OPERATING MAUAL

HYD. CRAWLER DRILL

/ JD-1400E

DATE	2013.11
Applicable Equipment No.	#4

JUNJINCSM

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☞For the User of JunJin Large hydraulic Crawler Drill (JD-1400E) ☜

JD-1400E that you have purchased is a large hydraulic crawler drill in which Jun Jin CSM's rich experience and technology are integrated. JD-1400E guarantees outstanding operation capabilities.

You can use the equipment safety, as it has passed thorough inspections and tests before shipment. However, performance, safety, operation efficiency, and lifespan of the equipment are greatly dependent on daily maintenance and regular inspection.

This Manual provides the information of equipment layout, correct operation method, inspection/maintenance and control method so that the users of JD-1400E have full knowledge the equipment.

Please make sure to read the Manual before using the equipment for its operation under the optimum condition. In addition, please contact the service factory nearby for malfunction, regular maintenance, repair and remodeling.

(Information described in the Manual is subject to change without prior notice for quality improvement.)

A moment of inattention and carelessness causes an accident.

[Safety First]

The key for safety is on your hands!

Warning!

- **Do not use this equipment for other operations than the designated works.**
- **If you this equipment for other purposes, serious injuries or deaths may be caused.**
- **Operators or repair personnel of the equipment should thoroughly read and understand the Manual before they operate or repair the equipment.**
- **Make sure to store the Manual in the nearest place to the equipment and make sure that the entire personnel who use or manage this**

equipment read the Manual on a regular basis.

- **If the Manual is lost or damaged, contact Jun Jin CSM.**
- **If you transfer the equipment, you must include the Manual, too.**
- **The equipment may be slightly different from what is described in the Manual as it is in constant improvement. If you have any questions, contact JunJin CSM.**
- **Make sure to read [Safety Cautions] and related description thoroughly.**

◆ Safety Guideline

Accidents happen when a basic safety rule is not observed in operation, inspection or maintenance, or when a pre-inspection or pre-caution is not made properly.

Some accidents could have been prevented by identifying a dangerous condition in advance and taking a proper action.

Make sure to thoroughly read and understand all accident prevention methods and [Warning] described in this Manual and the equipment before operation, inspection or maintenance of the equipment.

The safety label and message are classified as the following to make you better understand [Warning] adopted in this Manual and the equipment.

	Danger	It indicates a greatly dangerous situation that may cause deaths or serious injuries if not prevented. It is only used in an extremely dangerous situation(Death or serious injuries)
	Warning	It indicates a potentially dangerous situation that my cause deaths or serious injuries if not prevented. (Deaths or serious injuries are possible)
	Caution	It indicates a dangerous situation that my cause a medium or a light injury if not prevented. It is also used to give a warning to a dangerous habitual action. (Light or medium injuries are possible)
※	Note	It indicates the points that have the direct/indirect relations with personnel safety or property protection.

The safety message includes preventive actions that should be considered to avoid danger.

Safety guidelines per items are described in [Safety Cautions], as well as this Manual.

As JunJin CSM cannot predict all possible danger in advance in terms of operation, inspection and maintenance, [Warning] stated in the Inspection Manual or the equipment cannot cover everything regarding safety. Therefore, if you happen to execute operation, inspection or maintenance not stated in this manual, make sure to take an action for safety under your own responsibility.

◆ Equipment Overview

1. Designated Operation

This equipment is mainly used for drilling to blast rocks in mining, quarrying and general civil engineering (dam, road, railway, ground works) sites.

♧ For the operation method, refer to 『Operation Control』 in the Manual.

⚠ Warning!	**Do not use this equipment for other operation than the designated work.**

2. Parts Type

Parts Type	Boom EXTEND	Cabin ROPS & FOPS	Auto Rod Changer
JD-1400E	○	○	○

3. Equipment Features

- Collaring device allows drilling in an optimum condition in the initial drilling work (Optional).
- Anti-jamming device allows safe drilling in an optimum condition by changes in rock quality.
- Engine Emergency Stop and various warning lamps detect an error in advance and inform it to the operator.
- 2-level control device with unload pressure is adopted to save engine fuel and enhance durability of compressor.
- The system is designed to effectively utilize the output; depending on the work load, power is selected for heavy works and speed is selected for light works by an independent hydraulic circuit, to allow effective operation of variable capacitance pump and engine output.
- With help of Rod-Changer, the rod connection and recovery is swiftly and

accurately made by the lever in the cabin.
In addition, auto grease nozzle is equipped as the standard, allowing single operator operation, without an assistant worker.

- Strong dust collector enables clean working environment by preventing the scattering of dust as much as possible.
- Traveling motor with built-in decelerator is adopted and it is compactly installed in the frame.

4. Initial Operation

This equipment has passed thorough inspections before shipment, but we recommend you to execute [initial operation] for the first 100 hours (time indicated in engine's hour meter).Immoderate equipment use from the beginning may deteriorate its functionality and decrease its lifespan.

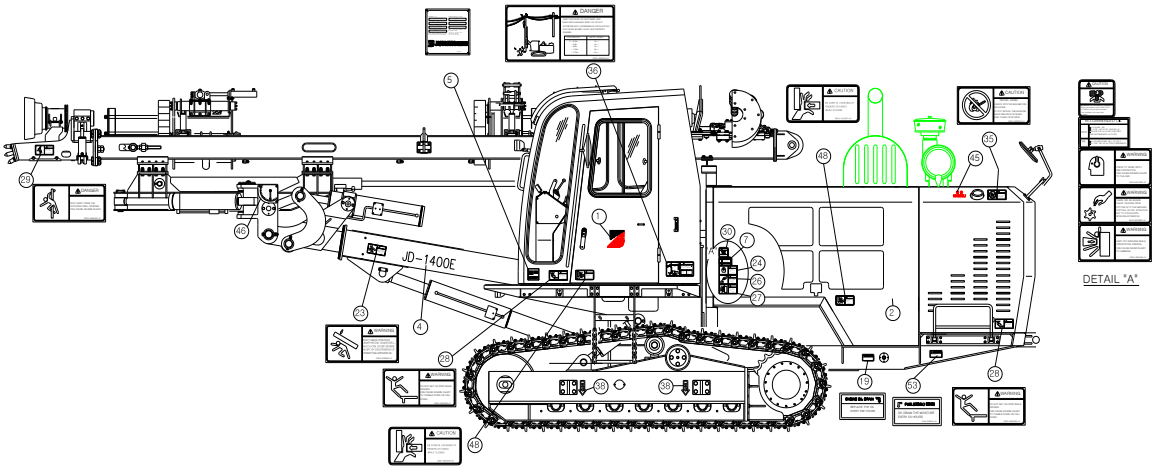
- Warm up the equipment for 5 minutes after starting the engine with no load idling.
- Heat the hydraulic oil sufficiently.
- Avoid a sudden rush/sudden acceleration, unnecessary sudden stop and radical turning.

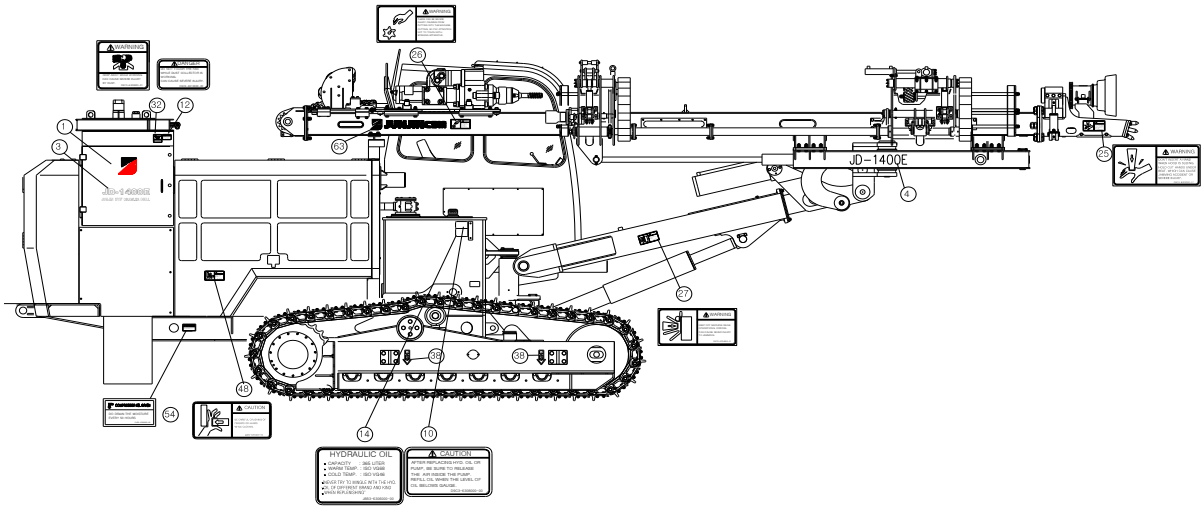
5. The 2nd Class Pressure Container

The separator receiver tank for the compressor belongs to the 2nd class pressure container in accordance with the [Boiler and Pressure Container Safety Regulations], but the revised law indicates that you do not need to submit the installation report of the 2nd class pressure container if an equipment is installed as a [movable]type like this equipment.
However, [Boiler and Pressure Container Safety Regulations] stipulates that [Cleaning and inspection of the tank shall be executed more than once a year]. Make sure to comply with the regulation. In addition, record the inspection results and store them for 3 years.

☐ Safety Cautions

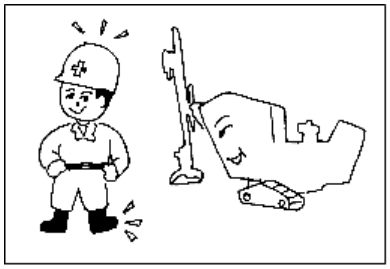
1-1. Before Operation





◆ **Wearing a protective helmet and neat clothes is essential for safety.**

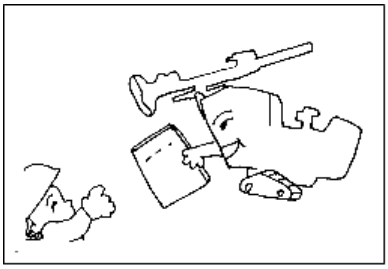
➢ Put on perfect-fitting working clothes to prevent yourself from being caught off by the control lever, projected or turning parts.



- Use necessary protection gears including protective glasses, earplugs, gloves and dust masks, depending on work types.

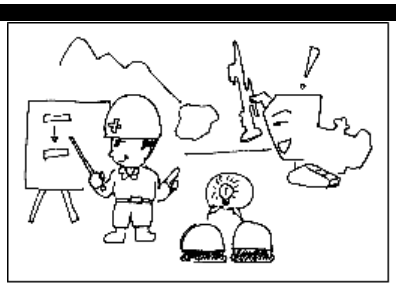
◆ **Description in the Manual is essential information for safe operation. Make sure to read it thoroughly.**

- Store the Manual in the place nearest to the equipment. The operator and the maintenance staff should have full knowledge of equipment control methods, safety warnings, dangers and cautions, before the equipment control, inspection or maintenance.



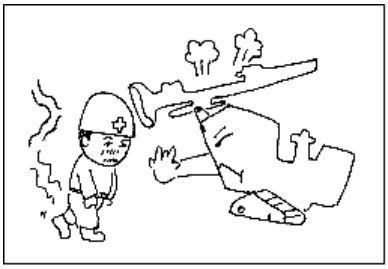
◆ **Make sure to understand the work before equipment operation and observe safety rules at work sites.**

- Make a work plan before operation and record the work progress in the daily and monthly work reports.
- Make a list of don't and caution, and the order of work with the site manager and make sure to observe them.
- When an operational attendant is deployed, decide a certain signal rule and make sure that the operator follows the attendant's signal.



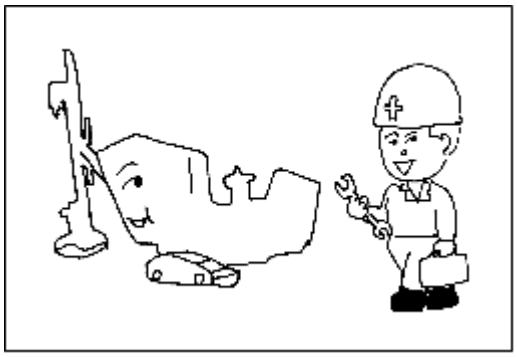
◆ **Do not make operation after drinking or overworking.**

- After drinking, taking a medicine or overworking, your ability to judge is weakened, which may lead to an accident.



◆ **Perform the daily inspection following the Manual.**

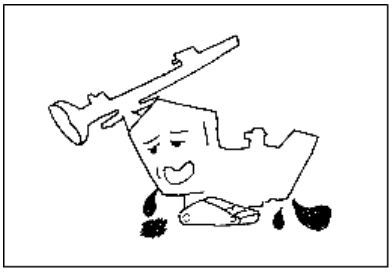
- Check any damaged parts, bolt looseness, and oil leakage before operation.
- Oil leakage may cause a fire. Check pipes or hoses in fuel, oil and lubrication systems. If you find any abnormality such as oil leakage or hose depletion, make sure to make a repair and replacement.



◆ **Illegal disposal of wastes may cause environmental destruction.**

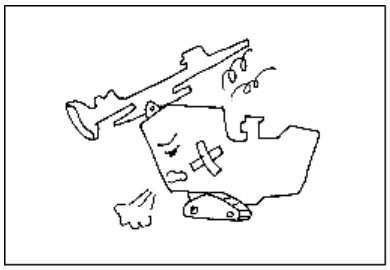
- Do not dispose waste oil such as engine oil or hydraulic oil directly into a river or a sewer.
- Make sure to dispose the waste oil by putting in a container to prevent direct oil disposal to the ground.

- Do not dispose hazardous materials such as fuel, oil solvents, filters or batteries, along with ordinary incombustible waste.
- Make sure to observe the relevant rules and regulations for waste disposal to eliminate any possible factors of environment destruction.



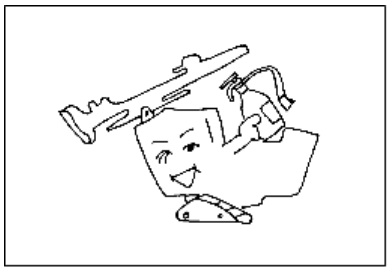
◆ **Do not make operation in abnormal conditions.**

- When a warning signal or a warning lamp is on, move the equipment to a safe place and make an inspection.
- Never operate the equipment when an error or a fault is detected after inspection.

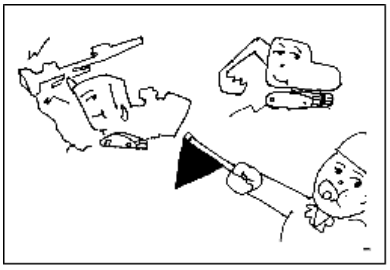


◆ **Keep the first-aid kit nearby for always.**

- Remember the location of extinguishers and first-aid kits.
- Make sure to learn the type of extinguisher and how to use it in advance.
- Make an emergency contact and decide communication method with a phone number.

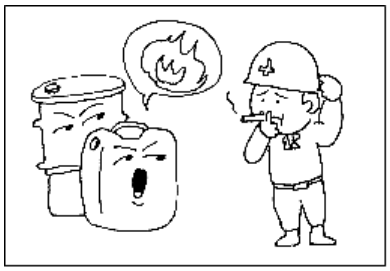


◆ **In joint operation, make sure to assign an operational attendant and perform the work following the mutually-agreed signal rules.**



◆ **Fuel or oil may cause a fire.**

➢ Never smoke during fueling or in a fueling place and never place heat of fire near the equipment.



➢ Store fuel or oil in a cool, well-ventilated place and never allow access of other people than the authorized personnel to fuel or oil.

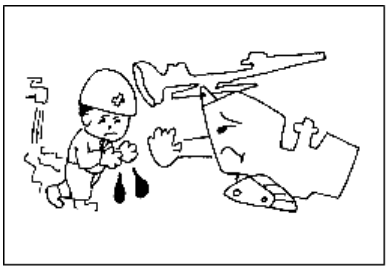
➢ Do not inspect fuel amount or oil leakage using a match or a lighter.

Caution!	**All oil is inflammable. When the heat of fire is nearby, there is a high possibility of inflammation. Make sure to stop the engine when you add fuel or oil.**

1-2. During Operation

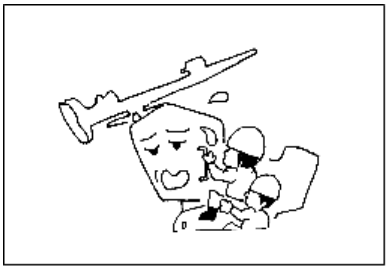
◆ **It is dangerous to operate the equipment by wet or oily hands.**

- Oily and slippery hands may cause incorrect operation, leading to equipment malfunction.
- You may fall off from the equipment when you get on/off to/from the equipment with oily hands.



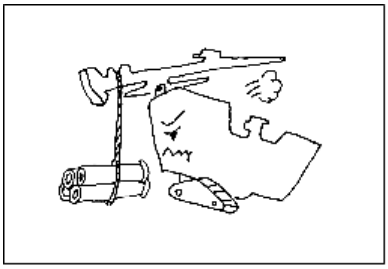
◆ **Boarding by other people than the operator is prohibited.**

- Only the operator can ride this equipment. Other people than the operator should not only get on the cabin but also the equipment itself.
- If other people are accompanied to the equipment, it may lead to incorrect operation and the operator may fall off with the fellow passenger.



◆ **Never use the equipment for other purposes than the designated work.**

➢ It is illegal to perform a crane work by hooking a chain or a wire rope to the operation equipment. Never execute such operation.

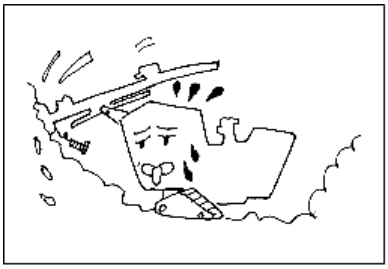


Use the designated device for the crane work.

◆ **Excessive work beyond equipment performances is prohibited.**

➢ Do not move the equipment main unit, boom or guide shell during drilling operation. It may lead to unexpected damage to the equipment.

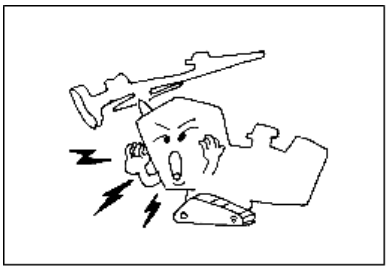
➢ Excessive work beyond equipment performances may decrease its life span and cause malfunction.



◆ **Check the surroundings before operation!**

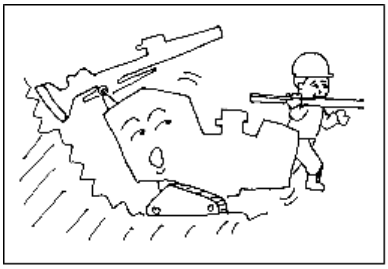
➢ Check if a person or an obstacle exists within the operation range.

➢ Before driving or traveling the equipment, ring the alarm to make the people within the operation range to be aware of the surrounding.



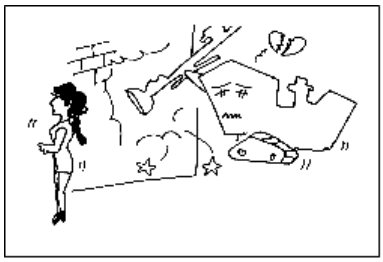
◆ **Take cautions to prevent an accident during drilling work.**

➢ Jamming in the equipment main unit, boom or guide shell may lead to deaths or serious injuries. Make sure to check if there is any person within operation range before operation.

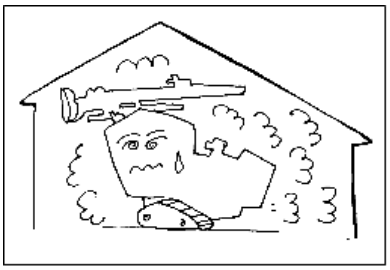


➢ Each moving unit may cause smashing, cutting or winding accidents. Make sure that your hands or gloves are not caught off in any of the moving units.

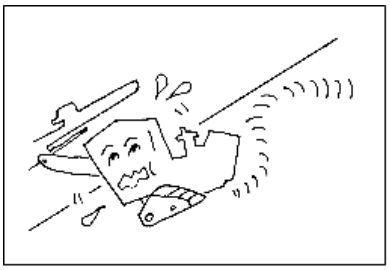
◆ **Operator should always care for safety and should not gauze around during operation.**



◆ **Make sure to have enough ventilation as there is a risk of gas poisoning when the engine runs in a closed space.**

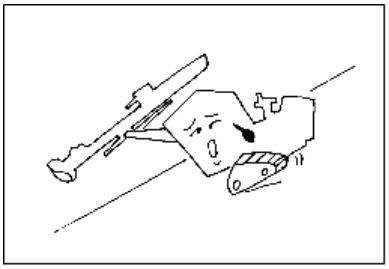


◆ **If the equipment moves to the side on an inclined surface or if it travels parallel to the inclined surface, the equipment may turn over.**



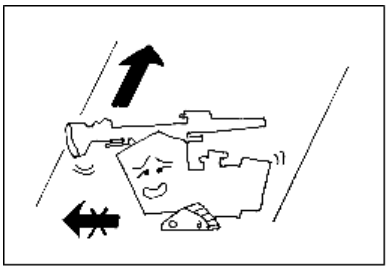
◆ **It is dangerous to travel on a steep slope.**

- ➢ On a steep slope, make the equipment cross at right angles against the inclined surface as much as possible using the oscillation lever and travel at low speed.
- ➢ On a downhill, move as slowly as possible using the engine throat lever and traveling lever.



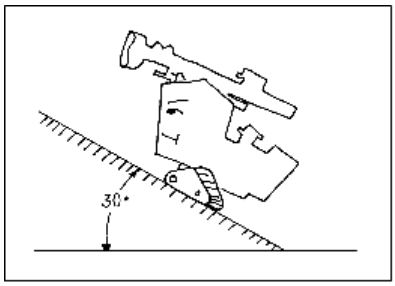
◆ **It is dangerous to turn direction while traveling on a slope.**

In case of an inevitable case, make sure to make a turn on moderately-sloped and solid surface.



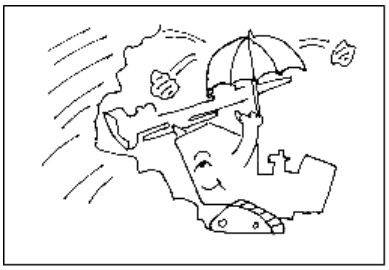
◆ **Allowable inclination angle for engine is 45°.**

Never operate the equipment in any cases beyond the allowable inclination angle. It may cause engine scuffing and early abrasion of major lubrication parts.

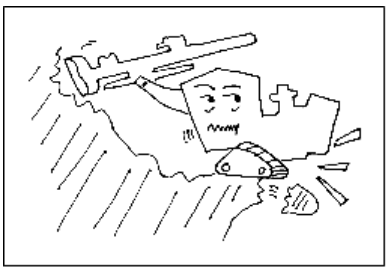


◆ **In case of rain, the operation is dangerous.**

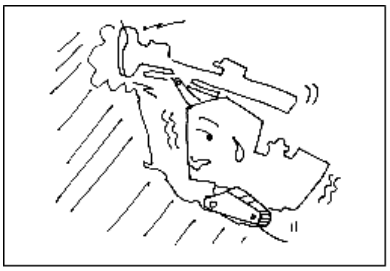
- In case of rain, ground surface becomes weak and a risk of falling rocks increases. Try to avoid operation when it rains.
- In an inevitable case, make sure to establish safety measures before starting the work.



◆ **Avoid operation on a precipice or at the tip of the road surface where ground is weak. It may lead to equipment overturn.**

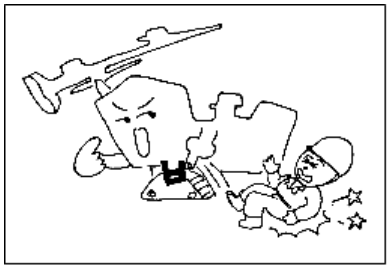


◆ **Use extra caution in operation on a slope.**



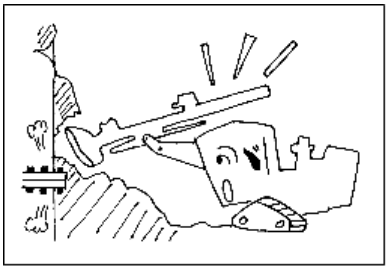
◆ **Get on/off the equipment in a correct way.**

- Before riding on the equipment, make sure to check around and under the equipment and check if no workers or obstacles are found.
- When you get on/off the equipment, use the handle and foothold for safe boarding and taking off.



- Do not jump on to/off from the equipment. Make sure to get on/off the equipment when it is completely stopped.

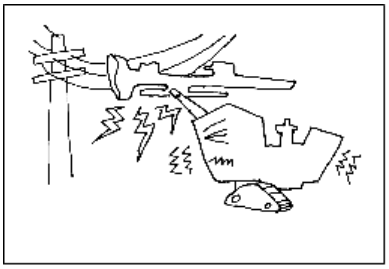
◆ **In case of the work site where gas or water pipes are laid, check its location in advance for safe operation.**



◆ **Operation near power lines is extremely dangerous.**

Precious lives may be lost or fetal injuries may occur due to electric shock.

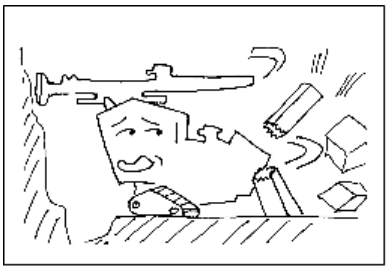
Set the minimum operation range and use extra cautions.



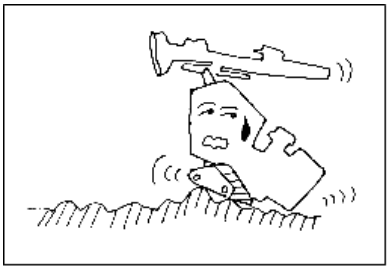
◆ **Use extra cautions to prevent the equipment from being bumped into obstacles in the work site with abundant obstacles.**

In particular, take cautions for operation device and lower operation unit when turning the equipment.

- In case of bad visibility, assign an operational attendant to control the equipment following the mutually-agreed signals.

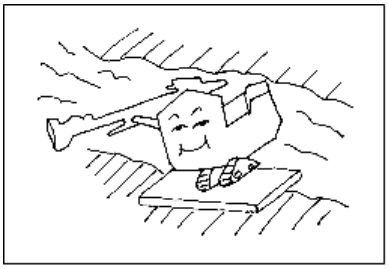


◆ **Travel slowly on an uneven ground surface or when passing an obstacle.**



In particular, the center of gravity should not move drastically when the equipment passes the obstacle.

◆ Take cautions not to make the equipment sink in weak or damp ground.
Use a mat or a wood board for safe passage if necessary.



1-3. Inspection and Maintenance

◆ **JunJin is not accountable for accidents or malfunction, caused by unauthorized modification (including disassembly and repair), and in particular, the secondary damages and claims, caused by the accidents or malfunction.**

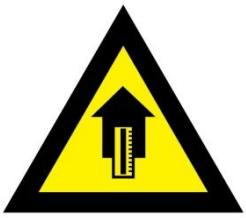
- Maintain the place for inspection and maintenance in a clean and dry condition.
- Do not place oil, grease or tools in the cabin or on the equipment body. It may lead to unexpected accidents.
  Always maintain the equipment clean and store the tools in a designated place.

◆ **Cautions in Inspection and Maintenance**

- Move the equipment to a flat surface and set up a [Inspection in Progress] post.
- Stop the engine during inspection and maintenance.
- If the body parts or tools contact with the rotational unit, such as the cooling fan or fan belt in operation, it may cause dragging or cutting accidents. Do not place an object easy to be caught into the rotational unit when you are near it.

- Hydraulic system always has internal pressure. When you fuel/refuel the hydraulic system or replace the hydraulic parts, stop the engine and eliminate the internal pressure before operation.
- Batteries generate inflammable gas. Do not smoke, have the heat of fire or take any actions to generate spark near the battery as it may be exploded.
- Battery fluid is acid. It should not touch your eyes or skin. Make sure to put on protective glasses and gloves when you touch the battery.

◆ **Each unit is very hot right after operation. Do not directly touch the unit, such as fittings. You may get burned.**



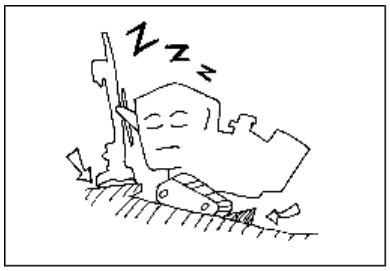
- When you execute hydraulic system inspection, oil replacement, filter maintenance, and coolant inspection, check if the temperature of each part is normal.

- When you open the radiator cab, make sure to turn the cab very slowly to completely eliminate the internal pressure. You may get burned due to belching up of hot vapor.

1-4. Operation End

◆ **Park the equipment at the designated lot.**

- Park the equipment on a flat surface and place the guide shell to the ground surface at a right angle.



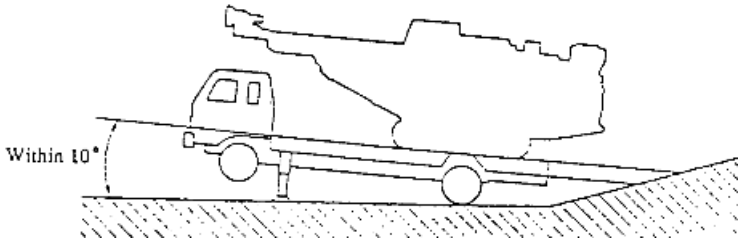
- Do not park the equipment near combustibles or dangerous articles such as oil, paper or fallen leaves.
- Do not park the equipment in the place with risk of falling rocks or weak ground, including a cliff or the shoulder of a road.

- Make sure to comply with safety rules for convenient and safe equipment use.

1-5. Cautions in Trailer Loading/Unloading

◆ **Take cautions in case of loading and unloading.**

- For the conveying trailer, choose a flat and solid surface and fix the wheels after applying the brake.
- The loading/unloading board laid from the ground to the trailer should be able to stand the weight of machine expected to be loaded, with sufficient length, width and strength.
- The angle of the loading/unloading board should be less than10°, and the board should be fixed in a way that the center of the trailer and the machine is aligned.



- Remove the oily substances on the loading/unloading board or the top of the trailer to prevent slippery action in loading/unloading.
- Conduct loading/unloading following the attendant's signal, and never change the direction on the loading/unloading board.
- After loading, fix the track shoe, located in the lower traveling unit, by a wire rope to prevent the machine from being moved.

1-6. Regular Replacement of Safety Parts

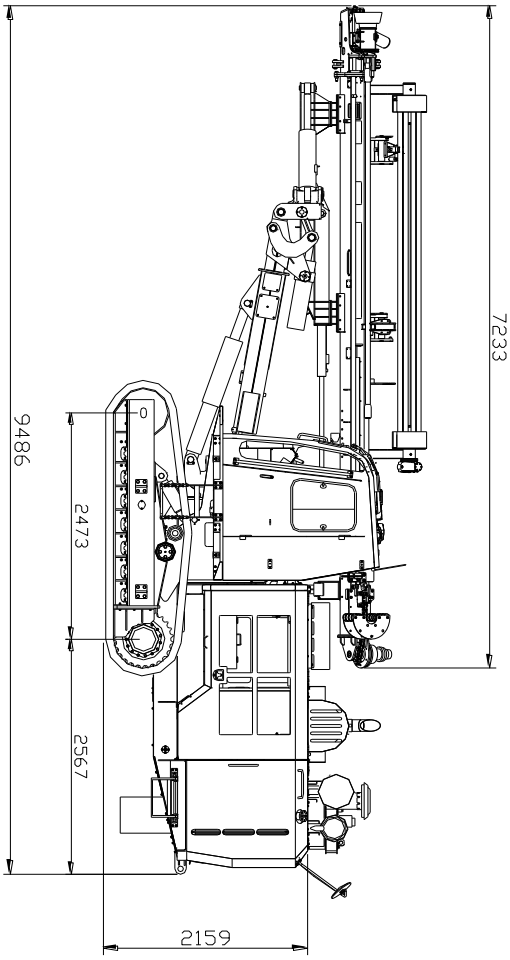
◆ **To secure safety in operation and travelling, the equipment owner must conduct a regular inspection. In particular, the security parts related to a fire should be replaced every 2 years.**

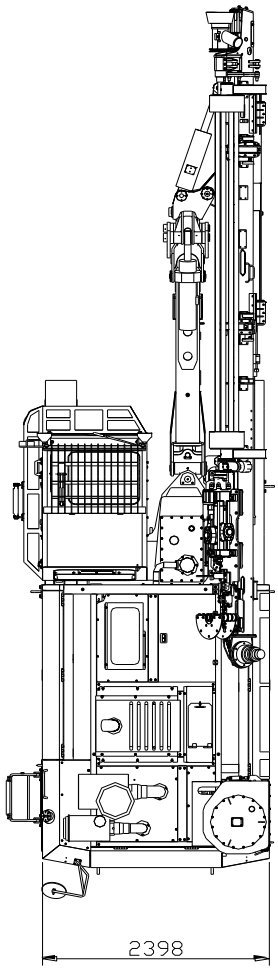
- Security parts are materials that are weak to abrasion or fire, and it is difficult to judge their damaged degree by a regular inspection. Therefore, after a certain period of time, it is recommended that you replace the security parts by new ones even if no specific disorder is found. Security parts mainly indicate rubber or covering materials.
- If any disorder is detected in the security parts even before the legitimate replacement period, you should make an immediate repair or replacement.
- If you think any depletion (deformation or crack) is found in a hose clamp, make sure to replace the clamp, too.
- When you replace a hose, make sure to also replace O-RING.

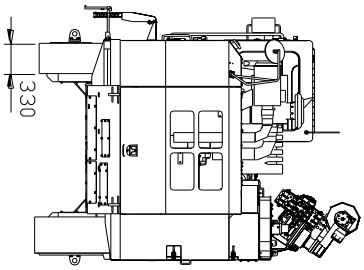
□Specification

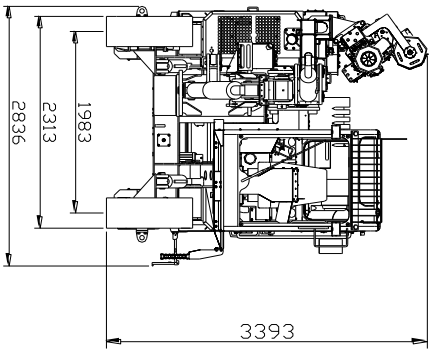
2-1. General Specification

- **JD-1400E**





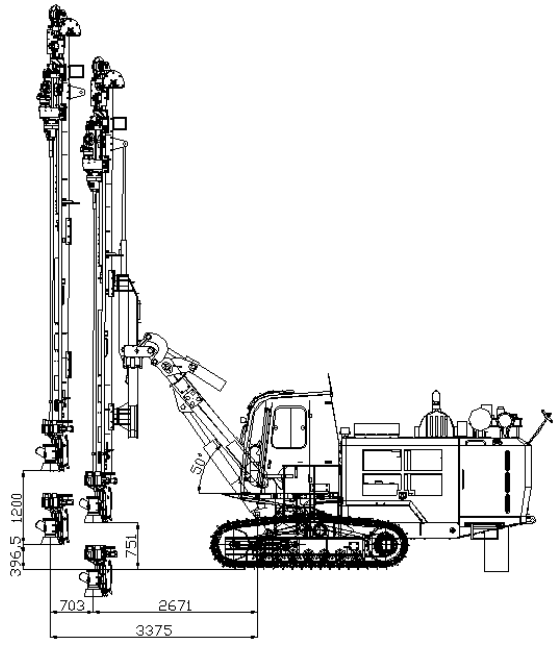
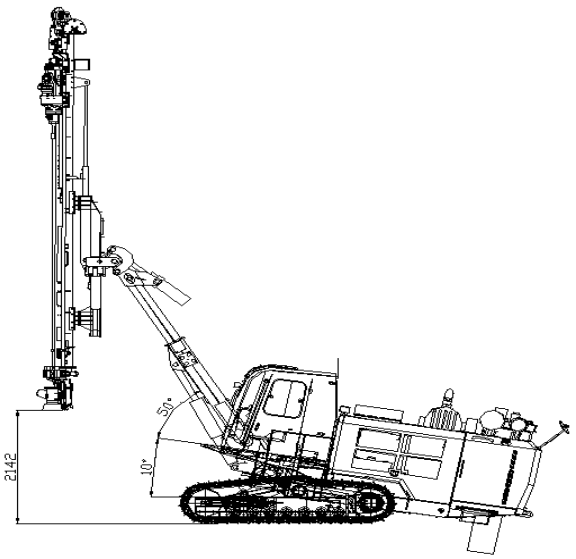
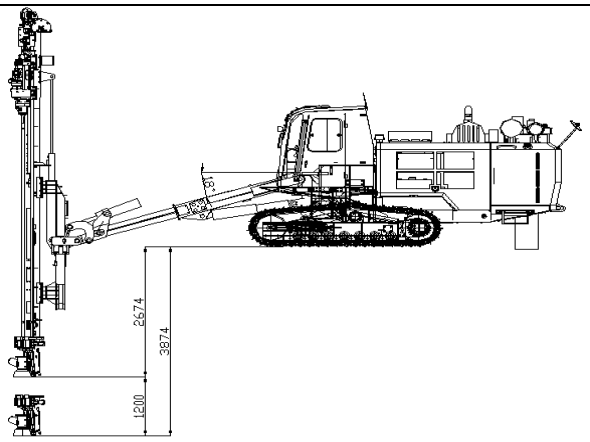
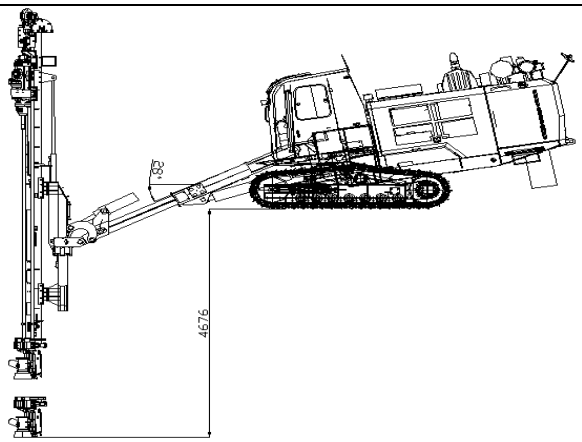


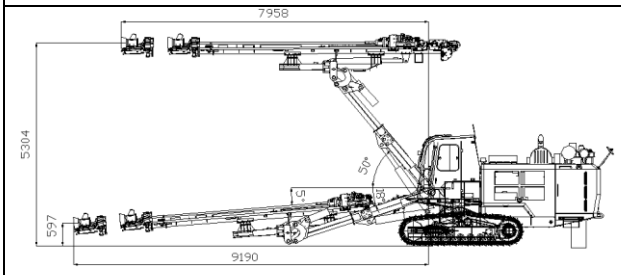
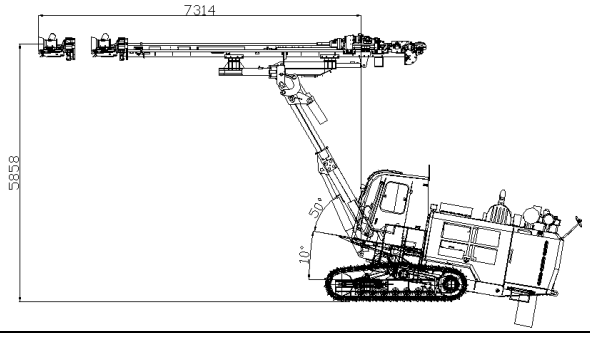
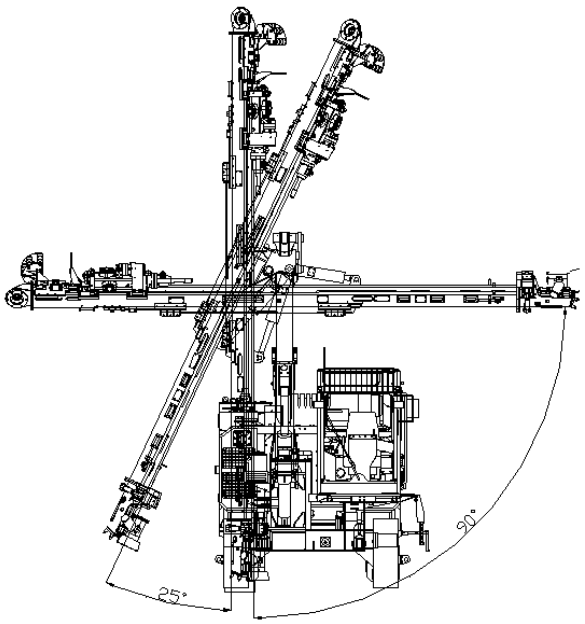
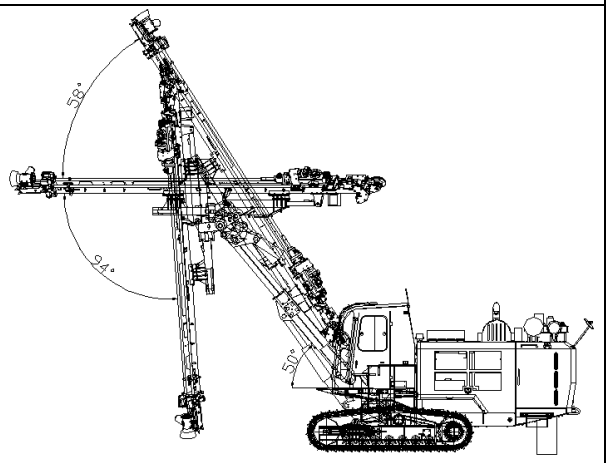
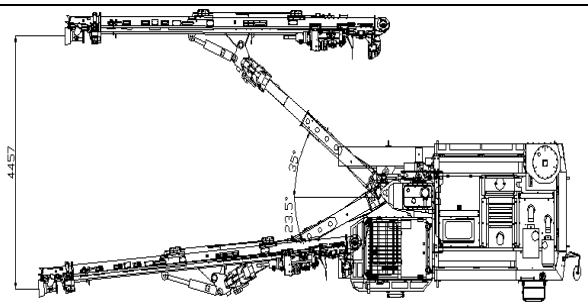
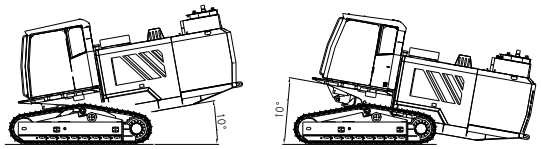


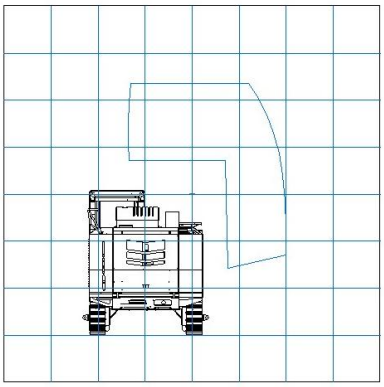
No.	Item			Model
				JD-1400E
1	Exterior	Total Weight	kg	16,000
		Total Length	㎜	9486
		Total Width	㎜	2,836/2398
		Total Height	㎜	3,393
		Ground Clearance	㎜	510
2	Performance	Excavation Radius	㎜	Φ89 ~ Φ127
		Ascending Power	°	28
		Traveling Speed	km/h	0 ~ 3.3
3	Engine	Model		QSC8.3-C(CUMMINS)
		Output	bhp/rpm	260/2,200
		Fuel Tank	Liter	540
4	Drifter	Model		YH-135
		Weight	kg	260
		Length	㎜	1,225
		Percussion Power	KW	21
		Percussion Frequency	BPM	2,500
		Torque	Kgf-m	120
		Spindle Frequency	Rpm	120
		Pressure PER.	Kgf/㎠	140
		Pressure ROT.	Kgf/㎠	140
5	Air compressor	Model		Single-stage screw compressor
		Pressure	Kgf/㎠	10.5
		Capacity	㎥/min	11.3
		Tank Capacity	㎥	0.075

No.	Item			Model
				JD-1400E
6	Guide	Total Length	㎜	7,233
		Extension Length	㎜	1,500
		Feeding Length	㎜	4,564
		Swing Angle	R/H°	90/25
		Tilting Angle	°	158
7	Boom	Total Length	㎜	3,000
		Ascending Length	U/D°	50/18
		Swing Angle	R/L°	23.5/35
		Extension Length	㎜	1100
8	Dust Collector	Suction Capacity	㎥/min	40
		Filter Count	EA	4
9	Track	Tumbler Center Distance	㎜	2,480
		Shoe Width	㎜	330
10	Tool	Rod Length	㎜	3,660
		Bit Diameter	㎜	Φ89 ~ Φ127
		Rod Type	㎜	T51
11	Hydraulic	Hydraulic Pump		2 Variable Piston Pump + 1 Gear Pump
				2 Gear Pump (Cooler)
12		Rod Installation		○
		# of Rod Installed	EA	6+1(5+1)
13	CABIN	ROPS & FOPS		○

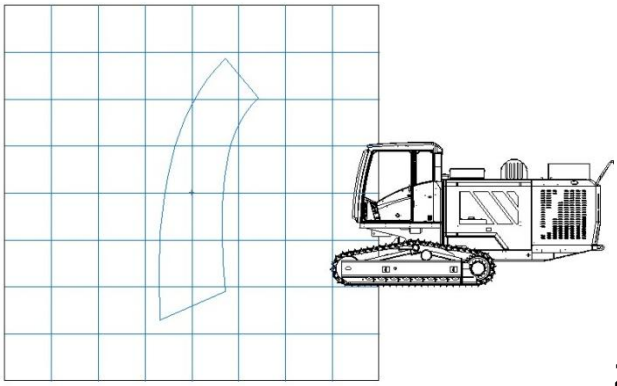
2-2. Operation Range

1) Boom Up/Extend and Guide Extend	2) Boom Up/Extend and Track Oscillation
	
3) Boom Down/Extend and Guide Extend	4) Boom Down/Extend, Guide Extend and Track Oscillation
	

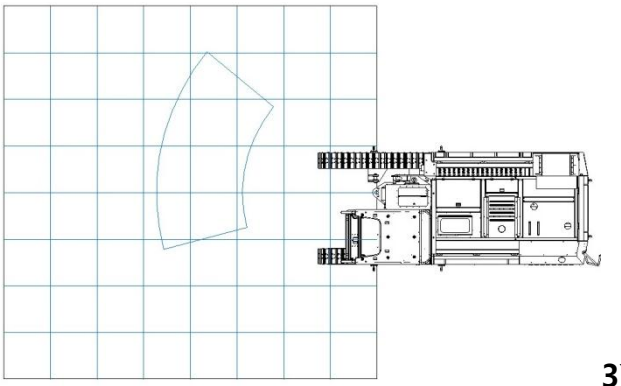
5) Boom Up/Down/Extend and Guide Extend (Horizontal Work)	6) Boom Up/Extend and Guide Sliding (Horizontal Work)
	
7) Guide Swing	8) Guide Tilting (Boom Up by 50°)
	
9) Boom Swing	10) Track Oscillation
	



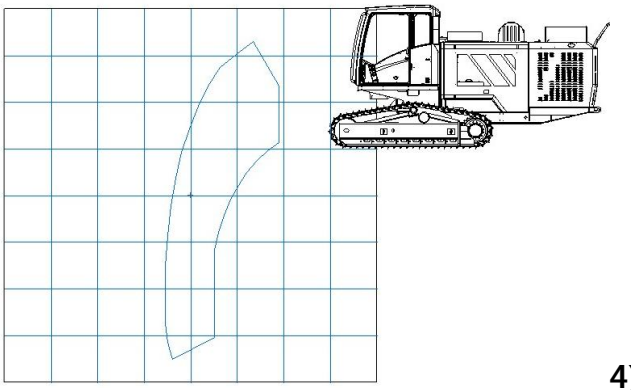
1) Horizontal Excavation Range (1)



2) Horizontal Excavation Range (2)



3) Vertical Excavation Range (1)

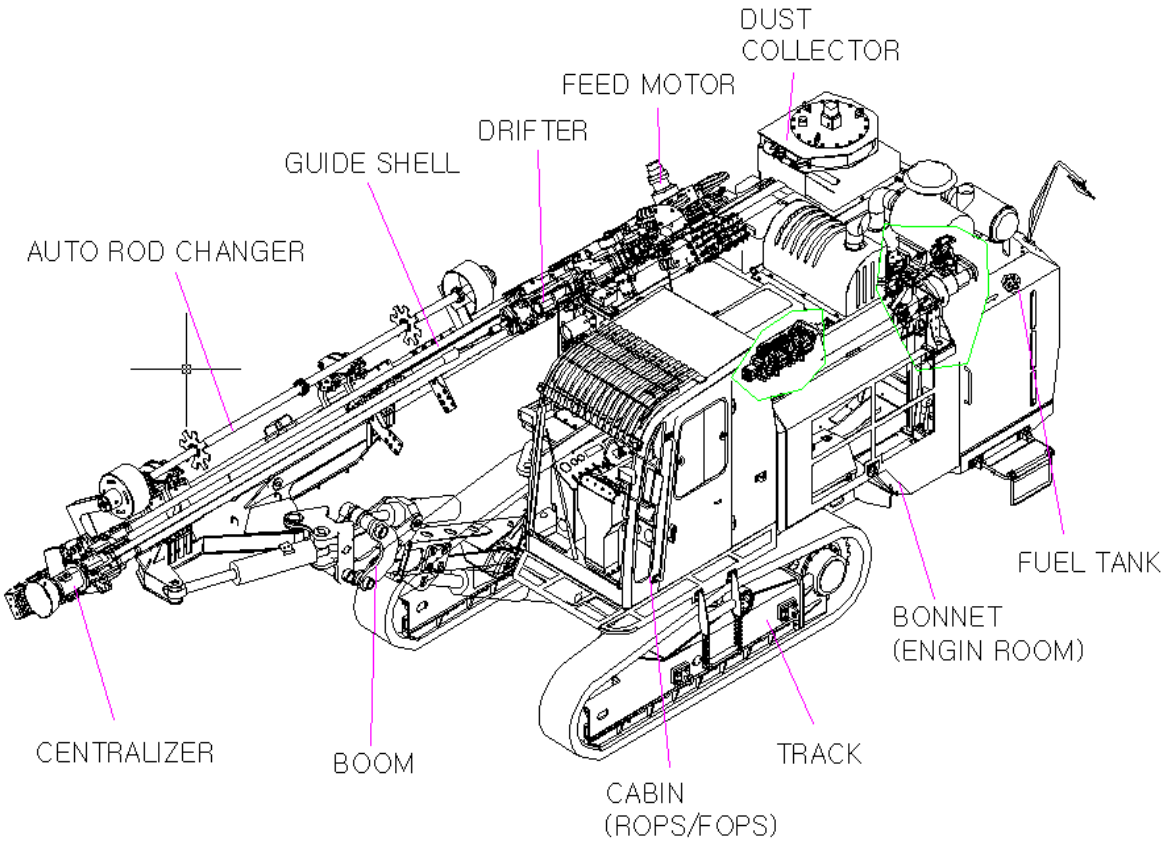


4) Vertical Excavation Range (2)

2-3. Name and Description of Main Body Unit Parts

1. Name of Main Body Unit Parts

This Drill is composed of three units: Traveling unit to move the equipment, operation unit (boom, guide shell and drifter) to perform drilling work and hydraulic control unit to control the motor operation of the previously-mentioned two units.

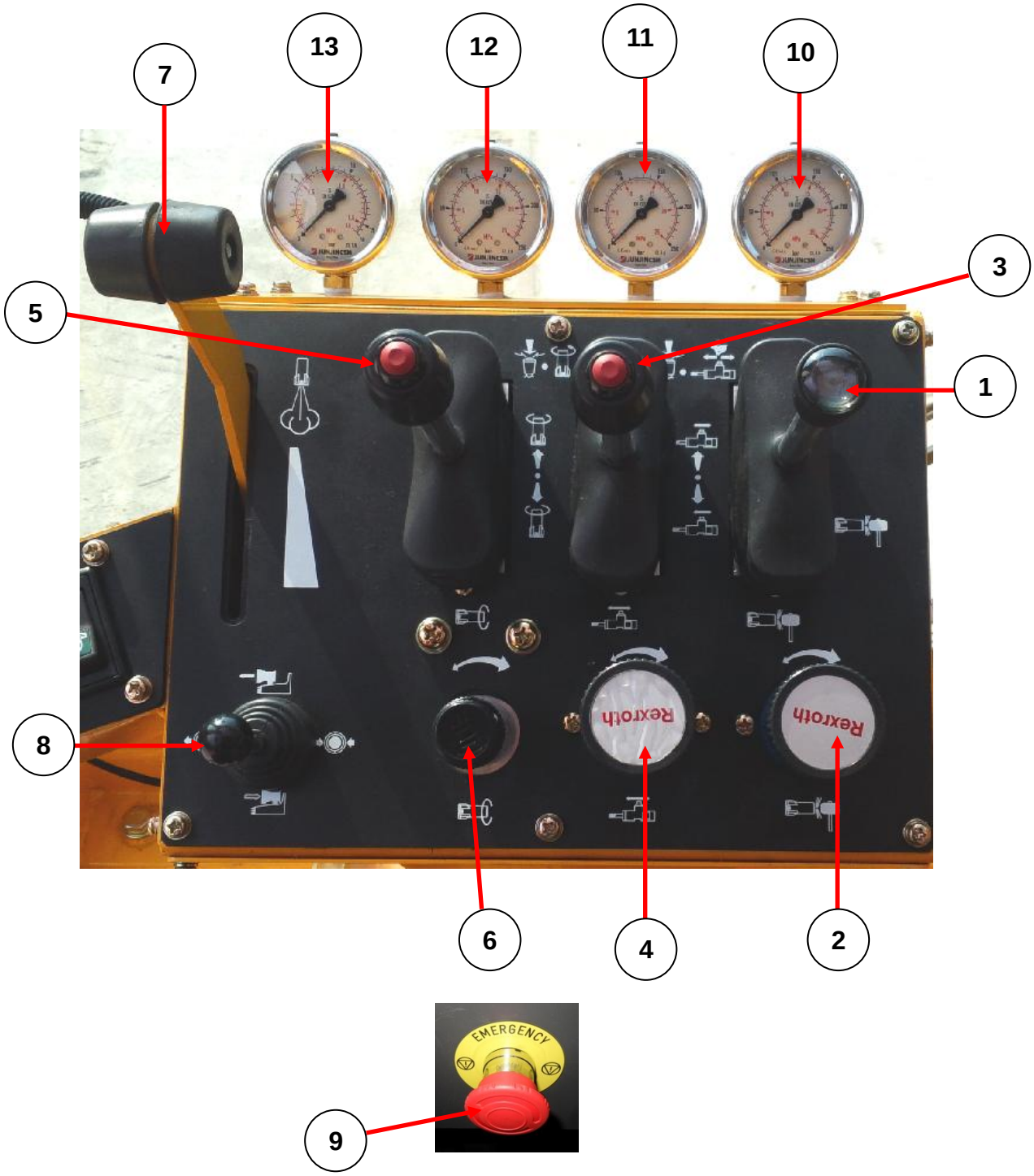


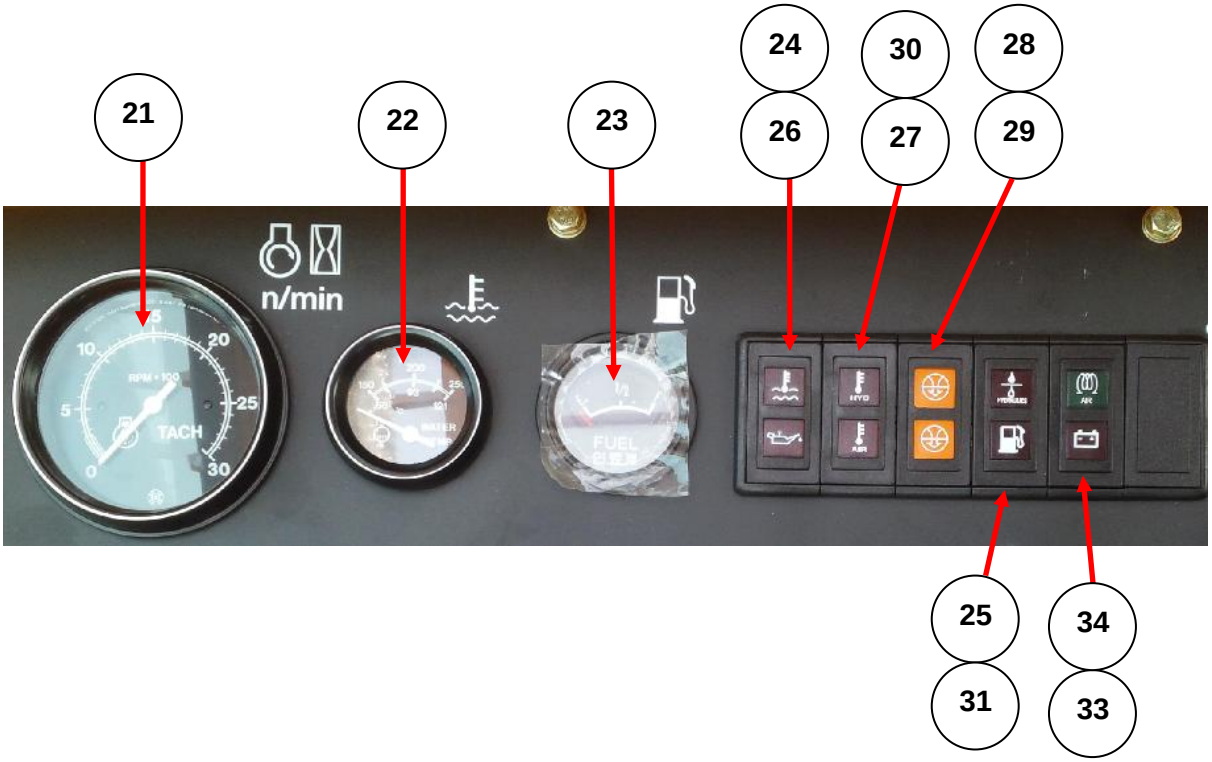
2. Description

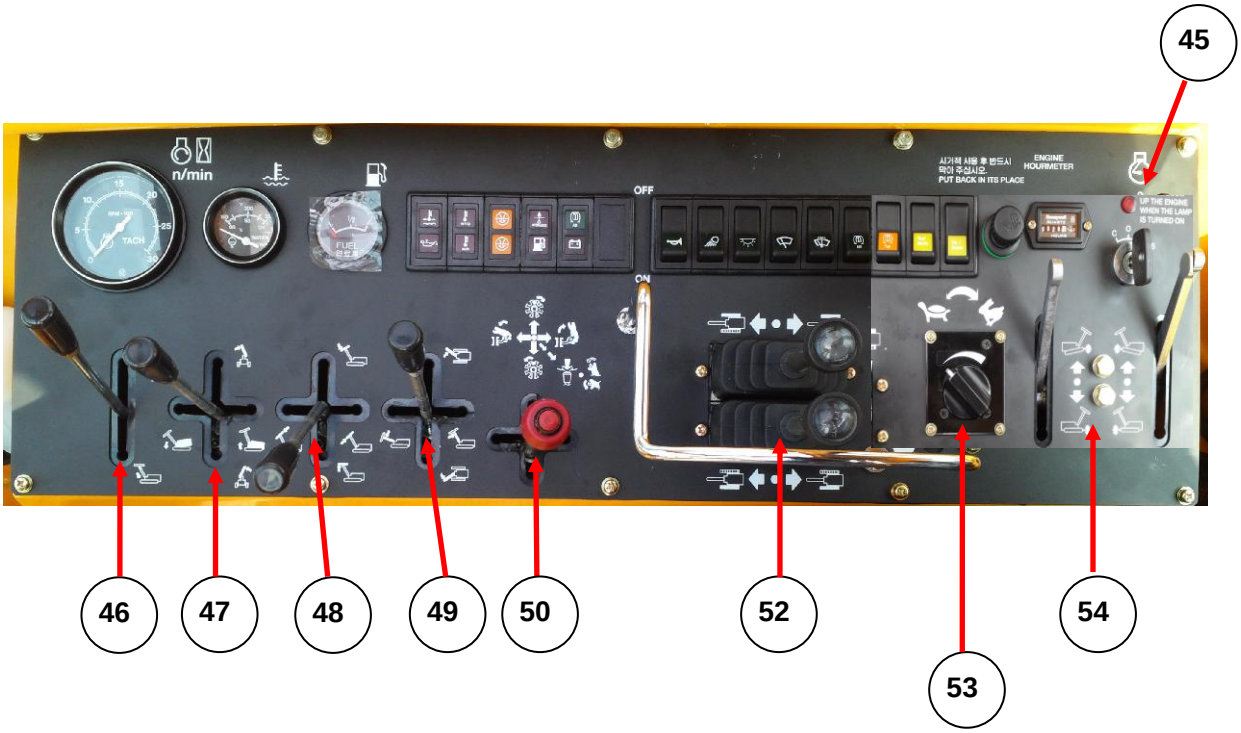
1)	Drifter	:	It consists of a percussion cylinder, a rotational oil motor, and a gear box that generates percussion and rotation power.
2)	Guide Shell	:	It is a rail to move the drifter to the destination.
3)	Boom	:	It is a device to move the equipment to the drilling point.
4)	Feed Motor	:	It is a hydraulic equipment to move the drifter on the shell forward and backward using a chain.
5)	Oil Cooler	:	It is a cooling device that prevents the increase in hydraulic oil temperature.
6)	Dust Collector	:	It is a device that filters dusts generated in drilling.
7)	Bonnet	:	It is a device that protects the interior device including the power unit and electric control box.
8)	Cabin	:	It is a room where traveling and operation equipment is operated.
9)	Traveling Motor	:	It is a hydraulic equipment to move the track link chain forward/backward for equipment traveling.
10)	Electric Control Box	:	It is equipment for power supply/control in equipment operation.
11)	Track	:	This device is connected to the traveling motor and makes the equipment move.
12)	Dump Clevis	:	It is attached at the end of the Boom and connects the Boom with the Guide.
13)	Centralizer	:	It is a device that enables punching in a specific point by fixing the Rod in punching operation, and collects dusts generated in punching.
14)	Auto Rod Changer	:	It is a device that automatically executes the Rod connection/separation using a hydraulic cylinder.

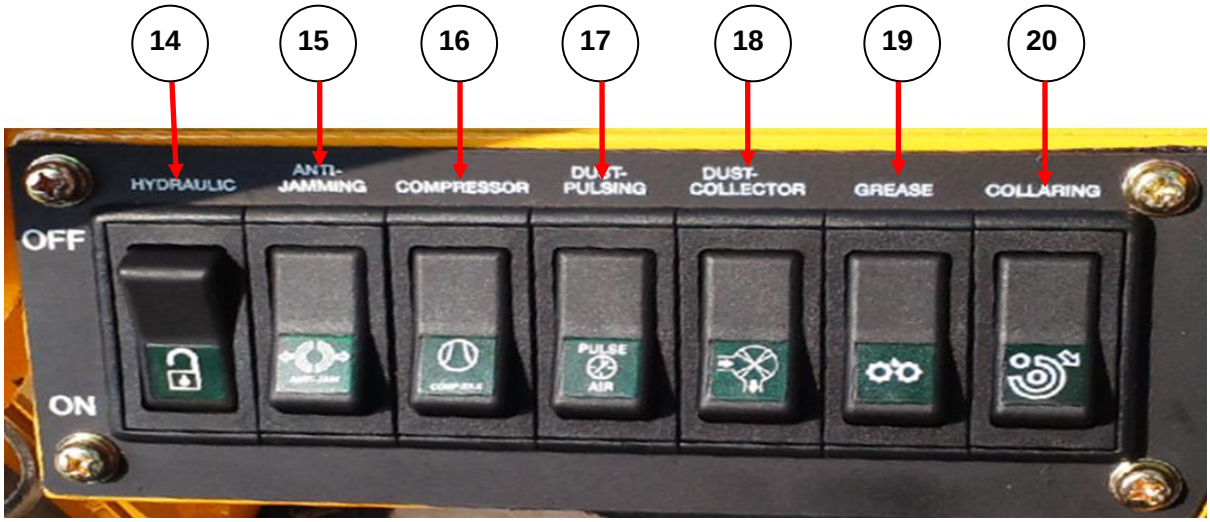
□Control Device

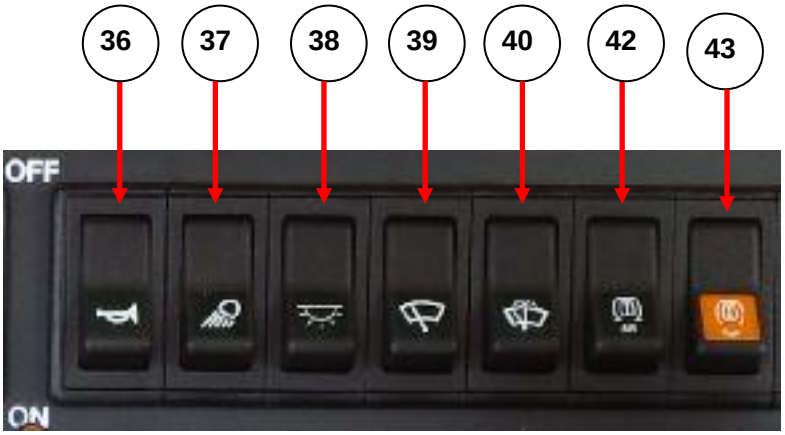
3-1. Layout




21
22
23
24
26
30
27
28
29
n/min
TACH
FUEL
25
31
34
33


45
n/min
OFF
ON
ENGINE HOURMETER
46
47
48
49
50
52
53
54


14
15
16
17
18
19
20
HYDRAULIC
ANTI-JAMMING
COMPRESSOR
DUST-PULSING
DUST-COLLECTOR
GREASE
COLLARING
OFF
ON
PULSE AIR


36
37
38
39
40
42
43
OFF
ON


VENT
HEATING
OFF
FAN
FOOT
COOLING
41

No.	Name	No.	Name
1	Percussion Lever	28	Engine Air Cleaner Alarm Lamp
2	Percussion Pressure Control Lever	29	Compressor Air Cleaner Alarm Lamp
3	Feed Lever	30	Hydraulic Oil Temperature Alarm Lamp
4	Feed Pressure Control Lever	31	Fueling Alarm Lamp
5	Rotation Lever	32	
6	Rotation Pressure Control Lever	34	Battery Charge Alarm Lamp
7	Air Flushing Lever	33	E/G AIR HEATING LAMP (AUTO)
8	Centralizer –Hood Forward/Backward Lever and Clamp Lever	35	
9	Emergency Stop Switch	36	Horn
10	Percussion Pressure Gauge	37	Work Lamp Switch(Front/Rear)
11	Feed Pressure Gauge	38	Work Lamp Switch(Bonnet)
12	Rotation Pressure Gauge	39	Wiper Switch
13	Compressed Air Pressure Gauge(Flushing)	40	Washer Spray Switch
14	Hydraulic Lock Switch	41	A/C Switch
15	Anti-Jamming Switch	42	Warm-Up Switch(Air)
16	Compressor Switch	43	Warm-Up Switch(Fuel)
17	Dust Pulsing Switch	44	
18	Dust Collector Switch	45	Engine Start Switch
19	Grease Switch	46	Boom Extension Lever
20	Collaring Switch	47	Oscillating Guide Swing Switch
21	Engine Speed (rpm) Gauge(H/M, T/M)	48	Guide Tilt/Extension Lever
22	Coolant Temperature Gauge	49	Boom Lift and Swing Lever
23	Fuel Gauge	50	Rod Change Lever
24	Engine Coolant Overheat Alarm Lamp	51	
25	Compressor Oil Filter Alarm Lamp	52	Traveling Lever
26	Engine Oil Pressure Down Alarm Lamp	53	Engine RPM Control Lever
27	Compressor Air Temperature Alarm Lamp	54	Oscillating Lock Lever

3-2. Control and Function

The entire control lever of the Drill is located in the place where the operator can reach from his seat, which allows easy and convenient operation.

1) Percussion Lever

It controls the drifter percussion.

▶Percussion: Pull the lever toward you to begin percussion.

▶Stop: Move the lever back to neutral position to stop.

2) PercussionPressure Control Valve

It adjusts percussion pressure of the drifter. To increase the percussion pressure, pull the handle upward to release the lock and then turn it clockwise, and vice versa.

※ ①Percussion pressure should be more than 125~135kgf/㎠ in curb stones and 140kgf/㎠in pumice stones.

②When you operate the Percussion Pressure Control Valve, the feed pressure is automatically set up to be lower than percussion pressure.

3) Feed Lever

It moves the drifter forward/backward.

- Forward: When you pull the lever toward you, the drifter table moves forward.
- Backward: When you push the lever to the front, the drifter table moves backward.
- Fast Feed: When you move the feed lever forward/backward and press the switch on top of the lever, fast feeding is available.

To operate it at a normal speed, cancel the switch on top of the lever.

4) Feed Pressure Control Valve

If controls the drifter feed pressure.

To increase the feed pressure, pull the handle upward to release the lock and then turn it clockwise. To decrease the percussion pressure, turn the handle counter-clockwise.

※Feedpressure should adjusted by rock quality.

If you increase the feed pressure too much, the rod bending or jamming may occur, and percussion straightness may get deteriorated. Adjust the feed pressure to below 50bar if possible

5) Rotation Lever

It rotates the shank adapter.

▶Normal: Pull the lever toward you.

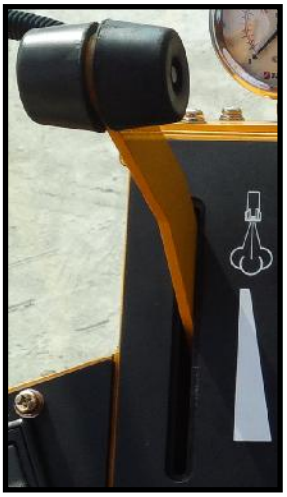
▶Reverse: Push the lever to the front.

6) Rotation Pressure Control Valve

It adjusts the rotational pressure of the drifter shank adaptor. To increase the speed, release the lock under the handle and turn it clockwise and vice versa.

※ Too fast shank rotation may decrease the bit and the rod lifespan, while damaging the equipment. Adjust the speed by rock quality.

7) Air Flushing Lever



This is the lever for the flushing air discharge.

- It flushes out the compressed air at the tip of the Bit through the drifter in drilling operation, to eliminate rock dust resided in the drilling hole.

Push the lever and its valve close. Pull it, and open it is used in driving and engine rpm is controlled to maintain 2200 rpm by automatic system.

The flushing air flow can be adjusted by the lever tilting angle.

▶ Discharge : Tilt the lever to your side

▶ Stop : Return the lever

8) Centralizer Hood Forward/Backward and Clamp Lever (Electronic)

- It moves the centralizer hood forward and backward and it opens/closes the clamp.

① Clamp (Close): Push the lever to the right for close.

② Clamp (Open): Push the lever to the left for open.

③ Hood Forward: Push the lever up to move forward

④ Hood Backward: Pull the lever down to move backward

9) Emergency Stop Switch

Press the switch in an emergency situation such as an error in hydraulic or electric system to stop the engine. To re-start the engine, turn the switch handle clockwise.

10) PercussionPressure Gauge

It displays the percussion pressure (max.: 150bar).

11) FeedPressure Gauge

It displays pressure when the drifter moves forward (max.: 150bar).

12) RotationPressure Gauge

It displays the conventional rotation pressure of the drifter shank adaptor (max.: 130bar). If the rotational pressure increases up to 130bar, the drifter automatically moves backward when the anti-jamming switch is on.

13) Compressed AirPressure Gauge

It displays the flushing pressure of compressed air when the air flushing valve is on.

14) Hydraulic Lock Switch

The hydraulic system only operates when the switch is on. For your safety, the engine only starts when the switch is off. When the switch is off, the traveling and percussion units, except for the cylinder, do not function.

Caution!	**When the hydraulic lock switch is 'ON,' the engine does not start. The engine only starts when the switch is 'OFF.' If you turn the switch 'OFF' during operation, the only work you can do is the boom and ARC cylinder works.**

15) Anti-Jamming Switch

When the air flushing pressure increases up to9bar, or when the drifter rotational pressure drastically increases up to 130bar, the drifter automatically moves backward to prevent jamming.

※ This function is only available when the anti-jamming switch is on.

16) Compressor Switch

Air is only compressed when the compressor switch is on.

※ Turn off the switch when you start the engine or take a long trip.

17) Dust Pulsing Switch

It pulses out the dust stuck to the dust collector filter on a regular basis. Make sure to turn on the pulsing switch in drilling work.

18) Dust Collector Switch

- When you turn on the switch in drilling work, the dust collector suctions the ejecting rock dust.
- Make sure to turn on the switch in drilling work.

Caution!	**Turn off the switch if underground water or moist is generated in drilling work.** **If moist touches the dust collector filter, it may deteriorate the device performance. Dry the filter and then, clean or replace it**

19) Grease Switch

It is a switch that applies the grease to the rod and shank adaptor screws in the rod change. Grease is only applied while the switch is pressed.

Caution!	**Mix the general grease with high viscosity with hydraulic oil in a ratio of 8:2 (grease: oil). When the viscosity is extremely low, grease may run down.**

20) Collaring Switch

- It determines the location of drilling hole in initial drilling.
- If you change the collaring switch from OFF to ON after determining the drilling location, the drifter percussion pressure and feed pressure decrease and the collaring begins on the determined drilling location. After completing the collaring, change the switch from ON to OFF.

Caution!	**Do not operate the collaring switch during a normal drilling work.**

* When an error occurs, the alarm and the alarm lamp turn on.

21) Engine RPM Gauge (Tachometer)

- It displays the engine RPM.
- The pointer in the engine RPM gauge indicates the engine's rotational spindle speed per minute.

22) Coolant Temperature Gauge

It displays the temperature of engine coolant.

23) Fuel Gauge

It displays the amount of fuel in the fuel tank. The fuel tank capacity is540ℓ.

24) Engine Coolant Overheat Alarm Lamp

- The lamp turns on when the temperature of the engine cylinder head reaches a dangerous point (over105℃). The engine automatically stops when the lamp is on.

Caution!	**When the engine coolant over-heat alarm lamp is on, stop the work and make an inspection.**

25) Compressor Oil Filter Alarm Lamp

The lamp turns on when the compressor oil filter is clogged.
Replace the filter when the lamp is on.

26) Engine Oil Pressure Down Alarm Lamp

The lamp turns off 1~2 seconds after the engine start.
The lamp is on when the engine oil pressure is down or the engine oil filter is clogged.

27) Compressor Air Temperature Alarm Lamp

When the compressor pulsing temperature reaches an abnormal point (over 120°), the lamp turns on and the engine stops. When the lamp is on, stop the work and make an inspection

28) Engine Air Cleaner Alarm Lamp

The lamp turns on when the engine air cleaner filter is clogged. When the lamp is on, clean the filter following the recommended cleaning method or make a replacement.

29) Compressor Air Cleaner Lamp

The alarm sound and lamp turns on when the air cleaner is clogged. When the lamp is on, clean the filter following the recommended cleaning method or make a replacement.

30) Hydraulic Oil Temperature Alarm Lamp

When the temperature of hydraulic oil reaches 93℃, the lamp turns on and the engine stops automatically.

Warning!	**Clean the oil-hole area so that an alien substance is not mixed with the engine oil in fueling.** **Do not feed the engine oil more than the max. line in the gauge.**

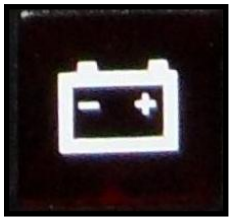
31) Fuel Alarm Lamp

When the remaining fuel is less than 18ℓ, the lamp turns on. When the lamp is on, stop the work and supplement the fuel.

Warning!	**Stop the engine first to clean and replace the engine cleaner. If you disassemble it during the engine running, it may cause fatal damage to the engine. If the lamp continues to be on even after cleaning, make a replacement.**

34) Battery Charge Lamp

It displays the battery charging status. The lamp should be off within 5 seconds after the engine start. If the lamp continues to be on, check the battery and generator.



36) Horn

It is used to make an emergency signal.

Caution!	**Blow the horn in traveling or work to make the surrounding workers be aware.**

37) Work Lamp Switch

In the 1st stage, the front lamp turns on. In the 2nd stage, the front and the rear lamp turn on at the same time.

38) Work Lamp Switch (Bonnet)

It turns on the work lamp in the bonnet.

39) Wiper

It turns on the front wiper on the 1st stage.

40) Washer Spray Switch

It sprays out the washer, while operating the wiper.

42) Warm-Up Switch (AIR)

It warms up the air in the engine before starting the engine in winter time

45) Engine Start Switch

It is used to start and stop the engine.

C: Alarm lamp error check

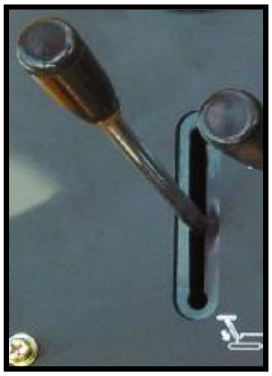
O: Position when the engine stops (OFF)

R: Position when the engine is running (RUNNING)

S: Engine initial start

If you take the hands off after the engine start, the key automatically returns to R position.

46) Boom Extension Lever



① Boom Out: Push the lever to extend the boom

② Boom In: Pull the lever to contract the boom

47) Oscillating and Guide Swing Lever

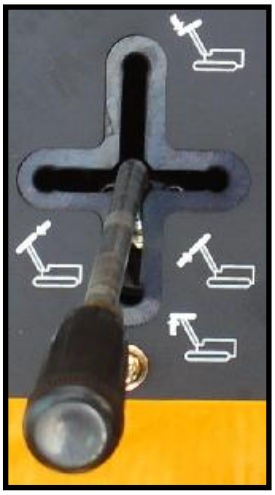
① Right Turn: Push the lever to the right to turn the guide tip to the right.

② Left Turn: Pull the lever to the left to turn the guide tip to the left.

③ Oscillating [Up]: Pull the lever down to ascend the equipment front, while descending the rear.

④ Oscillation [Down]: Push the lever up to descend the equipment front, while ascending the rear.

48) Guide Tilt and Guide Extension Lever



① Guide Tilt [Up]: Push the lever to the right to descend the guide tip.
② Guide Tilt [Down]: Pull the lever to the left to ascend the guide tip.
③ Guide Extension [Backward]: Pull the lever backward to move the guide backward.
④ Guide Extension [Forward]: Push the lever forward to move the guide forward.

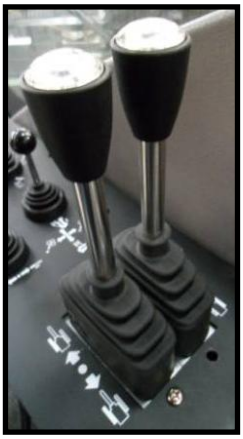
49) Boom Lift and Boom Swing Lever

① Boom [Right]: Push the lever to the right to turn the boom to the right.
② Boom [Left]: Pull the lever to the left to turn the boom to the left.
③ Boom [Up]: Pull the lever backward to ascend the boom.
④ Boom [Down]: Push the lever forward to descend the boom.

50) Auto Rod Change Lever

① Arm [Right]: Move arm to the return position
② Arm [Left]: Move arm to the center position for rod adding and collecting.
③ Rod [Down]: Rotate star to the left to set a rod on the arm.
④ Rod [Up]: Rotate star to the right for rod storing
⑤ Claw [Open]: Press the swich to open Claw.

52) Traveling Lever (Left/Right)



Left/Right Traveling Motor operates in an independent structure, respectively. If you push the Lever forward, the vehicle moves forward. If you pull the Lever backward, it moves backward. If you take the hands out, the motor returns to the neutral position and stops.

☞ Steering Direction by Operation of Control Lever

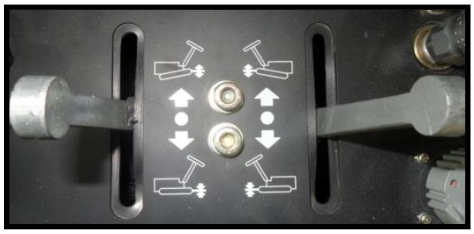
Warning!	**When you turn the equipment to the left/right, secure the available space first and make a radius of gyration as big as possible. If you make a frequent rapid turn while traveling, the track parts may wear out early.**

53) Engine RPM Control Lever

It adjusts the engineRPM from low to high.
If you pull the lever to the left, the engine is adjusted to high speed. If you push the lever to the right, it is adjusted to low speed (1000 ~ 2,200 R.P.M).

* In general, maintain the engine speed at 1,300 RPM for operation. When you turn on the compressed air switch, the engine RPM automatically increases to 2,200rpm.

54) Oscillation Lock Lever (Left/Right)



When you travel on the uneven or rough ground, the crawler tracks operate individually by the oscillation cylinder on the left/right, thereby increasing the traveling stability.
When the oscillation lever is locked, the left/right track does not shake.

① Track Oscillation (Cancel) –Left/Right
② Track Oscillation (Lock) –Left/Right

Warning!	**Release the oscillation lock when traveling.** **If you travel while the oscillation is locked, the oscillation cylinder may get damaged and the vehicle may turn over on a round ground.**

3-3. A/C and Heater

1. A/C and Heater Management

※A/C「ON/OFF」Switch

ON: You can use A/C.

OFF: You can use Heater only.

※ Cautions in Use

1. Ventilate the space once every hour in case of a long operation.

2. New refrigerant (R134a) used for A/C is a tasteless and odorless substance and is not harmful for humans.

Warning!	**A/C refrigerant is colorless and odorless and is not harmful in the atmosphere.** **If the refrigerant gets into eyes or touches your hands, you may lose your eyesight or get frostbite. Make sure to put on protection gear, such as protective goggles and gloves, when checking the parts in the refrigerant circuit.**

2. Inspection and Maintenance of Each Unit

Caution!	**Make sure to use the new refrigerant (R134a) for the cooler. If you fill up R12 refrigerant or use an unauthorized refrigerant, it may lead to unexpected errors, including the compressor damage.**

Caution!	**If you operate the A/C without refrigerant, it may lead to the A/C compressor error. Check the refrigerant amount twice a year in spring/summer.**

Caution!	**Do not fill up too much refrigerant. It may reduce cooling ability and generate a high-voltage error in the circuit.**

■ Check list when the cold air is reduced or weak

- A/C compressor
- Condenser clogging
- Refrigerant abnormality and gas leakage

■ Maintenance in Summer and Winter

- In summer, add the refrigerant to enhance the A/C performances.
- In winter, do not take off the compressor belt but maintain it in a condition that allows year-round use.
- If you operate A/C for several minutes 2~3 times a month, you can prevent the gas leakage from the compressor seal.
- If you neglect the leaking refrigerant for a long time, the interior of A/C may get rusty.

□Operation Control

- Check if each lever is in neutral position.

- Check if the compressor switch is OFF.

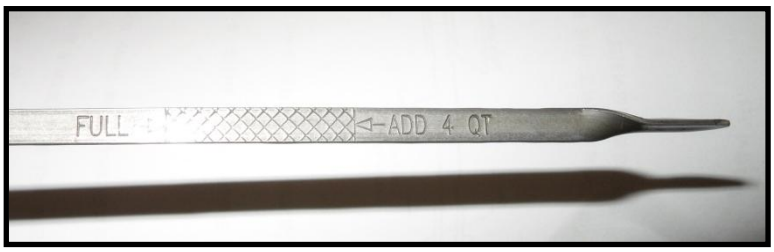
<Note>For the engine operation and maintenance, refer to CUMMINS Water Cooling Diesel Engine Operation and Maintenance Guide. For questions, contact CUMMINS service center or JunJin CSM.

4-1. Inspection Before Operation

1. Engine

1) Engine Oil Inspection

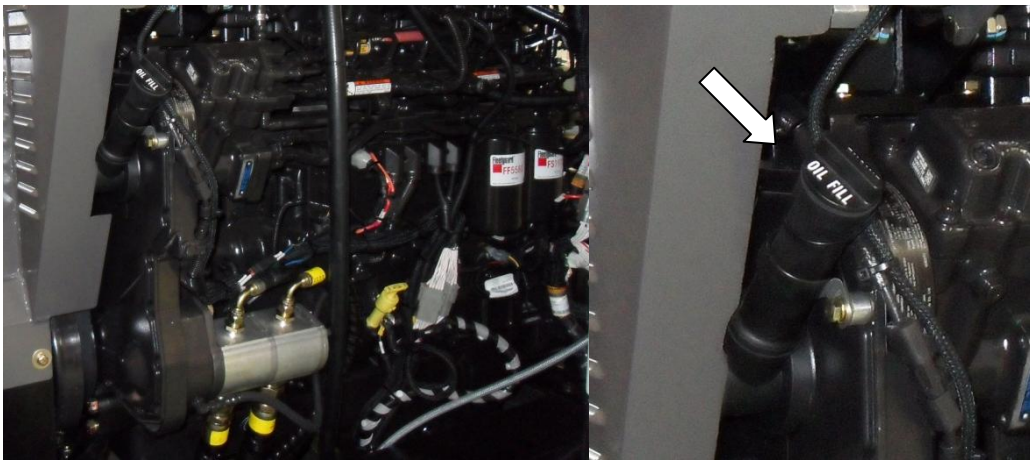
※Note	**Inspect the oil level before starting the engine on a flat surface ground. When the engine has already started, stop the engine and make an inspection 10~20 minutes later.**



① Take out the Oil Level Gauge and clean it with clothes. Insert it to the original place again and carefully take it out to check the oil level indicated on the gauge.

② Appropriate engine oil level is between 'FULL' and 'ADD' on the Oil Level Gauge described in the figure above. Make an inspection of pollution and viscosity of oil.

③ When the engine oil is short, add it by the designated level through the inlet (Arrow in the figure below).



※Note	**Use the engine oil with appropriate temperature depending on the seasonal temperature.**

2) Belt Tension Inspection

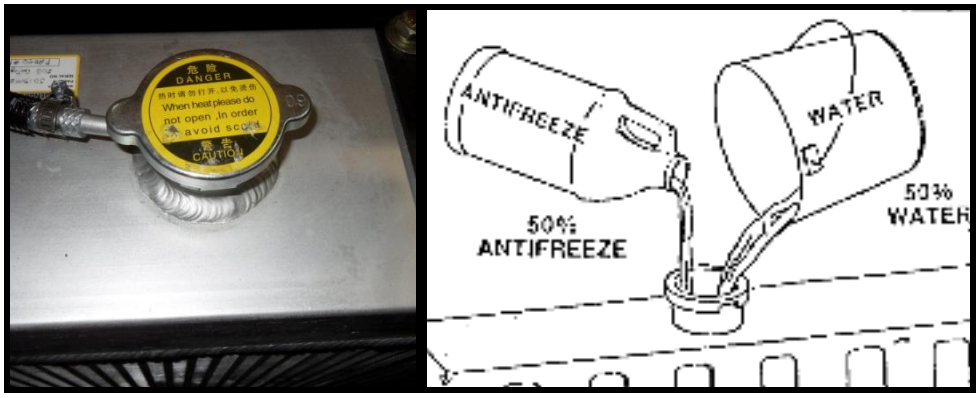
Check the belt looseness and pulley abrasion/damage. To check the appropriate belt tension, press the middle point between the fan pulley and the generator pulley by your thumb (10kg). If the bending range is 10mm~13mm, it is appropriate.

※Note	**The loosened belt may generate an issue of poor battery charging, engine overheat and early belt abrasion.**

3) Coolant Level

① Open the radiator cap and check the coolant level and pollution status. Appropriate coolant level is about 10mm over the radiator core surface.

② Use clean water (distilled water) for the coolant.



Caution!	**If you open the radiator cap while the engine is heated, you may get burned by ejection of high-temperature vapor. Cover the radiator cap with clothes and slowly turn it to the left to reduce pressure before opening the cap completely.**

4) Battery Liquid Level

When you repeat charge/discharge of the battery, the battery liquid will decrease. Check if the liquid surface reaches the specified level. If not, make sure to add the battery liquid.

Caution!	**Batteries generate inflammable gas and an explosive reaction may occur when hydrogen gas touches the heat of fire.**

Caution!	**The battery liquid is thin sulfuric acid and it should not touch eyes or skin. If it touches eyes or skin, rinse it with running water immediately and go to the doctor.**

5) Battery Terminal Looseness and Corrosion

Check if the terminal is not loosened or corroded. After the cleaning, lightly apply the grease to the terminal.

6) Others

For other maintenance and inspection items of the engine, refer to the Engine Operation and Maintenance Guideline.

2. Compressor Receiver Tank

1) Oil Level in Receiver Tank

The oil level should be maintained over the middle of the level gauge. In addition, check if the oil surface is maintained within the level gauge range when the compressor is operated.

Warning!	**Maintain the vehicle body horizontally when you check the compressor oil level. When the compressor oil level is short, an abnormal heat generation and oil degradation may occur because the oil is not sufficiently supplied to the lubrication unit of the compressor, which may lead to the compressor damage.**

Caution!	**Check the compressor oil level while the compressor is in operation. Check if the oil level is between the markings indicated on the oil gauge.**

Caution!	**Check the compressor oil color. Replace it when its color is changed.**

2) Safety Valve Check

Check the operation of safety valve by pulling out its test ring when the receiver tank pressure is 7~8kg/㎠ after starting the compressor.

3) Receiver Tank Drain

Open the drain valve located on the right of the main frame to discharge water or alien substances.

Warning!	**Moist in the receiver tank may reduce the compressor lifespan.**
Caution!	**Make sure to completely eliminate pressure in the tank when you drain moist or compressor oil in the receiver tank.**

3. Hydraulic Oil

Warning!	**If you operate the equipment with insufficient hydraulic oil, the equipment may get fatally damaged.**

Hydraulic oil tank is located in the box area at the rear of swing post. You can check the hydraulic oil level in the tank through the oil level gauge attached on the right of hydraulic oil tank.

Normal level of hydraulic oil is when the oil level is over the 1/2 line on the scale of oil level gauge when the equipment travels on a flat surface.

4. Fuel

Fuel tank is located in the left rear of the bonnet.

1) Fuel Level

① Check the oil level through the level gauge at the rear of tank.

② Use extra care to prevent water or alien substances from being mixed with oil when adding fuel.

Caution!	**The fuel quality greatly affects the engine performance and lifespan. Make sure to use high-quality fuel. Take cautions for the heat of fire and static electricity when adding fuel.**

Caution!	**If you use lower-quality fuel, it may lead to the damage of fuel pump or fuel spray nozzle.**

Caution!	**If you use poor-quality fuel, it may lead to the damage of fuel pump or nozzle.**

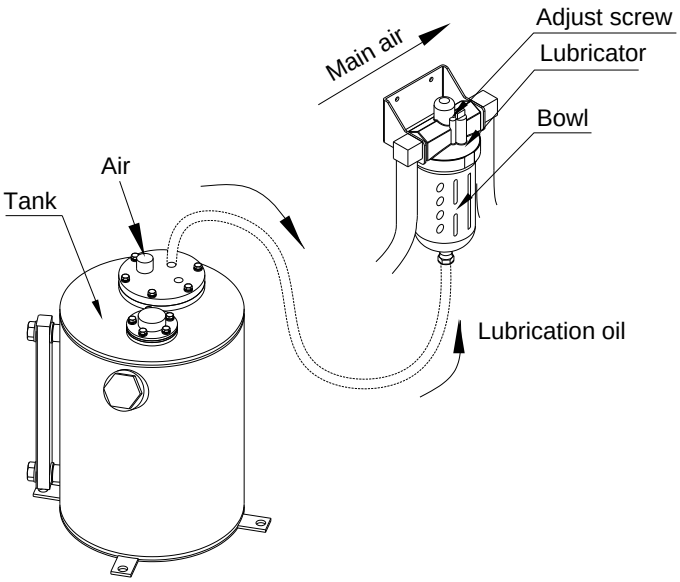
※Note	**When you travel the equipment on a slope with full tank of fuel, the fuel may be leaked from the inlet. Maintain the vehicle horizontally, if possible.**

2) Fuel Tank Drain

Open the drain valve located at the bottom of the fuel tank to discharge water gathered on the floor or deposits along with fuel.

5. Drifter Lubricant (Lubricating Oil)

Lubricator part and an oil tank are installed to refuel the Drifter Front Part(gear box). The flow rate of the Lubricator has automatically supplied from an oil tank. You have to manually supply oil to the tank.(About 15liter)



Oil flow can be adjusted by turning the adjusting screw.

*Turn right : The flow rate decrease

*Turn left : The flow rate increase

*The proper amount of the flow rate is 1drop every 2 seconds (40cc/hr)

You should adjust to formation of proper oil film is SHANK ROD.

※The standard tank pressure for the summer : 2bar, winter : 3bar

Please check and adjust the about stated oil flow.

Caution!	**If you operate the drifter for a long time when there is no or insufficient oil in the lubricator, its friction and rotation unit may get worn out or damaged early. Check the oil level in the tank before operation and add the oil if necessary.**

Caution!	**Make sure to use the lubricating oil with appropriate viscosity (recommended: VG100)**

6. Drifter

Drifter is a hydraulic device that generates percussion and rotation force.

Check the followings before the use.

* Check any looseness of bolts/hoses
* Check any oil leakage (Lubricating oil runs from the front area)
* Check any exterior damage, including cracks or damages

7. Boom, Guide Shell and Oil Hose

* Check any damages in fitting of each oil hose
* Check any looseness of bolts/nuts

4-2. Engine Start/Operation/Stop and Hydraulic Oil Heating

Make [Inspection Before Operation] and start the engine.

※Note	**Check the surrounding for safety before you start the engine even if it is a 'one-man operation.'**

1. Start

It is normal that the engine oil down lamp is on with a buzzer when you move the engine start switch to ON(R).

In addition, check if various warning lamps are turned on, and then turn the key to START(S) to start the engine.

Once the engine starts, leave the hand from the key. The key will automatically return to 'R' position. Do not turn the key for more than 10 seconds to start the engine. Once the engine start, the oil pressure down lamp turns off.

⚠ Warning!	**If you re-start the engine while the air pressure in the compressor receiver tank is not sufficiently released, it may lead to engine and compressor damages.**

⚠ Caution!	**1. If you re-start the engine while the engine is running, it may damage the engine start motor.** **2. If you re-start the engine after stopping the running equipment or after failure of the 1st time trial, make sure to completely remove the pressure in the compressor receiver tank.**

※Note	**In winter, make sure to start the engine after operating the fuel and air warm-up device.**

2. Operation

Once the engine starts, pull up the engine throttle lever to adjust the engine RPM to 1300rpm. Warm up the engine for 5 minutes (More than 10 minutes in winter) When the warming-up ends, conduct hydraulic oil heating, compressor operation, traveling or drilling operation.

3. Stop

※Note	**Stop the engine after turning off the compressor (compressor switch'OFF').**

1) Make the entire equipment body be in a traveling posture or make the tip of the centralizer touch the ground with vertically standing guide shell.

2) Move all control levers to the neutral position to reduce the engine load, and then run the equipment for 2~3 minutes by idling.

3) The engine stops when you turn the start key to'OFF.'

** Note: when the start key is 'OFF,' the fuel lock valve is closed to make the engine stop automatically.

4-3. Compressor Start/Operation/Stop

1. Start

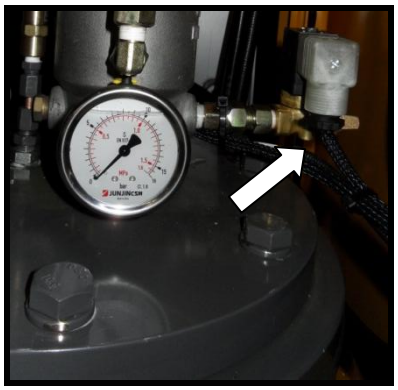
Turn 'ON' the compressor switch on the control panel.

※Note	**Turn 'ON' the compressor switch when the engine reaches 1,300rpm.**

※Note	**When the compressor switch is'OFF,' air compression is made to maintain just the minimum pressure (3bar) for compressor lubrication.**

2. Stop

Turn 'OFF' the compressor switch before stopping the engine. When the engine stops, the pressure in the receiver tank is automatically discharged to atmosphere through the auto relief valve.



4-4. Traveling

⚠ Warning!	**Make sure to check the surrounding for safety before traveling.**

1. Move Forward/Backward and Turning

You can move the vehicle forward/backward or make a turn by pushing and pulling two traveling levers located on the right of the driving seat. The vehicle stops when you leave your hand from the lever.

※Note	**Maintain the traveling posture for a long-distance moving.**

Warning!	**This equipment can travel at the maximum speed of 3.8km/h for emergency turning-out. However, drastic forward/backward movement, not in an emergency situation, may damage the equipment and reduce its lifespan. Make sure to accelerate slowly. And avoid high-speed traveling with the engine speed of over 1,300rpm.**

2. Transportation

When the equipment is loaded/unloaded to/from a truck for long-distance transportation, make sure to observe the followings to prevent equipment damage caused by impacts during transportation or accidents in loading/unloading.

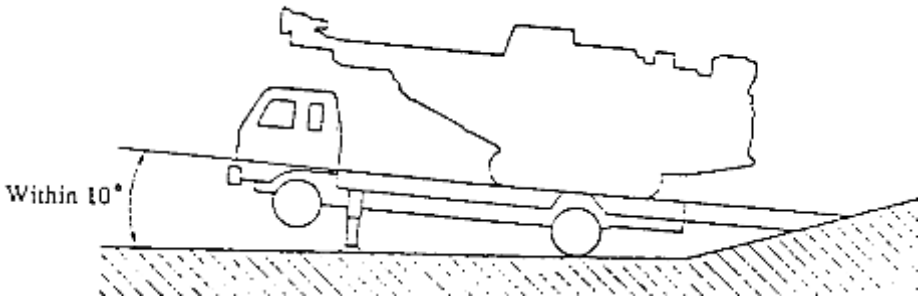
- Lock the oscillation lock valve.
- Load/unload the equipment using the slope with the inclination angle of less than 10 degrees from the ground to the truck.

In the case of oscillation cylinder operation, make sure to first release the oscillation lock valve.

- The engine speed should be less than 1,300 RPM, and the equipment should be in traveling posture.
- Once the equipment is loaded, fix the front/back of equipment by wires or chain blocks, with a vehicle hold. Make sure to transport the equipment while holding up the front lower part of the guide shell by a supporting wood.

※Note	**Take off the assistant foot located on the left of the cabin before the equipment transportation.**

3. Loading/Unloading Posture



4-5. Drilling

1. Preparation

- Check if each control lever is in the neutral or block position.
- Start the engine and warm it up.
- Turn 'ON' the compressor switch.
- Check if pulse air comes out from the dust collector.
- Set the flushing lever at [ON] and make sure that the flushing air flows out of the bit end.
- Move the percussion, feed and rotation levers, respectively to check if they function properly.

2. Drilling Work

- Move the crawler drill to the drilling point.
- Operate each lever in the hydraulic cylinder control to move and fix the guide shell to the drilling point.
- In the case of downward drilling, press down the guide shell foot bed on the ground by the guide slide cylinder, to prevent shaking.
- Turn 'ON' the anti-jamming, dust collector and dust collector pulsing switches.

- Move the flushing lever half and pull the percussion lever.
  Move the rotation lever to Normal Rotation and the feed lever to Forward and turn ON the collaring (drilling) switch.
- From the point that the bit tip passes the surface soil area and the rock bed is uniform, turn off the collaring switch. Then, operate percussion control valve, feed control valve, and rotation control valve, and move the flushing lever.

Caution!	**-Check if rock dust is discharged properly by the flushing air during drilling work(If the flushing air pressure decreases, the drifter at the bit tip automatically moves backward only when the anti-jamming switch is 'ON.').** **-If rock-dust pulsing does not function properly, stop percussion and release the flushing air. Check the status while turning the rod clockwise and if everything is fine, continue drilling work by the drifter (when rock-dust pulsing does not function properly, rotation resistance of the rod increases, which leads to automatic temporary stop of the feed, only when the anti-jamming switch is 'ON.').** **-Excessive increase in feed pressure may lead to early worn-out of the bit and the machine or rod damage because the hole center does not fit in a correct point.**

3. Control during Drilling Work

Rock quality keeps changing during the drilling operation. By selecting the most appropriate drilling condition that suits the rock quality, the drilling tools are worn out less and the operation efficiency increases.

1) Percussion Pressure Control

Adjust the percussion pressure to High in the case of pumice stones and large caliber and to Low in the case of curb stones and small caliber. In addition, decrease the pressure when the equipment passes over the clay layers or fracture.

Caution!	**Percussion pressure should be over 120kgf/㎠ at the least. Too low pressure of percussion decreases the drifter's lifespan.**

2) Rod RPM Control

Rod rotation frequency depends on the rock quality and the bit caliber. In general, in the case of operation with pumice stones or large caliber, use low-speed rotation, while for the operation with curb stones or small caliber, use high-speed rotation.

3) Feed Control

To increase the feeding force, pull up the dial of feed control valve to release the cock and turn it clockwise. If you turn the dial counter-clockwise, the feeding force decreases.

During the drilling operation, make sure to adjust the feeding force by paying attention to rock dust discharging status, changes in drifter percussion sound, and changes in rod rotation pressure.

Usually, you need to increase the thrust when you drill pumice stones or use a large caliber. The thrust needs to decrease when you drill curb stones or use a small caliber.

Caution!	**If feeding force is too low, the drilling tool (bit/rod) may wear out more. If feeding force is too high, jamming or the rod bending may occur. Make sure to adjust the speed to an appropriate level.**

4. Rod Attachment/Detachment

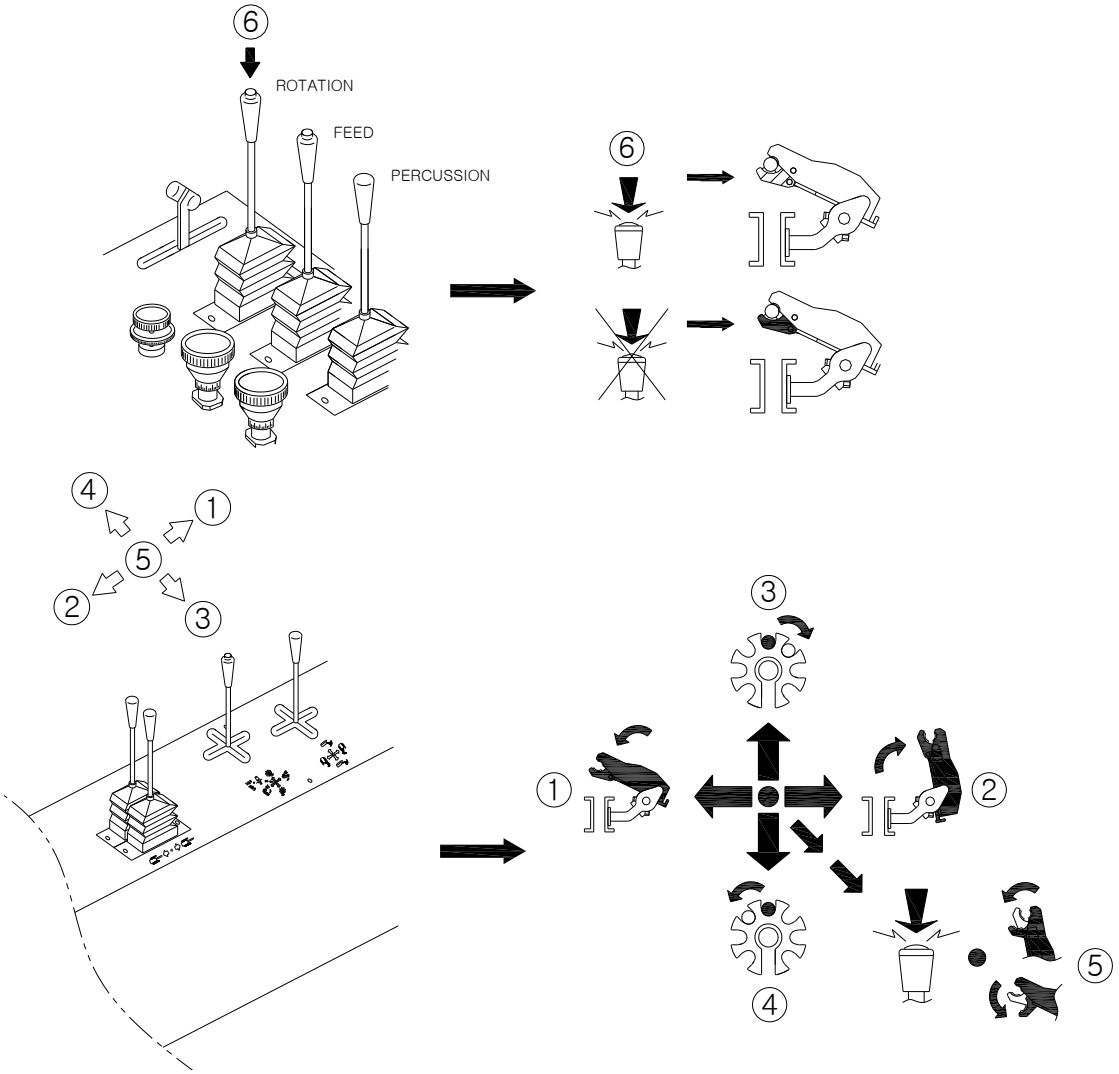
The operator can attach/detach the rod by controlling the rod changer, without directly touching the rod.

When the drilling is completed, execute no-rotational percussion by lightly pressing the bit tip at the end of the drilling hole, thereby loosening the SHANK ROD and the Sleeve.

※ For the rod connection or return, refer to Rod Changer Control in Section 4-6.

Caution!	**Operate the rod changer following the order in the control panel while securing safety of the surrounding.**

4-6. Auto Rod Changer



1 : Move arm to the center position for rod adding and collecting.

2 : Move arm to the return position

3 : Rotate star to the right for rod storing

4 : Rotate star to the left to set a rod on the arm.

*When you load/unload the rod, the clamp will be opened automatically before the star starts moving. If the star stops, the clamp will be closed automatically.

5 : Clamp open(switch on) / Clamp close(switch off)

If rod is on center position , operate arm after pushing switch.

6 : Loose grip(switch on) / Grab the rod thightly(switch off)

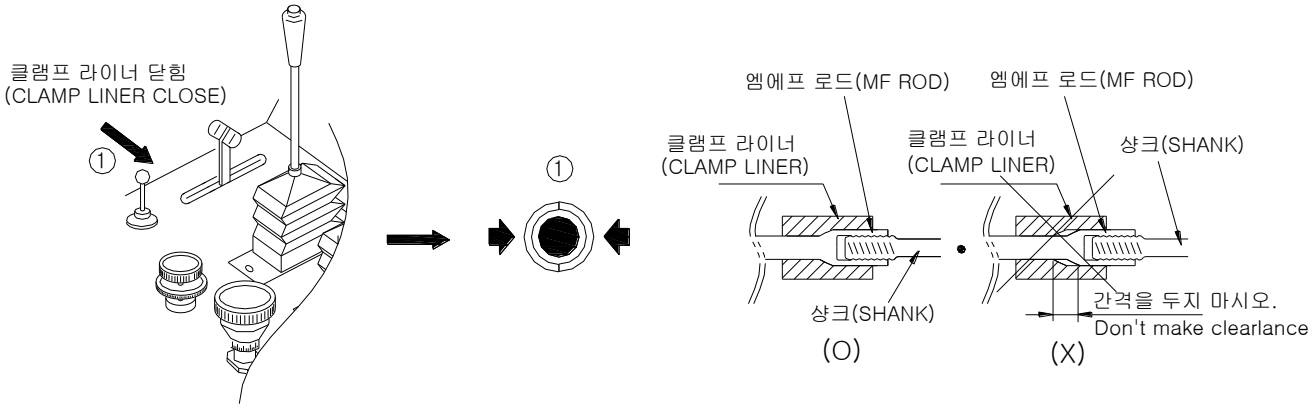
※ Use this function for rod adding and collecting.

1. Adding rods after drilling down with starter rod.

1) After drilling down with starter rod, loosen the starter rod from the shank with non-spin impact

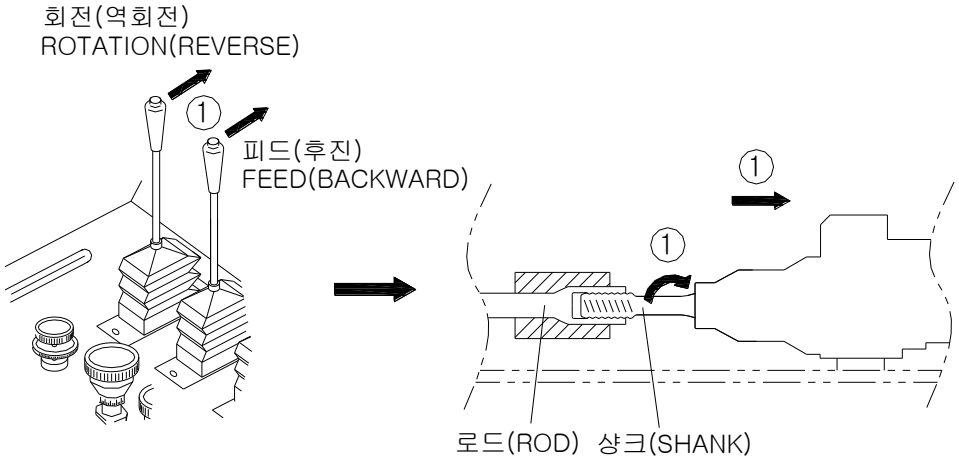
※Note	In case a Rod does not loosen even after the non-spin impact, the thread should loosen smoothly if you try with air flushing on.

2) ① Move lever #1 to the right to close clamp liner.

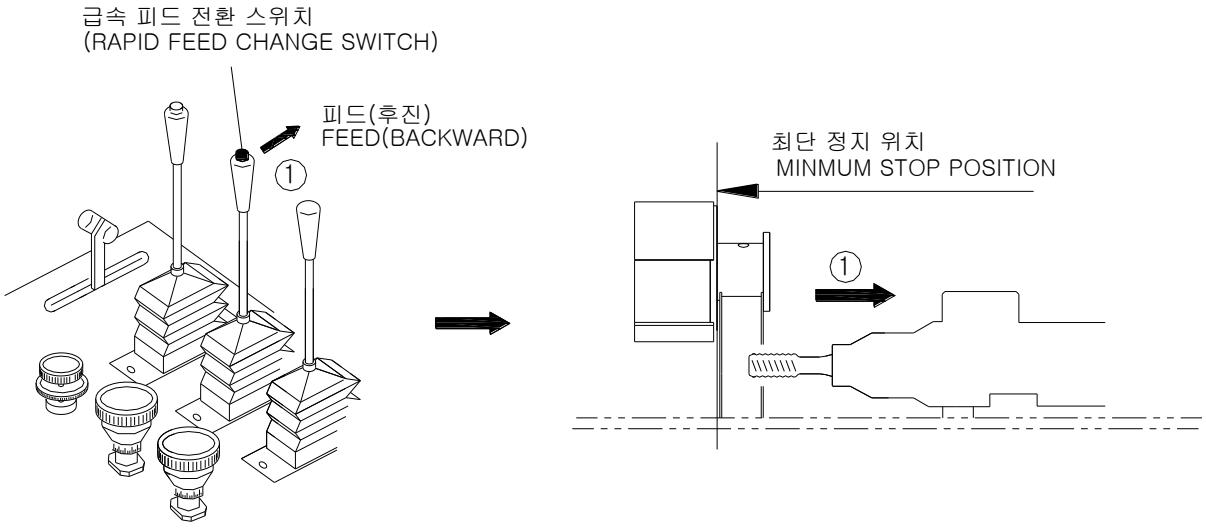


※Note	Move the feed lever forward to until the coupling is seated in the centralizer bushings.

3) ① Push rotation and feed lever #1 for reverse feed and rotation.
[Uncoupling rod/Shank]

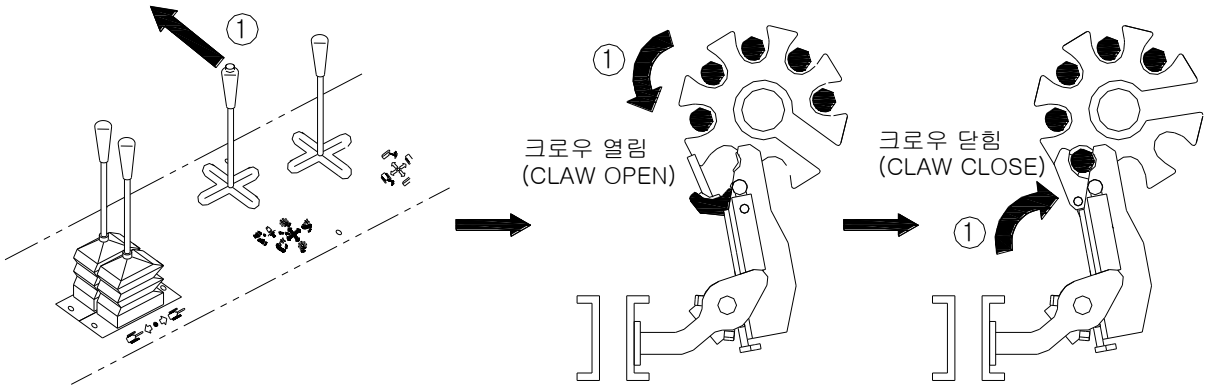


4) ① Push lever #1 for reverse feed
[Move the drifter to the minimum stop position as shown in diagram below]



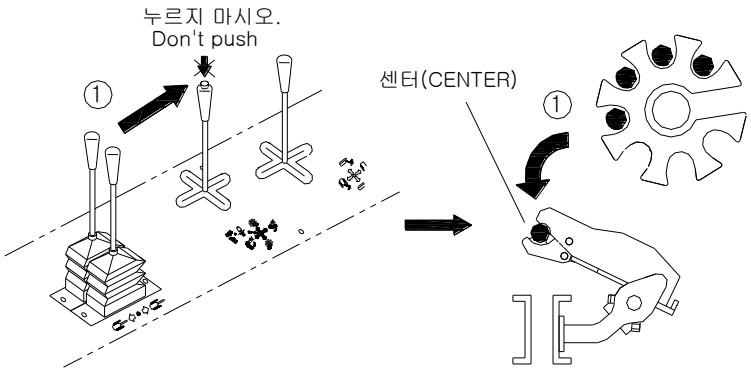
※Note	In order to change the feed speed to Rapid mode, press the switch on the top of the lever or push the percussion lever forward at with pulling the feed lever backward.

5) ① Move lever #1 to the left for rod unloading and wheel rotation



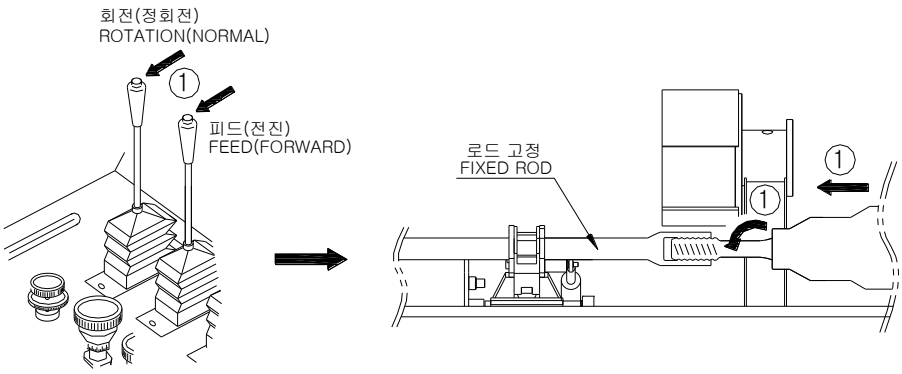
※Note	The clamp is automatically opened before the wheel moves to load/unload the rod, If you stop the operation, the clamp will be closed automatically.
※Note	It will be stopped for two seconds operated by a proximity sensor when wheel reaches the mounting position of the next rod and it means that the rod is completely unloaded.

6) ① Push lever #1 to move arm to the center.

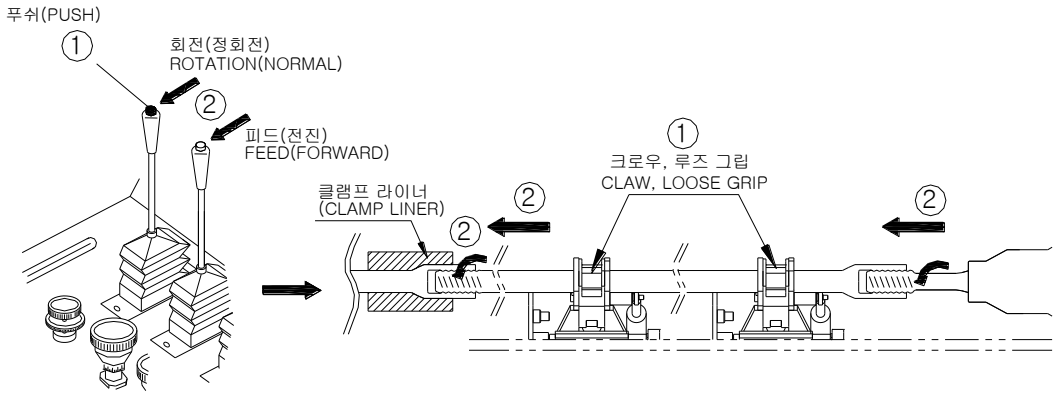


※Note	Please do not press the switch on the top of lever when the rod is clamped. There is a risk of accidents caused by derailing the rod

7) ① Pull rotation and feed lever #1 to advance feed and normal rotation.
[Rod / Shank cuppling]

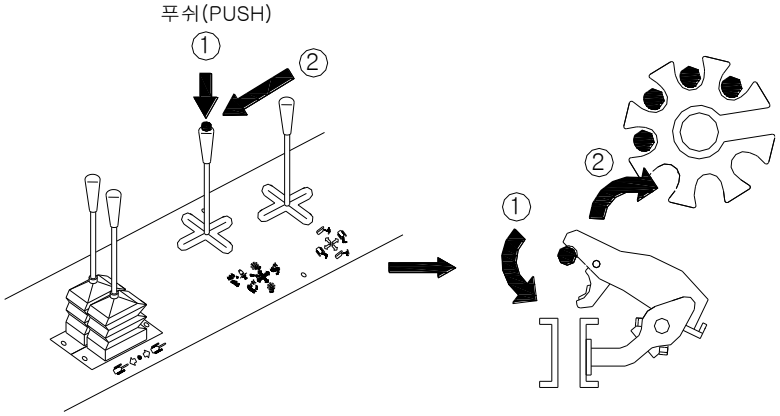


8) ① Push button #1 for soft clamp.
[when you push the button, the clamp grabs rod loosely] (soft clamp)
② Pull rotation and feed lever #2 for advance and normal rotation.
[Rod/Rod Coupling]



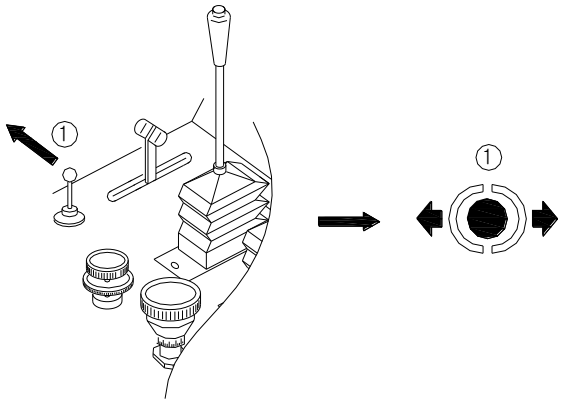
※Note	The rod will not be able to move, if rod is hard clamped. Make sure to use soft clamp or there is a high risk of damage to the related parts

9) ① Push button #1 to open clamp.
② Pull lever #2 to move arm to loading position.



※Note	If you operate with closed clamp, there is a risk of damage to the related parts. So operate the arm only after pushing the switch.

10) Complete the rod adding.
① Start to drill after moving the lever #1 to the left to open clamp liner.



2. Rod collecting

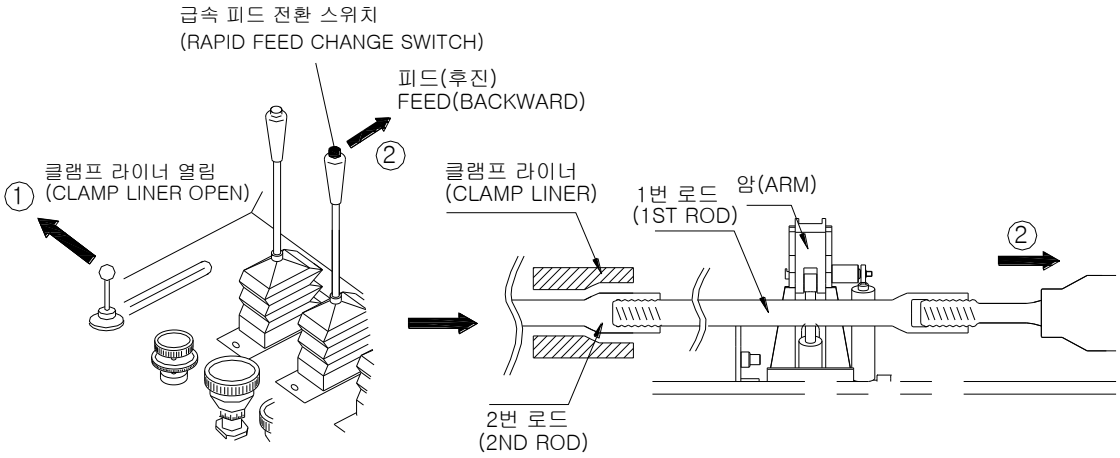
1) After completing the drilling, please loosen each screw part with non-spin impact.

※Note	In case the rod does not loosen even after the non-spin impact, the thread will be loosen smoothly if you try with air flushing on.

2) ① Move lever #1 to the left to open clamp liner.

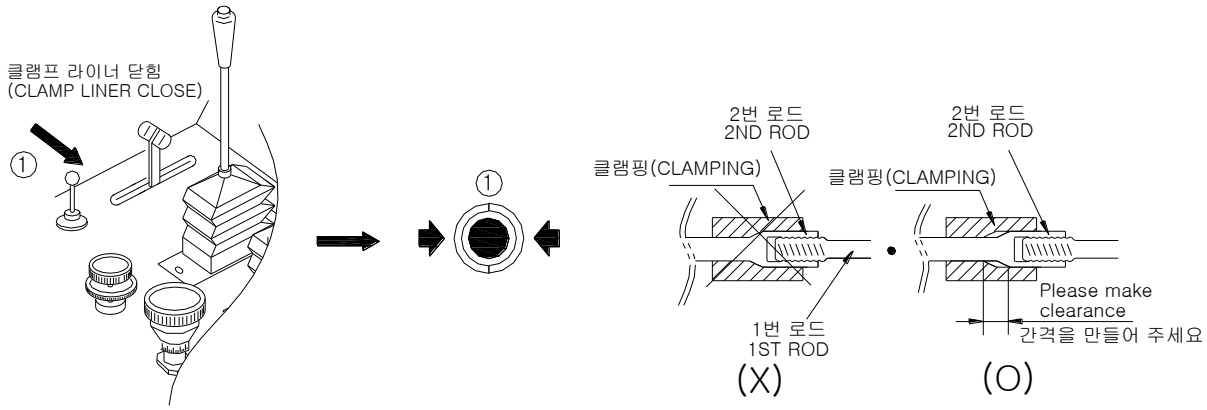
② Push lever #2 for reverse feed.

[Move the 2nd rod to Clamp liner as shown in diagram]



※Note	In order to change feed speed to high speed mode, press the switch on the top of the lever or push the striking lever forward at the same time after pull the feed lever backward.

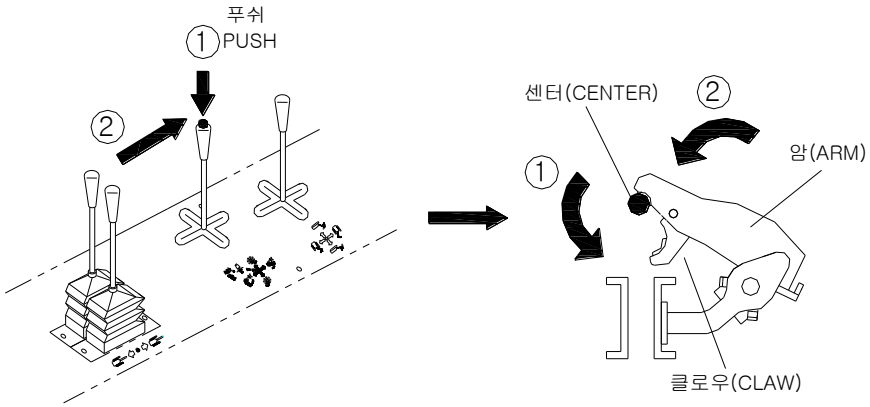
③ Move lever #1 to right to close clamp liner.



※Note	When you close the clamp to grab the 2nd rod to store 1nd rod as shown in diagram above, please make a clearance to loosen connection between Rod/Rod with non-spin impact.

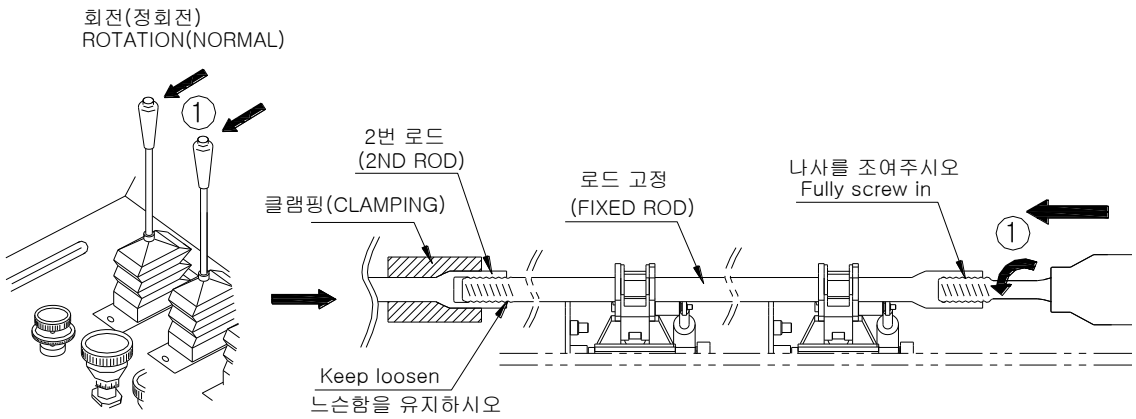
3) ① Push button #1 to open clamp.

② Push lever #2 to move arm to the center.



※Note	There is a risk of damage to the related parts if you operate with closed clamp. Operate the arm only after pushing the switch.

4) ① Pull rotation and feed lever #1 for advance feed and normal rotation.
[Tighten screw between rod and shank to avoid being uncoupled the 2nd rod which is grabed by clamp.]



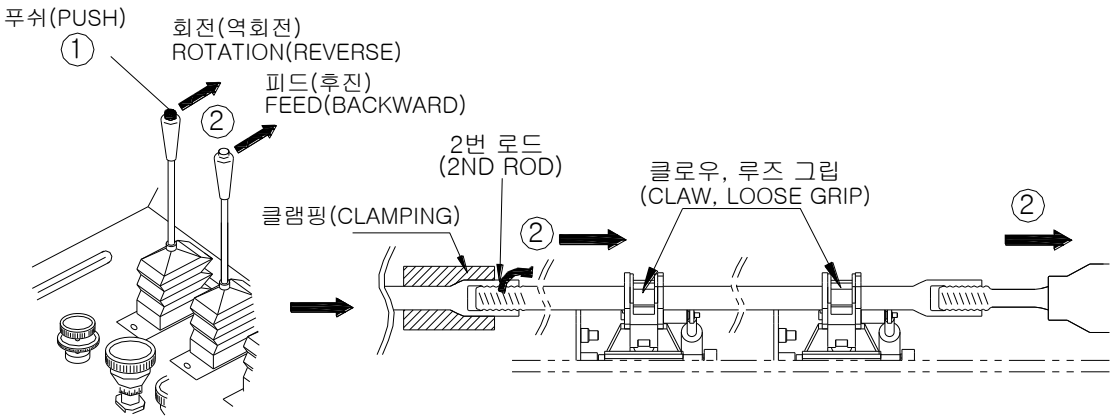
※Note	Be careful not to couple the rod with the clamp liner side.

5) ① Push button #1 for soft clamp.

[when you push the button, the clamp will soft clamp]

② Push feed and rotation lever #2 for reverse feed and rotation.

[Move the 2nd rod to Clamp liner as shown in diagram]



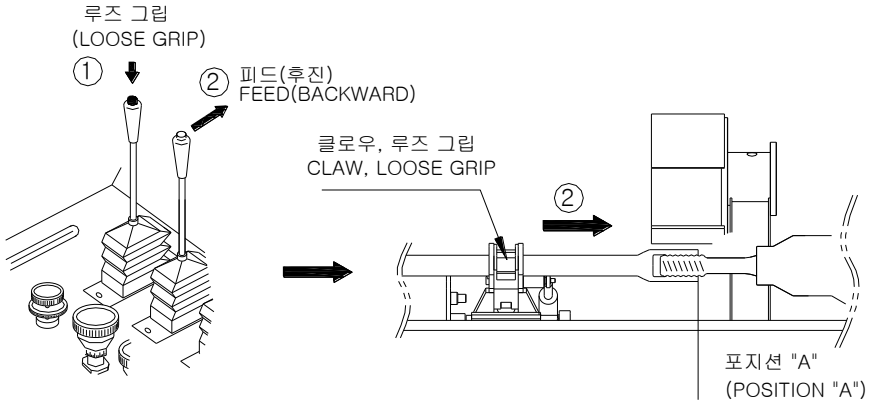
※Note	The rod will not be able to move if you hard clamp. Follow the instructions for soft clamping. Failure to follow soft clamp instructions could result in damage to the related parts.
※Note	Be careful not to loosen the connection between shank and rod. Make sure the bottom part of the rod uncouples first at the centralizer bushing end.

6) ① Push button #1 for soft clamp.

[when you push the button, the clamp grabs rod loosely.] (soft clamp)

② Push lever #2 for reverse feed.

[Move to the point "A" as shown in diagram below]

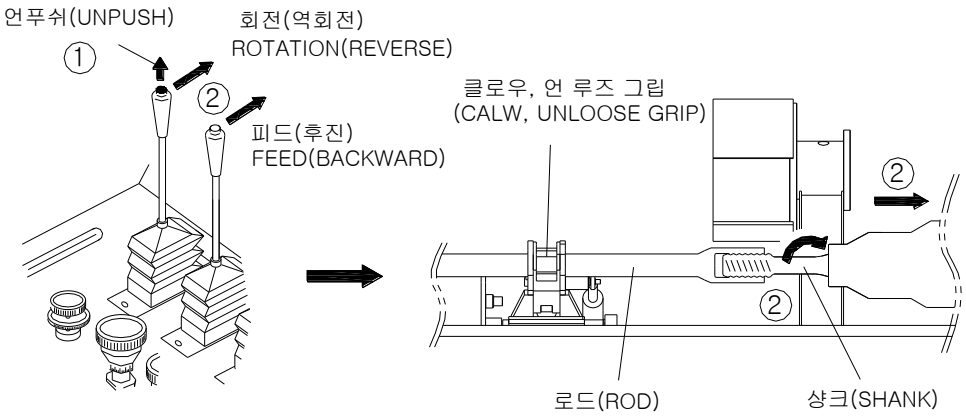


※Note	The rod will not be able to move if you don't follow the operation for soft clamping, and there will be a risk of damage to the related parts.

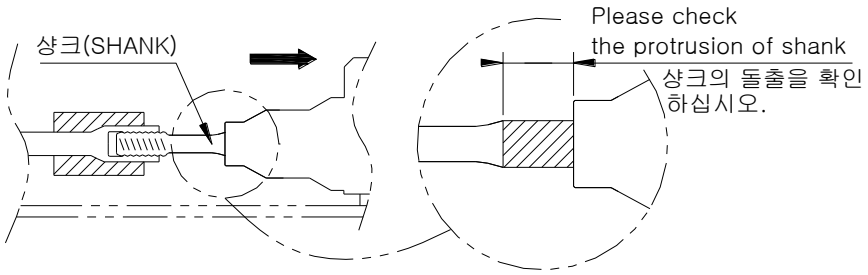
7) ① Release button #1

② Push rotation and feed lever #2 for reverse feed and reverse rotation.

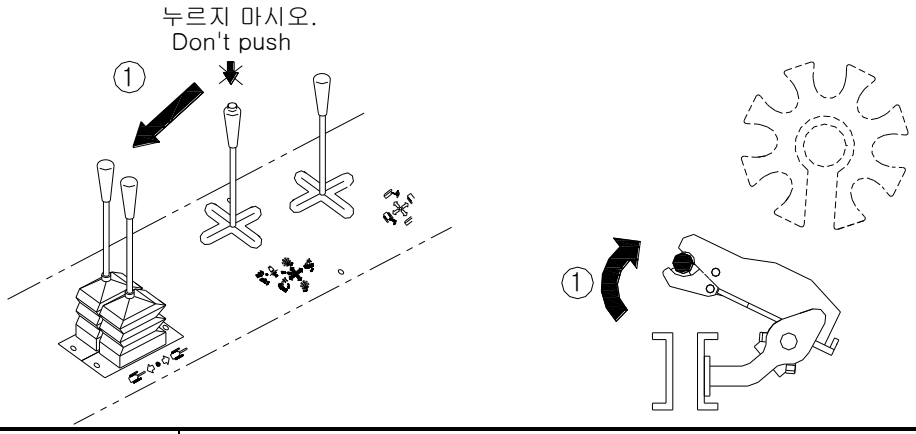
[Uncoupling rod / shank]



※Note	You can smoothly uncouple the rod string if you follow the steps below. Through the operation of reverse feed, allow the striking bar to pull out from the front head of drifter and uncouple with reverse feed/rotation while in the state of soft clamp.

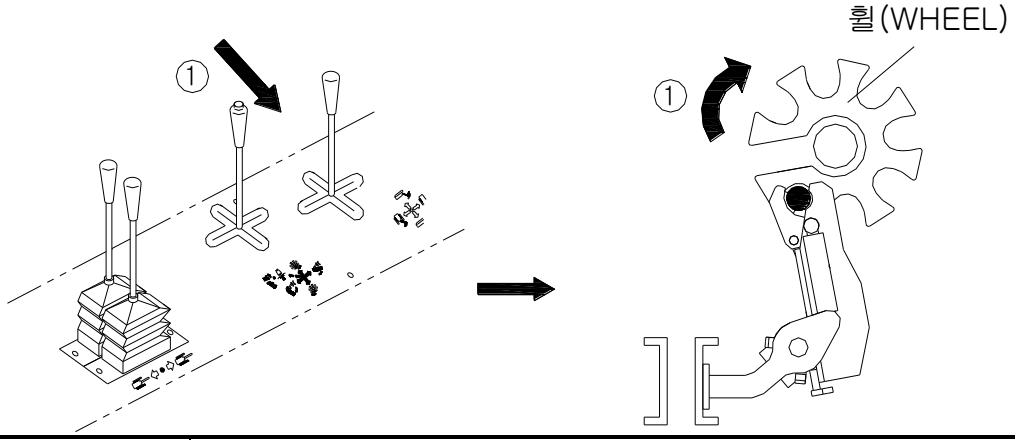


8) Pull lever #1 to position arm as shown in diagram.



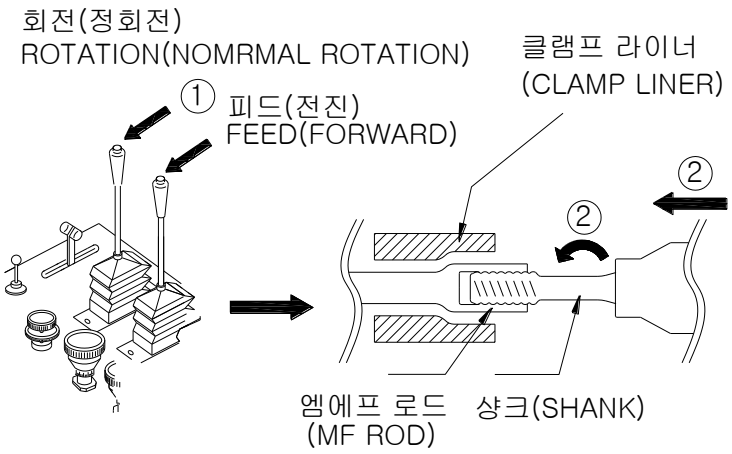
※Note	Do not press the switch on the top of lever when the rod is grabed by clamp. There is a risk of accidents caused by derailing the rod

9) ① Move lever #1 to the right to rotate the wheel for rod loading.



※Note	You can see that that the rod is loaded when wheel reaches the mounting position of the next rod. It will be stopped for two seconds operated by a proximity sensor.
※Note	The clamp is automatically opened before the wheel moves to load / unload the rod. If you stop the operation, the clamp will be closed automatically.
※Note	Please do not operate wheel except when using the rod loading / unloading operation. The clamp is opened automatically in response to the operation of the wheel, there is a risk of accidents caused by derailing the rod

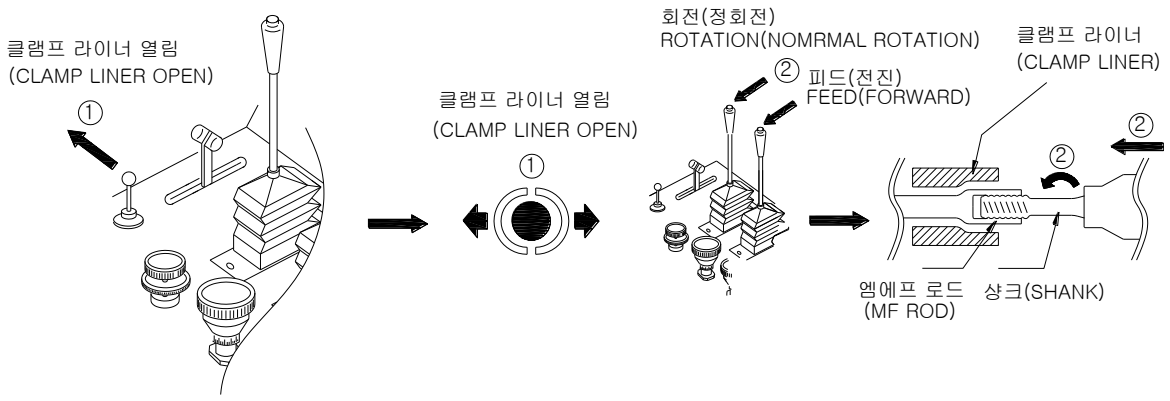
10) ① Pull rotation and feed lever for advance feed and normal rotation.
[Coupling shank/rod]



11) Please repeat the process from 2) to 10) after complete the coupling

3. Rod storing

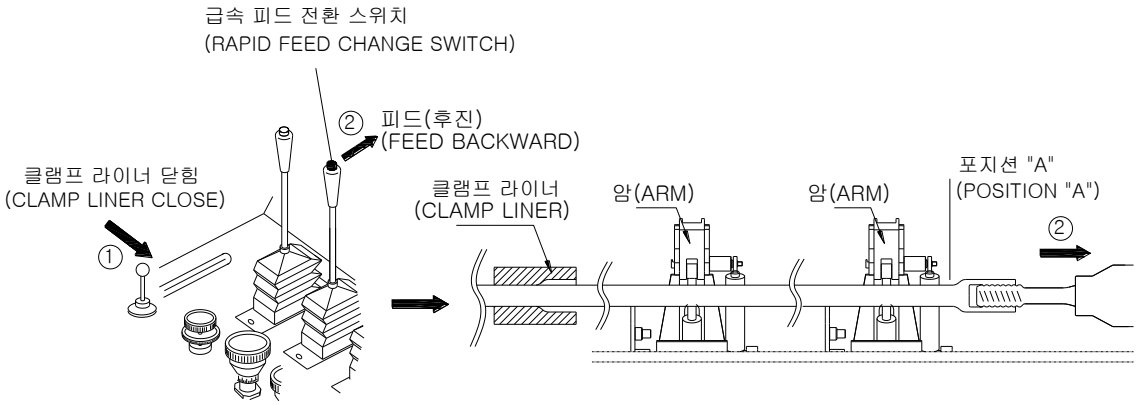
1) ① Move lever #1 to the left to open clamp liner.
② Push feed and rotation lever for advance feed and normal rotation.
[coupling Shank/Rod]



※Note	Do not thighten the rod tightly when you couple the shank with starter rod.

4) ① Move lever #1 to the right to close centralizer

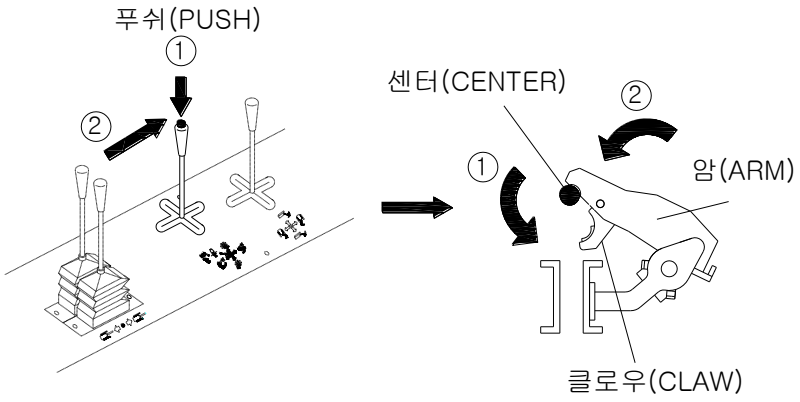
② Push lever #2 for Reverse feed. [Please move to the point "A" as shown in diagram below]



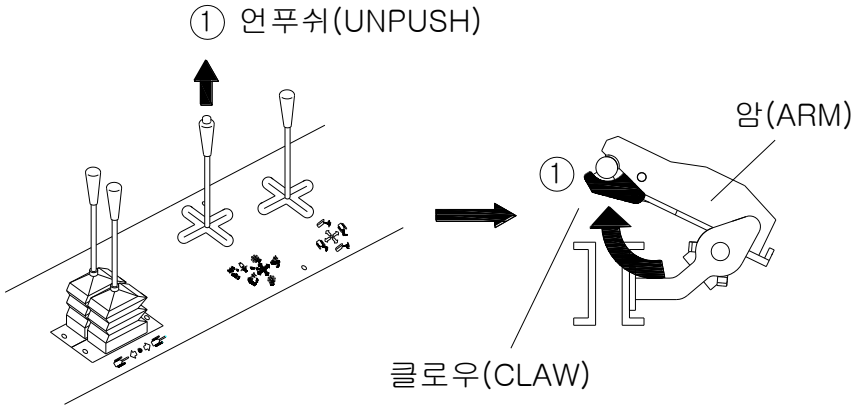
※Note	In order to change to the feed speed rapid mode , press the switch on the top of the lever or push the percussion lever forward at the same time , with the feed lever backward

5) ① Push button #1 to open clamp.

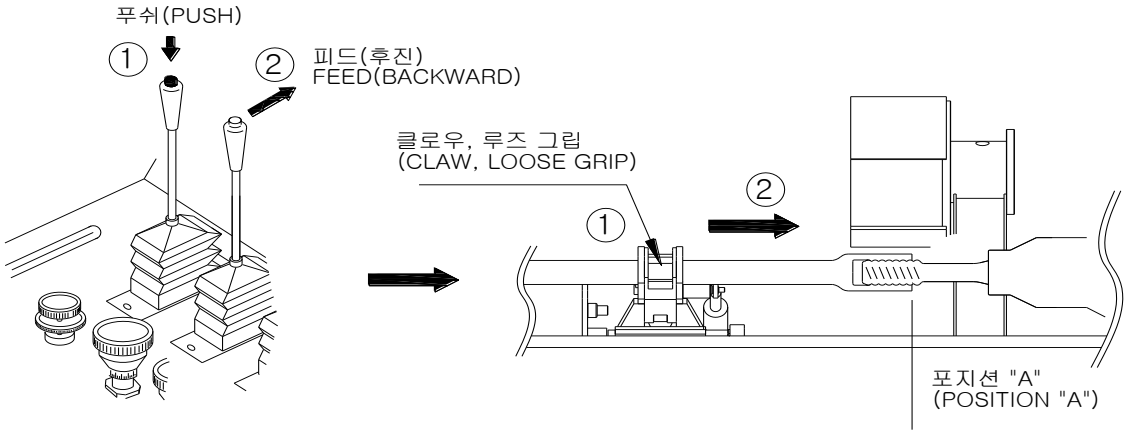
② Push lever #2 to move arm to the center.



6) ① Release button #1 to close clamp.[The clamp automatically closes when you release the button #1]



7) ① Push button #1 for loose grip.
[when you push the button, the clamp soft clamps the rod.]
② Push lever #2 for reverse feed.
[Please move to the point "A" as shown in diagram below]

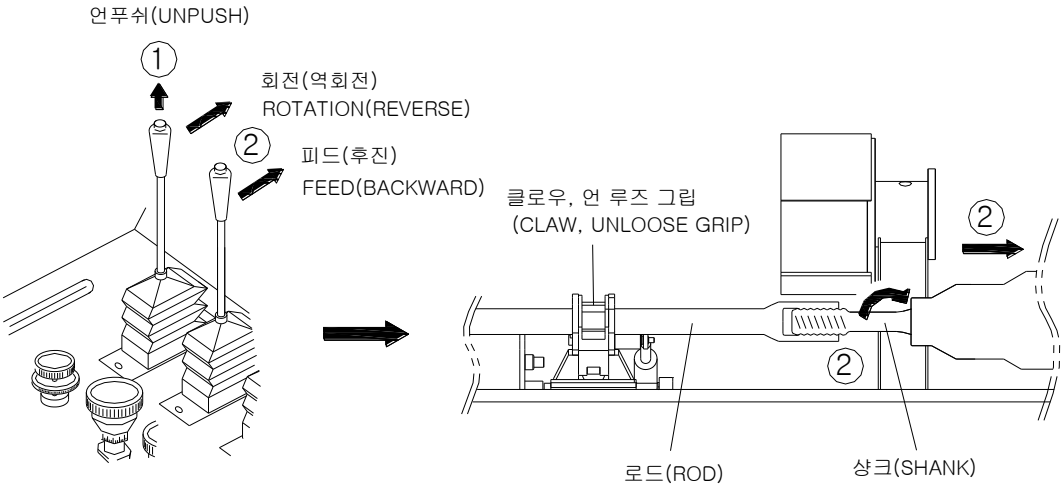


※Note	The rod will not be able to move if it is hard clamped. Make sure to soft clamp. If you do not soft clamp there is a risk of damage to the related parts

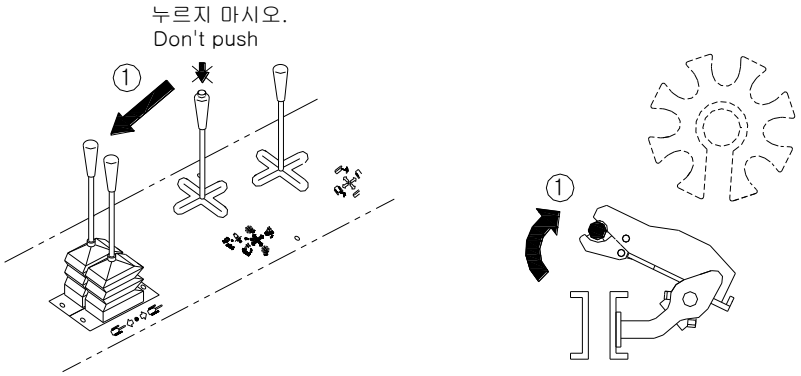
8) ① Release button #1 to release loose grip(soft clamp).

② Push rotation and feed lever #2 for reverse feed and rotation.

[Uncoupling Rod/Shank]

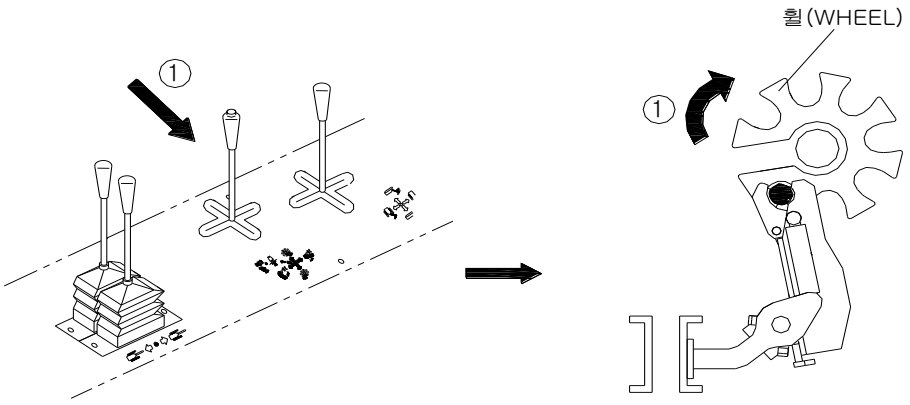


9) ① Move lever #1 right to move the rod to the loading position



※Note	Please do not press the switch on the top of lever when the rod is grabed by clamp. There is a risk of accidents caused by derailing the rod.

10) ① Push lever #1 to rotate the wheel.

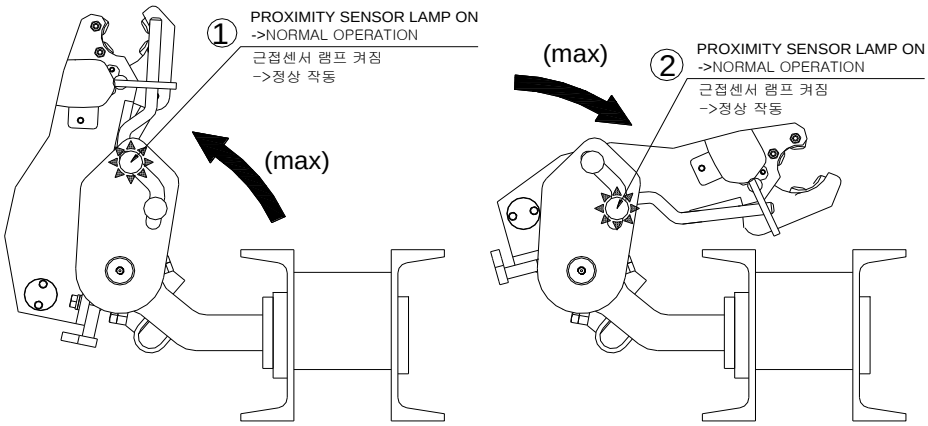


※Note	You can see that the rod is completely loaded when wheel reaches the mounting position of the next rod, and it will be stopped for two seconds operated by a proximity sensor .
※Note	The clamp is automatically opened before the wheel moves to load / unload the rod,. If you stop the operation, the clamp will be automatically. closed
※Note	Please do not operate wheel except when using the rod loading / unloading operation. Response to the operation of the wheel, the clamp is opened automatically there is a risk of accidents caused by derailing the rod

11) For additional collect, please repeat the process from 3) to 10).

12) NOTICE

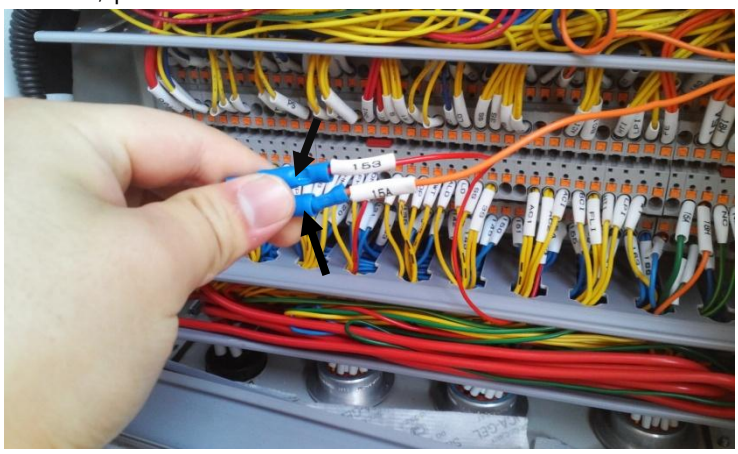
- The sensor is installed for preventing the collision accidnet with Arm and Drifter.
- The arm will be detected by sensor when it is on the position of #1 and #2 as shown in diagram below.
- If the arm is in the out of possible sensing area, drilling operation will be stopped automatically.



※Note	If the sensor is damaged, the function of percussion, rotation and feed and travel will not work. Please set the arm to the position #1 or #2 when you would like to drill or drive.

13) How to deal with sensor failure

- Please connect the connector 15A and connector 153 for the emergency response of sensor failure.
- After replacing the sensor, please disconnect 15A and 153 and return to the it's original position.



□Fuel and Lubricant

If you neglect regular refueling or supplement, it may cause the equipment malfunction and even reduce its lifespan.

5-1. Fueling Unit and Inspection

For the inspection and replacement cycle of refueling units, refer to [Inspection and Maintenance Table].

◎JD-1400E

5-2. Fuel

Quality of the fuel used for the engine considerably affects its performance or lifespan. Make sure to use good-quality diesel oil.

5-3. Lubricant

①Do not mix a different type of lubricants. When you add the lubricant, make sure to use the same brand.

②When you add the oil, carefully wipe out the inlet, the grease nipple, your hands and the tools and make sure that no alien substances are mixed with the oil.

③If the oil is warmed up, it is released more easily.

④When you replace the oil, completely release the previously used one and clean up thoroughly, before adding the new oil. In particular, make sure to use the oil in viscosity appropriate for the outdoor temperature.

1) Hydraulic Oil

Viscosity of the hydraulic oil has a direct relationship with the engine mobility, and lifespan, efficiency and lubrication of the hydraulic devices. Make sure to use appropriate oil depending on the air temperature and maintain it cleanly.

Air Temperature(℃)	-30 ~ 10	-10 ~ 30	30 ~ 50
Viscosity	ISO VG32	ISO VG46	ISO VG68

* If the air temperature is beyond the above range, contact JunJin CSM.

2) Compressor Oil

This equipment uses a screw-type compressor. Therefore, make sure to use the oil for screw-type compressors.

Appropriate air temperature for the recommended oil (viscosity class: ISO VG46) is within the range of -5℃ ~ 30℃. If air temperature that you will use the oil is below -5℃, contact the manufacturer.

Injection temperature	℃	up to 50	up to 60	up to 70
ISO-Viscosity class		VG 32	VG 46	VG 68
Viscosity at 40 ℃	mm^2/s	28.8-35.2	41.4-50.6	61.2-74.8
Flashpoint COC	℃	>200	>210	>220

3) Engine Oil

Engine oil affects performance and lifespan of the engine. Make sure to use the oil with appropriate viscosity depending on the air temperature.

Air Temperature (℃)	-30 ~ 0	-10 ~ 35	0 ~ 30
Viscosity(SAE)	#10W	#20, 20W	#30
API Class	CH-4, CG-4, CF-4		

4) Gear Oil for Decelerator

Air Temperature (℃)	Less than -10℃	-10 ~ 40	More than 40℃
Viscosity (SAE)	80W/90	90	140
API Class	GL-4, GL-5		

5) Pin Assembly and Bearing: Grease Application to Sliding Unit

Before starting the work, add lithium-soap-grease every day.

* Continue to add the grease until the old grease inside flows out.

6) Grease Application to Rod, Shank, Sleeve and Bit Screw Parts

Use the graphite-filled, heat-resistant extreme pressure grease with molybdenum disulphide.

5-4. Recommended Lubricant

1) Hydraulic Oil

Air Temperature (℃)	-30 ~ 10	-10 ~ 30	30 ~ 50
Viscosity Class	ISO VG32	ISO VG46	ISO VG68

2) Compressor Oil

Manufacturer	Mobil	Esso	GS-Caltex	Shell	SK	Remark
Compressor Oil	Mobil Rarus SHC 1025 Mobil Rarus 425	Compressor Oil 46	Compressor RA-X 46	Corena RS 46	COMP RS 46	ISO VG 46

3) Engine Oil (CG-4)

Manufacturer		Mobil	Esso	GS-Caltex	Shell	SK	Remark
Engine Oil	Below -30℃	Mobil Delvac 1 SHC				SD 5000 GOLD(15W/40) (API CI-4)	Synthetic Lubricant
Engine Oil	Normal Temp.	Mobil Delvac MX 15W/40	Essolube XD-3 Extra 15W/40	Delo VI 15W/40	Shell Rimula Super 15W/40	SD 5000 GOLD(15W/40) (API CI-4)	API CG-4

4) Gear Oil for Decelerator

Manufacturer		Mobil	Esso	LG-Caltex	Shell	SK	Remark
Gear Oil	Below -20℃	Mobilube SHC 75W/90				Super Gear EP (ISO VG 150)	API GL-5
	-20℃~40℃	Mobilube HD 80W/90	Gear Oil GX 80W/90	Thuban EP GL-5 80W/90	Spirax HD 80W/90		
	avobe 40℃	Mobilube HD 85W/140		Thuban EP GL-5 85W/140	Spirax HD 85W/140		

5) Grease

Manufacturer		Mobil		Esso	LG-Caltex	Shell	SK	Remark
Grease	Normal	Mobilux EP2	Mobilith SHC 220	Beacon EP2	Multifak EP2	Alvania EP2	CROWN GREASE EPI	NLGI No2
	Extreme	Mobilgrease special			Molytex EP2	Retenax Grease HDX2	CROWN GREASE MOLY	NLGi NO2 + MoS2

6) Drilling Oil

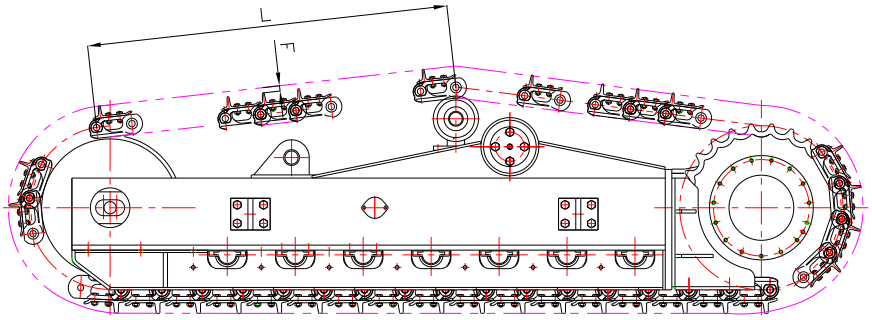
Manufacturer	Mobil	Esso	Shell	BP	SK
Drilling Oil	Almo	Arox	Torcula	Energol RD-E	Super Rock Drill

□Inspection, Maintenance and Repair

6-1. Lower Body Unit

1. Track Front Take Up Tension Control

Falling (F) of the center point between the carrier roller and the front idler should be 25~30mm.



<Track Tension Control>

① Move the equipment slowly for about 1m.

② Stop the equipment slowly.

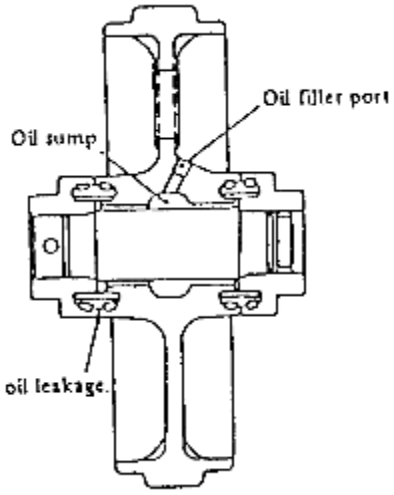
③ Align the center of the top roller and that of the track pin.

④ Place a straight ruler or stick on the track shoe.

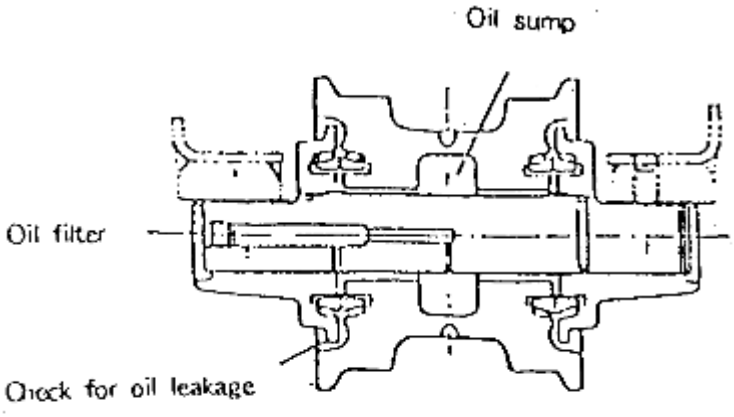
⑤ Measure the falling amount of the lowest point.

⑥ If the falling amount is too much or too small, inject or release the grease and make an adjustment to meet F = 25~30mm.

2. Front Idler Oil Leakage Check



3. Track Roller Oil Leakage Check



4. Equipment Towing(Brake Release and Restoration in Manual Towing)

▣Tow Traveling

If this equipment is towed by another vehicle, make sure to have a traveling posture and release the brake following the instruction below.

Warning!	**Avoid the brake release on a slope. It may lead to serious accidents such as equipment turnover, narrowness or death.**

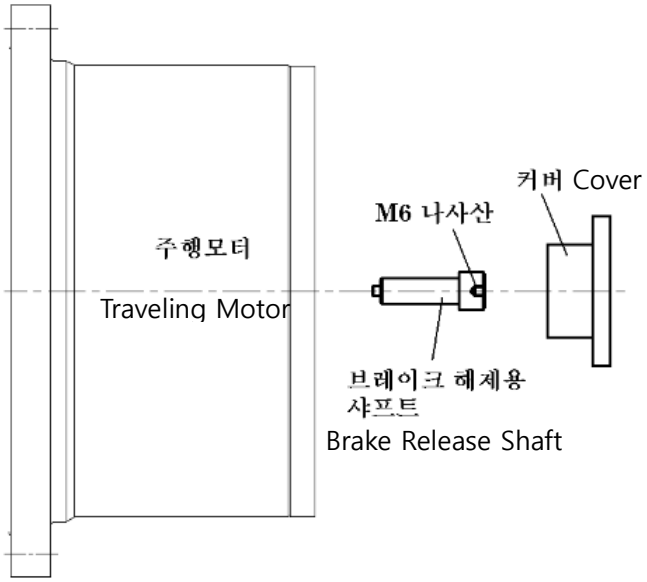
1) Separate the cover from the decelerator using an Allen wrench.

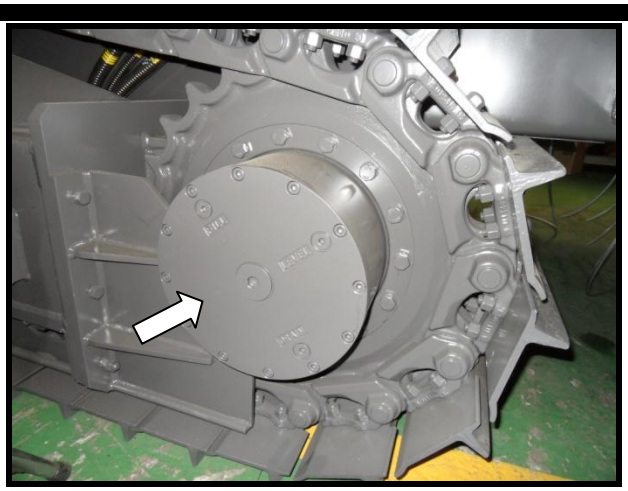
2) Assemble M6bolt to the screw thread located at the end of the traveling motor whose cover is separated, and completely separate the brake release shaft from the traveling motor.

3) Re-assemble the separated cover to the traveling motor.

4) Now, the brake is released.

5) Tow the equipment using a drawbar hook installed on the left/right track frame or on the front/back of the equipment.





Caution!	**1. Make sure to store the separated brake release shaft without contamination until the brake is re-locked.** **2. Do not operate the hydraulic motor while the brake is released.**

▣Brake Lock Control

1) Separate the cover from the traveling motor.
2) Remove the M6bolt assembled to the brake release shaft.
3) Insert the brake release shaft into the traveling motor.
4) Assemble the cover firmly.
5) Now, the brake is completely locked.

Caution!	**Move the equipment back/forth slightly to check if traveling (brake locked) is available.**

5. Decelerator

Even though the lubricant (gear-oil) for decelerator is filled in the time of shipment, make sure to check the lubricant before operating the equipment.

(1) Gear Oil in Use

Gear oil that contains SAE #90 relevant extreme pressure additive (API Class GL-4 Grade and Over)

(2) Gear Oil Replacement Cycle

① Initial 1 Time Replacement (the first replacement since the beginning of operation): 500Hr

② Replacement after 2 Times: 1000Hr or 1 Year

In case the gear oil is reduced for some reasons, identify the cause, take a corrective action and supplement the gear oil.

③ Gear Oil Replacement Amount: 1.6ℓ

④ How to Replace Gear Oil

ⓐMake sure that the refueling port and discharging port stand vertically on a horizontal surface.

ⓑIn case of replacement, take off the plug of both ports and flow out the gear oil. To add, take off the refueling port plug only.

ⓒ Add the gear oil until it overflows in the refueling port. The refueling port also plays the role of check port.

ⓓWhen you plug the port, make sure to wrap the plug with seal tape before locking.

6-2. Fuel System

- Replace the fuel filter every 600 hours.
- If the fuel filter is disassembled or the fuel tank is emptied, make sure to belch out the air.

ⓐUnscrew the air bleeding screw from the injection pump by a screwdriver/a spanner.

ⓑTurn and loosen the fuel plumbing pump handle and move up/down the handle by hand to release the fuel until the air does not come out from the air bleeding screw.

ⓒOnce the bubble does not come out anymore, fasten the air bleeding screw first and return the plumbing pump into its original status.

⚠ **Caution!**	**Sealing of injection pump can only be broken off by a professional repair factory.**

6-3. Cooling System

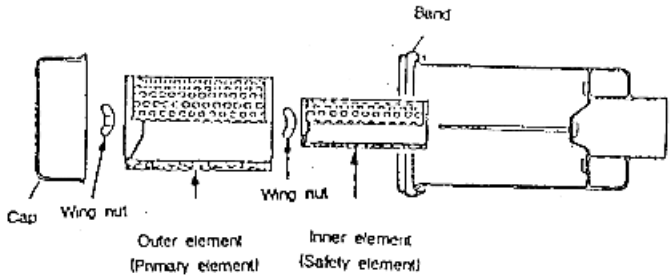
□Coolant Replacement

- Replace the coolant every 600 hours of operation.
- Clean the radiator fan every 600 hours by steam or compressed water.
- Rinse the coolant every 1000 hours in principle by adding a cleaning liquid.

6-4. Suction System

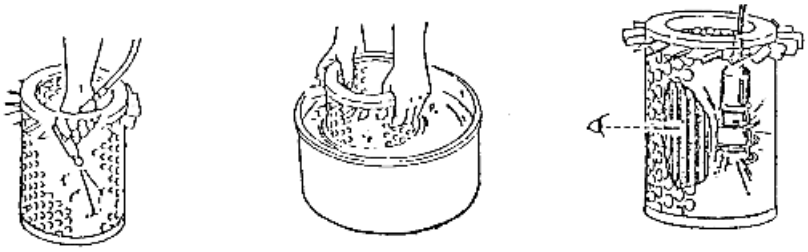
1. When the pilot lamp turns on or when the specified time in use reaches, re-use the exterior element for 4 times by cleaning it. And in the 5th cycle (600 hours), make sure to replace the element.

* Remark: Secure and use the interior element 5 times more than the exterior element.



2. How to Clean Air Cleaner Element

- If it is filled with dry dust, clean it with the compressed air.
- If it is dirty by carbon or grease, soak it in the specified cleaning liquid for 30 min and rinse it with clean water. Then, dry it in a well-ventilated place.
- Inspection: If you find a rupture, hole or damaged packing when you shed the light on it in the inspection of the cleaned element, make sure to replace it with the new product.

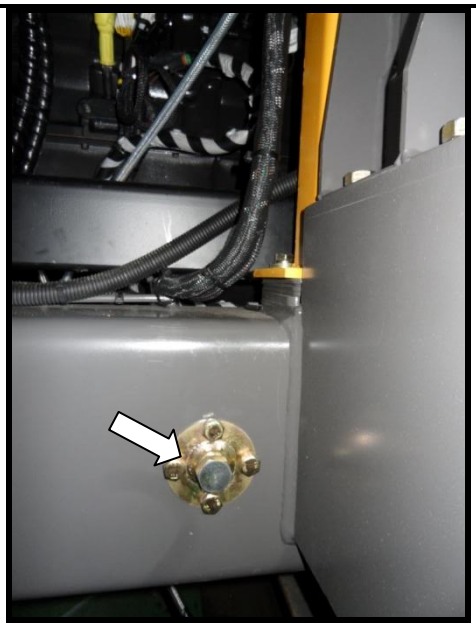


6-5. Lubrication System

1. Engine Oil Change

Make a replacement every 50 hours for the initial change and every 200 hours afterwards.

Caution!	**Drain the oil from the drain plug of the oil fan while the engine is warm and add the designated amount of new oil.**



2. For the oil filter change, follow the instruction above.

3. After the oil change, run the equipment by idling rotation for 5 minutes and stop it. 10~20 minutes later, check the oil level and make a supplement if more oil is necessary.

6-6. Compressor

1. Regulator Control

① Stop using all air (lock the valve) and stop the engine.
② Loosen the nut of the regulator pressure control bolt and loosen the bolt sufficiently.
③ Start the engine and adjust the engine speed to 1200RPM.
④ Fasten the pressure control bolt while looking at the pressure gauge on the oil separator to maintain the pressure at 10.5kg/㎠. Fix it by fastening the fixing nut.

2. Replace the oil separator element assembled in the receiver tank every 1000 hours.

3. Return Orifice Cleaning

It is attached on the receiver tank. Loosen it for cleaning when oil is mixed in the flushing air.

<Refer to the sticker attached on the receiver tank>

4. Others

ⓐ Compressor Oil Filter Element

Change the cartridge only.

ⓑ Air Cleaner Cleaning and Change
ⓒ Compressor Oil Change
Change the oil every 200 hours for the first time and 600 hours from the 2nd time.
ⓓ Oil Separator Element Change

6-7. Return Filter Change

[Refer to Inspection and Maintenance Table for change cycle]

- How to Change

a) Unscrew SOCKET bolt 4EA in the return filter.
b) Take off the cover and take out the filter element.
c) Attach the new element and close the cover (cap).

6-8. Electric System

1. General Cautions
   - When you wash the equipment, take caution to protect electric parts from direct contact of water.
   - If the pilot or other parts are not in normal condition, stop the operation and make sure to make an inspection.
   - Make a frequent inspection to check slackened wiring or looseness of connection terminals.

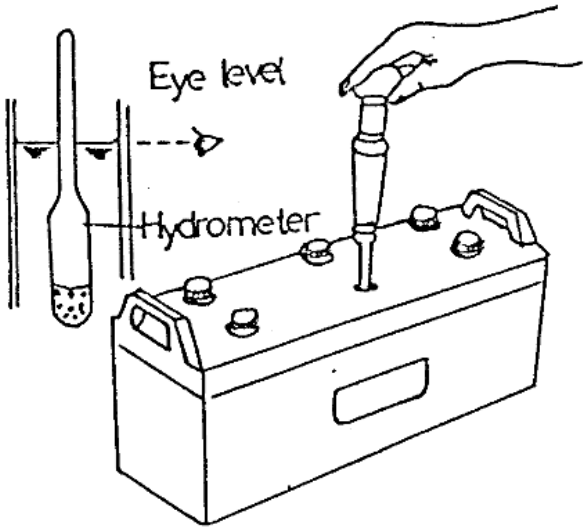
2. Control Power

Use 12V, PT80-34FR x 2 battery.

Always store the battery in a dry condition, and maintain the electrolyte level at 10~13mm from the pole plate. If the electrolyte is insufficient, supplement the distilled water.

<Battery Condition by Specific Gravity>

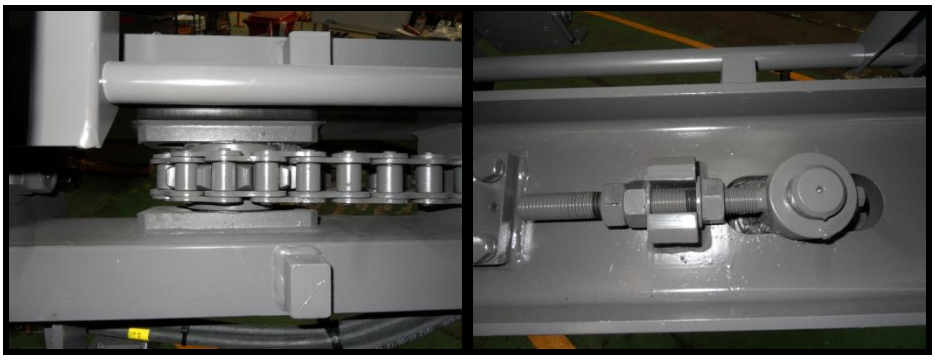
More than 1280	High Gravity, Readjustment Required
1280 ~ 1250	Good
1250 ~ 1240	Generally Good
Less than 1240	No Good

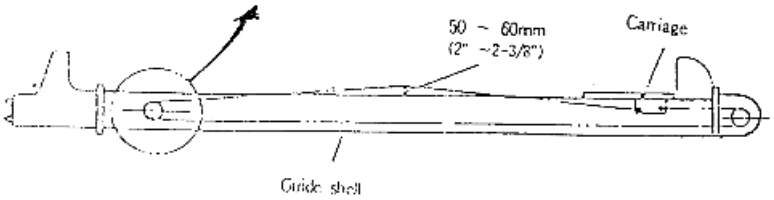


6-9. Guide Shell

1. Feed chain tension should be adjusted on a regular basis.

1) Loosen the nuts (both left/right) and (2) slowly fasten the nuts comparing the left and the right. (3) At this time, make sure to make the front shaft stand vertically against the guide shell.





2. No Guide Grease Application

※If you apply grease on the entire section indicated with arrows in the picture for drilling work, alien substances may pile up, which may lead to early worn-out of the guide or the pad.

※In drilling work, make a frequent inspection to check if an alien substance is attached on the arrowed area and check if the drifter moves properly.

6-10. Dust Collector

1. Pulse Air Pressure Control

The pulse air pressure control regulator for the dust collector, along with the filter, is installed on the rear top of the dust collector main unit.

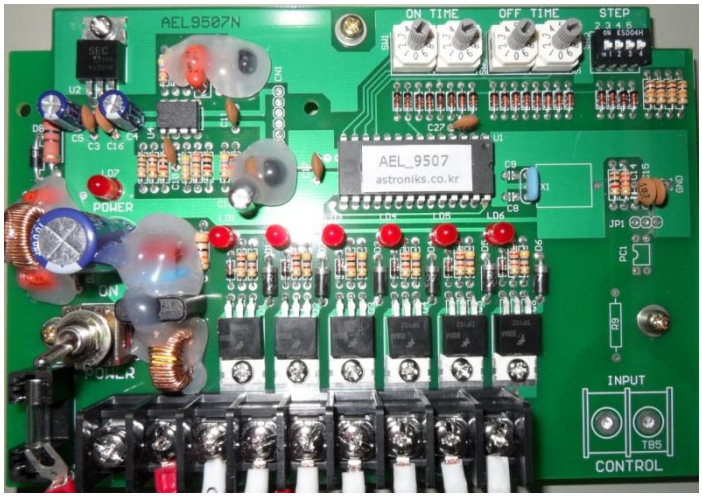
If the pressure adjustment is necessary on the pulse, pull down the lower handle of the regulator and turn it left/right for operation. (Right Turn: Pressure Increase, Left Turn: Pressure Decrease)

Appropriate pressure of pulse air is3.5 ~ 4.5bar.

Caution!	**If you excessively increase pulse air pressure, the dust collector filter may get worn out early.** **The filter has an auto-discharge structure during operation. Therefore, no separate drain is necessary. Clean the inside once a month.**

2. Pulse Timer

- The pulse-timer for dust collector is installed on the side.
- Even though the pulse-timer has passed the test in shipment, make sure to have full knowledge of the following to prepare for the case that an adjustment is necessary.



1) Electric Specification

① Input Voltage: 24V DC (±10%)

② Pulse Control Range: 0.01 ~ 1.00 sec.

③ Interval Control Range: 1 ~ 100 sec. (1 sec. distance)

④ Step Control Range: 1 ~ 6 points

2) Switch Setup

① Pulse Switch Setup (ON TIME)

Turn 2 dials of the pulse switch to set the desired pulse time. The value displayed on the switch is in 0.01 second. When you set "00", the value will become 1 second. Appropriate setting value is 15.

Make an adjustment as shown in the picture.

② Interval Switch Setup (OFF TIME)

Turn 2 dials of the interval switch to set the desired time. The value displayed on the switch is in 1 second. When you set "00", the value will become 100 seconds. Appropriate setting value is 05.

Make an adjustment as shown in the picture.

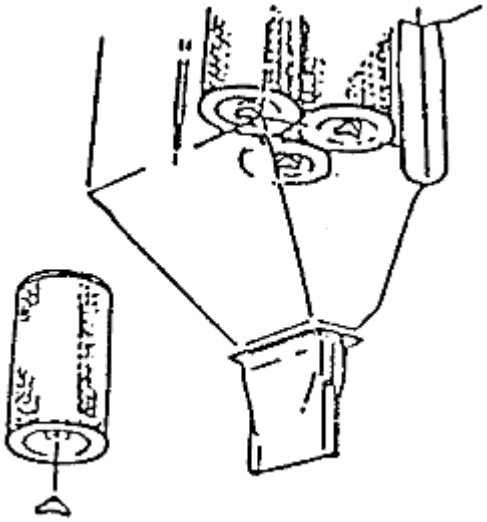
③ Pulse Step Switch Setup (STEP)

Set the step switch located on the far left of the control board, as shown in the picture.

Caution!	**When you set up the pulse and interval switches, make sure to turn off the power switch. The setting value of the step switch is 4. If you make an arbitrary change, the dust collector performance may get deteriorated.**

3) Filter Cleaning and Change

As the filter gasket is stuck fast to each other as a single body, you should pull out with strength. Clean it with the compressed air and take caution not to damage the filter bed. Change the filter every 600 hours.



6-11. Winter and Summer Management

□ Winter Management

a) Fuel Management

- Make sure to use diesel designed for winter use.

If not, the engine may not start properly.

- If you should use diesel designed for summer use inevitably (when it is hard to find diesel designed for winter use), add the additive to enhance liquidity.

Standard Usage: 1ml per 1L of fuel

※ Make sure to bleed the water in the fuel system on a regular basis.

b) Hydraulic Oil Management

- Use different hydraulic oil for winter and summer, respectively.

Season	Winter	Summer
Viscosity Class (ISO)	46	68

c) Engine Start in Winter Time

1) Turn the start key to key on(O) position

2) From this moment, the warm-up lamp turns on and the engine warming-up is made for 20 seconds.

3) When the engine warm-up is done, the warm-up lamp turns off. Turn the start key to start(S) position to start the engine.

4) Once the engine starts, turn off the warm-up switch and make idle running for 10 minutes.

※If the engine does not start proper even after warming-up, repeat the above 1~5.

d)) In the area with intense cold, put on the shoe plate to wood or rock when parking the equipment to prevent the tires from being frozen on the ground.

□ Summer Time

a) Battery electrolyte may be evaporated easily. Frequently check the oil level.

b) After operation, sufficiently cool down the engine by idle running and then stop it.

c) Dirty oil cooler pin may cause overheating. Clean rock dust attached to the radiator and oil cooler pin.

6-12. Long-Term Storage

When the equipment takes a long-term rest, store it in a dry garage. Do not leave it outside.

If you inevitably need to leave the equipment outside, place it on wood in a flat surface with good drainage and make sure to cover it with packing materials. And apply the grease to the grease inlet and sliding area.

6-13. Radio

Outside noise may be generated through the speaker when you listen to the radio, but it does not affect the equipment control or condition at all.

If noise is generated, turn off the radio for a while and turn it on again.

6-14. Angle Sensor(Option)

1. On/Off
2. Guide Swing "ABS"
3. Guide Tilting "ABS"

■ E/G Fault(error) code

Fault Code	Lamp Color	J1939 SPN Description	Cummins Description
111	Red	Controller #1	Engine Control Module Critical internal failure – Bad intelligent Device or Component
115	Red	System Diagnostic Code # 2	Engine Speed/Position Sensor Circuit lost both of two signals from the magnetic pickup sensor – Data Erratic, Intermittent, or incorrect
122	Amber	Boost Pressure	Intake Manifold Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
123	Amber	Boost Pressure	Intake Manifold Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
124	Amber	Boost Pressure	Intake Manifold 1 Pressure – Data Valid but Above Normal Operational Range – Moderately Severe Level
131	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit – Voltage Above Normal, or Shorted to High Source
132	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
133	Red	Remote Accelerator	Remote Accelerator Pedal or Lever Position Sensor Circuit – Voltage Above Normal, or Shorted to High Source
134	Red	Remote Accelerator	Remote Accelerator Pedal or Lever Position Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
135	Amber	Engine Oil Pressure	Oil Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
141	Amber	Engine Oil Pressure	Oil Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
143	Amber	Engine Oil Pressure	Oil Pressure Low – Data Valid but Below Normal Operational Range – Moderately Severe Level
144	Amber	Engine Coolant Temperature	Coolant Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
145	Amber	Engine Coolant Temperature	Coolant Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
146	Amber	Engine Coolant Temperature	Coolant Temperature High – Data Valid but Above Normal Operational Range – Moderately Severe Level
147	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit – Abnormal Frequency, Pulse Width, or Period
148	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor Circuit – Abnormal Frequency, Pulse Width, or Period

151	Red	Engine Coolant Temperature	Coolant Temperature Low – Data Valid but Above Normal Operational Range – Most Severe Level
153	Amber	Intake Manifold #1 Temp	Intake Manifold Air Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
154	Amber	Intake Manifold #1 Temp	Intake Manifold Air Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
155	Red	Intake Manifold #1 Temp	Intake Manifold Air Temperature High – Data Valid but Above Normal Operational Range – Most Severe Level
187	Amber	5 Volts DC Supply	Sensor Supply Voltage #2 Circuit – Voltage Below Normal, or Shorted to Low Source
193	Amber	Cruise Control	Cruise Control (Resistive) Signal Circuit – Voltage Above Normal, or Shorted to High Source
194	Amber	Cruise Control	Cruise Control (Resistive) Signal Circuit – Voltage Below Normal, or Shorted to Low Source
195	Amber	Coolant Level	Coolant Level Sensor Circuit – Voltage Above Normal, or Shorted to High Source
196	Amber	Coolant Level	Coolant Level Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
197	Amber	Coolant Level	Coolant Level – Data Valid but Below Normal Operational Range – Moderately Severe Level
199	Amber	Engine Automatic Start Lamp	Engine Automatic Start Lamp Driver Circuit – Voltage Above Normal, or Shorted to High Source
211	None	J1939 Error	Additional Auxiliary Diagnostic Codes logged – Condition Exists
212	Amber	Oil Temperature	Engine Oil Temperature Sensor 1 Circuit – Voltage Above Normal, or Shorted to High Source
213	Amber	Oil Temperature	Engine Oil Temperature Sensor 1 Circuit – Voltage Below Normal, or Shorted to Low Source
214	Red	Oil Temperature	Engine Oil Temperature – Data Valid but Above Normal Operational Range – Most Severe Level
221	Amber	Barometric Pressure	Barometric Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
222	Amber	Barometric Pressure	Barometric Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
227	Amber	5 Volts DC Supply	Sensor Supply Voltage #2 Circuit – Voltage Above Normal, or Shorted to High Source
231	Amber	Coolant Pressure	Coolant Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
232	Amber	Coolant Pressure	Coolant Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
233	Amber	Coolant Pressure	Coolant Pressure – Data Valid but Below Normal Operational Range – Moderately Severe Level
234	Red	Engine Speed	Engine Speed High – Data Valid but Above Normal Operational Range – Most Severe Level

235	Red	Coolant Level	Coolant Level Low – Data Valid but Below Normal Operational Range – Most Severe Level
237	Amber	External Speed Input	External Speed Input (Multiple Unit Synchronization) – Data Erratic, Intermittent, or Incorrect
238	Amber	System Diagnostic code # 1	Sensor Supply Voltage #3 Circuit – Voltage Below Normal, or Shorted to Low Source
239	Amber	System Diagnostic code #2	Sensor Supply Voltage #3 Circuit – Voltage Above Normal, or Shorted to High Source
241	Amber	Wheel-based Vehicle Speed	Vehicle Speed Sensor Circuit – Data Erratic, Intermittent, or Incorrect
242	Amber	Wheel-based Vehicle Speed	Vehicle Speed Sensor Circuit tampering has been detected – Abnormal Rate of Change
244	Amber	Red Stop Lamp	Red Stop Lamp Driver Circuit – Voltage Below Normal, or Shorted to Low Source
245	Amber	Fan Clutch Output Device Driver	Fan Control Circuit – Voltage Below Normal, or Shorted to Low Source
249	Amber	Ambient Air Temperature	Ambient Air Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
256	Amber	Ambient Air Temperature	Ambient Air Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
261	Amber	Fuel Temperature	Engine Fuel Temperature – Data Valid but Above Normal Operational Range – Moderately Severe Level
263	Amber	Fuel Temperature	Engine Fuel Temperature Sensor 1 Circuit – Voltage Above Normal, or Shorted to High Source
265	Amber	Fuel Temperature	Engine Fuel Temperature Sensor 1 Circuit – Voltage Below Normal, or Shorted to Low Source
268	Amber	Fuel Delivery Pressure	Fuel Pressure Sensor Circuit – Data Erratic, Intermittent, or Incorrect
271	Amber	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve Circuit – Voltage Below Normal, or Shorted to Low Source
272	Amber	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve Circuit – Voltage Above Normal, or Shorted to High Source
281	Amber	Fuel Pump Pressurizing Assembly #1	High Fuel Pressure Solenoid Valve #1 – Mechanical System Not Responding Properly or Out of Adjustment
284	Amber	Internal Sensor Voltage Supply	Engine Speed/Position Sensor (Crankshaft) Supply Voltage Circuit – Voltage Below Normal, or Shorted to Low Source
285	Amber	SAE J1939 Datalink	SAE J1939 Multiplexing PGN Timeout Error – Abnormal Update Rate
286	Amber	SAE J1939 Datalink	SAE J1939 Multiplexing Configuration Error – Out of Calibration

287	Red	Accelerator Pedal Position	SAE J1939 Multiplexing Accelerator Pedal or Lever Sensor System Error – Received Network Data In Error
288	Red	Remote Accelerator	SAE J1939 Multiplexing Remote Accelerator Pedal or Lever Data Error – Received Network Data In Error
292	Red	Auxiliary Temperature 1	Auxiliary Temperature Sensor Input 1 – Special Instructions
293	Amber	OEM Temperature	Auxiliary Temperature Sensor Input # 1 Circuit – Voltage Above Normal, or Shorted to High Source
294	Amber	OEM Temperature	Auxiliary Temperature Sensor Input # 1 Circuit – Voltage Below Normal, or Shorted to Low Source
295	Amber	Barometric Pressure	Barometric Pressure Sensor Circuit – Data Erratic, Intermittent, or Incorrect
296	Red	Auxiliary Pressure	Auxiliary Pressure Sensor Input 1 – Special Instructions
297	Amber	Auxiliary Pressure	Auxiliary Pressure Sensor Input # 2 Circuit – Voltage Above Normal, or Shorted to High Source
298	Amber	Auxiliary Pressure	Auxiliary Pressure Sensor Input # 2 Circuit – Voltage Below Normal, or Shorted to Low Source
319	Maint	Real Time Clock Power	Real Time Clock Power Interrupt – Data Erratic, Intermittent, or Incorrect
322	Amber	Injector Cylinder #01	Injector Solenoid Cylinder #1 Circuit – Current Below Normal, or Open Circuit
323	Amber	Injector Cylinder #05	Injector Solenoid Cylinder #5 Circuit – Current Below Normal, or Open Circuit
324	Amber	Injector Cylinder #03	Injector Solenoid Cylinder #3 Circuit – Current Below Normal, or Open Circuit
325	Amber	Injector Cylinder #06	Injector Solenoid Cylinder #6 Circuit – Current Below Normal, or Open Circuit
331	Amber	Injector Cylinder #02	Injector Solenoid Cylinder #2 Circuit – Current Below Normal, or Open Circuit
332	Amber	Injector Cylinder #04	Injector Solenoid Cylinder #4 Circuit – Current Below Normal, or Open Circuit
334	Amber	Engine Coolant Temperature	Coolant Temperature Sensor Circuit – Data Erratic, Intermittent, or Incorrect
338	Amber	Vehicle Accessories Relay Driver	Idle Shutdown Vehicle Accessories Relay Driver Circuit – Voltage Above Normal, or Shorted to High Source
339	Amber	Vehicle Accessories Relay Driver	Idle Shutdown Vehicle Accessories Relay Driver Circuit – Voltage Below Normal, or Shorted to Low Source

341	Amber	Calibration Memory	Engine Control Module data lost – Data Erratic, Intermittent, or Incorrect
342	Red	Calibration Memory	Electronic Calibration Code Incompatibility – Out of Calibration
343	Amber	Controller #1	Engine Control Module Warning internal hardware failure – Bad Intelligent Device or Component
349	Amber	Transmission Output Shaft Speed	Transmission Output Shaft Speed – Data Valid but Above Normal Operational Range – Moderately Severe Level
351	Amber	Controller #1	Injector Power Supply – Bad Intelligent Device or Component
352	Amber	5 Volts DC Supply	Sensor Supply Voltage #1 Circuit – Voltage Below Normal, or Shorted to Low Source
386	Amber	5 Volts DC Supply	Sensor Supply Voltage #1 Circuit – Voltage Above Normal, or Shorted to High Source
415	Red	Engine Oil Pressure	Oil Pressure Low – Data Valid but Below Normal Operational Range – Most Severe Level
418	Maint.	Water in Fuel Indicator	Water in Fuel Indicator High – Data Valid but Above Normal Operational Range – Least Severe Level
422	Amber	Coolant Level	Coolant Level – Data Erratic, Intermittent, or Incorrect
425	Amber	Oil Temperature	Engine Oil Temperature – Data Erratic, Intermittent, or Incorrect
428	Amber	Water in Fuel Indicator	Water in Fuel Sensor Circuit – Voltage Above Normal, or Shorted to High Source
429	Amber	Water in Fuel Indicator	Water in Fuel Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
431	Amber	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit – Data Erratic, Intermittent, or Incorrect
432	Red	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit – Out of Calibration
435	Amber	Engine Oil Pressure	Oil Pressure Sensor Circuit – Data Erratic, Intermittent, or Incorrect
441	Amber	Electrical Potential (Voltage)	Battery #1 Voltage Low – Data Valid but Below Normal Operational Range – Moderately Severe Level
442	Amber	Electrical Potential (Voltage)	Battery #1 Voltage High – Data Valid but Above Normal Operational Range – Moderately Severe Level
449	Red	Injector Metering Rail 1 Pressure	Fuel Pressure High – Data Valid but Above Normal Operational Range – Moderately Severe Level
451	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source

452	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
488	Amber	Intake Manifold	Intake Manifold 1 Temperature – Data Valid but Above Normal Operational Range – Moderately Severe Level
489	Amber	Transmission Output Shaft Speed	Transmission Output Shaft Speed – Data Valid but Below Normal Operational Range – Moderately Severe Level
497	Amber	Switch Circuit	Multiple Unit Synchronization Switch Circuit – Data Erratic, Intermittent, or Incorrect
523	Amber	System Diagnostic code # 1	OEM Intermediate (PTO) Speed switch Validation – Data Erratic, Intermittent, or Incorrect
527	Amber	Circuit – Voltage	Auxiliary Input/Output 2 Circuit – Voltage Above Normal, or Shorted to High Source
528	Amber	Switch – Data	Auxiliary Alternate Torque Validation Switch – Data Erratic, Intermittent, or Incorrect
529	Amber	Circuit – Voltage	Auxiliary Input/Output 3 Circuit – Voltage Above Normal, or Shorted to High Source
546	Amber	Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
547	Amber	Fuel Delivery Pressure	Fuel Delivery Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
551	Amber	Accelerator Pedal Low Idle Switch	Accelerator Pedal or Lever Idle Validation Circuit – Voltage Below Normal, or Shorted to Low Source
553	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail #1 Pressure High – Data Valid but Above Normal Operational Range – Moderately Severe Level
554	Amber	Injector Metering Rail 1 Pressure	Fuel Pressure Sensor Error – Data Erratic, Intermittent, or Incorrect
559	Amber	Injector MeteringRail 1 Pressure	Injector Metering Rail #1 Pressure Low – Data Valid but Below Normal Operational Range – Moderately Severe Level
584	Amber	Starter Solenoid Lockout Relay Driver Circuit	Starter Relay Circuit – Voltage Above Normal, or Shorted to High Source
585	Amber	Starter Solenoid Lockout Relay Driver Circuit	Starter Relay Circuit – Voltage Below Normal, or Shorted to Low Source
595	Amber	Turbocharger 1 Speed	Turbocharger #1 Speed High – Data Valid but Above Normal Operational Range – Moderately Severe Level
596	Amber	Alternate Potential (voltage)	Electrical Charging System Voltage High – Data Valid but Above Normal Operational Range – Moderately Severe Level

597	Amber	Alternate Potential (voltage)	Electrical Charging System Voltage Low – Data Valid but Below Normal Operational Range – Moderately Severe Level
598	Red	Alternate Potential (voltage)	Electrical Charging System Voltage Low – Data Valid but Below Normal Operational Range – Most Severe Level
599	Red	Engine External Protection Input	Auxiliary Commanded Dual Output Shutdown – Special Instructions
649	Maint	Engine Oil Change Interval	Change Lubricating Oil and Filter – Condition Exists
687	Amber	Turbocharger 1 Speed	Turbocharger #1 Speed Low – Data Valid but Below Normal Operational Range – Moderately Severe Level
689	Amber	Engine Speed	Primary Engine Speed Sensor Error – Data Erratic, Intermittent, or Incorrect
691	Amber	Turbocharger #1Compressor Inlet Temperature	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
692	Amber	Turbocharger #1Compressor Inlet Temperature	Turbocharger #1 Compressor Inlet Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
697	Amber	Sensor Circuit – Voltage	ECM Internal Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
698	Amber	Sensor Circuit – Voltage	ECM Internal Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
719	Amber	Crankcase Pressure	Extended Crankcase Blow–by Pressure Circuit – Voltage Above Normal, or Shorted to High Source
729	Amber	Crankcase Pressure	Extended Crankcase Blow–by Pressure Circuit – Voltage Below Normal, or Shorted to Low Source
731	Amber	Engine Speed Sensor #2	Engine Speed/Position #2 mechanical misalignment between camshaft and crankshaft sensors – Mechanical System Not Responding Properly or Out of Adjustment
757	Amber	Electronic Control Module	Electronic Control Module data lost – Condition Exists
778	Amber	Engine Speed Sensor #2	Engine Speed Sensor (Camshaft) Error – Data Erratic, Intermittent, or Incorrect
779	Amber	Auxiliary EquipmentSensor Input	Warning Auxiliary Equipment Sensor Input # 3 (OEM Switch) – Root Cause Not Known
951	None	Cylinder Power	Cylinder Power Imbalance Between Cylinders – Data Erratic, Intermittent, or Incorrect
1117	None	Power Supply	Power Lost With Ignition On – Data Erratic, Intermittent, or Incorrect

1139	Amber	Injector Cylinder # 01	Injector Cylinder #1 – Mechanical System Not Responding Properly or Out of Adjustment
1141	Amber	Injector Cylinder # 02	Injector Cylinder #2 – Mechanical System Not Responding Properly or Out of Adjustment
1142	Amber	Injector Cylinder # 03	Injector Cylinder #3 – Mechanical System Not Responding Properly or Out of Adjustment
1143	Amber	Injector Cylinder # 04	Injector Cylinder #4 – Mechanical System Not Responding Properly or Out of Adjustment
1144	Amber	Injector Cylinder # 05	Injector Cylinder #5 – Mechanical System Not Responding Properly or Out of Adjustment
1145	Amber	Injector Cylinder # 06	Injector Cylinder #6 – Mechanical System Not Responding Properly or Out of Adjustment
1239	Amber	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor 2 Circuit – Voltage Above Normal, or Shorted to High Source
1241	Amber	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor 2 Circuit – Voltage Below Normal, or Shorted to Low Source
1242	Red	Accelerator Pedal Position	Accelerator Pedal or Lever Position Sensor 1 and 2 – Data Erratic, Intermittent, or Incorrect
1256	Amber	Control Module Identification Input State	Control Module Identification Input State Error – Data Erratic, Intermittent, or Incorrect
1257	Red	Control Module Identification Input State	Control Module Identification Input State Error – Data Erratic, Intermittent, or Incorrect
1852	Amber	Water in Fuel Indicator	Water in Fuel Indicator – Data Valid but Above Normal Operational Range – Moderately Severe Level
1911	Amber	Injector Metering Rail	Injector Metering Rail 1 Pressure – Data Valid but Above Normal Operational Range – Most Severe Level
2111	Amber	Coolant Temperature	Coolant Temperature 2 Sensor Circuit – Voltage Above Normal, or Shorted to High Source
2112	Amber	Coolant Temperature	Coolant Temperature 2 Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
2113	Amber	Coolant Temperature	Coolant Temperature 2 – Data Valid but Above Normal Operational Range – Moderately Severe
2114	Red	Coolant Temperature	Coolant Temperature 2 – Data Valid but Above Normal Operational Range – Most Severe Level
2115	Amber	Coolant Pressure	Coolant Pressure 2 Circuit – Voltage Above Normal, or Shorted to High Source
2116	Amber	Coolant Pressure	Coolant Pressure 2 Circuit – Voltage Below Normal, or Shorted to Low Source
2117	Amber	Coolant Pressure	Coolant Pressure 2 – Data Valid but Below Normal Operational Range – Moderately Severe Level

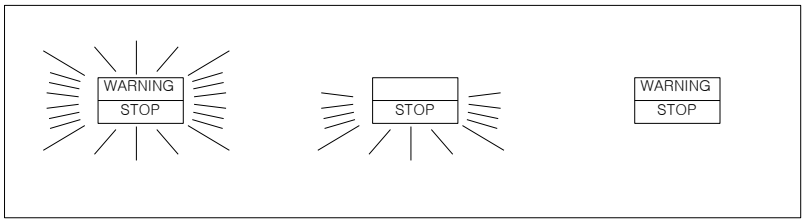
2182	Amber	Engine Brake Output # 1	Engine Brake Actuator Driver 1 Circuit – Voltage Above Normal, or Shorted to High Source
2183	Amber	Engine Brake Output # 1	Engine Brake Actuator Driver 1 Circuit – Voltage Below Normal, or Shorted to Low Source
2185	Amber	System Diagnostic code # 1	Sensor Supply Voltage #4 Circuit – Voltage Above Normal, or Shorted to High Source
2186	Amber	System Diagnostic code # 1	Sensor Supply Voltage #4 Circuit – Voltage Below Normal, or Shorted to Low Source
2195	Red	Auxiliary Equipment Sensor	Auxiliary Equipment Sensor Input 3 Engine Protection Critical – Special Instructions
2215	Amber	Fuel Delivery Pressure	Fuel Pump Delivery Pressure – Data Valid but Below Normal Operational Range – Moderately Severe Level
2216	Amber	Fuel Delivery Pressure	Fuel Pump Delivery Pressure – Data Valid but Above Normal Operational Range – Moderately Severe Level
2217	Amber	Calibration Memory	ECM Program Memory (RAM) Corruption – Condition Exists
2249	Amber	Injector Metering Rail 1 Pressure	Injector Metering Rail 1 Pressure – Data Valid but Below Normal Operational Range – Most Severe Level
2261	Maint	Fuel Delivery Pressure	Fuel Pump Delivery Pressure – Data Valid but Above Normal Operational Range – Least Severe Level
2262	Maint	Fuel Delivery Pressure	Fuel Pump Delivery Pressure – Data Valid but Below Normal Operational Range – Least Severe Level
2263	Amber	Battery Temperature	Battery Temperature – Data Valid but Above Normal Operational Range – Moderately Severe Level
2264	Amber	Battery Temperature	Battery Temperature – Data Valid but Below Normal Operational Range – Moderately Severe Level
2265	Amber	Electric Lift Pump for Engine Fuel	Fuel Priming Pump Control Signal Circuit – Voltage Above Normal, or Shorted to High Source
2266	Amber	Electric Lift Pump for Engine Fuel	Fuel Priming Pump Control Signal Circuit – Voltage Below Normal, or Shorted to Low Source
2292	Amber	Fuel Inlet Meter Device	Fuel Inlet Meter Device – Data Valid but Above Normal Operational Range – Moderately Severe Level
2293	Amber	Fuel Inlet Meter Device	Fuel Inlet Meter Device flow demand lower than expected – Data Valid but Below Normal Operational Range – Moderately Severe Level
2311	Amber	Fuel Control Valve #1	Fueling Actuator #1 Circuit Error – Condition Exists
2321	None	Engine Speed	Engine Speed / Position Sensor #1 – Data Erratic, Intermittent, or Incorrect

2322	None	Engine Speed Sensor #2	Engine Speed / Position Sensor #2 – Data Erratic, Intermittent, or Incorrect
2345	Amber	Turbocharger 1 Speed	Turbocharger speed invalid rate of change detected – Abnormal Rate of Change
2346	None	System Diagnostic Code #1	Turbocharger Turbine Inlet Temperature (Calculated) – Data Valid but Above Normal Operational Range – Least Severe Level
2347	None	System Diagnostic Code #1	Turbocharger Compressor Outlet Temperature (Calculated) – Data Valid but Above Normal Operational Range – Least Severe Level
2363	Amber	Engine Compression Brake Output # 2	Engine Brake Actuator Circuit #2 – Voltage Below Normal, or Shorted to Low Source
2365	Amber	Engine Brake Output # 3	Engine Brake Actuator Driver Output 3 Circuit – Voltage Below Normal, or Shorted to Low Source
2367	Amber	Engine Compression Brake Output # 2	Engine Brake Actuator Circuit #2 – Voltage Above Normal, or Shorted to High Source
2368	Amber	Engine Brake Output # 3	Engine Brake Actuator Driver 3 Circuit – Voltage Above Normal, or Shorted to High Source
2372	Amber	Engine Fuel Filter Differential Pressure	Fuel Filter Differential Pressure – Data Valid but Above Normal Operational Range – Moderately Severe Level
2373	Amber	Exhaust Gas Pressure	Exhaust Gas Pressure Sensor Circuit – Voltage Above Normal, or Shorted to High Source
2374	Amber	Exhaust Gas Pressure	Exhaust Gas Pressure Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
2375	Amber	Exhaust Gas Recirculation Temperature	Exhaust Gas Recirculation Temperature Sensor Circuit – Voltage Above Normal, or Shorted to High Source
2376	Amber	Exhaust Gas Recirculation Temperature	Exhaust Gas Recirculation Temperature Sensor Circuit – Voltage Below Normal, or Shorted to Low Source
2377	Amber	Fan Clutch Output Device Driver	Fan Control Circuit – Voltage Above Normal, or Shorted to High Source
2425	Intake	Air Heater # 2	Intake Air Heater 2 Circuit – Voltage Below Normal, or Shorted to Low Source
2426	Intake	Air Heater # 2	Intake Air Heater 2 Circuit – Voltage Above Normal, or Shorted to High Source
2555	Amber	Inlet Air Heater Driver #1	Intake Air Heater #1 Circuit – Voltage Above Normal, or Shorted to High Source
2556	Amber	Inlet Air Heater Driver #1	Intake Air Heater #1 Circuit – Voltage Below Normal, or Shorted to Low Source
2557	Amber	Auxiliary PWM Driver #1	Auxiliary PWM Driver #1 – Voltage Above Normal, or Shorted to High Source

2558	Amber	Auxiliary PWM Driver #1	Auxiliary PWM Driver #1 – Voltage Below Normal, or Shorted to Low Source
2963	None	Engine Coolant Temperature	Engine Coolant Temperature High – Data Valid but Above Normal Operational Range – Least Severe Level
2973	Amber	Boost Pressure	Intake Manifold Pressure Sensor Circuit – Data Erratic, Intermittent, or Incorrect

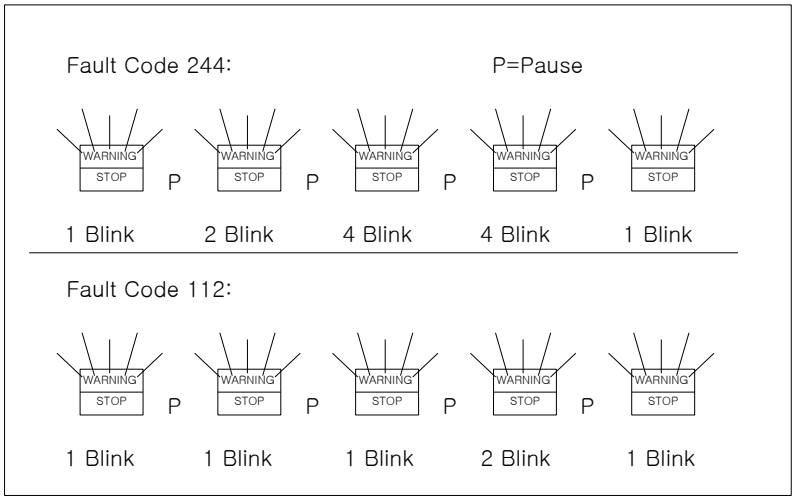
Cummins E/G Error Code

1.Error Code : Turn The Ignition Key To The On Position, WARNING Lamp or STOP Lamp Is Turn On
YELLOW WARNING Lamp is Lit : Require Careful Handling
RED STOP Lamp is Lit : E/G Stop For Protection



2. Test Mode Button ON : Lamp Is Turn On/Off Show The Error Code

3. Lamp is Used To Indicate The Existence Of a Fault by Flashing a Fault Code.
(Ex. STOP Lamp '244' Error Code : Lamp is Turn On – Blinks On And Off Twice At 0.5 Second Intervals – Blinks Off For Two Second – Blinks On And Off Four Times At 0.5 Second Intervals – Blinks Off For Two Second –Blinks On And Off Four Times At 0.5 Second Intervals – Blinks Off)



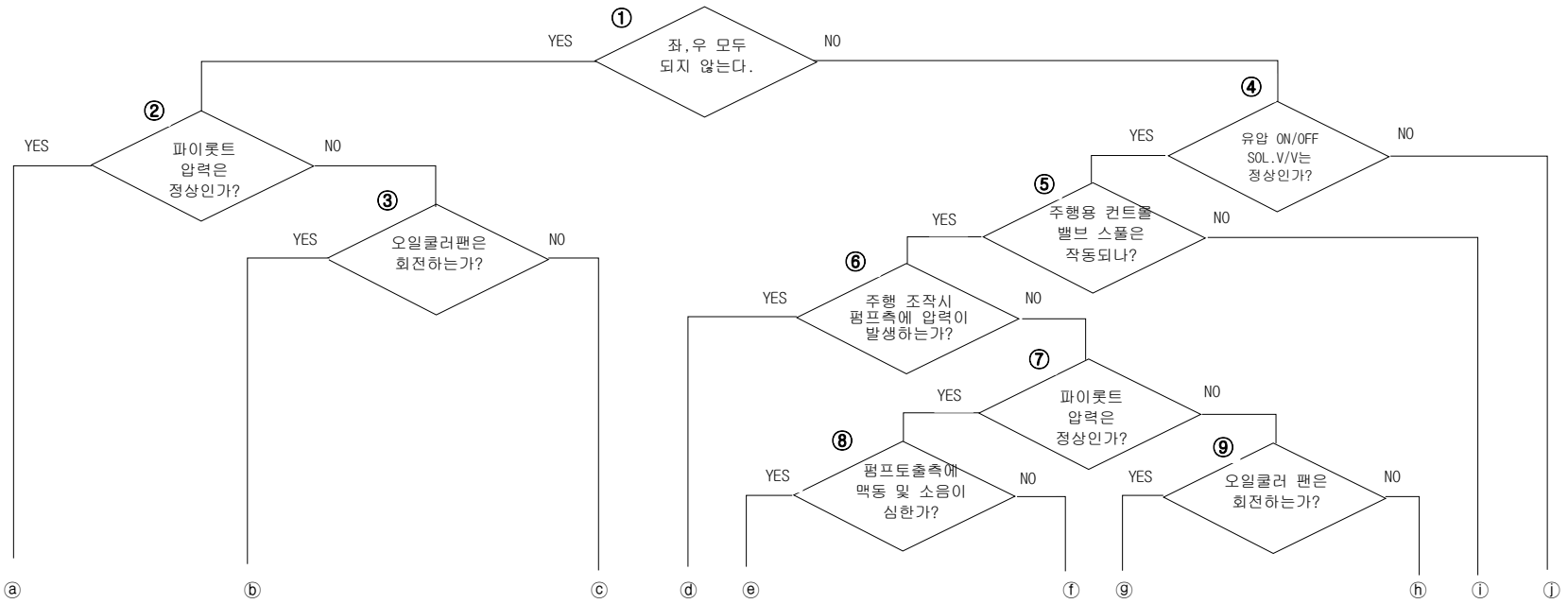
4. Up/ Down Switch : Up Switch – Show The Previous Error Code
: Down Switch – Show The Next Error Code

D8B3-6304000-00

7 고장 원인과 대책

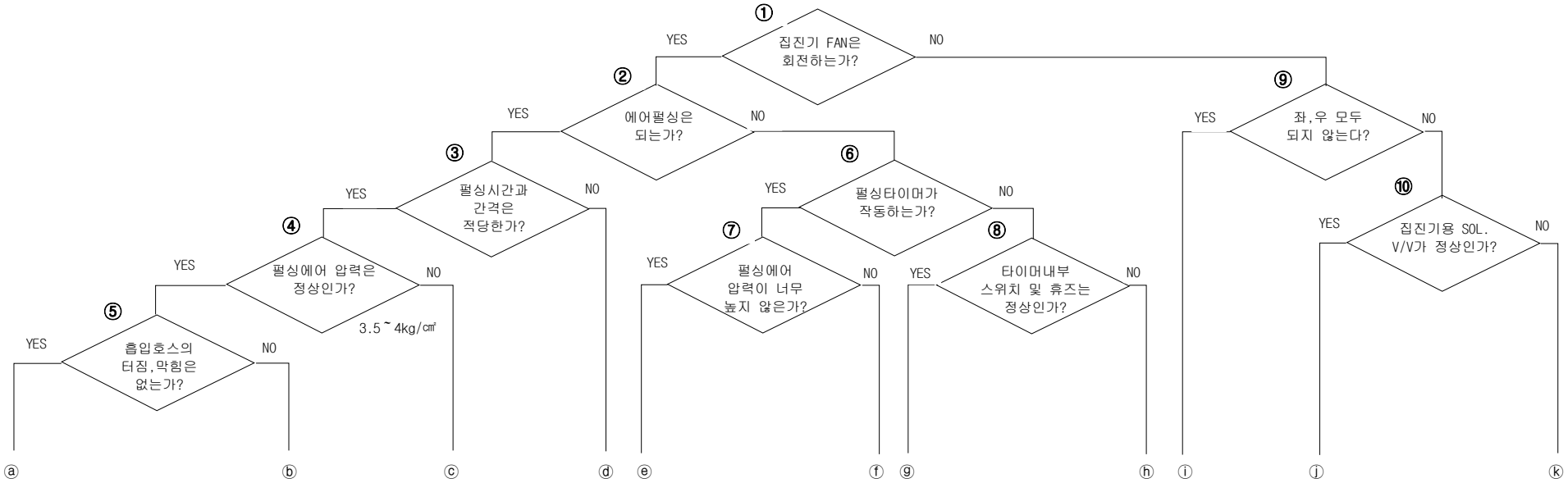
고장 발생시는 원인을 신속히 조사하여 대책을 강구하도록 하십시오

[주행이 되지 않는다]



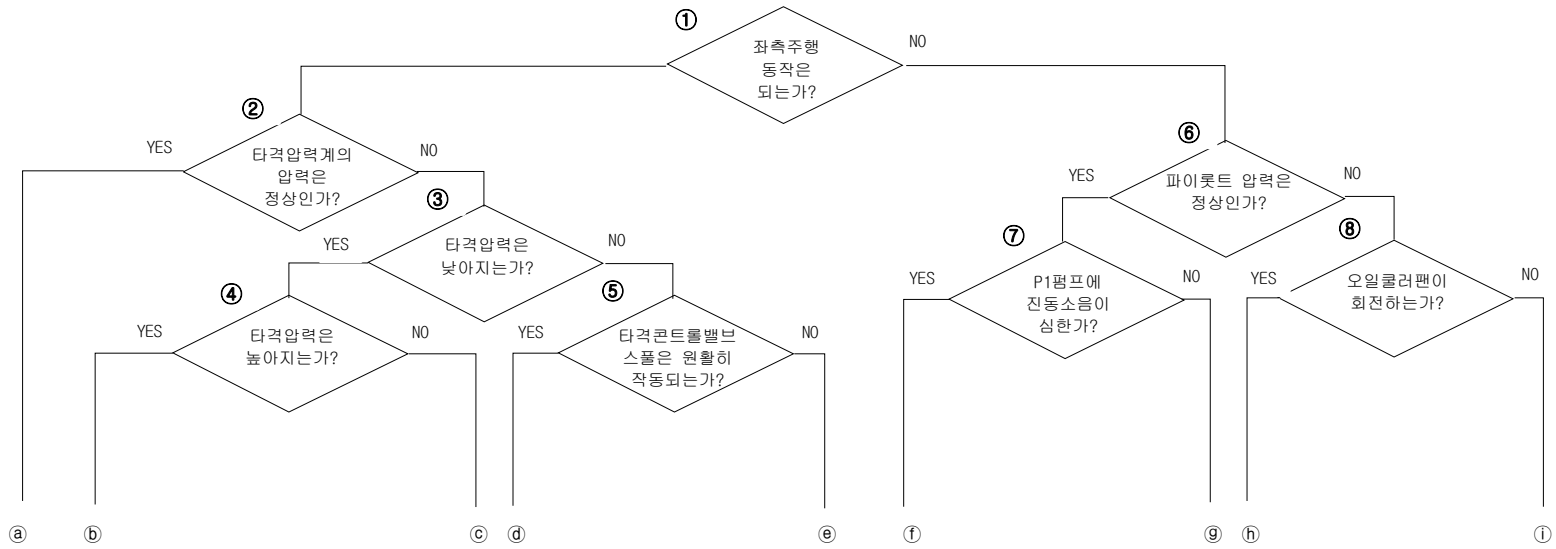
고장 원인		점검 사항	
ⓐ	P1, P2 펌프 이상	①	좌우 주행 레버를 조작하여 주행여부를 확인한다.
ⓑ	파이롯트 프레셔 밸브 이상	②	PILOT FILTER 다음의 압력을 측정한다. (25BAR 이상) 간단한 방법으로 작업 (피이드, 로테이션, 타격) 레버를 조작하여 작동 여부를 확인한다.
ⓒ	엔진과 유압펌프 사이 동력계통 기계적인 이상 (커플링의 이상 증속기 내부 이상 등)	③	오일 쿨러 팬의 회전 여부를 육안으로 확인한다.
ⓓ	주행 모터의 브레이크 해제 불능 또는 감속기 이상	④	시동이 안된 상태에서 시동키를 ON의 스위치로 하고 유압작동 선택 스위치를 전환하면서 솔레노이드 작동음을 확인 등의 방법으로 작동 여부를 판단한다.
ⓔ	메인펌프 내부의 기계적인 손상	⑤	주행용 컨트롤 밸브 스풀 커버를 분해하고 스풀을 밀어 보아 원활히 움직이는지 확인한다.
ⓕ	메인펌프 레귤레이터 계통 이상	⑥	주행 레버를 조작하면서 펌프 압력이 상승되는지 확인한다.
ⓖ	파이롯트 프레셔 밸브 이상	⑦	②번과 동일
ⓗ	P3 기어 펌프 이상	⑧	아이들링 상태에서 펌프 토출라인의 진동 및 소음을 확인, 메인펌프 손상의 경우에는 호스 진동 및 기계 소음이 크고 작동유 색깔이 검게 변한다.
ⓘ	주행 컨트롤 밸브 스풀이 이물질 혼입 또는 손상으로 고착됨	⑨	③번과 동일
ⓙ	주행 작업 선택 밸브 또는 관계 전기회로 이상		

[집진이 되지 않는다]



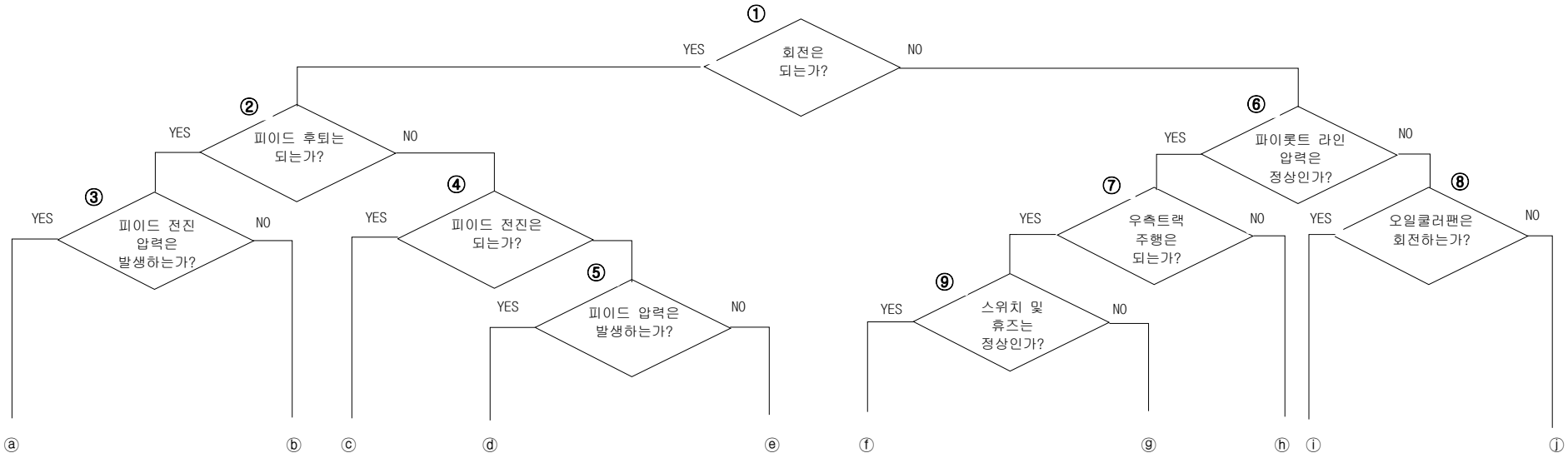
고장원인		점검 사항	
ⓐ	집진기 필터의 눈메움이 있음. (필터 교체 또는 청소)	①	집진기 스위치 ON상태에서 집진기 FAN이 정상회전 하는지 확인
ⓑ	호스 손상부 수리 또는 교체 석분으로 막혔을 경우 청소해 줌.	②	집진기의 에어 펄싱음이 규칙적으로 들리는지 확인
ⓒ	펄싱에어 압력 조정이 불량 (적정 압력으로 조정함)	③	타이머 커버를 열고 조정 다이얼 눈금을 확인한다. (좌측부터 15, 5, 3)
ⓓ	펄싱시간과 간격을 조정함 (펄싱시간 10m/s 간격 5sec)	④	아이들링 상태에서 펄싱에어 압력 조정기의 압력계 확인한다. (3.5 ~ 4kg/㎠)
ⓔ	펄싱 에어 압력이 5kg/㎠ 이상이 되면 솔밸브가 작동되지 않음 (3.5~4kg/㎠으로 조정)	⑤	흡입호스의 내부에 석분이 고여 있는 곳이 있는지 흔들어 확인하고 외부 손상을 육안으로 검사한다.
ⓕ	에어 솔레노이드 밸브 이상	⑥	타이머 커버를 열고 내부 LED가 순차적으로 점등되는지 확인한다. (1, 2, 3번이 순차적으로 점등하면 정상임)
ⓖ	타이머 기판의 이상	⑦	펄스에어 압력계에서 확인한다. (펄스에어 압력이 너무 높으면 솔레노이드 밸브가 작동 않음)
ⓗ	스위치 및 퓨즈를 정상상태로 함	⑧	타이머의 커버를 열고 스위치가 ON 상태에 있는지 휴즈가 이상이 없는지 확인한다.
ⓘ	FAN의 하우징에 접촉 또는 유압모터의 이상	⑨	팬 모터 유압라인 압력을 체크한다. (100bar)
ⓙ	릴리프 밸브나 체크 밸브 이상	⑩	솔레노이드 밸브의 작동을 체크한다. (집진기 S/W ON / OFF를 행하며)
ⓚ	집진기 솔레노이드 밸브 이상 또는 관련 전기계통의 이상		

[타격이 되지 않는다]



고장원인		점검 사항	
ⓐ	드리프터 이상	①	좌측 주행레버를 작동하여 주행하여 본다.
ⓑ	타격압력 조정 불량 (타격 압력 조정 핸들을 너무 낮추어 놓음)	②	타격 레버를 타격의 위치로 하고 타격 압력게이지를 확인한다.
ⓒ	메인릴리프 밸브에 이상 또는 메인 릴리프 밸브 셋팅 압력이 낮음	③	타격 레버를 타격 위치로 한 상태에서 타격력 조정 핸들을 반시계 방향으로 돌리면서 타격 압력 게이지를 확인한다.
ⓓ	타격 레버 (리모트 컨트롤 밸브 이상)	④	타격 레버를 타격의 위치로 한 상태에서 타격력 조정 핸들을 시계 방향으로 돌리면서 타격력 압력 게이지를 확인한다.
ⓔ	타격 컨트롤 밸브가 이물질 유입 또는 손상되어 움직이지 않음	⑤	타격용 컨트롤 밸브의 스풀 커버를 분해한 후 스풀을 눌러서 원활히 작동되는지 확인한다.
ⓕ	P1 펌프 내부의 기계적 손상 (이때는 작동유 색깔이 검게 변함)	⑥	파이롯트 필터 다음의 압력을 확인한다.
ⓖ	P1 펌프 레귤레이터 계통 이상	⑦	아이들링 상태에서 P1 펌프의 진동 소음을 확인한다. (이상이 있을 경우 규칙적인 진동 기계 소음이 있으며 압력게이지의 진폭이 20kg/㎠이상으로 나타난다)
ⓗ	파이롯트 프레셔밸브 이상	⑧	오일쿨러의 팬을 육안으로 확인한다.
ⓘ	P3 펌프 이상		

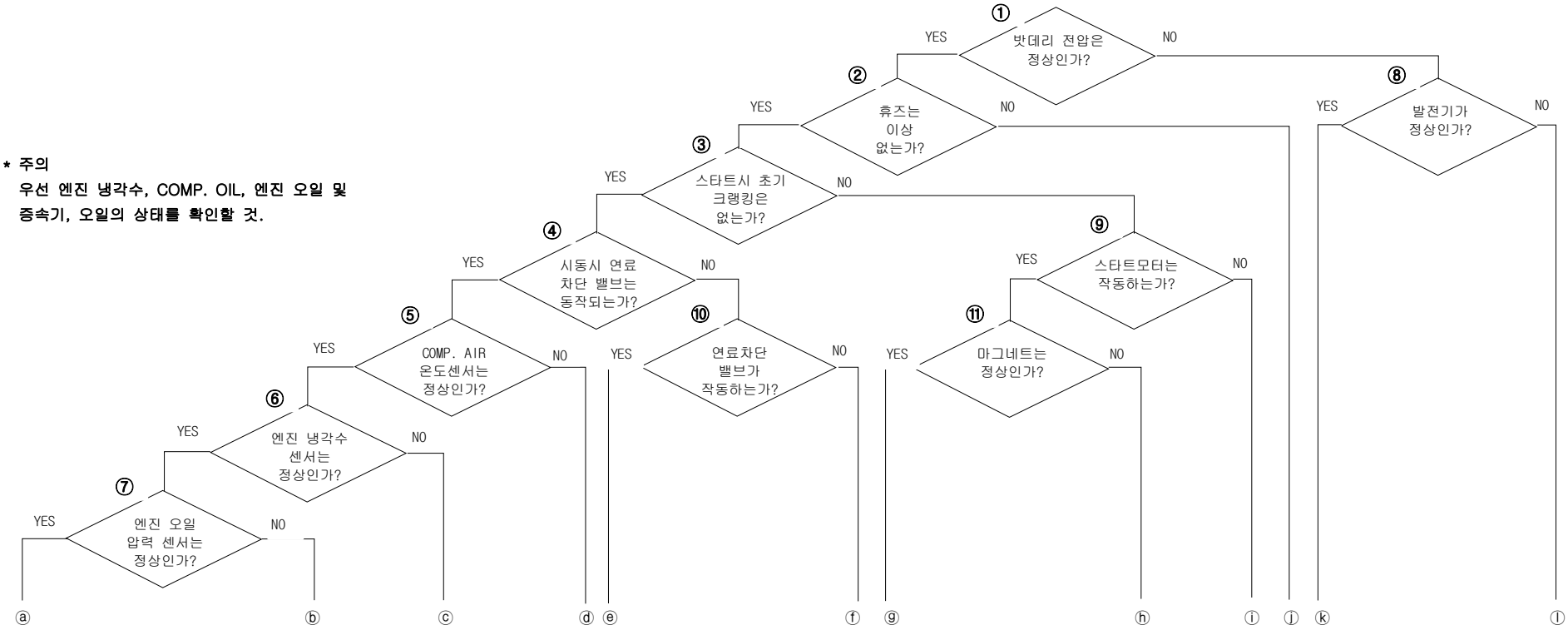
[피이드가 되지 않는다]



고장원인		점검 사항	
ⓐ	피이드 모터의 릴리프 밸브 전진쪽 이상	①	회전 레버를 조작한다.
ⓑ	전진쪽 릴리프 밸브 셋팅 불량 또는 이상, 피이드력 조정밸브 동작 이상	②	피이드 레버를 후진 조작한다.
ⓒ	후퇴쪽 릴리프 밸브 셋팅 불량 또는 이상	③	피이드 전진 조작시 피이드 압력 게이지를 확인한다.
ⓓ	피이드 모터, 감속기, 드리프터, 테이블중 한가지 이상이 고착되었음.	④	피이드 레버를 전진 조작한다.
ⓔ	피이드 컨트롤밸브 동작 기능 이상, 피이드 조작 레버(리모트 밸브) 이상	⑤	피이드 전진 조작시 피이드 압력 게이지를 확인한다.
ⓕ	피이드 릴리프 밸브 이상 또는 피드력 조정 밸브 이상	⑥	PILOT FILTER 다음의 압력 측정한다. (25bar 이상)
ⓖ	유압작동 선택 솔밸브 이상 또는 선택 스위치 전기계통 이상	⑦	우측 주행 레버를 조작한다.
ⓗ	펌프 (P2) 이상	⑧	오일 쿨러 팬을 육안으로 확인한다.
ⓘ	파이롯트 프레셔 밸브 이상	⑨	유압 작동 스위치 및 퓨즈의 이상 여부를 확인한다.
ⓙ	기어 펌프 (P3) 이상		

[엔진 시동이 되지 않는다]

*** 주의**
우선 엔진 냉각수, COMP. OIL, 엔진 오일 및 증속기, 오일의 상태를 확인할 것.



고장 원인		점검 사항	
ⓐ	연료흡입계통이 막히거나 공기가 흡입됨. (연료필터, 연료호스, 가버너 이상 점검)	①	전압계 전기테스터로 밧데리 단자 전압을 측정한다.
ⓑ	엔진 오일 압력센서 이상 또는 엔진오일이 부족함.	②	휴즈 박스를 열고 각각의 휴즈를 육안 또는 테스터기로 점검한다.
ⓒ	엔진 냉각수 온도센서 이상	③	시동키를 돌려서 시동시켜 본다.
ⓓ	COMP. 에어 온도 센서 이상	④	시동키를 1단으로 돌리면서 연료차단밸브에 동작음 또는 진동이 있는지 확인한다.
ⓔ	엔진 시동 계통 전기회로 이상	⑤	콤프레셔 에어 온도 센서의 단자를 풀어 놓고 시동시켜 본다. (시동이 되면 온도센서 이상임)
ⓕ	연료 차단 밸브 이상	⑥	엔진 냉각수 온도센서의 단자를 풀어놓고 시동시켜 본다. (시동이 되면 센서 이상임)
ⓖ	증속기 내부, 콤프레셔, 엔진 또는 유압펌프중 하나가 기계적으로 고착됨	⑦	엔진 오일 압력 센서의 단자를 풀어 놓고 시동시켜 본다. (시동이 되면 센서 이상이거나 오일이 부족하다)
ⓗ	마그네트 이상	⑧	타 밧데리로 시동시킨 다음 밧데리 단자를 풀어본다. (계속 운전이 되면 알터네이트는 정상임)
ⓘ	스타트 모터 또는 관련 전기회로 이상	⑨	스타트 모터를 엔진으로부터 분해한 상태로 시동키를 돌려본다. (미니어 기어가 앞으로 전진하면 정상임)
ⓙ	문제가 발생된 휴즈에 과전류가 흘렀다. 관계 전기회로 점검	⑩	연료차단 밸브의 단자를 풀어낸후 밧데리 전원으로 직접 동작 시켜 본다.
ⓚ	밧데리의 노후 또는 과잉 방전	⑪	마그네트가 전진되어야 모터가 회전할 수 있다.
ⓛ	알터네이터 발전 불량		

8 장비 보증 사항

각종 건설중장비를 생산하면서 세계속에 중장비 메이커로 성장해 가고 있는 전진 CSM은 완벽한 작업 능력과 탁월한 최고의 작업 능률을 보장하며 여러 작업 환경에 적합하도록 인간공학적 연구를 토대로 계속 연구 개발에 힘쓰고 있습니다.
당사에서는 사용자의 편의를 위하여 정기점검을 실시하고 있으므로 장비 최초 사용시 및 장비 사용시간 100시간, 500시간 도달시 당사에 연락해 주시면 즉시 방문, 무상 서비스 및 점검을 아울러 다음과 같이 장비의 성능 및 품질보증을 실시하오니 사용자 여러분께서는 이용에 차질이 없도록 하시길 바랍니다.

▣ 보증 범위

당사가 생산 판매한 중장비는 정상적으로 사용한 상태에서 출고일로부터 12개월 또는 서비스메타로 2000시간중 먼저 도달한 보증기간내에 재질이나 제조상의 결함으로 인정하는 경우에는 무상으로 해당 부품의 교환 또는 수리 및 정비해 드립니다.

▣ 보증에서 제외되는 사항

보증기간 이내일지라도 아래의 사항은 보증에서 제외됩니다.

1) 당사의 [운전자 매뉴얼]에서 제시된 취급, 조작, 정기 점검, 보관 방법을 지키지 않아 그것이 원인으로 판단된 사항
2) 사용자 과실로 인한 고장, 정비 지연, 사고(천재지변 포함)에 의해서 발생한 것으로 판단되는 하자 사항
3) 장비에 사용된 모든 부품이 당사에서 인정하는 순정 부품을 사용하지 않아서 발생된 것으로 판단되는 하자 사항
4) 정상적 장비 관리
   : 연료계통 청소, 브레이크 점검 및 조정 등 기타 당사에서 고객이 시행하도록 요망한 정기점검 사항
5) 정상적 사용으로 인한 소모품 즉, 필터류, 전구류, 퓨즈, 유류 등 장비를 위한 정기적인 교환 부품
6) 마모성 부품의 마모

전진 CSM 주식회사는 보다 우수한 성능과 품질 향상을 위하여 끊임없는 연구와 개발을 하고 있습니다. 따라서 본 운전자 매뉴얼의 내용은 사전 통지없이 언제든지 변경될 수 있습니다.

Crawler Drill Training Check List

Contract No		Model		Company Name		User Name	
Delivery date		Serial No		Training date		Training Place	
User Address					Tel		

Contents		Change Hour	Check	Contents		Change Hour	Check
Engine	①Engine oil quantity check (Oil plug location, Oil filter location and Change period (hour))	Initial 50Hr Every200Hr		Hyd' System	①Return filter element change & Method	Initial 50Hr	
	②Air cleaner,pre-cleaner maintenance (When use Comp Air for clean the element, Don't operate engine the engine without element !!!)				②HYD. OIL maintenance and water Drain (Check very 50Hr)	Every1000Hr	
	③Coolant check	Every day		Electric' System	Explanation of electricity fuse in the box.		
	④Fuel(engine) check and water drain from tank.	Every200Hr					
	⑤Radiator cleaning.	Every600Hr		Structure	①Grease nipple location.		
	⑥Idling after work (3~5min)				②Auto rod changer canter adjust method.		
Air Compressor	①Receiver tank oil check and water drain	Initial 200Hr Every600Hr			③Track tension adjusting Method.		
	②Ori-piece cleaning method & period	Every200Hr		Operating	①Explanation of every Lever.		
	③AIR pressure setting method.				②Auto rod changer operating.		
	④SEPARATOR change method and period	Every1000Hr			③Rotation ,Feed,Percussion '-Pressure,Supply oil quantity adjusting method.		
	⑤OIL FILTER ELEMENT change method	Initial 50Hr Every600Hr			④Percussion working.		
					⑤Notice for traveling.		
Traveling Motor	①Gear oil check and change method	Initial 600Hr			⑥Worming up in the winter.		
	②Brake release and recovery method	Every1000Hr		Drifter	①N2 Gas charging method.		
Dust Collector	①Dust FILTER change period and cleaning method	청소50Hr 애600Hr			②Diaphragm change method.		
					③Shank adapter change method.		
	②AIR PULSING Pressure Setting and CONTROLLER Setting method.			Etc	①Boom guide plate change method.		
Air-System	①Lubricator's oil supply quantity setting Method.				②Auto changer setting method.		
	②Auto grease pump's grease and viscosity and dilute method.				③Motor chain adjusting method.		
					④Hose tension adjusting method.		
	③Regulator setting method.						

*** Note : Warranty claims are not accepted If it is as below case..**

- The machine out of ordered by natural calamity (disaster).

- The machine out of ordered by operator who is mis-use,mis- operating, working with over capacity..

I received crawler drill training according to above contents.

Date :

Junjin CSM

Trainer :

Trainee :

Hydraulic Drifter

YH-135

Instruction and Operation Manual

YAMAMOTO ROCK MACHINE CO., LTD

2010/04/30

Form 013-1004

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YH-135 HYDRAULIC DRIFTER

1. DESCRIPTION

1-1. GENERAL DESCRIPTION

The YH-135 Hydraulic Drill is a valved, hydraulically operated hammer drill that incorporates an integral, independently controlled, hydraulically powered rotation motor to rotate the drill steel and bit.

The YH-135 is capable of drilling 89 mm (3-1/2 in) to 127 mm (5 in) diameter holes in all types of rock formations. It is especially suitable for pipeline work, drilling vertical and angle blast holes in quarries and on any construction jobs where large volume rock excavations are required.

The YH-135 is a hydraulic drill which has only two moving parts to control hammer action - the piston and piston valve. This piston provides the impact force which is transmitted to the drill steel. The valve alternately switches pressure from supply to exhaust. This action produces a high frequency reciprocation of 2500 cycles per minute. The piston strikes the striking bar on each forward (power) stroke, thus, transmitting the blow energy through the steel to the bit at 2500 blows per minute.

The hydraulic powered rotation motor is independently controlled and is designed to provide continuous drill steel rotation - forward or reverse. The motor converts hydraulic fluid to rotation power and transmits the rotation power to the spur gear train housed in the drill front end. The hydraulic rotation motor provides smooth, powerful rotation, especially at low rotation speeds, and assures the operator of positive rotation control under all drilling conditions.

Since hammer action and drill steel rotation are independently controlled, the best combination of individual control of both functions can be selected for the most efficient drilling in a particular formation.

Since the YH-135 operates on hydraulic fluid power, in lieu of air, its operation is unaffected by altitude. In addition, there is no noise from air exhaust and no fog buildup in working areas.

The only air requirements for the YH-135 are for hole cleaning and front end lubrication. The YH-135 is equipped with a flushing head at the front end part which carries hole cleaning air from the inlet connection in the flushing case, through striking bar, steel and bit to the bottom of the hole without contacting any of the internal parts of the drill.

The air for front end lubrication is supplied at inlet connection in the front part of the cylinder and through the rotation parts to the chuck parts.

The drifter uses three nitrogen charged diaphragm accumulators to dampen vibrations in the supply and return hoses. At the standard factory percussion setting the supply line (high pressure) accumulator must be charged to 853 psi (60 kg/cm^2). The return line (low pressure) accumulator must be charged to 57 psi (4 kg/cm^2).

An accumulator charging kit is furnished as a standard accessory item with the hydraulic machine.

The YH-135 is designed with chuck parts to accommodate a 8 - splined striking bar, T45 or T51 male spiral threads. A striking bar is not furnished as standard equipment with a YH-135 Hydraulic Drill; it must be specially ordered. Refer to table below for the parts numbers of the striking bars available for use with the YH-135 and the specifications of the striking bars.

1-2. SPECIFICATIONS

	METRIC	(ENGLISH)
Net Weight	260 kg	(573 lbs)
Overall Length	1225 mm	(48.23 in)
Overall Width	360 mm	(14.17 in)
Overall Height	335 mm	(13.19 in)
Hammer Blows per Minute	2500 bpm	
Hyd. Fluid for Drilling	140 l/min	(37 gpm)
Operating Pressure at Drill Inlet	140 kg/ cm^2	(2000 psi)
Hyd. Fluid for Rotation	80 l/min	(21 gpm)
Diameter of Drill Inlet and Outlet Hoses	25.0 mm	(1 in)
Diameter of Rotation Inlet and Outlet Hoses	19.0 mm	(3/4 in)
Diameter of Blower Hose	25.0 mm	(1 in)
Diameter of Lubricator Hose	9.5 mm	(3/8 in)

STRIKING BAR SPECIFICATIONS

STRIKING BAR	STRIKING BAR SPECIFICATIONS
S127M45SFAG (for YH-135 standard)	8-Splined Drive T-45 Male Threads
S127M51SFAG (for YH-135 standard)	8-Splined Drive T-51 Male Threads
S218M51SFAG (for YH-135 with RP)	8-Splined Drive T-51 Male Threads

NOTE

The YH-135 does not include a striking bar as standard equipment. The striking bar must be specially ordered.

2. OPERATION

2-1 SAFETY PRECAUTIONS

The following safety precautions (dangers) must be observed before operating the Hydraulic Drill:

DANGERS

1. DO NOT ATTEMPT TO OPERATE THE YH-135 DRILL UNLESS YOU ARE THOROUGHLY FAMILIAR WITH ALL THE PRESSURE GAUGES, CONTROLS AND FUNCTIONS. REFER TO THE OPERATION SECTION OF THIS INSTRUCTION BOOK FOR DETAILED INSTRUCTIONS. FAILURE TO COMPLY COULD RESULT IN BODILY INJURY.
2. ALWAYS WEAR APPROVED HARD HAT, SAFETY SHOES, SAFETY GLASSES, NOSE MASK AND EAR PROTECTION WHEN NEAR A YH-135 DRILL IN OPERATION. FAILURE TO WEAR APPROVED SAFETY GEAR COULD RESULT IN BODILY INJURY.
3. KEEP HANDS, ARMS, LEGS AND CLOTHING AWAY FROM ALL MOVING PARTS. FAILURE TO COMPLY COULD RESULT IN BODILY INJURY.
4. THE DRILL, COUPLING, STRIKING BAR AND STEEL ARE HOT WHEN DRILLING. DO NOT TOUCH ROTATING PARTS WITH BARE HANDS. A SEVERE BURN WILL RESULT IF ROTATING PARTS ARE TOUCHED WITH BARE HANDS.

2-2. BASIC OPERATING PRINCIPLE

The operation of the YH-135 Hydraulic Drill is based on two independent basic operating principles:

（1） The principle that causes the piston to reciprocate (i.e., hammer action)
（2） The principle governing the drill steel rotation.

1) DRILL PISTON RECIPROCATION

The YH-135 is a valved hydraulic drill. The valve cylinder assembly and cylinder liner convert hydraulic fluid pressure into efficient hammer action. The piston within the cylinder liner provides the impact force which is transmitted to the drill steel.
The valve alternately switches pressure from supply to exhaust.
This action produces a high frequency reciprocating action of 2500 cycles per minute. The piston strikes the striking bar on each forward (power) stroke, and through the striking bar and steel, drives the drill bit into the rock at 2500 blows per minute.

2) DRILL STEEL ROTATION

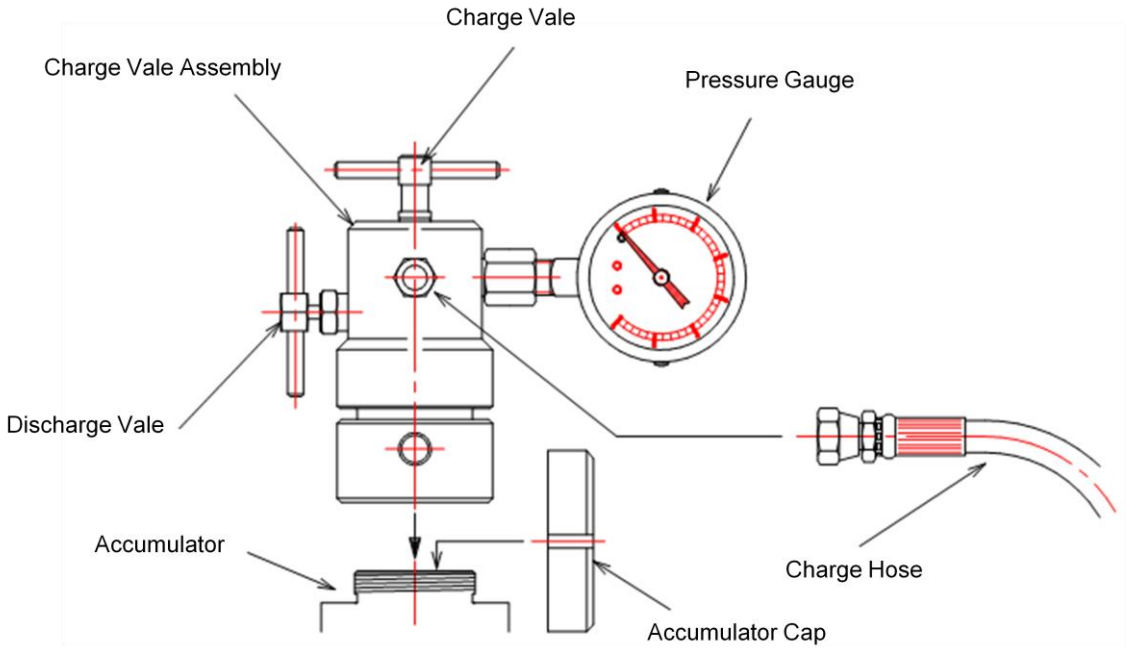
The YH-135 Drill is designed with an independently controlled, hydraulic powered rotation motor that provides continuous drill steel rotation forward or reverse.
The motor converts hydraulic fluid to rotation power and transmits the rotation power to a rotor gear in the front end of the drill. Thus, as the motor shaft is rotated, the idle gear, meshing chuck driver, and mating chuck jaw follow the rotation. Splines within the chuck jaw mate with those in the striking bar thereby imparting the rotation through the drill steel to the bit.

2-3. OPERATING CONTROLS

Hammer action, drill steel rotation, and feed are controlled separately and each must be regulated for optimum results in the drilling conditions encountered. All operating controls for the YH-135 Drill are located on the Crawler drill Control Console. Refer to the operation section of the Instruction book for detailed descriptions and instructions covering all operating controls and gauges.

2-4. CHARGING THE DRILL ACCUMULATORS

The YH-135 Hydraulic Drill uses three nitrogen accumulators to dampen vibrations in the pressure and return hoses. Before operating the drill, the two high pressure accumulators must be charged to 60 kg/cm^2 (853 psi) and a lower pressure accumulator to 4 kg/ cm^2 (57 psi). An accumulator charging kit is available as an accessory item with the Crawler Drill.



The following DANGER must be observed when charging the drill accumulators:

DANGER

DRY NITROGEN IS THE ONLY GAS PRODUCT TO BE USED TO CHARGE THE DRILL ACCUMULTORS. NEVER USE OXYGEN TO CHARGE THE ACCUMULATORS. IGNITION OF AN OXYGEN AND OIL MIXTURE IN THE ACCUMULATOR COULD PRODUCE AN EXPLOSION, WHICH COULD SEVERELY INJURE PERSONNEL IN THE AREA.

To charge the drill accumulators, proceed as follows:

1. Using a spanner wrench, remove the protective caps from the accumulator covers on all accumulators.
2. Loosen the accumulator valve slightly (about 1/8 of a turn).
3. Attach the charge valve assembly to the accumulator, turning the assembly hand tight.

NOTE

Be sure the slightly loosened accumulator valve lines up with the charging valve socket before tightening.

4. Connect the nitrogen bottle hose to the charge valve assembly charging port.
5. Make sure the discharge valve on the side of the charging valve assembly is closed. (Turning clockwise closes the valve).
6. Turn the charge valve on top of the charging valve assembly counter-clockwise to open the accumulator valve.
7. Slowly open (turn counter-clockwise) the valve on the nitrogen bottle and allow the pressure to build. Close the valve when the pressure reaches. If the pressure becomes higher, adjust the pressure by using the discharge valve on the charging valve assembly.
8. Close the accumulator valve by turning the charging valve on the charging valve assembly.
9. Open the discharge valve to release gas in the charging valve assembly and the hose.
10. Remove the nitrogen bottle hose.
11. Remove the charging valve assembly.
12. Tighten the accumulator valve. Torque the valve to 22 lb-ft (30 Nm).
13. Replace the accumulator protective cap.
14. Follow the same procedure to charge the second accumulator. The drill is then ready for service.

2-5 CONNECTING THE STRIKING BAR TO THE DRILL

NOTE

It is very important that all threads be properly lubricated and cared for at all times. Proper lubrication will result in longer part life and will simplify threading and un-threading of all connections. Make sure that all threads are clean and free of dirt and coated with a high pressure grease each time they are coupled or stored.

1. Make sure all striking bars and threaded accessories are properly greased.
2. Remove the two front flushing device installation bolts and nuts.
3. Coat the striking bar with clean oil and insert the shank end of the striking bar into the chuck.
4. Re-install the front flushing device and bolts and nuts. Torque the bolts to 454 lb-ft (615 Nm).

2-6 DRILLING PROCEDURES

To insure maximum operating efficiency, the following suggestions should be observed.

1) SUGGESTIONS FOR DRILLERS

1. Never pound on stuck steel. Nothing is accomplished thereby and the drill and bit may be permanently damaged in the process.
2. Never strike the drill with tools.
3. Never try to repair the drill on the job. Take it to a repair shop.
4. Every effort must be made to keep dust and dirt from entering the drill. Preventing impurities from entering the drill pays off in improved operation and reduced downtime for repairs.
5. Always be sure the drill is well lubricated. Adjust the lubricating oil reservoir or air line lubricator, so that the shank piece always shows oil film, yet does not cause fogging. The oil level in the reservoir should be checked once a week.
6. Always keep the drill aligned with the drill steel and hole. This assures straight and true holes that go down fast. Most importantly, this prevents unnecessary wear and damage to the drill.

2) DRIELL STEEL CARE

1. It is very important that the threads of the drill steel be properly lubricated and cared for at all times. Steels having stripped threads, cracks, or severe galling must not be used. Also, care should be taken while drilling not to bend steel or gall threads due to misuse.
2. Bent steel produces unnecessary stresses and accelerates wear on all front end components.
   Bent steel and severe thread galling can be avoided if the following steps are taken:

   (a) Be sure that the steel is bottomed in the striking bar, couplings, and bit.
   (b) All threads must be in good condition and well, greased.
   (c) Always drill with a sharp bit (no more than 1/8 in [3.175 mm] flat on carbides). Dull bits cause excessive pounding and unnecessary stresses on all threads and drill front end parts.
   (d) Approach the rock at reduced feed pressure, position carefully, and collar the hole. Once bit is collared in rock, full feed pressure may be applied.
   (e) Always keep sufficient feed pressure on steel system. Insufficient feed pressure will cause joints to loosen and threads will be damaged.
   (f) Always maintain alignment between the drill and the hole.

3) BIT CARE

For long bit life, the following steps must also be taken:

1. Never allow the bit to become plugged with loose cuttings. Blow the hole continuously.
2. Never force or broach the bit into a hole.
3. ."Rattle" bits from steel using the drill hammer action with light feed pressure and no rotation. Never strike the bit with a hammer.
4. Bit carbides should never be allowed to flatten any greater than 1/8 in. (3.1-75 mm) between re-grinding intervals.

4) ADJUSTING FEED PRESSURE

This machine is equipped with remote controlled feed pressure adjusting system which adjusts the feed force according to the drilling condition (hardness of the rock or ground stratum).
Appropriate feed force varies according to the rock to drill.
However, when drilling, you shall adjust the feed force with the feed pressure adjusting valve (Figure x-x of Section x) based on the pressure indicated below as the pressure reading on the feed pressure gage in side cab.

Hole Direction	Feed Pressure
Vertical hole drilling (Downward)	xx – xx Kg/cm^2
Horizontal hole drilling	xx – xx Kg/cm^2

5) ADJUSTING ROTATION SPEED.

The drifter's rotation system is equipped with rotation speed adjuster (Figure x-x of Section x) which can adjust the rotation speed according to whether the drilling is made with cross bit or button bit.
Rotation speed adjustment according to bit size would result in longer bit life and more stable drilling.
The rotation speed shall be adjusted based on the values shown below.

Hole (bit) size	89mm (3.5")	102mm (4")	114mm (4.5")	127mm (5")
Cross Bit	150 RPM	130 RPM	120-110 RPM	110-95 RPM
Button Bit	110 RPM	85-100RPM	75-90 RPM	65-80 RPM

6) ROCK DRILL OIL

The Rock Drill Oil used in the air line lubricator should be suitably compounded to provide the specified steam emulsion, consistency and load-carrying ability. It should be substantially and non-corrosive to steel and bronze, and high viscosity index is desirable.

ROCK DRILL OIL SPECIFICATIONS

Characteristics	Method	Below 20 °F (-6.7 ℃) Light	20 to 90 °F (-6.7 ℃ to 32.2 ℃) Medium	Above 90 °F (32.2 ℃) Heavy
Viscosity SUS at 100 °F(37.8 ℃) SUS at 210 °F(98.9 ℃) cSt at 40 ℃ cSt at 100 ℃	 ASTM-D2161 ASTM-D2161 ASTM-D445 ASTM-D445	 175Min. 46min. 37Min 6Min.	 450Min 65Min. 105Min. 11Min.	 750Min 85Min. 160Min. 16Min.
Flash Point °F (℃) Min.	ASTM-D92	370 (188)	400 (204)	450 (232)
Pour Point °F (℃) Max.	ASTM-D97	-10 (-23)	-10 (-23)	0 (-18)
Viscosity Index, Min.	ASTM-D2270	90	90	90
Steam Emulsion No, Min.	ASTM-1935-65	1200	1200	1200
Consistency		Stringy	Stringy	Stringy
Falex Load Test lbs(Min.)	ASTM-D2670	2000 (907kg)	2000 (907kg)	2000 (907kg)
Timken E.P. Test lbs(Min.)	ASTM-D2782	30 (14kg)	30 (14kg)	30 (14kg)

The composition of the film strength additive is not specified. The additive must be suitable for use with both steel and bronze, and be substantially non-corrosive to both metals. Except for consistency, all tests mast be conducted in accordance with the standard method (latest edition) of the American Society for Testing Materials.

In addition to meeting the above specifications, the Rock Drill Oil must perform satisfactorily in the drill.

There is possibility for meeting these specifications, the quality of the product, and its performance in service mast necessarily rest with the oil supplier.

7) DRILL STEEL THREAD LUBRICANT

Coat all thread connections with a good molybdenum disulphide thread grease.

THREAD LUBRICANT SPECIFICATIONS

	Summer	Winter
NLGI grade	1	0

8) HYDRAULIC OIL SPECIFICATIONS

The fluid in the hydraulic system should be a high-quality, petroleum-based oil having all the desirable properties of a high-grade oil. The recommended oil should provide high viscosity index for keeping higher efficient output in wider ambient temperature and shorter warm-up time in colder seasons, and contains anti-wear additives for using the unit at lower running cost. The unit should conform to the specifications listed in Table below for the expected drilling output. This unit is filled with SHELL TELLUS OIL T46 on shipping from the factory.

HYDRAULIC OIL SPECIFICATIONS

* Gravity	API 29.58
* Flash Point, Min.	410 ˚F (210 ℃)
Fire Point, Min.	437 ˚F (225 ℃)
Viscosity, SUS at 100 ˚F (37.8 ℃)	213.7
Viscosity, SUS at 210 ˚F (99 ℃)	52
** Viscosity, Index	142
Pour Point, Max	-40 ˚F (-40 ℃)

NOTE: * Approximate-for information only.

** This value or above should be recommended.

3. MAINTENANCE SCHEDULE

To keep the drifter in its optimum and increase the service life, daily inspection and maintenance is the most important. The table below and in following pages includes inspection and maintenance duties, among which those marked by the letter **A** are assigned to operators, and the others marked by the letter **B** are assigned to technical and engineering service men.

Be sure to follow the intervals specified in this table for inspection and maintenance.

NOTE

This table provides a maintenance schedule for normal operating condition, and thus more severe operating condition require different or frequent servicing schedules accordingly.

3-1 INSPECTION AND MAINTENANCE SCHEDULE

Inspection and maintenance table 1/3

Inspection Item	**Inspection Point**	**Inspection intervals (Based on Hour Meter)**							Page
		10	50	250	500	1000	1500	2000	
		Daily	Weekly	Monthly	Every 3 Month	Every 6 Month	Every 9 Month	Annually	
Loosened bolt	Through bolt	A							17
	Motor bolt	A							
	Accumulator bolt	A							
	Front bolt	A							
	Reverse cylinder bolt	A							
	Flushing Cap bolt	A							
Oil leaks	Front head	A							18
	Seal					B Replace			
	O-ring					B Replace			

Inspection and maintenance table 2/3

Inspection Item	Inspection Point	Inspection intervals (Based on Hour Meter)							Page
		10	50	250	500	1000	1500	2000	
		Daily	Weekly	Monthly	Every 3 Month	Every 6 Month	Every 9 Month	Annually	
Front inside	Striking face of Piston			**A**				**B** Replace	18
	Flushing bushing			**A**					
	Shank rod		**A**						
	Cylinder front liner			**A**					
	Chuck bushing			**A**		**B** Replace			
	Chuck		**A**						
	Cap liner		**A**			**B** Replace			
Lubricator	Dripping oil amount	**A**							18
	Lubricating oil level	**A**							
	Lubricating air volume	**A**							
Accumu-lator	Gas pressure				**A, B**				7 - 8
	Diaphragm					**B** Replace			
	Seal washer					B Replace			
Hydraulic oil	Contami-nation			**A**		**B** Replace			18
	Air bubble			**A**					

Inspection and maintenance table 3/3

Inspection Item	Inspection Point	Inspection intervals (Based on Hour Meter)							Page
		10	50	250	500	1000	1500	2000	
		Daily	Weekly	Monthly	Every 3 Month	Every 6 Month	Every 9 Month	Annually	
During Drilling	Individual working pressure	**A**							19
	Drilling speed and rotation	**A**							
	Unusual noise and heat	**A**							
	Unusual hose vibration	**A**							
	Blow condition	**A**							
Overhaul	O-rings, Seal rings, Diaphragms, And Wear off parts					**B** Replace seal rings, diaphragms and check dimensions of wear off parts			

3-2 MAINTENANCE DUTIES ASSIGNED TO OPERATOR

1) INSPECTION FOR ANY LOOSENED BOLT

Any loosened locking bolt has a detrimental effect on keeping optimum performance of drifter and life expectancy, causing trouble, and thus this inspection for any loosened bolt is one of the most important inspection items for drifter.

Loosened bolt is mostly attributed to vibrating drifter, though in earlier stage of use, run-in may cause loss of bolt tension. Thus in addition to implementation of daily inspection, early retightening is indispensable.

Tightening torque for main locking bolts is shown below.

Description	**Tightening Torque Nm (kg·m)**							
Drifter	YH-10	YH-25	YH-35	YH-55	YH-70	YH-80	YH-135	YH-200
Accumulator bolt	-	160 (16)	160 (16)	245 (25)	245 (25)	245 (25)	245 (25)	245 (25)
Rotation motor bolt	60 (6)	118 (12)	118 (12)	118 (12)	137 (14)	137 (14)	137 (14)	137 (14)
Chuck end cap bolt	196 (20)	245 (25)	245 (25)	392 (40)	490 (50)	490 (50)	588 (60)	588 (60)
Through bolt nut	177 (18)	294 (30)	294 (30)	294 (30)	490 (50)	490 (50)	588 (60)	588 (60)
Accumulator cover	-	294 (30)	294 (30)	343 (35)	343 (35)	343 (35)	343 (35)	343 (35)
Accumulator valve	7 (0.7)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)
RP accumulator bolt	160 (16)	160 (16)	160 (16)	160 (16)	160 (16)	160 (16)	245 (25)	245 (25)
RP accumulator cover	294 (30)	294 (30)	294 (30)	294 (30)	294 (30)	294 (30)	343 (35)	343 (35)
RP accumu -lator valve	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)

2) INSPECTION FOR ANY LEAKING OIL

Any oil leaking inside the drifter will flow out to the shank rod assembly, where oil leak may be identified by increasing oil. Into this assembly, lubricating oil from the lubricator is also injected. Thus learning of correct oil quantity in the normal condition helps identify which oil is flowing into this assembly, hydraulic oil or lubricating oil and then take correct action accordingly.
Typically, lubricating oil is more viscous and smellier to hydraulic oil.

3) INSPECTION OF FRONT INSIDE

Look at the inside of front during replacement of shank rod.

- Inspect for any defective part, significant galling, and/or seizure.
- Inspect for any excess wear and/or incorrect lubrication.

For inspection methods and replacement intervals, see pages on and after xx.

4) INSPECTION OF LUBRICATOR

The lubricating oil from the lubricator located in the middle of air piping provides lubrication for the rotation assembly and cooling for the component parts by the compressed air containing traces of rock drill oil.

- Check if the lubricator is filled with a sufficient amount of oil.
- Check if the recommended rock drill oil is used
- Check if proper amount of oil mist is supplied.

The proper amount of oil is defined as such that a satisfactory oil film becomes formed over the shank rod.

5) INSPECTION OF HYDRAULIC OIL

Hydraulic oil plays an important part in every hydraulic system just like the human blood. Any mixed dirt/water content, deteriorated oil or occurrence of air bubbles results impaired performance of drifter and also decreased life expectancy of component parts. Remember to check the hydraulic oil during replenishment, and contact our service department if any unusual condition is discovered.

6) INSPECTION DURING DRILLING

If drilling is kept on with any problem discovered during the operation and let unsolved, the problem may grow and finally lead to total trouble. If any unusual condition is detected in terms of items listed below, identify the situation then contact our service department.

- Varying working pressure
- Drilling speed and rod rotation
- Sound of percussion and rotation of drifter, heat generation from drifter, and heat generation from shank rod (joint assembly in particular)
- Vibrating hydraulic hoses
- Blow condition

3-3 MAINTENANCE DUTIES ASSIGNED TO SERVICE MEN

1) INSPECTION OF GAS PRESSURE IN ACCUMULATOR

Varying percussion pressures, decelerated drilling speeds, and unusual vibration of drifter and hydraulic hoses may result from any trouble in accumulator.
Using the charging valve provided as an accessory tool, follow the steps below for inspection.

(1) Remove the accumulator cap.
(2) Slightly loosen the accumulator valve with a 14mm T-shaped wrench.
(3) Attach the charging valve to the accumulator.
(4) Turn the pressure relief handle clockwise to shut off the pressure relief valve.
(5) Turn the charging handle counterclockwise to open the charging valve, and the gage should read an injection pressure.

2) GAS CHARGING METHOD

After completing the steps (1) through (5) for inspection, follow the additional steps below.

(6) Run the charging hose between the charging valve and the cylinder.
(7) Gradually open the gas cylinder valve to inject the gas, and shut off the gas cylinder valve when a setting pressure is reached.

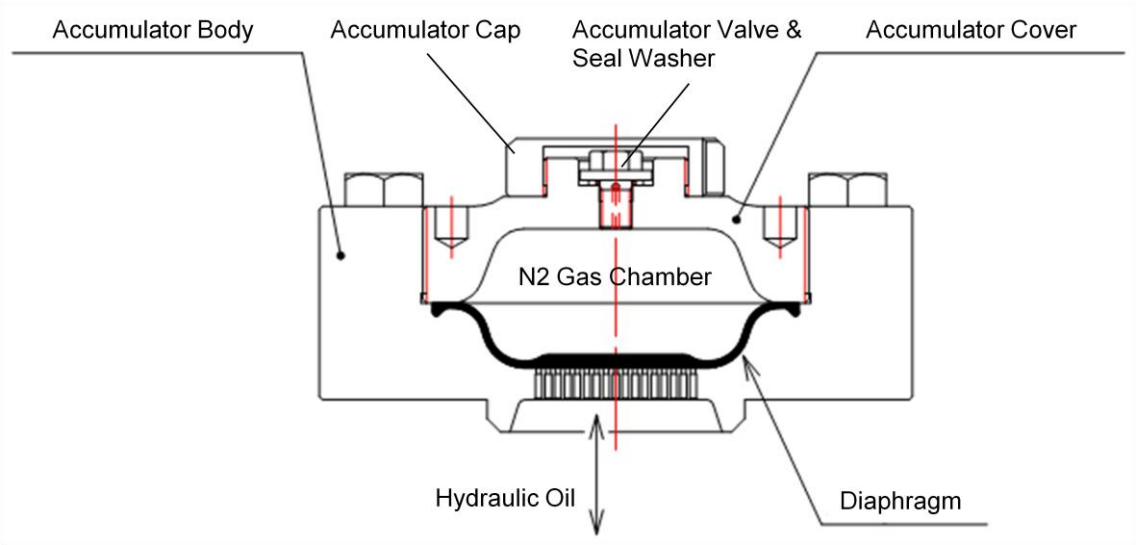
    If excess amount of gas is injected, gradually turn the pressure relief handle counterclockwise to release the excess gas.

(8) Turn the charging handle clockwise to tighten and shut off the accumulator valve.
(9) Turn the pressure relief handle counterclockwise to open the pressure relief valve then to release any residual gas from the charging valve and the hose.
(10) Disconnect the hose and the charging valve.
(11) Retighten the accumulator valve with T-shaped wrench.
(12) Reinstall the accumulator cap.

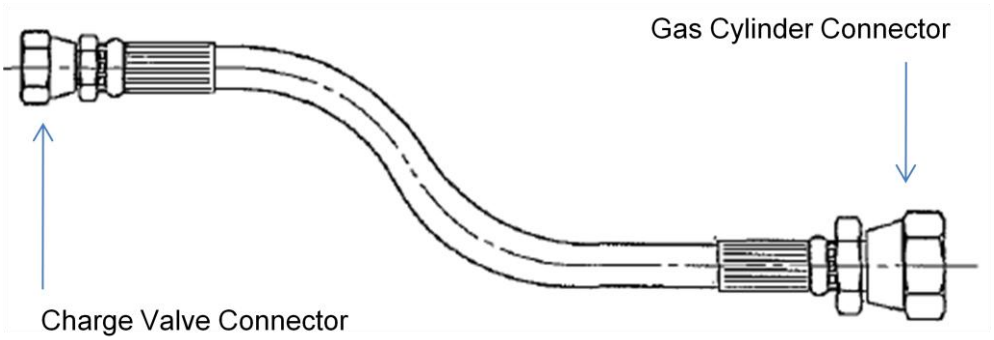
To set a correct gas charging pressure, re-measurement of gas pressure is recommended.
To do so, remember to charge the gas slightly more than the setting pressure in the step (7).
After releasing any residual gas, turn the pressure relief handle clockwise to shut off the pressure relief valve then open the charging handle, and the charging pressure may be checked again. Then adjust the gas pressure to the setting pressure. (See page xx)

Gas Charging Equipment and Accumulator

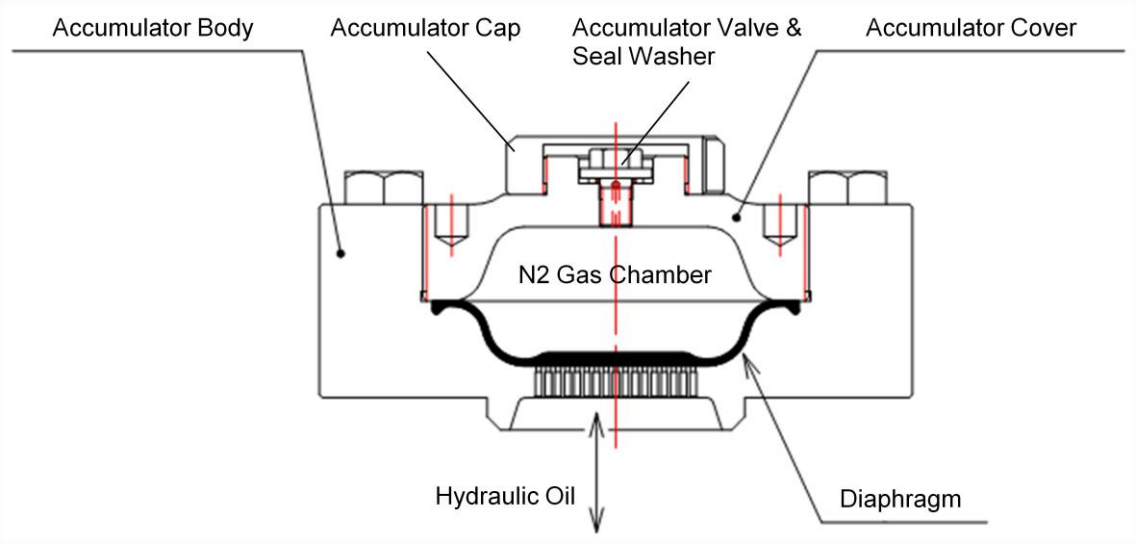
Charging Valve Assembly



Charging Hose Assembly



Accumulator Assembly



3) PRECAUTIONS FOR HANDLING OF ACCUMULATOR

(1) Never use any gas other than nitrogen for charging gas.

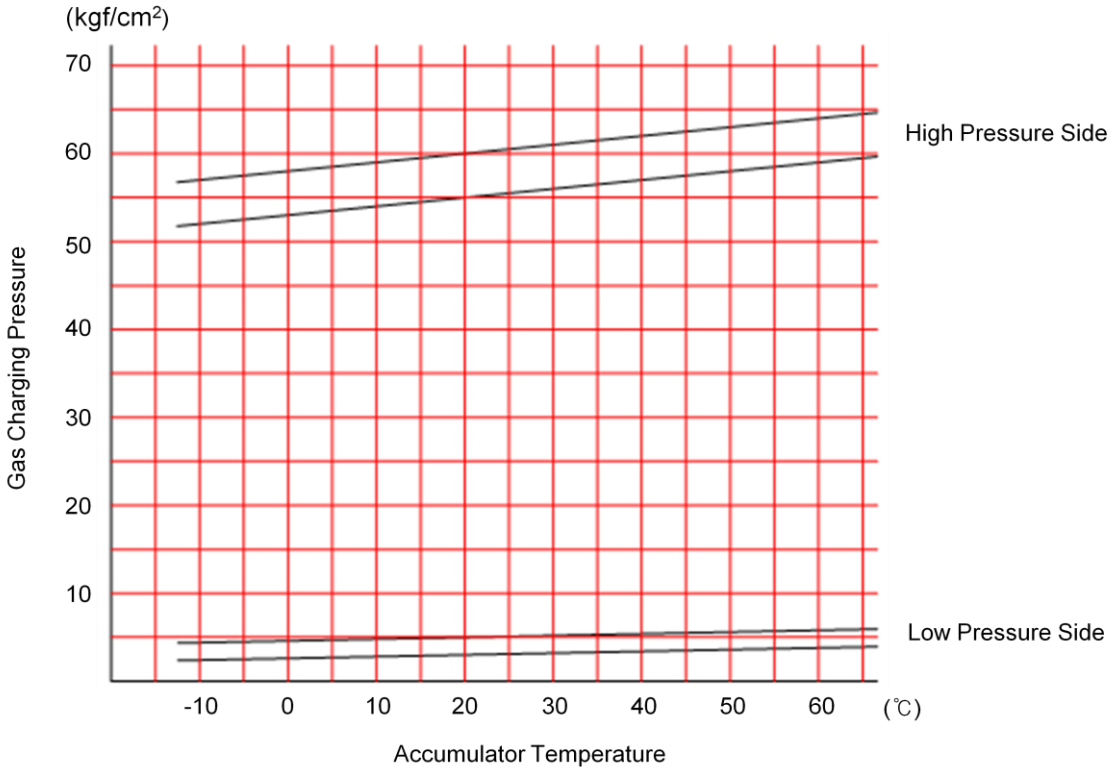
(2) Use a T-shaped wrench to retighten the accumulator valve without over-tightening to prevent possible broken seal washer. Recommended Tightening Torque: 4 kgf·m

(3) Quick and abrupt gas charging or releasing can cause damaged pressure gage and/or seal washer. Be sure to gradually charge or release the gas.

(4) When the charging valve is attached to the accumulator and the valve is set open for gas inspection, the charging gas will flow into the charging valve, causing a pressure drop of about 5 kg/cm^2 in the high-pressure line. Be sure to set the gas cylinder at hand for inspection.

(5) When gas inspection is attempted immediately after end of operation, the accumulator remains at an elevated temperature with the charging pressure also at an increased value accordingly.

Refer to the graph below for gas replenishment.

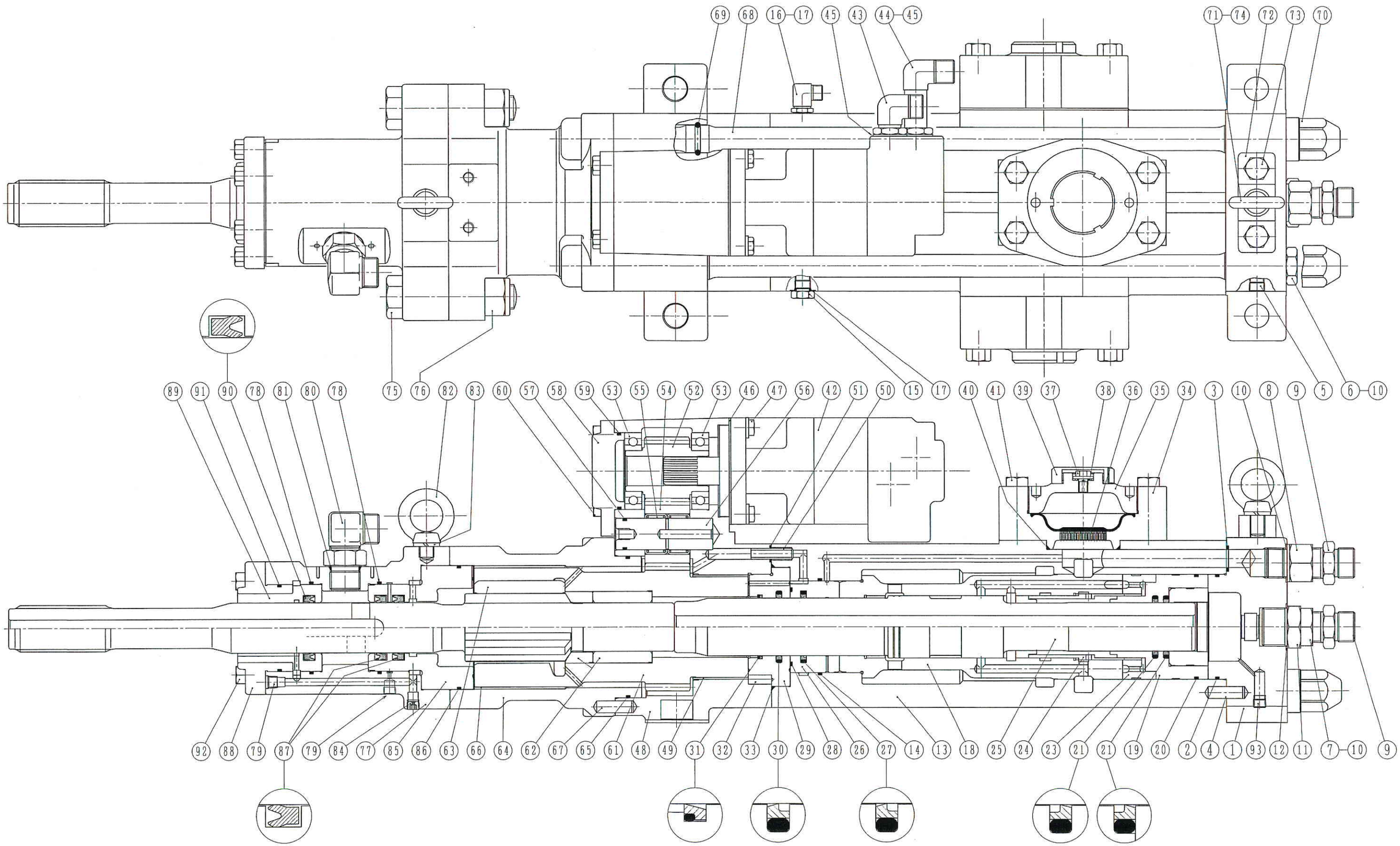


(6) Allowable gas pressure range Mpa (kg/cm^2) at ordinary temperature is shown on the table below

Drifter	**YH-10, 25, 35**	**YH-55, 70. 80, 135, 200**
High pressure side	4.9 – 5.4 (50 - 55)	5.4 – 5.9 (55 – 60)
Low pressure side	0.3 – 0.5 (3 – 5)	0.3 – 0.5 (3 – 5)

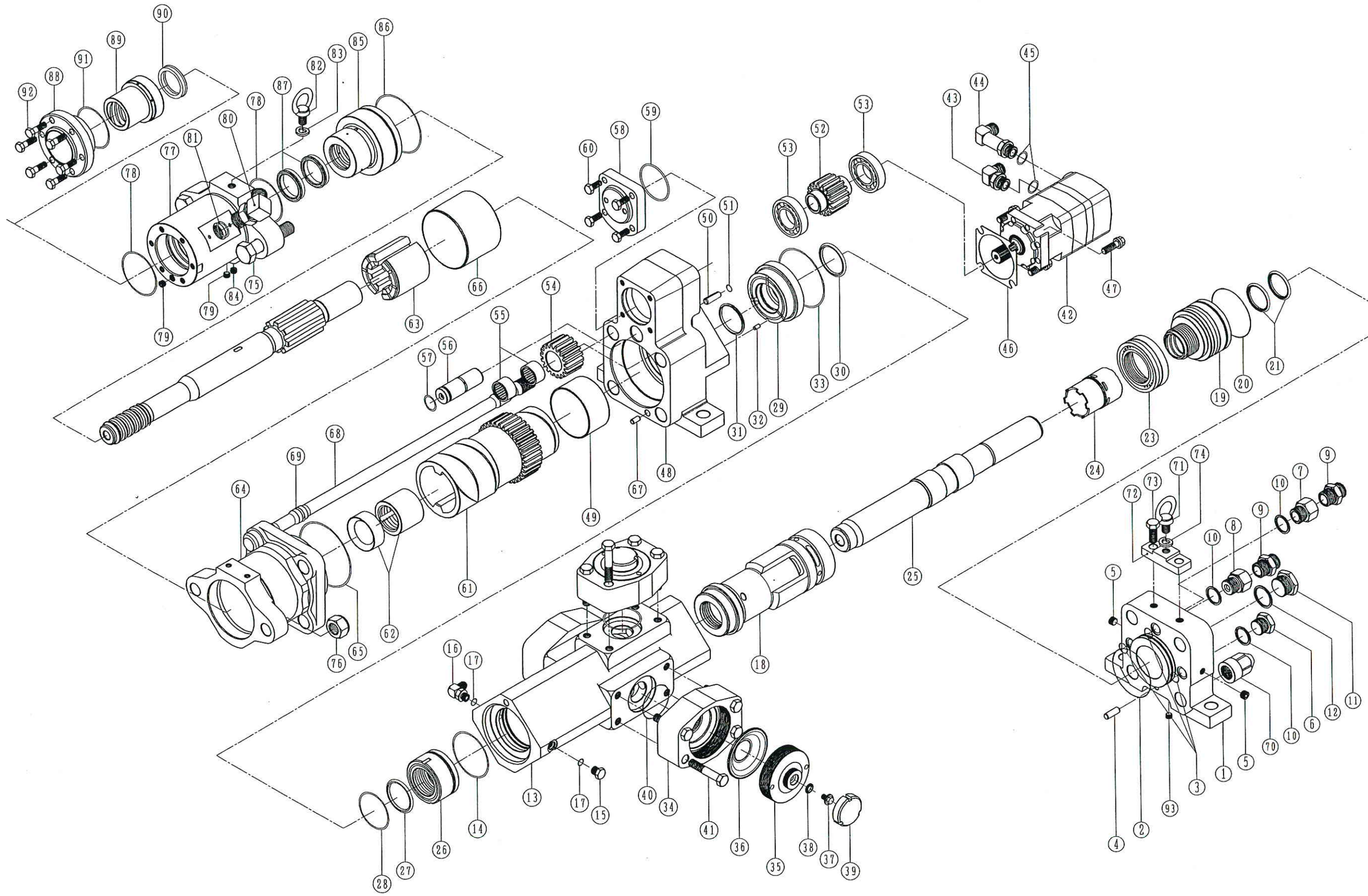
YH－135JJC HYDRAULIC DRIFTER

YAMAMOTO IRON WORKS CO, LTD
4.20. 2010 (S=1/2)



D,R No 135JJCKT-001

YH-135JJC HYDRAULIC DRIFTER



DRIFTER (YH-135)

NO. 순번	PART CODE 부품 코드	DESCRIPTION 품 명		Q'TY 수량	REMARK 비 고
	8301359-0000128	Back Head ASSY.			
1	8301351-1000106	Back Head	백 헤드	1	
2	8300804-7004905	O-Ring	O - 링	1	
3	8300074-7004302	O-Ring	O - 링	3	
4	8300804-7002105	Dowel Pin	맞춤 핀	1	
5	8300804-7002303	06 Screw Plug	06 스크류 플러그	2	
6	8300074-7002406	16 Plug	16 플러그	1	
7	8301354-7002608	MF Adapter	MF 아답터	1	
8	8301351-1000605	Outlet Adapter	아웃렛 아답터	1	
9	8301354-7002512	16 Adapter	16 아답터	2	
10	8300804-7002204	Seal	시일	3	
11	8301354-7002407	20 Plug	20 플러그	1	
12	8301354-7002205	Seal	시일	1	
93	8300074-7002302	04 Screw Plug	04 스크류 플러그	1	
	8301359-0000435	Cylinder ASSY.	실린더 조립체	1	
13	8301351-1001410	Cylinder	실린더	1	
14	8300804-7004614	O-Ring	O - 링	1	
15	8300804-7002401	06 Plug	06 플러그	1	
16	8301354-7003228	Elbow	엘보우	1	
17	8300804-7004803	O-Ring	O - 링	2	
18	8301351-1001506	Cylinder Liner	실린더 라이너	1	
	8301359-0000619	Cylinder Back Liner ASSY	실린더 백 라이너 조립체	1	
19	8301351-1001803	Cylinder Back Liner	실린더 백 라이너	1	
20	8300804-7004905	O-Ring	O - 링	1	
21	8301354-7005112	Step Seal	스텝 시일	1	
23	8301351-1001906	Valve Guide	밸브 가이드	2	
24	8301351-1002006	Valve	밸브	1	
25	8301351-1002106	Piston	피스톤	1	
	8301359-0003301	Piston Front Guide Assy	피스톤 프론트 가이드 조립체	1	
26	8301351-1001601	Piston Front Guide	피스톤 프론트 가이드	1	
27	8301354-7005120	Step Seal	스텝 시일	1	
28	8301354-7004610	O-Ring	O - 링	1	
	8301359-0000724	Cylinder Front Liner ASSY	실린더 프론트 라이너 조립체	1	
29	8301351-1002205	Cylinder Front Liner	실린더 프론트 라이너	1	
30	8301354-7005120	Step Seal	스텝 시일	1	
31	8301354-7005306	Wiper Ring	와이퍼 링	1	
32	8301354-7002103	Key	키이	1	
33	8301354-7004619	O-Ring	O - 링	1	
34	8300809-0000804	Accumulator ASSY.	어큐물레이터 조립체	3	
35	8300801-1002404	Accumulator Body	어큐물레이터 몸체	1	
36	8300801-1002505	Accumulator Cover	어큐물레이터 커버	1	
37	8300807-7000106	Diaphragm	다이아프램	1	

DRIFTER (YH-135)

NO. 순번	PART CODE 부품 코드	DESCRIPTION 품 명		Q'TY 수량	REMARK 비 고
37	8300801-1002601	Accumulator Valve	어큐물레이터 밸브	1	
38	8300804-7001001	Seal Washer	시일 와셔	1	
39	8300801-1002701	Accumulator Cap	어큐물레이터 캡	1	
40	8300804-7004609	O-Ring	O - 링	1	
41	8300804-7000109	Accumulator Bolt	어큐물레이터 볼트	4	
	8301359-0000954	Rotation Motor ASSY(Sea	회전 모터 조립체(시일 킷)	1	
42	8301354-7006651	Hydraulic Motor	16 플러그	1	
43	8301354-7003239	Elbow	엘보우	1	
44	8301354-7003239	Elbow	엘보우	1	
45	8301354-7005006	O-Ring	O - 링	2	
46	8301351-1003001	Motor Gasket	모터 가스켓	1	
47	8301351-1002803	Motor Bolt	모터 볼트	4	
	8301359-0001008	Gear Box ASSY.	기어박스 조립체	1	
48	8301351-1003407	Gear Box	기어박스	1	
49	8301354-7001606	DU Bushing	DU 부싱	1	
50	8300804-7002003	Spring Pin	스프링 핀	1	
51	8300804-7004301	O-Ring	O - 링	1	
	8301359-0001104	Drive Gear ASSY.	드라이브 기어 조립체	1	
52	8301351-1003605	Drive Gear	드라이브 기어	1	
53	8301354-7000705	Ball Bearing	볼 베어링	2	
	8301359-0001205	Idler Gear ASSY.	아이들러 기어 조립체	1	
54	8301351-1003805	Idler Gear	아이들러 기어	1	
55	8301354-7000804	Needle Bearing	니이들 베이링	2	
56	8301351-1003906	Idler Gear Shaft	아이들러 기어 샤프트	1	
57	8301354-7004101	O-Ring	O - 링	1	
	8301359-0001303	Gear Box Cover ASSY.	기어박스 커버 조립체	1	
58	8301351-1004103	Gear Box Cover	기어박스 커버	1	
59	8301354-7004102	O-Ring	O - 링	1	
60	8300804-7000117	Gear Box Cover Bolt	기어박스 커버 볼트	4	
	8301359-0001505	Chuck Driver ASSY.	척 드라이버 조립체	1	
61	8301351-1004306	Chuck Driver	척 드라이버	1	
62	8301351-1004502	Chuck Bushing (2pcs)	척 부싱(2pcs)	1	
(62)	8301351-1004911	Shank Aligner	생크 얼라이너	(1)	
(62)	8301351-1004605	Shank Bushing	생크 부싱	(1)	
63	8301351-1004705	Chuck	척	1	
	8301359-0001610	Chuck End ASSY.	척 엔드 조립체	1	
64	8301351-1006407	Chuck End	척 엔드	1	
65	8301354-7004110	O-Ring	O - 링	1	
66	8301354-7001609	DU Bushing	DU 부싱	1	
67	8300804-7002105	Dowel Pin	맞춤 핀	1	
	8301359-0001909	Through Bolt ASSY.	관통 볼트 조립체	4	
68	8301351-1007307	Through Bolt	관통 볼트	1	

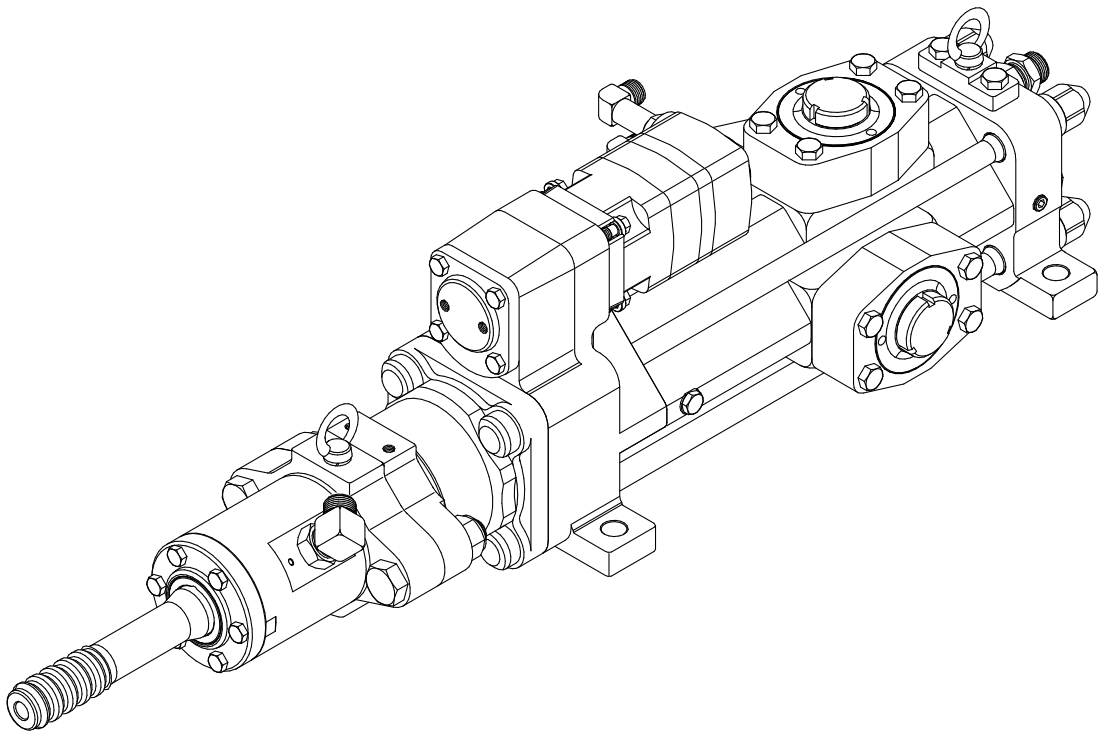
DRIFTER (YH-135)

NO. 순번	PART CODE 부품 코드	DESCRIPTION 품 명	Q'TY 수량	REMARK 비 고
69	8300804-7004204	O-Ring 0 - 링	1	
70	8301351-1007405	Through Bolt Nut 관통 볼트 너트	1	
	8300079-0002002	Eye Bolt Assy 아이 볼트 조립체	1	
71	8300804-7001502	Eye Bolt 아이 볼트	1	
72	8300801-1007502	Hook Plate 후크 플레이트	1	
73	8300804-7000114	Hook Plate Bolt 후크 플레이트 볼트	2	
74	8300804-7001202	Lock Washer 잠금 와셔	1	
	8301359-0003401	Front Bolt Assy 프론트 볼트 조립체	2	
75	8301354-7000101	Front Bolt 프론트 볼트	1	
76	8301354-7000301	Nylon Nut 나일론 너트	1	
	8301359-0002609	Flushing Case Assy 플러싱 케이스 조립체	1	
77	8301351-1009001	Flushing Case 플러싱 케이스	1	
78	8300804-7004613	O-Ring 0 - 링	2	
79	8300074-7002302	04 Plug 04 플러그	2	
80	8301354-7003243	16 Elbow 16 엘보우	1	
81	8301354-7004810	O-Ring 0 - 링	1	
82	8300804-7001502	Eye Bolt 아이 볼트	1	
83	8300804-7001202	Lock Washer 잠금 와셔	1	
84	8301351-1009201	Lubrication Plug 윤활 플러그	1	
	8301359-0002802	Flushing Bushing Assy 플러싱 부싱 조립체	1	
85	8301351-1009301	Flushing Bushing 플러싱 부싱	1	
86	8301354-7004109	O-Ring 0 - 링	1	
87	8301354-7006306	U Packing U 패킹	2	
	8301359-0003501	Flushing Cap Assy 플러싱 캡 조립체	1	
88	8301351-1009601	Flushing Cap 플러싱 캡	1	
89	8301351-1009701	Cap Liner 캡 라이너	1	
90	8301354-7006306	U Packing U 패킹	1	
91	8301354-7004104	O-Ring 0 - 링	1	
92	8301354-7000116	Flushing Cap Bolt 플러싱 캡 볼트	6	

YH Series Hydraulic Drifter

YH-135

Service and Maintenance Manual



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1. System Configuration

Hydraulic drifter model YH-135 feature a front motor driven hydraulic drifter composed of a rotation assembly in the middle of the body, a blow equipment “flushing head” in the front, an optional reverse percussion assembly in between the rotation assembly and the flushing head, and a percussion assembly in the rear.

The percussion assembly provides a reciprocating motion of piston in the back and forth direction to drive a rod. It contains a cylinder, a cylinder liner, a valve, three accumulators and other such equipment. Reciprocating motion of the piston consistently based on its own valve selector assembly, featuring a high energy efficient, thereby providing an excellent drilling capability.

The reverse percussion assembly is anti-jamming equipment working with the normal percussion assembly. It features a shank rod inserted inside the reverse piston, allowing the piston to hit against the front of shank rod in a reverse direction, which facilitates the recovery of rod. It is made up of reverse piston, reverse cylinder, accumulator, etc.

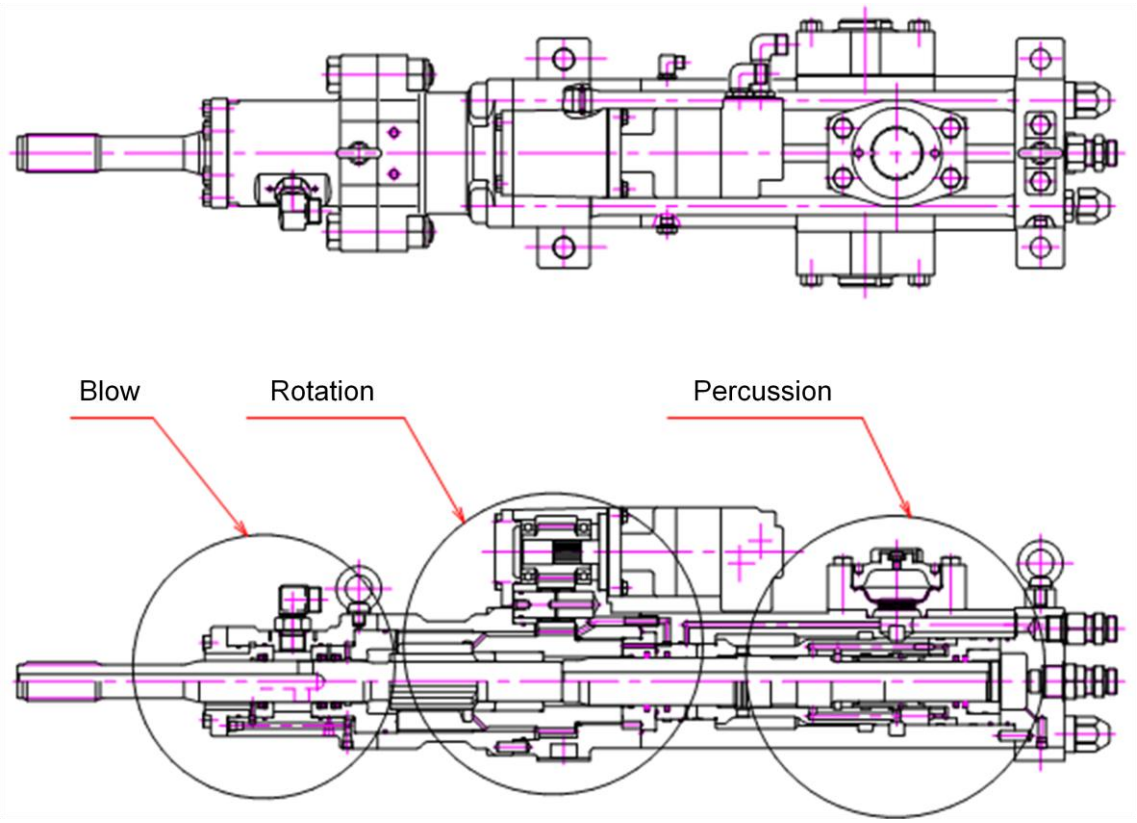
The rotation assembly provides a rotary motion, containing a hydraulic motor, driver gear, chuck driver, chuck and other power transmission components. The hydraulic motor assembly is compact sized and incorporates a strong and highly durable low speed and high torque motor.

The blow equipment contains a flushing case, a flushing bushing and a flushing cap. This equipment is designed to provide straight and strong blow effect.

The percussion assembly and the rotation assembly are firmly fastened with each other through four (4) through-bolts using difficult- to-loosen fine screw threads.

The entire system features a simple design, less number of component parts, ease of disassembling and maintenance.

1-1 Main Assemblies

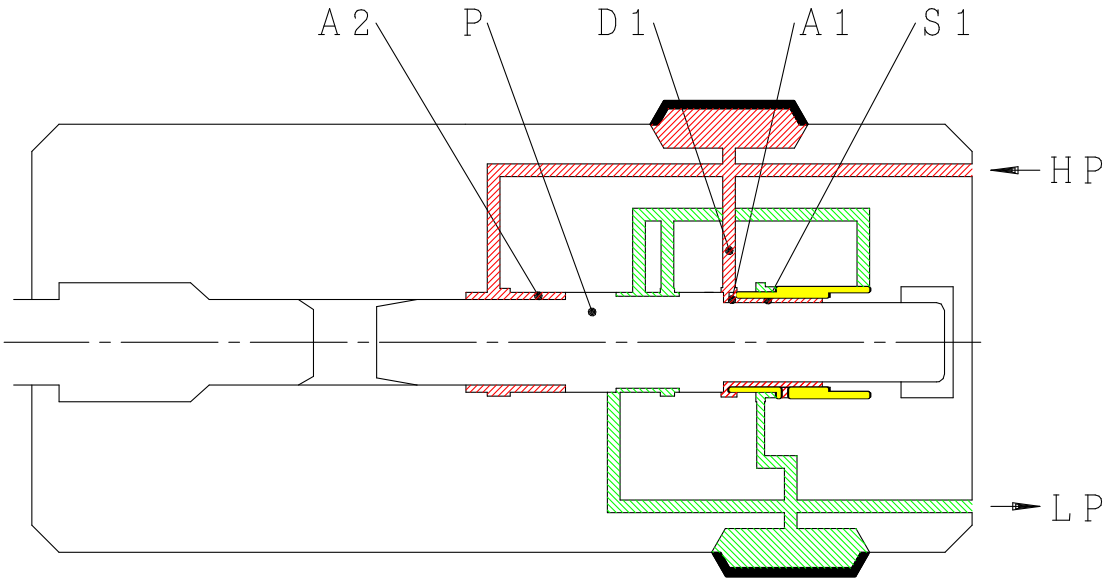


1-2 Principle of Operation of Piston

In Fig-1, the piston (P) is positioned at the top dead point, and the chamber (S1) behind the piston is exposed to high-pressure oil (HP) from the high-pressure port (D1).

Between the pressure receiving areas in the chamber (A1) behind the piston and the chamber (A2) ahead the piston, there is a relationship of A1>A2.

This means that the chamber behind the piston is subject to a larger force than the chamber ahead the piston when the high-pressure line leads to the chamber behind the piston, thereby causing the piston to star percussion cycle.



Fig–1

In Fig. 2, the piston continues moving forward. In this process, the accumulator (A3) feeds oil to make up consumption and maintain a required oil level.

The larger diameter section in the piston opens the valve selector port (D2), and the high pressure in the chamber behind the piston runs to the chamber (S2) behind the valve, switching the valve (V).

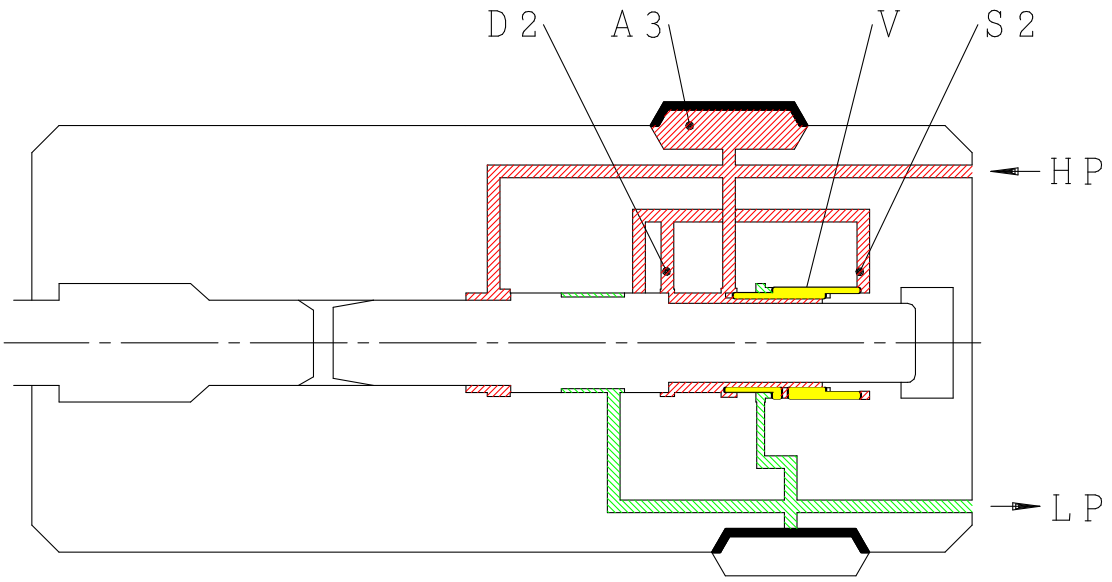


Fig-2

In Fig-3, the piston reaches a percussion point, where it delivers a kinetic energy accumulated in the process of percussion cycle to the rod (R), which, in turn, transmits a percussion energy required for destruction.

At this point of time, the valve has been switched, blocking the high pressure port (D1) and opening the low pressure port (D3), thereby allowing the chamber behind the piston to communicate with the low pressure line (LP).

The pressure in the chamber behind the piston becomes decreased, and the force acting on the front of the piston is larger than that on the rear of piston, thus causing the piston to move backward.

When the piston further moves forward past the percussion point due to no load percussion, the piston blocks the port (D4) to form a cushion chamber (S3), after which it stops and then starts moving backward.

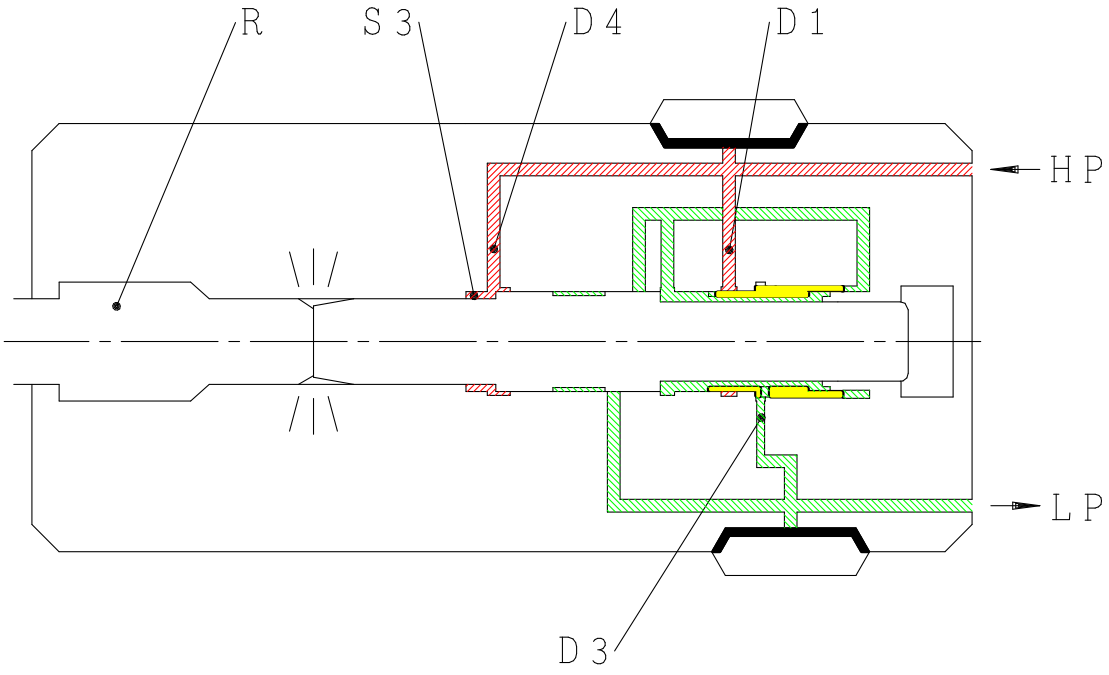


Fig-3

In Fig-4, the piston is still moving backward, and the valve also moves backward because it is pushed by the rear of larger diameter section in the piston.

In this mode, the oil from the chamber behind the piston flows through the low pressure port (D3), and the oil from the chamber behind the valve flows through the groove (D5) on the larger diameter section in the piston, and then the both oil is discharged to the low pressure line (LP).

In the process of backward motion of piston, high pressure oil to the accumulator (A3) and low pressure oil to the accumulator (A4) are filled up.

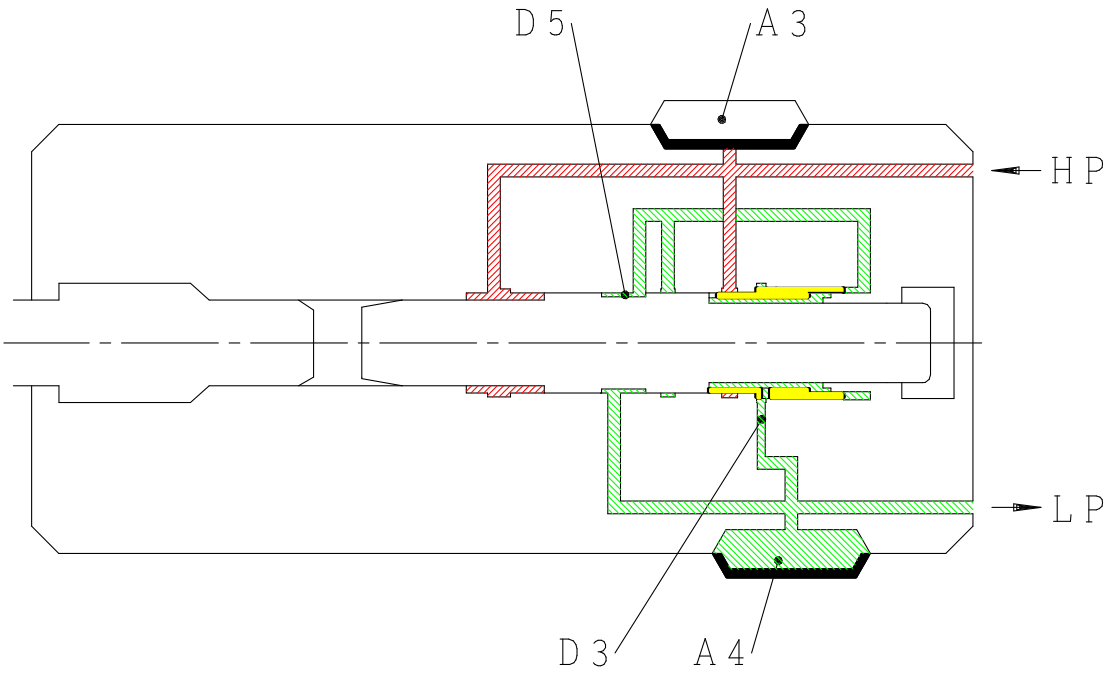


Fig-4

In Fig-5, as the piston continues moving backward, the valve blocks the low pressure port (D3), and opens the high pressure port (D1), causing the chamber behind the piston to lead to the high pressure line (HP).

The chamber behind the piston blocking the low pressure port (D3) forms a cushion chamber in the high pressure line with the aid of inertia energy obtained in the process of backward cycle of piston, and the pressurized oil is stored in the accumulator (A3).

The piston reaches the top dead point at which it stops due to the cushion effect, and the switching of valve is also completed, thereby returning to the status in Fig-1.

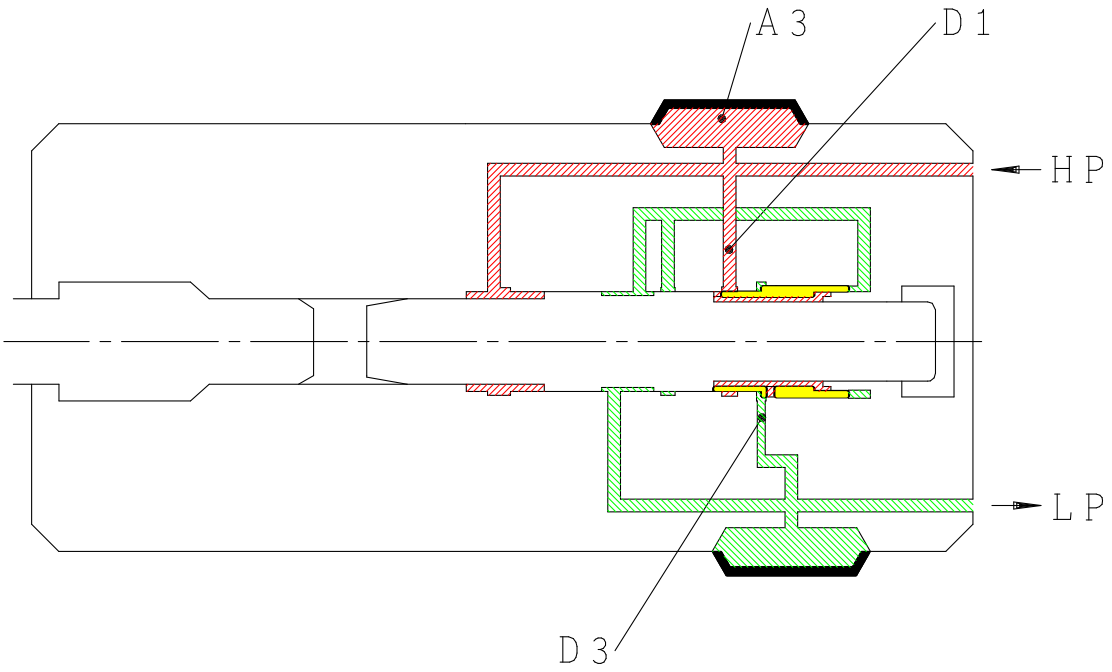


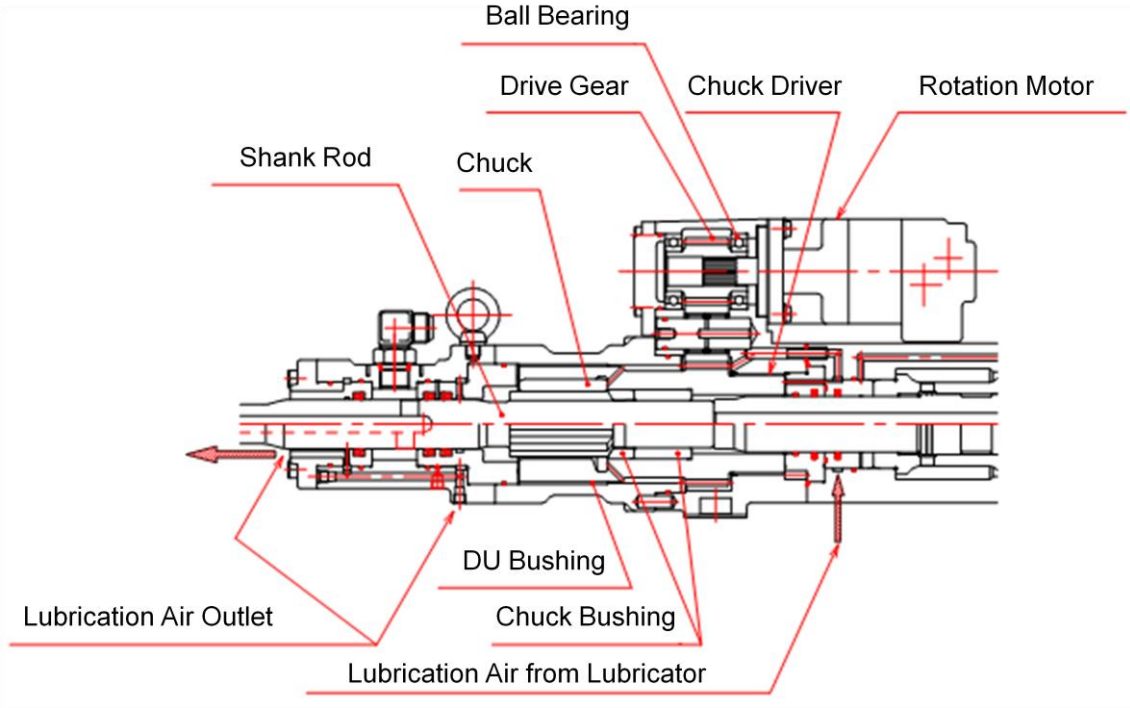
Fig-5

1-3 Rotation Assembly

The rotary motion is produced by a strong hydraulic motor, and its torque is transmitted to a drive gear connected to the motor, which is then delivered to a chuck driver through an idler gear.

On YH-135, the chuck driver contains two jaws at the bore for engagement with the chuck which consists two pieces as to be inserted to the bore of the chuck driver.

The chuck has internal 8 spline to deliver the rotary motion to the shank rod having mating male 8 spline.



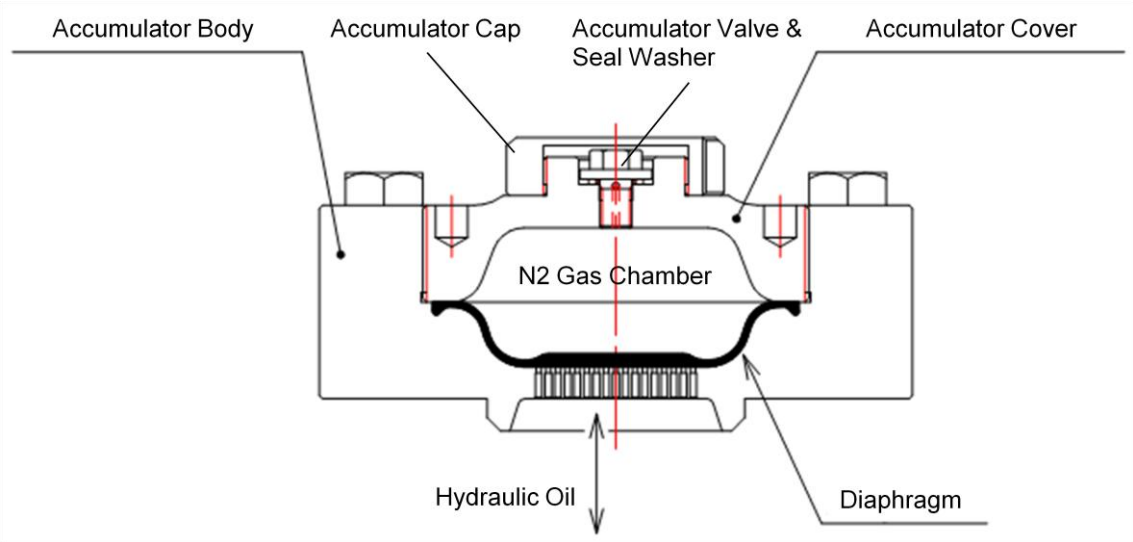
1-4 Lubrication

The piston and the valve work in the hydraulic oil, though the totation assembly is exposed to the open air, thus requiring lubrication.

Lubrication is available through the lubricator installed in the middle of air piping with compressed air containing a little amount of rock drill oil. This compressed air also serves to cool the rotating component parts. Refer to the figure above.

1-5 Accumulator

The accumulator features a closed chamber formed by an accumulator body and an accumulator cover, containing a diaphragm packing inside to isolate the nitrogen gas from the hydraulic oil. It plays an important role in the maintenance of drifter, hydraulic equipment, hose and other such devices by obstruction of impact and releasing of pulsation as well power-up in the process of piston percussion.



1-6 Nitrogen Gas Charging Pressure (kg/cm^2)

For gas charging procedures, see page 23 to 27

Model		YH-10M	YH-25	YH-35L	YH-55	YH-70	YH-80	YH-135	YH-200
HP	Mpa	5.4	5.4	5.4	5.9	5.9	5.9	5.9	5.9
	(kg/cm^2)	(55)	(55)	(55)	(60)	(60)	(60)	(60)	(60)
LP	Mpa		0.4	0.4	0.4	0.4	0.4	0.4	0.4
	(kg/cm^2)		(4)	(4)	(4)	(4)	(4)	(4)	(4)
RP	Mpa	5.4	5.4	5.4	5.9	5.9	5.9	5.9	5.9
	(kg/cm^2)	(55)	(55)	(55)	(60)	(60)	(60)	(60)	(60)

2. Operation of Drifter

2-1 Hydraulic Oil

Selection and management of hydraulic oil is one of the most important factors to take full advantage of optimum performance of drifter and to implement correct maintenance of drifter. In actuality use of such hydraulic oil as listed below can cause impaired drifter performance and/or other various problems.

(1) Incorrect type and improper viscosity
(2) Contaminated

It is recommended to use our specified genuine hydraulic oil. In addition, be sure to use the hydraulic oil in a temperature range between 40℃ and 60℃. Any incorrect oil temperature may shorten the service life of drifter internal components and/or units and also cause other problems. Thus keep monitoring the oil temperature. Follow the manufacturer's recommendations below for correct management of hydraulic oil.

ISO Viscosity	Viscosity Index (℃)	Pour Point (℃)	Flash Point (℃)
46	142	-40	228

2-2 Lubricating Oil

Regulation of lubricating oil level is achieved by turning the oil level regulating needle on the lubricator in the air piping.

For rate of dripping oil, one drop per two (2) seconds is recommended. This oil dripping must be properly adjusted to form a satisfactory oil film over the shank rod. Based on a guideline showing that one (1) oil drop is about 0.02cc, accurate oil level regulation should be available.

Any oil of inferior quality can cause heat generation, seizure, or other such trouble, and thus be sure to use good quality of rock drill oil. For selection of optimum viscosity at an atmospheric temperature, follow the table below.

Ambient Temperature	0 up to 30℃	20 up to 50℃
Viscosity	SAE 20 W – 30 or equivalent	SAE 30 or equivalent

2-3 Description of Components on the Lubricator

(1) Pressure Valve: This feeds compressed air into the bowl. When the oil plug is loosened, the pressure valve becomes closed, allowing lubrication without shutting off the pneumatic circuit.

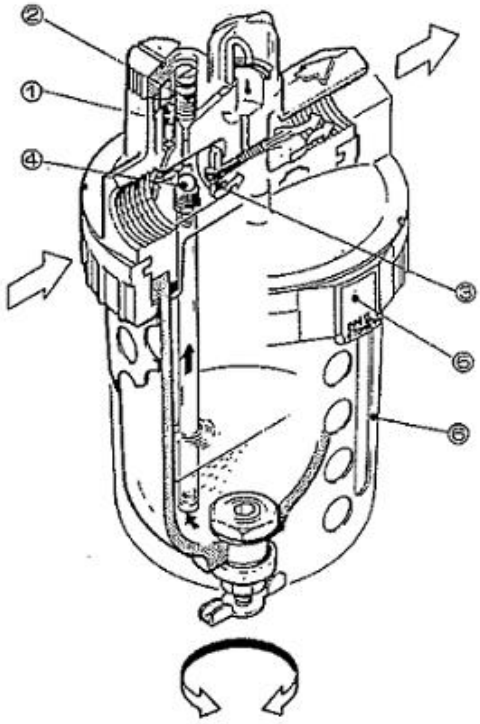
(2) Oil Level Regulating Needle: This regulates the amount of oil to be fed to the compressed air. This features a specifically designed needle for accurate adjustment of oil level. One (1) drop oil is about 0.02cc.

(3) Flow Guide: This contributes to the constant mixture ratio of compressed air and oil in both flow rates, high and low, to consistently feed oil mist to pneumatically powered equipment.

(4) Check Valve: The lubricating oil in the bowl flows through the siphon tube to the drip tube. This check valve is incorporated in this oil path to prevent possible back flow of oil.

(5) Clamp Ring: This features ease of operation by a single pushing clamp ring, allowing easy cleaning of bowl and correct lubrication from the bowl.

(6) Bowl Guard: This provides observation of lubricating oil level through a long slot, contributing to ease of maintenance. Should the bowl become broken, this helps prevent possible scattering of bowl fragments.



Close / Open

2-4 Grease

For shank rods, bolts, screws and individual joints, be sure use proper high-pressure grease containing molybdenum disulfide and featuring good heat resistance and extreme pressure properties.

A hydraulic drifter transmits much more energy than a pneumatic drifter, and thus it is susceptible to larger energy loss and also abnormal heat generation in screws causing burnt threads and difficult loosening when conventional graphite grease is used.
Taking more time in loosening or removing screws not only causes work loss but also has an adverse effect on life expectancy of accessories, drifter bolts and other parts.

2-5 Correct Implementation of Warm-Up Cycle

Be sure to provide a running-in period to warm-up the drifter before starting work.
Required period of time for no-load operation depends on different ambient temperatures, though remember to allow the outside surface of drifter to reach your body temperature for about three (3) minutes before starting drilling work.
Immediate use of drifter without warm-up running especially in a low air temperature environment can cause failure of taking advantage of available performances and also lead to seizure of other such trouble due to abrupt heat changes.

2-6 Basic Consideration for Drilling

A basic consideration for drilling involves a combination of proper feed force and alignment of the axes of drifter, shank rod and bit in a straight line, while paying constant attention to any play in drifter, deflection/deviation of rod, and dislocation of guide cell.
Drilling in any misaligned condition can cause broken shank rod or other accessories, heat generation, worn drifter component part, or other such trouble.

2-7 Management of Accessories

Proper management of bit, rod and other accessories contributes to the maintenance of optimum performance and life expectancy of drifter.

Continuous use of any worn bit causes decreased drilling speed, leading to corresponding reaction against rod and drifter resulting in damaged/worn screws, broken bolts, and other such trouble.

An attempt to compensate the decrease in drilling speed by thrust can cause bent rod broken screw neck, longitudinal crack of joint part, and/or other trouble, also affecting the drifter.

Therefore, keep in mind that every bit must be re-grind on a regular basis for use in a good condition as in new product.

2-8 Notes for Application of Reverse Percussion

When Jamming occurs in the progress of drilling work, resulting in a difficulty to pull out rod, use the reverse percussion cycle to remove the rod.

In this cycle, shank rod and rod will be exposed to a large impact and tensile force, causing significantly reduced life expectancy, and thus remember to complete the reverse percussion in a short period of time as possible.

More important is careful drilling work to eliminate or prevent possible jamming.

3. Maintenance Schedule

To keep the drifter in its optimum and increase the service life, daily inspection and maintenance is the most important.
The table below and in following pages includes inspection and maintenance duties, among which those marked by the letter **A** are assigned to operators, and the others marked by the letter **B** are assigned to technical and engineering service men.

NOTE

This table provides a maintenance schedule for normal operating condition, and thus more severe operating condition require different or frequent servicing schedules accordingly.

3-1 Inspection and Maintenance Schedule

Inspection and maintenance table 1/3

Inspection Item	**Inspection Point**	**Inspection intervals (Based on Hour Meter)**							Page
		10	50	250	500	1000	1500	2000	
		Daily	Weekly	Monthly	Every 3 Month	Every 6 Month	Every 9 Month	Annually	
Loosened bolt	Through bolt	A							20
	Motor bolt	A							
	Accumulator bolt	A							
	Front bolt	A							
	Reverse cylinder bolt	A							
	Flushing Cap bolt	A							
Oil leaks	Front head	A							21
	Seal					B Replace			
	O-ring					B Replace			

Inspection and maintenance table 2/3

Inspection Item	Inspection Point	Inspection intervals (Based on Hour Meter)							Page
		10	50	250	500	1000	1500	2000	
		Daily	Weekly	Monthly	Every 3 Month	Every 6 Month	Every 9 Month	Annually	
Front inside	Striking face of Piston			**A**				**B** Replace	21
	Flushing bushing			**A**					
	Shank rod		**A**						
	Cylinder front liner			**A**					
	Chuck bushing			**A**		**B** Replace			
	Chuck		**A**						
	Cap liner		**A**			**B** Replace			
Lubricator	Dripping oil amount	**A**							21
	Lubricating oil level	**A**							
	Lubricating air volume	**A**							
Accumu-lator	Gas pressure				**A, B**				23 - 28
	Diaphragm					**B** Replace			
	Seal washer					B Replace			
Hydraulic oil	Contami-nation			**A**		**B** Replace			23
	Air bubble			**A**					

Inspection and maintenance table 3/3

Inspection Item	Inspection Point	Inspection intervals (Based on Hour Meter)							Page
		10	50	250	500	1000	1500	2000	
		Daily	Weekly	Monthly	Every 3 Month	Every 6 Month	Every 9 Month	Annually	
During Drilling	Individual working pressure	**A**							23
	Drilling speed and rotation	**A**							
	Unusual noise and heat	**A**							
	Unusual hose vibration	**A**							
	Blow condition	**A**							
Overhaul	O-rings, Seal rings, Diaphragms, And Wear off parts					**B** Replace seal rings, diaphragms and check dimensions of wear off parts			30 - 34

3-2 Maintenance Duties Assigned to Operator

1) Inspection for any loosened bolt

Any loosened locking bolt has a detrimental effect on keeping optimum performance of drifter and life expectancy, causing trouble, and thus this inspection for any loosened bolt is one of the most important inspection items for drifter.

Loosened bolt is mostly attributed to vibrating drifter, though in earlier stage of use, run-in may cause loss of bolt tension. Thus in addition to implementation of daily inspection, early retightening is indispensable.

Tightening torque for main locking bolts is shown below.

Description	**Tightening Torque Nm (kg·m)**							
Drifter	YH-10	YH-25	YH-35	YH-55	YH-70	YH-80	YH-135	YH-200
Accumulator bolt	-	160 (16)	160 (16)	245 (25)	245 (25)	245 (25)	245 (25)	245 (25)
Rotation motor bolt	60 (6)	118 (12)	118 (12)	118 (12)	137 (14)	137 (14)	137 (14)	137 (14)
Chuck end cap bolt	196 (20)	245 (25)	245 (25)	392 (40)	490 (50)	490 (50)	588 (60)	588 (60)
Through bolt nut	177 (18)	294 (30)	294 (30)	294 (30)	490 (50)	490 (50)	588 (60)	588 (60)
Accumulator cover	-	294 (30)	294 (30)	343 (35)	343 (35)	343 (35)	343 (35)	343 (35)
Accumulator valve	7 (0.7)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)
RP accumulator bolt	160 (16)	160 (16)	160 (16)	160 (16)	160 (16)	160 (16)	245 (25)	245 (25)
RP accumulator cover	294 (30)	294 (30)	294 (30)	294 (30)	294 (30)	294 (30)	343 (35)	343 (35)
RP accumul-ator valve	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)	39 (4)

2) Inspection for any leaking oil

Any oil leaking inside the drifter will flow out to the shank rod assembly, where oil leak may be identified by increasing oil.
Into this assembly, lubricating oil from the lubricator is also injected. Thus learning of correct oil quantity in the normal condition helps identify which oil is flowing into this assembly, hydraulic oil or lubricating oil, and then take correct action accordingly.
Typically, lubricating oil is more viscous and smellier to hydraulic oil.

3) Inspection of front inside

Look at the inside of front during replacement of shank rod.

- Inspect for any defective part, significant galling, and/or seizure.
- Inspect for any excess wear and/or incorrect lubrication.

For inspection methods and replacement intervals, see pages on and after 30.

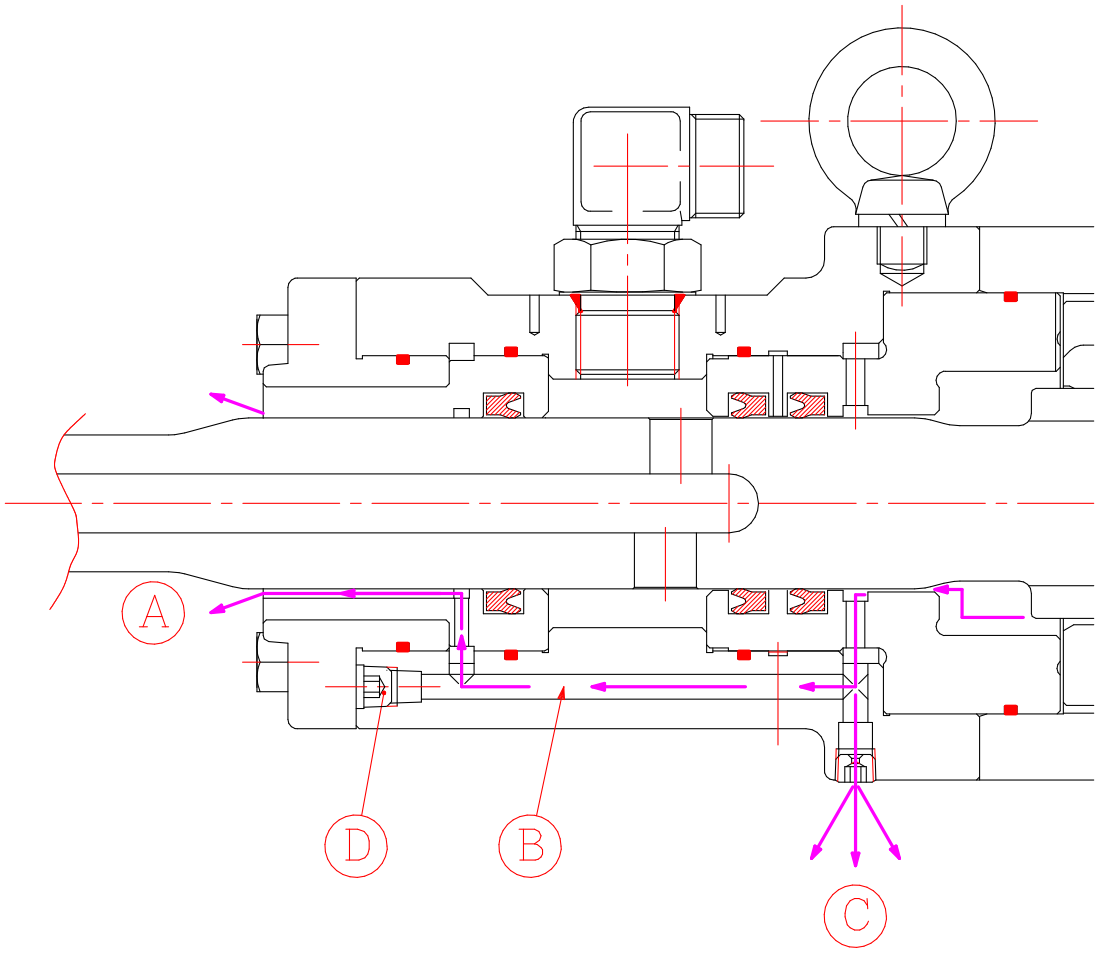
4) Inspection of Lubricator

The lubricating oil from the lubricator located in the middle of air piping provides lubrication for the rotation assembly and cooling for the component parts by the compressed air containing traces of rock drill oil.

- Check if the lubricator is filled with a sufficient amount of oil.
- Check if the recommended rock drill oil is used
- Check if proper amount of oil mist is supplied.

NOTICE

The proper amount of oil is defined as such that a satisfactory oil film becomes formed over the shank rod.



NOTICE

The striking bar/shank rod always shows an oil film during drilling i.e. the lubrication oil must be detected on the striking bar/shank rod. In case no oil can see on the striking bar/shank rod, the air passage in the flushing case should be inspected and any Sediments and/or Dregs must be removed to clean up the air passage.

REMOVE THE PLUG “D” AND CLEAN UP THE AIR PASSAGE “B”.

5) Inspection of hydraulic oil

Hydraulic oil plays an important part in every hydraulic system just like the human blood.
Any mixed dirt/water content, deteriorated oil, or occurrence of air bubbles results impaired performance of drifter and also decreased life expectancy of component parts.
Remember to check the hydraulic oil during replenishment, and contact our service department if any unusual condition is discovered.

6) Inspection during drilling

If drilling is kept on with any problem discovered during the operation and let unsolved, the problem may grow and finally lead to total trouble. If any unusual condition is detected in terms of items listed below, identify the situation then contact our service department.

- Varying working pressure
- Drilling speed and rod rotation
- Sound of percussion and rotation of drifter, heat generation from drifter, and heat generation from shank rod (joint assembly in particular)
- Vibrating hydraulic hoses
- Blow condition

3-3 Maintenance Duties Assigned to Service Men

1) Inspection of gas pressure in accumulator

Varying percussion pressures, decelerated drilling speeds, and unusual vibration of drifter and hydraulic hoses may result from any trouble in accumulator.
Using the charging valve provided as an accessory tool, follow the steps below for inspection.

(1) Remove the accumulator cap.
(2) Slightly loosen the accumulator valve with a 14mm T-shaped wrench.
(3) Attach the charging valve to the accumulator.

(4) Turn the pressure relief handle clockwise to shut off the pressure relief valve.
(5) Turn the charging handle counterclockwise to open the charging valve, and the gage should read an injection pressure.

2) Gas charging method

After completing the steps (1) through (5) for inspection, follow the additional steps below.

(6) Run the charging hose between the charging valve and the cylinder.
(7) Gradually open the gas cylinder valve to inject the gas, and shut off the gas cylinder valve when a setting pressure is reached.

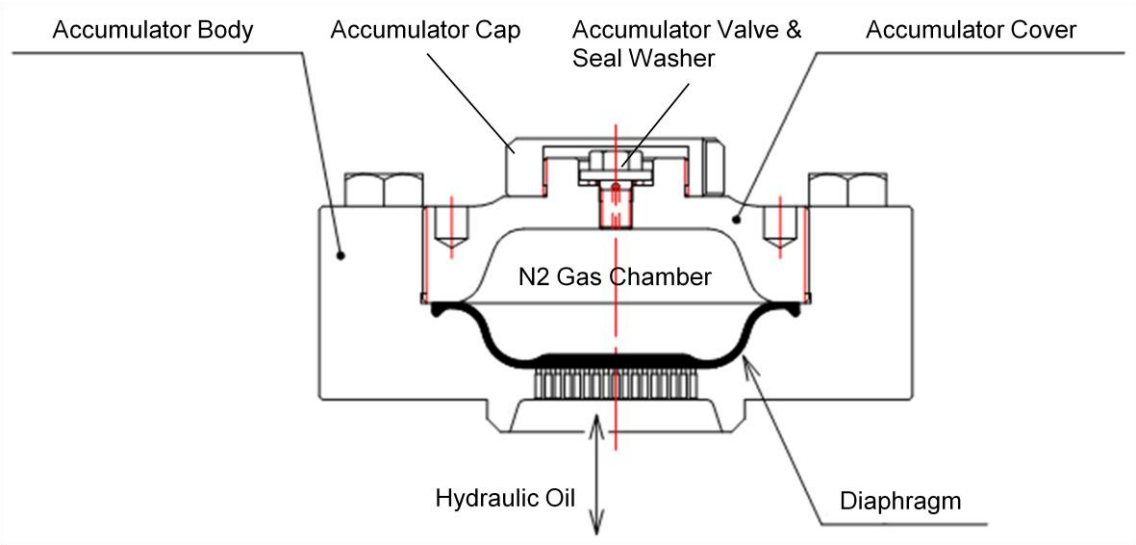
    If excess amount of gas is injected, gradually turn the pressure relief handle counterclockwise to release the excess gas.

(8) Turn the charging handle clockwise to tighten and shut off the accumulator valve.
(9) Turn the pressure relief handle counterclockwise to open the pressure relief valve then to release any residual gas from the charging valve and the hose.
(10) Disconnect the hose and the charging valve.
(11) Retighten the accumulator valve with T-shaped wrench.
(12) Reinstall the accumulator cap.

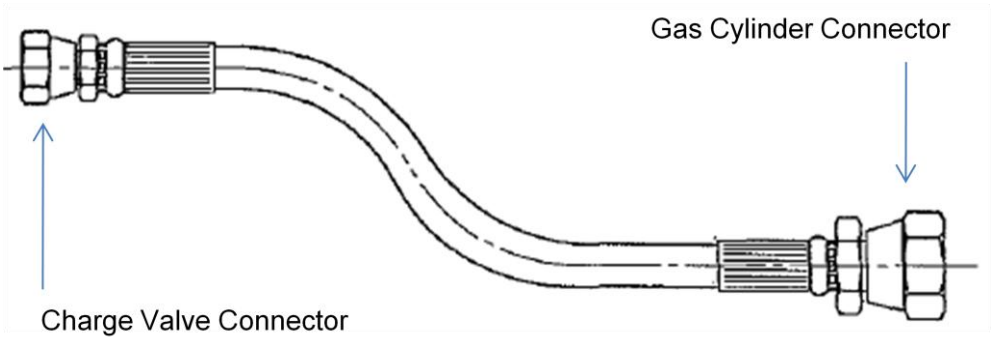
To set a correct gas charging pressure, re-measurement of gas pressure is recommended.
To do so, remember to charge the gas slightly more than the setting pressure in the step (7).
After releasing any residual gas, turn the pressure relief handle clockwise to shut off the pressure relief valve then open the charging handle, and the charging pressure may be checked again. Then adjust the gas pressure to the setting pressure. (See page 12)

Gas Charging Equipment and Accumulator

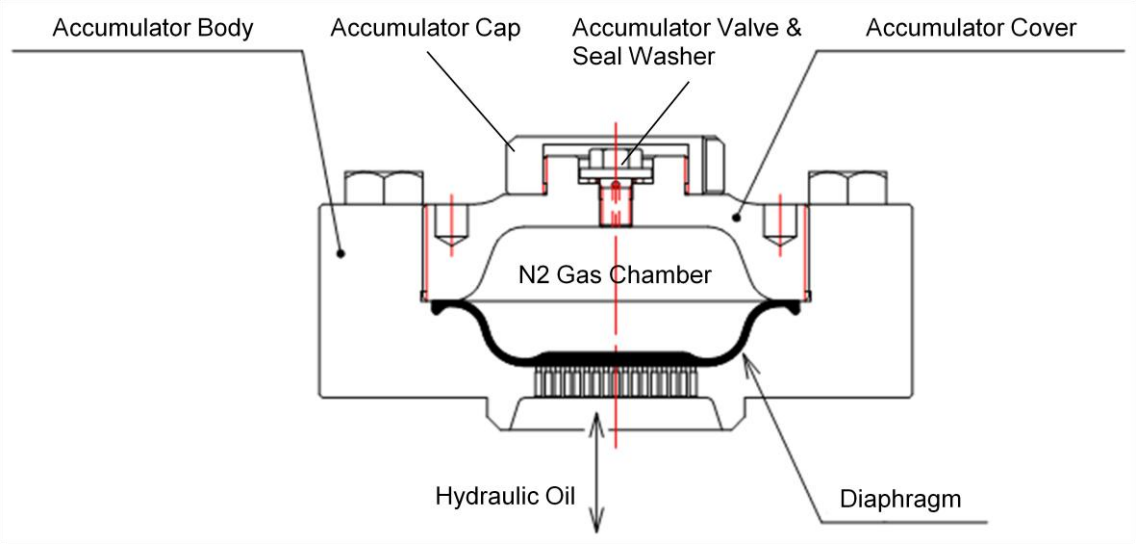
Charging Valve Assembly



Charging Hose Assembly



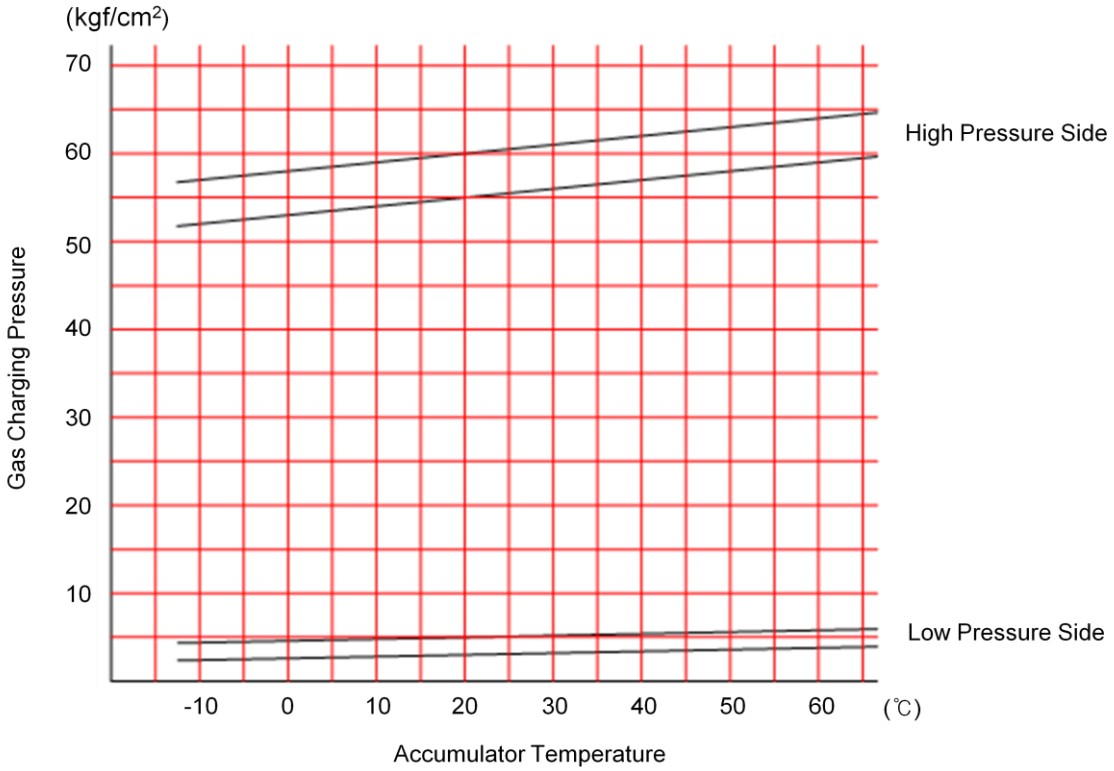
Accumulator Assembly



3) Precautions for handling of accumulator

(1) Never use any gas other than nitrogen for charging gas.
(2) Use a T-shaped wrench to retighten the accumulator valve without over-tightening to prevent possible broken seal washer. Recommended Tightening Torque: 4 kgf·m
(3) Quick and abrupt gas charging or releasing can cause damaged pressure gage and/or seal washer. Be sure to gradually charge or release the gas.
(4) When the charging valve is attached to the accumulator and the valve is set open for gas inspection, the charging gas will flow into the charging valve, causing a pressure drop of about 5 kg/cm^2 in the high-pressure line. Be sure to set the gas cylinder at hand for inspection.
(5) When gas inspection is attempted immediately after end of operation, the accumulator remains at an elevated temperature with the charging pressure also at an increased value accordingly.

Refer to the graph below for gas replenishment.



(6) Allowable gas pressure range Mpa (kg/cm^2) at ordinary temperature is shown on the table below

Drifter	**YH-10, 25, 35**	**YH-55, 70. 80, 135, 200**
High pressure side	4.9 – 5.4 (50 - 55)	5.4 – 5.9 (55 – 60)
Low pressure side	0.3 – 0.5 (3 – 5)	0.3 – 0.5 (3 – 5)

4. Troubleshooting

Possible problems with drifter may be often attributed to rough operation or incorrect inspection/maintenance. Therefore, review the descriptions titled “Operation of Drifter” in Section 2 and “Maintenance Schedule” in Section 3 to understand correct operation of drifter, problems possibly encountered during use of drifter, and their possible causes and solutions.

Should any trouble occur in the drifter, first check that a proper quantity of high pressure oil is correctly fed to the inlet of drifter and that the pump is correctly functioning before starting disassembling and investigation. After identifying possible cause(s), consult us for ordering of spare parts or repair service. If possible causes remain unidentified, inform our service department of detailed description of trouble for our investigation.

4-1 Troubleshooting

Problem	No.	Possible Causes	Solution	Remarks
Piston does not work	1	Galling in piston/valve	Disassemble and replace the part	
Percussion pressure and drilling speed become decreased	2	Accumulator malfunction	Check the gas pressure	
	3	Cylinder inside malfunction	Disassemble and investigate	
	4	Degraded hydraulic oil	Replace the oil with recommended hydraulic oil	
	5	Over heat of hydraulic oil	Inspect the oil cooler	
Rotation motor does not run	6	Hydraulic motor malfunction	Investigate and repair the motor at the plant	
	7	Broken gear/bearing	Disassemble and replace the part	
	8	Galling in bearing part	Disassemble and remove the galled part	

Problem	No.	Possible Causes	Solution	Remarks
Heavily contaminated oil to shank rod	9	Worn/damaged/degraded seal ring/ back ring	Disassemble and replace the part	
	10	Worn out of piston outside surface	Replace the part	
	11	Minor galling in piston	Interrupt the operation then replace the part	
Heavily contaminated oil to shank rod	12	Worn out seal in hydraulic motor	Replace the part	
	13	Too much lubricating oil flow	Adjust the lubricator valve	
Unusual vibration of hose	14	Accumulator malfunction	Check the gas pressure	

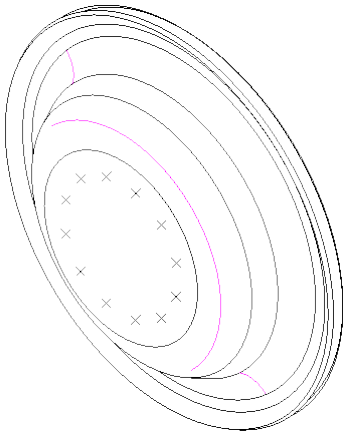
5. Inspection of Component Parts

5-1 Part Inspection Procedures

Inspection of component parts requires a full understanding of functions of individual parts in drifter and also possible adverse effects of worn or damaged parts.

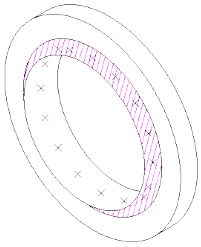
1) Diaphragm

In practice replacement of diaphragm becomes required only when the gas is released due to the puncture. In the inspection of diaphragm, check for any deformed or deteriorated rubber and/or damaged surface.



2) Seal washer

This is a critical part to maintain a specified gas pressure, and thus replace this when the inner rubber packing is found damaged.
Any sudden releasing of gas can cause damaged packing.

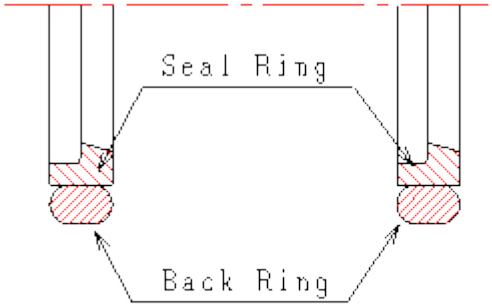


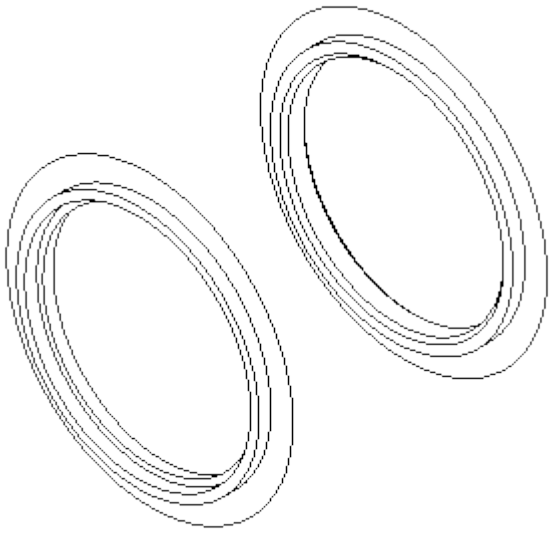
3) Seal ring and back ring

These parts help prevent possible oil leak from the front/rear of piston, and also direct contact of piston outside surface with any metallic part. Typical replacement time is when any oil leak is found, though additional replacement is required when these parts are disassembled.

NOTE

Seal rings and back rings are not allowed to reuse once they are removed.





4) O-ring

The O-rings are incorporated in every parts-joining section to prevent oil leak and air leak. Replace those O-rings as listed below;

(1) Damaged/broken or deformed ring

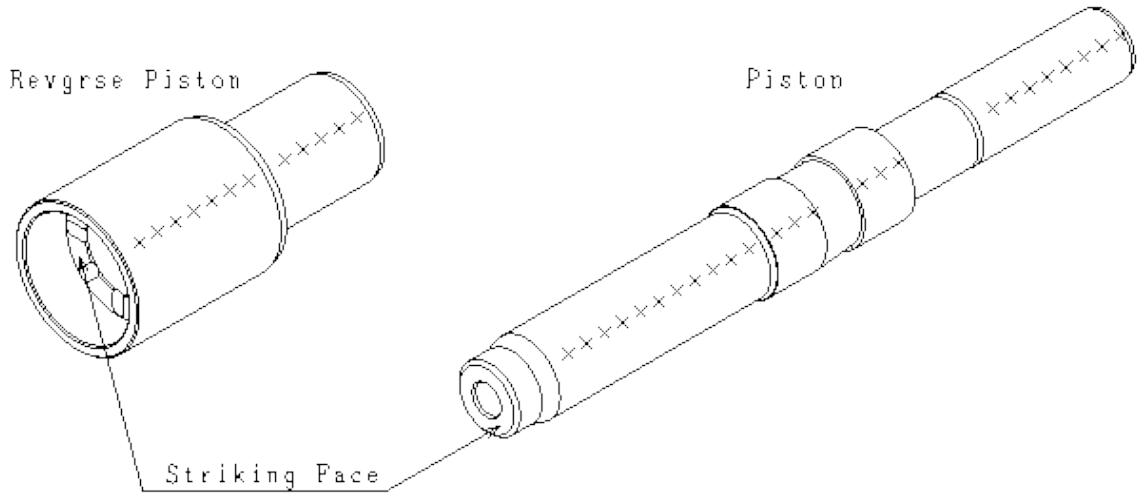
(2) Deteriorated and elasticity-lost ring

(3) Oversized diameter then loose to correctly fit in O-ring groove.

(4) It is recommended to replace every O-ring at each disassembling.

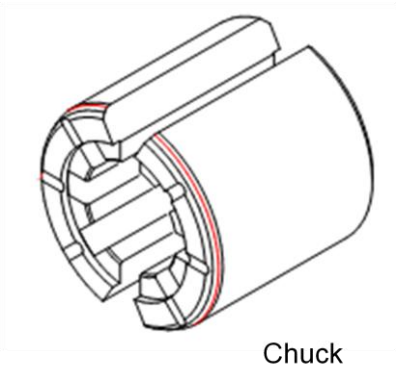
5) Piston (Reverse Piston)

The piston (Reverse piston) in the drifter directly hits against the shank rod to effectively transmit percussion energy to the drilling rod.
Inspect the following items:
(1) Worn percussion face
(2) Worn/damaged outside surface
Any piston found to have a burnt damage may become broken and thus never use such piston.



6) Chuck

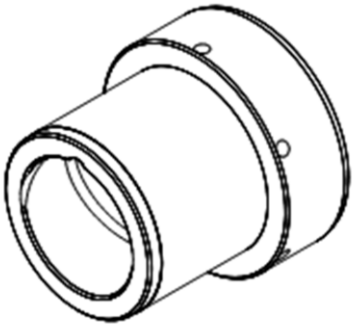
The chuck is engaged with the shank rod through spline to transmit rotating torque to the rod. Replace such chuck found to have heavily worn or burnt spline or worn outside surface.



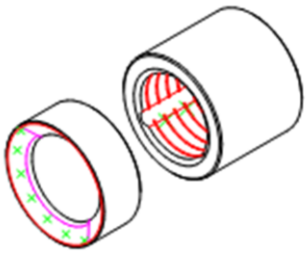
Chuck

7) Chuck bushing and chuck end cap liner

These parts support the shank rod at the ends which transmits the percussion energy and the rotating torque to the rod. Replace any heavily worn/burnt part.



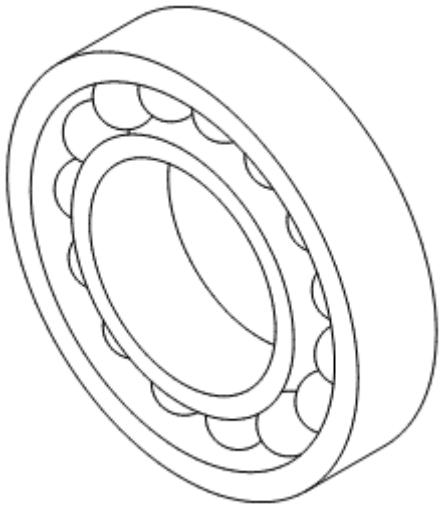
Cap Liner
(Flushing Bushing)



Chuck Bushing
(2 pcs)

8) Bearing

Replace those bearings found to have any play between the inner and outer faces. Any slight play may quickly grow.



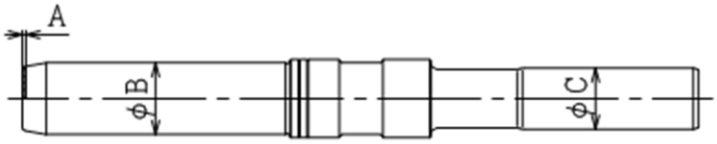
5-2 Dimensions for Disposal/Scrapping of Parts

For different parts, dimensions for disposal/scrapping are show below.

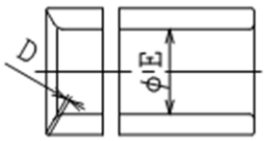
Early replacement of parts contributes toward keeping optimum performance of hammer and preventing possible trouble, and thus even when inspection results show parts are in the allowable ranges of specifications, early replacement is recommended.

No.	Part Name	Symbol	Dimensions For Disposal/Scrapping	Remarks
1	Piston	A	0.5	Dent on percussion face
		B	62.89	Front outer diameter
		C	52.89	Rear outer diameter
2	Chuck Bushing	D	1.0	Dent on shank holding face
		E	54.0	Rear inner diameter
3	Flushing Cap Liner	F	56.0	Front inner diameter
4	Chuck	H	15.0	Spline width
5	DU Bushing	J	110.6	Inner diameter
			130.7	Inner diameter
6	Front Liner	K	1.0	Dent on thrust face

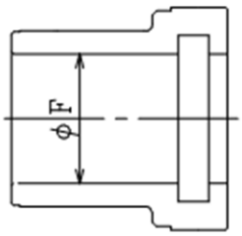
1 : Piston



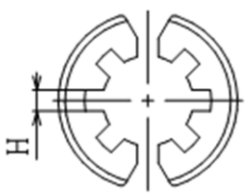
2 : Chuck Bushing



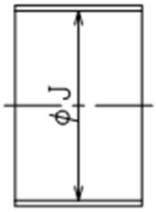
3 : Flushing cap Liner



4 : Chuck



5 : DU Bushing



6 : Front Liner