LiuGong 柳工

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CLG835H
WHEEL LOADER

SERVICE MANUAL

Applicable type and model: CLG835H PERKINS Engine 1204F-E44AT/ LIUGONG Wet Axle/ ZF 4WG158 Gearbox

Contents

General Information

How to Use the Manual

This manual is written for an experienced technician. Essential tools required in performing certain service work are identified in this manual and are recommended for use.

This is the safety-alert symbol. When you see this symbol on the machine or in this manual , be alert to the potential for person injury.

Technical manuals are divided in several parts : repair and test . Repair sections tell how to repair the components. Tests sections help you identify the majority of routine failures quickly.

Information is organized in groups for the various components requiring service instruction. At the beginning of each group are summary listings of all applicable essential tools, service equipment and tools, other materials needed to do the job, service part kit , specifications ,wear tolerances, and torque values.

Technical Manuals are concise guides for specific machines. They are on-the-job containing only the vital information needed for diagnosis, analysis, testing, and repair .

Fundamental service information is available from other sources covering basic theory of operation, fundamentals of troubleshooting, general maintenance, and basic type of failures and their causes.

Other reference manuals

- Parts manual
- Use and maintenance manual
- Cummins engine parts manual
- Cummins engine overhaul manual
- ZF axle case 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. The company 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 Wheel Loader Marketing Co., Ltd.

Important Safety Information

Most accidents involving product operation, maintenance and repair are caused by failure to observe safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards. This person should also have the necessary training, skills and tools to perform these functions properly.

Improper operation, lubrication, maintenance or repair on this product can be dangerous and could result in injury or death.

Do not operate or perform any lubrication, maintenance or repair on this product, until you have read and understood the operation, lubrication, maintain and repair information.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or other persons.

The hazards are identified by the "Safety Alert Symbol" and followed by a "Signal Word" such as "WARNING" as shown following.

⚠WARNING

The meaning of this safety alert symbol is as follows:

Attention. Be alert. Your safety is involved.

The message that appears under the warning, explaining the hazard, can be either written or pictorially presented.

Operations that may cause product damage are identified by NOTICE labels on the product and in this publication.

LiuGong cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are therefore not all inclusive. If a tool, procedure, work method or operating technique not specifically recommended by LiuGong is used, you must satisfy yourself that it is safe for you and others. You should also ensure that the product will not be damaged or made unsafe by the operation, lubrication, maintenance or require procedures you choose.

The information, specification, and illustrations in this publication are on the basis of information available at the time when it was written. The specification, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service given to the product. Obtain the complete and most current information before starting any job. LiuGong has the most current information available.

CALIFORNIA PROPOSITION 65

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects and other reproductive harm.

Battery post, terminal and related accessories contain lead and lead compounds, Always wash hands after handling.

Manual Identification

IMPORTANT: Use only supporting manuals designed for your specific machine. If incorrect manual is chosen, improper service may occur. Verify product identification number (PIN) and engine model number when choosing the correct manual.

Choosing the Correct Supporting Manuals

LiuGong wheel loaders are available in different machine configurations based on the various markets into which they are sold. Different supporting manuals exist for different machine configurations.

When necessary, product serial numbers and engine model numbers are listed on the front covers of loader manuals. These numbers are used to identify the correct supporting manual for your machine.

Product Serial Number Identification

The product identification number (PIN) plate is located on left side of machine front frame under the pin of boom . Each machine has a 17- character PIN or shown on this plate and under this plate, The last 6 characters of the PIN represent the machine's product serial number.

Figure 1 PIN Plate Location

Figure 2 Pin Plate (17-character with CE mark)

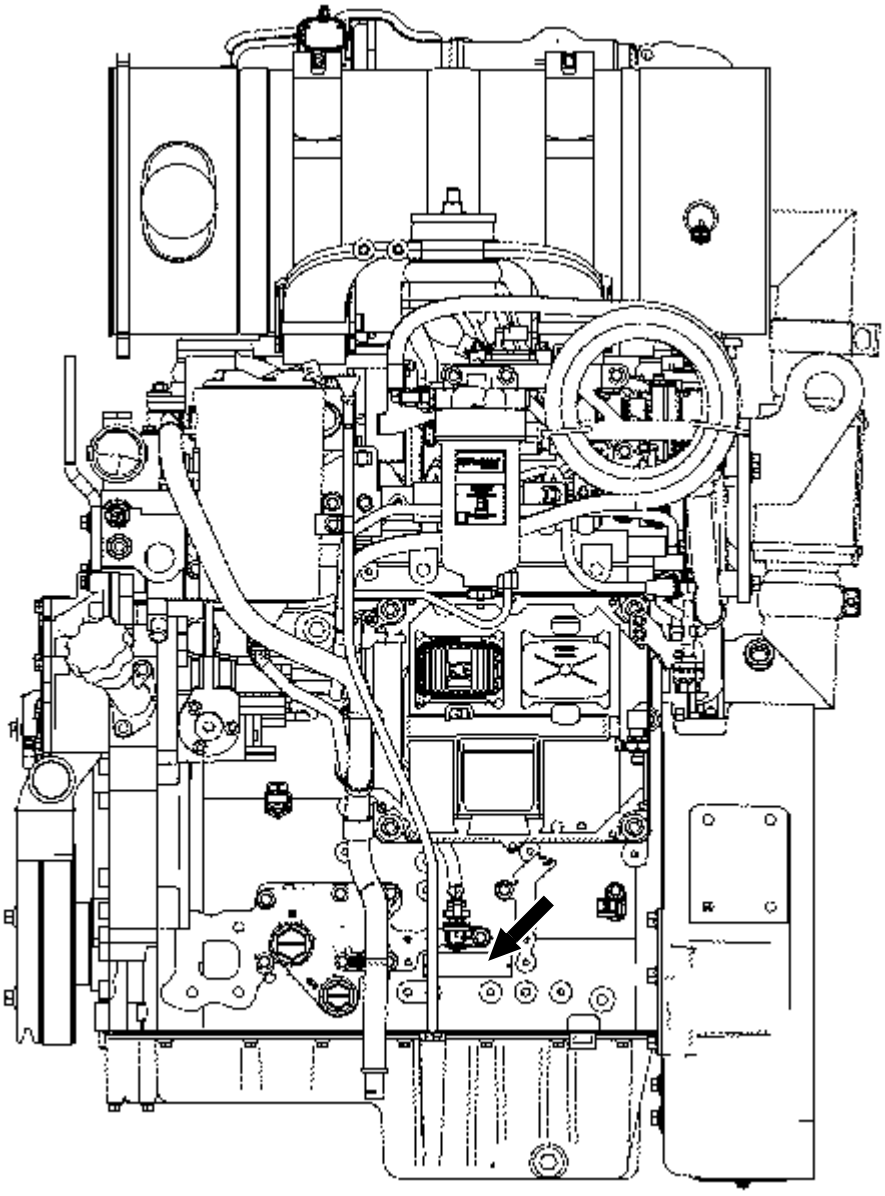
Engine Identification

The engine serial number plate is located on the right side of engine model 1204F. Each engine has two engine numbers (LIST NO. and SERIAL NO.) shown on this plate.

Engine Emission Level Identification

EMISSION CONTROL INFORMATION: In the U.S., this engine is solely for export and is therefore exempt under 40 CFR 1068.230 from emission standards and related requirements. Outside the U.S., the engine may be subject to other emission regulations.

Figure 3 Engine Serial Number Plate Location



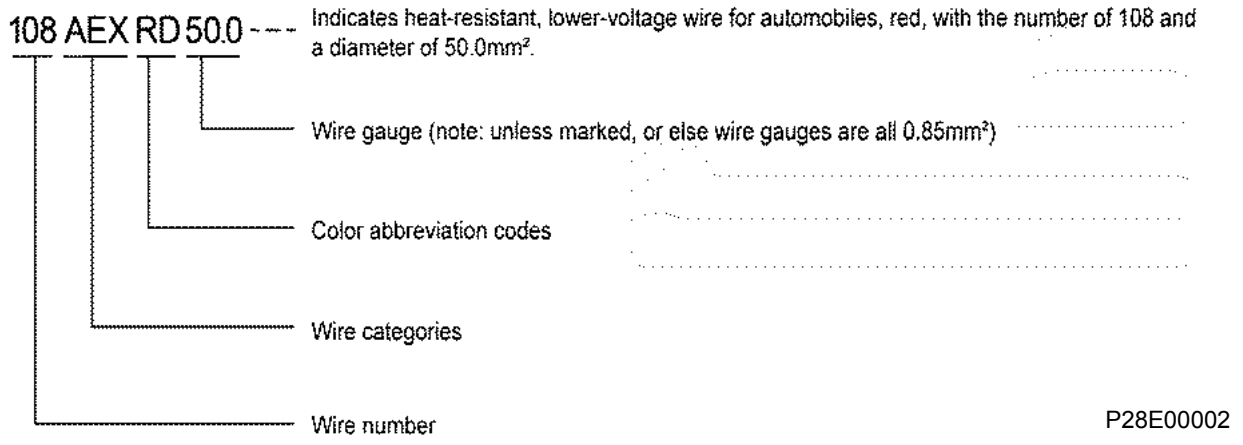
P11000003

Figure 4 Engine Serial Number Plate

P11000004

Cable Code Identification

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.

S/N	Wire type	Wire name	Description	Heat resistance
1	QVR	Low-voltage wire for road vehicles	70 °C (158°F) heat-resisting, copper core PVC-insulated	≤ 70°C(158°F)
2	AVSS	Thin-wall insulated low-voltage wire for vehicles	The thickness of insulation layer is 0.30~0.40mm	≤ 80°C(176°F)
3	AVS	Thin-wall insulated low-voltage wire for vehicles	The thickness of insulation layer is 0.50~0.70mm	≤ 80°C(176°F)
4	AV	Insulated low voltage wire for vehicles	The thickness of insulation layer is 0.60~2.0mm	≤ 80°C(176°F)
5	AEX	Heat-resisting low voltage wire for vehicles	Heat resistance and cross-linking polyethylene	≤ 110°C(230°F)

Color abbreviation codes

Color	English	Abbreviation	Color	English	Abbreviation
Black	BLACK	BK	Blue	BLUE	BU
Grey	GREY	GY	Green	GREEN	GN
Red	RED	RD	Yellow	YELLOW	YL
Brown	BROWN	BR	Pink	PINK	PK

Color	English	Abbreviation	Color	English	Abbreviation
Violet	VIOLET	VT	Orange	ORANGE	OR
White	WHITE	WH	Light blue	LIGHT BLUE	LTBU
Red/green	RED/GREEN	RD/GN	Yellow/blue	YELLOW/BLUE	YL/BU

Remarks: The code composed of 2 colors indicates double-color wire
For example: "RD/GN" shows red-green wire.

Wire specifications

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

Ambient temperature		30°C(86°F)		40°C(104°F)		50°C(122°F)		60°C(140°F)		70°C(158°F)	
Allowable current/ voltage drop		A	mV/m	A	mV/m	A	mV/m	A	mV/m	A	mV/m
Nominal sectional area(mm^2)	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
Earthing	BK, GY
Communication line	RD/GN, YU/BU

Coating Materials

Name	Specification	Main features and purposes
1277 Thread locker sealants	1277	● Features: anaerobic and fast air drying ● Purposes: used for parts not frequently removed
1243 Thread locking sealant	1243	Used for removable parts (speed sensor in general)
Long-term anti-rust agent	LONG#2 light yellow	● Features: rust protection for a long time ● Purposes: used for mounting face of pump, sensor, hydraulic fitting, etc
Efficient cleaning agent 1755	1755	● Features: strong ability of cleaning ● Purposes: 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 medium (sealing oil, air, vapor, water) pipeline cone/taper thread ● Purposes: used for water temperature sensor and oil pressure sensor
Cleaning agent for electro-mechanical equipment	HD-10	Used for cleaning oil pipe connectors, etc.
Diesel engine sealant	1515	Used for mounting face of diesel engine flange
Polyurethane sealant	1924	Used for waterproof of start motor and assembling clearance
Mobilux EP	None	Used for rust protection of rear cover hinge

Paint standard:

There are two main kinds of colors that applied to 835H:

Yellow: matte (50%) RAL1006 yellow

Grey: matte (40%) RAL7021 grey

The standard of paint quality is as follows (for more information, see QJ/LG 08.44-2013):

S/N	Items	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 check	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/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 thickness at all levels of surface	Thickness gauge of paint film	For details, please see the requirements at all levels of surface

S/N	Items	Indicator	Testing method	Remarks
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 1 mm~1.5 mm 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 the whole piece of grid film drops. (Little film drop around the scribing lines can be allowable.)
5	Color difference	Meet color difference requirements at all levels of surface	Visual check/Color difference meter	For details, please see the requirements at all levels of surface
6	Shield	There is no paint contamination, mechanical impurity, rust and dirts	Visual check	
7	Decal	The decal should be correct, complete, decorous, firm, smooth and no popping	Visual check	

Weight Table

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

Component	Weight (kg)
Engine	571kg\ 1259 lb
Radiator	285 kg \ 628 lb
Fuel tank	122 kg\ 269 lb
Front axle assembly	788 kg\ 1738 lb
Rear axle assembly	779 kg\ 1718 lb
Tire rim	295 kg\ 650 lb
Drive shaft	83 kg\ 183 lb
Gearbox & torque converter assembly (oil bearing)	510 kg\ 1125 lb
Cab	685 kg\ 1510 lb
Seats	29 kg\ 64 lb
Engine hood as	210 kg\ 463 lb
Left rear fender	27 kg\ 60 lb
Right rear fender	30 kg\ 66 lb
Air conditioner	100 kg\ 221 lb
Steering pump	34 kg\ 75 lb
Control valve	45 kg\ 99 lb
Fan drive motor	12 kg\ 26 lb
Hydraulic oil tank	130 kg\ 287 lb
Boom cylinder assembly (single)	122 kg\ 269 lb
Bucket tilting cylinder assembly	124 kg\ 283 lb
Secondary steering pump	20 kg \ 44 lb
Ride control accumulator	41 kg\ 90 lb
Rocker arm	138 kg\ 304 lb
Boom	662 kg\ 1460 lb
Front frame	942 kg\ 2077 lb
Rear frame	882 kg\ 1945 lb
Battery box-lh	71 kg\ 157 lb
Battery box-rh	71 kg\ 157 lb
Counterweight	152 kg\ 335 lb
Work implement	880 kg\ 1940 lb
Linkage	34 kg\ 75 lb
Quick coupler frame	267 kg\ 589 lb
Quick Coupler Bucket	734 kg\ 1618 lb
Tooth	190 kg\ 419 lb
Movable blade(*6)	15 kg\ 33 lb
Battery(*2)	18 kg\ 40 lb

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	0.10197
	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

Standard Torque Table

TORQUE SPECIFICATIONS – METRIC HARDWARE

Use the following torques when specifications are not given.

These values apply to fasteners with coarse threads as received from supplier, plated or unplated, or when lubricated with engine oil, These values do not apply if graphite or Moly disulfide grease or oil is used.

Grade 8.8 Bolts , Nuts , and Studs	
Size	**N.m \ lbf·ft**
M6	7.7±1.1 N.m \ 5.67±0.81 lbf·ft
M8	19±2.9 N.m \ 14.01±2.13 lbf·ft
M10	72±6 N.m \ 53±4 lbf·ft
M12	120±10 N.m \ 89±7 lbf·ft
M14	195±15 N.m \ 144±11 lbf·ft
M16	305±25 N.m \ 225±18 lbf·ft
M18	415±35 N.m \ 306±26 lbf·ft
M20	600±50 N.m \ 443±37 lbf·ft
M22	800±70 N.m \ 590±52 lbf·ft
M24	1020±100 N.m \ 752±74 lbf·ft
M27	1500±100 N.m \ 1106±77 lbf·ft
M30	1850±150 N.m \ 1364±111 lbf·ft
M33	2900±400 N.m \ 2139±295 lbf·ft
M36	3100±250 N.m \ 2286±184 lbf·ft

Grade 10.9 /12.9 Bolts , Nuts , and Studs	
Size	**N.m**
M10	72±6 N.m\ 53±4 lbf·ft
M12	120±10 N.m\ 89±7 lbf·ft
M14	195±15 N.m\ 144±11 lbf·ft
M16	305±25 N.m\ 225±18 lbf·ft
M18	415±35 N.m\ 306±26 lbf·ft
M20	600±50 N.m\ 443±37 lbf·ft
M22	800±70 N.m\ 590±52 lbf·ft
M24	1020±100 N.m\ 752±74 lbf·ft
M27	1500±100 N.m\ 1106±77 lbf·ft
M30	1850±150 N.m\ 1364±111 lbf·ft
M33	2900±400 N.m\ 2139±295 lbf·ft
M36	3100±250 N.m\ 2286±184 lbf·ft

Tightening torque of 24° cone O-ring sealed hose connector

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

Tightening torque of flange-type sealed hose connector 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

Series	Bolt	Bolt performance level	Tightening torque	
			N.m	kgf.m
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, 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	74±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	/	/

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

Oils use specifications

Fluids and lubricants for CLG835H-T4F

Category		Name	Capacity	Application parts	Remarks
Engine oil	≥-10°C(14°F)	★ SAE 15W/40 CJ-4	12L\ 3 US gal	Diesel engine	
	≤-10°C(14°F)	SAE 5W/40 CJ-4			
Engine fuel	≥-10°C(14°F)	★ 10# Ultra low sulfur diesel	190L\ 50 US gal	Diesel engine	
	≤-10°C(14°F)	35# Ultra low sulfur diesel			
Adblue		★ RD-11	19L\ 5 US gal	Diesel engine def tank	
Hydraulic oil	-15~40°C(5~104°F)	★ HM-46 Anti-wear hydraulic oil	120L\ 32 US gal	Work hydraulic system, steering hydraulic system	
	-25~40°C(-13~104°F)	HV-46 low-temperature anti-wear hydraulic oil			
Torque converter oil	≥-10°C(14°F)	★ SAE 15W-40 Mobil Delvac 1300	40L\ 11 US gal	Torque converter and power shift gearbox	
	≤-10°C(14°F)	S4 TXM 10W-30			
Gear oil	≥-10°C(14°F)	★ SAE 80W-90/LS Heavy-load wheel gear oil	34L\ 9 US gal	Front and rear axle bevel gear and wheel reducer	LiuGong bridge
	≤-10°C(14°F)	75W-90/LS Heavy-load wheel gear oil			
Refrigerant		★ R134a	2.5Kg\ 5.5 lb	Air conditioner	
Grease	Manual lubrication	★ 2# Molybdenum disulfide lithium grease	2L\ 1 US gal	Roller bearing, slide bearing, pin shaft of work implement, pin shaft of steering cylinder, pin shaft of vehicle frame, swing frame of rear axle, spline of drive shaft, cardan joint, and water pump shaft	
	≤-10°C(14°F)	0# Composite lithium base grease			
	Central lubrication	2# Composite lithium base grease			
Coolant		★ Shell anti-freezing solution	22L\ 6 US gal		

★ refers to the standard configuration

NOTE 1 : DO NOT use an alternate oil in the axle , the transmission box ,the engine . the parts could be damaged as a result of using an alternate oil.

NOTE 2: SEE your dealer for winter fuel requirements in your area , if the temperature of fuel below the cloud point , will cause the engine lose power or not start.

NOTE 3: Low sulfur fuel should be used. the wrong fuel used will cause the engine damaged as a result.

Specifications for acceptable Diesel Fuel

Perkins Specification for Distillate Diesel Fuler			
Property	**Units**	**Requirements**	
Aromatics	%Volume	35% maximum	“ISO”3837
Ash	%Weight	0.01% maximum	“ISO”6245
Carbon Residue on 10% Bottoms	%Weight	0.35% maximum	“ISO”4262
Cetane Number	_	40 minimum	“ISO”5165
Cloud Point	°C	The cloud point must not exceed the lowest expected ambient temperature.	“ISO”3015
Copper Strip Corrosion	–	No. 3 maximum	“ISO”2160
Density at 15°C (59°F)	Kg/m^3	801 minimum and 876 maximum	“ISO”3675 “ISO”12185
Distillation	°C	10% at 282°C (539.6°F) maximum 90% at 360°C (680°F) maximum	“ISO”3405
Flash point	°C	Legal limit	“ISO”2719
Thermal Stability		Minimum of 80% reflectance after aging for 180 minutes at 150°C (302°F)	No equivalent test
Pour Point	°C	6°C (42.8°F)minimum below ambient temperature	“ISO”3016
Sulfur	% mass	0.0015	“ISO”20846 “ISO”20884
Kinematic Viscosity	mm2/s(cSt)	The viscosity of the fuel that is delivered to the fuel injection pump.”1.4 minimum/4.5 maximum”	“ISO”3405
Water and sediment	%weight	0.1% maximum	“ISO”
Water	%weight	0.1% maximum	No equivalent test
Sediment	%weight	0.05% maximum	“ISO”3735
Gums and Resins	mg/100ml	10 mg per 100 ml maximum	“ISO”6246
Lubricity corrected wear scar diameter at 60°C (140°F)	mm	0.52 maximum	“ISO”12156-1

MAINTENANCE SCHEDULE

SERVICE INTERVAL	SERVICE POINTS	INITIAL SERVICE	FREQUENCY IN HOURS						
			CHECK	CLEAN	CHANGE	DRAIN	LUBRICATE	REPLACE	ADJUST
As Required	Radiator Coolant Level		★						
	Tires		★						
	Hydraulic Filter		★						
	Air Cleaner		★	★					
	Alternator , AC ,Drive Belt		★						
	Fire Extinguisher		★						
Every 10 Hours	Check Engine Oil Level		10						
Every 50 Hours	Check Engine Coolant Level		50						
	Check Transmission Oil Level		50						
	Check Hydraulic Oil Level		50						
	Grease Bucket Mounting Fittings						50		
	Bleed Fuel Filter of Condensation					50			
First 100 Hours	Change Engine Oil and Filters	100							
	Replace Fuel Filters	100							
	Change Hydraulic Filter	100							
	Change Transmission Oil and Filter	100							
	Change Oil in Axles	100							
Every 100 Hours	Grease Front Drive Shaft Support Bearing						100		
	Grease Steering Cylinder Pivots (4 Fittings)						100		
	Grease Lift & Tilt Cylinder Pivots (6 Fittings)						100		
	Grease Articulation Fittings						100		
Every 250 Hours	Check Cab Fresh Air Filter		250	★					
	Check AC Return Air Filter		250	★					
	Check Radiator Coolant Level		250						
	Check Tire Pressure & Wheel Torque		250						
	Check Drive Belts		250						
	Check Air Filter		250						
Every 500 Hours	Check Axle Oil Level		500						
	Check Battery Volt and Nuts Torque		500						
	Change Engine Oil and Filter				500				
	Replace Fuel Water Separator							500	
	Replace Fuel Filter							500	

SERVICE INTERVAL	SERVICE POINTS	INITIAL SERVICE	FREQUENCY IN HOURS						
			CHECK	CLEAN	CHANGE	DRAIN	LUBRICATE	REPLACE	ADJUST
Every 1000 Hours	Replace Hydraulic Oil Filter	500						1000	
	Replace Pilot Hydraulic Oil Filter	500						1000	
	Change Front & Rear Axle Oil				1000				
	Replace Cab Fresh Air Filter							1000	
	Replace AC Return Air Filter							1000	
	Change Transmission Oil and Filter	100			1000				
	Check Accumulator Nitrogen Press	500	1000						
	Clean Fuel Tank	100		1000					
Every 2000 Hours	Change Hydraulic Oil & Filter				2000				
	Change Coolant				2000				

Note: ★ means service as required.

Technical Specification of the Machine

P11000006

Application

This loader is a kind of engineering machinery mainly used for loading & unloading loose materials. It is mainly used for loading, unloading, bulldozing and traction operation etc. at mine areas, ports and docks, capital construction, road repair and steel & iron enterprises etc. It is a kind of multi-purpose and high efficiency engineering machinery.

This loader is a kind of general-purpose engineering machinery and is not suitable for the flammable, explosive, dusty and air poisonous environments.

Requirements of Work Environments

1. Altitude: ≤ 3000 m
2. Environmental temperature: -15°C~40°C (The cold starting Aid device is not available)
3. Water Depth: ≤ 630 mm

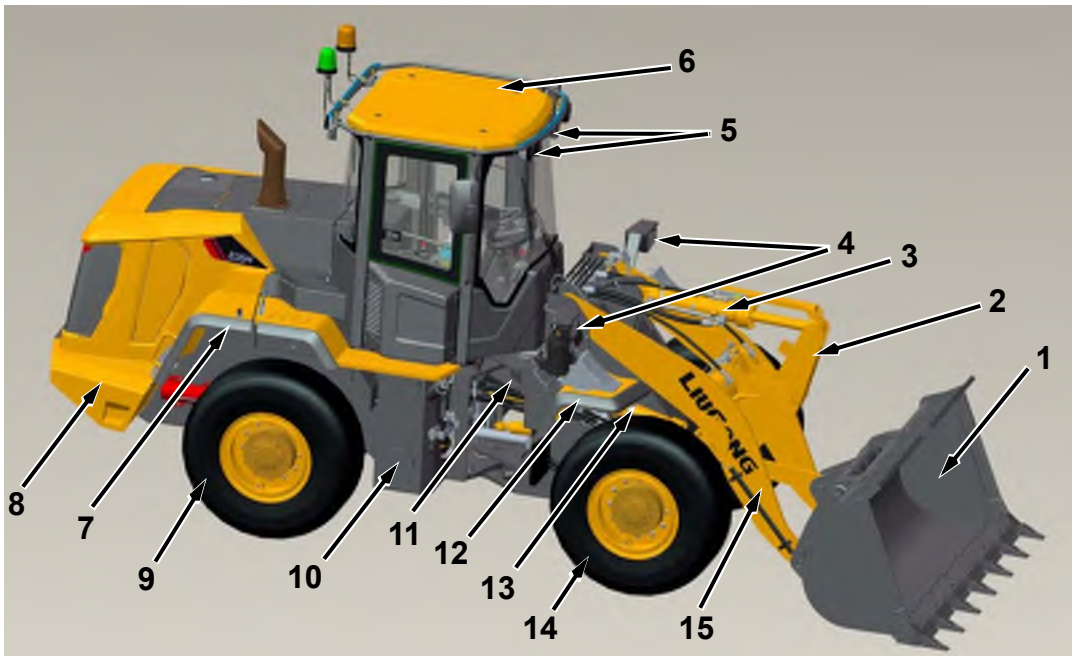
⚠WARNING

Do not operate machine in conditions with rollover or falling object risk.

⚠CAUTION

Preventive measures for operation, maintenance and safety rules outlined on this manual are only suitable for the stipulated applications of the machine. Do not use the machine beyond the stipulated application scope, Guangxi LiuGong Machinery Co., Ltd will not bear any safety liability, and these safety liabilities will be born by users. Under any cases, do not use the forbidden operation outlined in this manual.

Main Components



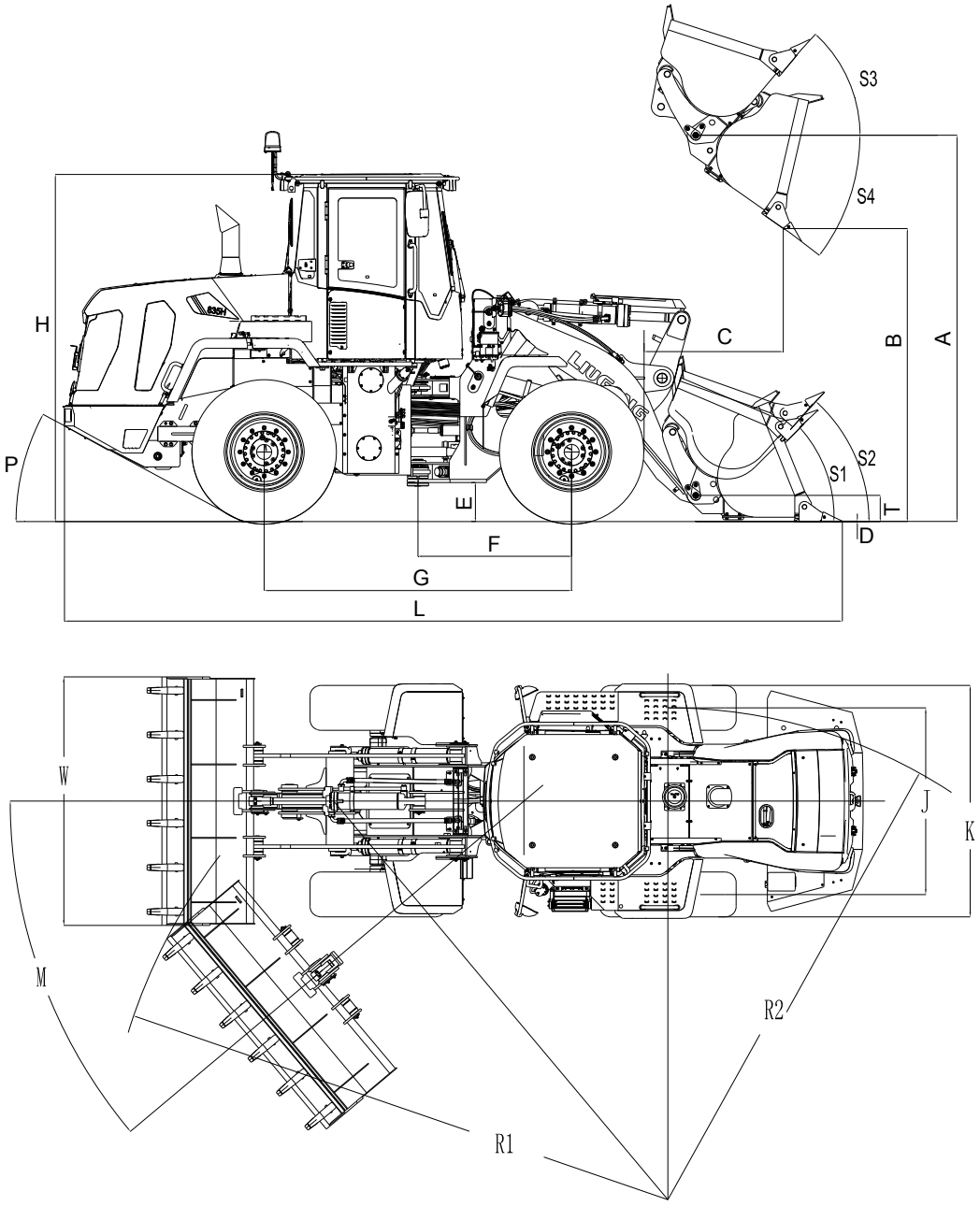
1. Bucket
2. Rocker arm
3. Bucket cylinder
4. Front combination lights
5. Front work lights
6. Cab
7. Rear fender
8. Counterweight
9. Rear wheel
10. Hydraulic oil tank
11. Front frame
12. Front fender
13. Boom cylinder
14. Front wheel
15. Boom
16. Engine hood
17. Rear combination lights
18. Ladder
19. Rear work lights

Performance Parameters

All rated lift capacities are based on the criteria of the machine being leveled on a hard and flat ground. When the machine is operated in conditions that deviate from these criteria (e. g. on soft or uneven ground, on a slope or when subject to slide loads), these conditions shall be taken into account by the operator.

The following table lists the specifications in standard collocation, please refer to the appendix of this section for the specification change parts of the other special collocations (such as larger bucket, longer boom, and side dump bucket).

Exterior Drawing



Machine Specifications

NO.	Item	Unit	CLG835H T4f	
			Quick coupler	Pin On
1	Rated load weight	kg (lb)	3000 (6615)	3000 (6615)
2	Rated power	kW	97.9	97.9
3	Operating mass	kg (lb)	11200 (24696)	10800 (23814)
4	Rated bucket capacity	m^3	1.9	1.9
5	Dumping height	mm (In)	2700 (106)	2800 (110)
6	Max. breakout force (bucket tilting)	kN (lbf)	85 (19108)	90.1 (20254)
7	Tipping load (aligning)	kg (lb)	7700 (16979)	9452 (20842)
8	Tipping load (full steering)	kg (lb)	6600 (14553)	7369 (16249)
9	Boom lifting time (full load)	s	5.5	5.5
10	Total time	s	9.7	9.7
11	Max. traveling speed	km/h(mph)	38.6 (23.9)	38.6 (23.9)
12	Max. gradeability	°	28	28
13	Min. turning radius (outside of front wheel)	mm (In)	4920 (194)	4920 (194)
Overall Dimensions				
Parameters below are for Z-bar or 8-bar machine			Z-bar	Z-bar
1	A: Height to hinge pin, fully raised	mm (In)	3720 (146)	3720 (146)
2	B: Dumping height, fully raised	mm (In)	2700 (106)	2800 (110)
3	C: Dumping reach, fully raised	mm (In)	1150 (45)	1076 (42)
4	D: Max. digging depth	mm (In)	100 (4)	80(3)
5	E: Min. ground clearance (at articulation joint)	mm (In)	325 (13)	325 (13)
6	F: Distance from centre of rotation to the centre of the front wheels	mm (In)	1435 (56)	1435 (56)
7	G: Wheel base	mm (In)	2870 (113)	2870 (113)
8	H: Overall height (top of cab)	mm (In)	3200 (126)	3200 (126)
9	J: Tread width	mm (In)	1855 (73)	1855 (73)
10	K: Overall width (outside of wheel)	mm (In)	2450 (96)	2450 (96)
11	L: Over length (bucket on ground)	mm (In)	7265 (286)	7115 (280)
12	M: Max. steering angle	°	38	38
13	W: Overall width (outside of bucket)	mm (In)	2530 (100)	2530 (100)
14	R1: Turning radius (outside of bucket)	mm (In)	5650 (222)	5050 (199)
15	R2: Turning radius (center of rear wheel)	mm (In)	4622.5 (182)	4622.5 (182)
16	P: Departure angle	°	28	28
17	S1: Bucket tilt back angle (on ground)	°	45	45
18	S2: Bucket tilt back angle (in transport position)	°	48	48
19	S3: Bucket tilt back angle (in highest position)	°	60	60
20	S4: Dumping angle (in highest position)	°	45	45
21	T: Bucket articulation height (in transport position)	mm (In)	450 (18)	450 (18)

Main Components Specifications

Engine			
1	Manufacturer	/	Perkins
2	Model	/	1204F-E44TA
3	Type	/	Electronic fuel injection
4	Displacement	L (US gal)	4.4 (1.16)
5	Rated power	KW (hp)	97.9 (131.3)
6	Emission level	/	Tier 4f
7	Number of cylinders and arrangement	/	Straight-four cylinders
8	Intake type	/	Turbocharged & inter-cooling
9	Rated speed	r/min	2200
10	Max. rotating speed (no-load)	r/min	2376
11	Min. rotating speed (no-load)	r/min	800
12	Rotating speed at max. torque	r/min	1400
13	Max. torque	N.m (lbf·ft)	530 (391)
14	Start motor	V-Kw	24V-5.5 KW
15	Alternator	V-A	24V- 70A
Power train system			
1	Torque converter	Type	Single turbine, three members
2	Transmission	Manufacturer	ZF
3		Model	4WG158A
4		Type	Fixed shaft type, power shift
5		Number of gears	Four forward gears and three reverse gears
6		Operating pressure of shift oil pump (gear pump)	1.6~1.8MPa (232~261psi)
7	Drive axle	Manufacturer	LiuGong
8		Model	LiuGong 3T wet-type axle
9		Type	Wet-type alxe
10		Max. traction force	100kN (22480lbf)
11		Front & rear axle reduction ratio	20.2656
12		Rear axle swing angle	12°
13	Wheels	Tire model	17.5-25 PR16/TL L-3
14	Traveling speed	F1/ R1	7.1/ 7.1km/h (4.4/ 4.4mph)
15		F2/ R2	12.3/ 12.3km/h (7.6/ 7.6mph)
16		F3/ R3	25.1/ 25.1km/h (15.6/ 15.6mph)
17		F4	38.6km/h (23.9/ 23.9mph)
Work hydraulic system			
1	Work pump	Type	Piston pump
2	Work pump displacement	ml/r (cc/rev)	100 (100)

Main Components Specifications

3	System pressure	Mpa (psi)	19 (2755)
4	Control valve	/	Three spools
5	System flow	L/min (US gpm)	210 (55.48)
6	Lifting time (full load)	s	5.5
7	Dumping time	s	1.5
8	Float lowering time	s	3.5
9	Total time	s	9.7
Steering hydraulic system			
1	Steering angle	°	38
2	Steering pump	Type	Piston pump
3	Steering pump displacement	ml/r (cc/rev)	Share with work pump
4	Steering system pressure	Mpa (psi)	19 (2755)
5	Steering system flow	L/min (US gpm)	210 (55.48)
6	Secondary steering pump	Type	Gear pump
7	Secondary steering pump displacement	ml/r (cc/rev)	10 (10)
8	Secondary steering system pressure	Mpa (psi)	16 (2320)
9	Secondary steering system flow	L/min (US gpm)	22-25l/min (5.8-6.6gpm) @52bar
Brake hydraulic system			
1	Service brake	Type	Full hydraulic wet type brake
2	Brake pump	Type	Gear pump
3	Brake pressure	Mpa (psi)	6 (870)
4	Nitrogen pre-charge pressure of service brake accumulator	Mpa (psi)	5.5 (797.5)
5	Parking brake	Type	Drum type parking brake
6	Parking brake control mode	/	Hydraulic control
7	Nitrogen pre-charge pressure of parking brake accumulator	Mpa (psi)	9.2 (1334)
Air conditioner system			
1	Type	/	Cooling & heating A/C
2	Heating capacity	W	5800
3	Cooling capacity	W	5000
4	Refrigerant	Model	R134a
Electrical system			
1	System voltage	/	DC 24V
Refill capacities			
1	Fuel tank	L (US gal)	190 (50.2)
2	Engine oil	L (US gal)	12 (3.17)
3	Cooling system	L (US gal)	22 (5.8)

Main Components Specifications

4	Transmission oil	L (US gal)	40 (10.57)
5	Drive axle oil	L (US gal)	34 (8.98)
6	Hydraulic oil	L (US gal)	120 (31.7)
7	AdBlue	L (US gal)	19 (5.02)
Other specifications			
1	Cooling pump type	/	Gear pump
2	Cooling pump displacement	ml/r (cc/rev)	27 (27)
3	Cooling pump flow	L/min (US gpm)	59.4 (15.7)
4	Cooling motor displacement	ml/r (cc/rev)	35 (35)
5	Cooling motor flow	L/min (US gpm)	77 (20)
6	Nitrogen pre-charge pressure of pilot oil supply valve accumulator	Mpa (psi)	0.6 (87)
7	Nitrogen pre-charge pressure of ride control accumulator	Mpa (psi)	2.5 (362.5)

Note:

1. Continuing improvement and advancement are made to LiuGong products. All the specifications are the latest product information obtainable at the time of publication. LiuGong will reserve the right to make change without notice.
2. The above parameters are the theoretical values, the tolerance ranges during testing are provided by LiuGong standard.

Machine Inspection Table

Inspection item	S/N	Inspection method and acceptance criteria
Inspection before test run	1	Complete machine information: visual check the complete machine number for compliance with description of model
	2	Fastening bolt: visual check whether the left and right mounting bolts of front axle are tightened firmly in place; visually check whether the left and right front rim bolts are firmly tightened
	3	Fastening bolt: visual check the mounting bolts between front drive shaft and front axle, output flange of transmission and middle bearing fastened;
	4	Fastening bolt: visual check whether the emergency braking flexible shaft is connected reliably; brake cylinder for oil leakage and connected reliably;
	5	Fastening bolt: visual check whether mounting bolts of upper and lower hinge are tightened
	6	Fastening bolt: visual check the left and right mounting bolts of rear axle are tightened; visually check the left and right rear rim bolts are firmly tightened
	7	Water level: anti-freeze level shall be over the middle line in the level window of expansion tank
	8	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: lay flat the bucket, lower the boom to the minimum at idling, and visual check the oil level of the hydraulic oil tank is within the green scale and the oil is not in white 5 min after the engine stalls
	10	Transmission fluid: when the engine is idling and the transmission fluid temperature is not more than 40 ℃ (104 ℉), check that the level shall be between cold fluid MAX and MIN marks. Then, place the shift lever at four gear and depress the brake, then the accelerator to run the transmission for 5~8min resulting in the transmission fluid temperature reaching 100~110℃(212~230℉). Release the accelerator and place the shift lever at 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 ℃ (176 ℉).
	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, front and rear sunshade, cigarette lighter, and they should function normally
	4	Inflatable seat (option): 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. There is no abnormal sound and parts interference during air-filled detection.
	5	Turning on the electric lock: turn on the front floodlight, work light, alarm light, parking light by order and get off the vehicle to check if they function normally
	6	Starting the complete machine: operate the engine speed adjustment switch and visual 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	Visual check: timer displays and record the time
	9	Steering wheel: it can be adjusted front and rear, upper and down normally; no looseness after locking. Lift the steering wheel upwards by hand and no axial runout occurs (≤3mm);

Inspection item	S/N	Inspection method and acceptance criteria
Climbing up the cab	10	Horn: press the horn button on the lever of the horn button/control lever on the combination lever horn button/steering wheel and listen, no abnormal sound and failure to the horn should occur
Air conditioning system	1	The air volume switch, temperature setting switch, defrost setting switch, air mode switch, auto mode switch on the A/C panel functions normally and is indicated correspondingly on the LCD; the temperature, air volume, direction at the air outlet is the same with setting value on the panel.
	2	Self-diagnosis of A/C: press the "OFF" switch on the LCD panel, and the temperature setting and air volume icon on the display disappears; press the up/down regulation button " " and " " on the temperature setting switch "TEMP" simultaneously for more than 3 seconds. If "E-" appears on the LCD, it indicates no failure, while "E1" appears, it indicates failures
Driving test	1	Starting the complete machine: it starts normally, and listen to the engine and air filter, no abnormal sound is heard, and it turns off normally without delay; observe the engine under the diesel engine idling and top speed, and it shall not stall
	2	Starting the complete machine: adjust the complete machine operating idle speed to a level more than 950rpm and the engine does not stall with the bucket lifted
	3	Starting the complete machine: visual check that no trouble code appears on the LCD of instrument panel, and no indicating identification, alarm and flashing appears on the instrument panel or normally on.
	4	Rearview instrument system (option): when placing the shift lever at reverse, the rearview instrument activates automatically and the image shall be clear
	5	Control lever: there is no seizing and interference with other parts when operating the FNR handle boom to rise, drop, take back and dump the bucket
	6	Pilot shutoff function: the pilot shutoff lever is at OFF position, operate the pilot lever and the work implement shall not act; the pilot shutoff lever is not installed reversely and has no interference with housing;
	7	Detection of bucket automatic reset: the bucket is unloaded, lift the boom to the highest position to make the bucket under discharging state and then take back the bucket and it should stop moving automatically and then control lever returns back to neutral position when the bucket comes near to the switch and bucket limitation magnet. Then lower the boom to place the bucket on the ground, at this time, check the bucket and it should be horizontal to the ground; and the engine is at full throttle during this process
	8	Detection of boom automatic reset: boom limitation: lift the boom and it should stop rising when it reaches the setting highest position; the control lever returns back to neutral position automatically. The engine is at full throttle during this process
	9	Work implement limitation: visual check that the bucket limit block contacts with boom and rocker arm limit block when the boom is lifted to the highest position for discharging; take back the bucket when the boom descends to a position that its front pin is about 500mm(19.7In) away from ground, visual check that boom limit block contacts after taking back the bucket and the clearance between boom and bucket is more than 5mm(0.197In)
	10	Inspection of work implement running: lift the boom during which no abnormal sound shall occur; no twisting to the bucket during taking and holding back the bucket when the boom is lifted to the highest position and lowest position;
	11	Floating function and inner leakage detection: when jacking up the bucket backward, visual check that the boom does not drop quickly; when the bucket is jacked up, push the control lever to the boom lowering, floating position, and the control lever shall close, visually check that the boom shall be floating and lowering

Inspection item	S/N	Inspection method and acceptance criteria
Driving test	12	Ride control (option): park the machine on the level ground, disconnect the ride control system button, jack up the shovel head; after 5 seconds, connect the ride control system button, and the boom shall perform automatic lowering operation.
	13	Visual check and listening: when turning to the maximum left and right steering angle, the limit block contacts and no abnormal sound shall occur; visually check that there is no interference between the armrest of cab and front frame, 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 and other sharp edges
	14	W/steering cushion: turn the complete machine to the limit position, and the steering cushion is compressed (8-12) mm
	15	Secondary steering (option): turn on the electric lock without starting, the secondary steering indicator on the instrument panel comes on when the secondary steering switch is pressed, and the steering can be normally performed
	16	Gear inspection: Manual 1) Place the manual/auto shift rocker switch to "Manual" 2) Start the complete machine and idle; 3) Release the parking brake; 4) Operate the shift lever and all the gears shall be available freely;
	17	Gear inspection: Semi-automatic shift 1) Place the manual/auto shift rocker switch at neutral position; 2) Start the complete machine and idle; 3) Release the parking brake; 4) Operate the shift lever, and place it at F1 position, and the gear to complete machine transmission shall be F1 5) Operate the shift lever, and place it at F2 position, and the gear to complete machine transmission shall be F2; 6) Operate the shift lever, and place it at F3 position, and the gear to complete machine transmission shall still be F2, depress the accelerator gradually to the maximum and hold it, increase the speed of complete machine, and when it reaches a certain value, the gear shall automatically shift up to F3; 7) Keep the opening of throttle, and continuously increase the vehicle speed and operate the shift lever and place it at F4, and when the speed reaches a certain value, the gear shall automatically shift up to F4 from F3; (the corresponding gear is displayed on the gear display during the above operation; and the corresponding speed is displayed on the LCD of instrument panel)
	18	Gear inspection: Full-automatic shift 1) Place the manual/auto shift rocker switch at "Auto" position; 2) Start the complete machine; 3) Release the parking brake; 4) Operate the shift lever, and place it at F3 position, depress the accelerator gradually to the maximum and hold it, when speed reaches a certain value, the gear shall automatically shift up to F3 from F2; 5) Keep the opening of throttle, and continuously increase the vehicle speed and operate the shift lever and place it at F4, and when the speed reaches a certain value, the gear shall automatically shift up to F4 from F3; (the corresponding gear is displayed on the gear display during the above operation; and the corresponding speed is displayed on the LCD of instrument panel)
	19	KD function test: Place the shift lever at 2 with low speed, test the key KD on the control lever and FNR respectively, press the key KD and the gear is switched to I
	20	FNR lever test: place the control lever at N2 firstly. And then push the key of FNR lever to N. The FNR function is activated after the enable key of the FNR lever is pressed. When the FNR function is activated, the FNR lever can be used to perform F(forward)\N(neutral)\R(reverse) and KD function operation
	21	Power shutoff function 1) place the power shutoff function selection switch at enable state; 2) release the parking brake; 3) operate the shift lever and place it at F1 or F2 and drive the vehicle; 4) depress the service brake pedal and when it reaches a certain level, the gear shall shift down to neutral; and the power shutoff indicator on the instrument panel comes on; 5) release the brake pedal, and the gear shall return back to F1 or F2; 6) the power shutoff fails when the shift lever is placed at F3 or F4.

Inspection item	S/N	Inspection method and acceptance criteria
Driving test	22	Backup alarm: when the shift lever is placed at reverse, the reverse alarm begins to perform buzzing alarm immediately.
	23	Brake system: 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
	24	Fault alarm inspection: observe that no axle oil pressure, oil pressure, service brake, emergency brake, transmission fluid pressure, hydraulic oil temperature alarm indicator on instrument panel indicates alarm during driving; visual check that torque converter oil temperature, engine water and oil temperature is displayed at green area;
	25	Steering during driving: no seizing and heavy, floating is felt when turning to the left and right during driving
	26	Power train system inspection: listen to the diesel engine operation for abnormal sound; front and rear axle for abnormal sound; gearbox & torque converter assembly for abnormal sound during driving
	27	Emergency brake: apply hand brake after climbing 15% of slope (for hand brake with lever, it needs to pull the hand brake latch for 2/3 travel), and then release the brake valve, the complete vehicle shall stay for 5 seconds and remain stationary
	28	Pressure maintaining of hydraulic system: extend and retract all oil cylinders to the maximum with control lever remained open at each end of travel to obtain safety valve pressure, which is remained for about 5 seconds, continuously check it for 120 times with interval more than 10 seconds
	29	Fan's positive and negative rotation (option): the engine is idling, press the fan's positive and negative rotation switching switch for less than 60 seconds, and then fan can be switched to negative rotation with indicator on; press the switch again for less than 60 seconds and the fan is switched to positive rotation with the indicator off, no abnormal sound occurs during switching
	30	Detection of rear axle swing angle: reverse the complete vehicle with single wheel on the slope of vehicle inspection slot, visual check that the tire has no interference with frame, fender, rear cover (with clearance more than 20 mm) pipe on axle has no interference with diesel engine after stopping the vehicle
	31	Centralized lubrication line: 1) fastened to pin lubrication pipe joints without oil leakage; 2) centralized lubricator time is correctly set; 3) oil pipe is not bent and twisted; 4) oil pipe runs smoothly without interference with proper length and beautiful appearance; there is no pulling interference during turning and operation of work implement

Inspection item	S/N	Inspection method and acceptance criteria
Static check	1	Visual check: gap of lapped surface at hinge between boom and frame, oil cylinder, rocker and tie rod light is ≤1mm
	2	Touch: there is no oil leakage at big cavity and small cavity pipe and joint of left and right boom oil cylinder pipeline; visual check that there is no oil leakage at big cavity and small cavity pipe and joint of bucket tilting cylinder pipeline
	3	Touch: there is no oil leakage at left and right front axle clamp; no oil leakage at front axle input flange; no oil leakage at axle housing and brake line joint on axle
	4	Touch: ride control accumulator is installed firmly with the joint free of oil leakage
	5	Touch: there is no oil leakage at transmission front output flange, transmission filler mounting face, shift control valve, level window, level mouth, breather and brake cylinder
	6	Touch: there is no oil leakage at steering gear and joint, pressure regulating valve, flow amplifying valve, unload valve, combination valve, electric proportioning valve, steering pump, priority valve, pilot valve, charge valve, mounting face of working pump and pipe joint; there is no water leakage at heater pipe and water return pipe joints
	7	Touch: there is no oil leakage at safety valve and oil inlet and return pipe joints to the boom, bucket tilting, control valve, pilot hose joint on the control valve; visually check that there is no interference between oil inlet and return pipe of control valve, pilot control pipe and other sharp edges, moving parts
	8	Touch: there is no oil leakage at left and right steering oil cylinder pipe and joint; visually check that there is no interference between steering and brake pipe and other sharp edges, moving parts
	9	Touch: there is no oil leakage at accumulator in transmission and brake pipe joint, pilot accumulator, transmission oil filter and its joint, charge valve and its joint and hydraulic rising mechanism
	10	Touch: there is no oil leakage at bottom of hydraulic oil tank, flange, plug, level window, oil inlet and return pipe joint and flange face
	11	Touch: there is no oil leakage at diesel fuel tank and outlet pipe joint, diesel fuel tank body and flange, plug
	12	Visual check: the left and right semi-circles fender and rear fender is matched flush without shaking
	13	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 baffle; there is no oil leakage at lifting cylinder joint
	14	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

Inspection item	S/N	Inspection method and acceptance criteria
Static check	15	Visual check: there is no interference between hydraulic oil tank and cab; there is no interference between left and right hydraulic oil tank guard, foot pedal and driver
	16	Visual check: diesel engine mounting bolt is fastened and there is no oil leakage at parts on left side and oil pan; there is no interference between diesel engine oil pan and sub frame, rear frame beam; no interference between diesel engine torque converter assembly oil return pipe joint and intermediate plate of frame
	17	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;
	18	Visual check: there is no interference between brake line at left side of engine, filter and sharp edges (harness is far away from high temperature area and not interfered with fuel pipe); there is no interference between filters and sharp edges and other parts, and the hoses are not twisted;
	19	Visual check: urea heating pipe, cool water pipe, diesel particle filter water pipe runs smoothly without interference and is far away from high temperature area.
	20	Visual check: arrow of solenoid water valve shall face the urea tank.
	21	Visual check: harness at upper side of diesel particle filter is far away from high temperature area.
	22	Visual check: A/C pipe runs smoothly and is not interfered with other parts, diesel engine high temperature area and the exposed A/C aluminium pipe is not interfered with other parts.
	23	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;
	24	Visual check: clearance between engine fan and shroud is ≥10mm, fan guard ≥15mm; the pulley is not interfered with fan guard
	25	Visual check + touch: there is no water and oil leakage at radiator assembly and its radiator pipe joint;
	26	Visual check+touch: there is no oil leakage at rear axle input flange, axle housing and plug, pipe on axle, left and right clamp, breather; axle brake hose joint is not interfered with oil pan;
	27	Visual check+touch: there is no oil leakage at radiator pipe at right side of engine, fuel pipe, brake pipe, filter; there is no interference between filters and sharp edges and other parts, and the hoses are not twisted
	28	Visual check +touch: there is no oil leakage at radiator pipe reversing valve, fan pump joint;
	29	Inspection of quick coupler: lower the bucket to the ground, shut it off and close the pilot shutoff valve to OFF position. Turn the spool lever to COUPLER, start the machine, open the pilot shutoff valve to OPEN. Operate the multi-functional pilot lever, and check the quick coupler frame movable pin for free extending and retracting. Turn the engine off, close the pilot shutoff valve to OFF position, and turn the spool lever to Aux position.

Power System

Basic Information

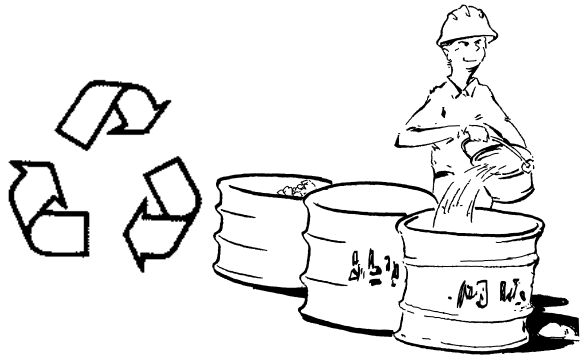
Safety

Compressed Air

Compressed air may cause personal injury. When using the compressed air for cleaning, wear the mask, protection suits and shoes. The maximum pressure of the compressed air for cleaning should be lower than 25psi (0.2MPa).

Safe Disposal of Waste Fluids

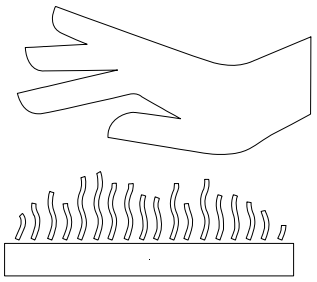
- Improper treatment of waste engine oil, waste diesel and waste DEF is harmful to environment and ecosystem. Treatment shall conform with the local laws and regulations.
- It is mandatory and necessary to collect the liquid with containers spattered during the inspection, maintenance, test, adjustment and repair of machine. Proper container 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.



P19M00059

Preventing Burns

After running for some time, parts of the machine will be hot,such as, engine, DPF (Diesel Particulate Filter) and inter-cooler steel pipe, those parts which are cooled down later shall be inspected or repaired.

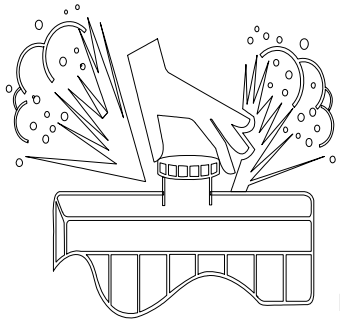


P11000148

Coolant

At working temperature, the coolant of the engine 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.

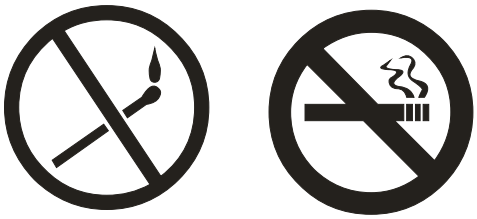


P11000147

Fire & Explosion Prevention

- All fuels, such as most of lubricants and some cooling agent 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, it shall be shall be cleaned completely with flammable liquid.
- 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 approach which attempts to start the engine by use of diethyl ether may cause serious damage to engine or casualties.

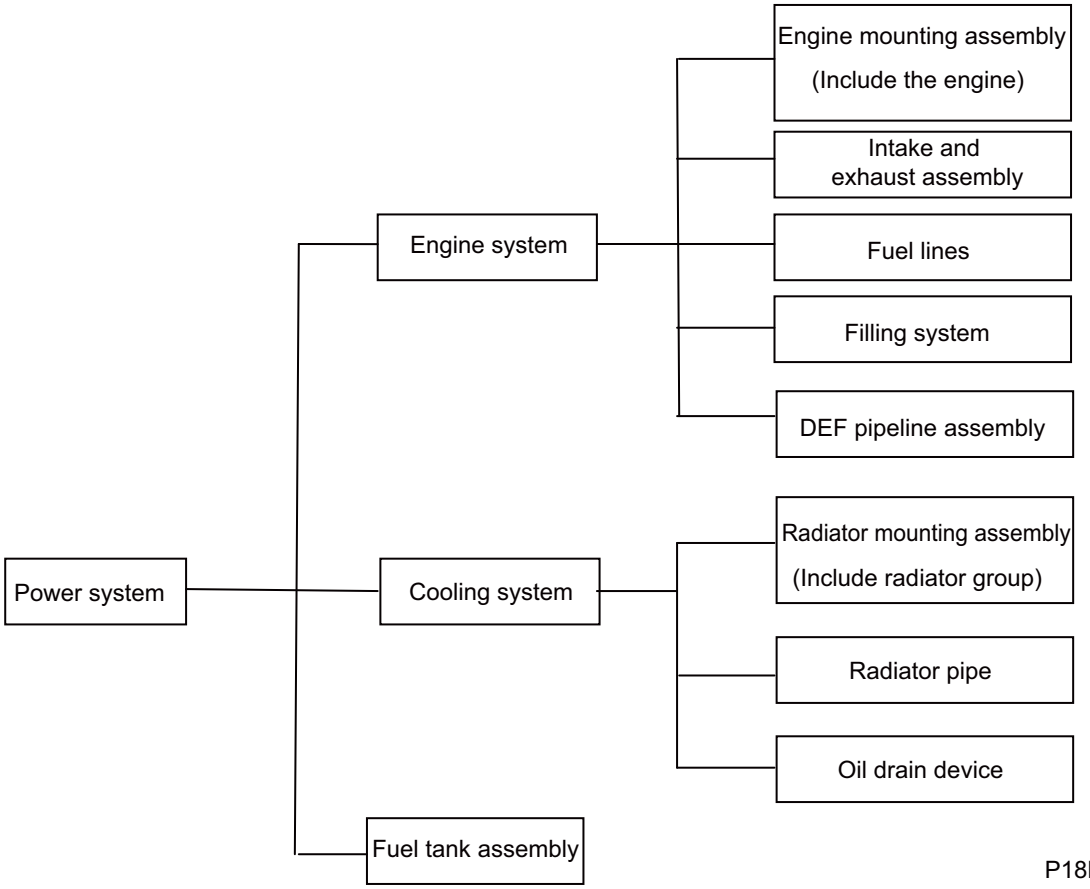
P11000158

Overview-components and position

Components and position

Power system has the function of converting chemical energy of fuel into mechanical energy to be supplied to the machine. Power system includes engine system, radiator system and fuel tank assembly. Among them, the engine mounting consists of engine, and the radiator mounting consists of cooler components.

Module structure figure of power system

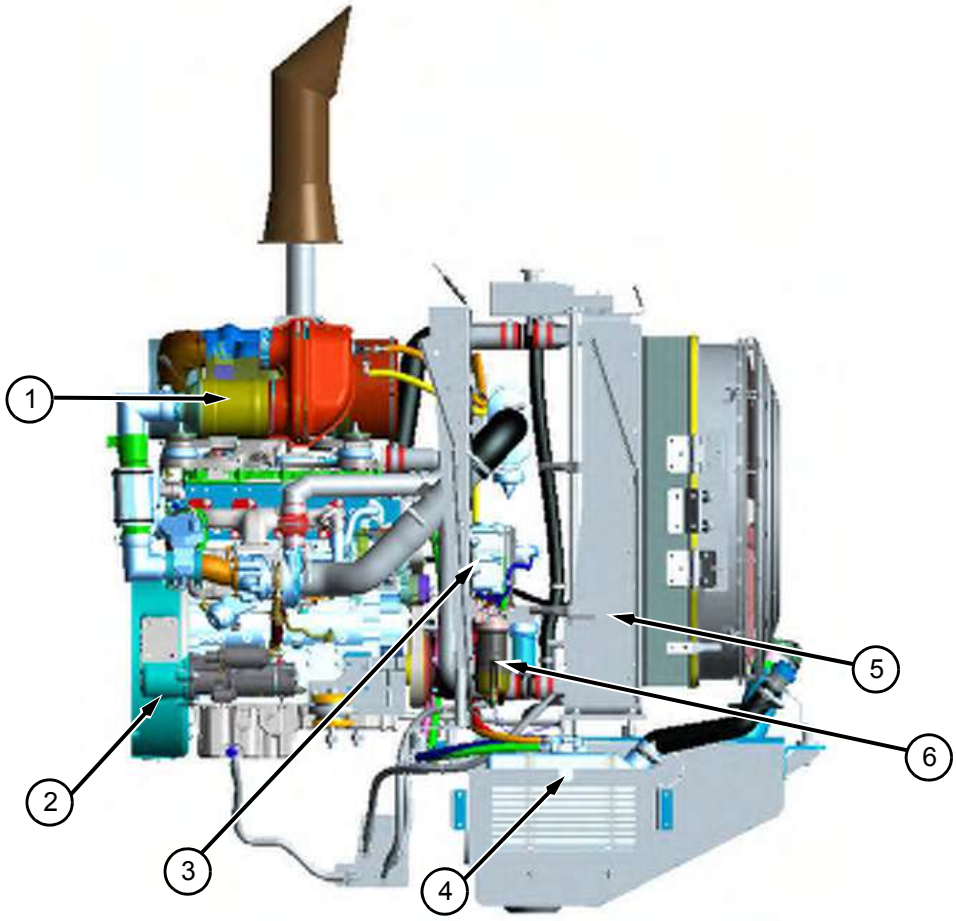


Position figure of power system in the machine

P18P00007

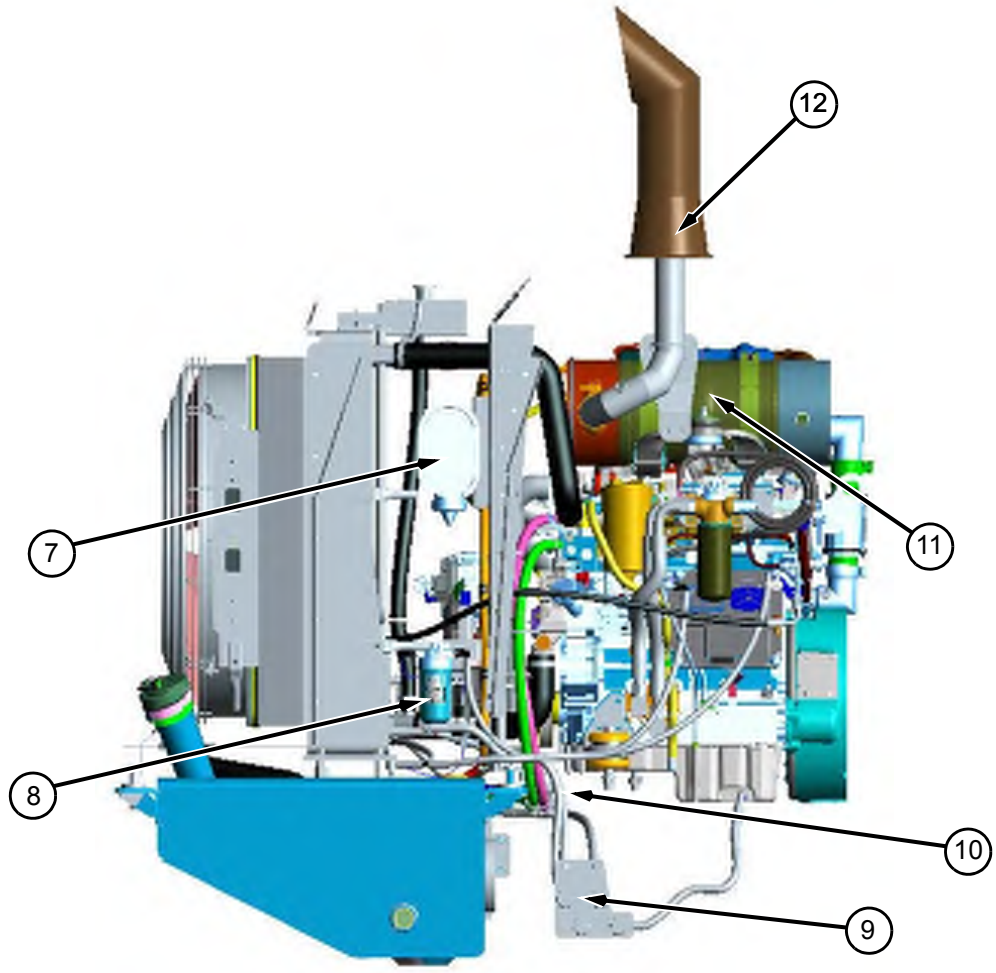
1. Engine system
2. Cooling system
3. Fuel tank assembly

Components of power system



1. Diesel particle filter DOC
2. Diesel engine
3. DEF pump
4. DEF tank
5. Radiator mounting assembly
6. Oil-water separator

Components of power system



P18P00009

7. Air filter	9. Oil drain device	11.Diesel particle filter SCR
8. Fuel fine filter	10.Solenoid water valve	12.Exhaust pipe

System technical parameters

Engine	Model	Perkins 1204F-E44AT
	Type	In line-four cylinders, four-stroke, turbocharged
	Emission	EPA Tier4 Final
	*Rated power	97.9kW/2200r/min(133.144PS/2200rpm)
	*Maximum idling speed	2376±50rpm
	*Minimum idling speed	800±50rpm
	Engine oil level	7.7L (2.03434USgal)
	Direction of rotation	Clockwise (viewed from the fan end to flywheel housing end)
Cooling system	Fan	Diameter of 880mm(34.6456In), 12 pieces of blades, air suction type
	Thermostat	Opening temperature: 82°C(179.6°F) Fully open temperature: 94°C(201.2°F)
Engine oil system	Oil filter	Full flow type and replaceable (filter can rotate)
Preheating system	Preheating method	Grid heater
Water radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	870mm X 454mm X 120mm (34.2519In X 17.87398In X 4.7244In)
Hydraulic oil radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	870mm X 166mm X 120mm (34.2519In X 6.53542In X 4.7244In)
Torque converter oil radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	870mm X 264mm X 120mm (34.2519InX 10.39368In X 4.7244In)
Air-air intercooler	Core type	Plate-fin type
	Core size (height × width × thickness)	870mm X 178mm X 120mm (34.2519In X 7.00786In X 4.7244In)

Notes: Data marked with * is based on engine with fuel system and water pump under intake resistance of 380 mm H2O (3.72 kPa) and exhaust resistance of 160.5 mm Hg (21 kPa) not including alternator, fan, optional configurations and drive components.

Universal tool, tooling list

Name	Specification
Open-end wrench	7#, 8#,10#, 11#, 12#, 13#, 16#, 18#, 19#, 20#, 22#, 24#, 30#
Ratchet wrench, socket	Ratchet wrench, 10#, 11#, 12#, 13#, 16#, 18#, 19#, 20#, 22#, 24# and 30# socket
Torque wrench	120±6N.m(12±0.6kgf.m), 1020±6N.m(102±0.6kgf.m)
Traveling crane	More than 2t (4410lb)
Wire rope with hooks	Weight load over 840Kg (1852.2Kg)
Steel ruler	Steel ruler
Straight screw-driver	
Cross screwdriver	T25
Lifting eye	
Plastic sealing membrane	
Waste oil tank	
Remarks:	

Precautions on removal and installation:

1. Assembly and disassembly must 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, etc. 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. If the removal and installation of other components on the complete machine are concerned in the removal and installation of each component, tools are referred to the tool list for the removal and installation of other components and not 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.

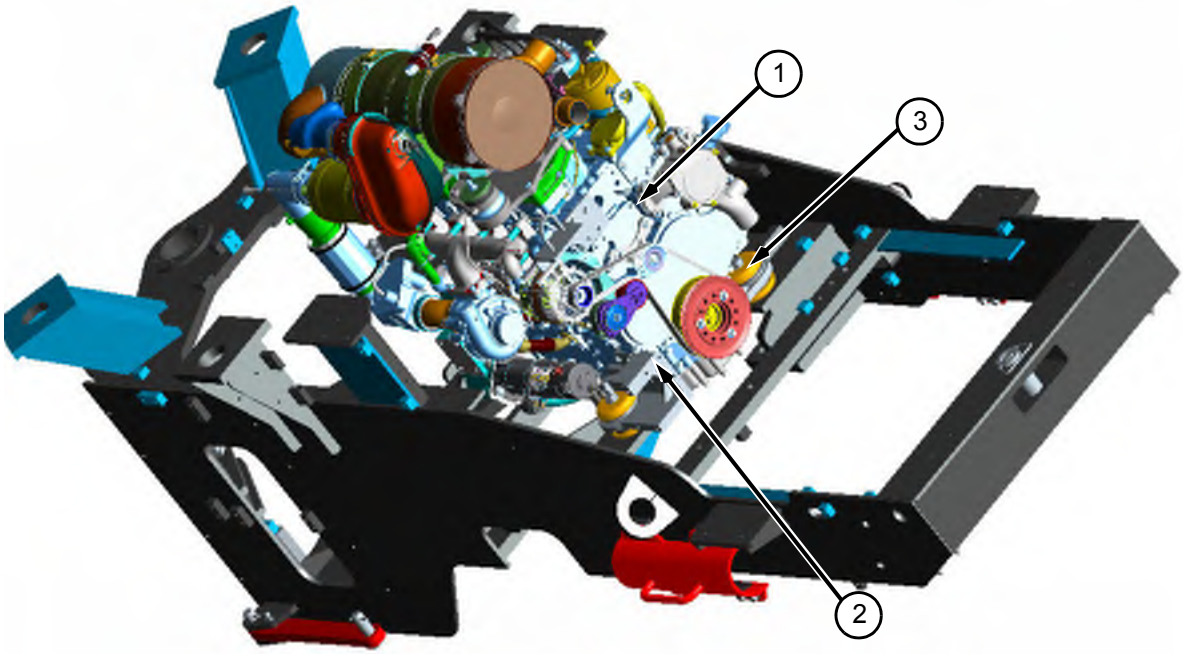
Structure Function Principle

Engine system

Overview

Components and position

The diesel engine mounting assembly is composed of diesel engine, bracket and shock absorber.



P18P00009

1. Diesel engine
2. Bracket
3. Shock absorber

Working principle description

Engine mounting as has the function of realizing effective installation of engine.

The working principle of engine as is as follows: engine is fixed on complete machine via engine mounting composed of mounting support and shock absorber, engine has excellent working environment through shock isolating action of shock absorber, vibration of engine transferred to complete machine is reduced, and riding comfort is improved.

Generally, requirements for the engine assembly are as following.

1. Active and static loads can be supported under all working conditions, and engine assembly has displacements in all directions within acceptable range and does not interfere with other parts on chassis. Meanwhile, before repairing the engine, there are no damaged parts.
2. Vibration generated by engine can be sufficiently isolated from being transferred to frame and cab, and cab operating comfort and service life of complete machine components are improved.

3. Impact generated by uneven roads can be effectively isolated from being transferred to engine through engine mounting, and influence of road impact on engine is reduced.

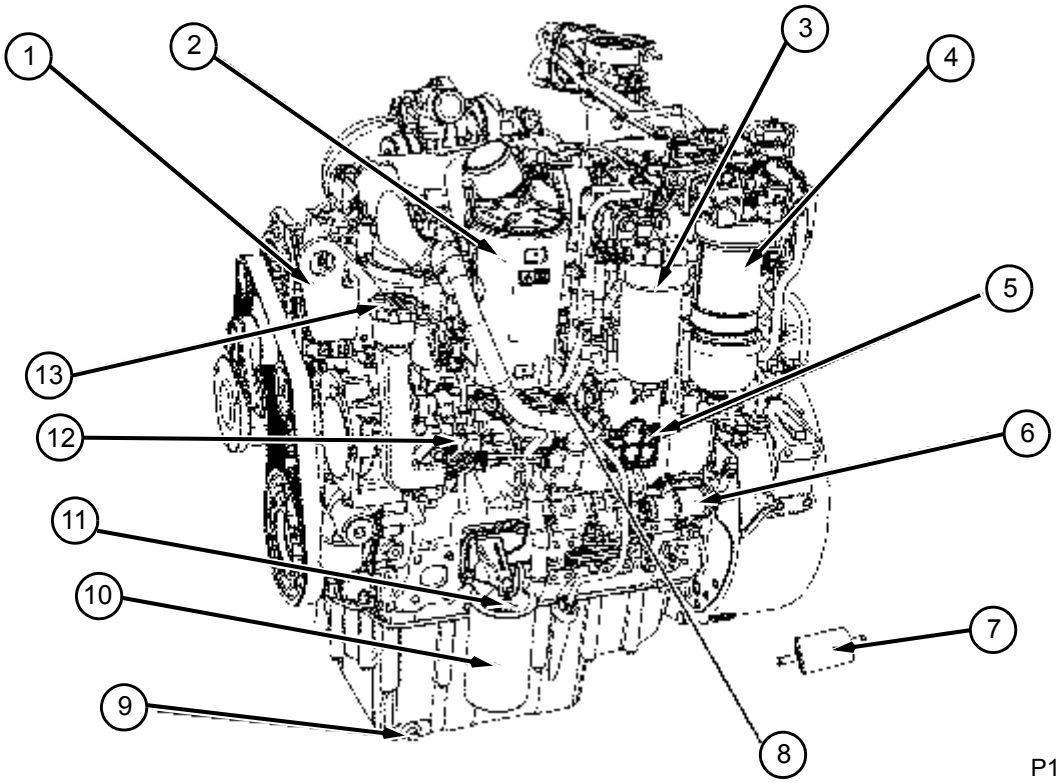
Diesel engine

Technical parameters

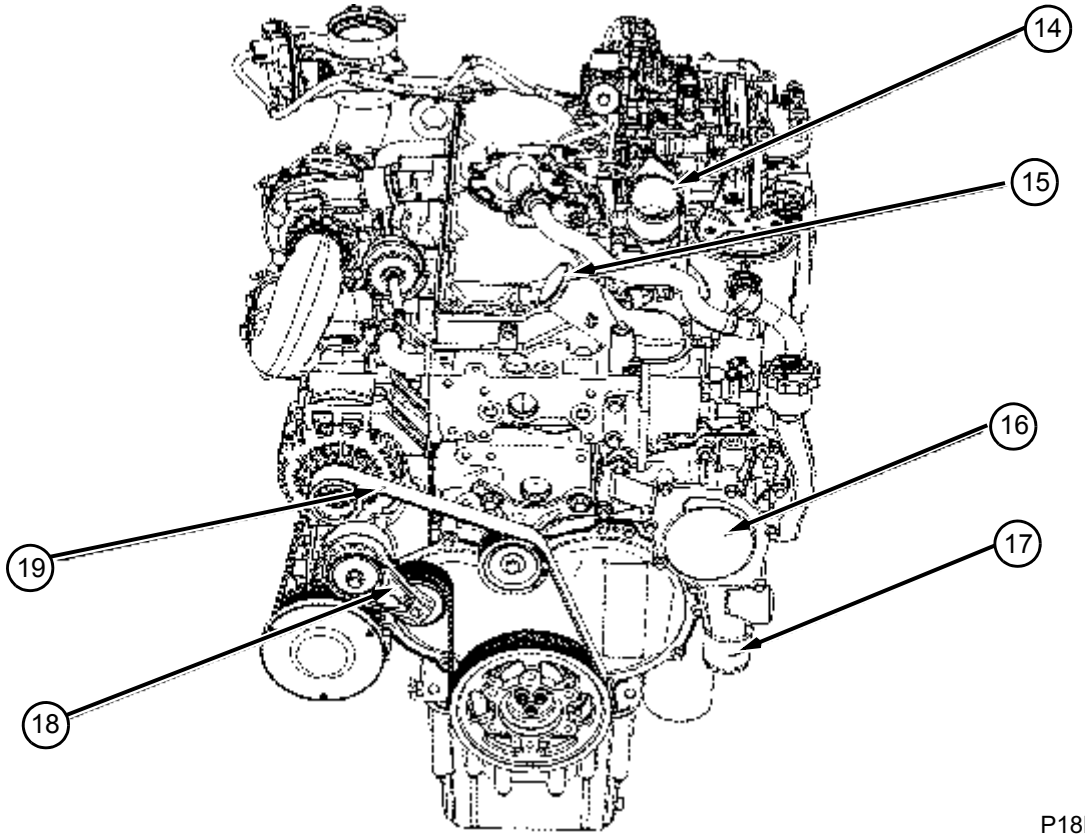
Model	Perkins 1204F-E44TA
Number of cylinder	4
Cylinder diameter	105 mm (0.344505ft)
Stroke	127 mm (0.416687ft)
Displacement	1.16248USgal
Suction mode	Turbocharged inter-cooled
*Rated power	97.9kW/2200r/min (133.144PS/2200rpm)
*Maximum idling speed	2376±50rpm
*Minimum idling speed	800±50rpm

Part Structure and Principle Introduction

External view of Perkins engine 1204F-E44TA

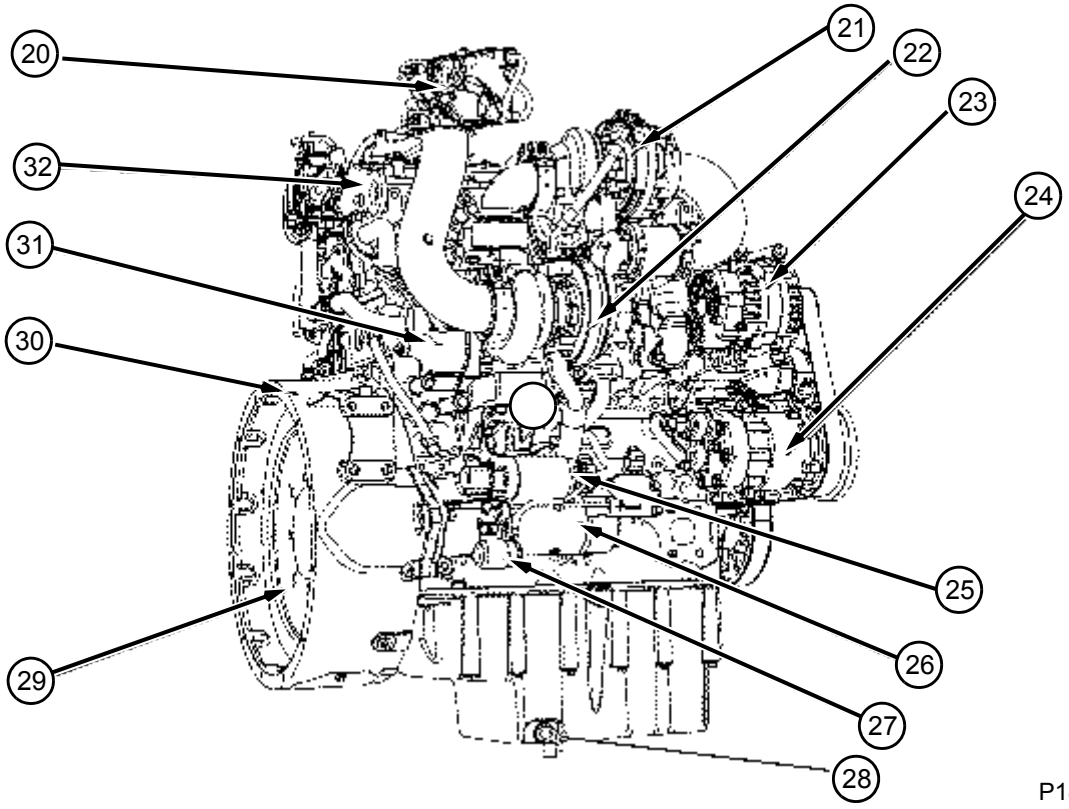


1. Front lifting eye
2. Crankcase breather
3. Secondary fuel filter
4. Primary fuel fitter
5. Electronic Control Module
6. Pnmiog/trarferfuel pump
7. In line fuel fitier
8. Oil level gauge (dipstick)
9. Oil drain plug
10. Oil filter
11. Oil sampling vafve
12. High-pressure fuel pump
13. Oil filler



P18P00012

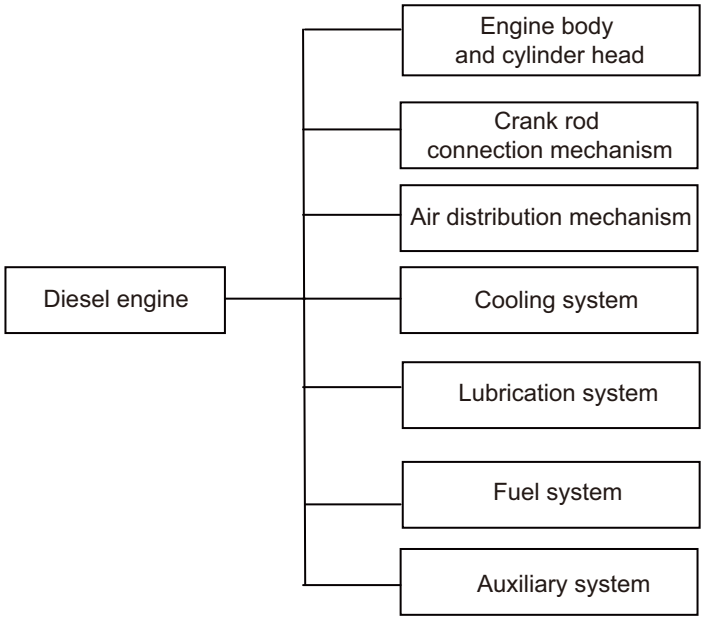
14.Air intake
15.Coolant outlet
16.Water pump
17.Coolant intake
18.Tensioner
19.Belt



P18P00012

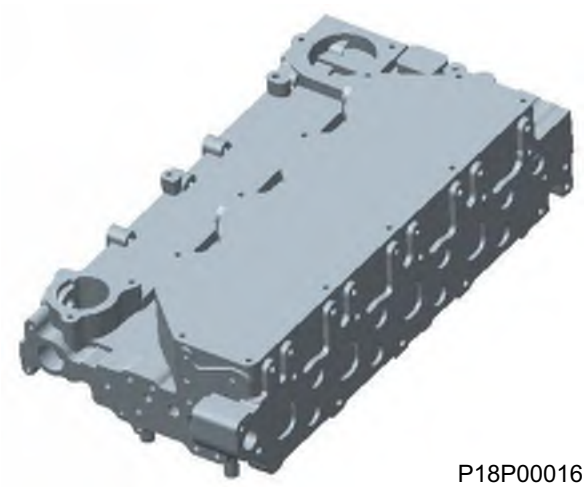
20.Back pressure valve
21.Htgh-pressure turtoocharger
22.Low-pressure turbocharger
23.Alternator
24.Refrigerant compressor
25.Starter solenoid
26.Starting motor
27.Starter relay
28.Oil dram tap
29.Flywheel
30.Flywheel housing
31.NOx reduction cooler
32.Rear lifting eye

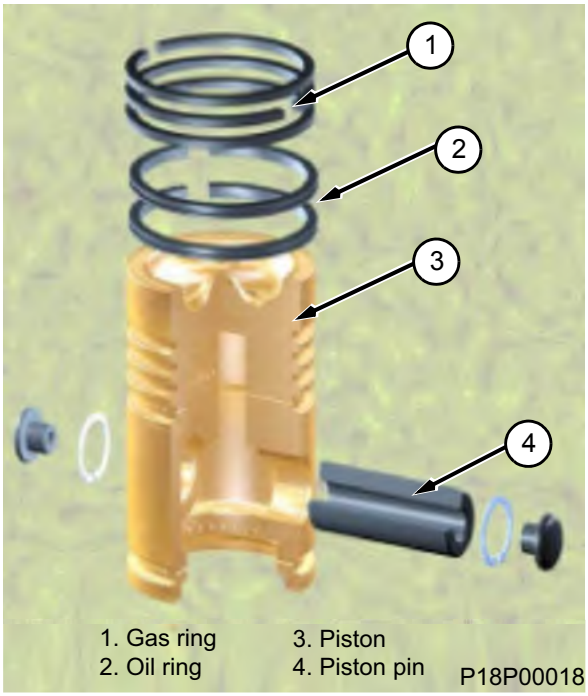
The diesel engine is generally composed of two major mechanisms and four systems:

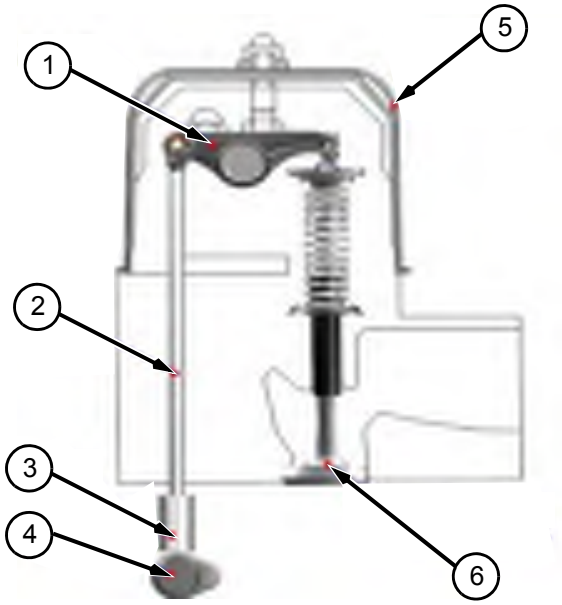


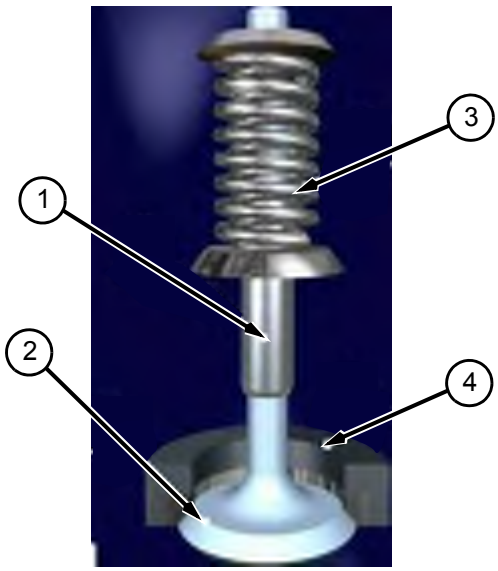
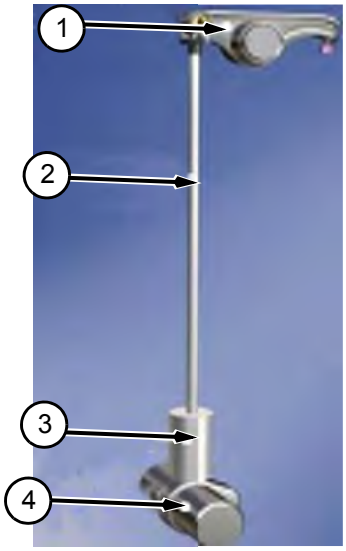
P18P00014

Basic body of engine		Engine body and cylinder head
 P18P00014	It is the frame of engine, and composed of cylinder block, crankshaft case and oil pan.	Engine body

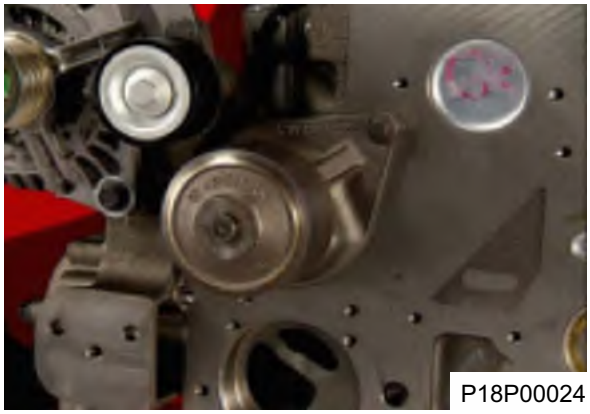
 P18P00016	It is located at top of cylinder block, and used for sealing the cylinder head, and forms a combustion chamber together with cylinder and piston. It is usually installed with nozzle, air intake/ exhaust valve, intake/exhaust pipe and rocker arm shaft assembly.	Cylinder head
 P18P00017	Machine body and work component, which is composed of piston group, connecting rod group, crankshaft flywheel group, and used for converting the chemical energy of fuel into mechanical energy for output.	Crank rod connection mechanism

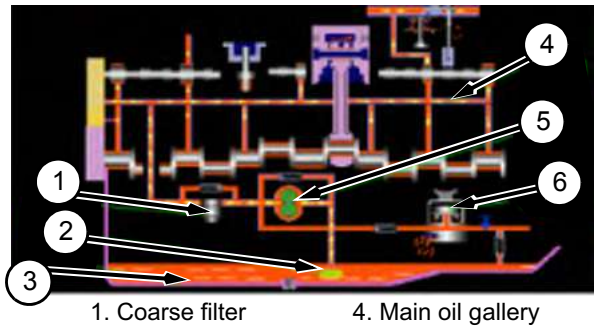
 1. Gas ring 2. Oil ring 3. Piston 4. Piston pin P18P00018	It is composed of piston, piston ring and piston pin. Piston: piston head is a part of combustion chamber, with the shape of dome head, flat head, crown head	Piston group
 P18P00019	It is composed of connecting rod, connecting rod bolt and connecting rod bearing. The connecting rod is used for converting the reciprocating motion of piston into the rotation motion of crankshaft, and transferring the force of piston to crankshaft.	Connecting rod group

 P18P00020	It is composed of crankshaft, fly-wheel and torsion damper	Crankshaft fly-wheel group
 1. Bucket lever 2. Push rod 3. Ejector pole 4. Cam 5. Air valve chamber cover 6. Air valve P18P00021	It is composed of valve group and valve train, and mainly used for controlling the intake/ exhaust process of engine and ensuring that the fresh air is filled into the cylinder timely and making the exhaust gas out of the cylinder in time.	Air distribution mechanism

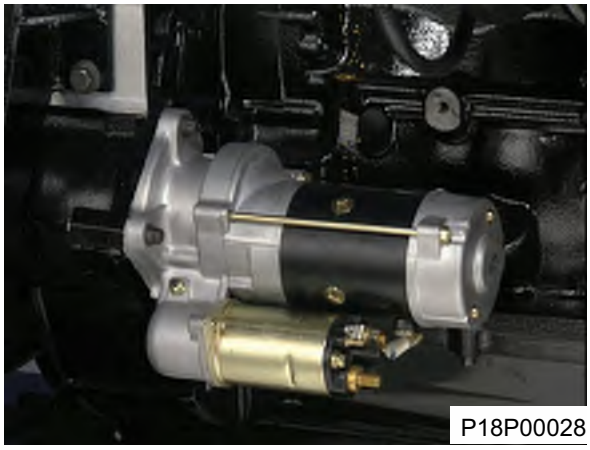
 1. Valve guide pipe 3. Valve spring 2. Valve 4. Valve seat ring P18P00022	It is composed of valve, valve guide, valve seat ring, valve spring, valve rotating mechanism	Valve group
 1. Bucket lever 2. Push rod 3. Ejector pole 4.Cam shaft P18P00023	It is composed of camshaft, tappet, push rod, rocker arm, timing gear	Valve train

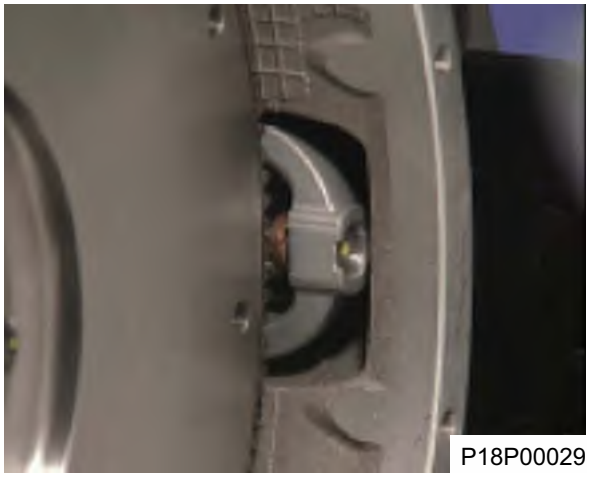
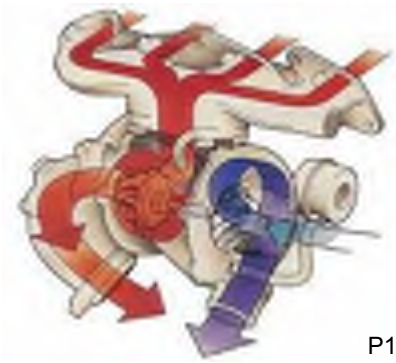
	Guarantee working under suitable temperature. It is composed of water pump, thermostat and water channel	Cooling system

 P18P00024	It is used for increasing the pressure of cooling water to accelerate the cycle of cooling water in the cooling system to enhance the heat radiating ability	Water pump
 P18P00025	It is used for controlling the cooling water to pass major cycle or minor cycle depending on the cooling water temperature to make the engine operate under the proper temperature	Thermostat
	It is built into the machine body to allow the cooling water flow over each component to be cooled	Water channel

 1. Coarse filter 2. Fine filter 3. Engine oil pan 4. Main oil gallery 5. Engine oil pump 6. Secondary filter P18P00026	Components: Oil pan, oil pump, oil radiator, oil filter Function: It is used for transferring the proper amount of lubricant to the system where the part to be lubricated locates and its attachment to ensure the normal operation of engine	Lubrication system

	It is composed of fuel coarse filter (oil-water separator),fuel delivery pump,fuel fine filter,fuel injection pump,injector,fuel pipe and combustion chamber,and used for supplying fuel to engine.	Fuel system
 P18P00027	It is used for filtering the larger particles of impurity and installed at the front of fuel inlet line (fuel delivery pump)	Fuel coarse filter (oil-water separator)

	Start and generate power, etc.	Auxiliary system
 P18P00028	The starter motor is energized and rotates to drive the crankshaft of engine to rotate and allow it transmitted to a state of running itself from static state.	Starting system

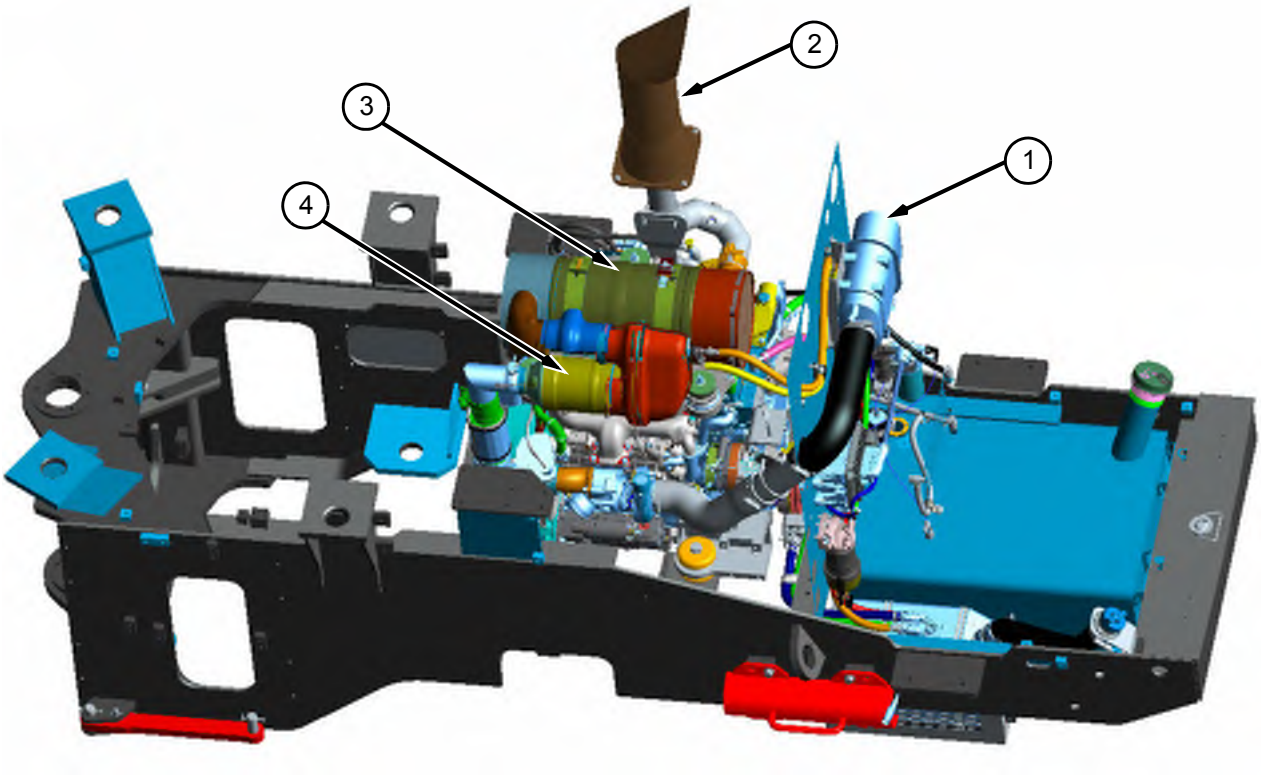
 P18P00029		
 P18P00030	It is used for charging the battery when the engine operates to ensure that the battery can provide high enough voltage during the engine cranking	Alternator
 P18P00031	It pushes the turbo to drive the vane rotating at high speed by using the high speed of exhaust to increase intake pressure and improve intake quantity (intake density), and finally improve engine power and economy.	Turbocharger

Intake and exhaust system

Intake and exhaust assembly

Components and position

Intake and exhaust assembly consists of air pre-filter, air filter, diesel oxidation catalyst (DOC), selective catalytic reducer (SCR) and exhaust pipe.



P18P00032

1. Air filter
2. Exhaust pipe
3. Selective catalytic reducer (SCR)
4. Diesel oxidation catalyst (DOC)

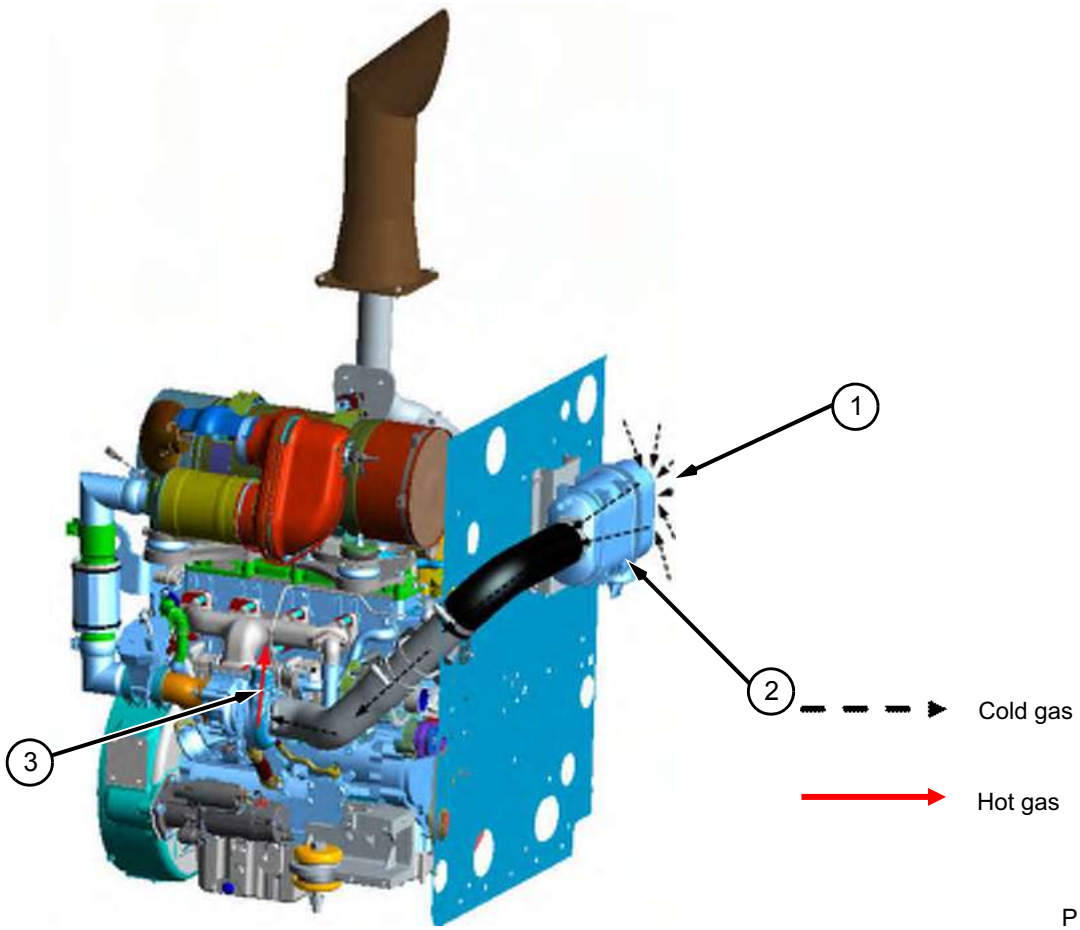
Description of principle diagram and working principle

The functions of the intake and exhaust assembly are:

1. Supply clean and dry air with proper temperature for engine to burn so as to minimize engine wear and optimize engine performance;
2. Keep all exhaust gases safely away from engine and discharge them into atmosphere quietly while optimizing engine performance.

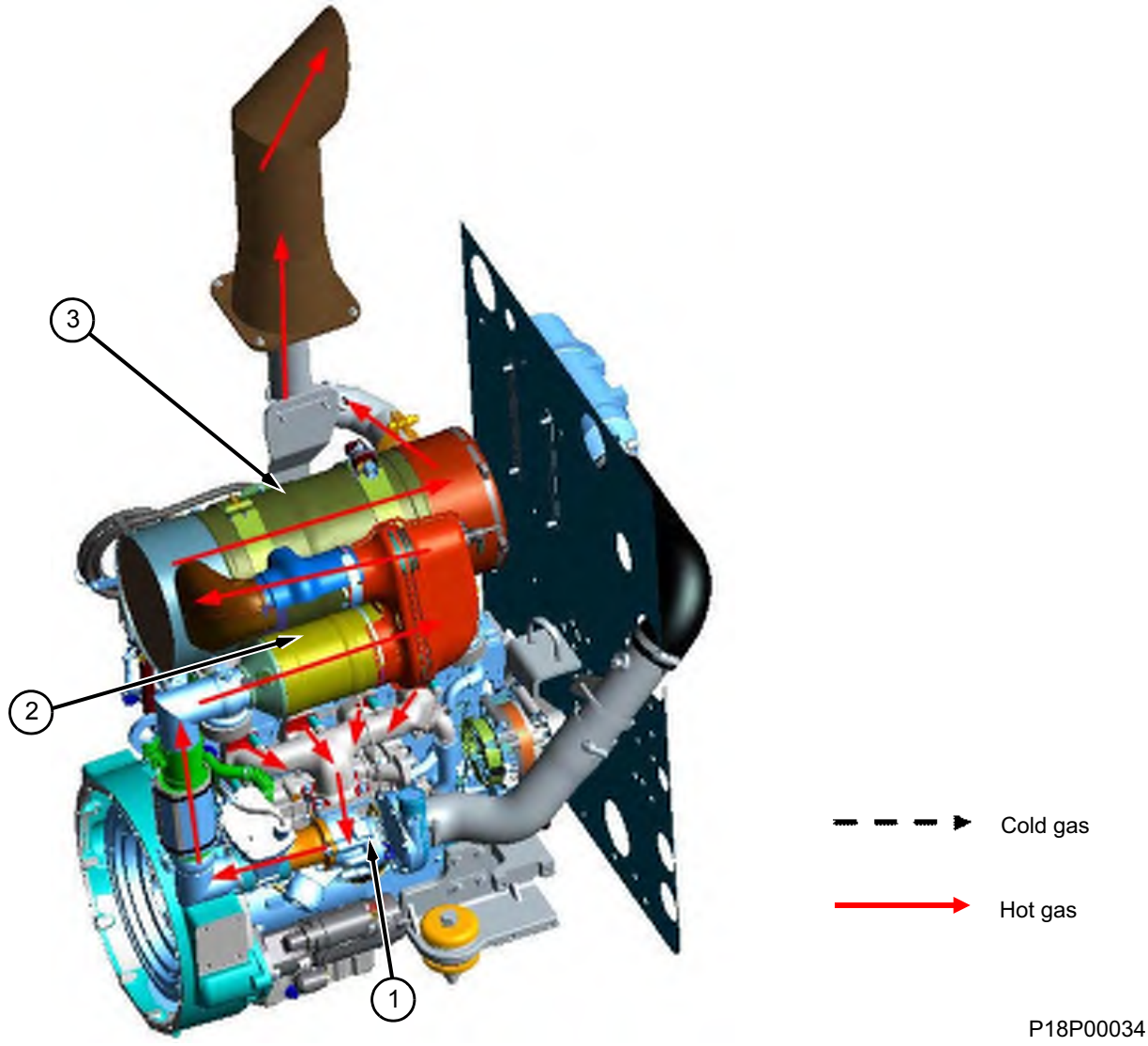
Working principle of the intake and exhaust assembly: air is taken in through air pre-filter. There are rotating blades inside the air pre-filter, which can discharge big dust in intake air from the bottom of air pre-filter. Intake air reaches air filter, filter element removes small dust and moisture to obtain clean and dry air to be sent to turbocharger, the turbocharger is driven by engine exhaust to pressurize intake air and increase intake quantity, and sufficient combustion of fuel can be ensured. Air coming out of turbocharger goes through air-air intercooler in cooling system and electric heater of engine itself to obtain proper temperature and then enters engine block to burn. Exhaust gas generated after combustion reaches turbocharger via exhaust manifold, drives turbocharger to pressurize intake air and is then discharged to DPF (Diesel Particle Filter). When exhaust gas gets to diesel particle filter DOC, particulates will be oxidized to CO2. Then enters into decomposition reactor tube (DRT). Urea solution injected to DRT from the outside will break down to form ammonia gas and mingle with exhaust gas. When gas mixture including exhaust gas and ammonia gas enters into diesel particle filter SCR, under the reaction of catalyzer, nitride oxides will be broken down into nitrogen and water. Finally, exhaust gas pollutants content injected into the atmosphere will be greatly reduced, conforming with Euro IV emission requirement.

Air intake path figure of engine:



1. Air pre-filter
2. Air filter
3. Turbocharger

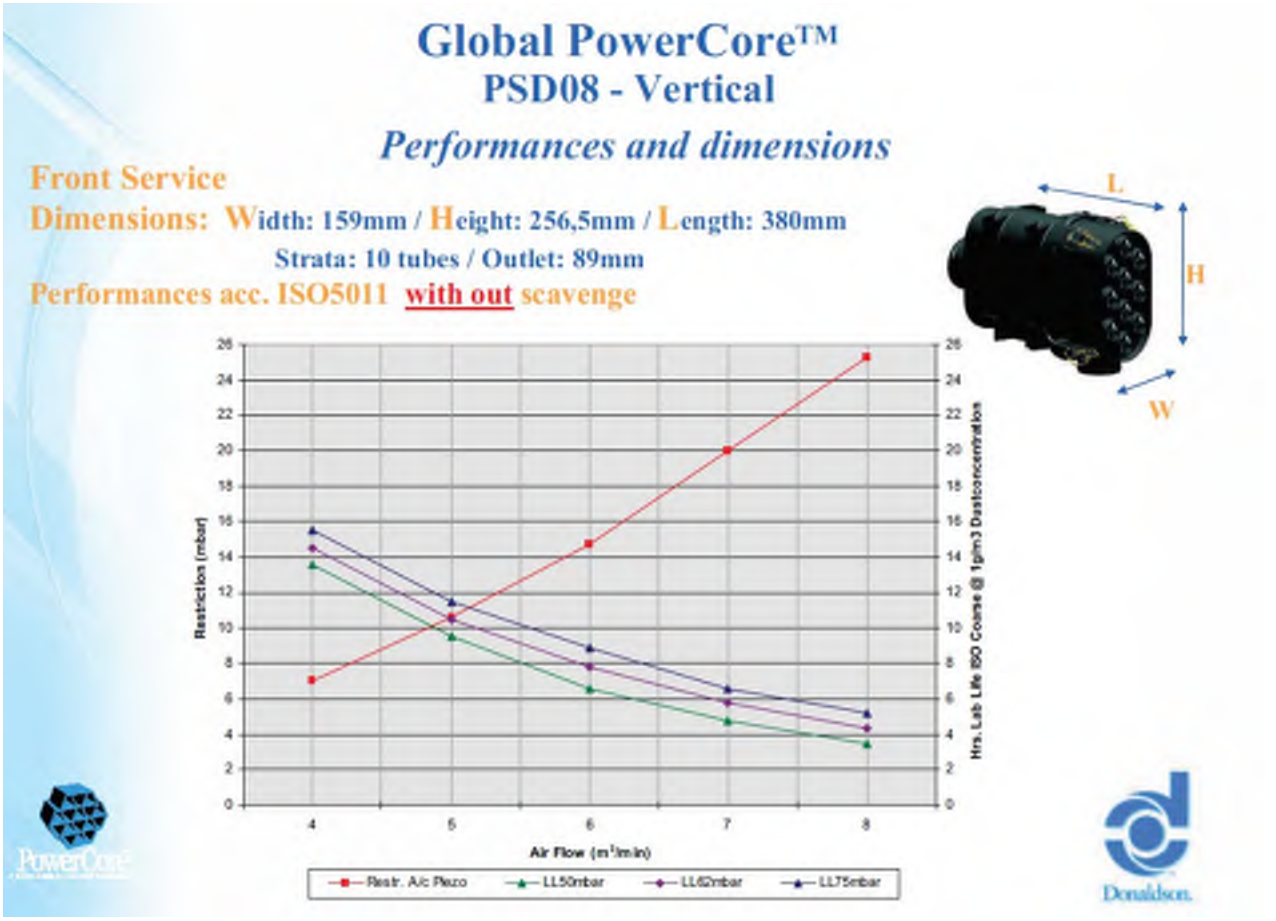
Exhaust path figure of engine:



1. Turbocharger
2. Diesel oxidation catalyst DOC
3. Selective catalytic reducer SCR

Air filter

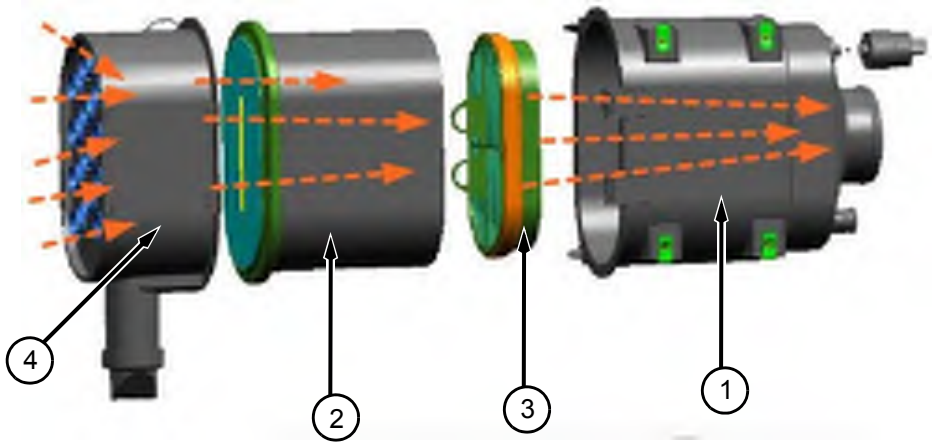
Technical parameters



P18P00035

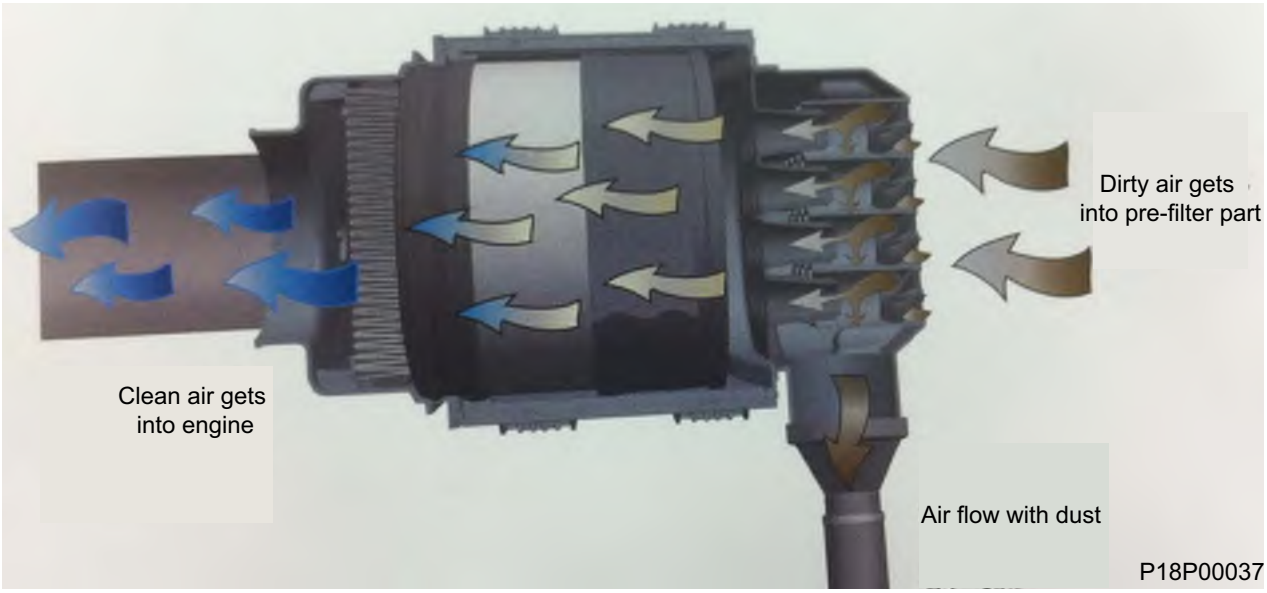
Part Structure and Principle Introduction

The air filter is composed of housing, main filter,safety filter and end cover. Air filter ensures clean and dry air to enter engine through main filter element and safety filter element. When engine operates, air enters air filter through pre-filter, and is filtered by main filter element and is then secondarily filtered by safety filter element,as shown in figure below:



P18P00036

1. Shell
1. Main filter element
2. Safety filter element
3. Cover



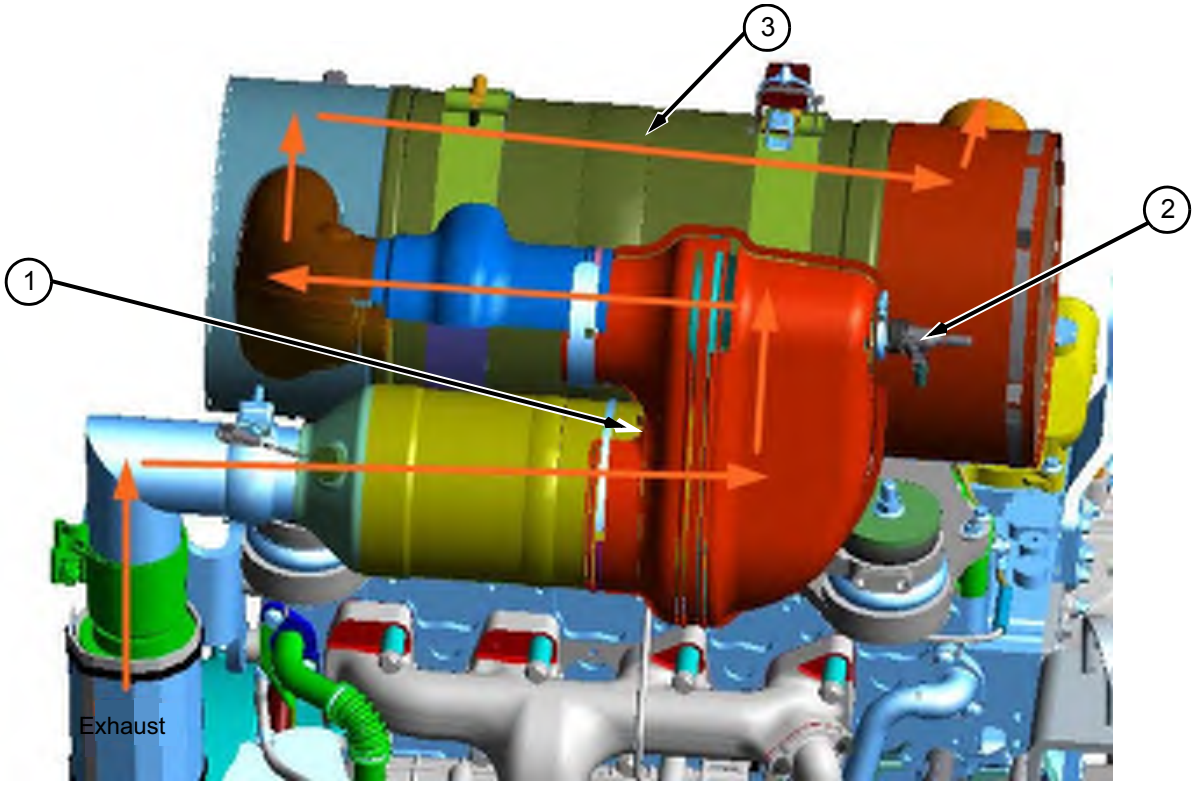
P18P00037

Air filter blocked 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 air resistance through filter is increased. When circulating air resistance is above 6.2KPa (0.0632214kgf/cm³), air filter blockage sensor installed between air filter and turbocharger will transmit signal to air filter alert indicator on instrument panel. When the indicator goes on, air filter shall be maintained.

Diesel Particle Filter System

Part Structure and Principle Introduction

The main function of DPF (Diesel Particle Filter) is to reduce the harmful substance of engine exhaust in order to conform with emission standard. Particulates and NOx emission of the model conform with the emission standard of Tier 4Final/Euro Stage IV.



P18P00038

1. DOC
2. DEF nozzle
3. SCR

Terminology:

DOC: Diesel Oxidation Catalyst

SCR: Selective Catalytic Reduction

Diesel particle filter of the model adopts DOC+SCR routine. When exhaust passes DOC, under the function of catalyzer, hydrocarbon HC is oxidized to CO2 and water. When exhaust passes SCR, nitride oxides NOx is reduced to nitrogen and water.

The reaction in the DOC:

HC (Hydrocarbon Compounds) + O2 → H_2O + CO_2

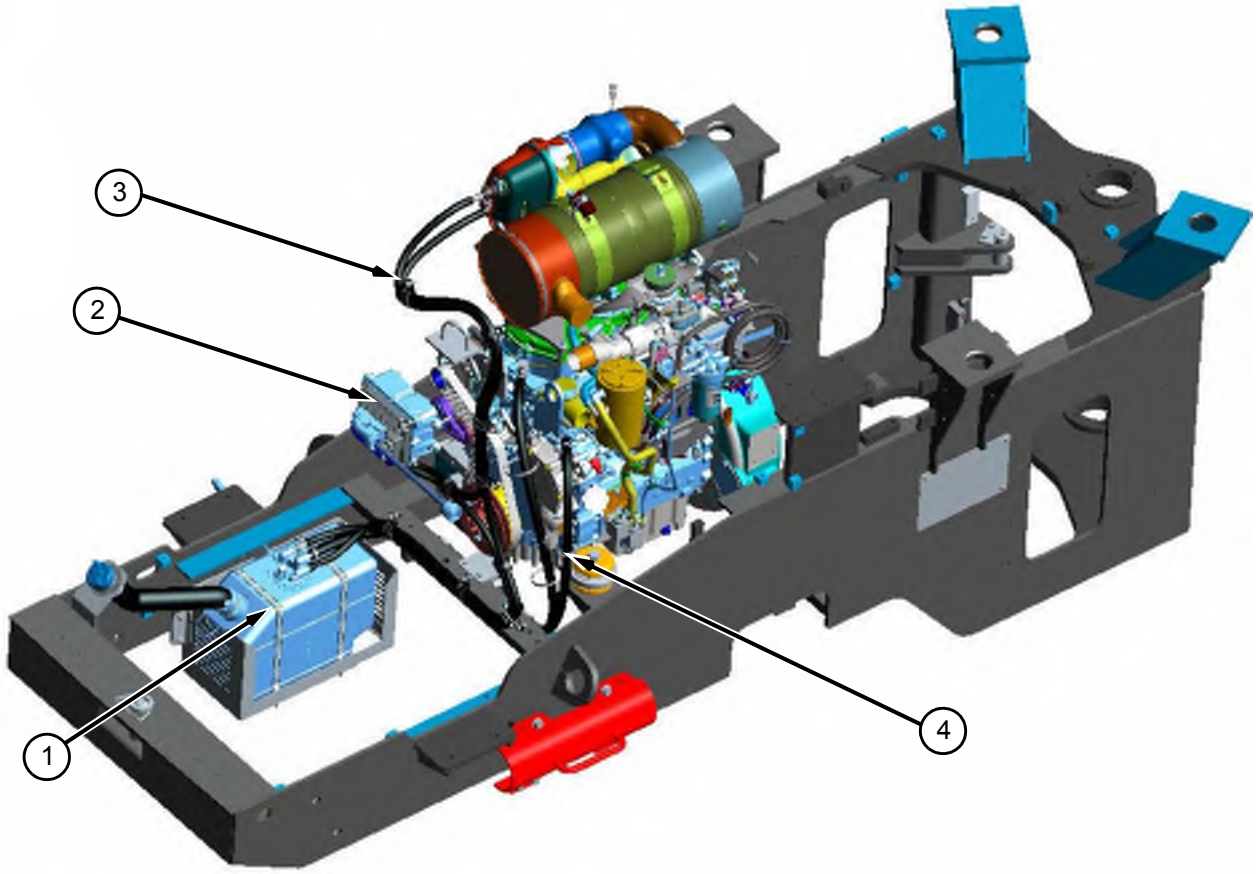
The reaction in the SCR:

NO_x(nitrogen oxides) + NH_3(ammonia)+ O_2 → (catalytic reaction) → N_2 + H_2O.

DEF pipeline assembly

Components and position

DEF pipe-line assembly includes DEF tank, DEF pump, DEF pipe-line and water way.

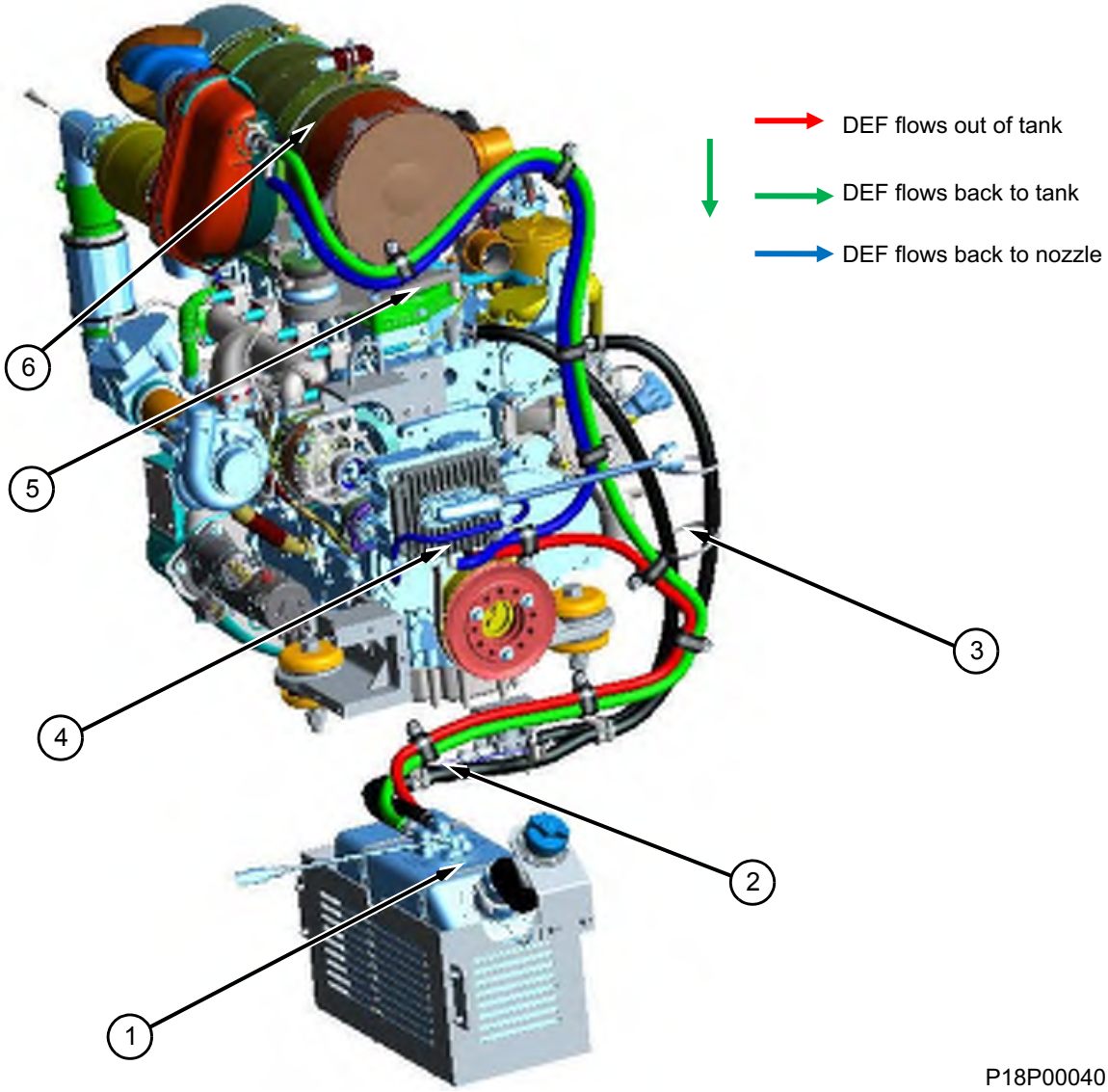


P18P00039

1. DEF tank
2. DEF pump
3. DEF pipe-line
4. Water way

Description of principle diagram and working principle

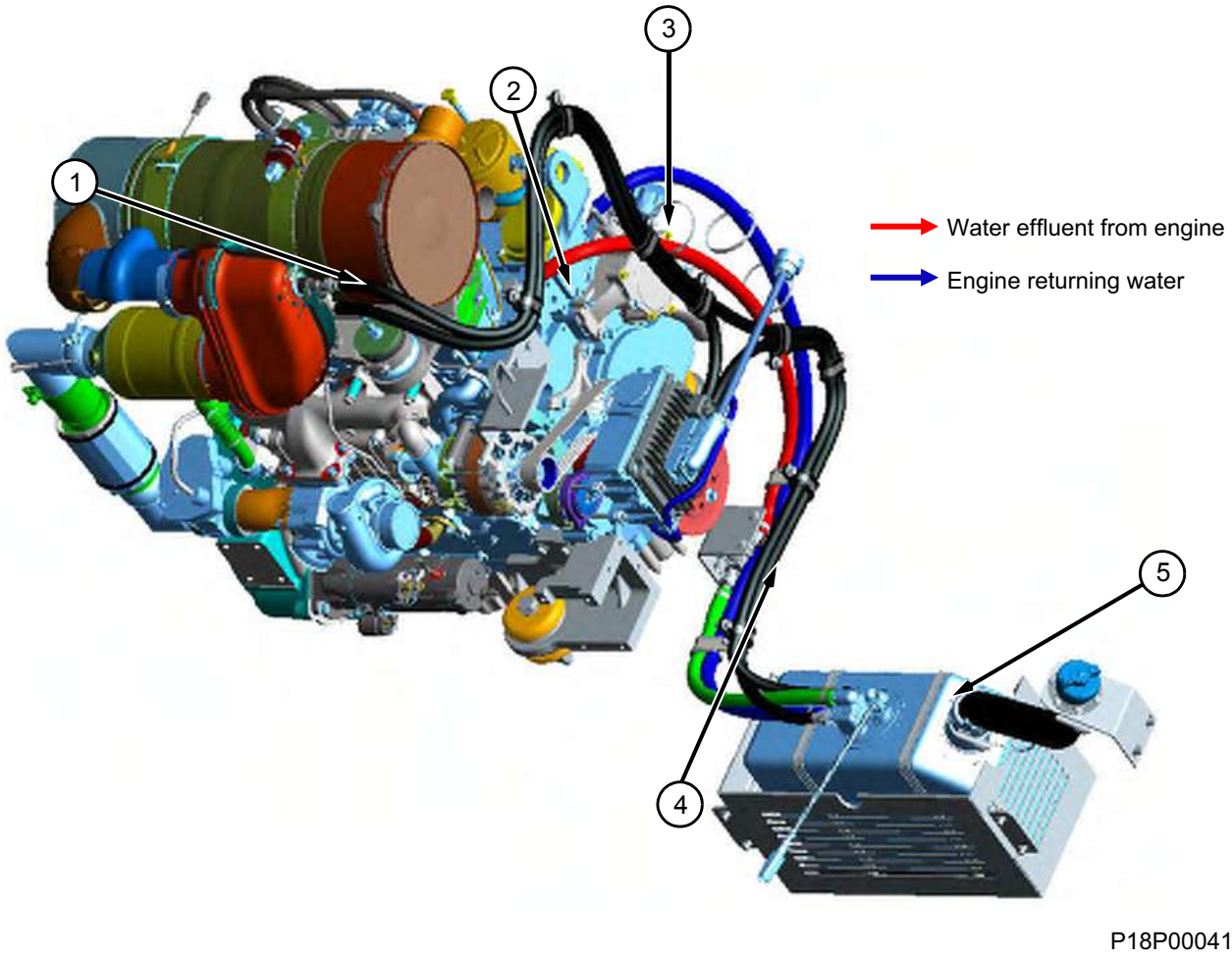
The function of DEF pipe-line is to provide appropriate amounts of DEF for DPF (Diesel Particle Filter) system in order to reduce nitride oxides content of exhaust. DEF is pumped to DEF pump from DEF tank via outlet pipe and then transported to injector via pressure pipe. Excess urea returns urea pump from the return pipe.



P18P00040

1. DEF tank
2. DEF outlet pipe
3. DEF liquid return pipe
4. DEF pump
5. DEF pressure pipe
6. Nozzle

Water way is used to transfer engine coolant to DEF tank and heat the DEF solution avoiding the crystallization. When urea temperature is less than -8°C(17.6°F), the solenoid water valve of water way opens, and engine coolant enters into urea tank to prevent urea solution from freeze, however, when urea temperature exceeds 5°C(41°F), the solenoid water valve of water way closes to prevent urea solution from precipitation out because of being excessively heated.



P18P00041

1. DEF nozzle
2. Engine water outlet
3. Engine returning water inlet
4. Solenoid water valve
5. DEF tank

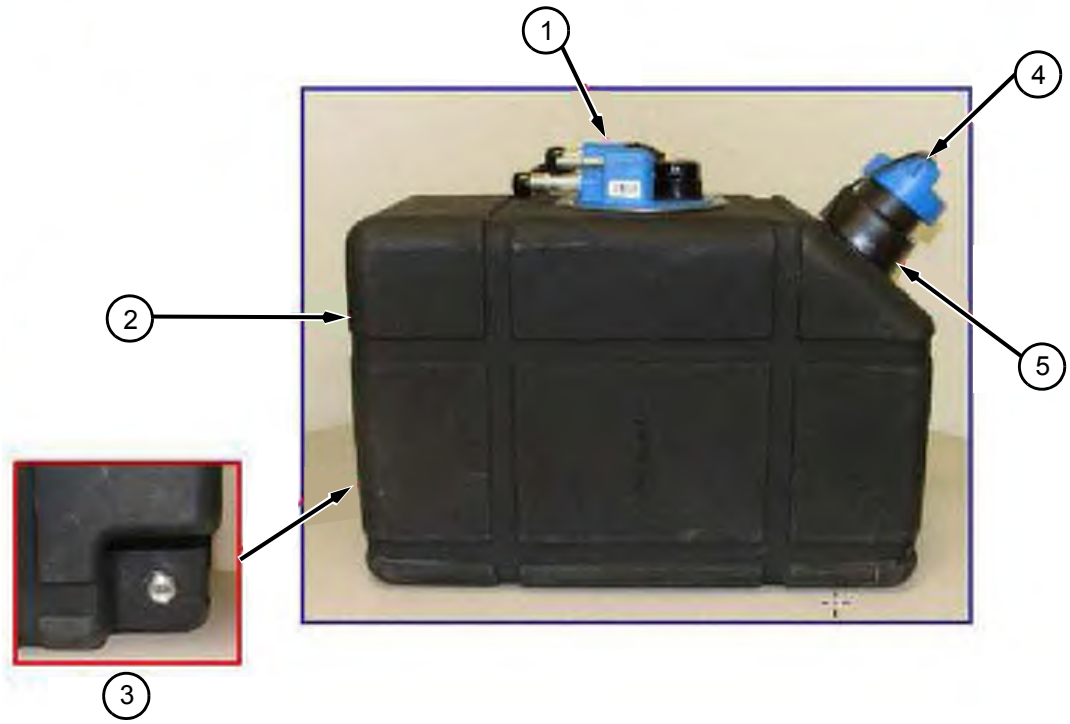
DEF tank

Technical parameters

USABLE VOLUME	19.3L
ELECTRICAL CONNECTOR:	DEUTSCH DT04-4P PIN #1: CAN LOW PIN #2: CAN HIGH PIN #3: GROUND PIN #4: POWER

Part Structure and Principle Introduction

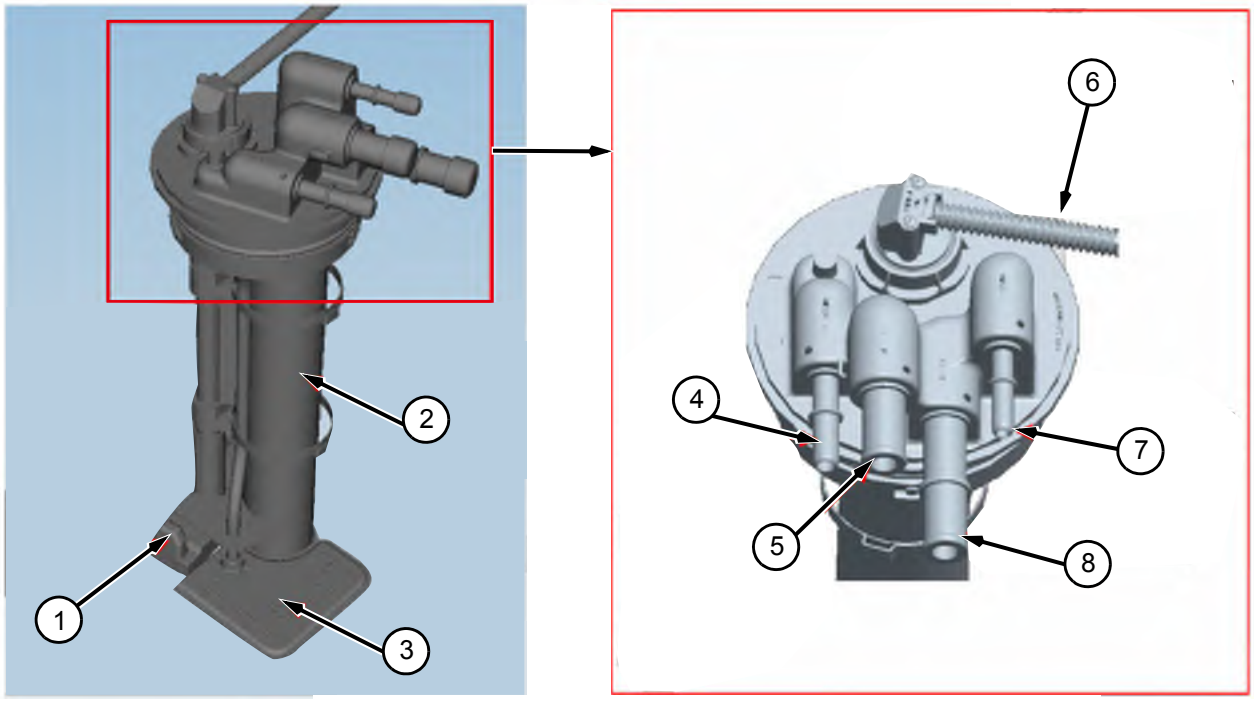
The function of DEF tank is to store DEF solution and provide DEF for DPF (Diesel Particle Filter) during the machine operates. DEF tank consists of shell, multi-functional head unit and cover. There are three sensors in the multi-functional head unit: temperature sensor, liquid level sensor and quality sensor. Temperature sensor detects DEF solution temperature and transports signal to ECM, when DEF temperature is less than -8°C, the solenoid water valve is opened, and engine coolant enters into def tank to prevent DEF solution from freezing, however, when DEF temperature exceeds 5°C, the solenoid water valve is closed to block coolant entering and prevent DEF solution from being excessively heated. Fuel level sensor detects the surplus of DEF solution and transports signal to ECM, if DEF fuel lever is less than alarm value, the situation will trigger low fuel lever alarm and remind the operator of adding DEF. Mass sensor detects DEF mass, if user wrong adds other oils or water,or the concentration of DEF solution is unqualified, these situations will lead to alarm and remind the operator of adding DEF.



P18P00042

1. Multifunction DEF Header Unit
2. Tank
3. Drain Plug
4. Fill Cap
5. Fill Port Adapter

Multi-functional head unit



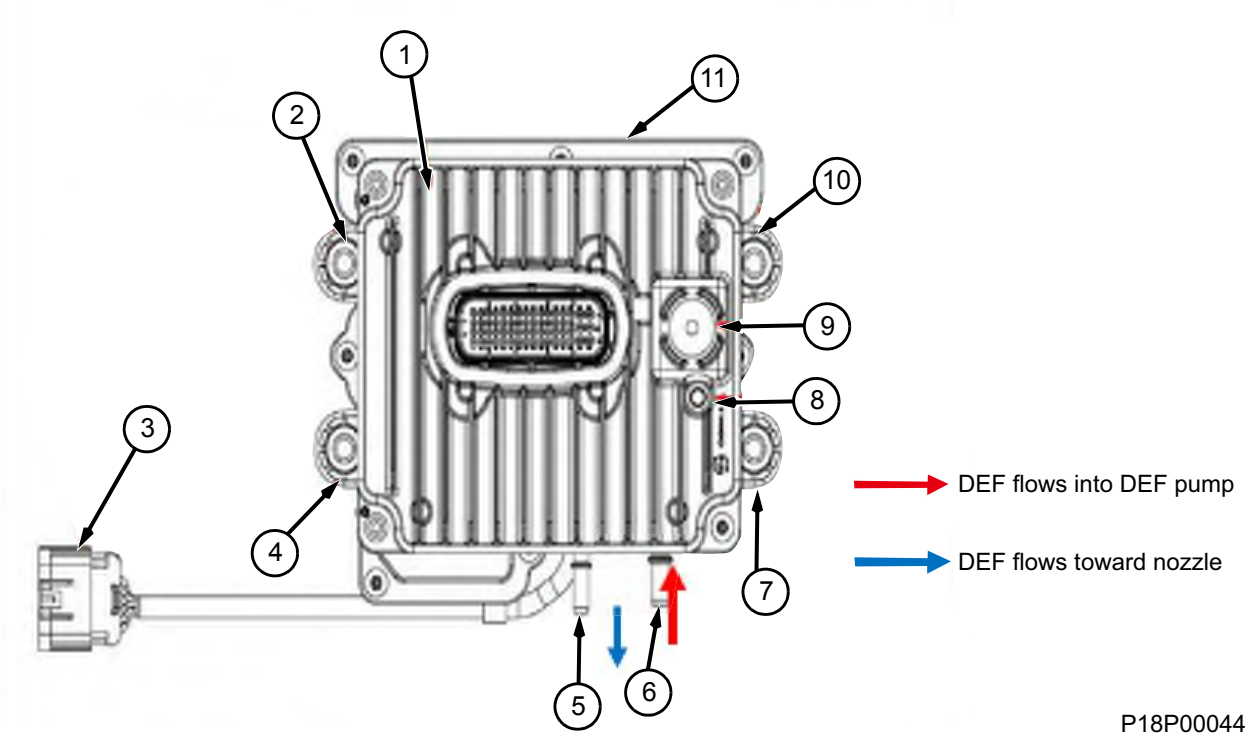
P18P00043

1. DEF level and temp sensor assembly
2. DEF tank heating tube (engine coolant flow internally)
3. DEF suction filter on pick up
4. DEF outlet
5. Coolant inlet
6. Electrical connection flying lead - 375mm long
7. DEF inlet
8. Coolant outlet

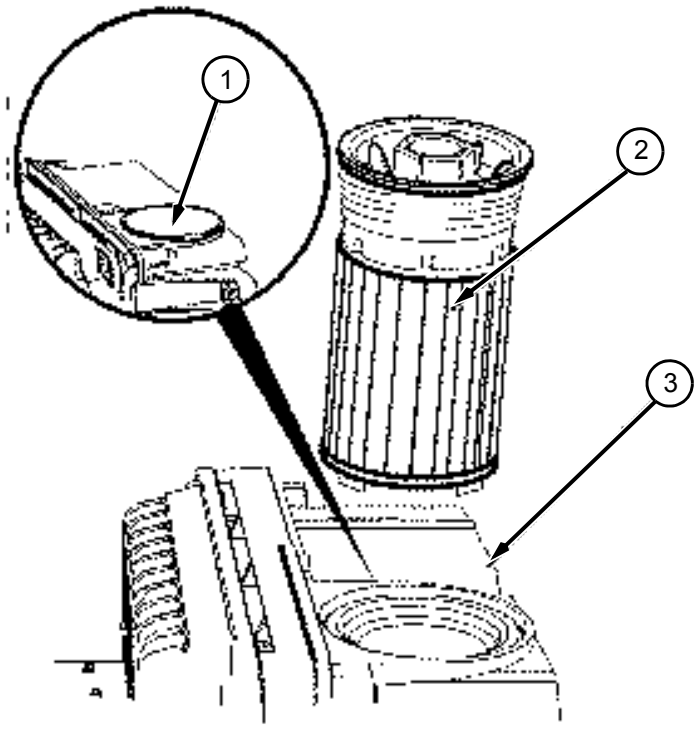
DEF pump

Part Structure and Principle Introduction

Urea pump will pump urea solution from urea tank, and the urea solution is transported to the nozzle of diesel particle filter after filtering.



1. DCU
2. Mounting Tab
3. PEU Harness Connectror
4. Mounting Tab
5. DEF Outlet to injector
6. DEF inlet from Tank
7. Mounting Tab
8. Harness Restraint
9. Vent
10. Mounting Tab
11. Cap for serviceable filter on top of unit



P18P00045

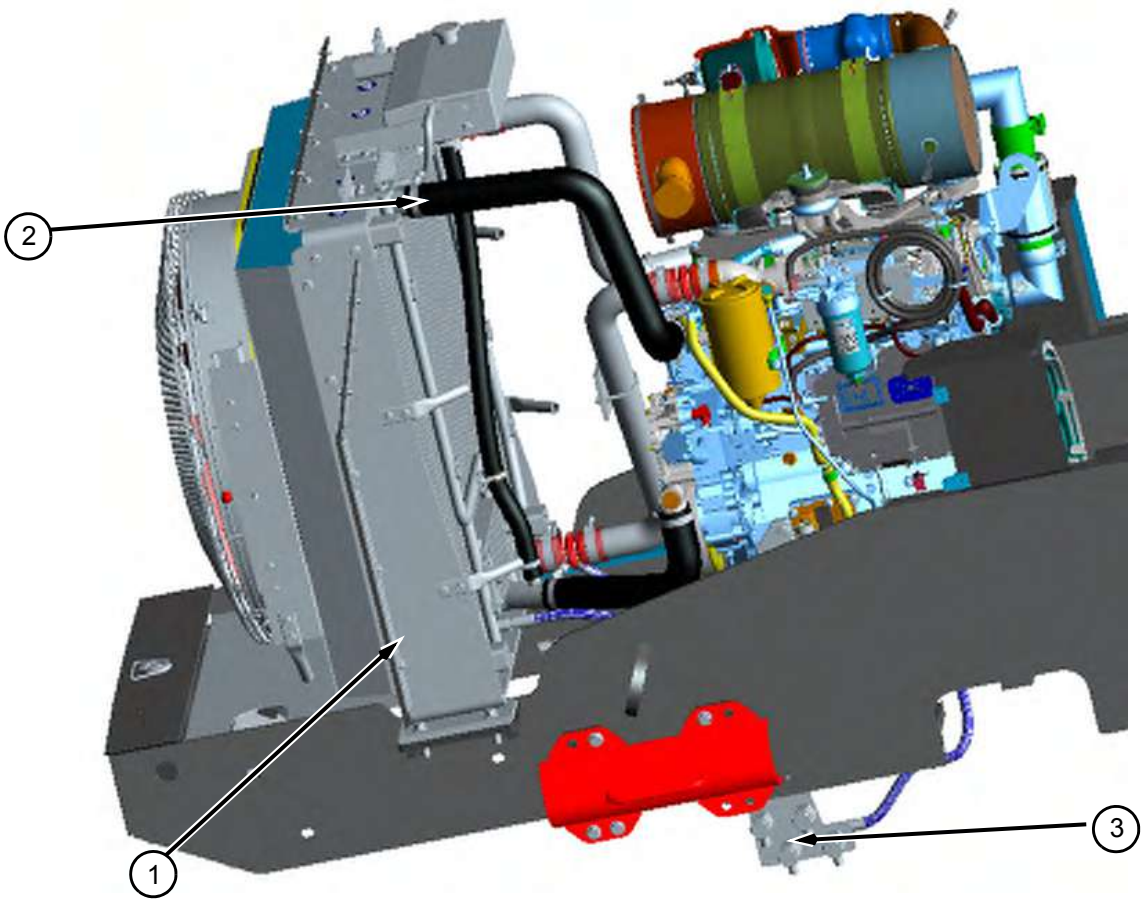
1. Protection shield
2. Strainer assembly
3. Housing

Cooling system

Overview

Components and position

The radiator system is composed of radiator mounting, radiator pipe and oil drain device.



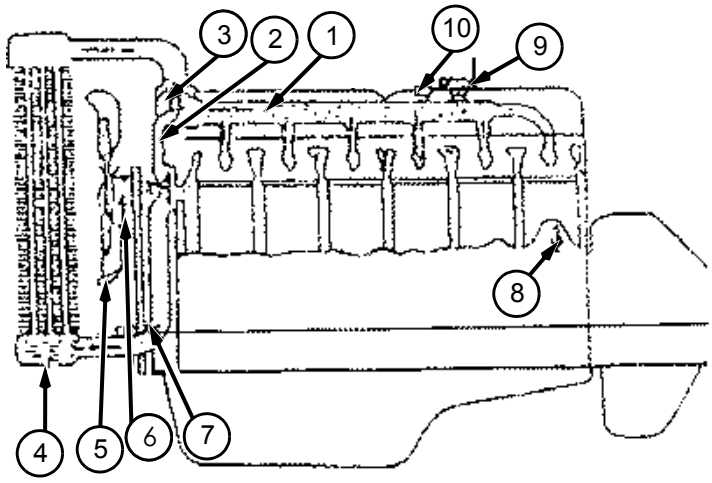
P18P00046

1. Radiator mounting
2. Radiator pipe
3. Oil drain device

Description of principle diagram and working principle

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

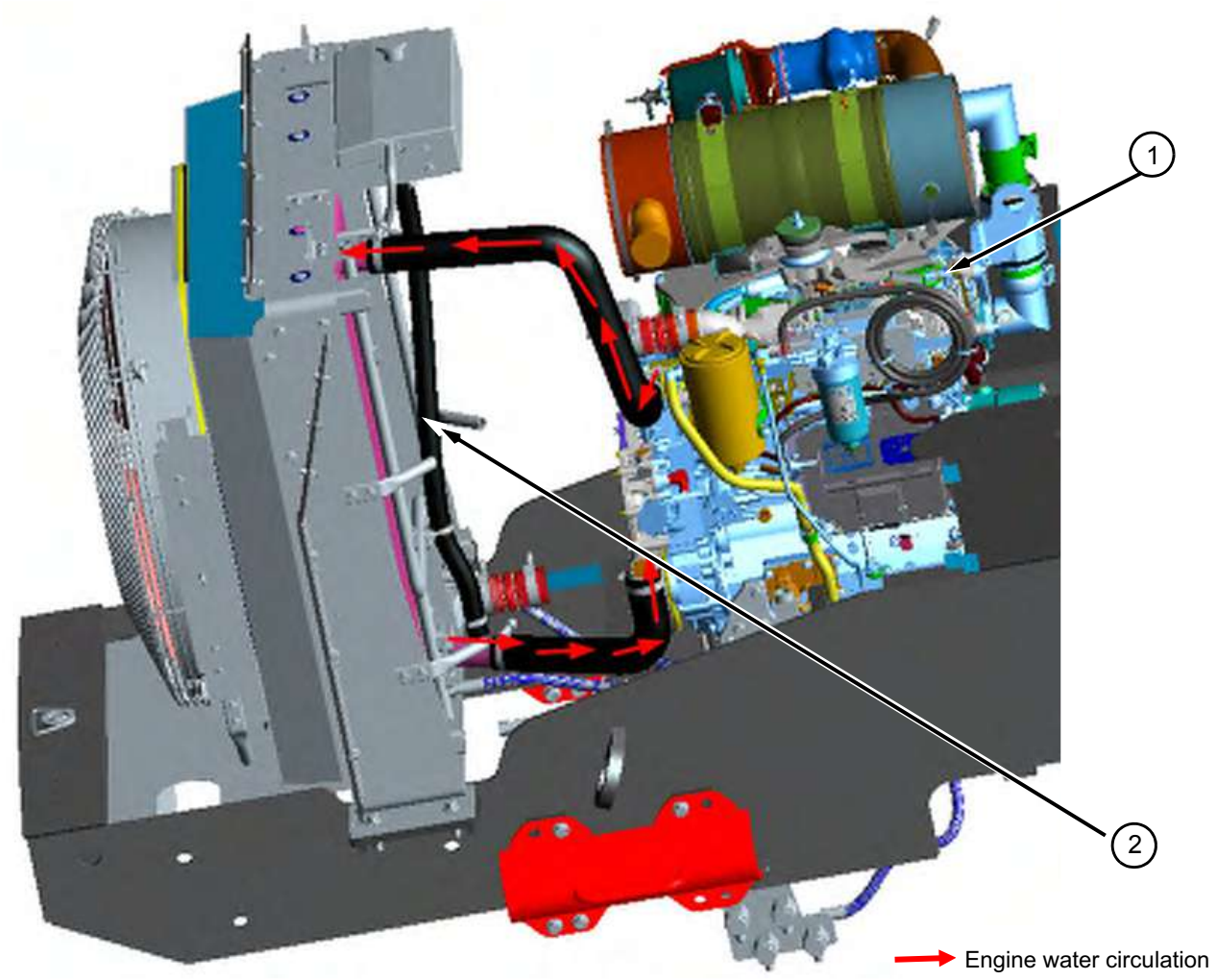
As shown below, diesel engine cooling system mainly comprises a radiator (water tank), a water pump, a fan, a thermostat, an engine oil cooler, water intake and outtake pipes, etc.



P18P00047

1. Water outlet pipe assembly
2. Small circulation
3. Thermostat
4. Radiator
5. Fan
6. Water pump
7. Engine oil radiator
8. Water drain valve
9. Heating valve
10. Water temperature sensor

Cooling system of this machine adopts hydraulic to drive fan and adopts suction 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 cooler is connected with water inlet of engine oil cooler via water hose, water outlet of engine oil cooler is connected with water pump via water hose, water pump pumps coolant into cylinder block water passage, coolant firstly cools cylinder through water jacket inside cylinder block, then flows up to cool cylinder head, and is collected by water outlet header pipe to reach thermostat. When coolant temperature is lower than 84°C(183.2°F), thermostat is closed, and all coolant is bypassed to water pump inlet. At the moment, coolant is only circulating between cylinder block and cylinder head, so that warm-up can be quickly realized. When coolant temperature is above 82°C(179.6°F), thermostat starts to be opened, part of coolant flows to water inlet at upper part of cooler and enters radiator to be cooled by cooling fan. When coolant temperature is above 95°C(203°F), thermostat is totally opened, bypass hole is closed, and all coolant is cooled by radiator. The coolant flowing direction at the moment is shown in the chart.

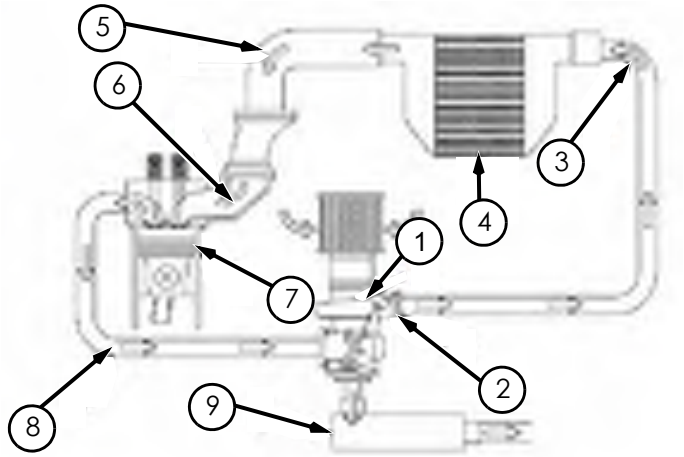


P18P00048

1. Engine
2. Water radiator

Air-air intercooler radiator

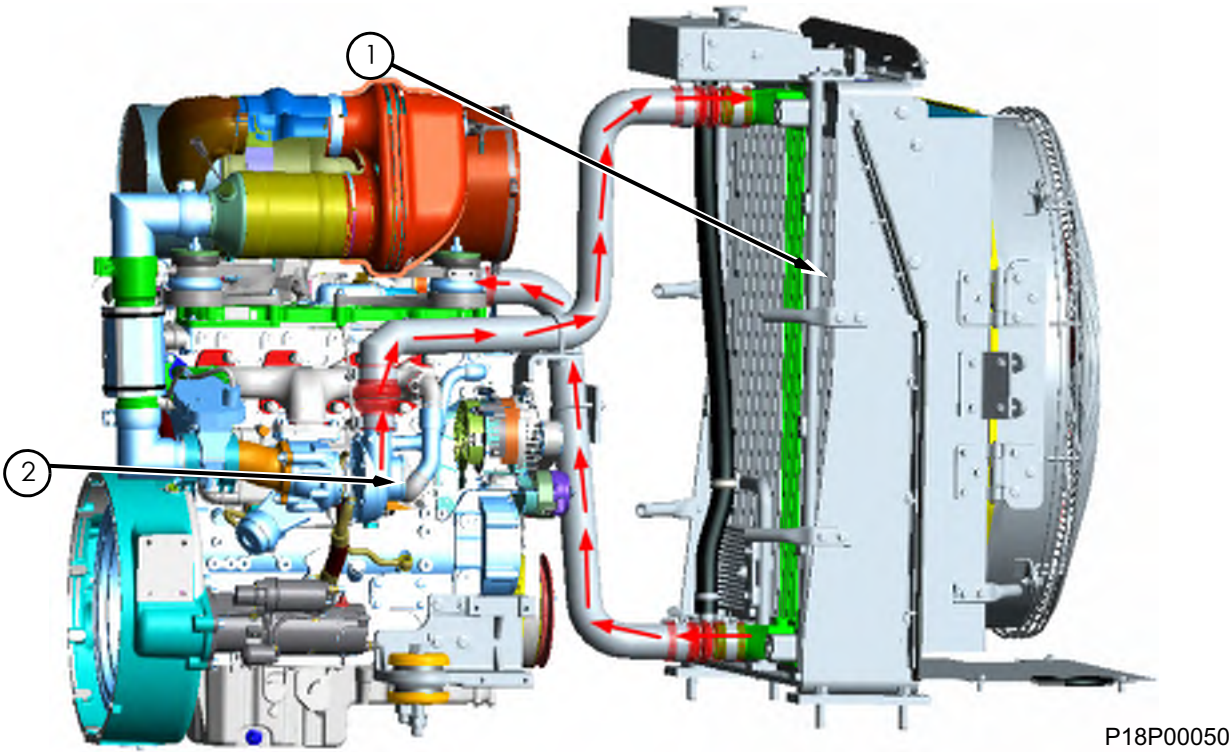
Air-air intercooler has the main function of cooling high-temperature high-pressure gas across turbocharger and reducing temperature of air entering engine combustion chamber to increase air density. Its working principle is shown in Fig. below. After air is pressurized by turbocharger, temperature rises up sharply, pressure is increased, air flows into air-air intercooler from left air pipe and passes across core of air-air intercooler, external cooling air flows by outside the core to bring away heat of air inside intercooler so as to reduce its temperature to be lower than 80°C(176 °F), and then, the air flows into engine intake manifold and cylinder from right air pipe of air-air intercooler.



P18P00049

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

The air-air inter cooler radiating system of the vehicle arranged as the drawing below.



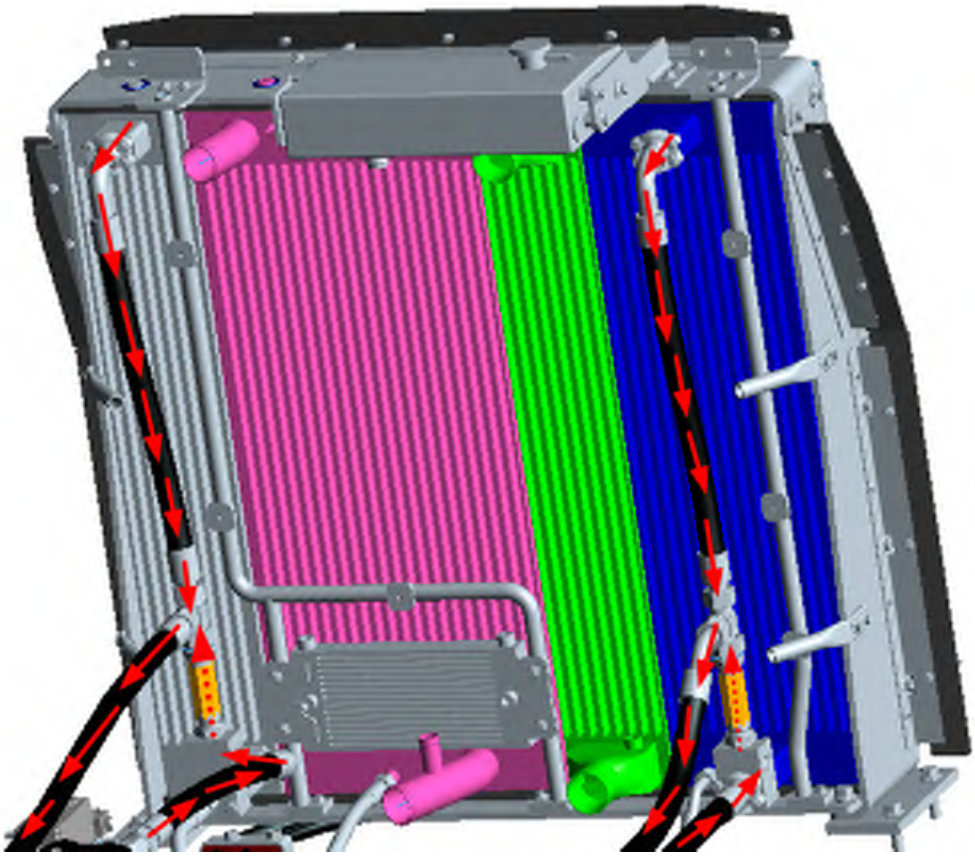
1. Air-air intercooler
2. Turbocharger

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.

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.



P18P00051

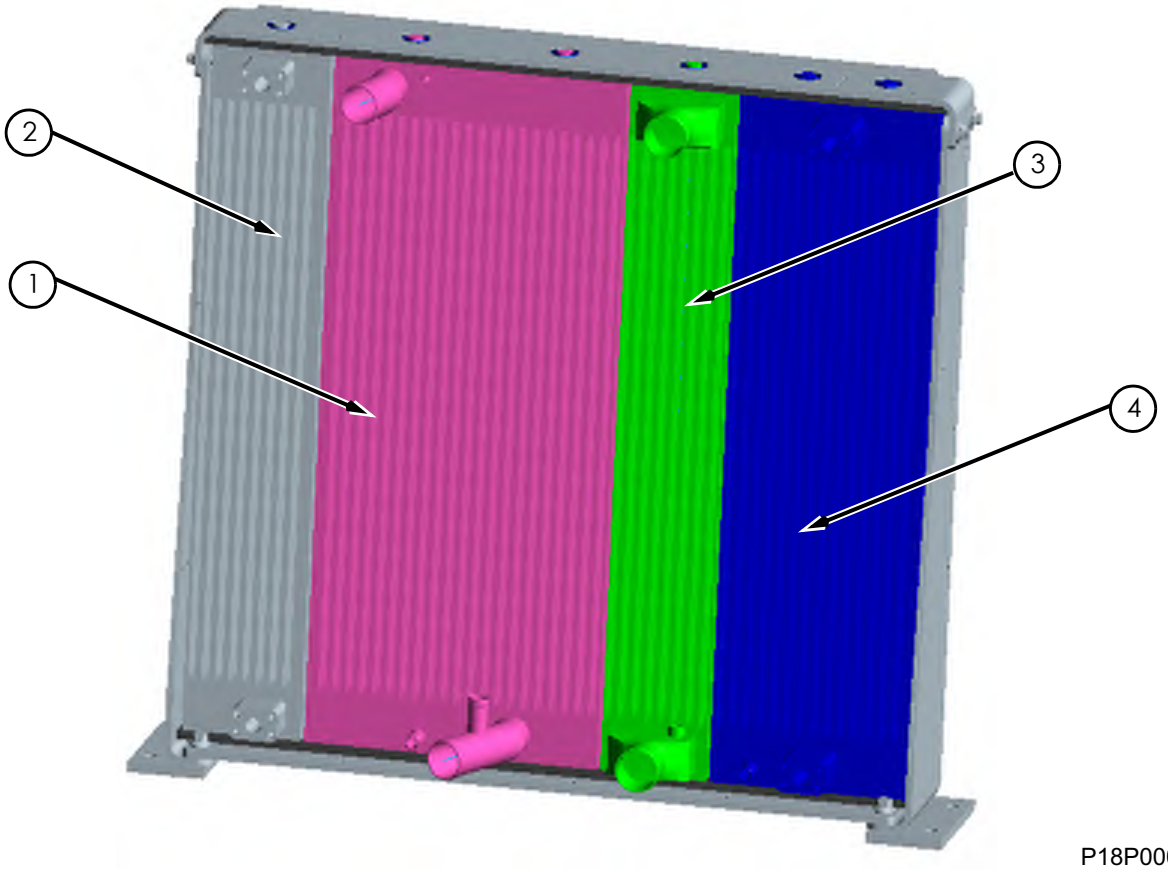
Radiator group

Technical parameters

Water radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	870mm X 454mm X 120mm (34.2519In X 17.87398In X 4.7244In)
Hydraulic oil radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	870mm X 166mm X 120mm (34.2519In X 6.53542In X 4.7244In)
Torque converter oil radiator	Core type	Plate-fin type
	Core size (height × width × thickness)	870mm X 264mm X 120mm (34.2519InX 10.39368In X 4.7244In)
Air-air intercooler	Core type	Plate-fin type
	Core size (height × width × thickness)	870mm X 178mm X 120mm (34.2519In X 7.00786In X 4.7244In)

Part Structure

The radiator assembly is composed of air-air intercooler, water radiator, hydraulic oil radiator and torque converter oil radiator.



P18P00052

1. Water radiator
2. Hydraulic oil radiator
3. Air-air intercooler
4. Torque converter oil radiator

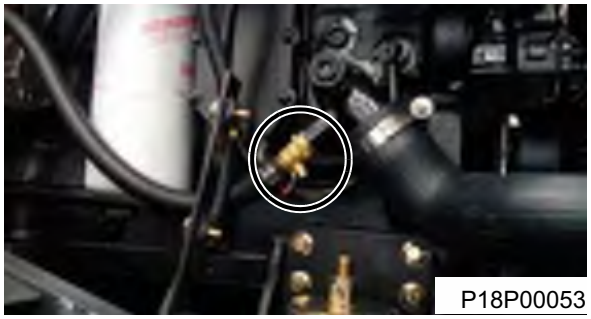
Fan

Technical parameters

	Number of vane	Diameter	Mode
Fan	12	880mm\ 34.6456In	Induced draft

Refilling and replacement of coolant

1. Completely mix water and anti-freeze in advance according to selected cooling proportion.
2. Park machine on flat ground, apply parking brake and shut down engine.
3. Turn on the power switch (-); insert the key into the start switch and turn to 1st gear clockwise to power on the machine, pull the change-over switch of air conditioning system to heating position.
4. Open engine hood, and turn the manual valve on the water inlet pipe of engine to ON position (at which, valve handle is consistent with line route).



P18P00053

5. (Only operate this step in replacing coolant.) Put a container with the capacity of about 35 L at rear left side of machine, connect one hose into water drain valve of drain hose, unscrew auxiliary tank cover, loosen water drain valve so that coolant flows into the container, and tighten water drain valve after draining coolant.
6. Slowly open auxiliary tank cover (wait until engine coolant temperature drops to be below 50°C\122°F), slowly add coolant until coolant level is within 1 cm higher than wellhead bottom, and remain stable within ten minutes.

P18P00054

P18P00055

7. Tighten auxiliary tank cover, start engine, firstly operate it for 5 minutes at low idle speed, then operate it for 5 minutes at high idle speed, and increase coolant temperature to be above 85°C(185°F).
8. Check coolant level through inspection window once again, and after engine coolant temperature drops to be below 50°C(122°F), continue to refill coolant until level is within 1 cm higher than wellhead bottom as necessary.
9. Close the engine hood.

⚠CAUTION

Do not only use the water as coolant

When filling coolant, air in engine cooling system pipe shall be discharged,

Do not refill coolant into hot engine to avoid possible damages to engine body. Wait until engine temperature is below 50°C(122°F).

Fuel System

Fuel Tank Assembly

Technical parameters

Effective volume	193L (50.9906USgal)

Part Structure and Principle Introduction

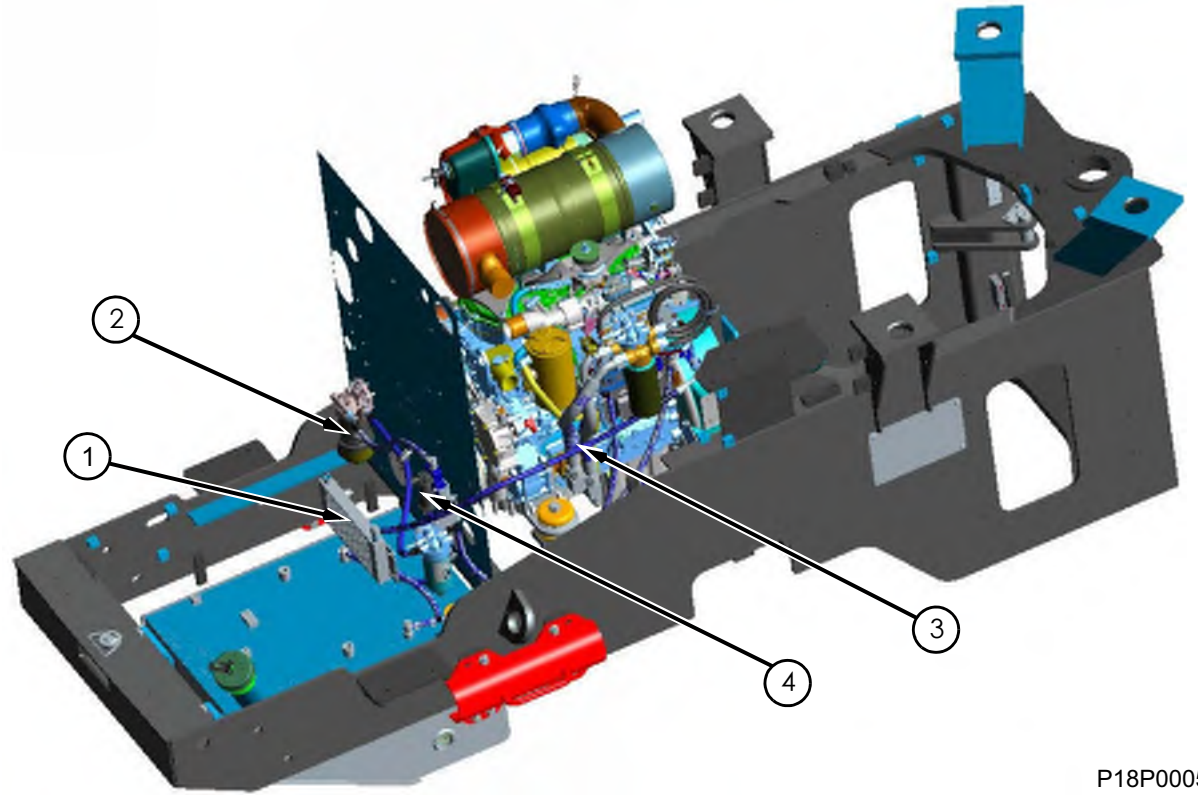
The fuel tank assembly is mainly composed of fuel tank, filler pipe, breather pipe, fuel tank cover.

P18P00056

Fuel Lines

Overview-components and position

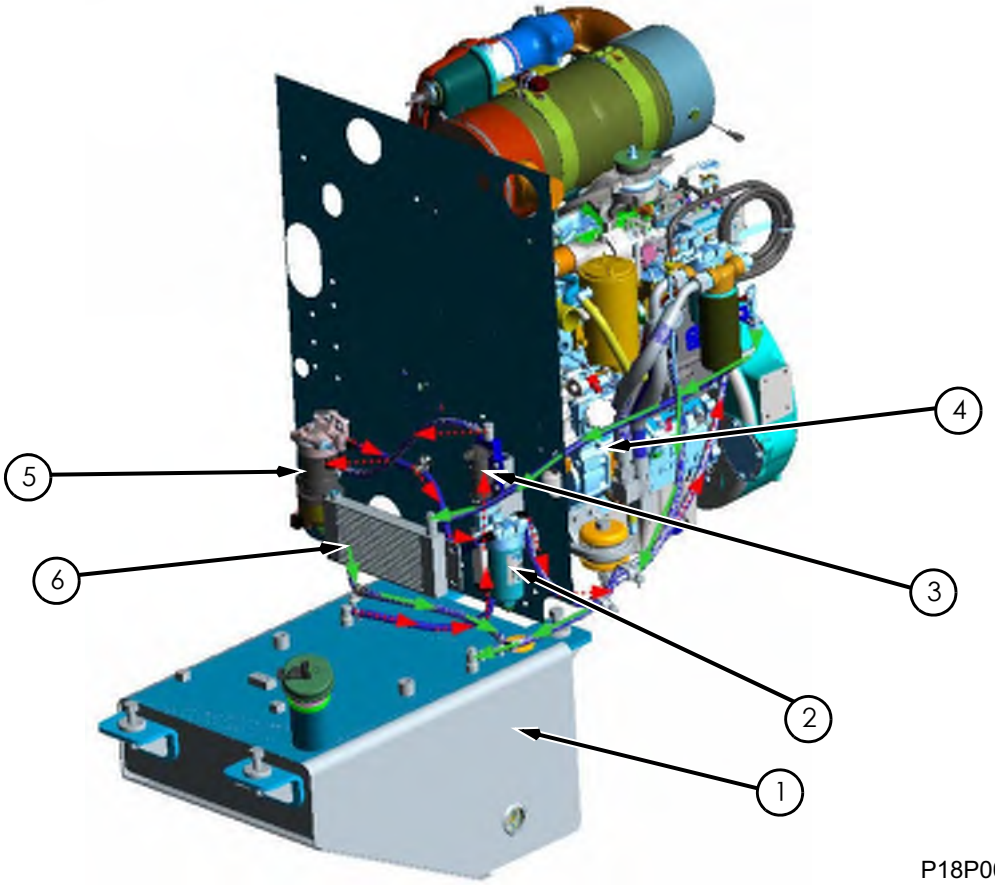
The fuel line is composed of fuel hose, fuel filter and fuel radiator.



P18P00057

1. Fuel radiator
2. Oil-water separator
3. Fuel hose
4. Fuel pump

Description of principle diagram and working principle



P18P00058

1. Fuel tank
2. Fuel filter
3. Oil transfer pump
4. High-pressure fuel pump
5. Oil-water separator
6. Fuel radiator

Fuel system acts to provide engine with clean and sufficient fuel, which thus ensures proper operation of engine. Its working principle is shown above: when engine works, oil transfer pump sucks fuel from fuel tank, then oil-water separator eliminates water from fuel, next fuel filter eliminates Impurities from fuel, and finally fuel enters high pressure fuel pump. The fuel is pressurized by the high pressure fuel pump and filled into high pressure common rail. Then, the fuel in the common rail enters into injector, while the spare fuel returns back to the outlet of high pressure fuel pump. The injector is controlled by ECM. The diesel fuel is injected into combustion chamber, while the spare fuel returns back to the outlet of high pressure fuel pump and then back to fuel tank after cooled.

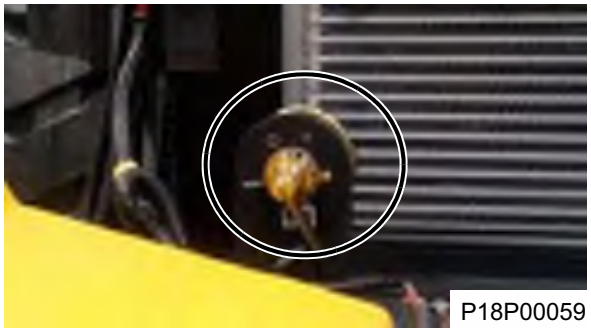
Fuel radiator

The fuel radiator is used for cooling the hot fuel that returns back from engine fuel pump to avoid the hot fuel directly flowing back to the fuel tank and heating the fuel in it.

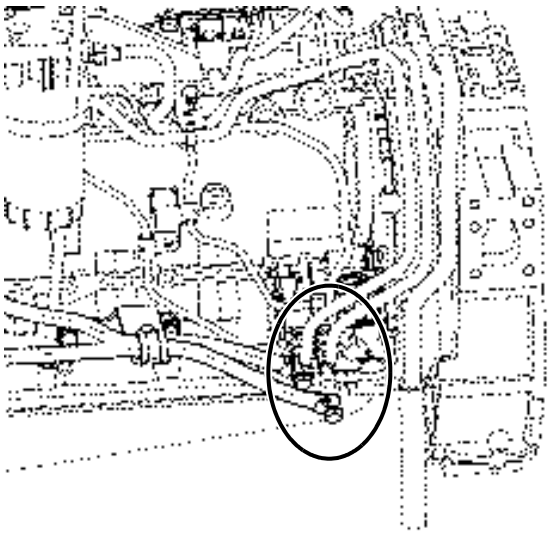
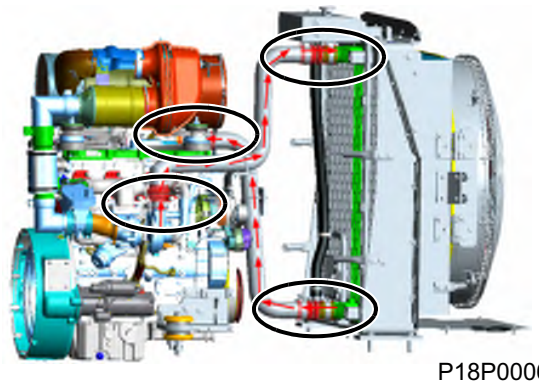
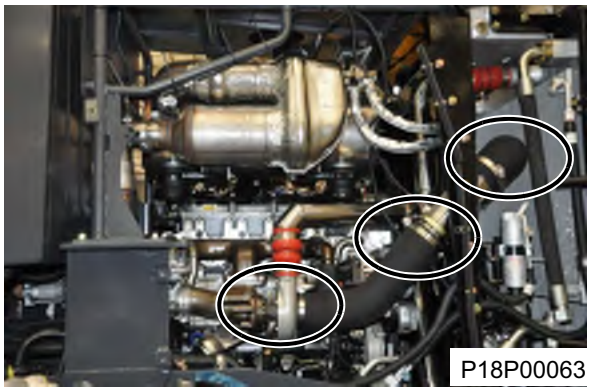
Removal and Installation

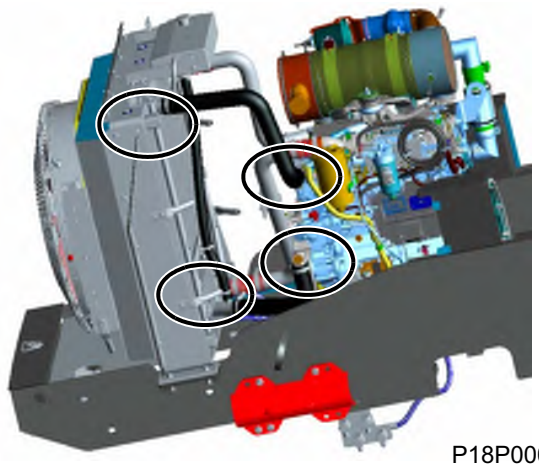
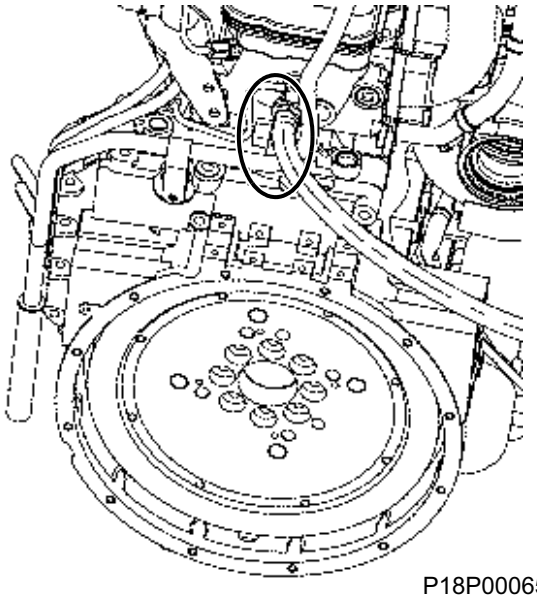
Removal and installation of diesel engine

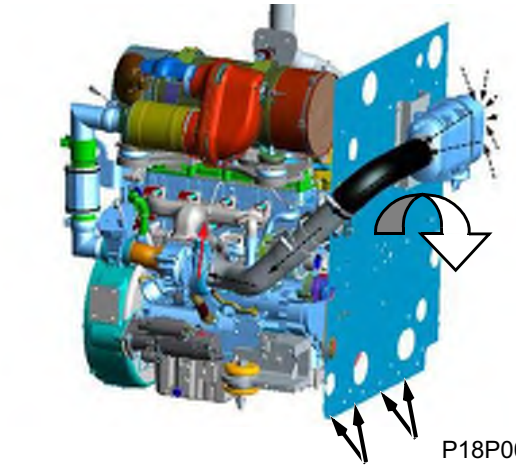
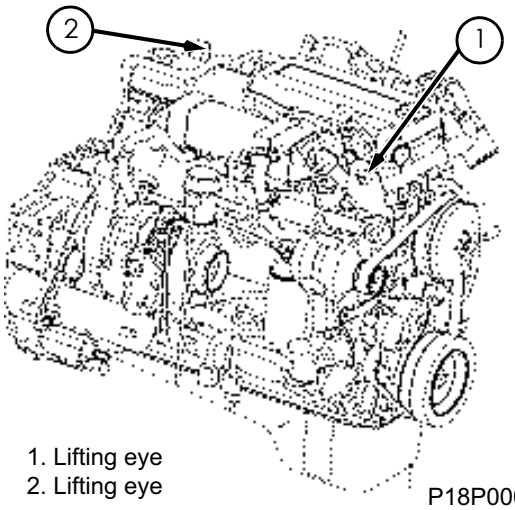
Removal

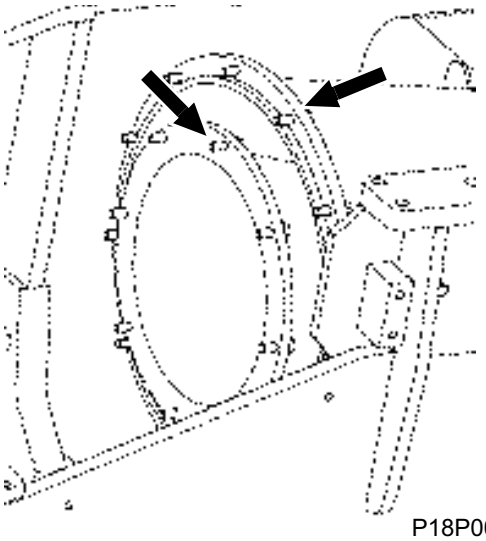
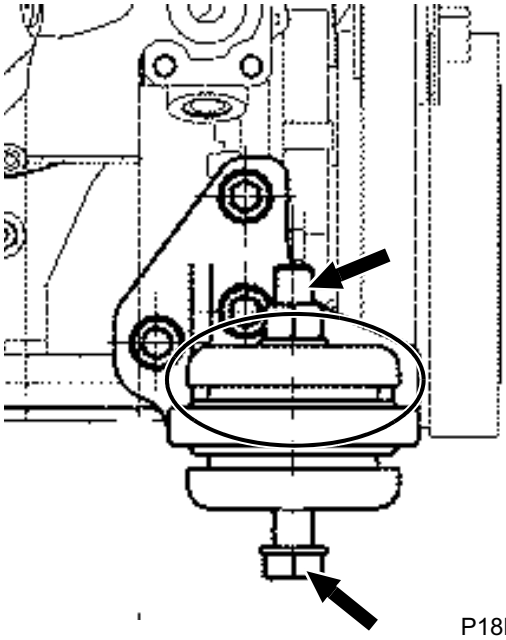
Figures	Contents	Tools
 P18P00059  P18P00060	1. Turn off the negative electrode switch, and hang on a "No operating" warning board.	

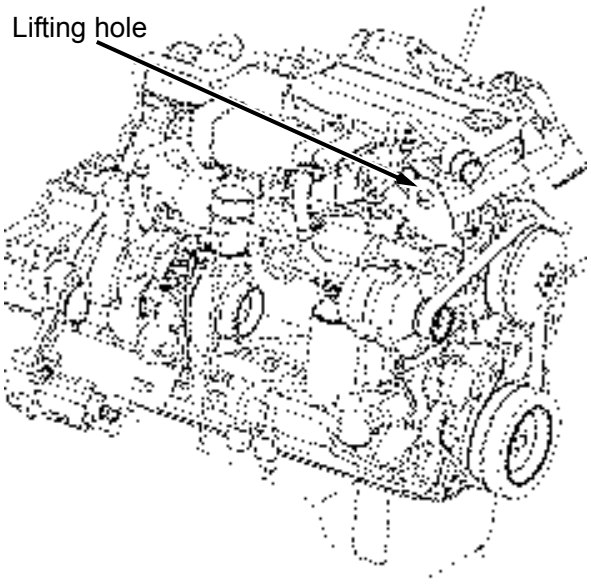
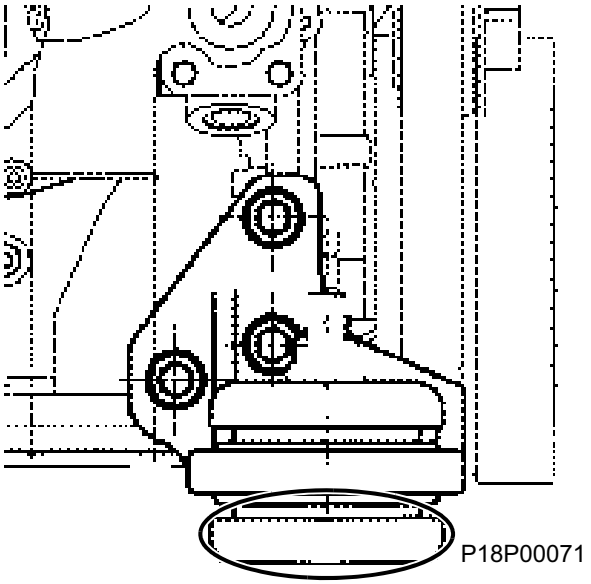
Figures	Contents	Tools
	1. Remove the engine hood top cover according to removal and installation requirements and steps of engine hood. 2. Remove air filter according to the removal steps of air filter and seal every port with plastic seal membrane as required. 3. Remove diesel particle filter and connecting pipe according to the removal steps of diesel particle filter and seal every port with plastic seal membrane as required. 4. Drain the cooled water in the engine to oil collection dish for unified disposal. 5. Remove electrical connector and wiring on engine according to removal and installation requirements and steps of electrical system. 6. Remove A/C compressor, A/C pipe and warm air hose from the engine according to removal and installation requirements and steps of air conditioning system, and seal every ports with plastic sealing membrane as required.	Plastic sealing membrane Oil collecting basin

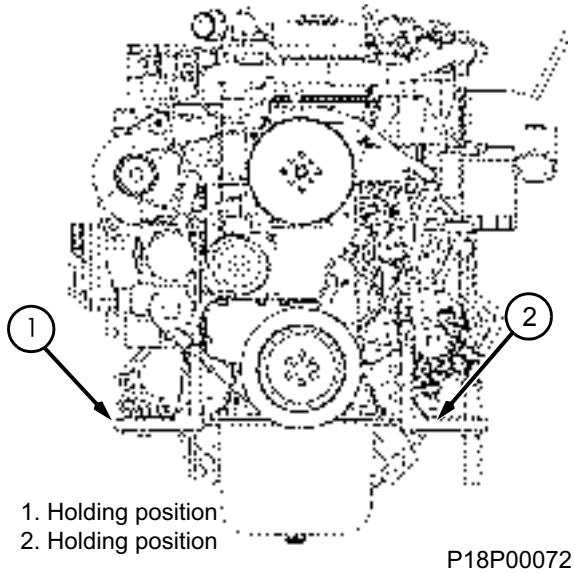
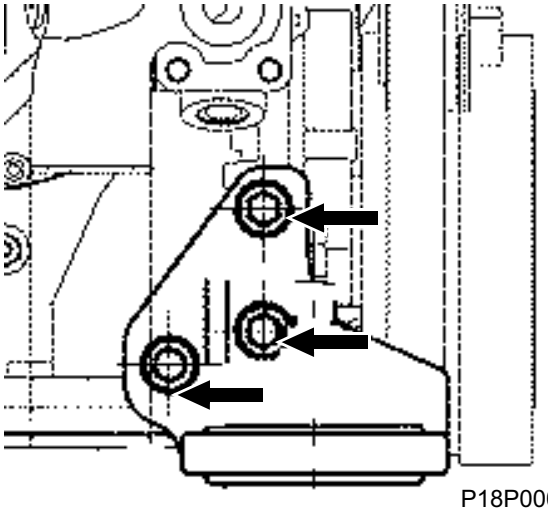
Figures	Contents	Tools
 P18P00061	7. Unscrew the fuel pipe joint screw connected to the diesel engine fuel pump with wrench. Remove the screw, seal gasket and keep them in a plastic bag. Mask the fuel pipe joint with sealing membrane.	Tool: Open-end wrench 19# Plastic sealing bag Plastic sealing membrane
 P18P00062	8. Unscrew the intercooler pipe fixing clamp and bracket. Unscrew the clamps at both ends of intercooler pipe, unplug the pipe and seal every port with plastic seal membrane.	Tool: Open-end wrench 12#, 16# Plastic sealing membrane
 P18P00063	9. Unscrew the clamp at the connection of intake pipe and engine, unplug the intake pipe. Unscrew the connecting clamp between intake pipe and intake hose, take off the intake pipe. Seal every port with plastic sealing membrane.	Tool: Open-end wrench 8# Plastic sealing membrane

Figures	Contents	Tools
 P18P00064	10. Unscrew the clamp at the connection of water inlet pipe, outlet pipe and engine, unplug the water inlet pipe, outlet pipe and seal every port with plastic seal membrane.	Tool: Open-end wrench 8# Plastic sealing membrane
 P18P00065	11. Unscrew the clamp at the connection of water inlet pipe and engine, unplug the water inlet pipe and seal every port with plastic seal membrane.	Tool: Open-end wrench 7# Plastic sealing membrane

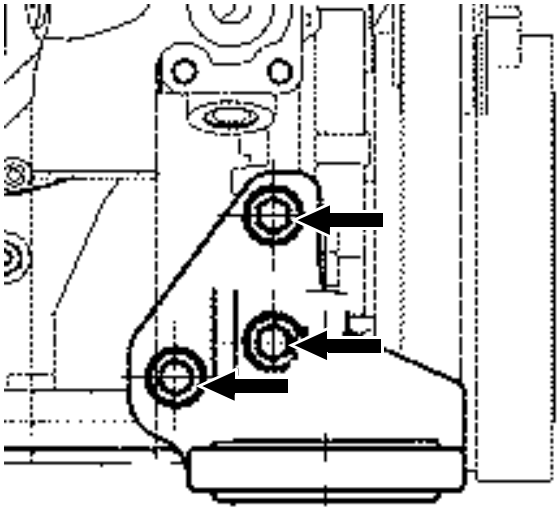
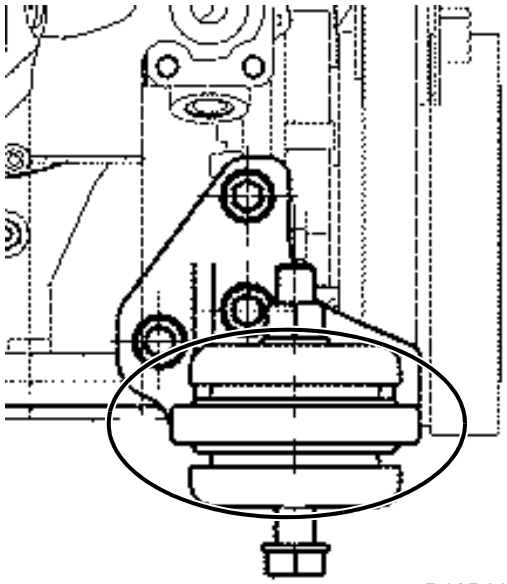
Figures	Contents	Tools
 P18P00066	12. Unscrew the 4 bolts on the heat insulation bracket, and tilt it to the radiator direction by an angle to avoid interference when lifting the engine.	
 1. Lifting eye 2. Lifting eye P18P00067	13. Slowly operate traveling crane, hang lifting eye on engine with hook on wire rope, and tauten wire rope without lifting engine.	Tool: Traveling crane Wire rope with hooks

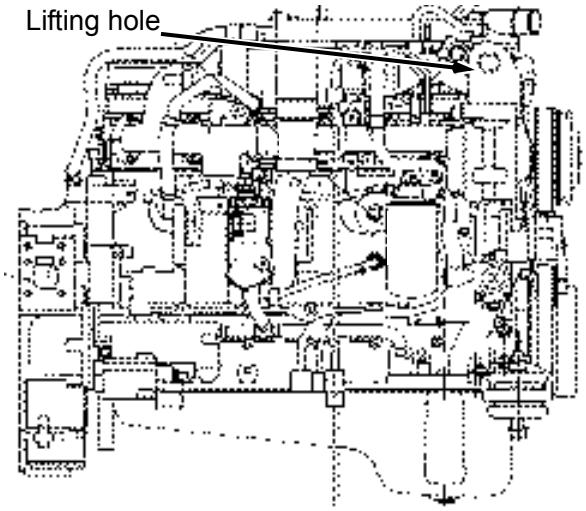
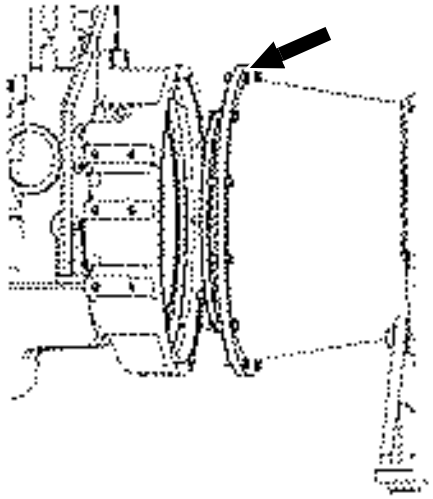
Figures	Contents	Tools
 P18P00068	14. Remove captive bolts on connecting surface of engine and torque converter & engine flywheel according to removal and installation requirements and steps of transmission & torque converter assembly.	
 P18P00069	15. Hold fixing nut of engine with an open-end wrench, and remove captive bolt of engine from under engine mounting support with a blower gun, a rod and a socket. And take down the upper shock absorber and its cover from the engine mounting support.	Tool: Open-end wrench 30#

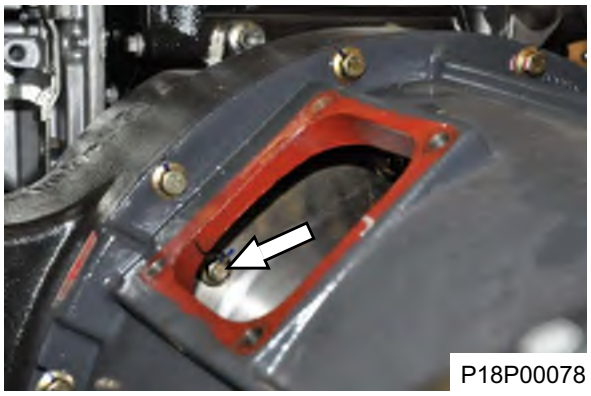
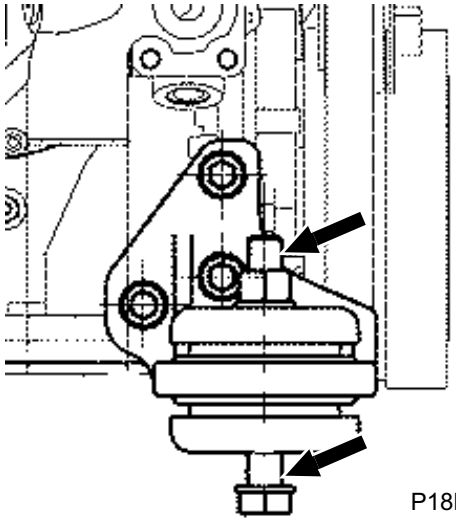
Figures	Contents	Tools
 P18P00070	16. Operate wire rope on traveling crane for lifting hook to pass hook through lifting hole at pulley side of engine, and lift engine as slowly as possible. It is recommended that lifting height is not more than 5 mm.	Traveling crane Wire rope with hooks
 P18P00071	17. Take out the shock absorber and cover under the mounting support of the engine.	

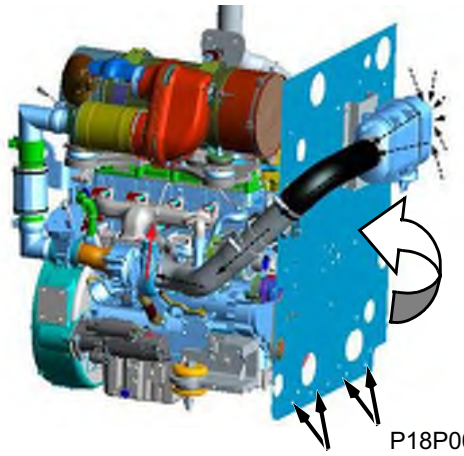
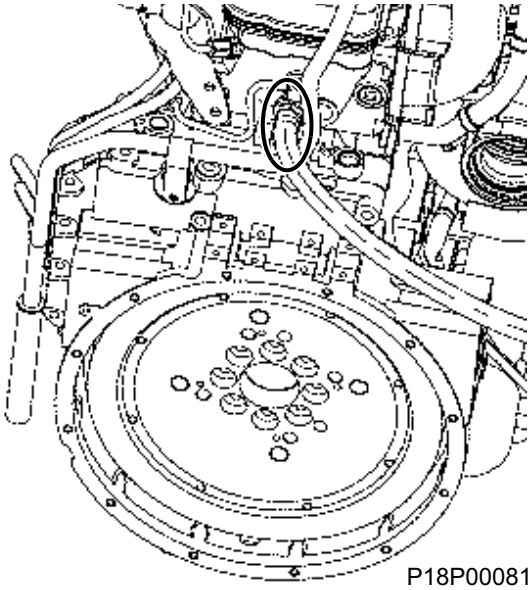
Figures	Contents	Tools
 1. Holding position 2. Holding position P18P00072	18. Slowly operate traveling crane and hold both sides of engine in order to ensure that engine is slowly and steadily lifted out of complete machine and will not collide with other parts of complete machine.	
 P18P00073	19. Loosen captive bolt of engine mounting support with an open-end wrench and take it out, then take down engine mounting support.	Tool: Open-end wrench 16#

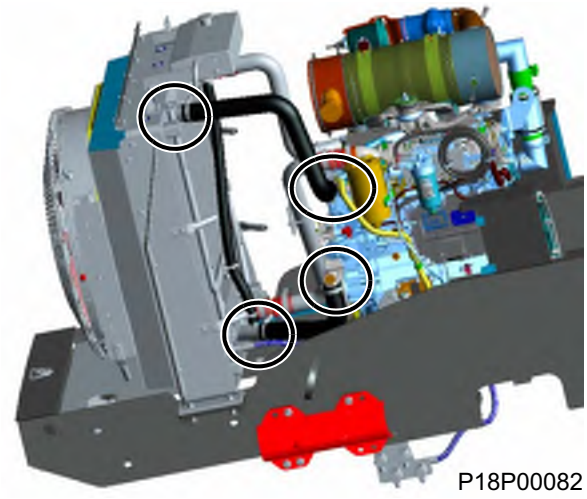
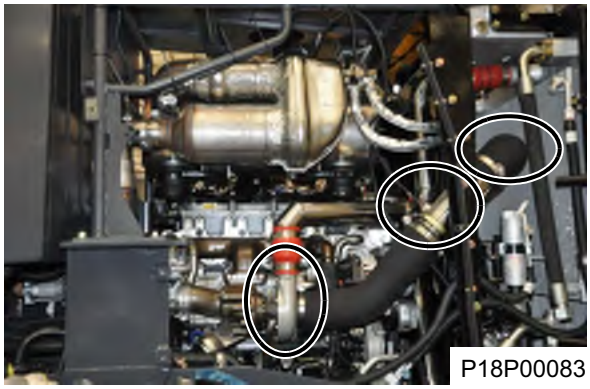
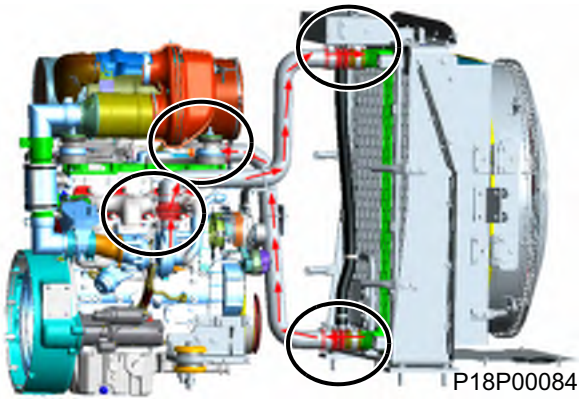
Installation

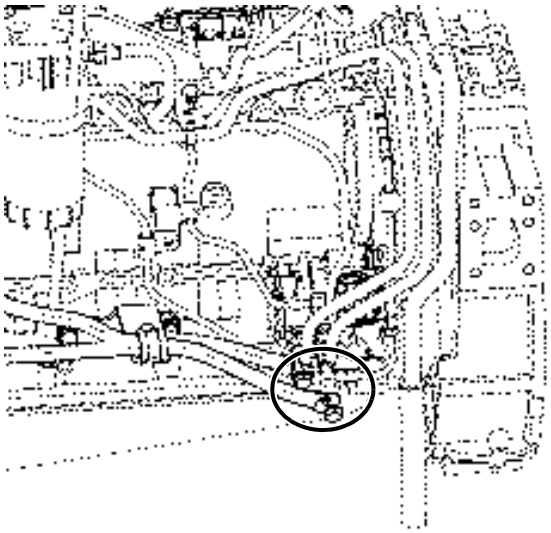
Figures	Contents	Tools
 P18P00074	1. Install engine mounting support on engine with captive bolt for engine mounting support, and pre-tighten captive bolt with an open-end wrench. 2. Tighten mounting base captive bolt of engine with a torque wrench to torque of 120±50N.m (12±5kgf.m).	Tool: Open-end wrench 16#, torque wrench 120±6N.m(12±0.6kgf.m)
 P18P00075	3. Place shock absorber and cover at upper and lower sides of engine mounting support respectively, and adjust shock absorber so that it is installed into hole of mounting support.	

Figures	Contents	Tools
 P18P00076	4. Operate the traveling crane and put down the engine as slow as possible to match the engine surface and gearbox & torque converter assembly surface, and align the holes.	
 P18P00077	5. Install and tighten the bolts and hard washer of the torque converter housing & the engine housing. Tightening torque: 72±6Nm (7.2±0.6kgf.m).	Tool: 16# socket, pneumatic impact wrench, open-end 16# fixed torque spanner

Figures	Contents	Tools
 P18P00078	6. Crank the engine flywheel case to make the torque converter align with mounting threaded hole on the engine flywheel, screw and tighten the fastening bolts and washer for attaching the torque converter to the engine flywheel by hand with a torque of 60±5Nm (6±0.5kgf.m).	Tool: 16# Socket, pneumatic impact wrench, open-end 16# fixed torque spanner
 P18P00079	7. Assemble shock absorber, cap and engine mounting support together by passing engine fasteners such as captive bolt and nut through them. 8. Hold nut with an open-end wrench, and pre-tighten captive bolt of engine from under engine mounting support with a blower gun, a rod and a socket. 9. Re-tighten captive bolt of transmission with a torque wrench according to removal and installation requirements and steps of transmission. 10. Tighten captive bolt of engine with a torque wrench to torque of 1020±6N.m (102±0.6 kgf.m) .	Tool: Open-end wrench 16# 1020±6N.m (102±0.6 kgf.m) torque wrench

Figures	Contents	Tools
 P18P00080	11. Push the heat-insulation bracket to installation position and tighten the 4 anchor bolts.	Tool:
 P18P00081	12. Insert the water inlet pipe into hot water inlet of engine, then clamp it with a clamp.	Tool: Open-end wrench 7#

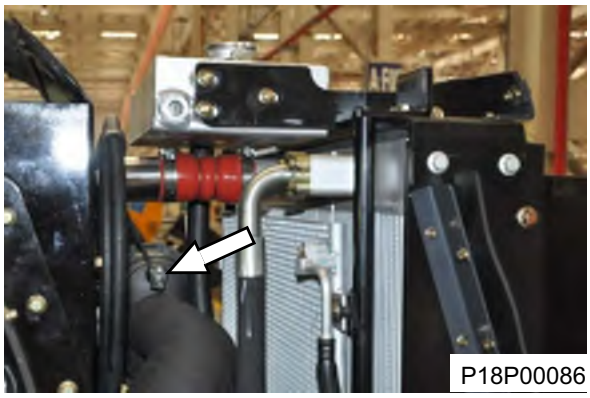
Figures	Contents	Tools
 P18P00082	13. Insert the water outlet pipe into water outlet of engine, the water inlet pipe into water inlet of engine, then clamp it with a clamp.	Tool: Open-end wrench 8#
 P18P00083	14. Insert the intake pipe into air inlet of engine, then clamp it with a clamp. Insert the intake pipe into intake hose and clamp it with a clamp.	Tool: Open-end wrench 8#
 P18P00084	15. Insert the intercooler pipe into silicone hose on the engine and radiator and clamp it with a clamp. Fix the intercooler pipe bracket on the intake/exhaust bracket and pre-tighten it with bolts. Fix the intercooler pipe on the bracket with U-clamp and tighten it with a nut. Tighten the intercooler pipe bracket mounting bolt.	Tool: Open-end wrench 12#, 16#

Figures	Contents	Tools
 P18P00085	16. Fix the diesel joint on the engine fuel pump with screw and seal gasket. The pipe connected to the oil-water separator is fuel inlet pipe and is connected to the fuel inlet of fuel pump with only the inlet marked "in" .	Tool: Open-end wrench 19#
	17. Install the A/C compressor, A/C pipe and warm air water pipe to the engine according to the installation requirements and steps of air conditioning system. 18. Install the electrical connector and circuit to the engine according to the removal and installation requirements and steps of electrical system described. 19. Install the diesel particle filter and connecting pipe according to the installation steps of diesel particle filter described.	

Figures	Contents	Tools
	20. Install the air filter according to the installation steps of air filter described. 21. Install the engine hood according to installation steps of engine hood. 22. Open the engine hood and fill the anti-freeze. 23. Close the engine hood and take off the warning board "No operating".	

Removal and installation of air filter

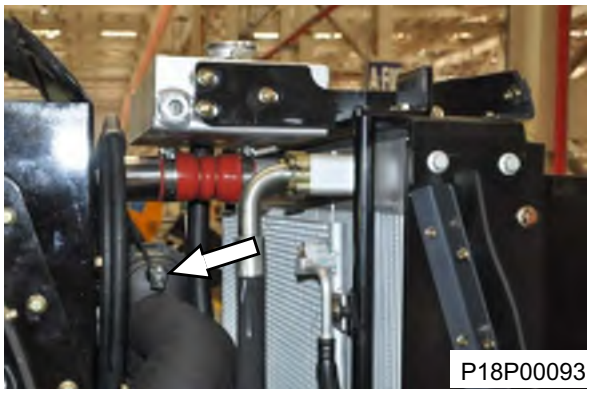
Removal

Figures	Contents	Tools
 P18P00086	1. Put out the harness connector on the air filter, and seal every ports with plastic sealing membrane as required.	Tool:
 P18P00087	2. Loosen the clamp connecting air filter and intake pipe with wrench, and remove the clamp. Pull out the intake pipe and seal the ports with plastic membrane.	Tool: Open-end wrench 8#

Figures	Contents	Tools
 P18P00088	3. Loosen the bolts of the air filter mounting plate with wrench, then remove the air filter with mounting plate.	Tool: Open-end wrench 13#
 P18P00089	4. Remove captive bolts of air filter with open-end wrench, and remove air filter. Remove the blocking indicator of air filter from the air filter.	Tool: Open-end wrench 10#

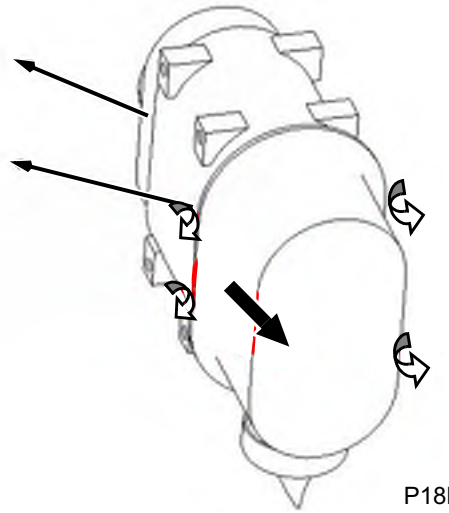
Installation

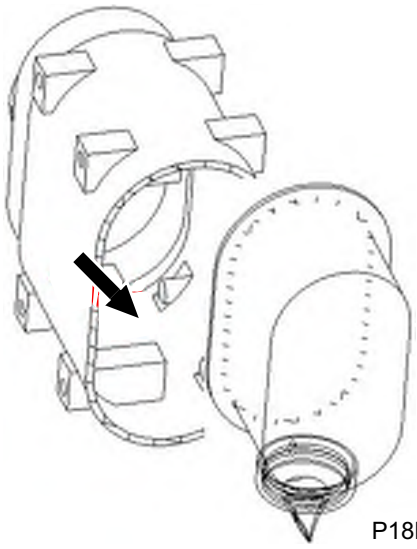
Figures	Contents	Tools
 P18P00090	1. Fix the air filter on the mounting plate with bolts.	Tool: Open-end wrench 10#
 P18P00091	2. Install the air filter with the mounting plate on the heat insulation bracket.	Tool: Open-end wrench 13#
 P18P00092	3. Install the intake pipe in the both ends of air filter, and hold them with clamps.	Tool: Open-end wrench 8#

Figures	Contents	Tools
 P18P00093	4. Install the blocking indicator of air filter on the air filter, and press the indicator end face to reset it.	Tool:
	5. Check the inner of connectors on the air filter and indicator for water or sand. If any, clean them up. Plug the harness connector on the two connectors.	Tool: Open-end wrench 10#

Disassembly and assembly of air filter

Disassembly

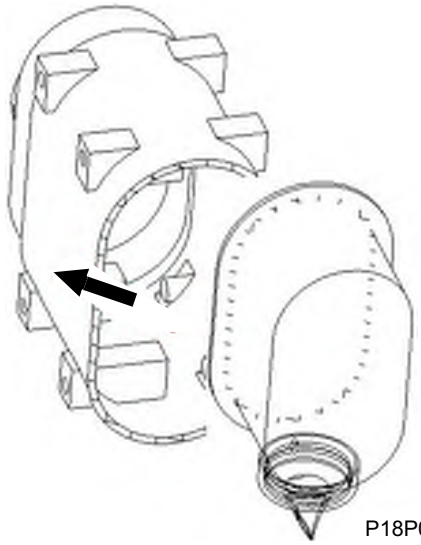
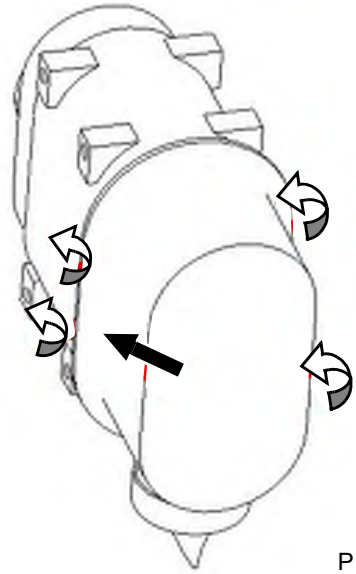
Figures	Contents	Tools
 P18P00094	1. Open the lock buckle, and remove the end cover on the air filter;	It needs no other tooling or tools in the disassembly process.

Figures	Contents	Tools
 P18P00095	2. Take out the main filter element along the direction of housing. It can be taken out directly by hand, and then take out the main filter element by sequence.	
 P18P00096	3. Take out the safety filter element along the direction of housing. Use the handle on the surface of safety filter element to pull the filter element towards the housing center, and remove it.	

Check

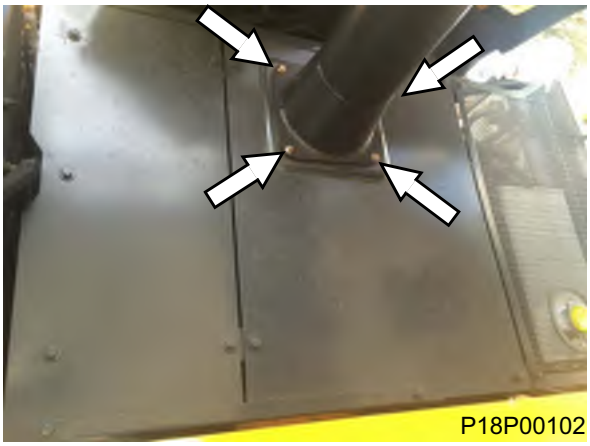
Check the main and safety filter element before installation. Visually check the sealing surface for cut, tear or indentation. If there is any visible damage, do not install them.

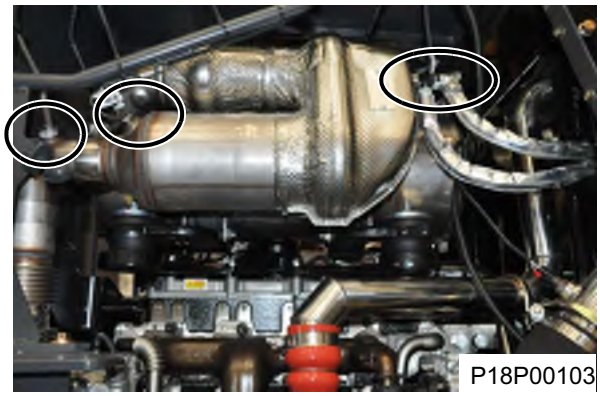
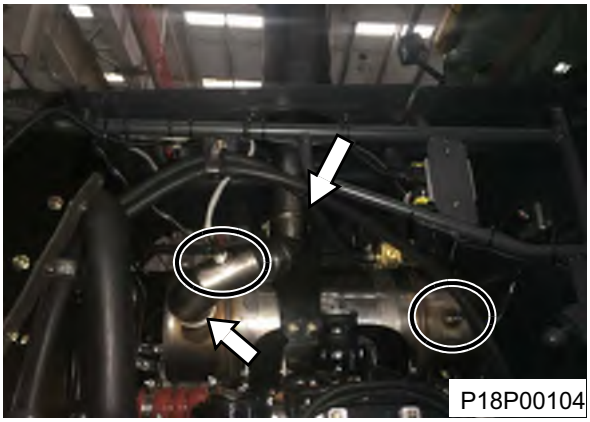
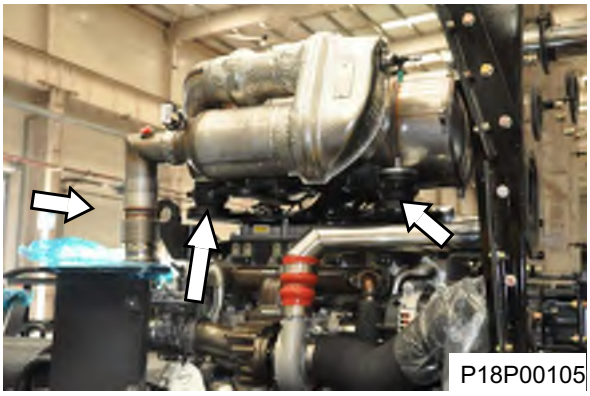
Assembly

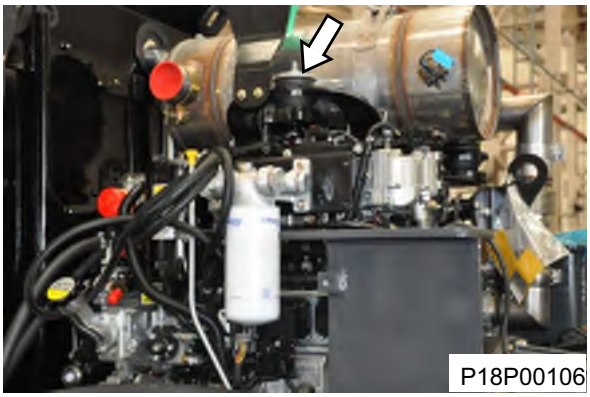
Figures	Contents	Tools
 P18P00097	1. Use the handle of safety filter element to make the filter element slide into the outlet side at an oblique angle and push it to the position, until the filter element is already firm and flat in the housing.	It needs no other tooling or tools in the assembly process.
 P18P00098	2. Insert the main filter element. Push downward the filter element at 5° angle, until it hit the end of housing.	
 P18P00099	3. Install cover of air filter and tighten the lock buckle. If uncovered, remove the cover and re-check the filter element position. If the installation of filter element is incorrect, it will be difficult to install the cover.	

Removal and installation of DPF (Diesel Particle Filter)

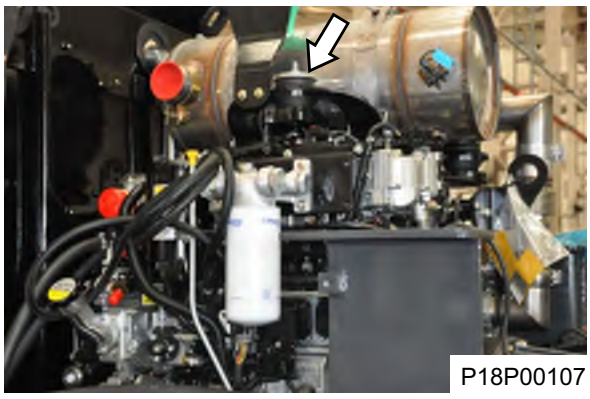
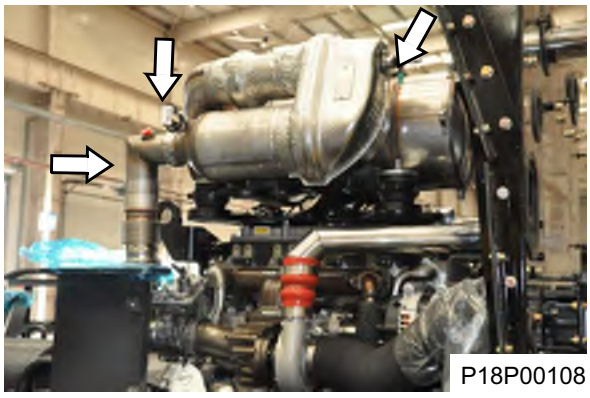
Removal

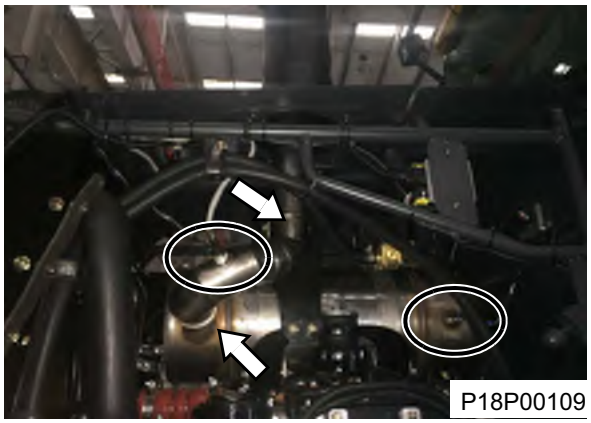
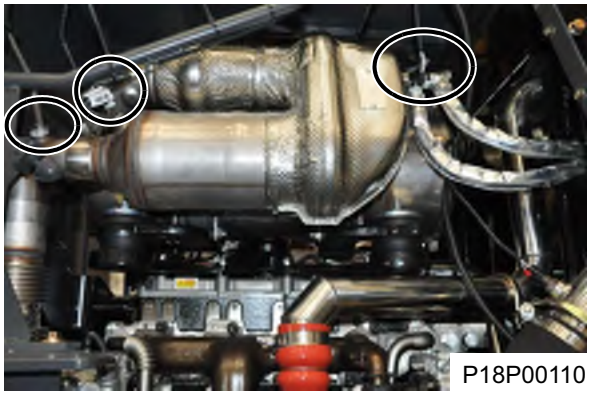
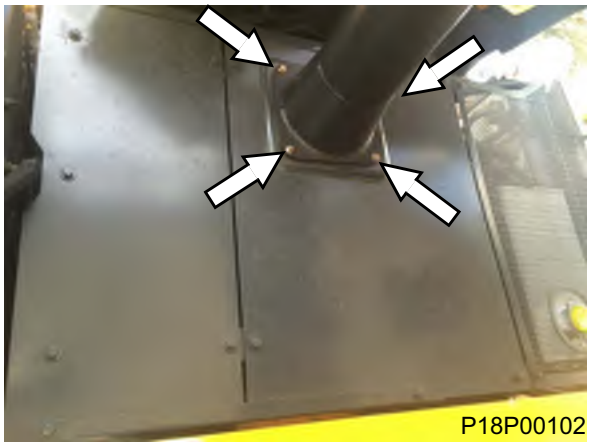
Figures	Contents	Tools
 P18P00100  P18P00060	1. Turn off the negative electrode switch, and hang on a "No operating" warning board.	
 P18P00102	2. Remove the mounting bolt of the exhaust pipe, and take off the exhaust pipe.	Tool: Open-end wrench 13#
	3. Remove the engine hood and top cover according to removal and installation requirements and steps of engine hood.	

Figures	Contents	Tools
 P18P00103	4. Remove the DEF(diesel exhaust fluid) pipe joint and electrical connector on the DOC.	
 P18P00104	5. Unplug the exhaust pipe and SCR electric connector, Remove the U-clamp and clamp, take off the exhaust pipe.	Tool: Open-end wrench 11#
 P18P00105	6. Loose the clamp of DOC & bellow, and unscrew the captive bolts of brackets.	Tool: Open-end wrench 11# Open-end wrench 18#

Figures	Contents	Tools
 P18P00106	7. Unscrew the captive bolts on one side bracket of SCR and lower the diesel particle filter. Take care of the clamp and seal gasket, and mask each port with plastic seal membrane.	Tool: Open-end wrench 18# Traveling crane Wire rope with hooks Plastic sealing membrane

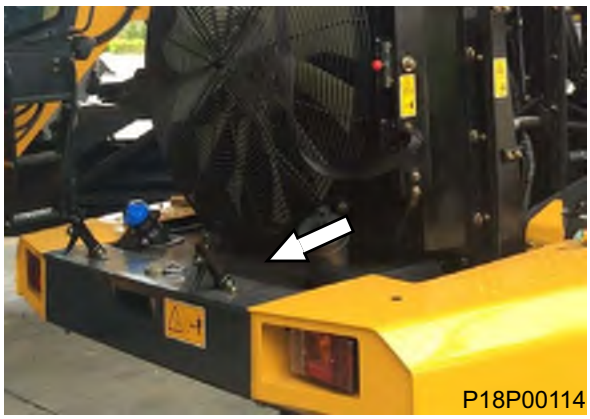
Installation

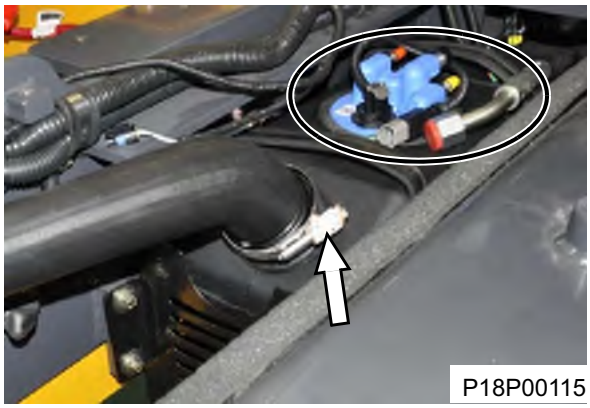
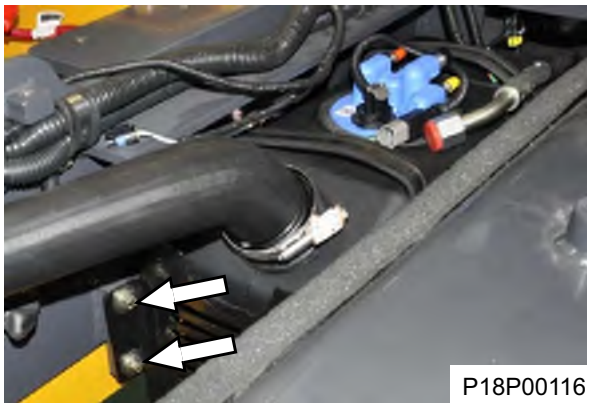
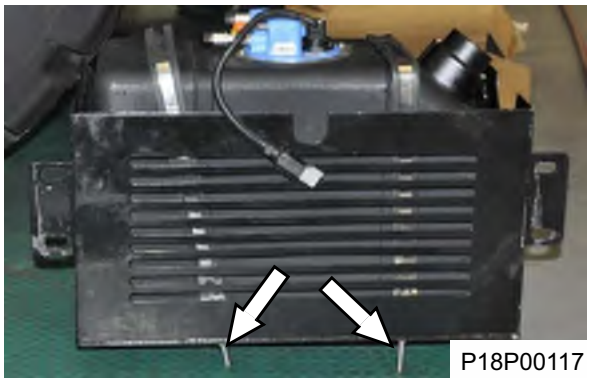
Figures	Contents	Tools
 P18P00107	1. Lift the diesel particle filter, put it to installing position, install the bracket bolts and pre-tighten the clamp.	Tool: Open-end wrench 11# Open-end wrench 18# Traveling crane Wire rope with hooks
 P18P00108	2. Adjust the diesel particle filter position, and tighten the clamp.	

Figures	Contents	Tools
 P18P00109	3. Insert the exhaust pipe into SCR outlet port, tighten the clamp and U-clamp, and insert the electric connector.	Tool: Open-end wrench 11#
 P18P00110	4. Connect the DEF pipe, and insert the electric connector.	
	5. Install the engine hood and top cover according to removal and installation requirements and steps of engine hood.	
 P18P00102	6. Fix the exhaust pipe to the engine top cover.	Tool: Open-end wrench 13#

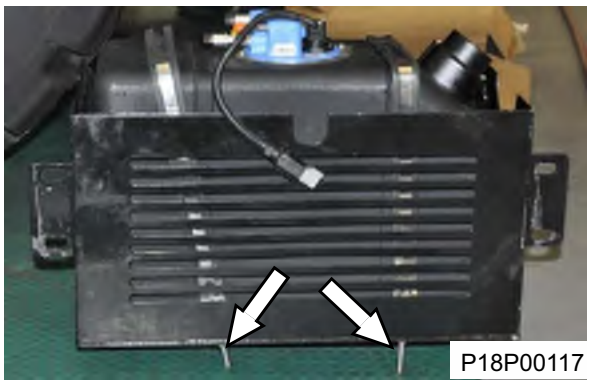
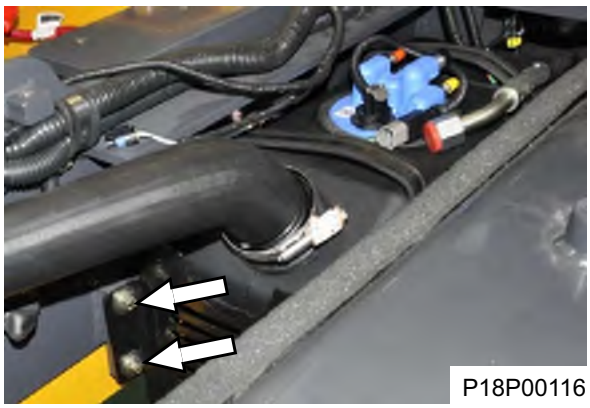
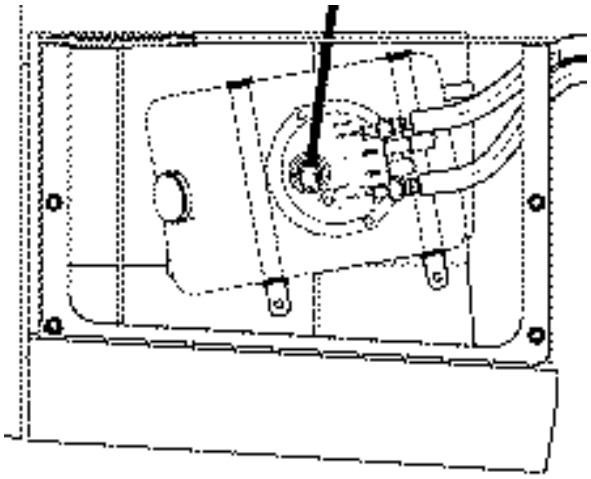
Removal and installation of DEF pump

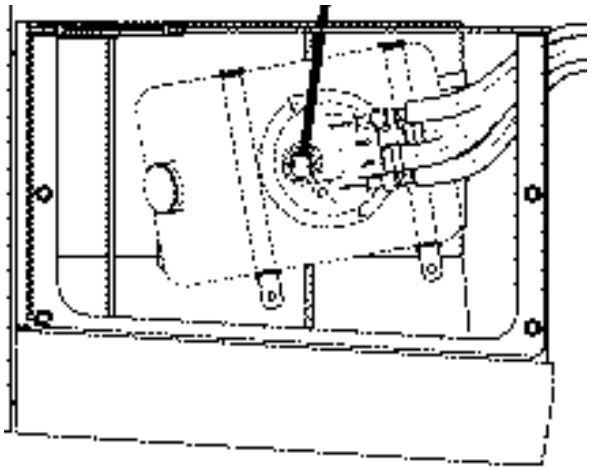
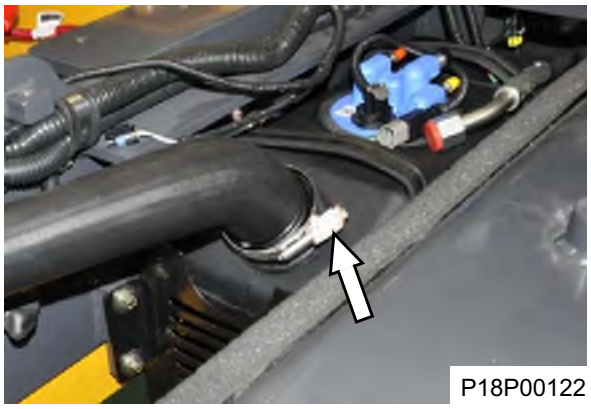
Removal

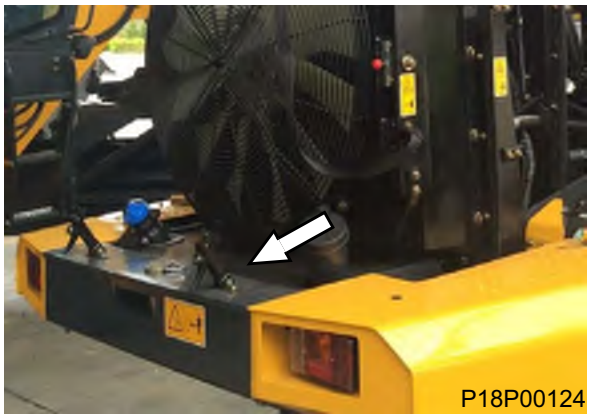
Figures	Contents	Tools
 P18P00112  P18P00060	1. Stop the vehicle, and turn off the negative electrode switch, and hang on a "No operating" warning board when the urea pump stops operating.	
 P18P00114	2. Open the engine hood, and remove the protection plate from the fuel tank.	Tool: Open-end wrench 13#

Figures	Contents	Tools
 P18P00115	3. Unscrew the clamp of urea pipe with straight screw-driver, and then pull out the pipe from the urea tank. Seal every port with plastic sealing membrane as required.	Tool: Straight screw-driver Plastic sealing membrane
 P18P00116	4. Remove the 4 captive bolts from the DEF bracket, and take out the DEF tank from the counterweight bottom.	Tool: Open-end wrench 13#
 P18P00117	5. Unscrew the mounting strap bolt of the DEF tank and the tank can be taken out.	Tool: Open-end wrench 10#

Installation

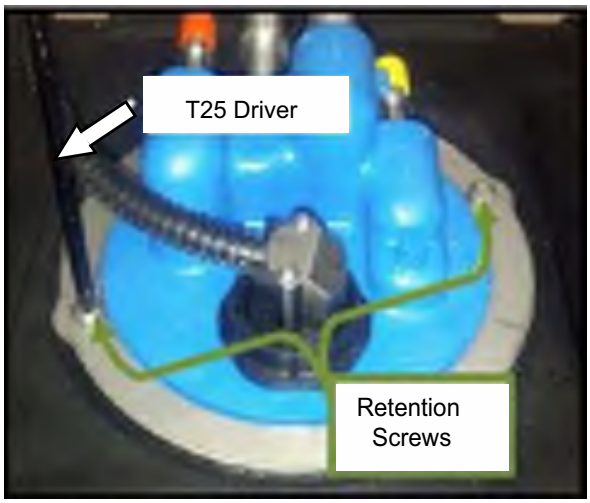
Figures	Contents	Tools
 P18P00117	1. Put the DEF tank into the bracket, get the strap through the tank body and tighten the strap bolt.	Tool: Open-end wrench 10#
 P18P00116	2. Put the DEF tank into installing position from the counterweight bottom and tighten the 4 captive bolts	Tool:
 P18P00120	3. Insert the quick joint of urea pipe to the joint of urea tank. It is not in place until a sound is heard. The two joints is different in specification, and can not be inserted if inversely connected.	Tool:

Figures	Contents	Tools
 P18P00121	4. Connect the water pipe to the water pipe joint of urea tank, and clamp it with clamp. The pipe connected to solenoid water valve is inlet pipe, which is connected to the water inlet on the urea tank with arrow indicated.	Tool: Straight screwdriver
 P18P00122	5. Insert the urea filler to the urea tank and clamp it with a clamp.	Tool: Straight screwdriver
 P18P00123	6. Insert the DEF(diesel exhaust fluid) tank joint to the vehicle wiring harness.	

Figures	Contents	Tools
 P18P00124	7. Put on the fuel tank protection plate and tighten with bolts.	Tool: Open-end wrench 13#

Disassembly and assembly of DEF tank

Disassembly

Figures	Contents	Tools
 P18P00125	1. Unscrew the retention screws that secure the Retaining Ring to the reservoir.	tool: T25 Torx Driver

Figures	Contents	Tools
 P18P00126		
 P18P00127	2. Using a flathead screwdriver, gently pry around where the head unit is connected to the reservoir while simultaneously pulling on the top of the unit. Continue until DEF mounting base is free from reservoir. DO NOT pull on the wires or fittings.	tool: flathead screwdriver

Figures	Contents	Tools
 P18P00128	3. Pull the DEF head unit out until the bottom of the header is at the bottom of the tank bore.	
 P18P00129		

Figures	Contents	Tools
 P18P00130  P18P00131	4. Angle the heel of Tri-function sensor foot upward and rotate the header until the bottom of the header is positioned inside the tank bore. When the bottom of the header is in the tank bore, fold the filter downward towards the interior of the tank. Continue to carefully remove the header out of the tank bore until completely freed. DO NOT pull directly out as this might damage the DEF head and bore seal.	

Check

Check the surface of filter element, and clean it if has sundries. If the filter element is found with cracks or big hole, replace it with new one.

Assembly

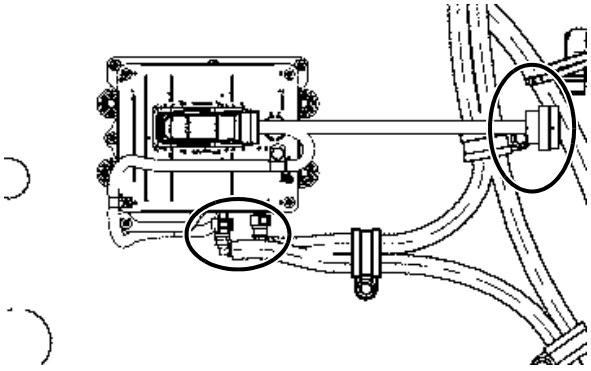
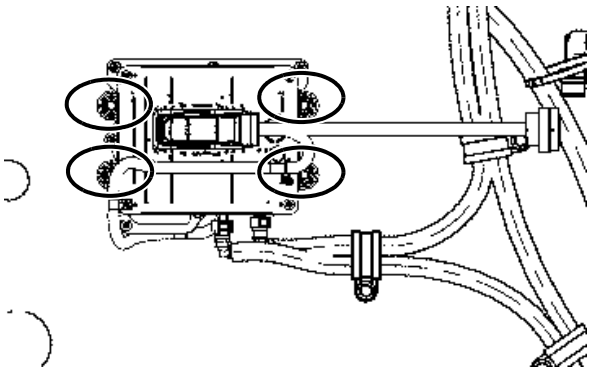
Figures	Contents	Tools
 P18P00132	1. Apply a thin layer of O-ring lubrication to the Bore seal O-ring.	
 P18P00133	2. Fold the Filter element in half towards the bottom of the Tri-Function Sensor. Tilt the header to an approximate 45° angle, with respect to the top of the tank. With the heel of the Tri-Function Sensor foot angled upward, place the filter edge and the toe of the Tri-Function Sensor into the tank bore. Gradually work the bottom portion of the DEF head into the Bore opening until completely inserted in the tank. DO NOT push the MFHU directly into the tank as this could damage the unit.	

Figures	Contents	Tools
 P18P00134  P18P00135		
 P18P00136	3. Position the DEF head unit in the desired orientation and press on the top of the blue mounting base until it is completely seated in the tank bore. DO NOT press directly on the fittings.	

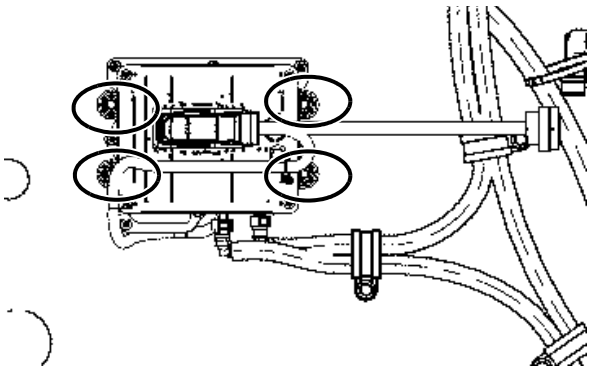
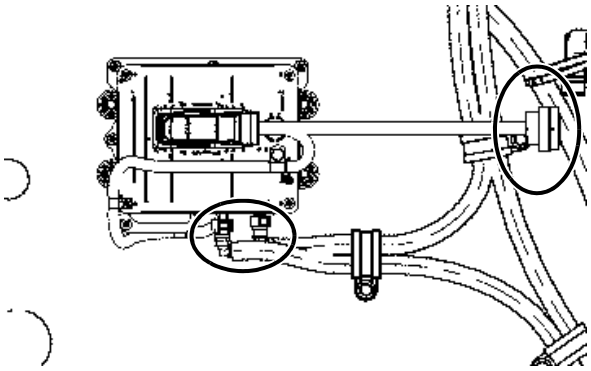
Figures	Contents	Tools
 P18P00137  P18P00138	4. Position the retaining ring on Head unit and install the retention screws using the T25 Torxwrench. Recommended torque on screws is 20 - 30 in-lbs (2.26 − 3.38 N m).	Tool: T25 Torx wrench

Removal and installation of DEF(diesel exhaust fluid) pump

Removal

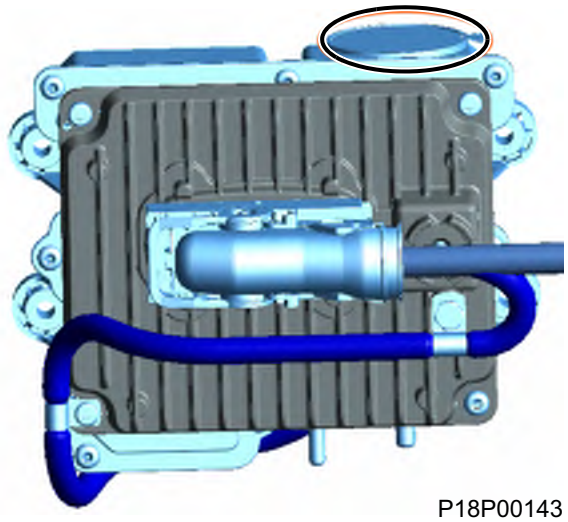
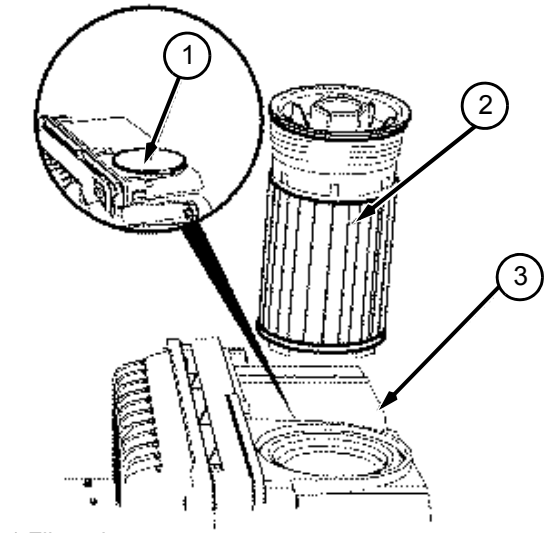
Figures	Contents	Tools
 P18P00139	1. Write 1, 2, 3 on the stickers respectively and stick them on the three DEF pipes from left to right. Pull out the urea pipe, harness connector from the urea pump. Seal every port with plastic sealing membrane.	Tool: Plastic sealing membrane Sticker
 P18P00140	2. Unscrew the urea pump mounting bolt from the bracket. Then remove the urea pump.	Tool: Wrench 13#

Installation

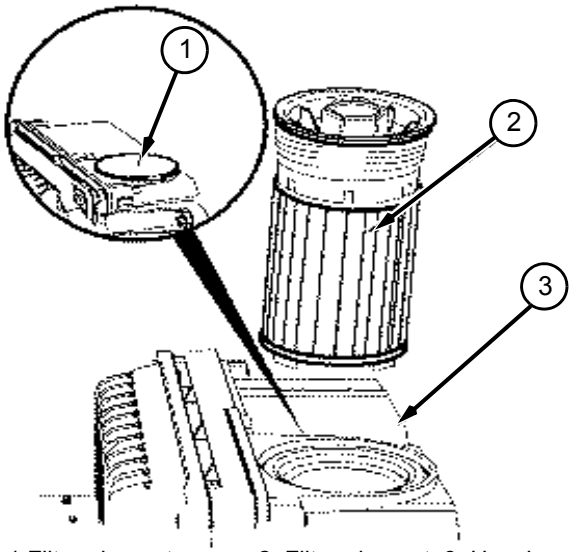
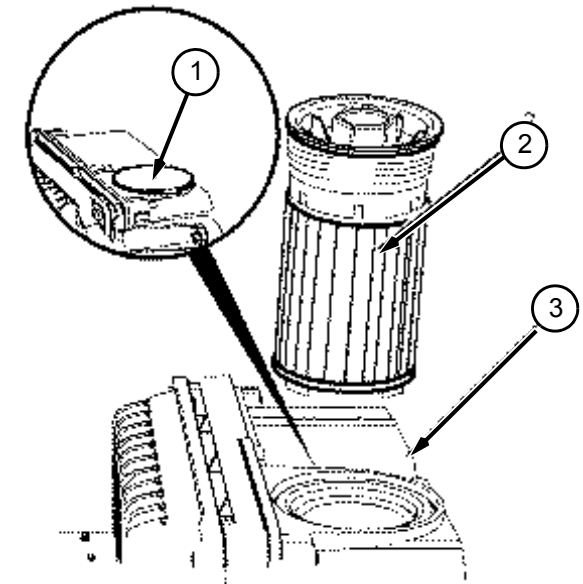
Figures	Contents	Tools
 P18P00141	1. Fix the urea pump on the bracket and tighten it with bolts. The recommended tightening torque is 15.2 – 22.8 N · m.	Tool: Wrench 13#
 P18P00142	2. Insert the three urea pipes to the urea pump by the order 1, 2, 3 from left to right until a sound is heard. Insert the urea pipe joint to the position of urea pump joint.	

Disassembly and assembly of DEF pump

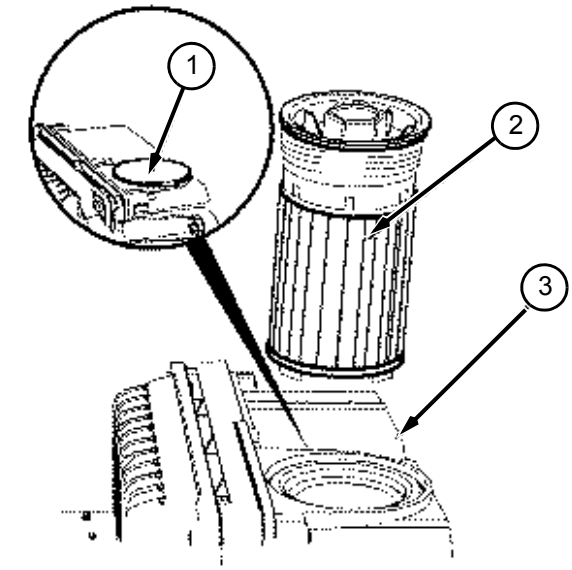
Disassembly

Figures	Contents	Tools
 P18P00143	1. Unscrew the filter element cover by hand.	
 1.Filter element cover 2.Filter element 3.Housing P18P00144	2. Take out the filter element assembly upward and vertically.	

Check

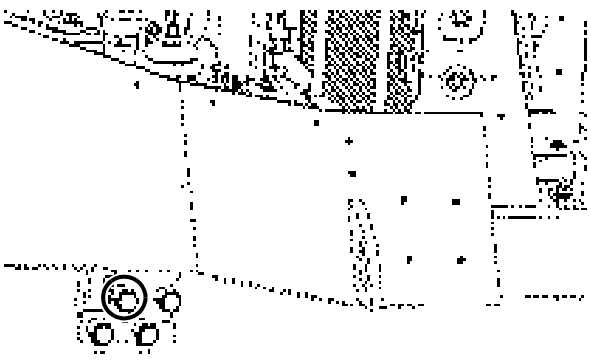
Figures	Contents	Tools
 1.Filter element cover 2. Filter element 3. Housing P18P00145	1. Check the filter element cover for cracks or hole. These cracks or holes may cause urea leakage. Check the thread of filter element cover for damage, and if does, replace it with a new one. Check the thread of urea pump body. If the thread is damaged, replace the complete urea pump.	
 1.Filter element cover 2. Filter element 3. Housing P18P00146	2. Clean the filter element cover with warm water and soft gauze.	

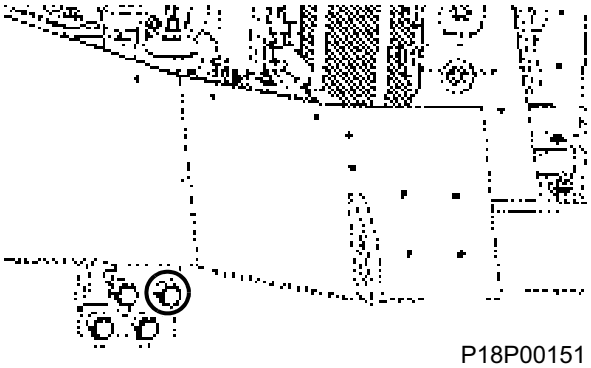
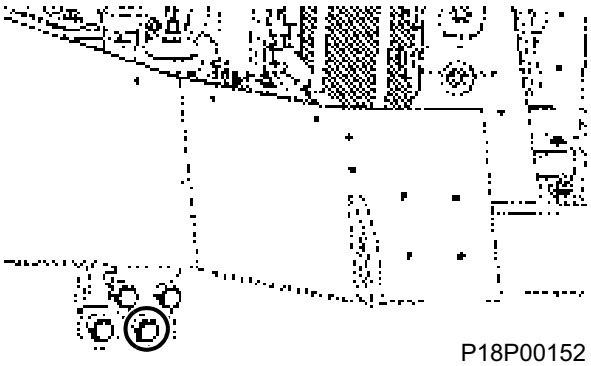
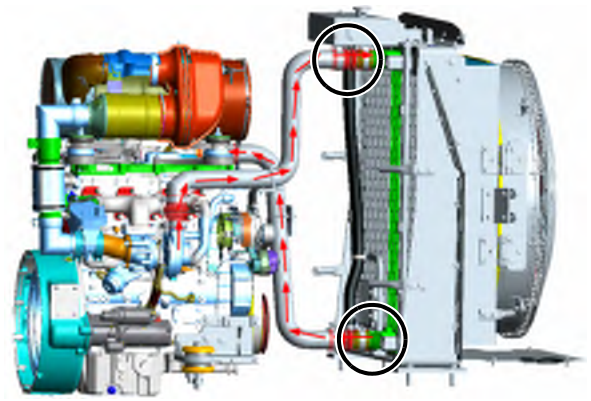
Assembly

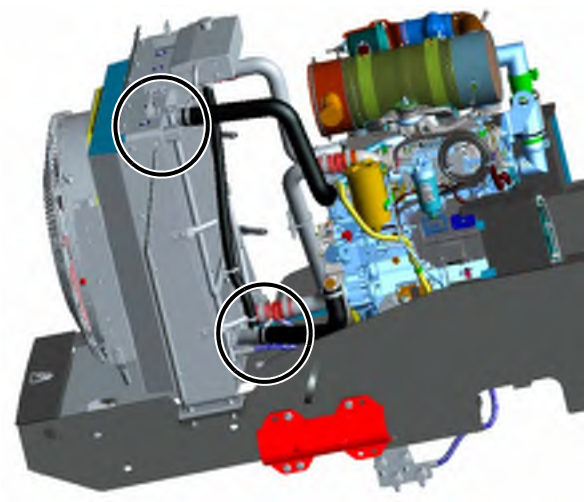
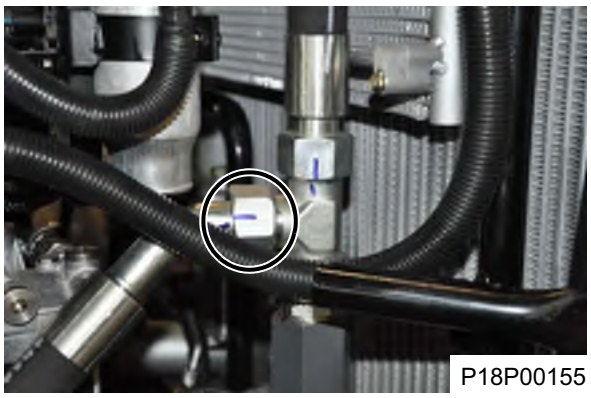
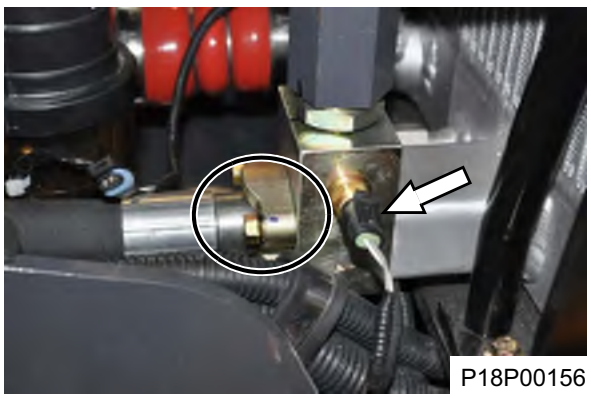
Figures	Contents	Tools
 1.Filter element cover 2 Filter element 3. Housing P18P00147	1. Install the filter element assembly into the DEF pump housing with filter element assembly tightening torque 14N.M(124lbin), and then tighten the protective cover.	Tool: Open-end wrench 27#
	2. Turn on the negative (-) switch and start the engine, check the urea pump for leakage. If there is leakage, please refer to the above steps of disassembly and inspection.	

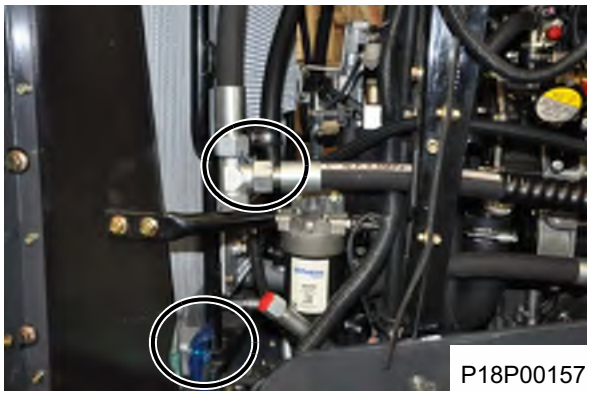
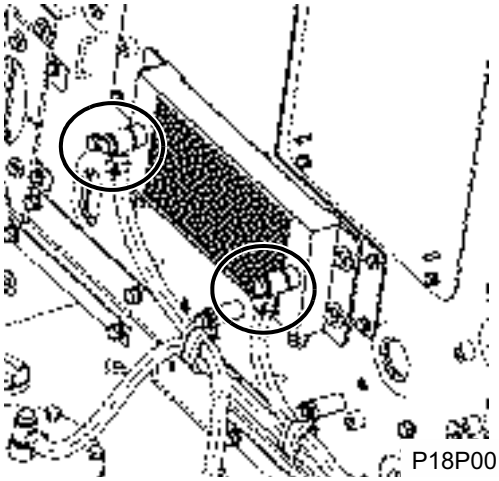
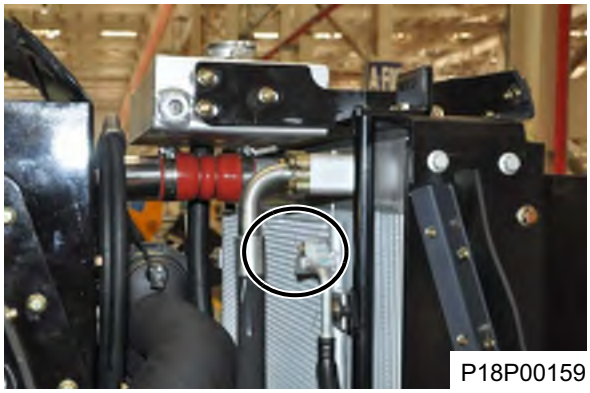
Removal and installation of radiator

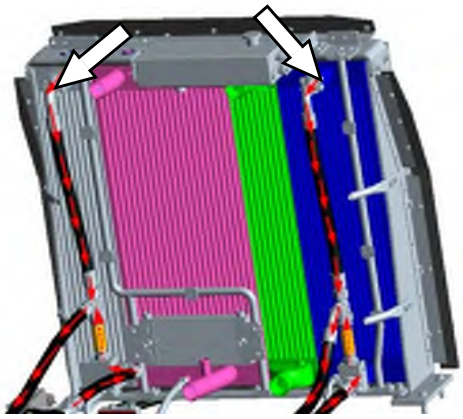
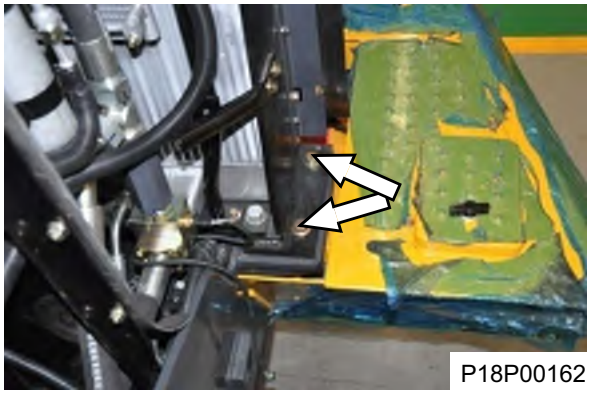
Removal

Graph	Contents	Tools
 P18P00148  P18P00060	1. Turn off the negative electrode switch, and hang on a "No operating" warning board.	
	2. Remove the engine hood and top cover according to removal and installation requirements and steps of engine hood.	
 P18P00150	3. Unscrew the drain connector to drain the engine cooling water.	Tool: Open-end wrench 36# Water tank

Graph	Contents	Tools
 P18P00151	4. Unscrew the hydraulic oil drain connector to drain the hydraulic oil in the radiator.	Tool: Open-end wrench 36# Oil tank
 P18P00152	5. Unscrew the torque converter oil drain connector to drain the torque converter oil in the radiator.	Tool: Open-end wrench 36# Oil tank
 P18P00153	6. Unscrew the clamp of intercooler pipe, unplug the silicone hose at radiator side and seal every port with plastic seal membrane.	Tool: Open-end wrench 12# Plastic sealing membrane

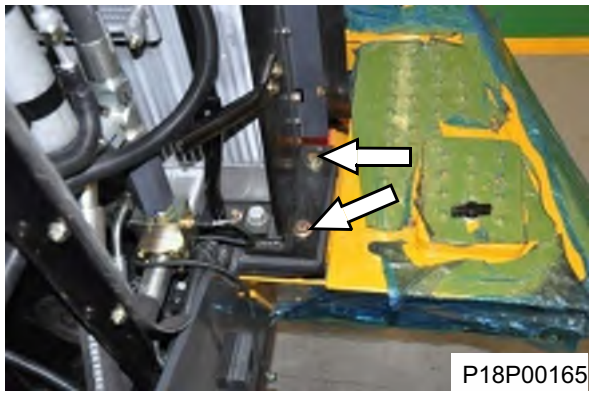
Graph	Contents	Tools
 P18P00154	7. Unscrew the water pipe clamp and pull out the water pipe from the radiator. Seal every port with plastic sealing membrane.	Tool: Open-end wrench 8# Plastic sealing membrane
 P18P00155  P18P00156	8. Remove the oil inlet/return pipes of the torque converter oil radiator & drain pipe joint, unplug the temperature sensor connector and seal each port with plastic seal membrane.	Tool: Outer hexagon wrench 8# Plastic sealing membrane

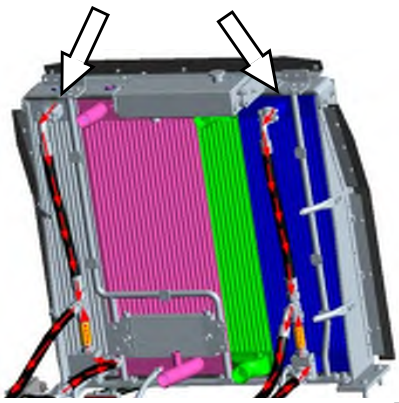
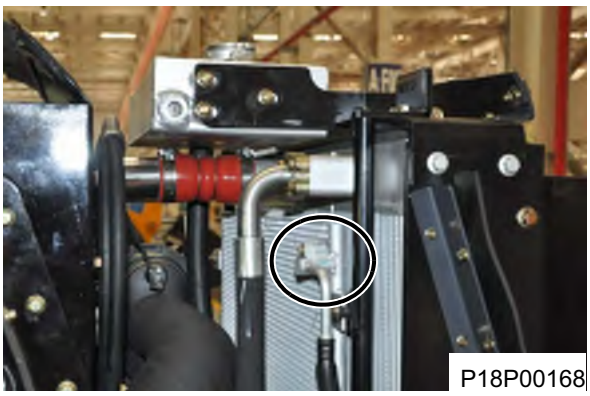
Graph	Contents	Tools
 P18P00157	9. Remove the oil inlet/return pipe joints of the hydraulic oil radiator and drain pipe joint, unplug the temperature sensor connector and seal each port with plastic seal membrane.	Tool: Open-end wrench Plastic sealing membrane
 P18P00158	10. Remove the oil inlet/return pipe connectors of the fuel radiator and seal each port with plastic seal membrane.	Tool: Open-end wrench Plastic sealing membrane
 P18P00159	11. Remove the condensing agent inlet/outlet connectors of the A/C radiator, and seal each port with plastic seal membrane.	Tool: Open-end wrench Plastic sealing membrane

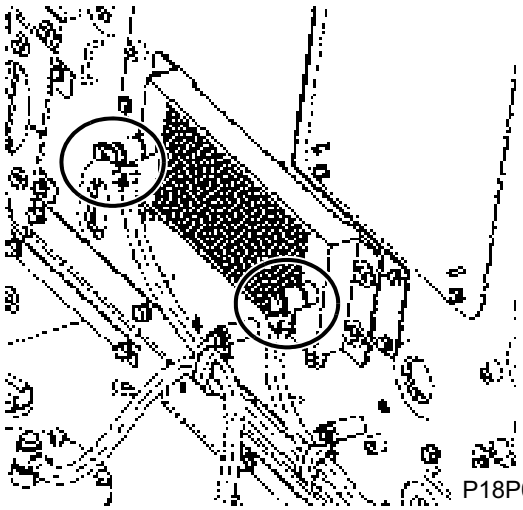
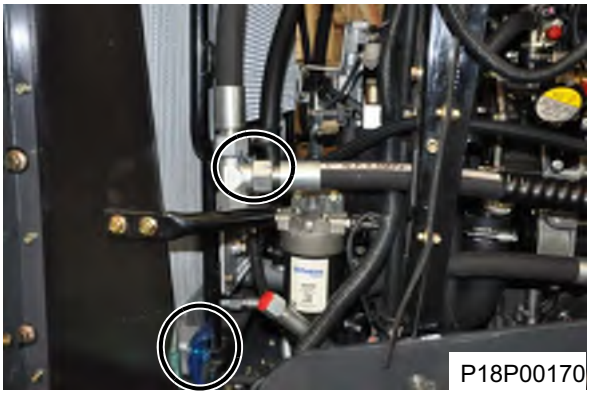
Graph	Contents	Tools
 P18P00160	12. Remove the oil inlet/outlet/ return pipe connectors of cooling motor and seal each port with plastic seal membrane.	Tool: Open-end wrench Plastic sealing membrane
 P18P00161	13. Slowly operate traveling crane, hang lifting eyes with wire rope, and tauten wire rope but not lift yet.	Tool: Traveling crane Wire rope
 P18P00162	14. Remove 4 anchor captive bolts from the radiator assembly.	Tool: Open-end wrench 24# Traveling crane

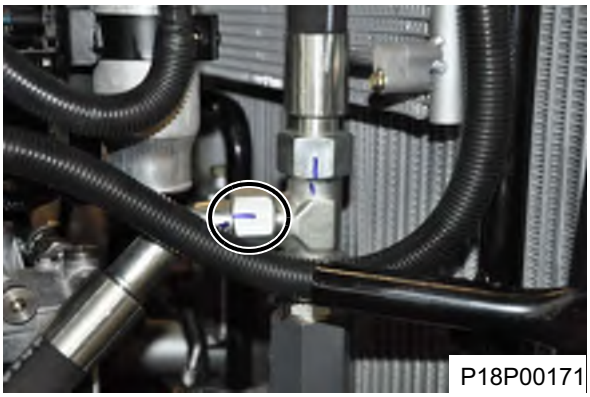
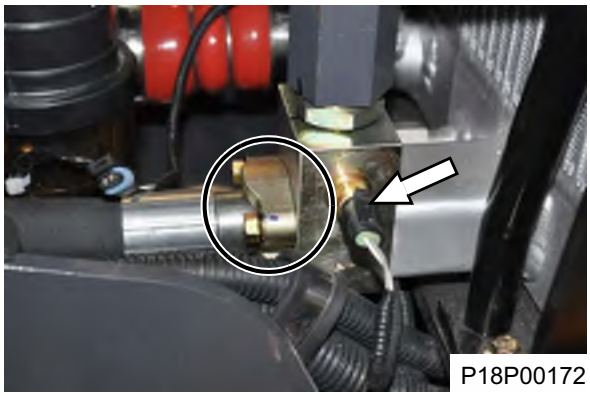
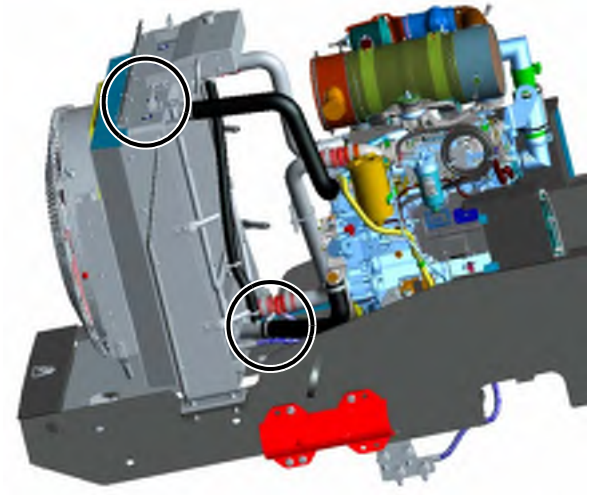
Graph	Contents	Tools
 P18P00163	15. Uplift the traveling crane, lift out the radiator assembly slowly and put it on flat ground.	Tool: Traveling crane

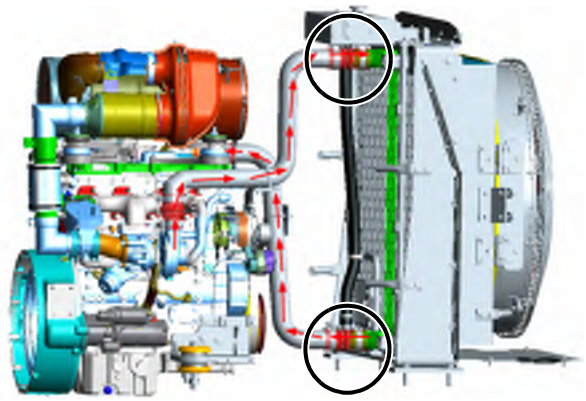
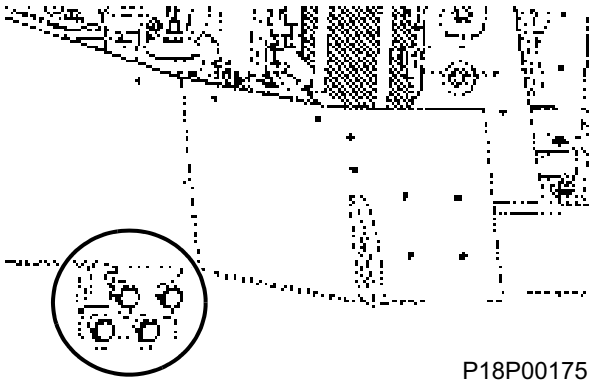
Installation

Graph	Contents	Tools
 P18P00164	1. Uplift the traveling crane, lift the radiator assembly to installing position.	Tool: Traveling crane Wire rope
 P18P00165	2. Tighten the radiator mounting bolts with the tightening torque 305 ± 25N.m.	Tool: Open-end wrench 24#

Graph	Contents	Tools
 P18P00166	3. Loose the wire rope	Tool:
 P18P00167	4. Install the oil inlet/outlet/ return pipe connectors of cooling motor	Tool: Open-end wrench
 P18P00168	5. Install the condensing agent inlet/outlet connectors of the A/C radiator.	Tool: Open-end wrench

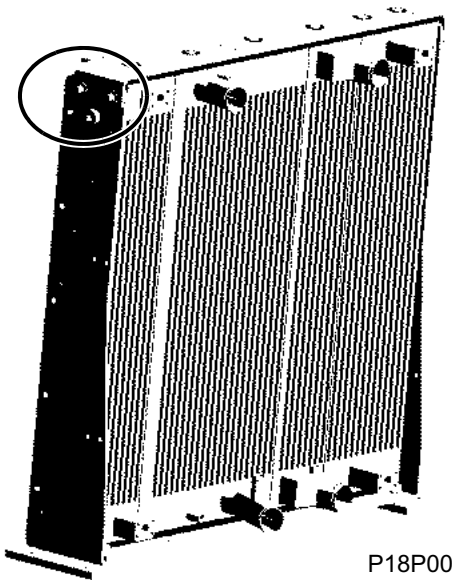
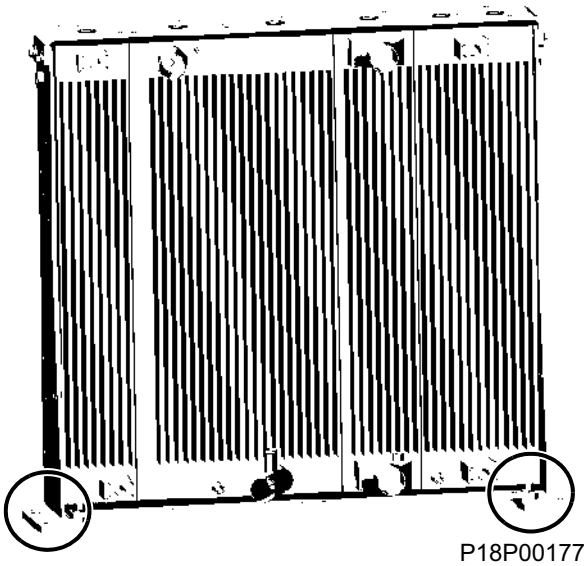
Graph	Contents	Tools
 P18P00169	6. Install the oil inlet/outlet connectors of fuel radiator.	Tool: Open-end wrench
 P18P00170	7. Install the oil inlet/return pipes of the hydraulic oil radiator & drain pipe joint, insert the temperature sensor connector.	Tool: Open-end wrench

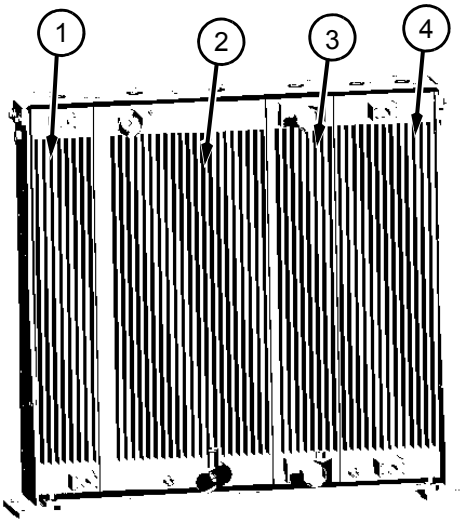
Graph	Contents	Tools
 P18P00171  P18P00172	8. Install the oil inlet/return pipes of the torque converter oil radiator & drain pipe joint, insert the temperature sensor connector.	Tool: Open-end wrench
 P18P00173	9. Insert the water inlet/ outlet pipes into the water radiator about 50mm, and then clamp the water pipe with clamp.	Tool: Open-end wrench 8#

Graph	Contents	Tools
 P18P00174	10. Connect the intercooler pipe and air-air intercooler with silicone hose and then clamp it with a clamp.	Tool: Open-end wrench 12#
 P18P00175	11. Tighten the radiator water draining switch, torque converter oil draining switch and hydraulic oil draining switch.	Tool:
	12. Replenish the coolant, hydraulic oil and torque converter oil as required.	
	13. Install the engine hood and top cover according to removal and installation requirements and steps of engine hood.	

Disassembly and assembly of radiator

Disassembly

Graph	Contents	Tools
 P18P00176	1. Unscrew the 4 fixing bolts on the upper connecting plate, remove the bolts and connecting plate.	Tool: Open-end wrench 16#
 P18P00177	2. Unscrew 4 captive bolts (do not remove) of lower connecting plate, so that left and right supports and lower connecting plate can rotate relatively.	Tool: Open-end wrench 18#

Graph	Contents	Tools
 1. Hydraulic oil cooler 3. Air-air intercooler 2. Water radiator 4. Torque converter oil cooler P18P00178	3. Push the radiator to right by the order 4321 with the aid of straight screwdriver, successively take out torque converter oil radiator, air-air intercooler, water radiator and hydraulic oil cooler and collect sponge and shock absorber. **CAUTION: Hold radiator assembly by someone or use corresponding stabilizing equipment to prevent radiator components from tilting when above 1, 2 and 3 operations are carried out.**	Tool: Straight screwdriver

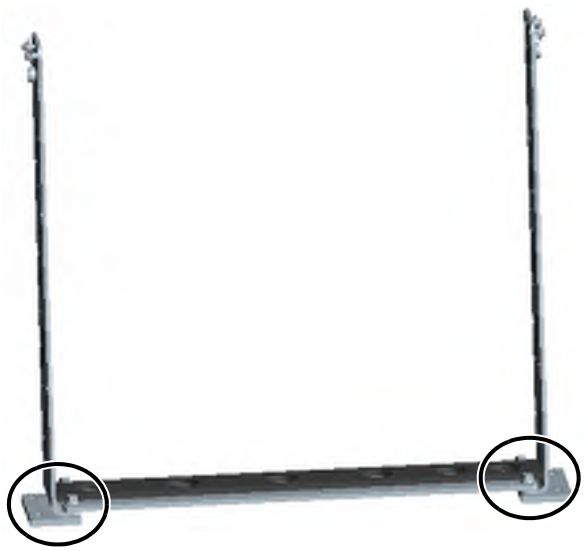
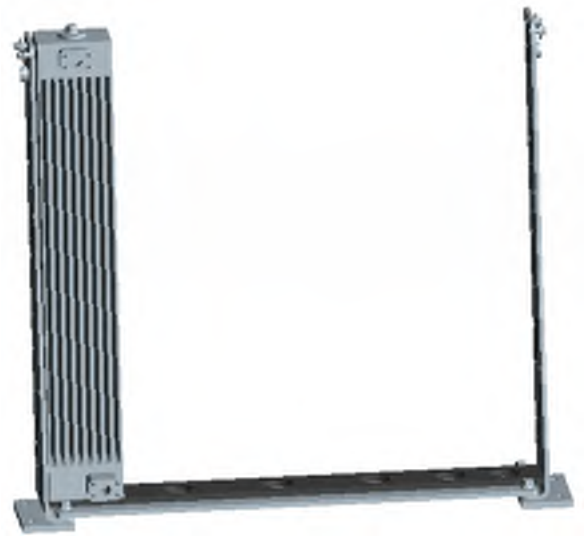
Check

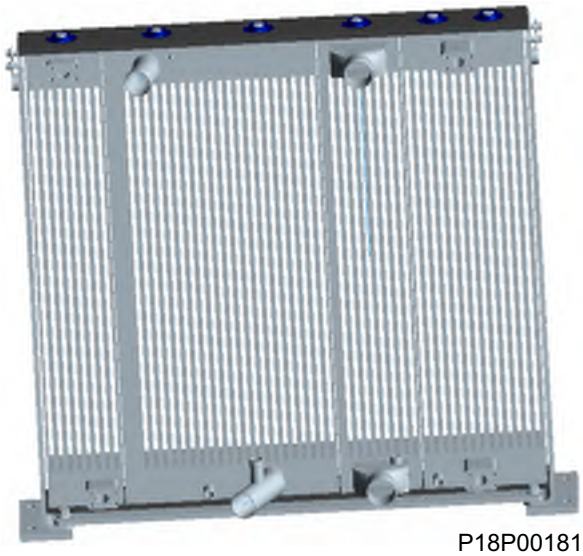
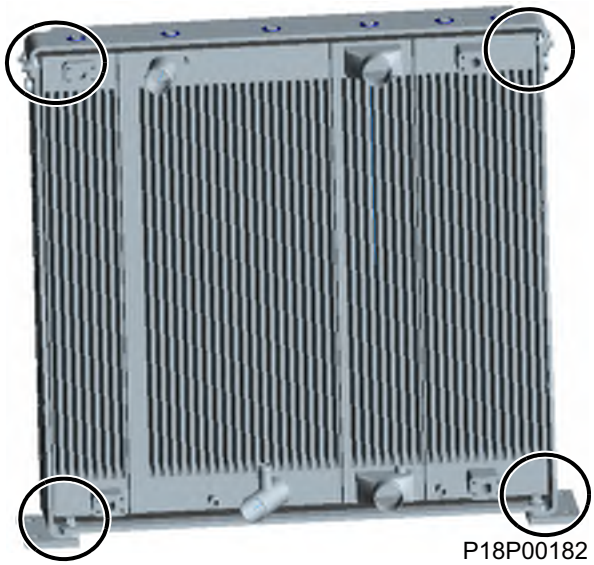
Check the radiator passage wall for cracks, and if does, it is necessary to perform the repair welding and replace the radiator.

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

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

Assembly

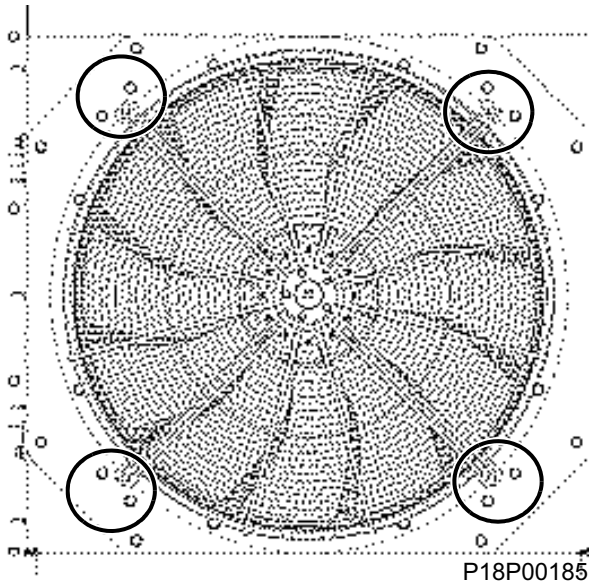
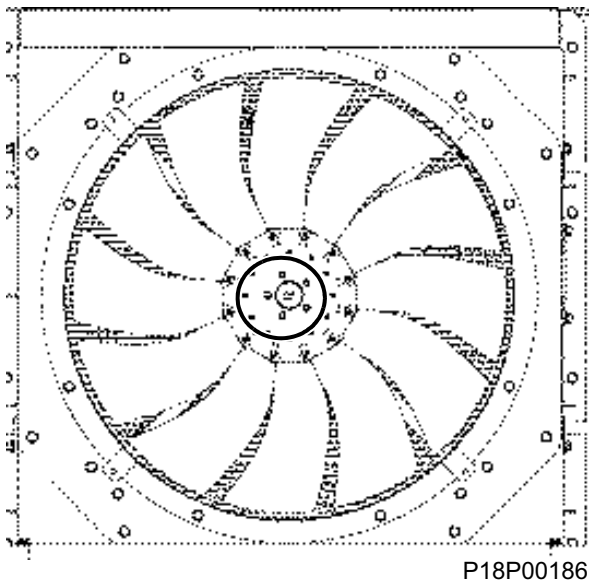
Graph	Contents	Tools
 P18P00179	1. Connect the left and right supports to the lower connecting plate with bolts, but not tighten the bolts, so that left and right supports and lower connecting plate can rotate relatively, and place the sponge on the lower backing plate.	
 P18P00180	2. Put the shock cushions to the lower plate holes and insert the radiator to the lower plate holes rightly. Perform the same assembly method for the other radiators.	

Graph	Contents	Tools
 P18P00181	3. Put the shock cushion on top of radiator to the radiator and put the sponge.	Tool: Open-end wrench 16#
 P18P00182	4. Install the upper plate and tighten the 4 captive bolts of the upper and lower connecting plates. **⚠ CAUTION: The radiator assembly shall be held by someone or using corresponding stabilizing equipment to prevent radiator assembly from tilting when above 1, 2, 3, 4 operations are carried out.**	Tool: Open-end wrench 18#

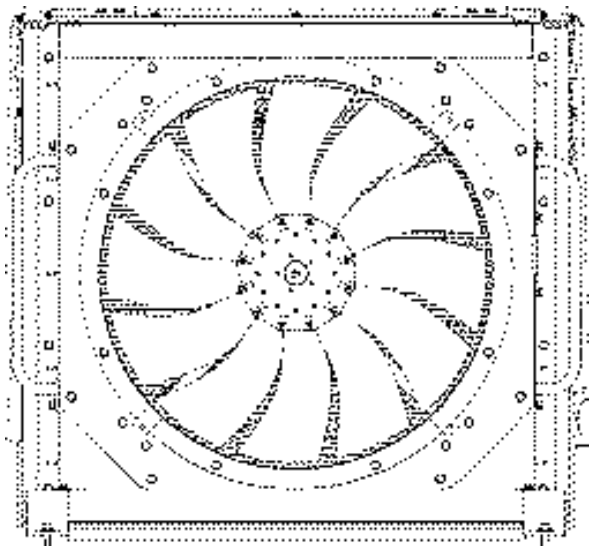
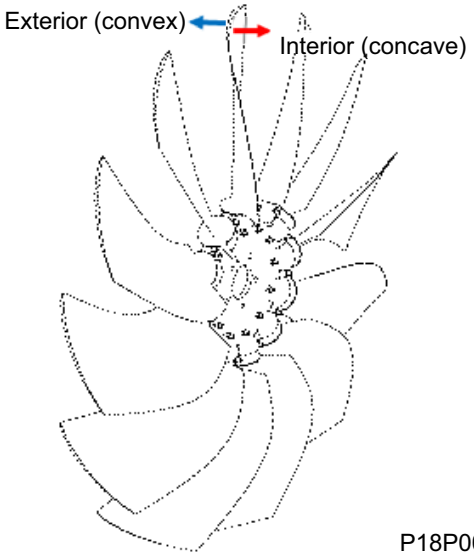
Removal and installation of fan

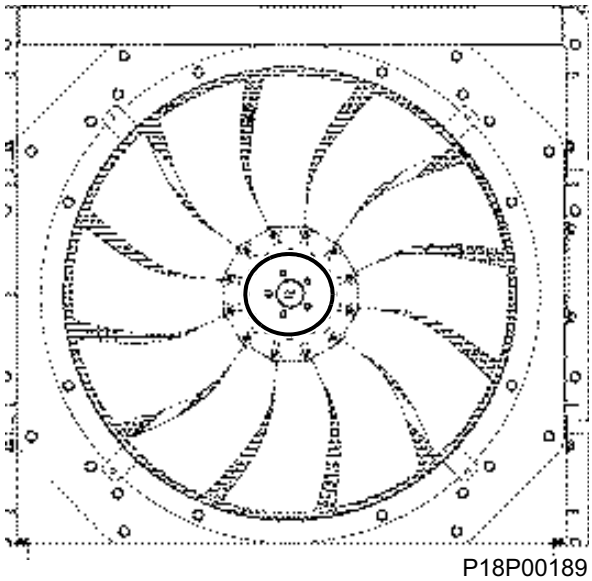
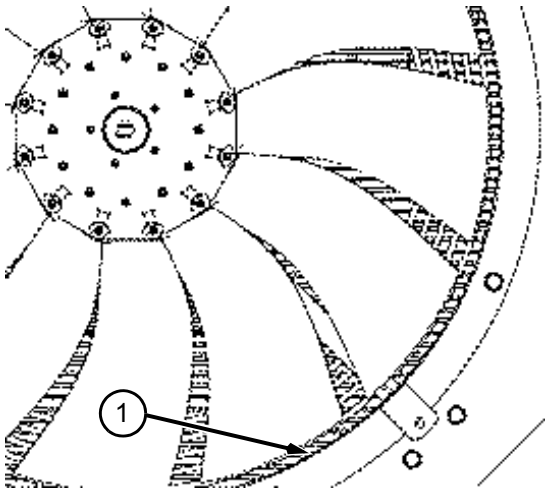
Removal

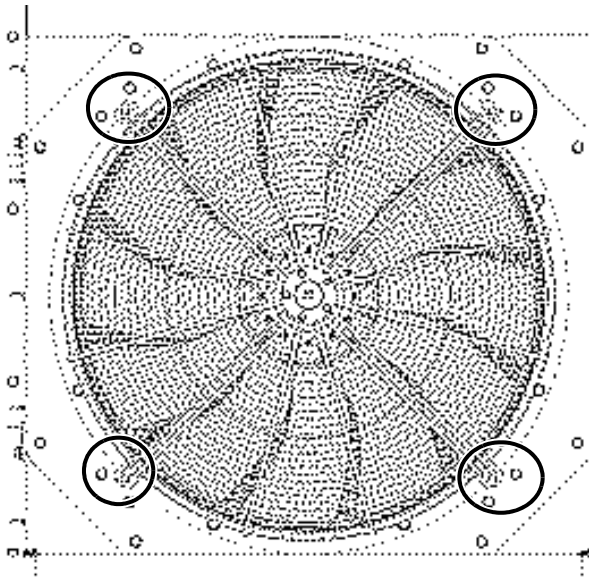
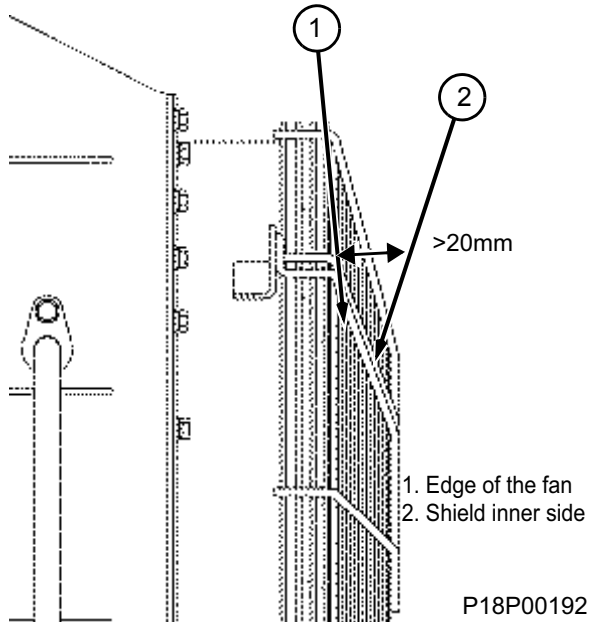
Graph	Contents	Tools
 P18P00183  P18P00060	1. Turn off the negative electrode switch, and hang on a "No operating" warning board.	
	2. Open engine hood	

Graph	Contents	Tools
 P18P00185	3. Unscrew the mounting bolt of shield and remove the shield.	Tools Open-end wrench 16#
 P18P00186	4. Unscrew the mounting bolt of fan, catch the root of fan vane and shake slightly to make the fan separate from the flange plate and then remove the fan.	Tools Open-end wrench 10#

Installation

Graph	Contents	Tools
 P18P00187  P18P00188	1. Install the fan to the flange with the inner side (concave side) of arc surface of fan facing the rear of complete machine.	

Graph	Contents	Tools
 P18P00189	2. Fix the fan on the flange with bolts.	Tools Open-end wrench 10#
 1. Clearance between fan and shroud >10mm P18P00190	3. Measure clearances between fan and shroud and it should be more than 10mm(0.3937In).	Tools Steel ruler

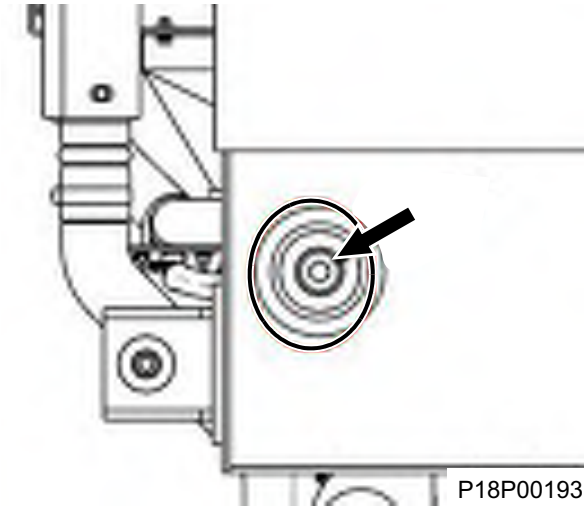
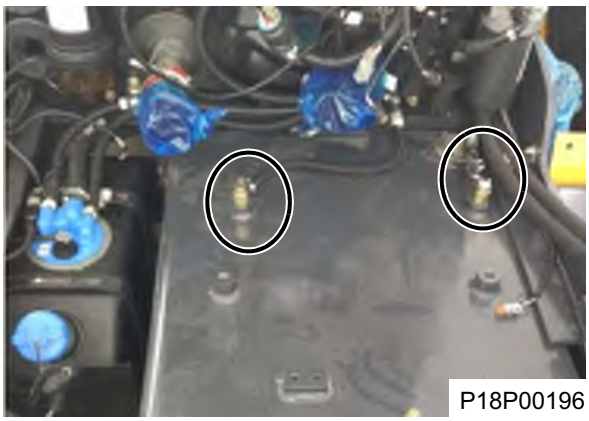
Graph	Contents	Tools
 P18P00191	4. Install the shield to the shroud and tighten it with bolts.	Tools Open-end wrench 16#
 1. Edge of the fan 2. Shield inner side P18P00192	5. Measure clearances between fan and shield and it should be more than 20mm (0.7874In).	Tools Steel ruler

Check

Check the fan vane for damage or scratches, the connection of fan vane and fan & hub for cracks, and if the fan is damaged, it is necessary to replace it with a new one with the same part number.

Removal and installation of fuel tank

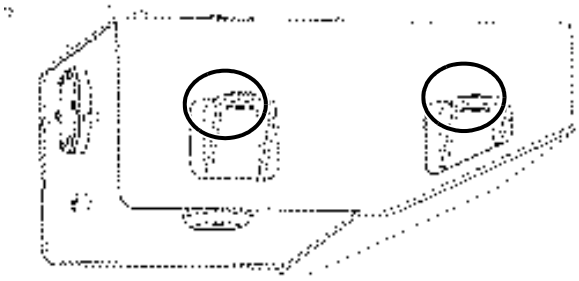
Removal

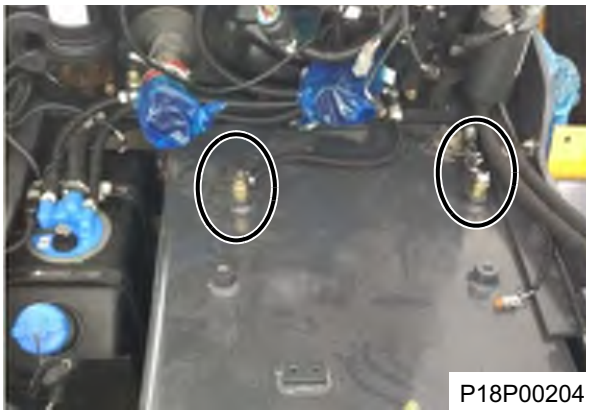
Graph	Contents	Tools
 P18P00193	1. Drainage of diesel fuel: Clean drain hole of fuel tank, place a clean oil container under the fuel tank, and unscrew drain plug. After fuel is drained, fix drain plug back to fuel tank. Drained fuel should be strictly sealed for preservation to prevent pollution to fuel.	Tool: 24# socket, socket wrench, oil tank
	2. Removal of pipe clamp: Remove all of hydraulic pipe or electric harness bolts, remove clamps, and loose the pipes and harness.	Tool: Open-end wrench 16#, 18#
 P18P00196	3. Remove the fuel lines of suction and return port: After fuel is drained, 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. Block the fuel hose with clean plastic bag.	Tool: Open-end wrench 19#

Graph	Contents	Tools
 P18P00197	4. Removal of fuel sensor wire harness: Remove the harness connector of fuel tank sensor.	
 P18P00198	5. Removal of fuel tank: Remove the 4 mounting bolts and nuts from the fuel tanks. **⚠ Caution: 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.** **Before step 5, make sure steps 2~4 have been done; otherwise, corresponding parts will be damaged, and even a safety accident will occur.**	Tool: Open-end wrench 30#, Carrier tool or tooling

Graph	Contents	Tools
 P18P00199  P18P00200		

Installation

Graph	Contents	Tools
 P18P00201	1. Install the cushion to the four brackets of diesel fuel tank.	
 P18P00202	2. 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 diesel fuel tank on the rear frame with bolts, hard washer, locknut with the tightening torque of fuel tank mounting bolt of 600 ± 50N•m (60 ± 5kgf.m).	Tool: Open-end wrench 30#, Carrier tool or tooling
 P18P00203	3. Connect the fuel level sensor harness connector to the complete machine harness.	

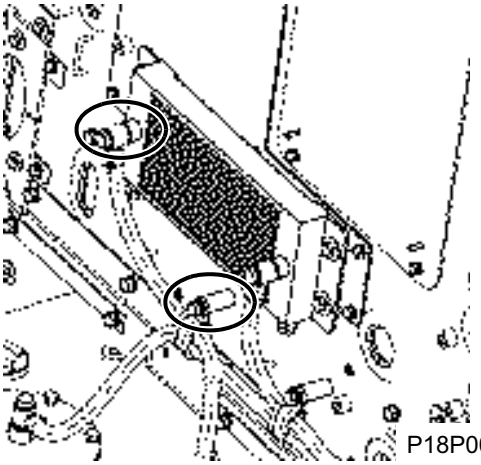
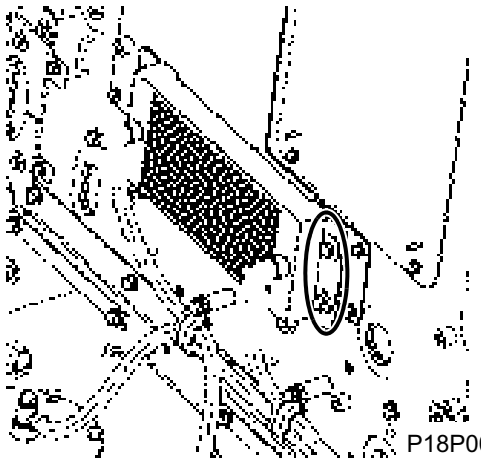
Graph	Contents	Tools
 P18P00204	4. Install the fuel pipe to the flange of the diesel fuel tank with screw, seal gasket.	Tool: Open-end wrench 19#
	5. Fix all of the hydraulic pipe or electric harness with clamps to corresponding positions, tighten and finish the fixing.	Tool: Open-end wrench 16#, 18#
	6. Refill the fuel.	

Cleaning

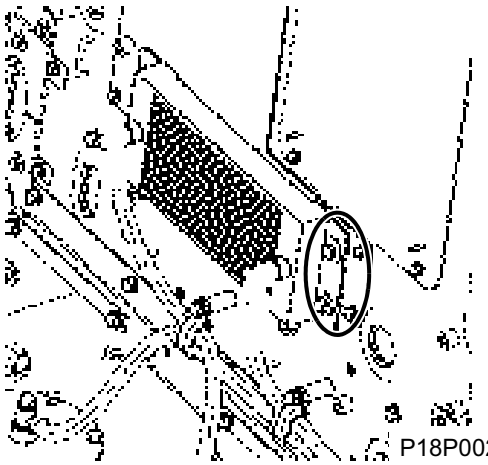
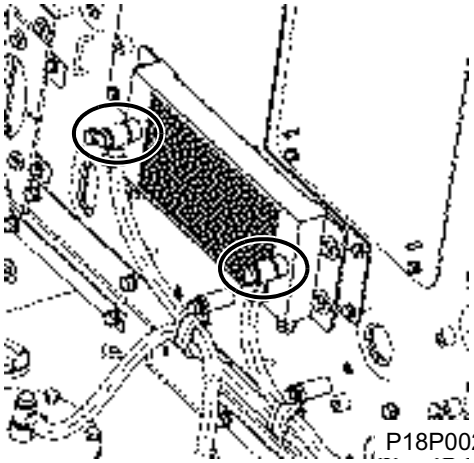
Remove the flange cover of washing port on the front end of fuel tank, use clean fuel to wash the inner oil tank surface. Unscrew drain plug at bottom of fuel tank to drain fuel (use a proper container to collect fuel). Rinse it by fuel repeatedly until the drained fuel is clean. Put drain plug back onto the floor of fuel tank.

Removal and installation of fuel radiator

Removal

Figures	Contents	Tools
 P18P00207	1. Unscrew the fuel pipe joint screw connected to the fuel radiator with wrench. Remove the screw, seal gasket and keep them in a plastic bag. Mask the fuel pipe joint with sealing membrane.	Tool: Open-end wrench 19# Plastic sealing bag Plastic sealing membrane
 P18P00208	2. Unscrew the mounting bolt of fuel radiator with wrench and remove the fuel radiator.	Tool: Open-end wrench 16#

Installation

Figures	Contents	Tools
 P18P00209	1. Install the fuel radiator on the support and tighten it with bolts.	Tool: Open-end wrench 16#
 P18P00210	2. Install the fuel pipe joint on the fuel radiator with screw, and please notice that the joint shall be added with seal gasket at both sides.	Tool: Open-end wrench 19#

Check

1. Check the fuel radiator, and if the radiator fin is blocked with dirt, please clean it with compressed air.
2. Check the fuel radiator, and if the fuel pipe is found damage, replace it with a new one.

Test Requirements

1. When the fuel radiator is installed, start the machine to allow it run for several minutes, observe the radiator for leakage.
2. If the leakage occurred at joint, there is a possibility that the screw is not tightened or the seal gasket is damaged, and it is necessary to tighten the screw or replace the seal gasket. If the leakage occurred at radiator itself, there is a possibility that the fuel line is damaged and it is necessary to replace the radiator with a new one.

Fault Diagnosis and Trouble-shooting

Precautions for fault diagnosis

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

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

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 do not be jammed by any rotating components.

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

Be sure to release the inner pressure 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 trouble-shooting

For common fault codes and troubleshooting, refer to Troubleshooting Manual of Perkins Engine1204F-E44TA&1204F-E44TTA.

Power Train System

Basic Information

Safety

Many accidents in operation, maintenance, repair and other aspects are caused by fail 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 methods may lead to hazardous condition, 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

⚠WARNING

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

⚠ DANGER

This word means danger will occurred immediately, 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 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".

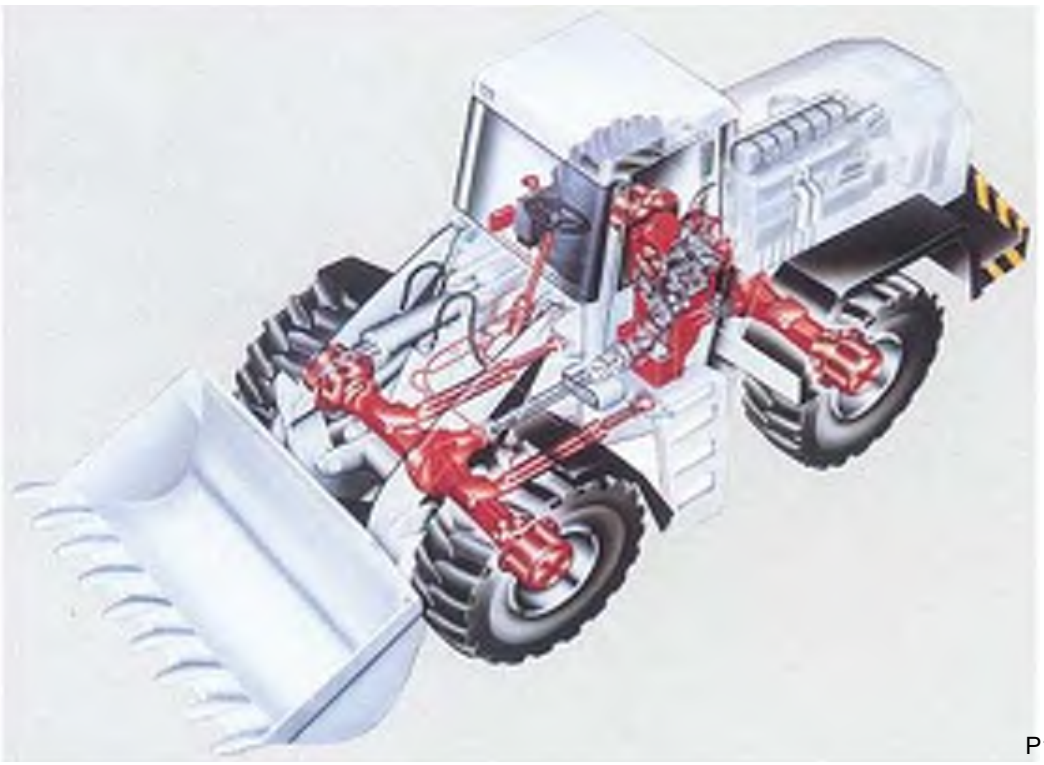
In addition, please carefully follow the "Cautions" listed in this Manual, otherwise, it may result in great damage to the machine. We are unable to enumerate all the possible risks (including potential dangers), and the warnings in the Manual and product do not cover all the risks and dangers. If the 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.

System composition and position

The power train system is a critical part of a loader, 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 three majority components: gearbox, drive shaft and drive axle.

Fig 3-1 Schematic diagram of position for wheel loader



P18T00001

System technical parameters

Main technical parameters for the power train system of this machine are listed in Table 3-1.

Table 3-1: Main technical parameter table for power train system

System components	Items	Parameters	Remarks
Gear box	Model	ZF 4WG158	
	Type	Fixed shaft type	
	Control mode	Full-auto electro hydraulic control	
Torque converter	Type	Single-turbo, three-element	
Drive axle	Drive mode	Spiral gear level-I reduction, wheel planetary gear reduction	
	Brake mode	Wet brake	

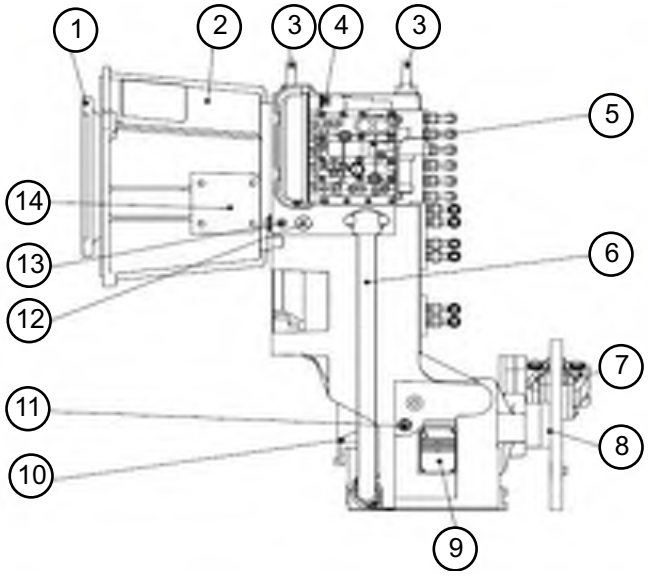
Table 3-1: Main technical parameter table for power train system

System components	Items	Parameters	Remarks
Tire	Tire structure	Radial tire	Tubeless bias tire or tubed bias tire is optional
	Specification	17.5R25 two star L3	
	Level	\	
	Type of tread	L-3	Ordinary block
Rim	Specification	25-14.00/1.5	

System schematic diagram and working principle description

The torque converter -gearbox assembly equipped in this machine is ZF 4WG158 full auto type, and the drive axle is 30 wet axle, whose structure diagram are shown as below:

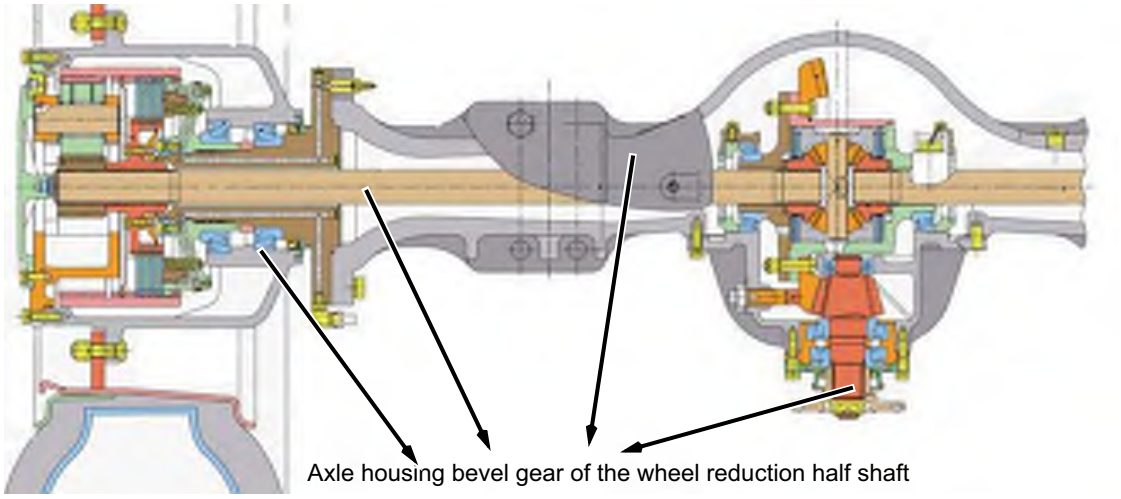
Figure 3-2 Diagram for gear box assembly composition



P18T00002

1. Coupling device
2. Torque converter housing
3. Lifting eye
4. Control harness interface
5. Electro-hydraulic shift control valve
6. Suction tube
7. Brake
8. Output plate
9. Nameplate
10. Output flange
11. Speed sensor
12. Oil outlet of torque converter
13. Torque converter outlet oil temperature sensor
14. Cover

Fig 3-3 Structure diagram for drive axle assembly



P18T00003

As shown in the above figure, the engine is coupled with the torque converter of the torque converter-gear box 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 gear box via the torque converter. Under the control of its electro-hydraulic shift control valve, the gear box can output power and speed at different positions with gear shafts and clutches.

The power output from the gear box is transmitted to the main drive of drive axle via a drive shaft, and then transmitted to wheel reducer by left and right axle shafts via main drive differential, and further to tire rim assembly by decelerating and increasing torsion, thus finally to drive the loader to travel and work.

Overview of transmission fluid

The oil product used for wheel loader 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 loader.

The lubricant, used in the loader, 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 composed of various petroleum-based additives. The wheel loader use a kind of lubricant which has four classes , i.e, diesel oil, gear oil, hydraulic drive shaft and hydraulic fluid. The applications of the lubricant used in the power train system of this machine are shown in the table below:

Table 3-2 Table of lubricant application

Category	Ambient temperature										Recommended brand	Application parts
	-40	-30	-20	-10	0	10	20	30	40	50		
Torque converter - gearbox assembly											Mobil Delvac Super 1300 engine oil (-15°C~+50°C)\ (-5°F~122°F) Mobil ATF 220 (-35°C~+50°C)\ (-31°F~122°F)	ZF torque converter & transmission assembly uses SAE 15-40 in general areas and in hot desert areas; and uses Mobil ATF220 in arctic areas.
Gear oil											Mobil gear oil 80W-90/LS with additives (-15°C~+50°C)\ (-5°F~122°F); Mobil gear oil 424 (-40°C~+50°C) \ (-40°F~122°F)with additives Shell SPIAX S6 AXME 75W-90/LS (-40°C~+50°C)\ (-5°F~122°F)	LiuGong axle uses SAE 80W-90/LS in general and hot areas, and Mobil 424 with additives and Shell SPIAX S6 AXME 75W-90/LS in arctic areas. LS means the additives are inclusive

Maintenance and replacement of gearbox and drive axle oil

The oil product added to the torque converter - gearbox assembly must be consistent with oil list TE-ML 03 recommended by ZF, the oil level shall be checked once a week by the following methods:

1) Park the machine on level ground;
2) Place the gear box gear in the neutral position;
3) Torque converter - gearbox oil is at 80-95°C\176°F~203°F;
4) The engine is idling 800rpm);
5) Observe the oil level gauge of gearbox and it shall be in the "HOT" zone;

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

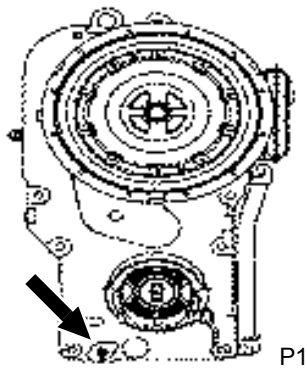
1) Unscrew the drain plug on the torque converter - gearbox assembly to drain the oil.

⚠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.

Figure 3-4 Gearbox drain plug



P18T00004

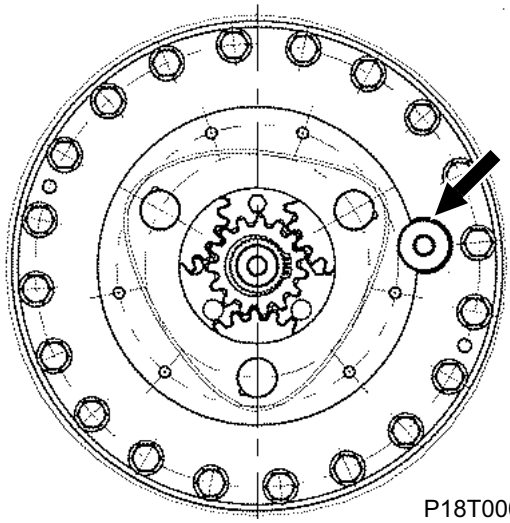
2) After the Oil sump tank of the gear box completely gets empty, wipe clean the mating surface on drain plug and gearbox housing that contacting with O ring of the oil drain plug. After the O-ring of the oil drain plug is replaced, reassemble and tighten it.
3) Add the oil in accordance with the oil 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 gear box. The oil filter may be installed by the following method:

1) Apply a small amount of the gear box 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.

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. The oil level of LiuGong axle may be checked by the following methods:

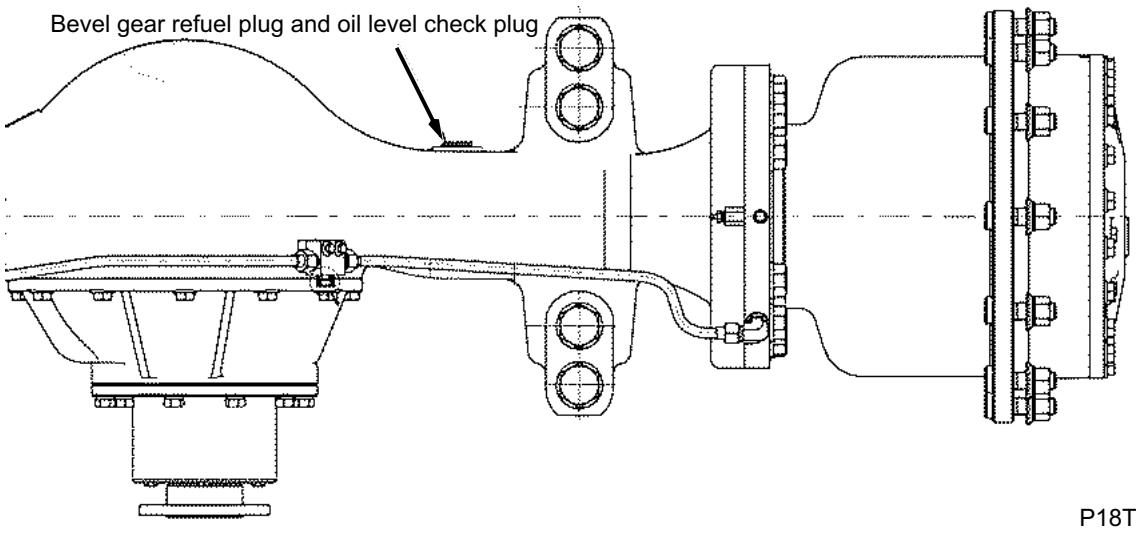
Figure 3-5 Wheel drain plug and oil level check plug



P18T00005

1) Wheel reducer: place the axle according to the installation position, and turn the hub to keep the oil level in a horizontal position, fill oil from left and right hubs respectively until the oil overflows the oil level plug; park the reducer for ten minutes after the drive axle running, and then check the oil level, and add enough lubricating oil.

Figure 3-6 Bevel gear refuel plug and oil level check plug



2) Axle housing: the oil is added into axle housing until it overflows from the oil filler.

The axle oil shall be replaced at the first 500h, after that once every 1000h, or at least once a year.

Universal tool, tooling list

For the universal tools, tooling list, please see the torque converter-gear box system, drive axle system and drive shaft system.

Special tool, tooling list

For the special tool, tooling list, please see "ZF Box Overhaul Manual" for details.

Structure Function Principle

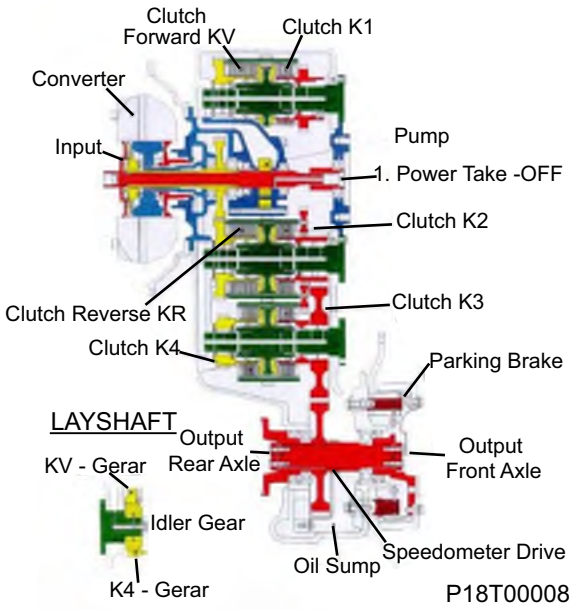
Torque Converter - Gearbox System

The torque converter -gearbox system equipped in this machine is ZF 4WG158 full auto type, which mainly consists of a three-element, single-turbo torque converter, mechanical gear box with four forward gears, three reverse gears and electro hydraulic shift control system, as shown below:

Figure 3-7 External view of torque converter - gear box assembly

P18T00007

Figure 3-8 Structural schematic diagram of torque converter - gear box assembly



P18T00008

System technical parameters

The technical parameters of ZF 4WG158 torque converter - gear box assembly in this machine are listed in Table 3-3.

Table 3-3 Technical parameter table of torque converter - gear box assembly

Component	Items	Parameters	Remarks
Gearbox	Model	ZF 4WG158	
	Type	Fixed shaft type	
	Gears	Four forward gears, three reverse gears	
	Torque converter-gear box assembly Quality (oil not included) /kg\lb	430\ 948.15	
	Type of emergence parking brake	Shoe brake	
Torque converter	Type	Single-turbo, three-element	
	Circulation circle diameter of torque converter/mm\In	340\ 13.39	
	Inlet pressure of torque converter/MPa\ psi	0.85\ 123.25	
	Outlet pressure of torque converter/MPa\ psi	0.50\ 72.5	
Shift control system	System voltage/V	24	
	Shift control mode	Auto electro hydraulic power shift	
	System working pressure/MPa\ psi	1.6+0.2\ 232+29	

System schematic diagram and working principle description

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:

Figure 3-9 Structure diagram for torque converter

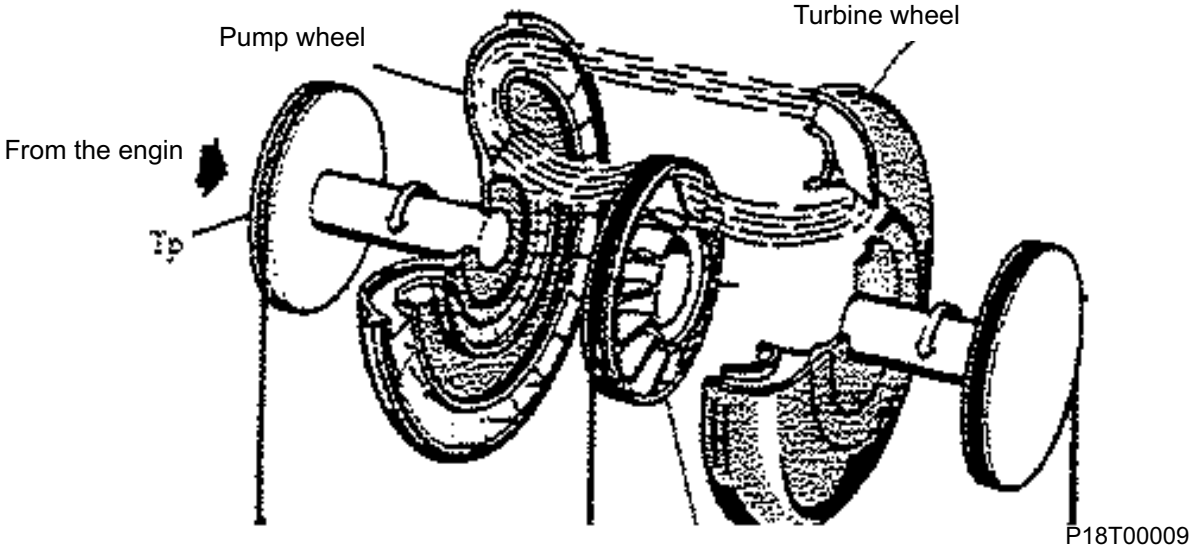
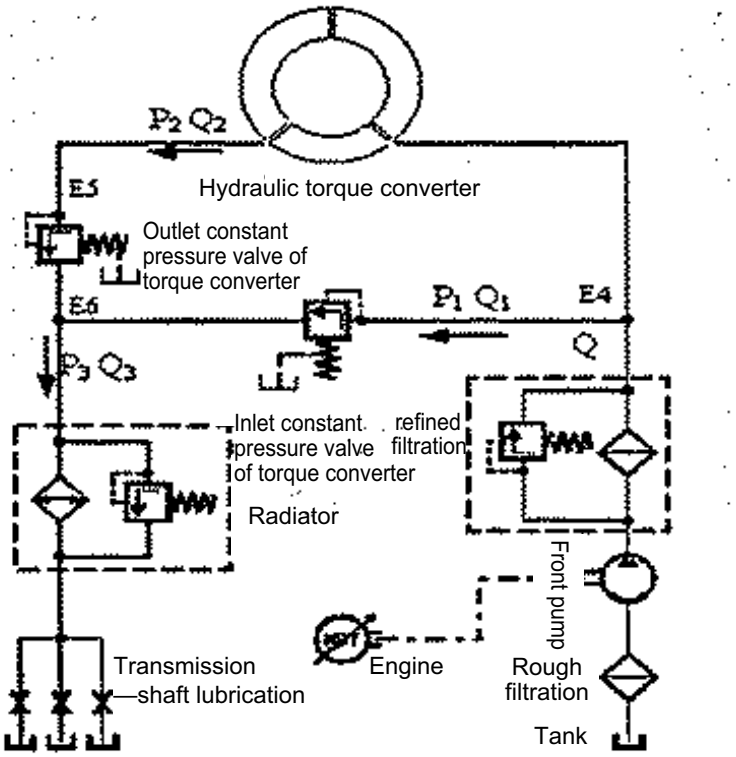


Figure 3-10Schematic diagram for torque converter hydraulic



We can see from structure diagram for torque converter, a three-element, single-turbo torque converter mainly consists of pump wheel, guide wheel and a 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 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 gearbox. The guide wheel is stationary. When the fluid flow(which is from the turbine and has some kinetic energy) passes through the curved blade of the guide wheel, the torque formed by the impact force and counterforce produced on the blade acts on the engine base, and equivalent to the sum of increased torque of turbine from counterforce and reduced torque of pump wheel from impact force. It is possible that the output torque of turbine is greater than input torque of pump wheel, based on which, the torque converter is variable.

The working oil of torque converter is imported into the torque converter through the coarse and fine filters from the oil tank by the variable pump. There is a constant pressure valve (safety valve) set at the inlet of torque converter, whose main role is to avoid excessive pressure in the torque converter to damage the parts. There is another constant pressure valve (back pressure valve) at the outlet 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 gear box assembly, see figure 3 -11 and 3-12 for structure composition and operating hydraulic pressure schematic diagram.

Figure 3-11 Diagram for structure and composition of electro-hydraulic shift control valve

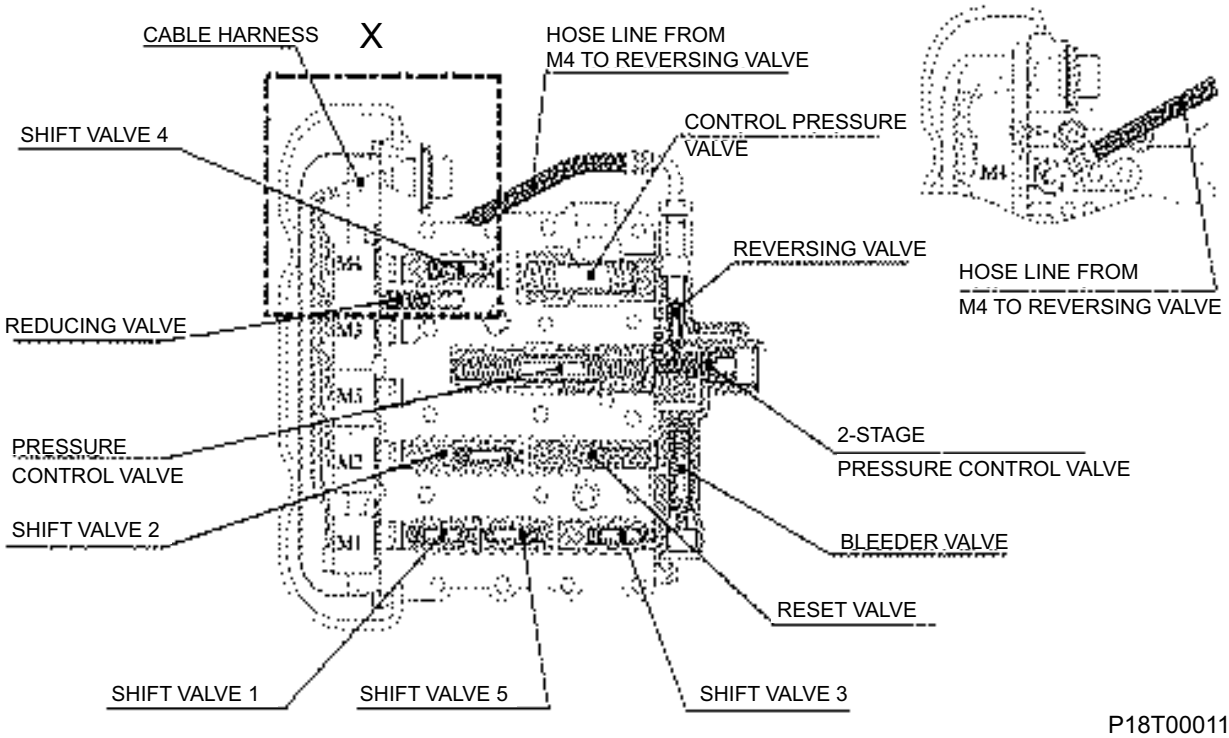
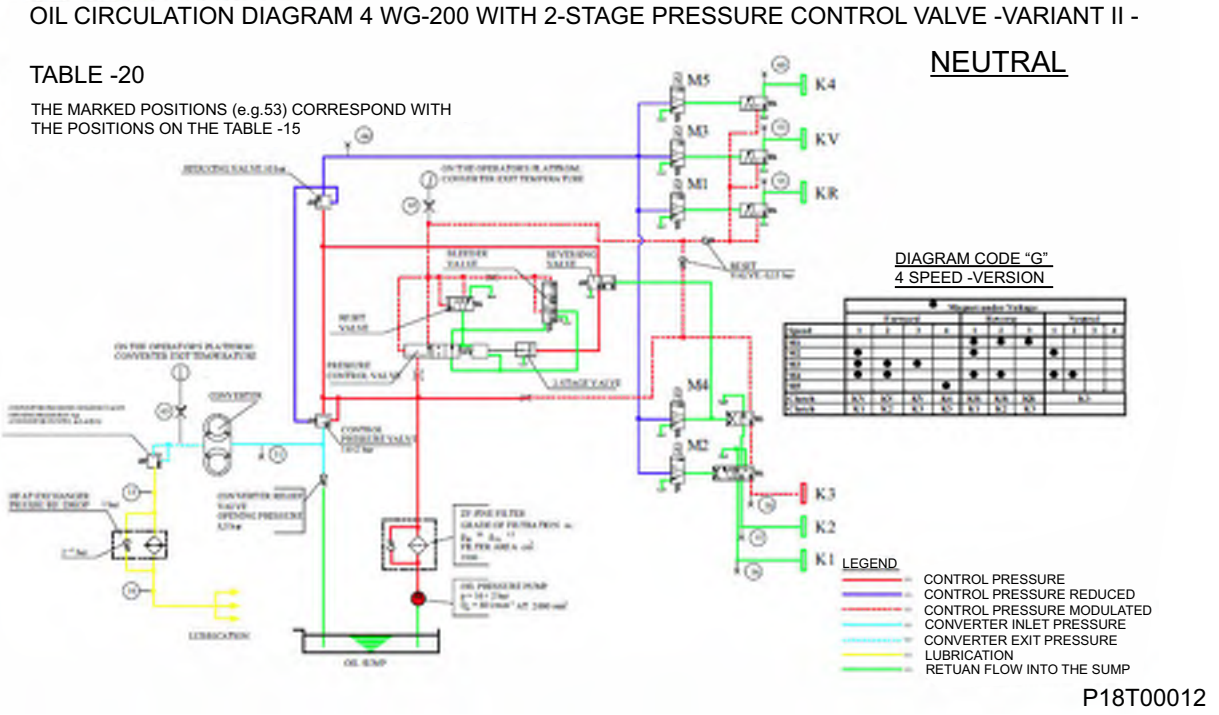


Figure 3-12 Schematic diagram for hydraulic pressure of torque converter - gear box assembly



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 in the valve stem oil passage is controlled by the power of solenoid valves, which finally control the engagement and disengagement of clutch in the gear box, thus to make the gear box achieve different shifts. For the power transferring line and gear engagement with the gear box in different gears, please see the figure of the power transferring line for each gear as the following figure 3-13 to 3-19.

Figure 3-13 Drive line of forward gear 1

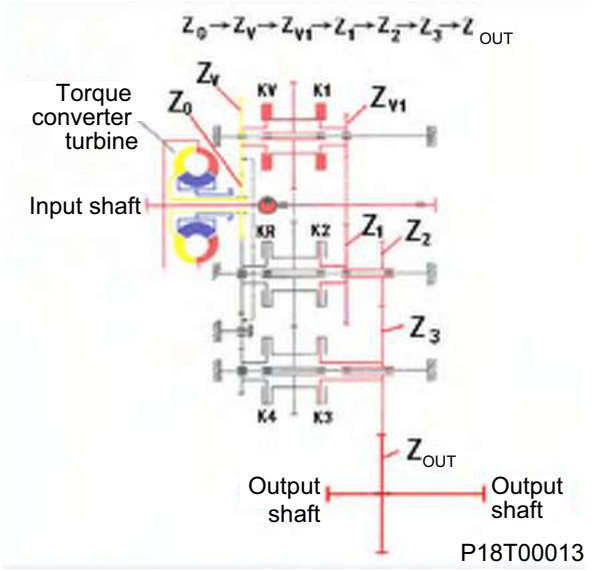


Figure 3-14 Drive line of forward gear 2

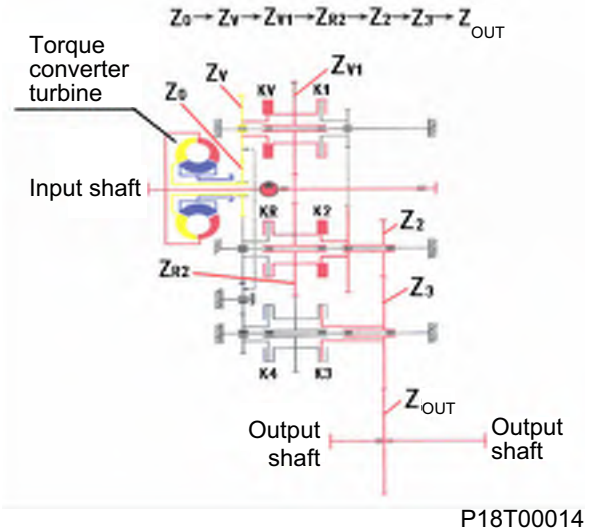


Figure 3-15 Drive line of forward gear 3

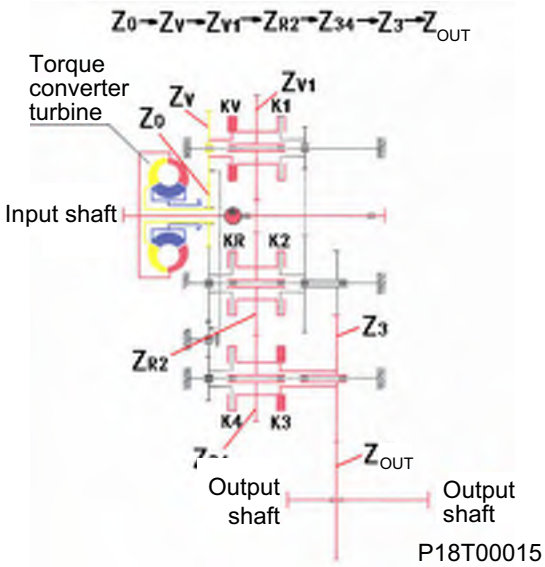


Figure 3-16 Drive line of forward gear 4

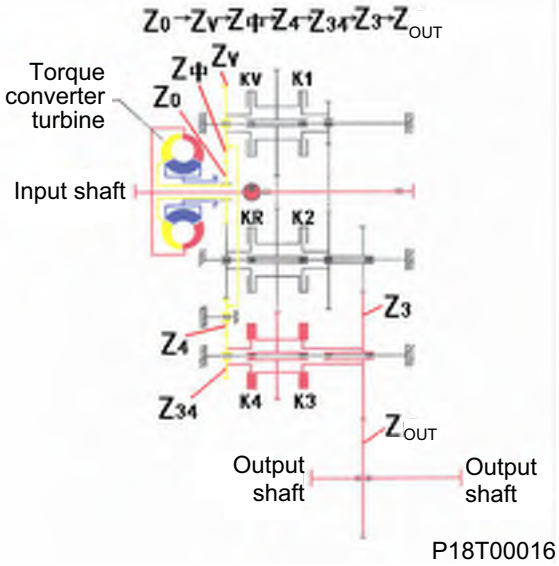
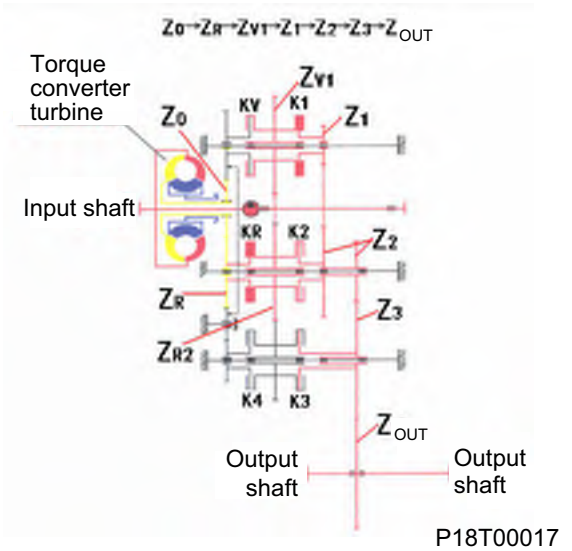
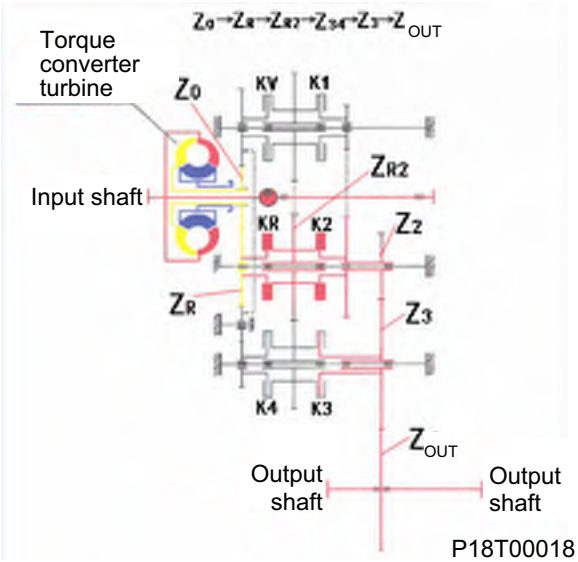


Figure 3-17 Drive line of reverse gear 1



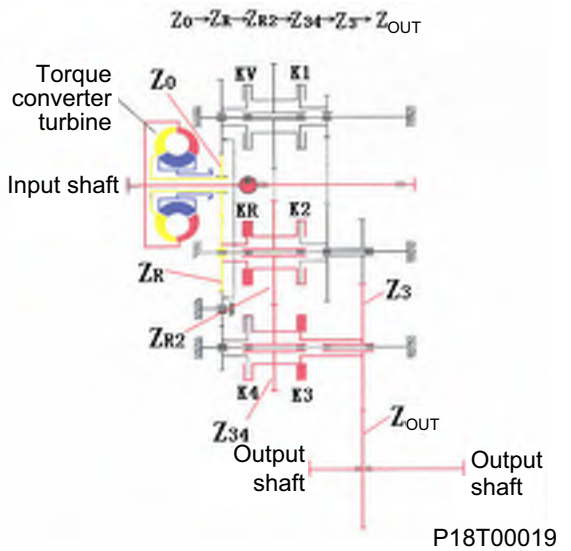
P18T00017

Figure 3-18 Drive line of reverse gear 2



P18T00018

Figure 3-19Drive line of reverse gear 3



P18T00019

Drive axle system

Composition and position of drive axle system

The basic function of drive axle for wheel loader is to reduce the gear box input speed with main drive and wheel reducer and increase the torsion, thus to meet the requirements of driving, operating speed and traction of the base machine. And also, change the straight line motion to vertical-lateral motion via main drive, so that the drive wheel can be driven to rotate to make the base machine drive along the straight route. The differential helps balance the speeds of left and right tires to make sure the machine can still drive when the driving resistances on both sides are different.

In addition to basic features of drive axle for wheel loader, it is also a load-bearing unit for complete machine, a support device for road wheel and mounting & support device for service brake. The drive axle system mainly consists of front axle, rear axle and brake lines. The swing axle also includes front, rear swing brackets, support shaft and other parts.

System technical parameters

Major technical parameters for the drive axle system of this machine are listed in Table 3-4.

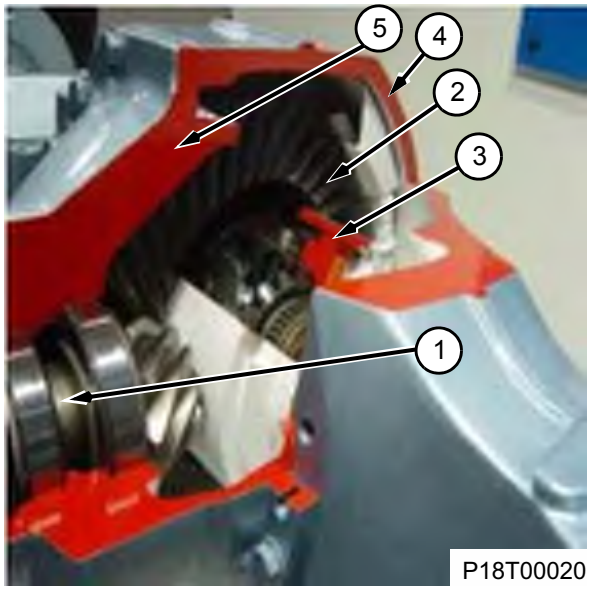
Table 3-4 Main technical parameter table for drive axle

System components	Items	Parameters	Remarks
Front axle	Drive mode	Spiral gear level-I reduction, wheel planetary gear reduction	
	Brake mode	Built-in wet multi-plate type	
	Brake pressure /MPa\psi	1450	
Rear axle	Drive mode	Spiral gear level-I reduction, wheel planetary gear reduction	
	Brake mode	Built-in wet multi-plate type	
	Brake pressure /MPa\psi	1450	

System schematic diagram and working principle description

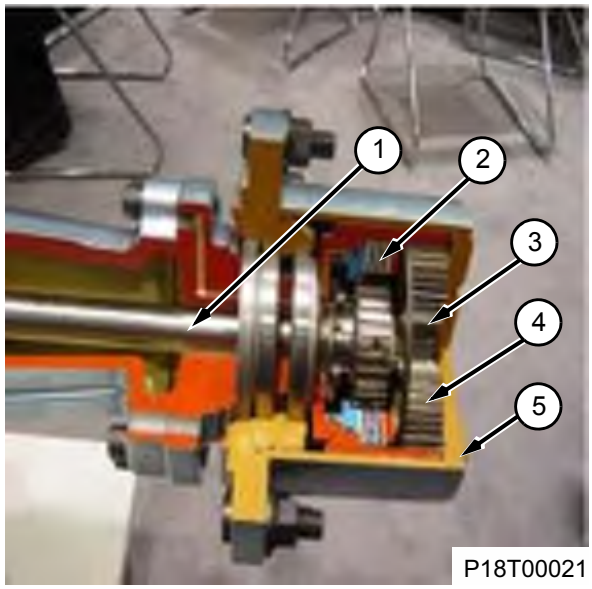
The drive axle for wheel loader is classified into two classes, i.e. front axle and rear axle, the main difference between which is the spiral directions of the spiral bevel gear pairs in the main drive. The driving spiral bevel gear of front axle is left-handed, and that of rear axle is right-handed. The structure diagram for bevel gear and wheel reducer of this machine is as shown in figure 3-20 and 3-21.

Figure 3-20 Structure diagram of the bevel gear



1. Driving spiral bevel gear
2. Axle housing
3. Driven spiral bevel gear
4. Carrier
5. Differential

Figure 3-21 Diagram of the wheel reducer



1. Axle shaft
2. Planetary gear
3. Brake
4. Hub
5. Sun gear

The bevel gear structure is shown in Figure 3-21. The bevel gear includes two parts, one is the bevel gear composed of driving spiral bevel gear and large size spiral bevel gear; the other is the differential composed of cross axle and bevel gear. The power is transmitted to the driving spiral bevel gear by the gear box through drive shaft, thus to drive the large size spiral bevel gear with differential to rotate together. The half shaft gear of differential passes the power to left/ right half shaft which is connected with the splines, and further to the wheel reducer. The power is then transmitted to hub and finally to drive the tire to rotate after further speed reduction, increasing torsion through wheel reducer.

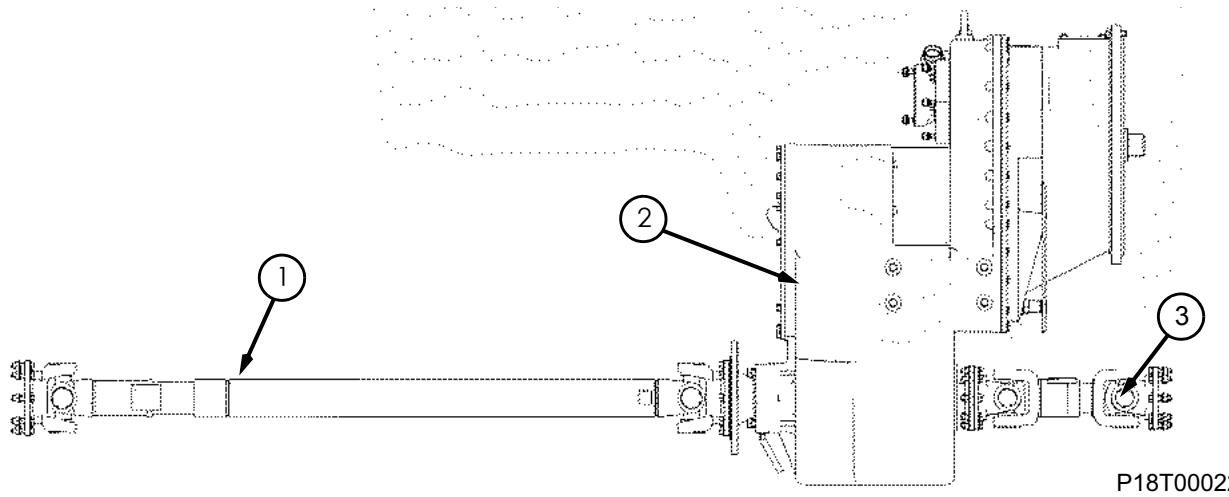
Drive Shaft System

In the wheel loader, the drive shaft system is mainly used to deliver the power between the two connected shafts, of which the relative position changes constantly during operation. Because of the special transmission characteristics of universal joint, the drive shaft may connect two transmission parts with nominal concentric axial line. However, an error may occur during installation and axial line deviates from the original position when operating, the drive shaft is widely used in shoveling transportation machine.

System composition and position

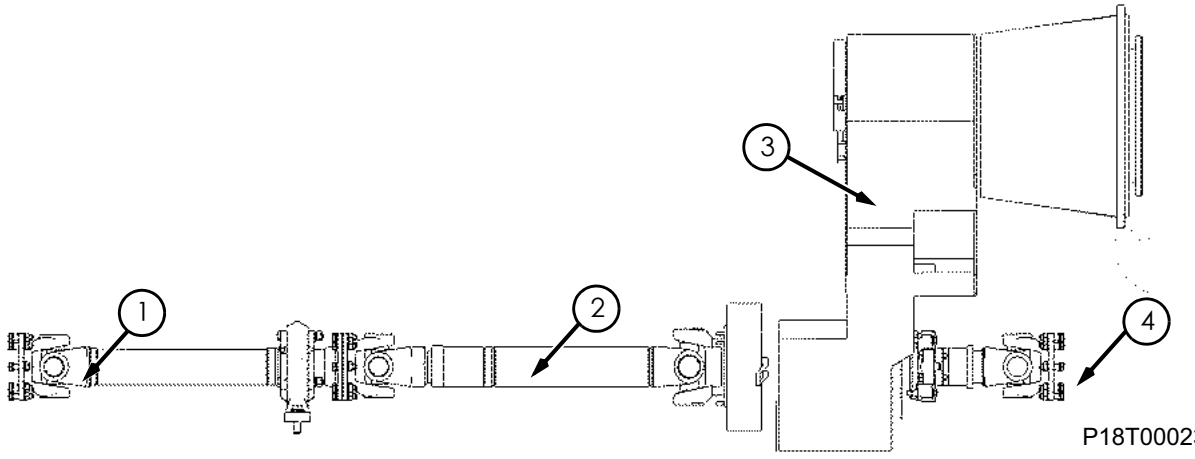
The drive shaft system of wheel loader is composed by the following two structural types in accordance with its formal layout, the drive shaft system shown in Figure 3-25 consists of rear and front drive shafts, the one shown in Figure 3-26 consists of rear, front, intermediate shafts and support assembly.

Figure 3-22 Drive shaft system



1. Front drive shaft
2. Torque converter-gear box assembly
3. Rear drive shaft

Figure 3-23 Drive shaft system



1. Front drive shaft&support assembly
2. Intermediate drive shaft
3. Torque converter-gear box assembly
4. Rear drive shaft

System technical parameters

The technical parameters for the drive shaft system are listed in Table 3-5.

Table 3-5 Technical parameter table for drive shaft system

Parts name	Input-end coupling type	Output-end coupling type
Rear drive shaft	7C FLANGE	7C FLANGE
Intermediate drive shaft	180 round flange	150 round flange
Front drive shaft&support assembly	150 round flange	150 round flange

Tire&rim system

System composition and position

Tire & rim system are both components bearing weight of a complete machine and direct components driving the complete machine to walk. Tires can be classified into bias tires with an inner tube, bias tires without an inner tube, radical tires, solid tires, etc. in accordance with it structural layouts. They can also be classified into block pattern tires, traction pattern tires, skidding tires, etc. according to pattern form.

System technical parameters

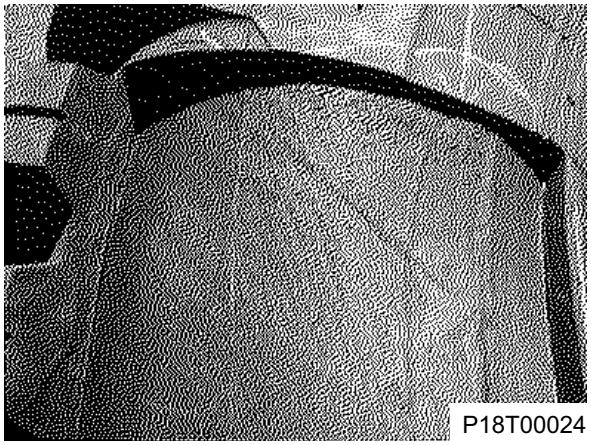
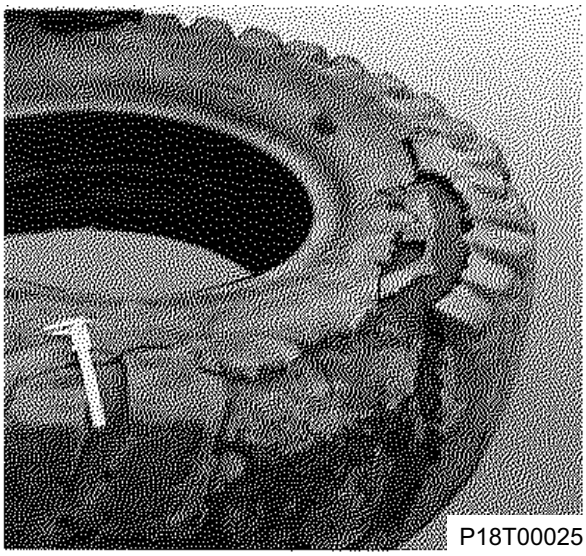
The technical parameters for the tire & rim system equipped in this machine are listed in Table 3-6.

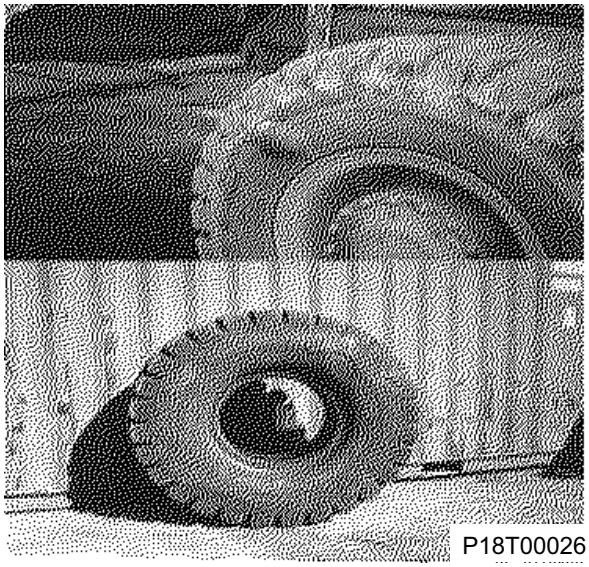
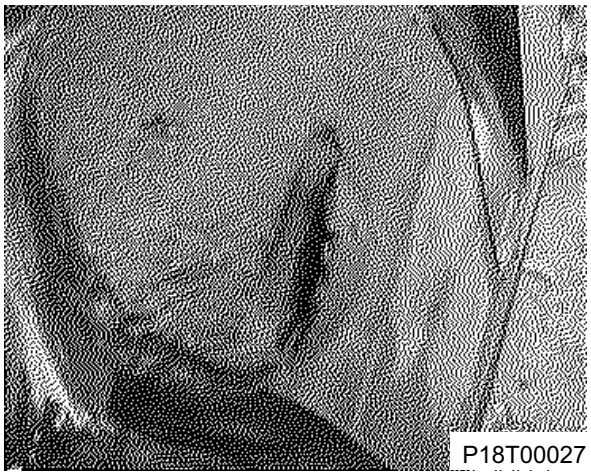
Table 3-6 Technical parameters of tire&rim system

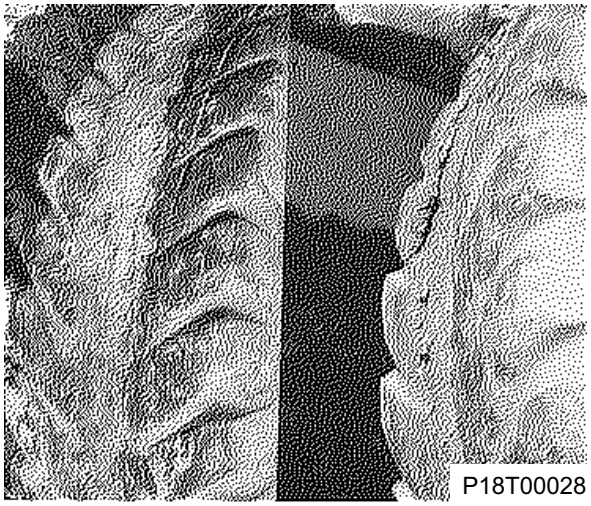
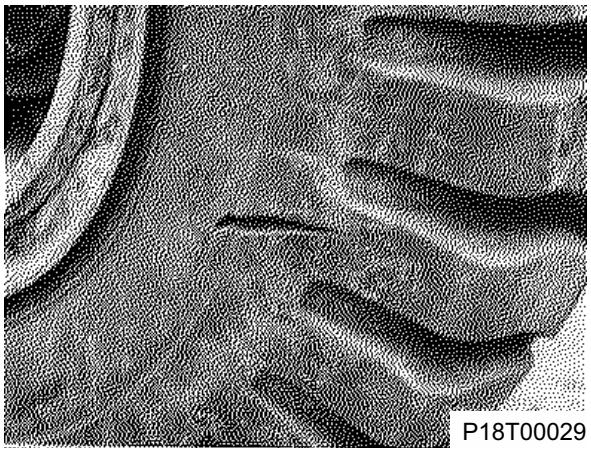
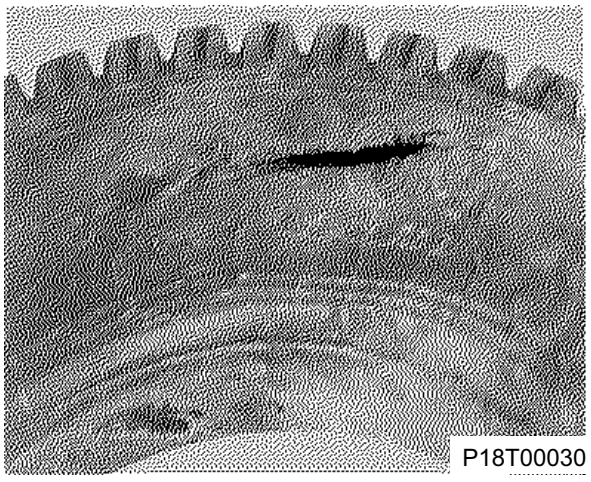
System components	Items	Parameters	Remarks
Tire	Tire structure	Radial tire	Tubeless bias tire or tubed bias tire is optional
	Specification	17.5R25 two star L3	
	Level	\	
	Type of tread	L-3	Ordinary block
	Tire pressure (MPa)\(psi)	Front wheel:0.55-0.58\79.75-84.10 Rear wheel: 0.52-0.55\75.40-79.75	
Rim	Specification	25-14.00/1.5	

Common failure modes of tire and reasons

Common failure mode of tire and reasons are as follows:

Typical pictures	Failure mode	Main reasons
 P18T00024	Delaminating of crown	1. Reasons for 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. Reasons for usage: speed is too fast (beyond specified speed), and directive pattern is traveling in reverse direction.
 P18T00025	Shoulder delamination blasting	1. Reasons for 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.

Typical pictures	Failure mode	Main reasons
 P18T00026	Delaminating of sidewall	1. Reasons for 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.
 P18T00027	Double skin	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.

Typical pictures	Failure mode	Main reasons
 P18T00028	Wearing of crown	Major reasons: traveling with too high pressure will cause earthed area reduction of tire crown, local load increase and wear intensification.
 P18T00029	Trauma	Major reasons: during traveling, outer tube is scratched by pointed objects or is stabbed evenly by pointed objects.
 P18T00030	Side trauma	Major causes: the vehicle speeds up when steering, the tire side rubs the roadside obstacles; and installed tire is stuck with hard objects; the machinery is damaged during transportation, installation.

Testing and adjustment

Power Train Test

Detection point layout of torque converter - gear box assembly as is shown in Figure 3-25, and names and parameters of each detection point can be found in Table 3-7.

Figure 3-25 Measuring point layout

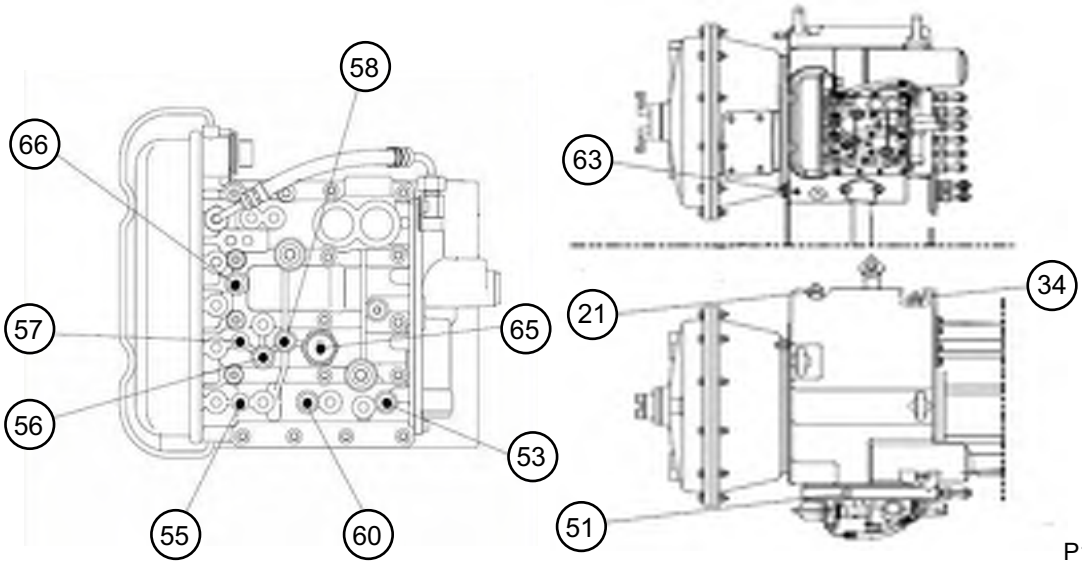


Table 3-7 Parameter list of the measuring point

S/N of the measuring point	Name of the measuring point	Theoretical value	S/N of the measuring point	Name of the measuring point	Theoretical value
21	Input sensor of the gear box	\	55	Reverse gear clutch	1.6-1.8MPa
34	Output sensor of the gear box	\	58	Gear 3 clutch	1.6-1.8MPa
51	Inlet pressure of torque converter	Opening pressure: 0.85	56	Gear 1 Clutch	1.6-1.8MPa
53	Forward gear clutch	1.6-1.8MPa\232-261psi	57	Gear 2 Clutch	1.6-1.8MPa
65	Pressure of shift control system	1.6-1.8MPa\232-261psi	63	Outlet pressure of torque converter	Opening pressure: 0.5
60	Gear 4 Clutch	1.6-1.8MPa\232-261psi			

Logical relations between gear states and working conditions of shift control valve solenoid valve can be found in Table 3-8.

Table 3-8 Logical relations between gear states and working conditions of shift control valve solenoid valve

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

Remarks: ● means the solenoid valve is energized;

Test Requirements:

Testing dynamic unbalance value

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

Torque Converter - Gearbox System

1. Leakage check

Start up the machine and operate it for several minutes, observe whether there is sign of leakage from the hose assembly coupled with gear box assembly, if so, re-tighten it.

2. Test of gear box shift pressure

Power on the machine, now the oil pressure warning light of gear box flashes on the instrument panel, and after startup of machine, the warning light shall go out, if not, inspect the oil level of gear box once again.

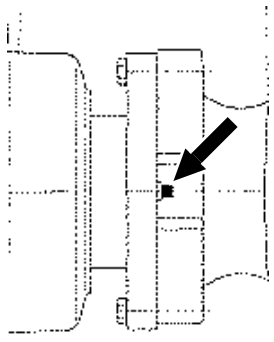
Drive axle system

1. Leakage check

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

2. Exhaust

Figure 3-24 Rear axle ventilation plug



1) Loosen the exhaust plugs at both ends of axle.

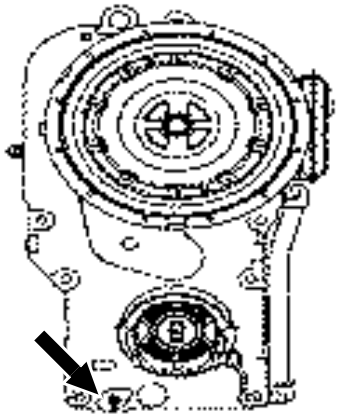
2) Start up the machine and step on the service brake pedal until the oil overflows from the exhaust plug.

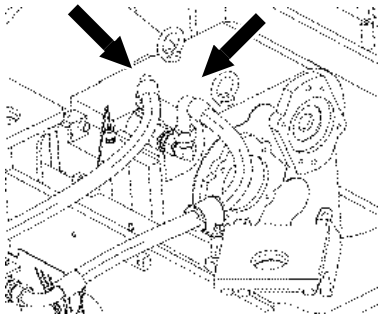
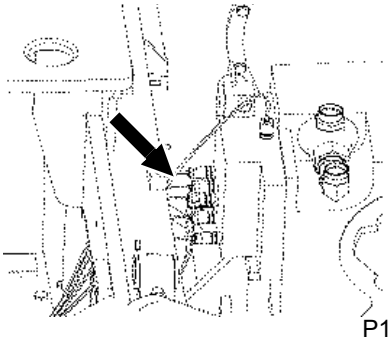
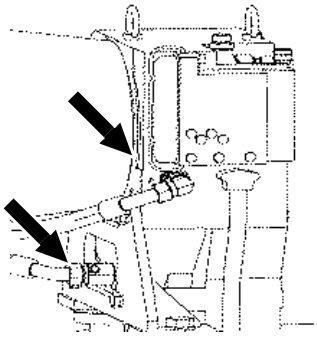
3) Tighten the exhaust plug.

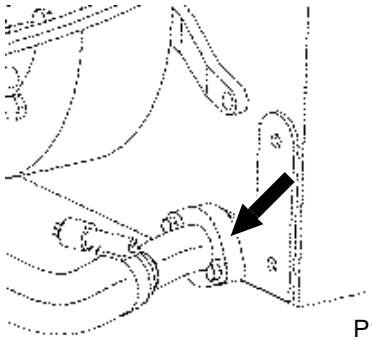
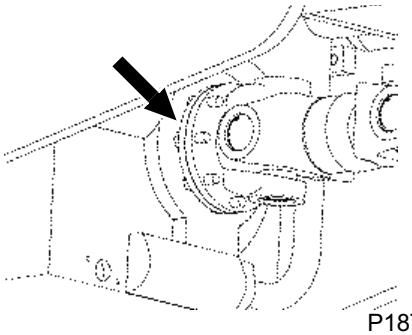
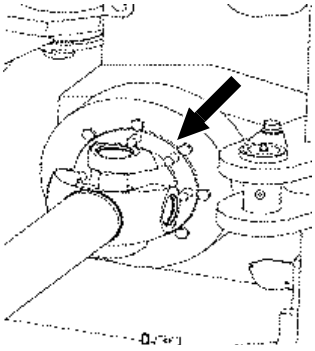
Removal and Installation

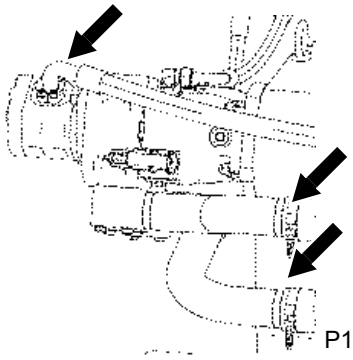
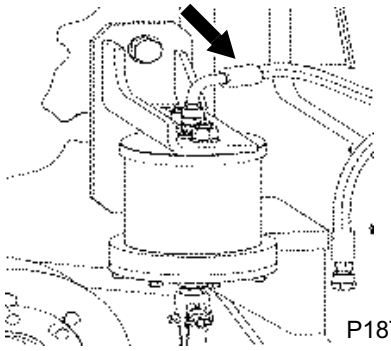
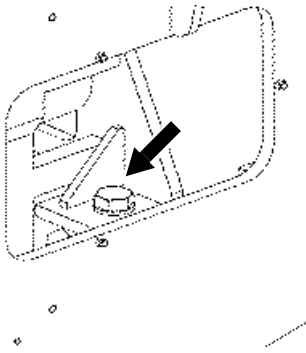
Removal and installation of torque converter-gearbox system

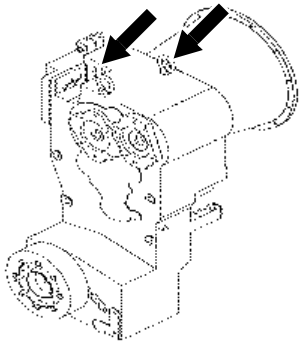
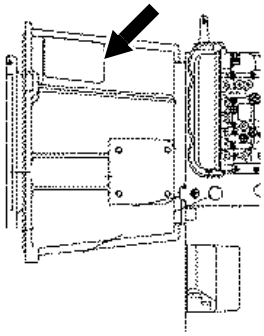
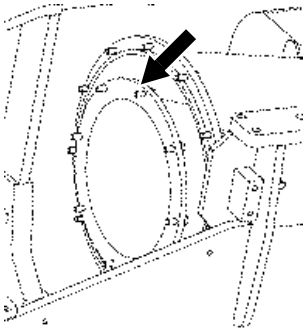
Removal of torque converter - gearbox system

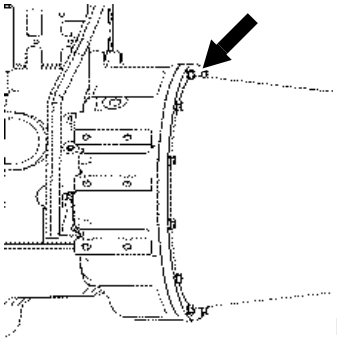
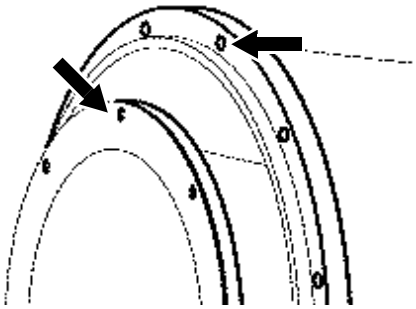
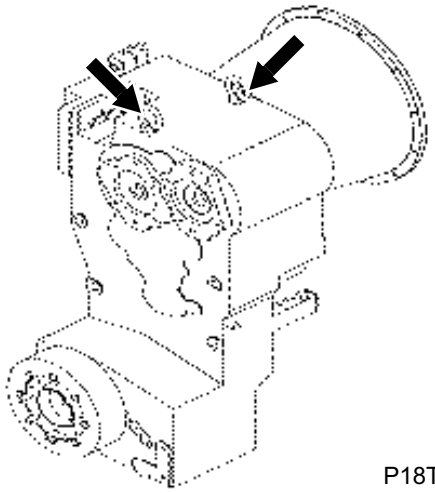
Reference picture	Operation step	Tools required (Remarks)
	1. Stop the machine on a level ground, put the work implement, bucket levelly, and pull up the emergency parking brake lever. 2. Turn off the engine and remove the key.	
 P18T00032	3. Remove the drain plug of gear box assembly to drain the oil. **⚠ Caution: The waste oil shall be recovered in a container during removal, in order to avoid environmental contamination. The removed hose is shielded to avoid contamination of parts.** **⚠ Danger: It is sure that the hose pressure is fully discharged and the oil is cooled sufficiently before removal of hose, in order to avoid personal injury of hose pressure and hot oil during removal.**	34# socket, 13# socket, pneumatic impact wrench
	4. Remove the cab assembly of machine, see section “Removal and Installation of Cab” for removal steps.	

Reference picture	Operation step	Tools required (Remarks)
 P18T00033	5. Remove the hose assembly connecting the oil filter pipe to the gear box assembly with wrench. **⚠ Caution: The waste oil shall be recovered in a container during removal, in order to avoid environmental contamination.** **The removed hose is shielded to avoid contamination of parts.**	41# wrench
 P18T00034	6. Remove the test line connected to gear box assembly and test hose.	18# Wrench
 P18T00035	7. Remove the hose assembly with a wrench.	41# Wrench

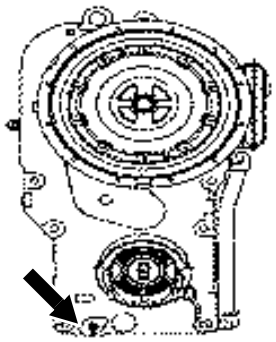
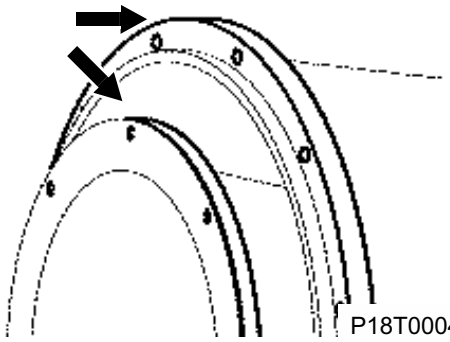
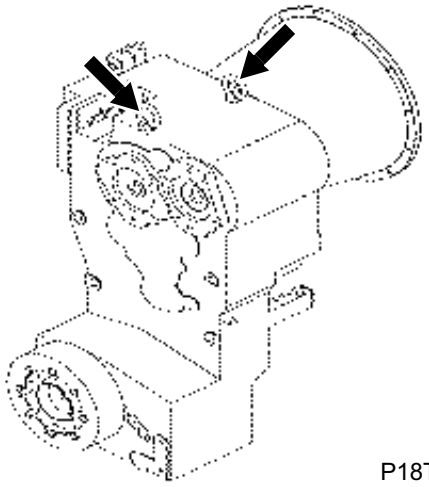
Reference picture	Operation step	Tools required (Remarks)
 P18T00036	8. Remove the clamping bolt fixing the oil filler steel-pipe with a wrench.	10# Wrench
 P18T00037	9. Remove the coupling lock-nut between rear drive shaft and rear output flange of gear box assembly. **⚠ Caution: The drive shaft assembly is composed of slidable spline sleeve, please take care to avoid personal injury caused by falling of slide shaft fork during removal.**	18# Wrench
 P18T00038	10. Remove the coupling lock-nut between intermediate drive shaft and front output flange of transmission assembly.	21# Wrench

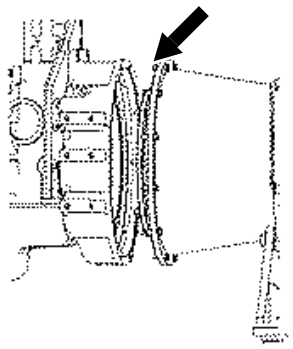
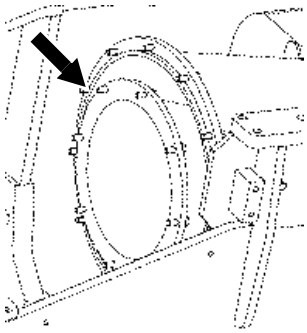
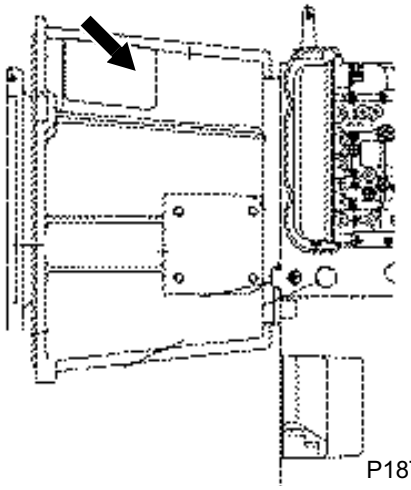
Reference picture	Operation step	Tools required (Remarks)
 P18T00039	11. Remove the hose assembly or the hose connected with hydraulic pump from the gearbox assembly, and refer to removal of hydraulic system for detailed procedures.	
 P18T00040	12. Remove the hose assembly connected with brake system from the emergency parking brake chamber.	24# Wrench
 P18T00041	13. Remove the bolts and washer for attaching the transmission mount to the frame with an air gun.	46# wrench, 46# socket, pneumatic impact wrench

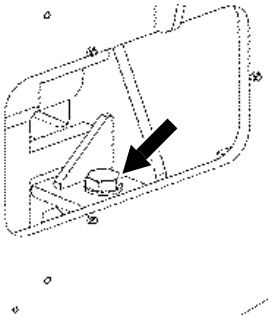
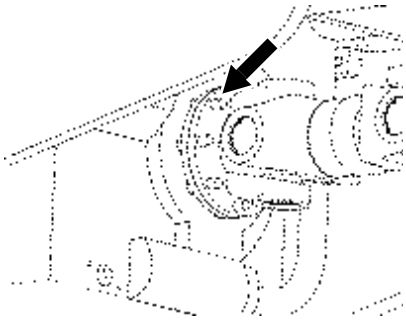
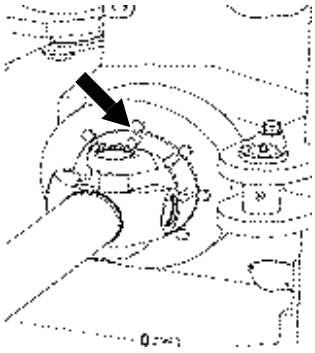
Reference picture	Operation step	Tools required (Remarks)
 P18T00042	14. Pre-lift the gear box assembly through the lugs with lifting device.	Sling (2 tons)
 P18T00043	15. Remove the cover plate from the transmission assembly with a wrench.	13# Wrench
 P18T00044	16. Remove the fastening bolts used to attach the gear box assembly to the engine flywheel with a wrench.	16# Wrench

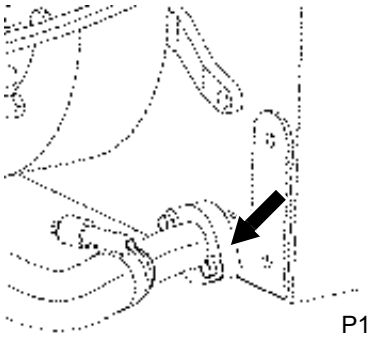
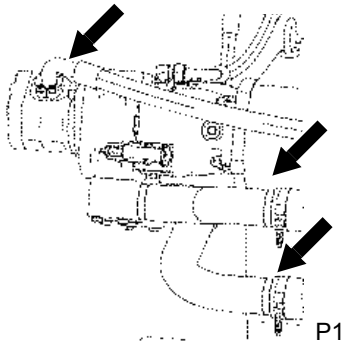
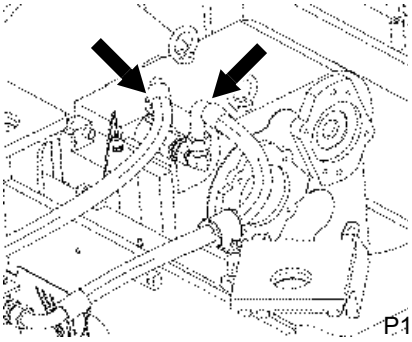
Reference picture	Operation step	Tools required (Remarks)
 P18T00045	17. Remove the fastening bolts used for attaching the gear box assembly-torque converter case to the engine housing with an blower gun and socket.	16# socket, pneumatic impact wrench
 P18T00046	18. Separate the transmission assembly from the engine, and secure the torque converter case and core through the bolt holes with ropes and steel wires.	Steel wire
 P18T00047	19. Lift up the gear box assembly from the machine through the lugs with the hoisting device and ropes and place it in a safe area.	Sling (2 tons)

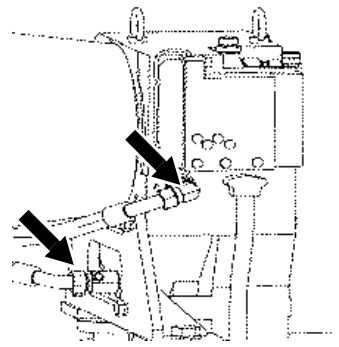
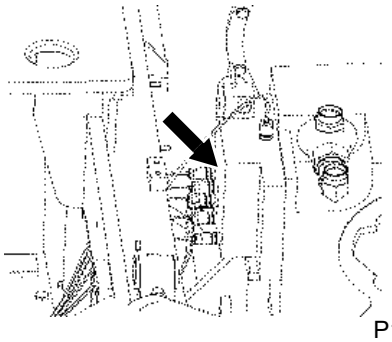
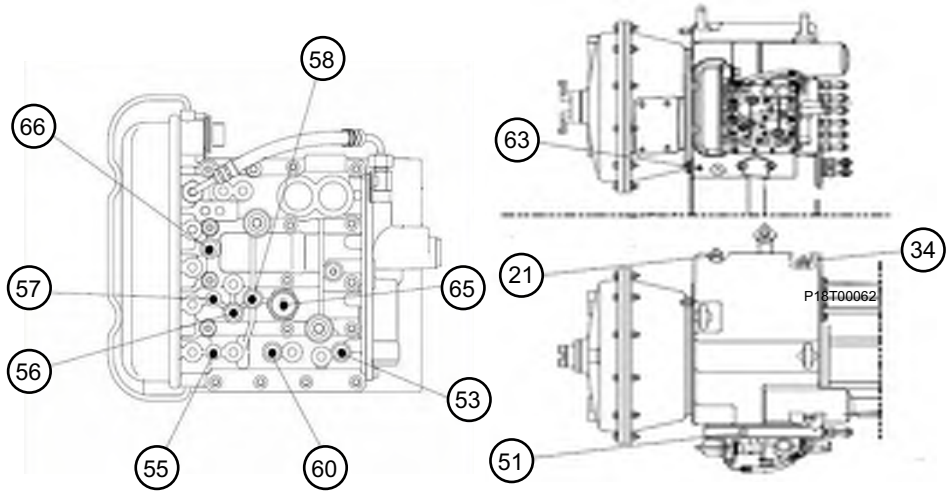
Installation of torque converter-gear box system

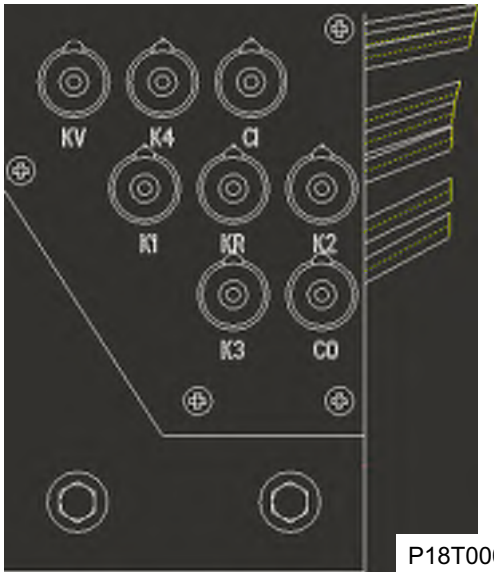
Reference picture	Operation step	Tools required (Remarks)
 P18T00048	1. Wipe clean the drain plug of gear box, and then install it in the threaded hole of gear box and tighten it with a torque of 600±70Nm\ 442.5±51.6 lbf•ft.	34# socket, 13# socket, pneumatic impact wrench, open-end 34# fixed torque spanner
 P18T00049	2. Secure the torque converter to its housing through threaded holes with the steel wire or ropes. **⚠ Danger: The torque converter can slide freely on the guide wheel seat. When lifting up it, the torque converter and its housing must be secured firmly with the steel wire or ropes, in order to avoid personal injury due to falling of torque converter.**	Steel wire
 P18T00050	3. Lift up the gear box assembly onto the machine through the lugs of gear box assembly with the hoisting device and ropes.	Sling (2 tons)

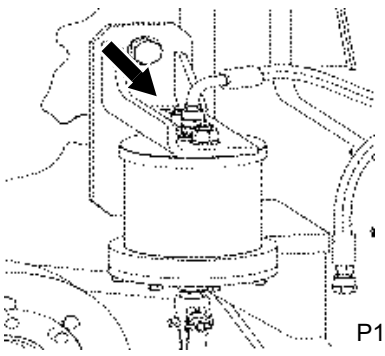
Reference picture	Operation step	Tools required (Remarks)
 P18T00051	4. Move gear box assembly to fit it with engine flywheel housing, and install the bolts and hard washer used for tightening the torque converter case to the engine housing and then tighten them. Tightening torque: 72±6Nm\ 53.1±4.4 lbf•ft.	16# socket, pneumatic impact wrench, open-end 16# fixed torque spanner
 P18T00052	5. Crank the engine flywheel case to make the torque converter align with mounting threaded hole on the engine flywheel, screw and tighten the fastening bolts and washer for attaching the torque converter to the engine flywheel by hand with a torque of 60±5Nm\ 44.25±3.7 lbf•ft	16# socket, pneumatic impact wrench, open-end 16# fixed torque spanner
 P18T00053	6. Install the mounting hole cover plate on the gear box.	13# Wrench

Reference picture	Operation step	Tools required (Remarks)
 P18T00054	7. Screw and tighten the bolts and washer for fastening the gear box mount to the frame with the torque of 2035±170Nm\ 1500.8±125.38 lbf•ft.	46# wrench, 46# socket, pneumatic impact wrench, open-end 46# fixed torque spanner
 P18T00055	8. Attach the mounting end flanges of drive shaft and gear box to the rear output flange of gear box, and tighten the locknut to 132±10Nm\ 97.35±7.38 lbf•ft.	18# wrench or open-end 18# fixed torque spanner
 P18T00056	9. Attach the intermediate drive shaft to front output flange of gear box and tighten the locknut to 200±15Nm\ 147.5±11.06 lbf•ft.	21# wrench or open-end 21# fixed torque spanner

Reference picture	Operation step	Tools required (Remarks)
 P18T00058	10. Install the oil filler steel-pipe on the gear box and tighten the set bolts with a torque of 26±3Nm\ 19.18±2.21 lbf•ft.	13# wrench or open-end 13# fixed torque spanner
 P18T00058	11. Install the hose referring to the hydraulic installation and hydraulic pump.	
 P18T00059	12. Install the hose assembly used for attaching the oil filter pipe to the gear box, and the tightening torque of hose joint is 137±6Nm\ 101.04±4.43 lbf•ft. **⚠ Caution: Two hose assemblies are respectively connected to the inlet, outlet of fine oil filter in directions as required, avoiding installation error.**	41# wrench or open-end 41# fixed torque spanner

Reference picture	Operation step	Tools required (Remarks)
 P18T00060	13. Install the hose assembly used for attaching the radiator pipe to the gear box, and the tightening torque of hose joint is 137±6Nm\ 101.04±4.43 lbf•ft.	41# wrench or open-end 41# fixed torque spanner
 P18T00061	14. Install the hose assembly used for attaching the test pipe to the gearbox, as shown in the following figure and table.	18# Wrench
Layout of test points of shift control valve  P18T00062		

<table>
<tr><th>Reference picture</th><th>Operation step</th><th>Tools required (Remarks)</th></tr>
<tr><td colspan="2">Logic diagram of test points and gear clutch
<table>
<tr><th>Decal marker</th><th>Meanings</th><th>Theoretical value</th><th>S/N in the corresponding valve</th></tr>
<tr><td>PRESSURE OF IN FRONT OF THE CONVERTER</td><td>Inlet pressure of torque converter</td><td>Opening pressure: 1.1 MPa</td><td>51</td></tr>
<tr><td>PRESSURE OF KV CLUTCH</td><td>KV clutch pressure</td><td>1.6-1.8MPa</td><td>53</td></tr>
<tr><td>PRESSURE OF KR CLUTCH</td><td>KR clutch pressure</td><td>1.6-1.8MPa</td><td>55</td></tr>
<tr><td>PRESSURE OF K1 CLUTCH</td><td>K1 clutch pressure</td><td>1.6-1.8MPa</td><td>56</td></tr>
<tr><td>PRESSURE OF K2 CLUTCH</td><td>K2 clutch pressure</td><td>1.6-1.8MPa</td><td>57</td></tr>
<tr><td>PRESSURE OF K3 CLUTCH</td><td>K3 clutch pressure</td><td>1.6-1.8MPa</td><td>58</td></tr>
<tr><td>PRESSURE OF K4 CLUTCH</td><td>K4 clutch pressure</td><td>1.6-1.8MPa</td><td>59</td></tr>
</table></td><td></td></tr>
<tr><td>Mapping diagram of centralized measuring point mounting plate and measuring point
 

P18T00063</td><td></td><td></td></tr>
<tr><td> 
P18T00064</td><td>15. Install the hose assembly used for attaching emergence parking brake chamber to the brake system, the tightening torque is 37±2Nm\ 27.29±1.48 lbf•ft.</td><td>24# wrench or open-end 24# fixed torque spanner</td></tr>
</table>

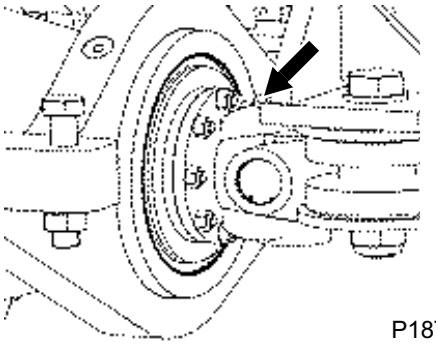
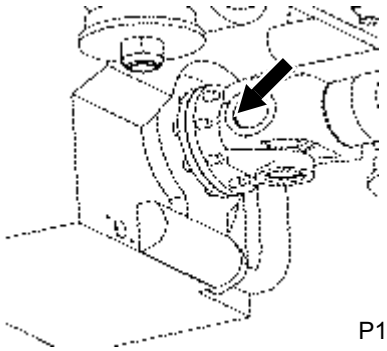
Reference picture	Operation step	Tools required (Remarks)
	16. Fill the gear box by referring to the Operation Manual of this machine, and check the oil level according to the specified method.	

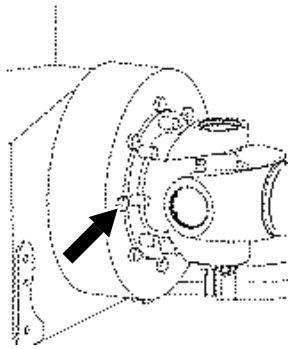
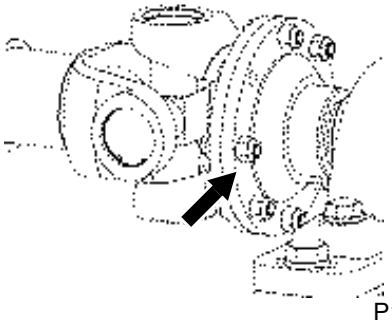
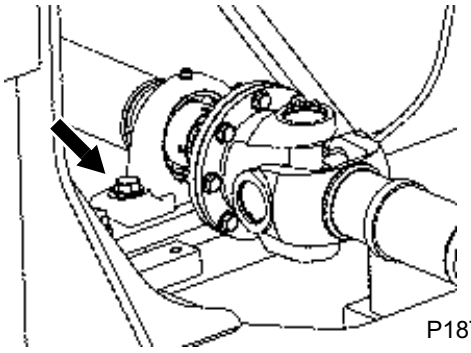
Disassembly and assembly of torque converter-gearbox assembly

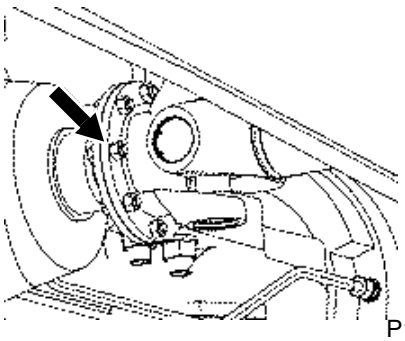
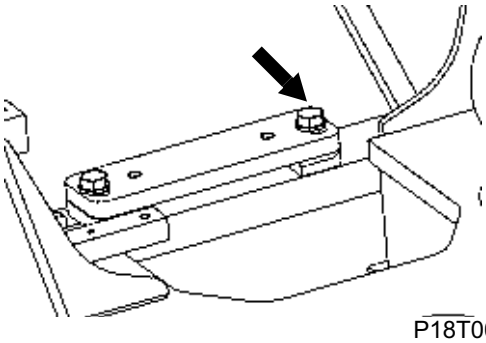
For disassembly and assembly of torque converter-gear box assembly in this machine, refer to "ZF Gear Box Overhaul Manual".

Removal and installation of drive shaft system

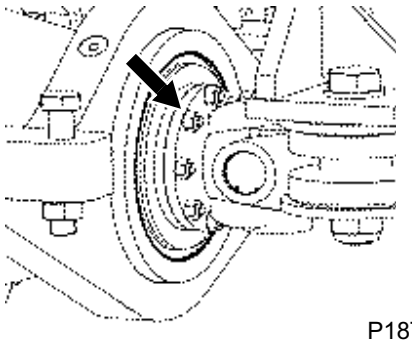
Removal of drive shaft system

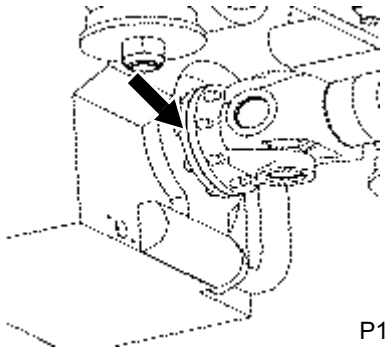
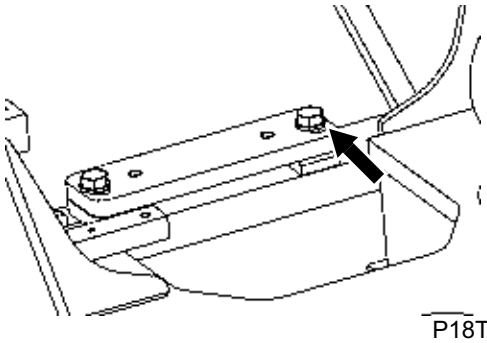
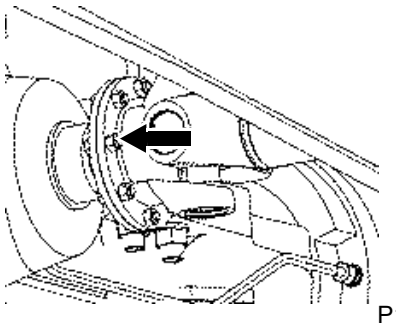
Reference picture	Operation step	Tools required (Remarks)
	1. Park the machine on a level ground, turn off the engine, and place the gear box handle in neutral position, pull up the emergency parking brake lever and place the wedges. **⚠ Caution: The drive shaft assembly is composed of slidable spline sleeve, please take care to avoid personal injury caused by falling of slide shaft fork during removal.**	
 P18T00065	2. Remove the connecting locknut between the rear drive shaft and rear axle input flange with a wrench.	18# Wrench
 P18T00066	3. Remove the connecting locknut between rear drive shaft and rear output flange of gear box with a wrench, and place the rear drive shaft assembly in a safe area.	18# Wrench

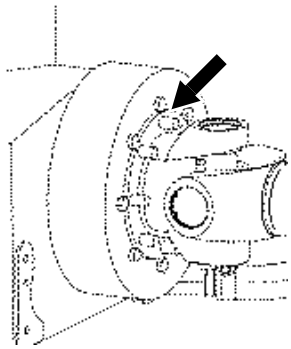
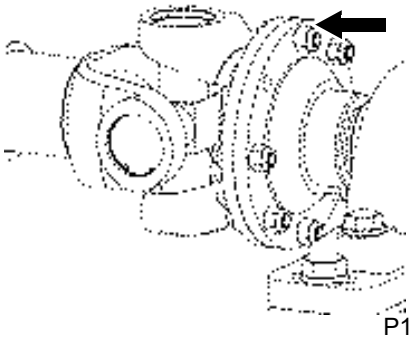
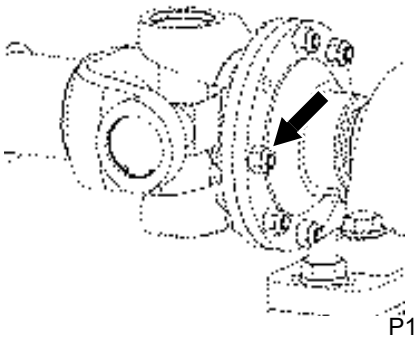
Reference picture	Operation step	Tools required (Remarks)
 P18T00067	4. Remove the connecting locknut between intermediate drive shaft and front output flange of gear box assembly with a wrench.	21# Wrench
 P18T00068	5. Remove tightening bolt and nut between intermediate drive shaft and front drive shaft & bearing assembly, and remove the intermediate drive shaft from machine with a wrench.	18# Wrench
 P18T00069	6. Remove the bolts and washer securely connecting the front drive shaft and support assembly to middle support plate with a wrench.	18# Wrench

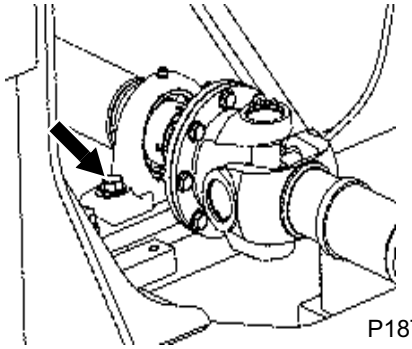
Reference picture	Operation step	Tools required (Remarks)
 P18T00070	7. Remove the bolts and nuts securely connecting the front drive shaft and support assembly and front axle, and remove front drive shaft and support assembly from machine with a wrench.	18# Wrench
 P18T00071	8. Remove the tightening bolts and washers of the support plate and frame with a blower gun or a wrench.	24# socket, pneumatic impact wrench or 24# wrench

Installation of drive shaft system

Reference picture	Operation step	Tools required (Remarks)
 P18T00072	1. Wipe clean the surface, install rear drive shaft and rear axle input flange, and align the the mounting holes, then insert the tightening bolt and screw in the nut and tighten it with a torque of 132±10Nm\97.35±7.38 lbf•ft.	18# wrench or open-end 18# fixed torque spanner

Reference picture	Operation step	Tools required (Remarks)
 P18T00073	2. Wipe clean the surface, install the rear drive shaft and rear output flange of the gear box, and align the mounting holes, screw in the locknut and tighten it with a torque of 132±10Nm\ 97.35±7.38 lbf•ft. **⚠ Caution: When assembling, please make sure to pay attention to the white arrows on the identification of drive shaft, both of which must be aligned after assembly!**	18# wrench or open-end 18# fixed torque spanner
 P18T00074	3. Wipe clean the two mounting surfaces of support plates, and then pre-install it onto the front frame. Set the front drive shaft and support assembly with middle support bearing on the front frame middle support bearing seat support plate.	
 P18T00075	4. Wipe clean the surface, install the front drive shaft and support assembly with front axle input flange, and align the mounting hole, screw in the locknut and tighten it with a torque of 132±10Nm\97.35±7.38 lbf•ft.	18# wrench or open-end 18# fixed torque spanner

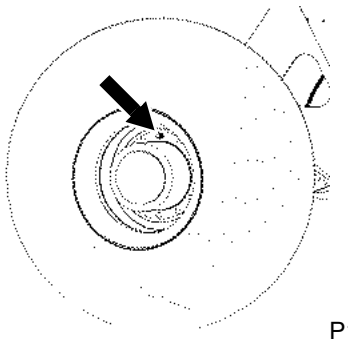
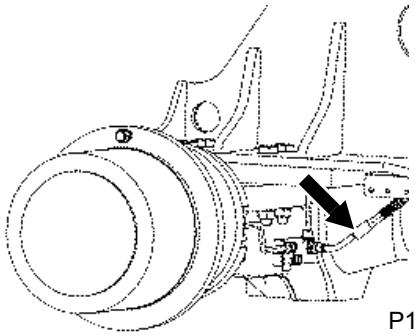
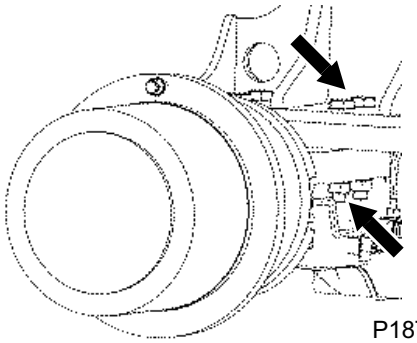
Reference picture	Operation step	Tools required (Remarks)
 P18T00076	5. Wipe clean the mounting surfaces of front output flange of gear box and intermediate drive shaft flange, and install the intermediate drive shaft to the front output flange bolts of gear box, screw in the locknut and tighten it with a torque of 200±15Nm\ 147.5±11.06 lbf•ft.	21# wrench or open-end 21# fixed torque spanner
 P18T00077	6. Install the middle drive shaft, front drive shaft and support assembly, and align the mounting holes. Insert the tightening bolt and screw in the locknut, and then tighten them to 132±10Nm\ 97.35±7.38 lbf•ft. **⚠ Caution: The intermediate drive shaft middle shaft fork must be aligned with the fork which is coupled with front axle on the front drive shaft and support assembly!**	18# wrench or open-end 18# fixed torque spanner
 P18T00078	7. Adjust the front&rear, left&right positions of intermediate, front drive shafts and support assembly to make sure that the bolts between support plate and frame can be screwed in smoothly with torque of 132±10Nm\97.35±7.38lbf•ft.	Open-end 18# fixed torque spanner or 18# wrench

Reference picture	Operation step	Tools required (Remarks)
 P18T00079	8. Install the tightening bolts and washer of the middle support bearing seat and support plate, and tighten them to 22494±18.44 lbf•ft.	24# socket, fixed torque blower gun or open-end 24# fixed torque spanner

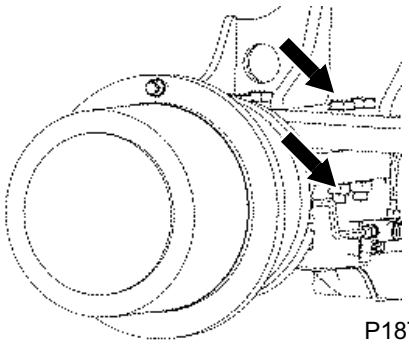
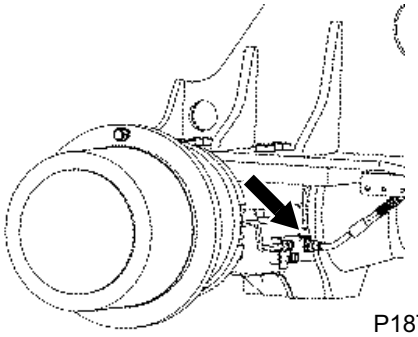
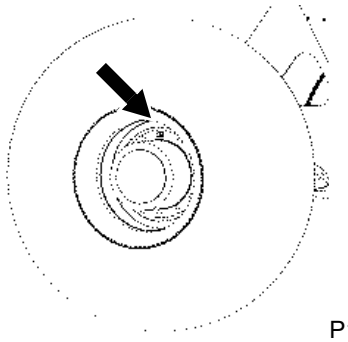
Removal and installation of front axle assembly

Removal of front axle assembly

Reference picture	Operation step	Tools required (Remarks)
	1. Stop the machine on a level ground, put the work implement, bucket levelly, and pull up the emergency parking brake lever. 2. Turn off the engine, step on the service brake pedal for several times, so as to release the pressures of energy accumulator and axle brake pipe. 3. Lift up the machine with a lifting device, and support it up with a supporting device with 4 tires off the ground	Sling (12 tons)

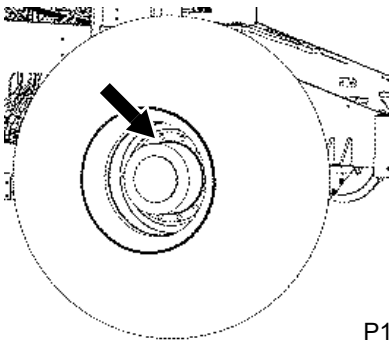
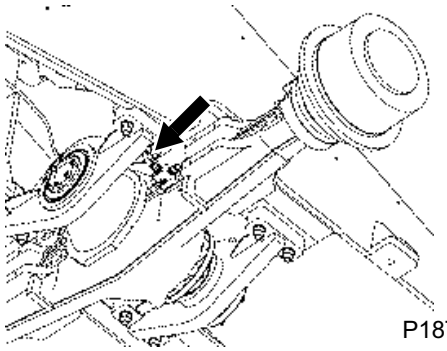
Reference picture	Operation step	Tools required (Remarks)
 P18T00080	4. Pre-lift up the tires with a hoist, remove the bolts and nuts used for tightening the rim and axle. 5. Lift the tires away from machine and put them in a safe area. 6. Repeat steps (4), (5), remove another tire installed on the front axle.	Sling(2 tons)30# socket, pneumatic impact wrench or open-end 30# wrench
 P18T00081	7. Remove the hose assembly connected to service brake system and the front axle. **⚠ Caution: The waste oil shall be recovered in a container during removal, in order to avoid environmental contamination. The removed hose is shielded to avoid contamination of parts.** **⚠ Danger: It is sure that the hose pressure is fully discharged and the oil is cooled sufficiently before removal of hose, in order to avoid personal injury of hose pressure and hot oil during removal.**	24# Wrench
 P18T00082	8. Pre-lift the front axle assembly with a sling. 9. Remove the bolts and nuts for connecting the front axle assembly to the front frame with a blower gun. 10. Put the axle assembly onto the ground slowly with a lifting device. 11. Remove the axle assembly from the bottom of machine with a handling equipment, and then put it on the appliance for axle assembly.	Sling(2 tons)40# socket, pneumatic impact wrench, 40# wrench

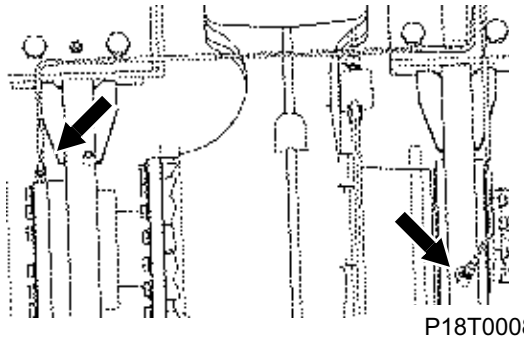
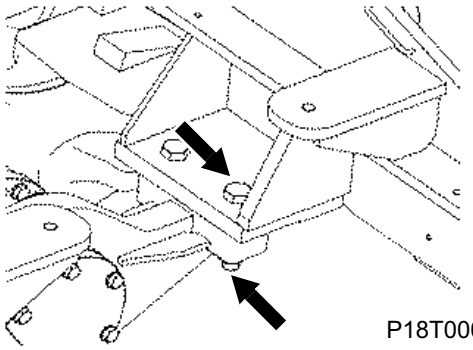
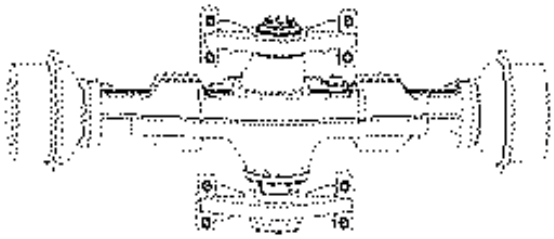
Installation of front axle assembly

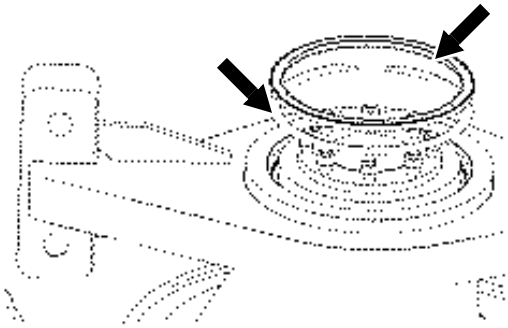
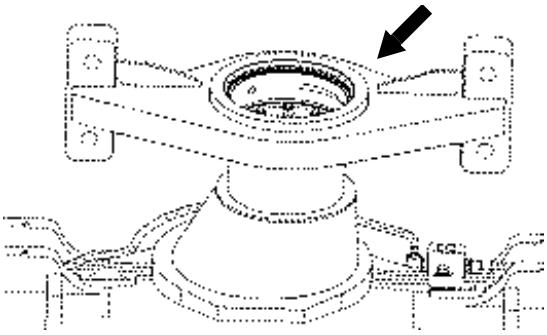
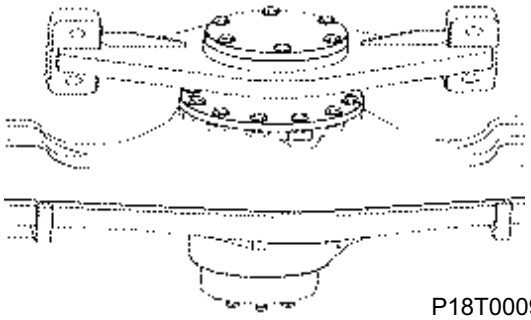
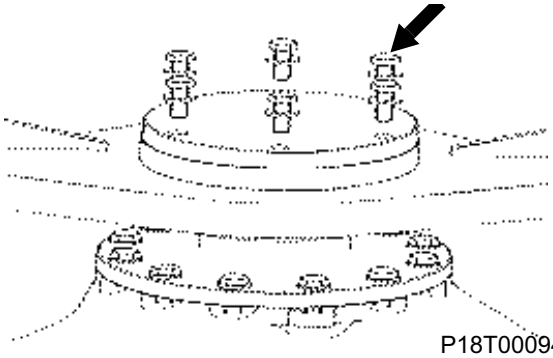
Reference picture	Operation step	Tools required (Remarks)
 P18T00083	1. Take the front axle assembly out of placed area with a handling device, and position it under its mounting point. 2. Lift up the front axle assembly with a hoist, and install it on the frame. 3. Install the tightening bolts and nuts and tighten them with torque of 2035±170Nm\ 1500.8±125.38 lbf•ft.	Sling(2 tons) 46# socket, pneumatic impact wrench, open-end 46# fixed torque spanner
 P18T00084	4. Install the front axle brake pipe and service brake hose. Tightening torque: 37±2Nm\ 27.29±1.48 lbf•ft.	Open-fixed 24# fixed torque spanner
 P18T00085	5. Lift up the tire with a hoist and install it onto the axle, and then install the rim nut and tighten it to 600±60Nm\ 442.5±44.25 lbf•ft.	Sling (2 tons)30# socket, pneumatic impact wrench, open-end 30# fixed torque spanner
	6. Lift the machine with a hoist, remove the support device, and put the machine onto the ground.	Sling (12 tons)

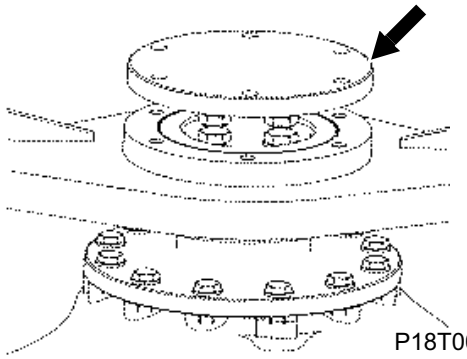
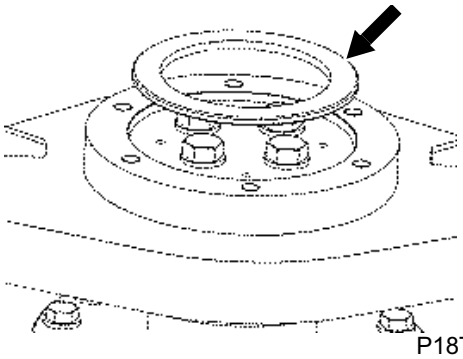
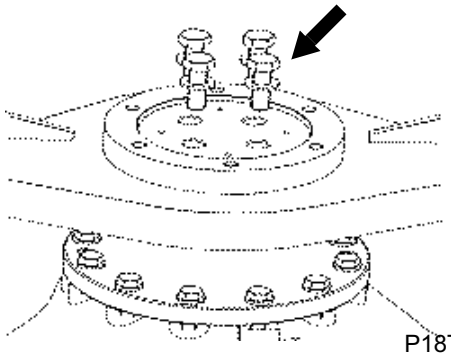
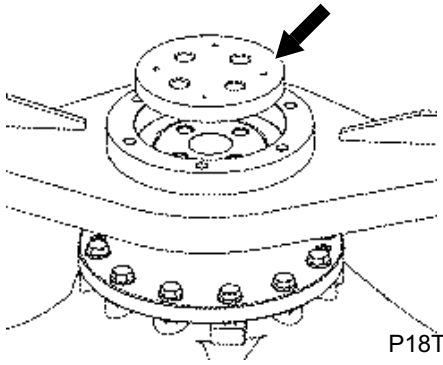
Removal and installation of rear axle assembly

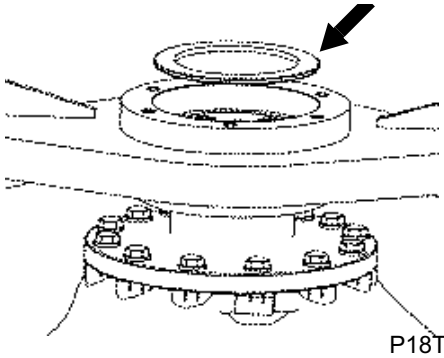
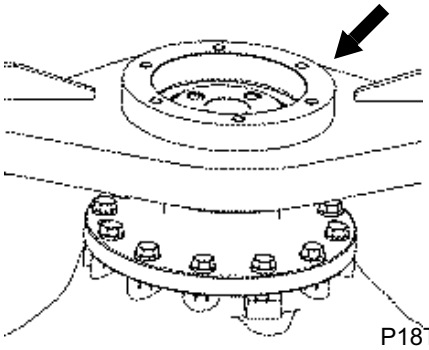
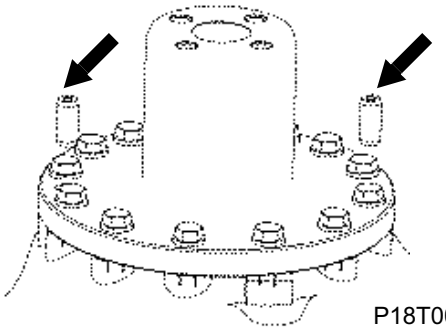
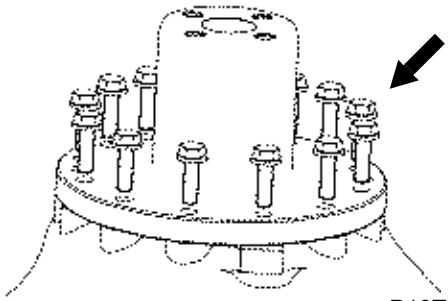
Removal of rear axle assembly

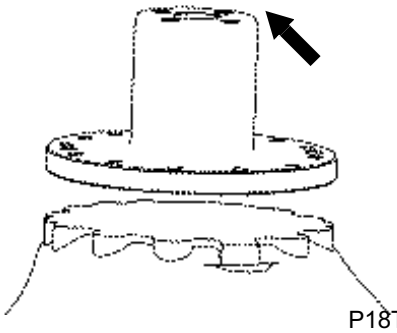
Reference picture	Operation step	Tools required (Remarks)
	1. Stop the machine on a level ground, put the work implement, bucket levelly, and pull up the emergency parking brake lever. 2. Turn off the engine, step on the service brake pedal for several times, so as to release the pressures of energy accumulator and axle brake pipe. 3. Lift up the machine with a lifting device, and support it up with a supporting device with 4 tires off the ground	Sling (12 tons)
 P18T00086	4. Pre-lift up the tires with a hoist, remove the bolts and nuts used for tightening the rim and axle. 5. Lift the tires away from machine and put them in a safe area. 6. Repeat steps (4), (5), remove another tire installed on the rear axle.	Sling (2 tons)30# socket, pneumatic impact wrench or open-end 30# wrench
 P18T00087	7. Remove the the rear axle and hose assembly connected to service brake system.	24# Wrench

Reference picture	Operation step	Tools required (Remarks)
 P18T00088	8. Remove the steel pipe connected to the rear axle and centralized lubricating system.	Open-end 16# wrench
 P18T00089	9. Pre-lift the rear axle assembly with a sling. 10. Remove the bolts and locknuts for connecting the rear axle assembly to the rear frame. 11. Put the axle assembly onto the ground slowly with a lifting device. 12. Remove the axle assembly from the bottom of machine with a handling equipment, and then put it on the appliance for axle assembly.	Sling (2 tons) 36# socket, pneumatic impact wrench, 36# wrench,
 P18T00090	13. Place the axle assembly as shown in the left figure to make front swing frame support shaft upward, and rear swing frame support shaft downward.	

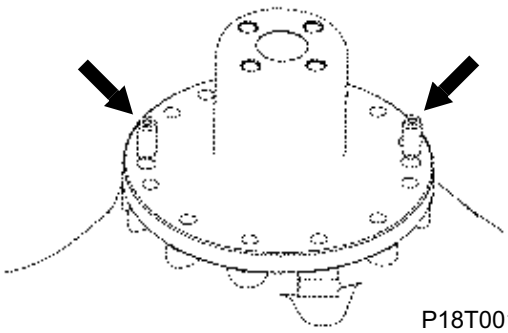
Reference picture	Operation step	Tools required (Remarks)
 P18T00091	14. Remove the seal ring and snap ring from the front swing support rack with a screwdriver.	Straight screwdriver
 P18T00092	15. Remove the front swing support rack from axle assembly with a lifting device and place it in a safe area.	Sling (2 tons)
 P18T00093	16. Place the axle assembly as shown in the left figure to make the rear swing support rack upward.	
 P18T00094	17. Remove the bolts, washers with a wrench or an pneumatic tool.	Open-end 18# wrench

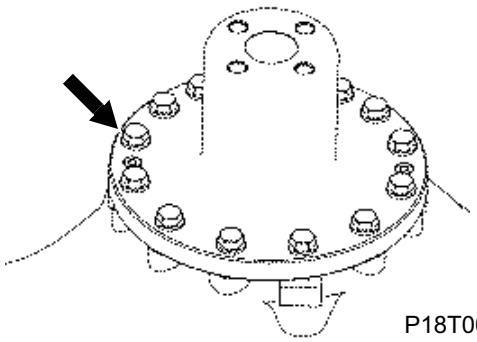
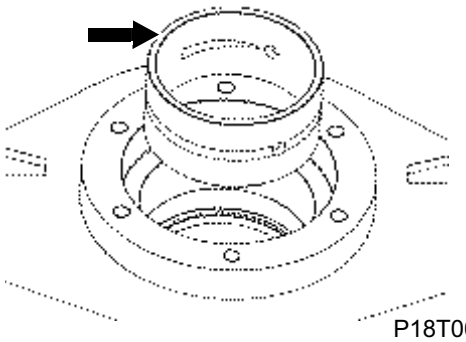
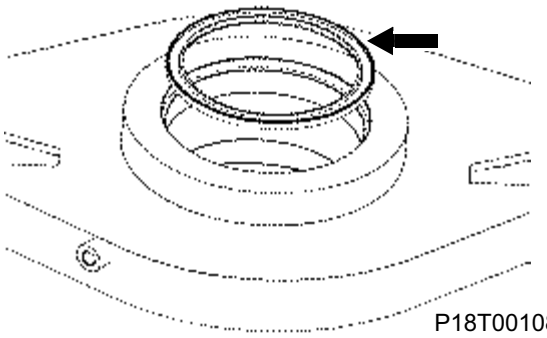
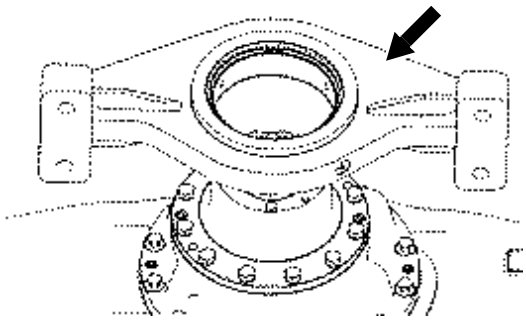
Reference picture	Operation step	Tools required (Remarks)
 P18T00095	18. Remove the cover.	Open-end 18# wrench
 P18T00096	19. Remove the thrust washer.	Straight screwdriver
 P18T00097	20. Remove the bolts and washer tightening the clamping plate.	Open-end 27# wrench or 27# socket, pneumatic impact wrench
 P18T00098	21. Remove the clamping plate.	Straight screwdriver

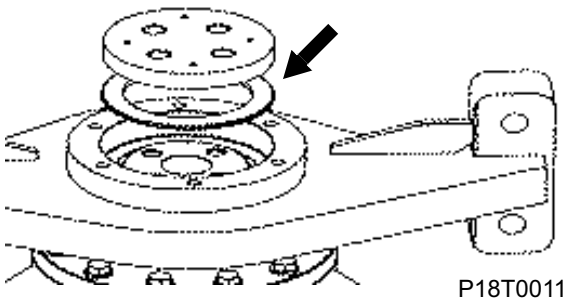
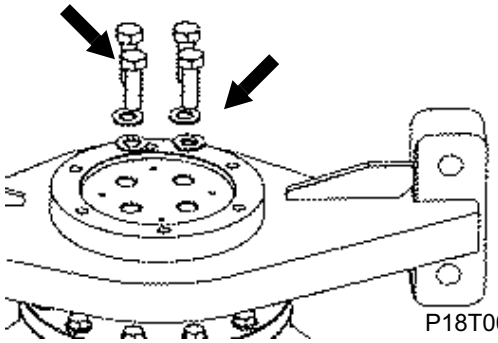
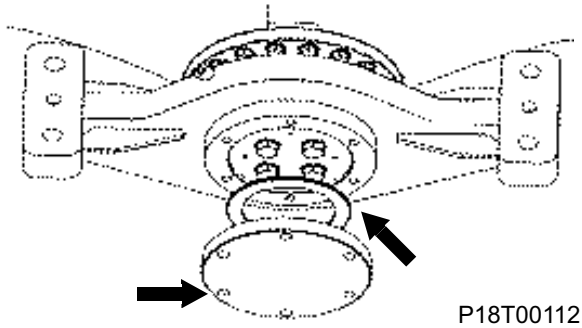
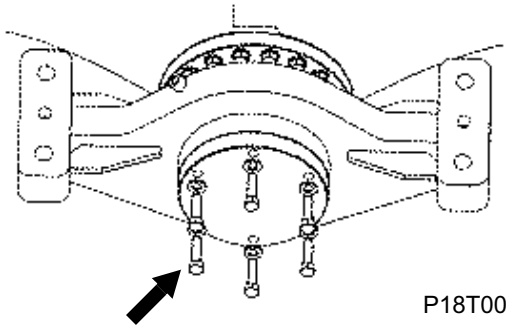
Reference picture	Operation step	Tools required (Remarks)
 P18T00099	22. Remove the thrust washer.	Straight screwdriver
 P18T00100	23. Remove the rear swing support rack with a lifting device.	Sling (2 tons)
 P18T00101	24. Screw the M8 bolt in the dowel and remove the dowel.	Open-end 13# wrench
 P18T00102	25. Remove the bolts and washers tightening the support shaft.	Open-end 21# wrench or 21# socket, pneumatic impact wrench

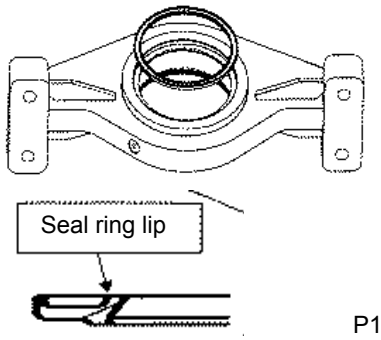
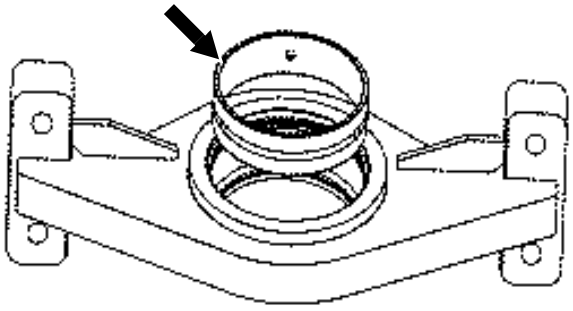
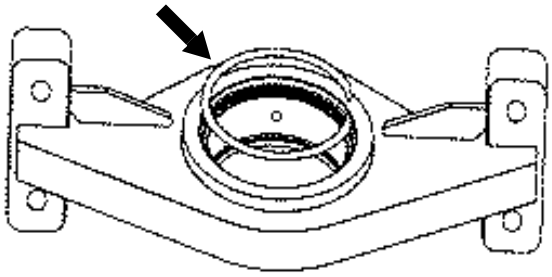
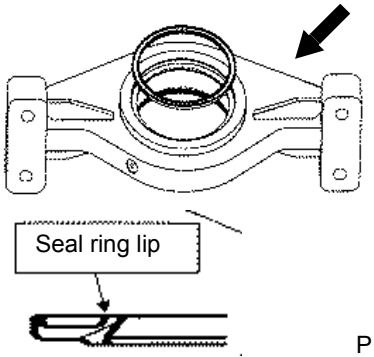
Reference picture	Operation step	Tools required (Remarks)
 P18T00103	26. Remove the support shaft with a lifting device.	Sling (2 tons)

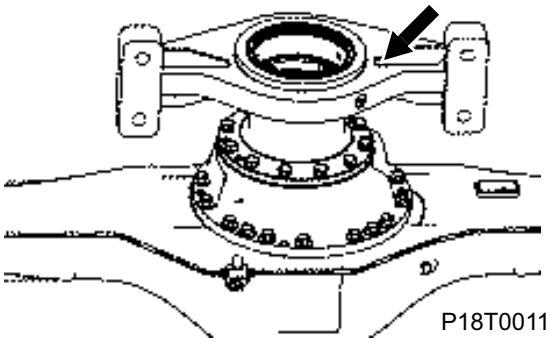
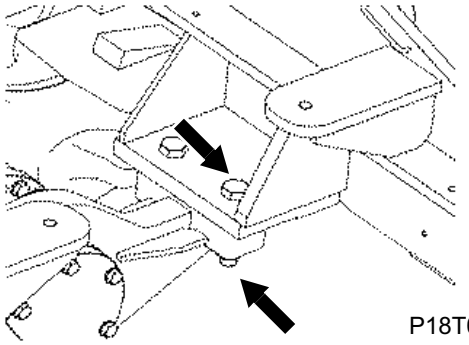
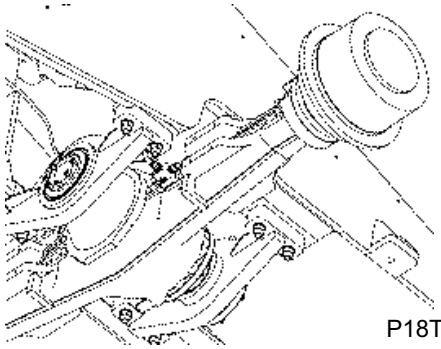
Installation of rear axle assembly

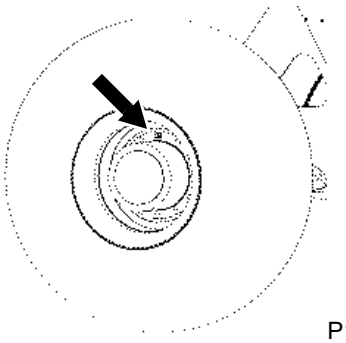
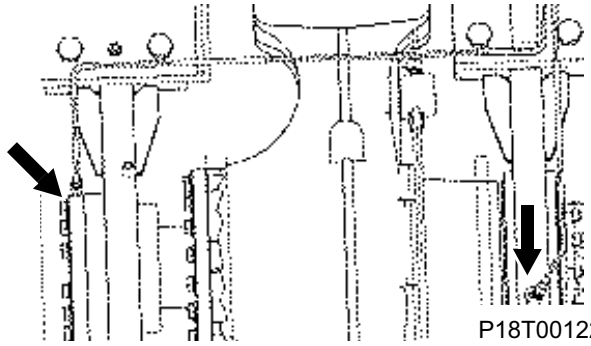
Reference picture	Operation step	Tools required (Remarks)
 P18T00104	1. Lift up the axle assembly and position it as shown in the left figure onto a special assembly device.	
 P18T00105	2. Wipe clean the mounting face between the support shaft and the axle case connected to it with a clean cloth, install the support shaft onto the axle and align two dowel pins accurately, strike it into the dowel pin with a copper bar.	Copper bar

Reference picture	Operation step	Tools required (Remarks)
 P18T00106	3. Apply thread lock sealant to thread portions of bolts, screw them into support thread holes by 2-3 threads by hand, and tighten them with an air gun. Tightening torque: 305±25Nm\ 22494±18.44 lbf•ft.	24# socket, pneumatic impact wrench, open-end 24# fixed torque spanner
 P18T00107	4. Horizontally place rear swing frame with the thread hole end upward, and install the bush into rear swing support rack.	
 P18T00108	5. Turn over swing frame by 180°, install seal ring and knock it to the end with nylon hammer.	Nylon hammer
 P18T00109	6. Turn over swing frame group by 180°, evenly apply molybdenum disulfide lithium base grease to bushing cone, and install rear swing frame group into spindle with lifting device.	

Reference picture	Operation step	Tools required (Remarks)
 P18T00110	7. Install thrust washer and pressing plate and align the holes well.	
 P18T00111	8. Apply thread lock sealant to thread portion of bolt, screw bolts and hard washers into the clamping plate thread holes by 2-3 teeth by hand, and drive them in symmetrically with pneumatic impact wrench with the tightening torque of 305±25Nm\ 224.94±18.44 lbf•ft.	24# socket, pneumatic impact wrench, open-end 24# fixed torque spanner
 P18T00112	9. Put a thrust washer and cover and align the holes well.	
 P18T00113	10. Apply thread lock sealant to thread of bolts, screw bolts and hard washers into cover thread holes by 2-3 teeth by hand, and drive them in symmetrically with pneumatic impact wrench with the tightening torque of 195±15Nm\ 143.81±11.06 lbf•ft.	21# socket, pneumatic impact wrench, open-end 21# fixed torque spanner

Reference picture	Operation step	Tools required (Remarks)
 P18T00114	11. Horizontally place front swing frame, and knock seal ring into front swing frame mounting hole to the end with nylon hammer. ⚠ **Caution: The seal ring lip faces outward.**	Nylon hammer
 P18T00115	12. Press the bushing into the front swing frame to the bottom ⚠ **Caution: The small hole of bushing must toward the lug end of front swing support.**	
 P18T00116	13. Install the snap ring into the groove with straight screwdriver.	Straight screwdriver
 P18T00117	14. Knock seal ring into front swing frame mounting slot to the end with nylon hammer; ⚠ **Caution:The seal ring lip faces outward.**	

Reference picture	Operation step	Tools required (Remarks)
 P18T00118	15. Evenly apply the molybdenum disulfide lithium base grease to bushing cone, and then lift and install the front swing support subassembly onto the bearing seat of the main transmission. 16. Place the axle assembly on a transport device with a lifting device, and right under mounting point of rear axle. 17. Install the axle assembly onto the rear frame with a lifting device and align the mounting holes.	Sling (2 tons)
 P18T00119	18. Install the mounting bolts, washers and nuts of the axle assembly and tighten them with an blower gun to 1122±90Nm\ 827.28±66.38 lbf•ft.	36# socket, pneumatic impact wrench, open-end 36# fixed torque spanner
 P18T00120	19. Install the axle and hose connecting the service brake pipe and tighten it to 37±2Nm\ 27.29±1.48 lbf•ft.	Open-end 24# wrench

Reference picture	Operation step	Tools required (Remarks)
 P18T00121	20. Lift up the tire with a hoist and install it onto the axle, and then install the rim nut and tighten it to 600±60Nm\ 442.5±44.25 lbf•ft.	30# socket, pneumatic impact wrench or open-end 30# fixed torque spanner
 P18T00122	21. Install the steel pipe connecting the centralized lubricating system and axle.	Open-end 16# wrench
	22. Lift the machine with a hoist, remove the support device, and put the machine onto the ground.	Sling (12 tons)

Disassembly and assembly of the drive axle

For disassembly and assembly of the drive axle in this machine, see "835H Drive Axle Service Manual" for details.

Fault Diagnosis and Troubleshooting Methods

	Fault features	Main reasons	Fault inspection and troubleshooting
1	The engine can not Activation	1. Start circuit of the base machine (such as power voltage, electric lock, startup relay and startup motor) has faults.	1. Check the circuit of the base machine.
		2. The lever is not at the neutral position.	2. Shift the lever to neutral position.
		3. The fuse to the control circuit on the base machine is burnt.	3. Replace the fuse.
		4. Poor contact of handle plug or the handle is failed.	4. Organize the plugs.
		5. Poor contact of controller plug or the controller is failed.	5. Organize the plugs.
2	Low shift pressure at all gears Low pressure	1. Oil pressure gauge is failed.	1. Replace the oil pressure gauge
		2. Insufficient tightening torque for bolt of shift control valve.	2. Tightening torque for M8-8.8 bolt of shift control valve is 26Nm.
		3. Spring of main pressure valve is broken.	3. Replace it.
		4. Gear shift pump is worn	4. Replace the gear shift pump.
		5. Fragments enter into shift control valve or valve is stuck	5. Replace the filter, and clean the control valve.
3	Too short shifting time at all gears	1. O-ring in throttle plug is damaged	1. Replace the O-ring
		2. The tightening torque of pressure control valve bolts is out of specified range	2. Tightening torque for M8-8.8 bolt of shift control valve is 26Nm.
4	Too long shifting time at all gears	1. Throttle plug is blocked.	1. Clean and dredge.
		2. Pressure control valve is stuck.	2. Wash and check.
5	The oil temperature of the torque converter is high	1. Oil temp sensor is failed.	1. Replace the part.
		2. Oil temperature gauge is failed.	2. Replace the part.
		3. Insufficient oil level.	3. Check oil level following the correct method.
		4. Air found in torque converter oil radiator.	4. Exhaust.
		5. Oil line from torque converter to radiator is poor.	5. Check oil pipe from radiator to gear box and radiator for blockage.
6	The oil temperature of the torque converter is high	1. Poor cooling capability of radiator.	1. 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.
		2. Back pressure valve of torque converter stuck.	2. Be careful to check hose connector from gear box to radiator. If hose connector enters housing too deeply, pushes spool of pressure valve and cause valve to stick, oil line will be getting blocked.

	Fault features	Main reasons	Fault inspection and troubleshooting
7	Vehicle does not move at any gear	1. Insufficient oil level.	1. Check oil level and add the oil by following the right operation.
		2. Elastic plate connecting engine and torque converter is torn, or power connection from torque converter to gear box input gear has faults.	2. Replace the elastic plate or replace the related damaged parts.
		3. Circuit failure of the complete machine.	3. Check the power voltage for abnormal and the cable for damage.
		4. Shift pressure is too low.	4. Refer to the troubleshooting above.
		5. Solenoid valve is damaged.	5. Check if the rated current of solenoid valve is 830 mA.
		6. Shift lever is damaged.	6. Refer to the troubleshooting for lever. Replace it.
		7. Controller is damaged.	7. Refer to the fault inspection of controller. Replace it

Power Train System

Basic Information

Safety

Many accidents in operation, maintenance, repair and other aspects are caused by fail 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 methods may lead to hazardous condition, 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

⚠WARNING

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

⚠ DANGER

This word means danger will occurred immediately, 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 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".

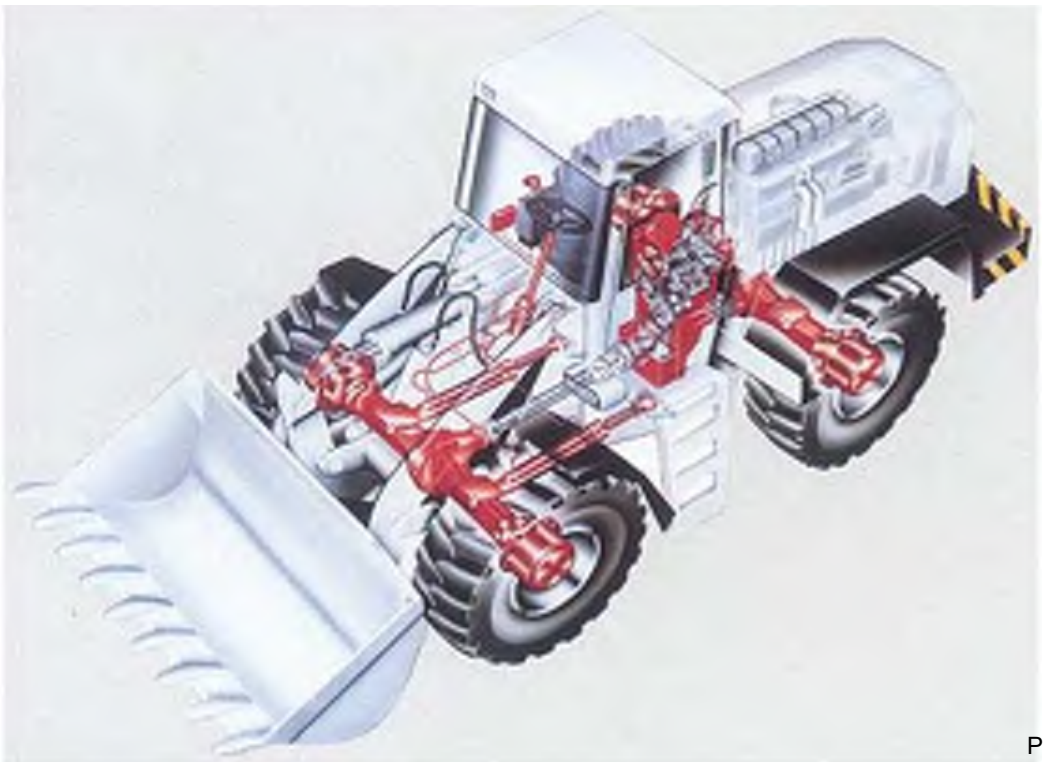
In addition, please carefully follow the "Cautions" listed in this Manual, otherwise, it may result in great damage to the machine. We are unable to enumerate all the possible risks (including potential dangers), and the warnings in the Manual and product do not cover all the risks and dangers. If the 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.

System composition and position

The power train system is a critical part of a loader, 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 three majority components: gearbox, drive shaft and drive axle.

Fig 3-1 Schematic diagram of position for wheel loader



P18T00001

System technical parameters

Main technical parameters for the power train system of this machine are listed in Table 3-1.

Table 3-1: Main technical parameter table for power train system

System components	Items	Parameters	Remarks
Gear box	Model	ZF 4WG158	
	Type	Fixed shaft type	
	Control mode	Full-auto electro hydraulic control	
Torque converter	Type	Single-turbo, three-element	
Drive axle	Drive mode	Spiral gear level-I reduction, wheel planetary gear reduction	
	Brake mode	Wet brake	

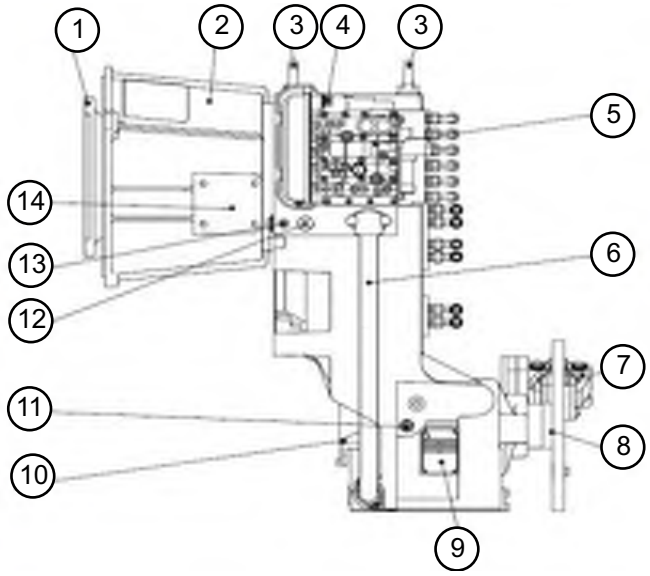
Table 3-1: Main technical parameter table for power train system

System components	Items	Parameters	Remarks
Tire	Tire structure	Radial tire	Tubeless bias tire or tubed bias tire is optional
	Specification	17.5R25 two star L3	
	Level	\	
	Type of tread	L-3	Ordinary block
Rim	Specification	25-14.00/1.5	

System schematic diagram and working principle description

The torque converter -gearbox assembly equipped in this machine is ZF 4WG158 full auto type, and the drive axle is 30 wet axle, whose structure diagram are shown as below:

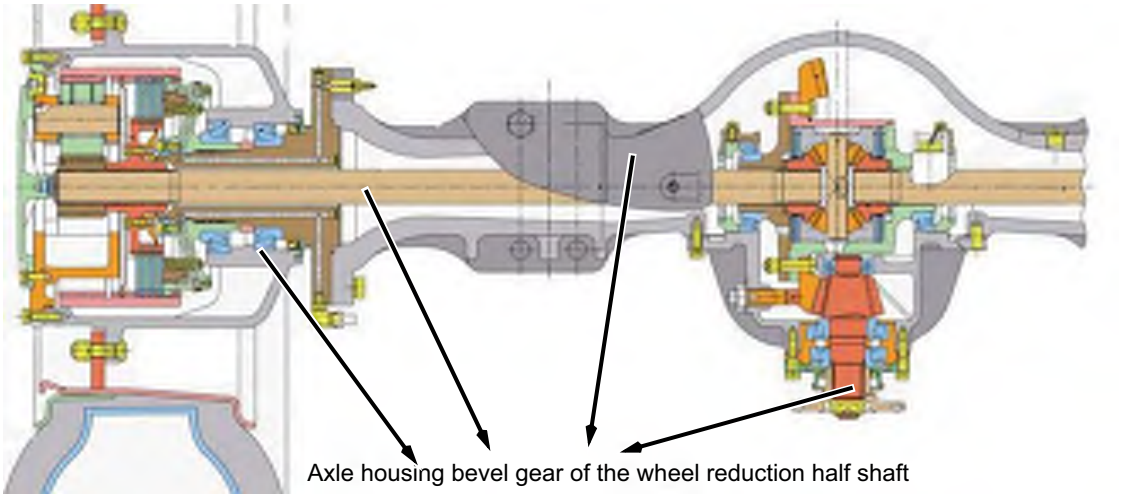
Figure 3-2 Diagram for gear box assembly composition



P18T00002

1. Coupling device
2. Torque converter housing
3. Lifting eye
4. Control harness interface
5. Electro-hydraulic shift control valve
6. Suction tube
7. Brake
8. Output plate
9. Nameplate
10. Output flange
11. Speed sensor
12. Oil outlet of torque converter
13. Torque converter outlet oil temperature sensor
14. Cover

Fig 3-3 Structure diagram for drive axle assembly



P18T00003

As shown in the above figure, the engine is coupled with the torque converter of the torque converter-gear box 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 gear box via the torque converter. Under the control of its electro-hydraulic shift control valve, the gear box can output power and speed at different positions with gear shafts and clutches.

The power output from the gear box is transmitted to the main drive of drive axle via a drive shaft, and then transmitted to wheel reducer by left and right axle shafts via main drive differential, and further to tire rim assembly by decelerating and increasing torsion, thus finally to drive the loader to travel and work.

Overview of transmission fluid

The oil product used for wheel loader 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 loader.

The lubricant, used in the loader, 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 composed of various petroleum-based additives. The wheel loader use a kind of lubricant which has four classes , i.e, diesel oil, gear oil, hydraulic drive shaft and hydraulic fluid. The applications of the lubricant used in the power train system of this machine are shown in the table below:

Table 3-2 Table of lubricant application

Category	Ambient temperature										Recommended brand	Application parts
	-40	-30	-20	-10	0	10	20	30	40	50		
Torque converter - gearbox assembly											Mobil Delvac Super 1300 engine oil (-15°C~+50°C)\ (-5°F~122°F) Mobil ATF 220 (-35°C~+50°C)\ (-31°F~122°F)	ZF torque converter & transmission assembly uses SAE 15-40 in general areas and in hot desert areas; and uses Mobil ATF220 in arctic areas.
Gear oil											Mobil gear oil 80W-90/LS with additives (-15°C~+50°C)\ (-5°F~122°F); Mobil gear oil 424 (-40°C~+50°C) \ (-40°F~122°F)with additives Shell SPIAX S6 AXME 75W-90/LS (-40°C~+50°C)\ (-5°F~122°F)	LiuGong axle uses SAE 80W-90/LS in general and hot areas, and Mobil 424 with additives and Shell SPIAX S6 AXME 75W-90/LS in arctic areas. LS means the additives are inclusive

Maintenance and replacement of gearbox and drive axle oil

The oil product added to the torque converter - gearbox assembly must be consistent with oil list TE-ML 03 recommended by ZF, the oil level shall be checked once a week by the following methods:

1) Park the machine on level ground;
2) Place the gear box gear in the neutral position;
3) Torque converter - gearbox oil is at 80-95°C\176°F~203°F;
4) The engine is idling 800rpm);
5) Observe the oil level gauge of gearbox and it shall be in the "HOT" zone;

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

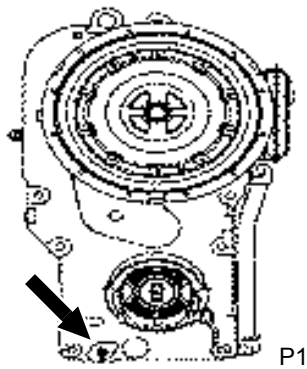
1) Unscrew the drain plug on the torque converter - gearbox assembly to drain the oil.

⚠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.

Figure 3-4 Gearbox drain plug



P18T00004

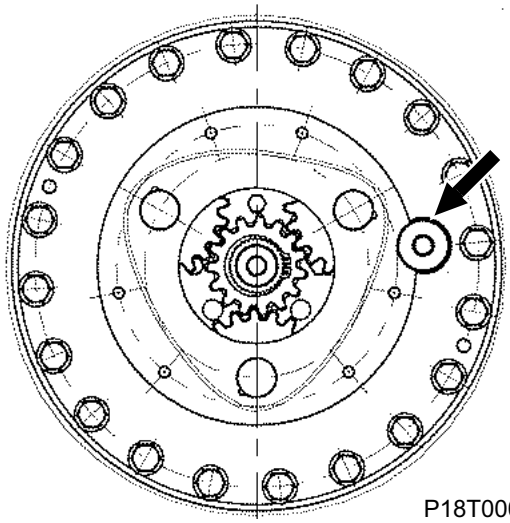
2) After the Oil sump tank of the gear box completely gets empty, wipe clean the mating surface on drain plug and gearbox housing that contacting with O ring of the oil drain plug. After the O-ring of the oil drain plug is replaced, reassemble and tighten it.
3) Add the oil in accordance with the oil 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 gear box. The oil filter may be installed by the following method:

1) Apply a small amount of the gear box 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.

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. The oil level of LiuGong axle may be checked by the following methods:

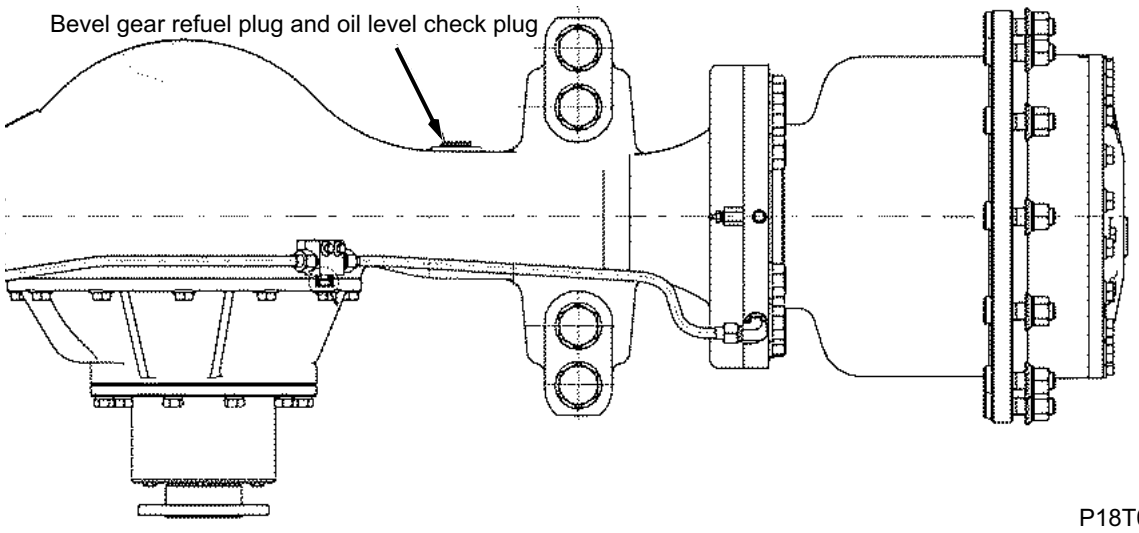
Figure 3-5 Wheel drain plug and oil level check plug



P18T00005

1) Wheel reducer: place the axle according to the installation position, and turn the hub to keep the oil level in a horizontal position, fill oil from left and right hubs respectively until the oil overflows the oil level plug; park the reducer for ten minutes after the drive axle running, and then check the oil level, and add enough lubricating oil.

Figure 3-6 Bevel gear refuel plug and oil level check plug



2) Axle housing: the oil is added into axle housing until it overflows from the oil filler.

The axle oil shall be replaced at the first 500h, after that once every 1000h, or at least once a year.

Universal tool, tooling list

For the universal tools, tooling list, please see the torque converter-gear box system, drive axle system and drive shaft system.

Special tool, tooling list

For the special tool, tooling list, please see "ZF Box Overhaul Manual" for details.

Structure Function Principle

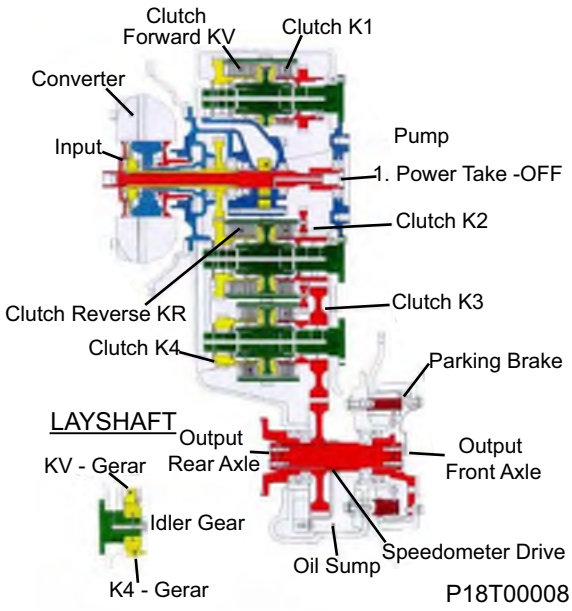
Torque Converter - Gearbox System

The torque converter -gearbox system equipped in this machine is ZF 4WG158 full auto type, which mainly consists of a three-element, single-turbo torque converter, mechanical gear box with four forward gears, three reverse gears and electro hydraulic shift control system, as shown below:

Figure 3-7 External view of torque converter - gear box assembly

P18T00007

Figure 3-8 Structural schematic diagram of torque converter - gear box assembly



P18T00008

System technical parameters

The technical parameters of ZF 4WG158 torque converter - gear box assembly in this machine are listed in Table 3-3.

Table 3-3 Technical parameter table of torque converter - gear box assembly

Component	Items	Parameters	Remarks
Gearbox	Model	ZF 4WG158	
	Type	Fixed shaft type	
	Gears	Four forward gears, three reverse gears	
	Torque converter-gear box assembly Quality (oil not included) /kg\lb	430\ 948.15	
	Type of emergence parking brake	Shoe brake	
Torque converter	Type	Single-turbo, three-element	
	Circulation circle diameter of torque converter/mm\In	340\ 13.39	
	Inlet pressure of torque converter/MPa\ psi	0.85\ 123.25	
	Outlet pressure of torque converter/MPa\ psi	0.50\ 72.5	
Shift control system	System voltage/V	24	
	Shift control mode	Auto electro hydraulic power shift	
	System working pressure/MPa\ psi	1.6+0.2\ 232+29	

System schematic diagram and working principle description

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:

Figure 3-9 Structure diagram for torque converter

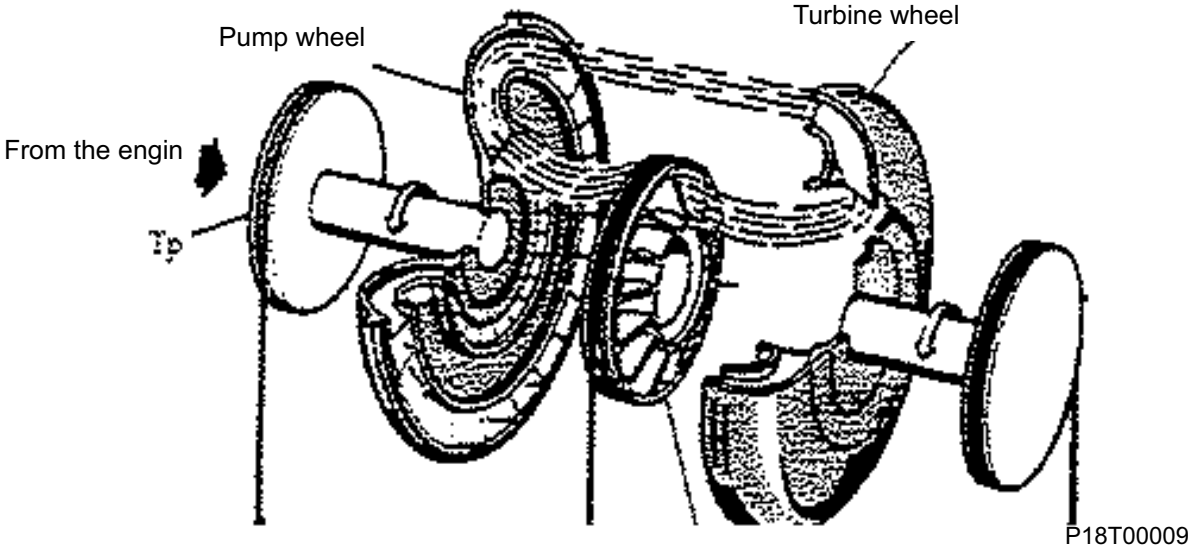
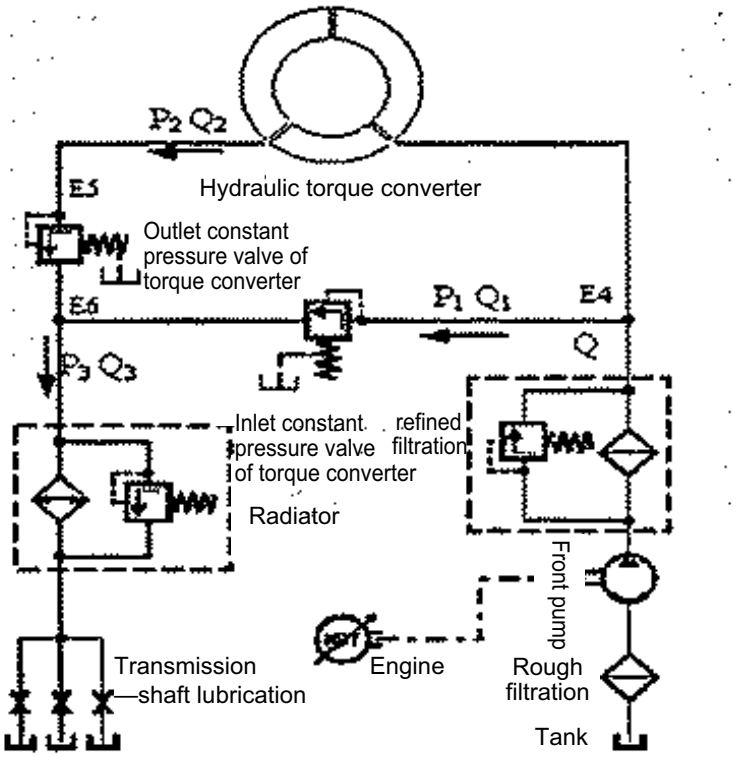


Figure 3-10Schematic diagram for torque converter hydraulic



We can see from structure diagram for torque converter, a three-element, single-turbo torque converter mainly consists of pump wheel, guide wheel and a 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 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 gearbox. The guide wheel is stationary. When the fluid flow(which is from the turbine and has some kinetic energy) passes through the curved blade of the guide wheel, the torque formed by the impact force and counterforce produced on the blade acts on the engine base, and equivalent to the sum of increased torque of turbine from counterforce and reduced torque of pump wheel from impact force. It is possible that the output torque of turbine is greater than input torque of pump wheel, based on which, the torque converter is variable.

The working oil of torque converter is imported into the torque converter through the coarse and fine filters from the oil tank by the variable pump. There is a constant pressure valve (safety valve) set at the inlet of torque converter, whose main role is to avoid excessive pressure in the torque converter to damage the parts. There is another constant pressure valve (back pressure valve) at the outlet 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 gear box assembly, see figure 3 -11 and 3-12 for structure composition and operating hydraulic pressure schematic diagram.

Figure 3-11 Diagram for structure and composition of electro-hydraulic shift control valve

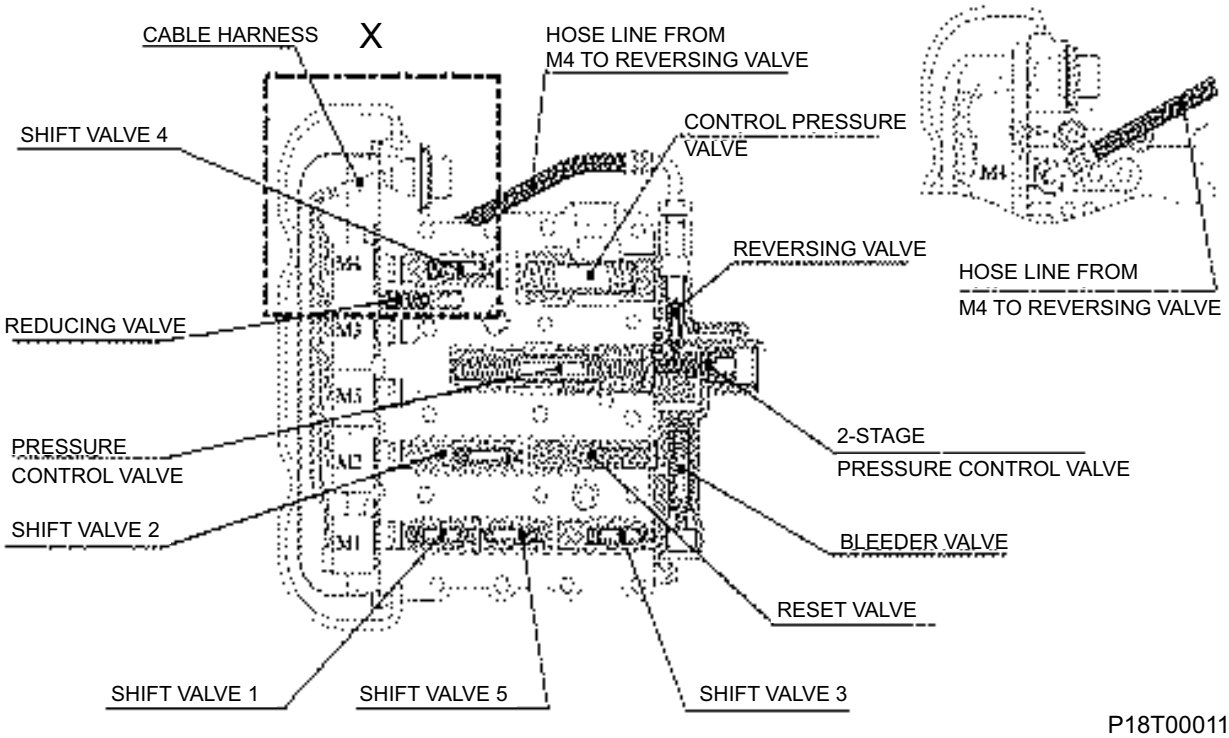
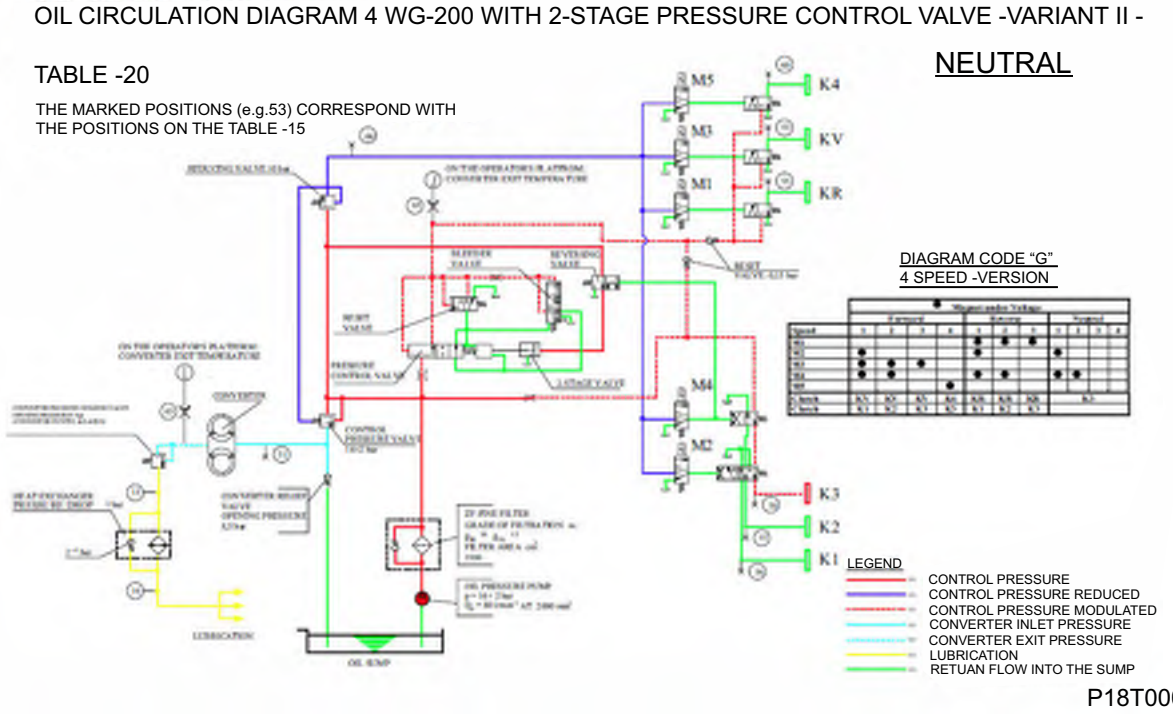


Figure 3-12 Schematic diagram for hydraulic pressure of torque converter - gear box assembly



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 in the valve stem oil passage is controlled by the power of solenoid valves, which finally control the engagement and disengagement of clutch in the gear box, thus to make the gear box achieve different shifts. For the power transferring line and gear engagement with the gear box in different gears, please see the figure of the power transferring line for each gear as the following figure 3-13 to 3-19.

Figure 3-13 Drive line of forward gear 1

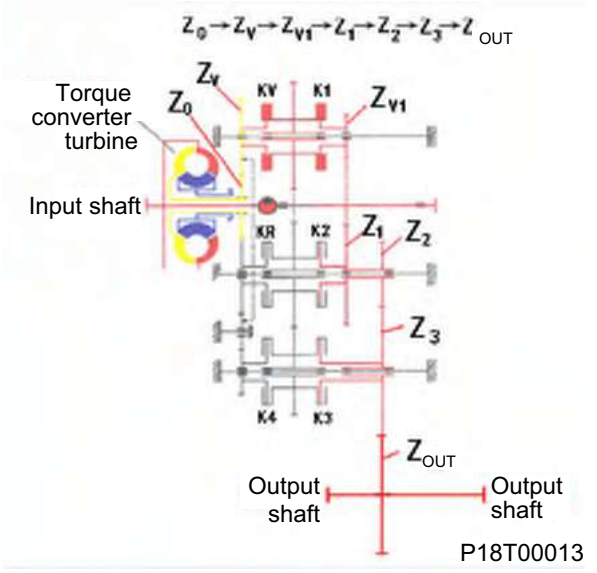


Figure 3-14 Drive line of forward gear 2

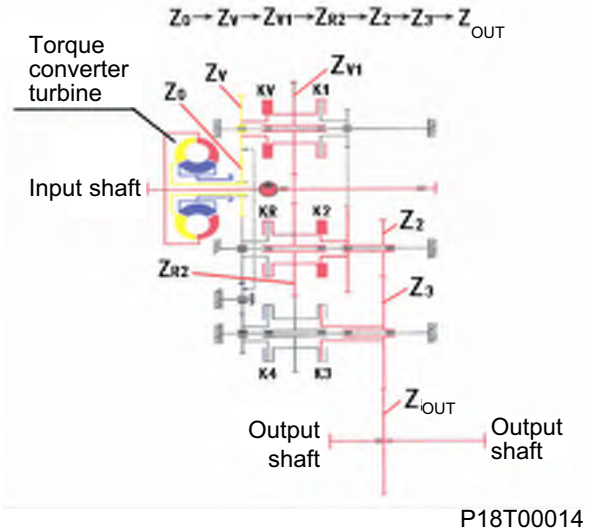


Figure 3-15 Drive line of forward gear 3

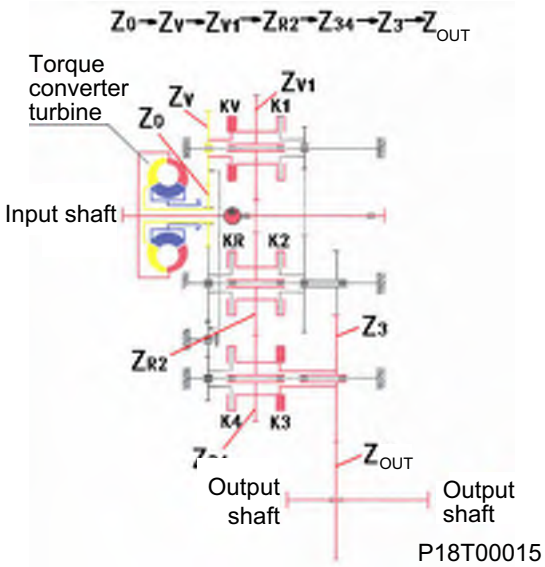


Figure 3-16 Drive line of forward gear 4

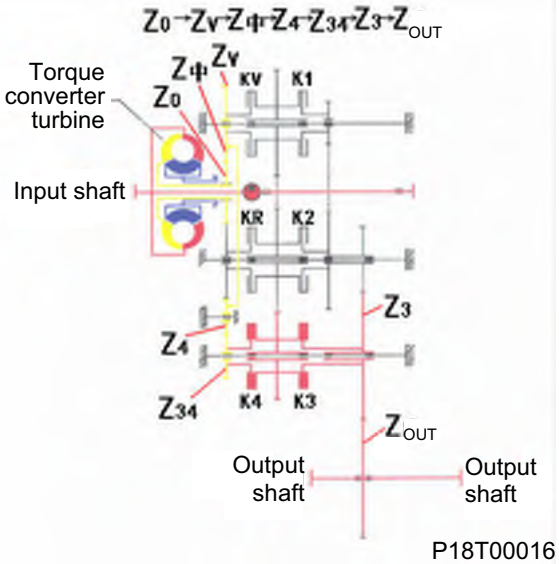


Figure 3-17 Drive line of reverse gear 1

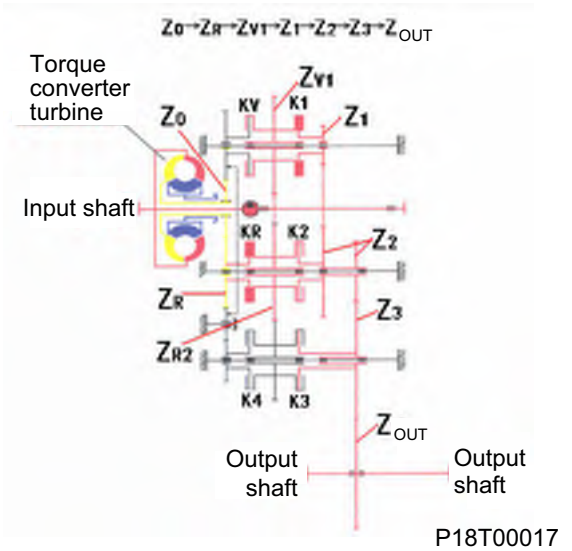


Figure 3-18 Drive line of reverse gear 2

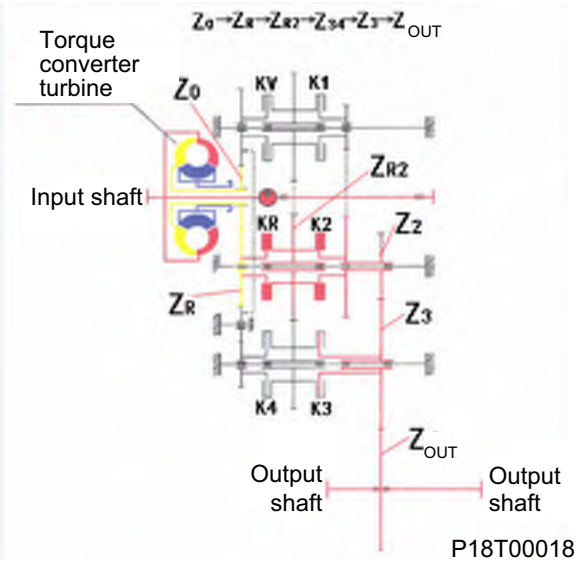
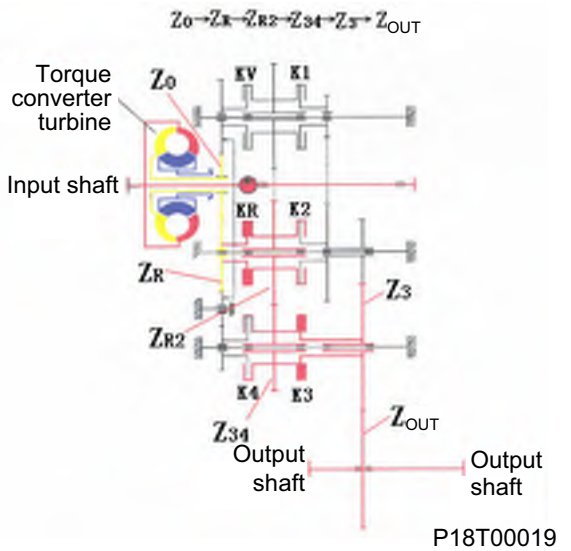


Figure 3-19Drive line of reverse gear 3



Drive axle system

Composition and position of drive axle system

The basic function of drive axle for wheel loader is to reduce the gear box input speed with main drive and wheel reducer and increase the torsion, thus to meet the requirements of driving, operating speed and traction of the base machine. And also, change the straight line motion to vertical-lateral motion via main drive, so that the drive wheel can be driven to rotate to make the base machine drive along the straight route. The differential helps balance the speeds of left and right tires to make sure the machine can still drive when the driving resistances on both sides are different.

In addition to basic features of drive axle for wheel loader, it is also a load-bearing unit for complete machine, a support device for road wheel and mounting & support device for service brake. The drive axle system mainly consists of front axle, rear axle and brake lines. The swing axle also includes front, rear swing brackets, support shaft and other parts.

System technical parameters

Major technical parameters for the drive axle system of this machine are listed in Table 3-4.

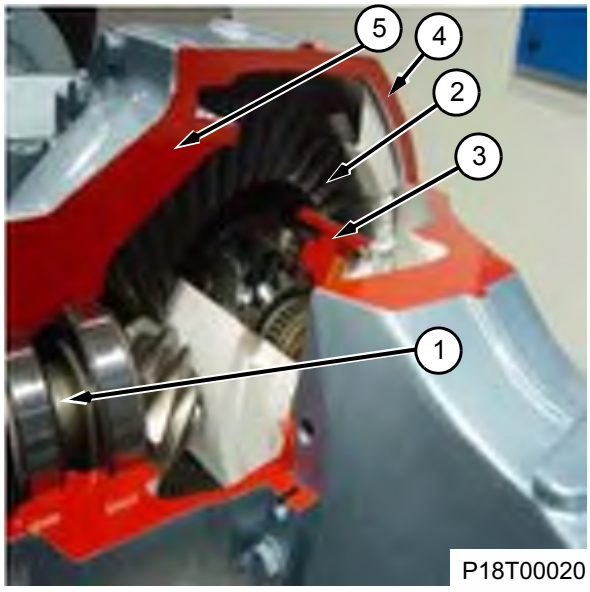
Table 3-4 Main technical parameter table for drive axle

System components	Items	Parameters	Remarks
Front axle	Drive mode	Spiral gear level-I reduction, wheel planetary gear reduction	
	Brake mode	Built-in wet multi-plate type	
	Brake pressure /MPa\psi	1450	
Rear axle	Drive mode	Spiral gear level-I reduction, wheel planetary gear reduction	
	Brake mode	Built-in wet multi-plate type	
	Brake pressure /MPa\psi	1450	

System schematic diagram and working principle description

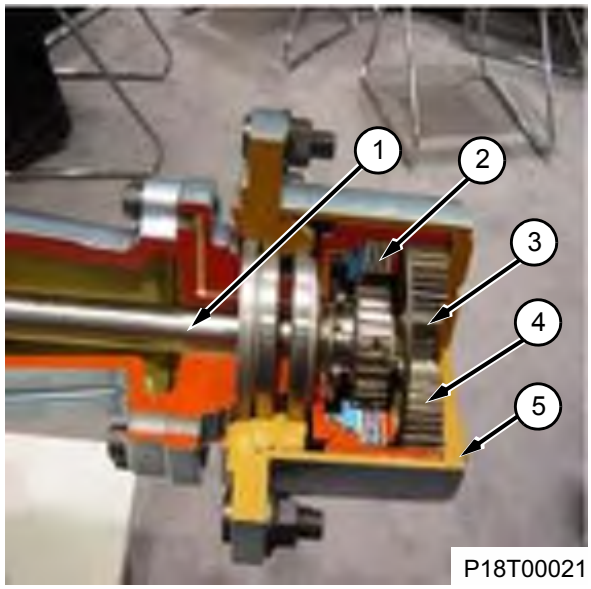
The drive axle for wheel loader is classified into two classes, i.e. front axle and rear axle, the main difference between which is the spiral directions of the spiral bevel gear pairs in the main drive. The driving spiral bevel gear of front axle is left-handed, and that of rear axle is right-handed. The structure diagram for bevel gear and wheel reducer of this machine is as shown in figure 3-20 and 3-21.

Figure 3-20 Structure diagram of the bevel gear



1. Driving spiral bevel gear
2. Axle housing
3. Driven spiral bevel gear
4. Carrier
5. Differential

Figure 3-21 Diagram of the wheel reducer



1. Axle shaft
2. Planetary gear
3. Brake
4. Hub
5. Sun gear

The bevel gear structure is shown in Figure 3-21. The bevel gear includes two parts, one is the bevel gear composed of driving spiral bevel gear and large size spiral bevel gear; the other is the differential composed of cross axle and bevel gear. The power is transmitted to the driving spiral bevel gear by the gear box through drive shaft, thus to drive the large size spiral bevel gear with differential to rotate together. The half shaft gear of differential passes the power to left/ right half shaft which is connected with the splines, and further to the wheel reducer. The power is then transmitted to hub and finally to drive the tire to rotate after further speed reduction, increasing torsion through wheel reducer.

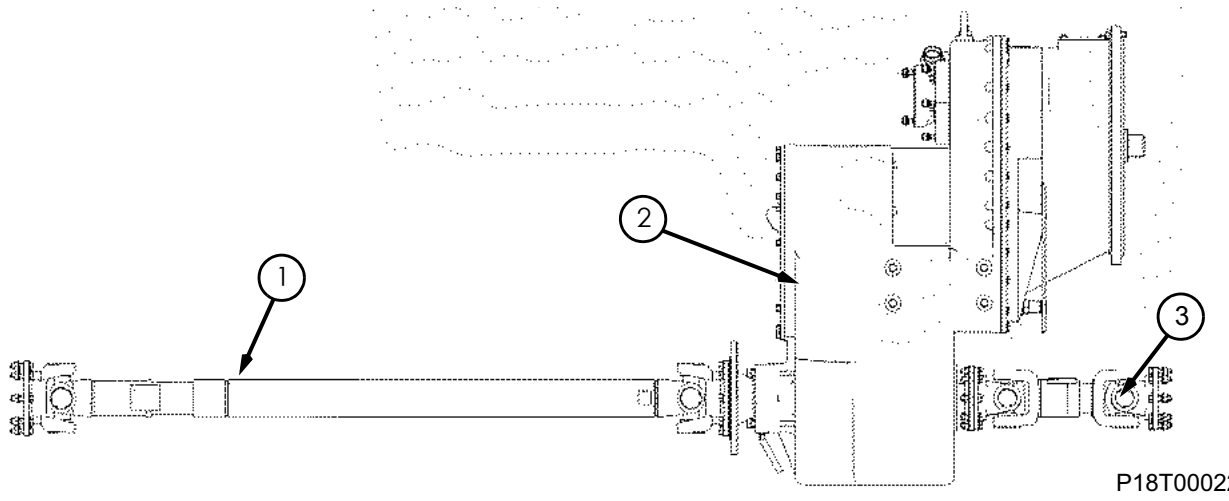
Drive Shaft System

In the wheel loader, the drive shaft system is mainly used to deliver the power between the two connected shafts, of which the relative position changes constantly during operation. Because of the special transmission characteristics of universal joint, the drive shaft may connect two transmission parts with nominal concentric axial line. However, an error may occur during installation and axial line deviates from the original position when operating, the drive shaft is widely used in shoveling transportation machine.

System composition and position

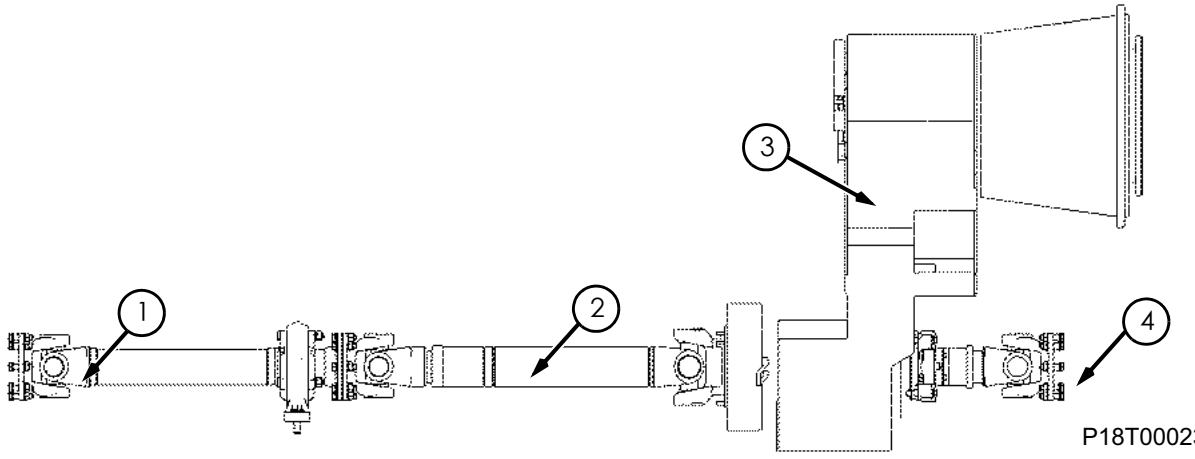
The drive shaft system of wheel loader is composed by the following two structural types in accordance with its formal layout, the drive shaft system shown in Figure 3-25 consists of rear and front drive shafts, the one shown in Figure 3-26 consists of rear, front, intermediate shafts and support assembly.

Figure 3-22 Drive shaft system



1. Front drive shaft
2. Torque converter-gear box assembly
3. Rear drive shaft

Figure 3-23 Drive shaft system



1. Front drive shaft&support assembly
2. Intermediate drive shaft
3. Torque converter-gear box assembly
4. Rear drive shaft

System technical parameters

The technical parameters for the drive shaft system are listed in Table 3-5.

Table 3-5 Technical parameter table for drive shaft system

Parts name	Input-end coupling type	Output-end coupling type
Rear drive shaft	7C FLANGE	7C FLANGE
Intermediate drive shaft	180 round flange	150 round flange
Front drive shaft&support assembly	150 round flange	150 round flange

Tire&rim system

System composition and position

Tire & rim system are both components bearing weight of a complete machine and direct components driving the complete machine to walk. Tires can be classified into bias tires with an inner tube, bias tires without an inner tube, radical tires, solid tires, etc. in accordance with it structural layouts. They can also be classified into block pattern tires, traction pattern tires, skidding tires, etc. according to pattern form.

System technical parameters

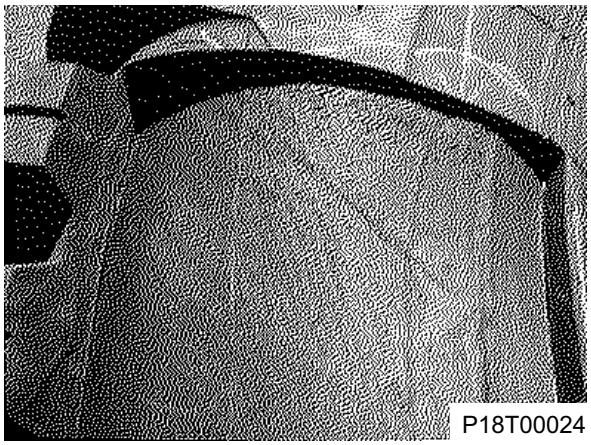
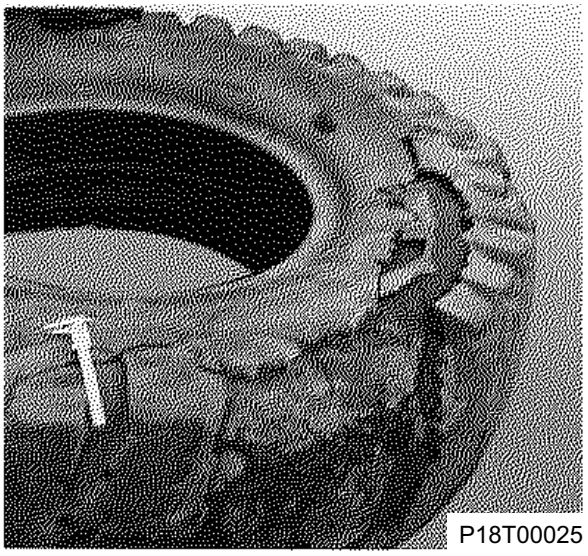
The technical parameters for the tire & rim system equipped in this machine are listed in Table 3-6.

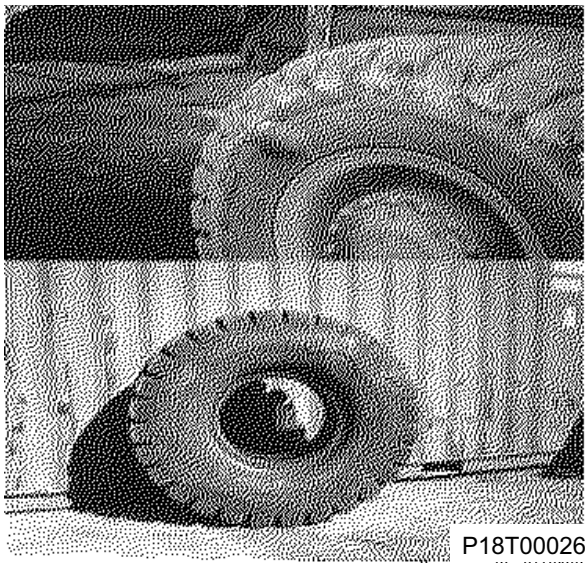
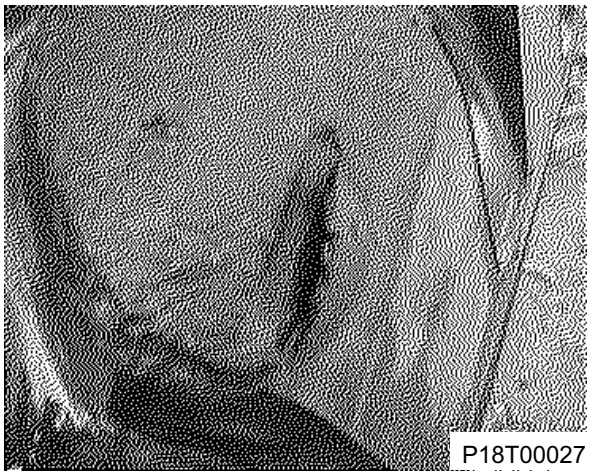
Table 3-6 Technical parameters of tire&rim system

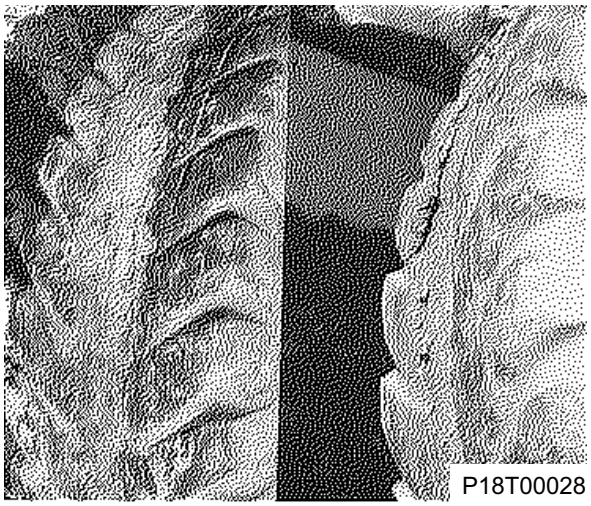
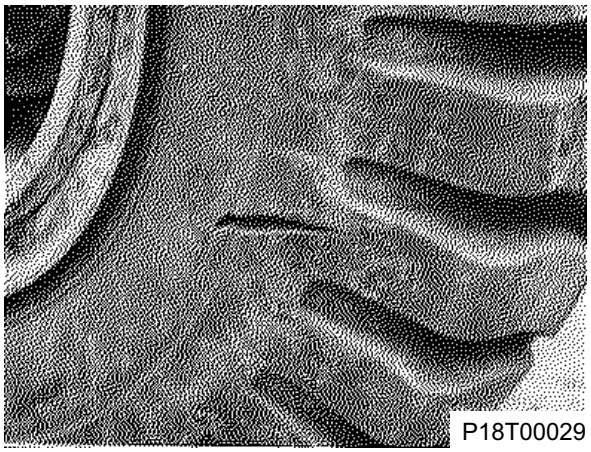
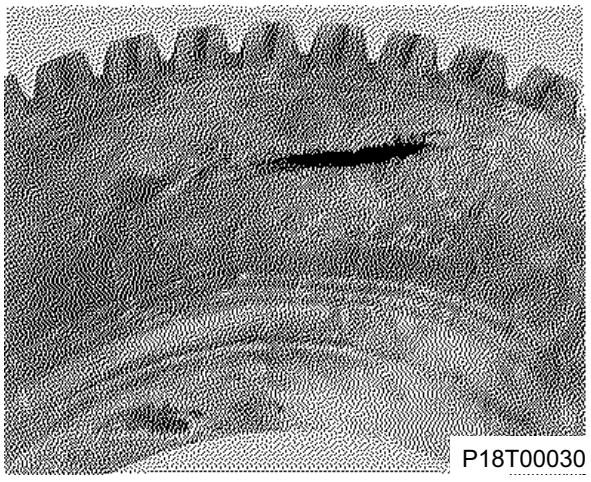
System components	Items	Parameters	Remarks
Tire	Tire structure	Radial tire	Tubeless bias tire or tubed bias tire is optional
	Specification	17.5R25 two star L3	
	Level	\	
	Type of tread	L-3	Ordinary block
	Tire pressure (MPa)\(psi)	Front wheel:0.55-0.58\79.75-84.10 Rear wheel: 0.52-0.55\75.40-79.75	
Rim	Specification	25-14.00/1.5	

Common failure modes of tire and reasons

Common failure mode of tire and reasons are as follows:

Typical pictures	Failure mode	Main reasons
 P18T00024	Delaminating of crown	1. Reasons for 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. Reasons for usage: speed is too fast (beyond specified speed), and directive pattern is traveling in reverse direction.
 P18T00025	Shoulder delamination blasting	1. Reasons for 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.

Typical pictures	Failure mode	Main reasons
 P18T00026	Delaminating of sidewall	1. Reasons for 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.
 P18T00027	Double skin	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.

Typical pictures	Failure mode	Main reasons
 P18T00028	Wearing of crown	Major reasons: traveling with too high pressure will cause earthed area reduction of tire crown, local load increase and wear intensification.
 P18T00029	Trauma	Major reasons: during traveling, outer tube is scratched by pointed objects or is stabbed evenly by pointed objects.
 P18T00030	Side trauma	Major causes: the vehicle speeds up when steering, the tire side rubs the roadside obstacles; and installed tire is stuck with hard objects; the machinery is damaged during transportation, installation.

Testing and adjustment

Torque Converter - Gearbox System

1. Leakage check

Start up the machine and operate it for several minutes, observe whether there is sign of leakage from the hose assembly coupled with gear box assembly, if so, re-tighten it.

2. Test of gear box shift pressure

Power on the machine, now the oil pressure warning light of gear box flashes on the instrument panel, and after startup of machine, the warning light shall go out, if not, inspect the oil level of gear box once again.

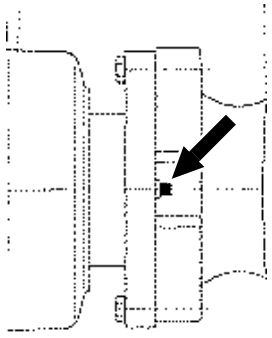
Drive axle system

1. Leakage check

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

2. Exhaust

Figure 3-24 Rear axle ventilation plug

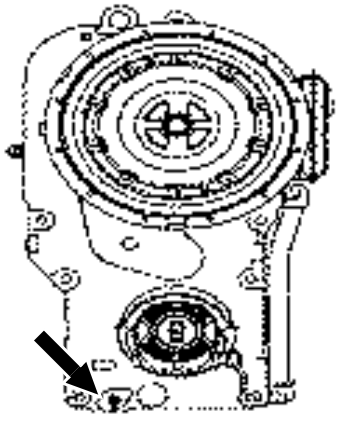


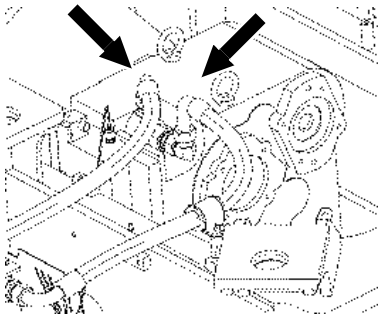
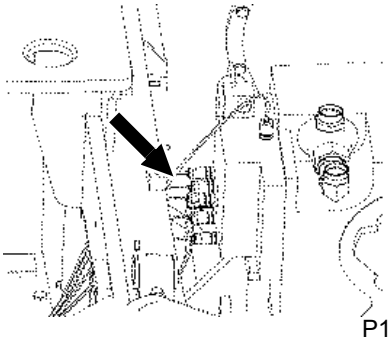
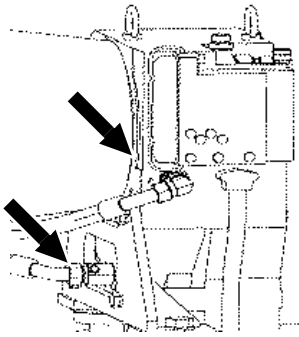
1) Loosen the exhaust plugs at both ends of axle.
2) Start up the machine and step on the service brake pedal until the oil overflows from the exhaust plug.
3) Tighten the exhaust plug.

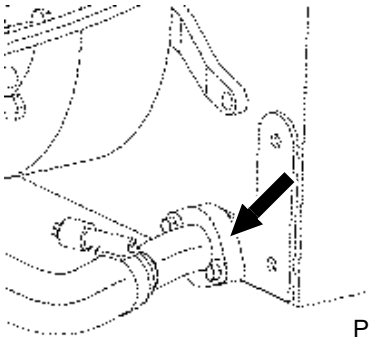
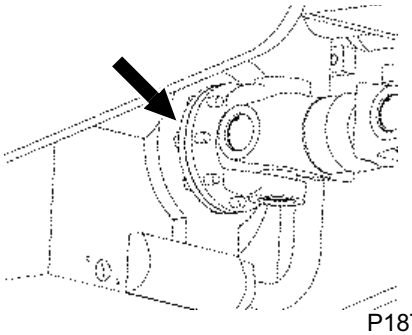
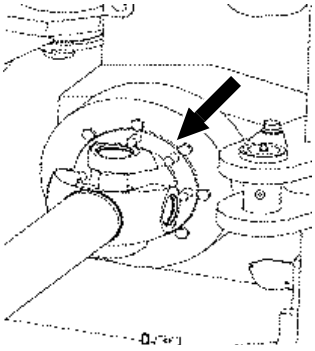
Removal and Installation

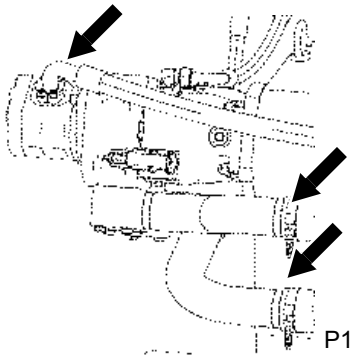
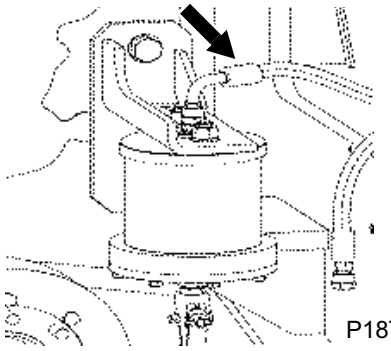
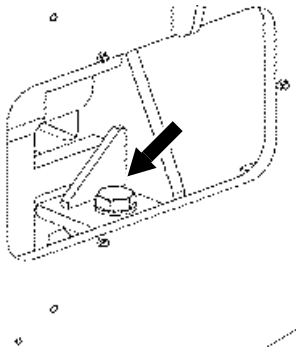
Removal and installation of torque converter-gearbox system

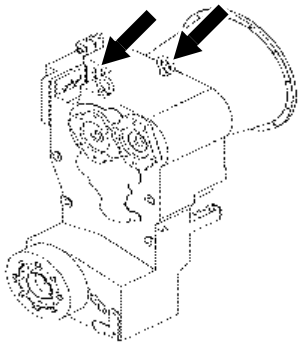
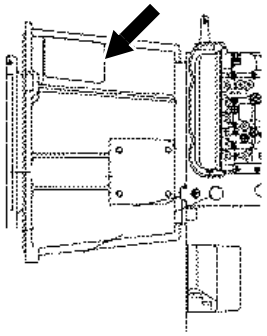
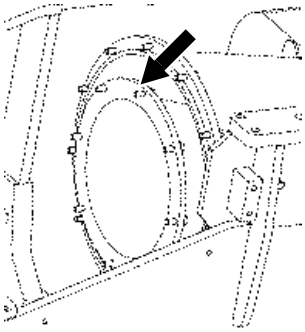
Removal of torque converter - gearbox system

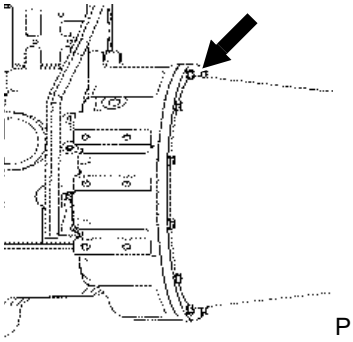
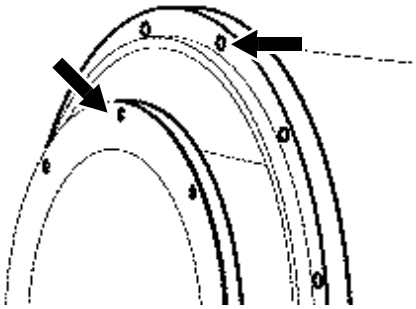
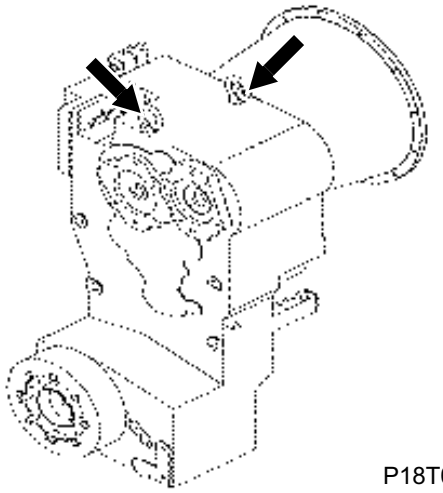
Reference picture	Operation step	Tools required (Remarks)
	1. Stop the machine on a level ground, put the work implement, bucket levelly, and pull up the emergency parking brake lever. 2. Turn off the engine and remove the key.	
 P18T00032	3. Remove the drain plug of gear box assembly to drain the oil. **⚠ Caution: The waste oil shall be recovered in a container during removal, in order to avoid environmental contamination. The removed hose is shielded to avoid contamination of parts.** **⚠ Danger: It is sure that the hose pressure is fully discharged and the oil is cooled sufficiently before removal of hose, in order to avoid personal injury of hose pressure and hot oil during removal.**	34# socket, 13# socket, pneumatic impact wrench
	4. Remove the cab assembly of machine, see section “Removal and Installation of Cab” for removal steps.	

Reference picture	Operation step	Tools required (Remarks)
 P18T00033	5. Remove the hose assembly connecting the oil filter pipe to the gear box assembly with wrench. **⚠ Caution: The waste oil shall be recovered in a container during removal, in order to avoid environmental contamination.** **The removed hose is shielded to avoid contamination of parts.**	41# wrench
 P18T00034	6. Remove the test line connected to gear box assembly and test hose.	18# Wrench
 P18T00035	7. Remove the hose assembly with a wrench.	41# Wrench

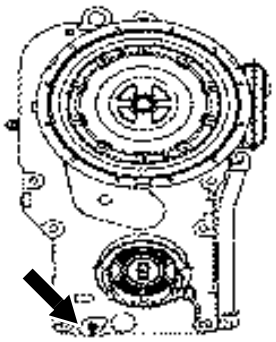
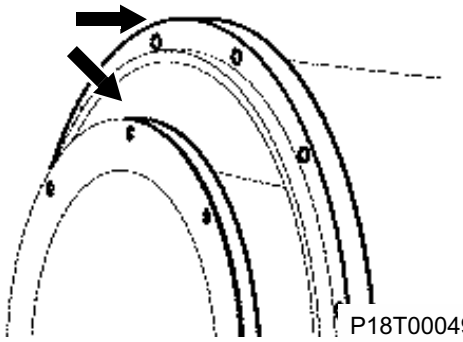
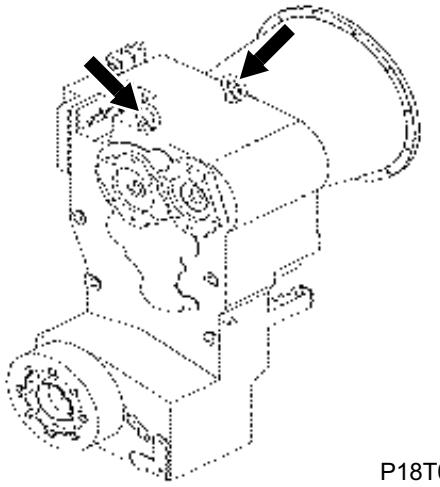
Reference picture	Operation step	Tools required (Remarks)
 P18T00036	8. Remove the clamping bolt fixing the oil filler steel-pipe with a wrench.	10# Wrench
 P18T00037	9. Remove the coupling lock-nut between rear drive shaft and rear output flange of gear box assembly. **⚠ Caution: The drive shaft assembly is composed of slidable spline sleeve, please take care to avoid personal injury caused by falling of slide shaft fork during removal.**	18# Wrench
 P18T00038	10. Remove the coupling lock-nut between intermediate drive shaft and front output flange of transmission assembly.	21# Wrench

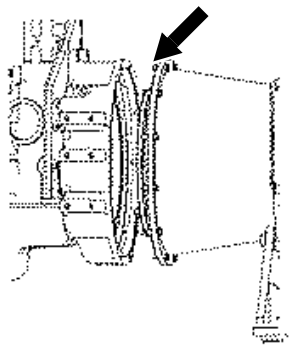
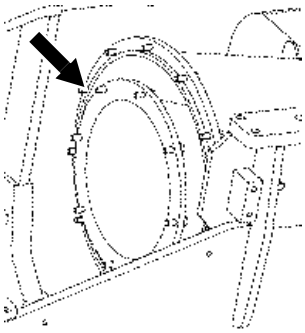
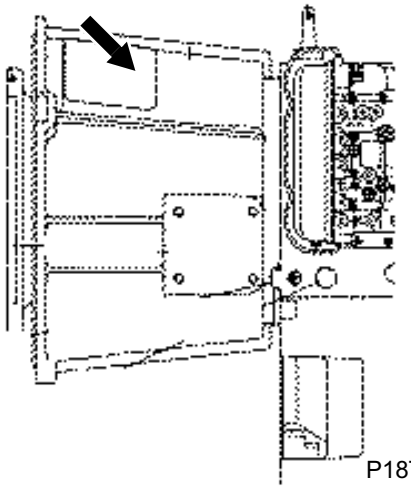
Reference picture	Operation step	Tools required (Remarks)
 P18T00039	11. Remove the hose assembly or the hose connected with hydraulic pump from the gearbox assembly, and refer to removal of hydraulic system for detailed procedures.	
 P18T00040	12. Remove the hose assembly connected with brake system from the emergency parking brake chamber.	24# Wrench
 P18T00041	13. Remove the bolts and washer for attaching the transmission mount to the frame with an air gun.	46# wrench, 46# socket, pneumatic impact wrench

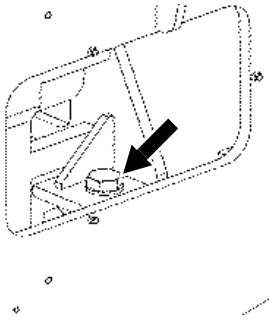
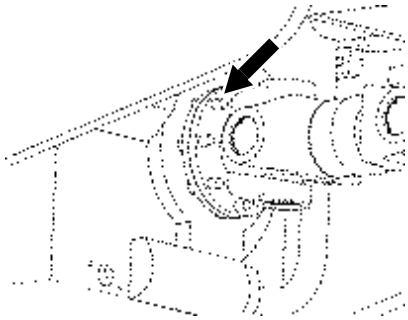
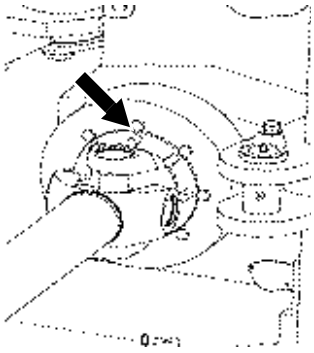
Reference picture	Operation step	Tools required (Remarks)
 P18T00042	14. Pre-lift the gear box assembly through the lugs with lifting device.	Sling (2 tons)
 P18T00043	15. Remove the cover plate from the transmission assembly with a wrench.	13# Wrench
 P18T00044	16. Remove the fastening bolts used to attach the gear box assembly to the engine flywheel with a wrench.	16# Wrench

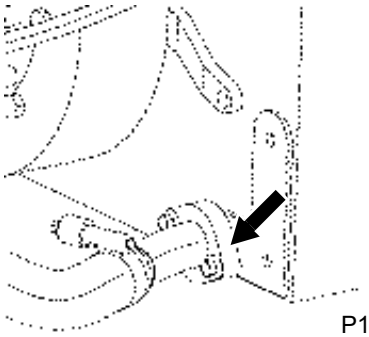
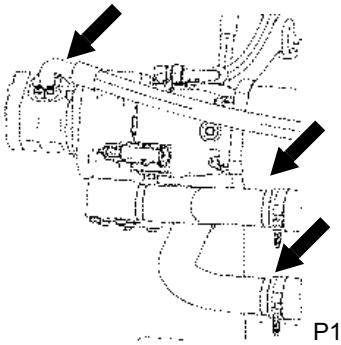
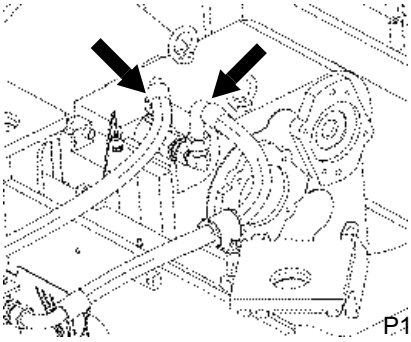
Reference picture	Operation step	Tools required (Remarks)
 P18T00045	17. Remove the fastening bolts used for attaching the gear box assembly-torque converter case to the engine housing with an blower gun and socket.	16# socket, pneumatic impact wrench
 P18T00046	18. Separate the transmission assembly from the engine, and secure the torque converter case and core through the bolt holes with ropes and steel wires.	Steel wire
 P18T00047	19. Lift up the gear box assembly from the machine through the lugs with the hoisting device and ropes and place it in a safe area.	Sling (2 tons)

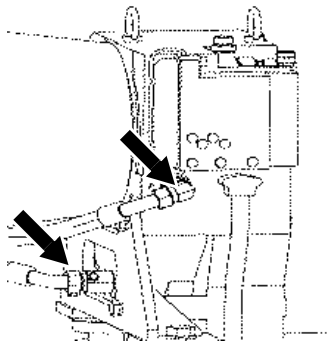
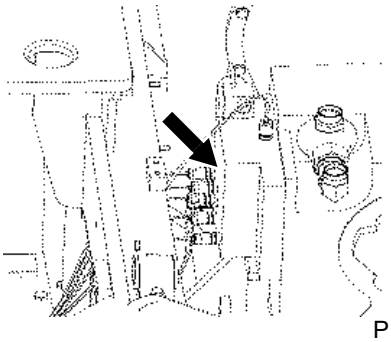
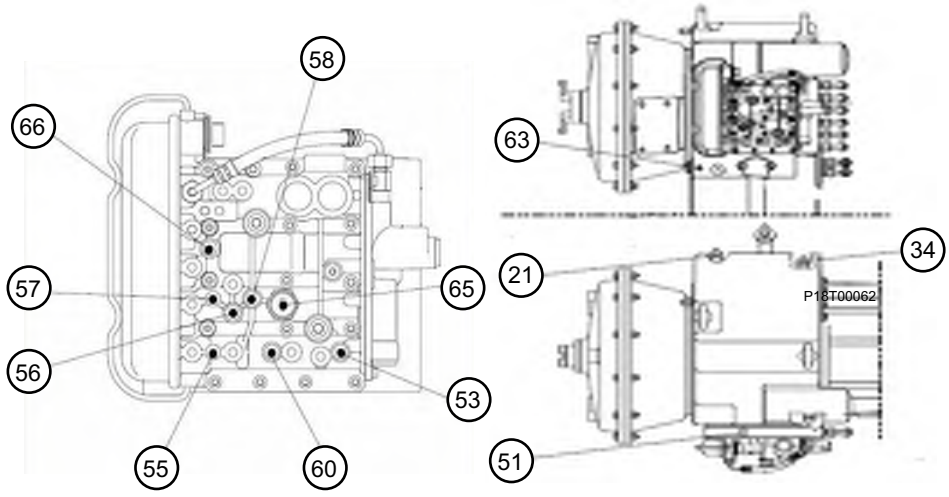
Installation of torque converter-gear box system

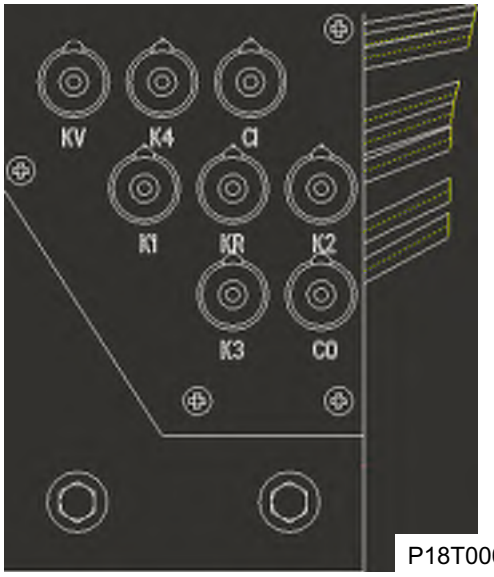
Reference picture	Operation step	Tools required (Remarks)
 P18T00048	1. Wipe clean the drain plug of gear box, and then install it in the threaded hole of gear box and tighten it with a torque of 600±70Nm\ 442.5±51.6 lbf•ft.	34# socket, 13# socket, pneumatic impact wrench, open-end 34# fixed torque spanner
 P18T00049	2. Secure the torque converter to its housing through threaded holes with the steel wire or ropes. **⚠ Danger: The torque converter can slide freely on the guide wheel seat. When lifting up it, the torque converter and its housing must be secured firmly with the steel wire or ropes, in order to avoid personal injury due to falling of torque converter.**	Steel wire
 P18T00050	3. Lift up the gear box assembly onto the machine through the lugs of gear box assembly with the hoisting device and ropes.	Sling (2 tons)

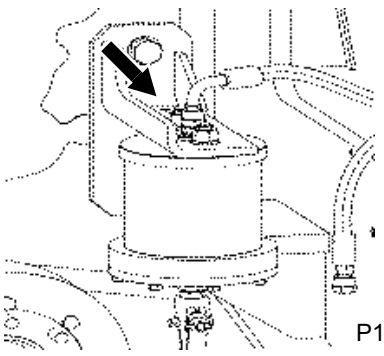
Reference picture	Operation step	Tools required (Remarks)
 P18T00051	4. Move gear box assembly to fit it with engine flywheel housing, and install the bolts and hard washer used for tightening the torque converter case to the engine housing and then tighten them. Tightening torque: 72±6Nm\ 53.1±4.4 lbf•ft.	16# socket, pneumatic impact wrench, open-end 16# fixed torque spanner
 P18T00052	5. Crank the engine flywheel case to make the torque converter align with mounting threaded hole on the engine flywheel, screw and tighten the fastening bolts and washer for attaching the torque converter to the engine flywheel by hand with a torque of 60±5Nm\ 44.25±3.7 lbf•ft	16# socket, pneumatic impact wrench, open-end 16# fixed torque spanner
 P18T00053	6. Install the mounting hole cover plate on the gear box.	13# Wrench

Reference picture	Operation step	Tools required (Remarks)
 P18T00054	7. Screw and tighten the bolts and washer for fastening the gear box mount to the frame with the torque of 2035±170Nm\ 1500.8±125.38 lbf•ft.	46# wrench, 46# socket, pneumatic impact wrench, open-end 46# fixed torque spanner
 P18T00055	8. Attach the mounting end flanges of drive shaft and gear box to the rear output flange of gear box, and tighten the locknut to 132±10Nm\ 97.35±7.38 lbf•ft.	18# wrench or open-end 18# fixed torque spanner
 P18T00056	9. Attach the intermediate drive shaft to front output flange of gear box and tighten the locknut to 200±15Nm\ 147.5±11.06 lbf•ft.	21# wrench or open-end 21# fixed torque spanner

Reference picture	Operation step	Tools required (Remarks)
 P18T00058	10. Install the oil filler steel-pipe on the gear box and tighten the set bolts with a torque of 26±3Nm\ 19.18±2.21 lbf•ft.	13# wrench or open-end 13# fixed torque spanner
 P18T00058	11. Install the hose referring to the hydraulic installation and hydraulic pump.	
 P18T00059	12. Install the hose assembly used for attaching the oil filter pipe to the gear box, and the tightening torque of hose joint is 137±6Nm\ 101.04±4.43 lbf•ft. **⚠ Caution: Two hose assemblies are respectively connected to the inlet, outlet of fine oil filter in directions as required, avoiding installation error.**	41# wrench or open-end 41# fixed torque spanner

Reference picture	Operation step	Tools required (Remarks)
 P18T00060	13. Install the hose assembly used for attaching the radiator pipe to the gear box, and the tightening torque of hose joint is 137±6Nm\ 101.04±4.43 lbf•ft.	41# wrench or open-end 41# fixed torque spanner
 P18T00061	14. Install the hose assembly used for attaching the test pipe to the gearbox, as shown in the following figure and table.	18# Wrench
Layout of test points of shift control valve  P18T00062		

<table>
<tr><th>Reference picture</th><th>Operation step</th><th>Tools required (Remarks)</th></tr>
<tr><td colspan="2">Logic diagram of test points and gear clutch
<table>
<tr><th>Decal marker</th><th>Meanings</th><th>Theoretical value</th><th>S/N in the corresponding valve</th></tr>
<tr><td>PRESSURE OF IN FRONT OF THE CONVERTER</td><td>Inlet pressure of torque converter</td><td>Opening pressure: 1.1 MPa</td><td>51</td></tr>
<tr><td>PRESSURE OF KV CLUTCH</td><td>KV clutch pressure</td><td>1.6-1.8MPa</td><td>53</td></tr>
<tr><td>PRESSURE OF KR CLUTCH</td><td>KR clutch pressure</td><td>1.6-1.8MPa</td><td>55</td></tr>
<tr><td>PRESSURE OF K1 CLUTCH</td><td>K1 clutch pressure</td><td>1.6-1.8MPa</td><td>56</td></tr>
<tr><td>PRESSURE OF K2 CLUTCH</td><td>K2 clutch pressure</td><td>1.6-1.8MPa</td><td>57</td></tr>
<tr><td>PRESSURE OF K3 CLUTCH</td><td>K3 clutch pressure</td><td>1.6-1.8MPa</td><td>58</td></tr>
<tr><td>PRESSURE OF K4 CLUTCH</td><td>K4 clutch pressure</td><td>1.6-1.8MPa</td><td>59</td></tr>
</table></td><td></td></tr>
<tr><td>Mapping diagram of centralized measuring point mounting plate and measuring point
 

P18T00063</td><td></td><td></td></tr>
<tr><td> 
P18T00064</td><td>15. Install the hose assembly used for attaching emergence parking brake chamber to the brake system, the tightening torque is 37±2Nm\ 27.29±1.48 lbf•ft.</td><td>24# wrench or open-end 24# fixed torque spanner</td></tr>
</table>

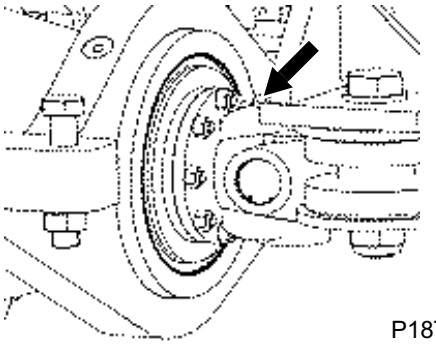
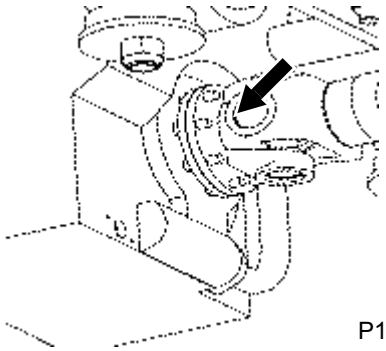
Reference picture	Operation step	Tools required (Remarks)
	16. Fill the gear box by referring to the Operation Manual of this machine, and check the oil level according to the specified method.	

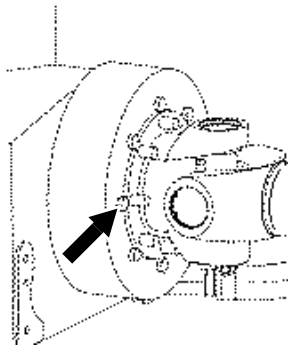
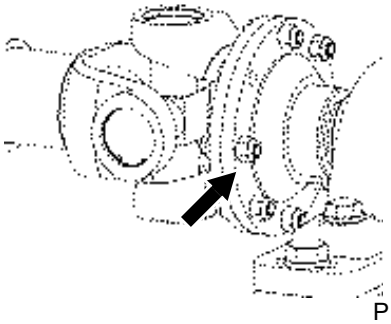
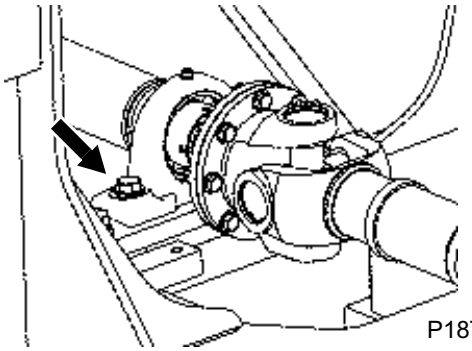
Disassembly and assembly of torque converter-gearbox assembly

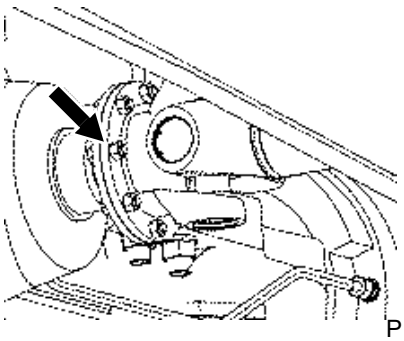
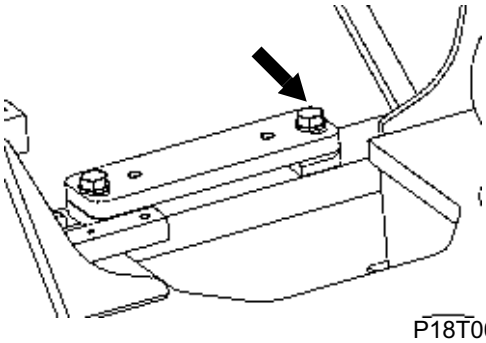
For disassembly and assembly of torque converter-gear box assembly in this machine, refer to "ZF Gear Box Overhaul Manual".

Removal and installation of drive shaft system

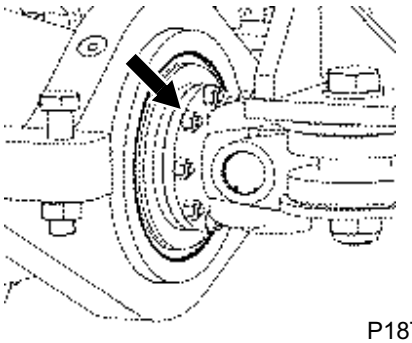
Removal of drive shaft system

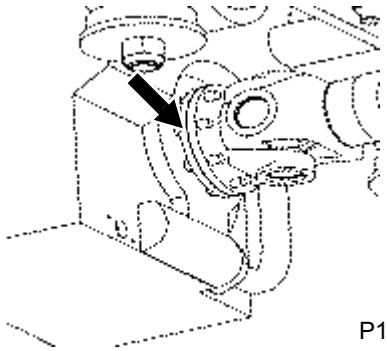
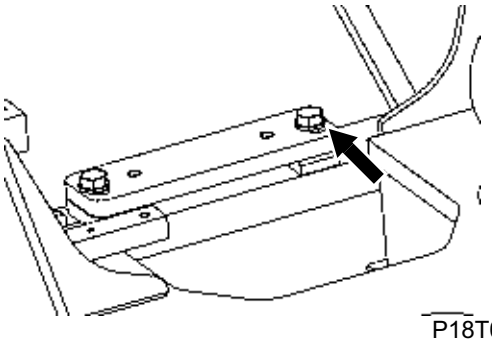
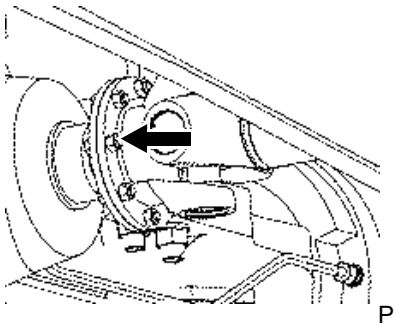
Reference picture	Operation step	Tools required (Remarks)
	1. Park the machine on a level ground, turn off the engine, and place the gear box handle in neutral position, pull up the emergency parking brake lever and place the wedges. **⚠ Caution: The drive shaft assembly is composed of slidable spline sleeve, please take care to avoid personal injury caused by falling of slide shaft fork during removal.**	
 P18T00065	2. Remove the connecting locknut between the rear drive shaft and rear axle input flange with a wrench.	18# Wrench
 P18T00066	3. Remove the connecting locknut between rear drive shaft and rear output flange of gear box with a wrench, and place the rear drive shaft assembly in a safe area.	18# Wrench

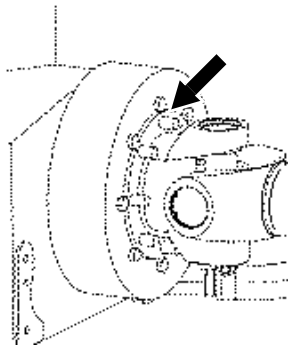
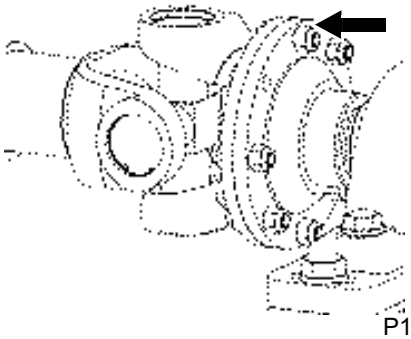
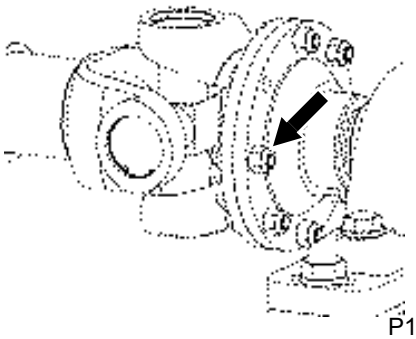
Reference picture	Operation step	Tools required (Remarks)
 P18T00067	4. Remove the connecting locknut between intermediate drive shaft and front output flange of gear box assembly with a wrench.	21# Wrench
 P18T00068	5. Remove tightening bolt and nut between intermediate drive shaft and front drive shaft & bearing assembly, and remove the intermediate drive shaft from machine with a wrench.	18# Wrench
 P18T00069	6. Remove the bolts and washer securely connecting the front drive shaft and support assembly to middle support plate with a wrench.	18# Wrench

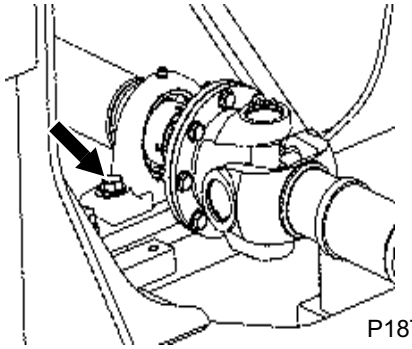
Reference picture	Operation step	Tools required (Remarks)
 P18T00070	7. Remove the bolts and nuts securely connecting the front drive shaft and support assembly and front axle, and remove front drive shaft and support assembly from machine with a wrench.	18# Wrench
 P18T00071	8. Remove the tightening bolts and washers of the support plate and frame with a blower gun or a wrench.	24# socket, pneumatic impact wrench or 24# wrench

Installation of drive shaft system

Reference picture	Operation step	Tools required (Remarks)
 P18T00072	1. Wipe clean the surface, install rear drive shaft and rear axle input flange, and align the the mounting holes, then insert the tightening bolt and screw in the nut and tighten it with a torque of 132±10Nm\97.35±7.38 lbf•ft.	18# wrench or open-end 18# fixed torque spanner

Reference picture	Operation step	Tools required (Remarks)
 P18T00073	2. Wipe clean the surface, install the rear drive shaft and rear output flange of the gear box, and align the mounting holes, screw in the locknut and tighten it with a torque of 132±10Nm\ 97.35±7.38 lbf•ft. **⚠ Caution: When assembling, please make sure to pay attention to the white arrows on the identification of drive shaft, both of which must be aligned after assembly!**	18# wrench or open-end 18# fixed torque spanner
 P18T00074	3. Wipe clean the two mounting surfaces of support plates, and then pre-install it onto the front frame. Set the front drive shaft and support assembly with middle support bearing on the front frame middle support bearing seat support plate.	
 P18T00075	4. Wipe clean the surface, install the front drive shaft and support assembly with front axle input flange, and align the mounting hole, screw in the locknut and tighten it with a torque of 132±10Nm\97.35±7.38 lbf•ft.	18# wrench or open-end 18# fixed torque spanner

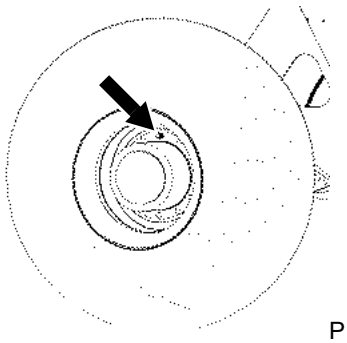
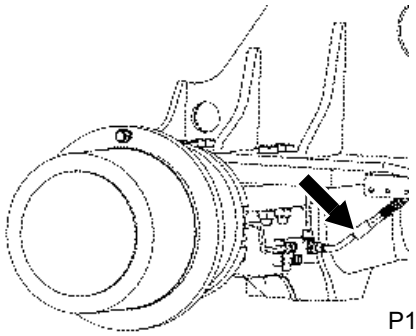
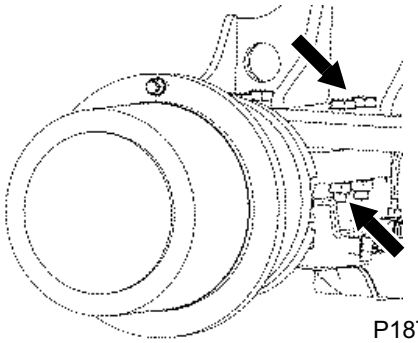
Reference picture	Operation step	Tools required (Remarks)
 P18T00076	5. Wipe clean the mounting surfaces of front output flange of gear box and intermediate drive shaft flange, and install the intermediate drive shaft to the front output flange bolts of gear box, screw in the locknut and tighten it with a torque of 200±15Nm\ 147.5±11.06 lbf•ft.	21# wrench or open-end 21# fixed torque spanner
 P18T00077	6. Install the middle drive shaft, front drive shaft and support assembly, and align the mounting holes. Insert the tightening bolt and screw in the locknut, and then tighten them to 132±10Nm\ 97.35±7.38 lbf•ft. **⚠ Caution: The intermediate drive shaft middle shaft fork must be aligned with the fork which is coupled with front axle on the front drive shaft and support assembly!**	18# wrench or open-end 18# fixed torque spanner
 P18T00078	7. Adjust the front&rear, left&right positions of intermediate, front drive shafts and support assembly to make sure that the bolts between support plate and frame can be screwed in smoothly with torque of 132±10Nm\97.35±7.38lbf•ft.	Open-end 18# fixed torque spanner or 18# wrench

Reference picture	Operation step	Tools required (Remarks)
 P18T00079	8. Install the tightening bolts and washer of the middle support bearing seat and support plate, and tighten them to 22494±18.44 lbf•ft.	24# socket, fixed torque blower gun or open-end 24# fixed torque spanner

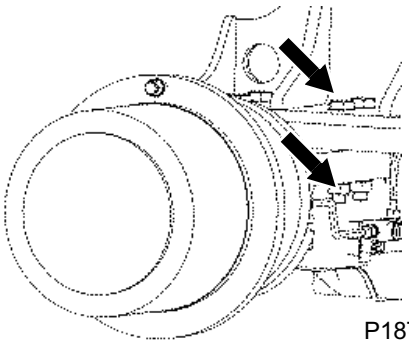
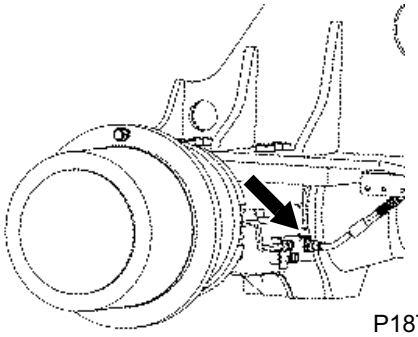
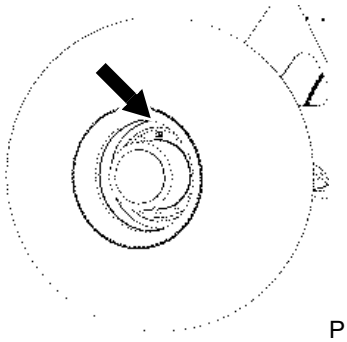
Removal and installation of front axle assembly

Removal of front axle assembly

Reference picture	Operation step	Tools required (Remarks)
	1. Stop the machine on a level ground, put the work implement, bucket levelly, and pull up the emergency parking brake lever. 2. Turn off the engine, step on the service brake pedal for several times, so as to release the pressures of energy accumulator and axle brake pipe. 3. Lift up the machine with a lifting device, and support it up with a supporting device with 4 tires off the ground	Sling (12 tons)

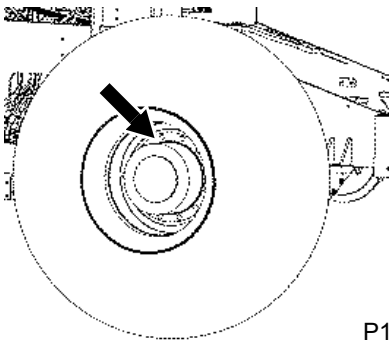
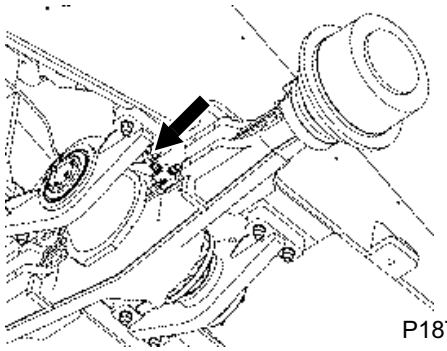
Reference picture	Operation step	Tools required (Remarks)
 P18T00080	4. Pre-lift up the tires with a hoist, remove the bolts and nuts used for tightening the rim and axle. 5. Lift the tires away from machine and put them in a safe area. 6. Repeat steps (4), (5), remove another tire installed on the front axle.	Sling(2 tons)30# socket, pneumatic impact wrench or open-end 30# wrench
 P18T00081	7. Remove the hose assembly connected to service brake system and the front axle. **⚠ Caution: The waste oil shall be recovered in a container during removal, in order to avoid environmental contamination. The removed hose is shielded to avoid contamination of parts.** **⚠ Danger: It is sure that the hose pressure is fully discharged and the oil is cooled sufficiently before removal of hose, in order to avoid personal injury of hose pressure and hot oil during removal.**	24# Wrench
 P18T00082	8. Pre-lift the front axle assembly with a sling. 9. Remove the bolts and nuts for connecting the front axle assembly to the front frame with a blower gun. 10. Put the axle assembly onto the ground slowly with a lifting device. 11. Remove the axle assembly from the bottom of machine with a handling equipment, and then put it on the appliance for axle assembly.	Sling(2 tons)40# socket, pneumatic impact wrench, 40# wrench

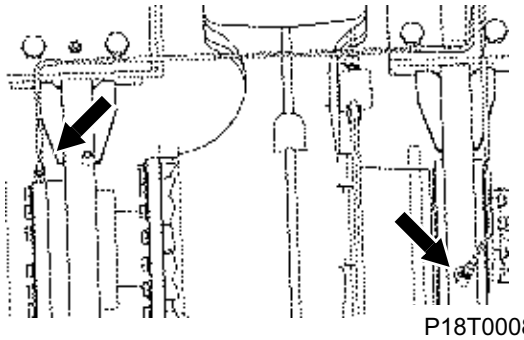
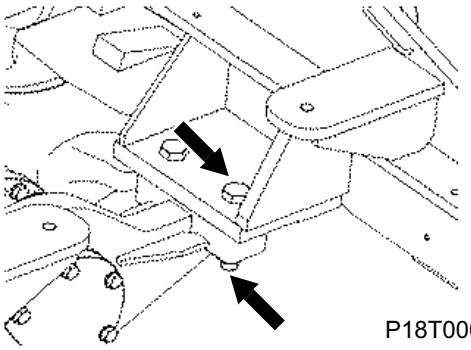
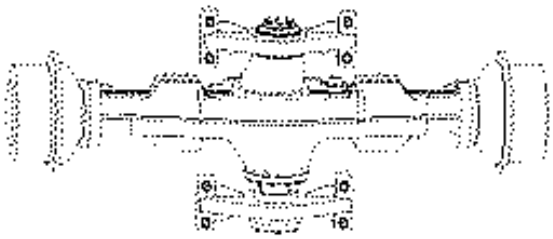
Installation of front axle assembly

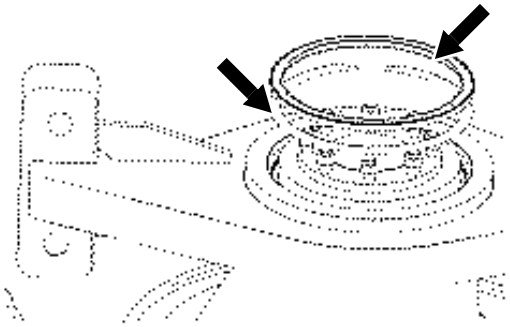
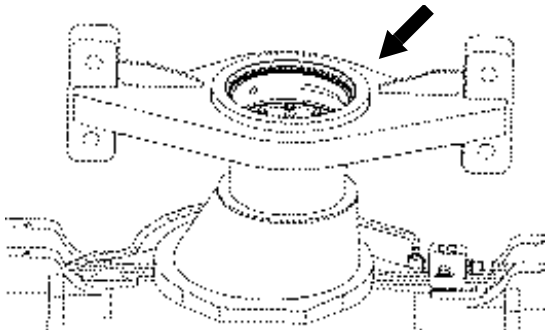
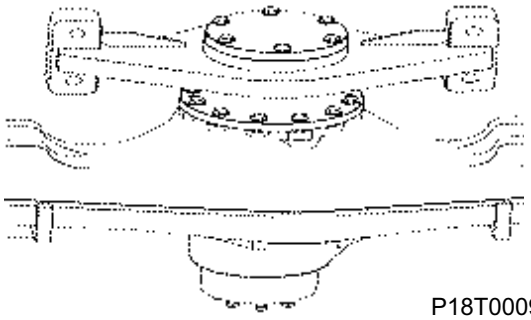
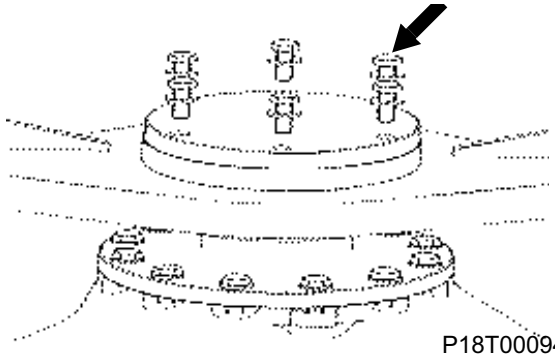
Reference picture	Operation step	Tools required (Remarks)
 P18T00083	1. Take the front axle assembly out of placed area with a handling device, and position it under its mounting point. 2. Lift up the front axle assembly with a hoist, and install it on the frame. 3. Install the tightening bolts and nuts and tighten them with torque of 2035±170Nm\ 1500.8±125.38 lbf•ft.	Sling(2 tons) 46# socket, pneumatic impact wrench, open-end 46# fixed torque spanner
 P18T00084	4. Install the front axle brake pipe and service brake hose. Tightening torque: 37±2Nm\ 27.29±1.48 lbf•ft.	Open-fixed 24# fixed torque spanner
 P18T00085	5. Lift up the tire with a hoist and install it onto the axle, and then install the rim nut and tighten it to 600±60Nm\ 442.5±44.25 lbf•ft.	Sling (2 tons)30# socket, pneumatic impact wrench, open-end 30# fixed torque spanner
	6. Lift the machine with a hoist, remove the support device, and put the machine onto the ground.	Sling (12 tons)

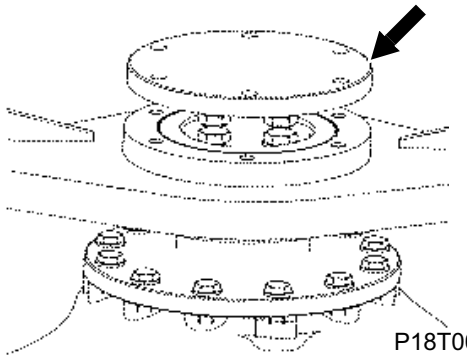
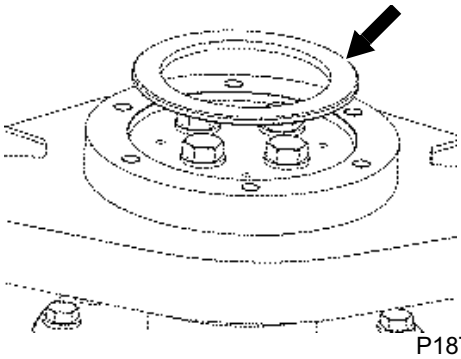
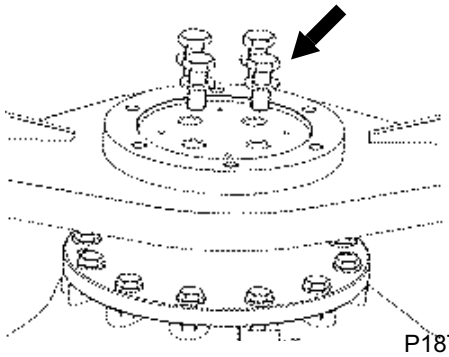
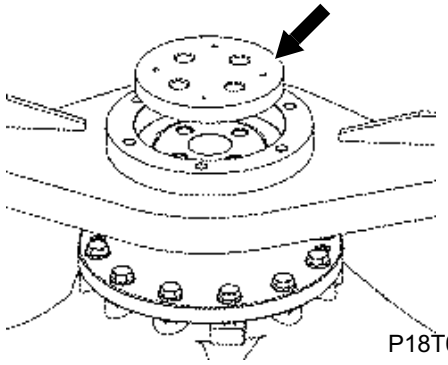
Removal and installation of rear axle assembly

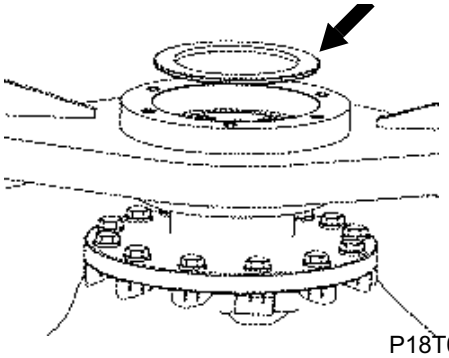
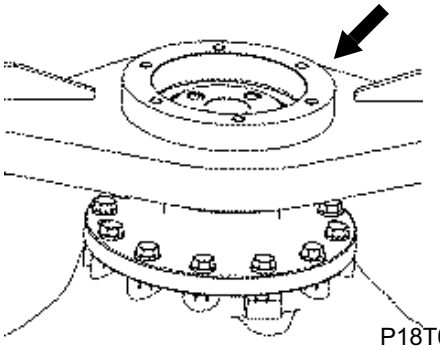
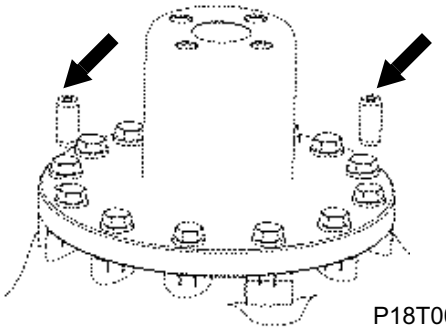
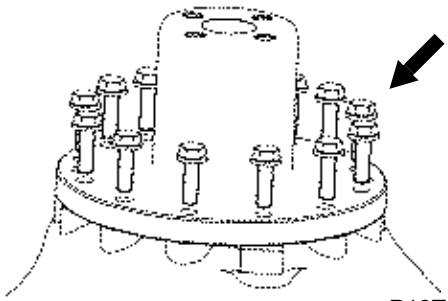
Removal of rear axle assembly

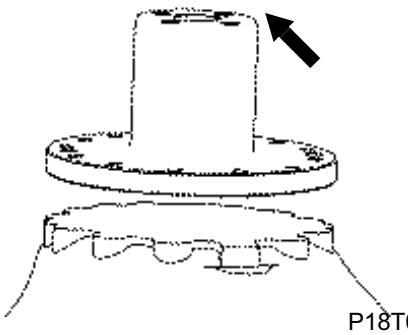
Reference picture	Operation step	Tools required (Remarks)
	1. Stop the machine on a level ground, put the work implement, bucket levelly, and pull up the emergency parking brake lever. 2. Turn off the engine, step on the service brake pedal for several times, so as to release the pressures of energy accumulator and axle brake pipe. 3. Lift up the machine with a lifting device, and support it up with a supporting device with 4 tires off the ground	Sling (12 tons)
 P18T00086	4. Pre-lift up the tires with a hoist, remove the bolts and nuts used for tightening the rim and axle. 5. Lift the tires away from machine and put them in a safe area. 6. Repeat steps (4), (5), remove another tire installed on the rear axle.	Sling (2 tons)30# socket, pneumatic impact wrench or open-end 30# wrench
 P18T00087	7. Remove the the rear axle and hose assembly connected to service brake system.	24# Wrench

Reference picture	Operation step	Tools required (Remarks)
 P18T00088	8. Remove the steel pipe connected to the rear axle and centralized lubricating system.	Open-end 16# wrench
 P18T00089	9. Pre-lift the rear axle assembly with a sling. 10. Remove the bolts and locknuts for connecting the rear axle assembly to the rear frame. 11. Put the axle assembly onto the ground slowly with a lifting device. 12. Remove the axle assembly from the bottom of machine with a handling equipment, and then put it on the appliance for axle assembly.	Sling (2 tons) 36# socket, pneumatic impact wrench, 36# wrench,
 P18T00090	13. Place the axle assembly as shown in the left figure to make front swing frame support shaft upward, and rear swing frame support shaft downward.	

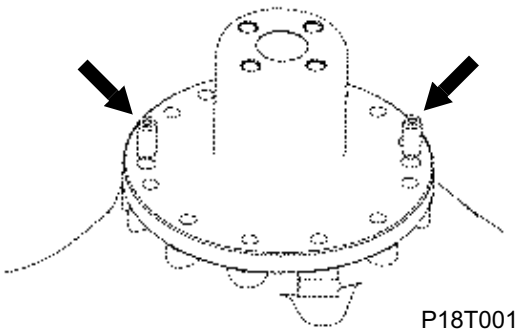
Reference picture	Operation step	Tools required (Remarks)
 P18T00091	14. Remove the seal ring and snap ring from the front swing support rack with a screwdriver.	Straight screwdriver
 P18T00092	15. Remove the front swing support rack from axle assembly with a lifting device and place it in a safe area.	Sling (2 tons)
 P18T00093	16. Place the axle assembly as shown in the left figure to make the rear swing support rack upward.	
 P18T00094	17. Remove the bolts, washers with a wrench or an pneumatic tool.	Open-end 18# wrench

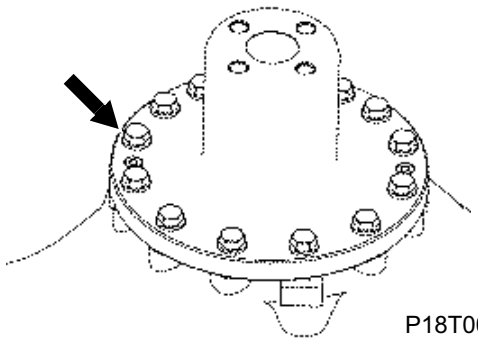
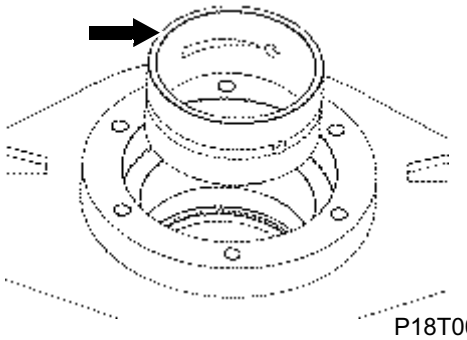
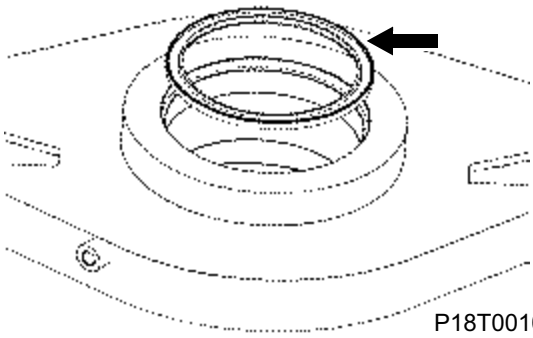
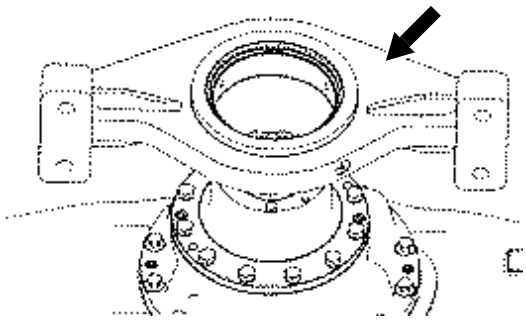
Reference picture	Operation step	Tools required (Remarks)
 P18T00095	18. Remove the cover.	Open-end 18# wrench
 P18T00096	19. Remove the thrust washer.	Straight screwdriver
 P18T00097	20. Remove the bolts and washer tightening the clamping plate.	Open-end 27# wrench or 27# socket, pneumatic impact wrench
 P18T00098	21. Remove the clamping plate.	Straight screwdriver

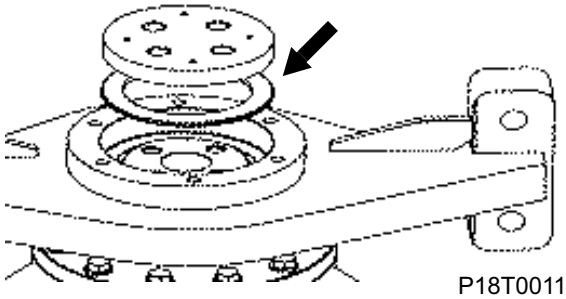
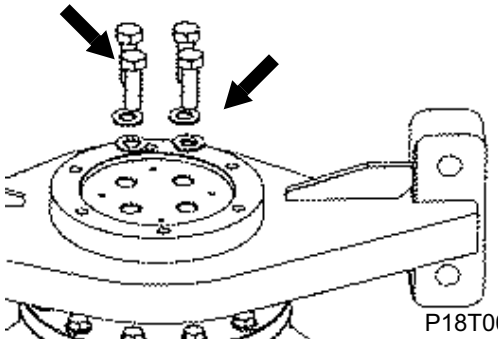
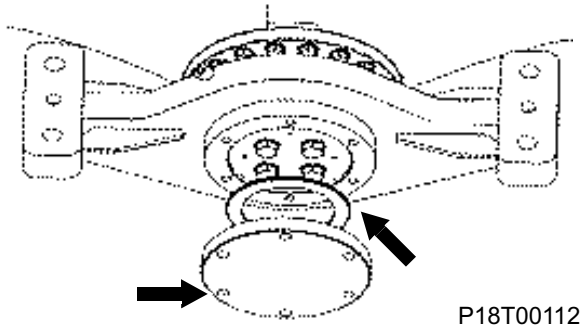
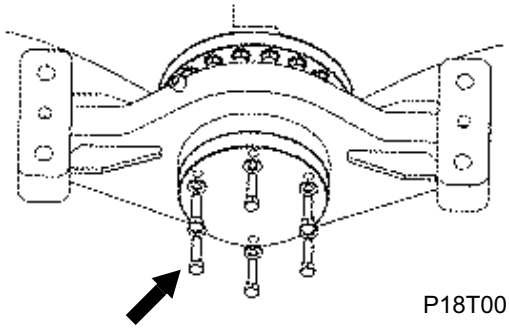
Reference picture	Operation step	Tools required (Remarks)
 P18T00099	22. Remove the thrust washer.	Straight screwdriver
 P18T00100	23. Remove the rear swing support rack with a lifting device.	Sling (2 tons)
 P18T00101	24. Screw the M8 bolt in the dowel and remove the dowel.	Open-end 13# wrench
 P18T00102	25. Remove the bolts and washers tightening the support shaft.	Open-end 21# wrench or 21# socket, pneumatic impact wrench

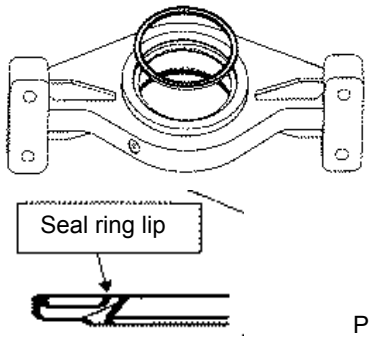
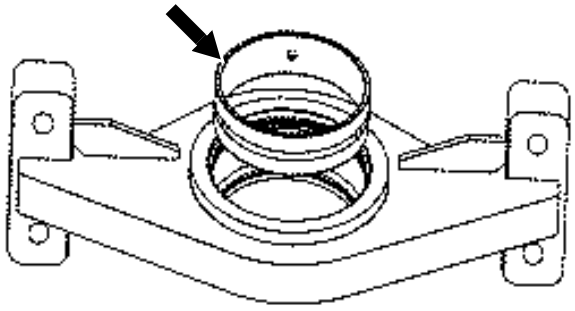
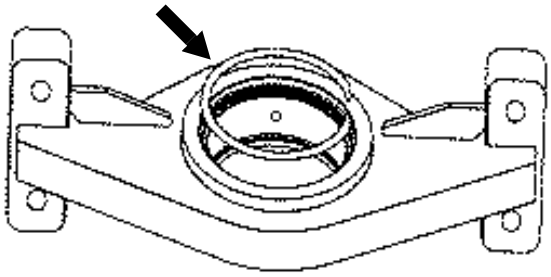
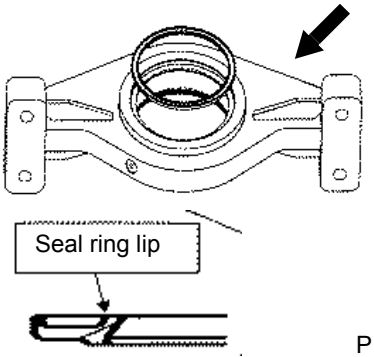
Reference picture	Operation step	Tools required (Remarks)
 P18T00103	26. Remove the support shaft with a lifting device.	Sling (2 tons)

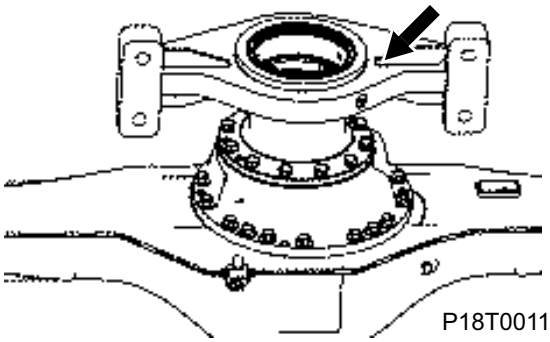
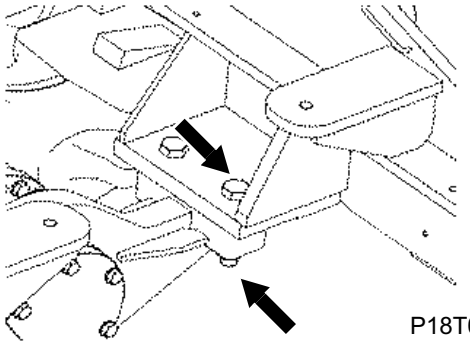
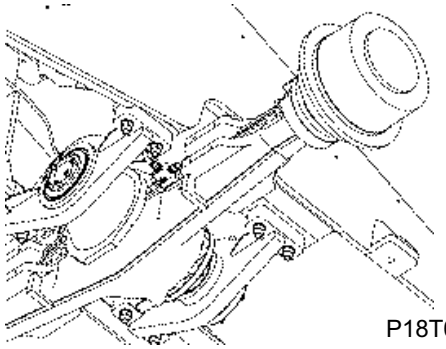
Installation of rear axle assembly

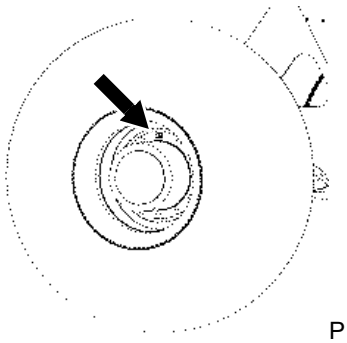
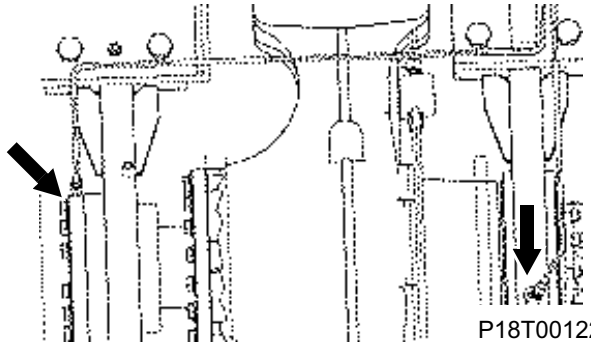
Reference picture	Operation step	Tools required (Remarks)
 P18T00104	1. Lift up the axle assembly and position it as shown in the left figure onto a special assembly device.	
 P18T00105	2. Wipe clean the mounting face between the support shaft and the axle case connected to it with a clean cloth, install the support shaft onto the axle and align two dowel pins accurately, strike it into the dowel pin with a copper bar.	Copper bar

Reference picture	Operation step	Tools required (Remarks)
 P18T00106	3. Apply thread lock sealant to thread portions of bolts, screw them into support thread holes by 2-3 threads by hand, and tighten them with an air gun. Tightening torque: 305±25Nm\ 22494±18.44 lbf•ft.	24# socket, pneumatic impact wrench, open-end 24# fixed torque spanner
 P18T00107	4. Horizontally place rear swing frame with the thread hole end upward, and install the bush into rear swing support rack.	
 P18T00108	5. Turn over swing frame by 180°, install seal ring and knock it to the end with nylon hammer.	Nylon hammer
 P18T00109	6. Turn over swing frame group by 180°, evenly apply molybdenum disulfide lithium base grease to bushing cone, and install rear swing frame group into spindle with lifting device.	

Reference picture	Operation step	Tools required (Remarks)
 P18T00110	7. Install thrust washer and pressing plate and align the holes well.	
 P18T00111	8. Apply thread lock sealant to thread portion of bolt, screw bolts and hard washers into the clamping plate thread holes by 2-3 teeth by hand, and drive them in symmetrically with pneumatic impact wrench with the tightening torque of 305±25Nm\ 224.94±18.44 lbf•ft.	24# socket, pneumatic impact wrench, open-end 24# fixed torque spanner
 P18T00112	9. Put a thrust washer and cover and align the holes well.	
 P18T00113	10. Apply thread lock sealant to thread of bolts, screw bolts and hard washers into cover thread holes by 2-3 teeth by hand, and drive them in symmetrically with pneumatic impact wrench with the tightening torque of 195±15Nm\ 143.81±11.06 lbf•ft.	21# socket, pneumatic impact wrench, open-end 21# fixed torque spanner

Reference picture	Operation step	Tools required (Remarks)
 P18T00114	11. Horizontally place front swing frame, and knock seal ring into front swing frame mounting hole to the end with nylon hammer. ⚠ **Caution: The seal ring lip faces outward.**	Nylon hammer
 P18T00115	12. Press the bushing into the front swing frame to the bottom ⚠ **Caution: The small hole of bushing must toward the lug end of front swing support.**	
 P18T00116	13. Install the snap ring into the groove with straight screwdriver.	Straight screwdriver
 P18T00117	14. Knock seal ring into front swing frame mounting slot to the end with nylon hammer; ⚠ **Caution:The seal ring lip faces outward.**	

Reference picture	Operation step	Tools required (Remarks)
 P18T00118	15. Evenly apply the molybdenum disulfide lithium base grease to bushing cone, and then lift and install the front swing support subassembly onto the bearing seat of the main transmission. 16. Place the axle assembly on a transport device with a lifting device, and right under mounting point of rear axle. 17. Install the axle assembly onto the rear frame with a lifting device and align the mounting holes.	Sling (2 tons)
 P18T00119	18. Install the mounting bolts, washers and nuts of the axle assembly and tighten them with an blower gun to 1122±90Nm\ 827.28±66.38 lbf•ft.	36# socket, pneumatic impact wrench, open-end 36# fixed torque spanner
 P18T00120	19. Install the axle and hose connecting the service brake pipe and tighten it to 37±2Nm\ 27.29±1.48 lbf•ft.	Open-end 24# wrench

Reference picture	Operation step	Tools required (Remarks)
 P18T00121	20. Lift up the tire with a hoist and install it onto the axle, and then install the rim nut and tighten it to 600±60Nm\ 442.5±44.25 lbf•ft.	30# socket, pneumatic impact wrench or open-end 30# fixed torque spanner
 P18T00122	21. Install the steel pipe connecting the centralized lubricating system and axle.	Open-end 16# wrench
	22. Lift the machine with a hoist, remove the support device, and put the machine onto the ground.	Sling (12 tons)

Disassembly and assembly of the drive axle

For disassembly and assembly of the drive axle in this machine, see "835H Drive Axle Service Manual" for details.

Fault Diagnosis and Troubleshooting Methods

	Fault features	Main reasons	Fault inspection and troubleshooting
1	The engine can not Activation	1. Start circuit of the base machine (such as power voltage, electric lock, startup relay and startup motor) has faults.	1. Check the circuit of the base machine.
		2. The lever is not at the neutral position.	2. Shift the lever to neutral position.
		3. The fuse to the control circuit on the base machine is burnt.	3. Replace the fuse.
		4. Poor contact of handle plug or the handle is failed.	4. Organize the plugs.
		5. Poor contact of controller plug or the controller is failed.	5. Organize the plugs.
2	Low shift pressure at all gears Low pressure	1. Oil pressure gauge is failed.	1. Replace the oil pressure gauge
		2. Insufficient tightening torque for bolt of shift control valve.	2. Tightening torque for M8-8.8 bolt of shift control valve is 26Nm.
		3. Spring of main pressure valve is broken.	3. Replace it.
		4. Gear shift pump is worn	4. Replace the gear shift pump.
		5. Fragments enter into shift control valve or valve is stuck	5. Replace the filter, and clean the control valve.
3	Too short shifting time at all gears	1. O-ring in throttle plug is damaged	1. Replace the O-ring
		2. The tightening torque of pressure control valve bolts is out of specified range	2. Tightening torque for M8-8.8 bolt of shift control valve is 26Nm.
4	Too long shifting time at all gears	1. Throttle plug is blocked.	1. Clean and dredge.
		2. Pressure control valve is stuck.	2. Wash and check.
5	The oil temperature of the torque converter is high	1. Oil temp sensor is failed.	1. Replace the part.
		2. Oil temperature gauge is failed.	2. Replace the part.
		3. Insufficient oil level.	3. Check oil level following the correct method.
		4. Air found in torque converter oil radiator.	4. Exhaust.
		5. Oil line from torque converter to radiator is poor.	5. Check oil pipe from radiator to gear box and radiator for blockage.
6	The oil temperature of the torque converter is high	1. Poor cooling capability of radiator.	1. 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.
		2. Back pressure valve of torque converter stuck.	2. Be careful to check hose connector from gear box to radiator. If hose connector enters housing too deeply, pushes spool of pressure valve and cause valve to stick, oil line will be getting blocked.

	Fault features	Main reasons	Fault inspection and troubleshooting
7	Vehicle does not move at any gear	1. Insufficient oil level.	1. Check oil level and add the oil by following the right operation.
		2. Elastic plate connecting engine and torque converter is torn, or power connection from torque converter to gear box input gear has faults.	2. Replace the elastic plate or replace the related damaged parts.
		3. Circuit failure of the complete machine.	3. Check the power voltage for abnormal and the cable for damage.
		4. Shift pressure is too low.	4. Refer to the troubleshooting above.
		5. Solenoid valve is damaged.	5. Check if the rated current of solenoid valve is 830 mA.
		6. Shift lever is damaged.	6. Refer to the troubleshooting for lever. Replace it.
		7. Controller is damaged.	7. Refer to the fault inspection of controller. Replace it

Testing and adjustment

Power Train Test

Detection point layout of torque converter - gear box assembly as is shown in Figure 3-25, and names and parameters of each detection point can be found in Table 3-7.

Figure 3-25 Measuring point layout

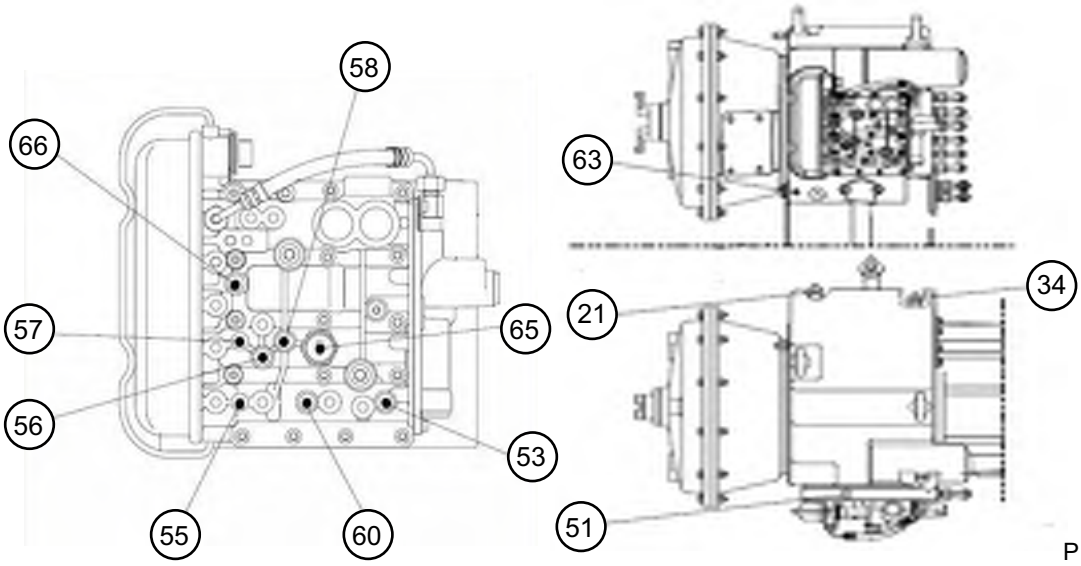


Table 3-7 Parameter list of the measuring point

S/N of the measuring point	Name of the measuring point	Theoretical value	S/N of the measuring point	Name of the measuring point	Theoretical value
21	Input sensor of the gear box	\	55	Reverse gear clutch	1.6-1.8MPa
34	Output sensor of the gear box	\	58	Gear 3 clutch	1.6-1.8MPa
51	Inlet pressure of torque converter	Opening pressure: 0.85	56	Gear 1 Clutch	1.6-1.8MPa
53	Forward gear clutch	1.6-1.8MPa\232-261psi	57	Gear 2 Clutch	1.6-1.8MPa
65	Pressure of shift control system	1.6-1.8MPa\232-261psi	63	Outlet pressure of torque converter	Opening pressure: 0.5
60	Gear 4 Clutch	1.6-1.8MPa\232-261psi			

Logical relations between gear states and working conditions of shift control valve solenoid valve can be found in Table 3-8.

Table 3-8 Logical relations between gear states and working conditions of shift control valve solenoid valve

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

Remarks: ● means the solenoid valve is energized;

Test Requirements:

Testing dynamic unbalance value

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

Hydraulic System

Basic Information

Safety precautions for hydraulic system

Compressed air

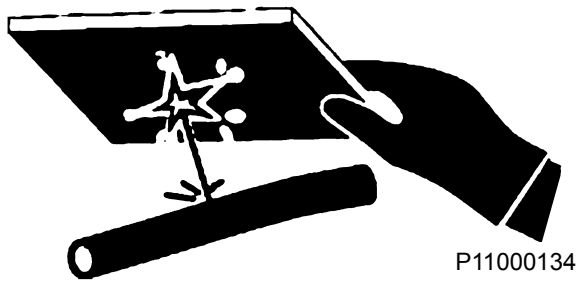
Compressed air may cause personal injury. When using the compressed air for cleaning, wear the mask, protection suits and shoes. Do not point the compressed air at yourself or anyone. The compressed air may penetrate the skin and lead to severe injury or even death. The maximum pressure of the compressed air for cleaning should be lower than 0.2 Mpa(29psi).

High-pressure solution

Prevent from being scalded by high-pressure oil. When overhauling or replacing the pipes of hydraulic system, check whether the pressure of system had been released. Hydraulic oil under pressure will damage your skin severely when it spattered on you.

Take care when remove the hydraulic pipelines or connectors. When the oil spouts, the released high-pressure oil may lead to the continuous movement of the hoses.

Please wear safety glasses and leather gloves when checking for leakages. Do not use bare hands to check the leakage but plate or paper plate.



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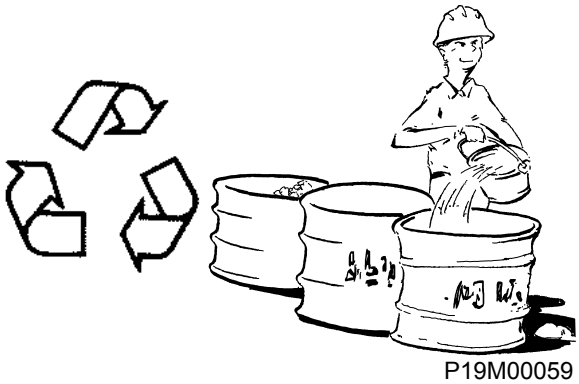
Even if the pressured liquid is leaked from a hole as small as a pin hole, it may penetrate the muscles and lead to death. If shot by the spouted high-pressure oil, please contact a doctor and take a medical treatment immediately.

Safe disposal of waste liquid

Inappropriate disposal of waste liquid will endanger environment and ecology. Please observe local laws and regulations when dispose the waste liquid.

It is mandatory and necessary to collect the liquid with containers spattered during the inspection, maintenance, test, adjustment and repair of machine. Proper container 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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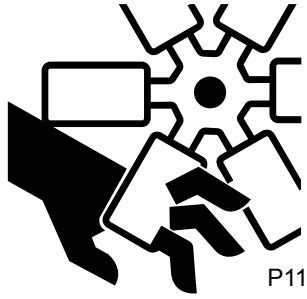
Precautions for accumulator application

The dangerous high-pressure nitrogen is contained in the accumulator, so 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 is defect with the housing and therefore safe use cannot be ensured.

The accumulator can only be filled with nitrogen other than oxygen, compressed air or other flammable air 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 shall 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 waste accumulator.

Preventing extruding or cut off

Do not have your hands, arms or any other bodies placed between moving parts. For example, between work implement and cylinder, between machine and working implement.

When working under the work implement, you shall support the equipment properly. 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, you shall fix it well after the repair.

Unless otherwise stated, any adjustment is not permitted to be performed when machine or engine is running. If the repair procedure must be performed when machine is running, do not let the machine stay in an unattended status. Arrange one operator seated in the seat and prepare to shut down the engine at any time.

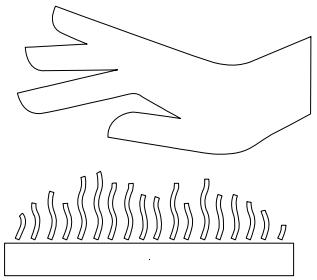
Do not use twisted or worn wire rope. Wear gloves during operation and move.

When forcing to extrude the bayonet, you shall make sure no one is standing around it. You shall wear safety goggles in order to protect your eyes.

When knocking object with hammer, please make sure the flying debris will not hurt others.

Oil

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


P11000148

At 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.

Release pressure of the system before disassembling all pipes, connector, 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 pipe or hose onto the machine.

Repair the loose or damaged pipe and hose of fuel and lubricant pipeline and 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, it shall be replaced.

- Damage or leakage of connector.
- 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 connectors.

Make sure all clamps, guard and heat shield are installed correctly to prevent shaking or overheating by friction with other parts.

Otherwise, it will generate toxic gases resulting in poisoning.

Precautions for accessories

It shall be installed and commissioned by qualified personnel; the operator shall 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 accessory, 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.

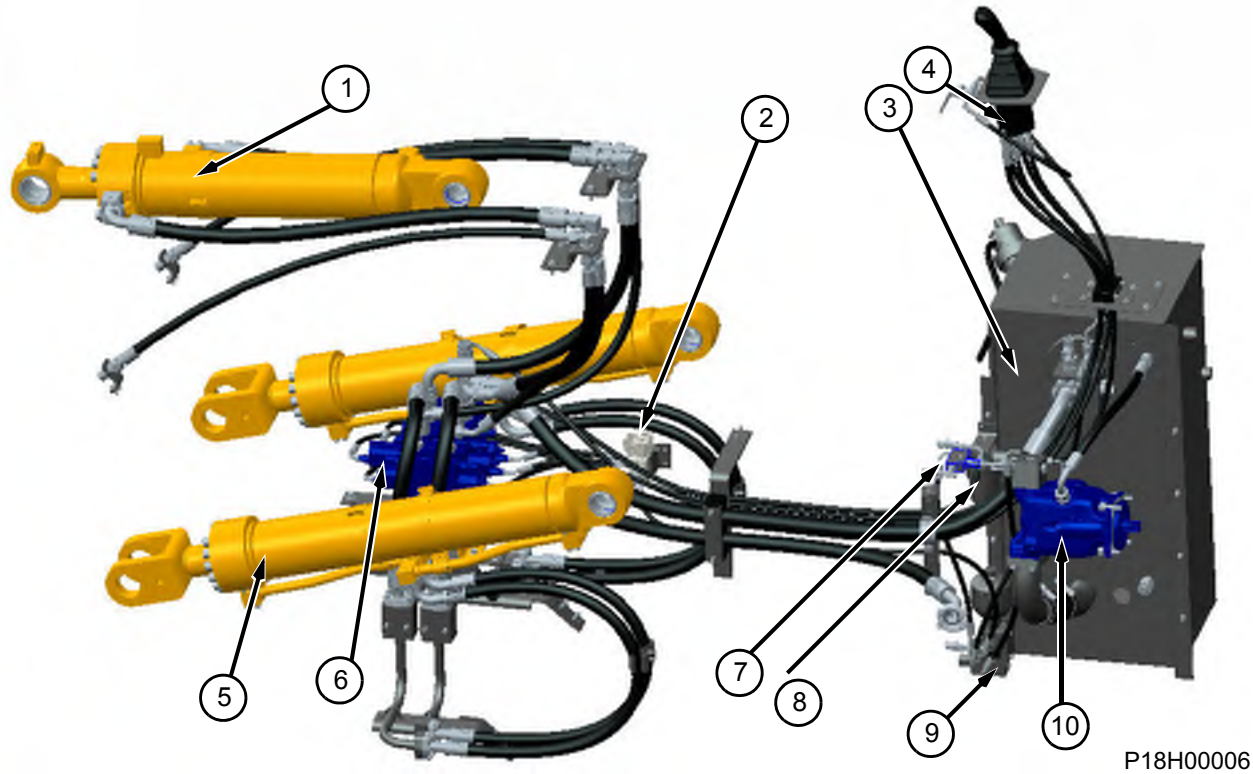
It is forbidden to make any refit on the accessories without permissions; otherwise you shall bear the responsibility.

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

Overviews of hydraulic system

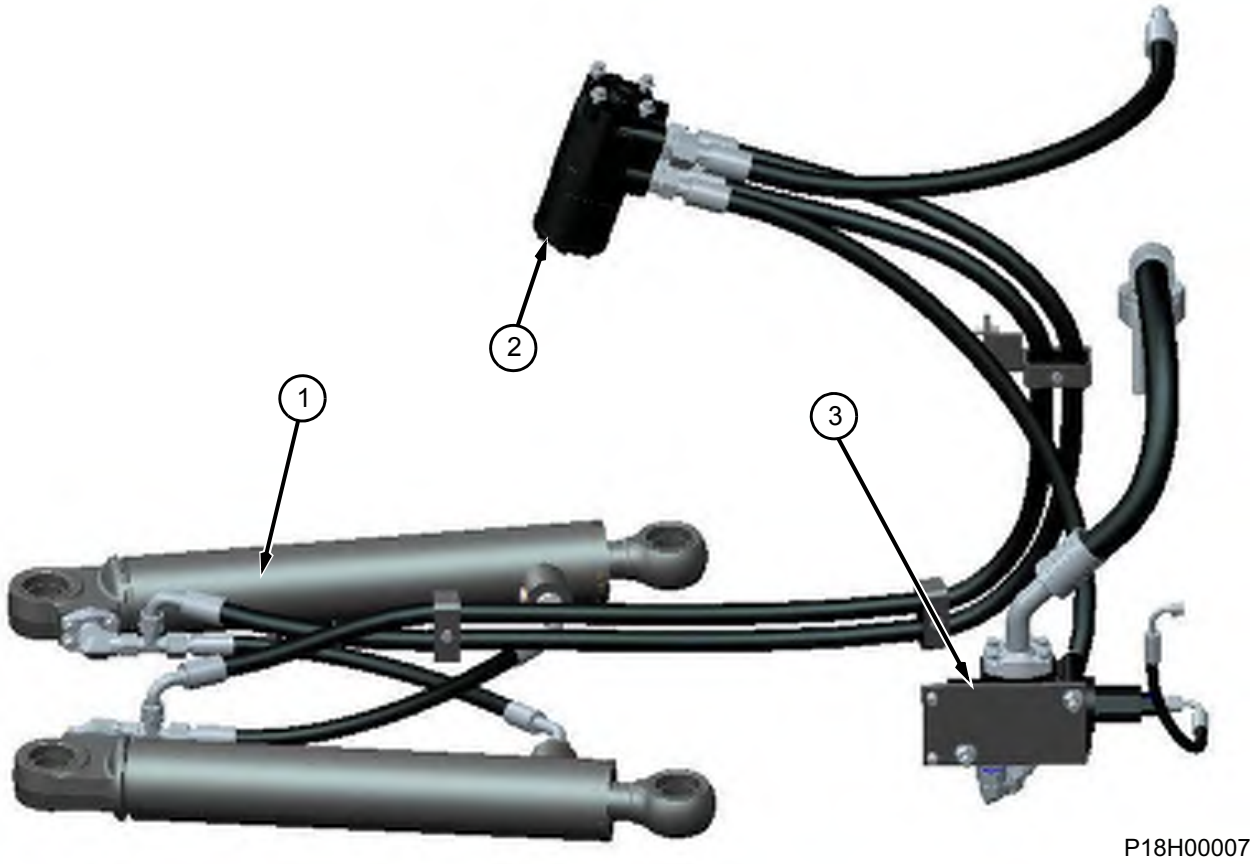
The hydraulic system is the actuator of the loader, mainly composed of four functional modules, i.e. a work implement hydraulic system, a steering hydraulic system, a brake system and a hydraulic cooling system. Where, the steering hydraulic system supplies oil for the steering circuit preferentially through the priority valve to ensure steering function; the work hydraulic system controls the coordinated actions of all oil cylinders through the control valve so that the loader can adapt to the requirements of different working conditions; the brake system can realize the function of service brake and parking brake; the hydraulic cooling system cools the hydraulic oil to ensure oil temperature within the reasonable scope of work. Layout of CLG835H-T4F hydraulic system is as follows:

CLG835H-T4f Work hydraulic system



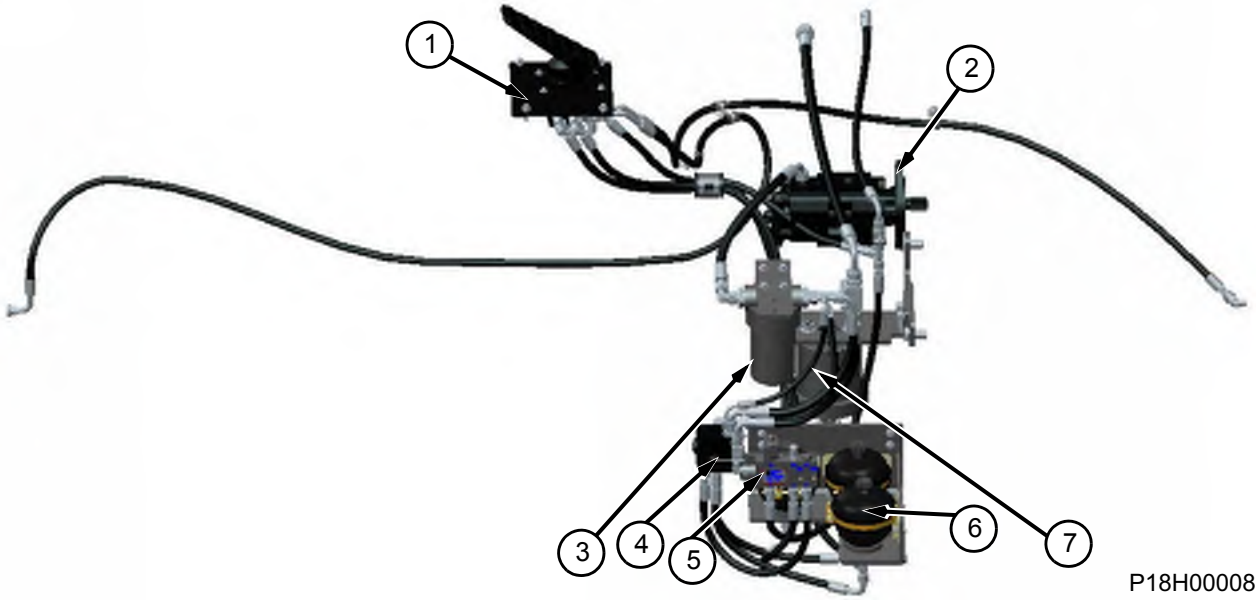
1. Bucket cylinder
2. Proportional pressure-reducing valve
3. Hydraulic oil tank
4. Pilot valve
5. Boom cylinder
6. Control valve
7. Shuttle valve
8. Pilot oil filter
9. Pilot oil supply valve
10. Plunger pump

CLG835H-T4f Steering hydraulic system



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

CLG835H-T4f brake system



1. Brake valve
2. Gear pump
3. High-pressure oil filter
4. Charge valve
5. Brake valve assembly
6. Accumulator assembly
7. Brake cylinder

Technical parameters of hydraulic system

Main technical parameters of CLG835H-T4F hydraulic system

	Items	Unit	Theoretical value
Work hydraulic system	Type		Single-pump variable hydraulic system
	Working pressure of the system	Mpa\psi	19\2755
	Pilot working pressure	Mpa\psi	3.5\507.5
	Displacement of working pump	ml/r\cc/r	100\100
	Rated speed of the working pump	r/min	2200
	Boom cylinder (cylinder number -- cylinder bore × stroke)	mm\in	2-φ125×728\2-φ4.92×28.66
	Bucket cylinder (cylinder number - cylinder bore × stroke)	mm\in	1-φ140×520\1-φ5.51×20.47
Steering hydraulic system	Type		Articulation frame and full hydraulic steering system
	Working pressure of the system	Mpa\psi	17.5
	Displacement of steering pump	ml/r\cc/r	100\100
	Rated speed of the steering pump	r/min	2200
	Metering pump	ml/r\cc/r	739/739
	Amplification ratio of metering pump		1.6
	Steering angle	°	38°±1°for both left and right sides
	Steering cylinder (cylinder number -- cylinder bore × stroke)	mm\in	2-φ80×420\2-φ3.15×16.54
Service brake system	Type		Dual-circuit full-hydraulic wet brake
	System oil pressure	Mpa\psi	6±0.4\870±58
Parking & emergency brake system	Type		Push-button hydraulic brake
	System oil pressure	Mpa\psi	16\2320
Working medium	Hydraulic oil	L\US gal	105\27.7
	Cleanliness	NAS1638	≤Grade 9

Hydraulic System Principle Schematic

Refer to attached drawing in Chapter 9 for schematic of hydraulic system

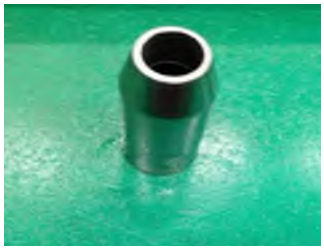
Universal tools and tooling for hydraulic maintenance

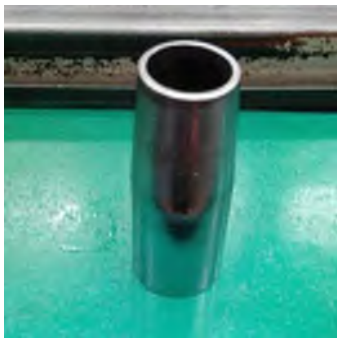
Common tools table

Name	Specifications (Qty.)
Open-end wrench	8#, 13#, 15#, 17#, 19#, 21#, 22#, 24#, 27#, 30#, 32#, 36#, 41#, 44#, 46#
Straight screwdriver	
Cross screwdriver	
Pliers	
Torque wrench	20~100N•m\ 14.75~73.75lbf•bt, 90~300N•m\ 66.38~221.25lbf•bt, 160~680N•m\ 118~501.5lbf•bt
Inner hexagon spanner	One set in metric standard and one set in British standard
Lifting equipment	2t
Sling	2t
Caution: the removed standard parts should be placed with relevant material together to avoid being mixed.	

Special tools and tooling for hydraulic maintenance

List of special tools and tooling for boom and bucket cylinder

S/N	LiuGong No.	Tool description	Figures	Purpose	Quantity for full-time service dealers
1	SP130702	Pry bar		For assembling the O-ring of piston	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
4	SP130915	Guide sleeve		For assembling the O-ring of piston rod	1

S/N	LiuGong No.	Tool description	Figures	Purpose	Quantity for full-time service dealers
5	SP130700	Guide sleeve		For assembling cylinder head assembly 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

S/N	LiuGong No.	Tool description	Figures	Purpose	Quantity for full-time service dealers
10	SP130929	Steel wire scissors		For snap ring of cylinder head	

List of special tools and tooling for steering cylinder:

S/N	LiuGong No.	Tool description	Figures	Purpose	Quantity for full-time service dealers
1	SP130702	Tooling for press fitting of friction ring		For pressing and fitting the friction ring onto piston	1
2	SP129313	Tooling for compressing friction ring		For compressing the friction ring	1
3	SP130917	Guide sleeve		For assembling cylinder head assembly onto piston rod	1
4	SP130915	Guide sleeve		For assembling the O-ring of piston rod	1

S/N	LiuGong No.	Tool description	Figures	Purpose	Quantity for full-time service dealers
5	SP130700	Tooling for press fitting of bushing		For assembling the bushing onto cylinder block	1
6	SP129308	Cylinder block support		For supporting the cylinder block and pressing the bushing to the cylinder block	1
7	SP130698	Bushing detection		For detecting the size of bushing which is 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	

S/N	LiuGong No.	Tool description	Figures	Purpose	Quantity for full-time service dealers
10	SP130929	Hook spanner		For pre-tightening the cylinder head assembly	
11	SP129306	Socket		For locking the cylinder head assembly	

Structure Function Principle

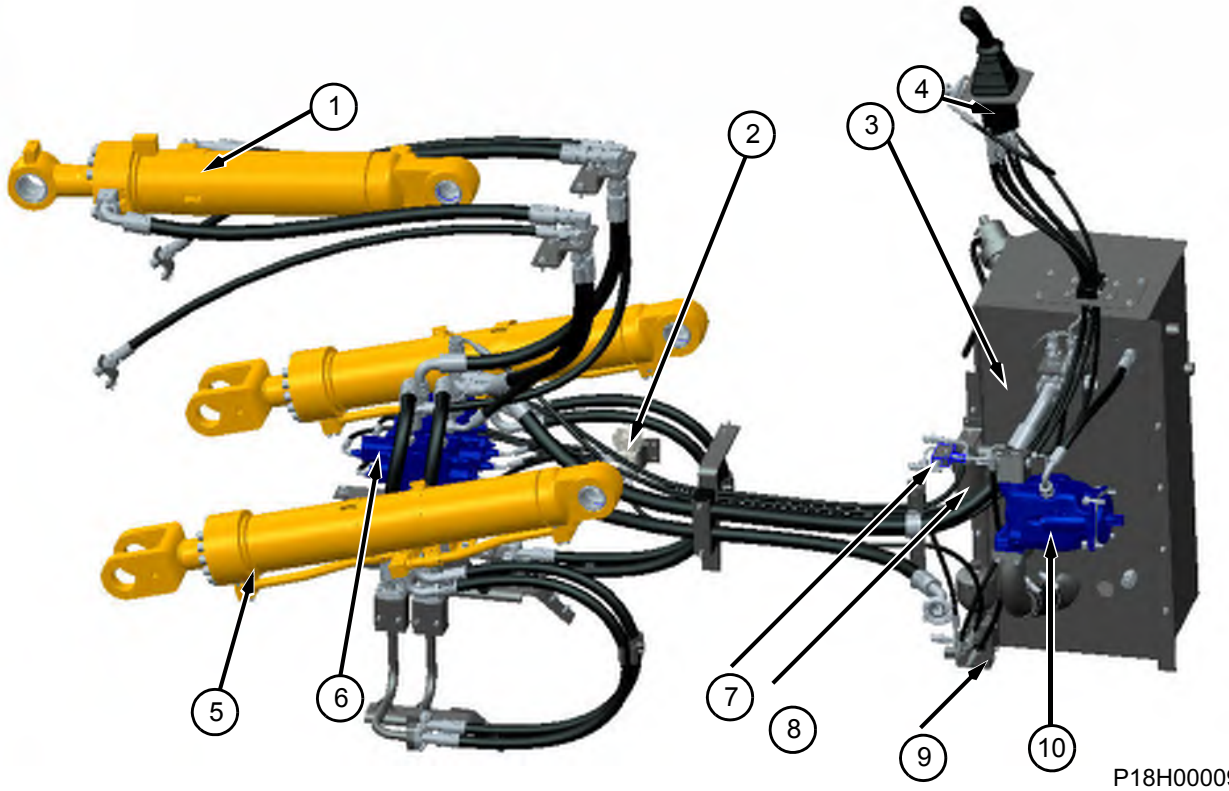
Work hydraulic system

A: Overview-components and position

The work hydraulic system is used to control the actions of the boom and bucket of the loader work implement and other additional work implement. It is a single-pump load sensing system (see schematic diagram of work hydraulic system). It is composed of one hydraulic oil tank, one variable plunger pump, one load sensing control valve and oil cylinders and pipelines of all work implements. The hydraulic oil from the tank flows into the plunger pump, after passing through the priority valve, it flows into the control valve by which controls telescoping of all cylinders so as to further control the loader work implement's actions of tilting back and dumping of the bucket and raise, lowering and floating lowering of the boom.

Layout drawing of CLG835H_T4f work hydraulic system is as follows: refer to attached drawing in Chapter 9 for schematic of hydraulic system

Layout drawing of work hydraulic system



1. Bucket cylinder
2. Proportional pressure-reducing valve
3. Hydraulic oil tank
4. Pilot valve
5. Boom cylinder
6. Control valve
7. Shuttle valve
8. Pilot oil filter
9. Pilot oil supply valve
10. Plunger pump

1. When there is no action in the work hydraulic system, i.e. boom reversing valve and bucket reversing valve in the control valve are in neutral position, and variable plunger pump is at minimum displacement position, the variable pump hardly has oil to output (only the minimum displacement required to keep self-running), oil passages of the control valve connected to both of big and small cavities of the boom cylinder and bucket cylinder are sealed, and boom and bucket are kept in original position.
2. Operate the boom reversing valve controlled by the pilot valve to lift, lower or float the boom and manipulate the bucket tilting reversing valve controlled by the pilot valve to tilt the bucket forward or backward. There is an automatic leveling device of bucket installed on bucket hydraulic cylinder.
3. Big and small cavities double-acting safety valves are installed in oil lines of the control valve connected with big and small cavities of the bucket cylinder to protect the big and small cavities of the bucket cylinder from overload and fill oil and play the role of stabilizing system work and protecting the relevant elements of the system.

B: Technical parameters of work system

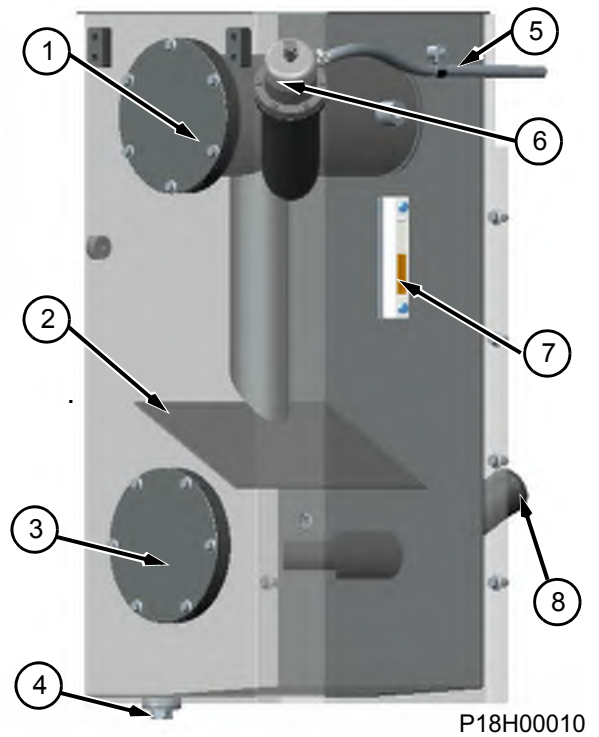
Items	Parameters
System pressure	19±0.3Mpa\2755±43.5psi
System flow	210L/min@2200r/min
Pressure of overload valve at A1 port	23±0.3MPa\3335±43.5psi
Pressure of overload valve at B1 port	23±0.3MPa\3335±43.5psi
Pressure of overload valve at A2 port	23±0.3MPa\3335±43.5psi
Pressure of overload valve at B2 port	23±0.3MPa\3335±43.5psi
Pressure of overload valve at A3 port	23±0.3MPa\3335±43.5psi
Pressure of overload valve at B3 port	23±0.3MPa\3335±43.5psi
Pressure of main safety valve	21±0.3MPa\3045±43.5psi

Hydraulic oil tank

Installation position and functional structure

The hydraulic oil tank is side-sited type, which is located on the rear frame in the middle of a machine, the right side of a cab. The main function is to store the hydraulic oil required for work cycle of the hydraulic system and precipitate the pollutant of oil in hydraulic 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:

Structural diagram of hydraulic oil tank



P18H00010

1. Oil return chamber and oil return filter
2. Baffle
3. Washing port
4. Oil drain hole
5. Ventilated oil conduit
6. Oil filler, oil filter element and breather
7. Sight glass
8. Oil suction port

In which, the oil return chamber 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 in the hydraulic oil tank resulted from too fast oil return. The oil return 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. The baffle is used to form isolation circulation for cold and hot oil in the oil tank to prevent oil shake from generating large quantities of bubbles and isolate oil suction port from oil return port to ensure gas separates out of hydraulic oil return. Washing port is used to clean the dirt in the oil tank. Oil drain hole is used to drain fluid out of oil tank when replace oil or clean oil tank. Oil suction port is used to supply oil for hydraulic pump. The ventilated oil conduit is used for exhalation of a breather and to lead the oil vapor exhaled by the breather to underbody. 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. The function of the breather is that it 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.

Plunger pump

Main technical parameters

Items	Parameters	Remarks
Rated pressure	19Mpa\ 2755psi	
Displacement	100ml/r\ 100cc/r	
Direction of rotation	Left rotation	
Rated speed	2200rpm	
Pressure of the shut-off valve	20Mpa\ 2900psi	
Pressure of flow compensator valve	2.6Mpa\ 377psi	

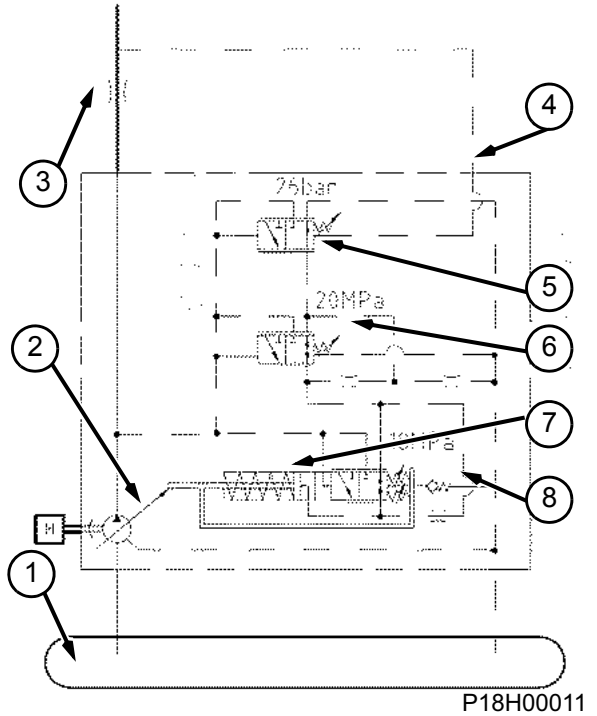
Items	Parameters	Remarks
Operating fluid	Anti-wear hydraulic oil	46#

Structure and working principle of plunger pump

Same pump is used for the plunger pump of work hydraulic system and that of steering hydraulic system, that is, work hydraulic system and steering hydraulic system share one pump. The plunger pump is located under cab and installed on the right power take-off of the transmission and tightened it by stud and nut. It is driven by engine via torque converter and transmission to supply oil for work and steering hydraulic system.

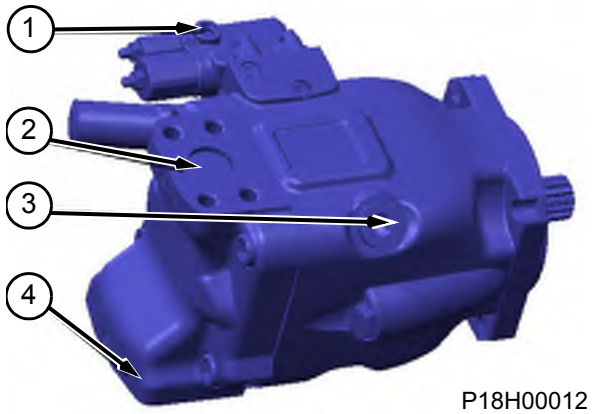
Outline diagram and working principle of plunger pump:

Schematic of working pump



1. Hydraulic oil tank
2. Swashplate
3. Control valve (simplified)
4. Load sensing port
5. Flow compensation valve
6. Pressure shut-off valve
7. Variable cylinder
8. Power control valve

Exterior drawing of working pump



1. Load sensing port
2. Oil outlet
3. Housing return oil
4. Oil suction port

1. Before starting, the pressure of pump opening P=0, the pressure of load sensing port 4 P_{LS}=0, the pressure difference between both ends of control valve 3 ΔP= P- P_{LS} =0 and the swashplate is in the maximum displacement position.
2. After starting, when the control valve 3 has no opening, P_{LS}=0, the pressure P of pump opening acts on left end of flow compensator valve 5, the flow compensator valve 5 moves rightwards, oil enters big cavity of variable cylinder 7, the swashplate turns anticlockwise and the displacement of pump is reduced to the minimum. The pressure P of the pump opening is generally set to 2.6Mpa\ 377psi at this time, i.e. the setting pressure of the flow compensator valve 5, in order to improve the response speed of the system and compensate a small amount of leak.
3. When the control valve 3 has an opening to some extent, P_{LS} occurs, ΔP starts to decrease from the maximum value, the flow compensator valve 5 moves leftwards under the action of its spring force P_K. The big cavity of differential variable cylinder 7 returns oil gradually, the swashplate turns clockwise and the displacement of pump starts to increase.
4. When the opening of the control valve 3 increases further, throttling effect fades, ΔP decreases, flow compensator valve 5 moves leftwards under the action of its spring force P_K, the big cavity of differential variable cylinder 7 returns oil gradually, the swashplate turns clockwise and the displacement of pump starts to increase. ΔP is also increased with the increase of displacement (flow), when flow of the system is stable, ΔP= P_K = fixed value, otherwise, balance of the flow compensator valve 5 will be disturbed.
5. When the opening of the control valve 3 decreases, throttling effect becomes enhanced, ΔP increases, the flow compensator valve 5 moves rightwards under the action of ΔP, oil enters big cavity of variable cylinder 7, the swashplate turns anticlockwise and the displacement of pump is reduced to the minimum. When the system is stable, ΔP= P_K = fixed value.
6. When the load pressure increases up to the setting pressure value of the system, the pressure shut-off valve 6 opens the pump pressure oil way to the big cavity of variable cylinder 7 so as to reduce the displacement of the pump rapidly. As shown, the action of the pressure shut-off valve has the priority to the flow compensator valve 5, that is, it works as long as the pressure reaches the setting value.
7. From above, we can learn that the flow compensator valve is in balanced state when the flow of the system is stable: ΔP= P_K = fixed value (without change). Therefore, the displacement of the pump is only related with the opening of main control valve other than the load (i.e. pressure). This is the pump load sensing control.
8. When pressure of pump opening reaches setting value, power control valve 8 moves rightwards, pressure oil at pump opening enters into big cavity of variable cylinder 7 via power control valve 8, swashplate turns anticlockwise and the displacement of pump starts to decrease.

Boom cylinder

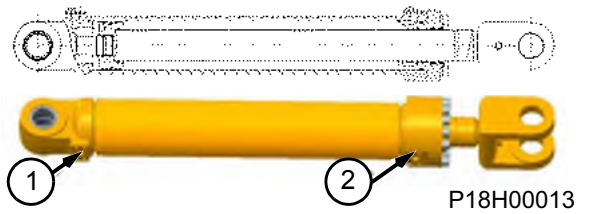
Main technical parameters

Items	Parameters	Remarks
Cylinder bore (mm\in)	125\4.92	
Rod diameter (mm\in)	80\3.15	
Stroke (mm\in)	728\28.66	
Minimum mounting distance (mm\in)	1287\50.67	

Structure and working principle of boom cylinder

The boom cylinder, which is installed at the articulated joint of boom cylinder on the front frame and the articulated joint of boom cylinder, is the actuator of the work hydraulic system. It realizes the raise and lowering of the bucket through pushing the boom to move up and down by piston rod telescoping actions of the boom oil cylinder.

Structure of boom cylinder



1. Oil port of big cavity
2. Oil port of small cavity

Bucket cylinder

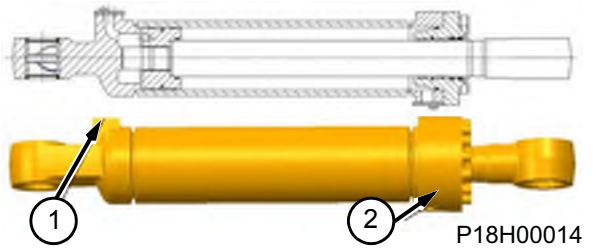
Main technical parameters

Items	Parameters	Remarks
Cylinder bore (mm\in)	140\5.51	
Rod diameter (mm\in)	80\3.15	
Stroke (mm\in)	520\20.47	
Minimum mounting distance (mm\in)	1110\43.70	

Structure and working principle of bucket cylinder

The bucket cylinder, which is installed at the articulated joint of the front frame and bucket cylinder and the articulated joint of bucket lever and cylinder, is the actuator of the work hydraulic system. It realizes the tilting forward and backward of the bucket through the movement of bucket lever pushed by piston rod actions of the bucket cylinder.

Structure of bucket cylinder



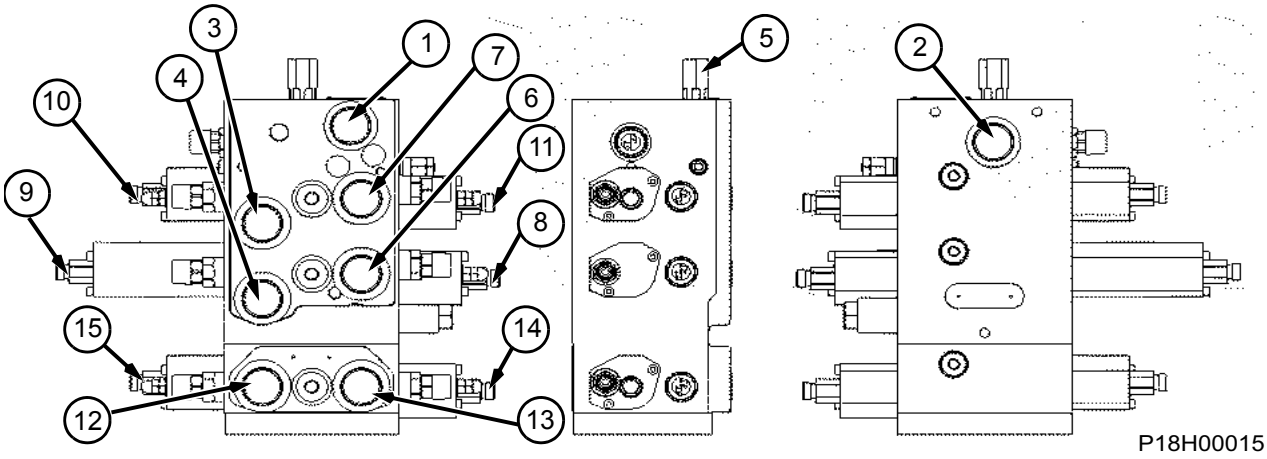
1. Oil port of big cavity
2. Oil port of small cavity

Control valve

Main technical parameters

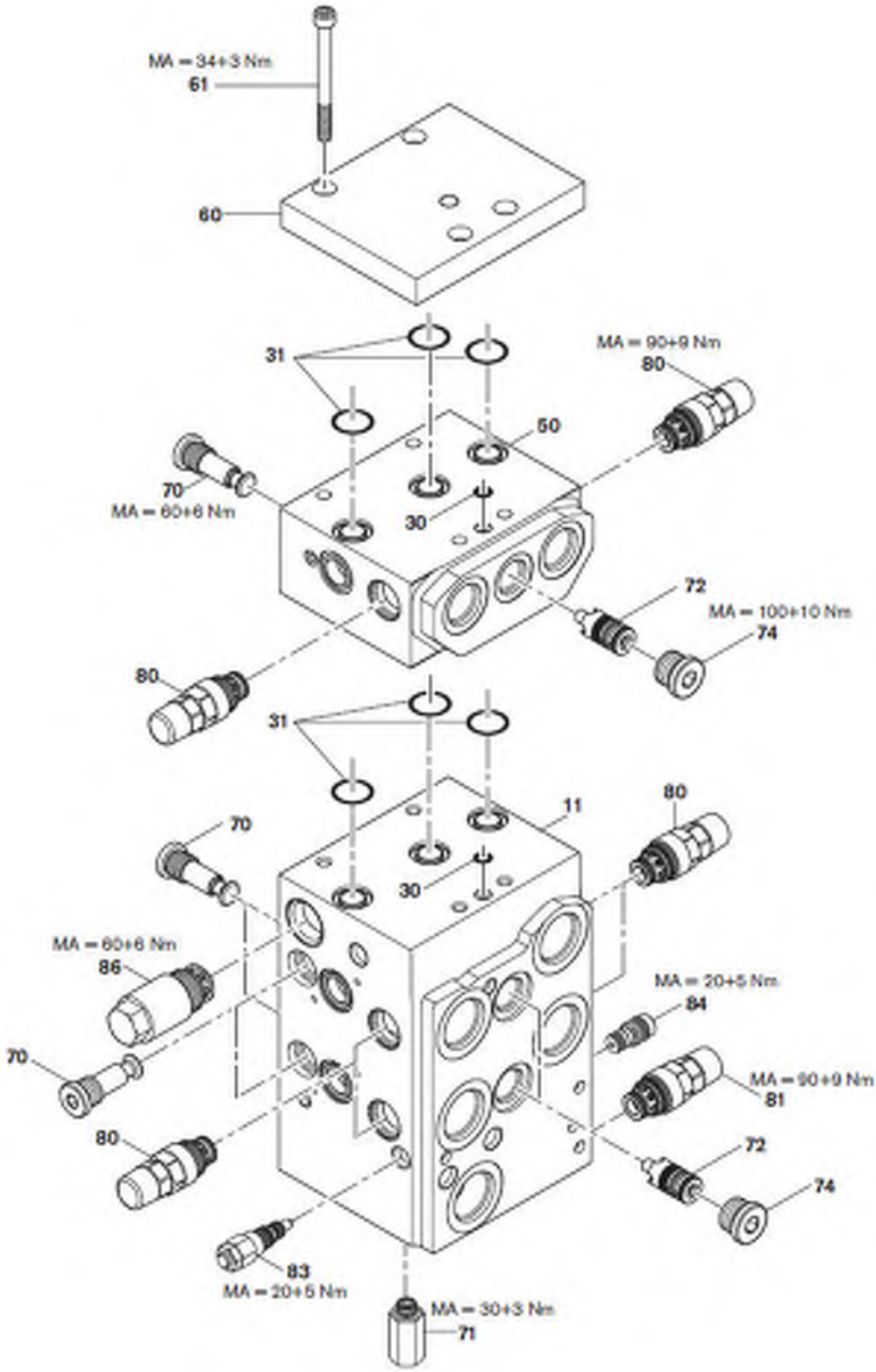
Items	Parameters	Service conditions	Remarks
Rated flow (L/min\ US gpm)	180\ 47.56	/	/
Pressure loss under rated flow △P (Mpa\psi)	2.5\ 362.5		
Setting pressure of main safety valve (MPa\psi)	21\ 3045	/	/
Pressure of safety valve of bucket cylinder small cavity (Mpa\ psi)	23\ 3335	/	/
Pressure of safety valve of bucket cylinder big cavity (Mpa\ psi)	23\ 3335	/	/
Operating fluid	Anti-wear hydraulic oil	HM46/HV46	/

Structure and working principle of control valve



1. Control valve oil return port
2. Control valve oil inlet
3. Oil outlet of bucket big cavity
4. Oil outlet of boom big cavity
5. Control valve LS port
6. Oil outlet of boom small cavity
7. Oil outlet of bucket small cavity
8. Boom lowering pilot port
9. Boom lifting pilot port
10. Bucket tilting and retracting pilot port
11. Bucket tilting and tipping pilot port
12. Oil outlet of multi-functional way big cavity
13. Oil outlet of multi-functional way small cavity
14. Oil outlet of multi-functional way small cavity
15. Oil outlet of multi-functional way big cavity

Exploded view of control valve



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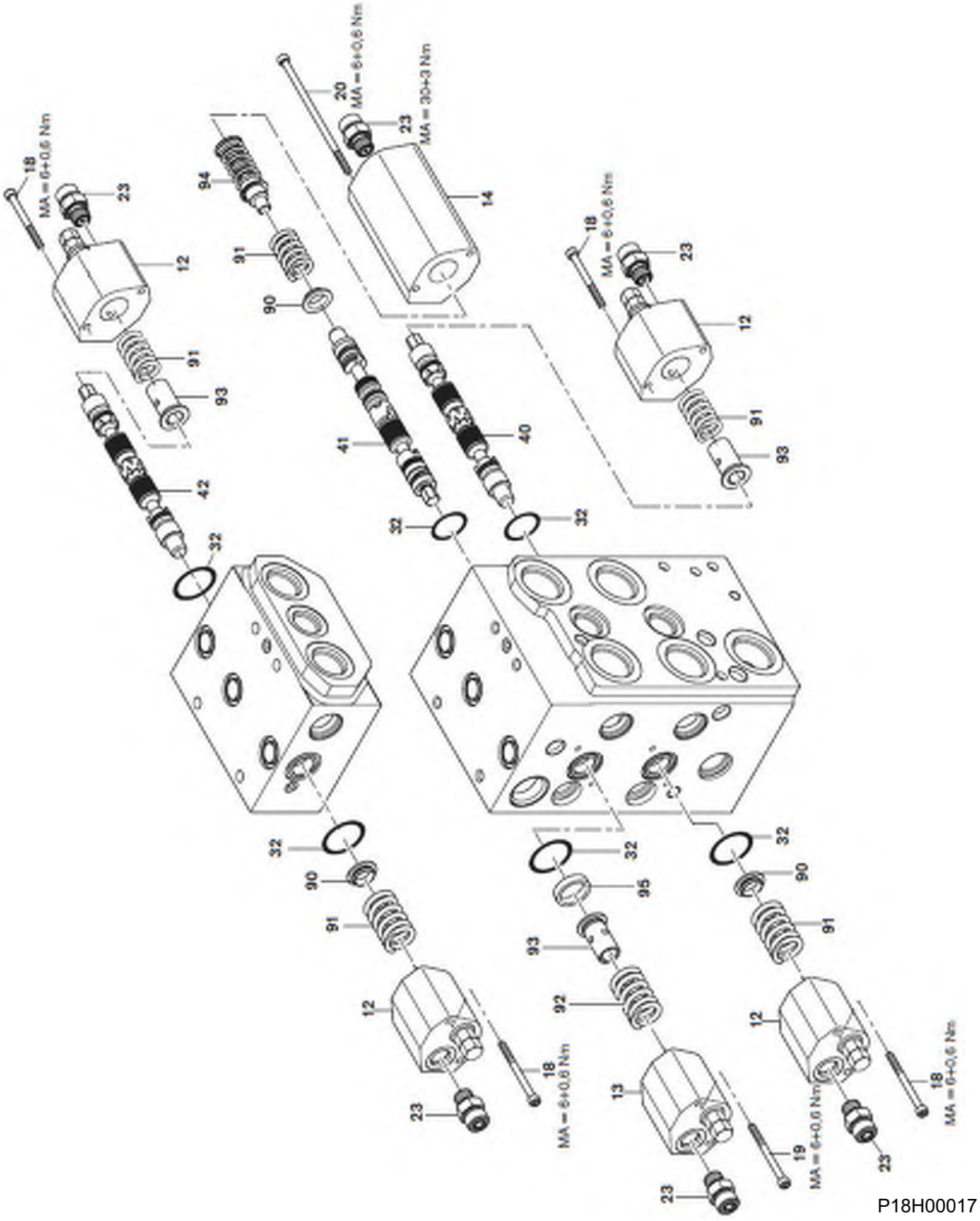
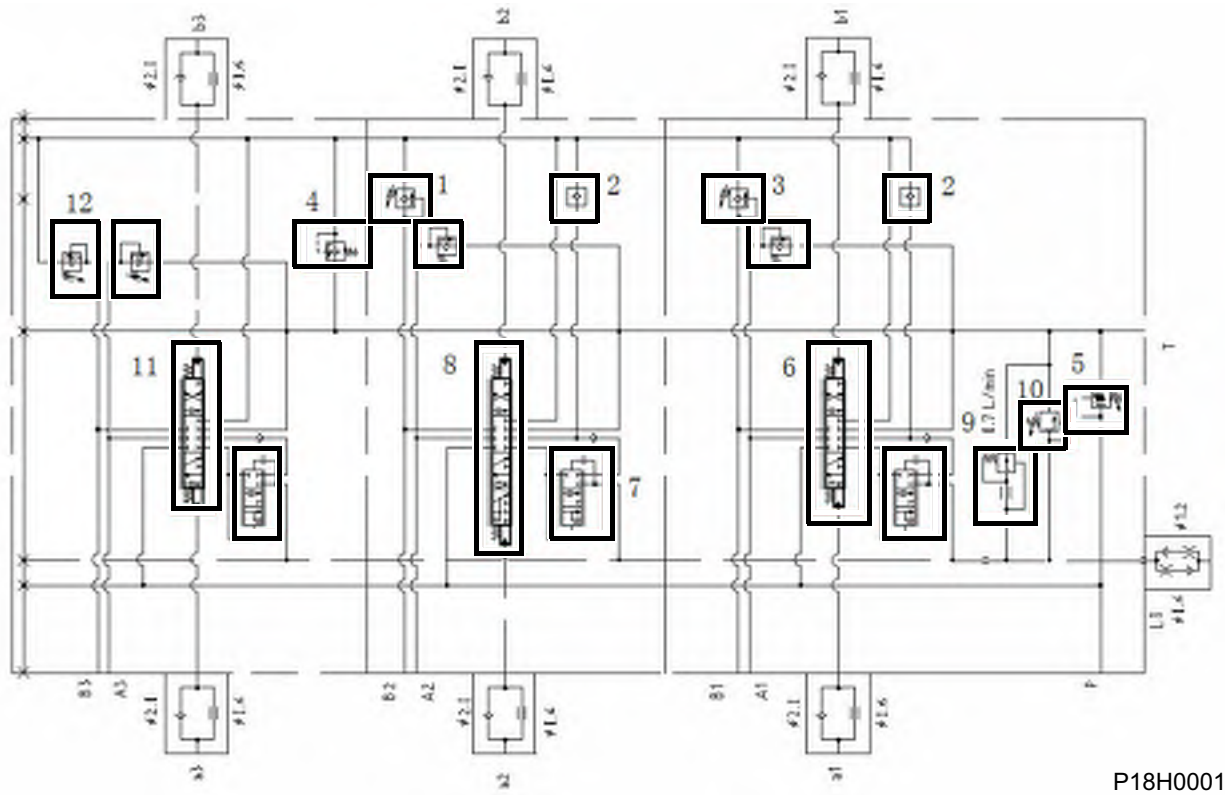
Exploded view of control valve



Hydraulic schematic of control valve



1. Boom overload valve
2. Oil supplement valve
3. Bucket overload valve
4. Backpressure valve
5. Main safety valve
6. Bucket way
7. Pressure compensation valve
8. Boom
9. LS flow controller
10. LS Relief valve
11. Multi-functional way
12. Multi-functional union overload valve

Installation position and working principle

The control valve is installed on the mounting board in front frame. The function of the control valve is to control moving direction and speed of the bucket cylinder and the boom cylinder by changing the flowing direction of oil so as to satisfy loader's working requirements under different work conditions.

Configuration: whole tandem closed neutral position slide valve;

Oil lines type: cascade and paralleling bucket tilting priority ;

Main components: bucket reversing valve, boom reversing valve, safety valve, pressure compensation valve, LS relief valve, LS flow controller, etc.

The bucket reversing valve is a three-stack valve, which can control three actions of the bucket, i.e. to tilting forward, backward and keeping.

The boom reversing valve is a four-stack valve, which can control four actions of the boom, i.e. raising, keeping, lowering and floating lowering.

The safety valve controls the pressure of system. When the pressure of system exceeds the setting value, oil will overflow to the oil tank to protect system from being damaged.

Pressure compensation valve, operated in multiple circuit, can guarantee that the flow of main valve can not be changed by different loads so that the system has the performance of composite operation.

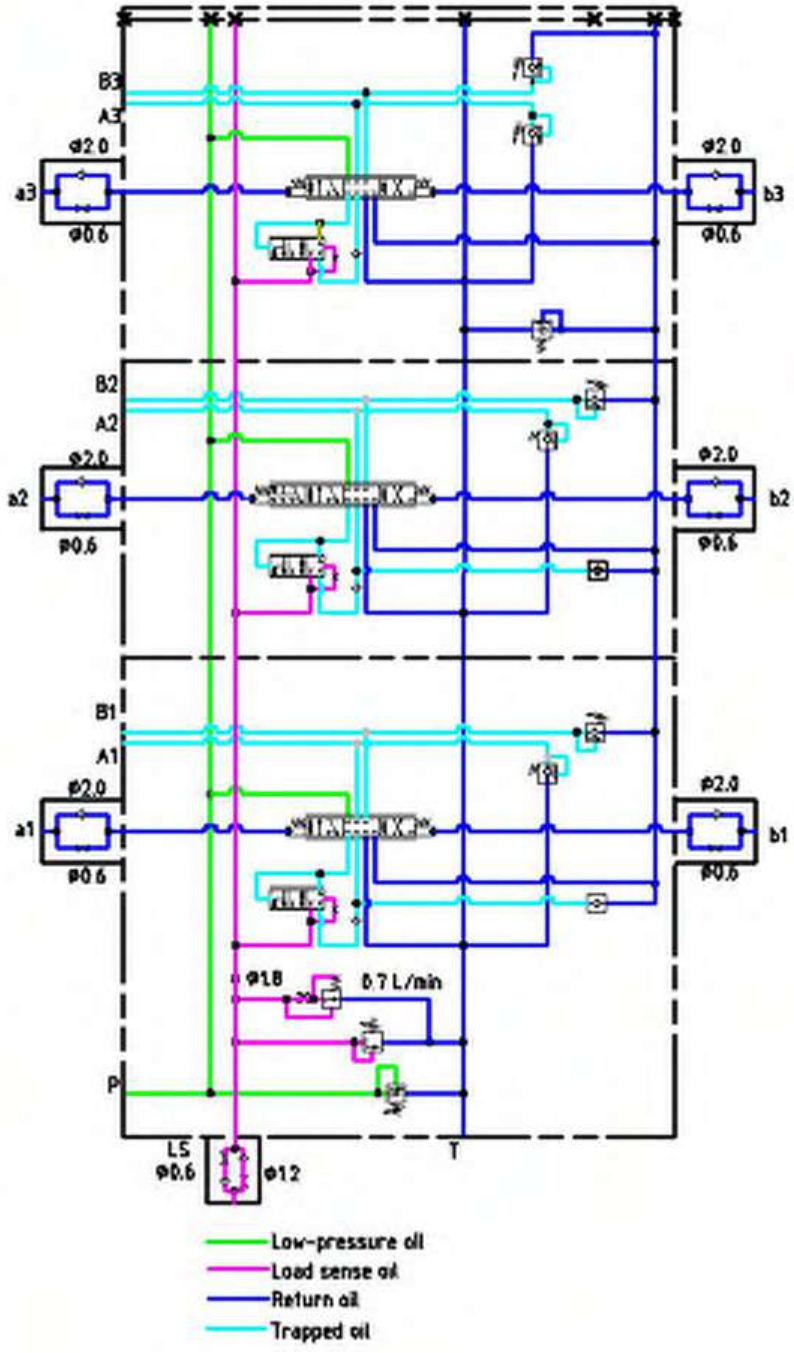
LS relief valve controls the pressure of LS oil line. When the LS pressure exceeds the setting value, oil will overflow to the oil tank. The pressure of work system is the sum of setting pressure of LS relief valve and the pump flow control valve in work hydraulic system.

LS flow controller can guarantee that the LS oil line has continuous flow and improve the response speed of LS oil line.

Back pressure valve increases the oil return pressure at the time of bucket dumping and boom descending and improves the stability of bucket dumping and boom descending.

1. Neutral position of control valve

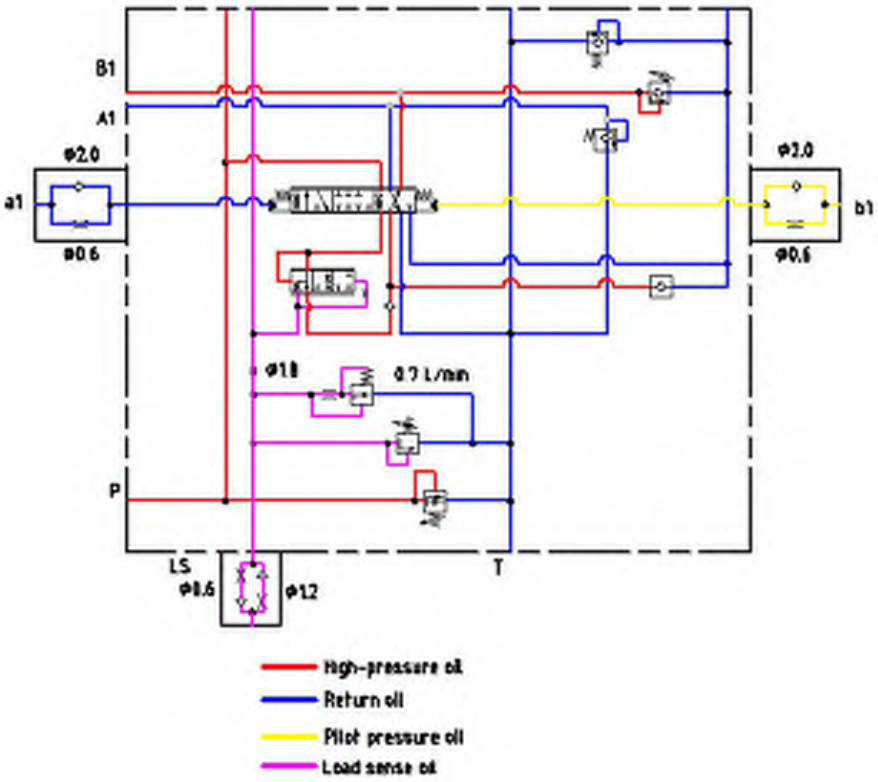
When the control valve is in neutral position, bucket valve rod 6 and boom union valve rod 8 are in neutral position. As for the closed neutral position structure, LS pressure is zero, the variable pump under the action of pump outlet pressure is in minimum displacement and the pump is in low-pressure standby state.



P18H00019

As for the closed neutral position structure of valve rod, oil line between big & small cavities of cylinder and valve rod is kept closed, the pressure of control valve oil inlet, which is the same as that of pump outlet, is in low-pressure state.

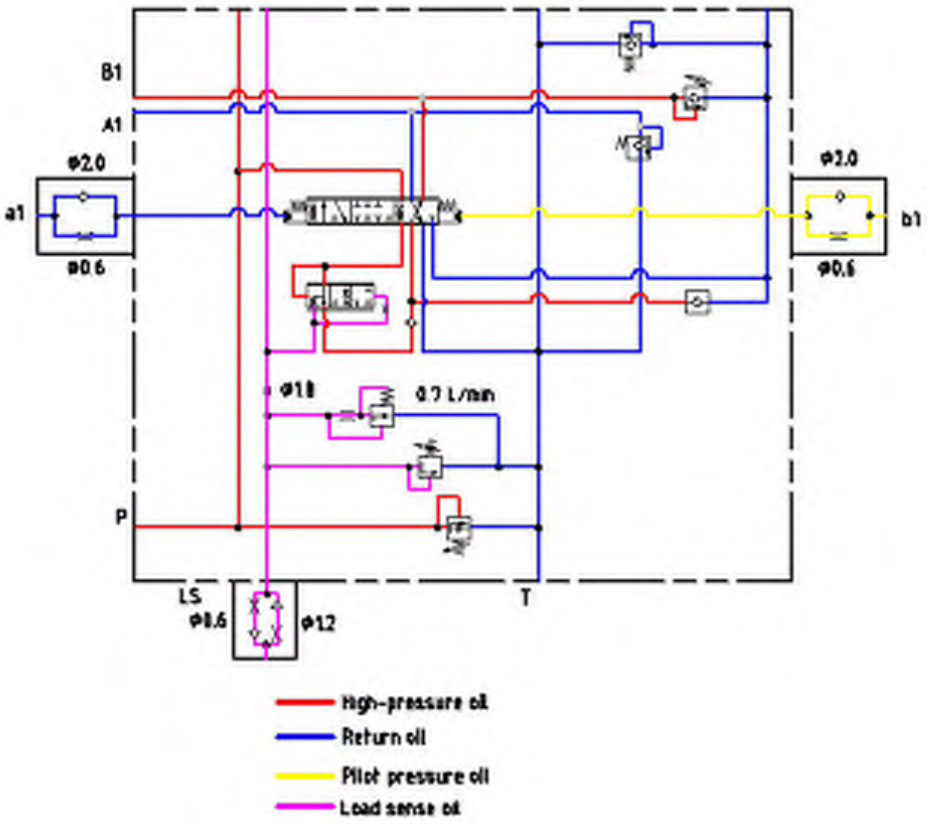
2. Bucket dump



P18H00021

When the control level is shifted to the tilting back position, the pilot pressure oil from the pilot valve acts on the pilot oil port at b1 end of the bucket tilting union, the bucket tilting union valve rod 6, which works in right position, moves leftwards, the pressure oil from P port returns to the bucket tilting union reversing valve rod via the orifice of bucket tilting union valve rod 6 and the pressure compensation valve 7, after reversing, the pressure oil enters into big cavity of the bucket tilting cylinder, meanwhile, LS oil line from the pressure compensation valve 7 acts (via shuttle valve) on flow control valve of variable pump and controls the displacement of the pump. Oil from small cavity of bucket tilting cylinder is connected with oil return port T of the control valve via bucket tilting union valve rod 6, bucket tilting cylinder piston rod extends to realize the bucket tilt back.

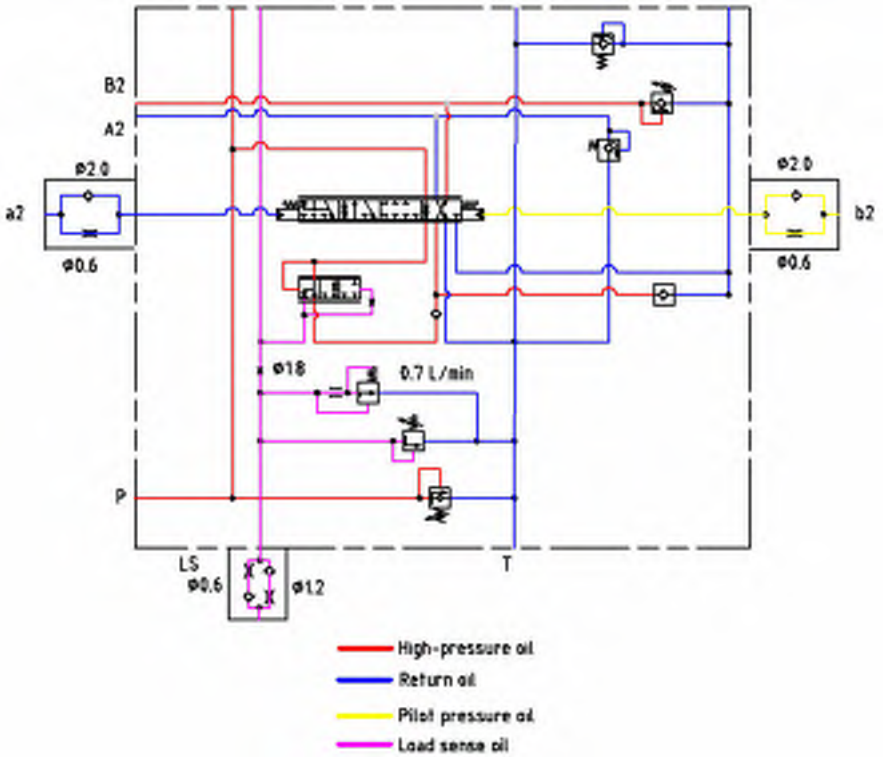
3. Bucket tilt back



P18H0037

When the control level is shifted to the tilting back position, the pilot pressure oil from the pilot valve acts on the pilot oil port at b1 end of the bucket tilting union, the bucket tilting union valve rod 6, which works in right position, moves leftwards, the pressure oil from P port returns to the bucket tilting union reversing valve rod via the orifice of bucket tilting union valve rod 6 and the pressure compensation valve 7, after reversing, the pressure oil enters into big cavity of the bucket tilting cylinder, meanwhile, LS oil line from the pressure compensat.

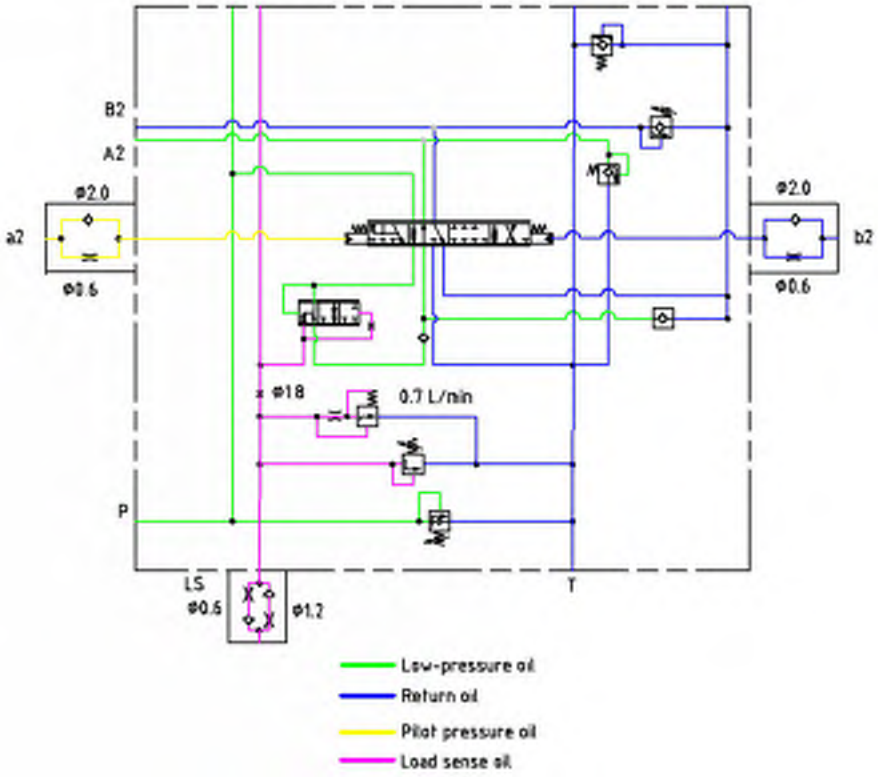
4. Boom raise



P18H00022

When the control level is shifted to the lifting position, the pilot pressure oil from the pilot valve acts on the pilot oil port at b2 end of the boom union, the boom union valve rod 8, which works in right position, moves leftwards, the pressure oil from P port returns to the boom union reversing valve rod via the orifice of boom union valve rod 8 and the pressure compensation valve 7, after reversing, the pressure oil enters into big cavity of the boom cylinder, meanwhile, LS oil line from the pressure compensation valve 7 acts (via shuttle valve) on flow control valve of variable pump and controls the displacement of the pump. Oil from small cavity of boom cylinder is connected with oil return port T of the control valve via boom union valve rod 8, boom cylinder piston rod extends to realize boom rise.

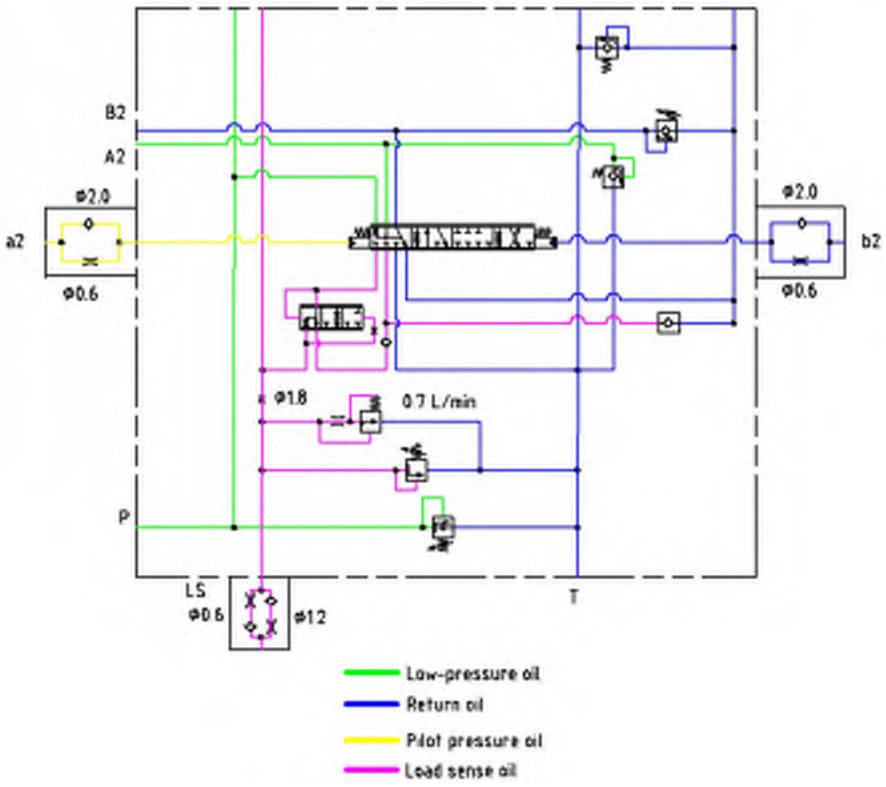
5. Boom lowering



P18H00023

When the control level is shifted to the descending position, the pilot pressure oil from the pilot valve acts on the pilot oil port at a2 end of the boom union, the boom union valve rod 8, which works in left position (descending position), moves rightwards, the pressure oil from P port returns to the boom union reversing valve rod via the orifice of boom union valve rod 8 and the pressure compensation valve 7, after reversing, the pressure oil enters into small cavity of the boom cylinder, meanwhile, LS oil line from the pressure compensation valve 7 acts (via shuttle valve) on flow control valve of variable pump and controls the displacement of the pump. Oil from big cavity of boom cylinder is connected with oil return port T of the control valve via boom union valve rod 8 and back pressure valve 4, boom cylinder piston rod retracts to realize the descending of the boom.

6. Floating descending position of boom union

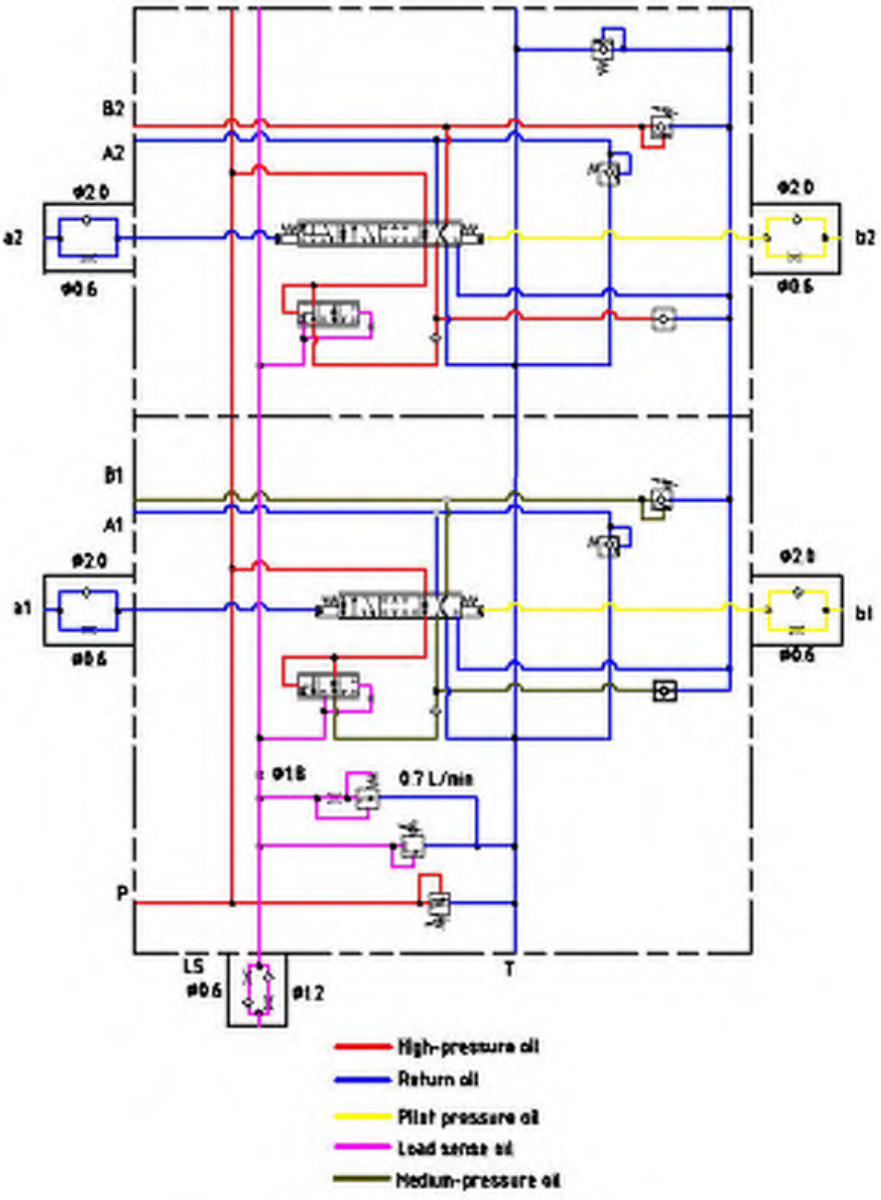


P18H00024

When the control lever is shifted to floating lowering position (the lever is pushed to front end), the pilot pressure oil acts on a2 end of the boom 8, as the pilot pressure in floating lowering position is high than that of boom lowering position, the boom valve rod 8 works in leftmost position (floating position), at this time, the pressure oil (not via the pressure compensation valve 7) from P port is directly connected with A2 & B2 port of the big & small cavity of the boom and the oil return port T of the control valve, the bucket descends rapidly under the effect of its dead weight to realize the floating lowering. At this time, the pressure of load sensitive oil line is zero, that is, the pump, in low pressure standby state, hardly supplies oil for the system. The rapid descending of the boom results in negative pressure in small cavity of the boom. The boom descending oil refilling valve is opened to reduce the negative pressure of small cavity.

7. Compound action position

When the control lever is in compound action position and non-load sensitive control valve conducts the distribution of oil flow in the bucket and boom, most oil flows to the oil line with low load, oil in the oil line with high load moves slowly or even stops moving, resulting in defects of machine function and low production efficiency. The control valve adopts pressure compensation behind valve, that is, place the pressure compensation valve behind the boom and bucket, the different loads of two unions at the time of compensating the compound action make flow through the union have nothing to do with its load, flows in two unions are distributed proportionately to realize the compound action of the complete machine. Take the raise and tilting back actions at the same time as an example in the following figure for explanation.



P18H00025

If load of boom is higher than that of bucket, the signal of high load pressure, detected from the pressure compensation valve 7, acts on its left side of spool to make 7 works in the left position, high load signal leads to reduction of the compensation valve 7 opening and improvement of the throttling effect so that the pressure behind orifice of the bucket valve rod (i.e. in front of pressure compensation valve 7) is equal to that of the boom union, meanwhile, as the pressure in front of unions valve rod is same (the pressure difference in front of unions valve rod is the same as that behind), flow of unions is only in relation to the valve rod opening other than their loads.

8. Multi-functional way

The multi-functional way is generally used for realizing actions of quick coupler cylinder, fork cylinder, side dump cylinder and other multi-functional attachments. Its principle is the same as that of the bucket.

Pilot valve

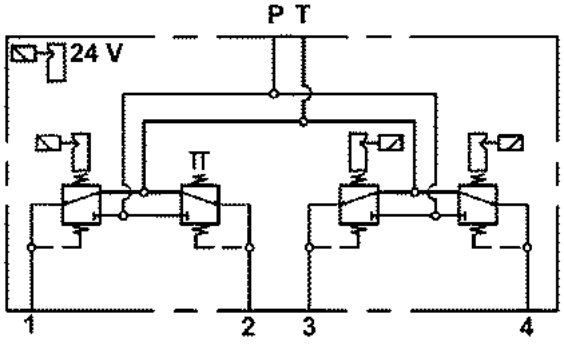
Main technical parameters

Items	Parameters	Service conditions	Remarks
Working pressure (MPa)	3.5\507.5	/	/
Maximum pressure (MPa)	5.0\725	/	/
Flow (L/min)	16\4.23	/	/
Operating fluid	Anti-wear hydraulic oil	HM46/HV46	/

Structure and working principle of pilot valve

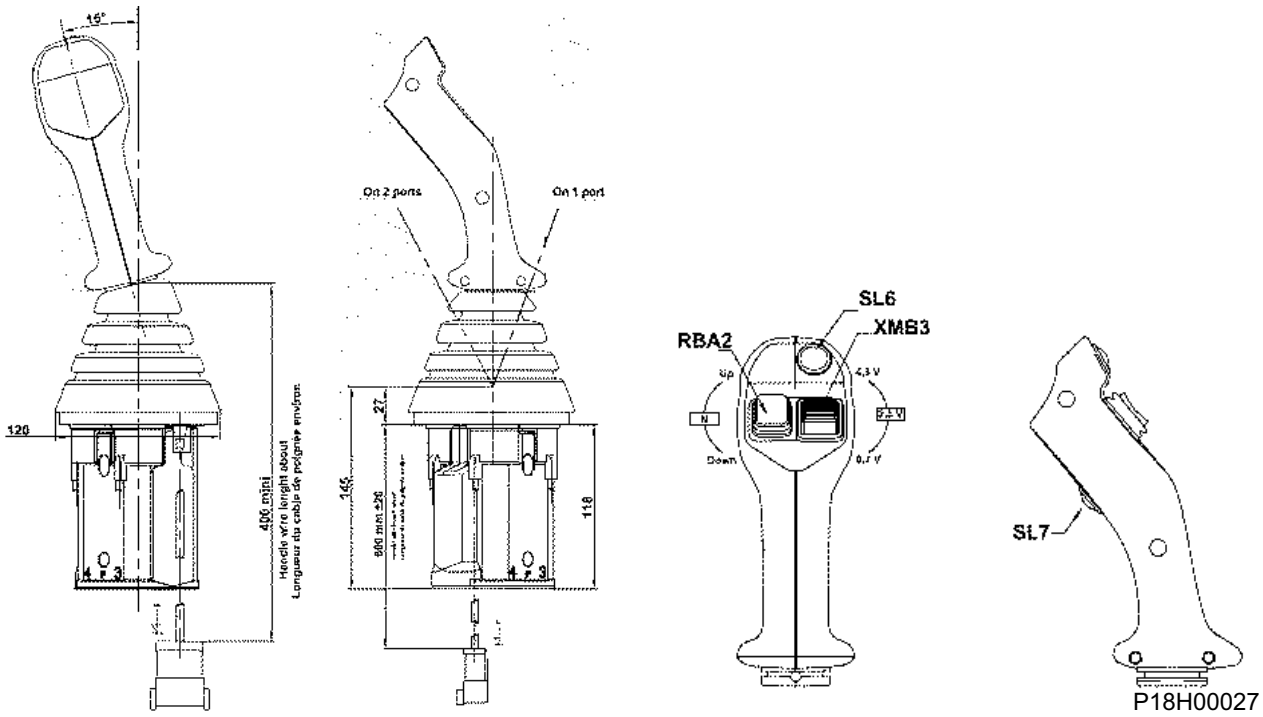
The pilot valve shall be installed on the handrail assembly in the cab and its position can be adjusted forwards and backwards with the handrail assembly. The standard configuration of the model is triplex pilot valve (boom and bucket way are hydraulically controlled and multi-functional way is electrically controlled), which consists of boom operating way, bucket operating way and multi-functional way. The boom operating way includes two metering valve groups, which are respectively used for raise, lowering and floating lowering of the boom. The bucket tilting operating way includes two metering valve groups, which are respectively used for bucket tilting back and dumping of the bucket. Multi-functional operating way includes two metering valve groups, which can be used to realize actions of multi-functional cylinder, for example, quick coupler, grapple device and other attachments. With controlling the handle of pilot operating valve, the action of each valve group in boom operating way, bucket operating way and multi-functional way can be controlled. In addition, in all metering valves, the displacement of the spool is in proportional relation with the operating angle displacement of the handle. The larger the operating angle of the handle is, the faster the action speed of the work implement is. Schematic diagram and outline diagram of pilot valve are as follows:

Schematic diagram of pilot valve



P18H00026

Outline diagram of pilot valve



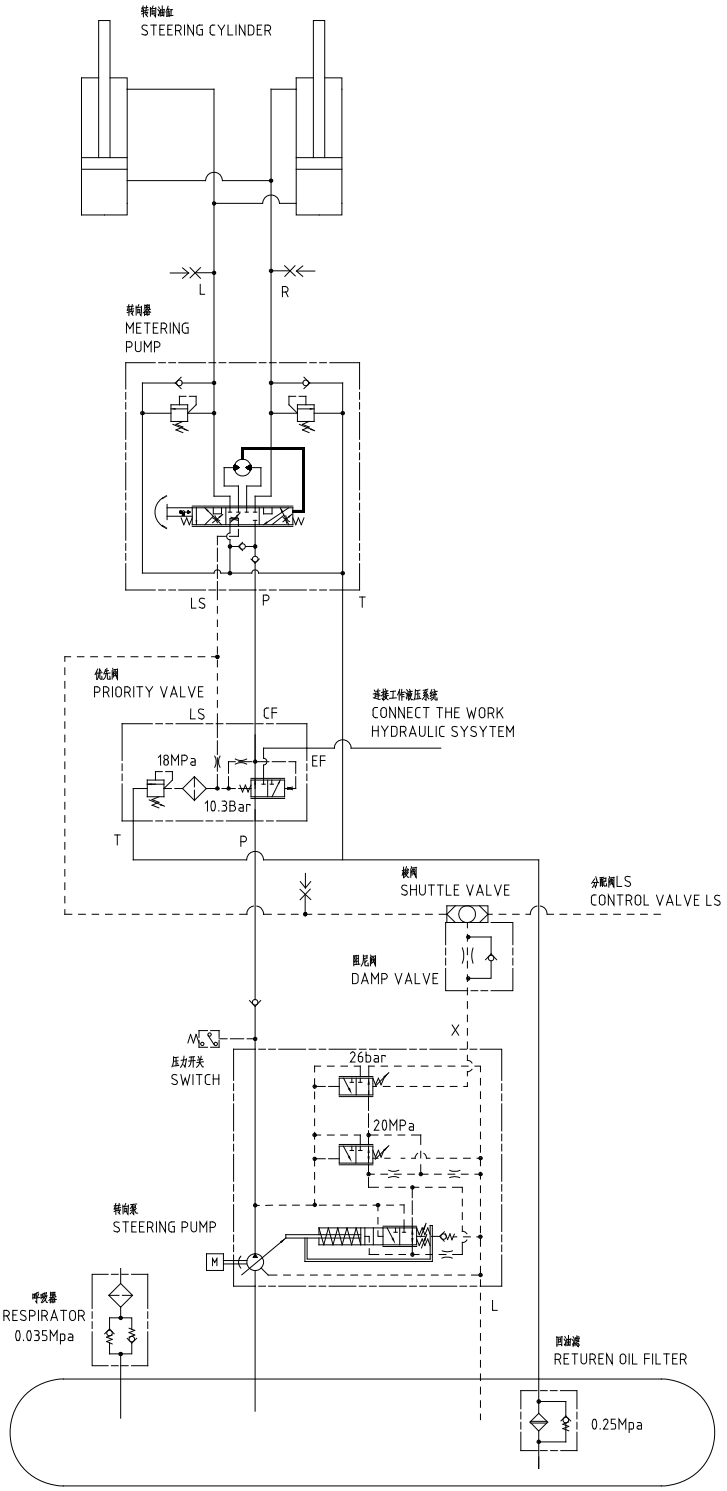
Steering hydraulic system

Overview-components and position

Steering hydraulic system is used to control the vehicle traveling direction, for this configuration, the steering hydraulic system is a variable load sensing hydraulic system, which is mainly composed of variable plunger pump, shuttle valve, priority valve, metering pump, steering cylinder and other pipeline accessories. This system can realize steering priority function.

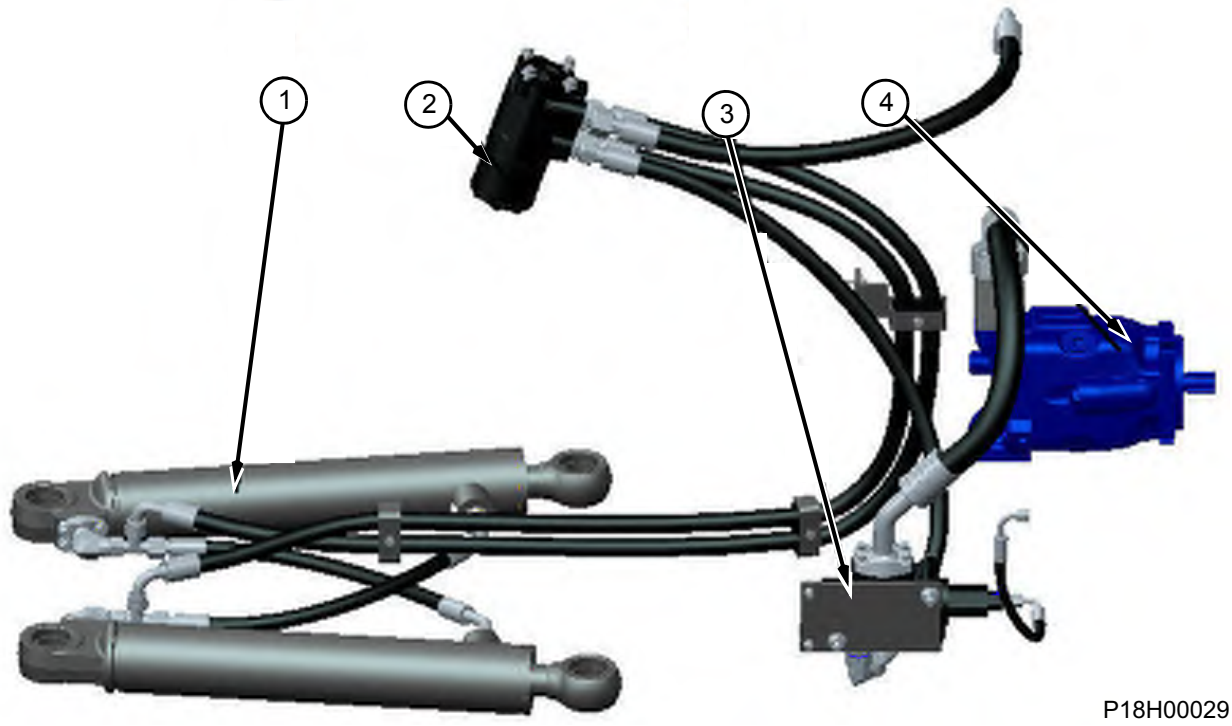
Steering priority refers that oil from the plunger pump will be supplied to steering system with priority and the surplus oil will be supplied to the work hydraulic system, which is realized by the priority valve. Priority valve, actually a floating spool, adjusts the flow of oil supply to steering system 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.

Schematic diagram of CLG835H-T4f steering hydraulic system and layout drawing of component are as follows:



P18H00028

Component layout



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

B:Overview - technical parameters of steering system

Items	Parameters
System pressure	18±0.3MPa\2610±43.5psi
System flow	220L/min@2200r/min\58.1US gpm@2200rpm
Pressure of overload valve at port A	24±0.3MPa@40±2L/min\3480±43.5psi@10.57±0.53US gpm
Pressure of overload valve at port B	24±0.3MPa@40±2L/min\3480±43.5psi@10.57±0.53US gpm
Pressure of main safety valve	23±0.3MPa@20±2L/min\3335±43.5psi@5.28±0.53US gpm
Steering angle	40°

Steering pump

Same pump is used for the plunger pump of work hydraulic system, that is, work hydraulic system and steering hydraulic system share one pump.

Metering pump

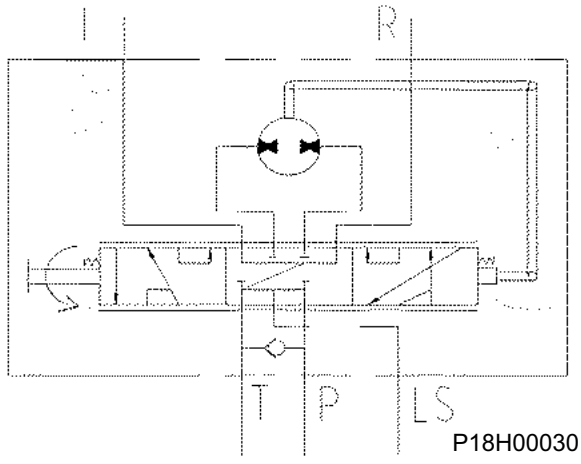
Main technical parameters

Items	Parameters	Remarks
Rated displacement	739ml/r\739cc/r	
Amplification ratio	1.6	
Max pressure of the system	24.1MPa\3494.5 psi	
Max back pressure	1Mpa\psi	
Contamination degree of recommended hydraulic oil	ISO18/13	
Operating fluid	Anti-wear hydraulic oil	HM46/HV46

Structure and working principle of components

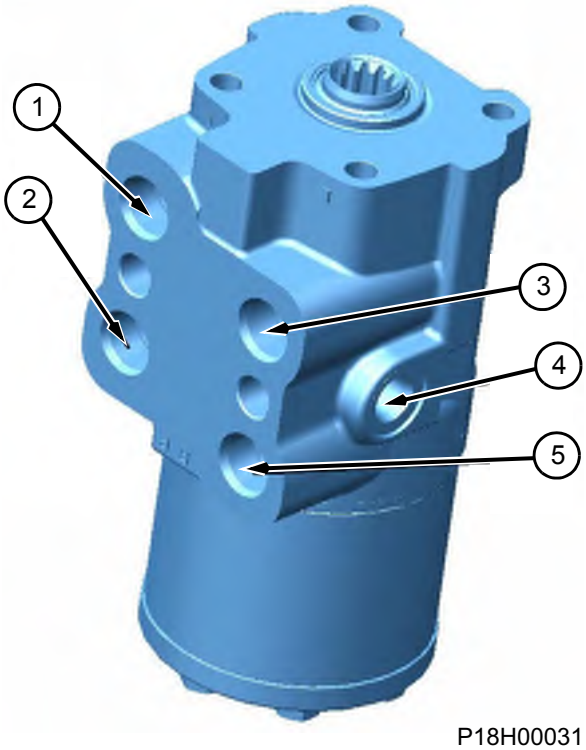
Metering pump is located above hinge joint and installed on bottom plate of steering column of cab.

Schematic of metering pump



P18H00030

Overall structure diagram of metering pump



P18H00031

1. T port
2. P port
3. L port
4. LS port
5. R port

Working principle:

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

1) When the steering wheel is not turned, metering pump is in neutral position, LS port is connected with T port, and L, 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 variable pump.

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 plunger pump flows into left cavity or right cavity of steering cylinder to realize steering.

b. For manual steering, the stator and rotor pair of metering pump will play the role of oil pump to press the oil in one cavity of steering cylinder to another cavity. Oil cylinder piston rod will push the wheel to realize steering. Manual steering has low steering torque.

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 turning is flexible after installation.

Fault and troubleshooting:

Faults	Symptom	Cause	Troubleshooting methods
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
	Oil leakage in bolt (plug)	Insufficient tightening torque of bolt (plug)	Tighten 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 priority valve spool is stuck	Check whether the main priority valve spool is flexible
	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, no steering cylinder action	Manual steering check valve failure	Check whether the steel ball exists and whether it is chocked
	No-load steering is light, heavy load steering is heavy	Leakage caused by chocked safety valve or safety valve spring failure	Clean and check the safety valve in priority valve
	Heavy steering	High hydraulic oil viscosity	
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 seizure, no oil at CF port, LS port blocked	

Faults	Symptom	Cause	Troubleshooting methods
No automatic return to the neutral position of steering wheel	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 break	
		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

Priority valve

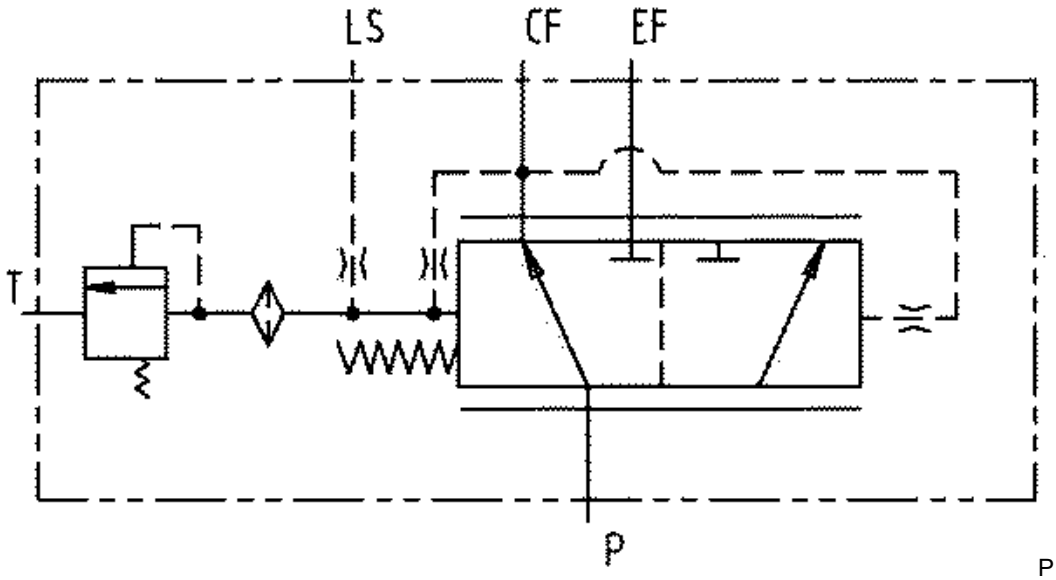
Main technical parameters

Items	Parameters	Service conditions	Remarks
Flux	240L/min\63.4US gpm		
Pressure of safety valve	18MPa\2610psi		
Operating fluid	Anti-wear hydraulic oil	HM46/HV46	

Structure and working principle of components

The priority valve is installed on the inner side of left web plate of rear frame and close to hinge position. Hydraulic oil from the plunger pump enters into metering pump via priority valve and then flows into steering cylinder to realize left-right turning. The priority valve realizes the steering priority function.

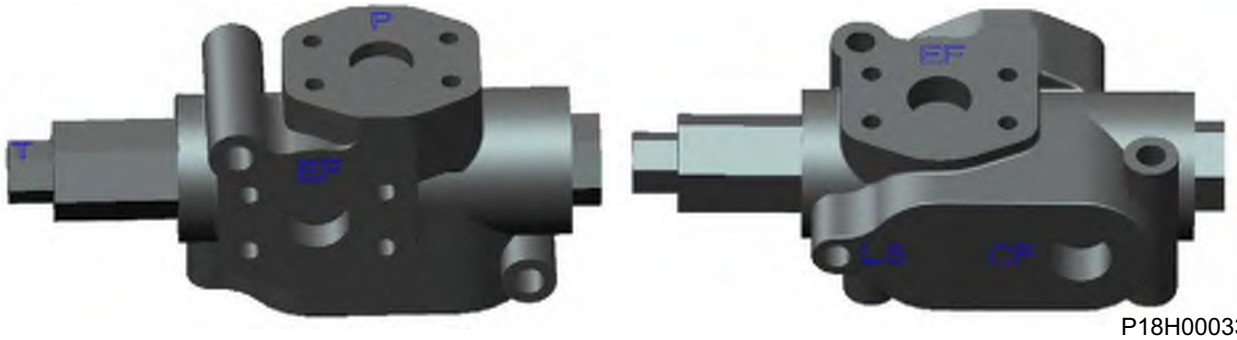
Schematic of priority valve



P18H00032

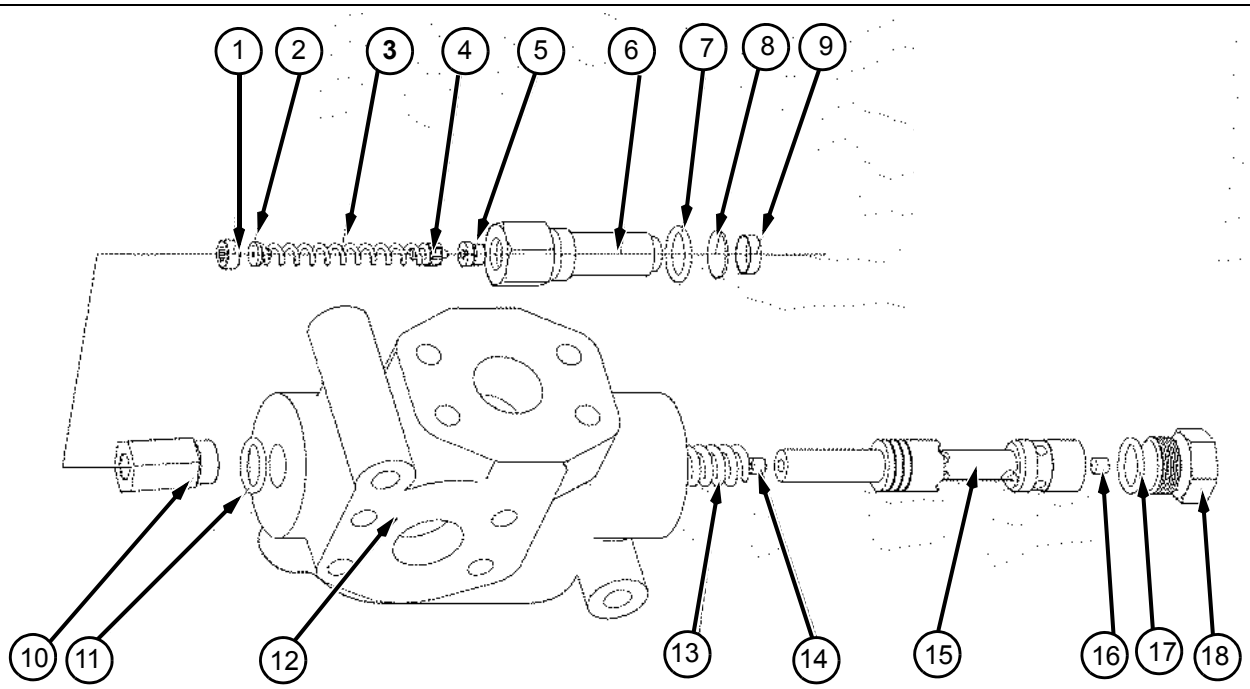
Working principle: during single steering, P port of metering pump communicates with L (or R) port, the channel from LS to T is closed and the channel from LS to L (or R) is open. LS oil pressure acts on left side of priority valve spool so that the spool moves rightwards, the opening of CF channel increases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

Outline diagram of priority valve



P18H00033

Exploded view of priority valve



P18H00034

1. Screwed plug
2. Adjusting plug
3. Spring
4. Guide holder
5. Valve seat
6. Guide
7. O-seal ring
8. Pressure ring
9. Strainer
10. Conversion connector
11. O-seal ring
12. Valve body
13. Spring
14. Orifice screwed plug
15. Spool
16. Orifice screwed plug
17. O-seal ring
18. Screw plug

Steering cylinder

Main technical parameters

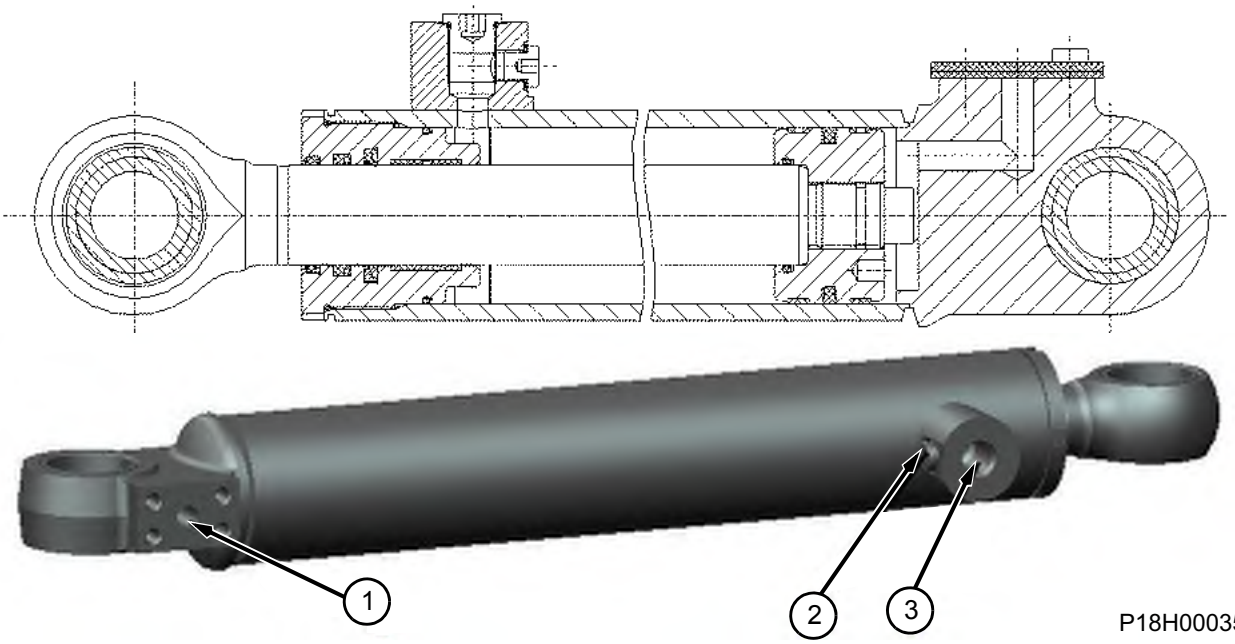
Items	Parameters	Remarks
Cylinder bore (mm\in)	80\ 3.15	
Rod diameter (mm\in)	45\ 1.77	
Stroke (mm\in)	420\ 16.54	
Maximum mounting distance (mm\in)	1148\ 45.2	
Minimum mounting distance (mm\in)	728\ 28.66	

Structure and working principle of steering cylinder

Steering cylinder, which is installed at the articulated joint of front & rear frame and cylinder, is the actuator of steering hydraulic system. It realizes the left-right steering by pushing the front and rear frame of left-right steering cylinder piston rod.

Structure of steering cylinder

Overall structure diagram of steering cylinder



1. Oil port of big cavity
2. Pressure measuring plug
3. Oil port of small cavity

Brake system

A: Overview-components and position

Brake system consists of service brake system, emergency & parking brake system. Service brake system is used in 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.

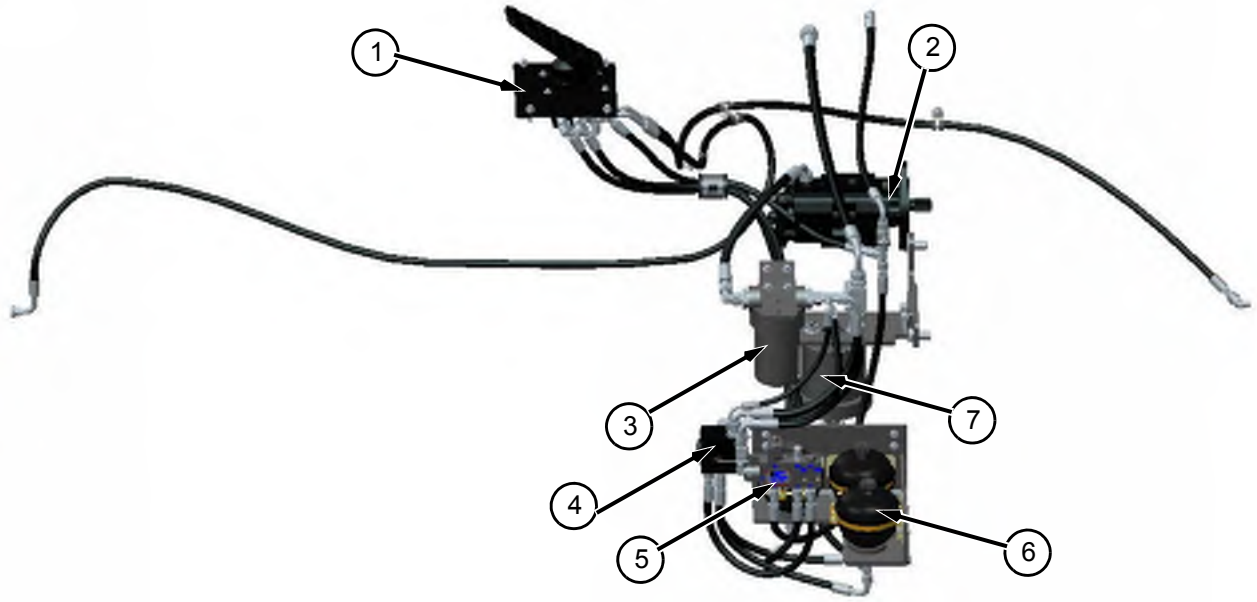
Service brake system consists of brake pump, brake valve, charge valve, accumulator, wet brake (in the axle), pressure switch and pipeline. Emergency & parking brake system consists of parking brake accumulator, brake cylinder, brake valve block and pipeline.

This is a full-hydraulic brake system and its features are as follows:

1. Using wet-type wheel brake: the system circuit is fully closed so as to avoid the influence of external uncertain factors (for example: sand invasion and oily friction disc) on braking performance. Using oil-immersed cooling method by which the friction plate is immersed in oil to avoid reduction of braking performance caused by heat fading of friction material due to high temperature of friction plate, at the same time, to reduce the requirement for brake oil.
2. Using full-hydraulic brake system: cancel air line and simplify the system so as to avoid the corrosion of pipeline and brake components caused by water in the air line system, and the reliability and response speed of the system are improved.
3. Using dual-circuit brake: front and rear axle brake lines are independent so as to make them safer and more reliable

Component layout drawing of full-hydraulic brake system CLG835H_T4f is as follows: refer to attached drawing in Chapter 9 for schematic of braking

Layout of full-hydraulic brake system component



P18H00036

1. Brake valve
2. Brake pump
3. High-pressure oil filter
4. Charge valve
5. Brake valve assembly
6. Accumulator assembly
7. Brake cylinder

Overview - technical parameters of brake system

Items	Parameters
Service brake system	Dual-circuit full-hydraulic wet brake
Parking brake system	Electronically controlled full hydraulic brake
Pressure of brake pump relief valve	18±0.5MPa\2610±72.5psi
Output pressure of brake valve	6±0.4MPa\870±58psi
System flow	30L/min@2200r/min\7.93US gpm@2200rpm

Overview - working principle of brake system

Working principle of full-hydraulic brake: the system pressure is kept by accumulator assembly and each brake circuit is equipped with accumulator independently. When oil pressure in the accumulator is lower than the setting minimum working pressure of the system (the pressure for CLG835H_T4f is \1957.5psi), the charge valve feeds the pressure oil of brake pump (CLG835H_T4f brake pump and cooling pump form tandem pump and share one pump body) filtered and outputted by oil filter into the accumulator. When oil pressure in the accumulator reaches the setting maximum working pressure (the pressure for CLG835H_T4f is 16MPa\2320psi), the charge valve stops supplying oil for the accumulator of brake system. The brake pump is unloaded by connecting S port of charge valve with oil tank. At the time of braking, depress the brake valve pedal, high pressure oil stored in the accumulator of service brake circuit enters into the axle via the service brake valve so as to push the brake piston in the axle, the piston compacts the wet-type friction plate and half shaft of wet-type brake axle to realize the service brake of the complete machine. After releasing the brake pedal and removing brake, oil in the axle returns to oil tank via the brake valve.

When applying the parking brake, emergency & parking brake system controls the brake valve block assembly using the parking brake solenoid valve switch in the cab to make the parking brake accumulator release pressure oil which controls the brake cylinder to realize emergency & parking brake function. In addition, the pressure control switch in electrical system can also realize the complete machine brake.

Power cut-off function (i.e. function of brake and spontaneous out-of-gear): when the shift control lever is in forward or backward I & II position and the clutch on/off switch is closed (i.e. push button lamp is on) during driving, once apply the foot brake, electric control box sends a command to the shift control valve to engage the transmission in N position and cut off power. When the shift control lever is in forward or backward I & II position and the clutch on/off switch is disconnected (i.e. push button lamp is off) during driving, once the brake is applied, the power will not be cut off.

Clutch on/off switch is a switch with self-locking function, refer to the electrical system in the manual for detail of using method.

The "function of brake and spontaneous out-of-gear" can work only in forward or backward I & II position. In order to guarantee safe driving, when load is in high-speed position, once the brake is applied, the electric control box will not sends the command of cutting off power no matter whether the clutch on/off switch is closed or disconnected, which is determined by driving properties of the loader.

Emergency brake button and clutch on/off switch

1. Emergency Brake Button
2. Clutch on/off sw

⚠CAUTION

When the shift control lever is in forward or backward I & II position during driving, do not disconnect the clutch on/off switch easily,otherwise, the brake and power train system may be damaged. When the machine is in operation at the upslope or downslope of rough road and the brake is applied, the function can be selected in order to ensure safe driving.

At short time of starting the machine, the service brake low pressure alarm light flashes and the alarm buzzer sounds. Because oil pressure in the accumulator of service brake circuit is still lower than the alarm pressure (11MPa\1595psi) at this time, and the alarm will stop automatically as pressure in the accumulator is higher than the alarm pressure. Press down the emergency brake button only after the alarm stops. During operation, if the system is faulty, resulting in oil pressure in the accumulator of service brake circuit lower than 11MPa\1595psi, the service brake low pressure alarm light flashes and the alarm buzzer sounds. At this time, stop operation and park the vehicle for inspection. During inspection, stop the machine on level ground and pull the emergency brake button.

When press down the emergency brake button, the solenoid valve is powered on, valve port is open, the pressure of oil outlet is 16MPa\2320psi, high pressure stored in the accumulator of parking & emergency brake circuit enters into parking brake cylinder via emergency brake solenoid valve to release the parking brake. At the moment of pressing down the emergency brake button, the parking & emergency brake low pressure alarm light flashes. Because oil pressure in the parking brake circuit is still lower than the alarm pressure (11MPa\ 1595psi) at this time. The machine can be started only when the emergency brake low pressure alarm light is off. When pull the emergency brake button, the solenoid valve is powered off, hydraulic oil in the parking brake cylinder flows back to oil tank via emergency brake solenoid valve and the parking brake is locked. During operation, if the parking & emergency brake circuit is faulty, resulting in oil pressure in the accumulator BR3 lower than 11MPa\1595psi, the emergency brake low pressure alarm light flashes. At this time, stop operation and park the vehicle for inspection. During inspection, stop the machine on level ground, pull the emergency brake button and chock the wheels with blocks to prevent the machine from moving.

If the service brake low pressure alarm fails and the system is faulty, which results in oil pressure in the accumulator of service brake circuit lower than 7MPa\1015psi, the clutch on/off switch of emergency brake in the system cuts off the power automatically to engage the transmission in N position. Simultaneously, the solenoid valve is powered off, hydraulic oil in the parking brake cylinder flows back to oil tank via emergency brake solenoid valve so that the parking brake is locked and the emergency parking of loader is achieved.

⚠WARNING

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

Brake pump

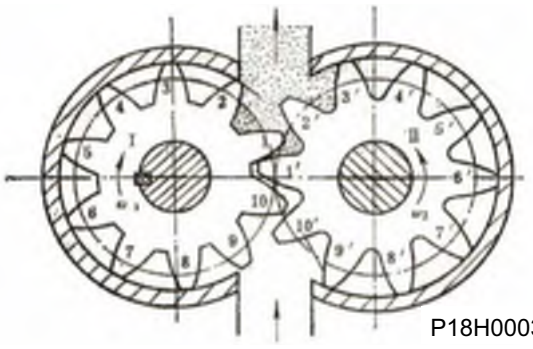
Main technical parameters

Items	Parameters	Service conditions
Theoretical displacement (ml/r\cc/r)	15\2175	/
Rated speed (r/min)	2200	/
Maximum speed (r/min)	2500	/
Rated pressure (Mpa\psi)	18\2610	/
Maximum pressure(Mpa\psi)	25\3625	
Volume efficiency	0.92	/
Operating fluid	Anti-wear hydraulic oil	HM46/ HV46
Direction of rotation	Left rotation	/

Structure and working principle of brake pump

The brake pump is a gear pump and located under cab and installed on the left power take-off of the gearbox and tightened by stud and nut. It is driven by engine via hydraulic torque converter and gearbox to supply oil for brake hydraulic system.

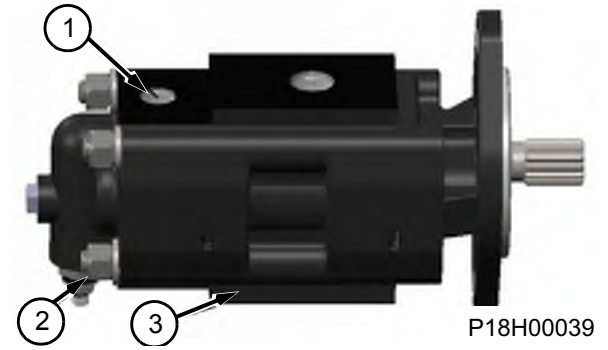
Gear pump working principle schematic



The gear pump works by using the meshing movement of a pair of gears and causing volume changes in the suction and discharge chambers. 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 an ever-reduced state. Generally, the side with larger port is the suction port, and the side with smaller port is the outlet.

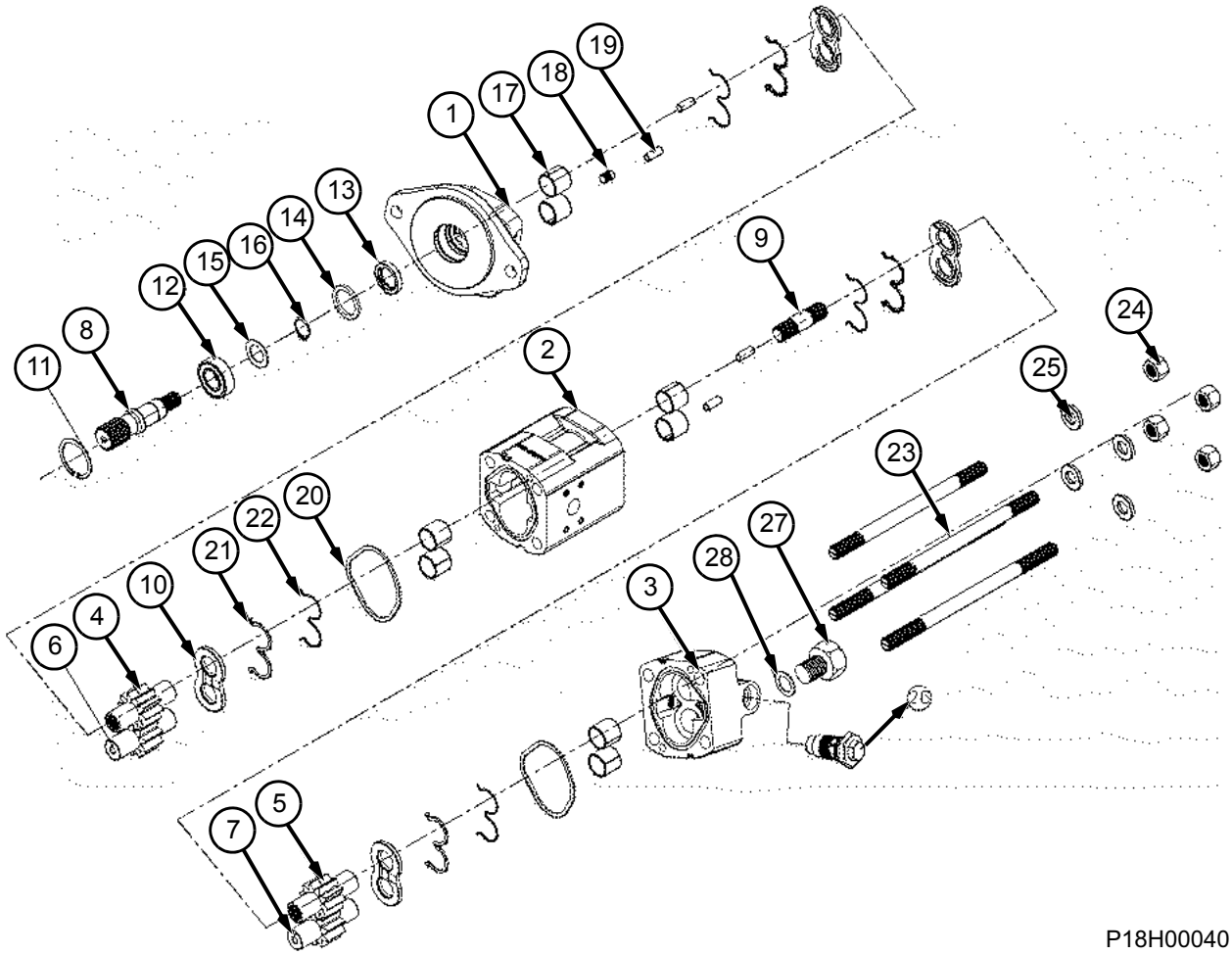
Overall structure of brake pump

Schematic diagram of brake pump



1. Oil outlet (for oil entering into high-pressure oil filter)
2. Safety valve of brake system
3. Oil inlet (to oil outlet steel tube of tank)

EXploded view of brake pump (cooling pump and brake pump form tandem pump)



1. Front housing
2. Pump body
3. Pump body
4. Drive gear
5. Drive gear
6. Driven gear
7. Driven gear
8. Connecting shaft
9. Connecting shaft
10. Lateral plate
11. Internal circlip
12. Outboard ball bearing
13. Skeleton oil seal
14. Washer
15. Snap ring
16. Snap ring
17. Roller bearing
18. Oil blocking screw
19. Cylindrical pin
20. O-ring
21. Seal ring of side plate
22. Seal ring of side plate
23. Stud bolt
24. Nut
25. Washer
26. Relief valve
27. Plug
28. Washer

Internal maintenance instructions of brake pump

1. Maintenance of brake pump: brake pump is the power source of brake hydraulic system, and its volume efficiency will influence the speed and efficiency of actuator directly. It is not recommended to remove or install the brake pump by non-professionals as it is a precise hydraulic element, and the broken pump shall be returned to the manufacturer and repaired by professionals; after repair, brake pump shall perform the test of airtightness and volume efficiency in order to guarantee its performance and normal application.
2. Installation requirements for brake pump:

(1) You shall understand fully about rotating direction of brake pump and its compliance with the requirements of the entire machine before installation of the brake pump.

(2) Inlet and outlet port of brake pump shall be kept clean without dirts, and its surface shall have no injuries so as to guarantee the sealing effect of O-ring.

(3) Before assembling the brake pump, check whether the mounting hole depth of gearbox spline is larger than the pump's shaft extension length or not, in order to prevent from culmination phenomenon, pump burnt out. Installation of spline shaft and spline housing shall be free without stuck.

3. Precautions for maintenance of brake pump:

(1) Apply a moderate force during assembly and disassembly of brake pump, and rude operation is not allowed; user shall not open the brake pump without manufacturer's consent, otherwise they cannot guarantee their product performance.

(2) Pay attention to maintenance of brake pump during operation, replace the hydraulic oil and check all bolts at connections for looseness according to the maintenance manual.

(3) Oil inlet and outlet of brake pump shall be installed firmly and sealing device shall be secured, otherwise it may cause oil leakage or air suction and affect the pump's performance.

(4) It is not allowed to operate the brake pump under maximum pressure, maximum speed or overloaded circumstances, otherwise, it may influence the service life.

(5) Oil temperature is required to be kept lower than 80 °C/176°F, otherwise it may affect the viscosity of hydraulic oil and also accelerate the oxidation of fluid.

4. Troubleshooting for brake pump

Fault phenomenon of oil pump	Possible cause	Handling method
Oil pump is noisy	Air enters the system	Tighten all joints
	Oil supply is insufficient	Refill the oil to a proper level
	Oil is cold	Operating in a low speed
	Oil suction tube is blocked	Remove the blocking object
	Air filter in tank is blocked	Clean or replace the air filter
	Bad right alignment between pump and input shaft	Check
	Resonance is serious (resonance of pump with peripheral components of oil tank and pipeline)	Check if mounting bolts of pipeline and components are tightened
Pump is slow at response or has no response	Oil supply is insufficient	Refill the oil to a proper level
	Setting pressure of relief valve is insufficient	Readjust the pressure of relief valve
	Pump is worn or broken	Repair or replace
	Valve is worn or stuck or leaks	Repair or replace
Oil temperature rises	Setting pressure of relief valve is too low	Adjust the pressure or replace the relief valve
	Low viscosity of fluid	Replace with recommended hydraulic oil
	Oil is dirty	Replace the hydraulic oil
	Low oil level	Refill hydraulic oil properly
	Pump is worn or broken	Repair or replace
Oil foaming	Air enters the system through oil suction tube	Tighten all joints
	Low oil level	Refill hydraulic oil properly
	Lip type seal ring (oil seal)of main revolving shaft is worn or damaged	Replace the lip type seal ring (oil seal)of main revolving shaft
The flow or pressure of pump is insufficient	Side plate is broken	Replace side plate
	Relief valve fails	Replace relief valve
	Air enters the system	Tighten all joints
Oil still leaks after replacing the lip type seal (oil seal)of main revolving shaft	Worn lip type seal ring (oil seal) of revolving shaft causes damage to the sealing area of drive gear shaft	Replace the drive gear shaft
	Seal ring is worn or damaged	Replace the seal ring

Brake valve

Main technical parameters

Items	Parameters	Service conditions
Maximum allowed system pressure	21MPa\ 3045psi	\
Maximum brake pressure	6±0.4MPa\ 870±58psi	\
Pedal force under maximum pressure (about)	170N\ 38.22lbf	\
Pedal stroke (about)	20°	\
Operating fluid	Anti-wear hydraulic oil	HM46/HV46

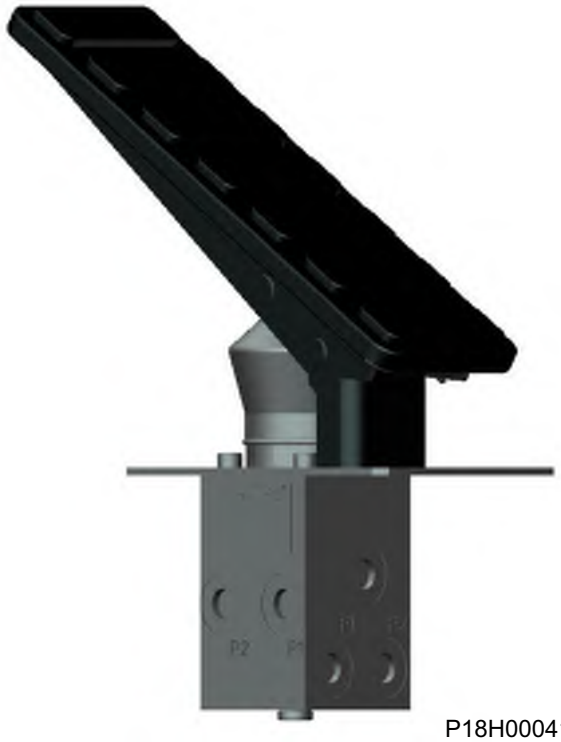
⚠CAUTION

As the structure of dual-circuit brake valve is complex and the requirement for assembly and adjustment is high, the removal & installation and adjustment can not be conducted by non-professionals without authorization. Before the dual-circuit brake valve is delivered, its pressure value has been adjusted. If fault occurs or the maximum brake pressure value is wrong, please contact its factory or dealer.

Structure and working principle of brake valve

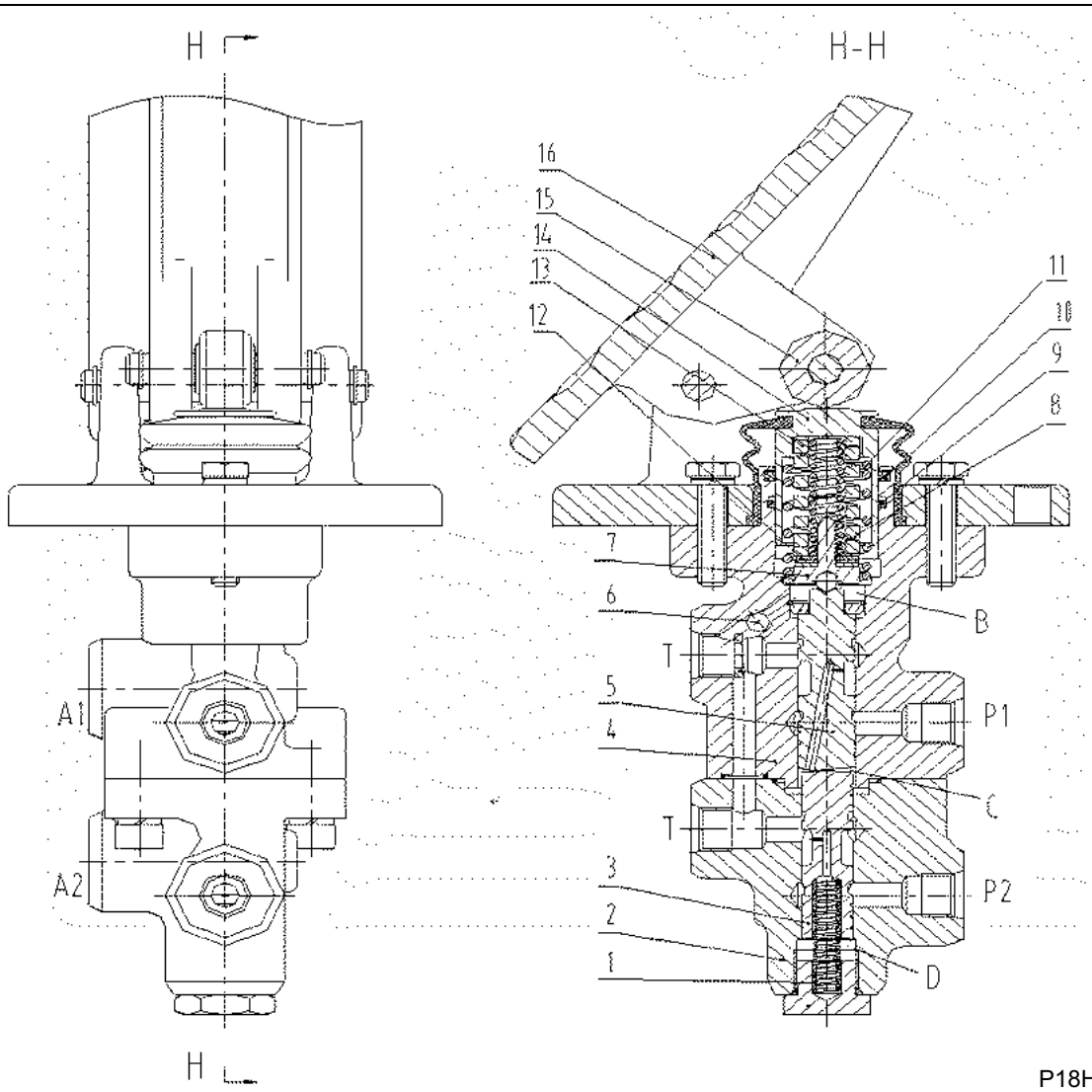
Brake valve (also called foot brake valve) is located on left floor of cab and its pedal can be controlled by left foot. Brake valve, which realizes the sensitive follow-up control during the brake and release process of service brake system, is one of the main parts of brake system.

Outline diagram of brake valve



P18H00041

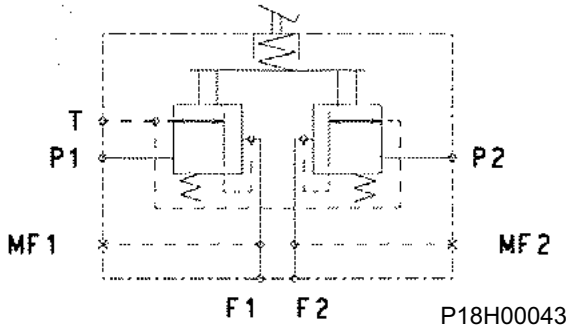
Structure of brake valve



P18H00042

1. Spring
2. Valve body
3. Lower spool
4. Valve body
5. Upper spool
6. Steel ball
7. Spring holder
8. Balance spring
9. X-ring
10. Y-ring
11. Reset spring
12. Adjusting shim
13. Balance spring
14. Piston
15. Roller
16. Step

Hydraulic schematic of brake valve



Main structure of brake valve is as shown in the Figure above , P1 port and P2 port are connected with accumulator BR1&BR2 respectively, F1 port and F2 port are connected with wheel brake of front and rear axle.

1) When the brake valve pedal is released, P1 port and P2 port are disconnected with F1 port and F2 port respectively, F1 port and F2 port are connected with T port and thus the machine is under non-brake state.

2) With the brake valve pedal depressed, F1 port and F2 port is disconnected with T port, and then P1 port is connected with A1 port, P2 port is connected with A2 port, high pressure oil stored in accumulator BR1 & BR2 enters into the wheel brake of front and rear axle to apply brake, at the same time, the brake switch acts and the brake light is on. Two circuits of dual-circuit are independent from each other, as one brake circuit is faulty, the other circuit can still work normally.

Under brake, output oil pressure of brake valve is proportional to brake pedal travel and force applied on the brake pedal. When the brake pedal is under static state (high-mounted position), the output pressure (F1 port and F2 port) is zero and the brake valve cavity is connected to oil tank (F1 and F2 are connected to T). When the brake is depressed, output pressure (F1 and F2) increases in proportional relation with angular displacement of brake pedal. When the brake pedal is depressed completely, output pressure (F1 port and F2 port) is limited to presetting pressure of valve and is not related with oil supply pressure.

Precautions for use and maintenance of brake valve

1. Be sure the connecting pipeline is clean, without any impurities;
2. Periodically check the connection and fastening condition of all parts and tighten timely if there is looseness;
3. Periodically check the working condition of pedal: whether it is stuck when depressing the pedal and whether it can return rapidly at the time release;
4. If it is necessary to remove and clean brake valve, do not clean seal ring, valve and other rubber parts using brake fluid, kerosene and other fluids which can corrode the rubber parts, they can only be wiped by blowing or clean cloth. Apply 3# lithium lubricating grease on the moving parts, such as valve and piston after being cleaned;

Charge valve

Main technical parameters

Items	Parameters	Service conditions
Shut-off pressure of charge valve	16+0.5/-1 Mpa\ 2320+72.5/-145psi	\
Connecting pressure of charge valve	13.5±1MPa\ 1957.5±145psi	\
Charging speed	8L/min\ 2.1US gpm	\
Operating fluid	Anti-wear hydraulic oil	HM46/ HV46

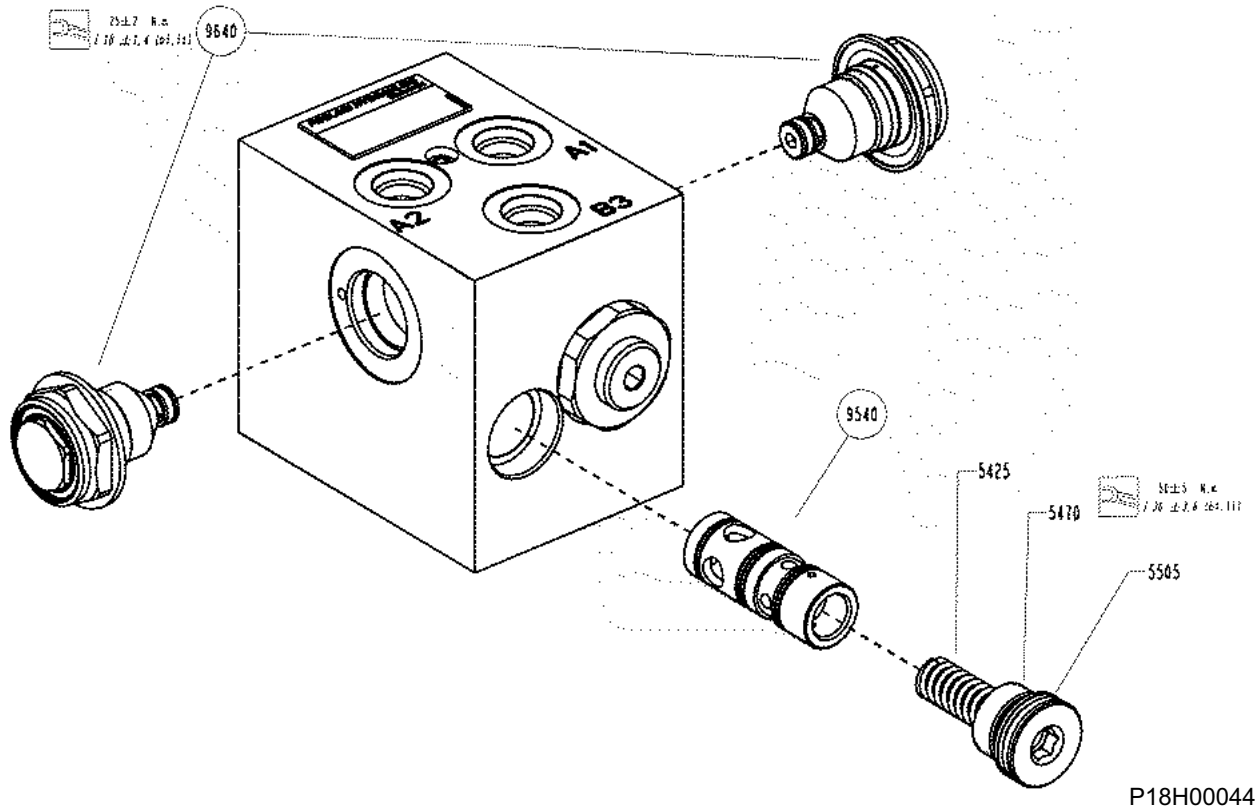
⚠CAUTION

As the structure of dual-circuit charge valve is complex and the requirement for assembly and adjustment is high, the removal & installation and adjustment can not be conducted by non-professionals without authorization. Before the dual-circuit charge valve is delivered, its pressure value has been adjusted. If fault occurs or charging pressure value is wrong, please contact its factory or dealer.

Structure and working principle of charge valve

Charge valve, located in left housing of rear frame, is used to charge the accumulator according to the pressure of brake system.

Structure diagram of charge valve

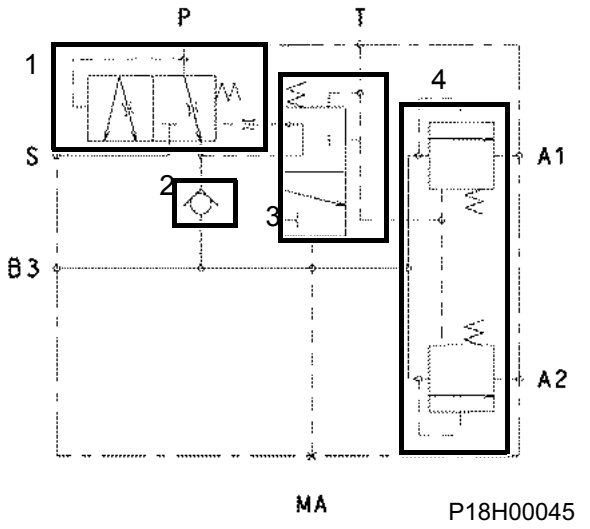


P18H00044

9640-charge valve (KIT SAFETY ISOLATED VALVE) 9540-spool (KIT EQ DIVIDER SPOOL) 5425–spring (SPRING)

5505-O-ring(O'RING)5470-plug(METAL PLUG)

Hydraulic schematic of charge valve



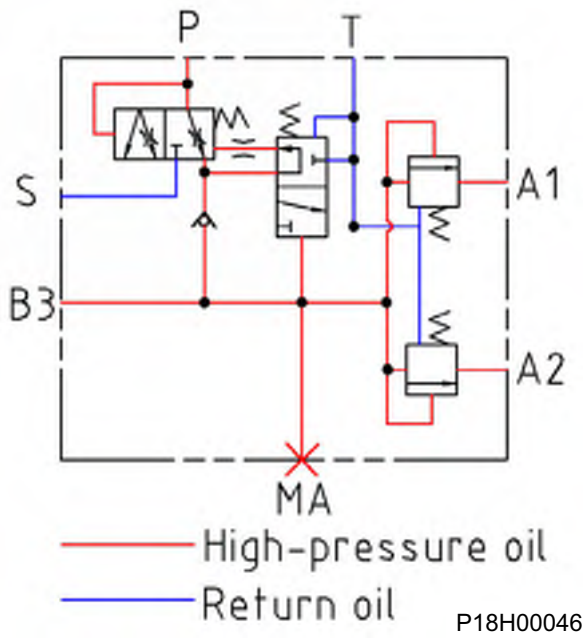
1. Priority valve (main spool)
2. Check valve
3. Connecting/shut-off spool
4. Shuttle valve

The priority valve 1 is used to supply oil for brake system preferentially and unload after meeting requirements for the accumulator of brake system; the connecting/shut-off spool 3 is used for setting the pressure for connecting and shutting off charge valve; The shuttle valve 4 is used to protect brake circuit A1 & A2 from interference with each other.

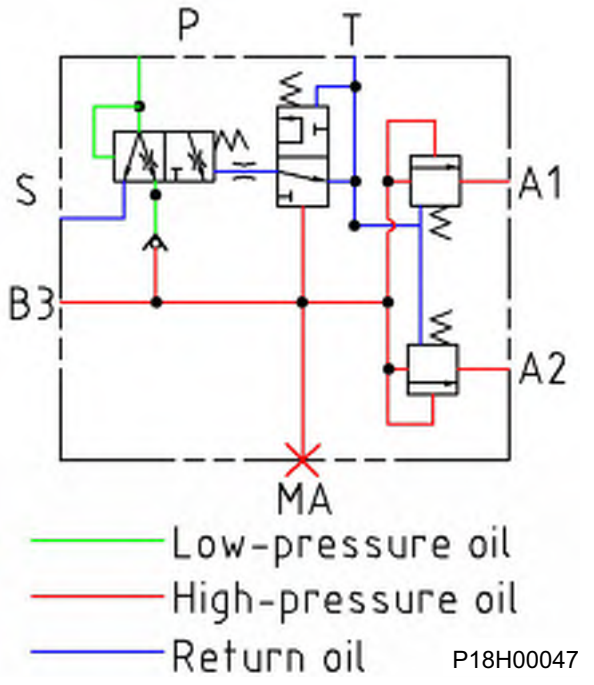
Hydraulic schematic of charge valve is shown in the above Figure. P port is connected with pump, A1 & A2 ports are connected with the accumulator for service brake, B3 port is connected with P port of brake valve block, and then connected with parking brake accumulator, T port is connected to oil tank and S port is connected to oil tank.

When the pressure of working oil port B3 of charge valve is lower than connecting pressure of charge valve (13.5±1MPa\1957.5±145psi), the connecting/shut-off spool 3 works in upper position and closes T port, the priority valve 1 works in right position; oil (via priority valve 1 and check valve 2) from the pump is supplied for the accumulator which reduces the pressure at B3 port. When the pressure of B3 port of charge valve is higher than connecting pressure of charge valve (16+0.5/-1 Mpa\2320+72.5/-145psi), the connecting/shut-off spool 3 works in lower position, oil from spring cavity of priority valve 1 is connected with T port via connecting/shut-off spool 3, the priority valve 1 works in left position; all oil from the pump returns to oil tank via S port. Recharge the accumulator as the pressure of accumulator is lower than that of connecting pressure of charge valve.

Oil line diagram in charging state:



Oil line diagram in bypass state:



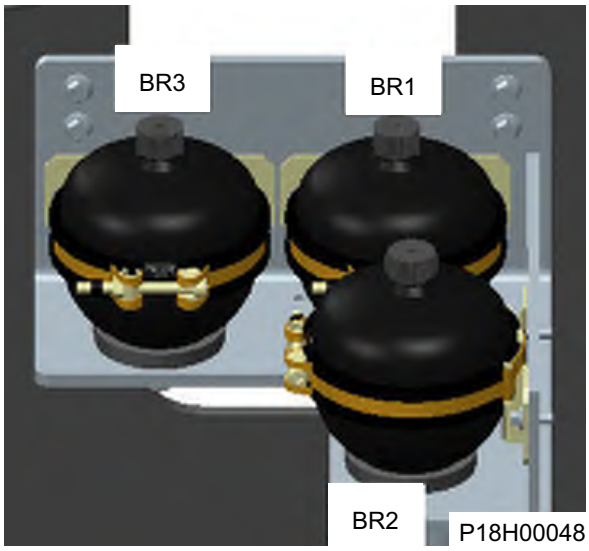
⚠CAUTION

Shuttle valve is used to guarantee two brake circuits are not in interference with each other. When one of circuits fails and the pressure decreases, the circuit is closed under spring force. Make sure that the brake circuit with zero-failure still realize braking function. At this time, the failed circuit is connected with the charge valve, the pressure of B3 port decreases, low pressure alarm switch of service brake acts, the machine shall be stopped immediately for inspection.

Accumulator assembly

The accumulator assembly, which is located in the housing at left side of complete machine and is fixed on rear frame, mainly consists of service brake accumulator and parking brake accumulator, and the service brake accumulator BR1 (front axle), service brake accumulator BR2 (rear axle) and parking brake accumulator BR3 are installed as shown in figure. Installation diagram is as follows:

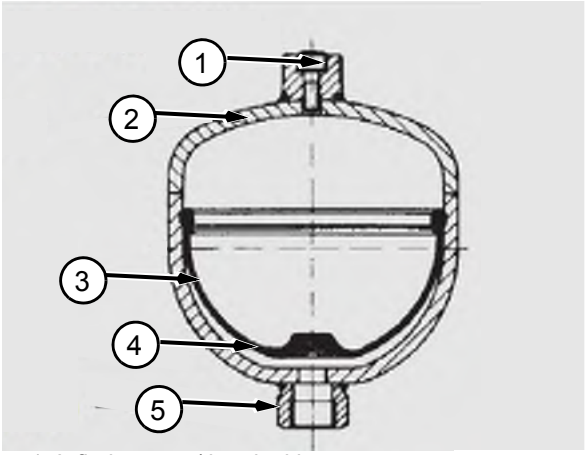
Installation diagram of accumulator



Structure principle

Diaphragm type structure is adopted for the accumulator, as shown in Figure below.

Structure diagram of diaphragm type accumulator



1. Inflating port / hex locking screw
2. Pressure vessel
3. Diaphragm
4. valve seat
5. Fluid side port

P18H00049

Diaphragm type accumulator is used to store pressure oil for braking and hold pressure of system. The operating principle is to isolate the fluid under pressure from the air volume chamber with pre-set pressure in the accumulator with diaphragm and store them in sealing housing. It absorbs and releases fluid for braking due to change of pressure. When the brake pump is operating, it inputs the pressurized fluid into the accumulator via charge valve to store energy, at this time, air in the air chamber is compressed so that the pressure of liquid is equal to air pressure to achieve energy storage. Nitrogen charged into the accumulator is non-flammable.

⚠CAUTION

The accumulator housing may be hot so as to cause burn.

Accumulator charging parameter

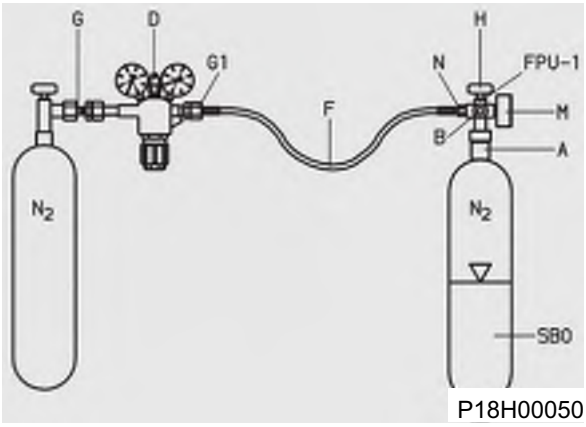
Items	Parameters	Items	Parameters
Rated capacity	1L\ 0.26US gal	Gas charging pressure of accumulator BR1 & BR2	Below 20°C\ 68°F 5.5MPa\ 797.5psi
Rated pressure	20MPa\ 2900	Gas charging pressure of accumulator BR3	Below 20°C\ 68°F 9.2MPa\ 1334psi
Pre-charging gas	Nitrogen	Charging pressure of accumulator BR1 & BR2	13.5~16MPa\ 1957.5~2320 psi
Working medium	Hydraulic oil	Charging pressure of accumulator BR3	16MPa\ 2320psi

Gas charging method of accumulator

1. Stop the machine, but do not turn off the electric lock. Depress the brake continuously for more than 20 times, and then press and release the button of manual solenoid valve for more than 20 times, drain high-pressure oil in the accumulator. Then, unscrew the plug of oil outlet at lower end of the accumulator slowly. At this time, there is residual pressure oil in the accumulator. Note that the residual pressure oil shall not splash onto person.
2. Remove the protective cap of gas charge valve from upper end of one accumulator.
3. Connect as shown in Figure Below.
4. Turn on the switch of the nitrogen cylinder, after reading of the pressure gauge is stable, turn on the switch on gas charge tool, that is, prop up the gas charge valve in the accumulator and conduct gas charging.
5. As pressure may reach the limit instantaneously, turn off the switch of nitrogen cylinder, check whether the pressure reaches limit after reading of pressure gauge is stable. If insufficient, recharging it. If the pressure is too high, conduct bleeding using the bleeding plug on the gas charge tool and reduce the pressure to a proper value.

6. After reaching the specified pressure, turn off the switch of the nitrogen cylinder, and then the switch on gas charge tool.
7. Remove gas charge tool.
8. If the accumulator leaks (apply oil onto head of the accumulator and check it for bubbles, if any, the accumulator leaks), knock down gas charge valve in the accumulator lightly using hammer or small screwdriver to make it move downwards and then return to its original position so that its sealing surface contacts completely.
9. Install the protective cap of accumulator gas charge valve.
10. Conduct gas charging for the other two accumulators according to above procedures.

Gas charge of accumulator



Precautions for safety use of accumulator

1. 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 is defect with the housing and therefore safe use cannot be ensured.
2. The accumulator can only be filled with nitrogen other than oxygen, compressed air or other flammable air to avoid explosion.
3. Slowly charge the nitrogen into the accumulator so as to avoid the breakage of the rubber bag.
4. The accumulator shall be installed vertically with the valve facing upwards. The accumulator shall be stably fixed on the bracket without being welded.
5. Before removal of the accumulator, drain the pressure oil, release nitrogen in accumulator using gas charge tool, and then remove parts.

Maintenance of accumulator

Check directly gas charging pressure in accumulator using gas charge tool. After the machine is delivered, check the pressure in plastic bag once a week; after a month, check it once a month, after half a year, check it once every three months; after one year, check it once half a year. Regular inspection is beneficial for keeping the accumulator in best service conditions, finding the leakage early and conducting repair in time.

Brake cylinder

The brake cylinder, as key actuation component for emergency & parking brake system, is installed on the left side of front end of transmission housing.

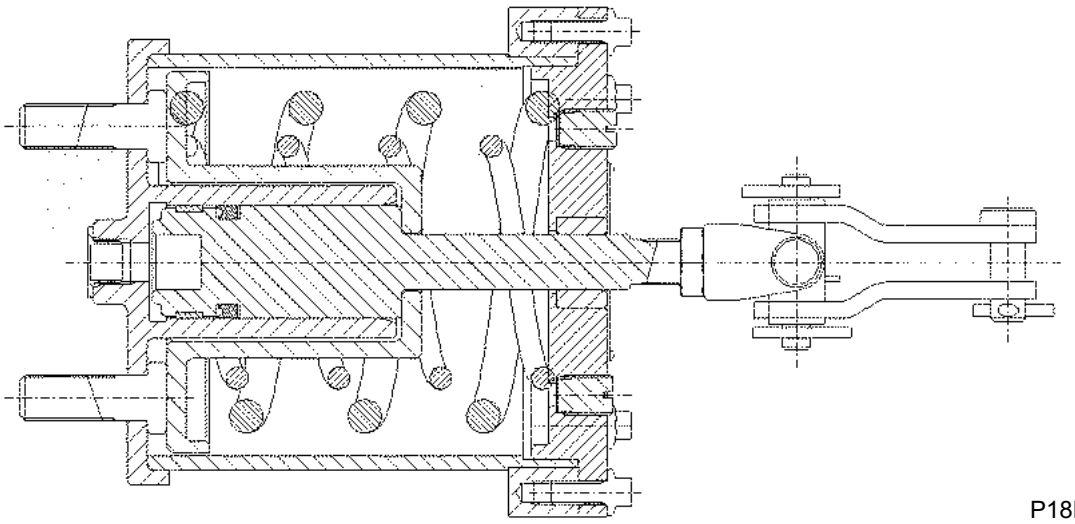
Structural composition and working principle of brake cylinder

The structure of brake cylinder is shown as below, its working pressure is 15.9MPa\2305.5psi. The disengagement and engagement of emergency & parking brake are available with brake cylinder whose lever is coupled with cam handle. When the system has no oil pressure or the control knob of emergency & parking brake is pulled up, no pressure oil enters the left chamber of brake cylinder. The spring seat and piston are always pushed to the left side by force from spring, pull the parking brake lever to engage it, thus to achieve the brake performance.

When the system reaches the working pressure, and the control knob of emergency & parking brake is pressed down, the pressure oil flows into the left chamber of brake cylinder through solenoid valve to compress the spring, push the spring seat and piston to right side and the parking brake lever so as to release the brake and drive the vehicle. When the oil pressure of accumulator in the circuit of service brake is lower than 7MPa\1015psi, the cut-off switch of emergency brake acts to cut off the power of solenoid valve. The hydraulic oil in the parking brake cylinder returns to oil tank via manual solenoid valve. Force from spring pushes the spring seat and piston left side and pulls the parking brake lever to lock the brake, meanwhile, transmission shifts to the neutral position to achieve the emergency parking of loader.

The machine is equipped with parking brake which is released by hydraulic pressure based on spring action (working of brake cylinder). If the engine, hydraulic system or the brake system fails, the machine is braked and unable to drive. When the machine fails to drive and needs to be towed, the pin shaft in the brake cylinder as shown below is removed, tow the machine after the parking brake is released.

Structure diagram of brake cylinder



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Main parameters of brake cylinder

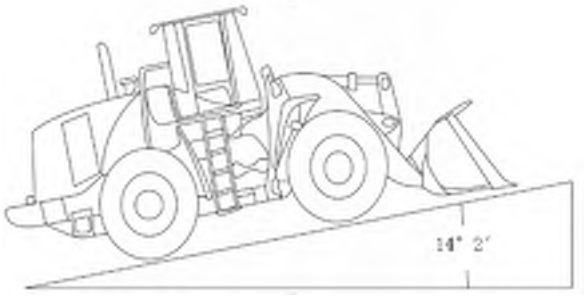
Items	Parameters	Service conditions
Fully release the pressure	5.2MPa\ 754psi	\
Maximal spring force	6422MPa\ 931190psi	\
Rated capacity	42ml\ 0.011US gal	\
Working pressure	16MPa\ 2320psi	
Operating fluid	Anti-wear hydraulic oil	HM46/HV46

Check the performance of service brake

⚠CAUTION

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

1. Adjust the tire pressure of machine to the specified value, and lay down the bucket levelly at approx. 300mm\ 11.8in from the ground. And confirm the machine have the performance of good service brake.
2. Start the engine, and drive the machine toward and on the 25% slope (14°2') and, the road surface shall be flat and dry.



P18H00052

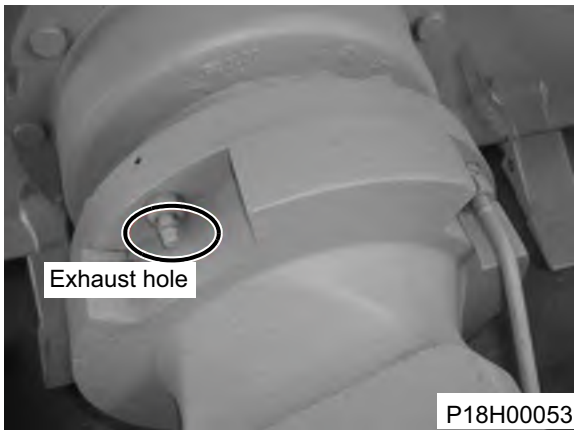
3. Depress the service brake pedal, stop the machine and place the shift control lever to neutral position, and engine won't cut-out.
4. Keep the service brake state and check whether machine will move.

⚠CAUTION

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

Exhaust of brake system

Bleeding position at front/rear axle



P18H00053

1. Stop the machine on a level and straight road.
2. Turn the shift lever to the neutral position, start up the engine and let it run at idle speed, activate the parking brake switch; switch off the low-pressure alarm lights for service brake and for parking brake, stall the engine and then activate the electric lock.
3. Put a transparent hose around the exhaustion nozzle of the left/right wheel brake of front drive axle and the other end of the hose into the oil pan.
4. It needs the coordination of two persons, one is to loosen the exhaustion nozzle to observe the exhaust situation; the other depresses the pedal firmly after stepping on it several times continuously until the the liquid column without bubbles is discharged, tighten the exhaustion nozzle.
5. Repeat these steps to discharge the gas from the rear axle.

6. After the gas in the front/rear axles is discharged, continuously pull up and press down the switch of parking brake for 3-4 times, and discharge the gas out of parking brake.

⚠WARNING

Since there is high pressure oil stored in the wheel brake, special care must be taken when bleeding. It is not allowed to loosen fully the bleeding valve. Keep the eyes and body away from the bleeding valve in order to avoid injuries caused by spraying oil liquid.

Check for the performance of parking brake

⚠CAUTION

You shall frequently inspect the performance of parking brake so as to guarantee parking safety and effect of emergency brake. Guarantee parking safety and effect of secondary brake.

1. Adjust the tire pressure of machine to the specified value, and lay down the bucket levelly at approx. 300mm\11.8in from the ground. And confirm the machine have the performance of good service brake.
2. Start the engine and load 5 tons weight and align the machine at 15% slope (8° 32') and the pavement shall be flat and dry.
3. Pull the parking brake button, stop the machine and place the shift control lever to neutral position, and the engine is not stalled.

Hydraulic cooling system

A: Overview-components and position

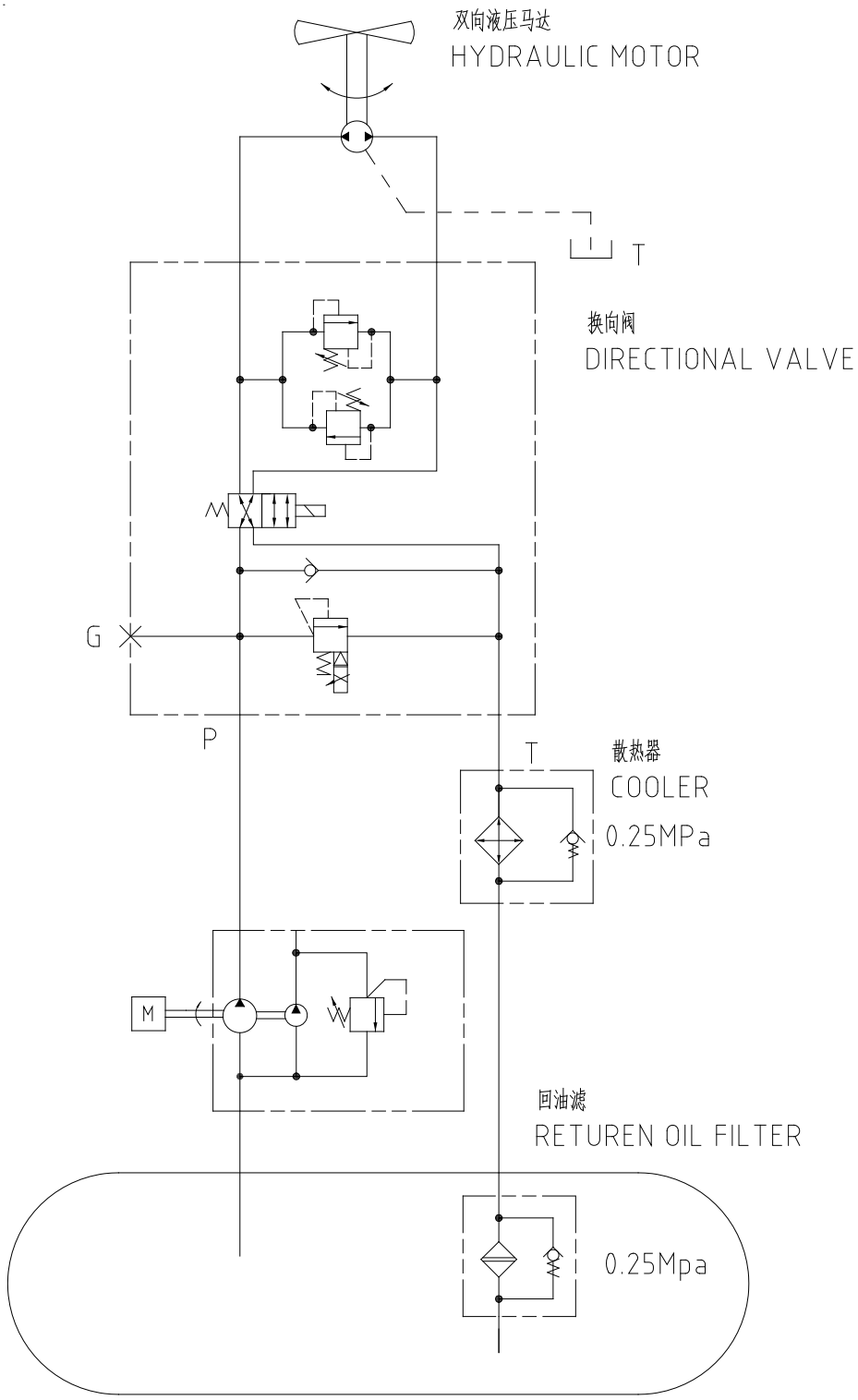
This machine is equipped with separate hydraulic fan motor cooling system, which acquires oil temperature and water temperature signals of torque converter and temperature signal of air-air inter-cooler, and controls the speed of fan with program. This not only meets needs for system cooling, but also achieves the purpose of energy saving. The system consists of cooling pump, motor, solenoid directional valve and other pipes (refer to the maintenance manual of electrical system for electrical controls).

System's features:

1. With electric adjustment, control pressure of proportional relief valve with signal of current so as to control inlet flow of motor and adjust fan speed.
2. The proportional relief valve integrates the reversing valve, when the relief valve is closed normally, it guarantees the fan works at full speed in the case of no electrical signal;
3. The fan is driven in reverse direction to make fan work reversely, dredging the impurities deposited on the radiator;

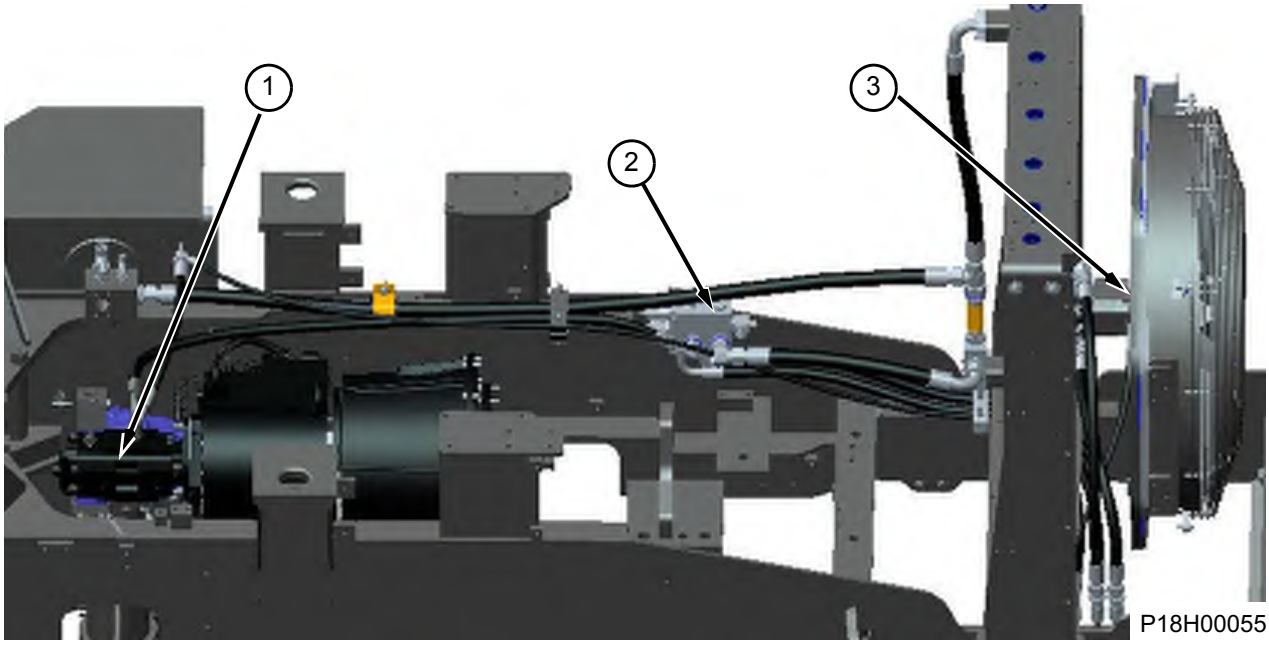
The schematic and component layout drawing of CLG835H-T4f cooling system are as follows:

Schematic of the hydraulic cooling system



P18H00054

Layout of hydraulic cooling system



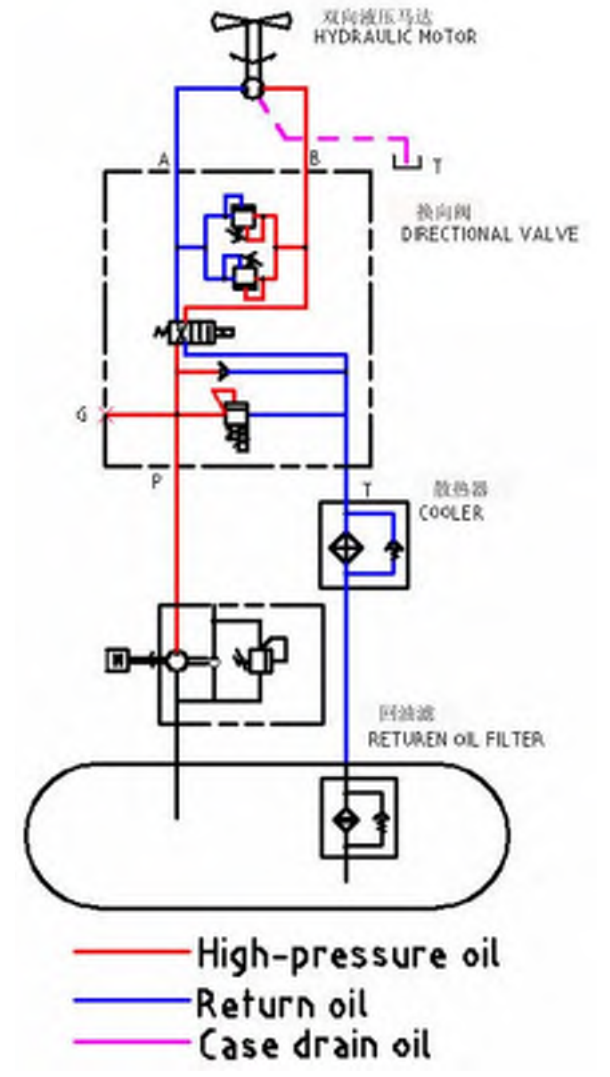
1. Cooling pump
2. Solenoid directional valve
3. Motor

Overview - technical parameters of hydraulic cooling system

Items	Parameters
System pressure	About 12.5±0.3MPa@1250rpm (fan speed)
System flow	53L/min@2200r/min\14US gpm@2200rpm
Pressure of overload valve at port A	22MPa\3190psi
Pressure of overload valve at port B	22MPa\3190psi

Overview - working principle of hydraulic cooling system

Oil line of fan rotation clockwise:

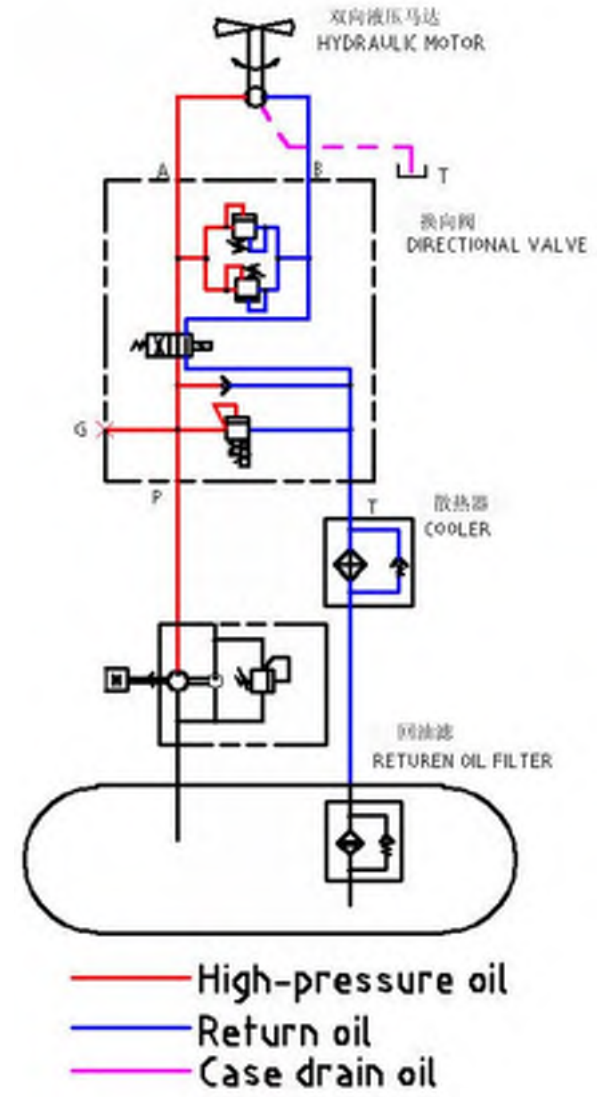


P18H00056

Working principle:

When the solenoid directional valve is not energized, under action of spring force, it works in left position. High pressure oil from cooling pump flows into the port B of cooling motor via solenoid directional valve. The oil in port A of cooling motor enters into radiator via the solenoid directional valve to achieve clockwise rotation of fan.

Principle of fan reverse rotation:



P18H00057

Working principle:

When the solenoid directional valve is energized, under action of electromagnetic force and standing the spring force, it works in right position. High pressure oil from cooling pump flows into the port A of cooling motor via solenoid directional valve. The oil in port B of cooling motor enters into radiator via the solenoid directional valve to achieve reverse rotation of fan.

In addition, the electric control system acquires the temp signal from air-air inter-cooler, oil and water temp signals from torque converter, to control the opening of proportional relief valve, so that the pressure difference between inlet and outlet of cooling motor, further to control motor flow and fan speed.

Cooling pump

Main technical parameters

Items	Parameters	Service conditions	Remarks
Theoretical displacement (ml/r\cc/r)	26.3\26.3	/	/
Rated speed (r/min)	600-2500	/	/
Rated pressure (Mpa\psi)	20\2900	/	/
Volume efficiency	0.92	/	/
Operating fluid	Anti-wear hydraulic oil	HM46/HV46	/
Direction of rotation	Left rotation	/	/

Structure and working principle of cooling pump

Since the cooling pump is a tandem pump with brake pump, and thus its content is the same with that of brake pump, please refer to Structure and working principle of brake pump.

Cooling motor

Main technical parameters

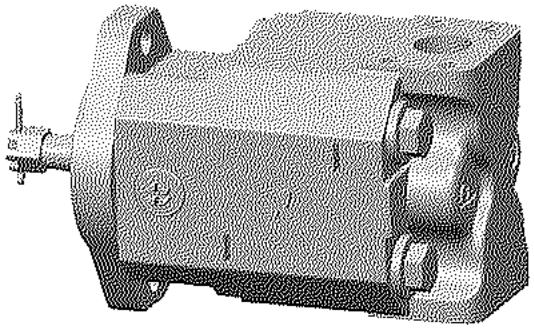
Items	Parameters	Service conditions	Remarks
Theoretical displacement (ml/r\cc/r)	35.5\35.5	/	/
Rated/maximum speed (r/min)	1250/3000	/	Set speed of fan 1250r/min
Rated pressure (MPa)	18\2610	/	/
Volume efficiency	0.92	/	/
Operating fluid	Anti-wear hydraulic oil	HM46/HV46	/
Direction of rotation	Bidirectional rotation	/	/

Structure and working principle of motor

The cooling motor, as an actuator of system, is used to pull the fan to rotate, so that the hydraulic pressure from cooling pump is converted into mechanical energy of fan.

Overall structure of motor:

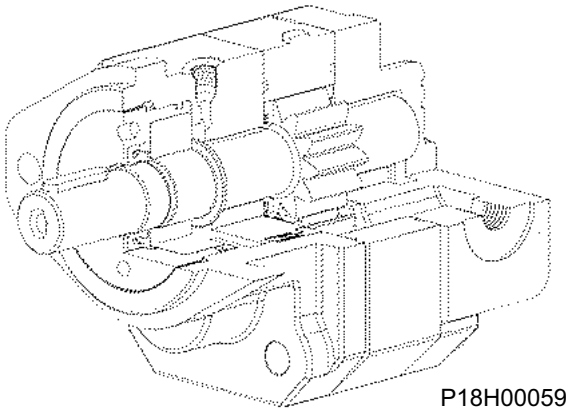
Schematic of cooling motor



P18H00058

1. A port
2. B port
3. Housing oil return port

Section of cooling motor



P18H00059

Solenoid directional valve

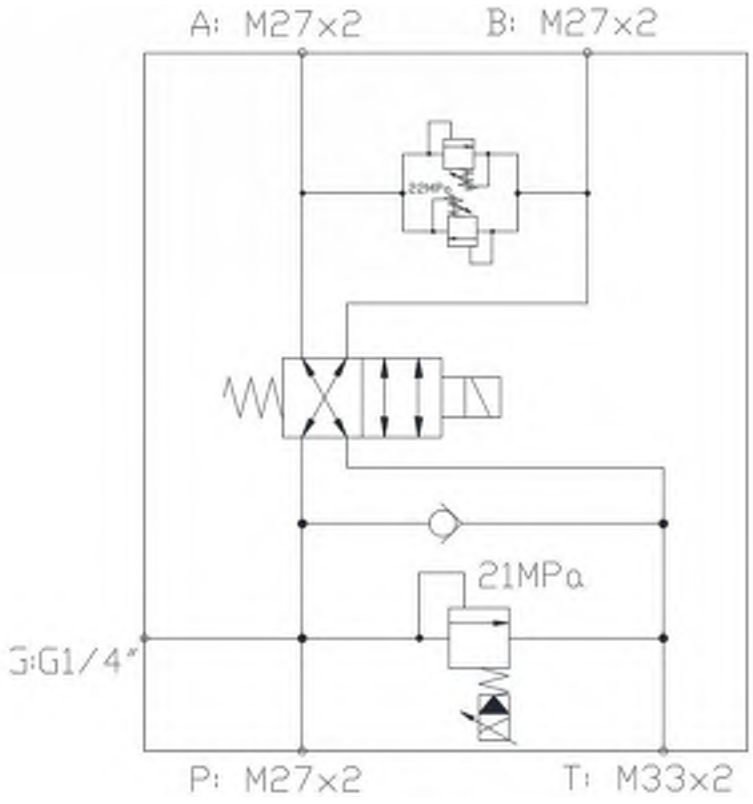
Main technical parameters

Items	Parameters	Service conditions
Rated flux	95L/min\25.1US gpm	/
Working voltage	24V	/
Operating fluid	Anti-wear hydraulic oil	HM46/ HV46

Structure and working principle

1. The solenoid directional valve uses electronic proportional relief valve to control pressure drop of oil after passing through cooling motor so as to control the flow entering into the motor to control speed of motor, whereby the speed of fan is controlled well;
2. When the directional valve is not energized, the high pressure oil from P port flows into A port of motor, thus driving the fan to rotate clockwise; when the directional valve is energized in right position, the high pressure oil from P port flows into B port of motor, thus driving the fan to rotate counterclockwise;
3. Bi-directional relief valve mainly plays a part of secondary relief.

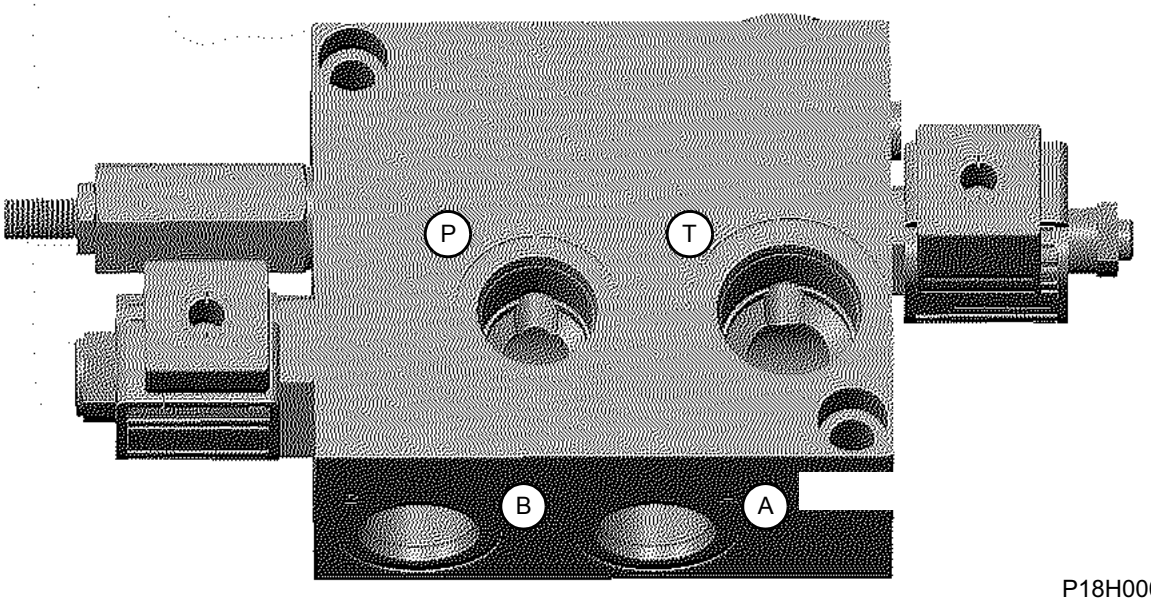
Schematic of the solenoid directional valve



P18H00060

Overall structure of solenoid directional valve:

Overall structure diagram of solenoid directional valve



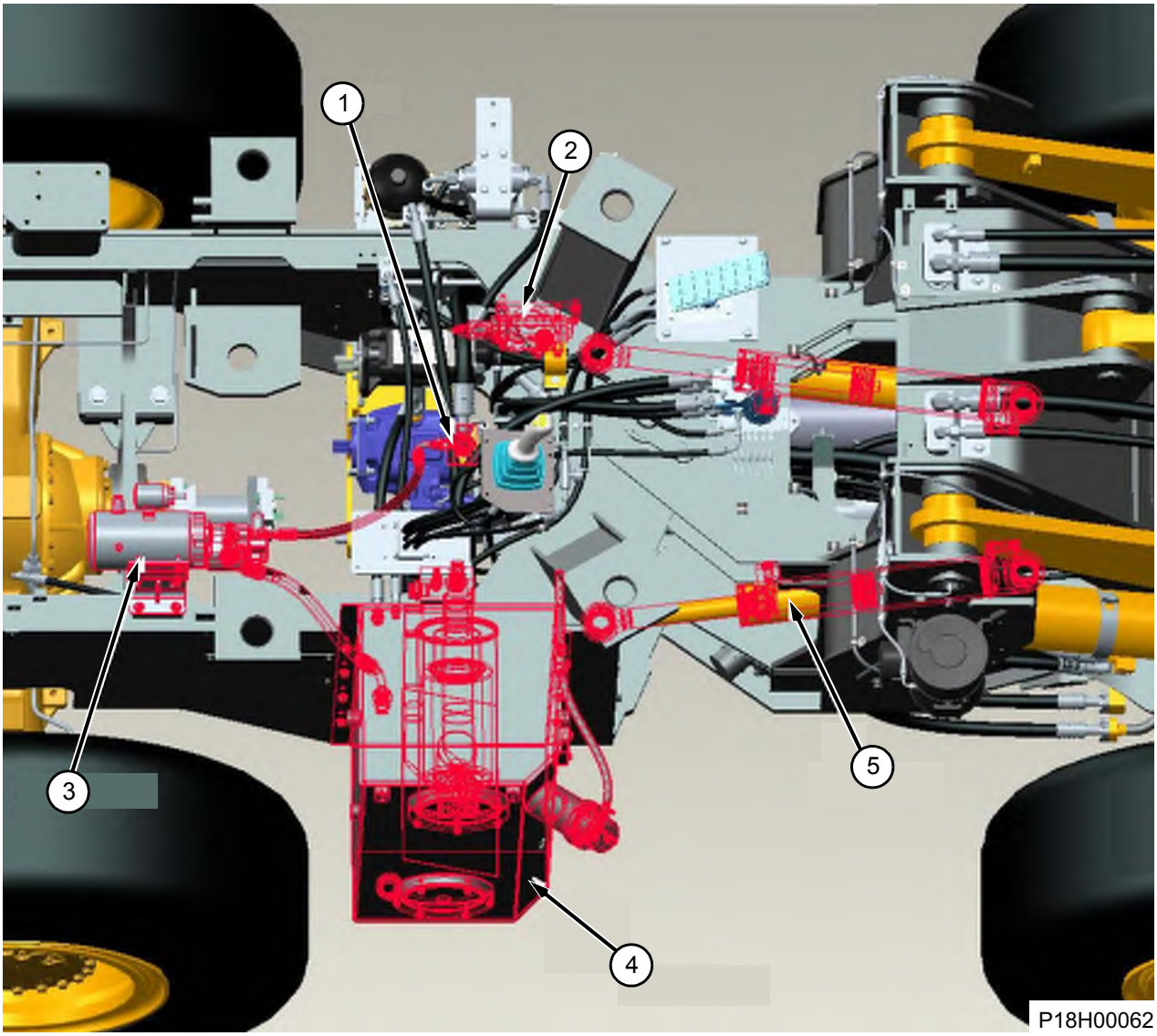
P18H00061

Emergency steering system

A: Overview-components and position

The secondary steering system is composed of secondary steering pump, check valve, priority valve, steering cylinder and hydraulic oil tank. The secondary steering pump is located at right side of rear frame, below right rear part of cab. For the positions of corresponding components on the complete machine, refer to the figure below for details.

Layout of secondary steering system component



1. Check valve
2. Priority valve
3. Secondary steering pump
4. Hydraulic oil tank
5. Steering cylinder

B: Overview - technical parameters of secondary steering system

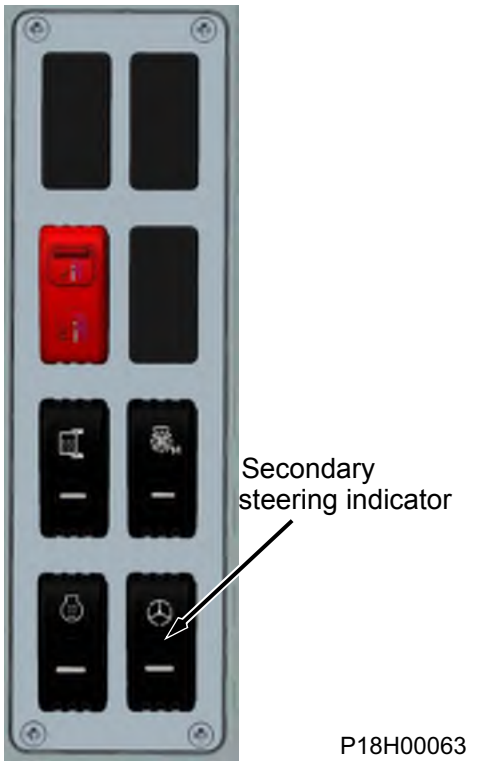
Items	Parameters
Theoretical displacement (ml/r\cc/r)	10\10
DC voltage (V)	24
Relief valve pressure (Mpa\psi)	16\2320
Maximum inlet pressure (bar\psi)	2\29
Operating fluid	Anti-wear hydraulic oil
Flow	22-25L/min@52bar\ 5.81-6.61US gpm@754psi
Current	190-210A@52bar\ 190-210A@754psi

Overview - working principles of secondary steering system

The check valve of secondary steering system is closed to protect the pressure oil from flowing back to the secondary pump during normal operation of complete machine. If the steering pump fails or engine fails, and complete machine is energized for more than 30s, the speed of complete machine is more than 5km/h\3.11mph, at this time, the secondary steering runs continuously for 60s, which is recyclable. The secondary steering pump sucks up the oil from the hydraulic oil tank, the oil flows through the secondary steering check valve and meanwhile closes the steering pump opening check valve and then reaches the steering cylinder via priority valve to achieve the secondary steering.

The secondary steering system can use manual test. The manual test switch is located at right upright of cab and is a momentary switch, which is usually ON. When testing the secondary steering system, the complete machine is energized but not started, press the test switch and the secondary steering indicator comes on, the secondary steering pump starts and the steering test can be performed.

Schematic of secondary steering indicator

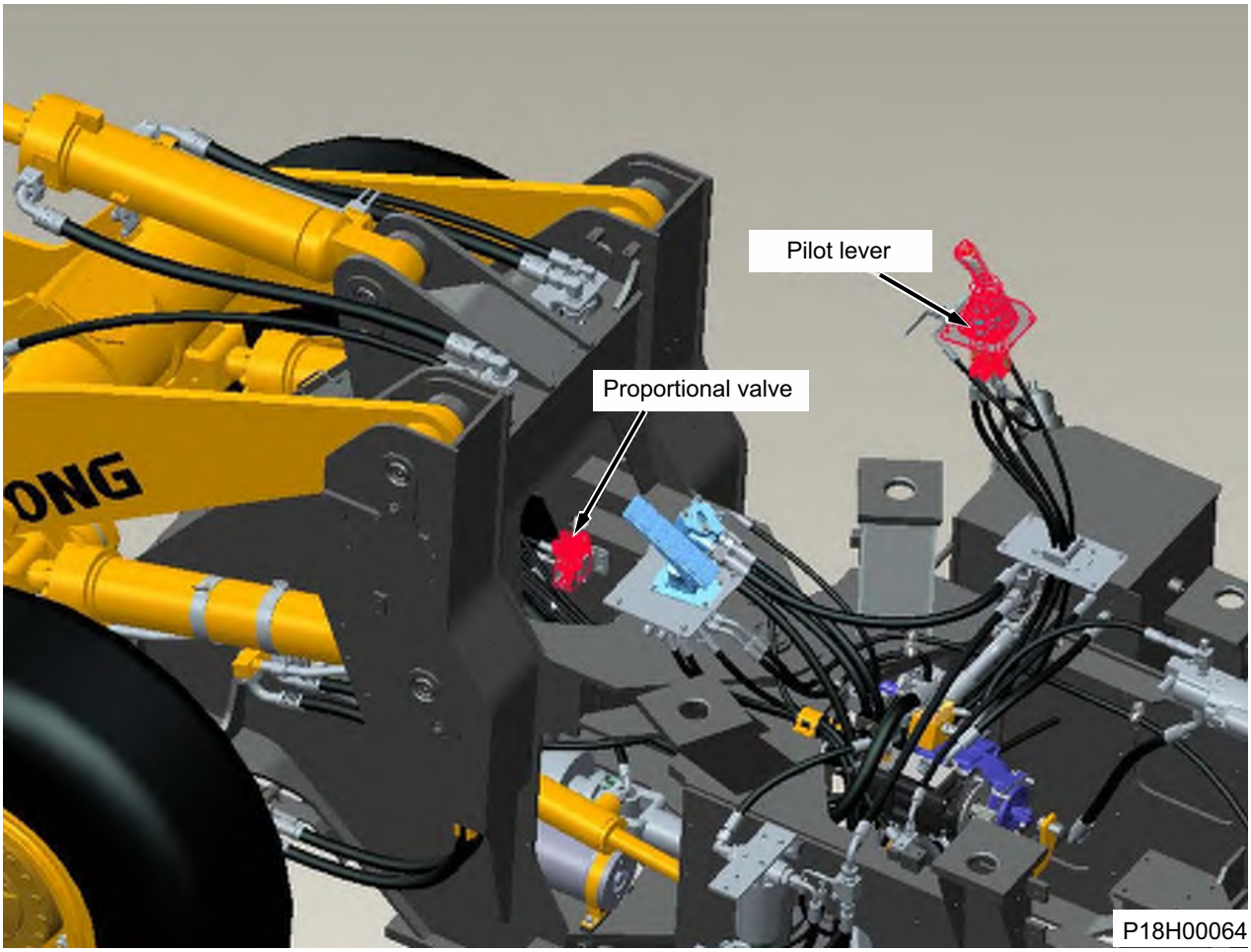


Pilot system of electronic control third linkage

A: Overview-components and position

The electronic control third linkage uses the proportional valve located at right inner side of front frame to control the pilot of third linkage. This system leads the oil from the pilot oil supply valve and controls the pilot pressure of third linkage respectively.

Schematic of pilot system of electronic control third linkage

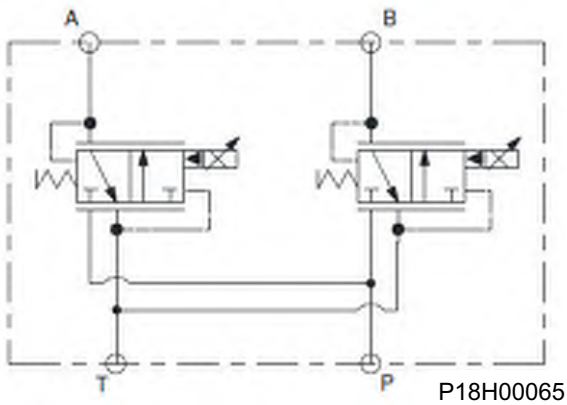


Overview- system principle

This system is controlled by the roller integrated on the pilot lever and a lock switch is provided on the right upright of cab to control the application of third linkage to avoid mis-operation.

For the machine with the pilot third linkage acting as electronic control valve, the action of third linkage is controlled via lock switch, in which when the switch is under lock state, the attachment controlled by pilot third linkage can not work, the quick coupler cylinder is under lock state, at which the working attachment can not be installed and removed.

System schematic diagram



P18H00065

Testing and Adjustment

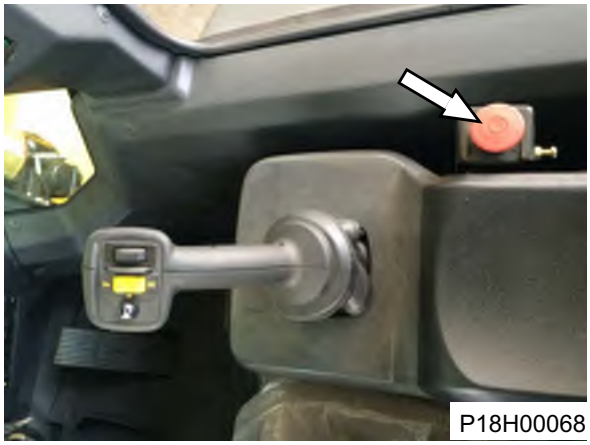
Pressure release of hydraulic system

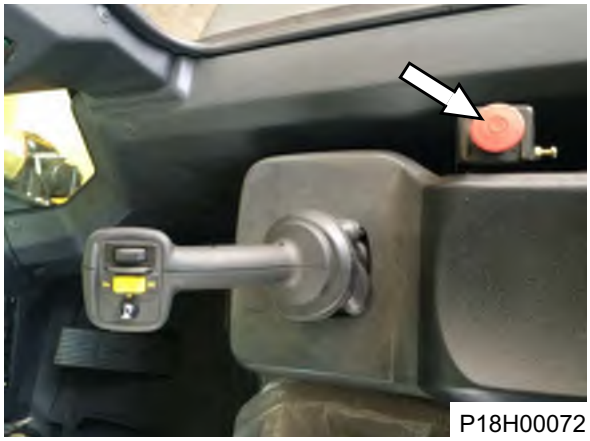
⚠WARNING

Sudden movement of vehicle or release of oil pressure may cause injury to the persons around the vehicle.

Perform the following procedures to avoid the possible injury:

Figures	Operation instruction	Tools
 P18H00066  P18H00067	1. Park the vehicle on flat and level ground, transfer vehicles and workers working around, place the work implements on the ground, and pad the wheel and install the lock device of steering frame.	
	2. Only operators other than other persons are allowed to work around vehicle;	

Figures	Operation instruction	Tools
 P18H00068	3. Pull up the emergency brake handle to apply parking brake.	
 P18H00069	4. Turn the starting switch to "OFF" position	
 P18H00070	5. Operate the control lever of the work implement to take the floating lowering & raising of boom and dumping and tilting back of bucket. Release pressure of work hydraulic system;	

Figures	Operation instruction	Tools
 P18H00071	6. Depress the service brake pedal more than 20 times to release the service brake system pressure;	
 P18H00072	7. Limit and immobilize the wheel to make sure the vehicle in a stopped state, turn on the cathode switch, and turn on/off paring brake button no less than 20 times to release parking brake system pressure.	

Pressure test of work hydraulic system

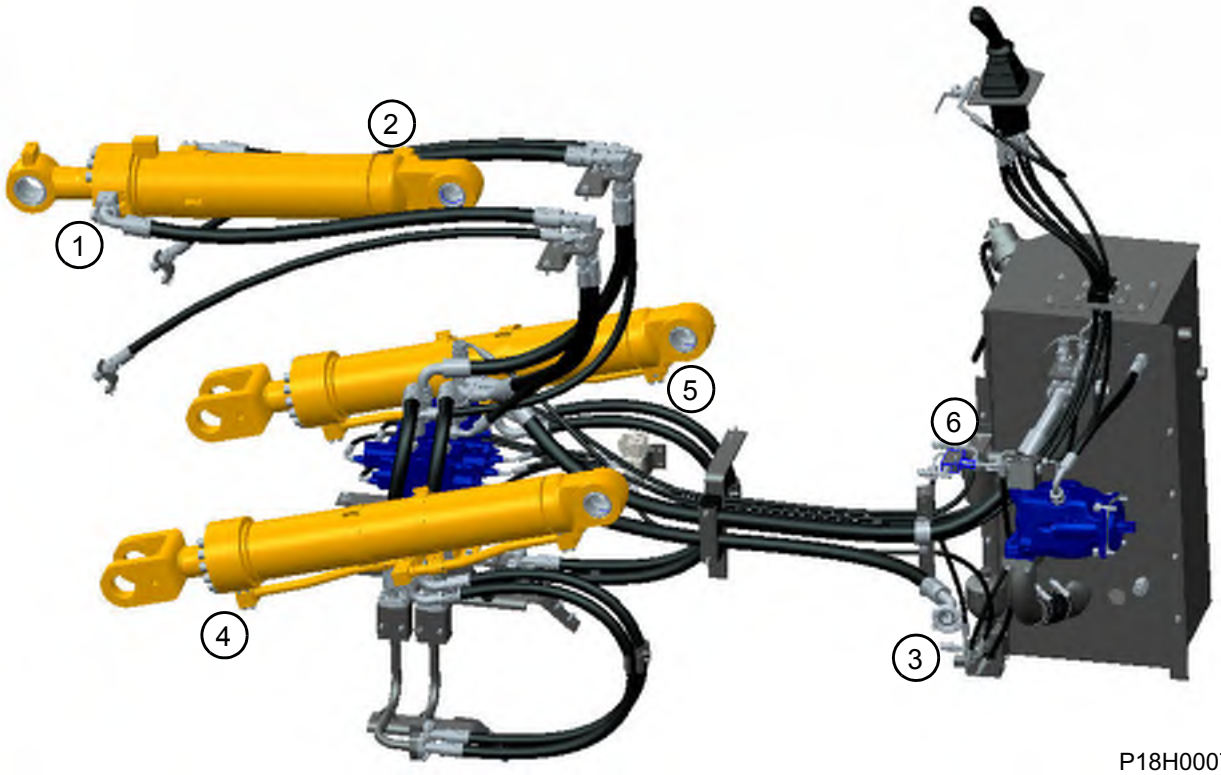
CLG835H_T4f loader work hydraulic system has set fast-connection pressure measuring connector or pressure measuring plug at all key points of loops for the convenience of detecting hydraulic system pressure and understanding the detection and maintenance of the working condition and fault of the hydraulic 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 test and adjustment, pressure shall be released according to Pressure Release of Hydraulic System The pressure test 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.

Positions of every gauging points of working hydraulic system

Layout of the pressure measuring point position of the work hydraulic system



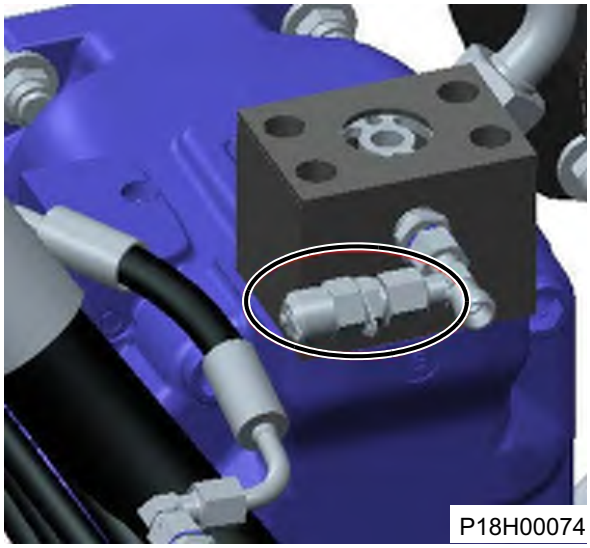
P18H00073

Description of every gauging points of working hydraulic system

Pressure measuring point	Description of pressure measuring point	Theoretical pressure value (Mpa\ psi)	Interface dimension	Brief introduction for test
Pressure measuring point 1	Pressure of small cavity of bucket cylinder	19\2755	M14×1.5-6H	Remove the plug, install the pressure measuring connector 30C3280 to take the test; after test, remove the pressure measuring connector and re-assemble the original plug.
Pressure measuring point 2	Pressure of big cavity of bucket cylinder	19\2755	M14×1.5-6H	Remove the plug, install the pressure measuring connector 30C3280 to take the test; after test, remove the pressure measuring connector and re-assemble the original plug.
Pressure measuring point 3	Pilot oil supply valve outlet pressure	3.5\507.5	M14×1.5-6g	It can be measured directly by pressure measuring connector 30C3278 mounted on complete machine.
Pressure measuring point 4	Pressure of small cavity of boom cylinder	19\2755	M14×1.5-6H	Remove the plug, install the pressure measuring connector 30C3280 to take the test; after test, remove the pressure measuring connector and re-assemble the original plug.
Pressure measuring point 5	Pressure of big cavity of boom cylinder	19\2755	M14×1.5-6H	Remove the plug, install the pressure measuring connector 30C3280 to take the test; after test, remove the pressure measuring connector and re-assemble the original plug.
Pressure measuring point 6	Pressure at oil outlet of working pump	19\2755	M14×1.5-6g	It can be measured directly by pressure measuring connector 30C3278 mounted on complete machine.

Inspection and adjustment for pressure of working hydraulic pressure system

1. Test method

Figures	Operation instruction	Tools
 P18H00074	1. Connect the pressure gauge at pressure measuring point 6 (as shown in figure);	Pressure gauge (range 6MPa/ 870psi);
 P18H00075	2. Start the machine, idling without action; The value of pressure gauge in pressure measuring point 6 (as shown in figure) is 2.6±0.1MPa/ 377±14.5psi; 3. In event of reaching the value, start the machine and operate the pilot valve to tilt back the bucket with very slow speed till suppression; pay attention to the value on the pressure gauge of pressure measuring point 6; 4. During step 3, when bucket is suppressed, the value on pressure gauge of pressure measuring point 6 shall be 19±0.3MPa\2755±43.5psi constantly.	Pressure gauge (range 40 MPa/ 5800psi).

Note: if the pressure measured at the end of oil cylinder may be about 1-2MPa\145-290psi more than that of pump opening, the variable system pressure is subjected to the pressure of pump opening.

2. Work system pressure adjustment:

Work system pressure components:

a. The outlet pressure of working pump at idling, namely as the spring setting pressure of working pump flow control valve. The value of pressure measuring point 6 at working pump opening shall be 2.6±0.1MPa\ 377±14.5psi by adjusting the flow control valve (refer to adjustment of working pump);

b. The pressure of LS oil line relief valve of control valve. The value at pressure measuring point 6 shall be 19±0.3MPa\ 2755±43.5psi (after the setting value of flow control valve are met) by adjusting LS relief valve (refer to adjustment for control valve).

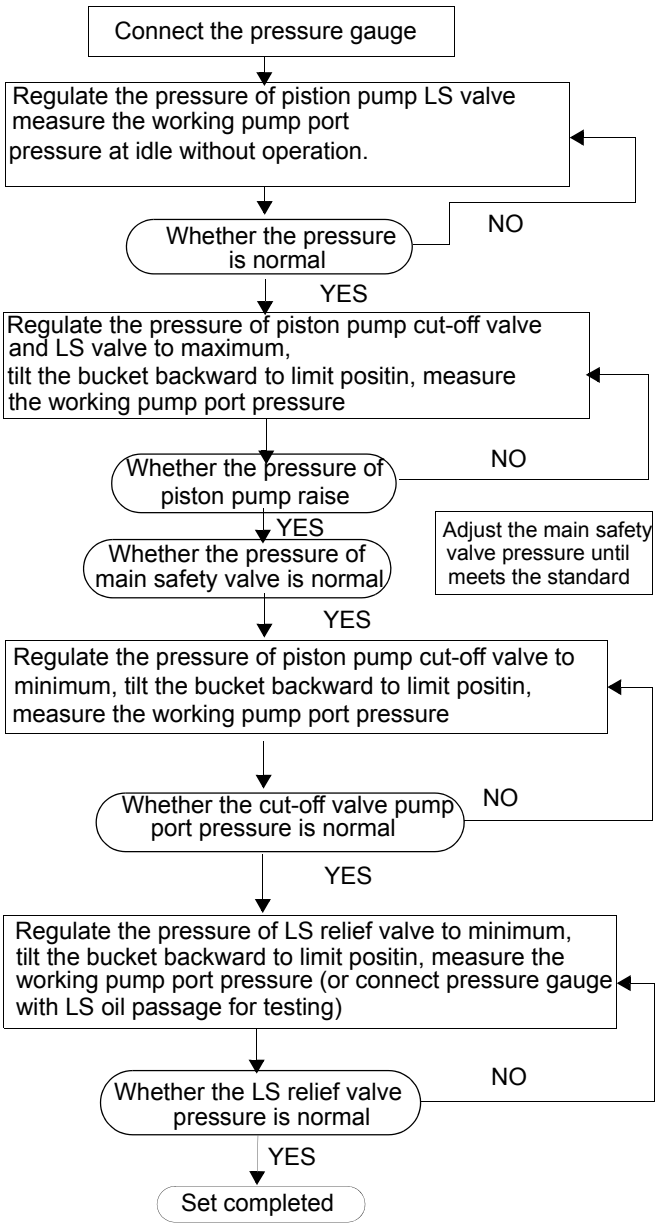
If the above two places are set, the work system pressure is always less than 19±0.3MPa/ 2755±43.5psi, which may be caused by the low cut-off pressure of working pump or low setting pressure of main safety valve of control valve. Refer to Inspection and adjustment of cut-off pressure of working pump for cut-off pressure adjustment of working pump, and refer to 6. Inspection and adjustment of main safety valve pressure of control valve for main safety valve pressure adjustment of control valve.

Note: If the cause that the work system pressure is always less than 19±0.3MPa/ 2755±43.5psi isn't determined, adjust that according to the following order:

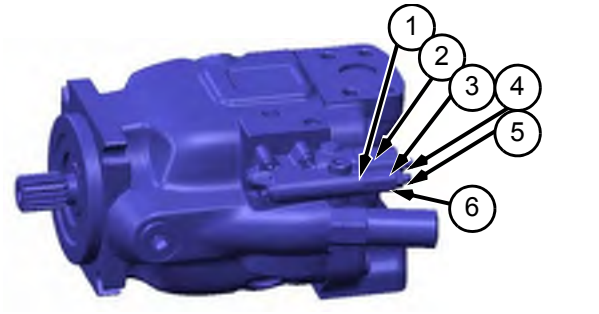
a. First set the pressures of LS relief valve of control valve and the cut-off and setting pressure of working pump to maximum, and see the respective adjustment for specific operations;

b. Second adjust the setting pressure of main safety valve of control valve to 21±0.3MPa\ 3045±43.5psi in sequence (refer to Adjustment and inspection of main safety valve pressure of control valve), the cut-off pressure of working pump to 20±0.3MPa\ 2900±43.5psi (refer to Adjustment of cut-off pressure of working pump), and the pressure of LS relief valve to 16.5±0.3MPa\ 2392.5±43.5psi. After the above each pressure meets the adjusted value, refer to Inspection and adjustment for pressure of work hydraulic system to control the constant pressure value of pressure gauge in pressure measuring point 6 as 19±0.3MPa\ 2755±43.5psi. Refer to the following flow chart:

Test and adjustment procedures for working hydraulic system pressure

Steps	Process	Operation method
Piston type pump △ P setting		Standard pressure gauge connector(M16X2), measuring range: 0-6MPa(0-870psi) LS relief valve adjusting method: unscrew the nut, adjust with inner hexagon spanner, turn up in clockwise, vice versa. Design pressure of the pistion pump LS valve is 2.6MPa(377psi).
Main safety valve pressure of distribution valve is set		Standard pressure gauge connector (M16X2), measuring range: 0-40MPa(0-5800psi) Pressure cut-off valve adjusting method: unscrew the nut, adjust with inner hexagon spanner, turn up in clockwise, vice versa. During measuring process, it needs to repeat adjusting and measuring to make it confirm. Pressure value of main safety valve is 21MPa(3045psi).
Piston type pump cut-off valve pressure is set		Standard pressure gauge connector(M16X2), measuring range: 0-40MPa(0-5800psi) Tighten up cut-off valve inner hexagon spanner . Pressure value of pistion pump cut-off valve is 20MPa(2900psi).
LS relief valve pressure is set		Standard pressure gauge connector(M16X2), measuring range: 0- 40MPa(0-5800psi) Pressure value of LS relief valve is 20MPa. Design pressure value of LS overflow valve 16.5MPa(2392.5psi) Pressure value of pistion pump port is 19MPa(2755psi). Screw tighten LS valve and cut off valve hexagon and nut.

Adjustment of working pump



P18H00077

1. Flow control valve
2. Pressure shut-off valve screw rod
3. Pressure shut-off valve
4. Flow control valve screw rod
5. Pressure shut-off valve nut
6. Flow control valve nut

1. Working pump adjustment: setting method for pressure of flow control valve 1:

   a. Loosen the hexagon nut 6 with open-end wrench (13mm);

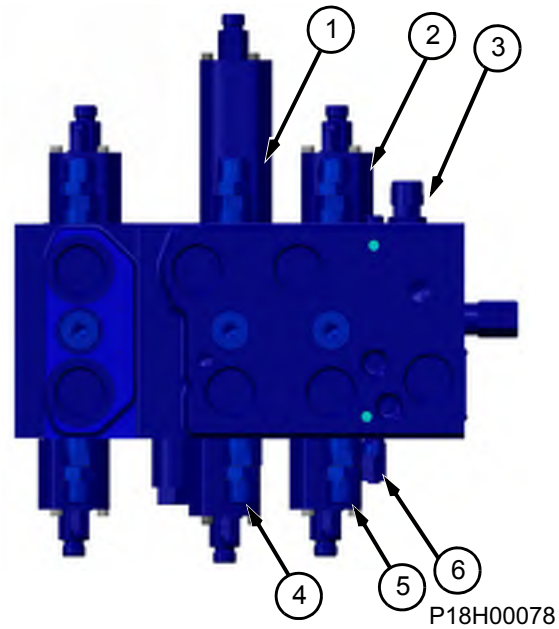
   b. Set the adjusting screw rod 5 of flow control valve with inner hexagon spanner (3mm). It is turned up in clockwise and turned down in counterclockwise.

2. Setting method for pressure of pressure shut-off valve 2:

   a. Loosen the hexagon nut 3 with open-end wrench (13mm);

   b. Set the adjusting screw rod 4 of pressure compensation valve with inner hexagon spanner (3mm). It is turned up in clockwise and turned down in counterclockwise.

Adjustment of control valve



P18H00078

1. Overload valve of boom big cavity
2. Overload valve of bucket big cavity
3. Main safety valve of control valve
4. Overload valve of boom small cavity
5. Overload valve of bucket small cavity
6. LS Relief valve:

1. Setting method for pressure of overload valve of bucket big cavity:

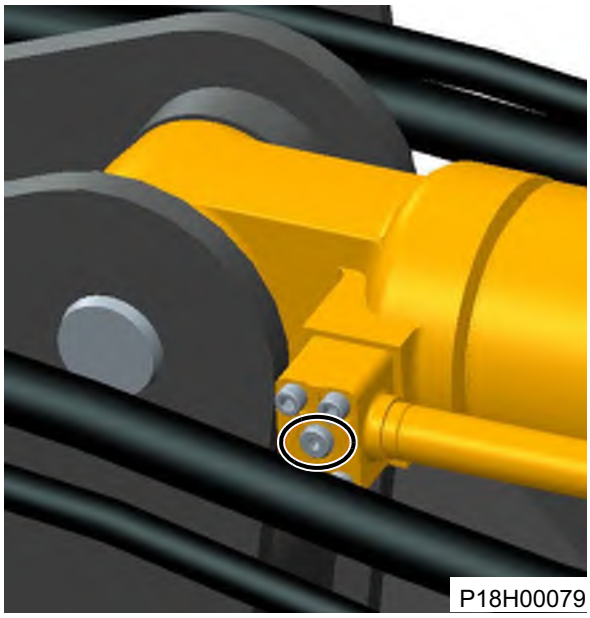
   a. Remove the plastic protective sleeve installed outside of overload valve, and loosen locknut with wrench;

   b. Set the screw rod of overload valve with inner hexagon spanner. It is turned up in clockwise and turned down in counterclockwise.

The setting method of overload valve of boom big cavity, overload valve of boom small cavity, overload valve of bucket small cavity, main safety valve of control valve is as above.

Pressure inspection and adjustment of overload valve of bucket tilting large chamber

1. Test method

Figures	Operation instruction	Tools
 P18H00079	1. Remove the plug, install the pressure measuring connector 30C3280; connect the pressure gauge at pressure measuring point;	Pressure gauge (range 40MPa\ 5800psi);
 P18H00080	2. Start the machine and lift the boom to the maximum position (when diesel engine and hydraulic oil is under normal operating temperature, the diesel engine will be in idle running);	

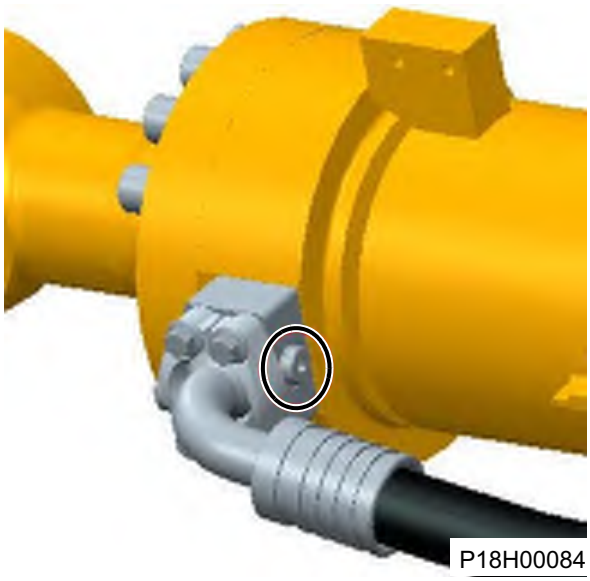
Figures	Operation instruction	Tools
 P18H00081	3. Operate the pilot valve to make it in the bucket tilting back position so that the bucket will rotate to the maximum bucket tilting back position; 4. The level returns to the neutral position;	
 P18H00082	5. Operate the pilot valve to make it in lowering position of the boom to lower the boom; check the pressure gauge at the same time;	
 P18H00083	6. When taking step 5, the maximum pressure value of pressure gauge at pressure measuring point shall be 23±0.3MPa\ 3335±43.5psi.	

2. Adjusting step:

If the pressure is nonconforming, adjust it according to adjustment for pressure of control valve and recheck whether the adjusting pressure is correct.

Pressure inspection and adjustment of overload valve of bucket tilting small chamber

1. Test method

Figures	Operation instruction	Tools
 P18H00084	1. Remove the plug, install the pressure measuring connector 30C3280; connect the pressure gauge at pressure measuring point;	Pressure gauge (range 40MPa\ 5800psi);
 P18H00085	2. Start the machine, operate the lever to lift boom to horizontal position (when the diesel engine and hydraulic oil is under normal operating temperature, the diesel engine will be in idle running)	

Figures	Operation instruction	Tools
 P18H00086	3. Operate the lever to make the bucket in maximum dumping position; 4. The level returns to the neutral position;	
 P18H00087	5. Operate the pilot valve to make it in boom raising position to lift the boom; meanwhile, observe the pressure gauge;	
 P18H00088	6. When taking the step 5, the maximum pressure value that can be displayed by pressure gauge at test point shall be 23±0.3MPa\ 3335±43.5psi.	

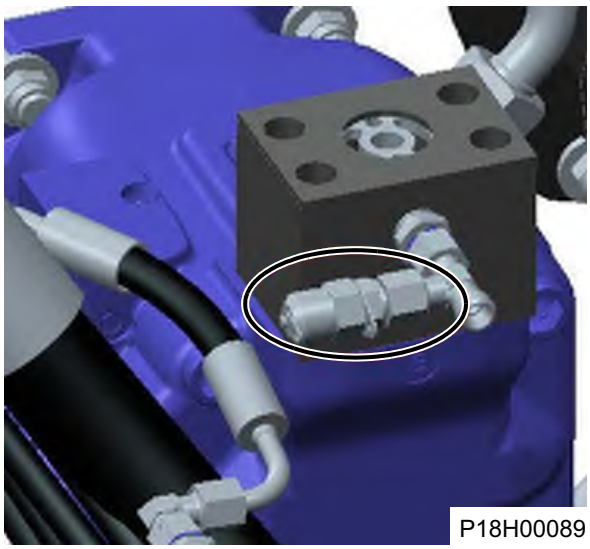
2. Adjusting step:

If the pressure is nonconforming, adjust it according to adjustment for pressure of control valve and recheck whether the adjusting pressure is correct.

Pressure inspection and adjustment of main safety valve of control valve

1. Test method

Note: Set the pressures of LS relief valve and the cut-off pressure of working pump to maximum before adjusting the main safety valve of control valve, and then perform the following steps. In fact, the safety valve basically does not work in the work hydraulic system, so it is not be adjusted in general.

Figures	Operation instruction	Tools
 P18H00089	1. Connect the pressure gauge at pressure measuring point;	Pressure gauge (range 40MPa\ 5800psi);
 P18H00090	2. Start the machine, operate the lever to lift boom to horizontal position (when the diesel engine and hydraulic oil is under normal operating temperature, the diesel engine will be in idle running)	
	3. The level returns to the neutral position;	

Figures	Operation instruction	Tools
 P18H00091	4. Operate the pilot valve to make it in bucket tilt back so as to rotate the bucket to the maximum rear tilting back position and keep it suppressed;	
 P18H00092	5. When taking step 4, the maximum pressure value of pressure gauge at pressure measuring point shall be 21±0.3Mpa\ 3045±43.5psi.	

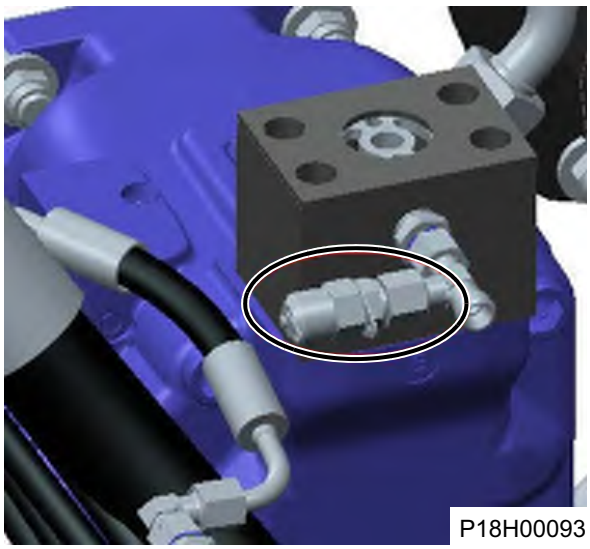
2. Adjusting step:

If the main safety valve pressure of control valve is nonconforming, adjust it according to the Adjustment for pressure of control valve and recheck whether the adjusting pressure is correct. After the correct adjustment is completed, recover the pressure of LS relief valve and the cut-off pressure of working pump.

Inspection and adjustment for cut-off pressure of working pump

1. Test method

Note: the pressures of LS relief valve of control valve should be adjusted to the maximum and the pressure of main safety valve of control valve should also be adjusted properly before adjusting the cut-off pressure of working pump.

Figures	Operation instruction	Tools
 P18H00093	1. Connect the pressure gauge at pressure measuring point 6;	Pressure gauge (range 40MPa\ 5800psi);
 P18H00094	2. Start the machine, operate the lever to lift boom to horizontal position (when the diesel engine and hydraulic oil is under normal operating temperature, the diesel engine will be in idle running)	
	3. The level returns to the neutral position;	

Figures	Operation instruction	Tools
 P18H00095	4. Operate the pilot valve to make it in bucket tilt back so as to rotate the bucket to the maximum rear tilting back position and keep it suppressed;	
 P18H00096	5. When taking step 4, the maximum pressure value of pressure gauge at pressure measuring point shall be 1-2MPa\ 145-290psi.	

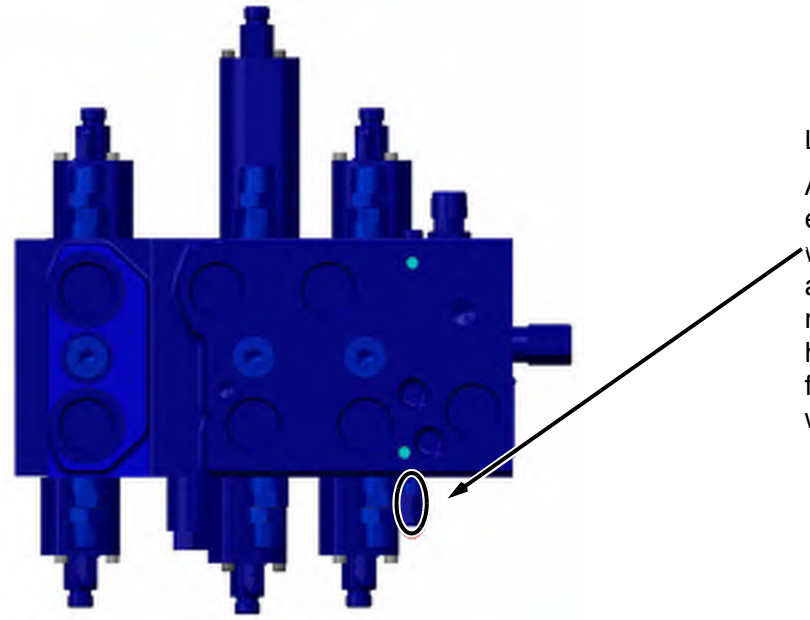
2. Adjusting step:

If the cut-off pressure of working pump is nonconforming, adjust it according to the adjustment for pressure of working pump and recheck whether the adjusting pressure is correct. After the correct adjustment is completed, recover the working pressure of work hydraulic system.

Adjustment for LS relief pressure of control valve

1. Test method

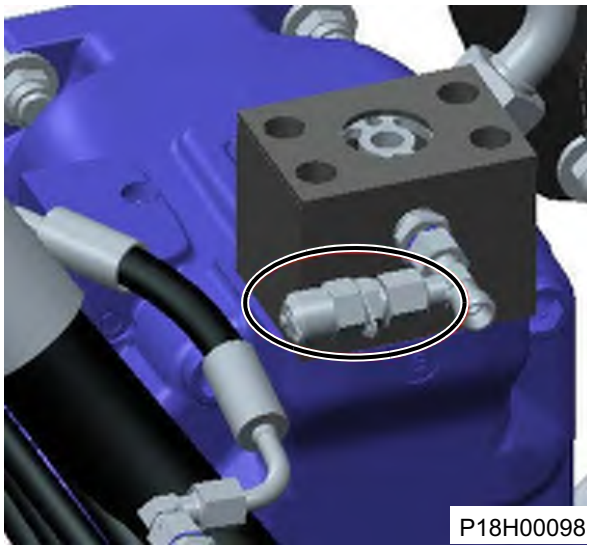
Note: the pressure of main safety valve of control valve and the cut-off pressure of working pump should be adjusted properly before adjusting the pressure of LS relief of control valve.



LS Relief valve:

Adjustment method: using 2 open-end wrenches of 17mm, one wrench gets valve body stuck, and the other unscrews the lock nut. Adjust the valve rod with inner hexagon wrench, turn it clockwise for waxing and anticlockwise for waning.

P18H00097

Figures	Operation instruction	Tools
 P18H00098	1. Connect the pressure gauge at pressure measuring point;	Pressure gauge (range 40MPa\ 5800psi);

Figures	Operation instruction	Tools
 P18H00099	2. Start the machine, operate the lever to lift boom to horizontal position (when the diesel engine and hydraulic oil is under normal operating temperature, the diesel engine will be in idle running)	
	3. The level returns to the neutral position;	
 P18H00100	4. Operate the pilot valve to make it in bucket tilt back so as to rotate the bucket to the maximum rear tilting back position and keep it suppressed;	
 P18H00101	5. When taking step 4, the maximum pressure value of pressure gauge at pressure measuring point shall be 19±0.3MPa/ 2755±43.5psi.	

Pressure inspection and adjustment of the pilot oil supply valve

1. Test method

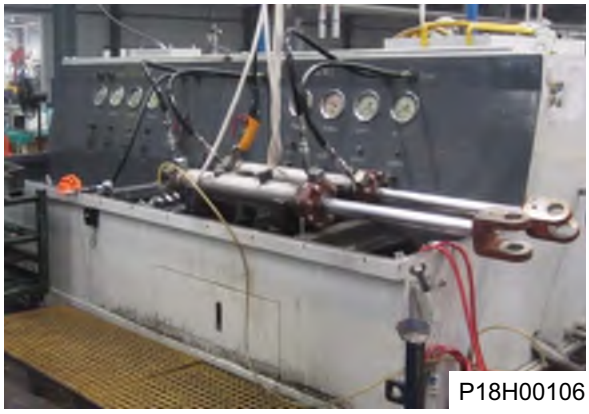
Figures	Operation instruction	Tools
 P18H00102	1. Connect the pressure gauge at pressure measuring point;	Pressure gauge (range 6 MPa);
 P18H00103	2. Start the machine, operate the lever to lift boom to horizontal position (when the diesel engine and hydraulic oil is under normal operating temperature, the diesel engine will be in idle running)	
	3. The level returns to the neutral position;	

Figures	Operation instruction	Tools
 P18H00104	4. Operate the pilot valve to make it in bucket tilt back so as to rotate the bucket to the maximum rear tilting back position and keep it suppressed;	
 P18H00105	5. When taking step 4, the pressure value of the pressure gauge at pressure measuring point 3 shall be 3.5±0.2MPa\507.5±29psi.	

2. Adjustment method:

If the pressure is incorrect, adjust the pressure of the pressure reducing valve for the pilot oil supply valve (for specific method, refer to the adjusting steps of the pressure reducing valve for the pilot oil supply valve) to make it reach 3.5±0.2MPa\ 507.5±29psi.

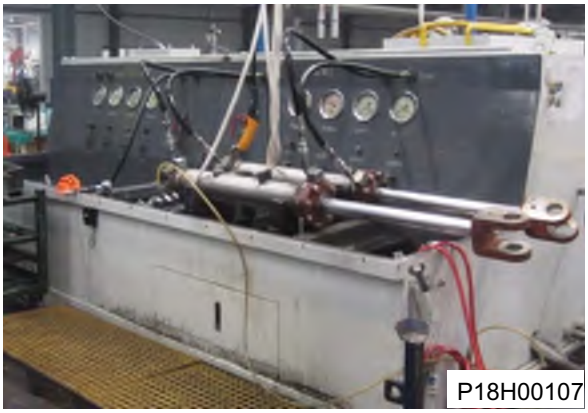
Boom cylinder test


P18H00106

Temperature of test oil:50±5°C\ 122±41°F

Test items	Test method	Criterion
Commissioning	Adjust the pressure of test system to make the tested hydraulic cylinder start without load condition and conduct full stroke reciprocating motion for more than 3 times to bleed the air from the hydraulic cylinder.	The hydraulic cylinder operates smoothly without being stuck.
Pressure tight test	Stop the tested hydraulic cylinder piston at both ends of stroke respectively (single-acting hydraulic cylinder stopped at the limit position of stroke), then apply 1.5 times rated pressure of oil to the working chamber and keep for 10s.	External leakage and damaged parts are not allowed.
Internal leakage test	Supply oil to the working chamber of tested hydraulic cylinder, then increase the pressure to the working pressure, measure the oil leakage at port of small cavity for 2min.	Internal leakage≤0.28ml/min\ 0.000074US gpm
Stroke test	Stop the tested hydraulic cylinder piston at the limit positions at both ends of stroke respectively, then measure its stroke length.	727mm~729mm\ 28.6~28.7in

Bucket cylinder test


P18H00107

Temperature of test oil: 50±5°C\ 122±41°F

Test items	Test method	Criterion
Commissioning	Adjust the pressure of test system to make the tested hydraulic cylinder start without load condition and conduct full stroke reciprocating motion for more than 3 times to bleed the air from the hydraulic cylinder.	The hydraulic cylinder operates smoothly without being stuck.
Pressure tight test	Stop the tested hydraulic cylinder piston at both ends of stroke respectively (single-acting hydraulic cylinder stopped at the limit position of stroke), then apply 1.5 times rated pressure of oil to the working chamber and keep for 10s.	External leakage and damaged parts are not allowed.
Internal leakage test	Supply oil to the working chamber of tested hydraulic cylinder, then increase the pressure to the working pressure, measure the oil leakage at port of small cavity for 2min.	Internal leakage≤0.30ml/min\ 0.000079US gpm
Stroke test	Stop the tested hydraulic cylinder piston at the limit positions at both ends of stroke respectively, then measure its stroke length.	519mm~521mm\ 20.4~20.5in

Steering hydraulic system test

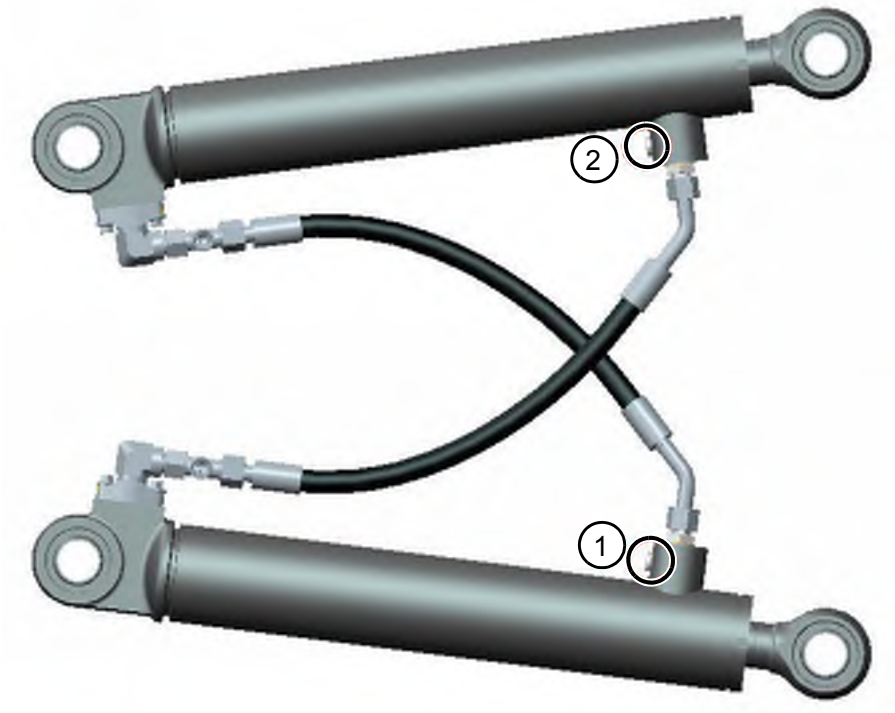
CLG835H_T4f loader steering hydraulic system has set fast-connection pressure measuring connector or pressure measuring plug at all key points of loops for the convenience of detecting hydraulic system pressure and understanding the detection and maintenance of the steering condition and fault of the 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 test and adjustment, pressure shall be released. The pressure test 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.

Measuring point position of steering hydraulic system

Layout of all measuring point position of steering hydraulic system



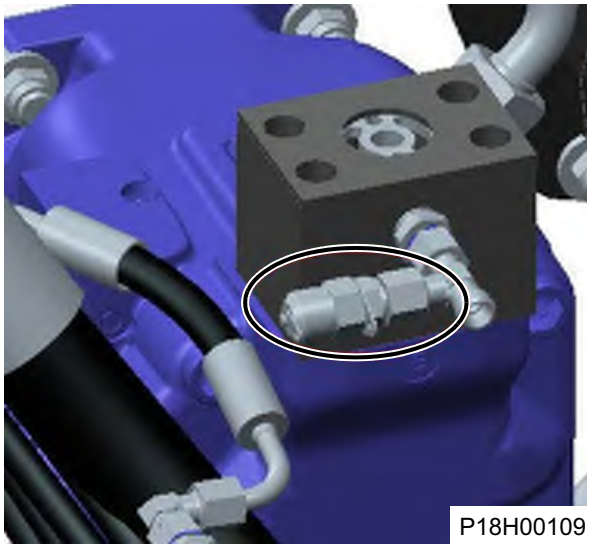
P18H00108

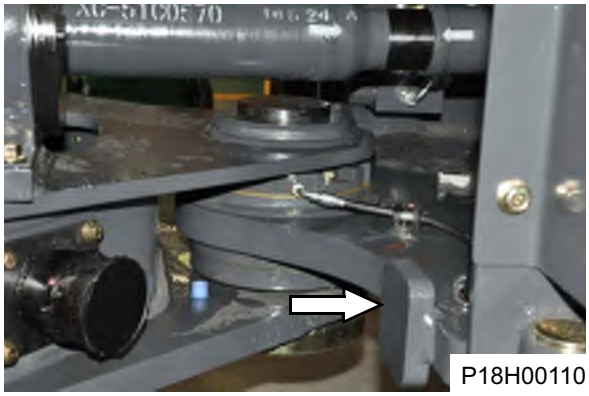
Description of measuring points of steering hydraulic system

Pressure measuring point	Description of pressure measuring point	Theoretical pressure value (Mpa\ psi)	Interface dimension	Testing step
Pressure measuring point 1	Pressure of small cavity of right steering cylinder	17.5\2537.5	M14×1.5-6H	Remove the plug, install the pressure measuring connector 30C3280 to take the test; after test, remove the pressure measuring connector and re-assemble the original plug.
Pressure measuring point 2	Pressure of small cavity of left steering cylinder	17.5\2537.5	M14×1.5-6H	Remove the plug, install the pressure measuring connector 30C3280 to take the test; after test, remove the pressure measuring connector and re-assemble the original plug.

Pressure testing and adjustment of steering hydraulic system

1. Testing method

Figures	Operation instruction	Tools
 P18H00109	1. Install the pressure gauge at pressure measuring point as shown in figure;	Pressure gauge (range 25MPa\ 3625psi);

Figures	Operation instruction	Tools
 P18H00110  P18H00111	2. Start machine and operate the steering wheel to make machine turn to maximum steering angle slowly and suppress the steering.	
 P18H00112	3. During the process of step 2 suppress steering, the pressure value of pressure gauge at pressure measuring point shall be 20±0.3MPa\ 2900±43.5psi constantly.	

Note: if the pressure measured at the end of oil cylinder may be about 1-2MPa\ 145-290psi more than that of pump opening, the variable system pressure is subjected to the pressure of pump opening.

2. Pressure adjustment:

a. Since the steering hydraulic system and work hydraulic system for this machine share the plunger pump, if there is problem with pressure, test whether the pressure of the plunger pump is normal according to “Pressure Test of Working Hydraulic System” and make correct adjustment.

b. LS relief pressure of priority valve can not be adjusted.

Steering cylinder test

P18H00113

Temperature of test oil: 50±5°C\ 122±41°F

Test items	Test method	Criterion
Commissioning	Adjust the pressure of test system to make the tested hydraulic cylinder start without load condition and conduct full stroke reciprocating motion for more than 3 times to bleed the air from the hydraulic cylinder.	The hydraulic cylinder operates smoothly without being stuck.
Pressure tight test	Stop the tested hydraulic cylinder piston at both ends of stroke respectively (single-acting hydraulic cylinder stopped at the limit position of stroke), then apply 1.5 times rated pressure of oil to the working chamber and keep for 10s.	External leakage and damaged parts are not allowed.
Internal leakage test	Supply oil to the working chamber of tested hydraulic cylinder, then increase the pressure to the working pressure, measure the oil leakage at port of small cavity for 2min.	Internal leakage≤0.13ml/min\ 0.000034US gpm
Stroke test	Stop the tested hydraulic cylinder piston at the limit positions at both ends of stroke respectively, then measure its stroke length.	419mm~421mm\16.5~16.6In

Brake system test

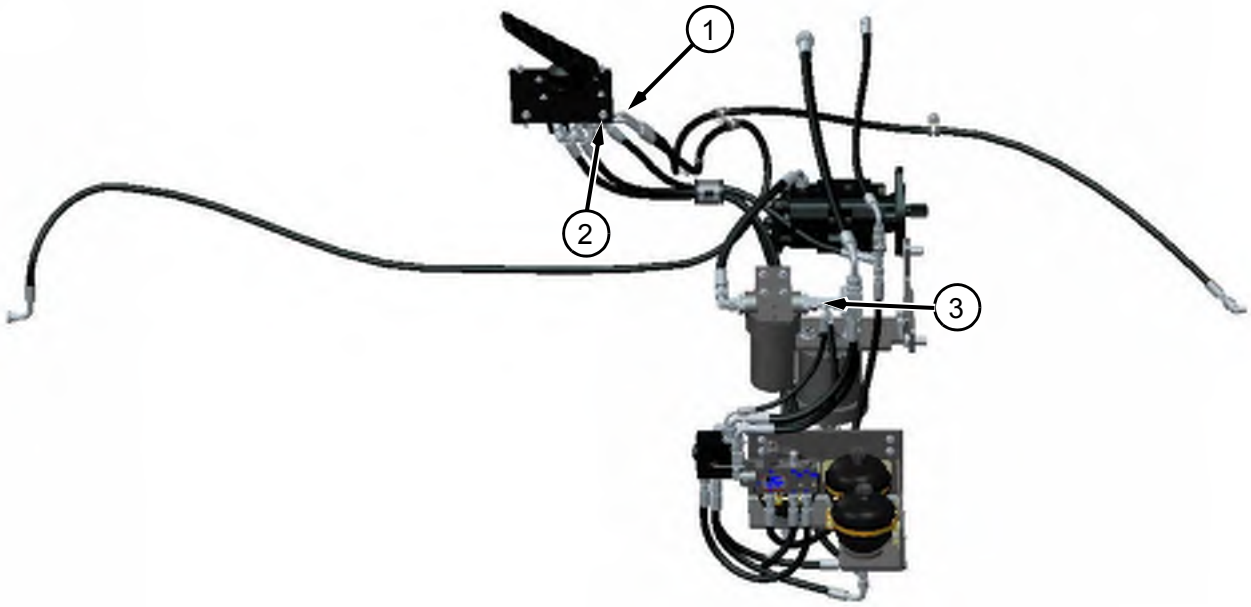
CLG835H T4f loader brake hydraulic system has set pressure measuring connector at all key points of loops for the convenience of the detecting hydraulic system pressure and understanding brake conditions and the detection and maintenance of the faults of hydraulic system. The followings are the detailed explanation and the instructions for these pressure measuring points.

⚠WARNING

When installing testing instruments for hydraulic system, perform the pressure test and adjustment, pressure shall be released according to Pressure Release of Hydraulic System. The pressure test 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.

Layout of pressure measuring points of brake system

Layout of pressure measuring points of brake system



P18H00114

Description of pressure measuring points of brake system

Pressure measuring point	Description of pressure measuring point	Theoretical pressure value (Mpa\ psi)	Interface dimension	Test specification
Pressure measuring point 1	Rear axle brake pressure	6±0.4\870±58	NPT 1/8	It can be measured directly by pressure measuring connector 30C3281 mounted on complete machine.
Pressure measuring point 2	Front axle brake pressure	6±0.4\870±58	NPT 1/8	It can be measured directly by pressure measuring connector 30C3281 mounted on complete machine.
Pressure measuring point 3	Outlet pressure of brake pump	16\2320	M14×1.5-6g	It can be measured directly by pressure measuring connector 30C3278 mounted on complete machine.

Test method of rear axle brake pressure

The low pressure alarm switch is equipped for the rear axle brake pressure during design, in order to act as low pressure alarm while the pressure decreasing. Therefore, under general conditions, when no low pressure alarm and brake performance for complete machine can meet the service brake performance described in 3.6, there is no need to adjust rear axle brake pressure.

Figures	Operation instruction	Tools
 P18H00115	1. Connect the pressure gauge at pressure measuring point;	Pressure gauge (range 6 Mpa\ 870psi);
	2. Start the machine and warm it for 3 minutes;	

Figures	Operation instruction	Tools
 P18H00116  P18H00117	3. Depress the brake pedal and hold it to the maximum angle; check the reading of pressure gauge, which shall be 6±0.4MPa\ 870±58psi at this time.	

Test method of front axle brake pressure

The low pressure alarm switch is equipped for the front axle brake pressure during design, in order to act as low pressure alarm while the pressure decreasing. Therefore, under general conditions, when no low pressure alarm and brake performance for complete machine can meet the service brake performance, there is no need to adjust front axle brake pressure.

Figures	Operation instruction	Tools
 P18H00118	1. Connect the pressure gauge at pressure measuring point 2;	Pressure gauge (range 6 Mpa\ 870psi);
 P18H00116	2. Start the machine and warm it for 3 minutes;	

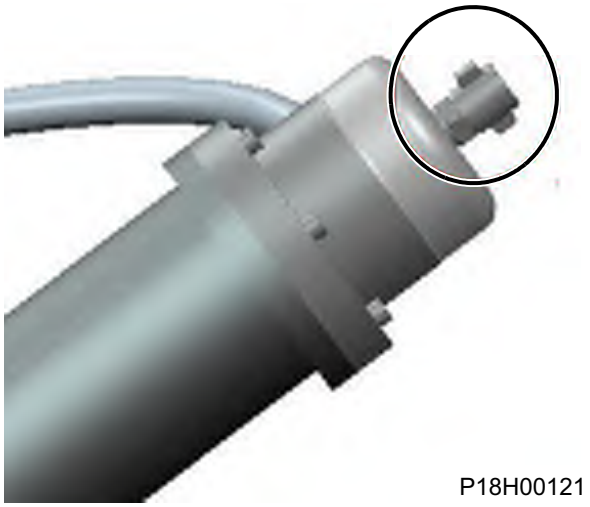
Figures	Operation instruction	Tools
 P18H00117	3. Depress the brake pedal and hold it to the maximum angle; check the reading of pressure gauge, which shall be 6±0.4MPa\ 870±58psi at this time.	

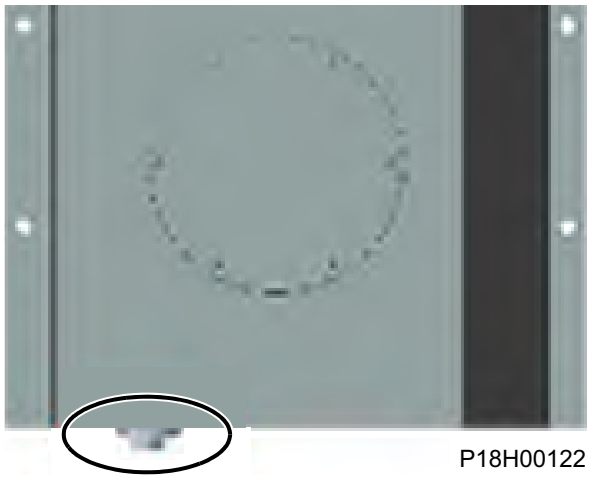
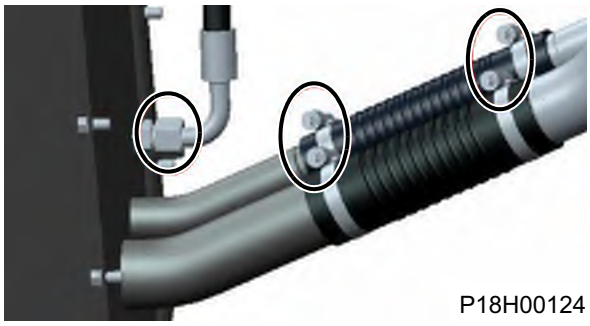
Removal and Installation

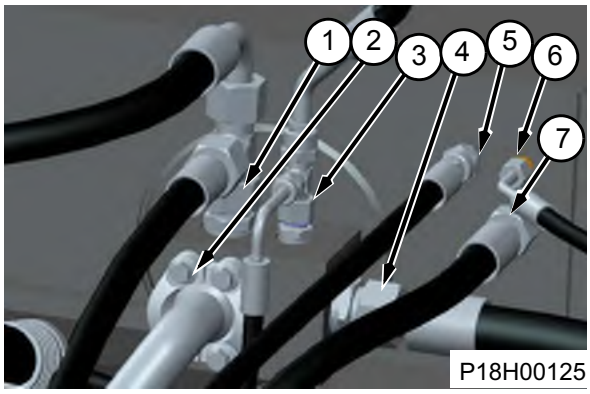
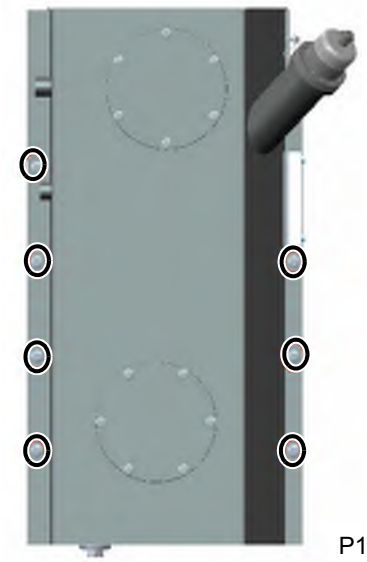
Work hydraulic system

Removal and installation of hydraulic oil tank assembly

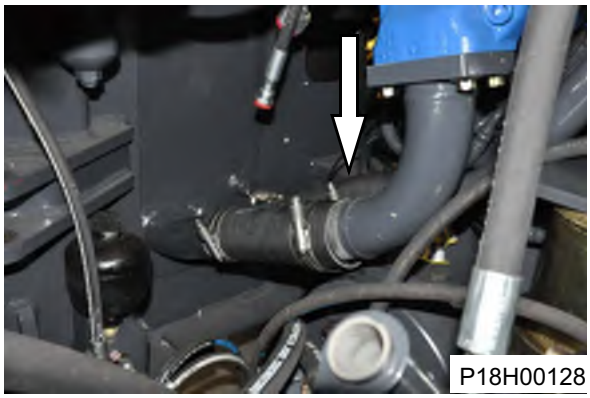
Removal for hydraulic oil tank assembly

Figures	Operation instruction	Tools
 P18H00121	1. Loosen the plug at the top of hydraulic oil tank breather and press the bleed screw in it to bleed the air;	

Figures	Operation instruction	Tools
 P18H00122	2. Find the drain plug at bottom of right oil tank at rear frame, and then wipe clean the circumference of drain plug; 3. Place a clean oil basin below the drain plug for collecting the hydraulic oil; screw off the drain plug;	Oil basin; Open-end wrench: 30mm
 P18H00123	4. After the hydraulic oil in the hydraulic oil tank is drained, hang the lug welded on both sides of the hydraulic oil tank with a lifting rope;	Lifting rope
 P18H00124	5. Loosen the oil suction hose clamp of the plunger pump and gear pump located at lower part of back of oil tank, remove the oil suction hose and mask the oil ports; remove the oil suction hose joint of secondary steering pump (option) and mask oil ports.	Open-end wrench: 8, 36mm;

Figures	Operation instruction	Tools
 P18H00125	6. Remove the oil return hose located at upper part of back of oil tank, mask oil ports;	Open-end wrench: 13, 17, 22, 24, 32, 36, 41mm;
 P18H00126	7. Unscrew out the 8 fastening bolts on both edges of the hydraulic oil tank side;	Open-end wrench: 15 mm
	8. Lift the hydraulic oil tank slowly away; note that the lifting process must be smooth, it is not allowed to damage the other areas of the complete machine;	2T \4410lb traveling crane; Lifting rope

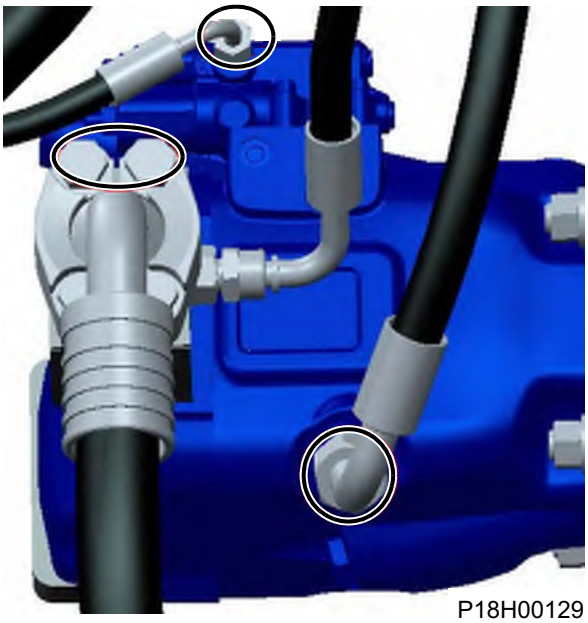
Installation for hydraulic oil tank assembly

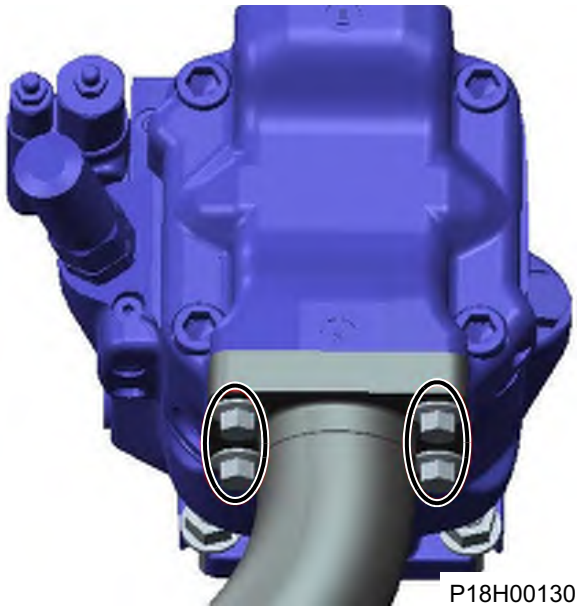
Figures	Operation instruction	Tools
	1. Check the oil tank for impurities, if any, it should be cleaned before installation	
 P18H00127	2. Install one end of oil suction hose to the oil suction steel pipe with clamp and install the steel pipe to the oil suction of oil tank	
 P18H00128	3. Hang the oil tank with traveling crane and install the other end of suction hose to the oil suction steel pipe of pump, meanwhile pretighten the mounting bolt of oil tank, and tighten the oil suction hose clamp	Open-end wrench: 8, 36mm;
	4. Connect hoses to the oil ports of oil tank according to the connection in the removal steps	

Removal and installation of the plunger pump

Removal of the plunger pump

Removal steps:

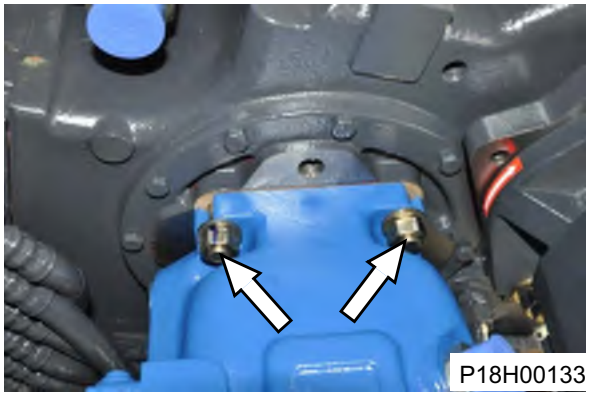
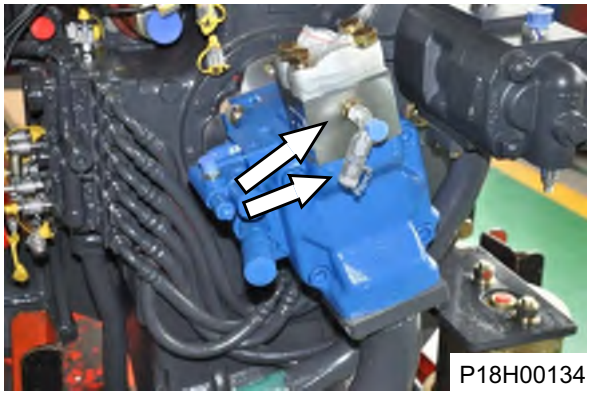
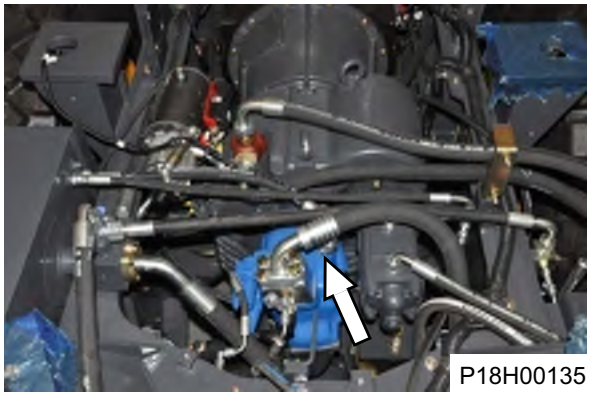
Figures	Operation instruction	Tools
	1. Remove the driver seat and the access port plate of the bottom plate to expose the access port at the bottom of the driver seat;	
	2. Refer to the steps 3, 4 in Installation Position and Functional Structure for draining the hydraulic oil;	
 P18H00129	3. Remove the hose assembly, plate, check valve from the plunger pump opening and then mask the oil ports;	Open-end wrench: 17, 21, 32mm

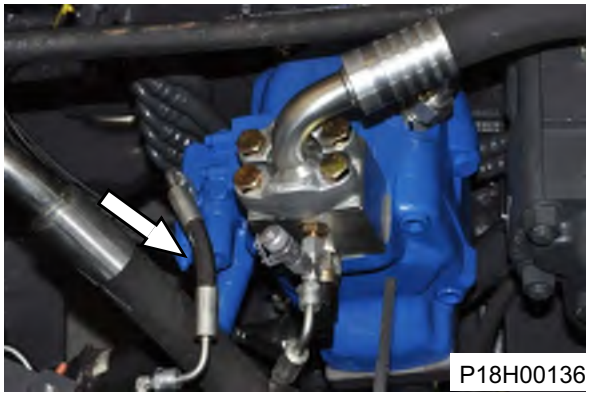
Figures	Operation instruction	Tools
 P18H00130	4. Remove the oil suction steel pipe of the plunger pump	Open-end wrench: 15mm;
	5. Install a lifting hook on the beam at the bottom of the cab, and tie and hang it on the pump assembly with a lifting rope;	Hook; Lifting rope
 P18H00131	6. Unscrew the 4 fastening nuts of the plunger pump; 7. Take out the pump and block the oil port.	Open-end wrench: 21mm;

Installation of plunger pump

The housing of assembled plunger pump must be filled with oil before starting the complete machine to prevent the skid shoe from damage due to dry friction after starting.

Figures	Operation instruction	Tools
	1. Check the pump for damage, rusting and if qualified, hang the pump to the mounting position and install the stud bolt to the gearbox;	
 P18H00132	2. Install the oil suction steel pipe to the plunger pump, tighten the bolts with the tightening torque 90±12Nm\ 66.4±8.9lbf·ft	Open-end wrench: 15mm;

Figures	Operation instruction	Tools
 P18H00133	3. When the spline shaft is coupled with gearbox, install the nut to the stud bolt and tighten it with torque 160±20Nm\ 118±14.8lbf·ft	Open-end wrench: 21mm;
 P18H00134	4. Install the plate, check valve to the plunger pump opening with the tightening torque of flange mounting bolt 145±15Nm\ 107±11.1lbf·ft	Open-end wrench: 21mm;
 P18H00135	5. Connect the return oil hose of the plunger pump housing with the tightening torque of hose joint 89 ± 4Nm\ 65.6 ± 3.0lbf·ft	Open-end wrench: 32mm;

Figures	Operation instruction	Tools
 P18H00136	6. Connect the LS hose of the plunger pump with the tightening torque of hose joint 16±1Nm\ 11.8±0.74lbf·ft	Open-end wrench: 17mm;
	7. Start the machine and idle it for 2min **Note:** If any abnormal noise or shake is heard, please stop the machine immediately and check whether the pipe is normal or not	
	8. Check the pipe connections for oil leakage	
	9. Refer to the Seat and Bottom Plate Overhaul Manual for recovering the seat and bottom plate	
	10. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level	

Removal and installation of boom cylinder

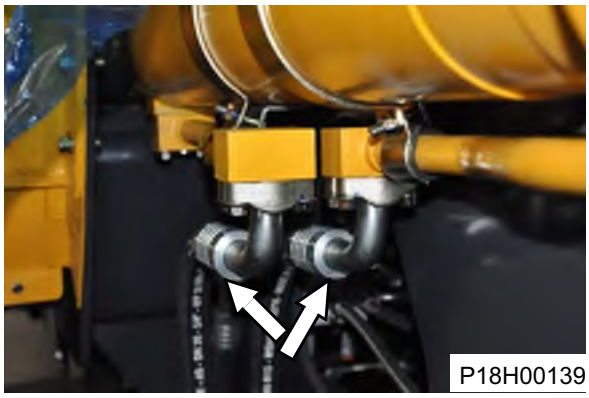
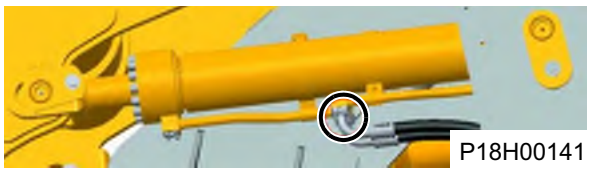
Removal of boom cylinder

⚠CAUTION

Place the machine in horizontal hard ground →lay flat the bucket →pull the hand brake →shut down→release the pressure in the boom cylinder.

Removal steps (take the left boom oil cylinder as an example, and the removal steps of the right boom oil cylinder are the same as those of the left boom oil cylinder):

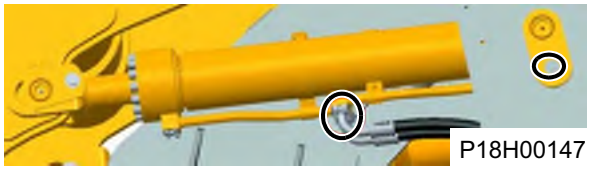
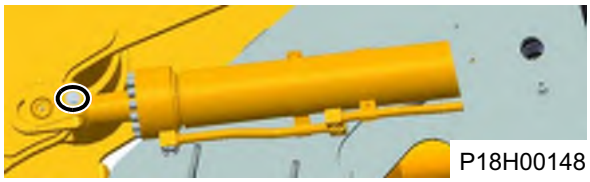
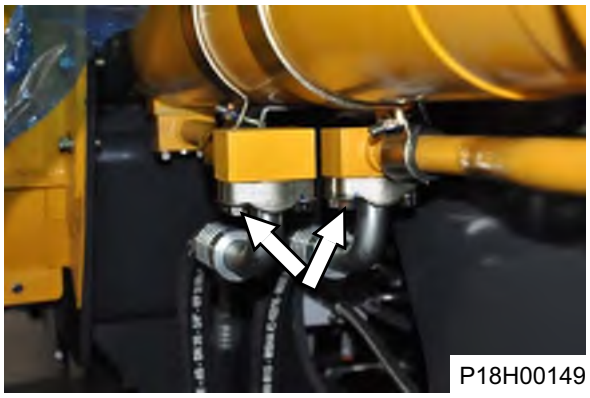
Figures	Operation instruction	Tools
	⚠ **Warning: Refer to the steps 3, 4 in Pressure Release of Hydraulic System for pressure relief of hydraulic system.**	
	1. Place an oil collecting container under the bottom of vehicle to prevent hydraulic oil from polluting ground;	Oil collecting container
 P18H00137	2. Remove boom pin lubrication lines;	

Figures	Operation instruction	Tools
 P18H00138	**⚠ The boom shall be supported firmly before removing the oil cylinder to prevent the boom from falling.**	
	3. Sleeve the lifting rope conforming to safety requirements on the boom oil cylinder and hang the boom oil cylinder with a traveling crane.	Lifting rope; 2T\4410lb traveling crane
 P18H00139	4. Loosen the hose plate bolt connected with the steel pipe below the big and small cavities of the boom oil cylinder, remove the hose assembly and mask the hose joint.	Open-end wrench: 13mm
 P18H00140	5. Remove the bolt tightening the front pin shaft of the boom and knock out the pin shaft with a copper bar.	Copper bar; Open-end wrench: 27mm
 P18H00141	6. Remove the tightening bolt of the rear pin shaft of the boom cylinder and knock out the pin shaft with a copper bar.	

Figures	Operation instruction	Tools
	7. Lift out the boom cylinder from the frame and place it on a level ground.	
 P18H00142	8. Remove steel pipe clamp of the big and small cavities of the boom cylinder and place it together with the removed bolts, nuts.	Open-end wrench: 13mm; Inner hexagon spanner: 6mm
 P18H00143	9. Remove the tightening bolt of the steel pipe of big and small cavities of the boom cylinder and remove the steel pipe; check whether the O-ring is aged or damaged and replace it in time, mask the oil ports of steel pipe. 10. Mask the big and small cavity oil ports of boom cylinder to avoid pollution.	Open-end wrench: 16mm; Shielding film

Installation of boom cylinder

Figures	Operation instruction	Tools
 P18H00144	1. Install the steel pipe of big and small cavities of the boom cylinder to the cylinder and tighten 8 mounting bolts to 52±6Nm\ 38.4±4.4lbf·ft, check whether the O-ring is aged or damaged and replace it in time before installation.	Open-end wrench: 16mm
 P18H00145	2. Install the pipe clamp, tighten the bolts, shims, nuts with the tightening torque 26±4Nm\ 19.2±3.0lbf·ft	Open-end wrench: 13mm
	⚠ The boom shall be supported firmly before installing the oil cylinder to prevent the boom from falling.	

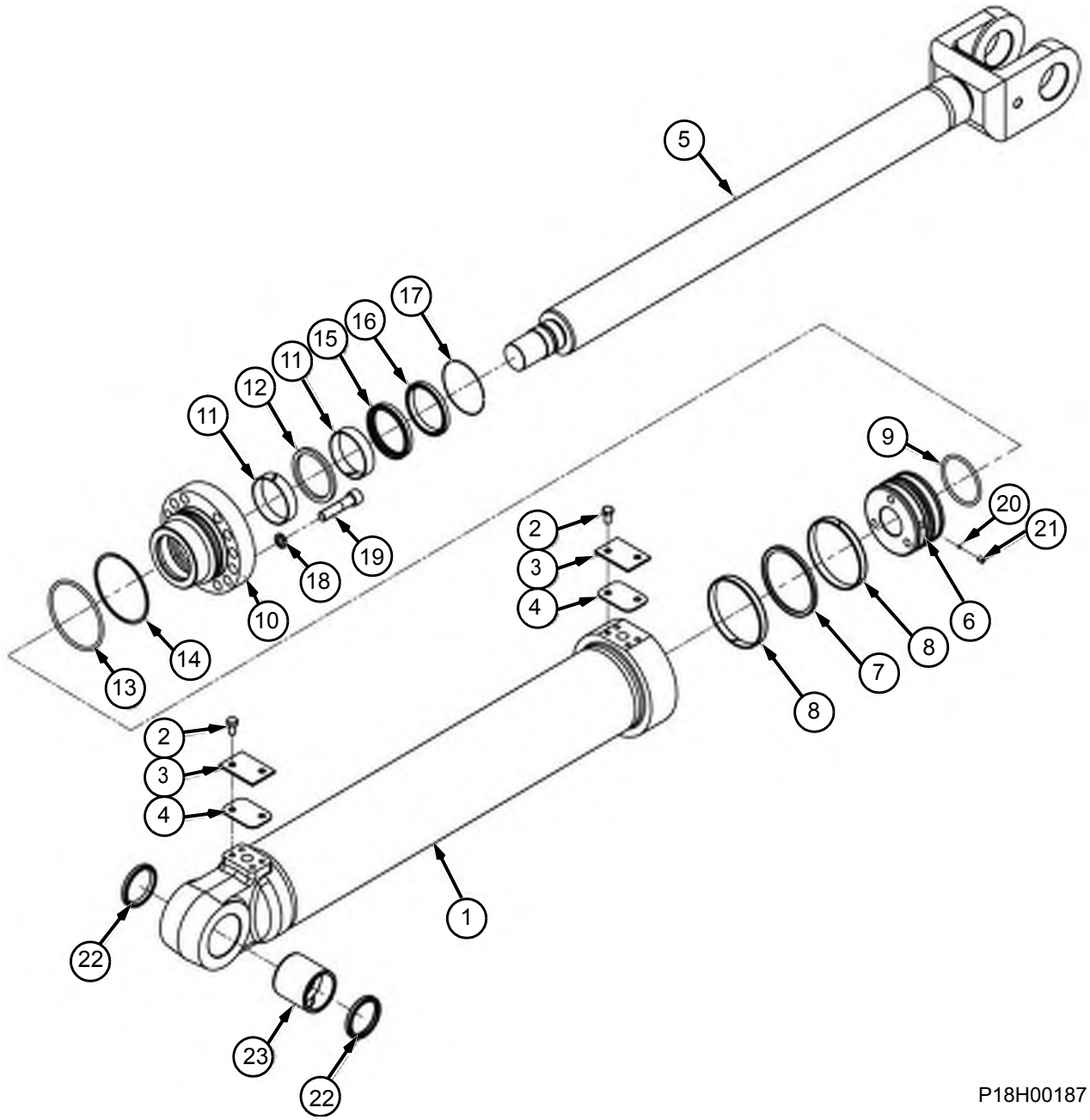
Figures	Operation instruction	Tools
 P18H00146	3. Lift and place the cylinder to the proper position with proper sling	
 P18H00147	4. Install rear pin shaft of boom cylinder, and tighten mounting bolt of pin shaft to 90±12Nm\ 66.4±8.9lbf·ft.	
 P18H00148	5. Align the pin hole of boom cylinder piston rod connecting fork with that of boom, and then insert the pin shaft into the pin hole, tighten mounting bolt of pin shaft to 310±45Nm\ 228.6±33.2lbf·ft.	
 P18H00149	6. Connect the big and small cavity hoses of boom cylinder, tighten the plate bolt to 72±6Nm\ 53.1±4.4lbf·ft.	

Figures	Operation instruction	Tools
 P18H00150	7. Install the centralized lubrication line joint. Install the centralized lubrication line joint.	
	8. Start the machine, and run it at idle speed, slowly lift and lower the boom cylinder for 3-5 times to bleed the air in the cylinder and line.	
	9. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level.	

Disassembly and assembly of boom cylinder

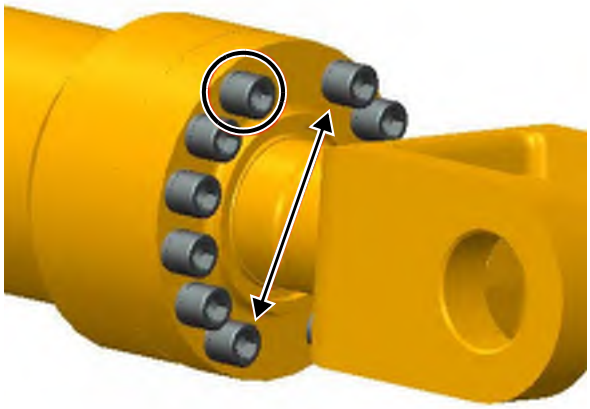
Disassembly of boom cylinder

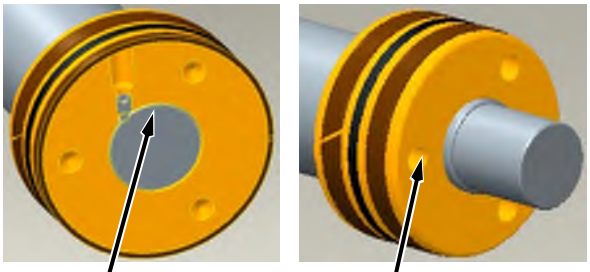
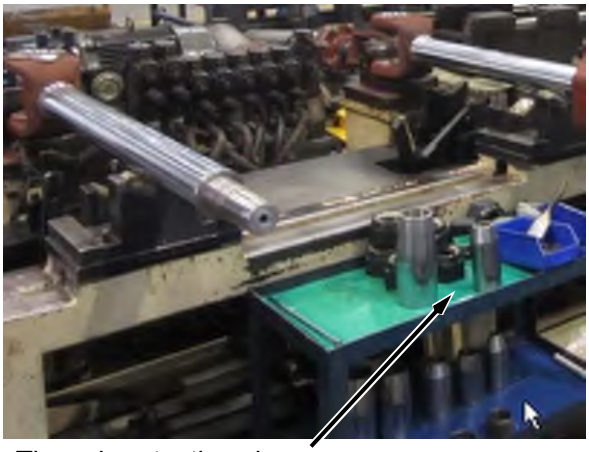
Exploded view of boom cylinder



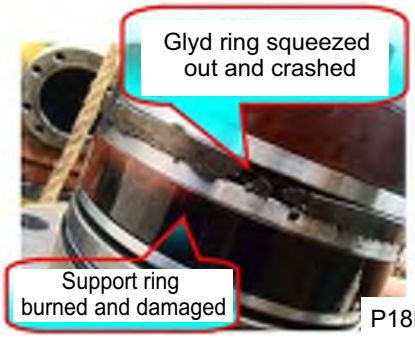
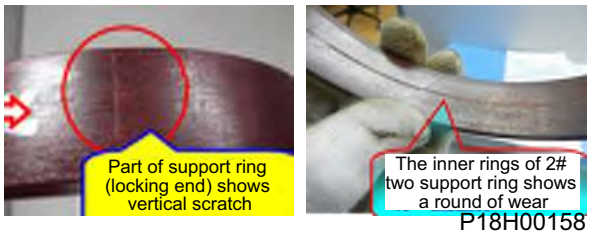
1. Cylinder block
2. Bolt
3. Cover
4. Cushion
5. Piston rod
6. Piston
7. Seal ring
8. Supporting ring
9. O-ring
10. Cylinder head
11. Support ring
12. Seal
13. O-ring
14. Snap ring
15. Y-seal
16. Dust ring
17. Spring retainer
18. Washer
19. Screw
20. Steel ball
21. Screw
22. Seal ring
23. Bushing

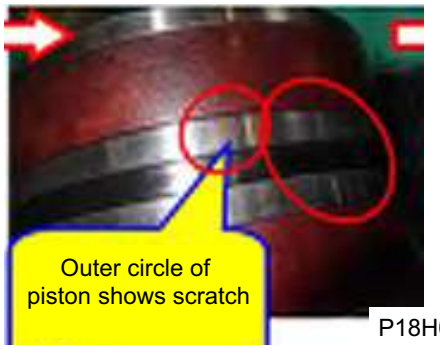
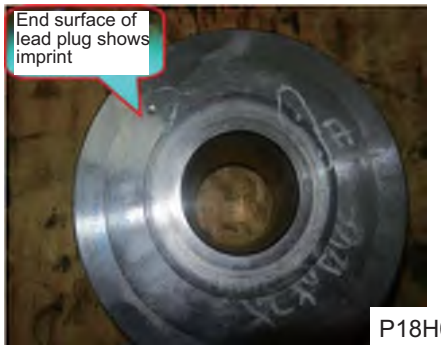
Removal steps

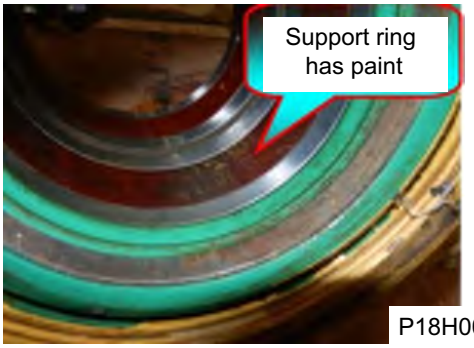
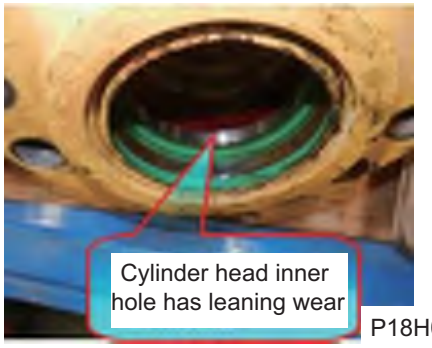
Figures	Operation instruction	Tools
 P18H00152	1. Loosen the 12 M16×70-10.9-Zn.D bolts diagonally (as shown by arrows in figure) with blower gun and then remove them one by one together with washer.	Blower gun Link for assembling 14mm hex bolt
 P18H00153	2. Put one end of lifting rope through the piston rod dual lug (single lug for bucket cylinder) and fix it crosswise with the other end on the lifting equipment, and then conduct slow, uniform and vertical lifting, place the piston rod group horizontally on special working position apparatus after it (see left figure) separates from cylinder block completely (Note: the contact surface of working position apparatus and the cylinder shall be made of soft material. **Note:** Put clean cotton on the contact surface of working position apparatus and piston rod to prevent the rod from being scratched.	Lifting equipment Lifting rope

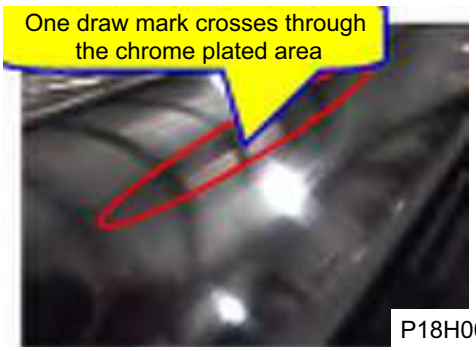
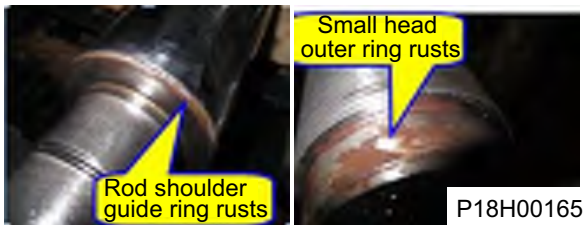
Figures	Operation instruction	Tools
Figure 1  P18H00154 *Figure 2*  P18H00155	3. Fix the lug of piston rod group, unscrew setscrew on piston using inner hexagon spanner and take out the screw and steel ball (see left picture in figure 1). 4. Assemble the tightening tooling for piston in auxiliary hole on the piston (see right picture in figure 1), unscrew piston using blower gun via tightening tooling, and then remove the piston from piston rod group along with axial direction of piston rod. 5. Install protective sleeve matched with thread at small end of piston rod on the threaded position (see Figure 2) and remove the cylinder head from piston rod group along with axial direction of piston rod. **Note:** the protective sleeve is used to prevent the seals from being scratched when removing the cylinder head from piston rod.	Inner hexagon spanner: 4mm Tightening tooling for piston Blower gun Thread protective sleeve

Inspection and clean of boom cylinder

Figures	Operation instruction	Tools
Piston group: *Fig. I*  P18H00156 *Fig 2*  P18H00157 *Figure 3*  P18H00158	Inspection of part: 1. Inspection of piston group: 1) Inspection of piston seal: a. Check whether glyd ring is scratched, worn, extruded and collapsed (Figure 1 and Figure 2). b. Check whether support ring is scratched, strained, worn and burnt (Figure 1 and Figure 3). c. Check whether O-ring at static seal of piston is worn and trimmed. 4) Inspection of piston: a. Check whether contour of piston is scratched and strained (Figure 4). b. Check whether two end surfaces are compressed seriously (Figure 5).	

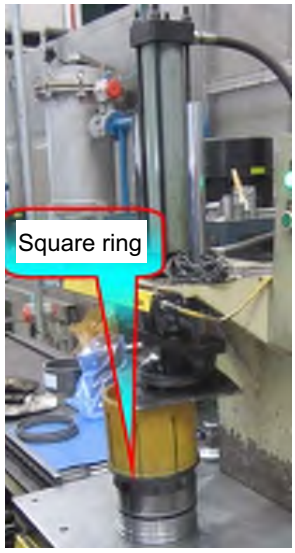
Figures	Operation instruction	Tools
Fig 4  P18H00159 *Fig 5*  P18H00160		

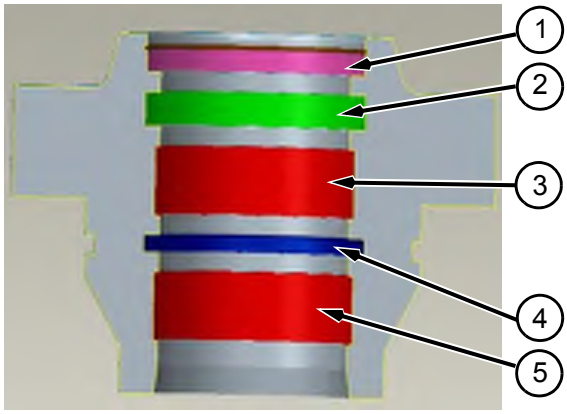
Figures	Operation instruction	Tools
Cylinder head assembly *Fig. I*  P18H00161 *Fig 2*  P18H00162	2. Inspection of cylinder head assembly: 1) Inspection of cylinder head seal: a. Check whether the dust cover is scratched, worn and damaged. b. Check whether Y-seal is scratched, worn, damaged and burnt. c. Check whether support ring is scratched, strained, worn, burnt and attached with foreign matter. (Figure 1) d. Check whether the buffer ring is worn and damaged. e. Check whether O-ring at static seal of cylinder head is worn and trimmed. 6) Inspection of cylinder head: a. Check whether the cylinder head bore is scratched, strained and eccentrically worn (Figure 2). b. Check each part of cylinder head for crack.	

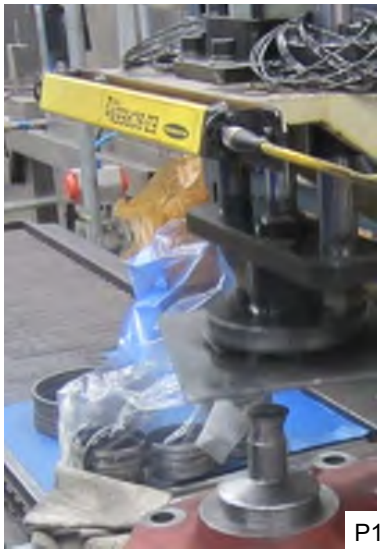
Figures	Operation instruction	Tools
Piston rod: *Fig. I*  P18H00163 *Fig 2*  P18H00164 *Figure 3*  P18H00165	3. Inspection of piston rod: a. Check whether the piston rod body (chrome plated area) is bumped, scratched, rusted and dechromed (Figure 1). b. Check whether the thread at small end of piston rod is rusted and damaged (mess thread) (Figure 2). c. Check whether small end contour of piston rod is rusted. Fig 3	

Figures	Operation instruction	Tools
Cylinder block *Fig. I*  P18H00166 *Fig 2*  P18H00167	4. Inspection of cylinder block: a. Check inner wall of cylinder block for score or scratch (Figure 1). b. Check whether the flange thread is damaged (mess thread). c. Check whether the bushing of cylinder head is eccentrically worn and cracked (Figure 2).	
	Cleaning of part: Clean cylinder block, piston rod, cylinder head and piston using kerosene and detergent, and then dry all parts with compressed air.	

Assembly of boom cylinder

Figures	Operation instruction	Tools
Assembly of piston group: *Fig. I*  P18H00168	1. Assembly of piston group (assembly of seal): a. Clean the piston, and then place it horizontally on the assembling stand. b. Press the inner ring (square ring) of glyd ring into the middle groove (figure 1) with special tooling and then separate the outer ring (with opening) of glyd ring by hands and assemble it to the outside of square ring. c. Separate the supporting ring (with opening) by hands and assemble it to the groove of supporting ring.	Assembling tooling for glyd ring

Figures	Operation instruction	Tools
Assembly of cylinder head assembly: *Fig. I*  1. Pink: groove of dust ring 2. Green: Groove of Y-ring 3. Red: groove of support ring 4. Blue: groove of buffer ring 5. Groove of O-ring P18H00169 *Fig 2*  P18H00170	2. Assembly of cylinder head assembly (assembly of seal): a. Clean the cylinder head, and place it on the assembly stand as shown in figure 1 (dust ring side faces upward). b. As shown in Figure 2, assemble Y-ring into green groove (shown in Figure 1) with dual lip of Y-ring facing downwards (facing to the support ring). c. Press dust ring metal frame excircle vertically into pink groove (shown in Figure 1) with special tooling (shown in Figure 3) with dual lip of dust ring facing downwards (facing to the support ring). d. Turn over the cylinder head with the dust ring facing downwards. e. Press the supporting ring (with opening) slightly by hands and install it to the red groove shown in figure 1. f. Install the O-ring of buffer ring (formed by O-ring and seal ring) to the blue groove shown in figure 1 and then install the seal ring to the outside of O-ring. g. Install the O-ring and snap ring to the groove of O-ring.	Assembling tooling for dust ring

Figures	Operation instruction	Tools
Figure 3  P18H00171		

Figures	Operation instruction	Tools
Assembly of piston rod group *Fig. I*  P18H00172 *Fig 2*  P18H00173	3. Assembly of piston rod group: a. Fix the lug (boom cylinder: dual-lug, bucket cylinder: single lug) of piston rod on the special tooling to make it not rotate. b. Put the thread protective sleeve (red ring in figure 1) on the thread at small end of piston rod to avoid scratching the seal. c. Apply clean hydraulic oil on the surface of piston rod and push the cylinder head (dust ring side facing towards the rod head) into the rod body (green ring in figure 1) along with axial direction of piston rod. d. Remove the thread protective sleeve. e. Install the piston to the small end of piston rod with the tightening tooling for piston and then tighten it with blower gun (figure 2). f. Install the steel ball into the threaded hole of the piston. g. Screw the setscrew to the threaded hole of the piston with inner hexagon spanner.	Fixing tooling for piston rod Thread protective sleeve Blower gun Tightening tooling for piston Inner hexagon wrench: 4mm

Figures	Operation instruction	Tools
Fig. I  P18H00174	4. Assembly of oil cylinder assembly: a. Fix the cylinder block on the assembly stand (figure 1) to make it not rotate, apply clean hydraulic oil to the inner chamber of cylinder block about 300mm\11.8in from top to bottom. b. Lift the piston rod group with sling and apply clean hydraulic oil to the excircle of piston, then install it to the cylinder block vertically along with the axis of inner chamber of cylinder block. c. Screw 12 M16×70-10.9-Zn.D screws to the threaded hole (screwed for at least 5 threads) by hands, then tighten the screws to the range 267±45Nm\196.9±33.2lbf·ft one by one diagonally with blower gun. d. Seal the big and small cavity of oil port with special cap.	Lifting rig Lifting rope Blower gun

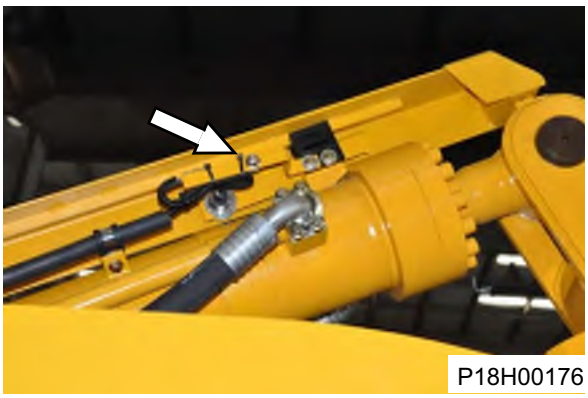
Removal and installation of bucket cylinder

Removal of bucket cylinder

⚠CAUTION

Place the machine in horizontal hard ground → lay flat the bucket → pull the hand brake → shut down → release the pressure in the rotating bucket cylinder.

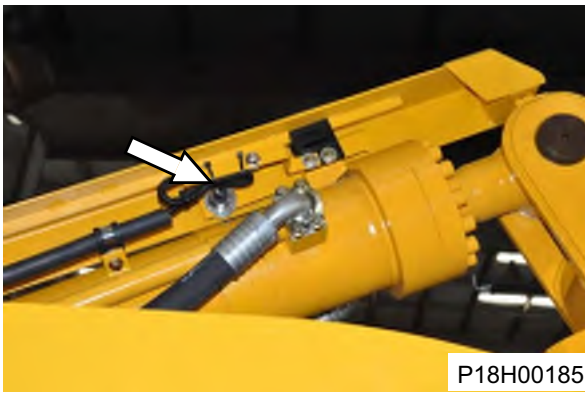
Removal steps:

Figures	Operation instruction	Tools
	⚠ Warning: Refer to the steps 3, 4 in Pressure Release of Hydraulic system for pressure relief of hydraulic system.	
	1. Place an oil collecting container under the bottom of vehicle to prevent hydraulic oil from polluting ground;	Oil collecting container
 P18H00175  P18H00176	2. Remove the bucket pin lubrication line; remove the harness line of front frame;	

Figures	Operation instruction	Tools
	3. Hold the bucket cylinder with lifting rope and traveling crane;	Lifting rope; 2T\4410lb traveling crane
 P18H00177	4. Loosen the hose plate bolt connected with the steel pipe of the small cavity oil port of the bucket cylinder, and remove the hose assembly and shield the hose joint.	Open-end wrench: 13mm
 P18H00178	5. Loosen the hose plate bolt connected with the steel pipe of the big cavity oil port of the bucket cylinder and remove the hose assembly and shield hose joint.	Open-end wrench: 13mm
 P18H00179	6. Remove the fastening bolt of the front and rear pin shaft of the bucket cylinder and knock out the pin shaft with a copper bar;	Copper bar; Open-end wrench: 15mm
	7. Lift out the bucket cylinder from the frame to place it on a level ground.	Lifting rope; 2T\4410lb traveling crane
 P18H00180	8. Remove the bolts tightening the steel pipe clamp and steel pipe of big cavity of the bucket cylinder and remove the steel pipe; check whether the O-ring is aged or damaged and replace it in time, mask the oil ports of steel pipe.	Open-end wrench: 13mm Inner hexagon wrench: 6mm, 8mm
	9. Mask the big and small cavity oil ports of the bucket cylinder to avoid pollution.	Shielding film

Installation of bucket cylinder

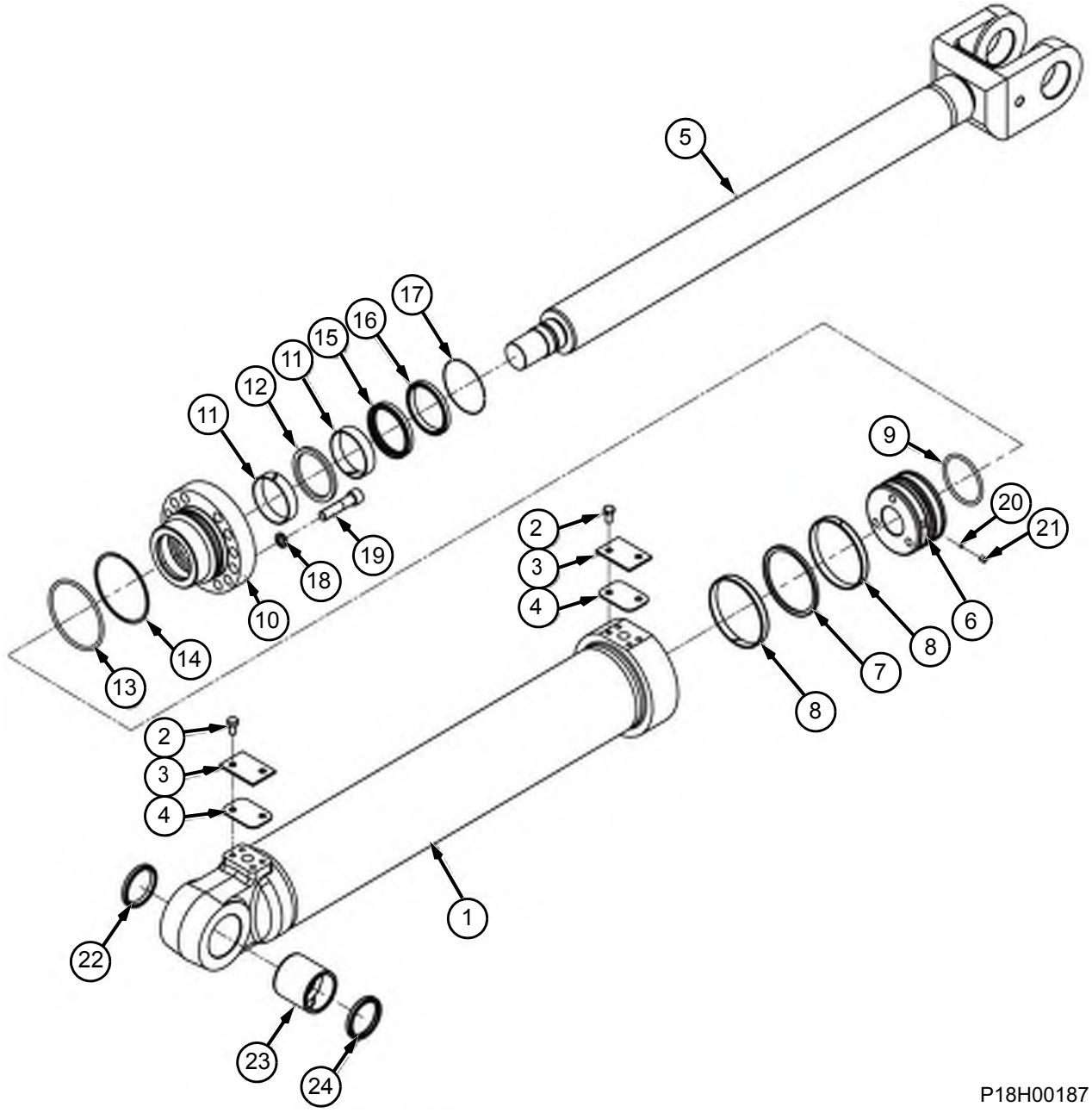
Figures	Operation instruction	Tools
 P18H00181	1. Install the steel pipe of big cavity of bucket cylinder and tighten the bolt to 52 ± 6Nm\ 38.4 ± 4.4lbf · ft; install the pipe clamp and tighten the bolt to 52±6Nm\ 38.4±4.4lbf·ft; Check whether the O-ring is aged or damaged and replace it in time	Open-end wrench: 13mm Inner hexagon wrench: 6mm, 8mm
	2. Hang the bucket cylinder to the mounting position with sling.	Sling, 2T\4410lb traveling crane
 P18H00182	3. Install the rear pin shaft of bucket cylinder, and tighten the pin shaft mounting bolt to 90±12Nm\ 66.4±8.9lbf·ft 4. Install the front pin shaft of bucket cylinder, and tighten the pin shaft mounting bolt to 90±12Nm\ 66.4±8.9lbf·ft.	Copper bar; Open-end wrench: 15mm
 P18H00183  P18H00184	5. Connect the big and small cavity hoses of bucket cylinder, tighten the plate bolt to 52±6Nm\ 38.4±4.4lbf·ft.	Open-end wrench: 13mm

Figures	Operation instruction	Tools
 P18H00185	6. Install the proximity switch wire harness line of bucket cylinder.	
 P18H00186	7. Install the centralized lubrication system joint.	
	8. Start the machine, and run it at idle speed, slowly deploy and retract the bucket for 3-5 times to bleed the air in the cylinder and line.	
	9. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level	

Disassembly and assembly of bucket cylinder

Disassembly of bucket cylinder

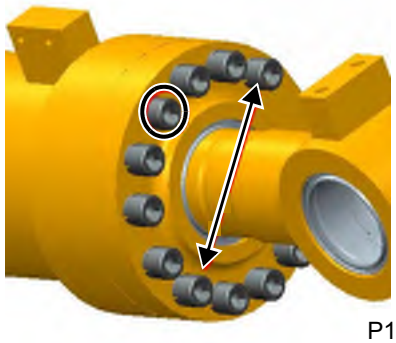
Exploded view of bucket cylinder

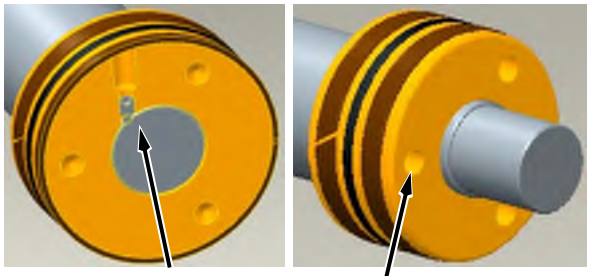
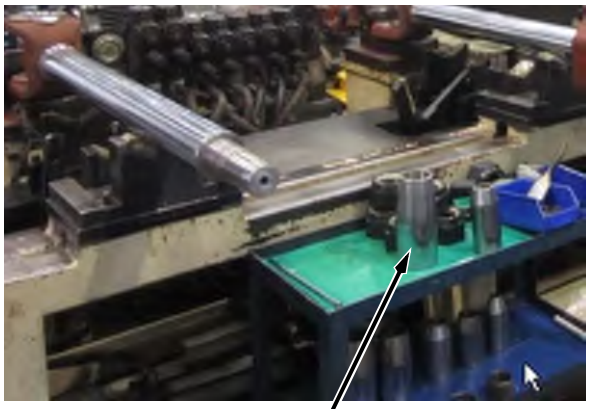


P18H00187

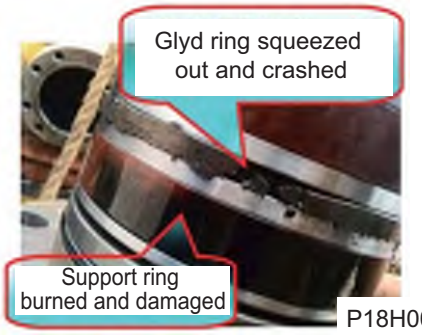
1. Bushing	6. Bolt	11.Piston rod	16.Snap ring	21.Screw
2. Seal ring	7. Piston	12.Cylinder head	17.Y-seal	22.Steel ball
3. Cylinder block	8. Seal ring	13.Support ring	18.Dust ring	23.Sleeve
4. Cushion	9. Supporting ring	14.Seal	19.Spring retainer	24.Seal ring
5. Cover	10.O-ring	15.O-ring	20.Washer	

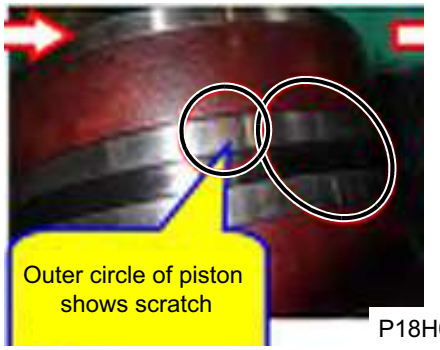
Removal steps:

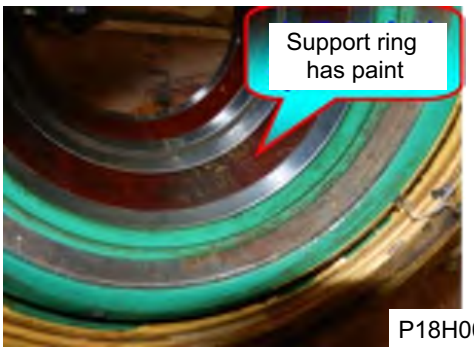
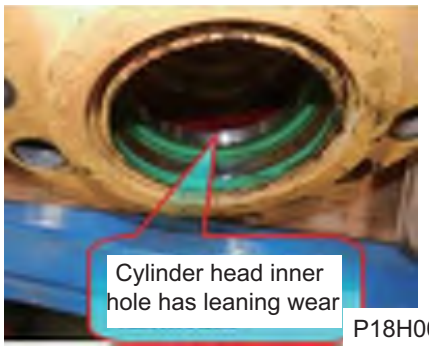
Figures	Operation instruction	Tools
 P18H00188	1. Loosen the 12 M16×70-10.9-Zn.D bolts diagonally (as shown by arrows in figure) with blower gun and then remove them one by one together with washer.	Blower gun Link for assembling 14mm hex bolt
 P18H00189	2. Put one end of lifting rope through the piston rod dual lug (single lug for bucket cylinder) and fix it crosswise with the other end on the lifting equipment, and then conduct slow, uniform and vertical lifting, place the piston rod group horizontally on special working position apparatus after it (see left figure) separates from cylinder block completely. The contact surface of working position apparatus and the cylinder shall be made of soft material. **Note:** Put clean cotton on the contact surface of working position apparatus and piston rod to prevent the rod from being scratched.	Lifting equipment Lifting rope

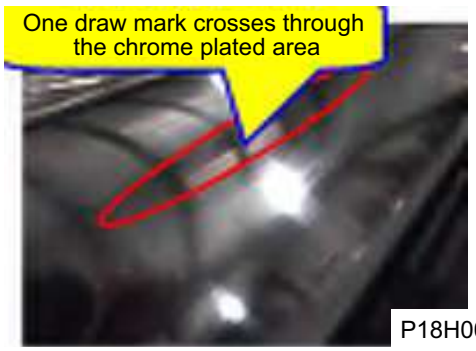
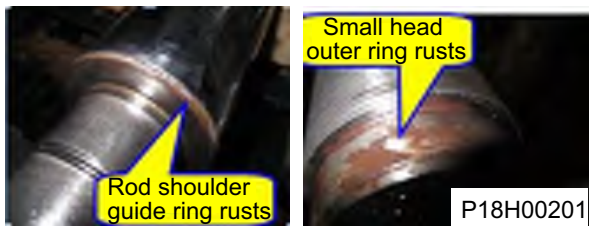
Figures	Operation instruction	Tools
Fig. 1  P18H00190 *Fig 2*  P18H00191	3. Fix the lug of piston rod group, unscrew setscrew on piston using inner hexagon spanner and take out the screw and steel ball (see left picture in figure 1). 4. Assemble the tightening tooling for piston in auxiliary hole on the piston (see right picture in figure 1), unscrew piston using blower gun via tightening tooling, and then remove the piston from piston rod group along with axial direction of piston rod. 5. Install protective sleeve matched with thread at small end of piston rod on the threaded position (see Figure 2) and remove the cylinder head from piston rod group along with axial direction of piston rod. **Note:** the protective sleeve is used to prevent the seals from being scratched when removing the cylinder head from piston rod).	Inner hexagon spanner: 6mm Tightening tooling for piston Blower gun Thread protective sleeve

Inspection and cleaning of bucket cylinder

Figures	Operation instruction	Tools
Piston group: *Fig. I*  P18H00192 *Fig 2*  P18H00193 *Figure 3*  P18H00194	Inspection of part: 1. Inspection of piston group: 1) Inspection of piston seal: a. Check whether glyd ring is scratched, worn, extruded and collapsed (Figure 1 and Figure 2). b. Check whether support ring is scratched, strained, worn and burnt (Figure 1 and Figure 3). c. Check whether O-ring at static seal of piston is worn and trimmed. 4) Inspection of piston: a. Check whether contour of piston is scratched and strained (Figure 4). b. Check whether two end surfaces are compressed seriously (Figure 5).	

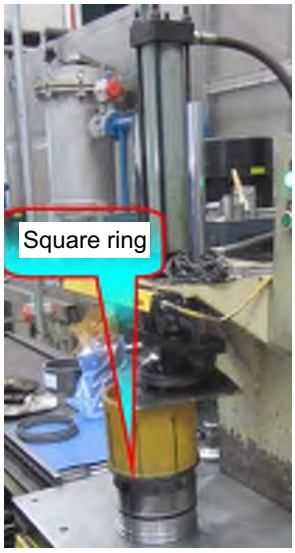
Figures	Operation instruction	Tools
Fig 4  P18H00195 *Fig 5*  P18H00196		

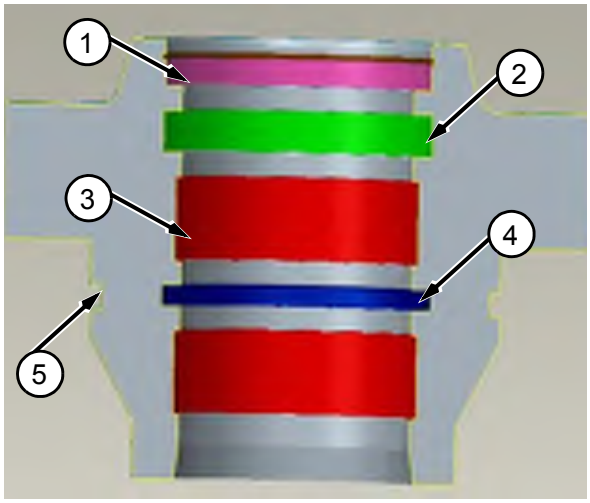
Figures	Operation instruction	Tools
Cylinder head assembly: *Fig. I*  P18H00197 *Figure 2*  P18H00198	2. Inspection of cylinder head assembly: 1) Inspection of cylinder head seal: a. Check whether the dust cover is scratched, worn and damaged. b. Check whether Y-seal is scratched, worn, damaged and burnt. c. Check whether support ring is scratched, strained, worn, burnt and attached with foreign matter. (Figure 1) d. Check whether the buffer ring is worn and damaged. e. Check whether O-ring at static seal of cylinder head is worn and trimmed. 6) Inspection of cylinder head: a. Check whether the cylinder head bore is scratched, strained and eccentrically worn (Figure 2). b. Check each part of cylinder head for crack.	

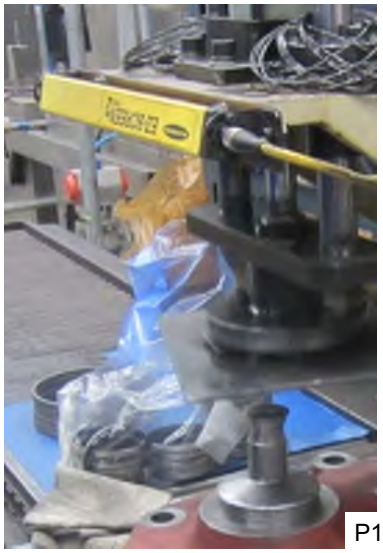
Figures	Operation instruction	Tools
Piston rod: *Fig. I*  *Figure 2*  *Figure 3*  	3. Inspection of piston rod: a. Check whether the piston rod body (chrome plated area) is bumped, scratched, rusted and dechromed (Figure 1). b. Check whether the thread at small end of piston rod is rusted and damaged (mess thread) (Figure 2). c. Check whether small end contour of piston rod is rusted. Figure 3	

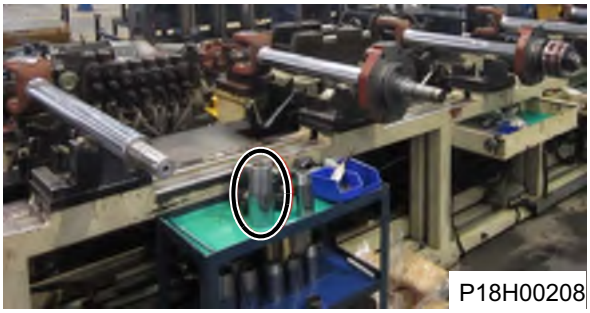
Figures	Operation instruction	Tools
Cylinder block: *Fig. I*  P18H00202 *Figure 2*  P18H00203	4. Inspection of cylinder block: a. Check inner wall of cylinder block for score or scratch (Figure 1). b. Check whether the flange thread is damaged (mess thread). c. Check whether the bushing of cylinder head is eccentrically worn and cracked (Figure 2).	
	Cleaning of part: Clean cylinder block, piston rod, cylinder head and piston using kerosene and detergent, and then dry all parts with compressed air.	

Assembly of bucket cylinder

Figures	Operation instruction	Tools
Assembly of piston group: *Fig. I*  P18H00204	1. Assembly of piston group (assembly of seal): clean the piston, and then place it horizontally on the assembly stand. a. Press the inner ring (square ring) of glyd ring into the middle groove (figure 1) with special tooling and then separate the outer ring (with opening) of glyd ring by hands and assemble it to the outside of square ring. b. Separate the supporting ring (with opening) by hands and assemble it to the groove of supporting ring.	Assembling tooling for glyd ring

Figures	Operation instruction	Tools
Assembly of cylinder head assembly:  1. Pink: groove of dust ring 2. Green: groove of Y-ring 3. Red: groove of support ring 4. Blue: groove of buffer ring 5. Groove of O-ring P18H00205  P18H00206	2. Assembly of cylinder head assembly (assembly of seal): a. Clean the cylinder head, and place it on the assembly stand as shown in figure 1 (dust ring side faces upward). b. As shown in Figure 2, assemble Y-ring into green groove (shown in Figure 1) with dual lip of Y-ring facing downwards (facing to the support ring). c. Press dust ring metal frame excircle vertically into pink groove (shown in Figure 1) with special tooling (shown in Figure 3) with dual lip of dust ring facing downwards (facing to the support ring). d. Turn over the cylinder head with the dust ring facing downwards. e. Press the supporting ring (with opening) slightly by hands and install it to the red groove shown in figure 1. f. Install the O-ring of buffer ring (formed by O-ring and seal ring) to the blue groove shown in figure 1 and then install the seal ring to the outside of O-ring. g. Install the O-ring and snap ring to the groove of O-ring.	1. Assembling tooling for dust ring

Figures	Operation instruction	Tools
 P18H00207		

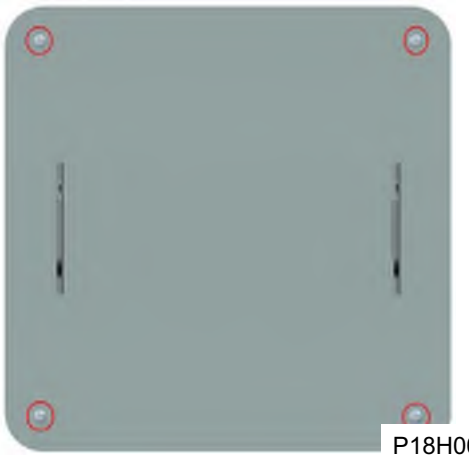
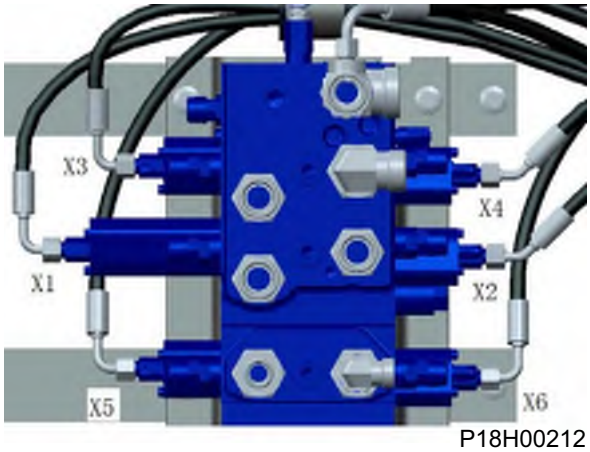
Figures	Operation instruction	Tools
Assembly of piston rod group *Fig. I*  P18H00208 *Figure 2*  P18H00209	3. Assembly of piston rod group: a. Fix the lug (boom cylinder: dual-lug, bucket cylinder: single lug) of piston rod on the special tooling to make it not rotate. b. Put the thread protective sleeve (red ring in figure 1) on the thread at small end of piston rod to avoid scratching the seal. c. Apply clean hydraulic oil on the surface of piston rod and push the cylinder head (dust ring side facing towards the rod head) into the rod body (green ring in figure 1) along with axial direction of piston rod. d. Remove the thread protective sleeve. e. Install the piston to the small end of piston rod with the tightening tooling for piston and then tighten it with blower gun (figure 2). f. Install the steel ball into the threaded hole of the piston. g. Screw the setscrew to the threaded hole of the piston with inner hexagon spanner.	Fixing tooling for piston rod Thread protective sleeve Blower gun Tightening tooling for piston Inner hexagon wrench: 6mm

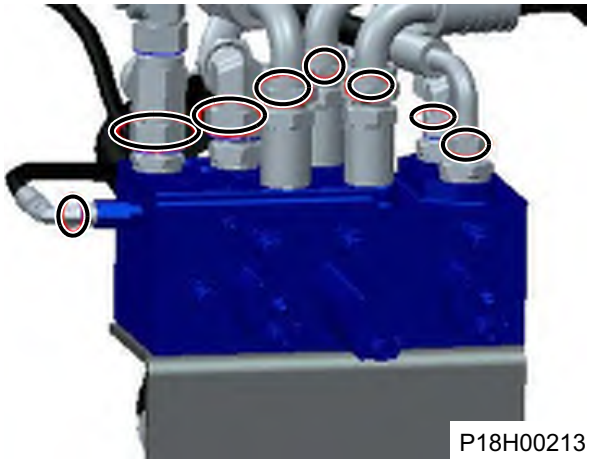
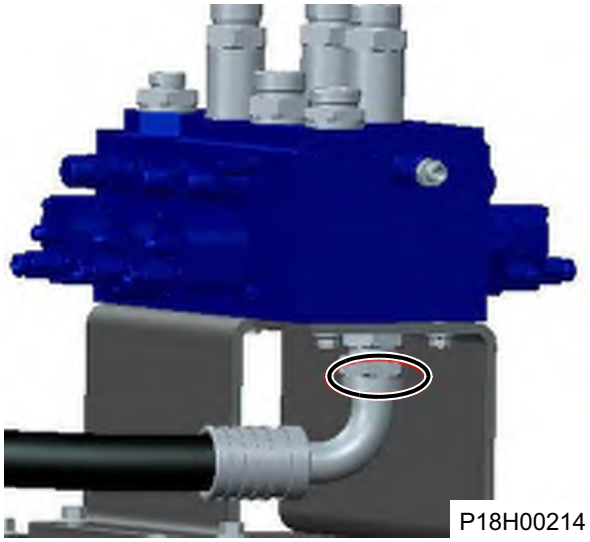
Figures	Operation instruction	Tools
Fig. I  P18H00210	4. Assembly of oil cylinder assembly: a. Fix the cylinder block on the assembly stand (figure 1) to make it not rotate, apply clean hydraulic oil to the inner chamber of cylinder block about 300mm\11.8in from top to bottom. b. Lift the piston rod group with sling and apply clean hydraulic oil to the excircle of piston, then install it to the cylinder block vertically along with the axis of inner chamber of cylinder block. c. Screw 12 M16×70-10.9-Zn.D screws to the threaded hole (screwed for at least 5 threads) by hands, then tighten the screws to the range 267±45Nm\196.9±33.2lbf·ft one by one diagonally with blower gun. d. Seal the big and small cavity of oil port with special cap.	Lifting rig Lifting rope Blower gun

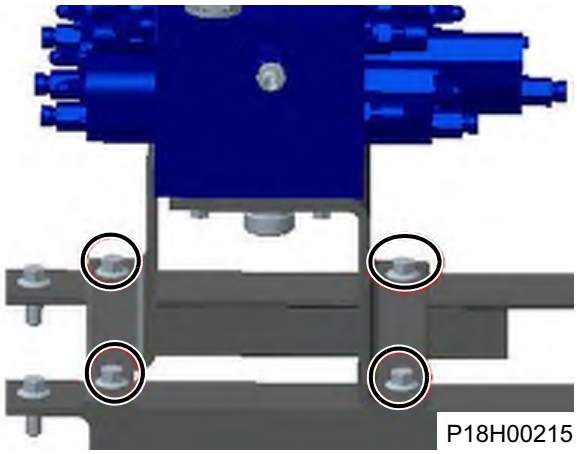
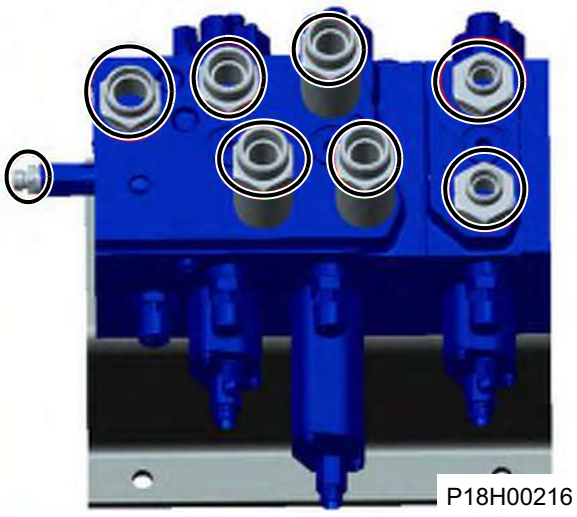
Removal and installation of control valve

Removal of control valve

Removal steps:

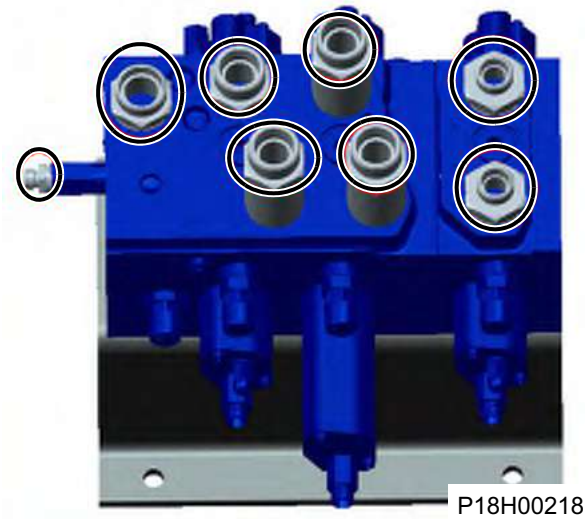
Figures	Operation instruction	Tools
	Before removing, release system pressure, support the boom firmly and fix the bucket	
 P18H00211	1. Screw off the 4 fastening bolts of the cover plate at the access port of the control valve of the front frame and remove the cover plate;	Open-end wrench: 10mm
 P18H00212	2. Mark the symbols: "X1-boom big cavity linkage pilot", "X2-boom small cavity linkage pilot", "X3-bucket big cavity linkage pilot", "X4-bucket small cavity linkage pilot" , "X5-multi-functional big cavity linkage pilot", "X6-multi-functional small cavity linkage pilot" respectively on the pilot hose connected to the control valve; the marks shall be firm. 3. Remove these 6 hoses together; mask oil ports;	Open-end wrench: 19mm

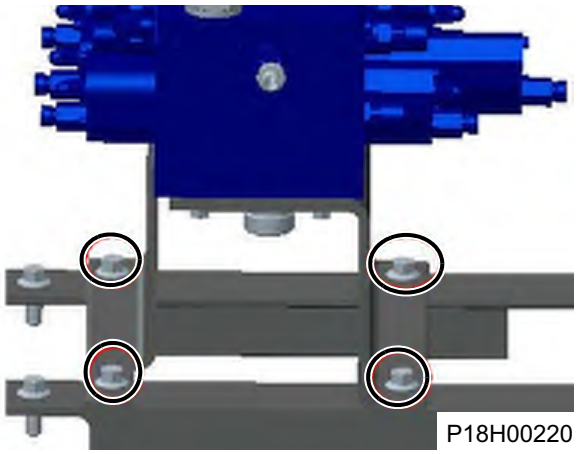
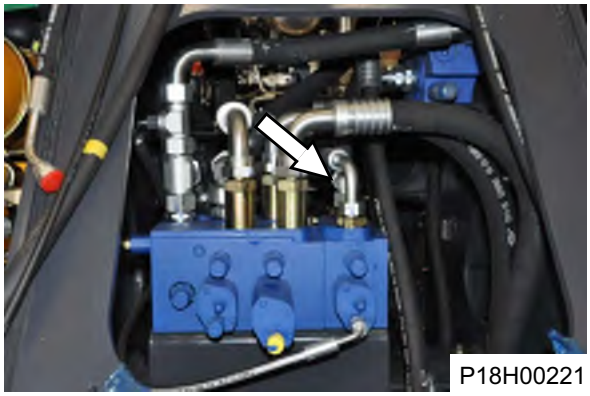
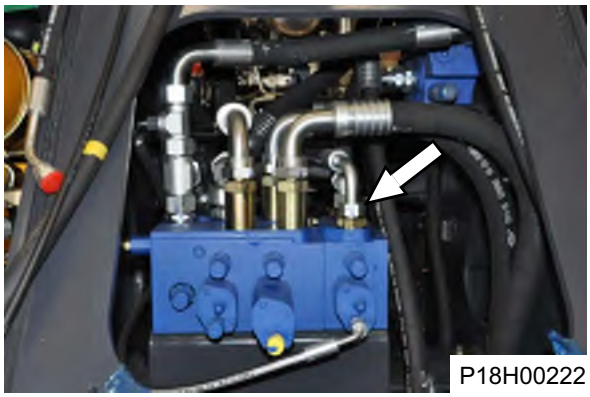
Figures	Operation instruction	Tools
 P18H00213	4. Remove the control valve LS, oil return port, boom big and small cavity, bucket big and small cavity, multi-functional linkage big and small cavity oil port joint and mask oil ports, as shown in the figure;	Open-end wrench: 17, 32, 41, 44, 46mm
 P18H00214	5. Remove the oil inlet joint of control valve and mask the oil ports, as shown in the figure;	Open-end wrench: 44mm
	6. Tie the control valve assembly with lifting rope;	Lifting rope

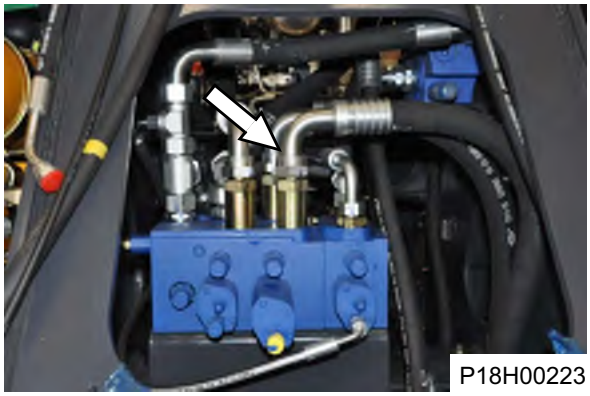
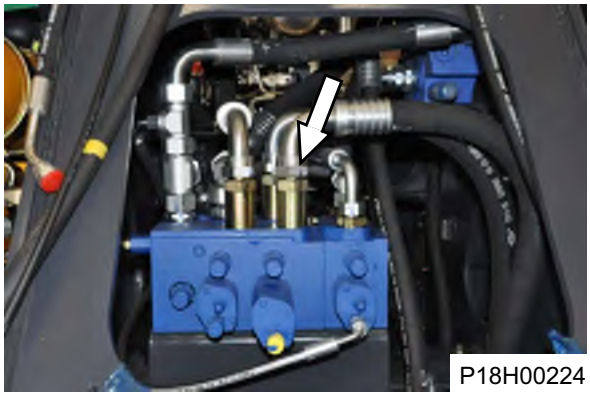
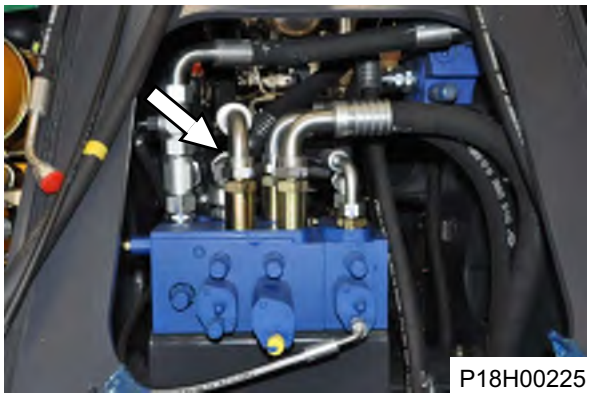
Figures	Operation instruction	Tools
 P18H00215	7. Unscrew the 4 fastening bolts, nuts from control valve and place it together with the bolts, nuts.	Open-end wrench: 15mm.
	8. Lift the control valve slowly and levelly and move out from the access port of the control valve of the front frame slowly;	Lifting rope, crane
 P18H00216	9. Place the control valve on the ground; remove the transition joint, mounting plate installed on the valve body and mask oil ports of control valve.	Open-end wrench: 13, 19, 41mm

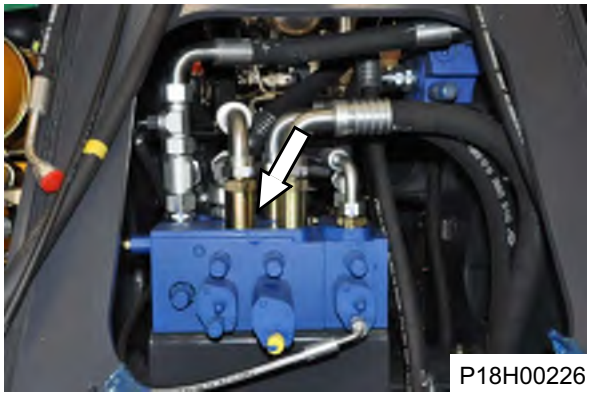
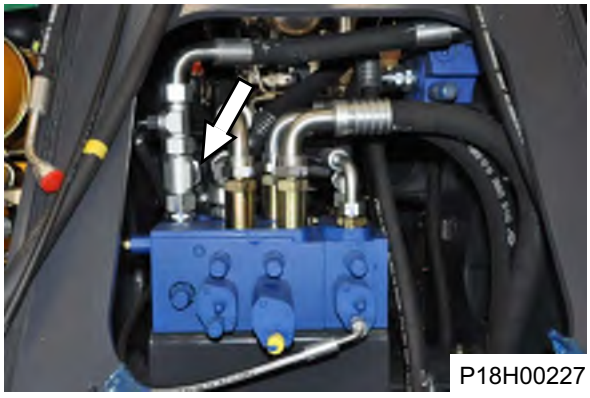
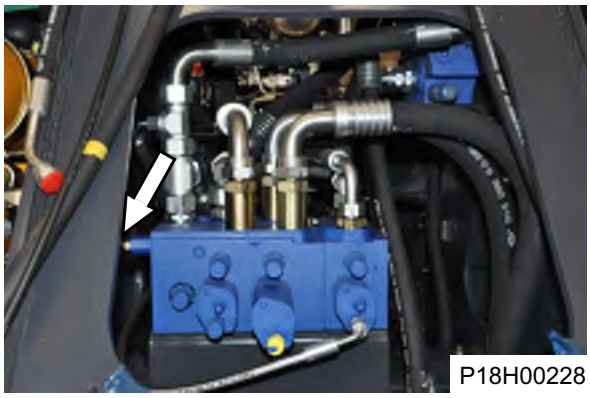
Figures	Operation instruction	Tools
 P18H00217		

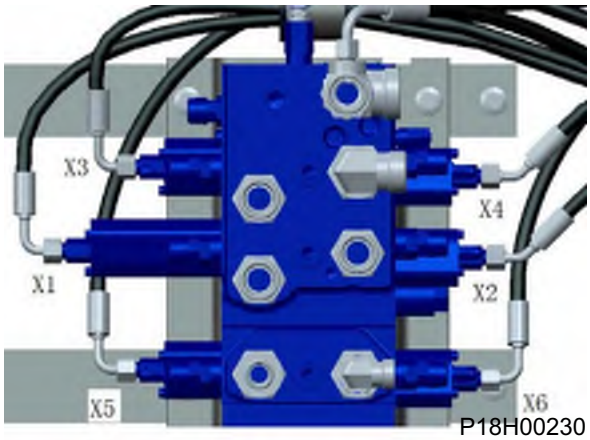
Installation of control valve

Figures	Operation instruction	Tools
 P18H00218  P18H00219	1. Install the transition joint, mounting plate to the control valve, check whether the O-ring is aged or damaged and replace it in time, tightening torque for bolts on mounting plate: 52±6Nm\ 38.4±4.4lbf·ft	Open-end wrench: 13, 19, 41mm
	2. Hang the control valve to the mounting position with proper sling.	Lifting rope

Figures	Operation instruction	Tools
 P18H00220	3. Install the control valve fastening bolts and nuts with the torque of 90±10Nm\ 66.4±7.4lbf·ft	Open-end wrench: 15mm
 P18H00221	4. Connect the multi-functional small cavity hose, tighten the hose joint to 89 ± 4Nm\ 65.6 ± 3.0lbf·ft	Open-end wrench: 32mm;
 P18H00222	5. Connect the multi-functional big cavity hose, tighten the hose joint to 89 ± 4Nm\ 65.6 ± 3.0lbf·ft	Open-end wrench: 32mm;

Figures	Operation instruction	Tools
 P18H00223	6. Connect the boom small cavity hose, tighten the hose joint to 179±8Nm\ 132±5.9lbf·ft	Open-end wrench: 41mm
 P18H00224	7. Connect the boom big cavity hose, tighten the hose joint to 179±8Nm\ 132±5.9lbf·ft	Open-end wrench: 41mm
 P18H00225	8. Connect the bucket small cavity hose, tighten the hose joint to 179±8Nm\ 132±5.9lbf·ft	Open-end wrench: 44mm

Figures	Operation instruction	Tools
 P18H00226	9. Connect the bucket big cavity hose, tighten the hose joint to 179±8Nm\ 132±5.9lbf·ft	Open-end wrench: 41mm
 P18H00227	10. Connect the oil return hose of the control valve, tighten the hose joint to 226±11Nm\ 166.7±8.1lbf·ft	Open-end wrench: 41mm
 P18H00228	11. Connect the LS hose, tighten the hose joint to 16±1Nm\ 11.8±0.74lbf·ft	Open-end wrench: 17mm

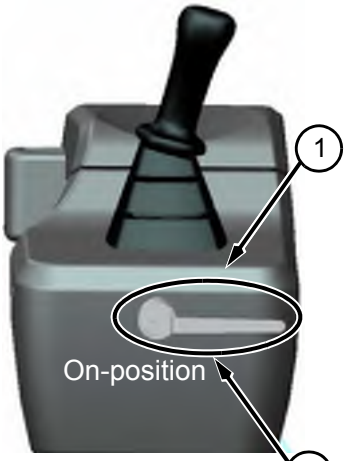
Figures	Operation instruction	Tools
 P18H00229	12. Connect the oil inlet hose of the control valve, tighten the hose joint to 179±8Nm\ 132±5.9lbf·ft	Open-end wrench: 44mm
 P18H00230	13. Connect the pilot hose to the control valve by the symbols during removal: "X1-boom big cavity linkage pilot", "X2-boom small cavity linkage pilot", "X3-bucket big cavity linkage pilot", "X4-bucket small cavity linkage pilot" , "X5-multi-functional big cavity linkage pilot", "X6-multi-functional small cavity linkage pilot".	Open-end wrench: 19mm
	14. Fill the hydraulic oil, start the machine and idle it for 5min	
	15. Tilt back and dump the bucket, raise and lower the boom slowly for at least 10 times to bleed the air in the line.	
	16. Stop the machine and check it for leakage.	
	17. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level	

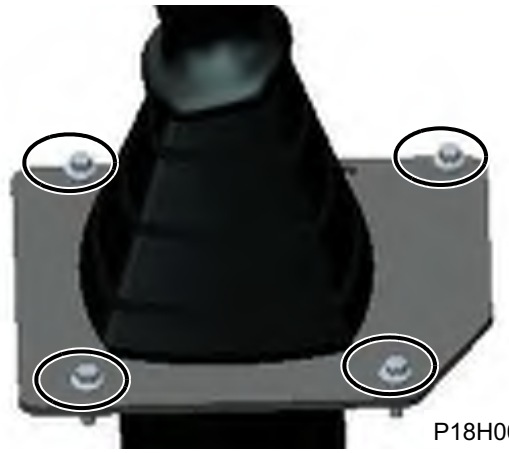
Removal and installation of pilot valve assembly

Removal of pilot valve assembly

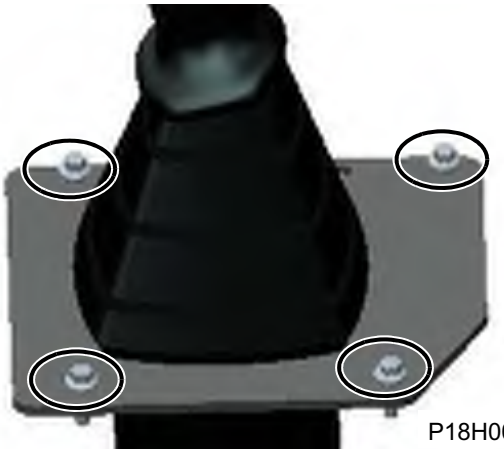
Removal steps:

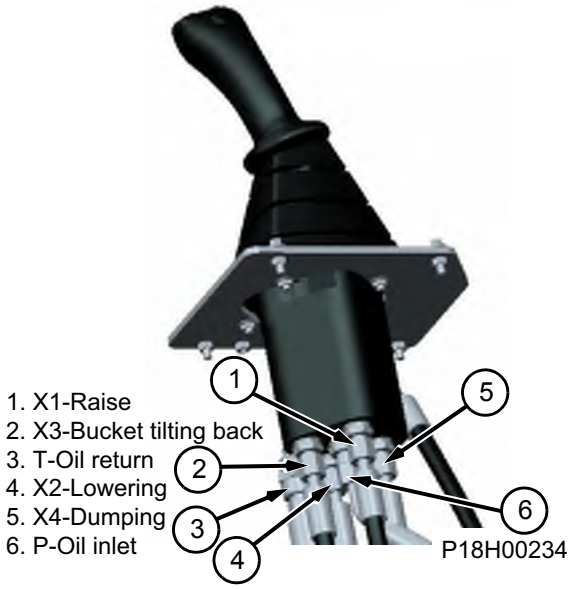
Figures	Operation instruction	Tools
 P18H00231	Before removal, release the system pressure, place the boom at the lowest position, and place the bucket flatwise on the ground.	
 P18H00232	1. Turn the pilot shut-off valve to the off-position (vertical position); **Note:** When turning the handle to the vertical position, the work implement will not work when the driver operates the pilot lever of the work implement. Thus it can prevent mis-operation of the control lever of the work implement from causing accidents.	

Figures	Operation instruction	Tools
 1. Upper cover plate 2. Lower cover plate P18H00233	2. Remove the upper and lower cover plate from the handrail group by referring to the Console Overhaul Manual;	
 1. X1-Raise 2. X3-Bucket tilting back 3. T-Oil return 4. X2-Lowering 5. X4-Dumping 6. P-Oil inlet P18H00234	3. Please mark the hose assembly connected to the pilot valve and shut-off valve respectively with: "P_oil inlet", "T_return oil", "X1_raising", "X2_lowering", "X3_bucket tilt-back", "X4_dumping"; the marks should be firm. 4. Remove the above hose assembly; mask oil ports;	Open-end wrench: 17, 24mm

Figures	Operation instruction	Tools
 P18H00235	5. Unscrew off the 4 tightening bolts of the pilot valve mounting board;	Open-end wrench: 8mm
	6. Remove the pilot valve from the right console and place it on the ground; mask the oil ports. Remove the joint, mounting plate from the pilot valve and place them well to spare.	

Installation of pilot valve assembly

Figures	Operation instruction	Tools
	1. Install the joint, mounting plate to the pilot valve.	
 P18H00236	2. Install the pilot valve to the mounting bracket of console from top to bottom, and tighten the mounting bolt to 10.5±1.5Nm\ 7.7±1.1lbf·ft	Open-end wrench: 8mm

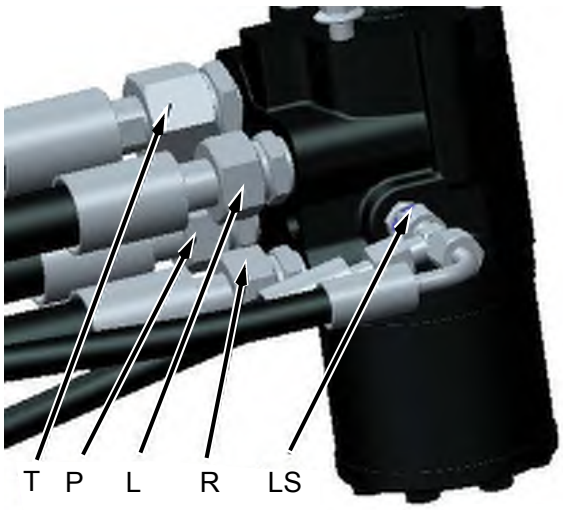
Figures	Operation instruction	Tools
 1. X1-Raise 2. X3-Bucket tilting back 3. T-Oil return 4. X2-Lowering 5. X4-Dumping 6. P-Oil inlet P18H00234	3. Connect the hose by the symbols: "P_oil inlet", "T_return oil", "X1_raising", "X2_lowering", "X3_bucket tilt-back", "X4_dumping"; tightening torque for "T_return oil" is: 37±2Nm\ 27.3±1.5lbf·ft, while the others: 16±1Nm\ 11.8±0.74lbf·ft;	Open-end wrench: 17, 24mm
	4. Fill the hydraulic oil, start the machine and idle it for 5min;	
	5. Tilt back and dump the bucket, raise and lower the boom slowly for at least 10 times to 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	

Figures	Operation instruction	Tools
 1. Upper cover plate 2. Lower cover plate P18H00238	8. Install the upper and lower cover plate to the handrail group by referring to the Console Overhaul Manual;	

Steering hydraulic system

Removal and installation of metering pump

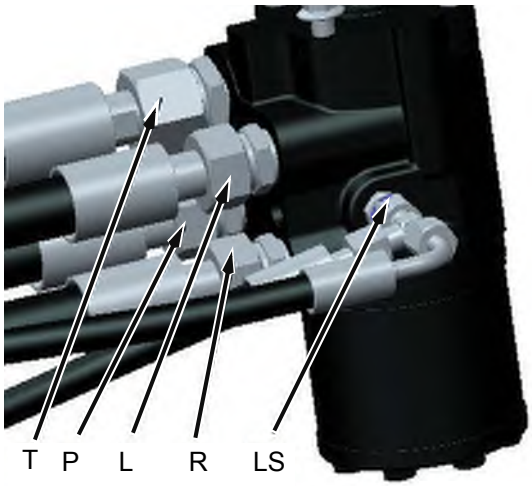
Removal of metering pump Removal steps

Figures	Operation instruction	Tools
 P18H00239	1. Mark hoses installed on the metering pump as: "T_ oil return pipe of metering pump", "P_ oil inlet pipe of metering pump", "L_ left steering pipe", "R_ right steering pipe" and "LS_ LS pipe of metering pump", the marks shall be clear, firm and shall not fall off. 2. Remove hoses at T, P, L, R and LS ports of metering pump and mask oil ports;	Marker: Open-end wrench: 17, 32, 36mm

Figures	Operation instruction	Tools
 P18H00240	3. Remove the joints installed on metering pump and shield the oil port of metering pump.	Open-end wrench: 17, 27, 32mm
 P18H00241	4. Remove captive bolts of metering pump on steering column of cab and take out the metering pump.	Open-end wrench: 13mm

Installation of metering pump

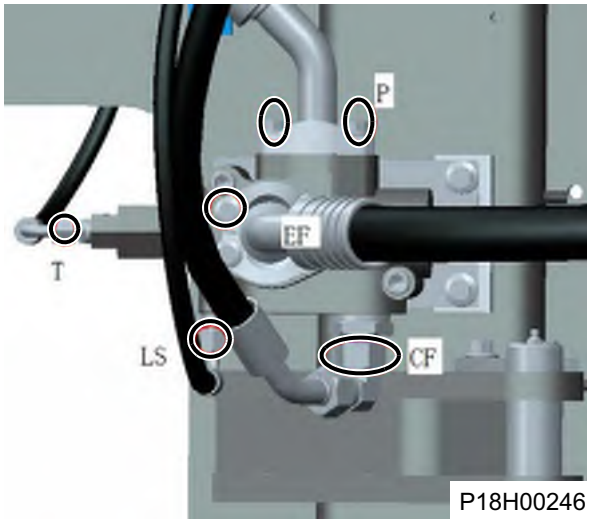
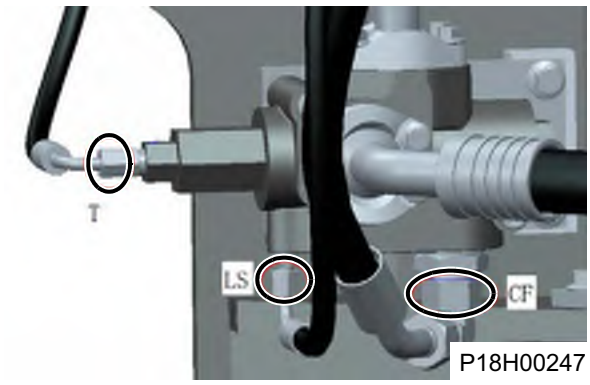
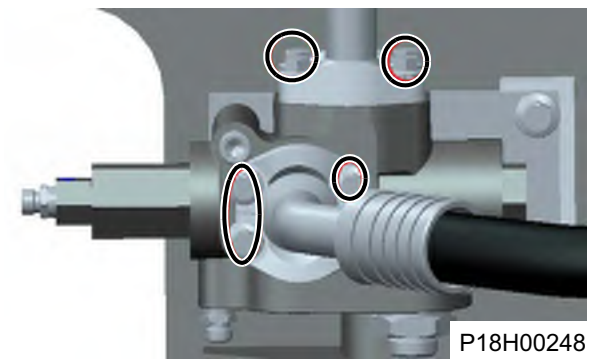
Figures	Operation instruction	Tools
 P18H00242	1. Install 4 captive bolts of metering pump and tightening torque is 52±7Nm\ 38.4±5.2lbf·ft.	Open-end wrench: 13mm
 P18H00243	2. Install T\P\R\L port joints of metering pump and tightening torque is 80±12Nm	

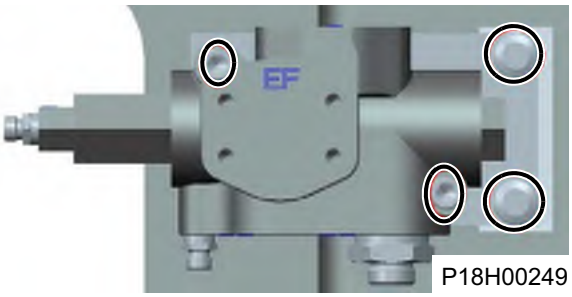
Figures	Operation instruction	Tools
 P18H00244	3. Install LS port joint and tightening torque is 35±5Nm	
 P18H00245	4. Connect hose: "T_ oil return pipe of metering pump" and tightening torque is 116±5Nm 5. Connect hoses: "P_ oil inlet pipe of metering pump", "L_ left steering pipe" and "R_ right steering pipe" and tightening torque is 89±4Nm\ 65.6±2.95lbf·ft 6. Connect hose: "LS_ LS pipe of metering pump" and tightening torque is 16±1Nm\ 11.8±0.74lbf·ft	
	7. Fill the hydraulic oil, start the machine and idle it for 5min; 8. Turn slowly for at least 10 times and bleed the air in the line. 9. Stop the machine and check it for leakage. 10. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level	

Removal and installation of priority valve

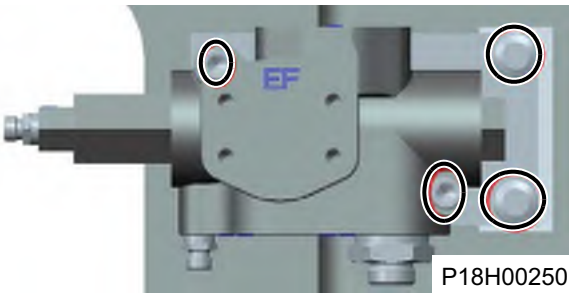
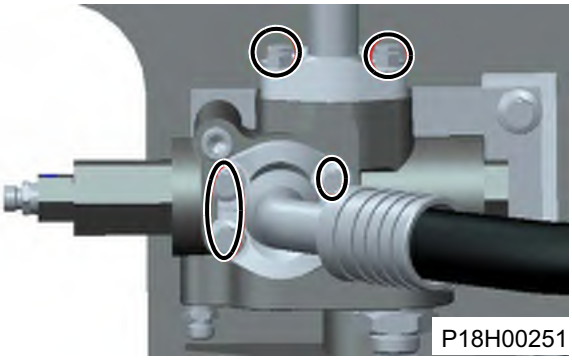
Removal of priority valve

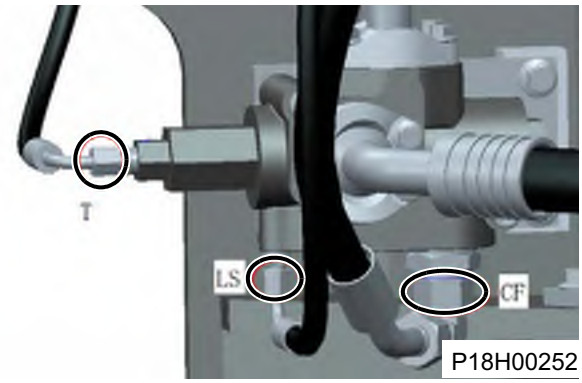
Removal steps

Figures	Operation instruction	Tools
 P18H00246	1. Mark hoses installed on the priority valve as T, P, LS, CF and EF, which shall be clear, firm and shall not fall off;	Marker:
 P18H00247	2. Loosen the CF, LS, T hoses joints with a open-end wrench and remove the hose joints by gentle knock-down, mask the oil ports;	Open-end wrench: 17, 32mm
 P18H00248	3. Remove flange bolts of P port and EF port and mask oil ports;	Open-end wrench: 13m

Figures	Operation instruction	Tools
 P18H00249	4. Remove bolts on mounting plate of priority valve and captive bolts of priority valve, take out the priority valve and place it in a clean container.	Open-end wrench: 15, 18mm Inner hexagon spanner: 10mm

Installation of priority valve

Figures	Operation instruction	Tools
 P18H00250	1. Install priority valve on fixing plate and tightening torque of bolts is 90±12Nm\6 6.4±8.9lbf·ft 2. Install priority valve on lug of rear frame and tightening torque of bolts is 90±12Nm\ 66.4±8.9lbf·ft	
 P18H00251	3. Connect hoses of P port and EF port and tightening torque of bolts is 72±6Nm\ 53.1±4.4lbf·ft	Open-end wrench: 13m

Figures	Operation instruction	Tools
 P18H00252	4. Connect hoses of T port and LS port and the tightening torque of hose joint is 16±1Nm\ 11.8±0.74lbf·ft 5. Connect hoses of CF port and the tightening torque of hose joint is 89±4Nm\ 65.6±2.95lbf·ft	Open-end wrench: 17, 32mm
	6. Fill the hydraulic oil, start the machine and idle it for 5min;	
	7. Turn slowly for at least 10 times and bleed the air in the line.	
	8. Stop the machine and check it for leakage.	
	9. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level	

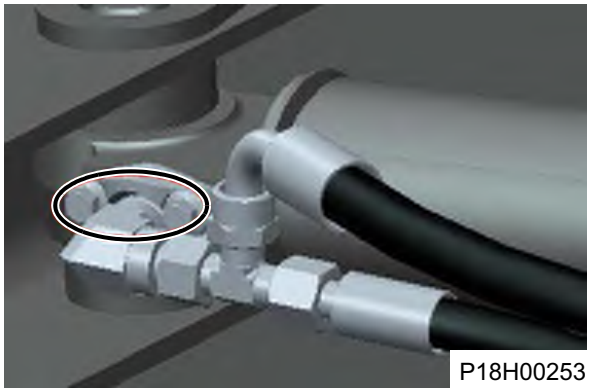
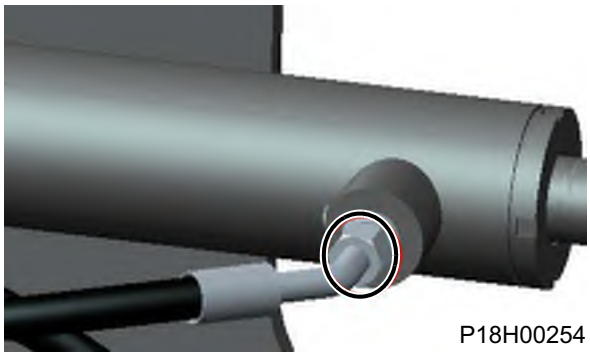
Removal and installation of steering cylinder

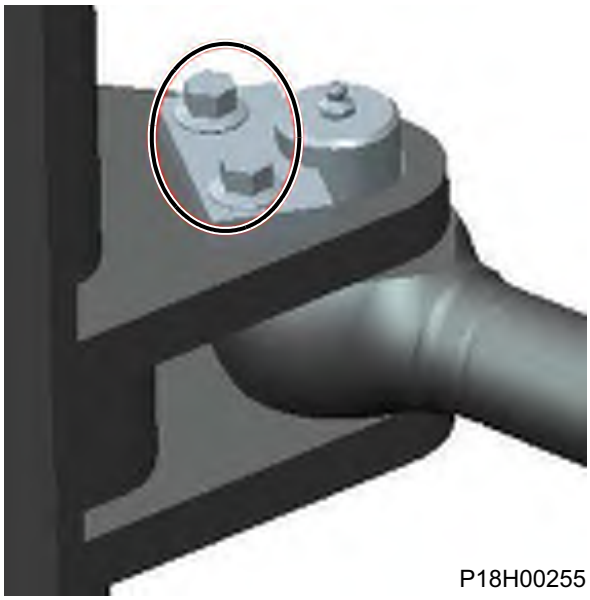
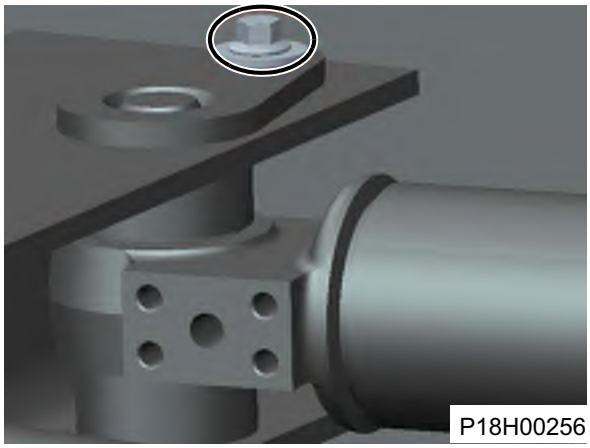
Removal of steering cylinder

⚠CAUTION

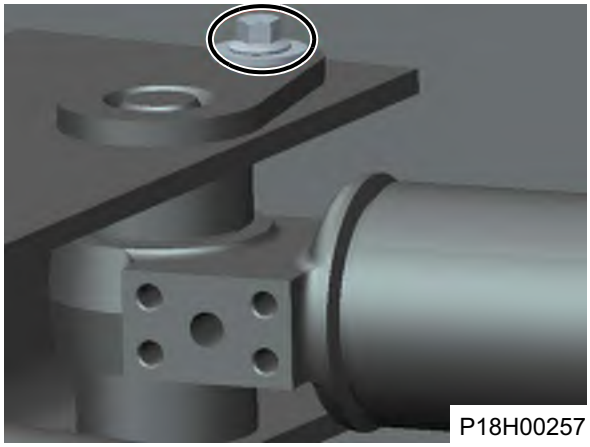
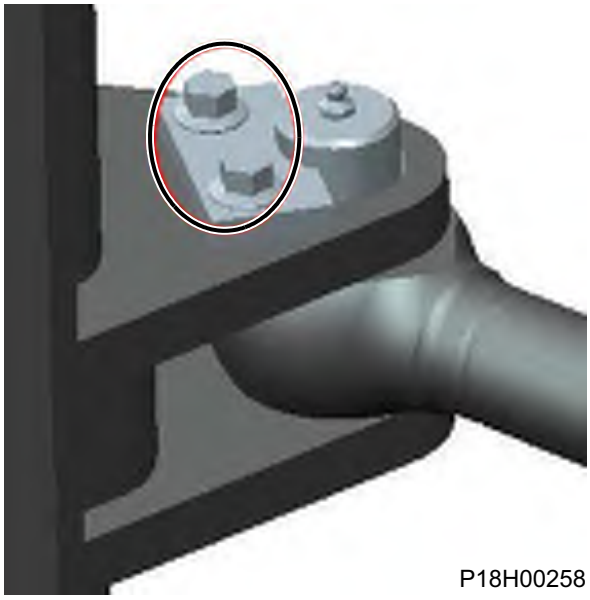
Place the machine in horizontal hard ground →lay flat the bucket →pull the hand brake →shut down→fix the front and rear frame by bumper.

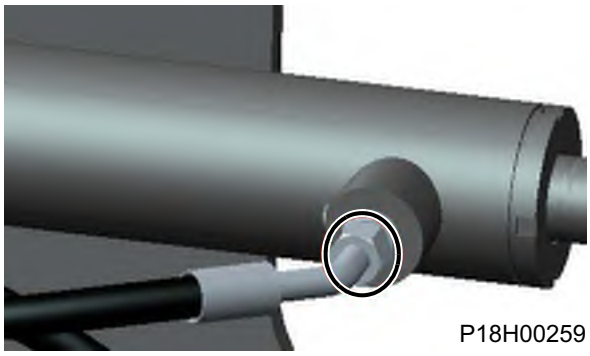
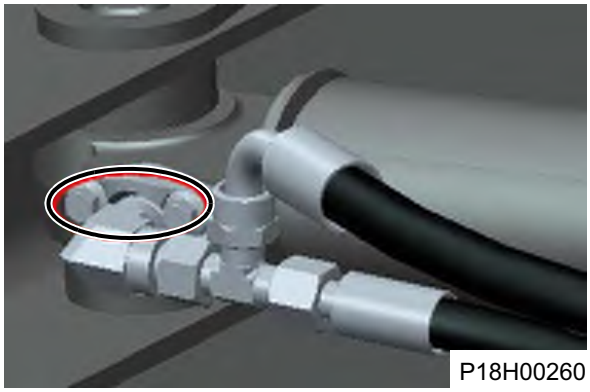
Removal steps (Take right steering cylinder as example, and the removal steps of left steering cylinder is the same)

Figures	Operation instruction	Tools
 P18H00253	1. Loosen and remove plate bolts of big cavity of steering cylinder by wrench and mask the oil ports.	Open-end wrench: 13mm
 P18H00254	2. Loosen the hose joint of small cavity of steering cylinder by wrench and remove the hose joint by gentle knockdown; mask the oil ports.	Open-end wrench: 27mm

Figures	Operation instruction	Tools
 P18H00255	3. Remove the tightening bolt of rear pin shaft of steering cylinder and knock out the pin shaft by copper bar;	Copper bar; Open-end wrench: 15mm
 P18H00256	4. Tie the steering cylinder with lifting rope, remove the tightening bolt of front pin shaft of steering cylinder and knock the pin shaft out with copper bar.	Copper bar; Open-end wrench: 15mm
	5. Lift the steering cylinder out of the frame using traveling crane and place it on a level ground.	Lifting rope; 2t\4410lb traveling crane
	6. Mask the big and small cavity oil ports of the steering cylinder to avoid pollution.	Shielding film

Assembly of steering cylinder

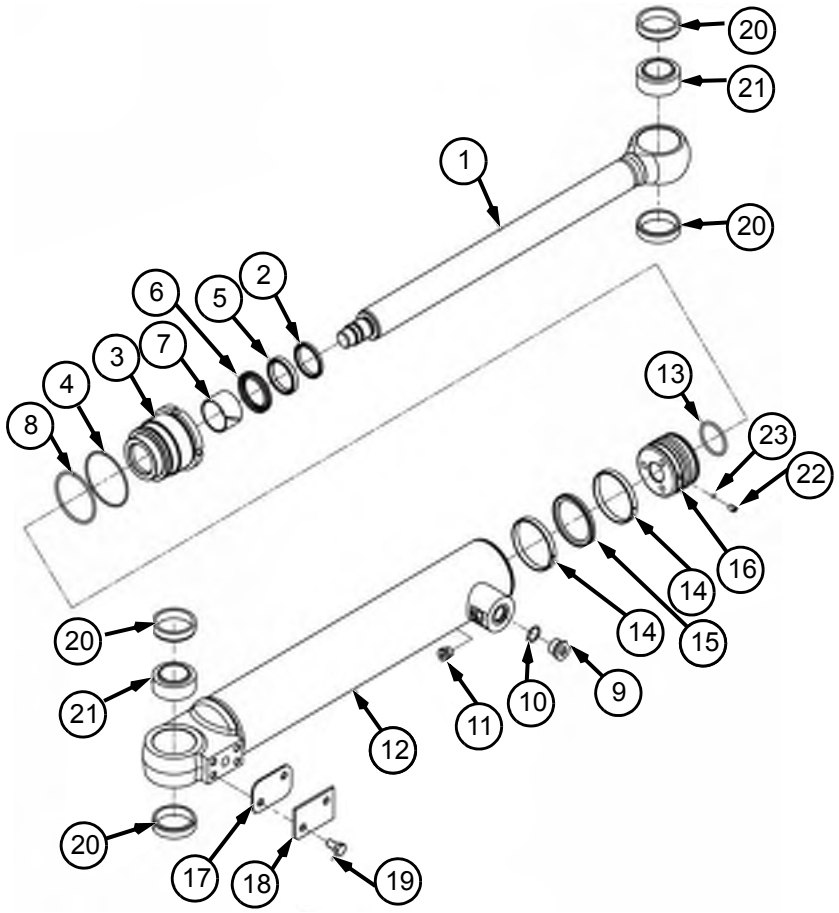
Figures	Operation instruction	Tools
	1. Hang the steering cylinder to the mounting position with proper sling.	Lifting rope; 2t\4410lbtraveling crane
 P18H00257	2. Install the front pin of steering cylinder and tighten the pin shaft captive bolt to 90±12Nm\ 66.4±8.9lbf·ft	Copper bar; Open-end wrench: 15mm
 P18H00258	3. Install the rear pin of steering cylinder and tighten the pin shaft captive bolt to 90±12Nm\ 66.4±8.9lbf·ft	Copper bar; Open-end wrench: 15mm

Figures	Operation instruction	Tools
 P18H00259	4. Connect the small cavity hose of steering cylinder with the tightening torque of hose joint 47±2Nm\ 34.7±1.5lbf·ft	Open-end wrench: 27mm
 P18H00260	5. Connect big cavity plate of steering cylinder with the tightening torque of bolts 72±6Nm\ 53.1±4.4lbf·ft	Open-end wrench: 13mm
	6. Fill the hydraulic oil, start the machine and idle it for 5min;	
	7. Turn slowly for at least 10 times and bleed the air in the line.	
	8. Stop the machine and check it for leakage.	
	9. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level	

Disassembly and assembly of steering cylinder

Disassembly of steering cylinder

Exploded view of steering cylinder

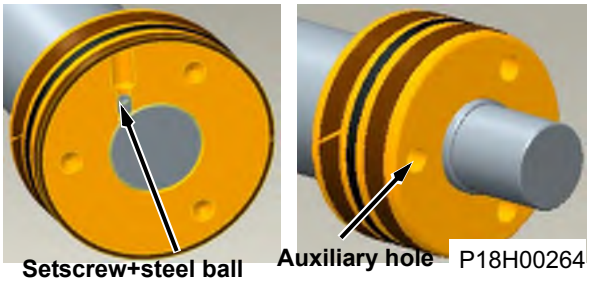


P18H00261

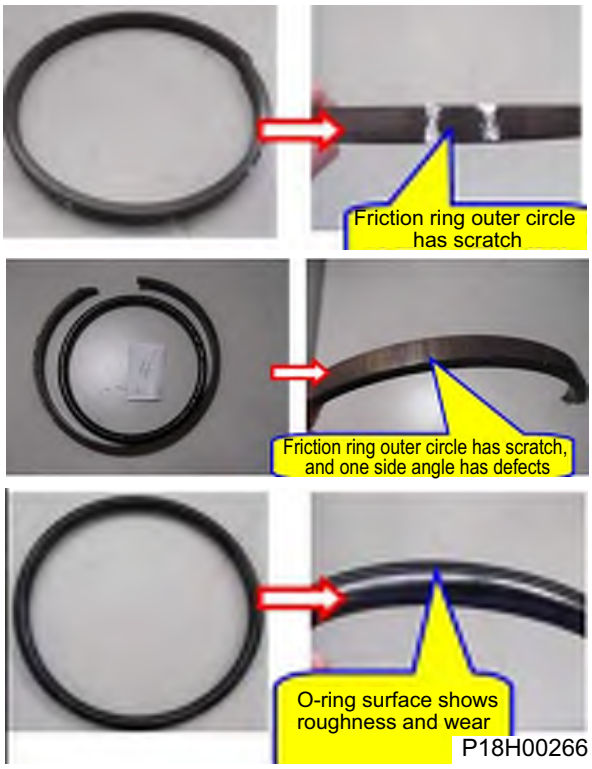
1. Piston rod
2. Dust ring
3. Cylinder head
4. O-ring
5. Y-seal
6. Seal ring
7. Supporting ring
8. O-ring
9. Plug
10. O-ring
11. Plug
12. Cylinder block
13. O-ring
14. Support ring
15. Glyd ring
16. Piston
17. Cushion
18. Cover
19. Bolt
20. Stopper
21. Knuckle bearing
22. Screw
23. Steel ball

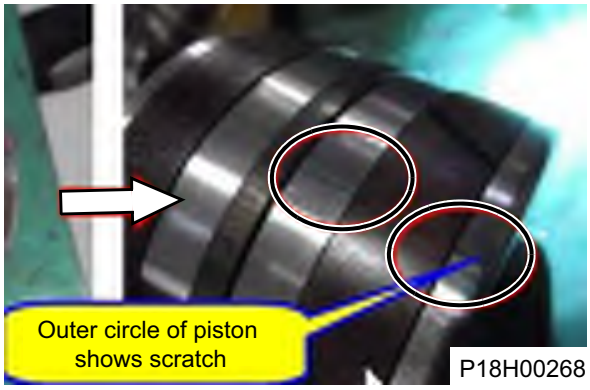
Removal steps

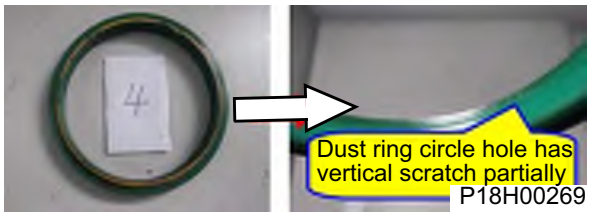
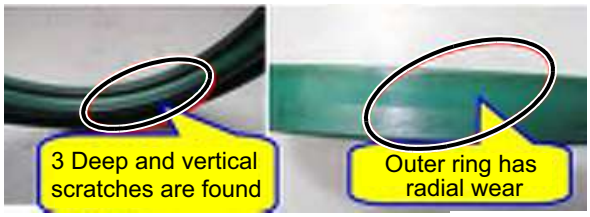
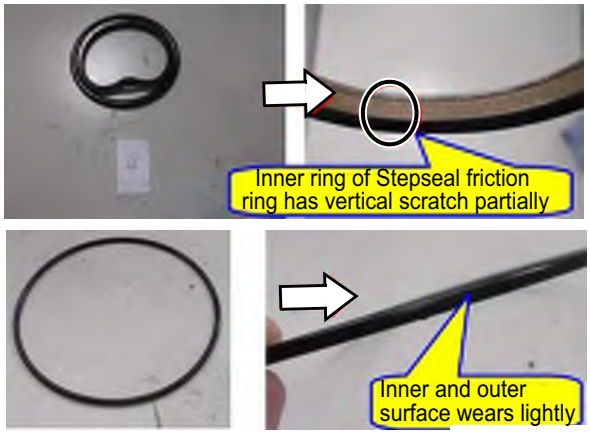
Figures	Operation instruction	Tools
 P18H00262	1. Fix the cylinder on assembly stand using pin shaft hole of cylinder head so that it can not turn. 2. Install boosting rod on hook spanner and unscrew cylinder head anticlockwise as shown in the figure.	Hook spanner Copper bar Boosting rod
 P18H00263	3. Put one end of lifting rope through the piston rod lug and fix it crosswise with the other end on the lifting equipment, and then conduct slow, uniform and vertical lifting, place the piston rod group horizontally on special working position apparatus after it (see left figure) separates from cylinder block completely (Note: the contact surface of working position apparatus and the cylinder shall be made of soft material. **Note:** the contact surface of working position apparatus and the cylinder shall be made of soft material. Put clean cotton on the contact surface of working position apparatus and piston rod to prevent the rod from being scratched.	Lifting equipment Lifting rope

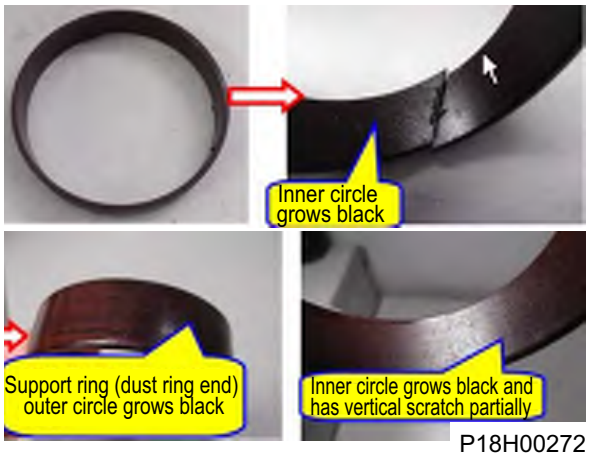
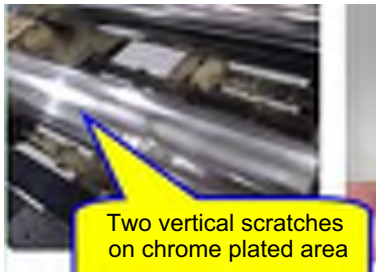
Figures	Operation instruction	Tools
Figure 1  *Figure 2*  	4. Fix the lug of piston rod group, unscrew setscrew on piston using inner hexagon spanner and take out the screw and steel ball. (see Figure 1-left) 5. Assemble the tightening tooling for piston in auxiliary hole on the piston (see right one of left Figure), unscrew piston using blower gun via tightening tooling, and then remove the piston from piston rod group along with axial direction of piston rod. 6. Install protective sleeve matched with thread at small end of piston rod on the threaded position (see Figure 2) and remove the cylinder head from piston rod group along with axial direction of piston rod. **Note:** the protective sleeve is used to prevent the seals from being scratched when removing the cylinder head from piston rod).	Inner hexagon spanner: 4mm Tightening tooling for piston Blower gun Thread protective sleeve

Inspection and cleaning of steering cylinder

Figures	Operation instruction	Tools
Piston group picture: *Figure 1*  *Figure 2*  	**Cleaning of part:** Clean cylinder block, piston rod, cylinder head and piston using kerosene and detergent, and then dry all parts with compressed air. **Inspection of part:** 1. Inspection of piston group: 1) Inspection of piston seal: a) Check whether glyd ring is scratched, worn, extruded and collapsed (Figure 1). b) Check whether support ring is scratched, strained, worn and burnt (Figure 2). c) Check whether O-ring at static seal of piston is worn and trimmed. 2) Inspection of piston: a) Check whether contour of piston is scratched and strained (Figure 3). b) Check whether two end surfaces are compressed seriously.	

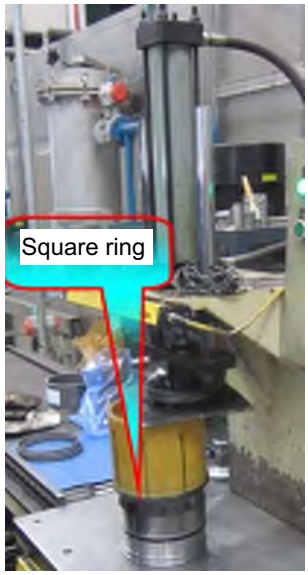
Figures	Operation instruction	Tools
(Figure 3) 		

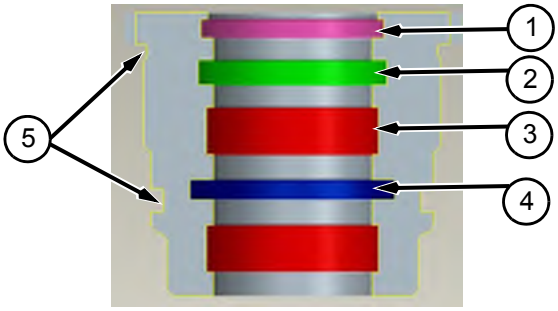
Figures	Operation instruction	Tools
Cylinder head assembly: *Figure 1*  P18H00269 *Figure 2*  P18H00270 *Figure 3*  P18H00271	2. Inspection of cylinder head assembly: 1) Inspection of cylinder head seal: a. Check whether the dust ring is scratched, worn and damaged (figure 1). b. Check whether Y-seal is scratched, worn, damaged and burnt (figure 2). c. Check whether seal is scratched, worn, damaged and collapsed (Figure 3). d. Check whether support ring is scratched, worn, burnt and attached with foreign matter. e. Check whether O-ring at static seal of cylinder head is worn, trimmed and burnt.	

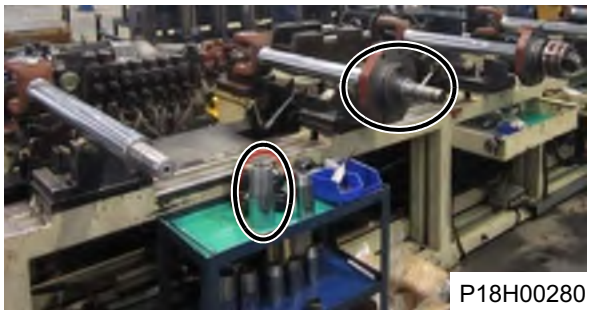
Figures	Operation instruction	Tools
Figure 4  P18H00272 *Figure 5*  P18H00273	6) Inspection of cylinder head: a. Check whether the cylinder head bore is scratched, strained and eccentrically worn. b. Check whether the thread of cylinder head is damaged (mess thread) (Figure 5).	
Piston rod:  P18H00274	3. Inspection of piston rod: a. Check whether the piston rod body (chrome plated area) is bumped, scratched, rusted and dechromed (Left figure). b. Check whether the thread at small end of piston rod is rusted and damaged (mess thread). c. Check whether knuckle bearing of rod head is damaged.	

Figures	Operation instruction	Tools
Figure 1  P18H00275 *Figure 2*  P18H00276	4. Inspection of cylinder block: a. Check inner wall of cylinder block for score or scratch (Figure 1). b. Check thread in cylinder block for burr or damage (mess thread). c. Check whether knuckle bearing of cylinder head is damaged. d. Check oil port surface of big & small cavity for scratches (affecting sealing) and oil port thread for damage.	
	Cleaning of part: Clean cylinder block, piston rod, cylinder head and piston using kerosene and detergent, and then dry all parts with compressed air.	

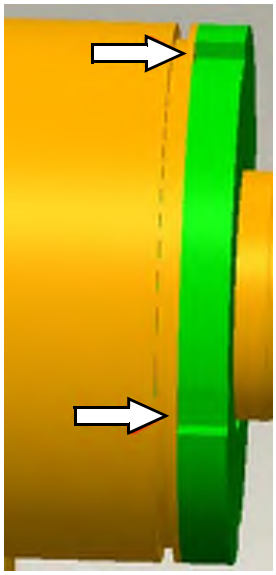
Assembly of steering cylinder

Figures	Operation instruction	Tools
Assembly of piston group: *Figure 1*  P18H00277	1. Assembly of piston group (assembly of seal): a. Clean the piston, and then place it horizontally on the assembling stand. b. Press the inner ring of gliding (O-ring) into the middle groove using special tooling (Figure I), and then assemble the outer ring at the outside of O-ring with tooling. c. Separate the support ring by hand (with opening) and assemble it into its groove.	Assembling tooling for glyd ring

Figures	Operation instruction	Tools
Assembly of cylinder head assembly: *Figure 1*  1. Pink: groove of dust ring 2. Green: groove of Y-ring 3. Red: groove of support ring 4. Blue: groove of buffer ring 5. Groove of O-ring P18H00278 *Figure 2*  P18H00279	1. Assembly of cylinder head assembly (assembly of seal): a. Clean the cylinder head, and place it on the assembly stand as shown in figure 1 (dust ring side faces upward). b. As shown in Figure 2, assemble Y-ring into green groove (shown in Figure 1) with dual lip of Y-ring facing downwards (facing to the support ring). c. Assemble dust ring into pink groove (shown in Figure 1) with dual lip of dust ring facing downwards (facing to the support ring) using the same method of assembling Y-ring. d. Turn over the cylinder head with the dust ring facing downwards. e. Press the supporting ring (with opening) slightly by hands and install it to the red groove shown in figure 1. f. Install the O-ring of buffer ring (formed by O-ring and seal ring) to the blue groove shown in figure 1 and then install the seal ring to the outside of O-ring. g. Assemble the O-ring into its groove.	Assembling tooling for dust ring

Figures	Operation instruction	Tools
Assembly of piston rod group *Figure 1*  P18H00280 *Figure 2*  P18H00281	2. Assembly of piston rod group: a. Fix the lug of piston rod on special tooling so that it can not turn. b. Put the thread protective sleeve (red ring in figure 1) on the thread at small end of piston rod to avoid scratching the seal. c. Apply cleaning hydraulic oil on the surface of piston rod and push the cylinder head (the side with dust ring facing rod head) into rod body (green ring shown in Figure I) along with axial direction of piston rod. d. Install the piston to the small end of piston rod with the tightening tooling for piston and then tighten it with blower gun (figure 2). e. Install the steel ball into the threaded hole of the piston. f. Screw the setscrew to the threaded hole of the piston with inner hexagon spanner.	Fixing tooling for piston rod Thread protective sleeve Blower gun Tightening tooling for piston Inner hexagon spanner: 4mm

Figures	Operation instruction	Tools
Figure 1  P18H00282	3. Assembly of oil cylinder assembly: a. Fix the cylinder block on assembly stand so that it can not turn (As shown in Figure I and Figure II) and apply cleaning hydraulic oil on inner cavity of cylinder block within the area of 300mm\ 11.8in from up to down. b. Lift the piston rod group with sling and apply clean hydraulic oil to the excircle of piston, then install it to the cylinder block vertically along with the axis of inner chamber of cylinder block. c. Tighten the cylinder head clockwise using hook spanner and knock the hook spanner with copper bar, and then install boosting rod on the hook spanner to tighten the cylinder continuously (Figure II) to make tightening torque of cylinder head thread reach 332±20Nm\ 244.9±14.8lbf·ft.	Lifting rig Lifting rope Hook spanner Copper bar Boosting rod

Figures	Operation instruction	Tools
Figure 2  P18H00283 *Figure 3*  P18H00284	d. Knock the locking edge of cylinder block into 4 square grooves of cylinder head using a punch (with one sharp end and one blunt end) in the arrow direction shown in Figure III (effect: locking). e. Seal the big and small cavity of oil port with special cap.	

Brake system

Removal and installation of brake pump

Removal of brake pump

Removal steps:

⚠CAUTION

Refer to Installation Position and Functional Structure to release the pressure of service brake system and parking brake system before removing the brake pump.

Since the brake pump is an integrated tandem pump with cooling pump, its removal steps are same as that of cooling pump.

Assembly of brake pump

Its installation steps are same as that of cooling pump.

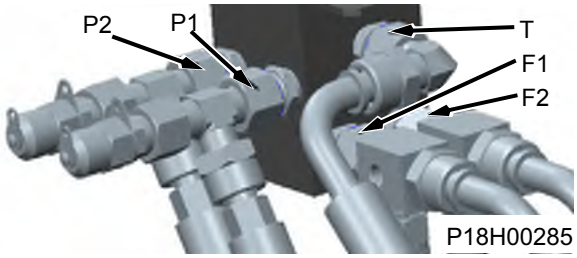
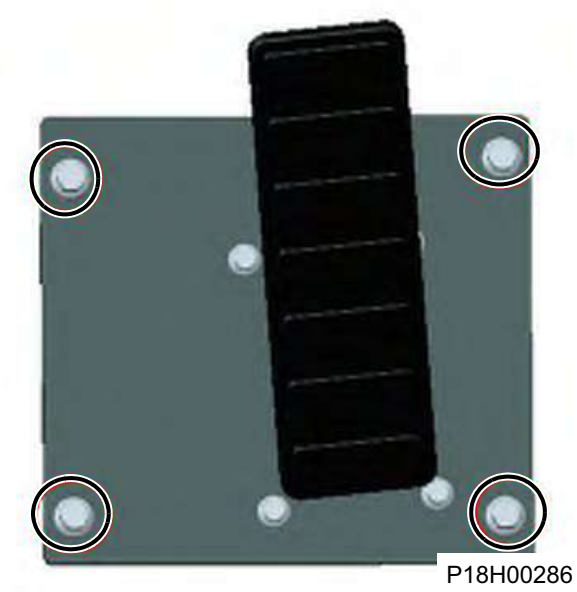
Removal and installation of brake valve

Removal of brake valve

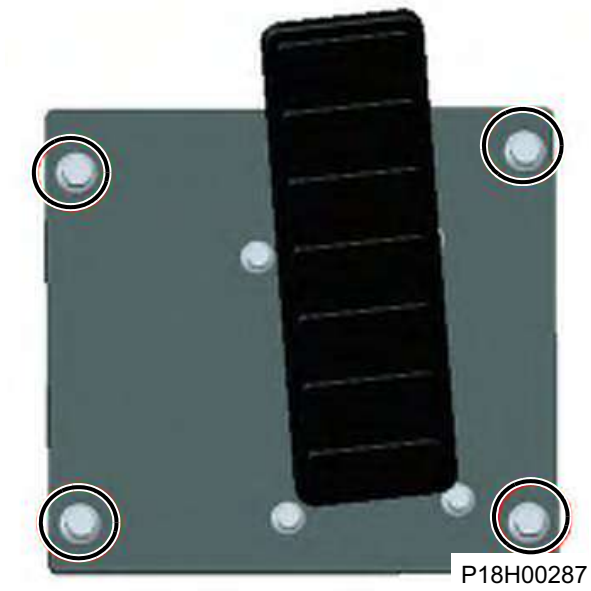
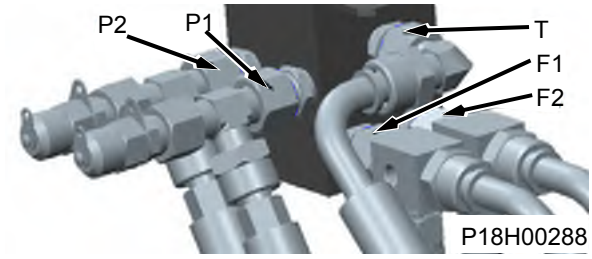
Removal steps:

⚠CAUTION

Refer to “Pressure Release of Hydraulic system” to release the pressure of service brake system and parking brake system before removing the brake valve.

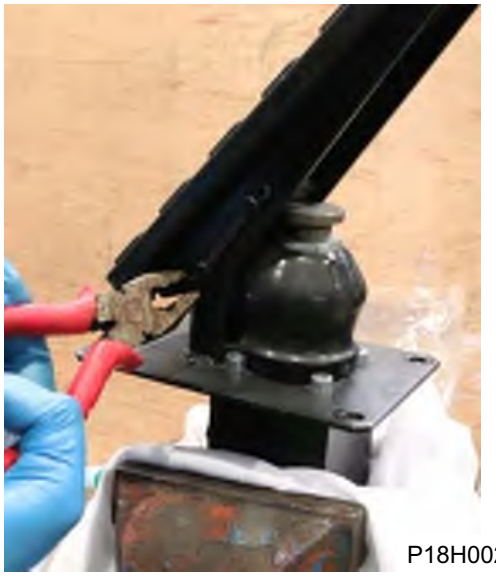
Figures	Operation instruction	Tools
 P18H00285	Remove the brake light switch or clutch on/off switch in the electrical system 1. Mark the 5 hoses connecting brake valve as P1, P2, F1, F2, T respectively. Pay attention to that the markings shall be firm. 2. Remove the joints of 5 hoses and shield the oil ports;	Open-end wrench: 22mm
 P18H00286	3. Unscrew the 4 bolts tightening the brake valve in the cab;	Open-end wrench: 13mm
	4. Take out the brake valve from the bottom of cab; 5. Shield the port of brake valve and store it in dry and clean place.	

Installation of brake valve

Figures	Operation instruction	Tools
	1. Install the brake valve onto the cab floor from the bottom, tighten the bolt. Tightening torque of bolt: 52±6Nm\ 38.4±4.4lbf·ft;	Open-end wrench: 13mm
	2. Tighten hose joints T, F2, F1, P1 and P2 with tightening torque 37±2Nm\ 27.3±1.5lbf·ft; 3. Connect the brake light switch and clutch on/off switch well in the electrical system by referring to Electrical System Overhaul Manual.	Open-end wrench: 22mm

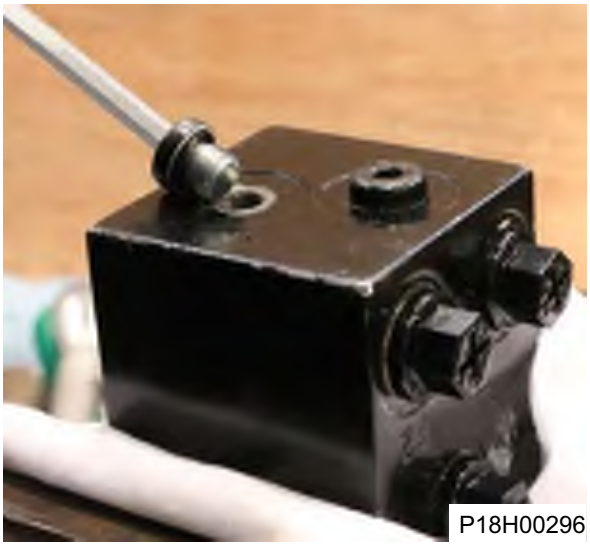
Disassembly and assembly of brake valve

Disassembly of brake valve

Figures	Operation instruction	Tools
 P18H00289	1. Take out cotter pin and two cross pins	Wire cutter
 P18H00290	2. Take down torsional spring	

Figures	Operation instruction	Tools
 P18H00291	3. Take down dust cover	
 P18H00292	4. Unscrew 4 hex bolts using inner hexagon spanner and take down the plate	Inner hexagon spanner:

Figures	Operation instruction	Tools
 P18H00293	5. Unscrew spool group using 36# open-end wrench	36# Open-end wrench
 P18H00294	6. Take out the spool group and gaskets on the group	

Figures	Operation instruction	Tools
 P18H00295	7. Take out two spools	
 P18H00296	8. Turn over the valve body and remove hex head plug from its bottom	Inner hexagon:

Figures	Operation instruction	Tools
 P18H00297		
 P18H00298  P18H00299	9. Push lightly spool and spring out of the other end using inner hexagon wrench	

Figures	Operation instruction	Tools
 P18H00300	10. Inner components of brake valve are shown in the Figure	

Inspection and cleaning of brake valve

The valve body and spool can be used if there are no obvious scratches, dents and corrosions on their surfaces by visual inspection. The components needed to be reassembled shall be cleaned in detergent (Loctite 755 detergent is recommended)

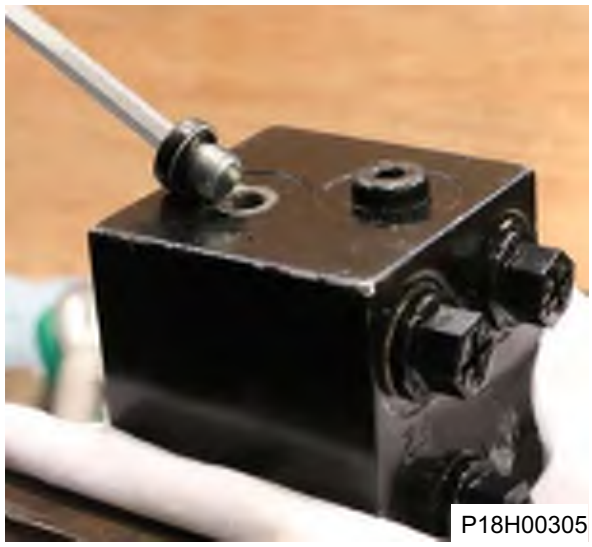
⚠CAUTION

The cleaned components shall touch hydraulic oil before reassembly;

Figures	Operation instruction	Tools
 P18H00301	1. Clean all parts needed to be assembled	Use Loctite 755 detergent

Assembly of brake valve

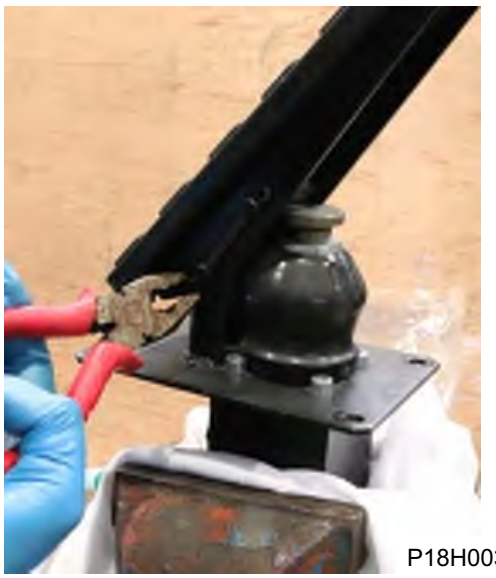
Figures	Operation instruction	Tools
 P18H00302	1. Refer to left figure for inner components of brake valve	
 P18H00303	2. Install spring and spool as shown in the figure	
 P18H00304		

Figures	Operation instruction	Tools
 P18H00305	3. Mounting torque of hex head plug: 13NM\ 9.6lbf	Inner hexagon spanner:
 P18H00306	4. Take over the valve body and install two spools (pay attention to the direction of spools)	

Figures	Operation instruction	Tools
 P18H00307	5. Stick the gasket onto valve group using grease	
 P18H00308	6. Install the spool group into valve body	

Figures	Operation instruction	Tools
 P18H00309	7. Tighten the spool group using 36# open-end wrench with torque 50NM\ 36.9lbf·ft	36# Open-end wrench
 P18H00310	8. Install the plate and 4 hex bolts with tightening torque 10 NM\ 7.4lbf·ft	Inner hexagon spanner

Figures	Operation instruction	Tools
 P18H00311	9. Install dust cover	
 P18H00312	10. Install torsional spring, cross pin and cotter pin	Wire cutter

Figures	Operation instruction	Tools
 P18H00313		
 P18H00314		

⚠CAUTION

Users can not remove and install the internal parts of brake valve on their own without authorization of manufacturer POCLAIN, otherwise, POCLAIN will not be liable for the service of quality assurance.

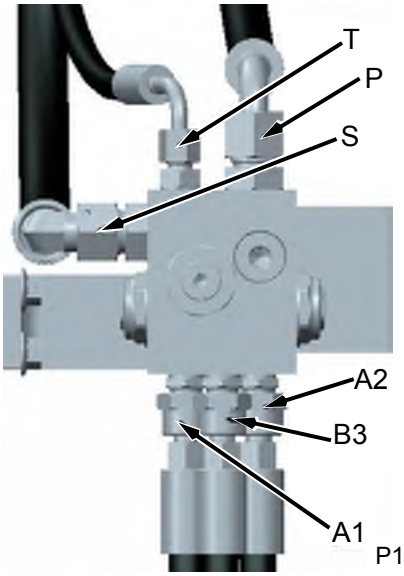
Removal and installation of charge valve

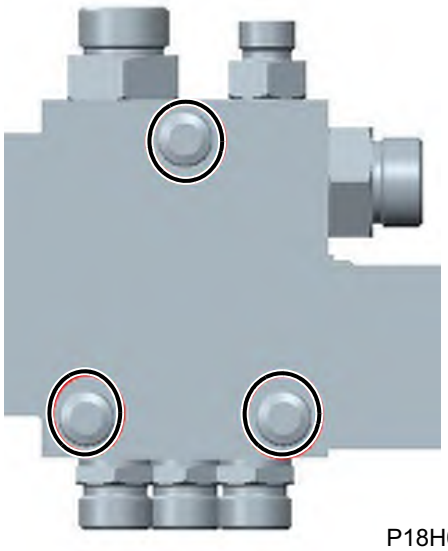
Removal of charge valve

Removal steps:

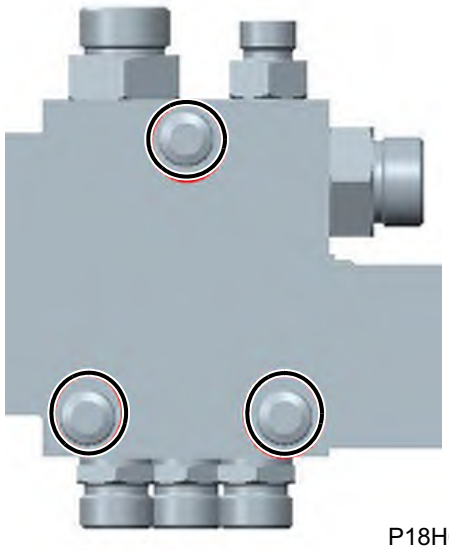
⚠CAUTION

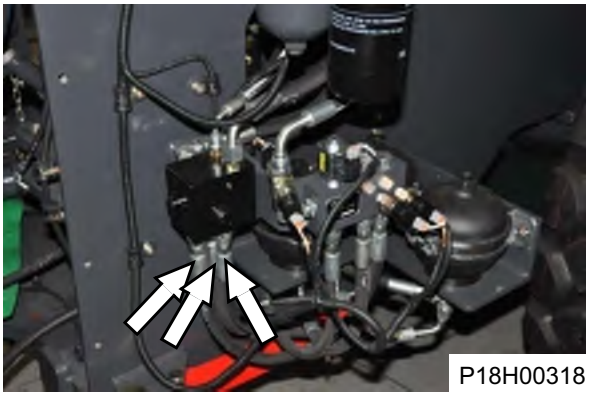
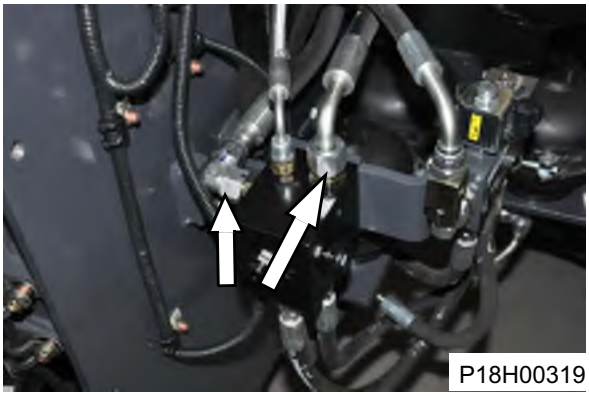
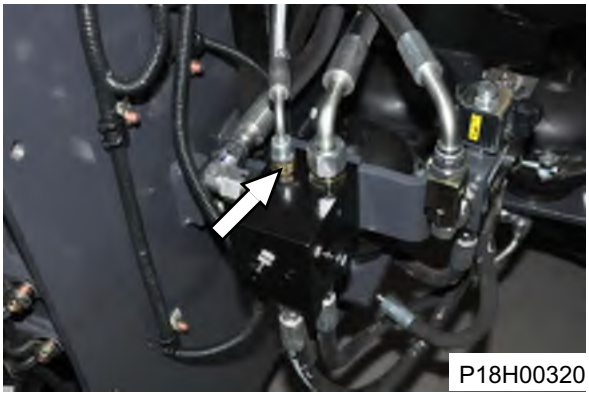
Refer to Installation Position and Functional Structure to release the pressure of service brake system and parking brake system before removing the charge valve.

Figures	Operation instruction	Tools
 P18H00315	1. Mark 6 hoses connecting with charge valve respectively as T, P, S, B3, A1, A2 and note that markings shall be firm; 2. Loosen the joints of 5 hoses and mask the oil ports;	Open-end wrench: 17, 24, 27mm

Figures	Operation instruction	Tools
 P18H00316	3. Unscrew the 3 bolts tightening the charge valve;	Open-end wrench: 8mm
	4. Take the charge valve out of left housing; 5. Shield the joint of charge valve and store it in dry and clean place.	

Installation of charge valve

Figures	Operation instruction	Tools
 P18H00317	1. Tighten bolts, install the charge valve onto the mounting plate of left box, tightening torque of bolts: 10.5±1.5Nm\ 7.7±1.1lbf·ft;	Open-end wrench: 8mm

Figures	Operation instruction	Tools
 P18H00318	2. Assemble joints marked with A2, A1 and B3 and tighten the joints with torque 37±2Nm\ 27.3±1.5lbf·ft;	Open-end wrench: 24mm
 P18H00319	3. Assemble joints marked with P and S and tighten the joints with torque 47±2Nm\ 34.7±1.5lbf·ft;	Open-end wrench: 27mm
 P18H00320	4. Assemble joint marked with T and tighten the joint with torque 16±1Nm\ 11.8±0.74lbf·ft;	Open-end wrench: 17mm

Disassembly and assembly of charge valve

Disassembly of charge valve

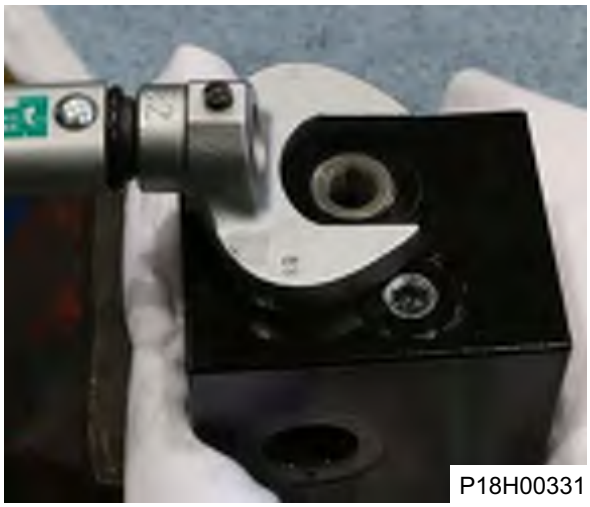
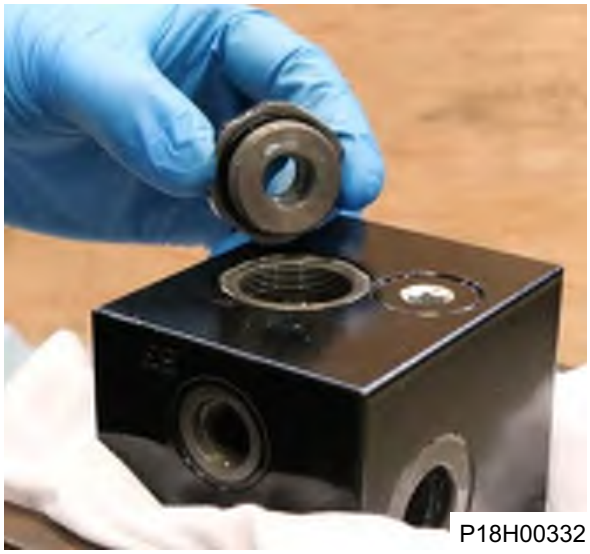
Figures	Operation instruction	Tools
 P18H00321	1. Fix the charge valve using vise	
 P18H00322	2. Remove the plastic plugs using straight screwdriver in sequence (P, T, A1, A2, B3 and S);	Cross screwdriver

Figures	Operation instruction	Tools
 P18H00323	3. Remove the charge valve spool using 30# hexagon socket wrench and note that the O-ring shall return to spool after removing the spool (three layers of O-rings)	30 hexagon socket wrench
 P18H00324		

Figures	Operation instruction	Tools
 P18H00325	4. Open the plug of switching spool using large straight screwdriver (special tool);	
 P18H00326		

Figures	Operation instruction	Tools
 P18H00327	5. Remove spring gasket and take out two springs and gaskets under springs (take out the components in sequence shown in the figure)	
 P18H00328		

Figures	Operation instruction	Tools
 P18H00329		
 P18H00330	6. Remove small metal plug at upper end using 6# inner hexagon spanner and remove large metal plug at secondary layer with 32# open-end wrench (or socket wrench); take out long rod spool by hand and attract small steel ball using magnetized screwdriver;	6# Inner hexagon spanner

Figures	Operation instruction	Tools
 P18H00331		32# Open-end wrench
 P18H00332		

Figures	Operation instruction	Tools
 P18H00333		
 P18H00334		

Figures	Operation instruction	Tools
 P18H00335		
 P18H00336		

Inspection and cleaning of charge valve

The valve body and spool can be used if there are no obvious scratches, dents and corrosions on their surfaces by visual inspection. The components needed to be reassembled shall be cleaned in detergent (Loctite 755 detergent is recommended)

⚠CAUTION

The cleaned components shall touch hydraulic oil before reassembly;

Figures	Operation instruction	Tools
 P18H00337	Clean all parts needed to be assembled	Use Loctite 755 detergent

Assembly of charge valve

Figures	Operation instruction	Tools
 P18H00338	1. Steel ball and long rod valve body is placed in the fixing position of valve body;	

Figures	Operation instruction	Tools
 P18H00339		
 P18H00340	2. Turn large metal plug at the bottom to original position using 32# open-end wrench (or socket wrench) with tightening torque 65N.M\ 47.9lbf·ft	

Figures	Operation instruction	Tools
 P18H00341	3. Install hex head plug with tightening torque 13N.M\ 9.6lbf·ft	
 P18H00342	4. Install spring gasket, springs and gaskets under springs (take out the components in sequence shown in the figure)	

Figures	Operation instruction	Tools
 P18H00343	5. Install the plug	
 P18H00344	6. Tighten the plug using special straight tooling with torque 50N.M\ 36.9lbf·ft	

Figures	Operation instruction	Tools
 P18H00345	7. Install two cartridge valves with torque 30NM\ 22.1lbf·ft	
 P18H00346		

Figures	Operation instruction	Tools
 P18H00347	8. Install plugs using straight screwdriver in sequence (P, T, A1, A2, B3 and S);	

⚠CAUTION

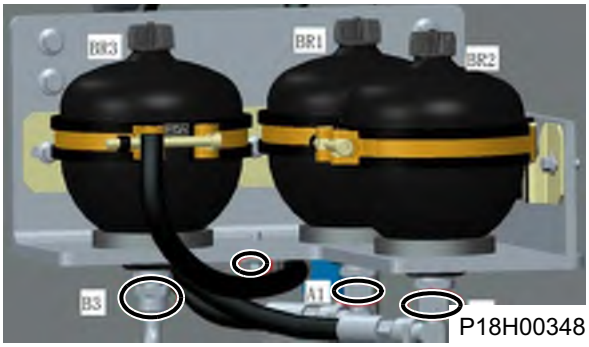
Users can not remove and install the internal parts of brake valve on their own without authorization of Liugong, otherwise, Liugong will not be liable for the service of quality assurance.

Removal and installation of accumulator

Removal steps:

⚠CAUTION

Refer to Pressure Release of Hydraulic system to release the pressure of service brake system and parking brake system before removing the accumulator.

Figures	Operation instruction	Tools
 P18H00348	Open door of left housing: 1. Mark accumulators respectively as BR1, BR2 and BR3 and hoses connecting with their lower parts as A1, A2 and B3, note that markings shall be firm; remove hoses and joints under accumulators and mask oil ports;	Open-end wrench: 10mm, 22mm and 24mm;
 P18H00349	2. Remove the 6 bolts from the accumulator;	Open-end wrench: 10mm
 P18H00350	3. Take the accumulator out of left housing; 4. Shield the joint of accumulator and store it in dry and clean place.	

Assembly steps: assemble it in the reverse order of the removal steps.

Removal and installation of brake cylinder

Removal steps:

⚠CAUTION

Refer to Pressure Release of Hydraulic system to release the pressure of service brake system and parking brake system before removing the brake cylinder.

Figures	Operation instruction	Tools
 P18H00351	1. Remove the pin shaft between the brake cylinder and manual brake;	Pliers
 P18H00352	2. Remove the hose from the brake cylinder, and then loosen the nuts from the above end of brake cylinder; 3. Take out brake cylinder; 4. Shield the port of brake cylinder and store it in dry and clean place.	Open-end wrench: 24mm

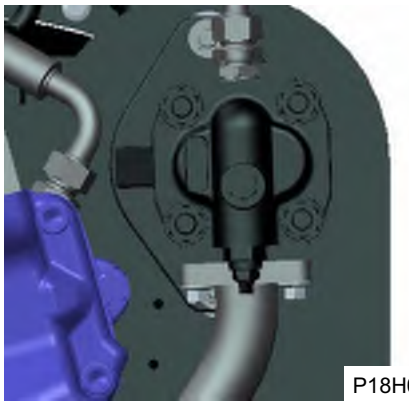
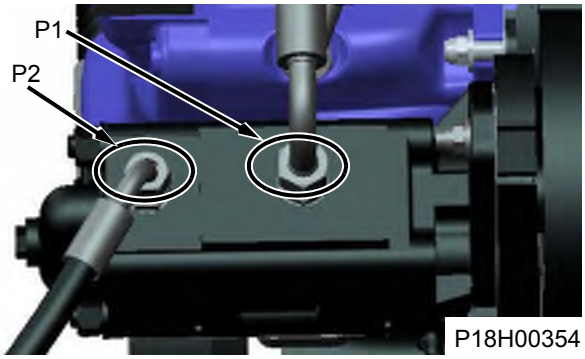
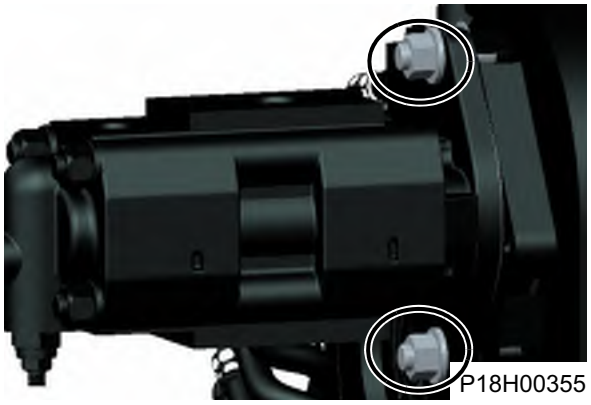
Assembly steps: assemble it in the reverse order of the removal steps.

Hydraulic cooling system

Removal and installation of cooling pump

Removal of cooling pump

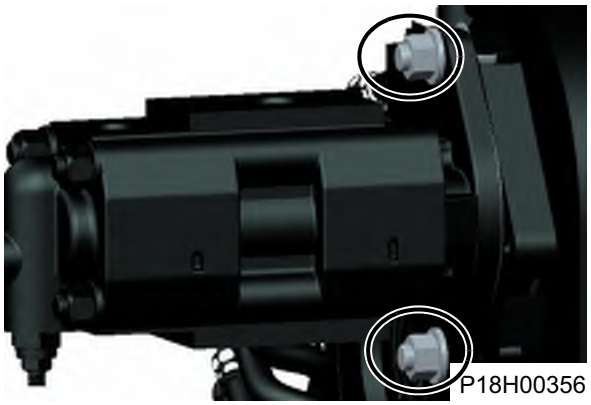
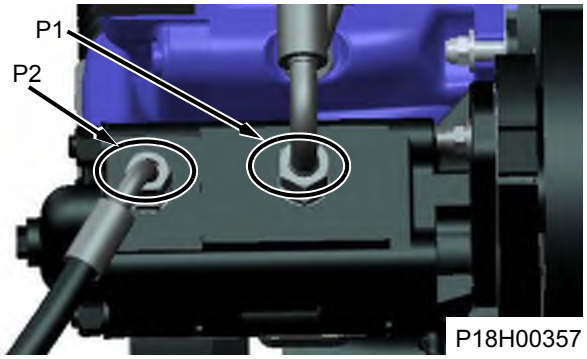
Removal of gear pump:

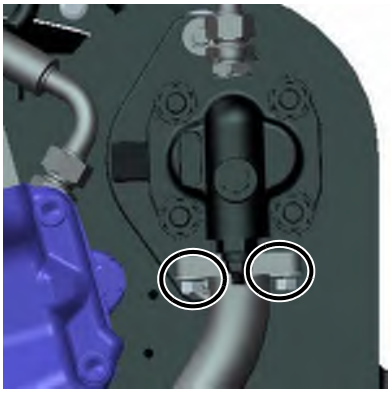
Figures	Operation instruction	Tools
 P18H00353	1. Remove 4 bolts at oil suction port of gear pump and mask oil ports;	Open-end wrench: 15mm
 P18H00354	2. Remove 2 oil outlet pipes shown in the figure, mark them respectively as P1 and P2 and note that markings shall be firm; Loosen the hose joint with wrench and remove the hose joint after gentle knock-down. Block the hose joint.	Open-end wrench: 27mm and 32mm
 P18H00355	3. Remove the captive bolt from the gear pump, and lift the pump body to the clean container; avoid collisions to ensure the personnel security during removal; mask the pump opening to prevent it from being contaminated.	Open-end wrench: 24mm

Assembly of cooling pump

⚠CAUTION

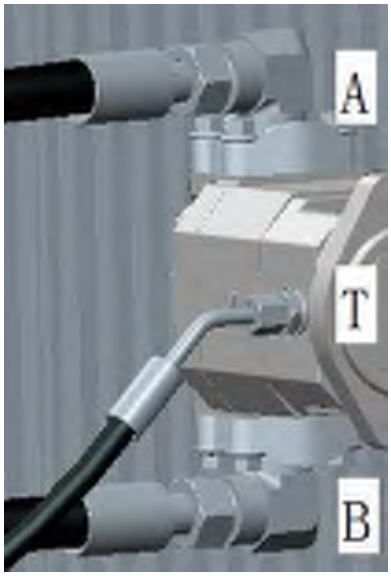
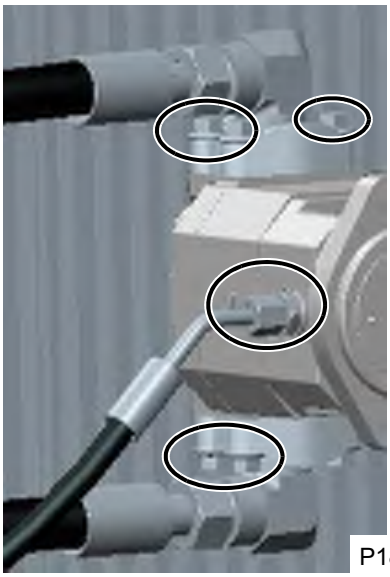
Make sure the connection of hose connector oil port is correct. During disassembly process, guarantee the cleanliness of pipeline and components and check whether O-ring is aged, damaged and replace timely.

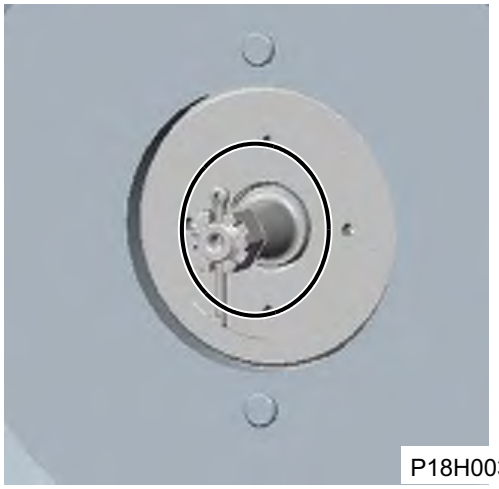
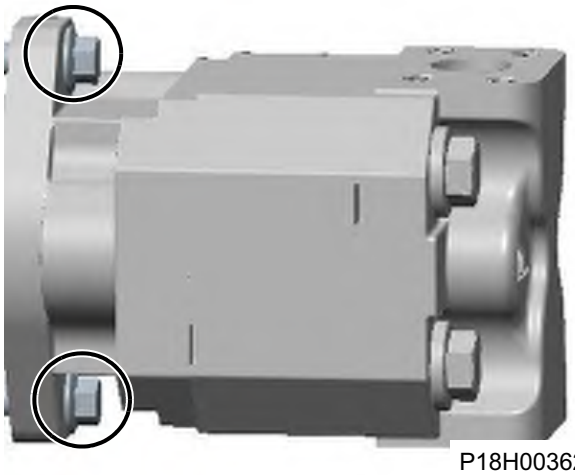
Figures	Operation instruction	Tools
	1. Hang the gear pump to the mounting position with proper sling;	
 P18H00356	2. Install gear pump and seal gasket on gear box;	
 P18H00357	3. Connect the P1 hose with the tightening torque of hose joint 89±4Nm\ 65.6±2.95lbf·ft 4. Connect the P2 hose with the tightening torque of hose joint 47±2Nm\ 34.7±1.5lbf·ft	

Figures	Operation instruction	Tools
 P18H00358	5. Connect steel pipe of oil suction port and tightening torque of bolts is 90±10Nm\ 66.4±7.4lbf·ft	
	6. Fill the hydraulic oil, start the machine and idle it for 5min to bleed the air in the line;	
	7. Stop the machine and check it for leakage.	
	8. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level	

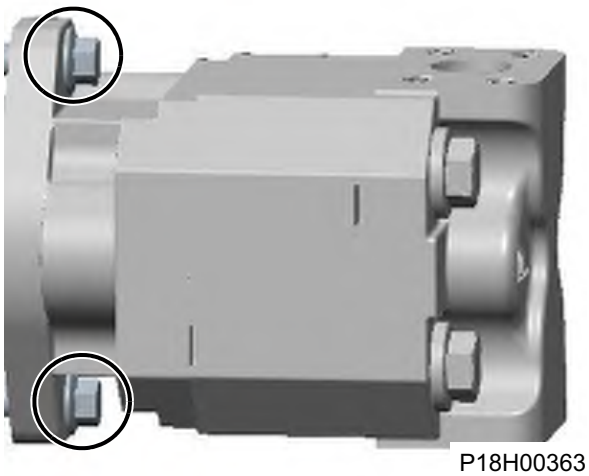
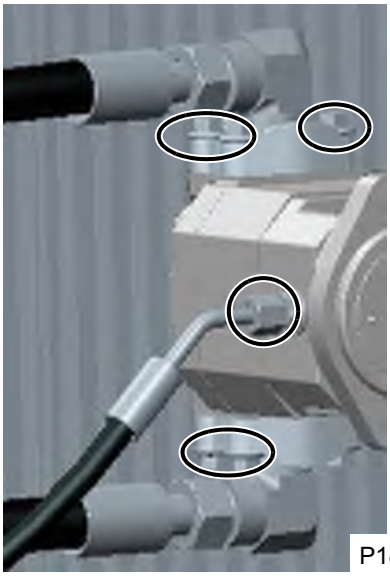
Removal and installation of cooling motor

Removal of motor

Figures	Operation instruction	Tools
	1. Remove fan guard and bracket by referring to the Power System - Radiator Overhaul Manual;	
 P18H00359	2. Mark the hoses on the motor respectively as: A port hose, B port hose and T port hose. The identification should be clear, firm and not fall off.	
 P18H00360	3. Remove the plates of A port and B port and T port hose. Loosen the T hose joint with wrench and remove the hose joint after gentle knock-down. Block the hose joint. Unscrew A and B plate bolts with wrench and then place plate and bolt well after put-ting them together and mask joints.	Open-end wrench: 13mm and 17mm

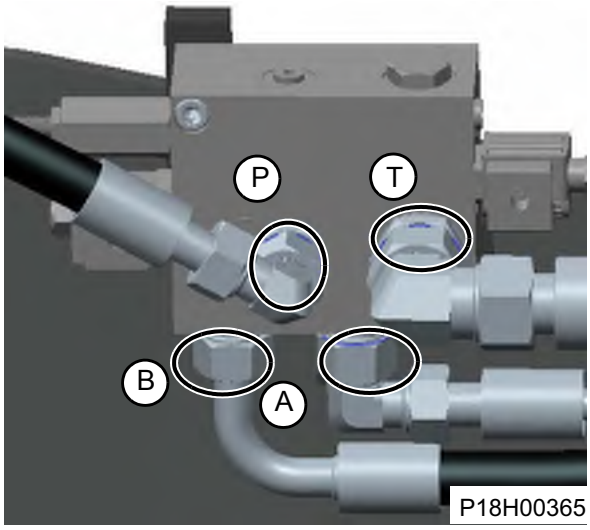
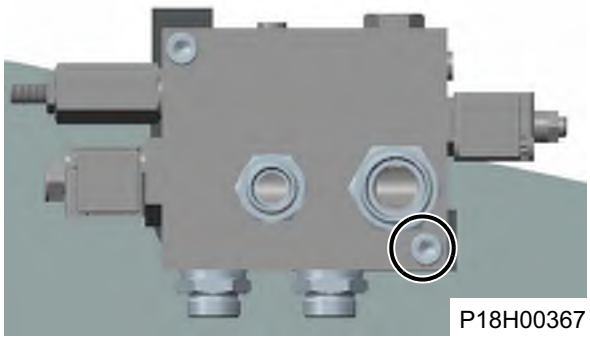
Figures	Operation instruction	Tools
 P18H00361	4. Remove lock nut of motor;	Open-end wrench: 17mm
 P18H00362	5. Remove the captive bolt from the motor, and hang it to the clean container; avoid collisions to ensure the personnel security during removal;	Open-end wrench: 13mm

Installation of motor

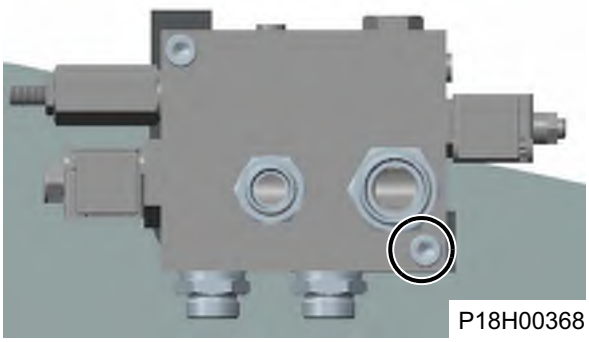
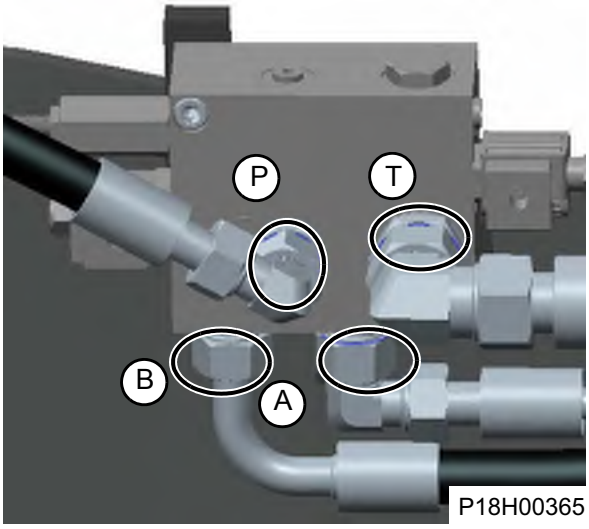
Figures	Operation instruction	Tools
 P18H00363	1. Install the motor on the bracket with tightening torque of bolts 72±6Nm\ 53.1±4.4lbf·ft, and then install locknut;	
 P18H00364	2. Connect the T hose with the tightening torque of hose joint 16±1Nm\ 11.8±0.74lbf·ft; 3. Connect A port hose and B port hose and tighten bolts to 72±6Nm\ 53.1±4.4lbf·ft; 4. Install fan guard and bracket by referring to the Power System - Radiator Overhaul Manual; 5. Fill the hydraulic oil, start the machine and idle it for 5min to 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.	

Removal and installation of solenoid directional valve

Removal of solenoid directional valve

Figures	Operation instruction	Tools
 P18H00365	1. Mark the hoses on the solenoid directional valve respectively as: A, B, P and T. The identification should be clear, firm and not fall off.	Marker
 P18H00366	2. Remove A port hose, B port hose, P port hose and T port hose; Loosen the hose joints with wrench and remove the hose joints after gentle knockdown. Mask joints;	Open-end wrench: 32m, 41mm
 P18H00367	3. Remove the captive bolt from the solenoid directional valve mounting plate, and place it in the clean container; avoid collisions to ensure the personnel security during removal;	Inner hexagon spanner: 8mm

Assembly of solenoid directional valve

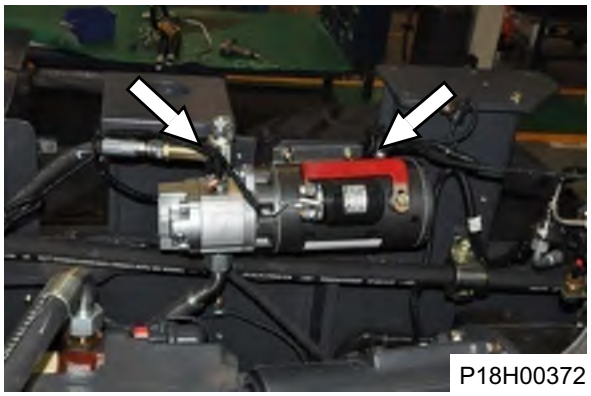
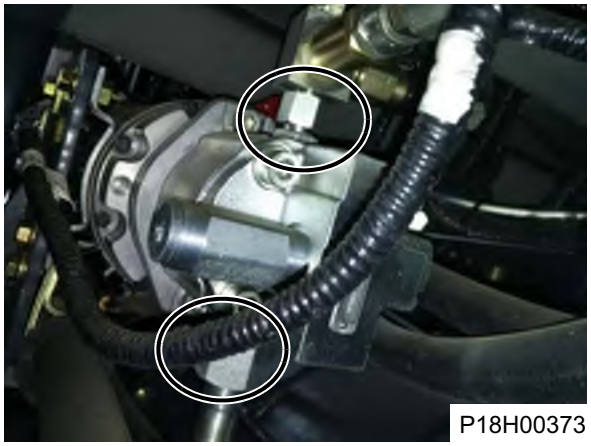
Figures	Operation instruction	Tools
 P18H00368	1. Install the solenoid directional valve to its original position and tighten 2 bolts to 52±6Nm\ 38.4 ± 4.4lbf · ft	
 P18H00365	2. Connect the T hose with the tightening torque of hose joint 137±6Nm\ 101±4.4lbf·ft 3. 3Connect hoses of B port, A port and P port and the tightening torque of hose joints is 89±4Nm\ 65.6±3.0lbf·ft	
	4. Fill the hydraulic oil, start the machine and idle it for 5min to bleed the air in the line	
	5. Stop the machine and check it for leakage.	
	6. Check whether the hydraulic oil level is normal, and if not, please fill the hydraulic oil to the specified level	

Secondary steering system

Removal and installation of secondary steering pump

Removal of secondary steering pump

Figures	Operation instruction	Tools
 P18H00370	1. Open rear hood of engine, remove 4 plate bolts at right side of the machine and take down side hood.	Open-end wrench
 P18H00371	2. Unplug electrical connector at outside of steering pump bracket	

Figures	Operation instruction	Tools
 P18H00372	3. Unplug electrical connector of secondary steering pump	
 P18H00373	4. Remove oil inlet & outlet pipe joint of secondary steering pump	Open-end wrench
 P18H00374	5. Fix the secondary steering pump on the frame using lifting rope, and then remove 2 anchor bolts from side plate, move them out slowly and place them on level ground.	Open-end wrench Lifting rope

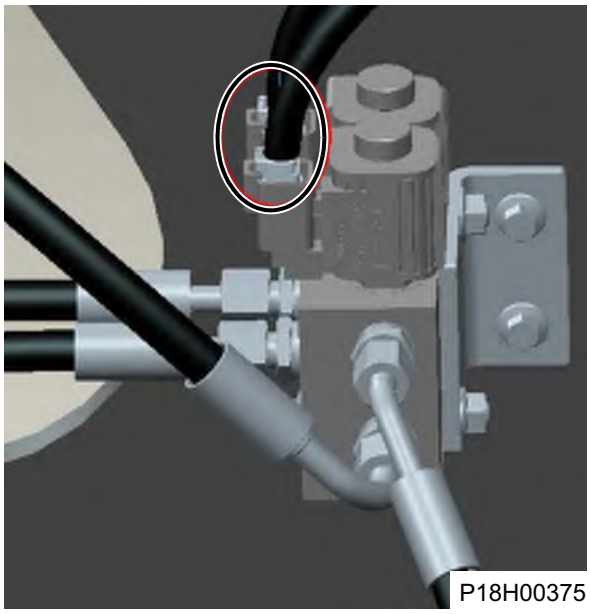
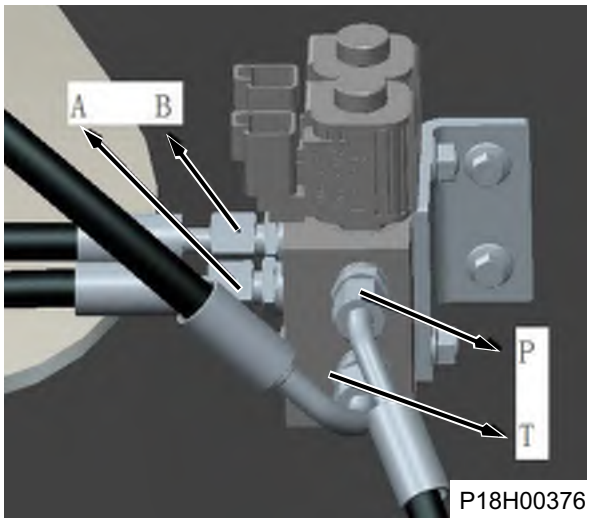
Installation of secondary steering pump

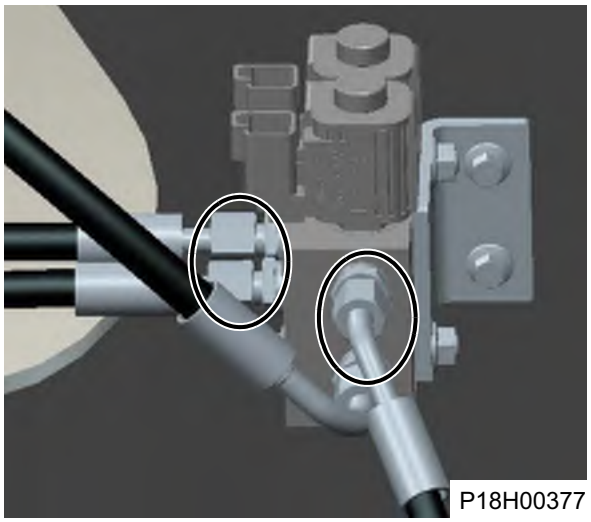
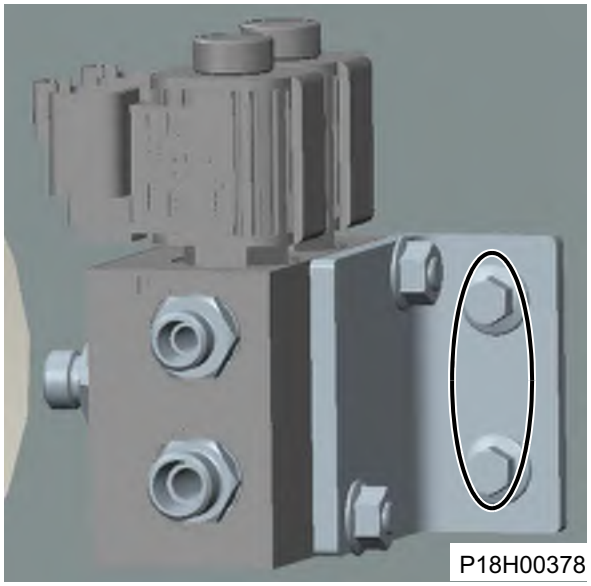
Assemble the secondary steering pump in reverse order of disassembly.

Pilot system of electronic control third linkage

Removal and installation of proportional valve

Removal of proportional valve

Figures	Operation instruction	Tools
 P18H00375	1. Remove two electrical connectors and make marks on them;	
 P18H00376	2. Mark the hoses on the proportional valve respectively as: A port hose, B port hose, P port hose and T port hose. The identification should be clear, firm and not fall off.	

Figures	Operation instruction	Tools
 P18H00377	3. Remove A port hose, B port hose, P port hose and T port hose. Loosen the A, B, P, T port hose joints with wrench and remove the hose joint after gentle knockdown. Block the hose joint.	Open-end wrench: 17mm
 P18H00378	4. Remove the bolts;	Open-end wrench: 10mm

Assembly of proportional valve

Assemble the proportional valve in reverse order of removal.

Fault Diagnosis and Troubleshooting

Common troubleshooting for brake system

S/N	Fault features	Reason	Troubleshooting methods
1	Insufficient foot braking force	1. Air in brake line	1. Bleed the brake line
		2. Brake valve fault	2. Check the brake valve and measure the pressure at port BR1, BR2
		3. Pump failure	3. Check the pump
		4. Leakage in brake line	4. Check the brake line
		5. Accumulator damaged	5. Check the pressure of the accumulator
		6. Wheel brake friction plate worn to limit	6. Replace the friction plate
2	Incapable of put-ting into gear	7. Brake valve fault	1. Check the brake valve and measure the pressure at B3 port
		8. Parking brake cylinder leakage	2. Check the pressure switch under the accumulator BR3
3	No normal release of parking brake	1. Brake valve fault	1. Check the brake valve and measure the pressure at port BR3
		2. Parking brake cylinder leakage	2. Replace cylinder oil seal parts
4	Insufficient parking braking force	1. Large clearance between brake drum and brake shoe	1. Readjust the clearance according to the requirements of use
		2. Oil on brake shoe	2. Clean up brake shoe
5	Accumulator doesn't work	1. Air valve leakage	1. Check air valve, and supplement nitrogen
		2. Diaphragm is damaged resulting in nitro-gen leakage	2. Replace the accumulator
6	No inching braking	1. Brake valve fault	1. Check the pressure at port BR1, BR2
7	Service or emer-gency brake low pressure alarm light comes on	1. Insufficient system oil pressure in a short period of time for machine starting	1. Please wait
		2. The machine has system failure and oil pressure drop during operation	2. Stop the machine for inspection
		3. Air leakage in accumulator	3. Check the pressure of the accumulator

Air Conditioning System

Basic Information

Safety

Drain refrigerant in air conditioning system as required in Release (recover) refrigerant in air conditioning system before removing compressor, condenser, reservoir, pressure switch, air conditioner coils, etc. Seal up the removed pipe joints through a reliable method to prevent moisture in the air from entering air conditioning system.

⚠WARNING

If liquid refrigerant splashing into eyes may lead to blind; and spraying on the skin 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. In this case, the temperature of the refrigerant easily rises to cause increase in pressure in the container. When the pressure reaches high enough, the container may have leakage or explosion.

The refrigerant itself is non-toxic, but it cannot be in direct contact with open flames or heated metal, otherwise toxic gases will be produced.

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

Universal tool, tooling list

Specifications	Main functions
10# Open-end wrench	It is used for removal and installation of captive bolts of the pipeline, joint box and cover plate
13# Open-end wrench	It is used for removal and installation of captive bolts (nuts) of the compressor
14# Open-end wrench	It is used for removal and installation of hold-down nuts (screw rods) of tension pulley
19# Open-end wrench	It is used for removal and installation of air conditioning pipe joint in the evaporator assembly
21# Open-end wrench	It is used for removal and installation of air conditioning pipe joint in the evaporator assembly
24# Open-end wrench	It is used for removal and installation of air conditioning pipe joint in the evaporator assembly
27# Open-end wrench	It is used for removal and installation of water hose joint of 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 of evaporator
13# Socket	It is used for removal and installation of captive bolts of evaporator
Extended rod	It is used for removal and installation of captive bolts of evaporator
Plastic bag, tape	It is used for sealing up the pipe joints
Marking pen	It is used for marking the removed joints

Special tool, tooling list

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

Tightening torque for lines connectors of A/C system

Thread size	Tightening torque
5/8-18UNF, M16×1.5	12~15Nm/1.2~1.5kgf•m
3/4-16UNF, M22×1.5	19.6~24.5Nm/1.96~2.45 kgf•m
7/8-14UNF, M24×1.5	29.4~34.3Nm/2.94~3.43 kgf•m
Water inlet and outlet threads	19.6~24.5Nm/1.96~2.45 kgf•m

Structure Function Principle

Components and position

(1) Compressor

Compressor is installed on the fan side of engine, at lower left side of complete machine, and is driven by engine through belt to operate.

(2) Evaporator assembly

A/C evaporator assembly of this machine is placed in the right of seat, parts inside evaporator assembly include expansion valve, air door, servo motor, blower unit, and pressure switch.

(3) Air duct assembly and inlet and outlet air vents

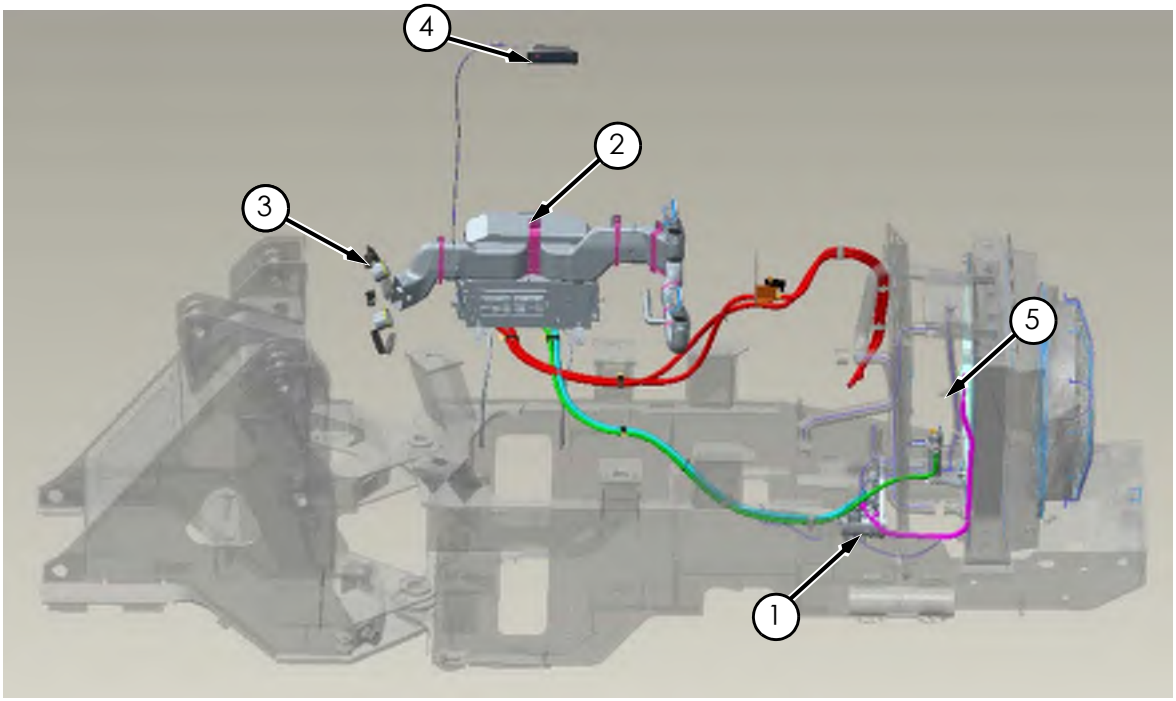
Air conditioner of this machine has 2 front vents, 2 rear vents, 4 defroster vents and 2 foot vents, and vents are connected with evaporator via air duct assembly. Meanwhile, air duct assembly also comprises new vents and strainers and accessories. Arrange inside the decoration in the front of, at the side of and behind the cab.

(4) Control panel

The air conditioner control panel lies on the right side of the cab's roof.

(5) Condenser&refrigerant reservoir assembly

It is located at the rear of the cooler.
The compressor keeps rotating, the above refrigeration process is cycled continuously. The heat in the car is taken away by refrigerant in the evaporator, so as to complete cooling and dehumidification of the complete vehicle.



P18A00001

System technical parameters

Heating module	Working medium	Engine cooling water	Unit
	Heating capacity	5000/6.80	W/PS
Air conditioner module	Refrigerant	R134a	
	Refrigerating capacity	5000/6.80	W/PS
	Refrigerant filling quantity	1200±30/2.65±0.07	g/lb
	Voltage	24	V

Description of principle diagram and working principle

Air conditioner of this machine is vapor compression type refrigeration air conditioner, refer to its working process and principle as follows:

(1) Compression process

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

(2) Condensation process

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

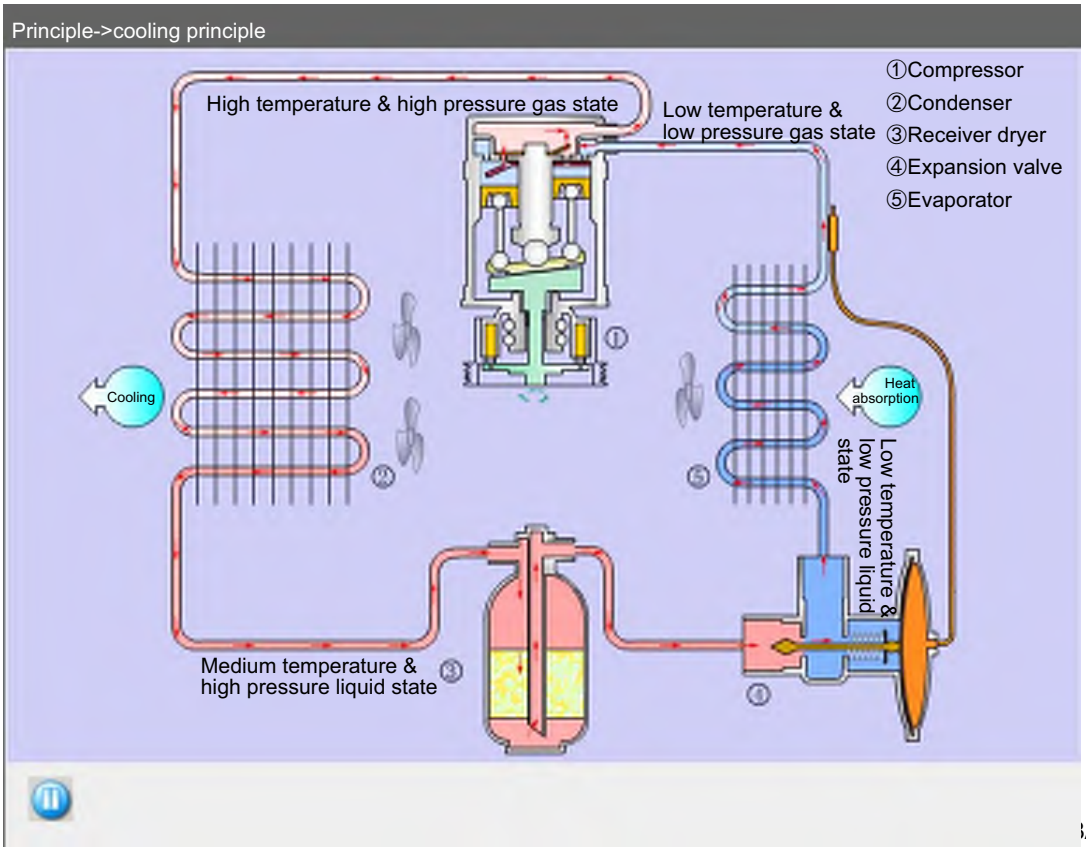
(3) Throttling process

Medium-temperature and high-pressure refrigerant liquid 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 for entering the evaporator.

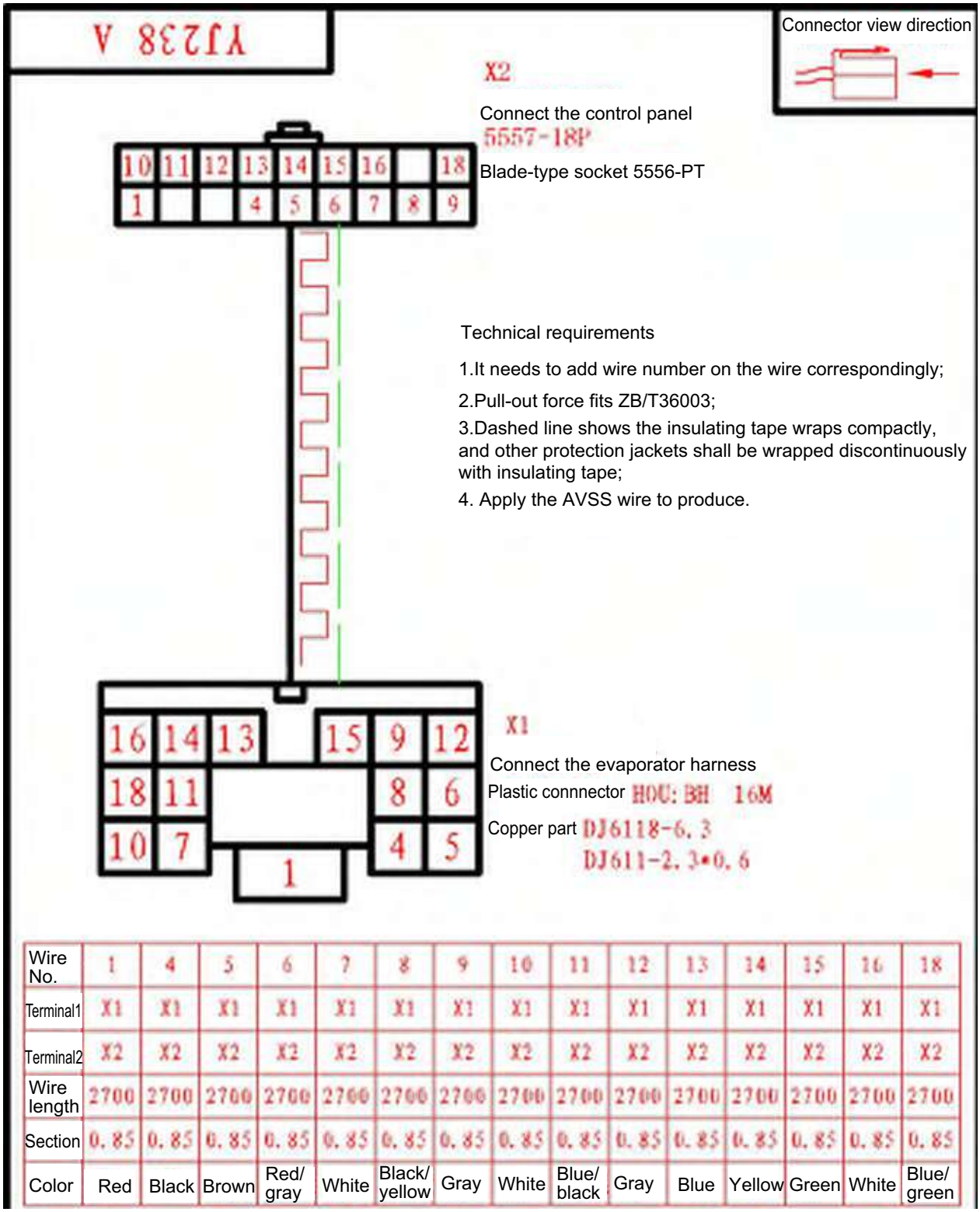
(4) Evaporator process

Low-temperature and low-pressure refrigerant liquid formed by the throttling of expansion valve is vaporized in the evaporator, the air in the car is driven by the evaporator fan unit to flow through the evaporator surface. The refrigerant absorbs the heat of air in the car, thus to reduce the air temperature, and dissolve out condensate water. Refrigerant absorbing heat is evaporated into low-temperature and low-pressure refrigerant vapor, which is sucked into the compressor and compressed again, so that one refrigeration cycle is completed.
The compressor keeps rotating, the above refrigeration process is cycled continuously. The heat in the car is taken away by refrigerant in the evaporator, so as to complete cooling and dehumidification of the complete vehicle.

Fig.1 Schematic diagram for A/C system



Refer to the attachment figure in Chapter 9 for the A/C system electrical principle.



Wire No.	1	4	5	6	7	8	9	10	11	12	13	14	15	16	18
Terminal1	X1	X1	X1	X1	X1	X1	X1	X1	X1	X1	X1	X1	X1	X1	X1
Terminal2	X2	X2	X2	X2	X2	X2	X2	X2	X2	X2	X2	X2	X2	X2	X2
Wire length	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700	2700
Section	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85	0.85
Color	Red	Black	Brown	Red/ gray	White	Black/ yellow	Gray	White	Blue/ black	Gray	Blue	Yellow	Green	White	Blue/ green

P18A00003

Testing and Adjustment

Air conditioning system test

⚠CAUTION

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

The above steps are used for simply judging whether air conditioning system works normally and is in good conditions. Where appropriate, it is more accurate to connect the pressure gauge for judging. If air conditioning system works obviously abnormally, refer to Fault Diagnosis and Judgment of the instructions for treatment method

Step 1

Park the complete machine on a flat ground, and check to make sure parking brake is applied. Start engine, and let a companion to depress the accelerator so that the engine operates at high idle speed.

Step 2

Turn on the A/C switch, adjust the air conditioner to the cooling mode, and control the air supply speed at high speed by adjusting the air speed switch. Select the minimum temperature.

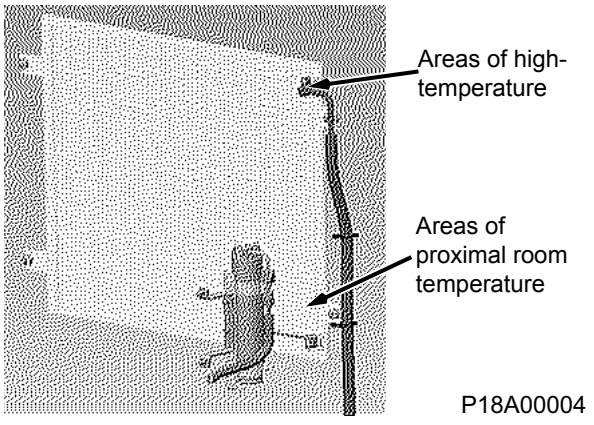
Step 3

Keep the air conditioning system operating stably for 2 min. 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 pulley is still, then the compressor is out of work. Confirm the working state of the compressor, then perform the following steps.

Step 4

Check whether the refrigeration function is normal according to the following steps

- Check whether outlet air temperature of cab vent is obviously lower than outside air temperature. If not, the air conditioner system works abnormally.
- Observe sight glass beside reservoir. In normal circumstances, no air bubbles or only few air bubbles shall be seen through sight glass. If a large number of air bubbles can be seen, or refrigerant appears like foam, it means air conditioning system is out of order.
- Respectively touch the air inlet part near upper part of condenser and air outlet part near lower part by hand, 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 close to air temperature. 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 high temperature zone, it means condenser has poor cooling. Please clean up the dirt on condenser surface.



- Observe sight glass beside reservoir, and touch lower end of reservoir by hand. If the lower end of reservoir is cold while bubbles appear through sight glass, it means strainer inside reservoir is blocked. In normal circumstances, the temperatures at all parts of reservoir are basically the same to that of condenser outlet.
- Touch air intake hose joint (thick joint) of compressor by hand. If it is not cold, it means refrigerant is insufficient or refrigerating system is blocked or compressor valve block is damaged. Further inspection is needed.
- If air cooler is switched on for about 20~50 minutes, air at the outlet is getting hot, air outlet volume becomes smaller. The cooling capacity and air outlet volume return to normal when the cooler is switched off (but air ON) and then switched on 10~15 minutes later, it means defrosting sensor in evaporator is out of order.
- If the refrigeration is operated normally for several minutes, and stops for several minutes, and then restores to normal for several minutes, so repeatedly, please observe the operation condition of compressor: If compressor operates in both cases of refrigeration and no ,refrigeration, 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 set temperature, or control panel is out of order.
- 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 due to overhigh pressure, so that further check and treatment are needed.

Removal and Installation

Introduction of air conditioner system main parts

1. Compressor

The compressor is a core component of the air conditioning system. It is used to compress low-temperature and low-pressure refrigerant vapor into high-temperature and high-pressure refrigerant vapor. The compressor used for the system is a swash plate one. Model: 10P17, displacement: 178cm³, and refrigerant oil brand: PAG46.

2. Evaporator

The evaporator is used to allow throttled low-temperature and low-pressure 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 of air conditioning system 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 includes: 1. storage, 2. filtration, 3. 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 air conditioner of the vehicle 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 air conditioning 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 hose and reservoir-to-evaporator hose are high pressure hoses, and evaporator-to-compressor hose is low pressure hose.

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 value of high pressure is 3.14 Mpa, and the lower limit value 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 air conditioning system. Automatically switch on/off air conditioner or heater through internal control program so as to maintain temperature inside cab to be around setting temperature.

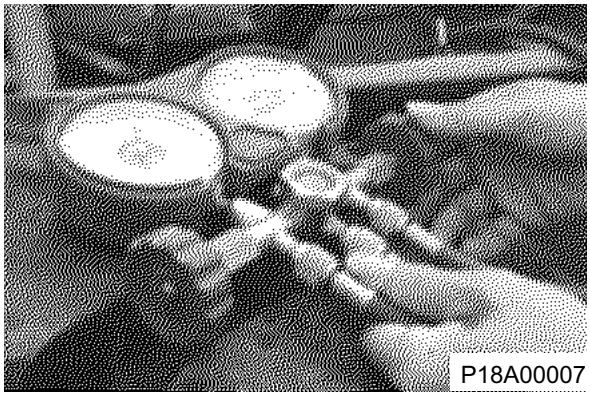
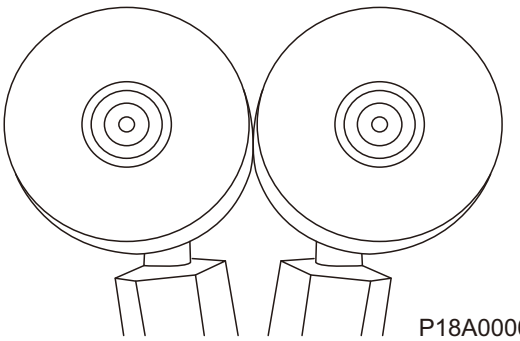
Removal and installation of A/C components

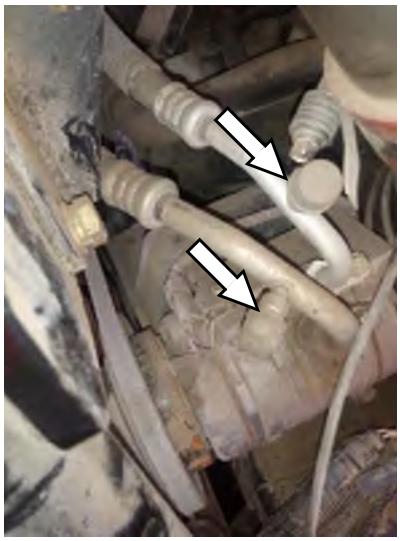
Removal of compressor

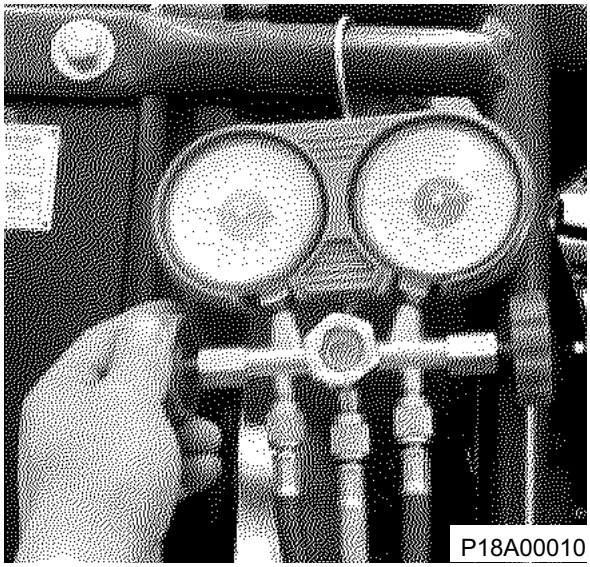
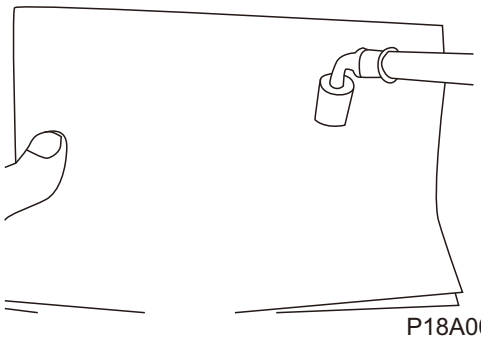
Release (recover) refrigerant in air conditioning system

Only the release of refrigerant is described in this manual. It is recommended to use special equipment to recover and recycle refrigerant if available.

Incorrect release of refrigerant will cause adverse effect on air conditioning system, especially service life of compressor.

Figures	Removal and installation	Tools
 P18A00006	1. Stop the machine or switch off the air conditioning system for at least more than one hour, then close the negative switch, and put up "DO NOT OPERATE" warning decal.	
 P18A00007	2. First close the high and low pressure valve at the place of manifold gauge.	Manifold gauge
	3. Close the valve of high and low pressure connector.	
 P18A00008		

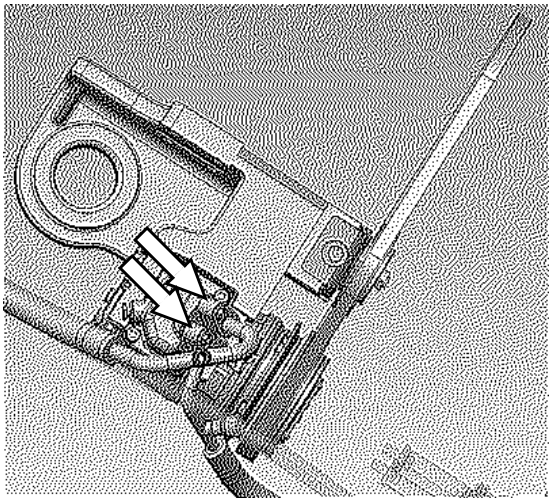
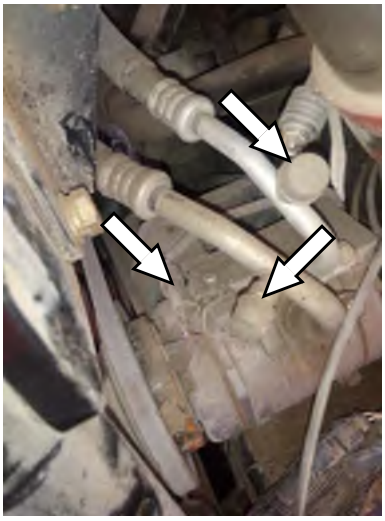
Figures	Removal and installation	Tools
 P18A00009	4. Open rear cover to the extent of sufficiently exposing compressor and lines thereof. 5. Unscrew the plugs from the high and low-pressure fillers of compressor, and connect the high and low-pressure valves of manifold meter respectively to fillers of high and low-pressure pipes. Open the valve of joint after connection. **Note:** The pipeline is very thick. The one with thinner interface is low pressure pipe; The pipeline is very thin, but the one with thicker interface is high pressure pipe. This part interface has a design to avoid being connected wrongly, it cannot be connected if connected wrongly.	

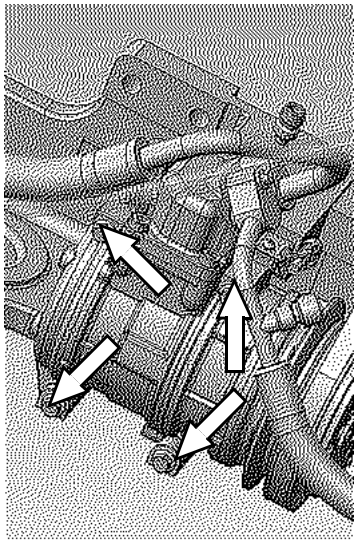
Figures	Removal and installation	Tools
 P18A00010	6. Slowly loosen low pressure valve on manifold gauge so as to slowly eject refrigerant. Note the opening of control valve. Too large flow rate may easily cause refrigerant oil to be ejected out along with refrigerant. Control the flow rate to the extent that no refrigerant oil is ejected out (released refrigerant is gaseous, and refrigerant oil is liquid. Aim refrigerant outlet at one piece of white paper, and observe whether there are liquid drops to be ejected out). After 10 minutes, slowly open high pressure valve, and continue controlling flow rate to avoid refrigerant oil from losing. The whole release process should keep 15-30 minutes. **⚠ WARNNING: It is forbidden to release refrigerant from high pressure end at the beginning, since high pressure end is easy to cause refrigerant oil to be ejected out along with refrigerant.**	
 P18A00011	7. Close the high and low pressure connector and remove it.	

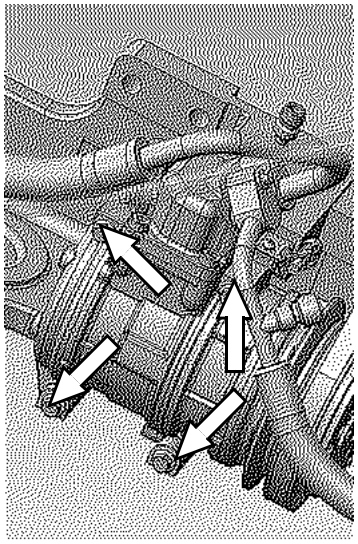
Remove lines connecting the compressor and compressor

⚠CAUTION

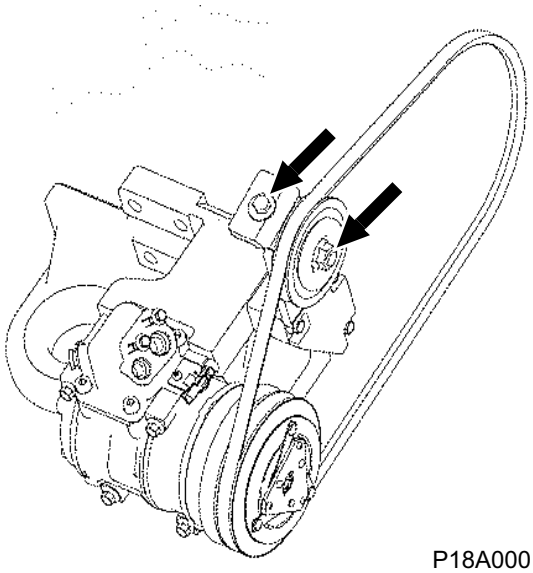
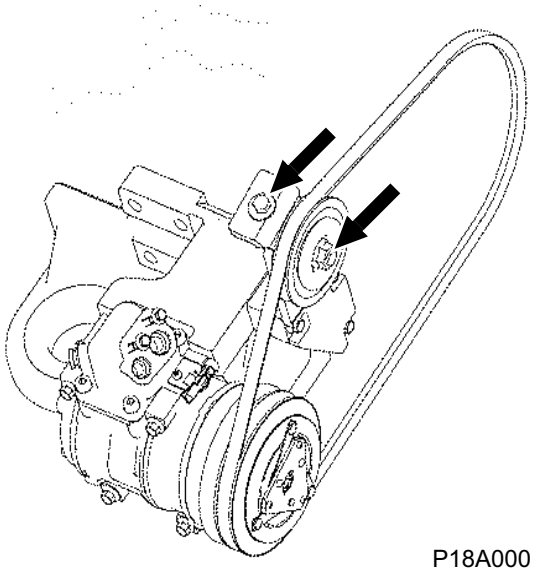
If interior of compressor is damaged or refrigerant oil becomes grey or black, receiver must be replaced while replacing compressor. Otherwise it will shorten service life of compressor.

Figures	Removal and installation	Tools
 P18A00012	1. Loosen M6 captive bolts of compressor line with a wrench, and remove the line.	10# Open-end wrench
 P18A00013	2. Wrap two removed line connectors with clean and unbroken plastic bags, tie them up with adhesive tapes to prevent air and foreign matter from entering the line.	Plastic bag, tape
	3. Disassemble the harness connector of compressor clutch.	#13 Open-end wrench
	4. Remove belt as specified in Removal and Installation of Belt and Tension Pulley. Loosen the idler disassembly belt first.	

Figures	Removal and installation	Tools
 P18A00014	5. Remove 4 M8 bolts fixing compressor, and remove compressor.	

Figures	Removal and installation	Tools
 P18A00014  P18A00015	Installation method: 1. Tighten 4 M8 captive bolts of A/C compressor with torque spanner, and control the torque to 22~30Nm. 2. Install the belt as specified in Removal and Installation of Belt and Tension Pulley of the book. 3. Connect the compressor clutch connectors, and fix the compressor line on the A/C compressor with the bolts of M6X30-8.8.	Torque spanner 10# Open-end wrench

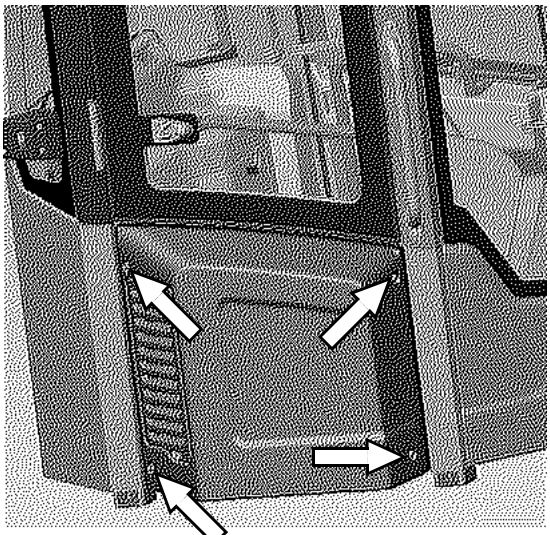
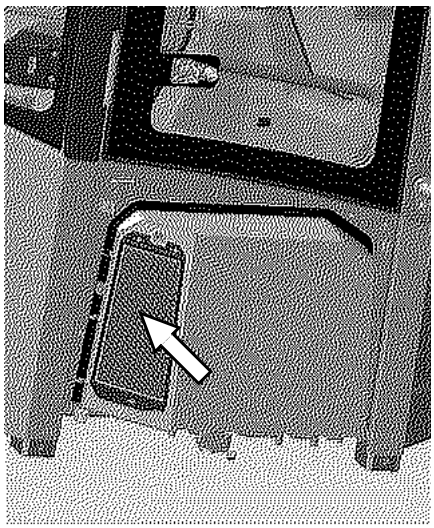
Removal and installation of belt and tension pulley

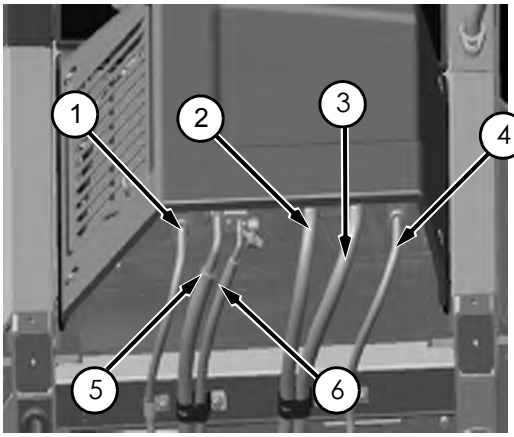
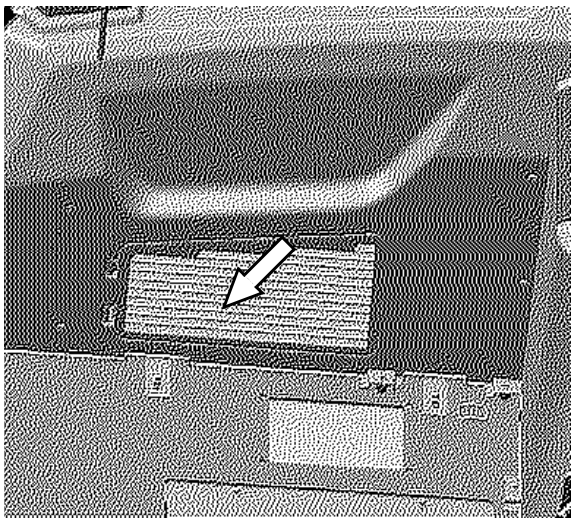
Figures	Removal and installation	Tools
 P18A00016	1. Loose the hold-down nut of tension wheel with a wrench.	13# Open-end wrench 10# Open-end wrench
	2. Loosen tension screws, and remove A/C compressor belt.	14# Open-end wrench
	3. Continue to loosen hold-down nut and tension screw rod of tension pulley and until it is disengaged, and remove tension pulley.	14# Open-end wrench
 P18A00016	Installation method: 1. Tighten the hold-down nut and tension of screw rod of tension pulley with wrench first, and fix the tension pulley at a position. 2. Install A/C compressor belt among tension pulley, A/C compressor belt pulley and engine belt pulley, and then adjust gradually tension screw rod and tighten hold-down nut to preliminarily fix belt. 3. Adjust the belt tension according to the Adjustment of Compressor Belt.	

Removal and installation of evaporator mounting assembly

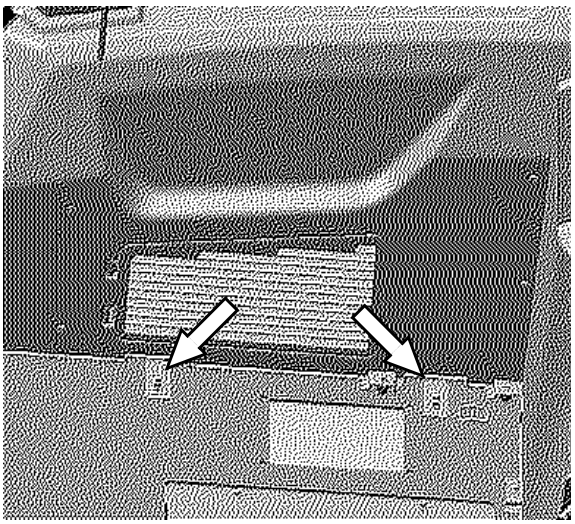
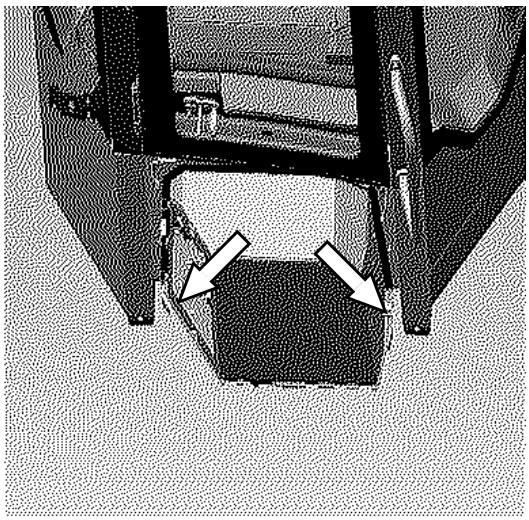
⚠CAUTION

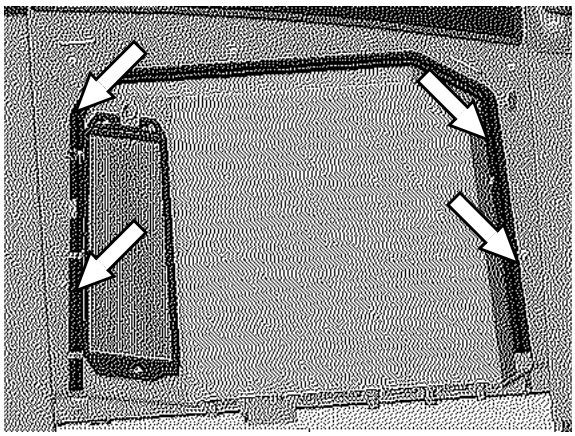
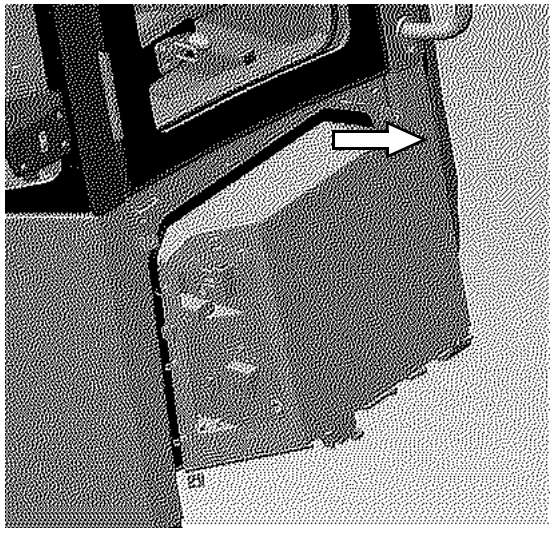
The following operation sequence is used for removing evaporator as from cab as. Most actual failures are failures of certain components (such as fan, circuit, etc.) in evaporator, so it is suggested to carry out selective removal, repair and replacement after failure judgment in Chapter Fault Diagnosis and Judgment of this manual in order to avoid unnecessary operations.

Figures	Removal and installation	Tools
 P18A00017	1. Drain refrigerant in air conditioning system as required in Release (recover) refrigerant in air conditioning system. 2. Remove the cab-rh cover (install flange bolt whose bolt is M8)	#13 Open-end wrench
 P18A00018	3. Remove the left evaporator fresh air filter which is fixed by three butterfly bolts.	

Figures	Removal and installation	Tools
 1. Water drain pipe 2. Warm water inlet pipeline 3. Warm water return pipeline 4. Water drain pipe 5. The hose from evaporator to compressor 6. The hose from resevior bottle to evaporator P18A00019	4. Remove the pipelines under evaporator and mark that with marker. Seal the connectors with plastic bags and adhesive tape after removal, in order to prevent foreign matter from entering the line.	19#, 21#, 24#, 27# Open-end wrenches Plastic bags, marker and adhesive tape
 P18A00020	5. Open the cover plate of right shutter inside cab.	

Figures	Removal and installation	Tools
 P18A00021  P18A00022	6. Remove two connectors, which connected with evaporator and electrical system One connector lies behind the shutter of recirculating air filter element, and the other lies beside fresh air filter.	

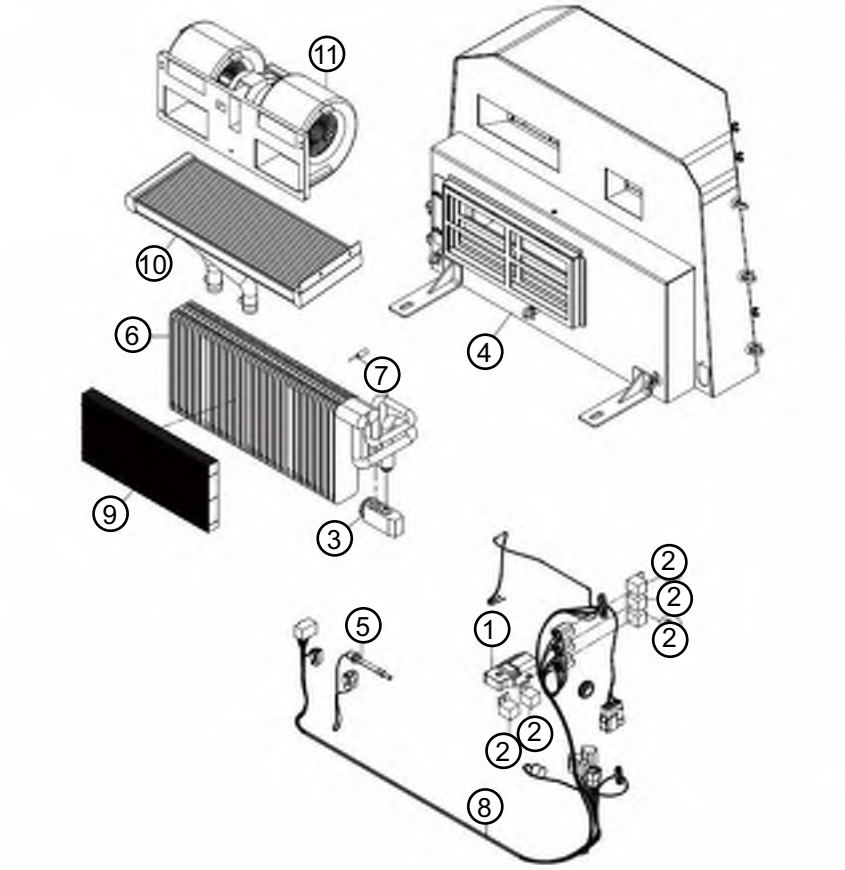
Figures	Removal and installation	Tools
 P18A00023  P18A00024	7. Remove 4 M8 mounting bolts, two of which are in inner cab, another two are in the cab's right.	13# Open-end wrench

Figures	Removal and installation	Tools
 P18A00025	8. Remove the the seal plate outside the evaporator. (4 M6 bolts)	10# Open-end wrench
 P18A00026	9. Take out the entire evaporator from left to right, and finish the removal. Installation sequence is in reverse order of removal sequence. The pipe connector torque should be based on the tightening torque requirements of the respective A/C pipe connector.	

Each lower part location of evaporator assembly

During the actual use, in general, motor, circuit and other faults of evaporator assembly appear. Therefore, please make an analysis and then disassemble the evaporator according to Fault Diagnosis and Judgment Fault Diagnosis in this manual. Each lower part location of evaporator assembly will be provided, so that it is easy to remove and install.

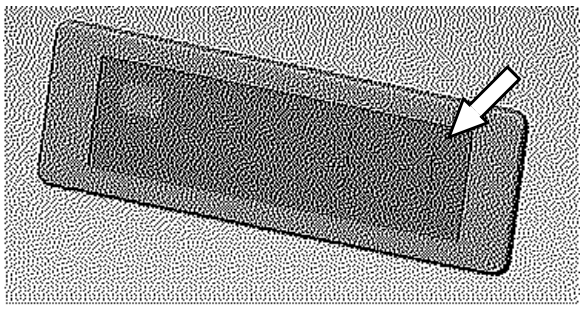
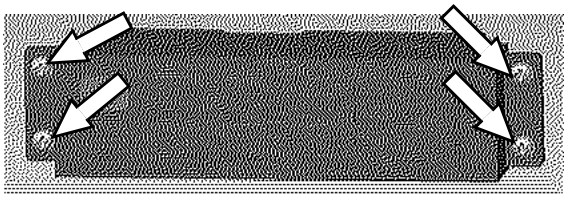
Evaporator assembly



P18A00027

1. Damper motor
2. Relay
3. Expansion valve
4. Shell
5. Temp sensor
6. Evaporator core
7. Temp sensor
8. A/c harness
9. Strainer
10. Heater core
11. Blower unit

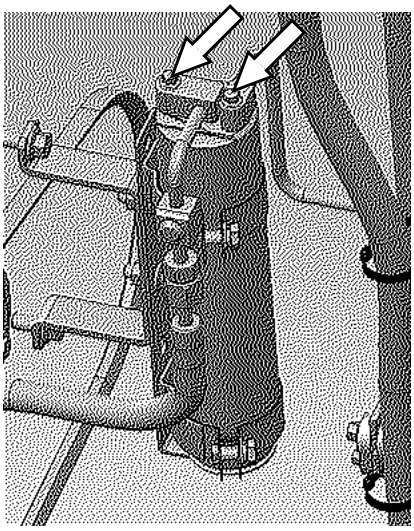
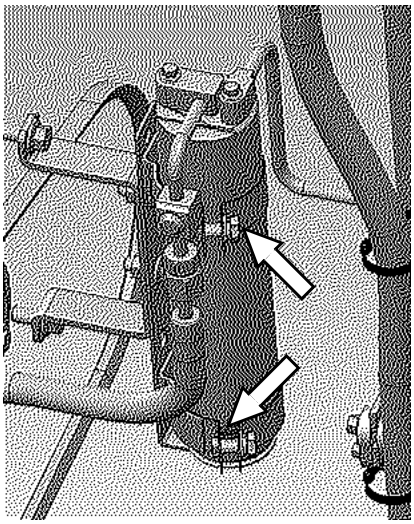
Replacement of A/C control panel

Figures	Removal and installation	Tools
 P18A00028	1. Remove the cover of control panel. (Cover is buckled on decoration through plastic buckle and can be directly plugged out.)	
 P18A00029	2. Remove four bolts fixing control panel.	Cross screw-driver
	3. Pull out the connector on the control panel and then take off the control panel.	

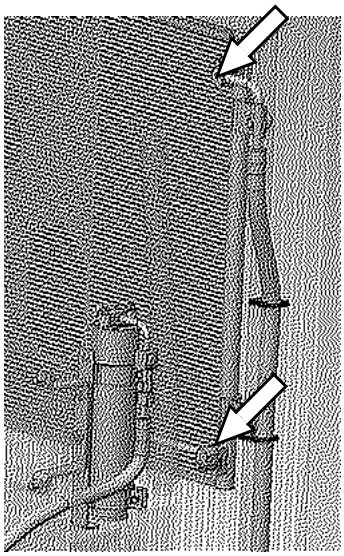
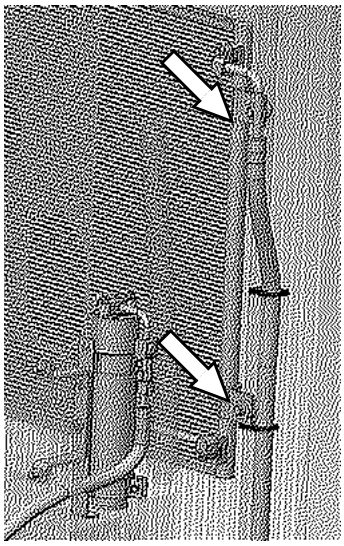
Inspection and replacement of A/C fuse

When there is no display on A/C panel and A/C is inoperative after starting the machine, check whether A/C fuse is burned out. Refer to the part of electric appliance in this Instruction for detail

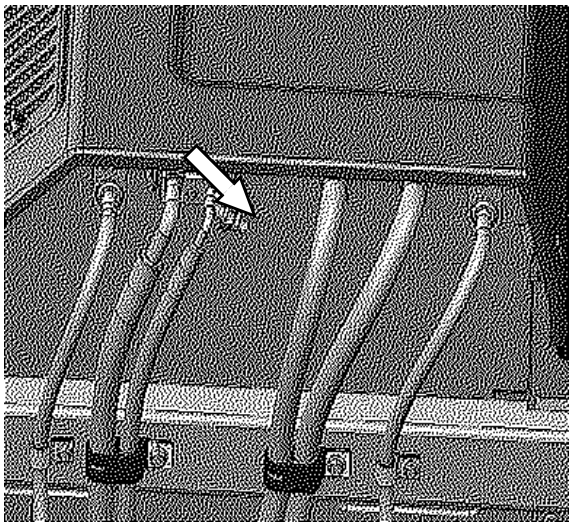
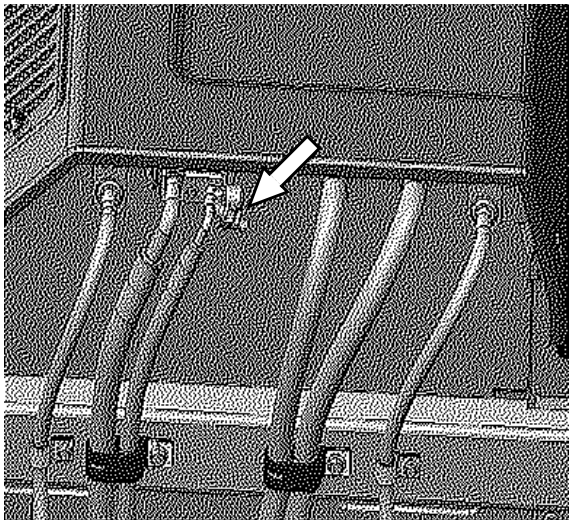
Removal and replacement of reservoir

Figures	Removal and installation	Tools
 P18A00030	1. Open the cover 2. Drain refrigerant in air conditioning system as required in Release (recover) refrigerant in air conditioning system.	
	3. Remove the captive bolt of the hose from condenser to reservoir, and the captive bolt of the hose from reservoir to evaporator. Remove the hose from condenser to reservoir, and the hose from reservoir to evaporator. Seal the open interfaces well with plastic bags and adhesive tapes. 4. Loosen the captive bolt on the fluid receiver bracket clamp. The refrigerant reservoir can be removed.	10# Wrench Plastic bag, tape
 P18A00030	Installation method: 1. Place refrigerant reservoir in the bracket, and tighten the bolts on the bracket with wrench. 2. Install the hose from condenser to reservoir and the hose from reservoir to evaporator to the refrigerant reservoir, and control the torque to 4~7Nm.	10#Wrench

Removal and installation of condenser

Figures	Removal and installation	Tools
 P18A00031	1. Open the rear cover by operating the step 1-3 of Removal and Replacement of Reservoir	
	2. Remove captive bolt of compressor-to-condenser hose and condenser-to-reservoir hose, and seal open joints with plastic bags and adhesive tapes.	10#Wrench Plastic bag, tape
 P18A00031	3. Remove the captive bolts of condenser (4 total on left and right side).	13#Wrench

Removal and installation of pressure switch

Figures	Removal and installation	Tools
 P18A00032	1. Drain refrigerant in air conditioning system as required in Release (recover) refrigerant in air conditioning system. 2. Pull out connector of pressure switch.	
 P18A00032	3. Unscrew the pressure switch. Installation sequence is in reverse order of removal sequence.	27# Wrench

Fault Diagnosis and Judgment

Classification of common faults

Common fault of air conditioning system includes:

1. The air conditioning panel neither display nor function.
2. No air comes out of air conditioner or air outlet volume of air conditioner is small (in the circumstance that correct position is selected).
3. It generates heater or natural wind under cooling mode.
4. It generates natural air blowing under heating mode.

Overhauling method

Maintenance method when backlight of A/C panel is not on and button does not work

Note: If the first item is normal, go to the second one, and the like.

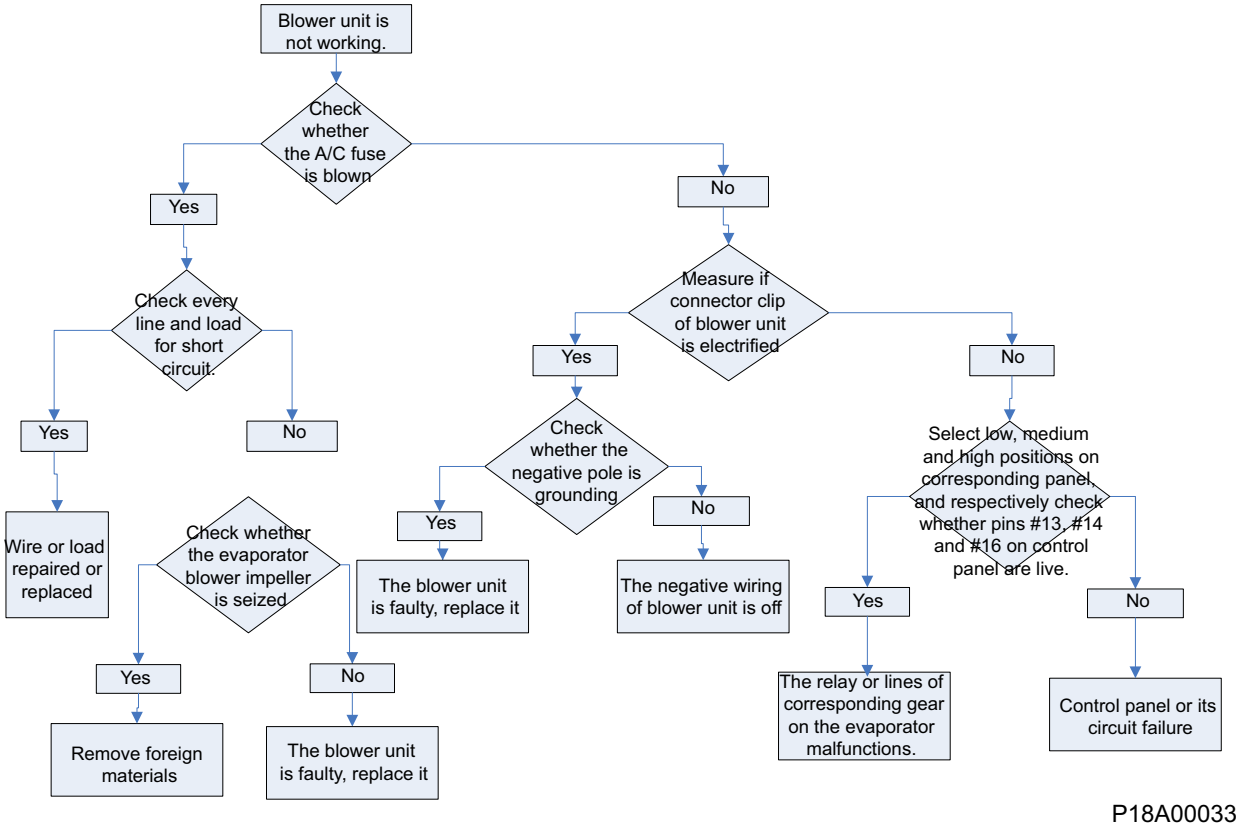
Items	Inspection items	Description	Troubleshooting methods
1	Check if the machine is started	The air conditioner cannot be used until the whole vehicle is started	Use the air conditioning when the complete engine is started
2	Whether the A/C fuse is burned	If fuse is burned, check whether wiring and each load are short-circuited	Replace, repair short circuit elements or parts
3	Connector XL8 is connected or not Whether the connectors at both ends of control panel harness is properly connected	Whether there are problems such as poor contact and exit of contact pin	Repair the damaged parts
4	Pull out connector XL8 and check every pin with a multimeter	Wire 220 (gray) should be earthed Line #138 (orange) should be high level Line #800 (white) should be high level Wire #484 (white) should be suspended	It indicates failure of complete engine circuit in case of any anomaly. Refer to the part of electric appliance in this Instruction for maintenance
5			Replace control panel

If failure is not eliminated by the above steps, it means control panel harness or evaporator harness is out of order. Please refer to schematic diagram of air conditioning system for troubleshoot procedures .

Maintenance method when no air comes out of air conditioner or air outlet volume is obviously smaller than the normal volume

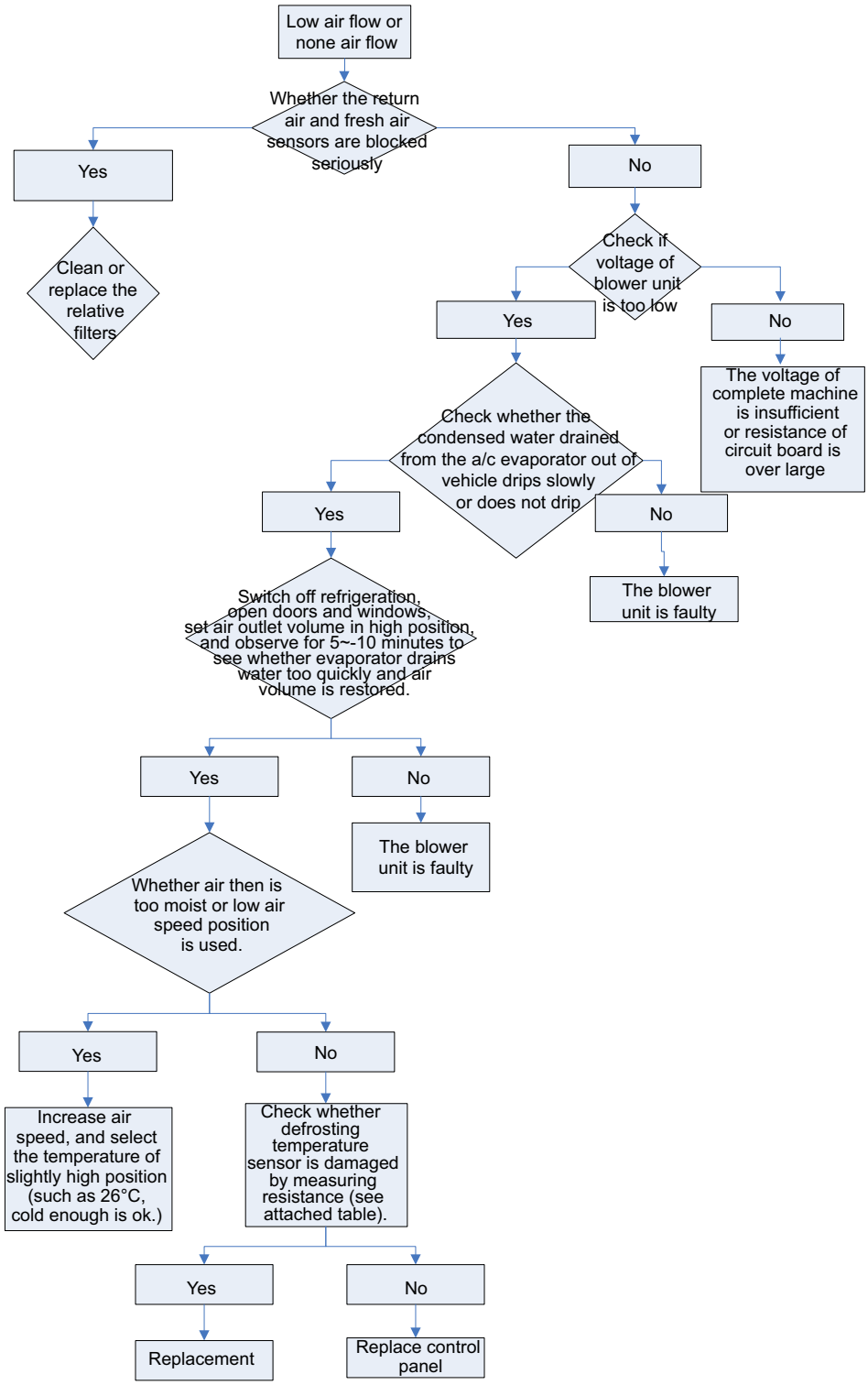
Firstly, set air outlet volume to maximum, and listen whether there is a sound of blower operation.

If the blower doesn't operate, overhaul it in the following order



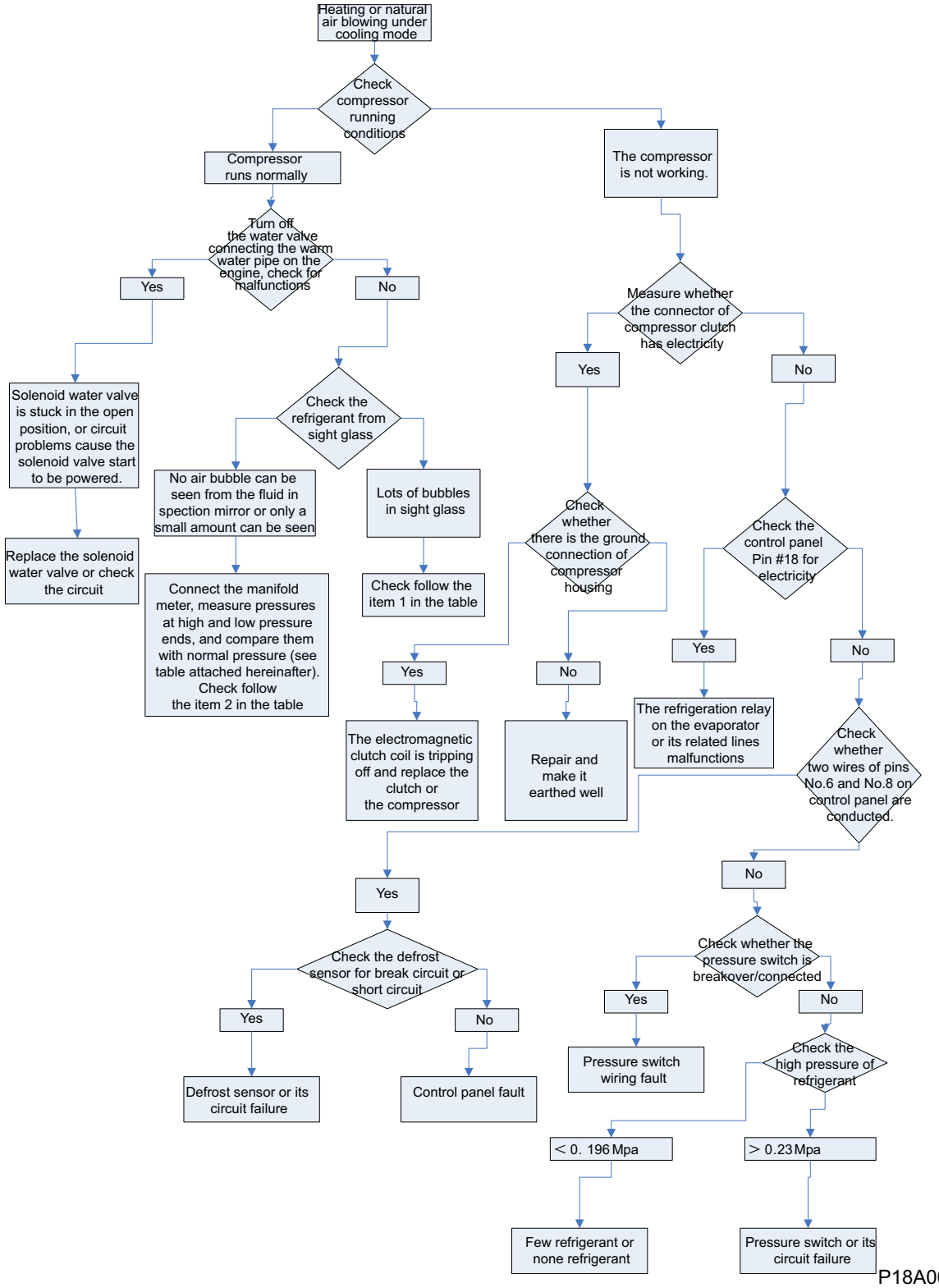
P18A00033

If the blower operate normally, overhaul it in the following order



P18A00034

Maintenance method when warm air or natural air comes out when refrigeration is switched on



P18A00035

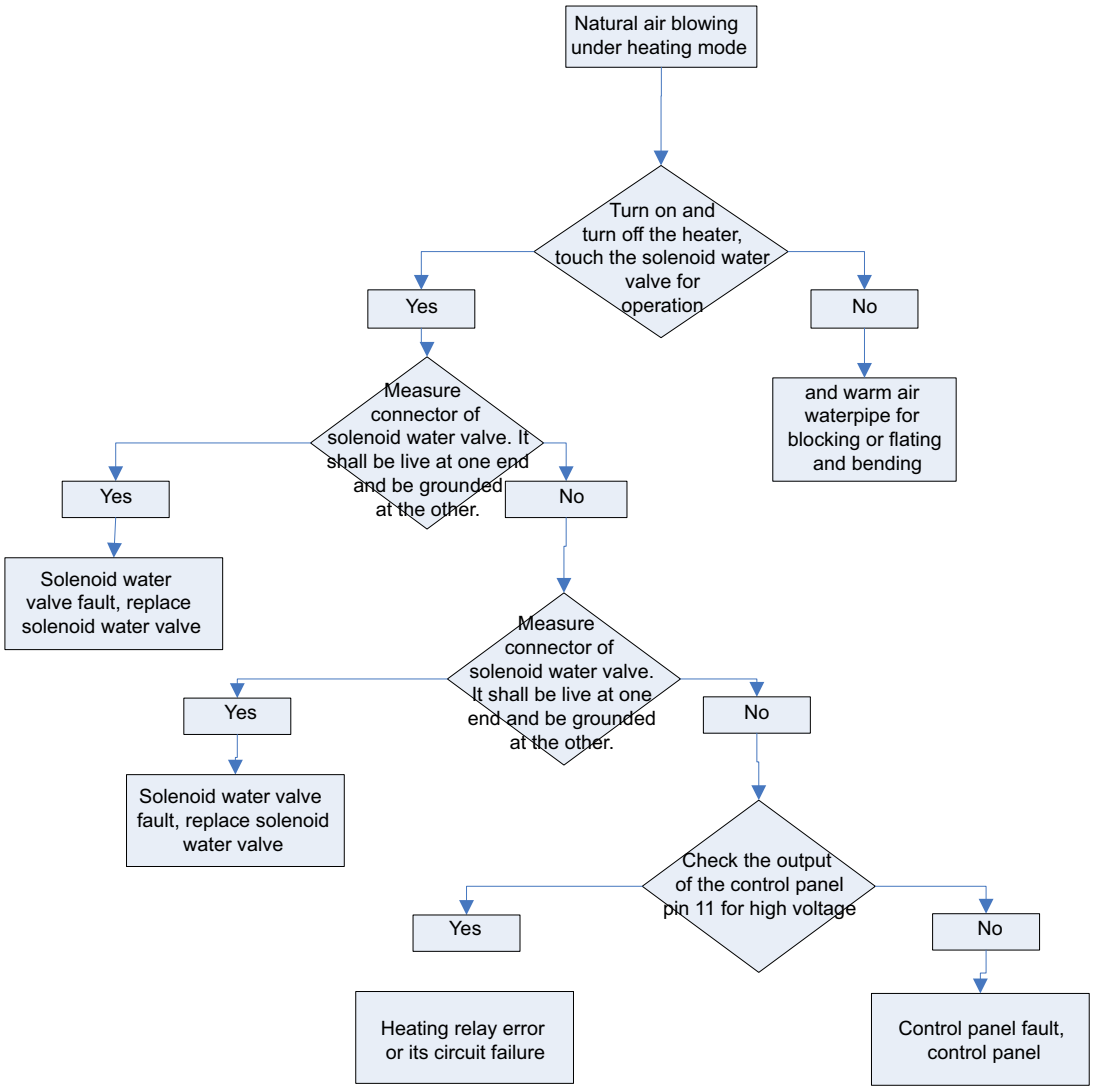
Items	Fault conditions		Cause	Troubleshooting methods
1	Air bubbles persistently exist in sight glass, compressor air intake hose joint is not cold enough and even warm, the upper end and lower end of reservoir do not have temperature difference, and temperature is higher than or equal to ambient temperature		Refrigerant leakage. Insufficient refrigerant filling amount.	Check and repair leakage parts, and refill refrigerant. Refer to A/C Refrigerant Filling Method
2	Compare the pressures of air conditioning system operating at high and low pressures with normal pressures (see table attached hereinafter)			
	Pressure of low pressure side and high pressure side are both low	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.	There is too much water in refrigerating system to cause ice blockage in expansion valve (orifice is frozen due to water accumulation to block orifice)	Replace reservoir, vacuum pumping for more than 1 h, and fill refrigerant once again as specified in Removal and Installation of A/C Components
		1. Touch compressor air intake hose joint (thick joint) by hand to feel no coldness. 2. There are no big differences in temperature of the high temperature zone and the low temperature zone of a condenser. 3. The temperature of each part of reservoir is basically the same to that of condenser outlet and close to ambient temperature.	The interior part of refrigerating system is very dirty, and the expansion valve orifice is blocked by dirt	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 three 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 reservoir.
			The expansion valve control head leaks and the valve hole switches smaller automatically	Replace the expansion valve; If gray black or brown black color appears in sight glass, please make sure to replace reservoir.

Items	Fault conditions		Cause	Troubleshooting methods
		1. Touch compressor air intake hose joint (thick joint) by hand to feel no coldness. 2. There are no big differences in temperature of the high temperature zone and the low temperature zone of a condenser. 3. The temperature of each part of 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 pipelines, blow out foreign matters or release the one being pressed to flat; If gray black or brown black color appears in sight glass, please make sure to replace reservoir.
		1. Touch compressor air intake hose joint (thick joint) by hand to feel no coldness. 2. There are no big differences in temperature of the high temperature zone and the low temperature zone of a condenser. 3. There is obvious temperature difference at both ends of the blocked part. 4. Bubble visible in sight glass.	Line between condenser outlet and sight glass inlet is blocked by foreign matter	
		1. Touch compressor air intake hose joint (thick joint) by hand to feel no coldness. 2. There are no big differences in temperature of the high temperature zone and the low temperature zone of a condenser. 3. Bubble visible in sight glass. 4. The bottom of the reservoir is cold and even has condensing dew.	Filter of reservoir is blocked by dirt	Replace the refrigerant reservoir
	Pressure of low pressure side and high pressure side are both high	5. Bubble visible in sight glass. 6. Touch compressor air intake hose joint (thick joint) by hand to feel no coldness. 7. The upper end and lower end of reservoir do not have temperature difference, and temperature is higher than or equal to ambient temperature.	Less refrigerant	Detect leakage, repair and add refrigerant
		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	Release or recycle some refrigerant
		1. Observe air bubbles in sight glass in the case of compressor operation. 2. The pointer of high pressure gauge vibrates sharply and frequently.	The cooling system has non-condensing gas such as air	Release refrigerant, vacuum pumping, and fill refrigerant once again as specified in Removal and Installation of A/C Components

Items	Fault conditions		Cause	Troubleshooting methods
		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 condensed water on surface of low pressure pipe, and middle housing of condenser is not hot or cold and even has condensed water. 2. There are bubbles in sight glass.	Expansion valve has too large opening degree or is stuck in large opening degree position by foreign matter	Clean or replace expansion valve
	Voltage of low voltage side is high, vice versa	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 block is damaged or cylinder body, piston or piston ring leaks air due to wear	Replace the compressor
		1. The compressor exhaust pipe joint is hotter than usual. 2. The pointer of high pressure gauge vibrates sharply.	The exhaust valve plate of compressor is damaged	Replace the compressor

Maintenance method when natural air comes out when heating is switched on

Note: Please check warm water valve on engine has been opened first, and engine coolant temperature has been far above air temperature. Or it is common to have no warm wind, it is not a malfunction.

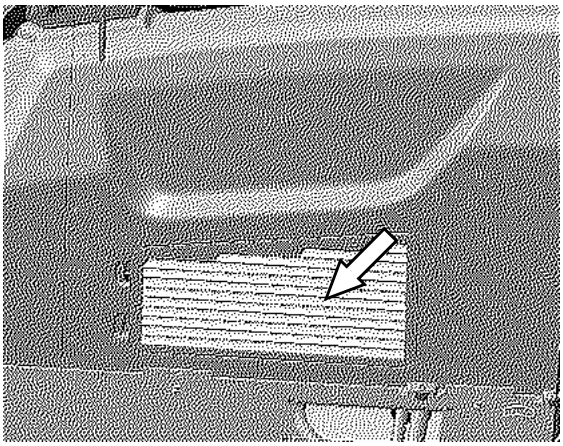
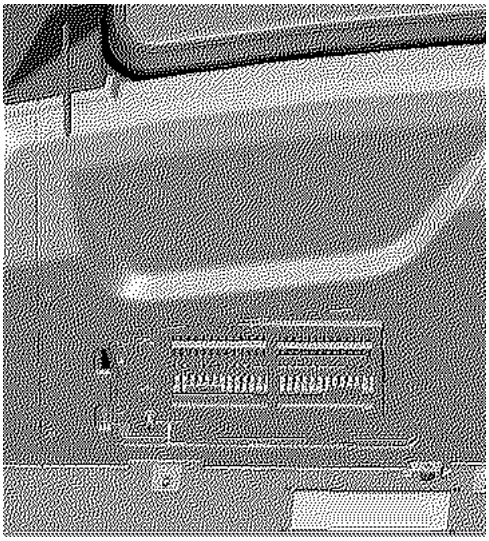


P18A00036

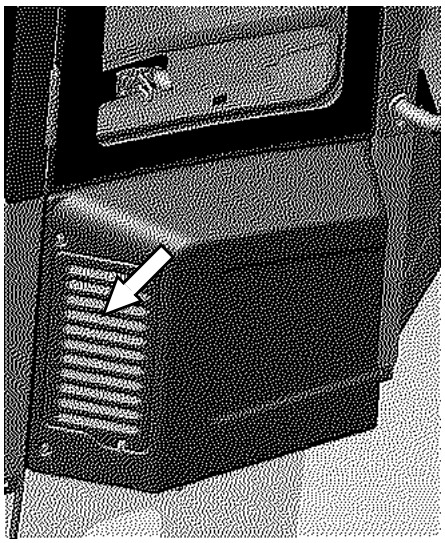
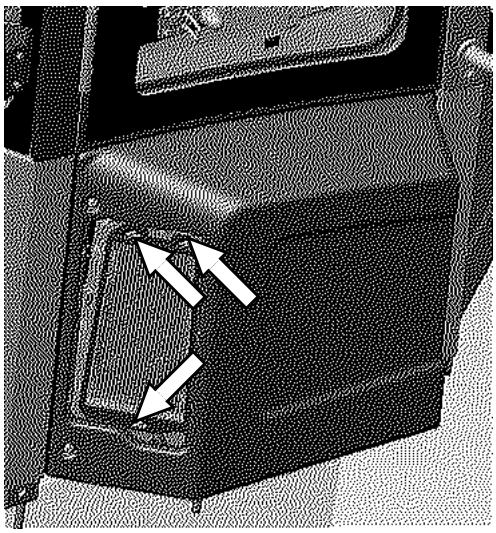
System Maintenance

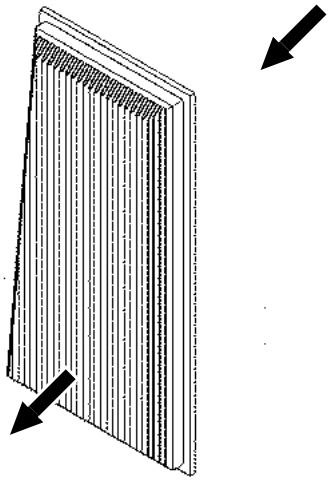
A/C system regular maintenance

Cleaning of recirculating air strainer

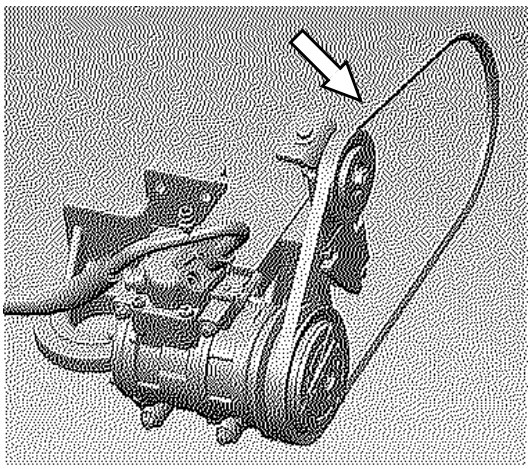
Figures	Operation step	Tools
 P18A00037	1. Open the shutter on the right of inner cab's plate.	
 P18A00038	2. Screw off the two butterfly bolts of the filter, and then remove the recirculating air strainer. 3. Blow off dust from air outlet surface to air inlet surface of recirculating air strainer with compressed air.	

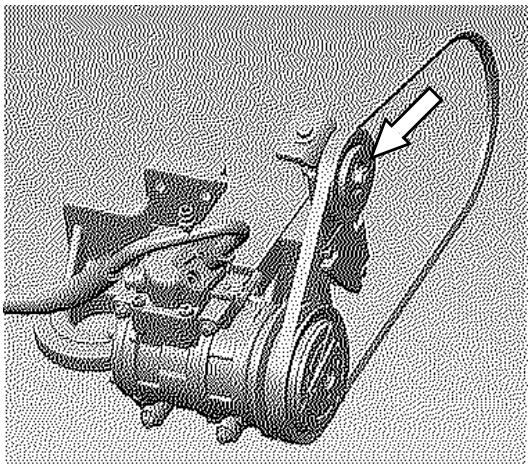
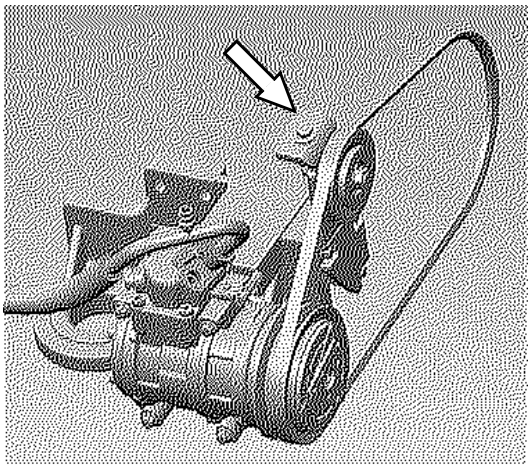
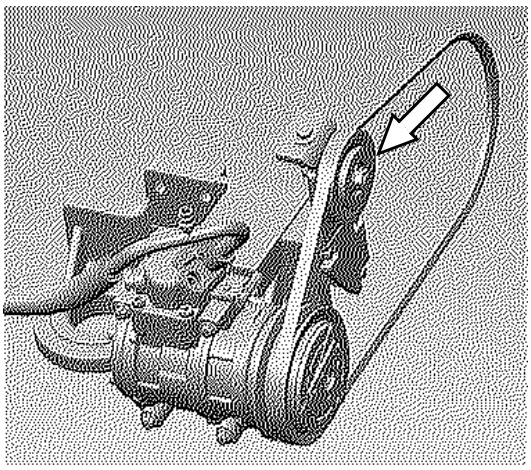
Cleaning of fresh air strainer

Figures	Operation step	Tools
 P18A00039	1. Remove the shutters on the right of the cab's cover.	
 P18A00040	2. Unscrew the three butterfly bolts fixing the new air filter of air conditioning.	

Figures	Operation step	Tools
 P18A00041	3. Remove the fresh air strainer. 4. Blow off dust from air outlet surface to air inlet surface of fresh air strainer with compressed air. (The arrowhead in the Figure is the air intake direction)	

Adjustment of compressor belt

Figures	Operation step	Tools
 P18A00042	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	

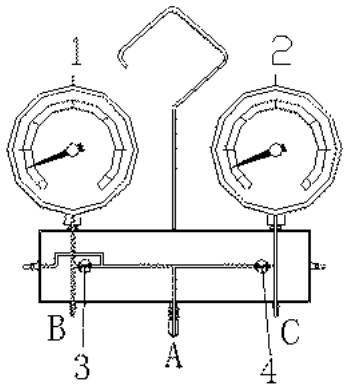
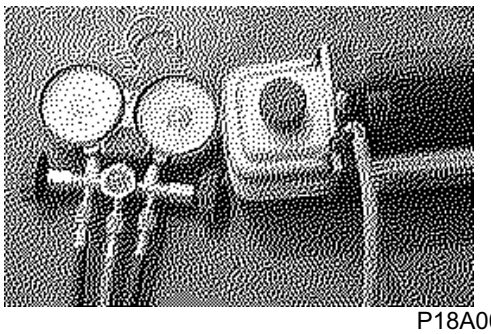
Figures	Operation step	Tools
 P18A00042	2. Loosen the hold-down nut of tension pulley.	14# Wrench
 P18A00042	3. Tighten tension bolt, and belt becomes taut; While loosen tension bolt, and belt becomes loose. Constantly adjust tension bolt, and test belt deformation until belt tension becomes appropriate.	14# Wrench
 P18A00042	4. Tighten the hold-down nut of tension pulley.	14# Wrench

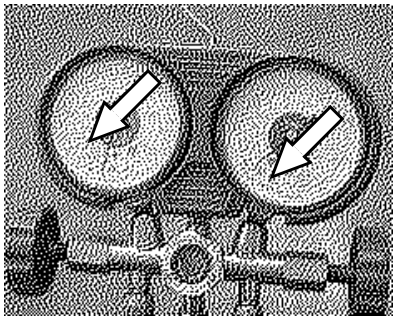
A/C refrigerant filling method

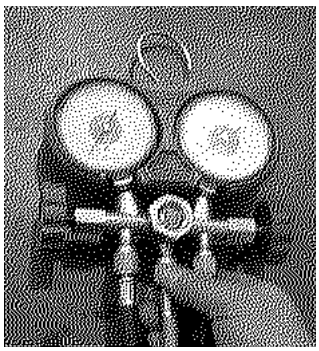
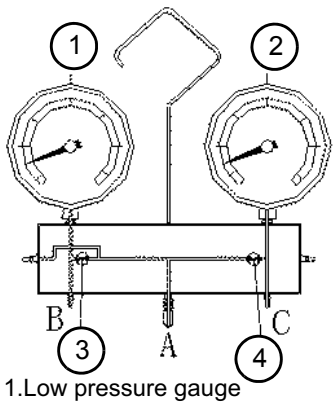
⚠CAUTION

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 vacuum pumping, 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 completely lose, start the operation of refilling refrigerant starting from step X of the instructions.

Figures	Operation step	Tools
 1.Low pressure gauge 2.High pressure gauge 3.Low pressure valve（LO） 4.High pressure valve（HI） P18A00043	1. Connect manifold gauge and A/C filler according to the sequence specified in Release (Recover) Refrigerant in Air Conditioning System, and make sure there is no refrigerant in the system.	
 P18A00044	2. Connect the hose connecting port A on the manifold gauge to vacuum pump.	Vacuum pump, manifold meter

Figures	Operation step	Tools
 P18A00045	3. Start vacuum pump to vacuumize for 5 minutes, and make sure indications of high and low pressure gauges are about -750 mm Hg (or -0.1 MPa/14.5psi). **Note:** In general, high pressure gauge and its connector are red, and low pressure gauge and its connector are blue.	
 P18A00046	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. The pick up of pressure indicates there is a leakage in the system. Check and repair leaking areas, repeat the 3-5 steps.	
	The steps 6-8 below are operations when portable canned refrigerant is used. It may change as the packaging type of cold media changes. Please confirm the refrigerant container is properly connected to the manifold gauge.	
	6. Install the plug clock to refrigerant container.	
	7. Connect hose connecting point A of manifold gauge to the screw plug of refrigerant container.	

Figures	Operation step	Tools
 P18A00047	8. Rotate handle of screw plug clockwise so that pintle punctures refrigerant container, and then rotate screw plug handle counterclockwise so that the pintle exits.	
	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.	
 P18A00048	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. **⚠ CAUTION: At the moment, make sure high pressure valve has been closed, or else subsequent operations may cause damages to compressor.**	
 1.Low pressure gauge 2.High pressure gauge 3.Low pressure valve（LO） 4.High pressure valve（HI） P18A00049	12. Start the engine to idle state and open the cab's door and window. And turn on the air conditioner to cooling mode. Adjust to the maximum wind.	

Figures	Operation step	Tools
	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 are no bubbles in sight glass.	
	14. First turn off 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 are 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

Driver's Cab System

Structure Function Principle

Driver cab system

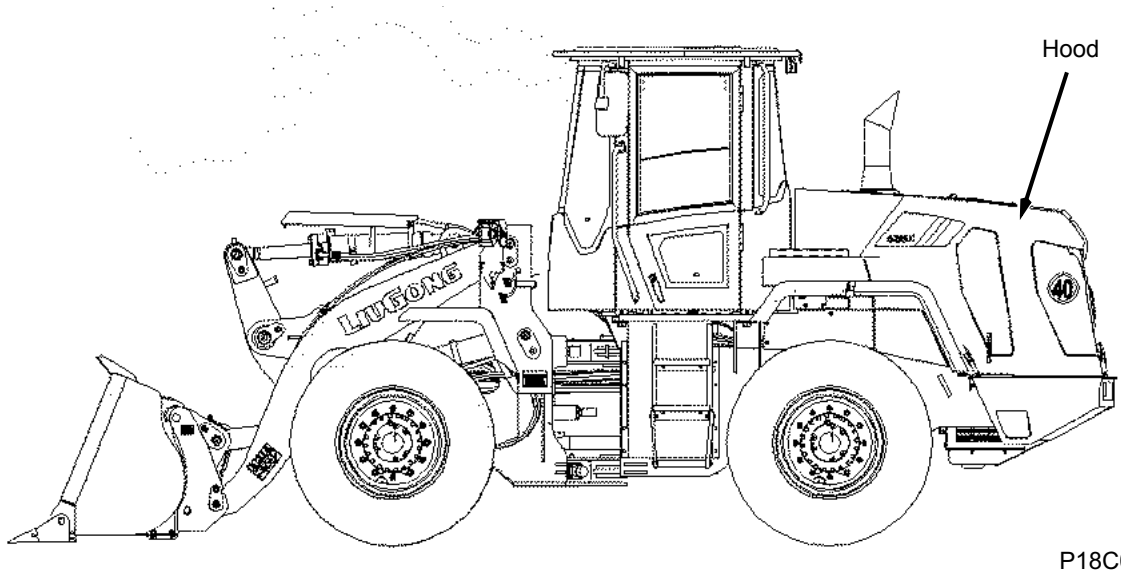
The cab system mainly consists of cab assembly, steering column assembly, driver seat assembly, protective cover console, console assembly and rear view mirror assembly. Among which some parts of hydraulic system, electrical system and air conditioning system are assembled on cab assembly.

Engine hood

Engine hood assembly

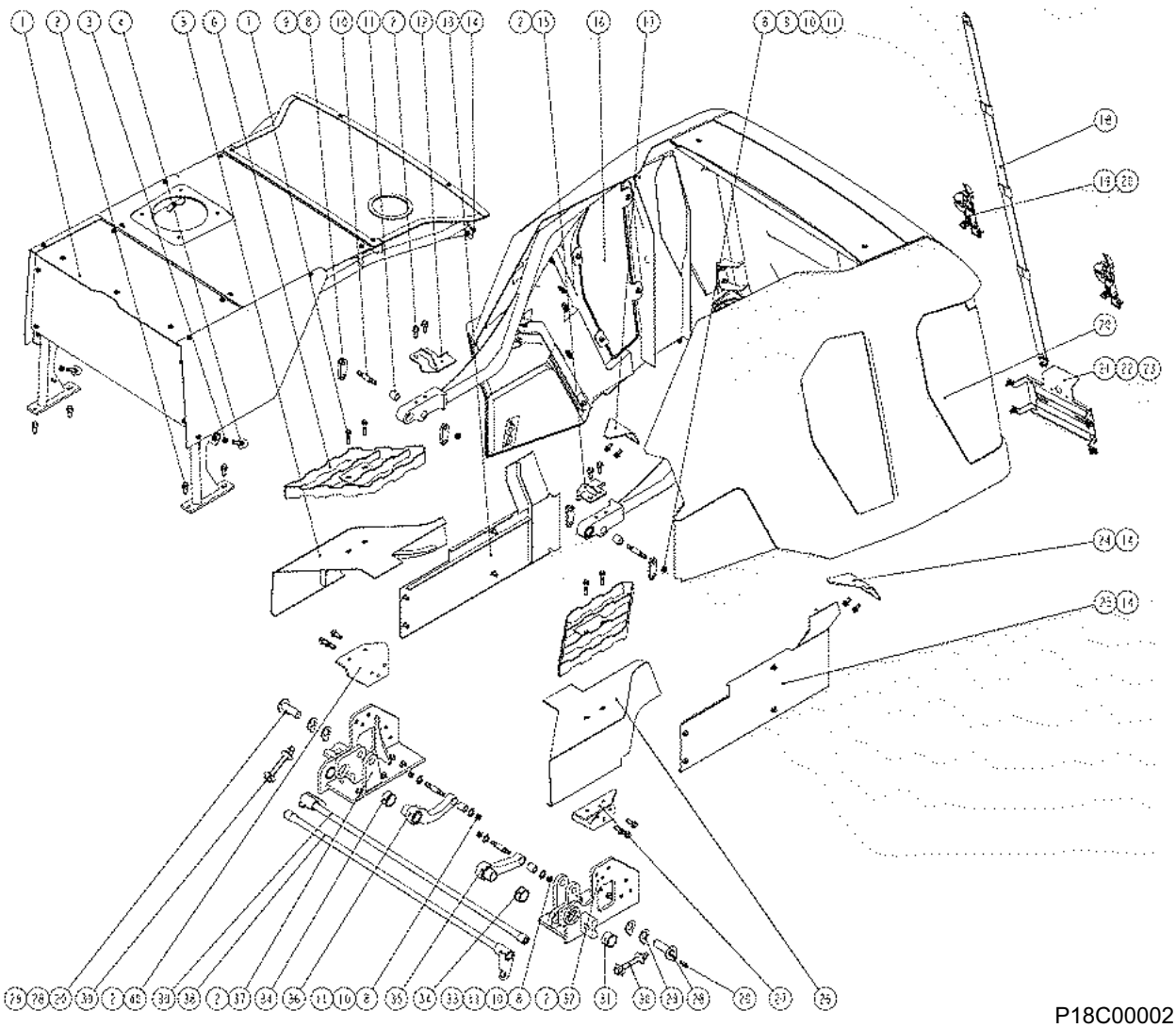
Overview of engine hood assembly

The engine hood mainly consists of two parts: one part is that can open round the engine hood hinge; and the other part is that fixed on the frame and radiator. The engine hood is front-hinged. The lifting mechanism mainly includes air spring and torsion spring. The maximum opening angle of engine hood is about 50°.



P18C00001

Main components of engine hood



P18C00002

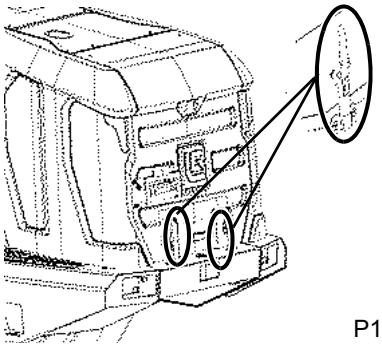
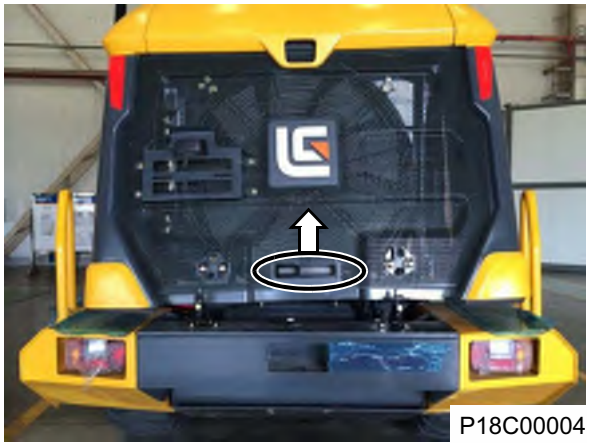
1. Bracket
2. Bolt
3. Nut
4. Cushion
5. Side plate-rh
6. Step
7. Bolt
8. Nut
9. Plate
10. Pin
11. Bushing
12. Angle block
13. Side plate-rh
14. Bolt
15. Angle block
16. Rear cover
17. Plate
18. Rope
19. Lock
20. Bolt
21. Mounting plate
22. Bolt
23. Nut
24. Plate
25. Side plate-lh
26. Side plate-lh
27. Bracket
28. Pin
29. Washer
30. Rod as
31. Bushing
32. Bracket
33. Washer
34. Bushing
35. Push rod
36. Push rod
37. Bracket
38. Torsion spring
39. Torsion spring
40. Bracket

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. If the removal and installation of other components on the complete machine are concerned in the removal and installation of each component, tools are referred to the tool list for the removal and installation of other components and not 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.

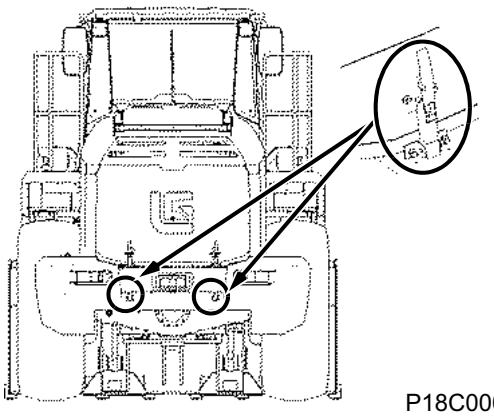
Opening and closing of engine hood

Opening of engine hood

Reference picture	Operation step
 P18C00003	1. Open the lock on both sides of engine rear hood by hand.
 P18C00004	2. Grab and lift the bottom handrail of rear hood

Reference picture	Operation step
 P18C00005	3. After the hood rises automatically, hold the rope at the hood bottom with hand to control the hood opening speed until it opens completely.

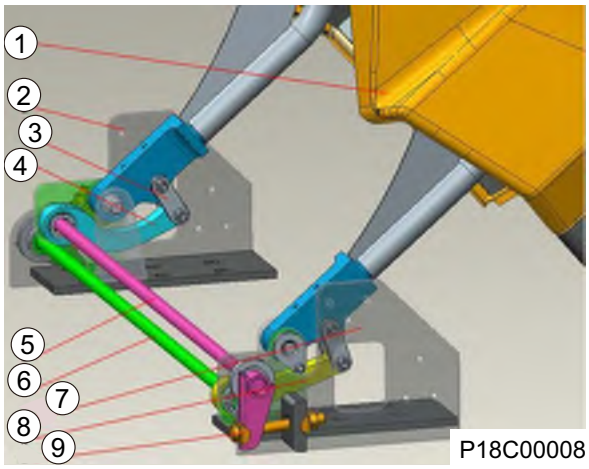
Closing of engine hood

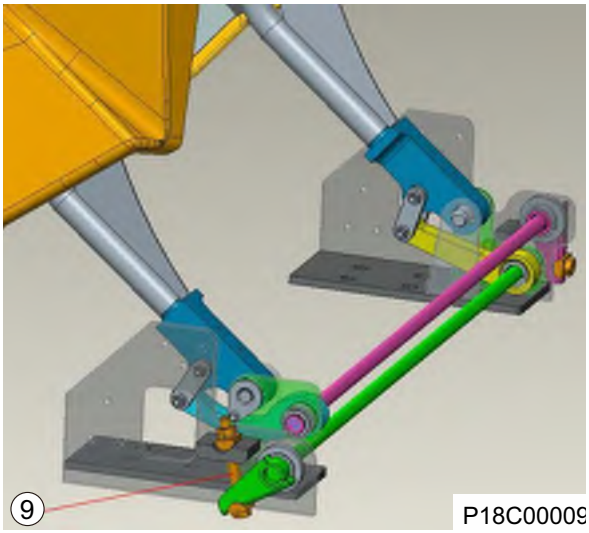
Reference picture	Operation step
 P18C00006	1. Grab and pull down the rope until the hood bottom matches with the counterweight.
 P18C00007	2. Tighten the locks on the both sides.

Lifting mechanism of engine hood torsion bar

1. Overview-components and position

The components and position of lifting mechanism of engine hood torsion bar used in complete machine are as shown in the figure below and mainly composed of rear cover, bracket and torsion spring. The torsion bar-assist type turnover mechanism involved in the mechanism is able to solve effectively the problem of difficult closing caused by large turning torque during the turning of torsion bar turnover mechanism, and the provided torsion bar-assist type turnover mechanism includes the base and the turning parts hinged on the base. The base is provided with torsion bar, which is mutual parallel to the center of rotation of mentioned turning parts with its one end permanently connected to the base, while the other end rotates relative to base and permanently connected to lever arm; moreover, it includes link, one end of which is hinged with lever arm, while the other end hinged with turning parts. The base, lever arm, link and turning parts in the torsion bar turnover mechanism forms four-bar mechanism.





1. Rear cover
2. Bracket
3. Plate
4. Push rod
5. Torsion spring - right
6. Torsion spring - left
7. Bracket
8. Push rod
9. Rod as

2. Overview - part working principle

When the torsion bar-assist type turnover mechanism used in this model is used on the engine hood of machine,the base acts as frame and the turning parts act as hood; the base, lever arm, link and turning parts forms four-bar mechanism; the distance between point A and C increases gradually to improve the torque in the later stage during the turning process for opening the hood; while the distance between point A and C decreases gradually to reduce the torque of the torsion bar against the turning part, i.e reducing the tensile force necessary for closing the engine hood to make easy closing of hood during the turning process for closing the hood.

Figure 1 is the structure diagram that the torsion bar-assist type turnover mechanism is used on the hood of machine;

Figure 2 is the structure diagram of the torsion bar-assist type turnover mechanism;

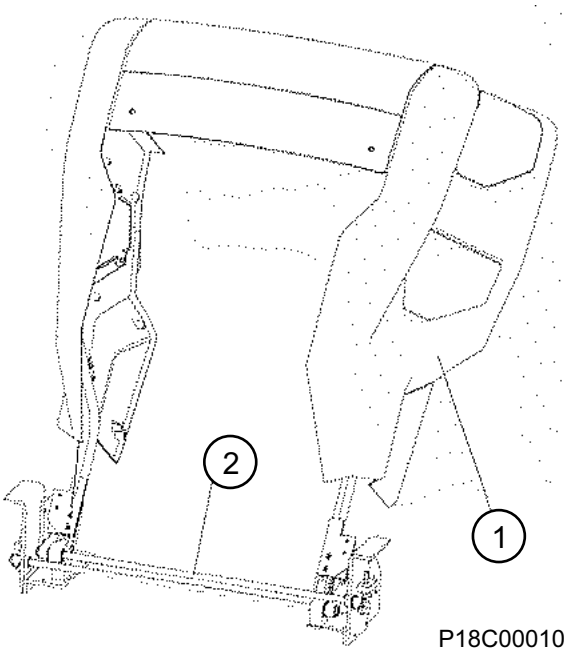
Figure 3 is the structure diagram of link with adjustable length;

Figure 4 is the relation diagram of rear cover opening angle vs required torque.

Component name and serial number in the figure;

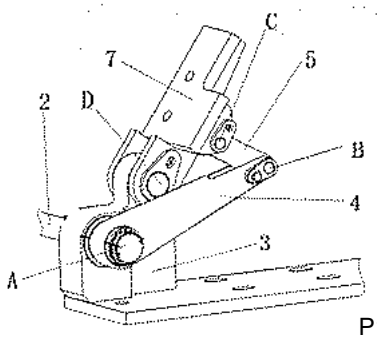
Rear cover 1, torsion bar 2, base 3, lever arm 4, link 5, turning part 7.

Figure 1



P18C00010

Figure 2

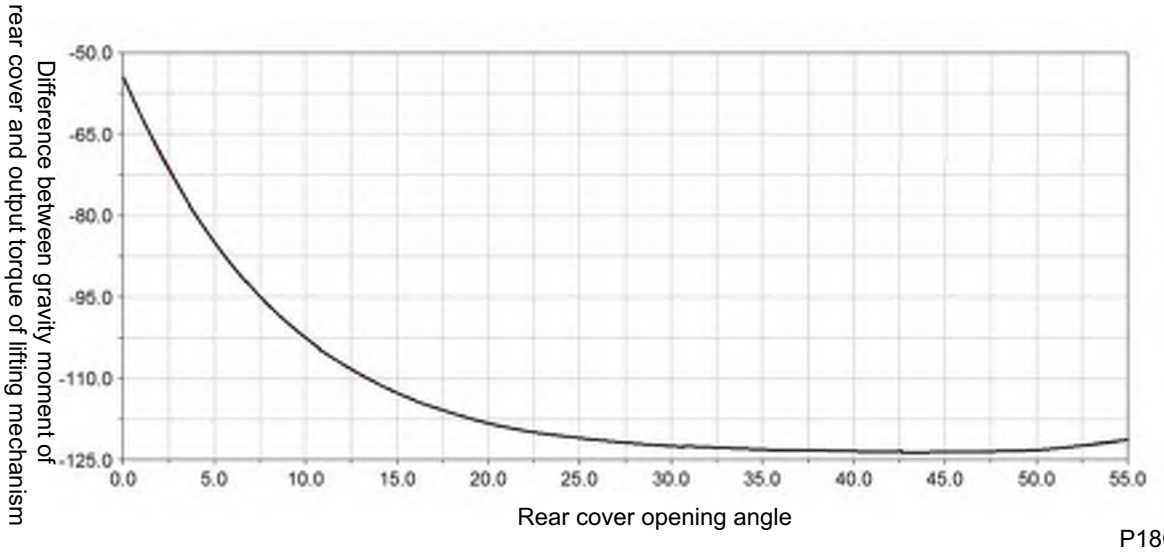


P18C00011

Figure 3

P18C00012

Figure 4



P18C00013

As shown in the figure 2, the torsion bar-assist type turnover mechanism includes base 3, the turning part 7 hinged on the base 3, which is provided with torsion bar2, which is mutual parallel to the center of rotation of turning part 7, one end of torsion bar 2 is permanently connected to base 3, and the device for adjusting the initial torque of torsion bar can be installed at this end, while the other end rotates relative to base and is provided with spline by which permanently connected to lever arm 4; the link 5 is connected between the free end of lever arm 4 and turning part 7, one end of link 5 is hinged with lever arm 5 and the other end is hinged with turning part 7.

As shown in figure 2, the connection point of torsion bar 2 and lever arm 4 is point A, the articulated joint of lever arm 4 and link 5 is point B, articulated joint of link 5 and turning part 7 is point C, articulated joint of turning part 7 and base 3 is point D, and this four points form convex quadrangle. The included angle formed by link 5 and lever arm 4 is acute angle. When the lever arm 4 rotates counterclockwise around the point A, i.e the hood is being opened, the distance between point A and C increases gradually, and included angle formed between CB and DC is reduced gradually to right angle from obtuse angle and thus to improve the torque in the later stage during the turning process for opening the hood; when the lever arm rotates clockwise around point A, i.e the hood is being closed, the distance between point A and C decreases gradually, and included angle formed between CB and DC is increased gradually from obtuse angle to reduce the torque of the torsion bar against the turning part, i.e reducing the tensile force necessary for closing the engine hood to make easy closing of hood. When the rear cover is opened and closed, the torsion bar-assist type turnover mechanism can provide the turning part of stable torque, whose curve has the good consistency of matching with gravity moment of turning part.

In this example, under the condition that the specification of torsion bar is not changed, several opening and closing force requirements of rear cover can be met through changing the effective length of lever arm, and in case of used for opening the different weight of rear cover, the change of effective length of lever arm can be achieved through the two methods below.

First method: the size of lever arm can be changed through changing the length of link 5 and if the link 5 uses screw mouth, whose structure is as shown in figure 3, the distance L between left U screw rod (left-handed thread) and right U screw rod (right-handed thread) of the thread can be adjusted by rotating the screw bushing and thus to change the length of link 5.

Second method: the adjusting mechanism is provided with long round hole at end of lever arm and locking mechanism, the length direction of long round hole is the same with that of lever arm, articulated shaft of link and lever arm is located in the mentioned long round hole and can move along the length direction of long round hole, and the mentioned locking mechanism is used for locking the position of positioning articulated shaft in the long round hole.

The Figure 4 shows the difference between gravity moment of rear cover and output torque of lifting mechanism, and the difference refers to the force applied by operator when opening or closing the rear cover. 0°indicates the close state of rear cover, 55°indicates the open state of rear cover. As can be seen from the figure, when the rear cover is closed from 55°to 0°, the difference between both is decreased gradually to make easy closing of engine hood.

Removal and Installation

Installation requirements for shock cushion of cab

The cushion of cab is installed with M30 bolts and #46 torque wrench, torque value: tightening torque (dry state) = 1055 N·m.

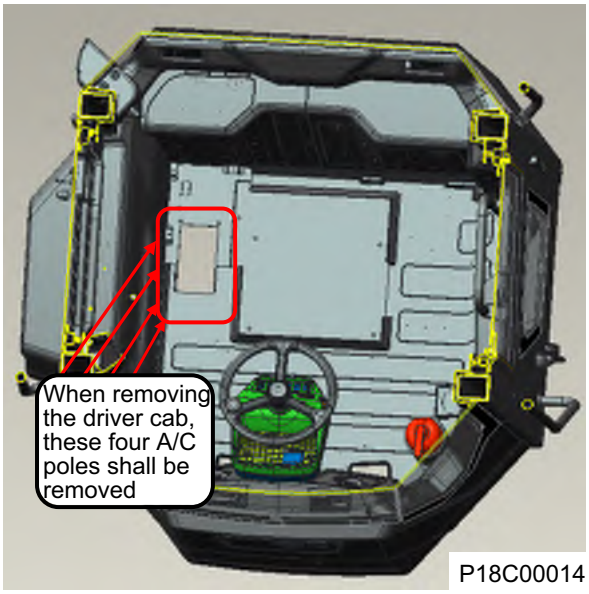
Removal and installation of cab

Disassembly order of cab lifting

1. Remove A/C components →remove hydraulic components → remove power components → remove electrical components → replace lifting rings of head cover → remove cushion → lift.
2. Step of installing cab onto machine: install it by the opposite steps of removal.

Removal of air conditioning components in cab

Disassembly of air conditioning connector



P18C00014

Fluoridation of air conditioning

For fluoridation of air conditioning, refer to the section of air conditioning in this manual.

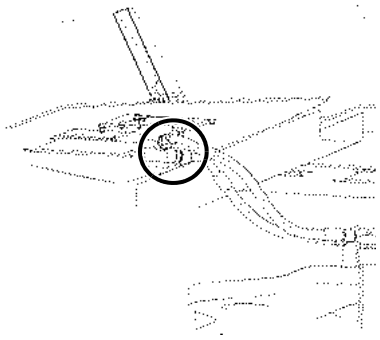
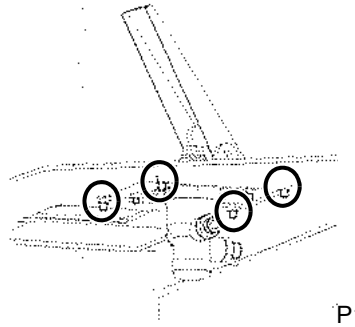
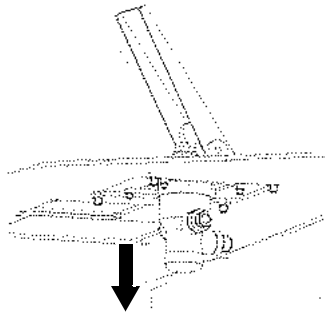
Disassembly of hydraulic components in cab

Remove brake pedal

1. Removal steps of brake valve from the machine:

⚠CAUTION

Before removing brake valve, make sure that the machine is in parking brake state.

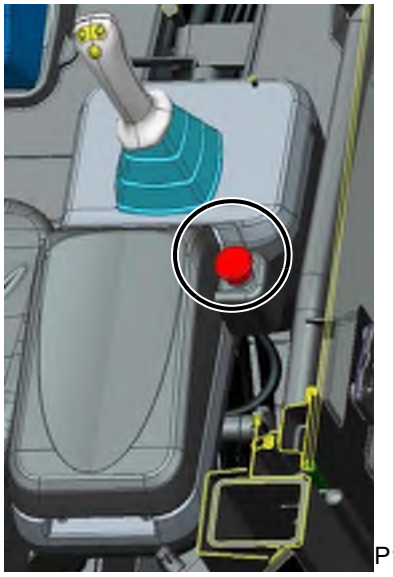
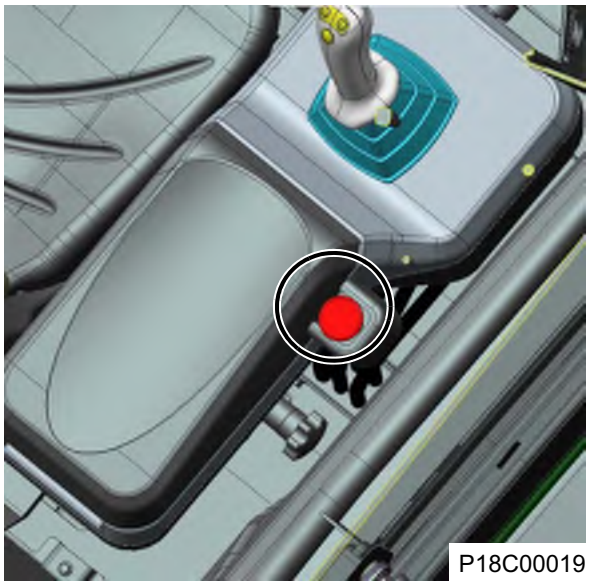
Figures	Operation step	Tools
 P18C00015	1. Mark the two hoses connecting brake valve as "P1" and "P2" respectively. Pay attention to that the markings shall be firm. 2. Loosen the joints of two hoses.	Tool: 27# Open-end wrench
 P18C00016	3. Unscrew the 4 bolts tightening the brake valve.	Tool: 16#Wrench
 P18C00017	4. Take out the brake valve from the bottom of cab. 5. Shield the port of brake valve and store it in dry and clean place.	

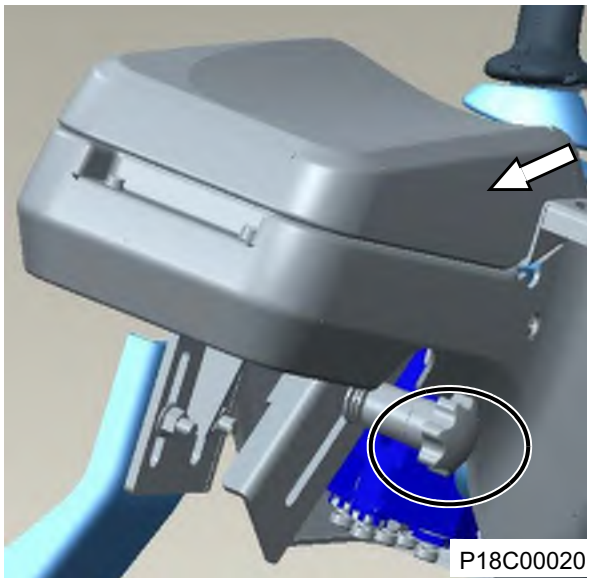
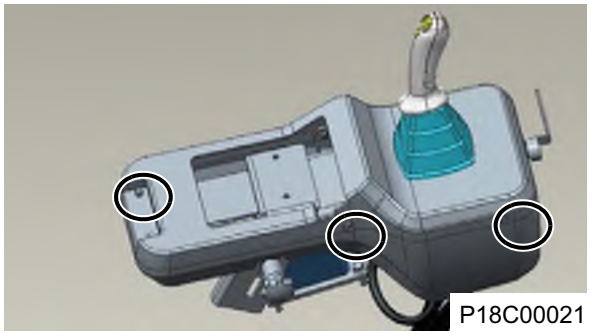
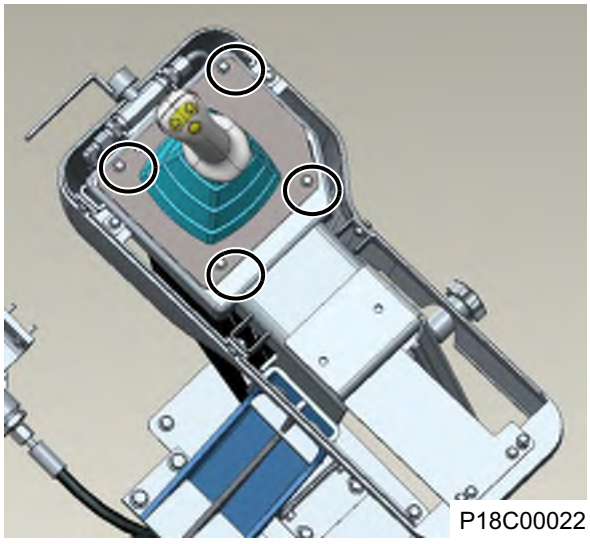
2. Step of installing brake valve onto machine: install it by the opposite steps of removal.

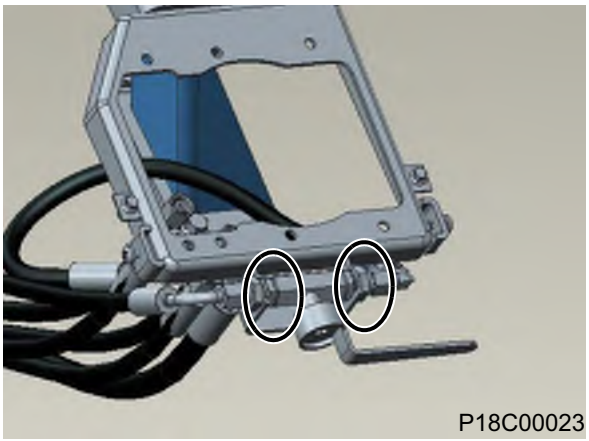
Remove console hydraulic system

1. Steps to remove the pilot valve from the machine:

First, remove all the pilot lines.

Figures	Operation step	Tools
 P18C00018	1. Pull out the housing	
 P18C00019	2. Remove the parking brake solenoid switch	

Figures	Operation step	Tools
 P18C00020	3. Remove the operating handle and take out the armrest upward	
 P18C00021	4. Screw off 4 screws and 2 bolts, and then remove the upper housing.	Tool: cross screwdriver, M6 inner hexagon spanner
 P18C00022	5. Remove 4 M6 captive bolts with #10 open-end wrench, and remove the pilot valve from the console housing.	Tool: 10#Wrench

Figures	Operation step	Tools
 P18C00023	6. Screw out pilot shutoff valve nuts as tightened in the left lower figure, and remove shut-off valve.	Tool: 21# wrench

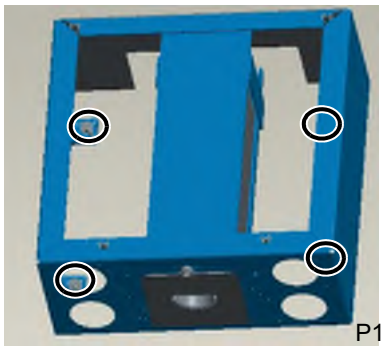
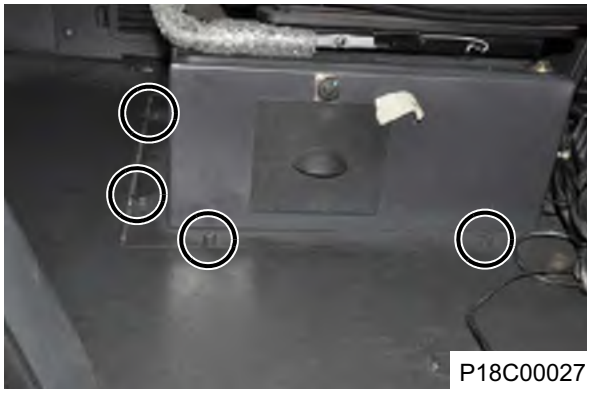
2. Step of installing pilot operating valve onto machine: install it by the opposite steps of removal.

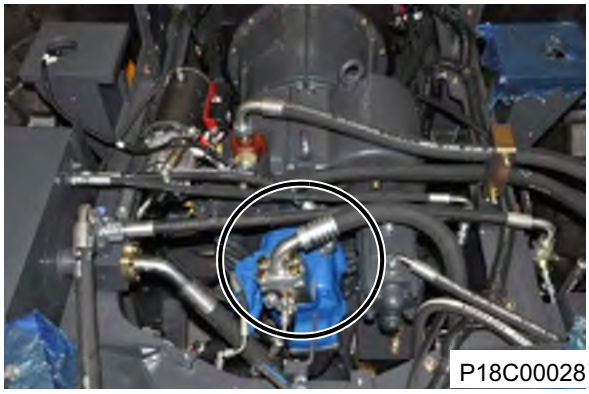
Removal of metering pump

Figures	Operation step	Tools
 P18C00024	1. Screw out 4 M10 bolts tightening metering pump, remove the metering pump and move it out of cab.	Tool: 16#Wrench

Maintenance of hydraulic parts

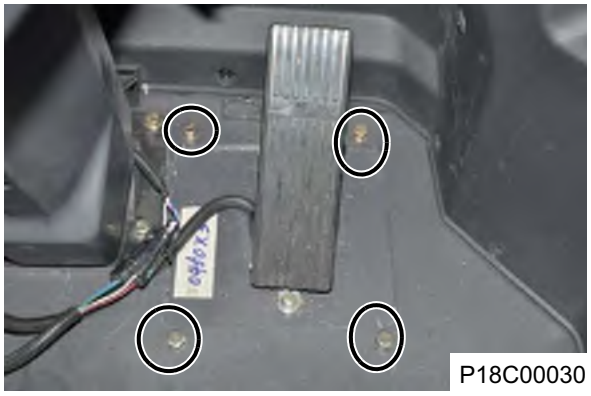
Seat needs to be removed for maintenance of hydraulic parts. The procedures are as follows:

Figures	Operation step	Tools
 P18C00025	1. Screw out 4 M8 bolts tightening seat and remove seat.	Tool: 13#Wrench
 P18C00026	2. Screw out 4 M10 bolts tightening shield and remove the shield.	Tool: 16#Wrench
 P18C00027	3. Screw out 8 M8 bolts tightening shield and remove the bottom plate.	Tool: #13 wrench

Figures	Operation step	Tools
 P18C00028	4. Repair the hydraulic components	

Disassembly of power components in cab

Removal of accelerator control system

Figures	Operation step	Tools
 P18C00029	1. Unplug the harness connector of electronic accelerator	
 P18C00030	2. Lift up floor mat, remove 4 captive bolts on accelerator control system, and remove the accelerator control system.	Tool: Open-end wrench 16#

Installation of accelerator control system

Installation of accelerator control system: install it by the opposite steps of removal.

Adjustment of accelerator control system

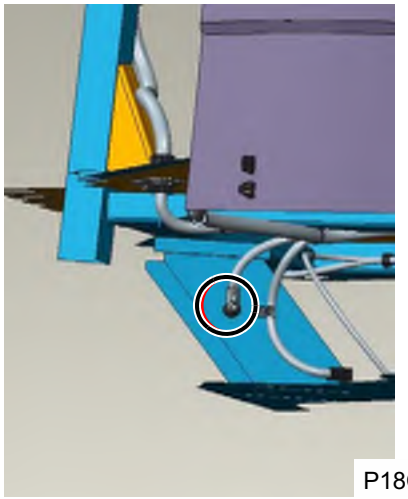
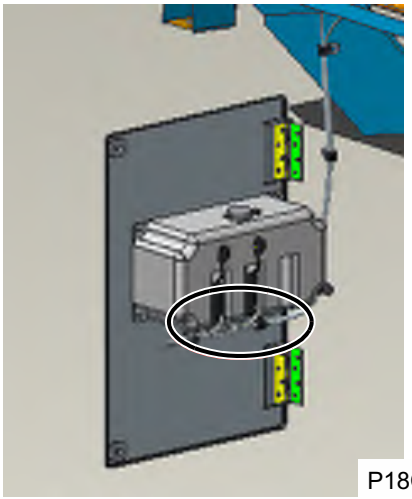
Normally, after the accelerator pedal is installed, the accelerator pedal can be operated smoothly and the normal operating condition of engine can be guaranteed. For the cases that the accelerator pedal is difficult to operate, the accelerator pedal cannot reach its maximum position or accelerator pedal does not return, check the installation procedures above until it can be operated smoothly.

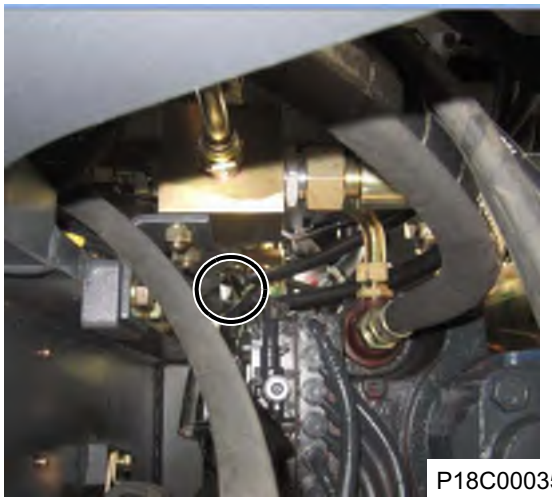
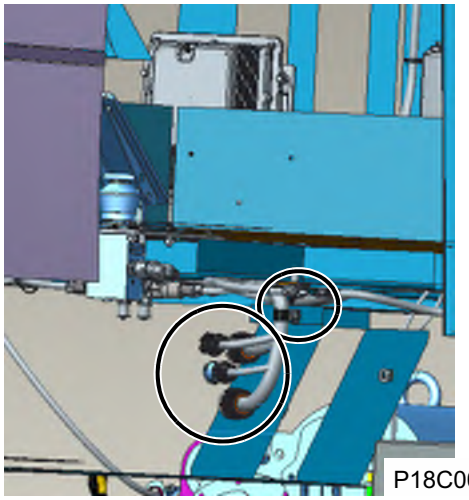
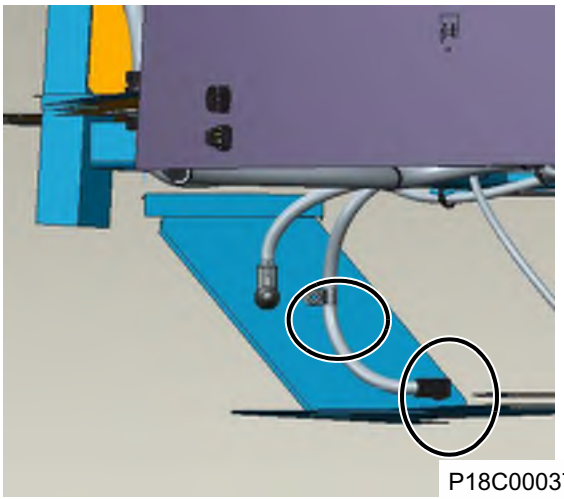
Removal of electric appliance components in cab

⚠CAUTION

The power of vehicle must be turned off before disassembling the electric appliance components. The power (-) of the whole machine is disconnected when the negative switch is turned to "O" (OFF). The power (-) of the whole machine is connected when the negative switch is turned to "I" (ON).

P18C00031

Figures	Operation step	Tools
 P18C00032	1. Screw out the earthing cable on the front cab mounting bracket-rh.	
 P18C00033	2. Pull out the ZF transmission speed sensor on the transmission-lh.	
 P18C00034	3. Pull out the connecting water pipe of the washer reservoir at the left ladder case.	

Figures	Operation step	Tools
 P18C00035	4. Pull out the shift control solenoid connector on the transmission-rh.	
 P18C00036	5. Unplug the 4 rear frame harness connectors on the left mounting bracket of cab and loosen the fixing ring nut fixing the harness.	Tool: Open-end wrench 16#
 P18C00037	6. Unplug the 1 front frame harness connectors on the right mounting bracket of cab and loosen the fixing ring nut fixing the harness.	Tool: Open-end wrench 16#

Replacement and installation for lifting rings of head cover

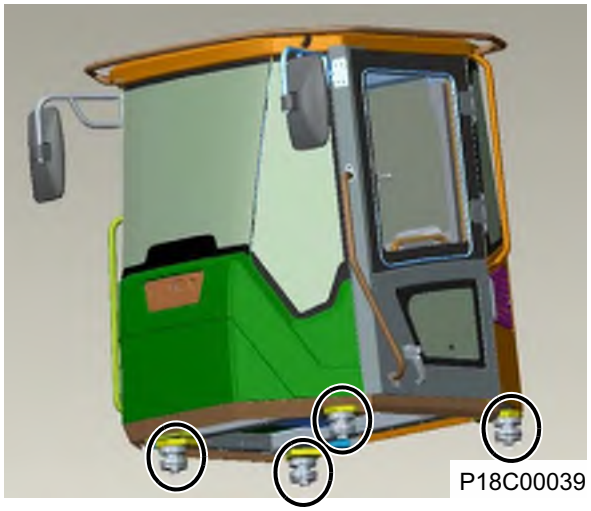
Figures	Operation step	Tools
 P18C00038	Loosen 4 M16 bolts and replace and install M16 lifting rings.	Tool: Open-end wrench 24#

Removal of shock cushion

1. Steps to removing the shock cushion from the machine:

⚠CAUTION

Before removing cushion, make sure that the machine is in parking brake state.

Figures	Operation step	Tools
 P18C00039	The cushion of cab is installed with M30 bolts which are screwed out with #46 torque wrench. Mounting torque value: tightening torque (dry state) = 1055 N.m.	Tool: Open-end wrench 46#

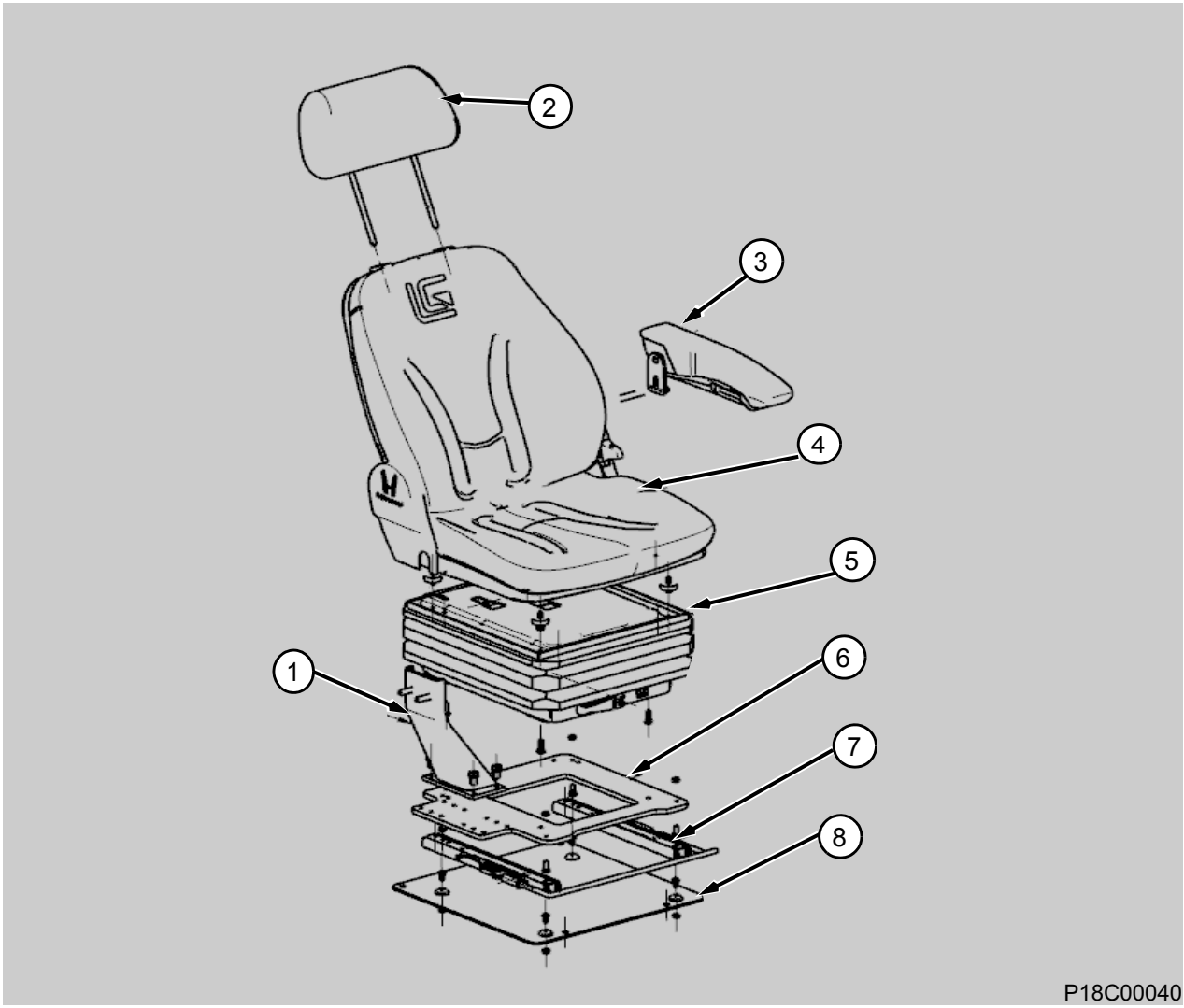
2. Step of installing shock cushion onto machine: install it by the opposite steps of removal.

Lift

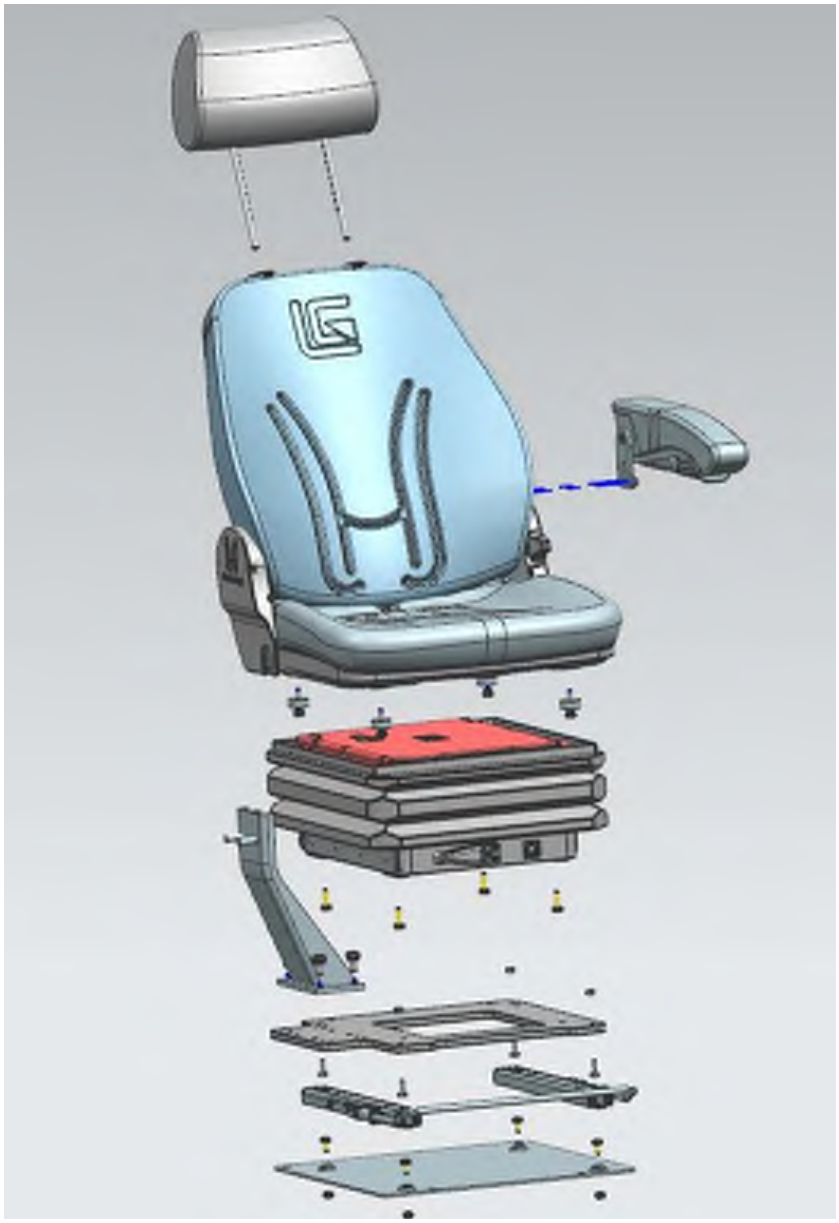
Install M16 lifting rings on the cover of cab and lift the cab.

Removal of the seat

Exploded view of driver seat



1. Bracket(14A7068)
2. Headrest(35C0877)
3. Handrail(34C3671)
4. Backrest as(14A7067)
5. Shock absorption frame(47C1358)
6. Bracket bottom plate(14A7069)
7. Slide rail(2048536)
8. Install the floor mat(LZY-LG6804001-1)



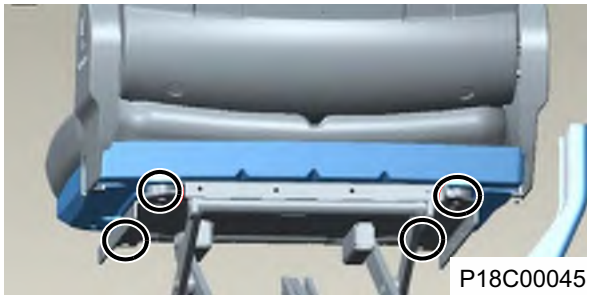
P18C00041

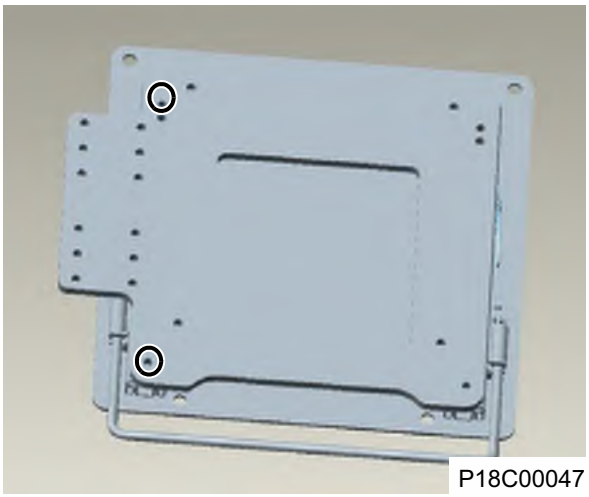
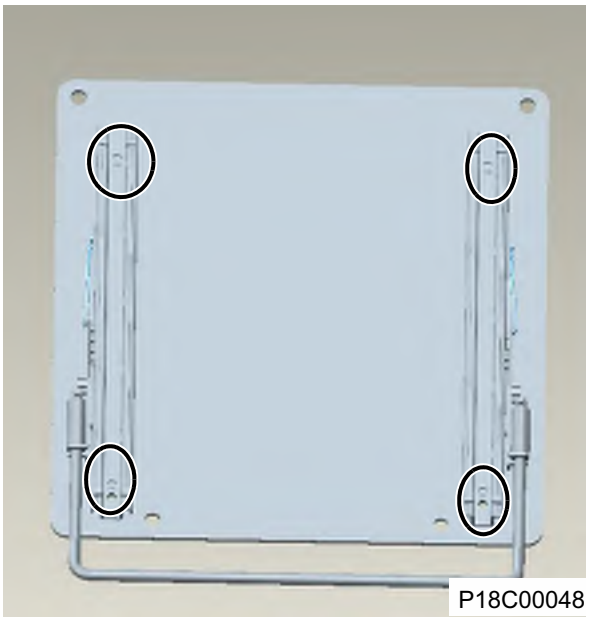
The seat consists of headrest, handrail, base assembly, shock mount, bracket, bracket bottom plate, slide rail and mounting bottom plate.

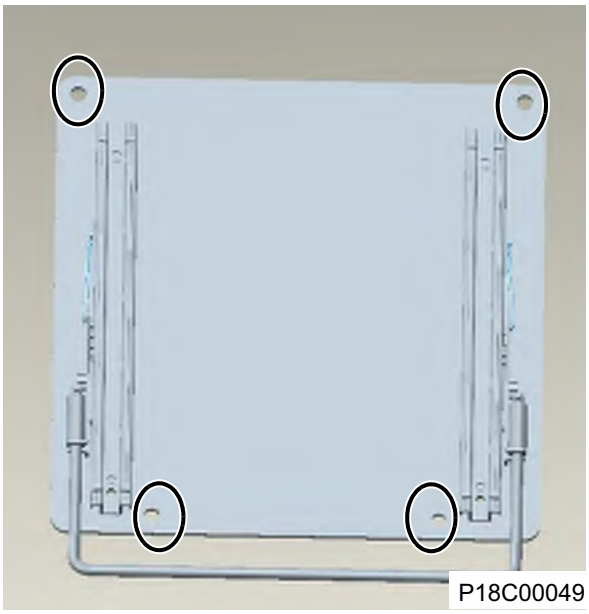
Removal of the seat

1. Removal steps of the seat:

Figures	Operation step	Tools
 P18C00042	1. As the headrest is not limited by any fasteners and bayonets, so it can be removed by pulling out by hands directly. 2. Insert the rod of headrest aligning with the hole during assembly.	
 P18C00043	3. Screw out two M8 cap nuts on the side of handrail, and the handrail can be removed.	Tool: 13#Wrench

Figures	Operation step	Tools
 P18C00044  P18C00045	4. Remove the clamp from the dust cover by hand. 5. Remove four M8 bolts from shock mount with #13 wrench and the backrest assembly can be removed.	Tool: 13#Wrench
 P18C00046	6. Slide the seat forward; remove the two M8 inner hexagon bolts from the shock mount lower part. 7. Slide the seat rearward; remove the two M8 inner hexagon bolts from the shock mount lower part. The shock mount can be removed then.	Tool: M8 inner hexagon spanner

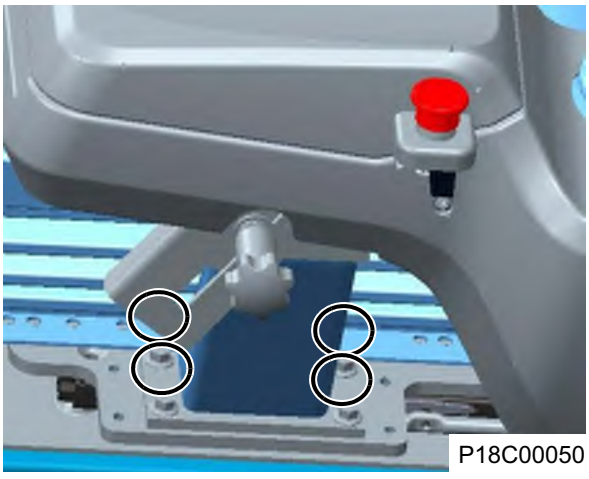
Figures	Operation step	Tools
 P18C00047	8. Unscrew the upper bolts of slide rail. (Slide the slide rail forward and remove the two front bolts; slide backward and remove the two rear bolts.)	Tool: 13#Wrench
 P18C00048	9. Unscrew the lower bolts of slide rail. (Bolt head is under mounting base plate)	Tool: #5 inner hexagon spanner

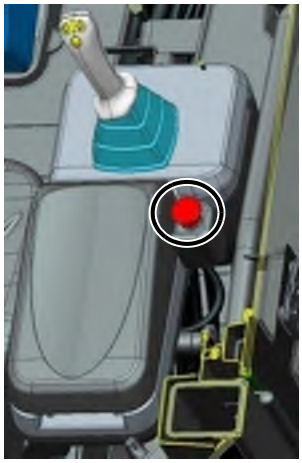
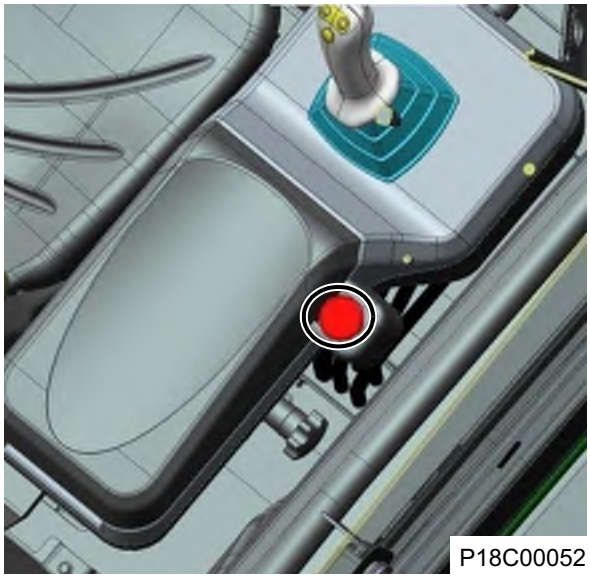
Figures	Operation step	Tools
 P18C00049	10. Unscrew the upper M12 bolts of slide rail. (Slide the slide rail forward and remove the two front bolts; slide backward and remove the two rear bolts.)	Tool: 18# Socket wrench

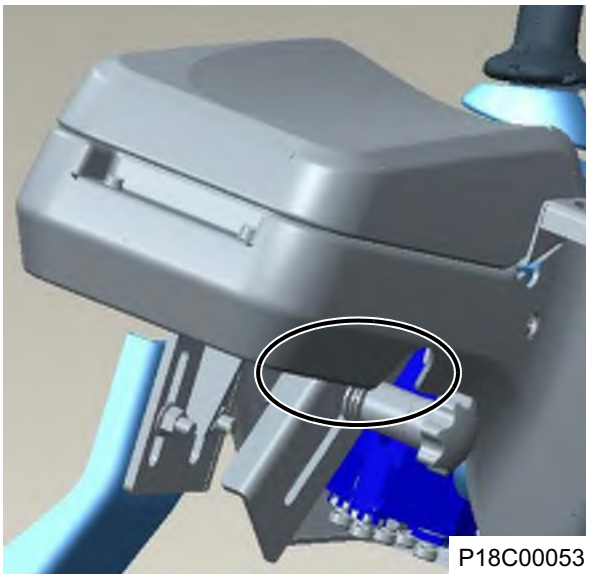
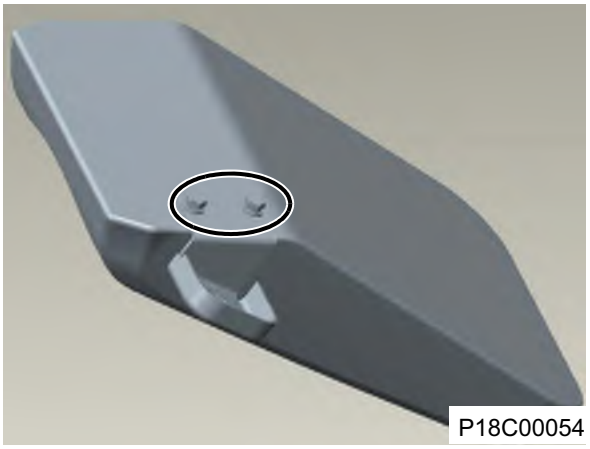
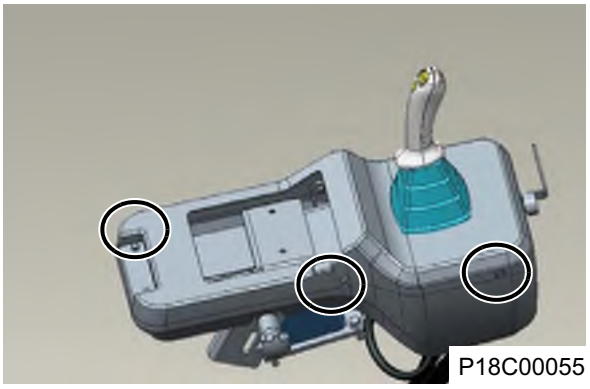
2. Step of installing seat onto machine: install it by the opposite steps of removal.

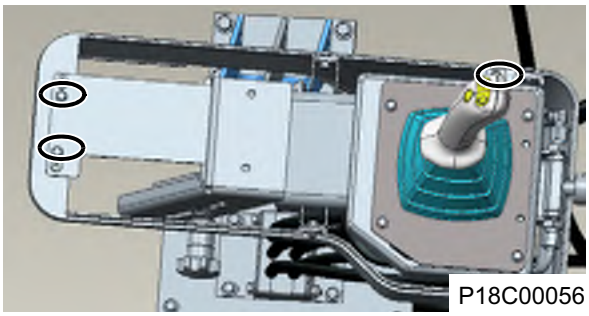
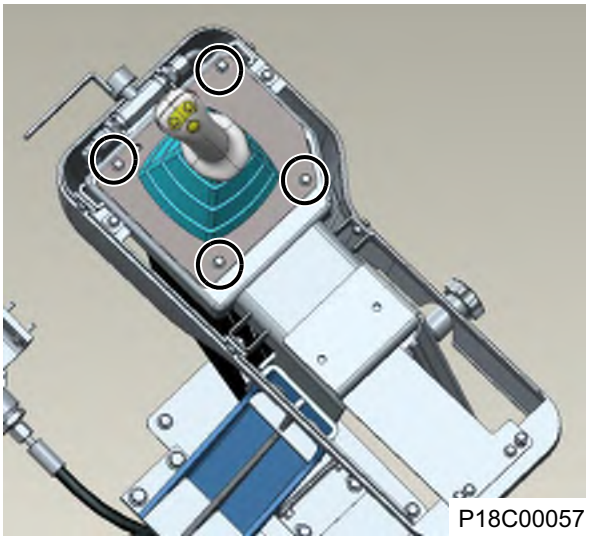
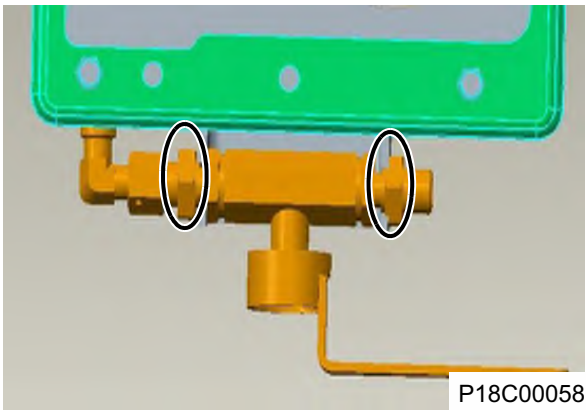
Removal of console

1. Removal steps of armrest:

Figures	Operation step	Tools
 P18C00050	1. Remove the M10 bolts on seat support and the console can be removed entirely.	Tool: 13#Wrench

Figures	Operation step	Tools
 P18C00051  P18C00052	2. Pull out the housing, 3. Remove the parking brake solenoid	

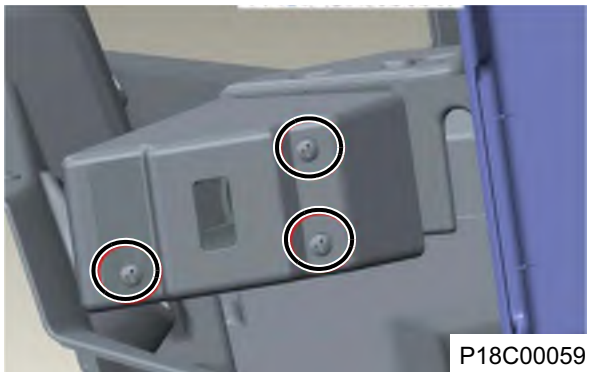
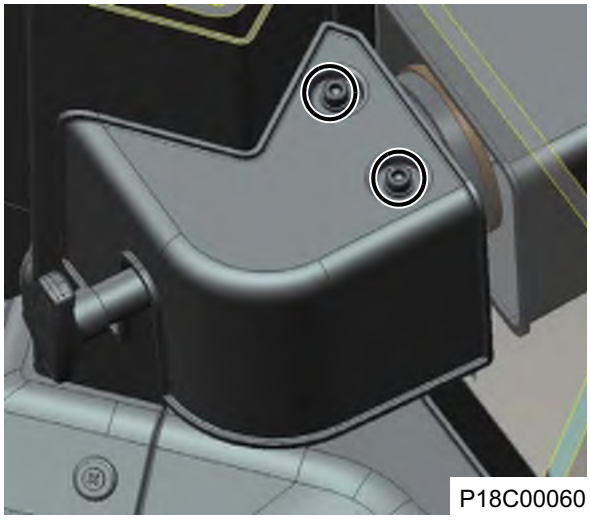
Figures	Operation step	Tools
 P18C00053	4. Remove adjusting lever on the side of console and then the armrest cushion can be removed by pulling upward.	
 P18C00054	5. Screw out two M6 bolts on support angle block of hand-rail.	Tool: 10#Wrench
 P18C00055	6. Remove the 4 screws and 2 bolts around housing, and then the upper housing can be removed.	Tool: cross screw-driver, M6 inner hexagon span-ner

Figures	Operation step	Tools
 P18C00056	7. Screw out the 4 screws on the lower housing and the lower housing can be removed.	Tool: M6 inner hexagon spanner, 8# open-end wrench
 P18C00057	8. Screw out 4 M6 bolts as tightened in the left figure, and then remove the pilot lever.	Tool: 10# Open-end wrench
 P18C00058	9. Screw out pilot shutoff valve nuts as tightened in the left lower figure.	Tool: 21# Open-end wrench

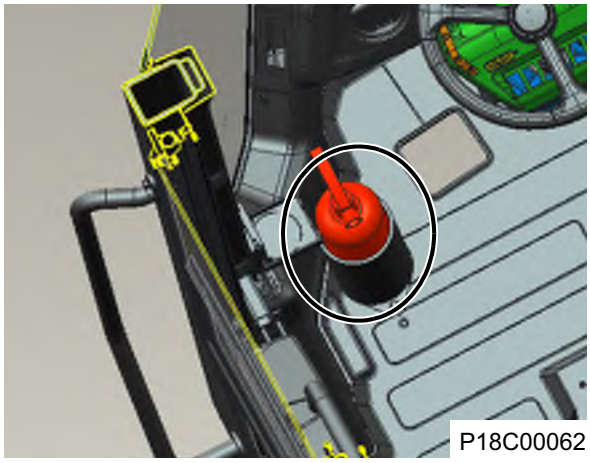
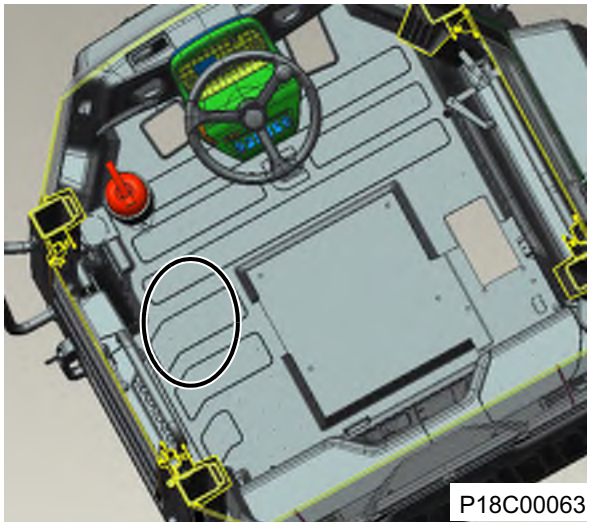
2. Step of installing console onto machine: install it by the opposite steps of removal.

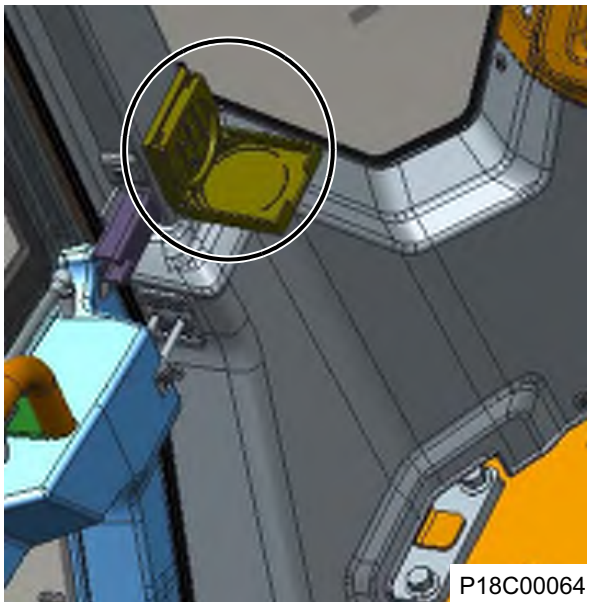
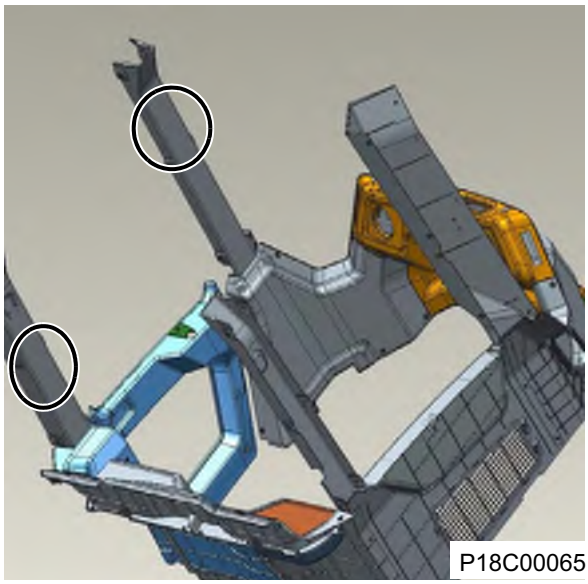
Removal of decoration

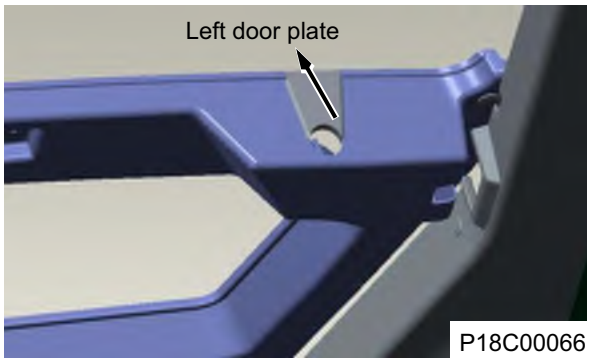
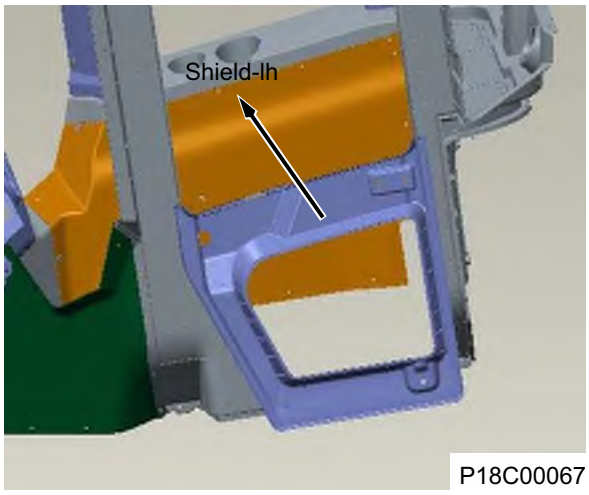
Removal of the rear right positioning lock trim cover in the cab

Figures	Operation step	Tools
 P18C00059	1. Screw out three setscrews on window-rh fixing lock cover and remove the cover.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002
 P18C00060	2. Screw out two countersunk bolts on window-rh position-ing lock cover.	Tool: Screwdriver for countersunk bolt 2 100P QB/ T2564.5-2002
 P18C00061	3. Screw out the set inflating screws on cover and remove the cover.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002

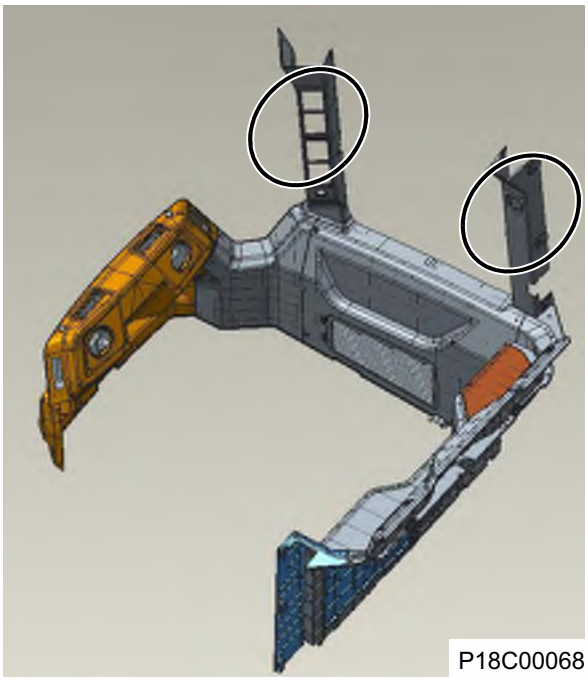
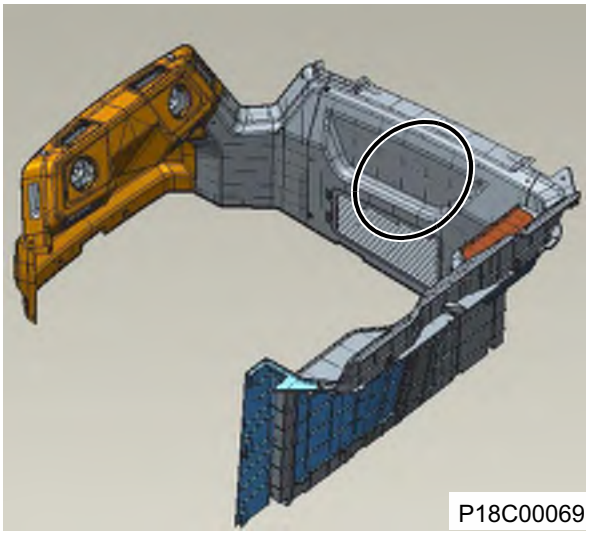
Removal of left decoration of cab

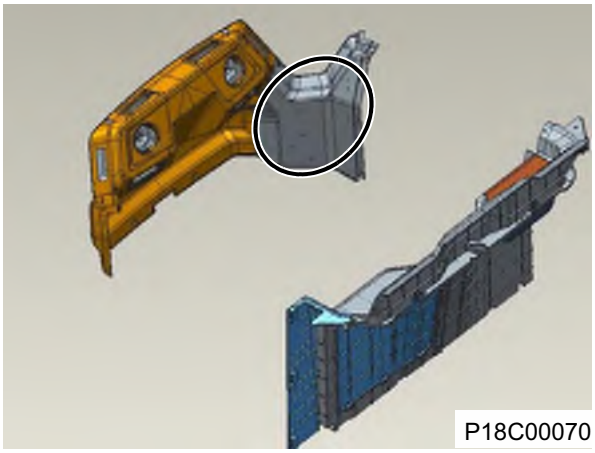
Figures	Operation step	Tools
 P18C00062	1. Loosen and remove the mounting bolt of fire extinguisher.	Tool: 10#Wrench
 P18C00063	2. Remove the floor mat directly from the cab.	

Figures	Operation step	Tools
 P18C00064	3. Screw off the 2 cross recessed screws from the cup mounting support.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002
 P18C00065	4. Screw off the screws from the left front and left rear decoration and then remove the decoration.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002

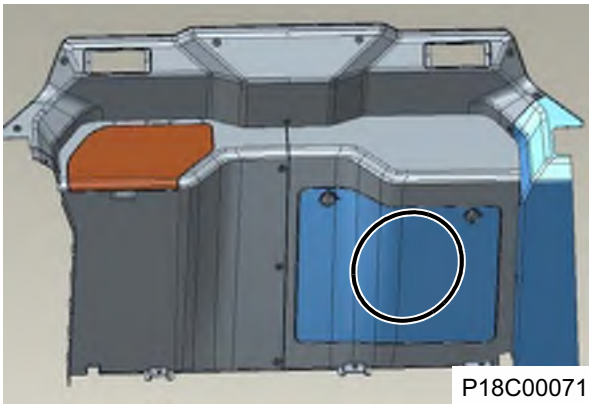
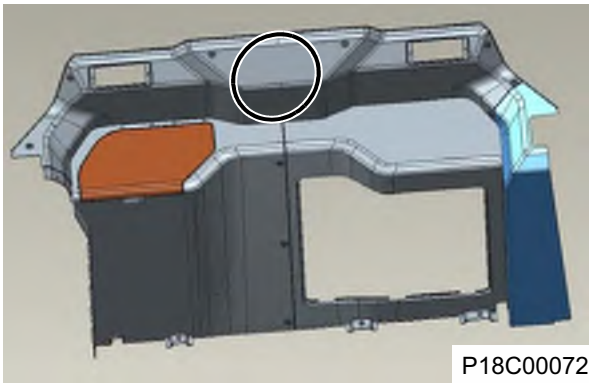
Figures	Operation step	Tools
 P18C00066	5. Remove the left door plate.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002
 P18C00067	6. Remove the set inflating screws and setscrews on door shield-lh and remove the shield-lh.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002

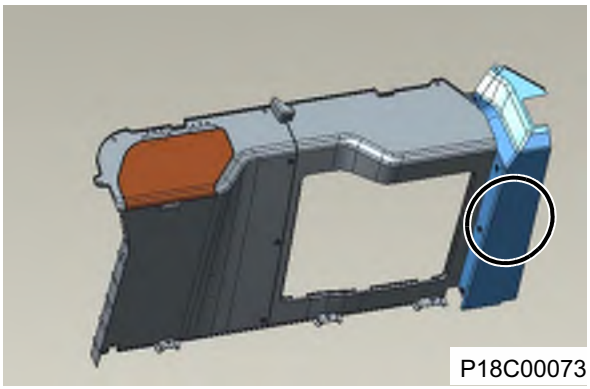
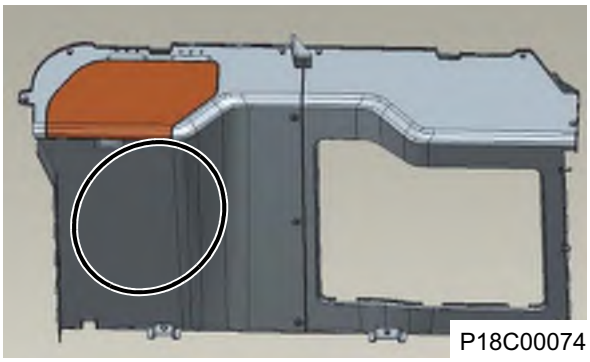
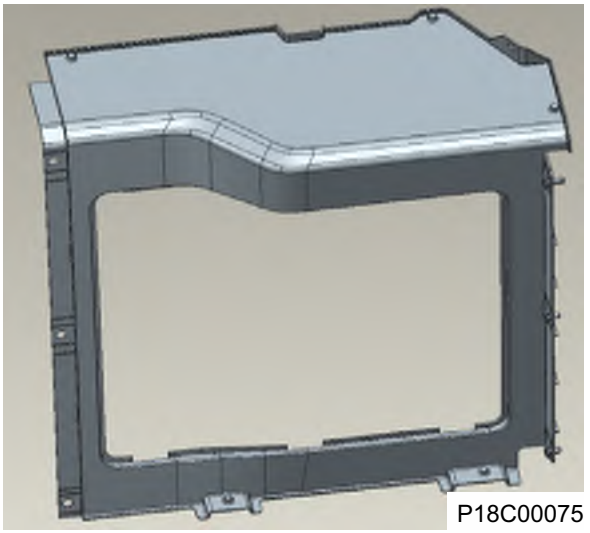
Removal of right decoration of cab

Figures	Operation step	Tools
 P18C00068	1. Remove the set inflating screws on right front&rear decorations and remove the right front&rear decorations.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002
 P18C00069	2. Remove the set inflating screws and mounting bolts on the right side decorations and remove the right side decorations.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002, 6# Open-end wrench

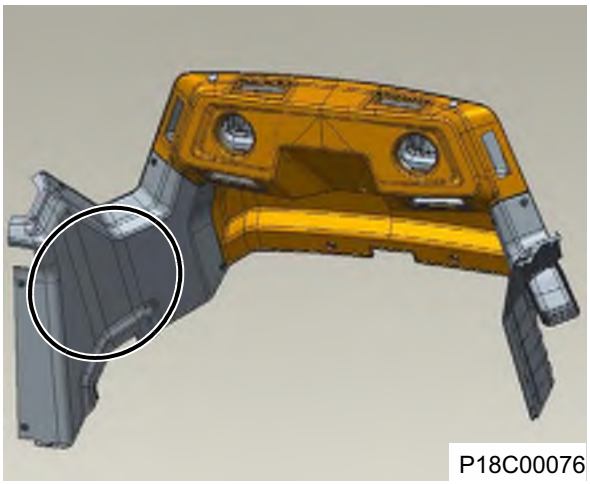
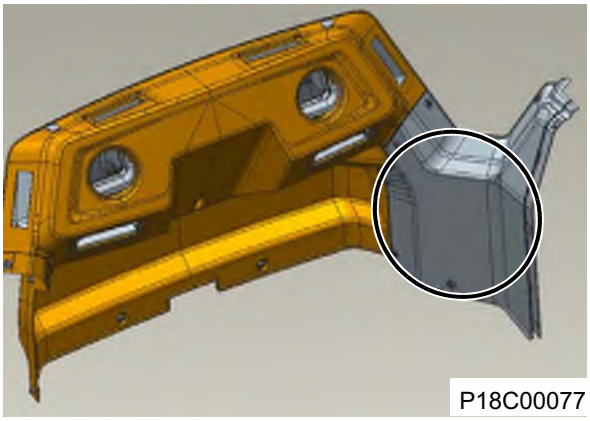
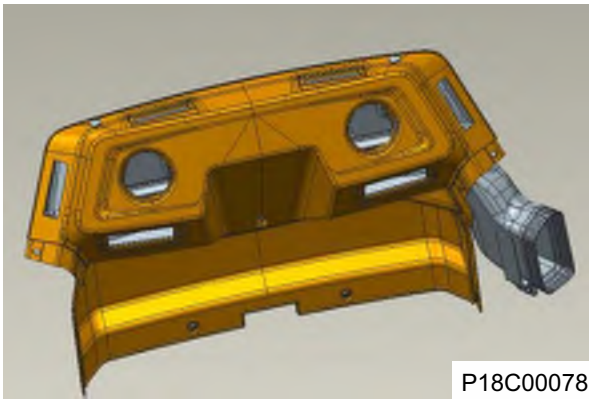
Figures	Operation step	Tools
 P18C00070	3. Remove the set inflating screws on the right front side decorations and remove the right side decorations.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002

Removal of decoration of rear plate

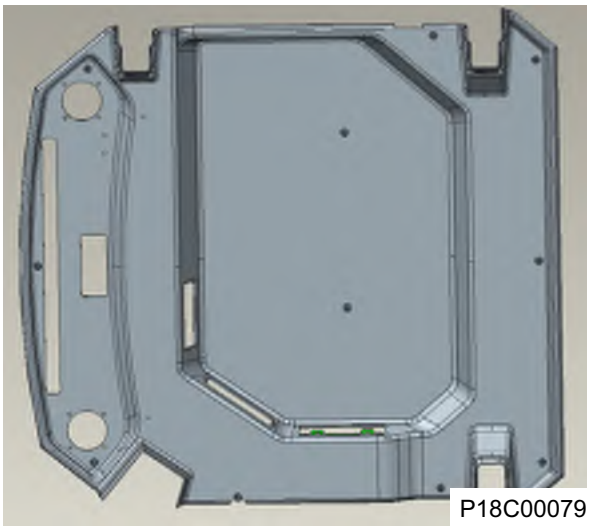
Figures	Operation step	Tools
 P18C00071	1. Remove two setscrews on access door by hands and remove the access door.	
 P18C00072	2. Remove the 8 inflating screws on the rear wall guard plate decoration and remove the rear wall guard plate decoration.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002

Figures	Operation step	Tools
 P18C00073	3. Remove the 3 set inflating screws on the decorations of rear plate-lh and remove the decorations of rear plate-lh.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002
 P18C00074	4. Remove the 4 bolts and 3 inflating screws on the decorations of rear plate-rh and remove the decorations of rear plate-rh.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002, 6# Open-end wrench
 P18C00075	5. Remove the 5 bolts and 3 inflating screws on the decorations of rear plate-lh and remove the decorations of rear plate-lh.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002, 6# Open-end wrench

Removal of decoration and platform and attachment

Figures	Operation step	Tools
 P18C00076	1. Remove the 7 set inflating screws on front decorations-lh and remove the front decorations-lh.	Tool: Cross-screwdriver 2 100P QB/T2564.5-2002
 P18C00077	2. Remove the 6 set inflating screws on front decorations-rh and remove the front decorations-rh.	Tool: Cross-screwdriver 2 100P QB/T2564.5-2002
 P18C00078	3. Remove the captive bolts on the platform decoration and remove the platform.	Tool: Screwdriver for countersunk bolt

Top decorations of cab

Figures	Operation step	Tools
 P18C00079	Remove the 12 setscrews on the top decorations and remove the top decorations.	Tool: Cross-screw-driver 2 100P QB/T2564.5-2002 Tool: Clean non-woven, Sika primer.

Assemble the glass of cab

1. Installation steps for glass:

⚠CAUTION

Before installing the glass, be sure that the machine is in parking brake state.

Figures	Operation step	Tools
 Clean and apply the base coat on it. P18C00080	1. Cleaning: dip a few amount of special activating agent with clean non-woven fabrics, and wipe the bonding position of steel window frame in one direction. 2. Prime coat: Shake the Sika primer sufficiently until the rolling of small ball inside the bottle can be heard, and continue shaking for another one minute. Wear protective gloves and apply a circle of primer evenly on the glass-bonded surface of window frame with a clean brush free of dead hairs.	Tool: Clean non-woven, Sika primer.
 Gluing P18C00081	3. Apply adhesive: wear protective gloves, apply Sika adhesive evenly to the glass bonding position or the bonding position of steel window frame with the surface treated along glass border, and make continuous triangular adhesive bead.	Tool: Sika glue

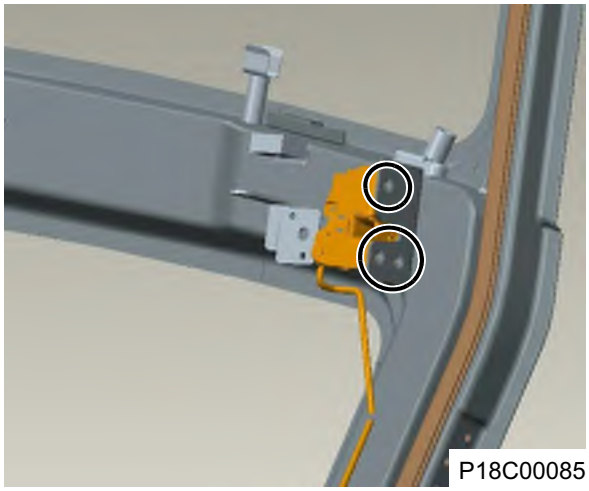
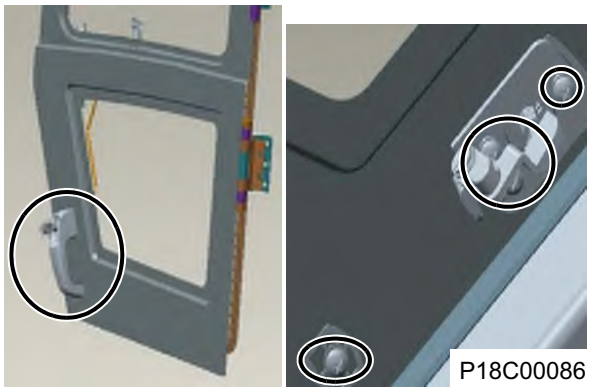
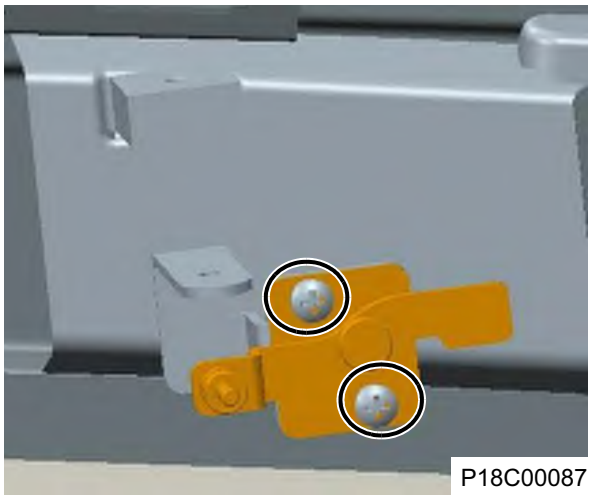
Figures	Operation step	Tools
 P18C00082	4. Put rubber blocks: insert rubber blocks at the inside of adhesive applying layer along the bottom at an interval of 30~35cm	Tool: Rubber limit block
 P18C00083	5. Bond glass: assist in installing the side glass with glass sucker and then installing the middle glass. Bond the glass to the steel window frame symmetrically, and apply pressure to bond glass, rubber blocks and steel window frame together closely. Pay attention that the gap between middle glass and side glass shall be about 8mm. Meanwhile fix all the glass with adhesive tape until the viscose dries.	Tool: Glass sucker Seal

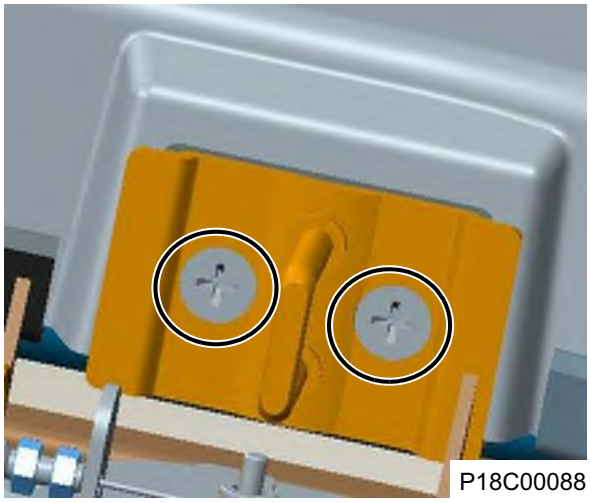
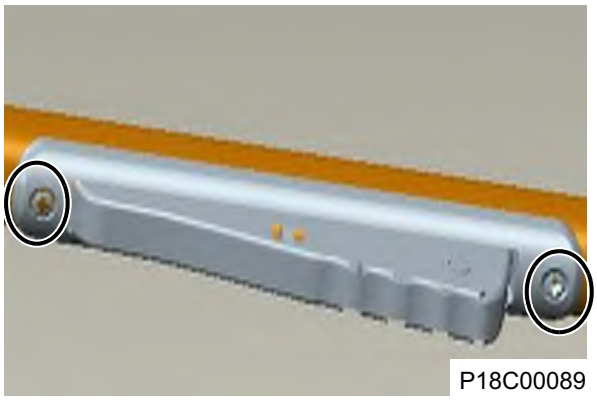
Figures	Operation step	Tools
 P18C00084	6. Glass joint filler: bond the color separation paper on both sides of adjacent glass edge, about 5mm away from the glass edge, and keep the spacing formed by color separation papers on both sides consistent from up to down; Meanwhile, seal the inside of glass joint with color separation paper to avoid rugged adhesive on the back when filling adhesive. After applying adhesive, flatten with self-made rubber plate.	Tool: Seal
Technical requirements: The speed of applying adhesive shall be even and the triangular adhesive bead shall be uniform without lumps or breakpoints. Insertion depth is 2mm. The rubber blocks shall not be placed within the scope of 10cm from corner point. The block shall not separate the adhesive bead. Flatten excessive glue of sheet metal side not receiving filler treatment, and no excessive adhesive shall remain.		

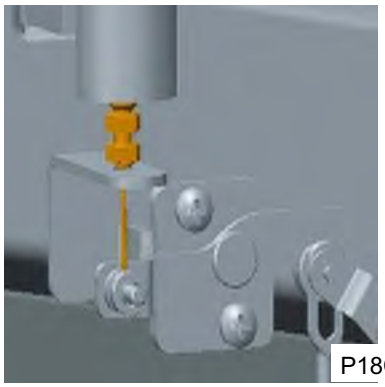
Installation of the left door lock in cab

⚠CAUTION

Before installing the left door lock, be sure that the machine is in parking brake state.

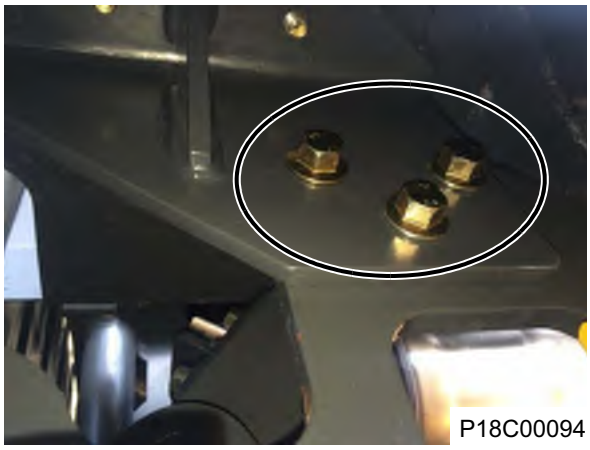
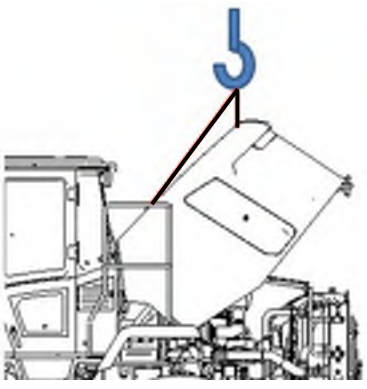
Figures	Operation step	Tools
 P18C00085	1. Check: check whether the left door lock parts are complete and in good condition or not. 2. Installation of lock block: Install lock block in the appropriate location of the door, and fix it with M6×16 screw. **⚠ Caution: The setscrews must be tightened without looseness.**	Tool: Cross screwdriver
 P18C00086	3. Installation of outside handle, mounting plate and pad: Install outside handle and mounting plate, pad in the appropriate location of the door together, and then fix them with M6×20 screw. The setscrews must be tightened without looseness.	Tool: Cross screwdriver
 P18C00087	4. Installation of adapter plate: Fix it with M6×16 screw, and setscrews must be tightened without looseness.	Tool: Cross screwdriver

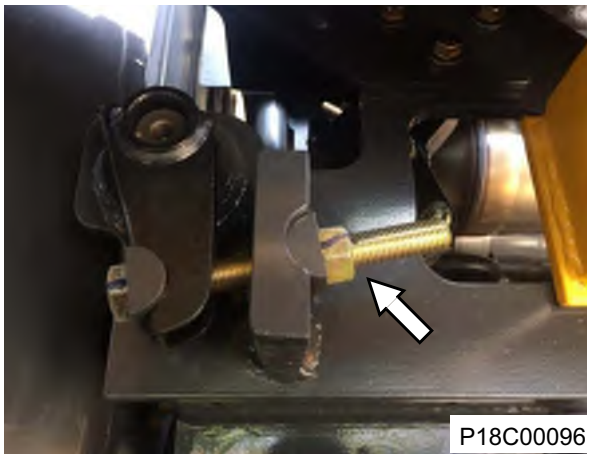
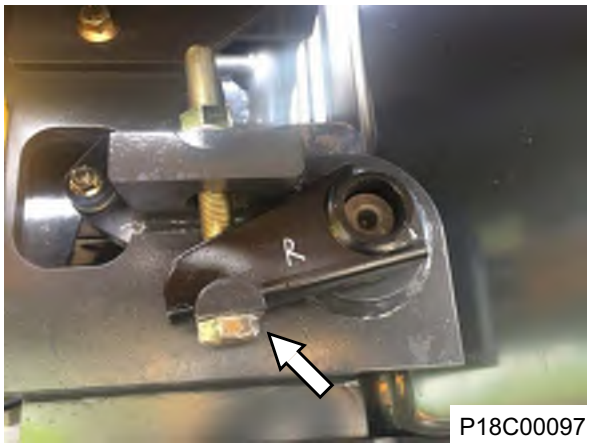
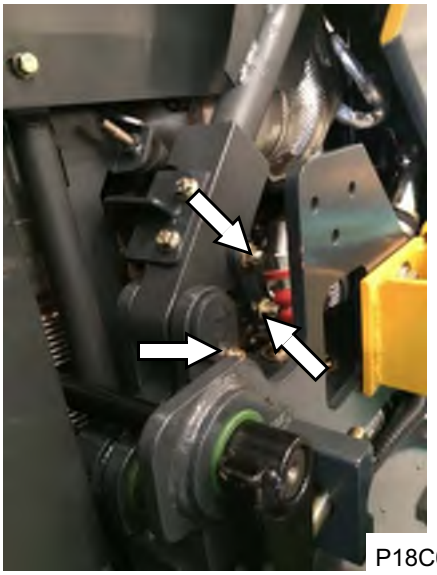
Figures	Operation step	Tools
 P18C00088	5. Installation of shim and lock buckle: Fix it with M8×20 screw after adjusting the lock buckle to the best locking position. Setscrews must be tightened without looseness.	Tool: Cross screwdriver
 P18C00089	6. Installation of inside handle in the left door locating lock: Fix it with screw, and setscrews must be tightened without looseness.	Tool: Cross screwdriver
 P18C00090	7. Adjust the mounting plate: Install the link in natural state into the mounting plate. **⚠ Caution: Adjust the screw cap to the best position, and install it into the mounting plate. The link needs to be left the movement clearance as 1-1.5mm.** **After installing the link, test the opening flexibility of outside handle by hand, and locking and opening in natural state should be flexible and spontaneous.**	

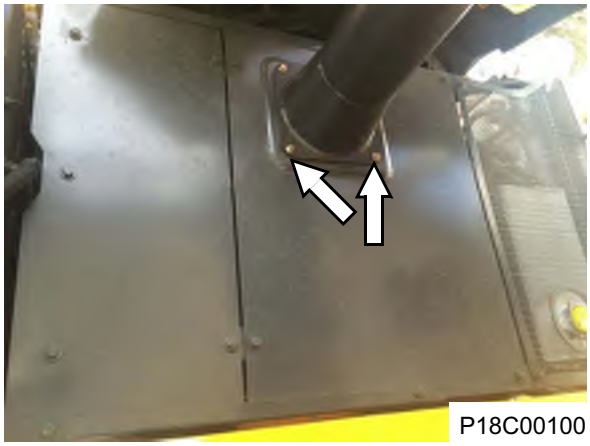
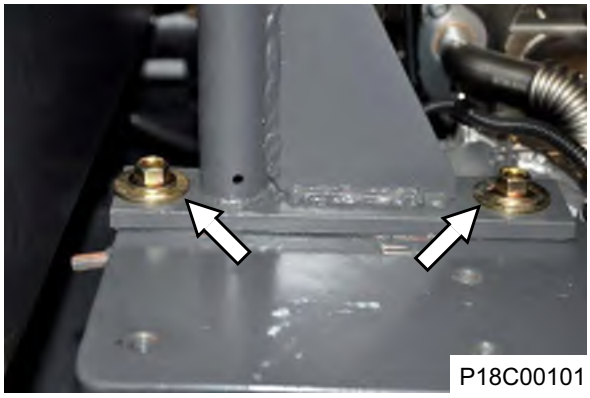
Figures	Operation step	Tools
 P18C00091	8. Adjustment of the inside handle in the left door locating lock: Connect the inside handle cable with the left door locating lock with adapter plate. **⚠ Caution:The setscrews must be tightened without looseness.** **After fixing the cable and adapter plate, the adapter plate should be left the natural movement clearance as 1-2mm.**	
 P18C00092	9. After installation, thoroughly check whether transmission, opening and locking of each parts of door lock are flexible or not.	

Removal and installation of engine hood

Removal of engine hood:

Reference picture	Operation step	Tools required
 P18C00093  P18C00094	1. Remove the mounting bolts of the left/right shield (symmetrical on both sides, 6 in total) with wrench, remove the left/right shield and place them on the level ground.	Tool: 16#Wrench
 P18C00095	2. Open the engine hood to the maximum angle, remove the harness connectors of license plate light, rear view camera. Hold the rear lifting points of rear cover with crane, lifting rings, etc.	Tool: Sling (1t), lifting ring (2×M16)

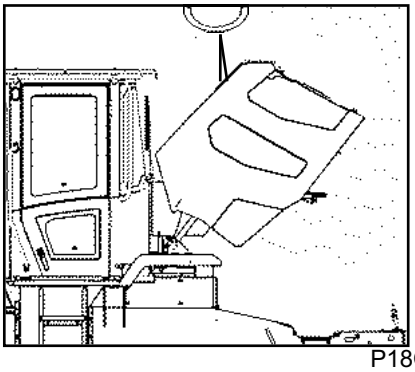
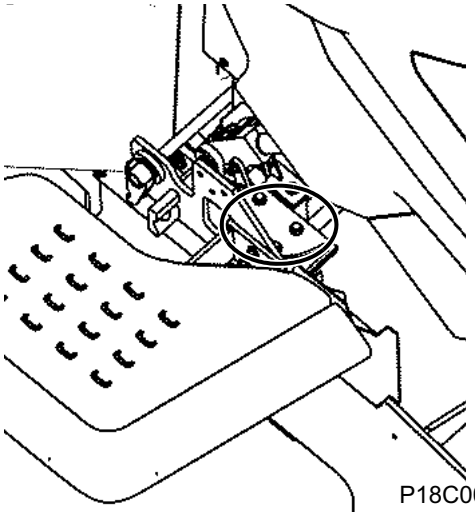
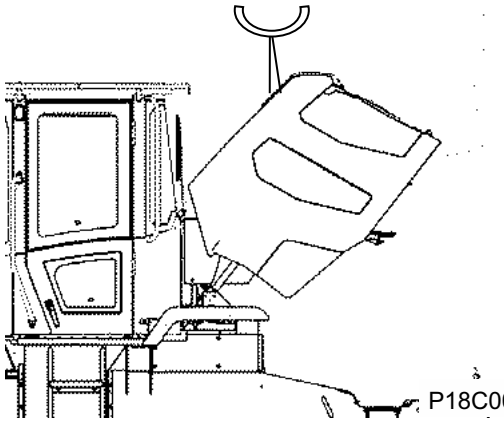
Reference picture	Operation step	Tools required
 P18C00096  P18C00097	3. Remove the bolt assembly of torsion spring at left and right sides of engine hood.	Tool: 24# Wrench
 P18C00098	4. Remove the link bolts at left and right sides of engine rear hood and 4 in total. Remove the captive bolts (2 in total) of hinge pin at left and right sides of engine rear hood and knock out the pin.	

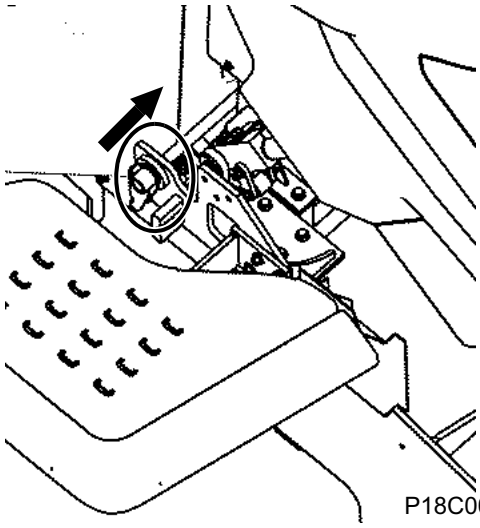
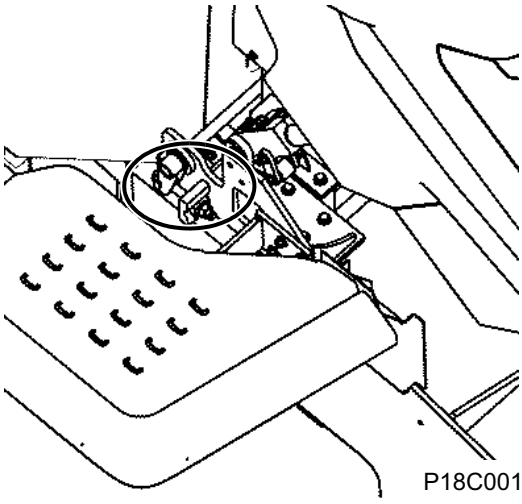
Reference picture	Operation step	Tools required
 P18C00099	5. Lift the engine rear hood out slowly and place it on the level ground.	Tool: Traveling crane Sling
 P18C00100	6. Remove the 4 captive bolts from exhaust pipe tail section and remove the exhaust pipe.	Tool: Open-end wrench 13#
 P18C00101	7. Remove the anchor bolts (4 in total) at left front and right front sides of engine upper hood bracket.	Tool: Open-end wrench 19#

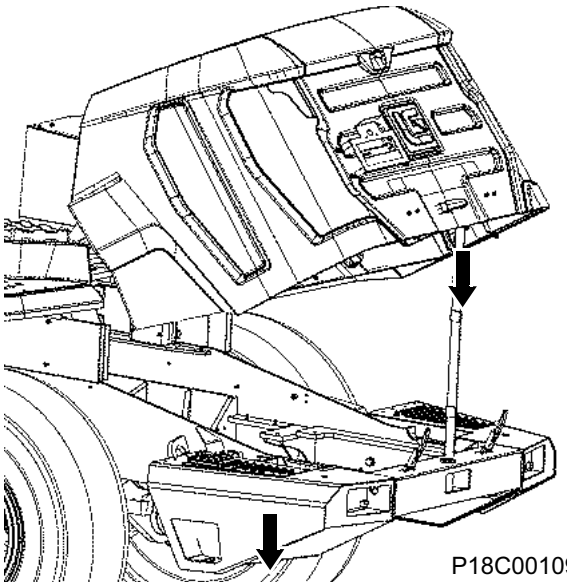
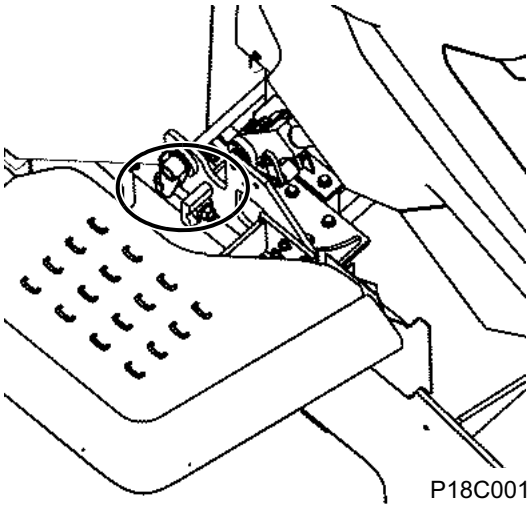
Reference picture	Operation step	Tools required
 P18C00102	8. Remove the captive bolts (4 in total) at left rear and right rear sides of engine upper hood bracket.	Tool: Open-end wrench 19#
 P18C00103	9. Lift up the upper hood slowly and place it on the level ground	Tool: Traveling crane Sling

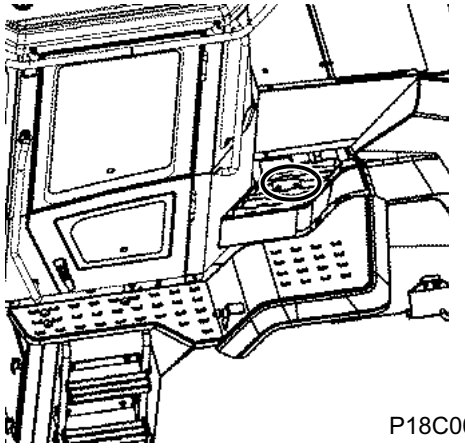
Installation of engine hood

Step of installing engine hood onto machine: install it by the opposite steps of removal.

Reference picture	Operation step	Tools required
 P18C00104	1. Lift and install the rear hood and hinge support together to the complete machine with a sling, a overhead crane, etc.	Sling (1t)
 P18C00105	2. After adjusting the position of hood, install the bolts of hood hinge support to the brackets on the left and right sides of hood with 16# wrench and tighten them.	16# Wrench
 P18C00106	3. Operate the overhead crane to lift and open the rear hood to an angle about 50°	Sling (1t)

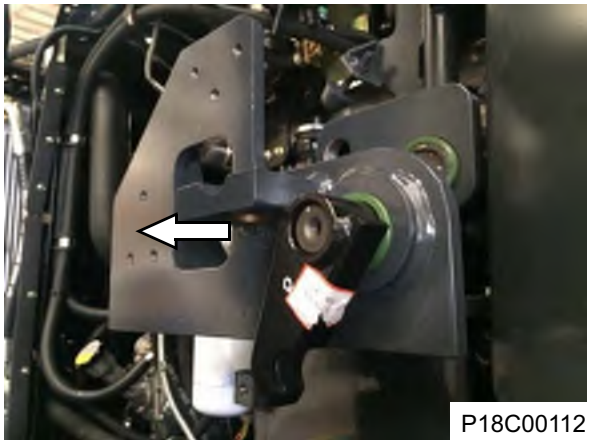
Reference picture	Operation step	Tools required
 P18C00107	4. Pass the torsion spring through the hinge support from both sides respectively,where the torsion spring- left is at bottom while the torsion spring - right is at top.	/
 P18C00108	5. Adjust the position of torsion spring and slowly lock the torsion spring with bolts and nuts, during which try to loosen the lifting point and the overhead crane can be removed when the opening angle of hood is kept between 50°-52°without changing.	#Wrench

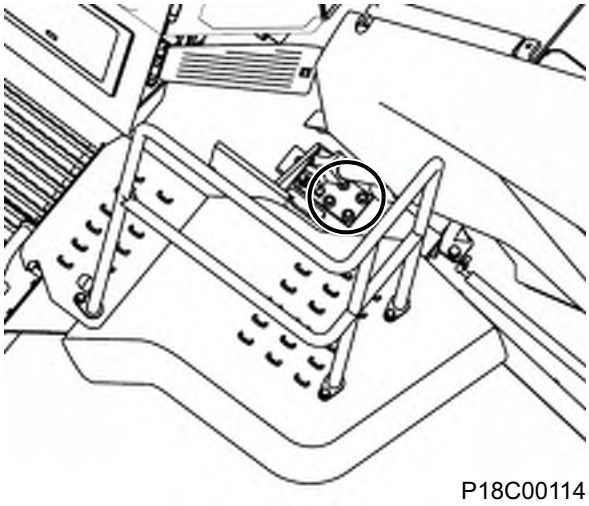
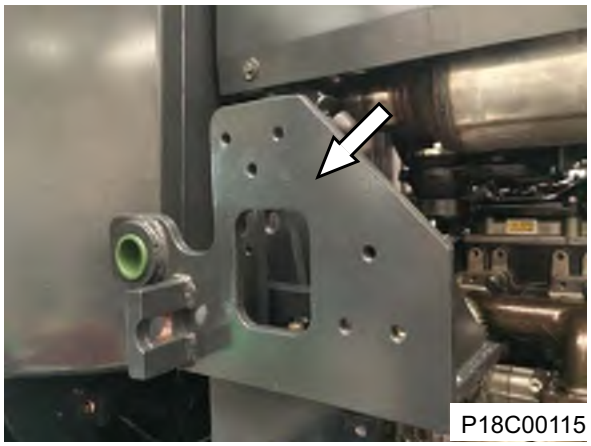
Reference picture	Operation step	Tools required
 P18C00109  P18C00110	6. Pull down the lock along with the direction of arrow to close the engine hood slowly until the pull force is nearly the same with that of hood before removal and installation and the hood adjustment is completed, and if the pull force is too large, the nut and bolt locking the torsion spring can be properly loosened under the condition of ensuring about 50° opening of engine hood and if the hood is opened less than 50°, the nut and bolt locking the torsion spring can be further tightened	#Wrench

Reference picture	Operation step	Tools required
 P18C00111	7. Install the pedals-lh and rh and shields-lh and rh and tighten the mounting bolts with 13# wrench (symmetrical on both sides, 4 in total).	13#Wrench

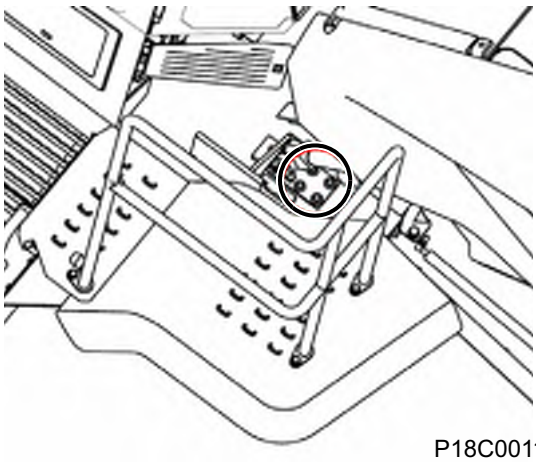
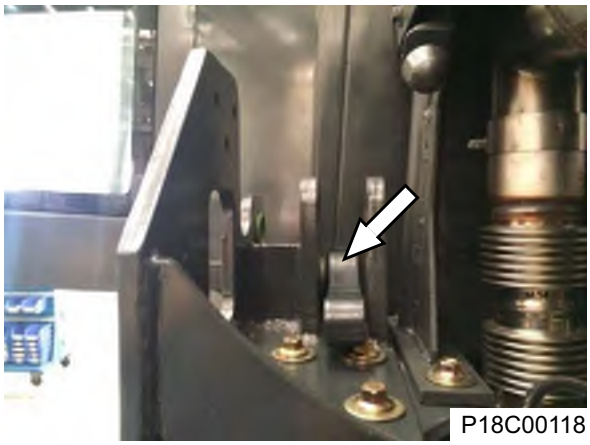
Removal and installation of the engine hood torque mechanism

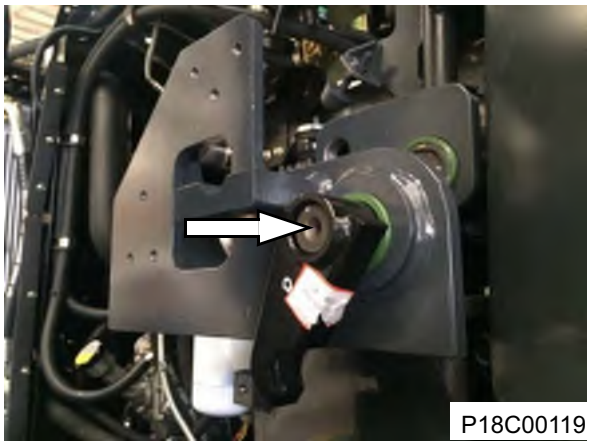
Disassembly of lifting mechanism of torsion bar

Reference picture	Operation step	Tools required
	1. Refer toRemoval of engine hood:	
 P18C00112	2. Remove the left and right torsion spring from both sides respectively.	

Reference picture	Operation step	Tools required
 P18C00113	3. Remove the push rod at left and right sides	
 P18C00114	4. Remove the bolts from the engine hood hinge support with 16# wrench (symmetrical on both sides, 10 in total).	16#Wrench
 P18C00115	5. Lift and place the left and right support on the level ground with overhead crane.	Overhead crane (1t), Manila rope

Installation of lifting mechanism of torsion bar

Reference picture	Operation step	Tools required
 P18C00116	1. Lift and place the left and right support on the mounting position with overhead crane.	Overhead crane (1t), Manila rope
 P18C00117	2. Tighten the bolts of the engine hood hinge support with 16# wrench (symmetrical on both sides, 10 in total).	16#Wrench
 P18C00118	3. Place the left and right push rods at the mounting position.	

Reference picture	Operation step	Tools required
 P18C00119	4. Pass the torsion spring through the hinge support from left and right sides respectively,where the torsion spring- left is at bottom while the torsion spring - right is at top.	Copper bar
	5. Refer toInstallation of engine hood	16#Wrench

Structure

Structure Function Principle

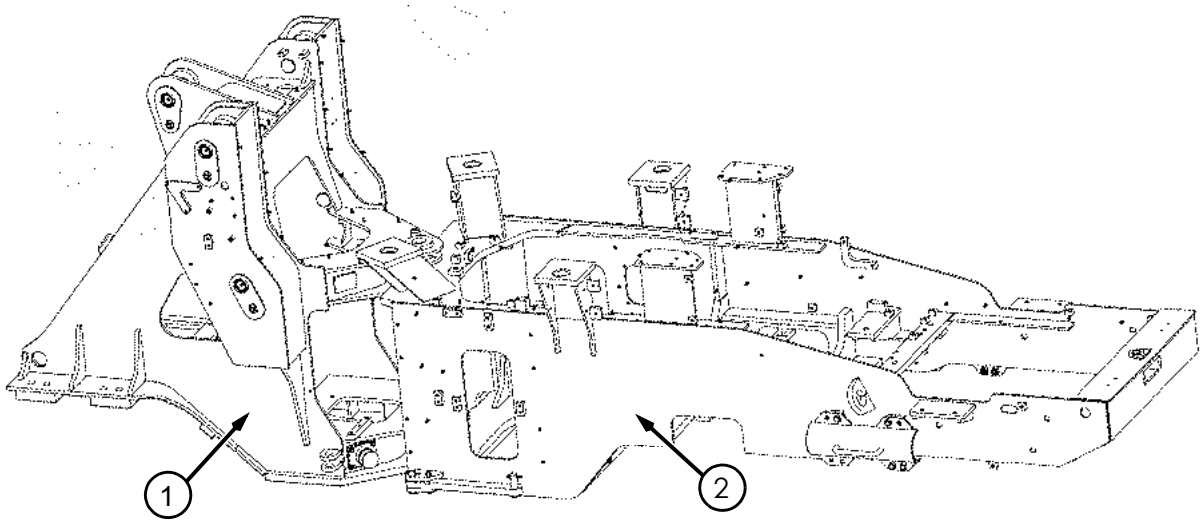
Frame system

Frame overview

The frame system includes front frame and rear frame. Front frame is of a welded frame structure, which is mainly used for installing front axle system, work implement system, etc. Rear frame is of a welded frame structure, which is mainly used for installing engine system, transmission & torque converter system, rear axle assembly, cooling system, engine hood assembly, counterweight, etc.

Frame configuration scheme

Frame system



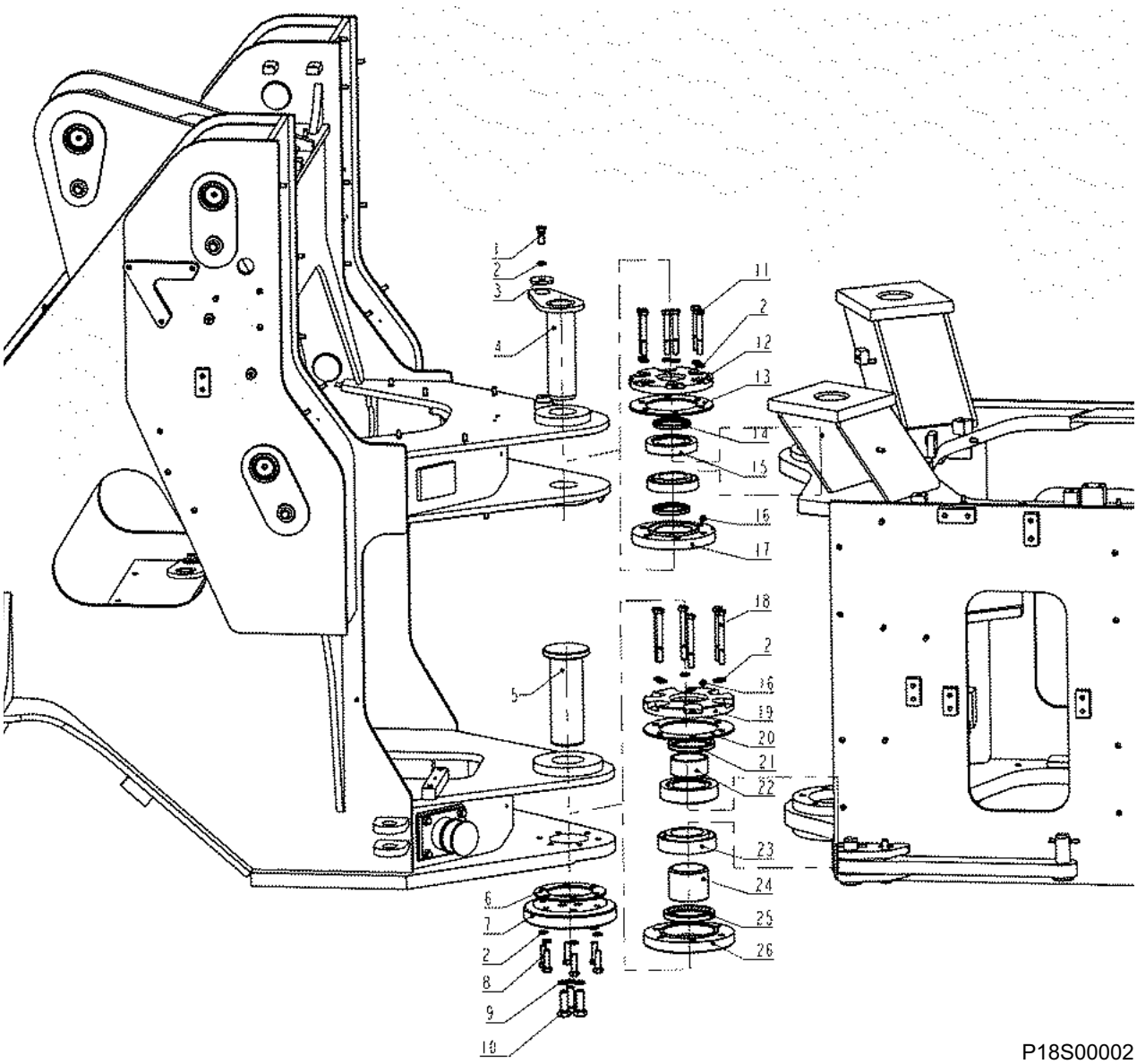
P18S00001

1. Front frame
2. Rear frame

Articulated hitch

Overview and configuration scheme of hinge assembly

The hinge assembly is the key part to connect front frame and rear frame and make front and rear frames to function in relatively steering.



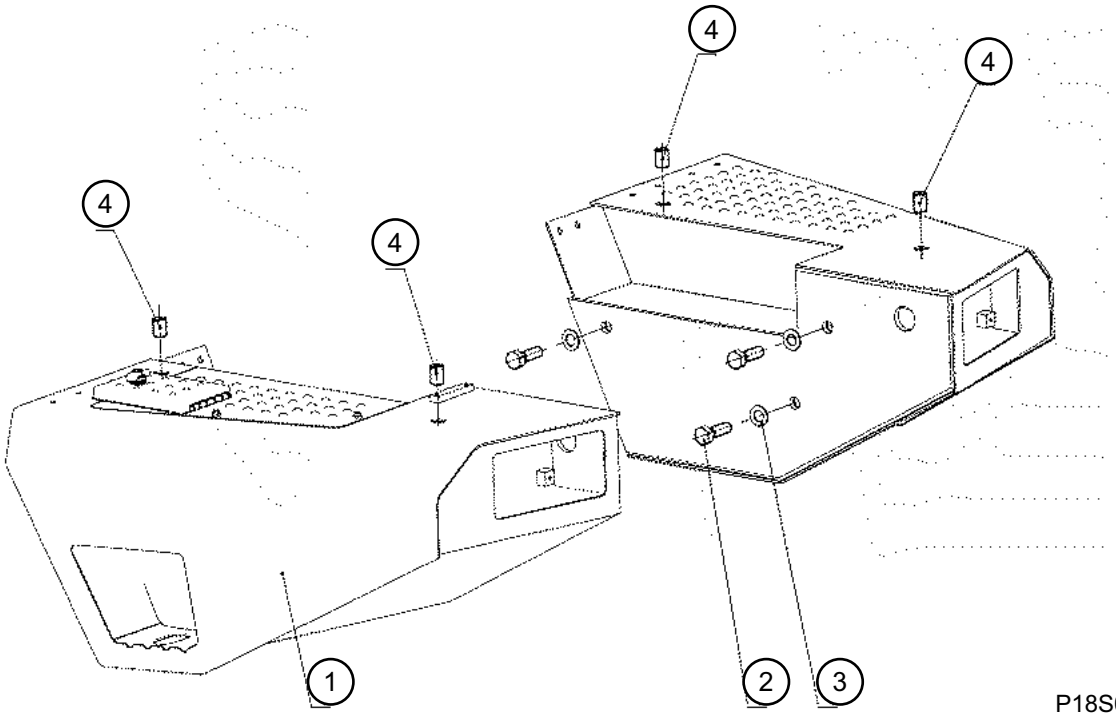
P18S00002

1. Bolt
2. Washer
3. Plate
4. Lower hinge pin
5. Hinge pin
6. Shim
7. Pin-on-disk
8. Bolt
9. Washer
10. Bolt
11. Bolt
12. Bearing cover
13. Shim
14. Seal ring
15. Tapered roller bearing
16. Grease fitting
17. Bearing cover
18. Bolt
19. Bearing cover
20. Shim
21. Seal ring
22. Spacer sleeve
23. Tapered roller bearing
24. Spacer sleeve
25. Seal ring
26. Bearing cover

Counterweight assembly

Overview and configuration scheme of counterweight assembly

Counterweight assembly is mainly connected and installed on both sides of rear frame tail by bolts, and mainly used for installing the battery, disconnect switch, rear floodlight, etc.



1. Counterweight assembly
2. Bolt
3. Washer
4. Plug

Note: If it is necessary to remove and install left and right battery boxes, first take out plug (4), and then install 4 M24 lifting screws that are used for lifting left and right battery boxes.

Work implement

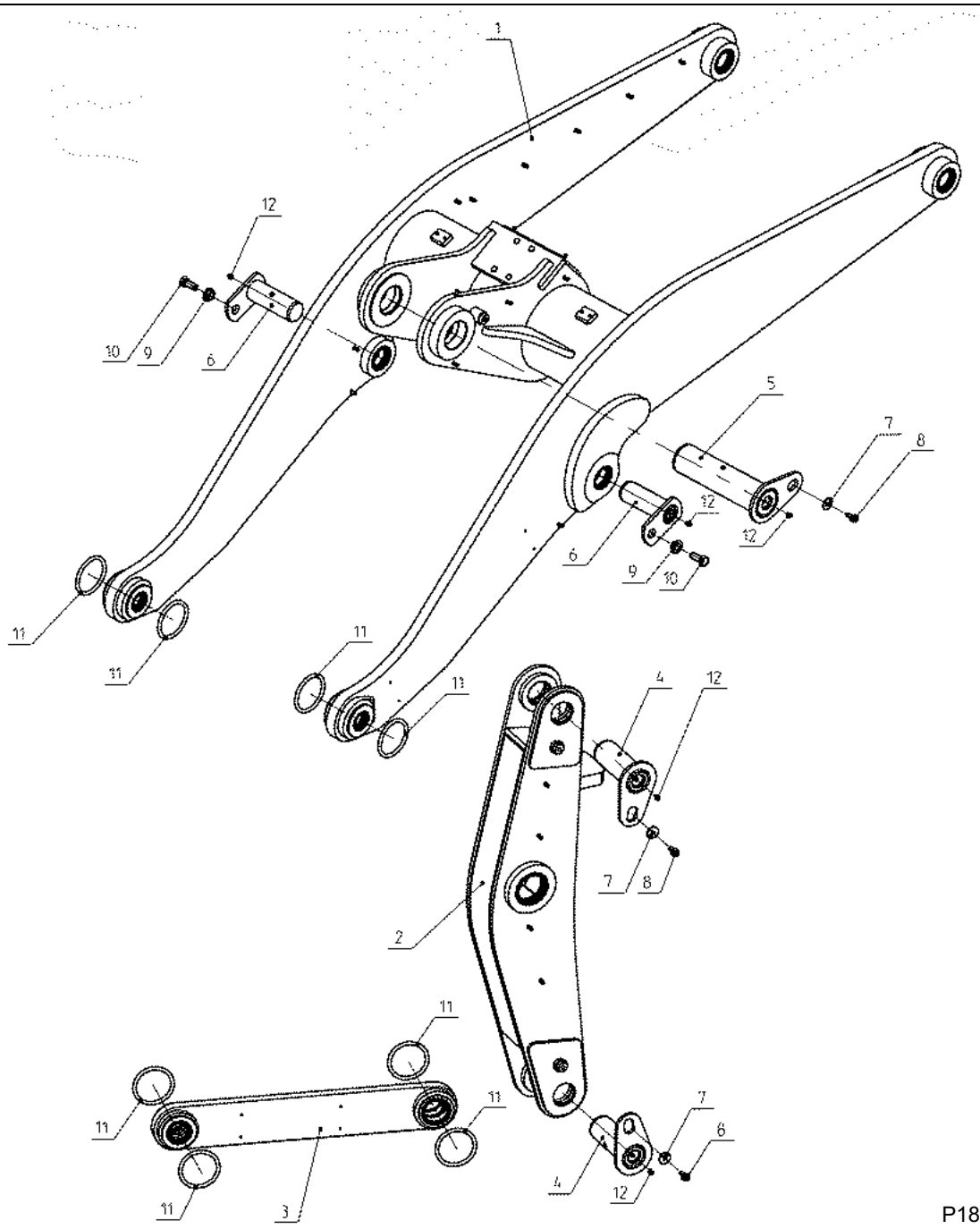
The parameters of work implement

Items	Standard boom+1.9 square quick coupler bucket	Standard boom+general bucket of 1.9 cubic meters	Extension boom +1.9 square quick coupler bucket	Extension boom+general bucket of 1.9 cubic meters
Dumping height	2650mm/ 104in	2762mm/ 108in	2930mm/ 115 in	3043mm/ 120in
Dumping reach	1150mm/ 45in	1050mm/ 41in	1157mm/ 45in	1058mm/ 42in
Breakout force of the bucket	85KN/ 19kips	100KN/ 22kips	83KN/ 18kips	98KN/ 22kips
Breakout force of the boom	71KN/ 16kips	78KN/ 17kips	64KN/ 14kips	70KN/ 16kips

Overview and configuration scheme of work implement system

Work implement is a reverse six-link mechanism, which is critical part for the whole loader to finish the motions of loading, transportation, discharge, etc., the bucket is installed on the front end of work implement, and the rear end is connected with front frame by the pin.

Work implement system



P18S00004

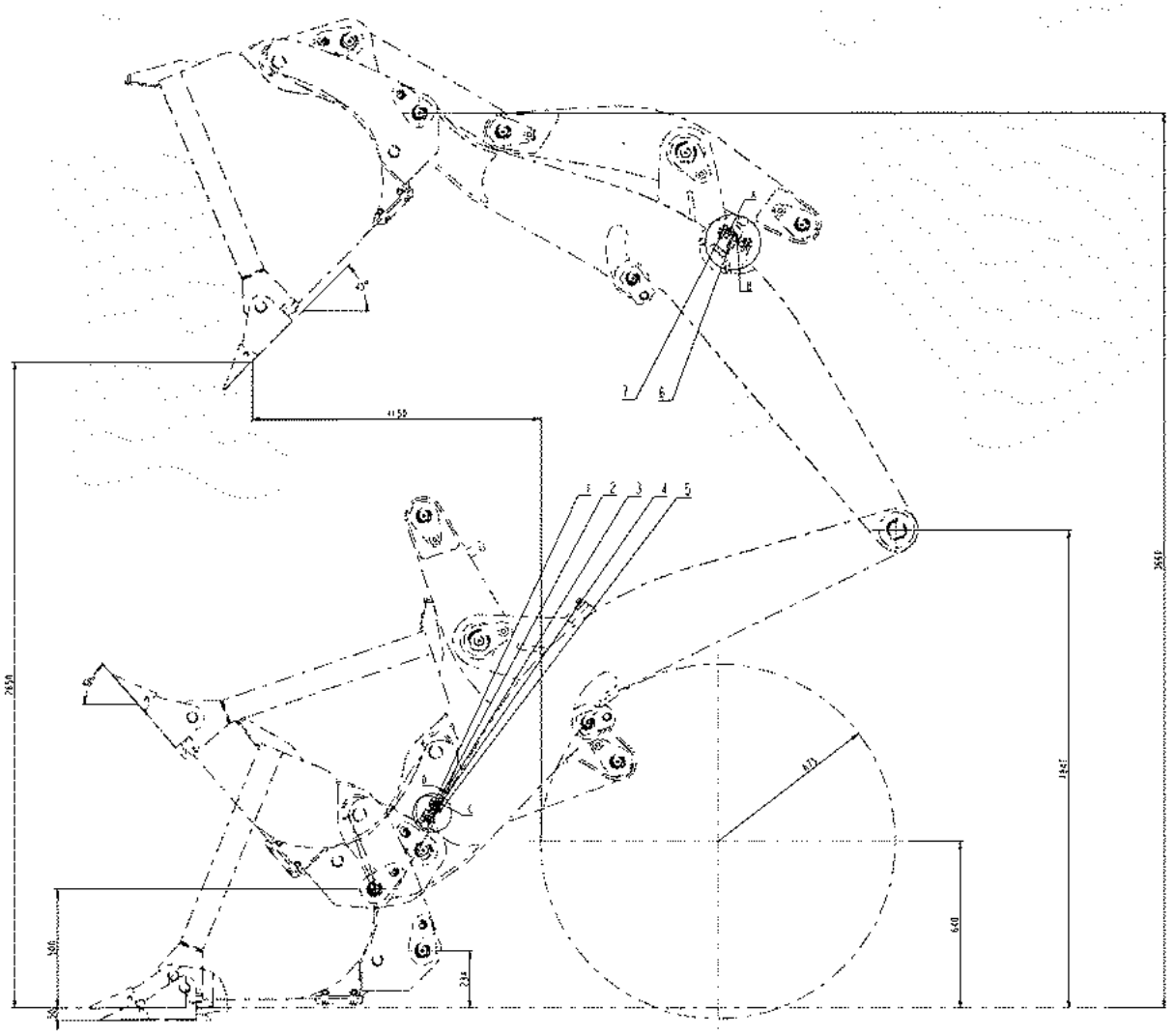
1. Boom
2. Rocker arm
3. Linkage
4. Pin
5. The middle pin of rocker arm
6. Pin assembly
7. Washer
8. Bolt
9. Cushion cover
10. Bolt
11. O-ring
12. Oil cup

Notes: For each hinge pin of work implement, the shim with appropriate thickness shall be selected according to assembly clearance to make sure clearance at one side is less than 1mm/0.04in.

Work implement limit system

Work implement limit system is mainly to limit cylinder stroke so as to protect the cylinder and overall work implement.

Diagram of standard boom limit system



P18S00005

1. Plate group
2. Rubber
3. Socket
4. Block
5. Bolt
6. Block group
7. Bolt

Notes: For each hinge pin of work implement, the shim with appropriate thickness shall be selected according to assembly clearance to make sure clearance at one side is less than 1mm/0.04in.

Assembly requirements for limiting system of work implement (Note: take standard boom as an example here):

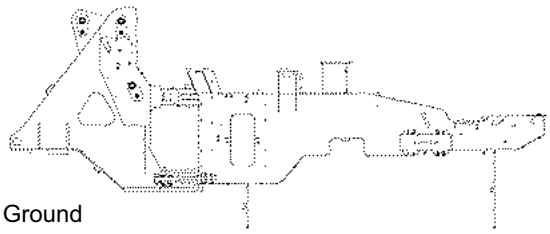
1. When the lower pin of bucket is 500mm/20in from the ground, turn up the bucket to form an angle of 48° with horizontal plane, then select the plate with appropriate thickness in plate groups (1) to install it on plane C according to the clearance between planes C and D, and guarantee block group (4) clings with plane D after installation.
2. When the pin is 3,660mm/144in from the ground, and the discharge angle is 45°, select block with appropriate thickness in block groups (6) to install it on plane A according to the clearance between planes A and B, and guarantee it clings with plane B.

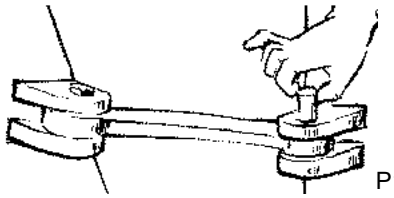
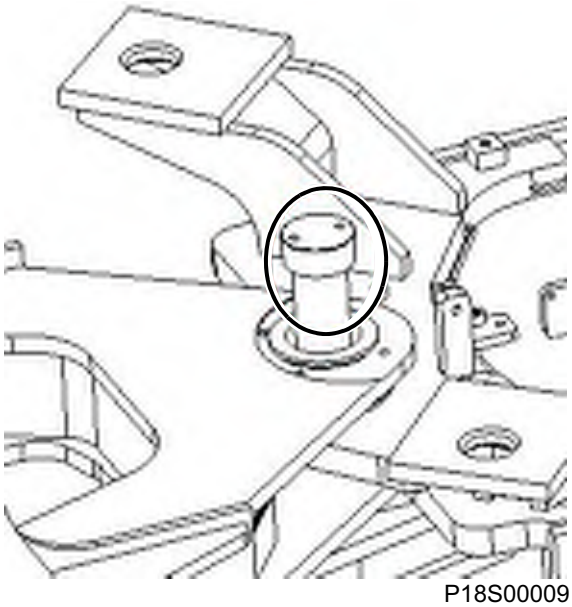
Removal and Installation

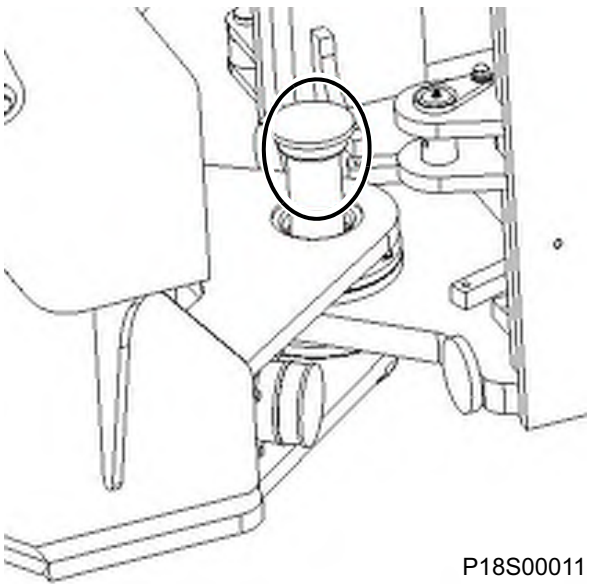
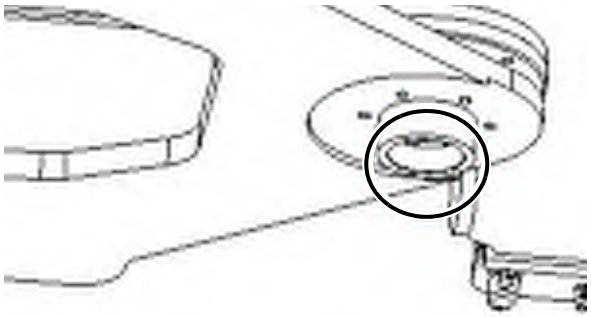
Removal and installation of hinge assembly

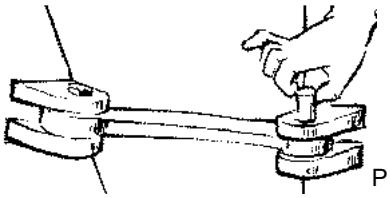
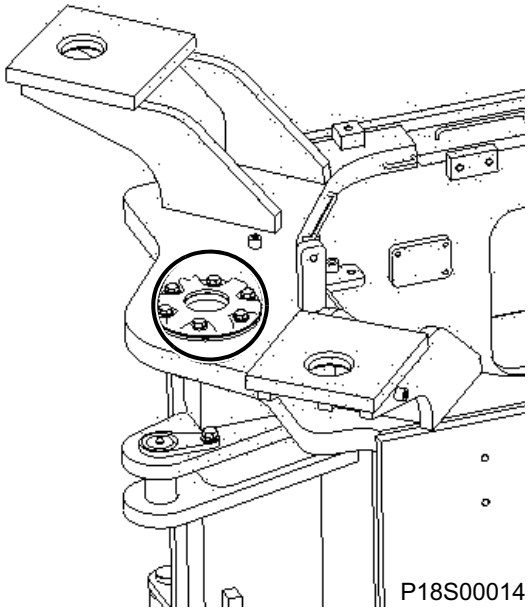
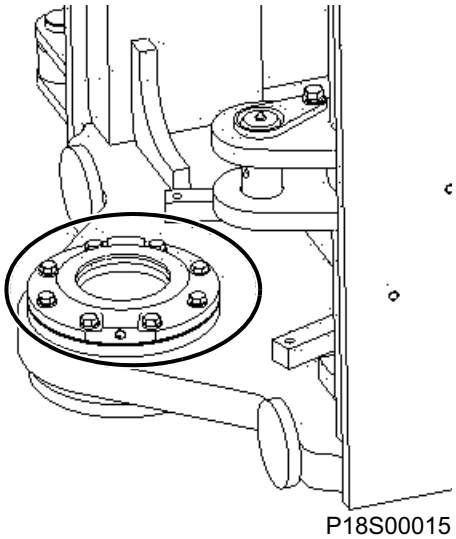
Removal of hinge assembly

Removal description:Before removing hinge assembly, please remove bucket assembly, work implement assembly, front axle assembly, cab assembly, engine assembly, transmission assembly, radiator assembly, cover assembly, counterweight assembly, hydraulic system, electrical system, etc., and only reserve front frame, rear frame, rear axle assembly and tire.

Figures	Operation instruction	Tools
 P18S00006	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 660mm/25.98in from the ground, and the rear end is 980mm/38.58in from the ground)	
	2. Hook the front frame by a lifting appliance and tighten the hanger slightly **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 5ton)

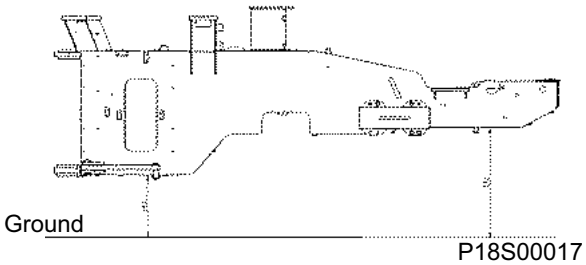
Figures	Operation instruction	Tools
 P18S00007	3. Install steering fixed link to prevent front and rear frames rotating.	Nipping pliers
 P18S00008	4. Remove upper hinge pin 1) Remove the upper hinge captive bolt and take down the cover plate	18# Wrench
 P18S00009	2) Knock out the upper hinge pin with pin knocking tooling and sledge hammer	Pin knocking tooling and sledge hammer

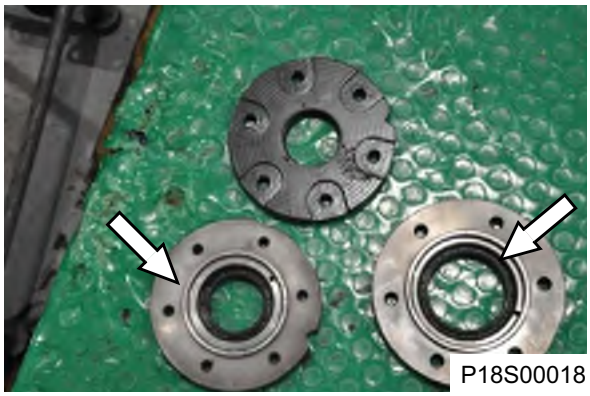
Figures	Operation instruction	Tools
 P18S00010	5. Remove lower pin 1) Remove the captive bolt of the lower hinge lock plate and take off the plate	18#, 24# Wrench
 P18S00011	2) Knock out the lower hinge pin with pin knocking tooling and sledge hammer	Pin knocking tooling and sledge hammer
 P18S00012	3) Remove the spacer sleeve	Removal tooling of spacer sleeve

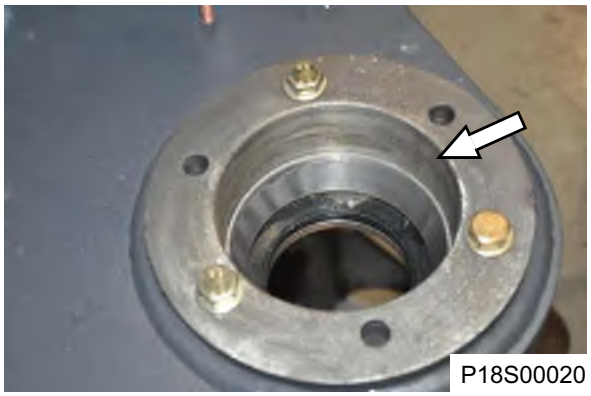
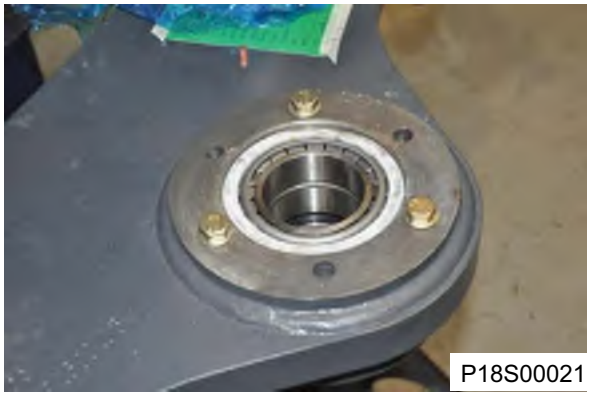
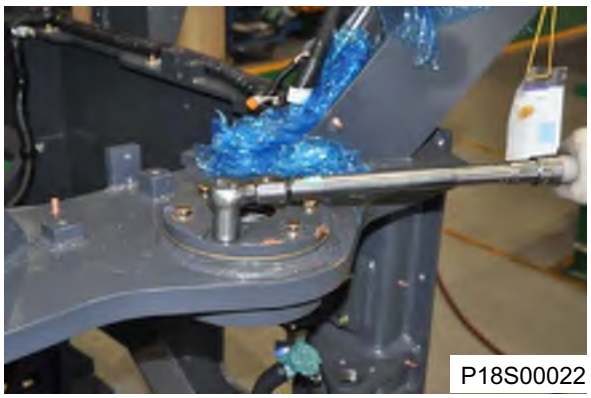
Figures	Operation instruction	Tools
 P18S00013	6. Remove steering fixed link, and lift the front frame out with lifting equipment and place on firm ground **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 5ton)
 P18S00014	7. Remove 6 captive bolts from upper hinge and remove the upper and lower end cover	18# Wrench
 P18S00015	8. Remove eight captive bolts from lower hinge, and remove upper cover and lower end cover	18# Wrench

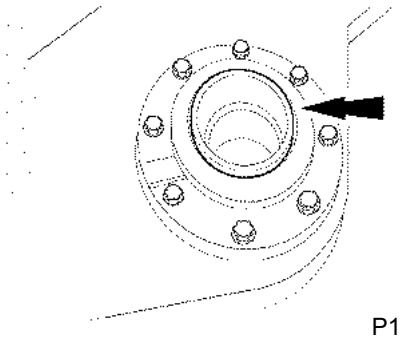
Figures	Operation instruction	Tools
 P18S00016	9. Knock out the bearings of upper and lower hinge with bearing knocking tooling and sledge hammer.	Bearing knocking tooling and sledge hammer

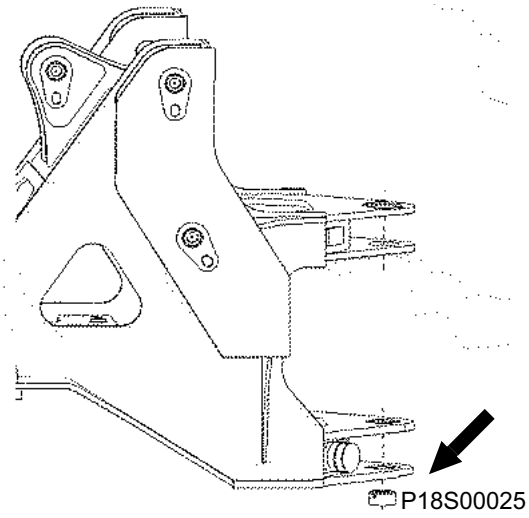
Installation of hinge assembly

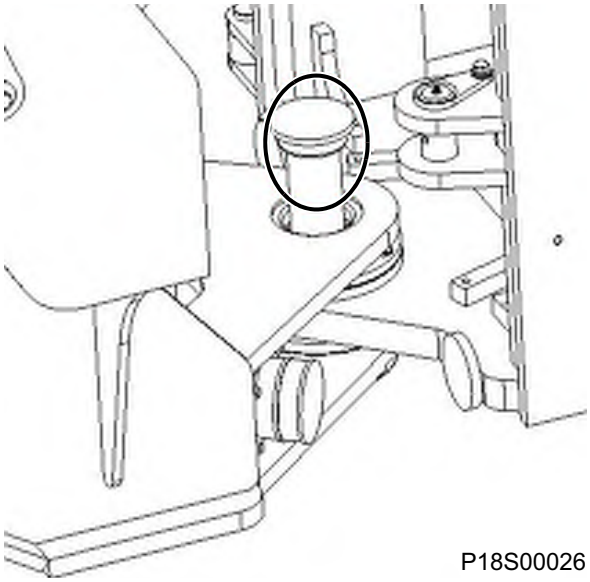
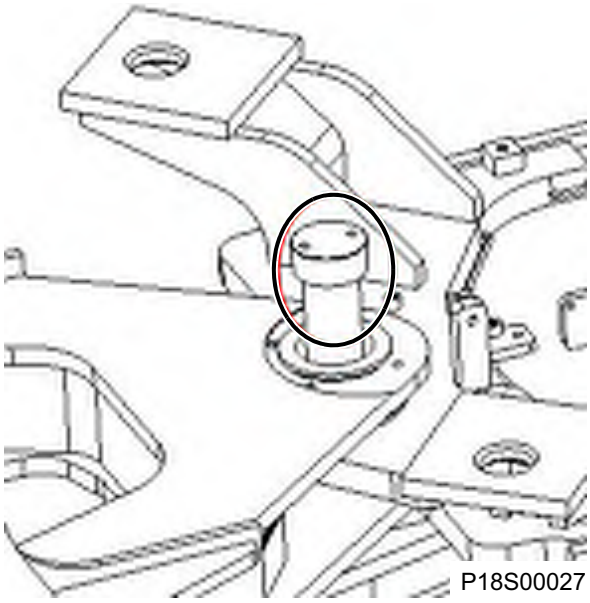
Figures	Operation instruction	Tools
 P18S00017	1. Lift rear frame with lifting equipment and put it on special firm tooling to make sure it is in level, safe and steady state (the front end of rear frame is about 660mm/25.98in from the ground, and the rear end is about 980mm/38.58in from the ground) **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 5ton)
	2. Put two pairs of bearing cone cups into liquid nitrogen for freezing until there is not a lot of smoke coming out.	Liquid nitrogen, hook fixture

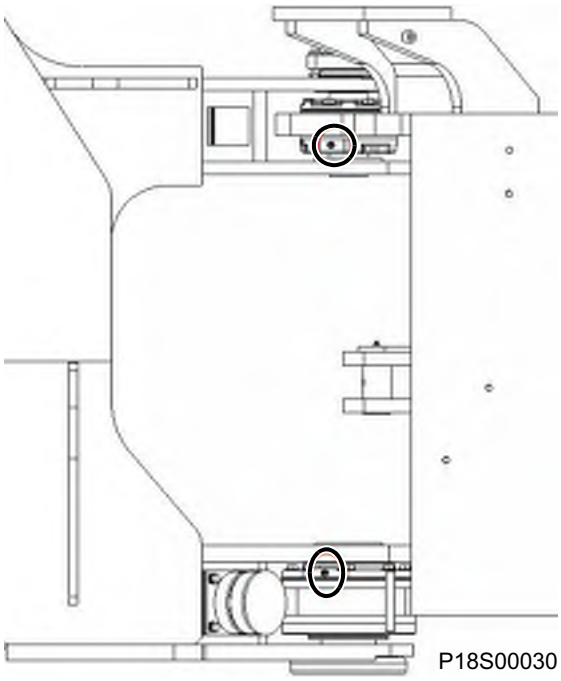
Figures	Operation instruction	Tools
 P18S00018	3. Install dust rings into upper and lower covers respectively, and apply grease to the lip of dust ring and the inner walls of upper and lower hinge hole.	Copper bar
 P18S00019	4. Fix the lower hinge lower cover on the rear frame with bolts.	18# Wrench

Figures	Operation instruction	Tools
 P18S00020	5. Install one frozen tapered roller bearing cone cup into lower hinge hole	Copper bar and bearing knocking tooling
	6. Install two tapered roller bearing cones into lower hinge holes, and pay attention that two tapered roller bearing cones are in opposite directions.	Copper bar
 P18S00021	7. Install another frozen taper roller bearing cone cup into lower hinge hole.	Copper bar and bearing knocking tooling
 P18S00022	8. Select the shim with appropriate thickness, install the shim and upper and lower covers, tighten mounting bolts, and tightening torque is: 120±10N.m/ 88.5±7.375 lbf·ft.	18# Wrench Torque wrench

Figures	Operation instruction	Tools
 P18S00023	9. Install the tooling for measuring bearing torque	Bearing torque tooling
	10. Measure the torque needed to rotate upper hinge bearing, and normal torque is: 2.3~13.6N.m/ 1.7~10.03 lbf·ft. If the torque is not within the scope, it can decrease or increase the shims to reach normal rotating torque.	Torque wrench, 18# wrench
	11. Install the lower hinge referring to Steps 4~10.	
 P18S00024	12. Install the lower hinge spacer sleeve	Copper bar
	13. Measure the torque needed to rotate lower hinge bearing, and normal torque is: 7.9~22.6N.m/ 5.83~16.67 lbf·ft. If the torque is not within the scope, it can decrease or increase the shims to reach normal rotating torque.	Torque wrench

Figures	Operation instruction	Tools
 P18S00025	14. Install the lower bushing	Copper bar
	15. Lift front frame to mounting position with lifting equipment, and align the hinge hole of front frame with that of rear frame **⚠ WARNNING: Fingers cannot be put into the hole when aligning with the hole, otherwise it may cause personal injury!** **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 5ton)

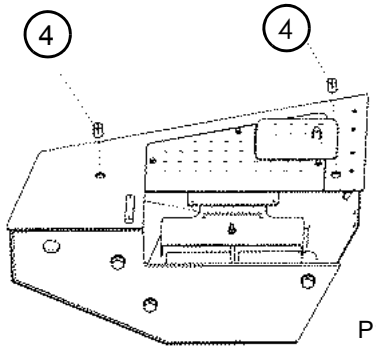
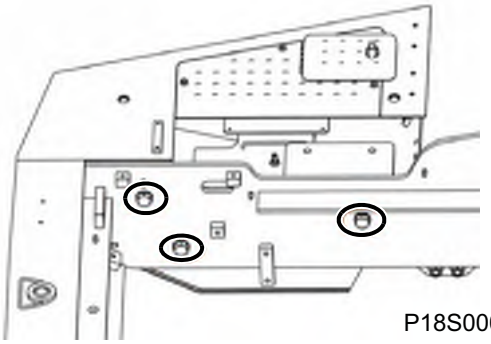
Figures	Operation instruction	Tools
 P18S00026	16. Install lower hinge pin	Copper bar
 P18S00027	17. Install upper hinge pin	Copper bar

Figures	Operation instruction	Tools
 P18S00028	18. Select the shim with appropriate thickness, install the shim and lock plate, tighten mounting bolts and the torque of bolts fixing the hinge pin is 68±14Nm/ 50.15±10.325lbf·ft.	18#, 24# spanner, torque spanner
 P18S00029	19. Install the upper hinge cover, tighten mounting bolt, and tightening torque is: 90±12N.m/ 66.375±8.85 lbf·ft	18# Wrench,torque wrench
 P18S00030	20. Install the joint of lubrication pipe	

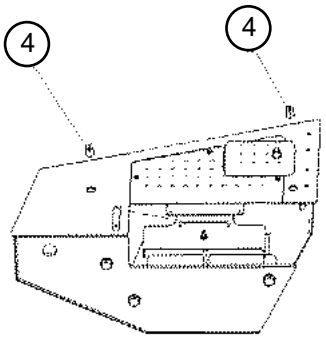
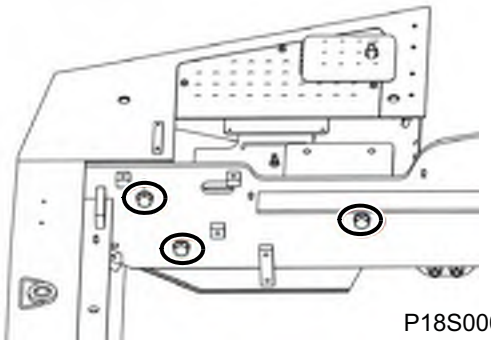
Removal and installation of counterweight assembly

Removal of the left and right battery box (take left battery box as an example)

Removal description: Before removing left and right battery box, please remove cooling system, fuel tank assembly and DEF lines assembly.

Figures	Operation instruction	Tools
	1. Remove rear floodlight and battery, and please refer to removal steps for rear floodlight and battery of electrical system.	
 P18S00031	2. First take out plug (4), and then install 2 M24 lifting screws	Straight screwdriver
	3. Hook the loop screw by a lifting appliance and tighten the hanger slightly **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)
 P18S00032	4. Remove 3 mounting bolts, lift the counterweight out with lifting equipment and put on firm ground. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	36# socket wrench, lifting equipments (over 3 tons)

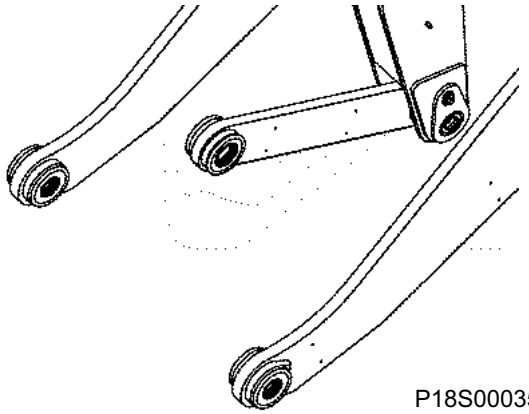
Installation of left and right battery box (take left battery box as an example)

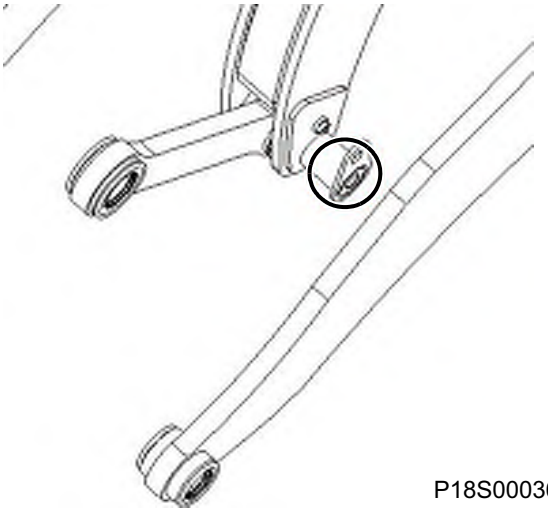
Figures	Operation instruction	Tools
 P18S00033	1. First take out plug (4), and then install 2 M24 lifting screws	Straight screw-driver
	2. Lift lifting screws with lifting equipment, lift the counter-weight to mounting position, and align with bolt mounting hole. **⚠ WARNNING: Fingers cannot be put into the hole when aligning with the hole, otherwise it may cause personal injury!** **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equip-ment (over 3ton)
 P18S00034	3. Install 3 mounting bolts and shims. Tightening torque: 410±50N.m/ 302.375±36.875lbf·ft	36# Socket wrench,torque wrench

Removal and installation of work implement system

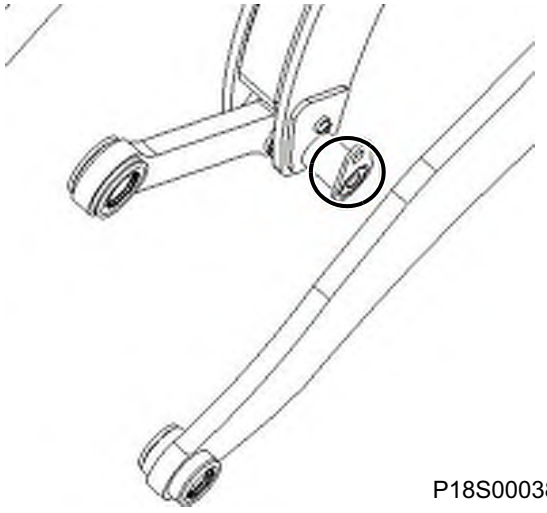
Removal and installation of linkage

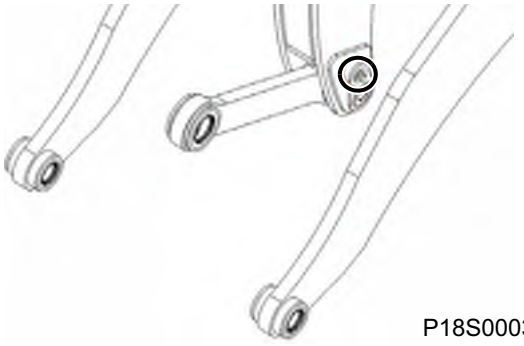
Removal of linkage

Figures	Operation instruction	Tools
	1. Remove linkage front pin By referring to the steps for removing linkage front pin in removal of bucket, remove linkage front pin.	
 P18S00035	2. Remove linkage rear pin 1) Remove captive bolt of rear pin of linkage	18# Wrench
	2) Hook the linkage by a lifting appliance and tighten the hanger slightly. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 1ton)

Figures	Operation instruction	Tools
 P18S00036	3) Knock out the rear pin of linkage with pin knocking tooling and sledge hammer	Pin knocking tooling and sledge hammer
	4) Lift the linkage to the firm ground with the lifting equipment **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 1ton)

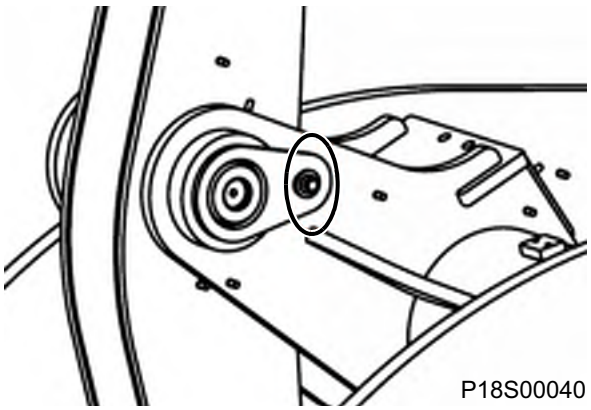
Installation of linkage

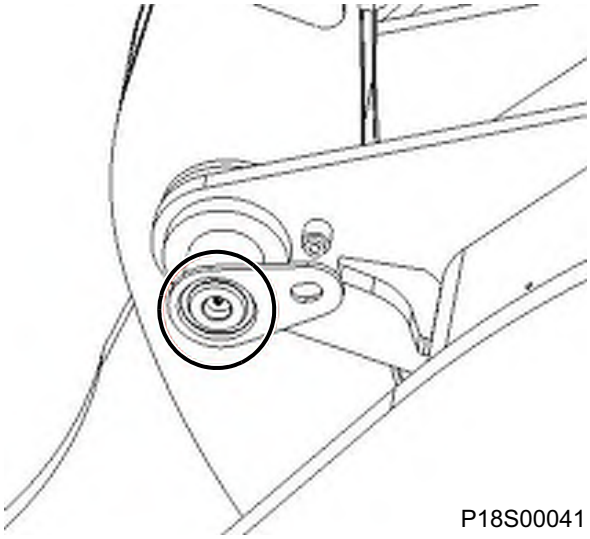
Figures	Operation instruction	Tools
 P18S00037	1. Install linkage rear pin 1) Install two O-rings at the rear end of linkage(connect with the end of rocker arm)	
	2) Lift the linkage to mounting position with lifting equipment, and align the front end hole of rocker arm with the rear end hole of linkage. **⚠ WARNNING: Fingers cannot be put into the hole when aligning with the hole, otherwise it may cause personal injury!** **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 1ton)
 P18S00038	3) Install lever rear pin, and simultaneously select the shim with appropriate thickness according to clearance of rocker arm and linkage to make sure the clearance at one side is less than 1mm/ 0.04in.	Sledge hammer

Figures	Operation instruction	Tools
 P18S00039	4) Install captive bolt	18# Wrench
	2. Install linkage front pin By referring to the steps for installing linkage front pin in installation of bucket, install linkage front pin.	

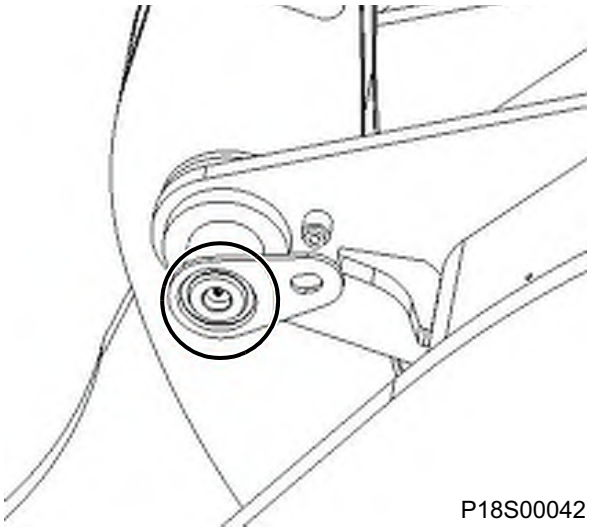
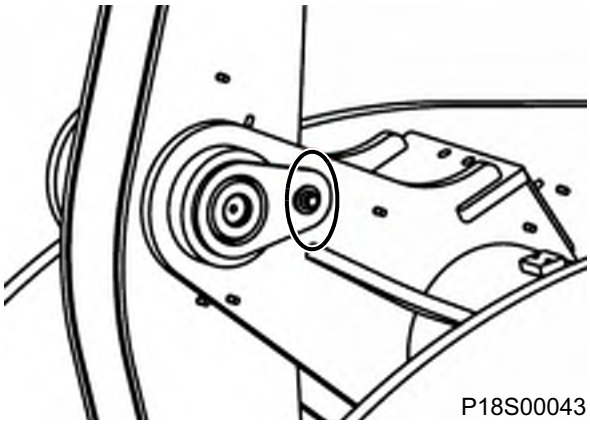
Removal and installation of bucket lever

Removal of rocker arm

Figures	Operation instruction	Tools
	1. Remove the linkage By referring to the steps for removing the linkage in removal and installation of linkage, remove the linkage.	
	2. Remove bucket tilting cylinder By referring to the steps for removing bucket tilting cylinder in hydraulic system, remove the bucket tilting cylinder from the machine	
 P18S00040	3. Remove the middle pin of rocker arm 1) Remove middle pin captive bolt of rocker arm	18# Wrench

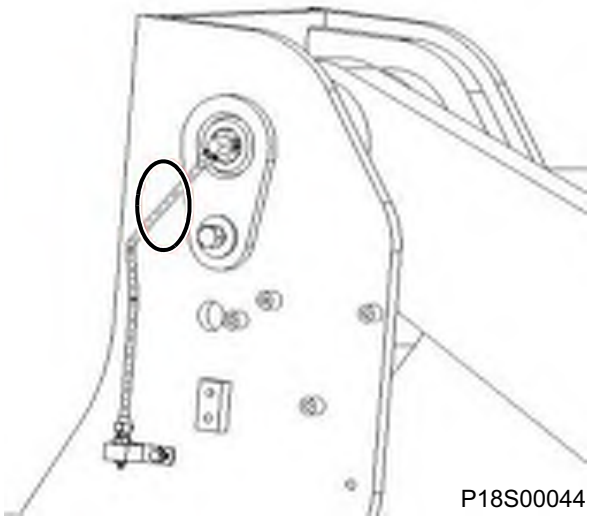
Figures	Operation instruction	Tools
	2) Hook the rocker arm by a lifting appliance and tighten the hanger slightly **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 1ton)
 P18S00041	3) Knock out the middle pin of rocker arm with pin knocking tooling and sledge hammer	Pin knocking tooling and sledge hammer
	4) Lift the rocker arm to the firm ground with the lifting equipment **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 1ton)

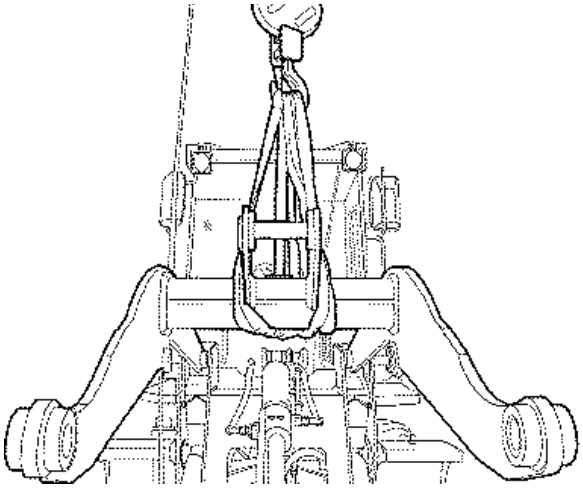
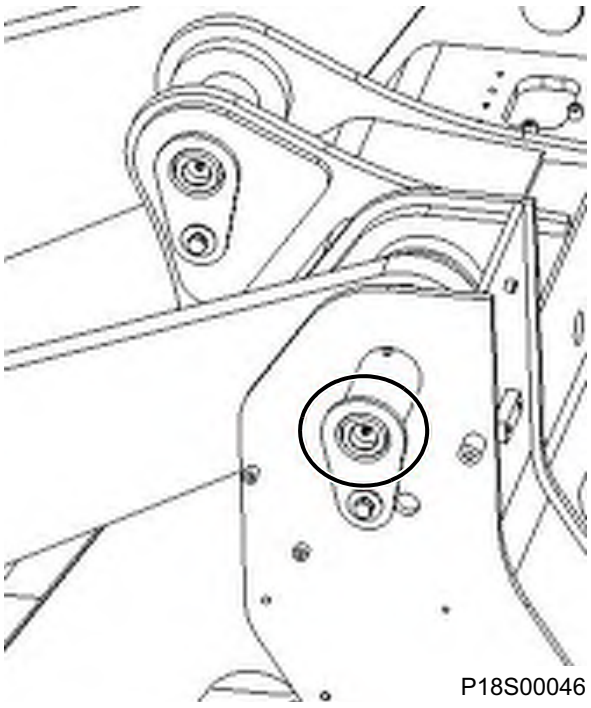
Installation of rocker arm

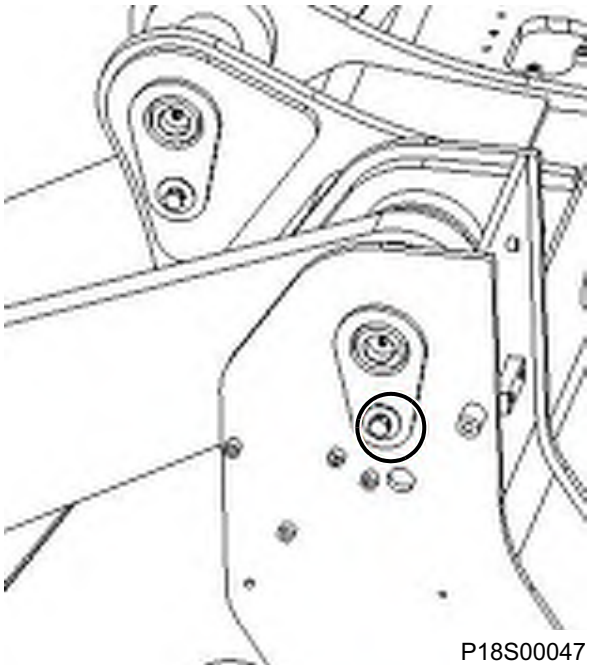
Figures	Operation instruction	Tools
	1. Lift rocker arm to mounting position with lifting equipment, and align the middle pin hole of rocker arm with arm mounting hole on the boom. **⚠ WARNNING: Fingers cannot be put into the hole when aligning with the hole, otherwise it may cause personal injury!** **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 1ton)
 P18S00042	2. Install rocker arm middle pin, and simultaneously select the shim with appropriate thickness according to clearance of rocker arm and boom to make sure clearance at one side is less than 1mm/0.04in.	Sledge hammer
 P18S00043	3. Install captive bolt	18# Wrench

Removal and installation of the boom

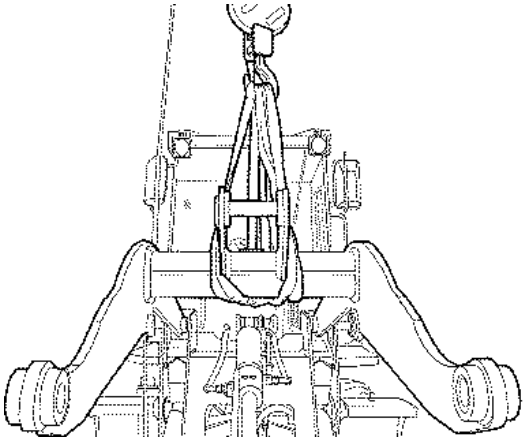
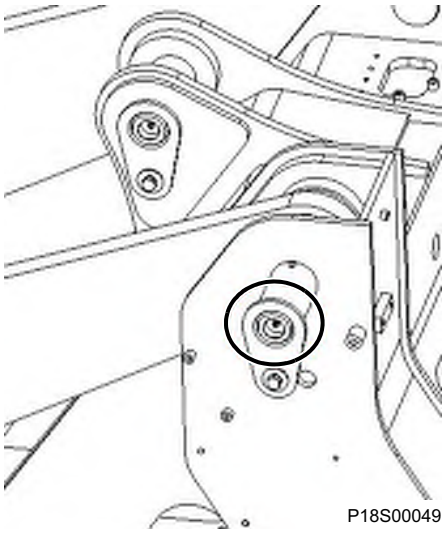
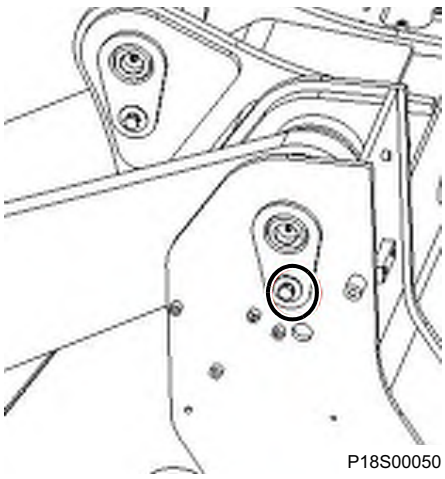
Removal of boom

Figures	Operation instruction	Tools
	1. Remove the bucket By referring to steps for removal of bucket , remove the bucket. 2. Remove the linkage By referring to the steps for removing the linkage in removal and installation of linkage, remove the linkage. 3. Remove the rocker arm By referring to the steps for removing the rocker arm in removal and installation of rocker arm, remove the rocker arm. 4. Remove bucket tilting cylinder By referring to the steps for removing bucket tilting cylinder in hydraulic system, remove bucket tilting cylinder. 5. Remove boom cylinder By referring to the steps for removing boom cylinder in hydraulic system, remove boom cylinder.	
 P18S00044	6. Remove lubrication pipe	16# Wrench

Figures	Operation instruction	Tools
 P18S00045	7. Remove the boom pin 1) Lift boom beam with lifting equipment, and tension lifting sling for holding the boom. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)
 P18S00046	2) Remove the captive bolts of boom pin at left and right sides	18# Wrench

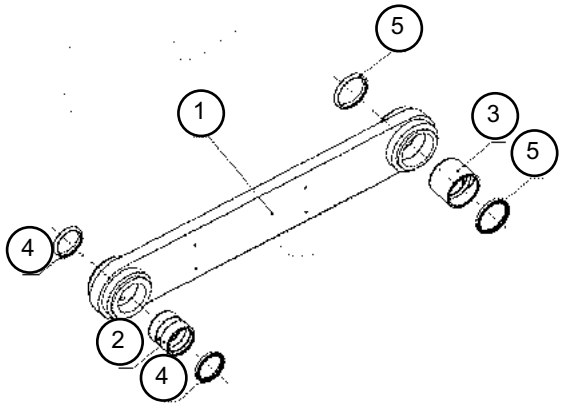
Figures	Operation instruction	Tools
 P18S00047	3) Knock out boom pins on right and left sides with pin knocking tooling and sledge hammer.	Pin knocking tooling and sledge hammer
	4) Lift out the boom with lifting equipment gently and place it on firm ground. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)

Installation of boom

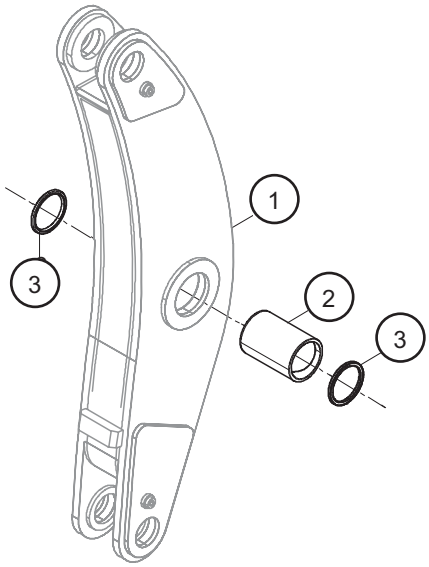
Figures	Operation instruction	Tools
 P18S00048	1) Lift the boom to mounting position with lifting equipment, and align boom hole with the boom mounting hole on front frame. **⚠ WARNNING: Fingers cannot be put into the hole when aligning with the hole, otherwise it may cause personal injury!** **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)
 P18S00049	2) Install boom pin, and simultaneously select the shim with appropriate thickness according to clearance of boom and front frame to make sure clearance at one side is less than 1mm/0.04in.	Sledge hammer
 P18S00050	3) Install captive bolt	18# Wrench

Replacement of work implement bushing

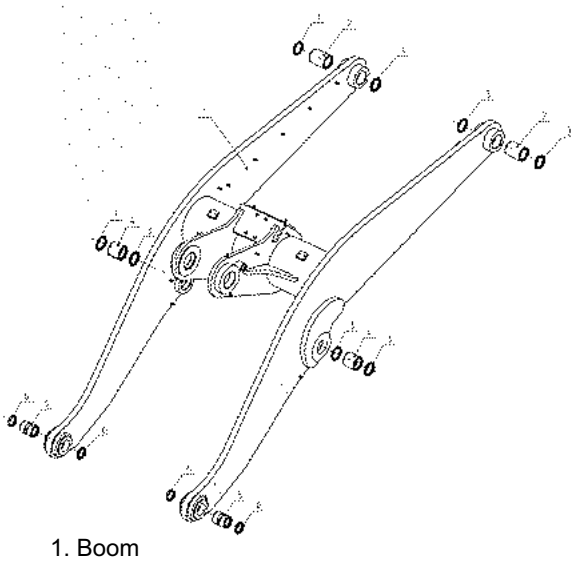
Replacement of linkage bushing

Figures	Operation instruction	Tools
 1. Linkage 2. Bushing 3. Bushing 4. Seal ring 5.Seal ring P18S00051	Replace the linkage bushing 1. Remove seal rings (4, 5) with a straight screwdriver	Straight screwdriver
	2. Knock out the linkage bushing (2, 3) with bushing knocking tooling and sledge hammer	Shaft bushing knocking tooling, sledge hammer
	3. Put new linkage bushing (2, 3) into liquid nitrogen for freezing until there is not a lot of smoke coming out	Liquid nitrogen, hook fixture
	4. Install frozen linkage shaft bushing (2, 3) into linkage (1) with shaft bushing knocking tooling and sledge hammer , and reserve mounting position for seal rings on both sides.	Shaft bushing knocking tooling, sledge hammer
	5. Knock new seal ring (4, 5) into linkage (1) gently with copper bar	Copper bar

Replacement of rocker arm bushing

Figures	Operation instruction	Tools
 1. Rocker arm 2. Rocker arm bushing 3. Seal ring P18S00052	Replace the rocker arm shaft bushing 1. Remove the seal ring (3) with a straight screwdriver	Straight screwdriver
	2. Knock out rocker arm bushing (2) with bushing knocking tooling and sledge hammer.	Shaft bushing knocking tooling, sledge hammer
	3. Put new rocker arm bushing (2) into liquid nitrogen for freezing until there is not a lot of smoke coming out.	Liquid nitrogen, hook fixture
	4. Install frozen rocker arm bushing (2) into rocker arm (1) with bushing knocking tooling and sledge hammer, and reserve mounting position for seal rings on both sides.	Shaft bushing knocking tooling, sledge hammer
	5. Knock seal ring (3) into rocker arm (1) gently with copper bar.	Copper bar

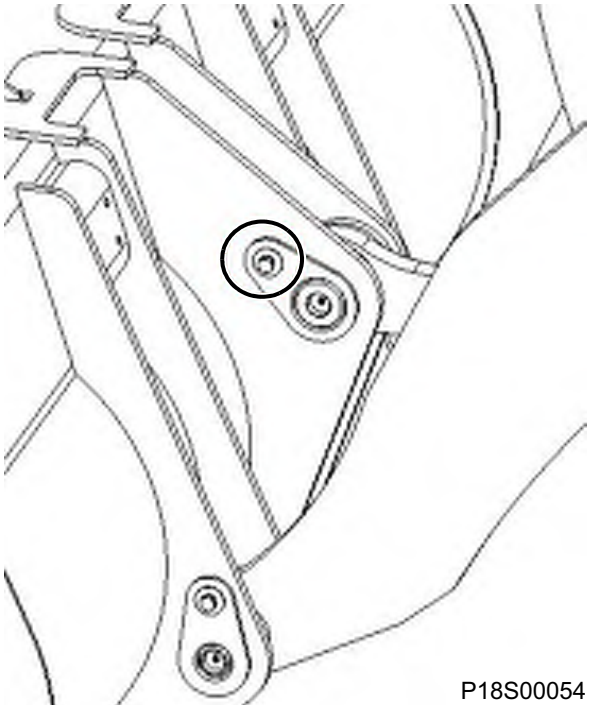
Replacement of boom shaft bushing

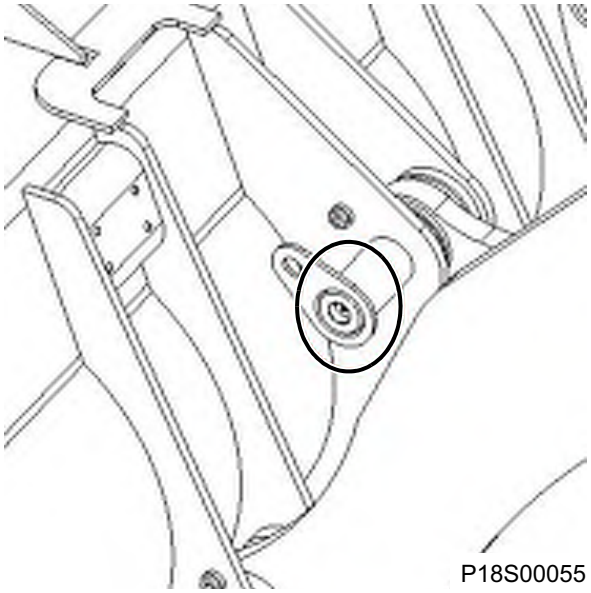
Figures	Operation instruction	Tools
 1. Boom 2. Frame bushing 3. Boom bushing 4. Bushing 5. Seal ring P18S00053	Replace the boom bushing 1. Remove seal rings (3, 6) with a straight screwdriver	Straight screwdriver
	2. Knock frame bushing (2), boom bushing (4) and bushing (5) out in sequence with bushing knocking tooling and sledge hammer.	Shaft bushing knocking tooling, sledge hammer
	3. Put new frame bushing (2), boom bushing (4) and bushing (5) into liquid nitrogen for freezing until there is not a lot of smoke coming out.	Liquid nitrogen, hook fixture
	4. Install frozen frame shaft bushing (2), boom shaft bushing (4) and shaft bushing (5) into the boom (1) in sequence with shaft bushing knocking tooling and sledge hammer, and reserve mounting position for seal rings on both sides.	Shaft bushing knocking tooling, sledge hammer
	5. Knock seal rings (3, 6) into the boom (1) gently with copper bar	Copper bar

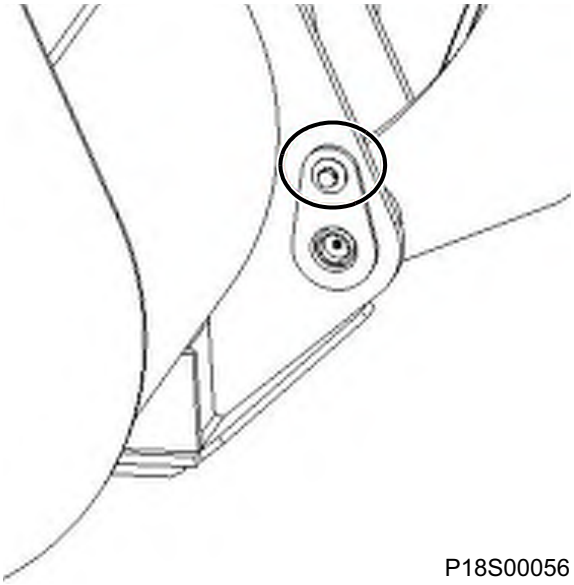
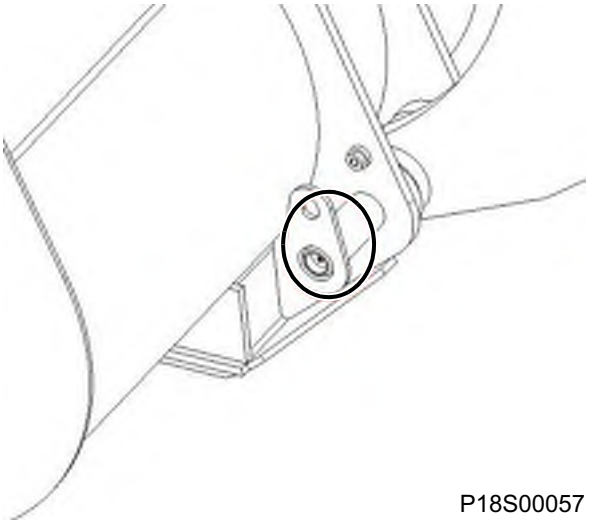
Removal and installation of accessory system

Removal and installation of bucket

Bucket removal

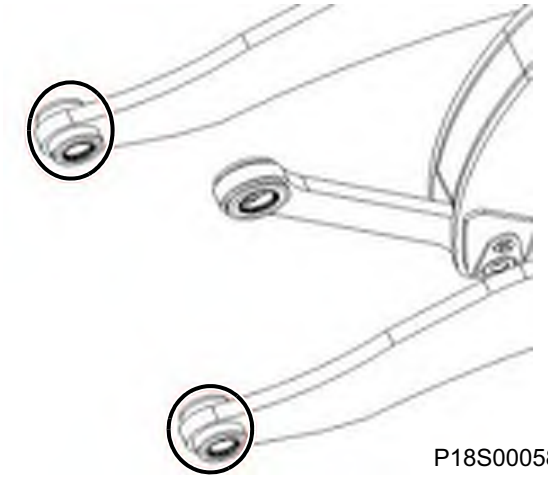
Figures	Operation instruction	Tools
	1. Remove linkage front pin 1) Start the machine, put the boom in the lowest position; lay flat the bucket and then switch off.	
 P18S00054	2) Disassemble the captive bolt of linkage front pin.	18# Wrench

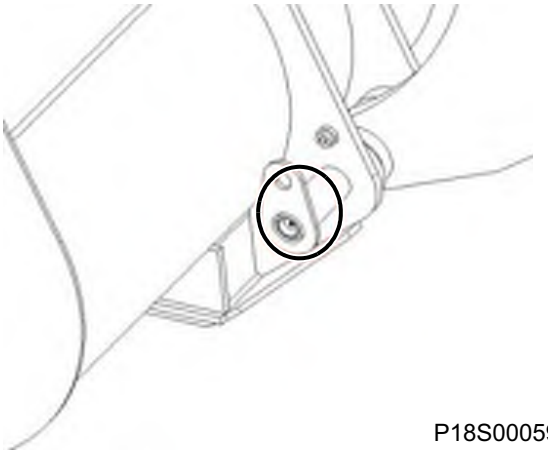
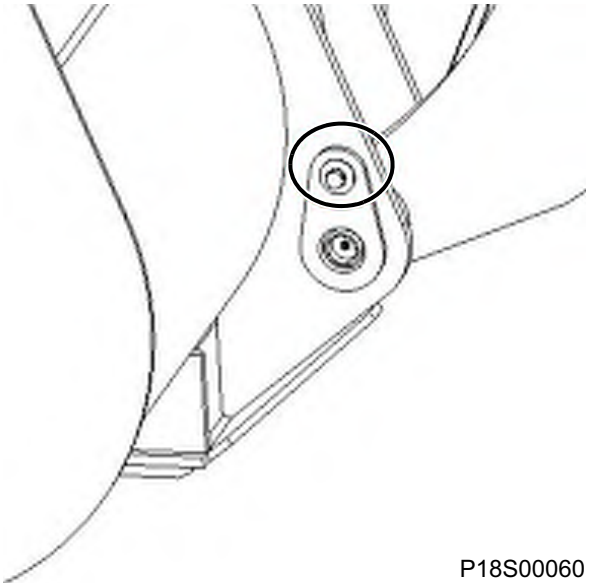
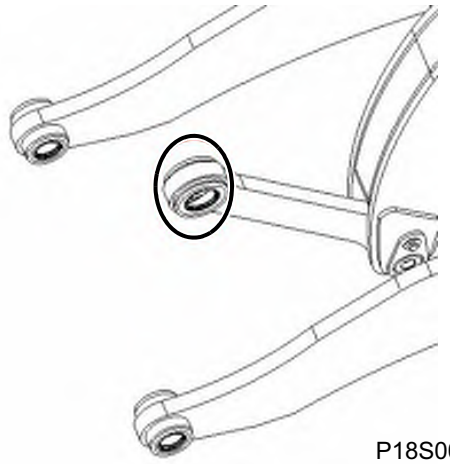
Figures	Operation instruction	Tools
 P18S00055	3) Lift linkage front end with lifting equipment, tension lifting tool gently, and remove linkage front pin with sledge hammer and pin knocking tooling. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Sledge hammer, pin knocking tooling, and a lifting appliance more than 3 tons
	4) Gently put linkage front end to ground with lifting equipment, and pad rubber or paperboard on the contact place with ground to prevent bumping against the ground. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)
	2. Remove the lower pin of the bucket 1) Hook the bucket by a lifting appliance and tighten the hanger slightly. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)

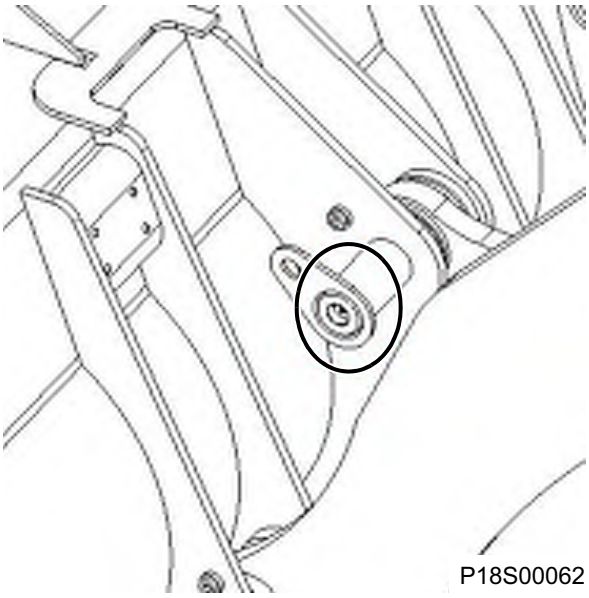
Figures	Operation instruction	Tools
 P18S00056	2) Remove the captive bolts of the bucket lower pin on the left and right sides.	18# Wrench
 P18S00057	3) Remove the bucket lower pins on left and right sides with sledge hammer and pin knocking tooling.	Sledge hammer and pin knocking tooling
	4) Lift the bucket out gently with lifting equipment, and put it on firm ground, and wait for repair or replacement. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)

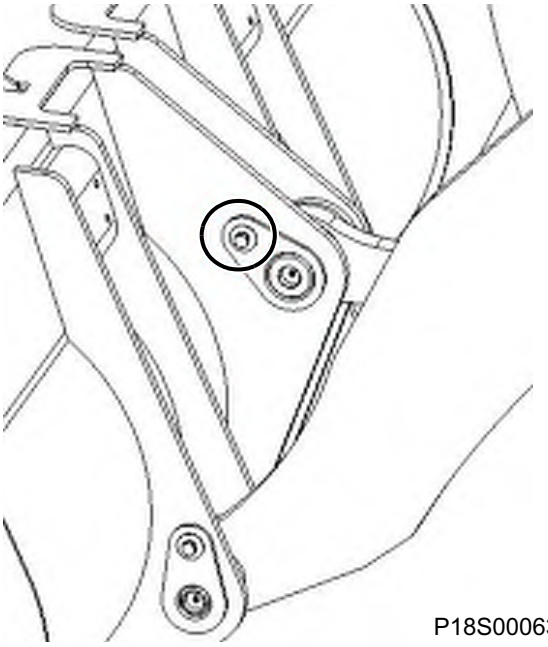
Installation of bucket

Description: In order to guarantee the traceability of the machine and bucket, the bucket cannot be replaced when installed!

Figures	Operation instruction	Tools
 P18S00058	1. Install the lower pin of the bucket 1) Install front O-ring of boom.	
	2) Lift the bucket to mounting position with lifting equipment, and align the lower pin hole of bucket with the front end hole of boom. **⚠ WARNNING: Fingers cannot be put into the hole when aligning with the hole, otherwise it may cause personal injury!** **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)

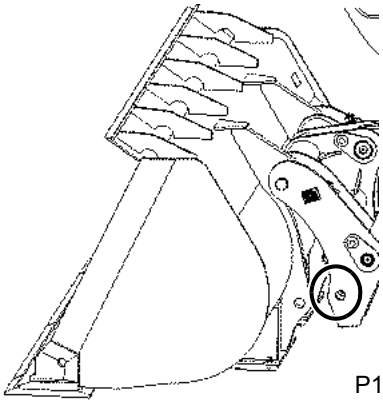
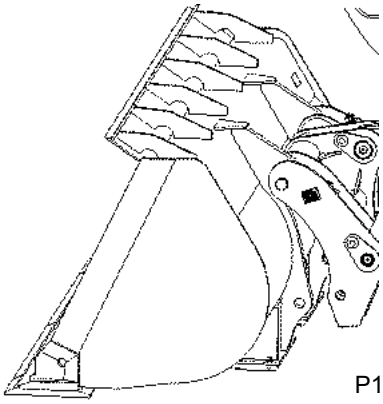
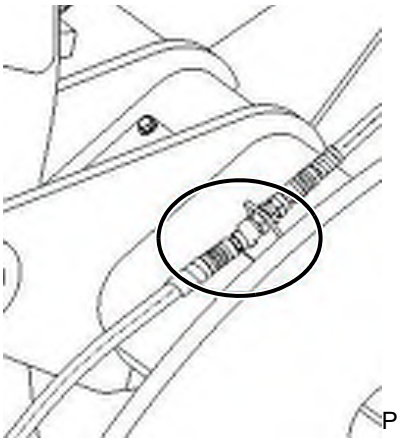
Figures	Operation instruction	Tools
 P18S00059	3) Install the bucket lower pins on left and right sides, and simultaneously select the shim with appropriate thickness according to the clearance of bucket and boom to make sure the clearance at one side is less than 1mm/0.04in.	Sledge hammer
 P18S00060	4) Install captive bolts at left and right sides.	18# Wrench
 P18S00061	2. Install linkage front pin 1) Install front O-ring of linkage.	

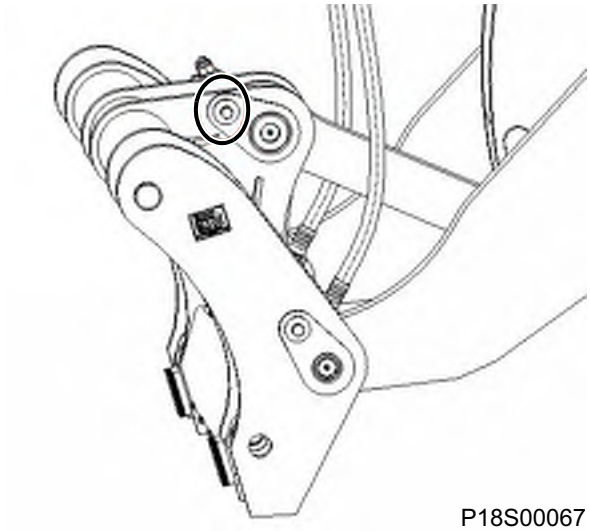
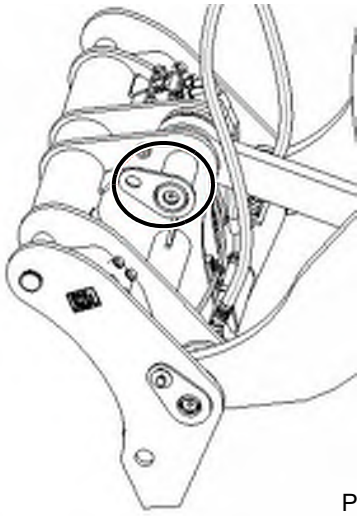
Figures	Operation instruction	Tools
	2) Lift linkage front end to mounting position with lifting equipment, start the machine, operate control lever to adjust linkage position, and align the upper hole of bucket with linkage front pin hole. **⚠ WARNNING: Fingers cannot be put into the hole when aligning with the hole, otherwise it may cause personal injury!** **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)
 P18S00062	3) Install the front pin of linkage, and simultaneously select the shim with appropriate thickness according to clearance of bucket and linkage to make sure the clearance at one side is less than 1mm/0.04in.	Sledge hammer

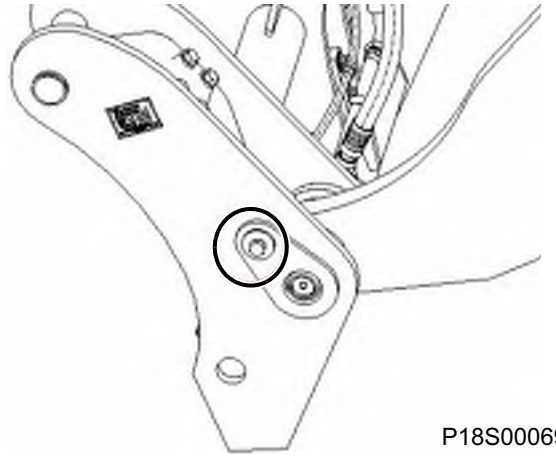
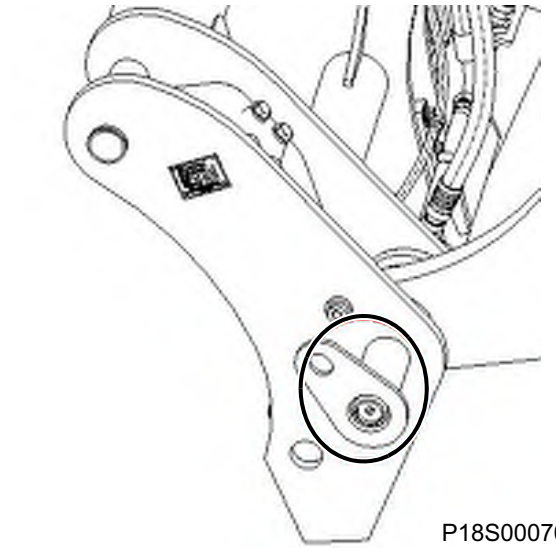
Figures	Operation instruction	Tools
 P18S00063	4) Install the captive bolt of linkage front pin.	18# Wrench

Removal and installation of quick coupler bucket and quick coupler frame

Removal of quick coupler bucket and quick coupler frame

Figures	Operation instruction	Tools
 P18S00064  P18S00065	1. Remove the quick coupler bucket 1) Start the machine, put the boom in the lowest position, lay flat the bucket 2) Operate the third linkage of pilot lever, and then retract the quick coupler bucket pin to the quick coupler frame. 3) Separate the quick coupler frame from the bucket.	
 P18S00066	2. Remove the quick coupler multi-functional pipe joint 1) Operate the complete machine, lower the boom to the lowest position and lean forward the quick coupler frame for a proper angle, then shut it off. 2) Remove the quick coupler multi-functional pipe joint at left and right sides, and then collect the hydraulic oil drained from the pipe with a drip pan to prevent contaminating the ground.	30# Wrench

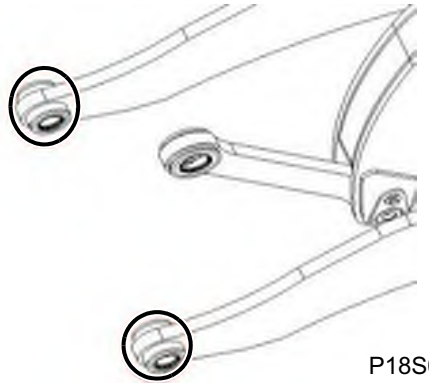
Figures	Operation instruction	Tools
 P18S00067	3. Remove linkage front pin 1) Pad the upper pipe of quick coupler frame with a tooling with proper height to prevent the quick coupler frame rotating forward, then remove the captive bolt of linkage front pin.	18# Wrench
 P18S00068	2) Lift linkage front end with lifting equipment, tension lifting tool gently, and remove linkage front pin with sledge hammer and pin knocking tooling. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Sledge hammer, pin knocking tooling, and a lifting appliance more than 3 tons
	3) Gently put linkage front end to ground with lifting equipment, and pad rubber or paperboard on the contact place with ground to prevent bumping against the ground. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)

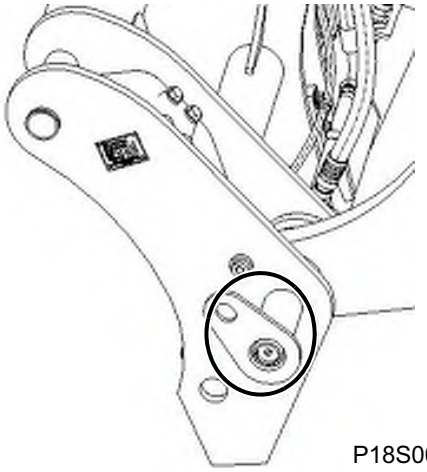
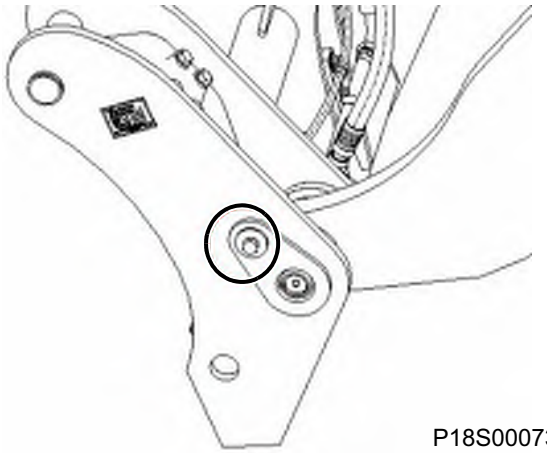
Figures	Operation instruction	Tools
	4. Remove the lower pin of the bucket 1) Hook the quick coupler frame by a lifting appliance and tighten the hanger slightly. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)
 P18S00069	2) Remove the captive bolts of the bucket lower pin on the left and right sides.	18# Wrench
 P18S00070	3) Remove the bucket lower pins on left and right sides with sledge hammer and pin knocking tooling.	Sledge hammer and pin knocking tooling

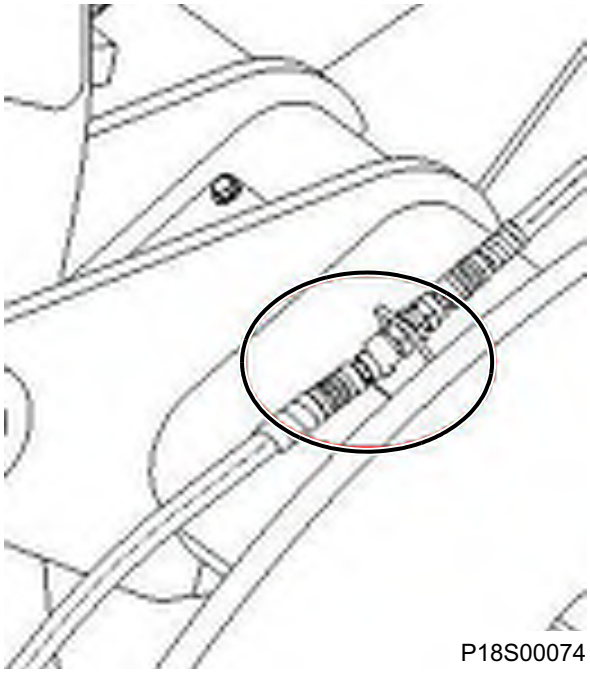
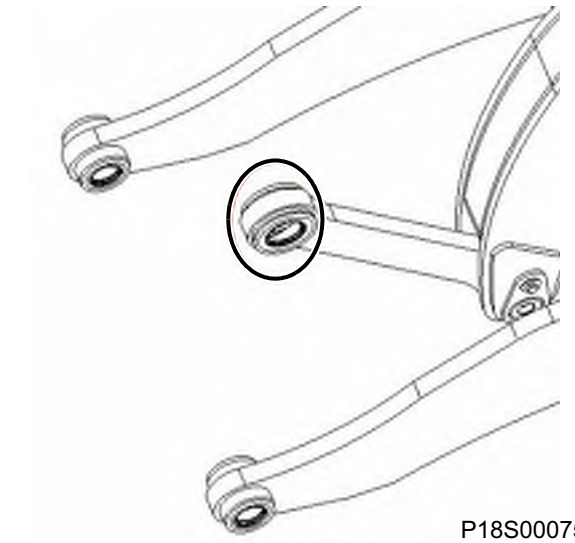
Figures	Operation instruction	Tools
	4) Lift the quick coupler frame out gently with lifting equipment, and put it on firm ground, and wait for repair or replacement. **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)

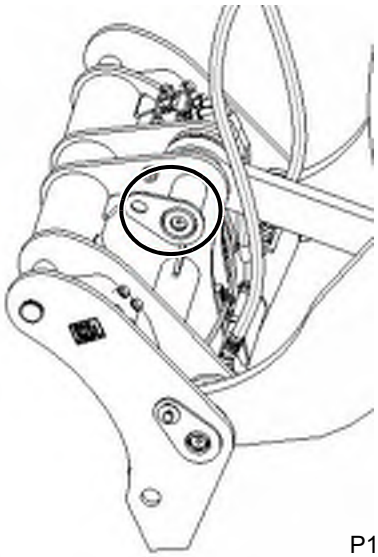
Installation of quick coupler bucket and quick coupler frame

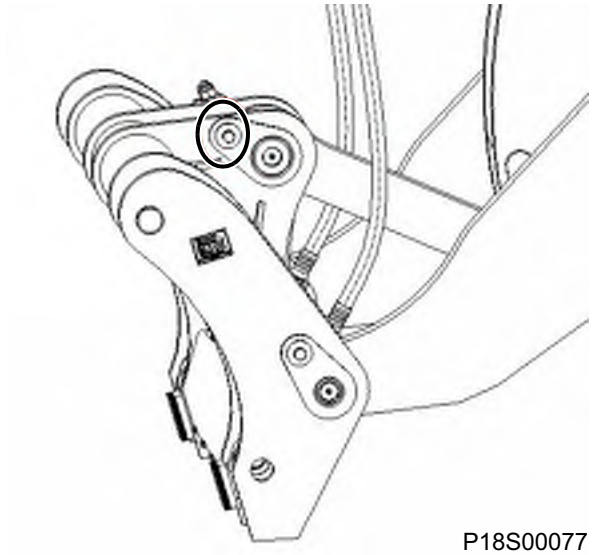
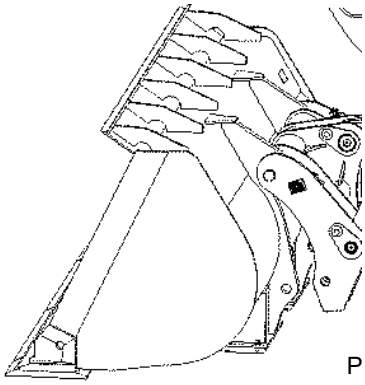
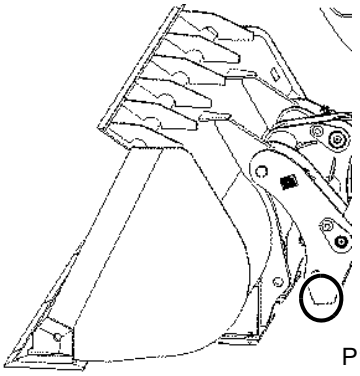
Description: In order to guarantee the traceability of the machine and bucket, the quick coupler bucket and quick coupler frame cannot be replaced when installed!

Figures	Operation instruction	Tools
 P18S00071	1. Install the lower pin of the bucket 1) Install front O-ring of boom.	

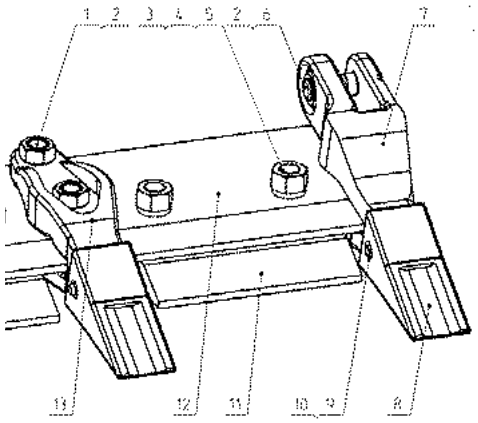
Figures	Operation instruction	Tools
	2) Lift the quick coupler frame to mounting position with lifting equipment, and align the lower pin hole with the front end hole of boom. **⚠ WARNNING: Fingers cannot be put into the hole when aligning with the hole, otherwise it may cause personal injury!** **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)
 P18S00072	3) Install the bucket lower pins on left and right sides, and simultaneously select the shim with appropriate thickness according to the clearance of quick coupler frame and boom to make sure the clearance at one side is less than 1mm/0.04in.	Sledge hammer
 P18S00073	4) Install captive bolts at left and right sides. 5) Pad the upper pipe of quick coupler frame with a tooling with proper height to prevent the quick coupler frame rotating forward, then loosen the quick coupler frame sling.	18# Wrench

Figures	Operation instruction	Tools
 P18S00074	2. Connect the quick coupler multi-functional pipe joint at left and right sides	30# Wrench
 P18S00075	3. Install linkage front pin 1) Install front O-ring of linkage.	

Figures	Operation instruction	Tools
	2) Lift linkage front end to mounting position with lifting equipment, start the machine, operate control lever to adjust linkage position, and align the upper hole of quick coupler frame with linkage front pin hole. **⚠ WARNNING: Fingers cannot be put into the hole when aligning with the hole, otherwise it may cause personal injury!** **⚠ CAUTION: The personnel operating lifting equipment shall have relevant qualifications, and only can operate on the premise that equipment and lifting sling are normal and safety is guaranteed!**	Hoisting equipment (over 3ton)
 P18S00076	3) Install the linkage front pin, and simultaneously select the shim with appropriate thickness according to clearance of quick coupler frame and linkage to make sure the clearance at one side is less than 1mm/ 0.04in.	Sledge hammer

Figures	Operation instruction	Tools
 P18S00077	4) Install the captive bolt of linkage front pin.	18# Wrench
 P18S00078	4, Install the quick coupler bucket 1) Operate the machine, and align the upper mounting pin of quick coupler frame with upper mounting hole of quick coupler bucket	
 P18S00079	2) Operate the machine, align the lower pin hole of quick coupler frame with the lower mounting hole of quick coupler bucket, and operate the third linkage of pilot lever, then extend the pin of quick coupler bucket, lock the quick coupler bucket.	

Replacement of bucket movable blade, movable tooth and tip

Figures	Operation instruction	Tools
 1. Lock bolt 2. Nut 3. Nut 4. Washer 5. Bolt 6. Lock bolt 7. Side gear body 8. Gear sleeve 9. Pin 10.Retainer 11.Movable Blade 12.Cutting edge 13.Gear body P18S00080	1. Replace the tip: 1) Use hammer and pin knocking tooling to remove the pin (9) connecting tip and tooth. 2) Take out the tip (8) and the retainer (10). 3) Install new retainer (10) and tip (8). (4) Align the tip with tip mounting hole, and install new pin (9).	Hammer and pin knocking tooling
	2. Replace the middle tooth of bucket: 1) Remove the nut (2) and lock bolt (1) fixing tooth. 2) Take out the tooth (13). 3) Install new tooth (13) on cutting edge (12). 4) Install new lock bolt (1) and nut (2).	50# Socket wrench
	3. Replace the side tooth of bucket: 1) Remove the nut (2) and lock bolt (6) fixing side tooth. 2) Take out the side tooth (7). 3) Install new side tooth (7) on cutting edge (12). 4) Install new lock bolt (6) and nut (2).	50# Socket wrench

Figures	Operation instruction	Tools
	4. Replace the movable blade: 1) Remove nut (3), washer (4) and bolt (5) fixing movable blade. 2) Take down movable blade (No.11). 3) Place new movable blade (11) on corresponding position of cutting edge. 4) Align the mounting holes of movable blade and cutting edge, and install new bolt (5), washer (4) and nut (3).	50# Socket wrench

Option work implement and accessory system

Option of work implement system

Work implement system has standard boom and extension boom for selection, please refer to "Work Implement Parameters", and select according to practical use and needs of working conditions.

Option of accessory system

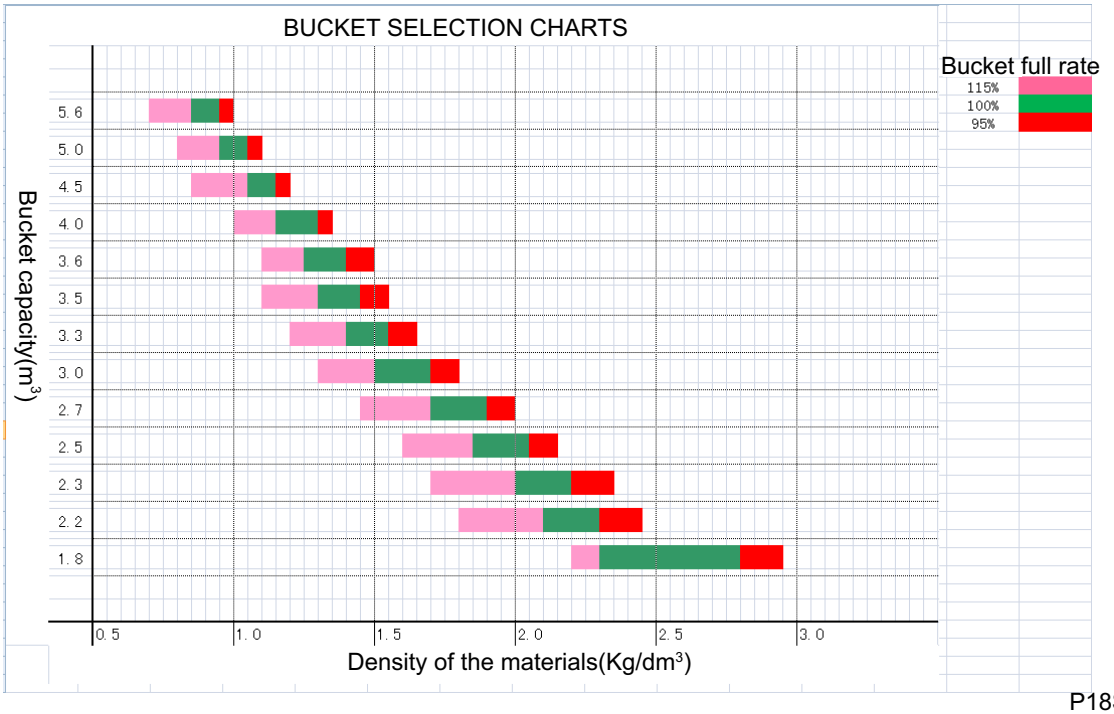
Procedure of selecting and assembling the bucket:

1. Identify the target condition.
2. According to working condition, select suitable bucket type according to Attached Table 1 - Bucket Classification Table.
3. Look up the Attached Table 3 Bulk Density of Bulk Materials to obtain the corresponding density of material of working condition.
4. According to material density value, select corresponding bucket capacity by checking Attached Table 2 - Recommendation List for Bucket Selection.

Attached table 1: The classification table of bucket

Types of Buckets	Acceptable range of density	Main purposes
GP bucket	1.2~1.9t/m^3	Applicable to various working conditions, provided with excellent insertion performance and material holding performance.
Light loading hopper	0.8~1.25t/m^3	It is mainly used in condition of loose light load material
Rock bucket	1.8~2.0t/m^3	It is under heavy load condition, such as rocks, etc.

Attached table 2:



P18S00081

Attached Table 3 Bulk density and repose angle of loose materials

Material	Bulk density /t•m^{-3}	Repose angle		Material	Bulk density /t•m^{-3}	Repose angle	
		Motion	Rest			Motion	Rest
Anthracite (Dry and small)	0.7~1.0	27°~30°	27°~45°	Zinc flue dust	0.7~1.5		
Bitumite	0.8	30°	35°~45°	Pyrite cinder	1.7~1.8		
Lignite	0.6 ~0.8	35°	35°~50°	Plumbum-zinc con-centrate	1.3~1.8		
Peat	0.29~0.5	40°	45°	Pyrite pellet	1.2~1.4		
Peat (damp)	0.55~0.65	10°	45°	Slag of the open hearth furnace (coarse)	1.6~1.85		15°~50°
Coke	0.36~0.53	35°	50°	Blast furnace slag	0.6~1.0	35°	50°
Charcoal	0.2~0.4			Lead and zinc granulated slag (wet)	1.5~1.6		42°
Anthracite culm	0.84~0.89		37°~45°	Dry coal ash	0.64~0.72		35°~45°
bitumite powder	0.4~0.7		37°~45°	Coal ash	0.70		15°~20°
Graphite powder	0.45		40° ~45°	Grit (dry)	1.4~1.9		50°

Material	Bulk density /t•m^{-3}	Repose angle		Material	Bulk density /t•m^{-3}	Repose angle	
		Motion	Rest			Motion	Rest
Magnet ore	2.5~3.5	30° ~35°	40° ~45°	Fine sand (dry)	1.4~1.65	30°	
Hematite	2.0~2.8	30°~35°	40° ~45°	Fine sand (wet)	1.3~2.1		30°~35°
Limonite	1.2~2.1	30°~35°	40° ~45°	Moulding sand	0.8~1.3	30°	45°
Manganese ore	1.7~1.9		35°~45°	Limestone (large block)	1.6~2.0	30°~35°	40°~45°
Magnesia (agglomerate)	2.2~2.5		40°~42°	Limestone (medium block)	1.2~1.5	30°~35°	40°~45°
Magnesia powder	2.1~2.2		45°~50°	Quicklime	1.7~1.8	25°	45°~50°
Copper ore	1.7~2.1		35°~45°	Gravel	1.32~2.0	35°	45°
Copper concentrate	1.3~1.8		40°	Dolomite (block)	1.2~2.0	35°	
Plumbum concentrate	1.9~2.4		40°	Dolomite fragment	1.8~1.9	35°	
Zinc concentrate	1.3~1.7		40°	Gravel	1.5~1.9	30°	30°~45°
Plumbum-zinc concentrate	1.3~2.4		40°	Clay (small block)	0.7~1.5	40°	50°
Sintered iron	1.7~2.0		45°-50°	Clay (wet)	1.7		27°~45°
Sinter fragment	1.4~1.6	35°		Concrete	0.9~1.7	35°	40°~45°
Sintered plumbum	1.8~2.2			Slaked lime (powder)	0.5		
Sintered plumbum and zinc	1.6~2.0			Slaked lime (block)	2.0		

Electrical System

Basic Information

Instructions of service manual

The Manual is written by introducing the different modules divided by the main functions of electrical system, whereby, the maintenance operations of maintenance technicians are facilitated as they are enabled to promptly find the chapters and sections corresponding to the failure at any time. Besides, the professional descriptions are compiled to be accessible in the Manual, nonetheless, the maintenance personnel shall be provided with necessary professional knowledge to understand the Maintenance Manual.

When dividing the modules, the Manual starts from introducing the functions of the module, then presents the main components of the functions, including the principles, functions an electrical diagrams of main components. Whereafter, operation of module function and the diagnosis and test of module failure are introduced.

The component symbols on the schematic diagram indicate the representing methods of components on the diagram. The majority of component symbols signify the actual schematic diagram of the components, whereas, the exceptions are specified when introducing the components. It will help to judge the failure symptom of components.

The component failure detection methods are also included in the component descriptions herein. In particular, such methods are only for the components, whereby, the failures are detected through dismounting the components from the complete machine. As it is unfeasible to detect the failures in accordance with the abovementioned methods if the components are mounted on the complete machine. Then determine in line with the failure detection methods described behind the system, or disassemble the components if necessary, to judge the condition of components based on the component troubleshooting method.

The module failure diagnosis and test introduced in the Manual does not cover all the faults, thus please rack your brain and focus on the accumulation of experience during the troubleshooting.

In order to describe the electrical principles intuitively, colored filling lines are applied to present the current flow when introducing the electrical system principles in the Manual.

Full consideration to the relationship between the general and the individual (system and component) when determining the failures will contribute to the rapid, accurate and facilitated troubleshooting.

On condition that digital multimeter (hereinafter referred to as DMM) is applied to detect faults, the inherent measuring errors might result in a value slightly differing from that described in the Manual. For instance, when selecting the 200Ω of Ω gear of DMM, the values described in the Manual are comparable through shorting out the red and black probes, measuring the lead resistance and subtracting such lead resistance from the measured resistance of other circuits.

Notes for welding

Be sure to comply with the correct welding procedures, so as to safeguard the electrical components and bearings against potential damages. When welding on a loader or diesel engine equipped with electrical components, please follow the operating steps below:

1. Place machine on level ground.
2. Put the electrical lock at "OFF" position, and shut down the diesel engine.
3. Pull up the handbrake.
4. Turn off the battery disconnect switch, and shut off the connection between battery and frame.

5. Clamp the parts to be welded with the grounding cable of the welder tightly. The closer the grounding position with the welding, the better. Check from earthing cable to circuit of welding assembly, to verify any of the below components has not been passed through:

- Bearing
- Hydraulic cylinder
- Internal circuits of the controller or other electrical units.
- Doing in this way is to keep the following parts away from the possible damage:
- Bearing
- Hydraulic parts
- Electronic component
- Other available components of the machine

6. Keep the inflammables away from the welding site while protect the cables, to safeguard them against the loss and damage resulted from the fire caused by splashing sparks and welding slag.
7. Perform the weldment according to the normal welding safe performing procedure.

⚠WARNING

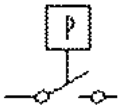
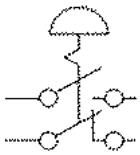
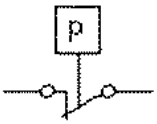
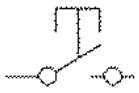
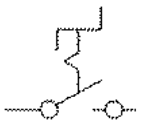
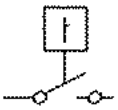
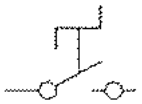
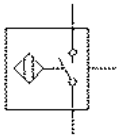
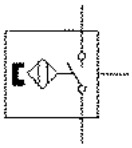
During welding, the earthing point of welder on the frame shall be close to the welding point to the greatest extent, for which a reliable large-area earthing shall be guaranteed.

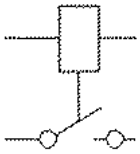
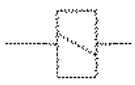
Do not use the earth point of any electric component on the machine as the earth point of the welding machine!

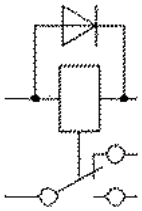
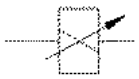
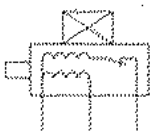
For welding near the earth point of the electric appliance, you must not perform welding operation until you disconnect the earth point of the electric appliance and make sure that the welding circuit of the welding machine does not pass through the electric appliance. Otherwise, it will damage the components of the electric appliance, and even lead to a fire!

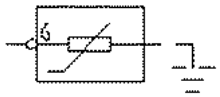
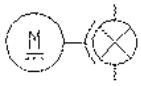
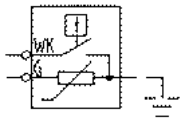
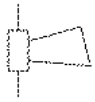
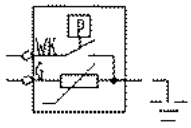
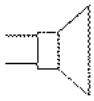
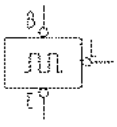
To prevent possible losses, for the machine equipped with electronic control components, such as the control unit EST-117 of ZF, control box, instrument, and engine ECM etc., ensure that the welding circuit is disconnected from that of the aforementioned electronic control components before weldment, while the connectors closest to such control components shall be unplugged to cut the circuit off.

The introduction of signs on the electrical schematic

Graphic symbol of the control switch				Graphic symbol of double position manual control switch			
S/N	Name	Graphic symbol	Description	S/N	Name	Graphic symbol	Description
1	Pressure switch		Normally open	1	Emergency stop switch		Keeping
2	Pressure switch		Normally closed	2	Button switch		Instantaneous acting
3	Temperature switch			3	Knob switch		Keeping
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			
S/N	Name	Graphic symbol	Description	S/N	Name	Graphic symbol	Description
1	GP relay		One group of normally-open contacts	1	Electromagnet of the switch		

Graphic symbol of the relay				Graphic symbol of the electromagnet			
S/N	**Name**	**Graphic symbol**	**Description**	**S/N**	**Name**	**Graphic symbol**	**Description**
2	With Contact Relay normally closed		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			
S/N	Name	**Graphic symbol**	**Description**	**S/N**	**Name**	**Graphic symbol**	**Description**
1	Lamp			1	Rheostat sensor		
2	Rotating beacon			2	Temp sensor with alarm switch		
3	Electric horn			3	Pressure sensor with alarm switch		
4	Buzzer			4	Inductive Speed sensor		
5	Speaker						
6	Flash relay						

Structure Function Principle

Power System

Power System

Introduction of the function

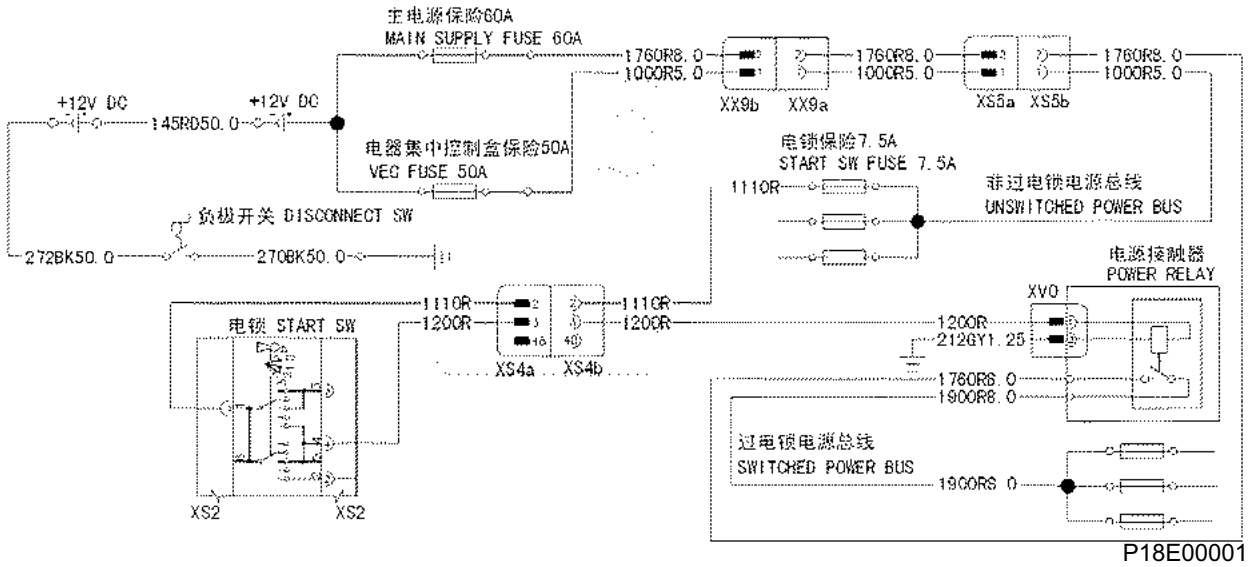
The power system equipped in CLG835H-T4F supplies power to the electrical appliances of the complete vehicle. The diesel engine is powered by battery separately before starting, which is then jointly powered by battery and alternator during running.

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, hazard flashers, clearance light and electric horn work properly once the negative switch is closed.

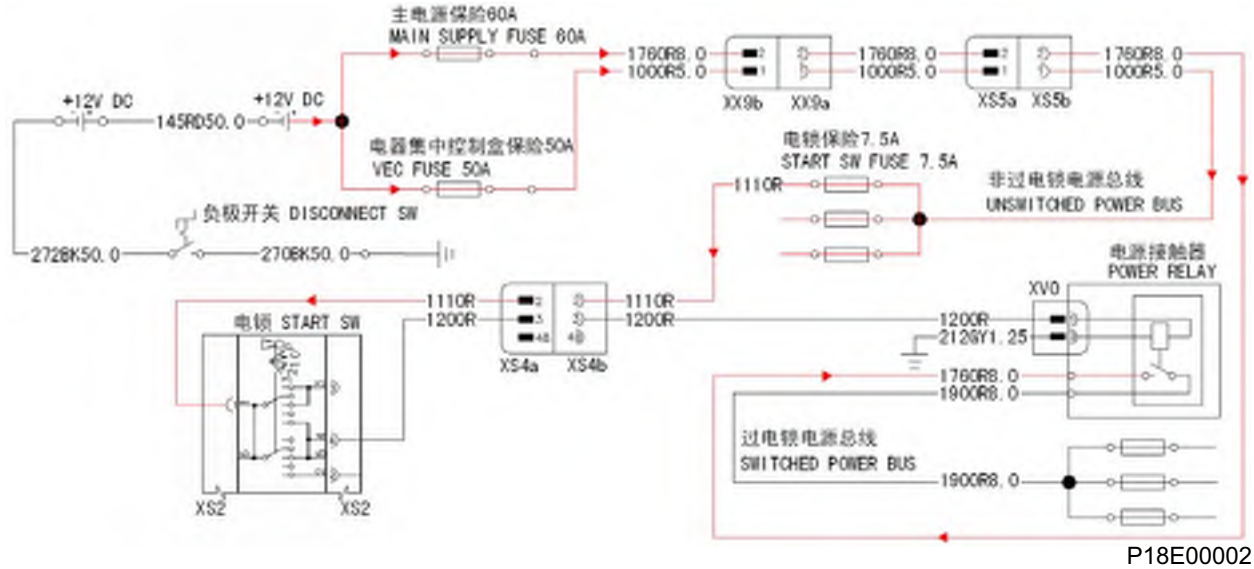
Other than the backup alarm and air conditioning function module, the electrical components are ready for normal use once the electric lock is turned to Gear IGN.

Schematic diagram of Power System



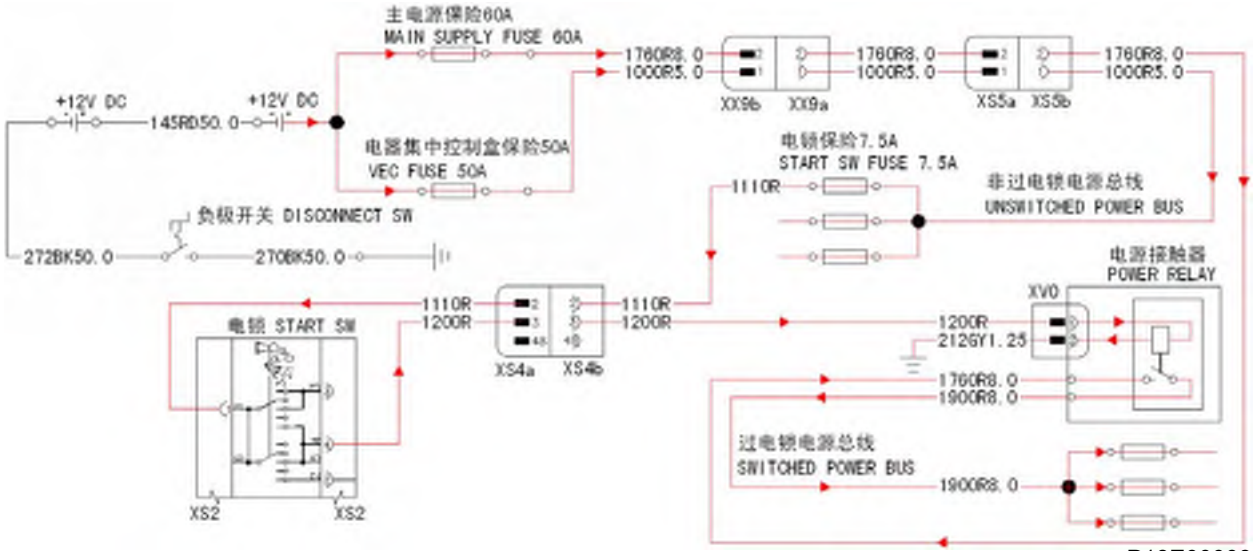
Analysis of the electrical schematic diagram

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.



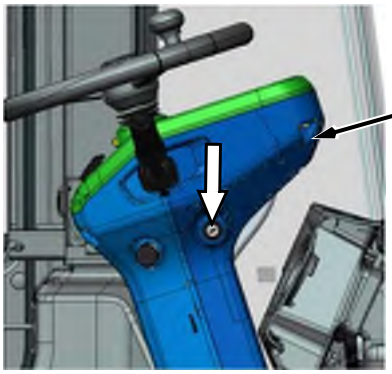
P18E00002

2. The power relay contacts turn on once the electric lock is turned to Position IGN, and the bus fuse, which passes through the electric lock, is powered.

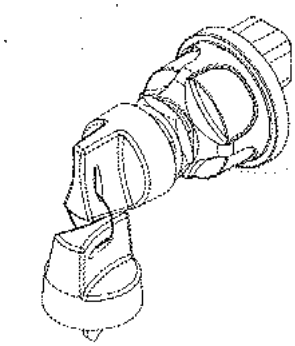


P18E00003

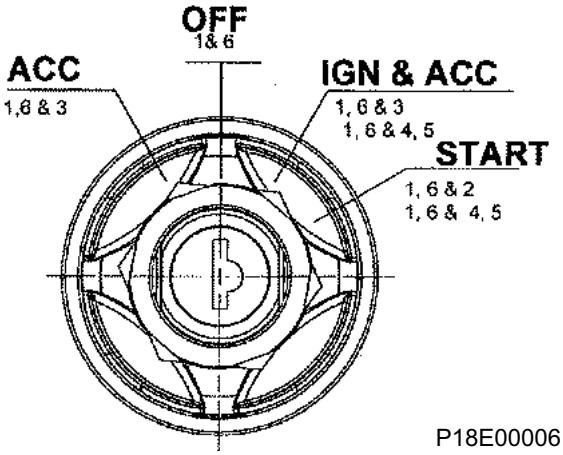
Electric lock



P18E00004



P18E00005



P18E00006

PIN	CIRCUIT	
2	START	
3	ACCESSARY	
4&5	IGNITION	
1&6	BATTERY	

PINS 1&6 CONNECTED TOGETHER INTERNALLY
PINS 4&5 CONNECTED TOGETHER INTERNALLY

Description of pin definition:

Pins 1, 2, 3, 4, 5, 6;

The pins 3, 5 are normally not used;

Pins 1 and 6 - power supply, pin 4 - ignition (control power relay coil), pin 2 - starter;

Specification of the positions of the electric lock

"OFF"-the position to insert and extract the electrical lock key. At this gear, cut off the power the electrical equipment on the vehicle. Except for some electrical equipment (such as dome light), which are controlled by the battery disconnect switch instead of the electric lock.

"IGN"-the first gear of the clockwise rotating key after inserting the key to electric lock. "IGN" connects the powers of electrical equipment throughout the machine, which are powered by battery.

"START"-the second gear of the clockwise rotating key after inserting the key to electric lock. Such gear starts the diesel engine, which is incapable of self-hold. The key to electric lock returns automatically to "IGN" once it is loosened.

Precautions

After starting the oil engine, loosen the key of the electrical lock 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 electrical lock key to "OFF" position. Second turn it to the "IGN" 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. Inspect the battery and start circuit, if necessary, to see whether there are failures in the way of 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.

For the disassembly of other components of the machine induced by the electric lock removal or installation, please refer to the corresponding tool lists which are excluded from the section hereof.

Procedures of failure detection for electric lock

1. Unplug the connectors connected with the electric lock, to separate the electric lock from the machine circuit.
2. Turn the digital multimeter to 200 Ω of Ω position.
3. According to the electric lock gear logical table, pins corresponding to "●" marked in each gear should be connected, and the display value of multimeter should be "0" when measuring; pins between "●" marked and "●" unmarked 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.

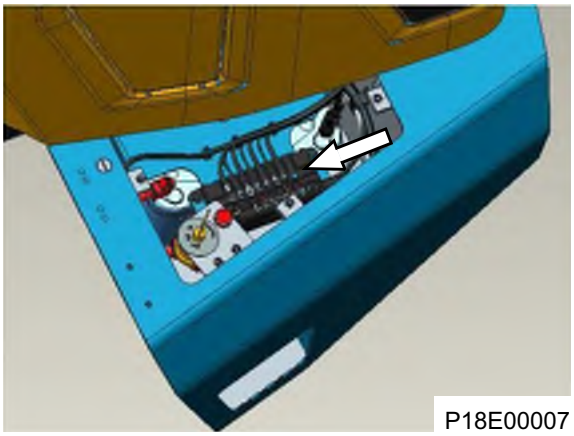
Electric lock gear logical table

Gears / Pin	1	2	3	4	5	6
OFF	●					●
IGN	●			●	●	●
START	●	●		●	●	●

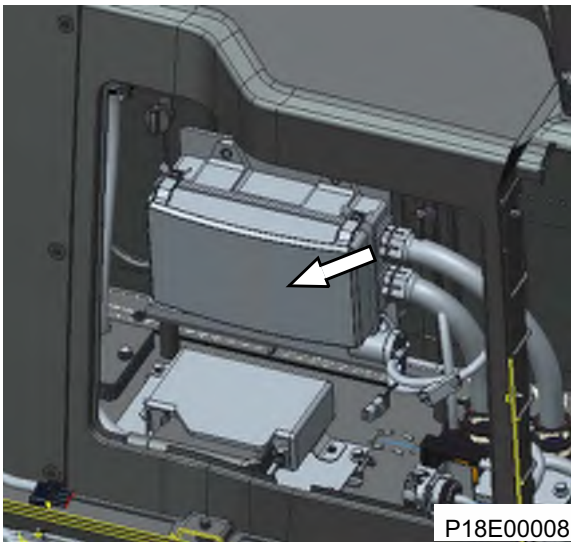
Fuse

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 ranges from 30A, 50A, 60A, 80A, 150A, for the main circuit.

Location diagram of complete bolt type fusing machine


P18E00007

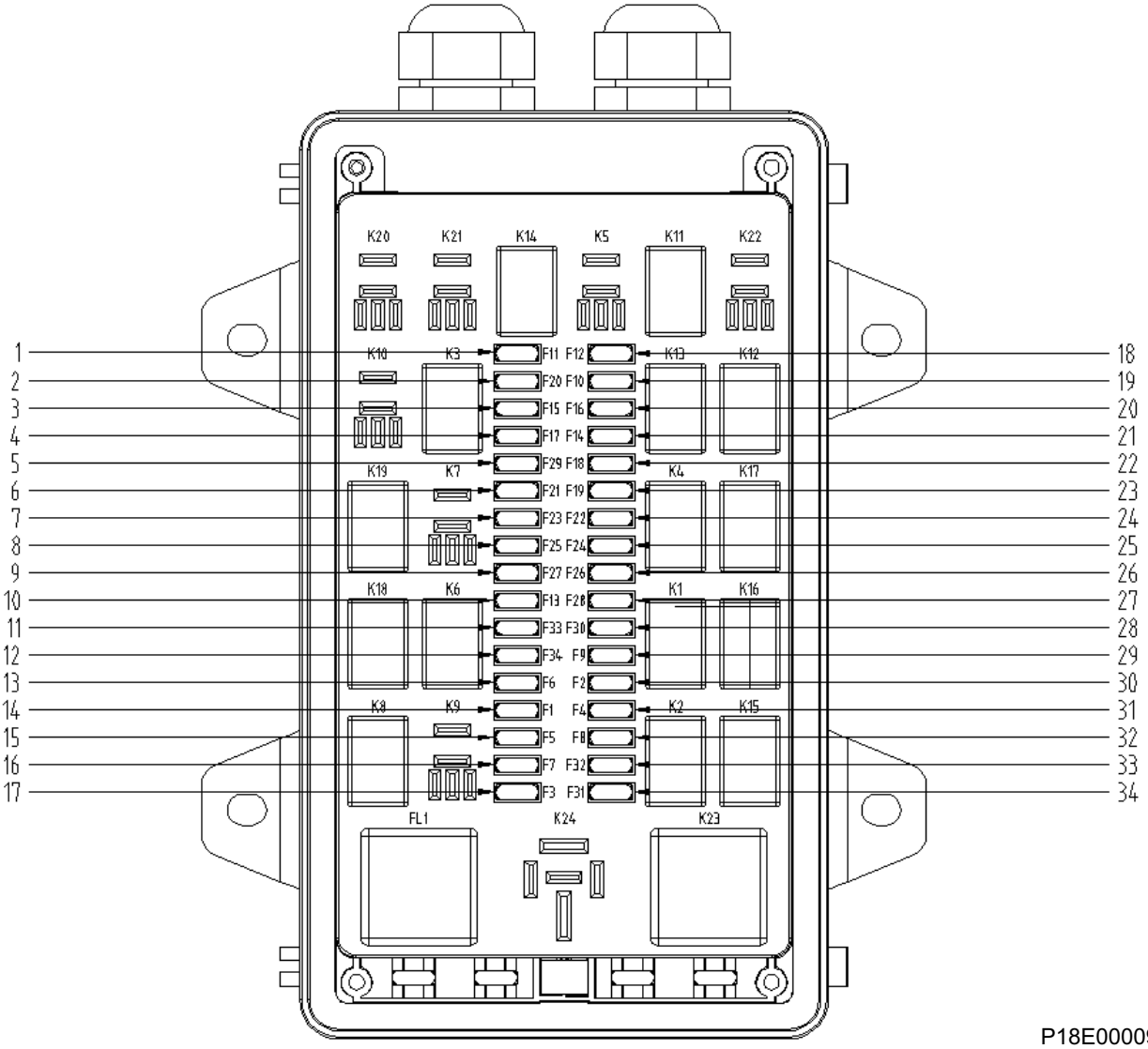
Location diagram of complete inserting disk fusing machine


P18E00008

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 component number	Specification	Color
37B2023	5A	Brown
37B2024	7.5A	Brown
37B2025	10A	Red
37B2026	15A	Blue
37B2027	Running time	Yellow

Definition table for function of plug-in fuse is as follows:



P18E00009

1. Aux control 4
2. DC-DC
3. Aux control 2
4. Headlight
5. Standby 6
6. Seats
7. Front work light
8. Standby 2
9. Standby 4
10. ECM power
11. Left small lamp
12. Right small lamp
13. Standby 12
14. Electric lock
15. Fuel lift pump
16. Aux control 1
17. Flasher/small lamp
18. Emergency steering system
19. Radio and tape player/cigar Lighter
20. Aux control 3
21. Instrument
22. Rear work light
23. Defroster
24. Wiper system
25. Standby 1
26. Standby 3
27. Standby 5
28. Standby 7
29. Electric horn / backup alarm
30. ECM power
31. Standby 13
32. Brake light
33. Right brake light
34. Left brake light

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 replacement of blown fuse break down again, proceed on replacing after inspecting the circuit under the jurisdiction of the fuse and troubleshooting.

The troubleshooting method of fuse

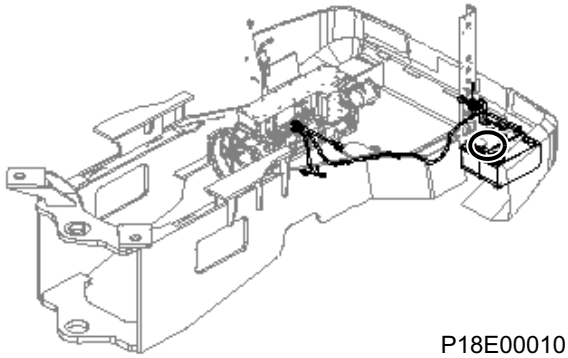
Remove the plug-in fuse from the fuse holder, to determine the condition of fuse visually. The inspection methods of bolt fuses can also be applied in the judgment.

Adjustment steps for blowout of bolting type fuse:

1. Turn the digital multimeter to 200 Ω 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.

Disconnect switch

Negative switch regulates the connection between battery (-) and the machine frame. The power (-) of the whole machine is disconnected when the negative switch is turned to "O" (OFF). The complete vehicle electrical equipment cannot work even turn on the electrical lock. Turn the negative switch to "I" (ON), the power (-) of the whole machine is connected. Whereby, the electric lock controls the connections between the electrical components and powers throughout the machine, as well as starts the diesel engine.



P18E00010

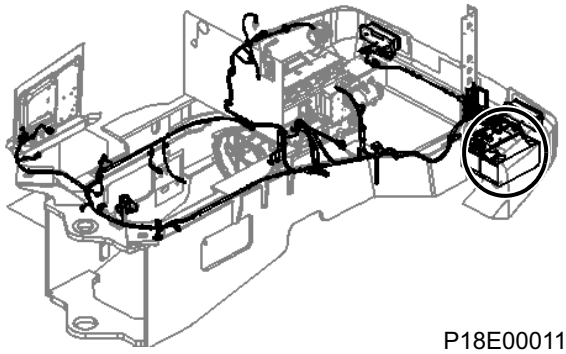
Precautions

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 be resulted in;
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 whole machine.

Battery

The machine obtains +24 V power through the series connection of 2 batteries. The rate capacity is 55Ah, and cold-starting current is 850CCA.

As reversible DC (direct current), 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 start the motor and further drive the diesel engine to start. Besides, the battery serves as an electrical appliance, which safeguards electrical equipment of the machine through absorbing the overvoltage arising from the circuit at any moment.



P18E00011

State detection of battery

Observe the built-in hydrometer of the battery cover in well-lighted condition, to figure out the charge state of battery or take appropriate measures in accordance with the color displayed in the hydrometer, in particular:

Indicator color	Green	Black	Transparent
State or solution	Good	Need be charged	Need be replaced

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 "0". Turn the electrical lock to "OFF", and extract the key.
2. Disassemble the battery from the machine. Turn off the battery cable (-) and battery cable (+) successively before disassembling the battery.
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. Charge the battery with the charger of 16.0V (within 16.2V) constant voltage until the battery hydrometer turns green. The green hydrometer indicates that the battery is fully charged.
6. On condition that constant voltage is unavailable, use constant current instead. Charge the battery with 12A charging current until the battery hydrometer turns green. The green hydrometer indicates that the battery is fully charged.

The relative relationship of auxiliary charging time with voltage of battery:

Battery voltage	12.45~12.55V	12.45~12.35V	12.45~12.20V	12.45~12.05V
Recharging time	2 hours	3 hours	4 hours	5 hours
Battery voltage	12.45~11.95V	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	

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 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 overdischarge or overcharge, shall rather be scrapped than recharged.
8. If the hydrometer remains black 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 battery troubleshooting

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 "0".
2. Turn the digital multimeter to 50 V 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. Put disconnect switch in the position of "I". Switch on the electrical 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.

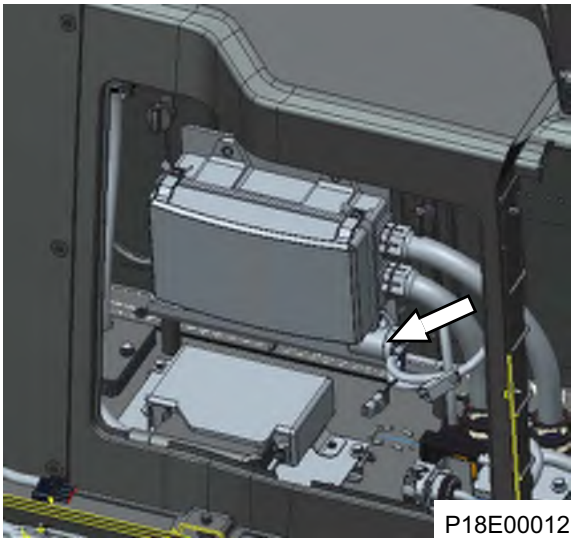
Any battery that is capable of completing the above steps and successfully starting the diesel engine, is in good service condition; otherwise, test by following steps.

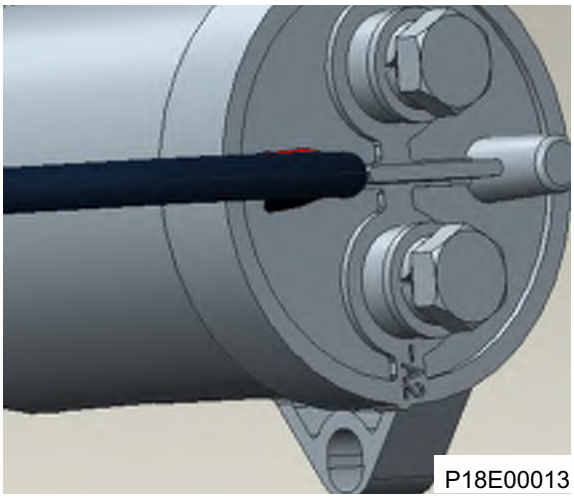
1. Disconnect all the battery connecting cables, thereby, two batteries are completely disconnected.
2. Turn the digital multimeter to 50 V of voltage position.
3. Connect the red probe of DMM to the positive terminal of one battery, while the black probe to the negative terminal, the value displayed 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 supply relay

The machine is equipped with a 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 attracts the armature inside the relay, whereby, the normally open contracts switch on.

The relay is assembled around the centralized control box of electric appliance.

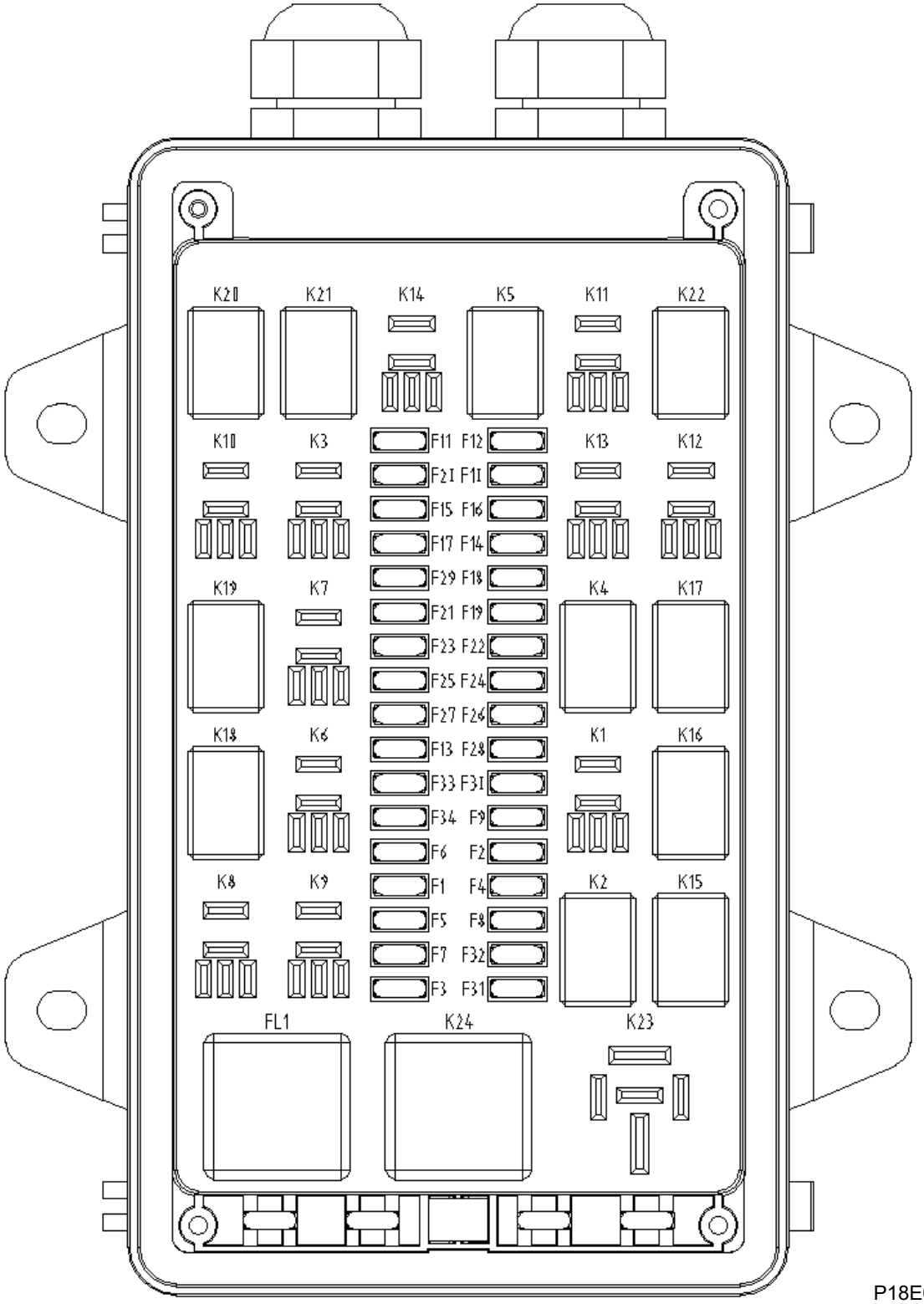

P18E00012


P18E00013

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.

Socket relay is concentrated on the control box, of which the location schematic and function diagram are as shown below. The location and function definitions of socket relay will not appear hereinafter.


K20
K21
K14
K5
K11
K22
K10
K3
F11 F12
K13
K12
F21 F11
F15 F16
F17 F14
K19
K7
F29 F18
F21 F19
K4
K17
F23 F22
F25 F24
F27 F26
K18
K6
F13 F28
K1
K16
F33 F31
F34 F9
F6 F2
K8
K9
F1 F4
K2
K15
F5 F8
F7 F32
F3 F31
FL1
K24
K23

P18E00014

S/N	Definition	PDM number	S/N	Definition	PDM number
K1	Electric horn	31B0173	K13	Front window washer	31B0173
K2	Brake light	31B0173	K14	Auto swing arm shock absorber	31B0173
K3	Fan reversing	31B0173	K15	Back-up Alarm	31B0173
K4	Defroster	31B0173	K16	G Relay	31B0173
K5	Secondary steering	31B0173	K17	D Relay	31B0173
K6	Standby	31B0173	K18	Starting protection	31B0173
K7	Standby	31B0173	K19	Neutral startup interlock	31B0173
K8	Ready to regenerate	31B0173	K20	Boom limit	31B0173
K9	Fuel lift pump	31B0173	K21	Bucket positioning	31B0173
K10	Standby	31B0173	K22	Standby	31B0173
K11	Wiper Position 2	31B0173	K23	DCU power	31B0095
K12	Wiper Position 1	31B0173	K24	Heating valve	31B0095
			FL1	Flasher	31B0005

Troubleshooting procedures of power relay

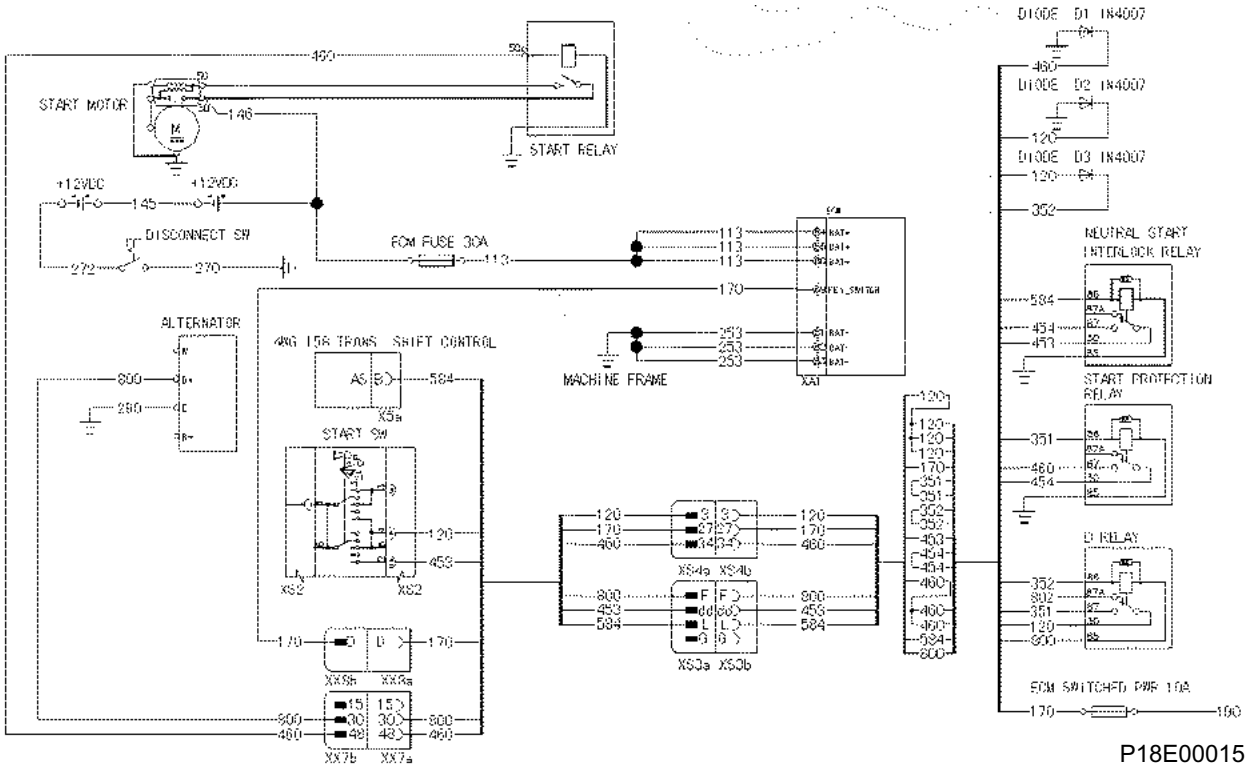
1. Remove the relay from the relay socket.
2. Turn the digital multimeter to 200 Ω of Ω position.
3. Connect the red probe of DMM to the relay terminal "86", while the black probe to terminal "85", the value displayed on DMM shall be around "330Ω" thereby.
4. Turn the digital multimeter to 200 Ω of Ω 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 (-) 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 values displayed 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.

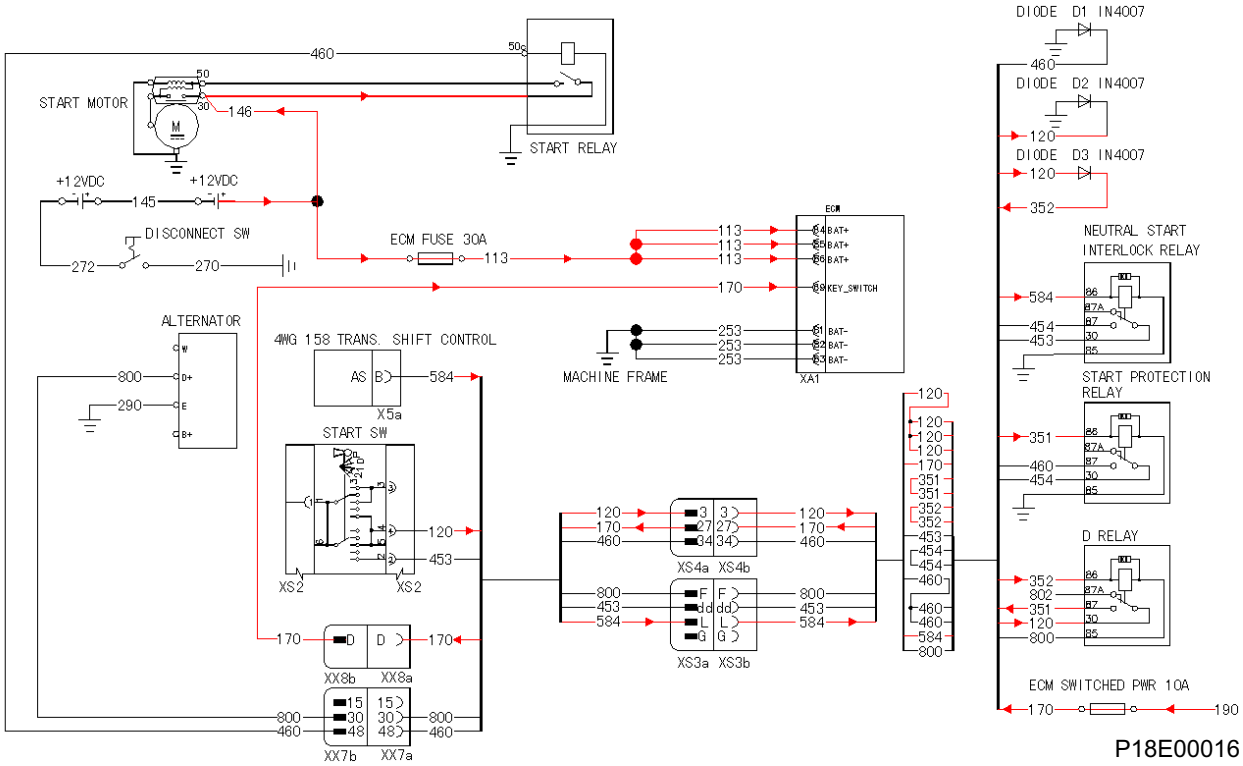
Starting module

Schematic diagram of starting module

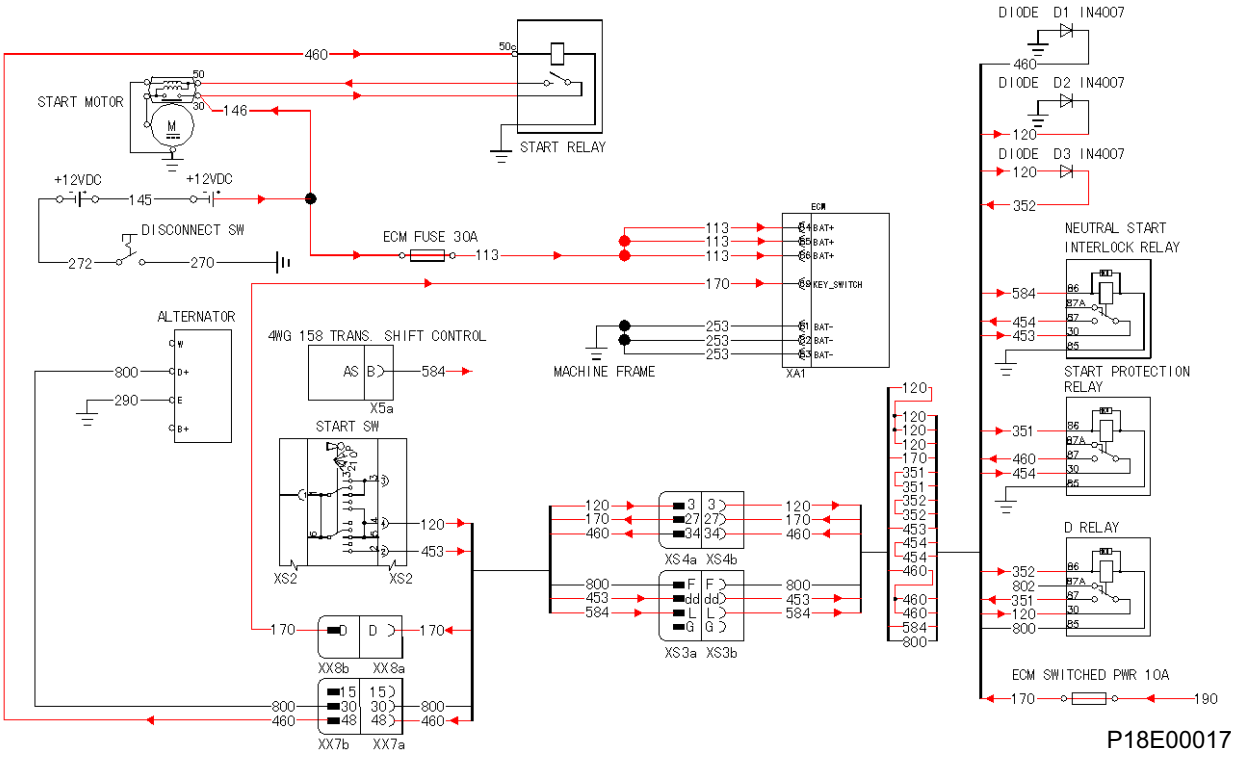


Analysis of the electrical schematic diagram

1. Turn on negative switch and switch electric lock to "IGN", the analysis of the schematic diagram hereof can be found in the power supply system;
2. Turn the shift control lever to neural position, No.584 wire of the ZF shift controller outputs a high level signal of (+24V); No.800 wire of engine D+ outputs a low level;

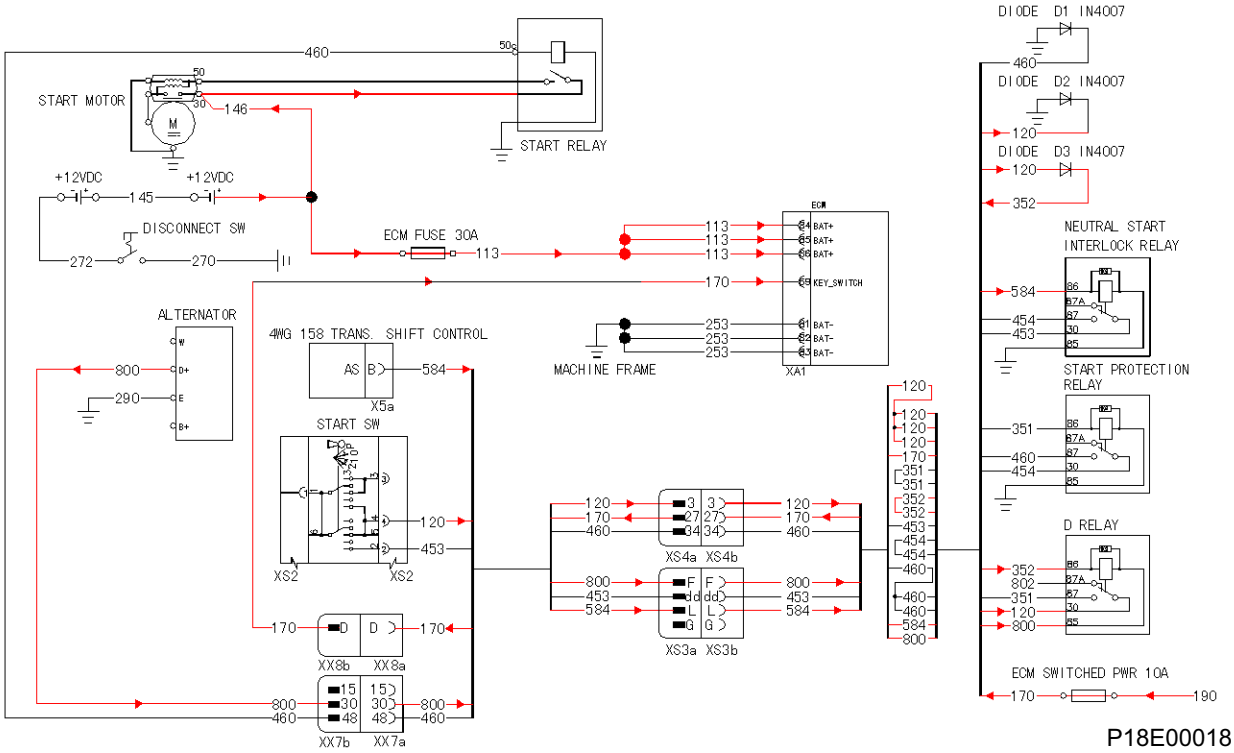


3. After the electric lock is rotated to START;



P18E00017

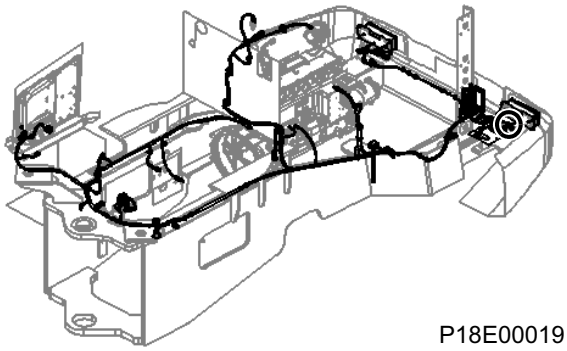
4. After the machine starts, No.800 wire of alternator D+ outputs high level signal, and starter protection function is enabled, at the same time release electric lock from "START" to "IGN".



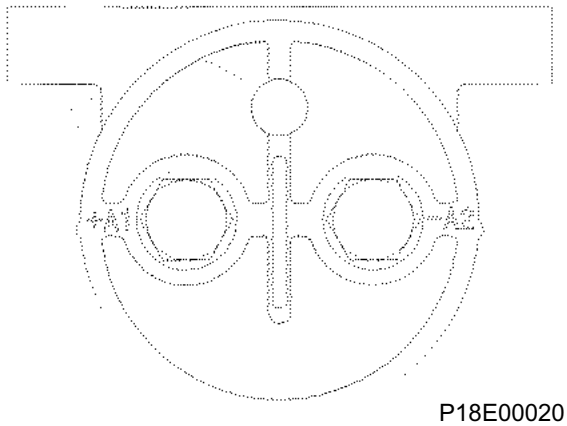
P18E00018

Start Contactor

A contactor of 100A is equipped in the machine to control the start. The rated load current of the contactor contact circuit is 100A, only a group of operating contacts are provided as 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.



P18E00019



P18E00020

Precautions

A1+ indicates the current input direction, and A2- shows the current output direction. In the case of connection error, the inoperative magnetic blow-out function of contactor will shorten its service life.

Troubleshooting procedures of contactor

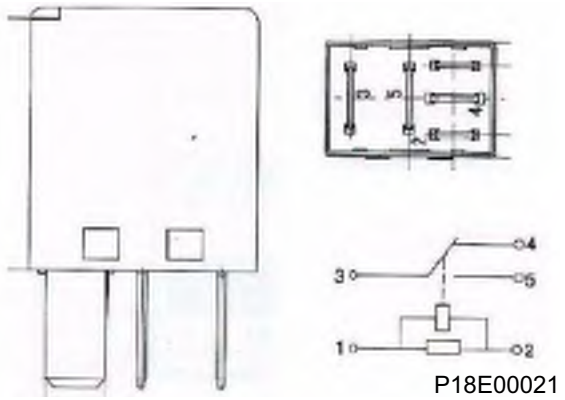
1. Turn the digital multimeter to 200 Ω of Ω position.
2. Connect both probes of DMM to the connector terminals of the contactor respectively, the value displayed on DMM shall be around "96Ω" thereby.
3. Connect both probes of DMM to the bolts (the operating contact terminals) of the contactor respectively, the value displayed on DMM shall be around "1" thereby.
4. Apply +24 V power to the connector (coil terminal) of contactor, while connect both probes of DMM to the bolts of contactor respectively, the value displayed on DMM shall be around "0" thereby.

After completing the above steps, if the values displayed on DMM conform to that described in the steps, the contactor is in good service condition. The above steps are inapplicable to the operating contacts (normally open) where the abrasion is very severe.

Relay

The rated load current of MINI relay is 10A/20A with two groups of operating contacts equipped, therein, the load current of normally open contact is 20A, while that of normally closed contact is 10A. Apply +24V voltage to the relay coil, and the generated electromagnetic force switches on the operating contact-normally open contact. Whereby, the external circuit, of which the rated load current is 20A, is connected. Disconnect +24V voltage to the relay coil, the relay recovers to reset condition.

MINI relay is concentrated on the control box.



P18E00021

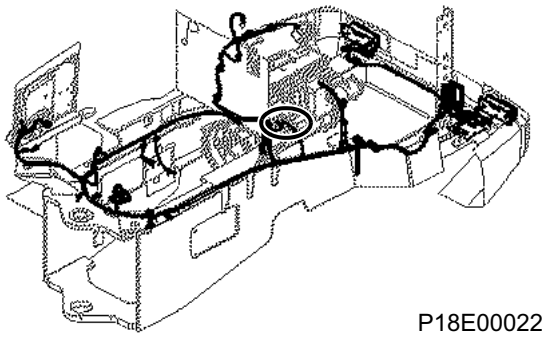
Steps of relay troubleshooting

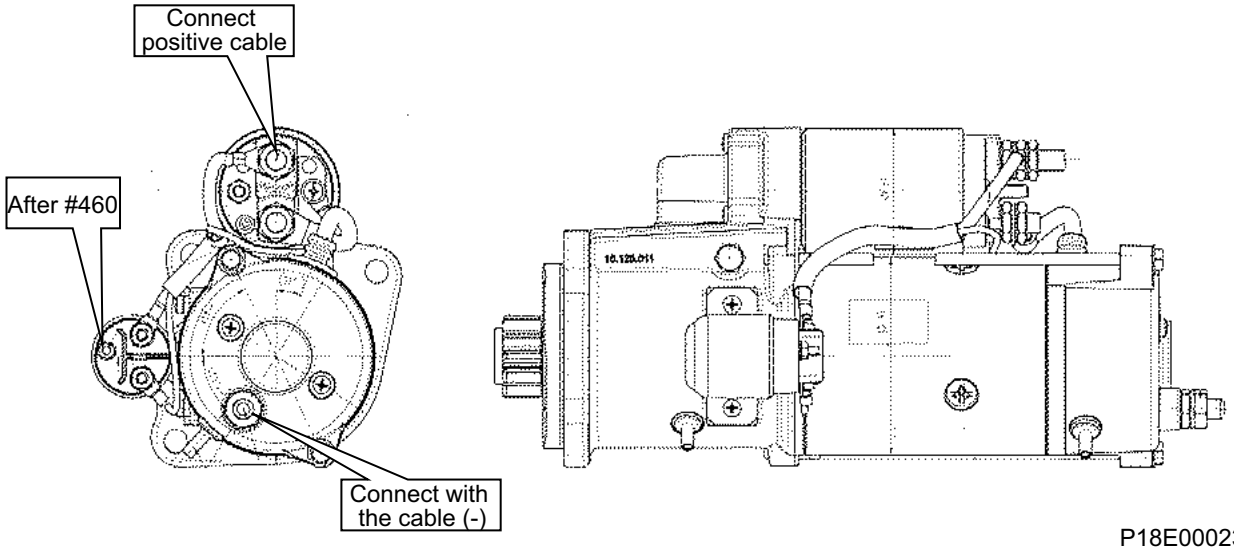
1. Turn the digital multimeter to 200 Ω of Ω position.
2. Connect the red probe of DMM to the relay terminal "1", while the black probe to terminal "2", the value displayed on DMM shall be around "155" thereby.
3. Connect the one probe of DMM to the relay terminal "5", while the other to terminal "3", the value displayed on DMM shall be "1" thereby; change the probe on the terminal "5" to the terminal "4" , the value displayed on DMM shall be "0".
4. Apply +24V external power (+) to the terminal "1" of relay, while (-) pole to terminal "2"; on the other hand, connect one probe of DMM to the terminal "5" of relay, the other probe to terminal "3", thereby, the DMM displayed value shall be "0". Shift the probe at terminal "5" to terminal"4", the value displayed on DMM shall be "1".

After completing the above steps, if the values displayed 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 (both normally open and closed contacts) where the abrasion is very severe.

Starting Motor

The starter motor equipped in the machine is configured for 24V/5.5kw. 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.


P18E00022

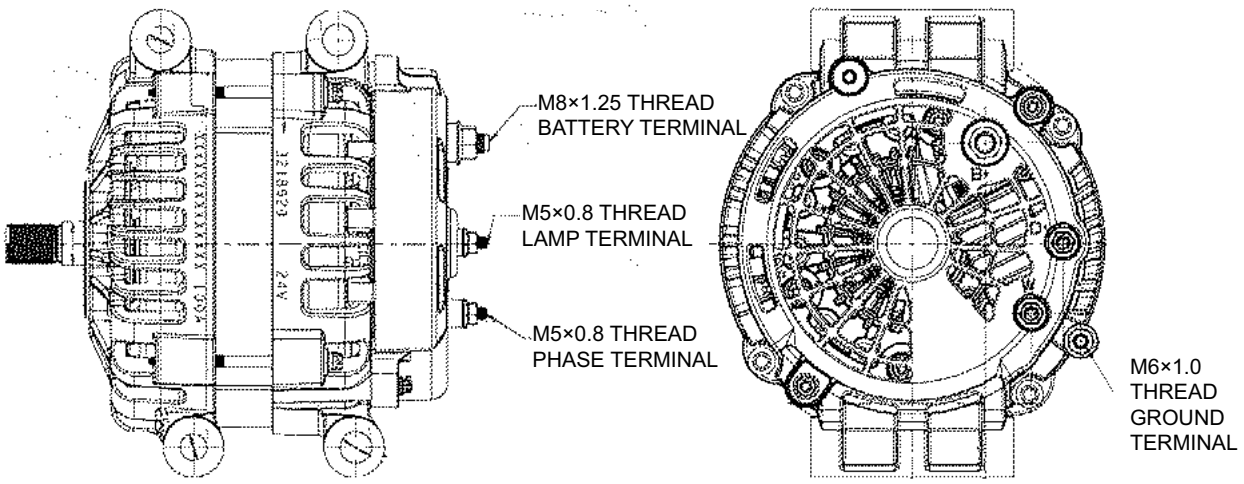


P18E00023

Alternator

As the main power unit of the machine, the alternator translates the energy from diesel engine into serviceable electric energy of electrical equipment. The electrical components are configured for 24V/100A, with electronic voltage regulator equipped inside. The alternator is connected in parallel with the battery to power the 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 machine.

This machine uses three terminals of generator, i,e. 1. Battery Positive；2. Ground；3.LAMP (D+).



P18E00024

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 +" (Battery Positive) terminal and "Ground" terminal of generator 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 entire 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 or above.

1. Turn the digital multimeter to 200V of voltage position.
2. Turn on disconnect switch of the machine, do not start the diesel engine, put red probe of a digital multimeter over "B+" end of an alternator, put black probe over "Ground" terminal of the alternator, and write down displayed value of the digital multimeter. The normal value is about 24-25 V.
3. 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 procedures shall be implemented on unloaded machine (unload: the condition that the electric lock is switched on, yet all the electrical switches or components on the machine are switched off).

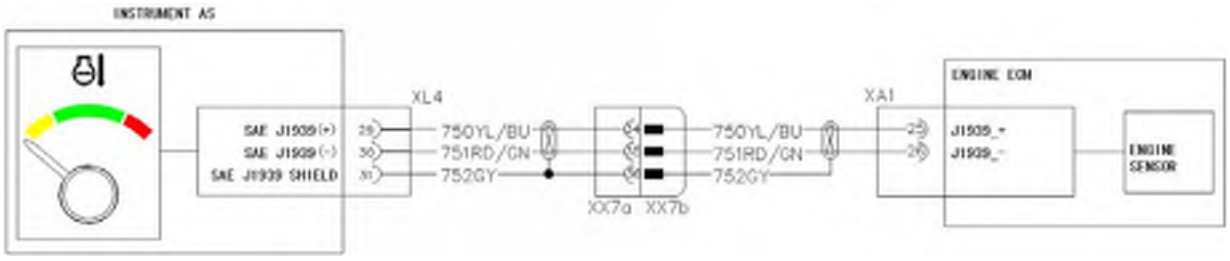
If the value on DMM is unchanged through the tests in steps 2 and 3, switch off the electric lock to inspect the alternator as per the following steps.

1. Inspect the transmission belt of alternator in accordance with the methods introduced in the specification. 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 Perkins.

Monitoring system

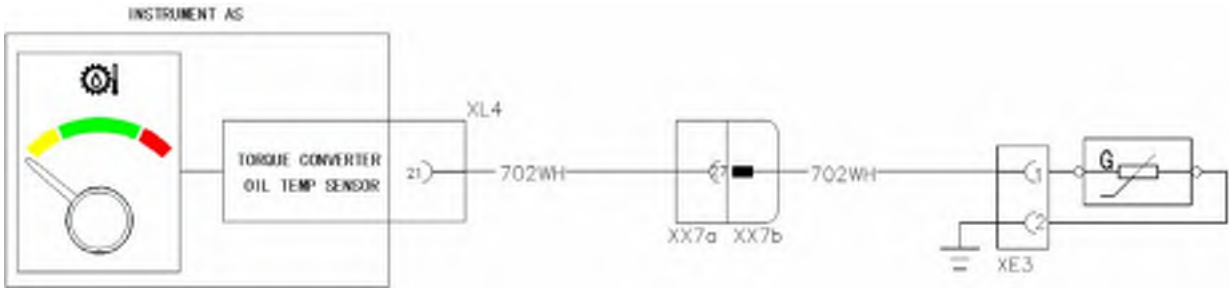
Circuit for engine water temperature indication



P18E00025

This machine uses Perkins 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.

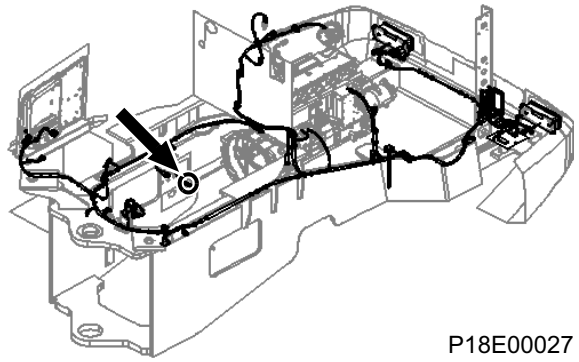
Circuit for torque converter oil temperature indication



P18E00026

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.

Torque converter oil temp sensor



P18E00027

Precautions

Switch off the electric lock, and replace the temperature sensor until the machine is completely cooled if necessary. Therein, measured liquid overflows once the temperature sensor is loosened, which shall be supplemented timely after the replacement.

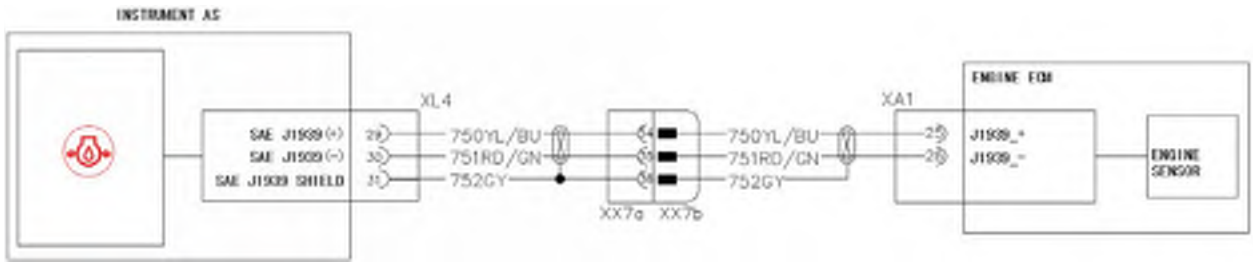
The detection of torque converter oil temp sensor

1. Unplug the connector, through which the rear frame harness connects to 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 for oil pressure alarm

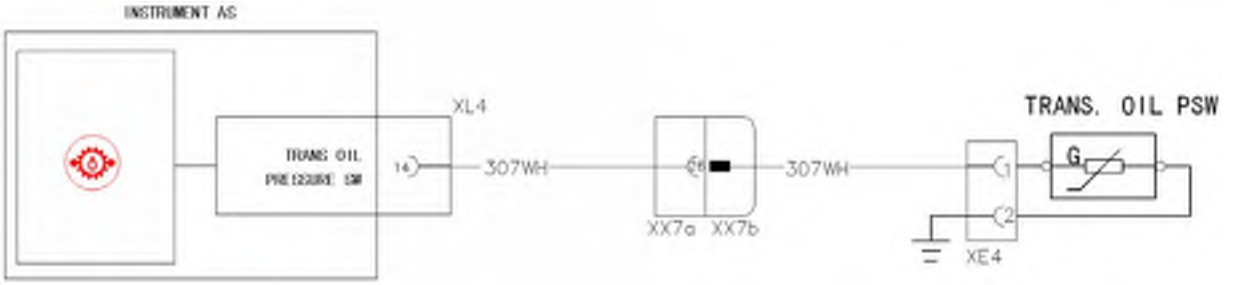
This machine uses Perkins Electric Injection Engine whose oil pressure signal is acquired and processed by ECM. If ECM decides the oil pressure falls below a specified value after processing, it will send alarm signal to the meter by CAN bus. The microcontroller actuates the appropriate alarm indicator light to ON after reading this signal.



P18E00028

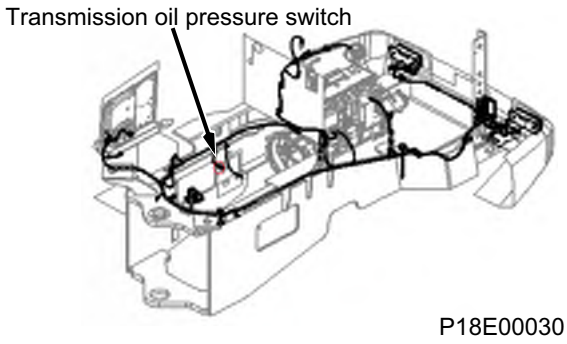
Circuit for transmission oil pressure alarm

For monitoring the pressure of shift control valve, the shifting oil pressure alarm indicator is lit once the pressure of shift control valve is lower than 1.45Mpa.



P18E00029

Transmission oil pressure switch



P18E00030

Precautions

Be sure to switch off the electric lock and wait until the machine is fully cooled, to replace the pressure switch if necessary.

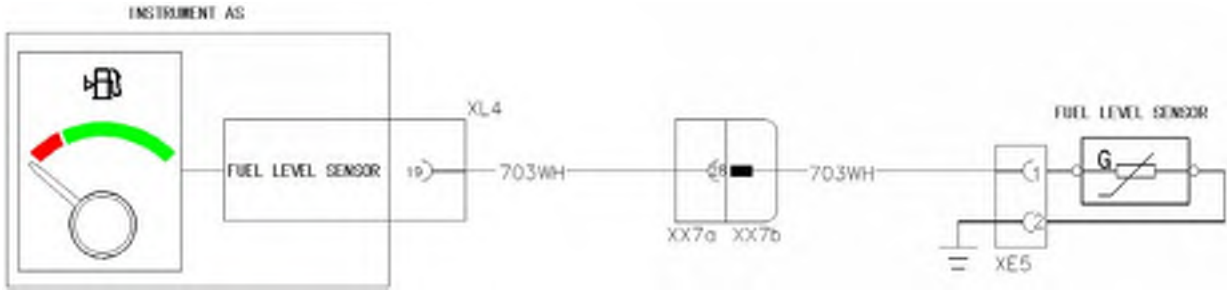
Therein, measured liquid overflows once the pressure switch is loosened, which shall be supplemented timely after the replacement.

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 operating value of pressure switch with pressure test bed, and the operating value of its normally closed contact is 1.45Mpa.

Circuit for fuel level indication

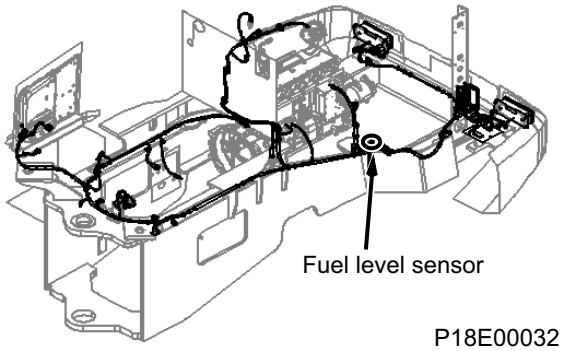
It is used to monitor the oil quantity of diesel tank.



P18E00031

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.



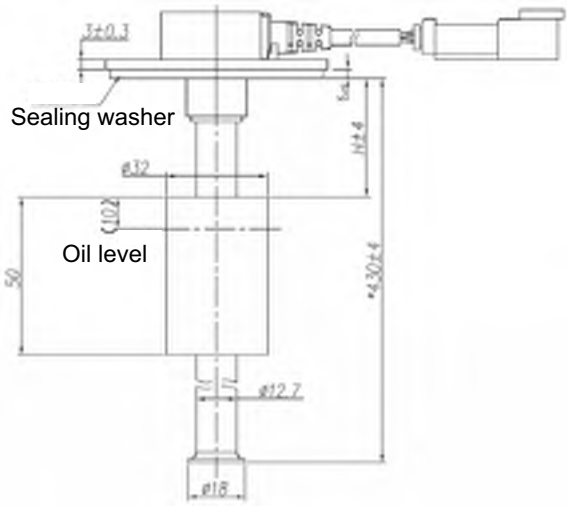
P18E00032

Precautions

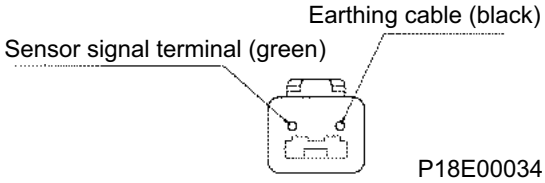
Switch off the electric lock, and replace the fuel level sensor until the machine is completely cooled if necessary. When replacing, prevent foreign matters from getting into the diesel tank.

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;
3. Turn the digital multimeter to 1000Ω 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;



P18E00033

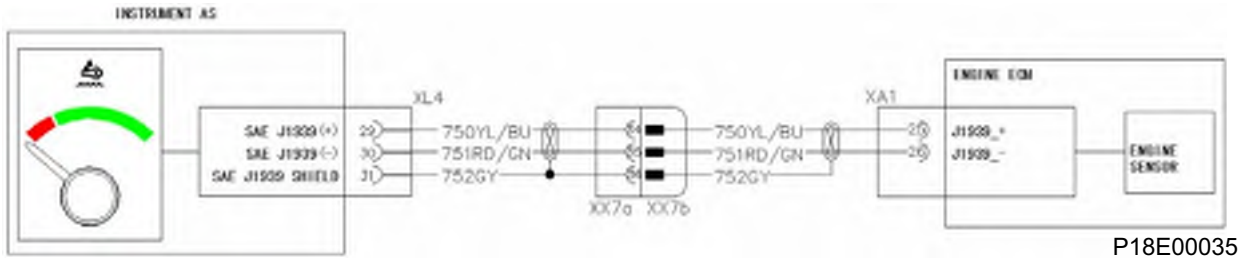


P18E00034

Technical parameters (After floater rises to the top, then drop to test)		
Floater position (H)	**Gear**	**Resistance (Ω)**
<65	Full level	68
65	8/9	136
94	7/9	204
123	6/9	272
152	5/9	340
181	4/9	408
210	3/9	476
242	2/9	544
277	1/9	612
316	0 level	680

Circuit for DEF level indication

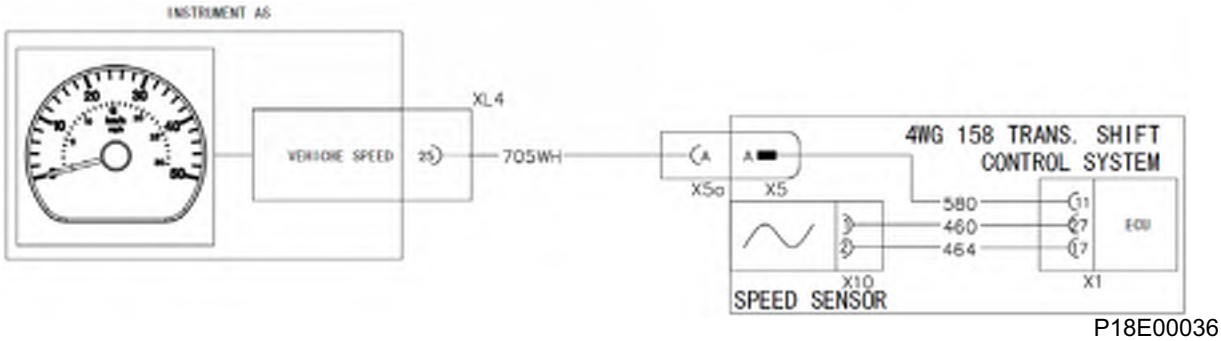
It is used for monitoring the liquid level of DEF pot. This machine uses Perkins Electric Injection Engine whose ECM sends the DEF liquid level signal to the meter by CAN bus. The meter microcontroller processes information after reading liquid level data, and finally to actuate the DEF liquid level gauge.



P18E00035

Circuit for vehicle speed indication

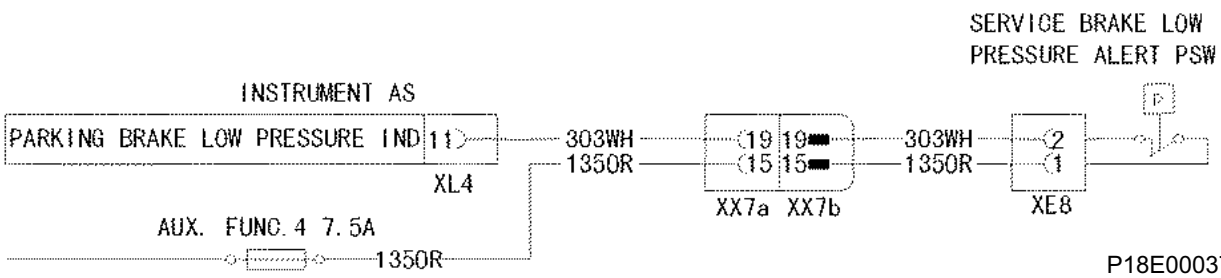
For monitoring the machine speed condition. The output speed sensor, installed on the gearbox housing, is used to detect the speed of gearbox output gear. The speed sensor consists of coil, permanent magnet and pole. The coil is wound outside the pole, and the pole is connected with the permanent magnet. 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.



P18E00036

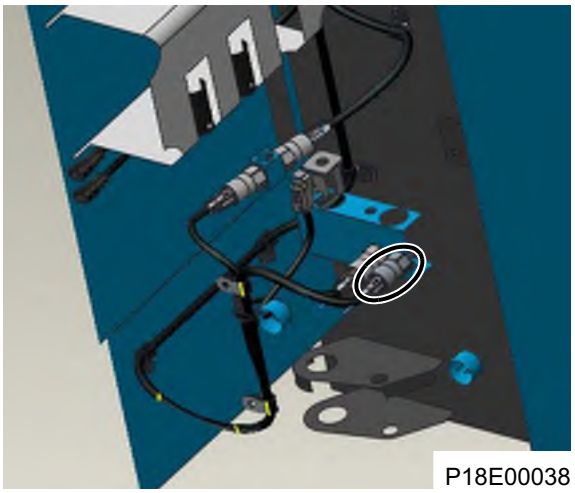
Service brake indication circuit

When sercive brake pressure is less than 9MPa, the pressure switch turns on and brake low pressure indicator turns on.



P18E00037

Low pressure alarm pressure switch of service braking



P18E00038

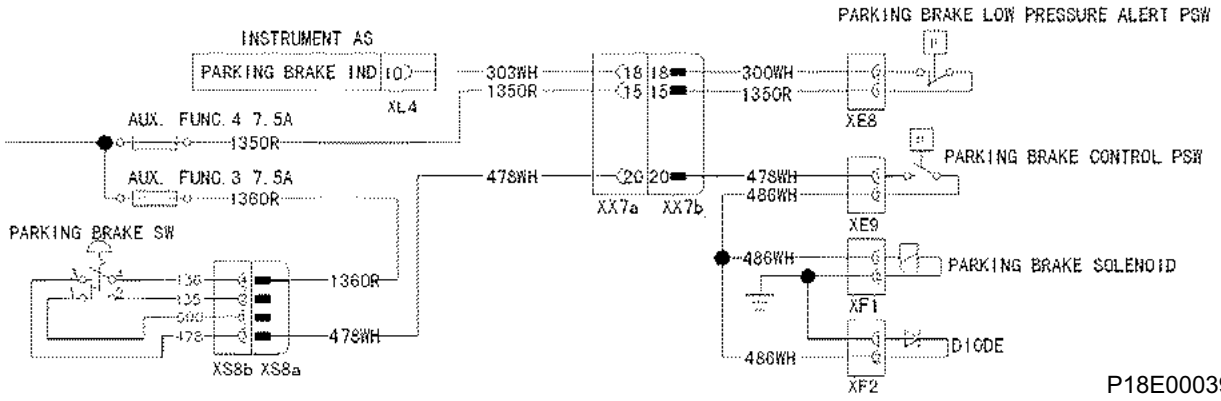
Test on pressure switch failures

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 9Mpa.

Wiring schematic diagram of braking

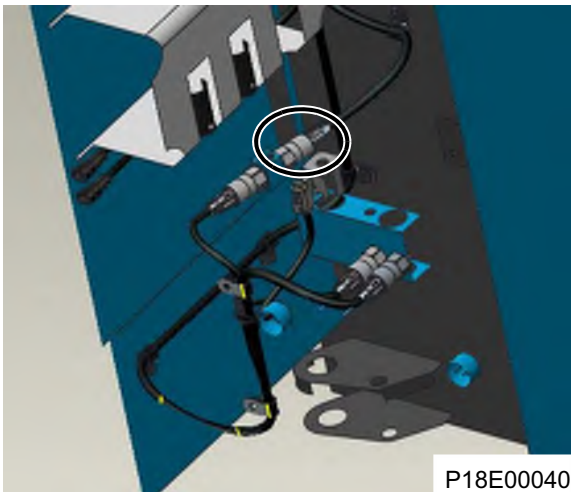
When parking brake switch is pressed down, connect pin 3 and 4. When brake pressure is less than 11MPa, the low pressure alarm switch of parking brake turns on and indicator turns on.

When brake pressure is less than 7MPa, control pressure switch of parking brake turns off, parking brake valve is outage and tyre is locked by action of brake.



P18E00039

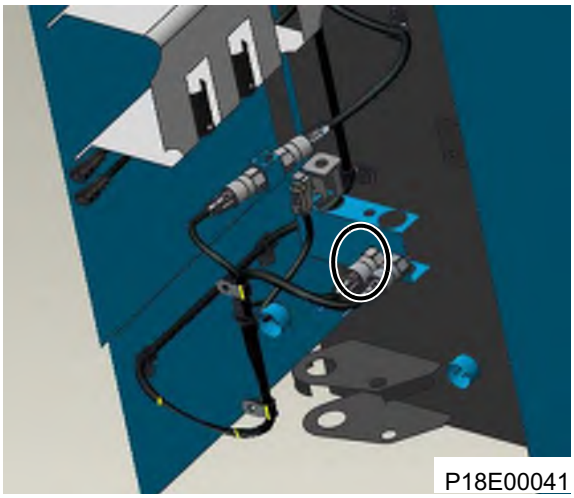
XE7 Parking brake low pressure alarm switch


P18E00040

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 11Mpa.

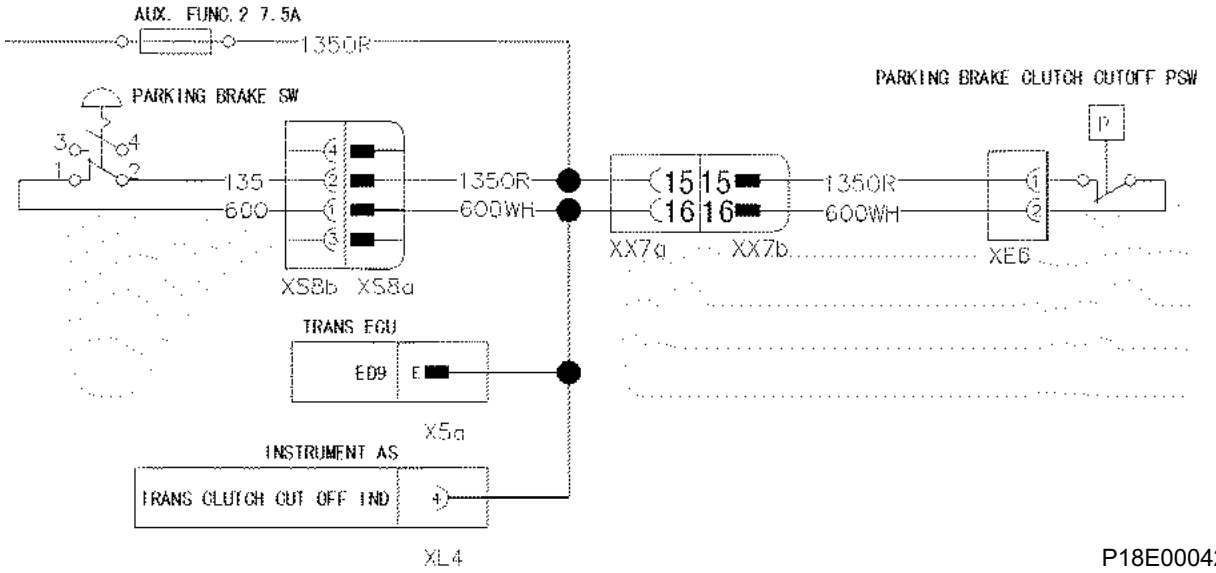
Parking brake control pressure switch


P18E00041

Test on pressure switch failures

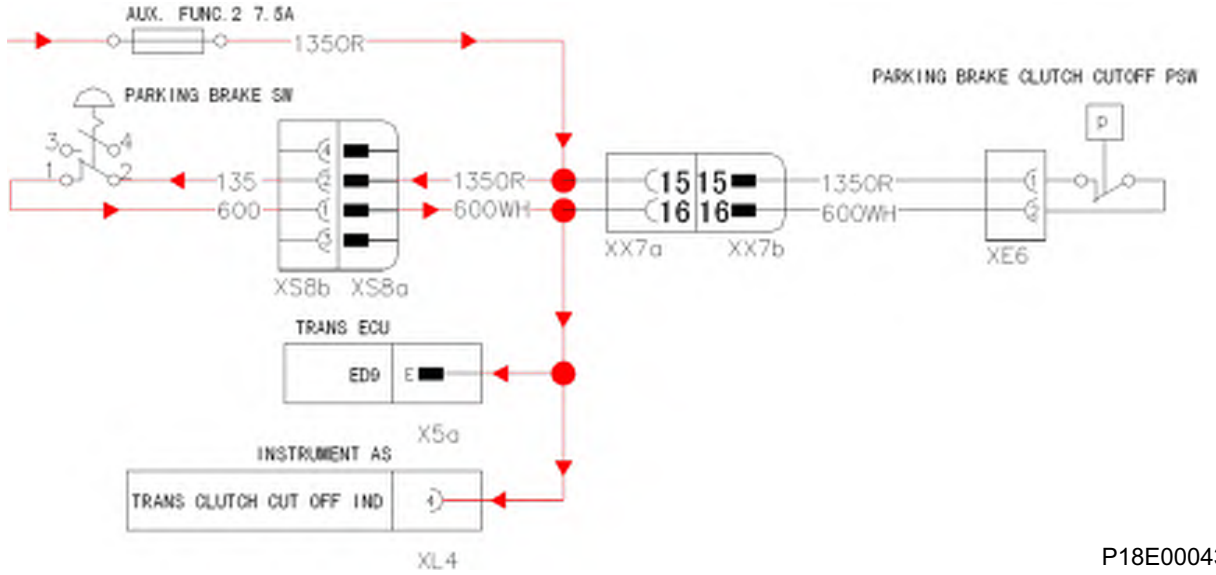
1. Unplug the connector connected to pressure switch in the rear frame harness;
2. Remove the pressure switch from the complete machine;
3. Assess the action value of pressure switch with pressure test bed, and its contact type is normally open with action value up to 7Mpa.

Circuit for parking brake power cut-off



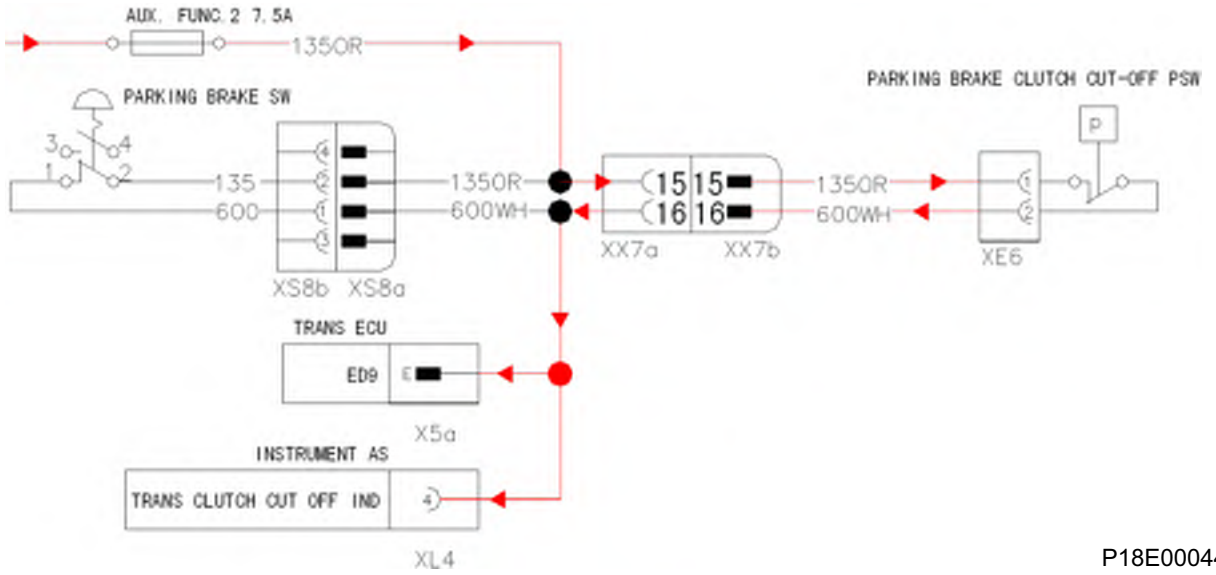
P18E00042

When the parking brake switch is pulled up, pin 1 and 2 is connected, the input signal of gearbox power cut-off is high, and the complete machine lie in the status of power cut-off, at the same time power cut-off indicator turns on.



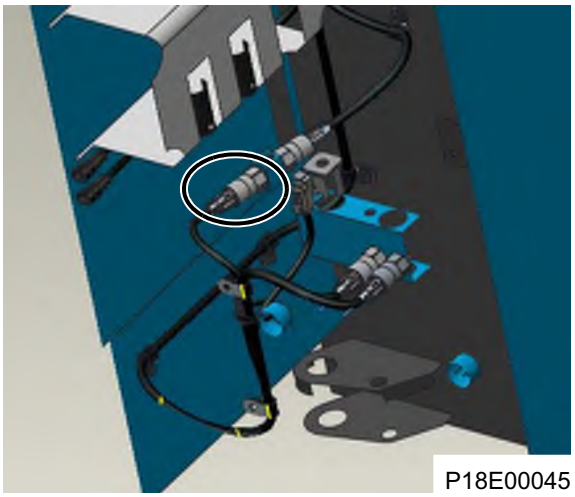
P18E00043

When the brake pressure is less than 6MPa, parking brake clutch on/off switch turns on, the input signal of gearbox power cut-off is high, and the complete machine lie in the status of power cut-off, at the same time power cut-off indicator turns on.



P18E00044

Parking brake power cut-off Switch



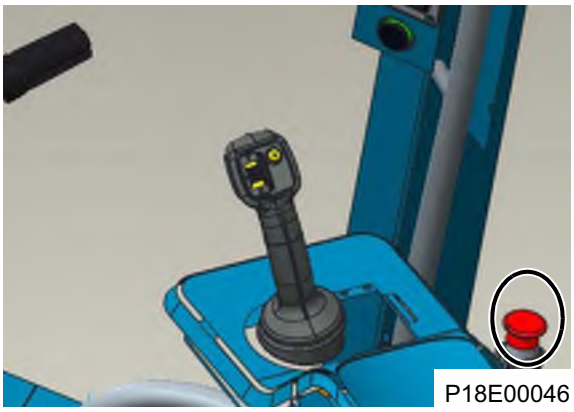
P18E00045

Test on pressure switch failures

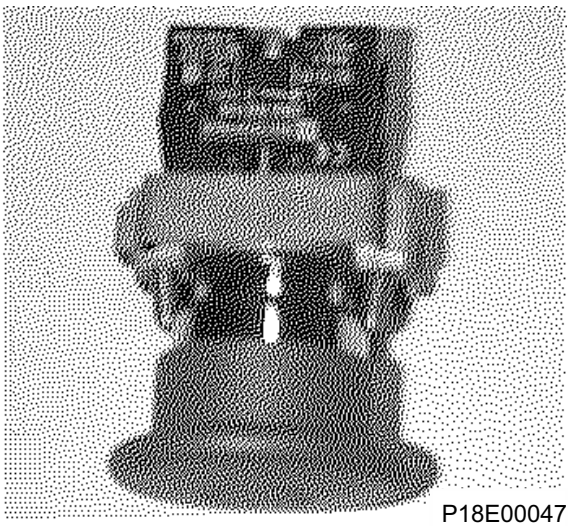
1. Unplug the connector connected to pressure switch in the rear frame harness;
2. Remove the pressure switch from the complete machine;
3. Assess the action value of pressure switch with pressure test bed, and its contact type is normally closed with action value up to 6Mpa.

Parking brake button

This switch includes a button and two contact modules (one is normally open, the other is normally closed). Press up the button, the normally-closed contact (1,2) is active, the normally-open contact (3,4) is inactive. When pressing down the button, the normally-closed contact is in active and normally-open contact active.



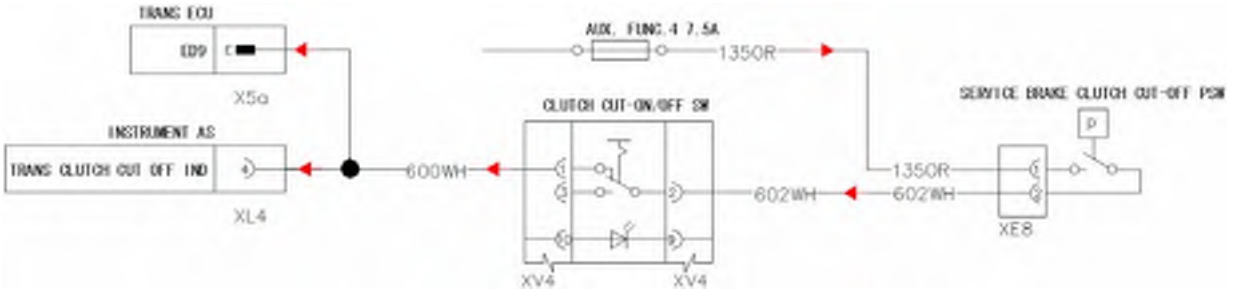
P18E00046



P18E00047

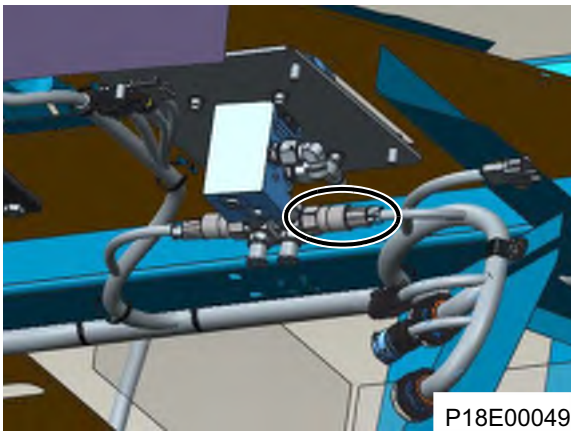
Circuit for service brake clutch on/off

Turn the clutch on/off switch to "on/off", the service clutch shutoff pressure switch is turned on once the brake pedal is pressed during the service, and the indicator of clutch shutoff switch on instrument is lit. This function is active only when the position selector is at I or II position.



P18E00048

Pressure switch for service power cutoff



P18E00049

Precautions

Be sure to switch off the electric lock and wait until the machine is fully cooled, to replace the pressure switch if necessary.

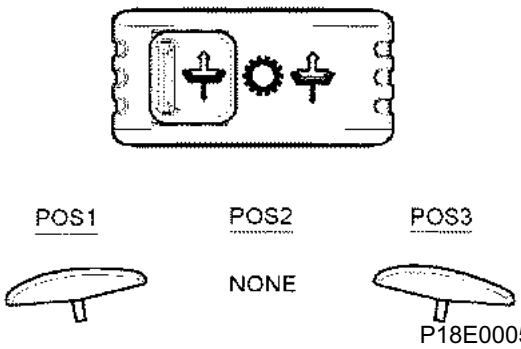
Test on pressure switch failures

1. Unplug the connector connected to pressure switch in the cab 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 open with action value up to 1.5Mpa.

Clutch on/off switch

POS3 indicates to select the service clutch shut-off function, while on the other hand, POS1 signifies not to select such function.

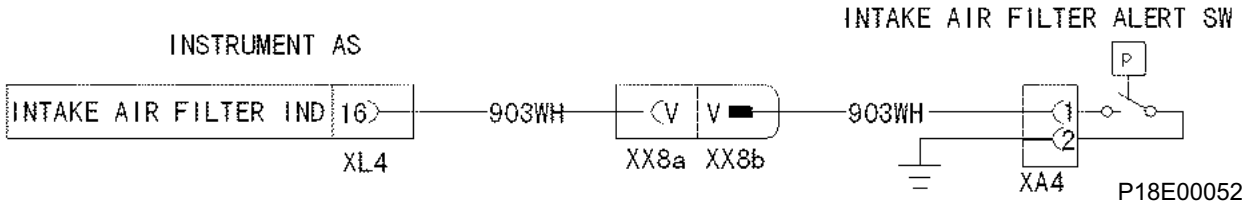
P18E00050



P18E00051

Circuit for air filter blockage alarm

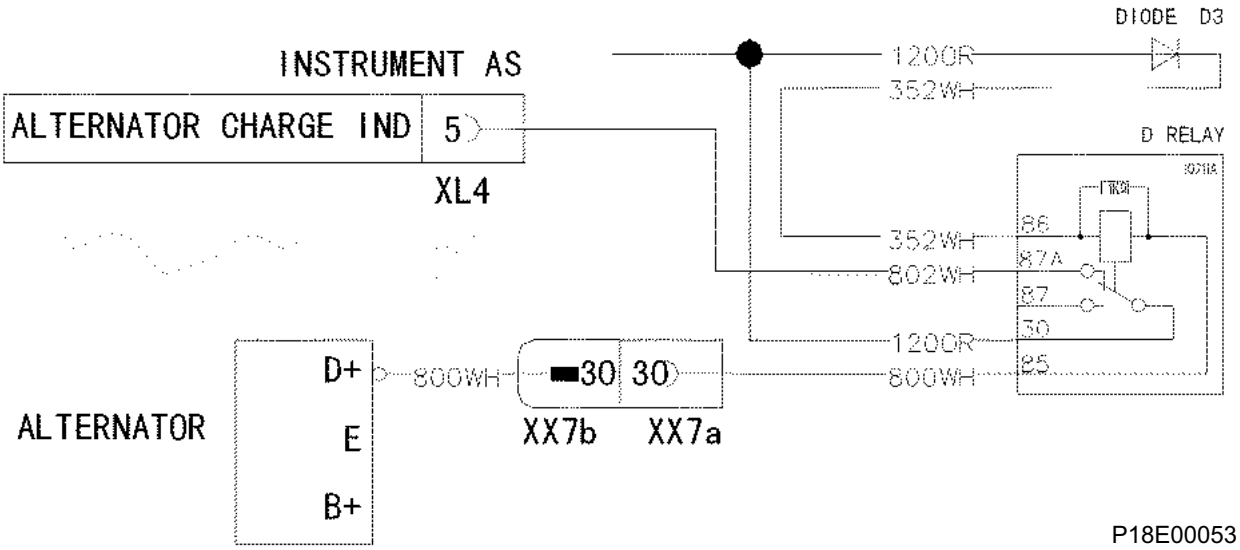
The intake air filter alert indicator is lit if the intake resistance exceeds 6.3KPa. The type of air filter blockage alarm switch is normally open.



P18E00052

Circuit for alternator charging indication

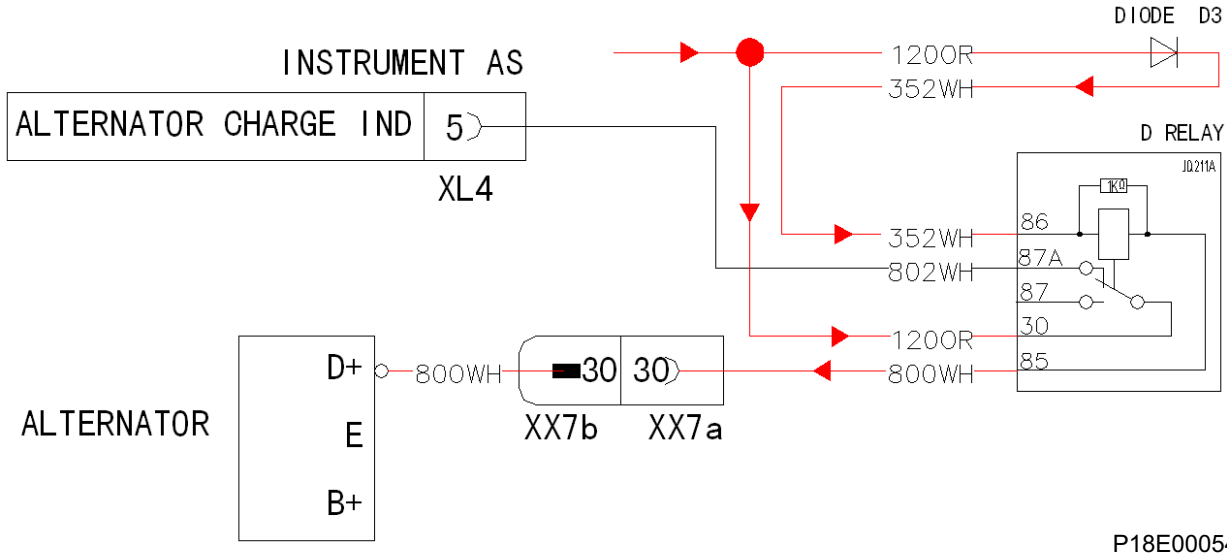
It is used for monitoring whether the alternator supplies power to the external circuit after the machine starts. The indicator goes out, which means the engine is in the state of supplying power outward.



P18E00053

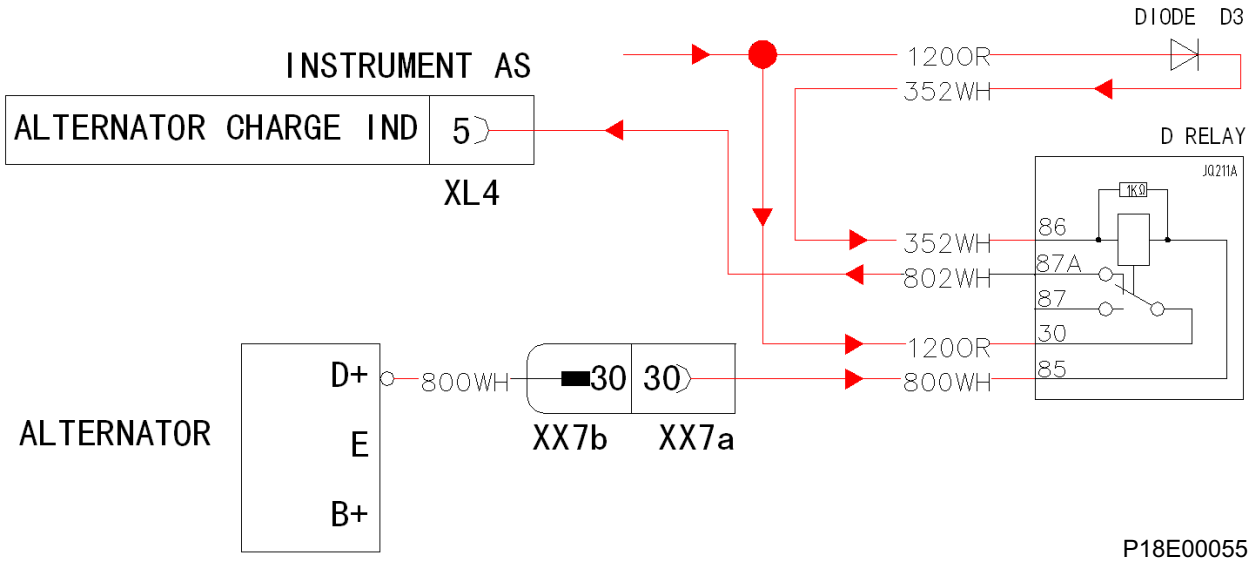
Analysis of the schematic diagram

1. When the complete vehicle is energized but not started, D+ terminal of alternator is under low level, at which the relay acts due to the voltage difference at the end 85 and 86, pin 30 and 87 of relay is connected to make No.802 wire suspend and indicator turns on.



P18E00054

2. After entire vehicle starts, if engine is normal, D+ terminal should output high level, at which the relay stays at normally-closed contact due to "Zero" voltage difference at the end 85 and 86, pin 30 and 87a is connected to make No.802 wire energize and indicator turns off.

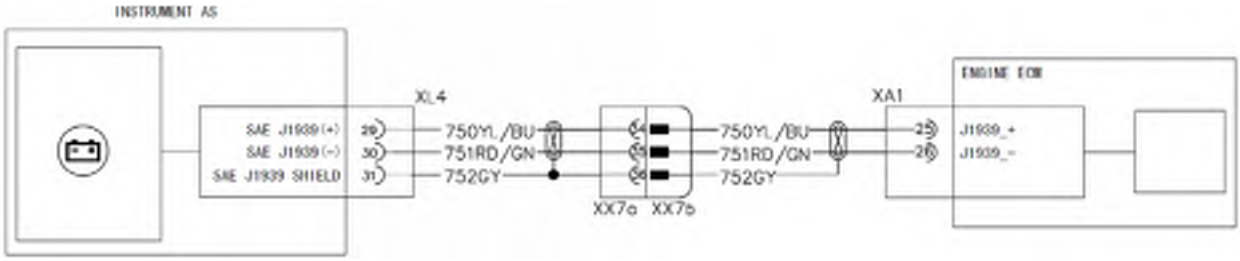


P18E00055

Circuit for voltage indication

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 Perkins 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.

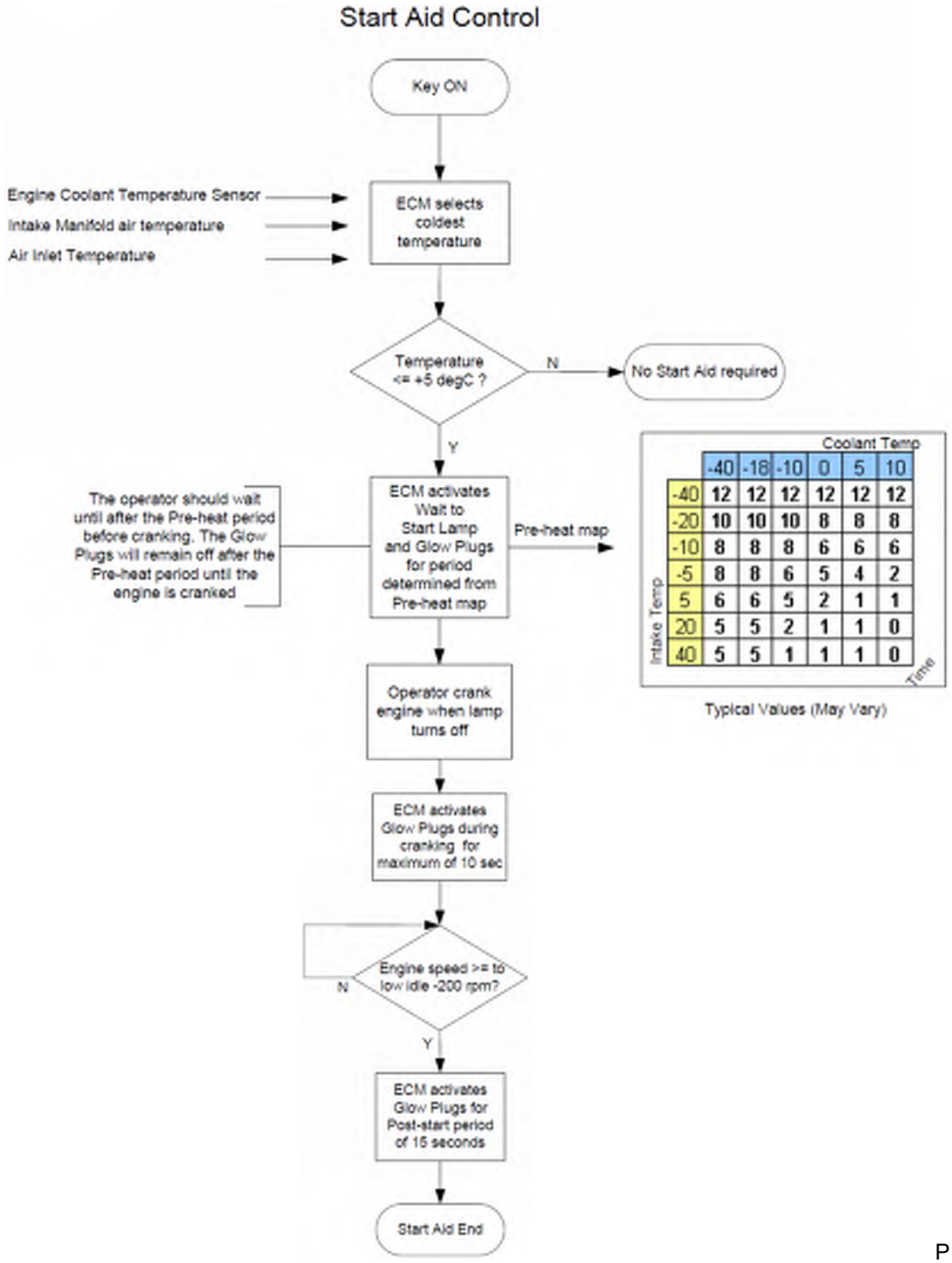


P18E00056

Circuit of preheat indicator

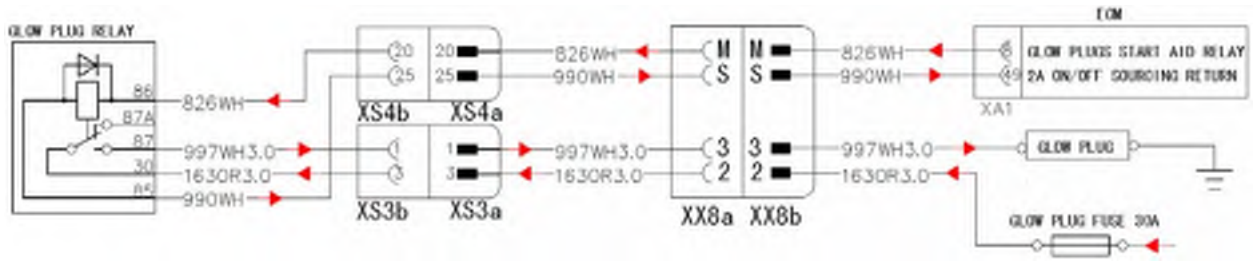
The Perkins Electric Injection Engine equipped in this machine, whose preheating uses glow plug system plan. When glow plug works before starting, WTS indicator of meter turns on.

Control flow diagram of glow plug



P18E00057

Schematic diagram

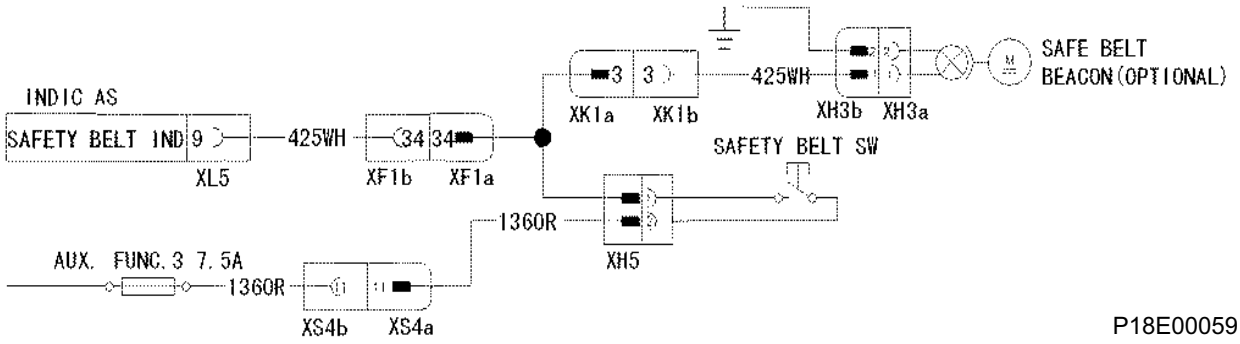


P18E00058

Circuit for seatbelt indicator

When the seatbelt is not buckled up, this indicator is active.

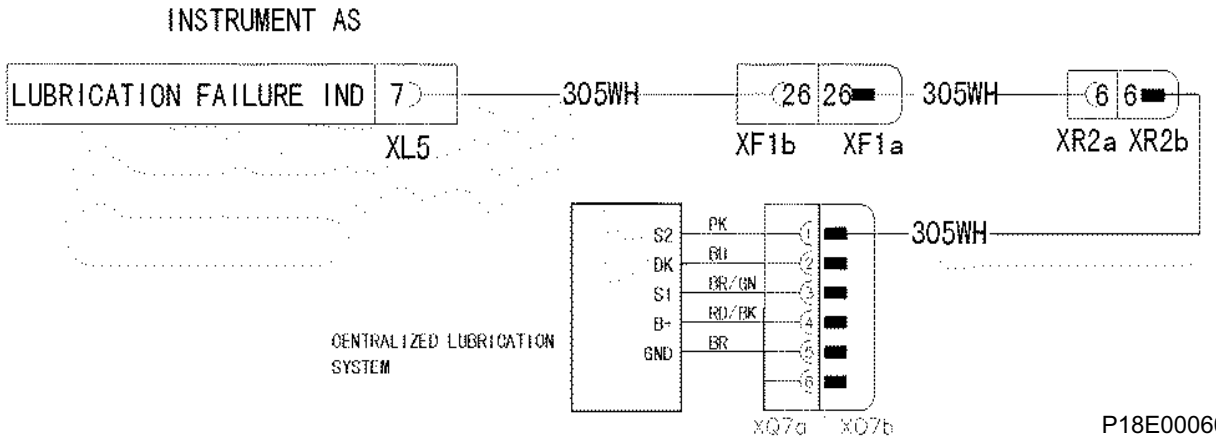
When the seatbelt is buckled up, this indicator turns off. At the same time, the rear seatbelt indicator of cab roof turns on.



P18E00059

Circuit for lube system failure indicator

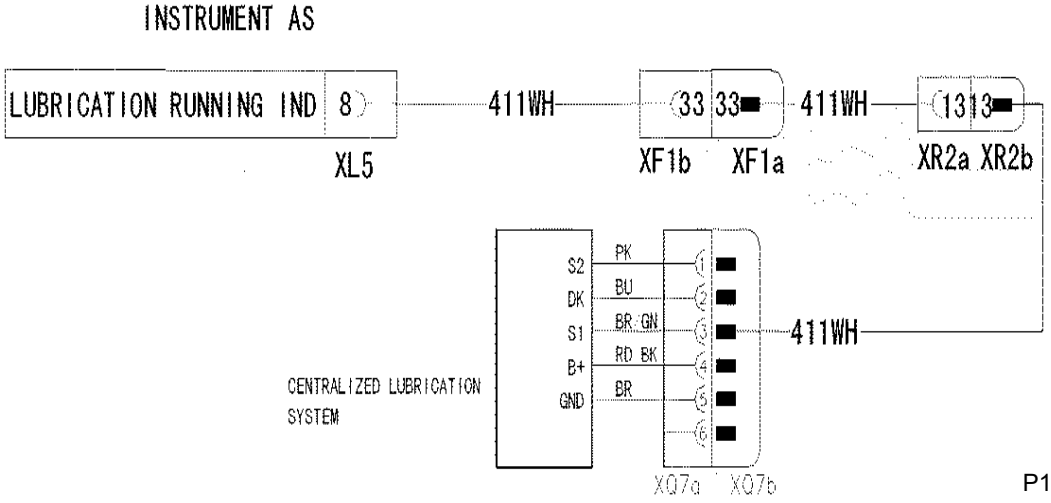
When the failure occurs in the lube system, the appropriate indicator light is active.



P18E00060

Circuit for lube system activated indicator

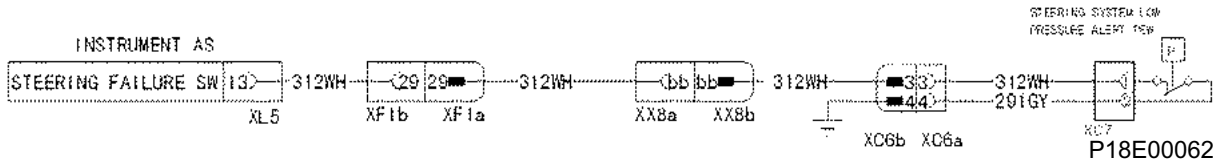
When the centralized lube function is activated, this indicator light is ON.



P18E00061

Circuit for steering system failure indicator

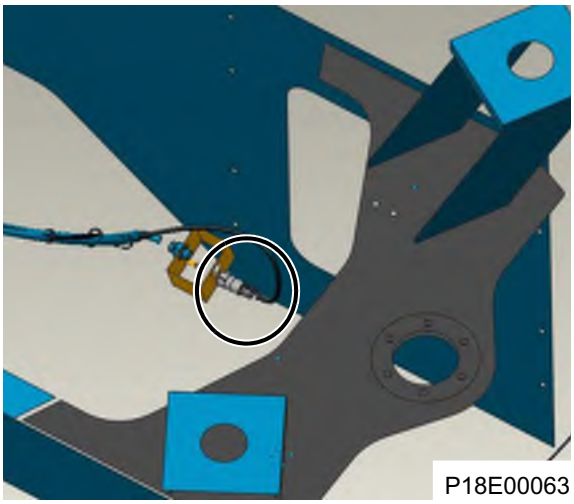
When the pressure of steering system is less than 0.6Mpa, the pressure switch contact is closed. If the instrument indicator is active. it indicates the steering system failure.



P18E00062

Failure detection for steering system low-voltage alarm switch

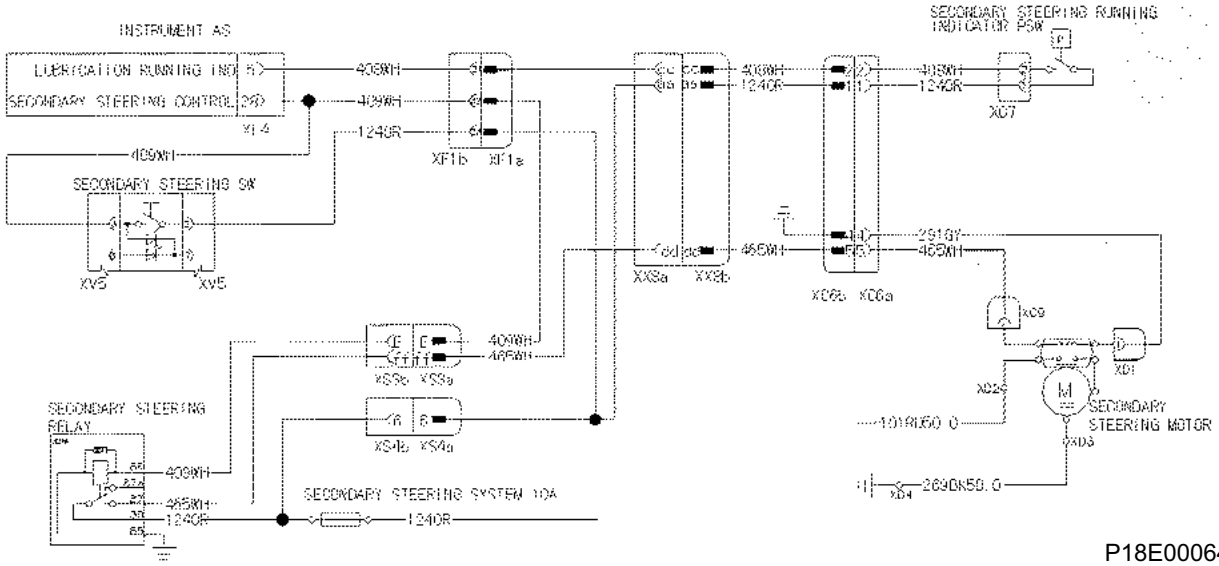
1. Unplug the connector connected to pressure switch in the rear frame harness;
2. Remove the pressure switch from the complete machine;
3. Assess the action value of pressure switch with pressure test bed, and its contact type is normally closed with action value up to 0.6Mpa.



P18E00063

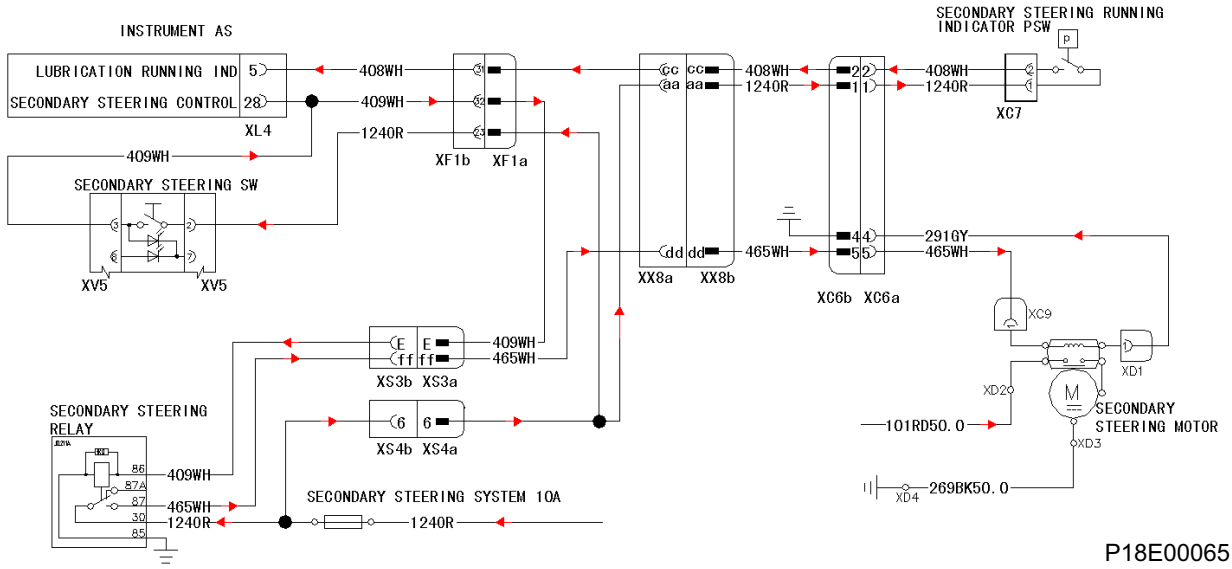
Circuit for secondary steering indicator

When the secondary steering function is active, this indicator light is ON. The secondary steering function has two kinds of enabled methods: manual and automatic.



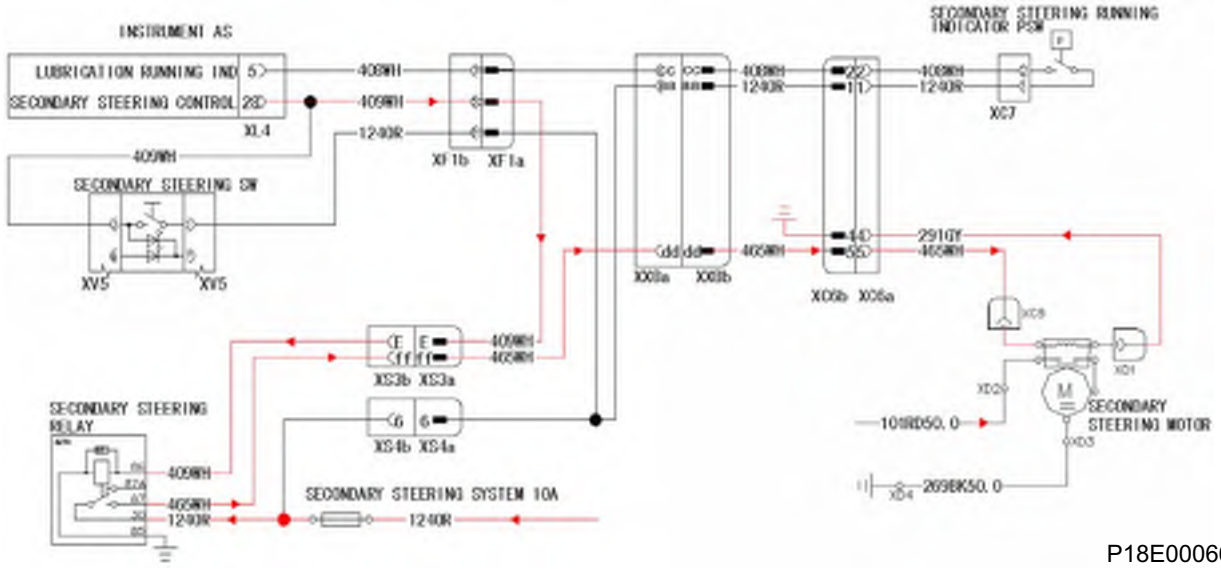
P18E00064

Manual method is controlled by secondary steering switch, schematic analysis:



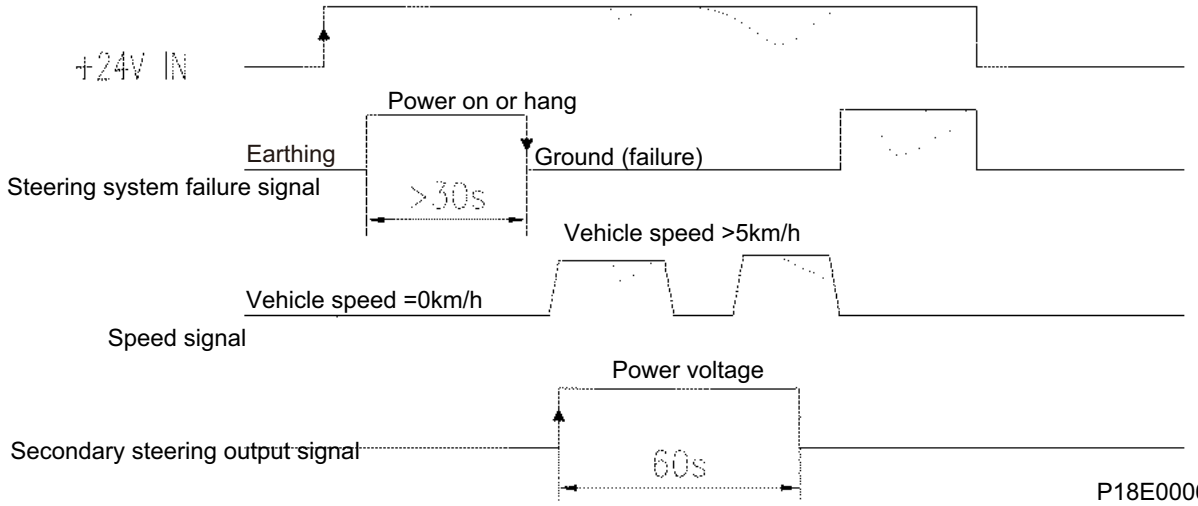
P18E00065

Automatic method controls signal by instrument output, schematic analysis:



P18E00066

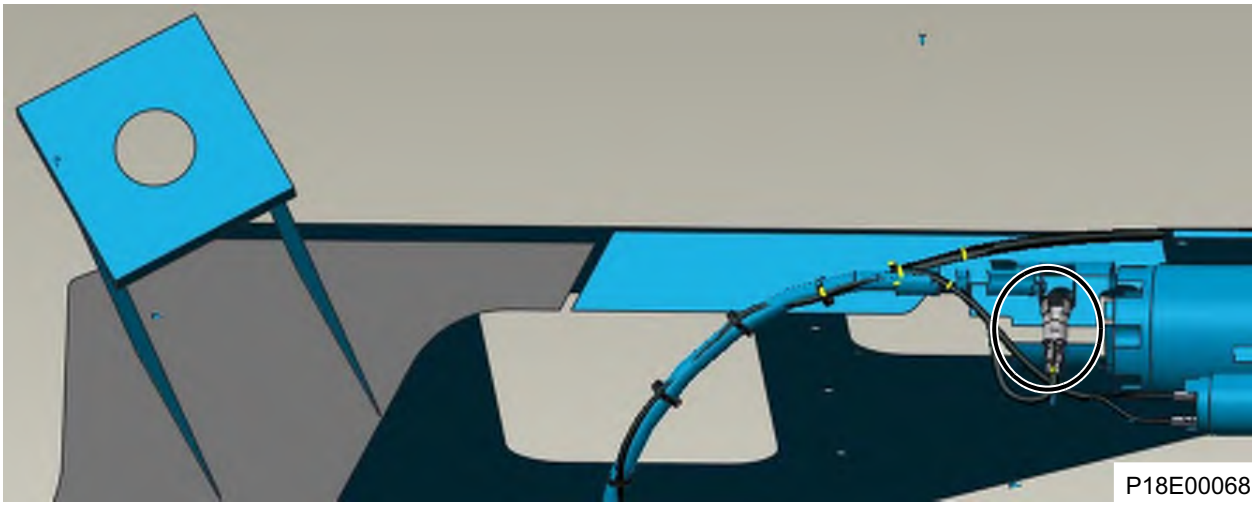
Timing diagram of secondary steering control signal output by instrument:



P18E00067

Troubleshooting for secondary steering pressure switch

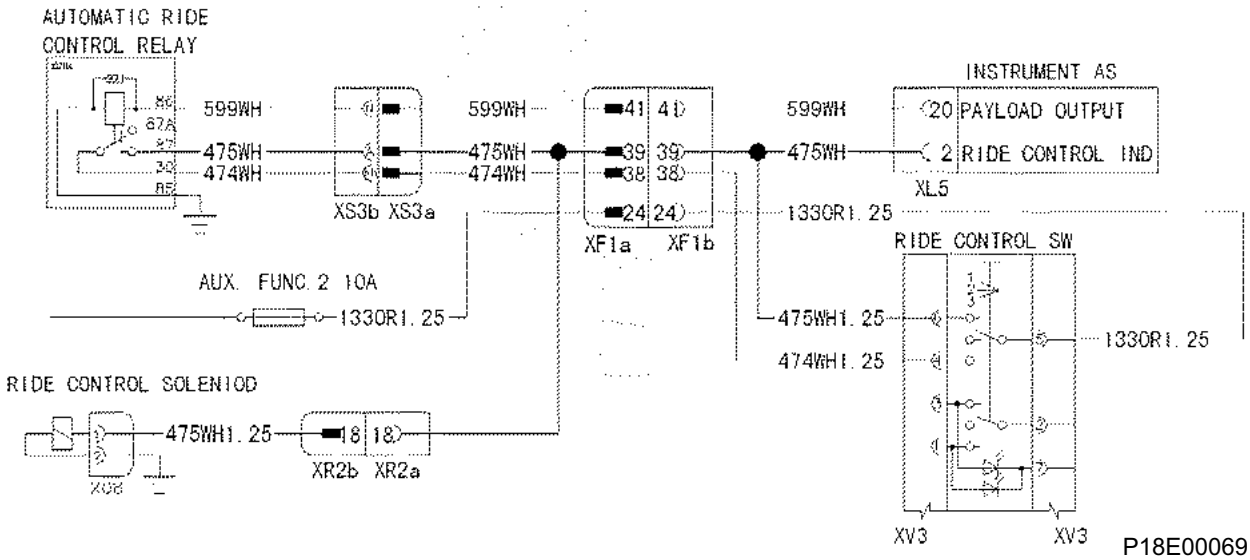
1. Unplug the connector connected to pressure switch in the rear frame harness;
2. Remove the pressure switch from the complete machine;
3. Assess the action value of pressure switch with pressure test bed, and its contact type is normally open with action value up to 0.6Mpa.



P18E00068

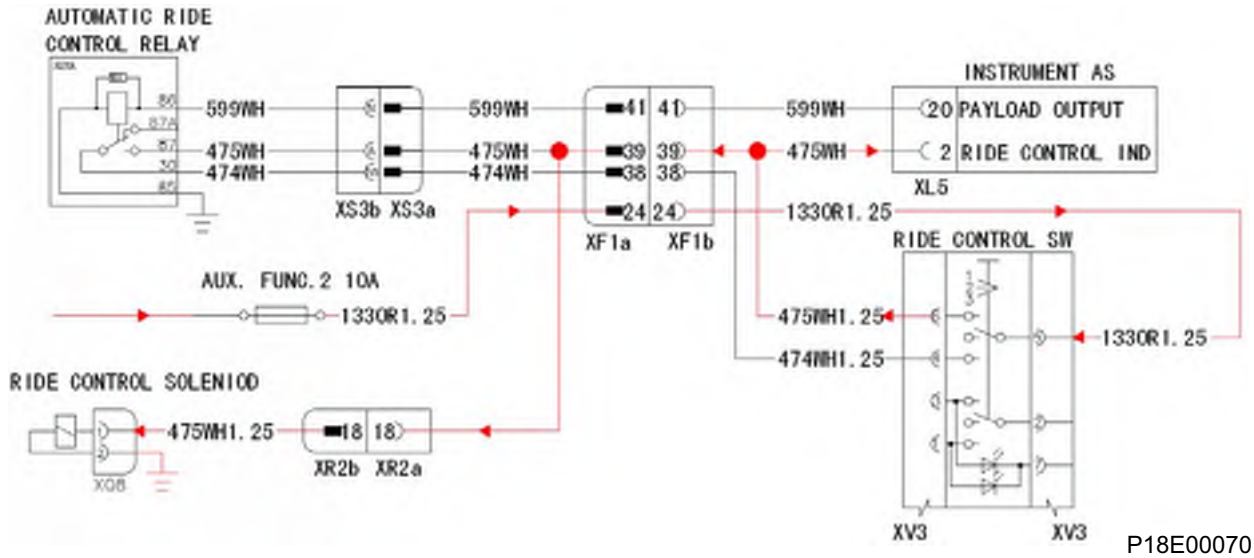
Circuit of ride control indicator

You can select manual and automatic methods according to actual situations. In auto mode, it is active when the speed is greater than 7 km/h.



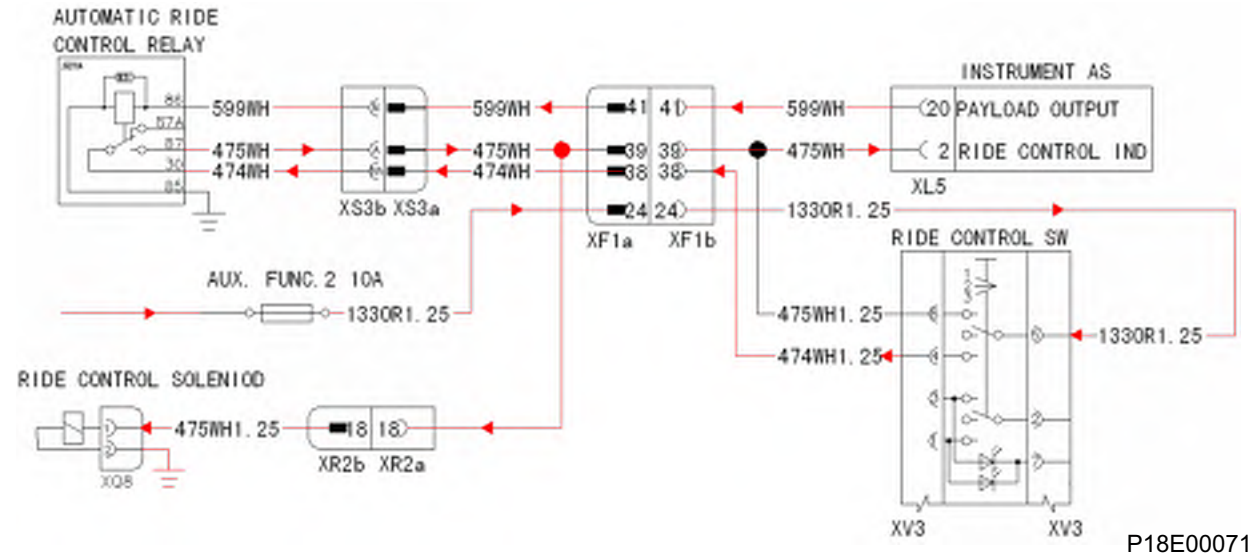
P18E00069

Manual method, move the ride control switch to manual gear, schematic analysis:



P18E00070

Automatic method, move the ride control switch to automatic gear and instrument output control signal according to vehicle speed, schematic analysis:

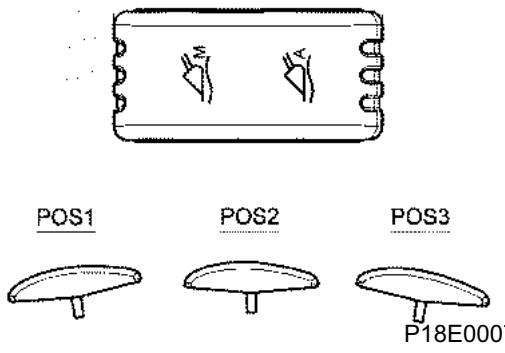


P18E00071

Ride control switch

POS1 is in manual mode, while POS3 is in auto mode.

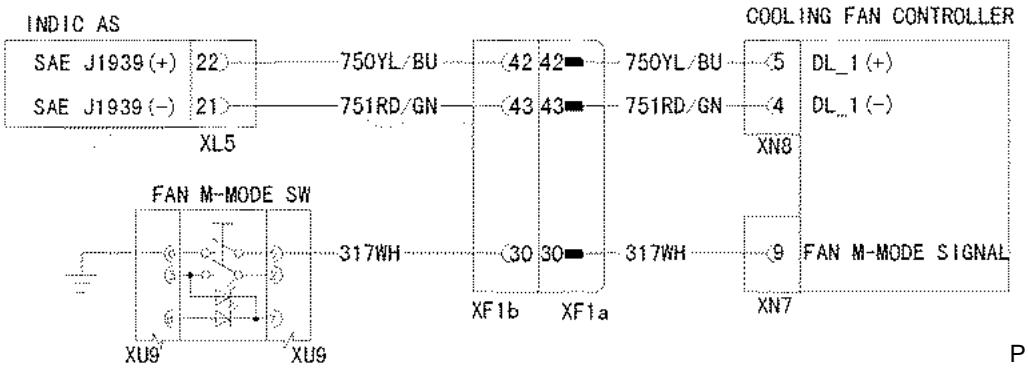
P18E00072



P18E00073

Circuit for radiator fan reverse indicator

When the radiator fan reverse indicator switch is pressed down, this indicator is ON. If the reverse signal is not received within 1 s, this indicator is out.

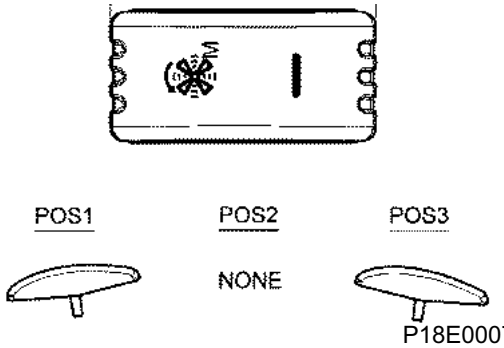


P18E00074

Fan reversing switch, manual

This switch is active instantly. When in POS1 mode, the fan reverse function is active.

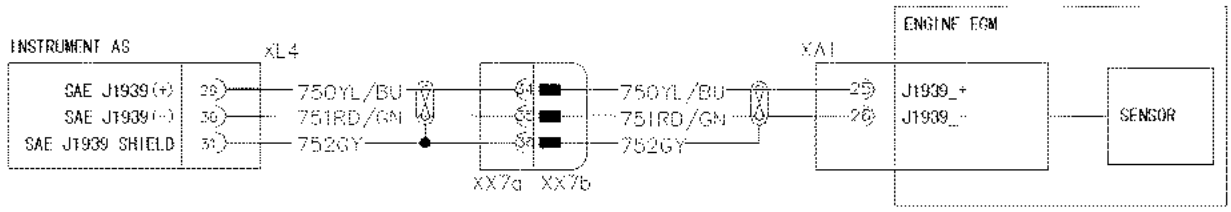
P18E00075



P18E00076

Circuit for engine indicator

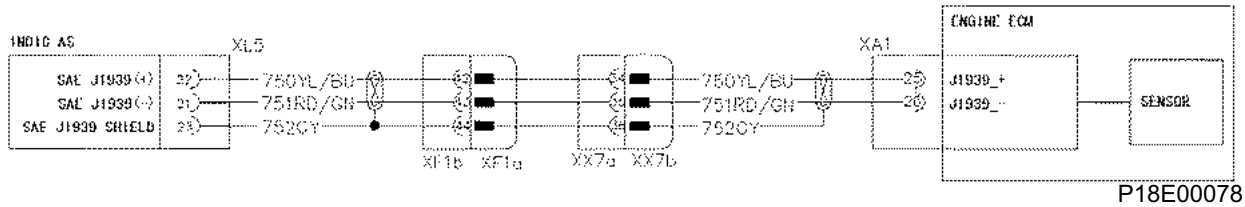
The Perkins Electric Injection Engine equipped in this machine, whose ECM transports to failure indicator, stop indicator, preheating indicator, and alarm indicator of low fuel pressure to the meter by CAN bus, and the meter drive indicator to be active.



P18E00077

Circuit for engine diesel particle filter indicator

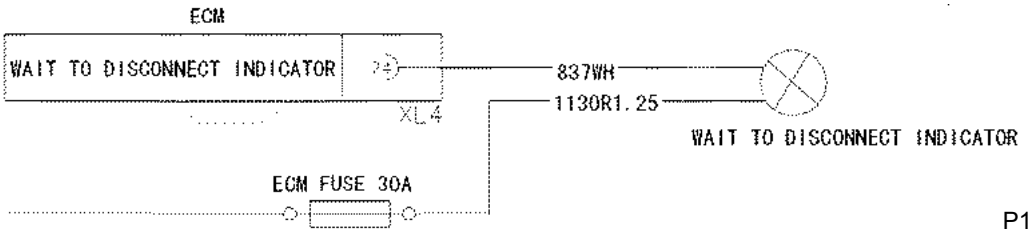
The Perkins Electric Injection Engine equipped in this machine, whose ECM transports to the emission system failure indicator related to diesel particulate filter system and DEF liquid level indicator to the indicator module by CAN bus, and the indicator module drive indicator to be active.



P18E00078

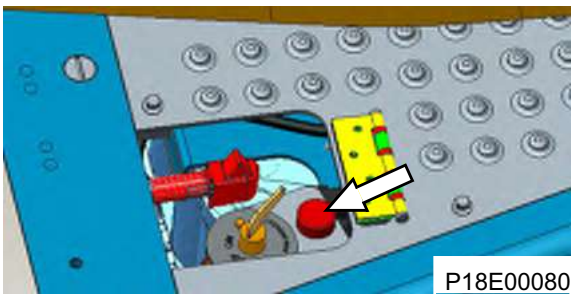
Circuit for latency shut-down indicator

The indicator is active, which indicates engine DEF system still works. Therefore, the disconnect switch cannot be turned off until indicator turns off, otherwise, which may cause DEF pipeline failure.



P18E00079

Latency shut-down indicator



P18E00080

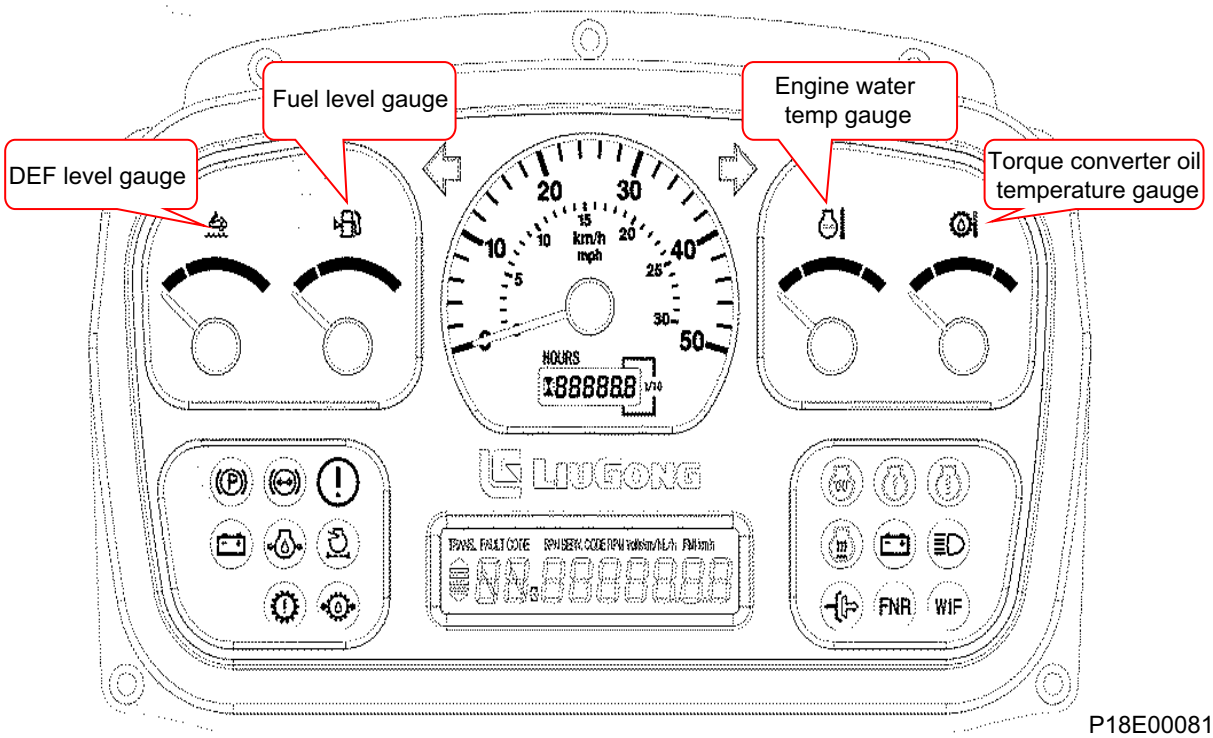
Instrument

Two instruments equipped in this machine are main instrument and accessory instrument (indicator module), which both are 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



P18E00081

Items	Indicating area		
	The first region	The second area (green)	The third area (red)
Engine water temp gauge	40-70°C(Yellow)	70-101°C	101-120°C
Torque converter oil temperature gauge	40-60°C(Yellow)	60-116°C	116-140°C
Fuel level gauge	0-0.2(red)	0.2-1	
DEF level gauge	0-0.2(red)	0.2-1	

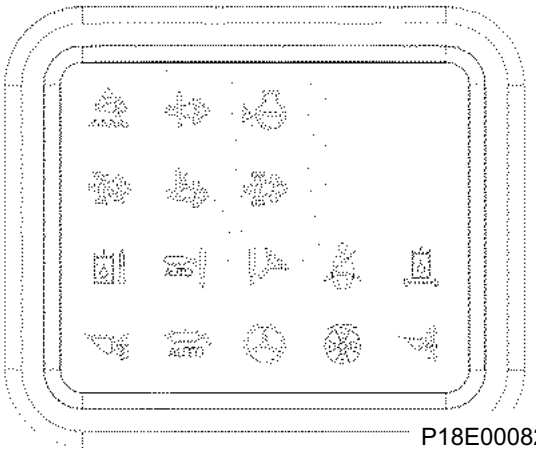
Indicator alarm zone

S/N	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	Power-off indicator	Yellow	No	Hang	+24V	
5	Parking brake indicator	Red	No	Hang	+24V	
6	Engine oil pressure alarm lights	Red	No	CAN bus actuated		
7	Brake low pressure warning lights	Red	No	Hang	+24V	
8	Transmission oil pressure warning lights	Red	No	Hang	Earthing	
9	Engine air filter blockage indicator	Red	No	Hang	Earthing	
10	Alternator charging indicator	Red	No	Set the D+ or L terminals of the alternator as charging indicating control		
11	Preheating indicator lamp	Amber	No	CAN bus actuated		
12	Heater activated indicator	Yellow	No	Hang	+24V	

Indicator alarm zone

S/N	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
13	State indicator	Red	Yes			
14	Transmission alert indicator	Red	No	Hang	+24V	
15	FNR state indicator	Yellow	No	Hang	+24V	FNR
16	Voltage indicator	Yellow	Yes	CAN bus actuated		
17	Stop indicator	Red	No	CAN bus actuated		
18	Warning indicator	Amber	No	CAN bus actuated		
19	Water in fuel indicator	Amber	No	CAN bus actuated		WIF

Sub instrument



P18E00082

S/N	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	Lube system activated indicator	Green	No	Hang	+24V	
2	Lube system fault indicator	Red	No	Hang	Earthing	
3	DPF regeneration disabled indicator	Amber	No	CAN bus actuated		
4	DPF regenerating indicator	Amber	Yes	CAN bus actuated		
5	DPF regeneration activated indicator	Amber	No	CAN bus actuated		
6	DEF low indicator	Red	No	CAN bus actuated		
7	Seatbelt warning light	Red	No	+24V	Hang	
8	Steering system failure indicator	Red	No	Hang	Earthing	
9	Secondary steering indicator	Yellow	No	Hang	+24V	
10	Ride control activated indicator	Green	No	Hang	+24V	
11	Radiator fan reverse indicator	Yellow	No	CAN bus actuated		
12	Hydraulic oil temp alarm light	Red	No	Hang	Earthing	

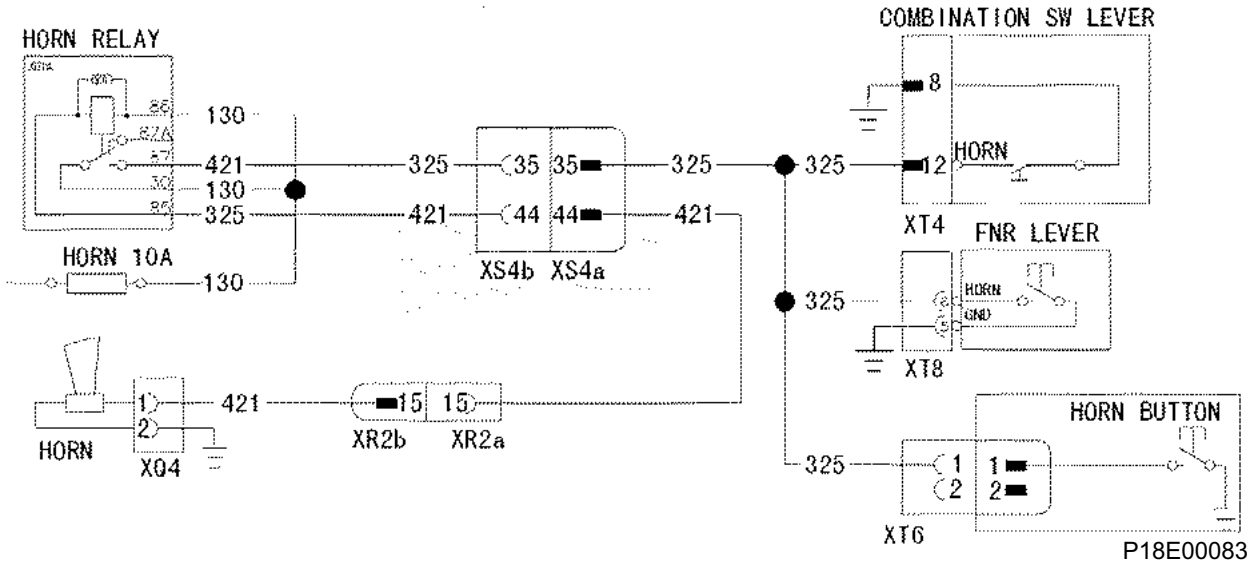
S/N	Name	Color of the warning light	Whether it flashes or not	The input signal level under normal state	The input signal level under alarm state	Icon
13	Emission system failure indicator	Red	No	CAN bus actuated		

If any one of the parking brake, brake low pressure, engine oil pressure, engine air filter blockage, lube system failure, gearbox oil pressure and gearbox failure alert indicators is active, the state indicator flickers; when and 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.

Sound and Light Alarm System/Audible and Visual Alarm System/ Acousto-optic alarm system

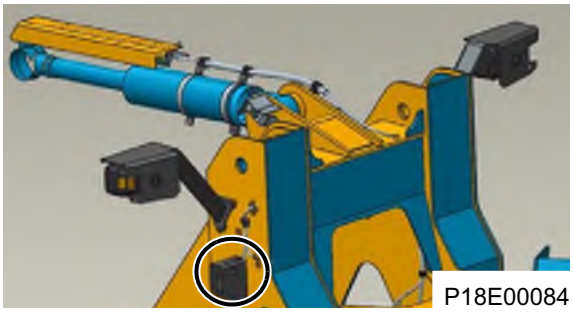
Circuit for electric horn

Three horn buttons are connected in parallel in the machine, locating on the steering column, combination lever and pilot-operated lever.



Electric horn

Electrical parameters: 1. rated voltage 24V; 2. maximum working current 3A; 3. basic frequency 400±20Hz; 4. sound level 105dB-118dB(A)

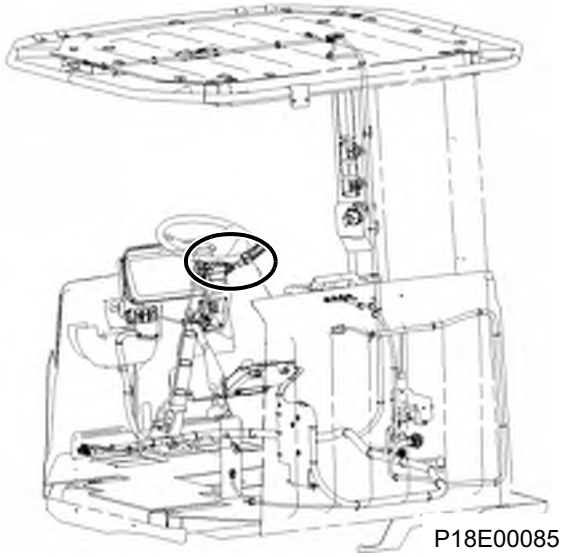

P18E00084

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).

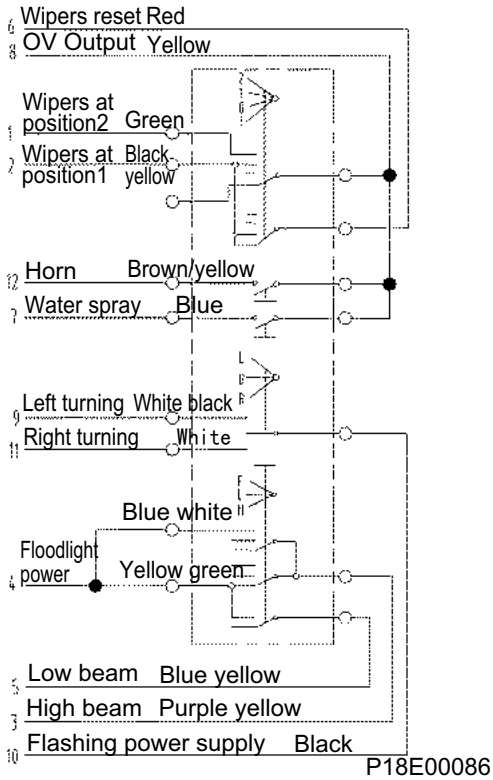
Combination lever

It integrates the functions of horn, front wiper, front washer, turn signal light and dimmer switch.

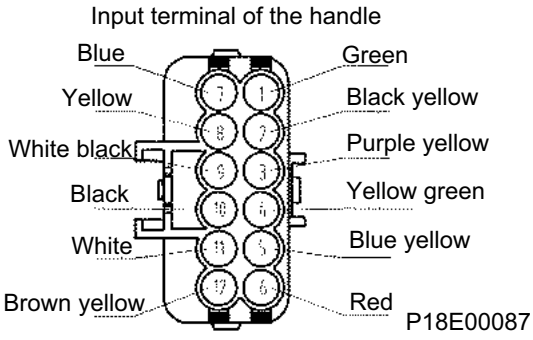

P18E00085

Detection procedure of combination lever

1. Disconnect the wiring harness of the combination lever and the cab;
2. Separate the combination lever from the steering column;
3. Turn the digital multimeter to 200Ω of Ω position.
4. Measure whether the pins are energized corresponding to the different function positions of the lever based on the function wiring diagram;

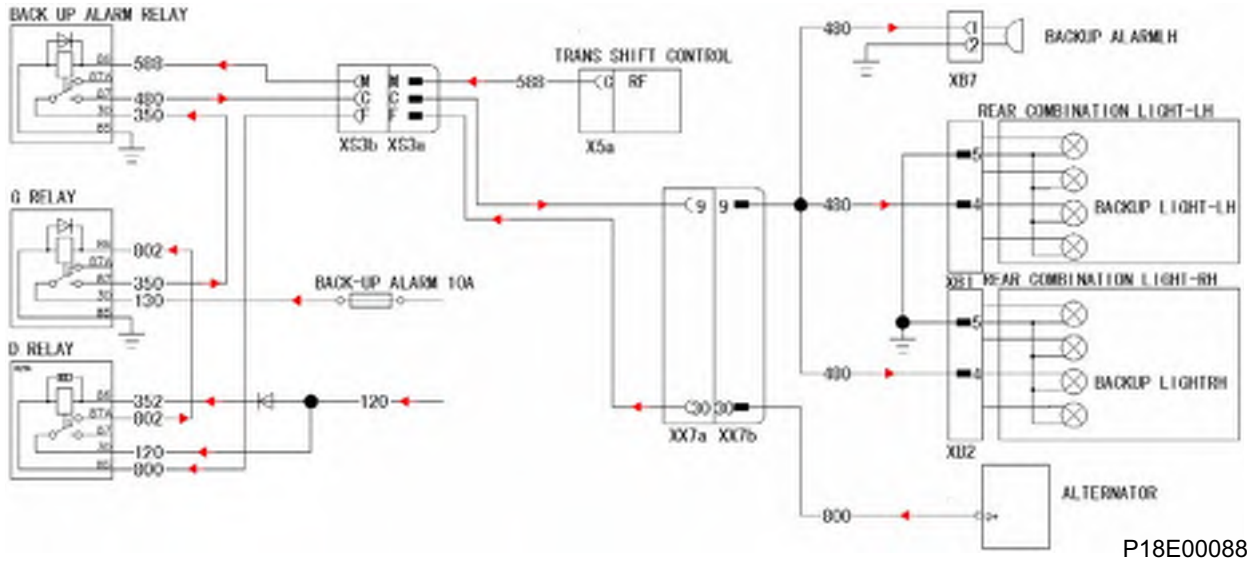


P18E00086



P18E00087

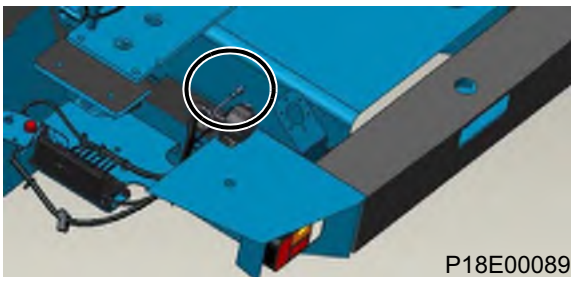
Circuit for backup alarm



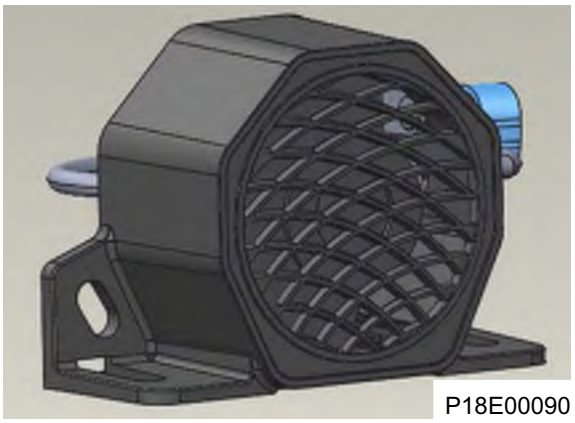
P18E00088

Backup alarm

An intermittent buzzer is applied as the backup alarm, which works together with the backup light during the operator's backup operation.



P18E00089



P18E00090

The electrical parameters of backup alarm

1. Rated voltage 24V; 2. working current 0.3A; 3. sound level 107dB±4dB(A).

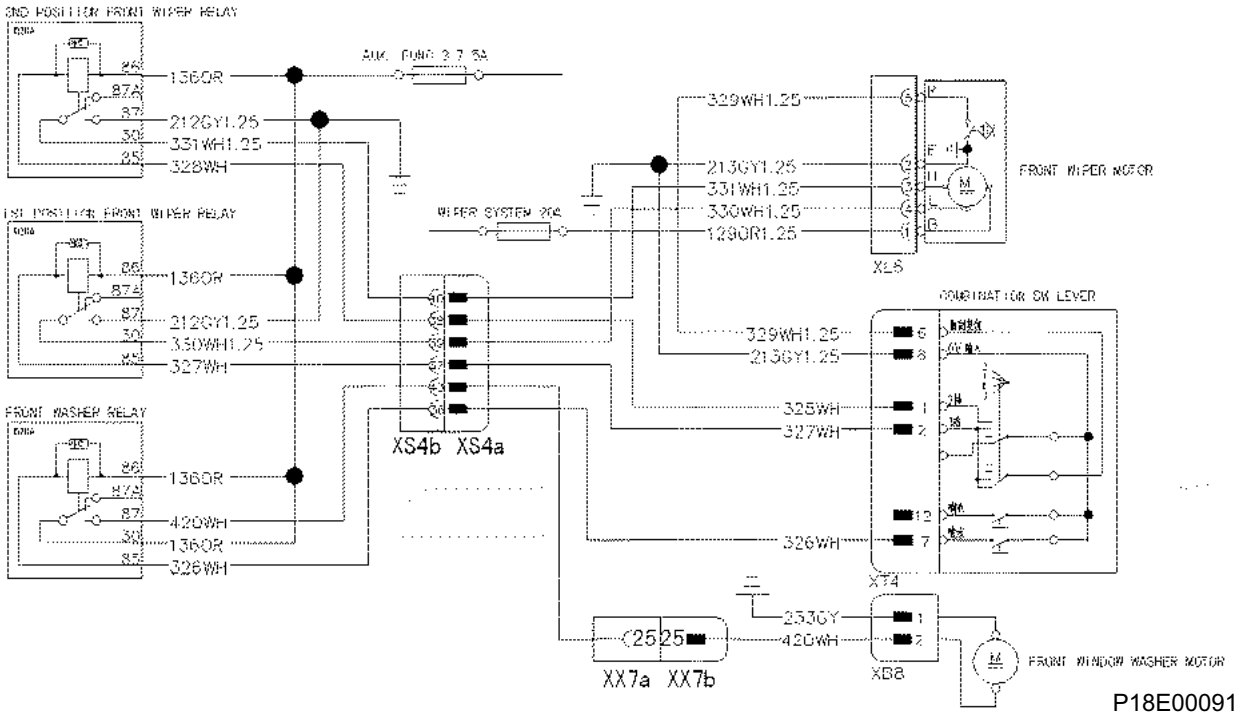
The detection procedures of backup alarm

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).

Wiper and washer system

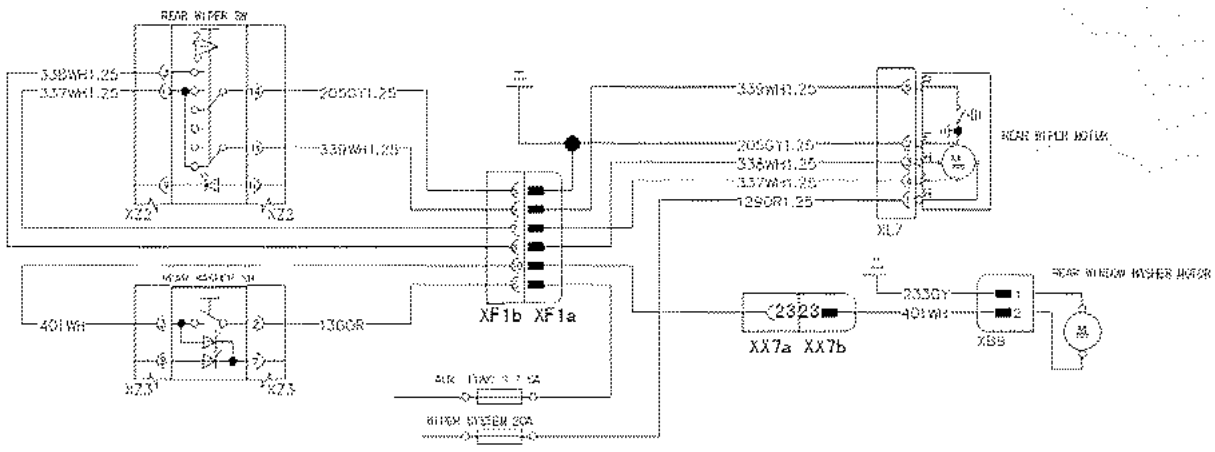
Circuit diagram for wiper and cleaning system

The functions of front wiper and front washer are implemented through the combination lever.



P18E00091

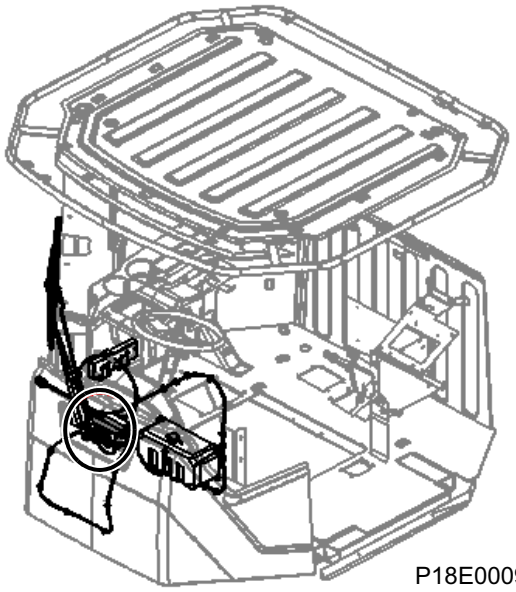
Rear wiper, rear window washer are all enabled by rocker switch.



P18E00092

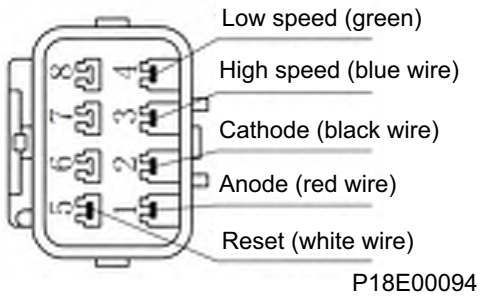
Wiper motor

Front wiper motor



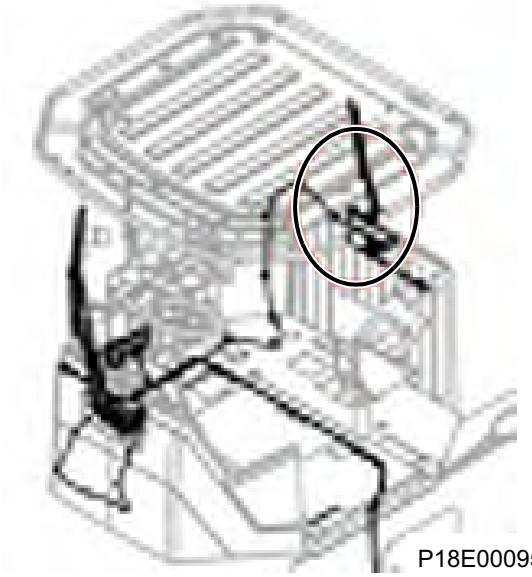
P18E00093

Surface of the connector



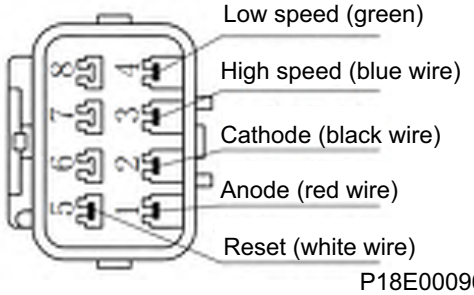
P18E00094

Rear wiper motor



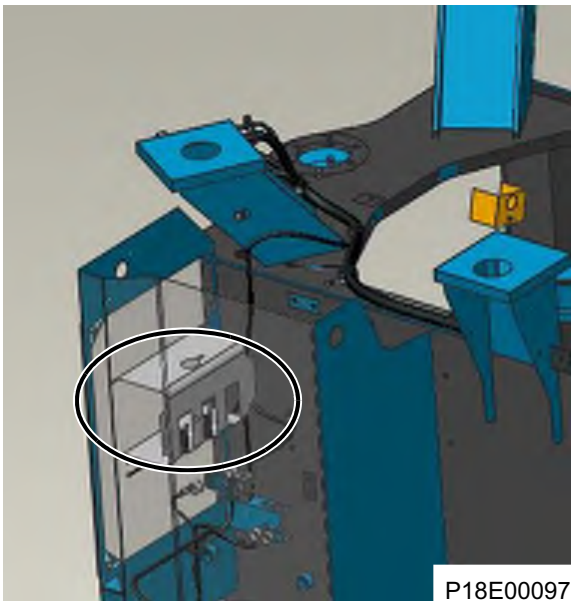
P18E00095

Surface of the connector

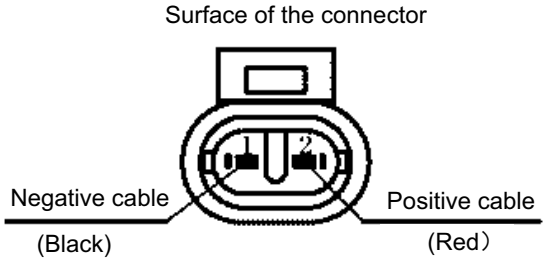


P18E00096

Washer reservoir



P18E00097

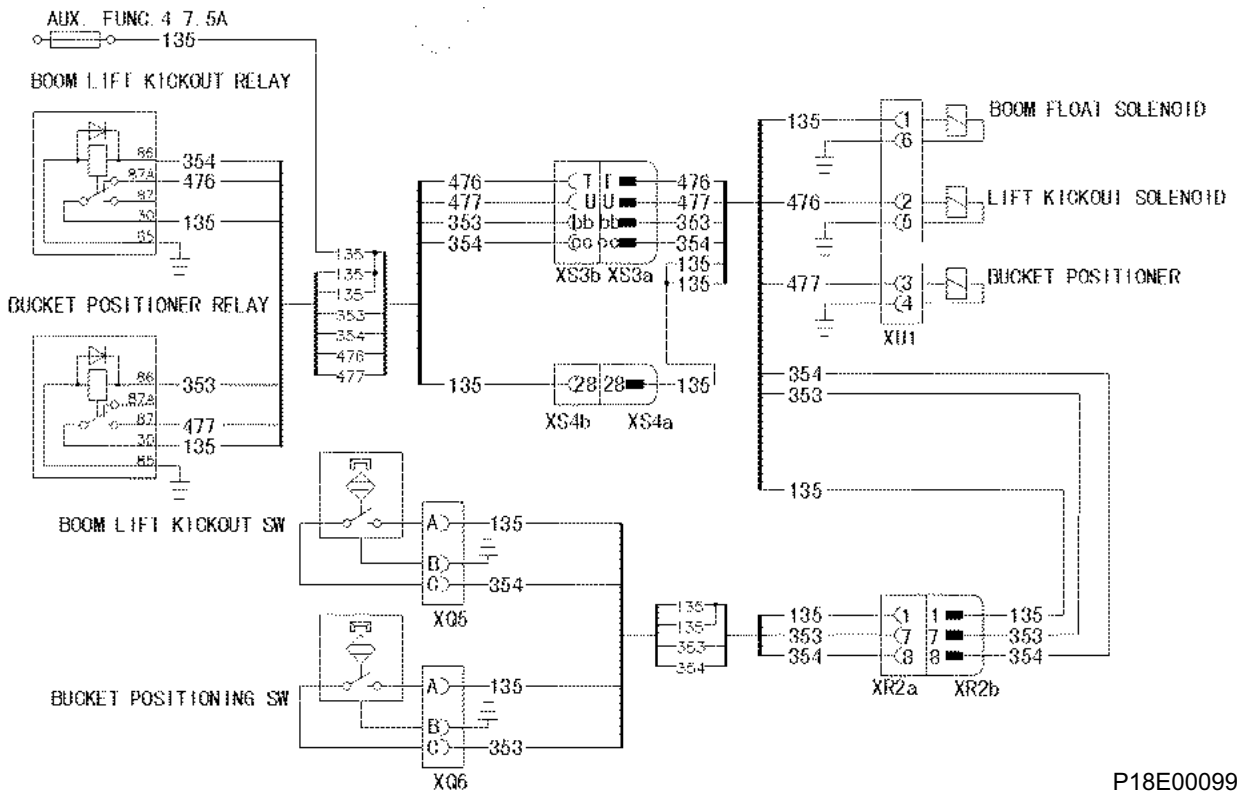


P18E00098

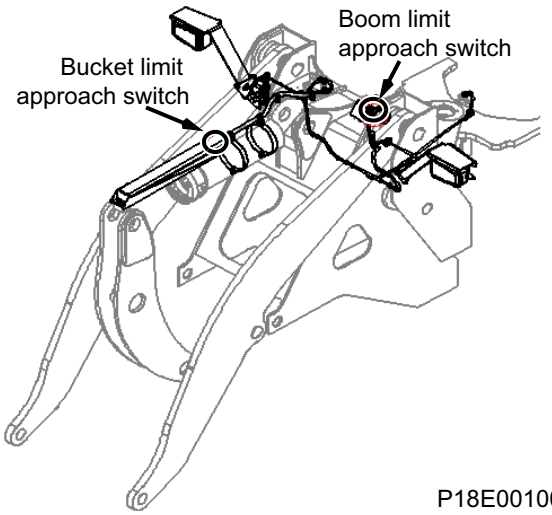
Positioner and kickout system

No matter the operator lower or lift the boom through pushing the control lever forward or backward, the control lever remains automatically in a forward or backward position, which returns to the neutral position automatically if the boom is lifted to the limit; on the other hand, when the boom is lowered to the limit, it requires the operator to move the control lever back to the neutral position instead of its automatic return. If the operator withdraws the bucket by pushing the control handle to the left, the control handle will remain in the position towards the left, which returns to the neutral position automatically once the bucket is leveled.

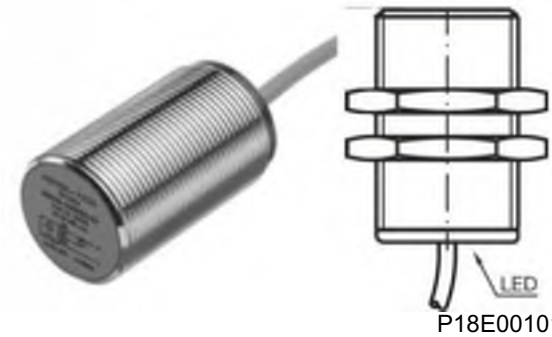
Principle for auto reset system



Approach switch



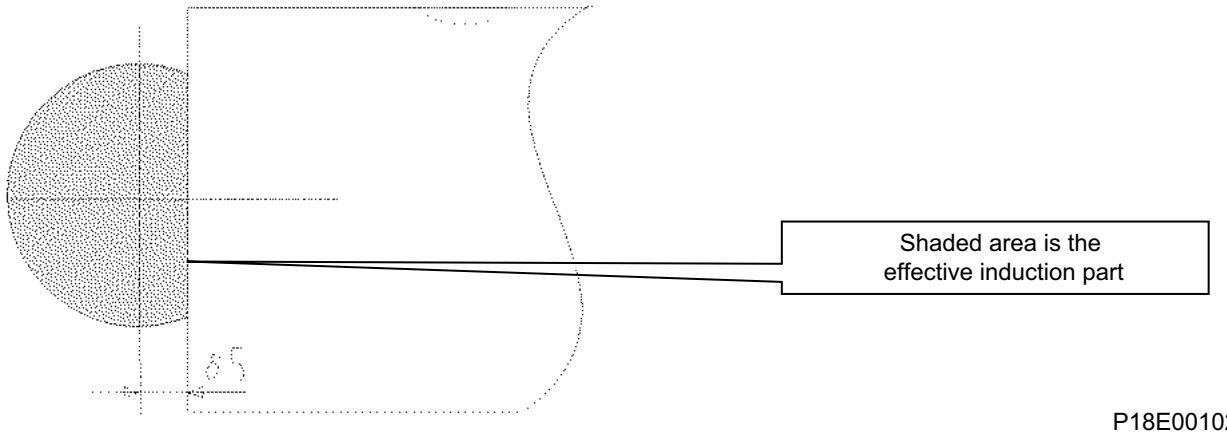
P18E00100



P18E00101

Test on bucket and boom proximity switches

1. Connect the 24V DC power (+) to the terminal at #1 hole of the proximity switch, while the (-) to the terminal at #2 hole;
2. Turn on the DC power;
3. Draw the metal induction board to the inductive surface of proximity switch, the proximity distance shall be less than or equal to 12mm, while the induction area shall be equal or greater than 2/3;
4. At this moment, the LED at the end of the switch is lighted up;
5. Turn the digital multimeter to 200V of voltage position.
6. Connect the black probe to the DC power (-), while the red probe to the terminal at #3 hole site of the parking brake switch, thereby, the value displayed on the DMM shall be 24V.



P18E00102

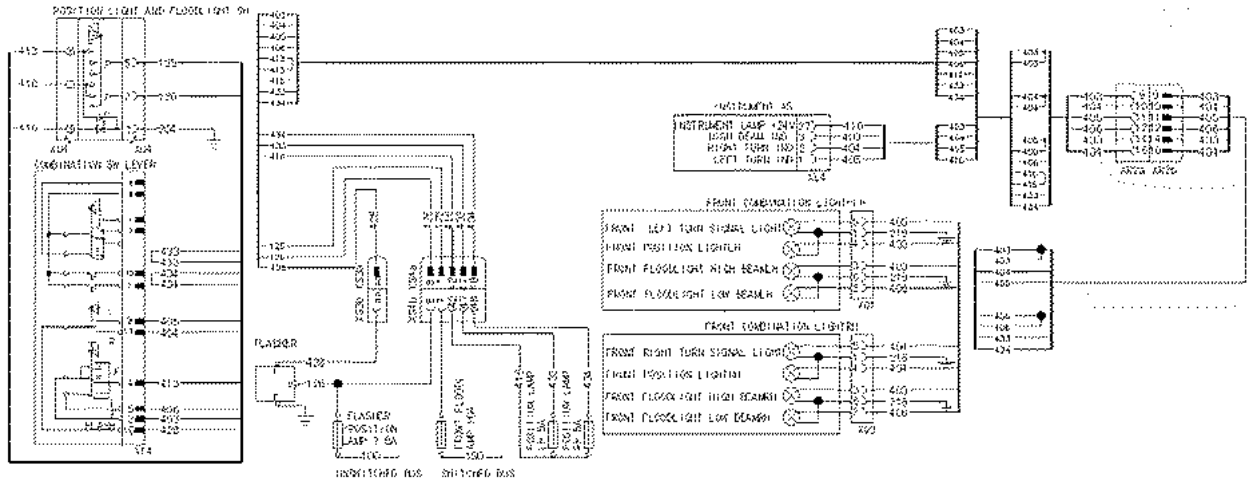
Lighting system

The reverse light is used to illuminate the area behind the vehicle when reversing. The machine is equipped with backup alarm, which works together with the backup light during backup operation. The brake light is used to alarm vehicles behind that this vehicle is braking.

The turn signal light indicates the direction to that the vehicle is turning, and the potential danger signals (when used as parking light).

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.

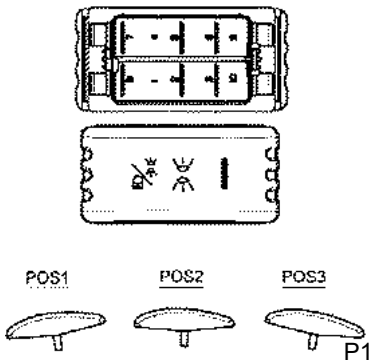
Circuit for front frame illumination



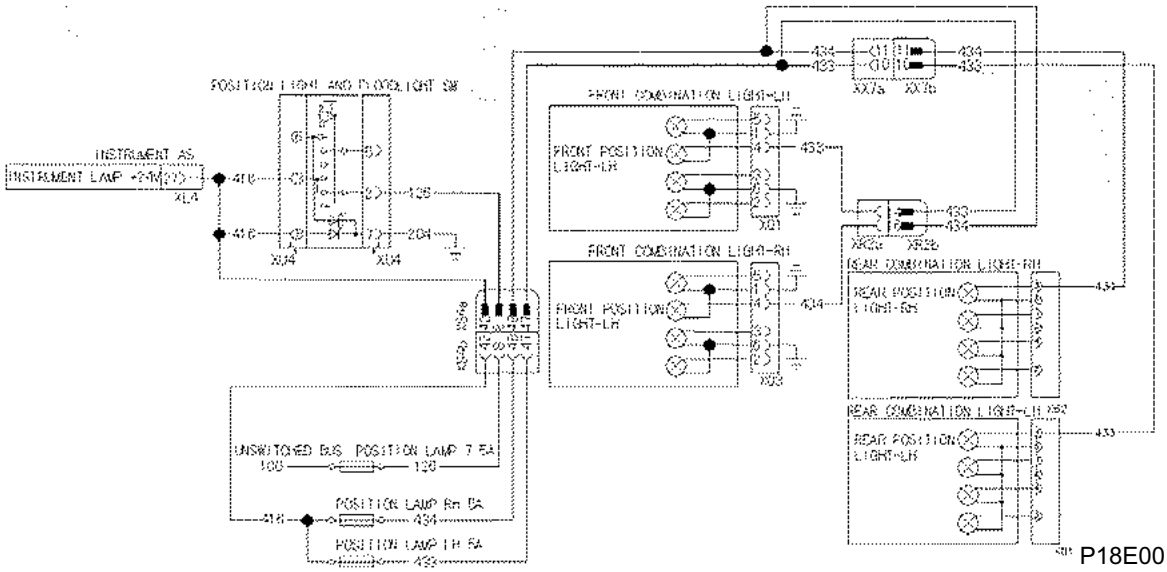
P18E00103

Position light & floodlight sw

P18E00104



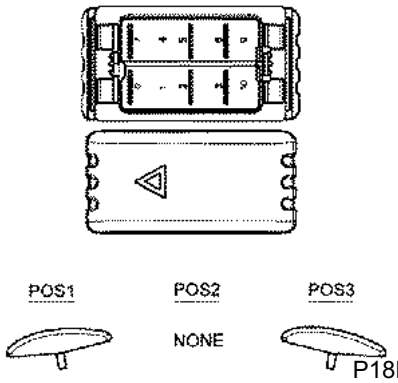
P18E00105



P18E00106

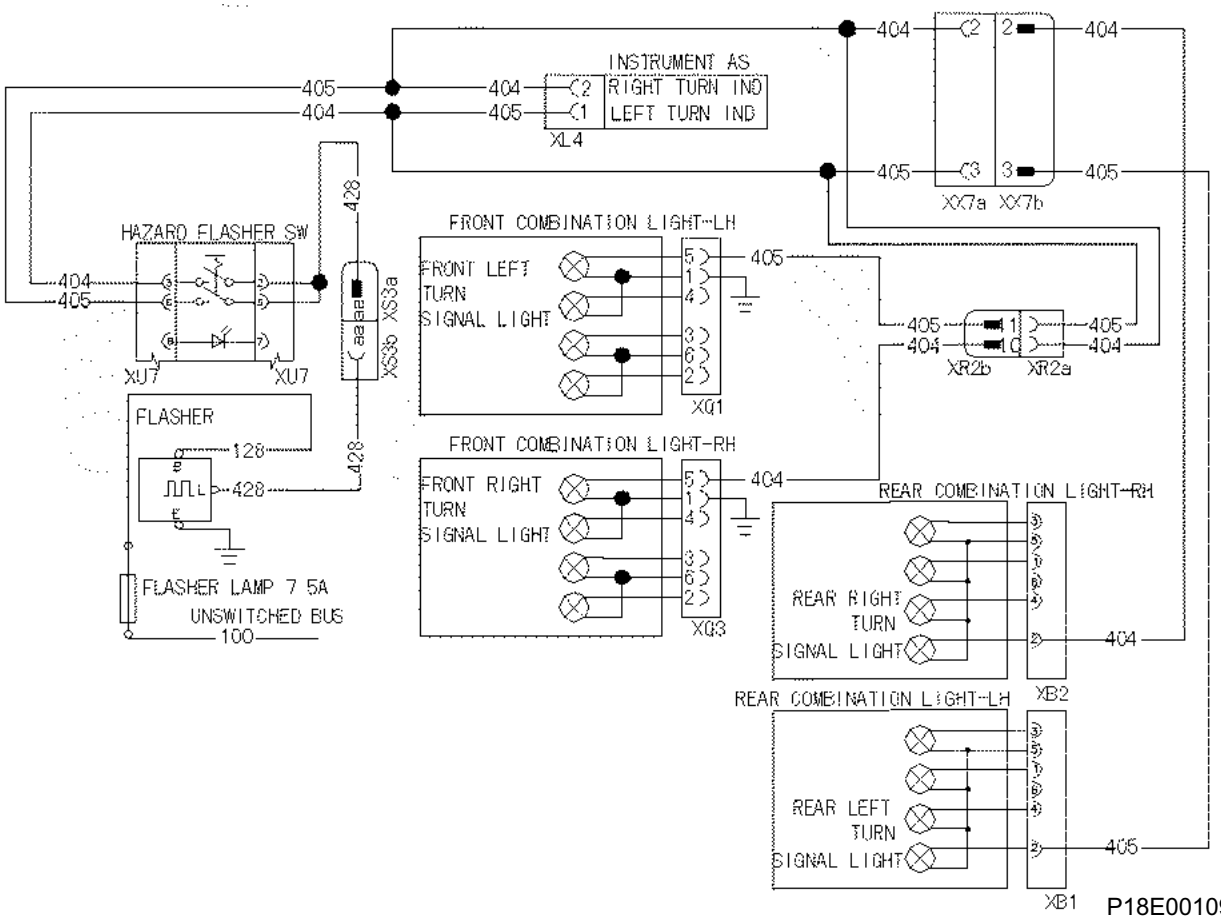
Hazard flasher switch

P18E00107



P18E00108

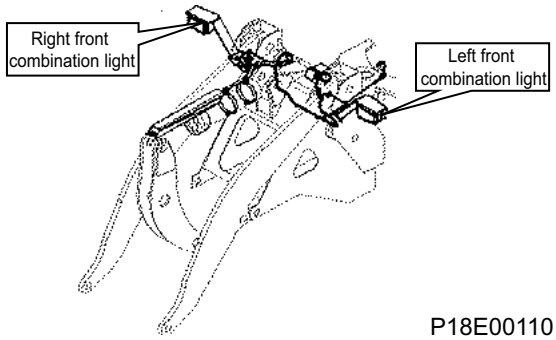
POS3 indicates the closed parking function, while POS1 signifies the enabled parking function.



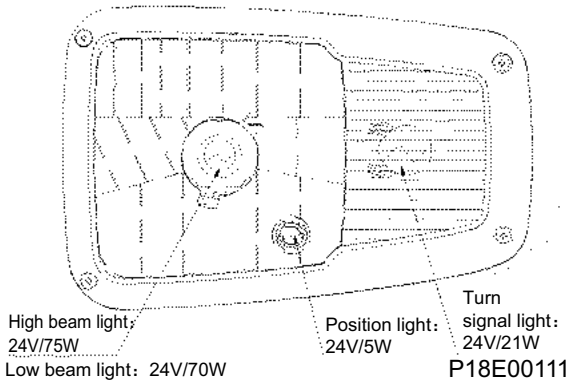
P18E00109

Front combination light

Function of integrated steering, high/low beam and clearance light.

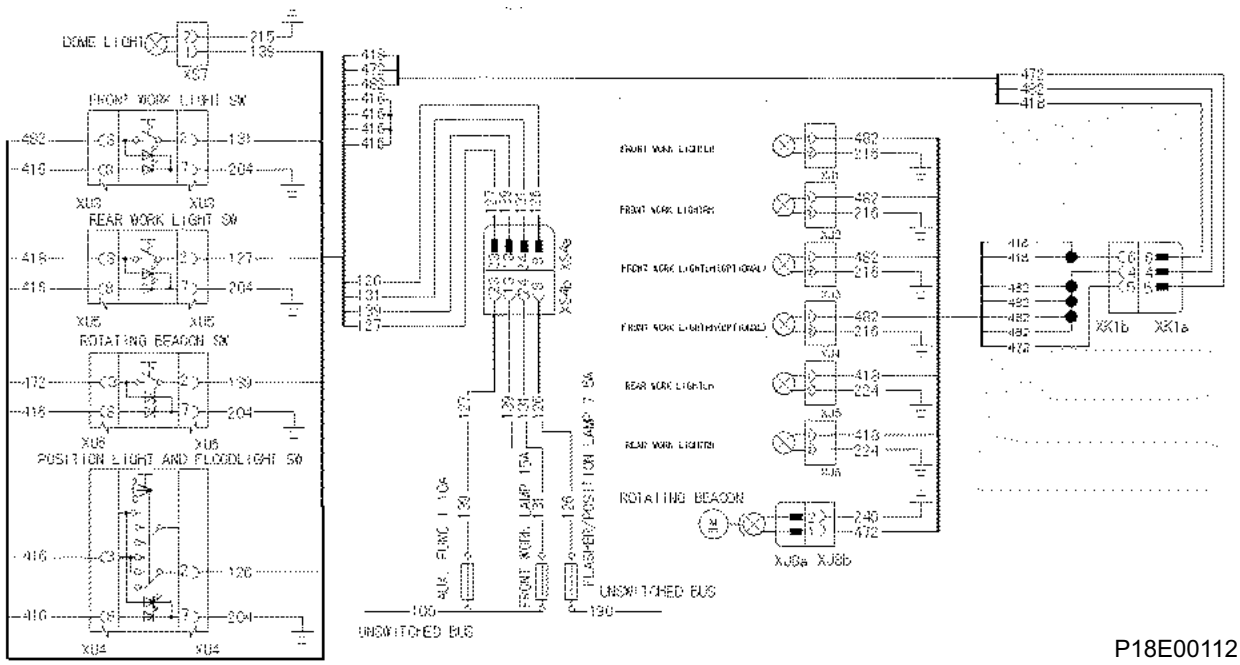


P18E00110



P18E00111

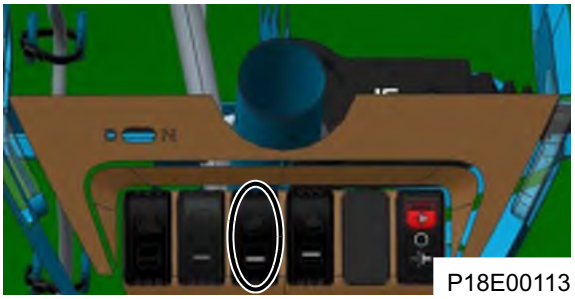
Circuit for cab lighting



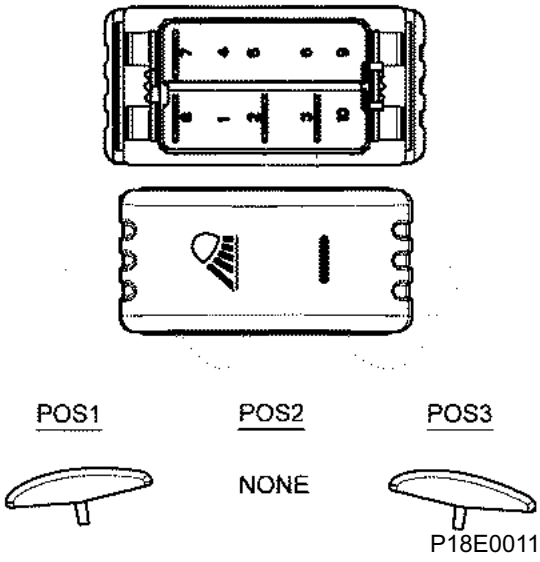
P18E00112

Work light switch

Front working light switch: POS3 means the working light is turned Off; POS1 means the working light is turned ON.

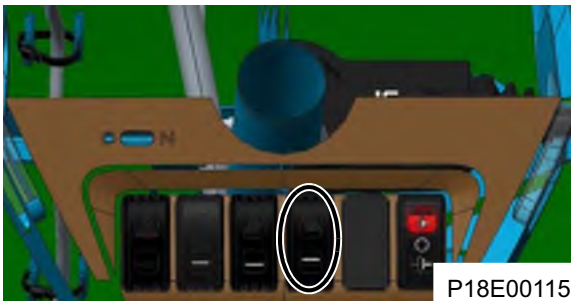


P18E00113

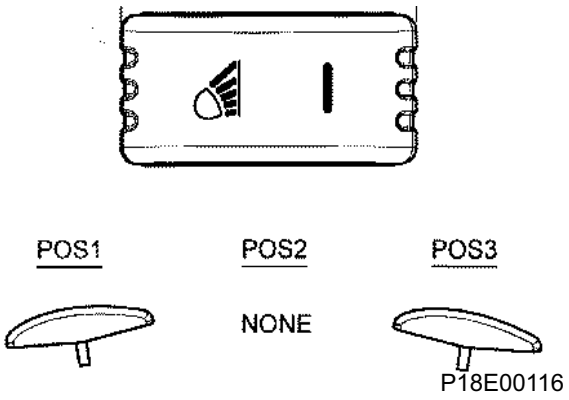


P18E00114

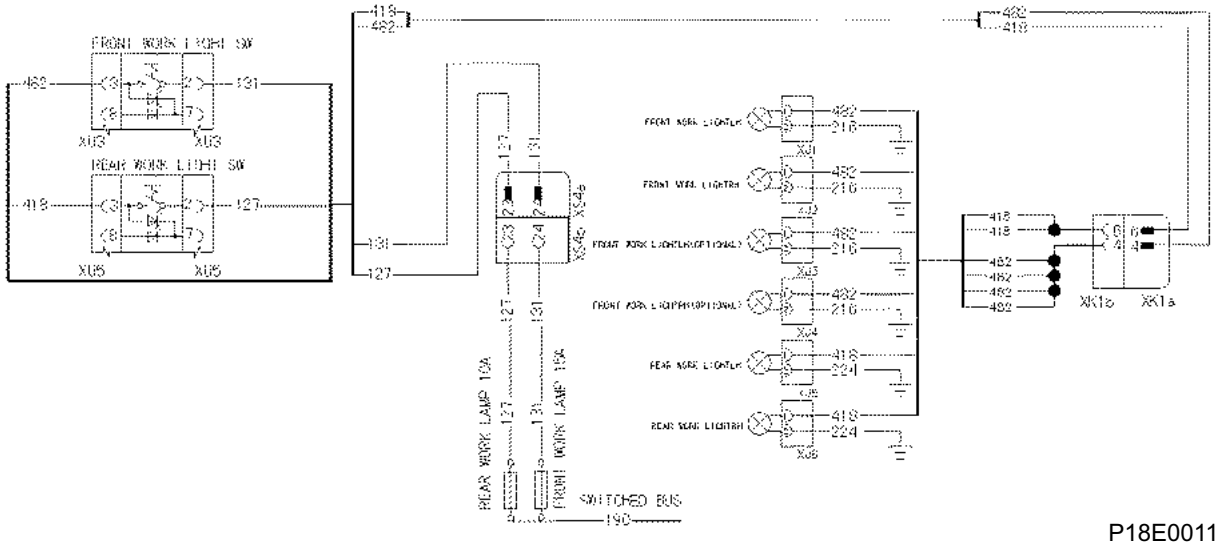
Rear working light switch: POS3 means the working light is turned OFF; POS1 means the working light is turned ON.



P18E00115



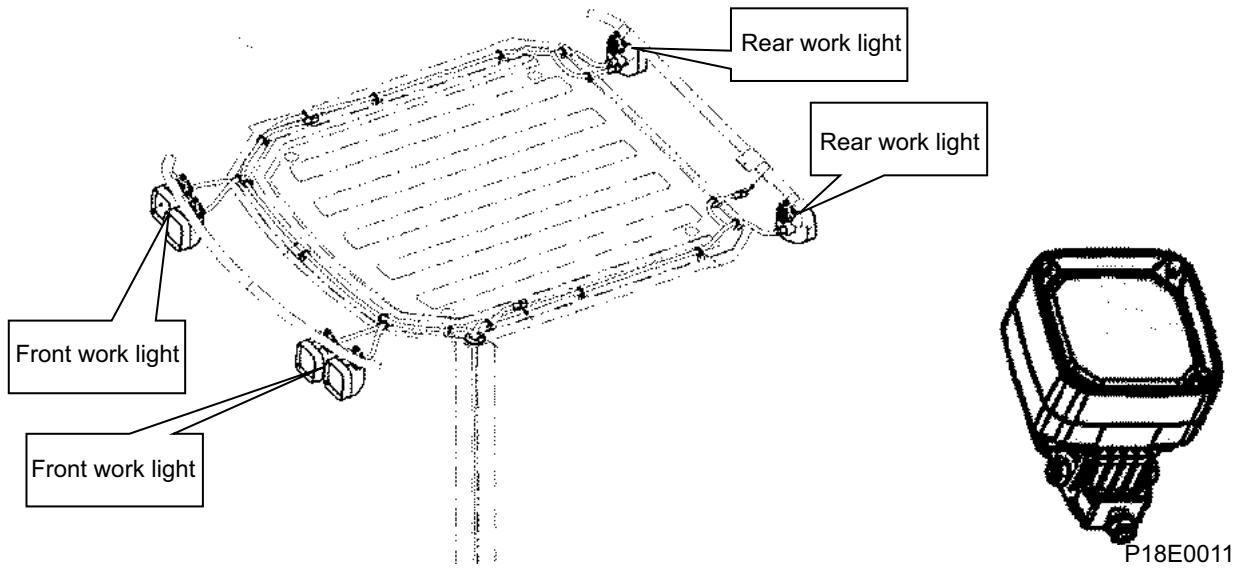
P18E00116



P18E00117

Work light

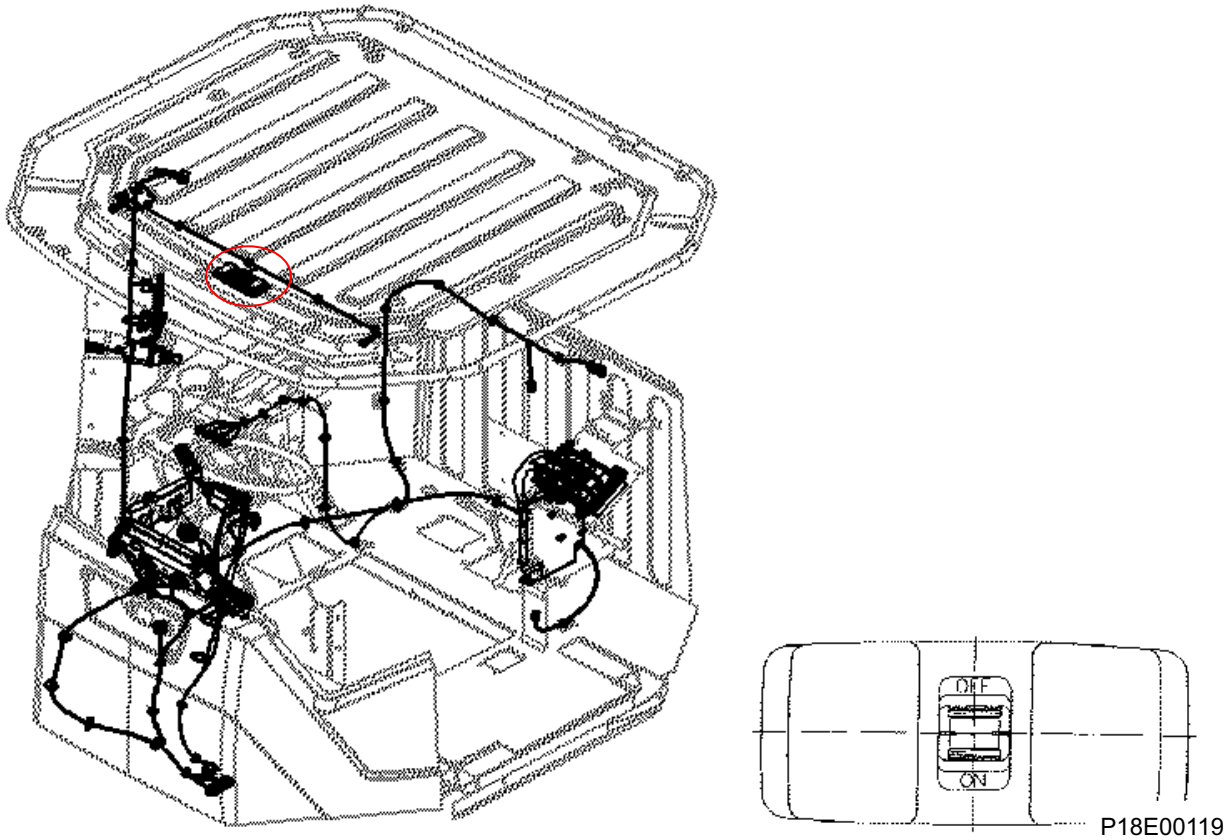
This machine is equipped with six work lights, front; four lights, rear: two lights. Electrical equipment parameters: 1. Rated working voltage is 24 V; 2. Rated power 70W.



P18E00118

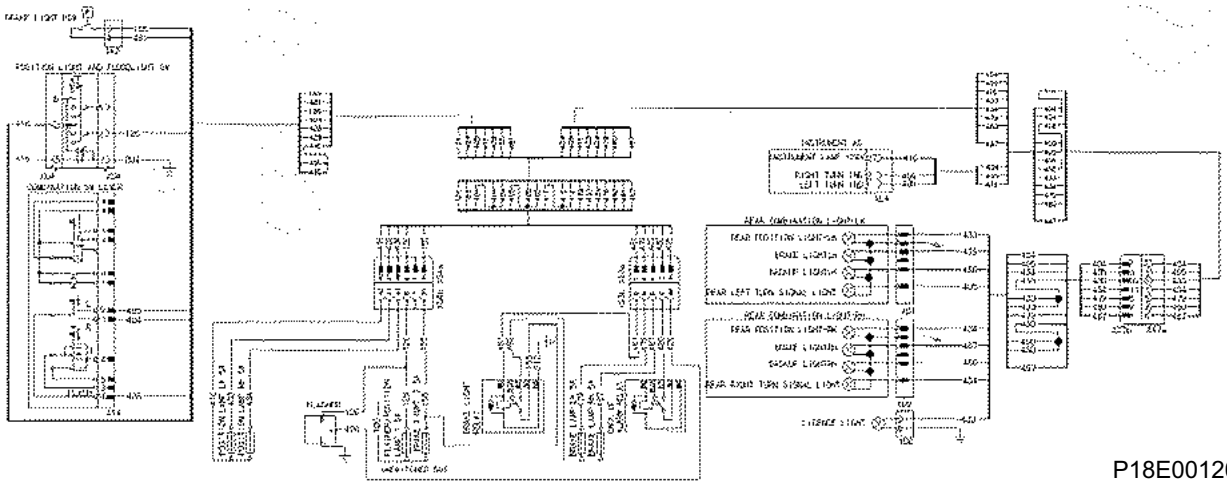
Dome light

Electrical equipment parameters: 1. Rated working voltage is 24 V; 2. Rated power 10W.



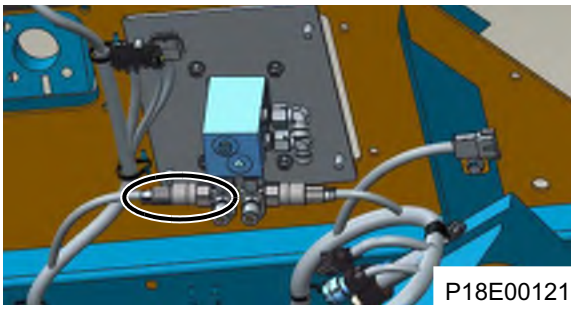
P18E00119

Circuit for rear frame illumination



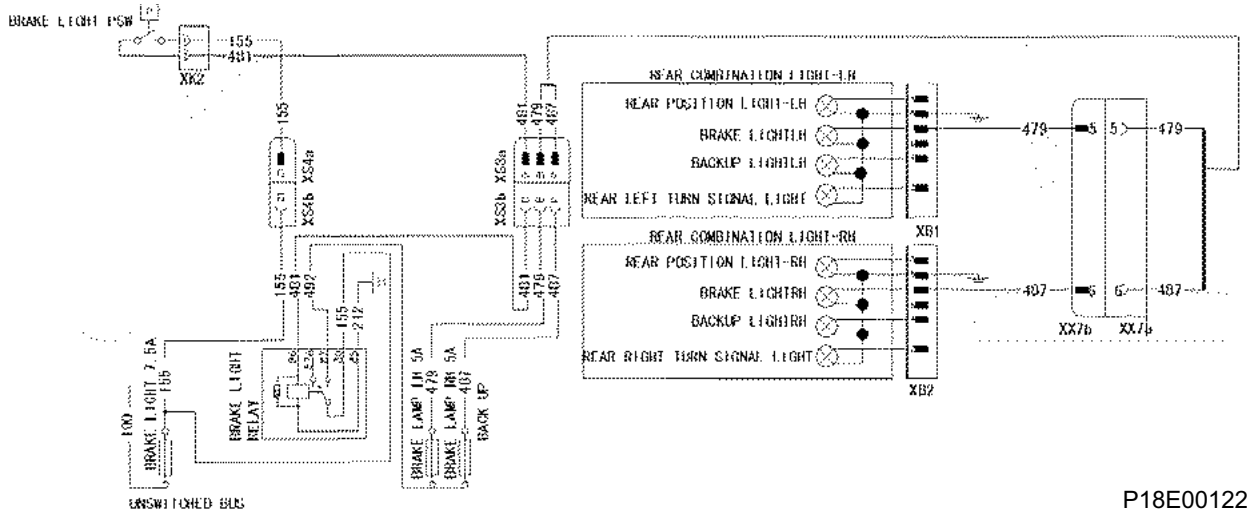
P18E00120

Brake light switch



P18E00121

After pressing the brake pedal, 1. The brake light switch acts, 2. Brake light is lit, 3. Brake light is lit.



P18E00122

Precautions

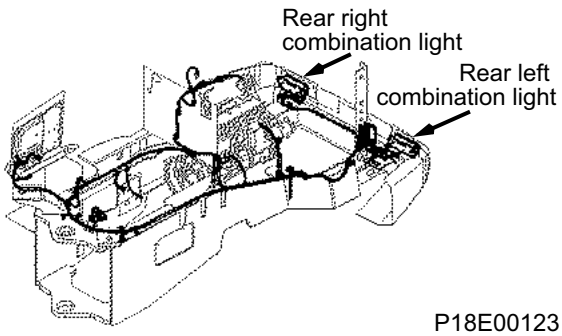
Be sure to switch off the electric lock and wait until the machine is fully cooled, to replace the pressure switch if necessary. Therein, measured liquid overflows once the pressure switch is loosened, which shall be supplemented timely after the replacement.

Test on pressure switch failures

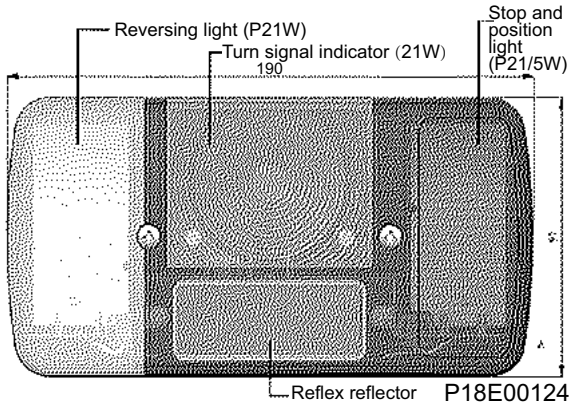
1. Unplug the connector, through which the rear frame harness connects to the engine oil pressure switch;
2. Remove the pressure switch from the complete machine;
3. Assess the action value of pressure switch with pressure test bed, and its contact type is normally open with action value up to 0.5Mpa.

Rear combination light

Integrate functions of steering, driving/braking and backup light.



P18E00123



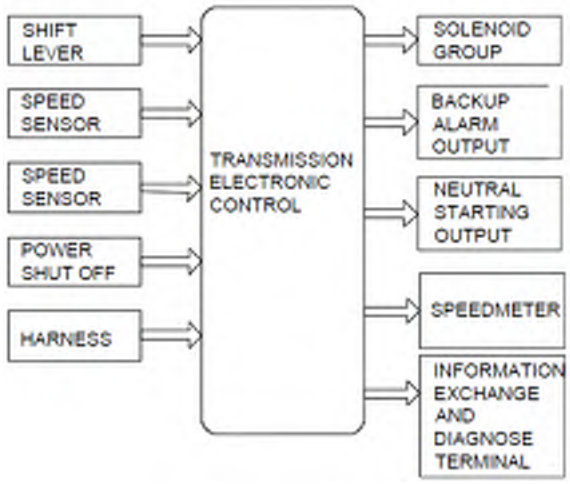
P18E00124

Shift control system

The electronic control unit EST 125 of the shift control system receives the external signals from gear selector, speed sensor and KD button, process such signals and send them to CPU for computing. Eventually, CPU drives the shift control valve combination located on the transmission by virtue of the output circuit, to get the operator selected gear.

The 4WG-158 transmission assembled in the machine is 4-speed transmission, with 4 gears for forward and 3 for reverse. DW-3 gear selector shifts reverse 4 gears, the electronic control unit EST125 actually outputs the control signal of reverse 3 gears.

The electronic control unit EST125 of the shift control system receives the external signals from gear selector, speed sensor and KD button, process such signals and send them to CPU for computing, where the driving state of vehicle is determined by comparison signal between the two speed sensors and other signals. Eventually, CPU drives the shift control valve combination located on the transmission by virtue of the output circuit, to get the operator selected gear. Certainly, as required by driving speed, this gear is possibly lower than that selected by the operator, but not higher than it.



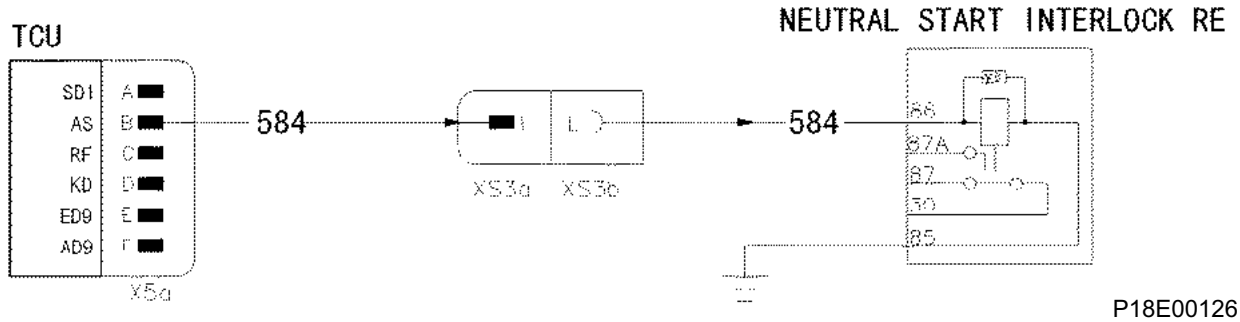
P18E00125

Principle for shift control

Shift control system is provided with the functions of neutral start interlock, clutch shutoff, backup alarm, KD, FNR speed displays and manual/automatic shift.

Neutral start interlock function

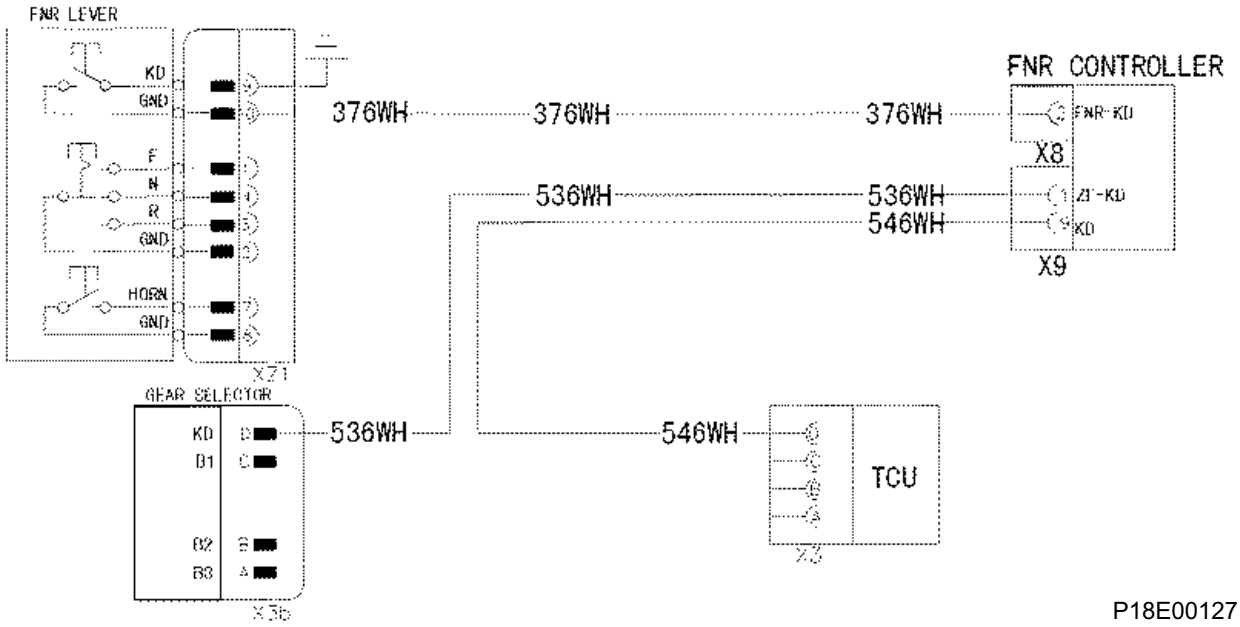
If the DW-3 gear selector is shifted to gear N, the electronic control unit EST125 will output a high level (24V) of #584, and the neutral interlock relay enabled. The exploded electrical schematic as follows:



P18E00126

KD functions

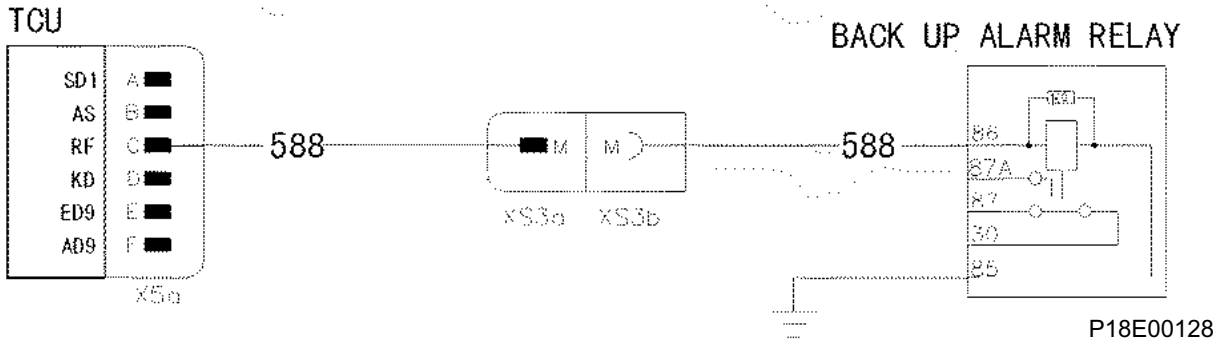
Apart from the KD button on DW-3 gear selector, another KD button is assembled on the pilot-operated lever of the machine. The exploded electrical schematic as follows:



P18E00127

Function of backup alarm

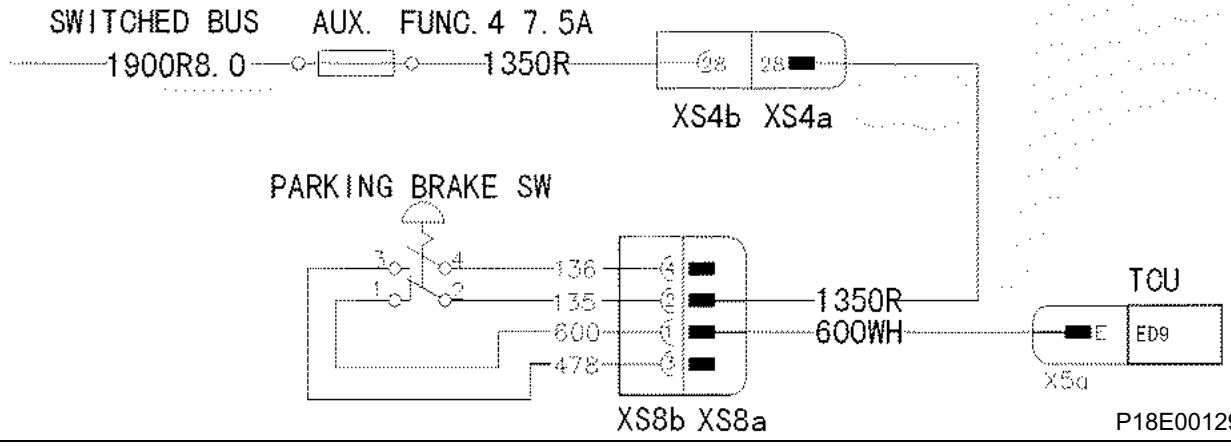
If the DW-3 gear selector is shifted to gear R, #588 outputs a high level, and the backup alarm relay enabled. The exploded electrical schematic as follows:



P18E00128

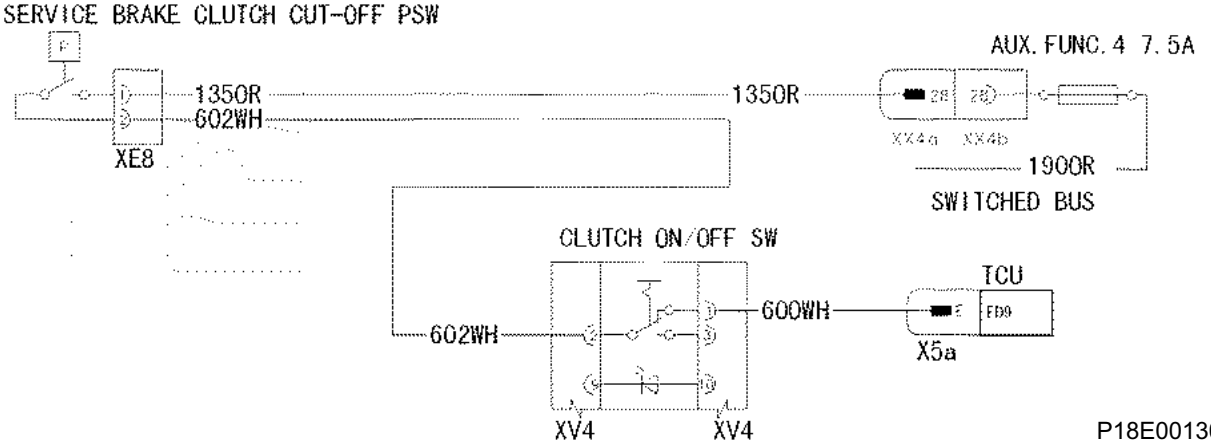
Power cut-off function

The power shutoff consists of parking clutch shutoff and service clutch shutoff, both of which shut off the powers at gear I and II of the transmission. The parking power cutoff system is started once the stop brake switch is pulled up, as shown below:



P18E00129

If the clutch on/off switch is turned on, the service clutch shutoff will start through press the brake pedal during the service, schematics as follows:



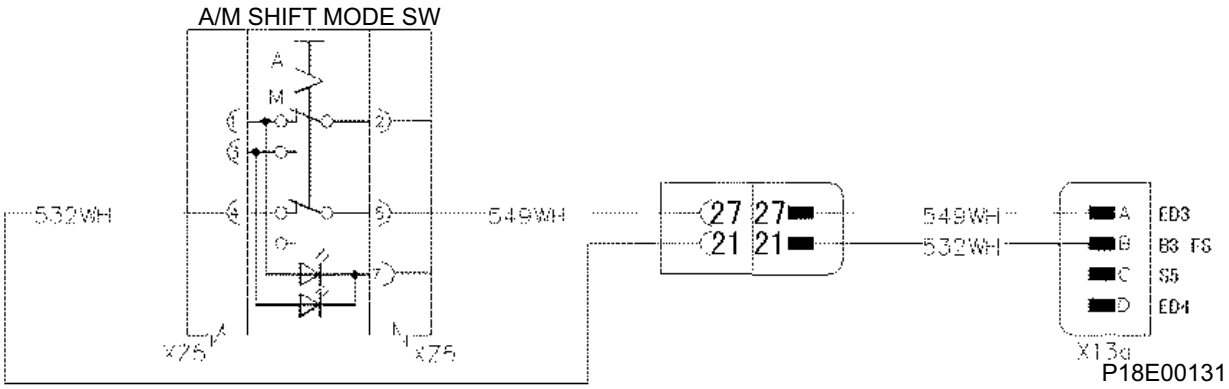
P18E00130

Function of indicating the speed

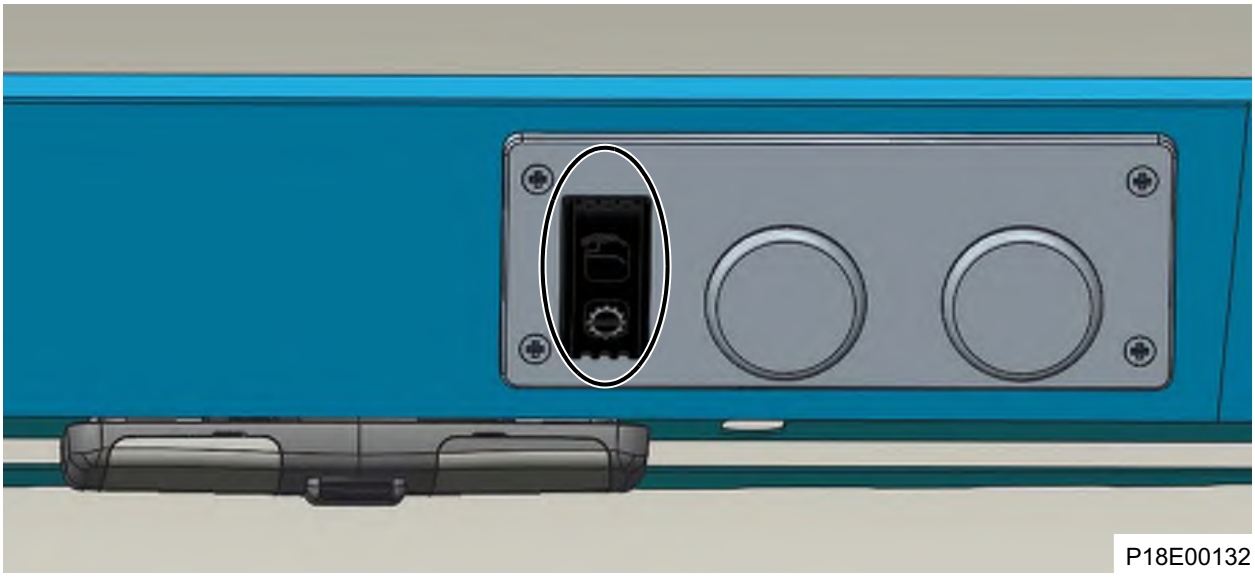
For the circuit of this part, please refer to Vehicle Speed Indicating Line Schematic Diagram.

Manual/automatic shift function

When the rocker switch is pressed down, turning on switch indicates automatic shift mode, and turning off switch indicates manual shift mode

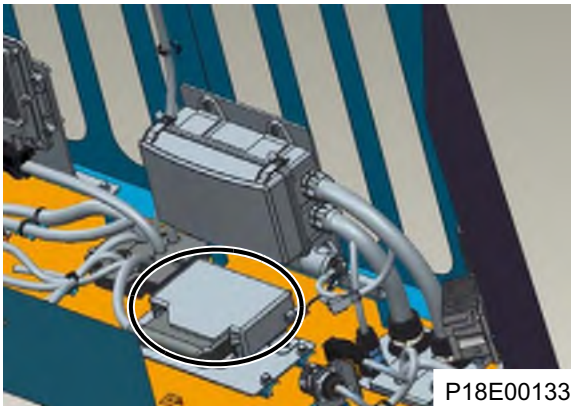


Manual/automatic shift rocker switch

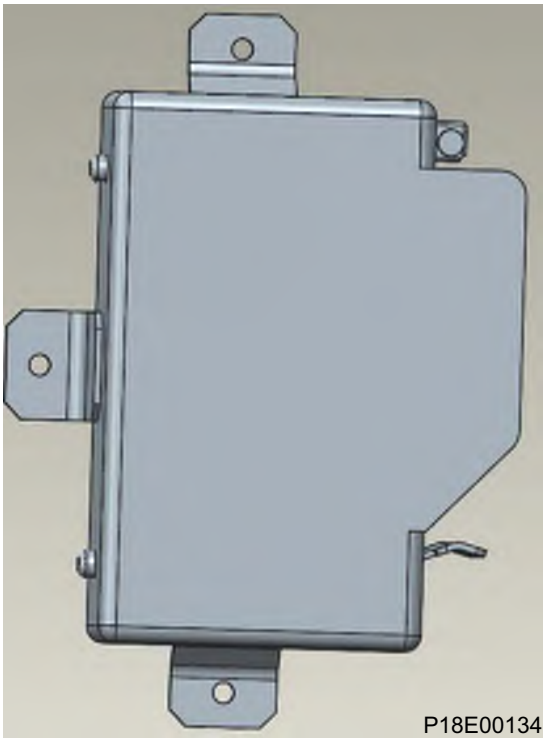


Electronic control unit

As the core of the shift control system, the electronic control unit EST125 processes and operates the signals of operator-selected gear, speed sensor, KD and engine shutoff. Whereby, EST125 drives the solenoid valve group combination through outputting control signals, to implement the gear selection and shift of transmission. Besides, EST125 also outputs neutral signals, to drive the gear/neutral interlock relay to act when the DW-3 gear selector is in neutral position. Output the reversing alarm signal and drive the reversing alarm relay to work.



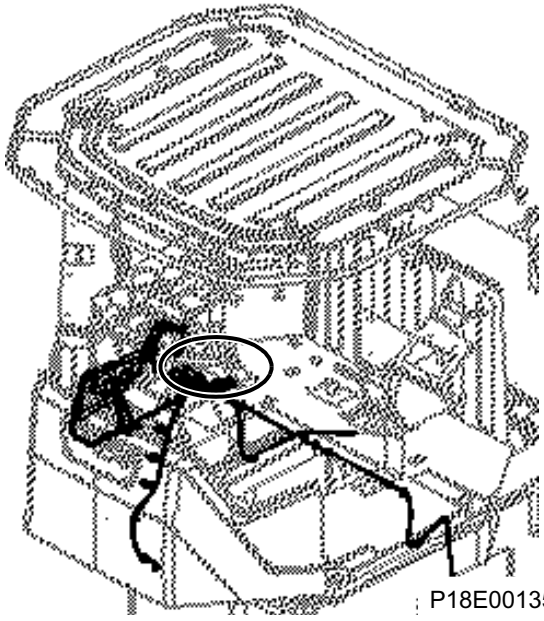
P18E00133



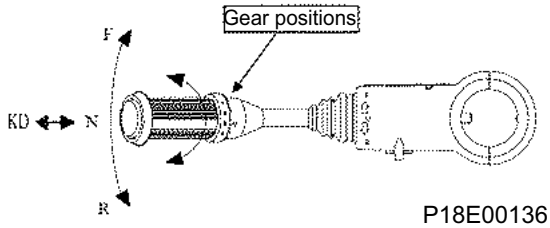
P18E00134

Shift selector

The internal part of a gear selector consists of many mini switches. When the operator selects gears and directions, the internal micro switch works, and the changed gear and direction signals ultimately enter into the electronic control unit EST125 through the connecting of harness.



P18E00135



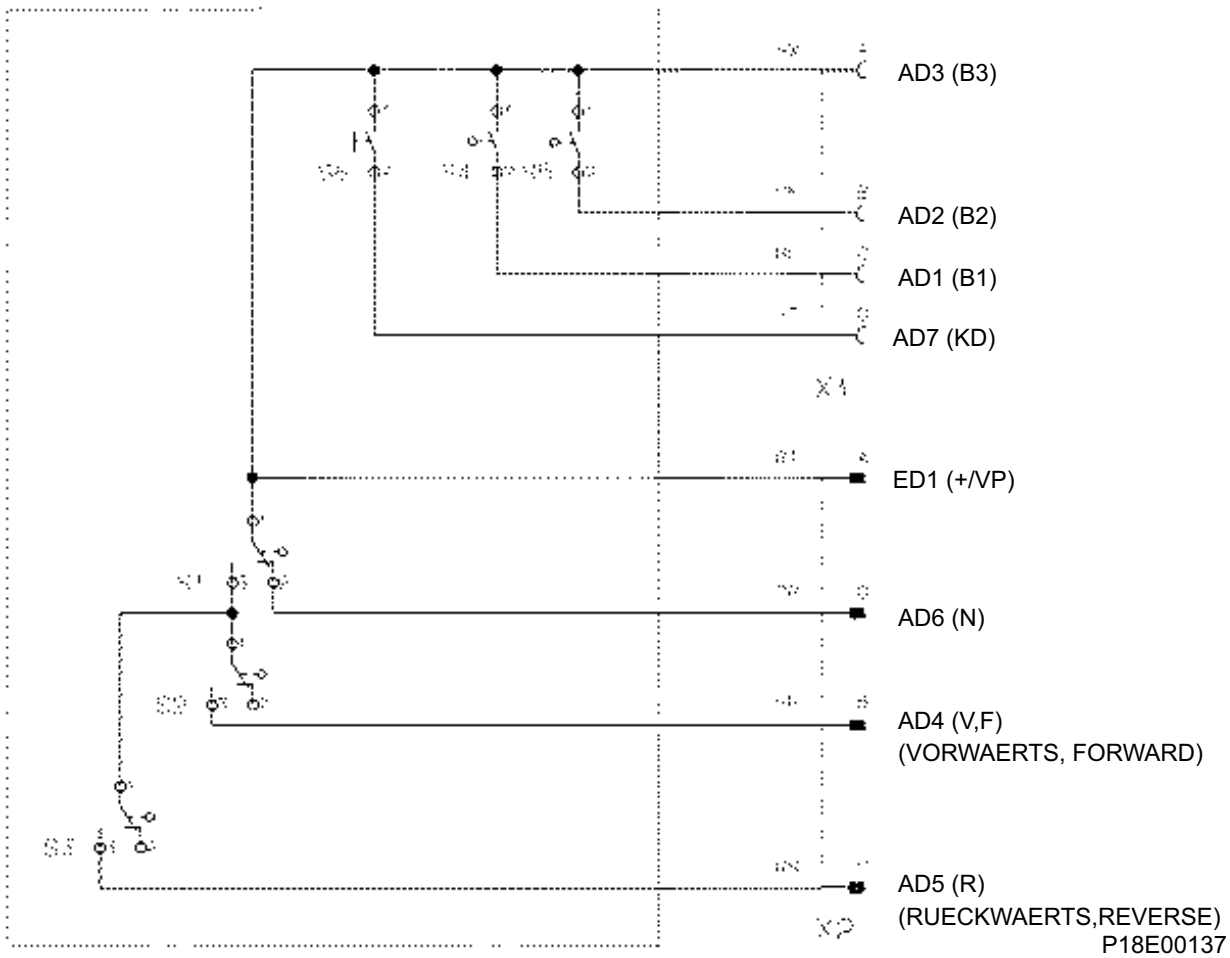
P18E00136

Fault detection procedures of DW-3 shift selector

1. Turn the digital multimeter to 200 Ω of Ω position.
2. Move DW-3 gear selector to N1 position;
3. Test if only [B1, B3], [B1, AS], [B3, AS] are pairwise energized;
4. Shift the gear selector to other appropriate gears, and check the parallelism in accordance with the gear logic diagram;

5. The gear selector is in normal condition, provided that all the gears conform to the gear logic diagram.

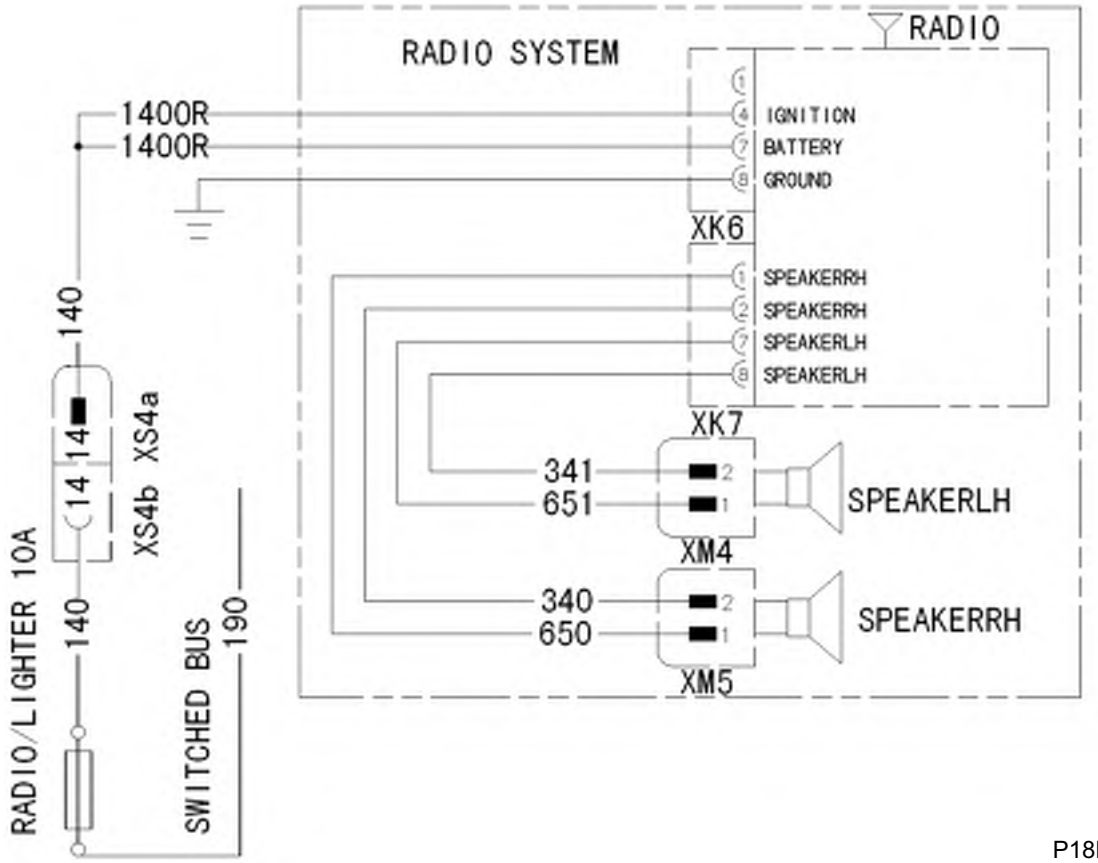
AUSGABE		OUTPUT SIGNAL												
GANG GEAR		YOWAERTS FORWARD				RUECKWAERTS REVERS				NEUTRAL				
		1	2	3	4	1	2	3	4	1	2	3	4	KD
AD1	B1	●			●	●			●	●			●	
AD2	B2			●	●			●	●			●	●	
AD3	B3	●	●	●	●	●	●	●	●	●	●	●	●	
AD4	V	●	●	●	●									
AD5	R					●	●	●	●					
AD6	AS									●	●	●	●	
AD7	KD													●



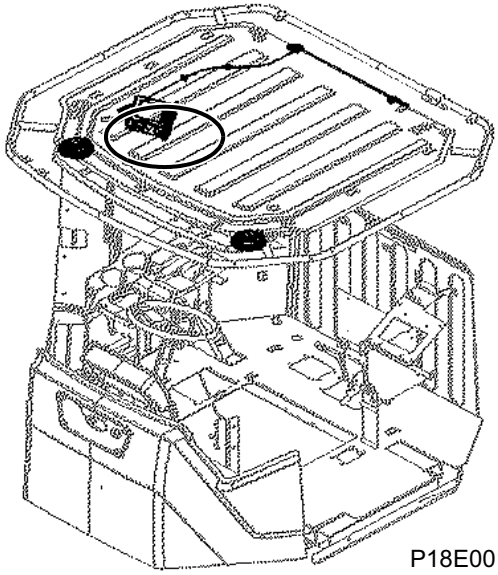
P18E00137

Audio system

Audio system principle

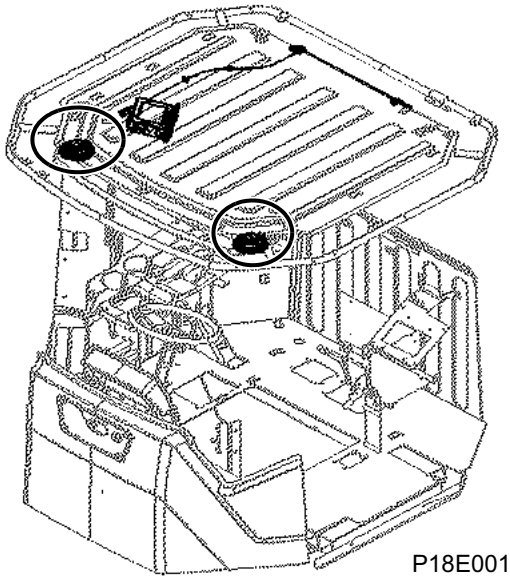


Radio

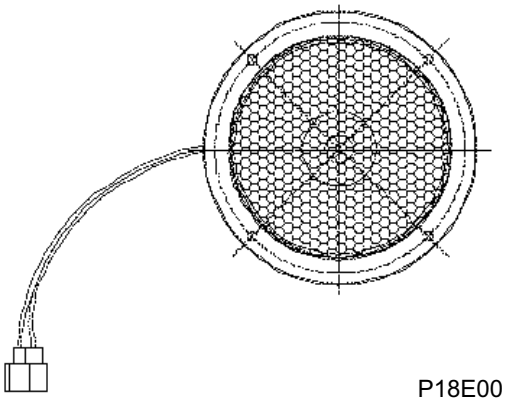


P18E00139

Speaker

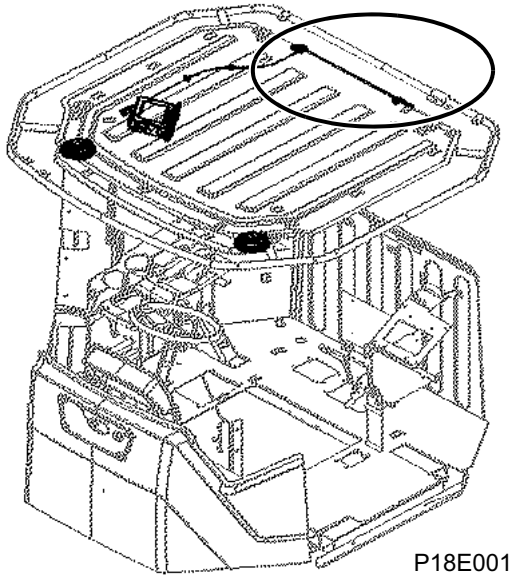


P18E00140



P18E00141

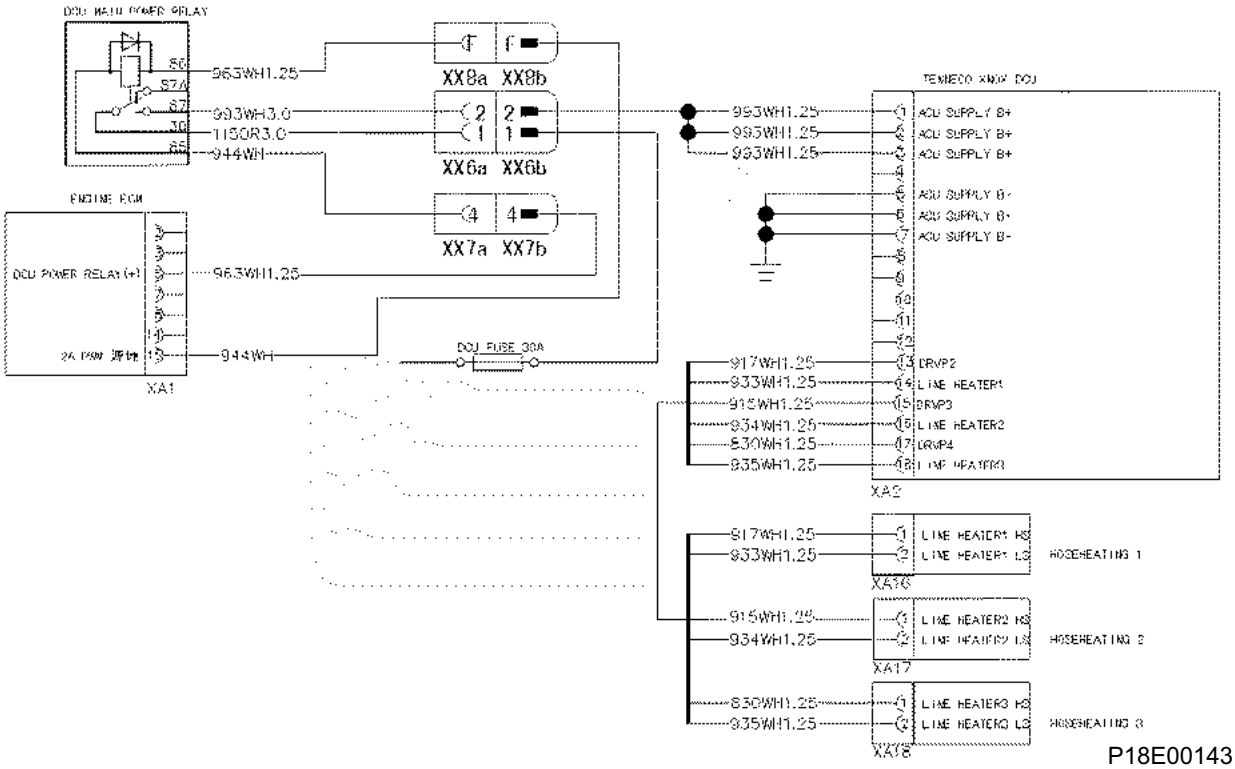
Antenna



P18E00142

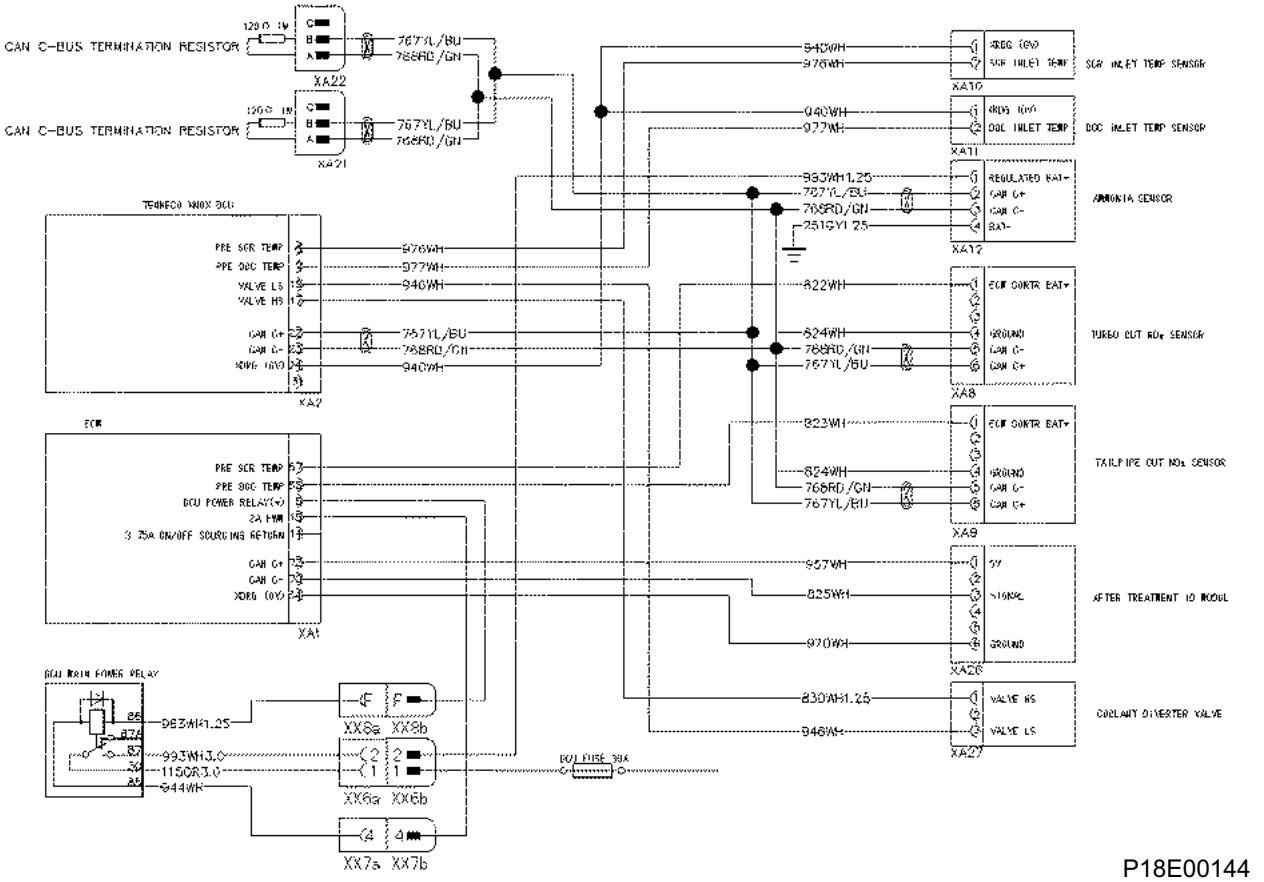
Engine electric control module

DEF heater pipe



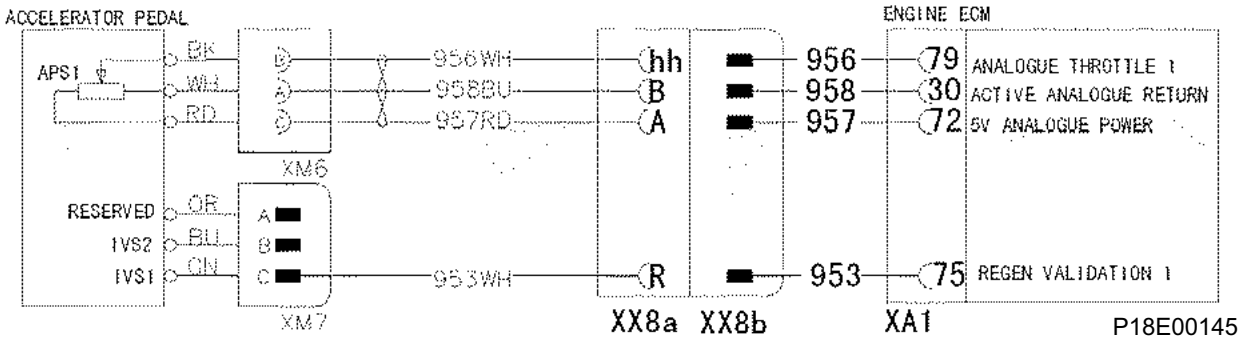
P18E00143

Principle for exhaust disposal



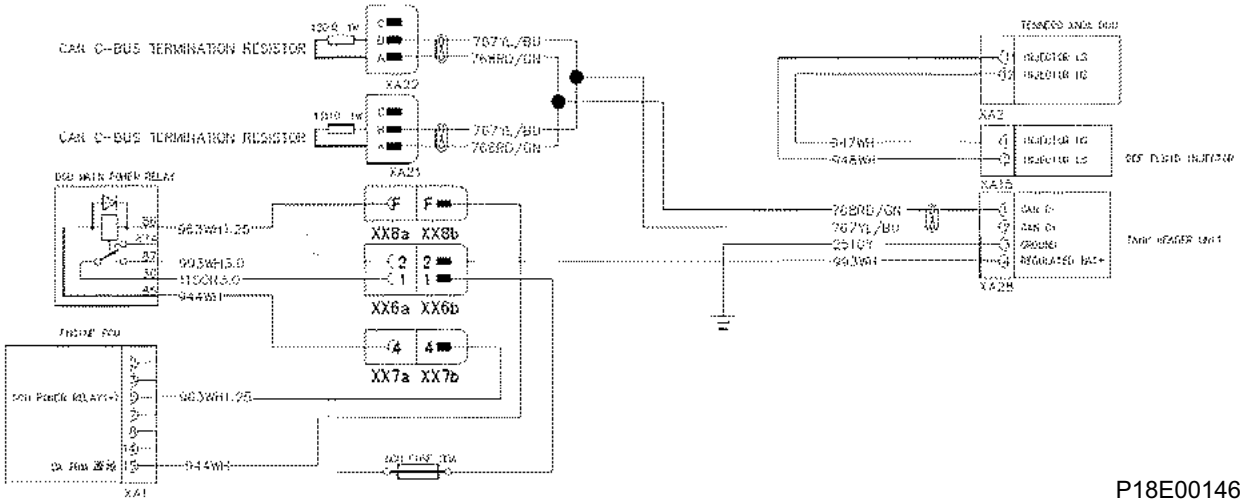
P18E00144

Electronic throttle line



P18E00145

DEF pump supply module line



P18E00146

Radiator fan control module

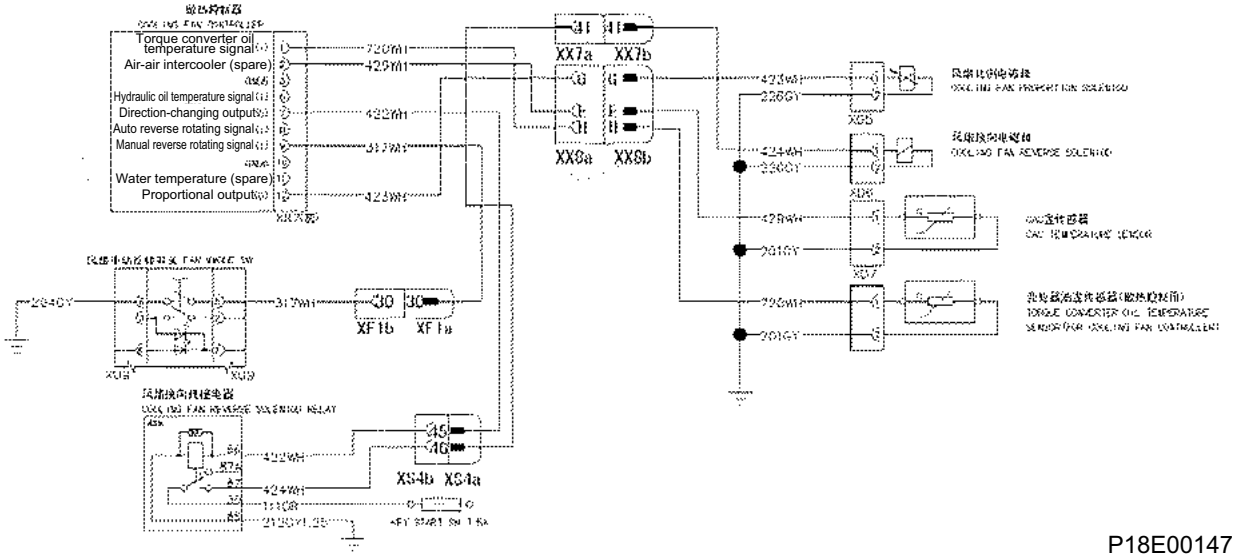
Control strategy

Water temperature: 90°C~100°C, target temperature: 95°C, PID regulation, i.e. fan begins to accelerate when the temperature is more than 95°C, or vice versa

Torque oil temperature: 105°C~110°C, linear adjustment, i.e. fan operates at the minimum speed when the temperature is not more than 105°C and other temperatures are not in the adjustable range; fan operates at the maximum speed when the temperature is more than 110°C; when the temperature is between 105°C~110°C, an corresponding speed can be achieved through linear scale calculation.

Air-air intercooler: temperature control node: 40,Fmin; 55,F80%; 70,80%; 75,Fmax;

Electrical schematic diagram

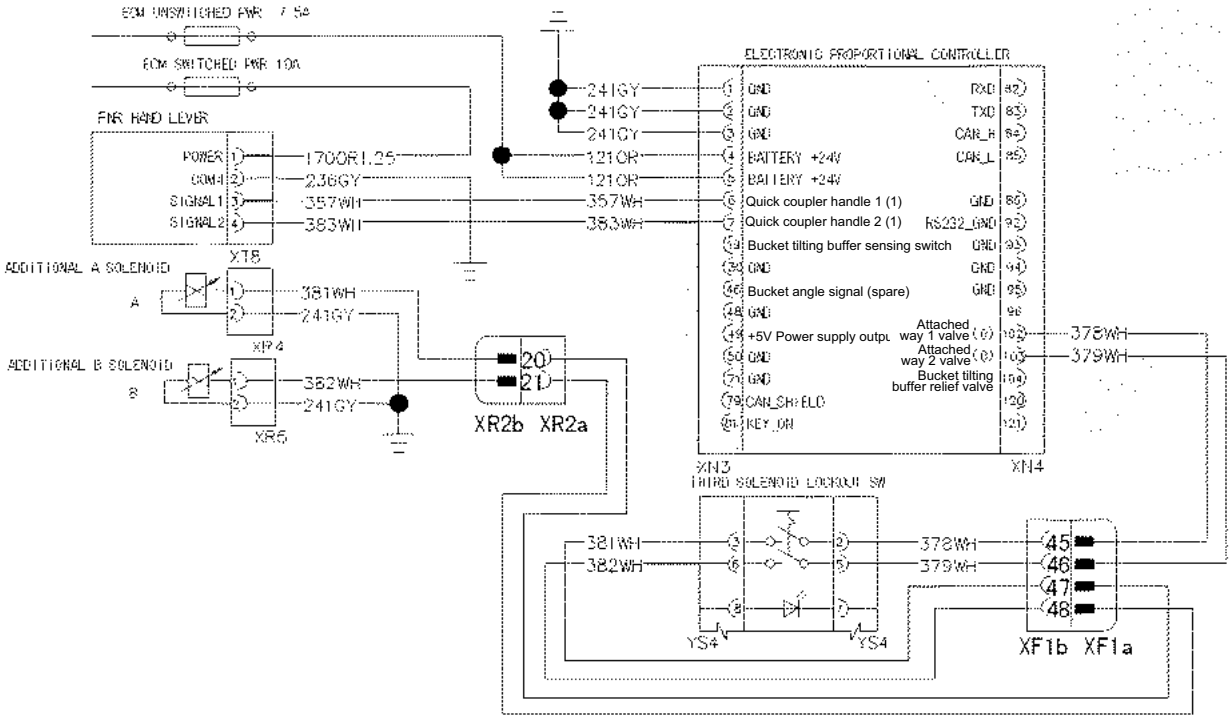


P18E00147

Electric proportional controller module of the third linkage

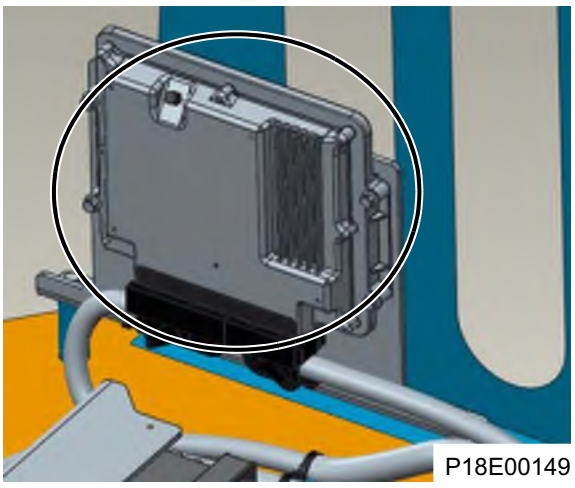
The operation of the third linkage of pilot lever for grapple accessories can be achieved flexibly.

Principle interpretation: signal is input to the controller by the roller on scroll handle, and controller output control signal to proportional valve according to input signal, eventually to control the opening of valve to control accessories. Add a lock switch at the end of controller output signal to achieve safety protection.



P18E00148

Electronic p.r controller



P18E00149

Switch

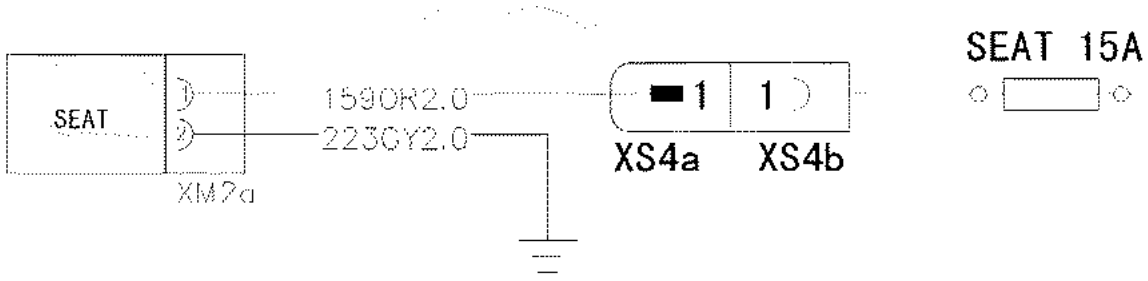
P18E00150

Control lever

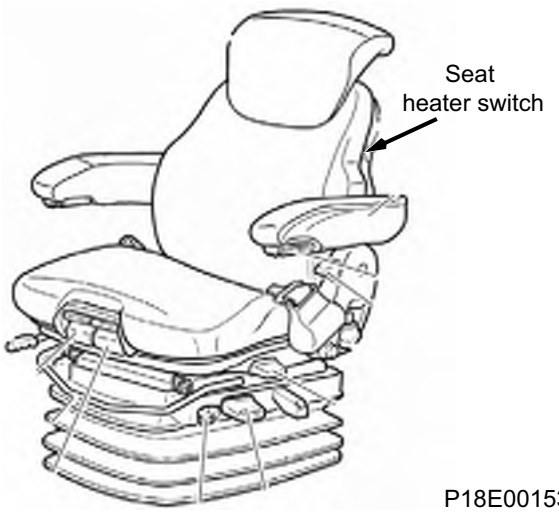
P18E00151

Seat heater

Supply power to the sear after the complete machine is energized, and seat heater is controlled the ON/OFF by the switch on the seat.



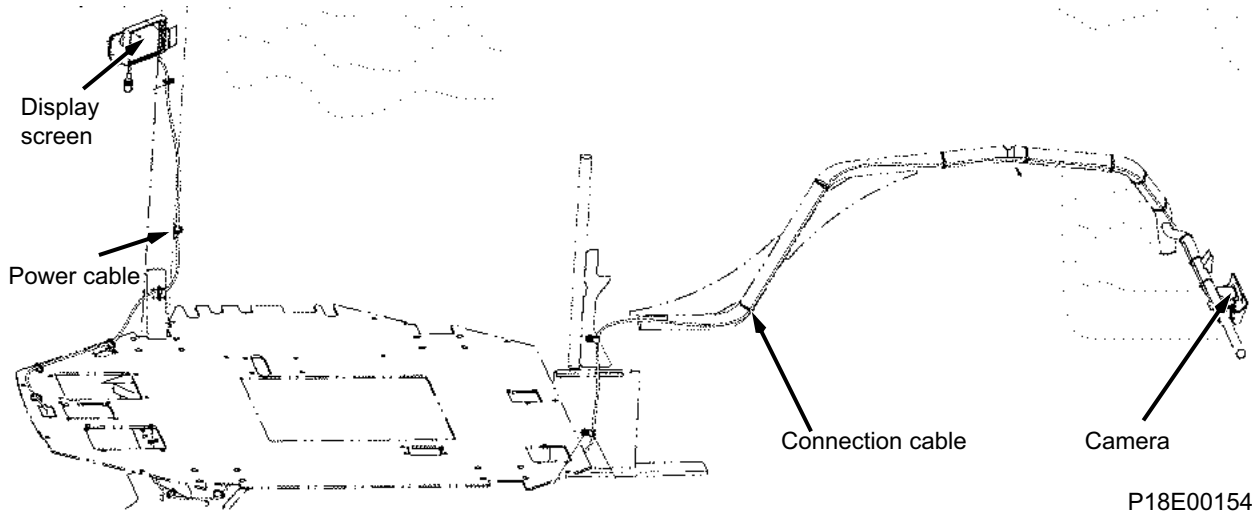
P18E00152



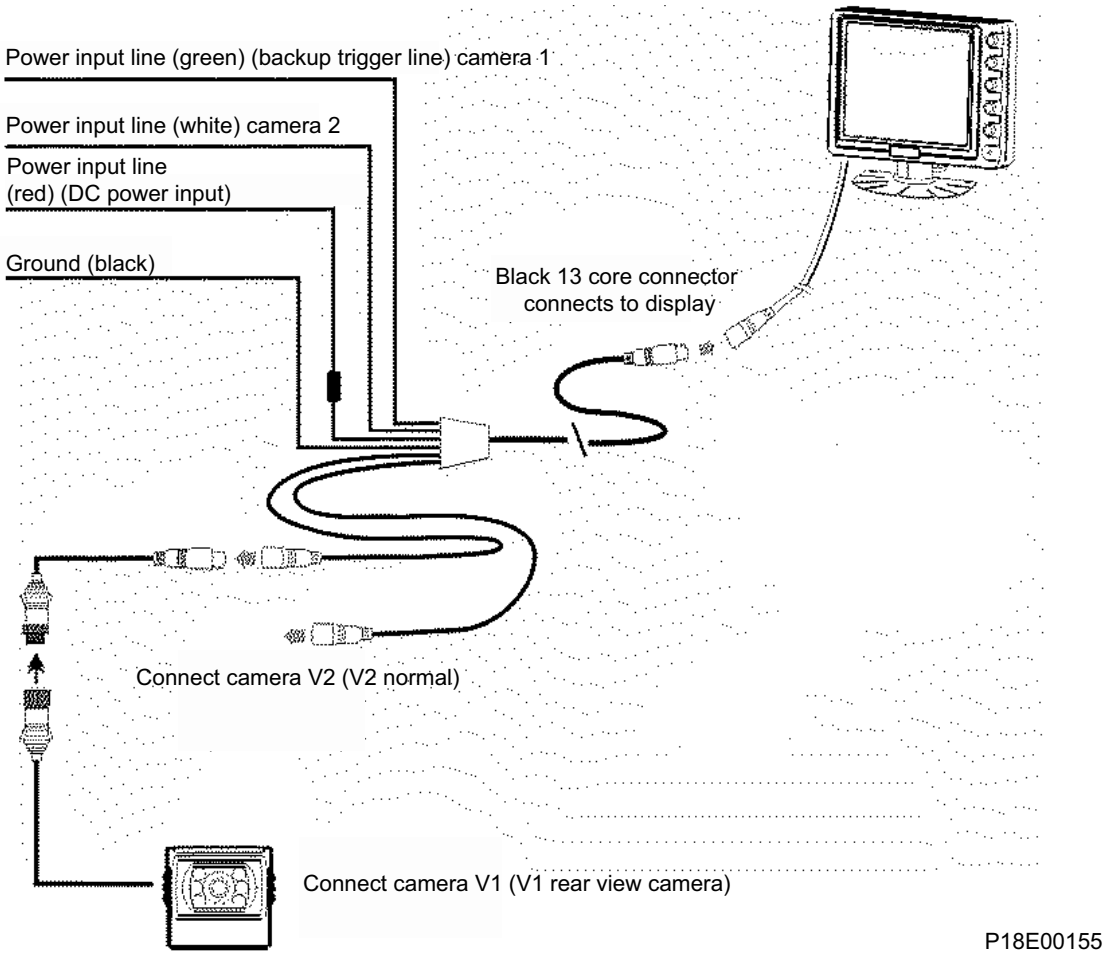
P18E00153

Backup monitoring system

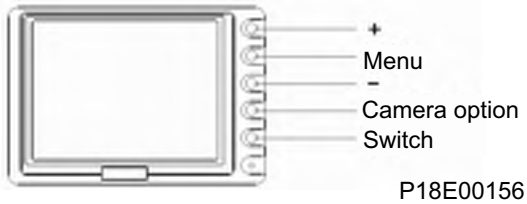
Backup monitoring system is composed of display screen, camera, power cable and connection cable.



Connection diagram



Display screen



P18E00156

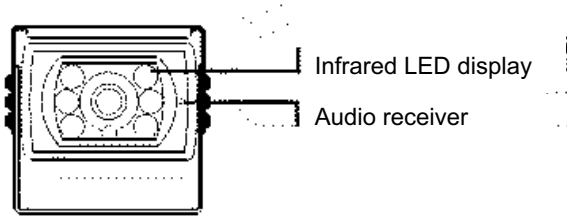
1. Camera Option

When the monitoring system is active, whether triggered, the camera 1 or 2 can be selected by button "CAM SELECT".

2. Switch

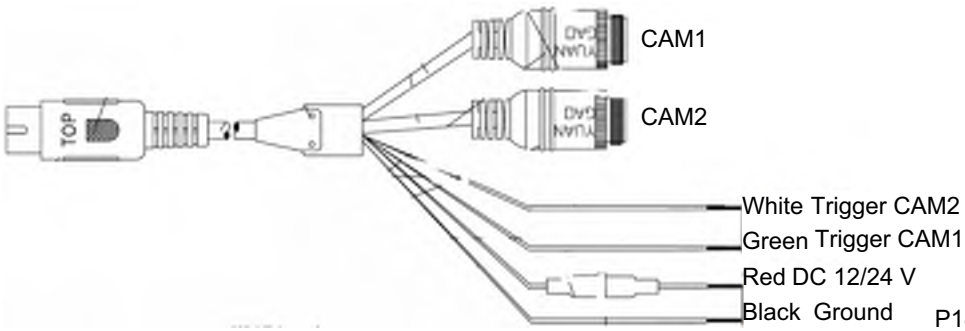
Switch button "POWER" controls the on/off of the monitoring system, while the switch button is unavailable at the triggered state.

Camera



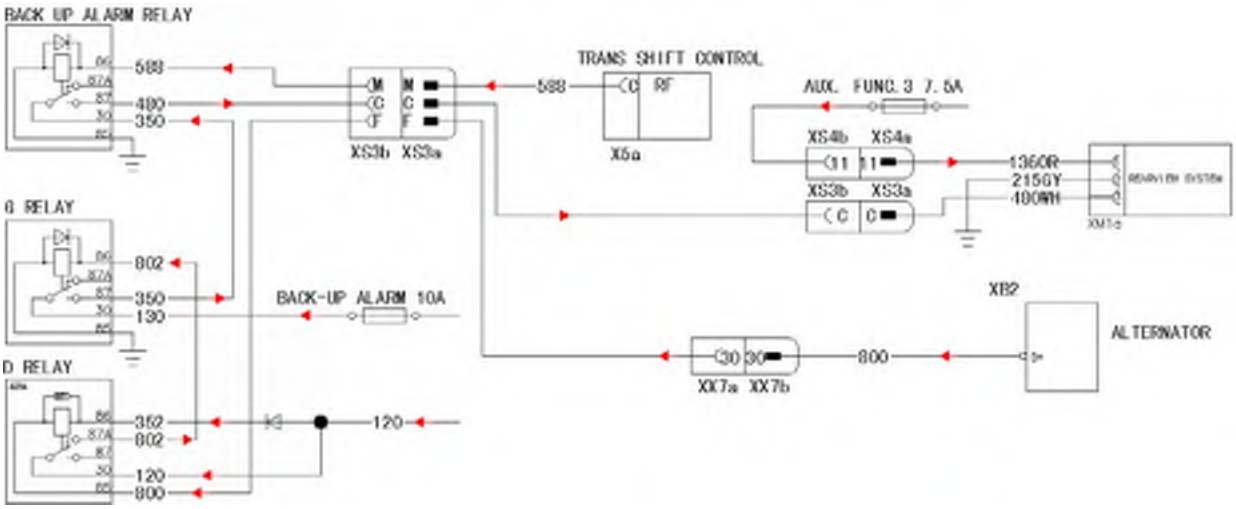
P18E00157

Power cable



P18E00158

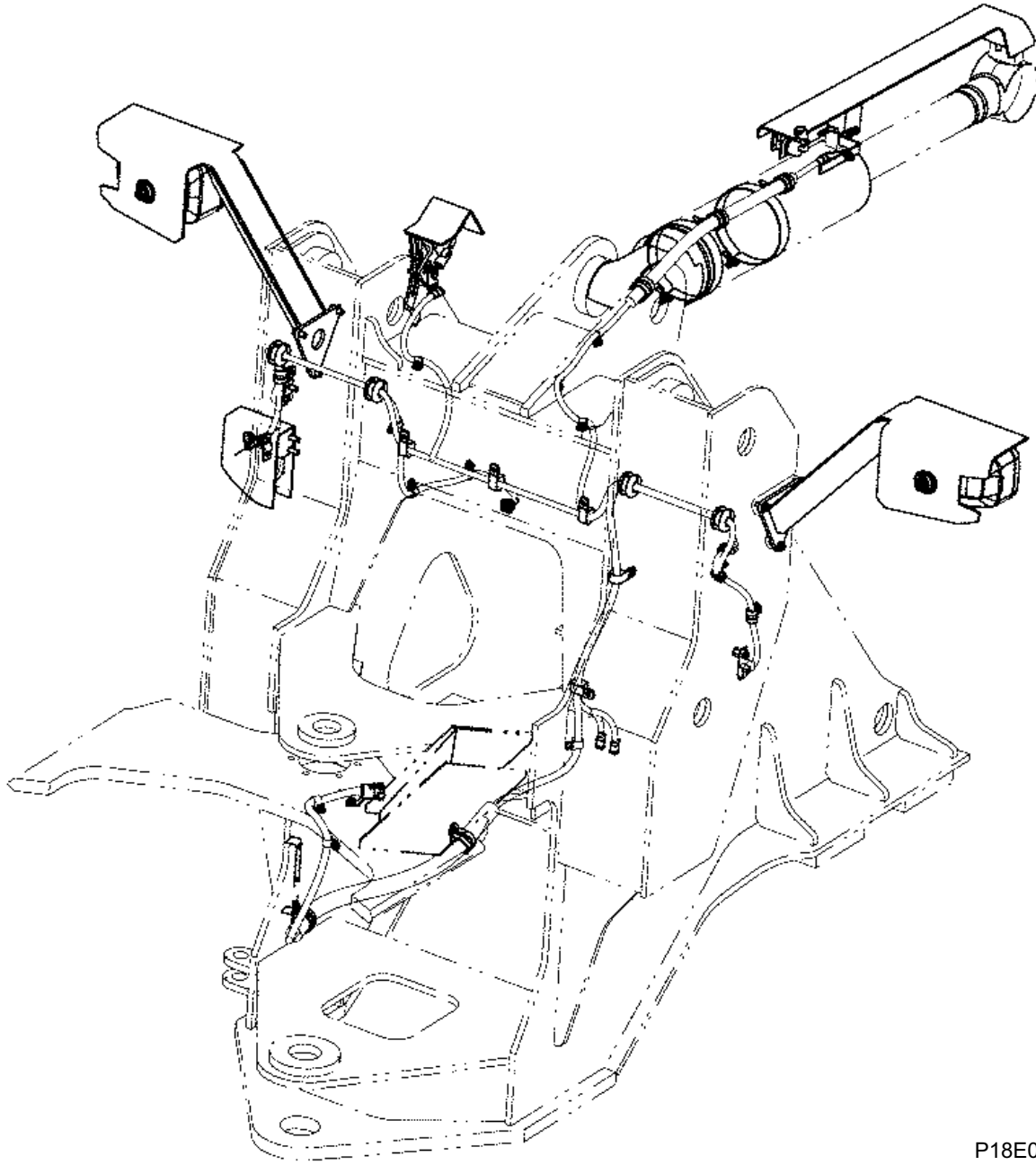
Circuit principle of the cab wire terminal power supply



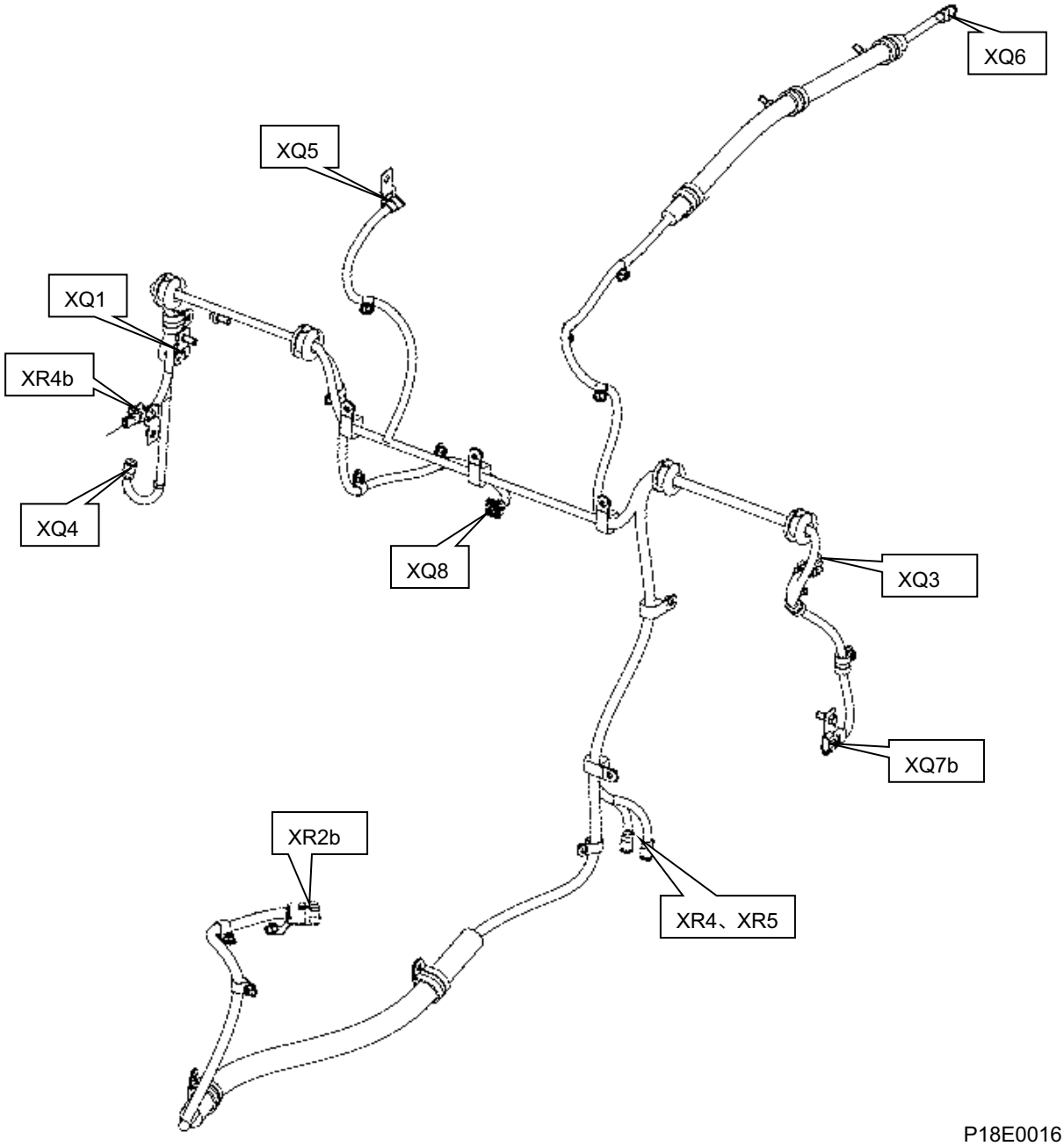
P18E00159

Appendix

Distribution diagram of front frame harness connector

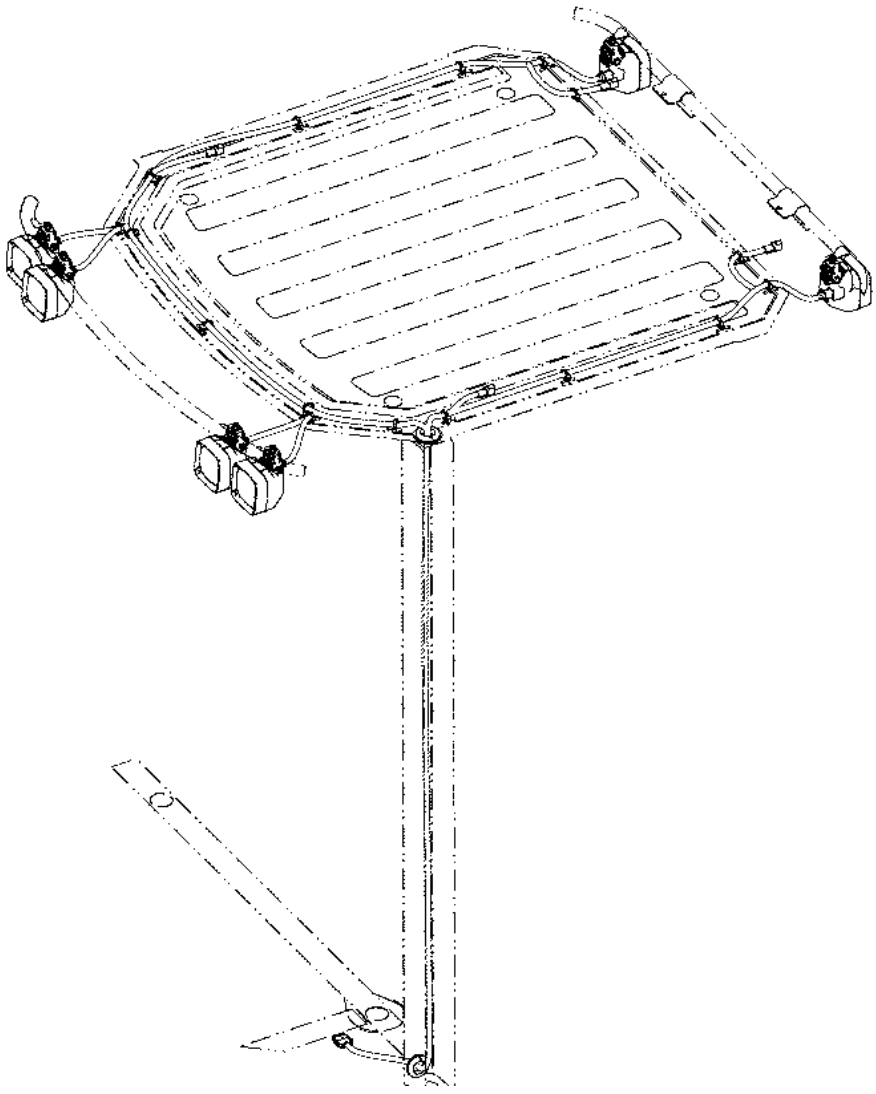


P18E00160

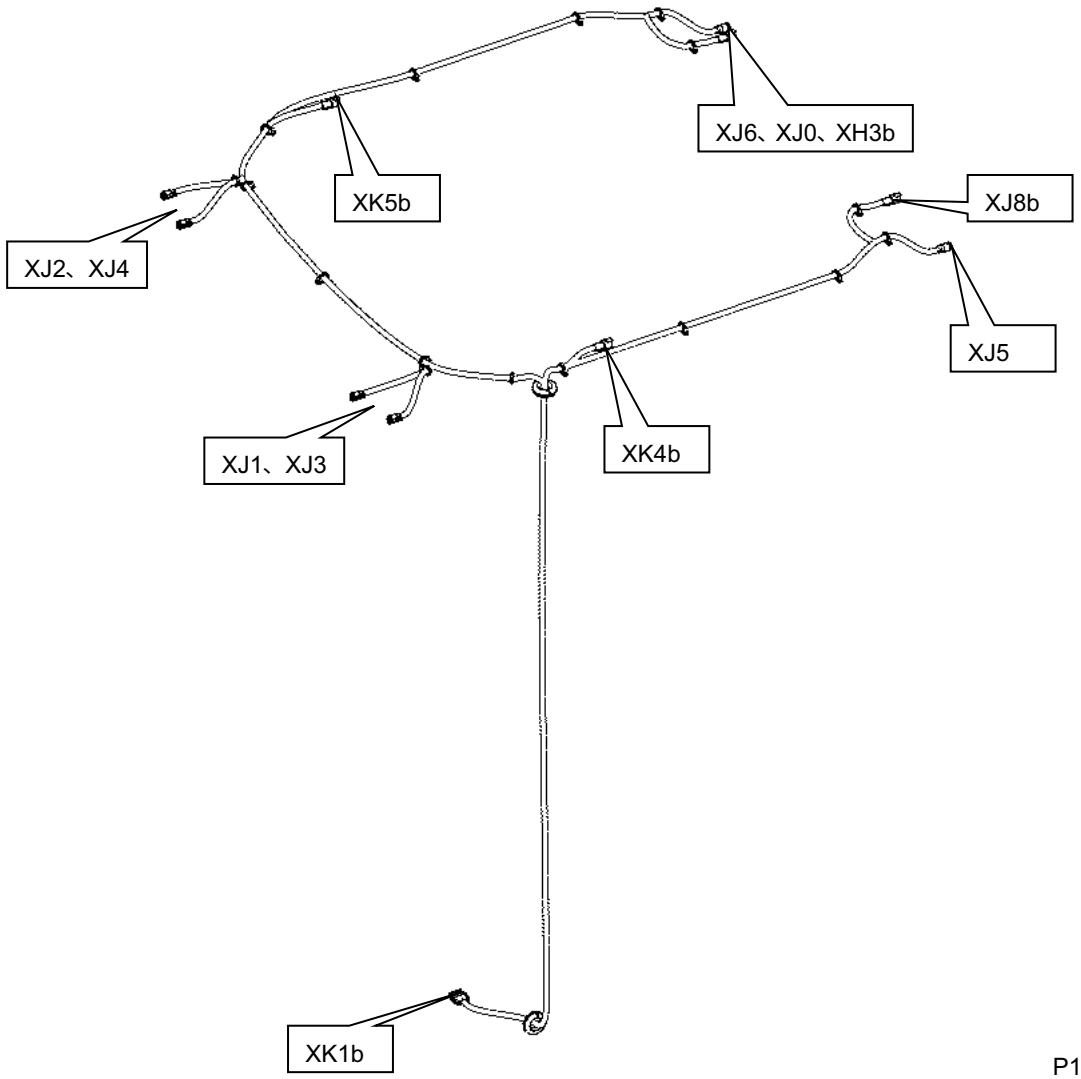


P18E00161

Distribution diagram of work light harness connector

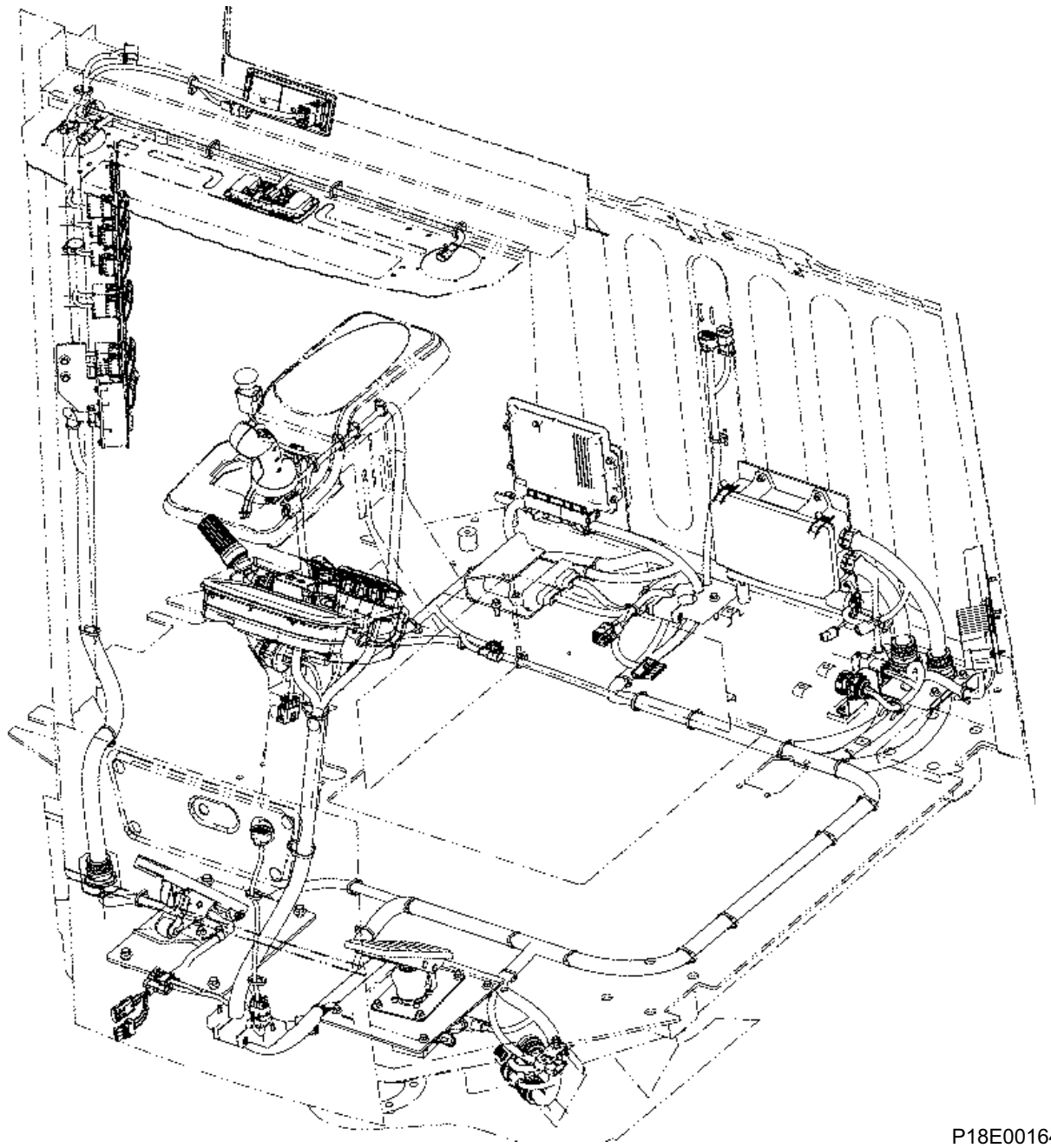


P18E00162

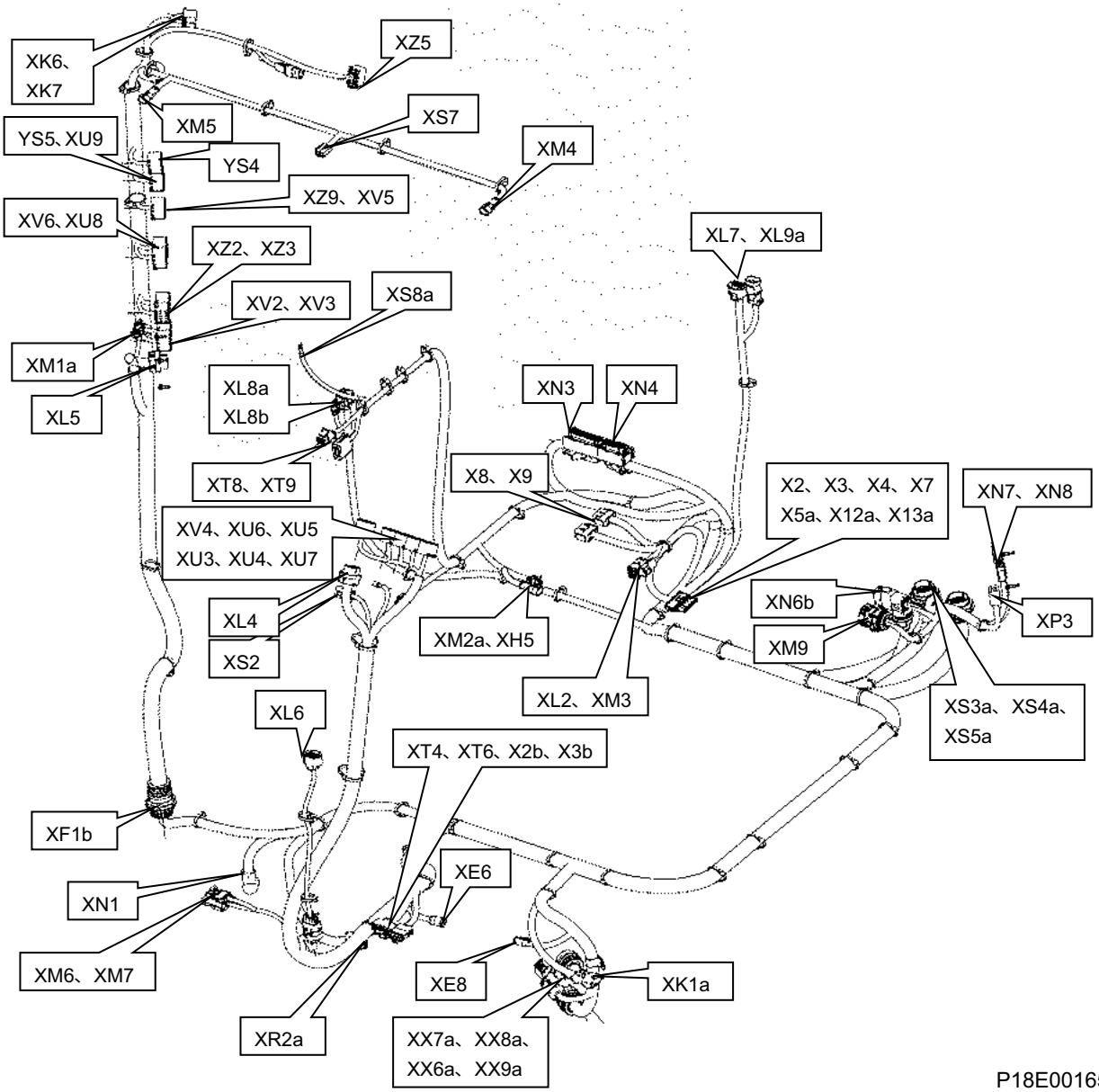


P18E00163

The distribution diagram of cab harness connector

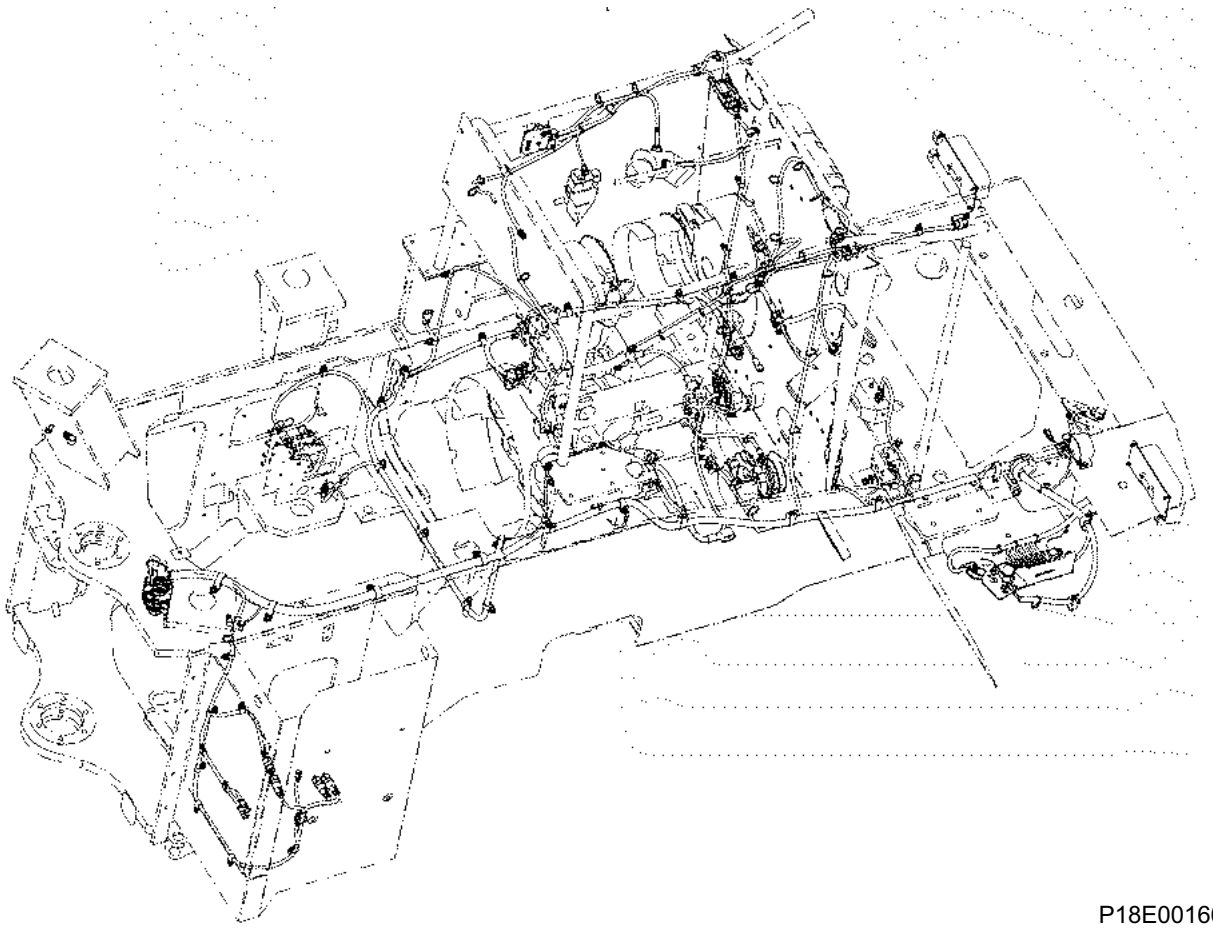


P18E00164

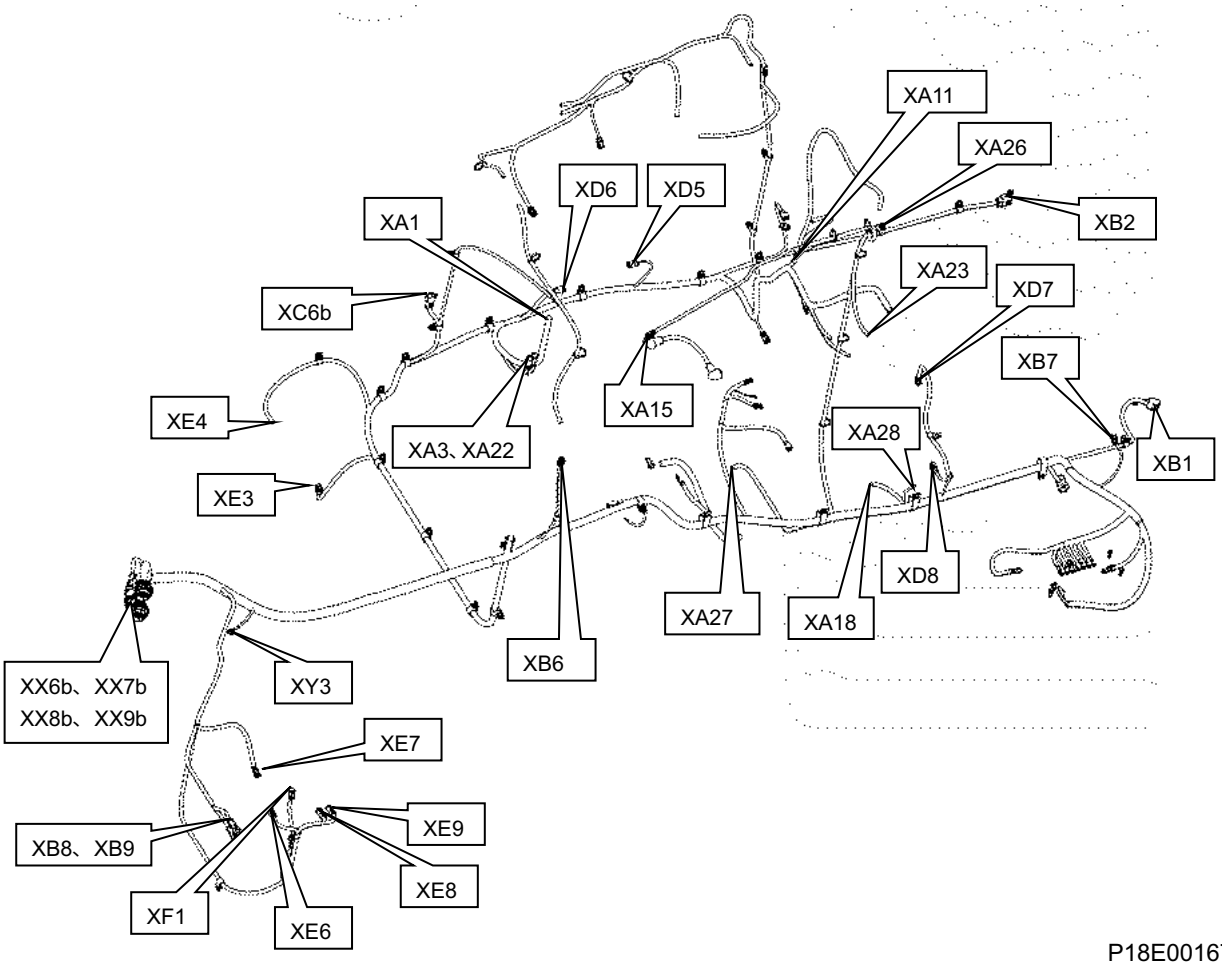

XK6、
XK7
XZ5
XM5
XS7
YS5、XU9
YS4
XM4
XZ9、XV5
XV6、XU8
XZ2、XZ3
XL7、XL9a
XV2、XV3
XS8a
XM1a
XL5
XL8a
XL8b
XN3
XN4
XT8、XT9
X8、X9
X2、X3、X4、X7
X5a、X12a、X13a
XN7、XN8
XV4、XU6、XU5
XU3、XU4、XU7
XN6b
XP3
XL4
XS2
XM2a、XH5
XM9
XL2、XM3
XS3a、XS4a、
XS5a
XL6
XT4、XT6、X2b、X3b
XF1b
XE6
XN1
XM6、XM7
XE8
XK1a
XR2a
XX7a、XX8a、
XX6a、XX9a

P18E00165

Distribution diagram of rear frame harness connector



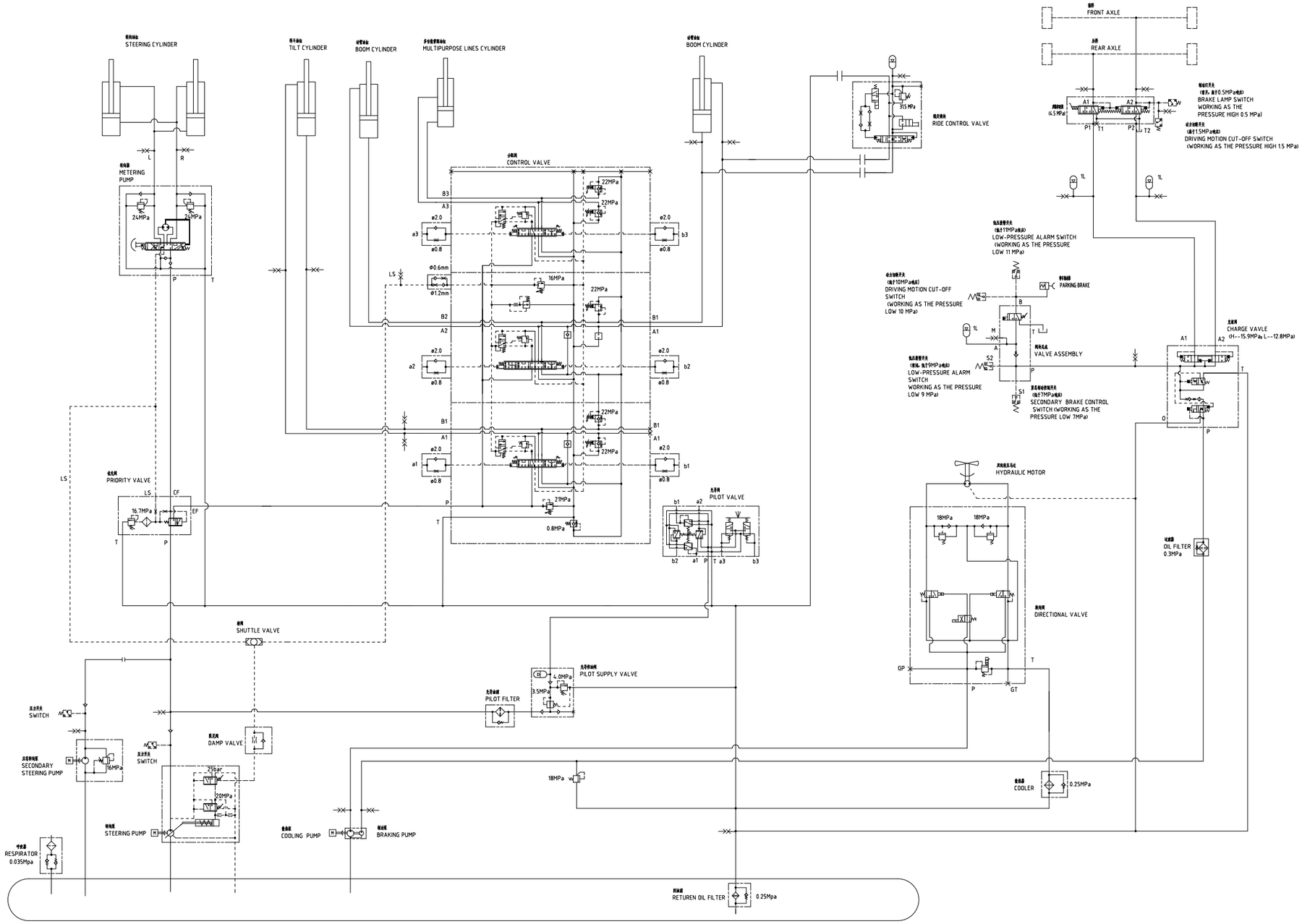
P18E00166


XA11
XA26
XD6
XD5
XA1
XB2
XA23
XD7
XC6b
XB7
XE4
XA15
XA28
XA3、XA22
XB1
XE3
XD8
XA27
XA18
XB6
XX6b、XX7b
XX8b、XX9b
XY3
XE7
XE9
XB8、XB9
XE8
XF1
XE6

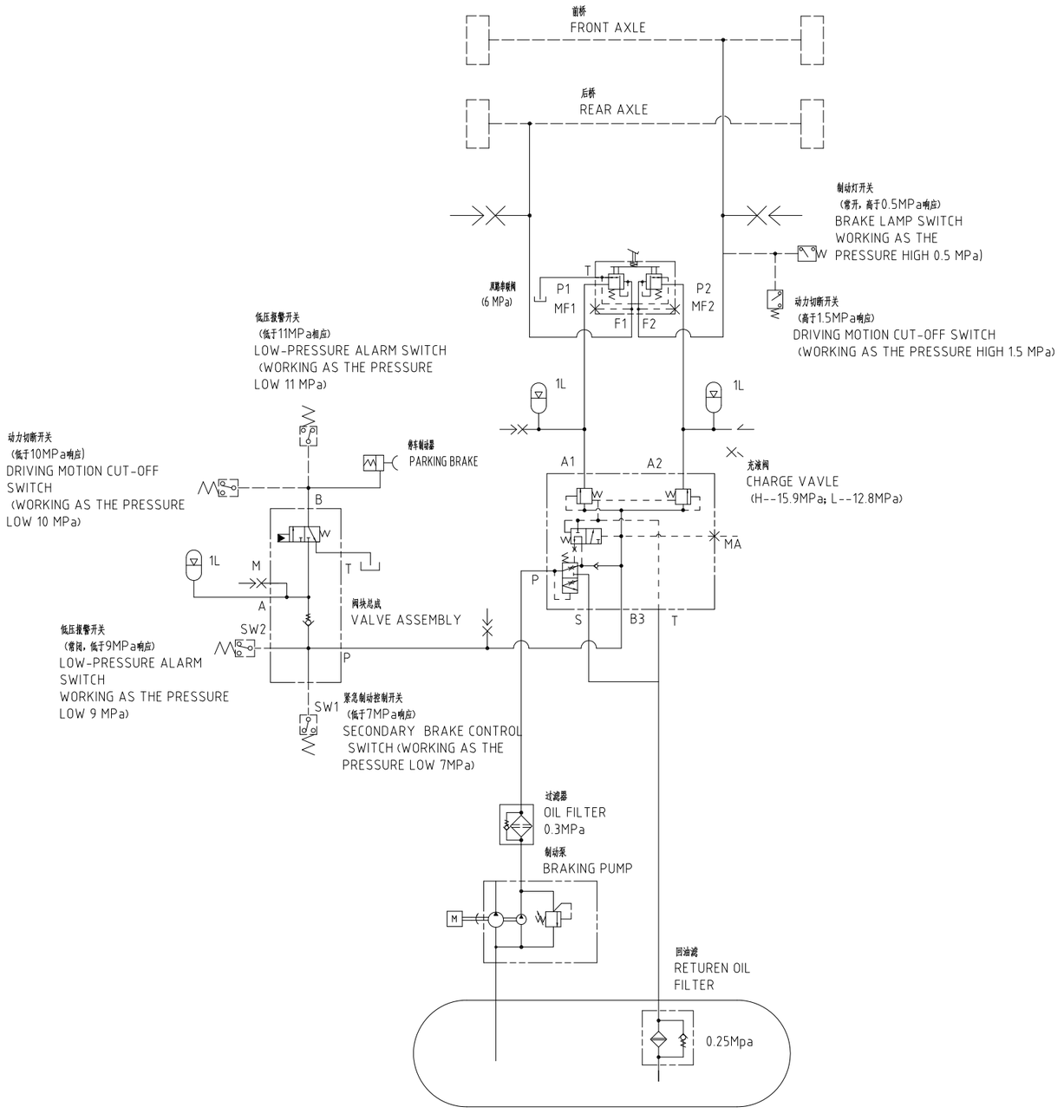
P18E00167

Appendix

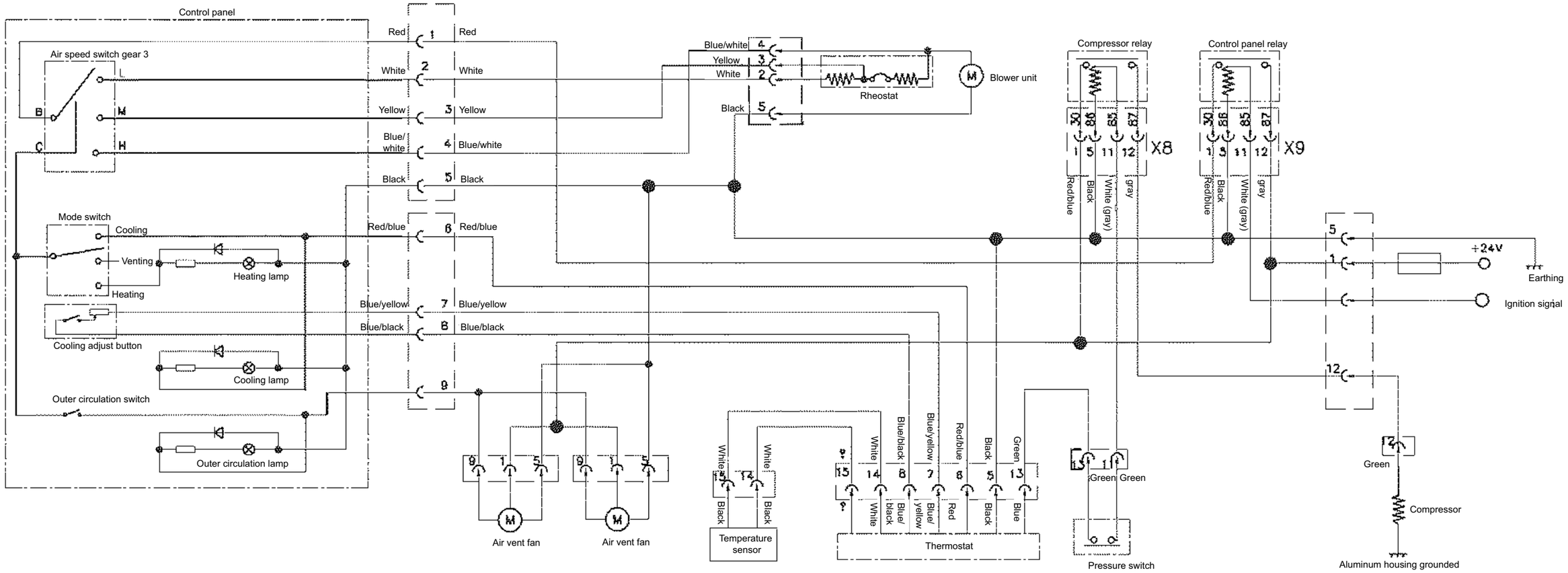
Schematic Diagram of Hydraulic System



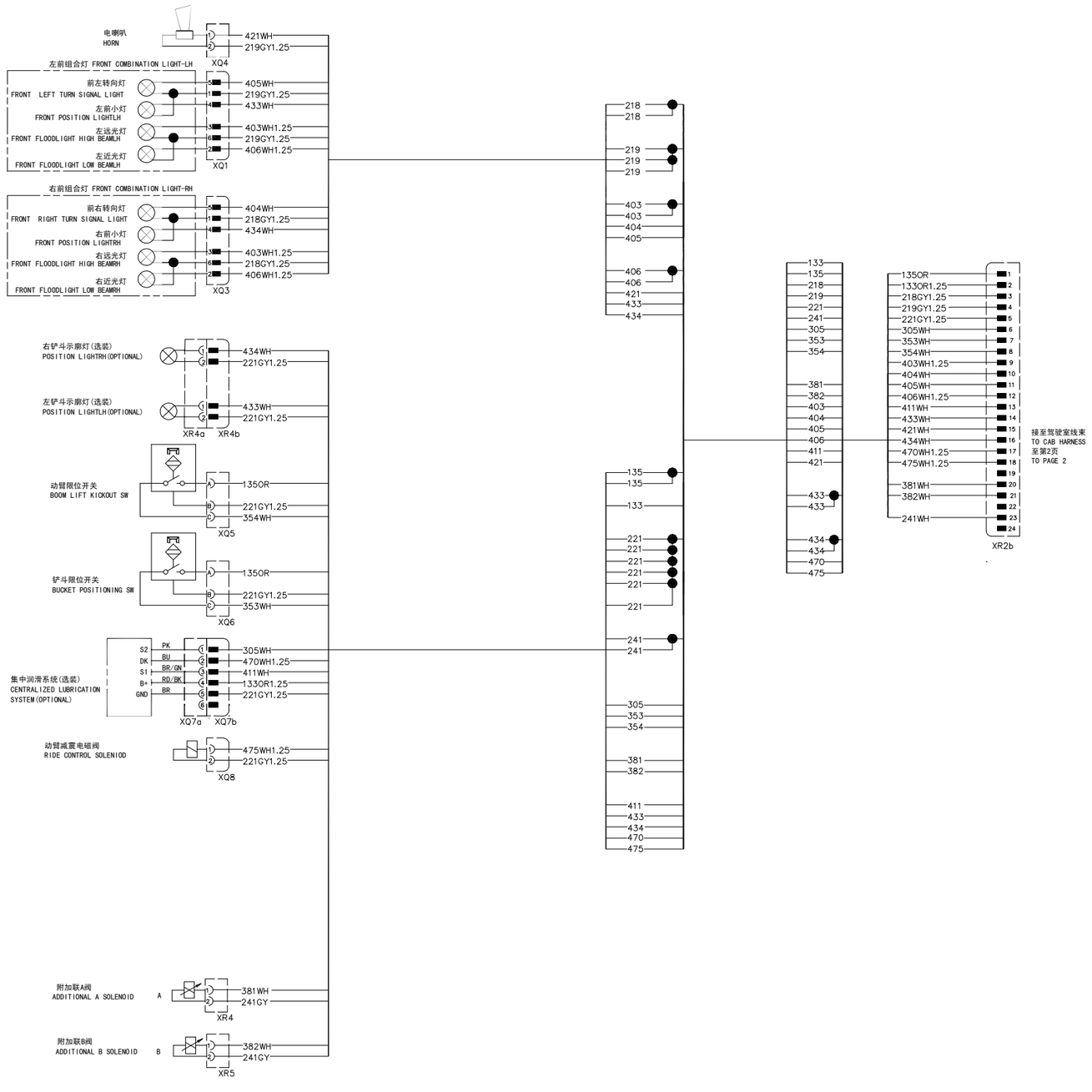
Schematic Diagram of Brake System



A/C System Schematic Diagram

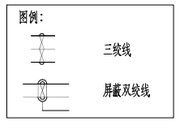


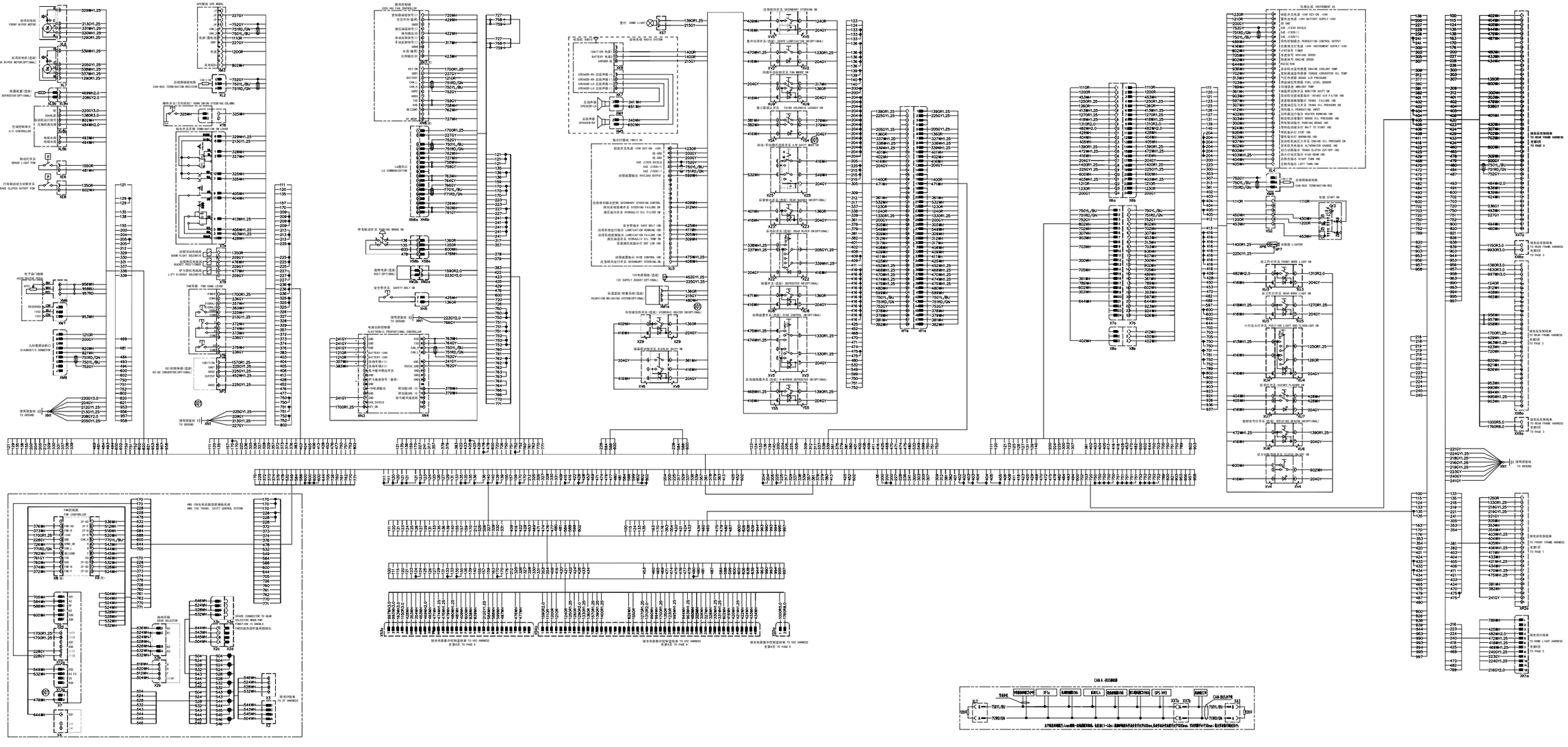
Electrical Schematic Diagram

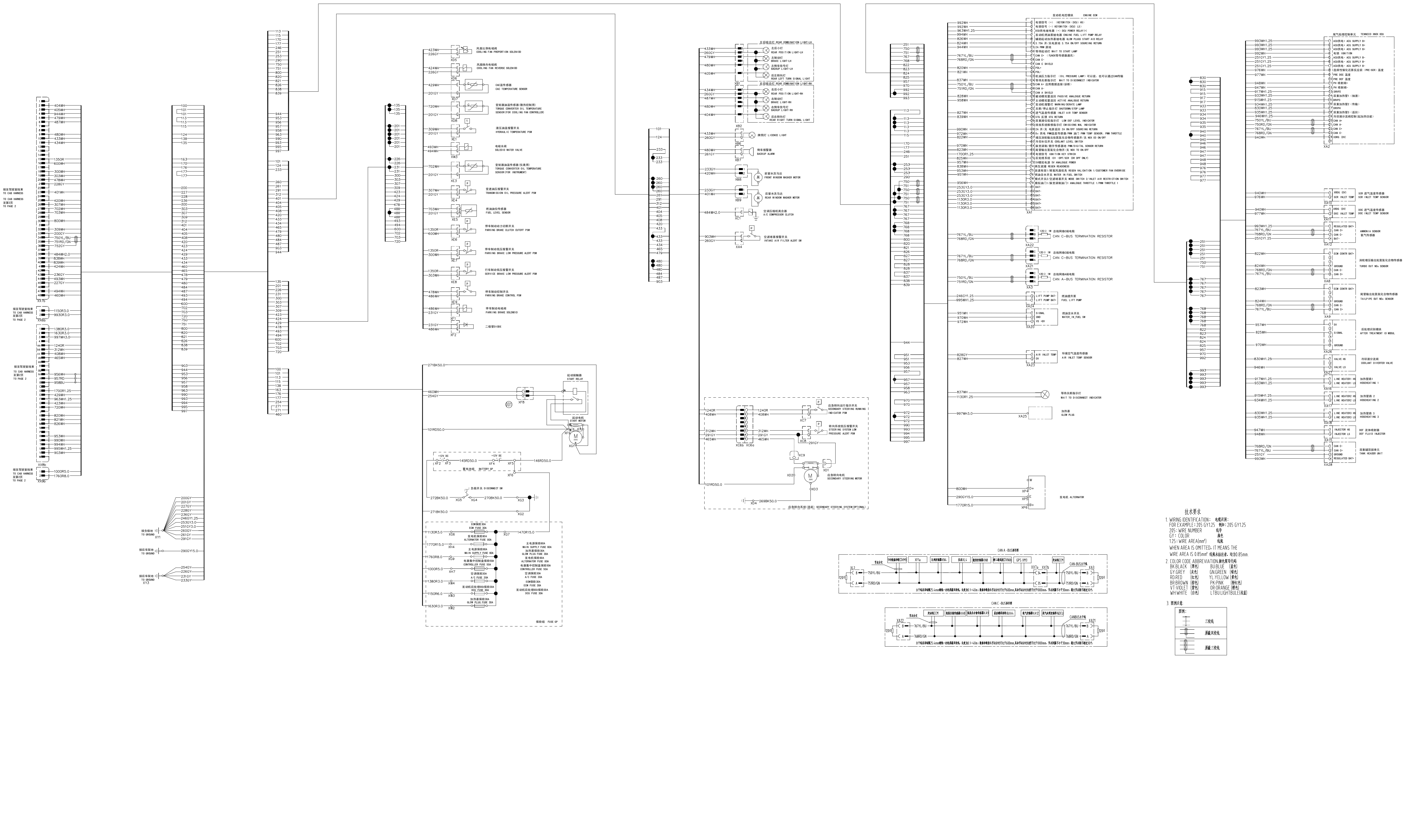


技术要求

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) 线规
   WHEN AREA IS OMITTED, IT MEANS THE
   WIRE AREA IS 0.85mm². 线规未标注者, 均为0.85mm².
2. COLOR CODE ABBREVIATION.颜色简写代码.
   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)
3. 图例示意:







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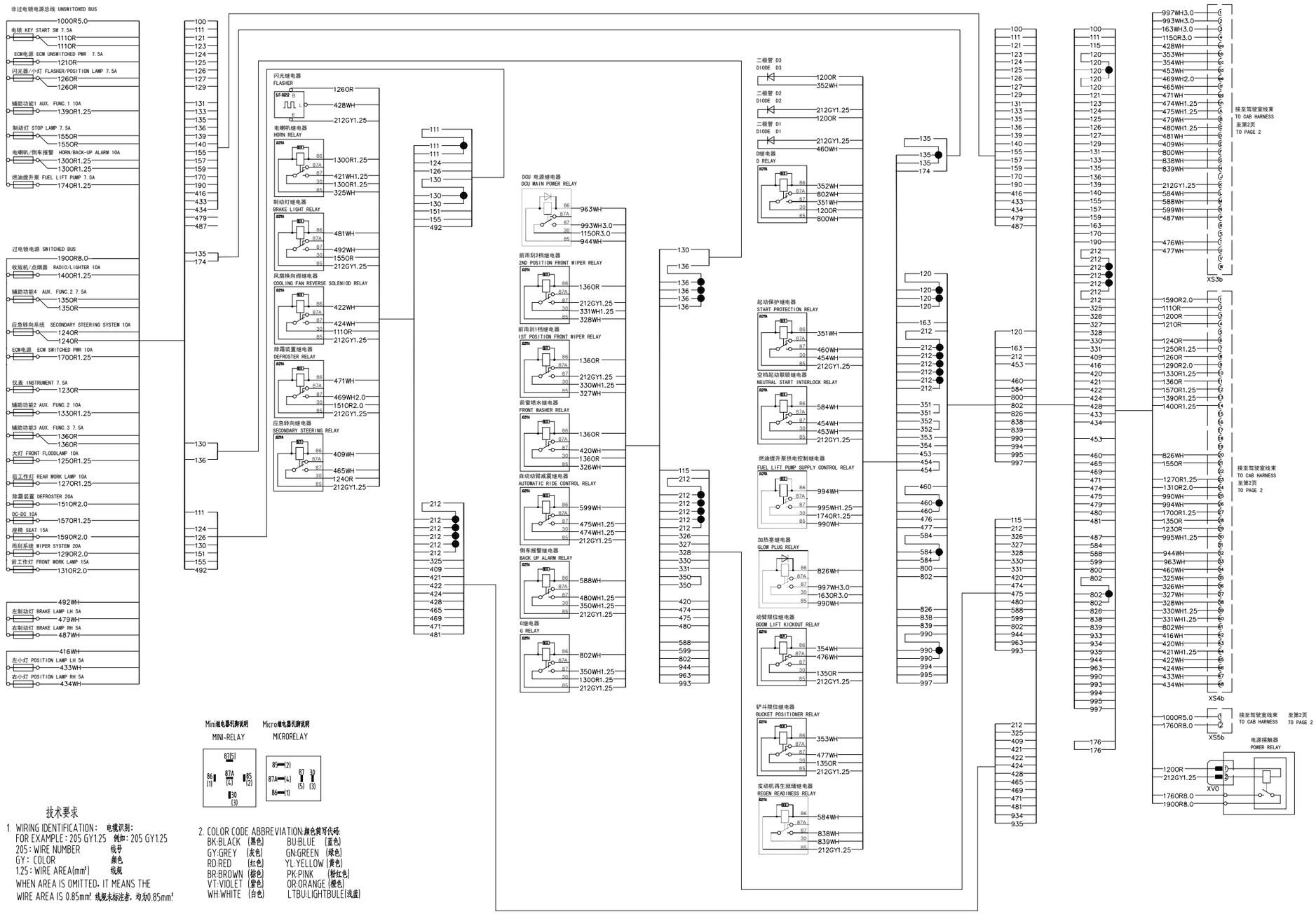
   WH:WHITE (白色) LTBU:LIGHTBULE(浅蓝)
3. 图例示意:

图例:	
	三绞线
	屏蔽双绞线
	屏蔽三绞线



技术要求

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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)
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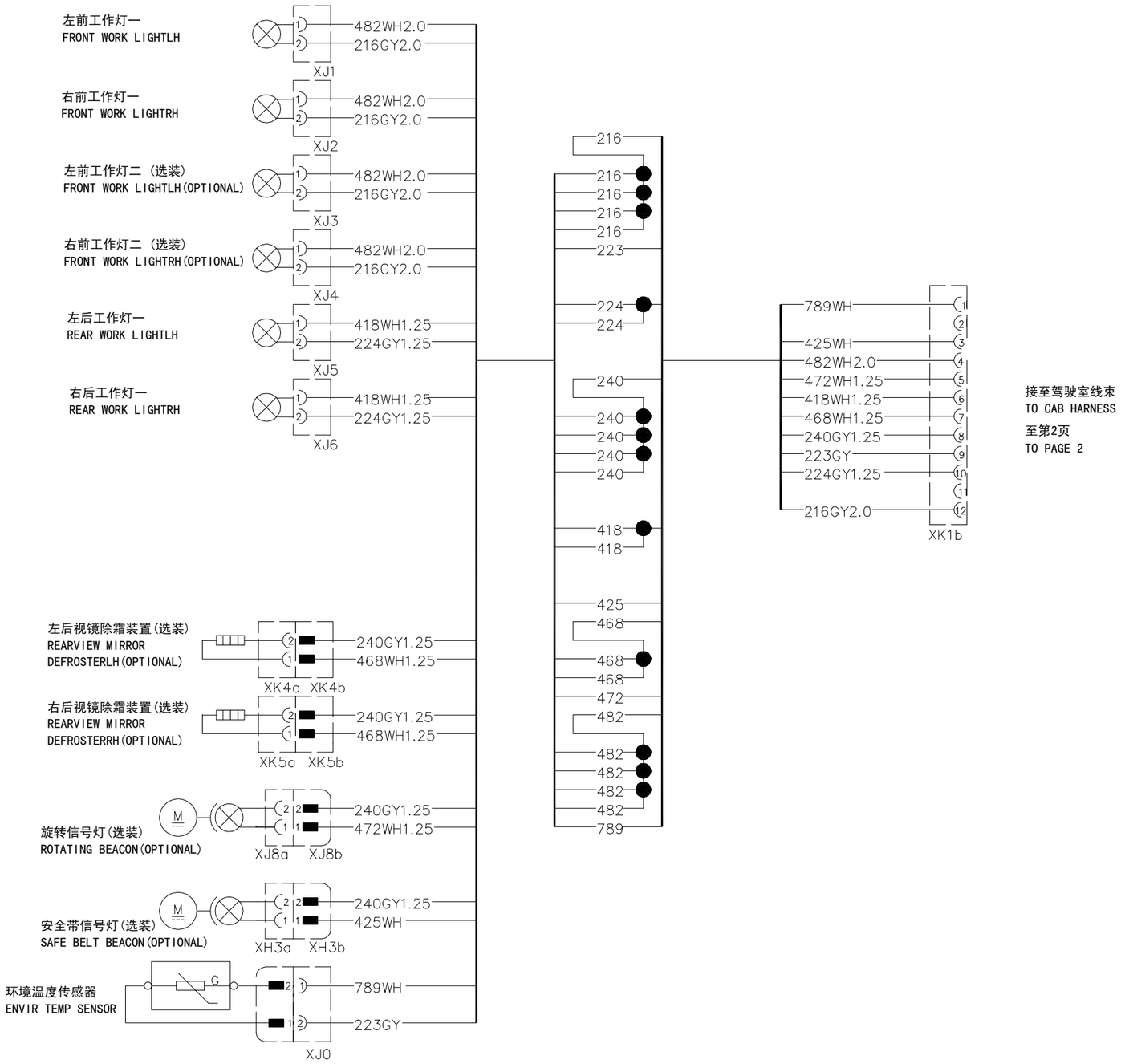
左前工作灯一
FRONT WORK LIGHTLH
482WH2.0
216GY2.0
XJ1
右前工作灯一
FRONT WORK LIGHTRH
482WH2.0
216GY2.0
XJ2
左前工作灯二（选装）
FRONT WORK LIGHTLH(OPTIONAL)
482WH2.0
216GY2.0
XJ3
右前工作灯二（选装）
FRONT WORK LIGHTRH(OPTIONAL)
482WH2.0
216GY2.0
XJ4
左后工作灯一
REAR WORK LIGHTLH
418WH1.25
224GY1.25
XJ5
右后工作灯一
REAR WORK LIGHTRH
418WH1.25
224GY1.25
XJ6
左后视镜除霜装置(选装)
REARVIEW MIRROR
DEFROSTERLH(OPTIONAL)
240GY1.25
468WH1.25
XK4a XK4b
右后视镜除霜装置(选装)
REARVIEW MIRROR
DEFROSTERRH(OPTIONAL)
240GY1.25
468WH1.25
XK5a XK5b
旋转信号灯(选装)
ROTATING BEACON(OPTIONAL)
240GY1.25
472WH1.25
XJ8a XJ8b
安全带信号灯(选装)
SAFE BELT BEACON(OPTIONAL)
240GY1.25
425WH
XH3a XH3b
环境温度传感器
ENVIR TEMP SENSOR
789WH
223GY
XJ0
216
216
216
216
216
223
224
224
240
240
240
240
240
418
418
425
468
468
468
472
482
482
482
482
482
789
789WH
425WH
482WH2.0
472WH1.25
418WH1.25
468WH1.25
240GY1.25
223GY
224GY1.25
216GY2.0
XK1b
接至驾驶室线束
TO CAB HARNESS
至第2页
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