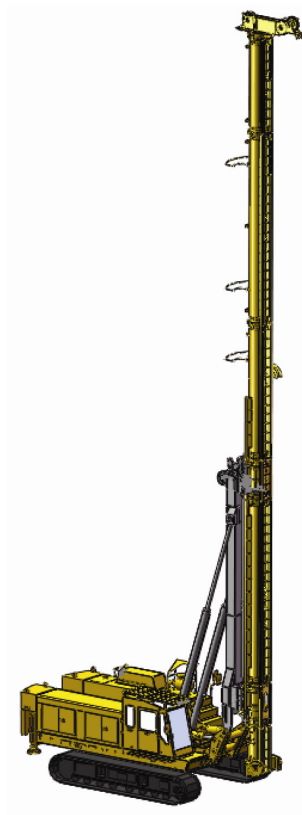


NISSHA

Hydraulic pile driving rig

DHJ-85



Operator's Manual

NIPPON SHARYO LTD,

Operator's manual

Manual reference number: MAN No. BE-14

This manual covers the operator's instructions of NISSHA pile driving rig.

Model: DHJ-85

Serial number: U1012

Manufacture date: May. 2009

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Chapter 1

Introduction section

The NISSHA DHJ-85 pile driving rig is designed for pile driving.

Maximum pile length is 16.5 m (54 ft).

The machine consists of a rotating machinery deck with leader on a crawler-mounted undercarriage.

The piling leader consists of a leader, basic leader and optional leader extension.

The lateral inclination cylinders and the forward/backward inclination cylinder control the inclination of the leader.

There are three winches at the rear of the machinery deck.

The winch on the front is the third winch, and the middle one is the main winch and the rear one is the auxiliary winch.

The main winch can be either a vibro-hammer, auger, or Ohammer winch.

The auxiliary winch is a pile winch.

The third winch doesn't have a foot brake, but rather has a hydraulic free fall system.

Note that the third drum should be used only to push the hammer, not for suspending loads.

The ropes of the winches run through sheaves in the upper slide and cathead to the front of the leader.

The leader lifting device raises and lowers the leader to and from the transport position.

There is also counterweight in the upper carriage.




Chapter 2

Safety instructions

2.1 Important aspects of safety

A signal word – **DANGER**, **WARNING** or **CAUTION** – is used and accompanied with a safety-alert symbol on your machine or in this manual to alert operators to the potential risk of injury or damage to the machine.

 **DANGER** : identifies the most serious hazards.

 **WARNING** : highlights specific hazards, or warns of significant damage.

 **CAUTION** : calls attention to safety messages or general precautions.

You should read and understand all the safety and operating instructions before you start using, maintaining, lubricating, or repairing this machine.

Accidents can ensue as a result of the operator being unfamiliar with, or neglecting, the safety measures.

Person operating, servicing, or repairing the machine or equipment should always be alert and have adequate training and skills to operate the machine and should operate the equipment according to the instructions.

Operators are responsible for the proper use of the machine.

Incorrect use, lubrication, or repair can be dangerous and lead to injury or damage to the machine.

The instructions in this manual, specifications, illustrations, and drawings are based on the information available at the time of writing.

The above information is subject to change without prior notice.

These changes may affect the use of the machine as well as lubrication, service and repair procedures.

NISSHA or its dealers will provide you periodically with up-to-date information regarding the operation and maintenance of this machine.

If the operator's manual is mislaid or becomes unusable due to use, a replacement manual can be obtained from NISSHA or one of its dealers.

Safe and efficient operation of this machine requires that it be maintained in good condition and that the operator be thoroughly familiar with the controls and the general capacity of the machine.

2.2 Safety aspects regarding the machine

The fluids used in the machine are flammable. Smoking is therefore forbidden when filling up or maintaining the fuel system.

The hydraulic oil is under pressure during operation and can become hot. Prior to disconnecting any parts from the hydraulic system make sure that you relieve pressure from the system.

Exercise adequate precautions when working with hot machine parts.

The batteries of the machine contain corrosive acid and may develop toxic or explosive gases. Do not smoke and avoid generating sparks when working with the batteries. Furthermore, be careful to avoid tipping the batteries over when lifting them.

Keep all materials and fluids in properly designed and marked containers.

Do not keep any loose items on the machine itself or in the cab. These should be stored in appropriate compartments or elsewhere outside the machine.

Report any damage to machine components immediately.
Repair oil leakages without delay.

Stay away from the engine exhaust when the engine is running.



Stay outside the operating radius of the machine.

2.3 Safety aspects regarding the work site

The machine should only be operated on ground which gives sufficient support.
Working or moving the machine on a slope should be avoided.

Familiarize yourself with the dimensions of the machine and use the mirrors to detect objects hidden by parts of the machine.

When working near power lines or high voltage lines, make sure to determine the safe working distance.

The danger zone is shown in the picture at the end of safety section.

Do not stand on any mobile parts of the machine during operation.
Do not stand or walk on any steel ropes, hydraulic tubes or hoses.
During operation do not stand over a rope.
Stay at a minimum distance of one meter from pressurized tubes and hoses.

Do not go under the machine or any part of it and, preferably, stay outside the working radius during operation.

Do not let unauthorized personnel into the working area.
Fence off the working area when necessary.
Keep doors and covers closed securely in their positions.

No adjustments should be made by the operator during operation unless expressly instructed to do so.

Keep your hands away from fans and any moving parts.

Do not start using the machine in a wind exceeding 10 m/s (36 km/h, fresh gale).

If the wind speed exceeds 20 m/s, i.e. a fresh gale, the machine must be lowered to the transport position.

Recommended operating temperature is $-20\text{ }^{\circ}\text{C}$ to $+40\text{ }^{\circ}\text{C}$ ($-4\text{ }^{\circ}\text{F}$ to $+104\text{ }^{\circ}\text{F}$).

Check that the emergency stops of the engine are in working order before starting each shift.

2.4 Safety aspects during non-operation

The machine should always be parked on level ground, leader feet on the ground, hammer against ground and leader tilted slightly backward.

Alternatively the machine can be parked in the transport position.

When storing the machine, lock the doors and covers, turn off the main switch and remove the ignition keys.

During transport, the slewing mechanism lock must be engaged.

When lifting the machine with slings, attach the slings to the indicated lifting points only.



There must always be at least two persons (operator, helper) when servicing or maintaining the machine in the working site.

One must supervise ensure the safety of the other workers.

The operator must have emergency stops available for use in all situations when using the machine.

Always ensure adequate illumination of the operating area.

Ensure clear communication between workers and operator in all situations.

2.5 Safety of personnel

When operating the machine at a worksite, wear a helmet.

Do not use oil stained or damaged clothing.

Do not wear loose garments or items that may become entangled in the machine.

Wear ear protection during operation.

Wear gloves when working with steel ropes.

Wear goggles to protect your eyes.



Do not position yourself under the vibro, auger, hammer, or any rope-suspended loads.

2.6 Emergency systems

The machine has a low voltage (24 VDC) electrical system.

The ignition switch switches off the instruments in the cab while the main switch turns off all the power.

There are fuses in all circuits.

The engine emergency stop switches are located in the cab and on the left sides of the machine.

The machine is equipped with two extinguishers (one in the cab and one on the left side of the machine).

In case of emergency it is possible to exit the cab through a window or the door.

The hydraulic system is equipped with main relief valves and work port relief valves.

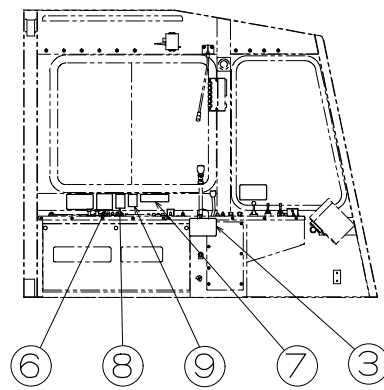
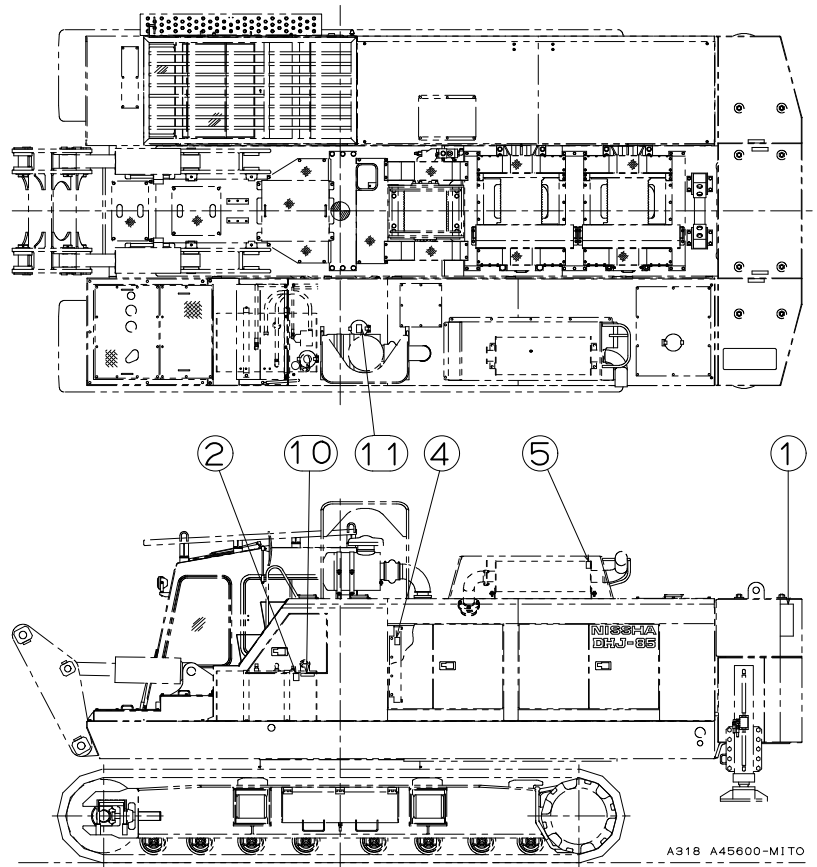
The load carrying hydraulic cylinders are equipped with load holding valves to prevent breakage of the hoses.

When the safety lever in the cab is in the backward position, it turns off the pilot pressure from all the hydraulic functions.

For the locations of the controls mentioned above, see the chapter related to the operator's controls.

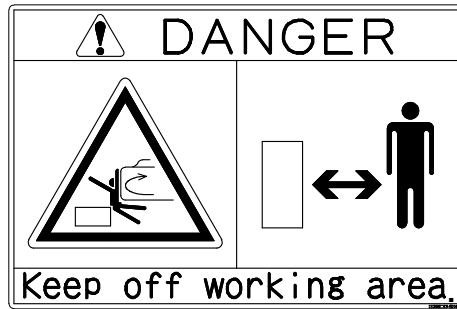
2.7 Warning signs

Warning signs are located in the position shown in the chart below.

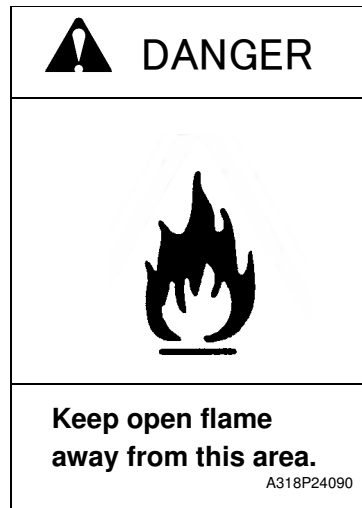


in cabin

①





②





③



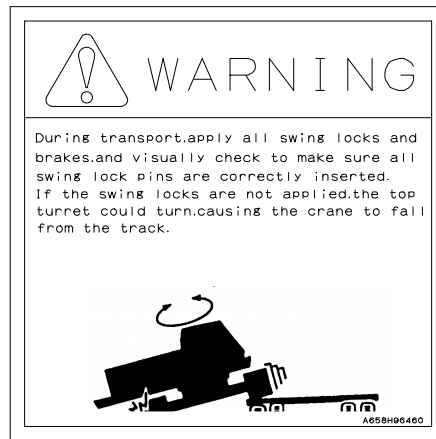
④

 DANGER

Turn off before inspection and maintenance. <small>A318P24110</small>

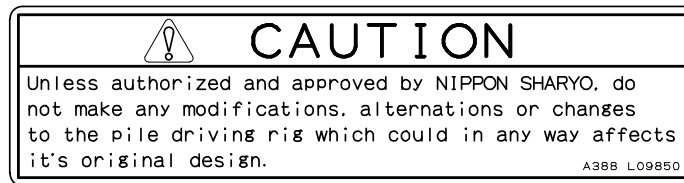
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 DANGER

Never touch when hot. <small>A318P24080</small>

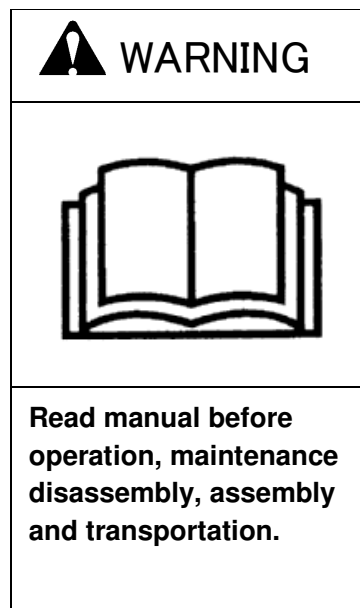
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⑦



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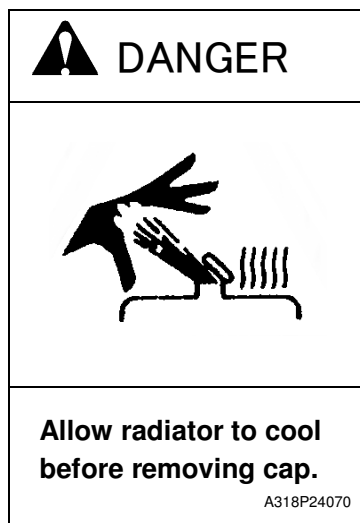
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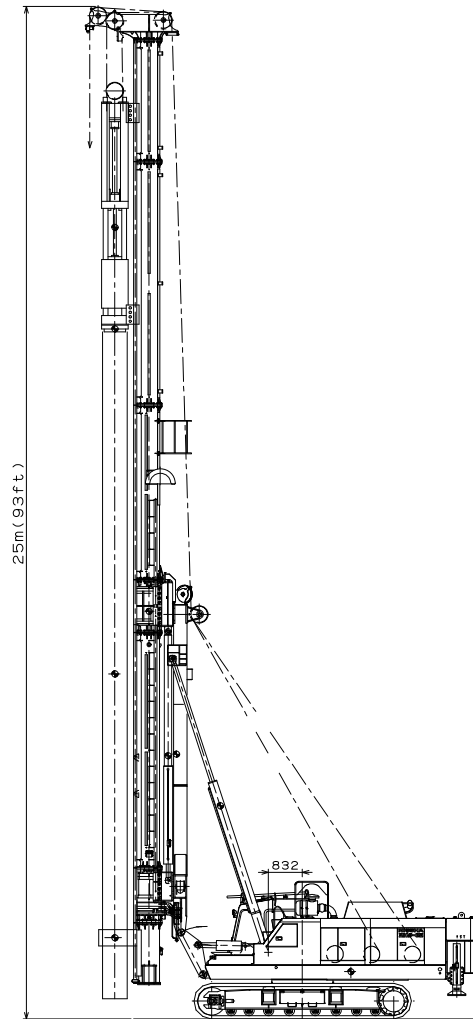
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2.8 Danger zone

Check that there is no person in the danger zone of the machine during operation.

<p>DANEGER ZONE</p> <p>25 m + 20 m = 45 m</p> <p>93 ft + 65 ft = 158 ft</p>
--





Chapter 3

Specifications section

3.1 General identification

Trade mark of the machine:	NISSHA DHJ-85
Machine type:	Pilling rig for vibro-hammer, auger, impact hammer, or diesel hammer driving.
Base machine model:	DHJ-85
Leader model:	M40D
Serial number:	U1012 (2009)
Name and address of manufacturer:	NIPPON SHARYO, LTD. 80, Ryucho, Narumi-cho, Midori-ku, Nagoya, Japan

3.2 General dimensions

Maximum height (with vibro):	21,939 mm (71'-11 3/4")
(with auger):	21,939 mm (71'-11 3/4")
(with hammer):	24,939 mm (81'-9 55/64")
Maximum width while working:	4,310 mm (14'-1 11/16")
Maximum length:	9,604 mm (31'-6 7/64")
Maximum pile length (with vibro-hammer):	15,000 mm (about 50')
(with auger):	15,000 mm (about 50')
(with hammer):	16,000 mm (about 52')

3.2.1 Transport dimensions

Overall height (base machine only):	3,390 mm (11'-1 15/32")
(with leader):	4,483 mm (14'-8 1/2")
Width:	4,310 mm (14'-1 11/16")
Length (base machine only):	9,095 mm (29'-10 5/64")
(with 20.3 m leader):	21,096 mm (69'-2 37/64")

3.2.2 Base machine

Crawler overall width while working:	4,310 mm (14'-1 11/16")
Crawler overall width during transportation:	3,400 mm (11'-1 55/64")
Crawler center to center distance while working:	3,450 mm (11'-3 53/64")
Crawler center to center distance during transportation:	2,540 mm (8'-4")
Crawler shoe width:	860 mm (2'-9 55/64")
Crawler overall length:	5,330 mm (17'-5 27/32")
Rear end radius:	4,550 mm (14'-11 9/64")
Ground clearance:	367 mm (1'-2 29/64")
Cab width:	3,280 mm (10'-9 9/64")

3.3 Performance

【Rope line speed】

Main drum (hoisting·lowering) [high/low]	45.4/22.7 m/min (149/74 fpm)
Auxiliary drum (hoisting·lowering)	22.7 m/min (74 fpm)
Third drum (hoisting·lowering)	27.1 m/min (89 fpm)
Swing speed	2 min ⁻¹ (2 rpm)
Travel speed [high/low]	1.2/0.7 km/h (0.75/0.4 mph)
	(Numerical value varies with load)
Maximum gradability (Basic machine)	30%

3.4 Diesel engine (U.S.EPA Tier3 measured type)

Maker:	Cummins Inc.
Model:	QSL 9 (intercooler, turbo-charger)
Serial number:	46943098
Type:	Water cooled, 4 cycle, 6 cylinder, direct fuel injection
Rated output:	261 kW (350 hp) /1900 min ⁻¹
Total displacement:	8.9 L
Fuel filter type (main):	Cartridge (part No. FF580, cummins)
(spare):	Cartridge (part No. FS19732, cummins)
Oil filter type:	Cartridge (part No. LF9009, cummins)
Air filter type:	Element inner(parts No.P822144,cummins) Element outer(parts No.P822413,cummins)
Cooling system type:	By liquid
Fuel tank capacity:	370 L (98 gal)
Battery:	12 V × 150 AH × 2 pc.

3.5 Hydraulic pumps

Main pump 1

Maker:	Kawasaki P.M. LTD
A use:	For driving base machine
Model:	K3V112DT-103L-2P39
Type:	Variable-displacement type axial piston double pump with power regulation
Rated capacity:	Max. 2 × 123 L/min at 1900 rpm
Service operating pressure:	Max. 320 kg/cm ² [314 bar] (4550 psi)

Main pump 2

Maker:	Kawasaki P.M. LTD
A use:	For driving vibro, auger, or hammer
Model:	K5V200S-106L-9E07
Type:	Variable-displacement type axial piston pump with power regulation
Rated capacity:	Max. 313 L/min at 1900 rpm
Service operating pressure:	Max. 300 kg/cm ² [294 bar] (4267 psi)

Gear pump

Maker:	Bosch rexroth Co. LTD
Model:	GXP10-125-35-15L-21
Type:	Fixed displacement type triple gear pump
A use:	For oil cooler
Rated capacity:	Max. 245 L/min at 1900 rpm
Service operating pressure:	Max. 3.5 kg/cm ² [3.4 bar] (50 psi)
A use:	For swing and front units
Rated capacity:	Max. 68 L/min at 1900 rpm
Service:	operating pressure Max. 210 kg/cm ² [206 bar] (2987 psi)
A use:	For control
Rated capacity:	Max. 29 L/min at 1900 rpm
Service operating pressure:	Max. 70 kg/cm ² [69 bar] (996 psi)

3.6 Winches

Main & auxiliary winch

Hydraulic motor

Maker:	SAI S.p.A. Hydraulic Motors
Model:	GM5A + R28
Type:	Fixed displacement type piston motor with counter balance valve
Service operating pressure:	Max. 210 kg/cm ² [206 bar] (2987 psi)
Reduction gear:	One stage planetary gears
Drum:	One drive shaft – one drum Main drum and auxiliary drum are same size and have ditches for ropes
Clutch:	Internal expanding friction band type
Brakes:	External expanding friction band type
Drum lock:	Pawl and ratchet wheel type

Main drum (for hammer)

Lifting capacity:	100 kN [10,200 kgf] (22,500 lb)
Rated lifting load:	49 kN [5,000 kgf] (11,000 lb)
Rope line specification:	φ 22 mm × 140 m, IWRC6 × Fi (29) 1910 N/mm ²

Aux. drum (for pile)

Lifting capacity:	100 kN [10,200 kgf] (22,500 lb)
Rated lifting load:	49 kN [5,000 kgf] (11,000 lb)
Rope line specification:	φ 22 mm × 140 m, IWRC6 × Fi (29) 1910 N/mm ²

Third winch

Maker:	TMA LTD
Model:	TMV-4/5-80P-3
Service operating pressure:	Max. 270 kg/cm ² [265 bar] (3840 psi)
Reduction gear:	Planetary gears with reduction rate 1:74
Brakes:	Multi negative brake and counterbalance valve
Third drum (for pull down only)	
Lifting capacity:	100 kN [10,200 kgf] (22,500 lb)
Rated lifting load:	49 kN [5,000 kgf] (11,000 lb)
Rope line specification:	φ 22 mm × 130 m, IWRC6 × Fi (29) 1910 N/mm ²

3.7 Travel

Travel drive and reduction gear

Maker:	Nabtesco LTD
Model:	M4V147/100D-RG12C
Type:	Variable-displacement type axial piston motor with brake valve and negative brake
Service operating pressure:	Max. 285 kg/cm ² [279 bar] (4050 psi)
Reduction gear:	Three stage planetary gears with reduction rate 1:162.214 (case rotating type)
Crawler shoe:	Lug type
Parking brake:	Wet negative multi-disk brake (auto brake)

3.8 Swing

Swing drive and reduction gear

Maker:	Kawasaki P.M. LTD
Model:	M5X180CHB-13A-1AA/210-169-RG23C34B7
Type:	Fixed-displacement type axial piston motor with negative brake
Service operating pressure:	Max. 210 kg/cm ² [206 bar] (2987 psi)
Reduction gear:	One stage planetary gears + one stage spur gears with reduction rate 1:33.88
Parking brake:	Wet multi-disk
Swing lock:	Pin type

3.9 Cylinders

Leader erect cylinders

Type: Double acting
 Boa × rod × Stroke: $\phi 170 \times \phi 110 \times 3140$ st 1 set
 Safety: Load holding valve installed

Leader sliding cylinder (leader up and down)

Type: Double acting
 Boa × rod × Stroke: $\phi 180 \times \phi 85 \times 2000$ st 1
 Safety: Load holding valve installed

Leader back and forth adjusting cylinders

Type: Double acting
 Boa × rod × Stroke: $\phi 200 \times \phi 120 \times 330$ st 1 set
 Safety: Double operated check valve installed

Leader left and right inclination cylinder

Type: Double acting
 Boa × rod × Stroke: $\phi 120 \times \phi 60 \times 480$ st 1
 Safety: Double operated check valve installed

Front jack cylinder

Type: Double acting
 Boa × rod × Stroke: $\phi 160 \times \phi 90 \times 790$ st 1
 Safety: Double operated check valve installed

Outrigger jack cylinders

Type: Double acting
 Boa × rod × Stroke: $\phi 150 \times \phi 100 \times 800$ st 1 set
 Safety: Double operated check valve installed

Spanner cylinder (crawler width adjustment)

Type: Double acting
 Boa × rod × Stroke: $\phi 120 \times \phi 60 \times 970$ st 1
 Safety: Double operated check valve installed

3.10 Hydraulic filters

See attached schematic diagram of hydraulic circuits of the machine and of the various items of equipment.

Piping:	Steel hydraulic pipes and reinforced hydraulic hoses
Cooling system:	Hydraulic oil coolers with fans

Filters

Pilot:	A306 D93530, cartridge
Front:	A336 G09730, cartridge
Suction:	A306 C64360, cartridge
Return:	A516 C81020, element

3.11 Electrical components

Battery type and capacity 12 V × 150 AH × 2 pc.

For details of electrical controls and equipment, see attached schematic diagram of electric circuits of the machine and of the various items of equipment.

3.12 Safety devices

Audible alarms

- Hammer top position on the leader
- Pile winch top position on the leader
- Travel
- Swing
- Position of the hammer when the leader is tilted backward
- Release switch of the winch top limits

Visual alarms

- Position of the safety lever
- Base carrier inclination meters
- Winch top position limits lamps
- Winch brake mode lamps
- Winch brake lining lamps
- filter blockage
- Air filter indicator lamp
- Engine oil pressure lamp
- Engine temperature
- Fuel level
- Engine indicator lamps

Warning signs

Warning signs are shown in safety section.

Others

- Safety lever to deactivate controls in the cab
- Engine emergency stop

Winch top limit

Stops the following functions, which can lead to damage of the steel ropes:

If the winch top limit or cable is broken and the leader is in the vertical position, it is not possible to lower the leader.

In this case you must by-pass the top limits; switch on the left console.

See also the section related to the signal lights in the upper console.

3.13 Weight (working at 23.3 m leader length)

Base machine with counterweight and hammer:	68,800 kg [75.8 US ton] (151,700 lb)
Base machine with leader:	49,340 kg [54.4 US ton] (108,800 lb)
Counter weight. (7,000 kg + 1,500 kg + 1,500 kg):	10,000 kg [11.0 US ton] (22,000 lb)
Hammer (J&M H115):	9,100 kg [10.0 US ton] (20,100 lb)

3.13.1 Transport weight (at 20.4 m leader length)

Approximate weigh with hammer (J&M 115)	64,000 kg [70.5 US ton] (141,100 lb)
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3.14 Capacity tables

Instructions on how to read capacity tables

Notice: Calculations are made according to

Model of leader:	M40D □80 × P430 revolving type (90°) Length 23.3 m (77 ft) [14.3 m (47 ft) + 6 m (20 ft) + 3 m (10 ft)] and top sheaves
Outrigger jacks:	1 set (L and R)
Counterweight:	10000 kg [11.0 US ton] (22000 lb)
Hydraulic hammer:	J&M H1 15 weight 9100 kg [10.1 US ton] (20100 lb)
Hammer cap weight:	500 kg [0.5 US ton] (1100 lb)

Note

- 1. The information above is based upon NIPPON SHARYO standard specifications on firm & level surface.**
- 2. While working on, or moving the rig, be sure to expand the crawler to the maximum width.**
- 3. The permissible lifting load of the pile suspension rope of $\phi 22$ is 5000 kg [5.5 US ton] with single-part line at the maximum.**
- 4. The permissible lifting load of the hammer suspension rope of $\phi 22$ is 5000 kg [5.5 US ton] with single-part line and 10000 kg [11.0 US ton] with two-part line at the maximum.**
- 5. Pile weight is not included in the total operating weight.**
- 6. The maximum permissible operation weight is 80000 kg [88 US ton].**

Horizontal slide position
Pile Length

Max. 510 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	2.9 ^{US ton} /2600 ^{kg} /5700 ^{lb}	6.0	28.1	17.7	69800	92.6 ^{kPa} /13.4 ^{psi}
at 4° out	2.98	4.2 ^{US ton} /3800 ^{kg} /8400 ^{lb}	6.0	27.8	17.6	69800	94.1 ^{kPa} /13.6 ^{psi}
at 3° out	2.98	5.5 ^{US ton} /5000 ^{kg} /11000 ^{lb}	6.0	27.5	17.4	69800	95.6 ^{kPa} /13.9 ^{psi}
at 2° out	2.98	7.0 ^{US ton} /6300 ^{kg} /13900 ^{lb}	6.0	27.2	17.2	69800	97.3 ^{kPa} /14.1 ^{psi}
at 1° out	2.98	8.4 ^{US ton} /7600 ^{kg} /16800 ^{lb}	6.0	26.9	17.1	69800	99.0 ^{kPa} /14.4 ^{psi}
Vertical	2.98	9.9 ^{US ton} /9000 ^{kg} /19800 ^{lb}	6.0	26.6	16.9	69800	100.8 ^{kPa} /14.6 ^{psi}
at 2° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.9	25.6	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 4° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.4	24.4	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 6° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.8	23.1	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 8° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.1	21.9	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 10° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.5	20.7	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 12° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.9	19.4	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}

Horizontal slide position
Pile Length

410 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.88	3.7 ^{US ton} /3300 ^{kg} /7300 ^{lb}	6.0	28.0	17.6	69800	93.5 ^{kPa} /13.6 ^{psi}
at 4° out	2.88	5.0 ^{US ton} /4500 ^{kg} /9900 ^{lb}	6.0	27.6	17.4	69800	95.0 ^{kPa} /13.8 ^{psi}
at 3° out	2.88	6.3 ^{US ton} /5700 ^{kg} /12600 ^{lb}	6.0	27.3	17.3	69800	96.5 ^{kPa} /13.9 ^{psi}
at 2° out	2.88	7.8 ^{US ton} /7100 ^{kg} /15700 ^{lb}	6.0	27.0	17.1	69800	98.3 ^{kPa} /14.3 ^{psi}
at 1° out	2.88	9.4 ^{US ton} /8500 ^{kg} /18700 ^{lb}	6.0	26.7	16.9	69800	100.1 ^{kPa} /14.5 ^{psi}
Vertical	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.0	26.4	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 2° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.4	25.2	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 4° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.8	24.0	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 6° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.1	22.8	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 8° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.5	21.5	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 10° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.9	20.3	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 12° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.3	19.0	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}

Horizontal slide position
Pile Length

310 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.78	4.4 ^{US ton} /4000 ^{kg} /8800 ^{lb}	6.0	27.8	17.5	69800	94.4 ^{kPa} /13.7 ^{psi}
at 4° out	2.78	5.8 ^{US ton} /5200 ^{kg} /11500 ^{lb}	6.0	27.5	17.3	69800	95.9 ^{kPa} /13.9 ^{psi}
at 3° out	2.78	7.2 ^{US ton} /6500 ^{kg} /14300 ^{lb}	6.0	27.2	17.2	69800	97.6 ^{kPa} /14.2 ^{psi}
at 2° out	2.78	8.7 ^{US ton} /7900 ^{kg} /17400 ^{lb}	6.0	26.8	17.0	69800	99.3 ^{kPa} /14.4 ^{psi}
at 1° out	2.78	10.4 ^{US ton} /9400 ^{kg} /20700 ^{lb}	6.0	26.6	16.8	69800	101.3 ^{kPa} /14.7 ^{psi}
Vertical	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.4	26.1	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 2° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.8	24.8	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 4° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.2	23.6	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 6° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.5	22.4	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 8° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.9	21.1	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 10° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.3	19.9	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 12° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.7	18.6	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}

Horizontal slide position
Pile Length

210 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.68	5.2 ^{US ton} /4700 ^{kg} /10400 ^{lb}	6.0	27.6	17.4	69800	95.3 ^{kPa} /13.8 ^{psi}
at 4° out	2.68	6.6 ^{US ton} /6000 ^{kg} /13200 ^{lb}	6.0	27.3	17.2	69800	96.9 ^{kPa} /14.1 ^{psi}
at 3° out	2.68	8.2 ^{US ton} /7400 ^{kg} /16300 ^{lb}	6.0	27.0	17.1	69800	98.7 ^{kPa} /14.3 ^{psi}
at 2° out	2.68	9.7 ^{US ton} /8800 ^{kg} /19400 ^{lb}	6.0	26.7	16.9	69800	100.5 ^{kPa} /14.6 ^{psi}
at 1° out	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.1	26.3	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
Vertical	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.8	25.7	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 2° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.2	24.5	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 4° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.6	23.2	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 6° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.0	22.0	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 8° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.3	20.7	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 10° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.7	19.5	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 12° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.1	18.3	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}

Horizontal slide position
Pile Length

110 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.58	6.1 ^{US ton} /5500 ^{kg} /12100 ^{lb}	6.0	27.4	17.3	69800	96.3 ^{kPa} /14.0 ^{psi}
at 4° out	2.58	7.5 ^{US ton} /6800 ^{kg} /15000 ^{lb}	6.0	27.1	17.1	69800	97.9 ^{kPa} /14.2 ^{psi}
at 3° out	2.58	8.0 ^{US ton} /7200 ^{kg} /15900 ^{lb}	6.0	27.0	17.1	69800	98.5 ^{kPa} /14.3 ^{psi}
at 2° out	2.58	10.8 ^{US ton} /9800 ^{kg} /21600 ^{lb}	6.0	26.5	16.8	69800	101.8 ^{kPa} /14.8 ^{psi}
at 1° out	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.6	25.9	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
Vertical	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.2	25.3	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 2° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.6	24.1	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 4° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.0	22.8	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 6° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.4	21.5	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 8° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.7	20.3	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 10° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.1	19.0	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 12° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.8	17.4	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}

Horizontal slide position
Pile Length

Min. 0 mm
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.88	7.1 ^{US ton} /6400 ^{kg} /14100 ^{lb}	6.0	27.3	17.2	69800	97.4 ^{kPa} /14.1 ^{psi}
at 4° out	2.88	8.6 ^{US ton} /7800 ^{kg} /17200 ^{lb}	6.0	27.0	17.0	69800	99.2 ^{kPa} /14.4 ^{psi}
at 3° out	2.88	10.3 ^{US ton} /9300 ^{kg} /20500 ^{lb}	6.0	26.6	16.9	69800	101.1 ^{kPa} /14.7 ^{psi}
at 2° out	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.3	26.2	16.8	69800	102.0 ^{kPa} /14.8 ^{psi}
at 1° out	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.0	25.5	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
Vertical	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.7	24.9	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 2° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.1	23.7	16.7	69800	102.0 ^{kPa} /14.8 ^{psi}
at 4° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.5	22.4	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 6° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.8	21.2	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 8° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.2	19.9	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 10° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.5	18.7	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}
at 12° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.9	17.4	16.6	69800	102.0 ^{kPa} /14.8 ^{psi}

Hydraulic hammer: J&M H115 weight 9100 kg [10.1 US ton]
(20100 lb)

Hammer cap weight: 500 kg [0.5 US ton] (1100 lb)

Horizontal slide position Max. 510 mm out

Pile Length 55 ft (16.8 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	2.8 ^{US ton} /2500 ^{kg} /5500 ^{lb}	6.0	27.9	17.6	69800	92.4 ^{kPa} /13.4 ^{psi}
at 4° out	2.98	4.0 ^{US ton} /3600 ^{kg} /7900 ^{lb}	6.0	27.6	17.4	69800	93.9 ^{kPa} /13.6 ^{psi}
at 3° out	2.98	5.3 ^{US ton} /4800 ^{kg} /10600 ^{lb}	6.0	27.2	17.2	69800	95.4 ^{kPa} /13.8 ^{psi}
at 2° out	2.98	6.7 ^{US ton} /6100 ^{kg} /13400 ^{lb}	6.0	26.9	17.0	69800	97.0 ^{kPa} /14.1 ^{psi}
at 1° out	2.98	8.4 ^{US ton} /7400 ^{kg} /16300 ^{lb}	6.0	26.6	16.8	69800	98.7 ^{kPa} /14.3 ^{psi}
Vertical	2.98	9.8 ^{US ton} /8900 ^{kg} /19600 ^{lb}	6.0	26.3	16.6	69800	100.6 ^{kPa} /14.6 ^{psi}

Hydraulic hammer: J&M H115 weight 9100 kg [10.1 US ton]
(20100 lb)

Hammer cap weight: 500 kg [0.5 US ton] (1100 lb)

Horizontal slide position Max. 510 mm out

Pile Length 50 ft (15.2 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	3.7 ^{US ton} /3300 ^{kg} /7300 ^{lb}	6.0	29.0	18.2	69800	93.5 ^{kPa} /13.6 ^{psi}
at 4° out	2.98	4.9 ^{US ton} /4500 ^{kg} /9700 ^{lb}	6.0	28.7	18.1	69800	94.9 ^{kPa} /13.8 ^{psi}
at 3° out	2.98	6.2 ^{US ton} /5600 ^{kg} /12300 ^{lb}	6.0	28.5	17.9	69800	96.4 ^{kPa} /14.0 ^{psi}
at 2° out	2.98	7.5 ^{US ton} /6800 ^{kg} /15000 ^{lb}	6.0	28.1	17.7	69800	97.9 ^{kPa} /14.2 ^{psi}
at 1° out	2.98	9.0 ^{US ton} /8100 ^{kg} /17900 ^{lb}	6.0	27.9	17.6	69800	99.6 ^{kPa} /14.4 ^{psi}
Vertical	2.98	10.5 ^{US ton} /9500 ^{kg} /20900 ^{lb}	6.0	27.6	17.4	69800	101.4 ^{kPa} /14.7 ^{psi}

Hydraulic hammer: J&M H115 weight 9100 kg [10.1 US ton]
(20100 lb)

Hammer cap weight: 500 kg [0.5 US ton] (1100 lb)

Horizontal slide position Max. 510 mm out

Pile Length 45 ft (13.7 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	4.4 ^{US ton} /4000 ^{kg} /8800 ^{lb}	6.0	30.2	19.0	69800	94.4 ^{kPa} /13.7 ^{psi}
at 4° out	2.98	5.6 ^{US ton} /5100 ^{kg} /11200 ^{lb}	6.0	29.9	18.8	69800	95.8 ^{kPa} /13.9 ^{psi}
at 3° out	2.98	7.0 ^{US ton} /6300 ^{kg} /13900 ^{lb}	6.0	29.7	18.6	69800	97.3 ^{kPa} /14.1 ^{psi}
at 2° out	2.98	8.3 ^{US ton} /7500 ^{kg} /16500 ^{lb}	6.0	29.4	18.5	69800	98.8 ^{kPa} /14.3 ^{psi}
at 1° out	2.98	9.7 ^{US ton} /8800 ^{kg} /19400 ^{lb}	6.0	29.2	18.3	69800	100.5 ^{kPa} /14.6 ^{psi}
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22000 ^{lb}	6.0	28.9	18.2	69800	102.0 ^{kPa} /14.8 ^{psi}

Hydraulic hammer: J&M H115 weight 9100 kg [10.1 US ton]
(20100 lb)

Hammer cap weight: 500 kg [0.5 US ton] (1100 lb)

Horizontal slide position Max. 510 mm out

Pile Length 40 ft (12.2 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	5.4 ^{US ton} /4900 ^{kg} /10800 ^{lb}	6.0	31.5	19.7	69800	95.5 ^{kPa} /13.9 ^{psi}
at 4° out	2.98	6.6 ^{US ton} /6000 ^{kg} /13200 ^{lb}	6.0	31.3	19.6	69800	96.9 ^{kPa} /14.1 ^{psi}
at 3° out	2.98	7.9 ^{US ton} /7100 ^{kg} /15700 ^{lb}	6.0	31.1	19.5	69800	98.3 ^{kPa} /14.3 ^{psi}
at 2° out	2.98	9.2 ^{US ton} /8300 ^{kg} /18300 ^{lb}	6.0	30.9	19.3	69800	99.9 ^{kPa} /14.5 ^{psi}
at 1° out	2.98	10.5 ^{US ton} /9500 ^{kg} /20900 ^{lb}	6.0	30.6	19.2	69800	101.4 ^{kPa} /14.7 ^{psi}
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22000 ^{lb}	6.0	30.2	19.1	69800	102.0 ^{kPa} /14.8 ^{psi}

Hydraulic hammer: J&M H115 weight 9100 kg [10.1 US ton]
(20100 lb)

Hammer cap weight: 500 kg [0.5 US ton] (1100 lb)

Horizontal slide position Max. 510 mm out

Pile Length 35 ft (10.7 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	6.4 ^{US ton} /5800 ^{kg} /12800 ^{lb}	6.0	33.0	20.6	69800	96.7 ^{kPa} /14.0 ^{psi}
at 4° out	2.98	7.5 ^{US ton} /6800 ^{kg} /15000 ^{lb}	6.0	32.8	20.5	69800	97.9 ^{kPa} /14.2 ^{psi}
at 3° out	2.98	8.7 ^{US ton} /7900 ^{kg} /17400 ^{lb}	6.0	32.6	20.4	69800	99.3 ^{kPa} /14.4 ^{psi}
at 2° out	2.98	9.9 ^{US ton} /9000 ^{kg} /19800 ^{lb}	6.0	32.4	20.3	69800	100.8 ^{kPa} /14.6 ^{psi}
at 1° out	2.98	11 ^{US ton} /10000 ^{kg} /22000 ^{lb}	6.1	32.2	20.2	69800	102.0 ^{kPa} /14.8 ^{psi}
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22000 ^{lb}	6.7	31.7	20.2	69800	102.0 ^{kPa} /14.8 ^{psi}

Notice: Calculations are made according to

Model of leader:	M40D □80 × P430 revolving type (90°)
	Length 23.3 m (77 ft) [14.3 m (47 ft) + 6 m (20 ft) + 3 m (10 ft)] and top sheaves
Outrigger jacks:	1 set (L and R)
Counterweight:	10000 kg [11.0 US ton] (22000 lb)
Diesel hammer:	APE D30-42 weight 7300 kg [8.1 US ton] (16100 lb)
Hammer cap weight:	500 kg [0.5 US ton] (1100 lb)

Note

- 1. The information above is based upon NIPPON SHARYO standard specifications on firm & level surface.**
- 2. While working on, or moving the rig, be sure to expand the crawler to the maximum width.**
- 3. The permissible lifting load of the pile suspension rope of $\phi 22$ is 5000 kg [5.5 US ton] with single-part line at the maximum.**
- 4. The permissible lifting load of the hammer suspension rope of $\phi 22$ is 5000 kg [5.5 US ton] with single-part line and 10000 kg [11.0 US ton] with two-part line at the maximum.**
- 5. Pile weight is not included in the total operating weight.**
- 6. The maximum permissible operation weight is 80000 kg [88 US ton].**

Horizontal slide position
Pile Length

Max. 510 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	6.0 ^{US ton} /5400 ^{kg} /11900 ^{lb}	6.0	29.3	18.4	67600	93.4 ^{kPa} /13.5 ^{psi}
at 4° out	2.98	7.1 ^{US ton} /6400 ^{kg} /14100 ^{lb}	6.0	28.9	18.2	67600	94.6 ^{kPa} /13.7 ^{psi}
at 3° out	2.98	8.4 ^{US ton} /7600 ^{kg} /16800 ^{lb}	6.0	28.6	18.0	67600	96.2 ^{kPa} /14.0 ^{psi}
at 2° out	2.98	9.7 ^{US ton} /8800 ^{kg} /19400 ^{lb}	6.0	28.3	17.8	67600	97.7 ^{kPa} /14.2 ^{psi}
at 1° out	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.0	27.9	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.7	27.3	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.1	26.1	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.4	24.9	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.8	23.7	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.2	22.5	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.5	21.3	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.9	20.1	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}

Horizontal slide position
Pile Length

410 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.88	6.6 ^{US ton} /6000 ^{kg} /13200 ^{lb}	6.0	29.0	18.2	67600	94.1 ^{kPa} /13.6 ^{psi}
at 4° out	2.88	7.8 ^{US ton} /7100 ^{kg} /15600 ^{lb}	6.0	28.6	18.0	67600	95.5 ^{kPa} /13.9 ^{psi}
at 3° out	2.88	9.2 ^{US ton} /8300 ^{kg} /18300 ^{lb}	6.0	28.3	17.8	67600	97.1 ^{kPa} /14.1 ^{psi}
at 2° out	2.88	10.5 ^{US ton} /9500 ^{kg} /20900 ^{lb}	6.0	27.2	17.2	67600	98.6 ^{kPa} /14.3 ^{psi}
at 1° out	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.4	27.5	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.1	26.9	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.5	25.8	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.9	24.6	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.2	23.4	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.6	22.2	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.9	20.9	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.88	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.2	19.7	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}

Horizontal slide position
Pile Length

310 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.78	7.4 ^{US ton} /6700 ^{kg} /14800 ^{lb}	6.0	28.8	18.2	67600	95.0 ^{kPa} /13.8 ^{psi}
at 4° out	2.78	8.7 ^{US ton} /7900 ^{kg} /17400 ^{lb}	6.0	28.5	17.9	67600	96.6 ^{kPa} /14.0 ^{psi}
at 3° out	2.78	10 ^{US ton} /9100 ^{kg} /20100 ^{lb}	6.0	28.2	17.7	67600	98.1 ^{kPa} /14.2 ^{psi}
at 2° out	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.2	27.7	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
at 1° out	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.9	27.1	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.5	26.6	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.9	25.3	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.2	24.1	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.6	22.9	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.9	21.7	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.3	20.5	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.78	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.6	19.3	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}

Horizontal slide position
Pile Length

210 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.68	8.2 ^{US ton} /7400 ^{kg} /16300 ^{lb}	6.0	28.6	18.0	67600	95.9 ^{kPa} /13.9 ^{psi}
at 4° out	2.68	9.5 ^{US ton} /8600 ^{kg} /19000 ^{lb}	6.0	28.3	17.8	67600	97.5 ^{kPa} /14.1 ^{psi}
at 3° out	2.68	10.9 ^{US ton} /9900 ^{kg} /21800 ^{lb}	6.0	28.0	17.6	67600	99.1 ^{kPa} /14.4 ^{psi}
at 2° out	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.6	27.4	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
at 1° out	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.3	26.8	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.0	26.2	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.3	25.0	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.7	23.8	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.0	22.6	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.3	21.3	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.7	20.1	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.68	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	16.0	18.9	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}

Horizontal slide position
Pile Length

110 mm out
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 6° out	2.58	7.7 ^{US ton} /7000 ^{kg} /15400 ^{lb}	6.0	28.8	18.1	67600	95.4 ^{kPa} /13.8 ^{psi}
at 5° out	2.58	9.1 ^{US ton} /8200 ^{kg} /18100 ^{lb}	6.0	28.5	17.9	67600	96.9 ^{kPa} /14.1 ^{psi}
at 4° out	2.58	10.5 ^{US ton} /9500 ^{kg} /20900 ^{lb}	6.0	28.1	17.7	67600	98.6 ^{kPa} /14.3 ^{psi}
at 3° out	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.4	27.6	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° out	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.1	27.0	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
at 1° out	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.7	26.4	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.4	25.8	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.7	24.6	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.1	23.4	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.4	22.2	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.7	20.9	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.1	19.7	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.58	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	16.4	18.5	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}

Horizontal slide position
Pile Length

Min. 0 mm
54 ft (16.5 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 7° out	2.47	7.4 ^{US ton} /6700 ^{kg} /14800 ^{lb}	6.0	29.0	18.2	67600	95.0 ^{kPa} /13.8 ^{psi}
at 6° out	2.47	8.7 ^{US ton} /7900 ^{kg} /17400 ^{lb}	6.0	28.6	18.0	67600	96.6 ^{kPa} /14.0 ^{psi}
at 5° out	2.47	10 ^{US ton} /9100 ^{kg} /20100 ^{lb}	6.0	28.3	17.8	67600	98.1 ^{kPa} /14.2 ^{psi}
at 4° out	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.2	27.8	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
at 3° out	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.9	27.2	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° out	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.5	26.6	17.6	67600	99.2 ^{kPa} /14.4 ^{psi}
at 1° out	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.2	26.0	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.9	25.4	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.2	24.2	17.5	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.5	23.0	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.9	21.7	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.2	20.5	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.5	19.3	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.47	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	16.8	18.1	17.4	67600	99.2 ^{kPa} /14.4 ^{psi}

Horizontal slide position
Pile Length

Max. 510 mm out
50 ft (15.2 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	6.6 ^{US ton} /6000 ^{kg} /13200 ^{lb}	6.0	30.2	19.0	67600	94.1 ^{kPa} /13.6 ^{psi}
at 4° out	2.98	7.7 ^{US ton} /7000 ^{kg} /15400 ^{lb}	6.0	29.9	18.8	67600	95.4 ^{kPa} /13.8 ^{psi}
at 3° out	2.98	8.9 ^{US ton} /8100 ^{kg} /17900 ^{lb}	6.0	29.6	18.6	67600	96.8 ^{kPa} /14.0 ^{psi}
at 2° out	2.98	10.3 ^{US ton} /9300 ^{kg} /20500 ^{lb}	6.0	29.3	18.4	67600	98.4 ^{kPa} /14.3 ^{psi}
at 1° out	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.3	28.8	18.3	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.0	28.3	18.3	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.3	27.1	18.2	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.6	25.9	18.2	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.0	24.8	18.2	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.3	23.6	18.1	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.7	22.4	18.2	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.0	21.3	18.2	67600	99.2 ^{kPa} /14.4 ^{psi}

Horizontal slide position
Pile Length

Max. 510 mm out
45 ft (13.7 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	7.4 ^{US ton} /6700 ^{kg} /14800 ^{lb}	6.0	31.4	19.7	67600	95.0 ^{kPa} /13.8 ^{psi}
at 4° out	2.98	8.6 ^{US ton} /7800 ^{kg} /17200 ^{lb}	6.0	31.1	19.5	67600	96.4 ^{kPa} /14.0 ^{psi}
at 3° out	2.98	9.8 ^{US ton} /8900 ^{kg} /19600 ^{lb}	6.0	30.8	19.3	67600	97.8 ^{kPa} /14.2 ^{psi}
at 2° out	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.0	30.6	19.2	67600	99.2 ^{kPa} /14.4 ^{psi}
at 1° out	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.6	30.0	19.1	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.3	29.4	19.1	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.6	28.3	19.0	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.9	27.2	19.0	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.2	26.1	19.0	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.5	25.0	19.0	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.8	23.8	19.0	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.1	22.7	19.0	67600	99.2 ^{kPa} /14.4 ^{psi}

Horizontal slide position
Pile Length

Max. 510 mm out
40 ft (12.2 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	8.3 ^{US ton} /7500 ^{kg} /16500 ^{lb}	6.0	32.7	20.5	69800	96.1 ^{kPa} /13.9 ^{psi}
at 4° out	2.98	9.5 ^{US ton} /8600 ^{kg} /19000 ^{lb}	6.0	32.5	20.3	69800	97.5 ^{kPa} /14.1 ^{psi}
at 3° out	2.98	10.6 ^{US ton} /9600 ^{kg} /21200 ^{lb}	6.0	32.2	20.2	69800	98.7 ^{kPa} /14.3 ^{psi}
at 2° out	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.4	31.8	20.1	67600	99.2 ^{kPa} /14.4 ^{psi}
at 1° out	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.0	31.2	20.1	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.7	30.7	20.0	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.9	29.6	20.0	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.2	28.6	19.9	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.5	27.5	19.9	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	12.8	26.4	19.9	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.0	25.3	19.9	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.3	24.2	19.9	67600	99.2 ^{kPa} /14.4 ^{psi}

Horizontal slide position
Pile Length

Max. 510 mm out
35 ft (10.7 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
at 5° out	2.98	9.3 ^{US ton} /8400 ^{kg} /18500 ^{lb}	6.0	34.1	21.4	67600	97.2 ^{kPa} /14.1 ^{psi}
at 4° out	2.98	10.4 ^{US ton} /9400 ^{kg} /20700 ^{lb}	6.0	33.9	21.2	67600	98.5 ^{kPa} /14.3 ^{psi}
at 3° out	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.2	33.6	21.2	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° out	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	6.8	33.1	21.1	67600	99.2 ^{kPa} /14.4 ^{psi}
at 1° out	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	7.5	32.6	21.1	67600	99.2 ^{kPa} /14.4 ^{psi}
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	8.1	32.1	21.0	67600	99.2 ^{kPa} /14.4 ^{psi}
at 2° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	9.3	31.0	21.0	67600	99.2 ^{kPa} /14.4 ^{psi}
at 4° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	10.6	30.0	20.9	67600	99.2 ^{kPa} /14.4 ^{psi}
at 6° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	11.8	29.0	20.9	67600	99.2 ^{kPa} /14.4 ^{psi}
at 8° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	13.0	28.0	20.9	67600	99.2 ^{kPa} /14.4 ^{psi}
at 10° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	14.2	26.9	20.9	67600	99.2 ^{kPa} /14.4 ^{psi}
at 12° in	2.98	11 ^{US ton} /10000 ^{kg} /22100 ^{lb}	15.5	25.9	20.9	67600	99.2 ^{kPa} /14.4 ^{psi}

Notice: Calculations are made according to

Model of leader:	M40D □80 × P430 revolving type (90°)
	Length 20.3 m (67 ft) [14.3 m (47 ft) + 6 m (20 ft)] and top sheaves
Outrigger jacks:	1 set (L and R)
Counterweight:	10000 kg [11.0 US ton] (22000 lb)
Vibratory hammer:	APE 170VM weight 6520 kg [7.2 US ton] (14400 lb) (The sled weight is included in the weight of the vibratory hammer) (The sled weight is 2130 kg [2.4 US ton] (4700 lb))

Note

- 1. The information above is based upon NIPPON SHARYO standard specifications on firm & level surface.**
- 2. While working on, or moving the rig, be sure to expand the crawler to the maximum width.**
- 3. The permissible lifting load of the pile suspension rope of φ22 is 5000 kg [5.5 US ton] with single-part line at the maximum.**
- 4. The permissible lifting load of the vibratory hummer suspension rope of φ22 is 5000 kg [5.5 US ton] with single-part line and 20000 kg [22.0 US ton] with four-part line at the maximum.**
- 5. Pile weight is not included in the total operating weight.**
- 6. The maximum permissible operation weight is 80000 kg [88 US ton].**

Horizontal slide position	Max. 510 mm out
Pile Length	49 ft (15 m)

Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22000 ^{lb}	8.4	29.9	19.9	66000	97.2 ^{kPa} /14.1 ^{psi}

Notice: Calculations are made according to

Model of leader:	M40D □80 × P430 revolving type (90°)
	Length 20.3 m (67 ft) [14.3 m (47 ft) +6 m (20 ft)] and top sheaves
Outrigger jacks:	1 set (L and R)
Counterweight:	10000 kg [11.0 US ton] (22000 lb)
Vibratory hammer:	APE 150 weight 6250 kg [5.8 US ton] (11600 lb) (The sled weight is included in the weight of the vibratory hammer) (The sled weight is 2130 kg [2.4 US ton] (4700 lb))

Note

- 1. The information above is based upon NIPPON SHARYO standard specifications on firm & level surface.**
- 2. While working on, or moving the rig, be sure to expand the crawler to the maximum width.**
- 3. The permissible lifting load of the pile suspension rope of φ22 is 5000 kg [5.5 US ton] with single-part line at the maximum.**
- 4. The permissible lifting load of the vibratory hummer suspension rope of φ22 is 5000 kg [5.5 US ton] with single-part line and 20000 kg [22.0 US ton] with four-part line at the maximum.**
- 5. Pile weight is not included in the total operating weight.**
- 6. The maximum permissible operation weight is 80000 kg [88 US ton].**

Horizontal slide position	Max. 510 mm out
Pile Length	49 ft (15 m)

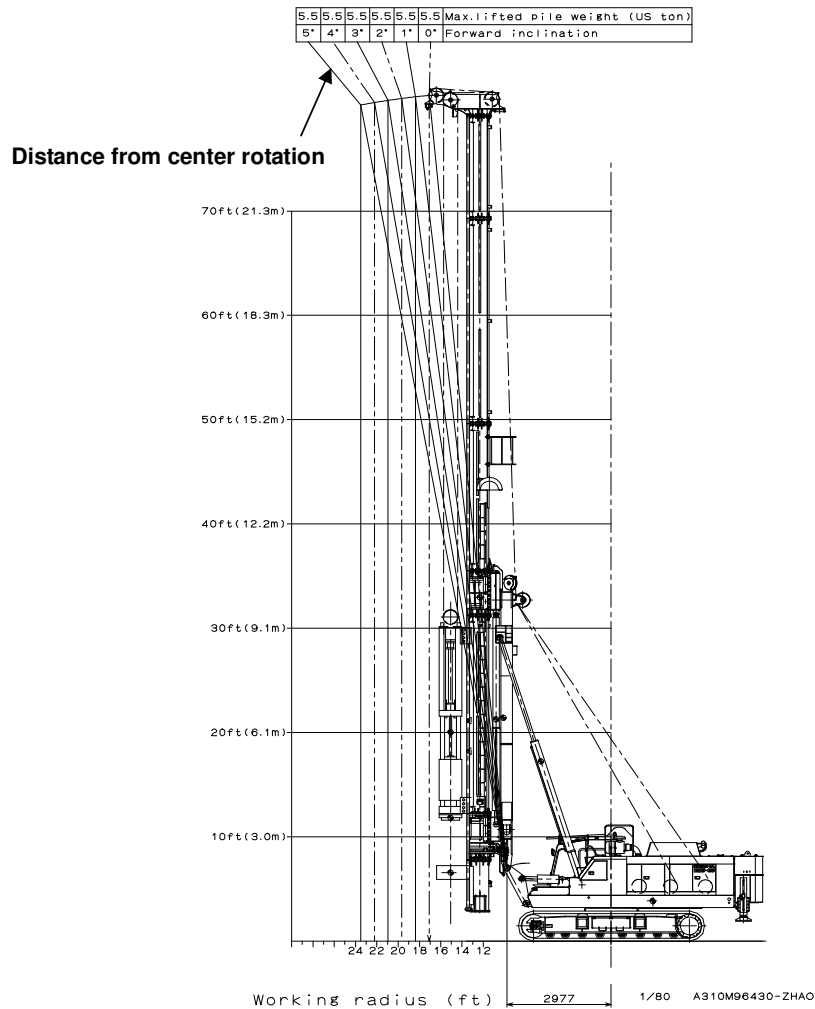
Leader angle degree	Working radius (m)	Pile Weight (US ton / kg / lb)	Stability			Total operating weight (kg)	Average ground pressure (kPa/psi)
			Forward (°)	Backward (°)	Sideward (°)		
Vertical	2.98	11 ^{US ton} /10000 ^{kg} /22000 ^{lb}	8.6	30.0	20.0	65800	96.8 ^{kPa} /14.0 ^{psi}

3.15 Lifting loads with pile winch

Model of leader:	M40D □80 × P430 revolving type (90°)
Counterweight:	Length 23.3 m (77 ft) and top sheaves
Hydraulic hammer:	10000 kg [11.0 US ton] (22000 lb)
	J&M H1 15 weight 9100 kg [10.1 US ton]
	(20100 lb)
Hammer cap weight:	500 kg [0.5 US ton] (1100 lb)
Horizontal slide position:	Max. 510 mm out (R=2977 mm)

Note

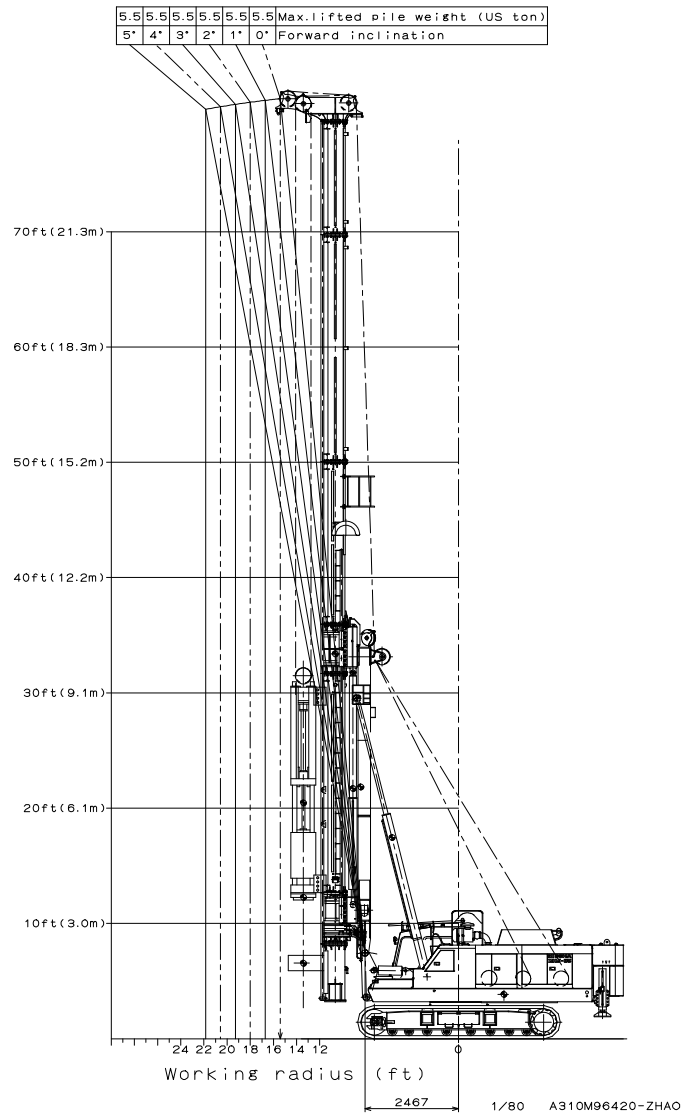
- 1. The information above is based upon NIPPON SHARYO standard specifications on firm & level surface.**
- 2. While working on, or moving the rig, be sure to expand the crawler to the maximum width.**



Model of leader: M40D □80 × P430 revolving type (90°)
 Length 23.3 m (77 ft) and top sheaves
 Counterweight: 10000 kg [11.0 US ton] (22000 lb)
 Hydraulic hammer: J&M H115 weight 9100 kg [10.1 US ton] (20100 lb)
 Hammer cap weight: 500 kg [0.5 US ton] (1100 lb)
 Horizontal slide position: Min. (R=2467 mm)

Note

1. The information above is based upon NIPPON SHARYO standard specifications on firm & level surface.
2. While working on, or moving the rig, be sure to expand the crawler to the maximum width.

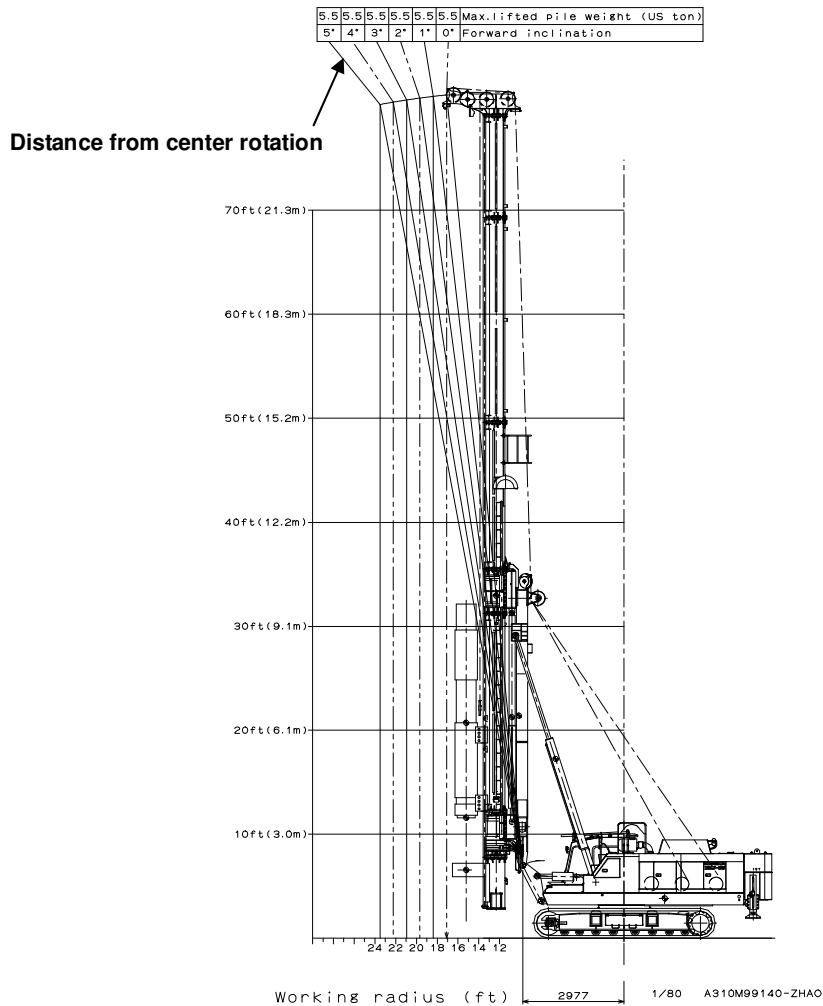


3.16 Lifting loads with pile winch

Model of leader:	M40D □80 × P430 revolving type (90°)
Counterweight:	Length 23.3 m (77 ft) and top sheaves
Diesel hammer:	10000 kg [11.0 US ton] (22000 lb)
Hammer cap weight:	APE D30-42 weight 7300 kg [8.1 US ton] (16100 lb)
Horizontal slide position:	500 kg [0.5 US ton] (1100 lb)
	Max. 510 mm out (R=2977 mm)

Note

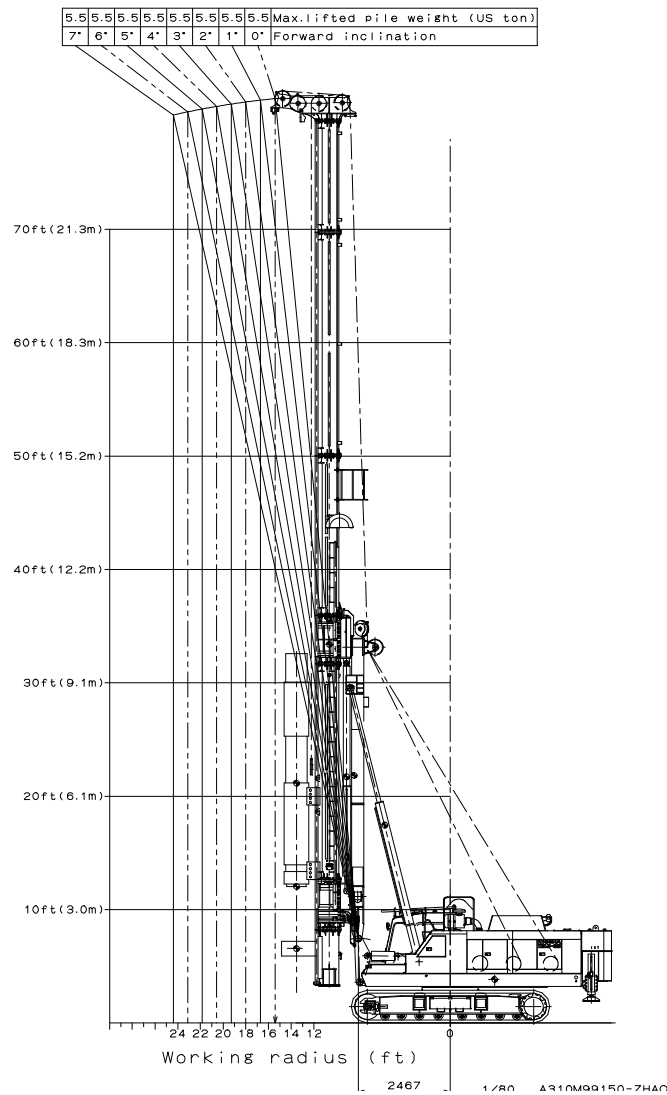
- 1. The information above is based upon NIPPON SHARYO standard specifications on firm & level surface.**
- 2. While working on, or moving the rig, be sure to expand the crawler to the maximum width.**



Model of leader: M40D □80 × P430 revolving type (90°)
 Length 23.3 m (77 ft) and top sheaves
 Counterweight: 10000 kg [11.0 US ton] (22000 lb)
 Diesel hammer: APE D30-42 weight 7300 kg [8.1 US ton] (16100 lb)
 Hammer cap weight: 500 kg [0.5 US ton] (1100 lb)
 Horizontal slide position: Max. 510 mm out (R=2977 mm)

Note

1. The information above is based upon NIPPON SHARYO standard specifications on firm & level surface.
2. While working on, or moving the rig, be sure to expand the crawler to the maximum width.



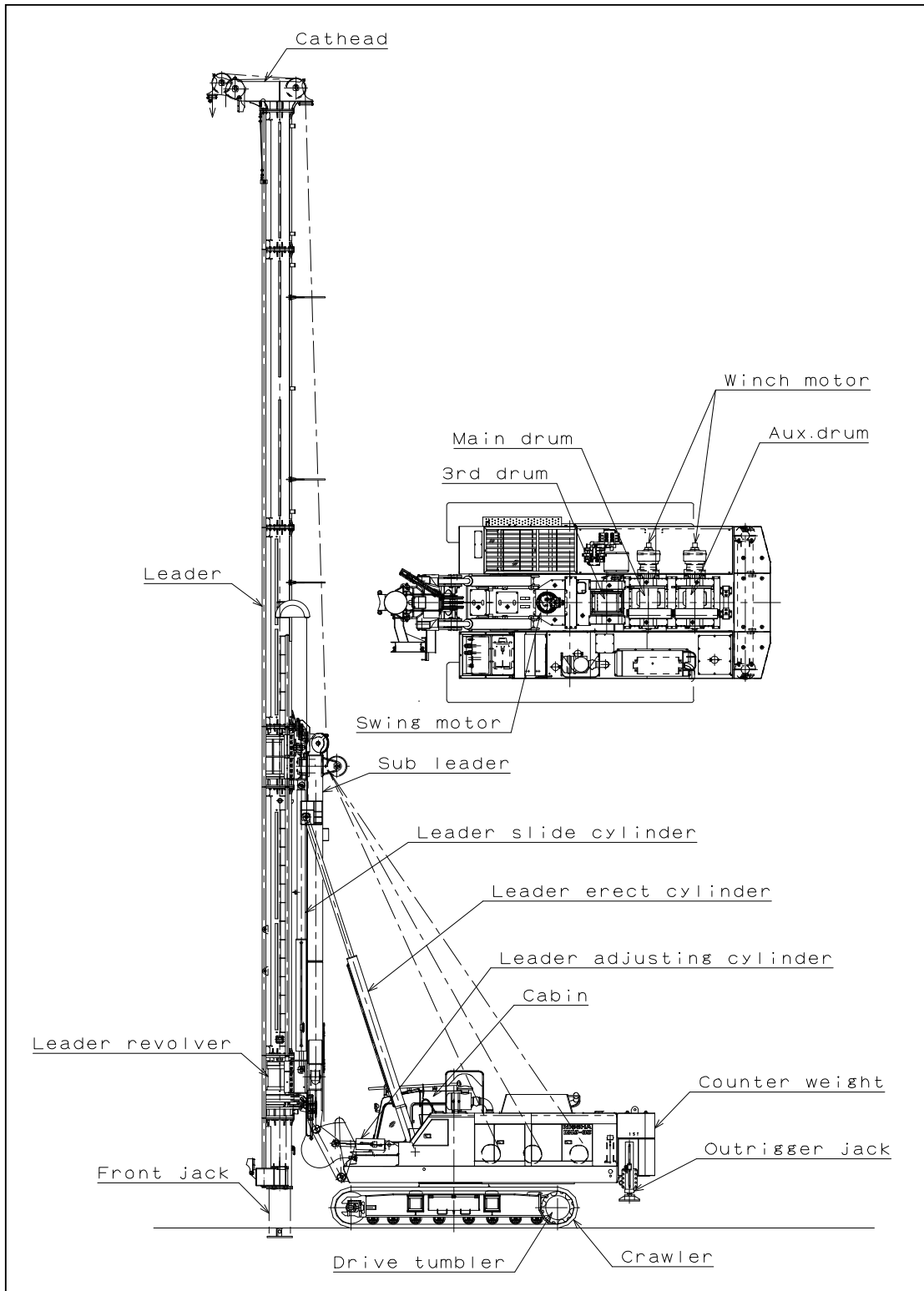
3.17 Ground pressure

Model of machine:	NISSHA DHJ-85
Base machine:	332 kN [37.4 US ton] (747000 lb)
Model of leader:	M40D □80 × P430 revolving type (90°) Length 23.3 m (77 ft) [14.3 m (47 ft) + 6 m (20 ft) + 3 m (10 ft)] and top sheaves
Counterweight:	98 kN [11.0 US ton] (22000 lb)
Hydraulic hammer:	J&M H115 weight 89 kN [10.1 US ton] (20100 lb)
Hammer cap weight:	4.9 kN [0.5 US ton] (1100 lb)
Operating weight:	685 kN [77.0 US ton] (154000 lb)
Total ground contact area	76712 cm ² (11890 in ²)
Average ground pressure	89 kPa [0.91 kgf/cm ²] (13.0 psi)

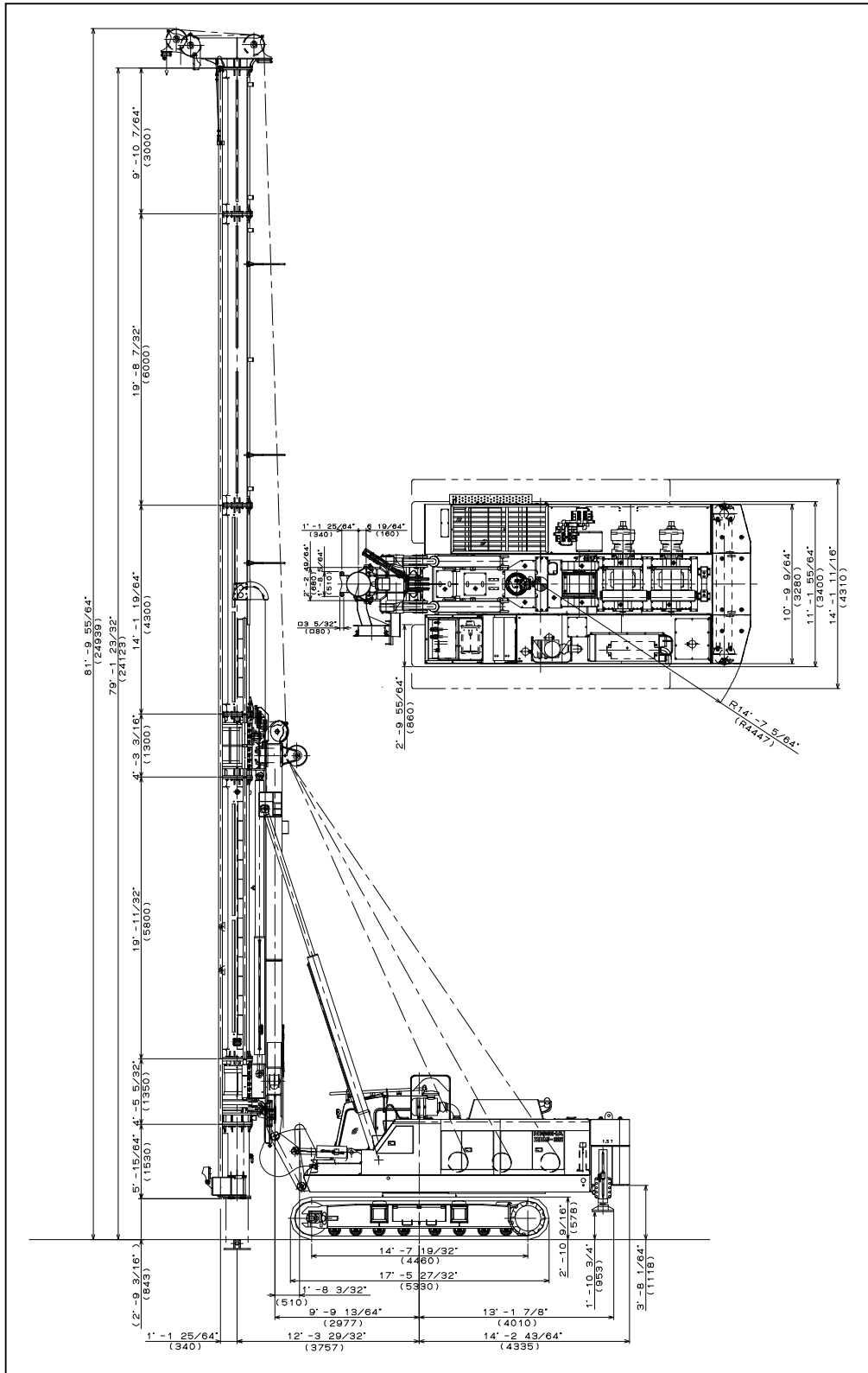


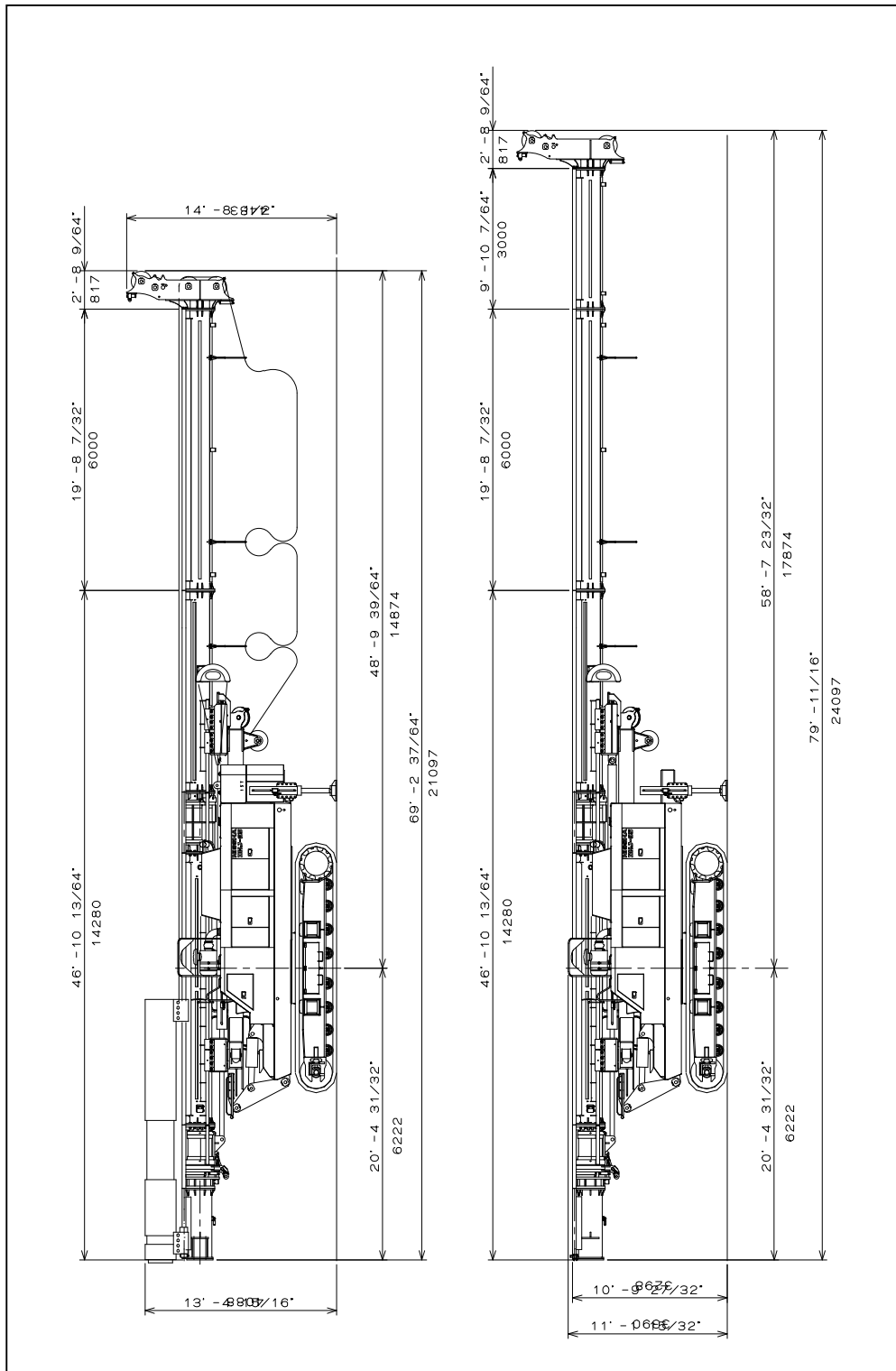
Chapter 4
General section

4.1 Name of components



4.2 General view

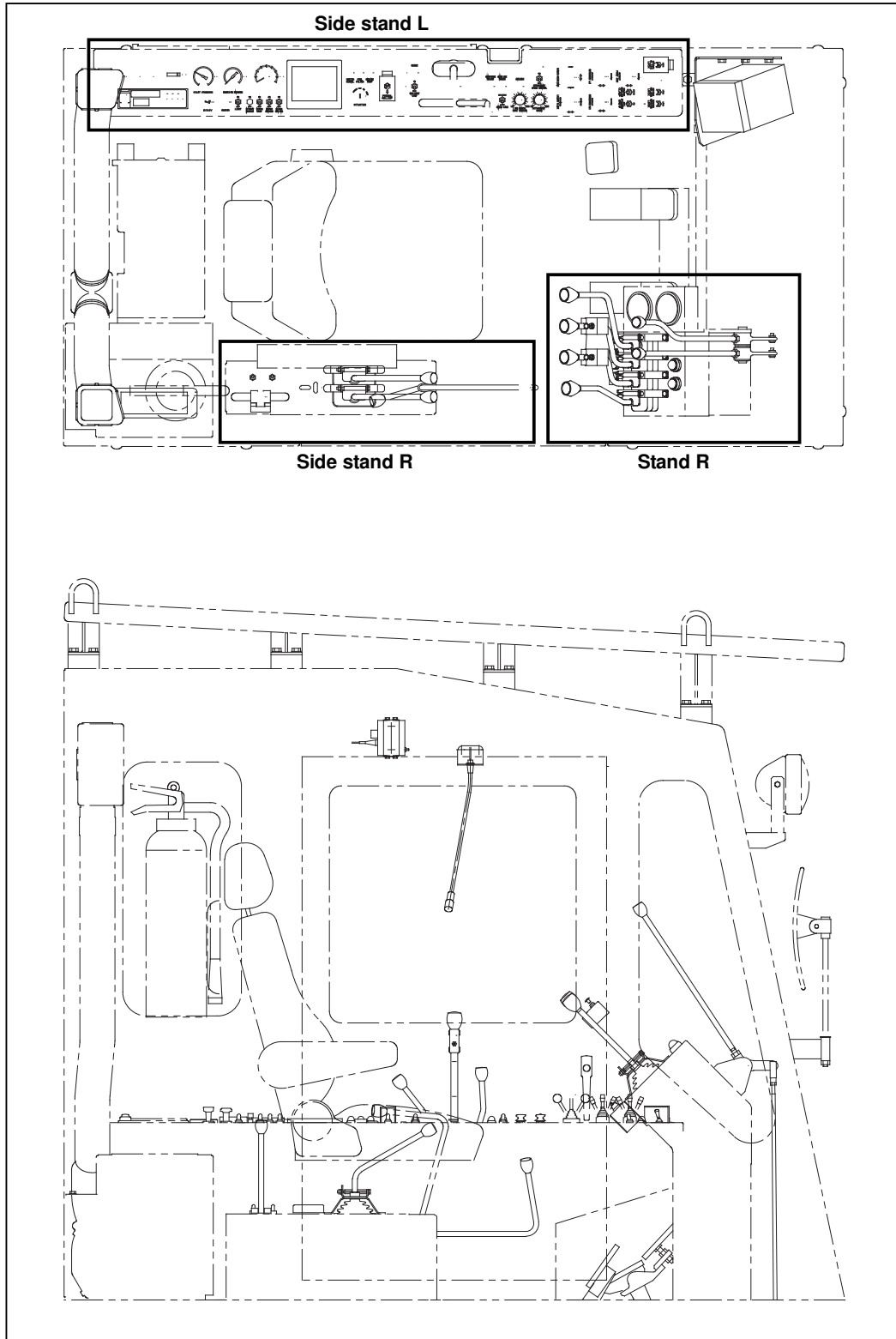






Chapter 5
Controls section

5.1 General layout




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Do not operate the machine unless you are trained and authorized to do so. Unintentional misuse of controls may damage the machine and cause personal injury.

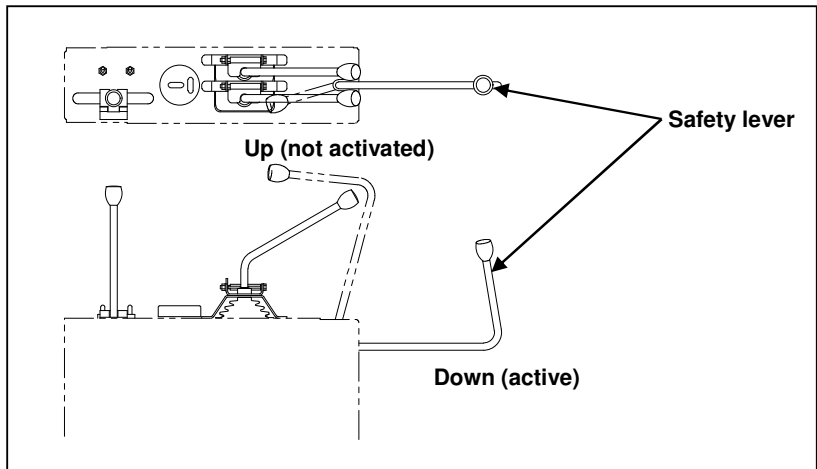
Figure 5.1 illustrates the general layout of the operator's controls and instrumentation in the cab. Note the position of the ignition switch and safety lever.

The operator's controls include those located on the right and left side stand and front stand, as well as the foot pedals on the floor.

Before starting the engine make sure that all the controls are in their neutral positions and the safety lever is in the up position (controls are not activated).

5.2 Side stand R

5.2.1 Safety lever



Safety lever is in the up position:
 Safety lever is in the down position:

controls are not activated.
 the pilot circuits are engaged and all the controls are active.

5.2.2 Travel control levers

With the hydraulic travel motors positioned at the rear of the machine, when the travel control levers are pulled toward the operator, the associated crawlers move backward.

When the travel control levers are pushed away from the operator, the associated crawlers move forward.

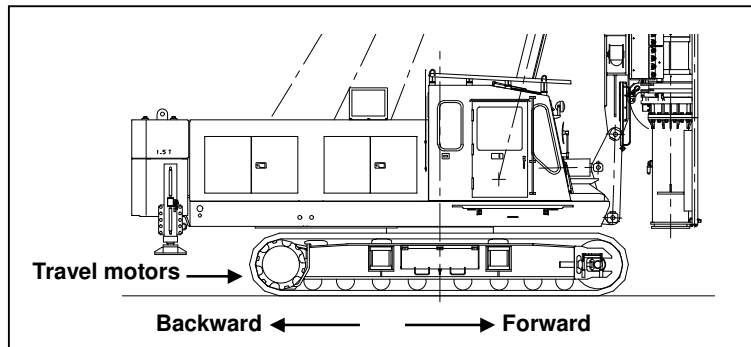
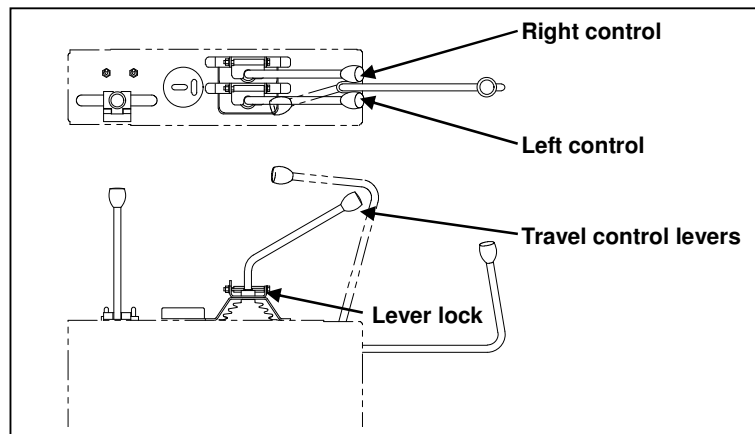
When a lever is released, it returns automatically to the neutral position.

When a control lever returns to the neutral position, travel motors are closed by brake valve and travel inertia is reduced.

Furthermore, travel brake pads are hydraulically activated to apply a braking function to the travel motors.

While activating the travel control lever, a voice alarm sounds.

When not in use, the lever should be locked.



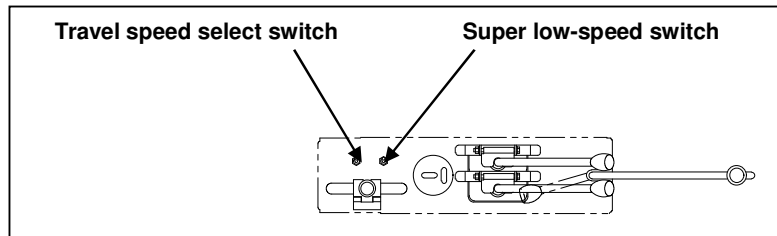
5.2.3 Travel speed select switch and super low-speed switch

These switches are used to reduce the drive speed of the machine.

When driving the pile, use these switches to adjust the speed.

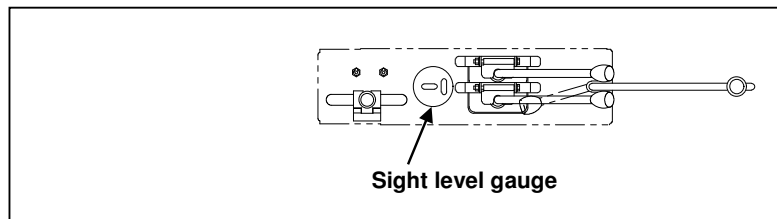
These are also used when transporting the machine to reduce the speed if necessary.

The main function of these switches is to reduce the driving speed.



5.2.4 Sight level gauge

The sight level gauge provided on the side stand R indicates the inclination of the superstructure.



5.2.5 Track extension control lever

The control lever is used for expanding and retracting the crawlers.

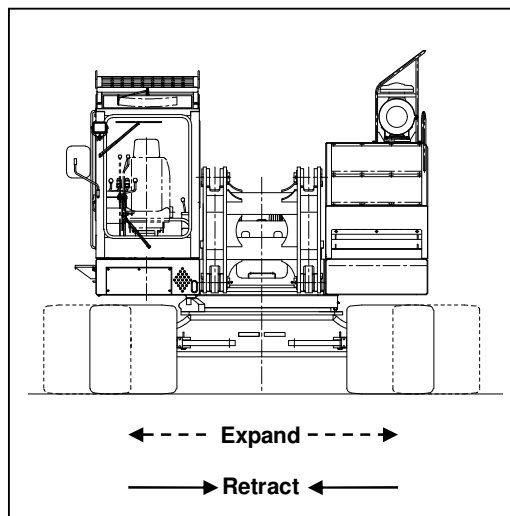
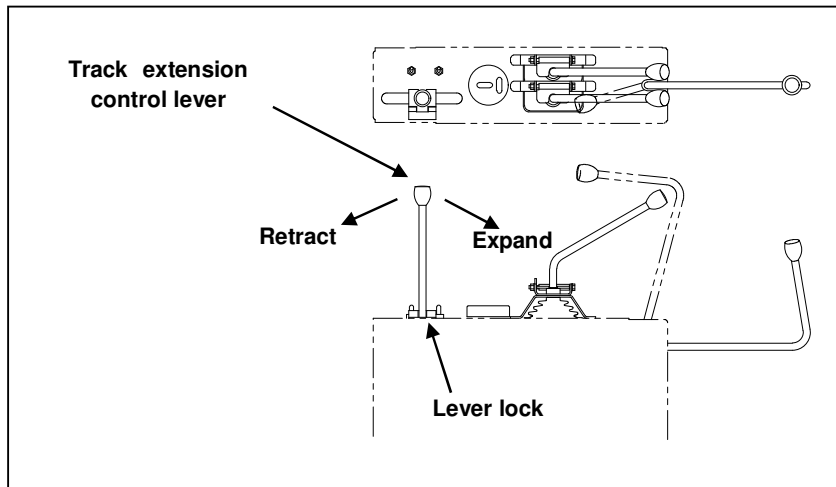
When the control lever is pushed, both R.H. and L.H. crawlers are expanded by extending the track extension cylinder.

On the other hand, when the lever is pulled, both R.H. and L.H. crawlers are retracted by retracting the track extension cylinder.

When the lever is released, it returns automatically to the neutral position.

Expand or retract the crawlers only after removing the lock-pin from the crawlers.

When not in use, the lever please should be locked.

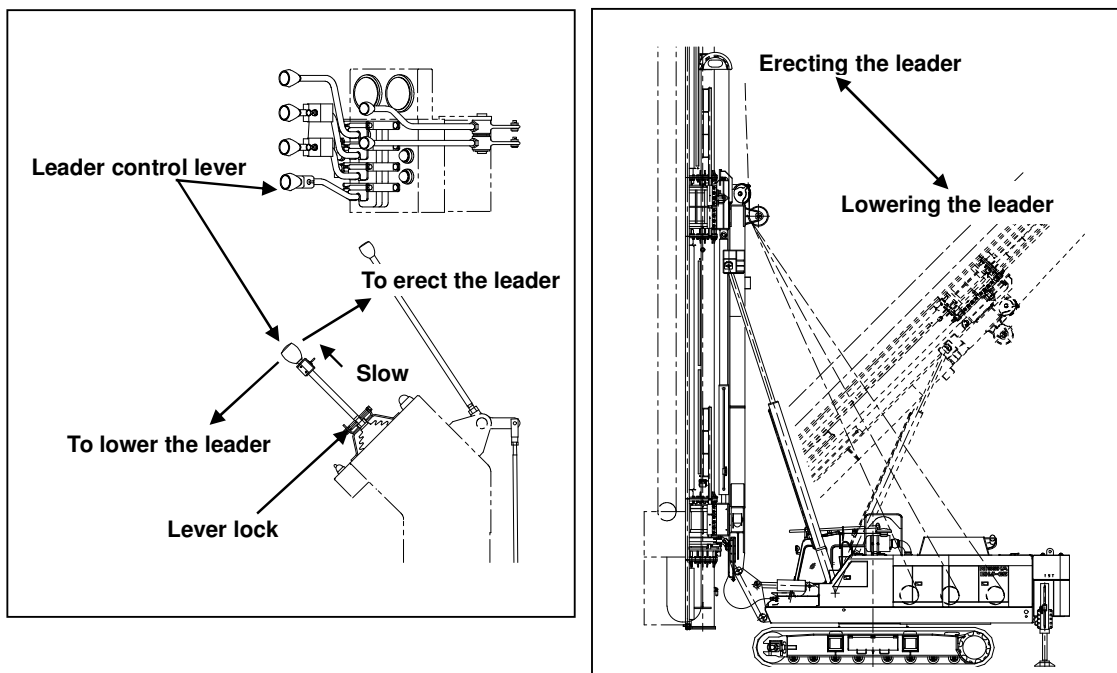


5.3 Stand R

5.3.1 Leader control lever

When the lever is pushed forward, the hydraulic cylinder extends and the leader is erected.
 When the lever is pulled toward the operator, the cylinder retracts and the leader is lowered.
 When the lever is released, it returns automatically to the neutral position.
 When not in use, the lever should be locked.
 When the switch is pulled up, erecting speed of leader and lowering speed of leader is slow down.

The auto-stop device will function, if necessary, when erecting or lowering the leader. (Refer to the section on lowering the leader.)



5.3.2 Main drum control lever

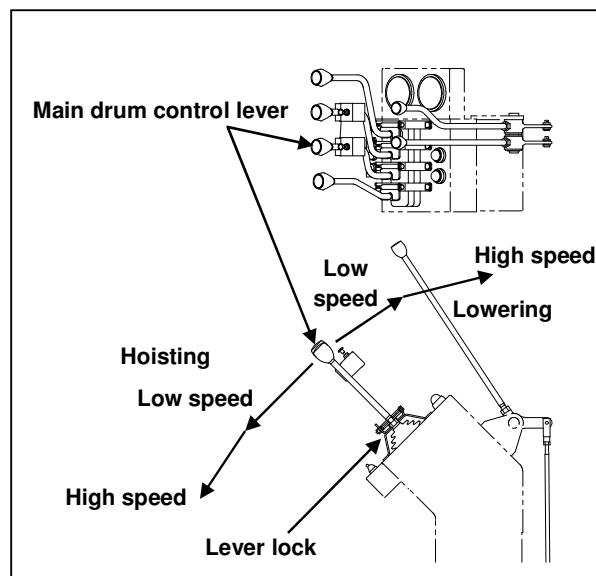
When the operator pulls the lever, the hydraulic winch motor rotates and winds up the winch drum. On the other hand, when the operator pushes the lever, the motor rotates in the reverse direction, unwinding the winch drum.

The control lever has two stages for both the winding up and unwinding the winch drum; the first stage operates at low speed while the second stage operates at high speed.

When the lever is released, it returns automatically to the neutral position.

Operate the winch only after releasing the brake pedal.

When not in use, the lever should be locked.



5.3.3 Brake mode change-over switch (main)

This switch is for toggling between [Auto brake] mode and [Free fall] mode.

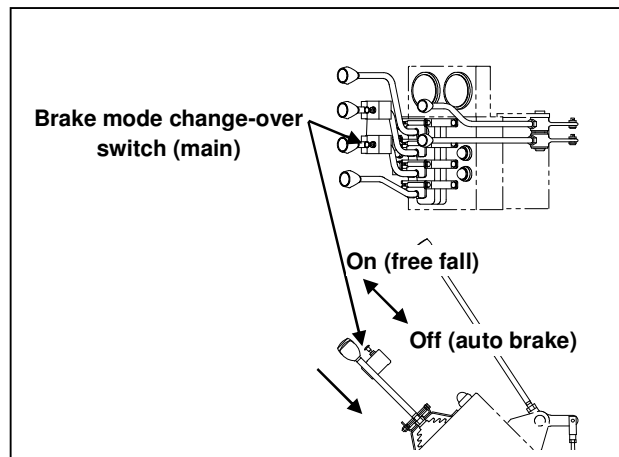
Toggle the mode change-over switch from [Auto brake] mode to [Free fall] mode while pressing on the main hoisting brake pedal; the mode lamp illuminates to indicate "free fall operation".

If the brake pedal is released at this time, it executes a free fall.

If the half clutch state of the clutch has been adjusted, a free fall does not occur but the clutch engages in half clutch state. For further details on the operating procedure, refer to section "5.3.4.3 [Half clutch] mode operation (main)".

Toggle the mode change-over switch from [Free fall] mode to [Auto brake] mode with the lever in neutral position; the mode changes to auto brake.

If the brake pedal is released at this time, automatic braking occurs.



5.3.4 Automatic clutch and brake operation [Each one] system

An automatic clutch and brake system called [Each one] is provided for all main and auxiliary drums.

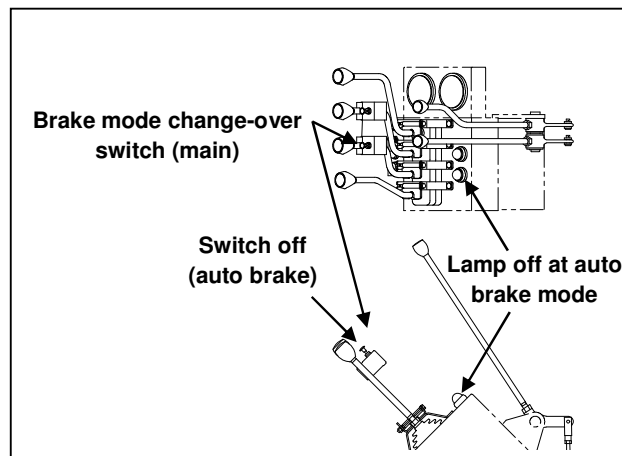
The [Each one] system consists of two functions; [Auto brake] mode and [Free fall] mode, which are used depending on work.

5.3.4.1 [Auto brake] mode operation

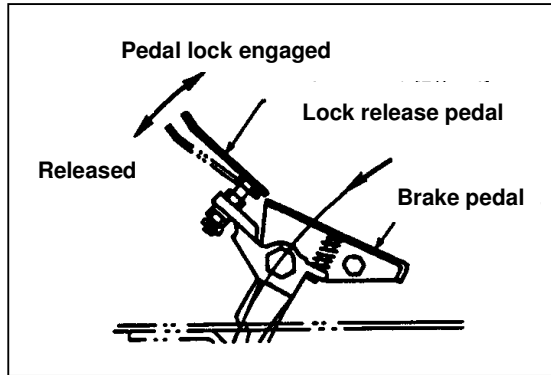


Release the brake pedal lock when operating the winch drums in [Auto brake] mode.

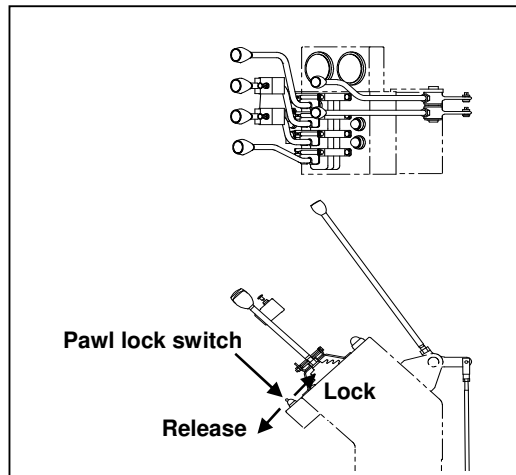
1. Turn the mode change-over switch on the winch control lever to [Auto brake] mode.
 - When turning to [Auto brake] mode, the winch brake are engaged automatically even if the brake pedal has been released.



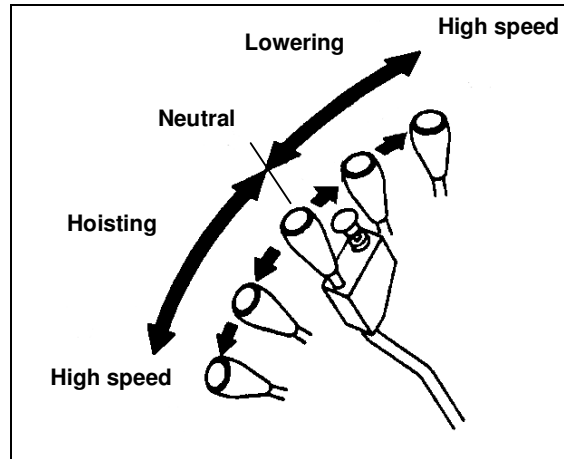
2. Release the pedal lock of the main hoisting brake pedal and the brake pedal is released but the drum brake is engaged.



3. Turn the drum pawl lock switch to [Release].



4. Set the control lever to either [Hoisting] or [Lowering]; the drum clutch is engaged and the drum brake is released, rotating the drum in the [Hoisting] or [Lowering] direction.

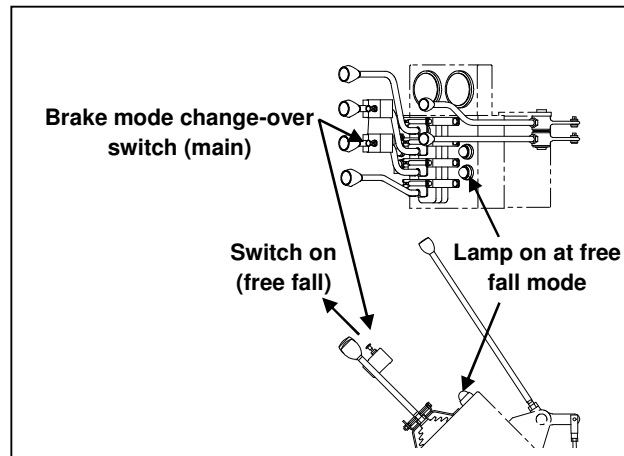


Engage the brake pedal lock and drum pawl lock securely with the load suspended.

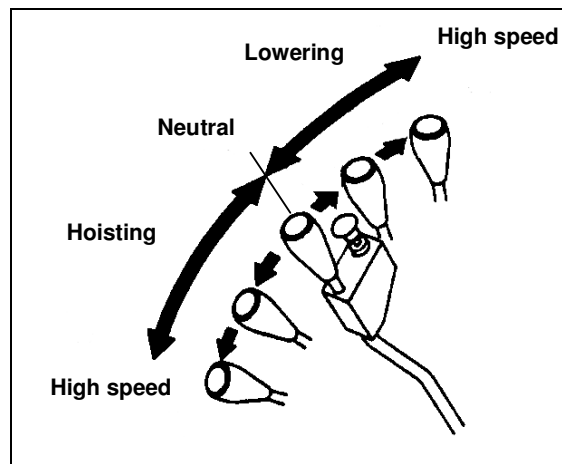
5. Turn the winch control lever to the neutral position; the drum brake is automatically engaged and the drum clutch is engaged, stopping hoisting or lowering.
 - **As mentioned above, the winding - stopping/braking - rewinding actions of the winch is controlled by 1 (one) control lever without the brake pedal control.**

5.3.4.2 [Free fall] mode operation (main)

1. Press the brake pedal fully and turn the mode change-over switch to [Free fall].
2. The mode change-over lamp illuminates, indicating "Free fall" mode. The suspended load can be lowered by pressing the brake.



3. When winding the load which has been suspended, pull the control lever and then release the drum brake gradually. When rewinding, push the control lever and then release the drum brake.





- Use [Power controlled lowering] if the suspended load is very heavy but do not press the brake pedal.

4. When lowering the suspended load by applying the drum brake, control its lowering speed using the brake pedal.
5. When lowering the suspended load via power-controlled lowering, push the winch control lever away and release the brake pedal.
6. When stopping the lowering motion, press the brake pedal first and then return the control lever to the neutral position.

5.3.4.3 [Half clutch] mode operation (main)

If the half clutch state of the main drum clutch has been adjusted, the half clutch operation is possible.

Half clutch system

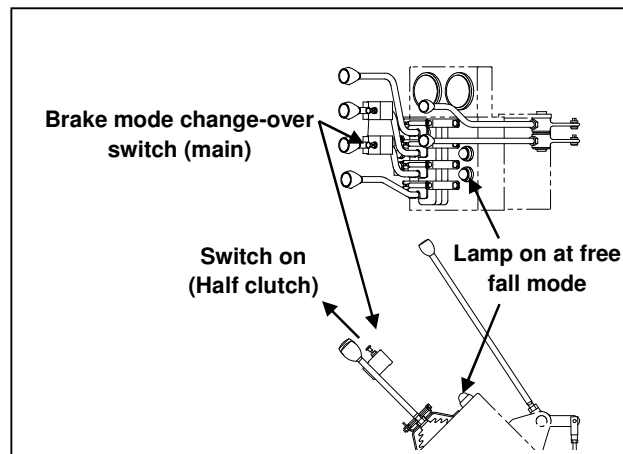
When the hydraulic vibratory hammer is installed on the front end, vibratory hammer is hanged by the rope of main drum, and the rope of third drum is used for pushing of vibratory hammer.

In this case the rope of main drum and the rope of third drum pull each other, therefore when the vibratory hammer is winded up (main drum), change third drum free fall mode. When the vibratory hammer is rewinded down (third drum), change main drum half clutch mode and release foot brake.

This operation can avoid disorder of rope.

Don't hoist anything, when main winch is half clutch mode.

1. Press the brake pedal fully and turn the mode change-over switch to [Free fall].
2. The mode change-over lamp illuminates, indicating "Half clutch" mode.



! DANGER

- In half clutch state, neither hoisting nor holding a heavy load is impossible. When the lever is in the neutral position, make sure to engage the brake pedal lock or drum lock.
Note that when turning on [Auto brake] mode, the half clutch state is canceled.
- In this mechanism, a mechanical adjustment has been made so that the clutch band is always slightly clamped against the inner surface of the drum. Therefore, the wire rope cannot be pulled out manually.

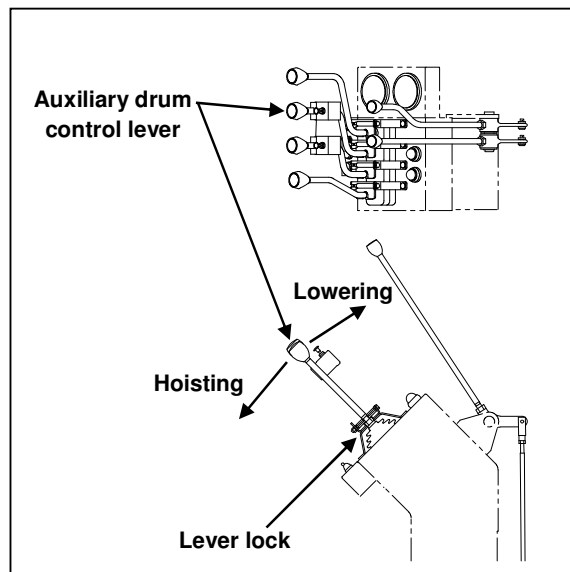
5.3.5 Auxiliary drum control lever

When the operator pulls the lever, the hydraulic winch motor rotates and winds up the winch drum. On the other hand, when the operator pushes the lever, the motor rotates in the reverse direction, unwinding the winch drum.

When the lever is released, it returns automatically to the neutral position.

Operate the winch only after releasing the brake pedal.

When not in use, the lever should be locked.



5.3.6 Brake mode change-over switch (auxiliary)

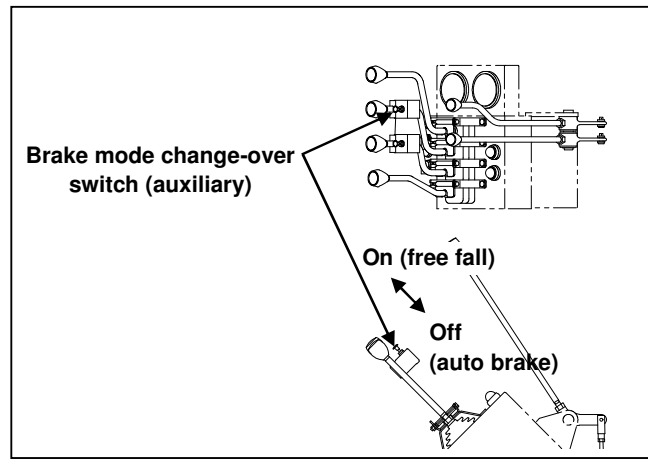
This switch is for toggling between [Auto brake] mode and [Free fall] mode.

Toggle the mode change-over switch from [Auto brake] mode to [Free fall] mode while pressing the brake pedals; the mode lamp illuminates to indicate "free fall operation".

If the brake pedal is released at this time, it executes a free fall.

Toggle the mode change-over switch from [Free fall] mode to [Auto brake] mode with the lever in neutral position; the mode changes to auto brake.

If the brake pedal is released at this time, automatic braking occurs.



5.3.7 Automatic clutch and brake operation [Each one] system

An automatic clutch and brake system called [Each one] is provided for all main and auxiliary drums.

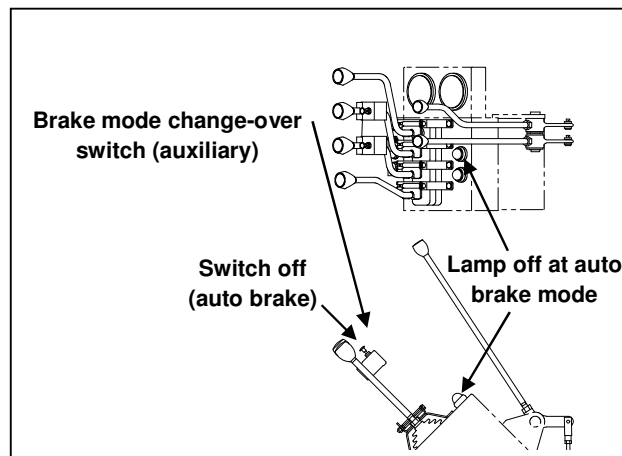
The [Each one] system consists of two functions; [Auto brake] mode and [Free fall] mode which are automatically depending on the application.

5.3.7.1 [Auto brake] mode operation (auxiliary)

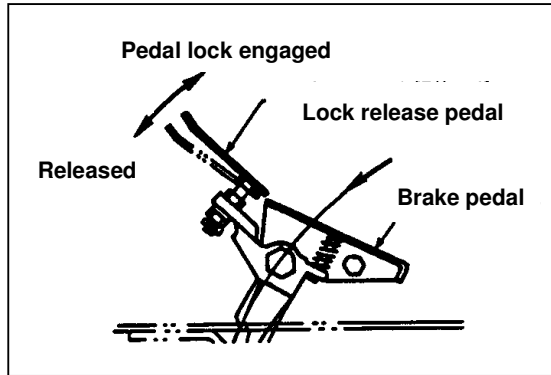


Release the brake pedal lock when operating the winch drums in [Auto brake] mode.

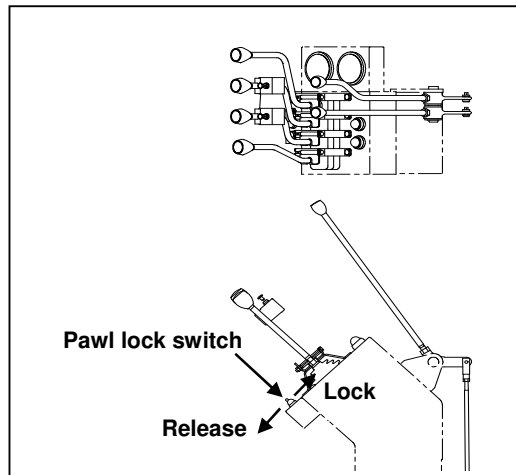
1. Turn the mode change-over switch on the winch control lever to [Auto brake] mode.
 - When turning to [Auto brake] mode, the winch brake are engaged automatically even if the brake pedal has been released.



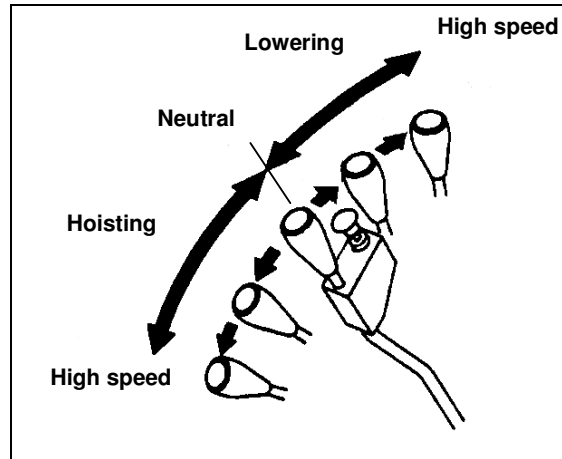
2. Release the pedal lock of the auxiliary hoisting brake pedal and the brake pedal is released but the drum brake is engaged.



3. Turn the drum pawl lock switch to [Release].



4. Set the control lever to either [Hoisting] or [Lowering]; the drum clutch is engaged and the drum brake is released, rotating the drum in the [Hoisting] or [Lowering] direction.

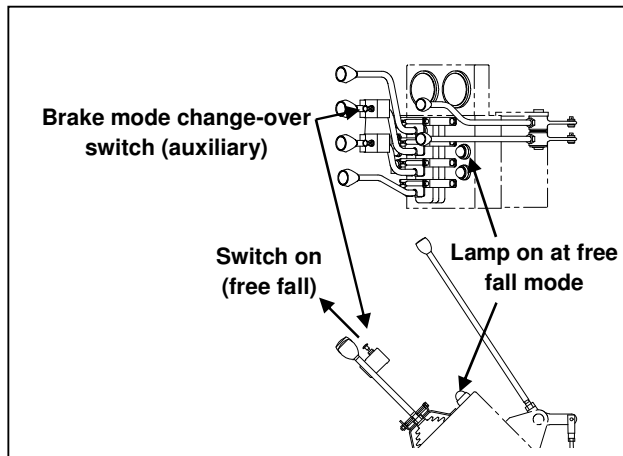


Engage the brake pedal lock and drum pawl lock securely with the load suspended.

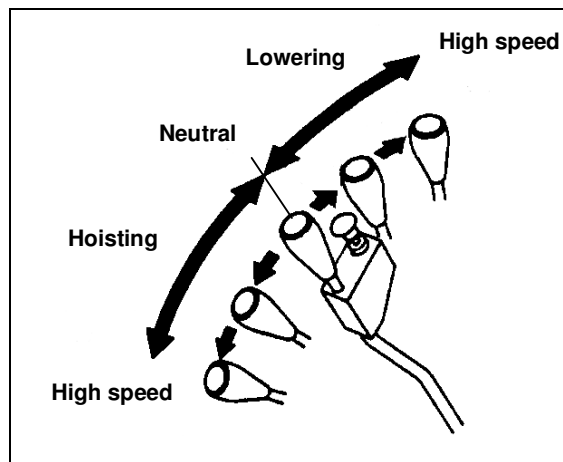
5. Turn the winch control lever to the neutral position; the drum brake is automatically engaged and the drum clutch is engaged, stopping hoisting or lowering.
 - **As mentioned above, the winding - stopping/braking - rewinding actions of the winch is controlled by 1 (one) control lever without the brake pedal control.**

5.3.7.2 [Free fall] mode operation (auxiliary)

1. Press the brake pedal fully and turn the mode change-over switch to [Free fall].
2. The mode change-over lamp illuminates, indicating "Free fall" mode. The suspended load can be lowered by pressing the brake.



3. When winding the load which has been suspended, pull the control lever and then release the drum brake gradually. When rewinding, push the control lever and then release the drum brake. (Refer to "power-controlled lowering" below).





- **Use [Power controlled lowering] if the suspended load is very heavy but do not press the brake pedal.**
4. When lowering the suspended load by applying the drum brake, control its lowering speed using the brake pedal.
 5. When lowering the suspended load via power-controlled lowering, push the winch control lever away and release the brake pedal.
 6. When stopping the lowering motion, press the brake pedal first and then return the control lever to the neutral position.

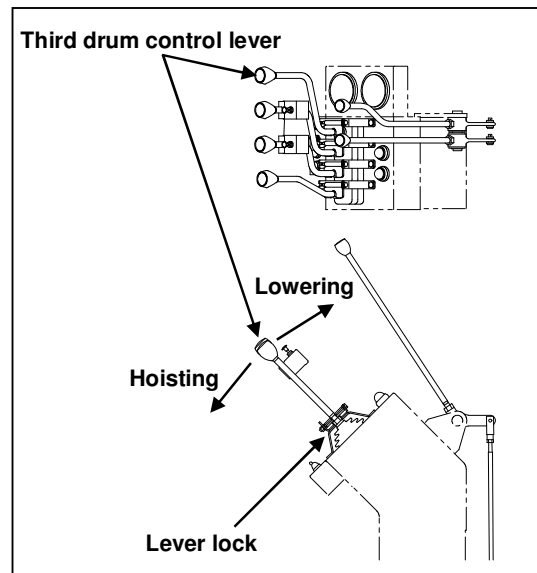
5.3.8 Third drum control lever

When the operator pulls the lever, the hydraulic winch motor rotates and winds up the winch drum. On the other hand, when the operator pushes the lever, the motor rotates in the reverse direction, unwinding the winch drum.

When the lever is released, it returns automatically to the neutral position.

There is no brake pedal for the third drum.

When not in use, the lever should be locked.



Do not use the third drum to hoist a load. This drum is used only for pushing the hammer.

With the lever in the neutral position, the third drum cannot hold a load.

The third winch therefore cannot be used to hoist a load; operators must not hoist any load with the third winch.

5.3.9 Leader forward and backward adjusting lever

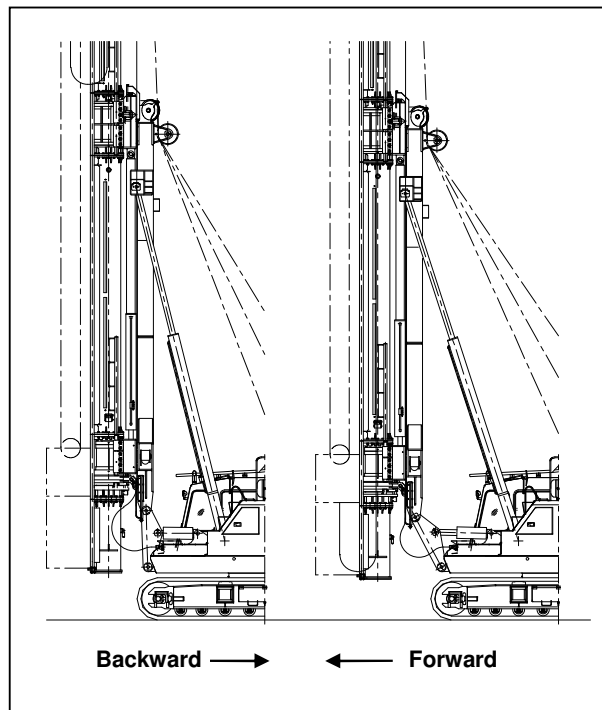
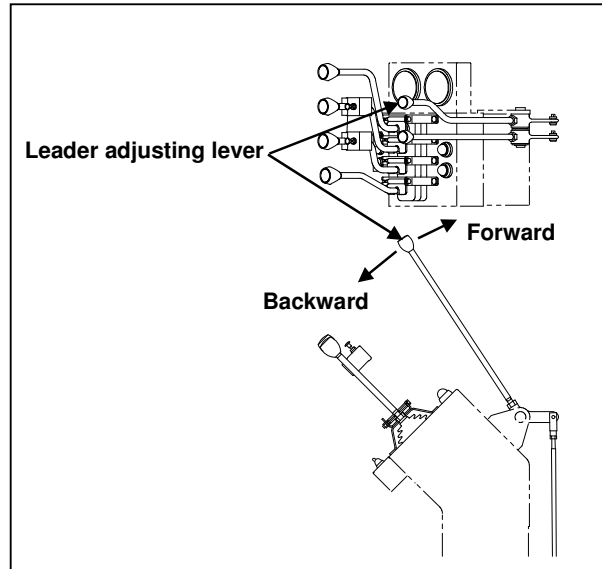
This lever operates hydraulic cylinders to move the lower end of the leader back and forth to facilitate the centering of a pile.

When the lever is pushed, the leader moves forward as cylinders expand.

When the lever is pulled, the leader moves backward as the cylinders retract.

When the lever is released, it returns automatically to the neutral position.

When the lever is in neutral, the cylinder can maintain position via the double-operated check valve.



5.3.10 Leader left and right adjusting lever

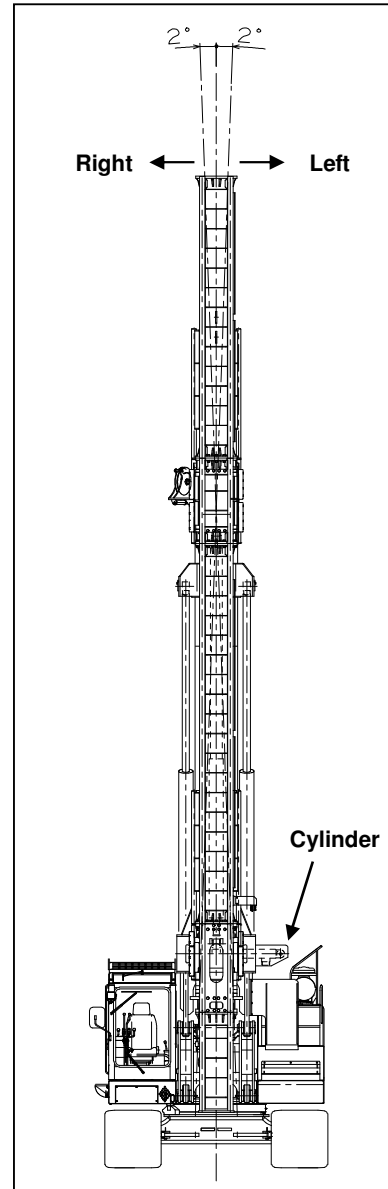
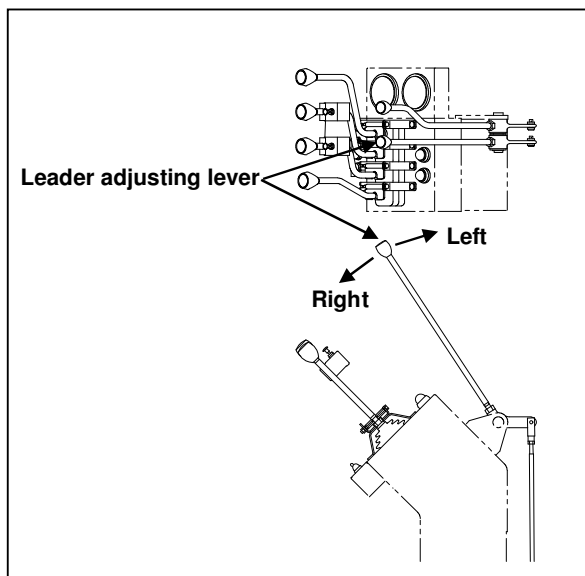
This lever operates a hydraulic cylinder to move the lower end of the leader to the left and right to facilitate the centering of a pile; it can also adjust the vertical tilt of the leader.

When the lever is pushed, the leader slides to the left as the cylinder retracts.

When the lever is pulled, the leader slides to the right as the cylinder expands.

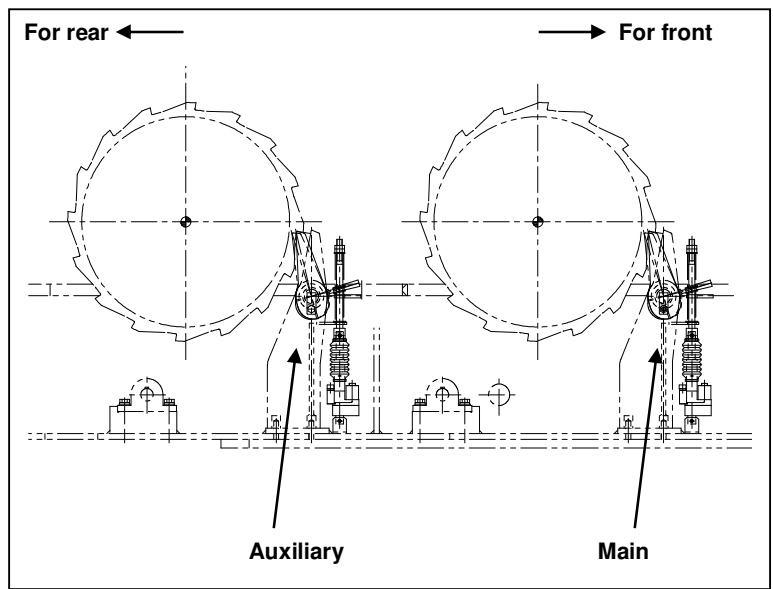
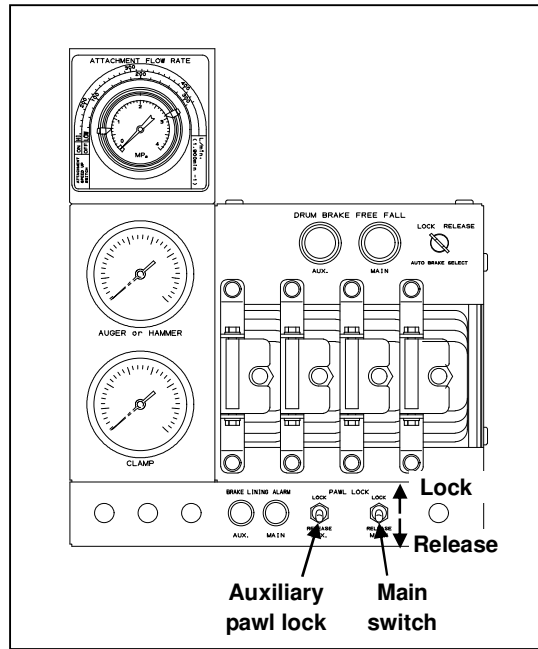
When the lever is released, it returns automatically to the neutral position.

When the lever is in neutral, the cylinder can maintain position via the double-operated check valve.



5.3.11 Pawl lock switch (main and auxiliary)

The purpose of this switch is to lock a ratchet wheel using the pawl of an appropriate drum. This lock is only effective when locking the wheel in the rewinding direction. When the toggle switch is pulled, the pawl lock is released as the electrical cylinder retracts. When the toggle switch is pushed, the pawl lock is locked as the electrical cylinder extends. Engage the pawl lock while the machine is suspended.



5.3.12 Auto brake select switch (main and auxiliary brake)

If this switch is turned to the LOCK position (see Photo 1), the operator cannot change the winch brake of either the main or auxiliary drums to free fall mode. After turning the switch to the LOCK position, the operator can remove the key from the lock (see Photo 2).

In this way, the operator can limit the operation of free fall mode.

When the switch is turned to the release side (see Photo 3), the winch brakes of both the main and auxiliary drums can be changed to free fall mode.

(Photo 1)



(Photo 2)

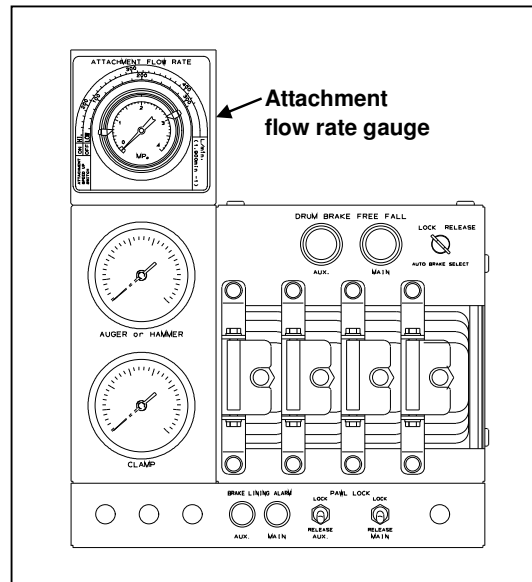


(Photo 3)



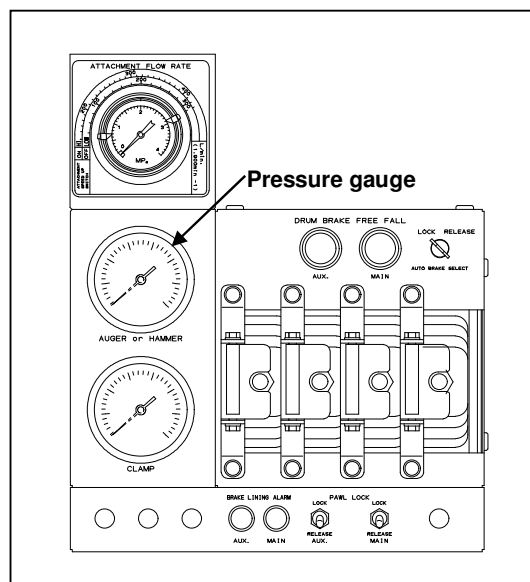
5.3.13 Attachment flow rate gauge

The gauge indicates the flow rate to attachments such as the hydraulic vibratory hammer, etc. A flow rate reading changes in accordance with the rpm; the one below is a reading at 1900 min⁻¹. The reading also changes in accordance with the load; the one below is the maximum flow rate with no load. (Refer to 5.4.12 and 5.4.13)



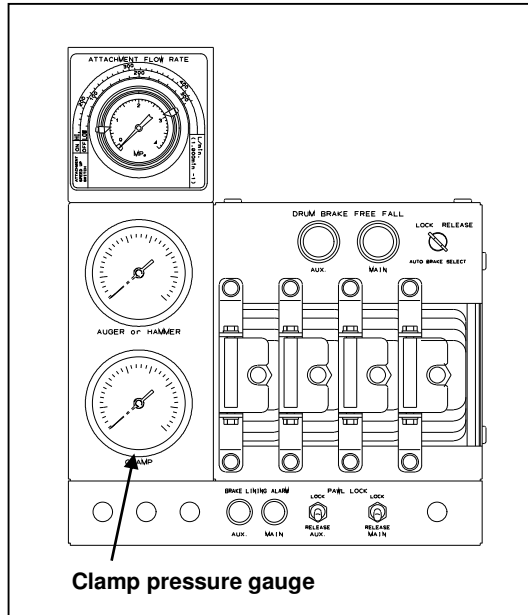
5.3.14 Pressure gauge

The gauge indicates the operating pressures of the auger and hammer.



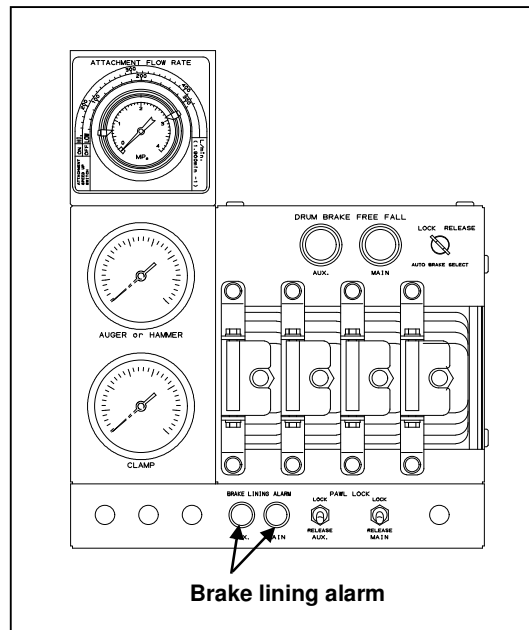
5.3.15 Clamp pressure gauge

The gauge indicates the clamp pressure of the hydraulic vibratory hammer.



5.3.16 Brake lining alarm

The alarm illuminates when the brake lining is worn. When this lamp illuminates, replace the brake lining with a new one and then adjust the brake. For the procedures for adjusting the brake, refer to section “7.3.6 Adjusting the brake band of the main, auxiliary.

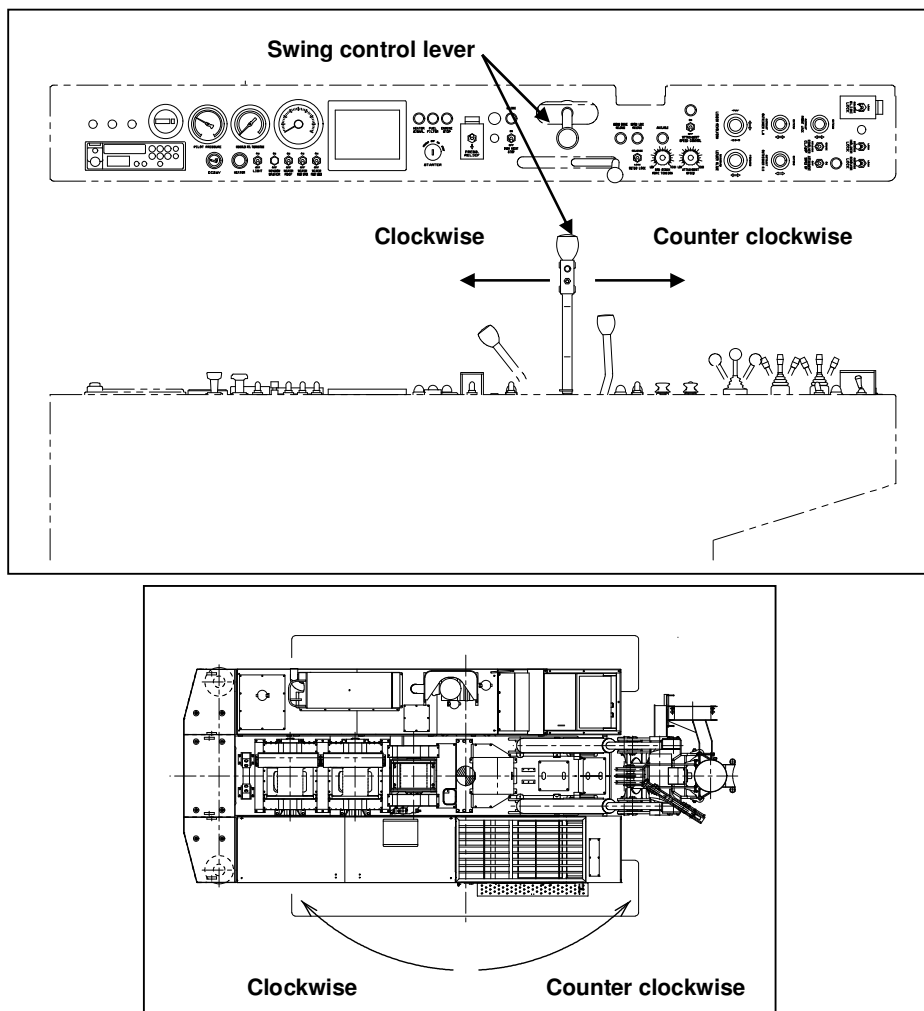


5.4 Side stand L

5.4.1 Swing control lever

When the swing control lever is pulled, the upper revolving superstructure rotates clockwise.
 When the lever is pushed, the superstructure rotates counter clockwise.
 When the control lever is returned to the neutral position, the swing motor is closed by brake valve and swing inertia is reduced.

While operating the swing control lever, a warning lamp flashes and a voice alarm sounds.
 Pay attention to the surrounding area of the machine when performing the swing motion.

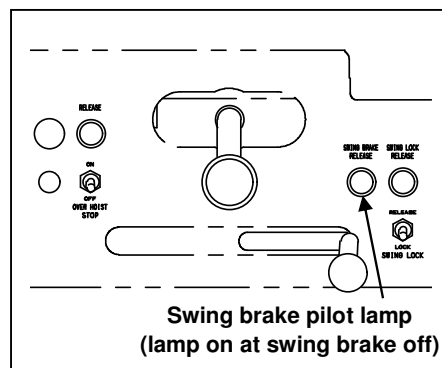
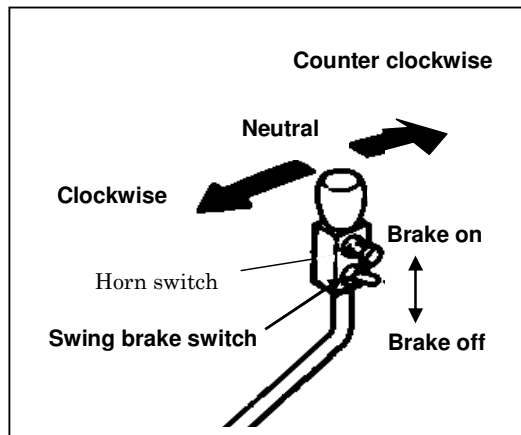


WARNING

Do not allow a swing motion to occur when the machine is on a trailer.

5.4.2 Swing brake switch

The swing brake switch is located beneath the grip of the swing control lever. It connects the upper revolving superstructure and lower machinery. When the toggle switch is set the upper position, the swing brake is applied. When the switch is in the down position, the brake is released. When the brake switch is turned on, the swing brake pads are activated hydraulically to apply a braking force to the swing motor. When the engine stops with the swing brake switch OFF, an alarm sounds. Turn the swing brake switch on to stop the engine. The swing brake is activated via a built-in spring and is released by the hydraulic oil from the pilot oil circuit. If the hydraulic oil pressure is 15 kg/cm² or below, the swing brake is not released and rotation is impossible.



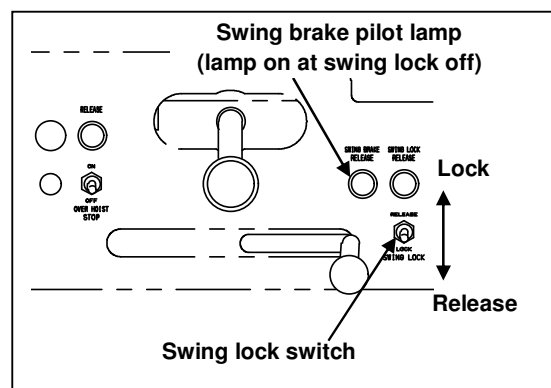
5.4.3 Swing lock switch

When the toggle switch is pulled, the swing lock pin is pushed up as the cylinder extends and swing lock is released.

When the toggle switch is pushed, the pin is pushed down as the cylinder retracts and the lock is locked.

When transporting the machine on a trailer, engage the swing lock by turning on the lock switch to lock the upper revolving superstructure thereby avoiding an accident which may result from an unexpected swinging motion.

To release the swing lock, turn off the lock switch and swing the upper revolving superstructure a little.



WARNING

Make sure that the swing lock is engaged securely with the hole of the track frame before transportation.

5.4.4 Leader sliding lever switch (forward-backward for transportation purposes)

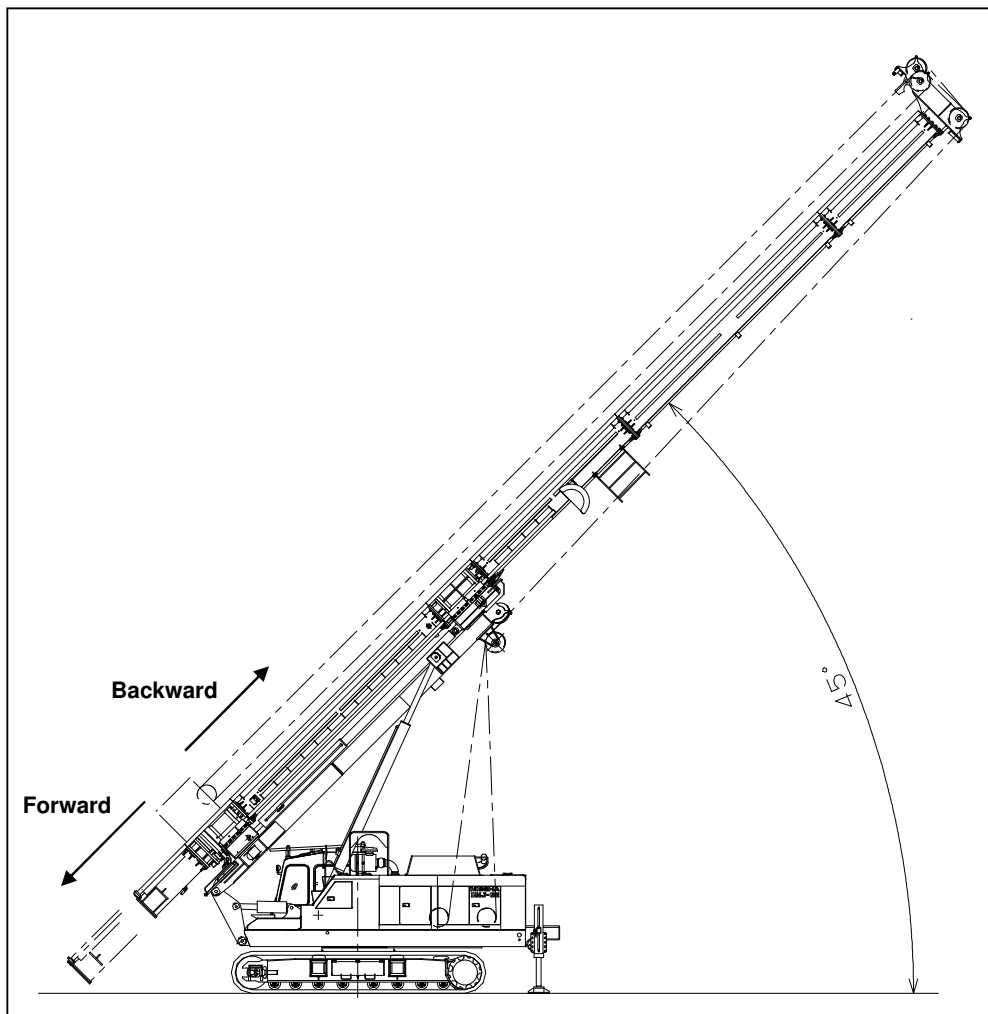
This lever switch is used to slide the leader forward and backward along the sub leader for transportation purposes.

When the lever switch is pushed, the leader slides forward during transportation as the cylinder expands. When the lever switch is pulled, the leader slides backward during transportation as the cylinder retracts.

When the lever switch is released, it automatically returns to the neutral position.

When the lever switch is in neutral, the cylinders can maintain their position via the double-operated check valve.

When revolving the leader, the slide position of the leader is limited.



5.4.5 Leader revolving lever switch

This lever switch is used to rotate the leader.

Release "Leader revolver pin-lock". (Refer to 5.4.7.)

Release "Leader holder pin-lock". (Refer to 5.4.8.)

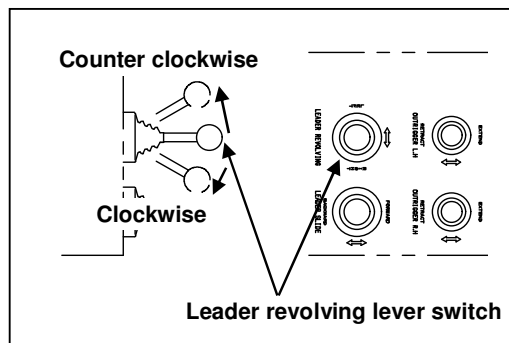
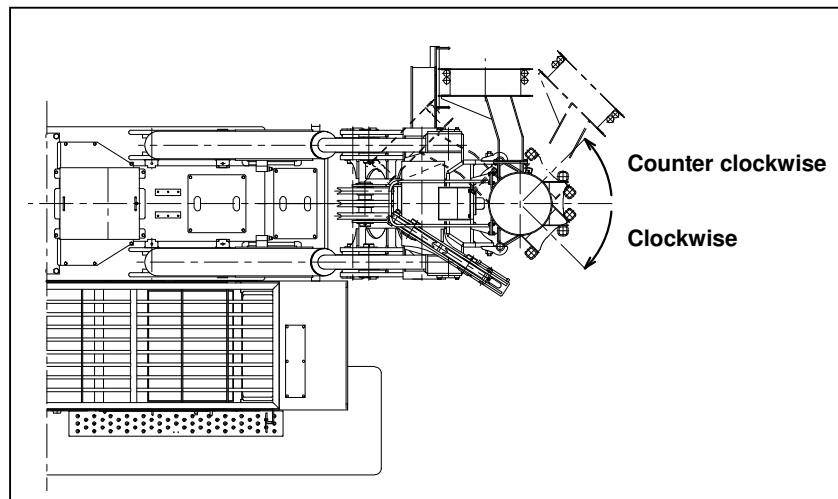
When the lever switch is turned to the right, the leader revolves clockwise.

When the lever switch is turned to the left, the leader revolves counter clockwise.

Since the leader when rotated cannot maintain its position, insert a revolver lock pin to keep its position.

Rotation of the leader is only possible when the leader is vertical.

Do not rotate the leader if it is tilted.



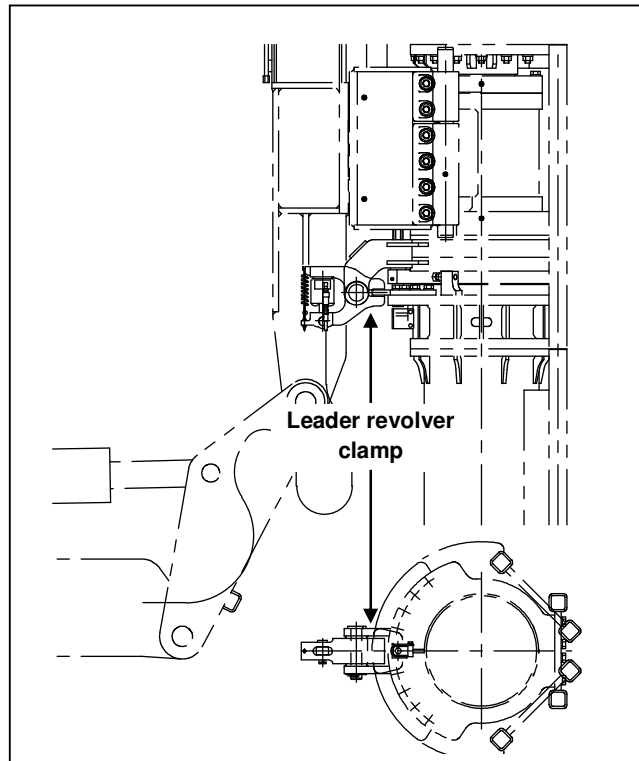
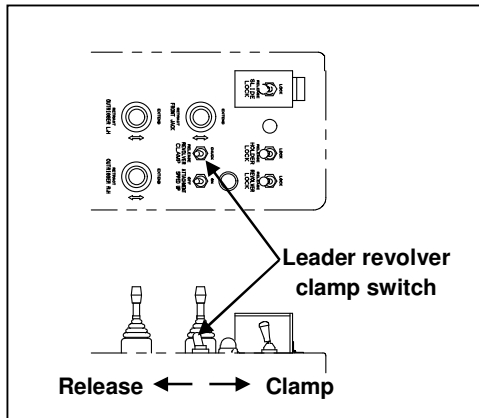
5.4.6 Leader revolver clamp switch (option)

When this switch is pushed the leader is clamped.

When the switch is pulled, the leader is released. It is not possible to slide the leader when this switch is in use.

This operation is possible only with the Vibratory Driver. Operation with other equipment is prohibited.

If the engine is not operating, clamping is impossible.



5.4.7 Leader revolver pin-lock switch

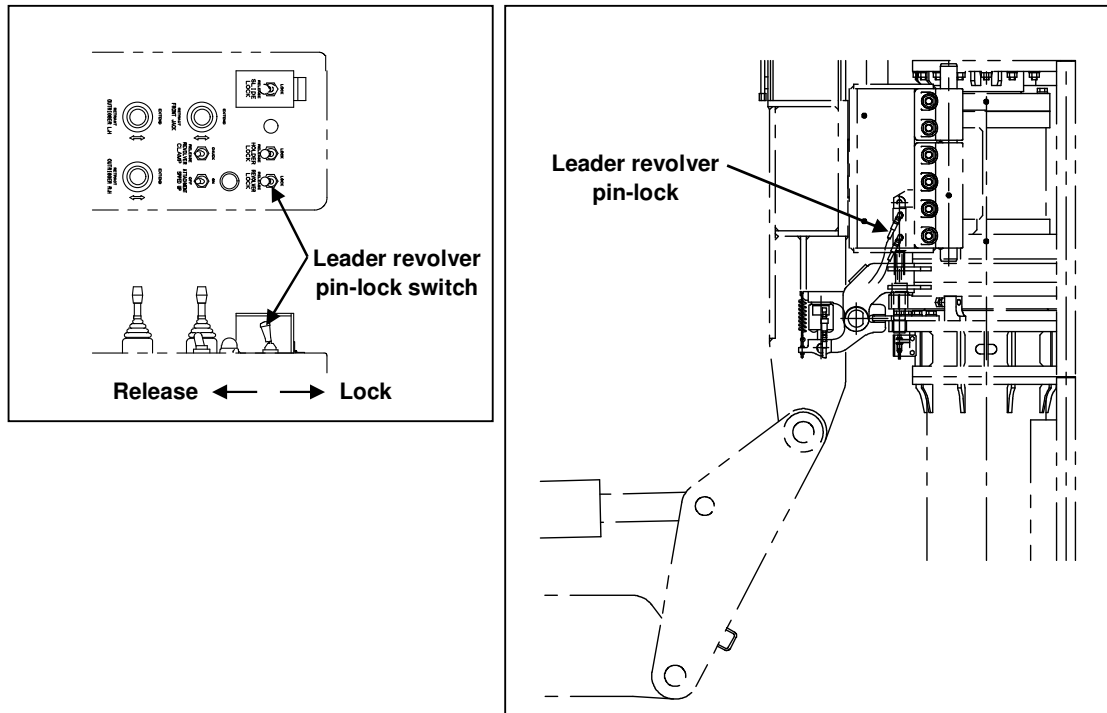
This switch is used to prevent rotation of the leader.

Push the tumbler switch forward to lock the leader revolver pin-lock.

Push it backward to release the lock.

The leader is prevented from rotating by inserting a lock pin into a hole in the revolver flange.

- **Ensure that the lock pin is inserted securely.**

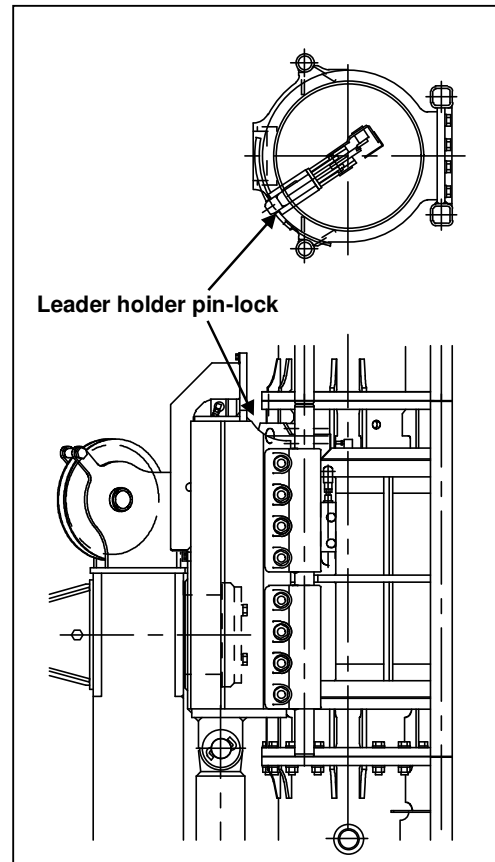
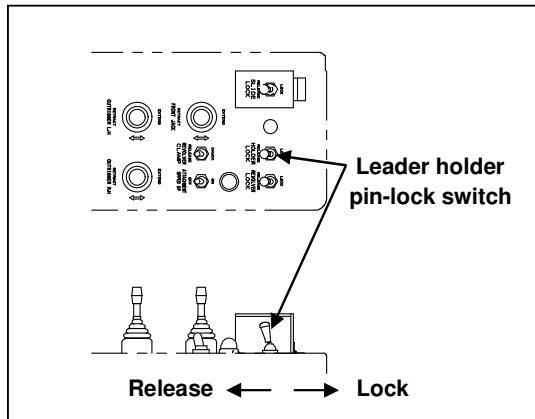



Engage the revolver lock when the machine is operating in order to prevent damage to the leader revolver.

5.4.8 Leader holder pin-lock switch

The switch secures the holder when erecting and lowering the leader for re-assembly. Push the tumbler switch forward to lock the holder by inserting a pin into a hole in the holder flange. Push it backward to unlock the holder, withdrawing a lock pin from the hole.

- Ensure that the lock pin is inserted securely before erecting and lowering the leader for assembly or disassembly.

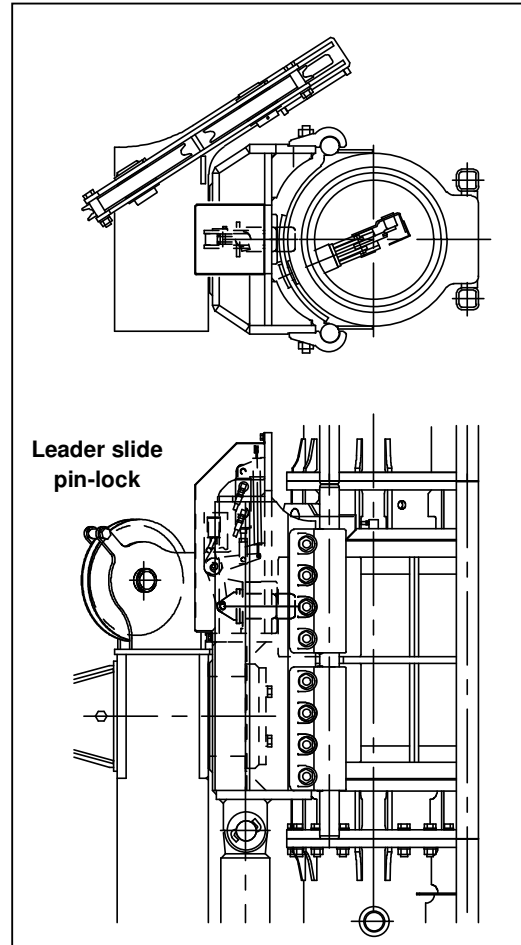
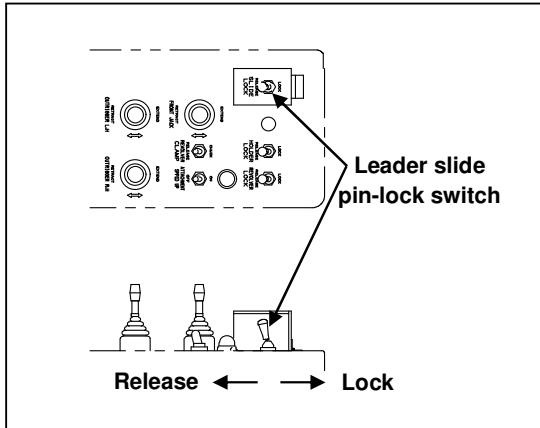



DANGER

Engage the holder lock while erecting and lowering the leader.

5.4.9 Leader slide pin-lock switch

This switch is used to secure the holder when erecting and lowering the leader. Only before the leader is slide to be ready for transportation, remove the leader slide lock pin.



⚠ DANGER

Always "lock" the leader slide lock pin when the leader is uprighted.

5.4.10 Outrigger cylinder lever switch

Outrigger cylinder control lever switches are used to extend or retract the R.H. and L.H. outrigger jack cylinders.

When the lever switch is pulled, the outrigger cylinder is retracted.

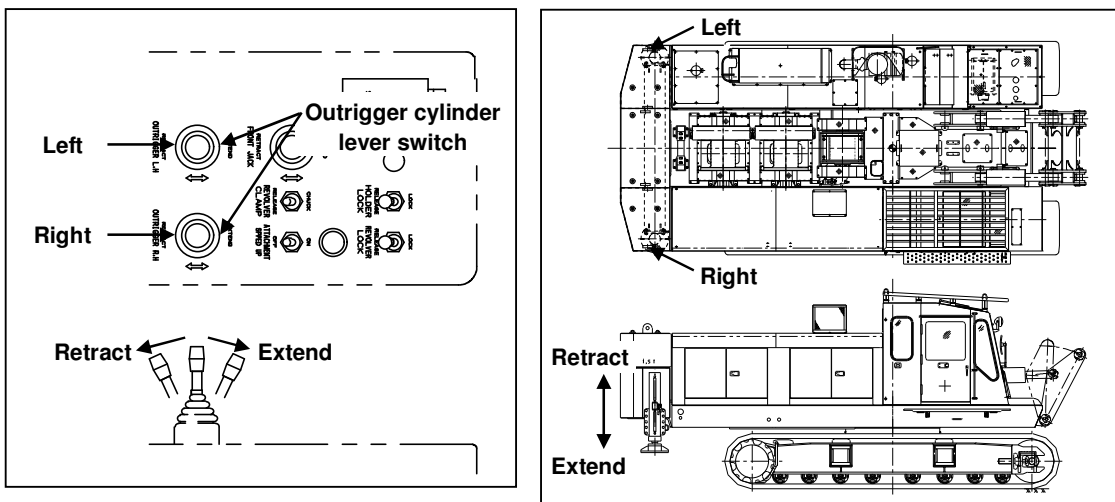
When the lever switch is pushed, the cylinder is extended.

When the lever switch is in neutral, the outrigger cylinders can maintain the position via the double-operated check valve.

Use the outrigger jack to prevent the upper revolving superstructure from oscillating.

This jack fulcrum is not fully dependable.

This jack is regarded as auxiliary equipment to support the machine.

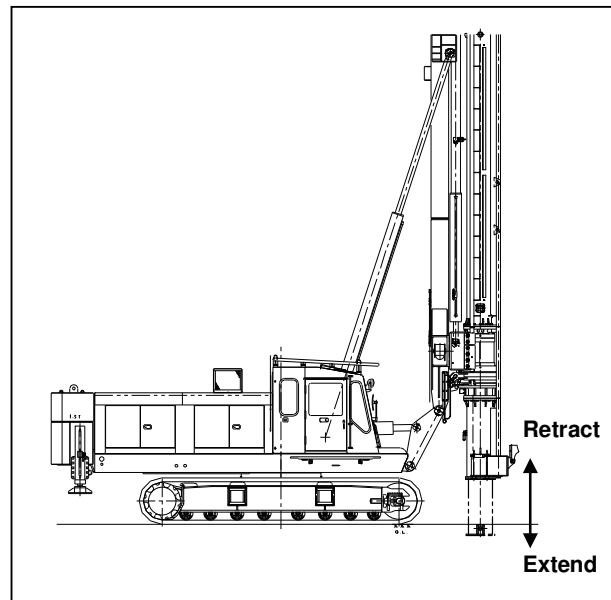
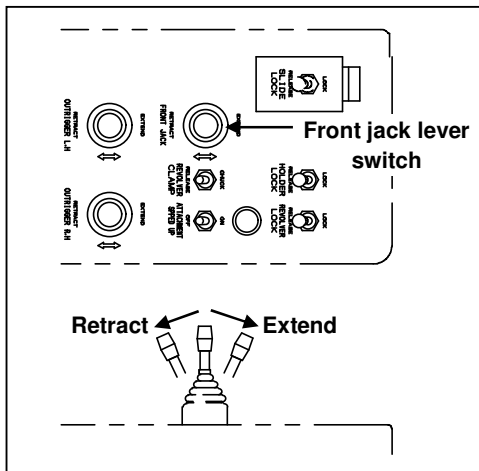


! WARNING

- Use outrigger jacks surely in case of backward batter pile driving for avoiding poor in stability. Not doing so may cause a backward overturn.
- Place an appropriate steel plate on the grounded part of the outrigger.

5.4.11 Front jack lever switch

When using a vibratory hummer, extend the front jack and ensure contact with the ground.
 When the lever switch is pushed, the front jack cylinder extends downward.
 When the lever switch is pulled, the front jack cylinder retracts upward.
 When the lever switch is neutral, the cylinder can keep the position by the double-operated check valve.



CAUTION

- Before rotating the superstructure, make sure to fully retract the front jack. If the superstructure rotates with the jack extended, it may obstruct the crawler and cause damage.

5.4.12 Attachment speed control switch and volume

This switch is used to adjust the flow rate of the hydraulic hammer, hydraulic vibratory hammer, or hydraulic auger.

To adjust the flow rate, push the switch; the lamp turns on.

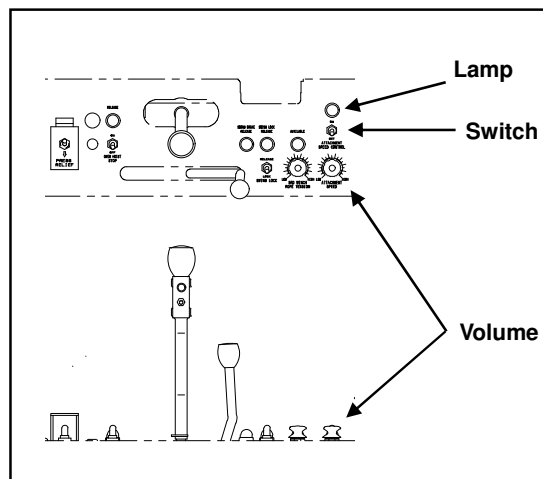
When the switch is pulled, the flow rate cannot be adjusted and the lamp turns off.

By adjusting the volume, the pump flow rate can be set as required.

When the hammer, vibratory hammer, or auger is started, it is recommended that the flow rate be minimized.

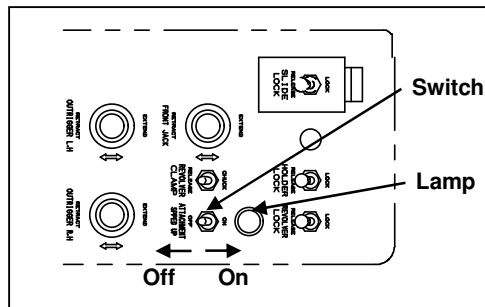
If these are not to be used, it is also recommended to minimize the flow rate.

This will save on energy.



5.4.13 Attachment speed up switch

This switch is used to increase the oil flow rate of the hydraulic vibratory hammer. To increase the flow rate, push the switch; the lamp turns on. When the switch is pushed, the oil flow rate at the oil pressure source junction **INCREASES** from 313 L/min (83 gpm) to 436 L/min (115 gpm). To decrease the flow rate, pull the switch. The lamp turns off. When the winch is operated simultaneously, the pump reduces the oil flow rate automatically; hoisting a load bigger than that is normally allowed by the engine output is possible. If the attachment is not to be used, it is recommended that the flow rate be minimized. This will save on energy.



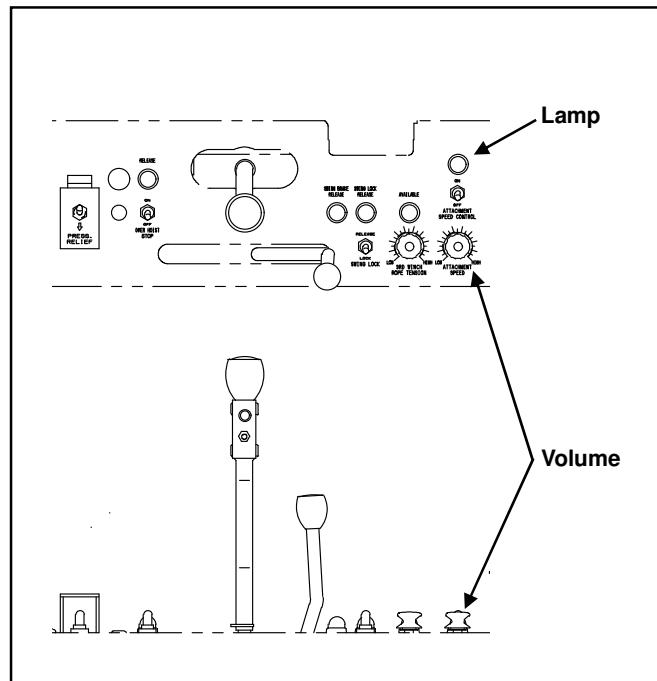
5.4.143rd winch rope tension control volume

This volume is the rope tension control of the third winch.

The lamp turns on when the main winch is in free fall mode, and this volume can then be controlled. The brake force (relief pressure) is set to the minimum, when the lamp turns off. While the lamp turns on, the volume is controllable and the winding force increases if the volume switch is turned clockwise.

As described above, the pushing force of the vibratory hammer can be adjusted by turning the volume.

The volume is used only when adjusting the pushing force of the vibratory hammer.



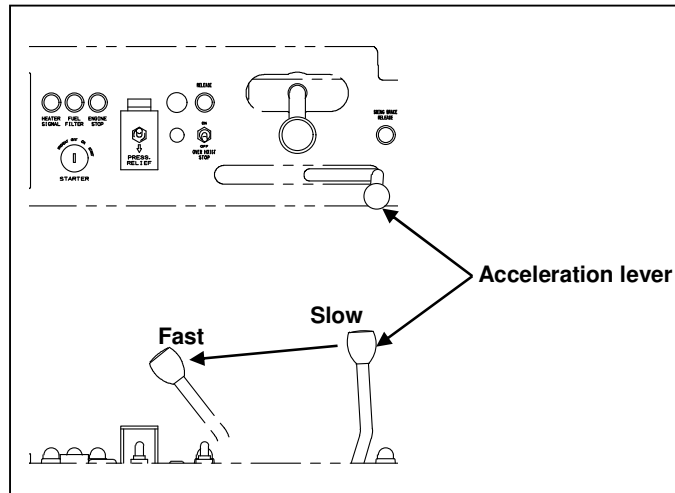
5.4.15 Acceleration lever

When the lever is pulled, the engine revolutions increase and the speed of the operation unit increases. The engine should be started with the acceleration lever at slow speed.



**Do not operate the acceleration lever/pedal abruptly.
This may result in engine trouble.**

The acceleration pedal and lever are linked via the injection pump controller. Set the acceleration lever to the desired position when a constant engine speed is desirable.

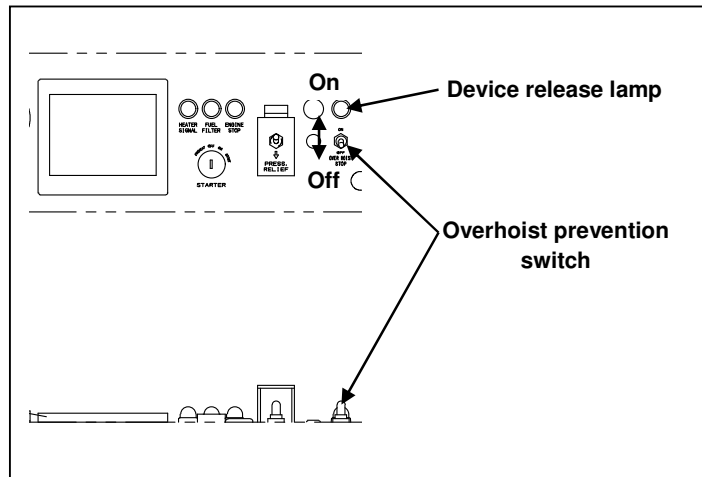


5.4.16 Overhoist prevention switch and the device release lamp

Turning the switch to the "ON" position readies the overhoist prevention device. If the switch is set to the "OFF" position, the device is released and the lamp illuminates.

When the front device (hammer or vibratory hammer or auger) is hoisted to within the specified range before reaching the top sheave section of the leader, the overhoist prevention switch is magnetized so that winding of the drum stops automatically.

While the leader is at vertical position, the overhoist limit switch may operate unexpectedly; the switch should therefore be released.



Keep the switch in the ON position during operation.

5.4.17 Engine starting switch

This switch is used to start the engine.

After inserting the engine key into the starting switch, turn it clockwise to [ON] to switch on the electric power.

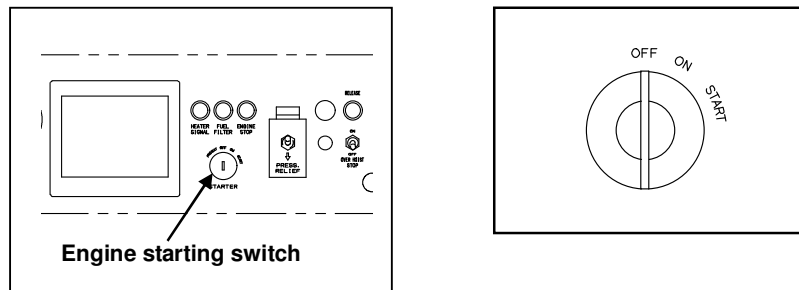
Turn it further to [START] and the diesel engine will start to run.

When the engine starts, release the key which will automatically return to the [ON] position.

Keep the engine key in the [ON] position while operating the machine.

When the diesel engine is cold in winter, turn the engine key clockwise to [ON]. The heater signal lamp blinks to heat the glow plugs in the cylinder head and facilitate starting the engine.

Turn the engine key to the [OFF] position to stop the diesel engine and turn off the electric power.

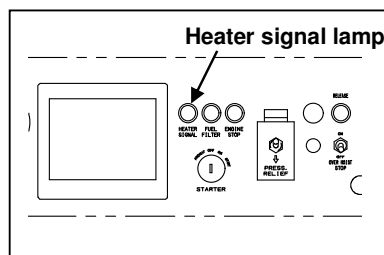


5.4.18 Heater signal lamp

A heater signal lamp is located beside the engine starting switch.

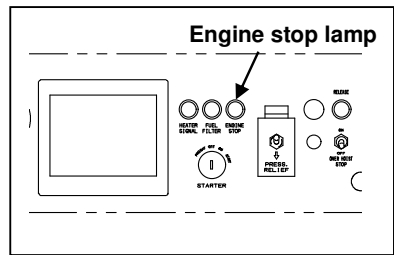
In cold weather, turn the engine key to the [ON] position; the heater signal lamp blinks and the glow plugs are heated.

When preheating is completed, the heater signal will go off.



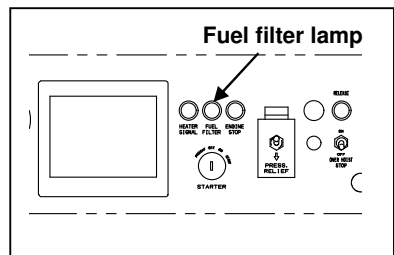
5.4.19 Engine stop lamp

When the engine key is turned to the [ON] position, the engine stop lamp illuminates. After a few seconds, the engine stop lamp turns off. If this lamp illuminates during engine start, this indicates a problem. If the lamp turns on, please call a service technician.



5.4.20 Fuel filter lamp

When the engine key is turned to the [ON] position, the fuel filter lamp illuminates. After a few seconds, fuel filter lamp turns off. If this lamp turns on during engine start, please check the fuel filter.

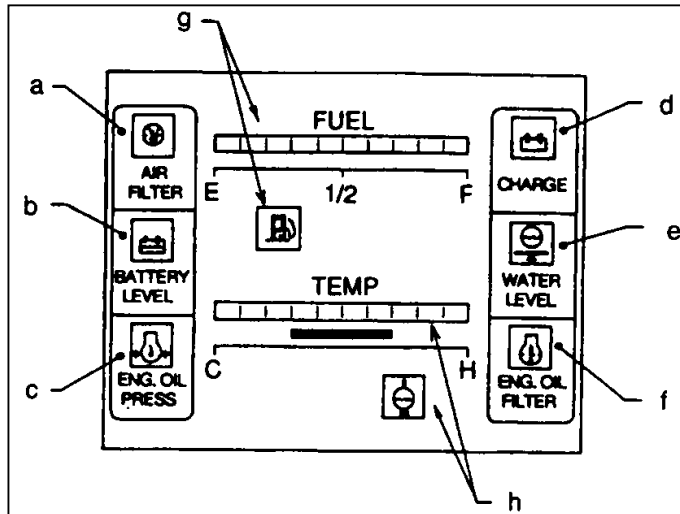


5.4.21 OK monitor

The OK monitor display is located on the L.H. lever stand to provide a warning in the event of a failure.

During operation, all fault lamps go off and the fuel level gauge and water temperature gauge illuminate.

All fault lamps on the monitor panel illuminate when the start switch turns on.

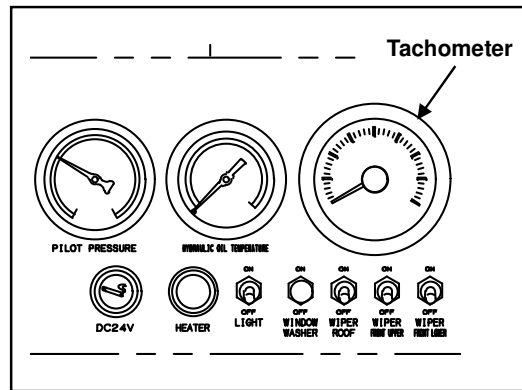


a	Air filter clogging	This lamp illuminates when the air filter element is clogged. Clean the filter element or replace it.
b	Battery electrolyte level	This lamp illuminates when the electrolyte level becomes too low. Check its level and replenish if necessary.
c	Engine oil pressure	This lamp illuminates when the engine lube. Oil pressure becomes too low. Check the engine oil level and quantity. The lamp goes out when the engine lube. Pressure reaches 0.5 kg/cm ² and higher.
d	Battery charging lamp	This lamp indicates the charged state of the battery. The lamp illuminates if the battery does not charge when the engine is running.
e	Coolant level	This lamp illuminates when the water level in the radiator falls to too low. Check the water level and replenish the water if necessary.
f	Engine oil filter	This lamp illuminates when the engine oil filter element is clogged. Replace the filter element if necessary.
g	Fuel level gauge	This meter indicates the quantity of fuel in the tank. Replenish with diesel fuel if necessary.

h	Engine water temperature gauge	<p>This gauge indicates engine water temperature.</p> <p>The lamp beneath the temperature gauge illuminates when the temperature is outside the safe operation range.</p> <p>Check coolant level, fan-belt loosening or radiator fin clogging.</p>
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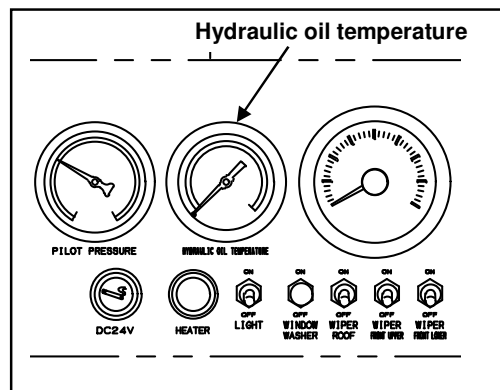
5.4.22 Tachometer

A tachometer is located at the rear of the L.H. panel stand and indicates the engine speed (R.P.M).



5.4.23 Hydraulic oil temperature gauge

The gauge is located beside pilot oil pressure gauge and indicates the hydraulic oil temperature. The correct temperature range of hydraulic oil is 20 to 80 °C. If the hydraulic oil temperature is outside the range 20 to 80 °C, refer to the section related to handling in severe climatic conditions.

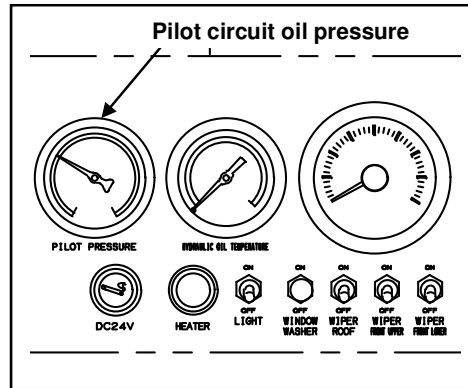


5.4.24 Pilot circuit oil pressure gauge

This gauge is located on the L.H. panel stand and indicates the hydraulic oil pressure in the pilot circuit.

The gauge indicates 6.9 to 7.4MPa within several seconds of starting the engine.

- **When the engine stops, no oil is supplied to the accumulator provided in the pilot circuit and the oil pressure shown on the gauge drops gradually.**

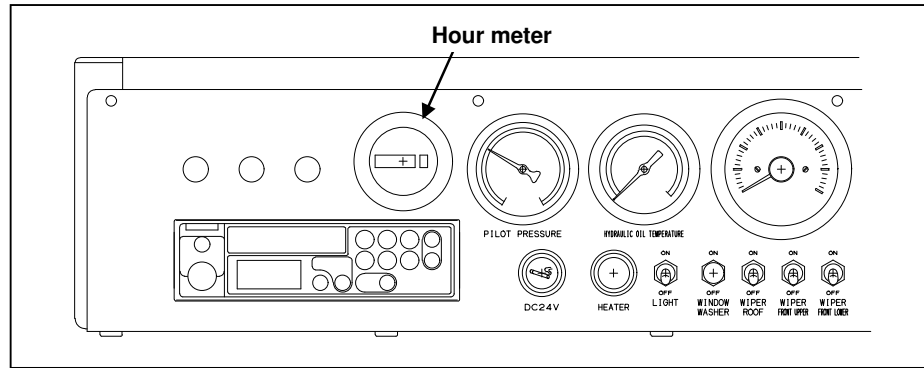


Insufficient oil pressure can cause unexpected disengaging of the drum clutches.

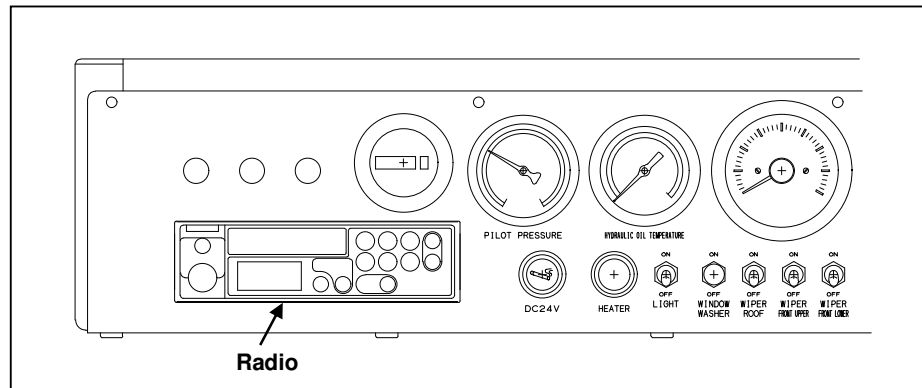
**The operator must always observe that the gauge indicates 6.9 to 7.4 MPa.
Stop operating the machine if the gauge indicates an incorrect oil pressure range.**

5.4.25 Hour meter

An hour meter indicates the total service hours of the engine. Periodical inspection and maintenance service of every device shall be carried out in accordance with the time indicated on the counter.



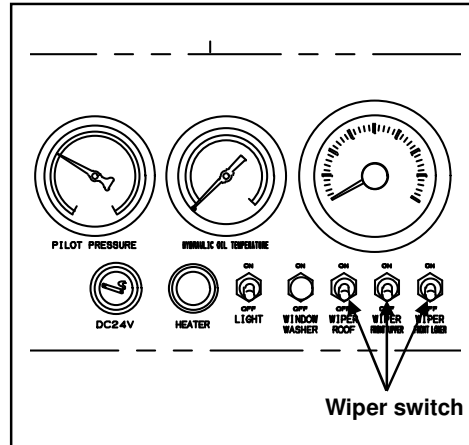
5.4.26 Radio



5.4.27 Wiper switch

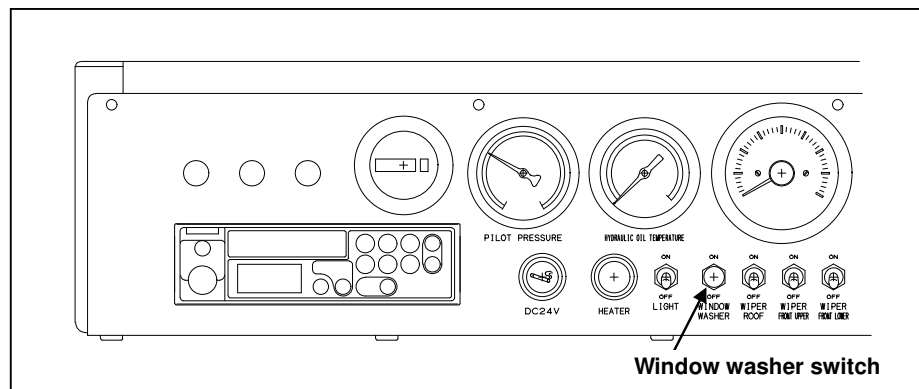
The switches are used to operate wipers.

- The wipers are located on the front shield and the roof window.



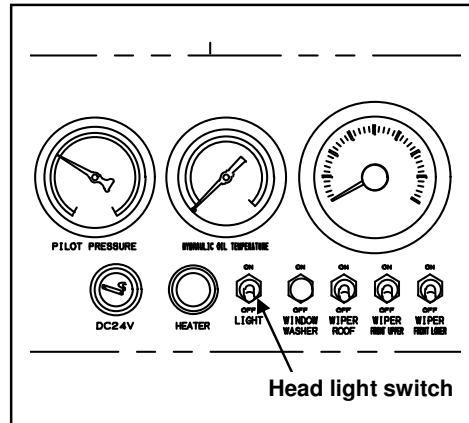
5.4.28 Window washer switch

The push button switch is used to wash the front shield.
When the switch is pressed, window washer comes out.



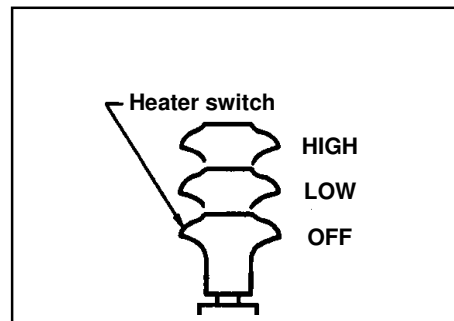
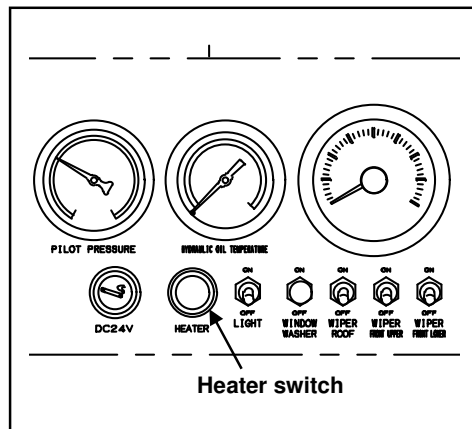
5.4.29 Head light switch

The switch is used to operate the head lights.



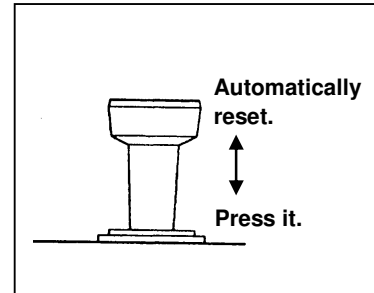
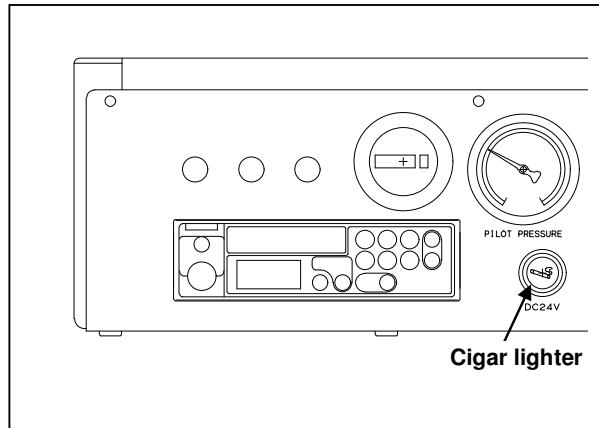
5.4.30 Heater switch

The switch is used to control the temperature of the heater and to turn it on and off.



5.4.31 Cigar lighter

When the button is pressed, the cigar lighter is activated; when the heater becomes hot, the button is automatically reset.

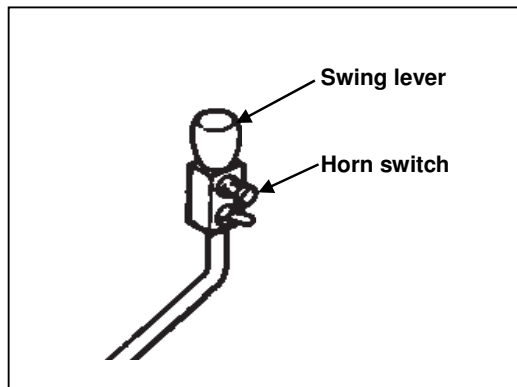


CAUTION

If the button is not reset after 30 seconds, pull it out. Leaving the button as it is may damage wiring.

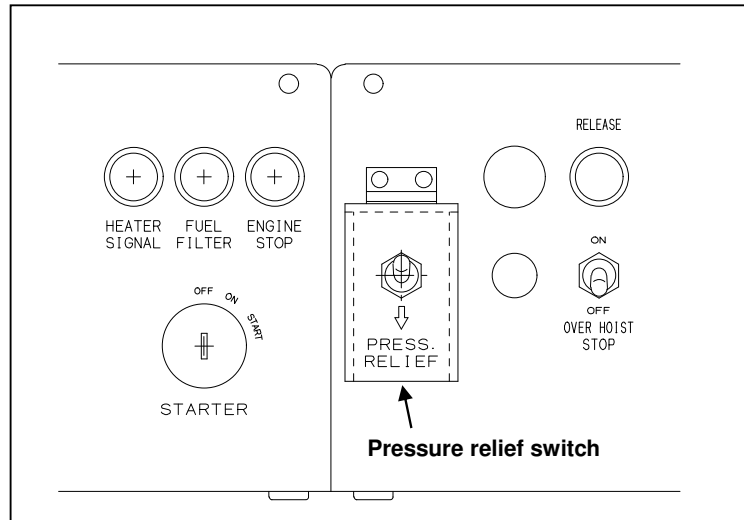
5.4.32 Horn switch

When the switch is pressed, an electrical horn sounds.



5.4.33 Pressure relief switch

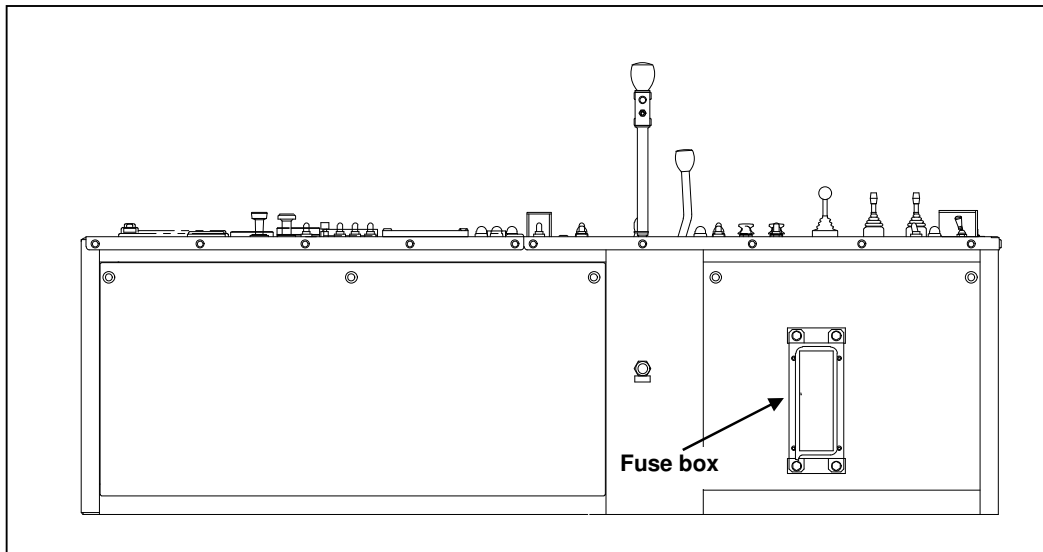
The switch is used to release pressure from the revolver lock, slide lock, holder lock, and vibratory clamp, allowing the couplings to be installed/removed easily.



Make sure to use the pressure relief switch only during assembly and/or disassembly. Avoid using it during operation.

5.4.34 Fuse box

The fuse box protects each of electrical equipment.
Before replacing with a new fuse, check causes and fix them.



 **CAUTION**

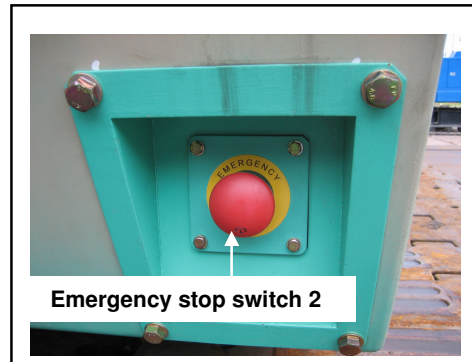
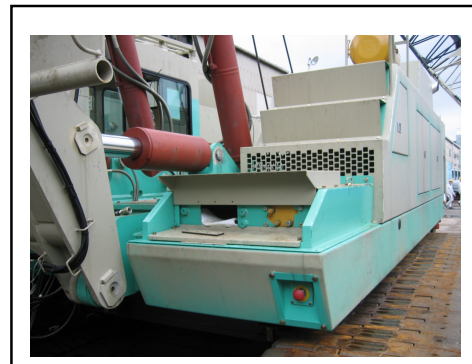
- **Never use fuses with different capacities.
Using fuses with different capacities may cause equipment malfunction and burnt wiring.**

5.5 Emergency stop switch

This is Emergency switch. The switch should not be pushed during normal operation. When this switch is pushed, the engine will stop. To reset the switch, turn it. But before resetting, make sure that all levers at the operator's seat are in the neutral position and the brake pedal is pressed and that the acceleration lever is set to slow.



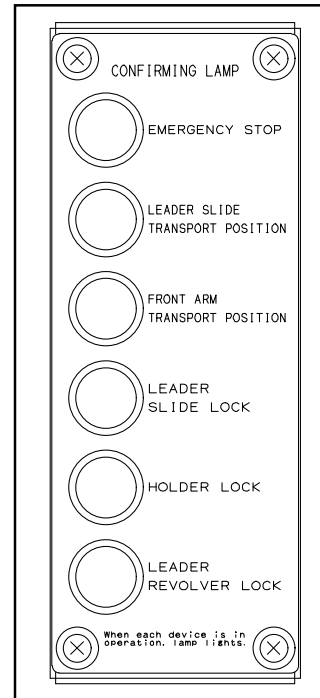
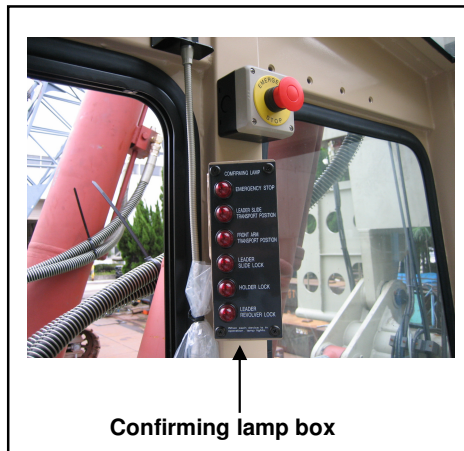
Installed in the operator's room



Installed on the left side of the room

5.6 Confirming lamp box

There are 6 kinds of confirming lamp.



5.6.1 Emergency stop lamp

Emergency stop switch turns on when pressed.

Under normal conditions, this lamp turns off.

Even if the emergency stop switch does not turn on when pressed, the light bulb may have burnt out. In such cases, please change the light.

5.6.2 Leader slide transport position lamp

During operation, this lamp turns off.

When erecting and transporting the leader, the lamp turns on. (See further details in the section related to erecting and lowering the leader.)

Even if the lamp does not turn on when the leader is in the transport position, the light bulb may have burnt out. In such cases, please change the light.

5.6.3 Front arm transport position lamp

When the front arm is slid to front and is in the transport position, this lamp turns on. This lamp turns on during operation and turns off otherwise. (See further details in the section related to erecting and lowering the leader.)

Even if the lamp does not turn on when the front arm is in the transport position, the light bulb may have burnt out. In such case, please change the light.

5.6.4 Leader slide lock lamp

The lamp turns on when the leader slide lock pin is inserted.

The lamp turns on during operation and turns off when erecting and transporting the leader. (See further details in the section related to erecting and lowering the leader.)

Even if the lamp does not turn on when the leader slide lock pin is inserted, the light bulb may have burnt out. In such cases, please change the light.

5.6.5 Holder lock lamp

The lamp turns on when the leader holder lock pin is inserted.

When the leader is in the transportation position, the operator should insert the leader holder lock pin so that the lamp illuminates.

This lamp turns on when erecting and transporting the leader. (See further details in the section related to erecting and lowering the leader.)

Even if the lamp does not turn on when the leader holder lock pin is inserted, the light bulb may have burnt out. In such cases, please change the light.

5.6.6 Leader revolver lock lamp

The lamp turns on when the leader revolver lock pin is inserted.

The leader should not be rotated when the diesel hammer and/or hydraulic hammer is installed. When the diesel hammer and/or hydraulic hammer are operating, the leader revolver lock lamp turns on.

The leader can be rotated when the hydraulic vibratory and/or hydraulic auger are operating. Before the rotation of the leader, the operator should remove the leader revolver lock pin, so that the lamp turns off. (See further details in the section related to erecting and lowering the leader.)

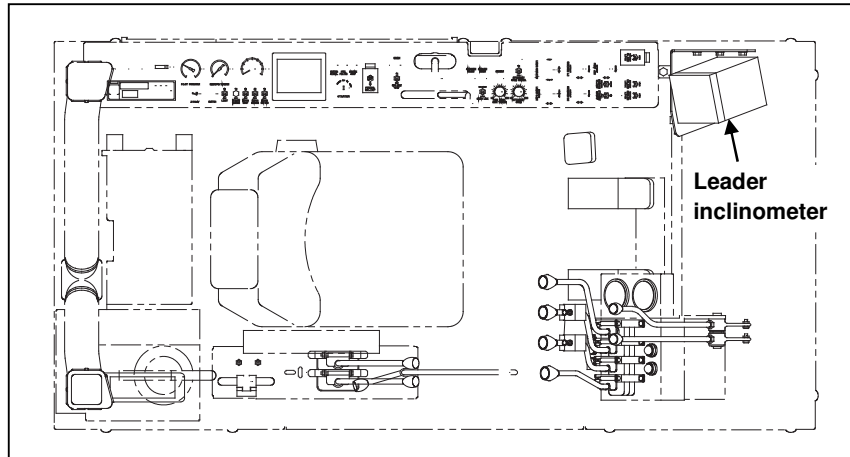
Even if the lamp does not turn on when the leader revolver lock pin is inserted, the light bulb may have burnt out. In such cases, please change the light.

5.7 Leader inclinometer

The leader inclinometer is used to detect (using the sensor installed on the leader main body) and display the inclination angle, and sound an alarm.

The display angle is within the range of 0 to $\pm 5^\circ$.

- For further detail on the operating procedure, refer to section "6.4.4 Inclinometer".



WARNING

It is dangerous to carry out work with the main body inclined laterally. Under this condition, excessive force may be applied to each part of the machine. Make sure to keep the work foundation level as long as possible.



Chapter 6

Operation procedure

This section describes the procedures which are required for using the machine. Refer to chapter "5 Controls section" for the function of the controls and instruments.

6.1 Prior to operation

6.1.1 Inspection prior to operation

An inspection must be carried out prior to daily operation.

This inspection is important not only in order to prevent accidents but to ensure efficiency of the operation.

This inspection must be carried out according to the instructions in section "7.2.1 Inspection before starting operation".

Once the inspection has been carried out normally, the engine can be started according to section "6.2 Operating the machine".

6.2 Operating the machine

6.2.1 Before starting the engine

After completing section "6.1.1 Inspection prior to operation", the following preparations are required.

1. Read operator's manual carefully.
2. Confirm that the brakes (including winches and swing brakes) and locks are activated.
3. Set the control levers (of winches, swing and motors) in neutral position.
4. Check that nobody is within the operating radius of the machine.

6.2.2 Starting the engine

1. The engine can be started with the following procedures.
 - a. Insert the engine key into the ignition switch, and then turn it to the "ON" position (first stage).

Two signal lamps (Fuel filter and Engine stop lamps) turn on and one signal lamp (Heater signal lamp) turn on momentarily and then off again. Wait until these lamps go off before proceeding.
 - b. Turn the ignition switch one step further until the engine starts.
 - c. Release the engine key free when the engine has started; the key will return to "ON" position automatically.



- **Before starting the engine, check that nobody is within the operating radius of the machine. Sound the horn if necessary.**

- **The starting motor should not be operated continuously for more than 15 seconds. Doing so may overheat the motor, causing it to fail, or may run down the battery.**
- **If the engine can not be started at first attempt, wait at least 30 seconds before trying again.**
- **When the engine is running, maintain the starting switch in the "ON" position.**

6.2.3 Check points after starting

Check the following points when the engine has started.



- **Operating the machine when the engine lubricants are at too low a temperature may cause engine wear and less than optimal performance. The machine should be operated only after the engine has been warmed adequately.**
- **While idling, the inside of the engine is lubricated adequately. Avoid applying any abrupt load to the engine when cold. The same applies to the hydraulic system which is vital to this machine; any heavy load applied while the hydraulic oil temperature is too low may result in damage in the hydraulic equipment.**

1. Keep the engine at low idling speed for at least 5 minutes to warm up the engine.
2. The engine speed is maintained at around 1000 rpm automatically for warming up. When warming up is finished, the engine speed slows automatically around 750 rpm.
3. Check the following during warm-up.
 - a. See that the [Engine oil pressure] lamp on the OK monitor goes off. The lamp will go off when the oil pressure exceeds 0.049 MPa.
 - b. After warm-up, see that the water temperature indicator shows in [Green range] and the hydraulic oil temperature gauge shows 20 to 80 .
 - **Insufficient warm-up may cause excessive engine wear and/or damage to the engine and hydraulic devices.**
 - c. See that the hydraulic oil pressure gauge in the pilot circuit indicates 6.9 MPa. If it is too low, the hydraulic equipment will not perform optimally.
 - d. See if there is any abnormal exhaust gas color, noise, or vibration.
 - e. See if any fault lamp on the OK monitor panel remains illuminated.
 - f. See if any oil, exhaust gas, or water leakage exists.

6.2.4 Inspection during operation

Pay attention to the following during operation.

1. See if any abnormal indication occurs on the OK monitor or temperature gauge.
2. See if any strange noise is generated.
3. See if any oil or water leakage occurs.

6.2.5 Stopping the engine

Stop the engine as follows when finishing work.



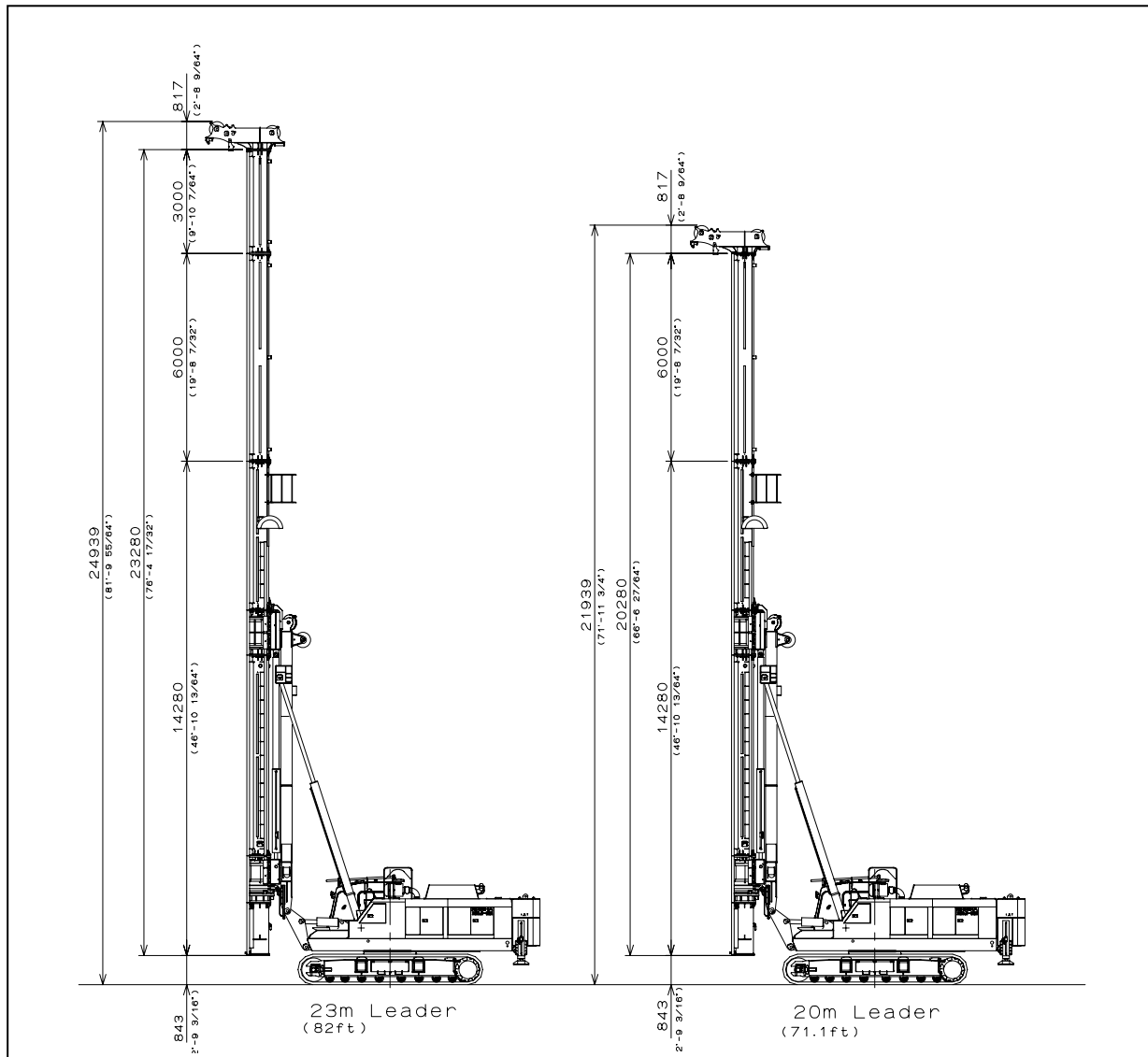
- **Keep the engine at low idling speed for at least 5 minutes before switching off to avoid damaging the turbo charger of the engine. This recommendation does not apply in the case of an emergency.**

1. Keep the engine at low idling speed for at least 5 minutes before switching off.
2. Turn the key to the [OFF] position and the engine will stop. Remove the key.
 - **If no anti-freeze is used in the coolant, then drain off all coolant in cold weather.**

6.3 Assembly and disassembly of the leader

6.3.1 Structure of the leader

The leader (M40D-S) of the DHJ-85 varies in length as follows.



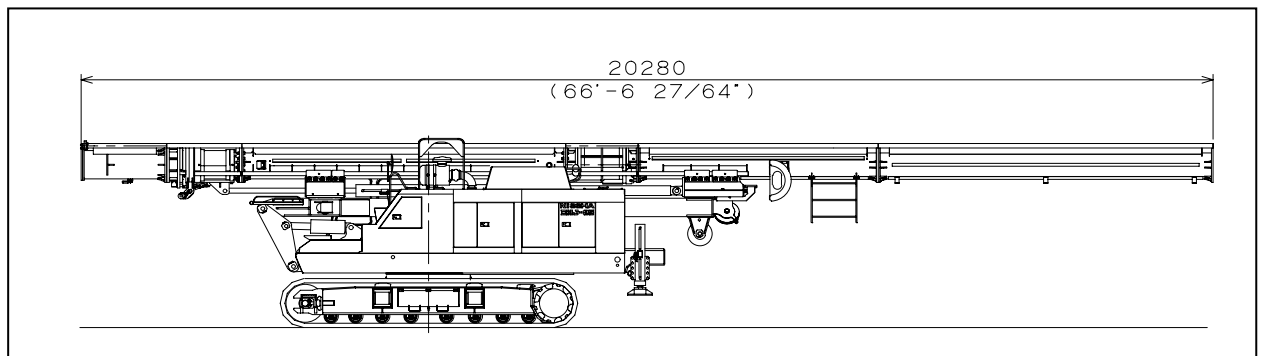
6.3.2 Leader assembly (23 m leader)

WARNING

- When assembling the leader, place the machine on a firm and level surface, allowing enough space for assembly.
- Before starting work, appoint one supervisor, ensuring that he/she is a qualified person. Coordinate working procedures with the supervisor, co-workers and crane operator.
- Cordon off the machine to keep people away.
- Check tools and sling ropes thoroughly prior to assembly work and do not use damaged ropes or tools.

The procedure below applies to the following leader.

- 20 m leader
- without front attachment
- without 10 ton counterweight

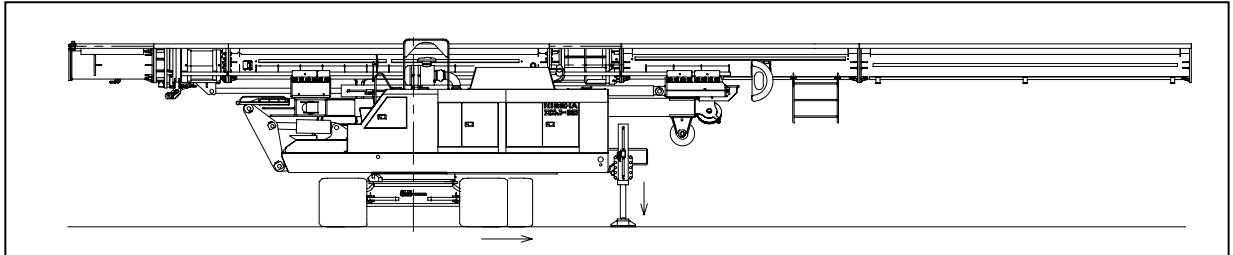


WARNING

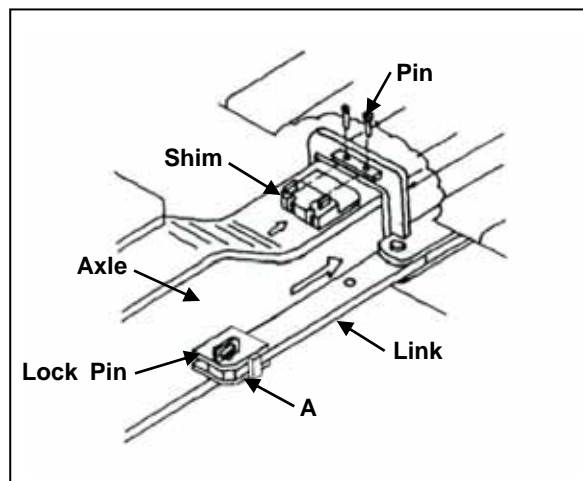
- Both crawlers must be extended before installing the counterweight.
- Do not swing the machine with counterweight installed when both crawlers are retracted.
- Do not operate the machine, when both crawlers are retracted.

1. Extending the crawlers

- a. Place the machine on firm and level ground and swing the upper revolving superstructure such that it is at right angles to the crawlers. Extend the outrigger jacks to **erect** the crawlers.



- b. Remove the pin.
Move the track extension control lever in the operator room to extend the crawler.
- c. After the crawler is extended fully, insert the pin into hole "A".
Insert a shim into the opening and then insert two pins.
 - **When storing shims, each one must be kept in its own holder at four locations to prevent mixing shims of different thickness. Make sure to use a shim of the correct thickness in the correct location.**



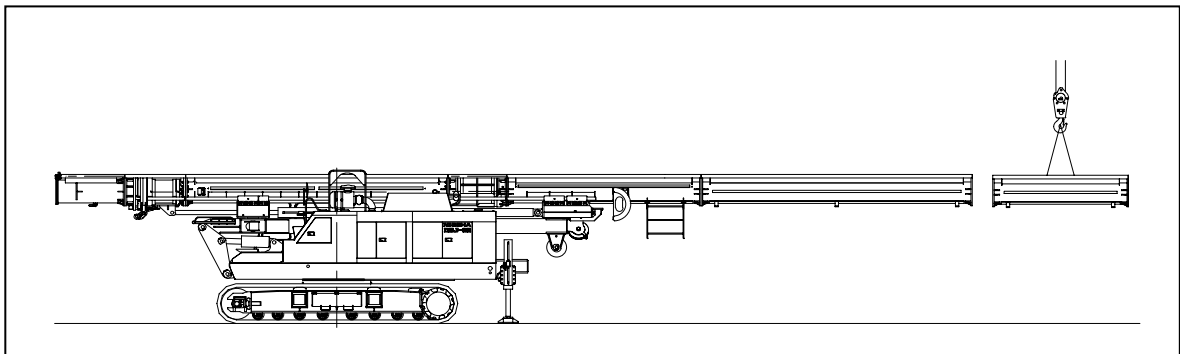
- d. Retract the outrigger jacks and swing the upper revolving superstructure 180°.
- e. Extend the opposite side of the crawler in the same way as described above.
 - **Set the engine speed to low idle (800 to 1000 rpm) when extending the crawlers.**
 - **When retracting the crawlers, follow the steps above in reverse order.**

2. Attaching the leader and cathead

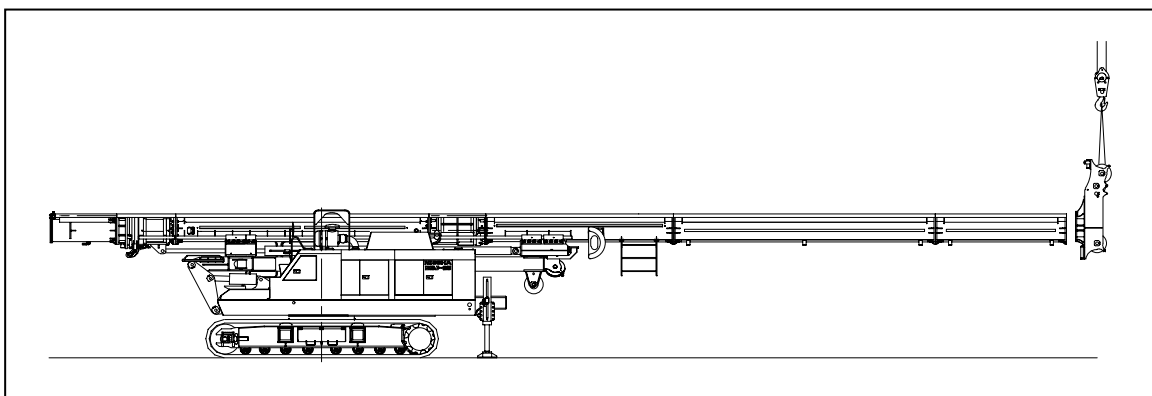
 **WARNING**

- Confirm that all joint bolts and nuts of the leader sections are firmly tightened. (Also check the joint bolts and nuts which were not removed for transportation.)
- Use genuine joint bolts and nuts and tighten them evenly with the specified torque of 690 to 830 Nm on the whole circumference.
- When working on the leader, be careful not to slip and fall from the leader; never jump off the leader.

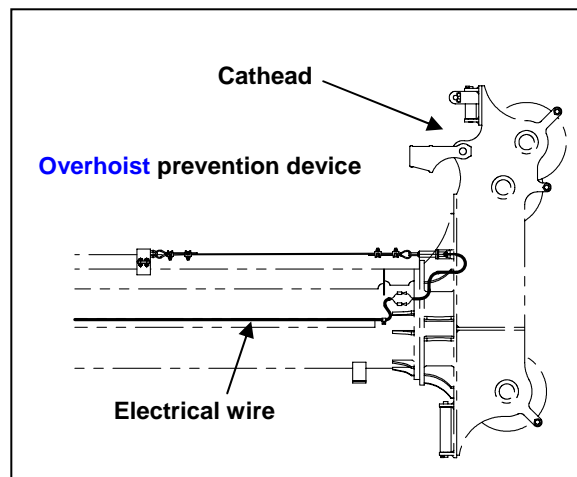
- a. Extend the outrigger jacks until they make contact with the ground.
- b. Connect the leader by using a crane when required.



- c. Mount the cathead by using a crane.



- d.** Install the wire ropes for the main and auxiliary drums. Install the wire ropes into the proper front end attachment, such as the sheaves for **erecting** the hammer, and route them through the cathead. Refer to the hammer manual for assembly instructions.
- e.** Install the **overhoist** prevention device into the cathead.
Connect the electric wire.
This device automatically stops the winch to prevent the front end attachment from **overhoist**.
If necessary, install the **overhoist** prevention device into the auxiliary winch, also.



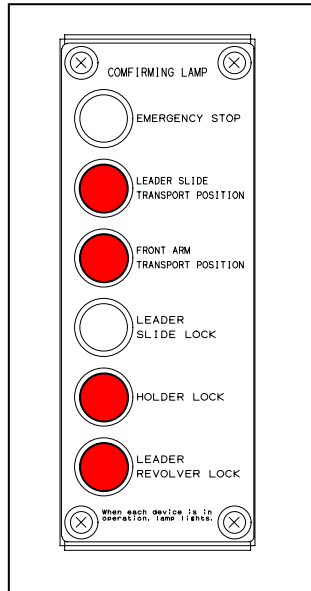
3. Erecting the leader

 **WARNING**

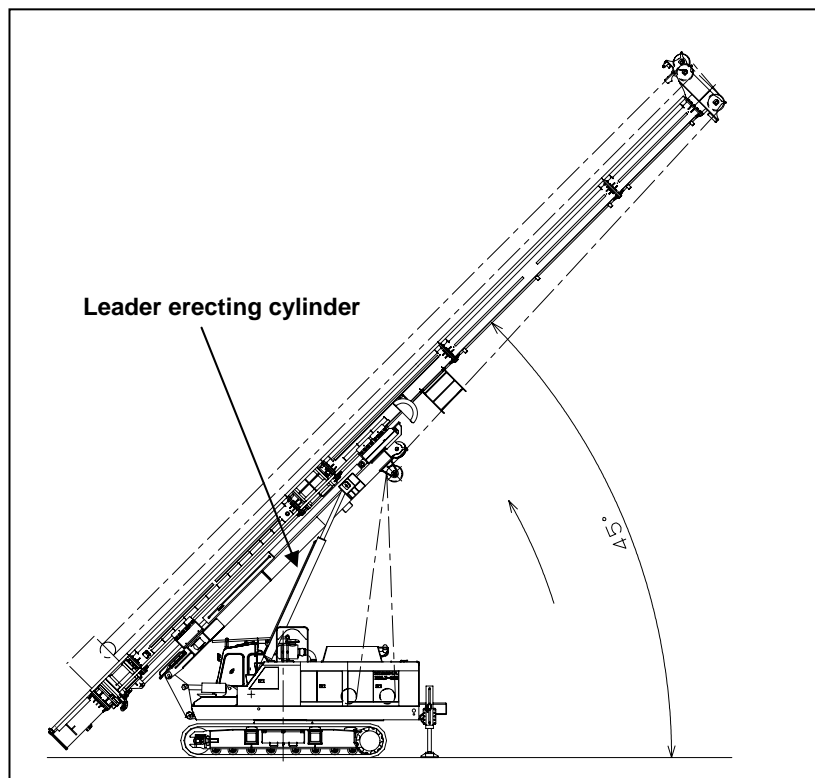
- Check that no tools or parts have been left on the machine or in the enclosure.
- Check that bolts, nuts, pins, sockets, etc. are in place and secure.
- Check that all wire ropes are properly routed through the sheaves and have not become twisted or entangled.

- a.** Extend the outrigger jacks until they touch the ground.
- b.** Check to see that the revolver lock pin and holder lock pin are engaged.

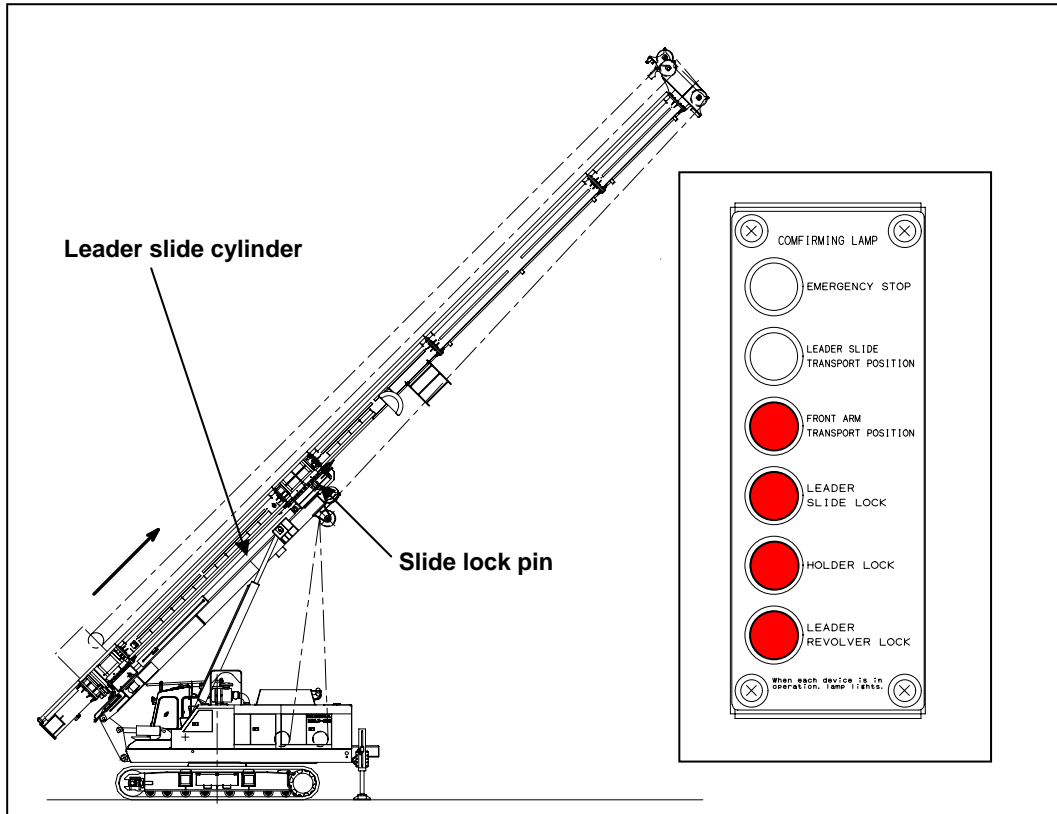
- c. Check the lighting pattern of the confirming lamp box in the operator's room. The lighting pattern is as follows.



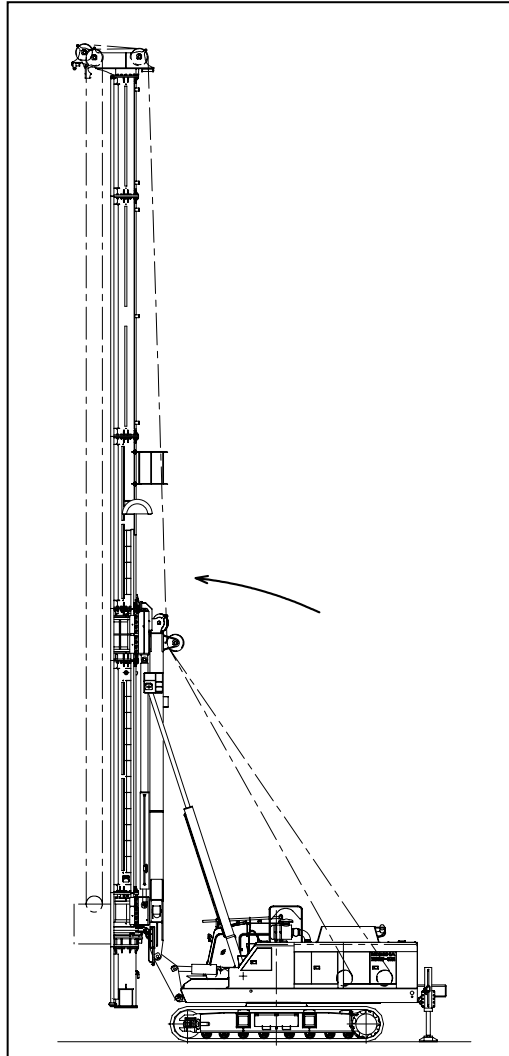
- d. Erect the leader with the leader erecting cylinder. When erecting the leader, check that the hoses and ropes are free to rise with the leader.
- e. When the angle of the leader is 45°, it will stop erecting.



- f.** Slide upward the leader to the full extent via the leader slide cylinder.
- g.** Turn on the slide pin-lock switch.
- h.** Slide the leader downward slightly, until you hear the pin engage.
- i.** Check the lighting pattern of the confirming lamp box, as follows.



- j.* Erect the leader to the vertical position via the leader erecting cylinder.
When operating the leader erecting cylinder, ropes must be unwound manually.

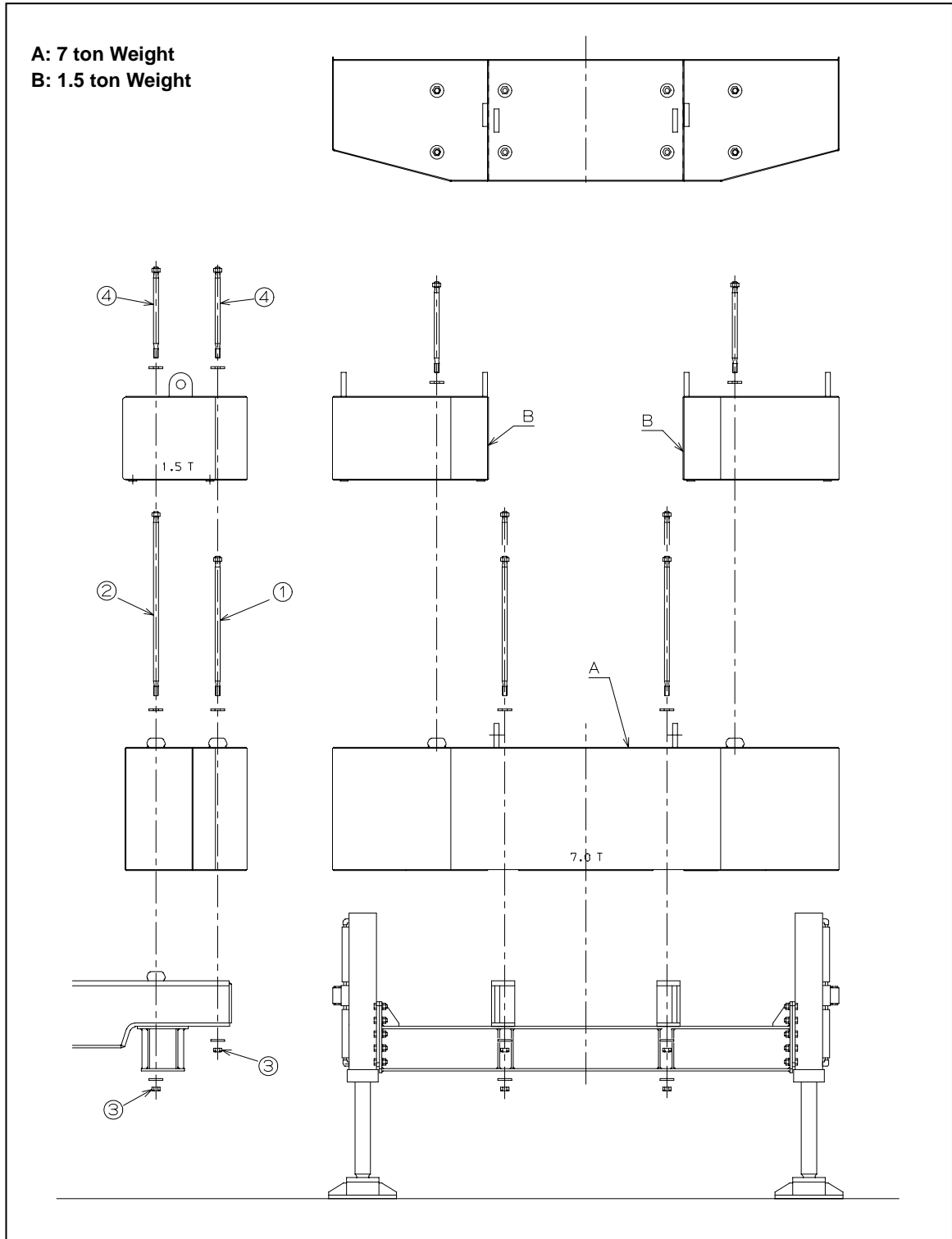


4. Installing the counterweight

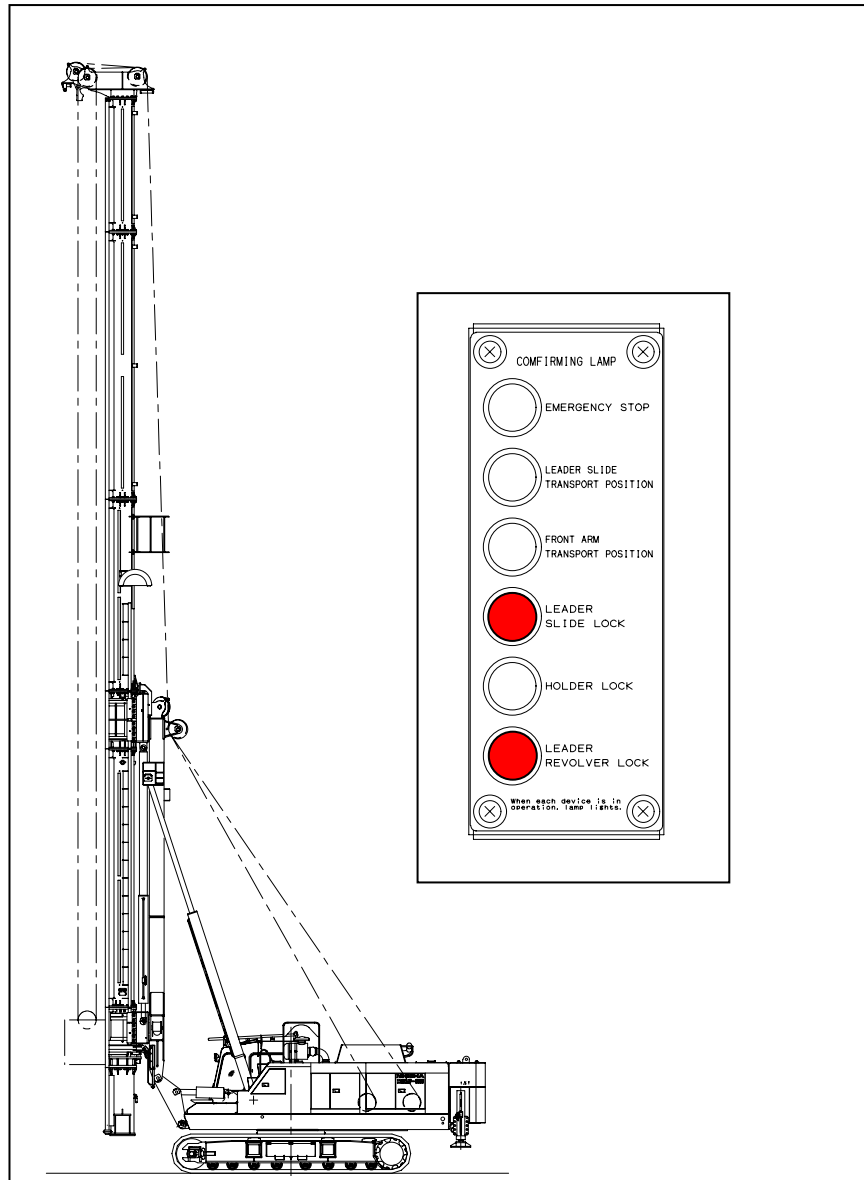
 **WARNING**

- Do not install a counterweight larger than the one specified.
- Extend the outrigger jacks until they touch the ground.
- Place the machine on firm and level ground when installing the counterweight.
- Use proper sling devices with adequate lifting capacity and check to see that none is damaged before use.

- a. Install weight A (7 ton) to main frame and secure it with bolt , and nut .
 - b. Install weight B (1.5 ton) onto the weight A and secure it with bolt .
- The required tightening torque of these bolts is 1261 to 1535 Nm.



5. After erecting the leader
 - a. After erecting the leader, release the holder lock pin. Check the lighting pattern of the confirming lamp box as follows.
 - b. The revolver lock pin is always locked. To rotate the leader, release the lock pin.



6. Installing the front end attachment

Follow the instruction manuals of the front end attachment, such as diesel hammers, when fixing them to the leader.

6.3.3 Leader disassembly

Read the instruction manuals of front end attachments such as diesel hammer before disassembly from the leader.

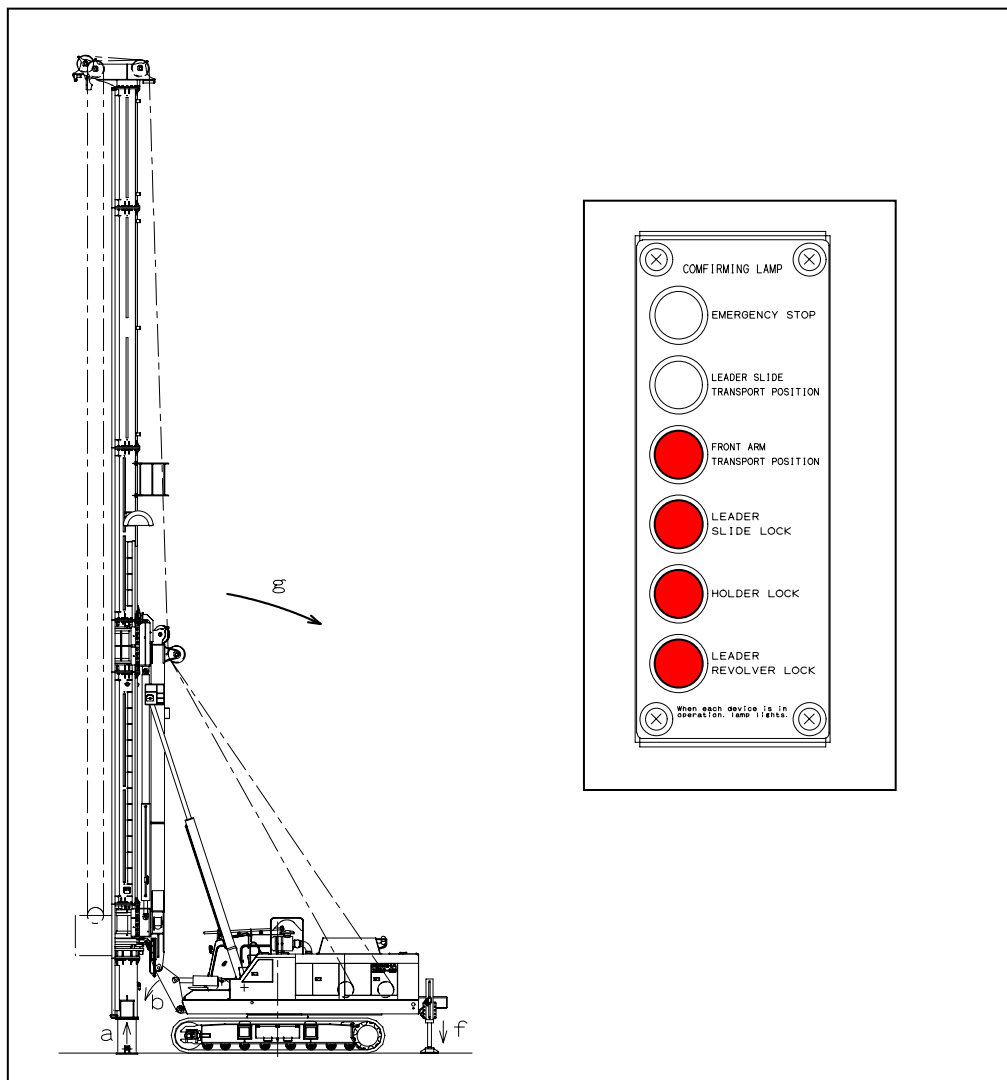
Disassemble the leader as follows:



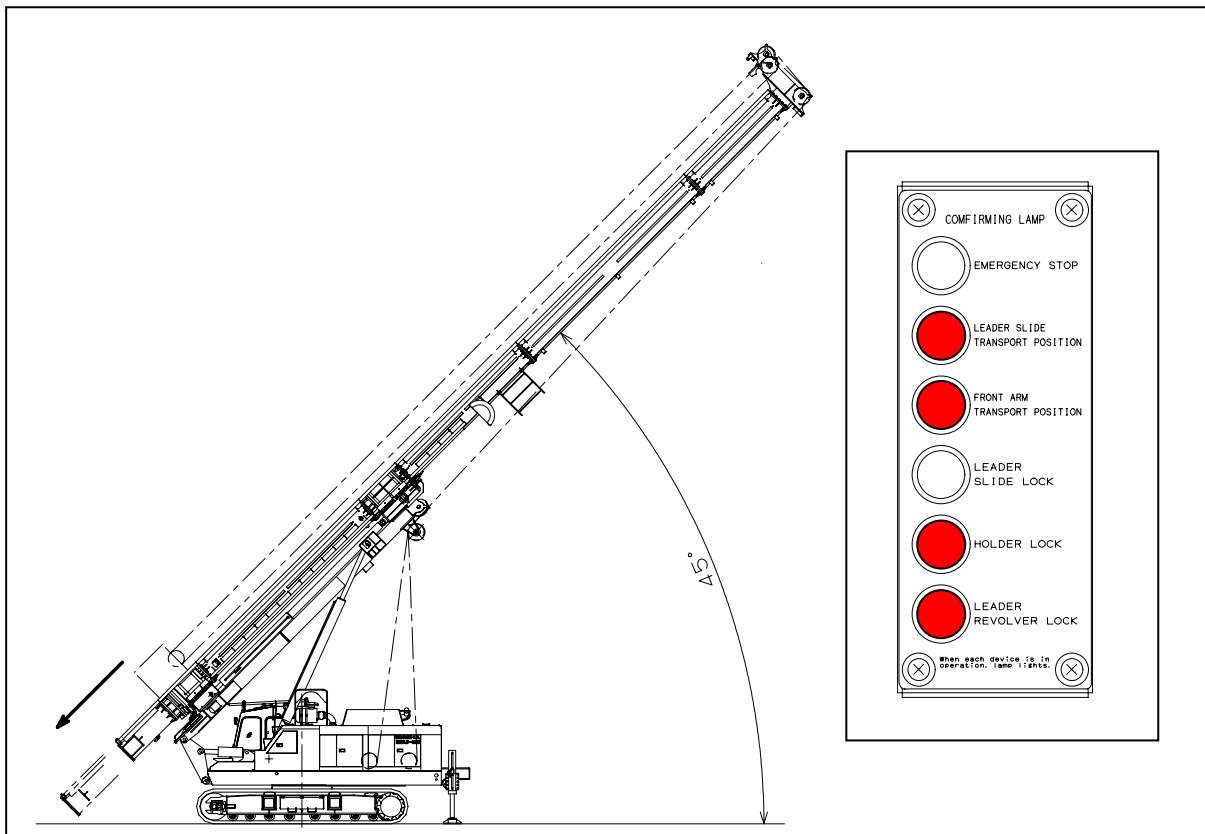
- **When disassembling the leader, place the machine on a firm and level surface, allowing enough space for disassembly.**
- **Before starting work, appoint one supervisor, ensuring that he/she is a qualified person. Coordinate working procedures with the supervisor, co-workers and crane operator.**
- **Cordon off the machine to keep people away.**
- **Check tools and sling ropes thoroughly prior to disassembly work and do not use damaged ropes or tools.**

- 1.** Taking down the counterweight
 - a.** Extend the outrigger jacks until they touch the ground.
 - b.** Take down the 1.5 ton weight. (Refer to the illustration in section 6.3.2-4)
 - c.** Take down the 7 ton weight. (Refer to the illustration in section 6.3.2-4)

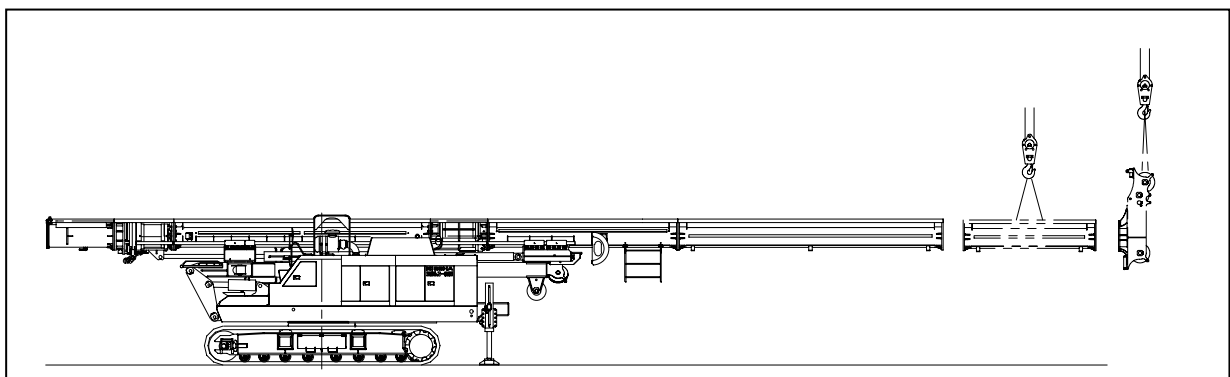
2. Lowering the leader
 - a. Retract the front jack fully.
 - b. Extend the Leader horizontal adjustment cylinder fully and move the leader forward. Check that the "FRONT ARM TRANSPORT POSITION" lamp is illuminated.
 - c. Engage the holder lock and check that the "HOLDER LOCK" lamp is illuminated.
 - d. Engage the revolver lock and check that the "LEADER REVOLVER LOCK" lamp is illuminated.
 - e. Position the leader vertically by moving the lateral inclination cylinder.
 - f. Extend the outrigger jacks until they touch the ground.
 - g. Lower the leader slowly and carefully, until it is at an angle of 45°. When operating the leader erecting cylinder, the ropes must be wound manually.



- h.** When the leader is being lowered, the leader stops at 45° automatically.
- i.** Release the slide lock pin and check that the confirming lamp turns off.
- j.** Slide the leader downward fully, and check that the confirming lamp is illuminated.
- k.** When the lighting pattern of the confirming lamp box is as follows, the leader can be lowered.



- l.** Remove the wire ropes, cathead, and leader.



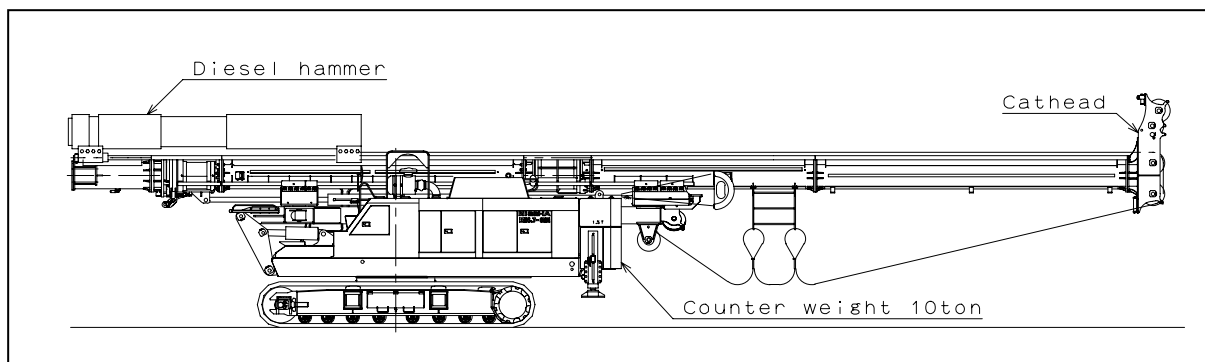
6.3.4 Erecting the leader with front attachment (20 m leader)

WARNING

- When erecting the leader, place the machine on a firm and level surface, allowing enough space to erect the leader.
- Before starting work, appoint one supervisor, ensuring that he/she is a qualified person. Coordinate working procedures with the supervisor, co-workers and crane operator.
- Cordon off the machine to keep people away.
- Check tools and sling ropes thoroughly prior to erecting work and do not use damaged ropes or tools.

The procedure below applies to the following leader.

- 20 m leader with cathead
- with front attachment (Diesel hammer)
- with 10 ton counter weight

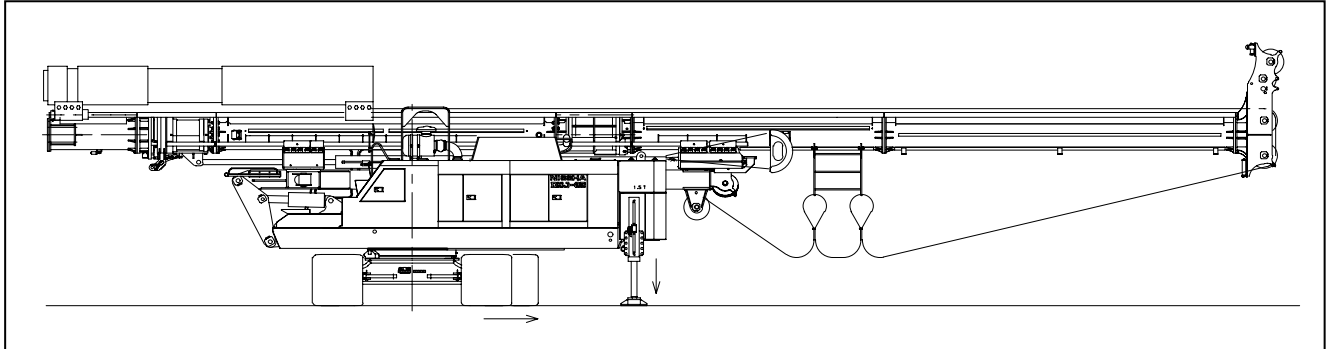


WARNING

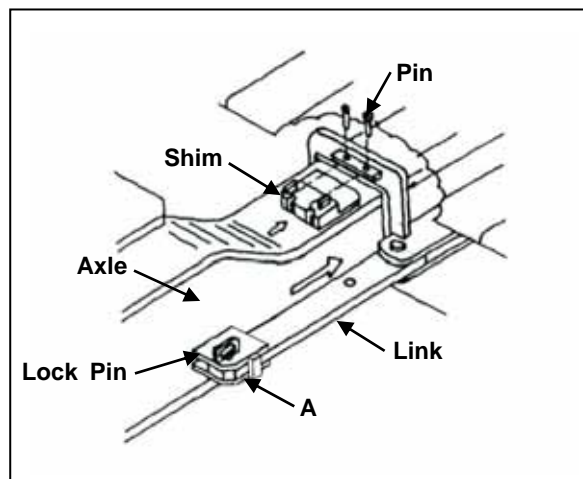
- Do not slide the leader backward when the machine is in the state shown in the above illustration. Sliding the leader backward can cause the machine to fall over backward.
- Do not swing the machine with counterweight installed when both crawlers are retracted.
- Do not operate the machine, when both crawlers are retracted.

1. Extending the crawlers

- a. Place the machine on firm and level ground and swing the upper revolving superstructure such that it is at right angles to the crawlers. Extend the outrigger jacks to **erect** the crawlers.



- b. Remove the pin.
Move the track extension control lever in the operator room to extend the crawler.
- c. After the crawler is extended fully, insert the pin into hole "A".
Insert a shim into the opening and then insert two pins.
 - **When storing shims, each one must be kept in its own holder at four locations to prevent mixing shims of different thickness. Make sure to use a shim of the correct thickness in the correct location.**



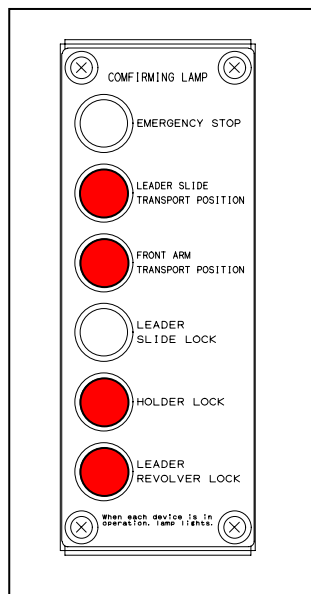
- d. Retract the outrigger jacks and swing the upper revolving superstructure 180°.
- e. Extend the opposite side of the crawler in the same way as described above.
 - **Set the engine speed to low idle (800 to 1000 rpm) while extending the crawlers.**
 - **When retracting the crawlers, follow the steps above in reverse order.**

2. Erecting the leader

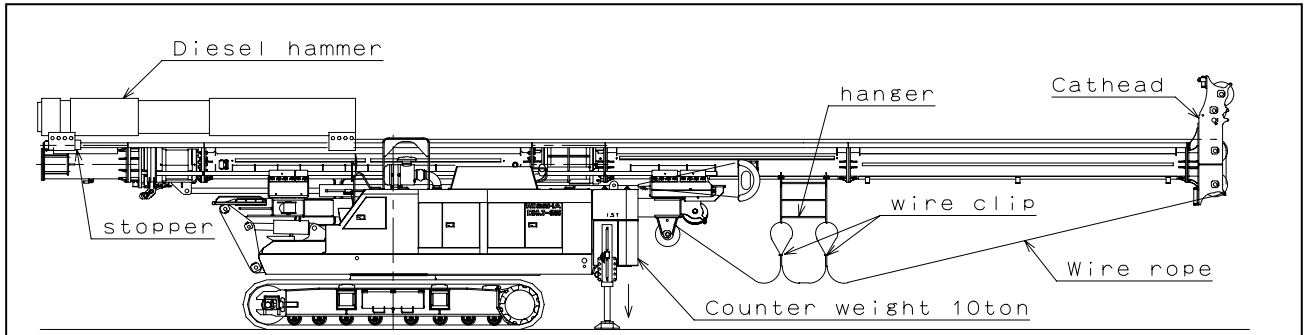


- Check that no tools or parts have been left on the machine or in the enclosure.
- Check that bolts, nuts, pins, sockets, etc. are in place and secure.
- Check that all wire ropes are properly routed through the sheaves and have not become twisted or entangled.

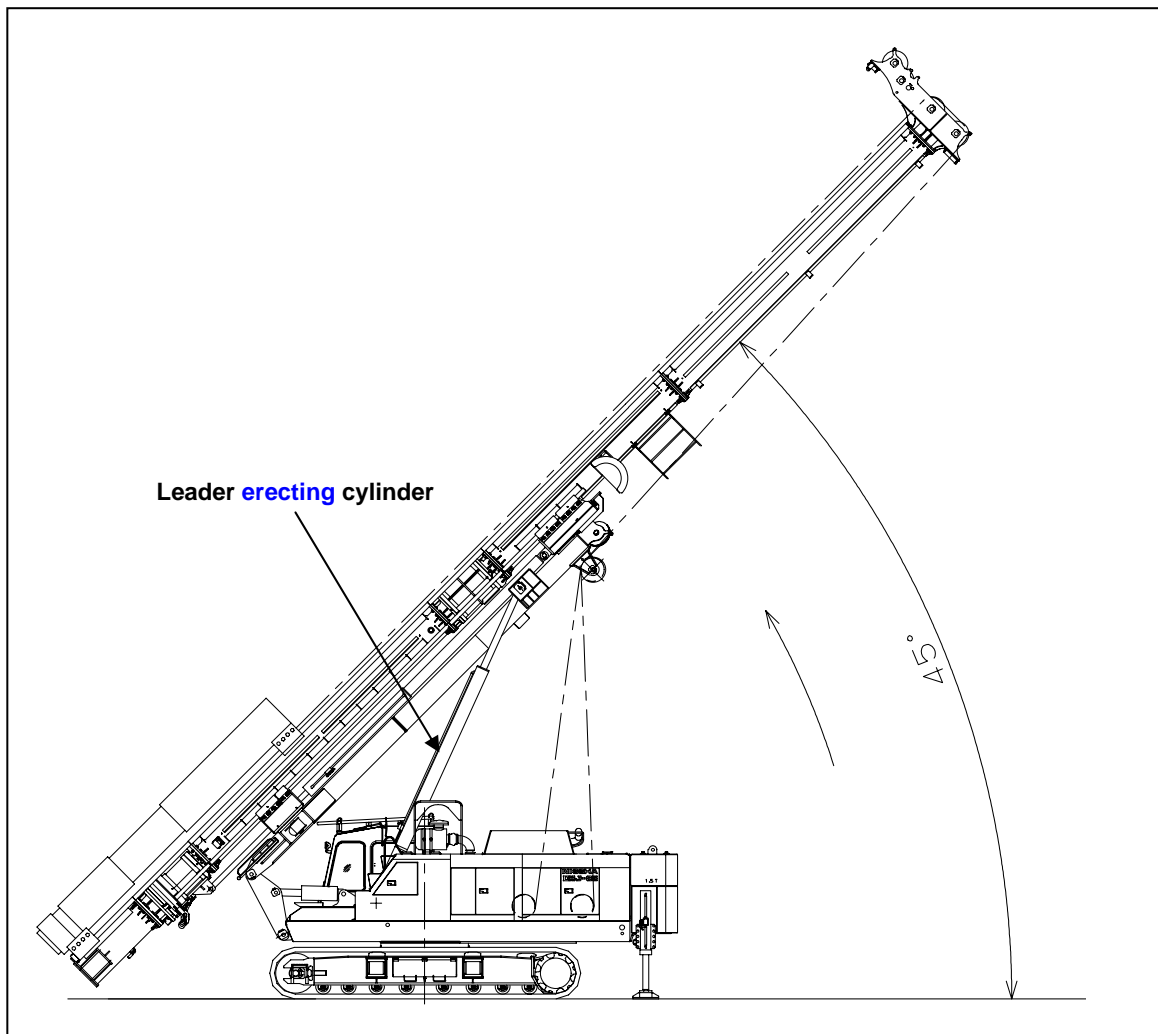
- a. Extend the outrigger jacks until they touch the ground.
- b. Check to see that the revolver lock pin and holder lock pin are engaged.
- c. Check the lighting pattern of the confirming lamp box in the operator's room. The lighting pattern is as follows.



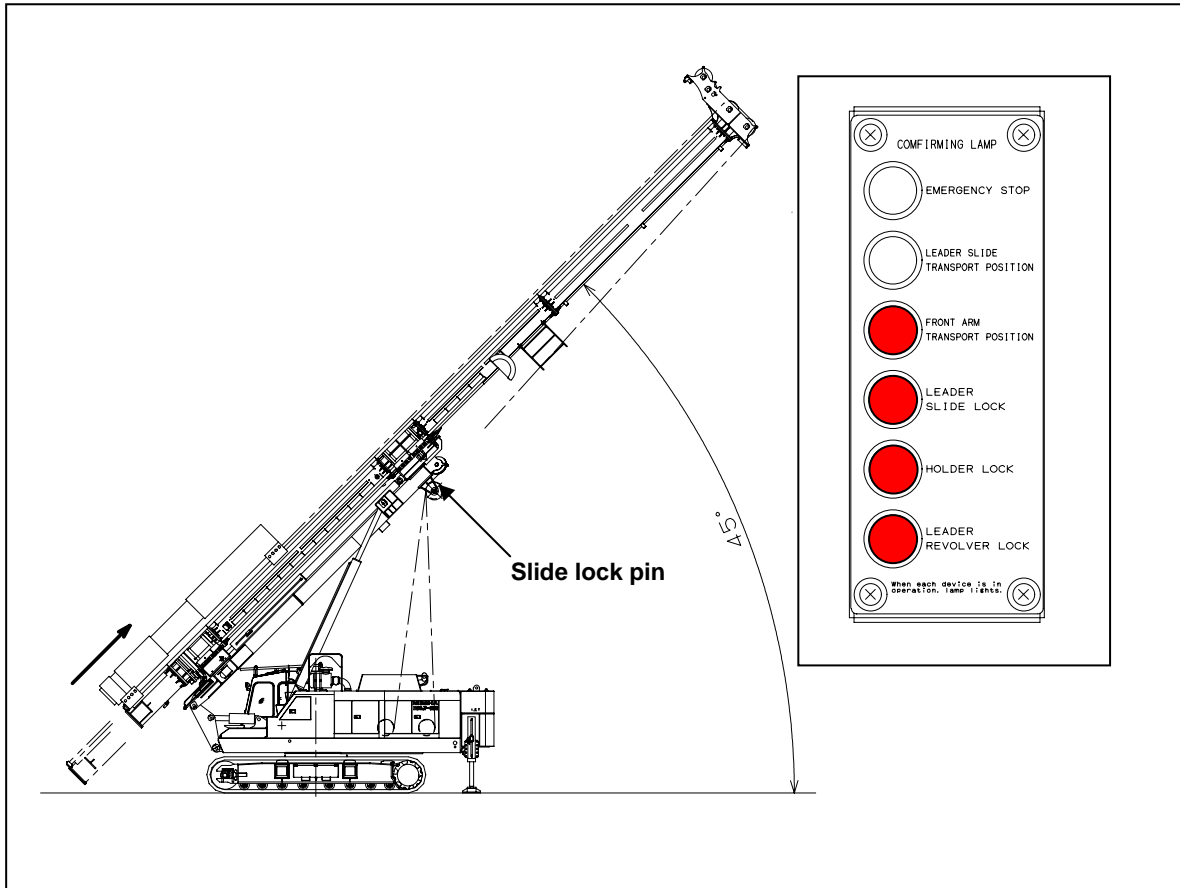
- d. Remove the wire clip.
- e. Remove the transportation stopper.



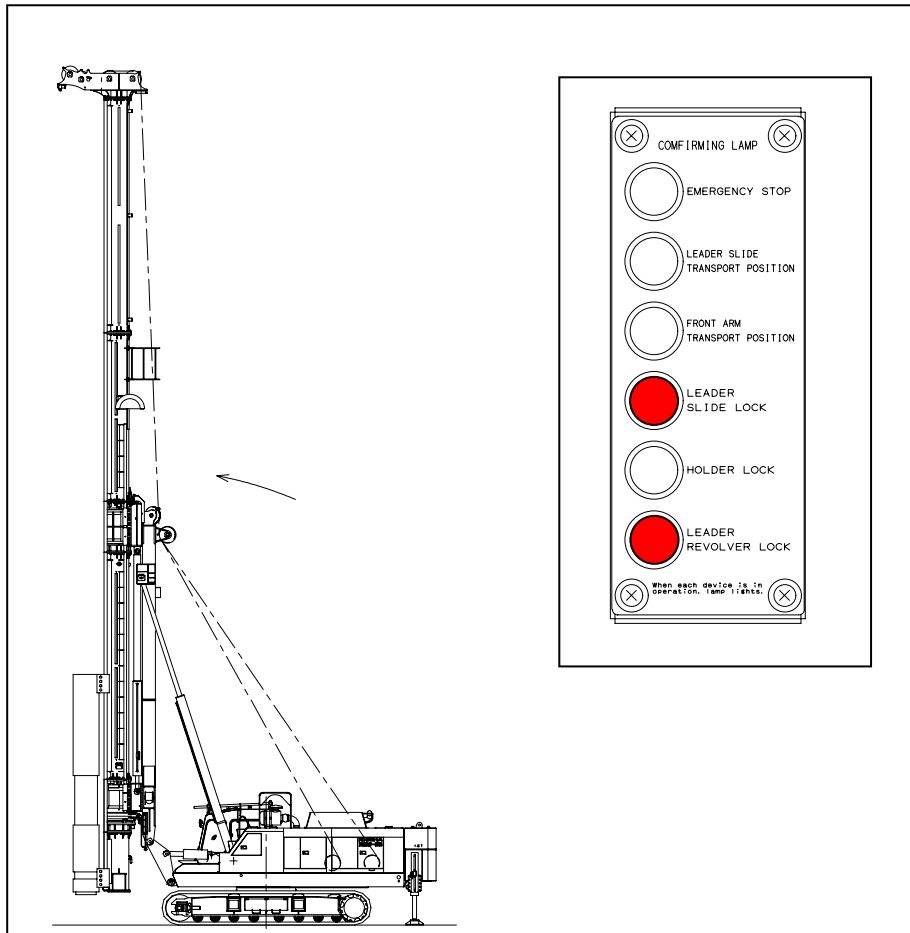
- f. Erect the leader with the leader erecting cylinder. When erecting the leader, check that the hoses and ropes are free to rise with the leader.
- g. When the angle of the leader is 45° , it will stop erecting.



- h.** Slide upward the leader to the full extent via the leader slide cylinder.
- i.** Turn on the slide pin-lock switch.
- j.** Slide the leader downward slightly, until you hear the pin engage.
- k.** Check the lighting pattern of the confirming lamp box, as follows.



- l.* Erect the leader to the vertical position via the leader erecting cylinder.
When operating the leader erecting cylinder, ropes must be unwound manually.
- m.* After erecting the leader, release the holder lock pin. Check the lighting pattern of the confirming lamp box as follows.
- n.* The revolver lock pin is always locked. To rotate the leader, release the lock pin.

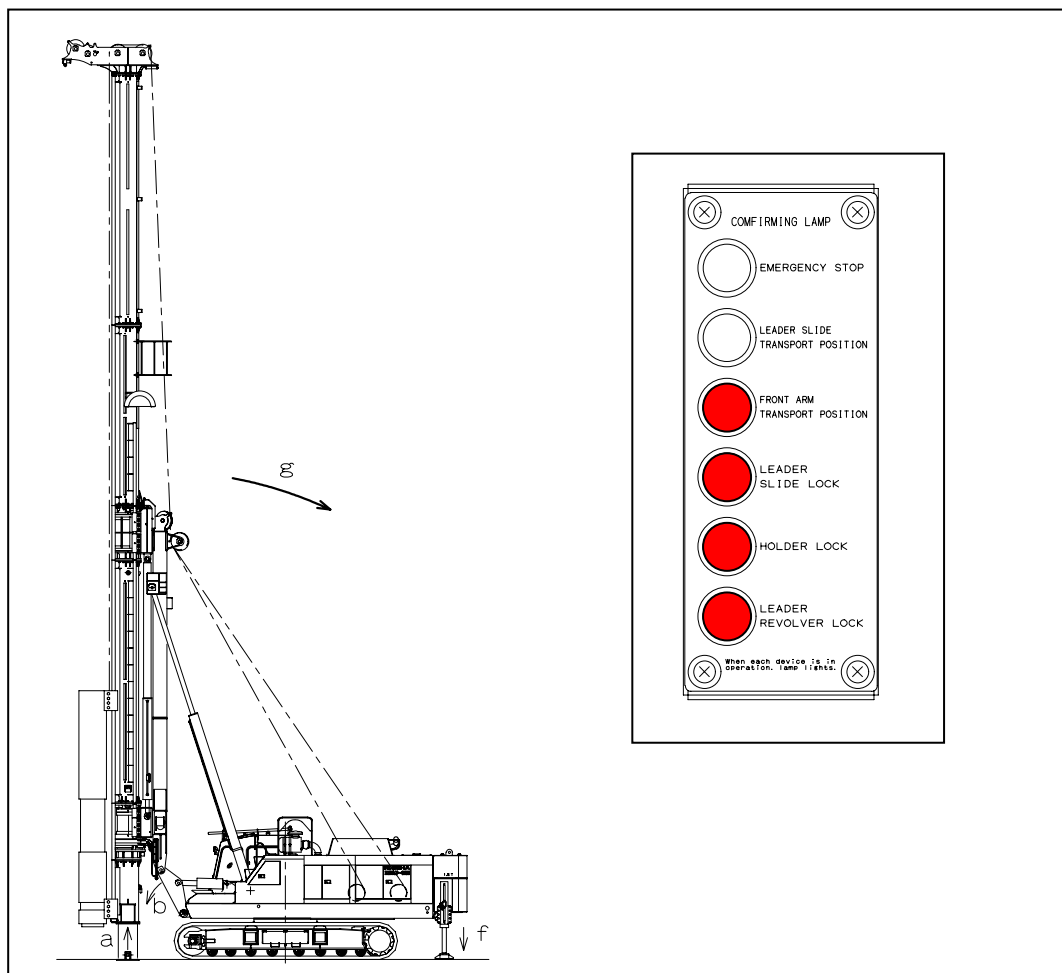


6.3.5 Lowering the leader with front attachment (20 m leader)

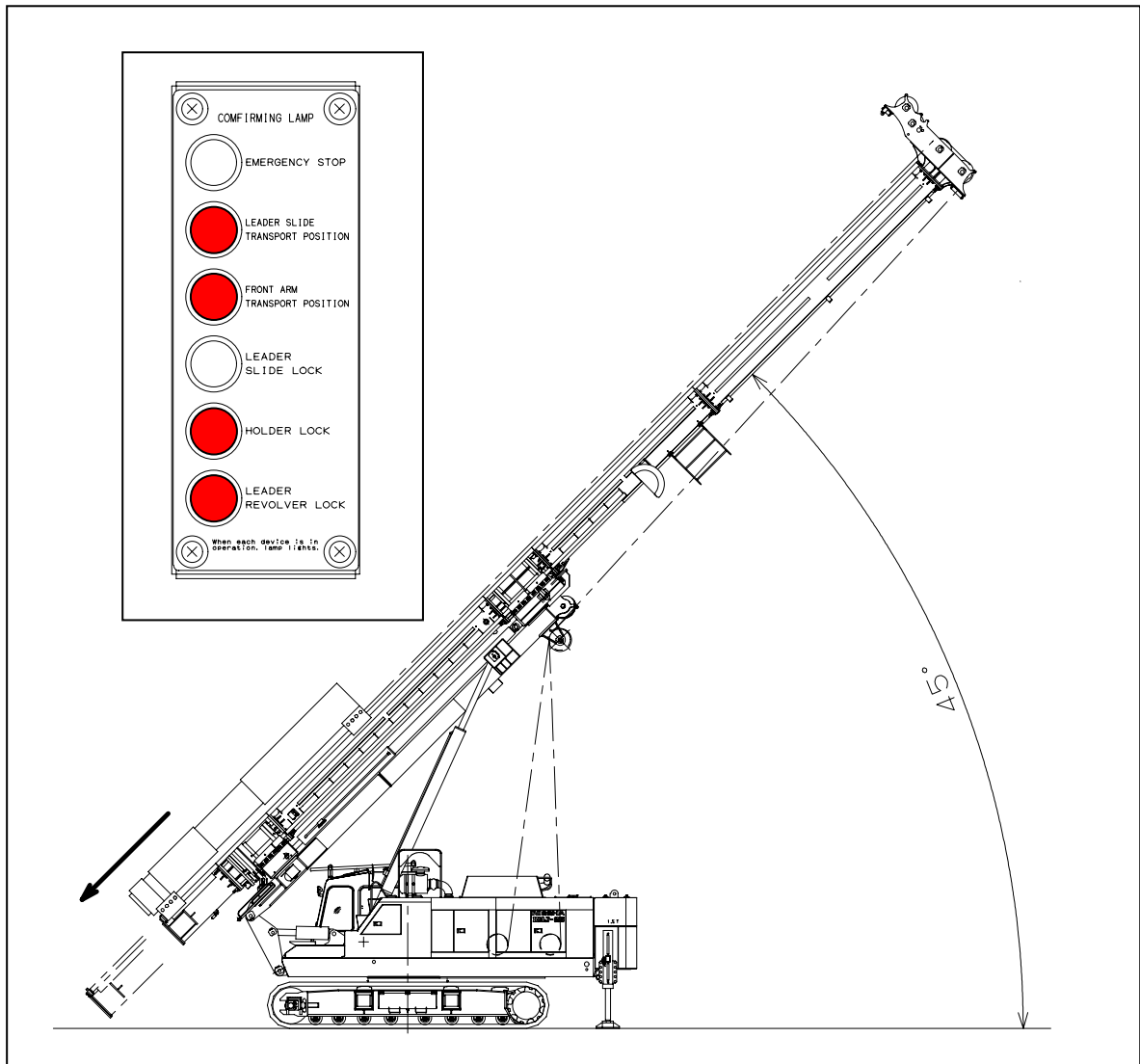


- When lowering the leader, place the machine on a firm and level surface, allowing enough space to lower the leader.
- Before starting work, appoint one supervisor, ensuring that he/she is a qualified person. Coordinate working procedures with the supervisor, co-workers and crane operator.
- Barricade the area around the machine to keep everybody away.
- Check tools and sling ropes thoroughly prior to lowering work and do not use damaged ropes and tools.

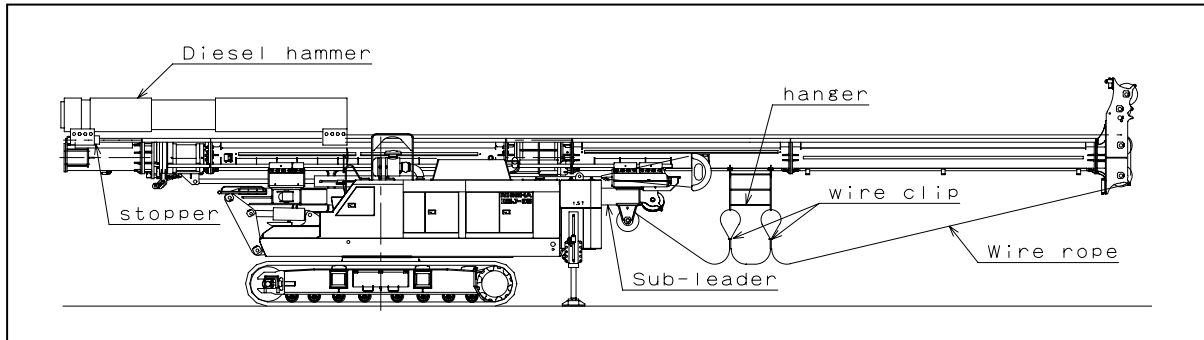
1. Lowering the leader
 - a. Retract the front jack fully.
 - b. Extend the Leader horizontal adjustment cylinder fully and move the leader forward. Check that the "FRONT ARM TRANSPORT POSITION" lamp is illuminated.
 - c. Engage the holder lock, and check that the "HOLDER LOCK" lamp is illuminated.
 - d. Engage the revolver lock, and check that the "LEADER REVOLVER LOCK" lamp is illuminated.
 - e. Position the leader vertically by moving the lateral inclination cylinder.
 - f. Extend the outrigger jacks until they touch the ground.
 - g. Lower the leader slowly and carefully, until it is at an angle of 45°. When operating the leader erecting cylinder, the ropes must be wound manually.



- h.** When the leader is being lowered, the leader stops at 45° automatically.
- i.** Release the slide lock pin and check that the confirming lamp turns off.
- j.** Slide the leader downward fully, and check that the confirming lamp is illuminated. When sliding the leader, the ropes must be wound manually.
- k.** When the lighting pattern of the confirming lamp box is as follows, the leader can be lowered.



- l.* Lower the leader until the sub-leader touches the support bracket.
- m.* Attach the stopper to fix the Diesel hammer for transportation.
- n.* Pull down the wire rope between the hangers and tie the ropes with cable ties as follows.



Do not slide the leader in this state.

Sliding the leader backward may cause the machine to fall over backward.

6.4 Operating the driving rig



- Never leave the operator's seat of the pile driving rig with a load suspended.
- The maximum bearing pressure of the pile driving during actual operation varies greatly depending on the ground conditions; sometimes the pressure is several times higher than the average bearing pressure.
Improve the ground surface where the pile driving rig is located with soil-stabilizing materials or grouting, making sure to level the ground as much as possible.
Place steel plates beneath the crawlers to prevent uneven settlement.
- Suspend front end operating attachments such as the hammer and earth auger in as low a position as possible when transporting the pile-driving rig.
- When extending the cylinder, place a suitable steel plate beneath the float of the front jack cylinder.
- Do not operate the control levers or brake suddenly: be careful when operating these.

6.4.1 Hydraulic auger operation

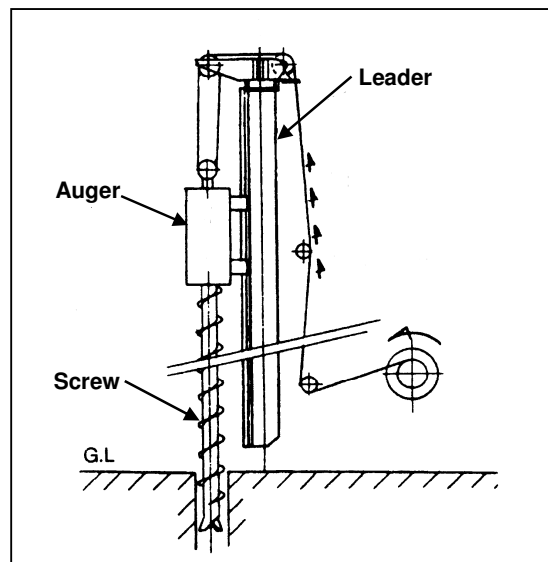
WARNING

- Use an over-hoist preventive device when carrying out hydraulic auger work.
- Insert a revolver lock pin before carrying out auger work.
- Permissible auger torque is 98.1kN-m. Do not exceed this torque.
- Permissible pulling force of the leader is 392kN.
(23.4m leader. The distance between the pile centre and the leader center is 960mm.)

The pulling force includes the weight of the front attachment resistance of the soil.

When the pile center is farther than 960mm (3.1ft) from the leader center, the permissible pulling force is reduced.

1. When handling the hydraulic auger, follow the auger instruction manual.
2. Set the revolver lock to "ON".
3. Align the screw head with the drilling point and erect the leader vertically using the leader control lever and the leader left and right adjusting lever.
4. Contact the front jack and outrigger jack with the ground.



5. Rotate the auger in the normal direction and set the main hoisting winch lever to [Lowering] to carry out drilling.



- After drilling has been finished, engage the brake pedal lock and drum lock of the main hoisting drum.

6. When the auger has got to the depth to be drilled, hoist the auger slowly to finish the drilling work.



- When removing soil from the screw, be careful not to be caught in the screw.
- Do not leave the hole created by the auger and the driven pile as they are, but always cover or enclose them.

6.4.2 Hammer operation



- Use over hoist preventive device when performing hammer work.
- Insert revolver lock pin during hammer work.

1. When handling the hammer, follow the hammer instruction manual.
2. Set the revolver lock to ON.



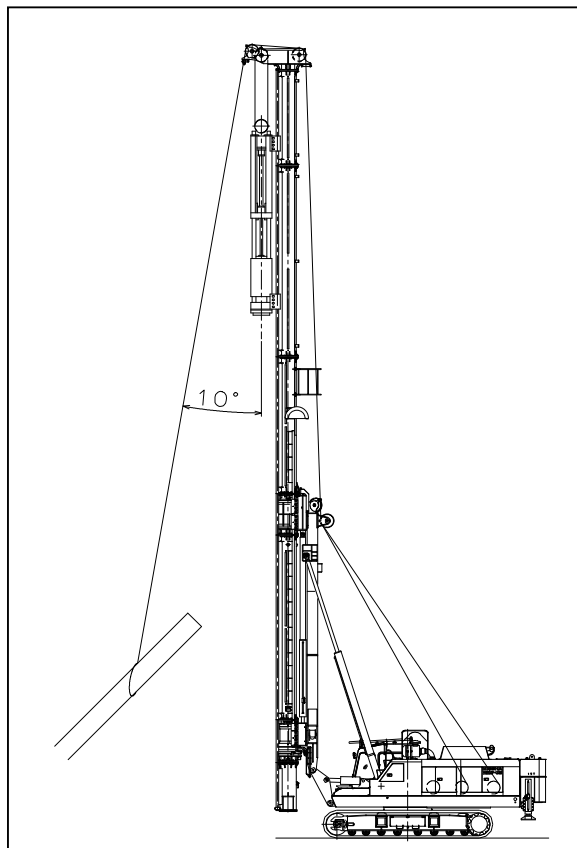
- Piles to be driven shall be unloaded at the place as near as possible to the machine.
If the piles unloaded far from the machine, once shift them to the place near the machine, or provide a sheave at the lower portion of the leader and reeve a wire rope through the sheave to the pile to withdraw them toward the machine.
- Do not travel the machine with the pile suspended.

3. Swing the superstructure toward the pile.
4. Fix a suitable sling rope to the top of the pile.

 **WARNING**

- **Never pull piles sideways with the leader, but from the front. Position the hammer as low as possible when withdrawing piles. Do not apply swing motion when withdrawing piles.**
- **Maintain the suspension rope angle of the pile 10 degrees or less against the leader.**

5. Hoist the pile gradually and withdraw it toward the pile driving rig.



- 6.** When the pile is withdrawn to the place below the leader, once release brake pedal lock of the hammer suspension rope.
- 7.** Hoist the hammer up to a suitable height and lift up the pile top to couple it with the hammer cap.
- 8.** Then, lift up the hammer together with the pile until the pile end is clear over the ground surface while the machine swings.
- 9.** Swing the machine slowing to position the pile end to the hole which is previously drilled by the auger.
- 10.** Lower the pile together with the hammer down into the hole.
- 11.** Remove the sling rope from the pile.

 **WARNING**

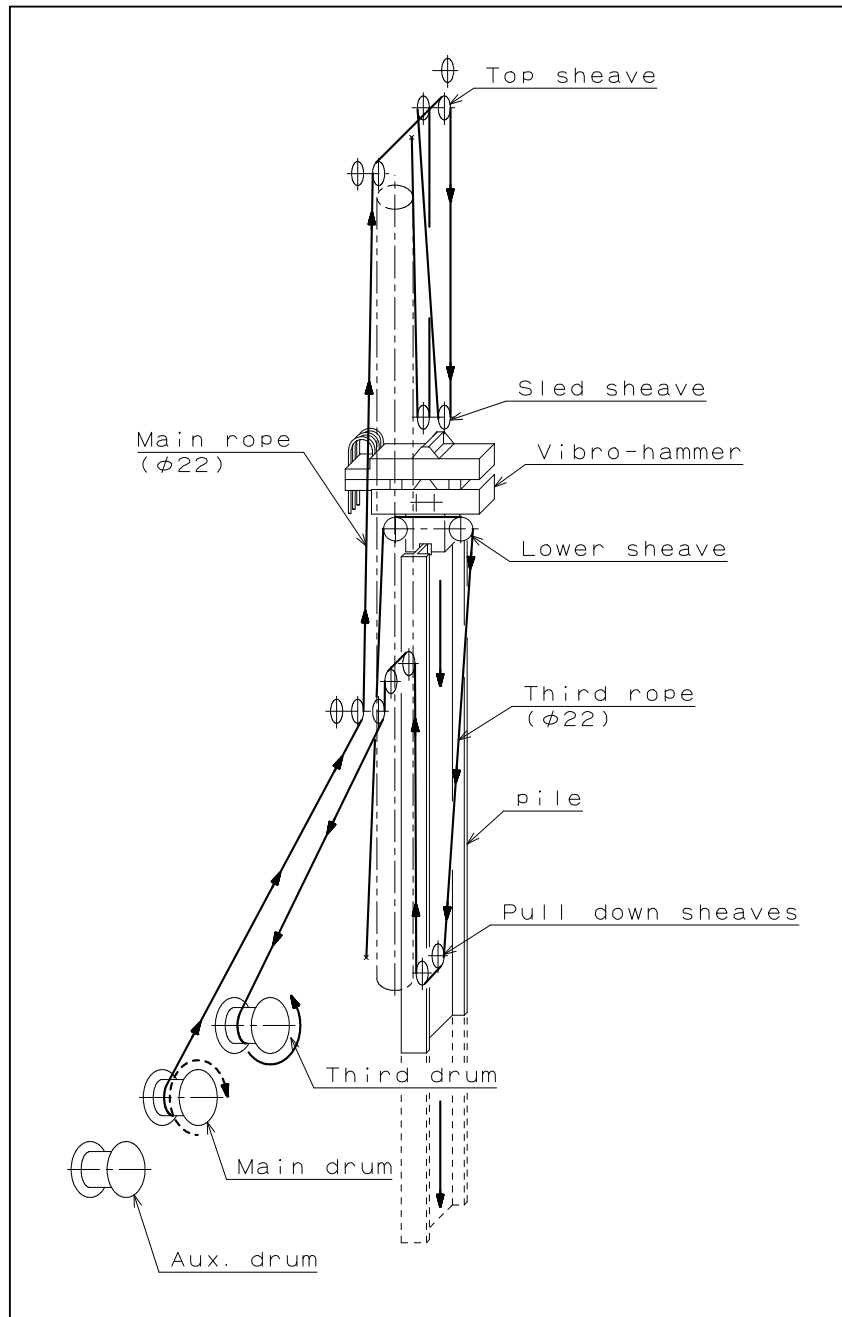
- **Use outriggers when performing batter pile driving.**
- **The maximum batter angle is 12° backward which may vary much depending on the leader length, pile length, hammer type, etc. Consult us when needed.**
- **Lean the leader after the hammer and pile have been surely suspended by the leader which is vertically erected.**

6.4.3 Vibro hammer



WARNING

- Use over hoist preventive device when performing vibro hammer work.

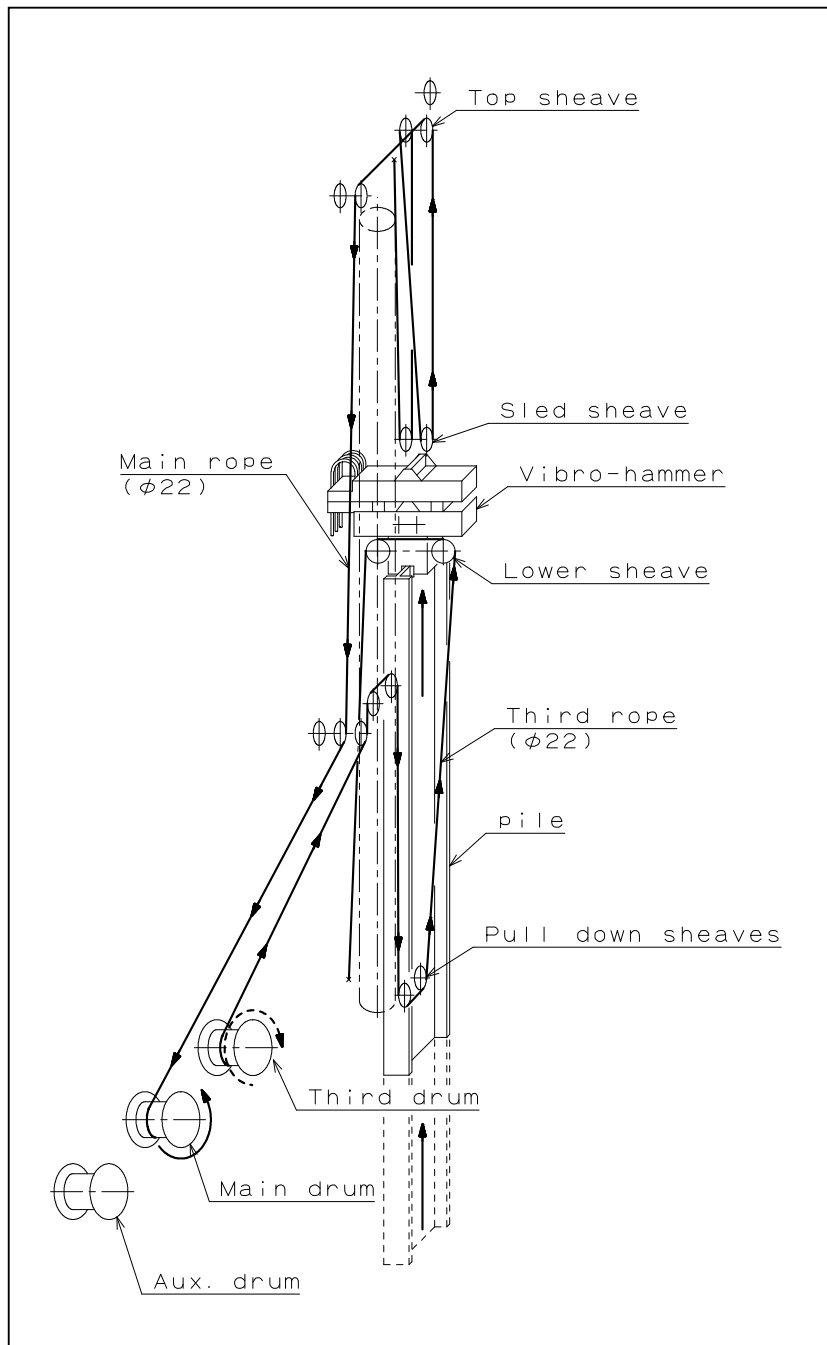


1. When handling the vibro-hammer, follow the vibro-hammer instruction manual.
2. To drive a pile, proceed as described below.
For the main hoisting drum, however, the half clutch adjustment is necessary in advance.
For further information on half clutch, refer to “5.3.4.3 [Half clutch] mode operation (main)”.
 - a. Release the main hoisting drum lock.
 - b. Apply the main hoisting brake.
 - c. Toggle the brake mode change-over switch to “Free fall” to place it in half clutch mode.
 - d. Unlock the brake to release it slowly.
At this time, make sure that the pile is placed on firm and level ground and does not lower.
When the brake is released, the main hoisting drum engages in half clutched state where the clutch is engaged with the drum loosely. Even if the vibro-hammer is lowered by winding the wire of the third drum, the main hoisting wire is wound off with light tension applied.
This prevents not only the main hoisting and third drums from pulling at each other but also the main hoisting from winding disorderly.
 - e. Set the third drum control lever to [Hoisting]. The pile will be lowered forcibly.
 - f. Then, the 3rd winch rope tension control lamp installed in the side stand L turns on. The force to lower the vibro-hammer can be adjusted by rotating the tension control volume below the lamp. (Refer to “5.4.14 3rd winch rope tension control volume”)

 **WARNING**

- **If the pile is forcibly driven by the third drum, place the main hoisting drum in half clutched state or wind off the main hoisting wire. Otherwise, the main hoisting and 3rd wire ropes may pull at each other, resulting in breakage of the wire.**
- **A load cannot be suspended in half clutched state. When a load is to be suspended using the main hoisting, be sure to switch to [Auto brake] mode rather than [Half clutch] mode.**

3. To withdraw the pile, proceed as described below.



- a.** Apply the main hoisting brake.
- b.** Set the main hoisting to [Auto brake] mode. (Refer to "5.3.4.1 [Auto brake] mode operation")
- c.** Release the main hoisting brake.
- d.** Set the main hoisting drum control lever to [Hoisting]. The vibro-hammer will hoist. At this time, the third drum is in half brake state. When the vibro-hammer is hoisted, the third drum wire rope is wound off with light tension applied. Thus, the vibro-hammer can be hoisted as the main hoisting and third wires do not pull at each other, preventing the third drum from winding disorderly.



- **The third drum can be used only for driving the vibro-hammer forcibly. Never use it for other purposes.**
- **The third drum cannot suspend a load as it is always in half brake state.**

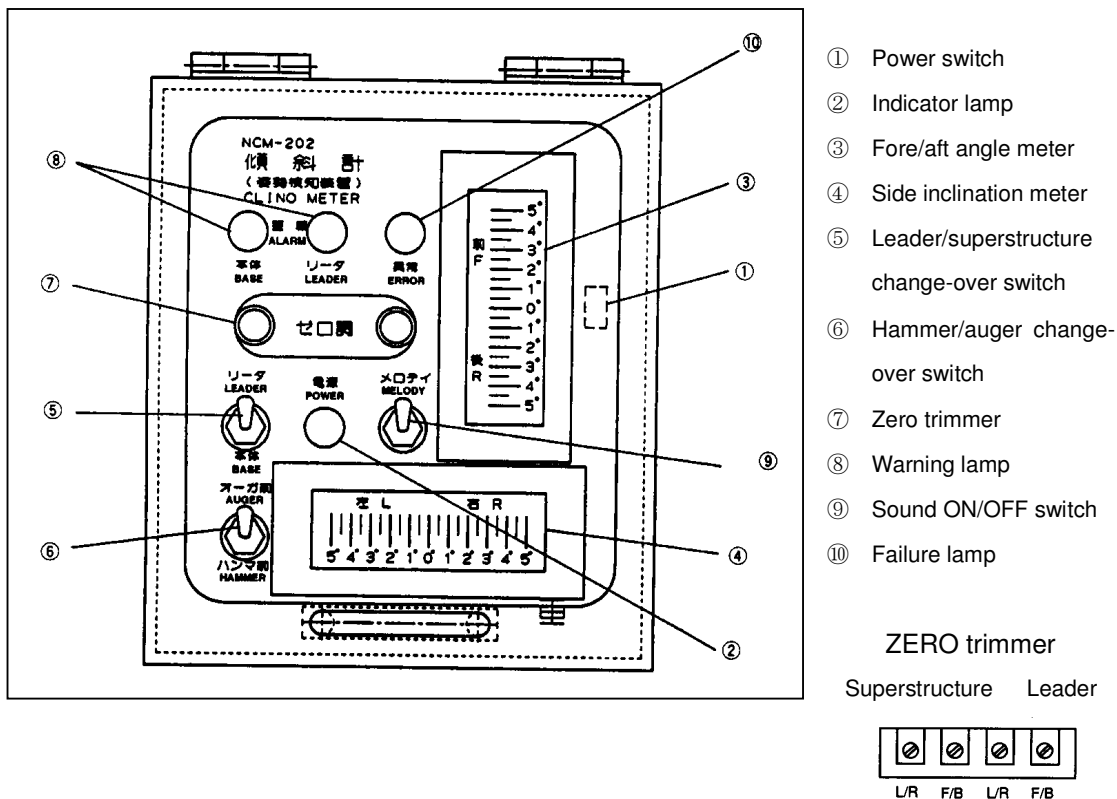
6.4.4 Inclinometer



WARNING

- The maximum permissible inclination angle of the leader is 1.5 degrees each R.H. and L.H. sides.
Excessive side inclination brings damage of leader, etc.

The inclination angle of the leader and the superstructure can be detected by the angle sensors provided on them and send electric signals to the angle meter in the operator's cab. The angle meter indicates the inclination ranging 0 ~ ± 5 degrees.



Operation procedures

1. Turn power switch ① on and see if indicator lamp ② lights. (Power switch ① is located at the back of the meter.)
2. Turn Leader/superstructure change over switch ⑤ to either leader or superstructure.
In case of hammer side, select hammer/auger change over switch ⑥ to either side.
3. The Fore/aft inclination meter ③ and side inclination meter ④ indicate both leader/superstructure inclination by performing the change-over switch ⑤, ⑥.

- 4.** When the leader is inclined up to 1.35 degrees either fore/aft or front/rear and warning lamp ⑧ flushes.
- 5.** When the leader is inclined up to 1.5 degrees either fore/aft or front/rear and alarm lamp ⑧ flushes and the chime built-in the meter sounds.
- 6.** The meter ③ and ④ can calibrate as follows.
 - a.** Turn power switch ① OFF.
 - b.** Check fore/aft angle meter and front/rear angle meter ③ and ④.
 - c.** Adjust the leader perpendicularity by the use of a transit.
 - d.** Turn power switch ① on and turn leader/superstructure change-over switch ⑥ to "Leader" side.
 - e.** Adjust "ZERO" point of fore/aft angle meter ③ and side angle meter ④ by ZERO trimmer ⑦.

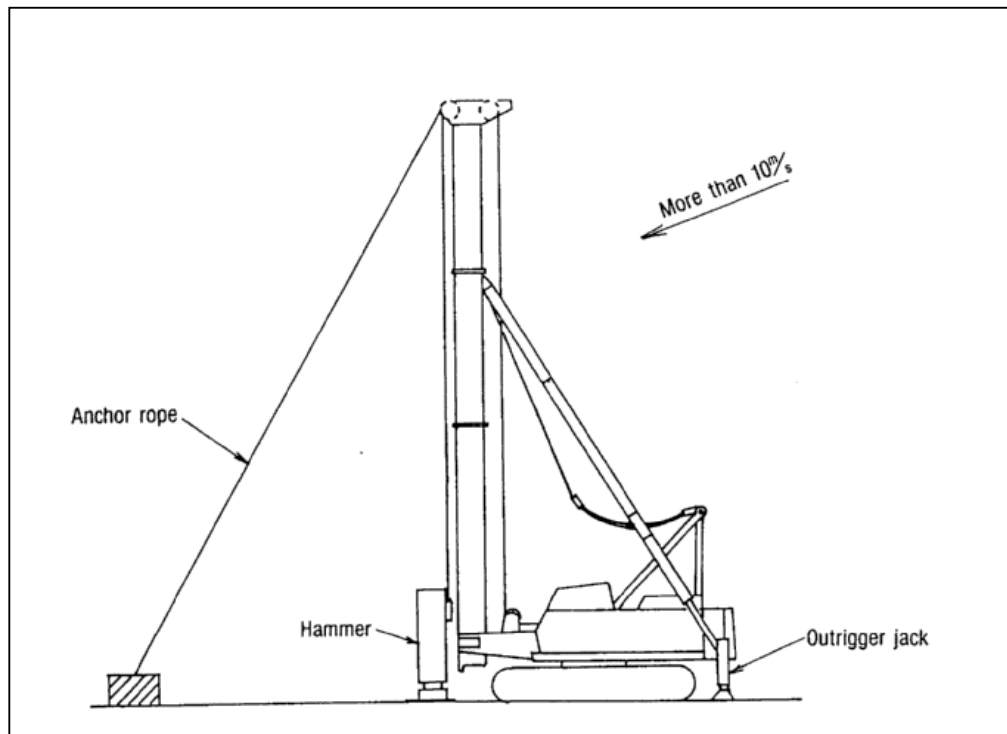
6.4.5 Safety measures in strong winds

- 1.** Regarding wind velocity
 - I.** Average wind velocity: average wind velocity measured at 10 m above ground for 10 minutes.
(Weather forecasts by the Weather Bureau are issued on the basis of average wind velocity.)
 - II.** Maximum average wind velocity: maximum average wind velocity of the average wind velocities observed in the last 24 hours.
 - III.** Maximum instantaneous wind velocity: maximum wind velocity observed momentarily during a certain period. (This value is used calculate wind pressure resistance.)

2. Measures necessary in strong winds

If the average wind velocity is 10 m/sec or higher and dangerous conditions are expected, stop work and take following measures.

- I.** If the average wind velocity is greater than 10 m/sec,
 - a.** adjust the superstructure and crawlers in the same direction and orient the rear face of the machine (counterweight side) against winds.
 - b.** stop the engine and apply brake lock and drum lock to each drum.
 - c.** position outrigger jacks.
 - d.** lower front attachments such as the hammer and auger.
Apply slight tension to the hoist rope, and apply brake lock and drum lock.
 - e.** apply tension to an anchor rope of adequate strength.
- II.** If the wind velocity exceeds 20 m/sec, lower the leader to the ground.



3. Other precautions

If the pile driver falls, for example in the event of a typhoon or other storm conditions, this may be caused not only by strong winds, but also by softened ground, ground erosion from the force of rainwater, etc.

If a typhoon or storm conditions are expected or if warnings of strong rain, etc. are issued, take the following actions.

- I.* Check for possible ground erosion from the force of rainwater under the machine and, if any risk is possible, relocate the machine to a safe place. The same applies if there is possibility that the machine will be submerged.
- II.* Where the ground is not rigid enough, place steel plates under the machine or relocate it to an area with adequate strength.
- III.* Have someone watch over the work.

<Reference>

Classification of wind pressure by the Weather Bureau

(Wind velocity indicates wind velocity equivalent to 10 m above ground.)

Level (Name)	W/V (m/sec)	<Observation on ground>
5 (Fast wind)	8.0 to 10.7	Low trees with leaves start to sway. Ripples start to rise on pond or lake surfaces.
6 (Quick wind)	10.8 to 13.8	Larger branches move. Electric cables generate noise. It is difficult to carry an opened umbrella.
7 (Strong wind)	13.9 to 17.1	Entire tree sways. It is difficult to walk against the wind.
8 (Quick, strong wind)	17.2 to 20.7	Small branches are broken. Unable to walk against winds.
9 (Large, strong wind)	20.8 to 24.4	House chimneys fall. Roof tiles are blown off.
10 (Total, strong wind)	24.5 to 28.4	Trees fall. Housing structures are damaged. Rarely observed on the ground.

6.4.6 Caution when working on rainy days

Rain affects work both when falling and after it has stopped. Brake and clutch pads sometimes slip when wet. Regardless of whether the rain is heavy or light, check brake functionality by erecting the suspended load about 50 cm and applying brake.

6.4.7 Stability of pile driver in the event of an earthquake

The pile driver will normally bear an earthquake of seismic intensity of 4 (strong earthquake). However, as earthquake activity is unpredictable, preparation is important to avoid potential hazards. The following safety measures should be taken.

1. The soil of the work place should be inspected before starting work. If any problem exists, take appropriate measures.
2. The machine installation location should be leveled until flat and horizontal. The installation location should have sufficient soil-bearing capacity corresponding to the machine weight. If possible, iron plates should be placed on the machine traveling route to maximize the safety.
3. If heavy rain has fallen on the previous day, inspect the soil carefully before starting the day's work.
4. Specific earthquake countermeasures should be established. All personnel involved in machine operation should be trained to be familiar with these measures.

Seismic intensity rank		Acceleration (cm/sec ²)	Contents
Value	Name		
I	Gentle earthquake	0.8 to 2.5	Only stationary people or some sensitive people can feel.
II	Weak earthquake	2.5 to 8	Many people can feel the earthquake. Sliding doors may move slightly.
III	Rather strong earthquake	8 to 25	Houses shake, sliding doors vibrate, and lights swing violently.
IV	Strong earthquake	25 to 80	Houses shake violently and unstable flower containers may fall. People walking also feel the earthquake and many leave their houses.
V	Very strong earthquake	80 to 250	Walls are cracked and gravestones and stone lanterns may fall down. Chimneys and stone fences may be damaged.
VI	Disastrous earthquake	250 to 400	About 30 % of houses and buildings collapse. Landslides or cracks in the roads may occur. Most people cannot stand upright.

6.4.8 Moving machine on slope with the leader upright

When moving the machine on a slope with the leader upright, machine stability may vary depending on the machine. For details of the permissible slope angle, contact Nippon Sharyo's service center and ask for details regarding the stability of the machine in question.

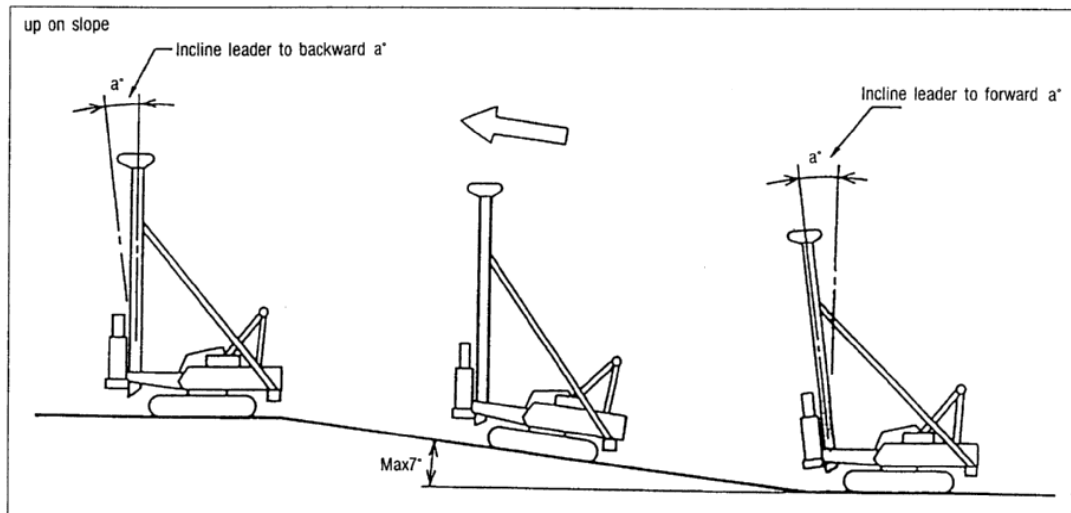
 **WARNING**

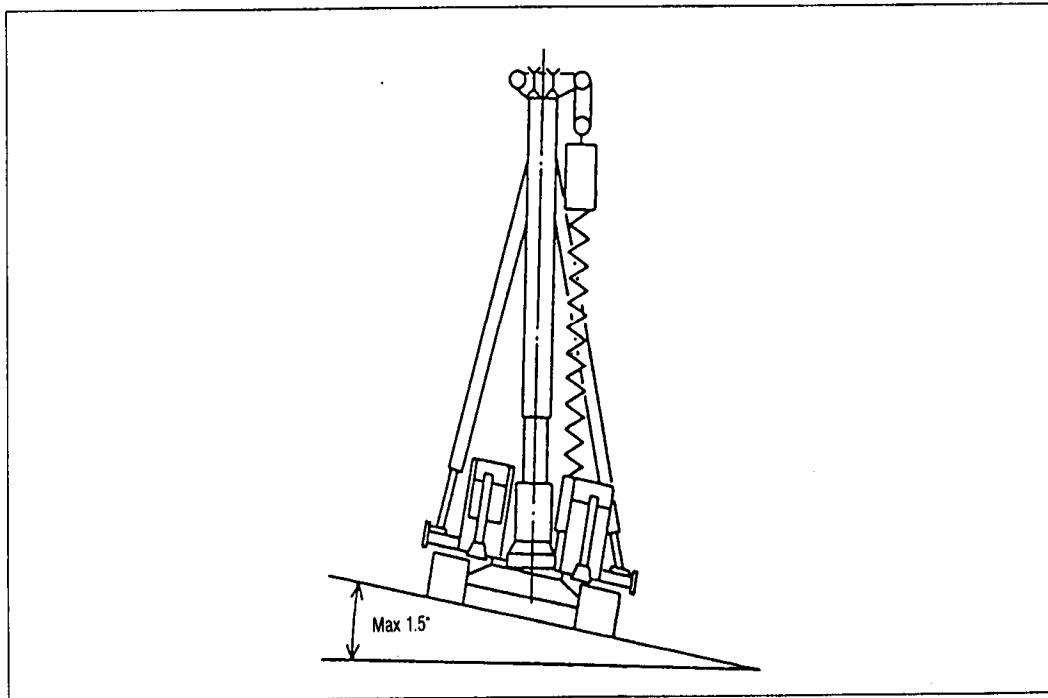
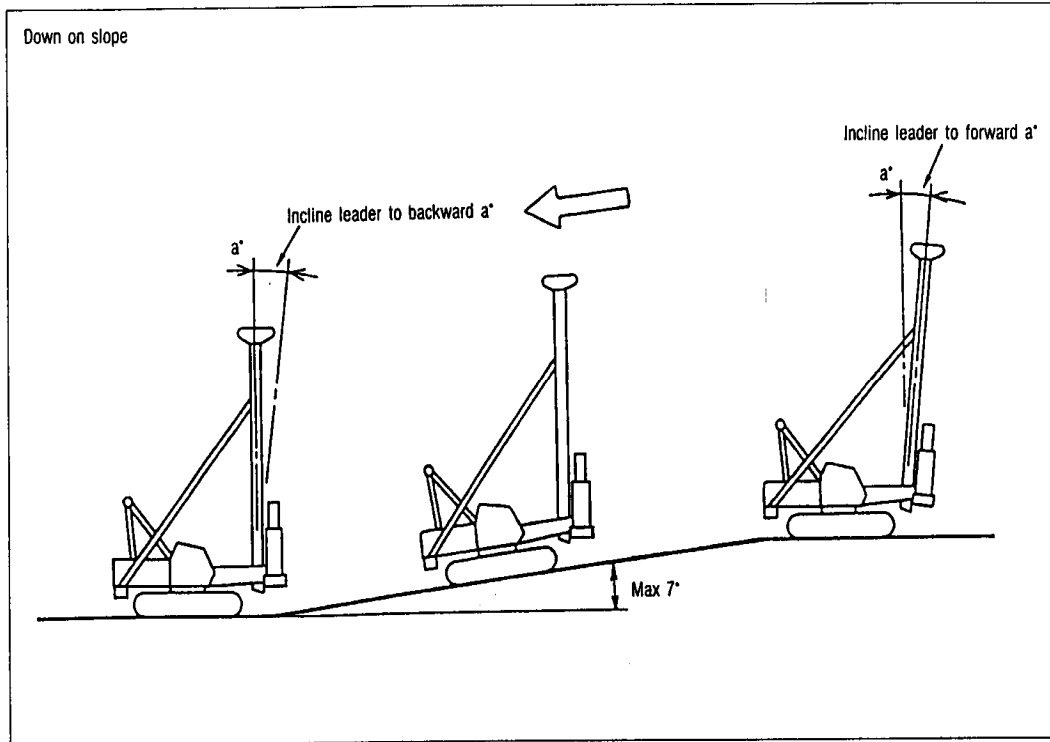
- **When traveling a slope with the leader upright, always ensure stability and ensure that the slope angle does not exceed 7°.**
- **Never swing or operate the machine when moving on a slope.**
- **If the machine is equipped with a hammer and auger, lower these as much as possible to lower the machine's center of gravity.**

 **CAUTION**

- **Always lock the swing brake, swing lock, drum brake, and drum lock securely.**
- **Before moving the machine on a slope, inspect the slope angle; the machine should tilt to the angle when being moved. Pay special attention, ensuring that the machine does not tilt against the angle and that steering does not stop halfway.**
- **Level the traveling route as much as possible. If the soil of the traveling route is soft, place reinforcement plates to strengthen the soil.**
- **Move the machine slowly on a slope. In particular, move the machine slowly when starting motion on a slope and when coming of a slope.**
- **Ensure that the area between slope and level terrain is as smooth as possible.**

To move the machine on a slope, follow the steps below.





6.4.9 Cautions regarding power transmission line

It is dangerous to bring parts of the machine such as the leader, etc. close to transmission lines. When working near transmission lines, observe the following precautions.

1. Ensure a safe distance from transmission lines.
 - a. Check to see if any transmission lines are located close to the work site when planning work.
 - b. Contact the power company to obtain information on the location and height of lines as it is difficult to determine this information visually.

	Electric line voltage	Approx. No. of insulators	Support	Safe distance (In accordance with work safety regulations)	Safer distance
Distributi on line	100,200 V	1	Wooden pole or concrete pole	1.0 m	2 m or over
	6,600 V	1		1.2 m	
Power transmis sion line	40,000 V or under	1 to 5	Wooden pole, concrete pole,	2.0 m	3 m or over
	70,000 V	4 to 9		2.4 m	4 m or over
	150,000 V	7 to 21	steel pole, or steel tower	4.0 m	5 m or over
	270,000 V	16 to 30	Steel tower	6.4 m	7 m or over

Electric line vs. safe distance

2. Discussions before planning work

Discuss details of work plan, including the following, with the power company.

 - a. Daily schedule, processes
 - b. Protection
 - c. Supervision
 - d. Whether power company personnel should be present.
 - e. Responsible person for contact
 - **You should obtain guidance and assistance about protection methods, work method, etc. from the power company as required.**
3. The machine driver and other workers should learn and have an adequate understanding of the risks of electric shock before starting work.
 - a. There is a risk of electric shock even without making actual contact with an electric wire.
 - b. Confirm and observe the items discussed with the power company.

4. Appoint a person in to be in charge of supervision.
5. In the event that an operator makes contact with an electric wire accidentally,
 - a. immediately separate the leader, etc. from the power line.
 - b. the operator should stay on the pile driver till power supply is turned off.
 - c. people working on the ground should in no circumstances touch either the machine body or the front attachment.
 - d. operators should in no circumstances touch broken wires.
 - e. report details of the accident to the power company.

6.5 Machine handling in special circumstances

6.5.1 Handling in summer

In summer, atmospheric temperature rises, water evaporates quickly, and problems like overheating are more likely to occur than in other seasons. Therefore, special attention must be paid to the following:

1. Engine
 - a. Inspection of cooling water
Check that the clean water in the tank is sufficient. If not, deposits from the water accumulate in the cooling water line or the fan belt may have come loose. This will cause less efficient cooling and/or overheating.
If deposits are found in the cooling water line, remove the deposits with commercial cleansing solution, and then rinse the line with water several times.
 - b. Engine oil
Oil viscosity will diminish in higher atmospheric temperature conditions. Refer to section "9.4 List of oils and grease" and change oil with a better type.
 - c. Inspection of battery fluid level
An insufficient quantity of battery fluid will damage pole plates. Replenish the battery with distilled water to the proper fluid level (10 to 13 mm above pole plates).
Regarding battery servicing, refer to chapter "7 Inspection and maintenance".

2. During operation

- a. In summer time, special attention should be paid to the water temperature indicator. Check the indicator lamp and oil temperature gauge for the prevention of overheating.



- **Refrain from opening radiator cap carelessly as very hot water and/or steam is likely to blow out and burn the operator. For further information, refer to the separate booklet entitled "Instruction Manual of Engine".**

- b. If cooling water in the radiator is overheated (exceeding 100 °C), do not stop engine suddenly but let it idle for a while until the water temperature falls. Then stop the engine.
- c. As oil viscosity will generally diminish in summer, it is likely that oil leakage will occur from various parts. Pay special attention, therefore. Particular attention should be paid also to the oil temperature gauge to monitor unusual rises in the oil temperature. The optimum temperature range is 20 to 80 °C.

6.5.2 Handling in winter

Low atmospheric temperature in winter may make it difficult to start the engine; frozen water, also, may pose problems. In light of the above, pay attention to the following.

1. Engine (For details, refer to the engine instruction manual.)

- a. Engine oil with proper viscosity
The flow capability of oil diminishes at low temperatures. Select adequate oil referring to section "9.4 List of oils and grease".
- b. Using fuel with lower pour point
At atmospheric temperature lower than -10 °C, the diesel fuel must have maximum cloud and pour points 6°C (10°F) lower than the ambient temperature in which the engine operates.
- c. Inspection of the insulation against high temperatures and battery charge
Electromotive force drops at low temperatures and, if fluid level is low, the fluid is consequently likely to freeze.
Therefore, the charge level should always be monitored and sufficient care should be taken for the insulation against high temperatures to ensure trouble-free engine start in the mornings.
- d. Use of antifreeze in cooling water
When atmospheric temperature falls to below 0 °C, use antifreeze in cooling water or drain water completely to prevent freezing.
Cooling water capacity is 32.5 l.
Mixing ratio of water and antifreeze is 50/50.

Precautions related to the use of antifreeze

- **Use soft water for mixture.**
- **Before pouring a mixture of water and antifreeze, drain water completely and rinse the cooling system thoroughly.**
- **Water/Antifreeze solution should be below 50/50.**
- **Antifreeze should be selected from those specified in the instruction manual of the engine and exchanged once every season.**
- **When the weather becomes warm, drain cooling water mixed with antifreeze from the engine, wash the cooling system and then replenish the engine with cooling water containing specified radiator rust prevention solution.**

2. Hydraulic oil

Viscosity of the hydraulic oil has increased. Keep the throttle lever in the idling position and operate the hydraulic devices repeatedly without load to erect the oil temperature gradually. Operate the machine when loaded only when the hydraulic temperature has risen. Increasing the engine speed without warm-up causes cavitation of the oil pump, which in turn may lead to serious problems.

3. During operation

- a.** Viscosities of the lubricating oil and hydraulic oil have increased.
Do not operate suddenly at high speed. Continue low speed operation for a while.
- b.** If the cooling water temperature does not rise even after warm-up because of severe cold, avoid cooling the engine excessively, for example by covering the front of the radiator.

6.6 Wire rope

6.6.1 Handling wire rope

Most major operations on the machine are carried out using wire ropes and, as a result, the quality and handling of these ropes are of vital importance to work efficiency.

Therefore, the ropes should be selected from the JIS standard items as specified by us. Low grade ropes should not be used.

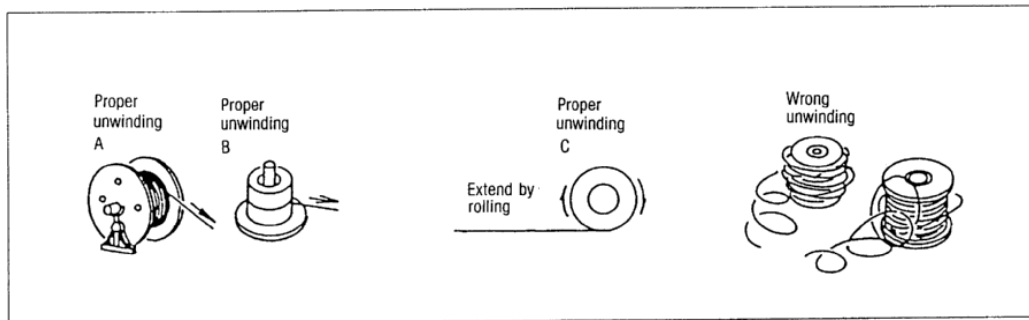
Regarding specifications of the wire ropes used on various sections, refer to section "6.6.5 Wire rope routing diagram".

1. Unwinding ropes

When unwinding ropes and connecting these to the machine, observe the proper procedures as illustrated below.



- **Incorrect unwinding may cause the ropes to become kinked, twisted, or distorted which in turn may make operation problematic and shorten the longevity of the ropes.**



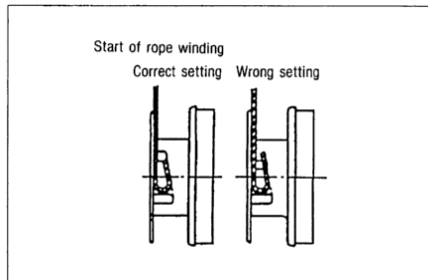
2. Inserting ropes in the drum



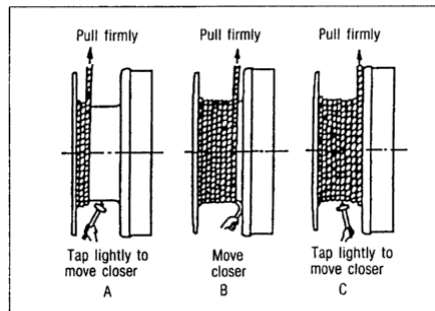
- **Avoid winding ropes casually.**
- **As new ropes can sometimes be wound in a disorganized way, rewind the ropes occasionally until they settle down properly.**

Insert a rope in the drum as follows.

- a. Insert the rope in the drum so that the end of the rope does not come away from the rope socket on the drum.



- b. When starting to wind a rope on a drum, run the rope along the drum edge. At the first wound layer on the drum, use a hammer or bar to wind the next layer uniformly on top, thus eliminating unused space. When continuing to wind additional layers, care should be taken to avoid a wider clearance on successive layers of rope wound around the drum. Adequate and uniform tension should be applied to the individual layers of rope on the drum.



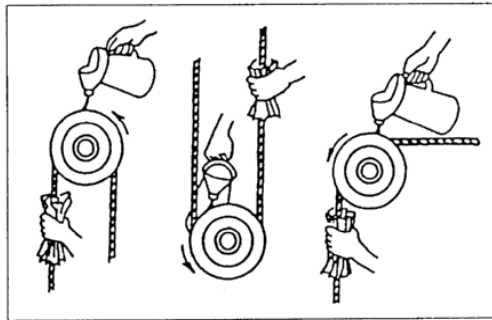
- c.** When the rope has been attached, check for obstruction with other sections on the machine.
 - Does the rope slip because of improper movement of the sheaves or rollers?
 - Is the rope making contact with any fixed object like a bracket, etc?
 - Is the rope making contact with the sheave flange?
- d.** To extend the life of the ropes, pay attention to the following:
 - Avoid non-uniform winding of the rope. This may result in premature breakage of the rope.
 - After using the rope for a certain period of time, disconnect the rope end to eliminate excessive twisting.
 - Apply oil occasionally to the rope to prevent wear caused by friction between rope strands and corrosion of element wires.

3. Lubrication of rope

Although oil is applied to the ropes during manufacture to prevent corrosion and wear, ropes should be lubricated occasionally during operation to extend their life.

- a.** Clean and dry the wire rope before lubrication.
- b.** If excessive oil has been applied, remove it.
- c.** Use rope oil for lubrication.
Regarding rope oil, refer to "9.4 List of oils and grease".

Supply oil as illustrated below. It is advisable to warm up oil before application. This will facilitate optimum application of the oil.

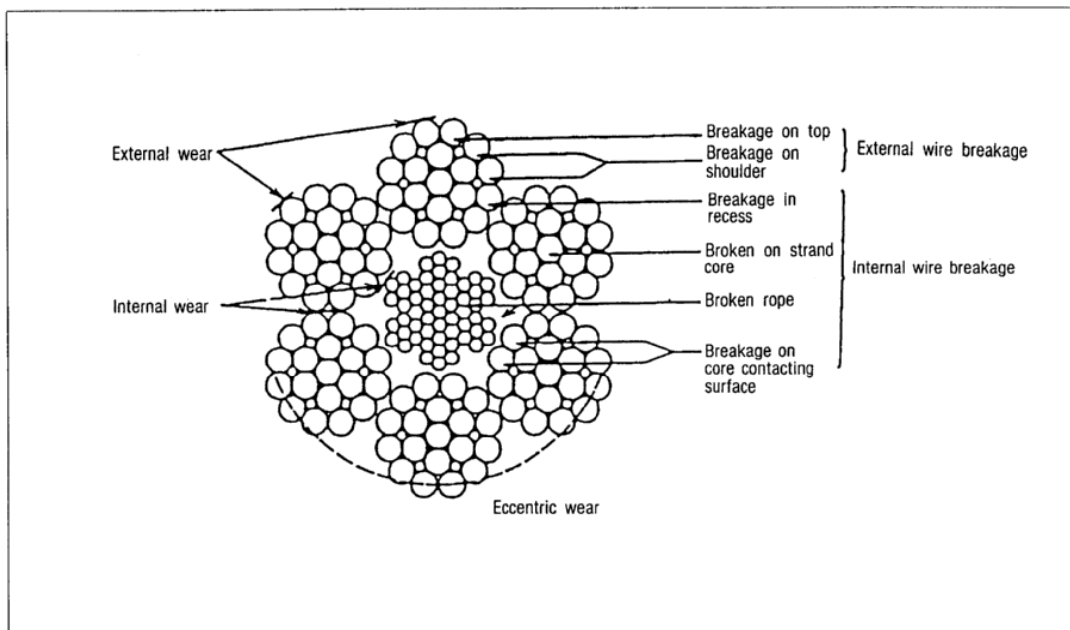


6.6.2 Inspection of wire rope

Over time, wear, breakage, corrosion, etc. occur and may accelerate the deterioration of the wire ropes. The extent of damage to the ropes varies, depending on various factors: hoisting drums, sheaves, terminals, etc., the size of a load and how it is applied, operating atmosphere, method of control and other factors, and, finally, the residual strength of rope itself. Therefore, make sure to check for the types of damage described below, during the inspection before starting work as well as during periodic inspection. During these inspections, closely check not only running wires like hoisting rope, but also stationary ropes like the pendant rope. Pay particular attention to damage that may have occurred on the compressed stopper section on the pendant rope.

1. Classification of wear and breakage of wire rope

Sections where wear and wire breakage occur



2. Classification of wear

Classification	Description	Caution, solution
External wear	Wear which occurs on rope surface due to contact with the sheave, drum, etc.	
Internal wear	Wear resulting from sliding contact between strand and element wire.	Less than the external wear generally.
Peripheral wear	Wear occurring over entire peripheral surface due to rotation of rope during unwinding.	
Eccentric wear	When a load is lifted only slightly by the crane, the sheaves become entangled with the rope, moving the rope over the equalizer sheave. On other occasions, rope rotation is limited because of smaller movement of rope so that eccentric wear occurs.	1) Tends to be overlooked depending on inspection method. 2) Loss of strength due to eccentric wear is equivalent to cases when max. wear occurs all over periphery.
Abrasion wear, collapsing wear	Simple wear of element wires. Element wires are worn and broken, due to such factors as rope vibration, larger fleet angle, severe abrasion against other objects, etc. In exceptional cases, wear accompanies hardening of element wires by non-uniform twisting (occurrence of ARUTEN) and reduces rope life considerably.	Check for rotation trouble and wear on sheaves and rope guide.

3. Classification of wire breakage

Classification		Description	Caution, remedy
External wire breakage	Breakage on top	When operating conditions are favorable, wire breakage occurs due to wear and fatigue at sections where rope and sheave come into contact or, more particularly, at the top of a strand. Rope may be used for a long period of time before wires break.	
Internal wire breakage	Breakage in recess	Where rope load conditions are severe, fatigue progresses earlier than wear. Fatigue of rope occurs most prominently at sections where strands make contact each other so that stress by contact which is larger than tensile stress, bending stress, and other stresses tends to occur. Wire breakage due to fatigue occurs at such sections. This type of wire breakage is referred to as breakage in recess and, if it starts to occur, is considered dangerous because element wires on other layers are also weakened correspondingly.	Breakage in recess is difficult to detect by visual inspection. Sections susceptible to breakage in recess should be inspected using a spike or via a rope bending test.
	Breakage on shoulder	When strands become distorted after the rope has been subjected to strong lateral stress, element wires may lift. Lifted wire forms a kind of bridge which is subjected to repeated bending stresses. Consequently, premature wire breakage occurs at the middle section between top and recess.	Inspect carefully when distortion is discovered on rope.
	Broken core Rope of IWRC rope	Fatigued core rope of IWRC rope generally progresses earlier than that of strand. When core rope breaks frequently, it is likely to cause greater contact pressure on side strands and result in a recess breakage.	

6.6.3 Inspection of internal wear and wire breakage

Since a wire rope is fed through a sheave, external wear generally occurs at first. However, internal damage may occur, too in certain instances.

In such situations although some external indication may be present, it is likely to be overlooked until a disaster occurs. The following section describes inspection methods related to internal wear and wire breakage.

1. Inspection point

Before starting work	Periodic or irregular inspection
Check the following points assiduously. 1. Section where passing over sheave 2. Fixed rope end (finished section)	Inspect entire extension of rope. Then, check the following points assiduously. 1. Rope end on drum 2. Rope section wound around drum 3. Section passing over sheave 4. Fixed rope end section (finished section)

Note 1.

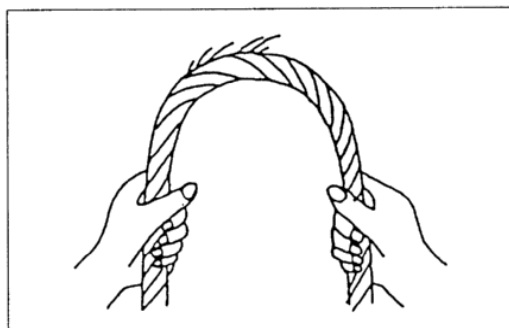
Irregular inspections are those carried out when the rope condition suddenly becomes problematic, operating is carried out for the first time after a period of non-use, before boom installation after machine delivery at site, or other particular situations.

Note 2.

Before starting a periodic or irregular inspection, remove oil, grease, dust, etc. thoroughly from rope. Coat the rope in oil after the inspection.

2. Inspection method

- a. Carefully inspect external rope parts, and, if even single element of wire is broken, bend the section as illustrated and check for breakage in recess of strand, broken core of IWRC, etc.



- b.** Measure the rope diameter over the entire extension of rope during periodic and irregular inspections. Determine the rope diameter by the average of measurements taken in 3 directions at the same place. Where a reduction in diameter (difference of measured diameters on new rope and that at inspection) exceeds 3 % of nominal diameter, check for internal wire breakage by bending the rope in the same way as step 1.

Note 1.

Make sure to check and keep a record of the rope diameter before use.

Note 2.

When a rope is bent, unusual cracking or abrading noises are heard if there is any internal breakage. They may be very small in some cases; it is therefore important to listen carefully.

Note 3.

Although it is generally considered that exact inspection of internal wear of boom ropes can be carried out only by selected engineers with a high level technical expertise in the manufacture of ropes, some indication of advanced internal wear can generally be detected even by non-experts.

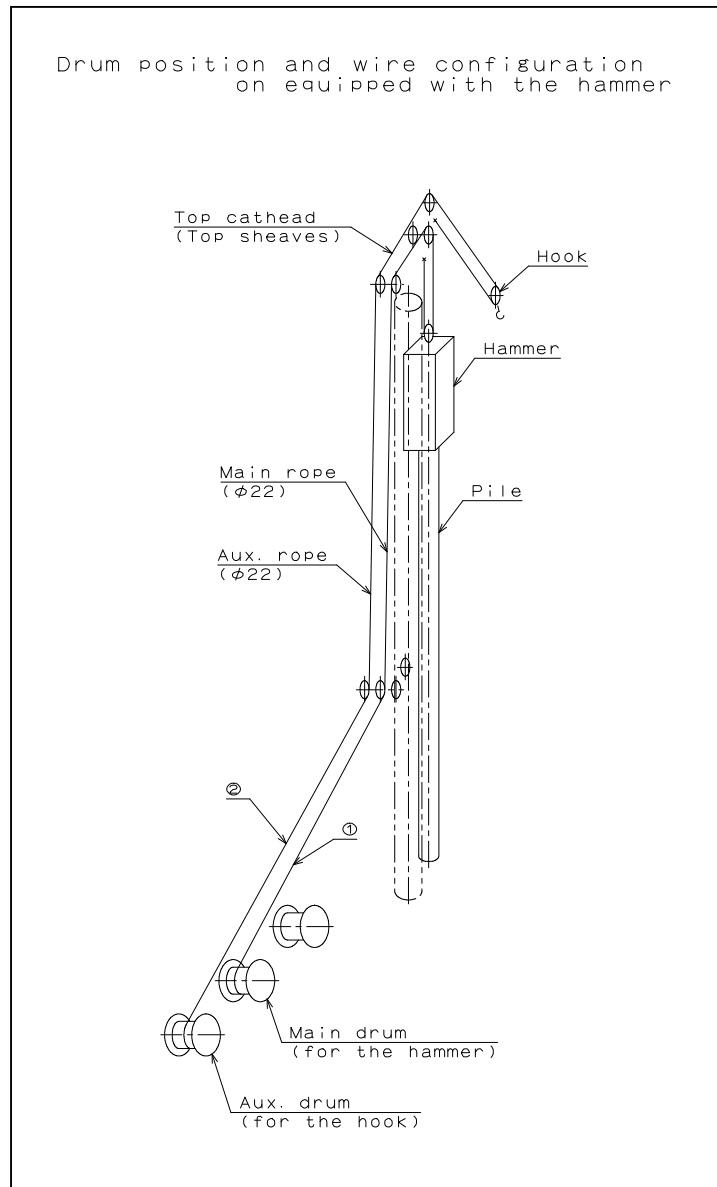
6.6.4 Standards for replacement of wire rope

Longevity varies depending on work conditions, operating methods, etc. However, as wire breakage can result in a serious accident, any rope discovered to be defective must immediately be put out of use. A general guideline for rope replacement is when the breaking load falls by more than 20 % of that of a new rope. If the actual breaking load has reached this limit, consider the replacement timing according to the extent of the damage to the rope. When replacing, refer also to the following regulation for the disposal of ropes.

- **Standards for disposal of ropes with internal wire breakage**
A rope detected to have internal wire breakage is considered to have developed fatigue in all its wire elements due to use under severe conditions. Even if only one part of the rope is detected to have this breakage, it is likely to cause breakage in other parts of the rope, too. Therefore this rope should be disposed of immediately.

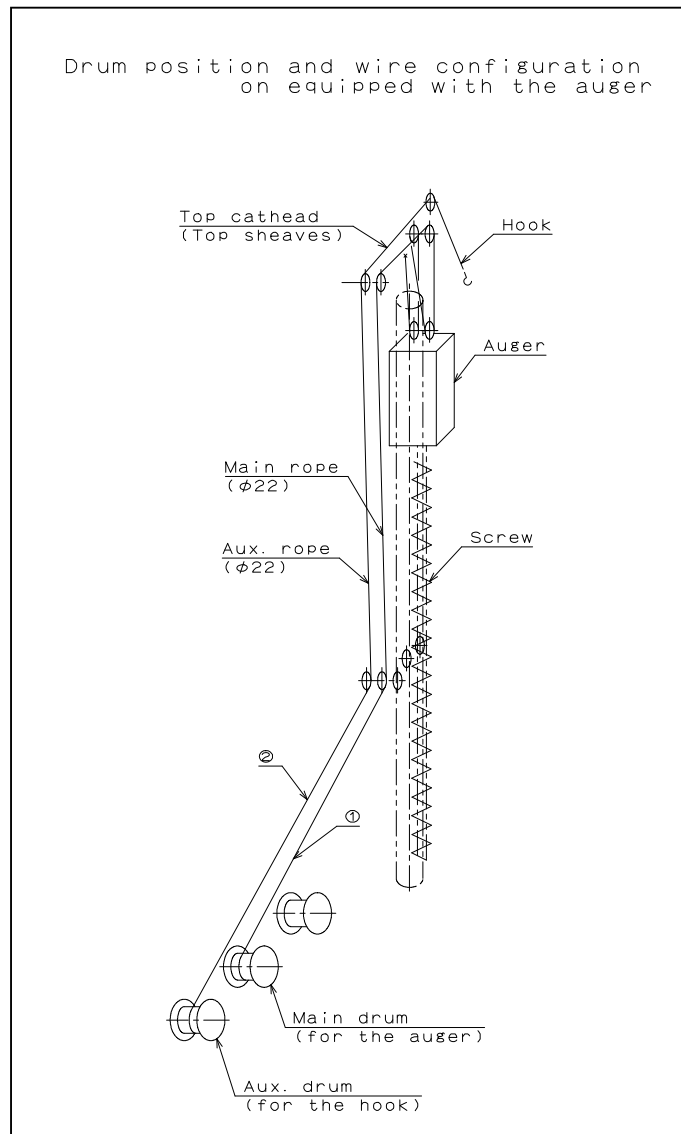
6.6.5 Wire rope routing diagram

6.6.5.1 Hammer



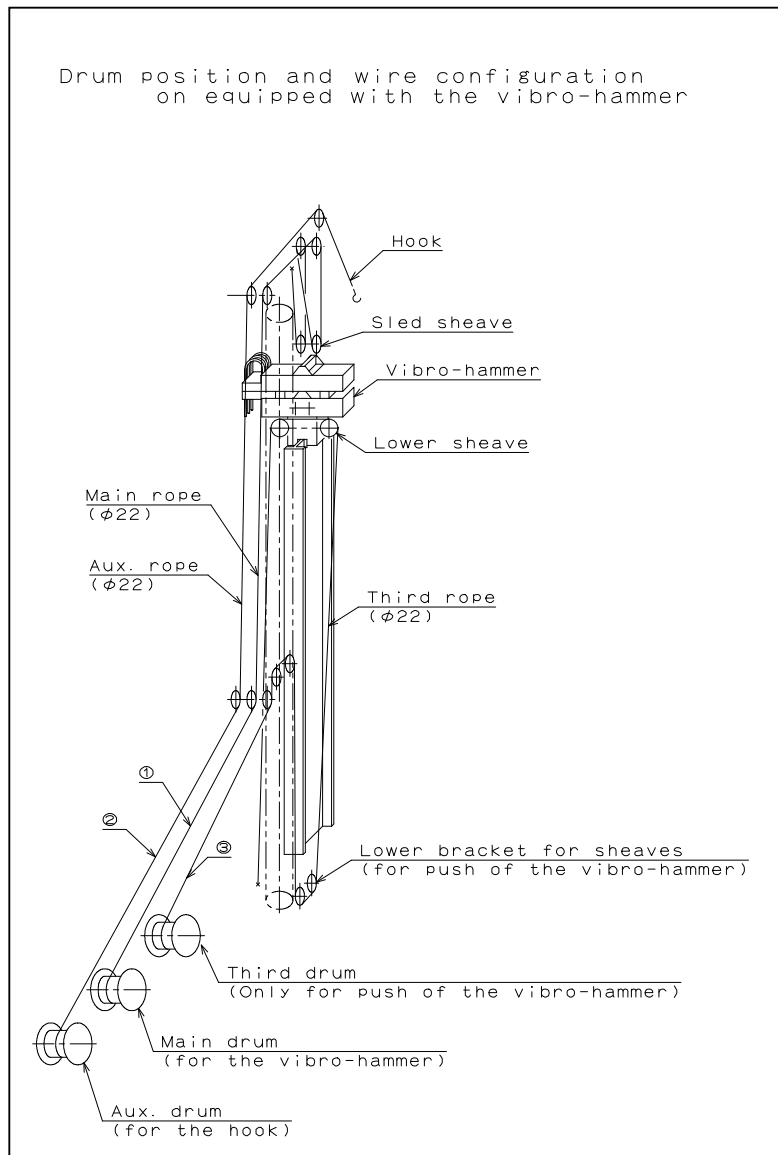
No.	Name of rope	Rope specification	Rope diameter (mm)	Rope length (m)
1	Hammer hoisting rope	IWRC 6 x Fi (29) O/O Grade C	φ 22	135
2	Pile hoisting rope	IWRC 6 x Fi (29) O/O Grade C	φ 22	100

6.6.5.2 Auger



No	Name of rope	Rope specification	Rope Diameter (mm)	Rope Length (m)
1	Auger hoisting rope	IWRC6xFi(29) O/O Grade C	φ 22	135
2	Pile hoisting rope	IWRC6xFi(29) O/O Grade C	φ 22	100

6.6.5.3 Vibro-hammer



No	Name of rope	Rope specification	Rope Diameter (mm)	Rope Length (m)
1	Vibro-hammer hoisting rope	IWRC6xFi(29) O/O Grade C	φ 22	135
2	Pile hoisting rope	IWRC6xFi(29) O/O Grade C	φ 22	100
3	Pushing rope	IWRC6xFi(29) O/O Grade C	φ 22	125



Chapter 7

Inspection and maintenance

7.1 Before starting inspection and maintenance

In order to operate the machine safely and at its full capacity, it is essential to inspect and service the machine periodically.

If any abnormal conditions arise during operation, stop the machine immediately on level ground. Determine the cause of the problem and take appropriate countermeasures before starting work again.



- **Do not attempt to inspect or maintain the machine when the engine and machine are operating; this is dangerous.**
- **Lower all of hoisted loads and working devices to the ground before starting inspection or maintenance.**
- **When working to disassemble or maintain any section which is generating high pressure or being pressurized, make sure to reduce pressure sufficiently, using a pressure-relief device, etc.**
- **If the engine is overheated, do not remove the radiator cap until the radiator fluid has cooled sufficiently.
Doing so may result in hot radiator fluid escaping and possibly causing injury.**
- **When working under heavy equipment, put a support block in place to prevent heavy components from falling.**

 **WARNING**

- Place the machine on level and firm ground for inspection and maintenance.
- Hang a “Do not operate” precautionary sign in a place where it can be seen easily by anybody present around the machine.
- Make sure to stop the engine and remove the key unless it is required to carry out inspection or maintenance.
- When operating the machine during inspection or maintenance, appoint someone to warn others of potential danger.
- Use a safety belt or a work platform when working at elevated positions.
- Do not lift or carry heavy equipment (more than 20 kg) alone. Make sure to use a lifting device or crane.
- Inspect tools and equipment for inspection or maintenance before starting work.
- The battery may release combustible gas from its electrolyte. Consequently, there is a risk of explosion. Do not smoke or use open flames near the battery.
- Be careful not to wet the skin or clothing with battery electrolyte.
- Do not put tools such as spanners, etc. on the battery. Doing so may result in an explosion or fire as a result of a short-circuit.
- Stop the engine before filling the fuel tank.
- Do not smoke or use open flames when filling the fuel tank.

 **WARNING**

- Make sure to replace all covers, panels, etc. which were removed during inspection or maintenance, before resuming work.
- Make sure to carry out inspections thoroughly before resuming work, including monthly and yearly inspections.
- If any anomalies are discovered during inspection, carry out maintenance before operating the machine again.
- Follow the instructions of the manufacturer with respect to the specification, number, and manner of reeving of wire ropes.
- When replacing parts, make sure to use only the authentic parts specified by us.
If other parts must be used, these parts must be of the applicable standards and be of equivalent or higher quality to that of the specification.



- **Avoid touching the engine, muffler, or machine sections immediately after having stopped this engine.**
- **Doing so may result in burning.**
- **Thoroughly inspect the specified sections, observe the specified inspection methods and instructions as specified in this manual.**
- **Use the specified brands of oil and grease for lubrication. Apply the oil and grease in accordance with the instructions presented in this manual.**

- **The periods of time quoted in section “7.3 Inspection and maintenance procedures”, are based on the standard work conditions and should be reduced where work environment and conditions are not favorable. When the machine is used in special conditions, additional arrangements or servicing may be required.**
- **For further details related to the engine, refer to the separate booklet entitled “Instruction Manual of Cummins QSL Model Diesel Engine”.**



Disconnect both the positive (+) and negative (-) battery cables from the battery before welding on the vehicle. Attach the welder ground cable no more than 0.61 meters [2 feet] from the part being welded. Do not connect the ground cable of the welder to the ECM cooling plate or ECM. Welding on the engine or engine mounted components is not recommended or damage to the engine or components can result.

7.2 Inspection and maintenance items

Make sure to carry out inspections and testing as well as service and maintenance such as lubrication, adjustment, repair, etc. in accordance with the instructions in this manual.

7.2.1 Inspection before starting operation

No.	Position	Check point	
1	Engine	Engine oil level, leakage of oil	
2	Radiator	Coolant level, leakage of coolant	
3	Fuel tank	Open drain cock of fuel tank and allow water to drain. Leakage of fuel	
4	Meters and gauges	Function and indication	
5	Electric equipment	Function	
6	Gear cases	Leakage of oil	
7	Hydraulic tank	Oil level, leakage of oil	
8	Hydraulic equipment	Function, leakage of oil	
9	Clutch and brake	Function	
10	Brake pedal lock	Function	
11	Drum lock	Function	
12	Swing brake and lock	Function	
13	Tumblers and rollers	Leakage of oil	
14	Traveling brake	Function	
15	Front Attachments	Leader, sub-leader	Cracks or distortion
		Wire rope	Damage
		Sheave	Function
16	Safety devices	Function	
17	Lubrication	Lubricate according to section "7.4 Application of oil and grease".	

7.2.2 Monthly inspection

No.	Position		Check point
1	Engine	Air filter	Contamination of element
2		Engine oil	Contamination of oil
3		Oil filter	Contamination of element
4		Fuel filter and strainer	Contamination
5		Coolant	Contamination
6		Fan belt	Tension and damage
7		Water pump	Lubricate
8		Radiator fin and radiator hose	Clogging and damage
9		Engine mount	Looseness of bolts and nuts
10		Engine	Function, damage
11	Electric	Battery	Level of electrolyte
12		Electric equipment	Damage
13	Hydraulic system	Pump gear case	Oil level
14		Center flex coupling	Damage
15		Hydraulic oil	Contamination
16		Filter	Contamination
17		Accumulator	Pressure of shielding gas
18		Pump, motor, valve and cylinder	Damage
19	Piping and hoses	Damage and oil leak	
20	Main and aux. drum	Winch gear case	Oil level, contamination
21		Clutch and brake	Function, clearance between lining and drum, wear of lining, damage to drum
22		Brake pedal lock, drum lock	Function, damage to and wear of pawl and drum

No.		Position	Check point
23	3rd drum	Winch gear case	Oil level, contamination
24	Swing device	Swing motor gear case	Oil level, contamination
25		Swing bearing, gear	Looseness of bolts, wear of internal gear
26		Swing brake	Function
27		Swing lock	Function and adjustment, damage to and wear of lock pin and hole
28	Travelling Device	Traveling gear case	Oil level, contamination
29		Shoe, tumbler, roller	Tension of shoe, damage to and wear of shoe, tumbler and roller
30	Front attachments	Leader, sub-leader, cathead, guide pipe, front arm	Cracks or distortion Looseness of pins, bolts, and nuts
31		Joint bolts of leader	Tightening
32		Wire rope	Damage
33		Sheave	Distortion of the bearing
34		Cylinder	Function, damage, oil leak
35		Counterweight	Looseness of mounting bolts, damage
36	Safety Device	Brake pedal and swing alarm device	Function, damage
37	Others	Cab and house	Damage
38		Mounting bolts, nuts and pins	Looseness
39		Lubrication	Lubricate according to section "7.4 Application of oil and grease".

7.3 Inspection and maintenance procedures

Inspection and maintenance procedures described below cover major items in sections "7.2.1 Inspection before starting operation" and "7.2.2 Monthly inspection".

Regarding engine and related sections, refer to the separate booklet entitled "Instruction Manual of Cummins QSL model Diesel Engine" (Issued by Cummins Sales Co., Ltd.). Also refer to section "7.4 Application of oil and grease".

7.3.1 Battery

1. Inspection of battery fluid



- **Be careful not to wet the skin or clothing with battery electrolyte.**
- **Do not smoke or use open flames near the battery.**
- **Do not put tools such as spanners, etc. on the battery. Doing so may result in an explosion or fire as a result of a short-circuit.**

- **If battery fluid comes into contact with the eyes or skin, wash the affected areas thoroughly and immediately with clean water. If the fluid comes into contact with the eyes in particular, consult a doctor.
Remove the plug and check the level of the fluid. If the level is insufficient, add distilled water.**
- **When replenishing the battery with distilled water, make sure to fill before charging (before starting operation).**

2. Checking the specific gravity of the battery fluid

As shown in the illustration, insert a specific gravity meter to check the specific gravity of the battery fluid.

Correct specific gravity: 1.27 to 1.240

The specific gravity meter reading varies depending on the ambient temperature at the measurement. It is therefore necessary to correct the measured value using the following formula which converts it to the equivalent value at standard temperature (20 °C). If the value after conversion falls outside the range quoted above, take necessary countermeasures.

SG at standard temperature (20 °C) = Reading on SG meter + 0.0007 x (Atmospheric temperature – 20 °C)

Example: Provided the atmospheric temperature at measurement is 30 °C and the reading on the SG meter is 1.250.

Then, SG at standard temperature = 1.250 + 0.0007 (30-20) = 1.257

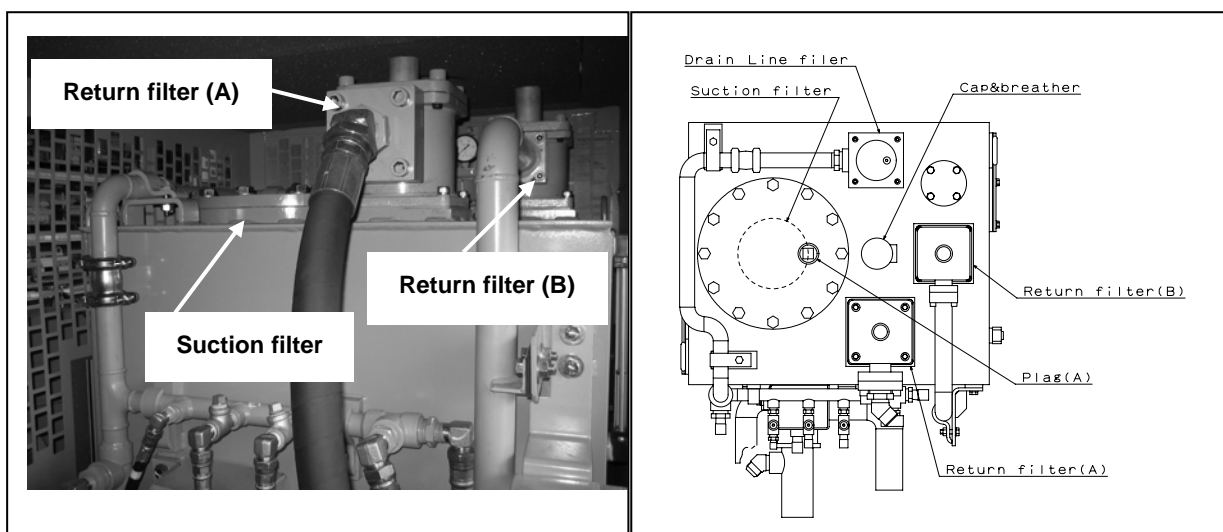
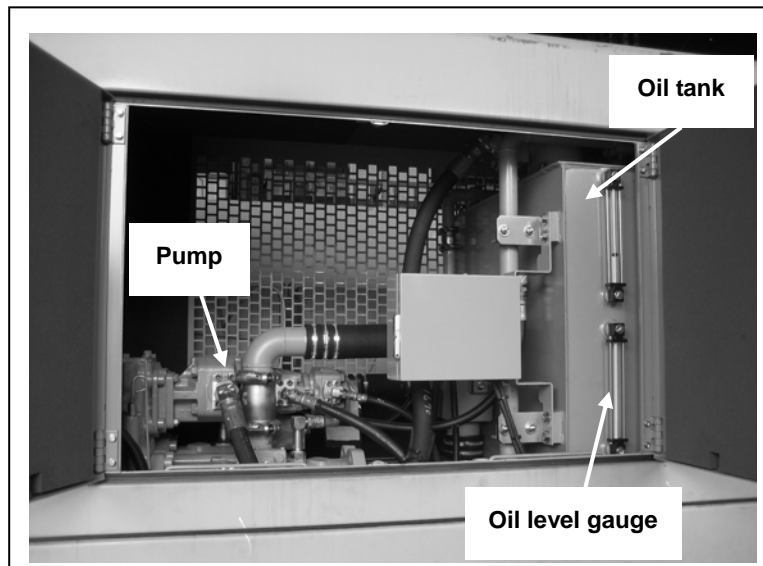


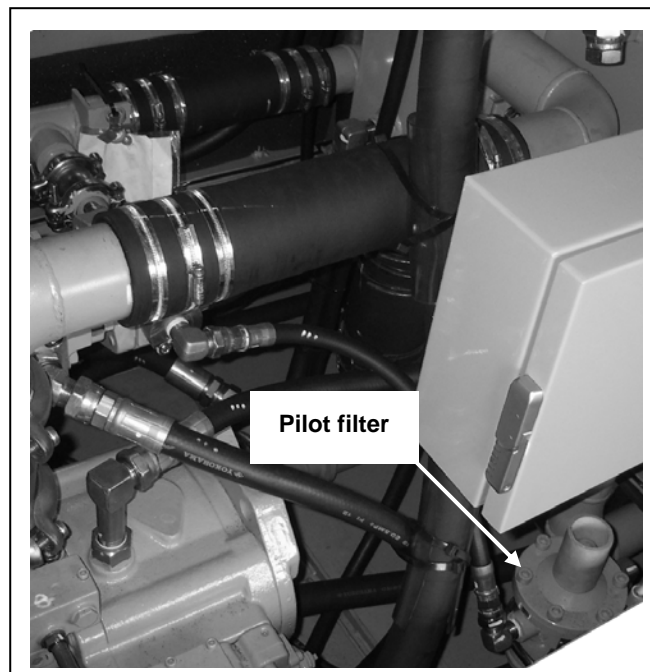
7.3.2 Hydraulic system

7.3.2.1 Cleaning and replacement of filter element

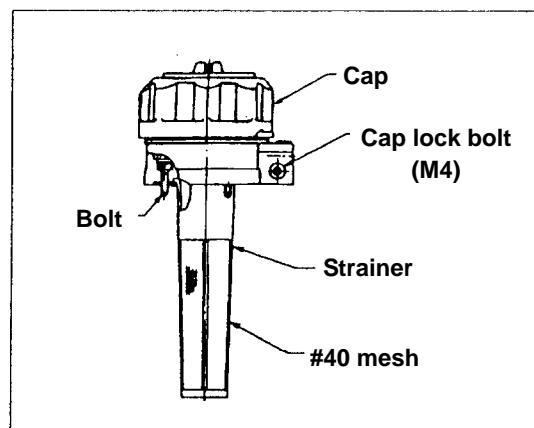
The filter shown in the illustration is installed in the machine's hydraulic system. The filter needs to be cleaned and replaced periodically.

- **When cleaning or replacing the element, first loosen the cap & breather and then loosen each plug. Do not loosen the plug before the cap & breather; doing so will allow oil to spurt out of the oil tank.**
- **After replacing the element, secure the flange (cover), plug, cap & breather tightly.**





- 1.** Handling the cap & breather and cleaning of filter
When replenishing hydraulic oil or cleaning or replacing filter element, loosen the cap lock bolt (4mm hexagon wrench). Then open the cap.
The strainer also needs to be cleaned periodically (every 6 months or every 500 hours' operation). To clean the strainer, remove the cap & breather assembly.

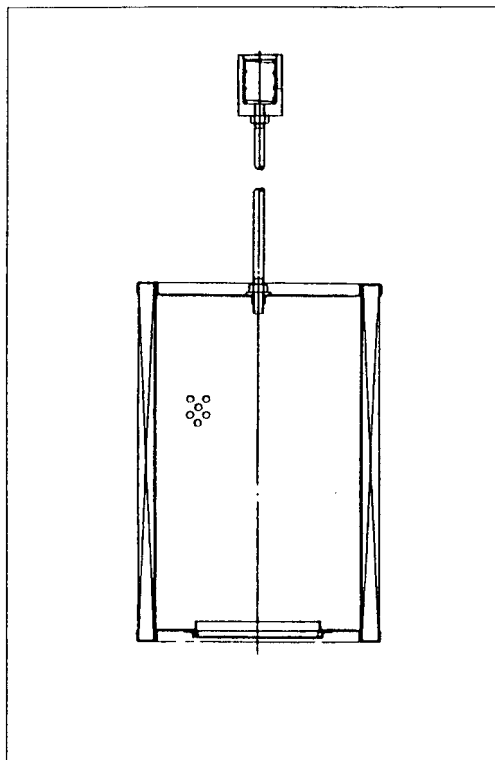


2. Cleaning and replacement of suction filter element

Clean or replace filter element periodically (every 6 months or every 500 hours' operation).

- a. Loosen the cap & breather cap.
 - b. Loosen the plug (A).
 - c. Remove the flange (cover).
 - d. Remove the element from the oil tank.
 - e. The element consists of a wire mesh. Wash the element with light oil or, if it is very dirty, replace the element altogether.
- **Be sure to tighten the flange securely or it may take in air.**

Element part No.	A336F16630
Flange packing No.	S9647 33501



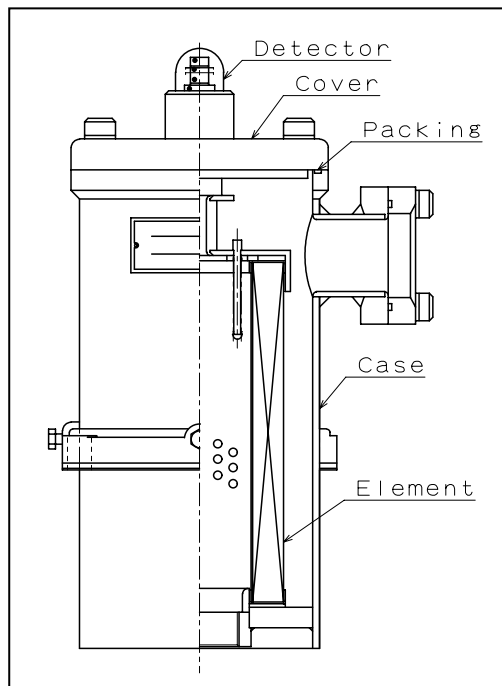
3. Replacement of return filters (A) and (B) elements

Annually or every 1000 hours' operation, whichever occurs more frequently, replace the element.

- a.** Loosen the cap & breather assembly.
- b.** Remove the cover and packing.
- c.** Remove the filter element and replace it.

Return filter(A) element part No.	A03XJ02870
Flange packing No.	S9645 03800

Return filter(B) element part No.	A03XJ02880
Flange packing No.	S9648 13500

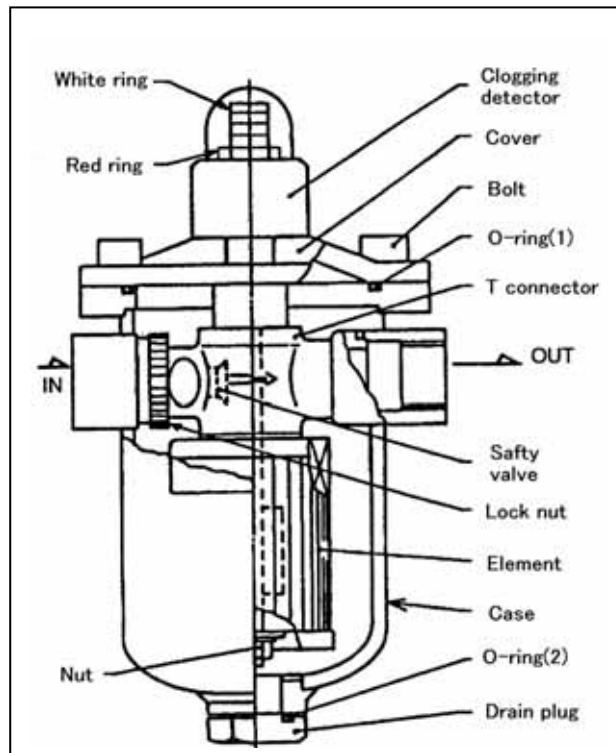


4. Replacement of pilot line filter element

When the red ring of the clogging detector rises to the white section, or annually or every 1,000 hours' operation, whichever occurs more frequently, replace the element.

- a.** Loosen the cap & breather assembly.
- b.** Loosen the drain plug.
- c.** Drain oil via the drain plug.
Loosening the upper cover bolts, remove the cover (with element).
- d.** Release the lock nut and remove the filter element.
- e.** Clean the casing inside with light oil, etc.
- f.** Reverse the above steps to install a new element. Be sure to replace the O-rings also at this time.

Pilot line filter element part No.	A406 765780
O-ring (1) part No.	S9645 01401
O-ring (2) part No.	S9647 01801

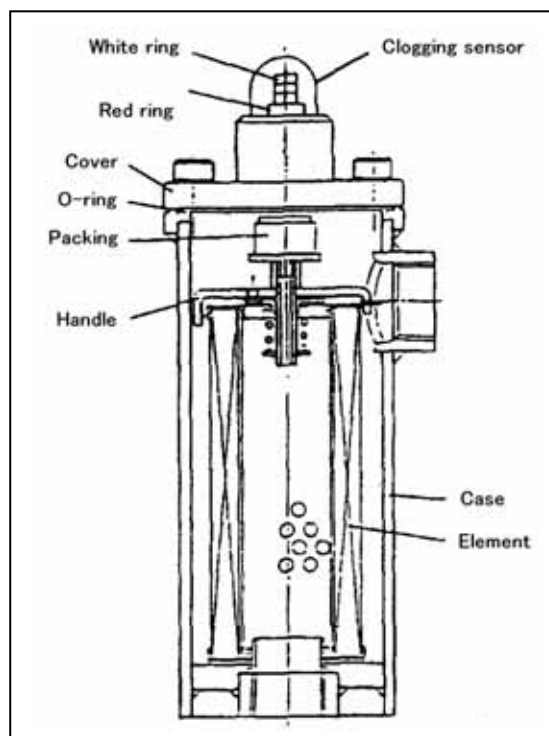


5. Replacement of return oil filter (front control valve)

When the red ring of the clogging sensor rises to the white band, or every 6 months or every 500 hours' operation, whichever occurs more frequently, replace the filter element.

- a.** Loosen the cap & breather assembly.
- b.** Remove the cover and packing.
- c.** Remove the filter element and replace it.

Element part No.	A336E59140
O-ring part No.	S964808500

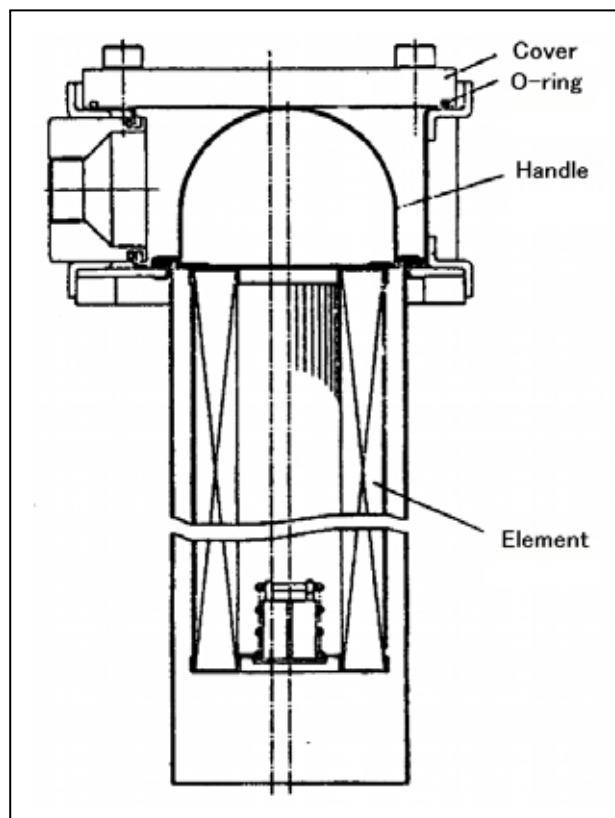


6. Replacement of drain line filter element

When the pressure gauge of drain line filter indicates a pressure of more than 0.3 Mpa, or every 6 months or every 500 hours' operation, whichever occurs more frequently, replace the element.

- a.** Loosen the cap & breather assembly.
- b.** Remove the cover.
- c.** Remove the filter element and replace it.
Be sure to replace the O-ring, also at this time.

Element part No.	A366 L02170
O-ring (1) part No.	S9645 01401
O-ring (2) part No.	S9647 03001
O-ring (3) part No.	S9647 02201



7.3.2.2 Changing hydraulic oil

After removing the cap & breather assembly, remove the drain plug to drain off dirty hydraulic oil. When the hydraulic oil has been fully drained, close the valve and tighten the plug.

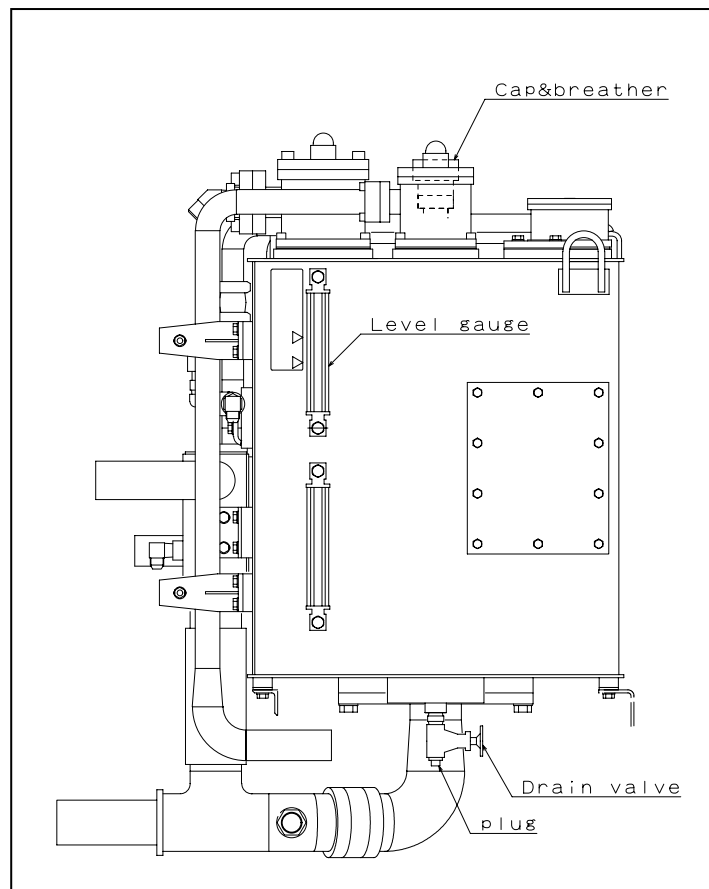
Supply new oil via the oil inlet (Cap & breather).

Replenish hydraulic oil to the upper limit on the level gauge.

Full oil capacity: 760 Litter

Oil tank capacity: 460 Litter (At upper limit of level gauge)

- Use the hydraulic oil of the same manufacturer; do not mix with other manufacturer's oils. If this is impracticable, replace all oil in the hydraulic oil tank, hydraulic equipment and piping.
- Select hydraulic oil from manufacturer's products specified in section "9.4 List of oils and grease". It is strictly prohibited to use gear oil, machine oil, spindle oil, or vegetable oil instead of hydraulic oil.
- When the oil change is complete, operate the engine at idling speed for a while and then check the oil level in the hydraulic oil tank again.
- When the machine is shipped from the factory, Cosmo Hydro HV32 oil is in the system.



7.3.2.3 Draining water from hydraulic oil tank

Loosen and remove the plug to drain water from the tank.

7.3.2.4 Inspection for looseness of and oil leakage from the hydraulic unit mounting

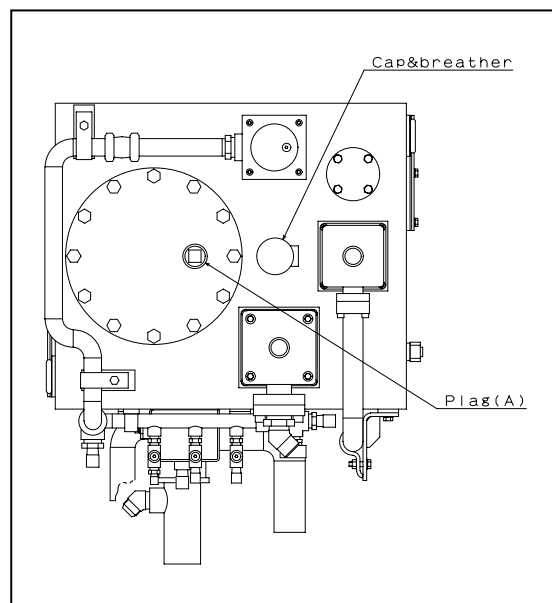
Check the mounting sections of the valve, pipe, coupling, hose, hydraulic oil tank, hydraulic pump, hydraulic motor, etc. in the hydraulic system for looseness and oil leakage.

If any oil leakage is discovered, take the following steps without panic.

1. Recover leaking oil in an appropriate vessel.
2. Loosen the cap & breather assembly on the top surface of the hydraulic oil tank and then loosen plug (A).

This will prevent oil from leaking as result of a siphoning phenomenon so that leaking oil is limited to the amount still remaining in the pipe.

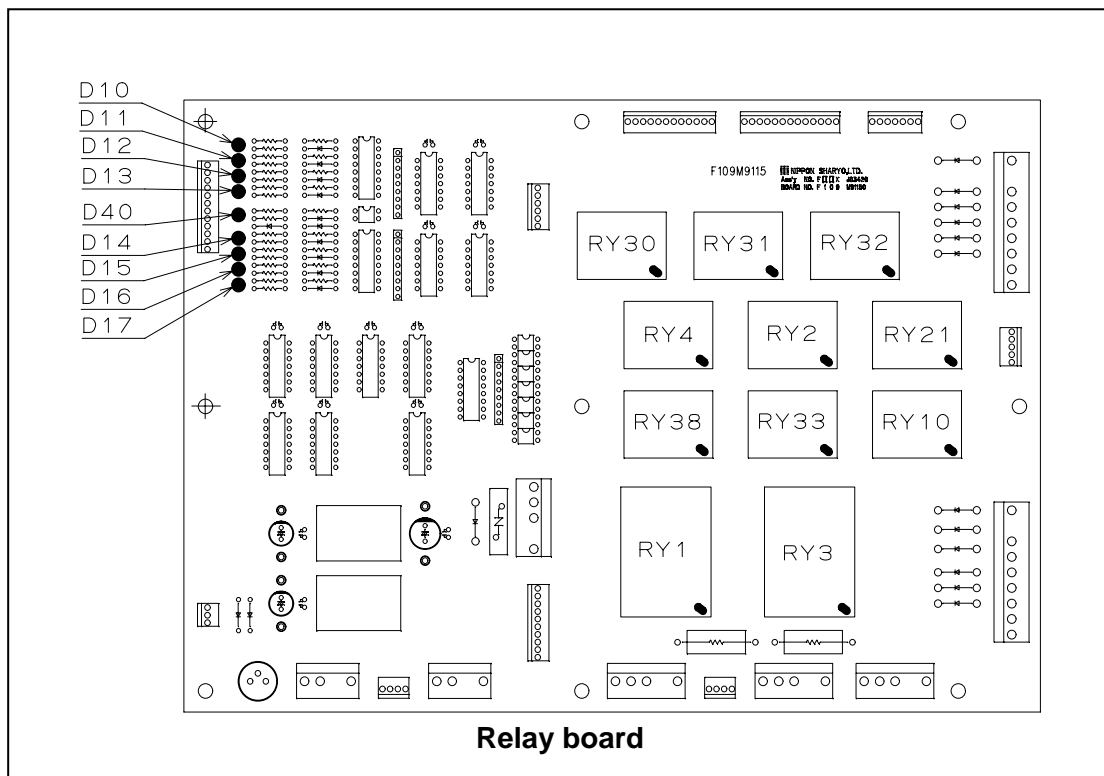
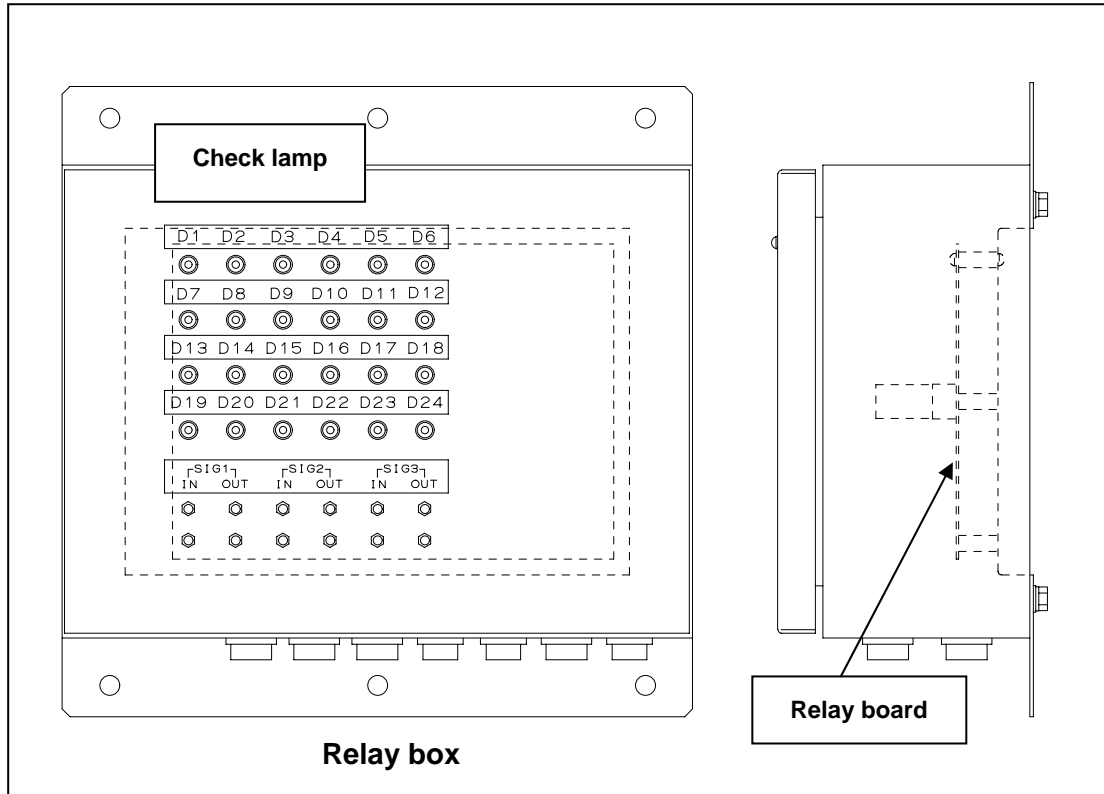
Complete the steps above and then consult a nearby service factory for repair.



After repair, take the following precautions.

- Be sure to tighten the plug on top of the tank, which was loosened previously.
- Run the machine at idling speed for a sufficient time (15 min) to purge air trapped in the pipes.
- Confirm that an adequate quantity of oil is maintained in the system. If the quantity is insufficient, add oil.
- Do not add oil previously recovered to the vessel arising from a leak.

7.3.3 Check lamp inspection of the relay box



7.3.3.1 Lamp status on the relay board and check lamp of the relay box

This section provides information on how the lamps on the relay board and check lamps of the relay box illuminate during operation.

Refer to the tables below to check the operation when a unit does not work.

1. During operation (The angle of the leader is less than 45°.)

Lamp status on the relay board							Check lamp of the relay box
Operation	Leader angle	Revolver lock	Slide lock	Holder lock	Leader slide	Leader forward and backward	
To erect the leader (possible)	The limit switch is ON. D13 illuminates.	---	The lock pin is inserted. D10 illuminates.	---	---	---	D13 and D23 go off.
To lower the leader (possible)	The limit switch is ON. D13 illuminates.	---	---	---	---	---	D14 and D21 go off.
To release the revolver lock	The limit switch is ON. D17 illuminates.	---	The lock pin is inserted. D10 illuminates.	---	---	---	D6 and D15 illuminate.
To release the holder lock	The limit switch is ON. D16 illuminates.	---	The lock pin is inserted. D10 illuminates.	---	---	---	D4 and D16 illuminate.
To release the slide lock	The limit switch is ON. D15 illuminates.	The lock pin is inserted. D12 illuminates.	The lock pin is inserted. D10 illuminates.	The lock pin is inserted. D11 illuminates.	---	The lock pin is inserted. D40 illuminate.	D2 and D17 illuminate.

2. During assembly or transportation (The angle of the leader is more than 45°.)

Lamp status on the relay board							Check lamp of the relay box
Operation	Leader angle	Revolver lock	Slide lock	Holder lock	Leader slide	Leader forward and backward	
To erect the leader (possible)	The limit switch is OFF. D13 goes off.	The lock pin is inserted. D12 illuminates.	---	The lock pin is inserted. D11 illuminates.	---	The limit switch is ON. D40 illuminates.	D13 and D23 go off.
To lower the leader (possible)	The limit switch is OFF. D13 goes off.	The lock pin is inserted. D12 illuminates.	---	The lock pin is inserted. D11 illuminates.	The limit switch is ON. D14 illuminates.	The limit switch is ON. D40 illuminates.	D14 and D21 go off.
To release the slide lock D15 illuminates.	The limit switch is OFF. D13 goes off.	The lock pin is inserted. D12 illuminates.	---	The lock pin is inserted. D11 illuminates.	---	The limit switch is ON. D40 illuminates.	D2 and D17 illuminate.

When the leader slide limit switch is ON, the leader has slid forward fully.

When the leader forward and backward limit switch is ON, the forward and backward adjusting cylinder has extended fully.

7.3.3.2 Alarm

The table below shows conditions where the alarm does not make sound. If the alarm sounds, check the following:

- When no operation is carried out, check each unit condition indicated in items 1, 2, and 5 of the table below.
- When releasing the revolver lock, check each unit condition indicated in item 3 of the table below.
- When releasing the holder lock, check each unit condition indicated in item 4 of the table below.
- When releasing the slide lock, check each unit condition indicated in item 6 of the table below.

1. During operation (The angle of the leader is less than 45°.)

Lamp status on the relay board							
	Operation	Leader angle	Revolver lock	Slide lock	Holder lock	Leader slide	Leader forward and backward
1	---	The limit switch is ON. D13 illuminates.	---	The lock pin is inserted. D10 illuminates.	---	---	---
2	---	The limit switch is ON. D13 illuminates.	The lock pin is inserted. D12 illuminates.	---	The lock pin is inserted. D11 illuminates.	---	---
3	To release the revolver lock D17 illuminates.	The limit switch is ON. D13 illuminates.	---	The lock pin is inserted. D10 illuminates.	---	---	---
4	To release the holder lock D16 illuminates.	The limit switch is ON. D13 illuminates.	---	The lock pin is inserted. D10 illuminates.	---	---	---

2. During assembly or transportation (The angle of the leader is more than 45°.)

Lamp status on the relay board							
	Operation	Leader angle	Revolver lock	Slide lock	Holder lock	Leader slide	Leader forward and backward
5	---	The limit switch is OFF. D13 goes off.	The lock pin is inserted. D12 illuminates.	---	The lock pin is inserted. D11 illuminates.	---	The limit switch is ON. D40 illuminates.
6	To release the slide lock D15 illuminates.	The limit switch is OFF. D13 goes off.	The lock pin is inserted. D12 illuminates.	---	The lock pin is inserted. D11 illuminates.	---	The limit switch is ON. D40 illuminates.

7.3.3.3 Checking each unit condition

The table below shows the lamp status on the relay board and check lamp status of the relay box in relation to each unit condition.

If the operation of each unit is abnormal, refer to the table below to check the operation.

(RB) indicates a lamp on the relay board while (CH) indicates a check lamp of the relay box.

1. Main drum

[Auto brake] mode	[Free fall] mode	Note
(CH) D7 goes off.	(CH) D7 illuminates.	
(CH) D18 goes off.	(CH) D18 illuminates.	Main drum brake solenoid Main drum clutch solenoid
-----	(CH) D12 goes off.	select switch (release)

2. Auxiliary drum

[Auto brake] mode	[Free fall] mode	Note
(CH) D8 goes off.	(CH) D8 illuminates.	
(CH) D19 goes off.	(CH) D19 illuminates.	Main drum brake solenoid and main drum clutch solenoid
-----	(CH) D12 goes off.	select switch (release)

3. Select switch (lock or release)

Switch in the lock position	Switch in the release position	Note
(CH) D12 illuminates.	(CH) D12 goes off.	

4. Swing brake (swing brake release lamp condition)

Brake on Swing brake release lamp goes off.	Brake released Swing brake release lamp goes off.	Note
(CH) D11 goes off.	(CH) D11 illuminates.	Swing lever switch

5. Erecting the leader

Erecting the leader is possible.	Erecting the leader is impossible.	Note
(CH) D13 goes off.	(CH) D13 illuminates.	
(CH) D23 goes off.	(CH) D23 illuminates.	Leader- erecting stop solenoid

6. Lowering the leader

Lowering the leader is possible.	Lowering the leader is impossible.	Note
(CH) D14 goes off.	(CH) D14 illuminates.	
(CH) D21 goes off.	(CH) D21 illuminates.	Leader-lowering stop solenoid

7. Overhoist

During operation	Overhoist prevention	Note
(CH) D10 illuminates.	(CH) D10 goes off.	
(CH) D20 goes off.	(CH) D20 illuminates.	Winding stop solenoids for the main drum and auxiliary drum

8. Slide lock pin

Inserted	Released
(RB) D10 illuminates.	(RB) D10 goes off.

9. Holder lock pin

Inserted	Released
(RB) D11 illuminates.	(RB) D11 goes off.

10. Revolver lock pin

Inserted	Released
(RB) D12 illuminates.	(RB) D12 goes off.

11. Leader slide limit switch

The leader has slid forward fully.	Other than the case described on the left.
The limit switch is ON. (RB) D14 illuminates.	The limit switch is OFF. (RB) D14 goes off.

12. Leader forward and backward limit switch

The forward and backward adjusting cylinder has extended fully.	Other than the case described on the left.
The limit switch is ON. (RB) D40 illuminates.	The limit switch is OFF. (RB) D40 goes off.

13. Leader angle limit switch

During operation (The angle of the leader is less than 45°.)	During assembly or transportation (The angle of the leader is more than 45°.)
The limit switch is ON. (RB) D13 illuminates.	The limit switch is OFF. (RB) D13 goes off.

14. Slide lock switch

The lock switch is inserted.	The lock switch is released.
The slide lock insertion solenoid has been activated. (CH) D1 illuminates.	The slide lock release solenoid has been activated. (CH) D2 illuminates.

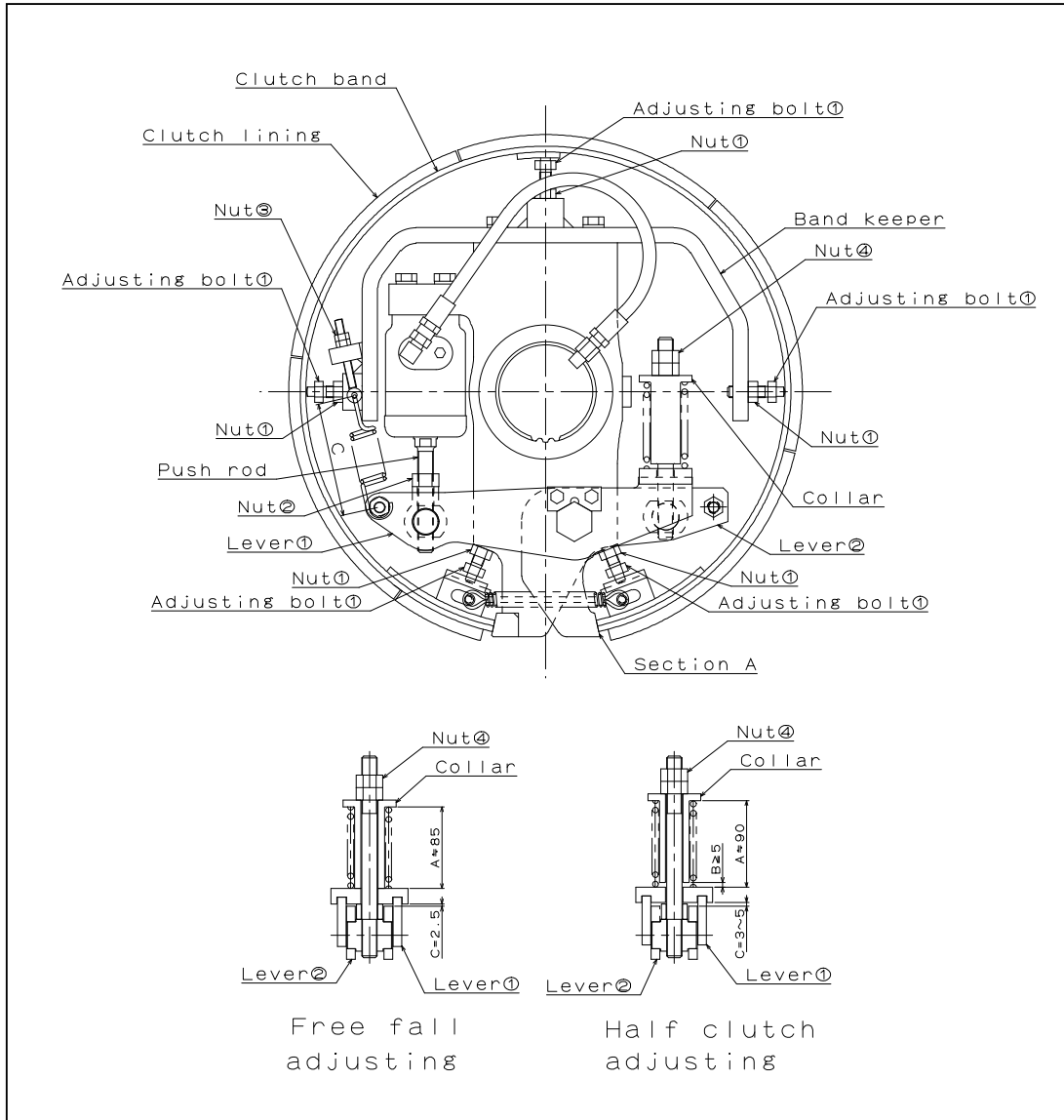
15. Holder lock switch

The lock switch is inserted.	The lock switch is released.
The holder lock insertion solenoid has been activated. (CH) D3 illuminates.	The holder lock release solenoid has been activated. (CH) D4 illuminates.

16. Revolver lock switch

The lock switch is inserted.	The lock switch is released.
The revolver lock insertion solenoid has been activated. (CH) D5 illuminates.	The revolver lock release solenoid has been activated. (CH) D6 illuminates.

7.3.4 Adjusting the main drum clutch



7.3.4.1 Half clutch adjustment

The main winch can set two clutch modes, "Half clutch" and "Free fall".

Half clutch adjustment is standard in this machine.

Half clutch adjustment prevents wire rope slackness.

Half clutch adjustment is carried out as follows.

- 1.** Set the clutch band as shown in the illustration and set the winch to "Free fall" mode.
The winch lever is in the neutral position. The clutch band is released.
Tighten the Nut ④ fully as shown in the "Free fall adjusting" illustration.
- 2.** Set the winch to "Auto brake" mode.
The winch lever is in the neutral position. The clutch band expands.
Turn the adjusting bolts ① (5 pcs.) 90 to 120 ° counter clockwise from the position at which the bolts are making contact with the clutch band, and then tighten the nuts ① (5 pcs.) to lock.
- 3.** Set the winch to "Free fall" mode.
The winch lever is in the neutral position. The clutch band is released.
Loosen the nut ② and the push rod until a clearance is created between the lever and end face A of the clutch band.
- 4.** Turn the push rod until the clearance between the lever and the end of face A of the clutch band is reduced to zero and the lever pushes lightly against the clutch band.
Tighten the nut ② to lock.
- 5.** Turn the nut ③ to adjust the spring length C to approx. 118 mm.
- 6.** Operate the brake mode change-over switch a few times to turn the clutch "ON" and "OFF" and then confirm that a consistent clearance of 0.3 to 0.5 mm is created between the lining and the drum when in "Free fall" mode.
If the clearance is inconsistent, adjust once again with the adjusting bolts ①.
- 7.** Set the winch to "Free fall" mode.
The winch lever is in the neutral position.
The clutch band is released. Loosen the nut ④, and adjust as shown in the "Half clutch adjusting" illustration.
- 8.** When the lining thickness is reduced to 6 mm, replace it. (The thickness of new lining is 12 mm.)

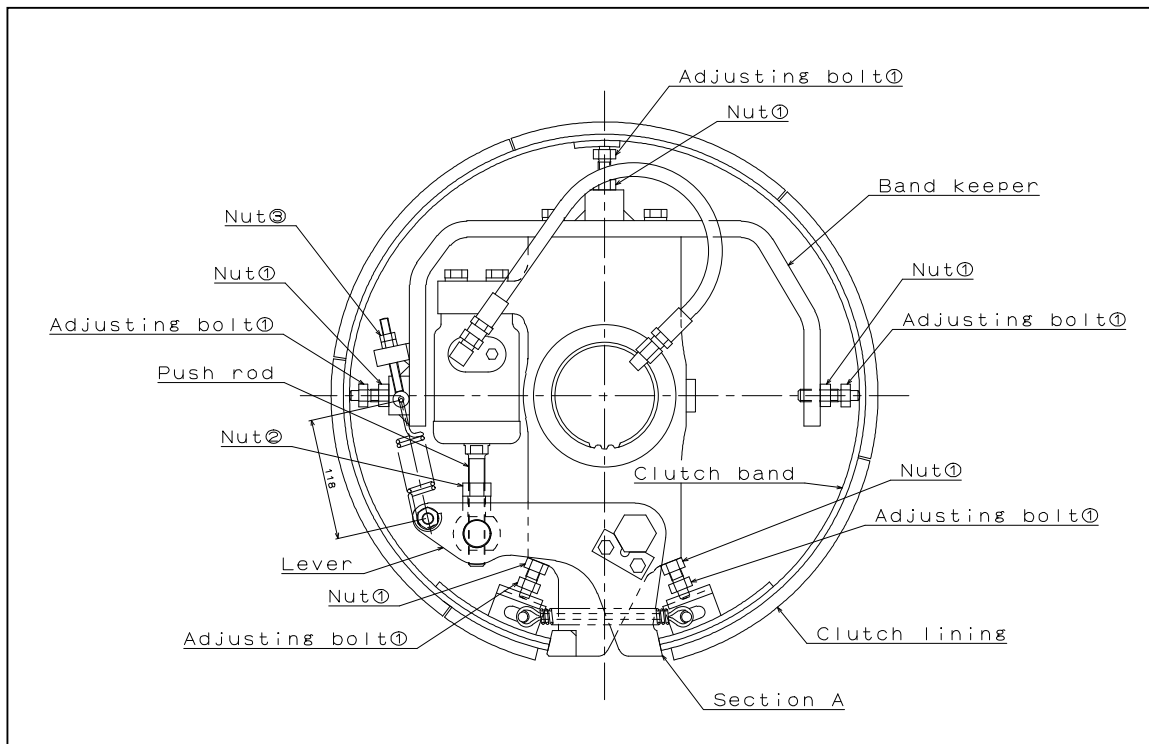
7.3.4.2 Free fall adjustment

Free fall adjusting is carried out as follows.

- 1.** Set the clutch band as shown in the illustration, and set the winch to “Free fall” mode.
The winch lever is in the neutral position. The clutch band is released.
Tighten the Nut ④ fully as shown in the “Free fall adjusting” illustration.
- 2.** Set the winch to “Auto brake” mode.
The winch lever is in the neutral position. The clutch band expands.
Turn the adjusting bolts ① (5 pcs.) 90 to 120 ° counter clockwise from the position at which the bolts are making contact with the clutch band, and then tighten the nuts ① (5 pcs.) to lock.
- 3.** Set the winch to “Free fall” mode.
The winch lever is in the neutral position. The clutch band is released.
Loosen the nut ② and the push rod until a clearance is created between the lever and end face A of the clutch band.
- 4.** Turn the push rod until the clearance between the lever and the end of face A of the clutch band is reduced to zero and the lever pushes lightly against the clutch band.
Tighten the nut ② to lock.
- 5.** Turn the nut ③ to adjust the spring length C to approx. 118 mm.
- 6.** Operate the brake mode change-over switch a few times to turn the clutch “ON” and “OFF” and then confirm that a consistent clearance of 0.3 to 0.5 mm is created between the lining and the drum when in “Free fall” mode.
If the clearance is inconsistent, adjust once again with the adjusting bolts ①.

7.3.5 Adjusting the auxiliary drum clutch

1. Set the clutch band as shown in the illustration, and set the winch to "Auto brake" mode. The winch lever is in the neutral position. The clutch band expands. Turn the adjusting bolts ① (5 pcs.) 90 to 120 ° counter clockwise from the position at which the bolts are making contact with the clutch band, and then tighten the nuts ① (5 pcs.) to lock.
2. Set the winch to "Free fall" mode. The winch lever is in the neutral position. The clutch band is released. Loosen the nut ② and the push rod until a clearance is created between the lever and end face A of the clutch band.
3. Turn the push rod until the clearance between the lever and the end of face A of the clutch band is reduced to zero and the lever pushes lightly against the clutch band. Tighten the nut ② to lock.
4. Turn the nut ③ to adjust the spring length C to approx. 118 mm.
5. Operate the brake mode change-over switch a few times to turn the clutch "ON" and "OFF" and then confirm that a consistent clearance of 0.3 to 0.5 mm is created between the lining and the drum when in "Free fall" mode. If the clearance is not consistent, adjust once again with the adjusting bolts ①.
6. When the lining thickness is reduced to 7.5 mm, replace it. (The thickness of new lining is 12 mm.)

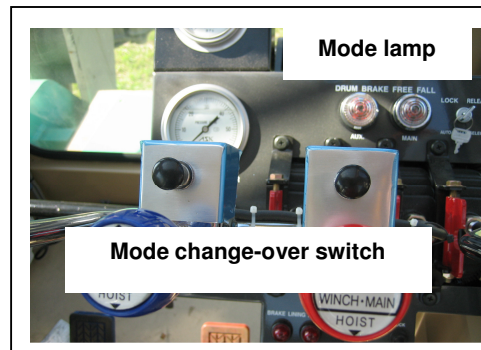
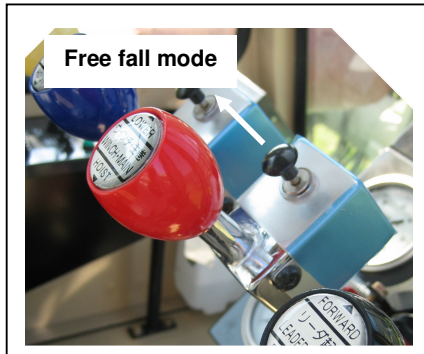


7.3.6 Adjusting the brake band of the main, auxiliary

- Adjust the brake band in both of [Free fall] and [Auto brake] mode.

7.3.6.1 Adjustment procedures in [Free fall] mode

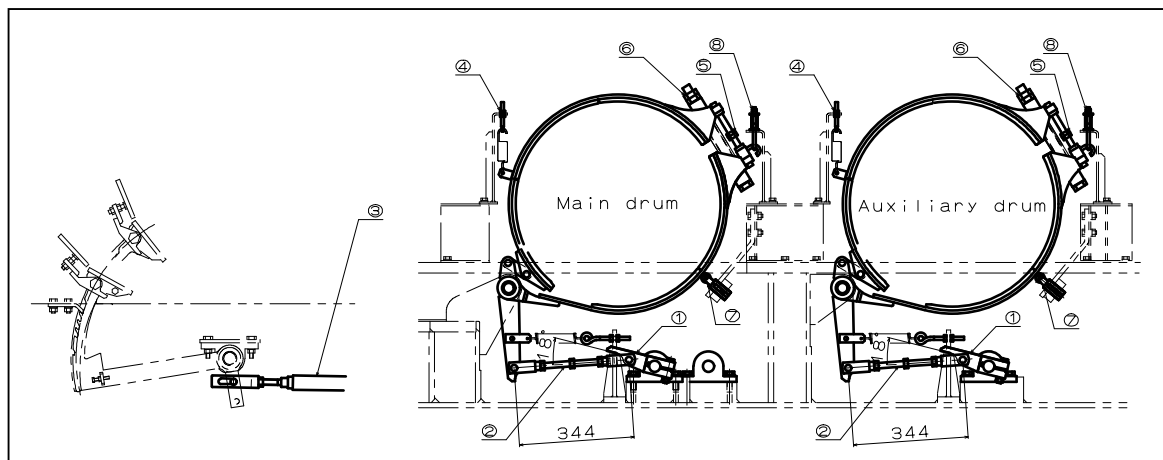
1. Turn the mode change-over switch to [Free fall] and press the brake pedal fully. Check that the mode lamp illuminates.



2. Press the brake pedal and apply the brake pedal lock at its highest ratchet. Check that the toggle angle θ between toggle lever ① and adjusting rod ② is 18° . If not, adjust it with adjusting rods ② and ③. Approximate lengths of these adjusting rods are as follows.

Adjusting rod ②: 344 mm

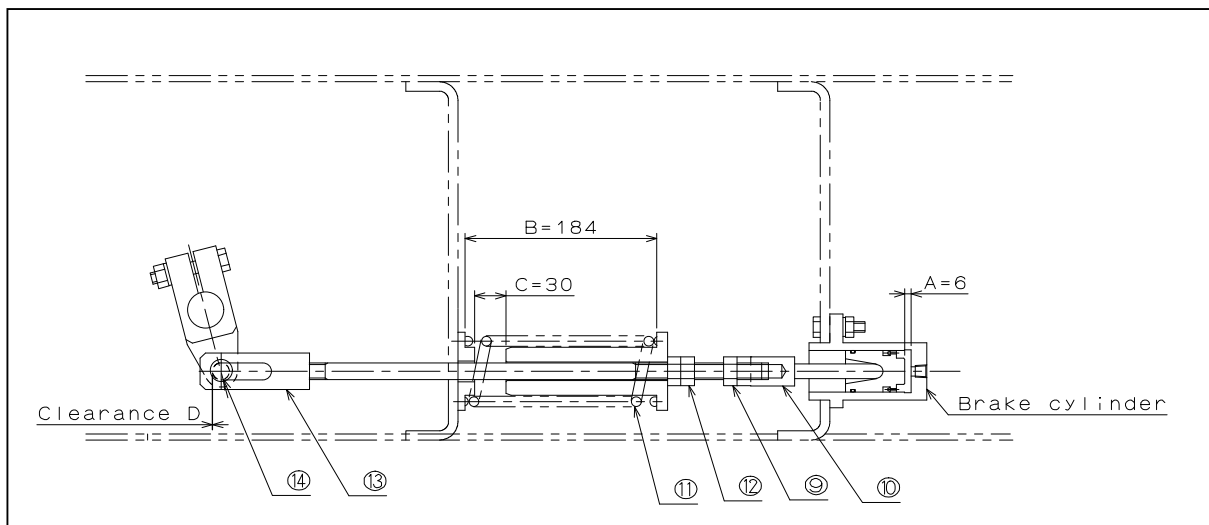
Adjusting rod ③: 2719 mm (main drum), 2880 mm (auxiliary drum)



3. Release the brake pedal lock and loosen stopper bolt ⑤ until its head clearance is sufficient.
Press the brake pedal at the top ratchet, and adjust the nut ⑥ to the point at which it can lock tightly. Lock securely after adjustment.
4. When the brake is locked, extend the stopper bolt ⑤ until the bolt heads make contact with each other. Extend the bolt further by 1/6 turn and lock with the lock nut.
5. Release the brake, and adjust the bolts ④, ⑦, and ⑧. Ensure that the clearance between the brake band and the brake drum surface is evenly distributed 0.8 to 1.0 mm over the circumference.
6. The normal thickness of the brake lining is 12 mm. Replace the lining when the thickness reduces to 7.5 mm.

7.3.6.2 Adjustment procedures in [Auto brake] mode

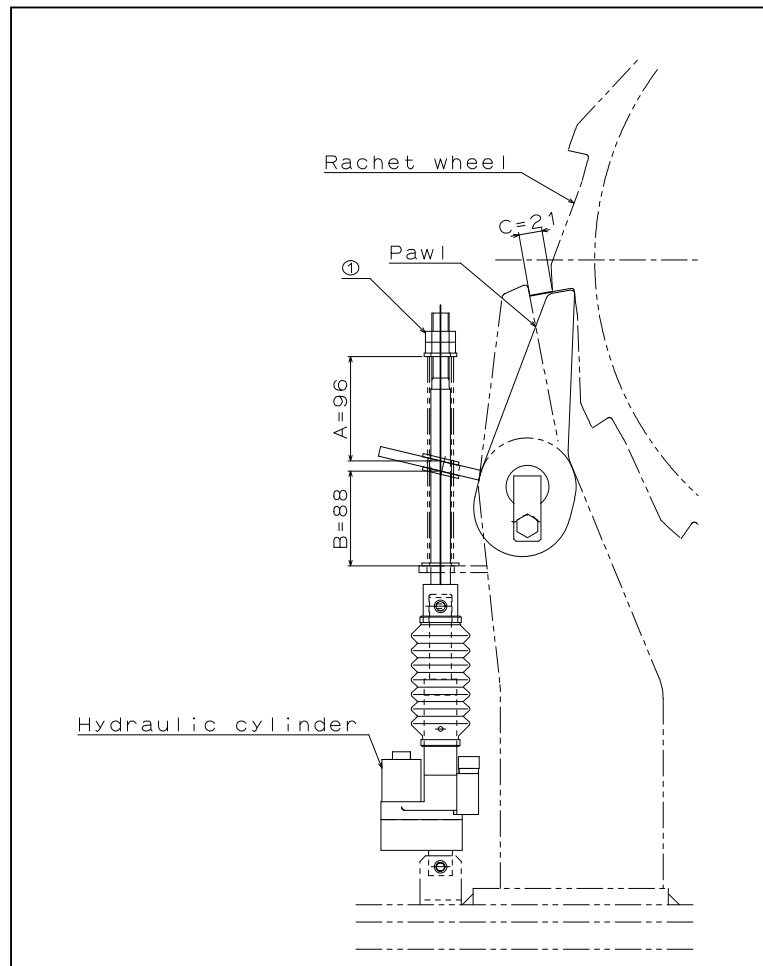
1. Turn the mode change-over switch to [Auto brake] mode.
2. After adjusting the brake linkage in accordance with "7.3.6.1 Adjustment procedures in [Free fall] mode", press the brake pedal fully to engage the brake pedal lock.
3. Loosen lock nut ⑨ and adjust gap A from the piston and cylinder to 6 mm using rod ⑩. Then retighten the rod with lock nut ⑨.
4. Adjust dimension B of brake spring ⑪ to 184 mm with nut ⑫. In this adjustment, the dimension C may be 30 mm.
5. Move the winch control lever in the "winding" direction to direct the hydraulic oil to the brake cylinder and see if the gap D between pin ⑭ and joint ⑬ is 4 ± 2 mm.



7.3.7 Adjusting the drum pawl lock of the main and auxiliary winch drums

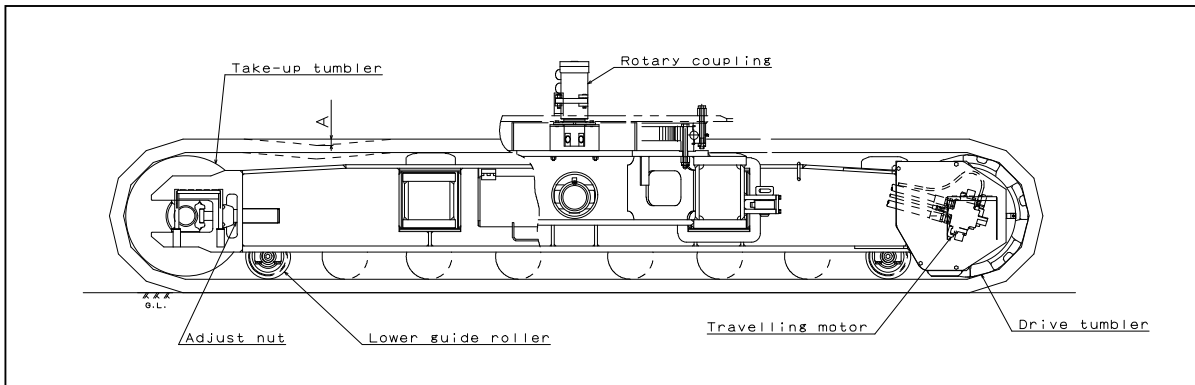
All drum pawl locks can be activated via the associated drum lock switches with the associated hydraulic cylinders.

1. Turn the drum pawl lock switch to [Lock] and see that the pawl is completely engaged in the ratchet wheel. Then adjust the length of springs A and B via nut ①.
A = 96 mm
B = 88 mm
2. Turn all drum pawl lock switches to [Release] and see that the corresponding pawl is completely opened from the ratchet wheel, then adjust the clearance between the pawl and ratchet wheel so that it is 21 mm.



7.3.8 Adjusting the track shoe chain

1. Position the machine on level ground and then move the machine forward a little to apply tension to section A on the take-up tumbler side
2. Using the adjust nut on the take-up tumbler side, adjust the deflection at section A to 20 mm. Align the notches on the inside and outside of the side flame and tumbler bearing to position the tumbler in parallel.



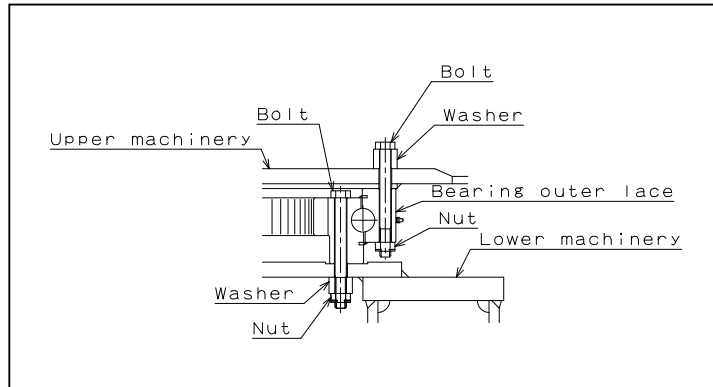
7.3.9 Inspection of swing bearing mounting bolts

7.3.9.1 Inspection frequency

- Inspect bolts for play on delivery of the new machine and 50 to 200 Hrs after replacing with new bolts.
- Inspect monthly.
- Inspect annually.
- Inspect if abnormalities (noise, rocking of upper machinery, etc) are detected on the mounting bolts.

7.3.9.2 Inspection procedures

1. Using an inspection hammer or wrench, check for play or damage to the bolt connecting the upper machinery and the swing bearing outer lace.
2. Using an inspection hammer or wrench, check for play or damage to the bolt connecting the lower machinery and the swing bearing inner lace.



7.3.9.3 Treatment after inspection

If play exists, or parts are missing or damaged, consult a nearby service shop.
 Size and tightening torque of the swing bearing mounting bolt.

Model	Bolt size, number		Tightening torque (N·m)	Width across flats (mm)
	Upper machinery	Lower machinery		
DHJ85	M24 x 44 pcs	M24 x 40 pcs	951 to 1167	36

7.3.10 Tightening the leader and stay joint bolts

7.3.10.1 Tightening torque



- **Always use leader joint bolts approved by Nippon Sharyo and tighten them with to the specified torque.**

1. When assembling a new machine or when assembling the leader with newly purchased nuts, bolts, and washers, tighten nuts with the following tightening torque.

Bolt size M24: Tightening torque 690 to 830 Nm

Oil is applied to nuts approved by Nippon Sharyo before shipment. The above tightening torque applies to such nuts.

If the nuts are not oiled when required for assembly, apply engine oil, hydraulic oil, or gear oil to the screw thread parts of the nuts, and then tighten them to the above tightening torque.

2. When tightening a nut to which general rust preventive oil has been applied, tighten it to the torque shown below.

Bolt size M24: Tightening torque 1000 to 1200 Nm

7.3.10.2 Tightening procedure

1. Before assembling the leader flange surfaces, clean the surfaces, lower inside section and seats of the bolts and nuts, and ensure that they are free of foreign matter.
2. If no oil is found on the screw threads, always apply engine oil, hydraulic oil, or gear oil.



- **Note that a different tightening torque applies if general rust preventive oil has been applied to the screw threads of the nut.**

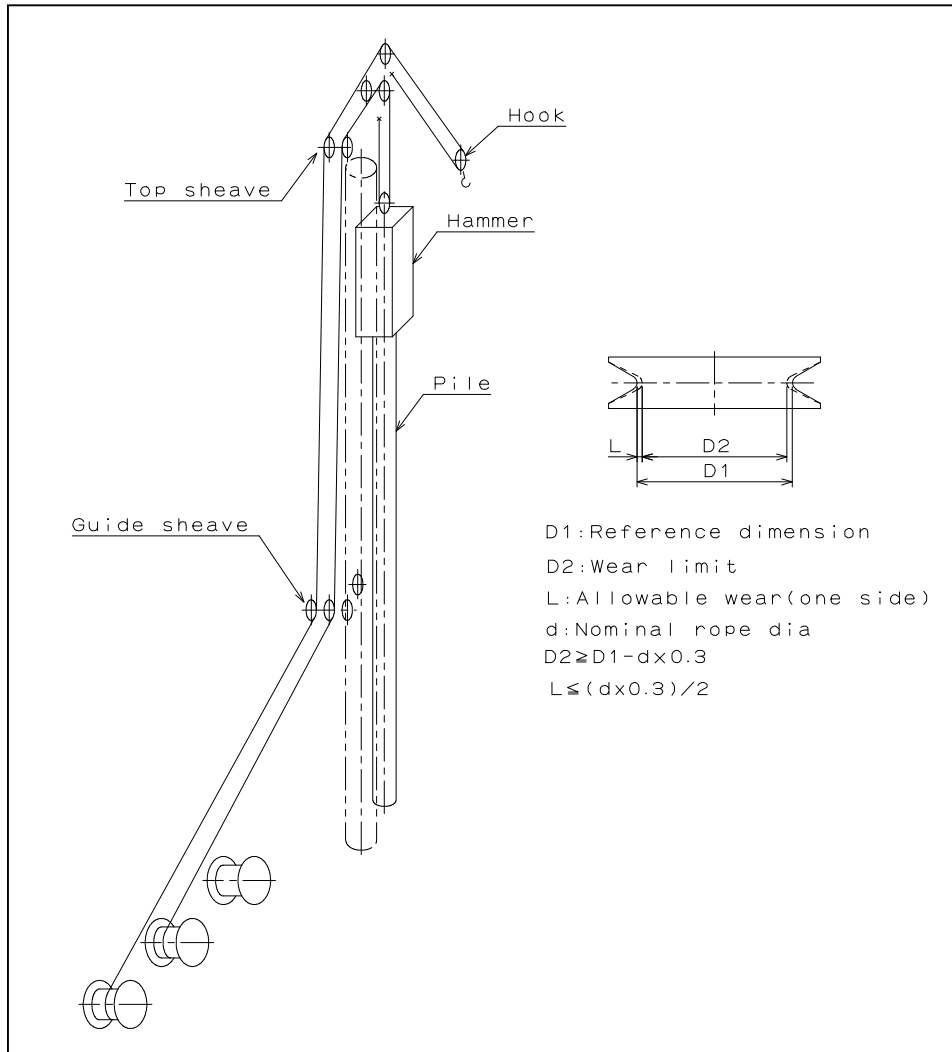
- 3.** Insert all the bolts into the bolt holes in the flange, attach the washers, and screw on the nuts.
- 4.** Temporarily tighten the bolts in diagonal lines alternately, tightening evenly on the periphery. Ensure that no gap exists between the flange mating surfaces.
- 5.** Firmly and evenly tighten the bolts diagonally with the specified tightening torque on the periphery. Using a torque wrench, check that the tightening torque is correct.

7.3.11 Inspection of top sheave bearing

- 1.** Inspection frequency
 - **Monthly and when disassembling the leader.**
- 2.** Inspection procedures
 - a.** Rotate the sheave manually ensuring that it rotates smoothly without abnormal sounds.
 - b.** Move the sheave manually ensuring that there is no excessive play.
 - c.** Visually check for damage to bearing seals.
- 3.** If any anomalies are found, replace the bearing with new one.

7.3.12 Wear limit of sheaves

Replace the sheaves with new ones if the wear of their grooves exceeds the permissible wear limit specified in the table below.



No	Rope name	Rope diameter (mm)	Sheave diameter	Sheave PCD (mm)	Nominal size D1 (mm)	Wear limit D2 (mm)	Permissible wear limit L (mm)
1	Top sheave	φ 22	φ 443	φ 402	φ 380	φ 374	3
2	Guide sheave	φ 22	φ 443	φ 402	φ 380	φ 374	3

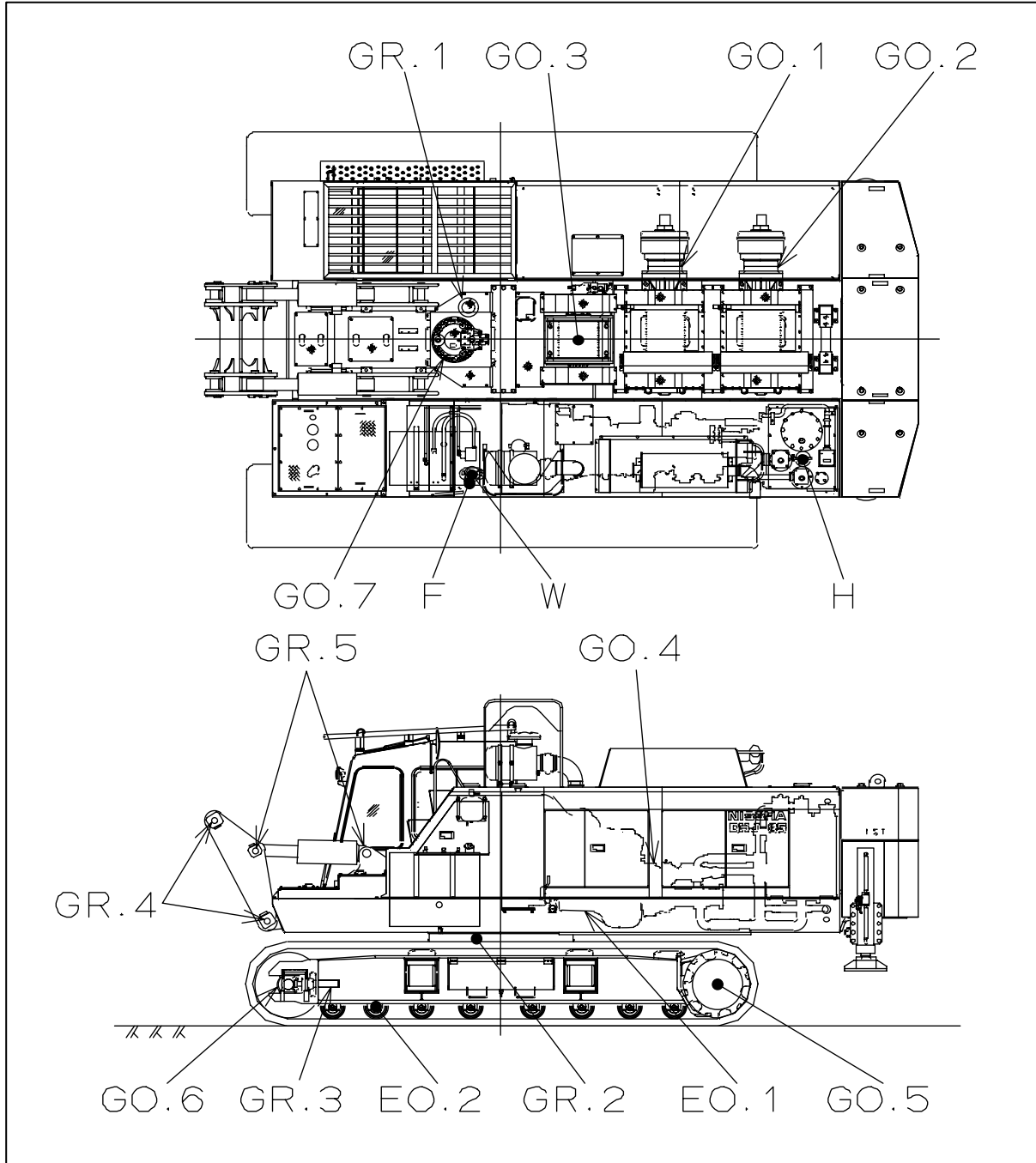
7.4 Application of oil and grease

The application of oil and grease is essential to minimize wear and damages to the machine and to maximize the machine capacity. Always apply oil and grease as instructed in this manual.

7.4.1 Precautions related to the application of oil and grease

- The appropriate oil and grease are specified in section “9.4 List of oils and grease”.
 - Oil and grease must be clean and free of dust, water, etc.
 - Clean lubricators and funnels must be used when applying oil and grease.
 - Clean oil inlets, grease nipples, and peripheries in advance to avoid contamination of oil and grease by grit or dust.
 - Be sure not to soil the clutch lining, brake lining, or electric wires with oil or grease. If this happens, remove oil or grease completely or replace the lining.
 - Remove spilled oil or excessively applied grease. Thorough cleaning is necessary, especially if sound insulation material has absorbed oil or grease.
 - When exchanging oil, check the gear case internally for cleanliness and, if necessary, clean the inside.
 - Do not dispose of discharged oil carelessly. It must be processed appropriately before disposal to protect the environment.
1. Regarding oil and grease supplies for the engine, refer to the separate booklet entitled “Instruction Manual of Cummins QSL 9 Diesel Engine”.
 2. For further details regarding maintenance involving oil and grease lubrication, refer to section “7.3 Inspection and maintenance procedures”.

7.4.2 Base machine lubrication



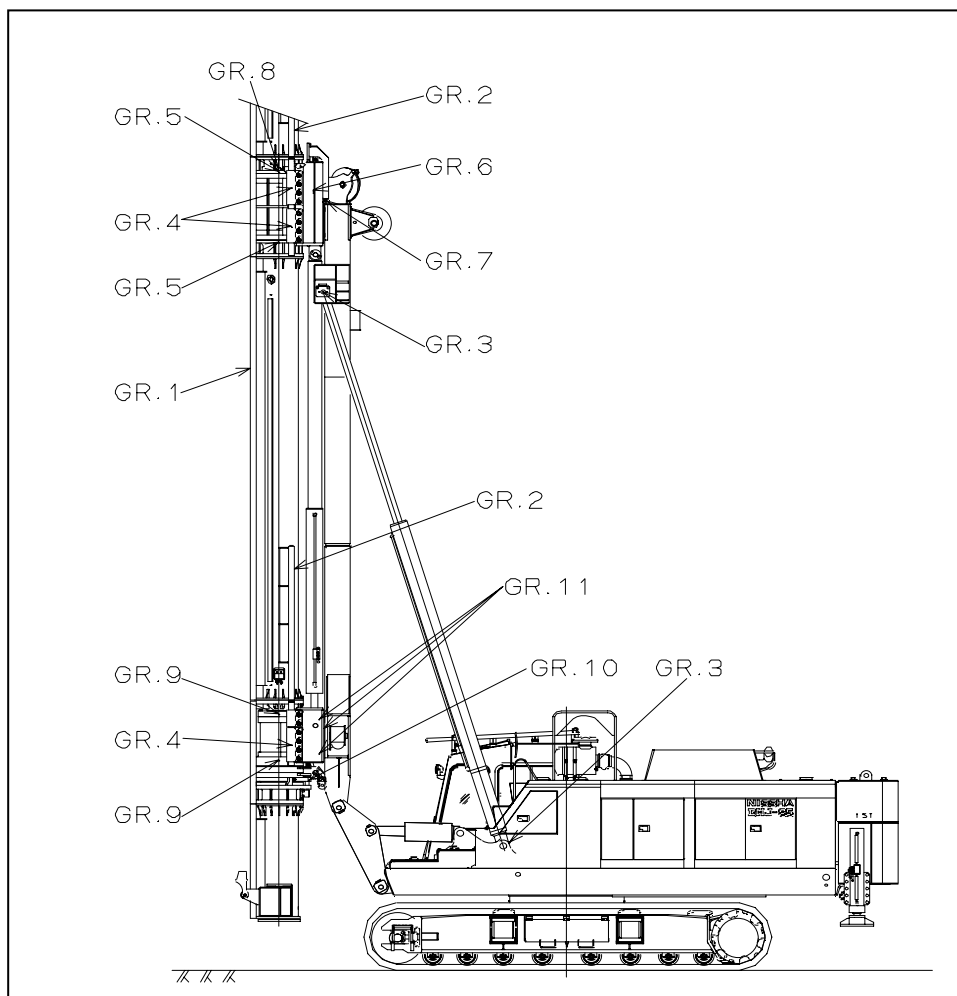
Lubricant Chart

Mark	Lubrication point	Lubricant	Quantity x No.	Service interval
F	Fuel tank	Gas oil	98 gal (370 liters)	Daily check
H	Hydraulic oil tank	Hydraulic oil	201 gal (760 liters)	
W	Radiator	Coolant 50% mixture	8.7 gal (33 liters)	
		Additive	0.6 gal (2.4 liters)	
EO.1	Engine oil pan	Engine Oil	7.4 gal (28 liters)	Monthly check
EO.2	Guide roller lower		0.05 gal (0.2 liters) x 16	
GO.1	Main drum gear case	Gear oil	0.7 gal (2.5 liters)	
GO.2	Sub drum gear case		0.7 gal (2.5 liters)	
GO.3	Third winch gear case		5.3 gal (20 liters)	
GO.4	Pump gear case		1.0 gal (3.9 liters)	
GO.5	Travel gear case		4.2 gal (16 liters) x 2	
GO.6	Take-up tumbler		0.08 gal (0.3 liters) x 2	
GO.7	Swing gear case		2.4 gal (9.2 liters)	
GR.1	Internal gear	Heat resistant grease	6.6 gal (25 liters)	
GR.2	Swing bearing	Extreme pressure grease	4 fittings	
GR.3	Adjusting bolt	Grease	4 fittings	
GR.4	Leader adjusting arm pin		4 fittings	
GR.5	Leader adjusting cylinder pin		4 fittings	

7.4.3 Front end attachments (leader/sub-leader) lubrication

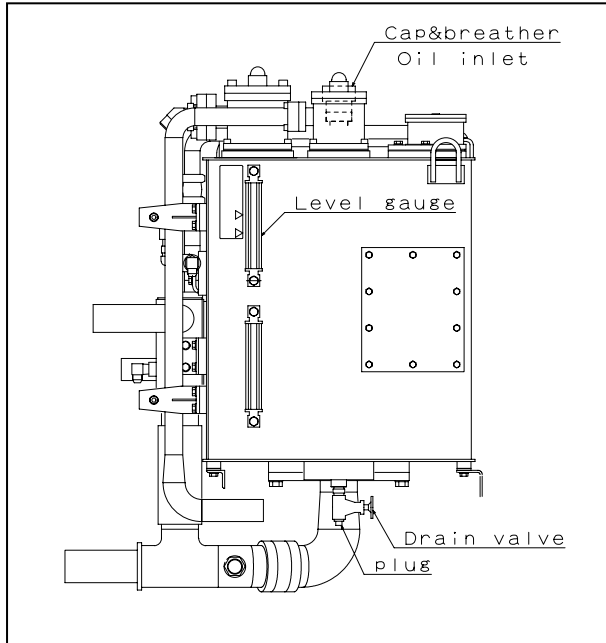
Lubricant chart

Mark	Lubrication point	Lubricant	Service interval
GR.1	Guide pipe	Grease	Daily check
GR.2	Sub-leader guide pipe		
GR.3	Leader hoist cylinder pin		
GR.4	Guide gib		
GR.5	Holder		
GR.6	Slide lock		
GR.7	Hinge		
GR.8	Holder lock pin		
GR.9	Revolver bearing		
GR.10	Revolver lock pin		
GR.11	Tilt slide		

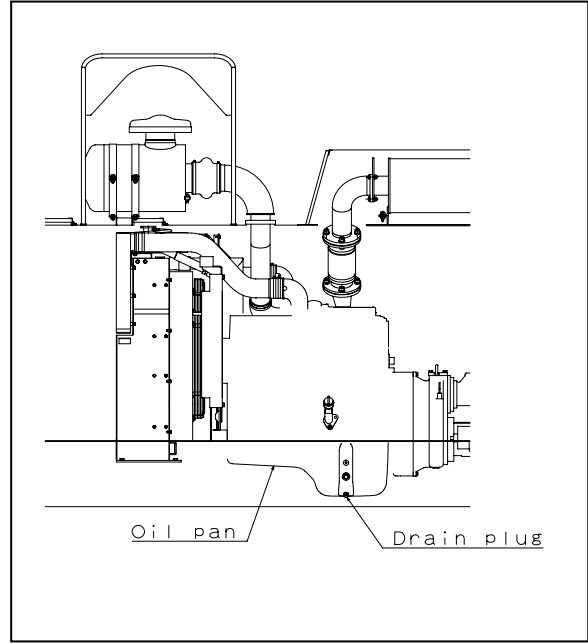


7.4.4 Base machine lubrication

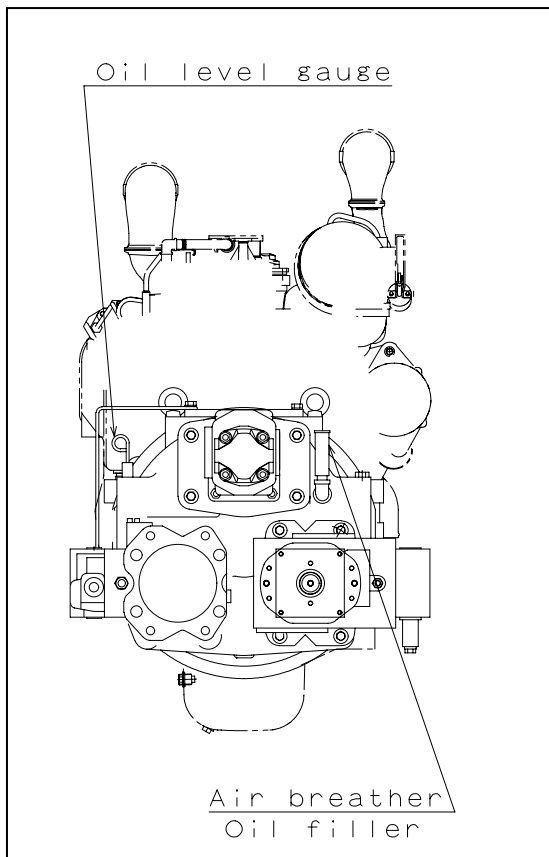
Hydraulic oil tank



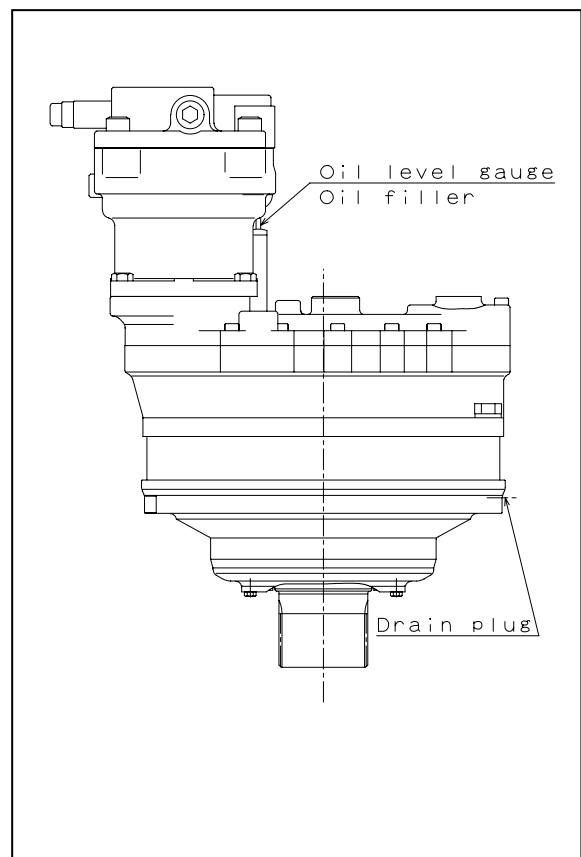
Engine oil



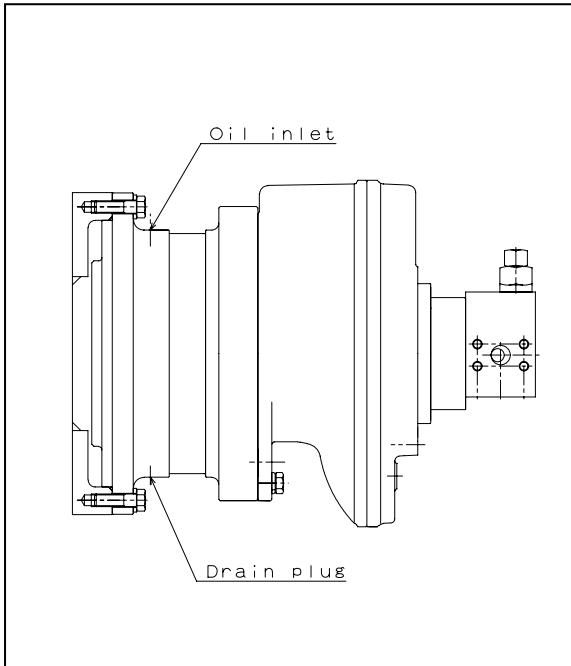
Pump gear case



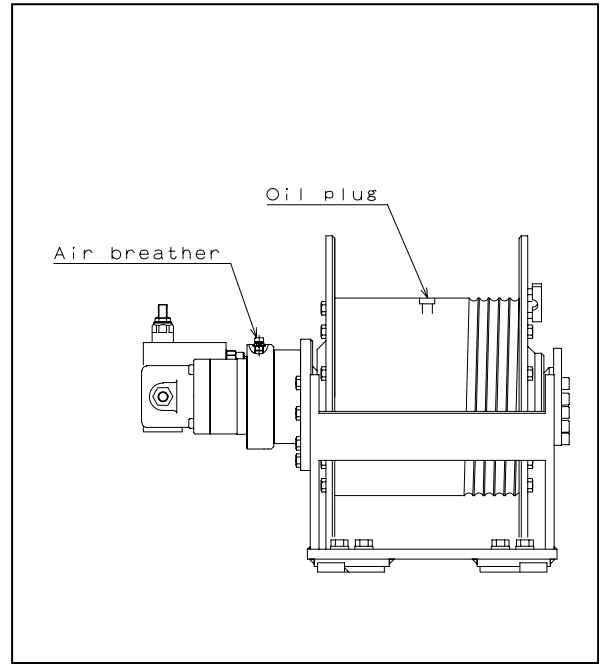
Swing gear case



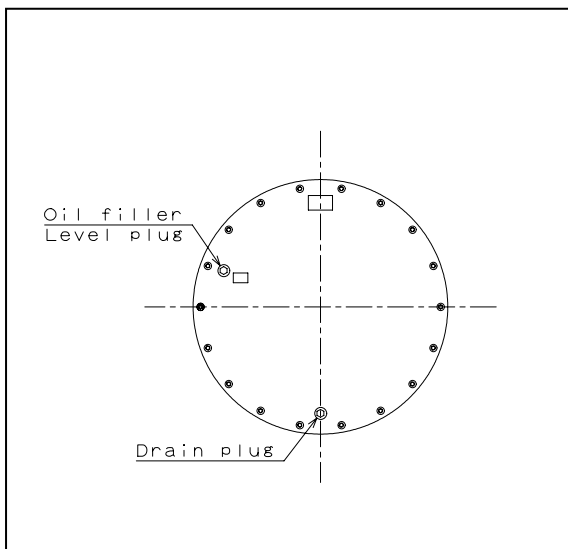
Main/aux. winch gear case



Third winch drum gear case



Drive tumbler gear case





Chapter 8

Transportation and storage

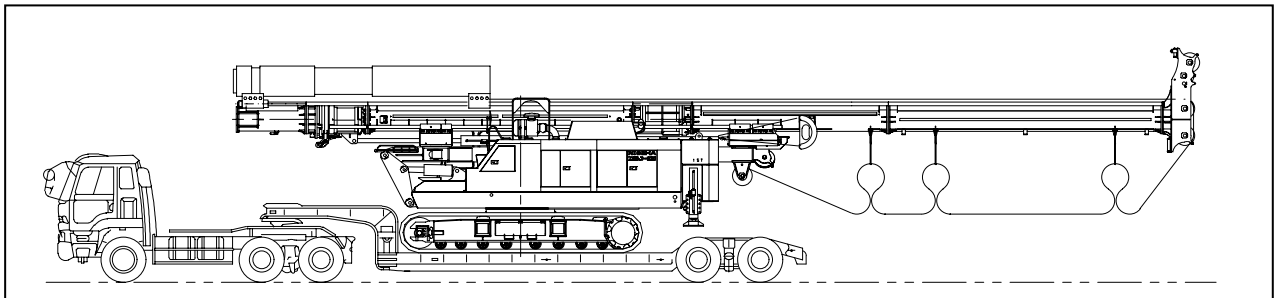
8.1 Transportation



- When using ramps to load the machine onto a trailer, consider the strength of the ramps beforehand.
- Keep the angle between the ramps and ground to below 15°.
- Make sure to fix the ramps firmly to the trailer.
- When moving up ramps, do not steer laterally. If lateral steering is necessary, stop moving and go back to a level place, and then effect steering.
- When moving up or down ramps, have the engine run at low as speed as possible.
- Fix the machine to the trailer for safety and apply the swing lock.
- Do not attempt to swing the superstructure when the machine has been loaded onto the trailer. Doing so may cause the trailer frame itself to tilt; this is dangerous.

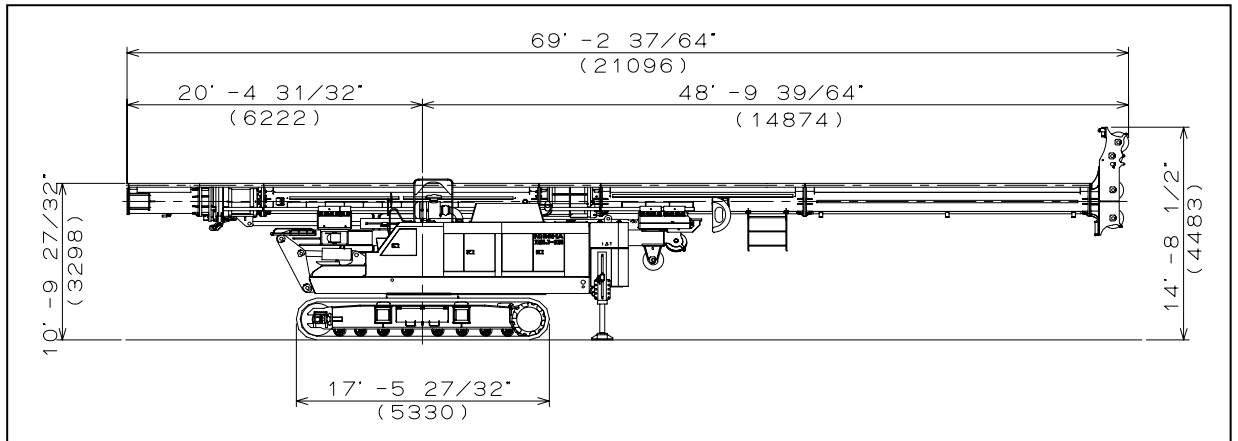
8.1.1 Driving onto the trailer

1. Apply the trailer brake.
2. Move the machine forward at low speed.
3. When on the ramps, it may be necessary to erect the leader slightly so that the cathode does not touch the ground.
4. When the machine is loaded on the trailer, lower the leader completely.
5. Apply the swing brake and swing lock and press all brake pedals firmly to apply the brake pedal lock.
6. Extend the outrigger cylinders until their float makes contact with the trailer frame.
7. Store the ramps and steps and lock all doors.
8. Apply chain blocks around the crawler and secure the machine with wire ropes and chains to prevent movement during transportation.

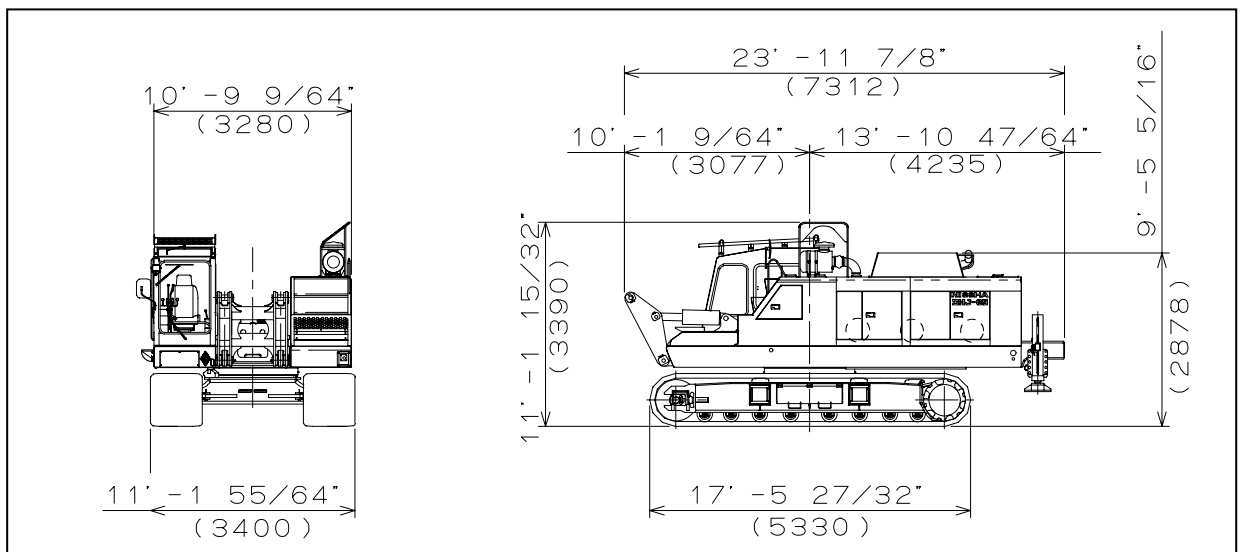


8.1.2 Dimensions and weight

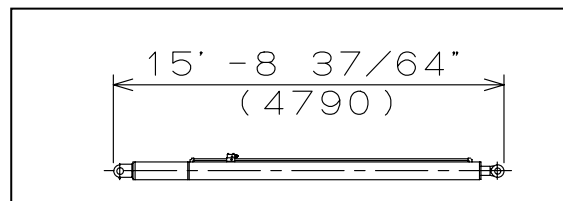
1. DHJ-85 assembly with 20.3 m leader: 58700 kg [64.7 US ton]



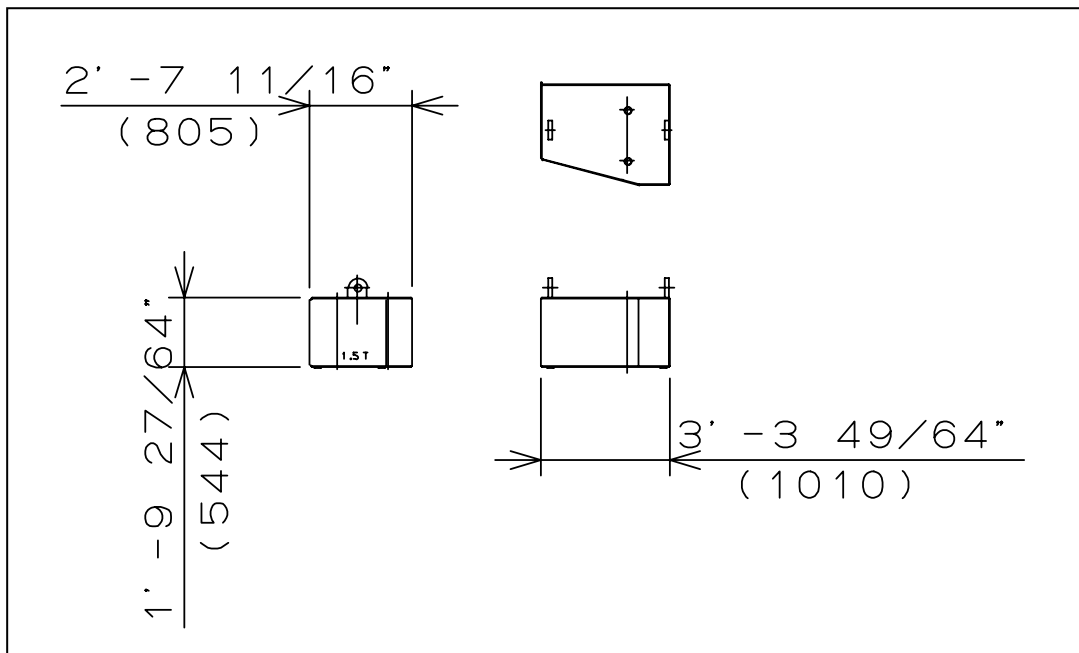
2. Superstructure: 33900 kg [37.4 US ton]



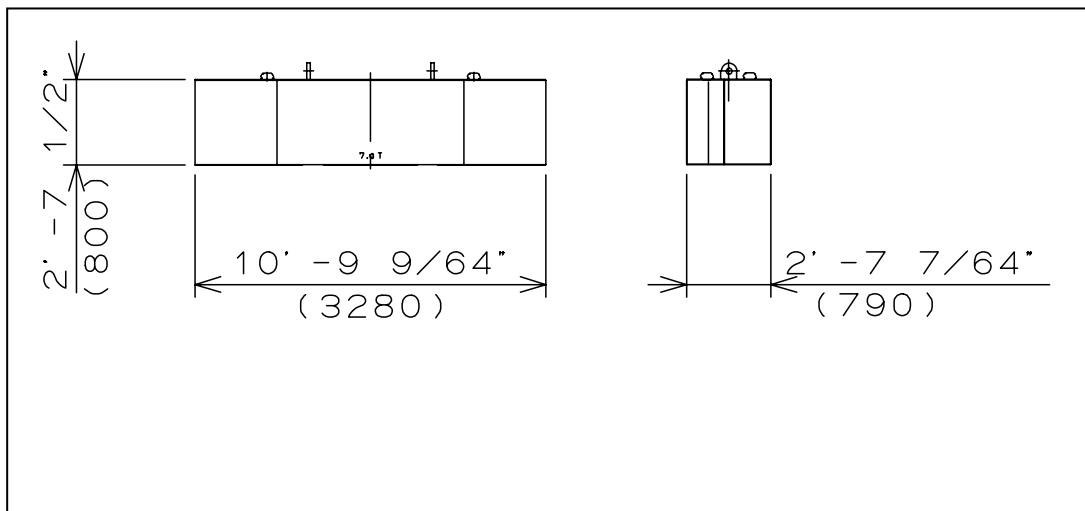
3. Leader erecting cylinder: 890 kg [1.0 US ton]



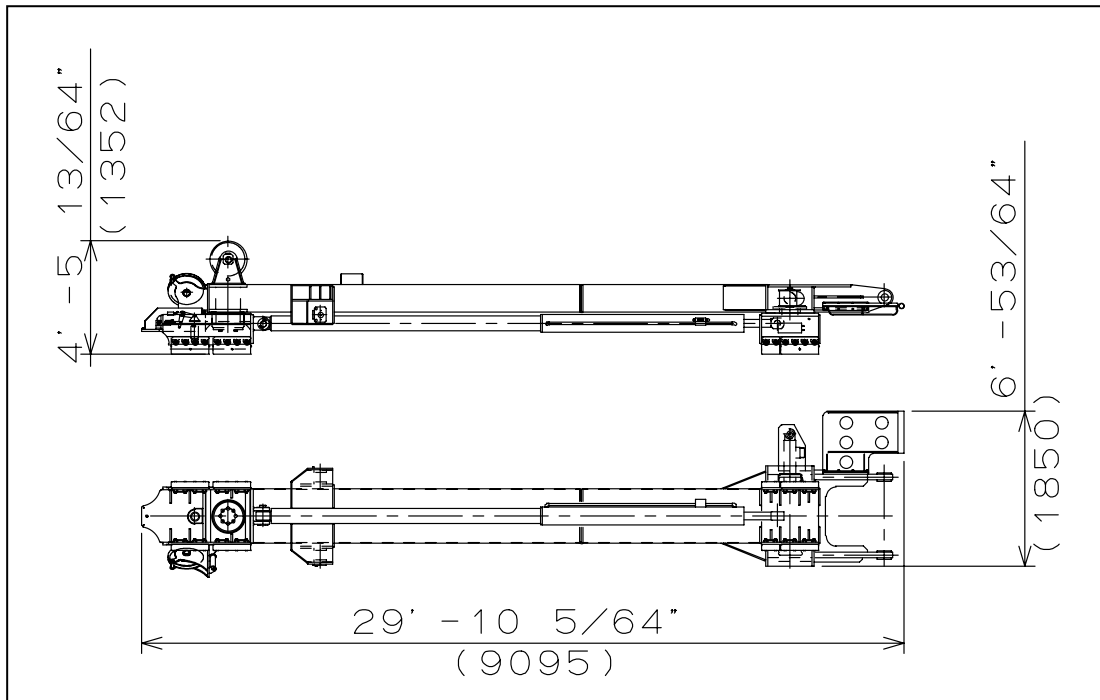
4. Counterweight: 1500 kg [1.7 US ton]



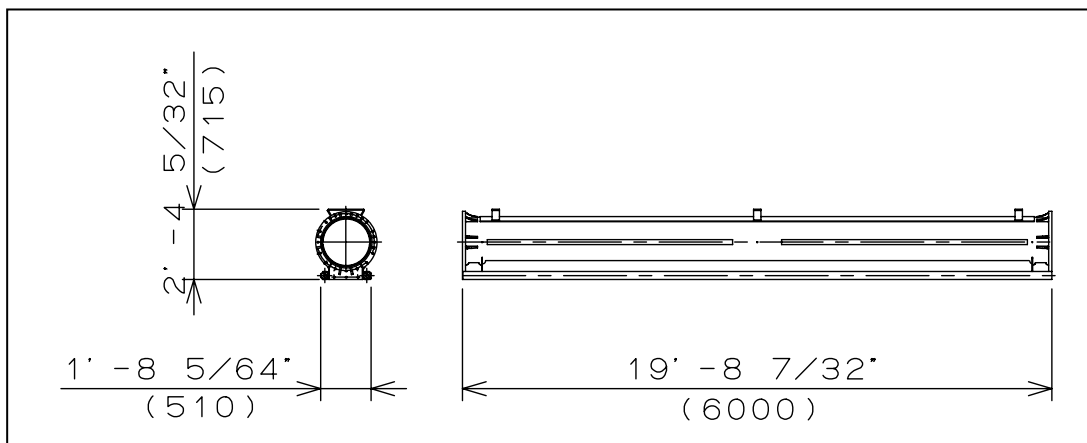
5. Counterweight: 7000 kg [7.7 US ton]



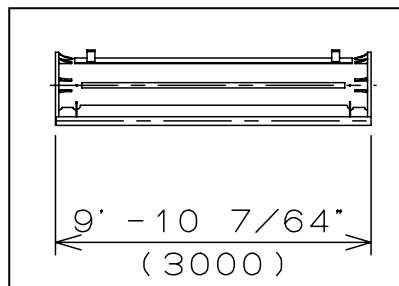
6. Sub-leader: 4800 kg [5.3 US ton]



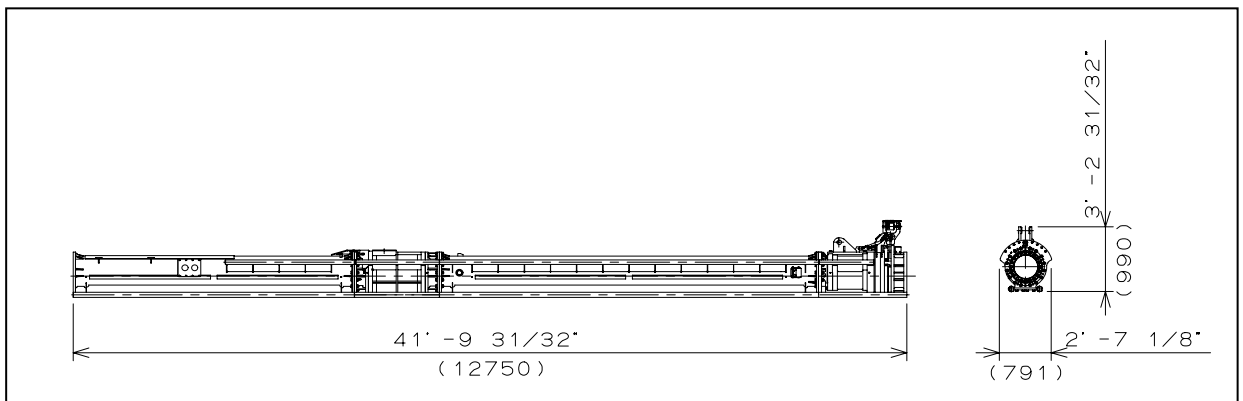
7. Leader 6 m: 1060 kg [1.2 US ton]



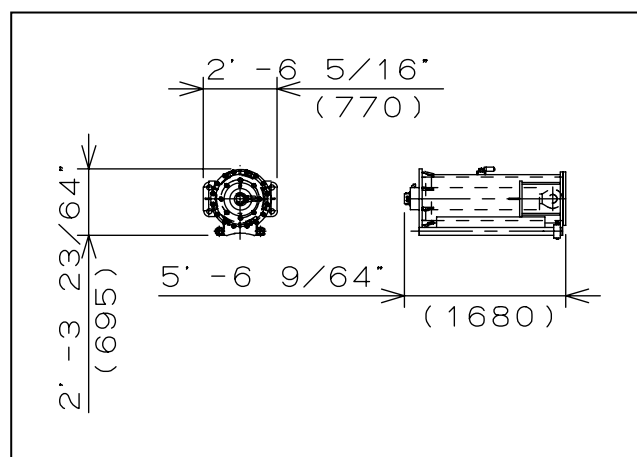
8. Leader 3 m: 580 kg [0.7 US ton]



9. Leader 12.8 m: 5460 kg [6.0 US ton]



10. Lower leader: 1150 kg [1.3 US ton]



8.2 Storage

8.2.1 Before storage

Follow the procedures below if the machine has been unused for an extended period.

1. Wash and clean the machine and store inside a building. Do not leave the machine outdoors. If the machine must, in fact, be stored outdoors, park on level ground with wood blocks beneath the machine; protect the machine with a tarpaulin.
2. Carry out lubrication and oil change properly in accordance with section "7.4 Application of oil and grease".
3. Apply grease sufficiently to the exposed portions on the piston rod of the hydraulic cylinder.
4. If the atmospheric temperature is expected to fall below 0 and antifreeze is not used, drain the engine coolant completely and tag the inside of cab "NO COOLANT".
5. Disconnect the battery terminals and protect the battery by covering it; alternatively, remove the battery from the machine altogether and store separately.
6. Pull out the starting switch and set the fuel control lever to the idling position.
7. Set all control levers to neutral, and apply all brakes and locks.

8.2.2 During storage

Carry out maintenance as follows during storage.

1. Run the engine and drive the machine for a short distance once a month to ensure freshly applied lubricant is absorbed; this will prevent the deterioration of lubrication coating over time.
2. Run the engine to charge the battery. The battery may be damaged if left unused for more than a month.

8.2.3 After storage

Before using the machine, carry out the following tasks after storage for a long period.

- 1.** Inspect lubricant oil in all gear cases and, if lubrication is insufficient, change or replenish.
- 2.** Inspect all sections with reference to the monthly inspection items and, if any abnormal conditions are discovered, take appropriate countermeasures.



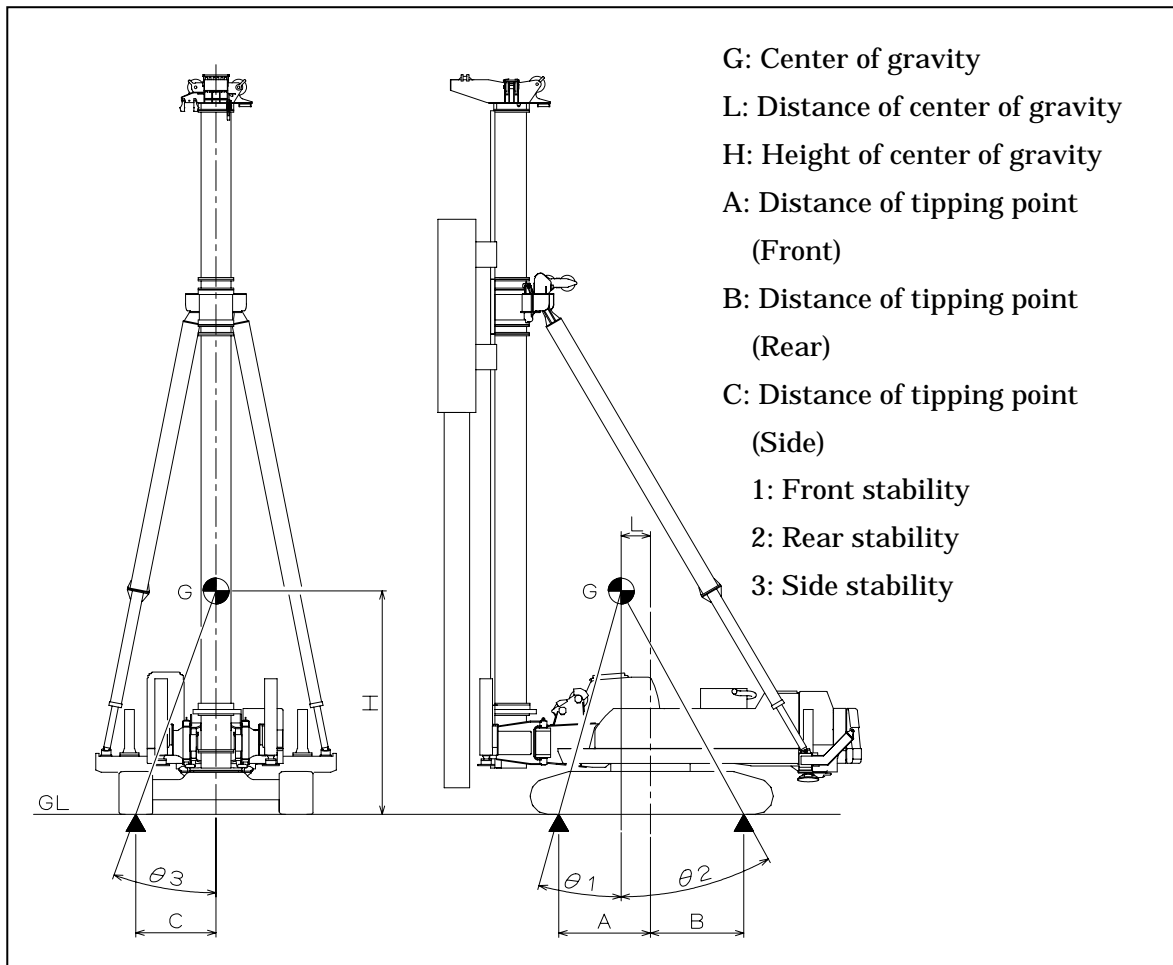
Chapter 9

Appendix

9.1 Stability calculation formula

9.1.1 Difinition "Stability"

The stability of pile driving rig is identified by the angle() which is formed by clossing a vertical line through the center of gravity of the pile driving rig equipped with whole end attachments(i.e. hammer, auger, pile, etc.) and a line from the center of gravity to its tipping point.



9.1.2 Permissible stability angle

The pile driving rig must be operated on firm and level surface with its stability of 5 degrees and larger under worst operation condition.

9.1.3 Calculation formula

$$\theta_1 = \tan^{-1} \frac{F-L}{H}$$

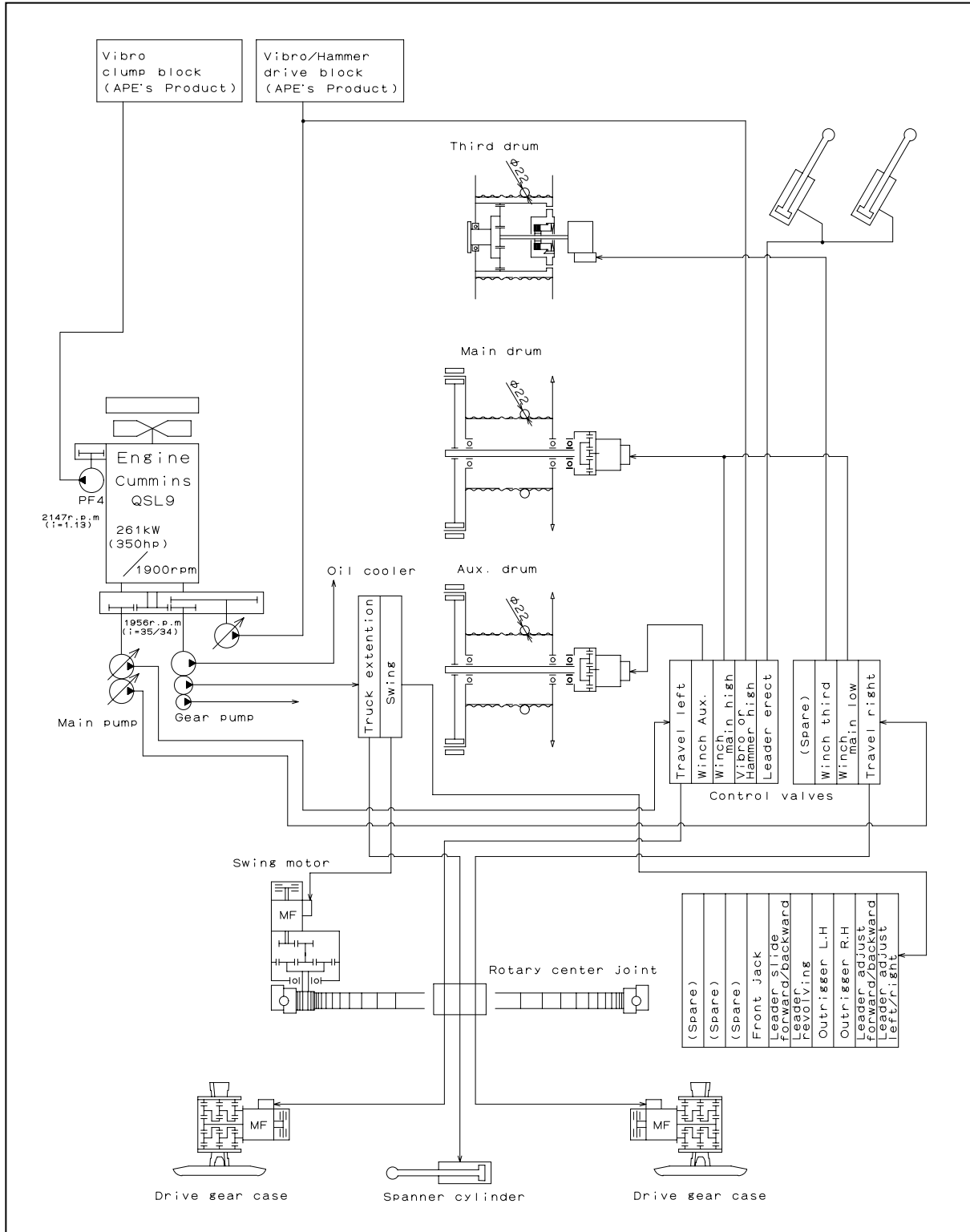
$$\theta_2 = \tan^{-1} \frac{F+L}{H}$$

$$\theta_3 = \tan^{-1} \frac{F}{H}$$

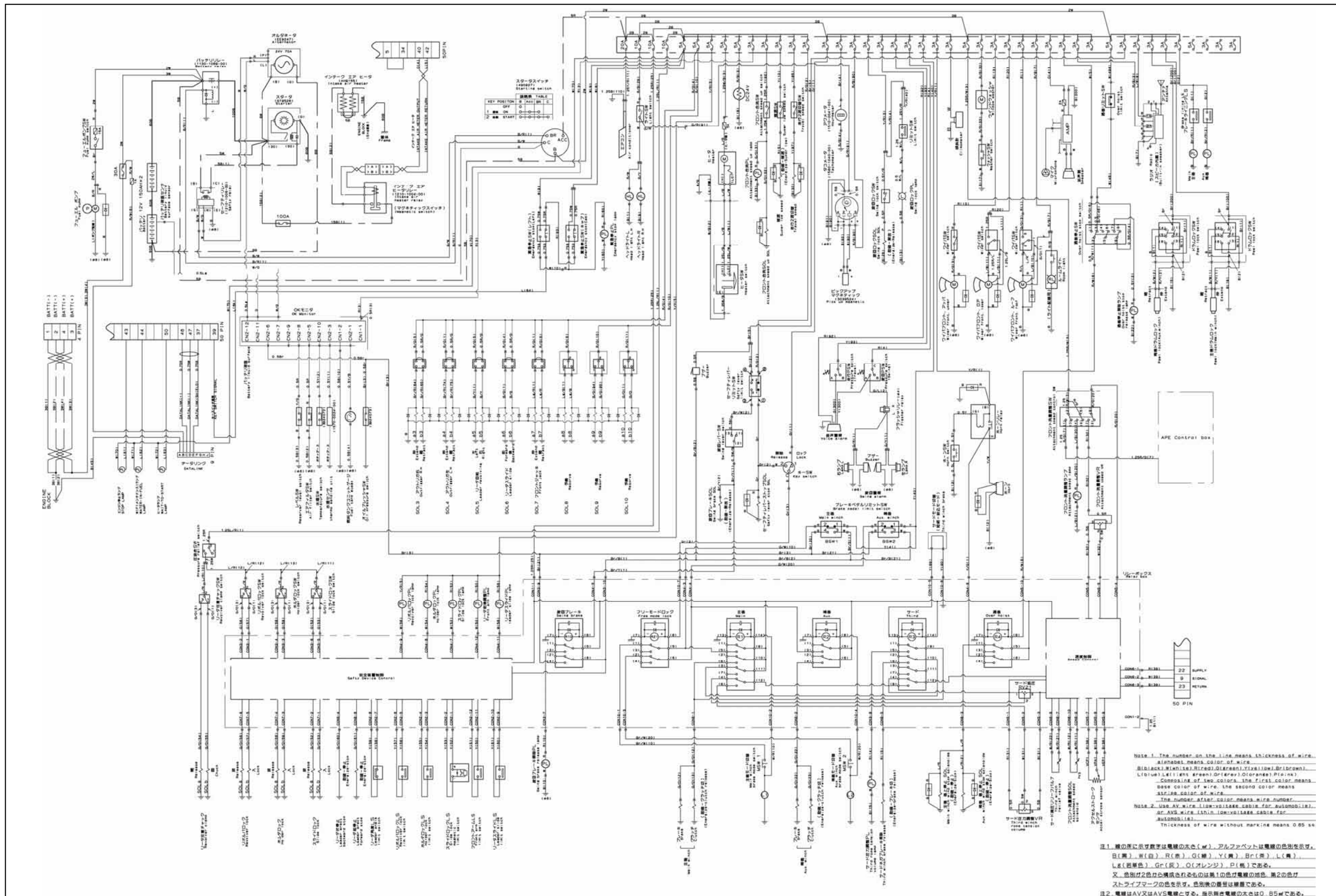
Take the smallest distance among A,B and C.

As shown in the above illustration, θ_1 is the most critical operation condition of pile driving rig in case of general vertical pile driving works.

9.2 Power train diagram



9.3 Electric wiring diagram



9.4 List of oils and greases

Kind of oil	Ambient temperature	SAE number	SHELL	MOBIL	ESSO
Engine oil	Normal (0 ~ 40°C)	SAE30	Rimra Z30	Delpack 1330	Exson D-3 30
	Cold climate (-25 ~ 20°C)	SAE20W20	Rimra Z20W20	-	-
Gear oil	Normal	SAE90	Spirax EP90	Pegasus 90	Standard 90
	Cold climate -20°C or lower	SAE80	Spirax EP80	Pegasus 80	GP80W90
	Hot climate Over 30°C	SAE140	Spirax EP140	Mobliub HD85W140	-
Hydraulic oil	Normal	ISOVG32	Tellus T32	DTE 24	Univis J32
Multi-purpose grease			Albania 2	Moblux 1	Ristan 2
Gear compound grease			Darina 2		Norpa 275