Service Manual

Product for the world

SWL

SKID-STEER LOADER

HUNAN SUNWARD INTELLIGENT MACHINERY CO., LTD.

INDEX

1 INTRODUCTION 4
1.1 MODELS AVAILABLE 4
1.2 ABOUT THIS MANUAL 4
1.3 TREATMENT OF THIS MANUAL 4
1.4 UNITS 4
1.5 DEFINITION OF “LEFT” SIDE AND “RIGHT” SIDE 4
1.6 PRECONDITION TO USE THE MACHINE 5
1.7 SIGNALS 5
2 SECURITY 7
2.1 MEANING OF THE SAFETY SIGNS 7
2.1.1 GENERAL SIGNS 7
2.1.2 ACOUSTIC SIGNS 10
2.2 LOCATION OF THE SAFETY LABELS 11
2.3 GENERAL PREVENTION 11
2.3.1 GENERAL SAFETY RULES 11
2.3.2 CLOTHING AND PERSONAL PROTECTION 12
2.3.3 ENTER AND LEAVE THE MACHINE 12
2.3.4 PREVENTION OF FIRE TO FUEL AND OIL 13
2.3.5 PREVENTION OF BURNS 14
2.3.6 PREVENTION OF DAMAGE OF WORKING EQUIPMENT 14
2.3.7 PREVENTION OF ELECTRIC SHOCK 14
2.3.8 LIMITS OF THE MACHINE 15
2.4 MAINTENANCE PREVENTION 15
2.4.1 GENERAL RULES 15
2.4.2 RUNNING THE ENGINE DURING THE MAINTENANCE 16
2.4.3 WORKING UNDER THE WORKING EQUIPMENT AND MACHINE 16
2.4.4 SAFETY RULES FOR HIGH-PRESSURE OIL AND HOSE 17
2.4.5 PREVENTION ON THE STARTER AND ALTERNATOR 17
2.4.6 PREVENTION OF BATTERY HAZARD 17
2.4.7 PRECAUTION DURING INFLATING THE TIRES 18
3 GENERAL DESCRIPTION OF THE MACHINE 19
3.1 DESCRIPTION OF THE MACHINE 19
3.1.1 FRONT VIEW 19
3.1.2 REAR VIEW 19
3.1.3 MACHINE DISTRIBUTION 20
3.2 SPECIFICATION 21
3.2.1 GENERAL DATA 21
3.2.2 OVERALL DIMENSION 21
3.2.3 ENGINE 22
3.2.4 ELECTRIC SYSTEM 22
3.2.5 PNEUMATIC 23
3.2.6 OILS AND COOLANT 23
3.2.7 CAPACITIES 23
3.2.8 TORQUE FOR SCREWS 24
3.2.9 LUBRICATION POINTS 25
4 HYDRAULIC SYSTEM 26
4.1 MAIN TRAVEL PUMP 26
4.1.1 ILLUSTRATION OF MAIN TRAVEL PUMP COMPONENTS 26
4.1.2 PIPELINE CONNECTION (FOR TESTING) OF MAIN TRAVEL PUMP 30
4.1.3 SET PRESSURE DATA FOR MAIN TRAVEL PUMP 31
4.2 TRAVEL MOTOR 33
4.2.1 ILLUSTRATION OF TRAVEL MOTOR MAIN COMPONENTS 33
4.2.2 PICTURE OF BRAKE OIL PIPES’ CONNECTION 35
4.2.3 ROTATION DIRECTION OF TRAVEL MOTOR. 35
4.2.4 PRESSURE FOR ARRESTING GEAR’S START 35
4.3 WORKING REAR PUMP 36

4.3.1 OUTSIDE VIEW OF GEAR PUMP 36
4.3.2 BREAKDOWN DRAWING OF GEAR PUMP 37
4.3.3 MANIFOLD VALVE 37
4.3.4 OUTSIDE VIEW AND ILLUSTRATION OF MANIFOLD VALVE 37
4.3.5 SET THE DATA 38
4.4 BUCKET-LIFT VALVE 39
4.4.1 THE OUTLINE AND ILLUSTRATION OF BUCKET-LIFT VALVE 39
4.5 LARGE FLOW CONTROL BLOCK (ONLY FOR LARGE FLOW SYSTEM) 41
4.5.1 OUTSIDE VIEW AND ILLUSTRATION OF LARGE FLOW CONTROL BLOCK 41
4.5.2 SET THE DATA 42
4.5.3 OPERATING HANDLE 42
4.5.4 OUTSIDE VIEW AND DATA OF HAND LEVER 42
4.6 PEDAL OPERATION VALVE 48
4.7 HYDRAULIC DIAGRAM 49

5 ELECTRICAL SYSTEM 50

5.1 INSTALLATION SITE 1 50
5.2 INSTALLATION SITE 2 51
5.3 DIAGRAM 52
5.4 CIRCUIT DIAGRAM 54
5.4.1 POWER AND ENGINE CIRCUIT 54
5.4.2 Safety and protection of circuit 60
5.4.3 MONITOR CIRCUIT 63
5.4.4 LAMP AND FLOAT CONTROL CIRCUIT 65
5.4.5 OPTION CIRCUIT 67

6 TRAVEL SYSTEM 68

6.1 TRAVEL SYSTEM COMPONENT 68
6.1.1 WHEEL SHAFT 69
6.2 POWER TRAIN MAINTENANCE 71
6.2.1 REMOVAL OF THE FRONT WHEEL SHAFT AND REAR WHEEL SHAFT 71
6.2.2 CLEANING AND INSPECTION 75
6.2.3 REPAIR OR REPLACEMENT 75
6.2.4 INSTALLATION 75

7 MAINTENANCE 77

7.1 REQUIREMENT SERVICE 77
7.2 ADVICE FOR THE MAINTENANCE 77
7.3 DESCRIPTION FOR MACHINE MAINTENANCE 78
7.3.1 ENGINE DESCRIPTION 78
7.3.2 SAFETY BELT 78
7.4 MAINTENANCE PLAN 79
7.4.1 BEFORE STARTING 82
7.4.1.1 CHECKING ENGINE OIL LEVEL 82
7.4.1.2 CHECKING ENGINE COOLANT LEVEL 82
7.4.1.3 CHECKING ENGINE FUEL LEVEL 82
7.4.1.3 CHECKING THE HYDRAULIC OIL LEVEL 82
7.4.1.4 CHECKING THE ELECTRIC CABLES 82
7.4.1.5 CHECKING THE TIRES 83
7.4.1.6 CHECKING THE SAFETY BELT 83
7.4.1.7 CHECKING THE LEAKING OF OIL 83
7.4.1.8 CHECKING THE QUICK COUPLER 83
7.4.1.10 ECKING THE WATER AND SEDIMENTS SEPARATOR 83
7.4.2 EVERY 50 HOURS OF OPERATION 83
7.4.2.1 CHECKING THE COOLER PIPES 83
7.4.2.2 CHECKING THE COOLANT LEVEL 84
7.4.2.3 CHECKING THE TIRE PRESSURE 84
7.4.2.4 GREASING THE PINS OF BOOM AND CYLINDERS 84
7.4.2.5 CHECKING THE WHEEL NUT DRIVING TORQUE 84
7.4.3 EVERY 100 HOURS OF OPERATION 84
7.4.3.1 CLEANING THE TERMINALS OF THE BATTERY 84
7.4.3.2 CLEANING THE OIL TANK'S BREATHER 84
7.4.3.3 CHECKING THE CYLINDER RODS 84
7.4.3.4 GREASING ALL OF PINS 85

7.4.4 VERY 250 HOURS OF OPERATION 85
7.4.4.1 CHECKING THE GEARING CHAIN TENSION 85
7.4.4.2 ADJUSTING THE CHAIN IF NECESSARY 85
7.4.4.3 CHECKING THE FAN BELT 85
7.4.4.4 CLEANING THE RADIATOR 85
7.4.4.5 CHECKING THE OIL LEVEL IN THE GEAR CHAIN 85
7.4.4.6 CHANGING THE ENGINE OIL 86
7.4.4.7 CHANGING THE ENGINE OIL FILTER 86
7.4.4.8 CHANGING THE FUEL FILTER 86
7.4.4.9 CHECKING THE NUT TORQUE OF THE HYDARULIC MOTOR AND THE HUB HOLDING TO THE CHASSIS 87
7.4.5 EVERY 500 HOURS OF OPERATION 88
7.4.5.1 CLAEN THE FUEL-WATER SEPARATOR 88
7.4.5.2 CHECK THE TIGHTENESS OF PUMP FIXING SCREWS 88
7.4.5.3 CHECKING THE FLUID LEVEL OF THE BATTERY 88
7.4.5.4 CHANGING THE HYDRAULIC OIL FILTER 89
7.4.6 EVERY 1000 HOURS OF OPERATION 89
7.4.6.1 CHANGING THE OIL IN THE GEAR CHAIN BOX 89
7.4.6.2 CHANGING THE HYDARULIC OIL AND CLEAN THE SUCTION 89
7.4.6.3 CHANGING THE AIR FILTER 90
7.4.6.4 CHECKING THE PUMP'S PRESSURE AND THE VALVE 91
7.4.6.5 CHANGING THE HYDRAULIC OIL TANK BREATHER 91
7.4.6.6 CHECKING THE TIGHTNESS OF THE CYLINDER HEAD SCREW 91
7.4.6.7 CHECKING THE LOOSENESS OF THE VALVE 91
7.4.7 EVERY 2000 HOURS OF OPERATION 92
7.4.7.1 CHANGING THE COOLANT 92
7.4.7.2 CHECKING THE STARTER AND ALTERNATOR 92
7.4.8 WHEN REQUIRED 92
7.4.8.1 DRAINING THE FUEL TANK 92
7.4.9 TROUBLE SHOOTING 93

8 INFORMATION OF MANUFACTURER 97

1 INTRODUCTION

1.1 MODELS AVAILABLE

This manual is special for the SWL series skid-steer loader. A series of skid-steer loaders "SWL" are developed by HUNAN SUNWARD INTELLIGENT MACHINERY CO., HUNAN SUNWARD INTELLIGENT MACHINERY CO., LTD own all intelligence property related to this machine.

1.2 ABOUT THIS MANUAL

This manual contents all the information about the SWL machine. The safety regulations, description, service and maintenance instructions are included in this manual. HUNAN SUNWARD INTELLIGENT MACHINERY CO., LTD supply this manual together with the spare parts book. He provide the user all information related to the SWL skid-steer loader and all safety regulations.

For more information, please contact your SWL dealer. The dealer knows how to get the best performance of the machine and how to use the machine correctly in any case.

1.3 TREATMENT OF THIS MANUAL

This operation and maintenance manual must be handled with great care and always kept in the machine, so that the operator can consult it at any moment. There is a compartment special for operation manual and spare parts inside cabin. It locates on the behind of the seat. See the right picture. The operation manual must be always kept in this case.

In case of damage or lose this manual, request to HUNAN SUNWARD INTELLIGENT MACHINERY CO., LTD or the SWL dealers for a new one.

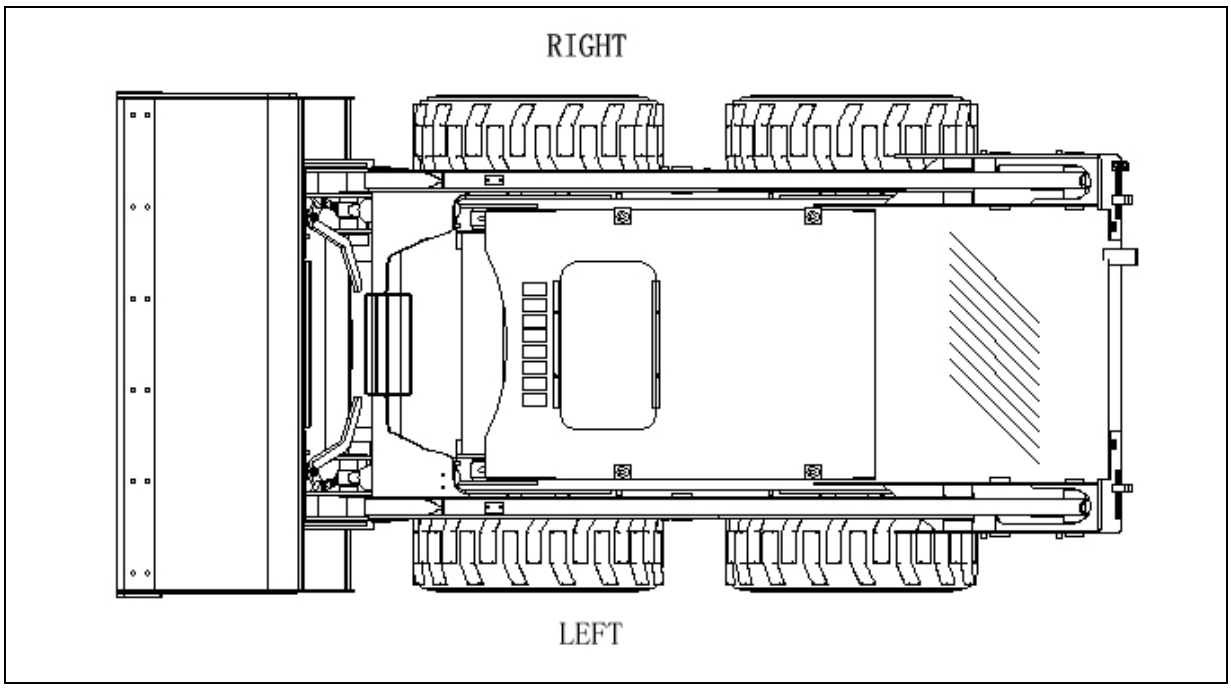
1.4 UNITS

In this manual we have taken the international unit system. We are using millimeter for distance, liter for volume, degree for angle, etc.

ITEM	UNIT	SYMBOL
Distance	Millimeter	mm
Volume	Liter	L
Angle	Degree	°
Temperature	Celsius degree	°C
Sound	Decibel	dB

1.5 DEFINITION OF "LEFT" SIDE AND "RIGHT" SIDE

In this manual, "left" and "right" imply your left hand side and right hand side when you are seated properly in the machine. It is also showed in the picture below.



1.6 PRECONDITION TO USE THE MACHINE

- To maintain this skid-steer loader properly and safely, operator must know well about this machine and have basic experience on using this kind of machine.
- The operator must take special attention on the security recommendation in order to preserve his security and the security of persons around him.
- Do not work with the machine until you are sure that you can control it properly. Do not begin a work until you are sure there is no danger for you and for people around you.
- If you have any doubt regarding the safety regulations, please contact your SWL dealer.

1.7 SIGNALS

To help you to maintain machine safely, we have described many safety precautions in this manual. Also many precaution labels are put on the machine. Many different signal words are used in the manual and on the labels.

The following signal words are used to inform you that there is a potential hazardous situation that may lead to personal injury and damage. In this manual and on the precaution labels on the machine, the following signal words are used to express the level of the potential hazardous.

DANGER

If not avoided, it has great possibility to lead to serious injuries or death to the operator (or other persons). It is used to express the most extreme dangerous situation.

WARNING

If not avoided, this situation could cause serious injuries even death.

If not avoided, this situation may cause minor or moderate injury to operator (or other persons) or damage to the machine.

There are other signal words showed under to indicate precautions that are useful for operator.

It is used for precautions that must be taken to avoid actions what could shorten the life of the machine.

It is used for information that is extremely useful to know.

The safety message may not include all the possible safety precautions. It is impossible to describe all the potential hazard may appear during the operation or maintenance. For any question regarding the safety regulation please contact your dealer.

2 SECURITY

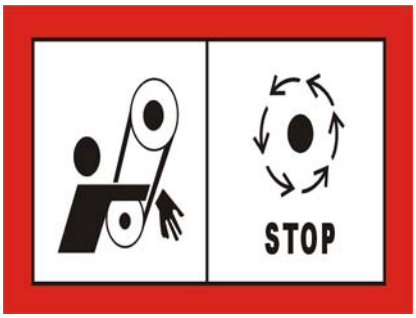
This section describes the possible hazards that may appear during the operation and maintenance of the machine. Authorized additional equipments have their manual given together with the equipments.

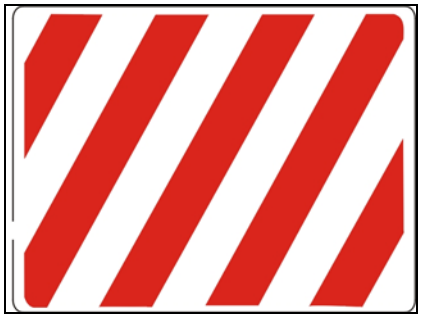
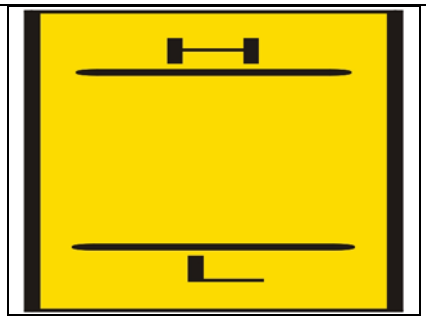
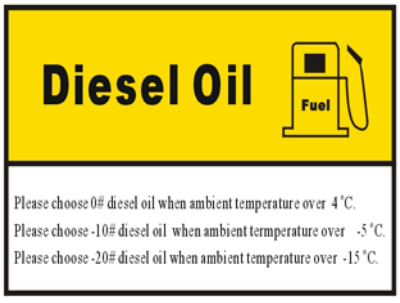
2.1 MEANING OF THE SAFETY SIGNS

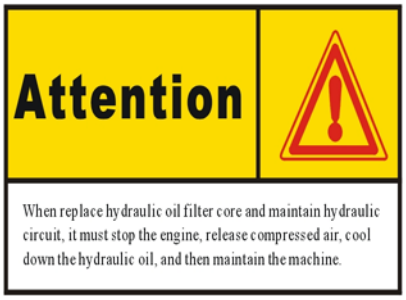
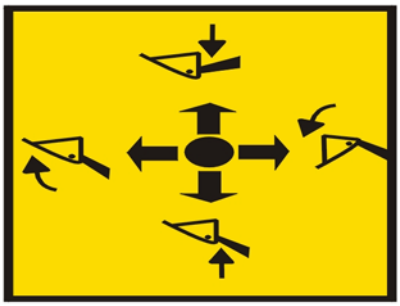
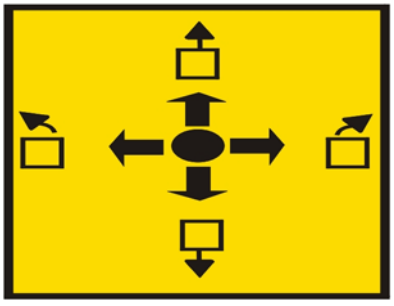
Safety precaution labels are fixed to the machine to warn about possible hazards that may cause personal injuries or even death. They are placed where the possible danger is. Before using the machine make sure you understand all the security labels. Keep all the labels clean and readable. Change all the damaged labels.

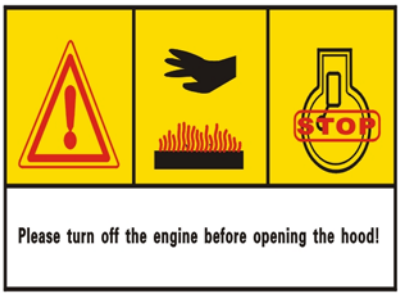
2.1.1 GENERAL SIGNS

The following table shows the different labels fixed on the machine and the respective meanings.

GENERAL LABELS	
	Moving crawlers, when Entanglements in can cause serious injury
	High temperature
	See manual book

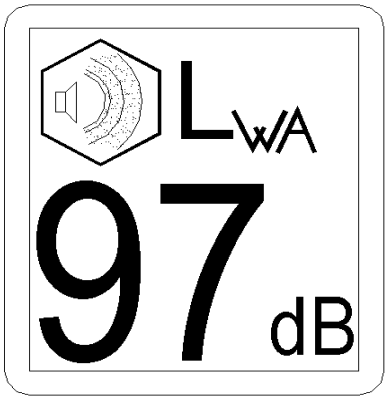
	Note
	Float
	Tail warning
	Oil level
	Diesel Oil

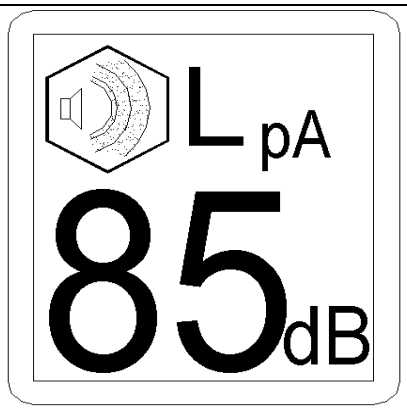
	Oil filter
	Drag position
	Lifting points
	Operation direction
	Operation direction
	Safety pin for boom

	Security button
	Emergency exit
	Engine hood

2.1.2 ACOUSTIC SIGNS

The following table shows the different acoustic labels fixed on the machine and the respective meaning.

ACOUSTIC LABELS	
	The max noisy level out of cabin.
	The max noisy level in cabin.

2.2 LOCATION OF THE SAFETY LABELS

The safety labels were located in striking position.

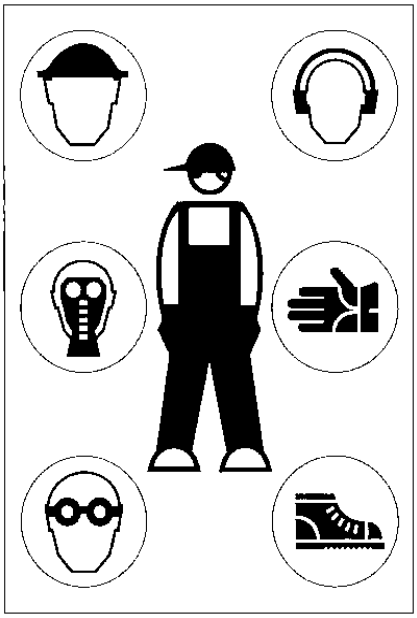
2.3 GENERAL PREVENTION

2.3.1 GENERAL SAFETY RULES

The following items are extremely important. Operators must read with great care and follow them while operating and performing maintenance.

- Only authorized and experienced personnel can use or maintain the machine.
- The using and maintenance must be taken follow with the safety rules describe in this manual.
- Use the machine only when the machine is in good operating condition.
- Don’t use the machine for the tasks exceed its capacity.
- Operate the machine only when the operator is seated correctly in the driving position.
- Before do any maintenance, position the machine on a firm and level surface, lower working equipments to the ground, engage the safety lock of working equipment, stop the engine.
- It is forbidden to modify the connections and safety settings of the hydraulic system. Before do any modification, please consult your dealer. Any unauthorized modification may lead to serious injury to operator or damage to the machine. HUNAN SUNWARD INTELLIGENT MACHINERY CO., LTD will not take the responsibility to the result caused by this kind of unauthorized modification.
- Install only authorized auxiliary equipments. Any additional equipment more than the authorized auxiliary equipments list in this manual may not perform well even cause damage to the machine and injury to persons. See the list of authorized auxiliary equipments.
- Before travel on the road, make sure the lights, signaling and safety device are in good condition and engage relative safety devices.
- Do not use the machine before read and understand this manual. Any inappropriate use of this machine could be very dangerous for the operator and the person around the machine. Many of the accident are caused by insufficient knowledge of the safety regulations described in this manual.
- It is extremely dangerous operate the machine under the effect of alcohol or drugs. Do not take alcohol, medicine what makes you sleepy or drugs before or during use the machine.

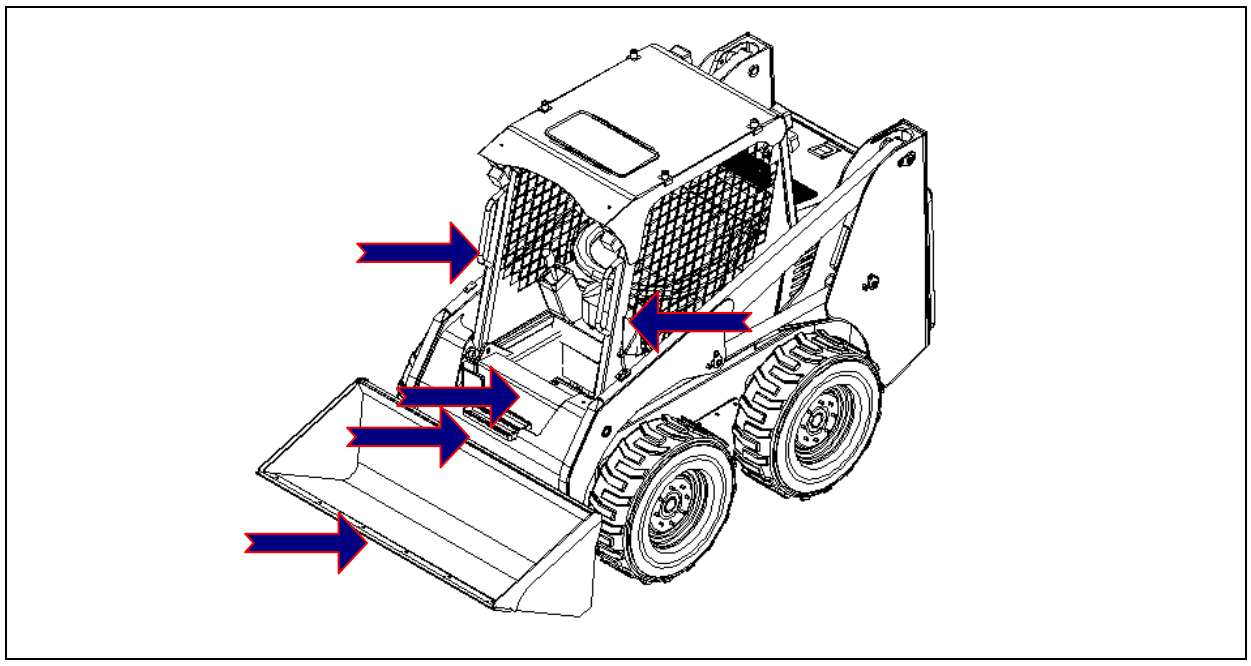
2.3.2 CLOTHING AND PERSONAL PROTECTION



- Inappropriate clothing may lead to injury to the operator. Please wear in the protective clothing while operating or performing maintenance such as hardhat, goggles glasses, mask gloves, safety shoes and headphones.
- If you have long hair, tie up them before approach the machine since they can get entangled in the moving part of the machine and cause serious injuries and damage.
- When working for 8 hours with a noise exceeding 90 dB, it is necessary to use headphones.
- When working in a special dangerous area, additional protections could be required according to the conditions.

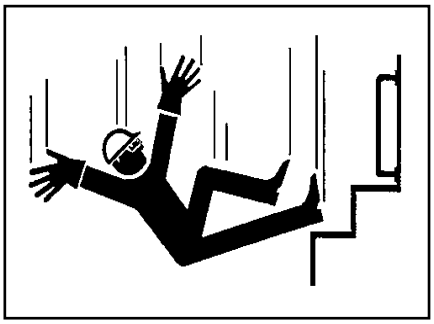
2.3.3 ENTER AND LEAVE THE MACHINE

Use the appropriate footplates and handles showed in the following picture while entering and leaving the machine.。



- Enter and leave the machine only when the machine is not moving unless it is in emergency.
- Never hold on the joysticks.
- Use always the appropriate handles while entering and leaving the machine.
- Always be carefully while entering and leaving the machine. Keep your body balance during the whole processes of entering and leaving the machine.

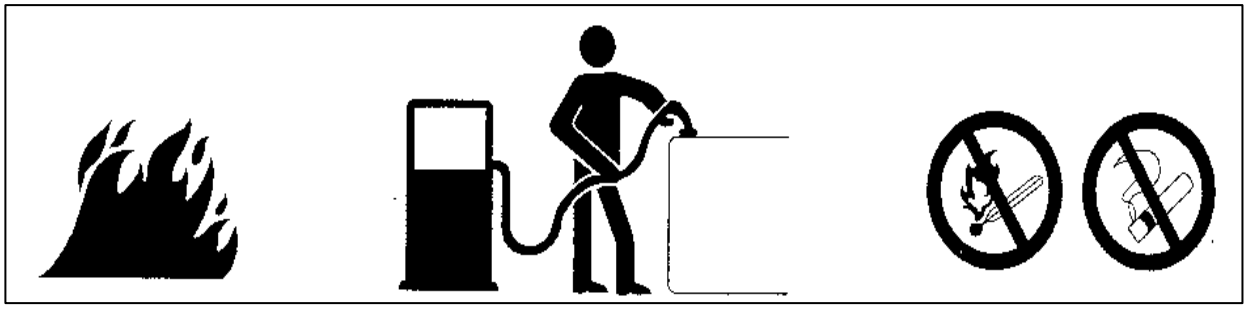
- Before enter and leave the machine, make sure the footplate and handles are not covered with oil, grease, ice or other slippery matter. In case it happens, clean the slippery matter carefully immediately.
- Take great care in case the machine is wet. It could be very slippery.



Before leave machine, carry out the following procedures in the sequence.

1) Park the machine in a safe position.
2) Lower the working equipment to the ground.
3) Engage the parking brake.
4) Engage the auxiliary equipment control pedal retainer.
5) Raise the restrain bar to upward.
6) Stop the engine.

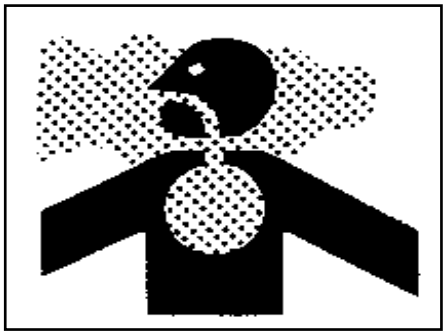
2.3.4 PREVENTION OF FIRE TO FUEL AND OIL



- Fuel and oil are easily to cause fire if they meet flame.
- Keep always flame away from the fuel and oil.
- Stop the engine and never smoke during refueling.
- Only do the refilling fuel and oil in the well ventilated areas.
- Close well the safety cap after charge or fuel.
- Do not fill the tanks in order to leave room for the fuel expansion.
- If some fuel or oil is spilled wipe it up immediately.

2.3.5 PREVENTION OF BURNS

- After operating for a period, the engine, coolant, hydraulic oil, engine oil, radiator and pumps are hot. Do not touch them until they cool down.
- In case of entailing working with hot oil, hot coolant or hot hydraulic oil, wear gloves, heavy clothing and safety goggles before do any check or maintenance.
- Loosen the coolant safety cap slowly when the coolant is hot to release the residual pressure inside the tank before open it. If it is hot it may spurt out and cause serious burns.



- Before checking the coolant level, the hydraulic oil level and the engine oil level, stop the engine and wait till they cool down.

2.3.6 PREVENTION OF DAMAGE OF WORKING EQUIPMENT

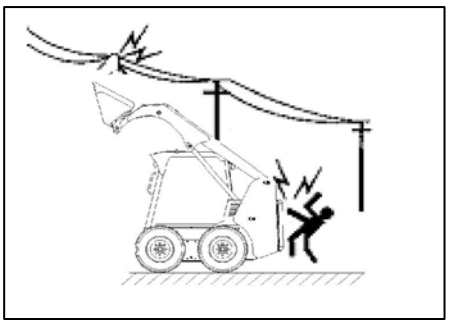
- Do not stand in the area that the working equipment can reach when the machine is operating. It may cause serious injury or even death.

- Before perform working equipments, the operator must make sure that nobody is in the dangerous area that working equipment can reach.
- Try to lower the working equipment to the ground every time when you park the machine.
- During maintenance, make sure the equipment is locked correctly before go into the area under lifted working equipment.

2.3.7 PREVENTION OF ELECTRIC SHOCK

Voltage of Cables (kV)	1.0	6.6	33	66	154	275
Distance must be kept (m)	5.0	5.2	5.5	6.0	8.0	10.0

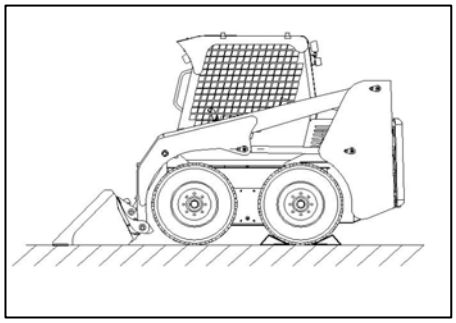
- Do not travel or operate the machine near the electrical cables. On the working sites where the machine may go close to electrical cables, follow the procedures below. Otherwise it is possible to get an electric shock, which may cause serious injury even death.
- Before starting working near the electrical cables, consult the power company what is the voltage with the cables and inform the power company of your coming work. If necessary, ask them to take actions.



- To prepare for any possible emergencies, wear rubber shoes and gloves. Prepare all things you need to call the power company immediately in case of accident.
- Even going close to the high-voltage cables can cause electric shock. Always maintain a safe distance (see the table up) from the cables.
- Use a signalman to give warning if the machine approached too close to the electrical cables.
- If the machine come too close to or entangled with the electrical cables, do not leave the cabin and let any person approach the machine until the electricity has been shut off.

2.3.8 LIMITS OF THE MACHINE

- This machine has been designed for one operator. More than one passenger on the machine can be extremely dangerous. Never transport more than one passenger with this machine.
- Overload could cause serious injuries or even death. Never overload the machine. For the detail capacity of machine, please refer the section of specification in this manual. Do not try to get a better efficiency of the machine by doing any unauthorized change.

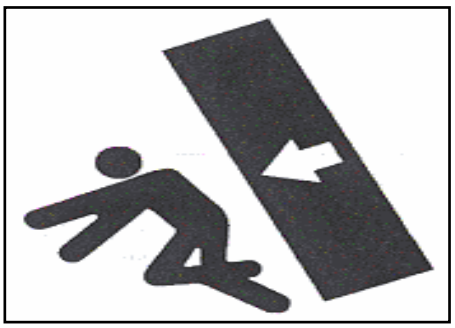


2.4 MAINTENANCE PREVENTION

2.4.1 GENERAL RULES

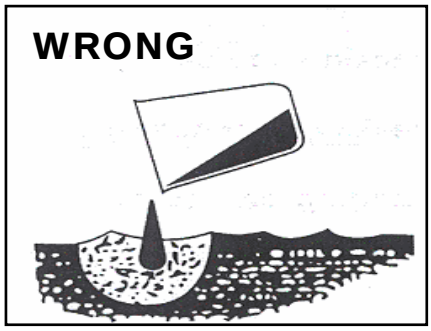
- To do any maintenance position the machine on a firm and flat surface, rest the equipments on the ground, engage the security locks, apply the parking brake and stop the engine. If necessary, put wedges under wheels to fix the machine.

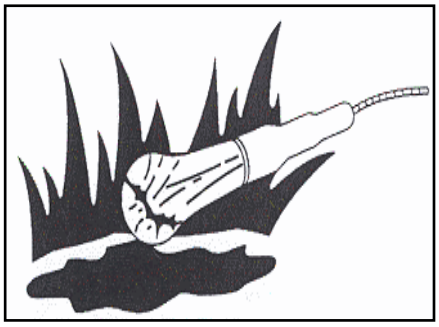
Before doing the maintenance, place the warning tag “DO NOT OPERATE” to the joysticks and ignition switch. Make sure nobody other who is not doing maintenance together with you operate the machine while you doing maintenance.



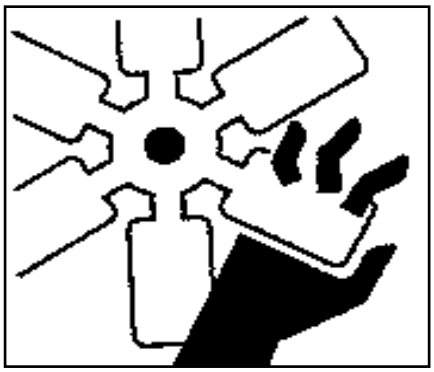
- Only authorized and duly trained personnel can do the service and repair. Only do the maintenance that you are certain. If you have any question, please consult the dealers.

- Keep the machine and the ambient clean. Keep the parts and tools in proper place.
- To prevent pollution, never deposit the fuel, oil and grease directly onto the ground. Use containers to keep the fuel, oil and grease and drain them according to the local regulations.





2.4.2 RUNNING THE ENGINE DURING THE MAINTENANCE



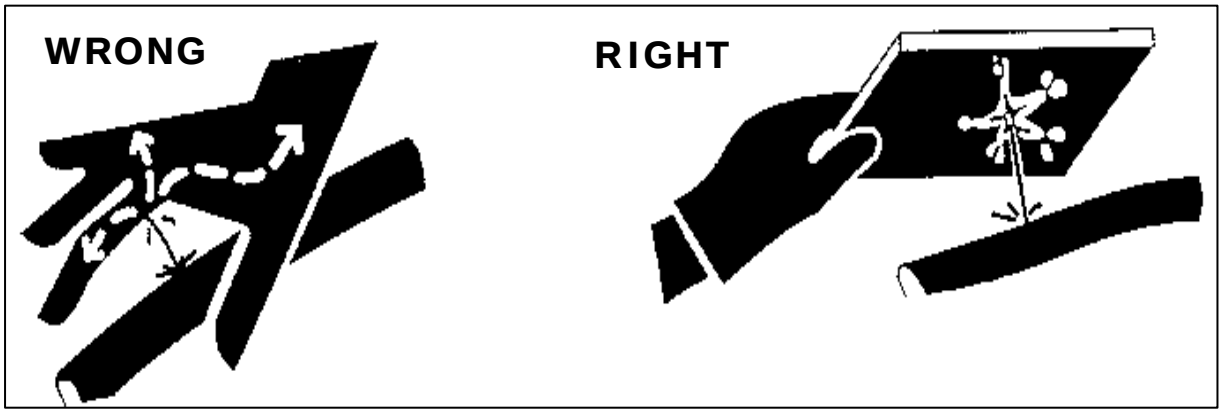
- If the maintenance must be carried out with engine running, two workers are necessary. One worker must always seat in the operator's seat and be ready to stop the engine at any time.
- Keep the safety lock in function during the maintenance operations.
- When the engine is running, don't touch the rotating parts. The rotating parts like fan and fan belt are extremely dangerous because they can make you get caught. Be careful not to come close to them.

2.4.3 WORKING UNDER THE WORKING EQUIPMENT AND MACHINE

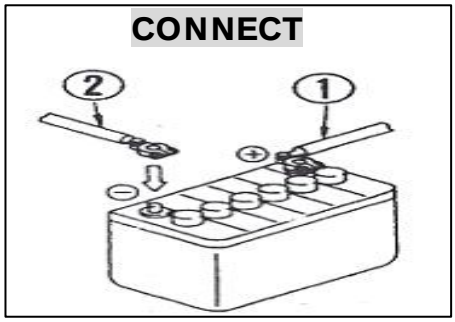
- If it is necessary to carry out service and maintenance under the working equipment or the machine, support the equipment and machine with block and stands strong enough to support the weight of the working equipment and machine.
- Lower the working equipment to the ground or the lowest position before working under the machine.

2.4.4 SAFETY RULES FOR HIGH-PRESSURE OIL AND HOSE

- The hydraulic system is always under internal pressure. Before do any inspecting or replacing hoses, always lower the working equipment and make sure that the pressure in the hydraulic circuit has been released.
- The high-pressure oil leakage from small holes can penetrate your skin or injury your eyes. Extreme care must be taken when you are inspecting high-pressure oil leakage. Wear goggles and thick gloves. Use a piece of cardboard to check oil leakage instead of your hands.
- Damaged hoses could be extremely dangerous and could cause serious injuries. Change the damaged hoses and connections as soon as possible.
- If you are hit by a jet of high-pressure oil and suffer injury to your skin and eyes, wash your skin and eyes with clean water and consult a doctor immediately.



2.4.5 PREVENTION ON THE STARTER AND ALTERNATOR



- Before doing any check on the electric circuit, disconnect the battery in order to cut off the current.
- If some electrical welding has to be done on the machine, it is necessary to disconnect the battery and also the alternator.
- Never try to start the engine by manipulating the connexions of the starter. It will cause sudden machine move. It is very dangerous for the operators.

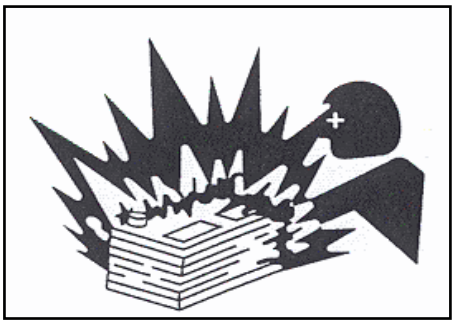
2.4.6 PREVENTION OF BATTERY HAZARD

Battery electrolyte contains sulphuric acid and generates flammable hydrogen gas. The sulphuric acid is extremely harmful to your body.

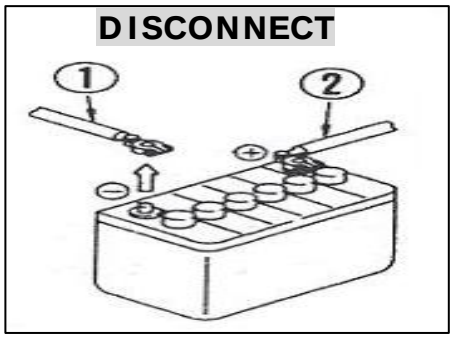
- Solutions for the accidents:
  1) If the electrolyte contact your eyes flush them immediately with plenty water and contact a doctor immediately. Acid could cause blindness.
  2) If some electrolyte contact with your skin, wash immediately with plenty water.
  3) If accidentally you ingest some acid, drink a large quantity of milk, eaten eggs or vegetable oil and call immediately a doctor.

Please always follow with the following precautions:

- Always wear goggles and gloves when you are working with the battery.
- Stop the engine and remove the key before working on the battery.
- Never smoke and use any flame near the battery.
- Always tighten the terminals and caps securely. Loosen terminals or caps may cause fire and explosion.
- Do not let tools other metal objects make any contact between battery terminal.



- Disconnect first the negative earth cable (-) and then the other positive cable (+).When connecting, connect fist the positive cable (+) and then the negative earth cable (-).
- If there is a welding operating on the machine, please disconnect the battery cables before it.



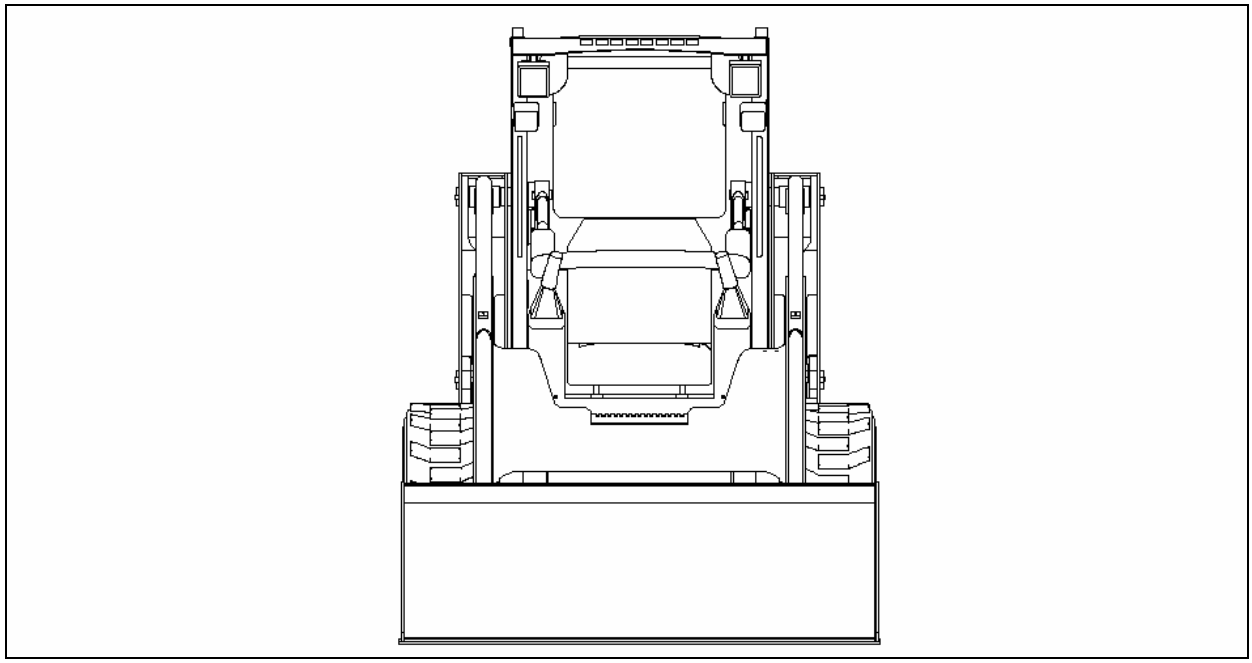
2.4.7 PRECAUTION DURING INFLATING THE TIRES

- Take into consideration that tires can burst while being inflating. Inflate the tires bit by bit.
- For inflating the tires use an air-compressing gun with extension and a gauge for control the pressure in the tire.
- Do the maintenance of the tires like described in the relating item of this manual.
- Do not stand very close to the tire during inflating the tire and make sure that nobody stands close.
- Follow the recommendation for the pressure given in the related item of this manual. Make sure that the tire pressure is the same on both sides of the machine.

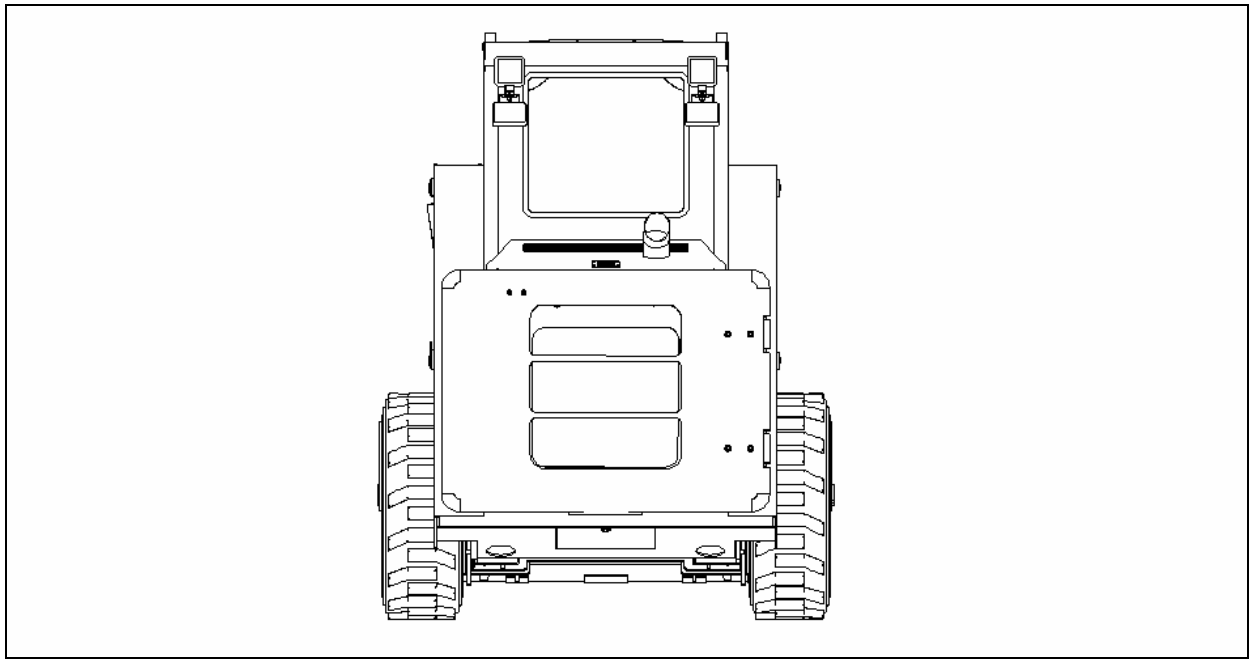
3 GENERAL DESCRIPTION OF THE MACHINE

3.1 DESCRIPTION OF THE MACHINE

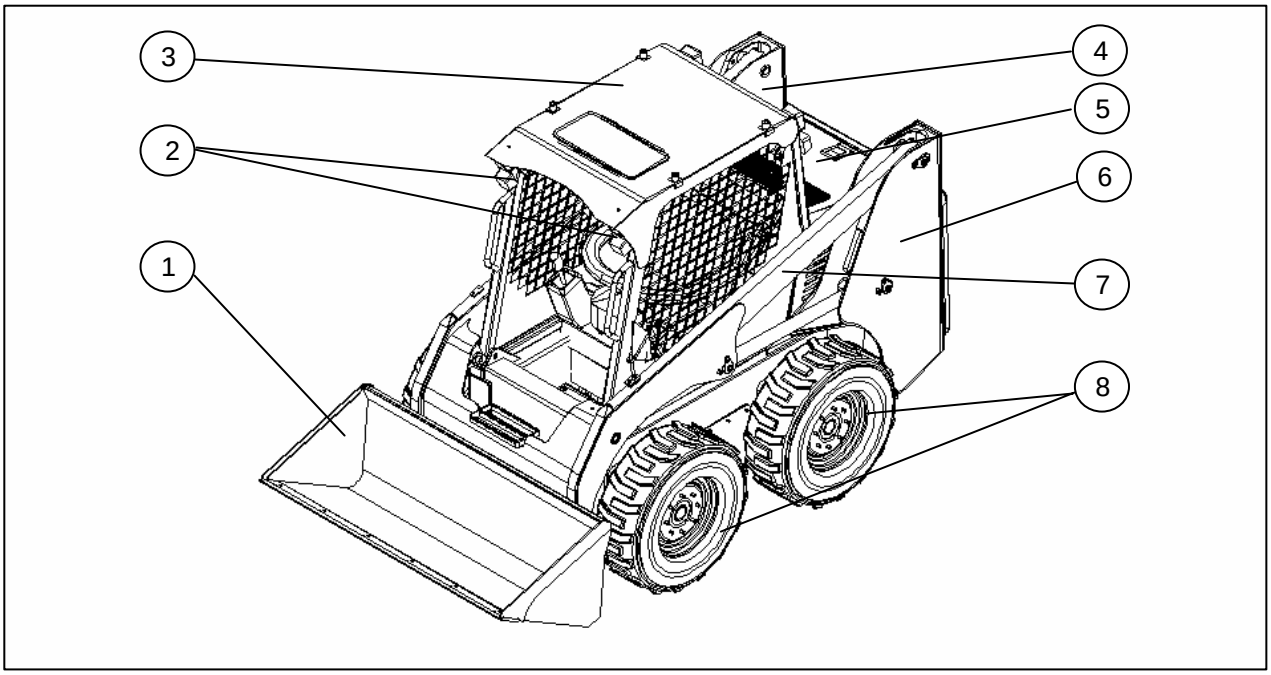
3.1.1 FRONT VIEW

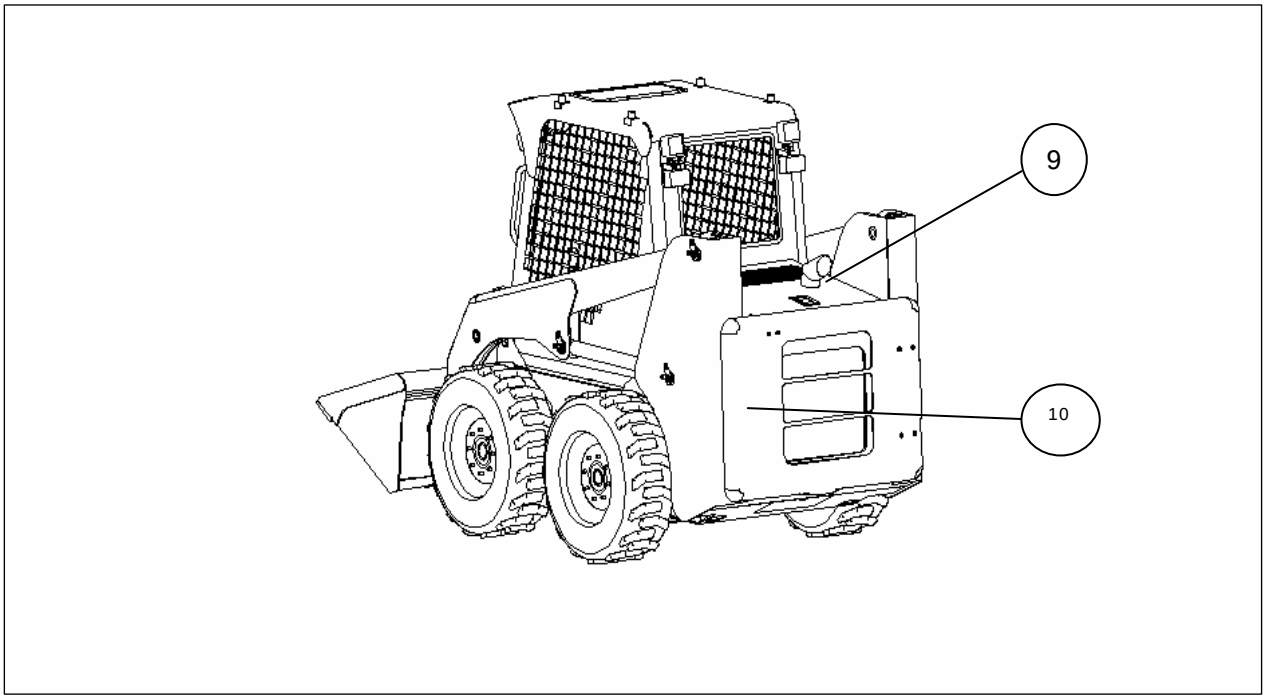


3.1.2 REAR VIEW



3.1.3 MACHINE DISTRIBUTION





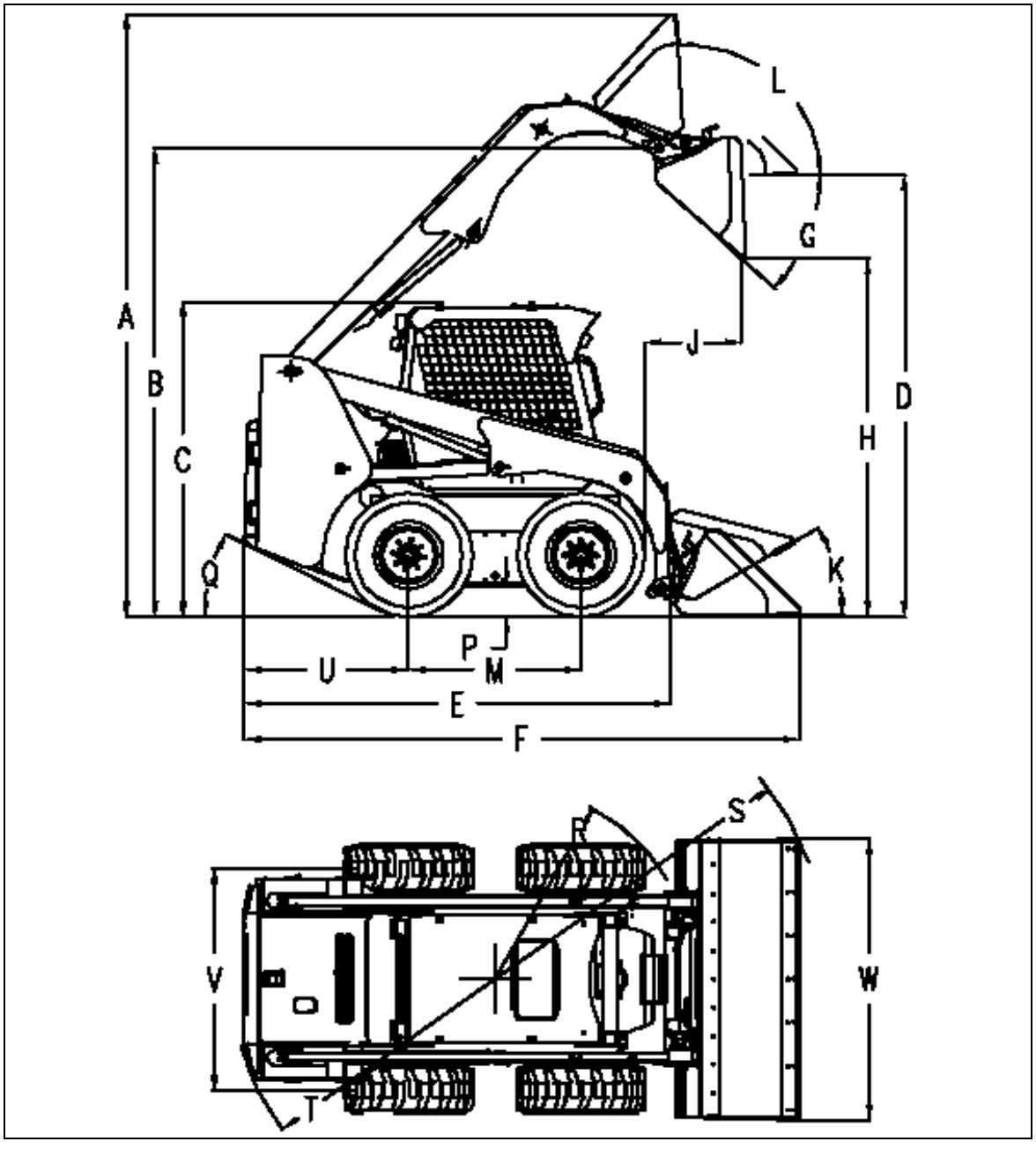
1. Bucket
2. Working lamp
3. Cabin
4. Hydraulic oil tank
5. Engine hood
6. Fuel tank
7. Arm
8. Wheel
9. Exhaust pipe
10. Rear cover

3.2 SPECIFICATION

3.2.1 GENERAL DATA

ITEM	SWL 3210	
Operating weight	3250kg	
Nominal load	950kg	
Tipping Load	1900kg	
Bucket volume	0.53m3	
Breakout force (lifting cylinder)	2420Kgf	
Breakout force (tilting cylinder)	2470Kgf	
Max traveling speed	12.6Km/h	

3.2.2 OVERALL DIMENSION



Item	Specification	SWL3210
A	Overall operating height	4020 ㎜
B	Height to bucket hinge pin	3123 ㎜
C	Height to top of cab	2100 ㎜
D	Height to bottom of level bucket	2950 ㎜
E	Overall length without attachment	2750 ㎜
F	Overall length with standard bucket	3590 ㎜
G	Dump angle at maximum height	43°
H	Dump height	2395 ㎜
J	Reach at maximum height	625 ㎜
K	Rollback of bucket on ground	30°
L	Rollback of bucket at full height	93°
M	Wheelbase	1116 ㎜
P	Bottom of belly pan	205 ㎜
Q	Angle of departure	27°
R	Clearance circle front without bucket	1300 ㎜
S	Clearance circle front	2180 ㎜
T	Clearance circle rear	1700 ㎜
U	Rear axle to bumper	1062 ㎜
V	Tread width, centerline to centerline	1475 ㎜
W	Width with excavating bucket	1880 ㎜

3.2.3 ENGINE

ITEM	KUBOTA V3300DI
POWER OUTPUT	54.9Kw
MAX TORQUE	244N-m
ROTATION	2600rpm

3.2.4 ELECTRIC SYSTEM

ITEM	SWL 3210
Battery	80Ah or 100Ah
Alternator	12V-45A
Starter motor	12V-3.0A

System voltage	12V
Current total	25A

3.2.5 PNEUMATIC

ITEM	Pressure
10X16.5 PR10 CHAOYANG	60PSI
12X16.5 PR10 CHAOYANG	60PSI
10X16.5 PR10 MECHILIN	65PSI
12X16.5 PR10 MECHILIN	65PSI
10X16.5 PR10 SOLIDEAL	65PSI
12X16.5 PR10 SOLIDEAL	65PSI

3.2.6 OILS AND COOLANT

- Use only oil and coolant recommended in this manual.
- Use different oils could reduce the efficiency of the machine or even damage the machine.

OILS, COOLANT AND FUELS	SPECIFICATION
Hydraulic Oil	TOTAL AZOLLA ZS46, MOBIL AW46
Engine Oil	MOBIL DELVAC1330, ESSO LUBE D-3 10W 30
Engine Coolant	TOTAL MULTIS EP2, ESSO BEACON EP2
Travelling Mechanism Oil	TOTAL AZOLLA ZS46, MOBIL AW46
Fuel	Diesel Fuel 0#

- **Do not mix different kind of oils. If you have oil different from the current oil, remove all the oil inside the machine.**

3.2.7 CAPACITIES

ITEMS	CAPACITY (Litre)
Model	SWL3210
Hydraulic oil tank	65
Hydraulic system (Pipes+Tank+Cylinders)	100
Engine coolant	3.5
Engine oil	13.2
Fuel tank	85
Travelling Mechanism	2X15

3.2.8 TORQUE FOR SCREWS

Unless other specification, tighten the nuts and bolts according to the torques shown in the below table. Tighten the goods by the wrenches with gauge.

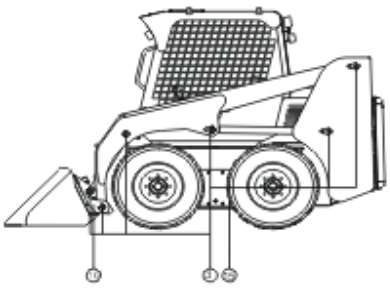
Thread Diameter (mm)	Quality 8.8 Torque (Nm)	Quality 10.9 Torque (Nm)
M 6	9~12	13~16
M 8	22~30	30~36
M 10	45~59	65~78
M 12	78~104	110~130
M 14	124~165	180~210
M 16	193~257	280~330
M 18	264~354	380~450
M 20	376~502	540~650
M 22	512~683	740~880
M 24	651~868	940~1120
M 27	952~1269	1400~1650
M 30	1293~1723	1700~2000

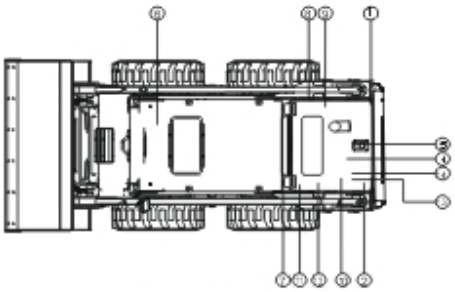
When tighten parts of the machine made by steel be careful to not tighten it too strong, since you could damage this parts.

3.2.9 LUBRICATION POINTS

The following drawing shows the main lubrication points.

Fuel and Lubricant Chart





▲ Check and clean.
■ Check and fill up
● Replace

Item	Description	Maintenance Interval (hours)						Oil Symbol	Maintenance points
		10	100	250	500	1000	2000		
1	Fuel level	■						DF	1
2	Hydraulic oil level	■					●	HO	1
3	Working device pins		■					PGL	12
4	Engine oil level	■		●				EO	1
5	Coolant		■				●		1
6	Panel and indicator lights	▲							1
7	Oil and water separator	▲							1
8	Accumulator(electrolyte)		■						1
9	Fuel filter		▲						1
10	Engine oil filter			●					1
11	Hydraulic oil return filter				●				1
12	Air filter		▲	●					1
13	Fuel filter element			●					1
14	Radiator				▲				1
15	Sprocket wheel box	■				●		GO	2
16	Quick hitch	■						PGL	2

Attention:

1. Oil symbol
   EO: Engine oil SAE#CF-4/SH15W-40
   GO: Gear oil SAE#85W140GL-5
   HO: Hydraulic oil ISO VG46 (for cold) of VG68 (for warm)
   PGL: Grease NLGI#2
   DF: Diesel oil
   Coolant: 50/50 water and anti-freeze
2. Refer to manual book to use hydraulic oil and gear oil.
3. Stop engine when fill up.
4. Don't open the cover or oil plug when coolant or oil temperature high, beware of scald.
5. Open covers slowly to release pressure.
6. Please refer to maintenance book for other details.

Remarks:

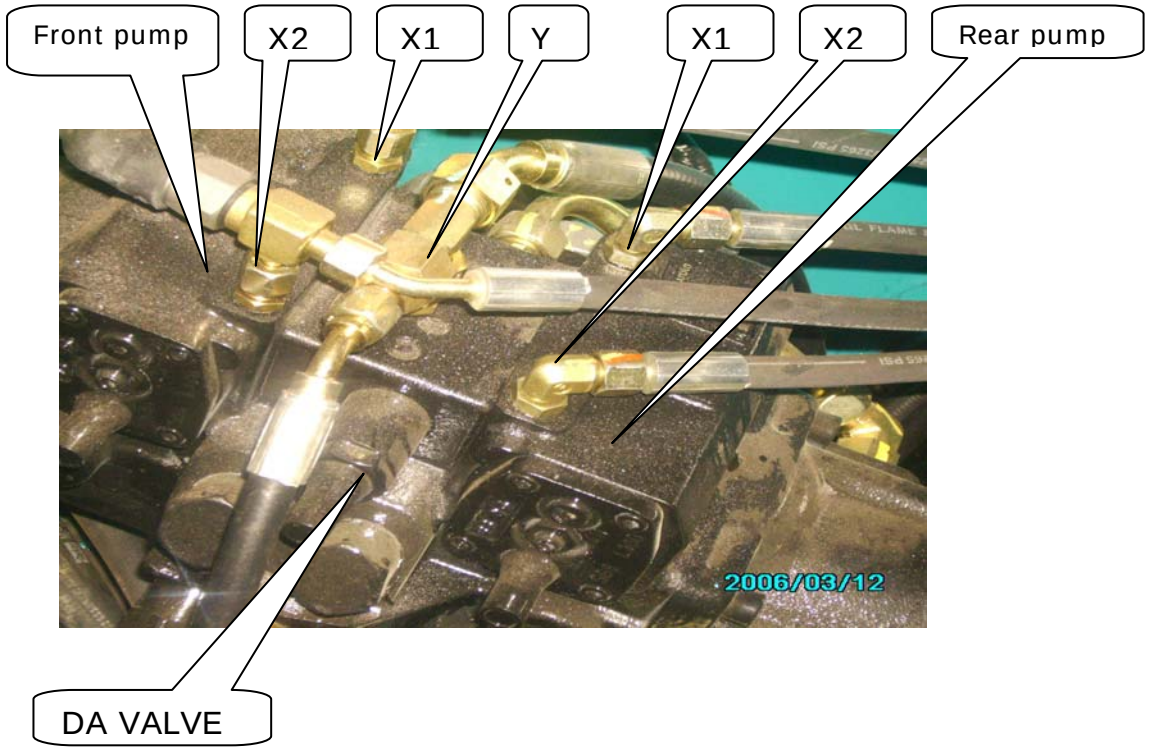
It must check and maintain following parts for the first 50 hours and every 250 hours operation.

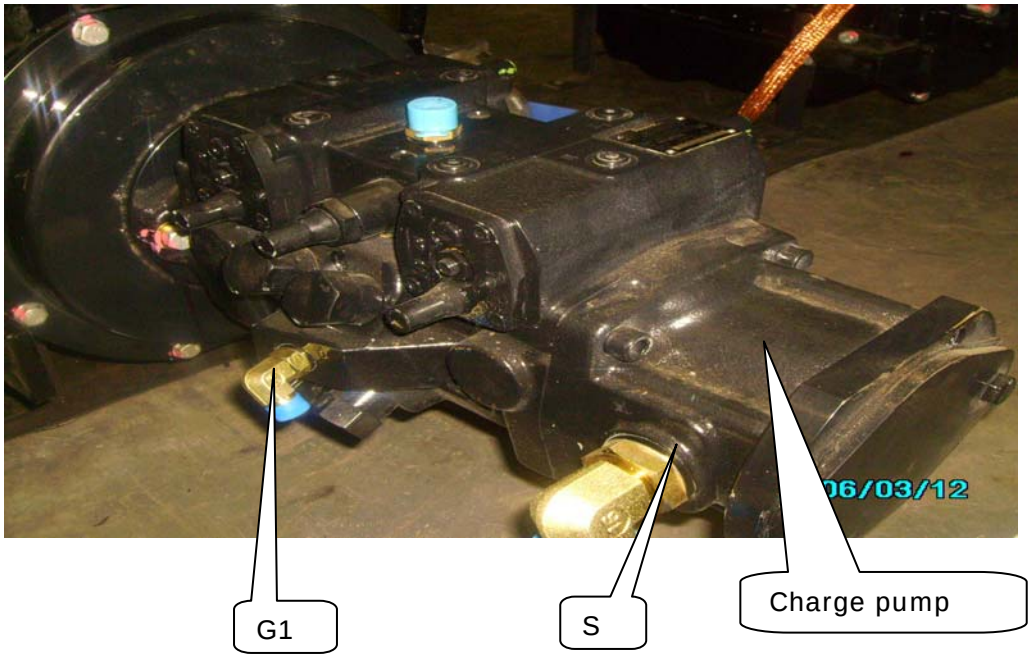
1. Engine set bolt.
2. Hydraulic pump set bolt.
3. Travel motor set bolt.
4. Tyre set bolt.
5. Axle bolt.
6. Other bolts for important parts.

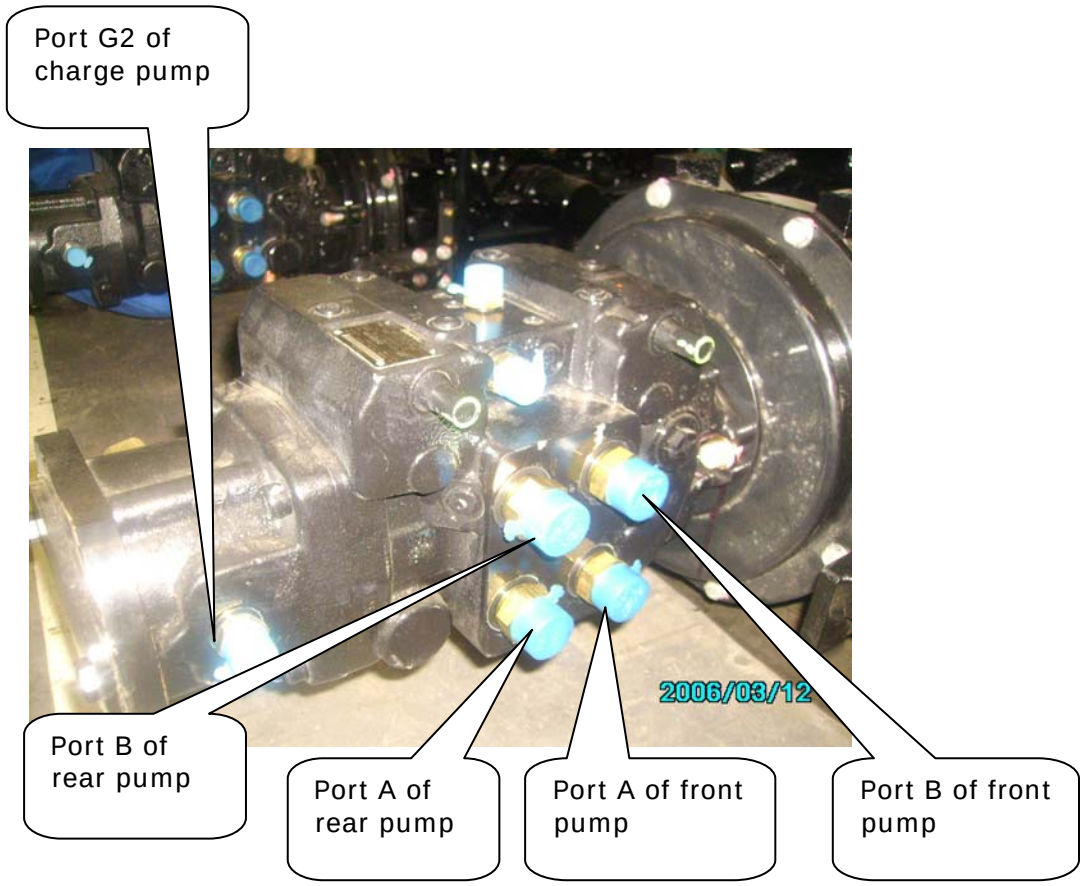
4 HYDRAULIC SYSTEM

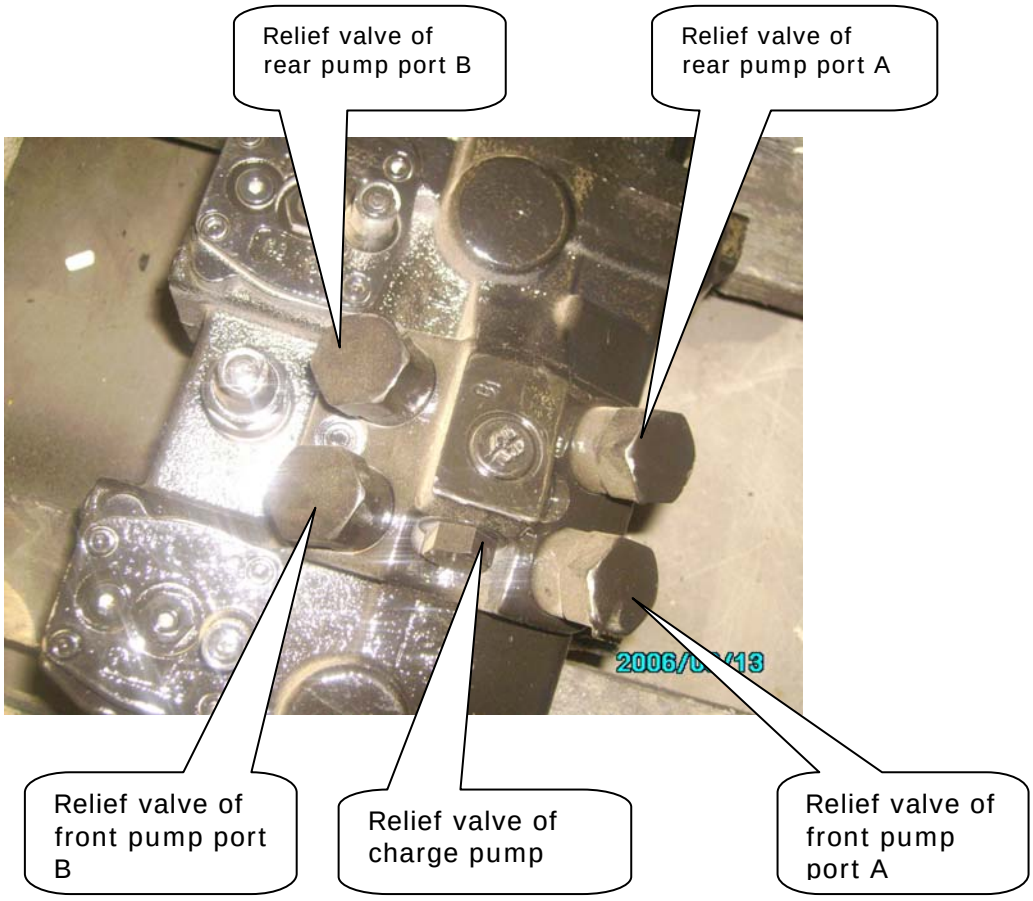
4.1 MAIN TRAVEL PUMP

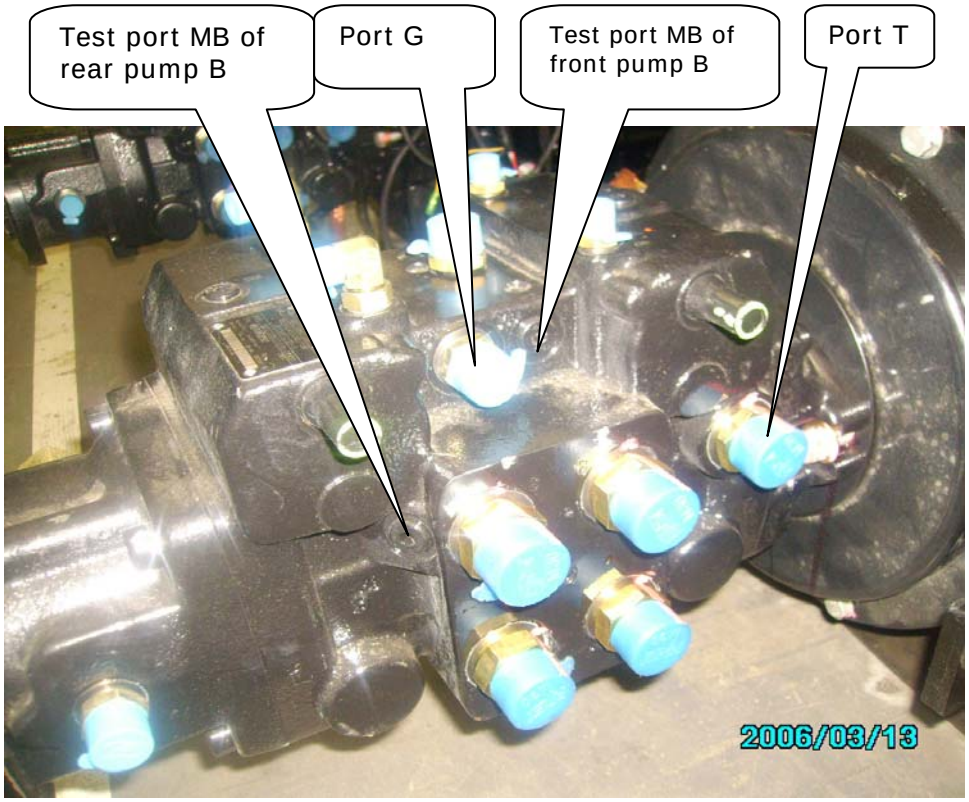
4.1.1 ILLUSTRATION OF MAIN TRAVEL PUMP COMPONENTS

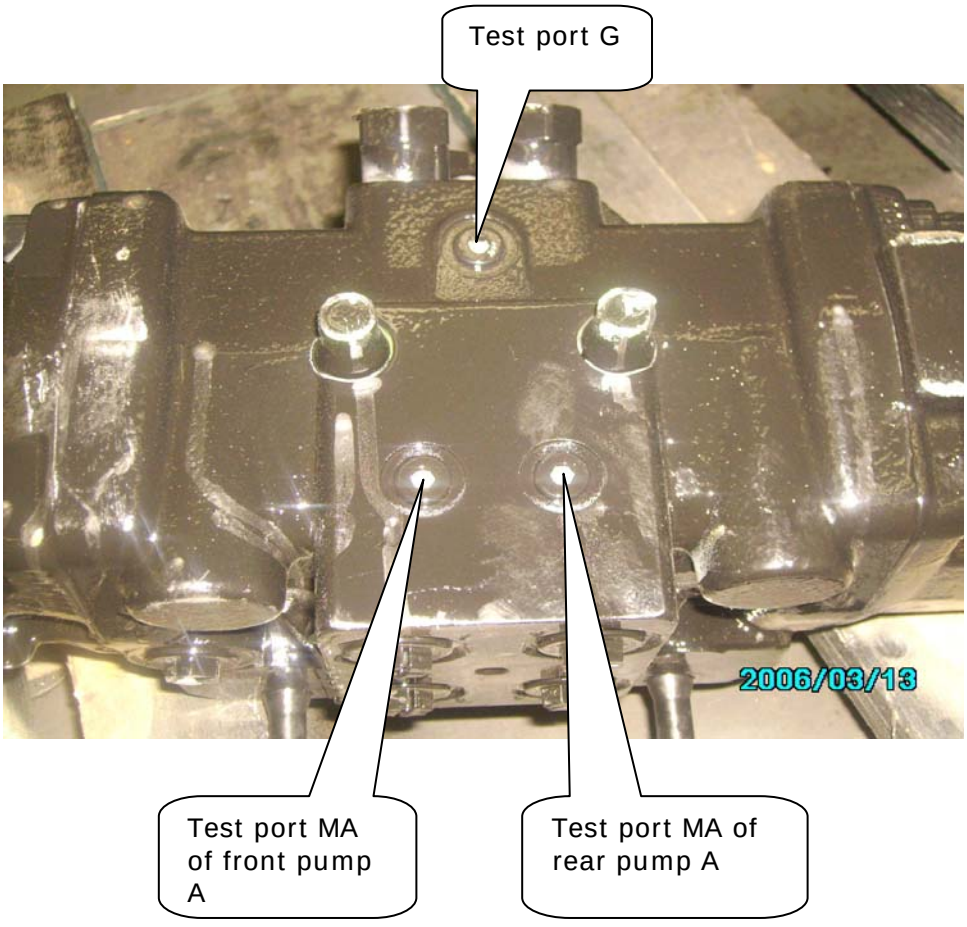


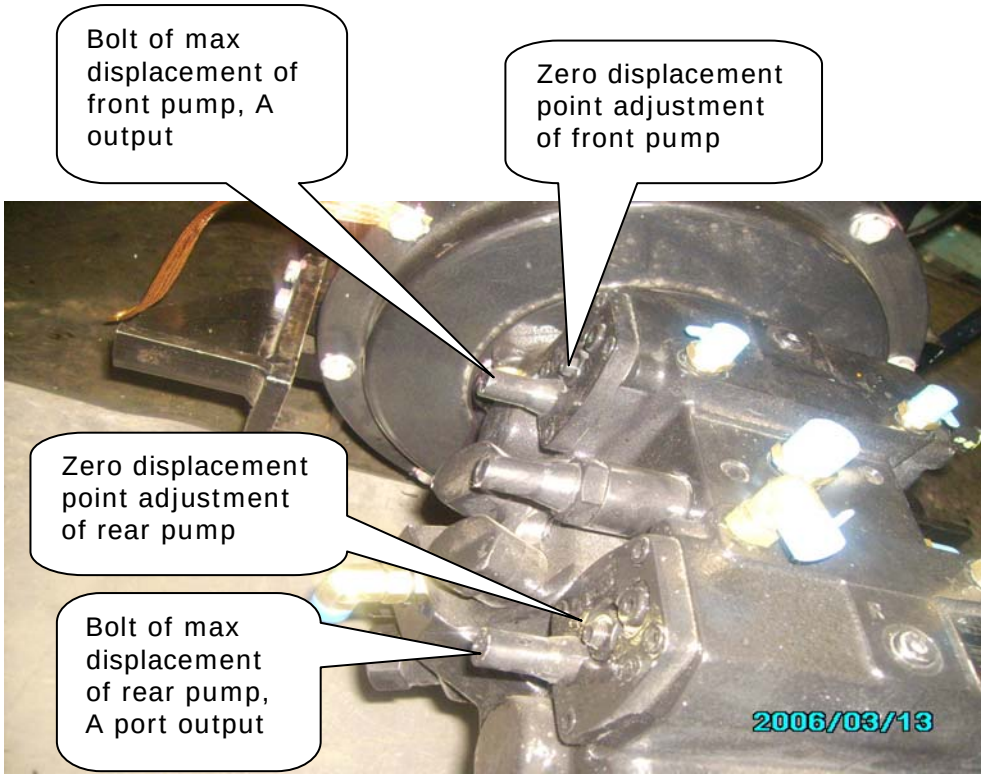


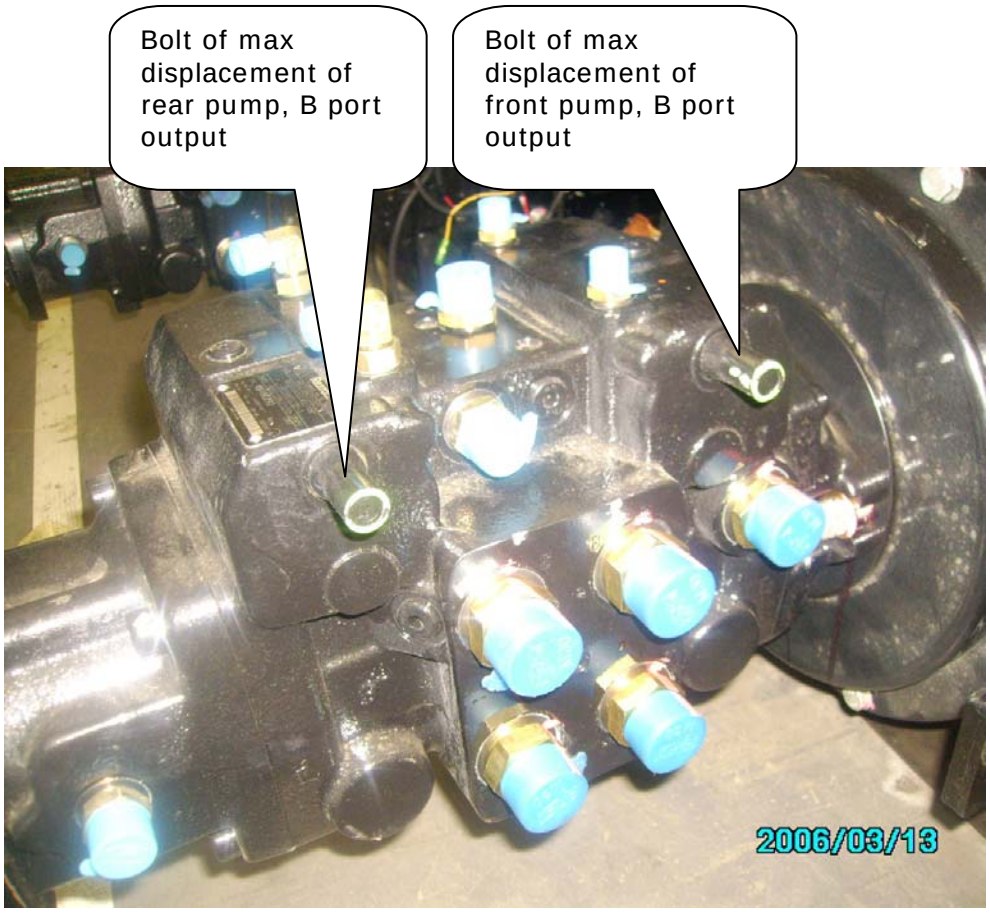

Port G2 of charge pump
Port B of rear pump
Port A of rear pump
Port A of front pump
Port B of front pump
2006/03/12


Relief valve of rear pump port B
Relief valve of rear pump port A
Relief valve of front pump port B
Relief valve of charge pump
Relief valve of front pump port A

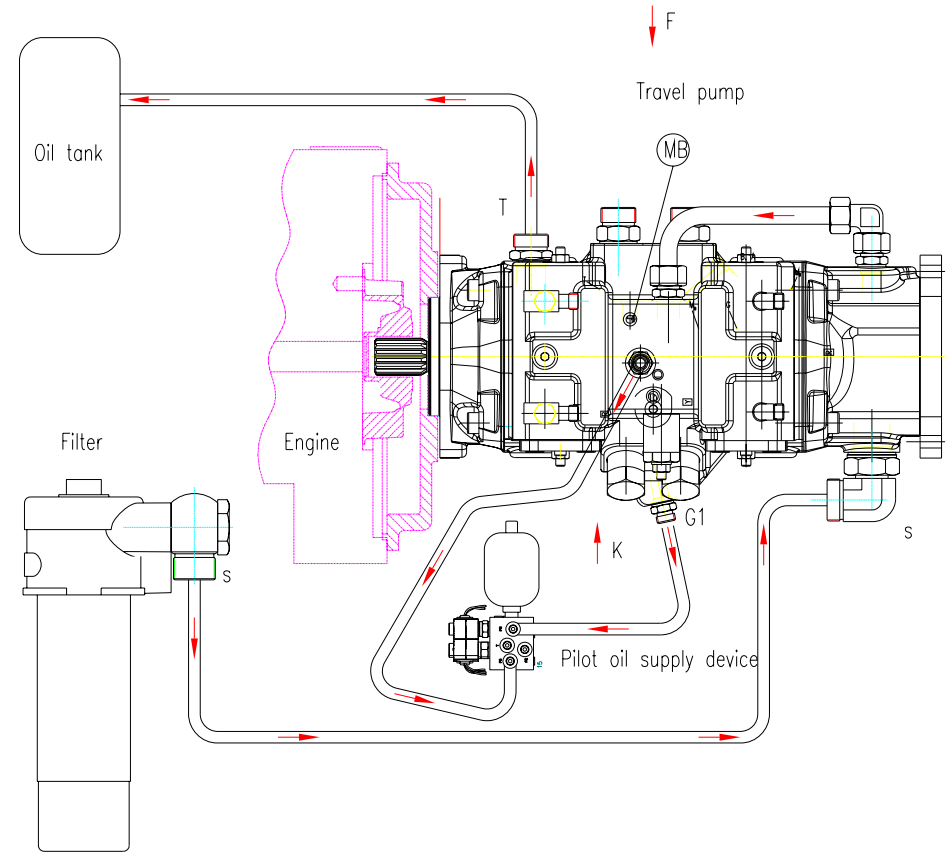

Test port MB of rear pump B
Port G
Test port MB of front pump B
Port T
2006/03/13

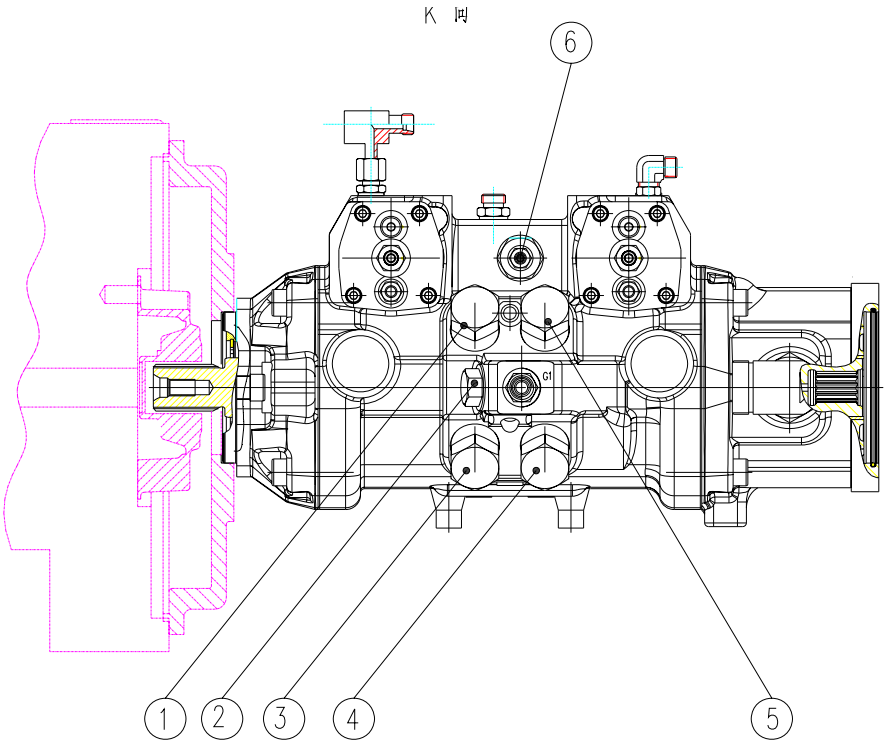

Test port G
2006/03/13
Test port MA of front pump A
Test port MA of rear pump A

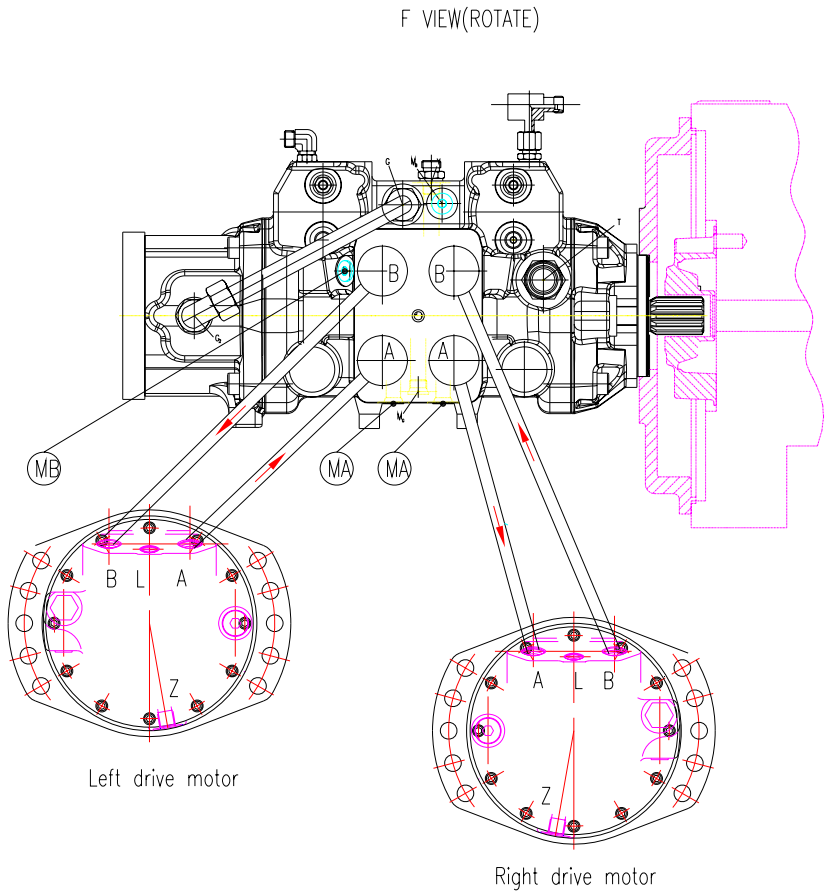

Bolt of max displacement of front pump, A output
Zero displacement point adjustment of front pump
Zero displacement point adjustment of rear pump
Bolt of max displacement of rear pump, A port output
2006/03/13


Bolt of max displacement of rear pump, B port output
Bolt of max displacement of front pump, B port output
2006/03/13

4.1.2 PIPELINE CONNECTION (FOR TESTING) OF MAIN TRAVEL PUMP







4.1.3 SET PRESSURE DATA FOR MAIN TRAVEL PUMP

⚠ Pay attention to the following items before the assembly of testing tools:

Lift up the boom, start safety rod, get the cabin upside down and insert safety pin.

⚠ Release the pressure of the system and that inside of the other components until the hydraulic oil has cooled down to normal temperature .

Hydraulic testing tools:

Two manometers: one with its measurement range of 60MPa(600ar), the other one with its measurement range of 6MPa(60bar)

※Rated engine rev: 2800±50rpm（for SWL28）or 2600±50rpm(forSWL32)

※Engine idle speed: 1000±50rpm

1） Pressure setting for charge pump

When leaving factory, the pressure for charge pump is 25±2bar. When testing its pressure, place a manometer with its measurement range of 6MPa on G test port.（screw thread for oil port：9/16-18NUF-2B）. The charge overflow valve ② can not be adjusted by screw rod, therefore, the pressure change can only be achieved by disassembling the valve to add or reduce the spacers.

2) Pressure setting for travel startup

For the sake of safety, when engine rev is less than 1300rpm, the machine traveling mechanism can not work. If abnormality occurs, take the following steps to check pressure data: place a testing tool with a manometer whose measurement range is 6Mpa in the pipeline of port Y. Then start the engine and set its rev at 1300±50rp. The pressure showed on the manometer now

should be about 6bar. If any deviation occurs, adjust the valve DA⑥ and correct it. When the engine rev is more than 2600rpm， the outlet pressure of port Y should be more than 18bar.

3）When leaving factory, the pressure for traveling pump' s main front and rear oil ports A and B is 325±5bar. Before testing their pressure, place a manometer whose measurement range is 60MPa in test ports MA and MB.（screw thread for oil port：9/16-18NUF-2B）. When it's necessary to change the pressure of main oil overflow valve, disassemble the valve and adjust its screw rod.

4）Adjust the zero displacement of variable cylinder

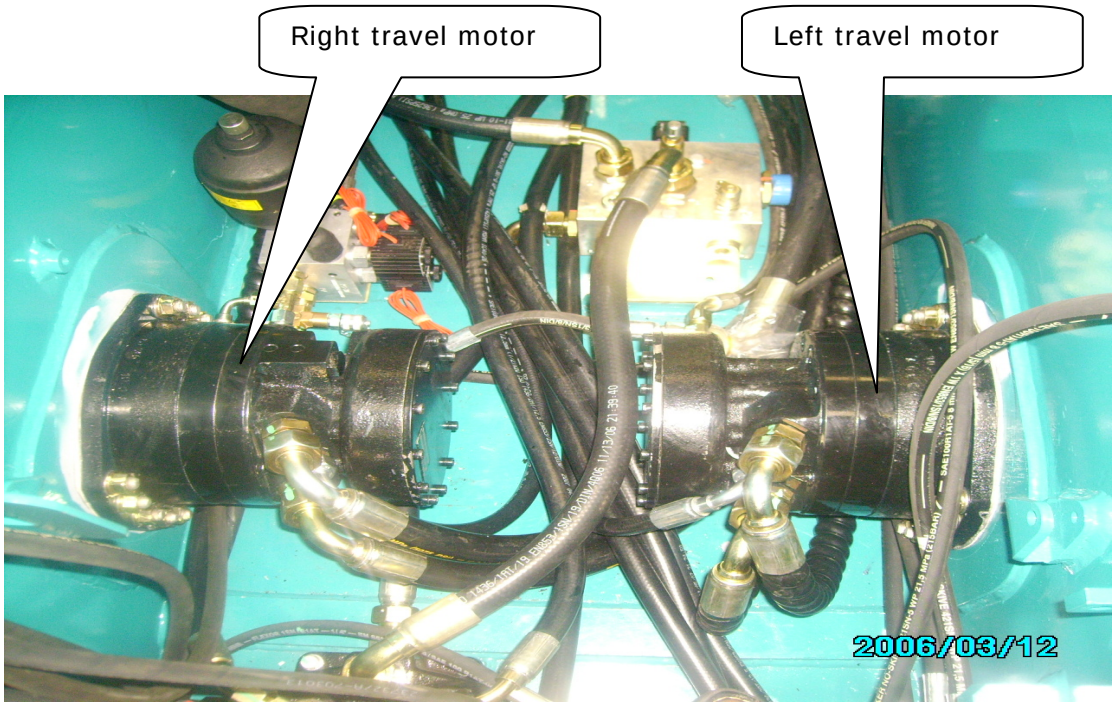
If the machine travels while hand lever is on neutral position, or if it travels in deviation when operating hand lever, check whether the variable cylinder is right on "zero" position. If not, adjust it by centering screw rod.

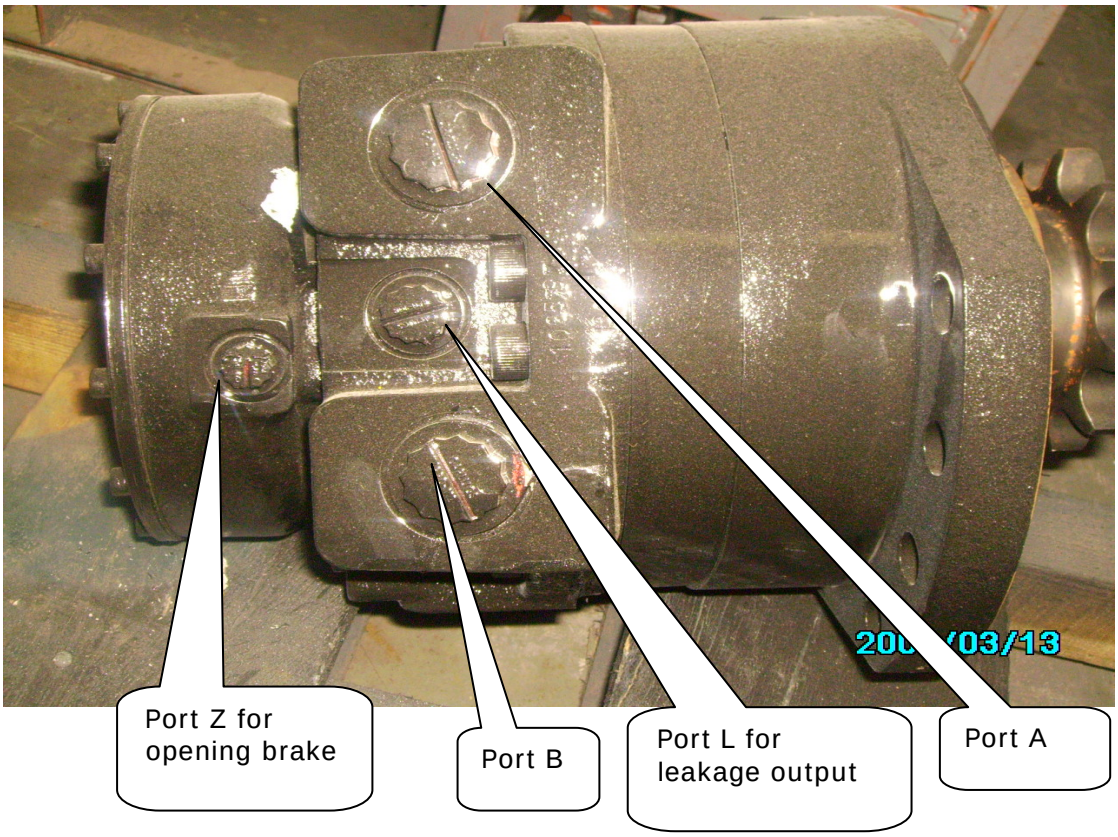
5）Adjust the max displacement of variable cylinder

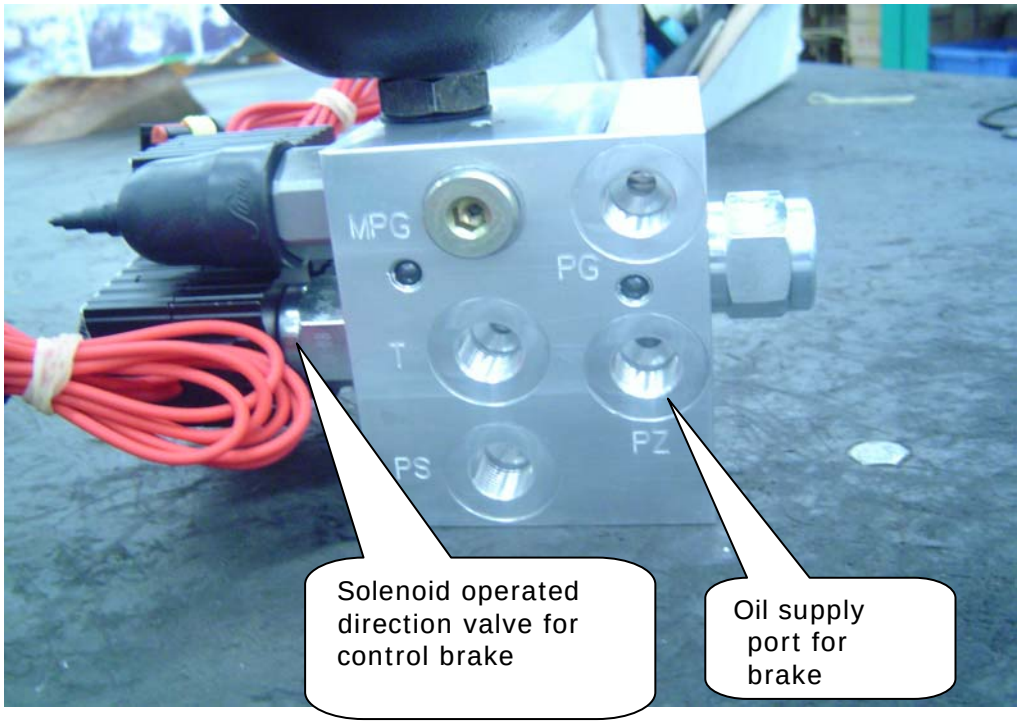
When leaving factory, the oil pump's displacement is set at 46ml/r (the max. one). If machine travels in deviation when hand lever is on the position of max. operation range, the output volume of two oil pumps is likely to be different, which can be adjusted by max. displacement limitation screw.

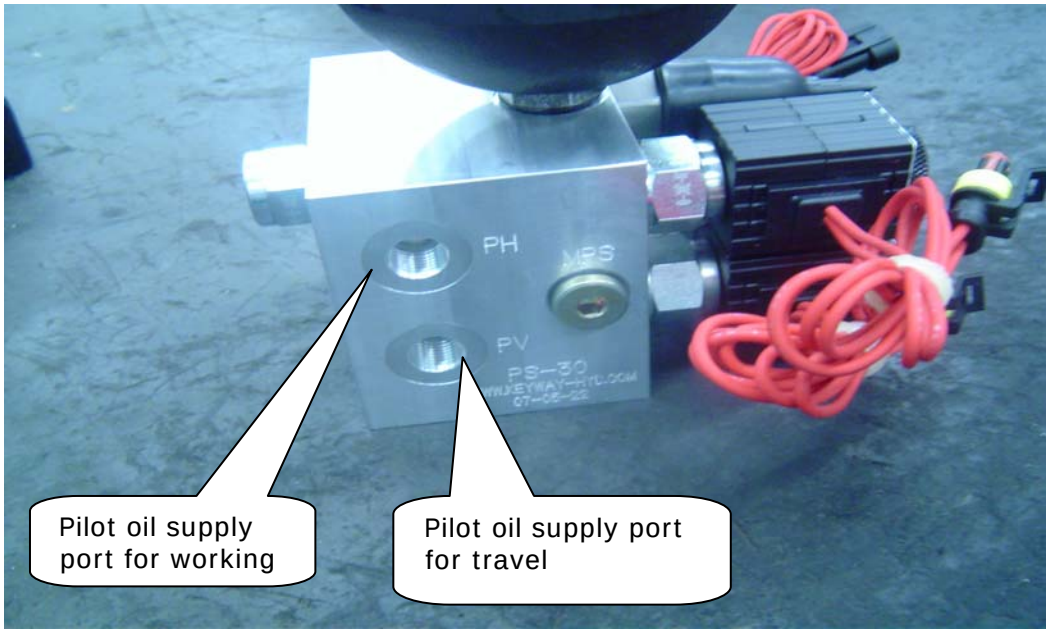
4.2 TRAVEL MOTOR

4.2.1 ILLUSTRATION OF TRAVEL MOTOR MAIN COMPONENTS

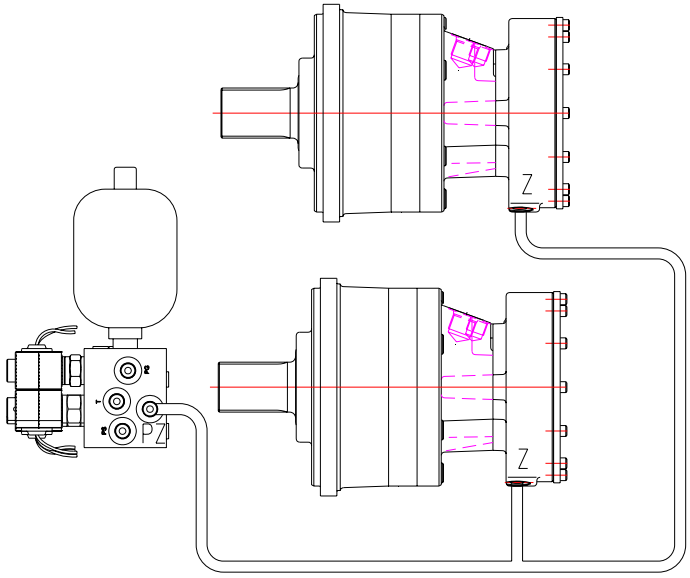





MPG
PG
T
PS
PZ
Solenoid operated direction valve for control brake
Oil supply port for brake


PH
MRS
PV
Pilot oil supply port for working
Pilot oil supply port for travel

4.2.2 PICTURE OF BRAKE OIL PIPES' CONNECTION



4.2.3 ROTATION DIRECTION OF TRAVEL MOTOR.

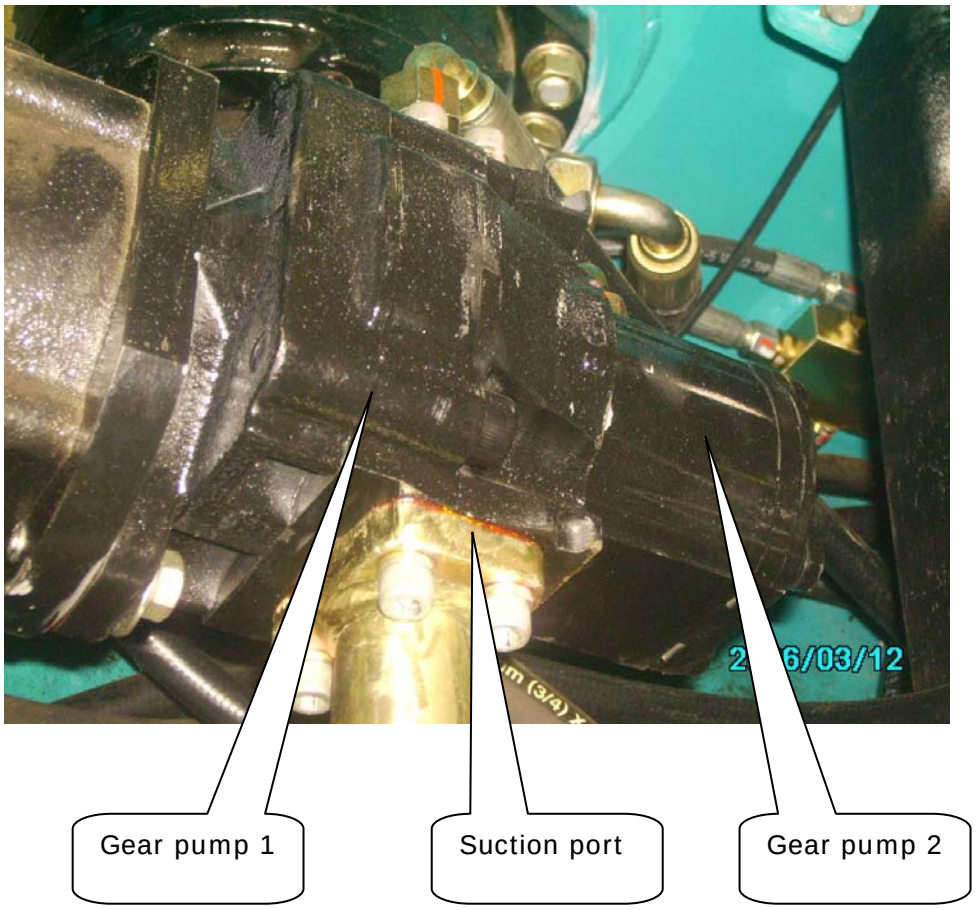
When port A begins to suck oil, it seems from the shaft end that the motor runs clockwise; when port B begins to suck oil, it seems from the shaft end that the motor runs anticlockwise.

4.2.4 PRESSURE FOR ARRESTING GEAR'S START

An often –closed brake is set at the end of motor. When starting the brake, the min. pressure is 15bar. The pressure for this system is supplied by travel charge pump (25bar) and controlled by pilot oil sources magnet valve. When abnormality of brake oil pipeline occurs, a manometer whose measurement range is 60bar is to be placed in the pipeline , to check whether the pressure is normal and whether the magnet-valve can carry out control as requested. Then resolve the malfunction.

4.3 WORKING REAR PUMP

4.3.1 OUTSIDE VIEW OF GEAR PUMP

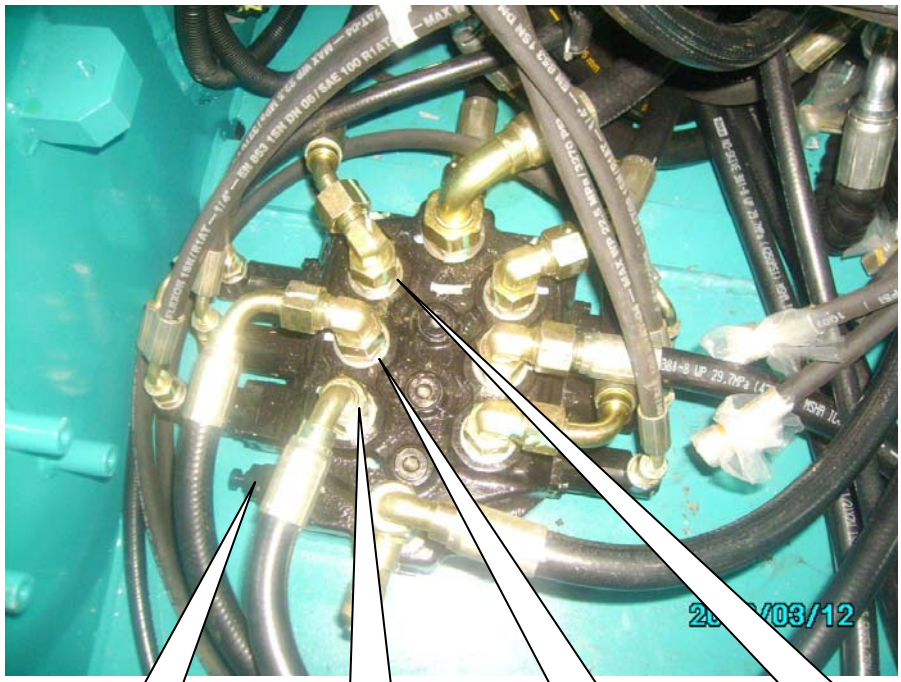


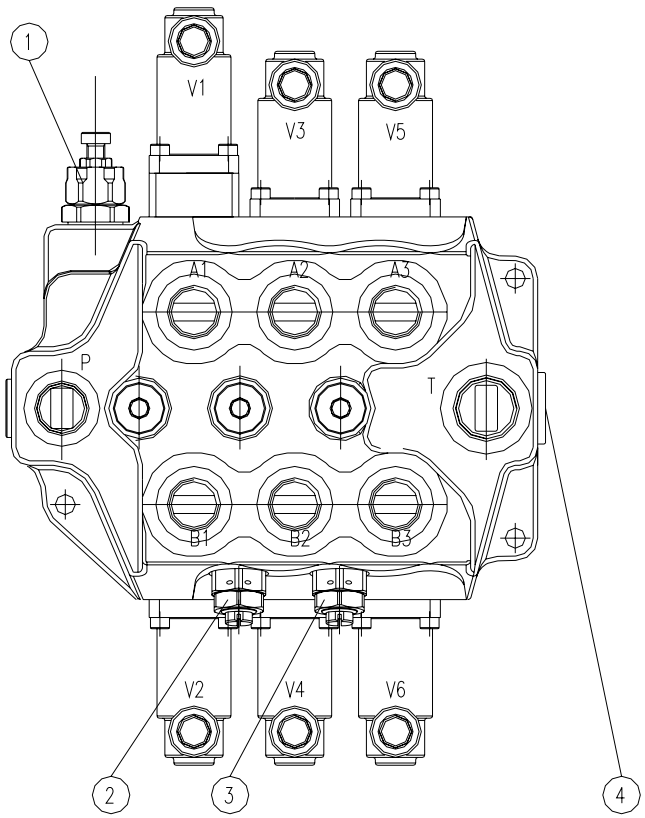
4.3.2 BREAKDOWN DRAWING OF GEAR PUMP

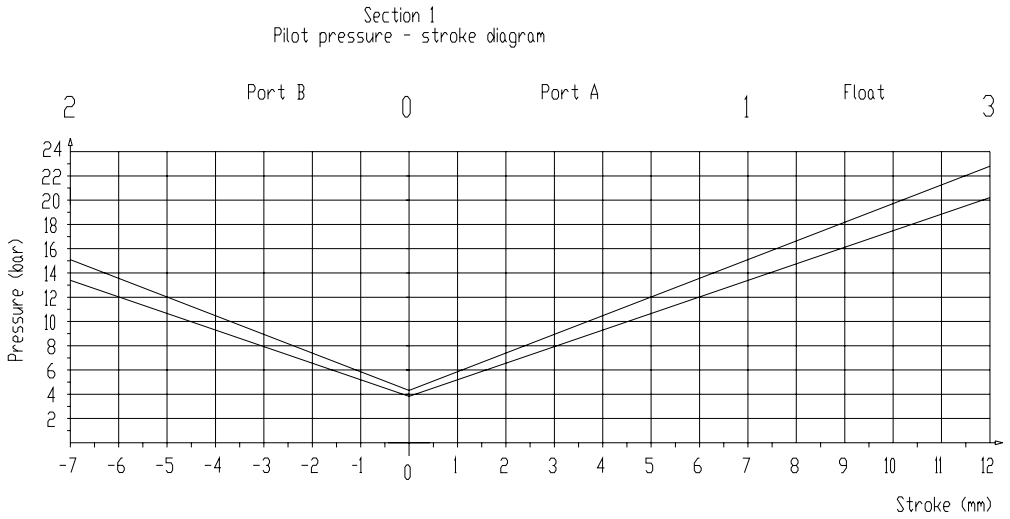
See the appendage

4.3.3 MANIFOLD VALVE

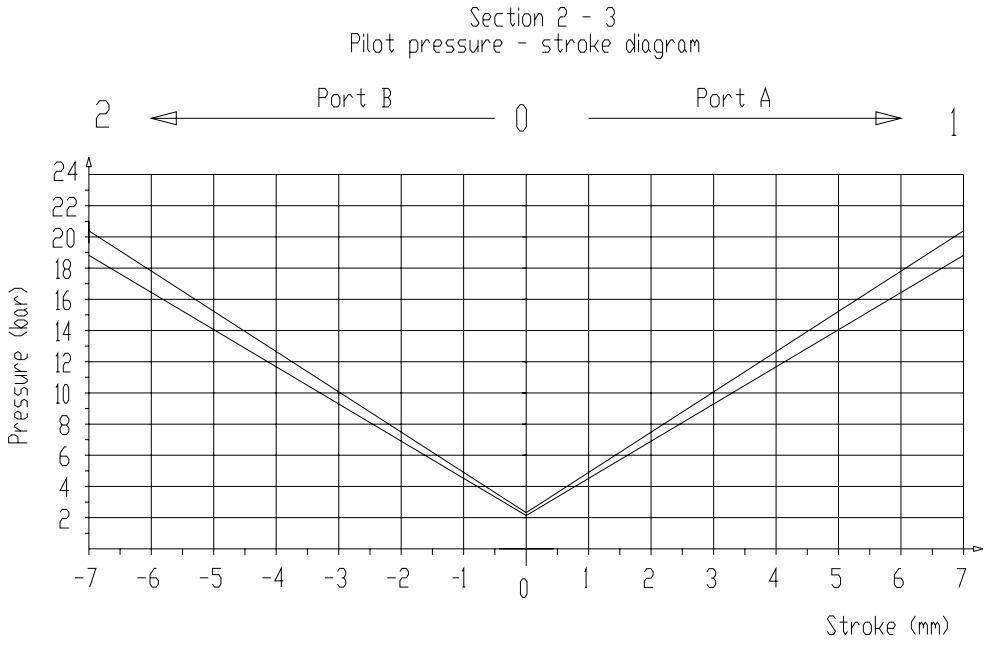
4.3.4 OUTSIDE VIEW AND ILLUSTRATION OF MANIFOLD VALVE







Pos.	Pressure [bar]	
	min	max
2	13.4	15.1
0	3.8	4.3
1	13.4	15.1
3	20.2	22.8



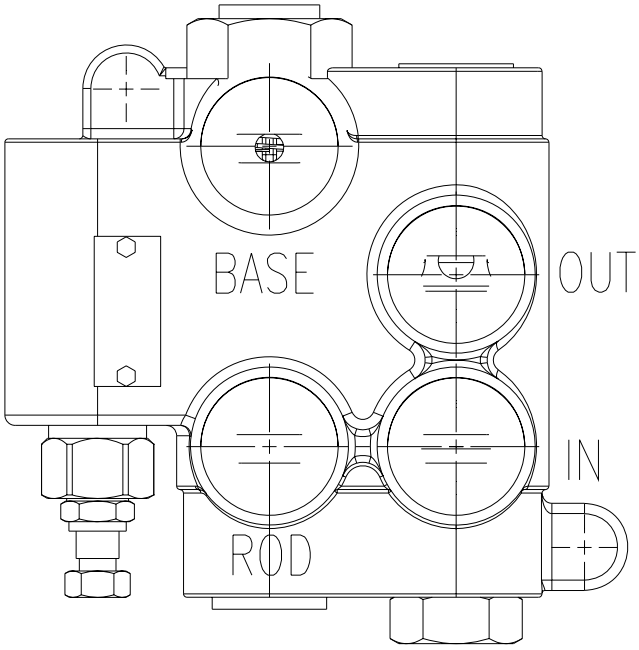
Pos.	Pressure [bar]	
	min	max
2	18.8	20.4
0	2.1	2.3
1	18.8	20.4

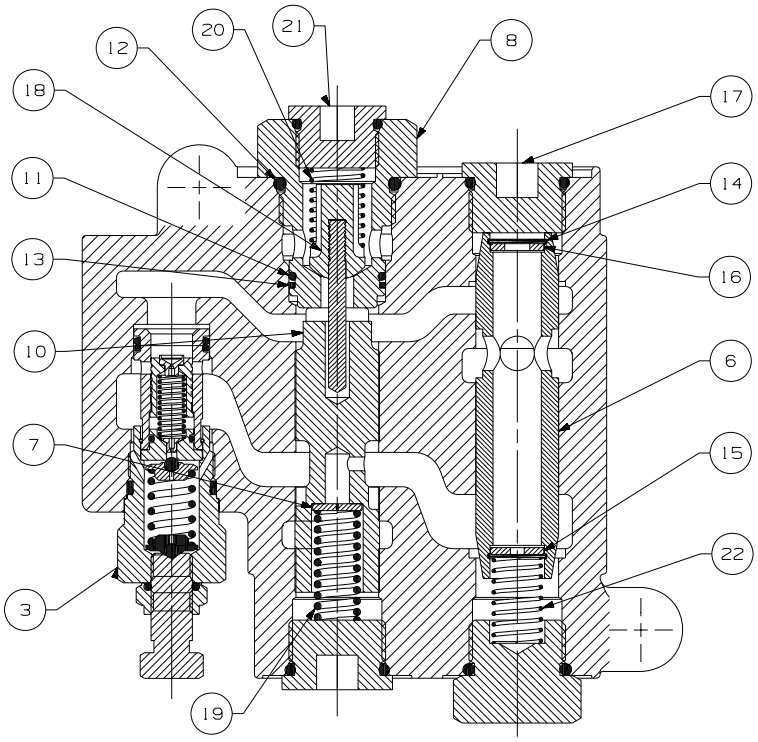
4.3.5 SET THE DATA

The main overflow valve① of manifold valve determines system's working pressure. The working pressure for this system is set at 210±10BAR, while the pressure for second overflow valves ②③ is set at 235±10bar. When manifold valve is used in large flow system, take away the plug ④, install a transition connector to channel hydraulic oil to large flow control block.

4.4 BUCKET-LIFT VALVE

4.4.1 THE OUTLINE AND ILLUSTRATION OF BUCKET-LIFT VALVE

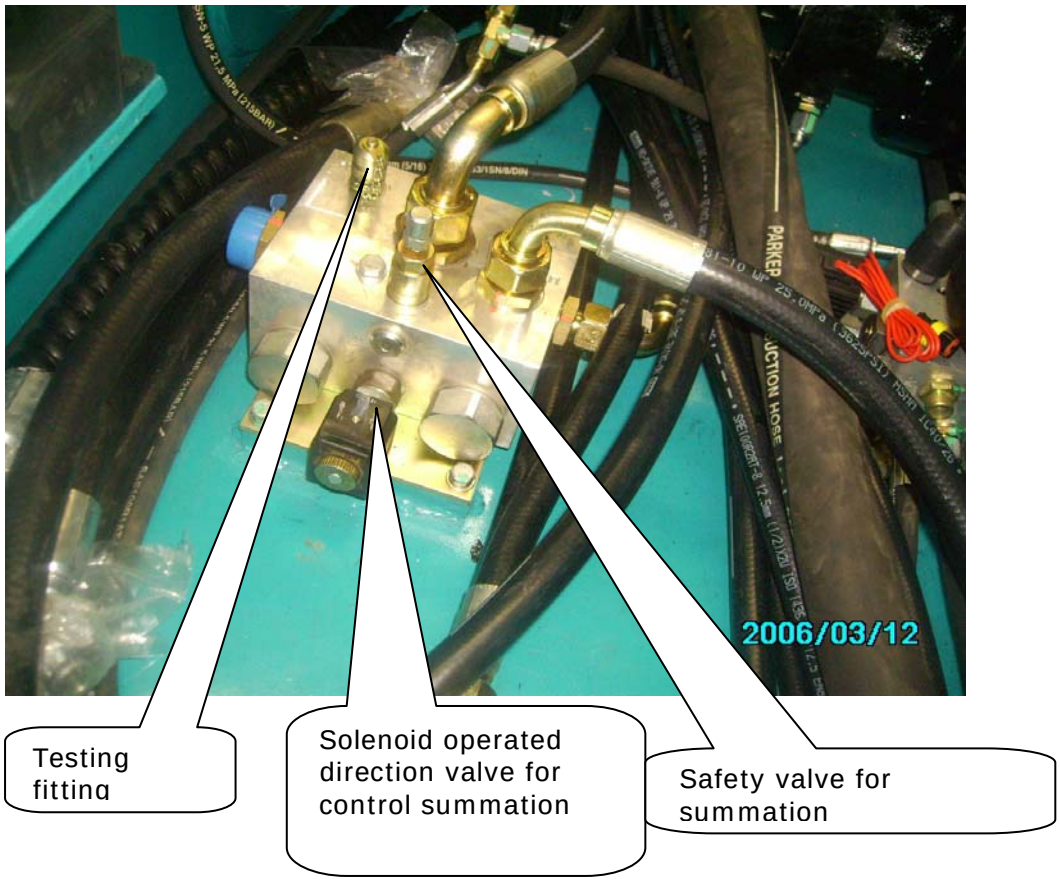




1	10205	SCREW, DRIVE	2
2	10239-9	PLUG, SHIPPING 3/4-16	4
3	10782	ASSEMBLY, RELIEF VALVE	1
4	1225-16	NAME PLATE	1
5	1480-1	BODY, MACHINED	1
6	1480-16	SPOOL, FLOW DIVIDER	1
7	1480-18	PLATE, ORIFICE	1
8	1480-2	CARTRIDGE, PILOT CHECK	1
9	1480-23	PLUG, (-10 SAE)	1
10	1480-3	SPOOL, METERING	1
11	156H2032 (10816-018)	O-RING	1
12	156H2049 (10816-912)	O-RING	1
13	156H2063 (10822-018)	BACKUP	1
14	156H4152	INTERNAL RETAINING RING	2
15	156L5027	PLATE, ORIFICE- .125 DIA	1
16	156L5248	PLATE, ORIFICE .228 DIA	1
17	156L8578 (30021-10A)	ASSEMBLY, PLUG	2
18	1606-10	POPPET	1
19	20420-01	SPRING	1
20	20500-03	SPRING	1
21	30021-8A	HOLLOW HEX PLUG ASSY	1
22	331629	SPRING	1
ITEM	PART NO	PART NAME	QTY

4.5 LARGE FLOW CONTROL BLOCK (ONLY FOR LARGE FLOW SYSTEM)

4.5.1 OUTSIDE VIEW AND ILLUSTRATION OF LARGE FLOW CONTROL BLOCK

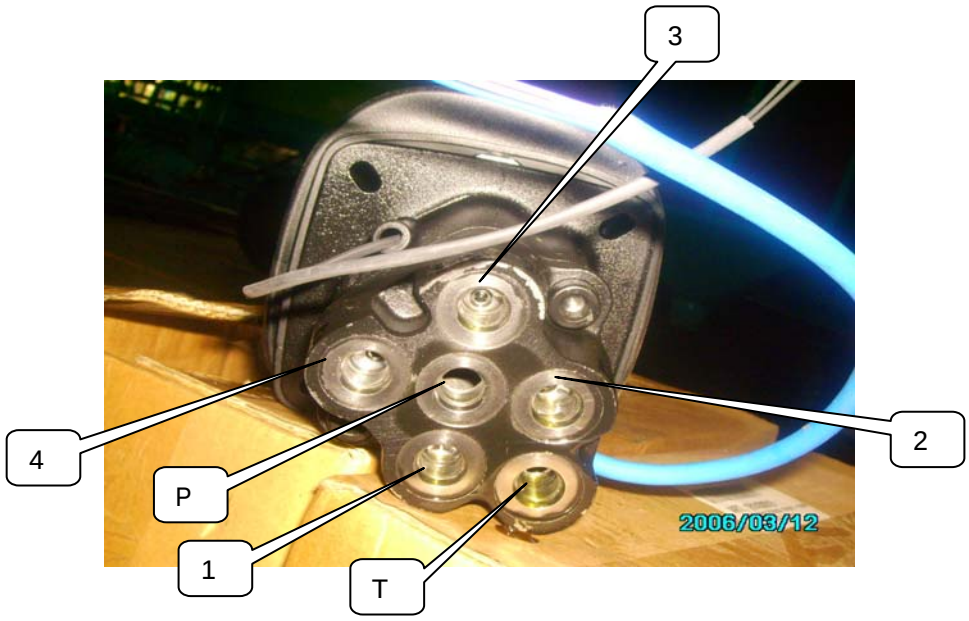


4.5.2 SET THE DATA

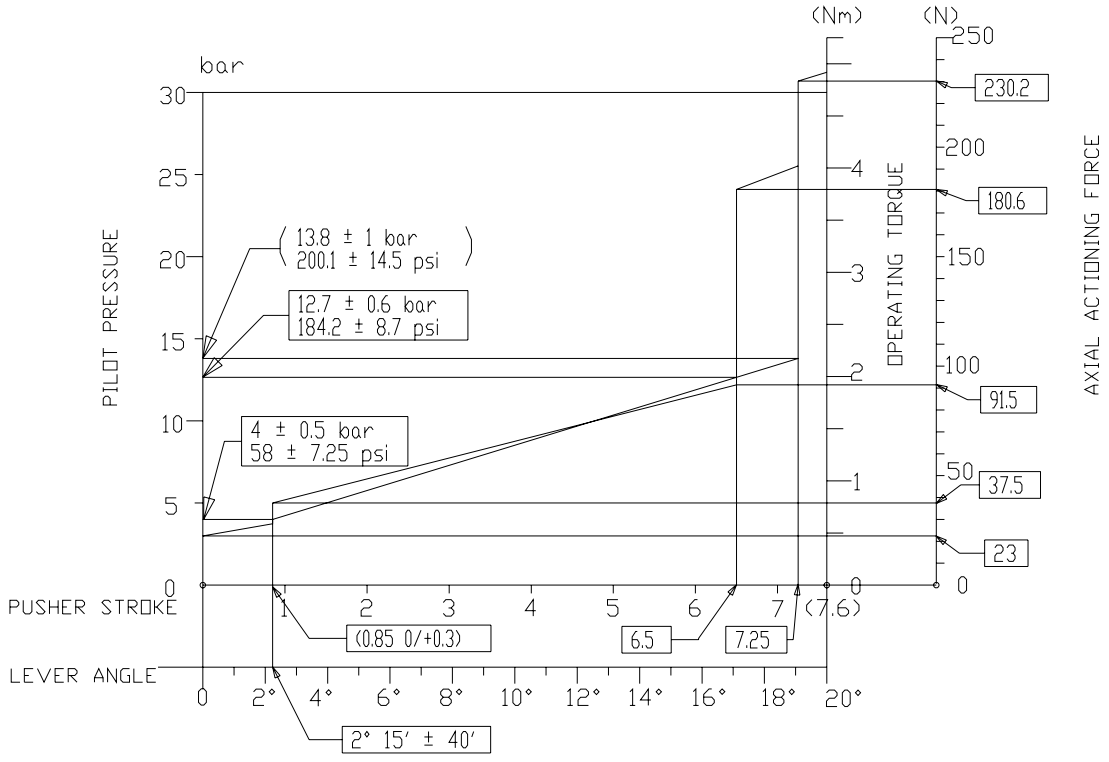
Place a manometer whose measurement range is 60MPa in connector for pressure test.（screw thread： M16X2） The pressure for this device can be set by adjusting safety valve. The pressure is set at 210bar when leaving factory.

4.5.3 OPERATING HANDLE

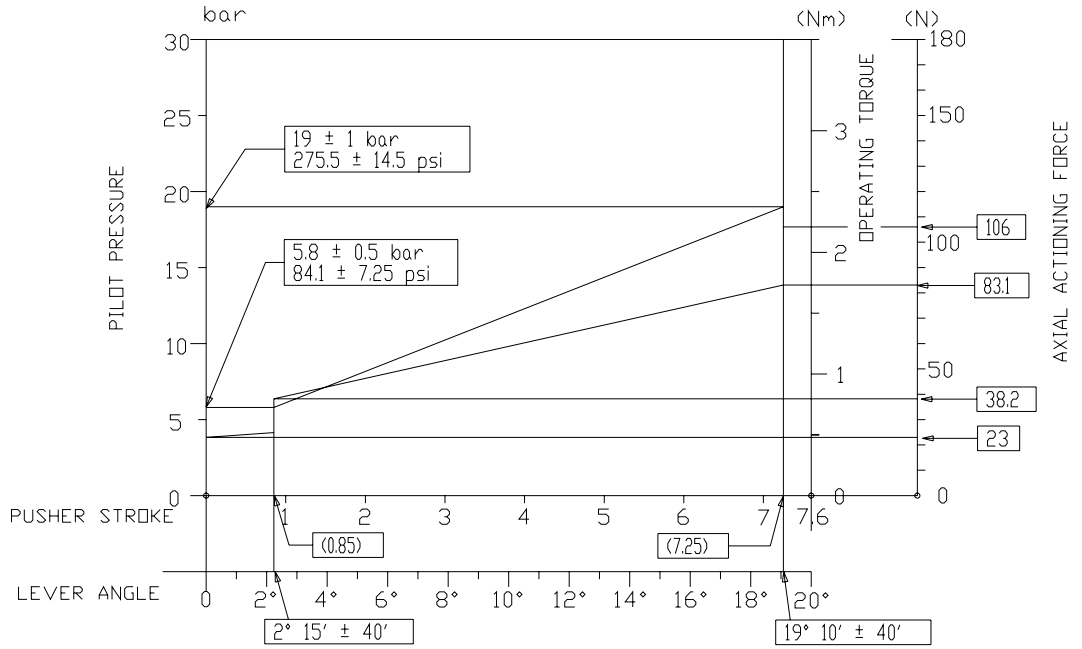
4.5.4 OUTSIDE VIEW AND DATA OF HAND LEVER



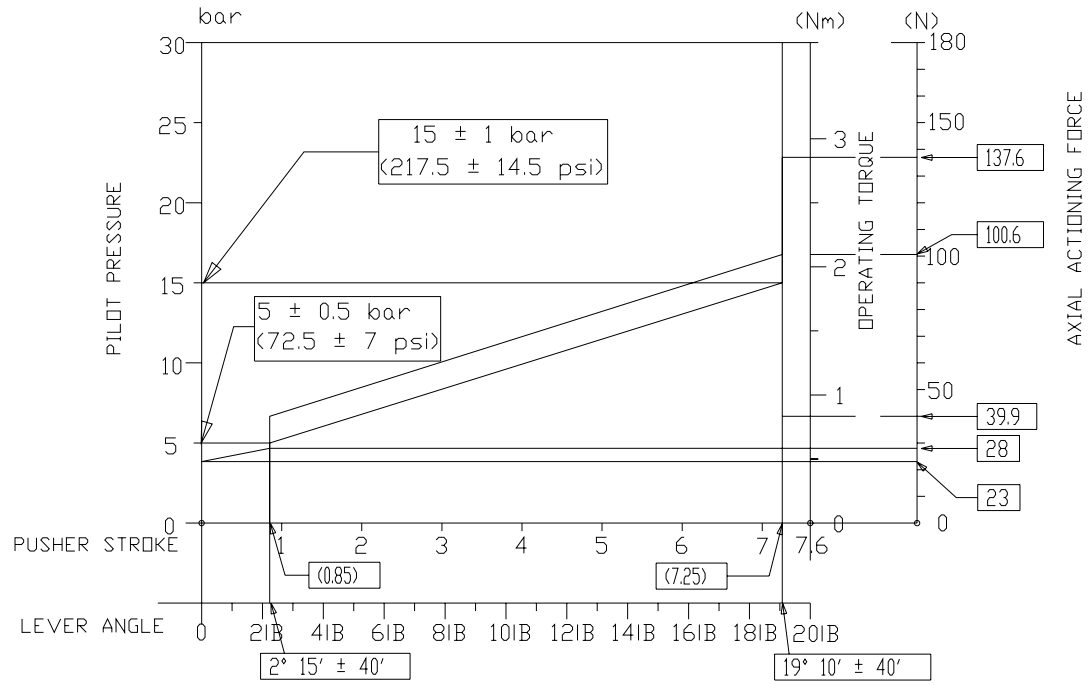
E094B CURVE DIAGRAMM
PORT 1



M033A CURVE DIAGRAMM
PORTS 2–4



M075B CURVE DIAGRAMM
PORT 3

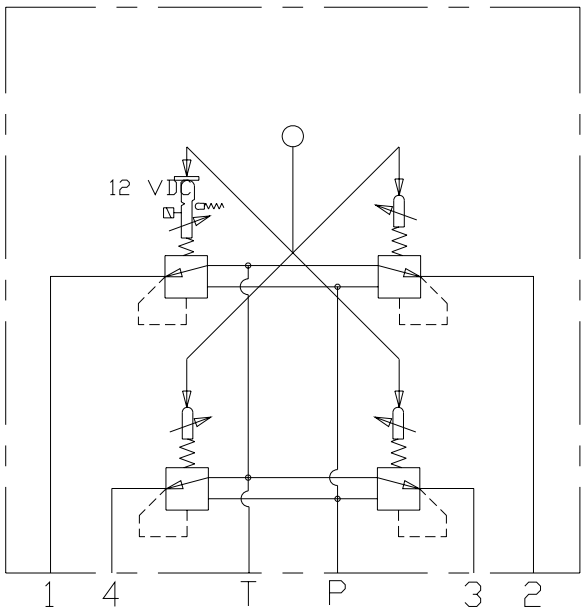


TECHNICAL FEATURES	
Min primary pressure	30 bar(435.1 psi)
Max primary pressure	100 bar(1451 psi)*
Max back pressure	3 bar(43.5 psi)
Min rated flow	5 l/min(1.32 gpm)
Max rated flow	20 l/min(5.28 gpm)
Hydraulic fluid	mineral oil
Kinematic viscosity	3-400 mm²/s
Operating temperature	-10/+80°C(+14/+176°F)
Contamination	15/12(ISO/DIS 4406)
Histeresis max	0.5 bar(7.25 psi)
Internal leakage P=>T 30 bar (435.1 psi)	10-18 cm³/min 0.61-1.09 in³/min
Max operating torque	10 daNm 73.8 lbft

SOLENOID ELECTRICAL FEATURES	
Nominal-Voltage	12 VDC ± 10%
Nominal-Power	8W max
Resistance	18 Ohm
Duty Cycle	100%
Operating temperature range	-40°C / +50°C
Weather Protection	IP65

* Max pressure with electromagnet in detent position is 30 bar (435 psi)

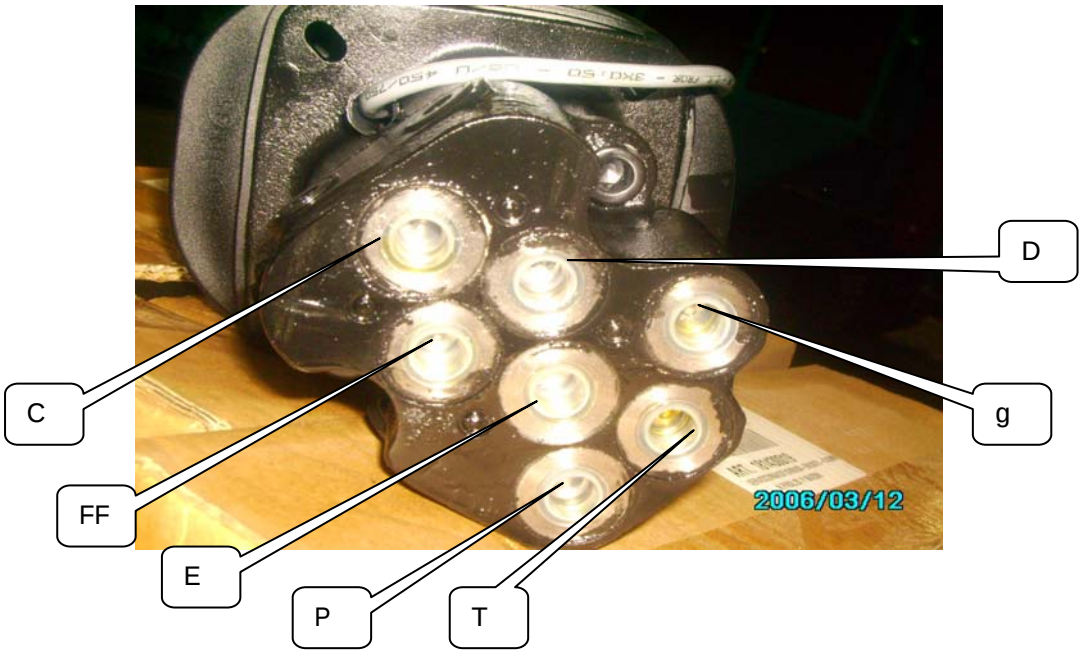
HYDRAULIC CIRCUIT

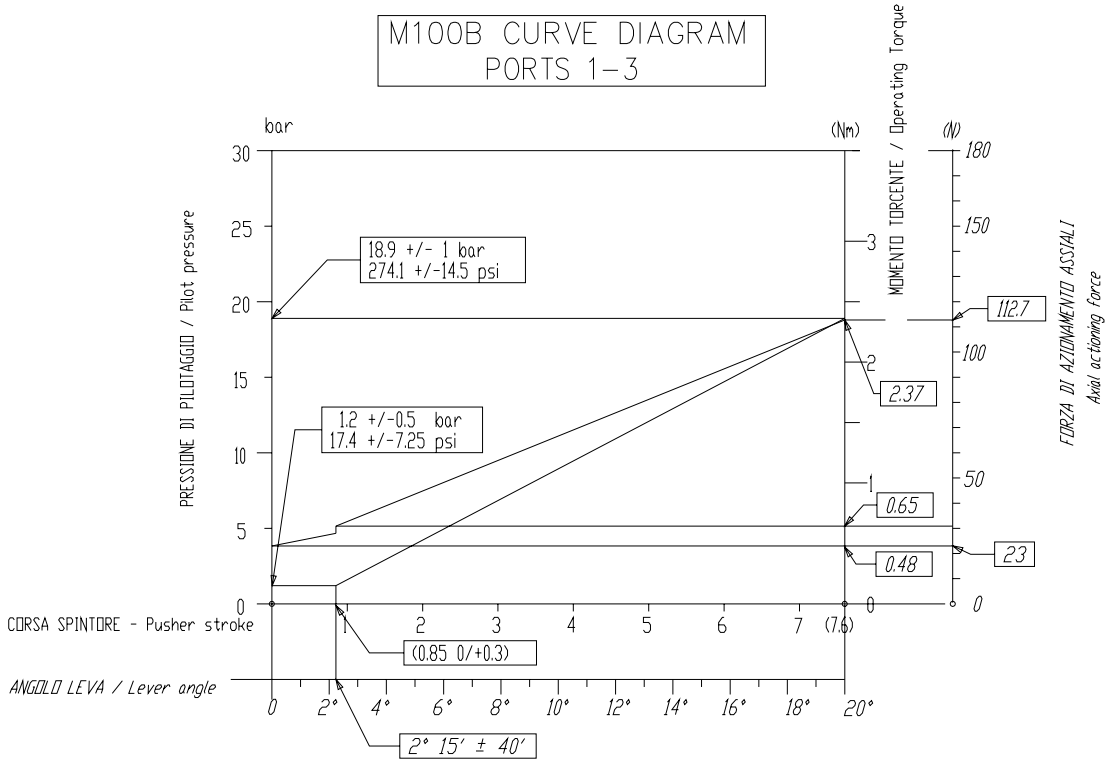


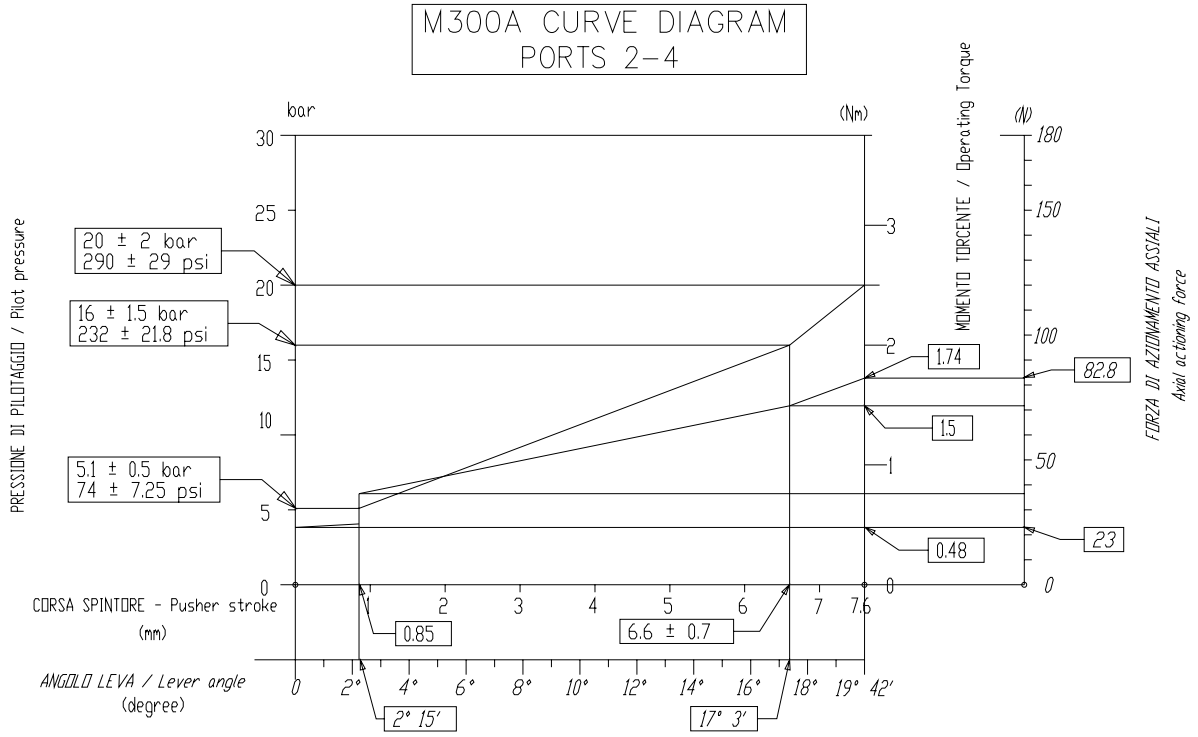
WORING HAND LEVER NOZZLE TABLE:

handle oil port	Multiunit valve pilot port
1	V1
3	V2
2	V4
4	V3
P	PH(pilot oil sources block

Outside view and data of travel hand lever

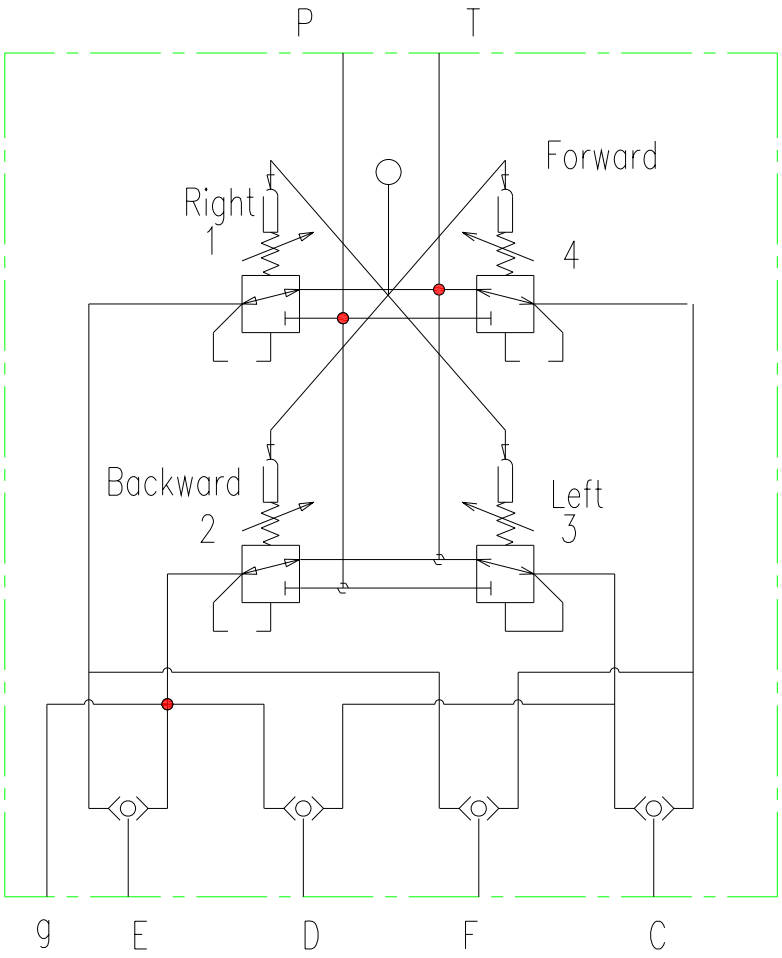






TECHNICAL FEATURES	
Min primary pressure	30 bar(435.1 psi)
Max primary pressure	100 bar(1451 psi)
Max back pressure	3 bar(43.5 psi)
Min rated flow	5 l/min(1.32 gpm)
Max rated flow	20 l/min(5.28 gpm)
Hydraulic fluid	mineral oil
Kinematic viscosity	3-400 mm ²/s
Operating temperature	-10/+80°C(+14/+176°F)
Contamination	15/12(ISO/DIS 4406)
Histeresis max	0.5 bar(7.25 psi)
Internal leakage P=>T (435.1 psi)	10-18 cm ³/min 0.61-1.09 in ³/min
Max operating torque	10 daNm 73.8 lbft

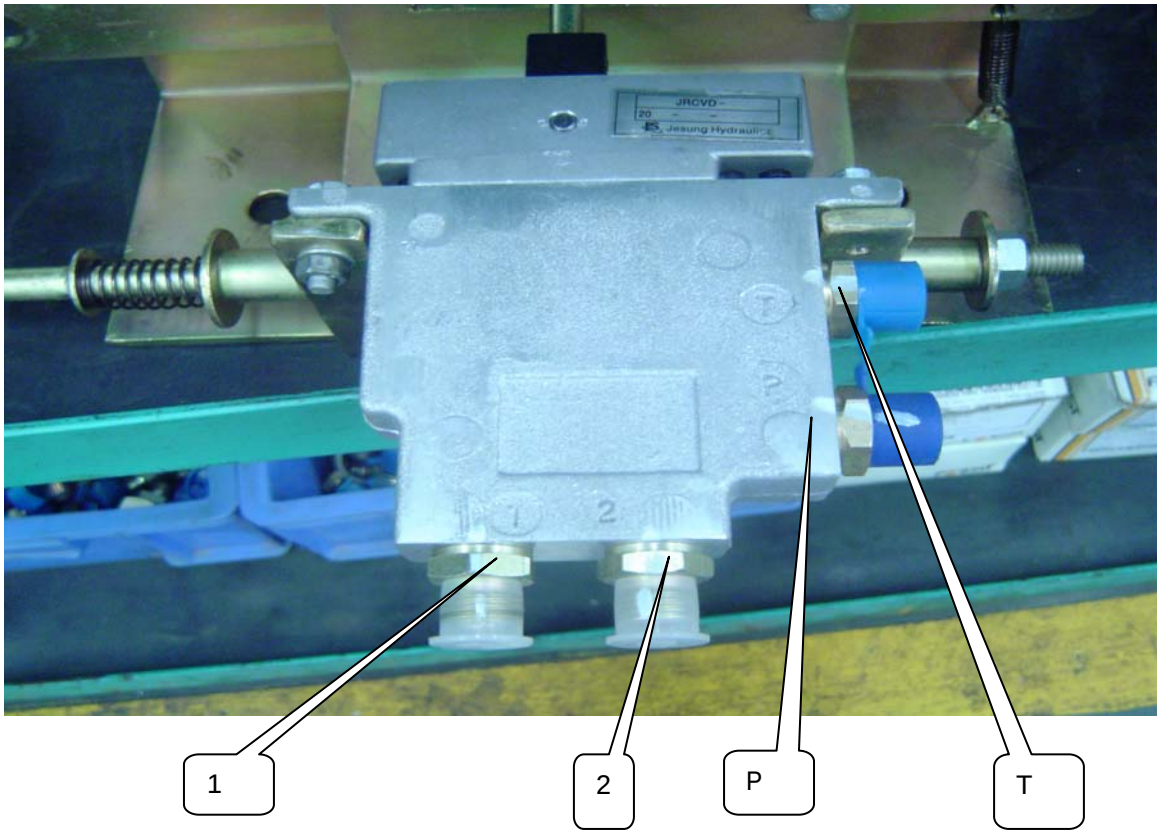
HYDRAULIC CIRCUIT



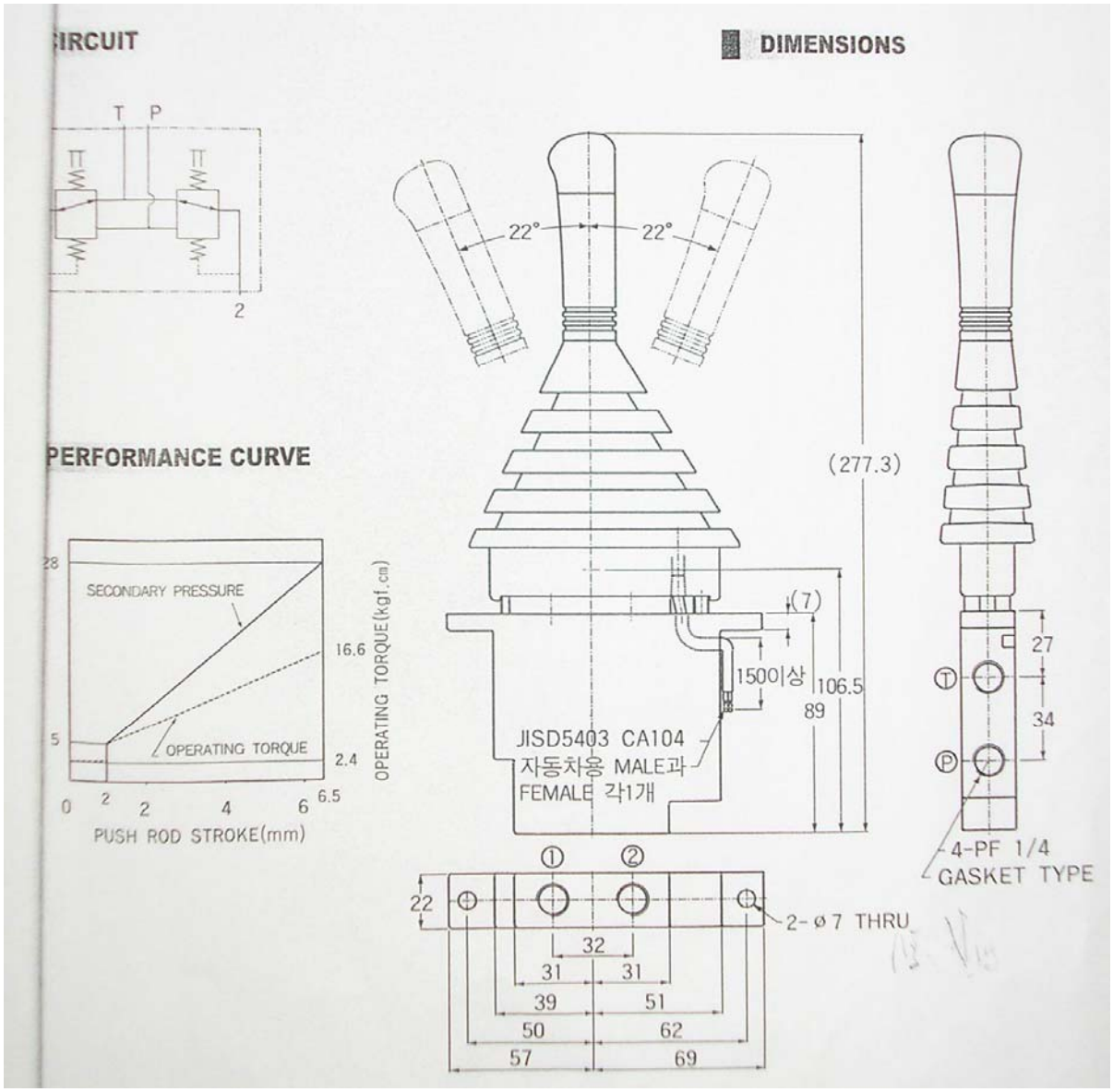
TRAVEL HAND LEVER CONNECTION：

Hand lever oil port	Travel pump pilot port
C	Front pump X1
D	Rear pump X1
E	Front pump X2
F	Rear pump X2
g	Signal connector for machine reversing
P	PV(pilot oil sources block)

4.6 PEDAL OPERATION VALVE



4.7 HYDRAULIC DIAGRAM

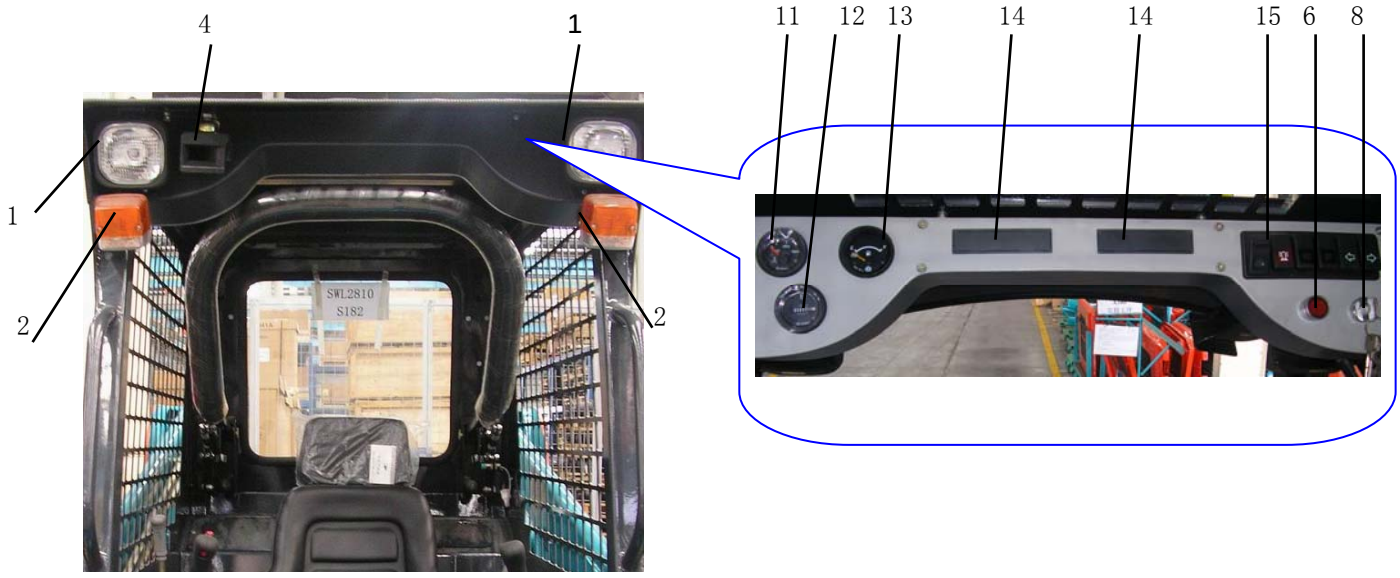


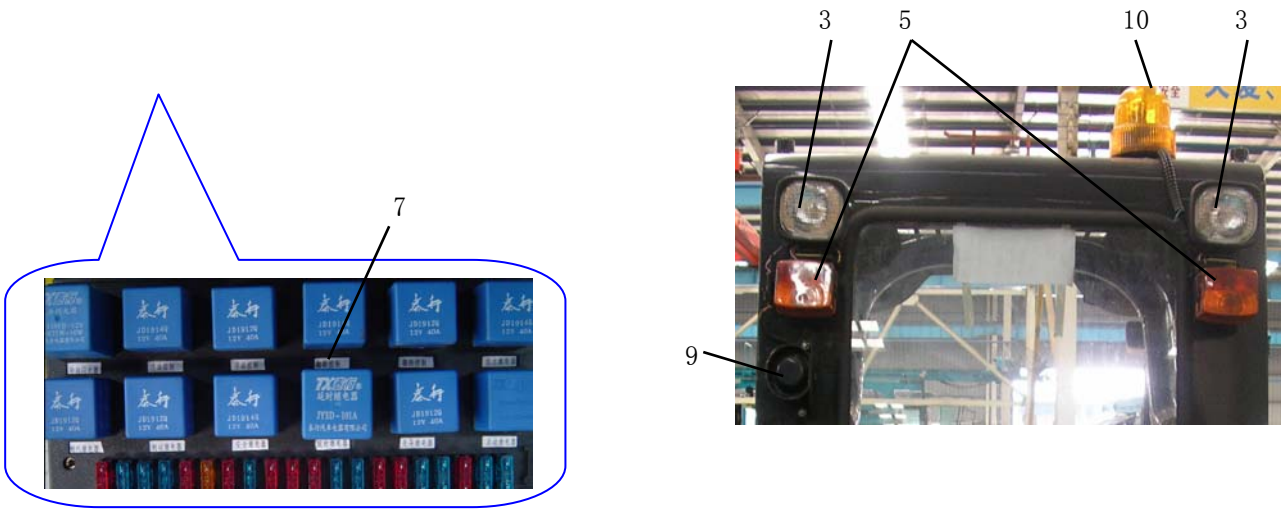
PEDAL VALVE NOZZLE TABLE：

Pedal valve oil port	Multiunit valve oil port
1	V5
2	V6
P	PH(pilot oil sources block)

5 ELECTRICAL SYSTEM

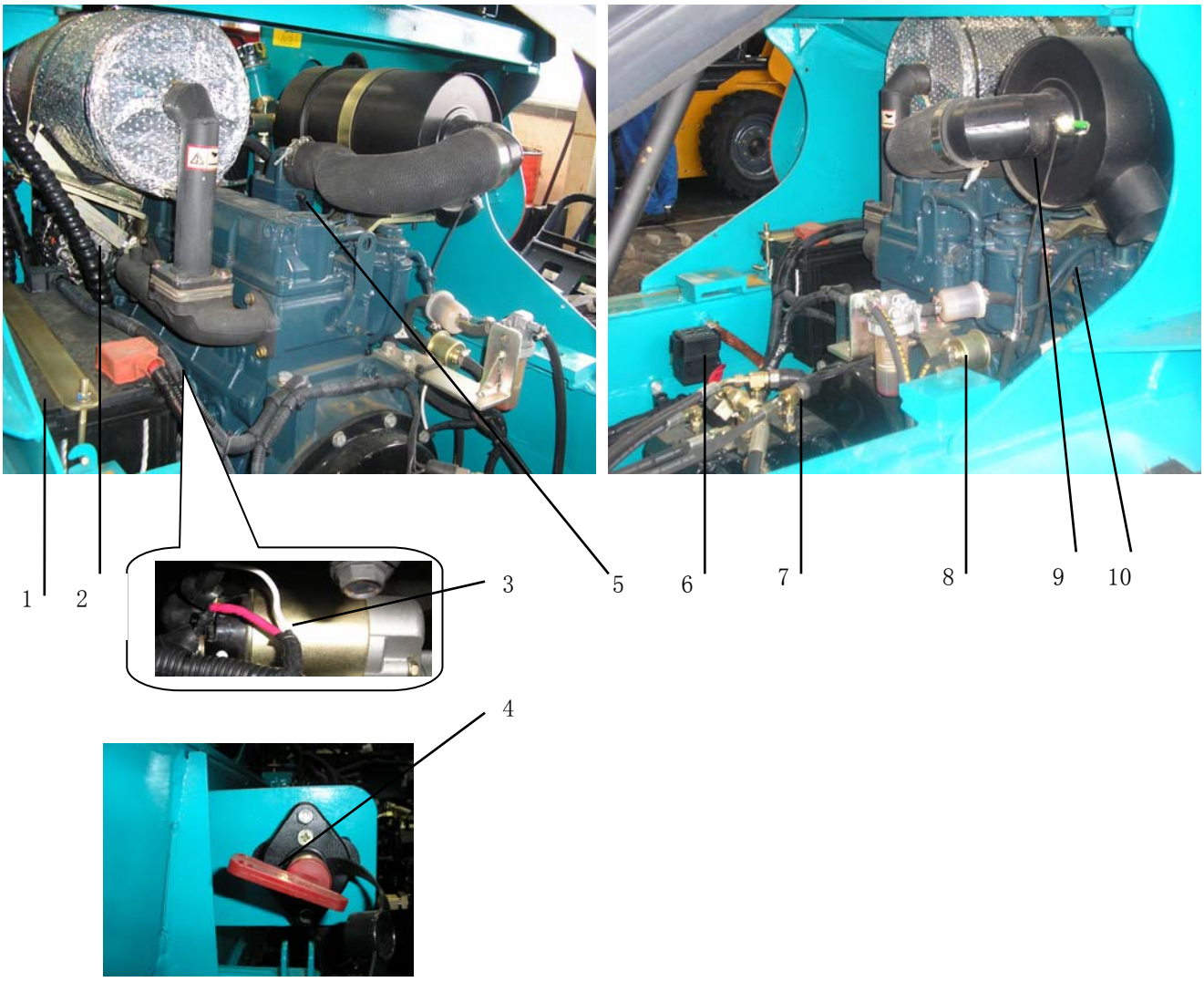
5.1 INSTALLATION SITE 1





1. Head work lamp 2.Head small lamp 3.Rear work lamp 4.Horn 5.Rear lamp
6. Enable switch 7. Fuses box 8.Start switch 9.Reversing horn 10.Beacon lamp
11.Water temperature meter 12.Hour meter 13. Fuel gauge 14.Indicators
15. Switch-group

5.2 INSTALLATION SITE 2



1. Battery 2.Alternator 3.Starter 4. Disconnect switch (Option)
5.Air heater(Preheating) 6.Relay box 7.Pressure switch 8.Fuel pump 9.Air filter
10.Stop solenoid valve

5.3 DIAGRAM

Code	Name and function
SQ2	Seat switch
SP1,SP2	Travel pressure switch
SP3	Brake pressure switch
SP4	Reversing pressure switch
L1~L5	Outline light
L6~L7	Head work lamp
L8~L9	Rear work lamp
L10~L11	Parking brake light
L12~L13	Turning light
L14	Beacon lamp
DL	Horn
SA0	Start switch
SA1	Working device switch
SA2	Beacon lamp switch
SA3	Clearance light /Head work lamp switch
SA4	Rear work lamp switch
SA5	Left Turning Light switch
SA6	Right Turning Light switch
SA7	Wiper switch
SA8	Warm air conditioner switch
SA9	High flow switch
S0	Enable switch
HL0	Enable switch lamp
S1	Disconnect switch
S2	Horn switch
S3	Boom float switch
S4	Washing switch
TR1	Water temperature sensor
TR2	Fuel sensor
TR3	Oil pressure sensor

Code	Name and function
K1	Start relay
K2	Protect relay
K3	Fast pull relay
K4	Delay relay
K5	Safety relay
K6	Pilot relay
K7~K8	Invert relay
K9	Brake indication relay
K10	Parking lamp relay
K11	Horn relay
K12	Flasher
K13~K14	Float relay
HL1	Brake indication lamp
T1	Delay module
XP	Maintainance power
DL1	Reversing horn
R0	Air heater
R1~R4	Resistance
D1~D7	Diode
HL0	Enable switch lamp
P1	Water temperature meter
P2	Fuel gauge
P3	Hour meter
E1~E8	Alarm lamp
TR5	Air filter sensor
TR6	Hydraulic oil filter sensor

Code	Name and function
BAT	Battery 12V
G1	Alternator
M1	Starter
F00	Main fuse
F01	Starting fuse
F02	Fast pull fuse
F0	Start switch fuse
F1	Safety switch fuse
F2	Meter fuse
F3	Clearance light fuse
F4	Head work lamp fuse
F5	Rear work lamp fuse
F6	Parking brake light fuse
F7	Horn fuse
F8	Float valve fuse
F9	Turning light fuse
F10	Beacon lamp fuse
F11	High flow valve fuse
F12	Warm air conditioner fuse
F13	Wiper fuse
M2	Wiper motor
M3	Washing motor
M4	Warm air conditioner
M01	Fuel pump
Y0	Fuel Valve
Y1	Pilot valve
Y2	Parking brake
Y3	Working device valve
Y4	Boom float valve
Y5	High flow valve
EDU	Indicators
SQ1	Safety-bar switch

5.4 CIRCUIT DIAGRAM

5.4.1 POWER AND ENGINE CIRCUIT

1. Power circuit

The cathode of battery is grounded through engine and chassis.

There are a mechanical type switch S1 on the battery(+)，the battery switch is always on the "ON" position when the machine is in operation.

When the ignition lock switch is on the "OFF" position, the current flows from the a battery anode as shown below：

- Battery + →disconnect switch S1→ main fuse F00 →
- Check point

→Ignition lock switch (B)
→Alarm lamp fuse F10→Alarm lamp switch SA2 →Alarm lamp L14→ GND
→maintenance power XP → GND
→High flow valve fuse F11→high flow switch SA9→high flow valve Y5→ GND

Engine	Ignition lock switch	Disconnect switch	Check point	Voltage
OFF	OFF	ON	①battery + - GND	DC10~14.5 V
			②fuse - GND	
			③switch - GND	
			④solenoid valve - GND	

※GND：Ground

※Disconnect switch S1, maintenance power XP, high flow switch SA9, high flow valve Y5 are assembled as options.

※ ATTENTION: When starting, the large displacement switch must be on the "ON" position, otherwise, the engine can not be started because of the large load.

2. Starting circuit

1) YANMAR diesel engine（SWL28）

Battery + →disconnect switch S1

Start switch position : ON

Start switch ON(Br)→ignition lock switch fuse F0

→starter (B+)
→main fuse F0
→alternator (IG)
→Stop solenoid valve Y0(hold-on solenoid)→GND
→Fuel pump M01→GND
→Delay module T1 (solenoid) →GND

Battery + →disconnect switch S1→fast pull Fuse F02→fast pull relay K3(normal open) →Stop solenoid Y0(start solenoid)→GND

- Start switch position : START

Start switch START(C) →relay K2 (normal close) → start relay K1 solenoid →GND

battery + →disconnect switch S1→start Fuse F01→relay K1(normal open)→starter (ST)→GND

- Start switch position: PRE-HEAT

Start switch PRE-HEAT (R1) → preheater R0→GND

2) KUBOTA diesel engine（SWL32）

Battery + →disconnect switch S1

Start switch ON (Br) → ignition lock switch Fuse F0 →Stop solenoid Y0(hold-on solenoid)→GND
→Fuel pump M0→GND

Start switch position: ON

- Start switch position : START

Start switch START(C)
→ Relay K2(normal close) →start relay K1 solenoid →GND
→Stop solenoid Y0 (start solenoid) →GND
→Preheating delay module T1→GND

Battery + →disconnect switch S1→start fuse F01→start relay K1 normal open →starter (B+)
(ST)→GND →main fuseF00 →start switch (B) →starter

Battery + →disconnect switch S1→main fuse F00→preheating delay module T1→air heater R0→GND

- Start switch position: PRE-HEAT

Start switch PRE-HEAT (R1)→preheating delay module T1→GND

Battery + →disconnect switch S1→main fuse F00→preheating delay module T1→air heater R0→GND

3) Check point

Engine	Start switch	Disconnect switch	Check point	Voltage
Operating	START	ON	①battery + - GND	DC10~14.5V
			②fuse - GND	
			③start switch - GND	
			④delay module - GND	
			⑤relay - GND	
			⑥air heater - GND	

GND：Ground

Disconnect switch S1 is assembled as an option.

Attention:

※ Do not operate the starter lock on the “START” position for more than 30 seconds。

※ Do not operate starter lock switch on the "START" position after the machine is started.

DANGER: Do not disconnect or shorten any lead wire while the starter is operating.

3. Charging circuit

Operator releases the start lock switch from the "START" position to the "ON" position after the machine is started.

Charging current generated by the operating alternator flows into the battery, it also flows from the alternator to each electrical component.

1) Circuit flow

⑴Charging circuit

Alternator B →disconnect switch S1→battery +
→main Fuse F00→start switch B
→alarm lamp fuse F10
→high flow valve fuse F11

⑵ Charging alarm circuit

When the machine is not yet started and the ignition lock is on the "ON" position, generator does not make electricity, so the indicator light for charge is on. After the machine is started, generator starts to make electricity, so the indicator light for charge is off.

Start switch on the "ON" position → start switch ACC →instruments fuse F2 →charging indicator light E2 →alternator (L)

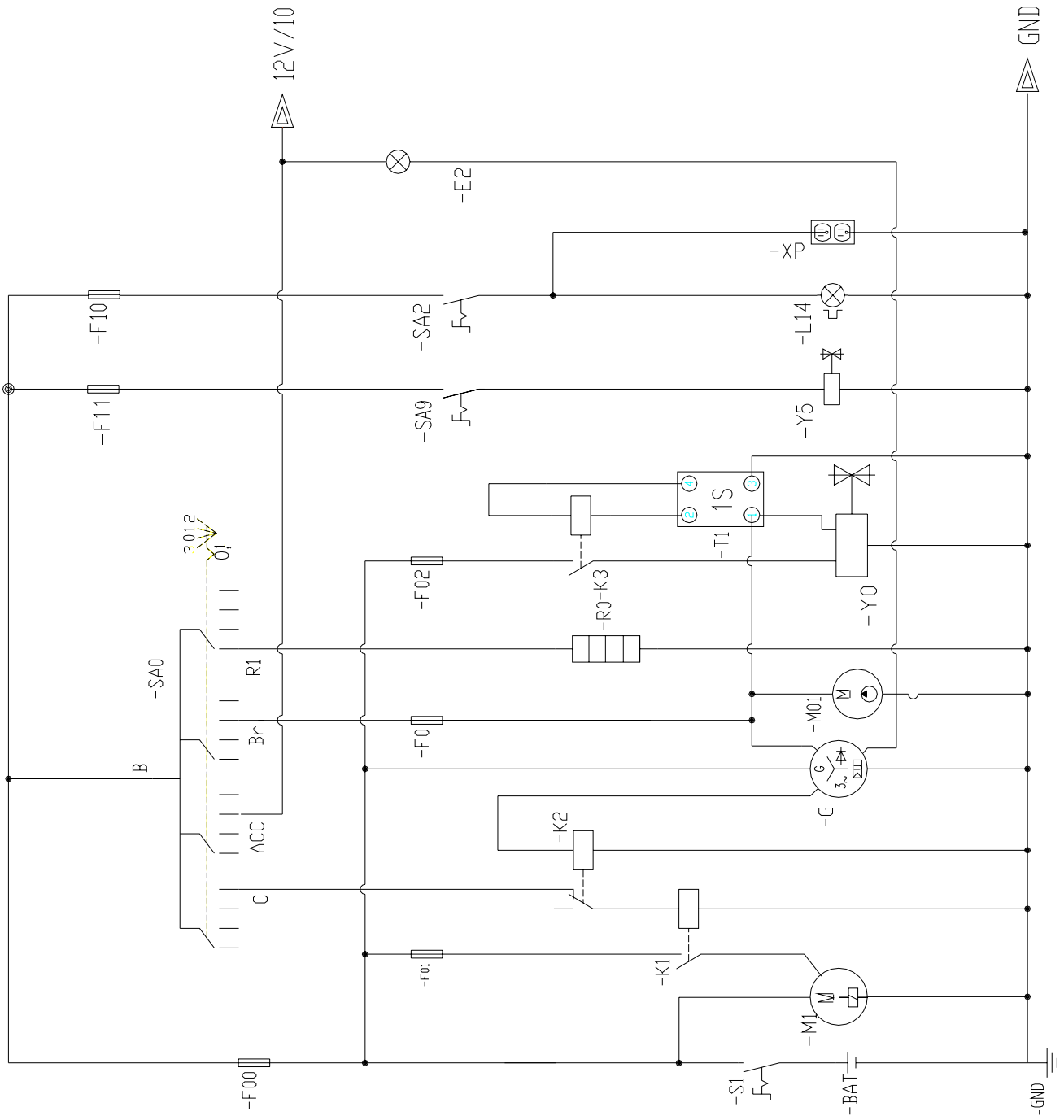
2) Check point

Engine	Start switch	Disconnect switch	Check point	Voltage
Operating	START	ON	①battery + to GND	DC10~14.5V
			②fuse to GND	
			③alternator B to GND	
			④alternator IG to GND	
			⑤charging indicator light E2 to GND	

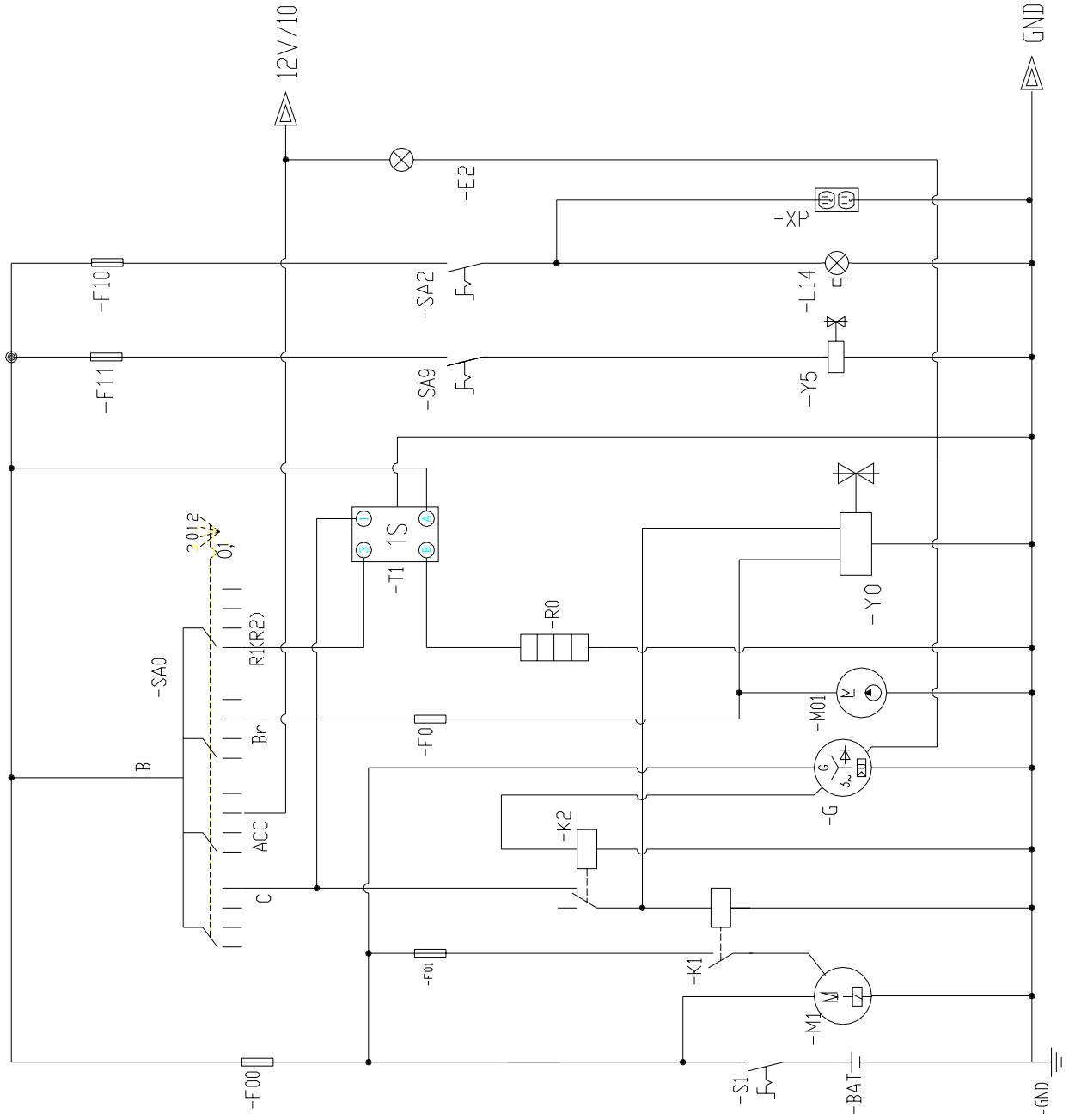
GND：Ground

Disconnect switch S1 is assembled as an option

- **When using an arc welder, always cutoff disconnect main switch to avoid damaging the alternator and battery.**
- **Attach the welder ground clamp as close to the weld area as possible to avoid damaging the bearings of the alternator from welding current.**
- **Do not disconnect the battery when the engine is running. The voltage surges can damage the diode and resistors of the electrical system.**
- **Stop the engine and ensure the switch on the "OFF" position before cutting off the electric wire.**



Power and engine circuit -------YANMAR（SWL28）



Power and engine circuit -------KUBOTA engine（SWL32）

5.4.2 Safety and protection of circuit

1) Safety circuit

For the sake of safety, two interlockers i.e. seat switch and safety bar switch are installed. Only when operator sits correctly, and gets the safety bar ready, the machine is likely to travel or do other tasks.

Circuit flow

Start switch position ON → start switch ACC →Safety Switch Fuse F1→

→safety relay K5（normal close）→safety light E7 →GND
→safety bar switch SQ1→GND
→delay relay K4（ solenoid ）→Seat switch SQ2→GND
→safety bar switch SQ1→delay relay K4（delay point）→safety relay K5→GND

2) Parking brake protection circuit

When safety interlockers are closed, brake parking system will be opened.

Start switch position ON → start switch ACC → Safety switch fuse F1→relay K9 (normal close) → parking brake light HL0→GND

- First push brake switch S0，circuit flow：

Safety Switch Fuse F1→safety relay K5（normal open）→

→Brake switch S0(1)→Pilot relay K6（ solenoid)→GND
→relay K6 (normal open) or S0 (1) →

→Resistance R2→relay K7 (normal open) → Brake switch S0 (2) →GND
→Resistance R1→relay K8 (solenoid) →diode D1→Enable switch S0 (2)→ GND
→diode D2→relay K8（normal open）→GND
→Resistance R2→relay K7(solenoid)→diode D2→relay K8（normal open）→GND
→Pilot solenoid valve Y1→GND
→Door limit switch SQ3→working device switch SA1→working device valve Y3→GND
→Brake valve Y2→diode D7→relay K8(normal open)→GND

Safety Switch Fuse F1→relay K9(solenoid) →relay K8（normal open）→GND

- Push the brake switch S0 again，circuit flow：

Safety Switch Fuse F1→safety relay K5（normal open）→

→Brake switch S0(1)→Pilot relay K6（ solenoid ）→GND

→Relay K6 (normal open) or S0 (1)→Resistance R1→relay K7(normal open)→S0(1) →GND

→Pilot solenoid valve Y1→GND

→Door limit switch SQ3→working device switch SA1→working device valve Y3→GND

Safety switch fuse F1→relay K9 (normal close)→ Parking brake lightHL0→GND

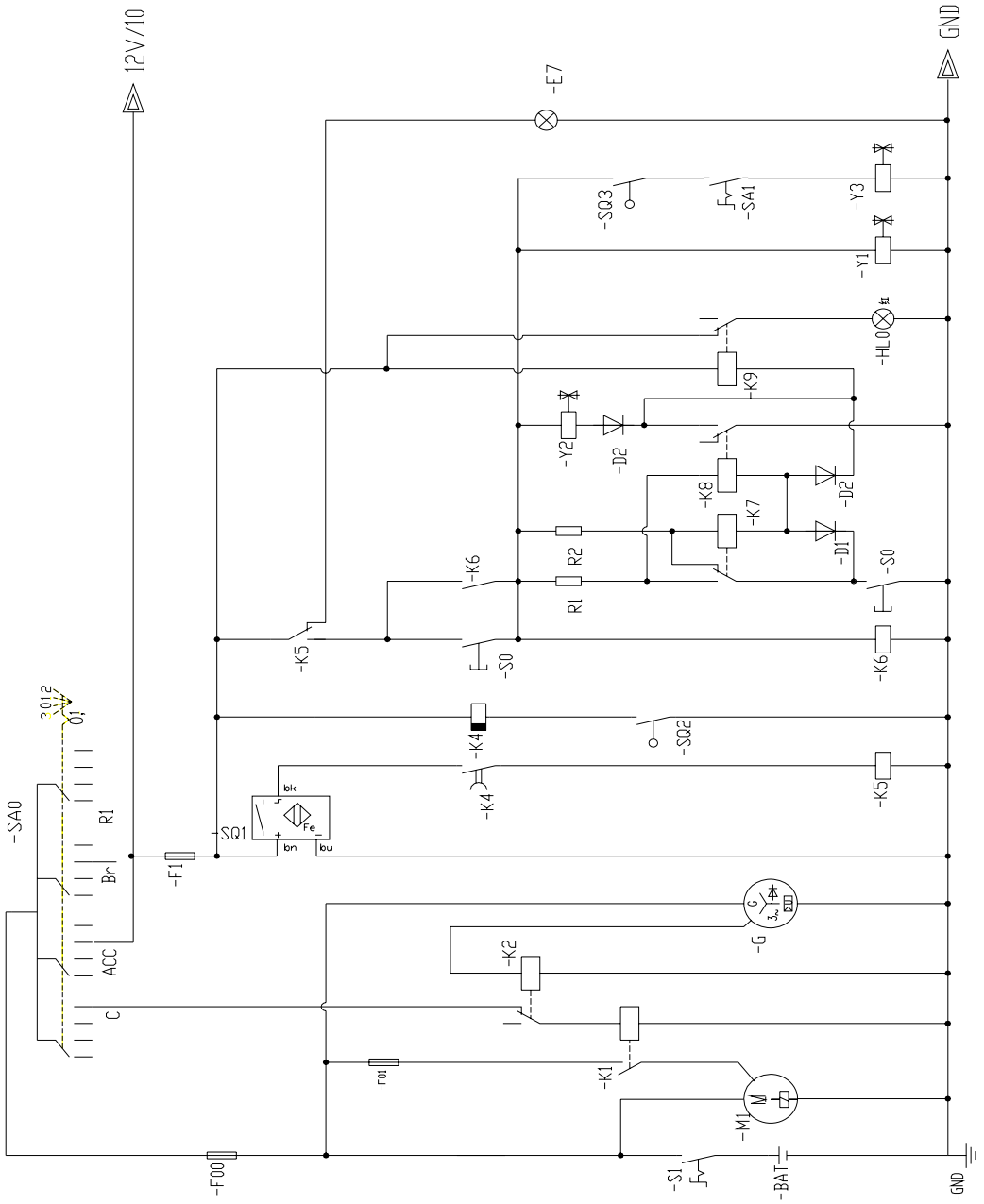
3) Check point

Engine	Start switch	Disconnect switch	Check point	Voltage
Operating/ OFF	ON	ON	①fuse - GND	DC10~14.5 V
			②relay - GND	
			③solenoid valve - GND	

GND：Ground

Disconnect switch S1 is assembled as an option

- **Do not disconnect the battery when the engine is running. The voltage surges can damage the diode and resistors of the electrical system.**
- **Stop the engine and ensure the switch on the “OFF” position before cutting off the electric wire.**



Safety protection circuit

5.4.3 MONITOR CIRCUIT

1) Circuit flow

Start switch position ON →start switch ACC →safety switch fuse F2→

→Water temperature meter P1 →water temperature sensor TR1→GND
→GND
→Fuel gauge P2 →fuel sensor TR2→GND
→GND
→Hour meter →GND
→Water alarm lamp E1→Water temperature sensor TR1→GND
→Oil pressure alarm lamp E3→oil pressure sensor TR3→GND
→Brake alarm lamp E4→pressure switch SP3→GND
→Air filter lamp E5→air filter sensor TR5→GND

Left (right) turning light switch →diode D5 (D6) → turning lamp E8→GND

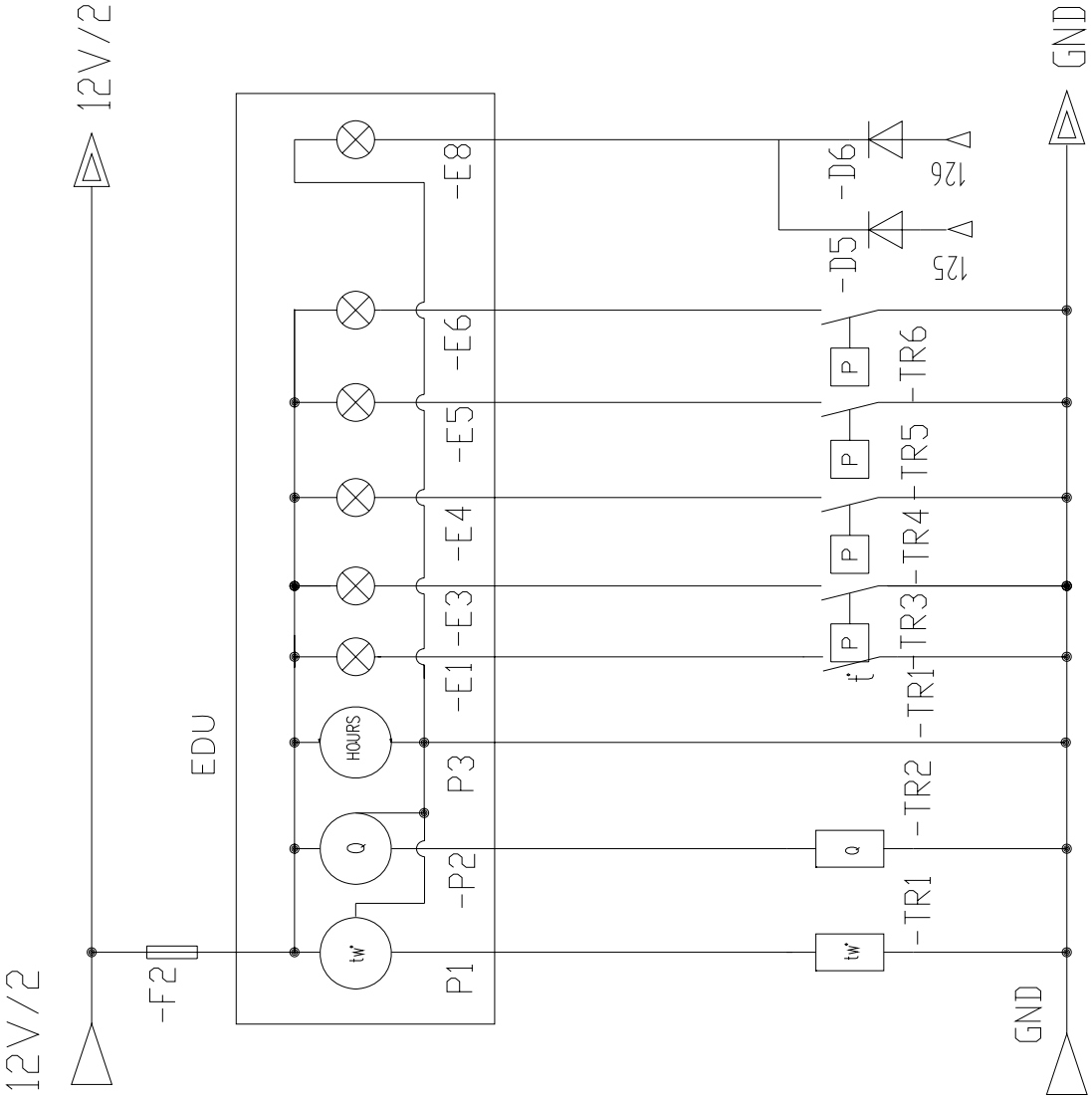
2) Check point

Engine	Start switch	Disconnect switch	Check point	Voltage
Operating/OFF	ON	ON	①fuse - GND	DC10~14.5V
			②instrument - GND	
			③alarm light - GND	

GND：Ground

Disconnect switch S1 is assembled as an option

Do not disconnect the battery when the engine is running. The voltage surges can damage diodes and resistors of the electrical system.



Monitor circuit

5.4.4 LAMP AND FLOAT CONTROL CIRCUIT

1) Circuit flow

Start switch position ON →start switch ACC→

→Safety switch fuse F3→outline light switch SA3 (I step) →outline light L1~L5→GND
→Safety switch fuse F4→outline light switch SA3 (II step)→Head work lamp L6~L7→GND
→Safety switch fuse F5→rear work lamp switch SA4→Rear work lamp L8~L9→GND
→Safety switch fuse F6→parking brake light relay K10 (solenoid)→ pressure switch SP1&SP2→GND
→parking brake light relay K10(normal open)→parking brake light L10~L11→GND
→safety switch fuse F7→horn relay K11 (solenoid) → horn switch S1→GND
→horn relay K11 (normal open) →horn DL→GND
→safety switch fuse F9→flasher K12 (solenoid) →GND
→flasher K12→left (right)Turning Light switch SA5(SA6)→left(right)Turning Light 12(E13)

Float control circuit:

→Safety switch fuse F8→Resistance R4→relay K13(normal close)→float switch S3→GND
→relay K13(solenoid)→diode D4→relay K14(normal open)→GND
→Resistance R3→relay K14(solenoid)→diode D3→float switch S3→GND
→diode D4→relay K14(normal open)→GND
→float valve Y4→relay K14(normal open)→GND

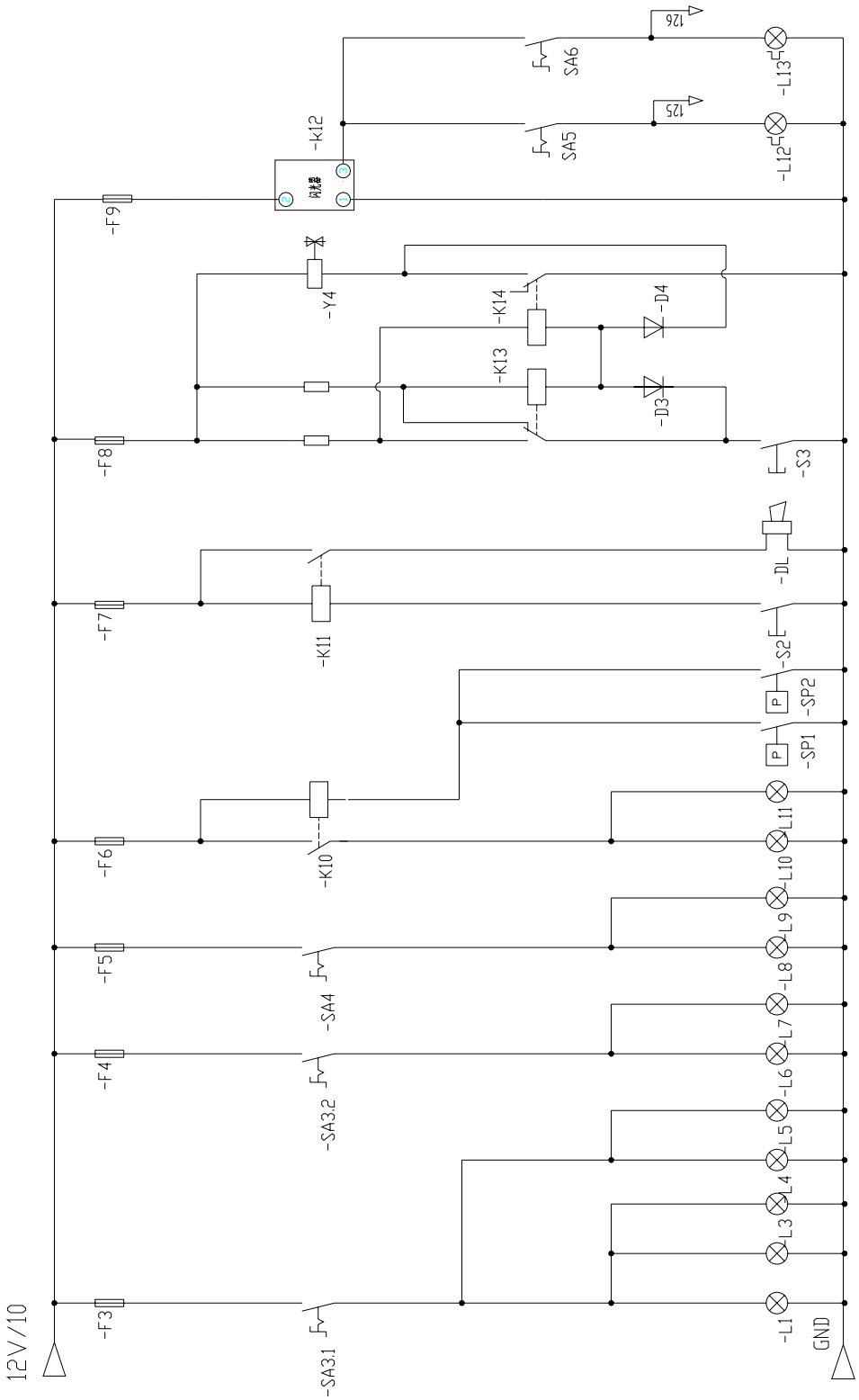
- Fist push float switch S3，Circuit flow：
- Push float switch S3 again，circuit flow：

→safety switch fuse F8→resistance R3→relay K13(normal open)→float switch S3→GND

2) Check point

Engine	Start switch	Disconnect switch	Check point	Voltage
Operating/ OFF	ON	ON	①fuse -GND	DC10~14.5V
			②relay -GND	
			③switch -GND	
			④light -GND	

GND：Ground



Lamp and float control circuit

5.4.5 OPTION CIRCUIT

1) Circuit flow

→Fuse F13 →wiper switch SA7 (I,II step) →wiper controller →wiper motor M2
→washing switch S4→wiper controller→ washing motor M3→GND
→pressure switch SP3→reversing horn DL1→GND
→fuse F12→warm air conditioner switch SA8 (I,II step)→warm air conditioner M4→GND

Start switch position ON → start switch ACC→

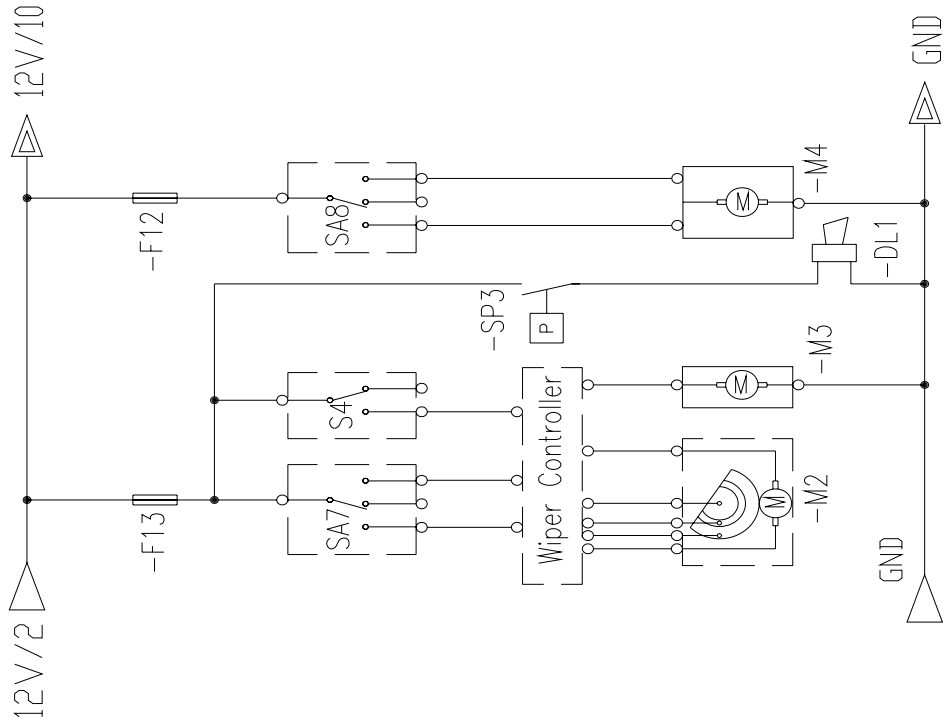
2) Check point

Engine	Start switch	Disconnect switch	Check point	Voltage
Operating/ OFF	ON	ON	①fuse-GND	DC10~14.5 V
			②wiper controller -GND	
			③switch -GND	
			④motor-GND	

GND：Ground

Wiper controller, wiper motor M2, Washing motorM3, Warm air conditioner M4 are assembled as options for closed cabin.

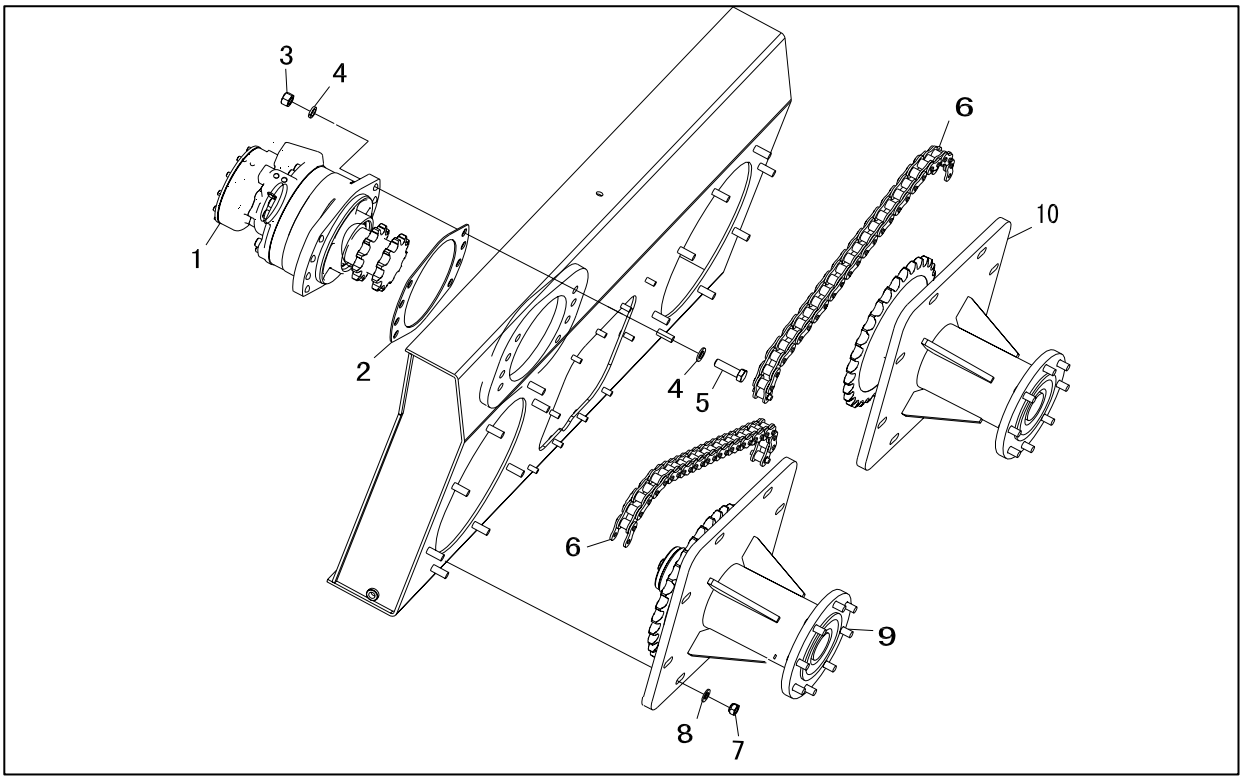
Pressure switch SP3, reversing horn DL1 are assembled as an option.



Option circuit

6 TRAVEL SYSTEM

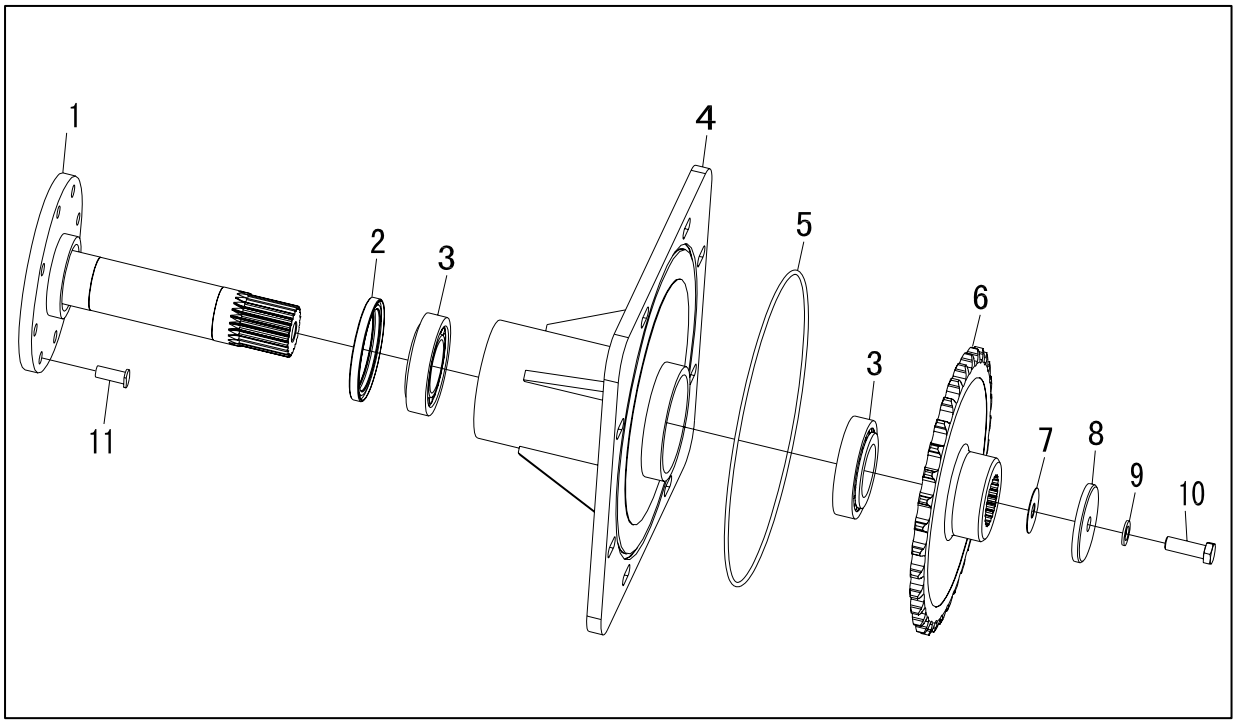
6.1 TRAVEL SYSTEM COMPONENT



TRAVEL SYSTEM

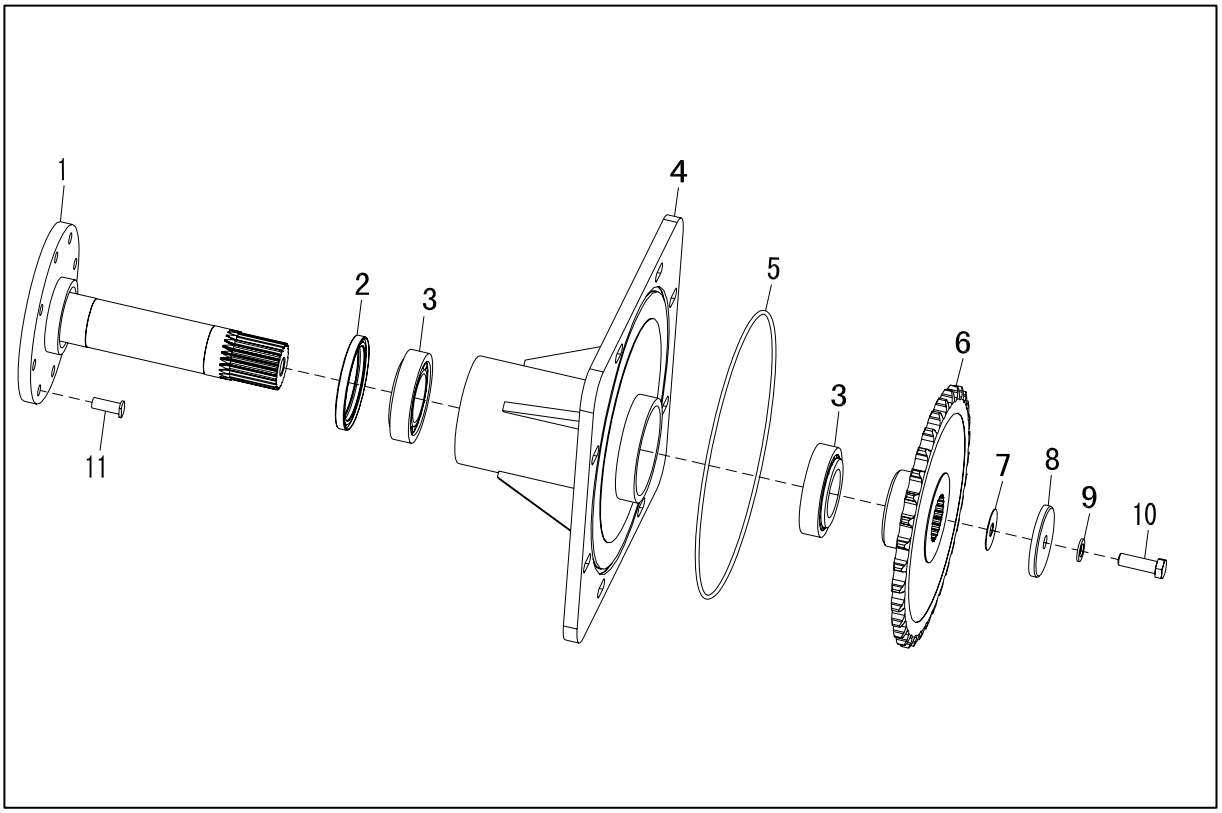
POS.	COD.	PART NAME	名 称	QTY	REMARK
1	730250000041	MOTOR	马达	1	
2	302030000728	RUBBER PAD	橡胶垫	1	
3	701427016001	NUT	螺母	8	
4	701504016003	WASHER	垫圈	16	
5	701103016048	BOLT	螺栓	8	
6	750313000014	CHAIN	链条	2	
7	701427014001	NUT	螺母	20	
8	701519014001	WASHER	垫圈	20	
9	814341000000	WHEEL SHAFT ASSY	前轮轴总成	1	
10	814341000000	WHEEL SHAFT ASSY	后轮轴总成	1	

6.1.1 WHEEL SHAFT



REAR WHEEL SHAFT

POS.	COD.	PART NAME	名 称	QTY	REMARK
1	814341020000	WHEEL SHAFT	轮轴	1	
2	730653000013	GASKET	骨架油封	1	
3	702104065002	BEARING	圆锥滚子轴承	2	
4	814341010000	WHEEL SHAFT	轮轴支座	1	
5	301020000025	O-RING	O 形圈	1	
6	306060000003	CHAIN WHEEL	链轮	1	
7	305070000011	CUSHION	调整垫	1	
8	305030000011	PRESS PLATE	压板	1	
9	701501016003	WASHER	垫圈	1	
10	701103016023	BOLT	螺栓	1	
11	751104000013	BOLT	滚花螺栓	10	



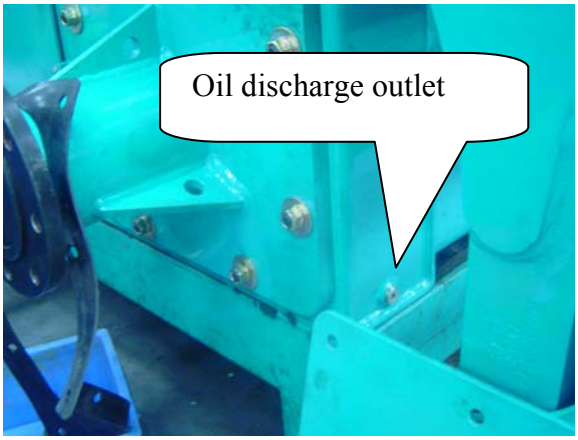
FRONT WHEEL SHAFT

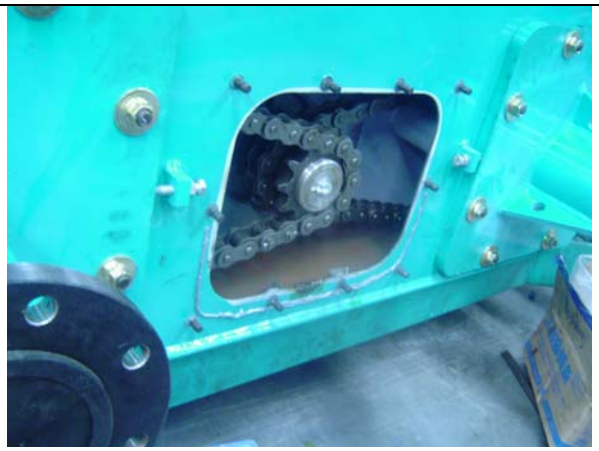
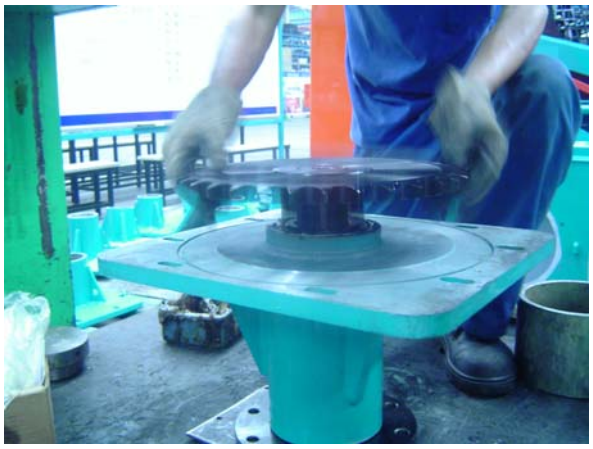
POS.	COD.	PART NAME	名 称	QTY	REMARK
1	814341020000	WHEEL SHAFT	轮轴	1	
2	730653000013	GASKET	骨架油封	1	
3	702104065002	BEARING	圆锥滚子轴承	2	
4	814341010000	WHEEL SHAFT	轮轴支座	1	
5	301020000025	O-RING	O 形圈	1	
6	306060000003	CHAIN WHEEL	链轮	1	
7	305070000011	CUSHION	调整垫	1	
8	305030000011	PRESS PLATE	压板	1	
9	701501016003	WASHER	垫圈	1	
10	701103016023	BOLT	螺栓	1	
11	751104000013	BOLT	滚花螺栓	10	

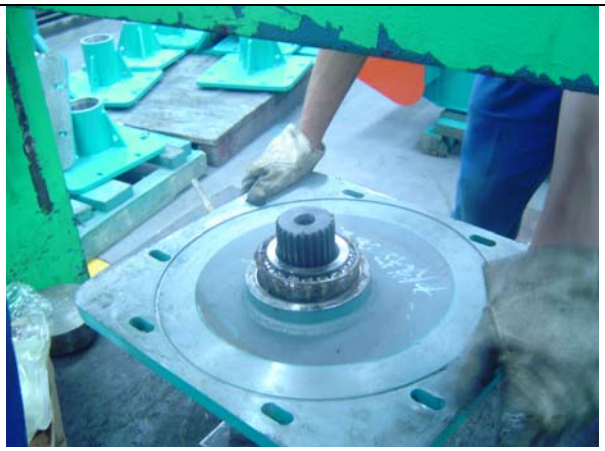
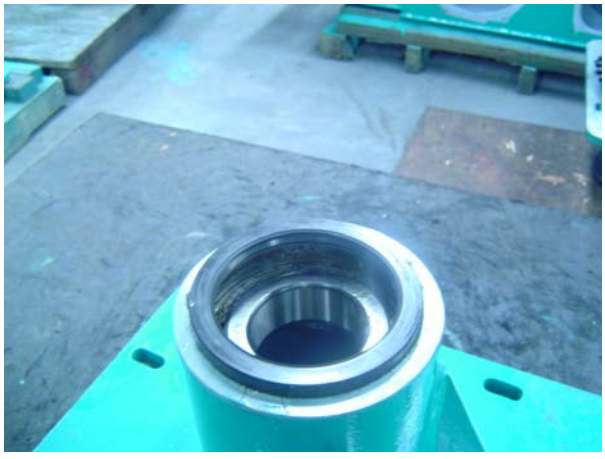
Notice: the different between the front chain wheel and the rear chain wheel is the direction of the boss. the boss of front chain wheel direction is inside. the boss of rear chain wheel direction is outside.

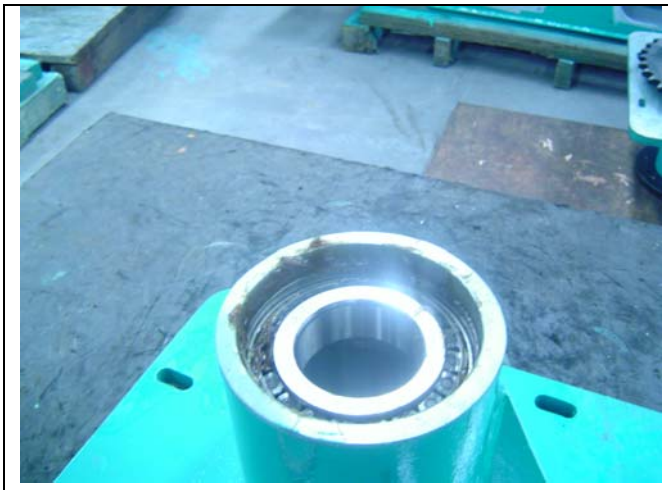
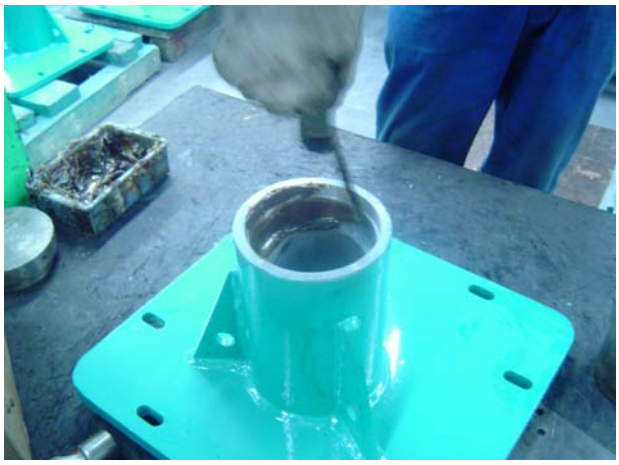
6.2 POWER TRAIN MAINTENANCE

6.2.1 REMOVAL OF THE FRONT WHEEL SHAFT AND REAR WHEEL SHAFT

	a. Clean the area of dirt and debris. b. Block the loader securely with four wheels clear of the ground.
	c. Remove the belly pan. d. Remove the wheels on the side of the machine that the travel motor is to be removed on.
	e. Remove the final drive lubricating oil drain plug at the front of the final drive housing and allow the oil to drain completely.

	f. Loose the lock nut, untie the chain wheel.
	g. Remove the axles.
	h. Remove the chain wheel of the axle.

	i. Remove the bearing of the axle.
	j. Remove the shift of the axle.
	K. Remove and discard oil seal.

	l. Remove the shaft of the axle.
	m. Remove the outer bearing cups with an inside bearing puller or brass punch. Be careful if using the brass punch.
	n. Clean the gears bearing cones and cups in a cleaning solvent. 2) Inspect the bearing cones and cups for flat areas，pitting，scoring and other damage. 3) Inspect the gears for flat areas pitting， Scoring and other damage.

6.2.2 CLEANING AND INSPECTION

1) Clean the gears， bearing cones and cups in a cleaning solvent.

2) Inspect the bearing cones and cups for flat areas， pitting， scoring and other damage.

3) Inspect the gears for flat areas， pitting， Scoring and other damage.

6.2.3 REPAIR OR REPLACEMENT

1) Replace the gears if they are pitted， scored or damaged.

2) Replace bearing cones and cups if they have flat areas, are pitted， scored or damaged.

If a bearing cone or cup is damaged, both parts must be replaced at the same time.

6.2.4 INSTALLATION

1) Shrink-fit bearing cups into the housing by refrigerating or cooling before pressing them into place.

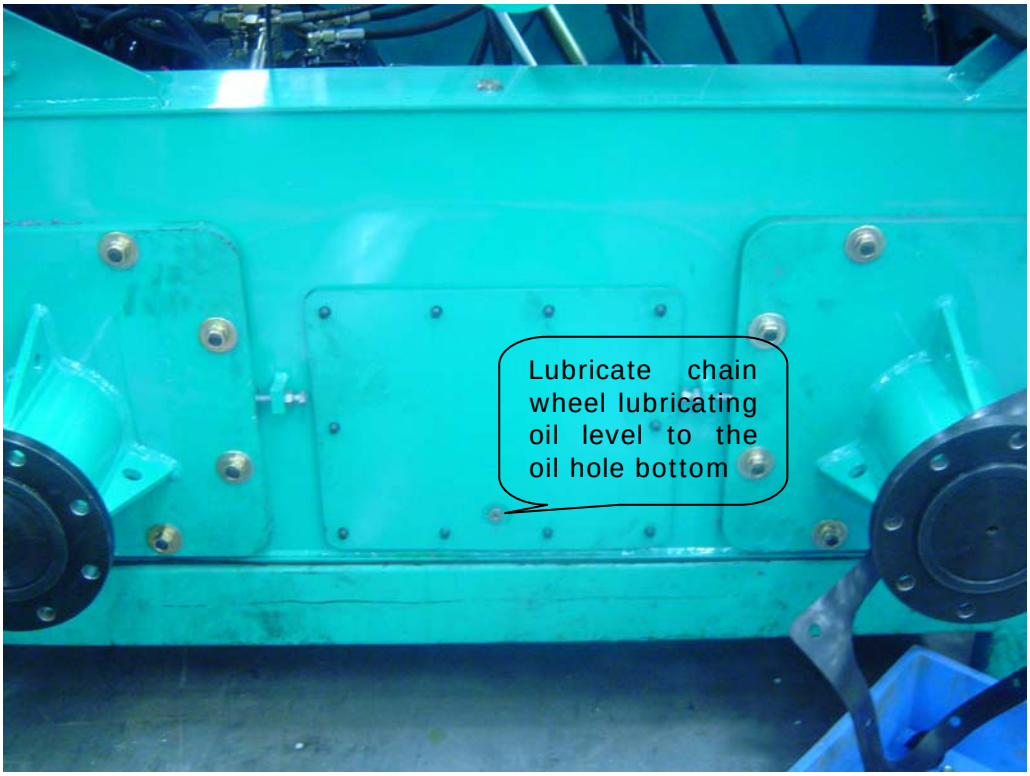
2) Lubricate the new oil seal and install with part number facing the flange end of the axle on the seal surface of the axle.

3) Heat or press the outer axle bearing cone into the axle Be sure the bearing is fully seated.

※If the bearing cone is heated use an induction type heater (Hot plate) .

4) When the bearing is cooled pack it with Multipurpose lithium bass grease.

5) Fill oil into the front and rear axle housing.



6) Install the axle assembly in the housing.

7) Pack the inner bearing cone with bearing grease.

8) Reach through the inspection cover opening and install the inner bearing cone on the axle. Make sure it is seated properly in the cup.

9) Reach through the inspection cover opening and install and sprocket on the axle. The hub end of the sprocket must face the flange end of the axle.

10) Place a bolt through the hole in the axle flange to prevent the axle from turning.

11) apply a gasket sealer to the outside of seal.

12) Install washer and nut.

13) Torque nut is close to 761bf. ft(1 03Nm) possible without backing off the nut to align the split pin holes.

Do not back off the nut.

1 4) Install a split pin through torque nut.

15) Secure the inspection cover and gasket to the final drive housing with four nuts.

7 MAINTENANCE

7.1 REQUIREMENT SERVICE

The machine has been designed and manufactured for giving the maximum autonomy with a minimum of maintenance. Before selling the machine SUNWARD has tested the machine to ensure an optimum working of the machine. To keep the machine in good working it is recommended to do maintenance program as described in this manual. In the following items it is described how to do the maintenance and in which intervals. For maintaining the efficiency of the machine it is recommended that only specialized person from SUNWARD SERVICE do the maintenance task, since they have the necessary tools to do the maintenance correctly and securely. All the services done to the machine has to be registered in a register table given with the machine. Only stuff from SUNWARD has the capacity to fill up the register table.

7.2 ADVICE FOR THE MAINTENANCE

- Keep the machine always clean and tidy. It makes much easier to find out troubles.
- Follow the recommendations given in the section 2 “security” to ensure your security and the security of the people around you.
- Before opening the engine hood, make sure all the security devices are engaged and the engine is stopped.
- Lower the boom and bucket to the ground when you need to check the hydraulic system.
- Apply the parking brake when going out from the machine.
- Raise the cabin following the recommendation .
- Always use the recommended oil and grease given in this manual.
- Before carrying out any maintenance, put warning plate for sure that nobody switches on the machine.
- Make sure you carry out the maintenance in a secure and flat place.
- Check and change the oil in a clean place to prevent dust or impurities getting into the tank.
- Wait after the hydraulic oil cools down to do any maintenance work.
- Never use flammable fluids to clean the machine.
- Never spray high pressure to the radiator, since it can damage it.
- Never spray water directly inside the cabin, since you can wet the electric system connectors or wetting the ignition switch.
- When working in dusty environment, check air filter, radiator, filters and electric components more often than usual.
- Take care before using the machine in mud or rainy weather to carry out a general lubrication. Clean the machine immediately after work under damp conditions in order to protect the different components from rust.
- Use the oil recommended in this manual. Use of another kind of oil could damage the machine. It is recommended not to mix the oil of different brands, neither to top up oil of different levels.
- Follow the current regulation for throwing out oils, filters, coolants and batteries, since they can damage the environment.
- Avoid the skin contacting with used oil since it could irritate it. If your eyes get in contact with oil, clear your eyes with plenty water and if discomfort persists, contact a doctor. In case of ingesting oil accidentally, contact as soon as possible a doctor.

7.3 DESCRIPTION FOR MACHINE MAINTENANCE

The following items describe different machines' parts and systems for a better understanding of doing the maintenance. This manual tries to go deeper in these parts or system that needs more attention in the maintenance.

7.3.1 ENGINE DESCRIPTION

This section describes or gives some advice about the engine. For deeper information about the engine, consult the engine manual which should be given together with this manual.

- The engine can be considered as the heart of the machine, so it needs a special attention.
- Take special care with the engine oil, since a good lubrication can extend the life of the engine.
- Use only oil recommended in this manual.
- Coolant containing antifreeze is flammable. Never contact this type of coolant with a flame.
- Use only coolant recommended in this manual. Never use any other coolant, since it could damage the rubber couplings.
- Take special care of the engine fuel, since a wrong fuel may damage the engine.
- Do not refill the tank fully, since it is recommendable to leave enough space for the expansion of fuel.
- When the fuel runs out or when the fuel filter has to be changed, the pipes needs to be drained.
- The fuel tank is located in the backside of the machine and has a capacity of 70L for SWL2810, 85L for SWL3210.
- Change all of fuel supply pipes every 2 years or 4000 hours (whichever occurs first).

7.3.2 SAFETY BELT

- Change the seat belt every 4 years.
- Check the situation of seat belt frequently.

7.4 MAINTENANCE PLAN

A maintenance plan has been described in this manual in order to maintain the efficiency of the machine and his parts. It is recommendable to follow this plan. Be aware of the working hours by reading the hour meter.

Write down all the maintenance assistance done to the machine in order to do a proper maintenance plan. The maintenance has to carry out by authorized and qualified persons.

The following table summarizes the entire maintenance plan.

TASKS	BS	50	100	250	500	1000	2000	WR
7.4.1.1 CHECKING ENGINE OIL LEVEL	X							
7.4.1.2 CHECKING ENGINE COOLANT LEVEL	X							
7.4.1.3 CHECKING FUEL LEVEL	X							
7.4.1.4 CHECKING HYDRAULIC OIL LEVEL	X							
7.4.1.5 CHECKING THE ELECTRIC CABLES	X							
7.4.1.6 CHECKING THE TIRES	X							
7.4.1.7 CHECKING THE SEAT BELT	X							
7.4.1.8 CHECKING THE LEAKING OF OIL	X							
7.4.1.9 CHECKING THE QUICK COUPLER	X							
7.4.1.10 CHECKING THE WATER AND SEDIMENTS SEPARATOR	X							
7.4.2.1 CHECKING THE COOLER PIPES		X						
7.4.2.2 CHECKING THE COOLANT LEVEL		X						
7.4.2.3 CHECKING THE TIRE PRESSURE		X						
7.4.2.4 CREASING THE PINS OF BOOM AND CYLINDERS		X						
7.4.2.5 CHECKING THE WHEEL NUTS DRIVING TORQUE		X						
7.4.3.1 CLEANING THE TERMINALS OF THE BATTERY			X					

7.4.3.2 CLEANING THE OIL TANK'S BREATHER			X					
7.4.3.3 CHECKING THE CYLINDER RODS			X					
7.4.3.4 GREASING ALL OF PINS			X					
7.4.4.1 CHECKING THE GEARING CHAIN TENSION				X				
7.4.4.2 ADJUST THE CHAIN IF NECESSARY				X				
7.4.4.3 CHECKING THE FAN BELT				X				
7.4.4.4 CLEANING THE RADIATOR				X				
7.4.4.5 CHECKING THE OIL LEVEL IN THE GEAR CHAIN BOX				X				
7.4.4.6 CHANGING THE ENGINE OIL				X				
7.4.4.7 CHANGING THE ENGINE OIL FILTER				X				
7.4.4.8 CHANGING THE FUEL FILTER				X				
7.4.4.9 CHECKING THE NUT TORGUE OF THE HYDRAULIC MOTOR AND THE HUB HOLDING TO THE CHASSIS				X				
7.4.5.1 CLEAN THE FUEL-WATER SEPATATOR					X			
7.4.5.2 CLEAN THE TIGHTENESS OF PUMP FIXING SCREWS					X			
7.4.5.3 CHECKING THE BATTERY FLUID LEVEL					X			
7.4.5.4 CHANGING THE HYDRAULIC OIL FILTER					X			
7.4.6.1 CHANGING THE OIL IN THE GEAR CHAIN BOX						X		
7.4.6.2 CHANGING THE HYDRAULIC OIL AND CLEAN THE SUCTION						X		
7.4.6.3 CHANGING THE AIR FILTER						X		
7.4.6.4 CHECKING THE PRESSURE OF PUMP AND VALVE						X		

7.4.6.5 CHANGING THE HYDRAULIC OIL TANK BREATHER						X		
7.4.6.6 CHECKING THE TIGHTNESS OF CYLINDER HEAD SCREW						X		
7.4.6.7 CHECKING THE LOOSENESS OF VALVE						X		
7.4.7.1 CHANGING THE COOLANT							X	
7.4.7.2 CHANGING THE SUCTION FILTER							X	
7.4.7.3 CHECKING THE STARTER AND ALTERNATOR							X	
7.4.8.1 DRAINING THE FUEL TANK								X

BS: Before Starting

WR: When Required

7.4.1 BEFORE STARTING

7.4.1.1 CHECKING ENGINE OIL LEVEL

- Cool down the oil if the engine was running before. In this case wait 15 minutes for cooling down the oil before carry out the check.
- For checking the oil level, raise the dipstick (see photo below) and read the oil marks on it. The oil sign should be between the Min. and Max. limit written on the dipstick.

- If the oil mark is lower than the minimum limit, refill engine oil as soon as possible. Refill the engine oil through the inlet shown in the right figure.

7.4.1.2 CHECKING ENGINE COOLANT LEVEL

- Cool down the coolant if the engine was running before. In this case wait 15 minutes for cooling down the coolant before carry out the check.

- The coolant level in the coolant tank should be between the two limit marks.
- If necessary, add coolant through the coolant cap (shown in the right figure).
- **Do not remove the coolant cap when the fluid is hot, since it could spray out violently and cause injury.**

7.4.1.3 CHECKING ENGINE FUEL LEVEL

- For checking the engine fuel level use the indicator located in the instrument panel. The indicator should comes on when turning the ignition key to position “ON”.

- If the fuel level is low, refuel before starting engine.

7.4.1.4 CHECKING THE HYDRAULIC OIL LEVEL

- Check the oil level through the gauge located in the backside of the hydraulic tank. The oil level has to be between the two limit marks on the gauge. Refill with the suitable oil if necessary.
- When refill hydraulic oil, do not exceed the Maximum limit.
- The level must be checked with the machine in a level surface and the oil cooled down.
- Check the hydraulic circuit when an abnormal decrease of the oil level is observed.
- Before check the level in the gauge, release the pressure inside the hydraulic tank by loosing the filling cap.
- Before check the level in the gauge, release the pressure inside the circuit by lowering slowly the hydraulic cylinders.

7.4.1.5 CHECKING THE ELECTRIC CABLES

- **Make sure all relays and fuses are well fastened and there are not loosen cables or connections.**

- **Make sure there is no sign of short circuit in the electrical system.**
- **Make sure there is no corroded cable or fuses. Change all the corroded cables or fuses with same character.**

7.4.1.6 CHECKING THE TIRES

- **Over inflated or overheated tires could burst during operation of the machine.**
- **Check visually the state of the tires. Make sure there are not cracked and make sure there are not wore out points.**
- **Check manually that all the nuts are tightened well.**

7.4.1.7 CHECKING THE SAFETY BELT

- **Check visually the screw and nuts that fasten the security belt. Make sure they are in good condition.**

7.4.1.8 CHECKING THE LEAKING OF OIL

- Check visually the hydraulic oil circuit and make sure there are no leaking in it. If any leaks appear, repair it immediately.
- Clean the spilled oil if there is.

7.4.1.9 CHECKING THE QUICK COUPLER

- **Check visually that the two coupler-pins are engaged. If any of the mechanisms is loosen (this means one or two pins are not engaged), you and the people around could result injured or even death.**
- **Never stand under the bucket, when the boom is raised.**

7.4.1.10 ECKING THE WATER AND SEDIMENTS SEPARATOR

- The fuel filter has a separator for water and sediment that it is recommendable to drain every time you start the engine.
- The water and sediment separator is located in the engine compartment. See the picture.
- When the ring floats on the water present in the separator, it needs draining. Do the following procedures:
    1) Close the handle to cut the flow of fuel to the separator.
    2) Loose the wring in the bottom side of the separator. Drain the water until clear fuel flows out and close the wring.
    3) Open the handle to let the fuel flow into the separator.
    4) Drain the fuel tank .
    5) Bleed the fuel supply circuit .

7.4.2 EVERY 50 HOURS OF OPERATION

7.4.2.1 CHECKING THE COOLER PIPES

- **Check the entire cooler pipes for any leakage. The machine could overheat if a big quantity of coolant spells out. The hydraulic circuit could result damage if a big quantity of oil spells out.**

- **The operator has to conscious of he importance of the coolant system and also of the hydraulic circuit.**

7.4.2.2 CHECKING THE COOLANT LEVEL

- Cool down the engine in case it was running before. In this case wait 15 minutes for cooling down the engine before carry out the check.
- Carry out the check with the machine on an level surface.
- Loosen the radiator cap slowly in order to release the pressure inside the radiator.
- Add coolant to the radiator if necessary.
- **Do not remove the radiator cap when the fluid is hot, since it could spray out violently and cause injury.**
- **Make sure there is not air leakage in the radiator-expansion tank tube. It could mark the wrong coolant level.**

7.4.2.3 CHECKING THE TIRE PRESSURE

- **Never exceed the pressure recommended in this manual. The tire could blast, you or the people around could result injured or even death .**
- **While inflating the tires never stand beside to the tires.**
- **While inflating the tires make sure you use the proper equipment.**
- **In case a tire has lost the entire air, only specialized person can repair it.**

7.4.2.4 GREASING THE PINS OF BOOM AND CYLINDERS

- Grease the pin located in the top of the boom. (See drawing 5.3.5 Lubrication point)
- Grease the pins that connect the cylinders (See drawing 5.3.5 Lubrication point)

7.4.2.5 CHECKING THE WHEEL NUT DRIVING TORQUE

- Check the wheel nut torque every 50 hours. Refer to the following table.

Driving Torque for Wheels	
Front Wheels	Rear Wheels
150 Nm	150 Nm

7.4.3 EVERY 100 HOURS OF OPERATION

7.4.3.1 CLEANING THE TERMINALS OF THE BATTERY

- Keep the battery terminals clean is very important, since it ensure a good electricity flow.。
- Clean the battery with gloves. Never clean the terminals directly with your hands.

7.4.3.2 CLEANING THE OIL TANK'S BREATHER

- Keep the tank breather clean is very important, since it ensures a pressure release inside the oil tank.

7.4.3.3 CHECKING THE CYLINDER RODS

- Make sure the cylinder rods are not corroded or damaged. It could reduce the machine's efficiency.

7.4.3.4 GREASING ALL OF PINS

- Grease the pins specified in the item 5. 8 Lubrication Points.

7.4.4 VERY 250 HOURS OF OPERATION

7.4.4.1 CHECKING THE GEARING CHAIN TENSION

- **Every transmission side is compound with 2 chains. One chain for one wheel.**

For checking the rear gearing chain tension proceed as follow:

1) Block the machine by pressing the Parking brake button.
2) Lift up the rear part of the machine and maintain it lifted by putting blocks under the machine (See picture below).
3) Fix a point on the perimeter of the tire. Try to do it in the highest position.
4) Try to move the entire wheel.
5) If the angle between the original position of the point and the turned position is more than 2 degree, the gearing chain is loosening.

Proceed on the same way for checking the other rear gearing chain.

Proceed on the same way for checking the front chain.

7.4.4.2 ADJUSTING THE CHAIN IF NECESSARY

Proceed as follow to tense the gear chain:

1) Remove the wheel.
2) Adjust the adjusting screw against the hub-holding plate (See picture below).
3) Loosen the screws that support the hub-holding plate (See picture right).
4) Turn the adjusting screw a few millimeters for tensing the chain.
5) Fasten the screws that hold the hub holding. Try to fasten the screws every 3 screws step by step.
6) Mount the wheel.

- **Try to do the adjustment on an level and clean surface. Make sure it is not slippery.**

7.4.4.3 CHECKING THE FAN BELT

- Check the engine manual

7.4.4.4 CLEANING THE RADIATOR

- Use jet of compressed air or low-pressure water for cleaning the radiator.
- If necessary use products available in the market specially prepared for cleaning radiators.
- **Never use oily products, since it facilitate the adhesion of dust and reduces the efficiency of the radiator.**

7.4.4.5 CHECKING THE OIL LEVEL IN THE GEAR CHAIN

- **The checking has to be carried out in an level surface.**

Proceed as follow to check the gear chain oil level:

1) Screw off the screw located in the bottom side on the chassis (See picture below).
2) If the oil reaches the high of the hole, there is enough oil. If the oil is lower than the hole, refill with the recommended type oil given in this manual.

7.4.4.6 CHANGING THE ENGINE OIL

- Proceed as follow to change the engine oil: refer to the ENGINE OPERATION AND MAINTENANCE MANUAL before you doing change the engine oil.
    1) Put a suitable container under the machine so that the oil can be drained into it.
    2) Remove the draining oil screw so that the oil flows into the container.
    3) During the oil is flowing remove the engine refilling cap, in order easy the flow.
    4) Check and clean the engine oil drain plug treads and sealing surface, install the drain plug.
    5) Refill with the recommended engine oil given in this manual.
    6) Fill the engine oil till the oil level to the H mark on the dipstick.
    7) Close the refilling cap.
- **Do not proceed to change the engine just after stopping the engine, since the oil is still hot. Wait a while until the oil cool down.**
- **Oil is considered special waste. It has to be collected following the current environment regulation.**

7.4.4.7 CHANGING THE ENGINE OIL FILTER

Proceed as follow to change the engine oil filters:

1) Unscrew the filter head with a suitable tool.
2) Clean the filter support.
3) Lubricate the seal of the new filter.
4) Screw the filter. Turn it by hands for a half turn.
5) Refill the engine with new oil. It has to be the oil recommended in this manual.
6) Start the engine and make sure the indicator for the engine oil pressure goes out.

- **Make sure you use the filter recommended in this manual.**
- **Do not proceed to change the engine oil filter just after stopping the engine, since the oil is still hot. Wait for a while until the oil cool down.**
- **Oil filters are considered special waste. It has to be collected following the current environment regulation.**
- **Use special spanner in order to ensure not damage the filter.**

7.4.4.8 CHANGING THE FUEL FILTER

- **Take into consideration that the fuel is flammable. Take care by handling with fuel.**
- **Use always the fuel filters recommended in this manual.**

Proceed as follow for changing the fuel filter located in the engine compartment (See picture below):

1) Remove the fuel filter.
2) Clean the gasket surface of filter head with a lint-free cloth.
3) Discard the O-ring.
4) Install a new O-ring.
5) Fill the new filter with clean fuel, and lubricate the O-ring seal with clean lubricating engine oil.
6) Install the new filter.

- **Make sure you use the filter recommended in this manual.**
- **Do not proceed changing the fuel filter just after stopping the engine, since the engine body is still hot.**
- **Oil filters are considered special waste. It has to be collected following the current environment regulation.**
- **Use proper tools only in order to avoid damaging the filter.**

7.4.4.9 CHECKING THE NUT TORQUE OF THE HYDARULIC MOTOR AND THE HUB HOLDING TO THE CHASSIS

- For the operator's security check the screw that hold the hydraulic motor to the chassis.

Take as reference the following driving torque given in the following table:

Driving Torque for Hydraulic Motor	160 Nm

- Check the driving torque that holds the hub-holding.

Take as reference the following driving torque given in the following table:

Driving Torque for Hub-Holding	160 Nm

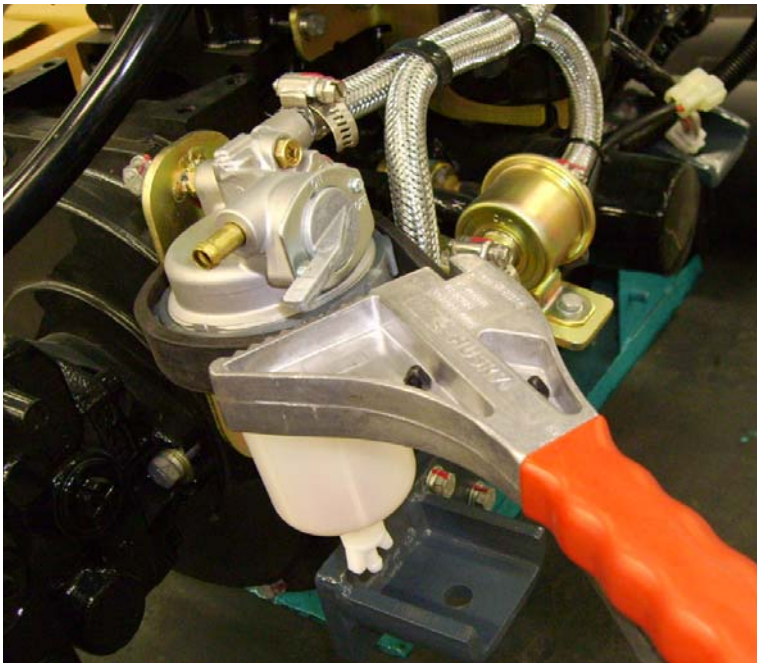
7.4.5 EVERY 500 HOURS OF OPERATION

7.4.5.1 CLAEN THE FUEL-WATER SEPARATOR

Proceed as follow for cleaning the fuel-water separator:：

1) Turn the handle to cut off the fuel flow into the separator.

2) Loosen the fuel-water separator by a ring (See picture below).



3) Clean the inner part of the separator with fuel.

4) Mount again the separator by tightening the ring again.

5) Release the handle to allow fuel into the separator.

6) Bleed the fuel circuit by turning a while ignition key to position START during 20 seconds.

- **Before precede to clean the separator cool down the engine.**
- **After bleeding the circuit, turn the ignition key to preheating position for 2 minutes and then start the engine.**
- **Take into consideration that fuel is a flammable fluid. Clean the spilled fuel in order to prevent risk of fire.**

7.4.5.2 CHECK THE TIGHTENESS OF PUMP FIXING SCREWS

- Check and if necessary tighten the screws of the gear pump fixing point.
- Take as reference the driving torque shown in the following tables:

Driving Torque for Piston Pump Elastic Coupler	Driving Torque for Gear Pump Piston Pump
130 Nm	130 Nm

7.4.5.3 CHECKING THE FLUID LEVEL OF THE BATTERY

For checking the fluid level of the battery proceed as follow:

1) Open the plug on the topside of the battery.
2) Check the acid level. The acid level has to be 6 mm above the plate edge.
3) Refill with distilled water if necessary.
3) Put back and tighten the plug.

- **Follow all the security regulation describes in the section 2.5.6.**
- **Park the machine on an level surface before checking the fluid level.**
- **In case you get in contact with the electrolyte, wash with plenty water and consult a doctor.**
- **Grease the terminals with special anti-oxidation if they are oxidized.**

7.4.5.4 CHANGING THE HYDRAULIC OIL FILTER

- **Never change the hydraulic oil filter when the oil is warm.**
- **Used filters must be collected following the local regulation.**

Proceed as follow for changing the hydraulic oil filter:

1) Remove the oil tank cap for releasing the remaining pressure inside the tank.
2) Remove the oil filter.
3) Renew the gasket when putting the new filter.
4) Put back the oil tank cap.

7.4.6 EVERY 1000 HOURS OF OPERATION

7.4.6.1 CHANGING THE OIL IN THE GEAR CHAIN BOX

Proceed as follow for draining the oil from the gear chain box:

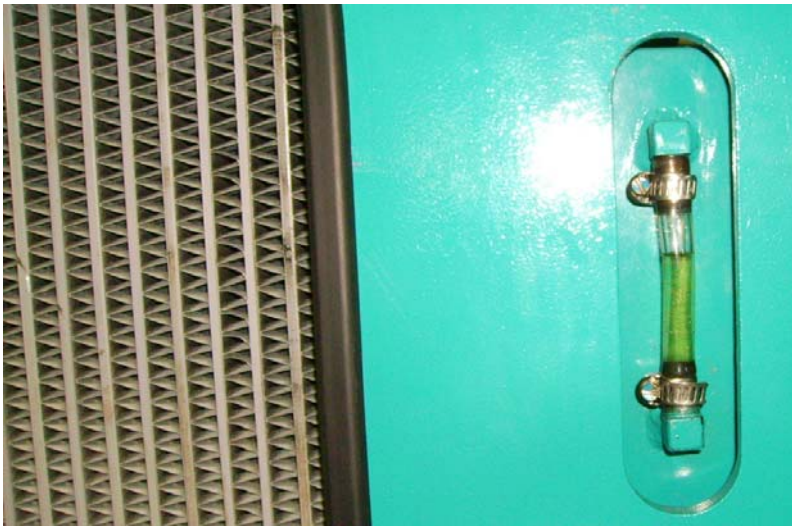
1) During the oil is hot (just after use the machine) screw off the drain plug located in the front part of the chassis (see picture below).
2) While the oil's draining screw off the screw located on the top of the chassis (see picture below).
3) Once the oil is drained screw on the plug located in the front part and fill through the plug located in the top until the oil reaches the lower edge of the hole. Only fill with oil recommended in the manual.
4) Tighten the screw located in the side.

7.4.6.2 CHANGING THE HYDARULIC OIL AND CLEAN THE SUCTION

Proceed as follow to change the hydraulic oil:

1) Park the machine on a level surface and release the residual pressure by moving a few times all the cylinders. Lower the boom and rest the bucket on the floor.
2) Cool down the oil by waiting a few minutes.
3) Remove the filling cap from the hydraulic tank.

4) Position a suitable container under the machine, so that the oil can flow into it.
5) Turn on the cock located under the hydraulic tank (See picture below).
6) Fill the circuit again with recommended hydraulic oil given in this manual.
7) Make sure hydraulic oil reaches the desiderate level. After the oil level has reached his level, the hole is completely full of oil when removing the plug in the piston pump.
8) Also check the oil level on the gauge located in the backside (See picture below).



9) If the gauge does not mark the maximum level and in the pump the hole is completely full, top up with oil recommended in this manual.
10) Wait a few minutes before operate the machine.
11) Move slowly every hydraulic cylinder.
12) Check again the gauge and in case it needs, refill it with more oil.

- **Never start the engine with empty oil tank, since it could damage hydraulic components.**
- **Hydraulic oil is considered as danger for the environment, since it can damage it. Throw the oil following the local regulations.**

7.4.6.3 CHANGING THE AIR FILTER

- **Always when the indicator of air filter pressure in the panel comes on, change the filter.**
- **Never wash the air filter, always change it with a new one.**
- **Never run the engine without air filter.**

Proceed as follow to change the air filter:

1) Stop the engine and wait till it cools down.
2) Loose the three flanges (1) that close the filter. Remove the cap (2).
3) Remove the filter (3) inside from inside. If necessary remove the part inside the filter (4).

4) Clean inside the filter-container.
5) Introduce the new filters carefully inside the filter-container.
6) Tighten the flanges and close the filter-container. Make sure the air's entrance (5) is in the bottom side of the air filter.
7) Make sure the switch (6) is connected.

7.4.6.4 CHECKING THE PUMP'S PRESSURE AND THE VALVE

7.4.6.5 CHANGING THE HYDRAULIC OIL TANK BREATHER

7.4.6.6 CHECKING THE TIGHTNESS OF THE CYLINDER HEAD SCREW

7.4.6.7 CHECKING THE LOOSENESS OF THE VALVE

7.4.7 EVERY 2000 HOURS OF OPERATION

7.4.7.1 CHANGING THE COOLANT

- **Never change the coolant just after stopping the engine, since the coolant is still warm. Let the coolant cool down until it goes under 40-45˚C.**
- **Never loosen the coolant cap when the coolant is still hot. Warm water could spill out violently and produce burnings.**
- **Always loose the coolant cap slowly, in order to release the pressure inside the coolant tank.**

Proceed as follow for changing the coolant:

1) Loosen slowly the coolant tank cap.
2) Open the drain plug located in the bottom side of the radiator (See picture below).
3) Remove the drain plug located in the bottom side of the engine.
4) Drain the coolant until it stops to flow.
5) Put on and screw up the two drain plug again.
6) Refill with the recommended coolant described in this manual.
7) Start the engine and let it run at idle speed for a while.
8) Stop the engine.
9) Check the coolant level. If necessary refill until the level reaches the right level.

7.4.7.2 CHECKING THE STARTER AND ALTERNATOR

7.4.8 WHEN REQUIRED

7.4.8.1 DRAINING THE FUEL TANK

- **Drain the fuel tank always with temperature exceeding 0˚C and before starting the machine. If the temperature is lower than 0˚C drain the fuel tank after using the machine, to prevent the condensate.**

Proceed as follow for draining the fuel tank:

1) Remove the fuel tank cap.
2) Position a container under the draining valve located in the bottom side of the chassis.
3) Release the draining valve.
4) Led the fuel flow totally.
5) Close the draining valve.
6) Refill the tank with the fuel type recommended in this manual.

7.4.9 TROUBLE SHOOTING

Trouble	Cause	Solution
Electric system		
Lamps do not work properly even with engine running at high speed	• Fault cables	• Check and repair any loose terminal and connection
Lamps come on intermittently with engine running	• Faulty fan belt tension	• Check the belt tension and adjust it or change it if it is necessary
Charge warming light dose not go out when the engine running, even at high speed	• Faulty alternator • Faulty cables	• Change • Check and repair
Alternator emits abnormal noise	• Faulty alternator	• Change
Starter does not work with key in START position	• Faulty cables • Battery charge insufficient • Faulty main fuse	• Check and repair • Charge battery • Change
Starter pinion engages and disengages while starting engine	• Battery charge insufficient	• Charge battery
Engine oil pressure warming light does not come on when engine is stopped	• Faulty bulb • Faulty pressure sensor	• Change • Change
Charging warming light dose not come on when engine is stopped	• Faulty bulb • Faulty cables	• Change • Check and repair
Hydraulic system		
Pumps emit abnormal noise	• No oil in the tank • Faulty pump • Hydraulic oil unsuitable for the temperature	• Refill oil • Check, then repair or change • Change the oil
Equipment moves only at low speed	• Faulty pump • Max. pressure valve setting incorrect, or valves closed due to impurities • Dirty drain filter	• Check, then repair or change • Reset or change • Change

Trouble	Cause	Solution
Power system		
Oil pressure warming light remains on even with engine at high speed	• Oil level too low • Oil filter clogged • Oil unsuitable for the ambient environment	• Refill • Change filter • Change
Steam comes out of radiator breather. The engine coolant temperature indicator reaches overheating range	• Coolant fluid level low • Radiator leakage • Fan belt slacked • Mud or limestone accumulated in cooling system • Radiator fins damaged or closed • Faulty thermostat • Radiator cap loosen or broken • Working at too high altitude	• Refill • Repair • Check belt tension and adjust • Change coolant and clean cooling system • Repair or clean • Change • Tighten cap or change unit
Coolant temperature indicator always at the end of right scale	• Faulty instrument	• Change
Coolant temperature indicator always at the end of left scale	• Faulty thermostat • Faulty instrument	• Change • Change
Engine dose not start with starter running	• No fuel • Air in fuel system • Compression defect	• Refuel • Bleed system • Adjust valve clearance
Exhaust gases white or light blue	• Too much oil in oil pan • Unsuitable fuel	• Drain some oil • Change with correct fuel
Exhaust gases occasionally tend to be black	• Air cleaner clogged • Faulty injectors • Faulty compression	• Clean or change • Change • Adjust valve clearance
Combustion noise occasionally resembles a blow	• Faulty injectors	• Change

Trouble	Cause	Solution
Abnormal noises (during combustion or in mechanical parts)	• Fuel with low cetane rating • Overheating • Exhaust silencer inside damaged • Excessive valve clearance	• Change with correct fuel • • Change • Adjust valve clearance
Transmission system		
Machine moves neither forward nor reverse	• Oil level insufficient • Suction filter clogged • Faulty flexible coupler • Max. pressure valves faulty or dirty • Positioning hydraulic connection interrupted • Travel motor faulty	• Refill • Change • Change coupler • Clean or change valves • Restore connection • Repair or change
Machine moves with delay (with abnormal noise)	• Oil level too low • Presence of foam • Suction pipe tightness • Suction filter clogged • Travel motor faulty	• Refill • Use the recommended oil • Check and eliminate leakage • Change • Repair or change
Traction force in the two travel directions is insufficient	• Endothermic engine does not reach max. speed • Auxiliary fuel pump (gear pump) faulty • Max. pressure valve setting incorrect • Connection to servo control faulty or lever angle incorrect • Pressure relief valve setting incorrect • Excessive oil temperature • Travel motor faulty	• Change diesel oil filter and check injection pump • Repair or change • Reset • Restore connection or shift lever to correct position • Reset • Check oil lever and clean exchanger • Repair or change
Traction force is insufficient in only one direction	• Endothermic engine strongly overloaded	• Reduce loads due to lifting

Trouble	Cause	Solution
	• Incorrect setting of the max. pressure valve relevant to that direction	• Set valve
Oil overheating	• Oil level too low • Exchanger clogged or dirty • Unsuitable oil • Suction pipe tightness • Setting and operation of the max. pressure valves • Travel pump faulty • Pressure relief valve with high setting • Travel motor faulty	• Refill oil • Check and change if necessary • Change with correct oil • Check and eliminate leakage • Check setting, repair or change • Repair or change • Set valve • Repair or change
Machine dose not reach max. speed	• Suction filter clogged • Endothermic engine dose not reach max. speed • Auxiliary pump (gear pump) faulty • Pilot pressure insufficient • Pressure relief valve setting incorrect	• Change • Change diesel oil filter and check injection pump • Check, repair or change • Set • Set to rated value
Machine decelerates discontinuously	• Mechanical connection with servo control lever too hard	• Check if rotation is smooth
Machine accelerate slowly	• Engine power drop • Pressure relief valve setting incorrect	• Check clogging of fuel filter, injection pump and valves • Set to rated value
Oil leakage from engine propeller shaft and/or pump	• Sealing rings faulty • Counter pressure in pump casing • By-pass valve setting too high	• Change • Drain pipes clogged or damaged • Check and restore
Others		
Fuel completely depleted	• Fuel runs out of	• Refuel and bleed the system before start the engine

Trouble	Cause	Solution
		again
Battery completely depleted	• Alternator faulty	• Repair or change
	• Consume electric power when the engine is stopped	• Charge the battery • Or start the engine with booster cables
Machine gets stuck in mud	• Can not get out by itself	• Use a wire rope suitable to remove the machine through the tow hook

8 INFORMATION OF MANUFACTURER

Company Name: Hunan Sunward Intelligent Machinery Co., Ltd.

Brand: SUNWARD

Address: No.16, Lixiang Road (M), Xingsha, Changsha, 410100 Hunan, China

Tel: 0086 731 4020688 4020666

Service point:

Information of Distributors

Information of Distributor	
Name:	
Address:	
Tel:	
Fax:	
Email:	
Contact:	
Remark	