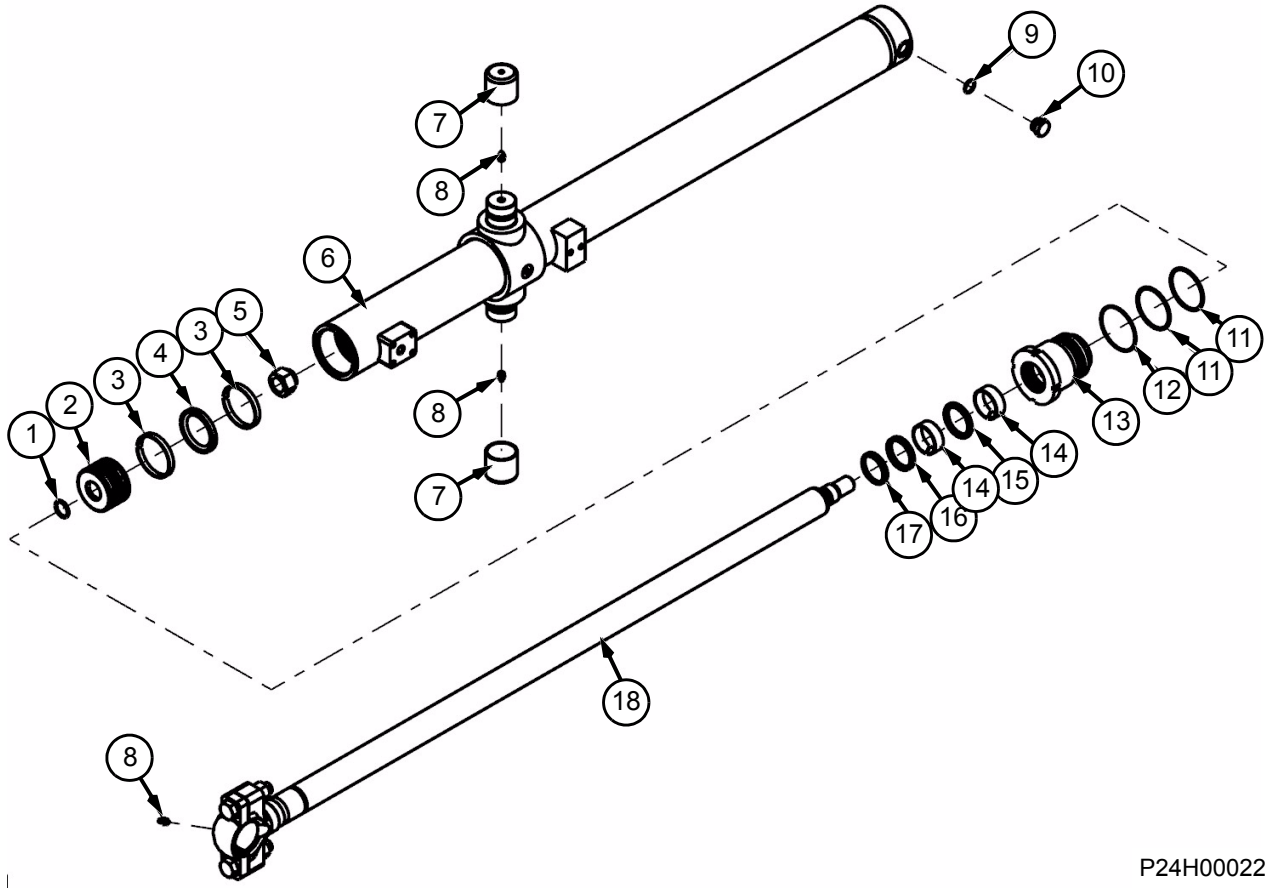
Item	Parameters	Remarks
Cylinder bore (mm)	80	
Rod diameter (mm)	50	
Stroke (mm)	1255	
Minimum mounting distance (mm)	566	

Structure and Working Principles of Left Blade Lift Cylinder

The left blade lift cylinder, located on the left side of the swing seat in the middle of the machine, connects the swing seat and rotating support. As an actuator of the blade lift device, it is mainly used to drive the blade to be lifted and lowered, and adjust the working depth of blade to adapt to the requirements of different operating conditions of grader. This cylinder is also a typical double-acting cylinder. The following is an exploded view of cylinder internal structure:

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Inner structure of blade lift cylinder



1. O-ring
2. Piston
3. Support ring
4. Combined seal ring
5. Nylon locknut
6. Cylinder block
7. Jacket
8. Oil cup
9. O-ring
10. Plug
11. O-ring
12. O-ring
13. Cylinder head
14. Support ring
15. Seal
16. Seal ring
17. Dust ring
18. Piston rod

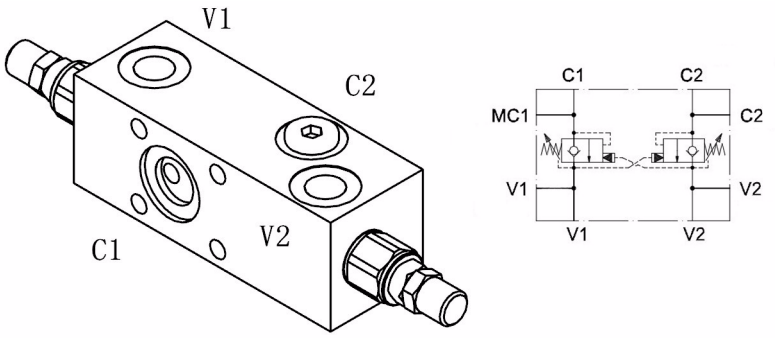
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Left Blade Lift Cylinder Balanced Valve

Structure and Working Principles of Left Blade Lift Cylinder Balanced Valve

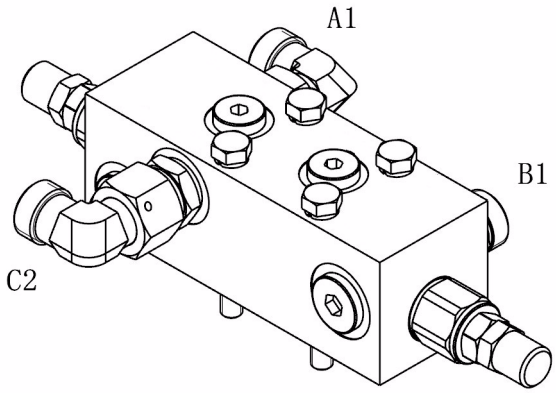
The left blade lift cylinder balanced valve is installed to the left blade lift cylinder, this balanced valve has the main function of pressure maintenance by locking the left blade lift cylinder to prevent displacement due to the weight and load of blade itself, and it ensures driving safety and blade working precision.

Balanced valve schematic diagram and oil port diagram



P24H00023

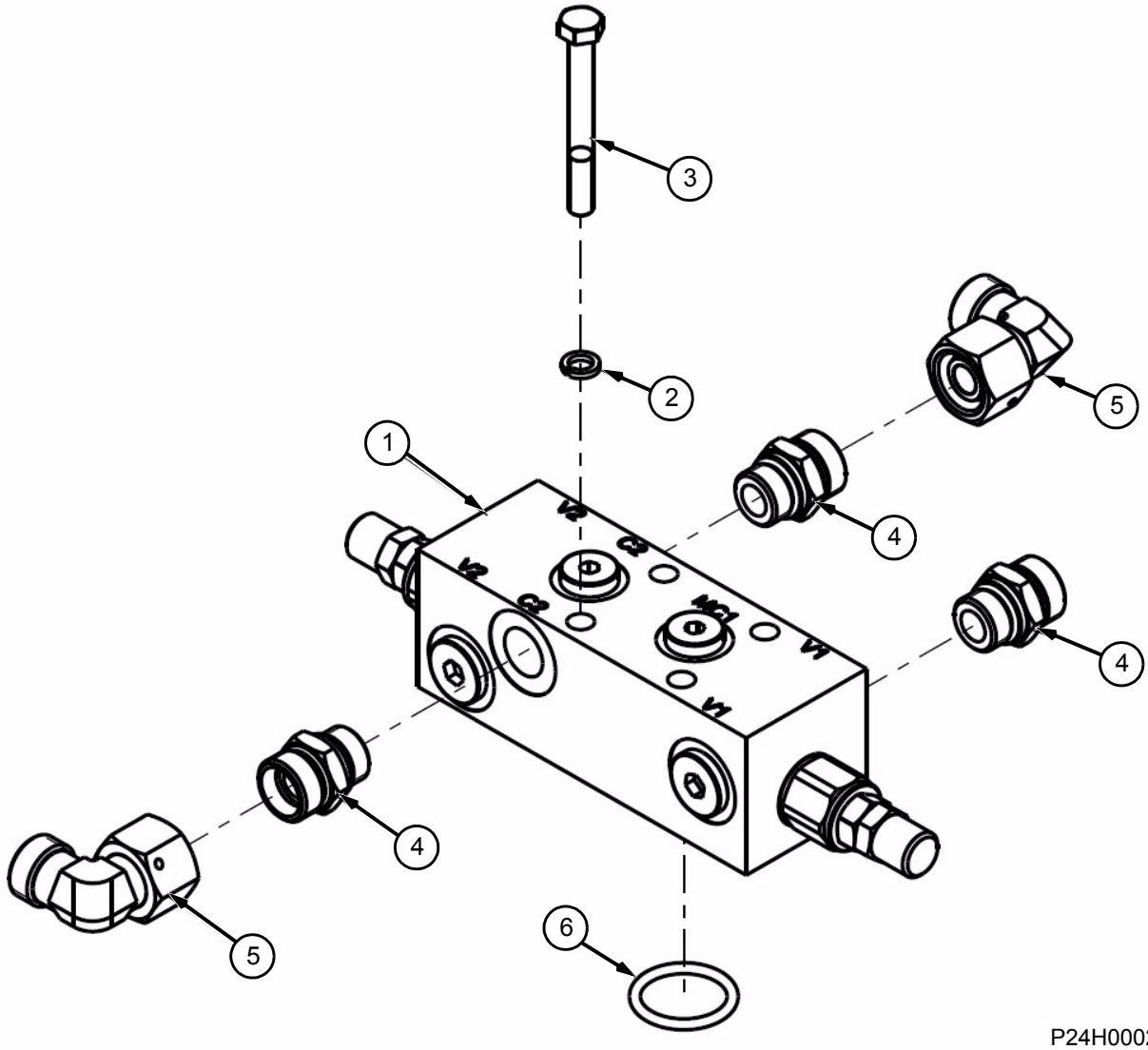
Balanced valve assembly oil port diagram



P24H00024

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Balanced valve assembly structure diagram



P24H00025

1. Balanced valve
2. Washer
3. Bolt
4. Joint
5. Elbow
6. O-ring

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Right Blade Lift Cylinder

Main Technical Parameters

Item	Parameters	Remarks
Cylinder bore (mm)	80	
Rod diameter (mm)	50	
Stroke (mm)	1255	
Minimum mounting distance (mm)	566	

Structure and Working Principles of Right Blade Lift Cylinder

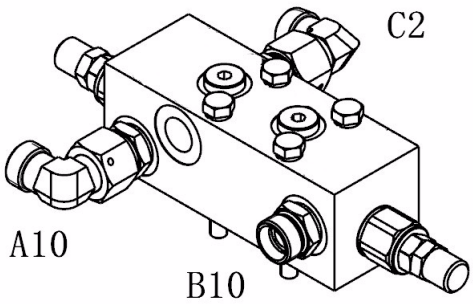
The right blade lift cylinder, located on the right side of the swing seat in the middle of the machine, connects the swing seat and rotating support. As an actuator of the blade lift device, it is mainly used to drive the blade to be lifted and lowered, and adjust the working depth of blade to adapt to the requirements of different operating conditions of grader. This cylinder is also a typical double-acting cylinder. For exploded view of inner structural parts from the cylinder, refer to inner structure of blade lift cylinder.

Right Blade Lift Cylinder Balanced Valve

Structure and Working Principles of Right Blade Lift Cylinder Balanced Valve

The right blade lift cylinder balanced valve is installed to the right blade lift cylinder, this balanced valve has the main function of pressure maintenance by locking the right blade lift cylinder to prevent displacement due to the weight and load of blade itself, and it ensures driving safety and blade working precision. For balanced valve schematic diagram and oil port diagram, refer to balanced valve schematic diagram and oil port diagram.

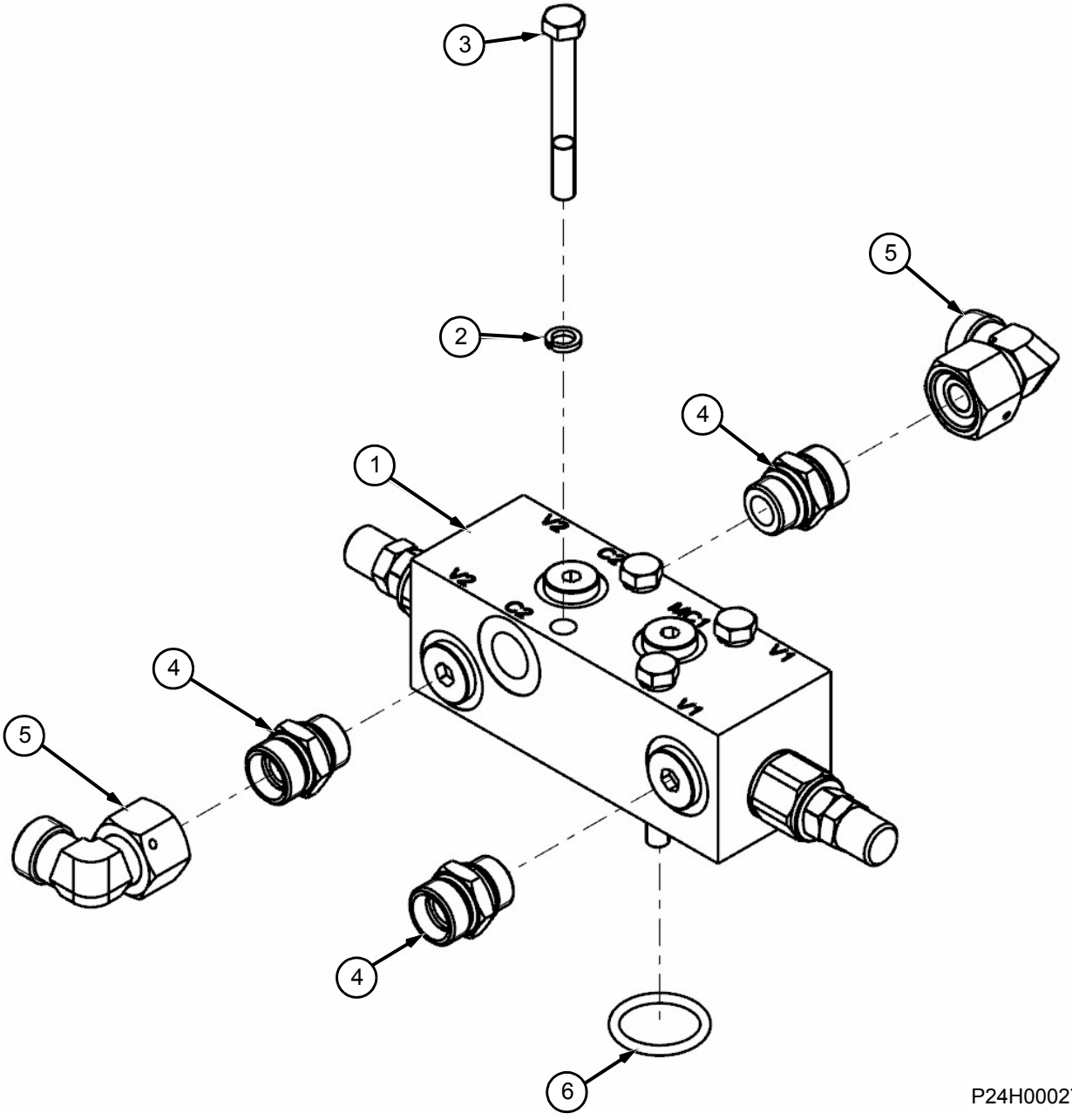
Balanced valve assembly oil port diagram



P24H00026

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Balanced valve assembly structure diagram



P24H00027

1. Balanced valve
2. Washer
3. Bolt
4. Joint
5. Elbow
6. O-ring

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Circle Sideshift Cylinder

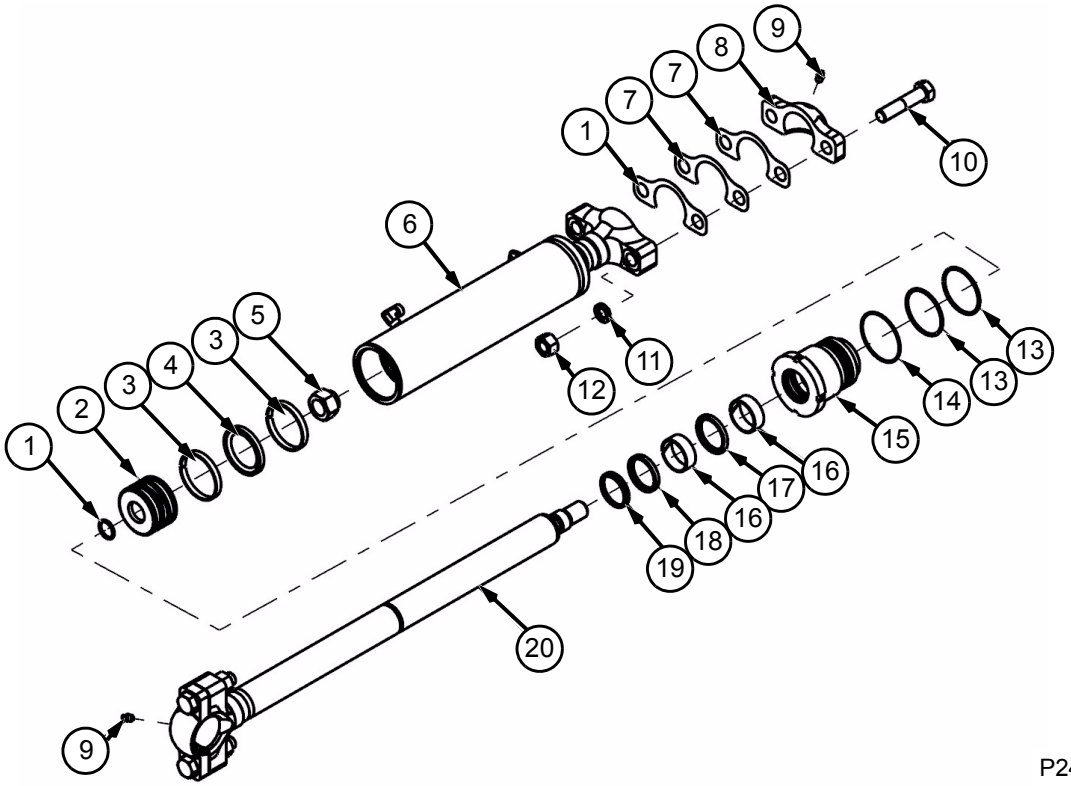
Main Technical Parameters

Item	Parameters	Remarks
Cylinder bore (mm)	80	
Rod diameter (mm)	50	
Stroke (mm)	295	
Minimum mounting distance (mm)	980	

Structure and Working Principles of Circle Sideshift Cylinder

The circle sideshift cylinder, located in the middle of the machine, connects the swing seat and rotating support. As an actuator of the circle sideway device, it is mainly used to drive the circle to make sideway relative to the longitudinal symmetry plane of grader to adapt to the requirements of different operating conditions of grader. This cylinder is also a double-acting cylinder. The following is an exploded view of cylinder internal structure:

Inner structure of circle sideshift cylinder



P24H00028

1. O-ring
2. Piston
3. Support ring
4. Combined seal ring
5. Nylon locknut
6. Cylinder block
7. Adjusting shim
8. Bush
9. Oil cup
10. Bolt
11. Washer
12. Nut
13. O-ring
14. O-ring
15. Cylinder head
16. Support ring
17. Seal
18. Seal ring
19. Dust ring
20. Piston rod

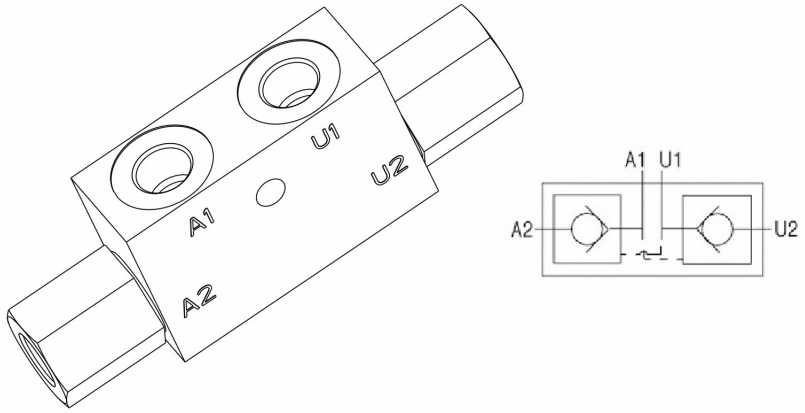
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Circle Sideshift Cylinder Hydraulic Lock

Structure and Working Principles of Circle Sideshift Cylinder Hydraulic Lock

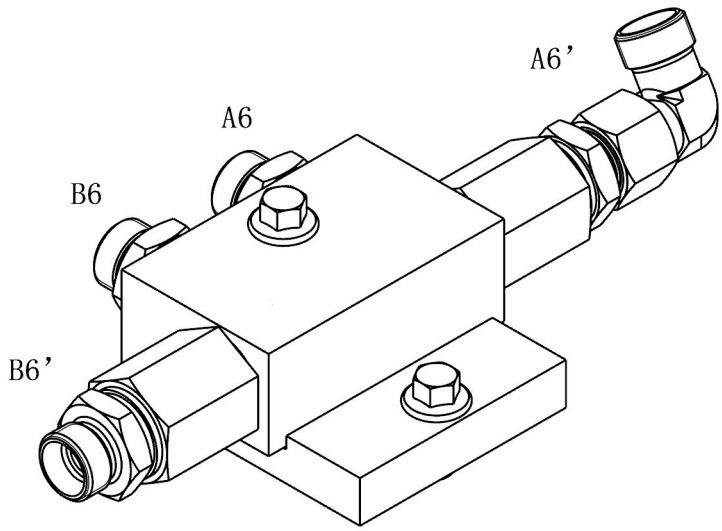
The circle sideshift cylinder hydraulic lock is installed in the front hinge of front frame, this bidirectional hydraulic lock has the main function of pressure maintenance by locking the circle sideshift cylinder to prevent displacement due to the weight and load of blade itself, and it ensures driving safety and blade working precision.

Hydraulic lock schematic diagram and oil port diagram



P24H00029

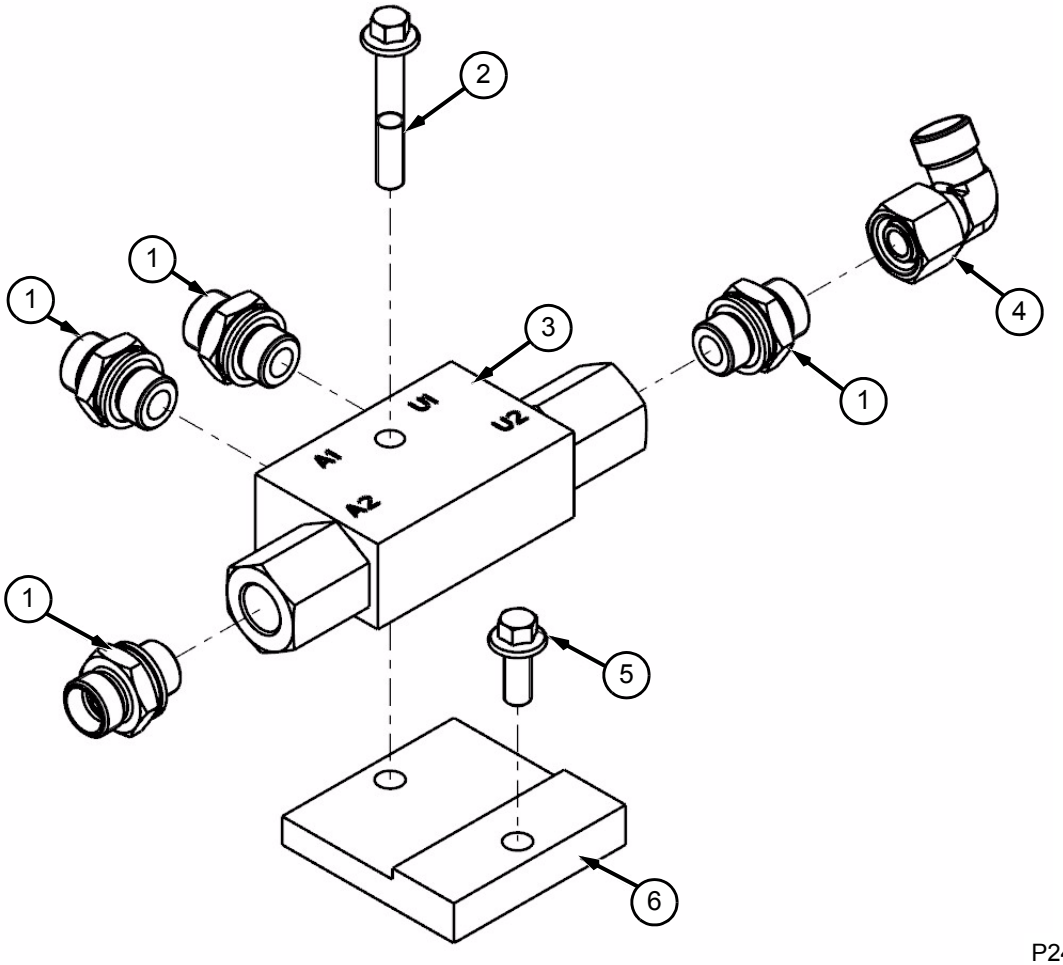
Hydraulic lock assembly oil port diagram



P24H00030

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Structural diagram of hydraulic lock assembly oil port



P24H00031

1. Joint
2. Bolt
3. Hydraulic lock
4. Elbow
5. Bolt
6. Mounting plate

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Front Wheel Tilt Cylinder

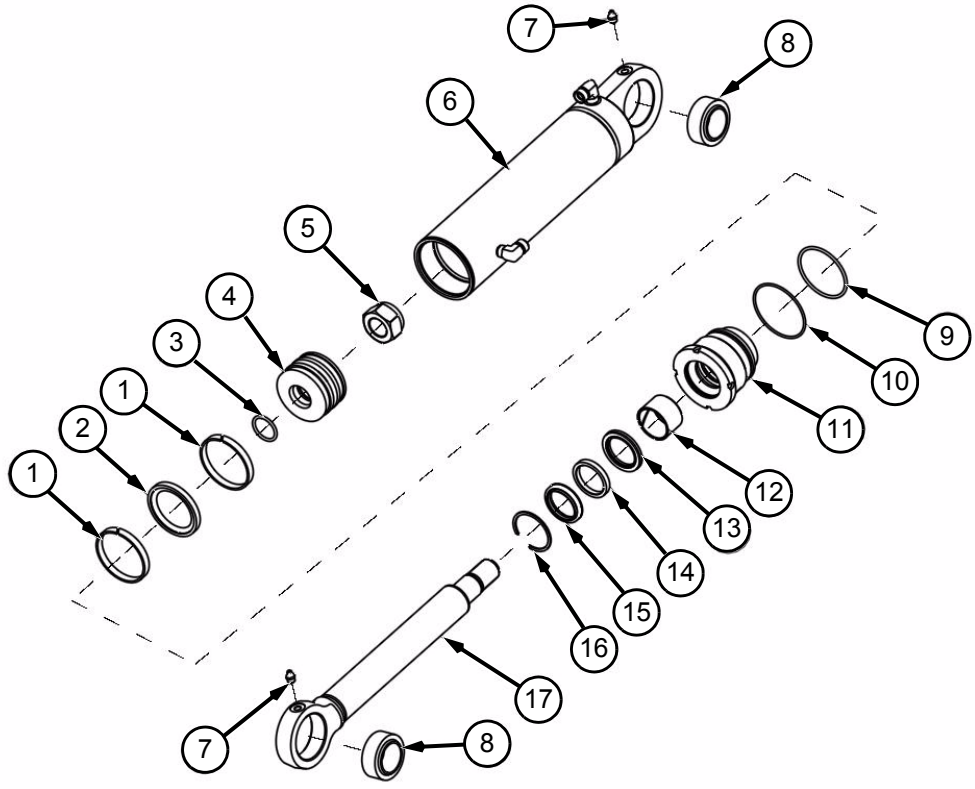
Main Technical Parameters

Item	Parameters	Remarks
Cylinder bore (mm)	80	
Rod diameter (mm)	45	
Stroke (mm)	193	
Minimum mounting distance (mm)	495	

Structure and Working Principle of Front Wheel Tilt Cylinder

The front wheel tilt cylinder, installed to the front axle in the front of the machine, connects the front axle stand and lean-joint. As an actuator of the front wheel tilt device, it is mainly used to drive two front wheels of grader to tilt toward one side simultaneously to adapt to the requirements of different operating conditions of grader. This cylinder is also a double-acting cylinder. The following is an exploded view of cylinder internal structure:

Inner Structure of front wheel tilt cylinder



P24H00032

1. Support ring
2. Combined seal ring
3. O-ring
4. Piston
5. Nylon locknut
6. Cylinder block
7. Oil cup
8. Radial knuckle bearing
9. O-ring
10. O-ring
11. Cylinder head
12. Support ring
13. Seal ring
14. Seal ring
15. Dust ring
16. Retainer
17. Piston rod

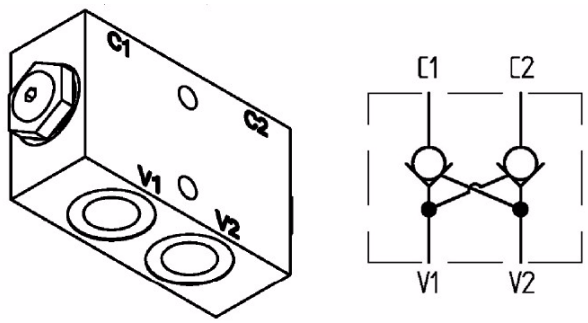
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Front Wheel Tilt Cylinder Hydraulic Lock

Structure and Working Principles of Front Wheel Tilt Cylinder Hydraulic Lock

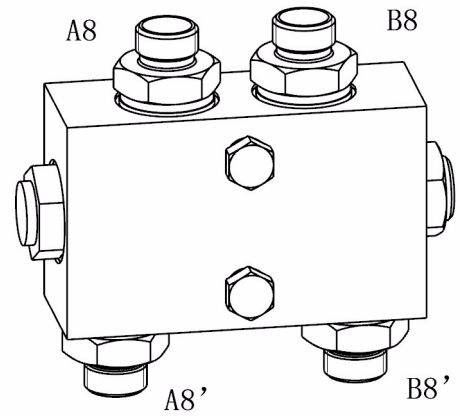
The front wheel tilt hydraulic lock is installed at the inside of the side plate-rh in the front of front frame, this bidirectional hydraulic lock has the main function of pressure maintenance by locking the front wheel tilt cylinder, allowing positions of two front wheels to be locked when they tilt toward any side to adapt to requirements of various operating conditions of grader. The hydraulic principle and oil port diagram of hydraulic lock are as follows:

Hydraulic Lock Schematic Diagram and Oil Port Diagram



P24H00033

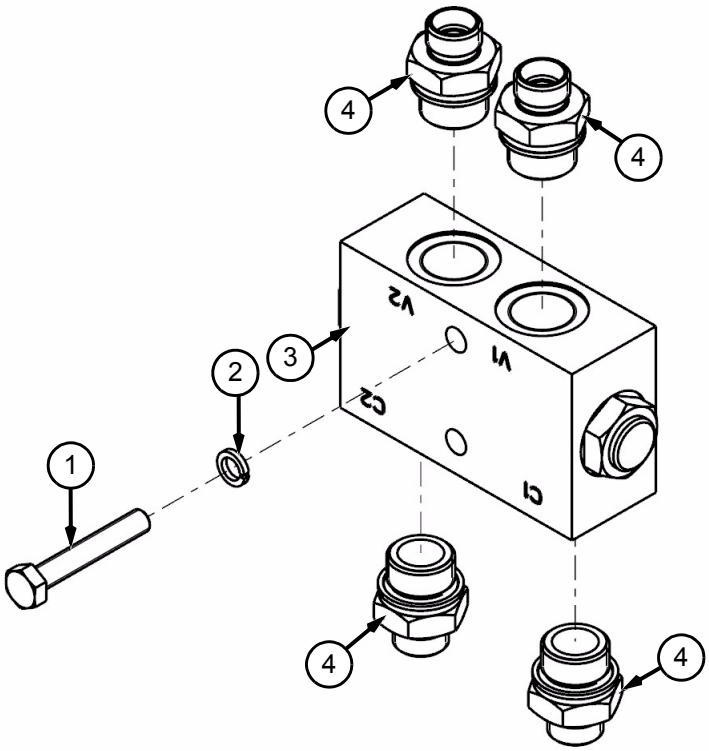
Hydraulic Lock Assembly Oil Port Diagram



P24H00034

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Structural Diagram of Hydraulic Lock Assembly Oil Port



1. Bolt
2. Washer
3. Hydraulic lock
4. Joint

Hitch Steer Cylinder

Main Technical Parameters

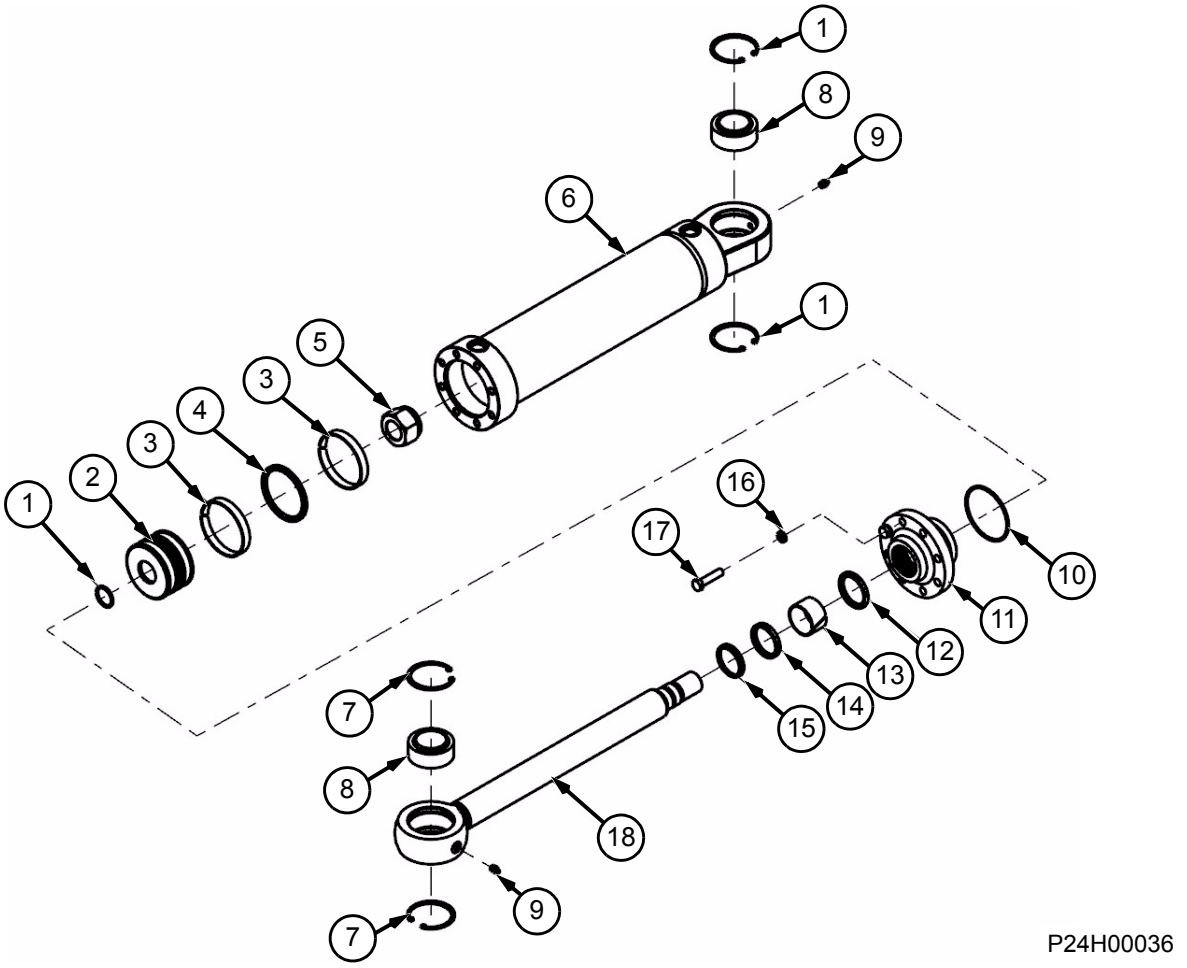
Item	Parameters	Remarks
Cylinder bore (mm)	100	
Rod diameter (mm)	50	
Stroke (mm)	375	
Minimum mounting distance (mm)	737	

Structure and Working Principle of Hitch Steering Cylinder

The hitch steer cylinder, located below the cab in the middle of the machine, connects the front and rear frames of grader. This cylinder is mainly used to drive the hitch steering of front and rear frames of grader to form different intersection angles of the front and rear frames of the machine, reduce the machine turning radius and improve the machine trafficability to adapt to the requirements of different operating conditions of grader. This cylinder is also a double-acting cylinder. The exploded view of cylinder internal structure is as follows:

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Inner Structure of Hitch Steer Cylinder



P24H00036

1. O-ring
2. Piston
3. Support ring
4. Seal ring
5. Nylon locknut
6. Cylinder block
7. Retainer
8. Radial knuckle bearing
9. Oil cup
10. O-ring
11. Cylinder head
12. Seal
13. Support ring
14. Seal ring
15. Dust ring
16. Washer
17. Bolt
18. Piston rod

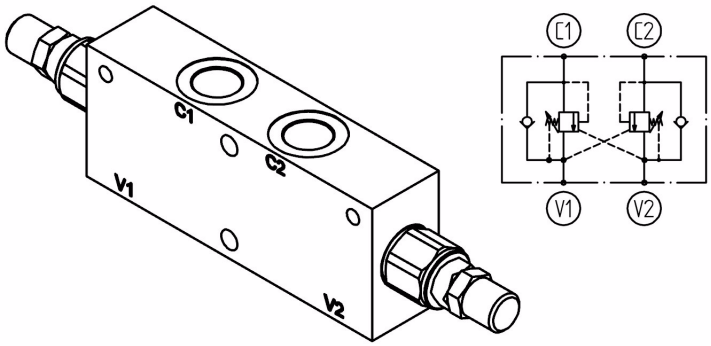
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Hitch Steer Cylinder Balanced Valve

Structure and Working Principle of Hitch Steering Cylinder Balanced Valve

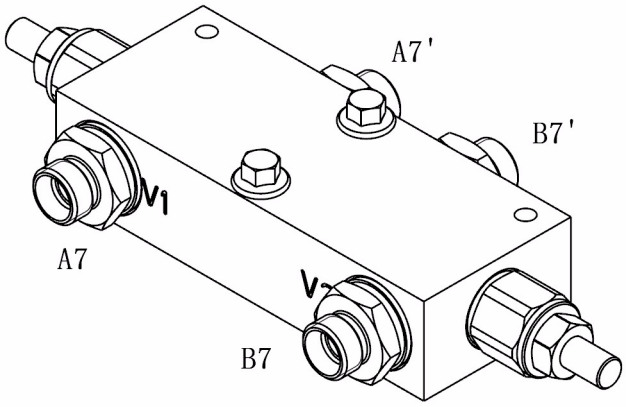
Hitch steer cylinder balanced valve is installed at the inner side from the middle of front frame, this balanced valve has the main function of pressure maintenance by locking the hitch steer cylinder, allowing front and rear frame hitch to be locked toward any position to adapt to requirements of various operating conditions of grader. The hydraulic principle and oil port diagram of balanced valve are as follows:

Balanced Valve Schematic Diagram and Oil Port Diagram



P24H00037

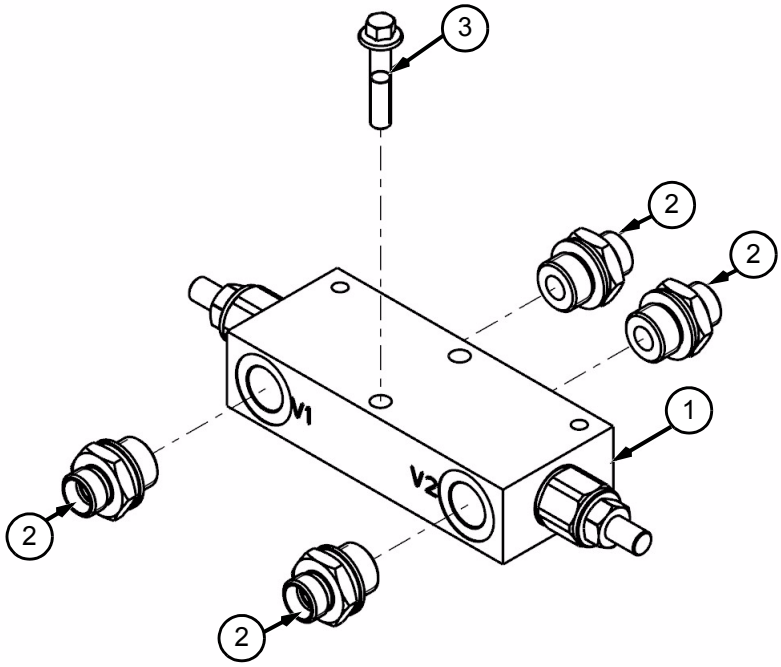
Balanced Valve Assembly Oil Port Diagram



P24H00038

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Balanced Valve Assembly Structure Diagram



P24H00039

1. Balanced valve
2. Joint
3. Bolt

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Blade Pitch Cylinder

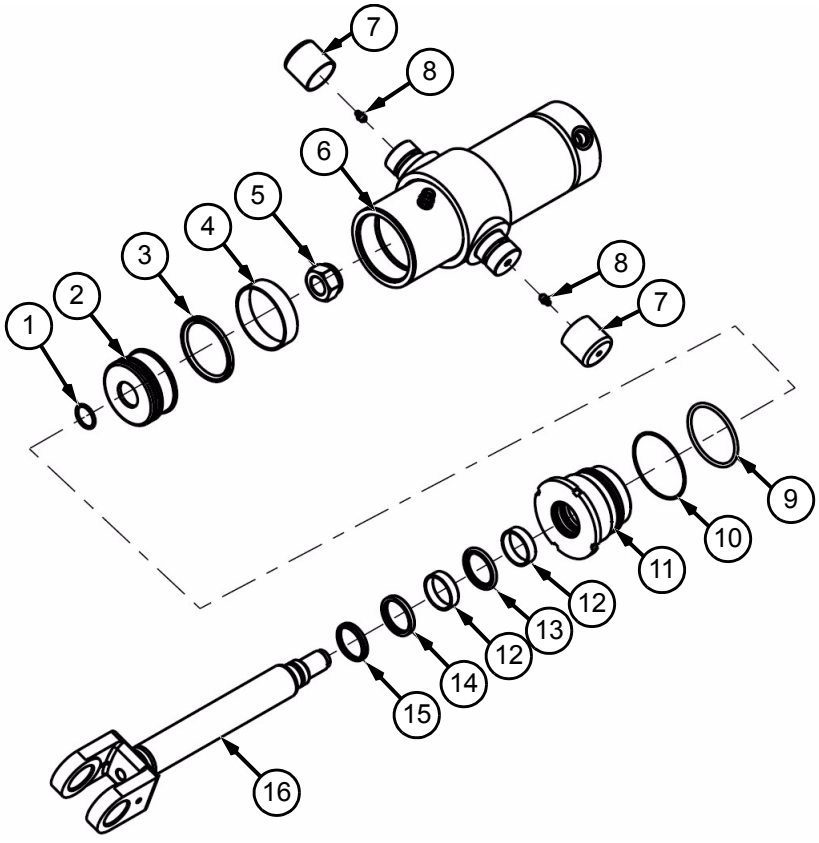
Main Technical Parameters

Item	Parameters	Remarks
Cylinder bore (mm)	100	
Rod diameter (mm)	50	
Stroke (mm)	195	
Minimum mounting distance (mm)	265	

Structure and Working Principle of Blade Pitch Cylinder

The blade pitch cylinder, located in the middle of the blade support in the middle part of the machine, is an actuator of the blade tilting device, mainly used to adjust the blade tilt angle to adapt to the requirements of different operating conditions. This cylinder is also a double-acting cylinder. The exploded view of cylinder internal structure is as follows:

Inner Structure of Blade Pitch Cylinder



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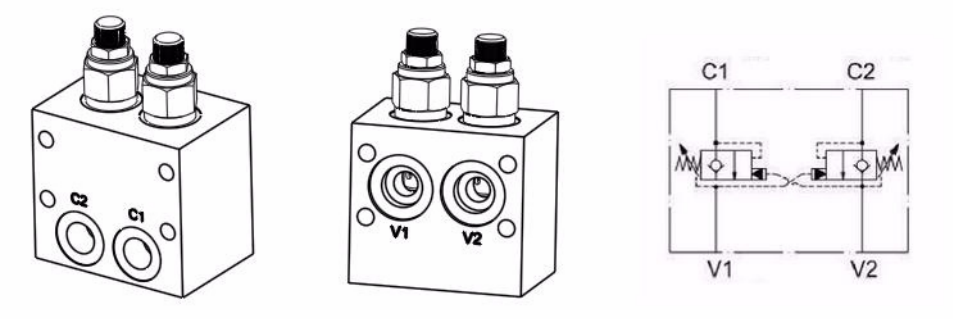
1. O-ring
2. Piston
3. Combined seal ring
4. Support ring
5. Nylon locknut
6. Cylinder block
7. Jacket
8. Oil cup
9. O-ring
10. O-ring
11. Cylinder head
12. Support ring
13. Seal ring
14. Seal ring
15. Dust ring
16. Piston rod

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Blade Pitch Cylinder Balanced Valve

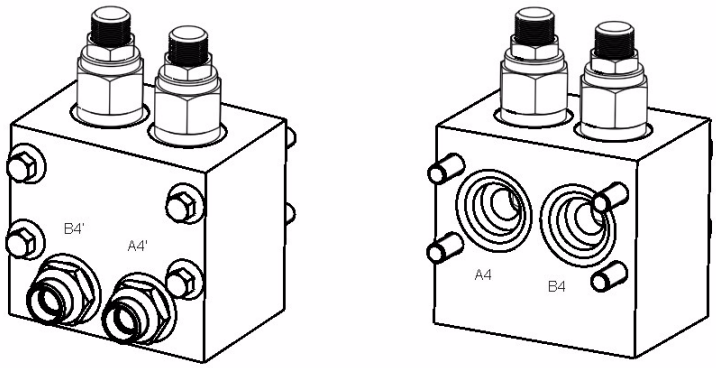
Blade pitch cylinder balanced valve is installed on the swivel joint of the work implement, this balanced valve has the main function of pressure maintenance by locking the blade pitch cylinder, allowing the blade body and blade support to be locked in any angle position to adapt to requirements of various operating conditions of grader. The hydraulic principle and oil port diagram of balanced valve are as follows:

Balanced Valve Schematic Diagram and Oil Port Diagram



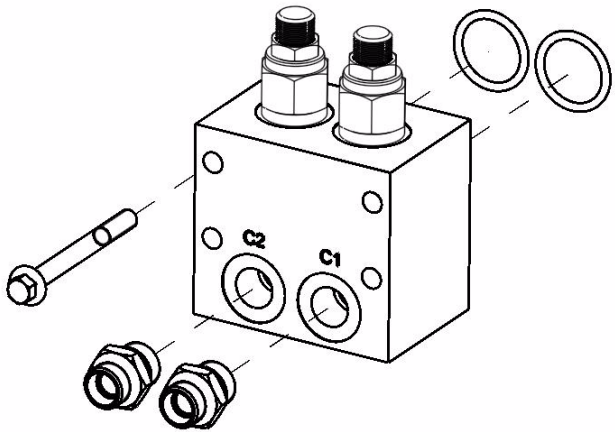
P24H00041

Balanced Valve Assembly Oil Port Diagram



P24H00042

Balanced Valve Assembly Structure Diagram



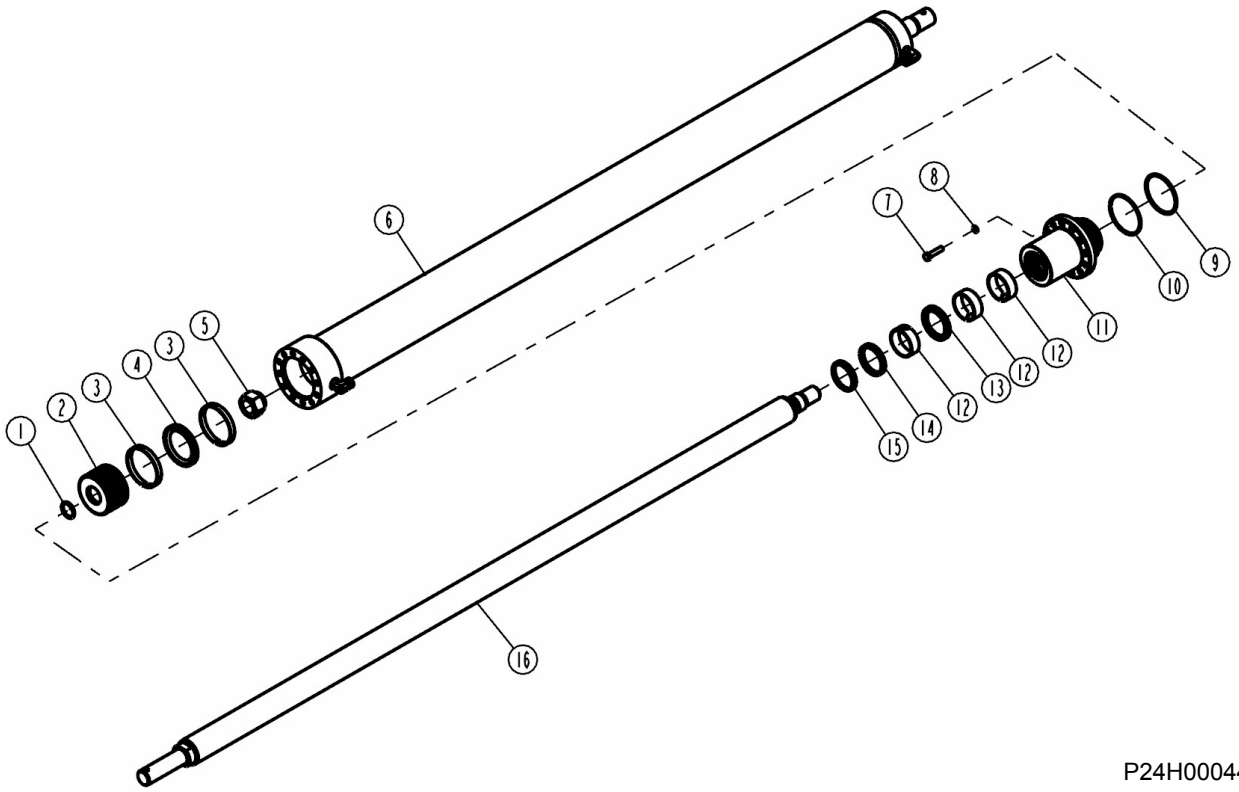
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Blade Lead-out Cylinder

The blade lead-out cylinder, located on the blade support in the middle of the machine, is an actuator of the blade tilting device, mainly used to drive the blade to make lateral movement relative to the circle along the blade axis to adapt to the requirements of different operating conditions. This cylinder is also a typical double-acting cylinder. The following is an exploded view of cylinder internal structure:

Inner Structure of Blade Lead-out Cylinder



P24H00044

1. O-ring
2. Piston
3. Support ring
4. Combined seal ring
5. Nylon locknut
6. Cylinder block
7. Bolt
8. Washer
9. O-ring
10. Retainer
11. Guide sleeve
12. Support ring
13. D seal
14. Seal ring
15. Dust ring
16. Piston rod

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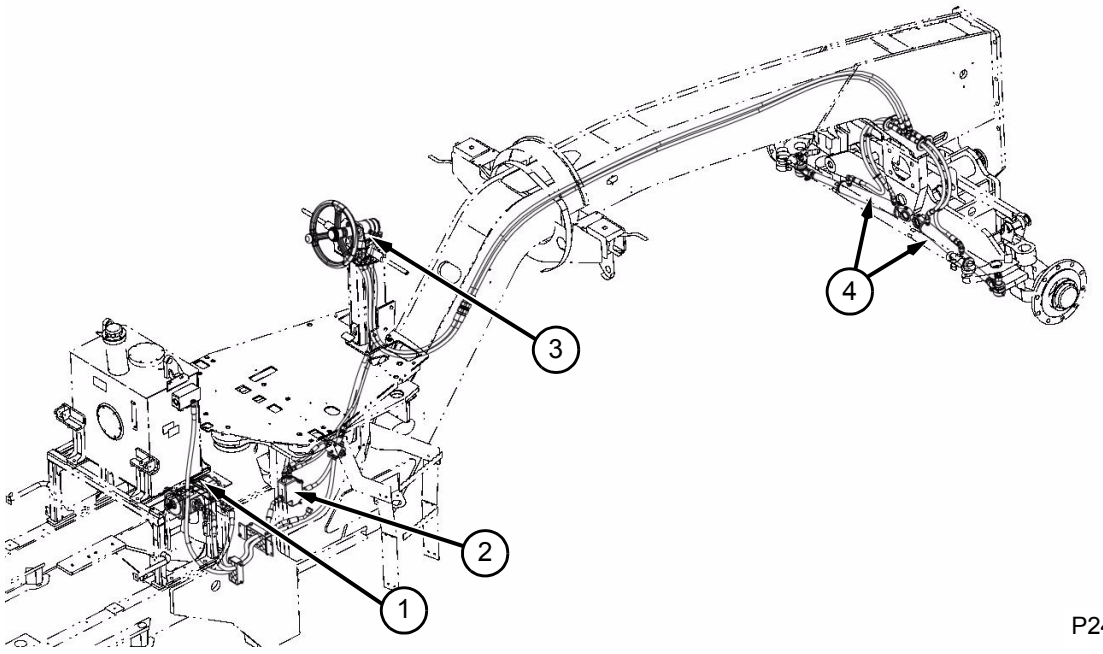
Steering Hydraulic System

A: Overview - components and position

Steering hydraulic system is used to control the vehicle traveling direction, which is mainly composed of gear pump, priority valve, metering pump, two steering cylinders and other pipeline accessories. The gear pump used for the system is shared with the work hydraulic system, and the oil required by the system is sucked out and conveyed from the hydraulic oil tank by the working pump.
This system can realize steering priority function.
Steering priority refers that oil from the gear pump will be supplied to steering system with priority and the surplus oil will be supplied to the work hydraulic system, which is realized by the priority valve. Priority valve adjusts the flow of oil supply to steering system through sensing the load pressure of the steering system. The oil flow supplied to the steering system will adapt to the steering load and velocity. Built-in safety valve of the priority valve will limit oil pressure of the steering system to 16.7MPa to protect the steering system. The steering gear used in the system is of a cycloidal rotary valve type load sensitive type, internally installed with two relief valves and two check valves, and it can protect the steering hydraulic system against damage by external pressure impact; when the external force makes the steering cylinder generate pressure impact and the steering system is under overpressure, for example, overpressure due to bumpy road, the relief valves and check valves are opened so that the oil flows from the high pressure side of the steering system into the low pressure side, so as to protecting the steering cylinder. The steering cylinder, a common double-acting single piston rod cylinder, is the final actuator of steering. The return oil filter filters the oil of steering system, it is internally integrated with a filter and a bypass check valve. During normal operation, return oil in the system flows back to the hydraulic oil tank via the filter; when the filter is clogged, the check valve is open, and the oil flows back to the tank via the bypass oil circuit at the check valve.

Layout of CLG4180D-T3 steering hydraulic system component is as follows:

Layout of steering hydraulic system component



P24H00045

1. Gear pump
2. Priority valve
3. Metering pump
4. Steering cylinder

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B: Overview - technical parameters of steering system

Main technical parameters of steering hydraulic system	
Maximum system pressure	16.7MPa
System working pressure	16.7MPa
Maximum operating back pressure	2.1MPa
Maximum operating temperature	93°C
Allowable spread with system	28°C
Power steering torque (0.63MPa back pressure)	2.8~4.0 N.m
Maximum allowable manual steering torque	136 N.m

Gear Pump

Main Technical Parameters

Gear pump used in the system is shared with working hydraulic system; for the technical parameters of the gear pump, refer to the main technical parameters of the working pump.

Structure and Working Principles of Quantitative Gear Pump

Please refer to the structure and operating principle of working pump

Metering Pump

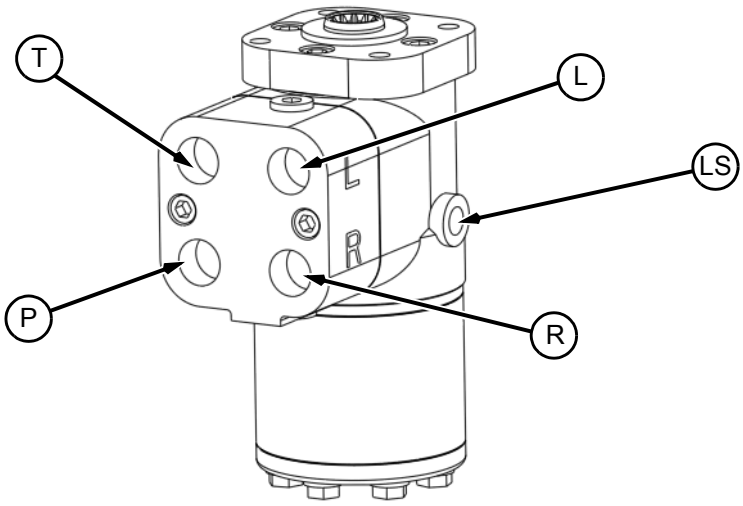
Main Technical Parameters

Item	Parameters	Remarks
Rated displacement	200ml/r	
Pressure of the system	16.7MPa	
Max back pressure	2.1MPa	
Pressure of overload valve	20 Mpa	
Max. system temperature	93°C	
Maximum temperature difference	28°C	
Steering moment	2.8-4.0N.m	
Contamination degree of recommended hydraulic oil	ISO18/13	
Operating fluid	Anti-wear hydraulic oil	HM46/HV46

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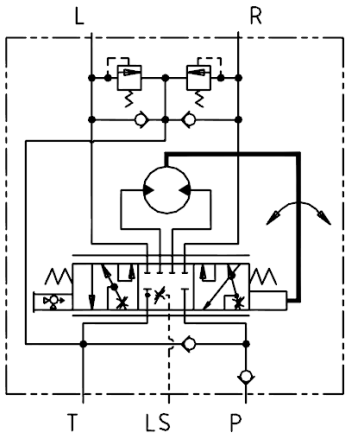
Structure and Working Principle of Components

Outline structure diagram of metering pump



P24H00046

Schematic of metering pump



P24H00047

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Working principle:

Metering pump is used to control the steering cylinder to realize left-right steering.

1) When the steering wheel is not turned, metering pump is in neutral position, LS port is connected with T port, and L and R ports are cut off.
2) When turning steering wheel to right (left), pressure oil of P port will be connected with R (L) port to control the action of steering cylinder to realize right (left) steering.
3) The pressure oil of LS port is fed back to LS port of priority valve.
   a. For power steering, pressure oil flows into stator and rotor pair in certain proportion (flow amplifying function) through spool and valve bushing pair to push rotor to rotate with steering wheel and oil from steering pump flows into left cavity or right cavity of steering cylinder to realize steering.
   b. During manual steering, the stator and rotor pair of metering pump plays the role of oil pump, presses oil in one cavity of the steering cylinder into the other, and the cylinder piston rod propels the wheels to realize steering.

Installation and Troubleshooting of Metering Pump

When installing, make sure that metering pump is concentric with steering column and there shall be clearance in axial direction to avoid jacking of spool. Check whether it is turned freely after installation.

Fault and troubleshooting:

Faults	Symptom	Cause	Troubleshooting
Oil leakage	Oil leakage in joint surface of parts	Dirt in joint surface	Check the joint surface and clean it up
	Oil leakage at front cover	Shaft seal ring is damaged	Replace the seal ring
	Bolt (plug) leaks	Bolt (plug) is tightened with insufficient torque	Tighten the bolt (plug)
Heavy steering	Steering wheel is heavy when turned quickly	Oil supply is insufficient	Check the oil pump and oil supply line
	Steering wheel is light when turned slowly	Main spool of priority valve is stuck	Check whether the main spool of priority valve is freely
	Cylinder crawling	Air in steering system	Bleed air in the system and check oil pump inlet for air leakage
	Foam in oil		
	Irregular noise		
	Heavy steering and no action of steering cylinder	Manual steering check valve failure	Check whether the steel ball exists and whether it is chocked by impurities
	No-load steering is light, heavy load steering is heavy	There is the leakage for safety valve or safety valve spring fails	Clean and check the safety valve in priority valve
	Heavy steering	High hydraulic oil viscosity	

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Faults	Symptom	Cause	Troubleshooting
Steering Steering failure	No steering back to neutral position	Leaf spring failure	Replace leaf spring
	Pressure oscillation is significantly increased, even no steering	Pull pin bend or broken Rupture at linkage shaft pin slot	Replace the pull pin or linkage shaft
	When you turn the steering wheel, it immediately rotates in the opposite direction or swings from side to side	Incorrect mutual alignment of linkage shaft and rotor	Reassembly
	No turning	Priority valve is stuck, no oil at CF port and LS port is blocked	
Steering wheel does not auto return to the neutral position	When the pressure drop in the neutral position increases and steering wheel stops turning, the metering pump is not unloaded (vehicle off tracking occurs)	Steering column axially abuts the spool to the bottom	Troubleshooting in accordance with specific conditions
		High resistance of steering column	
		Leaf spring is broken	
		The installation of steering column is not concentric to that of spool	
No steering to the extreme position	No steering of steering cylinder to the extreme position, steering is heavy as reflected	Low pressure of safety valve	Increase the pressure of safety valve properly
No manual steering	During power steering, the cylinder piston moves to the extreme position, the driver does not have obvious feel of end point; during manual steering, the steering wheel rotates but the cylinder is still	Large radial or axial clearance of stator and rotor pair	Replace the stator and rotor pair

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Priority Valve

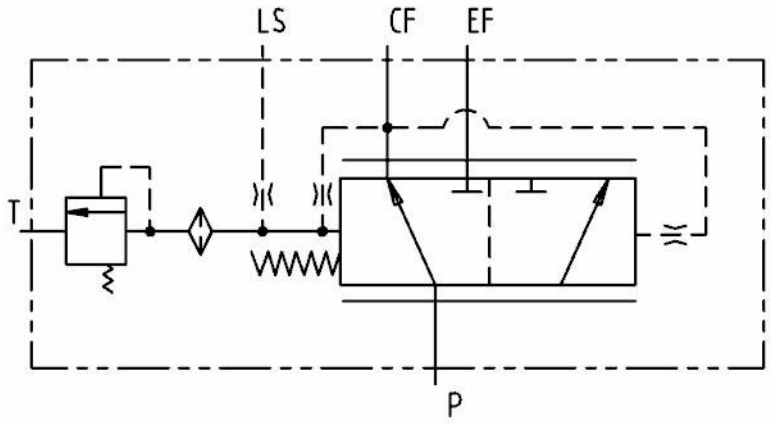
Main Technical Parameters

Item	Parameters	Service conditions	Remarks
Flux	60L/min		
Pressure of safety valve	16.7MPa		
Operating fluid	Anti-wear hydraulic oil	HM46/HV46	

Structure and Working Principle of Components

Priority valve is installed inside the front frame close to the hinge joint just below the cab, and the hydraulic oil from steering pump (sharing with the working pump) will enter the steering gear by passing through the priority valve, and then enter into the steering cylinder, which makes action to realize left and right steering. The priority valve realizes the steering priority function.

Schematic of priority valve

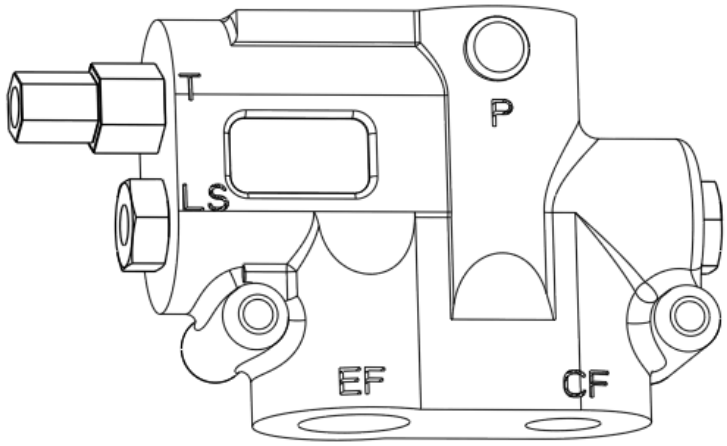


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Working principle: during single steering, P port of metering pump communicates with L (or R) port, the channel from LS to T is closed and the channel from LS to L (or R) is open. LS oil pressure acts on left side of priority valve spool so that the spool moves rightwards, the opening of CF channel increases and the opening of EF channel decreases. This is steering priority.

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Outline diagram of priority valve



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Steering Cylinder

Main Technical Parameters

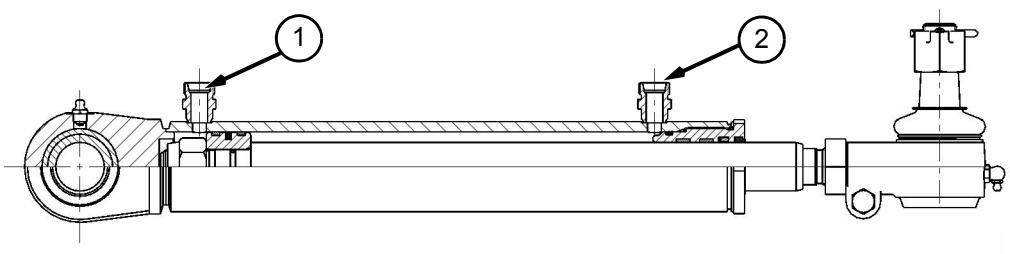
Item	Parameters	Remarks
Cylinder bore (mm)	50	
Rod diameter (mm)	35	
Stroke (mm)	290	
Minimum mounting distance (mm)	620	

Structure and Working Principle of Steering Cylinder

Steering cylinder, which is installed at the articulated joint of front axle knuckle and frame, is the actuator of steering hydraulic system. The left-right steering of the front wheel is realized by pushing left-right steering cylinder piston rod.

Structure of steering cylinder

Outline structure diagram of steering cylinder



P24H00050

1. Big cavity oil port
2. Small cavity oil port

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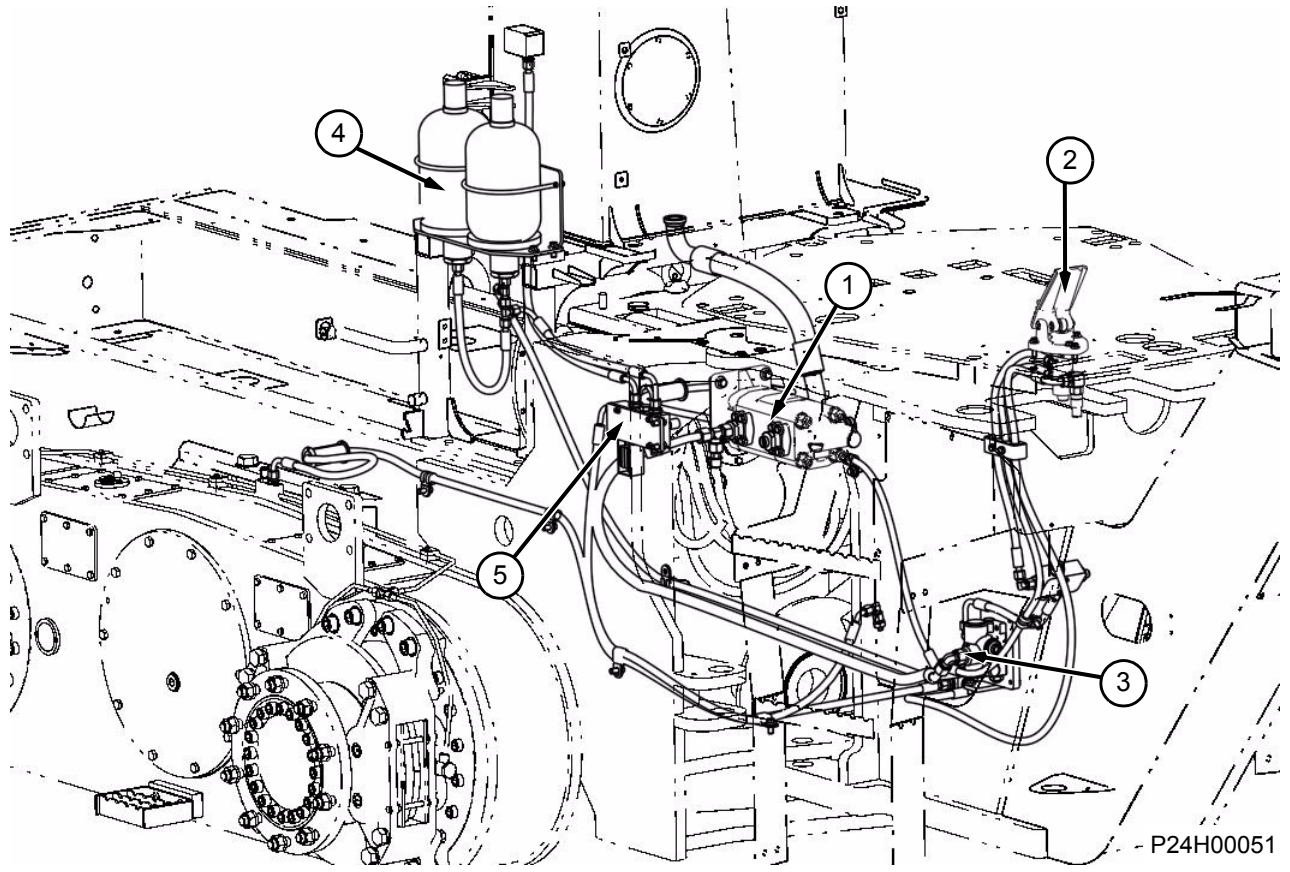
Brake System

A: Overview - components and position

Brake system consists of service brake system, emergency & parking brake system. Service brake system is used in regular speed control and parking in general traveling. Emergency & parking brake system is used for brake after parking, or emergency brake in case of service brake system failure.

Service brake system is mainly composed of gear pump, charge valve, brake valve, accumulator, joint and lines. Emergency braking & parking brake system are composed of parking brake valve, accumulator, joint and lines.

Brake system component layout



1. Gear pump
2. Brake valve
3. Charge valve
4. Accumulator
5. Parking brake valve

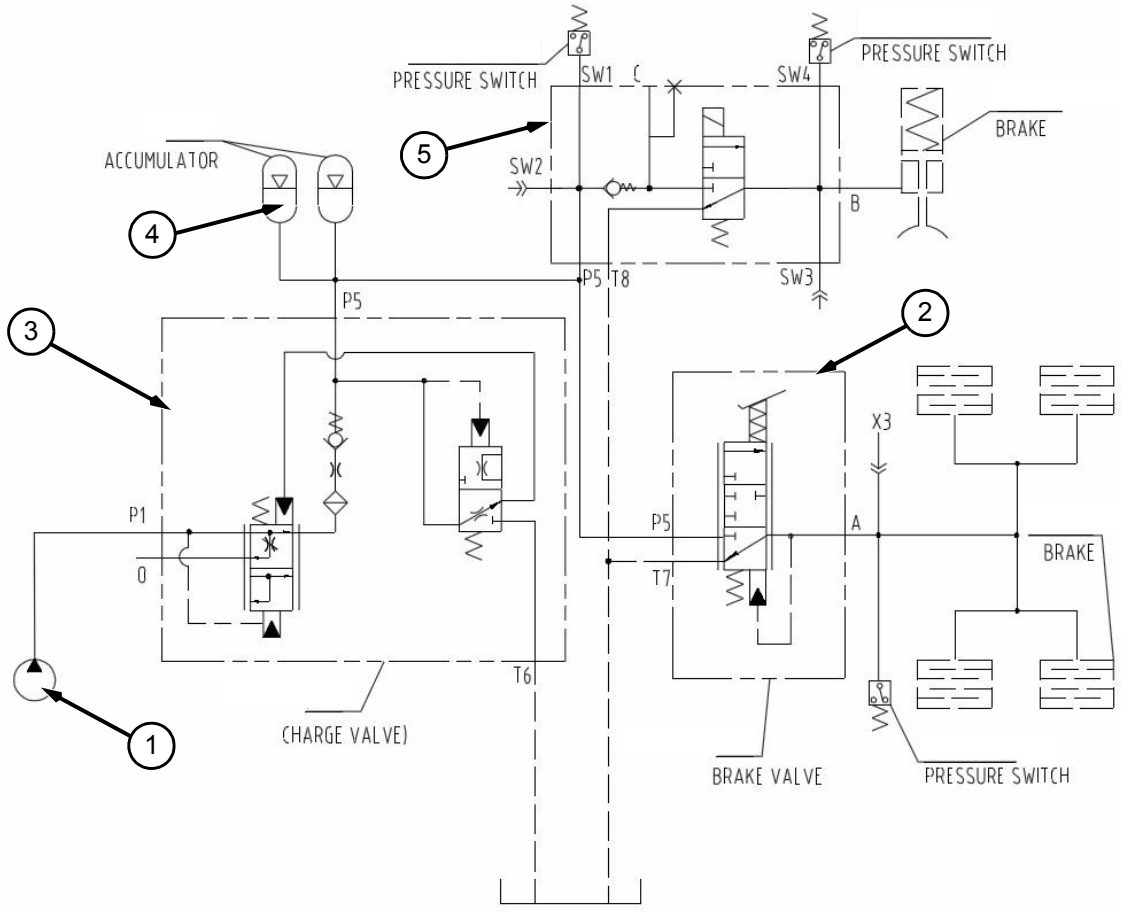
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B: Overview - technical parameters of brake system

Item	Parameters
Service brake system	Full hydraulic brake system
Parking brake system	Electronic-control hydraulic parking brake
Charging pressure of accumulator	12.8~15.9MPa
Service brake pressure	10.3±0.3MPa

C: Overview - working principle diagram of the brake system

Schematic Diagram of Brake System



P24H00052

⚠WARNING

Unless in emergency, do not apply parking & emergency brake when the machine is traveling. Applying parking & emergency brake in normal operation will cause serious damage to the brake and power train system.

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Gear Pump

Main Technical Parameters

Gear pump used in the system is shared with working hydraulic system; for the technical parameters of the gear pump, refer to the main technical parameters of the working pump

Structure and Working Principles of Quantitative Gear Pump

Please refer to the structure and operating principle of working pump

Brake Valve

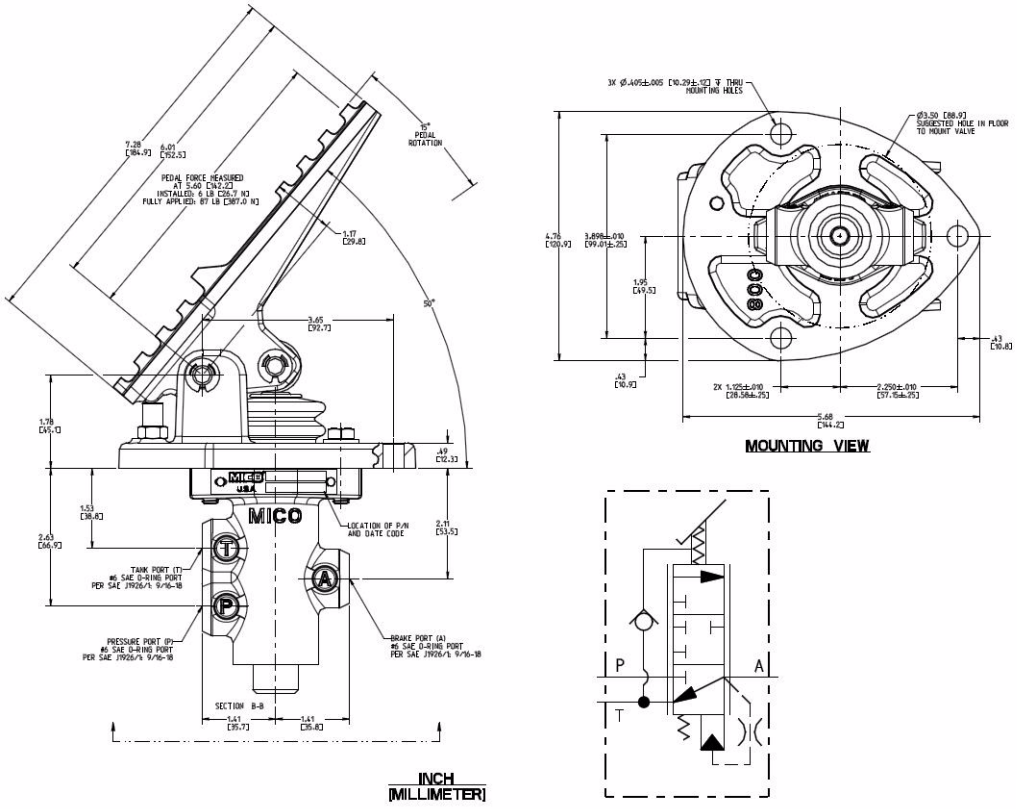
Main Technical Parameters

Brake pressure	10.3±0.3MPa
Temperature range	-40°C—+107°C

Structure and Working Principle of Brake Valve

Brake valve is located at front-right side of the platform inside the cab, mainly providing the output of brake power for the complete machine. Outline structure and schematic are as shown in the figure below:

Structure of brake valve



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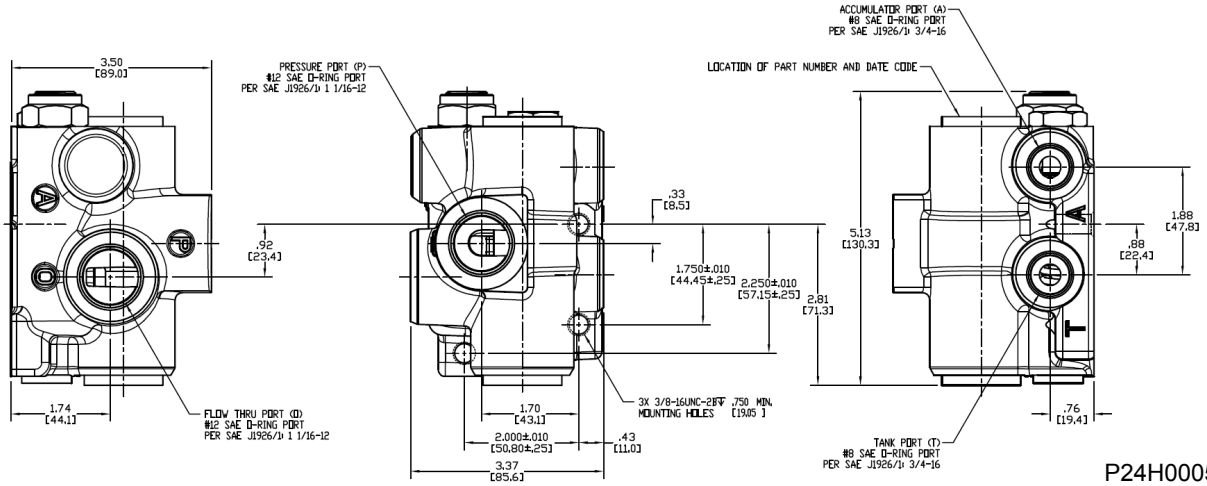
Charge Valve

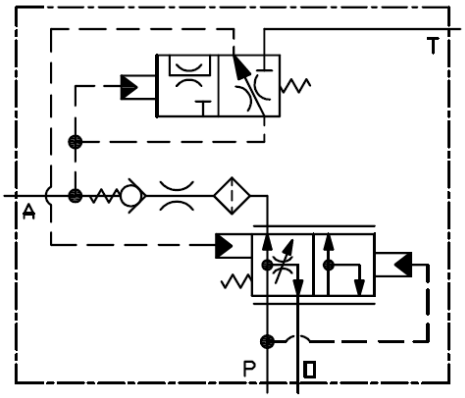
Main Technical Parameters

Connect pressure of charge valve	12.8±0.3MPa
Cut-off pressure of charge valve	15.9±0.3MPa
Charging rate	10.2±1.9LPM

Structure and working principle of the charge valve

Charge valve is located at inner cavity of the front frame on the bottom of the cab, of which main function is to charge the fluid for the accumulator of the brake system. Outline and schematic are as follows:





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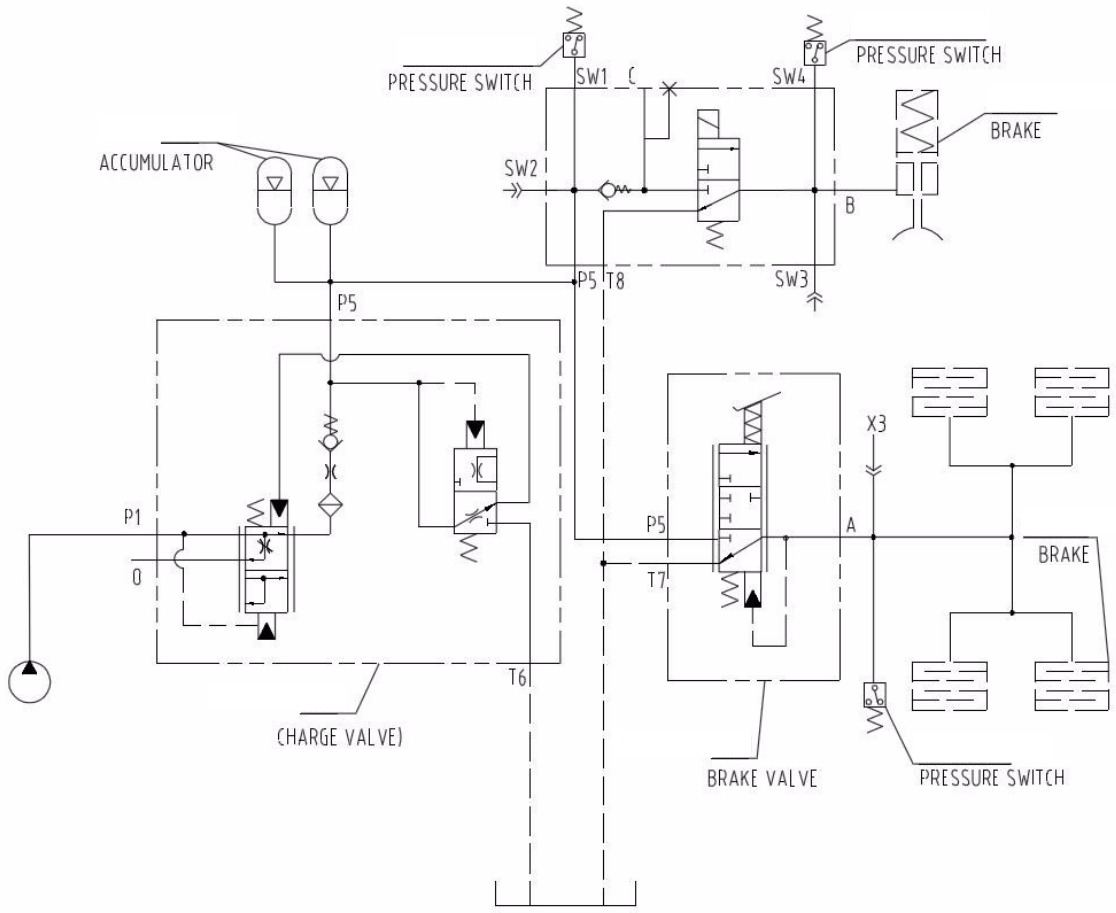
Accumulator

Main Technical Parameters

Capacity of the accumulator	1.6Lx2
Nitrogen pre-charging pressure	9.2MPa

Emergency & Parking Brake System

Structural Composition and Working Principles of Emergency & Parking Brake System



P24H00056

Working principles of emergency & parking brake system: the operator pulls up the button of emergency & parking brake on the control box, emergency & parking brake valves lose the power, the parking brake is locked, the power of the transmission is cut off;

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Maintenance of Brake System

1. Frequently check the brake system for leaks, and all kinds of connectors, connections are secured without loosen.
2. Regularly check whether the nitrogen pressure of the accumulator is normal.

Check the Performance of Service Brake

⚠CAUTION

Before checking the performance of service brake, inspect the performance of parking brake so as to guarantee parking safety and effective emergency brake.

3. Adjust the tire pressure of the forklift to specified value, put away the blade, and make sure that the forklift has good performance of service brake.
4. Start the engine, and drive the machine toward and on the 25% slope (14°2'), and the road surface shall be flat and dry.
5. Depress the service brake pedal, stop the machine and place the shift control lever to neutral position, and engine won't cut-out.
6. Keep the service brake state and check whether machine will move.

⚠CAUTION

If the machine moves during inspection, it may cause personal injury.

Exhaust of Brake System

Gas in the hydraulic lines of service brake system may influence the braking performance. Therefore, system exhaust shall be performed after repair service brake system. Specific operations are as follows:

1. Clear away the sediment incrustation at hydraulic oil lines, deflating valve of brake system.
2. Start the engine, after the accumulator is filled up, shu down the machine.
3. Release the deflating valve of rear axle for exhausting, and depress and hold the brake pedal after that pedal has been pressed for several times, until fluid column without air bubbles has discharged.
4. Release the brake pedal after tightened the deflating valve.

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Check for the Performance of Parking Brake

⚠CAUTION

The performance of parking brake shall be checked frequently so as to guarantee the parking safety and effective emergency brake.

1. Adjust the tire pressure of machine to the specified value, and put away the blade. And confirm the machine have the performance of good service brake.
2. Start the engine, and drive the machine toward and on the 15% slope (8°32'), and the road surface shall be flat and dry.
3. Depress the service brake pedal, stop the machine and place the shift control lever to neutral position, and engine won't cut-out.
4. Pull up the parking brake button, and slowly release the service brake pedal and then check whether the machine moves.

⚠CAUTION

Vehicle movement during the inspection may cause personal injury or death.

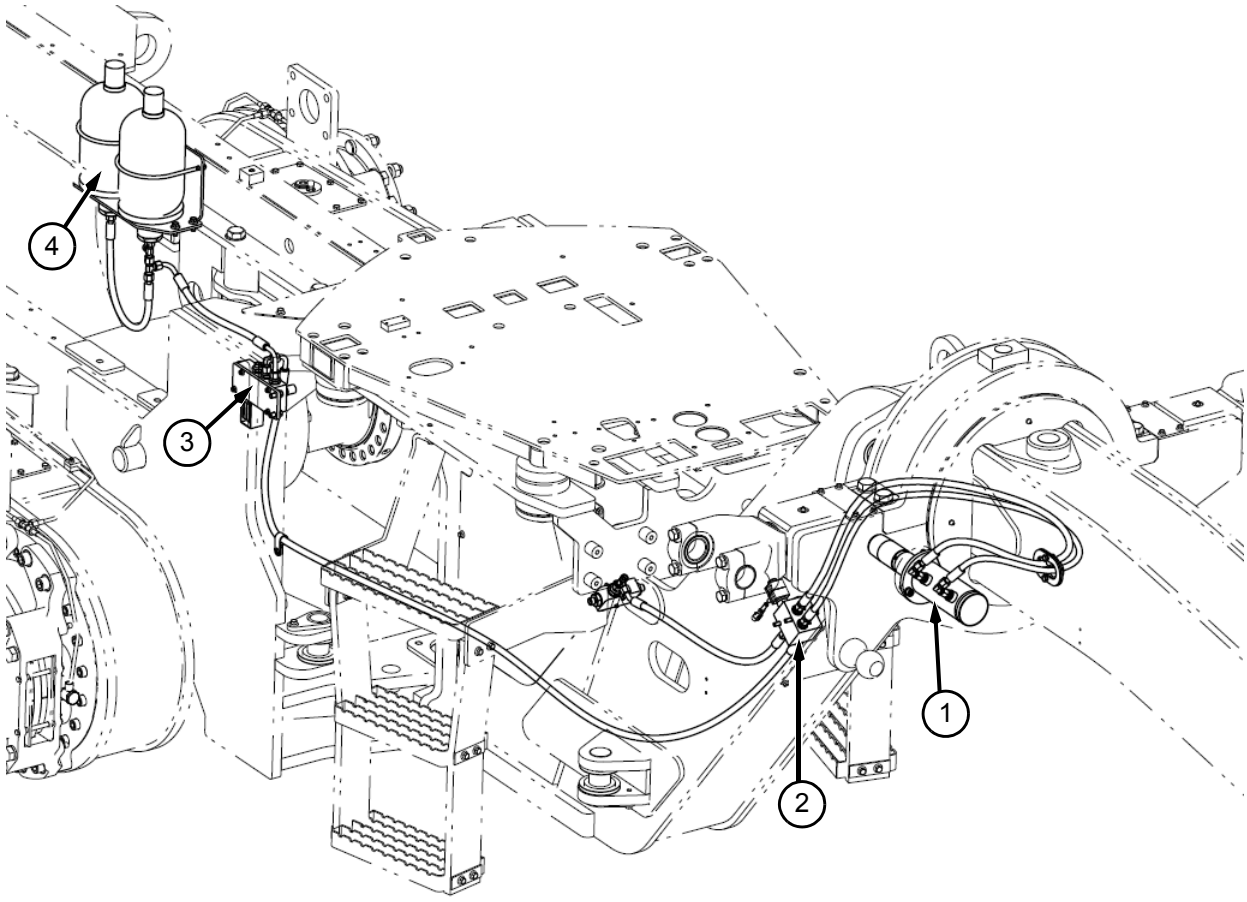
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Latch Hydraulic System

A: Overview - components and position

Latch hydraulic system is used for that work implement swings, the function of the Track frame is removed. Mainly including latch cylinder, solenoid directional valve and lines, the power source comes from the accumulator of the brake system.

Layout of latch hydraulic system elements



P24H00058

1. Latch cylinder
2. Solenoid directional valve
3. Parking brake valve
4. Accumulator

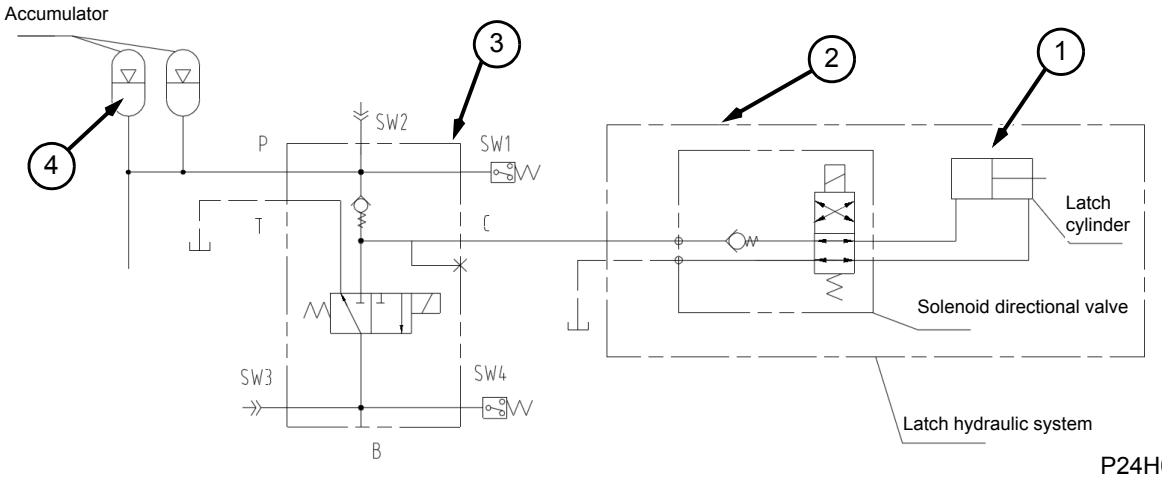
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B: Overview - technical parameters of latch hydraulic system

Item	Parameters
Working pressure of the hydraulic system	12.8~15.9MPa
Charging pressure of accumulator	12.8~15.9MPa

C: Overview - working principle diagram of the latch hydraulic system

Schematic Diagram of Latch Hydraulic System



1. Latch cylinder
2. Solenoid directional valve
3. Parking brake valve
4. Accumulator

Latch Cylinder

Main Technical Parameters

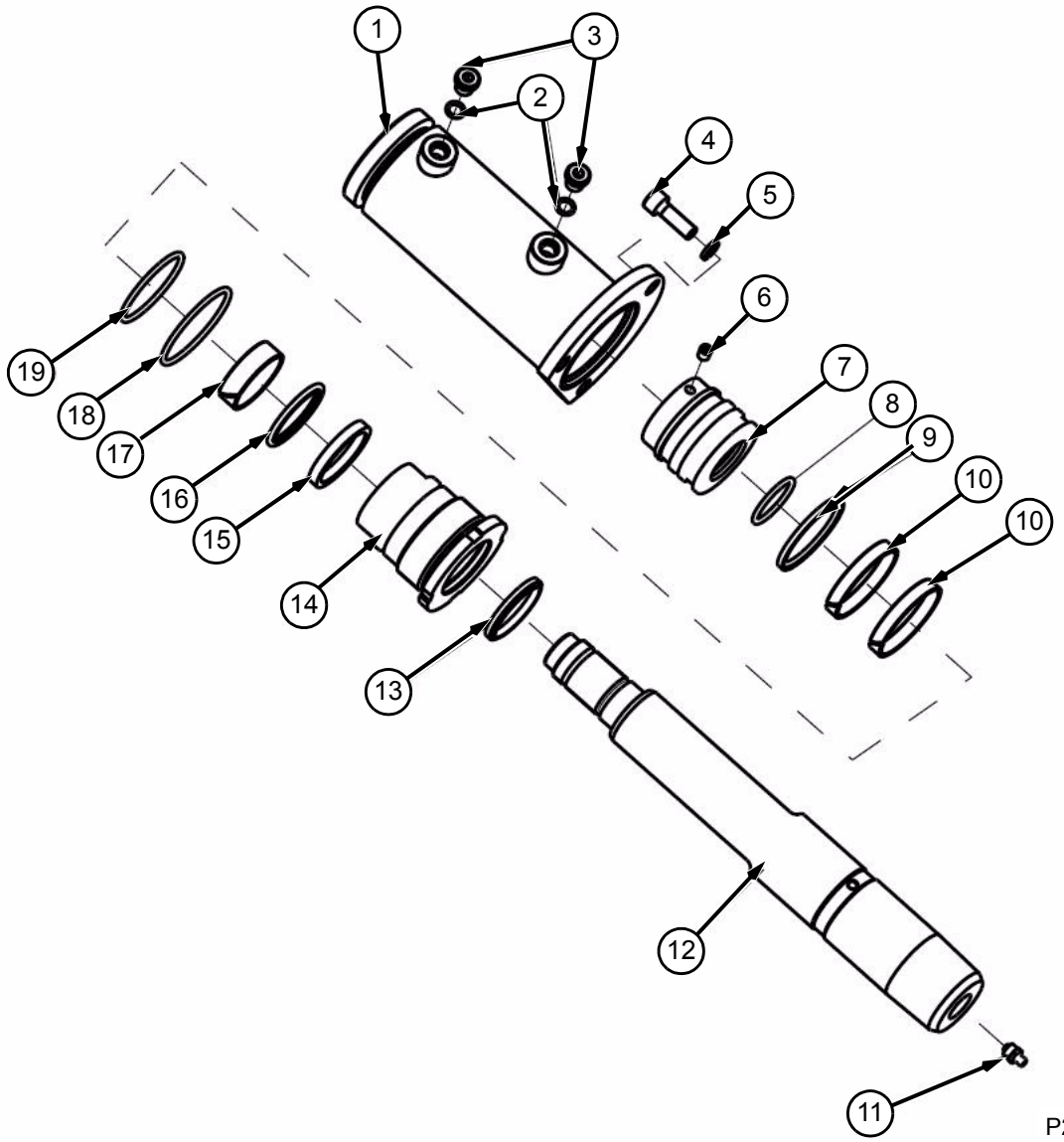
Item	Parameters	Remarks
Cylinder bore (mm)	63	
Rod diameter (mm)	45	
Stroke (mm)	47	

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Structure and Working Principles of Latch Cylinder

The latch cylinder, located on the right side of the swing seat from the front frame of the machine, it is used for the fixation and adjustment to adapt to the requirements of different operating conditions of grader. This cylinder is a double-acting cylinder. The following is an exploded view of cylinder internal structure:

Structure drawing of latch cylinder



P24H00059

1. Cylinder block
2. O-ring
3. Plug
4. Screw
5. Washer
6. Screw
7. Piston
8. O-ring
9. Seal ring
10. Support ring
11. Oil cup
12. Rod
13. Dust ring
14. Cylinder head
15. Y-seal
16. Seal
17. Support ring
18. O-ring
19. O-ring

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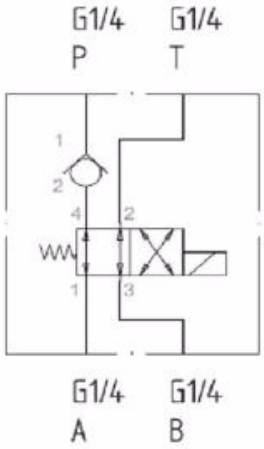
Solenoid Directional Valve

Main Parameters

Item	Parameters	Remarks
Rated flow	20L/min	
Rated pressure	21MPa	

Working Principle of Solenoid Directional Valve

Solenoid directional valve is installed in the abdominal cavity of the front frame, of which function is to control the actions of the extension and retraction for the latch cylinder and unlock the swing seat. Its principle is shown in the figure below:



P24H00060

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Test and Adjustment

Steering Hydraulic System Test

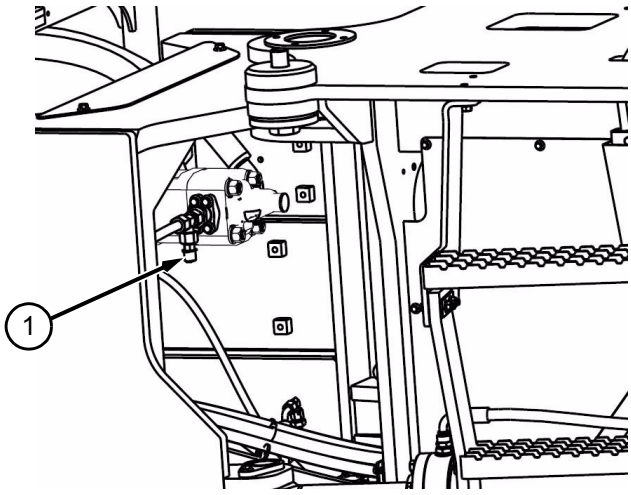
CLG4180D_T3 grader steering hydraulic system has set fast-connection pressure measuring connector at the oil outlet of gear pump for the convenience of detecting hydraulic system pressure and understanding the detection and maintenance of the steering condition and fault of the hydraulic system. The followings are the detailed explanation and the instructions of these pressure measuring points.

⚠WARNING

When installing testing instruments for hydraulic system, perform the pressure detection and adjustment, pressure release “mounting location and functional structure of hydraulic oil tank”should be operated. The pressure detection and adjustment shall be performed by professionals; non-professionals need consult from the professionals and adjust strictly in accordance with instructions from the professionals, or adjustment is prohibited.

Pressure Measuring Point Position of Steering Hydraulic System

Measuring points position diagram of steering hydraulic system



P24H00061

Description for Measuring Points of Steering Hydraulic System

Pressure measuring points	Description of pressure measuring points	Theoretical pressure values (MPa)	Testing steps
Pressure measuring point 1	Measuring points of the steering gear pump	16.7 ± 0.5	Remove the cap nut of the pressure measuring connector, after pressure gauge is installed, the test will be carried out; when the test is completed, remove pressure gauge, and install the cap nut of the pressure measuring connector again.

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Brake System Test

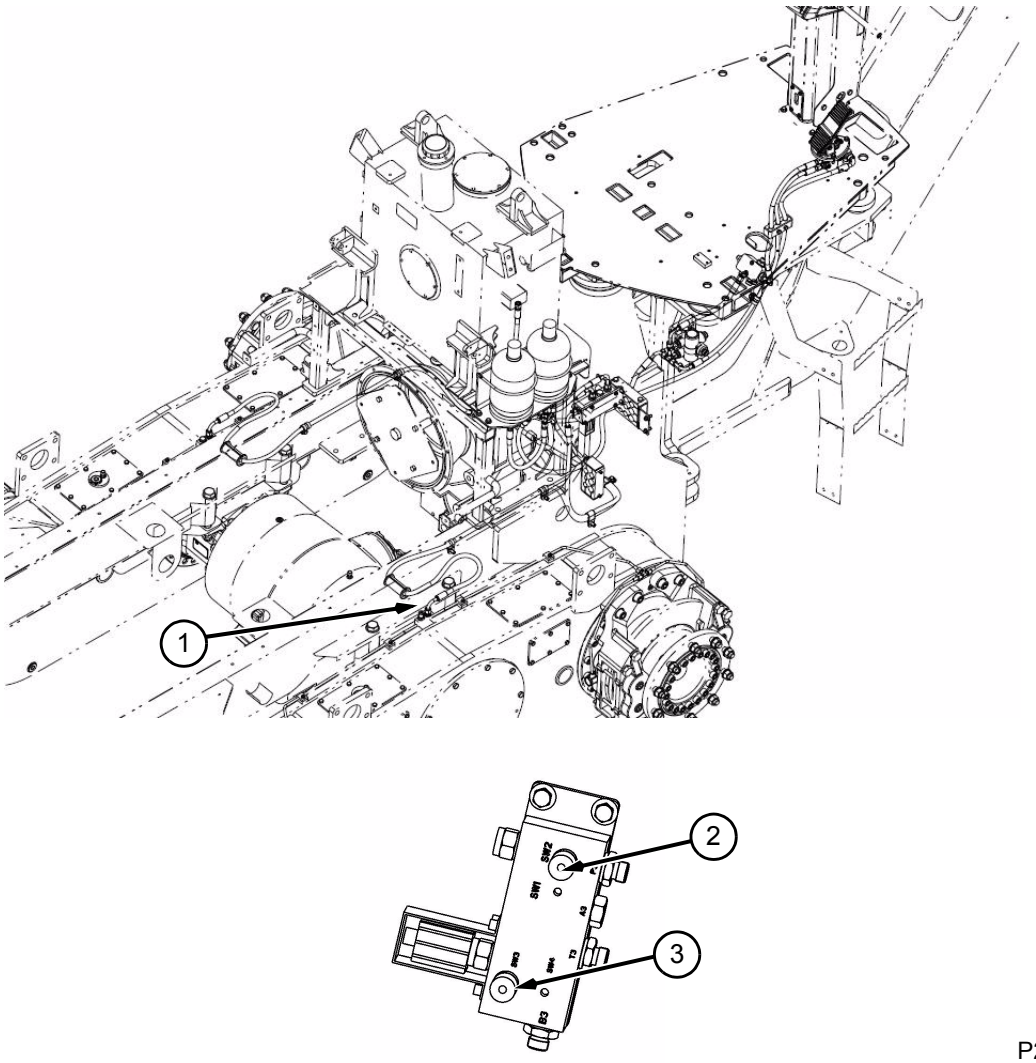
⚠WARNING

When installing testing instruments for brake system, the system pressure shall be released

The following pressure testing and adjustment shall be performed by professionals; non-professionals shall consult from the professionals and adjust in strict accordance with instructions from the professionals, or adjustment is prohibited.

Brake System Measuring Points Diagram

Brake system measuring points diagram



P24H00062

1. Test points of rear axle brake pressure
2. Test points of charge pressure
3. Test points of parking brake pressure

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Description of Pressure Measuring Points of Brake System

Pressure measuring points	Description of pressure measuring points	Theoretical pressure values (MPa)	Test specification
Pressure measuring point 1	Test points of rear axle brake pressure	10.3	Test the brake pressure of the wheel
Pressure measuring point 2	Test points of charge pressure	12.8~15.9	Test charge pressure of the charge valve
Pressure measuring point 3	Test points of parking brake pressure	12.8~15.9	For the test of parking brake pressure, when the brake for the transmission brake is removed, inlet pressure

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Removal and Installation

Work Hydraulic System

Removal and Installation of Hydraulic Oil Tank Assembly

Removal of Hydraulic Oil Tank Assembly

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	8#	1
2	Wrench	10#	1
3	Wrench	13#	1
4	Wrench	15#	1
5	Wrench	22#	1
6	Wrench	24#	1
7	Wrench	27#	1
8	Wrench	30#	1
9	Wrench	32#	1
10	Wrench	36#	1
11	Sling	Set	1
12	Shielding film	Roll	1
13	Oil collecting basin	Piece	1
Other information			
Weight of fuel tank/Kg		226	

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

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⚠CAUTION

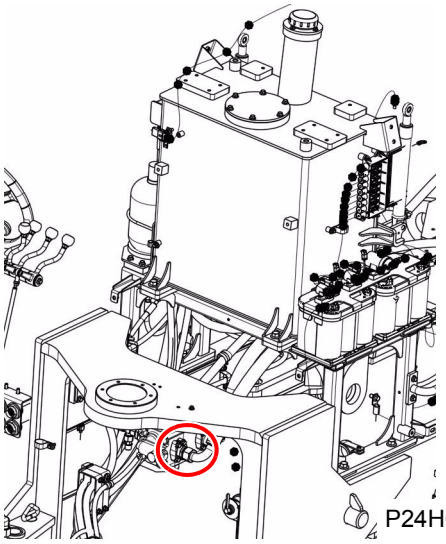
The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

⚠WARNING

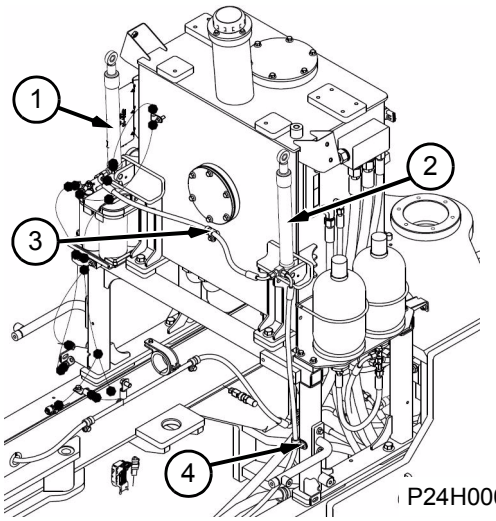
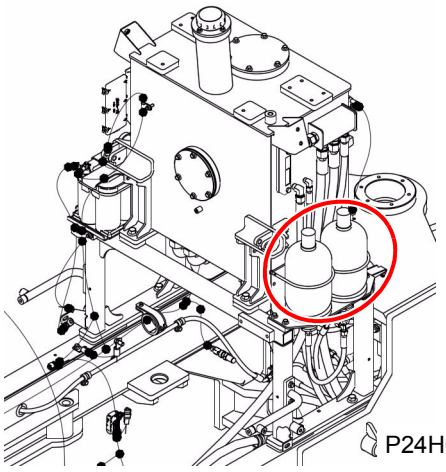
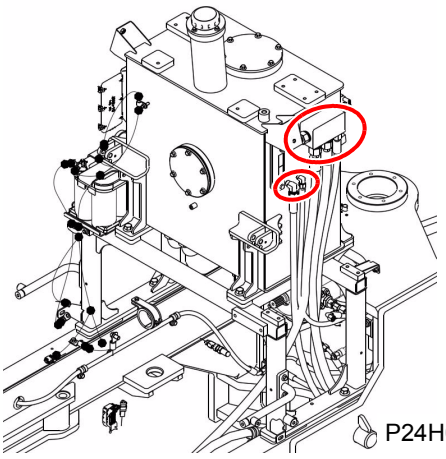
Hydraulic oil pressure and hot oil may cause personal injury or even death.

There may be residual hydraulic oil with pressure in the hydraulic system after the engine stops. Release the residual pressure before repairing the hydraulic system, otherwise the serious personal injury or even death may be caused.

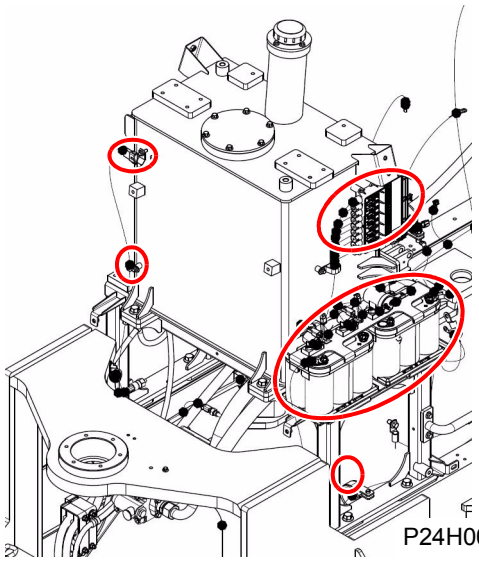
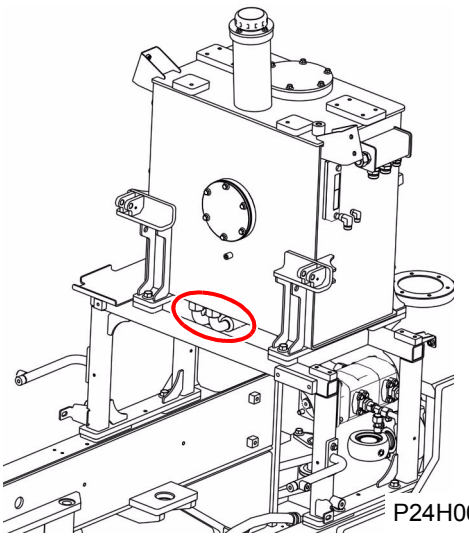
Make sure that all the work implements have been lowered down and the hydraulic oil has cooled before removing any component or pipe. The oil filter cover can not be removed until the engine stopped and the filter cover is cool enough that can be touched by bare hand.

Figure	Operation steps	Tool(s)
	1. Refer to the chapter for removal of the engine hood to remove and place the hood according to requirements	
 P24H00063	2. Remove the suction hose from the rear pump of the working pump, and collect the hydraulic oil flowing out of the suction hose with a collecting basin until no oil flowing out. And then shield the hose port.	41# Wrench Oil collecting basin Shielding film

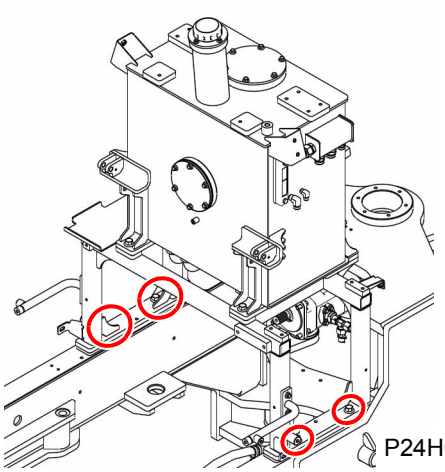
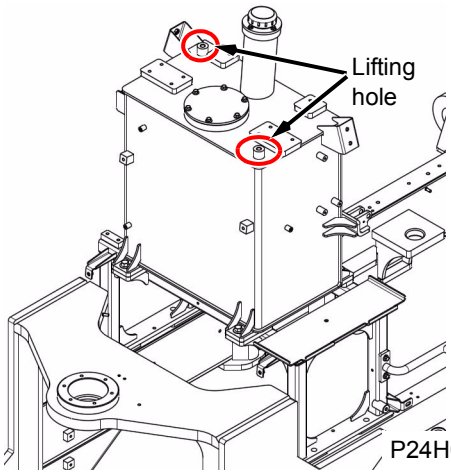
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Figure	Operation steps	Tool(s)
	3. Remove the lines at the engine hood lift cylinder(1)and(2), mask every oil port; remove the mounting pin of the engine hood lift cylinder, and take down the engine hood lift cylinder; remove the clamp at (3)and(4), and take down the hose assembly;	8# Wrench 10# Wrench Shielding film
	4. Refer to the chapter for removal of the accumulator of hydraulic brake system, remove the accumulator assembly on the right side of the hydraulic oil tank, and hydraulic oil in lines is led into the oil collecting basin, and mask every oil ports;	13# Wrench 19# Wrench Oil collecting basin
	5. Remove the oil return hose on the right side of the hydraulic oil tank, and hydraulic oil in the pipeline will be led into the oil collecting basin, with each hose marked and each oil port masked;	19# Wrench 27# Wrench 36# Wrench Shielding film Oil collecting basin

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Figure	Operation steps	Tool(s)
 P24H00067	6. Refer to the chapter for removal of battery and control box from electrical system, remove battery and control box on the left side of hydraulic oil tank, and remove electrical cable and clip fixed on the left, front and rear side of the hydraulic oil tank and the bracket;	8# Wrench 10# wrench, 15# wrench
 P24H00068	7. Remove the two pump suction hoses on the bottom of the hydraulic oil tank, and the hydraulic oil in the pipeline will be led into the oil collecting basin, with each hose marked and each oil port masked;	41# Wrench Oil collecting basin Shielding film

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Figure	Operation steps	Tool(s)
 P24H00069	8. Remove the 4 mounting bolts at the joint connecting the hydraulic oil tank and ear frame;	22# Wrench
 P24H00071	9. Hoist the hydraulic oil tank slowly away; note that when lifting, the process must be smooth and steady and not allowed to damage other parts of the complete machine, and horizontally place it on the ground.	Sling

Installation of Hydraulic Oil Tank Assembly

Relevant preparation before starting

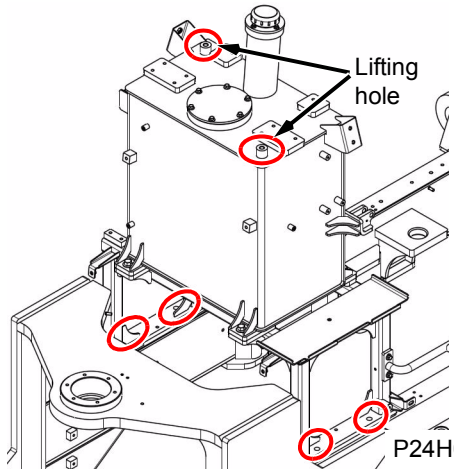
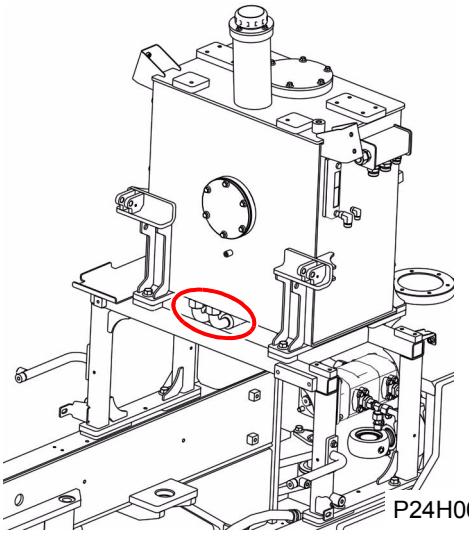
See the section of Complete Machine Placement for parking the machine.

NOTICE

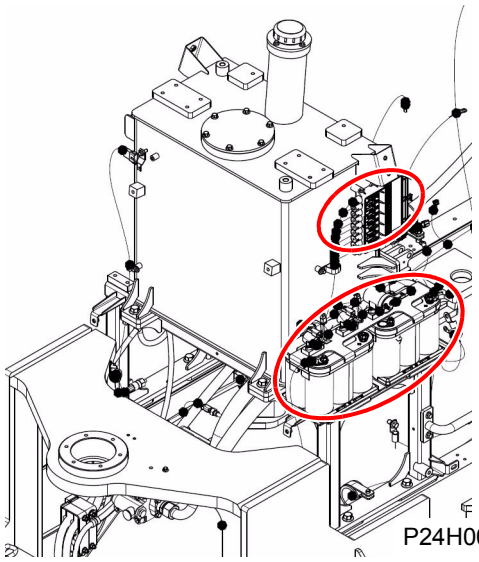
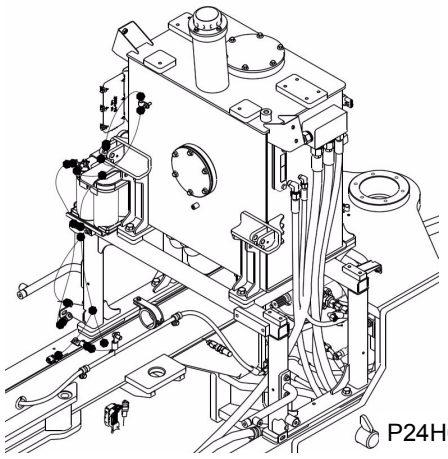
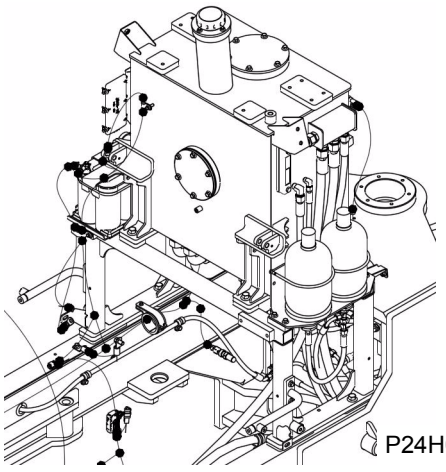
Please keep clean. All components shall be cleaned thoroughly with cleaning solution prior to assembly. The components are allowed for natural drying. Never wipe them dry with cloth. The fiber from the cloth will accumulate on the parts and cause fault. Check all components. If the components are worn or damaged, please replace them with new ones.

Figure	Operation steps	Tool(s)
	1. Check the oil tank for impurities, if any, it should be cleaned before installation.	

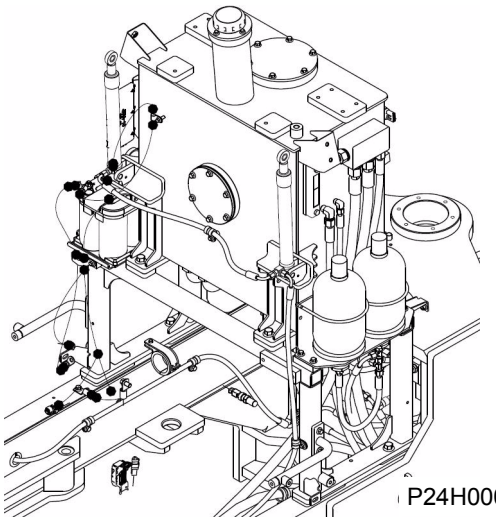
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Figure	Operation steps	Tool(s)
	2. Lift the oil tank with traveling crane and install it on rear frame with tightening torque of 4 bolts: 225±35N.m.	Sling
	3. Assemble the suction hose on the suction steel tube from the bottom of the hydraulic oil tank, with tightening torque of hose joint: 137±6 N.	41# Wrench

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Figure	Operation steps	Tool(s)
 P24H00067	4. Refer to the chapter for removal of the battery and control box of the electrical system, install the battery and control box on the left side of the hydraulic oil tank bracket, and in the meantime, every wire is connected well and fixed with clamps.	8# Wrench 10# wrench, 15# wrench
 P24H00066	5. Connect the return oil hose assembly to the joint of oil return seat from the right side of the hydraulic oil tank.	19# Wrench 27# Wrench 36# Wrench
 P24H00065	6. Refer to the chapter for removal of accumulator assembly of the hydraulic brake system, assemble the accumulator on the right side of the hydraulic tank bracket.2300	13# Wrench 19# Wrench

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Figure	Operation steps	Tool(s)
 P24H00064	7. Install the engine hood lift cylinder on the mounting seat from the reverse side of the hydraulic oil tank, and hose assembly is connected well and fixed to the designated position with the clamp.	8# Wrench 10# Wrench

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Removal and Installation of Working Pump Assembly

Removal of Working Pump Assembly

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	9#	1
2	Wrench	13#	1
3	Wrench	15#	1
4	Wrench	18#	1
5	Wrench	19#	1
6	Wrench	27#	1
7	Wrench	41#	1
8	Shielding film		1
9	Sling		1
Other information			
Weight of working pump		26Kg	

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

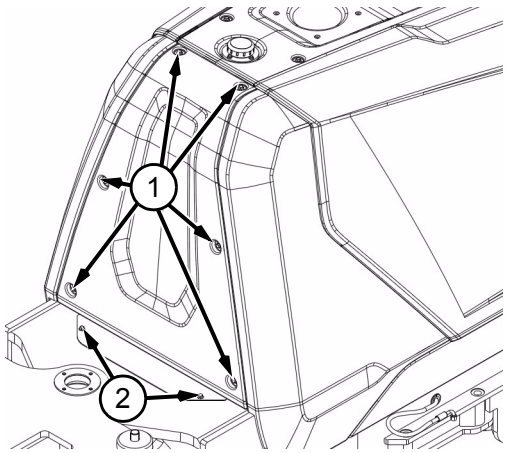
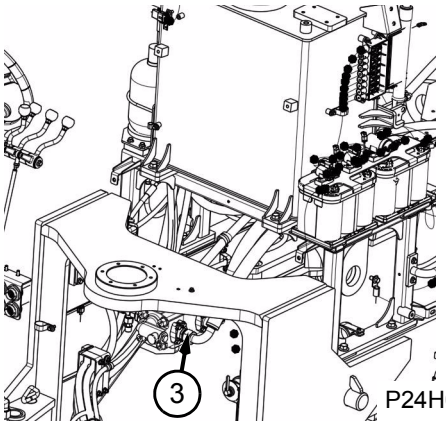
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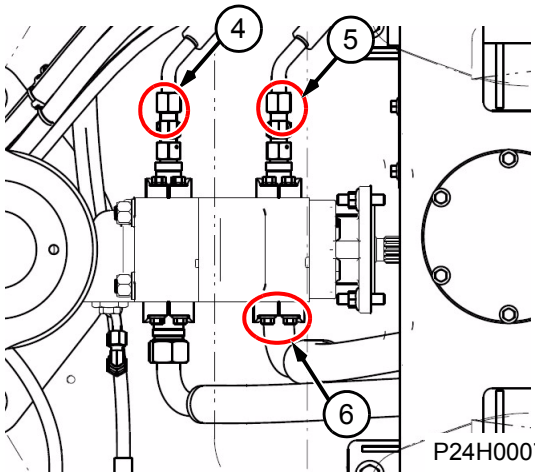
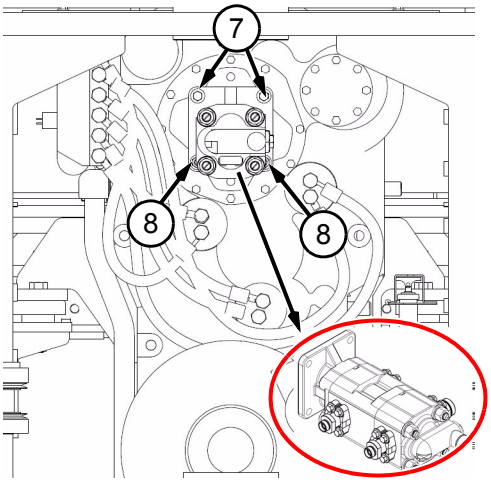
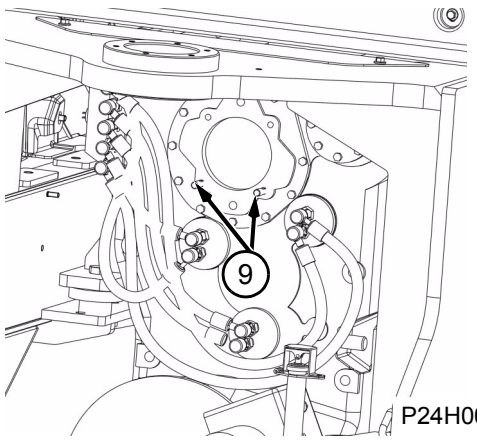
Hydraulic oil pressure and hot oil may cause personal injury or even death.

There may be residual hydraulic oil with pressure in the hydraulic system after the engine stops. Release the residual pressure before repairing the hydraulic system, otherwise the serious personal injury or even death may be caused.

Make sure that all the work implements have been lowered down and the hydraulic oil has cooled before removing any component or pipe. The oil filter cover can not be removed until the engine stopped and the filter cover is cool enough that can be touched by bare hand.

Figure	Operation steps	Tool(s)
 P24H00070	1. Park the complete machine well, refer to the chapter for removal of the engine hood, remove 6 bolts (1) from panel A of the fixed guard, and remove panel A. 2. Refer to the chapter for Removal of the frame, remove 2 captive bolts (2) of the plate, and remove the plate.	13# Wrench
 P24H00063	3. Remove the suction hose (3)from the rear pump of the working pump, and collect the hydraulic oil flowing out of the hose with a collecting basin until no oil flowing out. And then mask the port.	41# Wrench Oil collecting basin Shielding film

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Figure	Operation steps	Tool(s)
 P24H00072	4. Firstly, remove oil outlet pipe joints(4)(5)of the pump assembly, and then remove 4 mounting bolts from the flange plate ○6 at the oil suction port of pump assembly, and mask every oil port.	13# wrench, 27# wrench, 41# wrench
 P24H00073	5. Remove 2 mounting bolts (7) and 2 nuts (8) of the pump assembly, take the transmission from the pump, if necessary, place it in a clean position with the sling; and clean seal gasket residues on the pump mounting spigot of the transmission and the spigot of the pump shaft end.	15# wrench, 18# wrench Sling
 P24H00074	6. Remove 2 pre-mounting studs (9) of the pump assembly.	9# Wrench

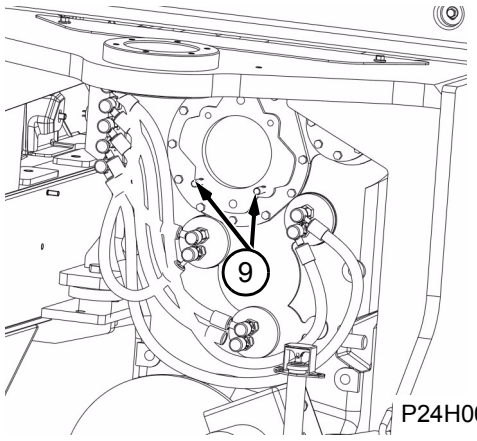
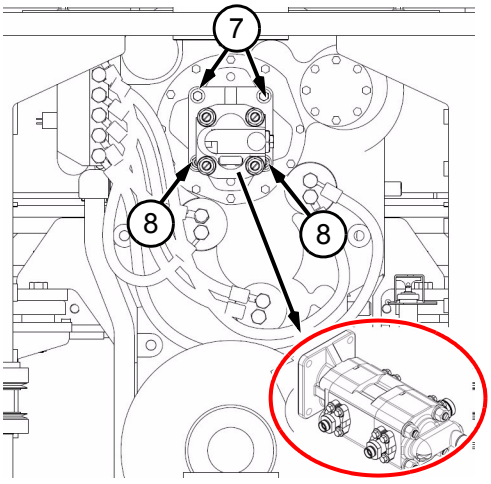
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Installation of Working Pump Assembly

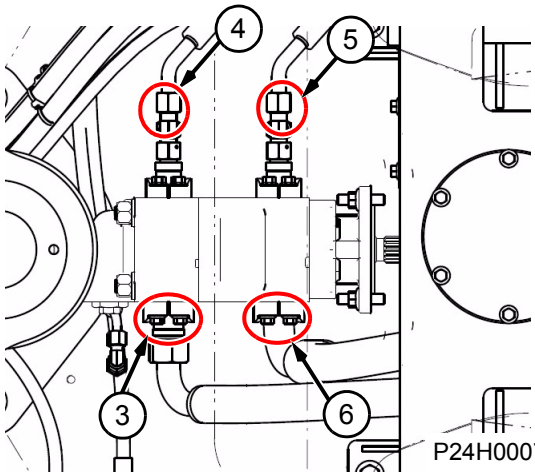
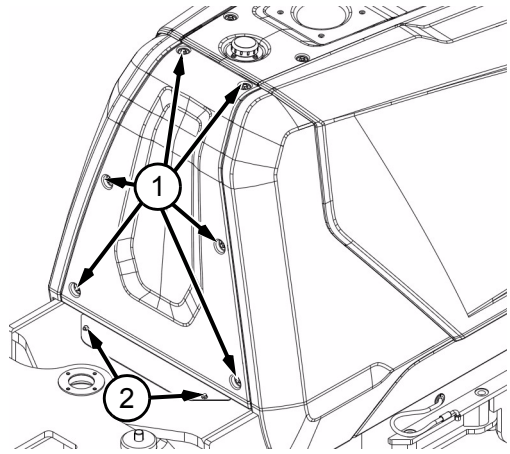
Relevant preparation before starting

NOTICE

Please keep clean. All components shall be cleaned thoroughly with cleaning solution prior to assembly. The components are allowed for natural drying. Never wipe them dry with cloth. The fiber from the cloth will accumulate on the parts and cause fault. Check all components. If the components are worn or damaged, please replace them with new ones.

Figure	Operation steps	Tool(s)
 P24H00074	1. Pre-install 2 pre-mounting studs (9) of the pump assembly, tightening torque is 90±12N.m.	9# Wrench
 P24H00073	2. Check whether there is damage, rusting, etc for the pump, if qualified, install new seal gasket applied the sealant on the of the pump shaft spigot, then lift and install the pump assembly to the installation position; install bolts (7) and nuts (8) on the transmission, and tighten mounting bolts and nuts of the pump, tightening torque is 90±12N.m.	15# wrench, 18# wrench, sling

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Figure	Operation steps	Tool(s)
 P24H00072	3. Install oil outlet pipe joints (4) (5) of the pump assembly, tightening torque is 47±12N.m, then install oil suction port hose joint (3) of the pump assembly, tightening torque is 137±6N.m, and install 4 mounting bolts of the flange plate (6), tightening torque is 52±12N.m.	13# wrench, 27# wrench, 41# wrench
 P24H00070	4. Refer to the chapter for removing the frame, tighten and remove 2 captive bolts (2) of the plate, and fix the plate. 5. Refer to the chapter for removal of the engine hood, tighten 6 bolts (1) from panel A of the fixed guard, and assemble panel A.	13# Wrench

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Removal and Installation of Left Multiple-way Valve

Removal of Left Multiple-way Valve

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	10#	1
2	Wrench	24#	1
3	Wrench	27#	1
4	Wrench	36#	1
8	Shielding film		1
Other information			
Weight of working pump		26Kg	

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

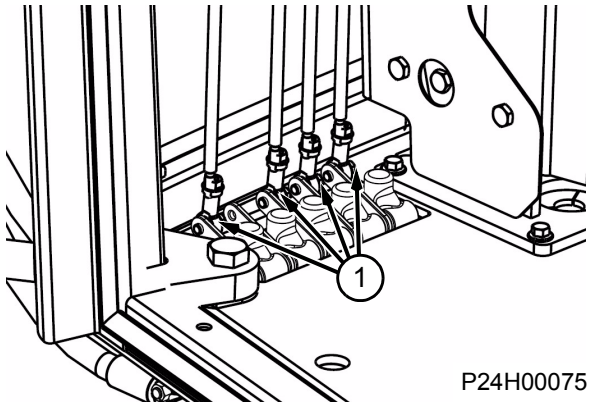
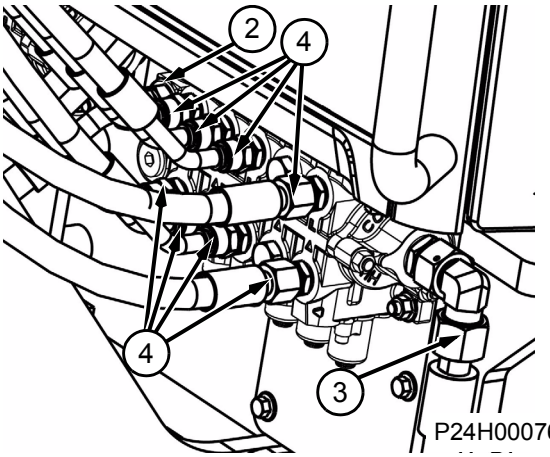
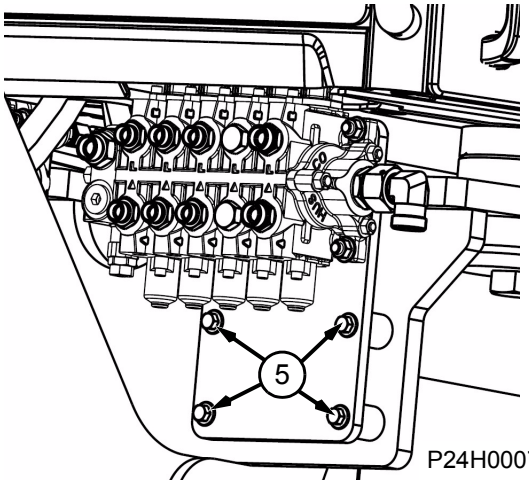
⚠WARNING

Hydraulic oil pressure and hot oil may cause personal injury or even death.

There may be residual hydraulic oil with pressure in the hydraulic system after the engine stops. Release the residual pressure before repairing the hydraulic system, otherwise the serious personal injury or even death may be caused.

Before any part or line is removed, make sure the blade is lowered to the ground, after the machine is shut down, operate control levers of all cylinders to release the pressure and hydraulic oil has been cooled.

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Figure	Operation steps	Tool(s)
	1. Refer to the chapter for removing the cab, and remove left side of the plate for the cab.	
 P24H00075	2. Remove 4 fastening bolts (1) of the knuckle bearing at the connection to the multi-way valve switching mechanism on the left side (the type of ripper equipped with is 5 fastening bolts).	10# Wrench
 P24H00076	3. Firstly, according to the diagram of multi-way valve oil port on the left side, pipe joint is marked, then remove the hose joint (2) of the port p, the hose joint (3) of the port T and the hose joints (4) of the port A,B on the multi-way valve assembly, and mask every oil port;	24# wrench, 27# wrench, 36# wrench, shielding film
 P24H00077	4. Remove 4 mounting bolts (5) of multi-way valve assembly, and take down multi-way valve assembly;	13# Wrench

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Installation of Left Multiple-way Valve

For installation of the left side of multi-way valve, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with each connector of the control valve as based on the identification of each hose without error.

Removal and Installation of Right Multiple-way Valve

Refer to removal and installation of left multi-way valve, in which signs for all ports are marked according to diagram for right multi-way valve oil port.

Removal and Installation of Swing Motor

Removal of Swing Motor

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

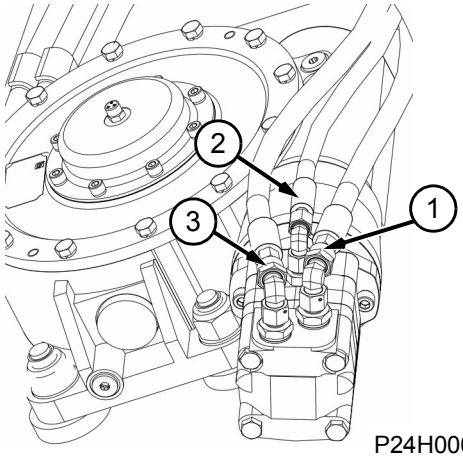
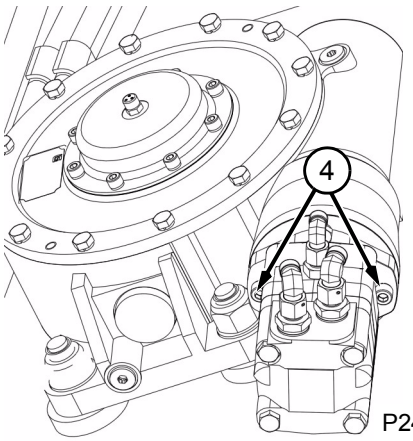
⚠WARNING

Hydraulic oil pressure and hot oil may cause personal injury or even death.

There may be residual hydraulic oil with pressure in the hydraulic system after the engine stops. Release the residual pressure before repairing the hydraulic system, otherwise the serious personal injury or even death may be caused.

Make sure that all the work implements have been lowered down and the hydraulic oil has cooled before removing any component or pipe.

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Figure	Operation steps	Tool(s)
 P24H00078	1. According to diagram of swing motor oil port, pipe joints are marked, and then remove hose joints (1) (2) (3) connecting to swing motor, and mask every oil port.	19# wrench, 24# wrench, shielding film
 P24H00079	2. Remove two mounting screws (4) of the swing motor assembly, and take out swing motor assembly.	10# Inner hexagon spanner

Installation of Swing Motor Assembly

For installation of swing motor assembly, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with each joint of the swing motor as based on the identification of each oil port without error.

Removal and Installation of Swivel Joint Assembly

Removal of Swivel Joint Assembly

Relevant preparation before starting:

https://truckmanualshub.com/

See the section of Complete Machine Placement for parking the machine.

NOTICE

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Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

⚠CAUTION

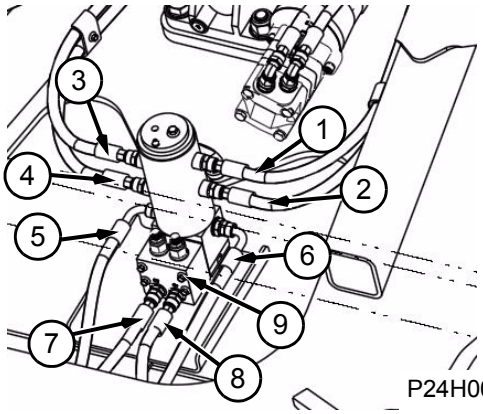
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⚠WARNING

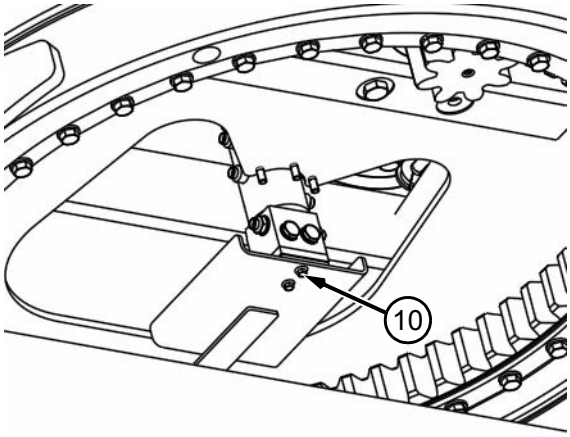
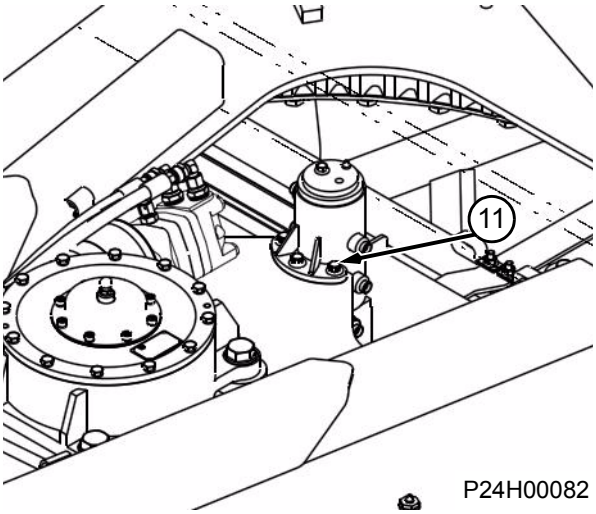
Hydraulic oil pressure and hot oil may cause personal injury or even death.

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Make sure that all the work implements have been lowered down and the hydraulic oil has cooled before removing any component or pipe.

Figure	Operation steps	Tool(s)
 P24H00080	1. According to diagram of swivel joint oil port, pipe joints are marked, and then remove the hose joint(1) (2) (3) (4) (5) (6) (7) (8) connecting to swivel joint, and mask every oil port. 2. Remove 4 mounting bolts (9)of the balanced valve assembly, and mask every oil port.	10# wrench, 24# wrench, shielding film

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Figure	Operation steps	Tool(s)
 P24H00081	3. Remove the two mounting bolts from the connecting bottom plate (10).	13# wrench, shielding film
 P24H00082	4. Remove 3 mounting bolts (11) of swivel joint assembly.	16# Wrench

Installation of Swivel Joint Assembly

For swivel joint assembly, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with each joint of the swivel joint as based on the identification of each oil port without error.

Removal and Installation of Left Blade Lift Cylinder

Removal of Left Blade Lift Cylinder

Relevant preparation before starting:

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See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

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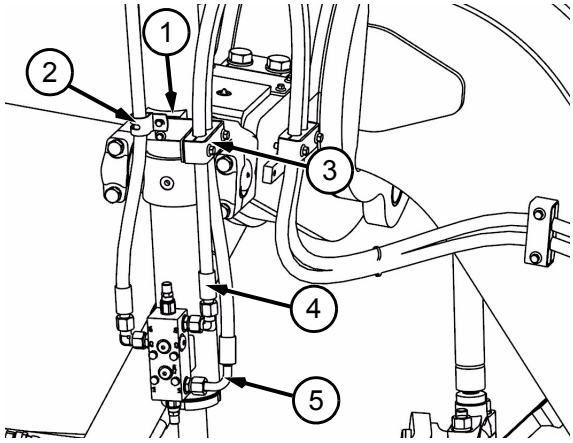
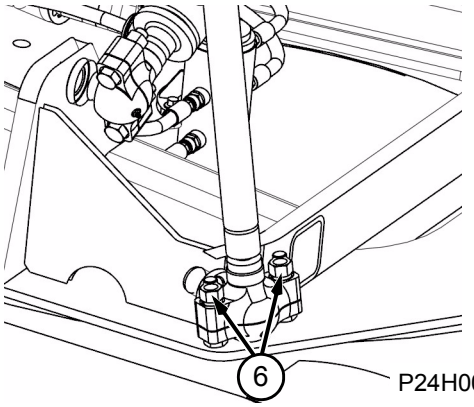
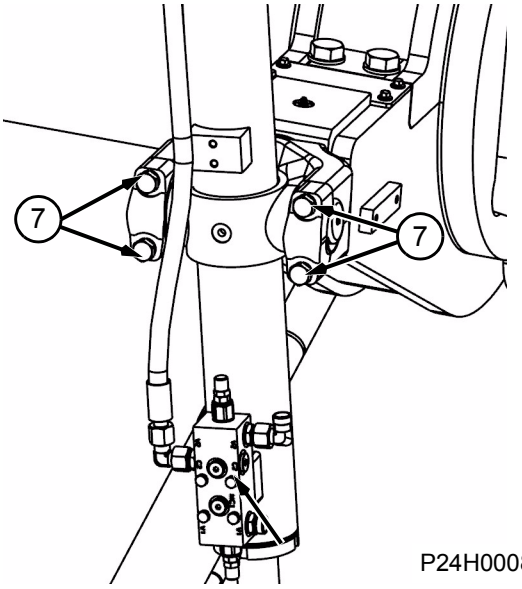
Before removal, put the blade on the ground;

⚠CAUTION

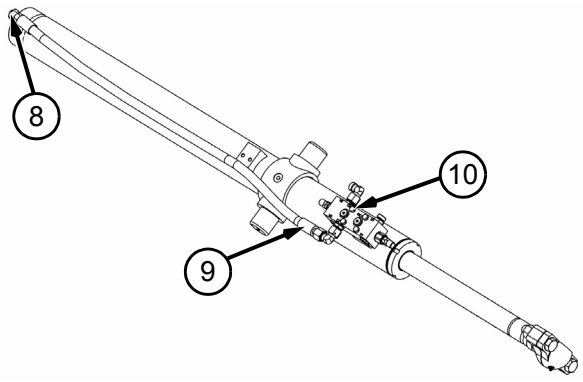
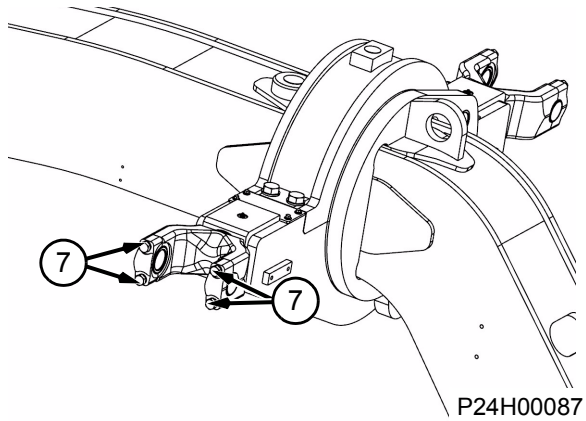
Do not make the work implement rise high into the air; otherwise, the work implement will instantly fall in the subsequent process of cylinder removal, causing safety accidents;

Figure	Operation steps	Tool(s)
	1. Park the grader horizontally, horizontally place the blade onto the ground; after the machine is shut down, continuously push and pull the control lever of the blade lift cylinder, and remove pressure oil inside lines.	
	2. Lift the cylinder with a lifting rope and hold, make the lifting rope slowly rise until it just tightens the cylinder.	Traveling crane, sling

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Figure	Operation steps	Tool(s)
 P24H00083	3. Remove 2 mounting bolts (1) of the clamp on the oil cylinder body, take down the clamp (2) (3); refer to the figure from the chapter for left blade lift cylinder balanced valve, after hose joints (4) (5) from are marked, remove them and mask every oil port.	10# wrench, 27# wrench
 P24H00084	4. Loose 2 bolts (6) of the bearing cap on the lower end of the cylinder to pre-tighten 2 bolts and bush after piston rod of the cylinder breaks away from ball joint.	30# Wrench
 P24H00085	5. Make pairing identifications of "I" and "II" respectively on the assembly surfaces on the left and right sides of the fork. For subsequent recovery, be sure to assemble them in pairs by identifications; remove 4 fastening bolts (7) on the fork cover, and take down the fork cover.	24# Wrench

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Figure	Operation steps	Tool(s)
 P24H00086	6. Lift down left blade lift cylinder, horizontally place it on the wooden pallet; remove connectors (8) (9), take down hose assembly; remove 4 mounting bolts (10) of the balanced valve, take down balanced valve.	13#Wrench, 27# wrench, traveling crane, sling
 P24H00087	7. Assemble the fork cover to the replacer according to the corresponding sign, and pre-tighten 4 mounting bolts (7).	24# Wrench

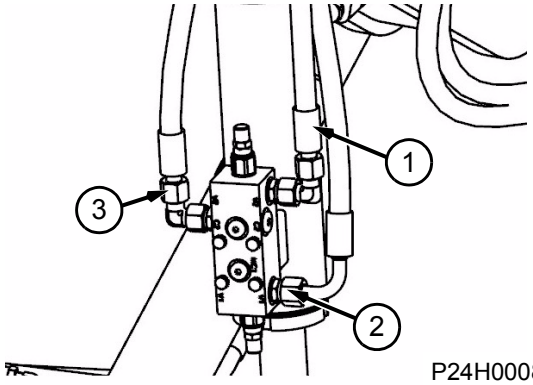
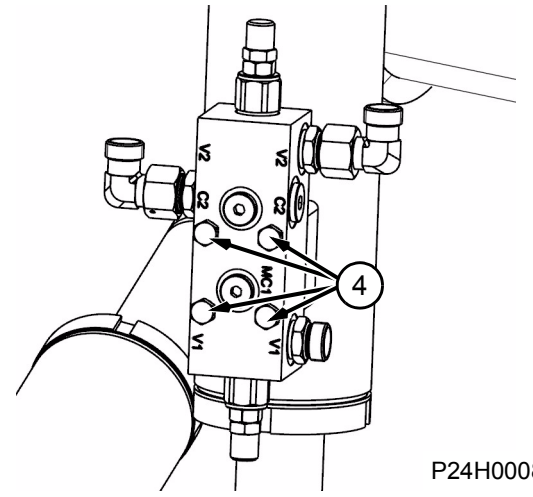
Installation of Left Blade Lift Cylinder

Installation of left blade lift cylinder is in reverse order of removal, in which hoses assembled shall be connected to every oil port according to the sign for every hose without error; during the process of the assembly, the extension length of piston rod from the cylinder shall be adjusted and installation of the balanced valve shall be loosed, after adjustment is completed, they are adjusted again.

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Removal and Installation of Left Blade Lift Cylinder Balanced Valve

Removal of Left Blade Lift Cylinder Balanced Valve

Figure	Operation steps	Tool(s)
	1. Park the grader horizontally, horizontally place the blade onto the ground; after the machine is shut down, continuously push and pull the control lever of the blade lift cylinder, and remove pressure oil inside lines.	
 P24H00088	2. According to the diagram of balanced valve assembly oil port, after every oil port is marked, remove hose connectors (1) (2) (3), and mask every oil port.	27# wrench, shielding film
 P24H00089	3. Remove 4 mounting bolts (10) of the balanced valve, take down the balanced valve, notice don’t lose O-ring, and mask every oil port.	13# wrench, shielding film

Installation of Left Blade Lift Cylinder Balanced Valve

Assemble in the reverse sequence of removal, of which the hose assembly part must be connected with 3 connectors of the blade lift hydraulic lock-rh as based on the identification of each hose without error.

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Removal of Right Blade Lift Cylinder

Refer to removal of left blade lift cylinder and installation of left blade lift cylinder. Notice: for the sign of every oil port, refer to diagram of balanced valve assembly oil port from the chapter for right blade lift cylinder balanced valve.

Removal of Right Blade Lift Cylinder Balanced Valve

Refer to removal of left blade lift cylinder balanced valve and installation of blade lift cylinder balanced valve. Notice: for the sign of every oil port, refer to balanced valve assembly oil port diagram.

Removal and Installation of Circle Sideshift Cylinder

Removal of Circle Sideshift Cylinder

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

⚠WARNING

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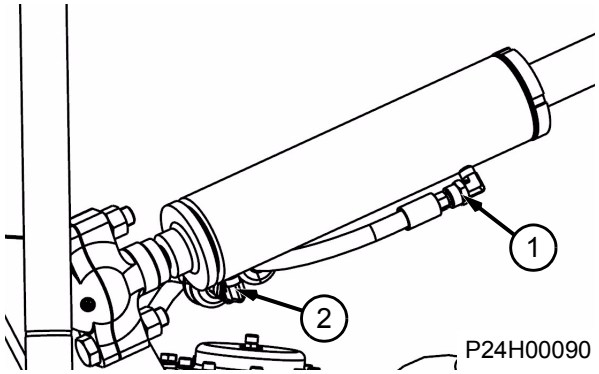
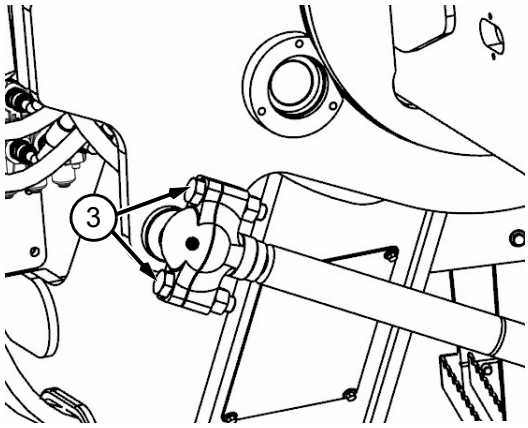
Make sure that all the work implements have been lowered down and the hydraulic oil has cooled before removing any component or pipe.

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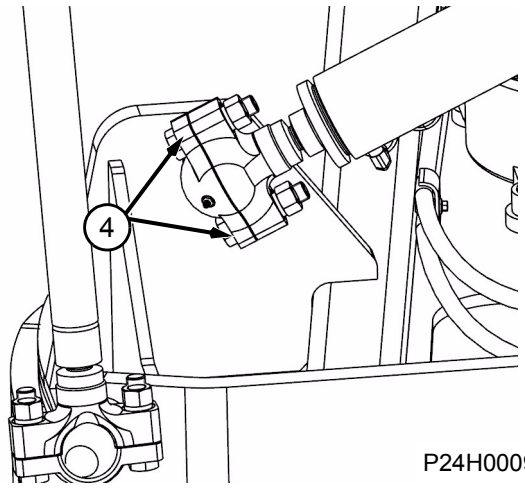
Before removal, put the blade on the ground;

⚠CAUTION

Do not make the work implement rise high into the air; otherwise, the work implement will instantly fall in the subsequent process of cylinder removal, causing safety accidents;

Figure	Operation steps	Tool(s)
	1. Park the grader horizontally, horizontally place the blade onto the ground; after the machine is shut down, continuously push and pull the control lever of the circle sideshift cylinder, and remove pressure oil inside lines.	
	2. Lift the cylinder with a lifting rope and hold, make the lifting rope slowly rise until it just tightens the cylinder.	Traveling crane, sling
 P24H00090	3. After hose connectors (1) (2) are marked, remove them and mask every oil port.	24# wrench, shielding film
 P24H00091	4. Loose 2 bolts (3) of the bearing cap on the piston rod end of the cylinder to pre-tighten 2 bolts and bush after piston rod of the cylinder breaks away from ball joint.	30# Wrench

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Figure	Operation steps	Tool(s)
	5. Loose 2 bolts (4) of the bearing cap on the cylinder body end of the cylinder to pre-tighten 2 bolts and bush after cylinder body of the cylinder breaks away from ball joint, lift down the cylinder and horizontally place it on the wooden pallet.	30#Wrench, traveling crane, Lifting rope

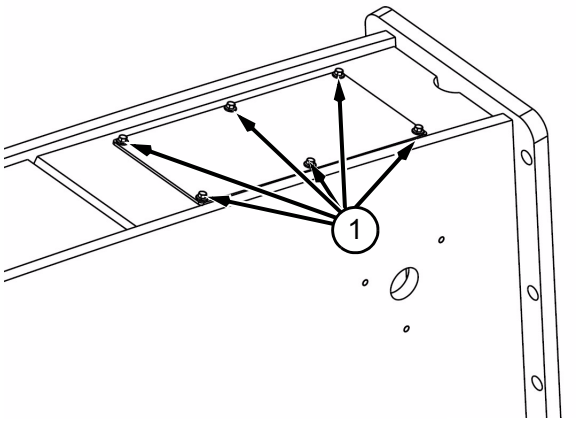
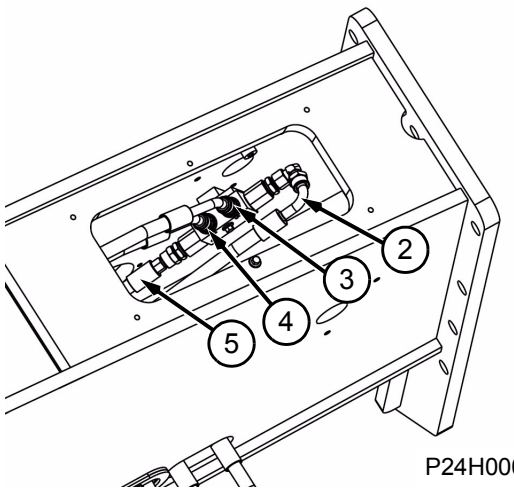
Installation of Circle Sideshift Cylinder

For the installation of circle sideshift cylinder, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with two oil port of the cylinder as based on the identification of each hose without error.

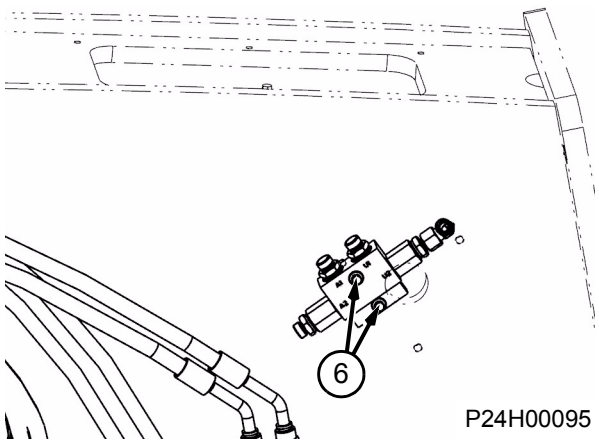
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Removal and Installation of Circle Sideshift Cylinder Hydraulic Lock

Removal of Circle Sideshift Cylinder Hydraulic Lock

Figure	Operation steps	Tool(s)
	1. Park the grader horizontally, horizontally place the blade onto the ground; after the machine is shut down, continuously push and pull the control lever of the circle sideshift cylinder, and remove pressure oil inside lines.	
 P24H00093	2. Remove 6 mounting bolts (1) on the coverplate on the upper surface of the front hitch from front frame, and remove the coverplate.	10# Wrench
 P24H00094	3. According to hydraulic lock assembly oil port diagram, after hose joints (2) (3) (4) (5) are marked, remove them, and mask every oil port.	24# wrench, shielding film

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Figure	Operation steps	Tool(s)
 P24H00095	4. Remove 2 mounting bolts (6) of hydraulic lock assembly, and take out hydraulic lock assembly.	10# Wrench

Installation of Circle Sideshift Cylinder Hydraulic Lock

For the installation of circle sideshift cylinder, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with every oil port of the hydraulic lock as based on the identification of each hose without error.

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Removal and Installation of Front Wheel Tilt Cylinder

Removal of Front Wheel Tilt Cylinder

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

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⚠CAUTION

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⚠WARNING

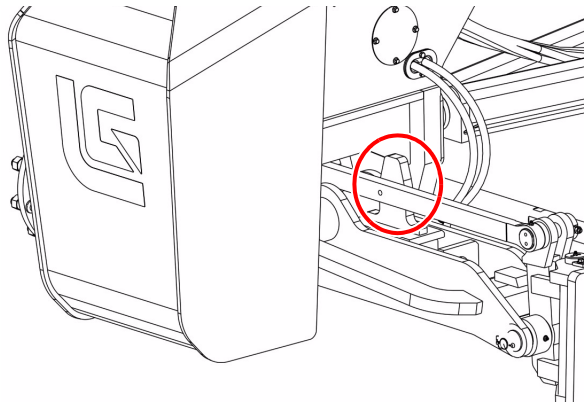
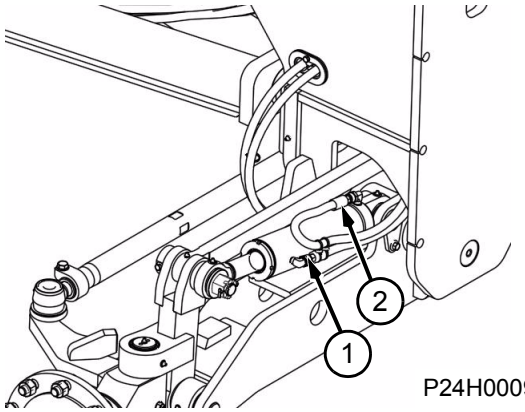
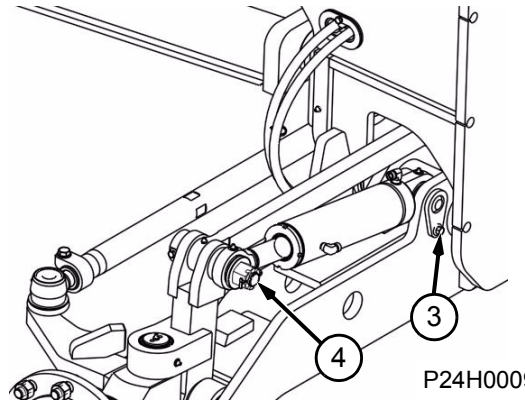
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Make sure that all the work implements have been lowered down and the hydraulic oil has cooled before removing any component or pipe.

Figure	Operation steps	Tool(s)
	1. Park the grader horizontally, horizontally place the blade onto the ground; after the machine is shut down, continuously push and pull the control lever of the circle sideshift cylinder, and remove pressure oil inside lines.	

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Figure	Operation steps	Tool(s)
 P24H00096	2. Use M12 bolts in the middle of the axle stand and tilt rod, and screw on the nuts, wherein, the length of the M12 bolts is more than 95 and the strength of the M12 bolts is Grade 10.9; **⚠ Notice: Proceed with the next steps after the axle stand and the tilt rod are connected via bolts; otherwise, potential safety hazard may occur because of tilt tires during removal.**	18# Wrench
 P24H00097	3. After the hose connector(1) (2)is marked, mask every oil port after removal.	24# wrench, shielding film
 P24H00098	4. Remove the mounting bolt from the pin shaft (3) and then take out the pin shaft. Remove the cotter pin on the locknut 4 to remove the locknut. Remove the tilt cylinder of the front wheel and horizontally place it on a wood tray.	15# Wrench 46# Wrench Traveling crane Lifting rope

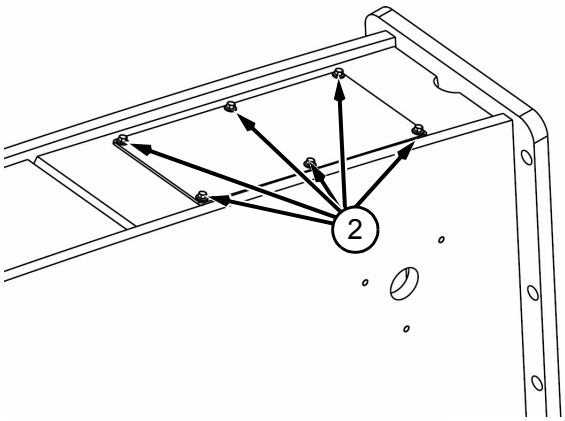
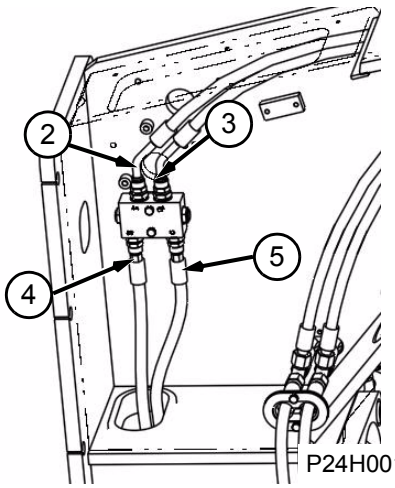
Installation of Front Wheel Tilt Cylinder

For the installation of front wheel tilt cylinder, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with two oil ports of the cylinder as based on the identification of each hose without error.

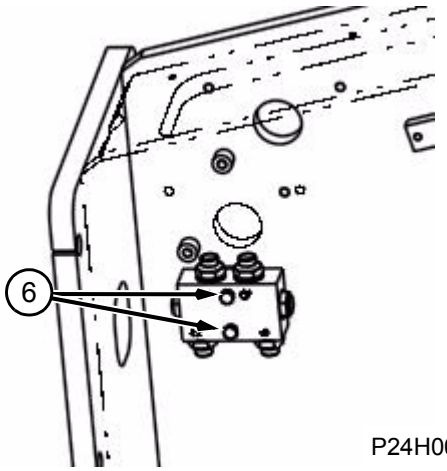
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Removal and Installation of Front Wheel Tilt Cylinder Hydraulic Lock

Removal of Front Wheel Tilt Cylinder Hydraulic Lock

Figure	Operation steps	Tool(s)
	1. Refer to step 1 and step 2 of removal from front wheel tilt cylinder, put away the grader and tighten tilt linkage.	
 P24H00093	2. Remove 6 mounting bolts (1) on the coverplate on the upper surface of the front hinge from front frame, and remove the coverplate.	10# Wrench
 P24H00100	3. Afer marked the hose joints according to the diagram of hydraulic lock assembly oil port , remove the hose joints (3), (4) and (5) , and then mask every oil port.	24# Wrench

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Figure	Operation steps	Tool(s)
 P24H00101	4. Remove 2 mounting bolts (6) of hydraulic lock assembly, and take out hydraulic lock assembly.	13# Wrench

Installation of Front Wheel Tilt Cylinder Hydraulic Lock

For the installation of front wheel tilt cylinder hydraulic lock, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with the oil port of the cylinder as based on the identification of each hose without error.

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Removal and Installation of Hitch Steering Cylinder

Removal of Hitch Steering Cylinder

Since the assembly or removal of hitch steer cylinder on the machine is divided into left and right directions, therefore, firstly, right hitch steer cylinder is removed; secondly, left hitch steer cylinder is removed:

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

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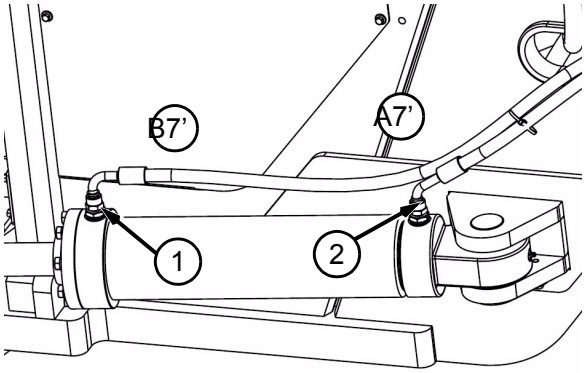
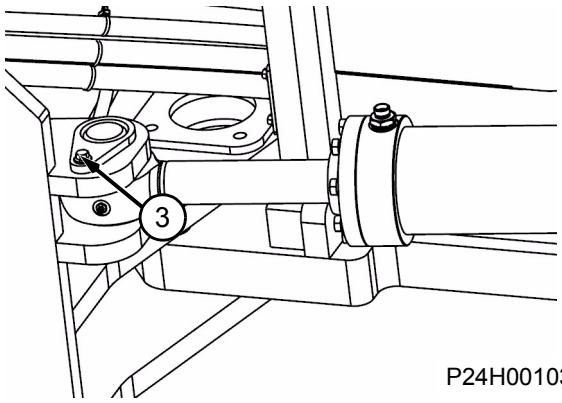
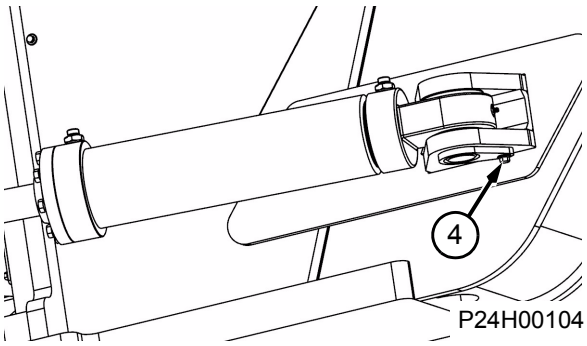
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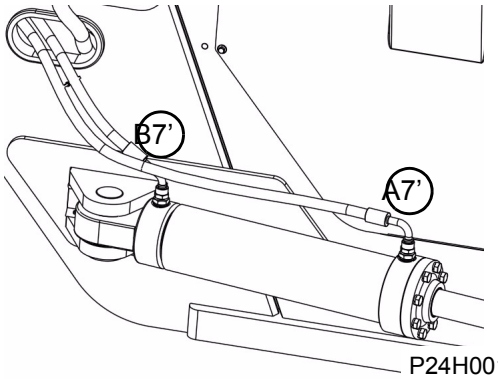
Make sure that all the work implements have been lowered down and the hydraulic oil has cooled before removing any component or pipe.

Figure	Operation steps	Tool(s)
	1. Park the grader horizontally, horizontally place the blade onto the ground; after the machine is shut down, continuously push and pull the control lever of the hitch steer cylinder, and remove pressure oil inside lines.	

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Figure	Operation steps	Tool(s)
 P24H00102	2. After hose joints A7' and B7' of right hitch steering cylinder are marked, Remove hose joints (1) (2), and mask every oil port.	24# wrench, shielding film
 P24H00103	3. Remove captive bolts (3) of the piston rod-end pin from right hitch steer cylinder, and knock out the pin with long iron bar and iron hammer.	13#Wrench, long iron bar, iron hammer
 P24H00104	4. Remove captive bolts (4) of the cylinder body-end pin from right hitch steer cylinder, and knock out the pin with long iron bar and iron hammer, take out the cylinder, ring and dust ring.	13#Wrench, long iron bar, iron hammer

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Figure	Operation steps	Tool(s)
	5. Remove left hitch steer cylinder, and refer to steps for right hitch steer cylinder, in which the oil port sign of the cylinder are as shown in the left figure.	24# wrench, 13# wrench, shielding film, long iron bar, iron hammer

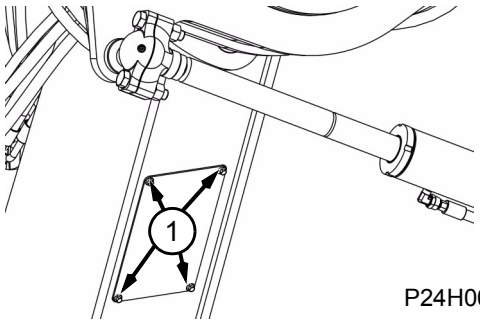
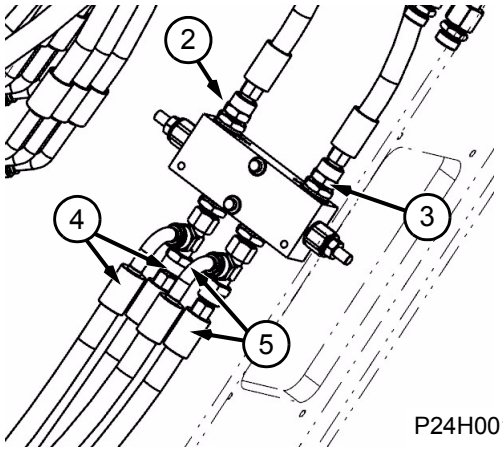
Installation of Hitch Steering Cylinder

For the installation of hitch steer cylinder, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with the oil port as based on the identification of each hose without error.

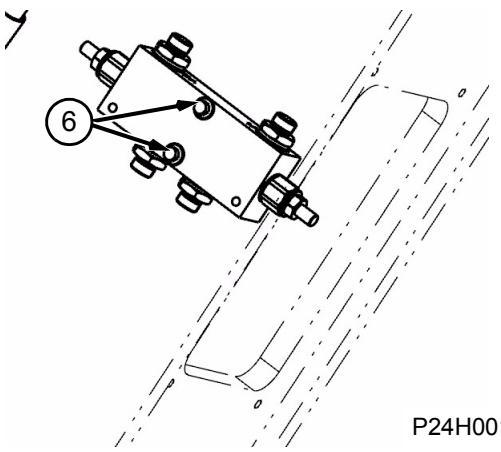
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Removal and Installation of Hitch Steering Cylinder Balanced Valve

Removal of Hitch Steering Cylinder Balanced Valve

Figure	Operation steps	Tool(s)
	1. Park the grader horizontally, horizontally place the blade onto the ground; after the machine is shut down, continuously push and pull the control lever of the hitch steer cylinder, and remove pressure oil inside lines.	
 P24H00106	2. Remove 4 mounting bolts (1) on the coverplate, and take down the coverplate.	10# Wrench
 P24H00107	3. According to balanced valve assembly oil port diagram, after hose joints (2) (3) and (4) (5) are marked, remove them, in the meantime, remove the tee, and mask every oil port.	24# wrench, shielding film

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Figure	Operation steps	Tool(s)
 P24H00108	4. Remove 2 mounting bolts (6) of balanced valve assembly, and take out balanced valve assembly.	10# Wrench

Installation of Hitch Steering Cylinder Balanced Valve

For the installation of hitch steer cylinder balanced valve, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with the oil port as based on the identification of each hose without error.

Removal and Installation of Blade Pitch Cylinder

Removal of Blade Pitch Cylinder

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

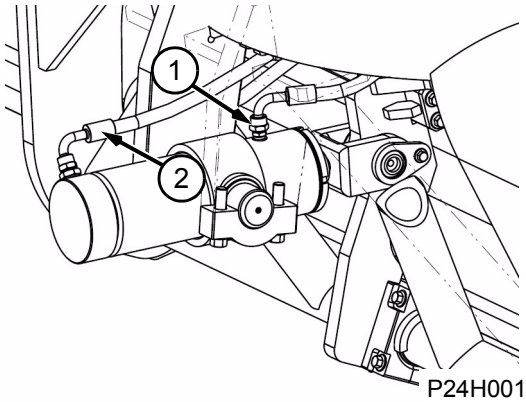
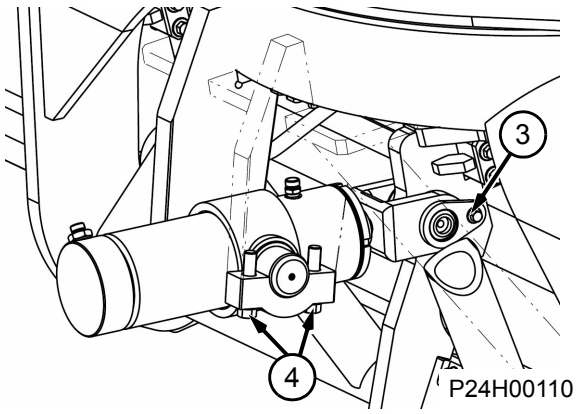
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⚠WARNING

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There may be residual hydraulic oil with pressure in the hydraulic system after the engine stops. Release the residual pressure before repairing the hydraulic system, otherwise the serious personal injury or even death may be caused.

Make sure that all the work implements have been lowered down and the hydraulic oil has cooled before removing any component or pipe.

Figure	Operation steps	Tool(s)
	1. Park the grader horizontally, horizontally place the blade onto the ground; after the machine is shut down, continuously push and pull the control lever of the blade pitch cylinder, and remove pressure oil inside lines.	
 P24H00109	2. After hose connectors (1) (2) are marked, remove them and mask every oil port.	24# wrench, shielding film
 P24H00110	3. Remove captive bolts (3) of the pin, knock out the pin with long iron bar and iron hammer; make pairing identifications of "I" and "II" respectively on the assembly surfaces on the left and right sides of the fork. For subsequent recovery, be sure to assemble them in pairs by identifications; remove 4 fastening bolts (4) on the fork cover, and take down the fork cover.	13# wrench, 21# wrench, long iron bar, iron hammer

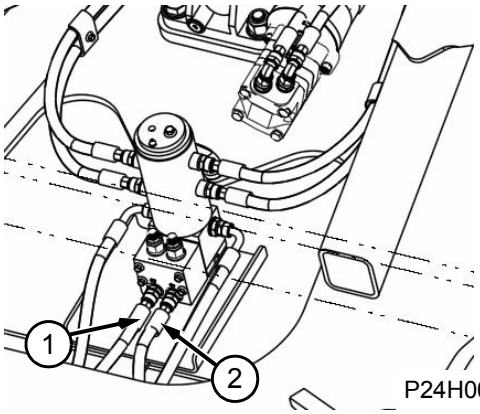
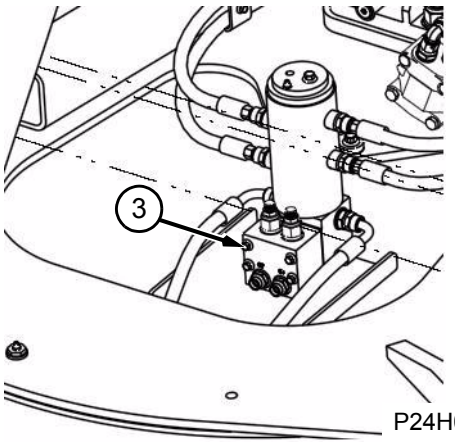
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Installation of Blade Pitch Cylinder

For the installation of blade pitch cylinder, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with the oil port as based on the identification of each hose without error.

Removal and Installation of Blade Pitch Cylinder Balanced Valve

Removal of Blade Pitch Cylinder Balanced Valve

Figure	Operation steps	Tool(s)
	1. Park the grader horizontally, horizontally place the blade onto the ground; after the machine is shut down, continuously push and pull the control lever of the blade pitch cylinder, and remove pressure oil inside lines.	
 P24H00080	2. According to oil ports diagram of balanced valve assembly, after hose connectors (1) (2) are marked, remove them, and mask every oil port.	24# wrench, shielding film
 P24H00111	3. Remove 4 captive bolts (3) of balanced valve, and take out balanced valve assembly, and mask every oil port.	10# wrench, shielding film

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Installation of Blade Pitch Cylinder Balanced Valve

For the installation of blade pitch cylinder, assemble in the reverse sequence of removal, of which the hose assembly part must be connected with the oil port as based on the identification of each hose without error.

Removal of Blade Lead-out Cylinder

For removal of blade lead-out cylinder, refer to the chapter for the removal of work implement.

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Steering Hydraulic System

Removal of Quantitative Gear Pump Assembly

Refer to removal of metering pump and removal of working pump assembly

Installation of Working Pump Assembly

Refer to installation of metering pump and installation of working pump assembly

Removal, Disassembly and Assembly of Metering Pump

Removal of Metering Pump

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	32#	1
3	Wrench	27#	1
4	Wrench	18#	1
5	Wrench	16#	1
6	Wrench	13#	1
7	Cross screwdriver		1
8	Shielding film		1
Other information			
Weight of the metering pump		8.52	

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

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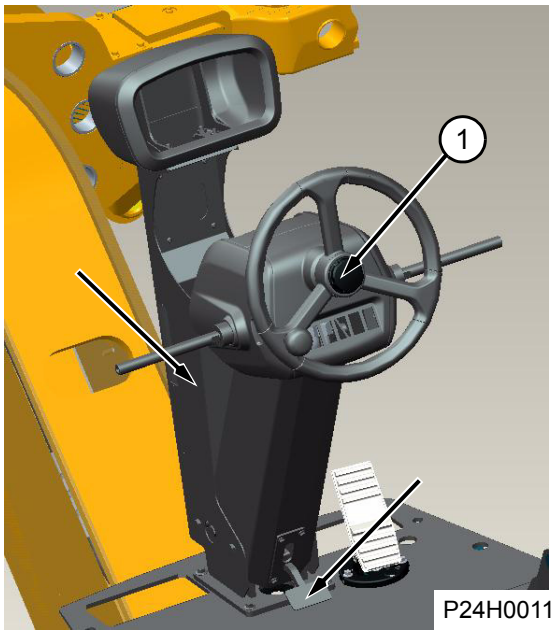
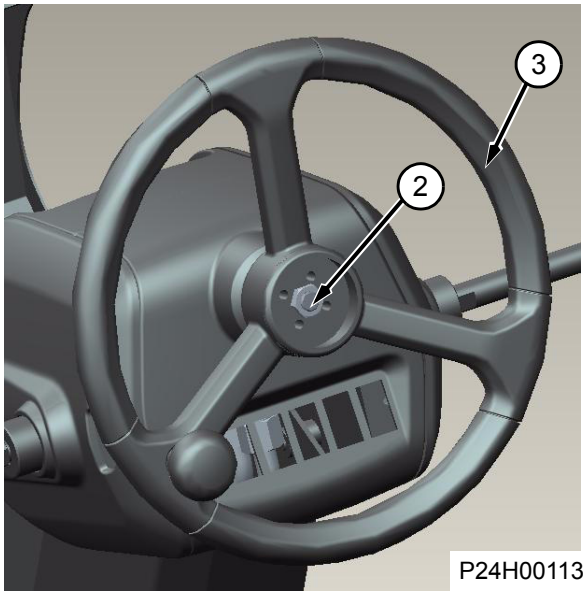
⚠WARNING

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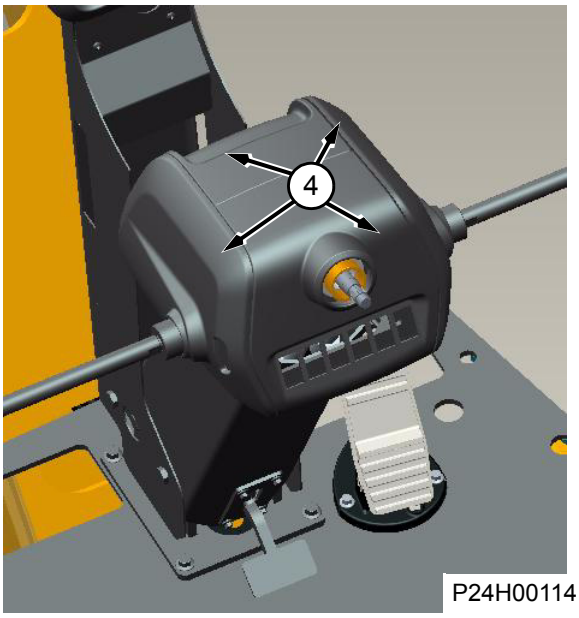
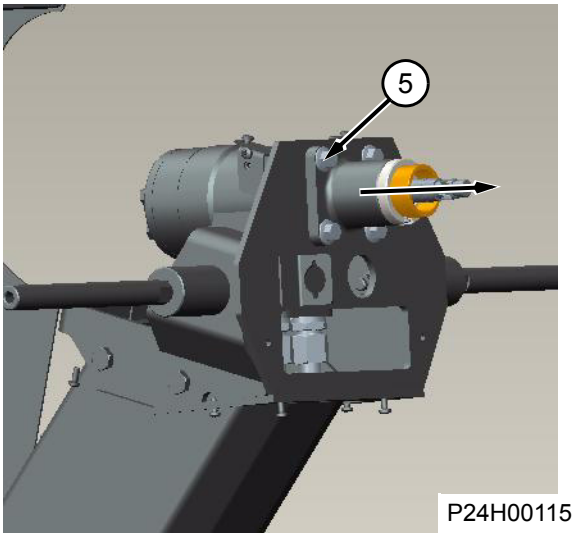
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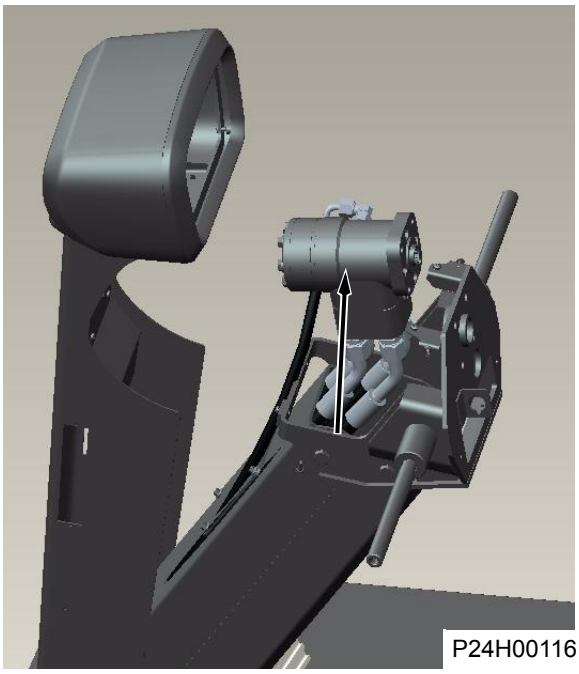
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Figure	Operation steps
 P24H00112  P24H00113	1. Step on the adjusted pedal of the platform, pull the platform away the fixing bracket; remove button cover1 of the horn, remove locknut 2 of the steering wheel, and remove the steering wheel.

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Figure	Operation steps
 P24H00114	2. Remove fixing screw of the trim cover on the platform, pry the clip, and remove the trim cover 4.
 P24H00115	3. Remove fixing bolts 5 of the metering pump with the wrench, remove parts, such as steering shaft, steel sleeve, etc.

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Figure	Operation steps
 P24H00116	4. Pull the metering pump away from the platform for a certain distance, remove the hose joints from the metering pump, after screwing out the hose by 1-2 circles with the wrench, knock the joint position with the wrench to completely relieve pressure of hydraulic oil, remove the hose, make marks and mask the oil ports, and remove the hose.
 P24H00117	5. Remove the metering pump and place it in a safe and clean space.

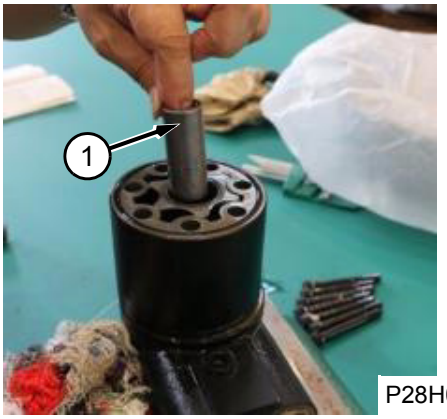
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Disassembling of Metering Pump

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	13#	1
2	Inner hexagon spanner		1
3	Vise		1

Figure	Operation steps
 P28H00386  P28H00387	1. Fix the metering pump on the vise. 2. Remove 7 bolts at the bottom.

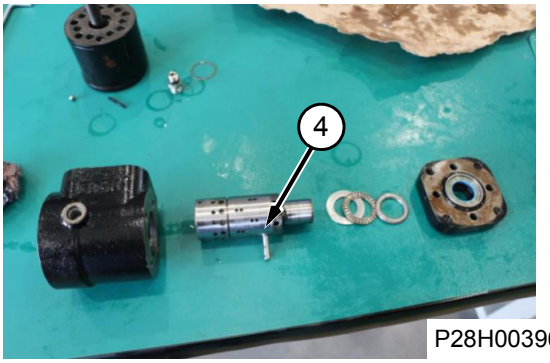
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Figure	Operation steps
 P28H00388  P28H00389	3. Take out the part (1). 4. Take out the part (2).

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Figure	Operation steps
 P28H00390  P28H00391  P28H00392  P28H00391	5. Loosen the metering pump, after adjustment, fix the metering pump with vise. 6. Unscrew the captive bolt using the inner hexagon spanner. Take down the cover plate.

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Figure	Operation steps
 P28H00394  3 P28H00395  4 P28H00396  P28H00397	7. Remove the metering pump from the vise. Take out gasket group (3). 8. Take out the part (4).

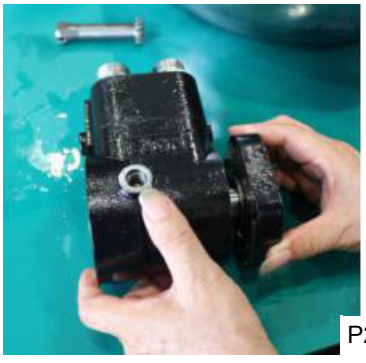
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Assembly of Metering Pump

Relevant preparation before starting

NOTICE

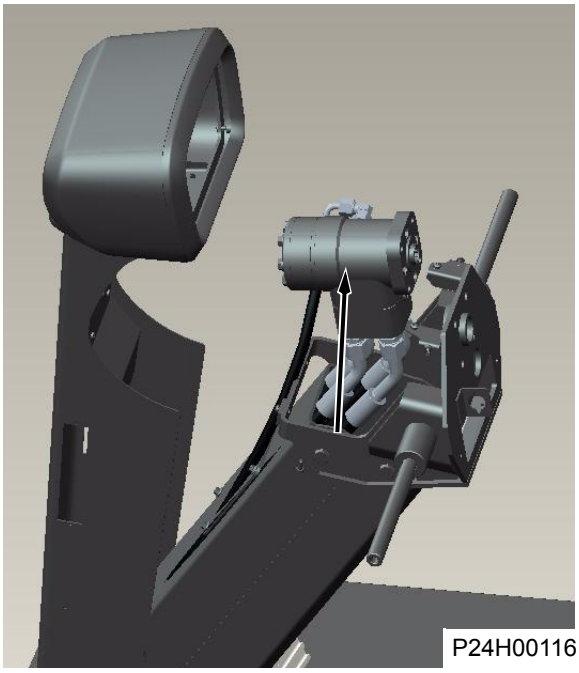
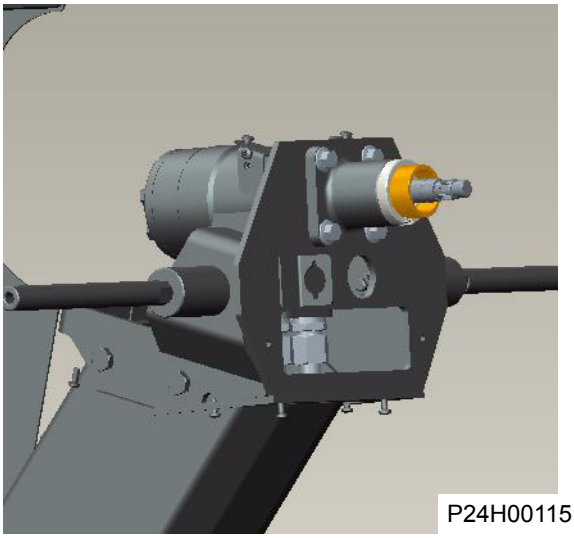
Please keep clean. All components shall be cleaned thoroughly with cleaning solution prior to assembly. The components are allowed for natural drying. Never wipe them dry with cloth. The fiber from the cloth will accumulate on the parts and cause fault. Check all components. If the components are worn or damaged, please replace them with new ones.

Figure	Operation steps
 P28H00398  P28H00399  P28H00400	1. Install parts and components of the metering pump in the reverse order of removal. Tightening torque of bolt is: 52±7N.m.

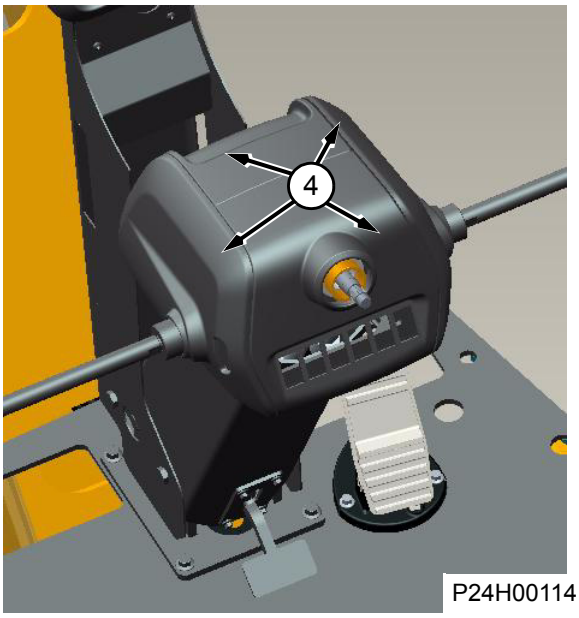
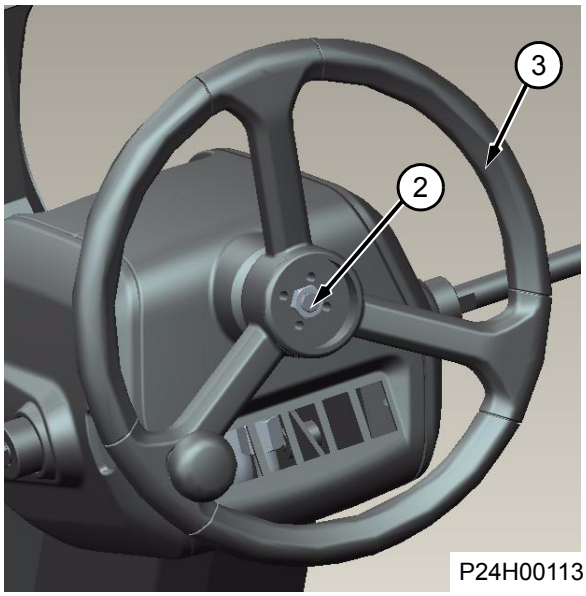
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Figure	Operation steps
 P28H00401  P28H00402  P28H00403  P28H00404	

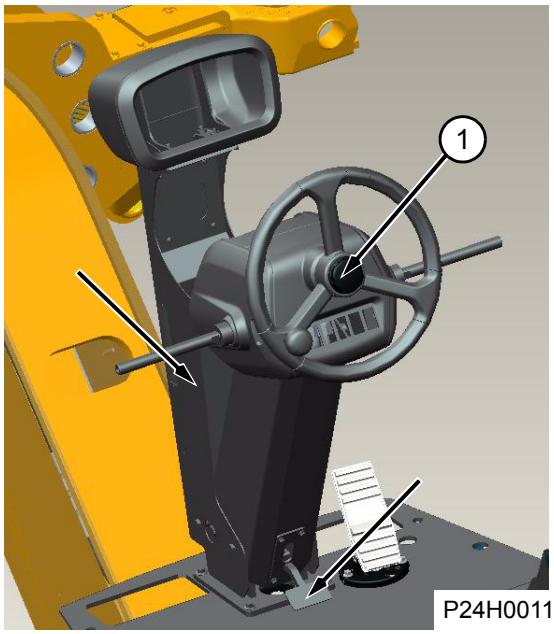
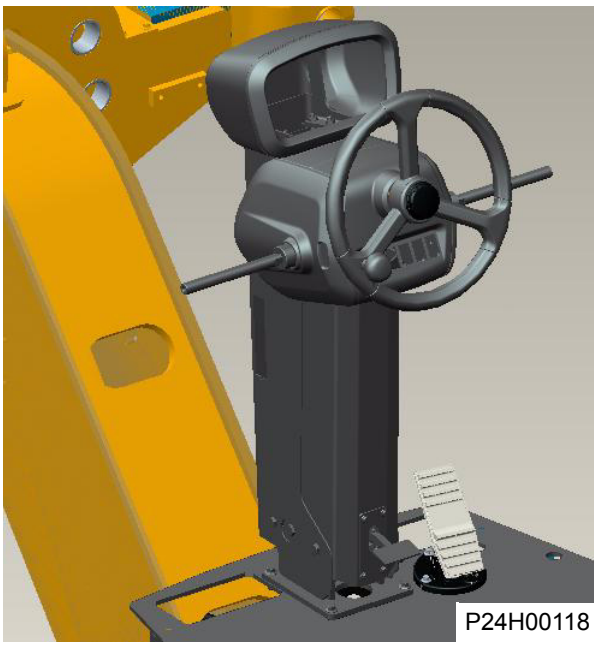
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Figure	Operation steps
 P24H00116  P24H00115	2. Connect the hose to the metering pump and tighten it; press the metering pump and hose into the platform, and then install and tighten the steering shaft, steel sleeve, etc with captive bolts.

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Figure	Operation steps
 P24H00114	3. Install trim cover 4 of the platform and tighten it with the setscrew.
 P24H00113	4. Install steering wheel 3, and tighten it with the locknut 2 of steering wheel.

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Figure	Operation steps
 P24H00112  P24H00118	5. Install button cover 1 of the horn, and push the platform into the fixing bracket.

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Removal, Disassembly and Assembly of Priority Valve

Removal of Priority Valve

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	36#	1
2	Wrench	32#	
3	Wrench	27#	1
4	Wrench	18#	1
5	Wrench	13#	1
6	Shielding film		1
7	Oil collecting basin		1
Other information			
Weight of the priority valve		2.3	

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

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⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

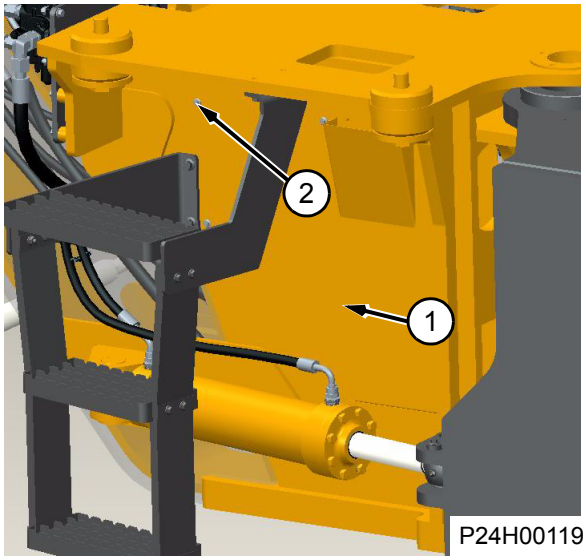
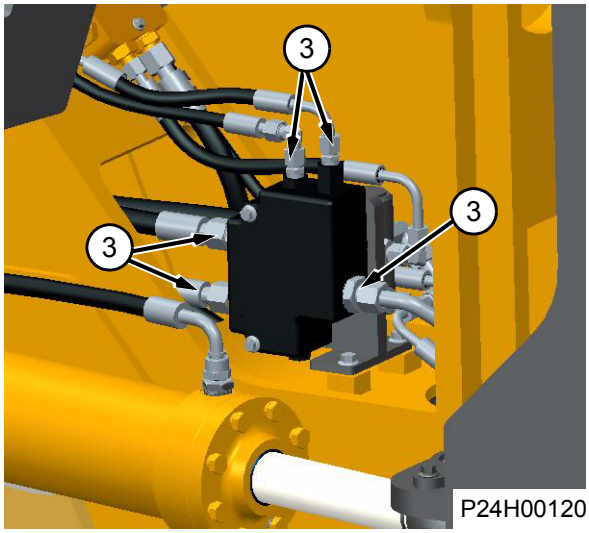
⚠WARNING

Hydraulic oil pressure and hot oil may cause personal injury or even death.

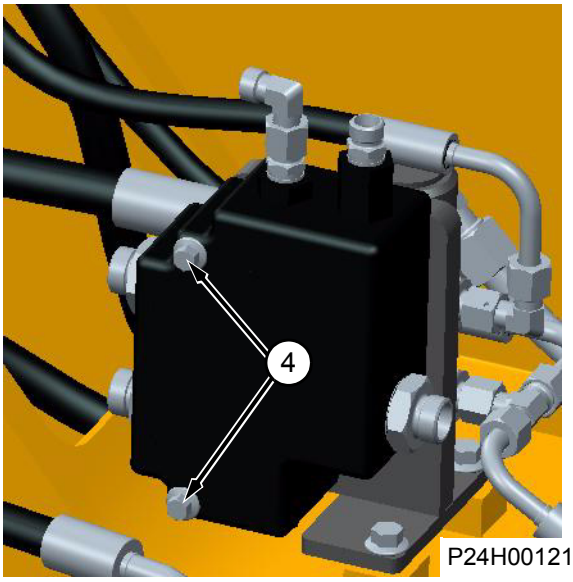
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Figure	Operation steps
	1. Start the complete machine, operate hitch steer cylinder to make right hitch steer of the vehicle reach the limit state. 2. Remove 5 captive bolts (2) of the left cover (1) with the wrench.
	3. Remove 5 oil port joints (3) of the priority valve; remove the oil pipe, make marks well, and mask the oil port.

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Figure	Operation steps
 P24H00121	4. Remove the mounting bolts (4) from the priority valve. Remove the priority valve. Place it at a clean and safe place.

Disassembly of Priority Valve

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	32#	
2	Wrench	27#	1
3	Wrench	24#	1
4	Wrench	21#	1
4	Wrench	17#	1

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Figure	Operation steps
 P28H00415  P28H00416  P28H00417  P28H00418	1. Screw off all joints on the valve. 2. Remove the spool plug, take out the spool, spring, etc.

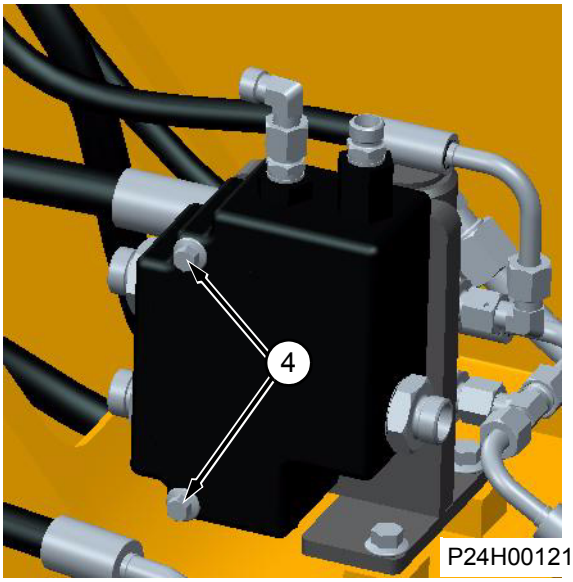
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Assembly of Priority Valve

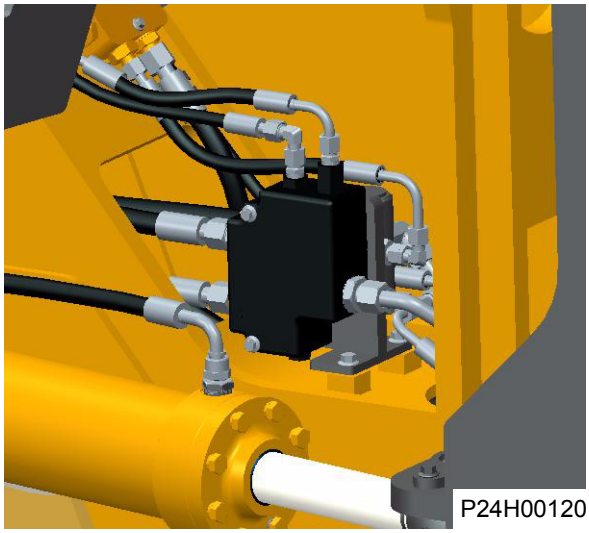
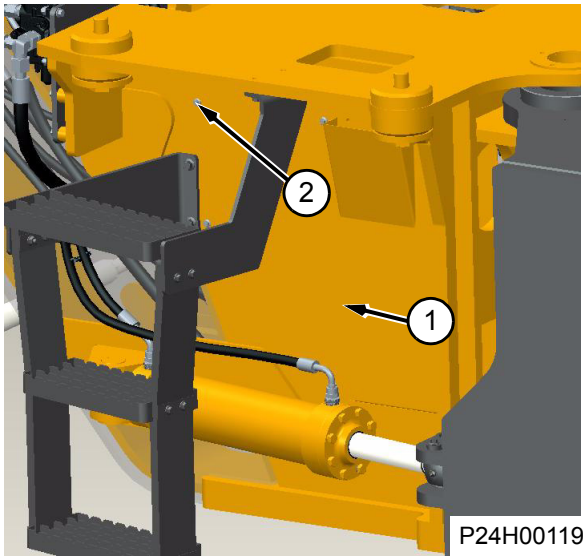
Relevant preparation before starting:

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Figure	Operation steps
 P28H00415	1. Install 5 oil port joints of the priority valve.
 P24H00121	2. Install captive bolts (4) of the priority valve.

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Figure	Operation steps
 P24H00120	3. Install every joint hose of the priority valve, and mounting torque is 52±5N.m.
 P24H00119	4. Install left cover (1), and tighten it with the bolt (2).

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Disassembly and Assembly of Steering Cylinder

Removal of Steering Cylinder

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	10#	1
2	Wrench	27#	1
3	Wrench	36#	1
4	Copper bar		1
5	Shielding film		1
6	Oil collecting basin		1
Other information			
Weight of steering cylinder		12.4	

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

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Hydraulic oil pressure and hot oil may cause personal injury or even death.

There may be residual hydraulic oil with pressure in the hydraulic system after the engine stops. Release the residual pressure before repairing the hydraulic system, otherwise the serious personal injury or even death may be caused.

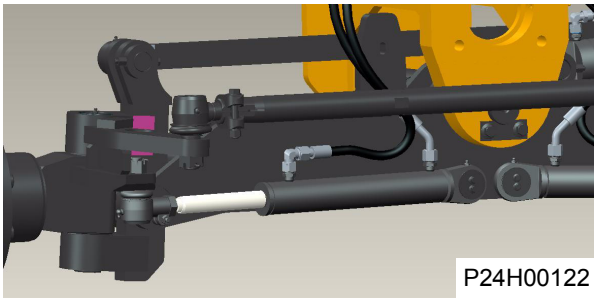
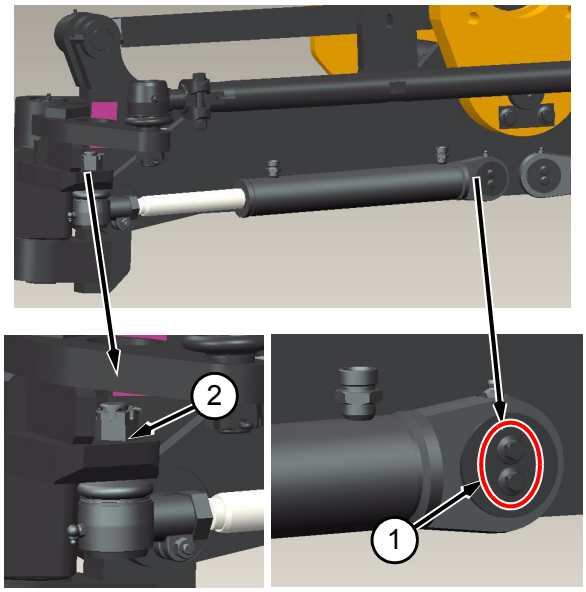
Make sure that all the work implements have been lowered down and the hydraulic oil has cooled before removing any component or pipe. The oil filter cover can not be removed until the engine stopped and the filter cover is cool enough that can be touched by bare hand.

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⚠CAUTION

Park the machine on horizontal hard ground→ place flat the blade onto the ground→ pull the hand brake→ shut down

Removal steps (Take left steering cylinder as example, and the removal steps of right steering cylinder is the same)

Figure	Operation steps
 P24H00122	1. Loosen the hose joints from big-cavity and small-cavity of steering cylinder and remove them; mask every oil port;
 P24H00123	2. Remove fastening bolts and cover (1) from cylinder body of the steering cylinder; 3. Take down limit cotter pin nuts (2) from ball joint nut of the steering cylinder, and remove nuts (2);
 P24H00124	4. Take down the steer cylinder, and place it onto clean horizontal ground, mask the big-cavity and small-cavity of steering cylinder to keep off the pollution.

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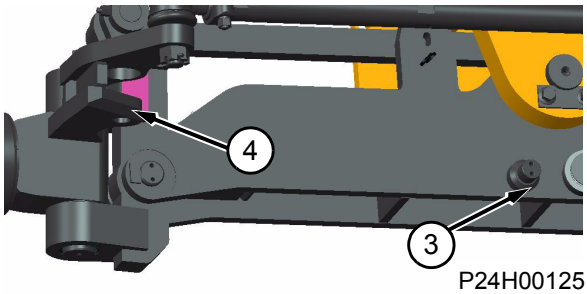
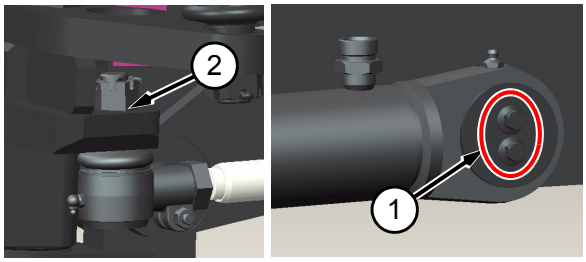
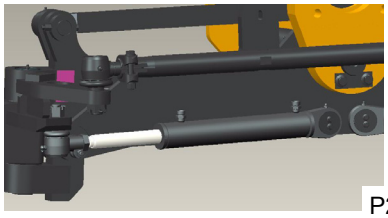
Assembly of Steering Cylinder

Relevant preparation before starting

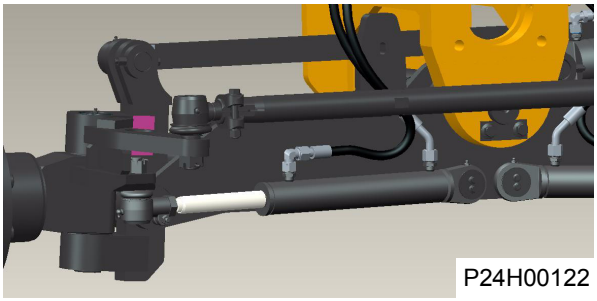
See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. All components shall be cleaned thoroughly with cleaning solution prior to assembly. The components are allowed for natural drying. Never wipe them dry with cloth. The fiber from the cloth will accumulate on the parts and cause fault. Check all components. If the components are worn or damaged, please replace them with new ones.

Figure	Operation steps
 P24H00125   P24H00123	1. Install cylinder body of the steer cylinder on the front bridge pin (3), install fastening bolts and cover (1); 2. Install ball joint shaft of the steer cylinder onto the hole of steering knuckle (4), tighten locknut (2), and carry out the limit with cotter pin.

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Figure	Operation steps
 P24H00122	3. Connect big-cavity and small-cavity hoses of steer cylinder. 4. Fill the hydraulic oil, start the machine and idle it for 5min; 5. Turn slowly for at least 10 times and bleed the air in the line; 6. Stop the machine and check it for leakage; 7. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level.

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Brake System

Removal of Quantitative Gear Pump Assembly

Refer to removal of working pump assembly

Installation of Working Pump Assembly

For installation of working pump assembly, refer to installation of working pump assembly

Disassembly and Assembly of Brake Valve

Removal of Brake Valve

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	10#	1
2	Wrench	13#	1
3	Wrench	17#	1
4	Wrench	19#	1
5	Wire cutter		1
6	Shielding film		1
Other information			
Weight of the brake valve		4.2	

⚠CAUTION

Before disassembling brake valve, make sure that machine is in parking brake and flameout state. Depress continuously the brake valve for 15-20 times to release the accumulator and the line air pressure.

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

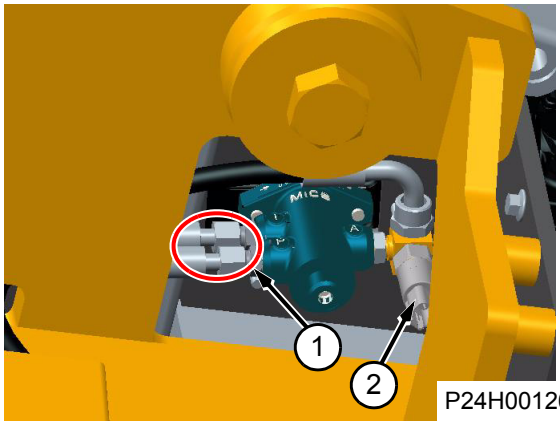
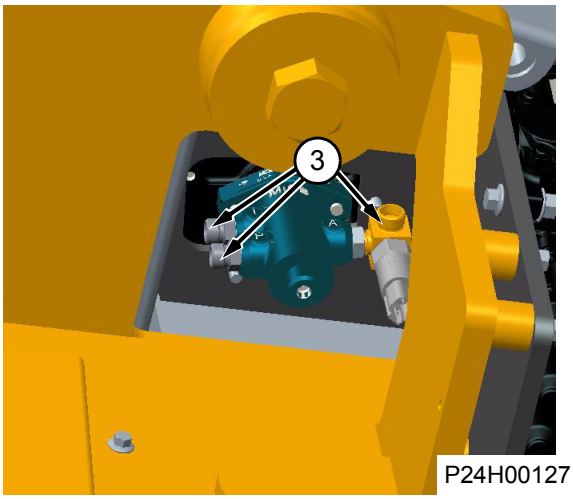
Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

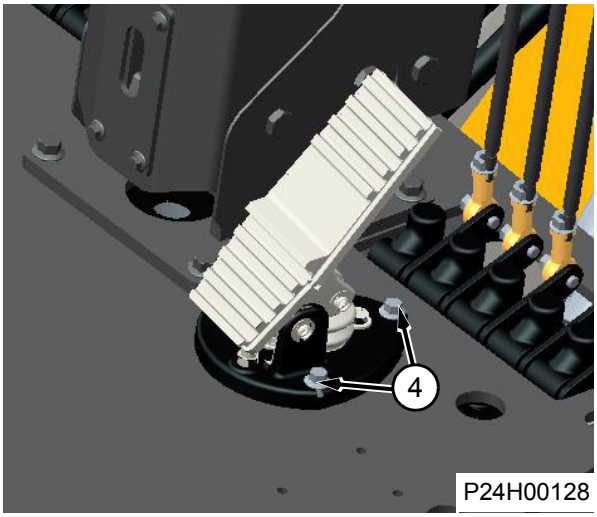
https://truckmanualshub.com/

⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

Figure	Operation steps
 P24H00126	1. Remove 3 hose joints (1) from the brake valve, remove the hose and mark it well. 2. Unplug the wire harness connector (2).
 P24H00127	3. Remove the connector (3) on the brake valve.

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Figure	Operation steps
 P24H00128  P24H00129	4. Remove 3 captive bolts(4) of the brake valve, take out the brake valve, and place them at a clean and safe site.

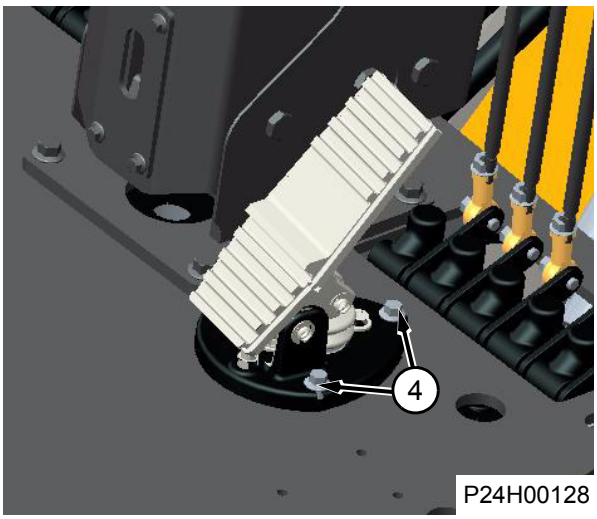
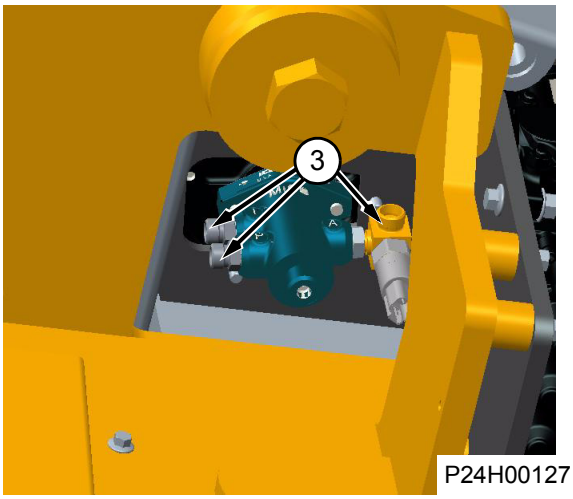
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Assembly of Brake Valve

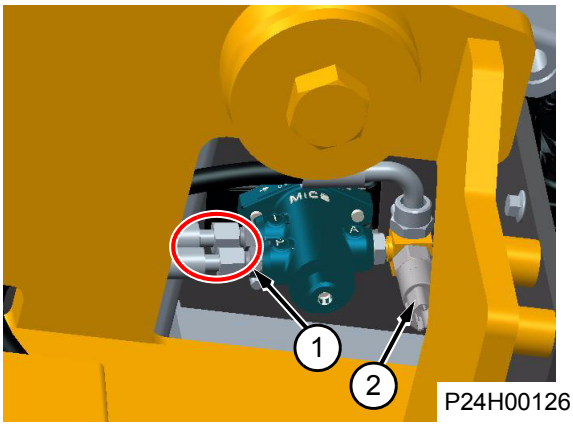
Relevant preparation before starting:

NOTICE

Please keep clean. All components shall be cleaned thoroughly with cleaning solution prior to assembly. The components are allowed for natural drying. Never wipe them dry with cloth. The fiber from the cloth will accumulate on the parts and cause fault. Check all components. If the components are worn or damaged, please replace them with new ones.

Figure	Operation steps
 P24H00128	1. Install captive bolts (4) of the captive valve.
 P24H00127	2. Install the connector (3) on the brake valve.

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Figure	Operation steps
 P24H00126	3. Connect 3 hoses (1) and harness connector (2) on the brake valve.

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Disassembly and Assembly of Charge Valve

Disassembly of Charge Valve

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	10#	1
2	Wrench	13#	1
3	Socket	17#	1
4	Wrench	19#	1
5	Wrench	24#	1
6	Wrench	27#	1
7	Wrench	32#	1
8	Shielding film		1
Other information			
Weight of charge valve		3.5	

⚠CAUTION

Before charge valve is removed, make sure that machine is in parking brake and flameout state. Depress continuously the brake valve for 15-20 times to release the accumulator and the line air pressure.

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

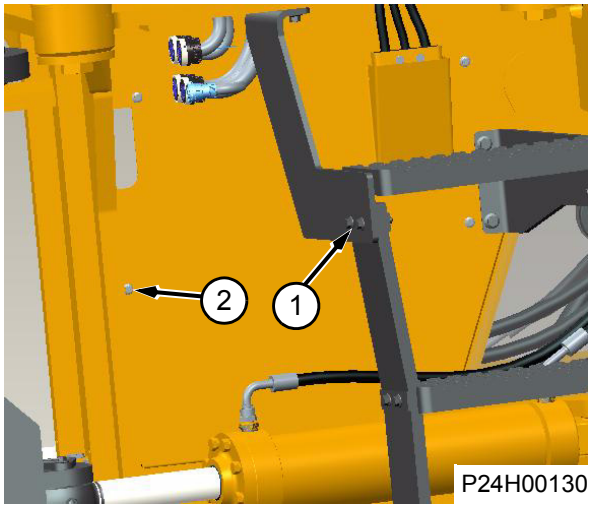
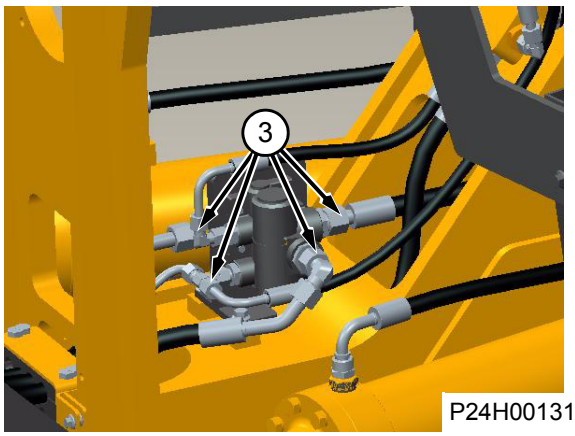
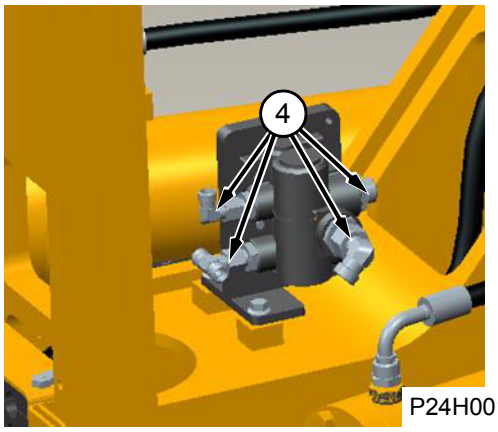
Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

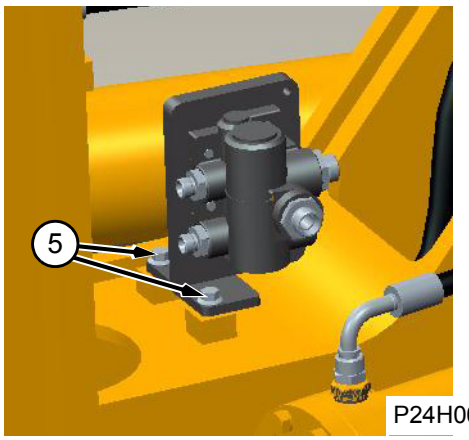
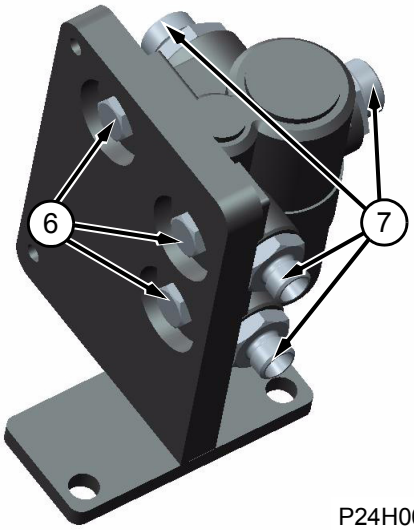
⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

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Figure	Operation steps
 P24H00130	1. Remove fastening bolts (2) of the right cover (1), and remove right cover (1).
 P24H00131	2. Remove the hose joint (3) of the charge valve.
 P24H00132	3. Remove the connector (4) on the charge valve.

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Figure	Operation steps
 P24H00133	4. Remove captive bolts (5) of the mounting plate on the charge valve, and take out charge valve assembly.
 P24H00134	5. Remove fastening bolt (6) of the charge valve, remove the connector on the charge valve (7), take down charge valve, and place it at a clean, safe site.
 P24H00135	

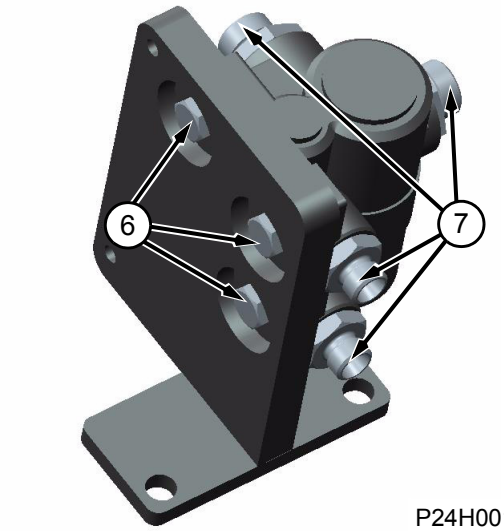
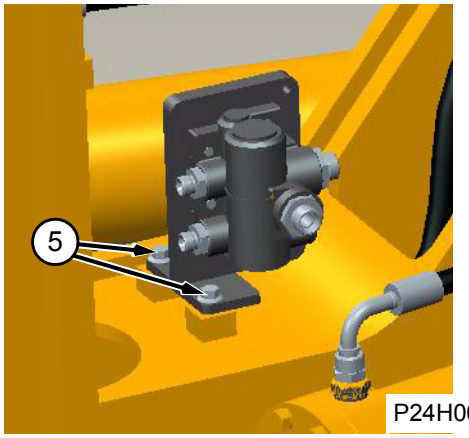
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Assembly of Charge Valve

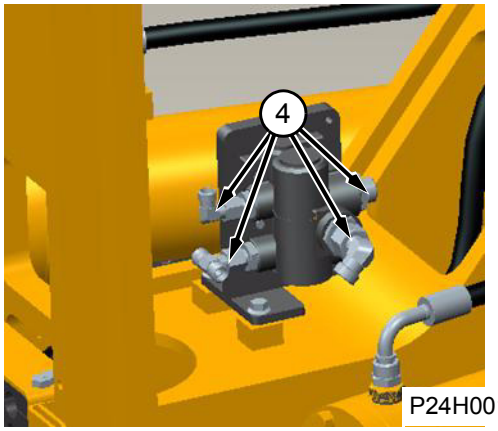
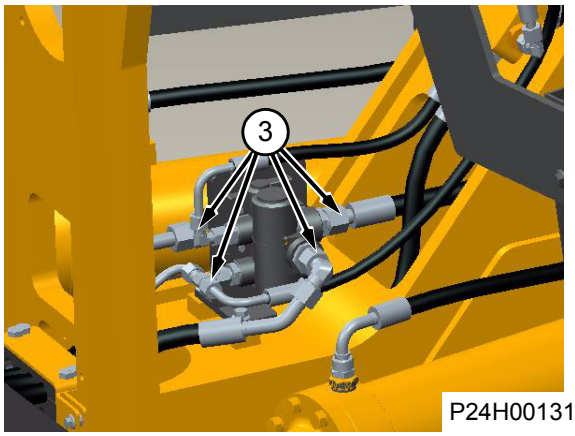
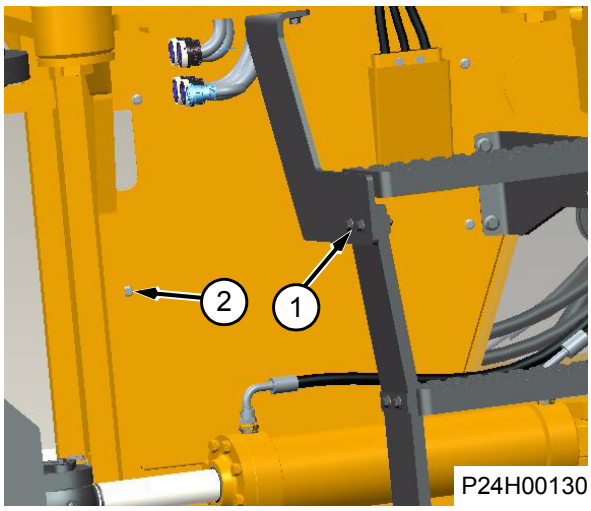
Relevant preparation before starting:

NOTICE

Please keep clean. All components shall be cleaned thoroughly with cleaning solution prior to assembly. The components are allowed for natural drying. Never wipe them dry with cloth. The fiber from the cloth will accumulate on the parts and cause fault. Check all components. If the components are worn or damaged, please replace them with new ones.

Figure	Operation steps
 P24H00134	1. Install the connector on the charge valve (7), install charge valve on the mounting plate, and tighten it with bolts (6).
 P24H00133	2. Install charge valve assembly, and tighten it with the bolt (5).

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Figure	Operation steps
 P24H00132	3. Install the transition joint (4).
 P24H00131	4. Install the hose (3).
 P24H00130	5. Install right cover (1), and tighten it with bolts (2).

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Disassembly and Assembly of Accumulator

Removal of Accumulator

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	13#	1
2	Wrench	19#	1
3	Wrench	50#	1
4	Shielding film		1
Other information			
Weight of the accumulator		12.5	

⚠CAUTION

Before disassembling the accumulator, make sure that machine is in parking brake and flameout state. Depress continuously the brake valve for 15-20 times to release the accumulator and the line air pressure.

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

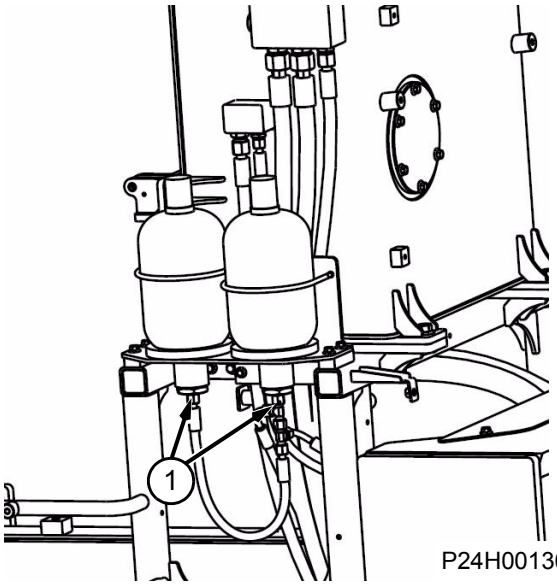
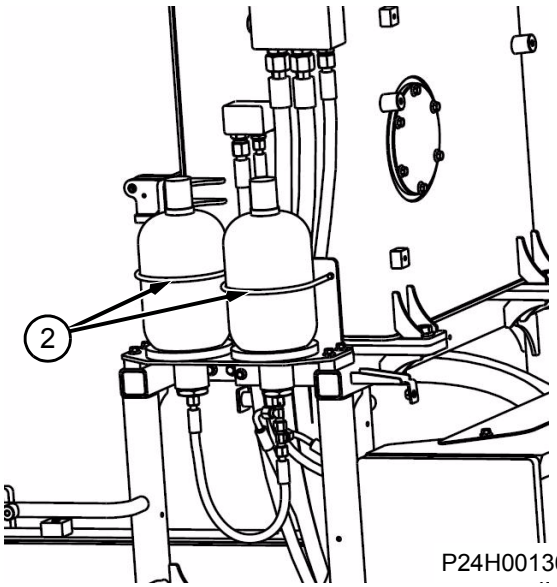
Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

⚠CAUTION

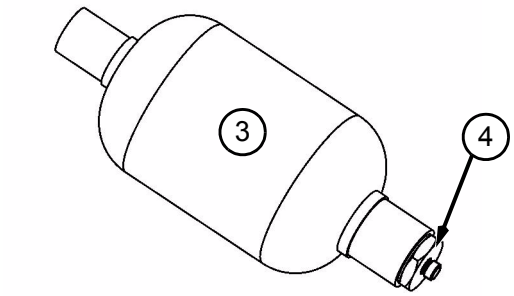
The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

Figure	Operation steps
	1. Open the hood, steps refer to

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Figure	Operation steps
	2. Remove the hose joint connecting to the accumulator (1), and seal it well for the hose joint.
	3. Remove the set U bolt (2) of the accumulator.

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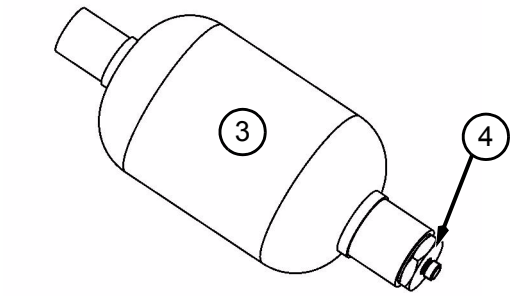
Figure	Operation steps
 P24H00137	4. Take down the accumulator (3), place it at a clean, safe site, and remove the connector connecting to the accumulator (4).

Assembly of Accumulator

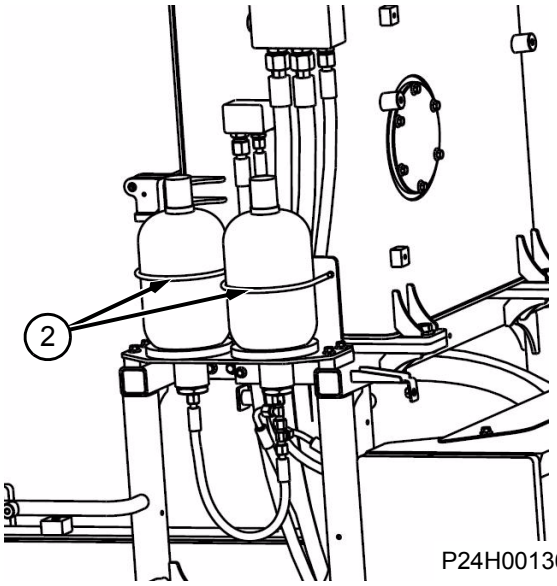
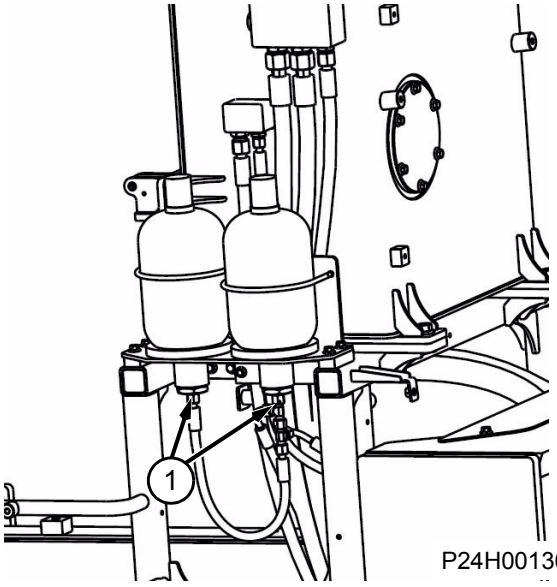
Relevant preparation before starting:

NOTICE

Please keep clean. All components shall be cleaned thoroughly with cleaning solution prior to assembly. The components are allowed for natural drying. Never wipe them dry with cloth. The fiber from the cloth will accumulate on the parts and cause fault. Check all components. If the components are worn or damaged, please replace them with new ones.

Figure	Operation steps
 P24H00137	1. Install the connector (4) connecting to the accumulator (3).

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Figure	Operation steps
	2. Install the set U bolt (2) of the accumulator.
	3. Install the hose joint connecting to the accumulator (1).

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Latch Hydraulic System

Disassembly and Assembly of Latch Cylinder

Disassembly of Latch Cylinder

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Inner hexagon spanner	8#	1
2	Wrench	10#	1
3	Wrench	19#	1
4	Wire cutter		1
5	Shielding film		1
Other information			
Weight of the brake valve		11.4kg	

⚠CAUTION

Before latch cylinder is removed, make sure that machine is in parking brake and flameout state, and work implement is placed flat on the horizontal ground, continuously step the brake valve for 15-20 times, release oil pressure of the accumulator, solenoid directional valve is on-off for several times, and release the oil pressure in the latch cylinder.

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

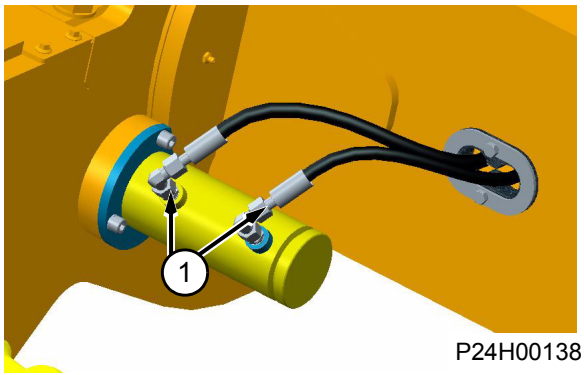
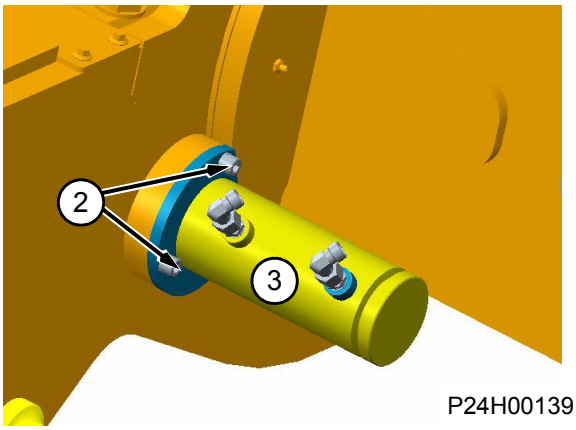
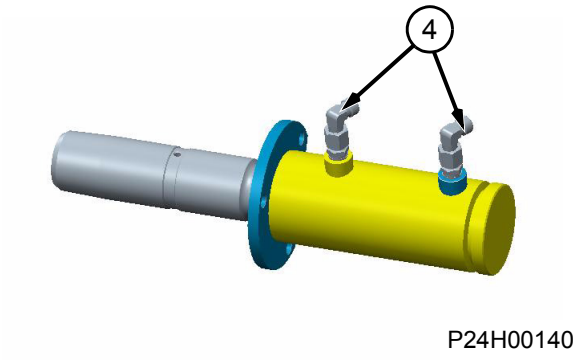
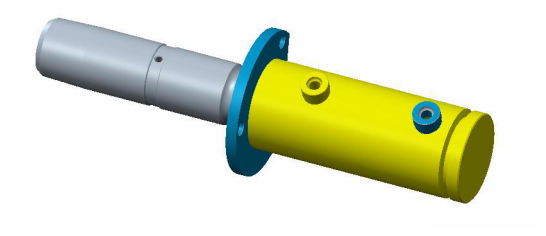
Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

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Figure	Operation steps
 P24H00138	1. Remove the hose joint connecting to the accumulator (1), and seal it well for the hose joint.
 P24H00139	2. Remove mounting bolt (2) of the latch cylinder. Take down the latch cylinder (3), and place it onto a safe, clean, horizontal ground.
 P24H00140	3. Remove the connector (4) on the latch cylinder.
 P24H00141	

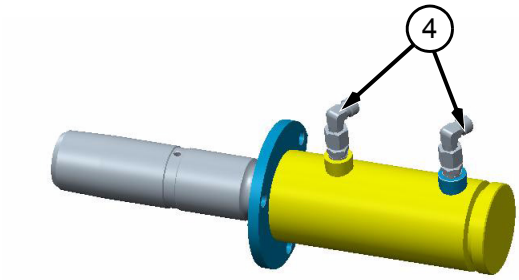
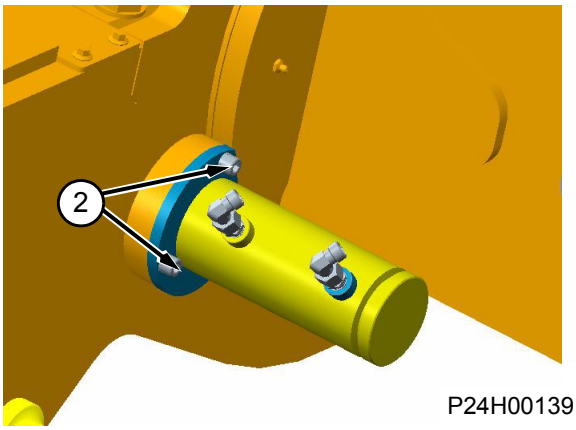
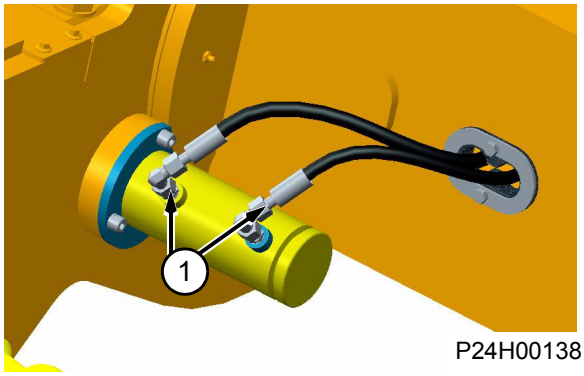
https://truckmanualshub.com/

Assembly of Latch Cylinder

Relevant preparation before starting:

NOTICE

Please keep clean. All components shall be cleaned thoroughly with cleaning solution prior to assembly. The components are allowed for natural drying. Never wipe them dry with cloth. The fiber from the cloth will accumulate on the parts and cause fault. Check all components. If the components are worn or damaged, please replace them with new ones.

Figure	Operation steps
 P24H00140	1. Install the connector (4) on the latch cylinder.
 P24H00139	2. Install the captive bolt (2) on the latch cylinder.
 P24H00138	3. Install the hose (1) on the latch cylinder.

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Disassembly and Assembly of Solenoid Directional Valve

Removal of Solenoid Directional Valve

Tools required			
Tool(s)	Part description	Standard	Quantity
1	Wrench	10#	1
2	Wrench	19#	1
3	Wire cutter		1
4	Shielding film		1
Other information			
Weight of solenoid directional valve		2.8kg	

⚠CAUTION

Before solenoid directional valve is removed, make sure that machine is in parking brake and flameout state, and work implement is placed flat on the horizontal ground, continuously step the brake valve for 15-20 times, release oil pressure of the accumulator, solenoid directional valve is on-off for several times, and release the oil pressure in the latch cylinder.

Relevant preparation before starting:

See the section of Complete Machine Placement for parking the machine.

NOTICE

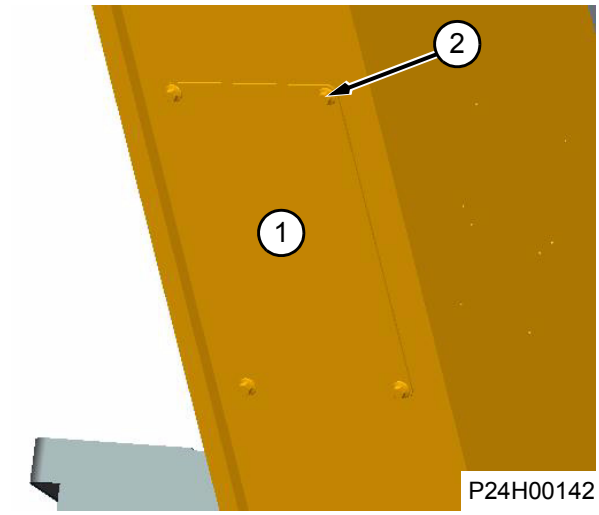
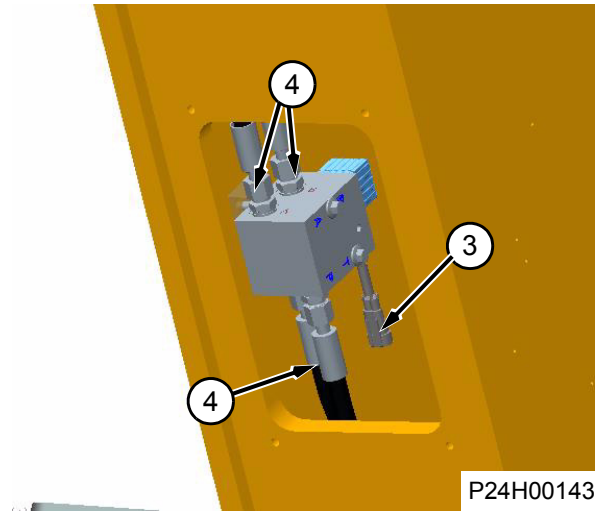
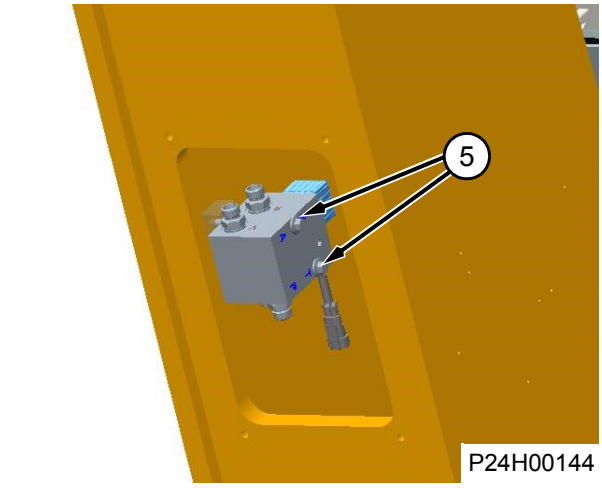
Please keep clean. Thoroughly clean the outer surface of the components before removal. It will prevent foreign matters from entering the mechanism.

Stick label identification stickers on all lines, hoses, circuits and tubes for easier installation. Clog up all the lines, hoses and tubes. That will prevent fluid loss and prevent dirts from entering the system.

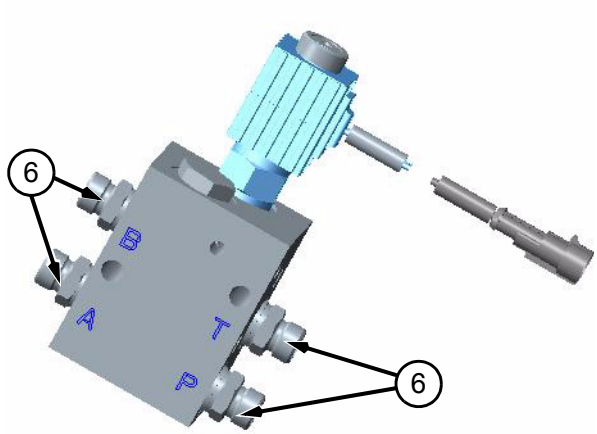
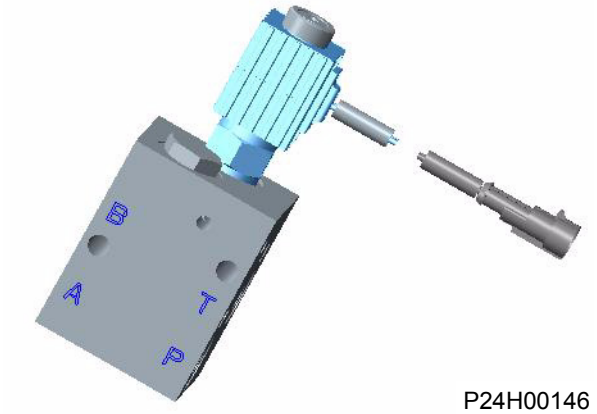
⚠CAUTION

The appropriate container shall be used to collect the liquid before removing any hydraulic oil lines or disassembling any components that contain liquid during the inspection, maintenance, test and adjustment of the machine. Dispose all the fluid in accordance with local laws and regulations.

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Figure	Operation steps
	1. Remove the plate of the front frame (1), and captive bolt (2).
	2. Unplug the plug of the solenoid directional valve (3), remove the hose joint (4) of the solenoid directional valve.
	3. Remove captive bolt (5) of the solenoid directional valve, take down solenoid directional valve, and place it onto a safe, clean, horizontal ground.

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Figure	Operation steps
 P24H00145	4. Remove the connector (6) on the solenoid directional valve.
 P24H00146	

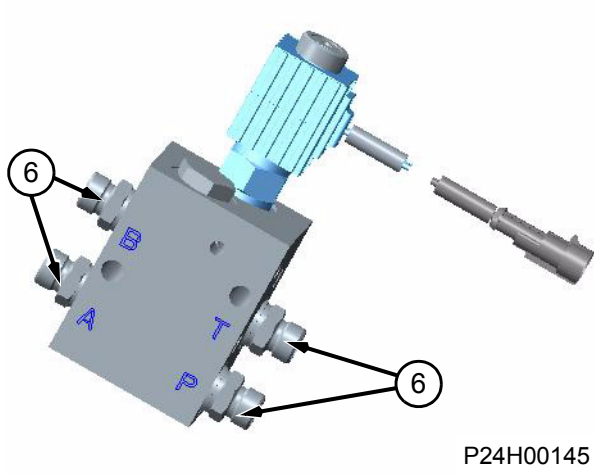
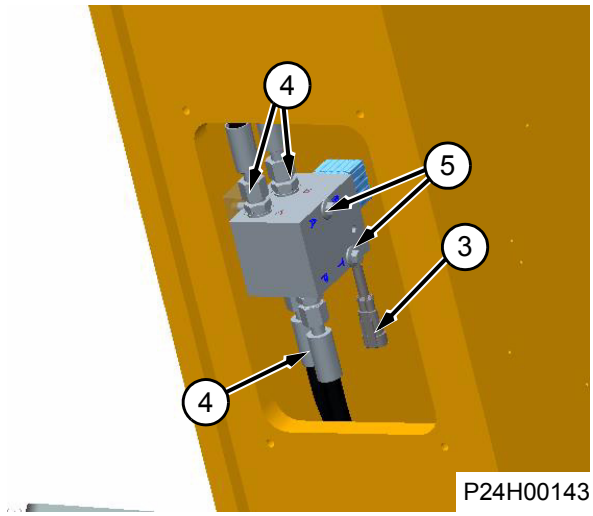
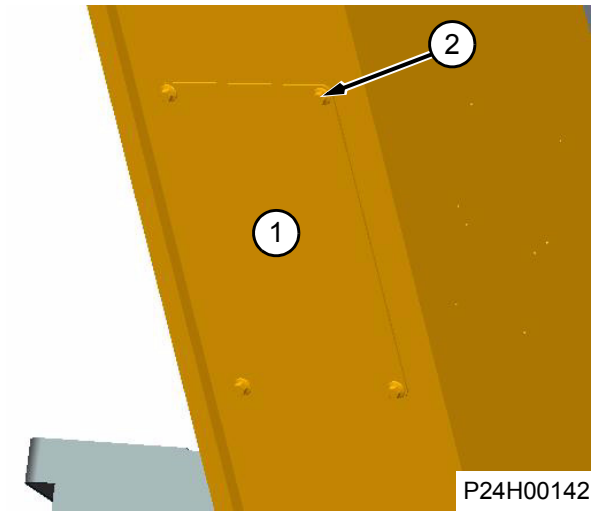
Assembly of Solenoid Directional Valve

Relevant preparation before starting:

NOTICE

Please keep clean. All components shall be cleaned thoroughly with cleaning solution prior to assembly. The components are allowed for natural drying. Never wipe them dry with cloth. The fiber from the cloth will accumulate on the parts and cause fault. Check all components. If the components are worn or damaged, please replace them with new ones.

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Figure	Operation steps
 P24H00145	1. Install the connector (6) on the solenoid directional valve.
 P24H00143	2. Install solenoid directional valve to the front frame, and install and fix the solenoid directional valve with fastening bolt (5), and the hose joint (4) on the solenoid directional valve is installed, plugging the electrical plug (3).
 P24H00142	3. Cover the cover of the front frame (1), and install and fix the cover with fastening bolt (2).

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Air Conditioning System

General Information 5-3
Safety 5-3
Universal Tool and Tooling List 5-3
Special Tool and Tooling 5-3
Structure and Function 5-4
Overview -- Components and Location 5-4
Technical Parameters of System 5-5
Description of Schematic Diagram and Working Principle 5-5
Test and Adjustment 5-8
Air Conditioning System Test 5-8
Removal and Installation 5-10
Introduction to Main Components of Air Conditioning System 5-10
Removal and Installation of A/C Components 5-11
Removal of Compressor 5-11
Remove and Install the Lines Connecting the Compressor and the Compressor 5-14
Removal and Installation of Evaporator Mounting Assembly 5-16
Replacement of A/C Control Panel 5-20
Inspection and Replacement of A/C Fuse 5-20
Removal and Replacement of Reservoir 5-21
Removal and Installation of Condenser 5-23
Removal and Installation of Pressure Switch 5-24
Fault Diagnosis and Judgment 5-25
Fault Diagnosis Process and Troubleshooting 5-25
Classification of Common Faults 5-25
Troubleshooting 5-25
Appendix 5-32
A/C Maintenance 5-33
Regular Maintenance of Air Conditioning System 5-33
Cleaning of Recirculating Air Strainer 5-33
Adjustment of Compressor Belt 5-34

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A/C Refrigerant Filling Method 5-35

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General Information

Safety

Discharge the refrigerant out of air conditioning system according to "Discharge (Recycle) the Refrigerant in the Air Conditioning System" before removing compressor, condenser, refrigerant reservoir, pressure switch and A/C pipes, etc. And seal the removed pipe joints using a reliable method to prevent moisture in the air from entering air conditioning system.

If liquid refrigerant is splashed into eyes, it may lead to blind; if sprayed on the skin, it may cause frostbite. In addition, the container for storing refrigerant can neither be exposed to ambient temperature above 50°C or placed near a heat radiating device or object, nor be exposed to direct sunlight. Otherwise, the temperature of the refrigerant easily rises and causes pressure in the container to increase. When the pressure is high enough, the container may have leakage or explosion.

The refrigerant itself is non-toxic, but cannot directly contact with open flames or heated metal, otherwise it may produce toxic gases.

In order to avoid personal injury from refrigerant, the goggles and gloves should be worn and open fire or smoking is prohibited.

Universal Tool and Tooling List

Specifications	Main functions
10# Open-end wrench	It is used for removal and installation of captive bolts on the line and cover plate of joint box
13# Open-end wrench	It is used for removal and installation of captive bolts (nuts) on the compressor
14# Open-end wrench	It is used for removal and installation of captive nuts (screw rods) on tension pulley
19# Open-end wrench	It is used for removal and installation of A/C pipe joint in the evaporator assembly
21# Open-end wrench	It is used for removal and installation of A/C pipe joint in the evaporator assembly
24# Open-end wrench	It is used for removal and installation of A/C pipe joint in the evaporator assembly
27# Open-end wrench	It is used for removal and installation of water pipe joint on the evaporator
Cross screwdriver	It is used for removal and installation of evaporator mounting assembly
Ratchet wrench	It is used for removal and installation of captive bolts on the evaporator
13# Socket	It is used for removal and installation of captive bolts on the evaporator
Extended rod	It is used for removal and installation of captive bolts on the evaporator
Plastic bag, adhesive tape	It is used for sealing up the pipe joints
Marker	It is used for marking the removed joints

Special Tool and Tooling

Specifications	Main functions
Manifold gauge	It is used for drainage and filling of refrigerant
Vacuum pump	It is used for filling the refrigerant

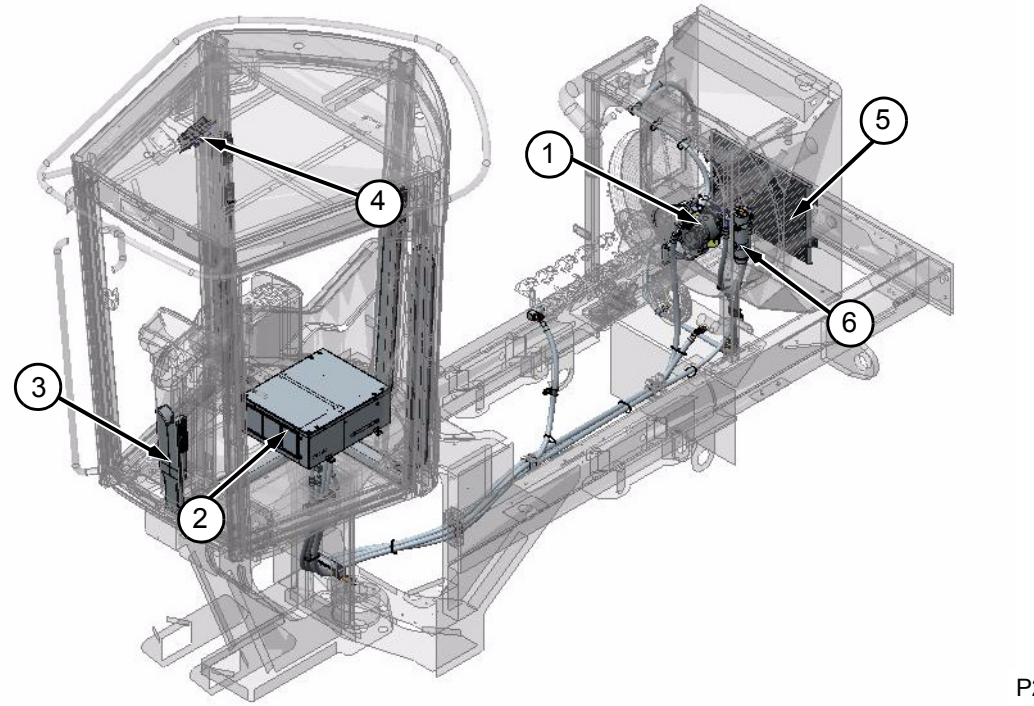
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Structure and Function

Overview -- Components and Location

1. Compressor: it is installed on engine rear end, at the upper left side of complete machine, and is driven by engine through belt to operate.
2. Evaporator assembly: the A/C evaporator assembly of this machine is located under the seat, and the components in the evaporator assembly include expansion valve, cold core, heat core and evaporator blower.
3. Air duct assembly and air inlet and outlet: the A/C of this machine has 4 left and right air outlets, 2 front defroster vents, 2 left and right defroster vents and 2 rear defroster vents, all of which are connected with evaporator via air duct assembly. The air duct is fitted in the cab pillar and the platform square steel and front air duct is installed in the platform housing.
4. Control panel: The A/C control panel lies on the right side of the cab's roof.
5. Condenser assembly: it is located in front of the radiator in the shroud.

The compressor keeps rotating, and the above cooling process cycles continuously. The heat in the cab is taken away by refrigerant in the evaporator, so as to complete cooling and dehumidification of the complete vehicle.



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Technical Parameters of System

Heater module	Working medium	Engine coolant	Unit(s)
	Heating capacity	5000	W
A/C module	Refrigerant	R134a	
	Refrigerating capacity	4600	W
	Refrigerant filling quantity	1000±50	g
	Voltage	24	V

Description of Schematic Diagram and Working Principle

A/C of this machine is vapor compression type cooling A/C, and its working process and principle are shown as follows:

1. Compression process

   Refrigerant absorbs heat in the evaporator and then changes into low-temperature and low-pressure gaseous refrigerant which is sucked into the compressor and compressed into high-temperature and high-pressure gaseous refrigerant, and then is discharged into the condenser.

2. Condensation process

   After high-temperature and high-pressure gaseous refrigerant enters the condenser, the air, driven by the engine radiator fan, is forced to pass across condenser surface and brings away heat of refrigerant. The refrigerant is condensed into medium-temperature and high-pressure liquid type.

3. Throttling process

   Medium-temperature and high-pressure liquid refrigerant is filtered by dryer and then throttled through the expansion valve (refrigerant is sprayed from the pores of expansion valve and expanded suddenly). It changes into low-temperature and low-pressure refrigerant mist to enter the evaporator.

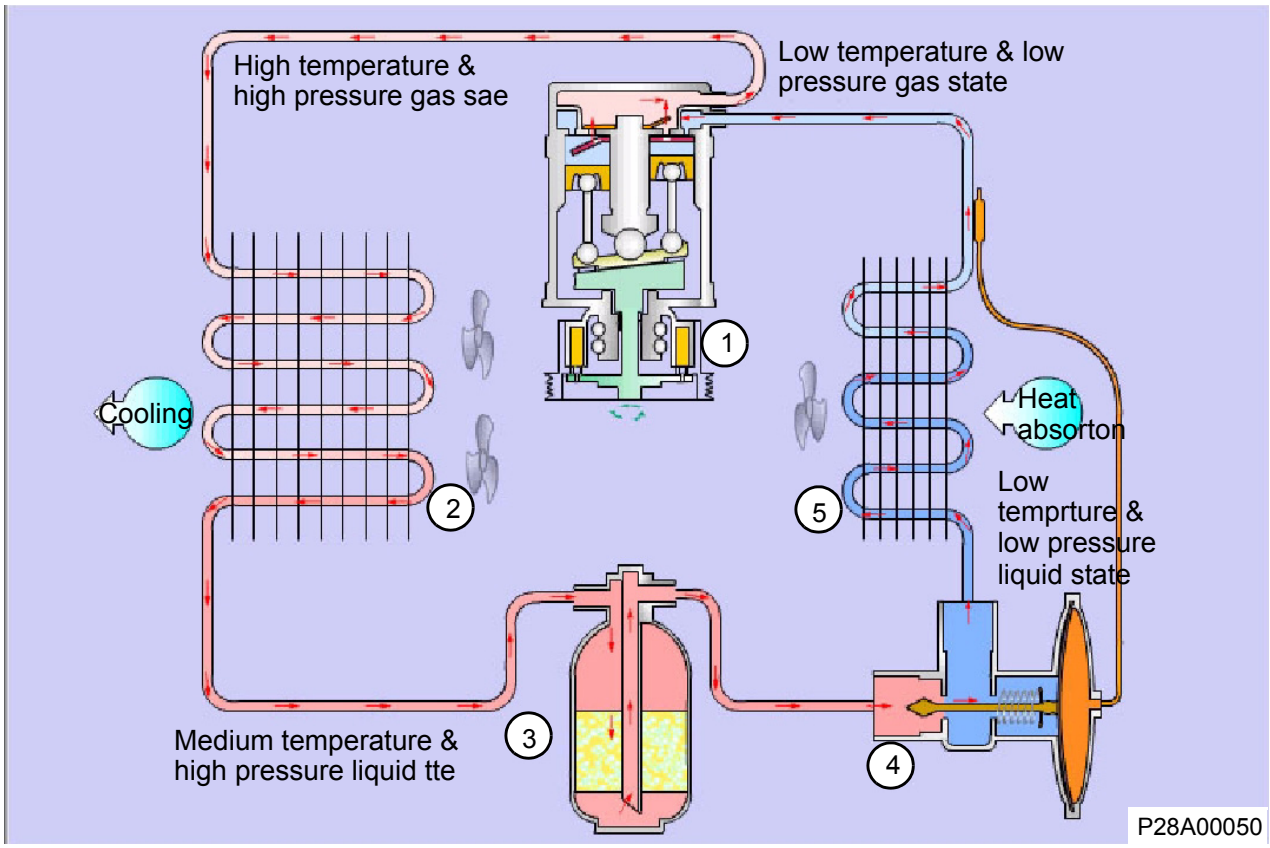
4. Evaporator process

   Low-temperature and low-pressure liquid refrigerant formed by the throttling of expansion valve is vaporized in the evaporator, and the air in the car is driven by the evaporator blower to flow through the evaporator surface. The refrigerant absorbs the heat of air in the car to reduce the air temperature, and dissolve out condensate water. Refrigerant absorbing heat is evaporated into low-temperature and low-pressure gaseous refrigerant, which is sucked into the compressor and compressed again, so that one cooling cycle is completed.

The compressor keeps rotating, and the above cooling process cycles continuously. The heat in the cab is taken away by refrigerant in the evaporator, so as to complete cooling and dehumidification of the complete vehicle.

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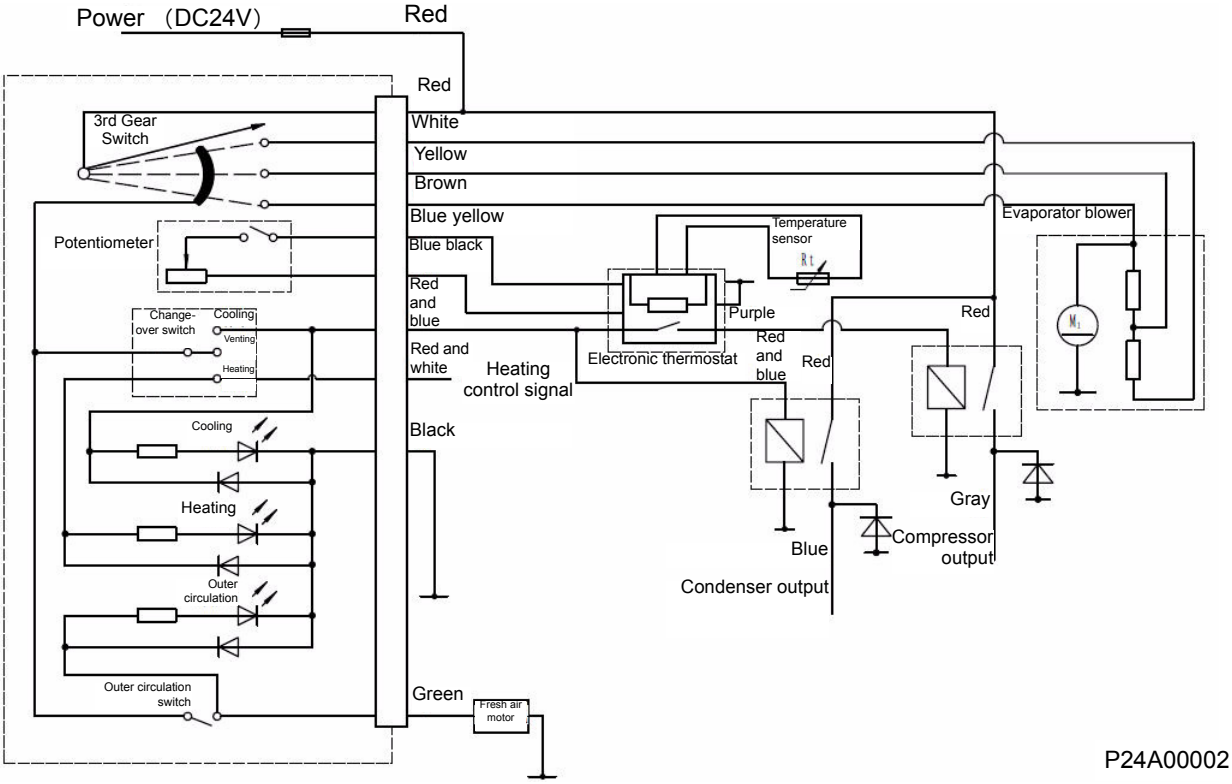
Schematic diagram for air conditioning system



1. Compressor
2. Condenser
3. Receiver dryer
4. Expansion valve
5. Evaporator

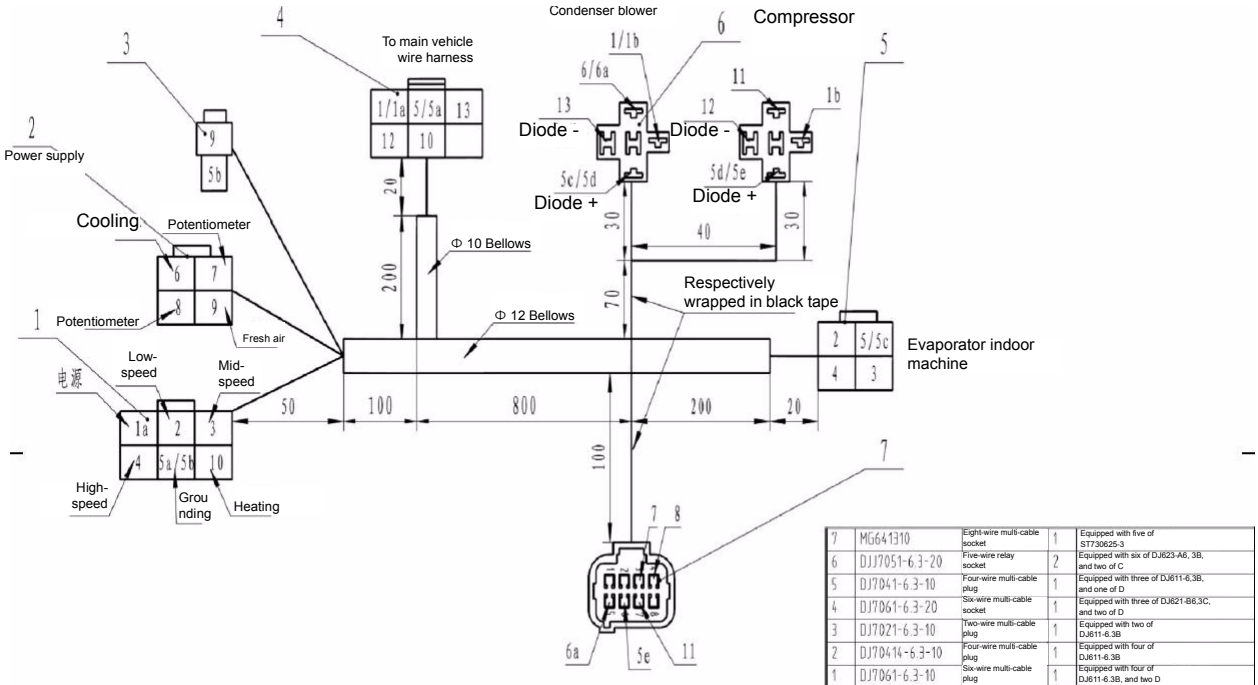
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Electrical principle of air conditioning system



P24A00002

Transition harness of control panel to evaporator



No.	Code	Name	Quantity	
7	MG641310	Eight-wire multi-cable socket	1	Equipped with five of ST730625-3
6	DJJ7051-6.3-20	Five-wire relay socket	2	Equipped with six of DJ623-A6, 3B, and two of C
5	DJ7041-6.3-10	Four-wire multi-cable plug	1	Equipped with three of DJ611-6.3B, and one of D
4	DJ7061-6.3-20	Six-wire multi-cable socket	1	Equipped with three of DJ821-B6.3C, and two of D
3	DJ7021-6.3-10	Two-wire multi-cable plug	1	Equipped with two of DJ611-6.3B
2	DJ7041-6.3-10	Four-wire multi-cable plug	1	Equipped with four of DJ611-6.3B
1	DJ7061-6.3-10	Six-wire multi-cable plug	1	Equipped with four of DJ611-6.3B, and two D

P24A00003

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Test and Adjustment

Air Conditioning System Test

⚠CAUTION

It is suggested to check air conditioning system at temperature above 28°C, since the air conditioning system can not be started normally at too low air temperature.

The following steps are repeated to simply judge whether the air conditioning system works normally and is in good conditions. If possible, it is more accurate to connect the pressure gauge for judgment. If it is obvious that air conditioning system operates abnormally, refer to "Fault Diagnosis and Judgment" for treatment methods.

1. Park the complete machine on a flat ground, and check it to make sure the parking brake is applied. Start the engine, and let a companion depress the accelerator, so as to make the engine operate at high idle speed.
2. Turn on the A/C switch, adjust the A/C to the cooling mode, and control the air supply speed at high speed by adjusting the air speed switch. Select the minimum temperature.
3. Keep the air conditioning system operating steadily for 2 minutes. Observe the end face of A/C compressor belt pulley. In normal circumstances, the clutch shall be engaged, and the end face of belt pulley shall rotate along with belt. If the end face of the belt pulley is still, it indicates that the compressor is out of operation. Confirm the operating state of the compressor, and then perform the following steps.
4. Check whether the refrigeration function is normal according to the following steps:

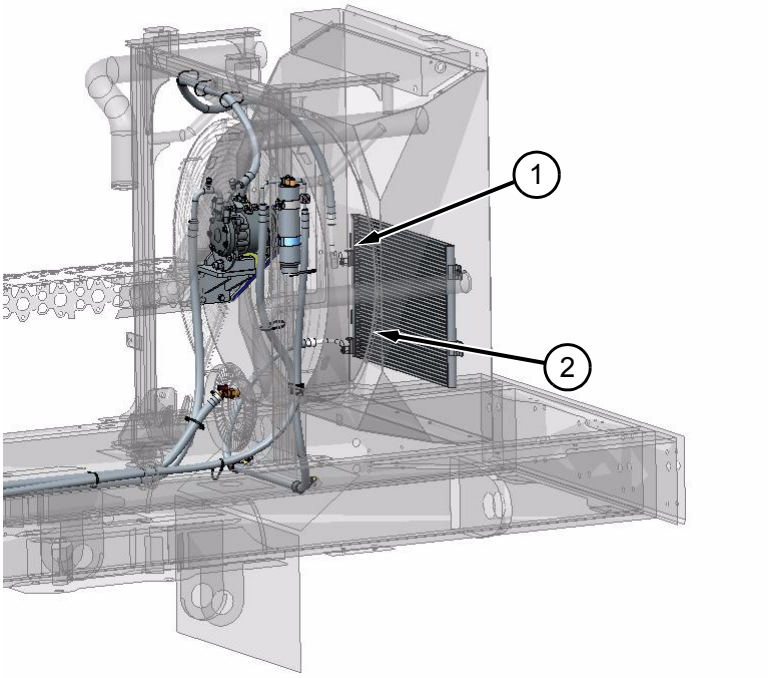
   1) Check whether temperature at cab air outlet is obviously lower than outside air temperature. If not, the air conditioning system operates abnormally.

   2) Observe the sight glass beside refrigerant reservoir. In normal circumstances, no air bubbles or only few air bubbles can be seen through sight glass. If a large amount of air bubbles can be seen, or foam appears, it means the air conditioning system is out of order.

   3) Respectively touch the air inlet part near upper part of condenser and air outlet part near lower part, as shown in the figure below. In normal circumstances, the air inlet part shall be hot to some extent, and the air outlet part shall be at a temperature close to air. The temperature near air inlet is not high, which means the refrigerant is insufficient, or compressor doesn't work normally; If the temperature in normal temperature zone is not obviously different from that in high temperature zone, it means the condenser has poor cooling. Please clean up the dirt on condenser surface.

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Transition harness of control panel to evaporator



P24A00004

1. High-temperature zone
2. Proximal normal temperature zone

4) Observe the sight glass beside refrigerant reservoir, and touch lower end of refrigerant reservoir. If the lower end of refrigerant reservoir is cold while bubbles appear in the sight glass, it means strainer inside the refrigerant reservoir is clogged. In normal circumstances, the temperatures at all parts of refrigerant reservoir are basically the same to that of condenser outlet.

5) Touch air intake pipe joint (the thicker one) of compressor. If it is not cold, it means refrigerant is insufficient or refrigerating system is blocked or compressor valve plate is damaged. Further inspection is needed.

6) If cooling is switched on for about 20~50 minutes, air at the outlet is getting warmer, air volume becomes smaller. The cooling capacity and air volume return to normal state when the cooling is switched off (but air switch is ON) and then switched on 10~15 minutes later, it means defrosting sensor in evaporator fails.

7) If the cool air comes out for several minutes, and natural air out for several minutes, and then restores to normal cool air for several minutes, so repeatedly, please observe the operation condition of compressor: If compressor operates in both cases of cool air and natural air, it means there is too much water in the system. If compressor only operates in the condition of refrigeration and does not operate in the condition of no refrigeration, the reason may be that the air temperature at that time is lower than or close to the setting temperature, or control panel is out of order.

8) If the refrigeration operates for several seconds to tens of seconds, and stops for several seconds to tens of seconds, so repeatedly, it means there is too much refrigerant or air is mixed in refrigerating system, or the condenser is too dirty, the system enters automatic protection mode due to overhigh pressure, so that further check and treatment are needed.

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Removal and Installation

Introduction to Main Components of Air Conditioning System

1. Compressor

   The compressor is a core component of the A/C refrigerating system. It is used to compress low-temperature and low-pressure gaseous refrigerant into high-temperature and high-pressure gaseous refrigerant. The A/C compressor used in this system is swash plate type. Model: GY5H-14, displacement: 138ml, and refrigerant oil brand: PAG100.

2. Evaporator

   The evaporator is used to allow throttled low-temperature and low-pressure liquid refrigerant to absorb large heat from the surrounding air during evaporation therein, so as to realize the purpose of cooling or dehumidification in the vehicle. The evaporator used for air conditioning system of this model is a double laminated type evaporator.

3. Receiver dryer

   The receiver drier is a unit as required to ensure the normal operation of compressor and refrigerating system. Its functions include: I. storage, II. filtration, III. drying.

4. Condenser

   The condenser is a heat-exchange unit which absorbs the heat of high-pressure overheated refrigerant vapor from the compressor, condenses into liquid type for over cool heat exchanger. The A/C of this machine adopts parallel-flow type condenser and others.

5. Expansion valve

   The expansion valve is a throttling unit, used for throttling and step-down as well as flow adjustment; meanwhile, it can also prevent wet compression, liquid impact and abnormal overheating. The A/C of this machine adopts the H-type thermal expansion valve.

6. A/C pipe

   The connection lines of air conditioning system include high-pressure pipes and low-pressure pipes. Among them, compressor-to-condenser pipe and refrigerant reservoir-to-evaporator pipe are high pressure pipes, and evaporator-to-compressor pipe is low pressure pipe.

7. Pressure switch

   The engagement and disengagement of compressor clutch are controlled by pressure of pressure switch monitoring system to realize the purpose of protecting refrigerating system. A high/low-pressure combination switch is used in this system, the upper limit of high pressure is 3.14 Mpa, and the lower limit of low pressure is 0.196 Mpa.

8. A/C control panel

   It has the action of controlling the ventilation, air change, refrigeration, heating, defrosting and other functions of A/C system.

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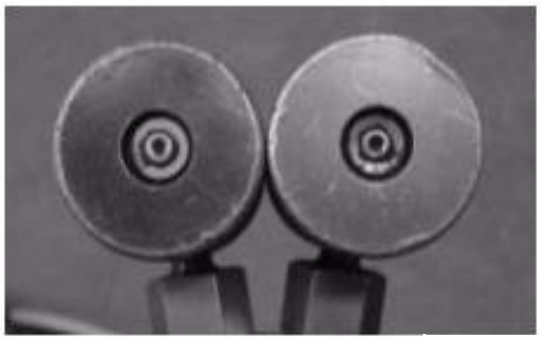
Removal and Installation of A/C Components

Removal of Compressor

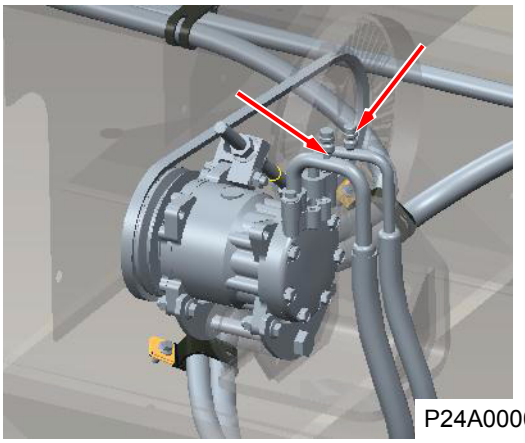
Discharge (Recycle) Refrigerant in Air Conditioning System

Only the discharging of refrigerant is described in this manual. It is recommended to use special equipment to recycle and reuse the refrigerant if available.

Incorrect discharging of refrigerant will cause adverse effect on air conditioning system, especially for the service life of compressor.

Figure	Operation steps	Tool(s)
 P11000175	1. Stop the machine or switch off the A/C system for at least more than one hour, then turn off the negative switch, and put up "DO NOT OPERATE" warning sign.	
 P28A00005	2. First close the high and low pressure valves at the place of manifold gauge.	Manifold gauge
 P28A00006	3. Close the valve of high and low pressure joints.	

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Figure	Operation steps	Tool(s)
 P24A00005	4. Open the rear cover to sufficiently exposing compressor and lines thereof. 5. Unscrew the plugs from the high and low-pressure fillers of compressor, and connect the high and low-pressure valves of manifold gauge respectively to the fillers of high and low-pressure pipes. Open the joint valve after they are connected properly. **Note:** The one with thicker pipeline and thinner interface is low pressure pipe; the one has thinner pipeline and thicker interface is high pressure pipe. This is error proof interface, it can't be connected with wrong method.	

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Figure	Operation steps	Tool(s)
 P28A00121	6. Slowly loosen low pressure valve on manifold gauge so as to make the refrigerant slowly eject. Note the opening of control valve. Too large flow rate may easily cause refrigerant oil to be ejected out along with refrigerant. Control the flow rate to the extent that no refrigerant oil is ejected out (the refrigerant is released in a gaseous state, and refrigerant oil is liquid. Align the refrigerant outlet with one piece of white paper, and observe whether there are liquid droplets to be ejected out). After 10 minutes, slowly open high pressure valve, and continue to control flow rate to avoid refrigerant oil from escaping. The whole process should keep 15-30 minutes. ⚠ **Notice: It is forbidden to discharge refrigerant from high pressure end at the beginning, since it is easy to cause the refrigerator oil to be ejected out along with refrigerant at high pressure end.**	
 P28A00122	7. Close the high and low pressure joint and remove it.	

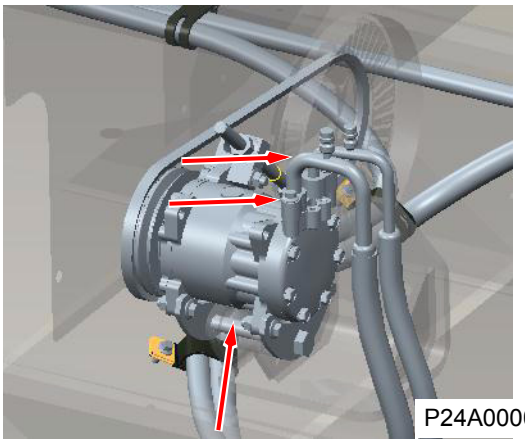
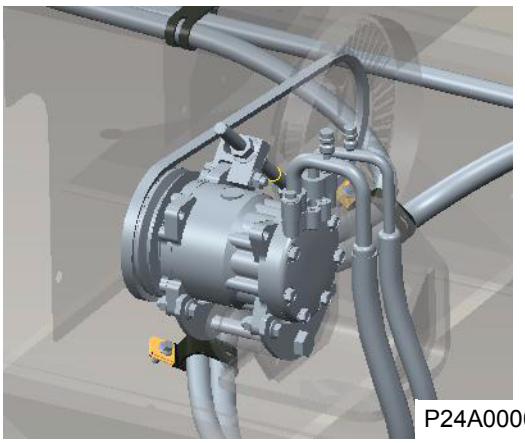
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Remove and Install the Lines Connecting the Compressor and the Compressor

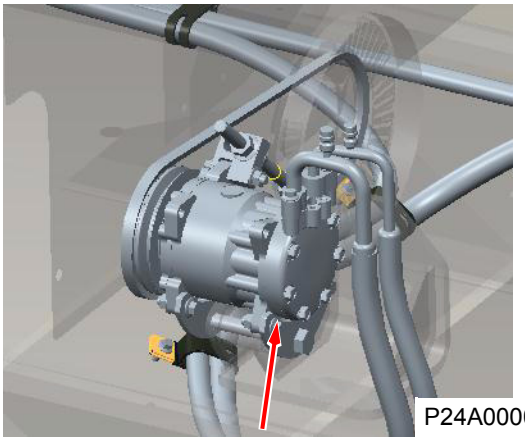
Remove the Lines Connecting the Compressor and the Compressor

CAUTION

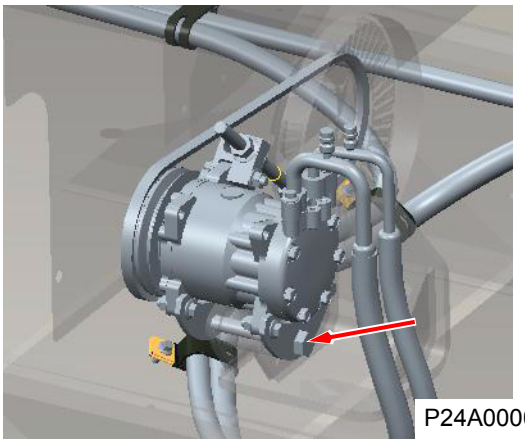
If the interiors of compressor are damaged or the refrigerator oil gets gray or black, the fluid reservoir must be replaced together with the compressor. Otherwise it will shorten the service life of compressor.

Figure	Operation steps	Tool(s)
 P24A00005	1. Unscrew M8 captive bolts of compressor line with a wrench, and remove the line.	13# Open-end wrench
	2. Wrap two removed line joints with clean and unbroken plastic bags, tie them up with adhesive tapes to prevent air and foreign matter from entering the line.	Plastic bag, adhesive tape
 P24A00005	3. Disassemble the harness connector of compressor clutch.	

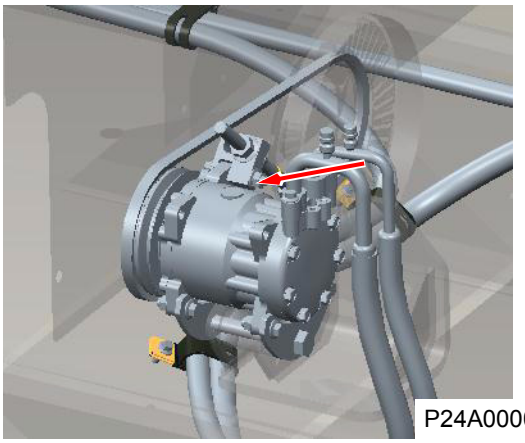
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Figure	Operation steps	Tool(s)
	4. Remove the belt as specified in "Removal and Installation of Belt". Remove the adjusting screw rod, and then remove the belt.	19# Open-end wrench
 P24A00005	5. Remove 5 M10 bolts fixing the compressor, and remove compressor.	
	Installation method: Install them in the reverse sequence of removal	

Removal and Installation of Belt

Figure	Operation steps	Tool(s)
 P24A00005	1. Unscrew M16 fixing nuts of the support plate using the wrench.	24# Open-end wrench

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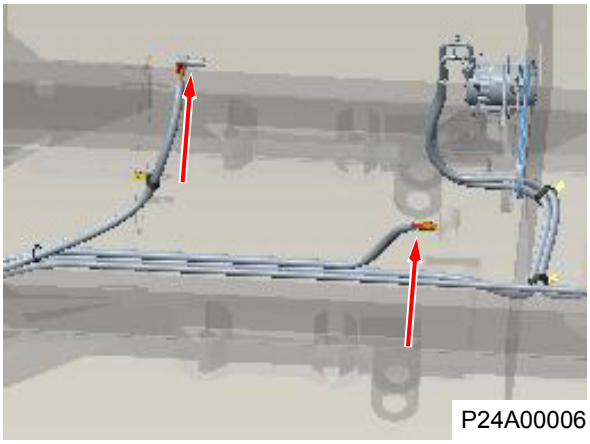
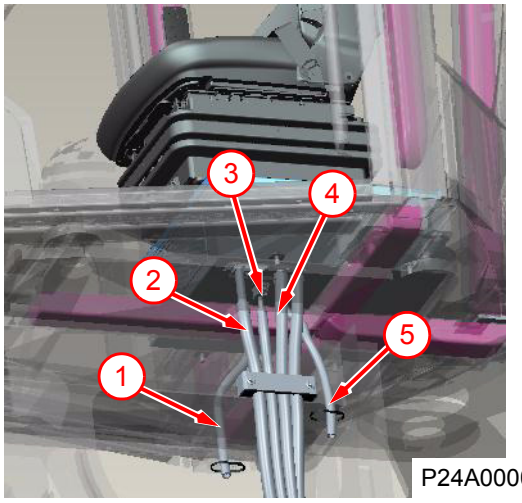
Figure	Operation steps	Tool(s)
 P24A00005	2. Unscrew M14 adjusting nuts using the wrench.	19# Open-end wrench
	3. Adjust the regulating lever. Swing the compressor inward and take down the belt.	
	Installation method: 1. Install them in the reverse sequence of removal. 2. Adjust the belt tension according to "Adjustment of Compressor Belt".	

Removal and Installation of Evaporator Mounting Assembly

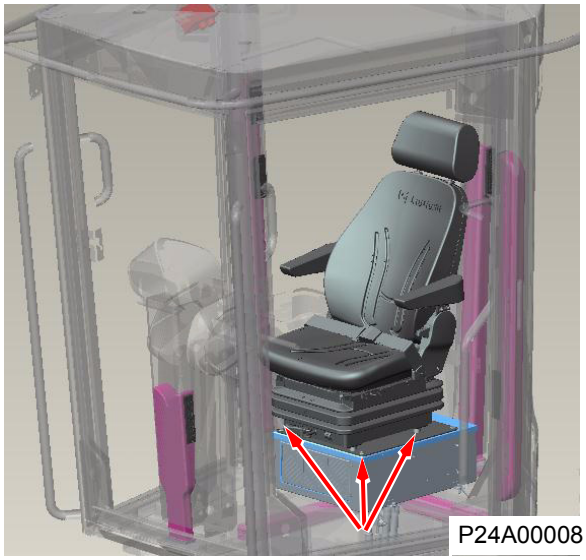
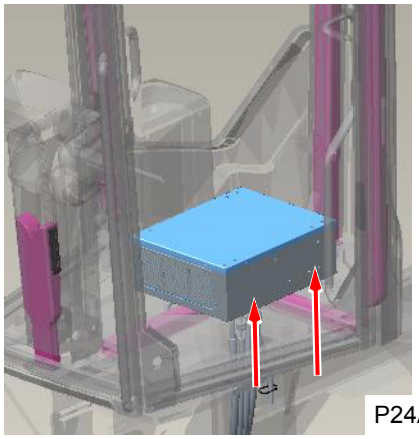
⚠CAUTION

The following sequence of operation is used for removing evaporator assembly from cab assembly. Most actual failures occur in certain components (such as blower, circuit, etc.) of evaporator, so it is suggested to carry out selective removal, repair and replacement after these failures are identified in accordance with "Fault Diagnosis and Judgment" in order to avoid unnecessary operations.

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Figure	Operation steps	Tool(s)
 P24A00006	1. Discharge the refrigerant in the air conditioning system as required in "Discharge (Recycle) the Refrigerant in the Air Conditioning System" and close two manual water valves for water returning.	
 P24A00007 1. Drain pipe 2. Evaporator-to-compressor pipe 3. Refrigerant reservoir-to-evaporator pipe 4. Warm water inlet pipeline 5. Warm water return pipeline 6. Drain pipe	2. Remove the pipelines under evaporator and mark on that with marker pen. Seal up the joints with plastic bags and adhesive tape after removal, in order to prevent foreign matter from entering the line.	9# Open-end wrench, plastic bag, marker and adhesive tape

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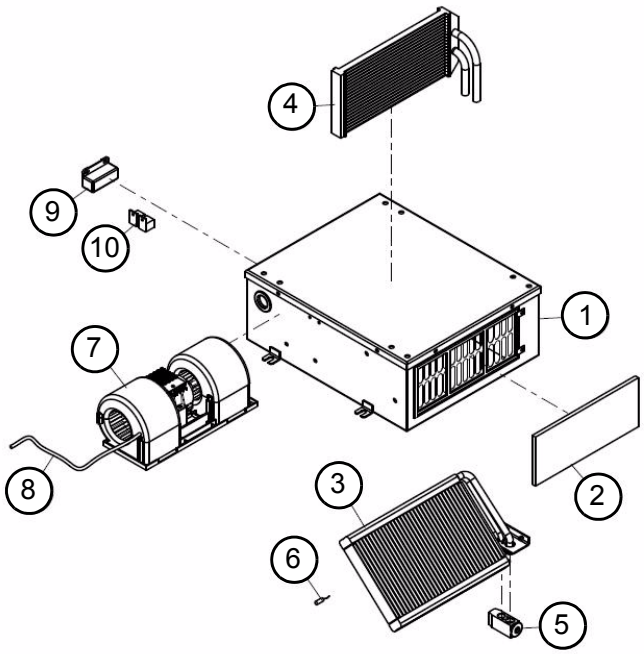
Figure	Operation steps	Tool(s)
 P24A00008	3. Remove 4 M10 captive bolts of the seat and move away the seat.	
 P24A00009	4. Remove 4 M10 bolts at fixing the evaporator, unplug the evaporator wire harness connector its right rear side and remove the evaporator assembly.	15# Open-end wrench
	Installation method: Install them in the reverse sequence of removal.	

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Each Lower Part Location of Evaporator Assembly

During the actual use, the motor, circuit and other faults of evaporator assembly generally appear. Therefore, please make an analysis on them and then disassemble the evaporator according to the section Fault Diagnosis in this manual. Each lower part location of evaporator assembly will be provided in the following, so that it is easy to remove and install them.

Evaporator assembly

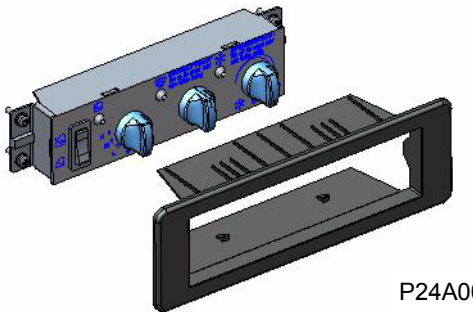


P24A00010

1. Housing
2. Strainer
3. Evaporator core
4. Heater core
5. Expansion valve
6. Temperature sensor
7. Evaporator blower
8. A/C harness
9. Electronic Thermostat
10. Relay

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Replacement of A/C Control Panel

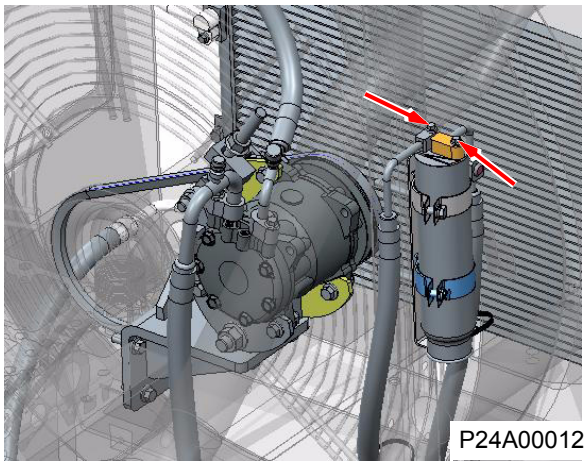
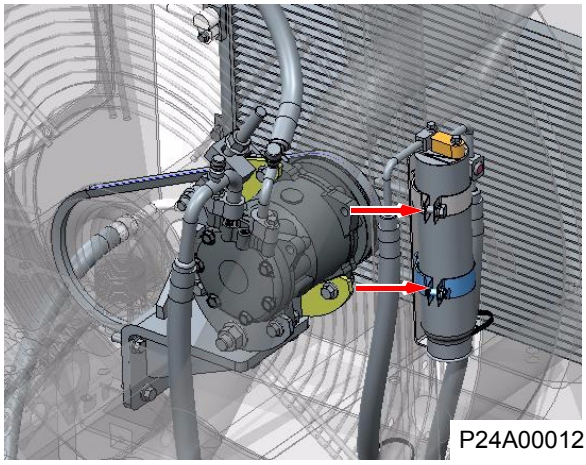
Figure	Operation steps	Tool(s)
 P24A00011	1. Pick up the trim cover with a straight screwdriver 2. Remove four screws fixing control panel. 3. Unplug the connector on the control panel and then take down the control panel.	Straight screwdriver Cross screwdriver

Inspection and Replacement of A/C Fuse

When there is no display on A/C panel and A/C is inoperative after starting the complete machine, check whether A/C fuse is burned out. Refer to Electrical Part in the manual for specific operation.

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Removal and Replacement of Reservoir

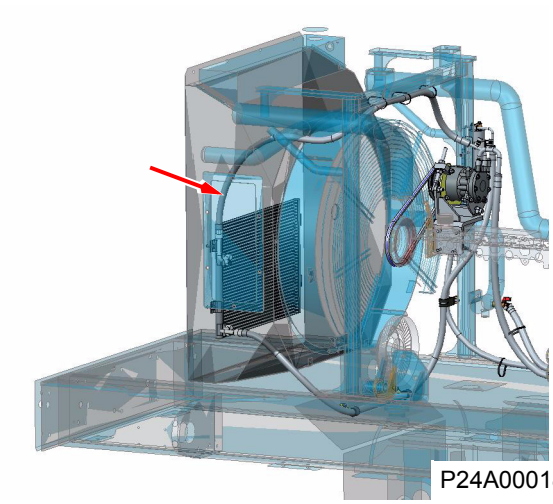
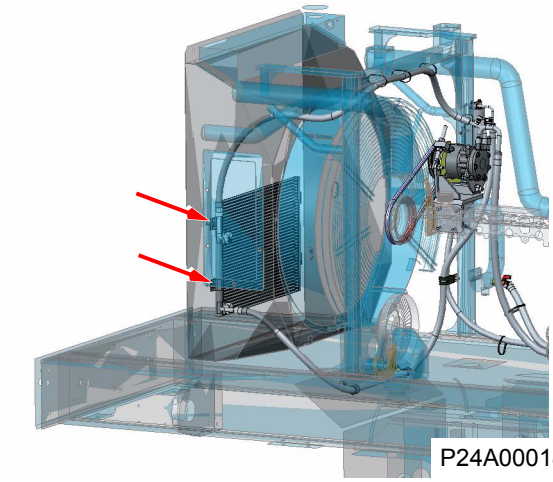
Figure	Operation steps	Tool(s)
	1. Open the rear cover.	
	2. Discharge the refrigerant in the air conditioning system as required in "Discharge (Recycle) the Refrigerant in the Air Conditioning System".	
 P24A00012	3. Remove the captive bolts of condenser-to-refrigerant reservoir pipe, and the captive bolts of refrigerant reservoir-to-evaporator pipe. Remove the condenser-to-refrigerant reservoir pipe, and the refrigerant reservoir-to-evaporator pipe. Seal up the opening joints with plastic bags and adhesive tapes.	10# Wrench Plastic bag, adhesive tape
 P24A00012	4. Loosen the captive bolt on the refrigerant reservoir bracket clamp. The refrigerant reservoir can be removed.	

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Figure	Operation steps	Tool(s)
	Installation method: 1. Place liquid reservoir in the bracket, and tighten the bolts on the bracket with a wrench. 2. Install the hose from condenser to liquid reservoir and the hose from liquid reservoir to evaporator onto the liquid reservoir, and control the torque to 4~7N. m.	10# Wrench

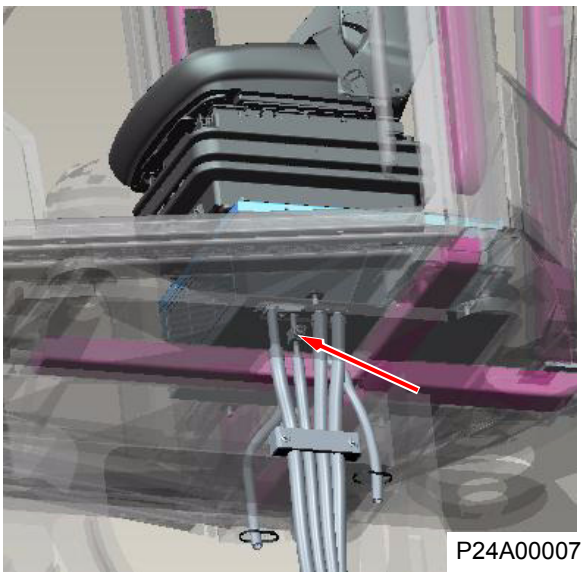
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Removal and Installation of Condenser

Figure	Operation steps	Tool(s)
	1. Operating the steps 1-3 "Removal and Replacement of Refrigerant Reservoir".	
 P24A00018	2. Remove the bolts on the left and right plates from the shroud to remove the plates.	
 P24A00018	3. Remove M6 bolts fixing compressor-to-condenser pipe and condenser-to-refrigerant reservoir pipe, and seal the opening joints with plastic bags and adhesive tapes.	10# Wrench Plastic bag, adhesive tape
	4. Remove M10 bolts fixing the condenser (4 in total both at left side and at right side).	15# Wrench
	Installation method: Install them in the reverse sequence of removal.	

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Removal and Installation of Pressure Switch

Figure	Operation steps	Tool(s)
	1. Discharge the refrigerant in the air conditioning system as required in "Discharge (Recycle) the Refrigerant in the Air Conditioning System".	
	2. Pull out connector of pressure switch.	
 P24A00007	3. Unscrew the pressure switch.	27# Wrench
	Installation method: Install them in the reverse sequence of removal.	

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Fault Diagnosis and Judgment

Fault Diagnosis Process and Troubleshooting

Classification of Common Faults

Common faults of air conditioning system include:

1. The A/C panel neither displays nor functions.
2. No air comes out of A/C or air volume of A/C is small (in the case that the position is selected correctly).
3. It generates heating or natural wind under cooling mode.
4. It generates natural wind under heating mode.

Troubleshooting

Troubleshooting for the backlight of A/C panel not on and the button not work:

Note: If the first item is normal, go to the second one, and the like.

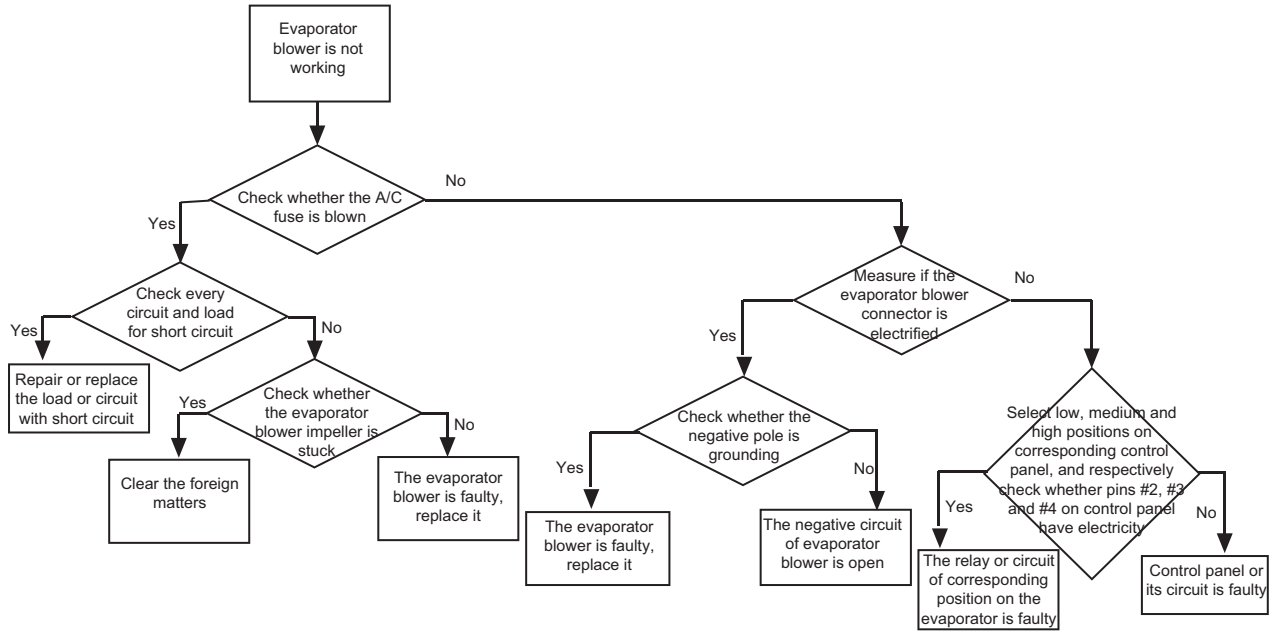
Item	Inspection items	Description	Troubleshooting
1	Whether the complete machine has been started	The A/C cannot be used until the complete machine is started	Use the A/C when the complete machine is started
2	Whether the A/C fuse is burned	If fuse is burned, check whether wiring and each load are short-circuited	Replace and repair short circuit elements or parts
3	Whether connector XL8 is connected properly Whether the connectors at both ends of control panel wire harness are properly connected	Whether there are problems such as poor contact and exit of contact pin	Repair the damaged parts
4	Unplug connector XL8 and check each pin with a multimeter	Wire # 220 (gray) should be grounding Wire # 458 (white) should be high level Wire # 463 (white) should be high level Wire # 493 (white) should be vacant	If any abnormality occurs, it indicates that the circuit of the complete machine is problematic. Refer to Electrical Part in this manual for maintenance
5			Replace the control panel

If failed to eliminate faults by the above steps, it means the harness of control panel or evaporator is out of order, and refer to electrical schematic diagram of air conditioning system for troubleshooting.

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Troubleshooting for no air out of air conditioner or air outlet volume obviously smaller than the normal volume:

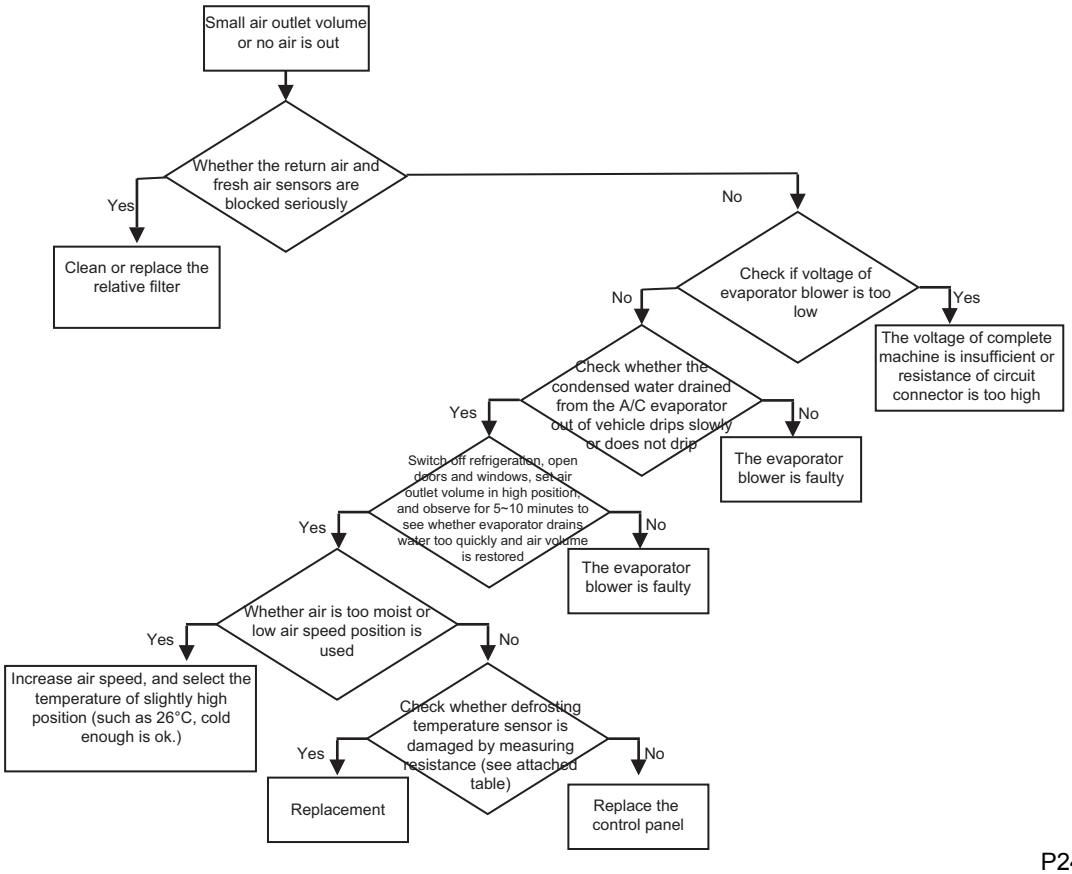
Firstly, set air outlet volume to maximum, and listen whether there is a sound of blower operation.



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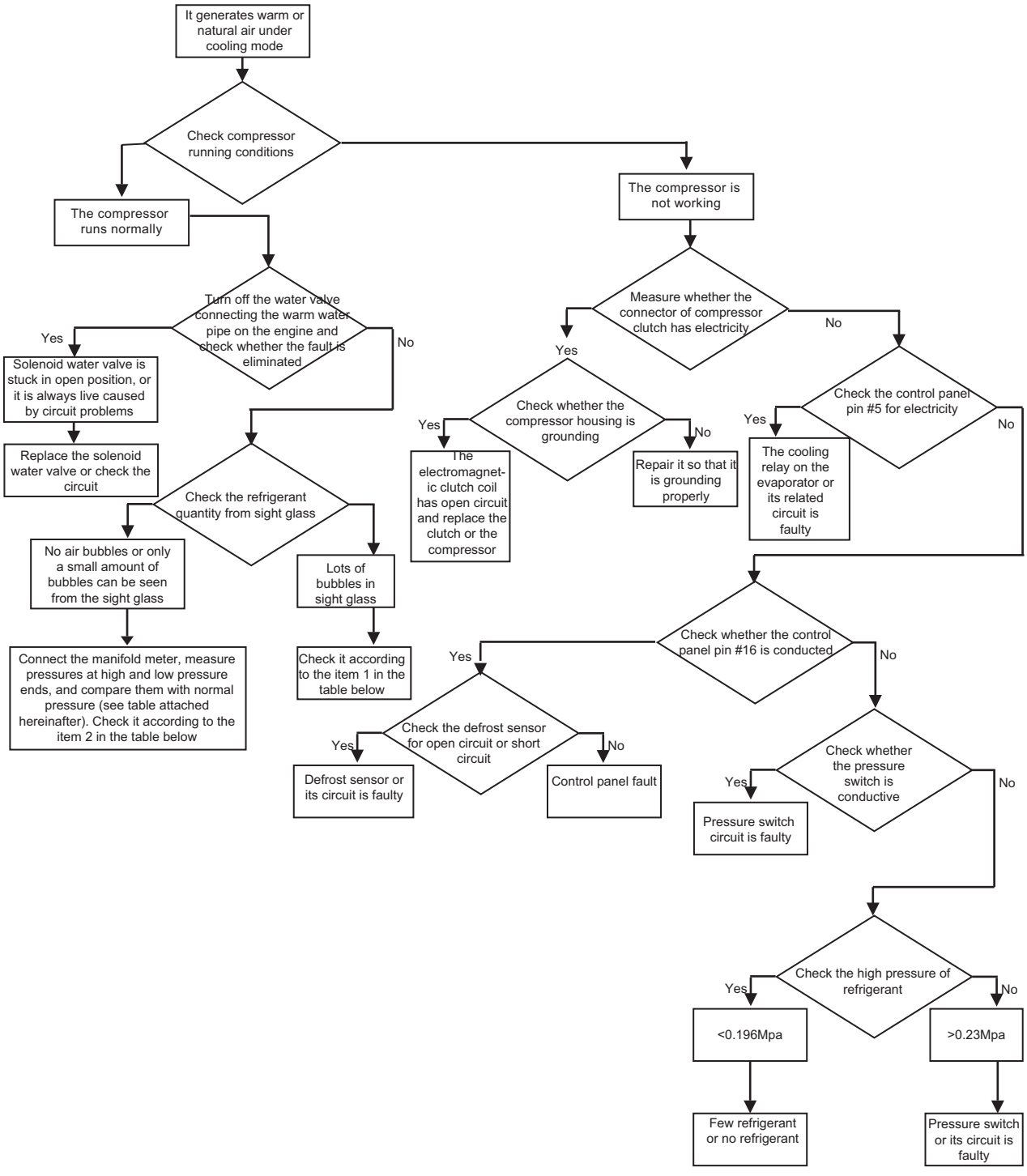
If the blower is out of work, overhaul it according to the following procedures



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Troubleshooting for warm or natural air out under cooling mode:



P24A00016

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<table>
<tr><th>Item</th><th colspan="3">Fault conditions</th><th>Judged reasons</th><th>Troubleshooting</th></tr>
<tr><td>1</td><td colspan="3">Air bubbles persistently exist in sight glass, compressor air intake hose joint is not cold enough and even warm, the upper end and lower end of refrigerant reservoir do not have temperature difference, and temperature is higher than or equal to ambient temperature.</td><td>1. Refrigerant leakage.
2. Insufficient refrigerant filling amount.</td><td>Check and repair the leakage parts, and refill refrigerant by referring to "A/C Refrigerant Filling Method".</td></tr>
<tr><td rowspan="3">2</td><td colspan="3">Compare the high and low pressures of air conditioning system when it is operating, and compare them with normal pressures (see table attached hereinafter).</td><td></td><td></td></tr>
<tr><td rowspan="2">Pressures both at low pressure side and at high pressure side are low</td><td>1. Normally refrigerate for several minutes, stop refrigerating for several minutes, and normally refrigerate for several minutes…repeat like this.
2. Compressor is operating continuously.
3. The pressure at the beginning of refrigeration is normal, and pressures at low pressure side and high pressure side when refrigeration stops are obviously low.</td><td>There is too much water in refrigerating system so that ice blockage in expansion valve is caused (orifice is frozen due to water accumulation to block orifice).</td><td>Replace the refrigerant reservoir, pump the vacuum for more than 1 h, and refill refrigerant again according to "A/C Refrigerant Filling Method".</td></tr>
<tr><td>1. Touch compressor air intake hose joint (thicker one) by hand and there is no cold feeling.
2. There are no big differences in temperature of the high temperature zone and the normal temperature zone of a condenser.
3. The temperature of each part of refrigerant reservoir is basically the same to that of condenser outlet and close to ambient temperature.</td><td>The interior of refrigerating system is very dirty, and the expansion valve orifice is blocked by dirts.</td><td>1. Switch on refrigeration for about 1 minute and switch off refrigeration for about 3~5 minutes with doors and windows open under high engine speed (engine can be at idle speed but air volume shall be in highest position), then step on accelerator to refrigerate for about 1 minute…repeat like this for 3 times so that contamination and blockage may be eliminated.
2. If the above methods are ineffective, clean or replace expansion valve; If gray black or brown black color appears in sight glass, please make sure to replace refrigerant reservoir.</td></tr>
<tr><td></td><td></td><td>The expansion valve control head leaks air making the valve hole smaller automatically.</td><td>Replace the expansion valve. If gray black or brown black color appears in sight glass, please replace the refrigerant reservoir altogether.</td></tr>
</table>

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Item	Fault conditions		Judged reasons	Troubleshooting
2	Pressures both at low pressure side and at high pressure side are low	1. Touch compressor air intake hose joint (thicker one) by hand and there is no cold feeling. 2. There are no big differences in temperature of the high temperature zone and the normal temperature zone of a condenser. 3. The temperature of each part of refrigerant reservoir is basically the same to that of condenser outlet and close to ambient temperature. 4. There is obvious temperature difference at both ends of the blocked part.	Line between sight glass outlet and compressor air intake port is blocked or crushed by foreign matter.	Remove blocked lines, blow out foreign matters or release the line being crushed; If gray black or brown black color appears in sight glass, please replace refrigerant reservoir.
		1. Touch compressor air intake hose joint (thicker one) by hand and there is no cold feeling. 2. There are no big differences in temperature of the high temperature zone and the normal temperature zone of a condenser. 3. There is obvious temperature difference at both ends of the blocked part. 4. Bubble is visible in sight glass.	Line between condenser outlet and sight glass inlet is blocked by foreign matter.	
		1. Touch compressor air intake hose joint (thicker one) by hand and there is no cold feeling. 2. There are no big differences in temperature of the high temperature zone and the normal temperature zone of a condenser. 3. Bubble is visible in sight glass. 4. The bottom of the refrigerant reservoir is cold and even has condensing dew.	Filter of refrigerant reservoir is blocked by dirt.	Replace the refrigerant reservoir.
		1. Bubble is visible in sight glass. 2. Touch compressor air intake hose joint (thicker one) by hand and there is no cold feeling. 3. The upper end and lower end of refrigerant reservoir do not have temperature difference, and temperature is higher than or equal to ambient temperature.	Less refrigerant.	Detect leakage, repair and fill refrigerant.

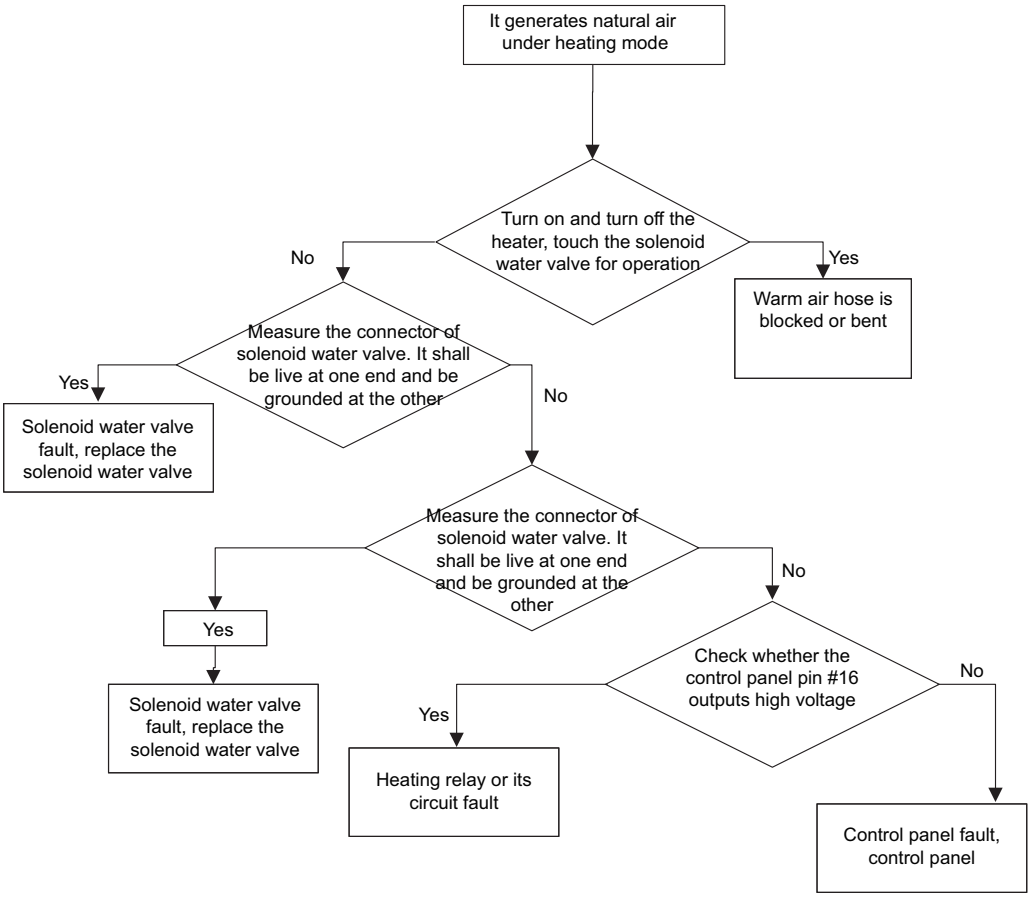
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Item	Fault conditions		Judged reasons	Troubleshooting
2	Pressures of low pressure side and high pressure side are both high	1. Observe sight glass in the case of compressor operation, and no air bubble in sight glass within 5~10 seconds after refrigeration is switched off. 2. Temperature in the condenser normal temperature zone almost has no difference with ambient temperature. 3. The condenser high temperature zone is hotter than normal situation.	Redundant refrigerant.	Discharge or recycle some refrigerant.
		1. There are bubbles in sight glass in the case of compressor operation. 2. The pointer of high pressure gauge vibrates sharply and frequently.	The refrigerating system has non-condensing gas such as air.	Discharge refrigerant, pump the vacuum, and refill refrigerant again according to "A/C Refrigerant Filling Method".
		1. High temperature zone of condenser is hotter than that in normal circumstance, and normal temperature zone of condenser is hotter than that in normal circumstance.	Dirty surface of the condenser.	Clean the surface of the condenser.
		1. There is too much condensing dew on surface of low pressure pipe, and middle housing of condenser is not hot or cold and even has condensing dew. 2. There are bubbles in sight glass.	Expansion valve has too large opening or the valve needle is stuck in large opening position by foreign matter.	Clean or replace expansion valve.
	Pressure of low pressure side is high, but pressure of high pressure side is low	1. The air intake hose joint of compressor is under normal temperature or warm. 2. The pointer of low pressure gauge swings.	Compressor air suction valve plate is damaged or cylinder block, piston or piston ring is worn and in air leakage.	Replace the compressor.
		1. The compressor exhaust pipe joint is hotter than usual. 2. The pointer of high pressure gauge vibrates sharply.	The compressor exhaust valve plate is damaged.	Replace the compressor.

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Maintenance method for natural air out with heating switched on:

Note: Please check warm water valve on engine has been opened, and engine coolant temperature has been far above air temperature first. Or it is normal instead of fault to have no warm air.



P24A00017

Appendix

Tightening torque of air conditioning system line joint clamp bolts:

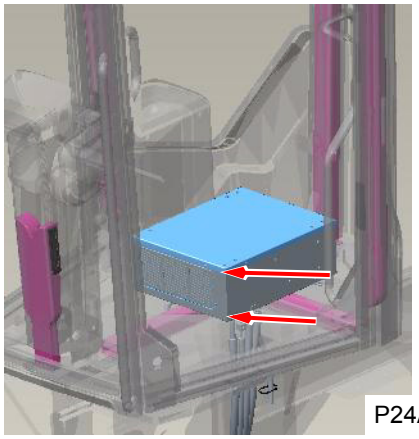
Thread size	Tightening torque
M6	10.5±1.5N.m
M8	26±4N.m

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A/C Maintenance

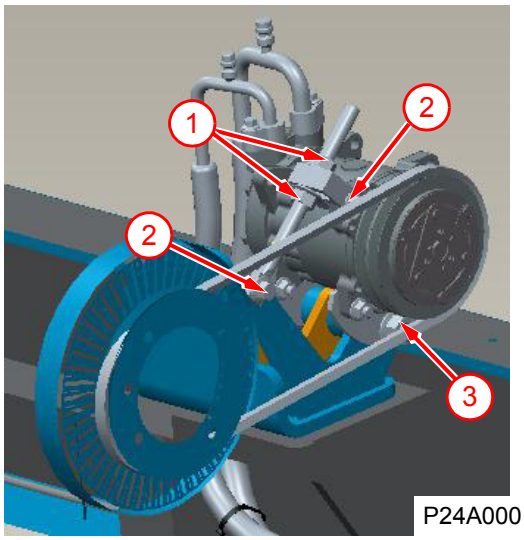
Regular Maintenance of Air Conditioning System

Cleaning of Recirculating Air Strainer

Figure	Operation steps	Tool(s)
 P24A00009	1. Screw off the two captive bolts of the filter, and then remove the recirculating air strainer.	
	2. Blow off dust from air outlet surface to air inlet surface of recirculating air strainer with compressed air.	

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Adjustment of Compressor Belt

Figure	Operation steps	Tool(s)
 P24A00013	1. When a load W=1.5 Kg is applied to perpendicular belt edge at neutral point of tangential edge between belt and two belt pulleys (a/c compressor belt pulley and belt pulley on engine) by hand, the deflection f of belt shall be 5±1 mm. If belt deformation is too large or too small, it means belt has inappropriate tension and needs to be adjusted.	
	2. Unscrew the adjusting nuts (1), adjusting screw rod captive bolts (2) and support plate captive bolts (3).	15# Wrench 19# Wrench 24# Wrench
	3. Unscrew the adjusting nuts (1) so that the compressor swings and the belt tension is proper.	
	4. Tighten the adjusting nuts (1), adjusting screw rod captive bolts (2) and support plate captive bolts (3).	

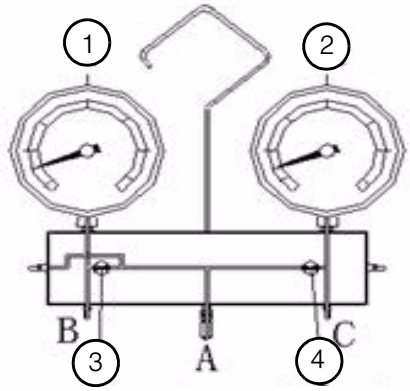
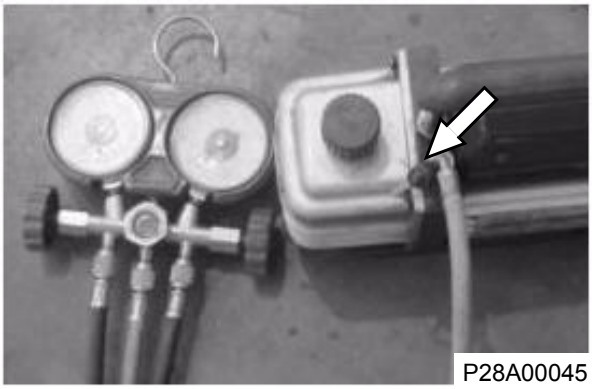
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A/C Refrigerant Filling Method

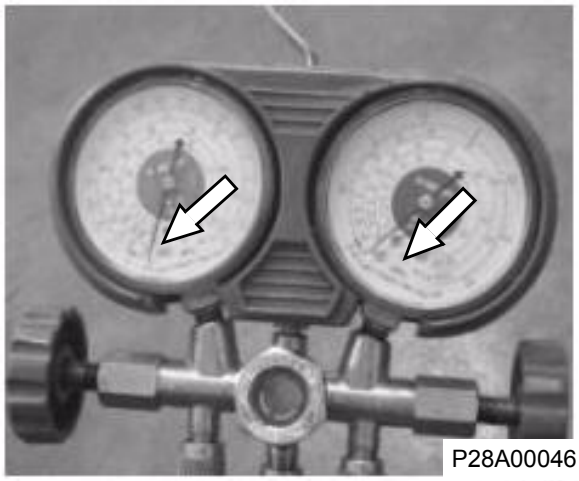
⚠CAUTION

Even though there is only little water in air conditioning system, water vapor at low temperature part may be frozen to cause refrigerant circulation blockage or compressor valve corrosion, etc. Therefore, when refrigerant is refilled after parts are replaced or air conditioning system is reinstalled in complete machine, strictly vacuumize and maintain pressure to check leakages and continue to refill refrigerant after system airtightness is confirmed to be good.

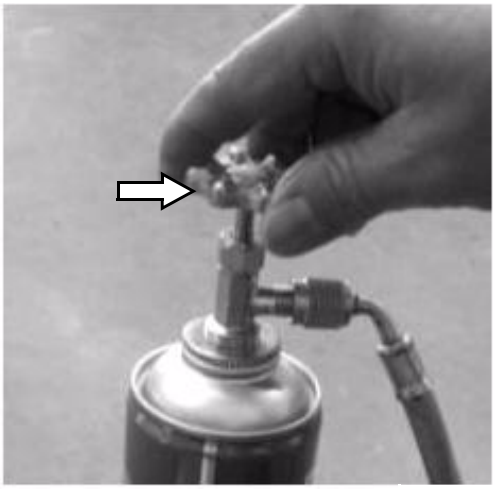
Because air conditioning system is not an absolutely airtight system, the problem of deficient refrigerant may occur after it is used for a period of time. At the moment, if refrigerant in the system is confirmed not to be completely lost, start the operation of refilling refrigerant starting from step X of the manual.

Figure	Operation steps	Tool(s)
 1. Low pressure gauge 2. High pressure gauge 3. Low pressure valve(LO) 4. High pressure valve(HI) P28A00044  P28A00045	1. Connect manifold gauge and A/C filler according to the sequence specified in "Discharge (Recycle) Refrigerant in Air Conditioning System", and make sure there is no refrigerant in the system.	

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Figure	Operation steps	Tool(s)
 P28A00046	2. Connect the hose connecting port A on the manifold gauge to vacuum pump.	Vacuum pump, manifold gauge
	3. Start vacuum pump to vacuumize for 5 minutes, and make sure indications of high and low pressure gauges are about -750 mmHg (or -0.1 MPa). Note: In general, high pressure gauge and its connectors are red, and low pressure gauge and its connectors are blue.	
	4. First close high pressure valve (HI) and low pressure valve (LO) of line pressure testing device, and then turn off vacuum pump.	
	5. Wait for 5 minutes in this status, and observe that the reading of low pressure gauge shall have no change. If the pressure is picked up, it indicates there is a leakage in the system. Check and repair leaking areas, and repeat the steps 3-5. The steps 6-8 below are operations for the portable canned refrigerant. It may change as the packaging type of refrigerant changes. Please confirm that the refrigerant container is properly connected to the manifold gauge.	

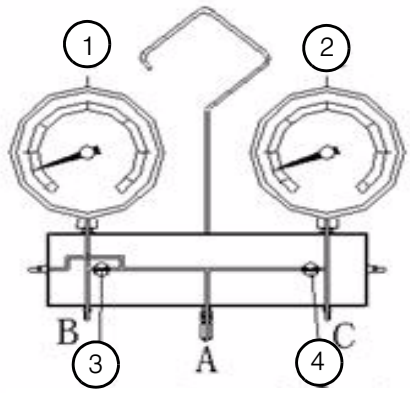
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Figure	Operation steps	Tool(s)
 P28A00047	6. Install the screw plug to refrigerant container.	
	7. Connect the hose at connecting point A of manifold gauge to the interface mounted on screw plug of refrigerant container.	
 P28A00048	8. Rotate handle of screw plug clockwise so that pintle injector punctures refrigerant container, and then rotate screw plug handle counterclockwise so that the pintle injector exits.	

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Figure	Operation steps	Tool(s)
 P28A00049	9. Loosen nut on manifold gauge connecting refrigerant receiver connecting hose, drain air in the filling hose by using refrigerant pressure, and tighten nut immediately after listening "Hissing" sound.	
	10. Open high pressure valve 4 so that refrigerant enters high pressure side of air conditioning system.	
	11. Observe high pressure gauge, and close high pressure valve 4 until pressures does not rise any more. At the moment, make sure high pressure valve has been closed, or else subsequent operations may cause damages to compressor	
	12. Start the engine to idle state and open the cab's door and window. And turn on the A/C to cooling mode. Adjust to the maximum air volume.	
	13. Open low pressure valve 3, depress accelerator with the aid of a companion, maintain the accelerator to be 80% or so, and observe high pressure gauge and sight glasses until the pressure reaches an appropriate value (refer to attached table). And there is no bubble in sight glass.	

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Figure	Operation steps	Tool(s)
 1. Low pressure gauge 2. High pressure gauge 3. Low pressure valve(LO) 4. High pressure valve(HI) P28A00044	14. First close all the valves, then remove the inflating unit.	

The table below gives reference values about corresponding relation between pressure and temperature. Because the actual working pressure of air conditioning system is related to compressor speed, sunlight intensity, evaporator air volume and other factors, data in the table below is only for reference:

Ambient temperature	Indicating range of the high pressure gauge	Indicating range of the low pressure gauge
°C	$Kg.f/cm^2$	$Kg.f/cm^2$
15.5 °C	8.4 ~10.5	1.57 ~1.9
21.1 °C	10.5~12.6	1.57 ~1.9
26.6 °C	12.6~14	1.67 ~2.1
32.2 °C	14~15.4	1.67 ~2.1
35 °C	15.4~16.4	1.77 ~2.1
37.7 °C	16.1~17.5	1.77 ~2.1
40.5 °C	17.5~19.3	1.9~2.4
43.3 °C	18.2~21.8	1.9~2.6

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Cab and Covering Parts

Structure and Function 6-3

Cab System 6-3
Engine Hood 6-4
Introduction to Engine Hood 6-4
Main Components of Engine Hood 6-5
Opening and Closing of Engine Hood 6-6

Removal and Installation 6-8

Removal of Cab System 6-8
Disassembly Order of Cab Lifting 6-8
Removal of Control Box Assembly 6-8
Removal for Cab Assembly 6-13
Removal of Seat Assembly 6-16
Removal of Console Assembly 6-17
Removal of Decoration 6-24
Removal of Lock 6-27
Removal and Installation of Engine Hood 6-30

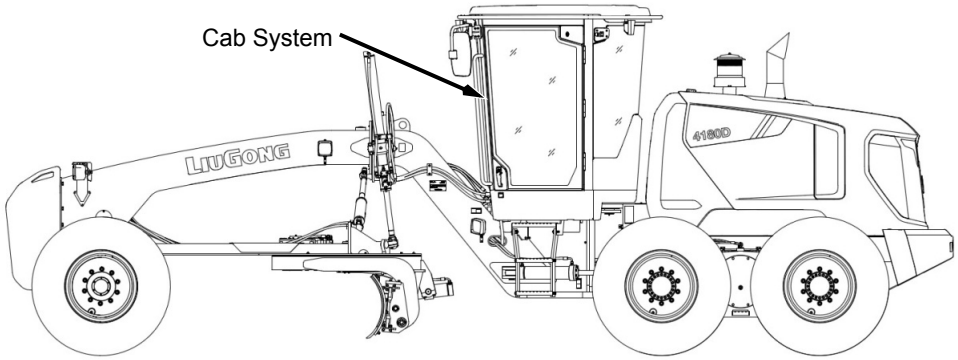
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Structure and Function

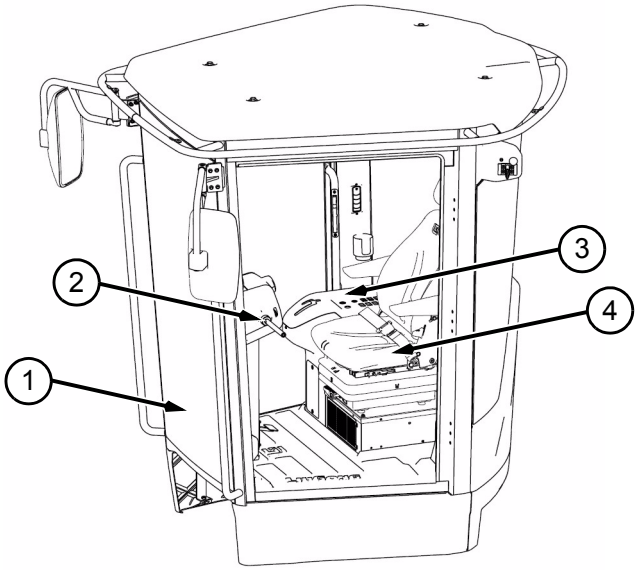
Cab System

The cab system mainly consists of cab assembly, console assembly, control box assembly, driver seat assembly. Among which some parts of hydraulic system, electrical system and air conditioning system are assembled on cab assembly.



P24C00001

Main Parts and Components of Cab System



P24C00002

1. Cab assembly
2. Console assembly
3. Control box assembly
4. Seat assembly

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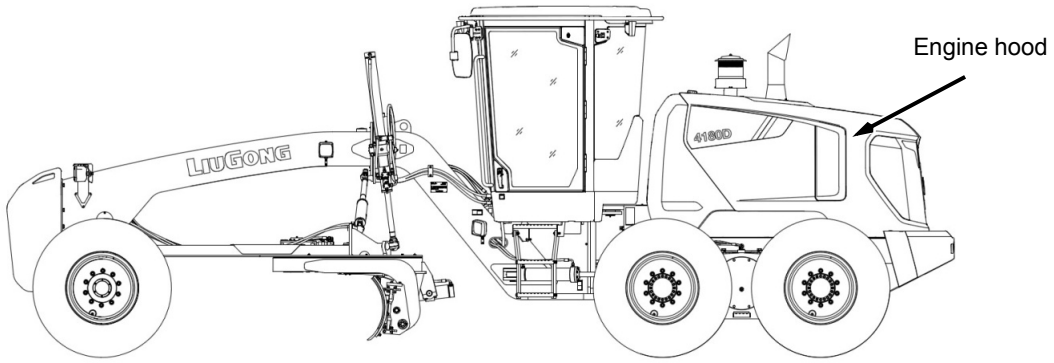
Precautions on removal and installation:

1. The operator for special equipments shall have corresponding operation certificate;
2. The measuring equipment and tools shall be provided with inspection certificates from metrological service;
3. Because many other related components on the complete machine are concerned during the removal and installation of each component, removed components (especially standard parts) shall be reasonably placed to avoid wrong installation, neglected installation, part missing, etc. during reassembly;
4. When other components are involved in the removal and installation of each component, please refer to the list of tools for removing and installing other components from/on the complete machine, these tools will not be listed in the tool list of this component;
5. If the expected effect can be reached in the ways of using open-end wrench, blower gun and socket as well as ratchet wrench and socket to remove and install, anyone can be chosen.

Engine Hood

Introduction to Engine Hood

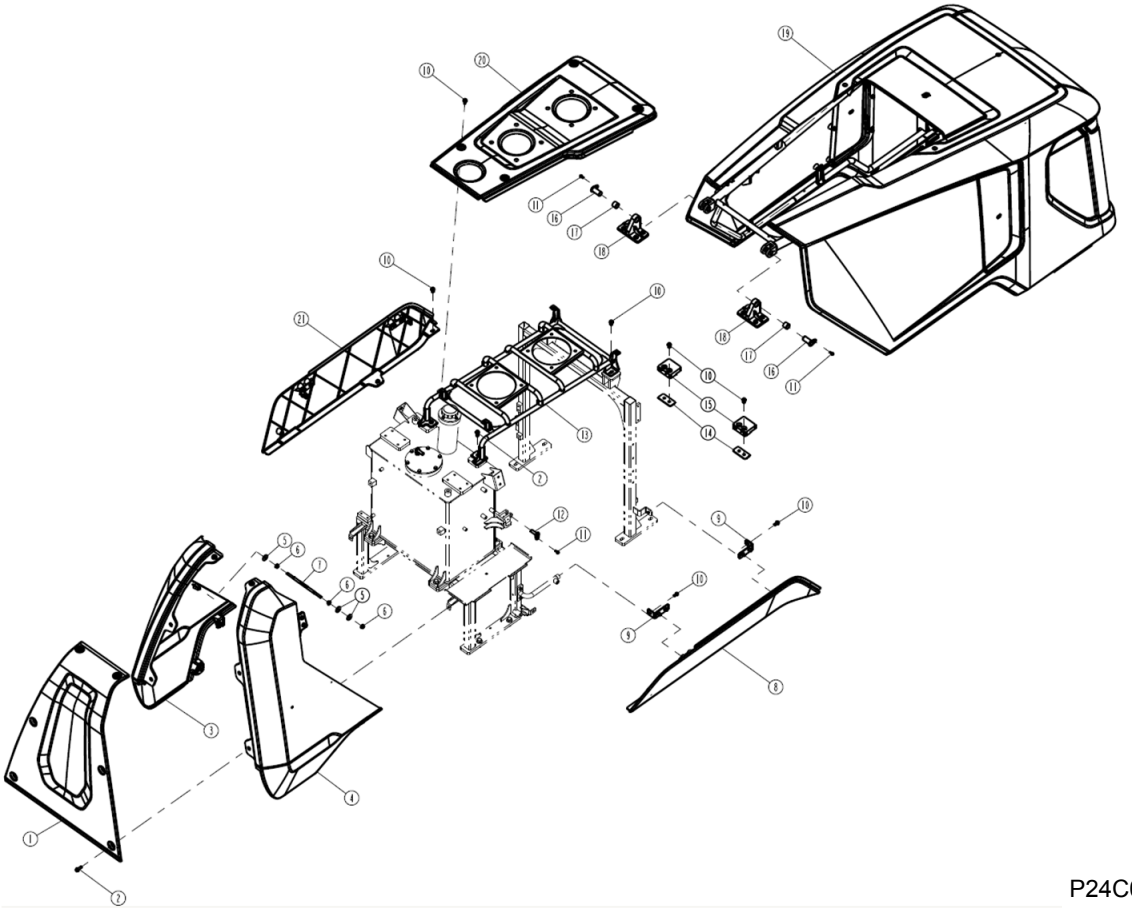
The engine hood mainly consists of two parts: one is a part that can be opened around the engine hood hinge; and the other is a part that is fixed on the frame and the hydraulic oil tank. Engine hood is forward tilting and hydraulic lifting Method. The maximum angle for engine hood opening is 50°.



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Main Components of Engine Hood



P24C00003

1. Front cover plate
2. Bolt
3. Right side plate
4. Left side plate
5. Washer
6. Nut
7. Stud bolt
8. Left plate
9. Angle block
10. Bolt
11. Bolt
12. Joint pin
13. Bracket
14. Adjusting shim
15. Rubber gasket
16. Pin shaft
17. Bushing
18. Bracket
19. Rear cover
20. Upper cover plate
21. Right plate

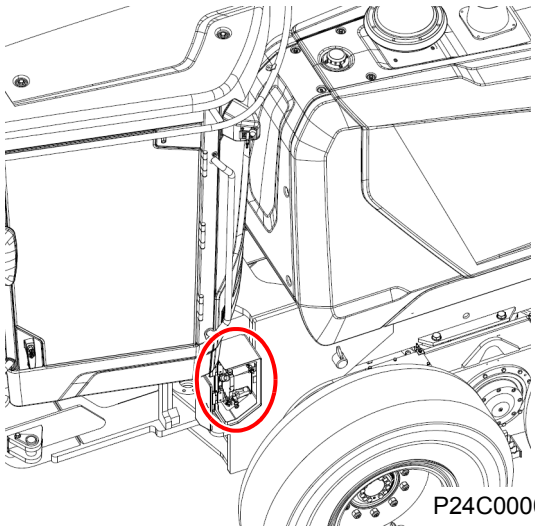
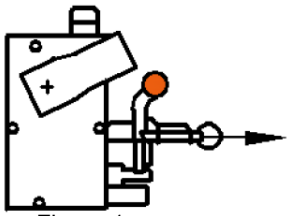
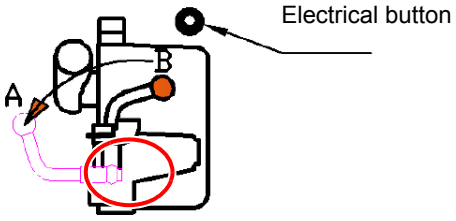
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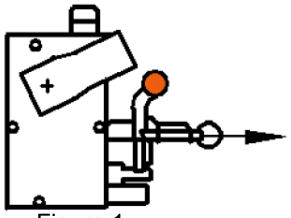
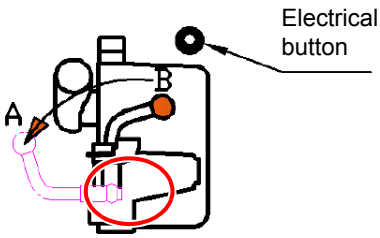
Opening and Closing of Engine Hood

Opening of Engine Hood

Figure	Operation steps	Tool(s)
 P24C00004	1. Find the location of lift switch between rear equipment and tire and at right side of complete machine.	
 Figure 1  Figure 2 P24C00005	2. Open the dowel pin in the direction of the arrow as shown in the figure 1, and move upward the electrical button to open the engine hood after moving the lever as shown in the figure 2 from A to B.	

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Closing of Engine Hood

Figure	Operation steps	Tool(s)
 Figure 1  Figure 2 P24C00005	1. Open the dowel pin in the direction of the arrow as shown in the figure 1 and move the lever as shown in the figure 2 from B to A, the engine hood can be closed.	

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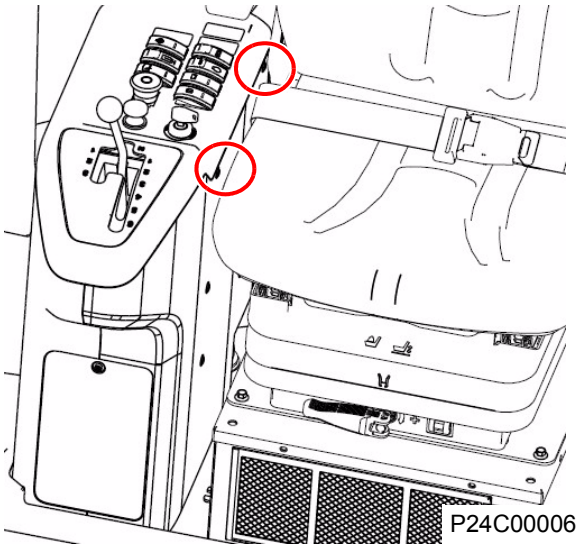
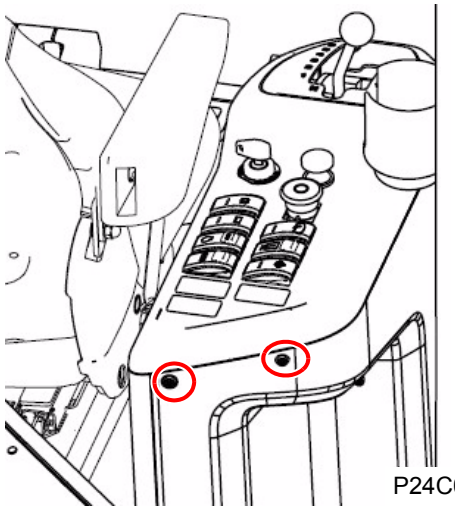
Removal and Installation

Removal of Cab System

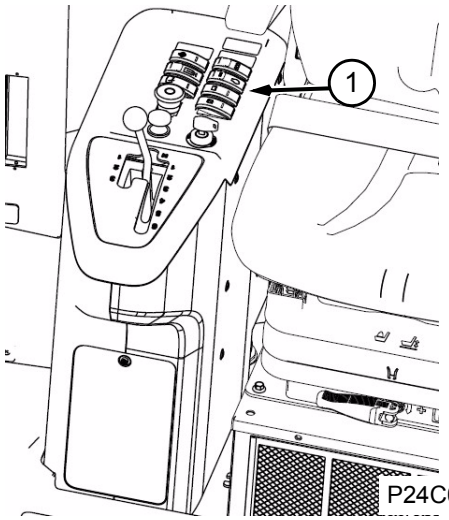
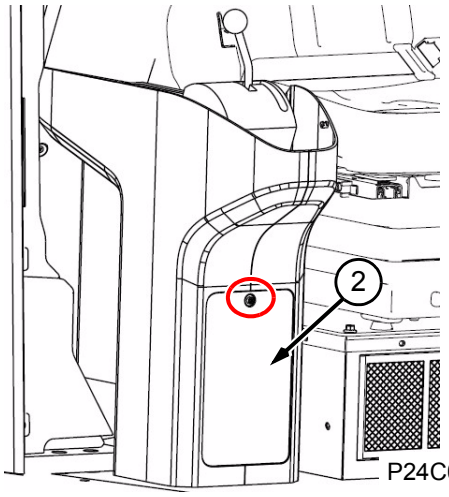
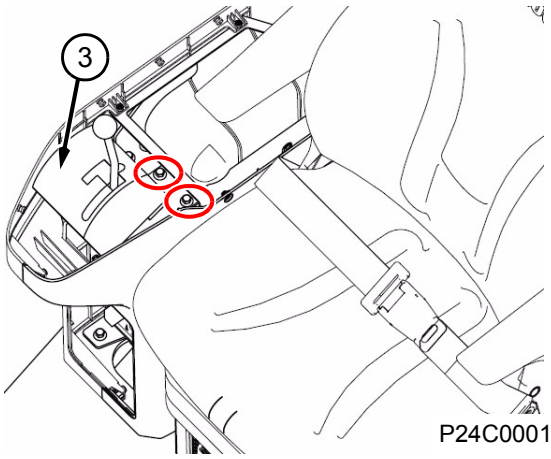
Disassembly Order of Cab Lifting

1. Disassemble the control box assembly → adjust the console assembly → adjust the driver seat assembly → replace lifting rings of head cover → remove the mounting bolts → lifting.
2. Step of assembling cab onto machine: assemble by the opposite steps of disassembly.

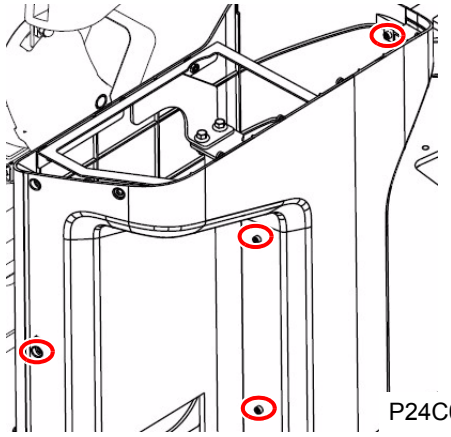
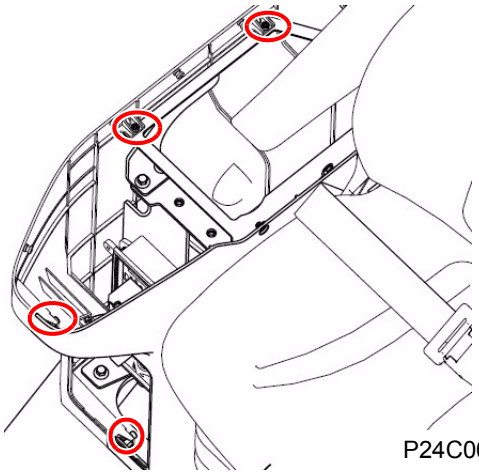
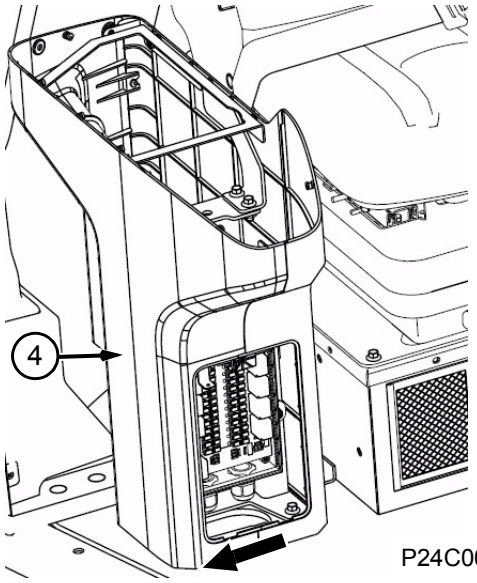
Removal of Control Box Assembly

Figure	Operation steps	Tool(s)
 P24C00006	1. Remove 2 mounting bolts at inner side of the control box.	4# Inner hexagon spanner
 P24C00007	2. Remove 2 mounting bolts at rear part of the control box.	4# Inner hexagon spanner

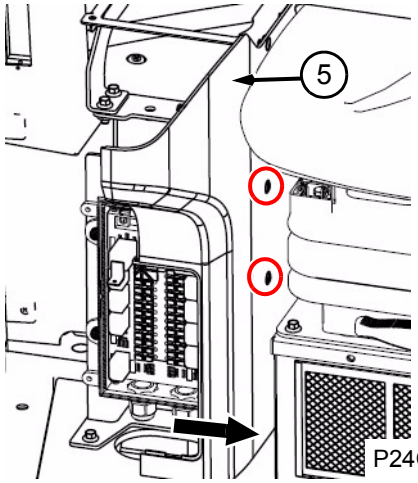
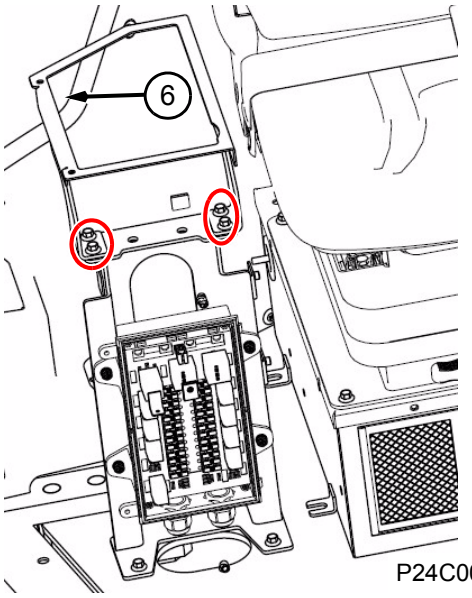
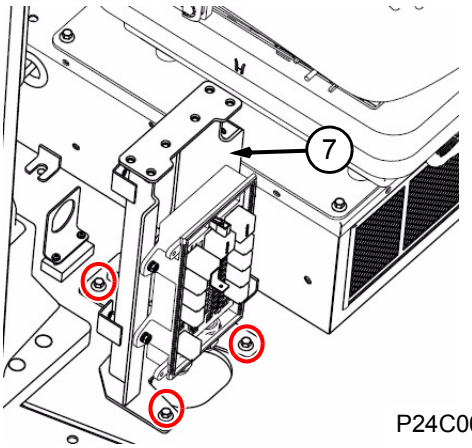
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Figure	Operation steps	Tool(s)
	3. Pry the control box upper cover (1) so as to separate the buckle at inner side of upper cover and remove the upper cover.	
	4. Remove the mounting screws of the control box side cover and remove the side cover (2).	4# Inner hexagon spanner
	5. Remove the mounting bolts of the gear selector bracket and remove the gear selector (3).	13# Wrench

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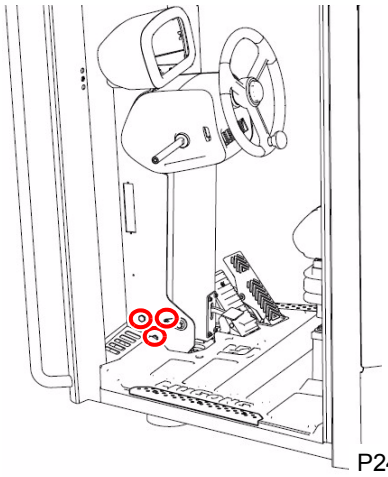
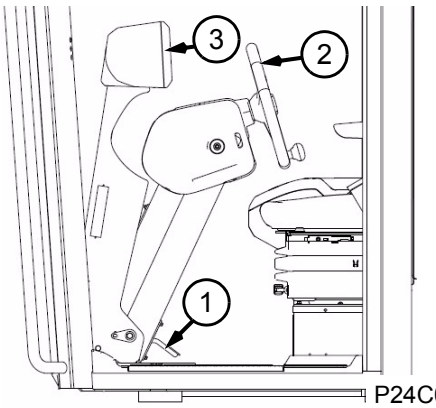
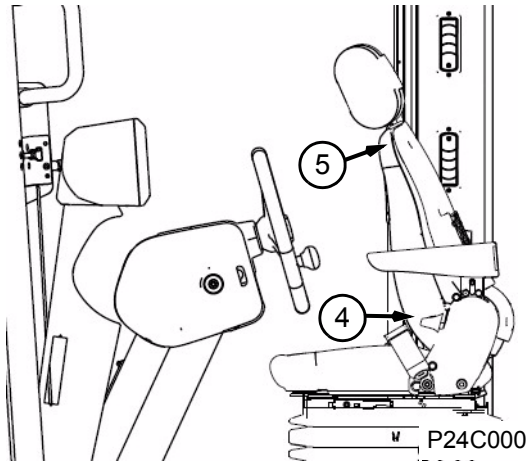
Figure	Operation steps	Tool(s)
 P24C00011	6. Remove the mounting screws at front upper part of the box and remove 3 mounting screws at rear part of the box.	4# Inner hexagon spanner
 P24C00012	7. Remove the mounting screws at front lower inner part of the box and remove mounting screws at upper part of the box.	4# Inner hexagon spanner
 P24C00013	8. Pry the buckle at the box joint and remove right box (4) in the direction of arrow.	

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Figure	Operation steps	Tool(s)
 P24C00014	9. Remove the mounting screws at inner side of the box and remove left box (5) in the direction of arrow.	4# Inner hexagon spanner
 P24C00015	10. Remove the mounting bolts of the bracket and remove the bracket (6).	13# Wrench
 P24C00016	11. Remove the mounting bolts under the fixing bracket and remove the bracket (7).	13# Wrench

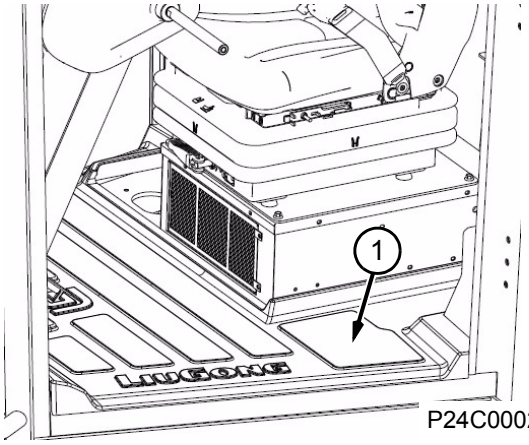
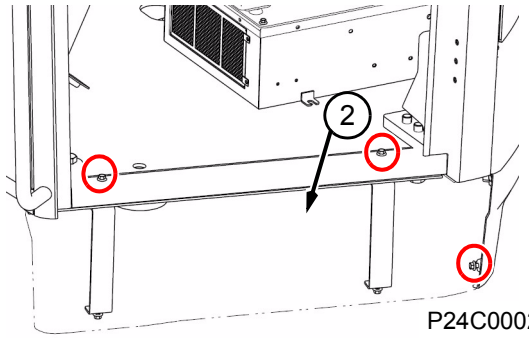
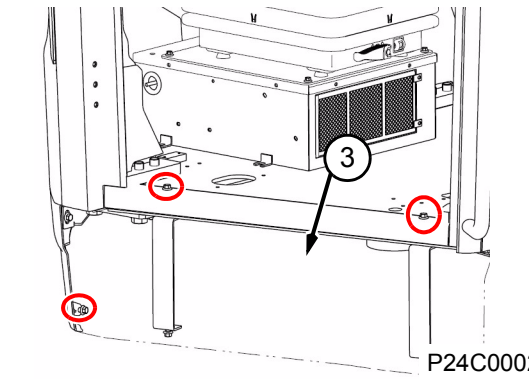
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Adjustment of Console Assembly and Driver Seat Assembly

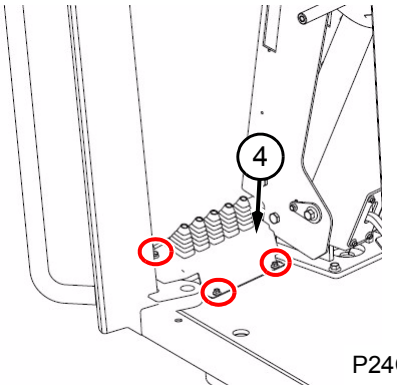
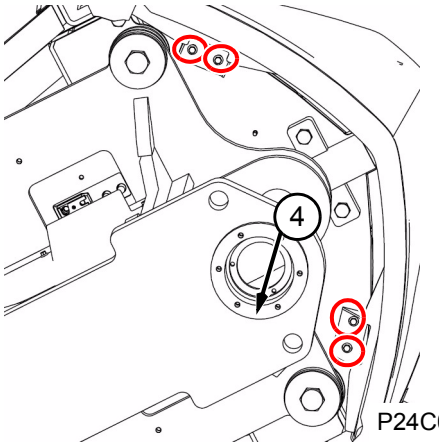
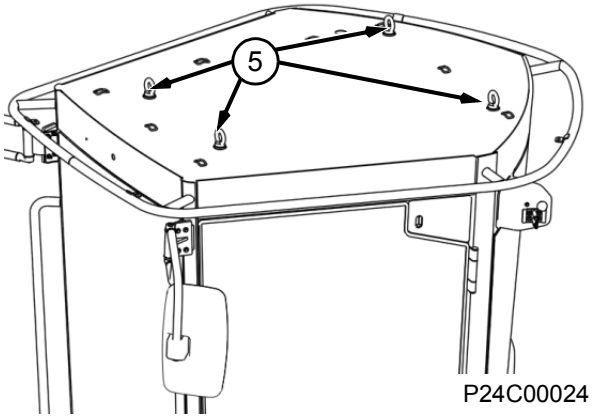
Figure	Operation steps	Tool(s)
 P24C00017	1. Unscrew the bolts at both sides (2 pcs at each side) for 3 - 5 teeth tread at lower part of the console.	18# Wrench
 P24C00018	2. Turn and move the console: depress the pedal (1), and then hold the steering wheel (2) by hands to move the console backwards to the limit position; and hold the instrument cover (3) by hands to move it backwards to the limit position.	
 P24C00019	3. Lift the seat backrest regulator (4), turn and move the seat backrest (5) forwards so that the backrest is tilting forwards.	

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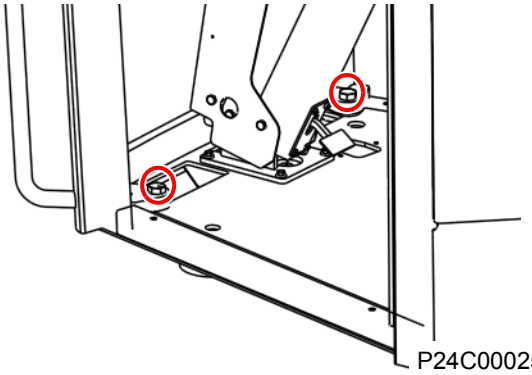
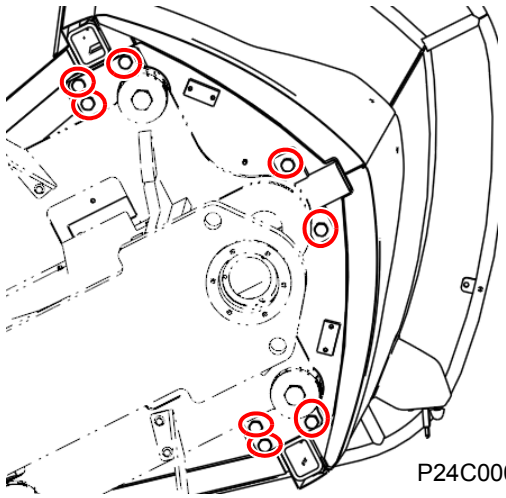
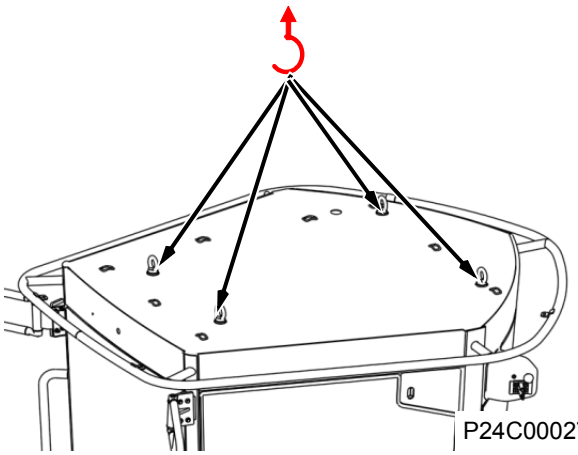
Removal for Cab Assembly

Figure	Operation steps	Tool(s)
 P24C00020	1. Lift the floor mat (1), move and place it at a clean and even position.	
 P24C00021	2. Remove 3 mounting bolts of left plate and move away left plate (2).	16# Wrench
 P24C00022	3. Remove 3 mounting bolts of right plate and move away right plate (3).	16# Wrench

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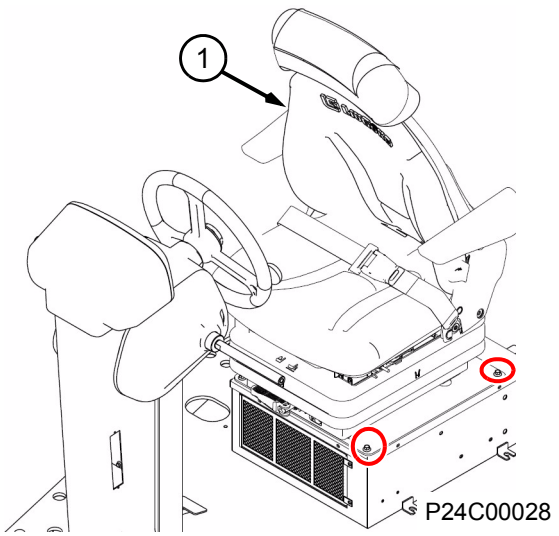
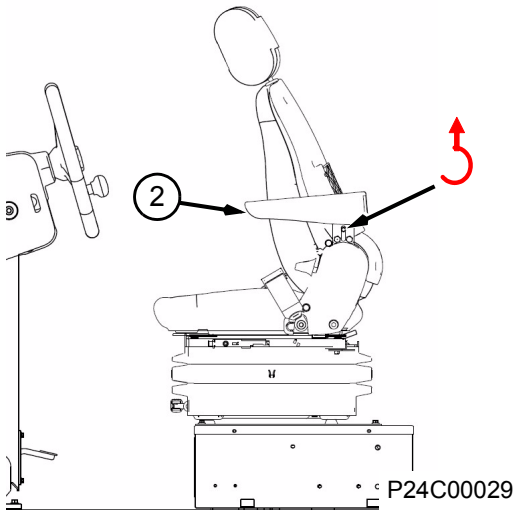
Figure	Operation steps	Tool(s)
 P24C00067	4. Remove the mounting bolts of dust cover at the both sides of the console, respectively, and remove the dust cover (4).	10# Wrench
 P24C00023	5. Remove 4 mounting bolts of rear plate bracket and move away rear plate (4).	16# Wrench
 P24C00024	6. 4 M16 bolts of roof, and replace and install M16 lifting ring (5).	24# Wrench

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Figure	Operation steps	Tool(s)
 P24C00025	7. Remove 2 captive bolts in the front of cab.	30# Wrench
 P24C00026	8. Remove 8 captive bolts under the cab.	30# Wrench
 P24C00027	9. Lift slowly the cab using the traveling crane and lifting rope to a clean and safe position.	Lifting rope

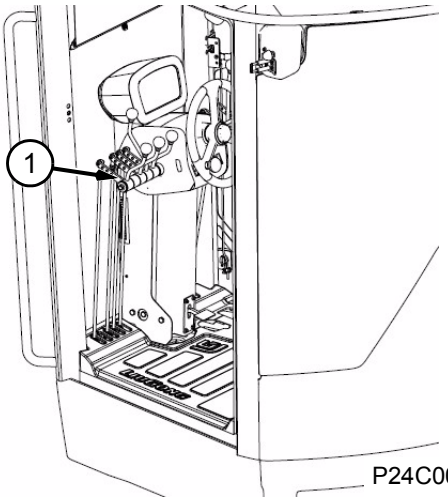
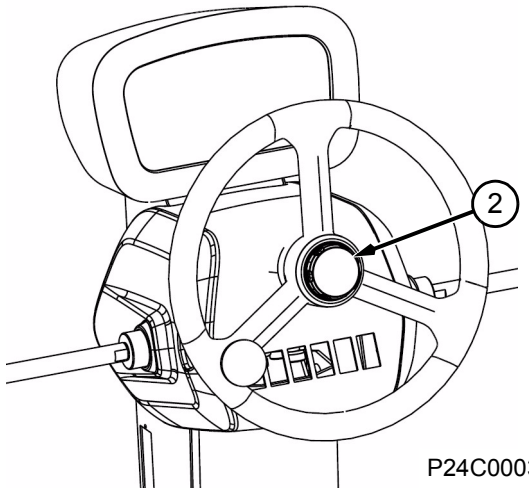
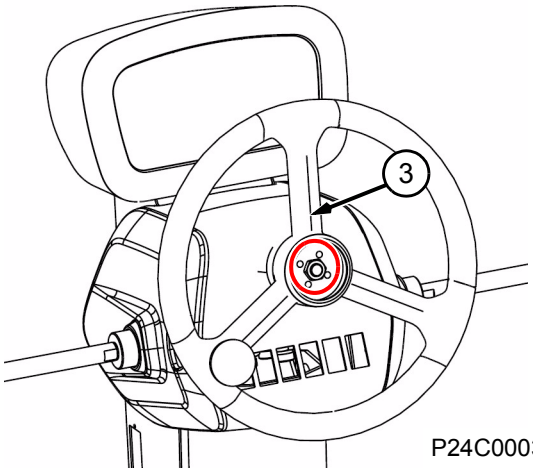
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Removal of Seat Assembly

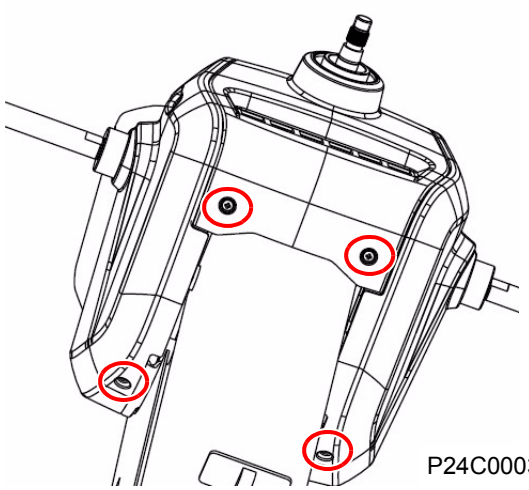
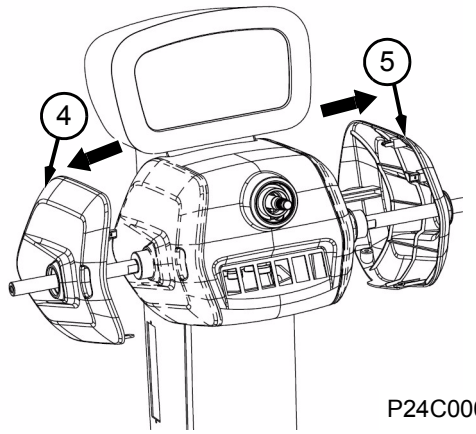
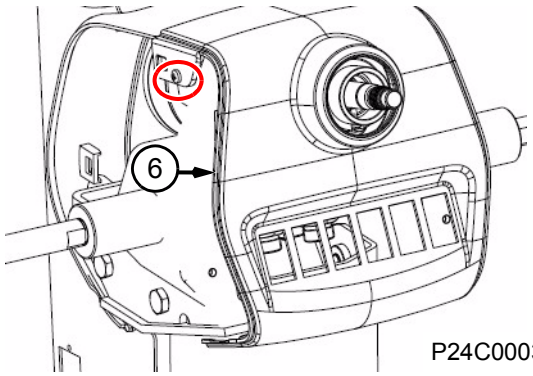
Figure	Operation steps	Tool(s)
	1. Remove 4 mounting bolts (2 pcs at each side) under the seat (1).	13# Wrench
	2. Hook the armrests (2) at both sides of the seat using the lifting rope, lift and place the seat at a clean and safe position.	Lifting rope

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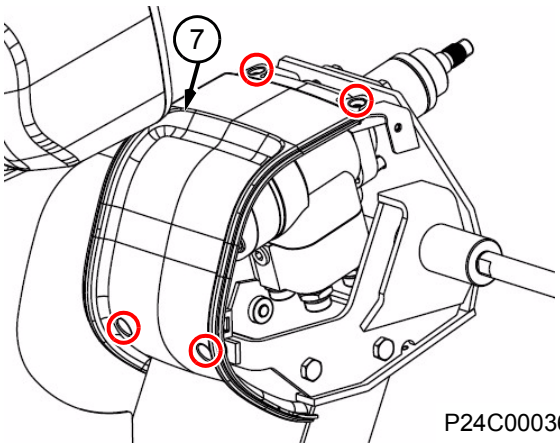
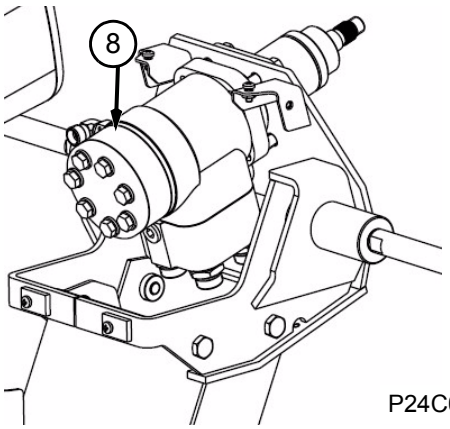
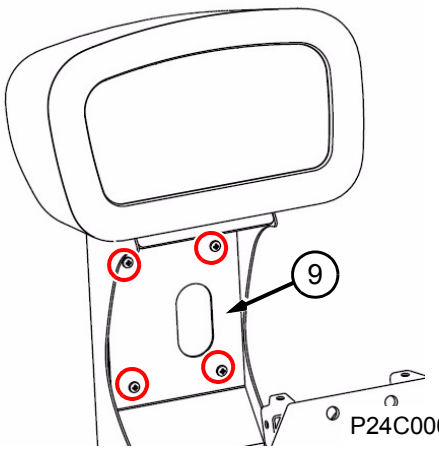
Removal of Console Assembly

Figure	Operation steps	Tool(s)
 P24C00030	1. Refer to "Hydraulic Part" for removal of control lever system (1).	
 P24C00031	2. Pry the steering wheel horn button cover (2).	
 P24C00032	3. Remove the mounting nuts in the middle of the steering wheel and remove the steering wheel (3).	21# Wrench

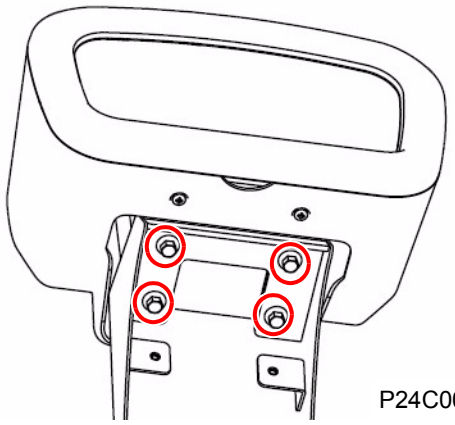
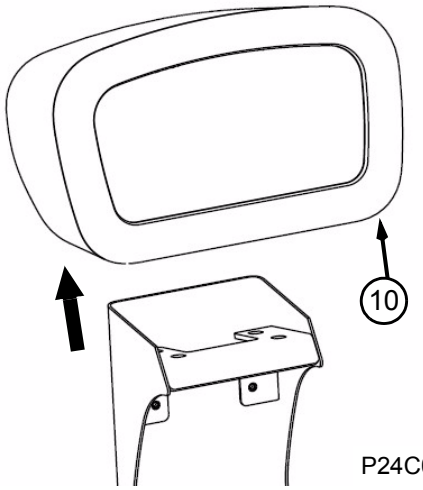
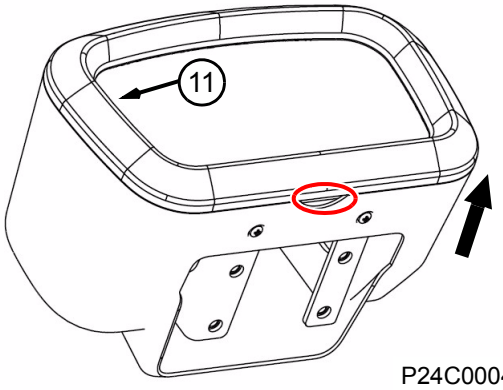
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Figure	Operation steps	Tool(s)
 P24C00033	4. Remove 4 screws under the console side cover.	Cross-screwdriver
 P24C00034	5. Pry side cover (4) to separate side cover inner buckle, remove the side cover along with the direction of control lever shaft. Remove side cover (5) using the same steps.	
 P24C00035	6. Remove respectively the screws at both sides of front cover (1 pcs at each side); and then remove front cover (6).	Cross-screwdriver

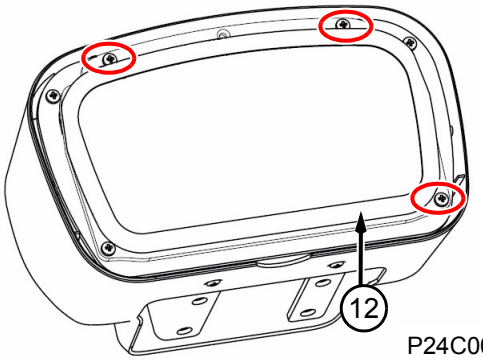
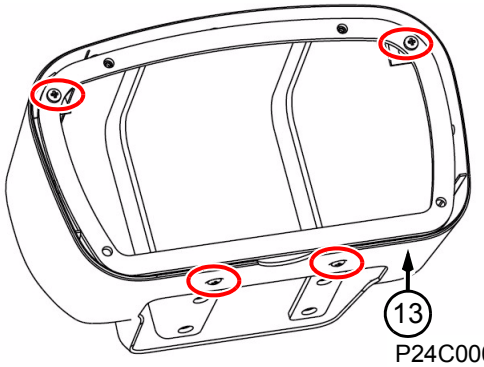
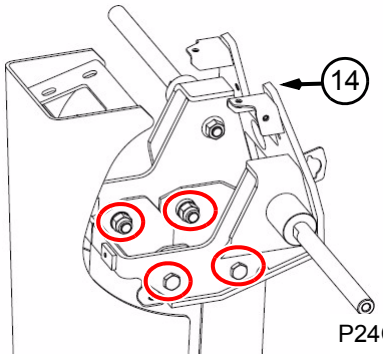
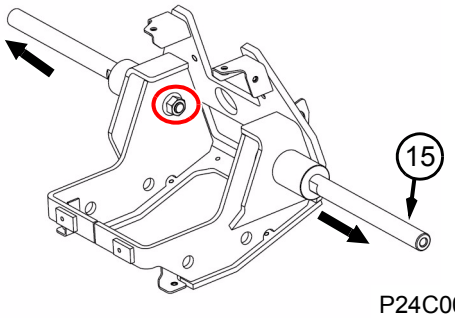
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Figure	Operation steps	Tool(s)
	7. Adjust the console backwards to the limit position, remove 4 mounting screws of rear cover, and then remove rear cover (7).	Cross-screwdriver
	8. Refer to "Removal of Hydraulic System Metering Pump" for removal of the metering pump (8).	
	9. Remove 4 mounting screws of the angle block and remove the angle block (9).	Cross-screwdriver

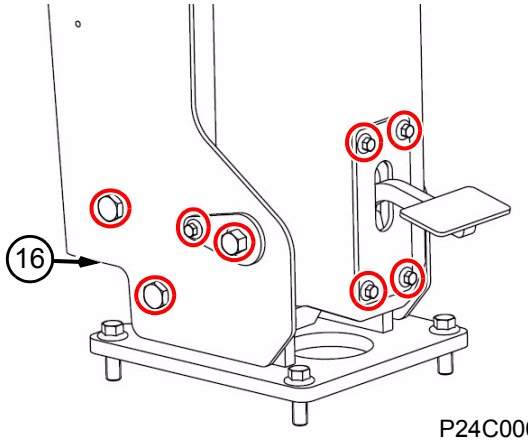
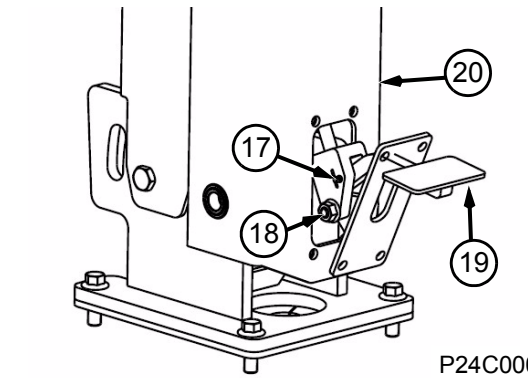
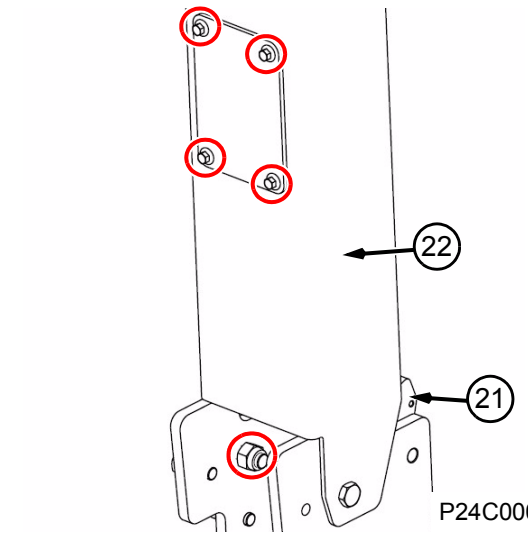
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Figure	Operation steps	Tool(s)
 P24C00039	10. Remove 4 mounting bolts under the instrument cover bracket.	13# Wrench
 P24C00040	11. Unplug the instrument wire harness connector before removing the instrument cover (15) in the direction of the arrow.	
 P24C00041	12. Pry the instrument cover (11) so as to separate the inner buckle and remove the instrument cover in the direction of arrow.	

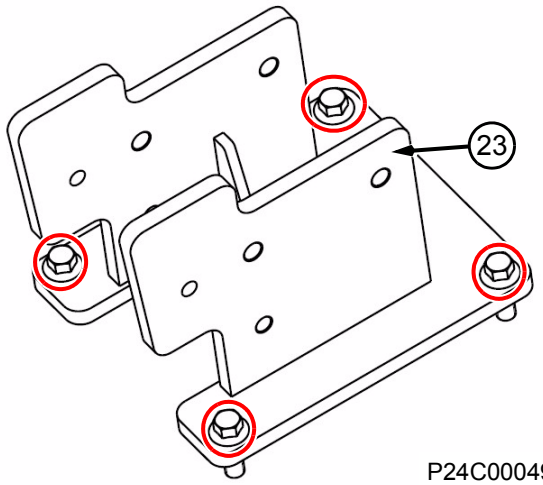
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Figure	Operation steps	Tool(s)
 P24C00042	13. Remove 4 mounting screws of the instrument and remove the instrument (12).	Cross-screwdriver
 P24C00043	14. Remove 4 mounting screws of the instrument cover and remove the instrument cover (13).	Cross-screwdriver
 P24C00044	15. Remove the four mouting bolts and nuts, two on each side; and then remove the support (14).	18# Wrench
 P24C00045	16. Remove the two nuts at shaft-end, respectively, one on each side; and remove the shaft (15) by rotating along with the arrow direction.	16# Wrench

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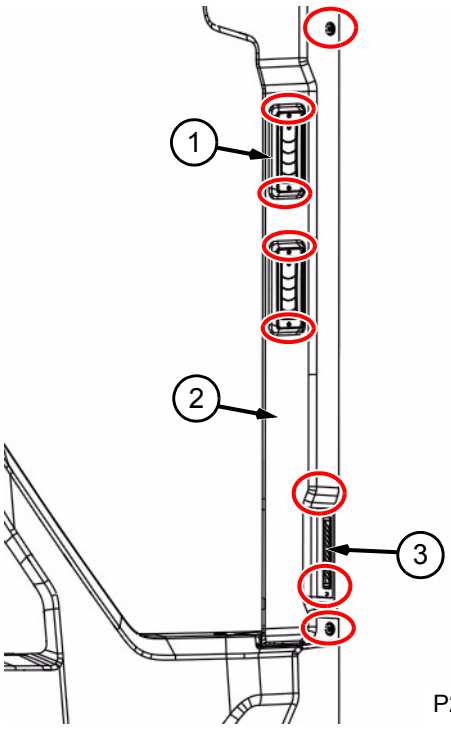
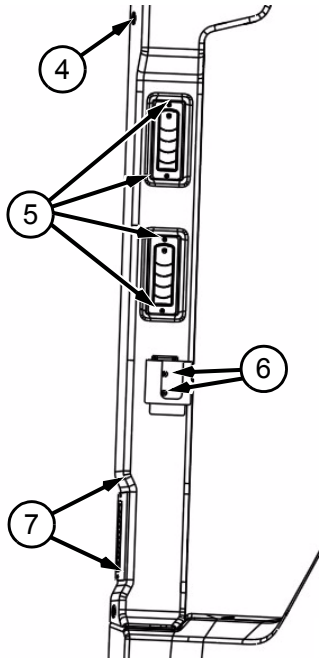
Figure	Operation steps	Tool(s)
 P24C00046	17. Remove the four mounting bolts of air-spring seat; remove the eight bolts at the outer of fixing support (four at each side), and then remove the fixing support (16).	7# Wrench 10# Wrench 18# Wrench
 P24C00047	18. Remove the pin shaft (17) and the bolts (18) and remove the pedal (19) and the support (20).	13# Wrench
 P24C00048	19. Remove the four captive bolts of the air-spring mouting seat; remove the two mounting bolts ouside and two nuts inside of the support (one at each side); and then remove the air-spring group (21) and support (22).	10# Wrench 18# Wrench

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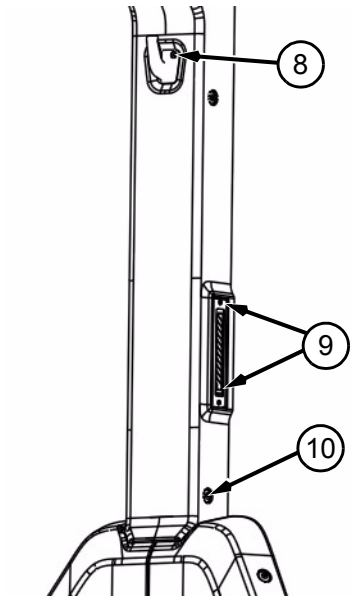
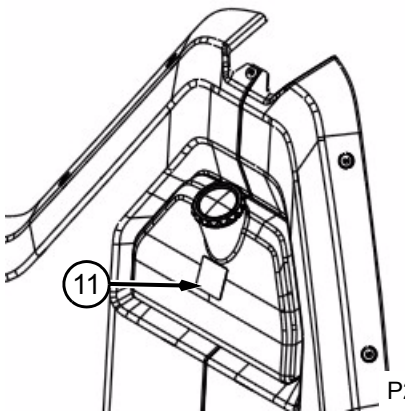
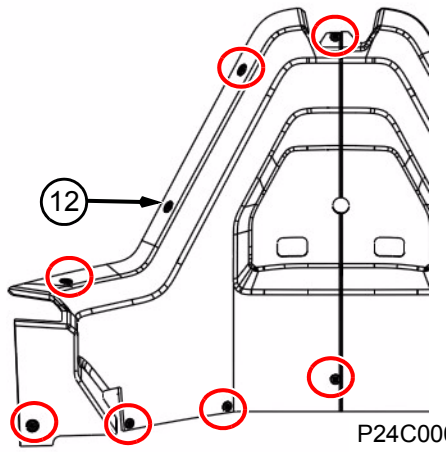
Figure	Operation steps	Tool(s)
 P24C00049	20. Remove the captive bolts of the base and remove the base (23).	16# Wrench

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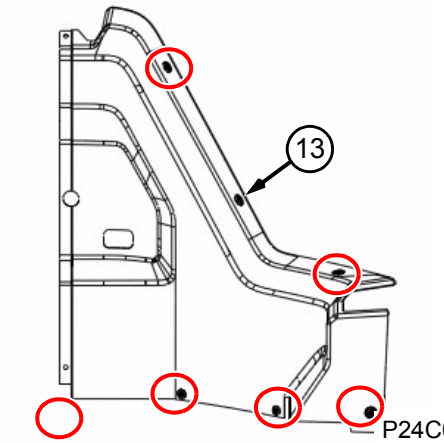
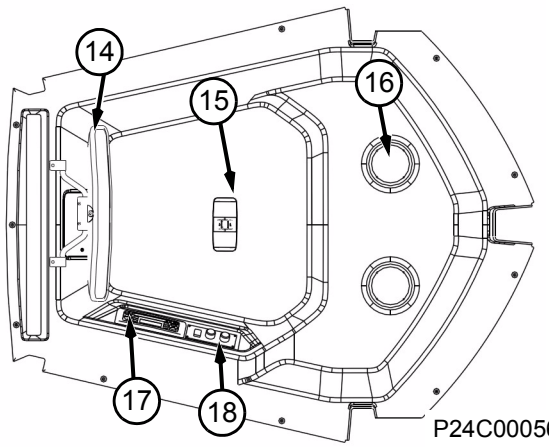
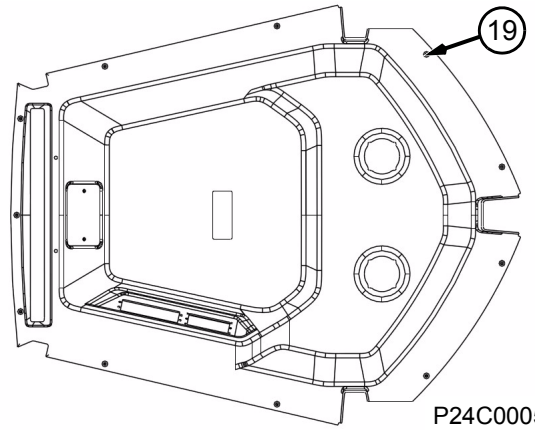
Removal of Decoration

Figure	Operation steps	Tool(s)
 P24C00050	1. Remove 4 inflating screws at both sides of left pillar decoration (2 pcs at each side); remove 4 mounting screws of air conditioner outlet; remove 2 mounting screws of air conditioner outlet at side of decoration; remove left pillar decoration.	Cross-screwdriver
 P24C00051	2. Remove 4 inflating screws (4) at both sides of right pillar decoration (2 pcs at each side); remove 4 mounting screws (5) of air conditioner outlet; remove 2 fixing screws (6) of the cup holder; remove 2 mounting screws (7) of air conditioner outlet at side; remove right pillar decoration.	Cross-screwdriver

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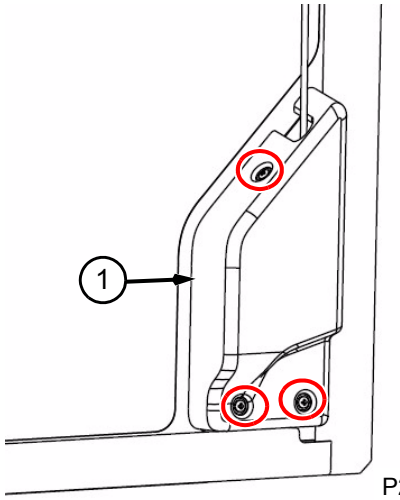
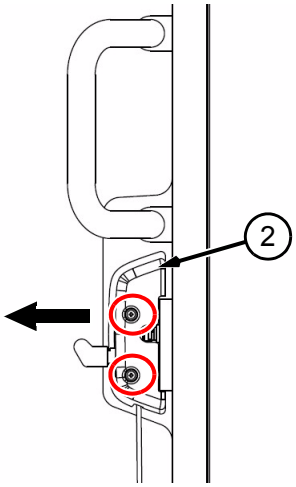
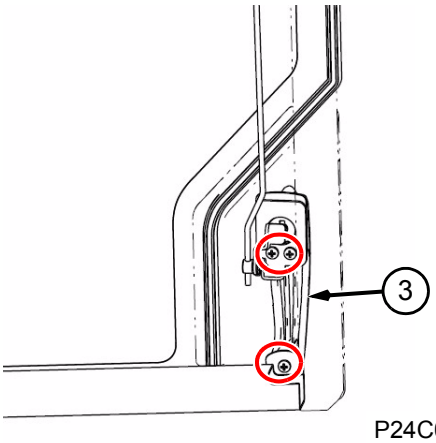
Figure	Operation steps	Tool(s)
 P24C00052	3. Remove 2 fixing screws (8) of coat hook; remove 4 mounting screws (9) of air conditioner outlet (2 pcs at each side); remove 4 inflating screws (10) at both sides of rear pillar decoration; remove rear pillar decoration.	Cross-screwdriver
 P24C00053	4. Rip the kettle label 11, remove the captive bolts at back of the label and remove the kettle.	16# Wrench
 P24C00054	5. Remove 8 inflating screws (12) of right rear wall decoration and remove rear wall decoration.	Cross-screwdriver

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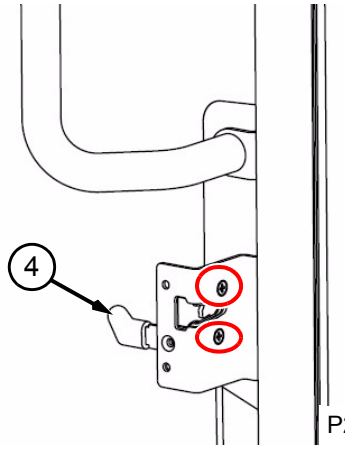
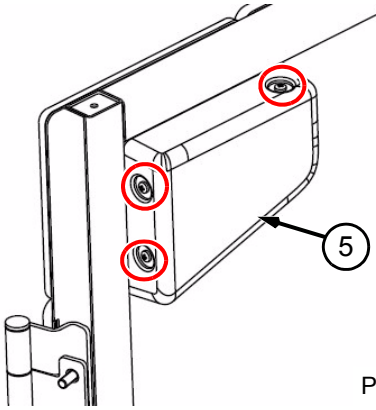
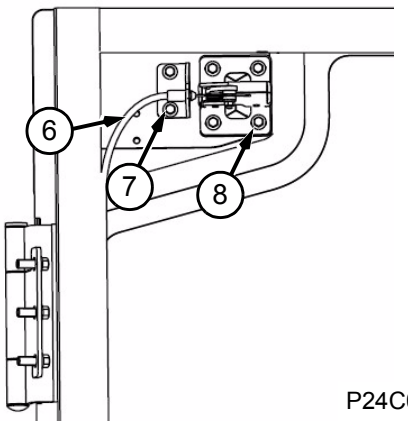
Figure	Operation steps	Tool(s)
	6. Remove 6 inflating screws (13) of left rear wall decoration and remove left rear wall decoration.	Cross-screwdriver
	7. Remove rear-view mirror (14), reading light (15) and 2 horns (16); 8. Remove the radio and tape player (17) and A/C panel (18).	Cross-screwdriver
	9. Remove the inflating screw of dome decoration and the dome decoration 19.	Cross-screwdriver

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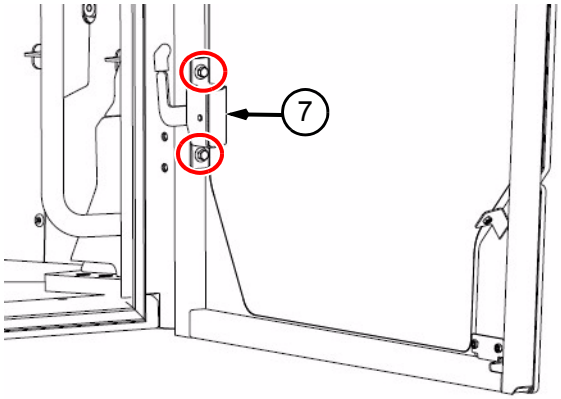
Removal of Lock

Figure	Operation steps	Tool(s)
 P24C00058	1. Remove the mounting screws of the lock cover (1) and the lock cover.	Cross-screwdriver
 P24C00059	2. Remove the mounting screws of the lock cover (2), and remove the lock cover in the direction of arrow.	Cross-screwdriver
 P24C00060	3. Remove the mounting screws of outer handle (3).	Cross-screwdriver

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Figure	Operation steps	Tool(s)
 P24C00061	4. Remove the mounting screws of the latch (4).	Cross-screwdriver
 P24C00062	5. Remove the mounting screws of the lock cover (5) and the lock cover.	Cross-screwdriver
 P24C00063	6. Remove the clamp nut at flexible shaft (6) end, separate the flexible shaft from the bracket (6) groove, remove the mounting bolts of the bracket (6) and remove the mounting bolts of the latch (7).	8# Wrench 10# Wrench

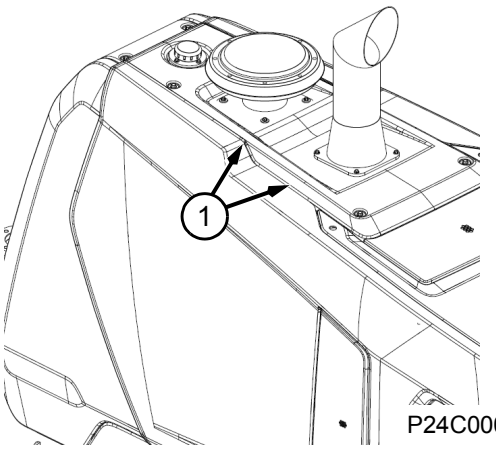
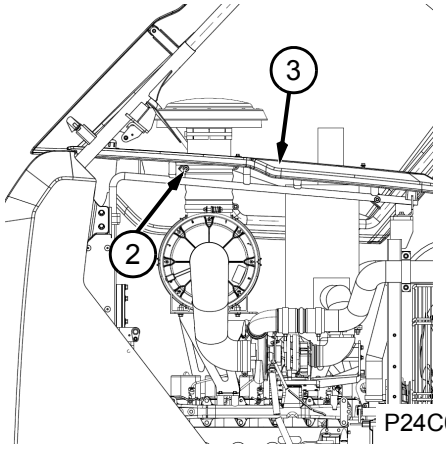
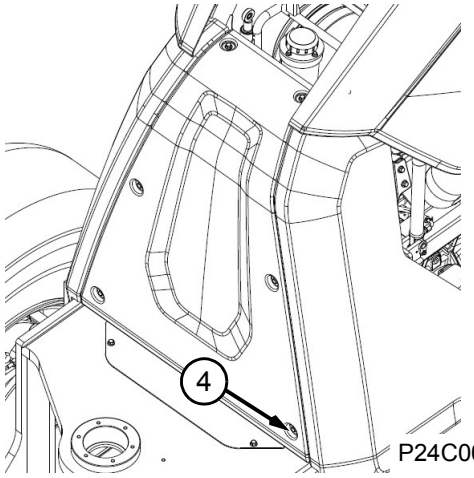
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Figure	Operation steps	Tool(s)
 P24C00064	7. Remove the inside handle (7) to install the bolts.	13# Wrench

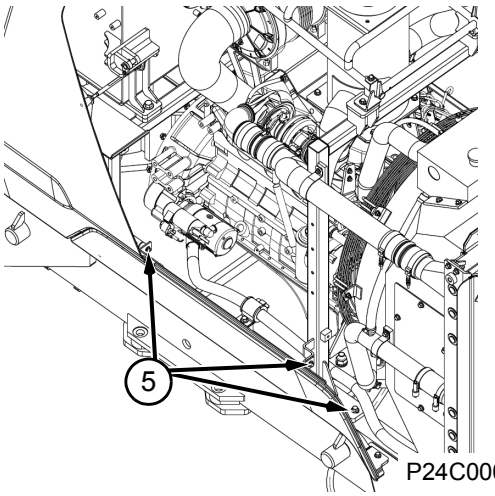
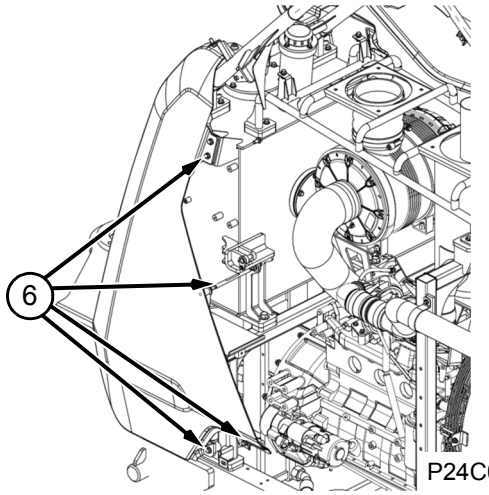
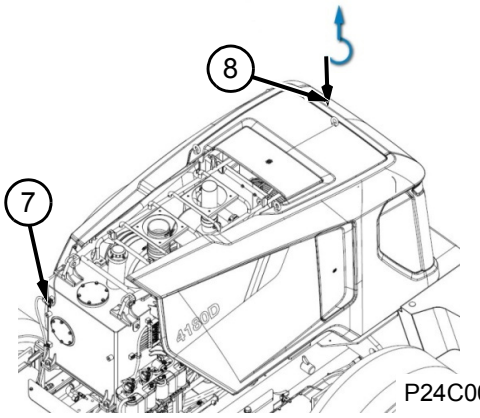
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Removal and Installation of Engine Hood

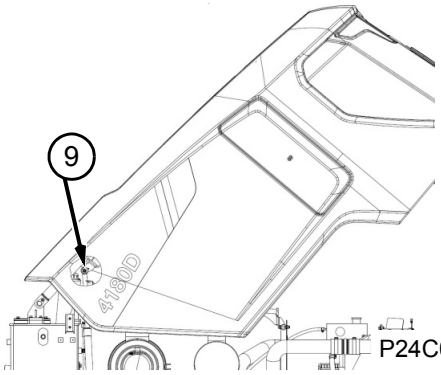
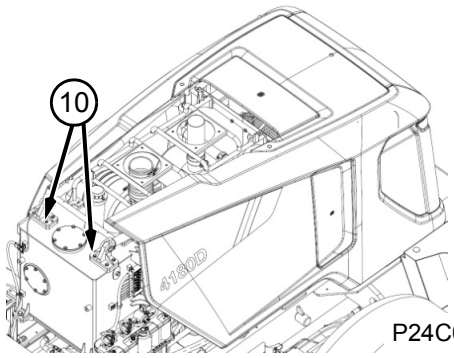
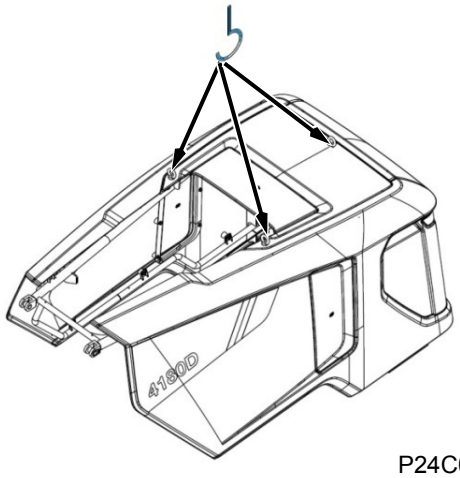
Removal of Engine Hood

Figure	Operation steps	Tool(s)
 P24C00065	**Warning: the exhaust pipe and air pre-filter can not be removed until the engine stops and they are cool enough for being touched by bare hand.** 1. Remove the air-filter rain cap, exhaust pipe and fastening bolt (1), and then remove the exhaust pipe.	13# Wrench 16# Wrench
 P24C00066	2. Open the hood to remove the clamp (2) on the rain-cap intake pipe, remove the air-filter rain cap, and at the same time, remove the upper cover (3).	11# Wrench
 P24C00069	3. Remove 6 fastening bolts of front cover plate and take down front cover plate (4).	16# Wrench

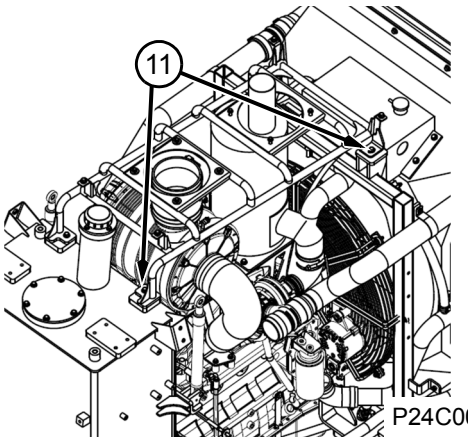
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Figure	Operation steps	Tool(s)
 P24C00070	4. Remove the fastening bolts of left and right plates (8 pcs in total, symmetrical on both sides) and take down left and right plates (5).	16# Wrench 13# Wrench
 P24C00071	5. Remove the fastening bolts of left and right side plates (8 pcs in total, symmetrical on both sides) and take down left and right side plates (6).	16# Wrench
 P24C00072	6. Close the engine hood, remove the wire harness connector (7) of rear combination light; screw on the eyebolt on the lifting point at tail part of the engine hood and hang on the lifting rope (8).	M16 Eyebolt Lifting rope

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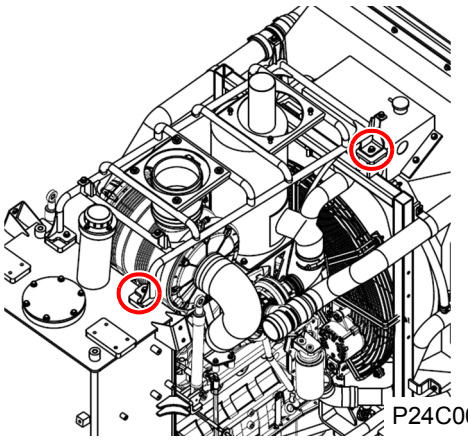
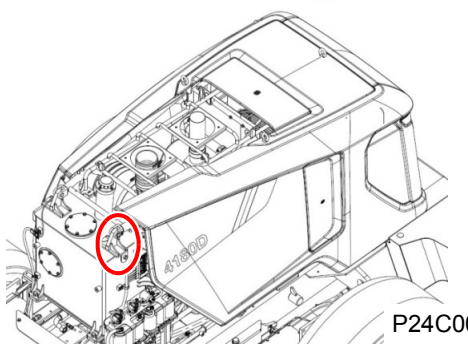
Figure	Operation steps	Tool(s)
 P24C00073	7. Open the engine hood to the maximum angle, hold rear lifting point of rear cover using the traveling crane, lifting ring and other tools, remove the captive bolts of pin connecting the lift cylinder with the engine hood and knock out the pin (9).	Lifting rope 11# Wrench
 P24C00074	8. Lower slowly rear cover to the closing state using the traveling crane and remove the captive bolts (10) of the hinge base.	16# Wrench
 P24C00075	9. Lift rear cover using the traveling crane and place it at a safe and clean position.	M16 Eyebolt Lifting rope

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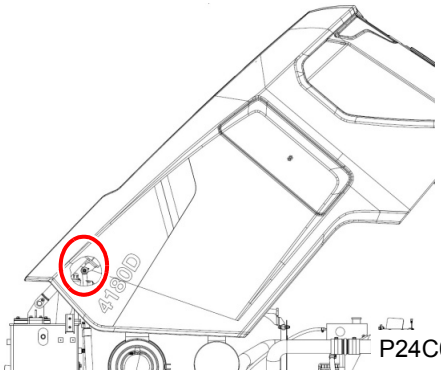
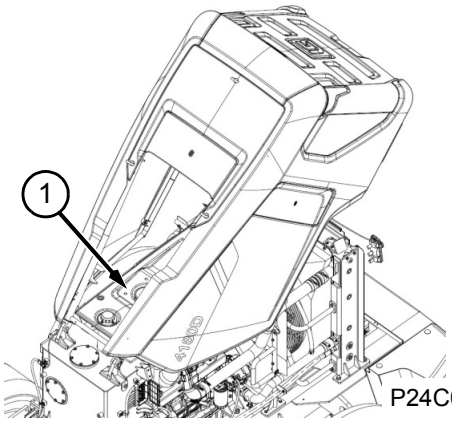
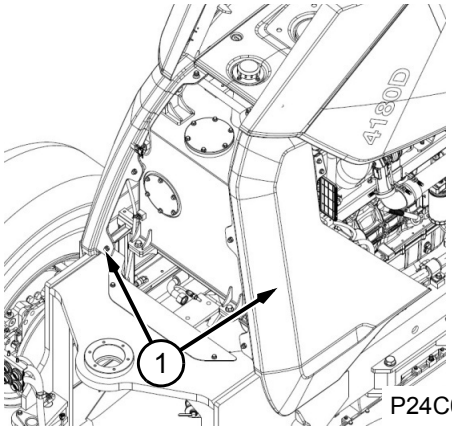
Figure	Operation steps	Tool(s)
 P24C00076	10. Remove the mounting bolts on the bracket (4 pcs in total, symmetrical on both sides), take down the bracket and place it at a safe and clean position (11).	16# Wrench

Installation of Engine Hood

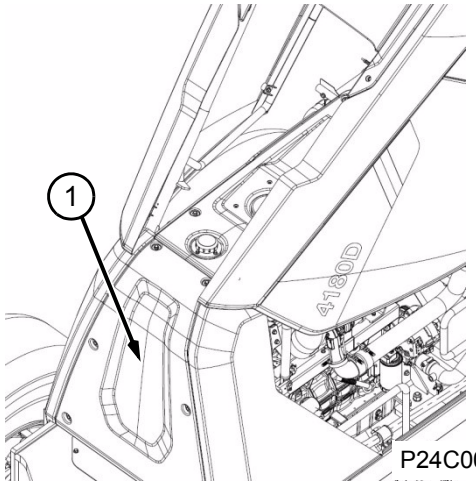
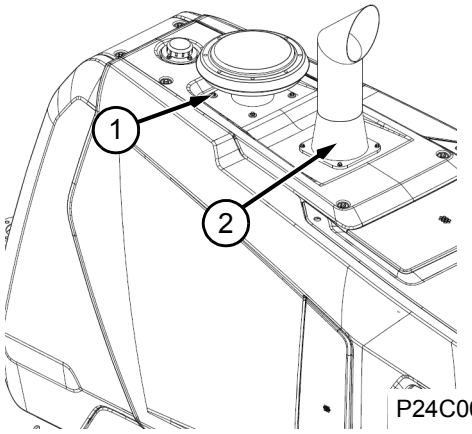
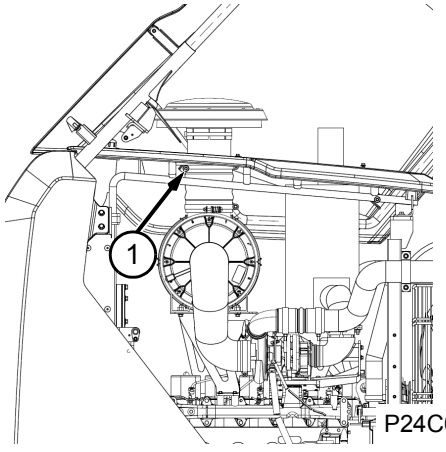
Installation steps of the engine hood: install it by the opposite steps of removal.

Figure	Operation steps	Tool(s)
 P24C00076	1. Put the bracket on the mounting point of hydraulic oil tank and baffle support and tighten the mounting bolts on the bracket.	16# Wrench
 P24C00072	2. Lift rear cover at the hinged mounting position on the oil tank bracket using traveling crane, lifting ring and other tools, tighten the bolts of the engine hood hinged base and connect the wire harness connector of rear combination light.	Traveling crane Sling 16# Wrench

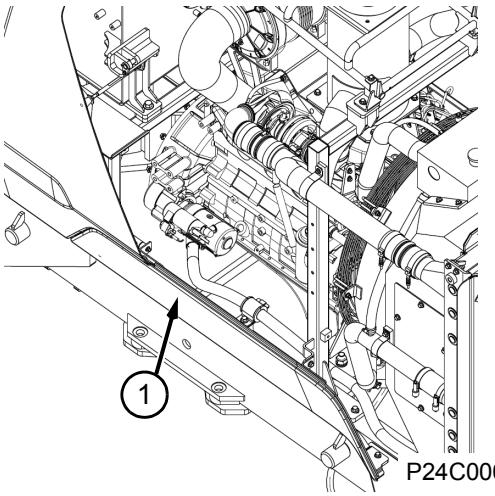
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Figure	Operation steps	Tool(s)
 P24C00073	3. Open rear cover to the proper angle using the traveling crane and install the pin connecting the lift cylinder with the engine hood.	Sling 13# Wrench
 P24C00077 1. Upper cover plate	4. Put upper cover plate on the bracket and tighten 4 mounting bolts of upper cover plate.	16# Wrench
 P24C00078 1. Left/right side plate	5. Put left and right side plates on the mounting position and tighten the mounting bolts.	16# Wrench

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Figure	Operation steps	Tool(s)
 1. Front cover plate	6. Put front cover plate on the mounting position and tighten the mounting bolts.	16# Wrench
 1. Air-filter rain cap 2. Exhaust pipe	7. Close the hood. Place the air-filter rain cap and exhast pipe to the mounting position, and then tighten the mounting bolts.	13# Wrench
 1. Clamp	8. Open the engine hood and tighten the clamp on the intake pipe of the air pre-filter.	11# Wrench

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Figure	Operation steps	Tool(s)
 1. Left plate	9. Put left\right plate on the mounting position and tighten the mounting bolts.	13# wrench, 16# wrench

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Structure

General Information 7-3
Safety Items 7-3
Universal Tool and Tooling List 7-4
Special Tool and Tooling List 7-4
Structure Function Principle 7-5
Overview of Frame System 7-5
Frame System Structure Diagram 7-5
Parameters of Frame System 7-5
Working Principle of Frame System 7-5
Articulated Hitch 7-6
Structure and Principle of Articulated Hitch 7-6
Working Principle and Installation of Swing Arm Assembly 7-7
Technical Parameters of Swing Arm Assembly 7-7
Front Counterweight 7-8
Overview and Structure Diagram of Front Counterweight 7-8
Rear Counterweight 7-9
Overview and Structure Diagram of Rear Counterweight 7-9
Work Implement System 7-10
Overview of Work Implement System 7-10
Structure Diagram of Work Implement System 7-10
Work Implement System Parameter 7-11
Work Implement Frame 7-12
Technical Parameters 7-13
Blade Assembly 7-13
Technical Parameters 7-13
Worm Gear Case Assembly 7-14
Technical Parameters 7-14
Structure and Schematic 7-14
Removal and Installation of Swing Arm Assembly 7-16
Removal of Swing Arm Assembly 7-16
Installation of Swing Arm Assembly 7-16
Removal and Installation of Fork Assembly 7-17

https://truckmanualshub.com/

Removal of Fork Assembly 7-17
Installation of Fork Assembly 7-17
Removal and Installation of Swing Seat Latch 7-18
Removal of Swing Seat Latch 7-18
Installation of Swing Seat Latch 7-18
Removal and Installation of Articulated Hitch 7-19
Removal of Articulated Hitch 7-19
Installation of Articulated Hitch 7-22
Removal and Installation of Front Counterweight 7-26
Removal of Front Counterweight 7-26
Installation of Front Counterweight 7-27
Removal and Installation of Rear Counterweight 7-28
Removal of Rear Counterweight 7-28
Installation of Rear Counterweight 7-29
Removal and Installation of Swing Bearing 7-30
Removal of the Swing Bearing 7-30
Installation of Swing Bearing 7-32
Removal and Installation of Blade Assembly 7-33
Removal of Blade Assembly 7-33
Installation of Blade Assembly 7-35
Removal and Installation of Worm Gear Case Assembly 7-39
Removal of Worm Gear Case Assembly 7-39
Installation of Worm Gear Case Assembly 7-40
Disassembly and Assembly of Worm Gear Case Assembly Parts and Components 7-41
Assembly of Worm Gear Case Assembly Parts and Components 7-45

Fault Diagnosis and Troubleshooting Methods 7-54

Precautions for Fault Diagnosis 7-54
Common Faults and Troubleshooting 7-54

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General Information

Safety Items

Many accidents in operation, maintenance, repair and other aspects are caused by failing to observe the basic safety rules and precautions. If the case of potential risk is fully aware in advance, these accidents usually can be avoided. The operators must pay attention to these potential risks, and be trained for relevant skills before properly and safely operating, maintaining and repairing the machine.

- Any improper operation, maintenance and repair method may lead to hazardous conditions, and may cause personal injury and even death.
- Be sure to read and understand the relevant security measures and precautions before operating, maintaining and repairing the machine.
- Please strictly obey the safety warning information listed in this Manual and on the machine during operating, maintaining and repairing the machine, otherwise heavy casualties will occur.

Safety warning information in the Manual is indicated by the following symbols:

⚠ DANGER

This word means danger will occurred immediately, and if no avoidance, it may cause death or serious personal injury.

⚠WARNING

This word means existing potential danger, and if no avoidance, it may cause death or serious personal injury.

⚠CAUTION

This word means existing potential danger, and if no avoidance, it may cause slight or medium personal injury.

"Caution" is also used for reminding the relevant safety attentions of unsafe operation possibly causing personal injury. "Danger" represents the worst dangerous conditions. Safety sign of "danger" or "warning" is an attachment set at the specific dangerous location. General precautions are listed on the safety sign of "Caution".

In addition, please carefully follow the "Cautions" listed in this Manual, otherwise, it may result in great damage to the machine. We are unable to enumerate all the possible risks (including potential dangers), and the warnings in the Manual and product do not cover all the risks and dangers. If the tools, operation procedures, methods or techniques are not specially recommended by our company, it is necessary to ensure the personal safety of every one, and protect the machine against any damage.

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The contents herein are provided based on the status of the machine at the time when the Manual was written, whereas, all products are updating, and this machine is no exception. Any modification will influence the operation, maintenance and repair of the machine, therefore, please contact the LiuGong dealers for latest and most comprehensive service information before operating, maintaining and repairing the machine.

Universal Tool and Tooling List

Specifications	Main functions
16# Open-end wrench	Used for removal and installation of articulated end cover captive bolts
18# Open-end wrench	Used for removal and installation of articulated end cover captive bolts
24# Open-end wrench	Used for removal and installation of articulated end cover captive bolts
36# Open-end wrench and socket	Used for removal and installation of front counterweight
48# Open-end wrench and socket	Used for removal and installation of front counterweight
Copper hammer	Used for removal and installation of blade support seat, etc.
Torque wrench	Used for presetting the torque of bolts
Blower gun	Used for installation of bolts
Needle nose pliers	Used for installation of cotter pin, etc.
Straight screwdriver	Used for removal of counterweight plug
Thread locker	Used for installation of hinged bolts

Special Tool and Tooling List

Specifications	Main functions
Bearing knocking tooling	Used for installation of bearing

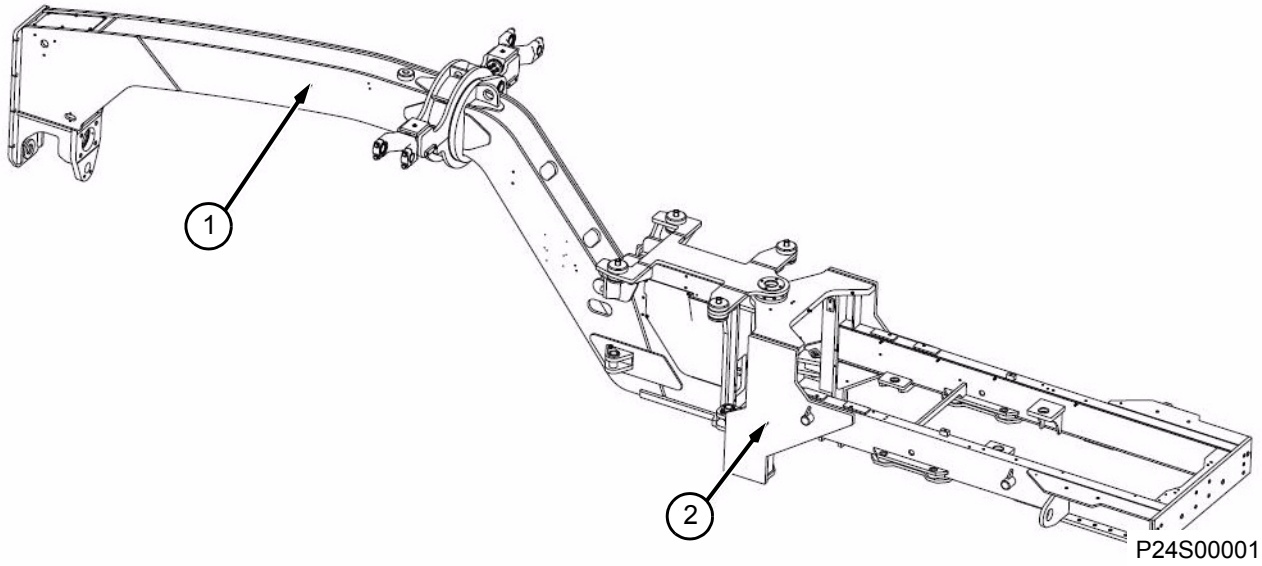
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Structure Function Principle

Overview of Frame System

The frame system includes front frame and rear frame. Front frame is a welded box type structure for mounting cab, front axle system, work implement system, front counterweight or bulldozer blade and other parts. Rear frame is a welded frame structure for mounting engine system, transmission and torque converter system, rear axle assembly, cooling system, engine hood assembly, rear counterweight or scarifier and other parts.

Frame System Structure Diagram



1. Front frame system
2. Rear frame system

Parameters of Frame System

Front frame system	Overall dimensions (length × width × height) mm	5335×1668×1800
	Weight (KG)	2015
Rear frame system	Overall dimensions (length × width × height) mm	3180×1582×1019
	Weight (KG)	946

Working Principle of Frame System

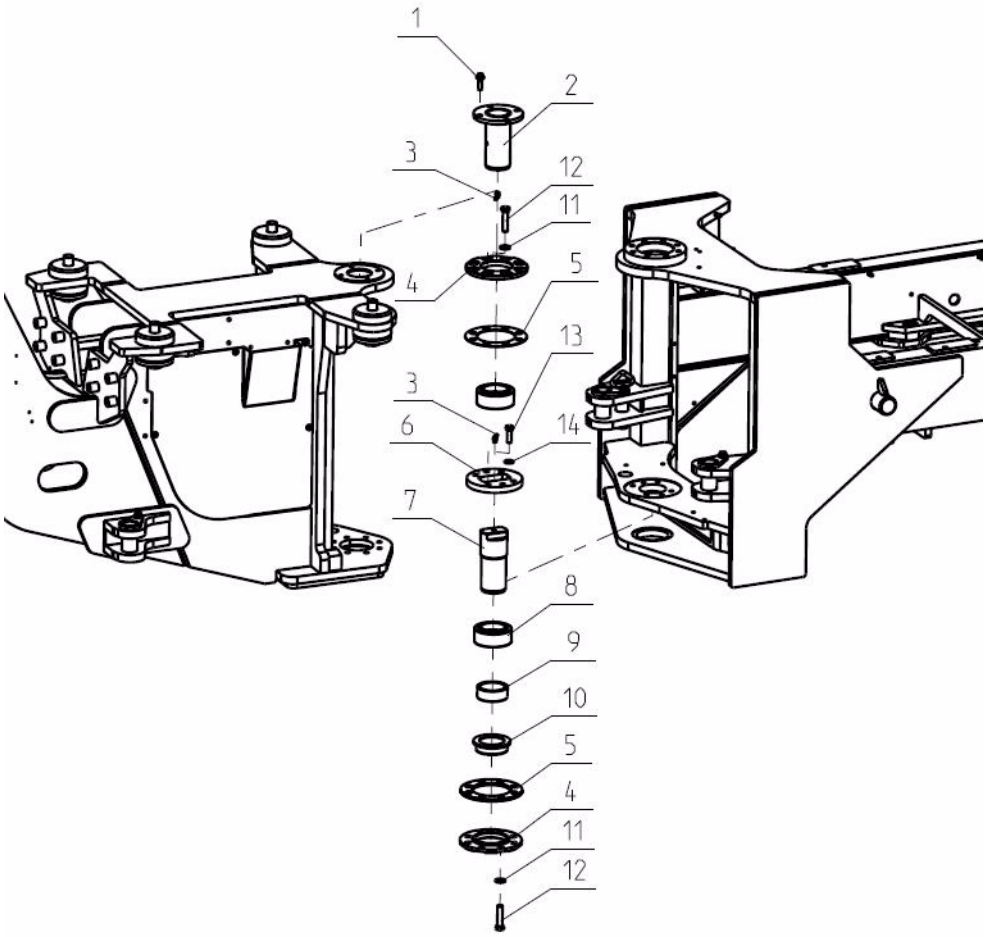
The frame system is mainly used to carry each system component and plays the role of articulated steering by the articulated hitch.

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Articulated Hitch

Structure and Principle of Articulated Hitch

The articulated hitch is the key part used to connect front frame and rear frame and to make both frames function in relative steering.



P24S00002

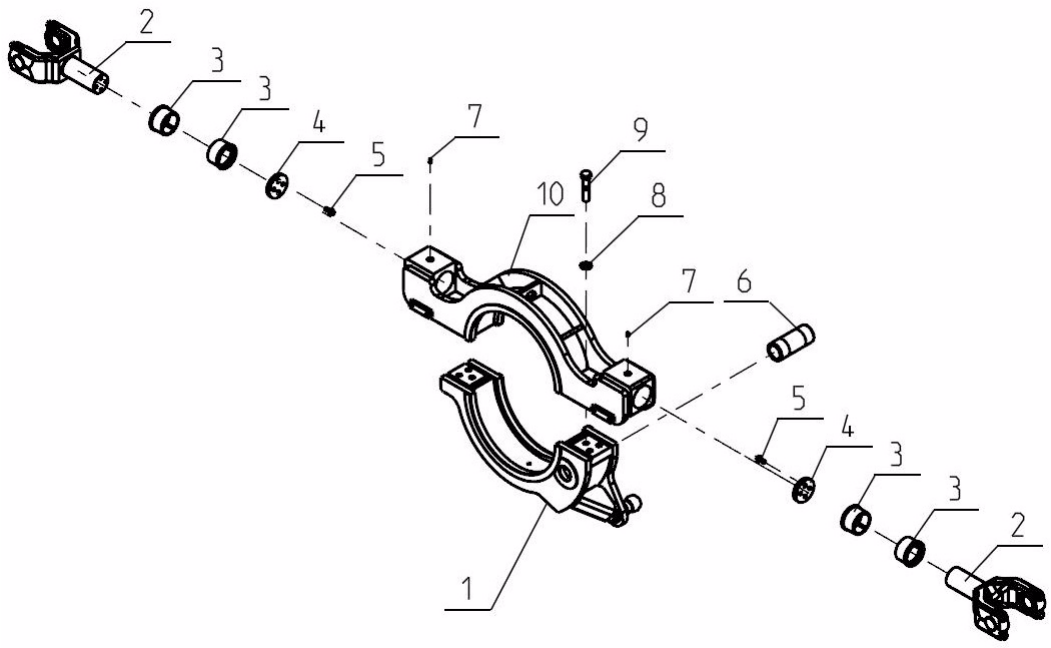
1. Bolt
2. Upper hinge pin
3. Oil cup
4. Cover
5. Adjusting shim
6. Adjusting shim
7. Lower hinge pin
8. Radial knuckle bearing
9. Connecting bushing
10. Bushing
11. Washer
12. Bolt
13. Bolt
14. Hard washer

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Working Principle and Installation of Swing Arm Assembly

Overview: The swing arm assembly is installed on front frame and is used to control the lifting and swinging movements of the work implement with the hydraulic lift cylinder and swing circle sideshift cylinder installed on the swing seat and is used to adjust the working angle of swing seat with a latch install on it so as to adjust the working angle of the work implement.

Structure diagram:



P24S00003

1. Lower cap
2. Fork assembly
3. Bushing
4. End cover
5. Bolt
6. Bushing
7. Oil cup
8. Washer
9. Bolt
10. Top cap

Technical Parameters of Swing Arm Assembly

Swing arm assembly	Overall dimensions (length × width × height) mm	1688×290×700
	Weight (KG)	263

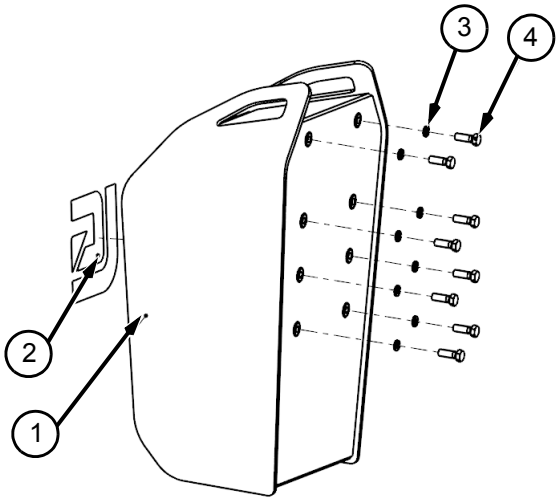
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Front Counterweight

Overview and Structure Diagram of Front Counterweight

Overview: Front counterweight is mounted on the front panel of front frame by binder bolts.

Structure diagram:



P24S00004

1. Front counterweight
2. Decal
3. Washer
4. Bolt

Technical Parameters of Front Counterweight

Front counterweight	Overall dimensions (length × width × height) mm	530×683×1201
	Weight (KG)	380

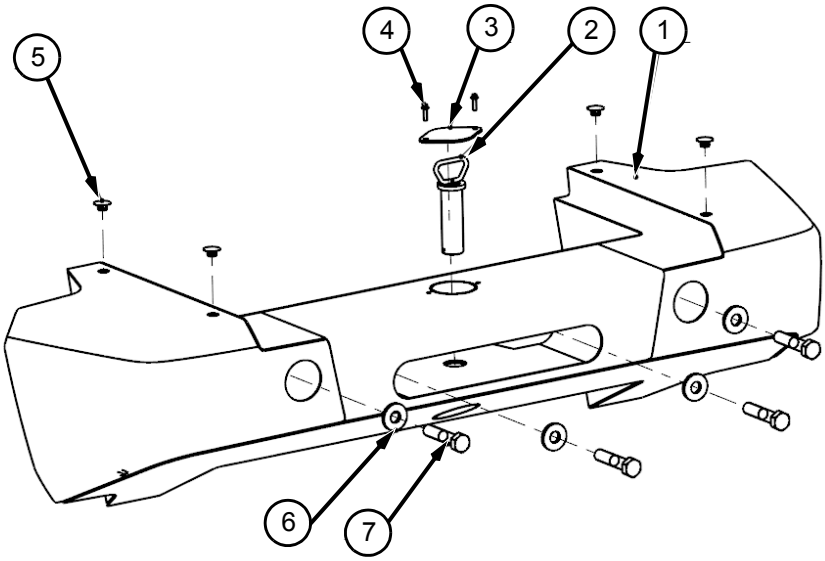
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Rear Counterweight

Overview and Structure Diagram of Rear Counterweight

Overview: Rear counterweight is mounted at the rear side of rear frame by the binder bolts.

Structure diagram:



P24S00005

1. Rear counterweight
2. Traction pin
3. Cover
4. Bolt
5. Plug
6. Washer
7. Bolt

Technical Parameters of Rear Counterweight

Front counterweight	Overall dimensions (length × width × height) mm	2196×690×548
	Weight (KG)	630

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Work Implement System

Overview of Work Implement System

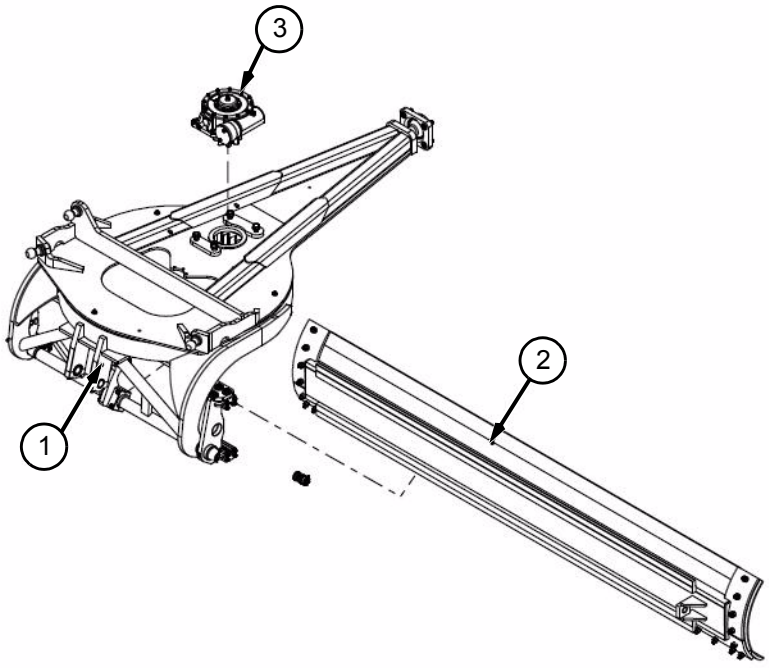
Grader’s work implement is composed of scraping work implement and attachment work implement.

Grader’s rolling disc work implement adopts a working mechanism of world-wide popular swinging-arm connecting rod. It is characterized with good inflexibility and high positioning accuracy and large operation range. With a standard fully-sealed slewing device free of adjustment, this work implement has a high slewing accuracy and can adapts to harsh working environment.

Structure Diagram of Work Implement System

The work implement system is composed of three modules:

Structure diagram:



P24S00006

1. Work implement frame
2. Blade assembly
3. Worm box

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Work Implement System Parameter

Parameters of rolling disc work implement system		
Blade width	3960mm	
Blade lifting speed	Up	≥150 mm/s
	Down	≥100 mm/s
Blade side shift speed	Out	≥100 mm/s
	In	≥150 mm/s
Maximum tip angle of the blade (leftwards/rightwards)	90 °	90 °
Maximum lifting height of the blade	600±50mm	
Maximum digging depth of the blade	≥680mm	
Overall dimensions (length × width × height)	3028mm×3967mm×1113mm	
Weight	2203kg	

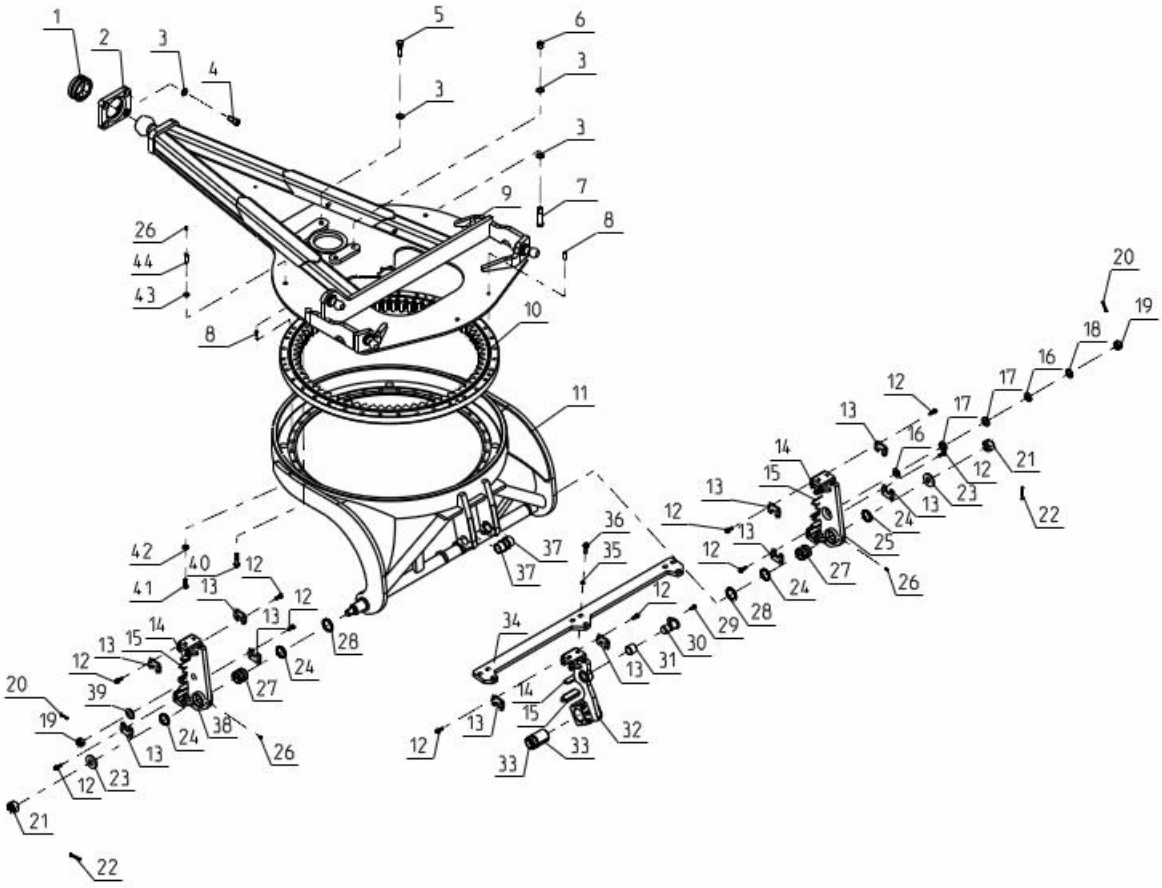
Working Principle of Work Implement System

The work implement is connected by the ball joint of the traction frame and by the swing seat between the cylinder and front frame so that the blade can realize the multi-angle and multi-direction shovel action. The front end of traction frame has a ball join connected with the front end of the frame, which enables traction frame turn and swing at an arbitrary angle surrounding the ball joint. The turning circle which is set up on the traction frame can rotate around the traction frame driven by slewing driving devices, which in turn makes the blade slew in 360°. These two guide plates at the back of blade, which hold against chute of guide stand, can move sideways under the force which is generated by blade side shifting oil cylinder. During the process of shoveling, small blade cutting angles can reduce cutting resistance while big blade cutting angles can adjust leveling precision and the effect of blending.

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Work Implement Frame

Configuration scheme



P24S00007

1. Knuckle bearing outer ring
2. Bearing inner end cover
3. Washer
4. Screw
5. Bolt
6. Lock nut
7. Bolt
8. Dowel pin
9. Traction frame
10. Swing bearing
11. Swing bearinng mounting
12. Bolt
13. Plate
14. Adjusting shim
15. Bushing
16. washer
17. washer
18. washer
19. Nut
20. Pin
21. Nut M36×3-8-Zn.D
22. Pin
23. Washer 36
24. Seal ring
25. Right bearing
26. Grease fitting
27. Bushing
28. Adjusting shim
29. Bolt
30. Stop pin
31. Steel bushing
32. Bracket
33. Steel bushing
34. Plate
35. Washer
36. Bolt
37. Bushing
38. Left bracket
39. Washer
40. Bolt
41. Bolt
42. Washer
43. Pad
44. Grease joint

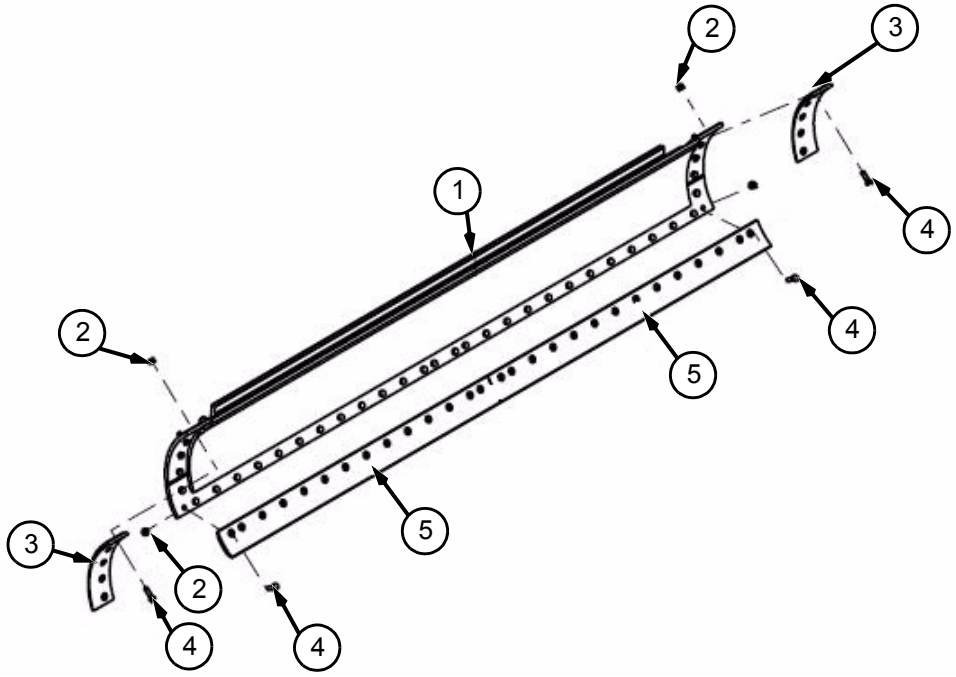
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Technical Parameters

Work implement frame	Overall dimensions (length × width × height) mm	3028×1815×1043
	Weight (KG)	1331

Blade Assembly

Configuration scheme



P24S00008

1. Blade
2. Nut
3. Side blade
4. Bolt
5. Cutting edge

Technical Parameters

Blade assembly	Overall dimensions (length × width × height) mm	3967×619×325
	Weight (KG)	779

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Worm Gear Case Assembly

Technical Parameters

The technical parameters of worm gear case equipped in this machine are listed in the Table below.

Technical parameters for worm gear case

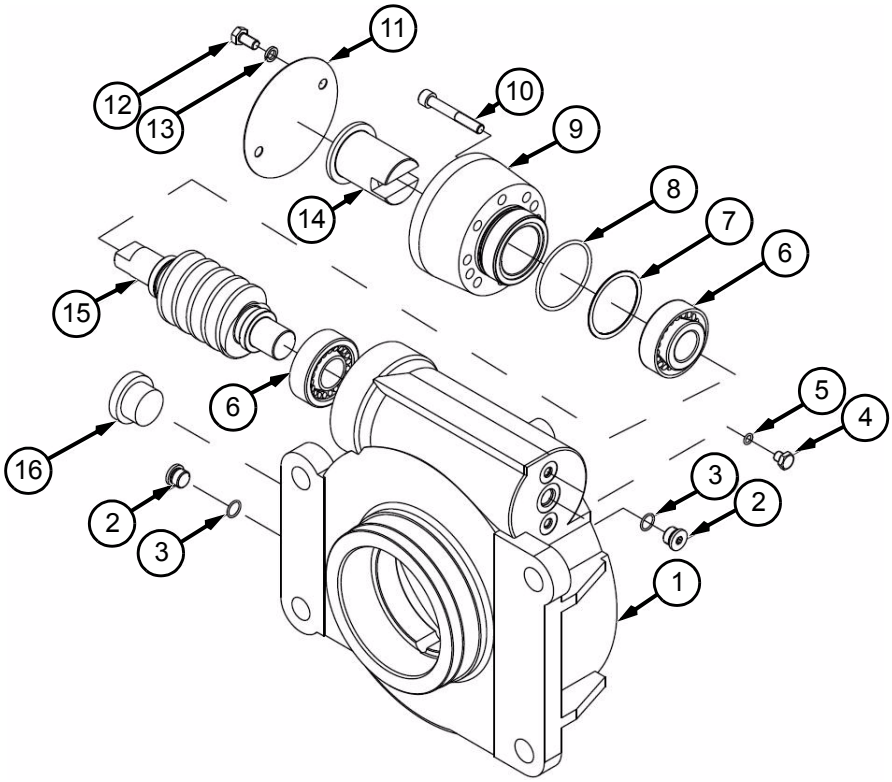
System components	Item	Parameters	Remarks
Worm gear case	Transmission type	Worm gear and worm	
	Transmission ratio	1:35	
		Worm gear and worm are in bidirectional self-locking	

Structure and Schematic

The worm gear case, driven by hydraulic motor, is decelerated by worm gear and worm and outputs power from the gear shaft to drive the work implement so that forward/reverse rotations of blade can be realized and the grader blade angle can be adjusted. Meanwhile, the worm gear case can bear large load and impact.

See the diagram below for the structure diagram of worm gear case

Structure diagram of worm gear case -1

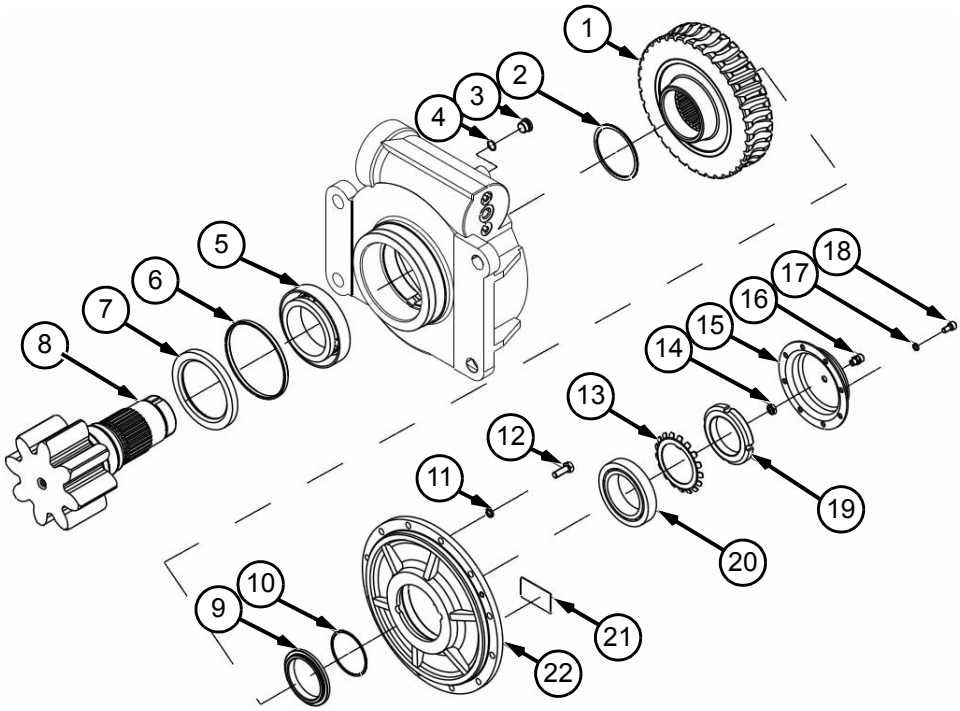


P24S00009

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1. Housing
2. Plug
3. O-ring
4. Plug
5. O-ring
6. Tapered roller bearing
7. Adjusting shim
8. O-ring
9. Support
10. Screw
11. Cover
12. Bolt
13. Washer
14. Connecting sleeve
15. Worm
16. Round dipstick

Structure diagram of worm gear case -2



P24S00010

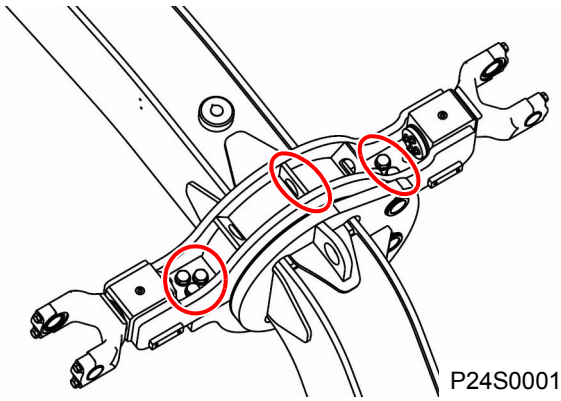
1. Worm gear
2. Adjusting gasket
3. Plug
4. O-ring
5. Tapered roller bearing
6. Shim
7. Oil Seal
8. Pinion Shaft
9. Steel sleeve
10. Adjusting gasket
11. Washer
12. Bolt
13. Lock washer
14. Nut
15. Cover
16. Respirator
17. Washer
18. Screw
19. Nut
20. Tapered roller bearing
21. Nameplate
22. Housing cover

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Removal and Installation of Swing Arm Assembly

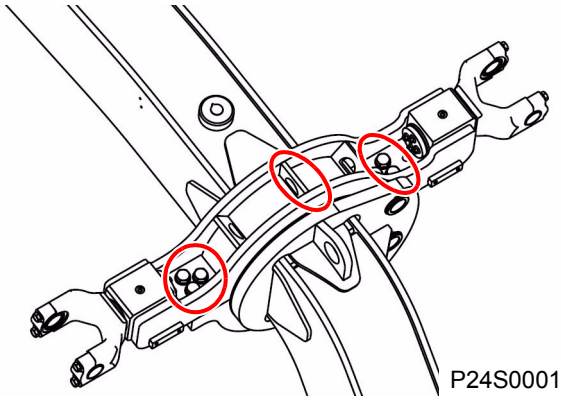
Removal of Swing Arm Assembly

Removal description: Place properly front frame assembly before removing the swing arm assembly to avoid shaking.

Figure	Operation steps	Tool(s)
 P24S00011	1. Remove the cylinder first, then using a soft rope to hang the lower cap (1), and lift the middle lifting point of top cap (10) with lifting device, remove 6 bolts (9) and lower down the top cap then the lower cap.	24# Wrench

Installation of Swing Arm Assembly

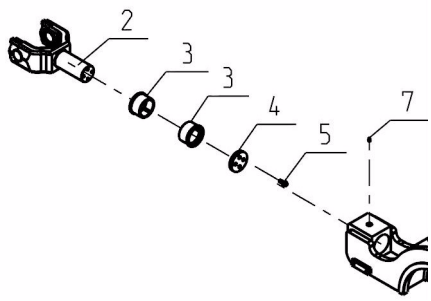
Installation description: Place properly front frame assembly before removing the swing arm assembly to avoid shaking.

Figure	Operation steps	Tool(s)
 P24S00011	1. Using soft rope hang the lower cap (1) and sleeve the lower part of front frame cylinder, lift the middle lifting point of top cap (10) with lifting device to the upper part of front frame cylinder, align the hole of lower cap and that of top cap, install 6 bolts (9) with the tightening torque 1020±100N.m.	24# Wrench

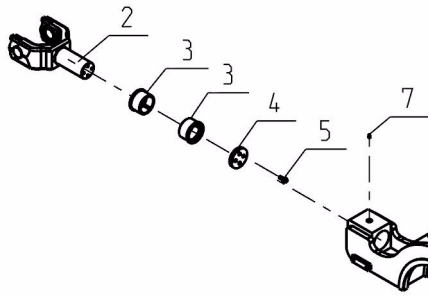
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Removal and Installation of Fork Assembly

Removal of Fork Assembly

Figure	Operation steps	Tool(s)
 P24S00012	1. Remove 4 bolts (5) and take down the end cover (4). Knock out the fork assembly using the hammer. 2. Disassemble the fork assembly at right side using the same method.	8# and 12# Wrench

Installation of Fork Assembly

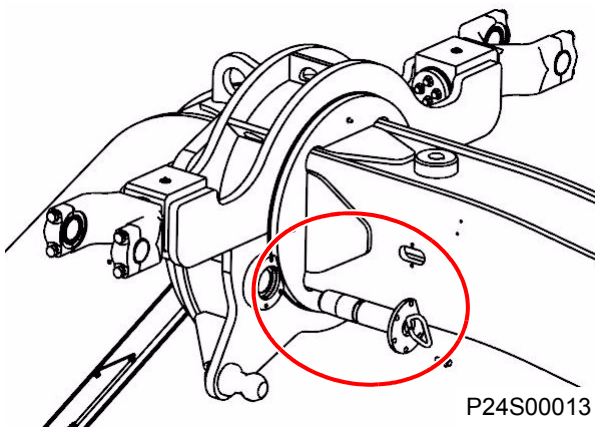
Figure	Operation steps	Tool(s)
 P24S00012	1. After the liquid nitrogen is cooled, knock two bushings (3) into the swing arm support using a hammer, and then knock the fork assembly (2) into the bushings, install the upper end cover (4) and 4 bolts (5) with the tightening torque 90±12 N.m. 2. Install the fork assembly at right side using the same method.	8# and 12# Wrench

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Removal and Installation of Swing Seat Latch

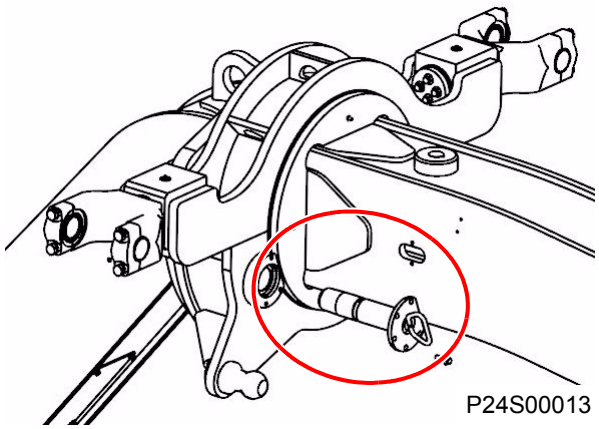
Removal of Swing Seat Latch

Removal description: Lay the blade on the ground using the lift cylinder before removing the swing seat latch.

Figure	Operation steps	Tool(s)
 P24S00013	1. Remove five captive bolts of the latch, and then take down the swing seat latch. If fail to pull it out directly by hands, knock it out using the copper hammer from the pin shaft end at the back face.	16# Wrench

Installation of Swing Seat Latch

Installation description: Align the swing seat latch hole with front frame swing arm latch hole using the lift cylinder before installing the swing seat latch.

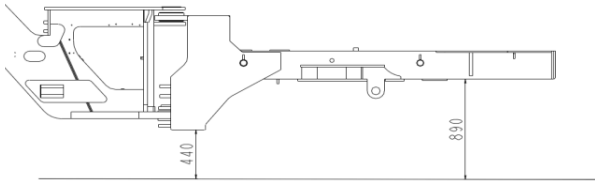
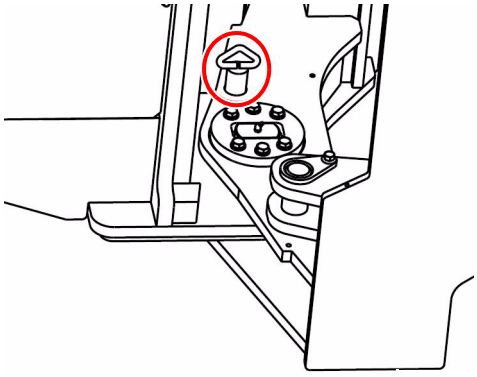
Figure	Operation steps	Tool(s)
 P24S00013	1. Pass the swing arm latch through its hole so that the mounting holes of its bolts are aligned. 2. Install five captive bolts with the tightening torque (72±6)N.m.	16# Wrench, torque wrench

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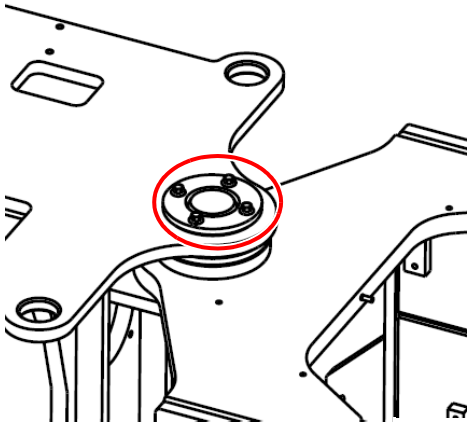
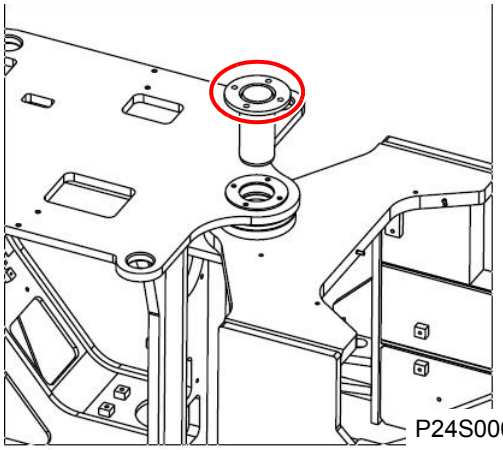
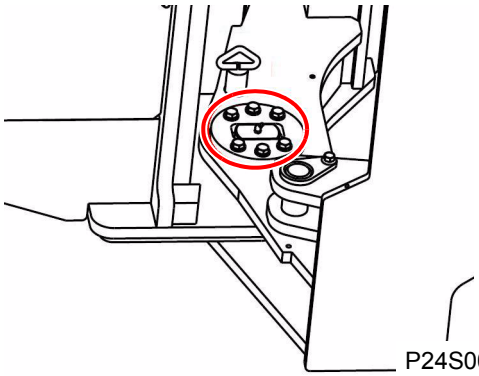
Removal and Installation of Articulated Hitch

Removal of Articulated Hitch

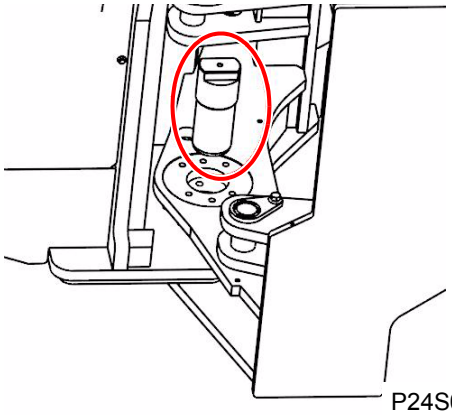
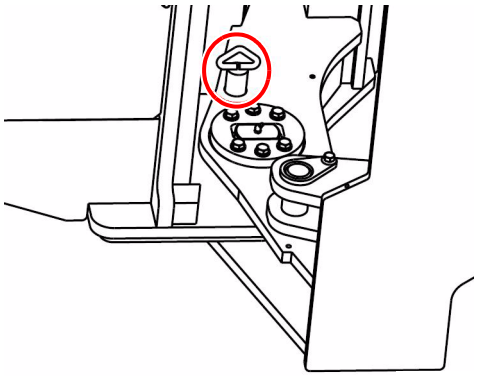
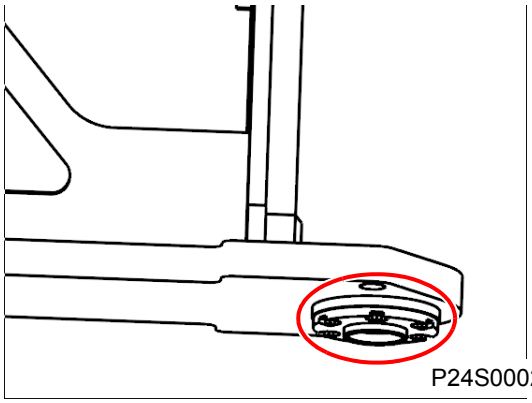
Removal description: Remove the followings before removing articulated hitch: bulldozer assembly, front axle assembly, work implement assembly, cab, hydraulic oil tank on front frame; engine hood assembly, radiator assembly, fuel tank assembly and engine assembly on rear frame. Only rear axle, rear frame and tire are remained.

Figure	Operation steps	Tool(s)
 P24S00014	1. Pad the front and rear ends of rear frame with special firm tooling to make sure rear frame is in level, safe and steady state (the front end of rear frame is at 440mm from the ground, and the rear end is at 890mm from the ground).	
	2. Hang the front frame by a hoisting equipment and strain the hanger slightly. **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 5 tons
 P24S00015	3. Install steering fixed link to prevent front and rear frames rotating.	

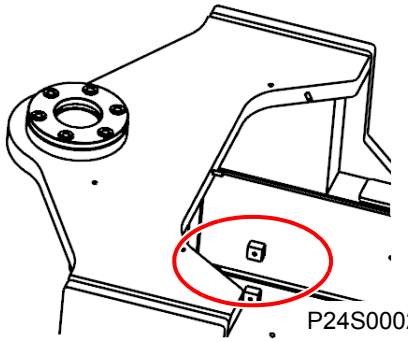
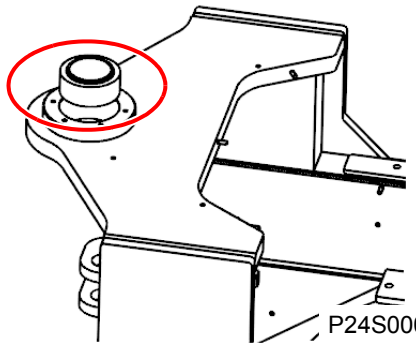
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Figure	Operation steps	Tool(s)
 P24S00016	4. Remove upper hinge pin: 1) Remove the captive bolts of upper hinge pin.	18# Wrench
 P24S00017	2) Knock out the upper hinge pin with pin knocking tooling and a sledge.	Pin knocking tool and sledge
 P24S00018	5. Remove lower hinge pin: 1) Remove the captive bolts of the stop plate on the lower hinge and take down the stop plate.	24# Wrench

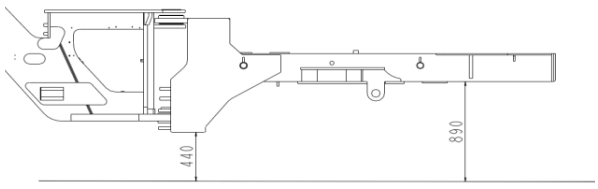
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Figure	Operation steps	Tool(s)
 P24S00019	2) Knock out the lower hinge pin with pin knocking tooling and sledge.	Pin knocking tool and sledge
 P24S00015	6. Remove steering fixed link, and lift the front frame out with hoisting equipment and place it on the solid ground. ⚠ **Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 5 tons
 P24S00020	7. Remove six captive bolts from lower hinge, and take down lower end cover and bushing.	18# Wrench

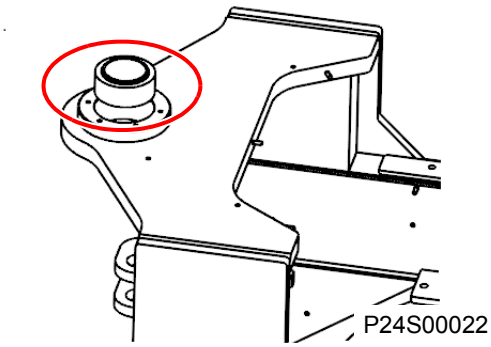
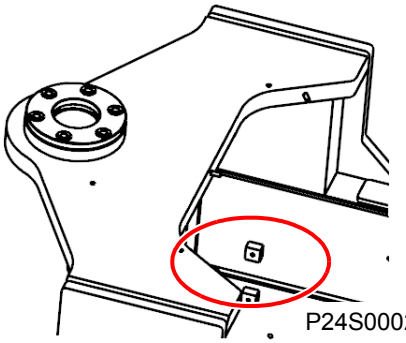
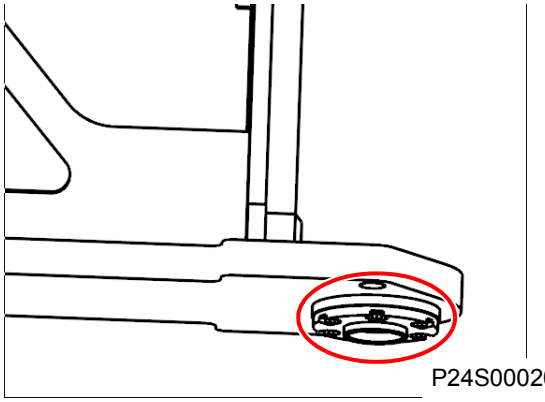
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Figure	Operation steps	Tool(s)
 P24S00021	8. Remove six captive bolts from upper hinge, and take down the upper end covers.	16# Wrench
 P24S00022	9. Knock out the knuckle bearing between upper hinge and lower hinge with bearing knocking tooling and sledge.	Bearing knocking tool and sledge

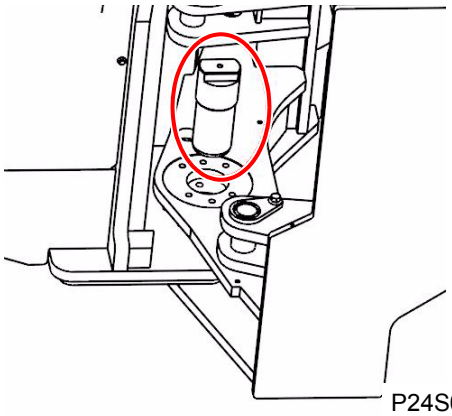
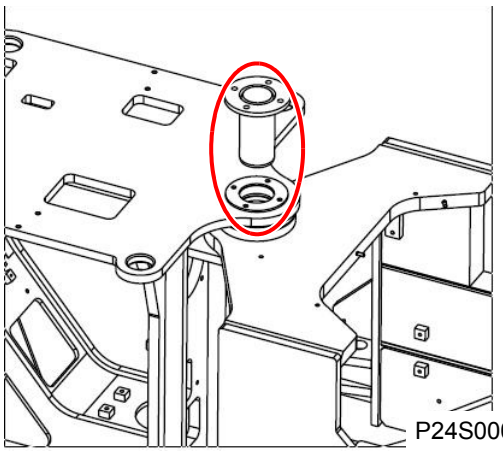
Installation of Articulated Hitch

Figure	Operation steps	Tool(s)
 P24S00014	1. Lift rear frame off with hoisting equipment and put it on special firm tooling to make sure it is in level, safe and steady state (the front end of rear frame is at about 440mm from the ground, and the rear end is at about 890mm from the ground). **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 5 tons

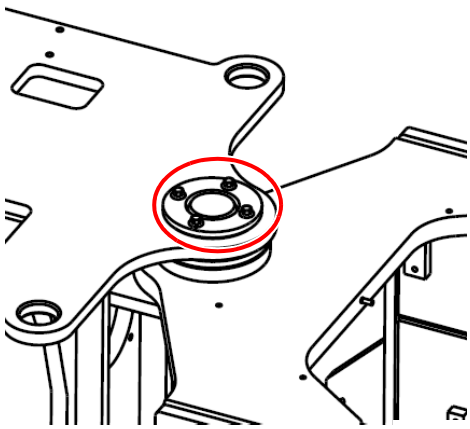
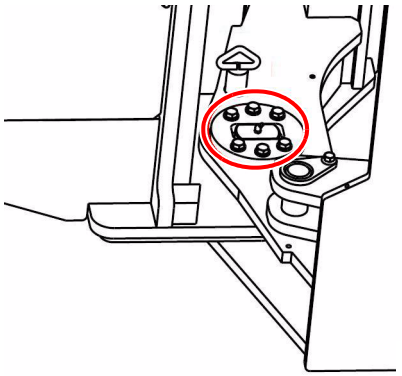
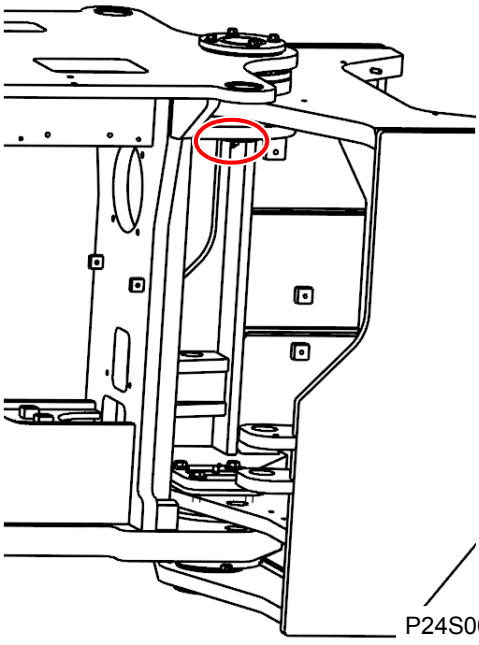
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Figure	Operation steps	Tool(s)
 P24S00022	2. Apply the outer wall of knuckle bearing and inner wall of upper hinge hole using the grease and install the knuckle bearing into rear frame hinge inner hole.	Copper bar
 P24S00021	3. Fix upper hinge end cover and adjusting gasket on rear frame using the bolts. Adjust the clearance between bearing cover plate and frame hole end face to 0-0.05mm. Apply thread locker onto the bolts. Tightening torque of bolts: (72±6)N.m.	16# Wrench, torque wrench
 P24S00020	4. Install properly the bearing, end cover, adjusting gasket and lower bushing of front frame with bolts using the same method. Adjust the clearance between bearing cover plate and frame hole end face to 0-0.05mm. Apply thread locker onto the bolts. Tightening torque of bolts: (120±10)N.m.	Copper bar, 18# wrench and torque wrench

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Figure	Operation steps	Tool(s)
	5. Lift up front frame to mounting position with hoisting equipment, and align the hinge hole of front frame with that of rear frame. **⚠ Warning: Do not put your fingers into the holes when aligning, otherwise it may cause personal injury!** **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 5 tons
 P24S00019	6. Install lower hinge pin.	Copper bar
 P24S00017	7. Install upper hinge pin.	Copper bar

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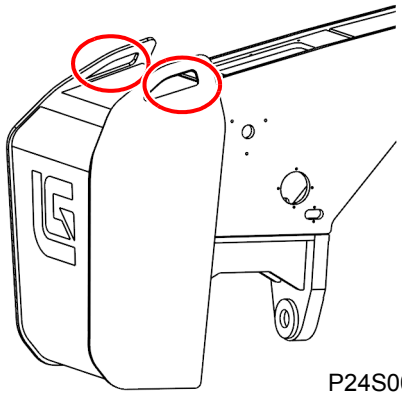
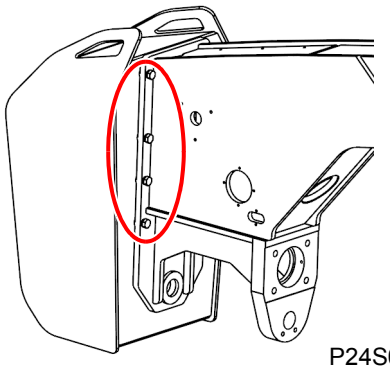
Figure	Operation steps	Tool(s)
 P24S00016	8. Tighten the mounting bolts of upper hinge pin with tightening torque (120±10)N.m.	Torque wrench, 18# wrench
 P24S00018	9. Install the stop plate and the adjusting gasket, and tighten the mounting bolts of hinge pin with tightening torque (305±25)N.m. The adjusting gasket is higher than the round lapped surface of frame about 0.1 - 1.1mm and make sure that the adjusting gasket can be pressed tightly after installation of stop plate.	Copper bar, torque wrench, 24# wrench
 P24S00023	10. Install the grease joint.	

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Removal and Installation of Front Counterweight

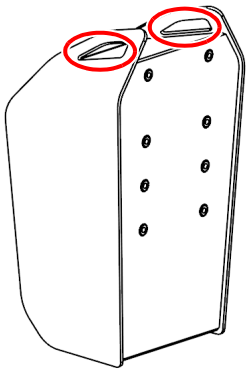
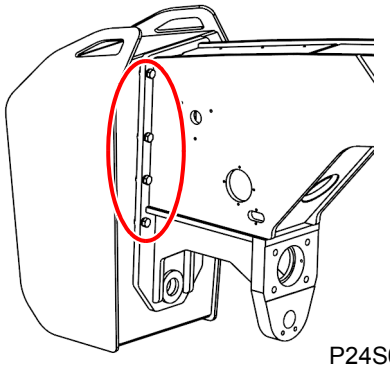
Removal of Front Counterweight

Removal description: Hang 2 lifting rings of front counterweight using the wire rope before removal of front counterweight.

Figure	Operation steps	Tool(s)
 P24S00024	1. Hook the lifting eye of front counterweight and lift it slowly to tense the wire rope just right.	Wire rope and hook
	⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!	Hoisting equipment over 3 tons
 P24S00025	2. Remove 8 mounting bolts, lift the counterweight out with hoisting equipment and put it on firm ground. ⚠ **Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	36# socket wrench, hoisting equipments (over 3 tons)

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Installation of Front Counterweight

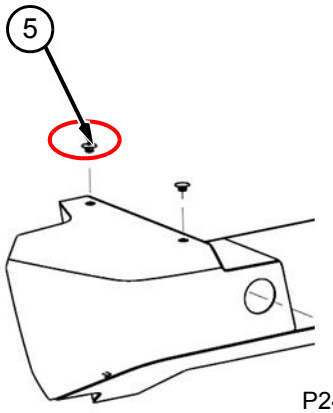
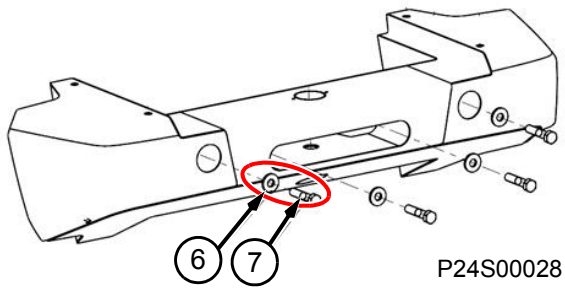
Figure	Operation steps	Tool(s)
 P24S00026	1. Hang the lifting ring of counterweight with hoisting equipment, lift the counterweight to mounting position, and align with bolt mounting hole. **⚠ Warning: Do not put your fingers into the holes when aligning, otherwise it may cause personal injury!** **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 3 tons
 P24S00025	2. Align with the mounting hole and install 8 M20 bolts and gasket. Tightening torque: (410±50)N.m	36# Socket wrench, torque wrench

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Removal and Installation of Rear Counterweight

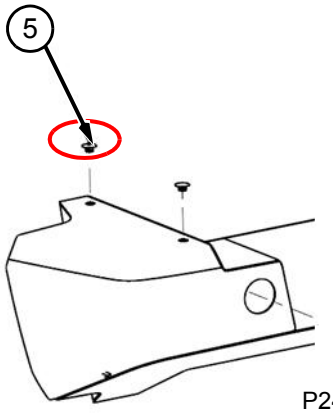
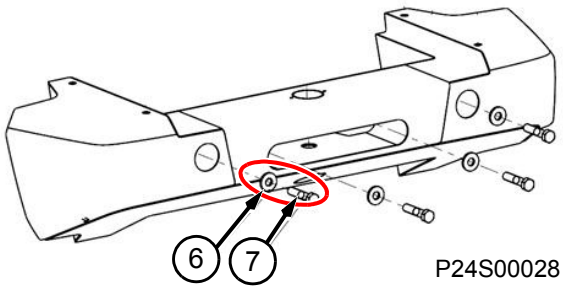
Removal of Rear Counterweight

Removal description: Hang 4 lifting rings of rear counterweight using the wire rope before removal of rear counterweight. (Lifting hole M24)

Figure	Operation steps	Tool(s)
 P24S00027	1. Take out plug (5), and then install four M24 eye screws.	Straight screwdriver
	2. Hang the lug screw by a hoisting equipment and tighten the hanger slightly. **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 3 tons
 P24S00028	3. Remove gaskets (6, 7) of 4 mounting bolts, lift the counterweight out with hoisting equipment and put it on firm ground. **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	48# socket wrench, hoisting equipments (over 3 tons)

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Installation of Rear Counterweight

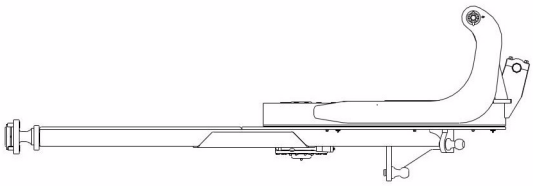
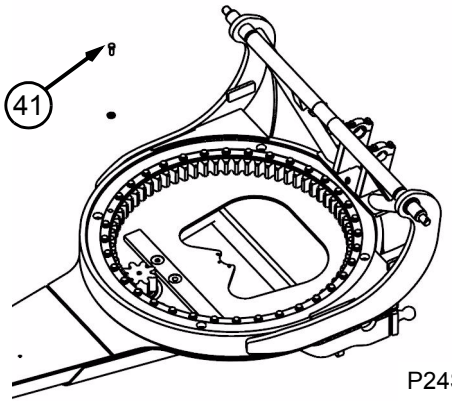
Figure	Operation steps	Tool(s)
 P24S00027	1. Take down the plug (5), hang the eye screws for installation of counterweight with hoisting equipment, lift the counterweight to mounting position, and align with bolt mounting hole. **⚠ Warning: Do not put your fingers into the holes when aligning, otherwise it may cause personal injury!** **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 3 tons
 P24S00028	2. Align with the mounting hole and install 4 M27 bolts and gasket. Tightening torque: (1500±100)N.m.	48# Socket wrench, torque wrench

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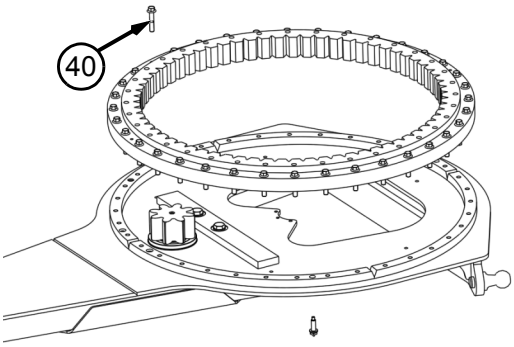
Removal and Installation of Swing Bearing

Removal of the Swing Bearing

Removal description: Before removing the swing bearing, remove the blade assembly, lift cylinder, swing cylinder and traction frame large ball joint so as to separate the work implement frame from front frame.

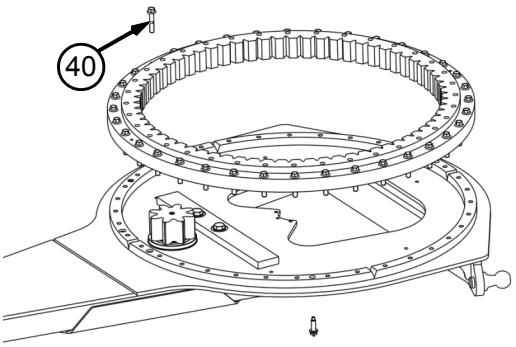
Figure	Operation steps	Tool(s)
 P24S00029	1. Lift the work implement frame with hoisting equipment and put it on special firm tooling to make sure it is in level, safe and steady state. ⚠ **Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 3 tons and special tooling
 P24S00031	2. Loosen 36 M18 bolts (41) and remove the swing bearing mounting.	32# Wrench
	3. Hang the work implement frame using the hoisting equipment and lightly put it on the firm ground. ⚠ **Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 1000kg

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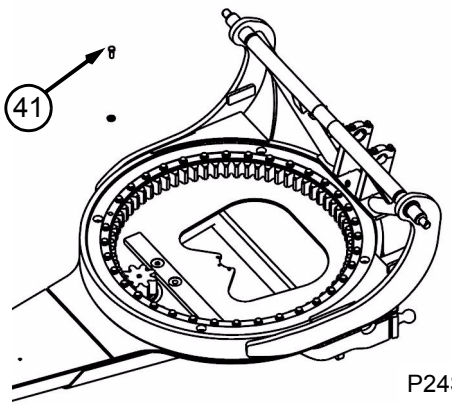
Figure	Operation steps	Tool(s)
 P24S00032	4. Unscrew 3 grease joints on the back before removing the swing bearing. And then unscrew 36 M16 bolts (40) and remove the swing bearing.	26# Socket wrench, adjustable wrench
	5. Hoist the swing bearing to the solid ground with hoisting equipment. **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 1000kg and M14 lifting ring

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Installation of Swing Bearing

Figure	Operation steps	Tool(s)
 P24S00032	1. Put the traction frame on special tooling using the hoisting equipment, hang the swing bearing to align it with the mounting hole of the traction frame. **⚠ Warning: Do not put your fingers into the holes when aligning, otherwise it may cause personal injury!** **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 1000kg and M14 lifting ring
	2. Install 36 M16 bolts (No.40). Pretighten 36 bolts using the blower gun and tighten them in sequence with star-shaped method after set the torque wrench to the torque of 305±25 N.m.	26# Socket wrench, blower gun and torque wrench
	3. Align the work implement frame with the mounting hole of swing bearing using the hoisting equipment. **⚠ Warning: Do not put your fingers into the holes when aligning, otherwise it may cause personal injury!** **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 1000kg and wire rope

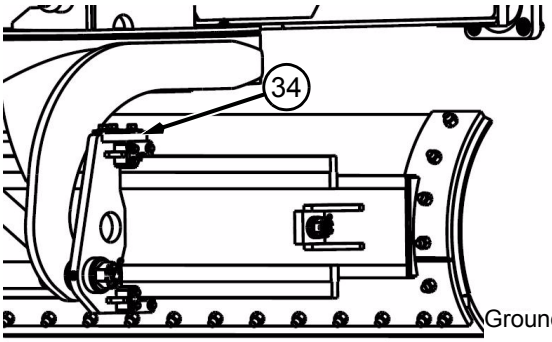
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Figure	Operation steps	Tool(s)
 P24S00031	4. Install 36 M18 bolts (41). Pretighten 36 bolts using the blower gun and tighten them in sequence with star-shaped method after set the torque wrench to the torque of 415±35 N.m.	32# socket wrench, blower gun and torque wrench

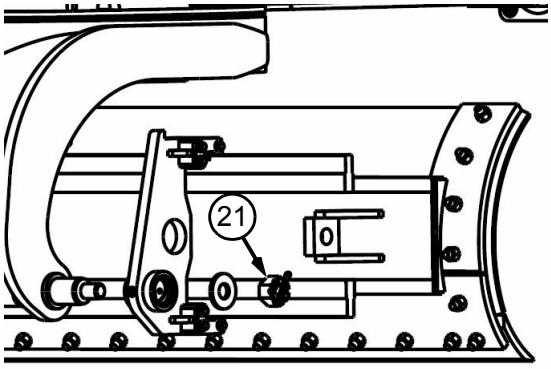
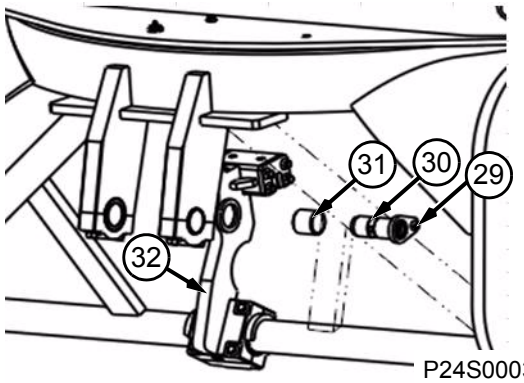
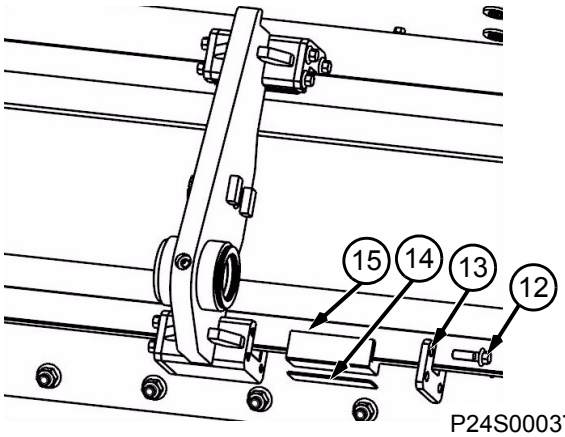
Removal and Installation of Blade Assembly

Removal of Blade Assembly

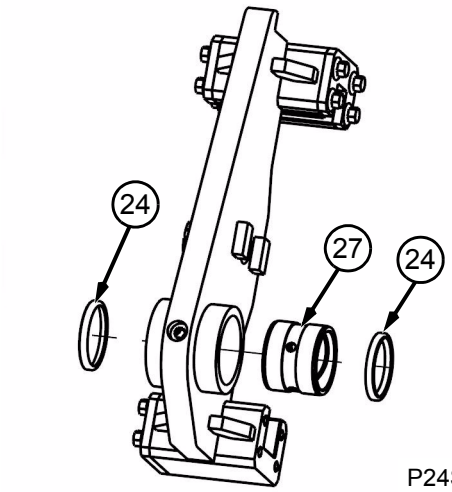
Removal description: Remove the blade angle changing cylinder and the blade lead-out cylinder before removing the blade assembly. The lift cylinder, swing cylinder and traction frame large ball joint are not removed temporarily, and then put the blade on the ground.

Figure	Operation steps	Tool(s)
 P24S00034	1. Put the work implement on the ground by controlling the cylinder. Then remove the plate of work implement frame (34) using the wrench.	24# Wrench
	2. Hook the blade assembly by a hoisting equipment and tighten the sling slightly. **⚠ Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 1000kg

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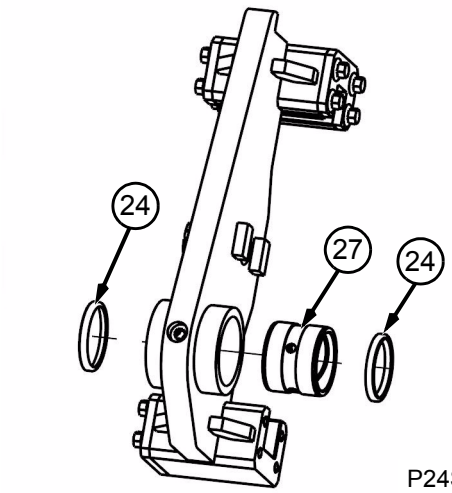
Figure	Operation steps	Tool(s)
 P24S00035	3. Unscrew the nuts (21) using the adjustable wrench, and then knock out right socket so that it can separate the work implement frame. Knock out left socket using the same method.	Adjustable wrench and sledge
 P24S00036	4. Using wrench to unscrew the stop in bolt (No.29) to remove the stop pin (No.30) and bushing (No.31) to separate the blade pitch cylinder from center mounting; using wrench to unscrew the bolt on No.32 mounting to separate the center mounting from work implement frame.	18# Wrench
 P24S00037	5. Using wrench to unscrew the bolt (12) on the blade socket guide to remove the plate (13), bushing (15) and adjusting shim (14), and then separate the blade socket from the blade assembly.	18# wrench and copper hammer

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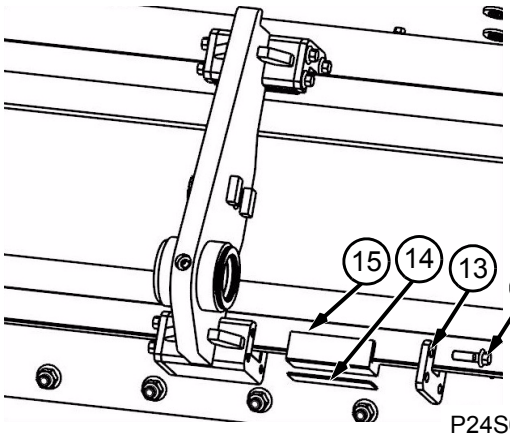
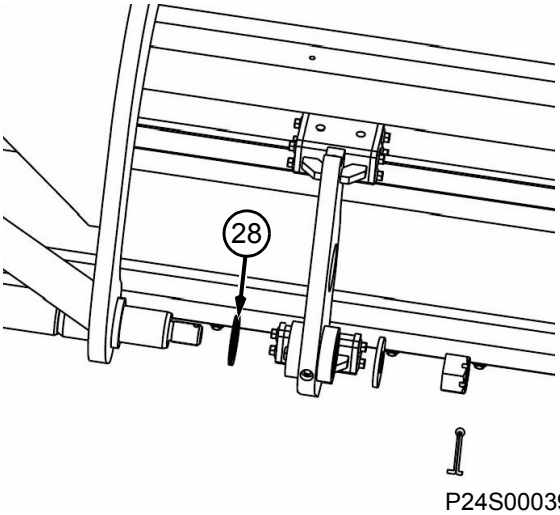
Figure	Operation steps	Tool(s)
 P24S00038	6. Take out of the seal ring (24) and tape out of the bushing (27).	Bushing knocking tooling and copper hammer

Installation of Blade Assembly

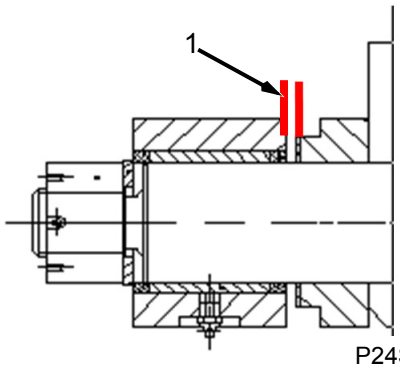
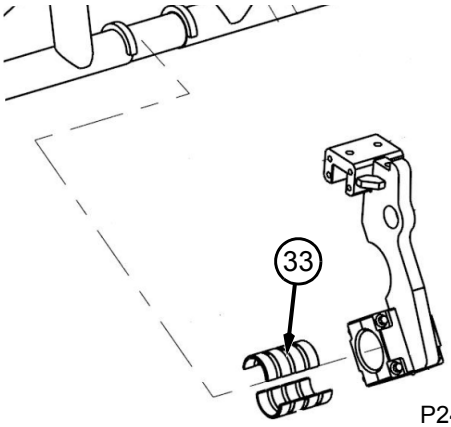
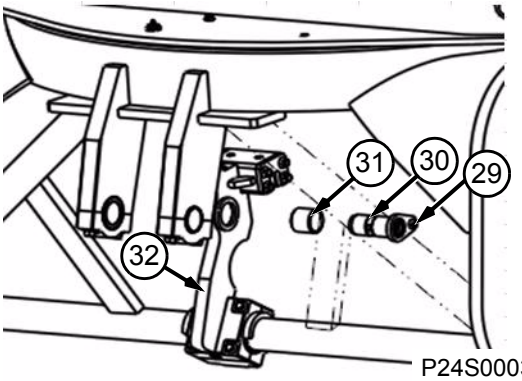
Installation description: As the blade assembly is connected with the work implement frame by three sockets, install each component before installing the blade assembly.

Figure	Operation steps	Tool(s)
 P24S00038	1. Install bushing (27) and seal ring (24) on the blade sockets (left and right).	Bushing knocking tooling and copper hammer

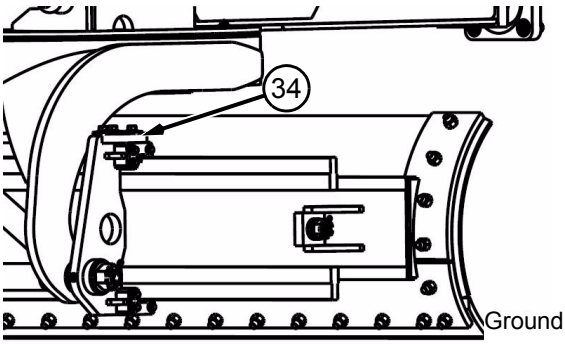
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Figure	Operation steps	Tool(s)
 P24S00037	2. Install left and right sockets to the blade guide rail and install the adjusting shim (14), bushing (15) and plate (13). Install the adjusting shim (14) as required so that the blade guide plate can slide freely on the bushing (15) without any shake.	18# wrench and copper hammer
	3. Move the blade with left and right sockets to the position of the work implement frame using the hoisting equipment. ⚠ **Notice: The hoisting equipment operator shall have relevant qualifications, and only when the equipment and the sling work normally for the sake of safety can they operate!**	Hoisting equipment over 1000kg
 P24S00039	4. Install the blade sockets (left and right) and the work implement frame, install the adjusting shim (28) as required so as to make sure that the clearance is 2±1mm. As shown in the left figure.	Sledge, adjustable wrench, needle nose pliers and feeler gauge

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Figure	Operation steps	Tool(s)
 P24S00040 1. Clearance 2±1mm		
 P24S00041	5. Install steel sleeve (33) at round steel of the work implement frame.	
 P24S00036	6. Fasten the upper guide on the blade guide rail and tighten the bolts at lower connection. Install the bushing (31), blade pitch cylinder and stop pin (30), then tighten the stop pin bolt (29).	16#, 18# Wrench

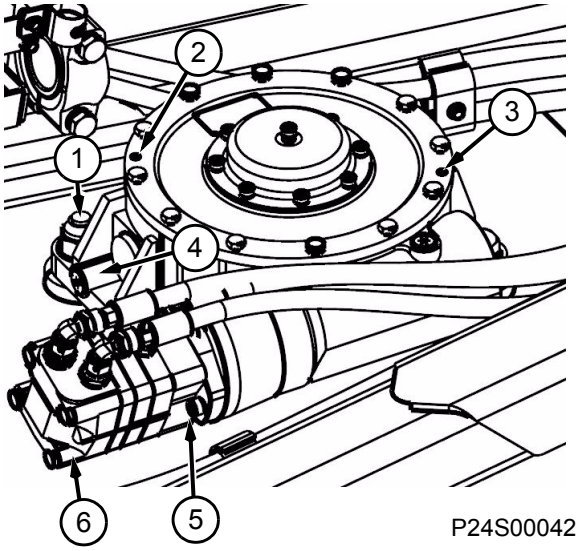
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Figure	Operation steps	Tool(s)
 P24S00034	7. Finally install the work implement frame plate (34).	24# Wrench

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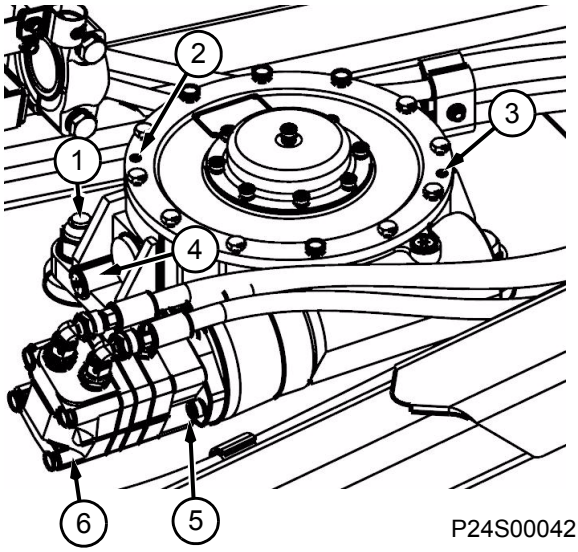
Removal and Installation of Worm Gear Case Assembly

Removal of Worm Gear Case Assembly

Figure	Operation steps	Tool(s)
 P24S00042	1. Park the machine on flat ground, operate the control lever to move the worm gear case to right limit position and keep it at a lower position. 2. Pull parking brake button and shut down the complete machine. 3. Remove the mounting bolts and nuts (1) of the worm gear case using the blower gun and the socket. 4. Screw in two eyebolts on the worm gear cases (2) and (3), lift the worm gear case using the traveling crane or other hoisting equipment off the traction frame and suspend it. **⚠ Notice: The worm gear case shall not collide with other components during lifting.** 5. Remove the drain plug (4) and drain completely the lubricant. **⚠ Notice: Before operating, put a drip pan under the oil drain port for collection of waste oil so as to prevent the environment from being contaminated.** 6. Remove the mounting bolts (5) of the motor and the hydraulic motor (6). 7. Lift the worm gear case to a proper position for subsequent maintenance and service according to "Disassembly of Worm Gear Case Components".	(3) 36# socket and pneumatic impact wrench (4) M10 eyebolt, sling (1000kg) and hoisting equipment (1000kg) (5) (6) Inner hexagon spanner 8# and drip pan

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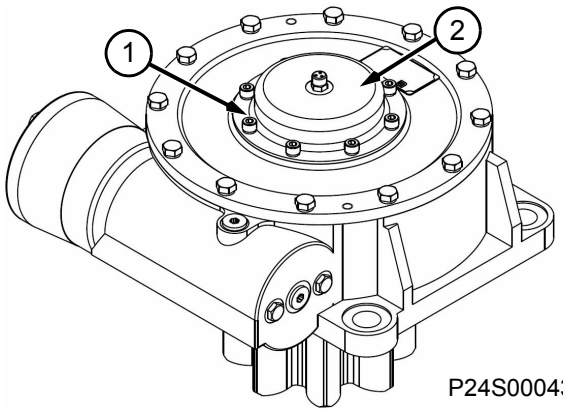
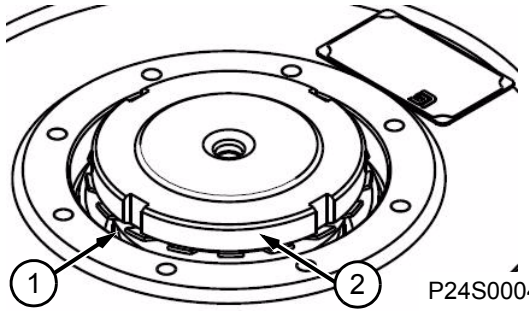
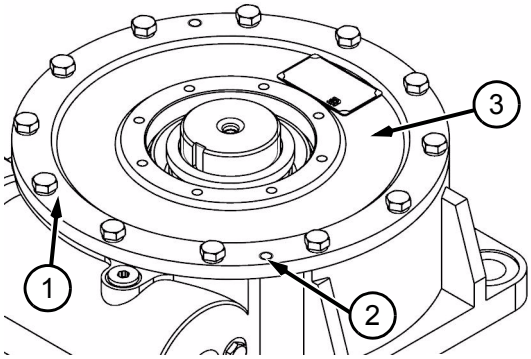
Installation of Worm Gear Case Assembly

Figure	Operation steps	Tool(s)
 P24S00042	1. Screw in two eyebolts on the worm gear cases (2) and (3), lift the worm gear case using the traveling crane or other hoisting equipment to the machine traction frame attachment and suspend it. 2. Install the hydraulic motor (5) and the hexagon socket bolt (4) with tightening torque 72±6N.m. 3. Lift the worm gear case above the mounting hole of the traction frame, slowly lower the worm gear case, meanwhile, pay attention to aligning with the bolt hole and to engaging the worm gear case gear with the swing bearing gear. **⚠ Notice: The worm gear case shall not collide with other components during lifting.** 4. Install the mounting bolts, washer, nuts (1) with tightening torque of bolts in grade 10.9 : 1020±100N.m; Tightening torque of nut in grade 8.8 is 760±100N.m. 5. Fill lubricant SAE 80W-90/LS to the middle and upper part of the oil level glass. Reference value of oil quantity is 1.5L.	(1) M10 eyebolt, sling (1000kg) and hoisting equipment (1000kg) (2) Inner hexagon spanner 8# (4) 36# socket and pneumatic impact wrench

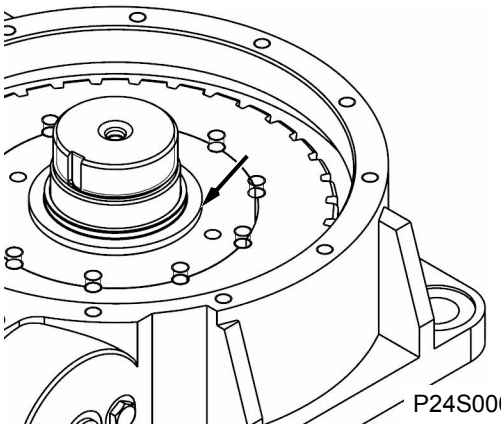
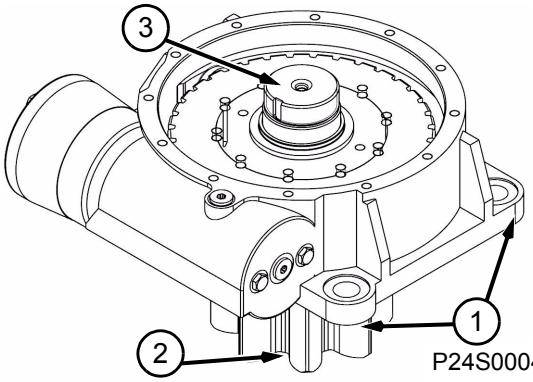
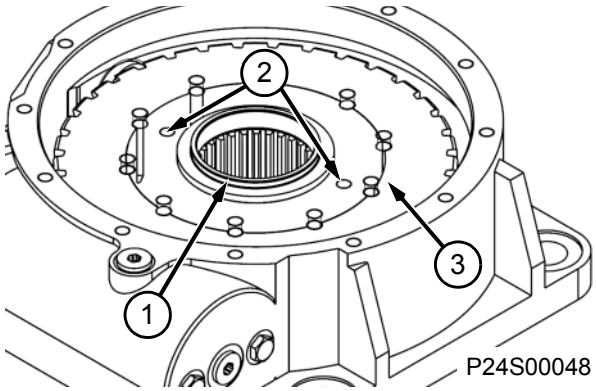
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Disassembly and Assembly of Worm Gear Case Assembly Parts and Components

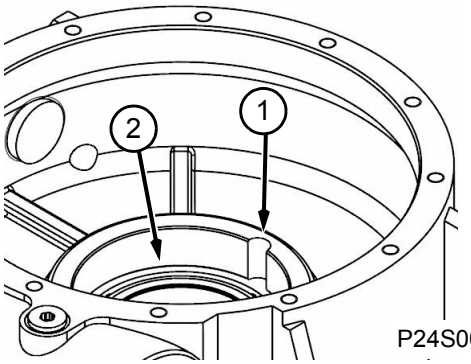
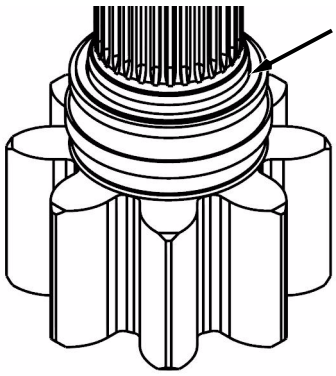
Disassembly of Worm Gear Case Assembly Parts and Components

Figure	Operation steps	Tool(s)
 P24S00043	1. Put the worm gear case on the maintenance workbench or special maintenance tooling and remove hexagon screws (1) and the cover (2).	6# inner hexagon spanner, straight screwdriver and hammer
 P24S00044	2. Press the jack catch (1) rolled by the lock washer. 3. Unscrew the lock round nut (2) and take down the lock washer.	Straight screwdriver, hammer and hook spanner
 P24S00045	4. Unscrew the bolts on the housing cover and take down the washer (1). 5. Screw 2 bolts in the auxiliary hole (2) on the housing cover, slowly jack out the housing cover and the bearing (3) and take them down.	16# socket and ratchet wrench

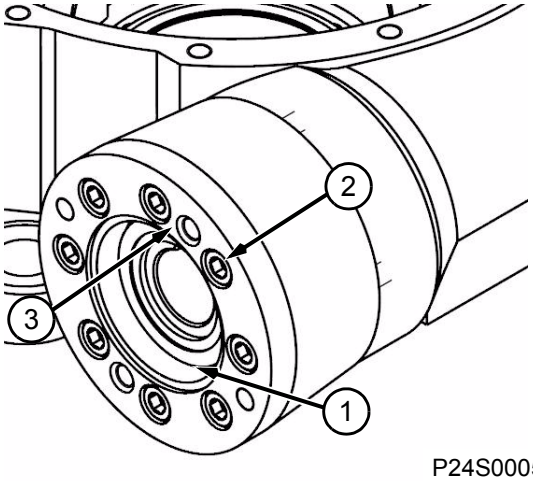
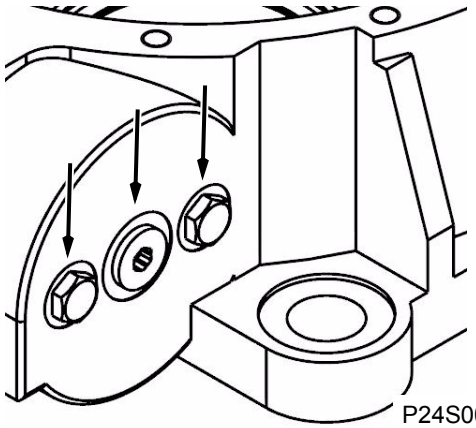
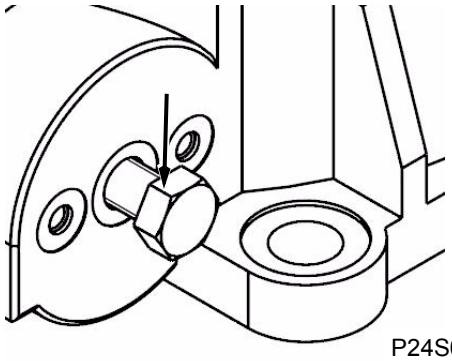
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Figure	Operation steps	Tool(s)
 P24S00046	6. Take out the adjusting gasket.	Straight screwdriver
 P24S00047	7. Block up the worm gear case (position (1)) so that lower end face of the gear shaft is off the maintenance workbench surface around 10mm and put a rubber pad under the gear shaft and above the workbench surface (position (2)). 8. Knock the upper end face (3) of the gear shaft using the copper bar so as to loosen the gear shaft. Lift the worm gear case housing and other components off the gear shaft using the sling.	Sling, cooper bar and M10 eyebolt
 P24S00048	9. Take down the steel sleeve (1). 10. Screw the eyebolt into two screw holes (2) of the worm gear and lift the worm gear (3) out using the sling.	Sling and M10 eyebolt

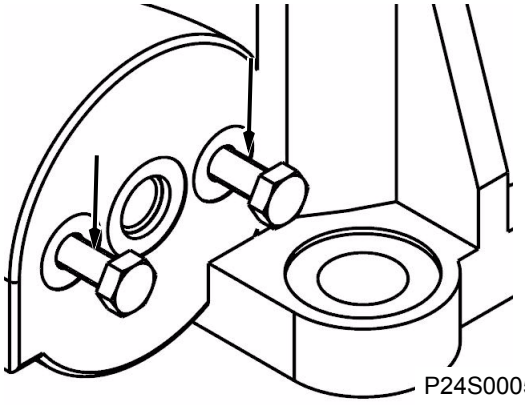
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Figure	Operation steps	Tool(s)
 P24S00049	11. Knock lightly the bearing cup (2) at lower end of the worm gear case via the process groove (1), meanwhile, bring out the gasket at lower end of bearing cup.	Copper bar and iron bar
 P24S00050	12. Take down the adjusting gasket on the gear shaft.	
 P24S00051	13. Align the screw rod tip of the puller with the center hole at the upper end of the gear shaft, fix the pull end of the puller on the skeleton oil seal through the backlash, use the box wrench to screw out the screw rod of the puller, and pull out the bearing cone and the seal ring. (Notes: The skeleton oil seal and the bearing cone will be damaged when they 1are pulled out, so replace new skeleton oil seal and the bearing cone during assembly).	Puller and box wrench

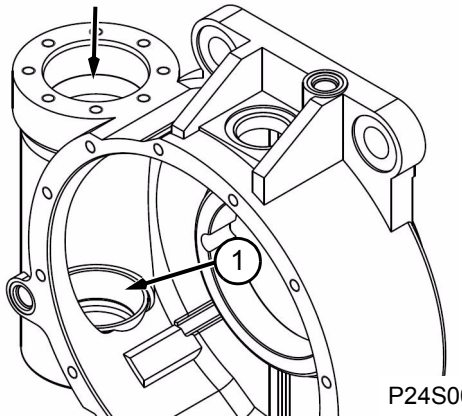
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Figure	Operation steps	Tool(s)
 P24S00052	14. Take out the connecting sleeve (1). 15. Remove the screw (2), screw two special screws into the auxiliary threaded hole (3) on the support to eject the support and to take out the adjusting gasket.	8# inner hexagon spanner, special screw (M10, with front thread length not less than 70mm)
 P24S00053	16. Remove 3 plugs.	8# inner hexagon spanner, 16# socket and ratchet wrench
 P24S00054	17. Eject the worm group out via the middle threaded hole using the wrench and bolts and unscrew the bolts. Take out the worm group.	M18X1.5X40 bolt, 27# socket and ratchet wrench

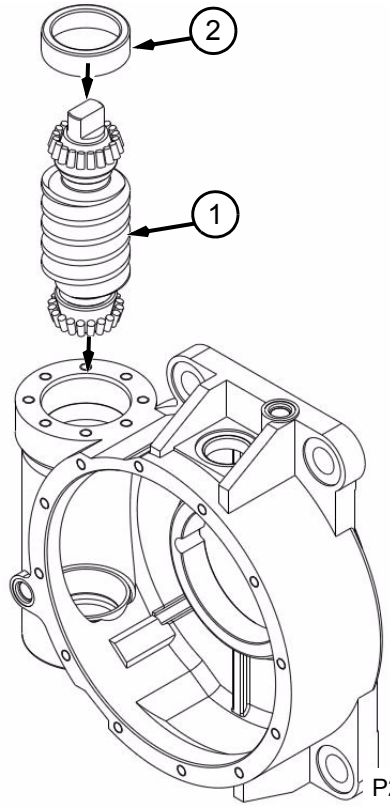
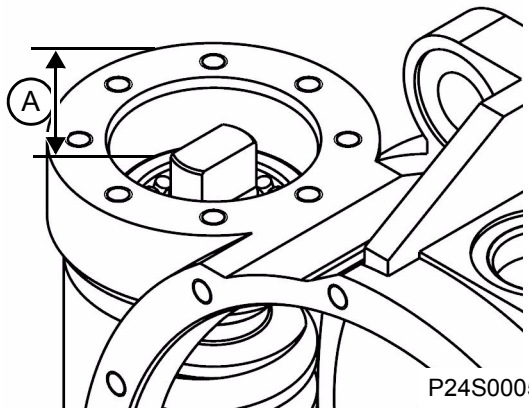
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Figure	Operation steps	Tool(s)
 P24S00055	18. Eject out the worm bearing cup in the housing via the threaded holes at two sides using the wrench and bolts and unscrew 2 bolts.	M10X1X30 bolts (2 pcs), 16# socket and ratchet wrench

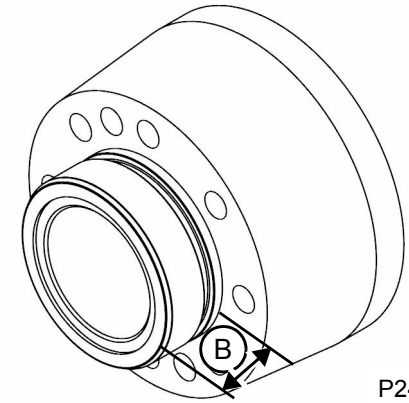
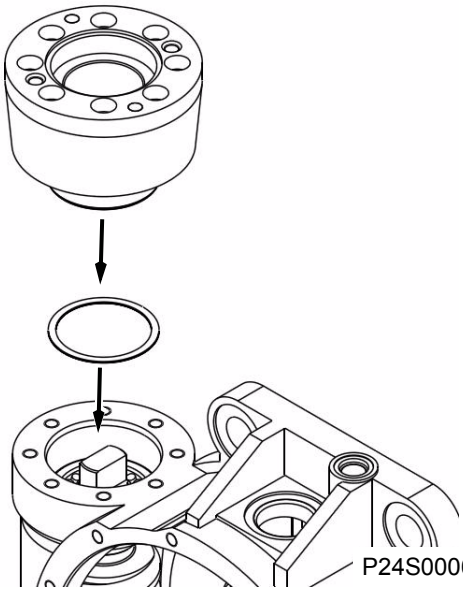
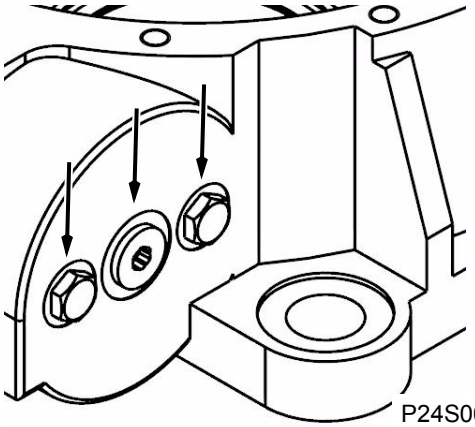
Assembly of Worm Gear Case Assembly Parts and Components

Figure	Operation steps	Tool(s)
 P24S00056	1. Clean all parts before assembly. 2. As shown in the Figure, raise and fix the housing. Put the bearing cup (1) in place, and knock it in place from upper end using the special tooling.	Special tooling and copper bar

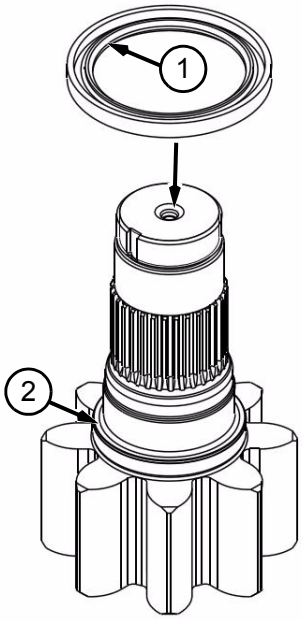
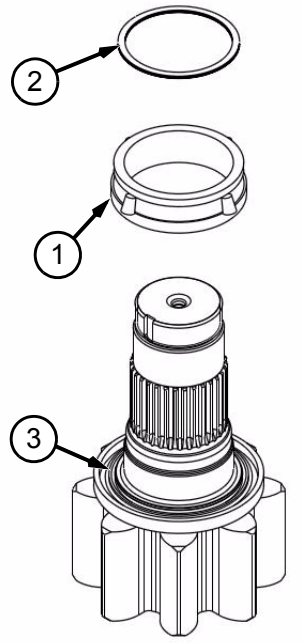
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Figure	Operation steps	Tool(s)
 P24S00057	3. Install the worm group (1) with bearing cone and the bearing cup (2) into the housing as shown in the Figure. 4. Knock the bearing cup (2) using the tooling and copper bar.	Special tooling and copper bar
 P24S00058	5. Measure the distance A from the housing end face to the bearing cup.	Depth indicator

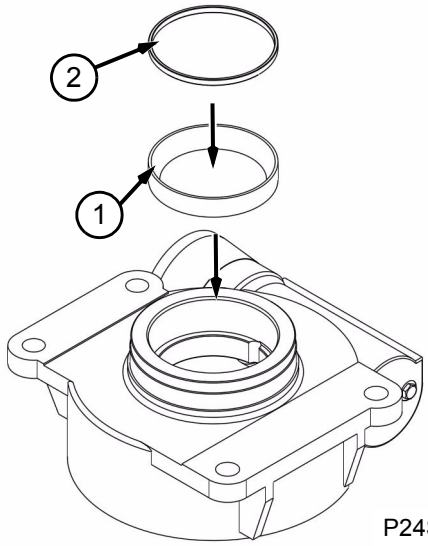
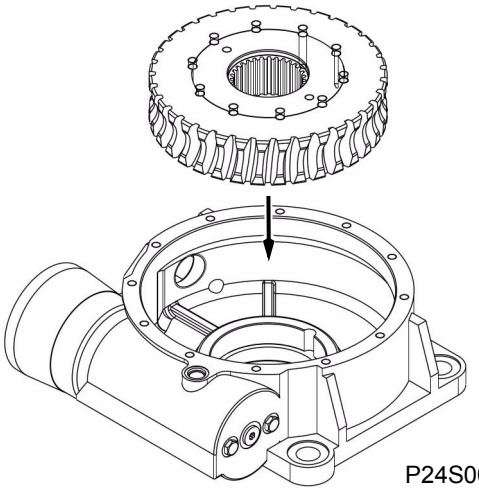
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Figure	Operation steps	Tool(s)
 P24S00059	6. Measure the support size B.	Depth indicator
 P24S00060	7. A-B+C=0.05~0.1mm, where C represents the thickness of the adjusting gasket. 8. Install the selected adjusting gasket. 9. Install the support with the O-ring. 10. Make sure that the pre-tightening torque of the bearing shall be 0.3 - 1.2N.m, if not, be sure to meet the requirement by increasing or decreasing the thickness of the adjusting gasket. 11. Install 8 screws (pre-apply thread locker) with tightening torque 52±7N.m.	Vernier caliper, 8# inner hexagon spanner and torque wrench
 P24S00053	12. Place horizontally the worm gear case housing and install 3 plugs (with O-ring) at rear part of worm shaft.	8# inner hexagon spanner, 16# socket and ratchet wrench

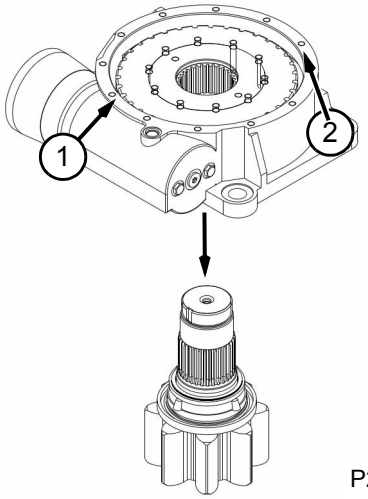
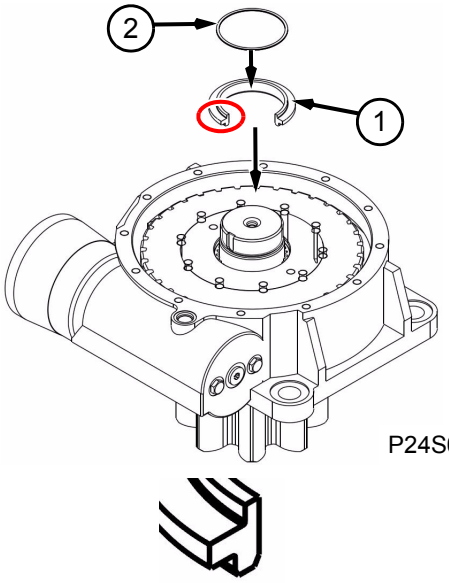
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Figure	Operation steps	Tool(s)
 P24S00061	13. Apply grease on the skeleton oil seal lip (1), sheath the skeleton oil seal into the gear shaft, press it to the bottom (2) and take care not to turn up the oil seal lip; the oil seal opening should face the non-gear end, and it is not allowed to assemble the oil seal in the reverse direction.	Grease
 P24S00062	14. Knock the bearing cone (1) into the gear shaft with the end face close to the shaft end (3); and then install the adjusting gasket (2) on the gear shaft. The thickness of the adjusting gasket (2) is confirmed after assembling the worm according to step 10 and step 11, adjust the thickness of the adjusting gasket to make the contact area between the adjusting gasket and the worm gear teeth surface locate in the middle of the teeth; the contact patterns are not less than 45% as per the teeth height and not less than 40% as per the teeth length.	Special tooling and copper bar

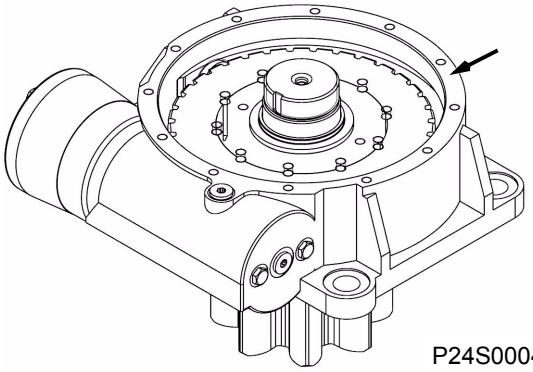
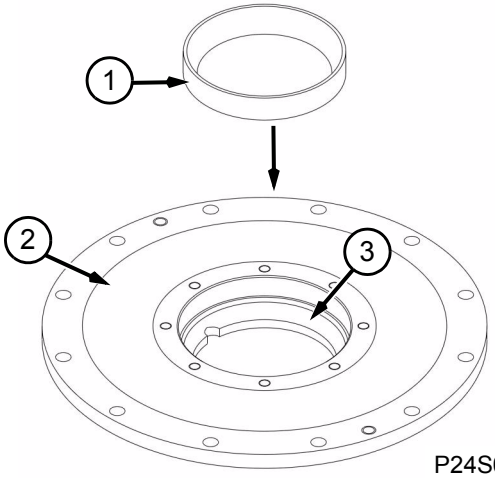
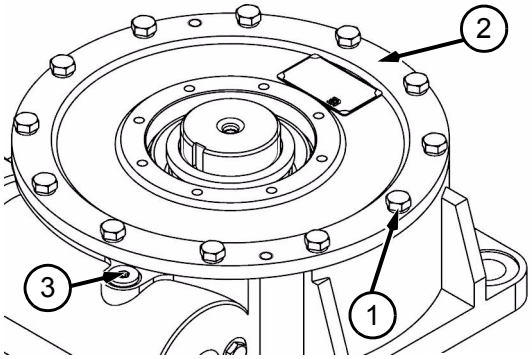
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Figure	Operation steps	Tool(s)
 P24S00063	15. Turn over the worm gear case housing, use a tooling and hammer to press the bearing cup (1) into the housing and press it to the bottom and then install the gaskets (2).	Special tooling and copper bar
 P24S00064	16. Turn over the worm gear case housing and put the worm gear into the housing.	

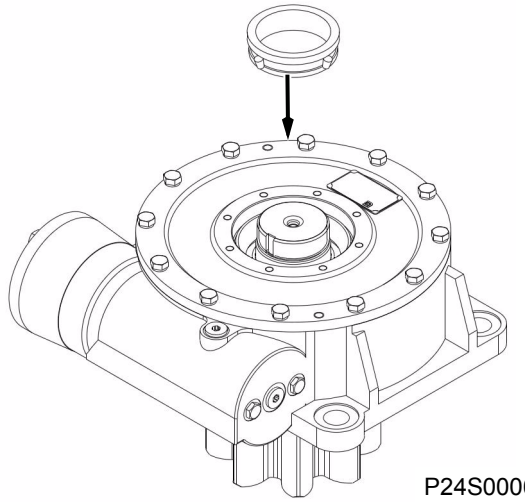
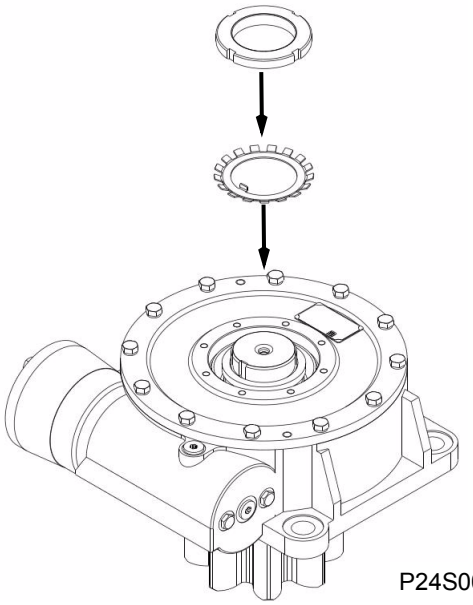
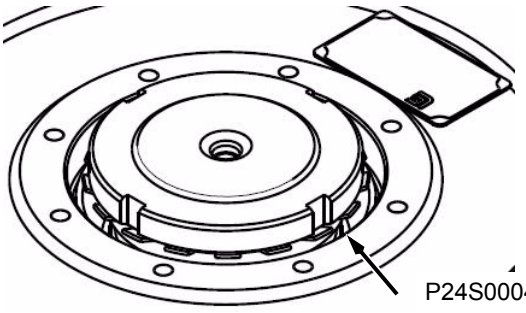
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Figure	Operation steps	Tool(s)
 P24S00065	17. Screw the eyebolts into two symmetric positions (1) and (2) on the worm gear case housing. 18. Lift the worm gear case housing using the sling so that the worm gear is aligned with the gear shaft spline and slowly lower the housing. Remove the eyebolts. 19. Knock the worm gear to the bottom using the copper bar and the tooling. **⚠ Notice: The washer installed at step (15) shall not drop out during the process.**	M10 eyebolts (2 pcs), sling, special tooling and copper bar
 P24S00066 Enlarged view	20. Sheath the steel sleeve (1) into the gear shaft and flatten it. **⚠ Notice: The end with the bigger shaft diameter faces down so that positioning is realized.** 21. Knock the steel sleeve to the bottom using the tooling and the copper bar. 22. Install the adjusting gasket (2) on the gear shaft.	Special tooling and copper bar

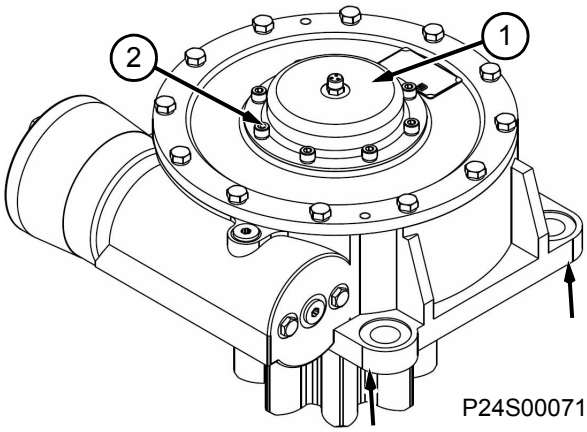
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Figure	Operation steps	Tool(s)
 P24S00047	23. Apply evenly one circle of flange sealant on upper end face of the housing.	Flange sealant
 P24S00068	24. Install the bearing cup (1) into the housing cover (2) and knock it in place (3) using the tooling and copper bar.	Special tooling and copper bar
 P24S00045	25. Install the housing cover (1) into the housing and evenly knock the housing cover using the copper bar so that the housing cover completely enters the housing. Please align it with the bolt mounting hole before pressing it. 26. Install the washer and bolts (2) and tighten them according to the order of crossing diagonal lines. Tightening torque: 52±7N.m. 27. Assemble the O-ring and the plug (3)	Copper bar, 16# socket, torque wrench and 8# inner hexagon spanner

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Figure	Operation steps	Tool(s)
 P24S00069	28. Install the bearing cone and knock the bearing to the bottom using the tooling and copper bar.	Special tooling and copper bar
 P24S00070	29. Sheath the lock washer into the gear shaft and clip the internal tab of the lock washer into the gear shaft spline groove. 30. Tighten the round nuts with the end with larger chamfer facing down and the tightening torque is 450±50N.m. 31. Align the lock washer with the jack catch lever of the round nut notch. 32. The pre-tightening torque for two bearings of the gear shaft shall be 1.5 - 2.6N.m. If not, please increase and decrease the adjusting gasket.	Special tooling, torque wrench and straight screwdriver.
 P24S00044	33. Apply one circle of flange sealant on the upper end face of the housing cover, pad the sealing gasket and then apply one circle of flange sealant.	Flange sealant

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Figure	Operation steps	Tool(s)
	34. Assemble the cover (1), washer and screw (2) by aligning with the mounting hole with the tightening torque 26±4N.m. 35. Block up the worm gear case so that the lower end face of the gear off the maintenance workbench, install the connecting sleeve into the worm end and use the tooling and the wrench for its commissioning so that the worm gear case can rotate freely.	6# inner hexagon spanner, special tooling and wrench

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Fault Diagnosis and Troubleshooting Methods

Precautions for Fault Diagnosis

- Park the machine on the flat ground, check whether the locking pin, block and parking brake are fixed firmly.
- When two or more personnels operate the machine, follow the agreed signal strictly, and any unauthorized people are not allowed to get close to the machine.
- If the radiator cover is removed when the engine is still hot, the hot coolant may spray out which will cause scald. Therefore, start the fault diagnosis when the engine is cooled.
- Specially notice that do not touch any hot components or avoid being jammed by any rotating components.
- When disconnecting the wire, be sure to disconnect the negative pole (—) of the battery firstly.
- Be sure to release the inner pressure first when removing the plug or cover where the oil pressure, water pressure or air pressure may exist. When installing the measuring device, make sure that it is connected correctly.

Common Faults and Troubleshooting

Some faults of the work implement and troubleshooting for these faults are introduced in the following part:

No.	Fault features	Main reasons	Fault inspection and troubleshooting
1	Front and rear frame hinge bounces up and down violently	1. Bolts are loose. 2. Adjusting gaskets are not installed properly.	1. Check the bolts and tighten properly them with specified torque. 2. Readjust and install the adjusting gaskets according to the requirements.
2	Fail to slide smoothly on the blade guide rail with shaking	1. Bolts are loose. 2. Adjusting gaskets of the guide are not installed properly.	1. Check the bolts and tighten properly them with specified torque. 2. Readjust and install the adjusting gaskets according to the requirements.
3	The blade is stuck in the angle change	Small clearance or no clearance at the connecting position between left & right sockets and the work implement frame.	Check the clearance and properly adjust it using the adjusting gasket.

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Electrical appliance

General Information 8-3
Safety Items 8-3
Precautions for Welding 8-3
Special Tool and Tooling 8-4
Special Tool and Tooling 8-4
Introduction of Electrical System 8-5
Introduction of Signs on the Electrical Schematic 8-6
Structure and Function 8-8
Power System 8-8
Components of the System and Position 8-8
Function Introduction 8-9
Schematic Diagram of Power System 8-9
Electric Lock 8-11
Fuse 8-12
Negative Switch 8-14
Battery 8-15
Power Relay 8-18
Alternator 8-18
Central Control Box 8-21
Start Stop System 8-23
Components of the System and Position 8-23
Function Introduction 8-24
Schematic Diagram of Flameout and Start-up System 8-24
Start Contactor 8-27
Relay 8-27
Starter Motor 8-28
Monitoring System 8-29
Inspect Components of the System and Position 8-29
Function Introduction 8-29
Monitoring System Schematic Diagram 8-29
Monitoring System of the Complete Machine 8-30
Monitoring System of the Engine 8-33

https://truckmanualshub.com/

Torque Converter & Transmission Monitoring System 8-36
Instrument 8-38
Shift Control System 8-42
Components of the System and Position 8-42
Function Introduction 8-42
Circuit Schematic Diagram for Shift Control 8-43
Audible and Visual Alarm System 8-48
Components of the System and Position 8-48
Function Introduction 8-48
Schematic Diagram of Electric Horn Circuit 8-49
Backup Alarm 8-50
Instrument 8-50
Lighting System 8-51
Components of the System and Position 8-51
Function Introduction 8-51
Schematic Diagram of Front Frame Illumination 8-52
Schematic Diagram for Cab Lighting 8-55
Schematic Diagram of Rear Frame Illumination 8-57
Instrument 8-58
Audio System 8-59
Components of the System and Position 8-59
Function Introduction 8-60
Schematic Diagram of Audio System 8-60
Wiper and Washer System 8-63
Components of the System and Position 8-63
Function Introduction 8-63
Schematic Diagram for Wiper and Washer System 8-64
Frame Steer Auxiliary Circuit 8-65
Components of the System and Position 8-65
Function Introduction 8-65
Schematic Diagram for Steer Auxiliary System of the Frame 8-66
Fault Diagnosis and Troubleshooting Methods 8-67
Precautions for Fault Diagnosis 8-67
Common Fault Judgment and Troubleshooting 8-68

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General Information

Safety Items

Any improper operation, maintenance and repair method may lead to hazardous conditions, and may cause personal injury and even death.

Be sure to read and understand the relevant security measures and precautions before operating, maintaining and repairing the machine.

Please strictly obey the safety warning information listed in this Manual and on the machine during operating, maintaining and repairing the machine, otherwise heavy casualties will occur.

⚠WARNING

This type of safety warning signs means:

Notice! Warning! Caution!

The explanatory notes underneath the warning symbols could be texts or graphic symbols.

In addition, please carefully follow the "Cautions" listed in this Manual, otherwise, it may result in great damage to the machine.

We are unable to enumerate all the possible risks (including potential dangers), and the warnings in the Manual and product do not cover all the risks and dangers. If the tools, operation procedures, methods or techniques are not specially recommended by our company, it is necessary to ensure the personal safety of every one, and protect the machine against any damage.

The contents herein are provided based on the status of the machine at the time when the Manual was written, whereas, all products are updating, and this machine is no exception. Any modification will influence the operation, maintenance and repair of the machine, therefore, please contact the LiuGong dealers for latest and most comprehensive service information before operating, maintaining and repairing the machine.

Precautions for Welding

Be sure to comply with the correct welding procedures, so as to prevent the electrical components and bearings from potential damages. When welding on the grader or the diesel engine equipped with electrical components, please follow the operating steps below:

1. Place machine on a flat ground.
2. Turn the electric lock to "OFF" position, and shut down the diesel engine.
3. Pull up the handbrake.
4. Turn off the battery disconnect switch, and disconnect the connection between battery and frame.
5. Clamp the parts to be welded and the ground cable of the welder tightly. The closer the grounding position from the welding site, the better. Check and make sure the circuit from ground cable to welding components has not passed through any of the following components:

- Bearing
- Hydraulic cylinder
- Internal circuits of the controller or other electronic components

So as to keep the following parts away from the possible damage:

- Bearing
- Hydraulic components
- Electronic component

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- Other available components on the machine

6. The inflammables shall be away from the welding site and protect the cables from the loss and damage resulted from the fire caused by splashing sparks and welding slag.
7. Perform the welding according to the safe operating procedure of normal welding.

⚠WARNING

During welding, the grounding point of welder on the frame shall be close to the welding point to the greatest extent, for which a reliable large-area grounding shall be guaranteed.

⚠WARNING

Warning: Do not use the grounding point of any electrical component on the machine as the grounding point of the welding machine!

⚠WARNING

For welding near the grounding point of the electrical components, you shall not perform welding operation until you disconnect the grounding point of the electric appliance and make sure that the welding circuit of the welder does not pass through the electric appliance. Otherwise, it will cause damage to the electrical component, and even lead to a fire!

⚠WARNING

Warning: To prevent possible losses, for the machine equipped with electronic control components, such as the control unit EST-117 of ZF, electrical centralized control box, instrument, and engine ECM etc., ensure that the welding circuit is disconnected from that of the aforementioned electronic control components before weldment, while the connectors closest to such control components shall be unplugged to cut the circuit off.

Special Tool and Tooling

List of universal tools for the electrical system is shown in the table below.

Tool name	Specifications	Purpose
Wrench		Install and remove the bolts
Cross screwdriver		Install and remove the screws

Special Tool and Tooling

Special tools for the electrical system are shown in the table below

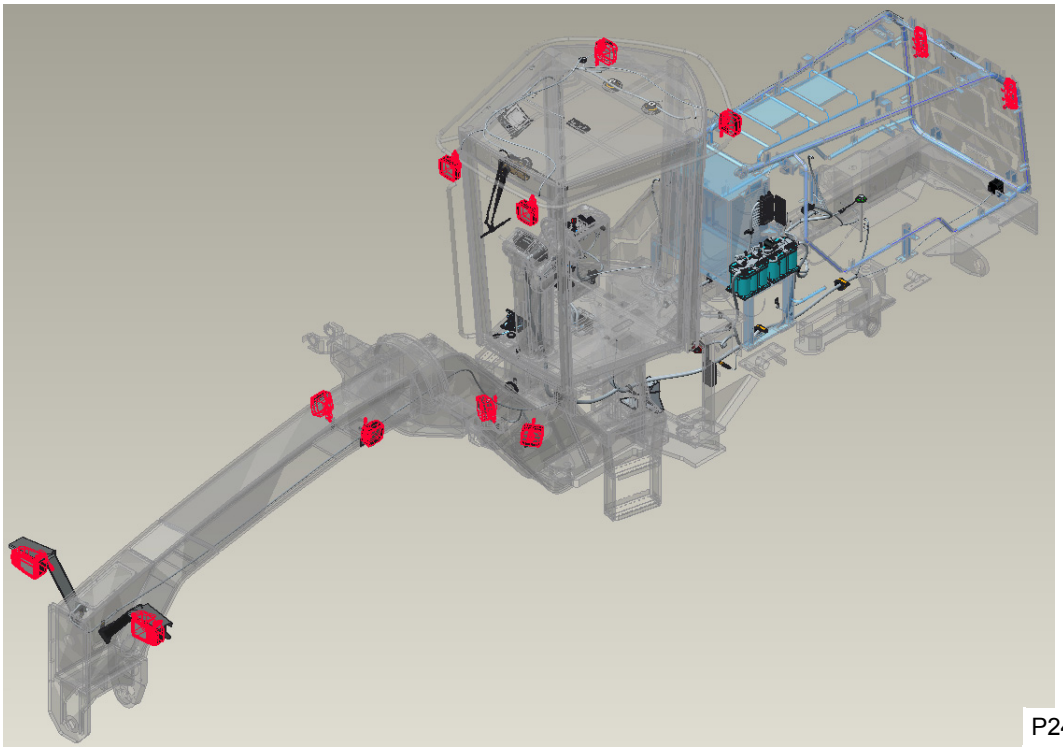
Tool name	Specifications	Purpose
Multimeter		Used for measuring the circuit and electrical equipment
Terminal wire returning pin	For the connectors from ITT, DEUTSCH and AMP	For removal of connector pin
Wire crimper	For wire diameters of 0.85mm^2, 1.2mm^2	Used for the crimp terminals on the wire

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Introduction of Electrical System

Composition and Layout of Electrical System

The electrical system of 4180D grader consists of power system, start stop system, detection system, shift control system, audible and visual alarm system, lighting system, audio system, wiper and washer system, which are mainly located at front & rear frame, cab and other positions of the complete vehicle.



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Electrical System Parameters

Main parameters of electrical system for 4180D grader are shown in the table below.

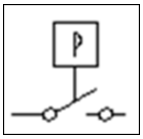
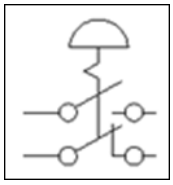
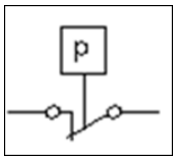
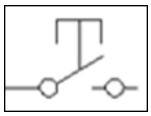
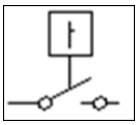
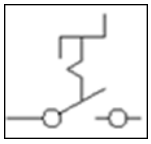
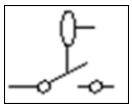
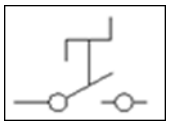
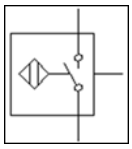
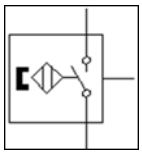
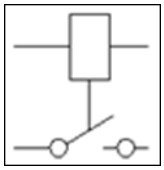
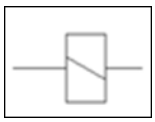
Voltage of the electrical system	24V
Battery type	6-SPB-50C
Battery capacity	55Ah
The contact current of main power relay	100A
Chip fuse type	ATS
Main fuse type	ANS
Alternator rated power	2000W

Working Principle of Electrical System

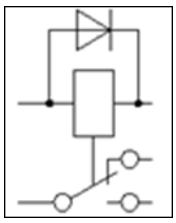
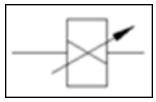
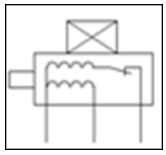
The working principle of electrical system for 4180D grader is that: the voltage is supplied by the battery or alternator, the circuit is protected by the fuse and is in the logic control by the switch, controller and relay so that all electrical equipments are working as per the expectation of the operator.

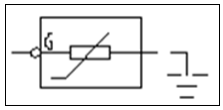
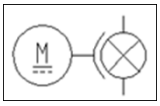
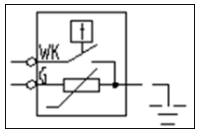
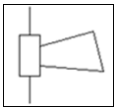
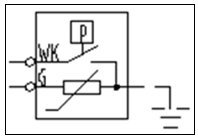
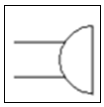
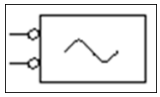
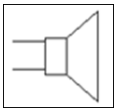
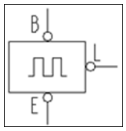
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Introduction of Signs on the Electrical Schematic

Graphic symbol of the control switch				Graphic symbol of double position manual control switch			
No.	**Name**	**Graphic symbol**	**Description**	**No.**	**Name**	**Graphic symbol**	**Description**
1	Pressure switch		Normally open	1	Emergency stop switch		Hold
2	Pressure switch		Normally closed	2	Button switch		Instantaneous acting
3	Temperature switch			3	Knob switch		Hold
4	Liquid level switch			4	Knob switch		Instantaneous acting
5	Induction proximity switch						
6	Magnetic induction proximity switch						
Graphic symbol of the relay				**Graphic symbol of the electromagnet**			
No.	**Name**	**Graphic symbol**	**Description**	**No.**	**Name**	**Graphic symbol**	**Description**
1	General-purpose relay		One group of normally-open contacts	1	Switch electromagnet		

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2	Relay with normally closed contact		A group of break-before-make changeover contacts, coil in parallel to restrain diode	2	Proportional electromagnet		
				3	Double-coil electromagnet		

Light and signal graphic symbol				Graphic symbol of the sensor			
No.	**Name**	**Graphic symbol**	**Description**	**No.**	**Name**	**Graphic symbol**	
1	Light			1	Rheostat sensor		
2	Rotating beacon			2	Temperature sensor with alarm switch		
3	Electric horn			3	Pressure sensor with alarm switch		
4	Buzzer			4	Inductive speed sensor		
5	Speaker						
6	Flash relay						

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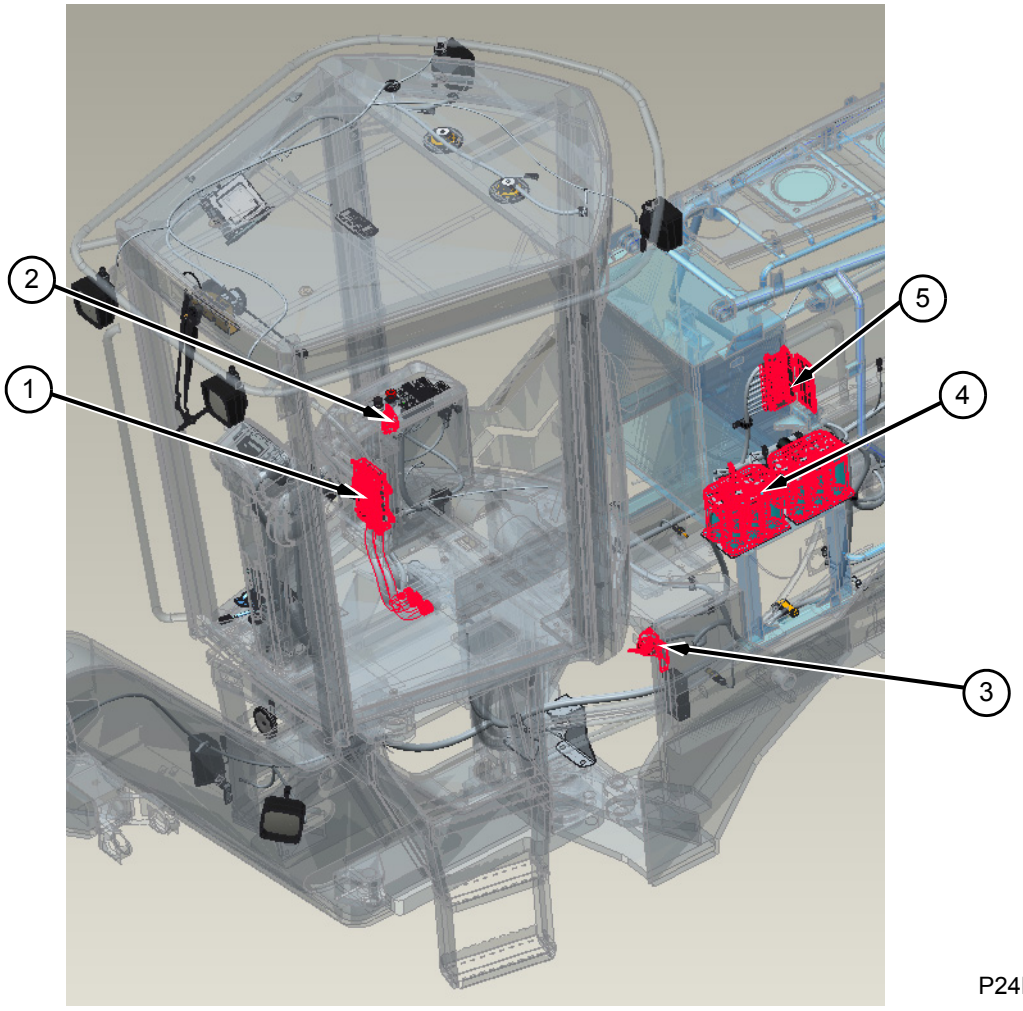
Structure and Function

Power System

Components of the System and Position

The components included in the power system: electric lock (2), fuses (1 and 5), disconnect switch (3), battery and power relay (4).

Location diagram



P24E00002

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Function Introduction

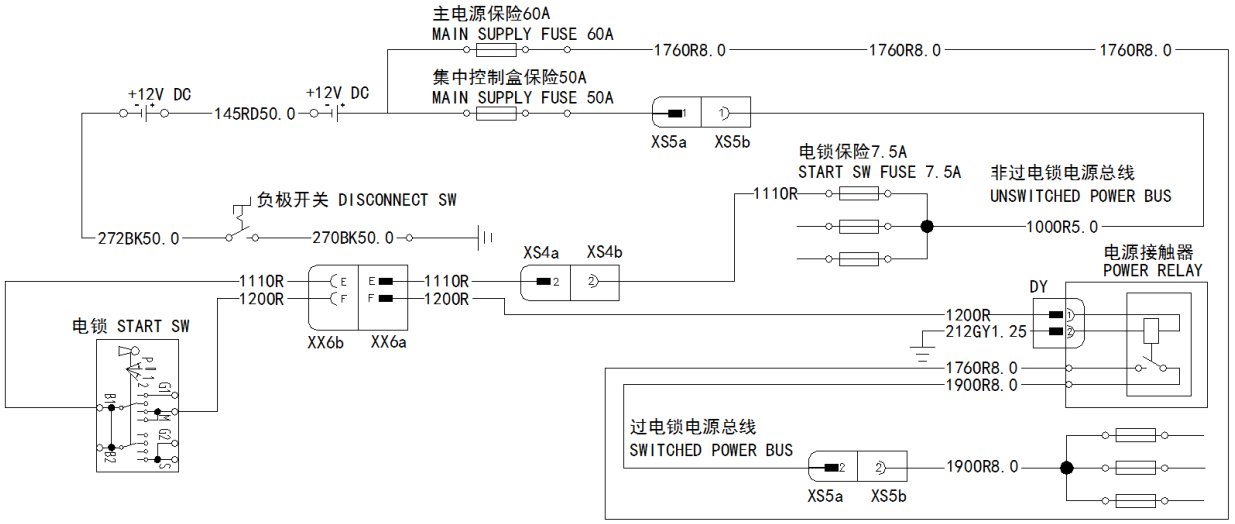
The power system equipped in CLG4180D supplies power for the electrical appliances of the complete vehicle. The diesel engine is powered by battery separately before starting, which is then jointly powered by battery and alternator during running.

Under normal operating circumstances, the normal power supply is available through switching on the electric lock or starting the diesel engine.

The electrical components, including dome lights, rotating beacons, parking lamps, clearance light and electric horn work properly once the disconnect switch is closed.

Turn the electric lock to ON position, all the other electrical components except the backup alarm and A/C function module can be used normally.

Schematic Diagram of Power System

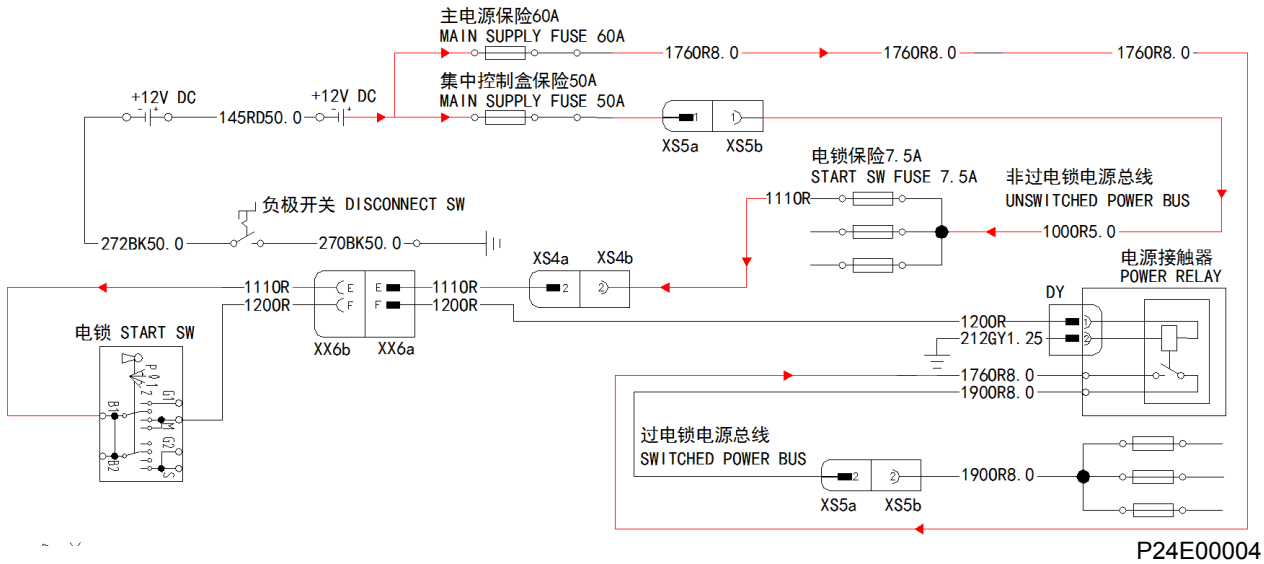


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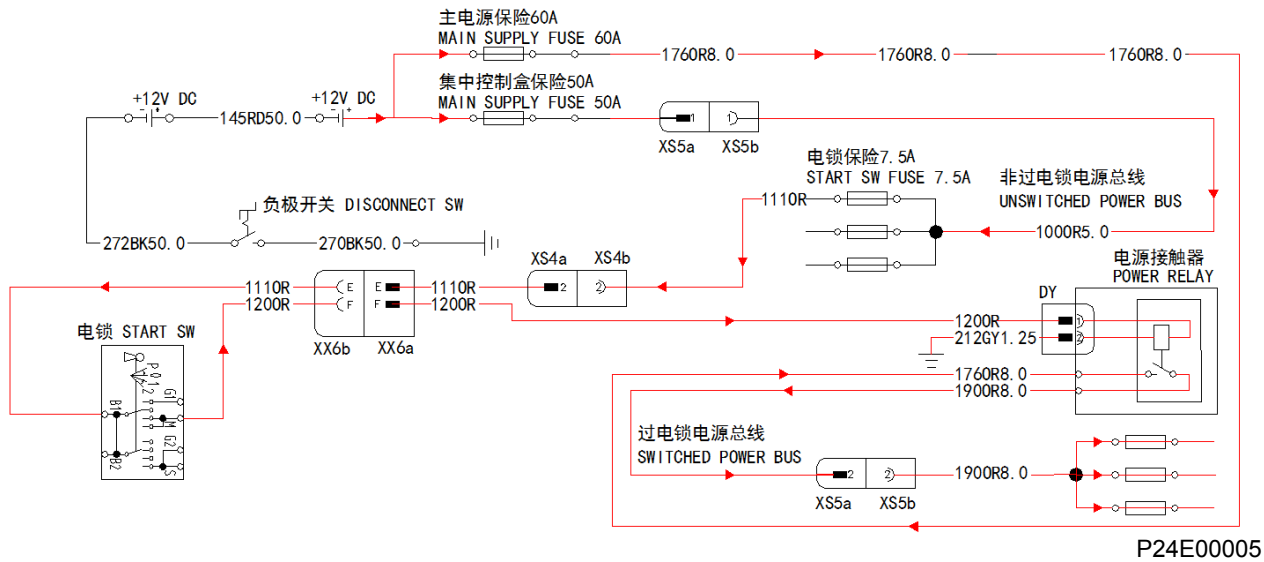
Analysis of the Electrical Schematic Diagram

1. After closing the negative switch, the circuit is shown as below. The bus fuse, which does not pass through the electric lock, is powered. Red part represents the powered section, while the arrows indicate the current directions, the same representing methods are applied to the sections below.



P24E00004

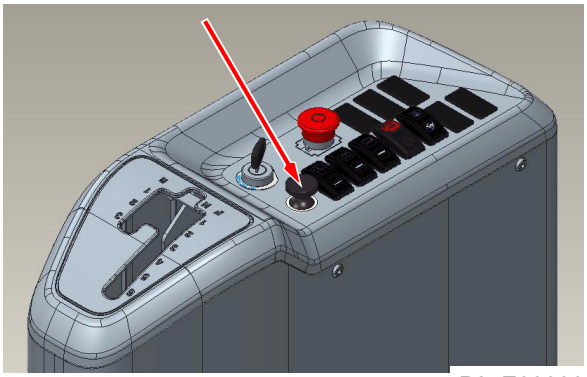
2. The power relay contacts turn on once the electric lock is turned to Position ON, and the bus fuse, which passes through the electric lock, is powered.



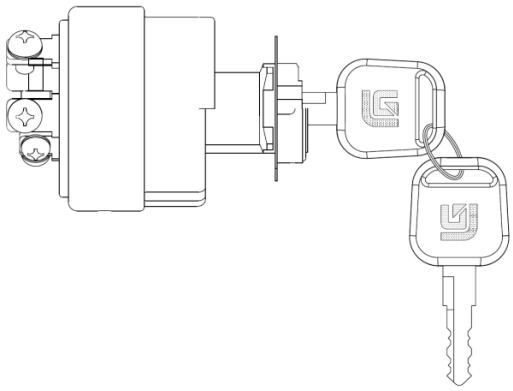
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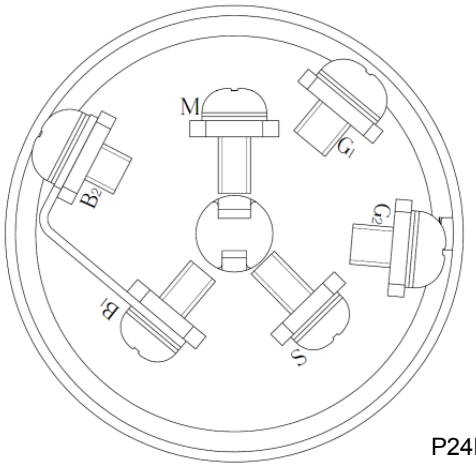
Electric Lock



P24E00006



P24E00007



P24E00008

Circuit power-on

Connector code / Gears	B_1	B_2	M	S	G_1	G_2
OFF	○	○				
ON	○	○	○			
START	○	○	○	○		○
HEAT	○	○			○	

P24E00009

Specification of the positions of the electric lock

"HEAT"-The first position of the clockwise rotating key after inserting the electric lock key. This position is generally used for the air intake preheating control of the complete machine of non-electronic fuel injection engine and incapable of self-hold, after releasing, the electric lock key returns automatically to "OFF" position.

"OFF"-the position to insert and extract the electric lock key. At this position, the power of the electrical equipment on the vehicle is cut off. Except for some electrical equipment (such as dome light), which are controlled by the battery disconnect switch instead of the electric lock.

"ON" -the first position of the clockwise rotating key after inserting the electric lock key. "ON" connects the powers of electrical equipment of the complete machine, which are powered by battery.

"START"-the second position of the clockwise rotating key after inserting the key to electric lock. Such position starts the diesel engine, which is incapable of self-hold. The electric lock key returns automatically to "ON" once it is loosened.

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Precautions

After starting the diesel engine, loosen the electric lock key immediately to make it return to its position. Otherwise it will lead to serious electrical fault.

Switch off the electric lock if it fails to start for the first time, then proceed on to second starts. First turn the electric lock key to "OFF" position. Second, turn it to the "ON" position; Finally to "START" position, which completes a startup circle.

If the diesel engine fails to start within 15S, switch off the electric lock. Continual starting should be less than three times. Each start time shall be controlled within 15S, or else power loss may be resulted in for the continuous high-power output of battery.

If the diesel engine fails to start in three consecutive trials, switch off the electric lock, and implement the second starting round after 30 minutes. Check the battery and start circuit, if necessary, to see whether there are failures affecting the starting.

A majority of the start difficulties happen outdoors in the cold winter, where the ambient temperature may be even lower than 5°C. If possible, try to start the diesel engine indoors instead, or improve the start with auxiliary heating.

Removal and Installation of Electric Lock

For removal and installation of other components on the complete machine, please refer to Tools for Removal and Installation of Components, which are excluded from the section hereof.

Procedures of failure detection for electric lock

1. Unplug the connectors connected with the electric lock, thus to separate the electric lock from the machine circuit.
2. Turn the digital multimeter to 200Ω of Ω position.
3. According to the electric lock gear logical table, pins with " ●" in each gear should be connected, and the display value of multimeter should be "0" when measuring; pins with " " and without " ●" should be disconnected, and the value of multimeter should be "1" when measuring. Otherwise, it can be judged as electric lock fault.

Note: "0" indicates the resistance between the two pins is measured as zero; "1" indicates the resistance between the two pins is infinite.

Electric lock position logical table

Circuit power-on

Connector code / Gears	B_1	B_2	M	S	G_1	G_2
OFF	○	○				
ON	○	○	○			
START	○	○	○	○		○
HEAT	○	○			○	

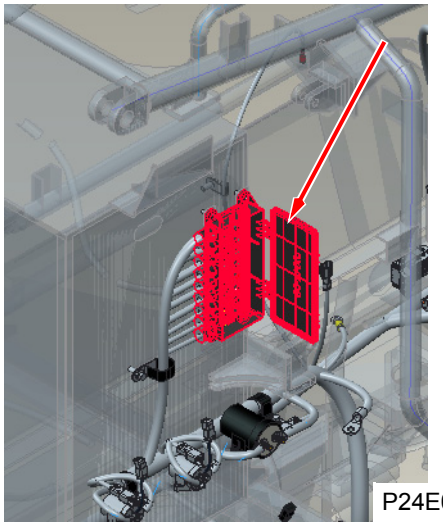
P24E00009

Fuse

Fuse acts as protecting terminal equipment during short circuit or overcurrent. Different series of fuses are applied in the power system, such as plug-in fuse and bolt fuse. The specifications of plug-in fuse diversified from 20A to 15A, 10A, 7.5A and 5A, for the branch circuits. The specifications of bolt fuse are 30A, 50A, 60A, 80A, 100A and 150A used for the main circuit.

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Diagram of bolt fuse on the complete machine



P24E00010

Diagram of plug-in fuse on complete machine

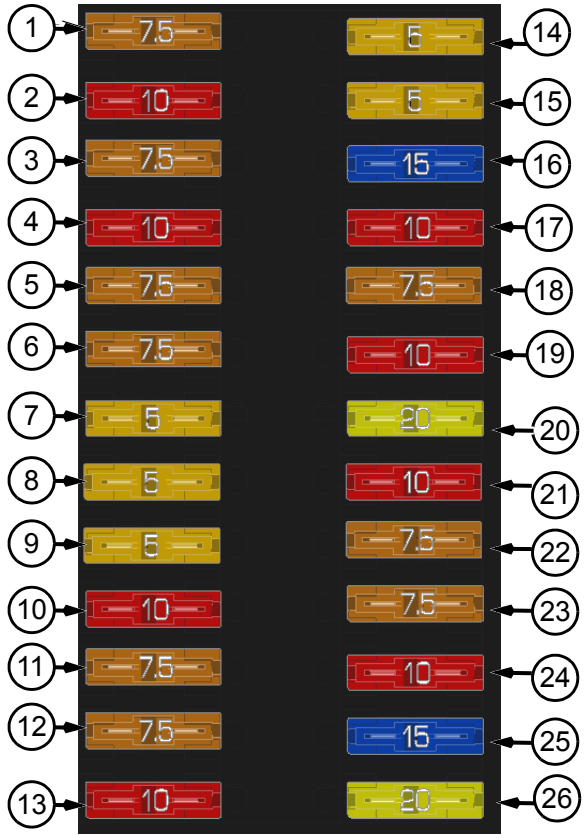


P24E00011

The colors of plug-in fuse vary in accordance with the specifications, the specifications and colors of plug-in fuses applied in the machine, together with the corresponding LiuGong part numbers are listed in the table below for reference only.

LiuGong part number	Specifications	Color
37B0041	7.5A	Coffee
37B0030	10A	Red
37B0062	15A	Blue
37B0073	20A	Yellow

Definition table for function of plug-in fuse is as follows:



P24E00012

1. Flasher
2. Electric horn / backup alarm
3. Electric Lock
4. Aux control 1
5. ECM power 1
6. Brake light
7. Left brake light
8. Standby 1
9. Right brake light
10. ECM power 2
11. Instrument
12. Emergency steering
13. Floodlight
14. Left position light
15. Right position light
16. Front work light 1
17. Front work light 2
18. Aux control 3
19. Rear work light
20. Wiper system
21. Radio cassette player/ cigar lighter
22. Aux control 4
23. Standby 2
24. Standby 3
25. Standby 4
26. Standby 5

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Precautions

The specifications of different fuses are available from calculation during the circuit design, accordingly, the blown fuse shall be replaced with that of the same series and specifications. Don’t replace the fuse with a fuse of different specifications.

On condition that the replaced blown fuse are blown again, do not replace it until the circuits under the jurisdiction of the fuse are checked and the fault is troubleshot.

The Troubleshooting Method of Fuse

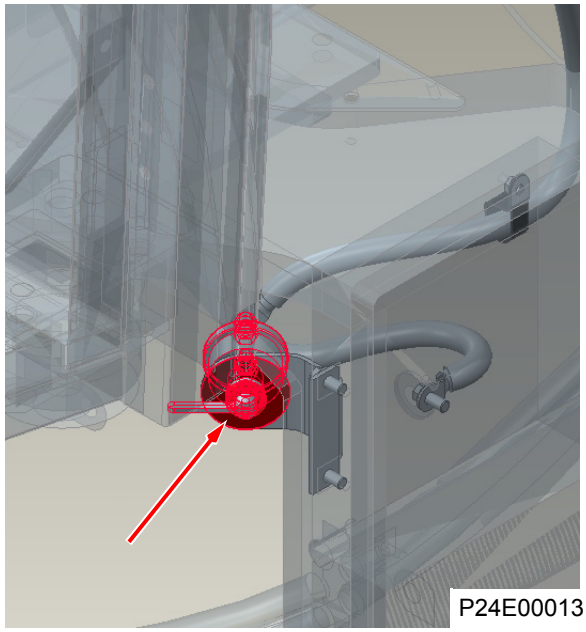
Remove the plug-in fuse from the fuse holder and visually check whether the internal fuse is blown. The inspection methods of bolt fuses can also be applied in the judgment.

Judgment steps for blowout of bolt fuse:

1. Turn the digital multimeter to 200Ω of Ω position.
2. Connect both terminals of the fuse with the DMM probes respectively.
3. The indicated value "1" of the DMM signifies that the fuse is blown and replacement is needed, while the value "0" displayed on the DMM indicates the good service condition of fuse.

Negative Switch

Disconnect switch regulates the connection between battery (-) and the complete machine frame. The power (-) of the complete machine is disconnected when the disconnect switch is turned to "O" (OFF). The complete machine electrical equipment cannot work even turn on the electric lock. Turn the disconnect switch to "I" (ON), the power (-) of the complete machine is connected. Whereby, the electric lock controls the connections between the electrical components and powers throughout the complete machine, as well as starts the diesel engine.



P24E00013

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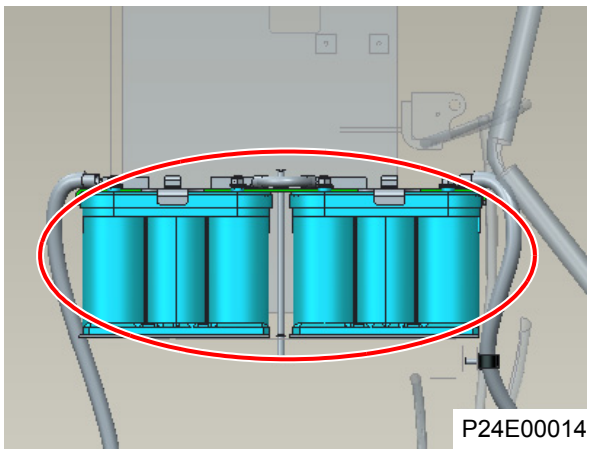
Precautions

1. Be sure to turn off the negative switch at the end of each operation or driving, or else severe consequences (such as electric leakage) might happen.
2. Don't close the negative electrode switch during engine’s running. Such error has a severe influence on the electrical systems of the complete machine.
3. Turn off the electric lock and then the negative switch to halt the machine.
4. Turn on the negative switch and then the electric lock to start the machine.
5. Be sure to turn off the negative switch before connecting battery cable, fastening the pile tip of battery cable or disassembling battery cable.
6. Be sure to turn off the negative switch before implementing welding operation on the complete machine.

Battery

The complete machine obtains +24 V power with 2 batteries in series connection. The rated capacity is 55Ah, and cold-starting current is 850CCA.

As reversible DC (direct current) power, the battery connects in parallel with the alternator to jointly power the electrical equipments of the complete machine. Battery supplies great current in a short time to starter motor, and further drive the diesel engine to start. Besides, the battery serves as a large capacitor, which safeguards electrical equipment of the complete machine through absorbing the overvoltage arising from the circuit at any moment.



State Detection of Battery

When the complete machine is difficult to start, first measure the battery voltage and check if it's already lower than 25V (not less than 12.5V for single battery), and judge the battery status.

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Battery Charging

For the batteries whose hydrometer is black, recharging is required.

For the batteries whose hydrometer has transparently light color, there might be bubbles in the hydrometer. Whereupon, remove all the battery connecting cables and shake the battery gently after it is fully cooled. The battery shall be scrapped, provided that the above-mentioned transparently light color remains.

1. Turn the negative switch to state "O". Turn the electric lock to "OFF", and extract the key.
2. Disassemble the battery from the machine. Disconnect the battery negative terminal cable and positive terminal cable successively before removing the battery.

⚠CAUTION

The battery should be installed in the reverse order that connect the battery positive terminal cable first and then the negative terminal cable.

3. Wipe the battery terminal and surface with a clean cloth, to remove the oxide scale on the surface.
4. Connect the charger positive (+) clip to the battery positive (+) terminal, while charger negative (-) clip to the battery negative (-) terminal at room temperature. Confirm that the battery terminals are clean, and the charging circuit is in good connection.
5. It is recommended to charge the battery at constant voltage of 16.0V (no more than 16.2V at most, otherwise a lot of water will be electrolyzed and cause liquid level dropping, battery scrap) with current limited to 25A, and if the battery voltage is stable and more than 13V 2 hours after charging, it indicates that the battery is fully charged.
6. If there is no condition for charging at constant voltage, constant current charging is allowed as per the following specification:
   a) Select 1/8~1/10 amp charging current (12-15A for 37B0108 battery, 10~12A for 37B0077 battery) of rated capacity, the voltage at the end of charging should be reached but cannot exceed 16V (voltage less than 16V at the end of charging is easy to cause the hydrometer to show black even after charging is completed). When the charger cannot guarantee that the charging voltage is limited below 16V, the charged battery terminal voltage must be manually monitored every hour; otherwise, it can cause water loss in battery due to overvoltage charging and affect the service life of battery and even failure.
   b) The relations between the recharging time and the voltage before charging of the battery (for reference)

Battery voltage	12.45~12.55V	12.45~12.35V	12.35~12.20V	12.20~12.05V
Recharging time	2 hours	3 hours	4 hours	5 hours
Battery voltage	12.05-11.95V	11.95~11.80V	11.80~11.65V	11.65~11.50V
Recharging time	6 hours	7 hours	8 hours	9 hours
Battery voltage	11.50~11.30V	11.30~11.00V	Below 11.00V	
Recharging time	10 hours	12 hours	14 hours	

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7. For the battery suffering severe power loss, it may be non-chargeable at the beginning of charging. As battery charging proceeds, the charging current of battery can return to normal state gradually. It takes about 14 hours to complete the charging process.
8. If the battery temperature gets too high (approximately 45 °C) during the charging process, stop charging the battery until the battery is cooled to room temperature, then recharge it through halving the charging current.
9. Check the hydrometer state once every hour during battery charging. The green battery hydrometer indicates that the battery has been fully charged, and stops charging at this time.
10. Coat the terminal with Vaseline after the charging is completed, to prevent galvanic corrosion.

Precautions for Battery Charging

1. Never charge two batteries in series.
2. Maintain a ventilated environment during charging, and charge at a normal temperature.
3. If acid is sprayed from the battery vent during charging, the charging shall be stopped immediately.
4. Charge the battery in well-ventilated area, and pay attention to the electrical safety.
5. Any battery that leaks or has a broken housing, shall rather be scrapped than recharged.
6. Any battery that has a broken terminal, shall rather be scrapped than recharged.
7. Any battery that is inflated or bulged for over-discharge or overcharge, shall rather be scrapped than recharged.
8. If the battery voltage does not change after being charged for a period of time, check whether the charging cable is well connected, the joint point is clean, or the charging voltage reaches 16V.

Steps of Troubleshooting for Battery Fault

The machine is in braking state, while the shift control lever is in neutral position. The densimeter mounted inside the battery cover is green. The test in this step need assist of partner.

1. Turn the negative switch to position "O".
2. Turn the digital multimeter to 50V of voltage position.
3. Connect the red probe of DMM to the positive terminal of one battery, while the black probe to the negative terminal of the other battery. Be sure not to connect them to the cable terminals. The value displayed on the DMM shall be controlled within "24" to "32" V.
4. Keep the two pointers of the digital multimeter still. Turn disconnect switch to position of "I". Switch on the electric lock and start the diesel engine.
5. The value displayed on the DMM is between "20" to "24"V at the moment the cranking motor starts running. The value returns to that described in step 3 once the diesel engine starts smoothly.

Any battery that is capable of completing the above steps and successfully starting the diesel engine, is in good service condition; otherwise, test according to following steps.

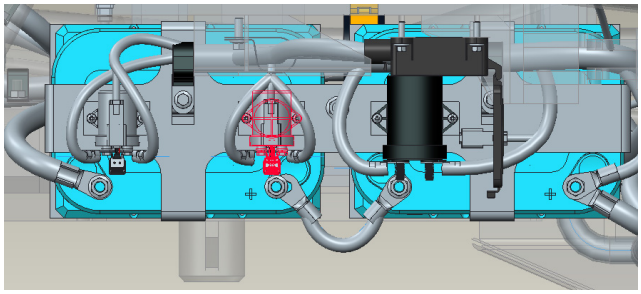
1. Disconnect all the battery connecting cables, thereby, two batteries are completely disconnected.
2. Turn the digital multimeter to 50 V of voltage position.

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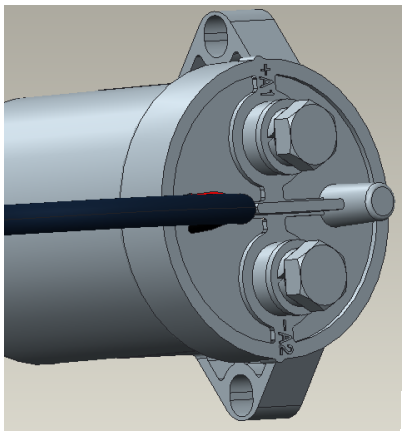
3. Connect the red probe of DMM to the positive terminal of one battery, while the black probe to the negative terminal, the value displayed on the DMM is around "12" to "16" V.
4. Inspect the other battery according to step3. The displayed value is the same as the step 3. Any battery that fails to implement the test procedures, shall be charged or replaced.

Power Relay

The machine is equipped with one relay for power control, besides, other than normally closed contacts, a group of normally open contacts is also provided. Both the relay parameters and internal schematics are labeled on the relay housing. The rated current of normally open contacts on the relay contact circuit is 100A. Apply +24 V voltage to the relay coil, then the electromagnetic force generated by the energized coil attracts the armature inside the relay, whereby, the normally open contracts switch on.



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P24E00016

Precautions

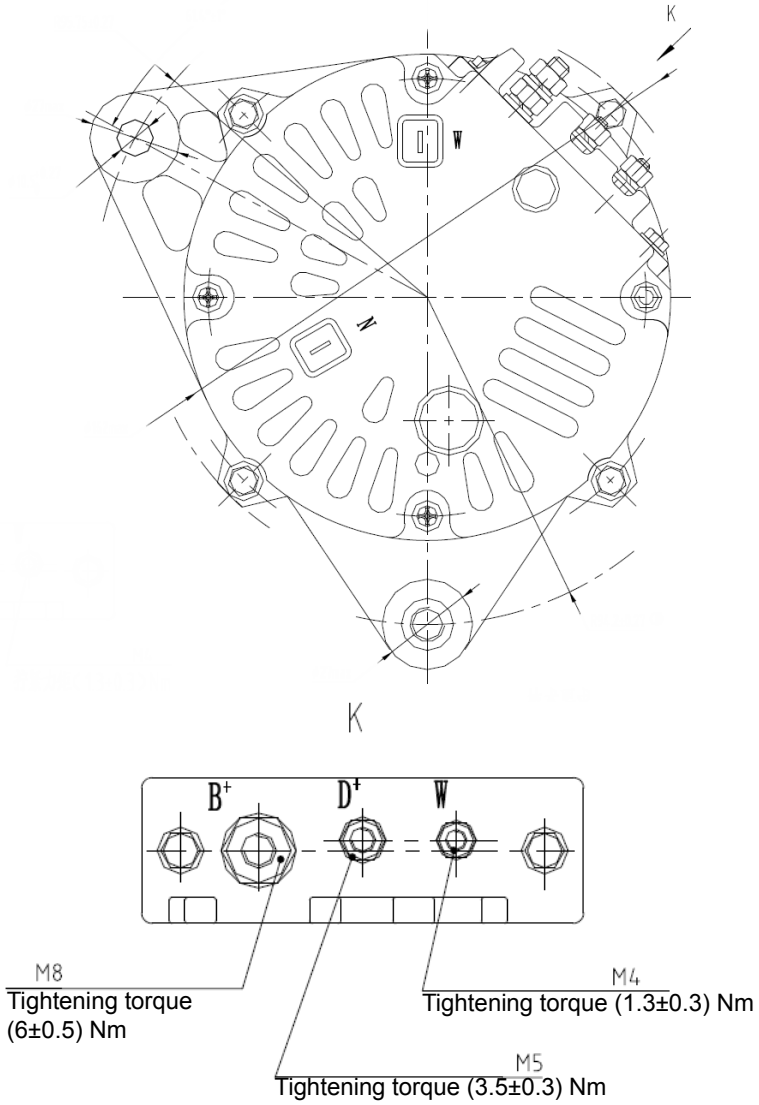
+A1 indicates the current input direction, and -A2 shows the current output direction. In the case of connection error, the inoperative magnetic blowout function of contactor will shorten its service life.

Alternator

As the main power unit of the complete machine, the alternator translates the energy from diesel engine into serviceable electric energy of electrical equipment. The electrical components are configured for 24V/70A, with electronic voltage regulator equipped inside. The alternator is connected in parallel with the battery to power the complete machine. The battery supplies power to the electrical components before the diesel engine starts; then after it starts, alternator powers the electrical components while charging the battery. Once the energy of alternator fails to meet the needs of the electrical components, the alternator and battery jointly power the complete machine.

This machine uses three terminals of alternator, i,e. 1. B+; 2. W; 3. D+. Where, terminal B+ is the alternator positive pole, terminal W is the negative pole and terminal D+ is the alternator work signal indicating terminal.

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P24E00017

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Precautions

The alternator of the machine is strictly prohibited to power the electrical equipments on the machine separately in the absence of battery.

Metal tools or other metal conductors shall be kept away from the "B +" terminal and "E" terminal of alternator during operating the diesel engine. In order to avoid short-circuit. Short circuit on the engine will lead serious results.

Troubleshooting Procedures of Alternator

Differing from the introduced fault detection methods for other components, the alternator fault detection is implemented on the complete machine, which shall not be removed for individual inspection.

The following detection steps are inapplicable to the cases where the battery is fully charged and the terminal voltage reaches 25V above.

1. Turn the digital multimeter to 200V of voltage position.
2. Turn on the disconnect switch of machine, but do not start the diesel engine. Connect the red probe of DMM to the "B +" terminal of alternator, while the black probe to the "W" terminal, to note down the value displayed on the DMM.
3. The normal value is about 24-25 V.
4. Start diesel engine, step on accelerator, follow the measuring method described in step 2, and note down the value on DMM again. Such value shall be higher than the measured value in step 2, whereby, the alternator is in normal condition.

The above test steps shall be implemented on unloaded complete machine (unload: the condition that the electric lock is switched on, yet all the electrical switches or components on the machine are switched off).

If the value on DMM is unchanged through the tests in steps 2 and 3, switch off the electric lock to inspect the alternator as per the following steps.

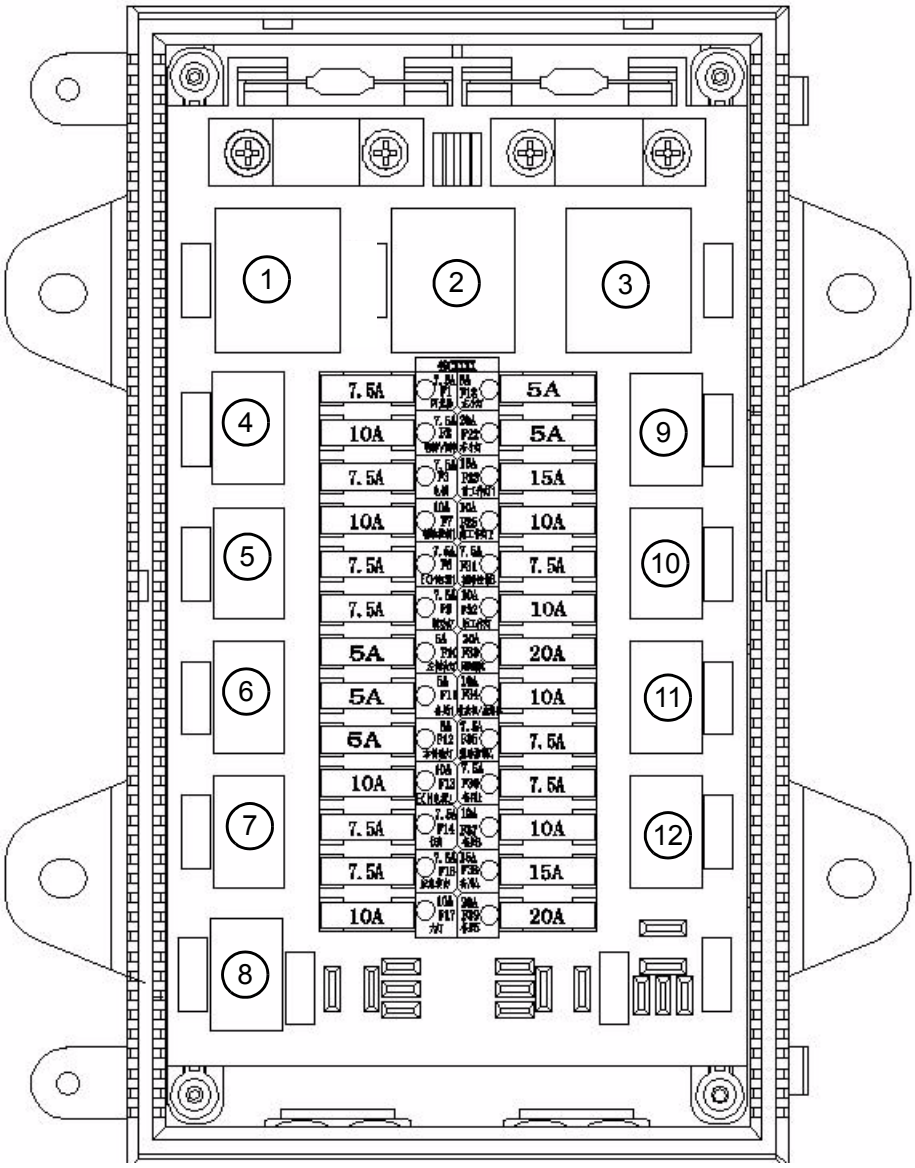
1. Check the transmission belt of alternator in accordance with the methods introduced in the manual. Readjust if it is too loose.
2. Check the security of alternator terminal, and fasten it with a wrench if necessary.

If the above-mentioned methods fail to solve the problem, please contact maintenance service sites of LiuGong and SDEC.

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Central Control Box

The centralized control box, located in the control box, consists of chip fuse and socket relay. The fuse location and function have been mentioned above. The following figure is the location and function chart of the socket relay and the subsequent chapters will not describe repeatedly the location and function definition of the socket relay.



P24E00018

1. Flash relay
2. A/C relay
3. ECM
4. G Relay
5. Back-up alarm
6. Brake light
7. Neutral start interlock
8. Aux
9. Rear wiper 1
10. Rear wiper 2
11. D Relay
12. Frame alignment display

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Steps of Troubleshooting for Relay Fault

1. Remove the relay from the relay socket.
2. Turn the digital multimeter to 2KΩ at the Ω position.
3. Connect the red probe of DMM to the relay terminal "86", while the black probe to terminal "85", the value displayed on DMM shall be around "300Ω" thereby.
4. Turn the digital multimeter to 200Ω of Ω position.
5. Connect the one probe of DMM to the relay terminal "30", while the other to terminal "87", the value displayed on DMM shall be "1" thereby.
6. Apply +24V external power (+) to the terminal "86" of relay, while (-) pole to terminal "85"; on the other hand, connect one probe of DMM to the terminal "30" of relay, the other probe to terminal "87", thereby, the DMM displayed value shall be "0".

After completing the above steps, if the display values on DMM conform to that described in the steps, the relay is in good service condition.

The above steps are inapplicable to the operating contacts where the abrasion is very severe.

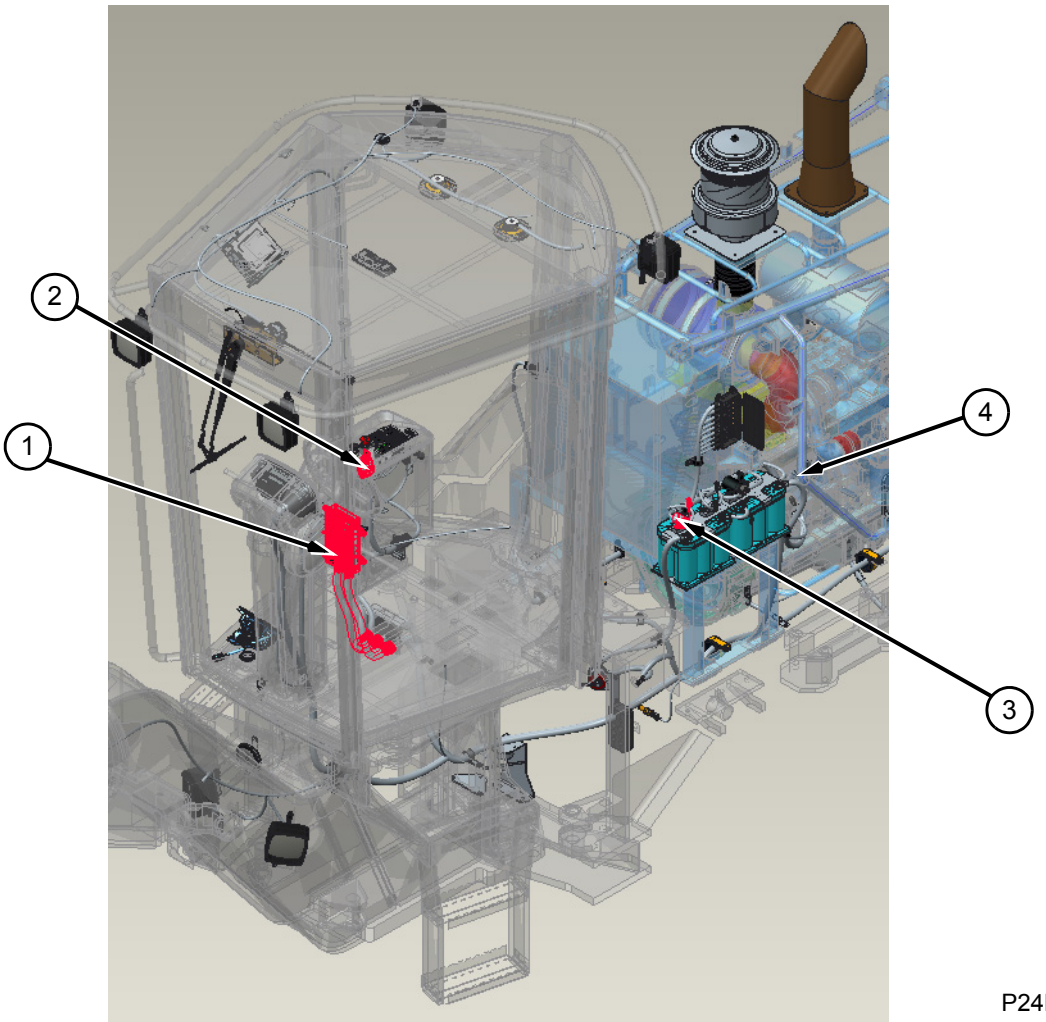
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Start Stop System

Components of the System and Position

The components of the start stop system consists of electric lock (2), start contactor (3), controller relay (1), starter motor (4), etc.

Location diagram



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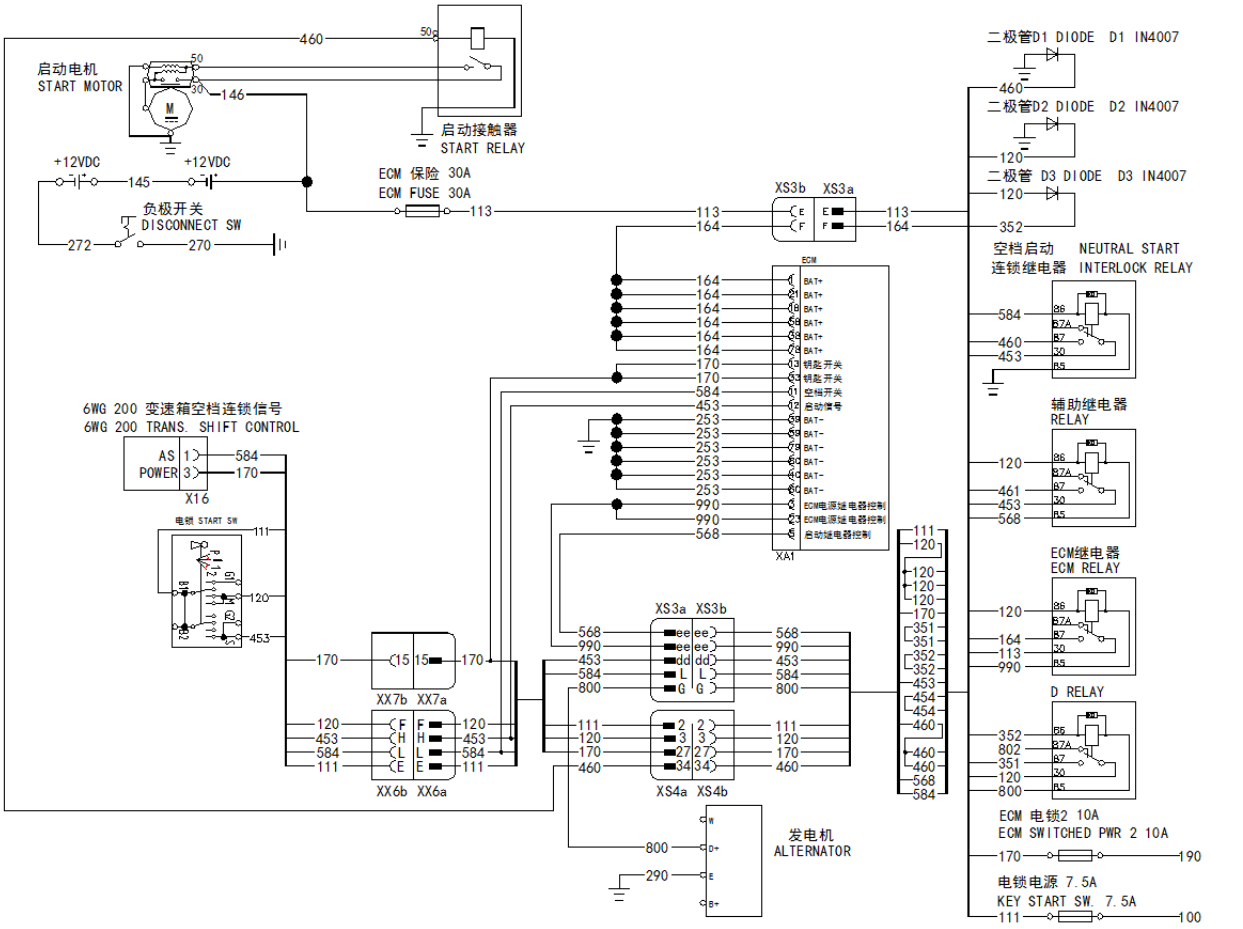
Function Introduction

The start stop system control starting and stopping the engine of the complete vehicle. When the electric lock is turned to START position and the transmission is in neutral gear, the current via the control circuit will make the starter motor rotate so as to drive the engine to start. When electric lock is closed, the engine ECM blacks out, there is no oil injection again, therefore, the engine shuts down and stops operating.

Schematic Diagram of Flameout and Start-up System

Analysis of the schematic diagram

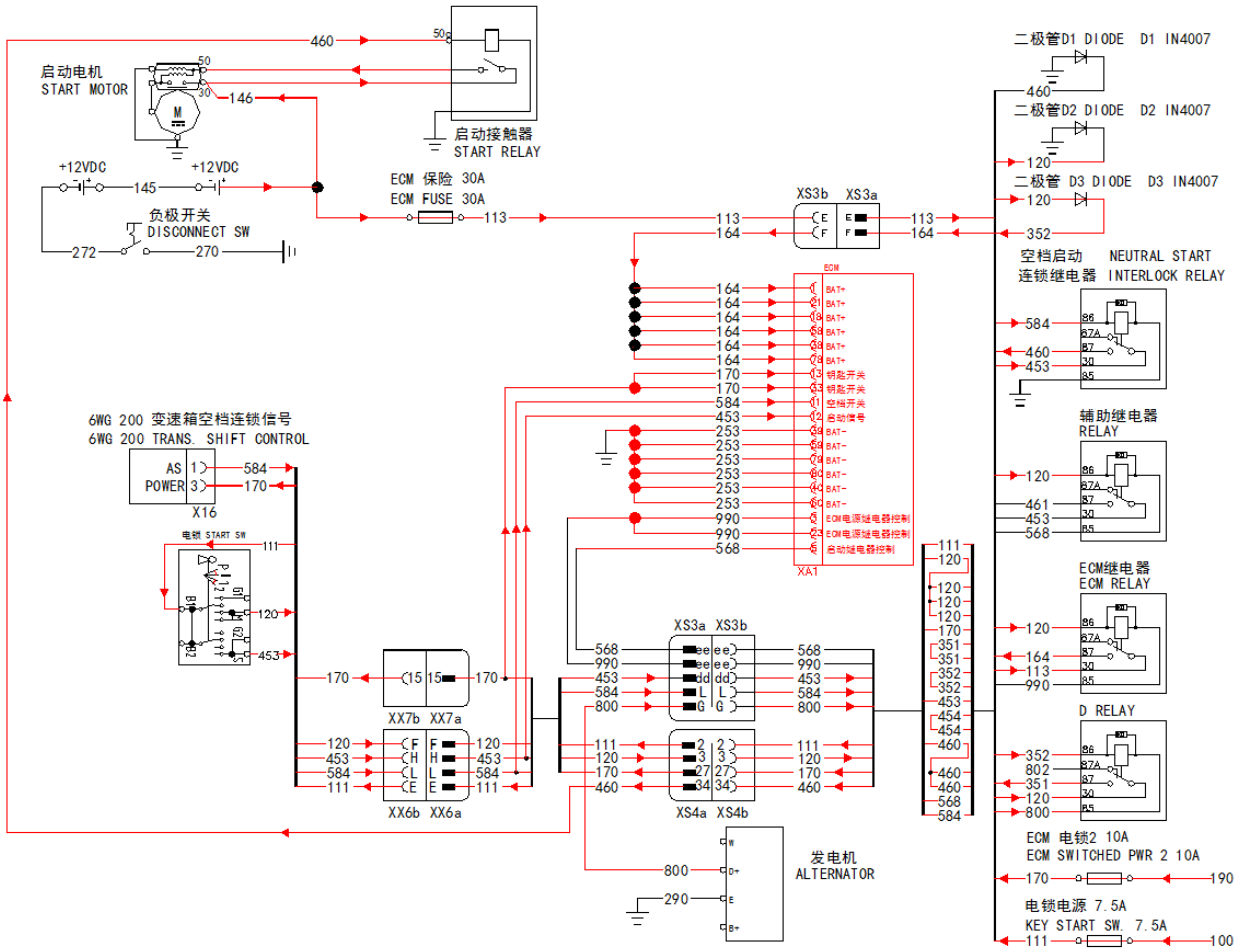
1. Turn on negative switch and switch electric lock to "ON", the analysis of the schematic diagram hereof can be found in the power supply system;
2. For neutral gear signal and start-up signal, high level is valid, when the signal is valid, it is valid to start the control signal, the action of the neutral interlock relay switches on 30, 87 feet, the complete machine can be started.



P24E00020

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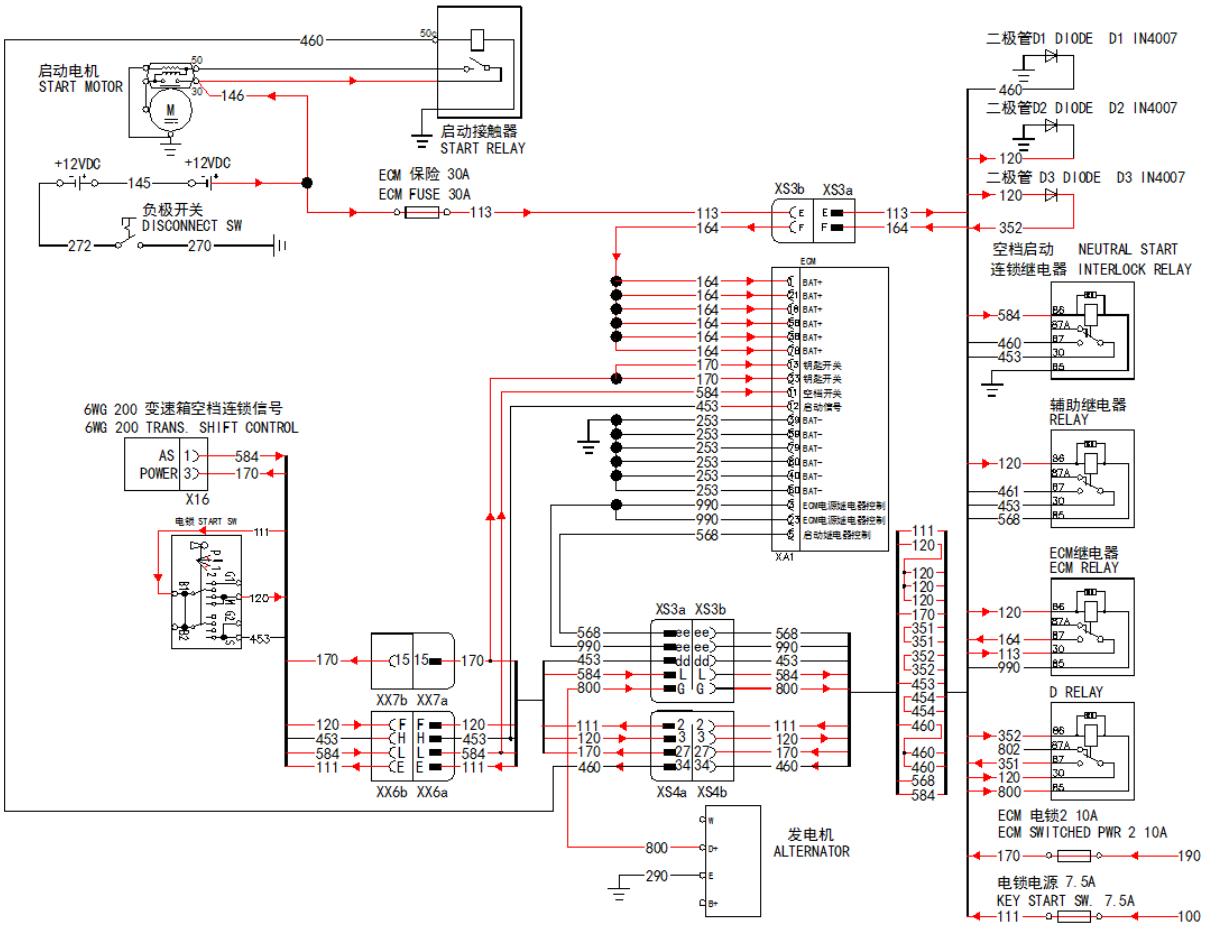
3. After the electric lock is rotated to START;



P24E00021

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4. Start the complete machine successfully, release electric lock and return to ON gear from START gear; the process of positive pole start-up is finished.

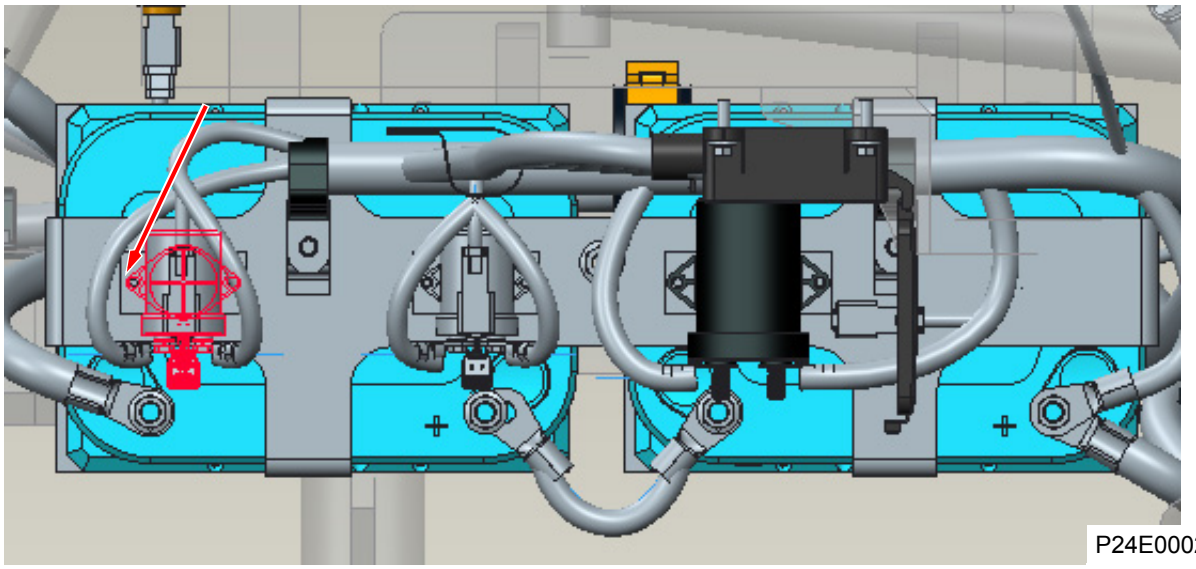


P24E00022

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Start Contactor

Start contactor used in the complete machine of this configuration is installed on the battery in the engine hood. This contactor only has a group of operating contacts, which are normally open contacts. Apply +24V voltage to the contactor coil, and the generated electromagnetic force drives the internal armature to switch on the operating contact-normally open contact against the spring force. Whereby, the external circuit, of which the rated load current is 100A, is connected. Disconnect +24V applied voltage to the contactor coil, the contactor recovers to reset condition.



P24E00023

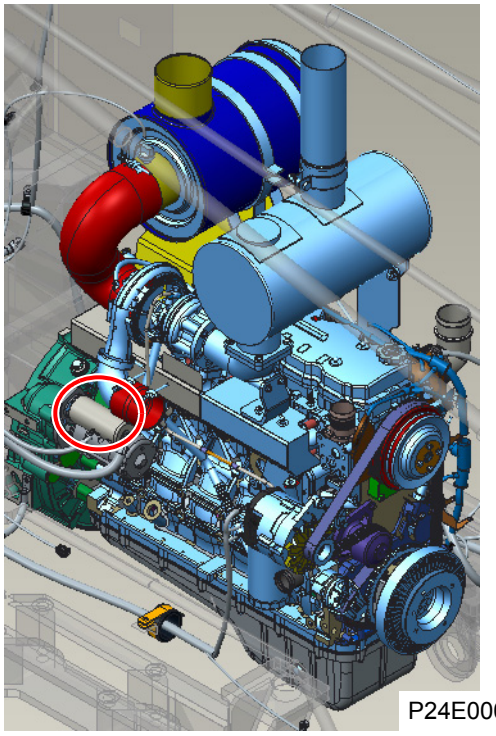
Relay

Relay which is used in starting flameout circuit is installed in the centralized control box, which can refer to the part for centralized control box in the manual, which are not described herein.

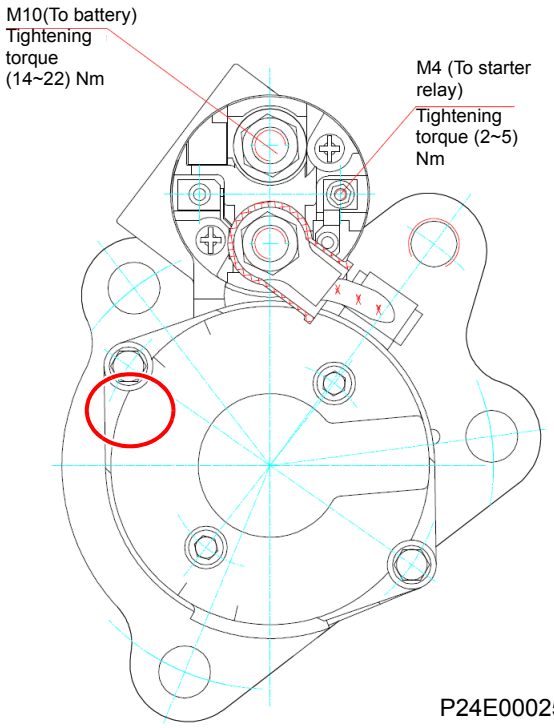
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Starter Motor

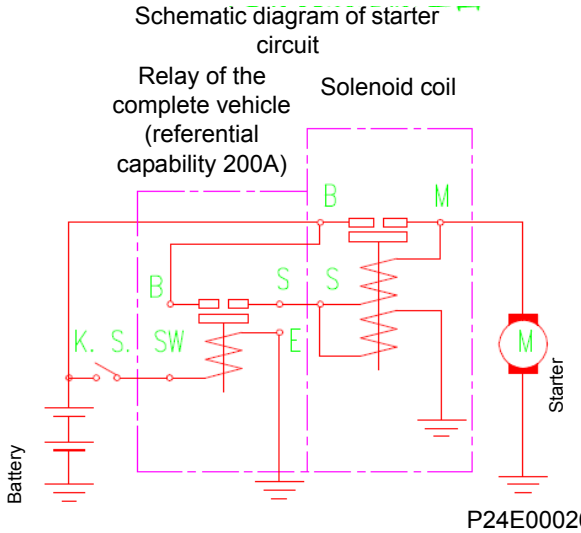
The parameter of starter motor equipped in this machine is 24V/8kw. The DC motor within the starter motor translates the electrical energy of battery into mechanical energy, whereby the internal transmission gear drives the motor flywheel to start the engine.



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P24E00025



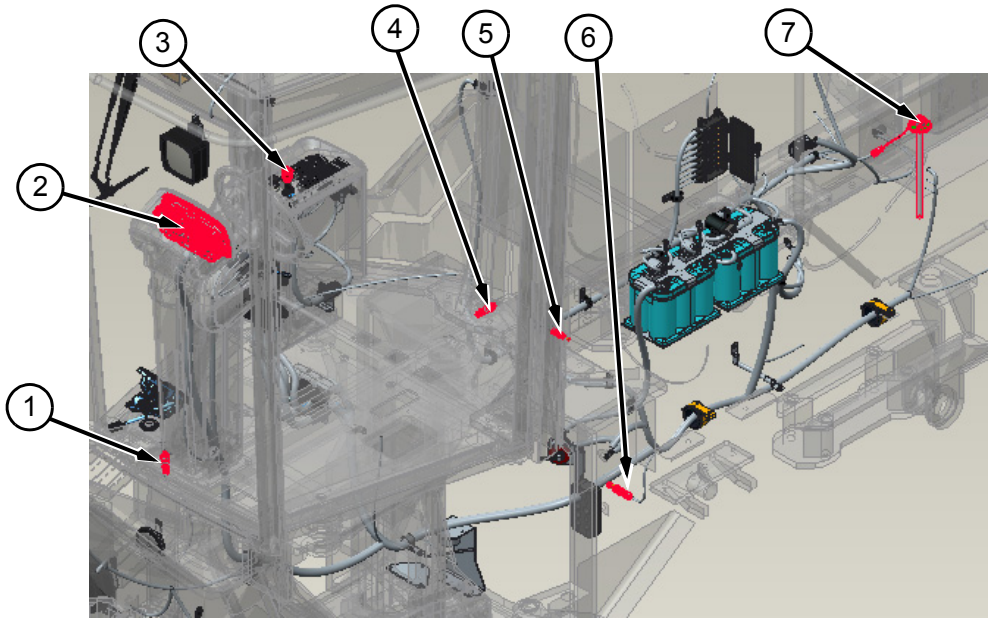
P24E00026

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Monitoring System

Inspect Components of the System and Position

Detection system includes instrument (2), fuel level sensor (7), service brake pressure switch (1), parking brake switch (3), transmission oil temperature sensor (5), transmission oil pressure switch (4), vehicle speed sensor (6), etc.



P24E00027

Function Introduction

Detect system includes three major parts of detection system of the complete machine, engine detection system and torque converter-transmission detection system, being used for showing operation state of parts.

Monitoring System Schematic Diagram

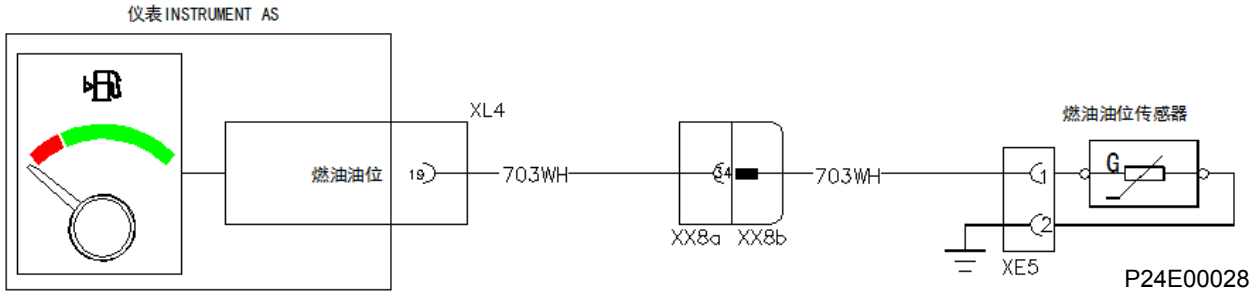
Schematic of monitoring system is divided into every schematic diagram of monitoring circuit alone, which are not described herein.

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Monitoring System of the Complete Machine

Circuit Diagram for Fuel Level Indication

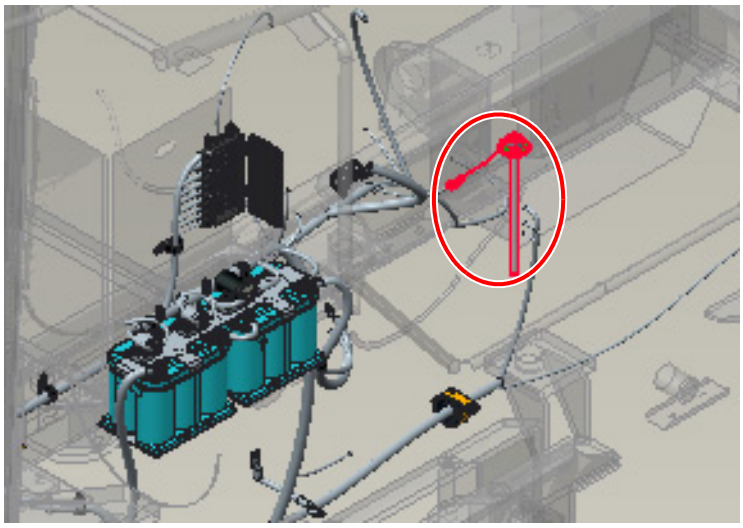
It is used to monitor the oil quantity of diesel tank.



P24E00028

Fuel Level Sensor

Floaters are applied in the sensor, which shift up and down along with the oil level of the fuel tank. The floater influences the resistance value passing through the sensor. Once the circuit is connected, the characteristics of resistance changing with oil level are converted to that of voltage varying with oil level. The changing voltage signal enters into the microcontroller of combination instrument, which outputs signal through the operation processing of microcontroller, to drive the stepping motor-type instrument for oil level indication.



P24E00029

Precautions

Switch off the electric lock, and replace the fuel level sensor until the machine is completely cooled. When replacing, prevent foreign matters from getting into the diesel tank.

Test steps of fuel oil level sensor faults

1. Disconnect the wiring harness of fuel level sensor and the wiring harness of the complete vehicle;
2. Remove the fuel level sensor from the fuel tank;

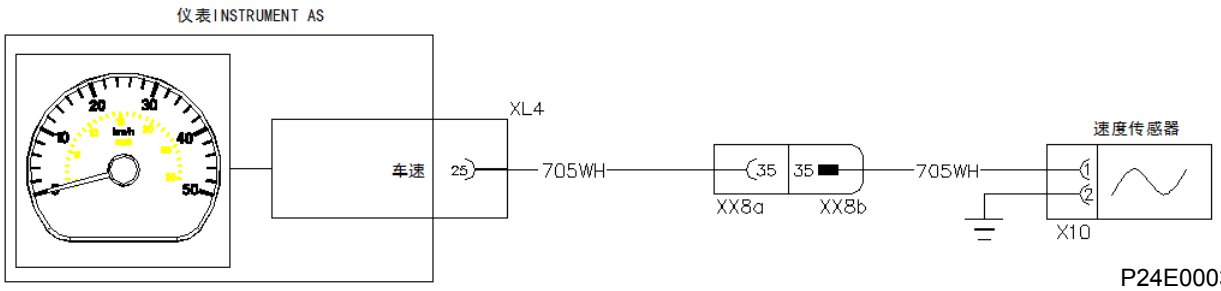
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3. Turn the digital multimeter to 200Ω of Ω position;
4. Connect the red probe to the terminal at #1 hole site of the sensor connector, while black probe to #2 hole site;
5. Measure the varied resistance values of fuel level sensor corresponding to the different positions of the floater;

Technical parameters (Floater falls to the bottom, and conduct rise test)		
Fuel level position H (mm)	**Gears**	**Resistance (Ω)**
48	Full level	68
94	8/9	136
146	7/9	204
197	6/9	272
249	5/9	340
300	4/9	408
353	3/9	476
405	2/9	544
462	1/9	612
>462	Vacancy	680

Wiring Schematic Diagram of Speed Indicator

For monitoring the machine speed condition. The output speed sensor, installed on the gearbox housing, is used to detect the speed of gearbox output gear. The speed sensor consists of coil, permanent magnet and pole. The coil is wound outside the pole, and the pole is connected with the permanent magnet. The magnetic field is formed around the permanent magnet, magnetic lines of force pass through air gap and act on the teeth of gear, forming a closed magnetic circuit. When the gear is rotating, the magnetic field acts on the tooth gap and tooth repeatedly, so the change in air gap is sometimes big and sometimes small; the flux changes with the air gap, and the changing flux induces sinusoidal signal in the coil, which is in proportion to speed. Connect to ZF harness, followed by being processed in the electrical control unit, the processed signal therefrom is sent to the instrument.

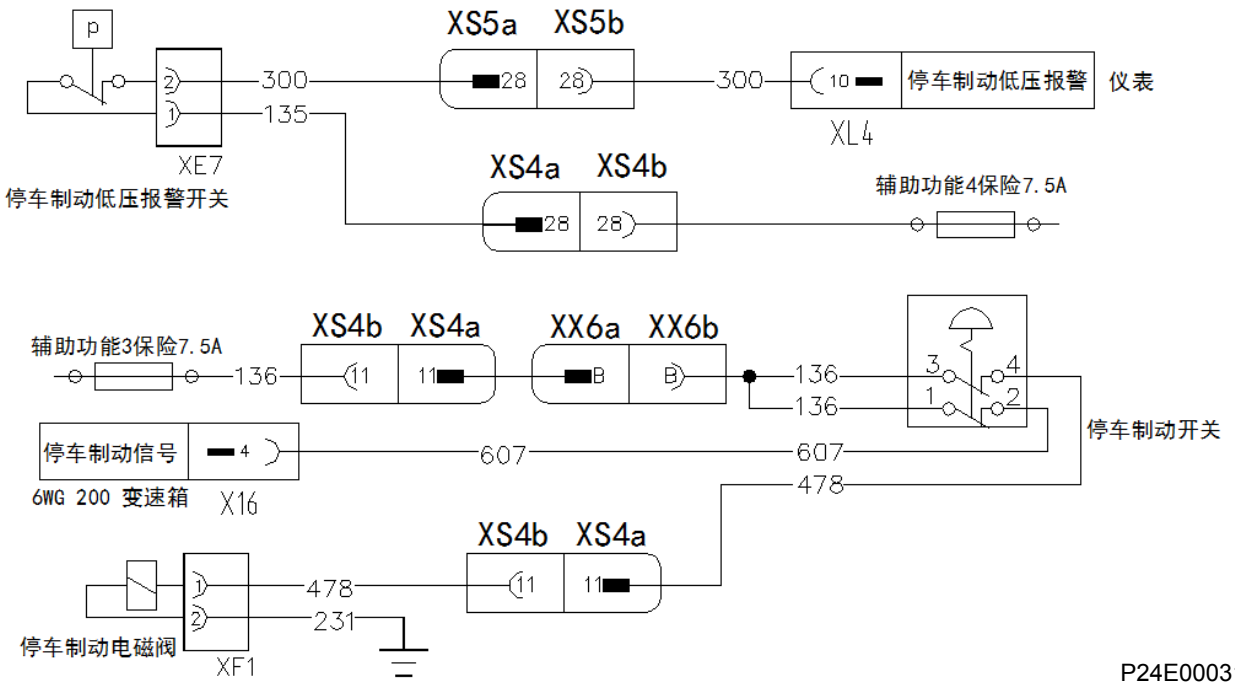


P24E00030

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Wiring Schematic Diagram of Parking Braking

Parking brake: Press the parking brake switch, parking brake solenoid valve blacks out, the fuel pressure of parking brake lines falls, low pressure alarm switch is closed, instrument parking brake low pressure alarm switch is on.



P24E00031

Parking brake button

Parking brake switch: the switch consists of button and two contact modules (all are normally closed), when the button is pulled up, normally closed contact modules are on; when the button is pressed, normally closed contact modules are off.

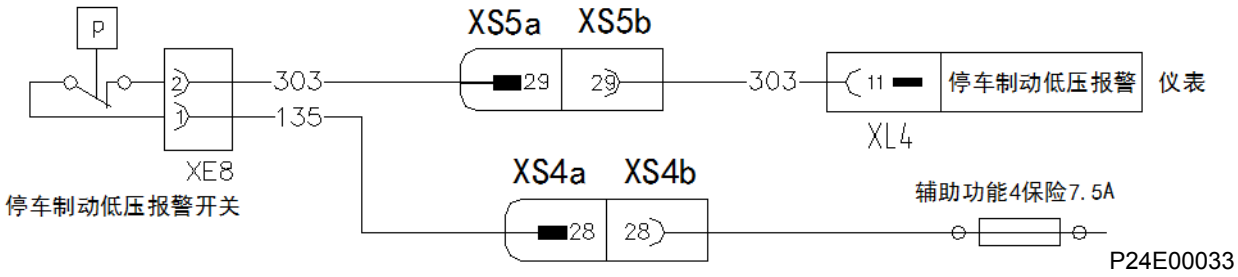


P24E00032

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Wiring Schematic Diagram of Service Brake

Service brake: Depress the brake pedal, when the service brake low pressure alarm switch turns on, and the service brake low pressure alarm on the instrument turns on.



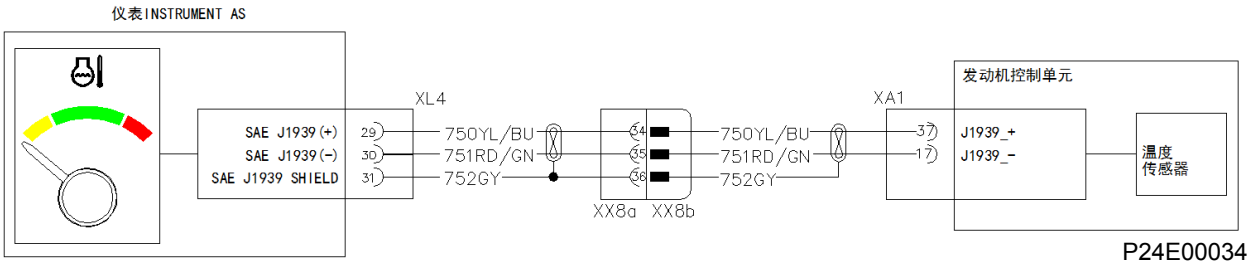
Service Brake Pressure Switch

Parameters for service brake pressure switch are as follows:

Operating value	Connecting thread	Action mode	Contact attribute	Connector type
0.5MPa	NPT1/8	Up	NO	DT04-2P

Monitoring System of the Engine

Circuit Diagram for Engine Water Temperature Indication



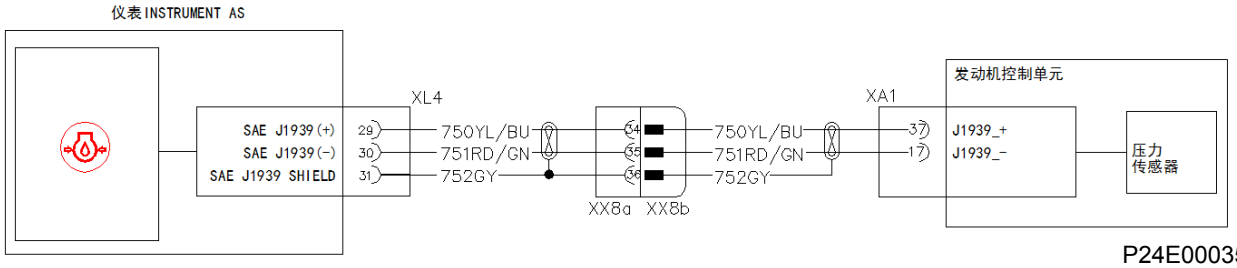
This machine uses electric injection engine whose ECM sends the water temperature (WT) signal to the meter by CAN bus. The meter microcontroller processes information after reading WT data, and finally to actuate the engine water-thermometer.

Water Temperature Sensor

The machine uses electric injection engine, water temperature sensor of the engine is included in the engine, for details, please refer to attachments, such as operation manual, etc.

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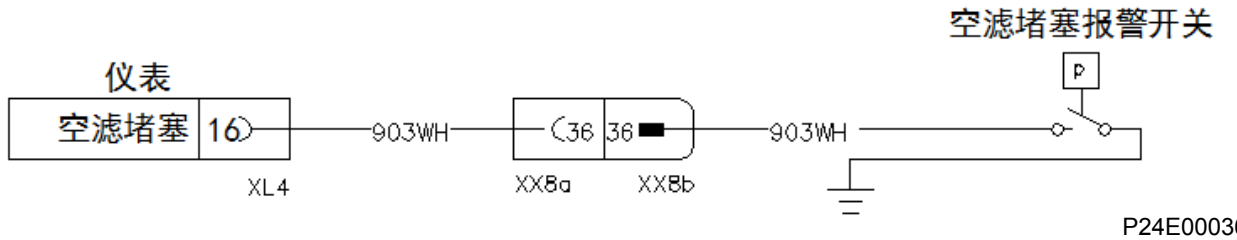
Circuit Schematic of Engine Oil Pressure Alarm



P24E00035

This machine uses electric injection engine whose oil pressure signal is acquired and processed by ECM. If ECM decides the oil pressure falls below a specified value after processing, it will send alarm signal to the meter by CAN bus. The microcontroller actuates the appropriate alarm indicator light to ON after reading this signal.

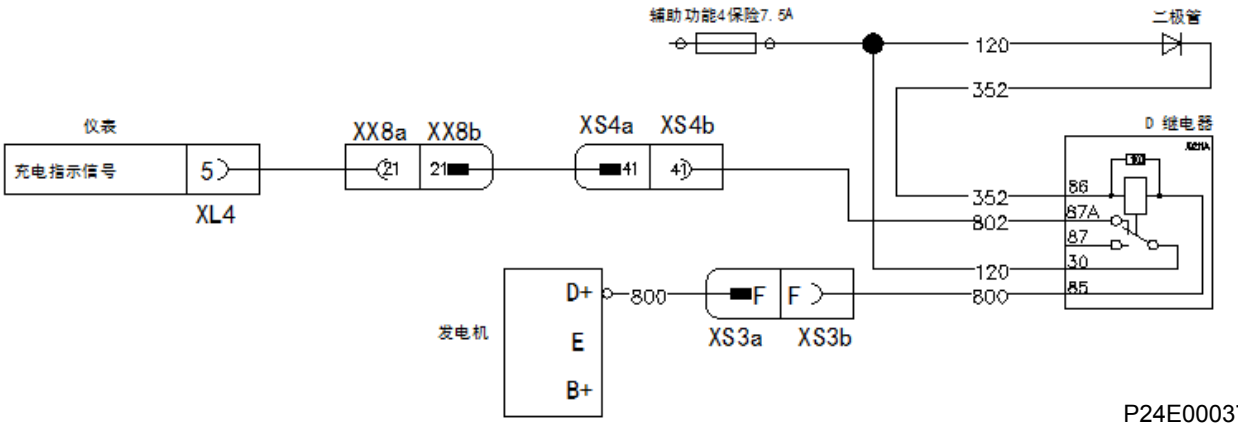
Circuit Diagram for Air Filter Blockage Alarm



P24E00036

The intake air filter alert indicator is lit if the intake resistance exceeds 6.3KPa. The type of air filter blockage alarm switch is normally open.

Circuit Diagram for Engine Charging Indication

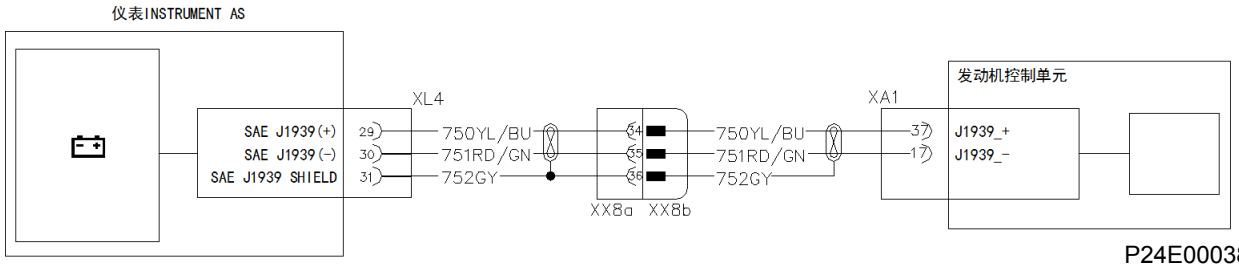


P24E00037

It is used for monitoring whether the alternator supplies power to the external circuit after the machine starts. The indicator goes out, which means the engine is in the state of supplying power outward.

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Circuit Schematic of Voltage Indicator

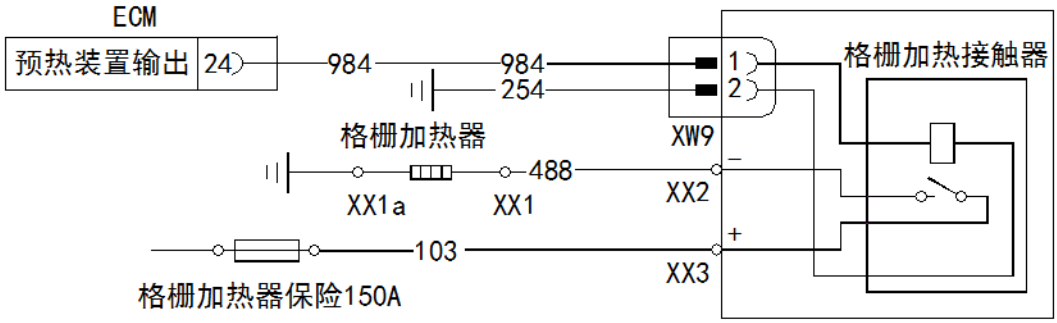


P24E00038

For monitoring the machine system voltage, lights when the machine power voltage is lower than 24.8V, extinguishes when within 24.8-29.5 V, lights when within 29.5-31.5 V, and blinks when greater than 31.5V.

The machine uses electric injection engine whose ECM sends the voltage parameter of complete machine to the meter by CAN bus after monitoring and reading. The meter judge the range of voltage by analysis of CAN agreement, eventually to control the ON/OFF of voltage indicator.

Schematic Diagram of Grid Heater Wiring



P24E00039

The machine uses electric injection engine, when the engine detects that ambient temperature needs start the function of the grid heating, ECM will output the signal to grid heating contactor, contact points of the contactor turns on to start the function of heating for grid heater power supply.

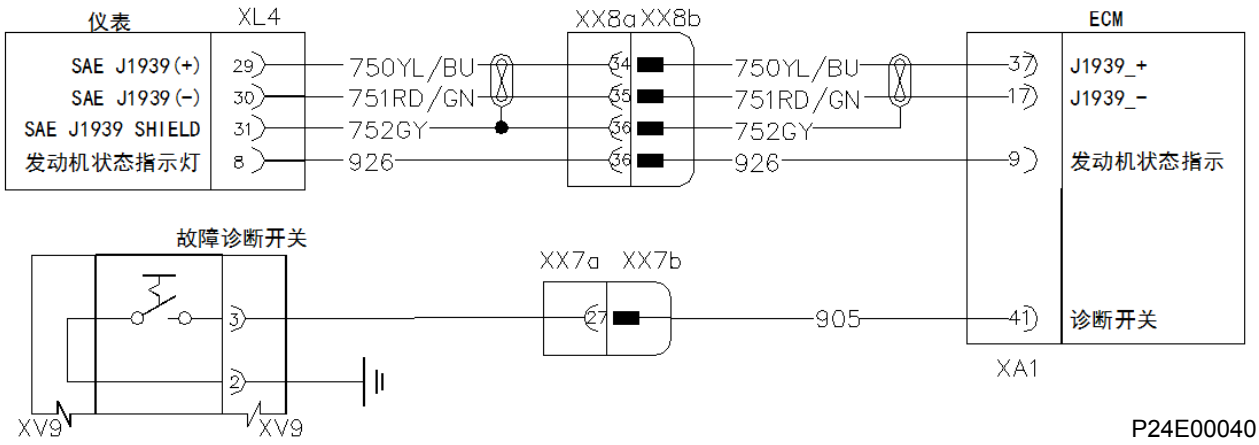
Grid heater contactor

The type of grid heating contactor used in the machine is JCC200/1C24.48A, parameters are as follows

Model	Rated voltage of contacts	Rated current of contacts	Rated voltage of coil
JCC200/1C24.48A	48V	200A	24V

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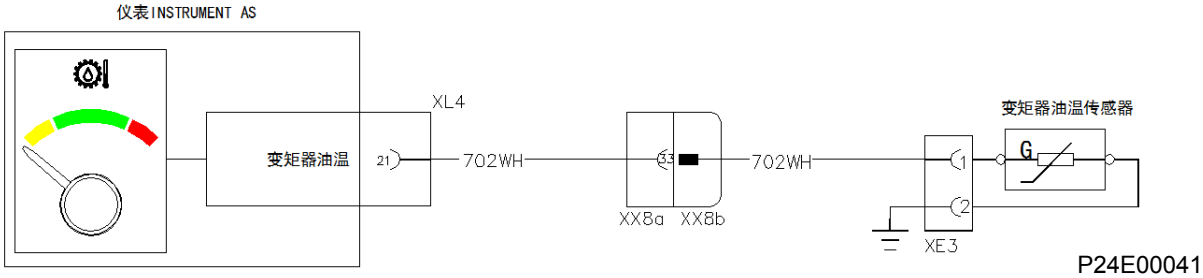
Circuit of Engine Alarm Indicator



This machine uses electric injection engine, operation state code of the engine will be sent to the instrument via CAN bus, the instrument shows operation code on the LCD screen by analysis of CAN agreement, there is fault diagnosis switch on the control box panel, after the switch is pressed, the signal will be sent to the engine ECM, by this time, the state indication function of the engine ECM will be activated, open the engine state indicator of the instrument to make the indicator flicker.

Torque Converter & Transmission Monitoring System

Circuit Diagram for Torque Converter Oil Temperature Indication



The temperature sensor used in the machine is resistance thermometer of contact type and negative temperature coefficient. The resistance of its internal temperature sensitive elements changes along with the temperature variation of measured medium, and the higher temperature of measured medium, the lower resistance of temperature sensitive elements. Once the circuit is connected, the characteristics of resistance changing with temperature are converted to that of voltage varying with temperature. The changing voltage signal enters into the microcontroller of combination instrument, which outputs signal through the operation processing of microcontroller, to drive the stepping motor-type instrument for temperature indication.

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Oil temp sensor

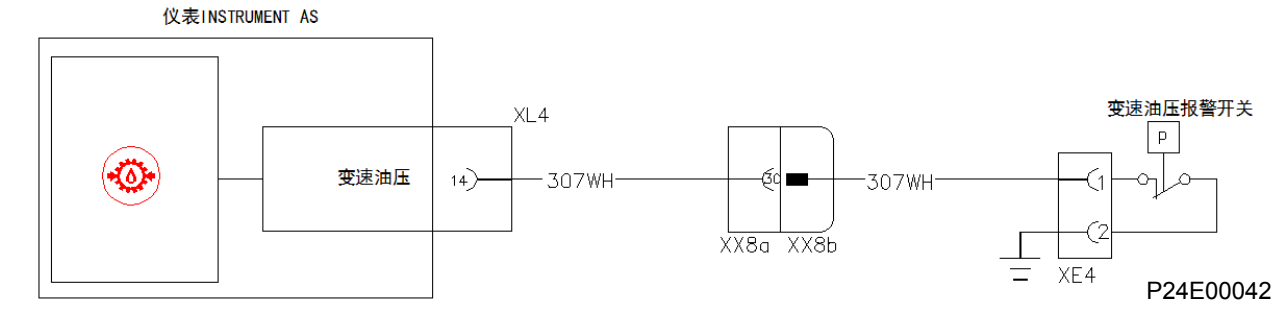
Switch off the electric lock and the machine is completely cooled before replacement of the temperature sensor. Therein, measured liquid overflows once the temperature sensor is loosened, drip pan will be used to collect the liquid in case of causing the pollution for the environment, which shall be supplemented timely after the replacement.

Detection of torque converter oil temperature sensor

1. Unplug the connector (in rear frame wire harness) connecting with the temperature sensor;
2. Disassemble the temperature sensor from the complete machine;
3. Place the temperature probe of temperature sensor into the liquid (water/ torque converter oil), and heat the liquid, to evaluate the temperature sensor performance based on the parameters below.

Temperature(°C)	Resistance (Ω)	Error± %	Min value	Max value
0	33650	8.8	30700	36600
25	10000	7	9304	10700
90	865.5	2.1	847.3	883.7

Circuit Diagram for Transmission Oil Pressure Alarm



For monitoring the pressure value of transmission control valve, the transmission oil pressure alarm indicator is lit once the pressure of transmission control valve is lower than 1.45±0.145Mpa.

Transmission pressure switch

Be sure to switch off the electric lock and wait until the machine is fully cooled, to replace the pressure switch if necessary. Therein, measured liquid overflows once the pressure switch is loosened, which shall be supplemented timely after the replacement.

Test on pressure switch failures

1. Unplug the connector connected to pressure switch in the rear frame harness;
2. Remove the pressure switch from the complete machine;
3. Assess the action value of pressure switch with pressure test bed, and its contact type is normally closed with action value up to 14.5Mpa.

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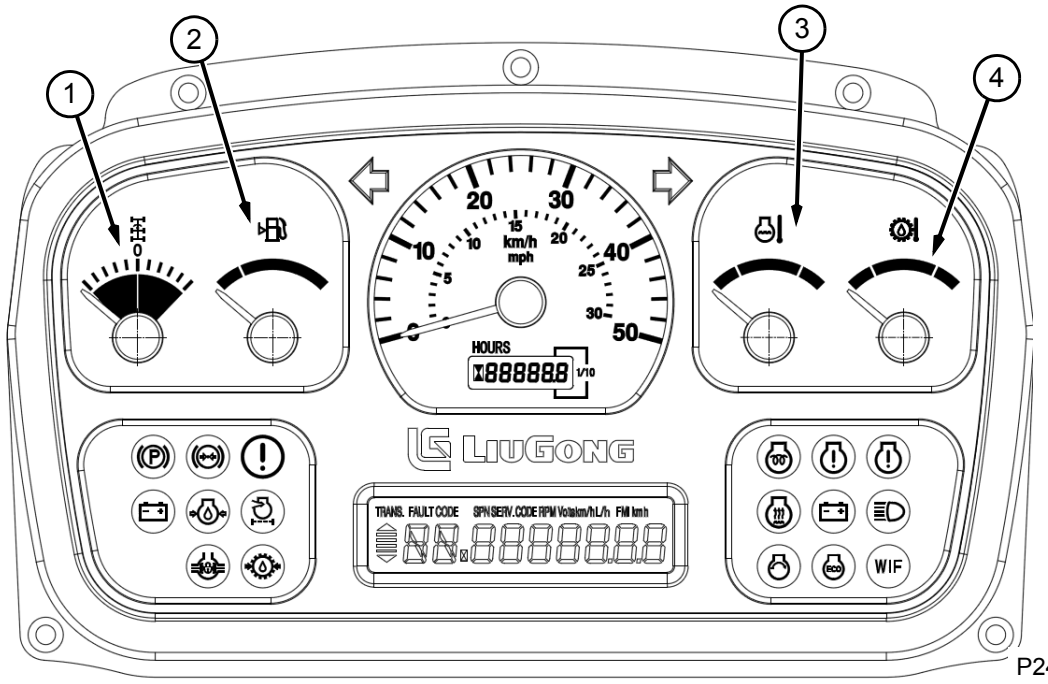
Instrument

The instrument configured for this machine is an main instrument, which is electronic combination instrument.

Main Instrument

Main instrument is divided into three indicator zones: pointer type instrument zone, indicator alarm zone and LCD display zone.

Pointer type instrument zone



P24E00042

No.	Item	Indicating area		
		The first region	The second area (green)	The third area (red)
1	Straight table of the frame	0-27°(yellow)	0-27°(red)	
2	Fuel level gauge	0-0.2 (red)	0.2-1	
3	Engine water temp gauge	40-70°C(Yellow)	70-104°C	104-120°C
4	Torque converter oil temperature gauge	40-60°C(Yellow)	60-116°C	116-140°C

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Indicator alarm zone

No.	Name	Color of the warning light	Whether it flashes or not	The input signal level under normal state	The input signal level under alarm state	Icon
1	Left turn indicator	Green	Yes	Hang	Flashing and intermittent signal	
2	Right turn indicator	Green	Yes	Hang	Flashing and intermittent signal	
3	Front floodlight high beam indicator	Blue	No	Hang	+24V	
4	Differential lock indicator	Yellow	No	Hang	Grounding	
5	Parking brake indicator	Red	No	Hang	+24V	
6	Engine oil pressure alarm lights	Red	No	CAN bus driver		
7	Brake low pressure warning lights	Red	No	Hang	+24V	
8	Transmission oil pressure warning lights	Red	No	Hang	Grounding	
9	Engine air filter blockage indicator	Red	No	Hang	Grounding	
10	Alternator charging indicator	Red	No	Set the D+ or L terminals of the alternator as charging indicating control		
11	"Wait to start" indicator	Amber	No	CAN bus driver		

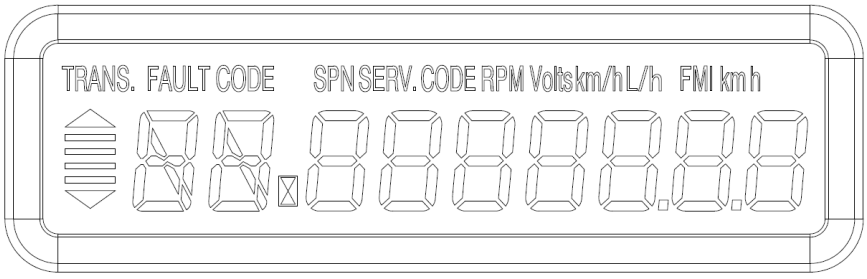
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No.	Name	Color of the warning light	Whether it flashes or not	The input signal level under normal state	The input signal level under alarm state	Icon
12	Heater activated indicator	Yellow	No	Hang	+24V	
13	State indicator	Red	Yes			
14	Voltage indicator	Yellow	Yes	CAN bus driver		
15	Stop indicator	Red	No	CAN bus actuated		
16	State indicator	Amber	Yes	Hang	24V	
17	Water in fuel indicator	Amber	No	CAN bus actuated		WIF



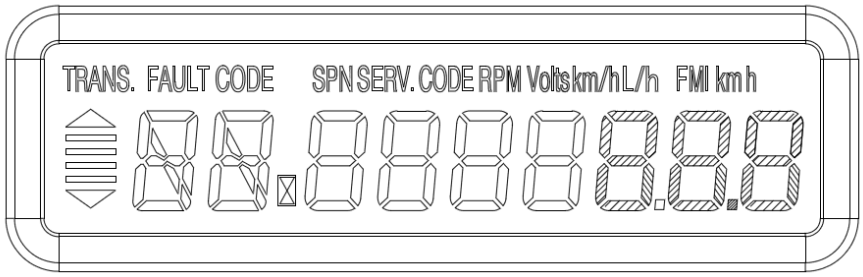
If any one of the parking brake, brake low pressure, engine oil pressure, engine air filter blockage, transmission oil pressure and transmission failure alert indicators is active, the state indicator flickers; when any one of the parking brake, brake low pressure and engine oil pressure alarm indicators is active, and the signal that the engine is activated is detected, the buzzer sounds.

LCD display zone

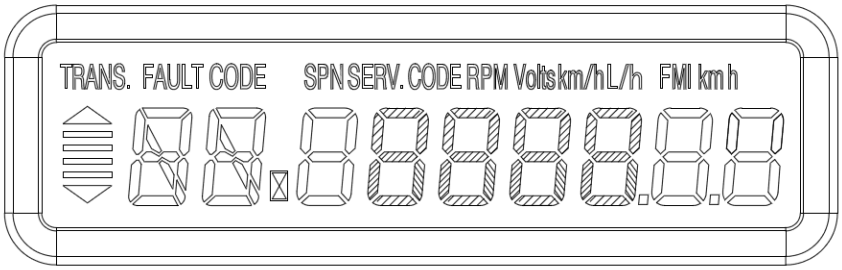


System voltage shows, the field “Volts” turns on, system voltage will show on the LCD

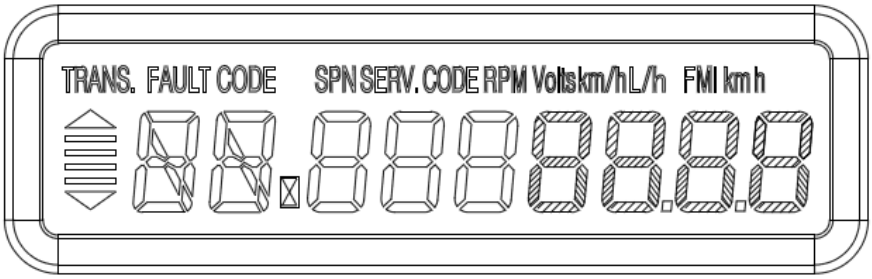
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The operation code of the engine shows, during the operation of the engine, when abnormal state appears, four-digit code will show on the LCD



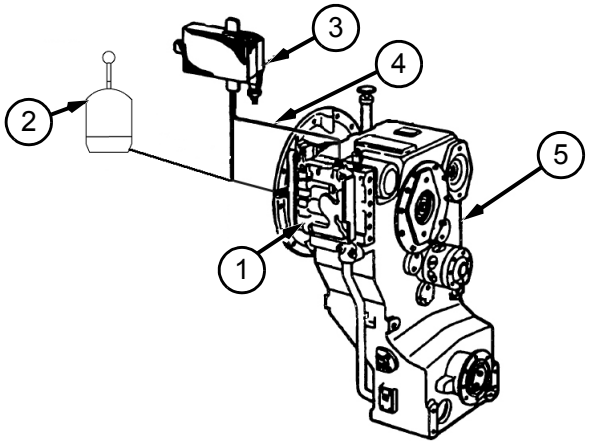
After the engine is started, the last four-digit code of LCD is used for showing the current rotate speed of the engine, unit R/M



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Shift Control System

Components of the System and Position



P24E00044

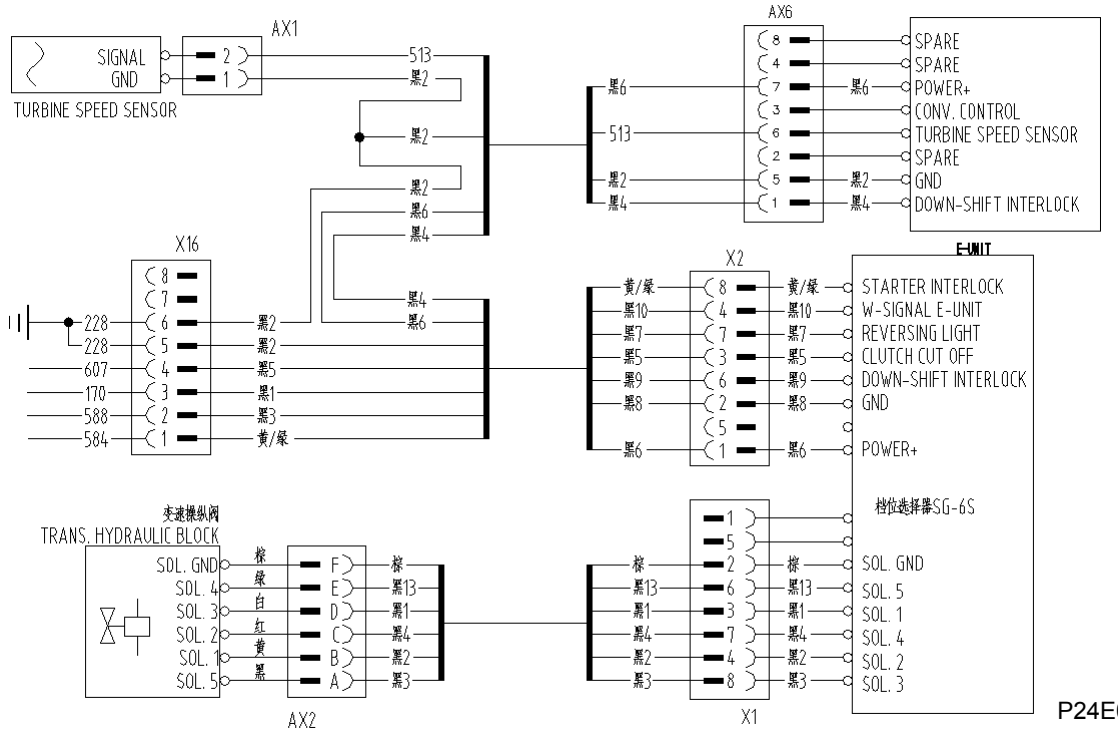
1. Shift control solenoid
2. SG-6S shift selector
3. E module
4. Connect the wire harness
5. Output speed sensor

Function Introduction

For the shift control system, the electrical control part of ZF6WG200 transmission produced from ZF company is mainly introduced. The gear selector output circuit of shift control system drives the combined motions of shift control solenoid located on the gearbox, so as to gain the gear selected by the operator. The gear selector has downshift protection function. If downshift operation is needed when the gearbox is above 3rd gear, the E module controls the opening and closing of shift selector return lock according to the feedback signal of speed sensor, and the downshift operation can be done only after the speed drops below the downshift point of each gear.

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Circuit Schematic Diagram for Shift Control



The output signal of shift selector is determined by the internal circuit, the output signal of different gear controls different solenoid group, and the clutch is controlled through the solenoid so as to control gearbox shift. The shift selector has downshift protection function. When the gearbox is in 3rd gear and 3rd above, the E module starts working, and judges the engine speed through the output speed sensor signal of torque converter turbine; when needed, downshift operation can be done only after the speed is below the downshift speed point of selected gear. Otherwise, the return solenoid of shift selector works, and downshift operation is unavailable. For example, if the speed is above the 3rd and 4th gear shift point when the gearbox is downshifted to 3rd gear from 4th gear, the shift selector cannot be pulled back to forward 3rd gear. The below figure is the shift output signal figure of the shift selector. According to the above figure, the digital multimeter can be used for fault judgment on shift selector.

Function Chart of Output Signals of SG-6S Series Gear Selector (F code)

OUTPUT	FORW.						REV.			N1	N2	N3
	1	2	3	4	5	6	1	2	3	–	–	–
M1							×	×	×			
M2	×	×					×					×
M3	×		×		×							
M4	×	×	×	×			×	×				
M5		×		×		×						
AS										×	×	×
RF							×	×	×			
W			×	×	×	×						

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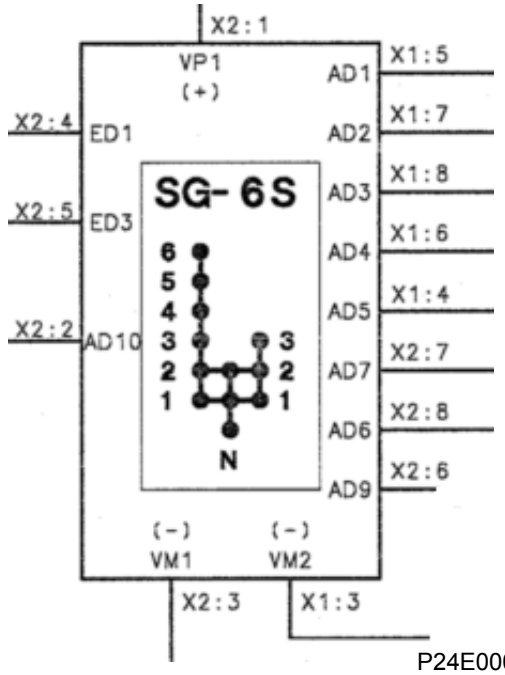
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Electronic Control Unit

Electronic control unit isn't configured for 6WG200 transmission

Shift Selector

Shift selector electrical



P24E00047

- Interface definition

AD1: Solenoid valve 1 (output)

AD2: Solenoid valve 2 (output)

AD3: Solenoid valve 3 (output)

AD4: Solenoid valve 4 (output)

AD5: Solenoid valve 5 (output)

AD6: Neutral start interlock (output)

AD7: E module W signal (output)

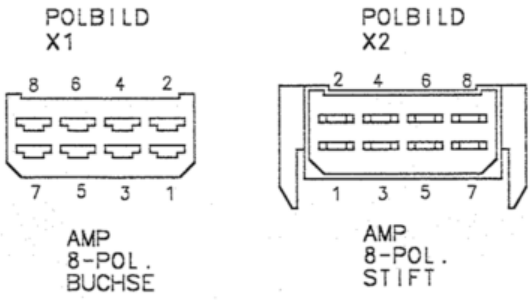
AD9: Backup signal (output)

ED1: Downshift interlock protection (input)

ED3: Clutch disengagement (power cutoff) (input)

- Fault detection of SG-6S shift selector

1. Pin diagram of shift selector X1 and X2 connectors



P24E00048

2. Wiring table of shift selector connector X1

Terminal No.	Signal	Guide wire color
1	Hang	None
2	Hang	None
3	VM2	Brown (earthing cable)
4	AD5	Back 13
5	AD1	Back 1
6	AD4	Back 4
7	AD2	Back 2
8	AD3	Back 3

3. Wiring table of shift selector connector X2

Terminal No.	Signal	Guide wire color
1	Power supply	Black 6 (with 5A fuse)
2	Hang	None
3	VM1	Black 8, brown
4	ED1	Back 9
5	ED3	Back 5
6	AD9	Back 7
7	AD7	Back 10
8	AD6	Green yellow

4. Use the multimeter for detection, and the detection steps are as follows:

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a. Turn off the electric switch lock, remove the mounting bolt of SG-6S shift selector, detect for good earthing, adjust the digital multimeter to ohm 200Ω range, and connect the pens to the No.3 hole earthing wire (brown wire) of X2 connector and to any earthing bolt in cab respectively. In theory, the resistance to earth shall be 0, the actual measured resistance value shall be milliohm level, and the multimeter displays 0.00X or 0.0XΩ; if the resistance value is bigger obviously, check whether the harness is connected reliably and the earthing point is secure.

b. After confirming good earthing, turn on the electric switch lock without starting the engine, adjust the digital multimeter to DCV 200V range, measure whether the lever power is connected normally, respectively connect the digital multimeter pens to the No.1 hole (black 6 wire) and No.3 hole (brown wire) of X2 connector, and the multimeter shall display between "24" and "31"V.

c. Disconnect the shift selector connector X1, and adjust the digital multimeter to DCV 200V range. The following combinations shall be detected when each gear of shift selector is placed (the following abbreviations indicate wire color and wire size): Black 1, Black 2, Black 3, Black 4, Black 5, Black 6, Black 7, Black 8, Black 9, Black 10, Black 13, Brown, Green, Yellow. (Caution: the emergency brake switch must be pulled up! As the complete vehicle is beyond emergency braking state at the moment, the complete vehicle must be parked in a flat road, and chocks shall be placed below wheels to ensure that the complete vehicle will not move.)

d. Place the shift selector to N position, and find out AD6 output +24V voltage signal at N position according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the No.8 hole (greenyellow wire) of X2 connector, and the black pen to the No.3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

e. Place the shift selector to N1 position, and find out AD6 output +24V voltage signal at N1 position according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the No.8 hole (greenyellow wire) of X2 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

f. Place the shift selector to N2 position, and find out AD2 and AD6 output +24V voltage signal at N2 position according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #7 hole (black 2 wire) of X1 connector and #8 hole (greenyellow wire) of X2 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

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g. Place the shift selector to forward 1st gear, and find out AD2, AD3 and AD4 output +24V voltage signal at forward 1st gear according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #6 hole (black 4 wire), #7 hole (black 2 wire), and #8 hole (black 3 wire) of X1 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

h. Place the shift selector to forward 2nd gear, and find out AD2, AD4 and AD5 output +24V voltage signal at forward 2nd gear according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #4 hole (black 13 wire), #6 hole (black 4 wire), and #7 hole (black 2 wire) of X1 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

i. Place the shift selector to forward 3rd gear, and find out AD3, AD4 and AD7 output +24V voltage signal at forward 3rd gear according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #6 hole (black 4 wire), #8 hole (black 3 wire) of X1 connector and the #7 hole (black 10 wire) of X2 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

j. Place the shift selector to forward 4th gear, and find out AD4, AD5 and AD7 output +24V voltage signal at forward 4th gear according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #4 hole (black 13 wire) and #6 hole (black 4 wire) of X1 connector and the #7 hole (black 10 wire) of X2 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

k. Place the shift selector to forward 5th gear, and find out AD3 and AD7 output +24V voltage signal at forward 5th gear according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #8 hole (black 3 wire) of X1 connector and the #7 hole (black 10 wire) of X2 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

l. Place the shift selector to forward 6th gear of forward gear, and find out AD5 and AD7 output +24V voltage signal at forward 6th gear according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #4 hole (black 13 wire) of X1 connector and the #7 hole (black 10 wire) of X2 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

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m. Place the shift selector to reverse 1st gear, and find out AD1, AD2, AD4 and AD9 output +24V voltage signals at reverse 1st gear according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #5 hole (black 1 wire), #6 hole (black 4 wire), #7 hole (black 2 wire) of X1 connector and the #6 hole (black 7 wire) of X2 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

n. Place the shift selector to reverse 2nd gear, and find out AD1, AD4 and AD9 output +24V voltage signals at reverse 2nd gear according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #5 hole (black 1 wire) and #6 hole (black 4 wire) of X1 connector and the #6 hole (black 7 wire) of X2 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

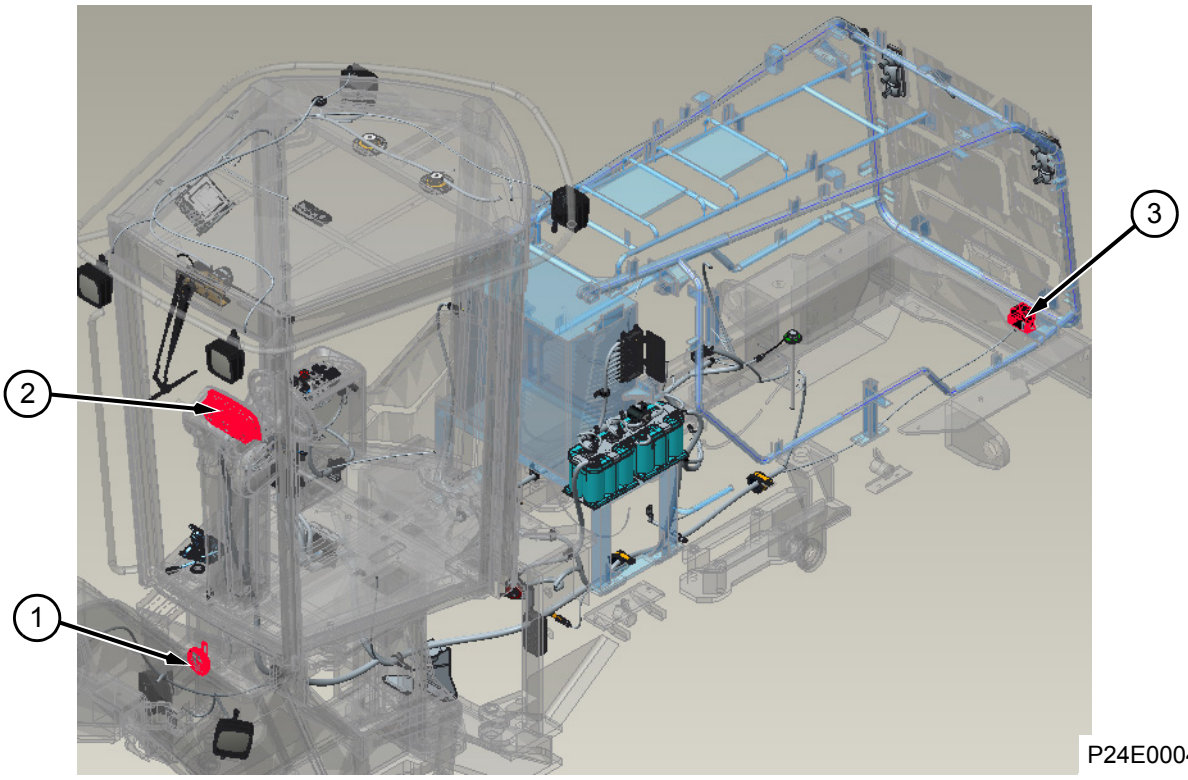
o. Place the shift selector to reverse 3rd gear, and find out AD1 and AD9 output +24V voltage signals at reverse 3rd gear according to the shift output signal figure of shift selector. Adjust the digital multimeter to DCV 200V range, respectively connect the red pen to the #5 hole (black 1 wire) of X1 connector and the #6 hole (black 7 wire) of X2 connector, and the black pen to the #3 hole (brown wire) of X1 connector according to the wiring table of shift selector connector, and the digital multimeter shall display between "24" and "31"V.

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Audible and Visual Alarm System

Components of the System and Position

Audible and visual alarm system includes electric horn (1), backup alarm (3), instrument (2), etc, the figure for position is as follows



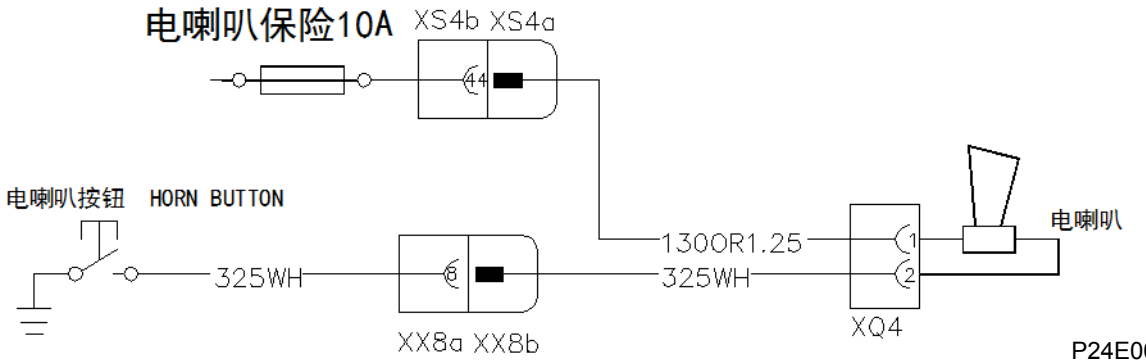
Function Introduction

Audible and visual alarm system includes electric horn, instrument, backup alarm, etc, electric horn is controlled by the switch on the steering wheel, after the switch is depressed, the horn will honk. When alarm signal appears on the alarm indicator zone of the instrument, corresponding alarm indicator will turn on or flash; if there is any light truning on for alarm indicators of parking brake, service brake, engine oil pressure, air filter of the engine being blocked and transmission oil pressure, main fault light will flash; if there is any light truning on for alarm indicators of parking brake, service brake, engine oil pressure, and engine speed signal is detected, the buzzer will honk. When reverse gear of the transmisson is selected with shift selector, backup alarm will work.

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Schematic Diagram of Electric Horn Circuit

Electric horn button of the machine is located at the steering wheel, the schematic diagram is as follows.



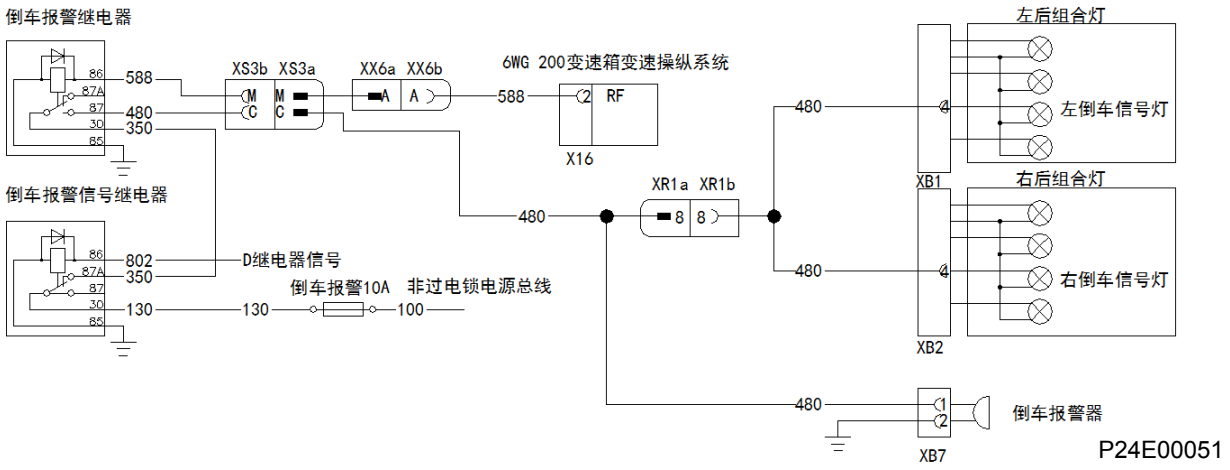
Electric Horn

Electrical parameters: 1. rated voltage 24V; 2. maximum working current 3A; 3. basic frequency 400±20Hz; 4. sound level 105dB-118dB(A)

Steps of electric horn troubleshooting

1. Connect the 24V DC power (+) to the terminal at #1 hole bit of the horn, thereby, while DC power (-) to the terminal at #2 hole bit;
2. Turn on the DC power;
3. The horn alarms at a sound level within 105dB-118dB(A).

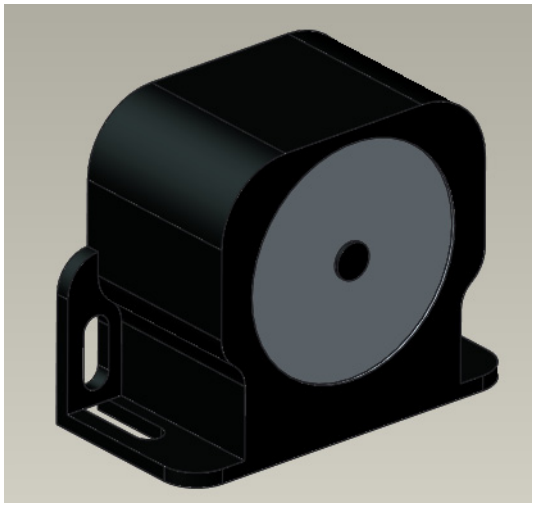
Wiring Schematic Diagram of Backup Alarm



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Backup Alarm

An intermittent buzzer is applied as the backup alarm, which works together with the backup light during the operator's backup operation.



P24E00052

The electrical parameters of backup alarm

1. Rated voltage 24V; 2. working current 0.3A; 3. sound level 107dB±4dB(A).

Detection procedures of backup alarm

1. Connect the 24V DC power (+) to the terminal at #1 hole site of the backup alarm, while the (-) to the terminal at #2 hole site;
2. Turn on the DC power;
3. Back up alarm makes alarm sound and the sound level is in the range of 107dB±4dB(A).

Instrument

For the details ofthe instrument, please refer to this manual, which are not described herein for this part.

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Lighting System

Components of the System and Position

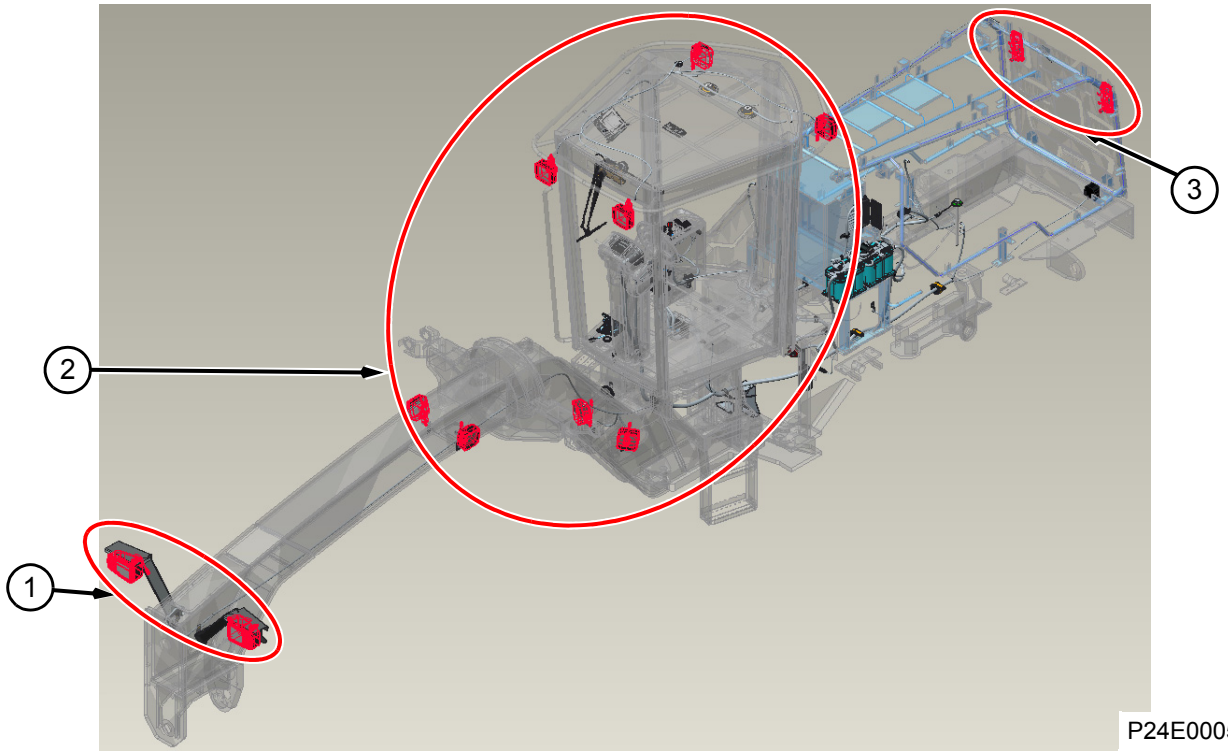
Lighting system includes front combination light (1), work light (2) and rear combination light (3). Position light, turn signal light, backup light and brake light are respectively integrated in the front and rear combination lights.

Function Introduction

The reverse light is used to illuminate the area behind the vehicle when reversing. The brake light is used to alarm vehicles behind that this vehicle is braking.

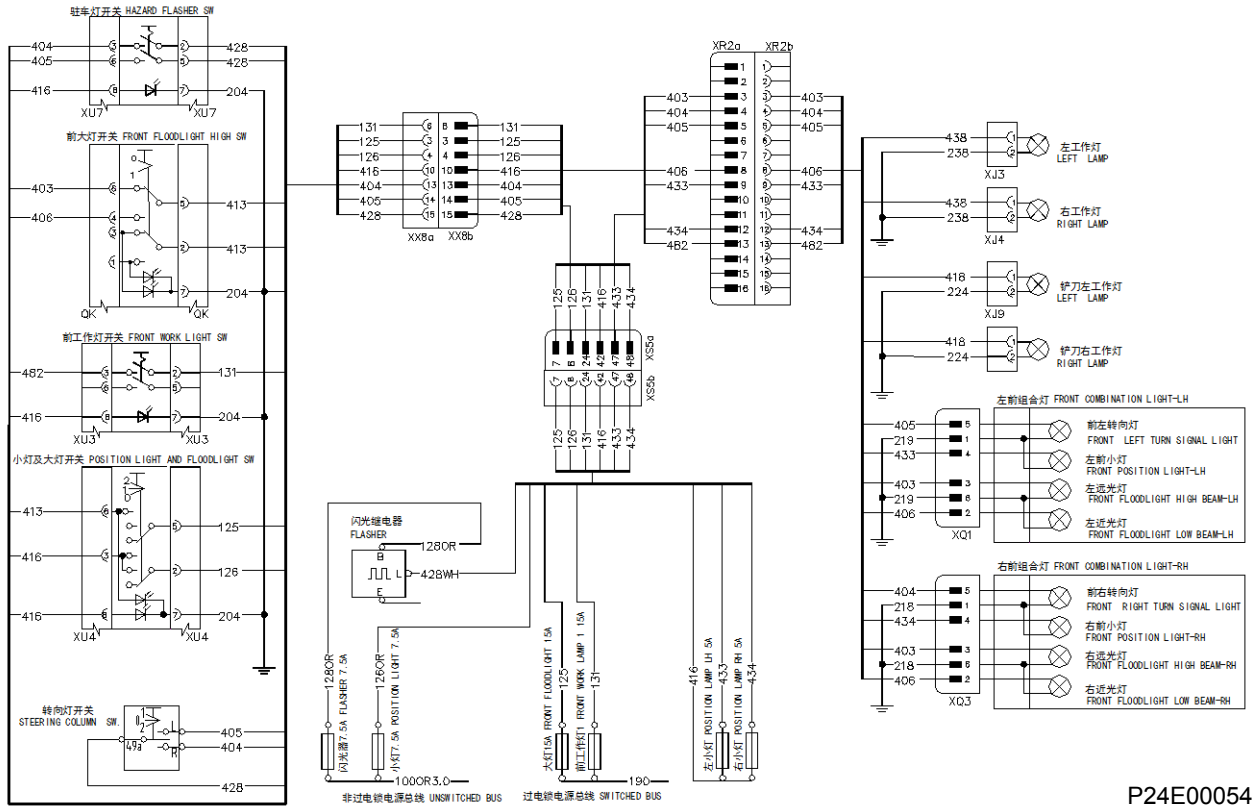
The turn signal light indicates the direction that the machine is turning to, and the potential danger signals (when used as hazard flasher).

The position lights are used for driving or operating at night, which indicate the relative location of the machine. The front headlamp and the rear headlamp are used to illuminate for the whole vehicle driving and working. The working light is mainly applied to lighting of complete machine. Dome light is used for illuminating and reading in the cab at night.



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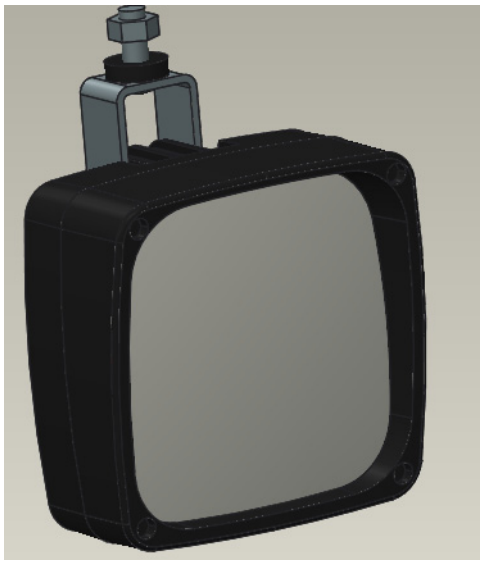
Schematic Diagram of Front Frame Illumination



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Work Light

Eight work lights are configured in the machine, 2 work lights of front frame blade, 2 front work lights, 2 front top work lights, 2 rear work lights, for location diagram, refer to components of the system and position. Electrical equipment parameters: 1. Rated working voltage is 24V; 2. Rated power 70W.



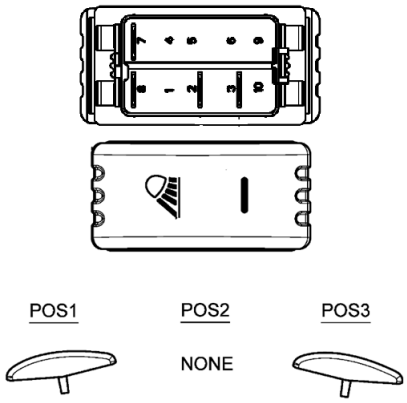
P24E00055

Front Work Light Switch

Front working light switch: POS3 means the work light is turned Off; POS1 means the work light is turned ON.



P24E00056

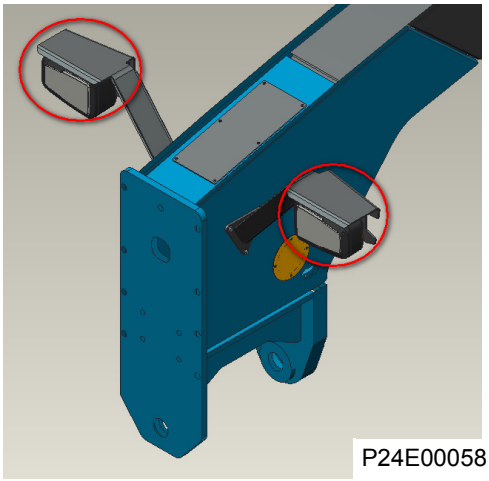


P24E00057

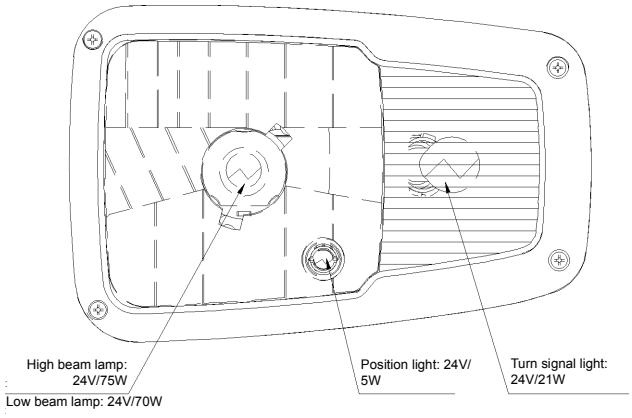
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Front Combination Light

Function of integrated steering, high/low beam and clearance light.

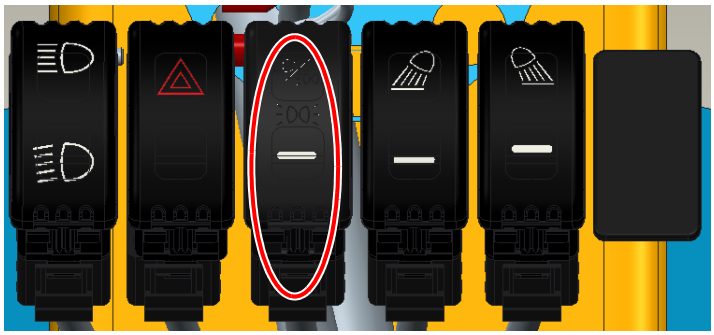


P24E00058

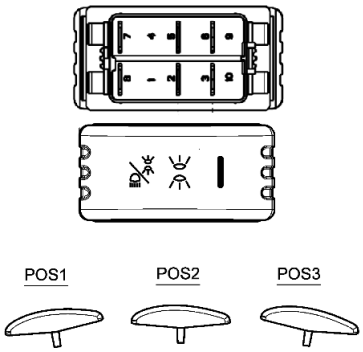


P24E00059

Position Light & Floodlight Switch



P24E00056



P24E00060

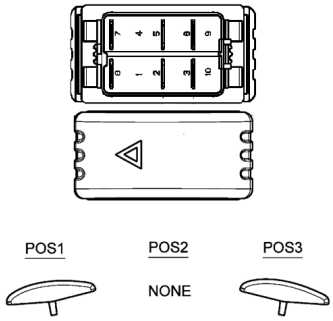
1. Turn the switch to POS3, the lighting function of combination light are shut down.
2. Turn the switch to POS2, the switch beacon, instrument backlight, and the front and rear position lights are lit.
3. Turn the switch to POS1, in addition to the functions in the above-mentioned step 2, the front floodlight is lit. At this moment, select high/low beam through operating the combination lever.

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Parking Lamp Switch



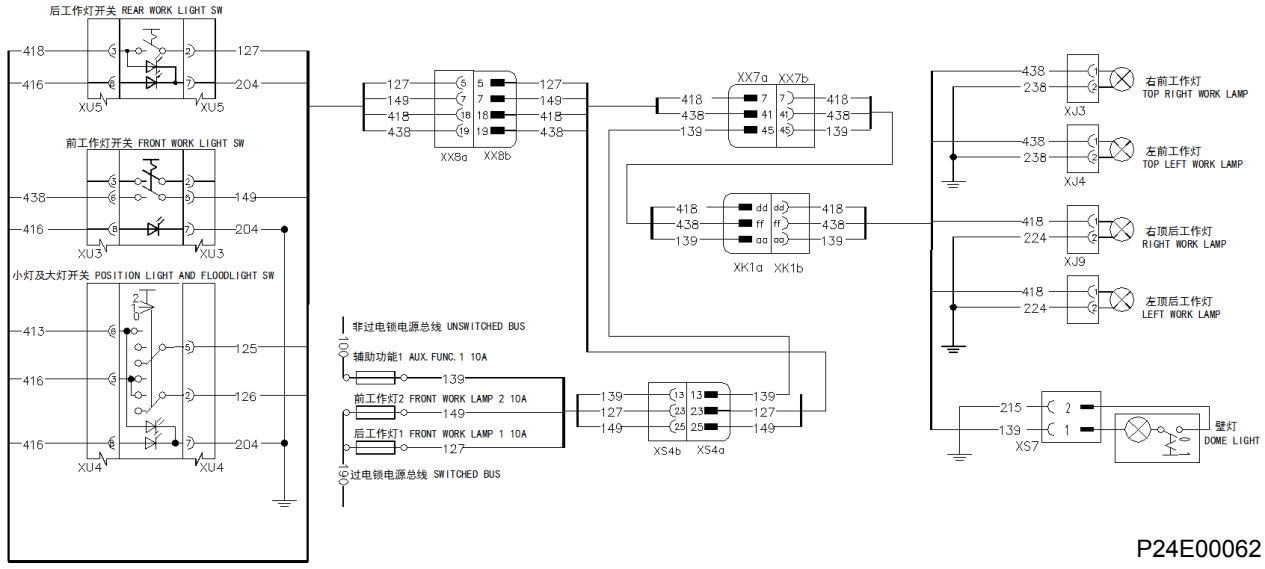
P24E00056



P24E00061

The electrical parameters of cab work light are the same as that of front frame work light, but opposite in installation method, please refer to work light.

Schematic Diagram for Cab Lighting



P24E00062

Work Light

The work light of the cab is the same part with work light of the front frame, please refer to Work Light.

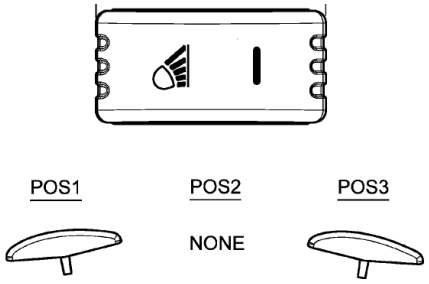
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Rear Work Light Switch

Rear work light switch: POS3 means the work light is turned OFF; POS1 means the work light is turned ON.



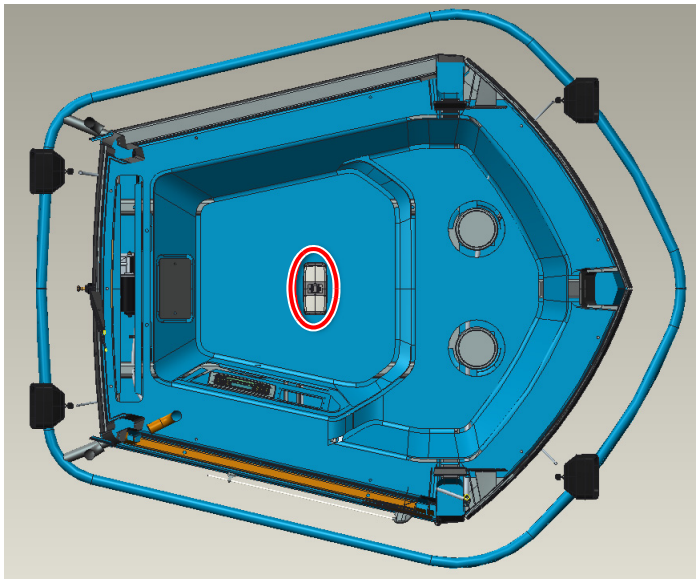
P24E00056



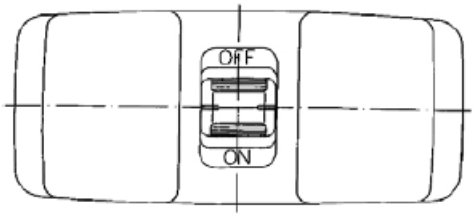
P24E00063

Dome Light

Located at the top of the cab, electrical equipment parameters: 1. Rated working voltage is 24V; 2. Rated power 10W. Including switch



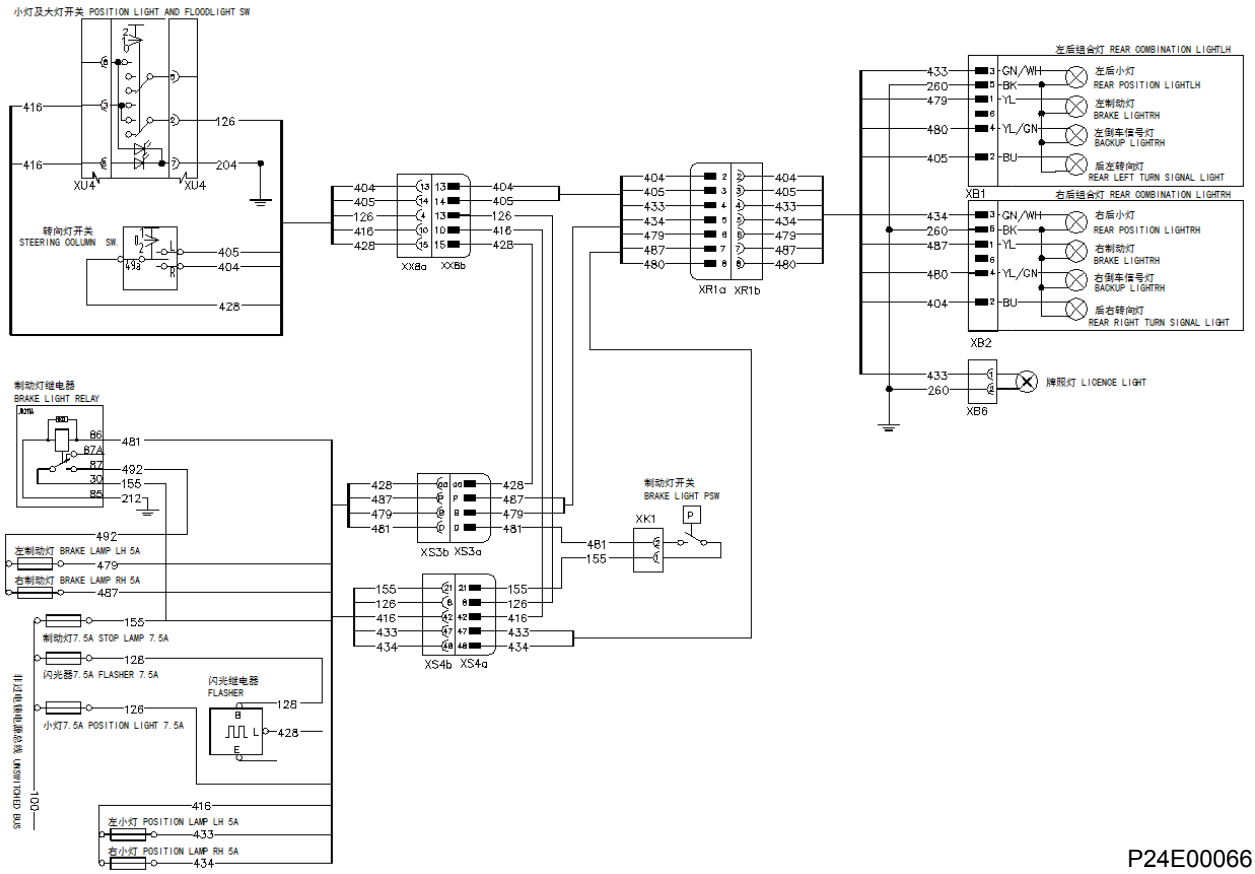
P24E00064



P24E00065

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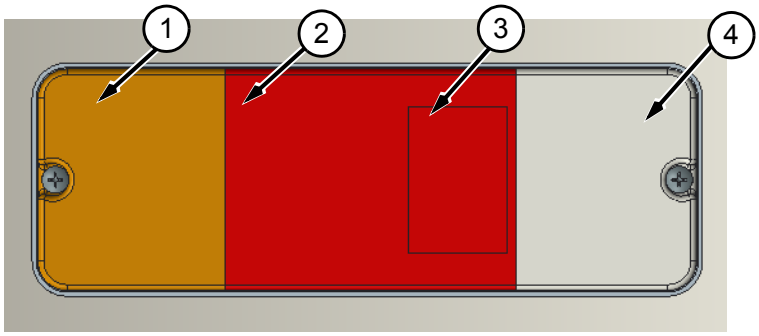
Schematic Diagram of Rear Frame Illumination



P24E00066

Rear Combination Light

Integrate functions of steering, driving/braking and backup light. For the position of rear combination lights, please refer to components of the lighting system and position

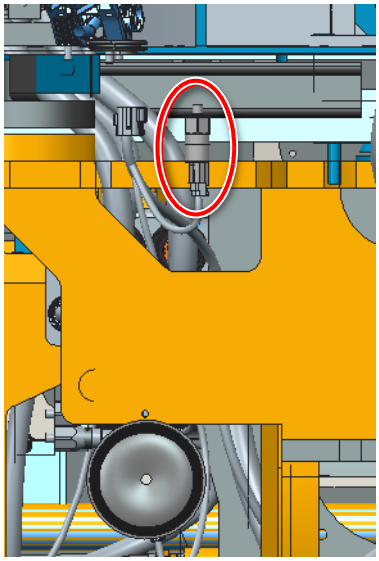


P24E00067

1. Turn signal light
2. Position light/brake light
3. Reflex reflector
4. Backup light

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Brake Light Switch



P24E00068

After pressing the brake pedal, 1. The brake light switch acts, 2. Brake light is lit, 3. Brake light is lit. For schematic diagram, please refer to schematic diagram of rear frame illumination

Precautions

Be sure to switch off the electric lock and wait until the machine is fully cooled, to replace the pressure switch if necessary. Therein, measured liquid overflows once the pressure switch is loosened, which shall be supplemented timely after the replacement.

Test on pressure switch failures

1. Unplug the connector, through which the rear frame harness connects to the engine oil pressure switch;
2. Remove the pressure switch from the complete machine;
3. Assess the action value of pressure switch with pressure test bed, and its contact type is normally open with action value up to 0.15Mpa.

Instrument

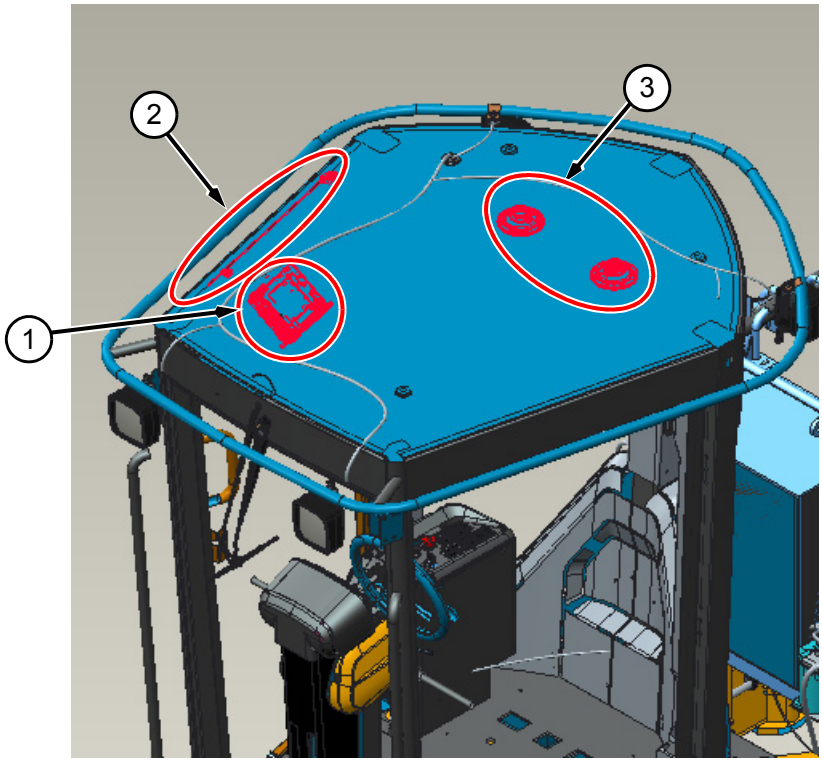
For the instrument, please refer to the instrument

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Audio System

Components of the System and Position

Sound system includes radio-cassette player (1), speaker (3), antenna, etc (2), the position is as shown in the picture:



P24E00069

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Function Introduction

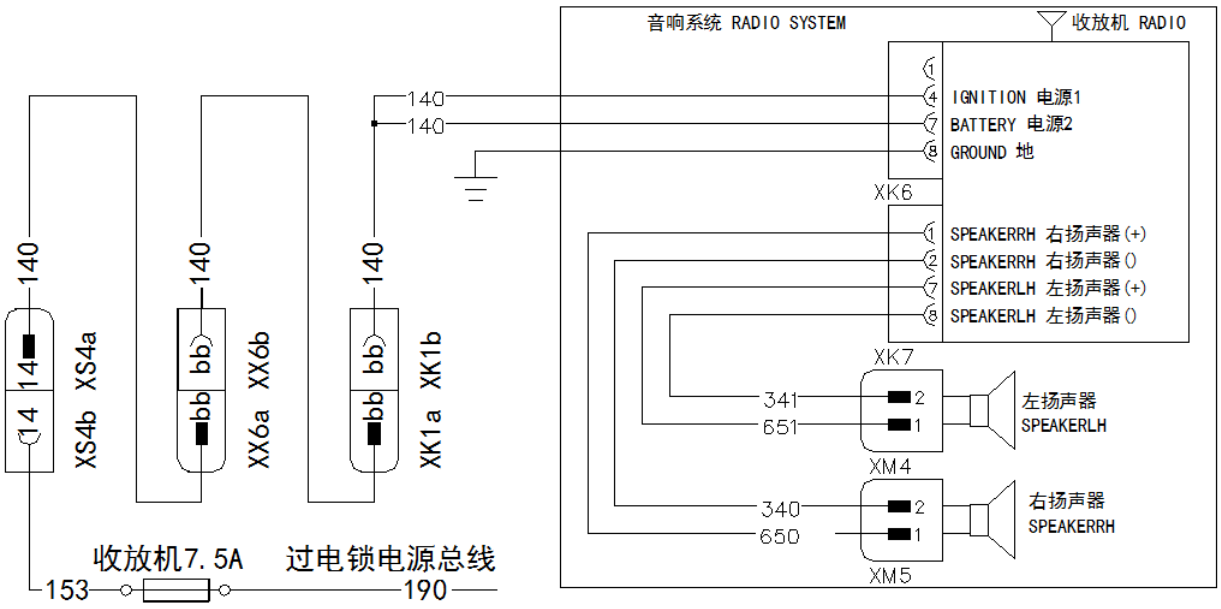
You can use the radio cassette player after turning on the electric lock. A standard USB interface is reserved for the radio, available for connecting USB devices, only supporting MP3 audio files.



P24E00070

1. Power supply
2. Sound mode/switching source
3. Volume adjusting
4. Radio reset key 1/track position
5. Radio preset key 2
6. Radio reset key 3/pause and play
7. Radio preset key 4 / PREV
8. Radio preset key 5 / NEXT
9. Radio reset key 6/track scan
10. Forward search / Prev song / adjusting hour
11. Automatic station storage/enter and exit setting screen
12. Backward scan/next track/adjust minute
13. Standard audio input interface
14. USB interface
15. Radio band selection

Schematic Diagram of Audio System



P24E00071

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Radio and Tape Player

Technical parameter table

	Radio 37B0769	Speaker 38B0047	Antenna 37B0243
Rated voltage	24V		
Maximum working current	5A		
Resister		4Ω	
Power		10W	
Connector	DJ7082A-3.5-10 DJ7082-3.5-10	DJ7021-1.5-21	

Function illustration diagram

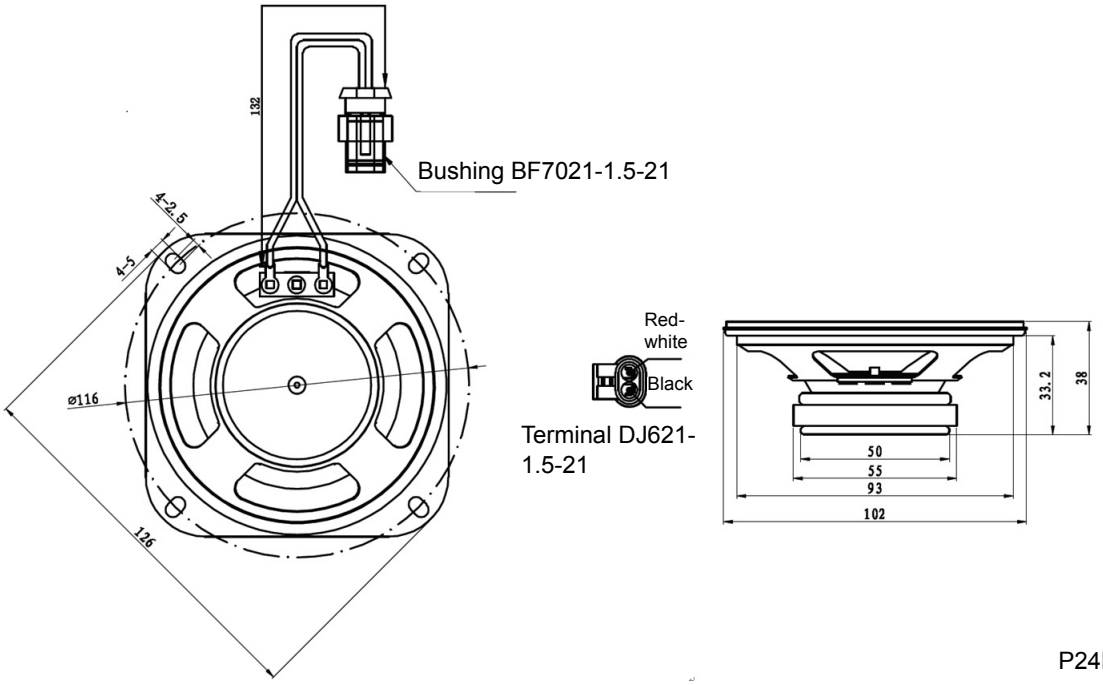
For the description of the function, please refer to the description for the function of sound system

Speaker

Performance and main parameters

Power	Rated power: 10W	Maximum power: 15W
Impedance	4Ω±15%(400Hz, 1V)	
Frequency response	95-13KHZ	
Sensitivity	85±3dB	

Exterior drawing

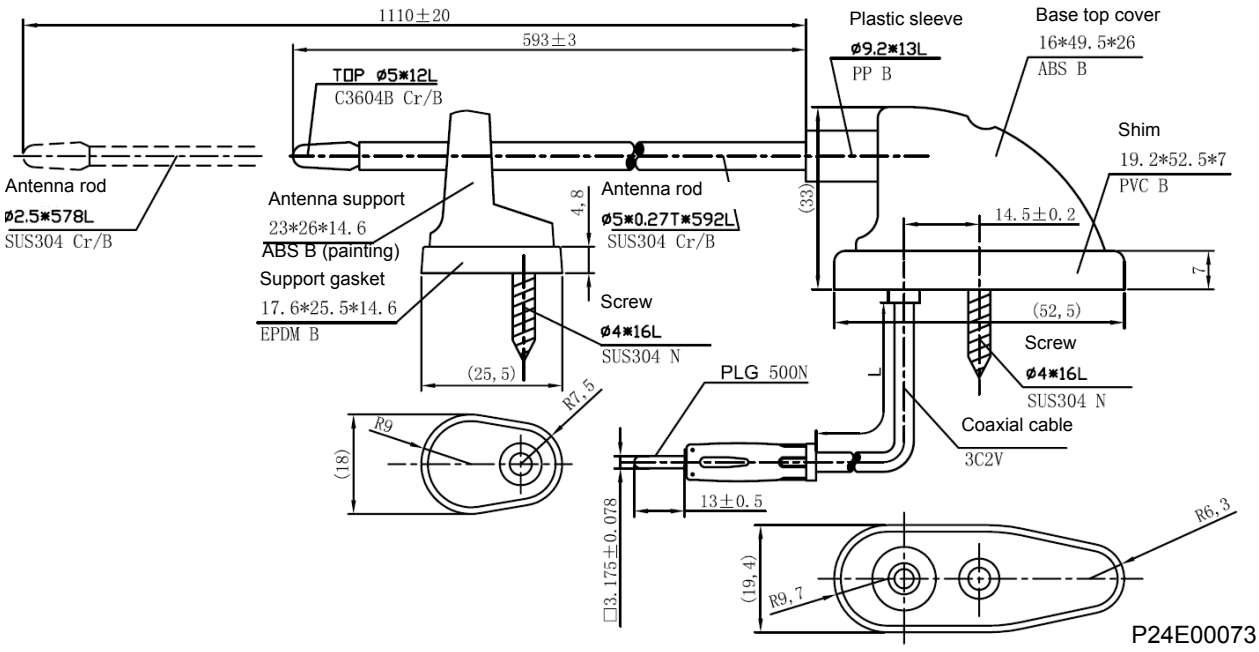


P24E00072

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Antenna

Exterior drawing



Performance and main parameters

Power	Rated power: 10W	Maximum power: 15W
Impedance	4Ω±15%(400 Hz, 1 V)	
Frequency response	95-13KHZ	
Sensitivity	85 ± 3dB	

Fault detection

Fault mode: The player panel displays normally, but there is no sound or the sound volume is too small.

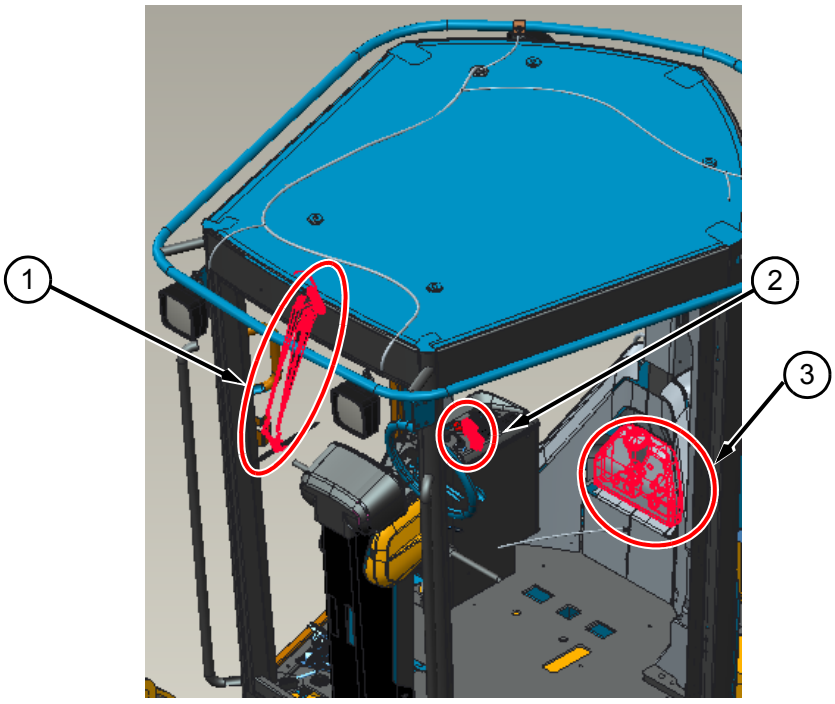
1. Ensure that the player is in radio or play state, and detect whether there is voltage at the speaker positive and negative terminals by digital multimeter; if any, check the speaker. Whether the speaker is good or not can be judged by detecting the resistance of speaker positive and negative terminals, which shall be equal to or close to the rated resistance of speaker; if the resistance is zero or the speaker is open, the speaker is damaged. If there is no voltage at the speaker positive and negative terminals, check whether the wiring and connector are loose or open.

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Wiper and Washer System

Components of the System and Position

Wiper and washer system consists of wiper motor and wiper (1), water reservoir (3), wiper switch, washer switch (2), etc.



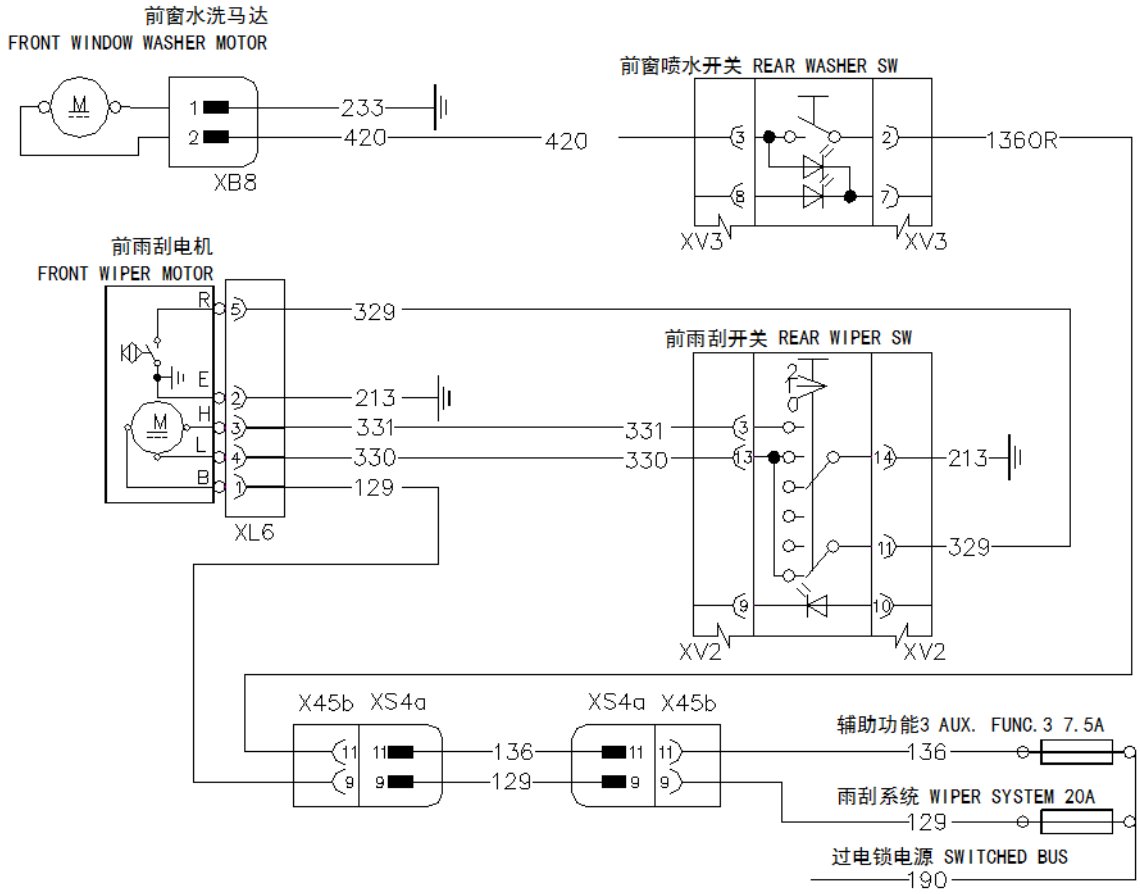
P24E00074

Function Introduction

Front wiper and front window washer are all enabled by rocker switch. There are two gears of high-speed gear and low-speed gear for front wiper. Press different gears of the switch, the wiper will work.

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Schematic Diagram for Wiper and Washer System

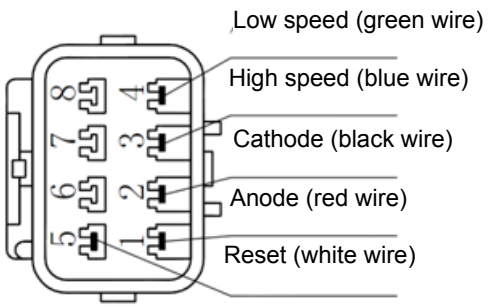


P24E00075

Wiper Motor

For the position of the front wiper motor, please refer to components of the system and position

Surface of the connector



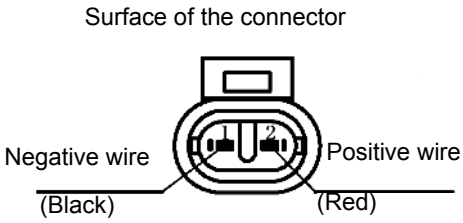
P24E00076

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Rear Wiper Motor

Water Reservoir

For the position of the washer reservoir, please refer to components of the system and position



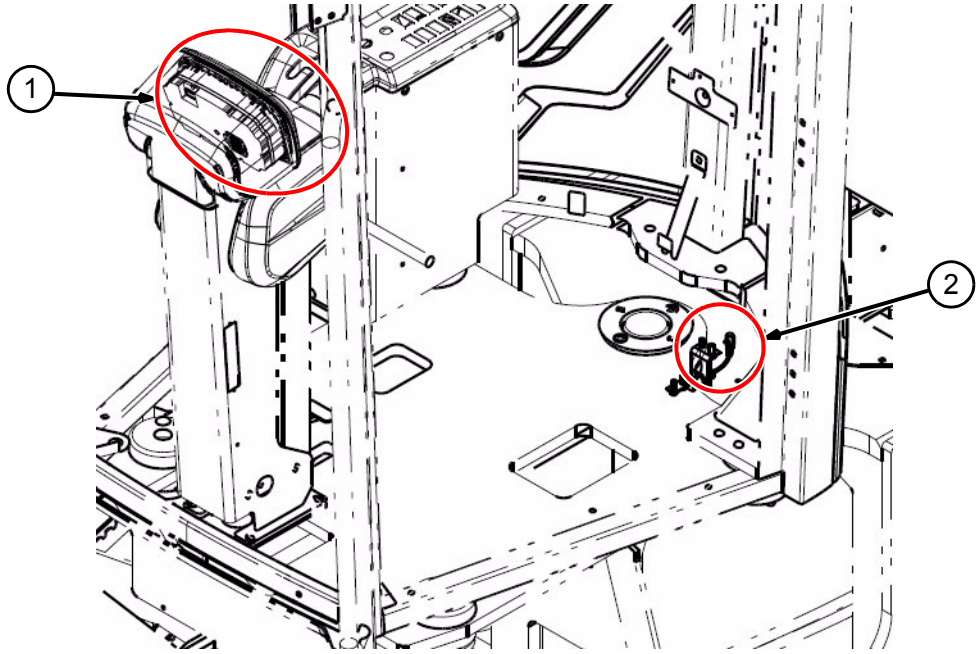
P24E00077

Frame Steer Auxiliary Circuit

Frame steering auxiliary function is optional.

Components of the System and Position

Steer auxiliary system of the frame consists of aligning indicator switch (2) and the instrument (1).



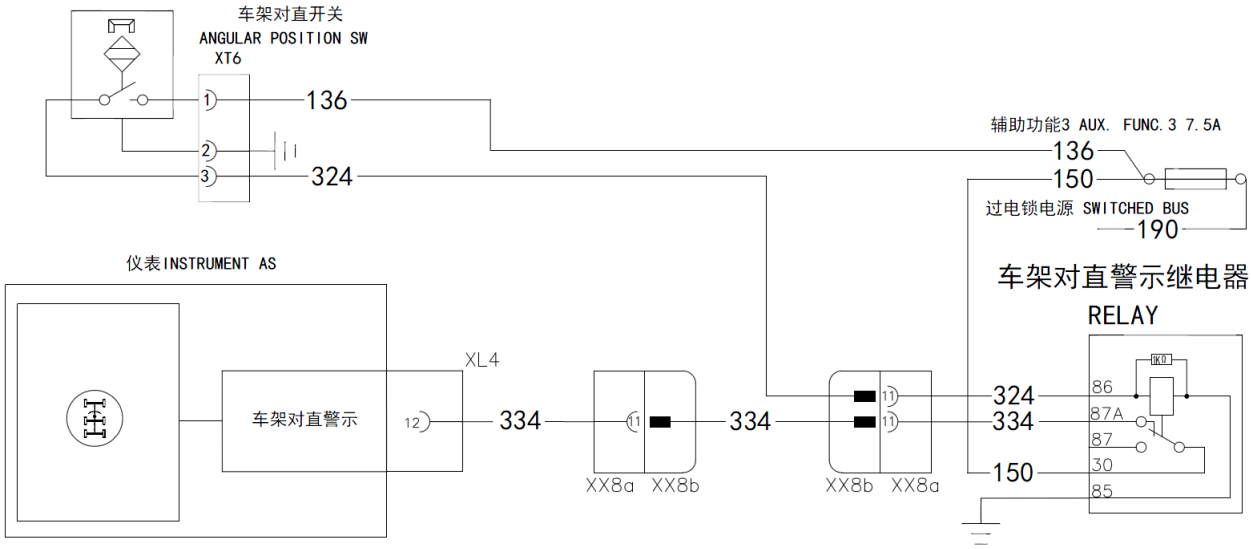
P24E00078

Function Introduction

The instrument illuminates the frame deflection indicator light by detecting the signal from frame auxiliary aligning switch when the frame does not align and prompt the driver that the frame articulation is not aligned.

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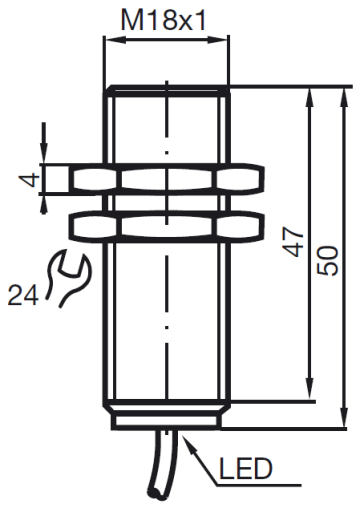
Schematic Diagram for Steer Auxiliary System of the Frame



P24E00079

Frame Auxiliary Aligning Switch

Exterior drawing



P24E00080

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Fault Diagnosis and Troubleshooting Methods

Precautions for Fault Diagnosis

Before fault diagnosis and maintenance, please do understand and keep the safety information, warning and precautions in mind, or else personal injuries or damages of electrical elements, relevant equipments may occur. Please observe the following precautions strictly during the maintenance of electrical system.

Read and understand the Manual for Testing Equipments to use the testing equipments correctly.

1. Correctly identify the wire colors and functions: wire colors and wire gauge are corresponding to three-digit line mark in the schematic. Please distinguish colors and wire gauges correctly for easy maintenance.
2. Properly connected connectors: the letter identification of connectors and wire colors are correspond when connecting. Otherwise, it may damage the connectors and even burnt the harness.
3. Please grasp the connector body when plugging the connectors. Do not pull out the wire with too much force. Make sure the fitting and good contact of lock buckles when connecting the connectors.
4. Make sure the connectors are dry and protective measure should be taken to meet the requirements of damp proof and water proof.
5. Read and understand the circuit diagram, which indicates the relationship and functions of the electrical system’s components and devices, which contributes quickly make the right judgments to the failure phenomenon, and then save maintenance time. Don't remove and dismantle the machine to a large extent blindly.
6. Understand the meaning of "ground" correctly: the negative pole of the battery is the "ground". Negative grounding is used in in the construction machinery, that is, negative pole of the battery is connected to the complete machine (including metal conductors linking together such as frame, cab, etc.); therefore, the complete machine body is also the ground when negative pole of the battery is connected to the complete machine tightly. (Notice: surface of the measuring ground position can be coated with butter, it should be appropriate to avoid the bad ground; paint, oil, dust etc are not allowed).
7. Bind harnesses and wires correctly: a. avoid folding and bending harnesses with excessive force; b. keep away from the movable parts and avoid breaking and wear; c. avoid friction with sharp metal edges and corners; d. keep away from oil and water to the greatest extent; e. keep away from the parts of high temperature(such as the engine body). When ties bundled up are clipped, notice that don’t damage the harness and the connector.
8. If wire or harness are found to be worn, they should be replaced and wrapped immediately, and fix the harness in place not be worn.
9. Correctly replace the safety device: when replace the safe device (also known as fuse), you must use one in the same specification, it does not allow use of copper wire for emergency treatment . Chip type fuse and flat plate type fuse used in this product should meet relevant regulations of QC/T 420 Fuses for Auto. Therefore, if fuses need to be replaced during the maintenance, please use the authentic accessories provided by Liugong.
10. Complete machine power should be cut off before maintenance; and then disconnect wires and connectors. If not, harness will be damaged and the fuse will be blown; even fire will be caused because of short circuit of wires.

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Common Fault Judgment and Troubleshooting

- Unable to start

1. Detect whether the battery cable (+) is loose or broken; if any, tighten immediately or replace the cable.
2. Measure whether the voltage at the terminal 30 of start motor is above 24V with digital multimeter; if not, check whether the battery is undercharged according to the battery detection method (refer to the battery above).
3. Turn the electric lock to the start gear, and measure whether there is 24V voltage at the terminal 50 of start motor; if any, the start motor is damaged, and let the dealer detect the start motor; if not, go to next step.
4. Measure whether there is 24V voltage at No. 460 wire of start contactor No. XS51 feet ; if not, go to next step; if any, go to Step 6.
5. Check whether electric switch lock fuse (7.5A) of centralized control box and centralized control box fuse (50A) of the fuse box are fusing, if so, replace the fuse; if not, check whether No.100 and No.111 wires are conducted.
6. Measure whether the No. 254 wire of start contactor is conducted to earth; if any, it is judged that the start contactor is faulty, and replace it; if not, No.254 wire is loose.
7. When selection lever of the transmission gear is placed on the neutral gear, measure whether there is 24V voltage at the terminal 86 feet of neutral interlock relay in the centralized control box; if any, go to Step 10; if not, go to next step.
8. Measure whether there is 24 Voltage at the terminal No.453 wire of electric switch lock when turning the electric switch lock to START position; if any, No.453 wire is loose; if not, go to next step.
9. 9.Measure whether there is conducted between neutral interlock relay terminal 86 and control box harness No.584 wire; if so, there are faults for the shift selector, and detect faults according to the detection method of shift selector (refer to Introduction to Functions above). If not, No.854 is loose, check connectors connected to No.854 are connected well.
10. Measure whether neutral interlock relay #200 wire is connected to earth; if connected, the neutral interlock relay is faulty, and replace it; if not, check whether the wire is loose or open.
11. Check whether there is 24V voltage at the terminal 111 of electric switch lock; if so, there are faults for the electric switch lock, and replace it.

- Open the eletric lock, the complete vehicle has no power.

1. Check main power fuse (80A) in the octuple fuse and electric lock (7.5 A) of the centralized control box are fusing, if so, and replace the fuse
2. Turn electric lock to ON gear, and measure whether there is 24V voltage at the No.120 wire of the electric lock with multimeter; if not, there are faults for the electric lock, and replace the electric lock; if so, go to the next step.
3. By use of multimeter, measure whether there is 24V voltage at DY connector No.1 pin (No.120 wire) of the main power relay and earthing for No.2 pin (No.212 wire) is fine; if not, check whether No.120 wire (XX6a, XX6bF pin) or No.212 wire (the earthing point of the negative-pole switch frame) is loose; if so, go to the next step.

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4. Measure whether there is 24V voltage for No.176 wire from main power contactor with multimeter; if not, check No.176 wire in the octuple fuse is loose; if so, go to the next step.
5. Measure whether there is electricity at No.190 wire from main power contactor with multimeter; if not, main power contactor is damaged, and replace main power contactor; if so, check if the connectors connected to No.190 wire are loose.

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Appendix

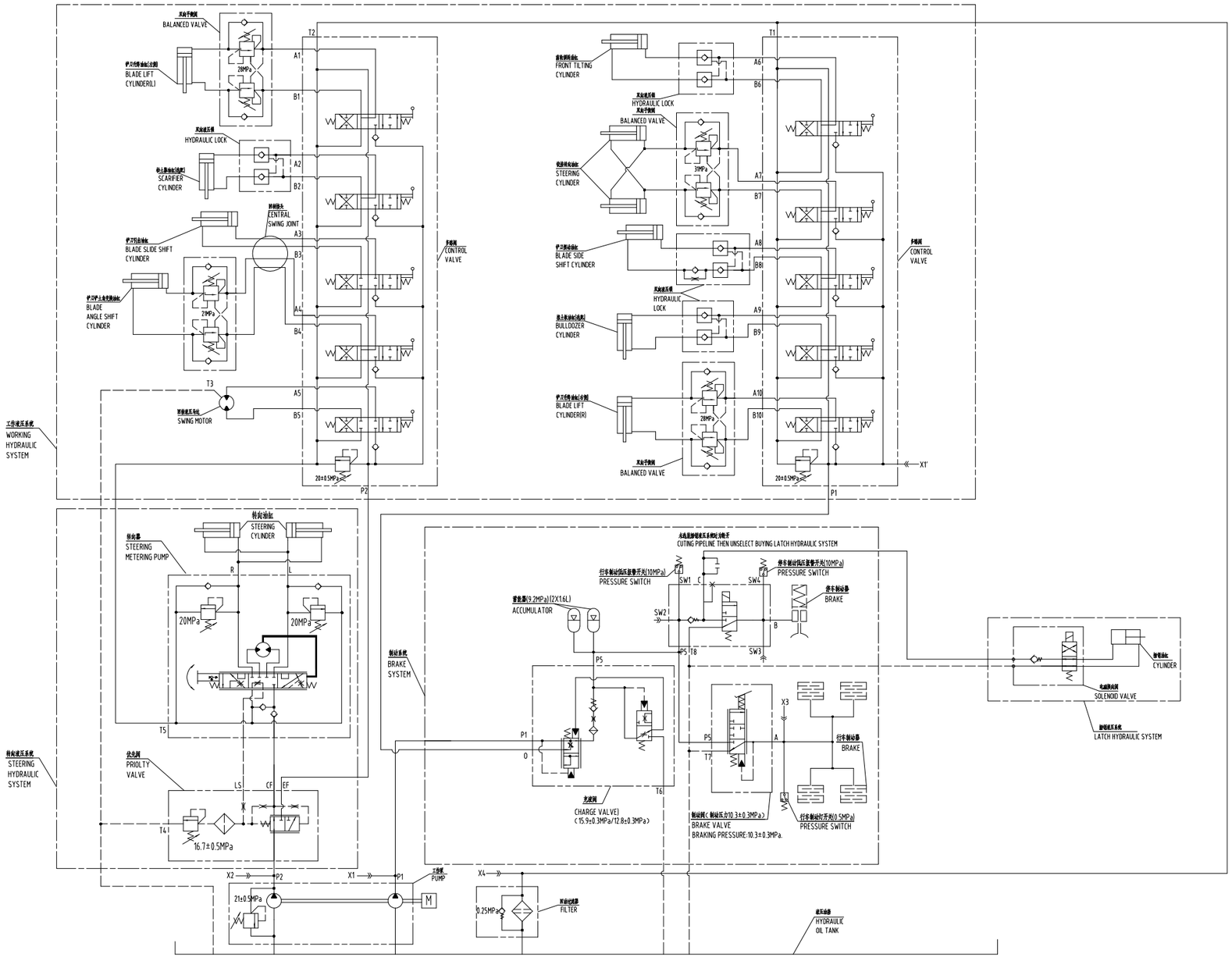
Schematic Diagram of Hydraulic System.....9-3

Electrical Schematic Diagram 9-4

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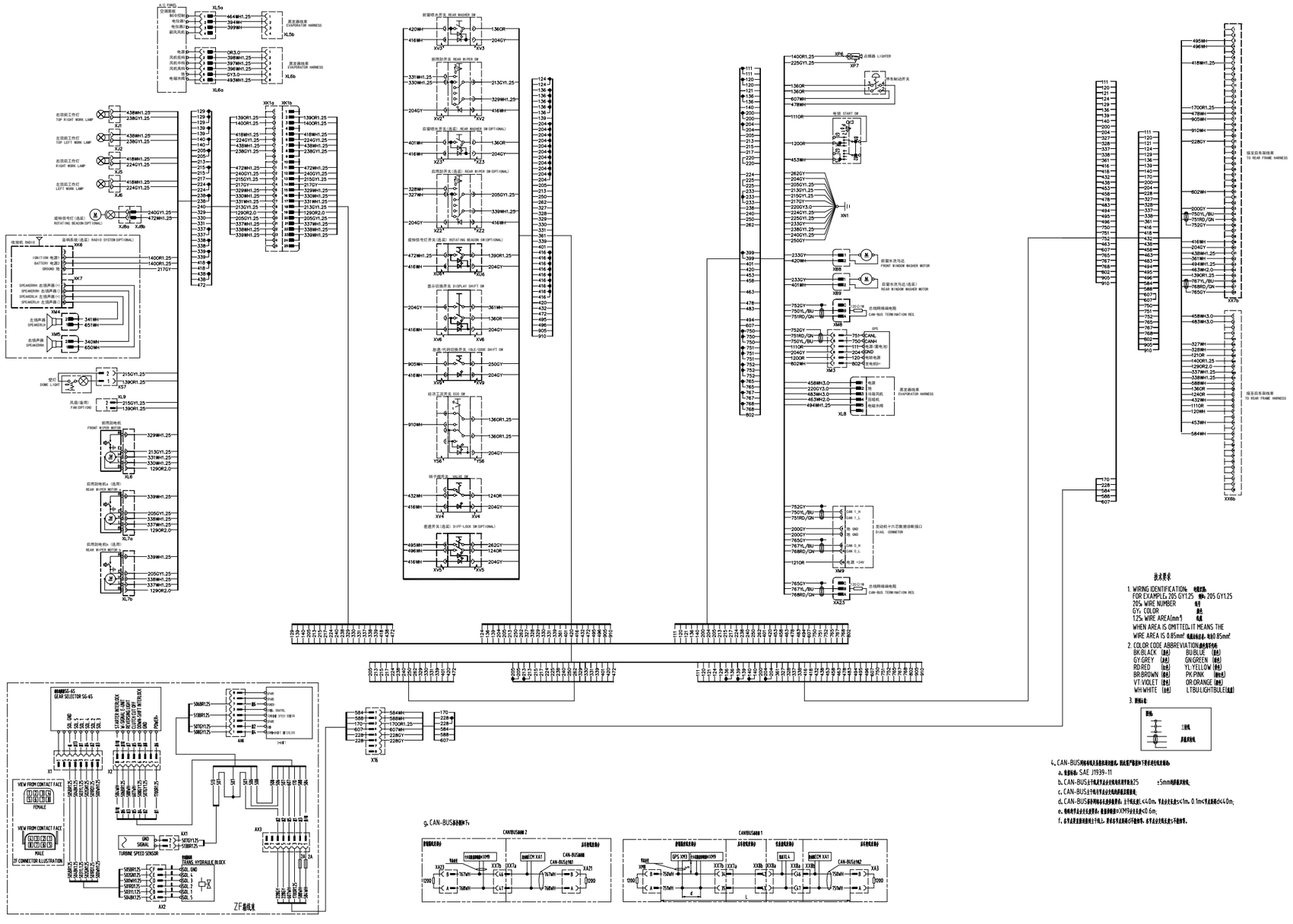
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Schematic Diagram of Hydraulic System

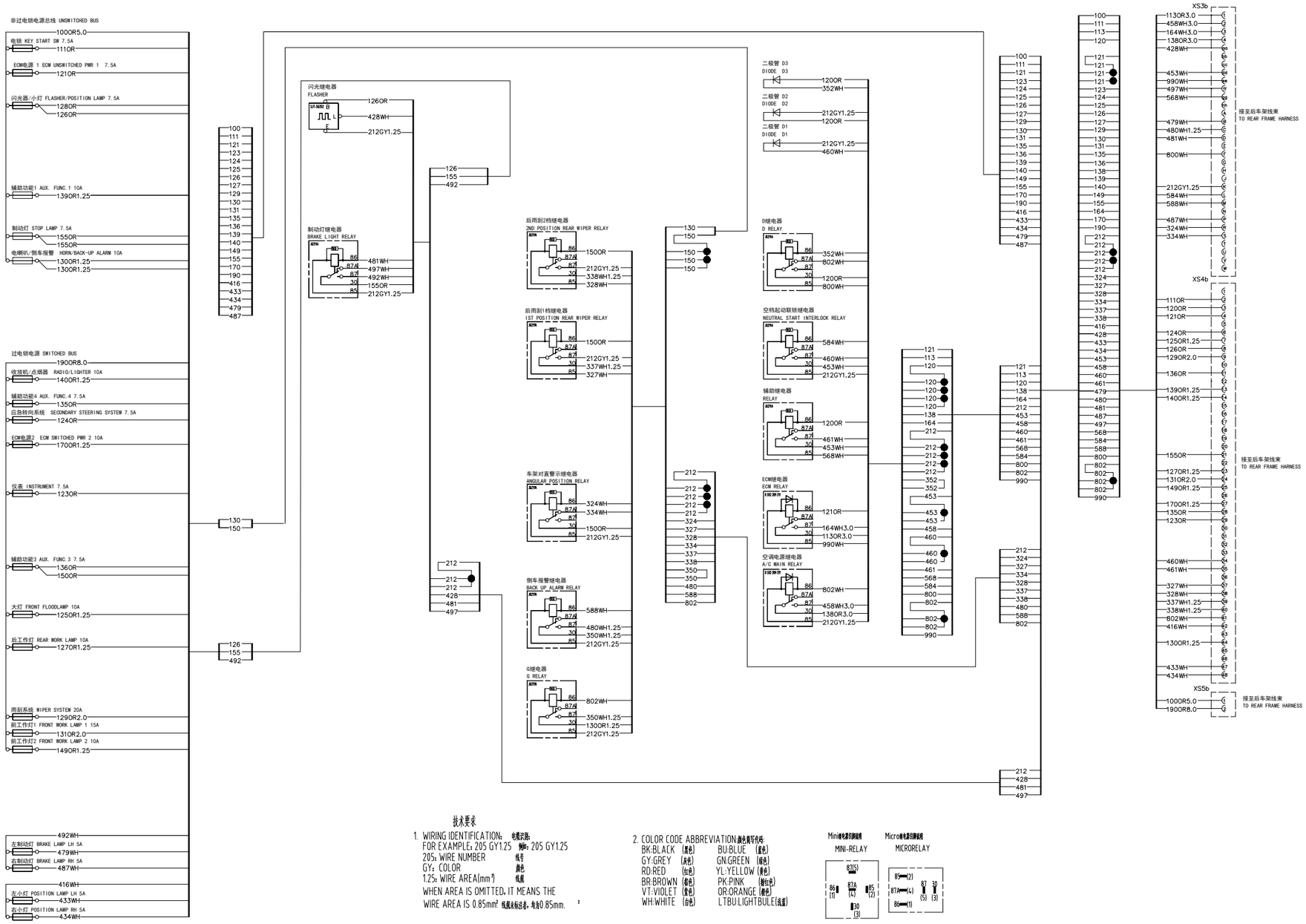


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Electrical Schematic Diagram



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技术要求

1. WIRING IDENTIFICATION: 电缆识别:
FOR EXAMPLE: 205 GY1.25 例如: 205 GY1.25
205: WIRE NUMBER 线号
GY: COLOR 颜色
1.25: WIRE AREA(mm²) 线截
WHEN AREA IS OMITTED, IT MEANS THE
WIRE AREA IS 0.85mm². 线截未标注者, 为为0.85mm.

2. COLOR CODE ABBREVIATION 颜色代码字母代码:

BK:BLACK	(黑色)	BU:BLUE	(蓝色)
GY:GREY	(灰色)	GN:GREEN	(绿色)
RD:RED	(红色)	YL:YELLOW	(黄色)
BR:BROWN	(棕色)	PK:PINK	(粉红色)
VT:VIOLET	(紫色)	OR:ORANGE	(橙色)
WH:WHITE	(白色)	LTBU:LIGHTBULE	(浅蓝)

Mini继电器引脚视图 MINI-RELAY

Micro继电器引脚视图 MICRORELAY

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