

# ***WATERTIGHT SLIDING DOOR USER MANUAL***

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## ***USER MANUAL***

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## ***ELECTRO-HYDRAULIC OPERATED WATERTIGHT SLIDING DOOR***

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## **1. INTRODUCTION**

### **1.1 GENERAL**

"BY Controls" watertight sliding doors are manufactured to your special requirements and to the SOLAS.

Every door is factory tested and adjusted.

On site installation is therefore limited to welding of the frame into the bulkhead and connection of the electric and hydraulics.

The door is approved by DET NORSKE VERITAS.

The BY Controls watertight sliding door, classIII, is an electric/hydraulic-operated sliding door.

#### **Standard Class III**

Each door has an electric driven hydraulic power pack complete with hydraulic accumulator, junction boxes for electric power, signals to/from Wheelhouse, alarm bell, flashing lights, hydraulic cylinder, hydraulic switches, solenoid valve and manual hydraulic hand pump with levers. The door has operating lever.

#### **The main principle of the door are:**

*Mimic panel / control panel* : A mimic panel is located at the control station(wheelhouse).

It gives door location, door status and has control switches.

*Remote control* : Each door can be closed from the control station. The door has a 5~10 second delay with local alarm before moving. The doors in remote closing mode may still be operated locally, however they will close automatically after use.

*Local operation* : Local operation can be operated from both sides of the door by the operating lever.

*Local manual operation* : In case of no electric or hydraulic power, it is possible to operate the door from both sides using the manual hand pump and operating lever.

## **1.2 SAFETY PRECAUTIONS**

### **1.2.1 Hydraulic System**

Installation and maintenance procedures must be performed by qualified personnel only.

For safety reasons, no pipe connections or components may be loosened while the hydraulic system is under pressure.

Always switch off the pumps and depressurize the accumulators before starting any work on the hydraulics. Never work with oily hands.

### **1.2.2 Electrical System**

Installation and maintenance procedures must be performed by qualified personnel only.

Use extreme care when troubleshooting or performing maintenance tasks on installation parts which use high voltages.

As a precautionary measure, use only one hand when servicing electrically live equipment.

Use caution when overriding interlocks to trouble shoot.

Remove all power from the system, before starting a maintenance procedure, to prevent unexpected door operation.

Always verify that power is shut-off before connecting or disconnecting cables.

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### **1.2.3 Warning**

Emergency closing, commanded from the control station, will automatically close all open doors with warning signals.

If power to both alarm and system fails at the same time, the open doors will automatically close without warning signals.

## **2. CHECKS**

Before starting up the operation of the door, the following points must be checked.

### **2.1 VISUAL CHECK**

Door system must be checked for fluid leaks, damage and dirt.

- Repair any leaks or damage and remove dirt.
- Checked for loose parts, pipes and fittings.
- Checked for damaged or stretched cables.

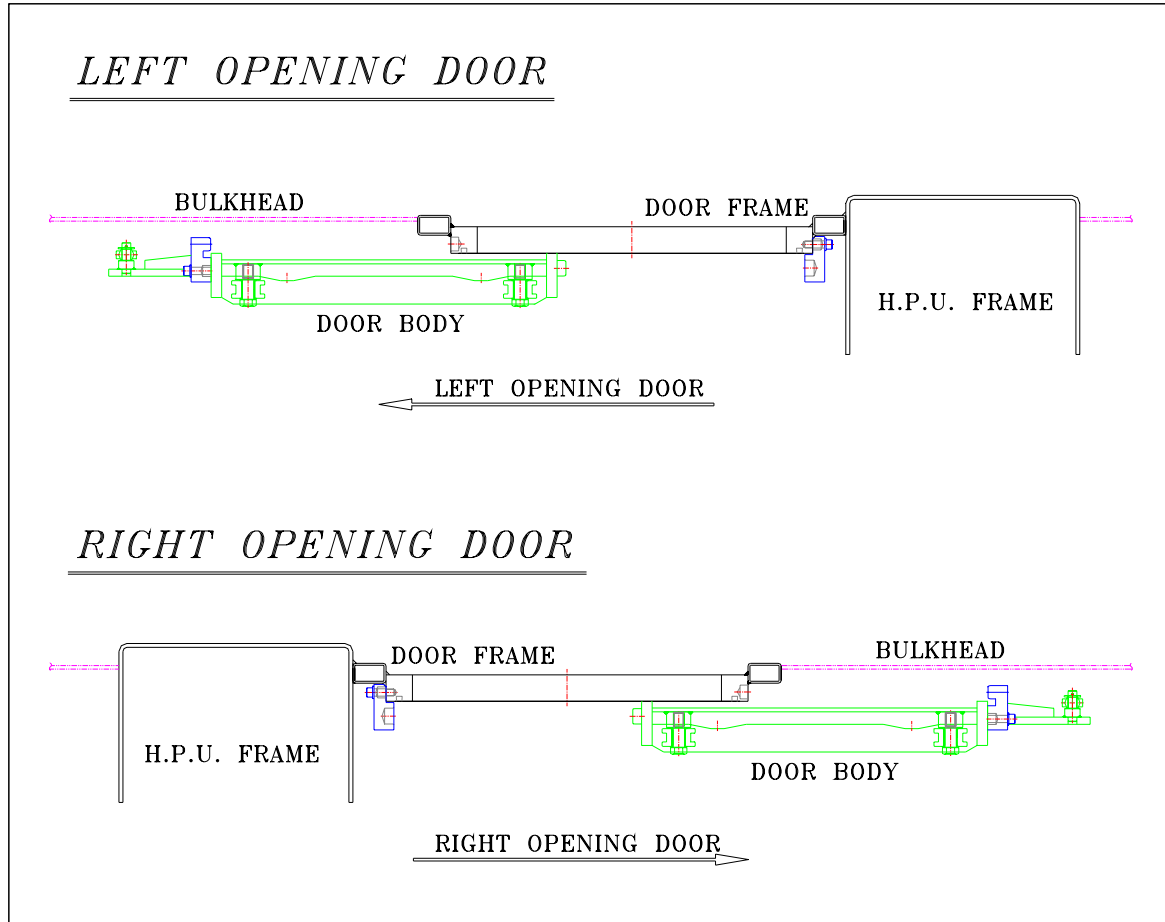
### **2.2 POWER PACK**

- Checked the fluid oil tank levels by the level inspection stick.
- The hydraulic pump is started by pushing on the switch in local control box and at the same time checked control the hydraulic pressure by the pressure gauge with bore hose.
- The pressure will rapidly increase up to pre-charged accumulator nitrogen pressure about 65bar and then continue to normal working pressure.
  - Relief valve : 210bar
  - Low-pressure switch for pump motor-on control : 150 bar
  - High-pressure switch for pump motor-off control : 180 bar
  - Low-pressure switch for alarm signal : 65bar
- Recommended hydraulic oil : Mineral oil ISO VG 32

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## **3. OPENING DIRECTION**





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## 4. OPERATION DESCRIPTION

### 4.1 OPERATION SYSTEM

OPEN		CLOSE	
R E M O T E  C O N T R O L	♣ IN THE WHEELHOUSE		
	Impossible	 Closing of one door : Normally the selector switch for door will be in "LOCAL CONTROL". By turning the switch to "DOOR CLOSED" position, which shall automatically close that, is open.	
L O C A L  C O N T R O L	♣ LOCAL MODE		
	When the lever is activated by turning approximately 20 degree towards door opening direction the door will go to open position.	When the lever is activated by turning approximately 20 degree towards door closing direction the door will go to close position.	
	 If the lever is turned to open and close position, the door will move until full open/close. The lever mounted with a return spring, so when operating power released, the lever return to the neutral position and the door will stop.		
	♣ CLOSED MODE		
	By activating the operating lever, the door shall be locally opened with automatic closure.	The door should be closed automatically upon release of the local control mechanism.	
	♣ EMERGENCY OPERATION		
Turning the lever towards door opening and simultaneously activating the hand pump can open the door when the door is closed.		When the door is opened that it can be closed by activating the hand pump	

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## 4.2 INDICATION & ALARM SYSTEM

Status		Local area	Wheelhouse area	
<b>♣ In the case of remote operating</b>				
11	Closed by power	shall sound 5~10 seconds before the door begins to move and shall continue sounding until the door is completely closed	Red lamp flashing	
<b>♣ In the case of local operating</b>				
21	Closed by power	Shall sound only when the door is moving	Red lamp flashing	
22	Opened by power	Shall sound only when the door is moving	Red lamp flashing	
23	Closed by hand pump	Shall sound only when the door is moving	Red lamp flashing	
24	Opened by hand pump	Shall sound only when the door is moving	Red lamp flashing	
<b>♣ Door open/close status</b>				
31	Open	Identification at sight	Red lamp	
32	Close	Identification at sight	Green lamp	
<b>♣ System failure status</b>				
41	Loss of power	Red lamp on (Power availability)	Red lamp & alarm	
42	Low pressure	Red lamp on	Red lamp & alarm	
43	Low level	Red lamp on	Red lamp & alarm	

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## **5. INSPECTION AND MAINTENANCE**

### **5.1 INSPECTION**

The hydraulic equipment has been designed for a long trouble free service life.

It requires very little maintenance. Nevertheless maintenance is essential in order to maintain trouble free operation because practical experience has shown that up to 80% of faults and damage are due to contamination, lack of servicing and incorrect choice of fluid.

By remaining alert and by paying close attention to detail it is possible to detect faults in their very early stages and do prevent them from developing into more serious malfunctions. This is particularly true during the early stages but also remains true throughout the service life of the equipment.

A constant look out must be kept for:

- external leak,
- dirt,
- damage, especially to hoses and pipes,
- unusual noises from pumps, motors, couplings, mountings etc.
- proper functioning of instruments.

Special attention must be given to the cylinder rods. Cylinder rod can be made of carbon steel or stainless steel and be protected by chrome layer or nickel chrome layers. Even the thickest protection layers can be affected by a corrosive atmosphere. It is therefore essential to either protect the protruding part of the rod retains a thin hydraulic oil film in that case. The intervals for retraction of piston rods depend on the circumstances and may vary from daily (in coastal areas and marine applications) to weekly.

If greases or other corrosion inhibitors are used the period may vary from monthly to each 6 months depending on the type of corrosion inhibitor used.(Please note that some types of corrosion inhibitor may damage seals and/or react with hydraulic fluid.)

**Use only recommended oil, see chapt. 8 Lubricant and oil chart.**

### **5.2 PREVENTIVE MAINTENANCE**

#### **5.2.1 Hydraulic fluid**

##### **Fluid level**

Continuous checking is necessary because, as the volume of the fluid in the system falls below the minimum mark this may cause a rise in the operating temperature, accumulation of undissolved air and pump failure due to cavitation.

##### **Fluid temperature**

The operating temperature is normally between 40°C and 90°C. A maximum temperature of 60°C is recommended for mineral oil based fluids because, higher temperatures cause aging of the fluid and shorten the life of seals and hoses.



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## **Fluid condition**

The aging of the fluid depends on a number of operating parameters such as temperature, pressure, air humidity, dirty environment, etc.

The aging of the fluid can be judged from a simple visual examination.

<b>Appearance</b>	<b>Contaminants</b>	<b>Possible Causes</b>
Dark in color	Product of oxidation	Overheating, insufficient fluid changes, possible ingress of other fluid
Milkiness	Water or foam	Ingress of water or air
Water separation	Water	Ingress of water, e.g. coolant
Air bubbles	Air	Ingress of air, e.g. due to low fluid level or leaky suction
Floating or sunken contaminants	Solids	Wear, dirt, aging
Smell of burnt oil	Product of aging	Overheating

## **5.2.2 Filter replacement**

By far the largest number of premature failures in hydraulic systems are due to contaminated fluid. The task of the filters is to keep contamination within limits, i.e. limit the size and concentration of the dirt particles in order to protect the equipment against excessive wear.

## **Filters without blocking indicators**

There must be changed for the first time immediately after the initial commissioning. subsequent changes are advised at monthly to six-monthly intervals depending on the operation conditions.

## **Filters with blocking indicators**

These are monitored continuously. The check must be made daily when working temperature has been reached.

## **Breather filter**

These filter the air which flows in and out the fluid reservoir as the level fluctuates. The frequency of inspection and element changing or cleaning depends on the condition of the environment.

## **5.2.3 Painting**

All corrodible parts of the door and the power pack are covered by a protective paint. Only if necessary these parts may be re-painted preferably in the original colors. Non-painted system parts or components such as air bleed plugs, pumps, directional valves, proximity switches, control/indication boxes and panels must not be painted.

Hand operated directional valves are supplied non-painted and must be protected against corrosion after assembly of the system. Be aware that paint might cause system failure and always obstructs an easy disassembly of system parts.

When painting the surroundings of the watertight hydraulic door or parts of the hydraulic system, the hydraulic door and the parts of the hydraulic system must be covered with protective covering.

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## **5.3 INSPECTION AND SERVICE INTERVALS**

### **Daily and (on ships) before departure**

- Check the free passage of the door and remove obstacles that door from closing.

### **Weekly**

- Check the hydraulic fluid level.  
Power units must be discharged first and filled up if necessary.
- Check for damage of the sealing surface of the door.
- Check the wedges and blocking cones.  
Lubricate these once again if necessary.
- Clean the rails.

### **Monthly**

- Check the pressure of the power unit.
- Check the operation of the complete system, hand pump.
- Check the operation of the audible and visual alarms.

### **Every two months**

- Check the setting of the pressure control valves, flow control valve and signaling devices such as pressure switches, proximity switches etc.

### **Hydraulic fluid filter**

- 1st replacement of the filter after approx. 50 working hours or max. 1 year.
- 2nd, 3rd, 4th, etc. replacement of the filter after 250 working hours or max. 4 years.

### **Hydraulic fluid**

- Renew the hydraulic fluid every 2 years

### **Accumulator**

After installation of a new unit or following repairs the initial pressure must be tested as follows:

- At least once during the first week so that any gas losses can be remedied.
- A second check must be carried out approximately 3 months later.
- If no gas losses are evident, a six month check is sufficient.  
At heavy duty applications a monthly check is recommended.

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## **6. TROUBLE SHOOTING**

<b>Fault</b>	<b>Possible Cause</b>	<b>Check</b>	<b>Remedy</b>
Door stuck	Mechanical failure	Door sealing sliding parts for obstructions(damage)	Remove obstructions, Repair damage.
Pump motor of the Power pack runs but Produces no hydraulic Pressure	Pump direction reversed	Direction of rotation of the motor	Change the electric power connections of the Pump motor
	No or too little hydraulic fluid	Fluid level of the Power pack	Stop the motor immediately and refill hydraulic tank
		Hydraulic system for leaks	Tighten leaky connectors and replace damaged part. Refill the hydraulic tank
	Hydraulic fluid is circulated	Safety valve setting (210 bar)	Adjust the valve setting
Door moves too slowly or not at all when the hand pump is operated.	No or too little hydraulic in the system	Hydraulic tank fluid level and check for leaks	Tighten leaky connectors and replace damaged part. Refill the hydraulic tank
	No or too little hydraulic system pressure	Hand pump relief valve (must be tightened)	Tighten relief valve
		Hand pump operation (both operation directions must produce pressure)	Remove and flush the pump
		Return filter for Contamination (clogging indicator if present)	Clean or replace filter element
		Pipelines for damage	Replace damaged pipeline

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Fault	Possible Cause	Check	Remedy
Pump motor of Power pack does not run	Power supply not available	Fuses and main switch of the supply panel	Replace fuses Switch-on main switch
	Power failure detected by the monitoring circuit	Fuses, main switches, circuit breakers of the starter box	Replace fuses Switch-on main switch, replace defective circuit Breaker
	Electric connection is interrupted	Low-pressure switch (150 bar) on the power pack	Replace pressure switch
		terminals	Tighten loose terminals
		wiring	Replace defective wiring
Pump motor of the Power pack does not stop	Control circuit of the Pump motor is interrupted	High pressure switch Setting(180 bar) and operation	Replace pressure switch
		Operation of control circuit	Replace defective parts
The system gives no alarm when the motor does not start and the system pressure drops below 150 bar.		Low pressure switch setting (150 bar) operation	Replace pressure switch
Door is open but solenoid of directional valve is not de-energized		“DOOR OPEN” proximity switch operation	Replace proximity switch or adjust distance setting.

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Fault	Possible Cause	Check	Remedy
Door stays open as a Remote “DOOR CLOSE” or “CENTRAL CLOSE” command is given	Remote control circuit interrupted.	“DOOR CLOSE” proximity switch operation	Replace proximity switch or adjust distance setting
		Operation of control circuit	Replace defective parts
		Starter box	Switch-on main switches
		Terminals	Tighten loose connections
		wiring	Replace defective wiring
No “DOOR OPEN” or “DOOR CLOSED” indication	Power supply not available	Main switch indicator circuit	Switch-on main switch
	Indicator defective	Lamp	Replace defective lamp
	Electrical connection interrupted	Proximity switches	Replace defective switch
		Terminals	Tighten terminal connections
		Wiring	Replace defective wiring
No bell signal	Bell defective	bell	Replace defective bell
	Electrical connection interrupted	“DOOR CLOSE” or “CENTRAL CLOSE” proximity switch	Replace defective switch
		Terminals	Tighten terminal connections
		Wiring	Replace defective wiring

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<b>Fault</b>	<b>Possible Cause</b>	<b>Check</b>	<b>Remedy</b>
All lights on remote panel light up (lamp test pushbutton not operated)	One of the indicator signals is applied to all indicators by way of the lamp test circuit	Diodes in terminals For a short-circuit	Replace defective terminal
Buzzer of remote panel fails	Power supply	Fuses	Replace defective fuses
		Control circuit in Remote panel	Replace defective parts
		Terminals	Tighten loose connections
		Wiring	Replace defective wiring
	Buzzer defective	buzzer	Replace defective buzzer

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## **7. DISASSEMBLY, REASSEMBLY AND REPAIR**

### **7.1 REMOVAL AND REPLACEMENT OF A HAND PUMP**

Remove the local hand pump in the following way:

- Drain the hydraulic tank, open the drain valve of the system or empty the tank using a suction-drain set.
- Remove the 2 hydraulic pipelines from the pump and seal them (preferably with special plastic sealing caps).
- Remove the 6 bolts which connect the pump to its mounting.

Replace the pump in the following way:

- Place the pump and connect the pump to its mounting using the 6 bolts.
- Remove the seals from the pipelines and reconnect the pipelines to the pump.
- Tighten the relief valve of the pump.(If any)
- Make sure the system drain is closed and refill the hydraulic tank with fresh hydraulic fluid.

### **7.2 REMOVAL AND REPLACEMENT OF A HYDRAULIC MANIFOLD**

Remove the valve in the following way:

- Drain the hydraulic tank
- Remove the hydraulic pipelines from the valve and seal them.
- Remove the control lever on the opposite side of the bulkhead and pull it out the bulkhead feed-through.
- Remove the bolts which connect the valve block to it's mounting plate to the seat on the power pack.
- Withdraw the valve block from the mounting.

Replace the valve in the following way:

- Connect the valve block to the mounting using the bolts the power pack seat.
- Push the valve control axis through the relevant bulkhead feed-through.
- Replace the control lever on the opposite side of the bulkhead.
- Remove the seals from the pipelines and reconnect the pipelines to the valve.
- Make sure the system drain is closed and refill the hydraulic tank with fresh hydraulic fluid.
- Bleed the system.

### **7.3 REMOVAL AND REPLACEMENT OF A HYDRAULIC CYLINDER**

Remove the cylinder of the door, a double cylinder operated door as follows:

- Place the door in closed or opened position.
- Remove the hydraulic pressure and drain the relevant system part.
- Disconnect the two pipeline connections seal them .
- Loosen the socket head screws in the cylinder supports.
- Dismounts the axles, which connects the ball joint eyes of cylinder to the lug for cylinder supports, carefully.
- Remove the ball joint eyes from the supports.

Replace the cylinder as follows:

- Replace the ball joint eyes in the supports.
- Make sure the socket head screws in the supports do not protrude in the supports.
- Replace the mounting axles by knocking it carefully the supports and ball joint eyes.
- Tighten the socket head screws again.
- Remove the seals from the pipelines and reconnect the pipelines to the cylinder.
- Make sure the system drain is closed and refill the hydraulic tank with fresh hydraulic fluid.
- Bleed the system using the cylinder air bleeding plugs.

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## **7.4 REMOVAL AND REPLACEMENT OF A DOOR SEAL**

Remove the seal in the following way:

- Place the door in the open position
- Disconnect the cylinder from the door mounting and move the door further open
- Pull the seal out from its groove
- Remove all remainders of the seal from the groove carefully.

Replace the seal by a new one using the correct seal material as follows:

- Smear the groove at the straight ends with acid free vase line(left, right, upper, lower side).
- Smear the groove at the edges with a little silicone paste.
- Press a new seal into the groove by hand (begin and ends in the middle of left or right groove).
- Cut the seal when it is placed in the groove at approximate 1,5 cm longer.
- Put some silicone paste at both ends and push the ends against each other into the groove.
- Flatten the seal by smoothing the seal.
- Be aware that the seal is everywhere at a same height.
- Grease the seal with acid free vase line when the silicone paste is dry.
- Move the door back in position to be able to reconnect the cylinder to the mounting.

## **7.5 REMOVAL AND REPLACEMENT OF AN ACCUMULATOR**

Remove and dismantle the accumulator in the following way:

- Isolate the accumulator from the hydraulic system or if this is not possible remove the hydraulic pressure and drain the system (part).
- Remove the hydraulic pipeline connection.
- Remove the accumulator from the bulkhead and place it in a horizontal vice.
- Remove the protection caps.
- Discharge gas from the bladder by means of the PC/unit.
- Dismantle the gas fill valve.

**\* Only at this point the liquid connection can be dismantled:**

- Remove the bleed screw.
- Remove the ring nut and the spacer ring.
- Push the fluid port body into the vessel and remove the gaskets.
- Remove by bending, the rubber coated retraining ring.
- Remove the fluid port body.
- Remove the nut holding the gas valve and name plate.
- Remove the bladder from the liquid side by slightly twisting.

Assemble and place the accumulator as follows:

**\* Before assembly of the accumulator, check:**

- The bladder is not damaged, worn or perished,
- The poppet valve slides freely and that the spring is undamaged.
- Gaskets and seals are not worn.
- The interior of the accumulator-body has no cracks or signs of failure.

### **Bladder gas valve assembly**

It is possible to fit a new bladder to the old gas valve (or vice-versa)

In this case take care to ensure that the edge of the mouth piece makes a perfect fit with the valve seat.

Put the valve into place, by means of hand pressure on the rubber coated washer until it is no longer possible to remove unless force is used.

The bladder can now be inserted into the accumulator.



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Assemble the accumulator in the following way:

- Insert the bladder.
- Mount the nameplate and nut for the gas valve body.
- Tighten the nut holding the gas valve body with a spanner.
- Insert the liquid valve and the rubber coated retaining ring.
- Tighten the ring nut making sure that the assembly is centrally located.
- Fit the bleed screw and gasket. Pour a small amount of liquid into the accumulator to lubricate.
- Mount the gas-fill valve and charge according to the instructions.
- Tighten again the gas valve nut.
- Mount the accumulator back on the bulkhead.
- Reconnect the hydraulic pipeline.
- Refill the hydraulic system with fresh hydraulic fluid.
- Bleed the system.

## **7.6 REMOVAL AND REPLACEMENT OF A PRESSURE SWITCH**

Remove a pressure switch in the following way:

- Disconnect the mains of the starter box.
- Withdraw the connector from the switch.
- Remove the hydraulic pressure from the system.
- Unscrew the pressure switch from its mounting using a suitable wrench.

Replace the pressure switch using the reverse working order.

Make sure that the setting of a new pressure switch is correct according to its function.

Pre-set the pressure switch by removing the connector and by turning the screw in the center of the electrical connector of the switch behind the cap.

## **7.7 REMOVAL AND REPLACEMENT OF A PROXIMITY SWITCH**

Remove the switch in the following way:

- Remove the nut, which hold the proximity switch in its seat.

Before replacing the proximity switch by a new one, check if the correct switch type is used.

Replace the switch using the reverse working order.

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## **8. LUBRICANT AND OIL CHART**

### **8.1 LUBRICANT MECHANICAL PART**

Use universal grease, Adjusting bolt, jointing pin

### **8.2 LUBRICANT RUBBER PACKING**

Clean with white spirit.  
Lubricant with silicone grease.

### **8.3 RECOMMENDED HYDRAULIC OIL**

Mineral oil ISO VG 32(To be changed every 2 years)

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## **9. LIST OF SPARE PARTS AND TOOL (FOR WATERTIGHT SLIDING DOOR)**

NO.	ITEM	SPECIFICATION	Q'TY/SHIP	REMARK
			SPARE	
1	Packing seal (for DOOR)	WTSE 378A Reference	1	BY
2	Door cylinder seal kit	WTSE 378A Reference	1 set	MERKEL & NOK
3	Local hand pump seal kit	WTSE 378A Reference	1 set	NOK
4	O-ring kit	WTSE 378A Reference	1 set	NOK
5	Proximity switch	E2E-X10ME1	1	OMRON
6	Relay	MY4N	1	OMRON
7	Accumulator N2 gas Charging kit	-	1	OLEAR

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## **10. WORLDWIDE SERVICE NETWORK**

Korea
Contact person : H.W. ANG / Sales Manager
Phone : 82-55-345-6110/4
Fax : 82-55-345-6115
E-mail : <a href="mailto:by@bycontrols.com">by@bycontrols.com</a>
Http : <a href="http://www.bycontrols.com">//www.bycontrols.com</a>

**All major spare parts are in our stock and,  
BYControls can dispatch spare parts and service engineer immediately on buyer's request**

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### **11. EQUIPMENT INFORMATION**

NO	COMPONENT NAME	MAKER	MODEL	REMARK	
1	ELE. MOTOR	HYOSUNG	0.75kw(1HP) Insulation : F	IP67	
2	HYD. PUMP	SHIMADZU	YP10-0.8A2H2-R		
3	CHECK VALVE	COMATROL	RC041/0.5-00		
4	ACCUMULATOR	OLEAR	SB330-10A1		
5	PRESSURE SWITCH	WIKA	871.24.510	IP67	
6	SHUT OFF V/V	COMATROL	REB04/EN-00		
7	RELIEF V/V	COMATROL	VEN04/EN-3-00		
8	FLOW CONTROL V/V	COMATROL	REB04/EN-00		
9	DIRECTIONAL V/V	HAWE	K3-1		
10	SOLENOID V/V	COMATROL	EVH06/D5(DC24)	IP67	
11	SOLENOID V/V	COMATROL	EVH06/A5(DC24)		
12	LEVEL SWITCH	COMATROL	LM1CFA380SA	IP67	
13	PIPE CONNECTOR	HYLOK	MALE STUD COUPLING	ABS, DNV	
14	PROXIMITY SWITCH	OMRON	E2E-X10ME1	IP67	
15	BELL	DAEYANG	φ 120	IP56	
16	LOCAL CONTROL BOX	FIBOX	SOLID PC/ABS	IP67	
17	RELAY	HONEY WELL	MY4N	UL,CE,CSA	
18	LOCAL LAMP (LOW PRESSURE)	EAO	SERIES 14	IP67	
19	MAGNETIC CONDUCTOR	HONEY WELL	HMC 10N	CE	
	*** THE END ***				