

UNIC Hydraulic Cranes

Model UR293

MAINTENANCE MANUAL

FURUKAWA UNIC Corporation

INTRODUCTION

This technical instruction manual describes the construction of the UNIC UR SERIES truck crane and maintenance procedures for the servicemen engaged in its maintenance.

Please carefully read the manual to acquire the proper maintenance skills and provide efficient, speedy, correct services that are essential to customer trust. In this way, the truck crane will be able to deliver their superb performance and be kept in satisfactory operating condition.

It is recommended that separate parts list be referred to together with this manual.

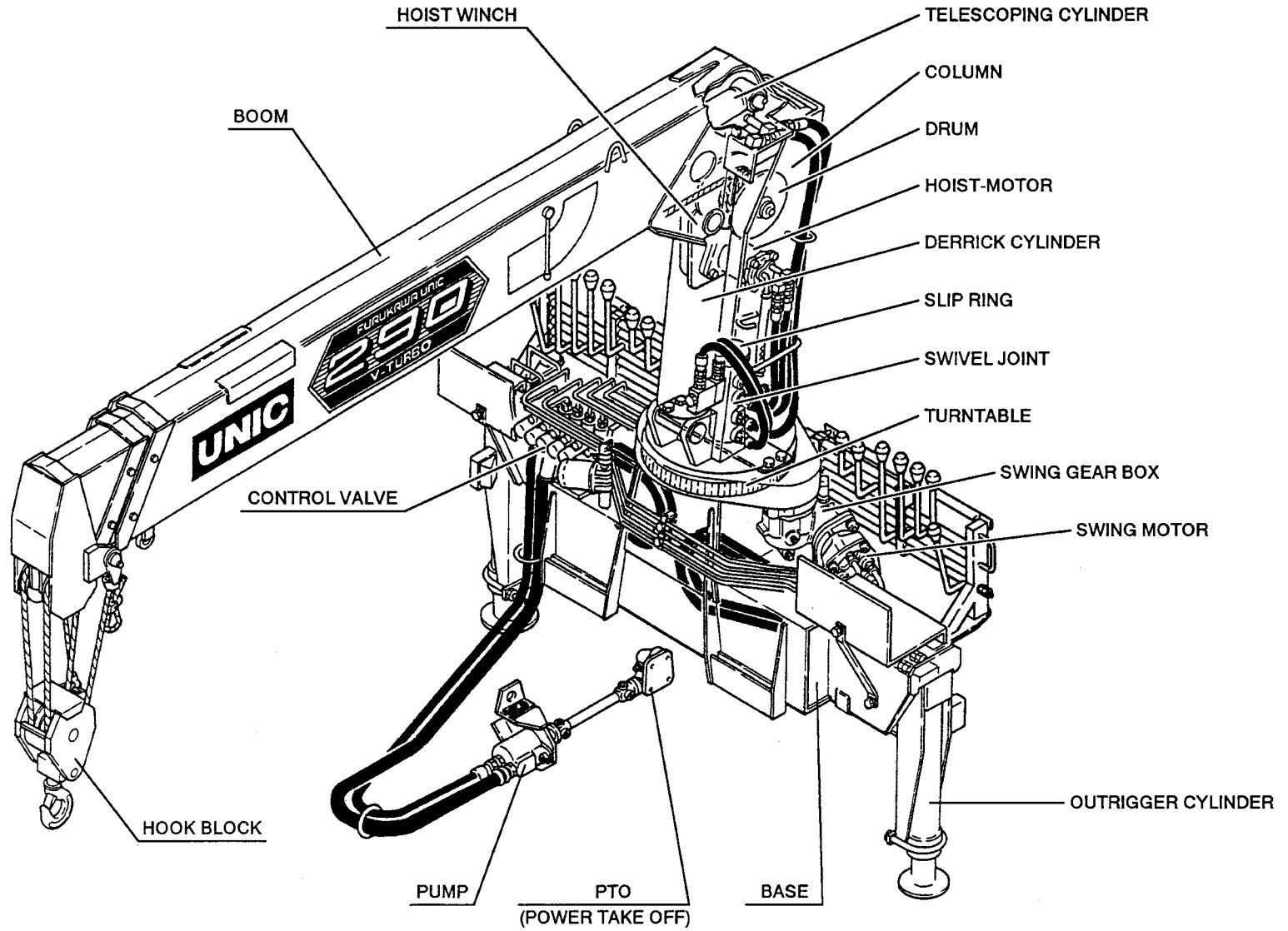
CONTENTS

§1. GENERAL VIEW	1
§2. BOOM	2
1) Construction of Boom and Telescoping Cylinder Installation	2
2) Boom Disassembly Procedure (3-Section Boom)	3
3) Installation Procedures for Slide Plate and Guide	5
§3. TELESCOPING CYLINDER	7
1) Constructions	7
2) 3-Section Boom (Disassembly Procedures for Dual Telescoping Cylinders)	8
3) 3-section Boom (Explanation of Dual Cylinder Operation).....	13
4) Cause of Troubles and Remedy	16
§4. BASE	17
1) Construction of Base	17
2) Horizontal Inner Box Disassembly Procedure	19
3) Construction of the Inner Box Extension Cable Installation.....	20
4) Extension Cable Mounting and Adjusting Procedures.....	21
5) Piping to Outrigger Cylinder.....	22
§5. OUTRIGGER CYLINDER	23
1) Construction of Vertical Outrigger Cylinder	23
§6. DERRICK CYLINDER	24
1) Construction	24
2) Disassembling Procedure.....	24
3) Cause of Derrick Cylinder Sinking (Retraction)	25
§7. SWING DEVICE	27
1) Position of Soft Zone “S” on the Turntable	27
2) Tightening Order of Turntable Bolts	27
3) Turntable Mounting Procedure	28
4) Tightening Torque for Bolts Fastening Turntable and Swing Gear Box	30
5) Tightening Torque for Bolts Fastening Column	31
6) Numerical Tightening Order for Bolts Tightening Column	31

- §8. SWING GEAR BOX** 32
 - 1) Construction 32
 - 2) Disassembly Procedure..... 33
 - 3) Caution When Assembling..... 37
 - 4) Bolt Tightening Torque for Bearing Housing..... 38
 - 5) Gear Oil 38
- §9. HOIST WINCH** 39
 - 1) Construction of Winch 39
 - 2) Construction of Brake..... 39
 - 3) Brake Shoe Adjusting Procedure..... 40
 - 4) Bolt Fastening Gear Box..... 41
 - 5) Gear Oil 41
 - 6) Cause of Troubles and Remedy 42
- §10. SWIVEL JOINT** 43
 - 1) Construction of Swivel Joint and Positions of Hoses 43
 - 2) Swivel Joint is installed 44
 - 3) Swivel Joint Assembling Procedure 45
- §11. SLIP RING** 46
 - 1) Construction of Slip Ring and Its Fitting Position 46
- §12. CONTROL** 47
- §13. HYDRAULIC CIRCUIT**..... 48
- §14. CONTROL VALVE**..... 49
 - 1) Composition of Valves and Inscribed Mark on Spool..... 49
 - 2) Relief Valve 50
- §15. COUNTER-BALANCE VALVE** 53
 - 1) Description of Counter-Balance Valve Operation..... 53
 - 2) Construction of Counter-Balance Valve (for Derrick and telescoping cylinder) 54

§16. SAFETY DEVICES	55
1) Construction of Anti Two Block Device.....	55
2) Construction of Pilot Check Valve.....	56
3) Description of Pilot Check Valve Operation	57
4) Troubleshooting.....	61
5) Alarm for Outrigger Extension/ Retraction.....	62
6) Relay and Limit Switches.....	63
§17. ELECTRIC CIRCUIT DIAGRAM (NORMAL WALKING)	64
§18. ELECTRIC WIRING DIAGRAM	65
§19. LUBRICATION DIAGRAM	67
§20. WELDING PRECAUTIONS	68
§21. OTHERS	69
1) Recommended Grease	69
2) Recommended Hydraulic Oil	69

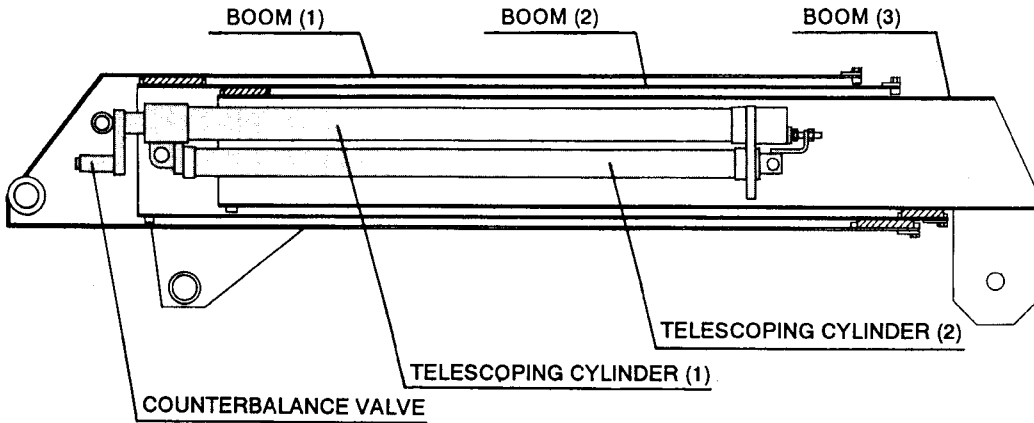
§1. GENERAL VIEW



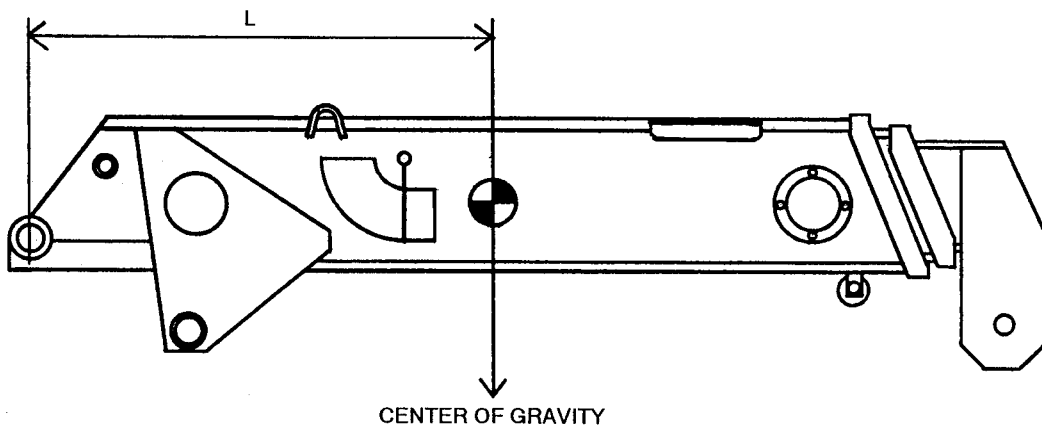
§2. BOOM

1) Construction of Boom and Telescoping Cylinder Installation

(1) 3-Section Boom (Dual Cylinder)



(2) Center of gravity of the boom ass'y (including the telescoping cylinder)



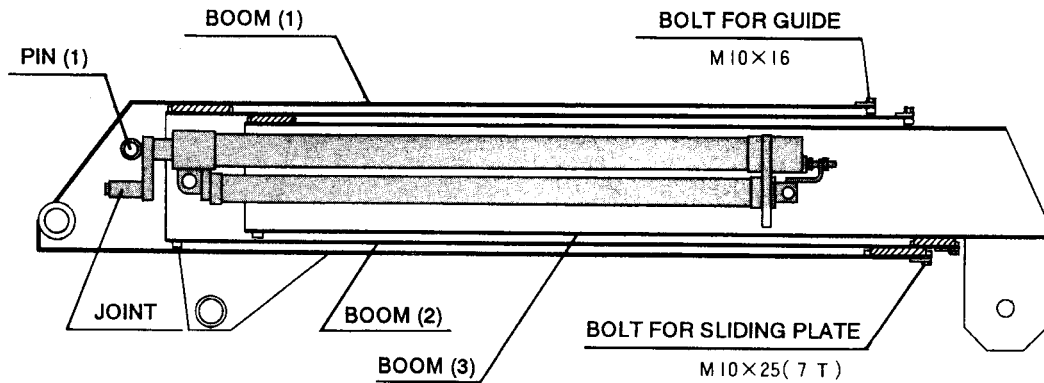
UR293-A2

3-Section Boom

L=1350 mm

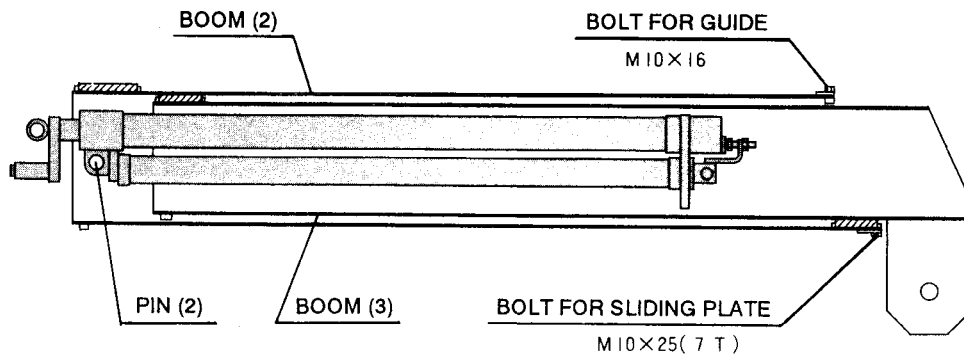
2) Boom Disassembly Procedure (3-Section Boom)

(1) Pull out the booms (2) and (3) from the boom (1).



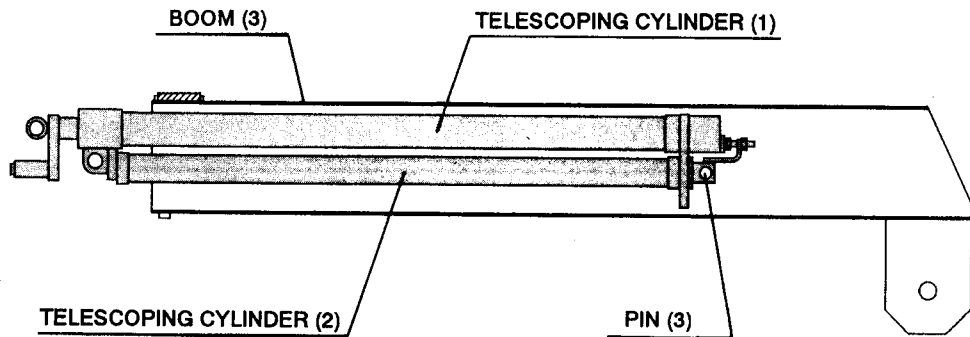
- ① Remove the joint (for piping) of the telescoping cylinder.
- ② Remove the slide plates, plates, and guide.
- ③ Remove the pin (1) from the boom (1), and pull the boom (2) and (3) out of the boom (1).

(2) Pull out the boom (3) from the boom (2).

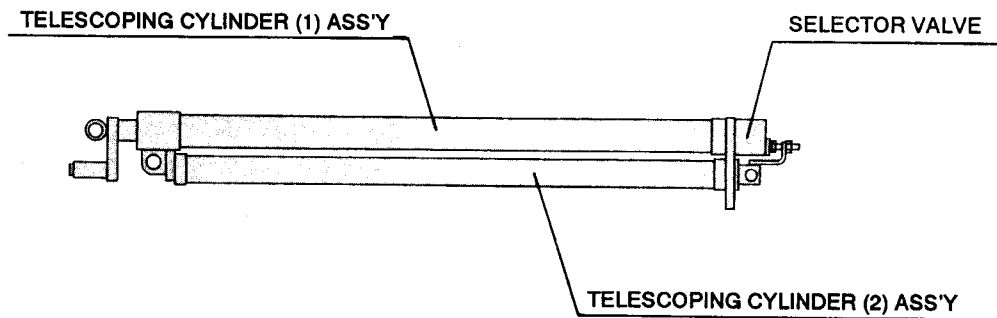


- ① Remove the slide plates and guide.
- ② Remove the pin (2) from the boom (2), and pull out the boom (3).

(3) Pull out of telescoping cylinders (1) and (2) from the boom (3).



- ① Pull out the telescoping cylinder (2) and the pin (3) from the boom (3).
- ② From the boom (3) pull out the telescoping cylinder ass'y (1) and the telescoping cylinder ass'y (2) in the direction towards the rear.



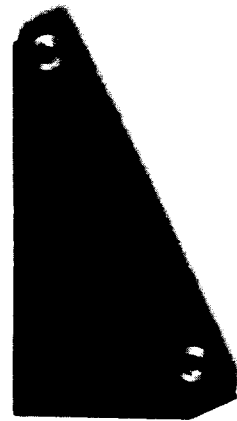
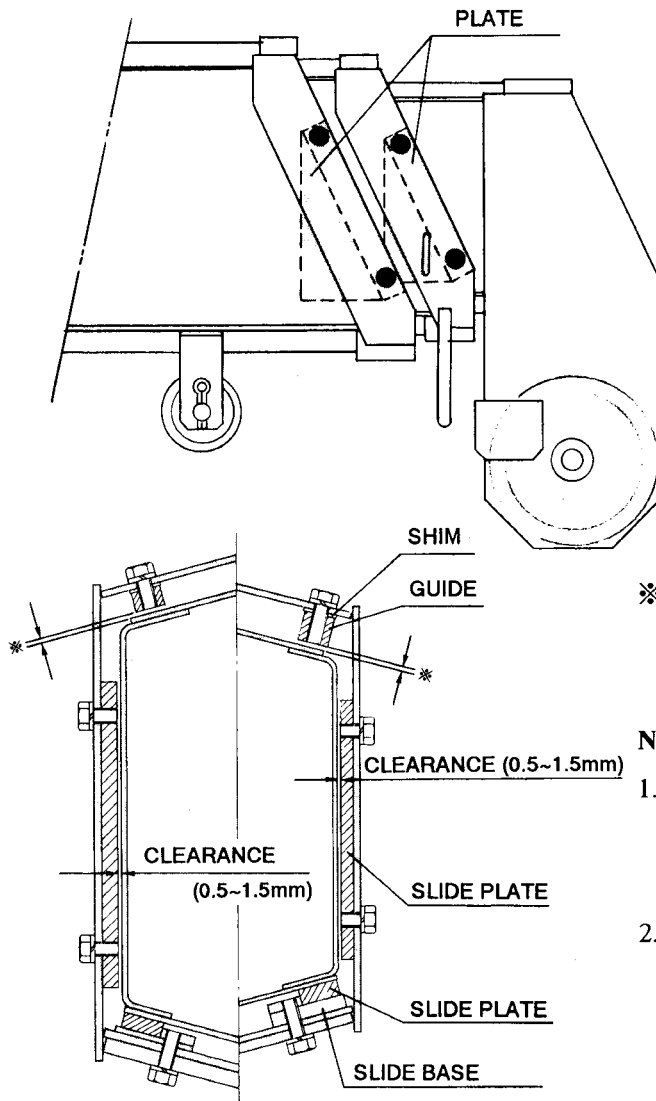
※ Reassembling shall be made in reverse order of the disassembly procedures.

Notes:

- ① When assembling the pin, apply grease to the inside of its base for rust proof purpose.
- ② Apply grease (Chassis Grease No.1) to the inner surface of the bush.
- ③ When replacing a slide plate, apply THREE BOND #1102 to prevent dropping.
※ Refer to the **precautions for slide plate replacement** on page 6 when replacing a slide plate.
- ④ When assembling, amply apply molybdenum disulfide grease to the upper part of the inner surface of the boom, side and bottom plates, and slide plate surfaces.
- ⑤ To the slide sheave pin do not apply grease.

3) Installation Procedures for Slide Plate and Guide

(1) Installation of slide plate and guide (3-Section boom)

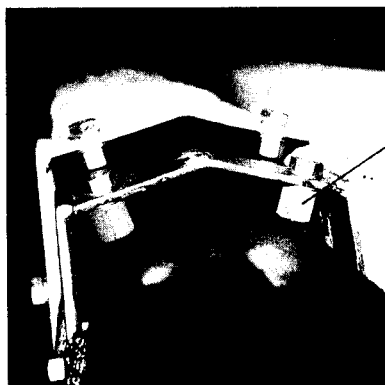


PLATE

※ Adjust to 2.0~3.0 mm with shims to the part marked ※ .

Notes:

1. If the slide plates are too close in contact with the boom, adjust the clearances with shims.
2. When taking out shim of the guide, put a plain washer under the conical spring washer.

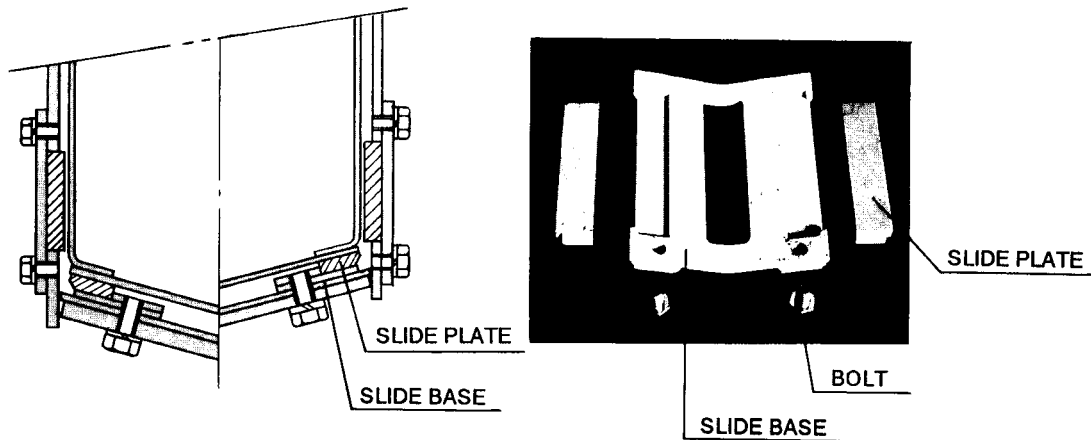


Fit guide this place

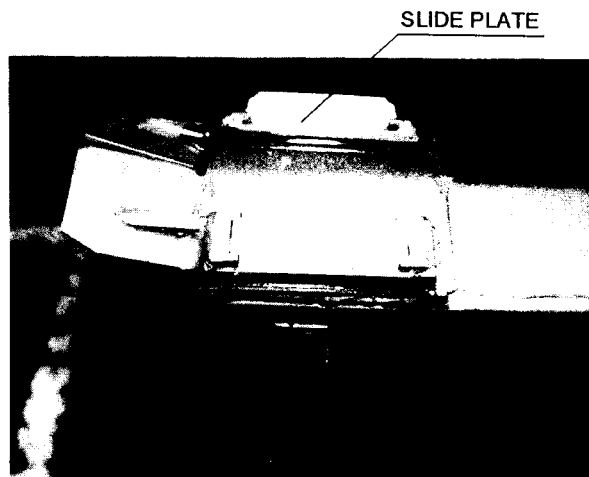


GUIDE

(2) Installing the lower slide plate



(3) Installing the slide plate at the rear end of the boom (upper part)



(4) Replacing precautions a slide plate

Note:

Apply "THREE BOND #1120" to the slide plate for preventing it from falling off.

※ Do not extend or retract the boom for one hour after applying THREE BOND #1120.

1. When replacing a slide plate, remove the old foreign matter adhering to the mounting surface before mounting a new one.
2. Replace slide plates before they reach the limit of use.

Slide plate check

Measure slide plate thickness and replace any which has exceeded the limit of use.

※ **Slide plate use limit**

If and when the slide plate wore out for 2 mm, be sure replace it with a new one.

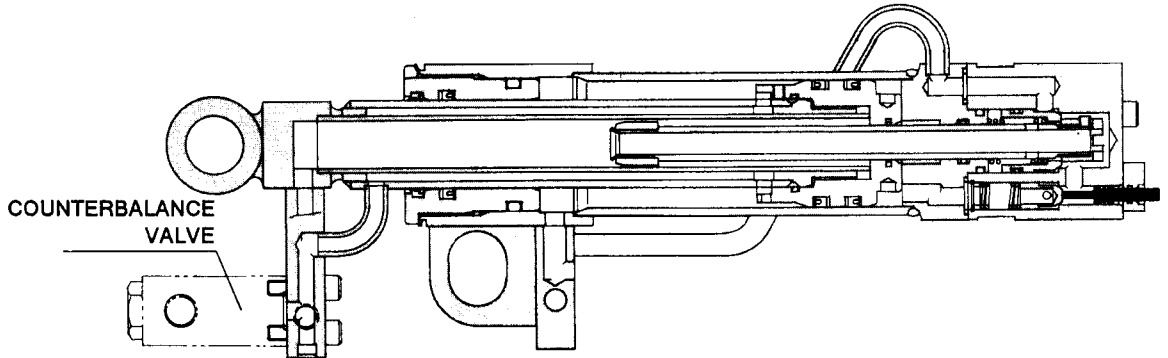
	Before use		Use limit
Slide plate	$t = 9.0$	—————	$t = 7.0$
(thickness in mm)			

§3. TELESCOPING CYLINDER

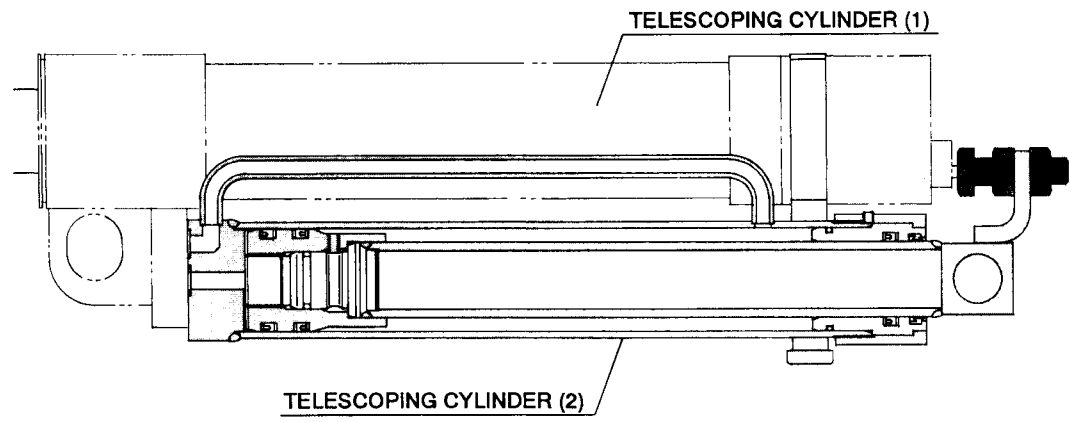
1) Constructions

(1) Dual Telescoping Cylinder of 3-Section Boom

① Construction of telescoping cylinder (1)

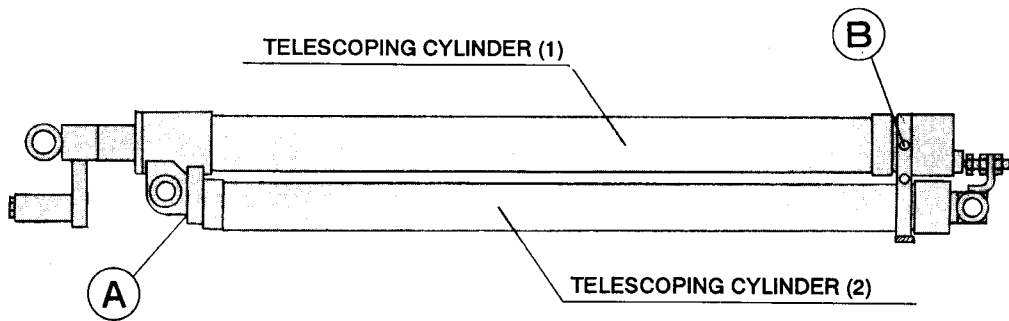


② Construction of telescoping cylinder (2)

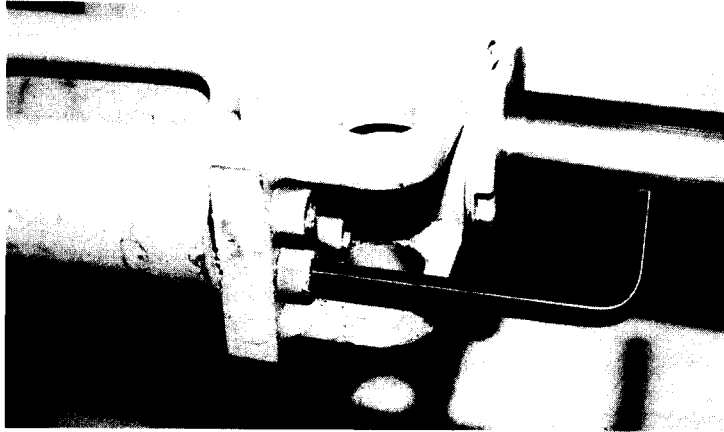


2) 3-Section Boom (Disassembly Procedures for Dual Telescoping Cylinders)

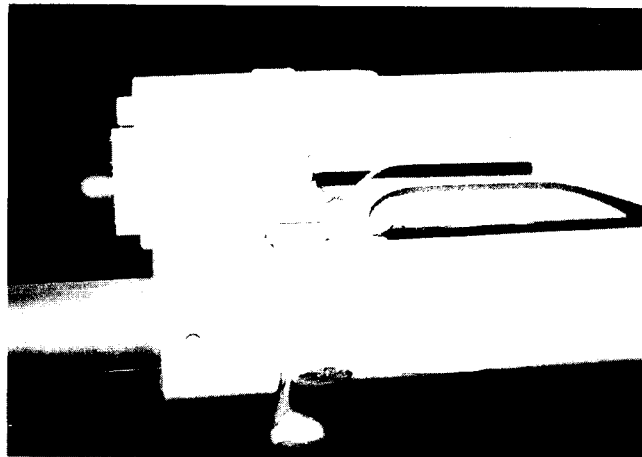
- (1) Remove the bolt which connects the telescoping cylinder (1) with the telescoping cylinder (2) and separate the one from the other.



- ① Remove 3 pcs. of hexagon socket head bolt from the part ①.

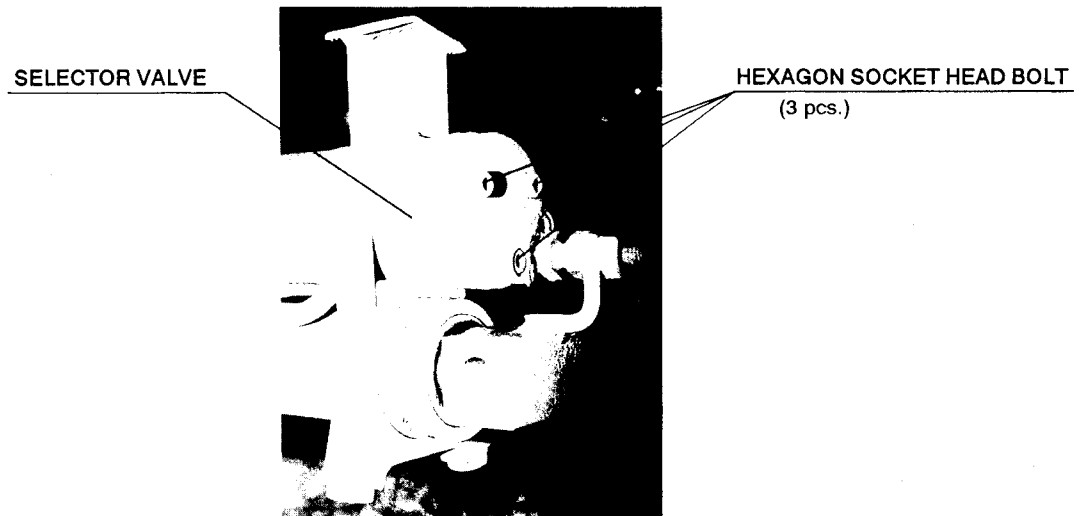


- ② next, remove 4 pcs. of hexagon socket head bolt from part ②.

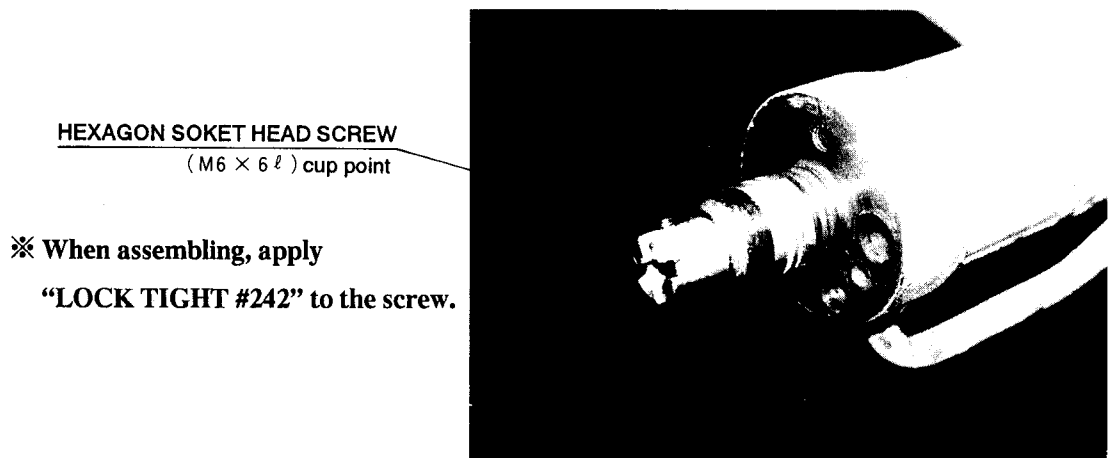


(2) Disassembly Procedures for Telescoping Cylinder (1)

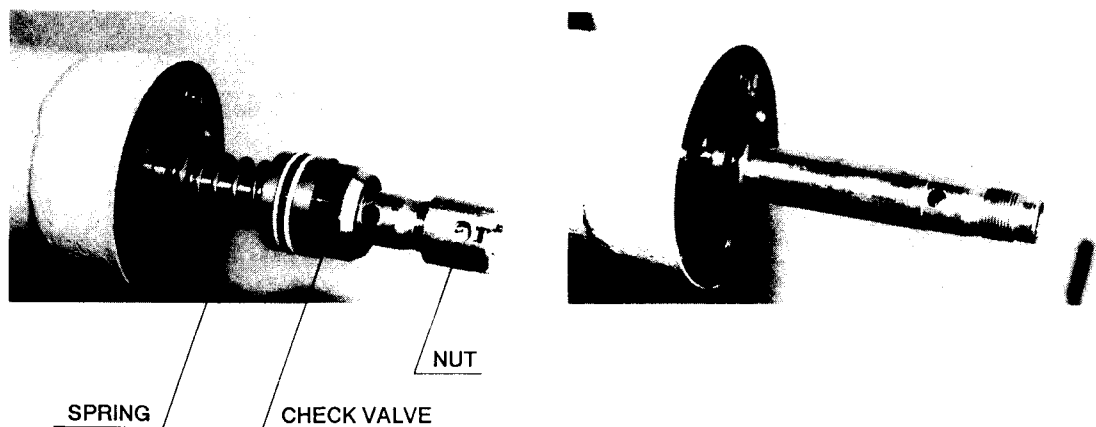
- ① Remove 3 pcs. of hexagon socket head bolt which fasten the selector valve.



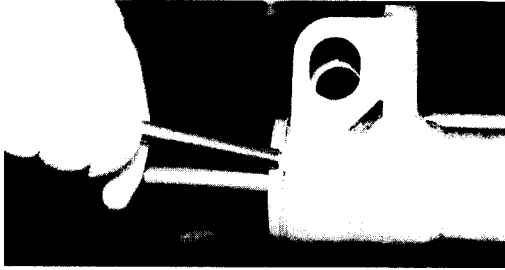
- ② Remove a lock screw for nut of the slide pipe.



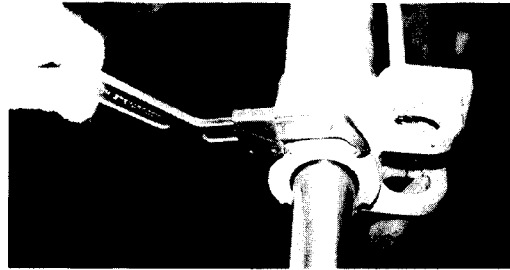
- ③ From the slide pipe remove the nut, check valve, and spring.



- ④ Compensate the revolution stopper of the gland, remove the gland from the tube with a look-spanner, and pull out the rod ass'y from the tube (1).

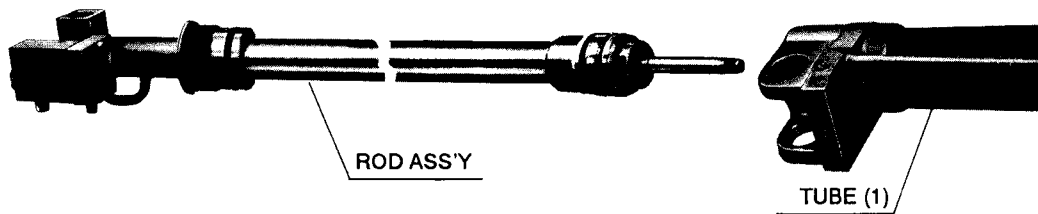


Compensate revolution stopper.

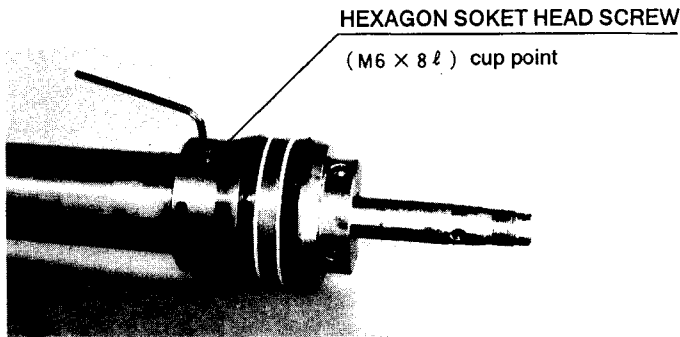


Loosen the gland.

Pull out the rod ass'y from the tube (1).

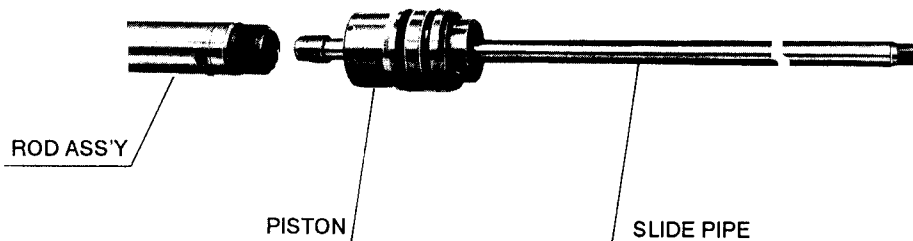


- ⑤ Loosen the screw which stops revolution of the piston, and take out the piston from the rod ass'y.



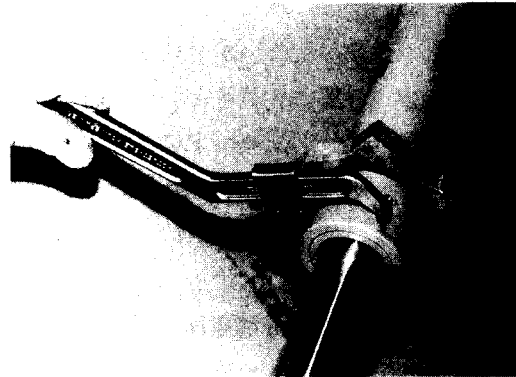
※ When assembling, apply
“LOCKTIGHT #242” to the screw.

- ⑥ From the rod ass'y pull out the piston and the slide pipe at the same time.



(3) Disassembly Procedures for Telescoping Cylinder (2)

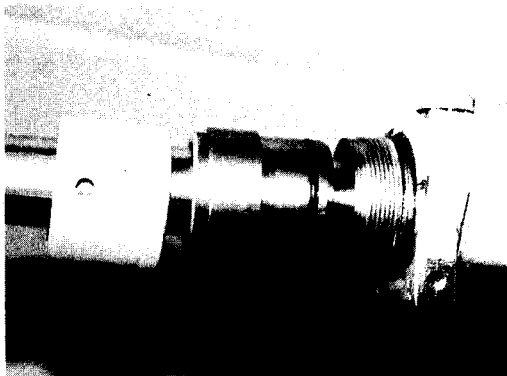
HEXAGON
SOKET HEAD SCREW
(M6 × 6ℓ) cup point



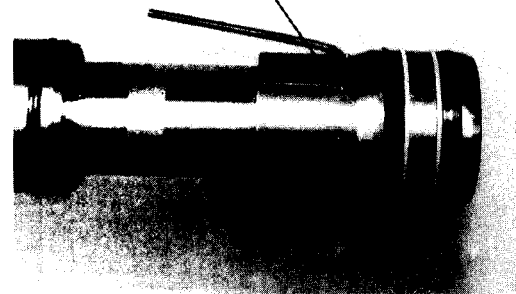
① Remove hexagon socket head lock screw for the cylinder cover.

② Loosen the cylinder cover with a hook-spanner.

※ When assembling, apply “LOCK TIGHT # 242.”



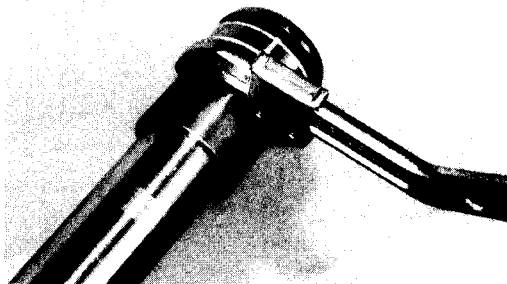
HEXAGON
SOKET HEAD SCREW
(M6 × 10ℓ) cup point



③ Pull out the rod ass'y from the tube (2)

④ Remove the lock screw of the piston.

※ When assembling, apply “LOCK TIGHT # 242.”



⑤ Loosen the piston with the hook-spanner.

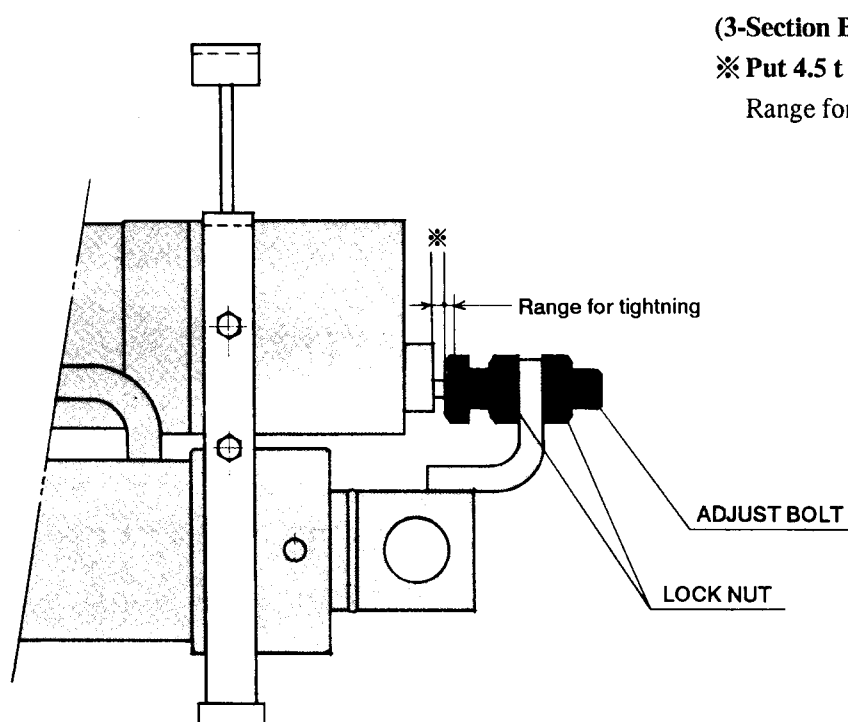
(4) Inspection

- ① Check all the parts that they are free of harmful defects for operation such as flaw, crack, deformation, rust, burr, etc.
- ② Check that every part is free of attachments of metal powder, foreign substances, etc.
- ③ Check to see if the piston rod sliding surface is free of damages harmful for operation.
- ④ In principle, packings and seals shall be replaced with new ones when disassembled. However, if these parts are forced to be reused, check very carefully and confirm that they are free of damage and foreign substances.

※ **Assembly procedure is in the reverse order of disassembly.**

- Check that every part is free of metal powder attachment and then soak the parts in hydraulic oil.

(5) Adjusting Procedure for Selector Valve with Adjust Bolt



Adjusting Procedure with Adjust Bolt

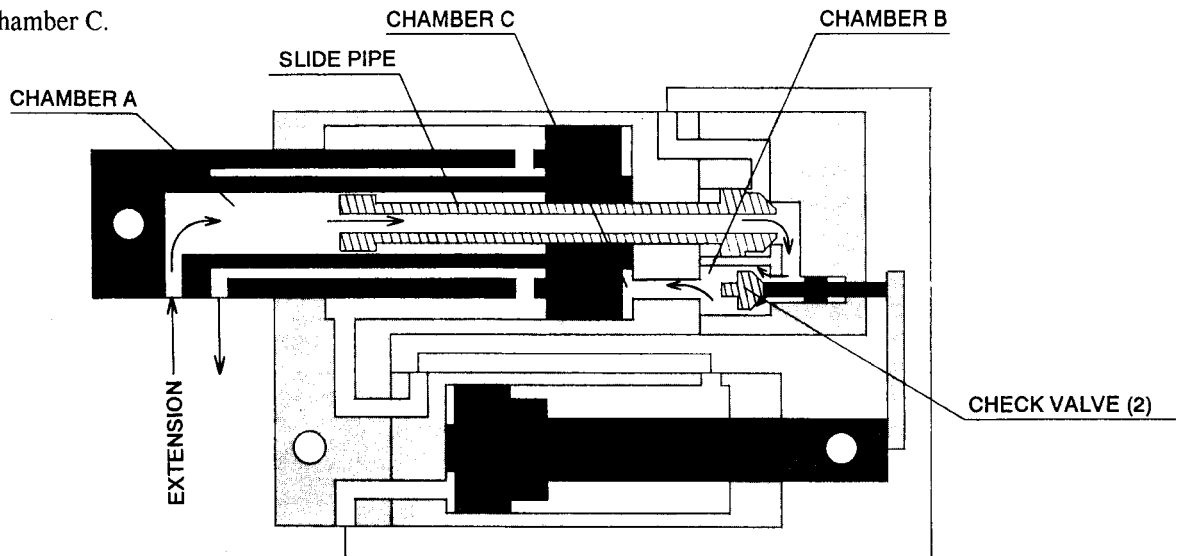
- ① Put the telescoping cylinders (1) and (2) in the most retracted state.
- ② Apply "LOCK TIGHT # 262" to the threaded part of the adjust bolt.
- ③ Put at above board to the part marked ※ and tighten the adjust bolt.
- ④ After adjusting, lock with the lock nut.

3) 3-section Boom (Explanation of Dual Cylinder Operation)

(1) Just before Extending Telescoping Cylinder

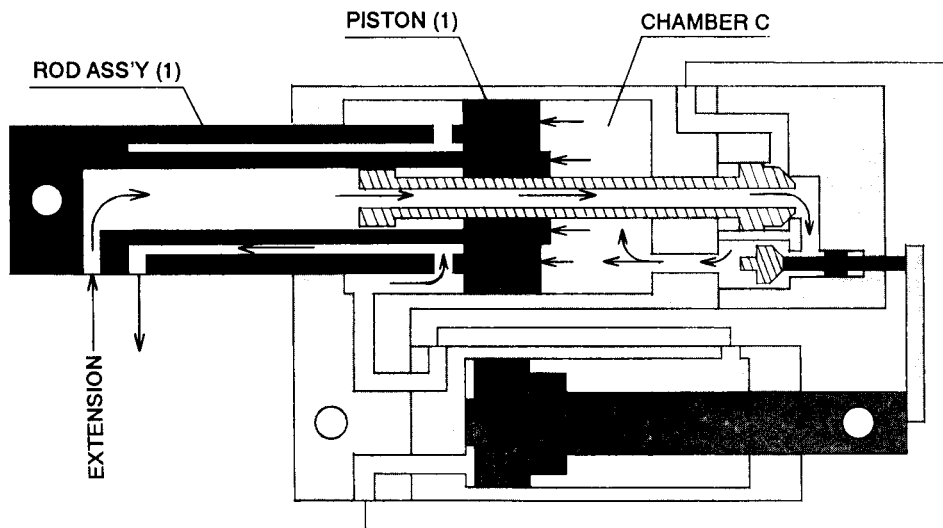
Pressure oil enters into the chamber A, and passes through the slide pipe.

Then it goes through the check valve (2) of the selector valve and the chamber B too. Finally it reaches the chamber C.



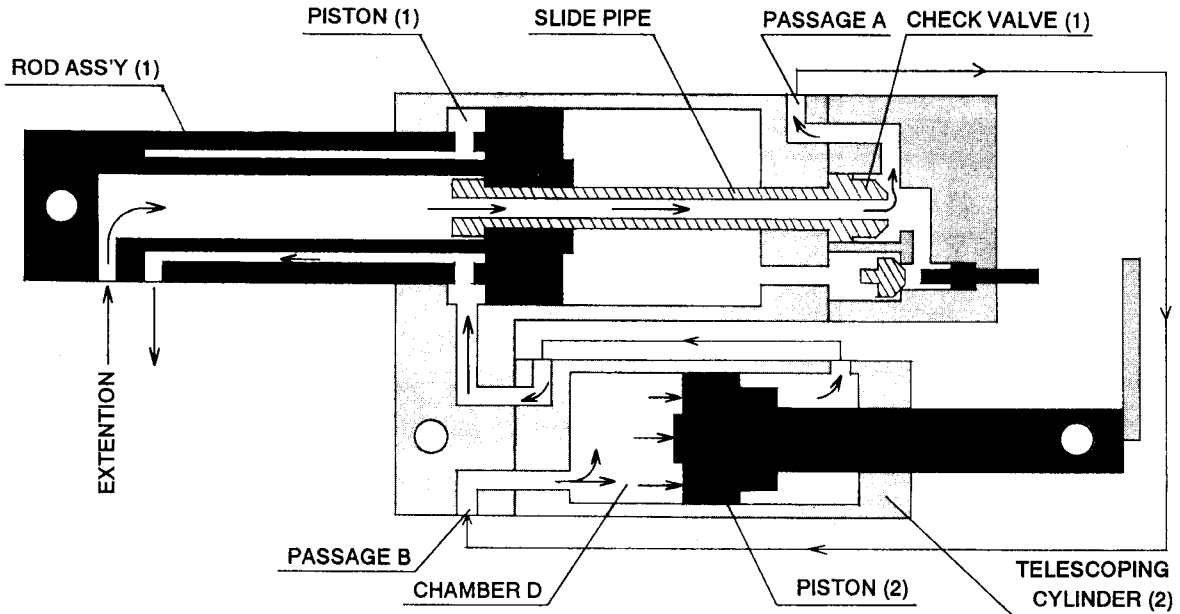
(2) Extending Telescoping Cylinder (1)

Pressure oil entered chamber C pushes up the piston (1); and the rod ass'y (1) extends.



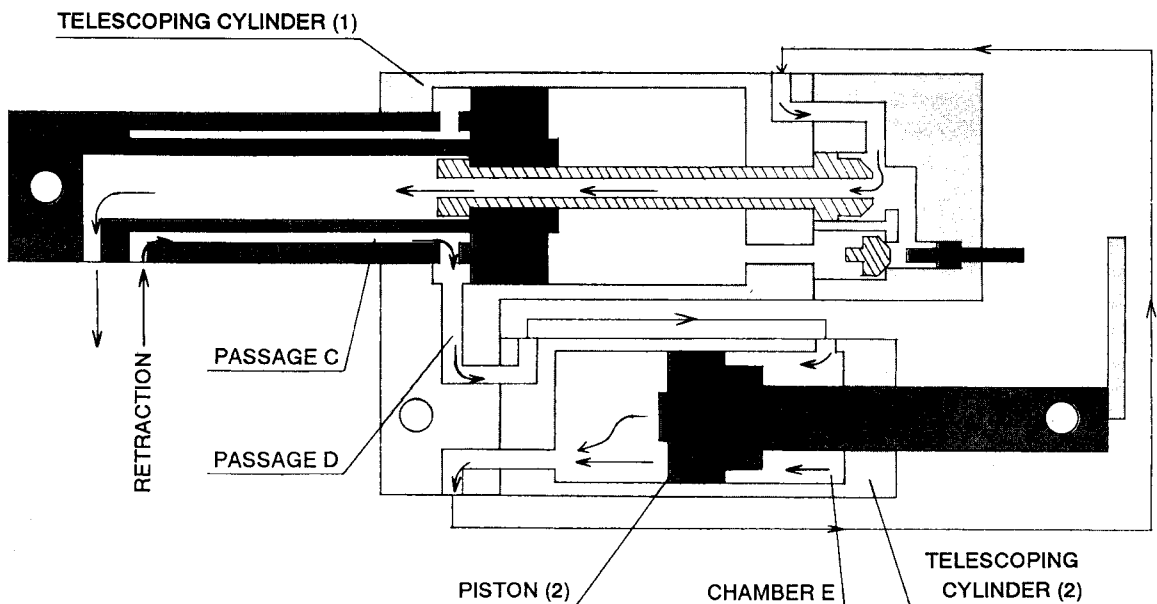
(3) Extending Telescoping Cylinder (2)

Just before the rod ass'y (1) of the telescoping cylinder (1) reaches its maximum extension, the stopper of the slide pipe hits the piston (1), and both of them are pushed up. Just at the same time, the check valve (1) of the selector valve opens. The pressure oil passage A and B, and reaches the chamber D of the telescoping cylinder (2), where it pushes up the piston (2); and as a result, the telescoping cylinder (2) extends.



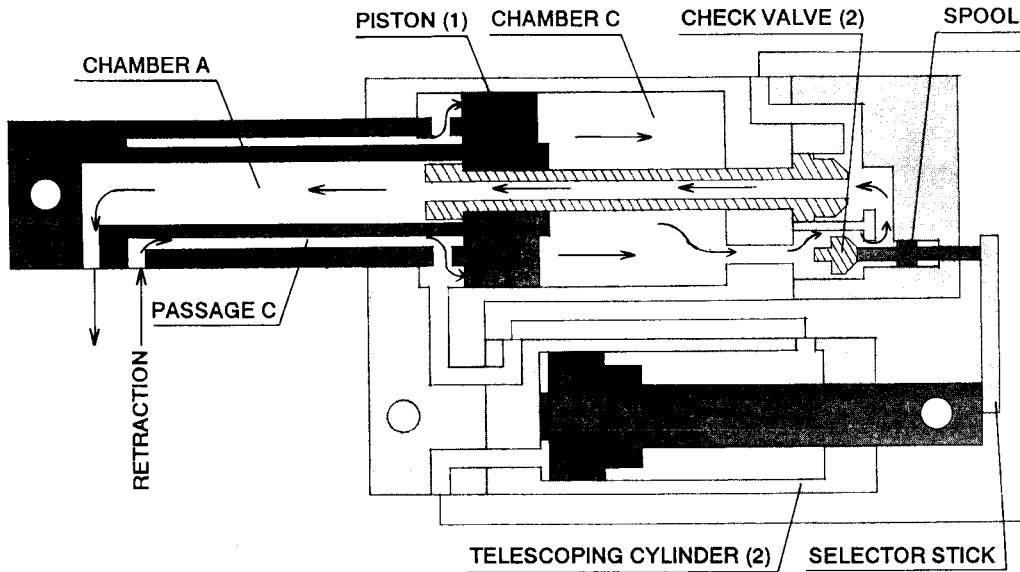
(4) Retracting Telescoping Cylinder (2)

Through the passage C of the telescoping cylinder (1) the pressure oil flows in, and it enters into the chamber E via the passage D and pushes down the piston (2). As a result, the telescoping cylinder (2) starts retracting.



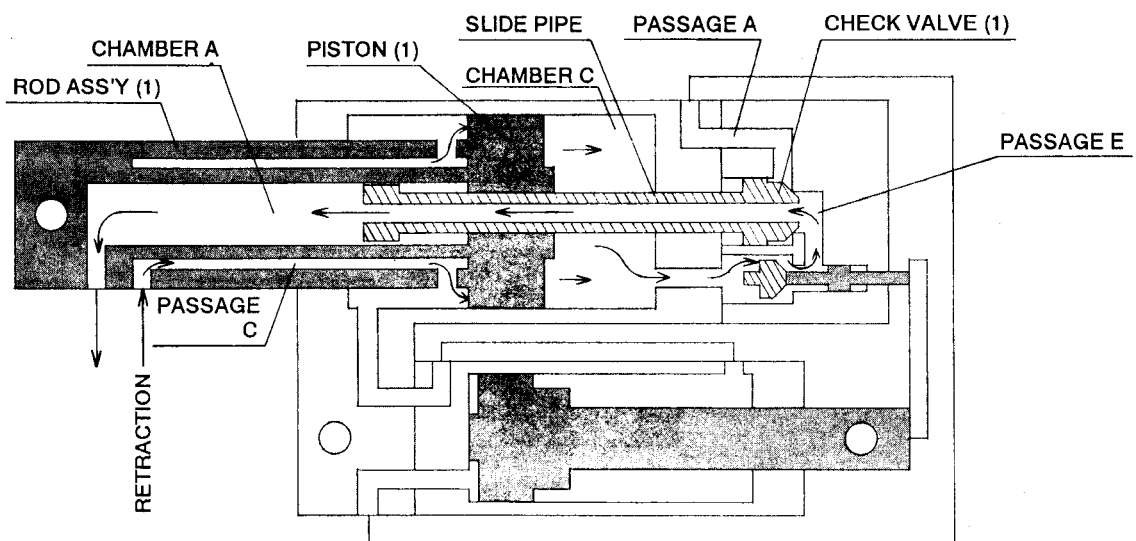
(5) Telescoping Cylinder (1) Starts Retracting

By means of the flow of pressure oil from the passage C the telescoping cylinder (2) retracts rapidly. Just before reaching the minimum retraction, the spool is pushed by the selector stick locating at the tip of the rod ass'y (2), and the check valve (2) opens, when the piston (1) starts to be pushed down. The pressure oil in the chamber D flows through the check valve (2) and the slide pipe, and reaches the chamber A. Then, it returns to the tank via the counterbalance valve.

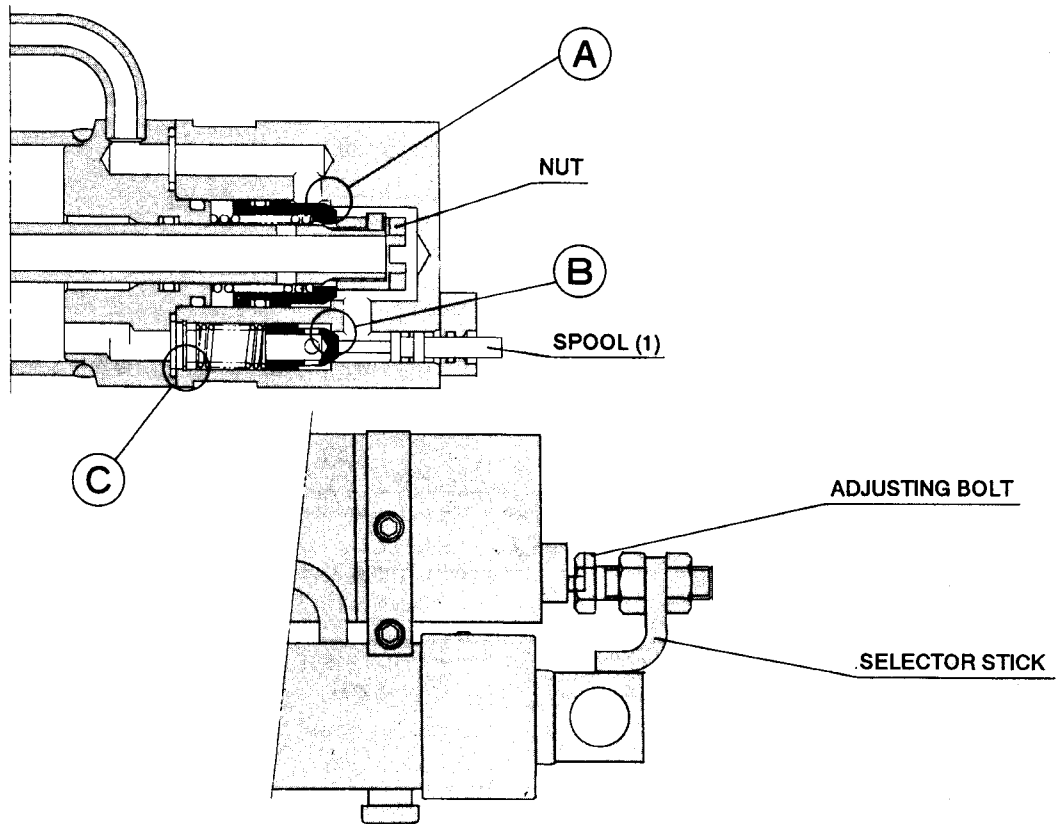


(6) Retraction of Telescoping Cylinder (1)

By means of the flow of pressure oil from the passage C the piston (1) is pushed down, and the rod ass'y (1) retracts. When the rod ass'y (1) retracts, the slide pipe returns to its original position from the position to which it was pushed up by the piston (1) ; and the passage A and E are shut by the check valve (1). When the rod ass'y (1) retracts, all of the pressure oil in the chamber C passes through the passage E and the slide pipe, and returns to the tank via the chamber A. In this way, the telescoping cylinder (1) finishes its retracting operation.



4) Cause of Troubles and Remedy

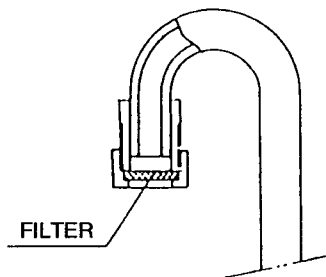
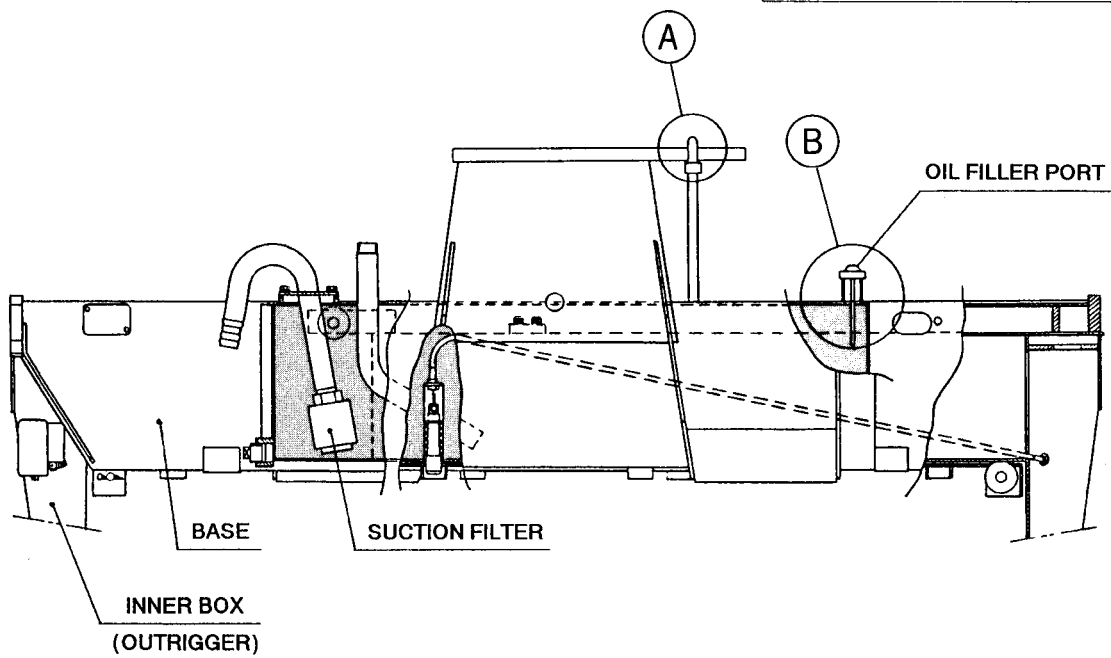
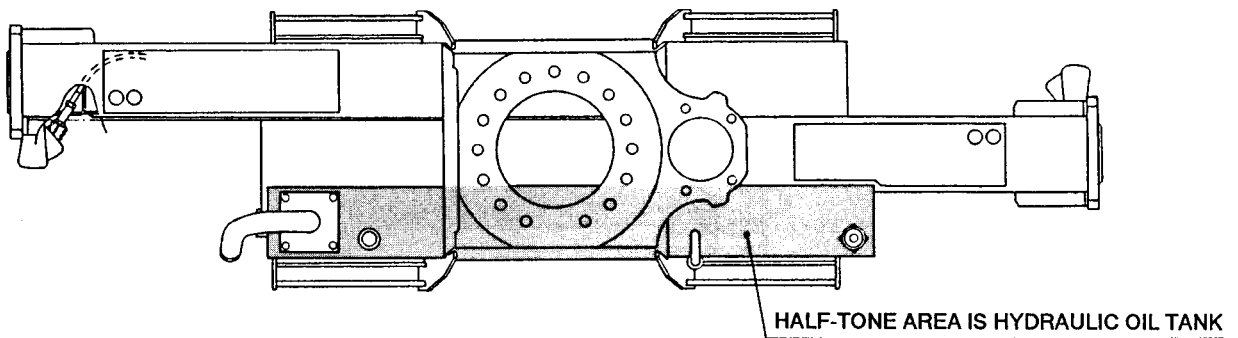


① 3-section boom (Dual cylinders)

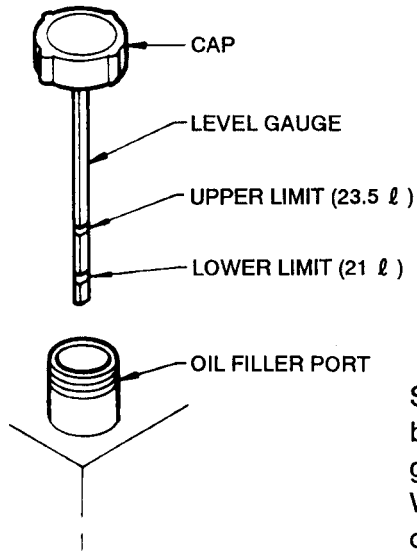
Abnormal phenomenon	Presumed cause	Remedy
1. Retraction is normal, but when extending, 2 and 3 booms extend at a time or not in a good order.	a) The part A of the selector valve is clogged with foreign substances.	<ul style="list-style-type: none"> Disassemble selector valve and clean it, or replace it with a new one.
2. Extension is normal, but when retracting, 2 and 3 booms retract at a time or not in a good order.	a) The part B of the selector valve is clogged with foreign substances. b) Snap ring of the part C got out of place.	<ul style="list-style-type: none"> Disassemble selector valve and clean it, or replace it with a new one. Rearrange snap ring.
3. Boom (2) extends but boom (3) does not extend.	a) Nut at the slide pipe of telescoping cylinder-(1) loosened.	<ul style="list-style-type: none"> Disassemble telescoping cylinder (1) and tighten the nut.
4. After full extension of booms, boom (3) retracts but boom (2) does not retract.	a) Adjust bolt pushing the spool of selector valve loosened or the stick was bended. b) Selector valve spool (1) was bended.	<ul style="list-style-type: none"> Adjust the bolt. Straighten bended stick. Replace selector valve ass'y with a new one

§4. BASE

1) Construction of Base

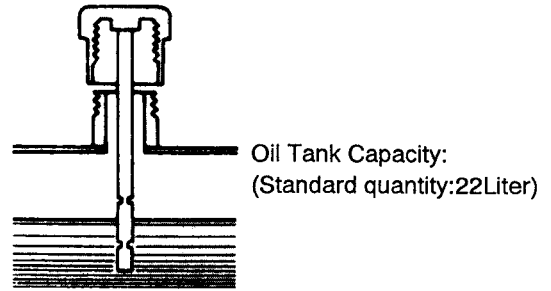


Filter fitting enlarged view of part A



Enlarged view of part ②

When checking oil quantity, just put the cap on the inlet but not screw gauge in.

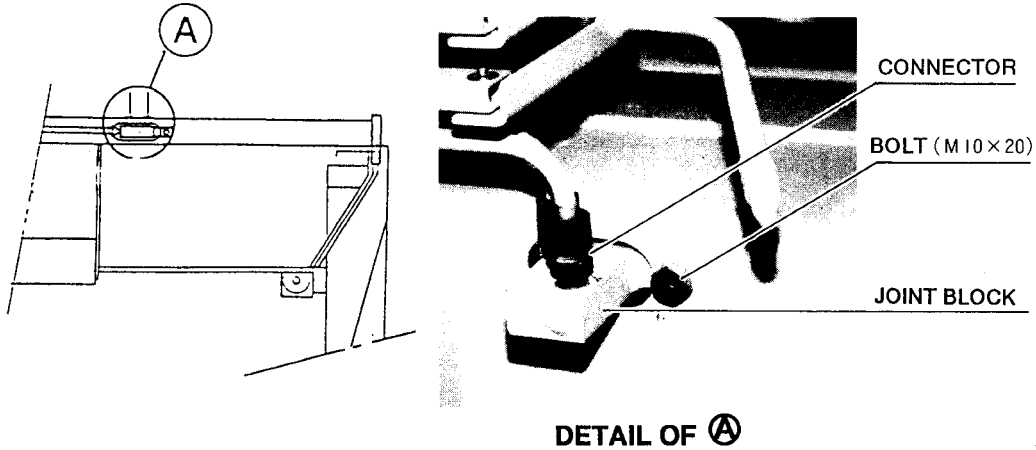


Standard oil quantity is the middle between upper and lower limits of oil gauge.

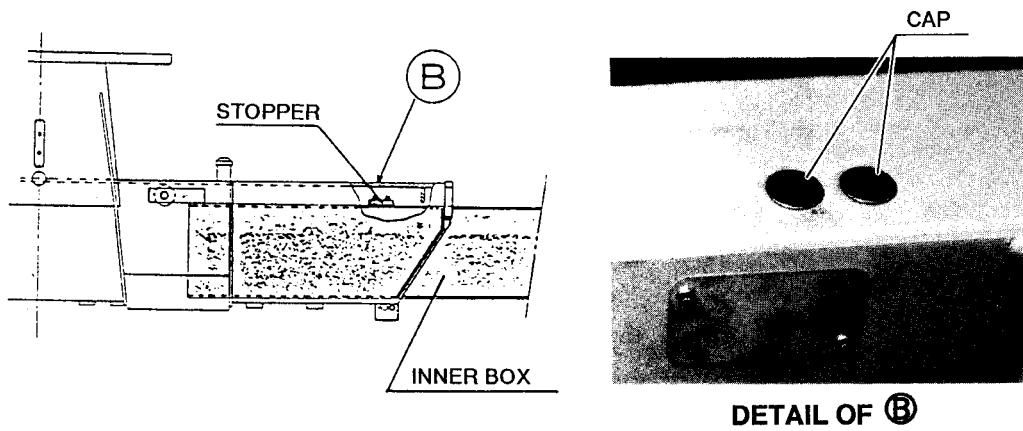
When checking quantity, just put the cap on the oil inlet but not screw the gauge in.

2) Horizontal Inner Box Disassembly Procedure

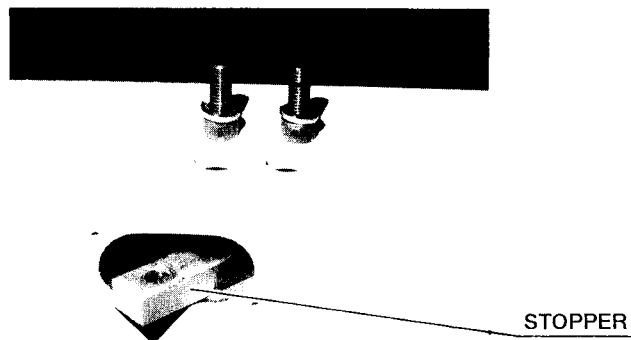
- ① Remove the connectors from the piping part ①.
- ② Remove a joint block fitting bolt.



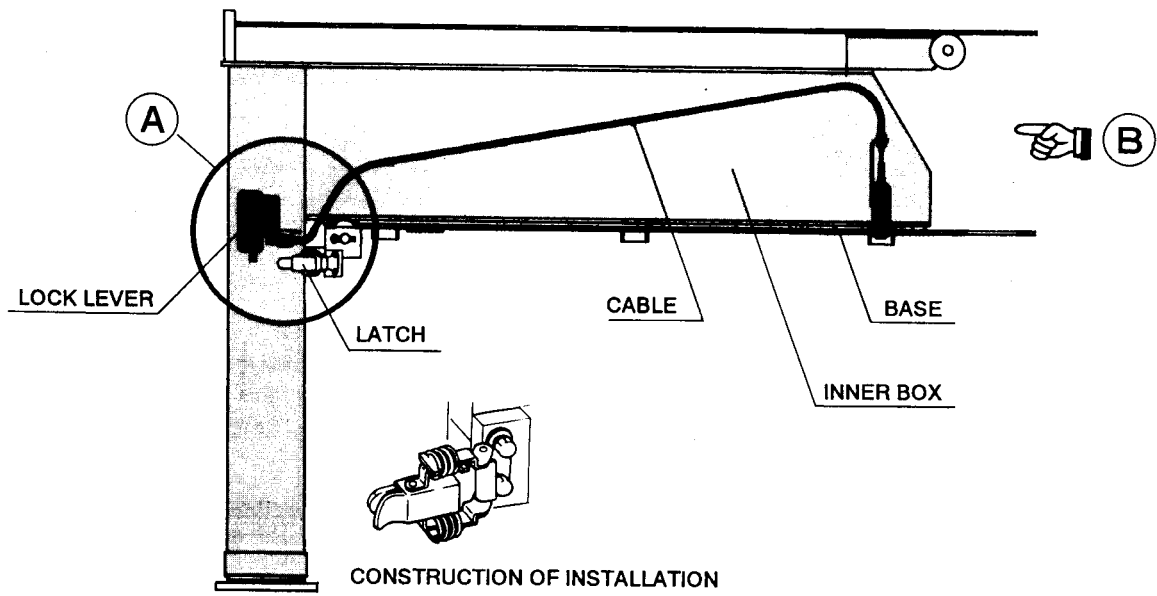
- ③ Remove 2-pcs. of caps from the part ②.
- ④ Pull the inner box, adjust for much part of stopper fitting bolt too part ②.



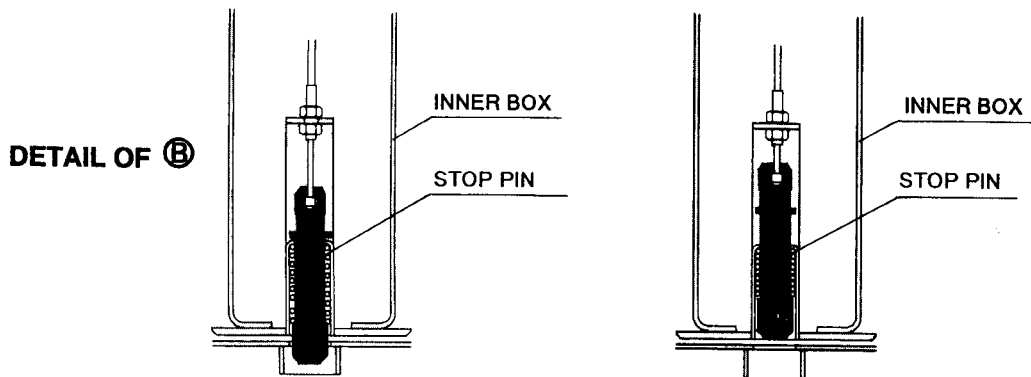
- ⑤ Remove the stopper fitting hexagon socket head bolt (M10 × 25 l).
- ⑥ Stopper take out from base side opening.
- ⑦ Pull out the inner box, take care when not damage to the hoses.



3) Construction of the Inner Box Extension Cable Installation



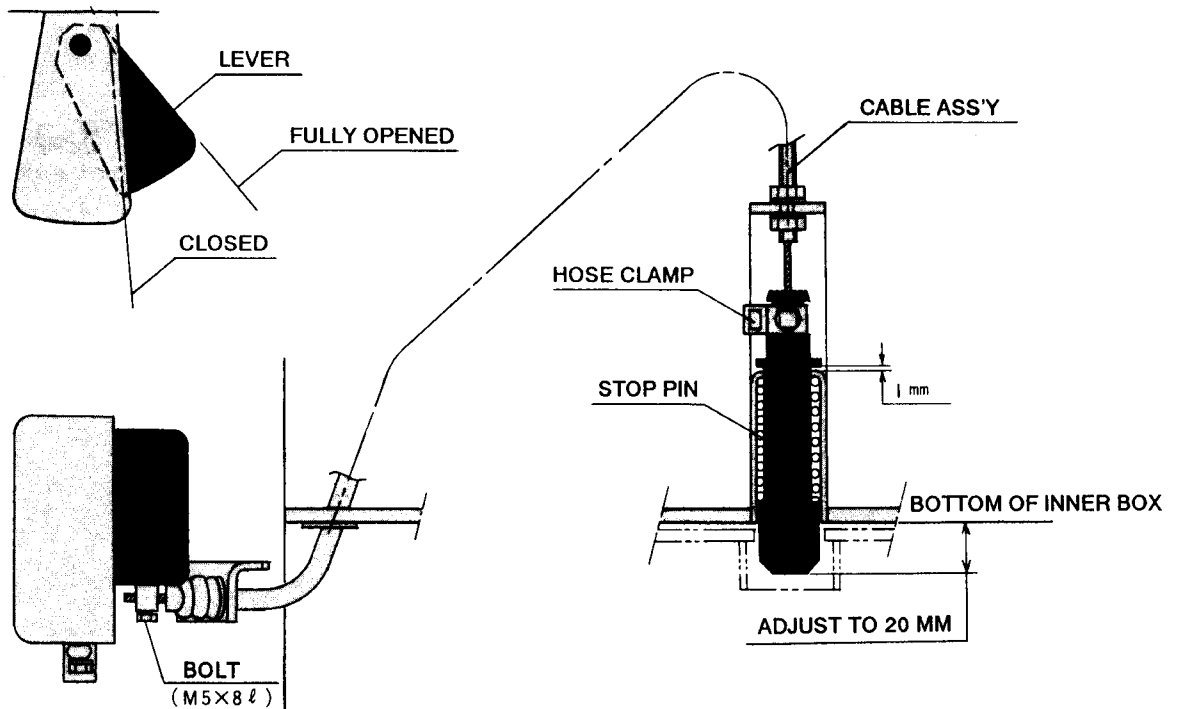
DETAIL OF A



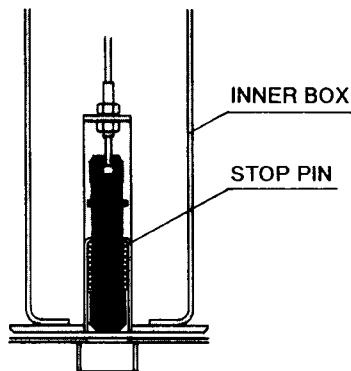
(The stop pin is neither for IN)

(The stop pin is neither for OUT)

4) Extension Cable Mounting and Adjusting Procedures

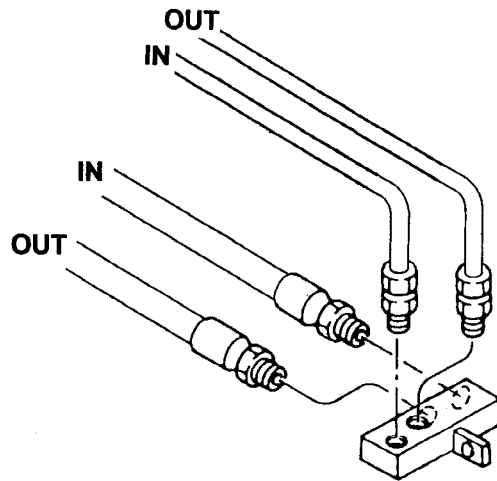
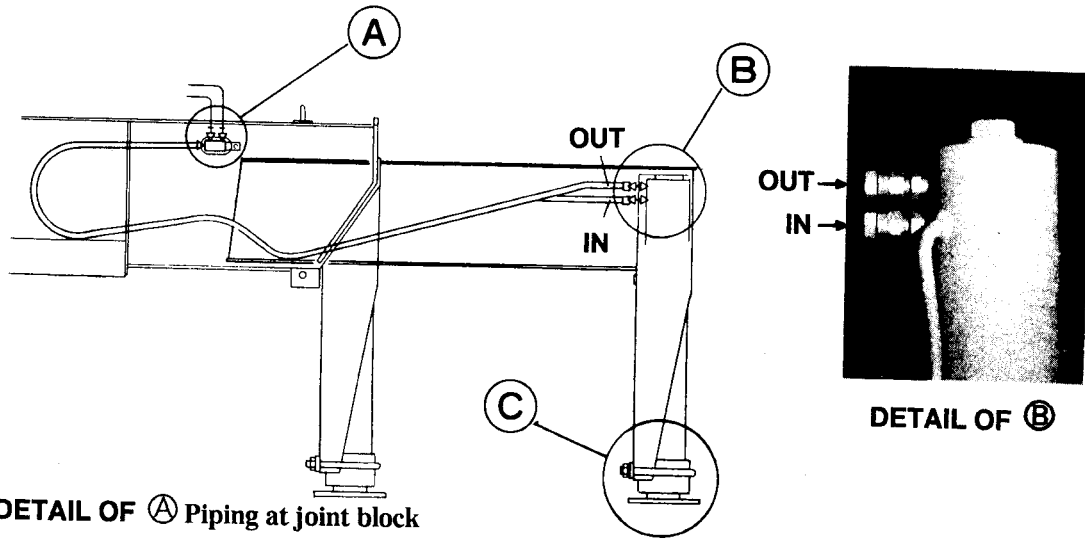


- ※ 1. After attaching the end of the cable ass'y to the stop pin, tighten the hose clamp to prevent the cable end from slipping out.
2. With the end of the stop pin projecting from the bottom of the inner box by **20 mm** when the lever is in the fully open position, fasten the inner cable with the lever bolt. (M5 × 8 mm long).
3. After fastening the cable, close the lever and check that the end of the stop pin is as shown below.



Note: Check that, when the lever is closed, the end of the stop pin is neither far out nor far in from the bottom of the inner box.

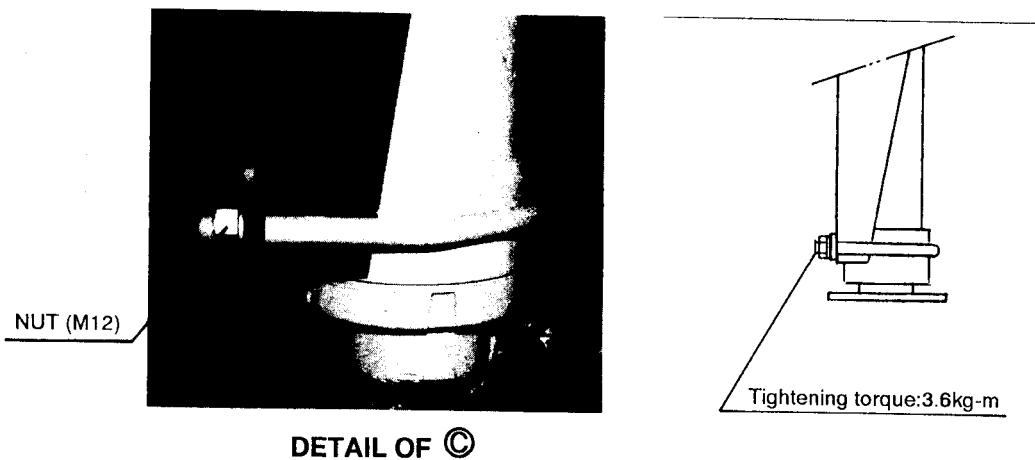
5) Piping to Outrigger Cylinder



Caution:

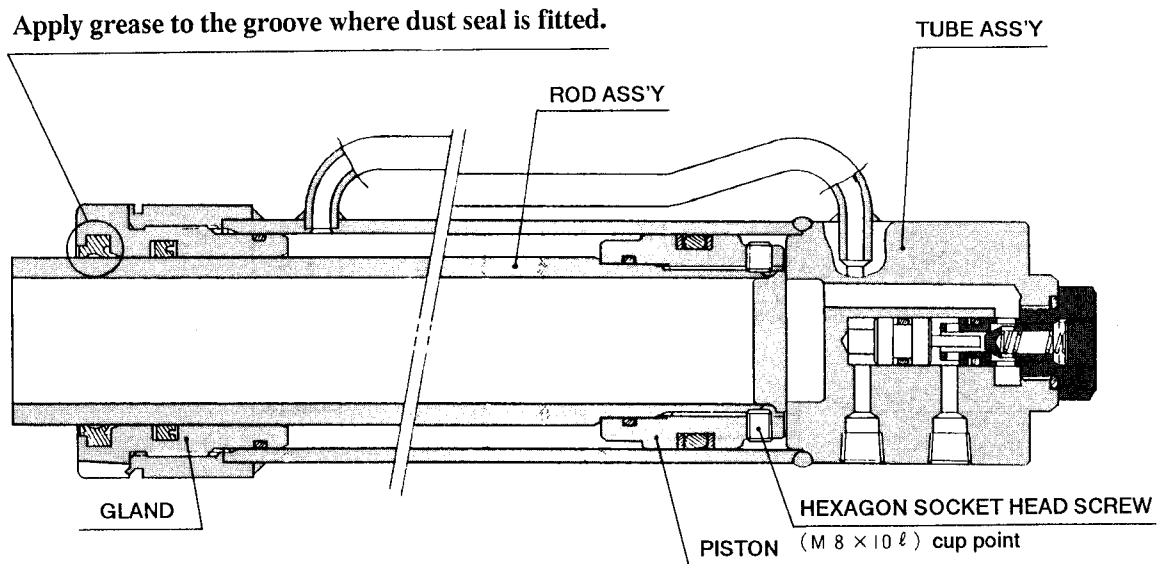
When connecting high pressure nylon hose, take special care not to twist the hose. Also when stretching or retracting outriggers, the hose should not be rubbed with the inside wall of the box.

※ Tightening torque for the nut to fasten the band



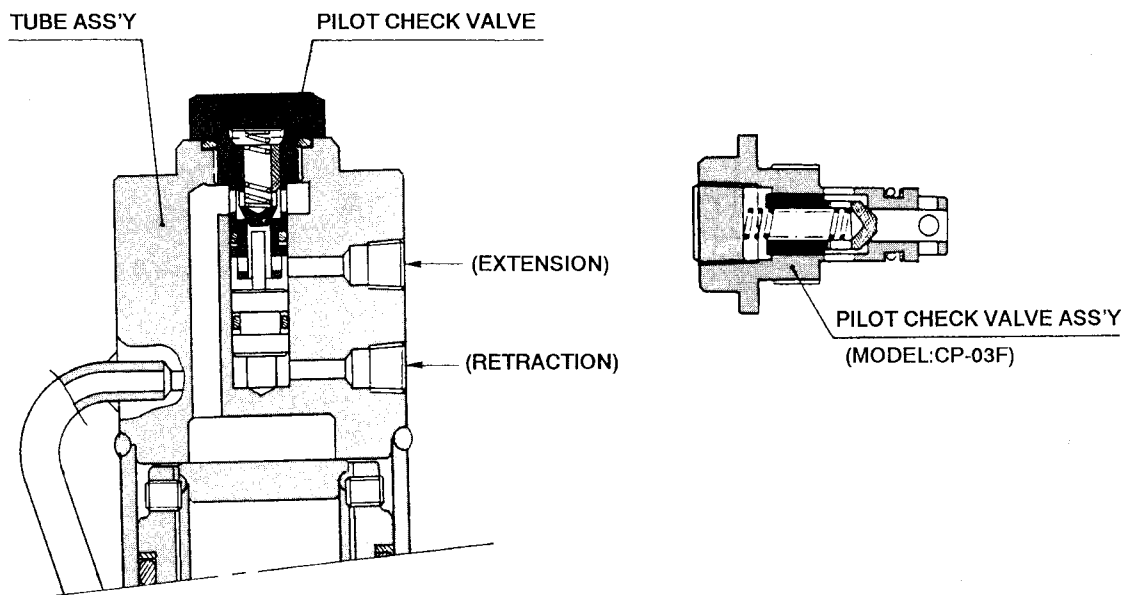
§5. OUTRIGGER CYLINDER

1) Construction of Vertical Outrigger Cylinder



Note: Before fastening hexagon socket head screw for piston, apply "LOCKTIGHT # 242." (After applying, do not flow hydraulic oil for about 1 hour.)

(1) Construction of the Part where Pilot Check Valve is Fitted

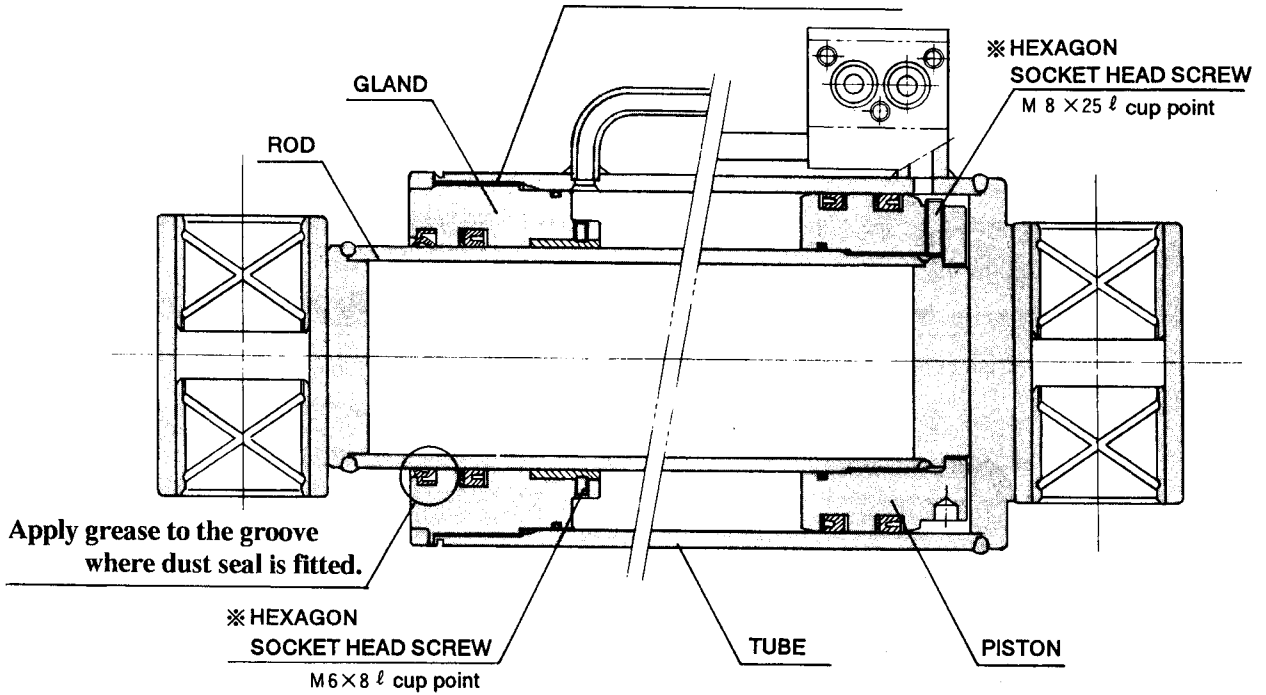


§6. DERRICK CYLINDER

1) Construction

Threaded part-Liquid type gasket (THREEBOND)

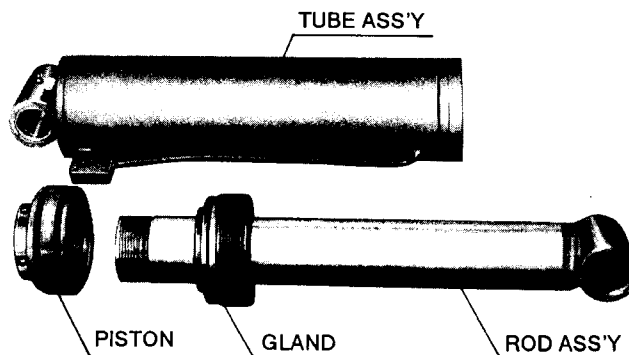
Apply non-liquid type #1101.



Note : Before tightening hexagon socket head screws to the piston and gland, apply "LOCK TIGHT # 242."
(After applying, do not flow hydraulic oil.)

2) Disassembling Procedure

- ① Remove the counterbalance valve.
- ② Compensate rotation stopper of the gland and then loosen and remove it from the cylinder tube. Pull out the piston rod.
- ③ Remove hexagon socket head screw which stops rotation of the piston. Pull out the piston from the rod ass'y.



3) Cause of Derrick Cylinder Sinking (Retraction)

Two causes can be assumed: Internal leak of the counter-balance valve and internal leak of the cylinder.

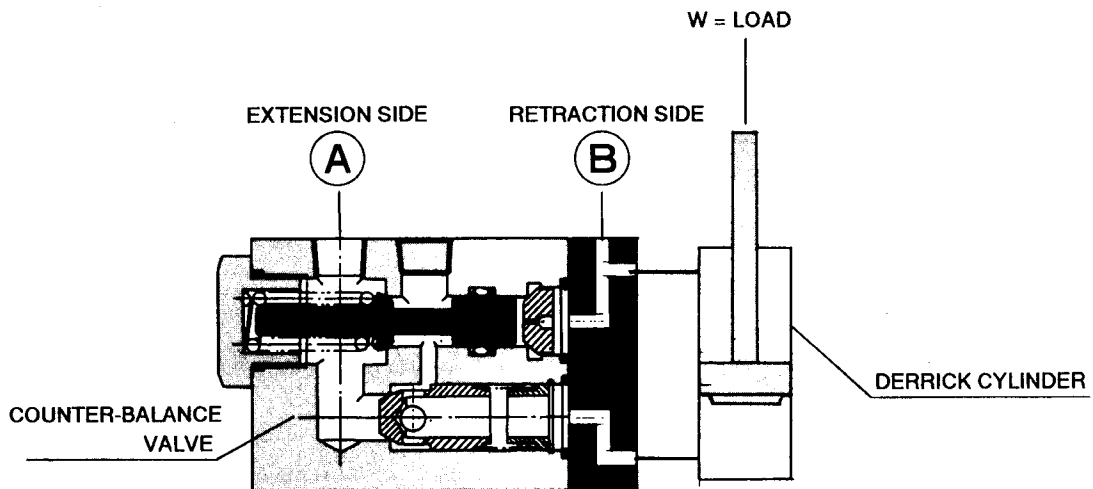
Checking Method

- ① Hoist a load not exceeding the specified limit, stop the engine, and disconnect both high-pressure hoses from the counter-balance valve (on the extension and retraction sides).

Notes:

1. When disconnecting the high-pressure hoses, be sure to move the control lever to the right and left to release the oil pressure after stopping the engine.
2. While loosening the high-pressure hoses, check that the oil is not flowing out of the hose joints and that the derrick is not lowering.

Make sure that there are no people and no objects under the boom. (If the derrick falls, stop disconnecting the hoses.)



(Determining Cause of Trouble)

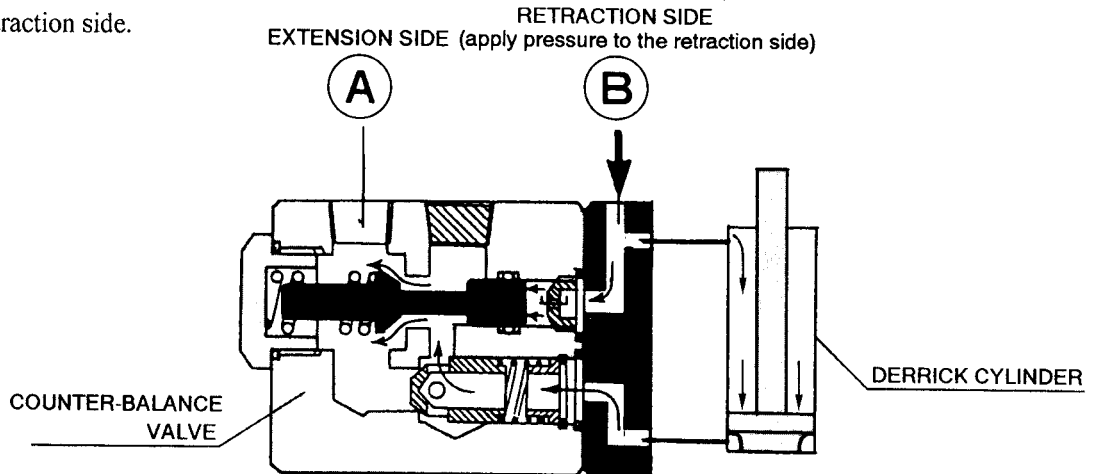
1. If the oil leaks out of the joint of the high-pressure hose at part ① of the extension side, the counter-balance valve is leaking inside.

Remedy: Disassemble and clean, or replace the ass'y.

2. If the oil leaks out of the joint of the high-pressure hose at part ② of the retraction side, the derrick cylinder is leaking inside.

Remedy: Replace the packing or tube ass'y.

- ② Fully retract the derrick cylinder, disconnect the high-pressure hose on the extension side, and apply pressure to the retraction side.



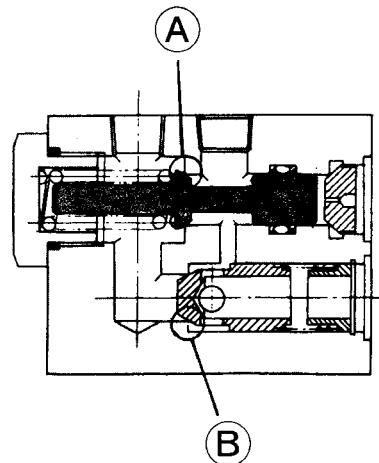
(Determining Cause of Trouble)

- If the oil leaks out of the joint of the high-pressure hose at part **A** of the extension side, the derrick cylinder is leaking inside.

Remedy: Replace the packing or tube ass'y.

Note: When checking the above, either cover the disconnected joint of the high-pressure hose on the extension side or place an oil pan under it to receive the oil flowing out.

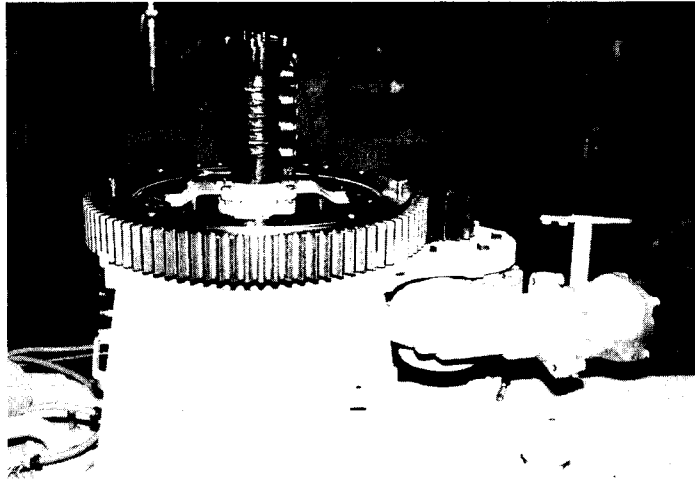
- ※ If the counter-balance valve leaks inside, check the following.



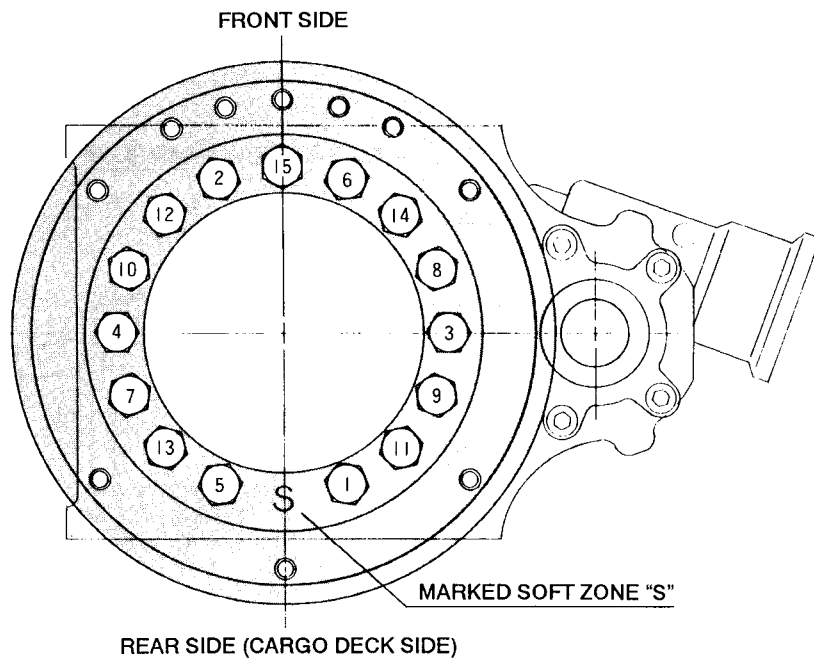
1. Foreign matter caught in part **A** ;
damage to seat surface
2. Foreign matter caught in part **B** ;
damage to seat surface

∴ The telescoping cylinders and outrigger cylinders can also be checked in a similar way.

§7. SWING DEVICE



1) Position of Soft Zone "S" on the Turntable

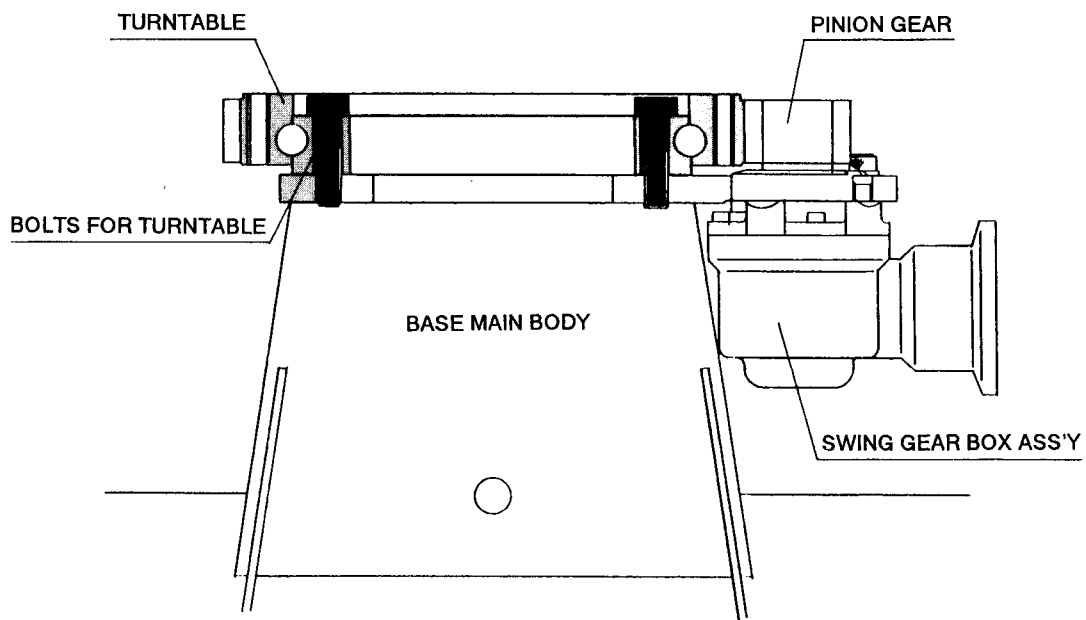
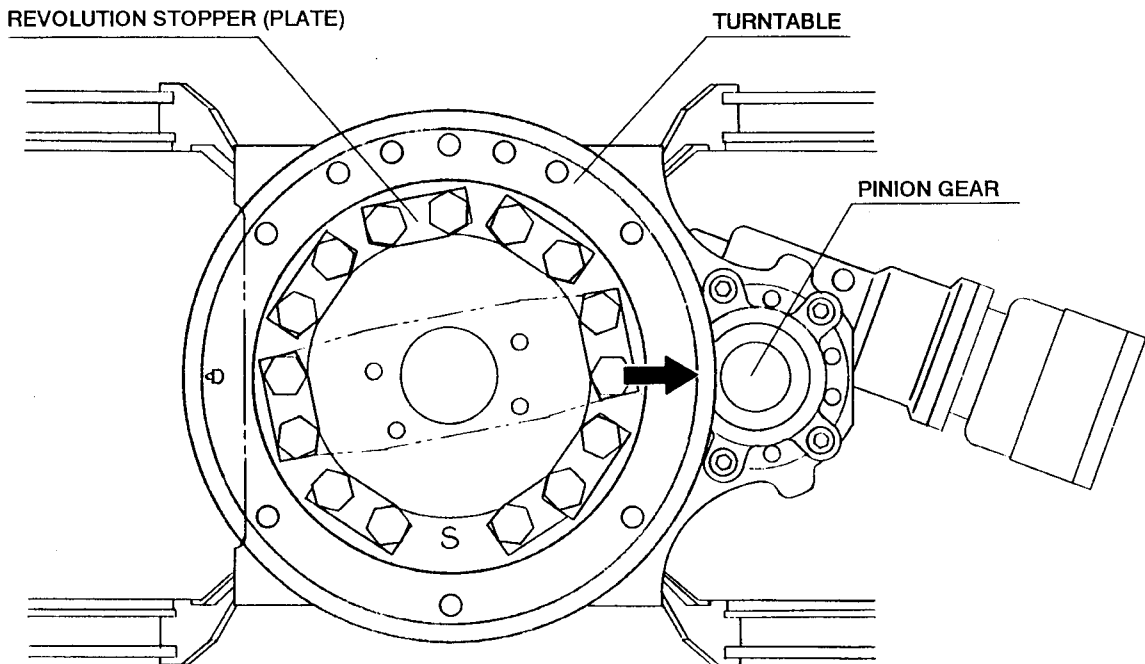


- When mounting the turntable, the inner soft zone marked "S" on the turntable must be positioned on the rear side (cargo deck side).

2) Tightening Order of Turntable Bolts

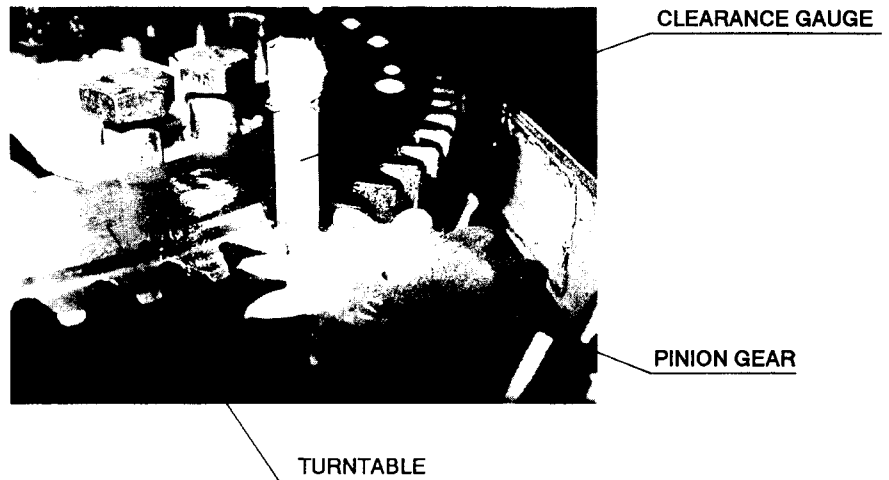
- Tighten the bolts in the numerical order as shown in the above illustration.

3) Turntable Mounting Procedure

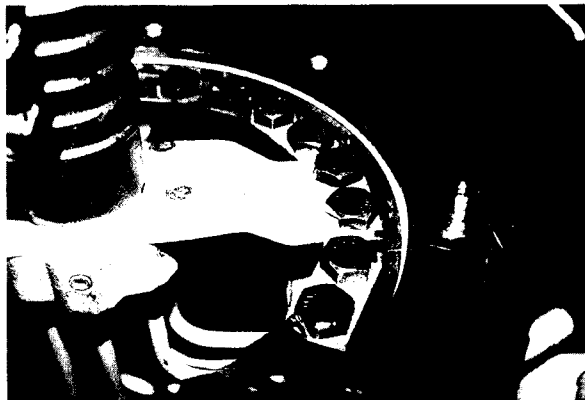


- ① Install the swing gear box ass'y to the base main body.
- ② Mount the turntable on the base and screw lightly the turntable bolts in the base main body.

- ③ Insert the clearance gauge (0~0.2 mm) into the space between the turntable gear and the pinion gear, and press strongly the turntable to the pinion gear.

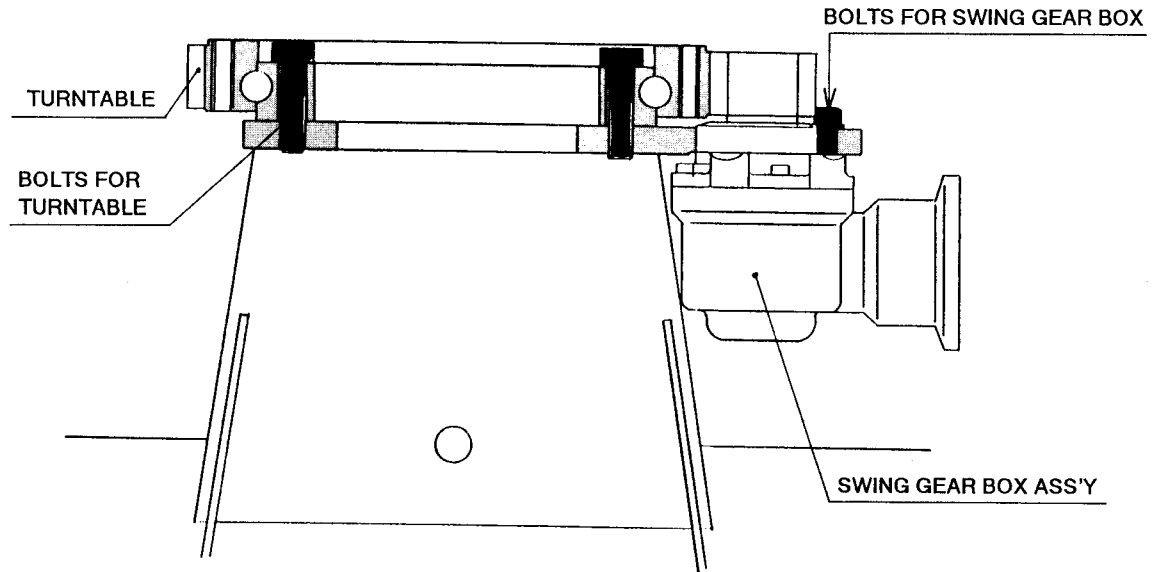


- ④ Fasten turntable bolts following the specified tightening torque and the numerical order so that it will not part from the pinion gear.
- ⑤ After tightening turntable bolts, fold the inside square corner of the revolution stopper plate to follow one flat side of the hexagon bolt head.



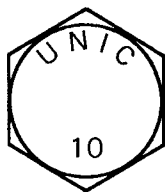
- ⑥ After assembling, apply grease to engaging tooth surfaces of the gears.

4) Tightening Torque for Bolts Fastening Turntable and Swing Gear Box

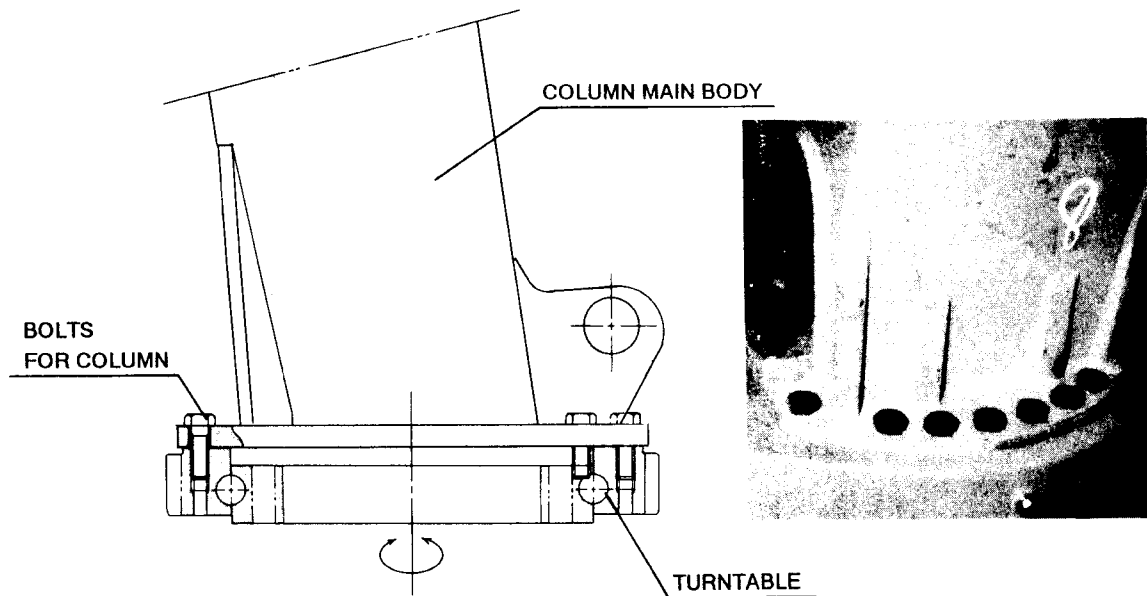


Place of use	Part name	Tightening torque
Swing gear box	Tempered bolt M14 × 45 ℓ (10T)	15~19 kg-m (Desired value:17 kg-m)
Turntable (Turntable inner ring)	Tempered bolt M20 × 75 ℓ (10T)	45~51 kg-m (Desired value:48 kg-m)

Note:The bolts for the turntable (tempered bolts) must be UNIC genuine bolt, on the head of which“UNIC 10” is inscribed.



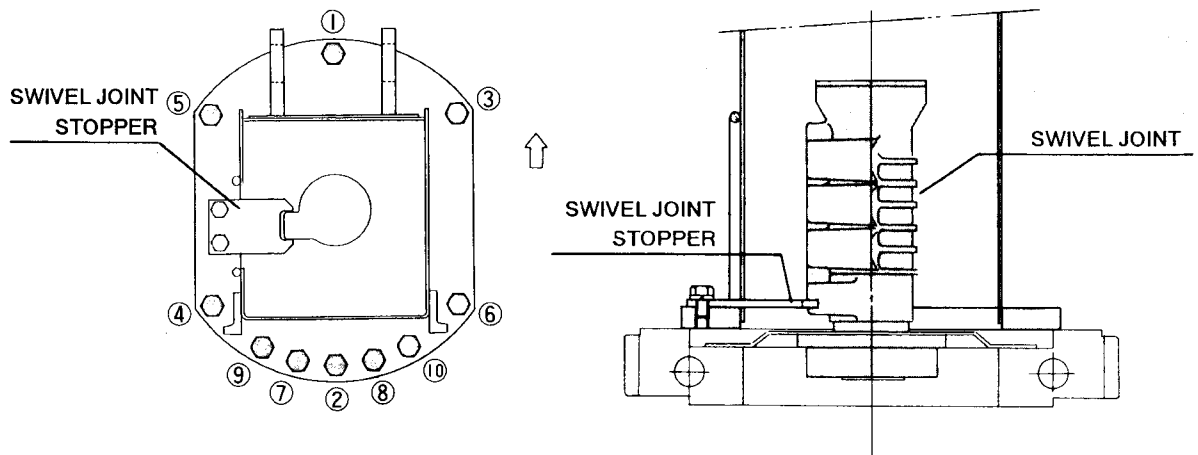
5) Tightening Torque for Bolts Fastening Column



Place of use	Part name	Tightening torque	Caution when tightening
Column (Turntable outer ring)	Tempered bolt M16 × 50 ℓ (12T)	23~27 kg-m (Desired value:25 kg-m)	Follow the below mentioned numerical order.

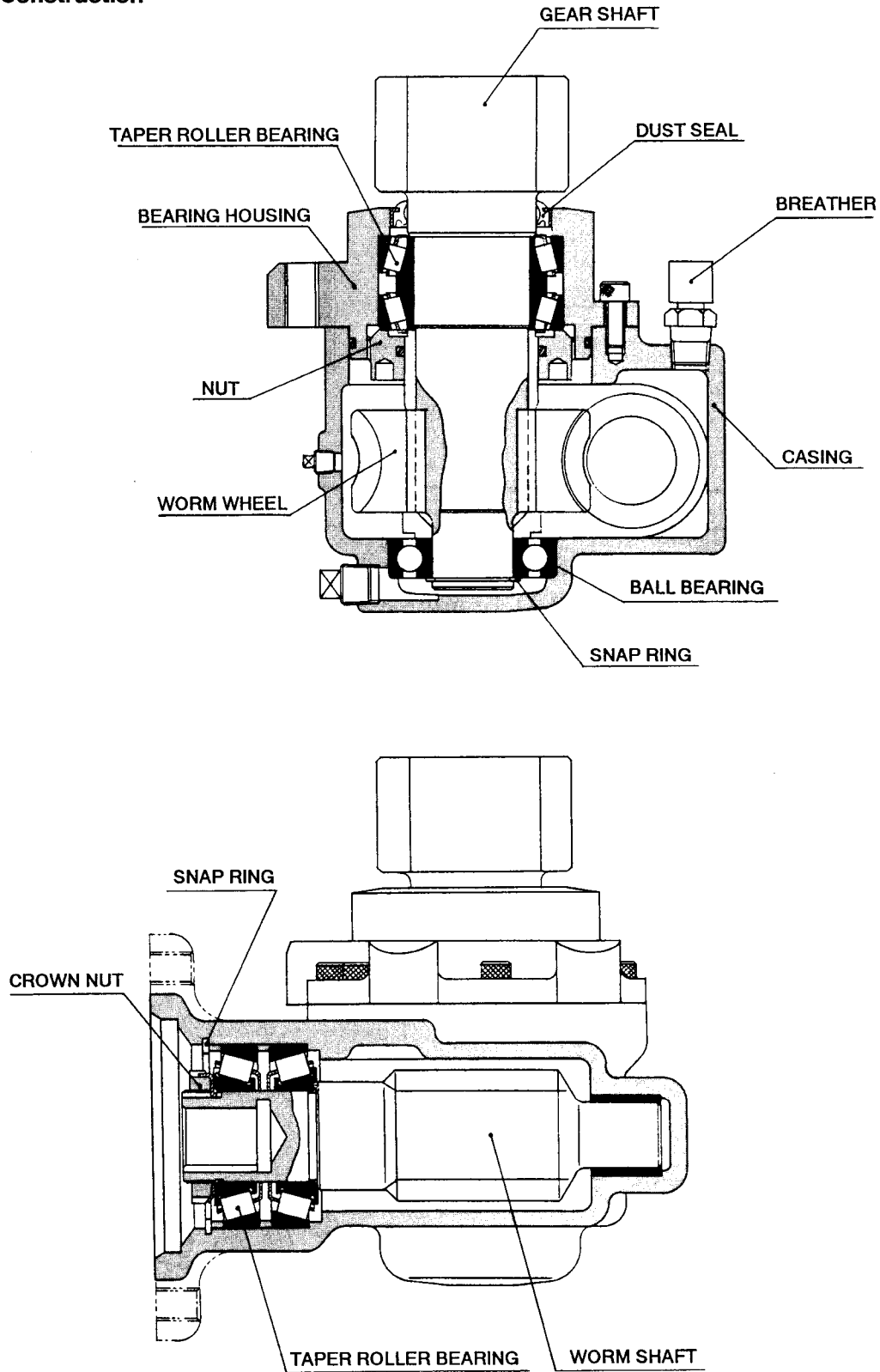
Note: Before tightening the bolts for column, apply “LOCKTIGHT # 262.”

6) Numerical Tightening Order for Bolts Tightening Column



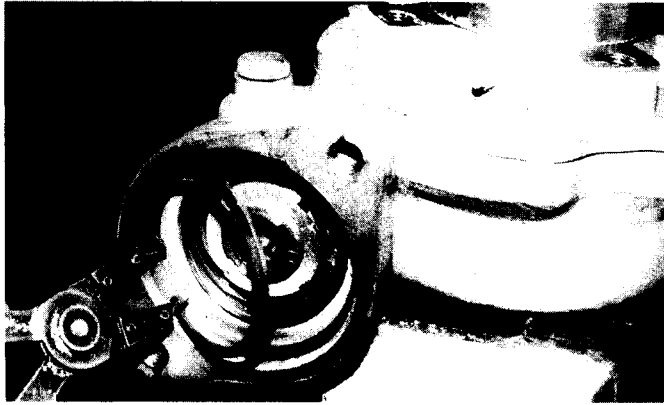
§8. SWING GEAR BOX

1) Construction



2) Disassembly Procedure

- ① Remove a snap ring (H-80) which retains the taper roller bearing which sustains worm shaft.



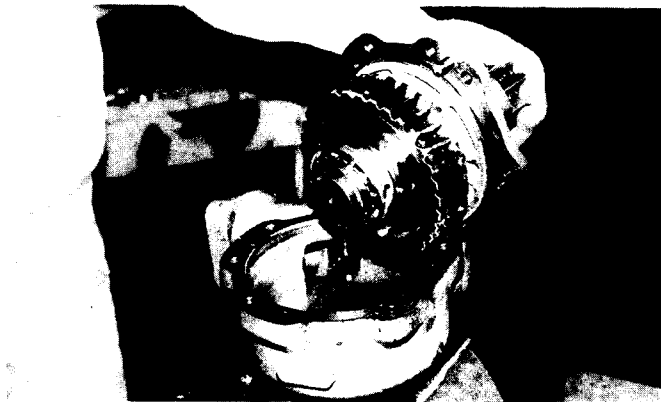
- ② Turn the gear shaft counterclockwise, pull out the worm shaft from the casing. (Use of special tool for removing worm shaft is recommended.)
※ For special tool, refer to page 36.



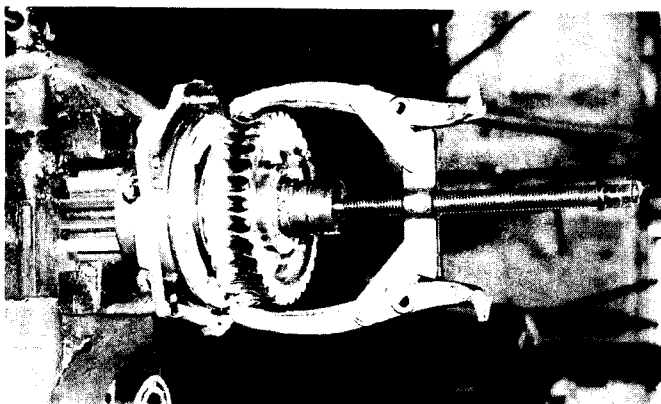
- ③ Remove 8 pcs. of bolt (M10 × 25 ℓ) which fasten the bearing housing and pull out the housing, utilizing 3 pcs. of bolt for 3 through holes in the housing.



- ④ This photo shows the pulled out housing with gear shaft and worm wheel.



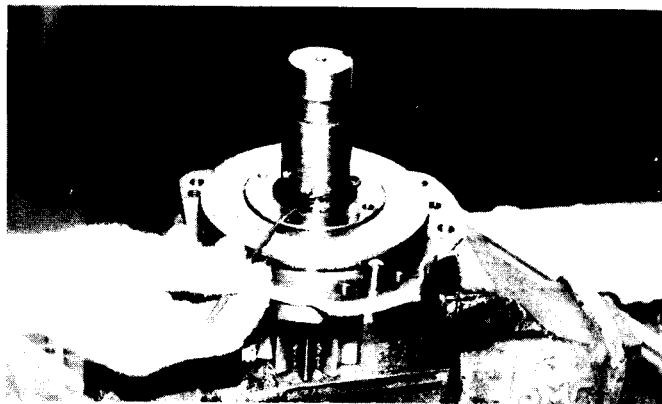
- ⑤ Grip the housing with a vice and pull out the worm wheel with a gear puller.



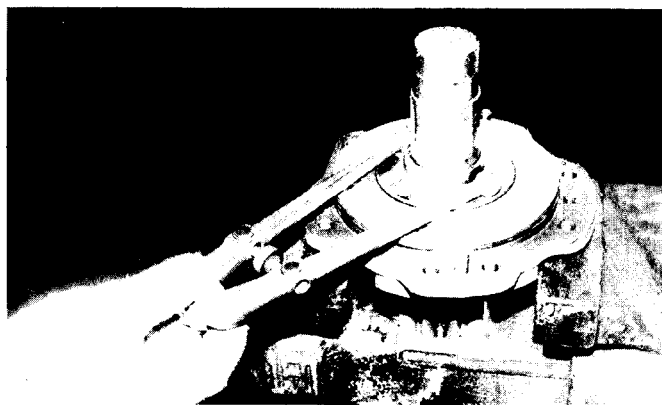
- ⑥ Pull out the collar which is assembled in the nut.



- ⑦ Pull out the O-ring which is assembled in the nut.



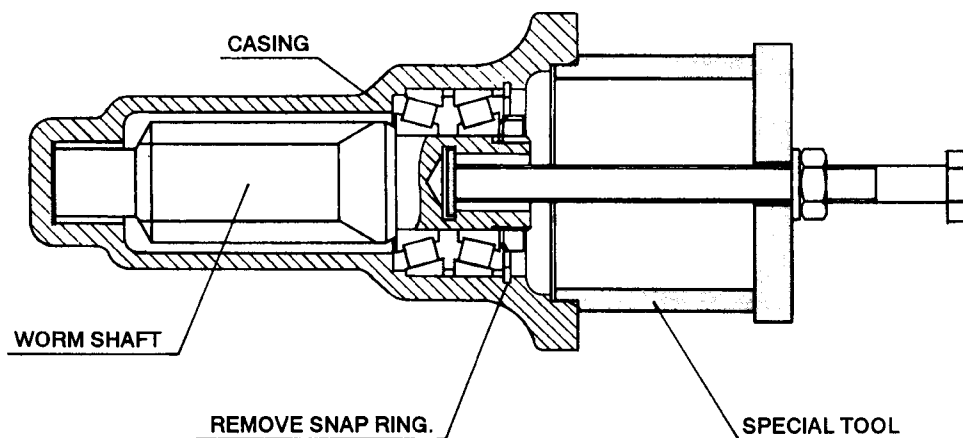
- ⑧ With a pin spanner remove the nut which retains the taper roller bearing.



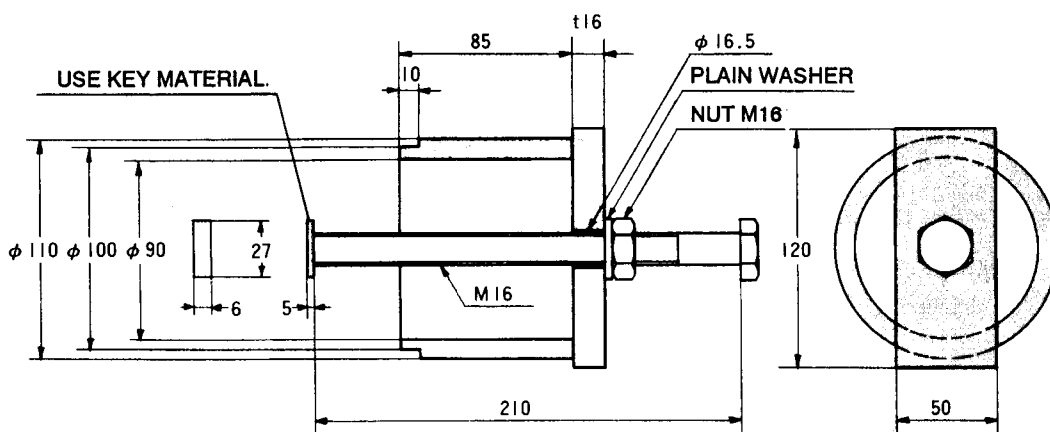
Note:To the threaded part of the nut “LOCKTIGHT” was applied. Therefore, when loosening, warm up lightly the threaded part with gas flame, and then loosen. When reassembling, be sure to apply “LOCKTIGHT # 262” to the threaded part.

※ Special tool for removing the worm shaft from the swing gear box

(Sectional view of worm shaft in assembly)

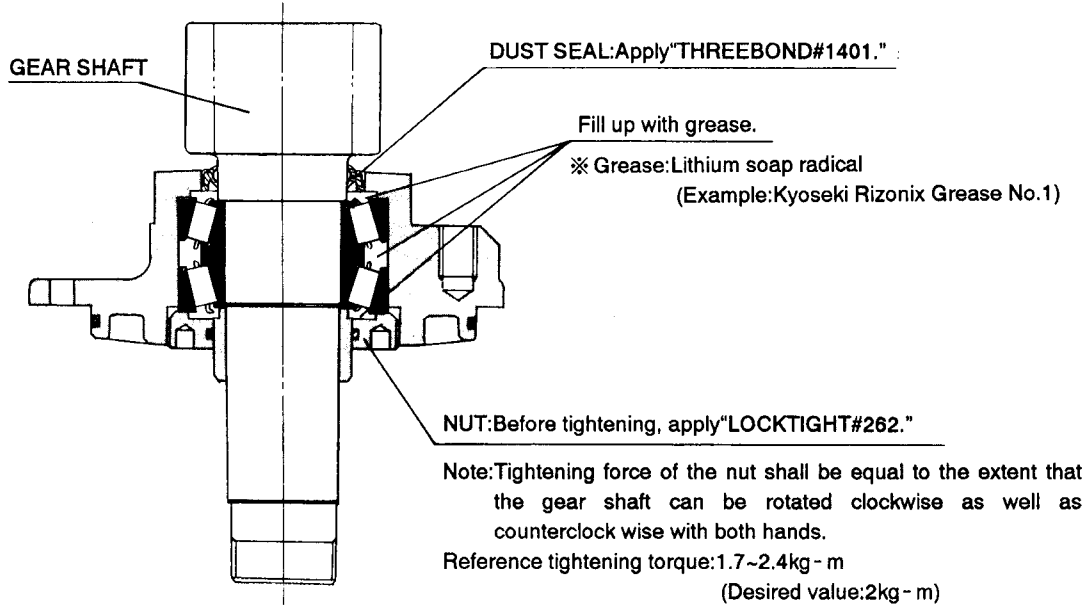


(DETAILED DRAWING OF SPECIAL TOOL)

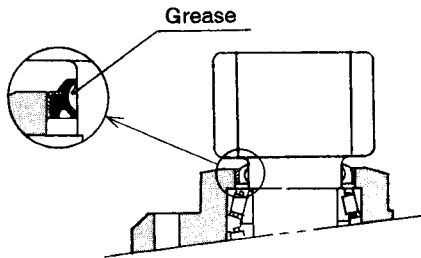


3) Caution When Assembling

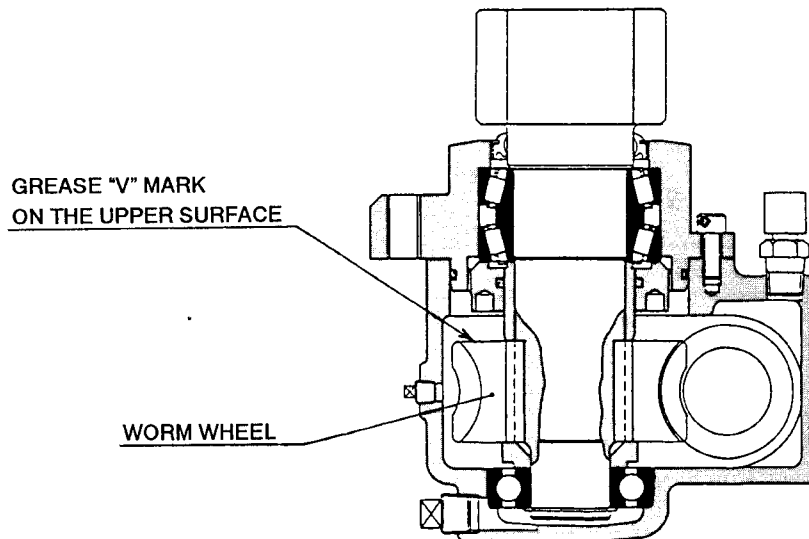
(1)



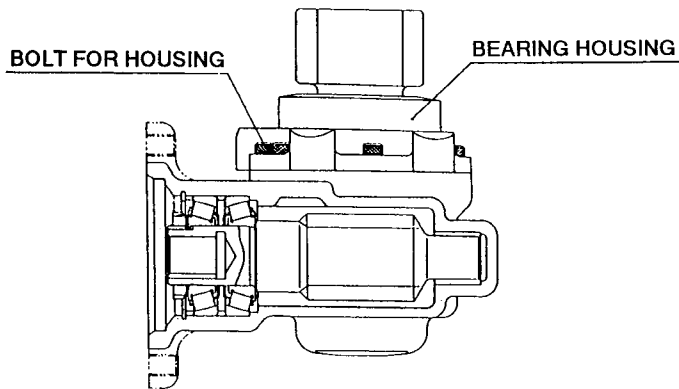
(2) Apply grease to the inside of lip of the dust seal.



(3) When assembling, be sure to have the side with the "V" face up.



4) Bolt Tightening Torque for Bearing Housing



Place of use	Part name	Tightening torque	Caution when teightening
Installation of swing gear box	Tempered bolt M8 × 20 ℓ (10T)	2~4 kg-m Desired value:3 kg-m	Before tightening tempered bolts, remove oil or grease from the bolts, and then apply "LOCKTIGHT # 262."

5) Gear Oil

The air goes in and out freely the inside of the gear case, and accordingly, water and dust are mixed in the gear oil. Also the gears themselves produce abrasion powder during operation. Therefore,make initial gear oil change at the time 6 months after the first use, and thereafter, make gear oil change once a year.

Quantity of gear oil
Approx. 0.45 liter (0.55 liter for new crane)

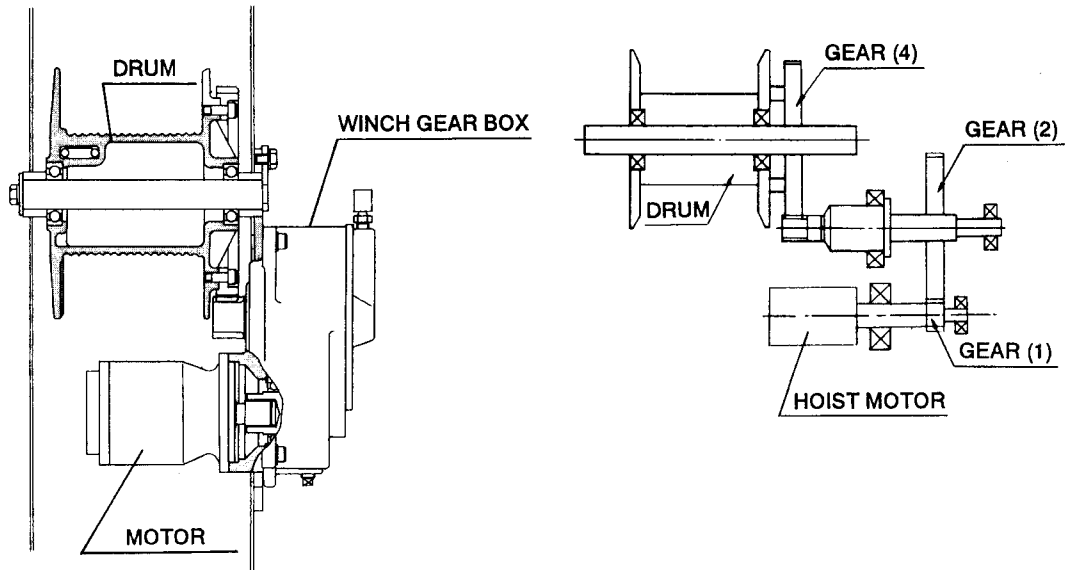
RECOMMENDED GEAR OIL

Use API Service GL-4 gear oils.

Petroleum Maker	Brand
ESSO	Standard gear oil 90
MOBIL	Mobilube GX90
CALTEX	Universal Thuban SAE 90
SHELL	Shell Spirax EP90

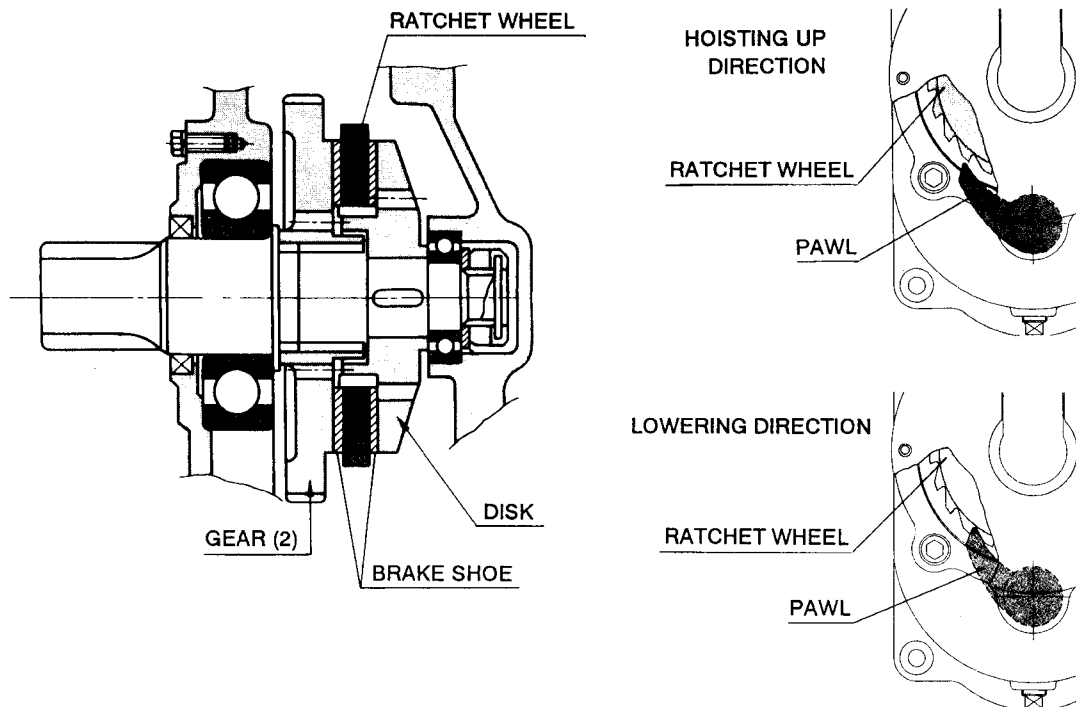
§9. HOIST WINCH

1) Construction of Winch

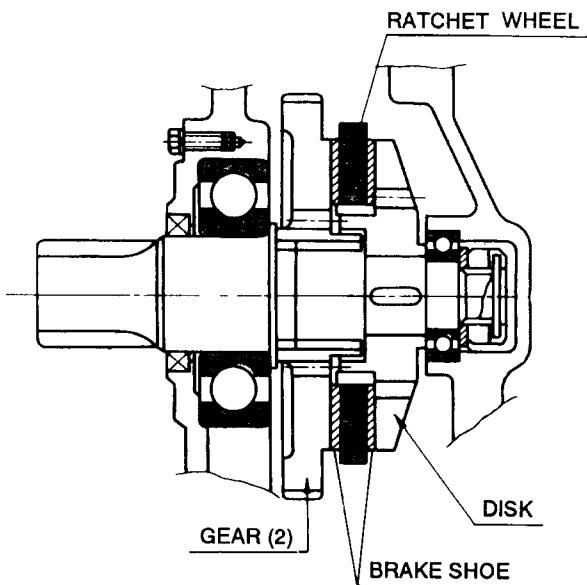


2) Construction of Brake

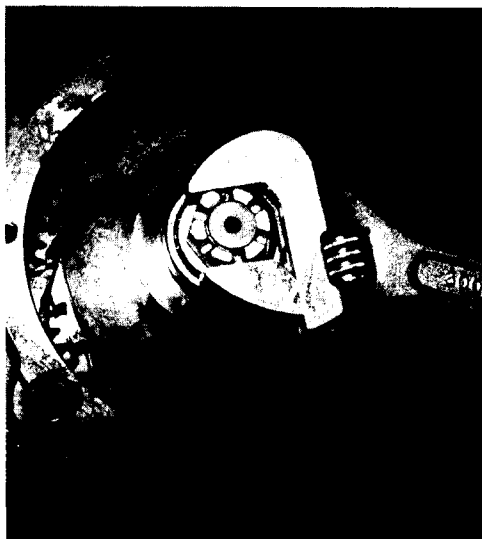
Brake shoe is put in the space between the gear (2) and ratchet wheel, and also in the space between the disk and ratchet wheel. Ratchet wheel can freely be rotated as long as the direction of rotation is winding up. However, when lowering, rotation is stopped by a pawl, and the gear (2) is pressed against the ratchet wheel through the brake shoe. Thus, the brake is applied in the lowering direction.



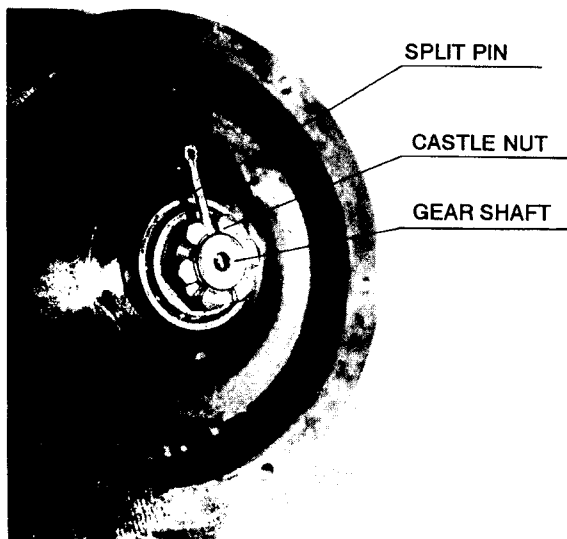
3) Brake Shoe Adjusting Procedure



Assemble in the order of gear (2), brake shoe, ratchet wheel, disk, and plain washer; and tighten castle nut with a spanner. Then loosen the castle nut for 1/6 turn and within this range match the hole for split pin in the gear shaft to the groove of the castle nut ; and fix with the split pin. If tightened too much, it may cause jogging.



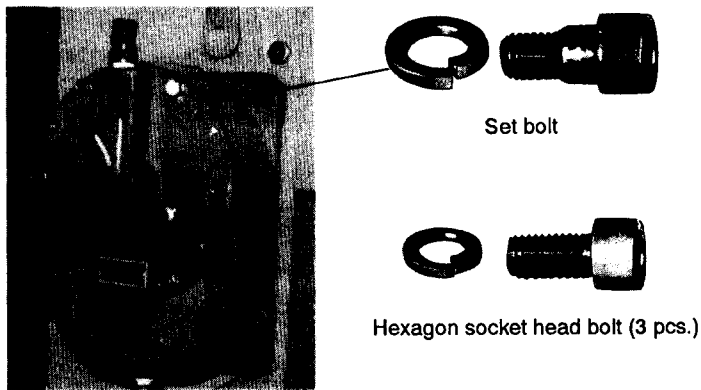
① Tighten castle nut with a spanner.



② Then loosen the castle nut for 1/6 turn and within this range match the hole for split pin in the gear shaft to the groove of the castle nut.

4) Bolt Fastening Gear Box

Bolt locating at the upper right of the gear box is a set bolt for positioning the casing. Other 3 pcs. are hexagon socket head bolts.



Note:Tightening order of bolt: Set bolt for positioning is the first, and then tighten the hexagon socket head bolts diagonally.

5) Gear Oil

The air goes in and out freely the inside of the gear case, and accordingly, water and dust are mixed in the gear oil. Also the gears themselves produce abrasion powder during operation. Therefore, make initial gear oil change at the time 6 months after the first use, and thereafter, make gear oil change once a year.

Quantity of gear oil
Approx. 0.8 liter (0.9 liter for new crane)

RECOMMENDED GEAR OIL

Use API Service GL-4 gear oils.

Petroleum Maker	Brand
ESSO	Standard gear oil 90
MOBIL	Mobilube GX90
CALTEX	Universal Thuban SAE 90
SHELL	Shell Spirax EP90

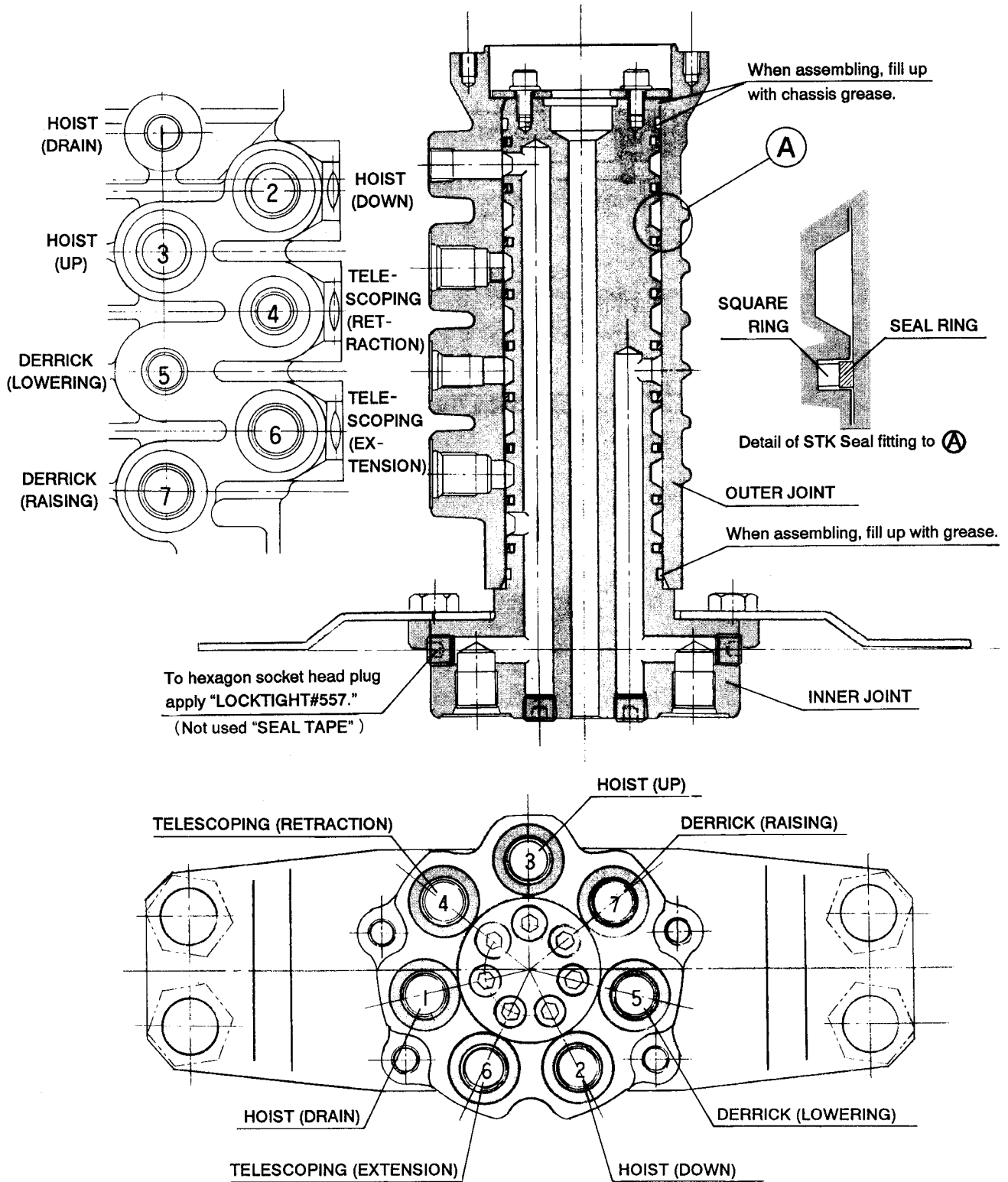
6) Cause of Troubles and Remedy

Hoist Winch

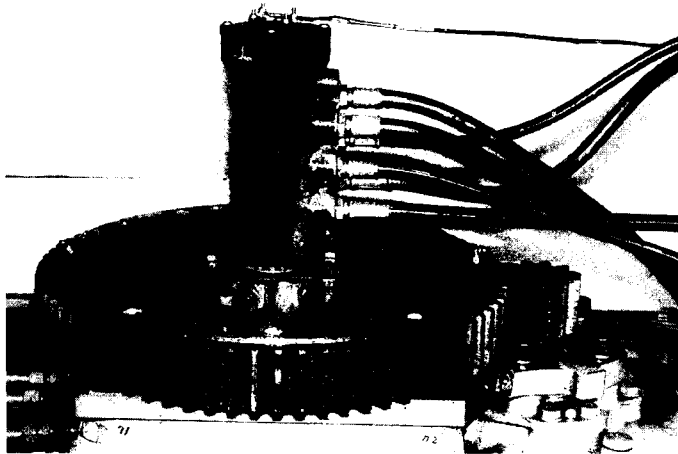
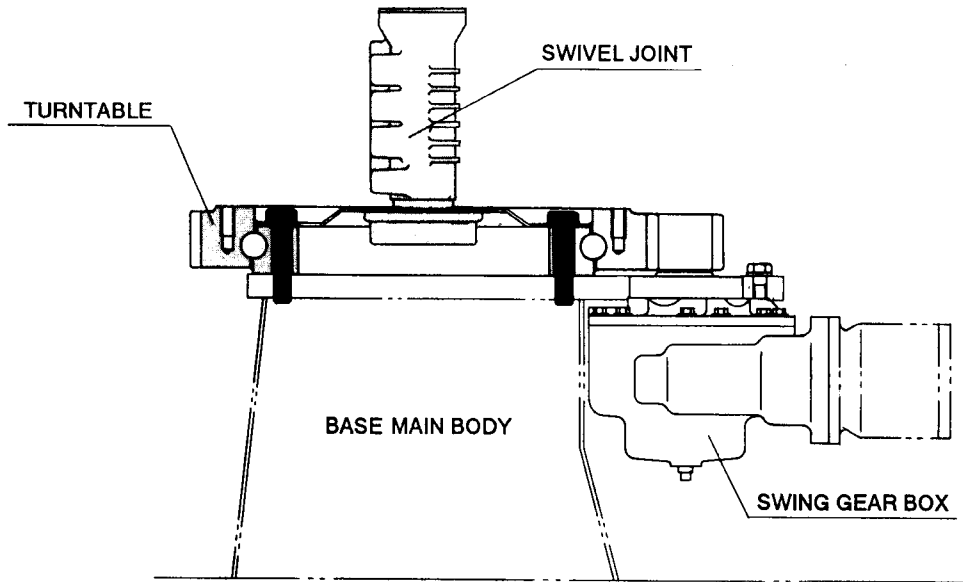
Abnormal phenomenon	Presumed cause	Remedy
1. Pressure does not rise.	a) Pump is faulty. (Pressure does not rise at idling rpm.) (Total pressure required for operation is insufficient.)	• Replace.
	a) Relief set of control valve is faulty. (Pressure rises but not enough.)	• Adjust or replace.
	a) O-ring and other parts of relief valve of control valve are faulty. (Adjust bolt of relief valve is tightened but unable to control pressure.)	• Replace parts or replace relief ass'y with a new ones.
	a) Hoist motor is faulty. (Quantity of drain is smaller than specified one.)	• Replace.
2. Pressure rises but hoisting up is impossible.	a) Drum or internal mechanism of gear box is faulty.	• Disassemble gear box. • Inspect the drum.
3. Pressure rises but lowering is impossible.	a) Drum or internal mechanism of gear box is faulty.	• Too much tightening of brake shoe. • Disassemble gear box. • Inspect the drum.
4. Unable to maintain suspended load.	a) Brake shoe is faulty. b) Pawl is faulty.	• Replace brake shoe. • Replace pawl.
5. When lowering, jogging occurs.	a) Brake shoe is faulty. b) Too much tightening of brake shoe. c) Internal mechanism of gear box is faulty.	• Inspect brake shoe and check quantity of oil. • Adjust tightening of nut. • Disassemble gear box.
6. When hoisting up, clattering sound is heard.	a) Spring to press the pawl against slide plate is faulty. b) Bush at the part of fitting pawl worn out.	• Replace spring. • Replace bush.

§10. SWIVEL JOINT

1) Construction of Swivel Joint and Positions of Hoses



2) Swivel Joint is installed.



3) Swivel Joint Assembling Procedure

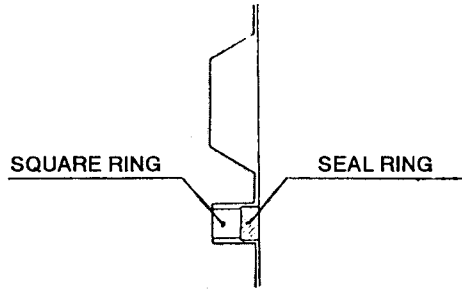
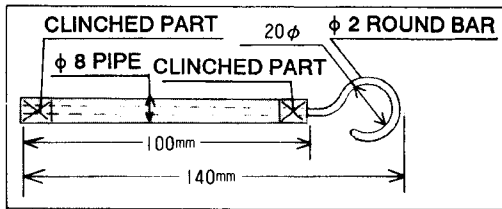
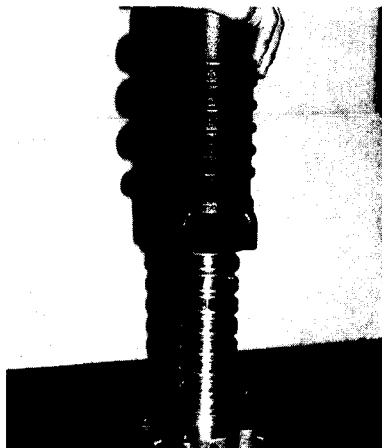
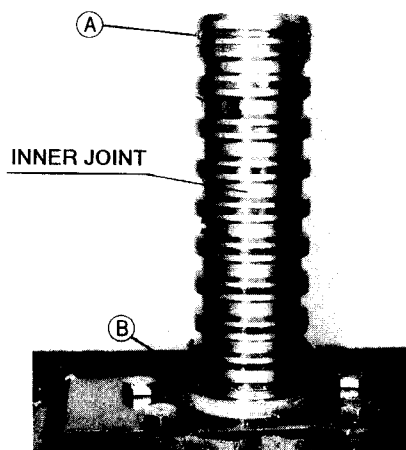
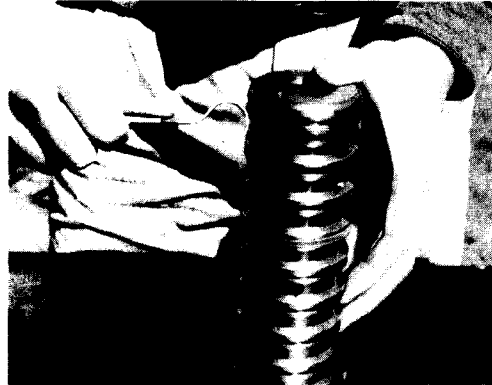


Illustration of STK Seal fitting



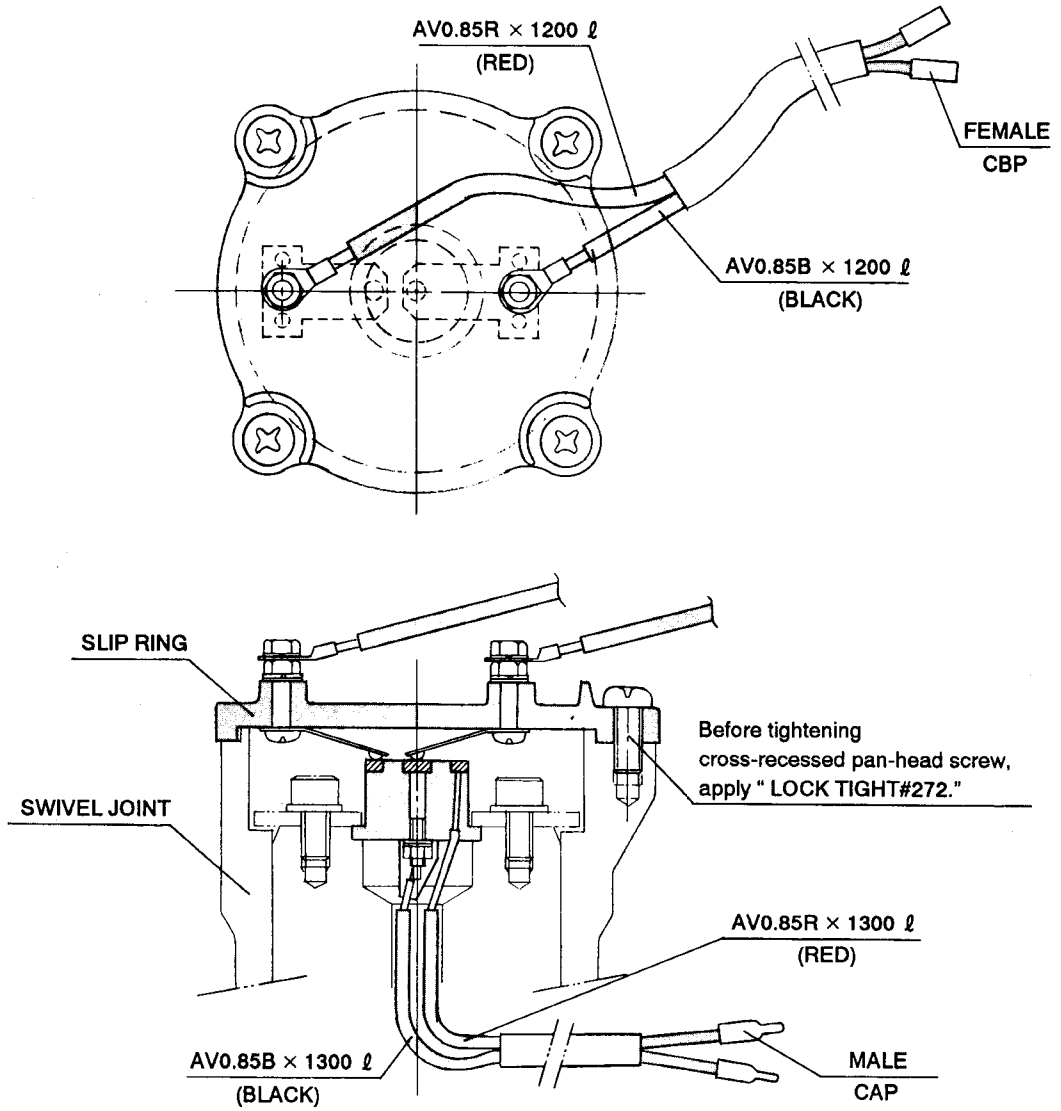
- After fitting the square ring, check to see if it is twisted, then fit the seal ring.
- ✘ When fitting seal ring, it is recommended to use the jig as shown below.



- The upper most (A) and the lower most (B) of the inner joint must be filled up with grease.
- To the part where STK seal is to be fitted apply chassis grease thinly.
- Put the outer joint over the inner joint taking care that the STK seal fitted to the inner joint will not be bit.

§11. SLIP RING

1) Construction of Slip Ring and Its Fitting Position



§12. CONTROL



CONTROL VALVE

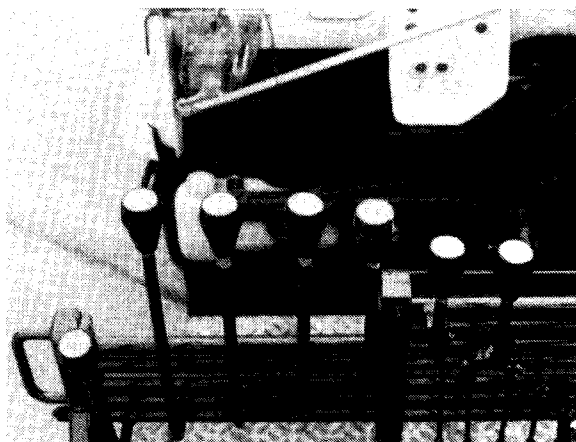


Photo shows the side the control valve is installed.

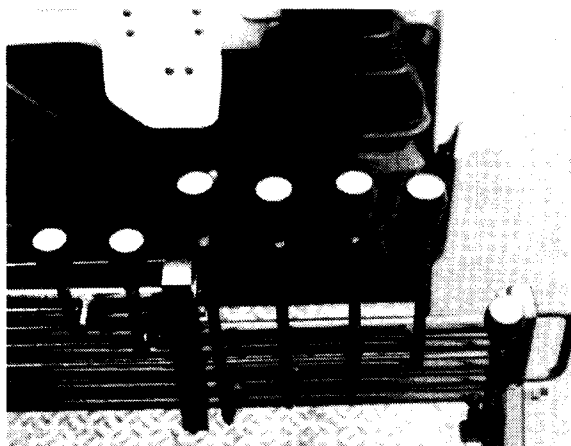
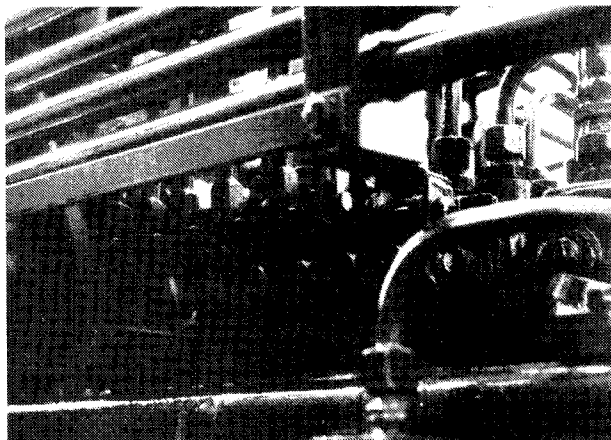


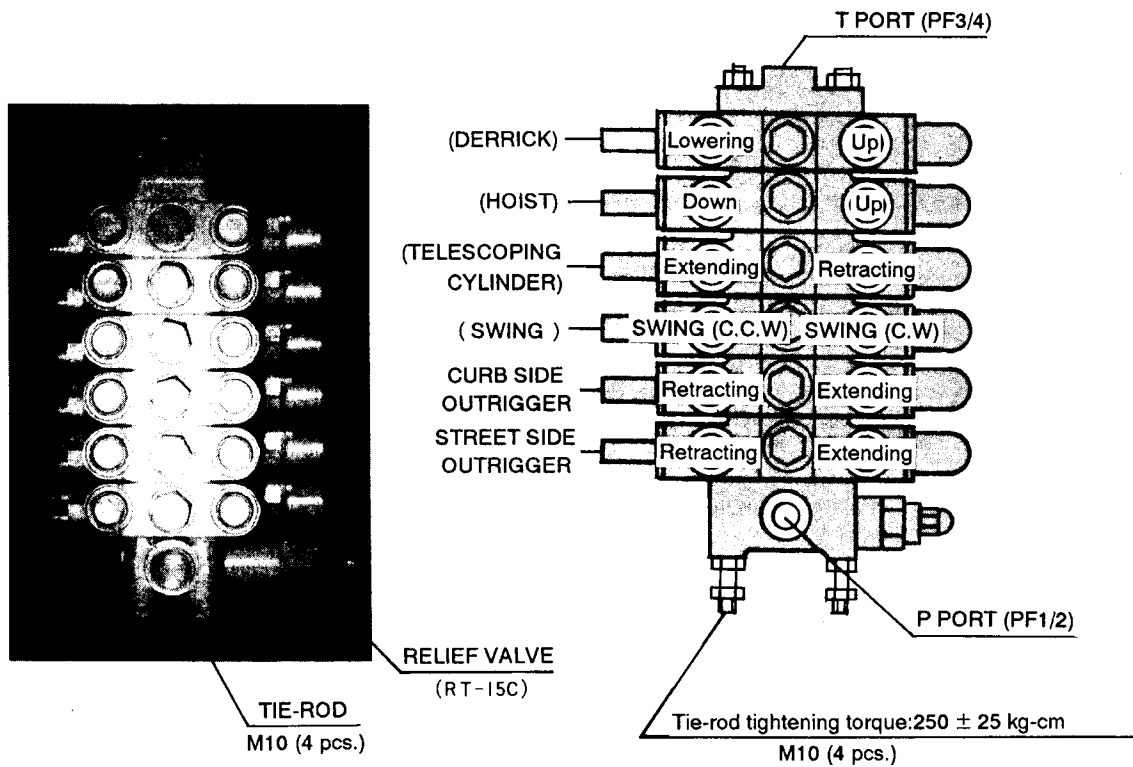
Photo shows the side the control valve is installed.

Use the clevis bolt to adjust the control lever neutral position.



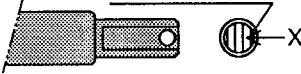
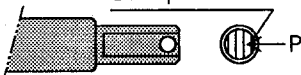
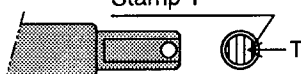
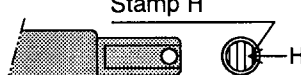

§14. CONTROL VALVE

1) Composition of Valves and Inscribed Mark on Spool



※ Control valves control working of every actuator of crane. The spools assembled in the control valves are different each other according to respective actuator.

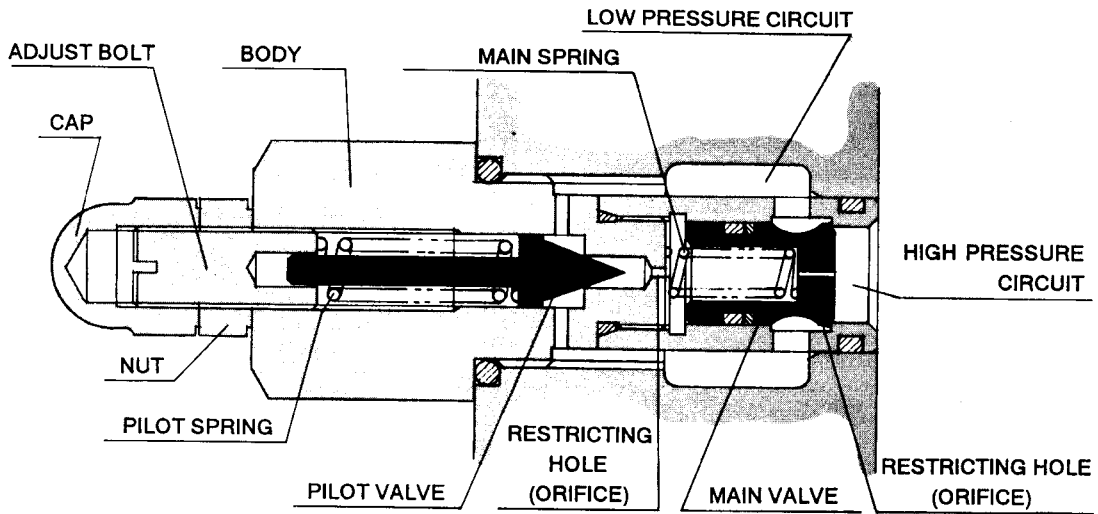
See the inscribed stamp on the end face of the spools.

MODELS SPOOLS	UR293
For Derricking	Stamp X
Spool Meter-in, -out	
For Hoisting	Stamp P
Spool Meter-out	
For Telescoping	Stamp T
Spool Meter-in	
For Swinging	Stamp H
Spool H-meter-out	
For Outrigger	No stamp
Spool Meter-in	

2) Relief Valve

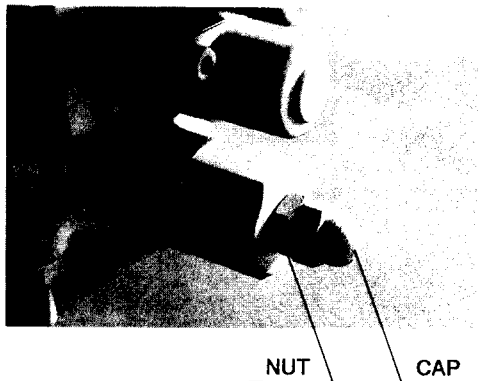
The relief valve is a preventive valve to control the pressure in the hydraulic circuit would not become higher than specified pressure.

(1) Construction of Valve

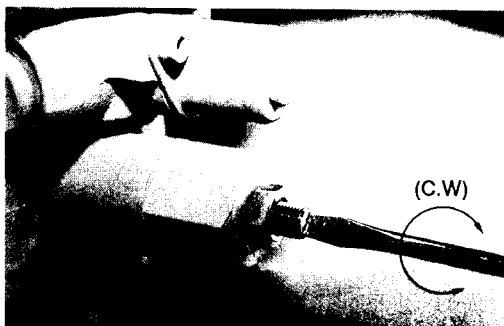


(2) Adjusting Procedure

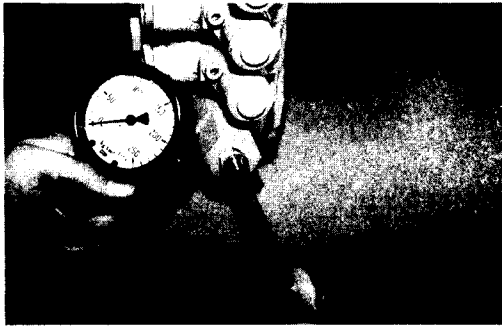
The hydraulic pressure in the relief valve is decided by the movable allowance of its adjust screw. For adjusting the pressure, loosen the cap and nut, and turn the screw clockwise with a (-) driver to increase the pressure, while on the contrary turn the screw counterclockwise for reducing the pressure.



Ⓐ Remove the cap and loosen the nut.



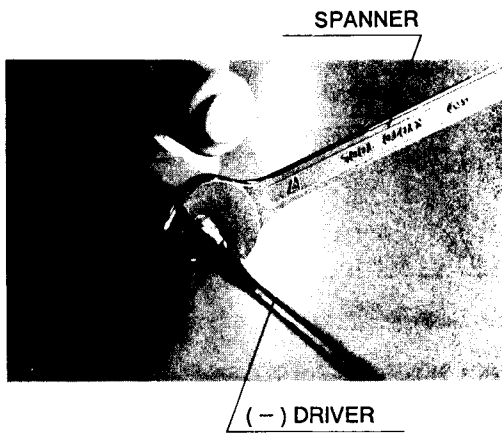
Ⓑ When tightening the nut and the cap, hold the screw with the (-) driver as it is feared that loosening of screw is apt to happen while tightening.



- © Retract the outrigger, telescoping, or derrick cylinder, and adjust the relief pressure while watching the pressure gauge.

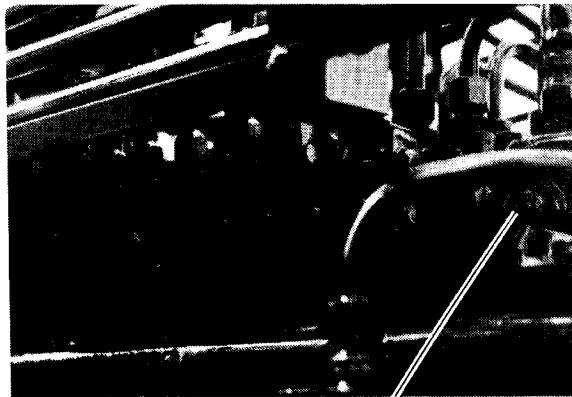
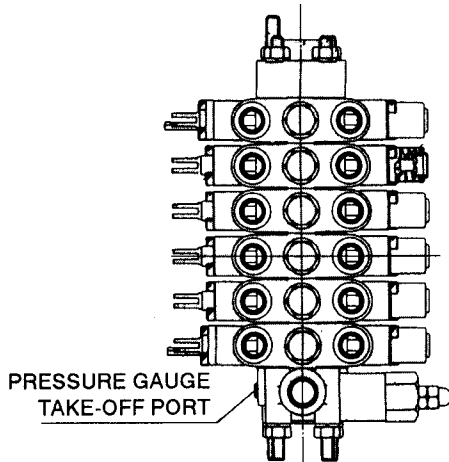
Setting up Hydraulic Pressure...2500 psi

- ※ Run the engine at the rated pump speed, not at idling or high speed, while setting relief pressure.



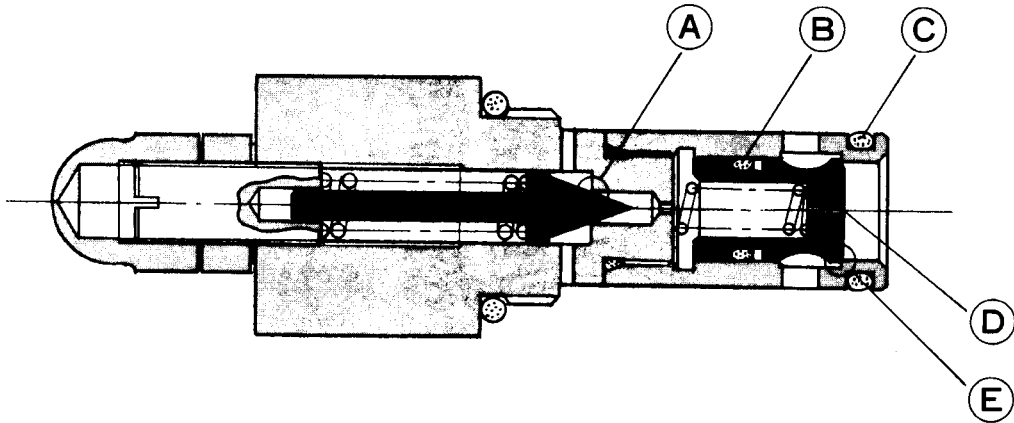
- ④ When tightening the nut and the cap, hold the screw with the (-) driver as it is feared that loosening of screw is apt to happen while tightening.

(3) Pressure Measuring Gauge Take-off Port



(4) Relief valve check point

If hydraulic oil pressure fails to rise, check the relief valve at the following points.

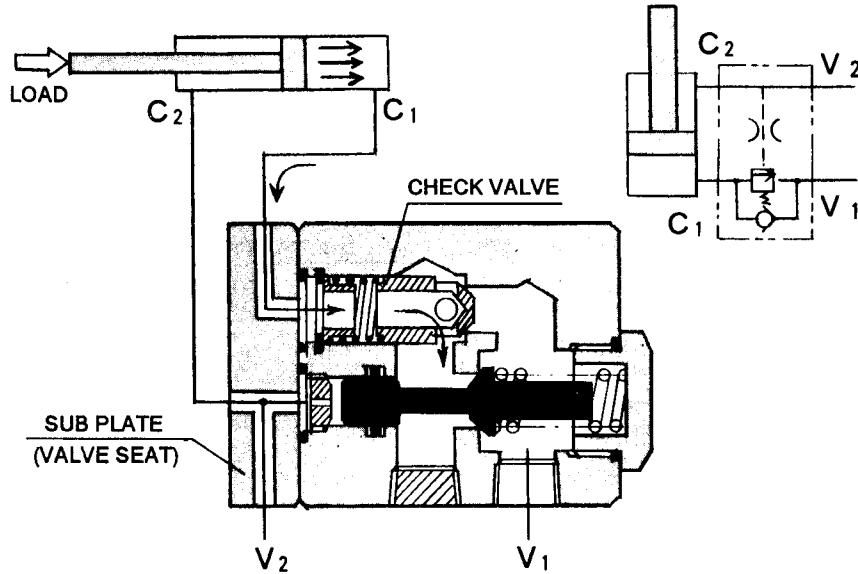


1. Foreign matter caught at part **A** ; damage to seat surface
2. O-ring at part **B** broken
3. O-ring at part **C** broken
4. Foreign matter caught in orifice in main valve at part **D**
5. Foreign matter caught at part **E** ; damage to seat surface

Note:If nothing is found wrong at the above points, the hydraulic pump is defective.

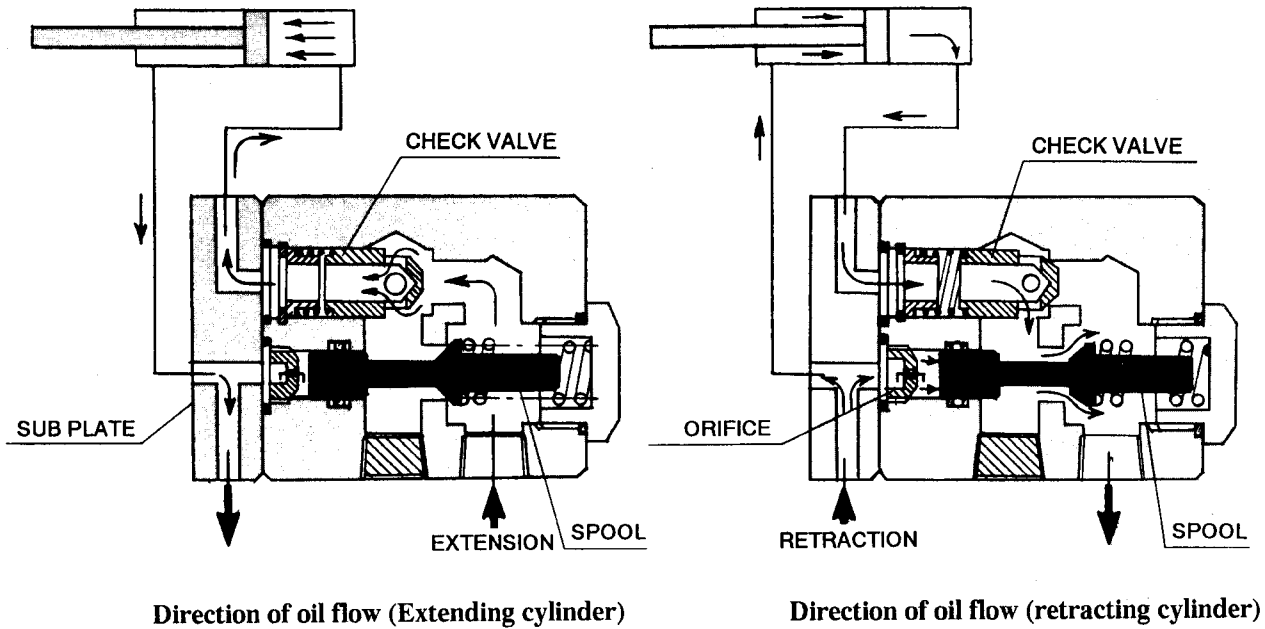
§15. COUNTER-BALANCE VALVE

The counter-balance valve applies the set back pressure to the oil flow in the retracting direction, and permits free flow of oil in the extending direction.



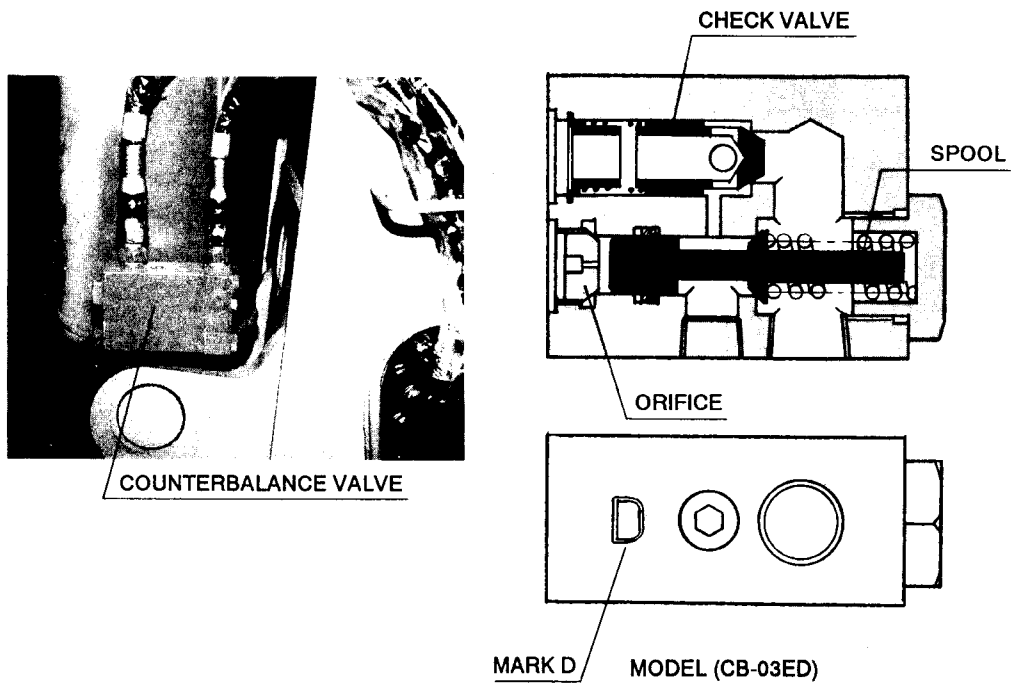
When the control valve is neutral, oil flow is blocked to both cylinder parts, extension and retraction. Even if the cylinder is subjected to a load and a force in the retracting direction, the oil in the extending direction is blocked by the body of the counter-balance valve and the seat of the check valve so that the cylinder remains as it is.

1) Description of Counter-Balance Valve Operation



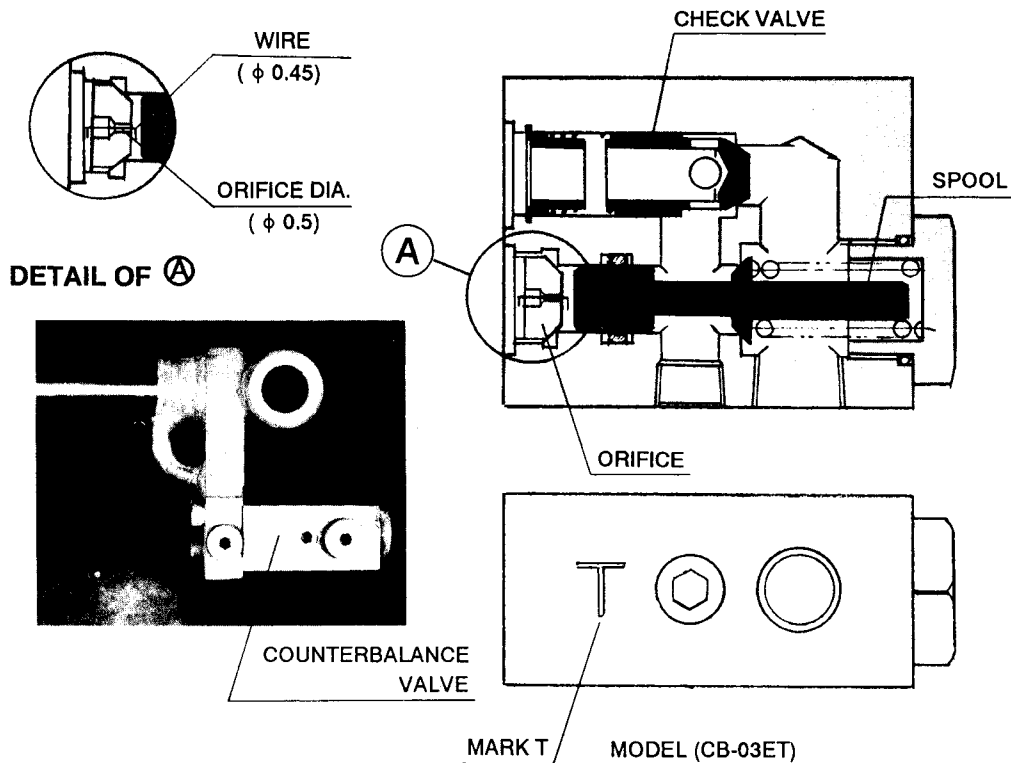
2) Construction of Counterbalance Valve (for Derrick and telescoping cylinder)

(1) Construction of Counterbalance Valve (for Derrick)



(2) Construction of Counterbalance Valve (for Telescoping Cylinder)

※ The counterbalance valve for telescoping cylinder has a wire in the part ① shown below (to prevent hunting when the telescoping cylinder is retracted).

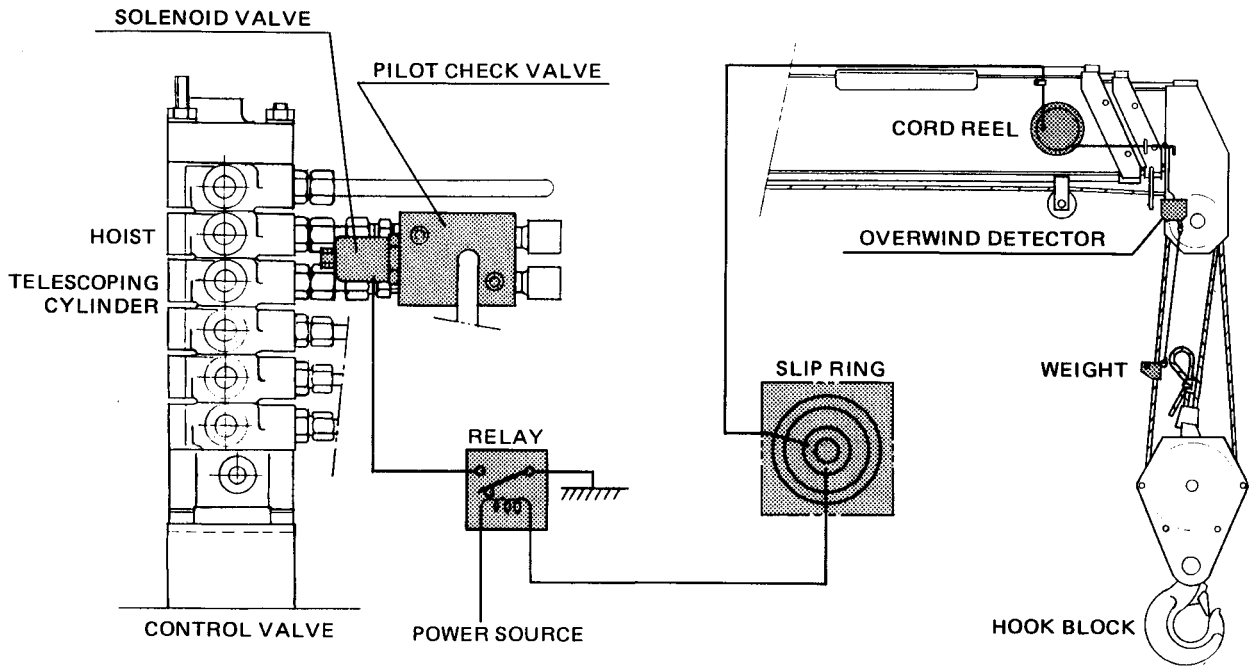


§16. SAFETY DEVICES

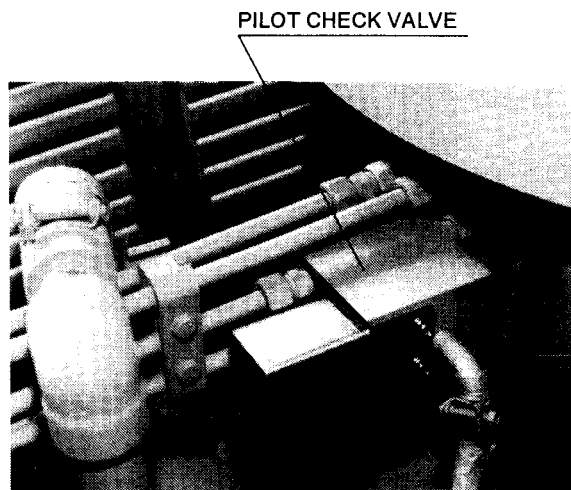
1) Construction of Anti Two Block Device

When the hook pushes the weight up to turn the overwind detector switch off in winding up the hook or extending the booms, the solenoid valve is switched on to operate so that the pilot check valve shuts off the oil flow for winding (return side of motor) and for boom extension to stop the operation.

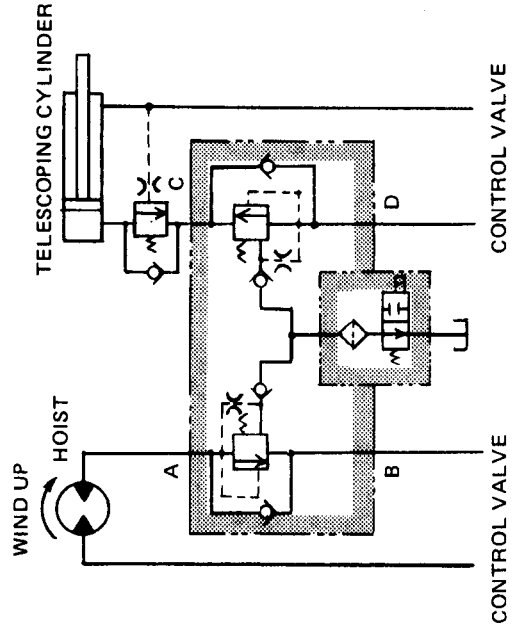
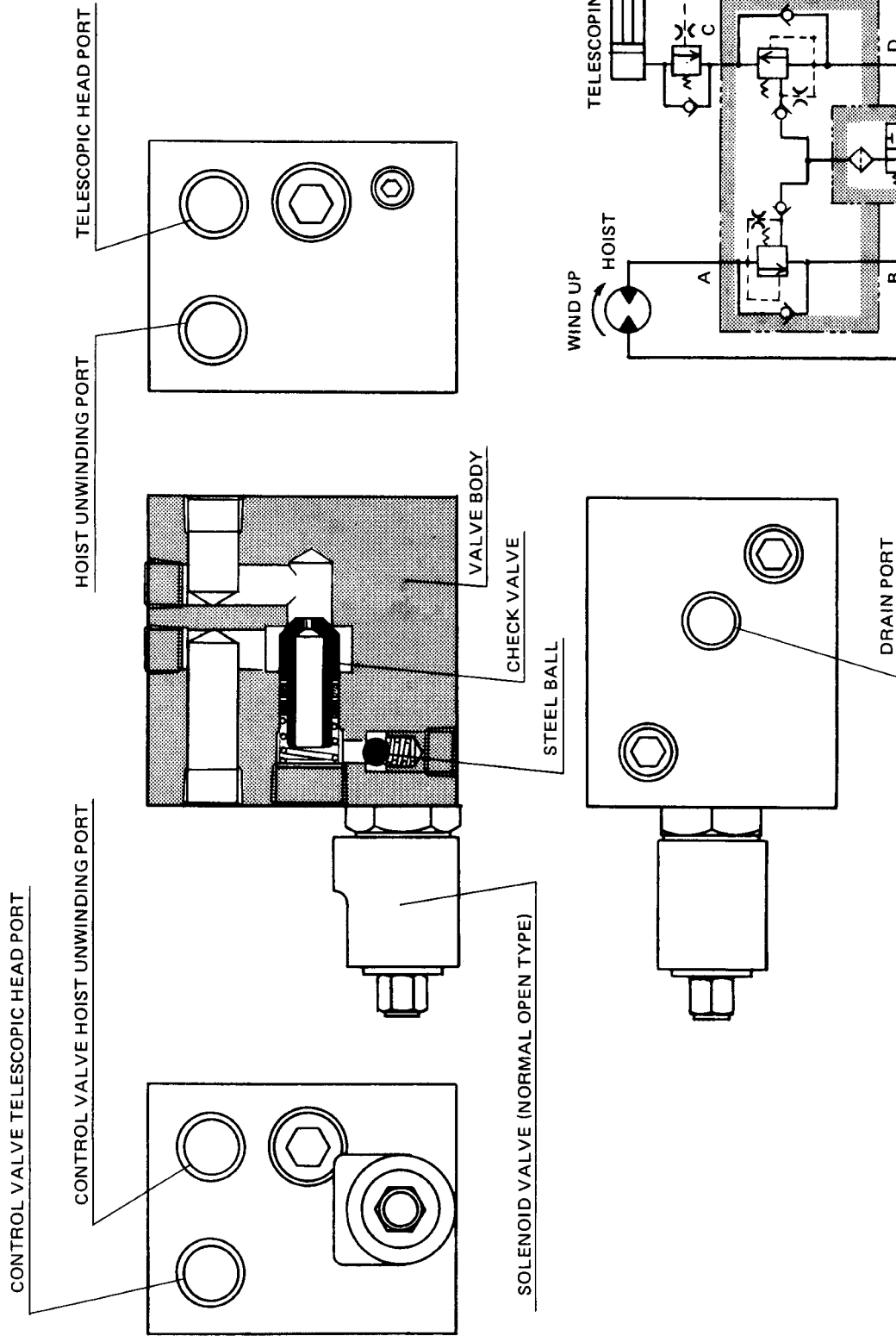
※ However, the hoist can be unwound and the booms can be retracted.



PILOT CHECK VALVE POSITION



2) Construction of Pilot Check Valve



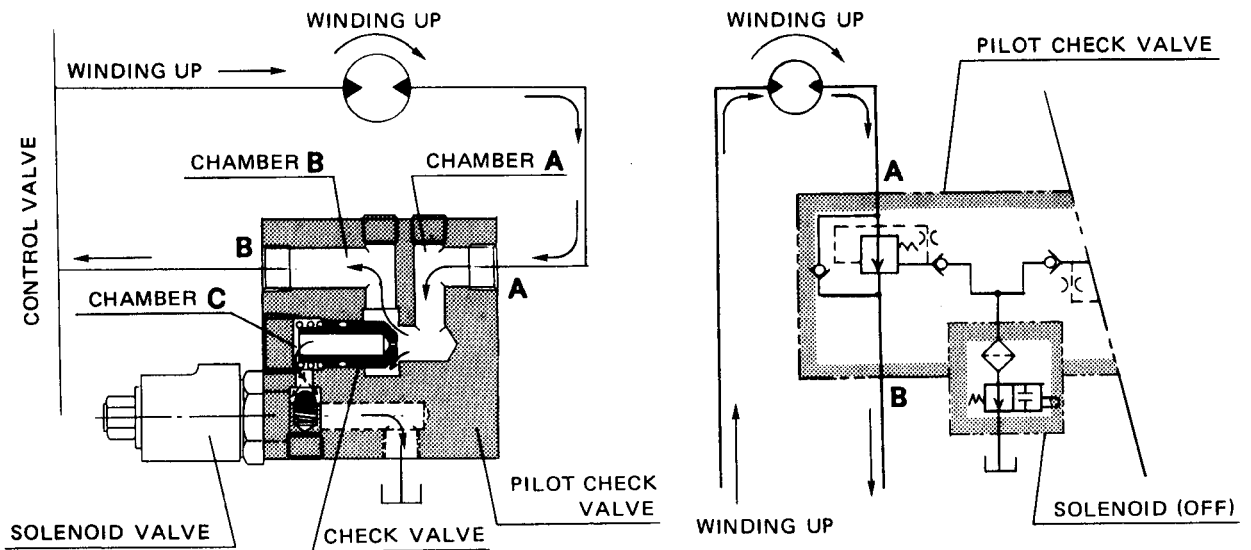
HYDRAULIC CIRCUIT

3) Description of Pilot Check Valve Operation

The pilot check valve is described as to oil flow through it and its check operation in winding/unwinding the hoist and extending/retracting the telescoping cylinders.

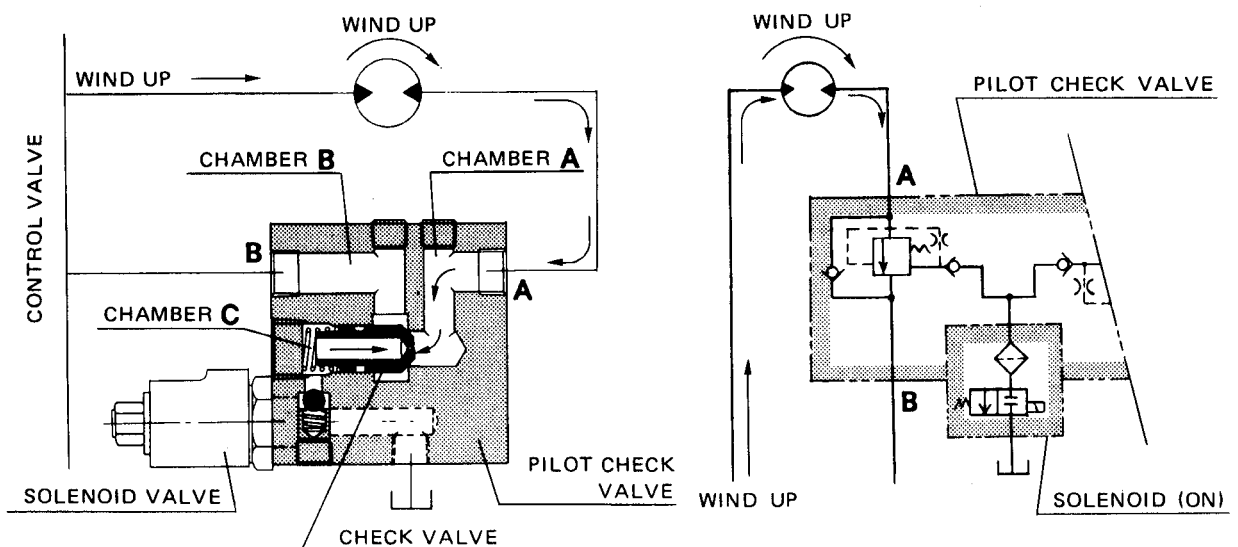
(1) Hoist Winding (In normal operation state, overwind detector is ON and solenoid valve OFF.)

In normal operation, the overwind detector is ON and the pilot check valve's solenoid valve is OFF. The return port is open to the tank port, and the oil in chamber C flows into the tank. Thus, the return oil in chamber A from the motor pushes open the check valve to flow via chamber B and the control valve back into the tank. This causes the motor to drive the hoist to wind.



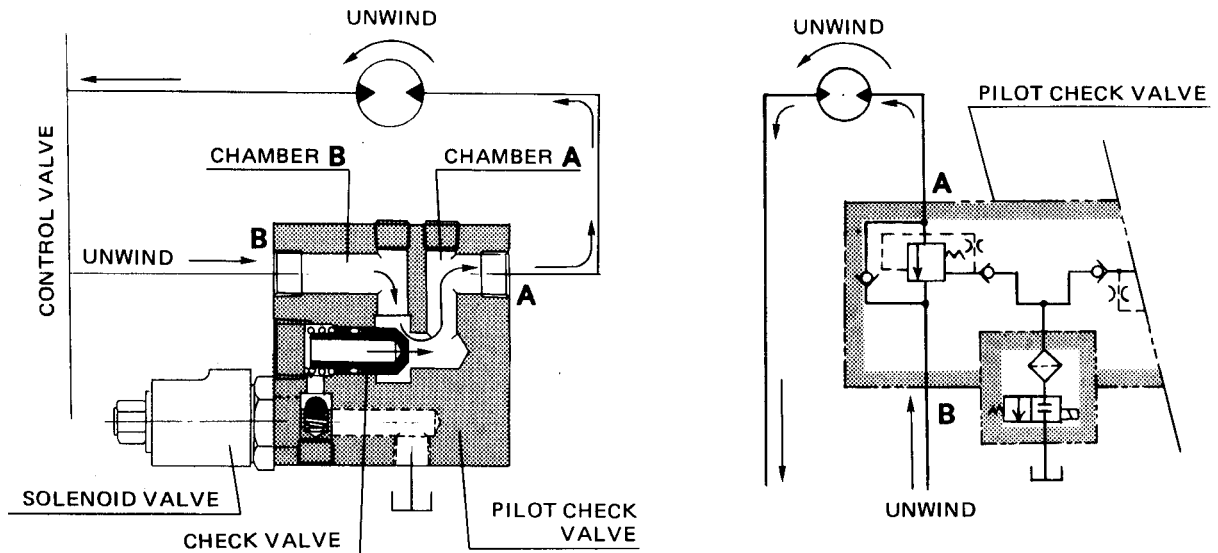
(2) Hoist winding stop (In overwound state, overwind detector is OFF and solenoid valve ON.)

In an overwound state, the overwind detector turns off and the solenoid valve of the pilot check valve turns on. The operation of the solenoid valve closes the tank port so that the return oil in chamber A from the motor enters chamber C through the hole drilled in the check valve. Because the tank port is closed, chamber A and C become the same in pressure, and the check valve is pushed to the right due to the area difference between chambers A and C. Thus, the return oil in chamber A is shut off by the check valve, causing the



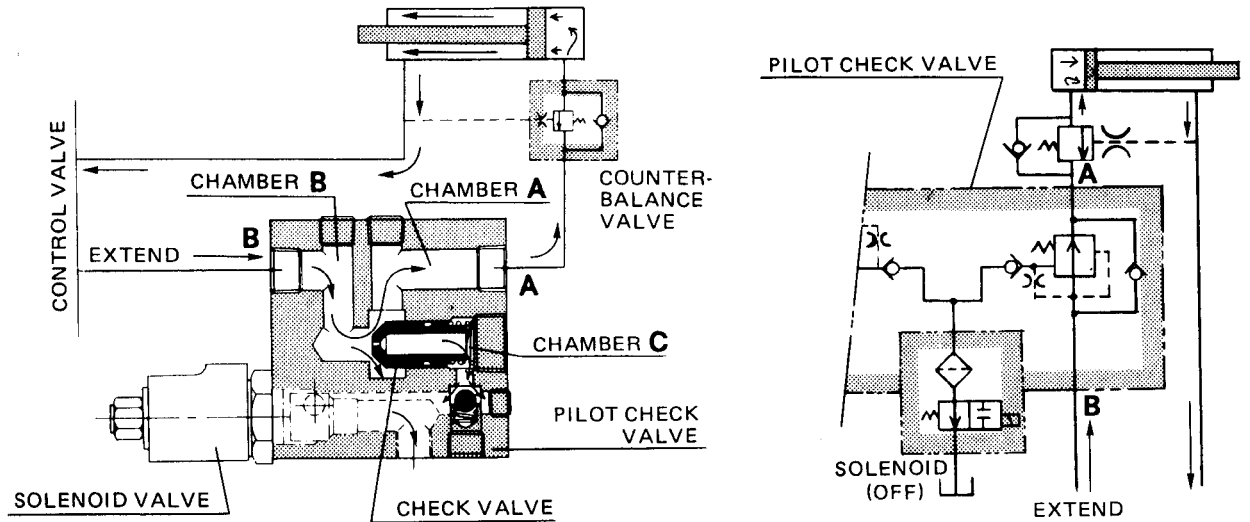
(3) Hoist unwinding

The oil entering chamber B from the control valve moves the check valve to the left to flow into chamber A and the unwinding end of the motor. The return oil from the motor flows via the control valve back into the tank, causing the motor to drive the hoist to unwind.



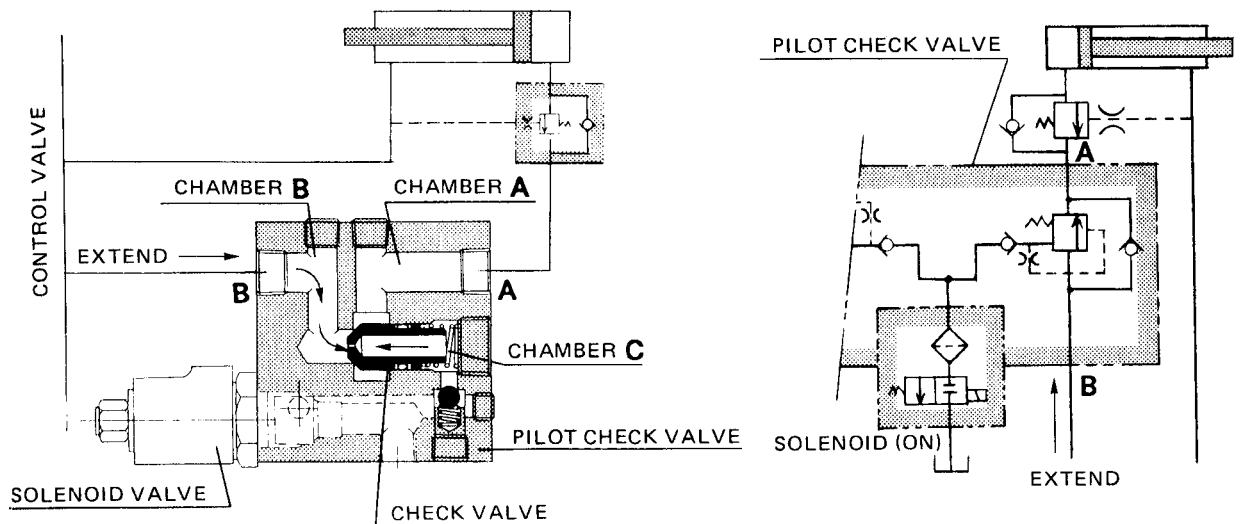
(4) Telescoping cylinder extending operation (In normal operating state, overwind detector is ON and solenoid valve OFF.)

In normal operation, the overwind detector is ON and the solenoid valve of the pilot check valve is OFF. The return port is open to the tank so that the oil in chamber C flows into the tank. Thus, the oil in chamber B from the control valve pushes the check valve open to flow into chamber A, from which it passes through the counterbalance valve into the extending end of the cylinder to extend it.



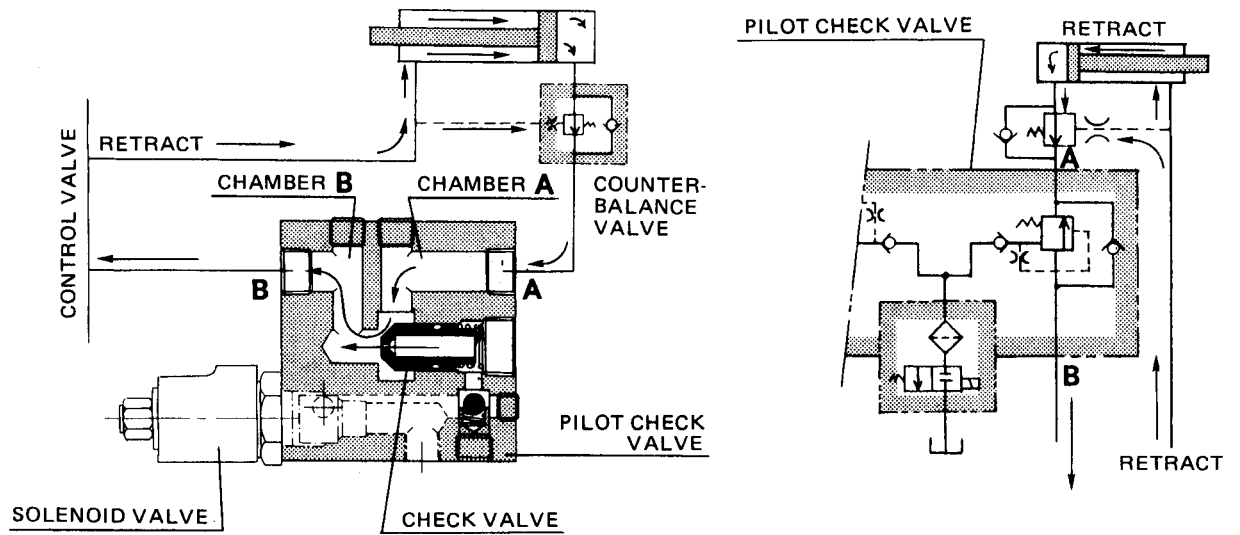
(5) Telescoping cylinder extension stop (In overwound state, overwind detector is OFF and solenoid valve ON.)

In an overwound state, the overwind detector turns off and the solenoid valve of the pilot check valve turns on. The operation of the solenoid valve closes the tank port so that the oil in chamber B from the control valve enters chamber C through the hole drilled in the check valve. Because the tank port is closed, chambers B and C become the same in pressure, and the check valve is pushed to the left due to the area difference between chambers B and C. Thus, the oil in chamber B is shut off by the check valve, and no longer flows into chamber A. This stops cylinder extending operation.



(6) Telescoping cylinder retracting operation

When the oil flows from the control valve into the retraction end of the cylinder, the oil in the cylinder pushing part flows via the counterbalance valve into chamber A of the pilot check valve to move the check valve to the right. Thus, it flows into chamber B and returns to the tank via the control valve to retract the cylinder.



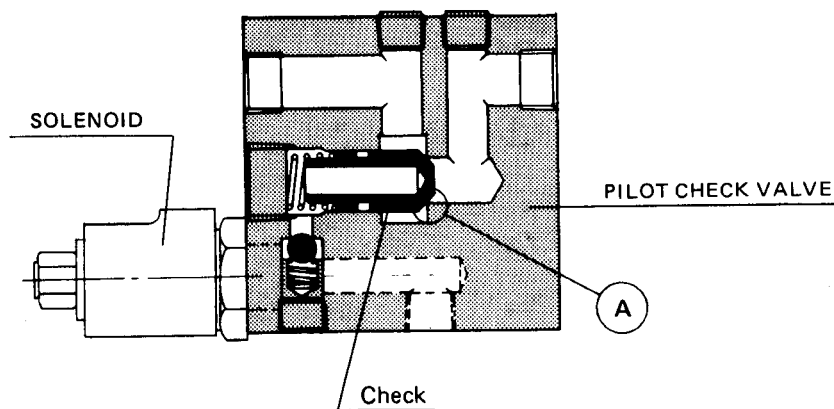
4) Troubleshooting

(1) Neither the hoist winds nor the telescoping cylinder extends in a normal operating state (not in an overwound state).

Suspected cause	Remedy
<ol style="list-style-type: none"> 1. No electric power 2. Wire is broken somewhere between overwind detector and solenoids, or cable is disconnected from connection terminal. 3. Overwind detector defective 4. Cord reel defective 5. Solenoid of pilot check valve defective 6. Slip ring defective 7. Relay defective 	<p>Check. Check cables and connection terminals.</p> <p>Check and repair or replace. Check and repair or replace. Check and repair or replace. Check and repair or replace. Check and repair or replace.</p>

(2) Either the hoist winds or the telescoping cylinder extends in an overwound state. Suspected cause:

- Check the pilot check valve for foreign matter that might be caught in part **A**.



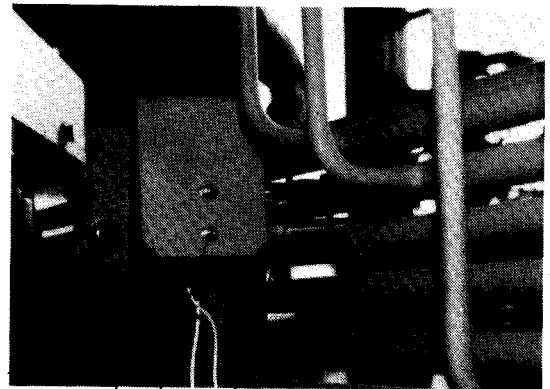
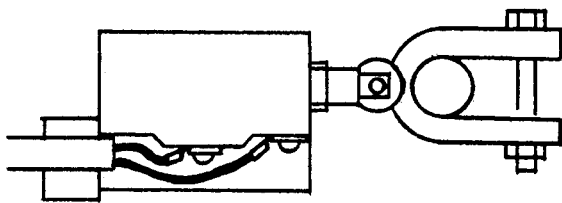
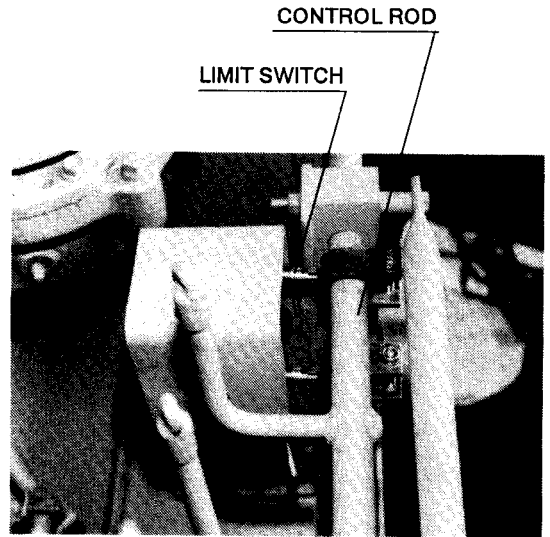
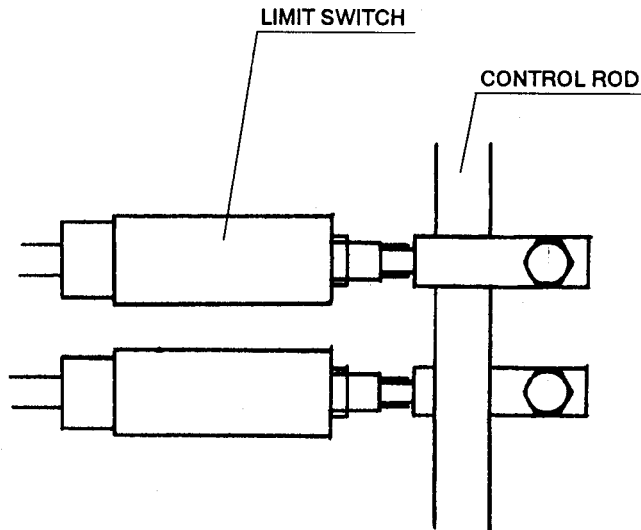
(3) Both the hoist winds and telescoping cylinder extends in an overwound state.

Suspected cause	Remedy
<ol style="list-style-type: none"> 1. No electric power 2. Wrong wiring of power supply, relay, or solenoid. 3. Overwind detector defective 4. Relay defective 5. Solenoid of pilot check valve defective 	<p>Check. Check Check and repair or replace. Check and repair or replace. Check and repair or replace.</p>

5) Alarm for Outrigger Extension/Retraction

When the outrigger control lever is moved for retraction, the control rods that connect the right and left push the limit switches to sound the alarm.

(1) Construction

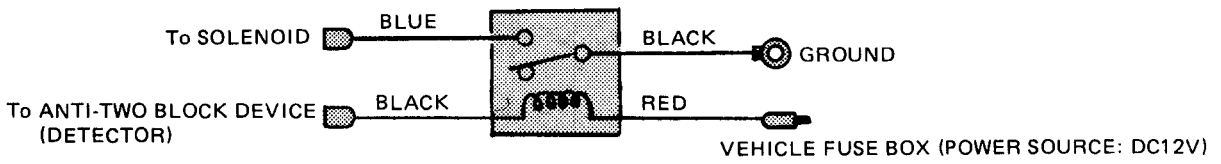
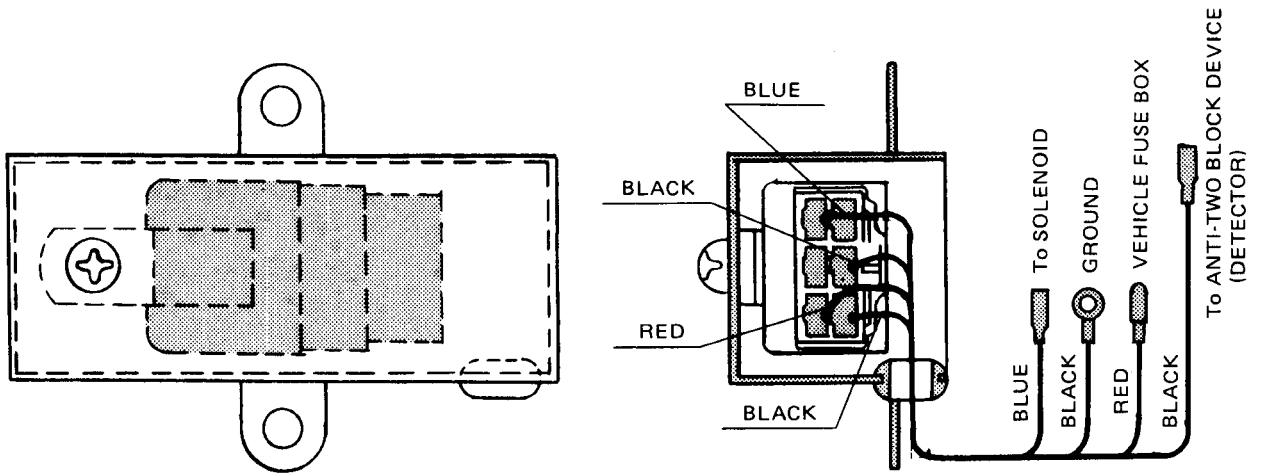


(2) Limit switch mounting and adjusting method

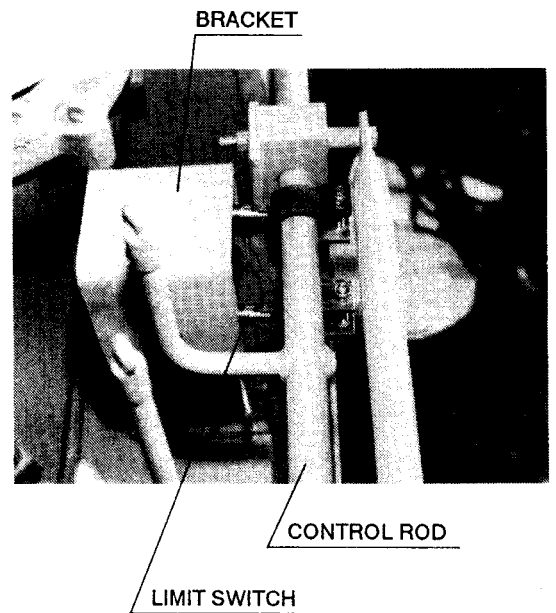
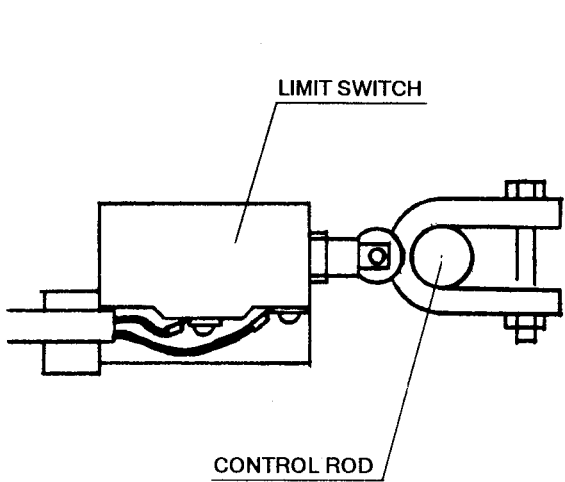
Adjust the limit switch and bracket position so that limit switch (A) turns on when the outrigger cylinders begin to extend or retract in response to outrigger lever movement. After adjustment, tighten the bolts.

6) Relay and Limit Switches

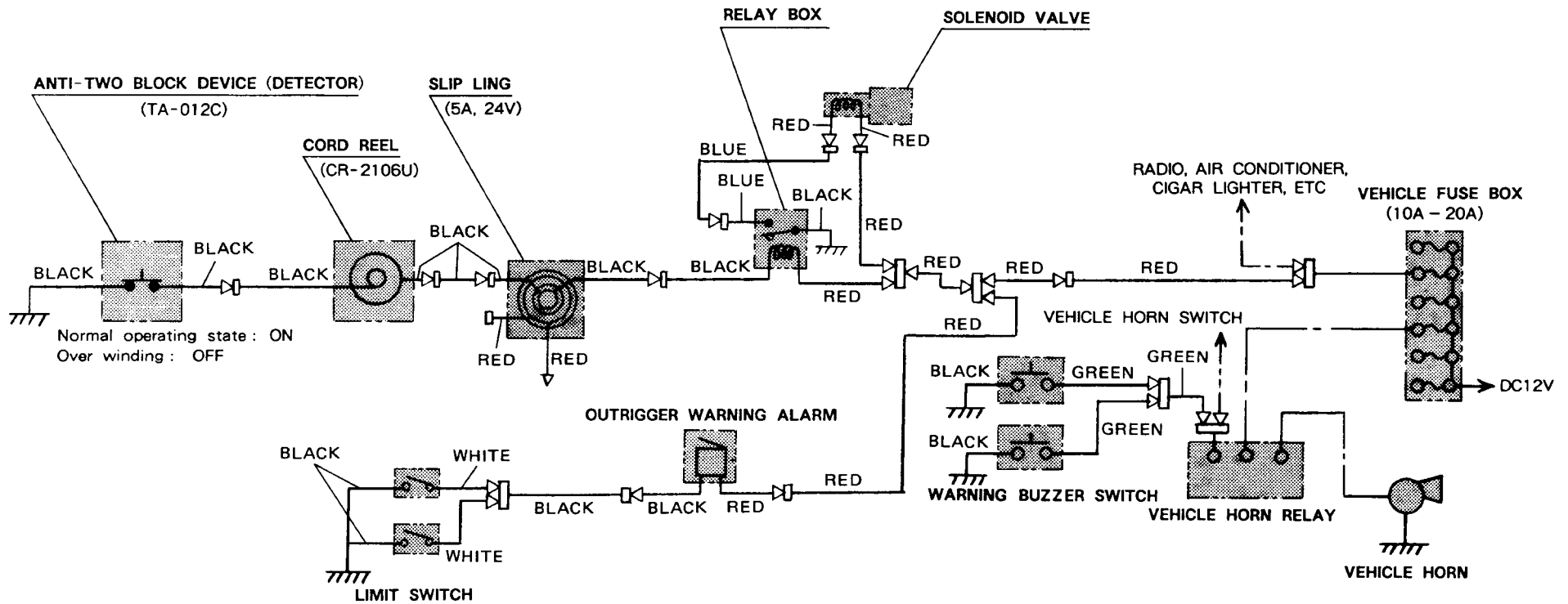
(1) Relay



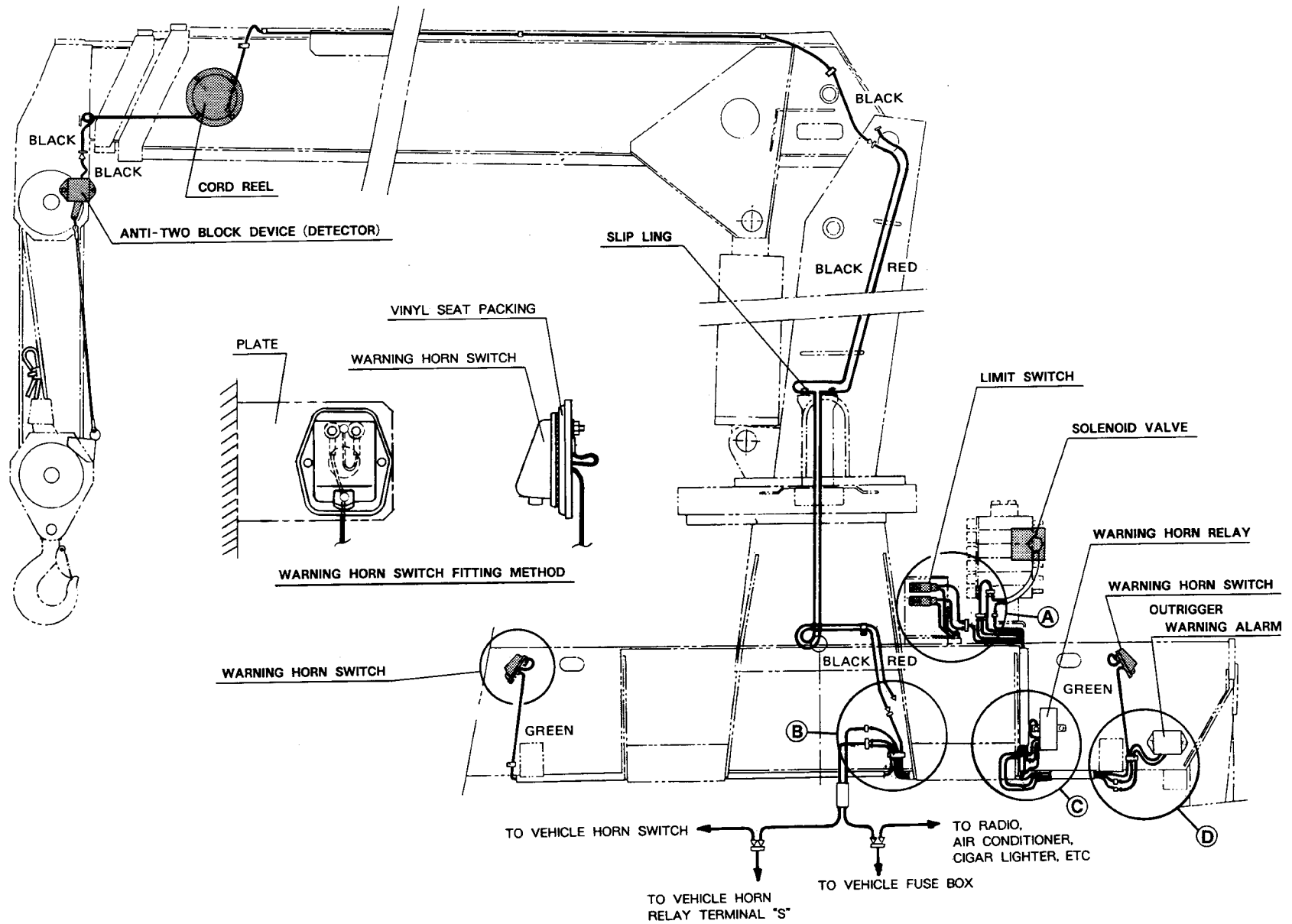
(2) Limit switches



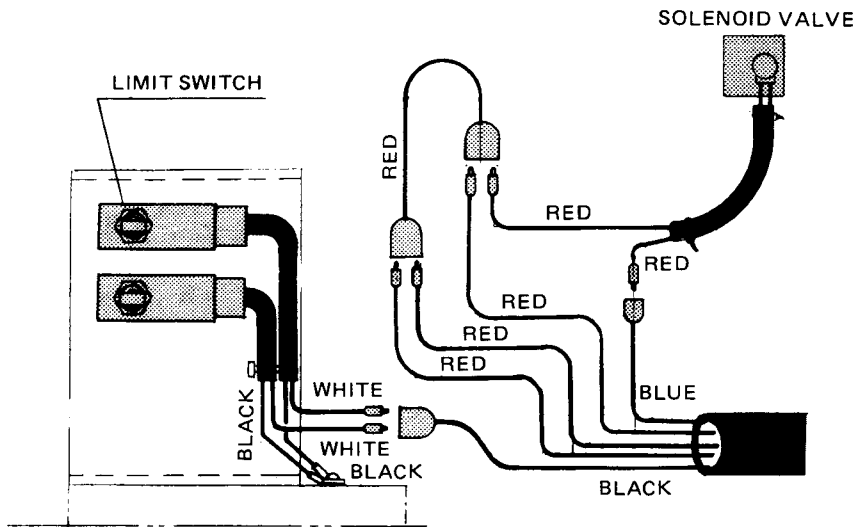
§17. ELECTRIC CIRCUIT DIAGRAM (NORMAL WALKING)



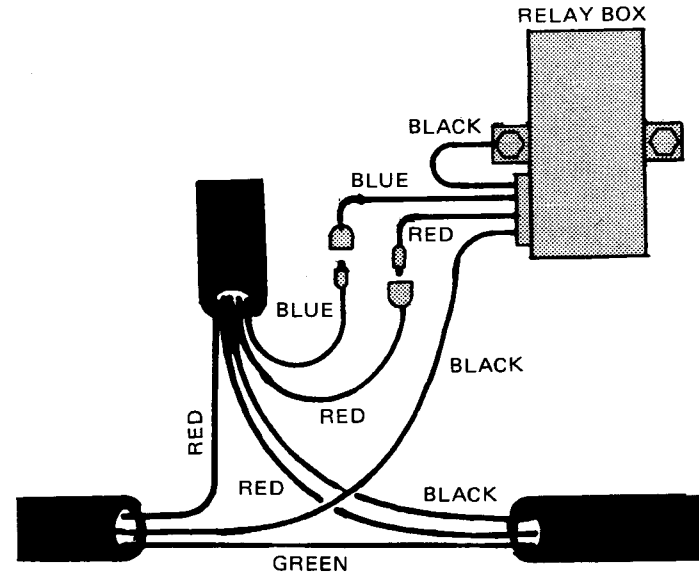
§18. ELECTRIC WIRING DIAGRAM



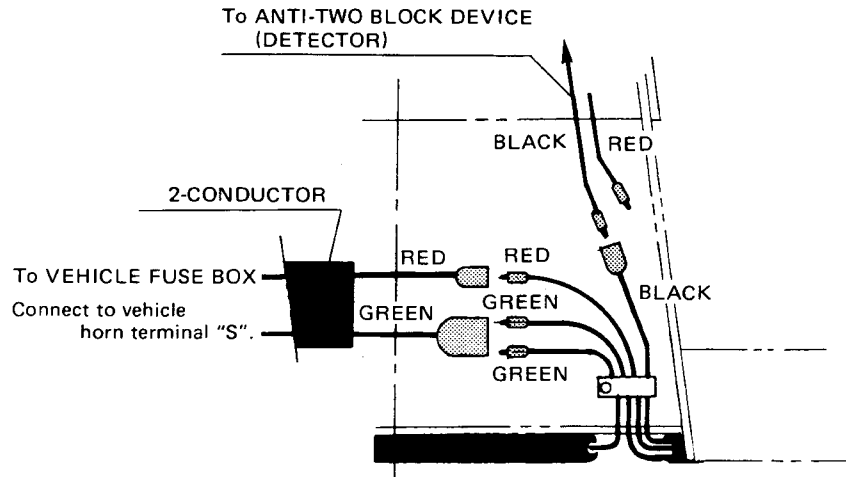
Enlarged View of Wiring in Parts (A), (B), (C), (D)



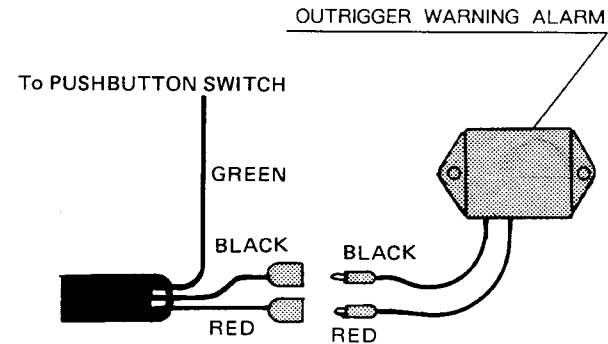
Enlarged View of Wiring in Parts (A)



Enlarged View of Wiring in Parts (C)

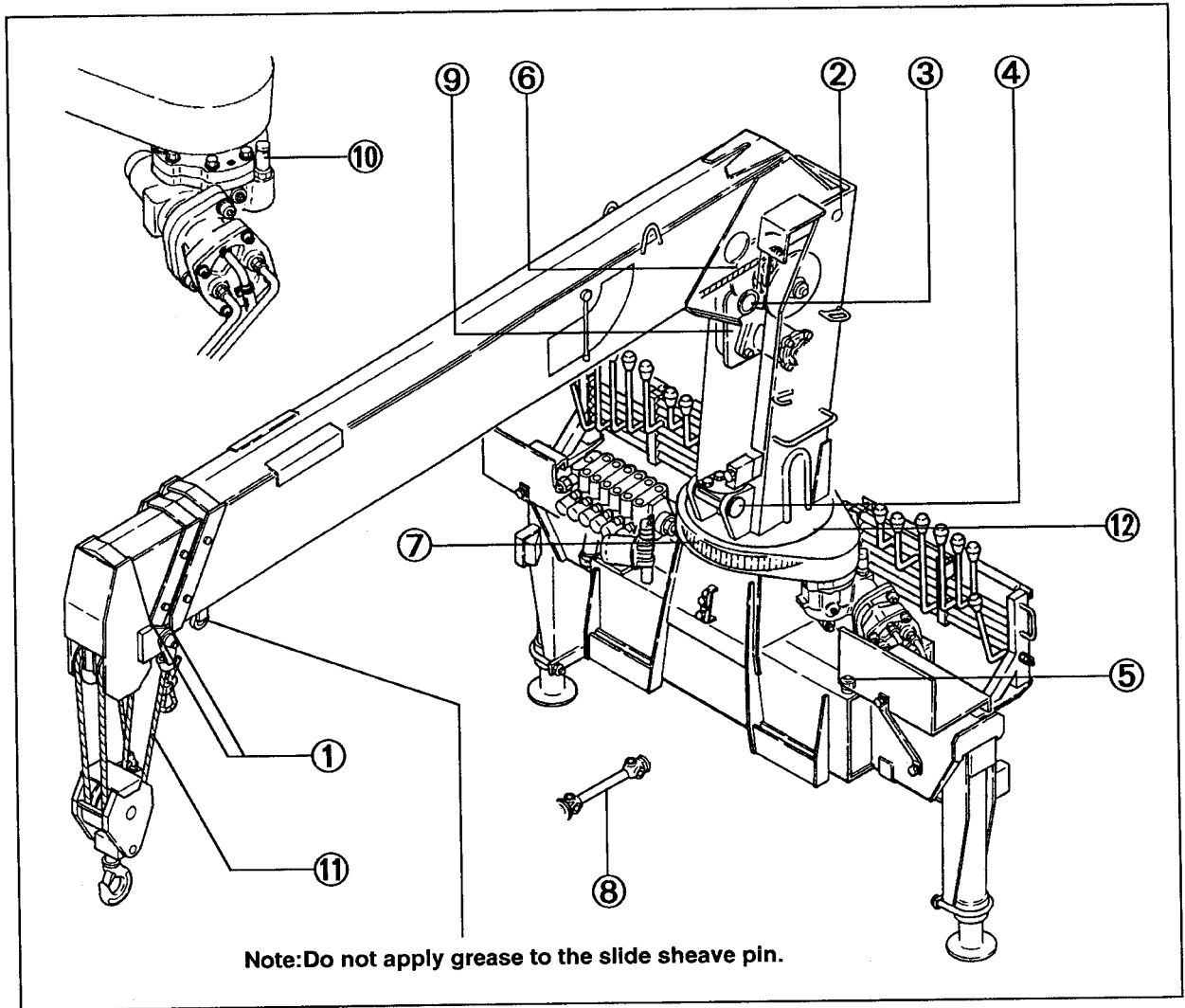


Enlarged View of Wiring in Parts (B)



Enlarged View of Wiring in Parts (D)

§19. LUBRICATION DIAGRAM

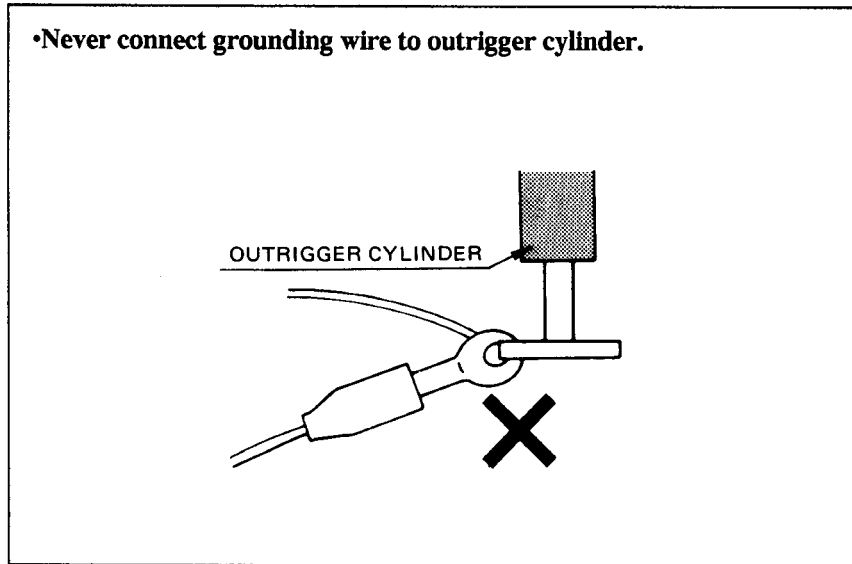


Period	Lubrication Point	No. of points	Lubricant	Method
Daily	① Boom slide plates (Boom ②, ③, 3-section boom)	2	Molybdenum grease	Brush
	② Boom foot pin	1	Chassis grease	Grease gun
	③ Derrick cylinder upper support pin	1	Chassis grease	Grease gun
	④ Derrick cylinder lower support pin	1	Chassis grease	Grease gun
	⑤ Oil tank(22-liter)	1	Hydraulic oil (Up to mid point on level)	
Weekly	⑥ Winch drum gear	1	Chassis grease	Grease gun
	⑦ Rotation gear teeth	1	Chassis grease	Brush
	⑧ Propeller shaft	3	Chassis grease	Grease gun
Monthly	⑨ Winch gear box(about 0.9 liter)	1	Gear oil	
	⑩ Swing gear box(about 0.45 liter)	1	Gear oil	
	⑪ Wire rope	1	Chassis grease	Brush
	⑫ Swing bearing	2	Chassis grease	Grease gun

§20. WELDING PRECAUTIONS

In case of doing welding work for some reason or other, do not connect the grounding wire to the outrigger cylinder.

Otherwise, current flows into the cylinder to spark, possibly causing damage to the rod and piston.



§21. OTHERS

1) Recommended Grease

(1) Chassis grease

Use NLGI No.2 grade for most temperature

Use NLGI No.1 grade for extremely low temperature

(2) Molybdenum grease

Use NLGI No. 2 grade.

Petroleum Maker	Brand
ESSO	Beacon Q2
MOBIL	Mobilplex Special
CALTEX	Molytex Grease EP 2
SHELL	Retinax A M

2) Recommended Hydraulic Oil

Use industrial type hydraulic oil:

ISO VG 46 for temperature above 32° F

ISO VG 22 for temperature below 32° F

Petroleum Maker	Brand	
	ISO VG 22	ISO VG 46
ESSO	Spinesso 22	Teresso 46
MOBIL	Mobil DTE 22	Mobil DTE Oil Medium
CALTEX	Spindura Oil 22	Rando Oil 46
SHELL	Shell Tellus Oil 22	Shell Tellus Oil 46

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