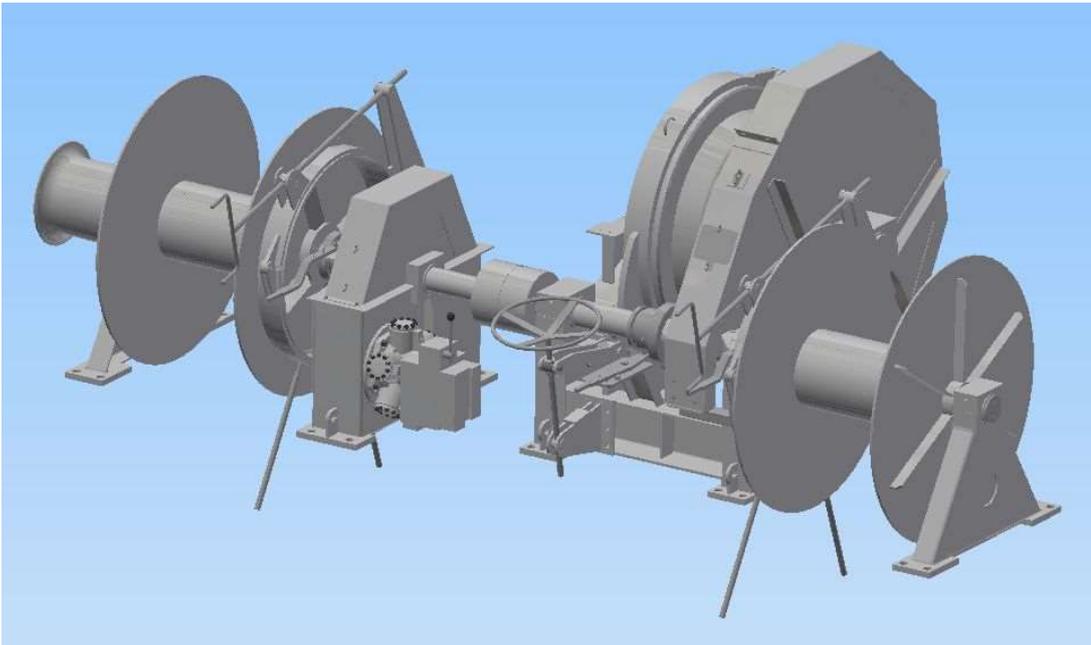


Deck Machinery Maintenance Manual



Kawasaki Heavy Industries, Ltd.
Precision Machinery Business Division
Precision Machinery & Robot Company

Contents

1. Overview	1
1.1 Precautions for Inspection and Maintenance	1
2. Winch body	2
2.1 Brake device	2
2.1.1 Inspection and maintenance for the brake device	2
2.1.2 Wear limit of brake lining	4
2.1.3 Instructions for brake lining replacement	5
2.2 Clutch device	5
2.2.1 Inspection and maintenance for the clutch	5
2.2.2 Maintenance method for clutch sticking	8
2.3 Coupling of main shaft connection	8
2.3.1 Inspection and maintenance for main shaft coupling	8
2.4 Bearings of main shaft	10
2.4.1 Inspection and maintenance for bearings	10
2.4.2 Inspection and maintenance for the clearance of bearing metal	12
2.5 Gear	13
2.5.1 Inspection and maintenance for open gear	13
2.5.2 Inspection and maintenance for enclosed gear	15
2.6 Chain drum, hawser drum	16
2.6.1 Inspection and maintenance for chain drum and hawser drum	16
2.6.2 Inspection and maintenance for chain guide	17
2.6.3 Cautions regarding chain drum and hawser drum during winch operation	17

3.	Hydraulic equipment	19
3.1	Hydraulic motor	19
3.1.1	Inspection and maintenance for hydraulic motor	19
3.2	Control valve	20
3.2.1	Inspection and maintenance for control valve	20
3.3	Counterbalance valve	21
3.3.1	Inspection and maintenance for counterbalance valve	21
3.4	SB Regulator	22
3.4.1	Inspection and maintenance for SB Regulator	22
3.5	Pump unit	23
3.5.1	Inspection and maintenance for hydraulic pump	23
3.5.2	Inspection and maintenance for the elements of return and suction filters	24
3.5.3	Inspection for solenoid valve	26
3.5.4	Inspection and maintenance for the oil cooler	26
3.6	Remote control devices (hydraulic and electric)	27
3.6.1	Inspection and maintenance for hydraulic remote control device	27
3.6.2	Inspection and maintenance for electric remote control device	28
3.6.3	Remote operation of the clutch and brake	28
3.7	Other valves	28
3.8	Hydraulic oil	28
4.	Inspection checklist	26

1. Overview

Daily inspection and maintenance are essential to ensure that our hydraulic deck machinery is used in a good condition. This manual is a simple manual that summarizes the contents of inspection and maintenance for the purpose of preventing problems with the equipment. This manual contains only general information, so please refer to the finished plan and instruction manual before carrying out inspections and maintenance. In addition to the inspection and maintenance on board, we recommend general inspection and periodic maintenance by our authorized service engineers before docking (3 to 6 months before).

1.1 Inspection and maintenance precautions

- Be careful of safety during inspection and maintenance work. In particular, be careful of being caught or pinched by machines when operating the winch. When it is necessary to disassemble the hydraulic equipment, be sure to turn off the power of the equipment and confirm that the electric motor is stopped and that there is no residual pressure in the hydraulic circuit.
- Be sure to use our genuine parts when you replace. If non-genuine parts including imitation parts are used, the functions and performance may not be satisfactory, which may lead to unexpected accidents. In addition, any trouble caused by the use of parts other than our genuine parts is not covered by our warranty.
- If disassembly or maintenance of the hydraulic equipment is required, it is recommended that it be carried out by our authorized service engineers.
- The corrosion (rusting, etc.) of steel may cause unexpected failures or accidents. Touch-up painting and greasing should be carried out frequently to prevent corrosion (rusting, etc.) of the steel.

2. Winch body

2.1 Brake device

Refer to Attachment 1 for each procedure of inspection and maintenance for a typical brake device. Since the brake device differs depending on the specifications of the winch, check the finished plan before carrying out inspection and maintenance.

2.1.1 Inspection and maintenance for the brake system

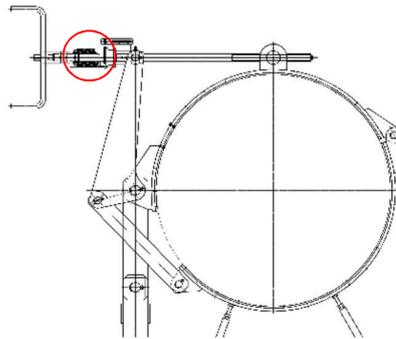
a. Apply grease

Grease the pins and threaded rod of the brake system weekly and before (after) use. (Grease used: JIS K 2220 grease concentric oil supplied type, Class 4, No. 2 or equivalent)

If there is insufficient grease, rust may cause sticking or poor lubrication. Then it make brake operation difficult and the specified brake force may not be obtained.

※Please use the spray grease for the pin where the grease nipple is not installed due to the structure reason of the equipment.

For manual brakes with springs (fail-safe brake), supply grease from the grease nipple on the spring case (bearing house). Also, grease up all sliding parts and make sure that the movement is smooth.



Manual brake with spring (fail-safe brake)

b. Adjust the brake band support

Adjust the clearance between the brake band and the brake band support by the adjustment bolt on the brake band support. If the clearance between the brake band and the brake band support is too large, the brake band will not open properly when the brake is released and the brake lining will continue to contact the brake drum,

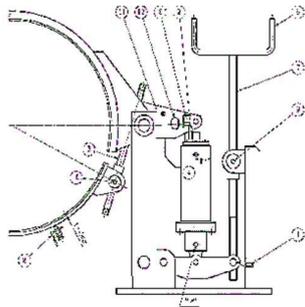
which may prevent the specified performance or cause damage to the brake device due to heat generation.

c. Adjust brakes with turnbuckles

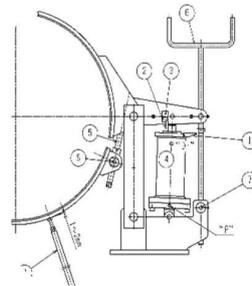
- The brake force of the hydraulic release type brake, which utilize hydraulic cylinder, will decrease due to the wears of brake lining. Check the level plate before use. If it is out of the proper range, adjust the strength to tighten of brakes with the turnbuckles.
- The brake linings of chain drum brakes will be gradually worn out by anchor-let-go (anchoring with clutch disengaged). Check the strength to tighten of the brakes. If it is out of the proper range, adjust the strength to tighten of the brakes with the brake end/turnbuckle.

Refer to the finished plan for adjustment, and be sure to do loosening prevention of turnbuckle after adjustment. Otherwise, vibration or other factors may have turnbuckle to be loosen, resulting in a loss of braking force.

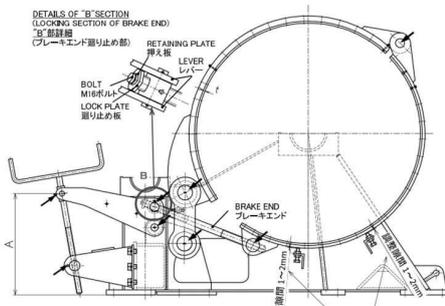
In addition, if the level plate cannot be adjusted up to the proper position even after adjusting the turnbuckle, replace the brake lining.



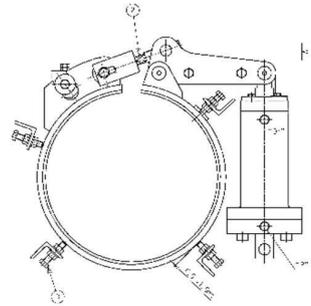
Hydraulic brakes for chain drums



Hydraulic brake for hawser drum



Manual brakes for chain drums



Hydraulic brake for ramp winch

d. Inspection for the brake linings and brake drums

Inspect the thickness of the brake lining and the surface condition of the brake drum before using the winch. If the brake lining is thinner than the wear limit replace the brake lining. Also, if the brake drum is severely rusted, smooth the surface with sandpaper, etc.



Example of worn and thin brake lining

If the thickness of the brake lining becomes thinner than the wear limit, replace the brake lining.



Example of a heavily rusted brake drum

If the brake drum is heavily rusted and the surface is not smooth, smooth the surface with sandpaper.

2.1.2 Wear limit of brake lining

If the brake lining becomes thinner than the wear limit, replace the brake lining.

a. Bolt and nut fixing type brake linings

Regarding to the bolt and nut fixing type brake linings, replace the innings before the fixing bolt contacts the brake drum. If the fixing bolt contacts the brake drum, the surface of the brake drum may be damaged or the friction force may be reduced and the specified brake force may not be obtained.

b. Adhesive brake linings

It is possible to use up to 2mm of the remaining thickness of the brake lining.

2.1.3 Brake lining replacement procedure

Please use genuine brake lining.

a. Bolt and nut fixing brake linings

While replacing the brake lining, be careful not to leave any gap between the brake lining and the brake band. Especially, when machining the mounting holes on brake linings, ensure that the brake lining is laid along ~~aligned~~ with the brake band without any gap. If the brake lining is not fixed properly, there is a possibility of brake force reduction or brake lining breakage.

b. Adhesive brake linings

Please replace whole brake band.

2.2 Clutch device

2.2.1 Inspection and maintenance for the clutch

a. Apply grease

Grease up the sliding parts of the clutch every week and before/after use.

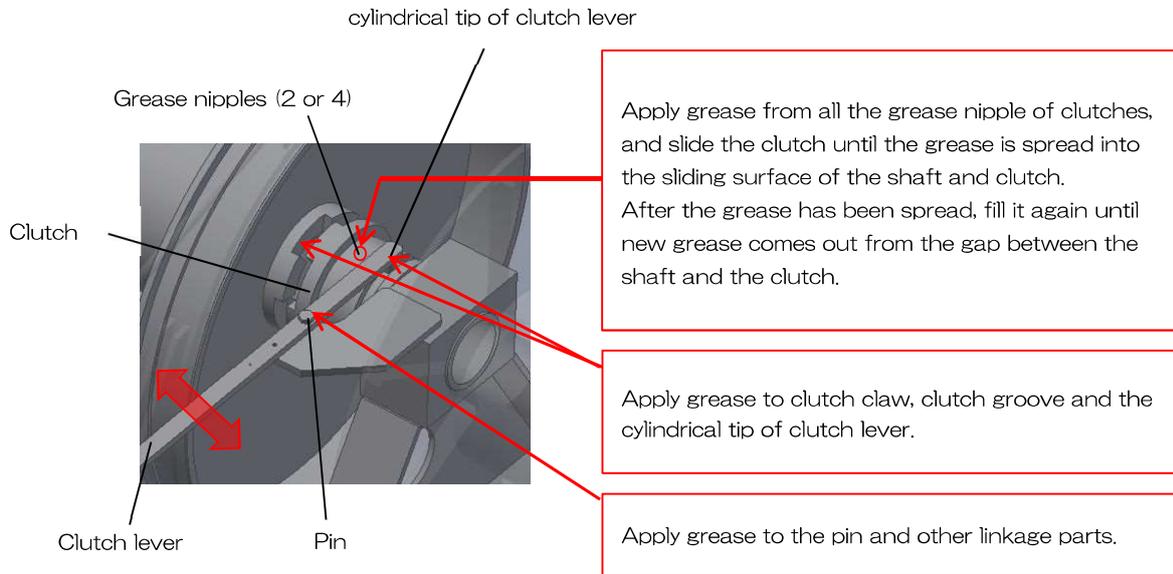
(Grease used: JIS K 2220 grease concentric oil supplied type class 4, No. 2 or equivalent.)

※Molybdenum grease may be specified for some winches.

If grease is insufficient, seawater will come into the clearance of the shaft and clutch, occurring rust and the clutch to stick.

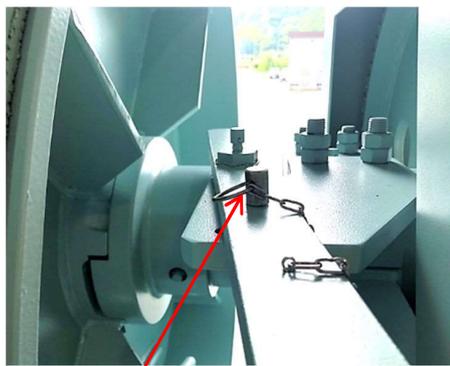
In case of rust occurring, refer to 2.2.2.

- Apply grease from all the grease nipple of clutches, and slide the clutches until the grease is spread into the sliding surface of the shaft and clutch.
- After the grease has been spread, fill the clutch with grease again until new grease comes out from the gap between the shaft and the clutch.
- Also, apply grease to the claw part and groove part of clutch and the cylindrical tip of clutch lever, and grease the pin and other linkage parts.



b. Inspection for clutch

- Before using the winch, carry out the external inspection of the clutch to make sure that there are no cracks or damage/deformation of the claw. If the engagement of the claw is not enough or unexpectedly large external force is applied to the clutch repeatedly, it may cause damage of clutch.
 - If the clutch claw is deformed to tapered shape, the clutch may disengaged while using the winch. Please make sure to insert the stop pin while using.
 - If the clutch is used without inserting the stop pin, the engagement of the claw will not enough due to the thrust force in the direction of release applied to the clutch, and the claw will be deformed.
- If the clutch is damaged or significantly deformed, the clutch must be replaced.



Manual clutches should insert a stop pin according to engagement/disengagement. The remote-controlled clutch uses a hydraulic cylinder to move the clutch, and it is not required to insert a stop pin when the winch is in use.

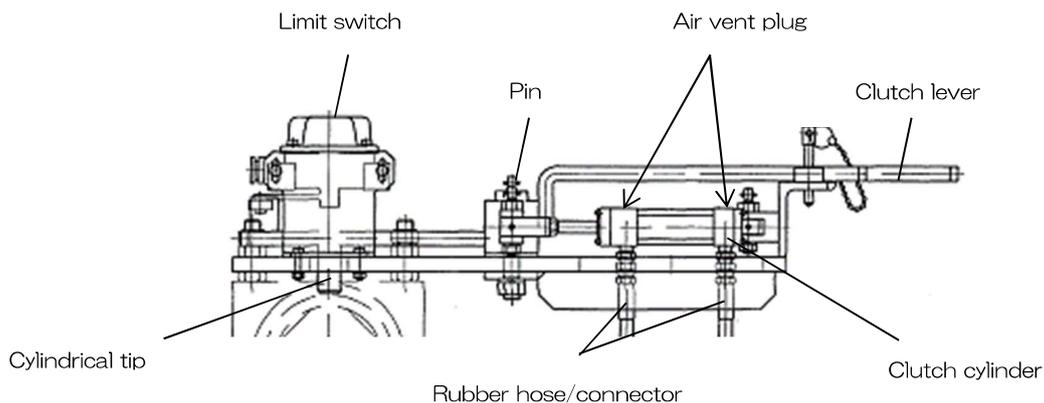
Inspect the condition of the claw

c. Inspection for clutch lever

- Before using the winch, conduct a visual inspection of the clutch lever and pin, and confirm that the cylindrical tip of clutch lever is firmly fitted in the clutch groove.
- If there is a large gap of the cylindrical tip of clutch lever or pin, there is a possibility that the clutch will disengage during use. Hence, make it sure that engaging/disengaging of clutch is in normal condition, before use.

d. Inspection for remote control clutch (clutch with clutch cylinder)

- Check that there is no oil leakage from the clutch cylinder or rubber hose /connector, and if oil leakage occurs, replace the sealing parts. Also, if oil leakage from hose or hardening of rubber is found, it must be replaced.
- To check the working of the clutch, operate from remote control stand and confirm that the engagement/disengagement operations are normal.
- Check that the limit switch is working properly through the remote control stand's engagement/disengagement lamp.
- If the working of the clutch cylinder is unstable when remote operation, air may be mixed in the clutch cylinder. In such case, bleed the air from the air vent plug at the top of the clutch cylinder.



2.2.2 How to maintain the clutch when it is sticking

If the handling force of clutch lever becomes heavy, the clutch may be sticking. In such case, perform maintenance by following procedure.

- Remove all grease nipples and spray penetrating lubricant to remove the old grease.
- Add impact to the clutch with a plastic hammer to release the sticking. If the clutch does not move even after impact, move it with a crowbar. Please be careful to strong impact or excessive force is applied to the sticking part, it may damage to clutch or other parts.
- If the clutch moves, spray lubricant and carry out engaging and disengaging the clutch.
- If the clutch moving becomes smooth, install grease nipples and supply sufficient grease. Once the clutch is sticking by rust, there is a possibility that the sticking may reoccur, because the rust in the sliding part cannot be removed completely, therefore, grease up the clutch frequently to avoid the lack of grease.

If the rust is heavy and cannot be recovered through the above procedure, it is necessary to dismantle the main shaft and drum from the frame, and then disassemble from shaft in order to remove the rust.

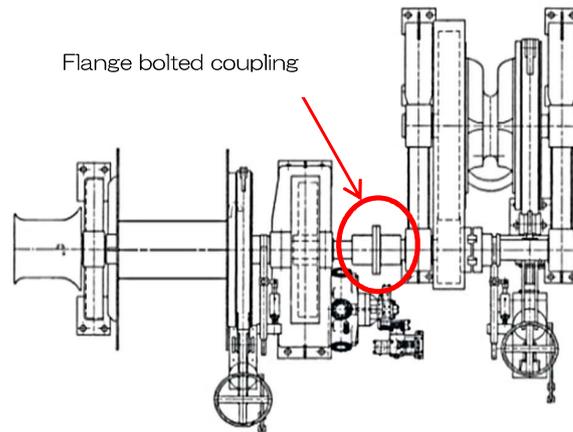
2.3 Coupling of main shaft connection

2.3.1 Inspection and maintenance for main shaft coupling

Before using the winch, carry out visual inspection of the main shaft connecting coupling, to make sure that there is no crack or damage.

a. Flange bolted coupling type

- Make sure that the reamer bolts and nuts are not loose or damaged.
- If the coupling or reamer bolt is significantly deformed, it is necessary to replace the coupling.

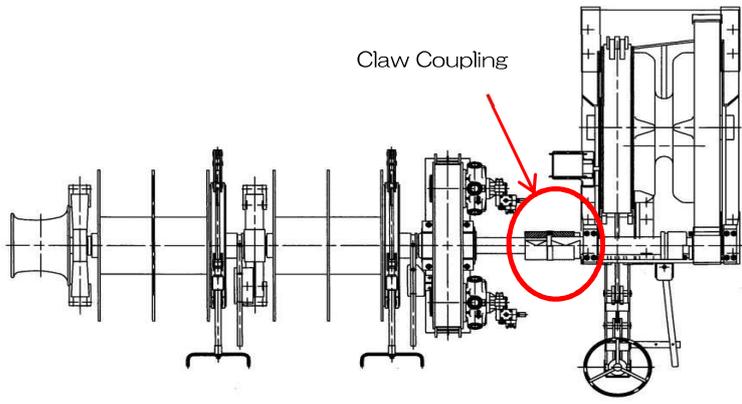


Make sure that the reamer bolts and nuts are not loose or damaged.

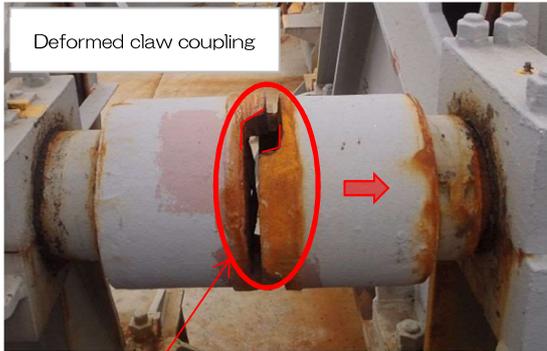
b. Claw coupling type

- Check that the claw is not deformed in tapered shape and the angle of the claw is maintained within 90 degrees angle. Check that there is no large misalignment or large gap between the claw couplings.
- If excessive load is repeatedly applied to the claw, the claw may be deformed and the thrust force may be applied to the claw coupling. In such case, the claw coupling will slide and the clearance between the claws will become larger.

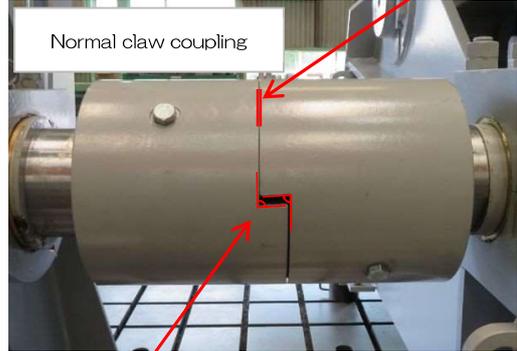
If “the claw coupling is significantly deformed” or “the gap between the claws is increased” or “there is a looseness at thrust direction” , there is a possibility that the claw will disengage while using the winch which is very dangerous. Check the engagement of the claws daily, and if any deterioration of engagement is observed, the coupling shall be replaced.



Check that the distance between the surfaces of claw couplings has not increased and that the claw couplings have not slidden.



If the claw is deformed more than 90 degree angle, thrust force will cause on the claw coupling during engagement. The thrust force causes the coupling to move, that increases the distance between the surfaces, which results in unstable engagement.



Make sure that the angle of the claw is maintained within 90 degree angle.

2.4 Bearing of main shaft.

2.4.1 Inspection and maintenance for bearing of main shaft.

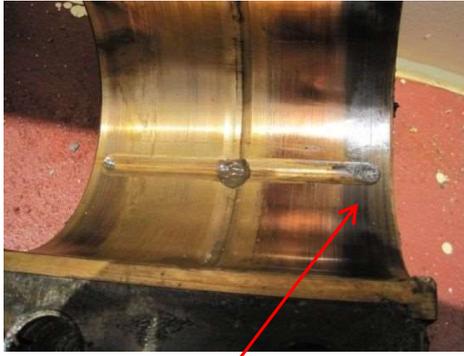
a. Apply grease

Grease the bearing metal of main shaft every week and before/after use. (Grease used: JIS K 2220 Class 4 grease for centralized lubrication, No.2 or equivalent.)

If there is not enough grease, the sliding surface heats up due to insufficient lubrication when the winch is used, and the bearing metal of main shaft may seize.

In addition, rust may occur on the main shaft due to seawater comes into the clearance of bearing because of insufficient grease.

If the clearance becomes larger due to wear of the bearing metal caused by rust on the main shaft, the bearing metal must be replaced. Also, if the main shaft is badly rusted, the main shaft to be replaced.

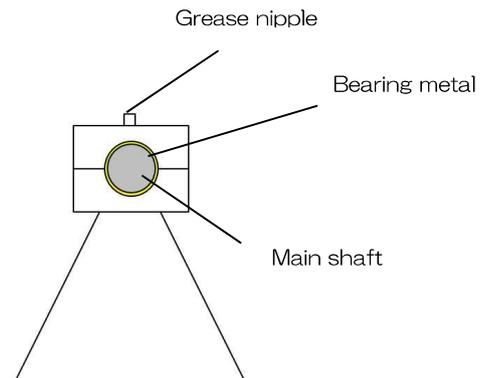
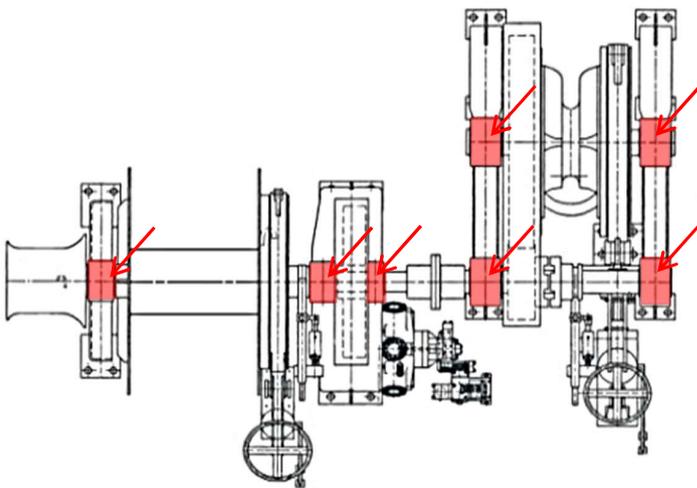


Bearing metal seizure due to insufficient grease



Rust on the main shaft due to seawater

- While rotating the main shaft at a low speed, apply grease from the grease nipples of all the bearings of main shaft, until grease comes out from the clearance between the shaft and the bearing metal.
- After greasing, disengage the drum clutch and rotate the main shaft only, and check that there is no abnormal noise or temperature rise.



• • • Grease point (all spindle bearings)

- Check that no tension by rope is applied at each drum, then apply grease the bearing metal of main shaft and bushing of drum, before running the main shaft. (For details, refer to Section 2.6.1 d.)

b. Inspection

In every three months, perform no-load operation (i.e. rotation of the main shaft only with clutch disengaged) for a total of 30 minutes: 15 min. in the winding direction and 15 min. in the payout direction, to check the following.

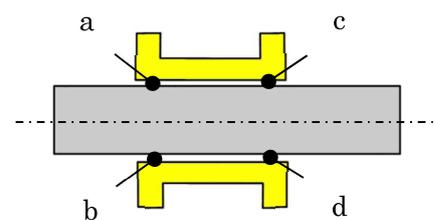
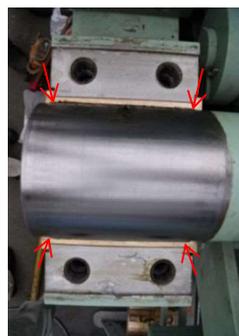
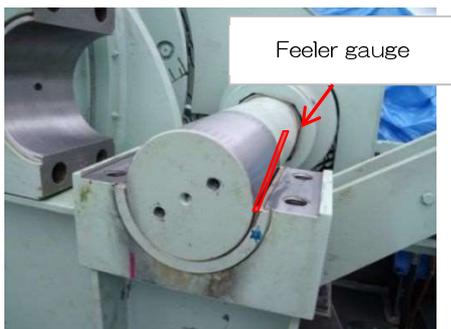
- No abnormal noises at bearing metal and drum bush
- Temperature rise is less than 5 degree Celsius

If temperature rise at the bearing or decentering of the main shaft is large, open the bearing part and take the following actions.

- Check whether there are no abnormality at bearing metal and main shaft.
- Measure the clearance between bearing metal and main shaft.

2.4.2 Inspection and maintenance for clearance of bearing metal of main shaft

If temperature rise in the bearing or decentering of the main shaft is observed, insert a feeler gauge into the clearance between the bearing metal and the main shaft, and measure the clearance at four points (a, b, c, d) as mentioned below.



If the clearance of “a+b” or “c+d” between the bearing metal and the main shaft is 2% or more of the original shaft diameter, the bearing metal shall be replaced. Also, if the main shaft is damaged or significantly worn out, the main shaft must be replaced.

2.5 Gear

2.5.1 Inspection and maintenance for open gear

a. Apply gear compound

- Apply gear compound to the gear tooth of the open gear every week and before/after use. Make sure that the gear compound is thoroughly applied to the all gear tooth by running the winch without load.

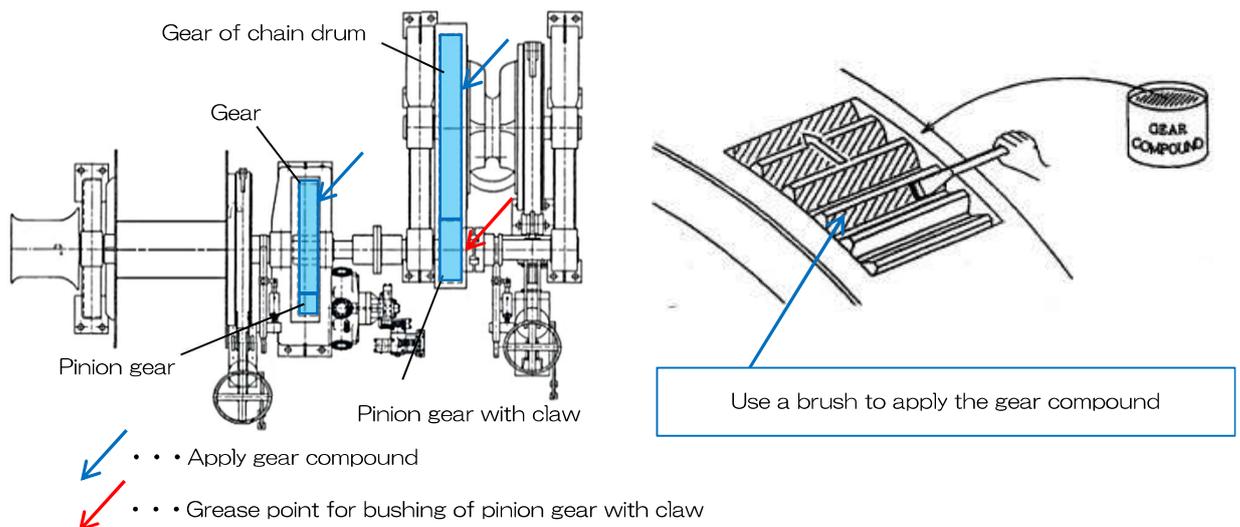
(Gear compound used: JIS K 2220 Gear Compound Class 1, No. 2 or equivalent)

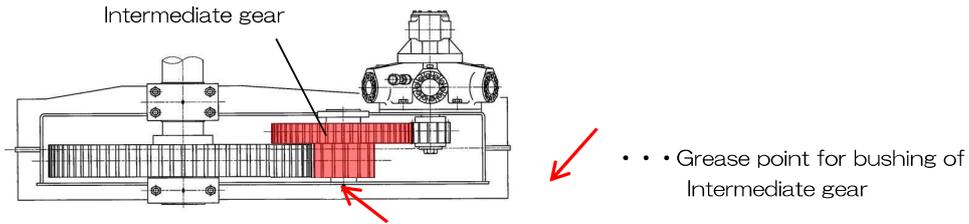
If the gear compound is insufficient, it may cause early wear of the gear tooth and abnormal noise when operating the winch. If the gear tooth is worn out significantly, the large gear and pinion gear must be replaced because it may cause gear meshing failure or breakage.

Contact us if the backlash is large due to wear or the operation noise is large.

- If there is pinion gear with a claw or intermediate gear, grease the bushing. (Grease used: JIS K 2220 Grease concentric oil supplied type Class 4, No. 2 or equivalent)

Insufficient grease of the bushing in the pinion with claw or intermediate gear will cause abnormal noise or looseness. If the looseness is excessive, the bushings need to be replaced.

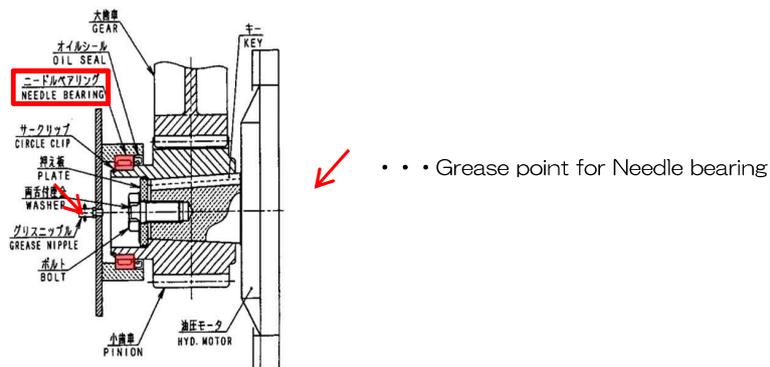




- Grease the needle bearings of shaft end of the hydraulic motor every week and before/after use.

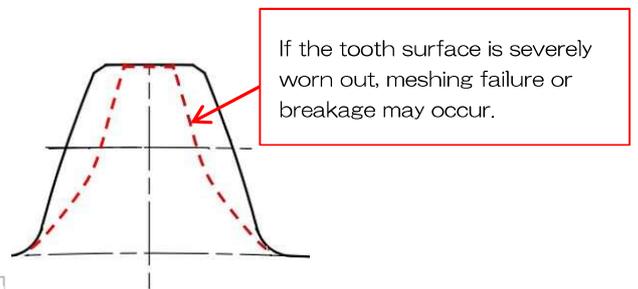
(Grease used: JIS K 2220 Grease concentric oil supplied type Class 4, No. 2 or equivalent)

If the grease is insufficient, the needle bearing will get broken, and the hydraulic motor will be damaged while using winch. If abnormal noise or vibration is observed at the needle bearing after greasing, the needle bearing needs to be replaced.



- Example of tooth surface wear due to lack of maintenance

Tooth surface wear due to insufficient gear compound



Tooth surface wear due to the use of unsuitable grease



Tooth surface worn out due to use of unsuitable grease

Use the specified gear compound or grease for open gears. If unsuitable grease is applied to the gear tooth, it will cause the grease to run out, leading to early wear.

2.5.2 Inspection and maintenance for enclosed gear

- a. Check the condition of gear oil
 - Check that the oil level of the gear oil is correct, before using the winch.
 - Check the color and clarity of the oil every three months or every voyage, and have the hydraulic oil manufacturer inspect the oil every year to check, whether it can be used continuously. If the transparency of the gear oil has worsened, there is a possibility that water has mixed into the gear oil. Check the path of water entry, repair it and change the gear oil.
(Gear oil used: JIS K 2219 Gear oil Class 2, ISO VG220 or VG320 equivalent)

- b. Inspection for air breather

Make sure that the air vent holes are not blocked by paint or foreign materials. If the air vent hole is blocked by foreign materials, the internal pressure of the gear case will rise due to temperature changes. Then, gear oil may leak out of from the seal.

Make sure the air holes are not blocked



2.6 Chain drum, hawser drum

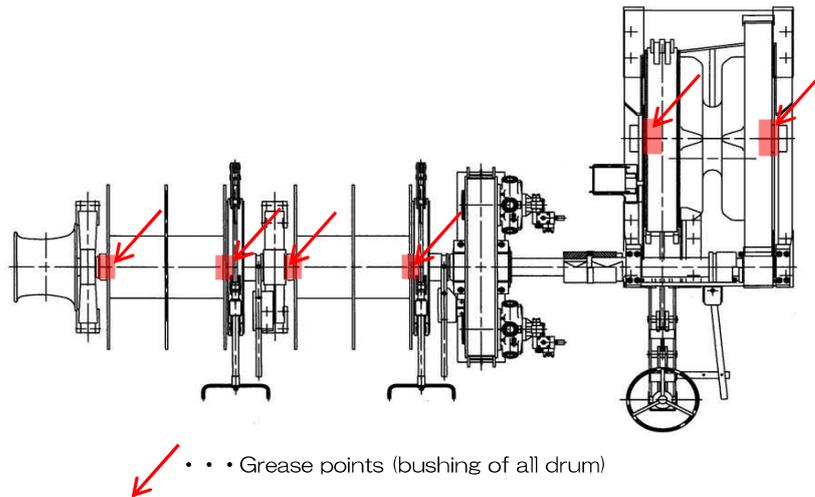
2.6.1 Inspection and maintenance for chain drum and hawser drum

a. Apply grease

- Grease the bushing of drum every week and before/after use.

(Grease used: JIS K 2220 grease concentric oil supplied type Class 4, No.2 or equivalent.)

If there is not enough grease, the sliding surface heats up due to insufficient lubrication when the winch is used, and the bushing of drum may seize. In addition, rust may occur on the main shaft due to seawater comes into the clearance between bushing and the main shaft. If the main shaft is rusted, the bush wears out quickly. Then, it will cause looseness between the drum and main shaft, so that the bushing needs to be replaced. In addition, if the main shaft is significantly rusted, it shall be replaced.



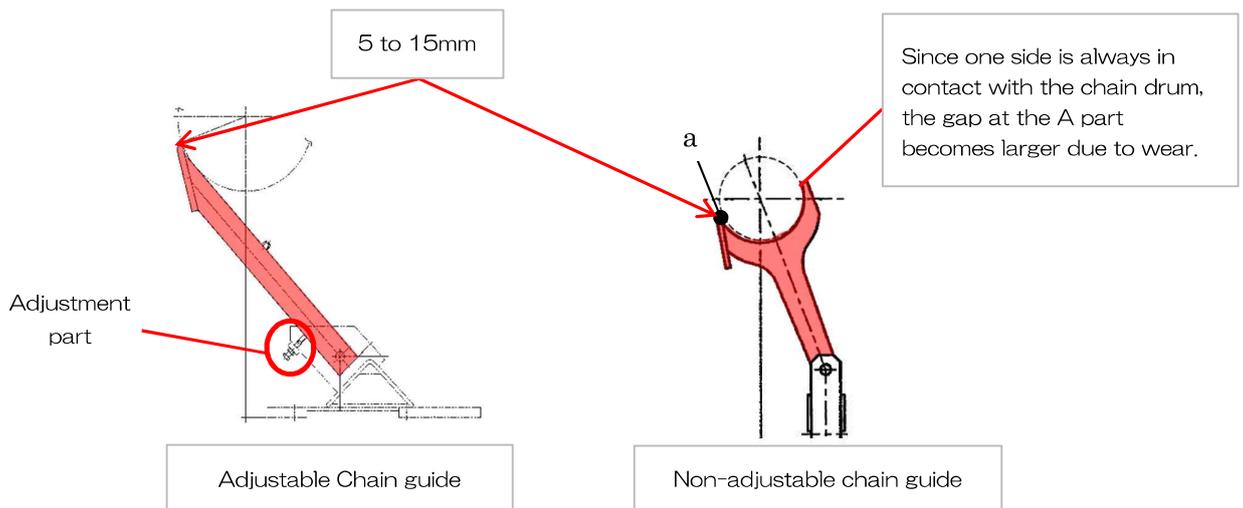
b. Inspection

Check there is no deformation or damage at the chain drum and hawser drum, before using the winch.

2.6.2 Inspection and maintenance for chain guide

- Before using the chain drum, check there is no deformation at the chain guide.
- Measure the clearance between the chain drum and the chain guide, and check it is maintained within 5 to 15 mm. If the clearance is large due to wear or corrosion, adjust the clearance, if it is an adjustable type. If the chain guide is not adjustable, it must be replaced.

If the clearance is larger than 15mm, the chain may get stuck on the chain drum and may not be able to be wound up/down normally. Also, the chain may get caught at the chain guide and cause the chain guide to bent.



2.6.3 Cautions to chain drum and hawser drum during winch operation

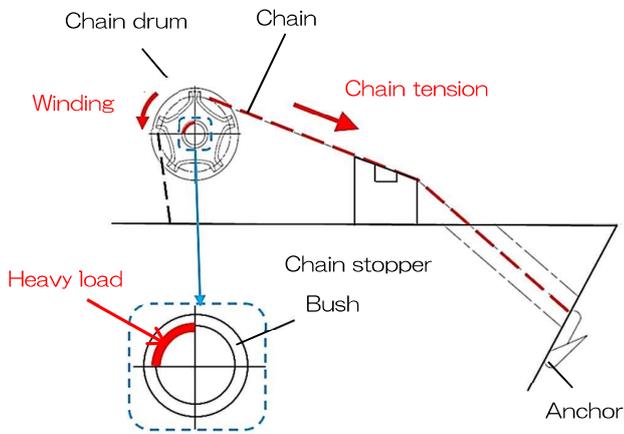
- When rotating the main shaft with hawser drum clutch disengaged and the brake tightened, make sure that there is no large tension on the hawser rope.

If the main shaft is rotated for a long period of time with a large tension applied to the hawser drum, the tension may cause the grease to run out, and the bushing and the bearing metal of main shaft may be seized.

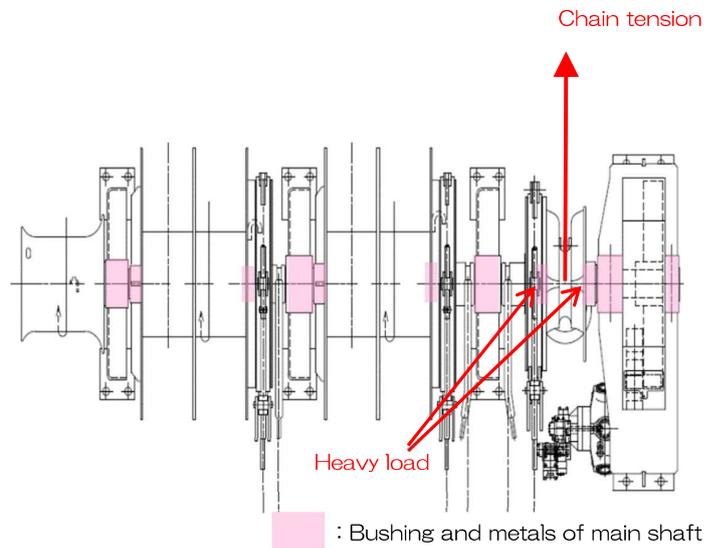
If it is unavoidable to rotate the main shaft while tension is applied to the drum, lubricate the grease to bushing and the bearing metal of main shaft, and try to run the winch for a short time as much as possible.

- In a single shaft windlass where the chain drum and the hawser drum are located on the same shaft, chain tension remains between the bell mouth and the chain drum if the brake is tightened with the control valve in the winding operation when storing the anchor. After fixed the chain with the chain stopper, release the chain tension by loosening the brake one time.

If the hawser drum is used while the chain tension remains between the bell mouth and the chain drum, the bushing and the bearing metal of main shaft may be seized.

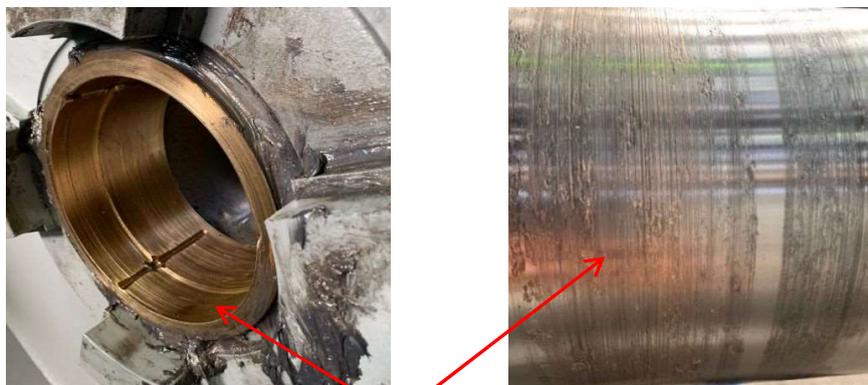


Example of a chain drum under tension



Load when chain tension is applied

Examples of damaged bushing and main shaft caused by operation with excessive tension applied on the drum



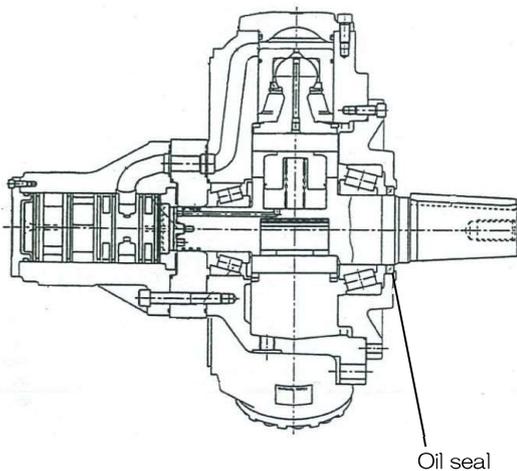
Many liner scratches on the inner surface of bushing and the outer surface of main shaft, caused by rotating the main shaft for a long time under excessive tension.

3. Hydraulic equipment

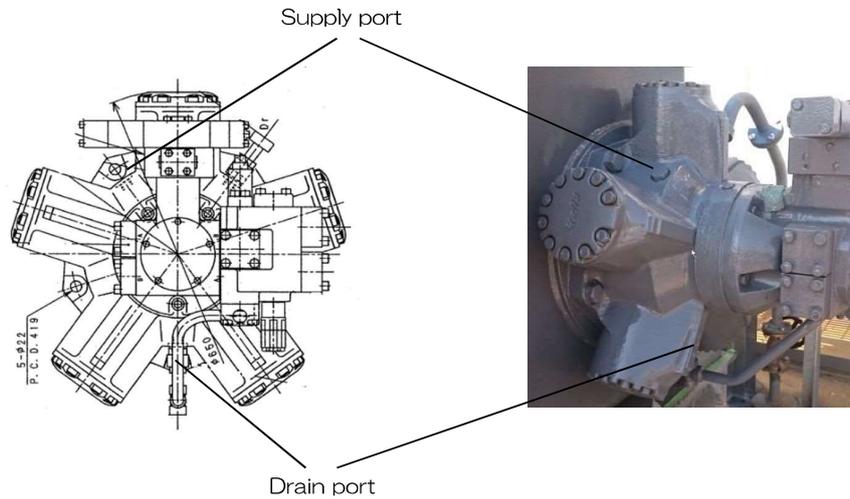
3.1 Hydraulic motor

3.1.1 Inspection and maintenance for hydraulic motor

- a. Perform a visual inspection of the hydraulic motor before using the winch, to check that there is no damage and/or oil leakage. If oil is leaking from the oil seal, replace the oil seal. If the body of the hydraulic motor is severely corroded, the hydraulic motor must be replaced. Otherwise, the hydraulic motor may be damaged by the internal pressure and hydraulic oil may flow out, during winch operation.



- b. Every 200 hours of operation, drain the hydraulic oil from the drain port of the hydraulic motor casing, and inspect the hydraulic oil to see if there are any metal fragments in the oil. If large metal fragments are found, the internal parts may be damaged and the hydraulic motor will need to be replaced.
When operating again the hydraulic motor after draining the hydraulic oil, fill the hydraulic oil from the oil supply port and fill the inside of the hydraulic motor casing with hydraulic oil.

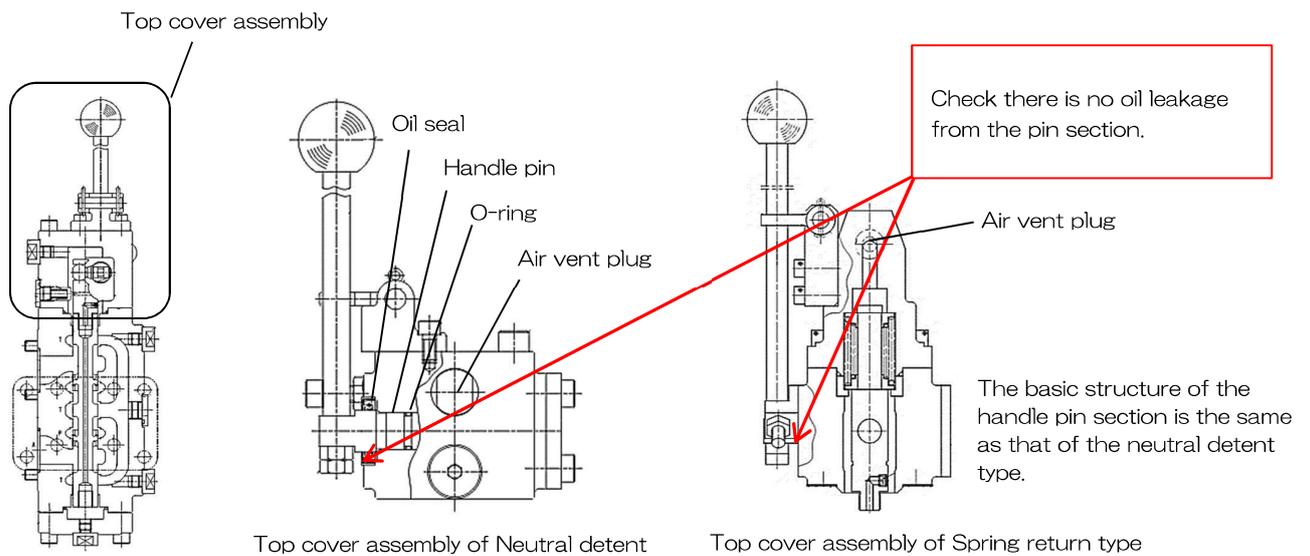


- c. Check that there is no abnormal noise or abnormal heat at the hydraulic motor, when using the winch.
- d. The wear of internal sliding parts of the hydraulic motor becomes larger with time due to sliding during operation. The internal leakage becomes larger due to wear, and the amount of sag (paying out of chain when the handle of control valve is kept at the stop position) may become increased during holding load by hydraulic motor. In addition, oil leakage may occur due to deterioration of the seal parts. Hence, maintenance by our authorized service engineers in every 5 to 7 years is recommended.

3.2 Control valve

3.2.1 Inspection and maintenance for control valve

- a. Perform a visual inspection of the control valve before using the winch to check that there is no damage and/or oil leakage. If oil leakage occurs from the oil seal of the handle pin, replace the oil seal and O-ring.

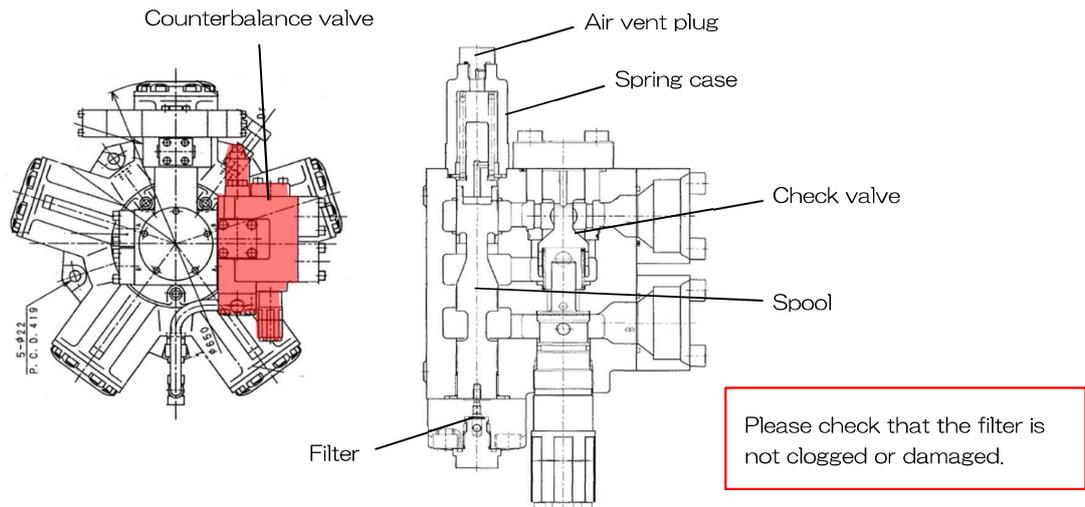


- b. Operate the handle of the control valve for winding and pay out direction, and check that the handle is working smoothly. If the working is heavy, the handle pin may be stuck due to rust. In such case, maintenance is required. If the rust has occurred up to the O-ring seal part, there is a concern that oil leakage will reoccur, even if the seal part is replaced. If so, the top cover assembly must be replaced.
- c. Check that the winch stops while the handle of control valve is locked by stopper at the neutral position. If the winch moves even though the handle is in the neutral position, there is a possibility that the internal parts may be worn out. In such case, it is recommended to replace the control valve. When the winch is not in operation, make it sure that the handle is locked by the stopper at the neutral position. Otherwise, the handle may move due to the influence of the pressure from the hydraulic circuit or air.
- d. If the handle is worked excessively light or hunting occurs at the winch when using the winch, bleed the air from the air vent plug. To bleed air, loosen the air vent plug slowly while operate the control valve and rotate the main shaft at slight slow speed. The bleeding work is finished when air is no longer mixed in the drained hydraulic oil. Be careful not to remove the air venting plug completely, as the hydraulic oil may spill out.

3.3 Counterbalance valve

3.3.1 Inspection and maintenance for counterbalance valve

- a. Perform a visual inspection of the counterbalance valve before using the winch to check that there is no damage and/or oil leakage.
- b. Clean the filter installed in the counterbalance valve, in every 200 hours of operation. If the filter is clogged or damaged, the internal spool may not operate properly and the winch may not operate properly.



- c. If hunting occurs when using the winch, bleed air from the air vent plug on the spring case. (Only for the case that the spring case is installed in the upward direction)

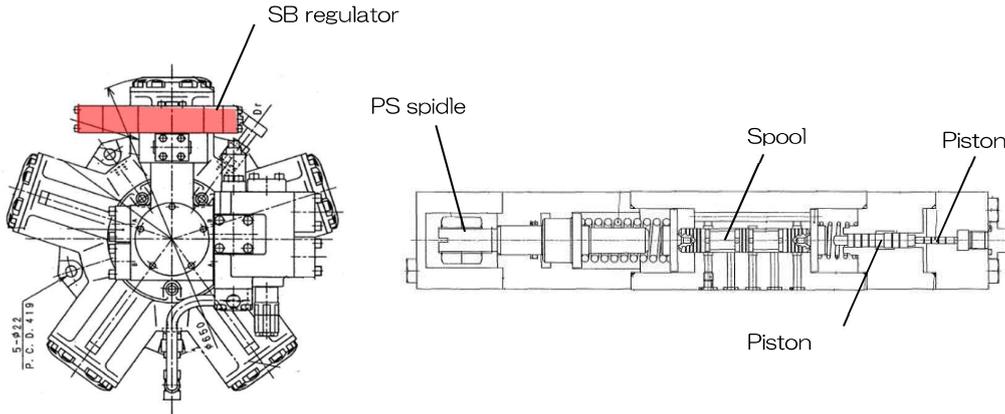
To bleed the air, operating the control valve and loosen the air bleed plug slowly while moving main shaft only at a slight low speed. Then, it will be completed when there is no air in the drained hydraulic oil. Be careful not to remove the air vent plug completely, as the hydraulic oil will spill out.

- d. If the leakage of the internal spool of the counterbalance valve increases due to wear over time, the amount of sag (paying out of chain when the handle of control valve is kept at the stop position) may increase during holding load by the hydraulic motor. In addition, if the check valve is inoperative, it is dangerous because the hydraulic motor hold cannot hold the load. The counterbalance valve must be replaced, if there is an increased sag or any sign of failure of load holding. If the winch is kept at the condition that hydraulic motor is loaded, such load will be retained by counter balance valve. However, in such case, hydraulic motor will act like as air motor. Then, hydraulic motor will operate other way round, so that the anchor may be dropped. Therefore, always keep the brake of winch when it is not used.

3.4 SB Regulator

3.4.1 Inspection and maintenance for SB Regulator

- a. Perform a visual inspection of the SB regulator before using the winch to check there is no damage and/or oil leakage.



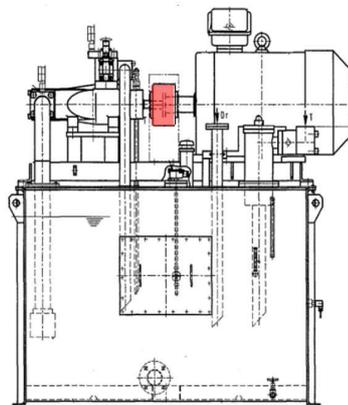
- b. The SB regulator controls the speed and torque of the hydraulic motor, according to the load of the winch. If the internal parts of the SB regulator got stuck due to foreign materials in hydraulic oil, the speed and torque cannot be switched. It is necessary to replace the SB regulator if the following happens.
- Speed is low while main shaft is rotated at no load condition
 - Torque is small while using the winch

3.5 Pump unit

3.5.1 Inspection and maintenance for hydraulic pump

- a. Before starting the hydraulic pump, perform a visual inspection of the pump unit to check there is no damage and/or oil leakage.
- b. Check that the tank oil level is correct, and if the oil level is low, fill the hydraulic oil.
- c. Inspect the coupling every three months to check whether there are no looseness or damage.

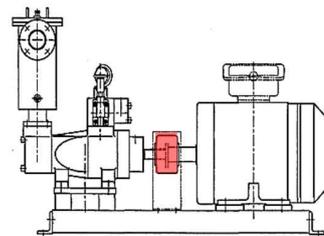
If there is any looseness, it is necessary to replace the coupling.



Silent series type / with tank

Chain Coupling

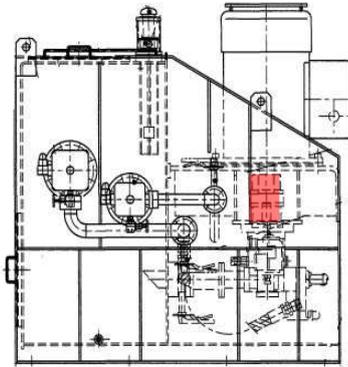
- Check the sprockets there is no wear or damage.
- Check the chain, there is no stretched or loose.
- Check that the amount of grease is sufficient, and replace the grease if it has deteriorated.



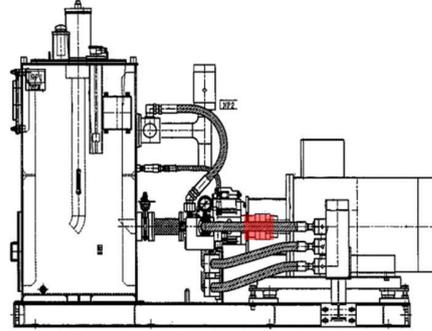
Silent Series Type/without tank

Rotex Coupling

- Check that the spider (intermediate resin parts) is not damaged. The coupling will be damaged if it continues to be used under the condition that the spider is damaged.



Advanced Series Type / Vertical

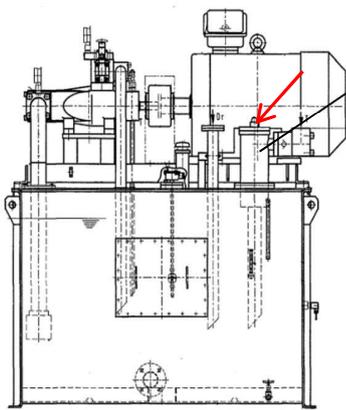


Advanced Series Type / Horizontal

- d. Start the hydraulic pump and check that there is no unusual noise and/or abnormal heat in the hydraulic pump.
- e. The internal sliding parts of the hydraulic pump will wear over time due to sliding during operation. As the internal parts wear, performance may deteriorate due to increased internal leakage. In addition, oil leakage may occur due to deterioration of the seal parts. Hence, maintenance by our authorized service engineers in every 5 to 7 years is recommended.
- f. It is recommended to replace the rubber hoses in every 5 to 7 years because oil leakage may occur due to degradation over time.

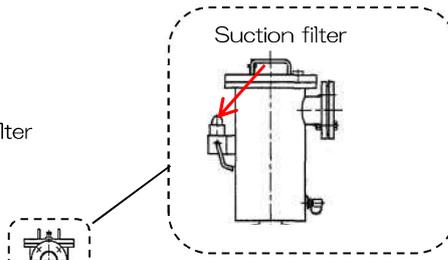
3.5.2 Inspection and maintenance for the elements of return and suction filters

- a. Check whether there are no clogging by the detectors installed on the return filter and suction filter. Even if the hydraulic pump operates with proper oil temperature, the indicator ring rises above the normal range (green), the filter element is suspected to be clogged. Hence, in such case, clean or replace the filter element. The paper element cannot be cleaned and it shall be replaced. The wire mesh element can be reused after cleaning, but repeated cleaning will cause the mesh to become wider and reduce its ability to trap foreign materials. Even if the detector does not indicate clogging, check the condition of the filter element every month to confirm that no foreign materials has been trapped.

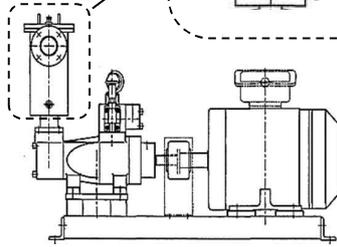


Silent series type / with tank

Return filter



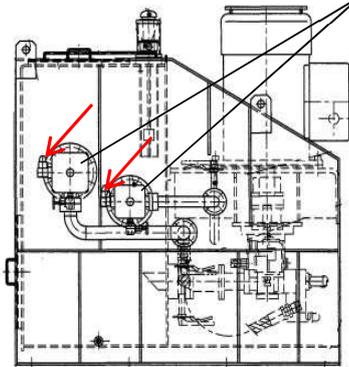
Suction filter



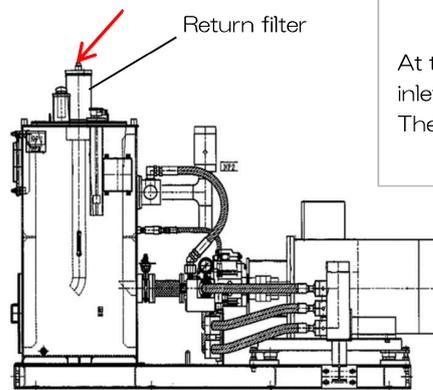
Silent Series Type/without tank

Return filter

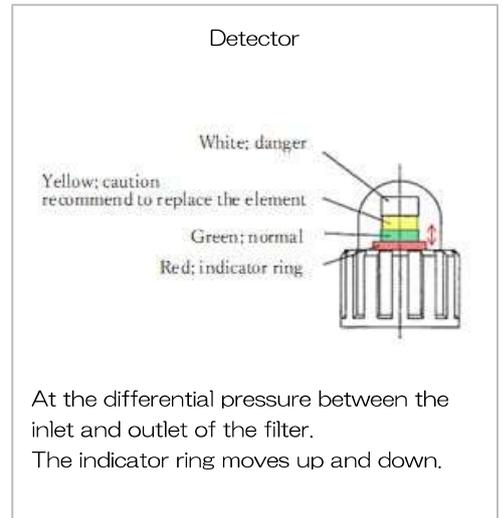
Return filter



Advanced Series Type / Vertical



Advanced Series Type / Horizontal



Detector

White; danger

Yellow; caution recommend to replace the element

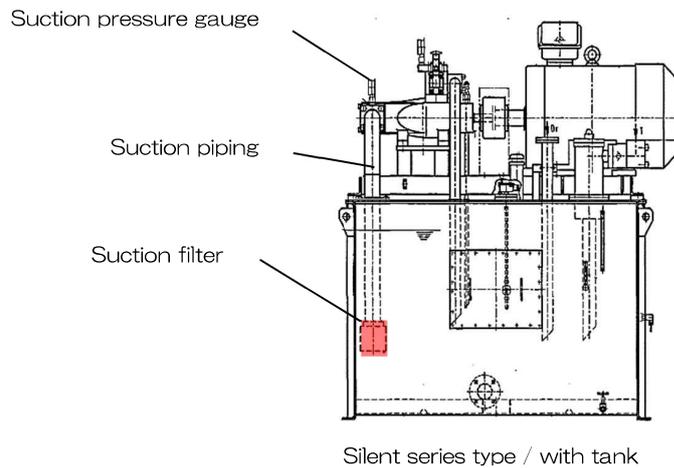
Green; normal

Red; indicator ring

At the differential pressure between the inlet and outlet of the filter. The indicator ring moves up and down.

• • • Detector position.

- b. For the pump unit of Silent Series type with tank, suction filter is installed in suction piping inside the tank. Check the suction pressure of hydraulic pump when hydraulic pump is operating, and if it is more negative than -0.02 MPa, pull out the suction piping and clean the suction filter. If the suction pressure becomes more negative than -0.02 MPa, it may cause abnormal noise due to cavitation or damage at the hydraulic pump. Also, if the suction filter is deformed or damaged, replace the suction filter.

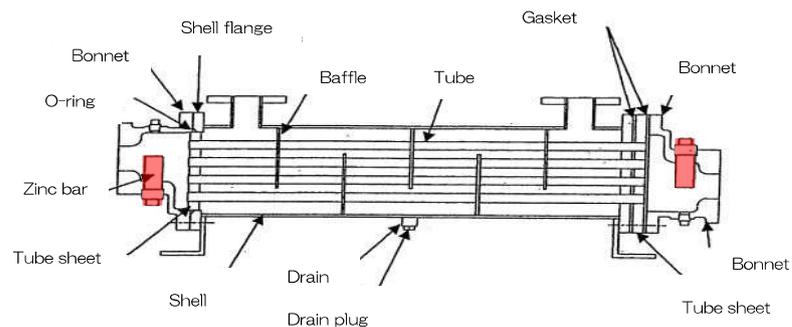


3.5.3 Inspection for solenoid valve

- a. If the hydraulic circuit is a single main system (parallel circuit), an on-load solenoid valve is installed on the hydraulic pump. Check that the on-load solenoid valve turns ON after the hydraulic pump starts and that the hydraulic pump enters the on-load state. If it does not turn on, the solenoid valve may be defective or the electrical circuit may be faulty. Check the electrical circuit including the starter panel, and if the solenoid valve is defective, replace the solenoid valve.

3.5.4 Inspection and maintenance for the oil cooler

- a. If an oil cooler is installed in the pump unit, open the bonnet every 6 months and clean inside the bonnet and cooling water tubes. If the cooling water tubes are clogged with foreign materials, decrease of cooling performance or damage at tubes will be caused.



- b. In every month, check the size of zinc bar for corrosion prevention, and replace them if it becomes less than 40% of its original volume because the size of zinc bar decreases with use. If the zinc bar disappears and the anti-corrosion performance decreases, the oil cooler body may be corroded or damaged.
- c. When using the oil cooler, open the valve on the cooling water outlet

side first, then the valve on the cooling water inlet side to pass the water to flow. If the valve on the inlet side is opened while the valve on the cooling water outlet side is closed, surge pressure will be occurred, which may damage the oil cooler body and pressure gauge.

- d. When the oil cooler is not in use and the outside temperature is low, drain the cooling water in order to prevent the cooling water freezing and causing the damage of oil cooler.

3.6 Remote control devices (hydraulic and electric)

3.6.1 Inspection and maintenance for hydraulic remote control device

- a. Before using the winch, perform a visual inspection of the receiver/transmitter/filler pump to check that there is no damage and/or oil leakage.
- b. Check whether the oil level of the filler pump is in correct level through oil level gauge. If the handle is raised, push the handle to supply the pressure in the circuit. Also, visually check the hydraulic oil in the filler pump, and replace the hydraulic oil if any deterioration such as cloudiness or whiteness is observed.
- c. Before using the winch, make sure of the followings
 - Handle of the transmitter and the lever of the receiver are neutral
 - Close bypass valves (If two transmitters are connected to one receiver, close the bypass valves of both transmitters.)
- d. If the operation is excessively light while the transmitter is operated, or out of phase, air mixing is suspected. Open the bypass valve of the transmitter, and bleed the air from the receiver and the transmitter. For bleed air, start from closer/lower one from the filler pump. During air bleeding, the pressure in the circuit will decrease. Hence, pressurize by filler pump Required accordingly.
- e. If the out of phase occurs even after bleeding air, there is a possibility of failure of internal seal part or failure of bypass valve seat. If so, maintenance is required. In addition, if the corrosion of the receiver or the transmitter is severe, it is necessary to replace the complete unit.

3.6.2 Inspection and maintenance for electric remote control device

- a. Perform a visual inspection of the actuator unit and portable controller to check that there is no damage, before using the winch.
- b. Move the actuator through the portable controller and check whether there are any abnormality in operation. If it cannot work properly, check whether error is indicated on the controller amplifier board. If an error is indicated, the equipment may be in failure or the wiring may be not arranged properly. In such case, contact us.

3.6.3 Remote operation of the clutch and brake

- a. Operate the clutch and brake of each drum through the remote control stand, and check whether there are any abnormality in operation. If the clutch or brake do not work properly against the operation of the remote control stand, there is a possibility that the electrical circuit may be defective. Check the wiring and the electrical parts in the relay box. In addition, there is a possibility that the solenoid valve is malfunctioning, so check the function of the solenoid valve.

3.7 Other valves

- a. Before using the winch, check the valves on the hydraulic circuit (i.e. directional valve, stop valve, solenoid valve, flow control valve, etc.) whether there are oil leakage or malfunction. Also, check that the open/close condition of the stop valve etc. is correct.

3.8 Hydraulic oil

- a. Check the color and clarity of the hydraulic oil every voyage or every three months to see if there is any cloudiness due to water mixing or discoloration due to deterioration. If cloudiness or discoloration is found, the hydraulic oil must be replaced because it will affect the operation and shorten the life of the hydraulic equipment.
- b. Hydraulic oil should be inspected by the hydraulic oil manufacturer every year in order to obtain the recommendation whether the existing hydraulic oil can be used continuously or replace to new one. When changing the brand of hydraulic oil, consult with the oil manufacturer to determine whether the new brand is acceptable.

When replacing the hydraulic oil, clean the inside of the tank and replace the filter element. Also, when filling the tank with hydraulic oil, fill the oil through a filter of 200 mesh or more to prevent foreign material entering the tank.

- c. Foreign material in the hydraulic oil will affect the operation and shorten the life of the hydraulic equipment, and should be controlled at the following contamination levels.

Silent Series : ISO 4406 -/19/16

Advanced Series : ISO 4406 -/18/15

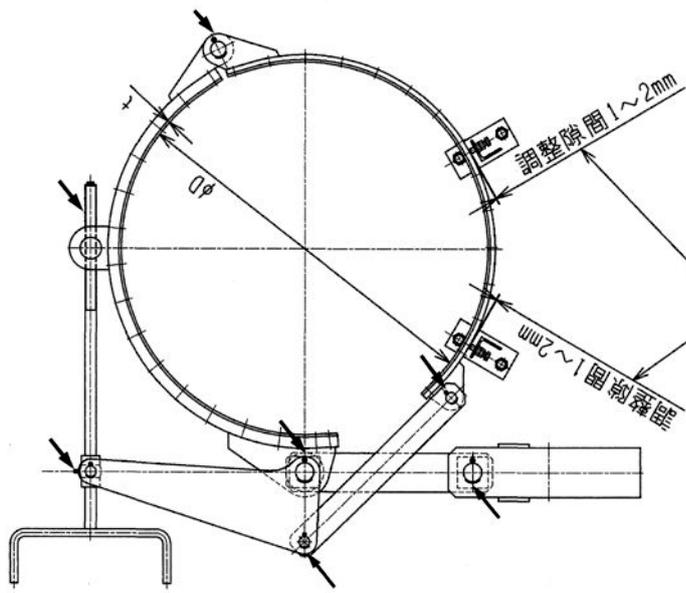
4. Inspection checklist

Inspect the entire deck machinery in accordance with the inspection details in this document every three months, and record the inspection results in a checklist and keep it for the maintenance of the deck machinery.

Please refer to Attachment 2 for the checklist.

チェーンドラム用ブレーキメンテナンス要領 / BRAKE MAINTENANCE PROCEDURES FOR CHAIN DRUM

Attachment 1-1



注意
本調整を行う前に、必ずチェーンストッパーを掛けてください。

NOTE
Before this adjustment, MUST apply the chain stopper.
1. ()は、グリス注油箇所を示しています。ブレーキを使用する前にグリスガンを使用し注油して下さい。

2. 本ブレーキのライニングは、皿小ネジにて取付けております。ライニングはネジの頭まで摩擦すると交換が必要です。(表1参照)

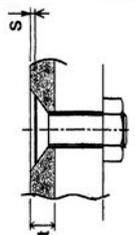
3. ブレーキのライニングを交換した場合、バンド受けのボルトとブレーキバンドのクリアランスはブレーキを締めた状態で1~2mmとなるように調整して下さい。

1. An arrow mark () shows a greasing point where a grease nipple is equipped. Before you use the brake, grease the points by using a grease gun.
2. Because the brake lining is fixed with the brake band by using countersunk head screws, if the lining has abraded excessively, the lining must be replaced with a new one so as to prevent the screw head from touching with the brake drum.(Refer to Fig.1)
3. If you exchanged lining of a brake, you adjust the clearance between the band support bolt tip and the brake band to be 1~2mm in length while the brake is being applied.

表1. ブレーキライニング厚さ

Fig.1. BRAKE LINING THICKNESS

チェーン径 CHAIN DIA.	ブレーキ径 BRAKE DRUM DIA. φ D [mm]	ブレーキライニング 厚さ BRAKE LINING THICKNESS t [mm]	摩耗代 WEAR LIMIT S [mm]	ライニング交換時 厚さ(目安) LINING THICKNESS FOR EXCHANGE [mm]
φ38~42	800	6.0	abt. 1.0	abt. 5.0
	1000	8.0	abt. 2.0	abt. 6.0
φ44~54	1200			
φ56~60	1300	10.0	abt. 2.5	abt. 7.5



チェーンドラム用ブレーキメンテナンス要領 / BRAKE MAINTENANCE PROCEDURES FOR CHAIN DRUM

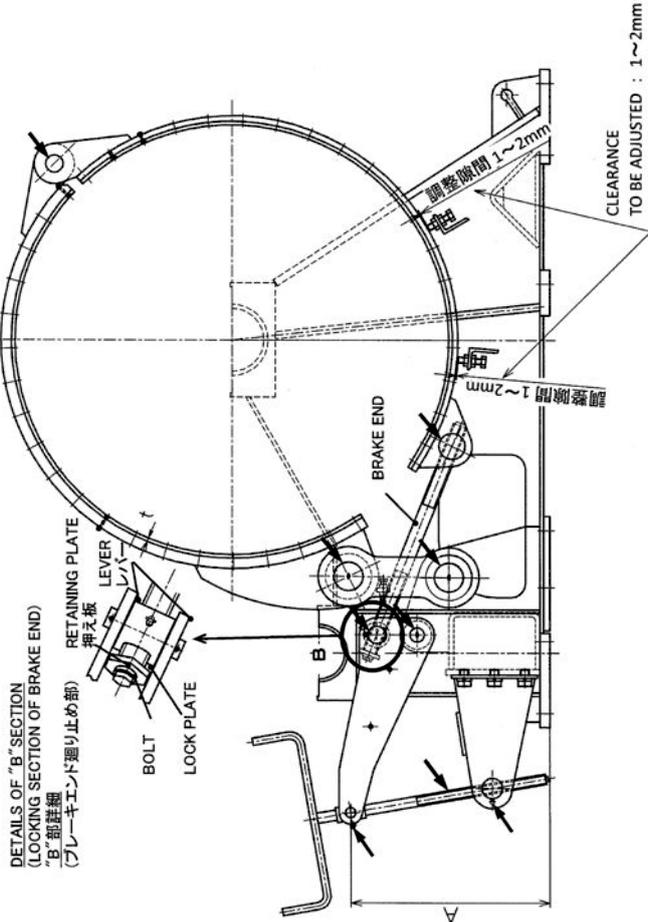


表1. ブレーキライニング厚さ

Fig.1. BRAKE LINING THICKNESS

チェーン径 CHAIN DIA.	ブレーキ径 BRAKE DRUM DIA. [mm]	ブレーキライニング 厚さ BRAKE LINING THICKNESS t [mm]	摩耗代 WEAR LIMIT S [mm]	ライニング交換時 厚さ(目安) LINING THICKNESS FOR EXCHANGE [mm]
φ62~66	1300	10.0	abt. 3.6	abt. 6.4
φ68~73	1400			
φ76~81	1500	12.5	abt. 5.0	abt. 7.5
φ84~87	1700			
φ90~95	1800			
φ97~102	2000	18.0	abt. 6.0	abt. 10.0
φ105~114	2240			

表3. ブレーキエンド寸法

Fig.3. DIMENSION OF BRAKE END

チェーン径 CHAIN DIA.	ネジ節 SCREW THREAD Tr "X" [mm]	口部長さ □ LENGTH "Y" [mm]	4平面(□)寸法 FOUR-SIDE FLAT (□) "Z" [mm]
φ62~66			
φ68~73	50	25	41
φ76~81			
φ84~87	60	28	50
φ90~95			
φ97~102			
φ105~114			

表2. A寸法

Fig.2. DIMENSION "A"

チェーン径 CHAIN DIA.	A寸法 DIMENSION "A"
φ62~66	
φ68~73	690
φ76~81	
φ84~87	
φ90~95	
φ97~102	870
φ105~114	700

注意
本調整を行う前に、必ずチェーンストッパーを掛けてください。

NOTE
Before this adjustment, MUST apply the chain stopper.

1. (ノ) は、グリス注油箇所を示しています。ブレーキを使用する前にグリスガンを使用し注油して下さい。

2. ハンド受けのボルトとブレーキバンドのクリアランスは、ブレーキを締めた状態で1~2mmとなるよう調整して下さい。

3. ブレーキを締めた状態で、A寸法が表の値となることを確認して下さい。

A寸法が外れている場合は、B部のM16ボルトを緩め、廻り止め板を外し、ブレーキエンドを回転させてA寸法が既定の値になるように調整して下さい。

ライニングが摩耗してくるとA寸法が小さくなりますので時々確認して下さい。(表1参照)

4. 本ブレーキのライニングは、皿小ネジにて取付けております。ライニングは、ネジの頭まで摩耗すると交換が必要です。

1. An arrow mark (ノ) shows a greasing point where a grease nipple is equipped. Before you use the brake, grease the points by using a grease gun.

2. Adjust the clearance between the band support bolt tip and the brake band to be 1~2mm in length while the brake is being applied.

3. Under the condition that the brake is being applied, make sure the Dimension "A" becomes the value in Fig.2.

If the Dimension "A" is out of scope of the specified value, first turn and loosen the M16 bolt provided in the Section "B".

Next, remove the lock plate from the assembly.

Then rotate the brake end until the specified Dimension "A" is obtained.

4. Because the brake lining is fixed with the brake band by using countersunk head screws, if the lining has abraded excessively, the lining must be replaced with a new one so as to prevent the screw head from touching with the brake drum. (Refer to Fig.1.)

※ 補足説明

・推奨するブレーキエンドの調整方法は上記3の通りです。

・ブレーキエンドの回転が重く、スムーズでない場合はネジ部"X"に潤滑油を挿して下さい。

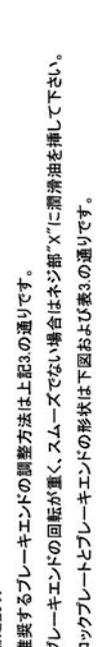
・ロックプレートとブレーキエンドの形状は下図および表3の通りです。

・ Recommended brake adjusting method at the brake end is as described above.

・ If the turning of brake end is heavy and not smooth, apply lubricants to the screw thread section of screwed pieces "X".

・ The shape of lock plate and brake end is as follows and Fig.3.

スナナをここにかけること。
Apply a spanner here.



断面 C-C

2軸型ウインドラス <G,H,I,J-CU> Chain draum for Windlass <G,H,I,J-CU>

ウインドラス用ブレーキのメンテナンス及び調整方法 (G, H, I, J-CU)

ウインドラス用ブレーキは適正なブレーキ保持力を発揮できるように、定期的メンテナンス及び調整する必要があります。以下の要領で、適宜メンテナンス及び調整をすること。

注意：

ウインドラス用ブレーキをメンテナンス及び調整する時は、必ずチェーンストッパーを掛けてアンカーの落下防止を実施すること。

1. リンク機構の動き

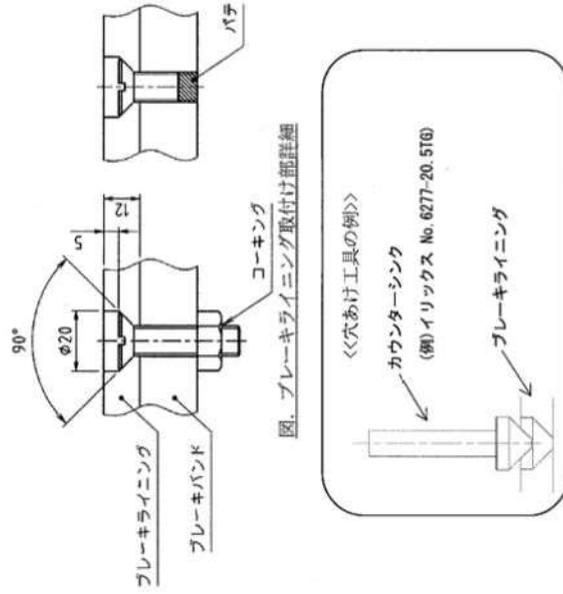
ブレーキ部品のリンク部が円滑に動くように定期的にグリスアップすること。固着等によりリンク部の動きが悪い場合は、ブレーキを緩めた後、ピンを抜き取り再度グリスアップすること。

2. ブレーキライニングの磨耗

ブレーキライニングの初期厚さは12mmであり、残り厚さが約8mmになったらブレーキライニングを交換すること。

注意：

ブレーキライニングを交換する場合は、必ず上下側同時に交換すること。



08071282

How to adjust the brake for windlass (Windlass type G, H, I, J-CU)

It is necessary to periodically maintain and adjust the windlass brake so that it can exert an appropriate brake holding force. Perform maintenance and adjustment as appropriate, in the following procedure.

Note:

When maintaining and adjusting the windlass brake, be sure to engage the chain stopper to prevent the anchor from falling.

1. Movement of link mechanism

Apply grease regularly so that the brake parts link moves smoothly. If the movement of the link is not good due to sticking etc., loosen the brake and then pull out the pin to clean it up again.

2. Wear of the brake lining

The initial thickness of the brake lining is 12 mm, and replace the brake lining when the remaining thickness is about 8 mm.

Note:

For changing the lining, the upper lining and the lower lining should be changed at the same time.

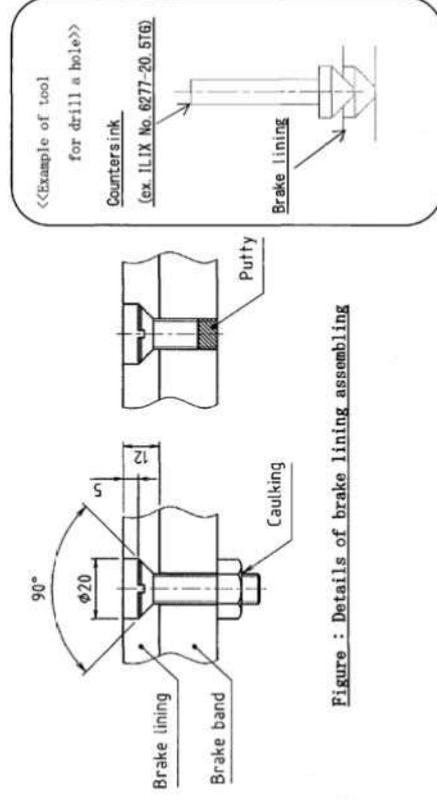


Figure : Details of brake lining assembling

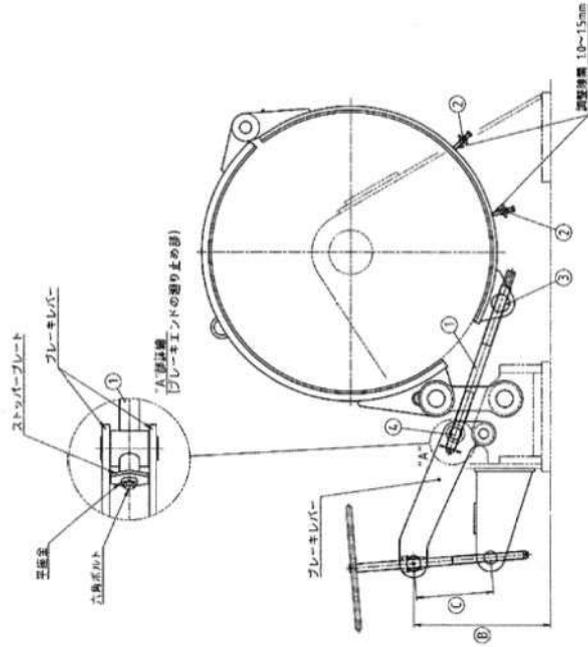
08071282

2軸型ウィンドラス <G,H,I,J-CU>
Chain drum for Windlass <G,H,I,J-CU>

3. ブレーキの調整

ブレーキを締めた状態で⑥（又は③）寸法を計測し、下表の値からずれている場合は下記要領で調整すること。

- (1) ブレーキを緩めた状態にして、“A”部の六角ボルトを緩めてブレーキエンド①からストップバープレートを取り外す。
- (2) ブレーキを締めた状態でブレーキレバー高さ⑥（又は③）寸法になるように、ブレーキエンド①を回して調整する。調整後、ねじ棒が底付することなく十分に回転できることを確認すること。
- (3) 調整完了後はストップバープレートをブレーキエンド①に取付けて、六角ボルトを確実に締付けること。
- (4) ブレーキを締めた状態でブレーキバンドとバンドサポートボルト②の先端の隙間が1.0～1.5mmになるようにバンドサポートボルト②の長さを調整する。調整後、ブレーキを緩めてブレーキドラムとブレーキライニングが接触していないことを確認すること。



型式	G-CU	H-CU	I-CU	J-CU
⑥寸法	685	685	685	710
③寸法	386	386	386	411

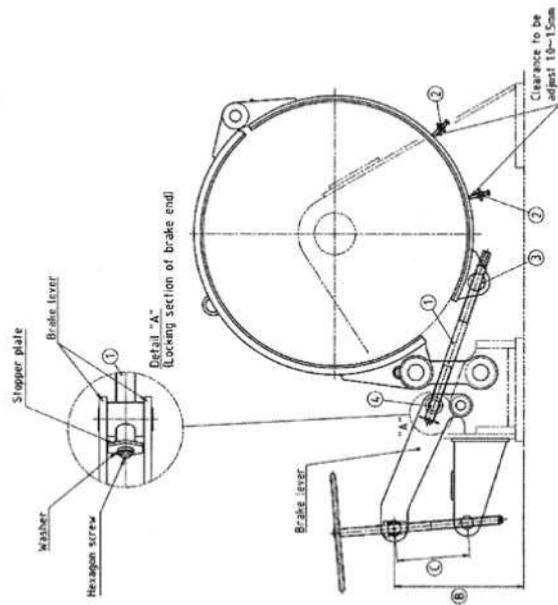
[mm]

0B071282

3. Adjustment of the brake

Measure dimension ⑥ (or ③) with the brakes tightened, and adjust in the following manner if the result measuring is out of the value in the table below.

- (1) With the brake released, loosen the “A” hex bolt and remove the stopper plate from the brake end ①.
- (2) Adjust the brake end ① by turning it so that the brake lever height becomes ⑥ (or ③) dimensions with the brakes tightened. After adjustment, confirm that the screw rod can rotate sufficiently without bottoming.
- (3) After adjustment is complete, attach the stopper plate to the brake end ① and securely tighten the hex bolt.
- (4) Adjust the length of the band support bolt ② so that the clearance between the brake band and the tip of the band support bolt ② becomes 1.0 to 1.5 mm with the brake tightened. After adjustment, loosen the brake and check that the brake drum and brake lining are not in contact.



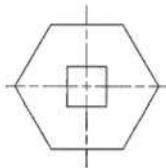
Type	G-CU	H-CU	I-CU	J-CU
⑥	685	685	685	710
③	386	386	386	411

[mm]

0B071282

【補足説明】

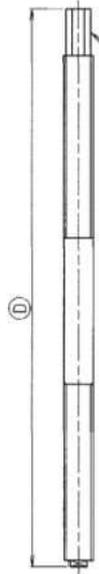
(1) ストッパープレート^①の形状は以下の通り。



(2) ブレーキエンド (ターンバックル) の形状と寸法は以下の通り。



①



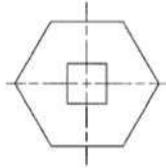
Six-side flat
Apply a spanner here.
スパナはここに掛けること。

型式	G-CU	H-CU	I-CU	J-CU		
①寸法	950	950	950	1000		
[mm]						

(3) ブレーキエンドの回転が重く、スムーズでない場合はスクリューナット^③及び^④のネジ部に潤滑油を注すこと。

【Supplementary explanation】

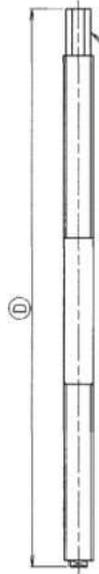
(1) The shape of stopper plate is as follows:



(2) The shape and dimension of brake end (turnbuckle) are as follows:



①



Six-side flat
Apply a spanner here.

Type	G-CU	H-CU	I-CU	J-CU		
①	950	950	950	1000		
[mm]						

(3) If the turning of brake end is heavy and not smooth, apply lubricants to the screw thread section of screw nuts ^③ and ^④.

2軸型ウィンドラス <K,M,N,P-CU> Chain draum for Windlass <K,M,N,P-CU>

ウィンドラス用ブレーキのメンテナンス及び調整方法 (K, M, N, P-CU)

ウィンドラス用ブレーキは適正なブレーキ保持力を発揮できるように、定期的にメンテナンス及び調整する必要があります。以下の要領で、適宜メンテナンス及び調整をすること。

注意：

ウィンドラス用ブレーキをメンテナンス及び調整する時は、必ずチェーンストップバーを掛けてアンカーの落下防止を実施すること。

1. リンク機構の動き

ブレーキ部品のリンク部が円滑に動くように定期的にグリスアップすること。固着等によりリンク部の動きが悪い場合は、ブレーキを緩めた後、ピンを抜き取り再度グリスアップすること。

2. ブレーキライニングの磨耗

ブレーキライニングの初期厚さは16mmであり、残り厚さが約11mmになったらブレーキライニングを交換すること。

注意：

ブレーキライニングを交換する場合は、必ず上下側同時に交換すること。

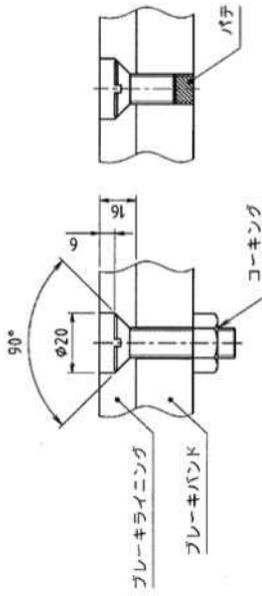
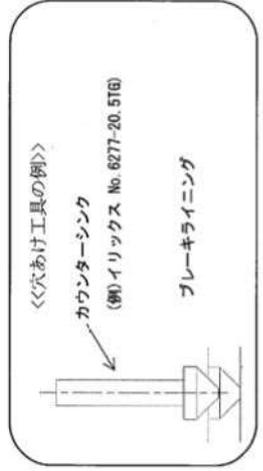


図. ブレーキライニング取付け部詳細



0B071282

How to adjust the brake for windlass (Windlass type K, M, N, P-CU)

It is necessary to periodically maintain and adjust the windlass brake so that it can exert an appropriate brake holding force. Perform maintenance and adjustment as appropriate, in the following procedure.

Note:

When maintaining and adjusting the windlass brake, be sure to engage the chain stopper to prevent the anchor from falling.

1. Movement of link mechanism

Apply grease regularly so that the brake parts link moves smoothly. If the movement of the link is not good due to sticking etc., loosen the brake and then pull out the pin to clean it up again.

2. Wear of the brake lining

The initial thickness of the brake lining is 16 mm, and replace the brake lining when the remaining thickness is about 11 mm.

Note:

For changing the lining, the upper lining and the lower lining should be changed at the same time.

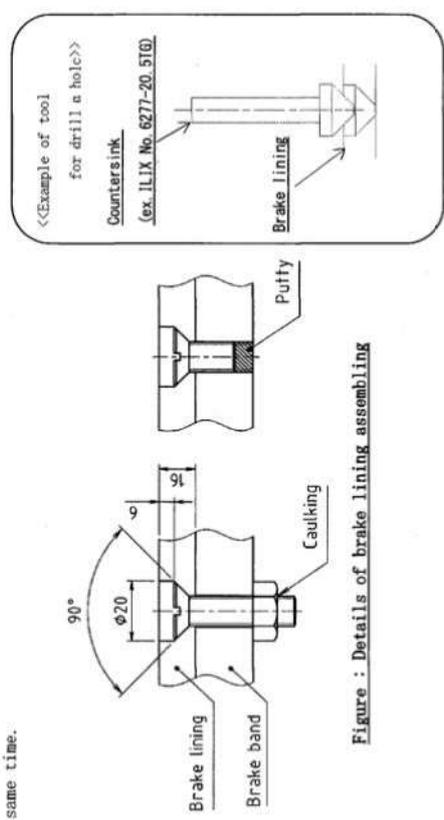


Figure : Details of brake lining assembling

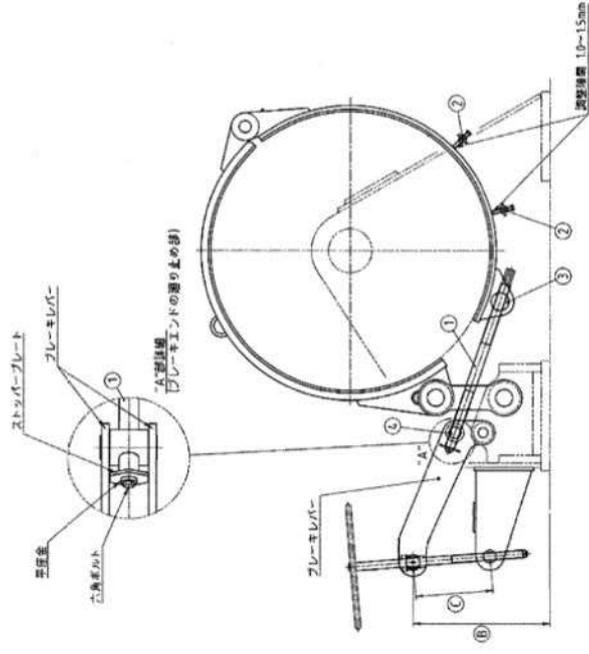
0B071282

2軸型ウインドラス <K,M,N,P-CU>
Chain draum for Windlass <K,M,N,P-CU>

3. ブレーキの調整

ブレーキを締めた状態で⑧（又は⑨）寸法を計測し、下表の値からずれている場合は下記要領で調整すること。

- (1) ブレーキを緩めた状態にして、“A”部の六角ボルトを緩めてブレーキエンド①からストップバープレートを取り外す。
- (2) ブレーキを締めた状態でブレーキレバー高さが⑧（又は⑨）寸法になるように、ブレーキエンド①を回して調整する。調整後、ねじ棒が底付することなく十分に回転できることを確認すること。
- (3) 調整完了後はストップバープレートをブレーキエンド①に取付けて、六角ボルトを確実に締付けること。
- (4) ブレーキを締めた状態でブレーキバンドとバンドサポートボルト②の先端の隙間が1.0～1.5mmになるようにバンドサポートボルト②の長さを調整する。調整後、ブレーキを緩めてブレーキドラムとブレーキライニングが接触していないことを確認すること。



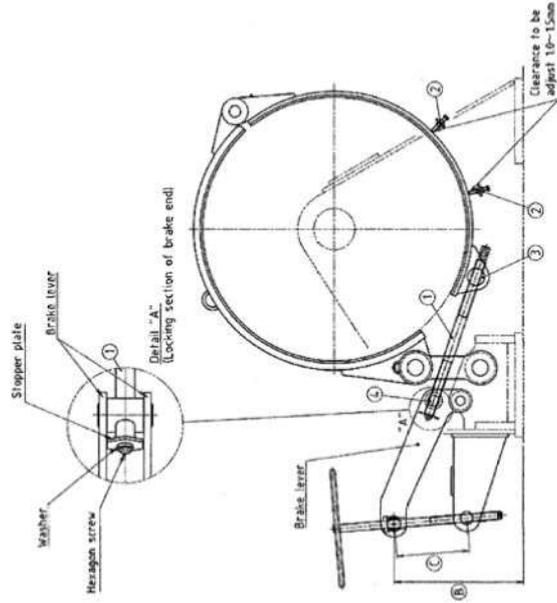
型式	K-CU	M-CU	N-CU	P-CU
⑧寸法	735	720	765	765
⑨寸法	436	421	535	536

[mm]

3. Adjustment of the brake

Measure dimension ⑧ (or ⑨) with the brakes tightened, and adjust in the following manner if the result measuring is out of the value in the table below.

- (1) With the brake released, loosen the “A” hex bolt and remove the stopper plate from the brake end ①.
- (2) Adjust the brake end ① by turning it so that the brake lever height becomes ⑧ (or ⑨) dimensions with the brakes tightened. After adjustment, confirm that the screw rod can rotate sufficiently without bottoming.
- (3) After adjustment is complete, attach the stopper plate to the brake end ① and securely tighten the hex bolt.
- (4) Adjust the length of the band support bolt ② so that the clearance between the brake band and the tip of the band support bolt ② becomes 1.0 to 1.5 mm with the brake tightened. After adjustment, loosen the brake and check that the brake drum and brake lining are not in contact.

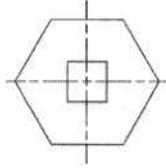


Type	K-CU	M-CU	N-CU	P-CU
⑧	735	720	765	765
⑨	436	421	535	536

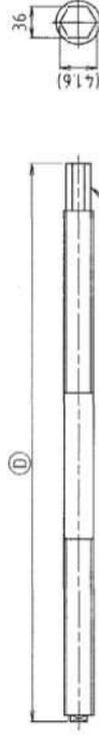
[mm]

【補足説明】

(1) ストッパープレート^①の形状は以下の通り。



(2) ブレーキエンド (ターンバックル) の形状と寸法は以下の通り。



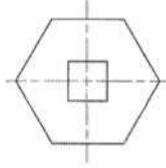
Six-side flat
Apply a spanner here.
スパナはここに掛けること。

型式	K-CU	M-CU	N-CU	P-CU	
①寸法	1060	1080	1180	1190	[mm]

(3) ブレーキエンドの回転が重く、スムーズでない場合はスクリーンナット^③及び^④のネジ部に潤滑油を注すこと。

【Supplementary explanation】

(1) The shape of stopper plate is as follows:



(2) The shape and dimension of brake end (turnbuckle) are as follows:



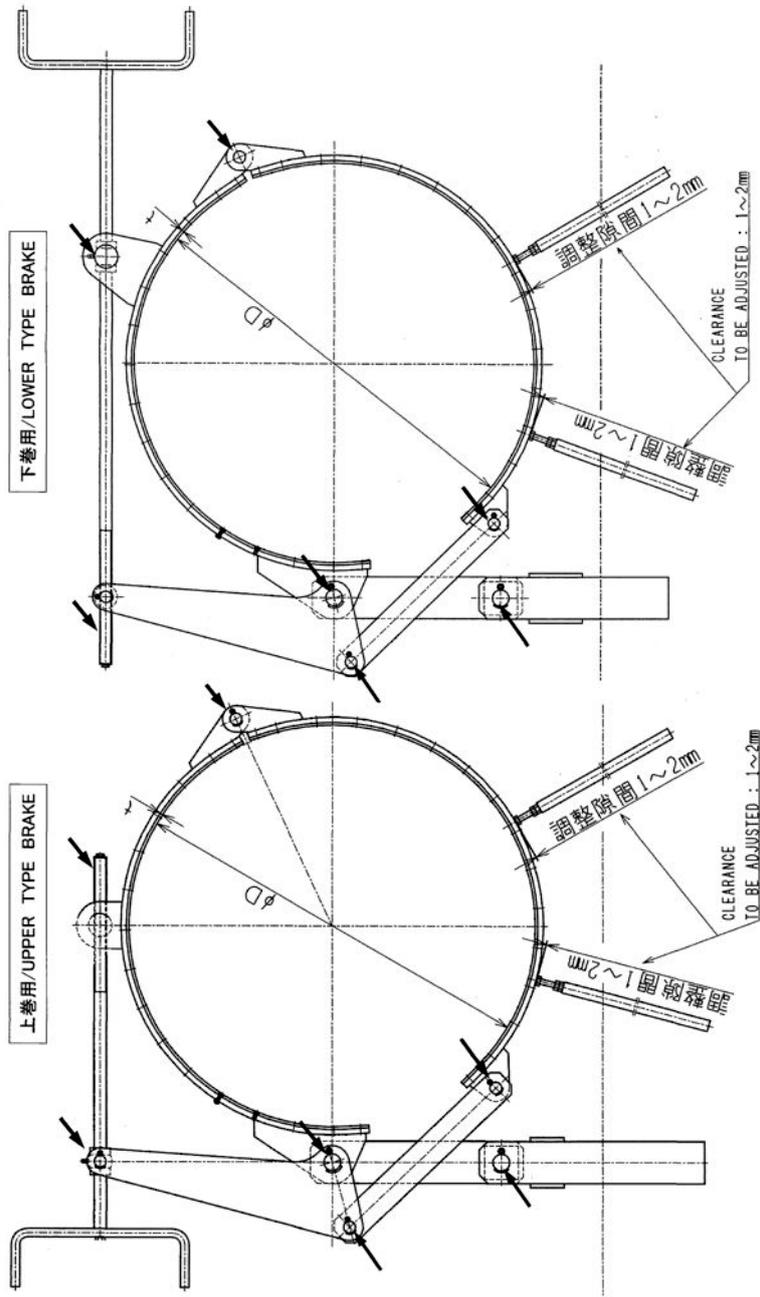
Six-side flat
Apply a spanner here.

Type	K-CU	M-CU	N-CU	P-CU	
①	1060	1080	1180	1190	[mm]

(3) If the turning of brake end is heavy and not smooth, apply lubricants to the screw thread section of screw nuts ^③ and ^④.

ホーサードラム用ブレーキメンテナンス要領 / BRAKE MAINTENANCE PROCEDURES FOR HAWSER DRUM

Attachment 1-5

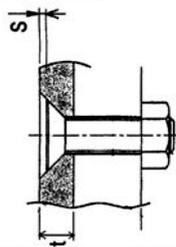


1. (✓)は、グリス注油箇所を示しています。ブレーキを使用する前にグリスガンを使用し注油して下さい。
2. 本ブレーキのライニングは、皿小ネジにて取付けております。ライニングはネジの頭まで摩耗すると交換が必要です。(表1参照)
3. ブレーキのライニングを交換した場合、バンド受けのボルトとブレーキバンドのクリアランスはブレーキを締めた状態で1~2mmとなるように調整して下さい。

1. An arrow mark (✓) shows a greasing point where a grease nipple is equipped. Before you use the brake, grease the points by using a grease gun.
2. Because the brake lining is fixed with the brake band by using countersunk head screws, if the lining has abraded excessively, the lining must be replaced with a new one so as to prevent the screw head from touching with the brake drum.(Refer to Fig.1)
3. If you exchanged lining of a brake, you adjust the clearance between the band support bolt tip and the brake band to be 1~2mm in length while the brake is being applied .

表1. ブレーキライニング厚さ

巻込荷重 WINDING LOAD [kN]	ブレーキ径 BRAKE DRUM DIA. φD [mm]	ブレーキライニング 厚さ BRAKE LINING THICKNESS t [mm]	摩耗代 WEAR LIMIT S [mm]	ライニング交換時 厚さ(目安) LINING THICKNESS FOR EXCHANGE [mm]
50	800	6.0	abt. 1.0	abt. 5.0
	1000	8.0	abt. 2.0	abt. 6.0
125/160	1200			
200/250	1400	10.0	abt. 3.5	abt. 6.5
	300			



ムアリング用ブレーキのメンテナンス及びブレーキライニング交換要領

ムアリング用ブレーキは適正なブレーキ保持力を発揮できるように、定期的にメンテナンスを
 する必要があります。以下の要領で適宜メンテナンスをすること。

1. リンク機構の動き
 ブレーキ部品のリンク部が円滑に動くように定期的にグリスアップすること。固着等によりリ
 ンク部の動きが悪い場合は、ブレーキを緩めた後、ピンを抜き取り清掃し再度グリスアップ
 すること。
2. ブレーキライニングの磨耗
 ブレーキライニングの初期厚さは12.5 mm であり、残り厚さが約9 mm になったらブレーキ
 ライニングを交換すること。

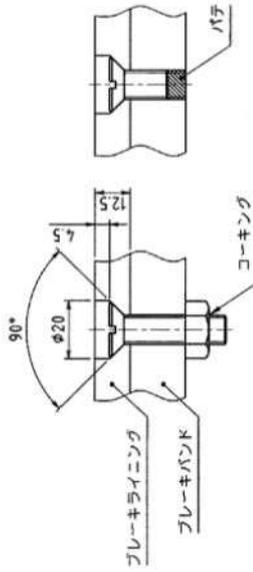
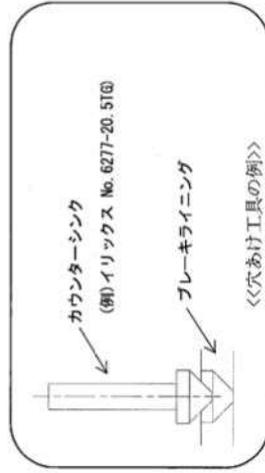


Fig.1 ブレーキライニング取付部詳細



Maintenance and replacement procedure of brake lining for mooring brake

It is necessary to periodically maintain so that it can exert an appropriate brake holding
 force. Perform maintenance as appropriate, in the following procedure.

1. Movement of link mechanism
 Apply grease regularly so that the brake parts link moves smoothly. If the movement of
 the link is not good due to sticking etc., loosen the brake and then pull out the pin
 to clean it up again.
2. Wear of brake lining
 The initial thickness of the brake lining is 12.5 mm, and replace the brake lining when
 the remaining thickness is about 9 mm.

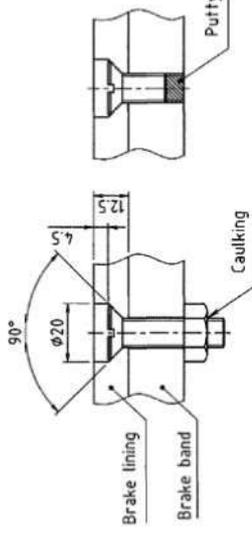
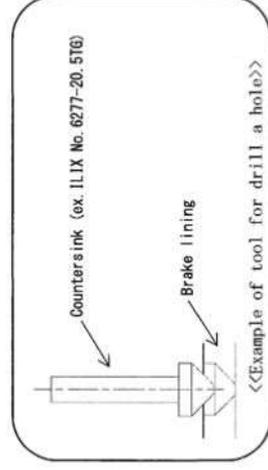


Fig.1 Detail of brake lining assembling



3. ブレーキライニング交換要領

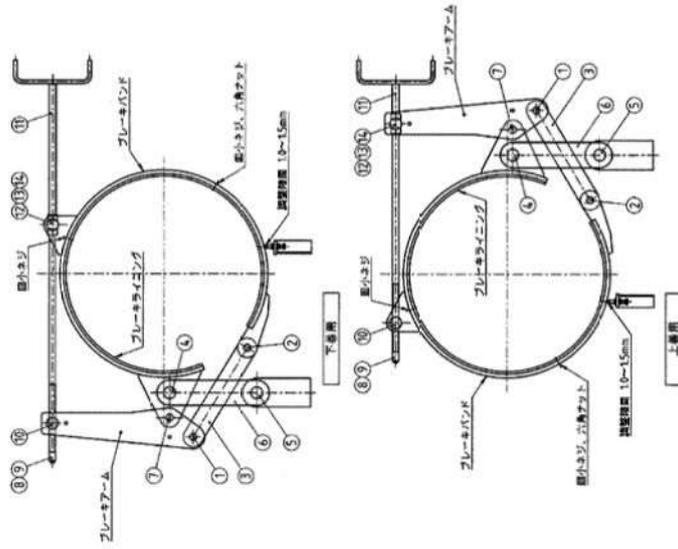


Fig. 2 ムアリング用ブレーキ組立図

- (1) ブレーキを十分に緩める。
- (2) ピン①及び②を抜いてリンク③を外す。
- (3) ピン④及び⑤を抜いてリンク⑥を外す。
- (4) ブレーキバンドをブレーキドラムから外す。
- (5) ピン⑦を抜く。割ピン⑧及びリング⑨を外して、ブレーキナット⑩をハンドル⑪から外す。
- (6) チューバピン⑫及びストップブリング⑬を外して、ハンドル⑭をターナー⑮から外す。
- (7) 皿小ネジ⑯及びナットを外して、ブレーキライニングを取り外す。
- (8) 交換用ブレーキライニングに穴あけ加工し、ブレーキバンドに取り付ける。
- (9) 全ての皿小ネジを取り付け後、皿小ネジ頭部がブレーキライニング表面より規定量、沈んでいることを確認する。[Fig. 1 参照]
- (10) 皿小ネジ及びナットをコーキングして緩み止めをする。[Fig. 1 参照]
- (11) ブレーキライニング交換完了後、取り外しと逆の手順で組み立てる。

3. Replacement procedure of brake lining

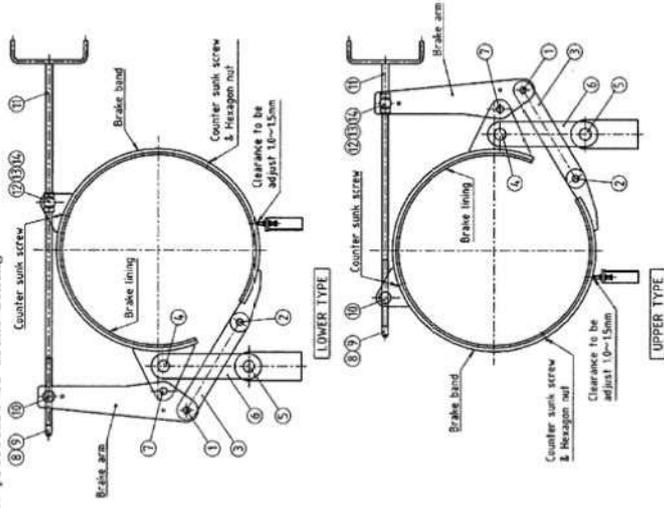


Fig. 2 Mooring brake assembly

- (1) Fully loosen the brake.
- (2) After removing the both pins ① and ②, remove the link ③.
- (3) After removing the both pins ④ and ⑤, remove the link ⑥.
- (4) Dis-assemble the brake band from the brake drum.
- (5) Remove the pin ⑦. After removing the split pin ⑧ and the ring ⑨, dis-assemble the brake nut ⑩ from the handle ⑪.
- (6) After removing the taper pin ⑫ and the stop ring ⑬, dis-assemble the handle ⑭ from the turner ⑮.
- (7) Remove the screws and nuts, then remove the brake lining.
- (8) Make the holes on new brake lining for screws and nuts, then fix the brake lining on the brake band.
- (9) After fixing the screws and nuts, check that all screws are suitably sunk with designated depth. [Refer to Fig.1]
- (10) Caulk the screws and nuts for avoiding looseness. [Refer to Fig.1]
- (11) After replacement of the brake lining, re-assemble by reverse procedure.

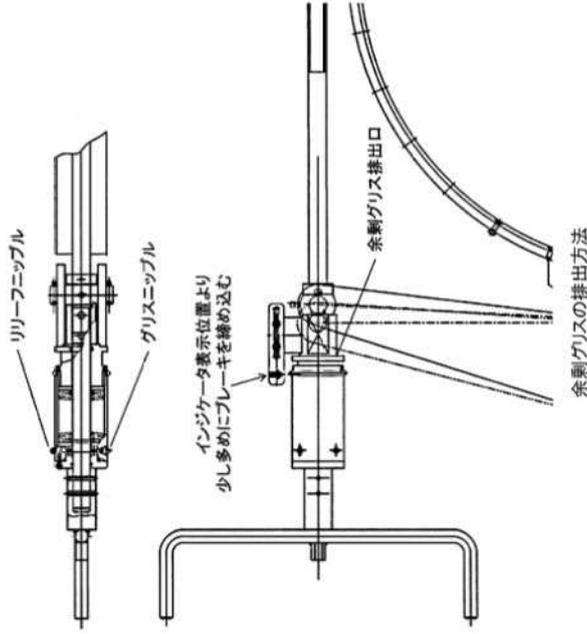
スプリング付手動ブレーキのグリスアップ要領
 ウィンチ使用前、使用後は、スプリングケース内にグリスガンで1〜2プッシュ程度グリスアップを
 実施してください。スプリングケース内一杯にグリスを充填しないようにご注意ください。

万が一、スプリングケース内にグリスを充填させてしまった場合は、下記要領で余剰なグリスを
 排出してから使用、又はブレーキテストを実施してください。

- ① ブレーキハンドルをインジケータ表示位置より少し多く締め込み、余剰グリスを排出して
 ください。
- ② 余剰グリスが排出されなくなるまで締め込みと開放を数回繰り返してください。

理由

余剰グリスはリリーフニップルと余剰グリス排出口から排出される構造ですが、低温環境下ではグリス
 粘度が上がり、締め込みの抵抗となるため、スプリングケース内にグリスが充填した状態では正しい
 ブレーキ力が出ません。



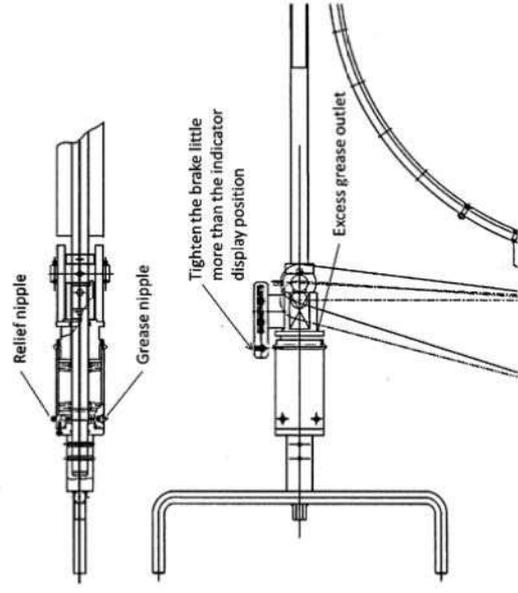
Grease-up procedure for "spring applied brake with manual setting and release"
 Before and after using the winch, grease up the spring case by pushing grease gun only
 once or twice. Be careful not to fill the spring case with grease.

If the spring case has been filled with grease, discharge excess grease as described
 below before using the winch or performing a brake test.

- ① Tighten the brake handle a little more than the indicator display position, and
 discharge the excess grease.
- ② Repeat tightening and release several times until discharging excess grease is
 finished.

Reason

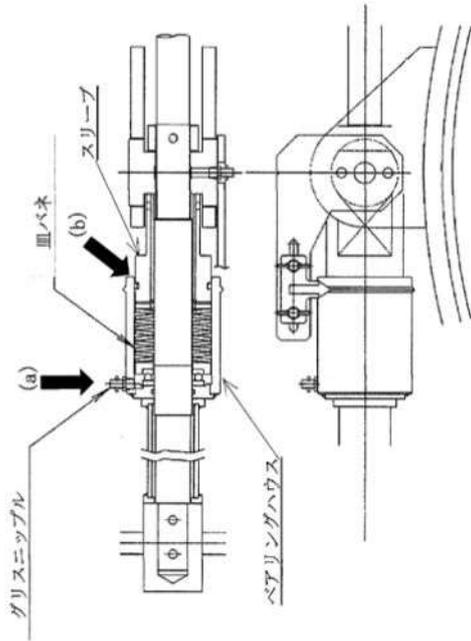
The excess grease is discharged from the relief nipple and the excess grease outlet.
 However, in low temperature environments, the viscosity of the grease increases and it
 becomes a resistance to tightening, so the correct braking force cannot be exhibited when
 the spring case is full of grease.



Discharge method of excess grease

ホーサードラム Hawser drum
スプリング付手動ブレーキ フェイルセーフブレーキ SPIRING APPLIED BRAKE

フェイルセーフブレーキ メンテナンス要領



フェイルセーフブレーキ詳細図

フェイルセーフブレーキの内部には、上図のとおり皿バネが入っております。皿バネの動きをスムーズにする、また内部の防錆のために定期的な給脂が必要です。

給脂頻度：【ポイント a】ブレーキ装置を使用する前、及び定期的にブレーキ装置と同時に給脂する。

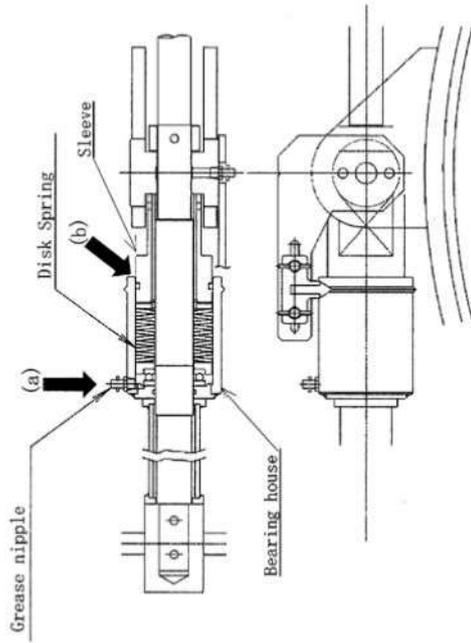
【ポイント b】回転部分の給脂時に目視点検をし、グリスが不足している場合に塗布する。

給脂方法：ブレーキを緩める。

グリスニップル (ポイント a) からベアリングハウスの内に給脂し、またベアリングハウスとスリーブの間 (ポイント b) にグリスを塗布してください。

グリス給脂および塗布した後、ブレーキを数回「締め/緩め」してベアリングハウスがスムーズに動くことを確認してください。

Maintenance manual for fail safe brake



Detail of fail safe brake

There are disc springs inside the fail safe brake as shown above. Regular lubrication are necessary to prevent internal corrosion and keep smoothly motion of the disc spring.

Lubrication frequency:

【Point a】 Lubricate before using the brake and at the same time of lubricating the brake links regularly.

【Point b】 Visually inspect when lubricate the rotating part, and apply grease when grease is insufficient.

Lubrication method:

Release the brake.

Lubricate from the grease nipple (point a) into the bearing house, and apply grease between bearing house and sleeve (point b). After lubricate, make sure that the bearing house moves smoothly by "tightening / releasing" the brake handle several times.

First edition : October 2021

Kawasaki Heavy Industries, Ltd.

Marine CS Section

Industrial & Marine Machinery Sales Dep., Marketing & Sales Group

Precision Machinery Business Division

Precision Machinery & Robot Company