

INSTRUCTION MANUAL

FOR

OILY BILGE SEPARATOR

TYPE : GRS-10EB (1.0m³/hr)

GRS-20EB (2.0m³/hr)

GRS-25EB (2.5m³/hr)

GRS-50EB (5.0m³/hr)

GRS-100EB (10.0m³/hr)



SAFETY INSTRUCTIONS



WARNING FOR THE SAFETY USE

Users must comply with the safety warnings and all other instructions contained in this manual.

Keep this manual available for all people assigned to this equipment.

For personal safety and proper operation of this equipment, read all instructions carefully.

- Read and understand these warnings to prevent injuries to yourself and bystanders.
- Refer to equipment use, maintenance and trouble shooting sections for additional information.



The exclamation point within an equilateral triangle is intended to alert user to the presence of important operating and maintenance instructions.



WARNING

Means, potential risk of death or serious injury, if not followed.



CAUTION

Means, potential risk may cause minor or moderate injuries, if not followed.



WARNING

There is danger of injury by failing, abnormal movements inside the control panel. Other persons than specified or a layman should never inspect or repair. Please never modify the apparatus.

If a heating device has been attached, do not touch heated parts or the steam pipe directly.

Will cause a burns. Be sure to stop the device after operating the oily water separator.

Pay attention to on overheating, overheated separator can produce flammable gas.

1. *It is prohibited that alien substances and discharged water from other tanks flow into the vessel's bilge holding tank (ex.: chemicals, surfactant detergent, soot, sewage, sludge, grey water, mud, rust particles, alien substances and water containing sulfur etc.)*

In case that these substances flow into the bilge holding tank, it may corrode inside of the tank, damage and dirty the filter, and increase PPM. This causes troubles in the oily water separator's normal operation, therefore please ensure the above-mentioned.

2. The coalescer should be serviced from 12 months to 18 months based on an hour operation per day. It is required that to place a strainer on the suction line to prevent dirt and sludge entering the separator.
3. Let go floating oil on the upper part to separated oil tank, not pass through the separator.
It would be lengthen the life span of filters.
4. Operate equipment after the oily water separator has been filled with fresh water,
5. Keep fire away from the coated film. The anti-corrosion epoxy coating on the inside of the oily water separator. The coated film will be damaged, and the main body will become corroded.
6. Detergent may affect separation ability and treatment capacity.
7. When the system stops, open the manual vent and check inside. If oil remains, remove it and take separator custody.
8. Be sure to discharge the collected separated oil. Frequently check the effluent to see the performance of the separator and verify that the treated water is not contaminated by oil. If the effluent is found to be contaminated, immediately stop the operation and take preventive measures according to the instruction manual.



Caution for Long term Preservation

1. FIRE

- This equipment is weak against fire because outside of the equipment is painted.
- If the paint is damaged, lifetime of the equipment can be shorten.

2. IMPACT

- All kinds of sensors and panel can be damaged by excessive impact while the equipment is being installed or moved.
- Particularly, inside of the bilge alarm is so delicate and glass tube inside of sensing module can be damaged.

3. OUTDOOR PRESERVATION

- When preserve outdoor, malfunction of electric apparatus can be caused by dust or rainfall.
- Avoid humid place, malfunction can be caused by humidity.

4. WHEN INSTALLING

- This equipment should be installed by designated workers.
Electric apparatus should be installed by designated workers too.

5. WHEN MOVING

- Check the weight of the equipment before moving and use proper vehicles which is enough to move the equipment safely.

6. FREEZE AND BURST

- Drain out the water inside of the sample tube(glass) of the sensing unit for 15ppm bilge alarm to prevent breakage at cold area or winter season.

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■ OILY BILGE SEPARATOR

1. THE GENERAL

GRS-EB Type Oily bilge separators separate oil and water from bilge by the difference of the specific gravity between oil and water. This equipment consists of two stages.

1st chamber(Pre-Separator Unit) treats mainly heavy oil particles and the 2nd chamber(Emulsion Treatment Unit) is configured to treat small oil particles and discharging the final discharged water to less than 5/15 ppm.

The system operation is controlled by the oily bilge separator control panel and can be operated automatically or manually depending on the operation method chosen. The oil level detector and solenoid valves installed in the system can automatically control each valve and operate them continuously.

2. DESIGN

2.1 This equipment meets the 15ppm requirements of IMO Resolution MEPC. 107(49) and the Type-Approval Certificate in accordance with IMO Resolution MEPC. 107(49)

2.2 Specified conditions

NO	TYPE	CAPACITY (m ³ /hr)	TYPE APPROVAL
			CERTIFICATE No.
1	GRS-02EB / 03EB / 05EB	0.2 / 0.3 / 0.5	BS-42 / BS-43 / BS-44
2	GRS-10EB / 20EB / 25EB	1.0 / 2.0 / 2.5	BS-45 / BS-46 / BS-47
3	GRS-50EB / 100EB	5.0 / 10.0	BS-48 / BS-49

3. SPECIAL FEATURE

3.1 The inside of this equipment is painted with tar free epoxy paint for anti-corrosion.

(The pipes are hot-dip galvanized.)

3.2 This equipment uses the hemispheric round plate to guarantee proper function despite the ship's vibration, rolling, waving etc.

3.3 Pallring and urethane coalescer material improve the separation efficiency and are semi-permanent.

3.4 Coalescer filter life is extended and the cost of maintenance is curtailed by interior cleaning function by using the electric control circuit for backwashing.

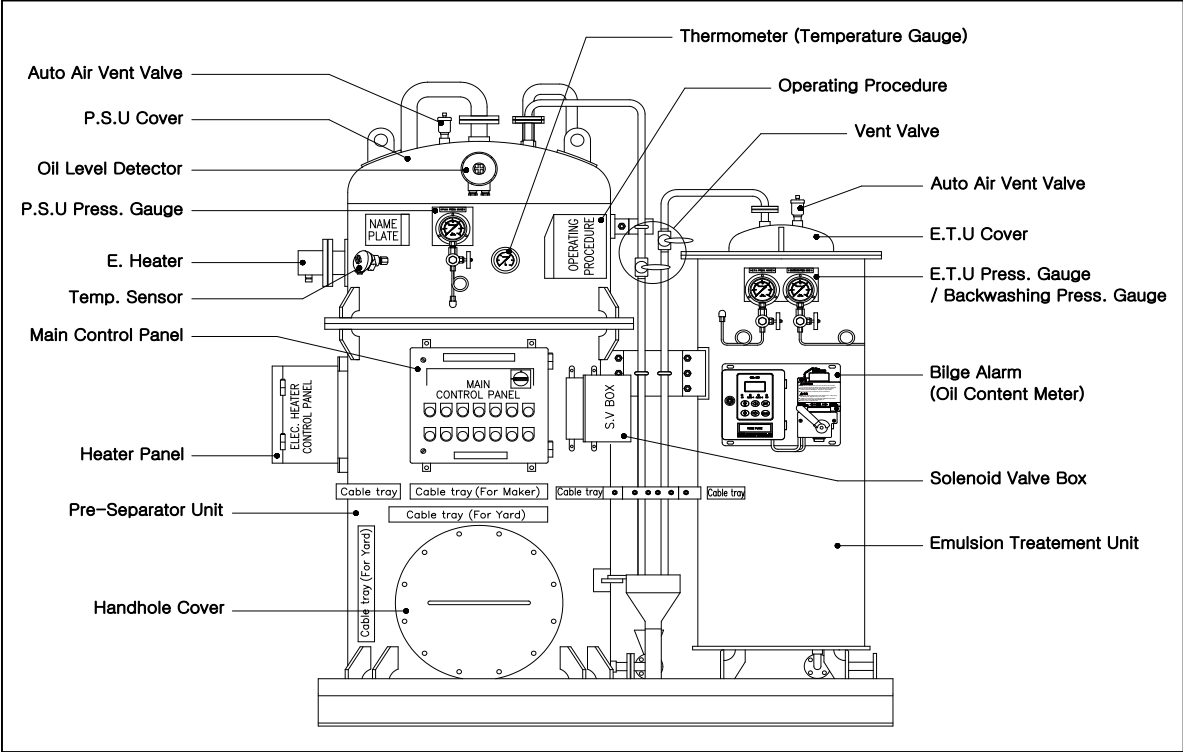
3.5 The oil is discharged automatically by a solenoid valve when detecting oil.

3.6 It helps to reduce maintenance costs and the replacement of parts.

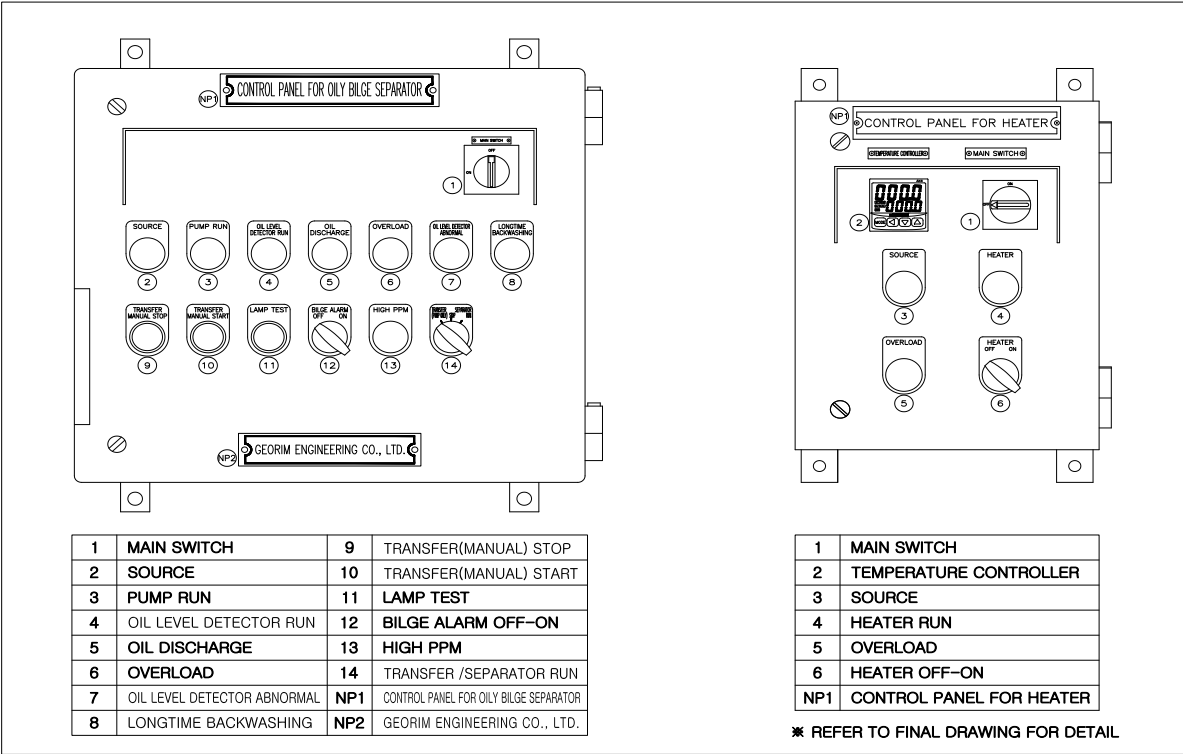
3.7 A 5/15ppm bilge alarm and pre-treatment system is optional.

4. STRUCTURE

4.1 Oily Bilge Separator



4.2 Panel

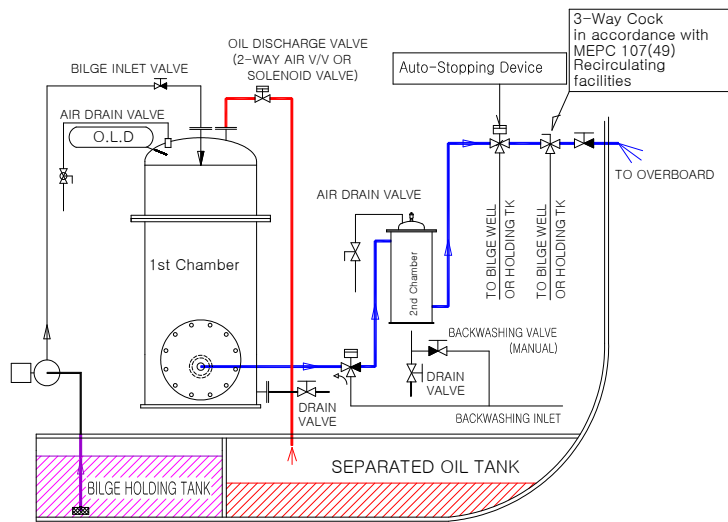


■ OILY BILGE SEPARATOR

5. FUNCTION

- 5.1 Oily water flows into the oily bilge separator through the oily water inlet connection.
- 5.2 Oily water flows into the body starts separating oil by the difference of specific gravity by a static pressure system and then floated oil and accumulated oil gathers in the upper round plate remaining minute particles of oily water pass through the pallring and urethane coalescer in sequence.
- 5.3 When Oil Level Detector(O.L.D) detects oil in the upper hemispheric round plate, the pump is stopped by the oil discharge valve at the same time the backwashing process starts and then the oil is discharged by fresh water pressure.
- 5.4 The ultra minute oil and corrupt component parts can be removed by the 2nd coalescer filter. Separated water oil density is with under 5/15ppm, The water can be discharged to overboard.
- 5.5 Life time of coalescer filter in the 2nd stage can be extended if you open the upper manual air vent and backwashing valve and backwash while stopping.
- 5.6 The accumulated oil separated by specific gravity in the bilge holding tank should not be treated through the oily bilge separator, but should be transferred directly to a separated oil tank. When it is transferred directly, it helps to reduce maintenance costs.
- 5.7 In case of being over 30PPM or high PPM, it does not pass through the 2nd chamber and is directly discharged to the bilge holding tank. This prevents from dirtying and damaging the filter of 2nd chamber, and helps you reduce the maintenance cost.

Fig.1 15PPM BILGE SEPARATOR
(GRS-10EB,20EB,25EB,50EB,100EB)

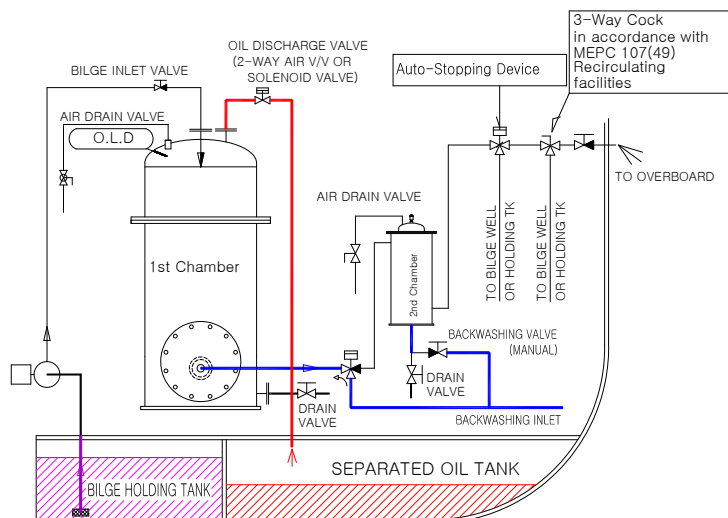


SEPARATION OF OIL AND WATER

GRS- TYPE 15PPM Bilge Separator separates oil and water by their difference in gravity.

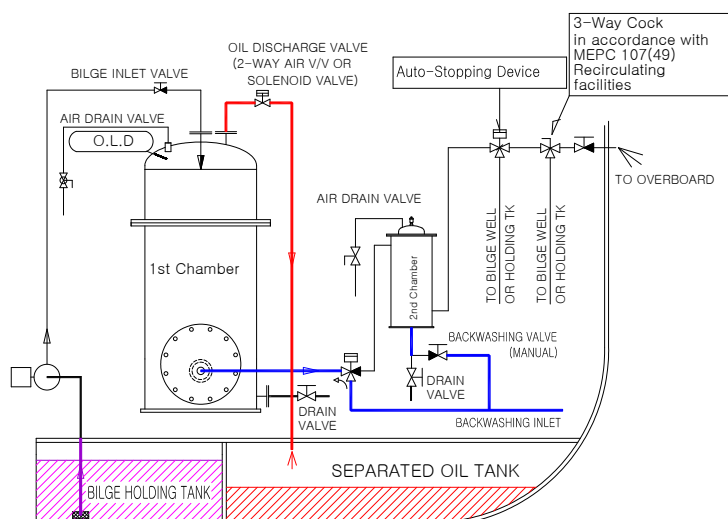
The oily water is commenced to be separated when passing 4-way distributing device, and the floated and accumulated oil are collecting into the upper part of 1st chamber and also the remains including minute oil particles of oily water passes through the Pallring & Urethane Coalescer equipped. During this process, the size of oil particles become bigger and the speed of the particles increase.

As the emulsified oil is removed by the coalescer, (Emulsion Treatment Unit) the water is discharged at/or below the 15PPM (or 5PPM) of oil density.



OIL DISCHARGE

When the collected oil in the upper part of the 1st chamber is detected by the Oil Level Detector, the oil discharging valve opens and oil is discharged automatically by the backwashing system.



BACKWASHING

[1st chamber (Pre Separator Unit)]

When the Oil Level Detector detects oil, the bilge pump stops and the oil discharge valve opens and the direction of the 3-way backwashing valve is changed to backwashing. The coalescer filter, Pallring and Urethane Coalescer in the 1st chamber are cleaned automatically by backwashing water, and floating debris with the oil are discharged.

[2nd chamber (Emulsion Treatment Unit)]

The emulsified oil is removed by the Coalescer and the equipment is cleaned by backwashing after opening the Air vent valve with manual Backwashing valve, thus the performance and efficiency improved.

6. CHECK POINT

6.1 The Essential Inspection Point For Installation

- 1) Confirm the oily water bilge pump is suction head's position.
- 2) Install the suction pipe as short as possible for improving the performance.
- 3) When installing the oily water bilge pump, you must install the strainer. Fresh water is needed during the first operation. You must install pipe line too. The operation of the oily water separator requires fresh water, and an air supply, so the piping must be installed.
- 4) Ensure sufficient maintenance space around the oily water separator. (at least 500mm)
- 5) Inlet valve must use non-return type valve to protect dry running of the oil separator system including related oily water bilge pump.
- 6) The oily bilge separator and bilge pump should be installed in a protectable structure.
- 7) In case bilge of high viscosity, install heating coils inside the bilge tank to improve separating efficiency and maintain viscosity under 1000cst.
- 8) Install the manual 3-way valve after checking its direction of flow.
- 9) Other details refer to system diagram or drawings.

6.2 Check Points Before Operation

- 1) Check each connection part and compare with system diagram.
- 2) Fill up with fresh water inside of the equipment.
- 3) Open the air discharge valve and remove air inside of the equipment, and then close the air valve.
- 4) Check the open / closed status of each valve for system operation is normal.
- 5) Check the operating air pressure of piston valve. (Normal pressure range 6~8bar(kg/cm²))
- 6) Inspect the electric cable installation compared with electric circuit diagram if there are missing cables.
- 7) Check the supply pressure of the backwashing water. (max. 2.0bar(kg/cm²))
- 8) Check the fresh water valve open.
- 9) Check the main power supply and sample valve open if bilge alarm system is installed.
- 10) Check the state of main power. (Check source lamp)
- 11) Check the operating condition of each lamp on the control panel when main switch is "ON".

6.3 Check Points During The Operation

- 1) Check the air pressure is working normally. (Normal pressure range 6~8bar(kg/㎠))
- 2) Check the power switch of the oil level detector and bilge alarm is "ON".
(The oil level detector turns on automatically according to the system.)
- 3) Check the inside pressure of the equipment keeping regular pressure.
- 4) Check the suction and discharge pressure of bilge pump.
- 5) Check the normal operation of the air piston valve.
- 6) Check the pressure regulating valve installed between separated water discharging valve and overboard discharging valve.
- 7) In case bilge alarm system is installed,
 - 7-1. Check alteration of oily density. (more than or less than 5/15ppm)
 - 7-2. Check 3-way valve whether operation availability by the state.
(Re-circulation or Overboard)
- 8) Check operating condition of oil level detector.
 - 8-1. Confirm oily water pump stop and oil is discharged when oil level detector is on.
- 9) Check the each connection part. (oil or water leakage)
- 10) Check the normal condition of treated water by sampling valve installed on the discharge line.

6.4 Check Points For The Stop

- 1) Open the manual air vent valve and check if oil is left on the top of the system.
When oil is found, remove it by referring to 「Section 8.5.2.」
- 2) Turn off the electric power source.
- 3) Stop the bilge pump.
- 4) Stop the heating system.
- 5) Close the air inlet valve.
- 6) Check that the direction of the 3-way piston valve(Automatic Stopping Device Valve) is in a recirculation direction.
- 7) Turn off the bilge alarm system, and turn to the right (cleaning mode) the 3-way cock handle of the sensing unit for Bilge alarm.
(For details on how to maintain and manage the bilge alarms, please refer to the bilge alarm instruction manual.)
- 8) Tighten the backwashing inlet valve, fresh water valve, outlet valve of oily bilge separator and overboard valve, etc.
- 9) Check each joint for oil or water leakage.

※ ***It is the best maintenance method when managing them using the above method even when it has been stopped for a long time.***

■ OILY BILGE SEPARATOR

7. OPERATION

- 7.1 Fill up the body with fresh water by opening the inlet valve for backwashing.
- 7.2 Refer to 「6.2 Check Points Before Operation」
- 7.3 Turn to the left (sampling position) the 3-way cock handle of the sensing unit for Bilge alarm to flow out the sampling water, and turn on the switch for the Bilge alarm, if it has been fitted. (Refer to 「Section 6. Operation」 of bilge alarm manual)
- 7.4 Operate the oily bilge separator by selecting the 'separator run mode' on the control panel.
※ The transfer mode is for inter-tank transfer only. It should not be used when operating the oily bilge separator.
- 7.5 During operation, check 「Section 6.3 Check Points During The Operation」.
- 7.6 Stop
- 1) After finishing oily water separation, operate the oily bilge separator again to remove remaining oil to prevent declining efficiency and wear of internal parts using fresh water for 5~10minutes.
 - 2) Press the manual discharge button on the oil level detector several times, then stop it after discharging the separated oil from the upper part (manual backwashing).
 - 3) Refer to 「Section 6.4 Check Points For The Stop」.
 - 4) Check the stopped condition of each equipment, after turning off the oily bilge separator's power supply.
 - 5) Check that the direction of the 3-way piston valve(Automatic Stopping Device Valve) is in a recirculation direction.



SAFETY, WARNING NOTICE FOR OPERATION AND MAINTENANCE

- 1) Fill up the body with fresh water before starting.
- 2) Clean inside of the sample tube(glass) of the sensing unit for the oil content meter (bilge alarm) with the cleaning brush before start and stop, if it has been fitted.
- 3) Check operating condition of the 3-way valve for automatic stopping device.
- 4) Check operating condition of the oil content meter(Bilge alarm) and oil level detector.
- 5) Change direction of the manual 3-way valve to circulate into engine room during harbor inspection.
- 6) Drain out the water inside of the sample tube(glass) of the sensing unit for oil content meter(Bilge alarm) to prevent breakage at cold area or winter season.
- 7) Turn off sources of electricity before maintenance.
- 8) ***When operating the oily bilge separator, make sure to clean the Bilge Holding Tank which contains rust particles, dust and paint powder during ship construction work. We cannot guarantee any damages caused by operation without cleaning the Bilge Holding Tank.***

8. MAINTENANCE

8.1 Daily Check Point

- 1) Check the oily bilge pump for vibration, noise or irregular pressure.
- 2) Check the pump and motor bearing conditions.
- 3) Check joints for leaks.
- 4) Check the operating condition of the control panel and lamps.
- 5) Inspect the sample water (under 5/15ppm) through the sample valve.
(Clean the inside of the sensing module as necessary.)

8.2 Monthly Maintenance

- 1) Clean the strainer.
- 2) Inspect the pump.
- 3) Check the operating condition of the oily water inlet valve, fresh water inlet valve and other valves.
- 4) Clean the tube according to maker's instruction manual if oily bilge alarm is fitted.
- 5) Clean the Oil Level Detector. (Connect wires according to the cable numbers when joining.)

8.3 Annual Maintenance

- 1) Inspect each valve (safety valve, piston valve, check valve, globe valve, solenoid valve).
- 2) Inspect pump. Replace with new parts if necessary.
- 3) Inspect bolts and screws.
- 4) Inspect coalescer filter. Pay attention to any internal filter contamination when the pressure inside the oily bilge separator rises.

8.4 Maintenance For Every 2 Years

- 1) Overhaul and clean inside of the equipment.
 - * Clean the system by 「Overhaul and Cleaning(8.5)」 before overhauling
- 2) Test the function of each sensor part (oil level detector, solenoid valve, etc.)
- 3) Inspect coalescer filter and check other filters.

 *The coalescer filter serves to maintain the treated water at 5/15ppm or below by removing ultra-fine particle oil ingredients and is configured to be cleaned by the backwashing system which is operated periodically during operation. However, If it is used for a long time or when the internal pressure of the equipment (vessel) rises remarkably, or if the bilge alarm device continues to sound high ppm alarms of 5/15 ppm or higher, then check it by opening and consider exchanging the filter with a new one.*

■ OILY BILGE SEPARATOR

8.5 Overhaul And Cleaning

- The cleaning procedure after a stopping.
 - 1) After filling up with fresh water, heat inside of the equipment to 40°C and keep the temperature for 3~4 hours.
 - 2) After carrying out above process 1), if you push manual push button of oil level detector, the oil discharging valve will opened and oil and oily particles have cleaned and discharged by backwashing operation by force.
 - 3) After cleaning up, check for remaining floating matter through the manual air vent.
- Overhaul and cleaning
 - 4) Before opening, carry out 「8.5.1)」 first.
 - 5) Turn off main switch of electric panel (all source are shut off).
 - 6) Close the air inlet valve.
 - 7) Close all in and out valves.
 - 8) Open drain valve and discharge water inside.
 - 9) Put the pallring in the net bag and urethane mat in the adequate vessel and clean them using filter cleaner and then rinse out them with fresh water.

8.6 Dismantling, Fitting & Exchange Of Coalescer Filter

- 1) Before exchanging it, completely remove floating matters and oil ingredients in the equipment(vessel) by referring to the opening and cleaning method in 「Section 8.5」 above, then open it as follows.
- 2) Drain out remain water thru drain valve. Open the hand hole cover.
- 3) Draw out filter after dismantle the fitting nut.

* Refer to instruction manual.

Exchange coalescer filter in 2nd stage Emulsion Treatment Unit.

In case of exchanging filter, open the upper cover and pull out the old one.

 *The coalescer filter is located in the lower part of 1st chamber(P.S.U) and inside 2nd chamber(E.T.U). It is recommended that filter cleaning and replacement cycle be between 1 and 1.5 years. However, if the pressure inside the vessel increases significantly due to excessive inflow of foreign matters or other reasons, or when the ppm of the bilge alarm device continues to exceed 5/15 ppm, consider the replacement of the coalescer filter with a new one. When replacing the filter, please use a genuine filter as we are not responsible for any problems or performance caused by using non-genuine parts. Therefore, we recommend that you use a genuine filter only.*

CAUTION

It is prohibited that alien substances and discharged water from other tanks flow into the vessel's bilge holding tank. (ex.: chemicals, surfactant detergent, soot, sewage, sludge, grey water, mud, rust particles, alien substances and water containing sulfur etc.)

In case that these substances flow into the bilge holding tank, it may corrode inside of the tank, damage and dirty the filter, and increase PPM. This causes troubles in the oily water separator's normal operation, therefore please ensure the above-mentioned.

9. HEATER

The heater is not be used at all times when operating the oily bilge separator, but it is used to conveniently remove oil etc. adhering to the inner wall of the equipment by heating the inside before opening and cleaning. For details on how to use the heater before opening and cleaning, please refer to the 「Overhaul and cleaning (Section 8.5)」.

10. CLEANING MATERIAL FOR ENGINE ROOM

10.1 Cleaning material : ph 8.0~11.0 (alkalinity)

10.2 Mixing rate - 1 (cleaning chemical) : 1000 (water)

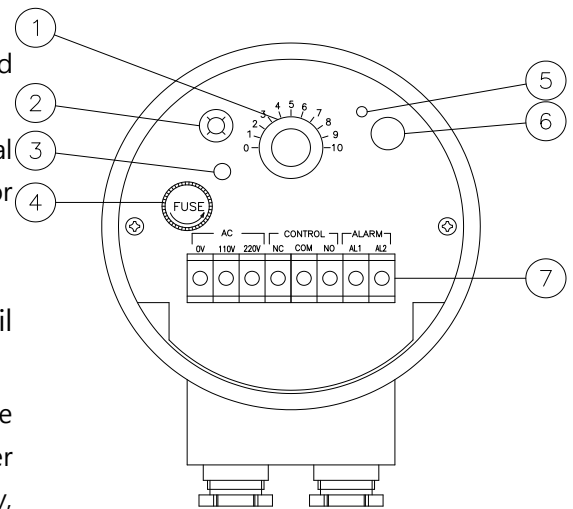
10.3 Temperature of the mixed cleaning material to treat by the oil filtering equipment : 25~30℃

⚠ Do not allow water used with cleaning agent to flow into the Bilge Holding Tank whenever possible.

11. AUTOMATIC OIL DISCHARGING SYSTEM

11.1 Automatic oil discharging system

- 1) Automatic oil discharging system has the electrostatic capacity type oil level detector and the solenoid valve for pilot. Oil level detector is fitted between water and oil boundary space inside of the separating stage.
- 2) The discharge valve is operated by the solenoid valve action caused by oil level detector.
- 3) Oil discharging is available by pushing manual operating button on the oil level detector during operating.



11.2 The operating condition of automatic oil discharge system

The oil level detector installed at the top of the oily bilge separator detects the oil/water boundary as a change in electrostatic capacity, giving a Light On/Off signal to the relay, thus causing to automatically discharge the oil. In a normal operation, it causes the Pilot Lamp light on, so you can check whether it is normal or not.

* Refer to Fig.2 for an outline of the operating condition.

1	ADJUSTING DIAL
2	PILOT LAMP
3	ADJUSTMENT TRIMMER
4	FUSE
5	TIMER SCREW
6	MANUAL PUSH BUTTON
7	TERMINAL BLOCK

■ OILY BILGE SEPARATOR

11.3 The adjusting method of the sensitivity for automatic oil discharge system

Automatic oil discharge system is fitted inside of the oily bilge separator, and that is adjusted before delivery at the factory. But that may be different according to the specific gravity of water. The adjusting method of the sensitivity for the automatic oil discharge system is as follow.

- 1) Fill with fresh water into the system, and then turn on the switch. (Confirm the pilot lamp "on" for the oil level detector.)
- 2) Turn the knob for the adjusting dial of the oil level detector to clockwise slowly, and then confirm the "off" condition of the pilot lamp. If the lamp is not "off", set the adjustment trimmer by the driver.
- 3) Confirm the lamp-off point of the pilot lamp, and then turn to counter clockwise about 1 graduation. That's correct setting point.
- 4) Disconnecting the electric cable for the solenoid valve at the connection terminal, and then confirm each lamp as follows ;
 - In case the inside of the equipment is filled with water : pilot lamp "ON"
 - In case the inside of the equipment is filled with oil or air : pilot lamp "OFF"
- 5) Refer to Fig.3 for this system.

11.4 Manual Push Button

Push the button so as to test whether Pilot Lamp works ON/OFF normally. (Water : ON / Oil : OFF)

When press the button, sensor pretends to detect oil so that Oil Discharge valve opens.

11.5 Timer

Timer adjusts open time of Oil Discharge Valve when sensor detects oil.

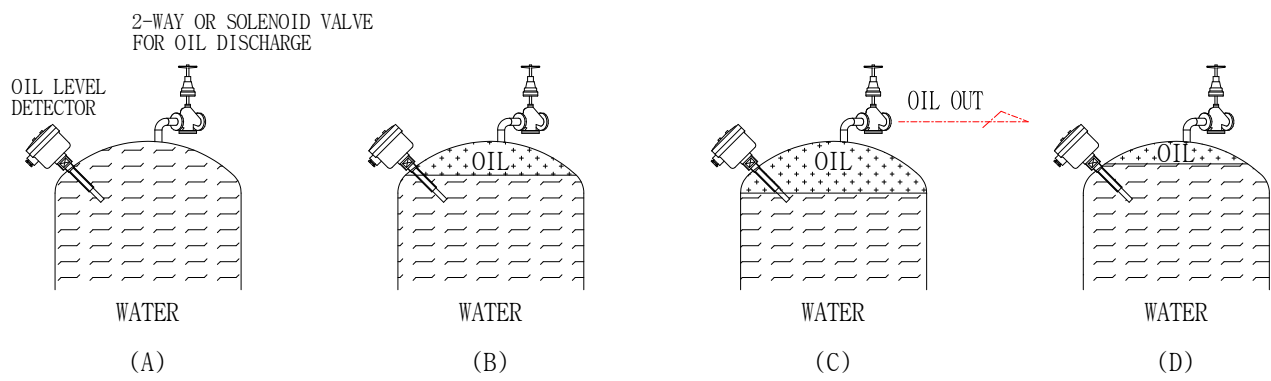
Do not adjust this because it is adjusted to 0 second at the factory in order to react immediately when detecting oil. (Setting range : 0~30sec, adjustable by screw driver)

11.6 Trimmer

Adjusting device for sensitivity of oil detect sensor. There is a little difference depend on vessels situation like temperature of water, specific gravity. In case adjusting dial is set 5, Oil Level Detector(LSC-75) is tested and delivered working normally at 5.

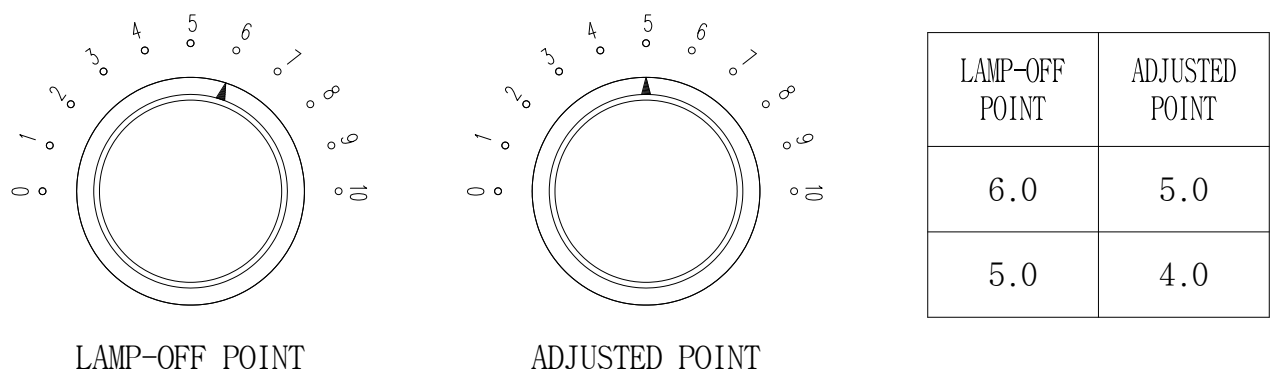
(Please refer to 「Section 11.3」 above when a change is necessary.)

Fig.2 OPERATION CONDITION
AUTOMATIC OIL DISCHARGE SYSTEM



CONDITION	(A)	(B)	(C)	(D)
OIL DISCHARGE VALVE	CLOSE	CLOSE	OPEN	CLOSE
OIL LEVEL DETECTOR PILOT LAMP	ON	ON	OFF	ON

Fig.3 ADJUSTING DIAL VIEW OF OIL LEVEL DETECTOR



⚠ The oil level detector has been adjusted at the factory, please do not adjust unless necessary. The oily bilge separator may not operate as a result of incorrect adjustment.

12. TROUBLE SHOOTING

Type	Trouble	Cause	Remedy/Action
Oil Level Detector	Malfunction of the oil level detector	1. Damage of the sensing part 2. Bad adjustment of trimmer 3. No water inside the oily water separator. (Air sensing) 4. Relay malfunction 5. Fuse defective	1. Clean the sensing part (Every Month) 2. Readjusted (Water, Oil motion) 3. Make sure the inside is full of water. 4. Check and renew if necessary (consumables) 5. Check and renew if necessary (consumables)
	Abnormal alarm of oil level detector	1. The oil level detector is damaged 2. Adjustment dial setting of the oil level sensor is low. 3. PCB defective	1. Check and renew if necessary (consumables) 2. Increase adjustment dial setting (Set to 5 at factory) 3. Check and renew if necessary
Valve	Pressure imbalance during operation of oil water separator.	1. Error of the pressure regulating valve adjustment 2. Decompression valve adjustment imbalance 3. Diaphragm breakage	1. Adjust pressure to 1.0kg/cm² 2. Adjust pressure to 1.0~2.0kg/cm² 3. Check and renew if necessary (Expendables)
	The piston valve is not working	1. Foreign materials on the seat 2. Solenoid valve malfunction 3. Air pressure depression 4. Relay malfunction 5. No air supply.	1. Check and renew if necessary (consumables) 2. Check power, Coil replacement (consumables) 3. Check air pressure or replace air pressure regulator (consumables) 4. Check and renew if necessary (consumables) 5. Confirmation of opening of air inlet valve Check air supply line(On board)
	Abnormal operation of the safety valve (leak/fixation)	1. Foreign materials on the seat 2. The safety valve will be fixated if not used for a long time	Check and renew if necessary (Expendables)
Filter	Internal pressure rises during the operation of the Oily Bilge Separator	1. Filter pollution 2. Filter clogged.	Check and replace filters (consumables)
Heater	When the temperature of the heater does not go up	1. Heater defective 2. Temperature sensor defective 3. Poor wiring 4. Temperature controller defective	Check and renew if necessary (consumables)
Pressure Gauge	The gauge needle is out of the scale	Gauge defective	Gauge replacement (consumables)
	Glycerin leakage	Gauge defective	Gauge replacement (consumables)
※ Purchase separately if consumables			

Type	Trouble	Cause	Remedy/Action
Bilge Pump	Abnormal operation of the safety valve (leak/fixation)	1. Foreign materials on the seat 2. The safety valve will be fixated if not used for a long time	Check and renew if necessary (consumables)
	Gland packing leakage	The packing alignment nut is poorly fastened	Fastened the packing alignment nut Packing exchange (consumables)
	Cracking and damage of the V belt	1. The center between the motor pulley and pump pulley is off 2. The belt tension is high	1. Move the motor to align the center between the pulleys and replace the belt (Expendables) 2. Lower the motor after moving the belt or move the motor to the pump pulley.
	Oscillation of the discharge gauge needle	Oscillation caused by pulsation due to the characteristics of the piston pump	Check if the gauge is normal
5/15PPM Bilge Alarm	alarming of over 5/15ppm	-	Refer to bilge alarm manual
※ <i>Purchase separately if consumables</i>			

13. ONBOARD TEST PROCEDURE AND CHECKLIST

13.1 Scope

This procedure is applied for test for Separator installed on-board.

13.2 Detail

Manufacturer : Georim Engineering Co., Ltd.

Equipment : Oily Bilge Separator

Capacity : 1.0/2.0/2.5/5.0/10.0m³/hr

13.3 Test Condition

- 1) Separator should be fully filled with water.

※ How to fill separator

Fill up separator with fresh water by opening the backwashing inlet valve.

Confirm if separator is fully filled by opening the manual vent valve on upper part.

- 2) Bilge water should be ready for operating from bilge holding tank or bilge well.



New Vessels.

If Bilge storage tank isn't clean enough to operate, commissioning can not be done correctly. Further function of separator could be damaged.

(Yard will be responsible for any claims due to a damaged filter after delivery)

Bilge tank should be away from alien substances such as paint powder, cloth for cleaning, rust particles.

- 3) Others to be prepared

- Air supply (for Air Piston valve)
- Fresh water supply (for Backwashing water)
- Elec. Power supply (for Control Panel)
- Valve open/shut (for Operating)
- Pipe line connection (from separator to yard connection)
- Elec. Cabling for Yard (Power, Alarm, Etc.)

- 4) Control Panel

- Source Lamp : ON
- Bilge Alarm Switch : ON

- 5) When testing at ports or bilge discharge prohibited areas, close the outboard discharge valve and switch the 3-way manual valve(Loose Supply) to the recirculation direction.

13.4 Test

- 1) When you select the Separator Run Mode from the control panel, the pump will run automatically.

- Oil Level Detector Lamp / Pump Run Lamp : ON

At this time, when the oil level detector detects bilge, the pump stops and oil will be discharged. When the discharging is complete, it will operate normally. During operation, this phenomenon occurs repeatedly as bilge is being separated.

** Please do not operate the oily bilge separator in a transfer mode because the oil level detector will not operate and oil will not be automatically discharged.*

2) Oil Level Detector Test

2-1. Oil Discharge

You can check if the oil is being discharged by opening the oil level detector cover on the oily bilge separator and pressing the manual push button on its inside.

(You can also check the operating condition of the oil discharge valve.)

- Oil Discharge Lamp : ON
- Pump Run Lamp : OFF

2-2. Oil Level Detector Abnormal

Turn the oil level detector knob to the left to reduce the sensitivity of the control probe rod.

- Oil Level Detector Abnormal Lamp : ON
- Pump Run Lamp : OFF

3) Longtime Backwashing

When oil is discharged and if a backwashing continues for more than its set time, an alarm is generated by the timer.

- Longtime Backwashing Lamp : ON

4) Overload

4-1. When stopping the pump : Confirm it by a test switch of EOCR which is inside the control panel.

4-2. When starting the pump : Confirm it by lowering the ampere value of EOCR.

- Overload Lamp : ON
- Pump Run Lamp : OFF

5) Safety Valve Popping Test

When you slowly close the outlet valve of the 2nd chamber, the internal pressure of both 1st and 2nd chamber is increasing gradually. Check the gauge and confirm if the safety valve opens at the set pressure.

6) Shut-off Test

3-way piston valve working test can be done by shutting-off air and electricity.

When shutting-off, flow direction of valve changes from overboard to re-circulation. You can confirm it by the valve indicator.

13.5 Bilge Alarm Function Test

1) Oppm Test

1-1. Stop operating while at a zero setting.

1-2. Block the sampling water line.

1-3. Fill with clean (drinking) water into sensing module after cleaning inside.

1-4. Check '0' ppm in the display monitor.

1-5. In case over '0 ppm', inspect whether alien substances are inside.

Clean inside using brush and test again.

■ OILY BILGE SEPARATOR

2) 5/15ppm Test

- 2-1. Check if ppm is rising by pouring diluted water to 5/15ppm into the sensing module.
 2-2. If 5/15ppm is displayed on the monitor, red lamps are displayed on alarms No. 1 and 2 and the alarm occurs at the same time, then the 3-way valve on the outlet side blocks the outboard discharge and changes to a recirculation direction.

- 3) **The accuracy of the Bilge Alarm** should be checked at **IOPP Certificate renewal surveys** according to the manufacturers instructions. Alternatively the unit may be replaced by a calibrated Bilge Alarm. **The calibration certificate** for the Bilge Alarm, certifying date of last calibration check, **should be retained onboard** for inspection purposes.

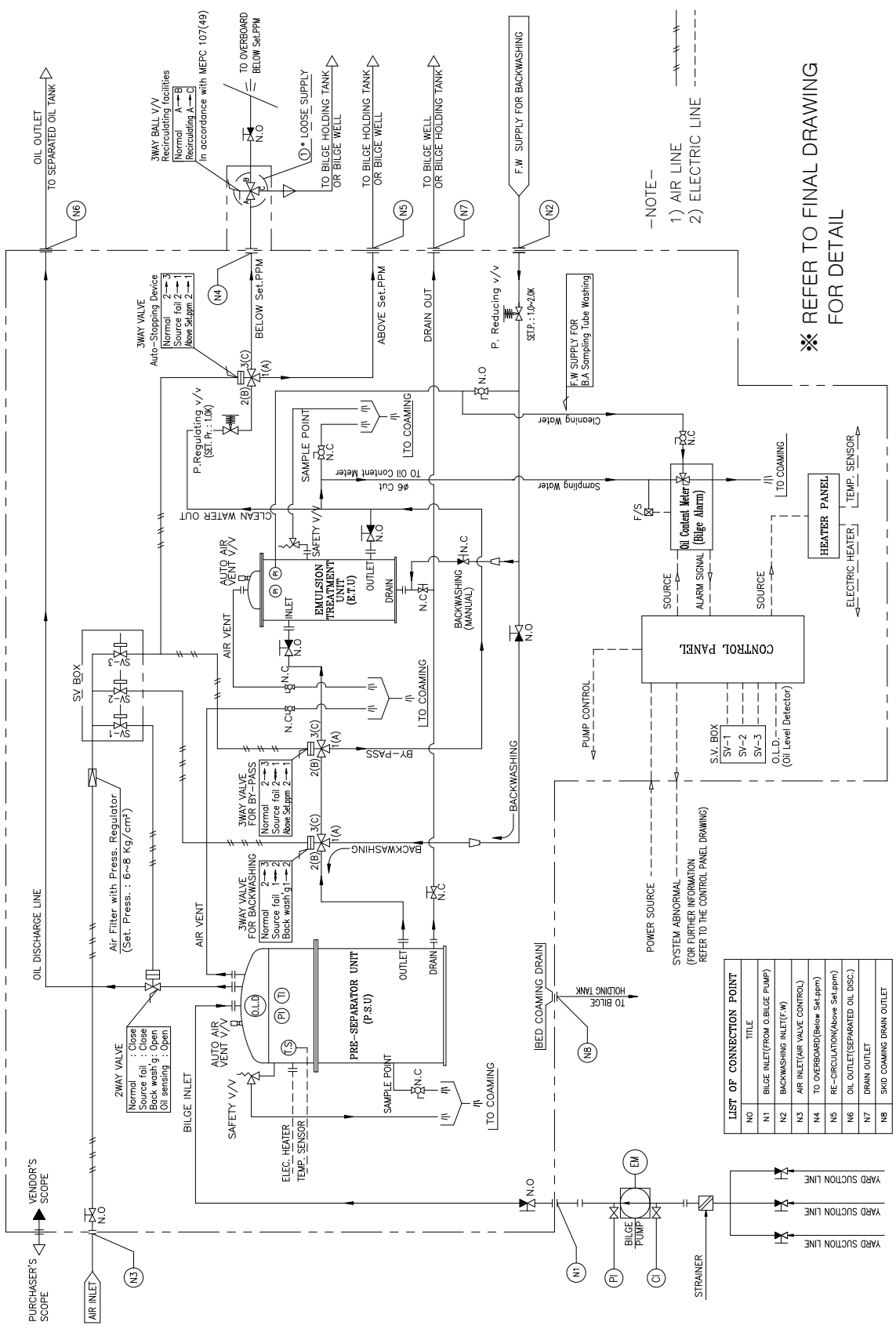
(MEPC49/22/4.2.11)

- 4) The accuracy checks can only be done by the manufacturer or persons authorized by the manufacturer.

13.6 Check List

No.	LIST		Result
1	Things to check before operating the oily bilge separator.	1) Check the inside of the oily bilge separator is full of fresh water.	
		2) Ensure all piping and electrical connections comply with drawings	
		3) Check the installation direction of the manual 3-way valve (loose supply)	
		4) Check the pressure of backwashing water (Max. 2bar)	
		5) Air supply and pressure check. (6~8bar, Max 10bar)	
		6) Check the open / closed status of each valve for system operation is normal.	
2	Panel	1) Oil Level Detector detects the oil. (Or press the manual push button)	
		1-1) Bilge pump stop (Lamp off of bilge pump)	
		1-2) Oil discharge valve opened (Oil discharge lamp "On")	
		1-3) The 3-way piston valve(Backwashing Piston Valve) switches to the backwashing direction	
		2) Abnormal operation of the oil level detector.	
		2-1) Abnormal alarm of oil level detector. (pump stop)	
	Long time backwashing test	1) An alarm occurs when backwashing operates for more than the set time	
	Overload test	1) Overload alarm (pump stop)	
3	Safety valve test	1) Check operation at set pressure.	
4	Power-off test	1) Check that the direction of the 3-way piston valve is to a recirculation direction.	
5	Bilge alarm ppm test	1) 0ppm check.	
		2) Check if the 3-way valve is in the overboard discharge direction if below the set ppm	
		3) Check the alarm if exceeds the set ppm. Also, check if the 3-way piston valve is in the recirculation direction	

<REFERENCE SYSTEM DIAGRAM>



13. APPENDIX

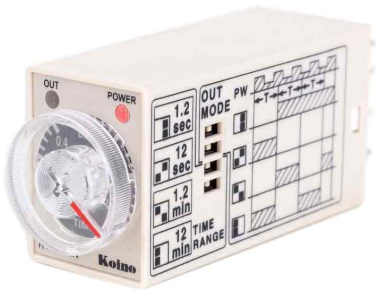
Koino MULTI TIMING RELAY

KTM-3MN Series Multi timing relay

Miniature timer with multiple time ranges and multiple operating modes

FEATURE

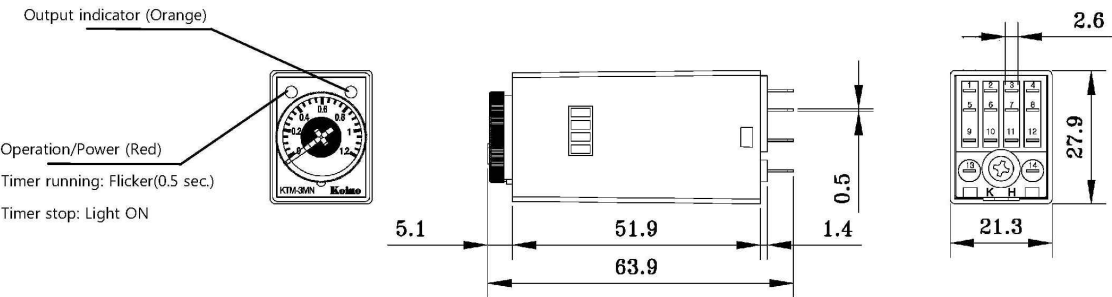
- Compact size
- Multiple operating modes and multiple time ranges.
- Output and operation indicator with LED lamp
- Change settings in real time (DIP switch)
- Time error $\pm 5\%$ max.



CLASSIFICATION

KTM-3MN	1	A2	2		Mark	Description
					KTM-3MN	KOINO 3M New (Multi timing relay)
TIME Range	1	A2	2		1	1.2sec ~ 12min
					3	3sec ~ 30min
					7	1.2min ~ 12hour
					9	3min ~ 30hour
	5 (Order made)				5 (Order made)	6sec ~ 60min
					6 (Order made)	6min ~ 60hour
Input voltage					A1	100~120VAC
					A2	200~230VAC
					D1	12VDC
					D2	24VDC
PIN Type					None	4PIN
					2	2PIN

DIMENSIONS

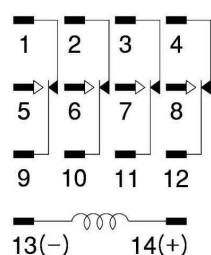


TECHNICAL DATA

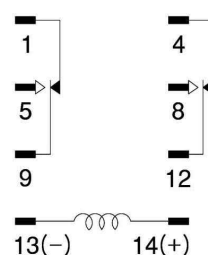
		KTM-3MNxA1(2)	KTM-3MNxA2(2)	KTM-3MNxD1(2)	KTM-3MNxD2(2)
Time		1.2sec~12min / 3sec~30min / 1.2min~12hour / 3min~30hour			
Operating mode		ON DELAY , INTERVAL , FLICKER ON START , FLICKER OFF START			
Compatible sockets		KH-RS-14M, KH-RS-14N (KOINO - 14Pin Socket)			
Input voltage		100~120VAC	200~230VAC	12VDC	24VDC
Operating voltage range		90~110% of rated voltage			
Power consumption		3VA max.		1.5W max	
Reset time		100ms max. (Power reset time)			
Contact output ratings		2PIN = 220VAC, 5A (Resistive) / 4PIN = 220VAC, 3A (Resistive)			
Relay durability	Mechanical	Minimum 10 million operations			
	Electrical	Minimum 200,000 operations(1800/ hour)			
Contact		2PIN : 2C (2a2b) / 4PIN : 4C (4a4b)			
Operating time deviation		±0.5%, 10msec max. (at the maximum time setting)			
Set deviation		±5%, 50msec max. (at the maximum time setting)			
Voltage deviation		±0.2% max. (at the maximum time setting)			
Temperature deviation		±2% max.(at the maximum time setting)			
Insulation resistance		100MΩ (at 500VDC)			
Noise-proof		By noise simulator (pulse width: 100 ns/1 μs, 1-ns rise)±2,000V			
Dielectric strength		2,000VAC 50/60Hz for 1minute (between live-part and dead-part)			
Vibration resistance		10 to 55 Hz, 0.5mm single double for 1 hour each in 3 directions			
Shock resistance		Approx. 30G (300m/s²)			
Ambient temperature		Operation: -10°C ~ +50°C (with no icing)			
		Storage: -20°C ~ +55°C (with no icing)			
Ambient humidity		35 ~ 85% RH			
Protection degree		IP40			
Materials		Case: ABS , Body: PC , Dial: PC			
Weight		Approx. 40g			

WIRING DIAGRAM

KTM-3MN□□□



KTM-3MN□□□2



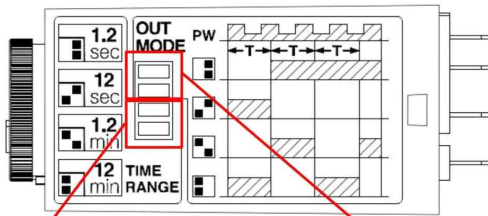
* AC: 100~120VAC, 200~230VAC 50/60Hz

* DC: 12VDC, 24VDC Be careful when connecting wires. Contact 13(-), 14(+)

OILY BILGE SEPARATOR

DIP Switch settings

EX) 1.2sec~12min



Time setting

Model	Time range	Time setting range	DIP switch
KTM-3MN1x	1.2sec	0.05 ~ 1.2sec	
	12sec	0.5 ~ 12sec	
	1.2min	0.05 ~ 1.2min	
	12min	0.5 ~ 12min	
KTM-3MN3x	3sec	0.125 ~ 3sec	
	30sec	1.25 ~ 30sec	
	3min	0.125 ~ 3min	
	30min	1.25 ~ 30min	
KTM-3MN7x	1.2min	0.05 ~ 1.2min	
	12min	0.5 ~ 12min	
	1.2hour	0.05 ~ 1.2hour	
	12hour	0.5 ~ 12hour	
KTM-3MN9x	3min	0.125 ~ 3min	
	30min	1.25 ~ 30min	
	3hour	0.125 ~ 3hour	
	30hour	1.25 ~ 30hour	

*KTM-3MN5x, KTM-3MN6x: Order made only

Mode setting

Operating mode	
MODE 1	ON DELAY
MODE 2	INTERVAL
MODE 3	FLICKER OFF START
MODE 4	FLICKER ON START

Precaution

For DC power supply type, be sure to check the polarity of terminals.

In case of 12VDC, 24VAC/DC model, isolated and limited voltage/current or Class 2 source should be provided for power supply.

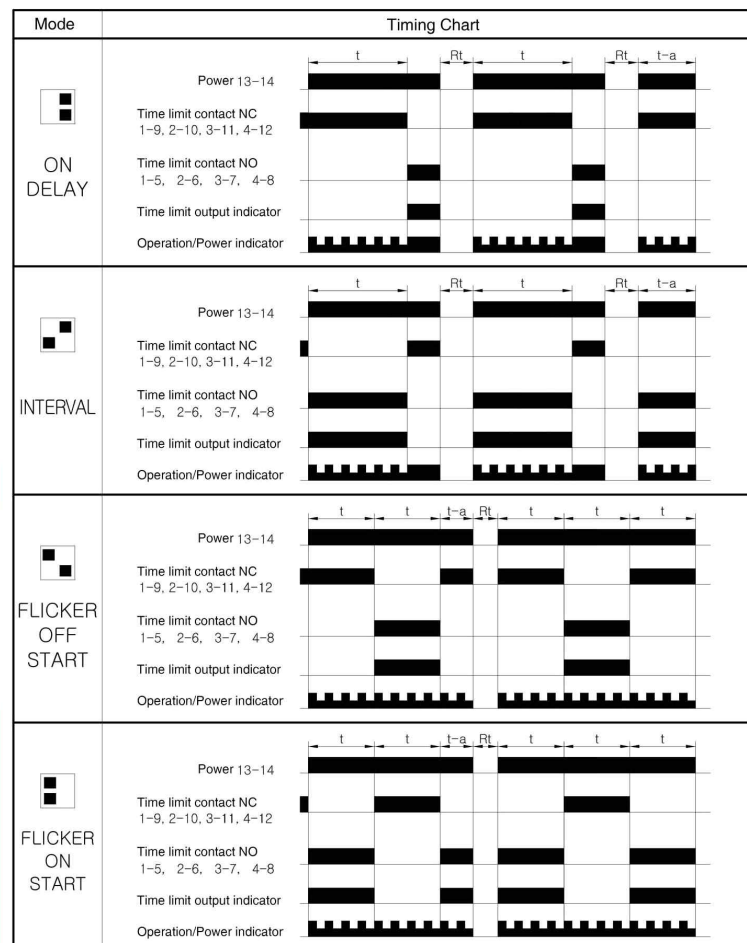
Do not use this unit at below places.

- Places where there are severe vibration or impact.
- Places where strong alkalis or acids are used.
- Places where there are direct rays of the sun
- Places where strong magnetic field or electric noise are generated.

Installation environment

- It shall be used indoor
- Altitude Max. 2,000m
- Pollution Degree 2

Timing Chart



*t= time, (t-a)<t

*Rt= Reset time (0.1 sec. min.)

*2 PIN: Time limit contact NC(1-9, 4-12),
Time limit contact NO(1-5, 4-8)

Digital temperature controller

AX series

INSTRUCTION MANUAL

Safety information

Alerts declared in the manual are classified to Danger, Warning and Caution by their criticality

	DANGER	DANGER indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury
	WARNING	WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury
	CAUTION	CAUTION indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury

DANGER

The electric shock may occur in the input/output terminal so please never let your body and/or conductive substance to be contacted by the input/output terminal.

WARNING

- Since this product is not designed as a safely used device the user must install double safety equipment when this product is used for equipment with possible fatal accident or large property damage.
- The power switch and fuse are not installed on this product so users need to install them separately on the outside. (Fuse rating : 250 V 0.5 A)
- Please supply in the rated power supply voltage in order to prevent this product from breaking down or damaged.
- To prevent electric shock and to prevent malfunction, do not supply the power until the wiring is completed.
- This is not designed as explosion-protective structure so avoid using this product at places where gas inflammability and explosive gases exist.
- Do not supply in the power until all wiring is fully completed in order to prevent the product from breaking down and prevent users from getting electric shock.
- Do not disassemble, manufacture, upgrade and repair the product by yourself. Doing so will break down the product, generate the electric shock and cause malfunction to occur.
- Please turn OFF the product and disassemble the product. Not doing so will break down the product, generate the electric shock and cause malfunction to occur.
- Electric shock may occur when operating this product so please install this product to the panel and use it

CAUTION

- The contents of this manual may be changed without prior notification
- Please check for correct model type and specification
- Please check for any damage or abnormality may caused during shipment.
- Please use this product at following range.
Ambient temperature : -5 ~ 50 °C (when installing them close to each other, max. 40 °C) / humidity : 35 ~ 85 % R.H (but without dew condensation)
- Please avoid the places where corrosive gas (especially noxious gas, ammonia and etc) and inflammable gas exist
- Please do not use this product at places where the vibration or impact is applied directly.
- Please avoid the places where liquid, oil, medical substances, dust, salt or iron contents exist (avoid place of pollution level 1 or 2)
- Do not clean the product with the organic solvent such as alcohols, benzene and etc. (Use neutral detergents)
- Please avoid the places where huge inductive interference exists and places where static electricity/self noise are generated.
- Display's text cannot be seen due to the light of the sun outside or the bright lightning inside.
- Please avoid the places where heat accumulates due to the direct sunlight, radiation and etc
- We recommend using it at altitude below the 2000 m.
- If the device is touched or contacted by water then short-circuit and fire may occur so please inspect the device carefully.
- With the thermocouple input, please use the stated compensation cable.
(Using regular compensation cable will generate the temperature error)
- With the RTD input, please use the cable with less lead-wire resistance and no difference in the resistance among 3-wires. (Using regular cable will generate the temperature error)
- For the input signal wire, please avoid from the power line and load line in order to avoid from the induction noise.
- Separate the input signal wire and output signal wire and if separating them from each other is impossible, then please use the shield wire for the input signal wire.
- For the thermocouple, please use it as the un-grounding type.
(When using the grounding type, malfunction may occur due to the electric leakage)
- When there are too much noises generating from the power, we recommend using the insulation Trans and noise filter. Noise filter must be mounted to the panel or etc that is grounded and please try to make the wiring of output and power terminal meter as short as possible.
- Tightly twisting the power line meter will reduce the noise generation
- If alarm function is not set properly, alarm will not be generated when it should so please check for the operation before running the product.
- When replacing the sensor, please turn OFF the power
- If operation frequency is too high (such as proportional operation and etc) and connecting the maximum rated load to output relay will shorten the life expectancy therefore, please use the auxiliary relay. We recommend using the SSR output type in such cases.
— When using the electrical switch: Set proportional cycle min 20 sec
— When using the SSR: Set proportional cycle min 1 sec
- Do not wire anything to the un-using terminal
- Please check the polarity of terminal before wiring.
- When installing this product to the panel, please use the authorized switch or circuit breaker (authorized by IEC60947-1 or IEC60947-3)
- Please install the switch or circuit breaker close to the operator for users' convenience
- Because switch or circuit breaker is being installed, please make a note on the panel that operating the switch or circuit breaker will block the power.

- We recommend the continuous inspection and repair in order to use it safely for a long period of time.
- Some parts in this product have life expectancy and gets old as time elapses.
- The warranty period is one year including the parts only under the condition where the product is used properly
- It needs the preparation time for contact output when supplying in the power. When applied as signal to the external interlock circuit and etc, please jointly use the delay relay.
- When changing the instrument or if the product broke down, users can replace with the prepared product but even suffix code stays same, operation may differ due to the parameter difference so please check for the compatibility and perform such action.
- Before using a temperature controller, there could be a temperature difference between PV of the temperature controller and the actual temperature so please operate the temperature controller after compensating the temperature difference appropriately.

Suffix code

Model		Code	Information		
AX	☐	☐	☐	Digital temperature controller	
Dimension	2			AX2 : 48 X 96 mm	
	3			AX3 : 96 X 48 mm	
	4			AX4 : 48 X 48 mm	
	7			AX7 : 72 X 72 mm	
	9			AX9 : 96 X 96 mm	
Output selection	1			SSR + Relay1 + Relay2	Relay or SSR as control output(selectable in operator setup mode)
	2			SSR + Relay1 + Relay2 + Relay3	
	1B			SSR + Relay1(Form c) + Relay2	
	2B			SSR + Relay1(Form c) + Relay2 + Relay3	
	3			4 - 20 mA + Relay2	Current output as control output
4			4 - 20 mA + Relay2 + Relay3		
Power supply voltage	A			100 - 240 V AC 50/60 Hz	

※ Form C : Normal close type contact

※ Relay output operates as control output, alarm output and LBA output depending on the internal parameter setting.

Input

Input selection	Multi input (selectable in operator setup mode) • Thermocouple : K, J, R, T (IEC) • RTD : Pt100 Ω (IEC)
Input sampling time	0.1 sec
Input impedance	1 MΩ max
Allowable wiring resistance	10 Ω / 1 wire max (RTD), but resistances among 3 wires should be same
Allowable input voltage	10 V DC max

Performance

Display accuracy	±0.3 % of F.S ±1 digit (In case of R type, ±1.0 % of ±1 digit in the 0 ~ 600 °C range)
Insulation resistance	More than 20 MΩ, 500 V DC for 1min (Primary terminal-Secondary terminal)
Dielectric strength	2300 V AC 50/60Hz, for 1 min (Primary terminal-Secondary terminal)

Range and input code

Classification	Code	Input type	Range	
			Celsius (°C)	Fahrenheit (°F)
Thermocouple		K	-100 ~ 1200	-148 ~ 2192
			-100.0 ~ 500.0	-148 ~ 932
		J	-100.0 ~ 500.0	-148 ~ 932
		R	0 ~ 1700	32 ~ 3092
		T	-100.0 ~ 400.0	-148 ~ 752
RTD		Pt100 Ω	-100.0 ~ 400.0	-148.0 ~ 752.0

Control function and output

- Control type : PID control, P control, ON/OFF control
- Auto-tuning : PID operation by the auto-tuning
- ON/OFF control : When PV > SV, it generates 0 % output.
When PV < SV, it generates 100 % output. (Only when control hysteresis is 0)
- Manual reset : Users set within the range from 0 % to 100 %.
- Control output operation : Direct action/Reverse action (selected by the parameter setting)
- Control output : Relay output/voltage pulse output (SSR output) * Selected by the parameter setting

Specification

* Weight included the weight of box



Main function explanation

Auto tuning function measures, computes and sets the optimum PID or ARW constant automatically. After supplying power in and while temperature is increasing, press the set key **MODE** and **▲** key synchronously for 2 sec, to begin the auto tuning. When auto tuning is finished, tuning operation will be ended automatically.

When input break (sensor break) occurs or exceeds the maximum temperature range, **boUt** will be displayed in the measured value displaying unit.

- Using the alarm

AX series supports 2 independent alarms (AL1 and AL2). These alarms can allocate AL1 or AL2 signal in the RLY1, RLY2 and RLY3 and be used. If alarm signal is not allocated in the RLY1 to RLY3 then the menu related to the alarm will not be displayed.

In order to prevent the low alarm to become ON during temperature is increasing, add the standby action function so from the point when supplying in the power to until the value goes beyond the set value. It can prevent the low alarm to be operated.

If the **Alarm** value is ON, Alarm is not cancelled even if it becomes the alarm cancel condition.
If users want to stop the alarm forcibly, please press the key for approx 2 sec.

LBA function starts to measure time from the moment when the PID computed value becomes 0 % or 100 %. Also, from this point, this function detects heater break, sensor break, manipulator malfunction and etc by comparing the changed amount of measured value in each set time. Also, it can set the LBA dead band in order to prevent any malfunction to happen in the normal control loop.

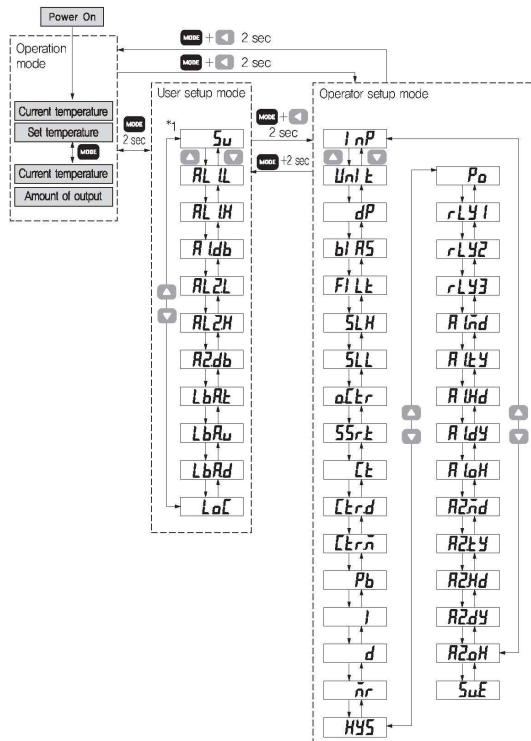
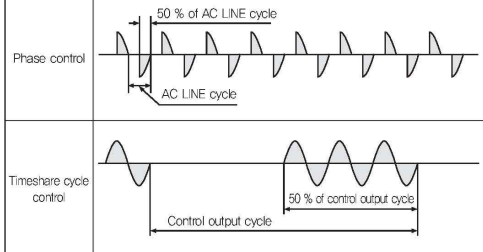
① When control output value which obtained by PID operation is 100 %.

If the temperature does increase more than **LbRu** value within the LBA set time, LBA output will become ON

② When control output value which obtained by PID operation is 0 %.

If the temperature does decrease more than **LbRd** value within the LBA set time, LBA output will become ON.

When selecting the control output type as SSR, users will be able to select the types for voltage pulse output. The timeshare cycle control turns ON/OFF the output by proportionating the certain time to an output amount in cycle. Set the cycle of control output in the **LC** parameter. Within the half cycle of power wave shape, the phase control (depending on an output amount) controls an output amount by computing the output ON phase. However, when using the phase control, users must use the RANDOM ON/OFF type SSR.



■ Operation mode

Supplying in the power after finish wiring will display the current temperature. Pressing the **MEM** key will display the set temperature and output amount alternatively on the set value (SV) displaying unit.

■ User setup mode

User setup mode is the setting mode that sets the set value that is changed by users frequently such as alarm set value and loop break alarm (LBA). It made the parameter of user setup mode to be displayed on the operator setup mode that allows users to set easily (divided the setting level).

■ SV setting

- ① In Operator Setup Mode, When the value of **SV** parameter is **on**, you can change the value with **0**, **0**, **0** and press the **MEM** key to set up.
- ② In operator Setup Mode, When the value of **SV** is **oFF**, you can change the value in **SV** parameter with **0**, **0**, **0** and Press **MEM** key to set up.

Symbol (PV)	Lists	Information	Display condition	Default value (SV)
SV	set temperature	EU 0 ~ 100 %	at all times	EU 0%
RL 1L	Alarm 1 low value	EU 0 ~ 100 % or EUS 0 ~ 100 % (temperature unit)	When RLYn ALn is set	EU 0%
RL 1H	Alarm 1 high value			EU 100%
RL 1d	Alarm 1 dead zone			EUS 0%
RL 2L	Alarm 2 low value			EU 0%
RL 2H	Alarm 2 high value			EU 100%
RL 2d	Alarm 2 dead zone			EUS 0%
LBRt	Loop break alarm time	0 ~ 7200 second	When LBA is set in the RLYn	460
LBRu	Loop break alarm temperature	0 ~ 100 °C (°F)	When LBA is set in the RLYn	2
LBRd	Loop break alarm dead zone	0 ~ 100 °C (°F)		2
LoC	KEY LOCK	0 : NO LOCK function	at all times	0
		1 : Operator setup mode LOCK, Auto-tuning prohibited		
		2 : Operator and user setup mode LOCK		

■ Operator setup mode

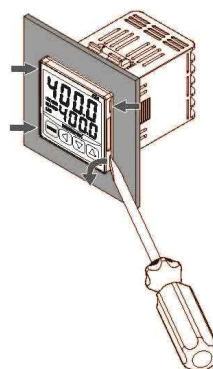
Operator setup mode is the setting mode that sets the specification of temperature controller when engineer installs it for the first time. Pressing the **MEM** key and **0** key synchronously in the operation screen or user setup mode will enter into the operator setup **MEM** and **0** keys one more time for 2 sec will return to the operation screen.

Symbol (PV)	Lists	Information	Display condition	Default value
INP	Input condition	PT : K thermocouple (Not display the decimal points)	At all times	PT
		RT : K thermocouple (Not display the decimal points)		
		J : J thermocouple		
		R : R thermocouple		
		T : T thermocouple		
PL		PL : RTD Pt100 Ω		
Unit	Temperature unit	°C / °F option	At all times	°C
dP	Decimal point	ON (YES) OFF (NO)	Select decimal point	on
BIAS	Input compensation	-100 ~ 100 (sensor input value + BIAS)	At all times	0
FLT	Input filter time	0 ~ 120 sec	At all times	0
SLH	High setting limitation	EU 0 ~ 100 %	At all times	1200
SLL	Low setting limitation	EU 0 ~ 100 %	At all times	-100
oLtr	Control output type	SSr : SSR operating voltage pulse output	When output selection 1 or 2	SSr
		RLY : Relay output		
SSrt	Voltage pulse output type	LYC : Timeshare proportional control PHR : SSR phase control (continuously preporioning)	When selected SSR control output	LYC
Ct	Control output cycle	0 ~ 1000 sec	When SSrt is C/O or oLtr is RLY	2
Ctrd	Control output action	rEu : Reverse action (heating control) dlr : Direct action (cooling control)	At all times	rEu
Ctrn	Control type	PI d : P, I, D control P : P control (proportional control) oNoF : ON / OFF control	At all times	PI d
Pb	Proportional band	1 (0.1) ~ EUS 100 %	When it is not ON/OFF control	30
I	Integral time	0 ~ 3600 sec	With PID control	240
d	Derivative time	0 ~ 3600 sec	With PID control	60

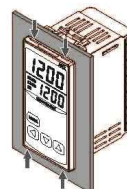
nr	Manual reset	0.0 ~ 100.0 %	With P control	500
HYS	Control hysteresis	EUS 0 ~ 100 % (Temperature unit)	With ON/OFF control	2
Pa	Output amount with input break	0 ~ 100 %	At all times	00
RLY1	Relay 1 property	non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output	When output selection is 1 or 2 and oLtr is not RLY	non
		non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output	At all times	RL1
		non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output	At all times (Option)	RL2
		non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output		---
RLY2	Relay 2 property	non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output	When AL1 or AL2 is set in RLY 1, 2, 3.	AbS
		non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output		oFF
		non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output		0
		non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output		oFF
RLY3	Relay 3 property	non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output		oFF
		non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output		oFF
		non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output		oFF
		non : Not using RL1 : Alarm 1 output RL2 : Alarm 2 output LbR : LBA output		oFF
RLnd	Alarm 1 mode (Alarm 1 or 2)	non : Not using ---[: High alarm]---- : Low alarm -[]- : Alarm within range]-[]- : Alarm not within range		---
RLnd	Alarm 2 mode (Alarm 1 or 2)	non : Not using ---[: High alarm]---- : Low alarm -[]- : Alarm within range]-[]- : Alarm not within range		---
RLtY	Alarm 1 type	AbS : ABS (Absolute alarm) dEu : DEV (Deviation alarm)		AbS
RLtY	Alarm 2 type	dEu : DEV (Deviation alarm)		AbS
RLnd	Alarm 1 standby mode	oFF : OFF (not using the standby mode)		oFF
RLnd	Alarm 2 standby mode	on : ON (using the standby mode)		oFF
RLdY	Alarm 1 delay time	0 ~ 9999 sec		0
RLdY	Alarm 2 delay time	0 ~ 9999 sec		0
RLoH	Alarm 1 output LOCK	oFF : Alarm output return action on : Alarm output maintain action		oFF
RLoH	Alarm 2 output LOCK	oFF : Alarm output return action on : Alarm output maintain action		oFF
SV	Change SV on the operation	oFF : No change SV on : Change SV	At all times	on

How to disassemble FND from case

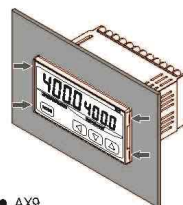
• AX4



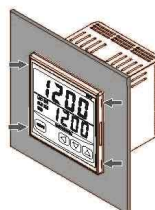
• AX2



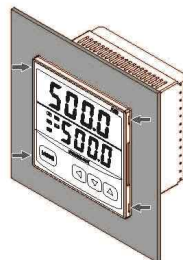
• AX3

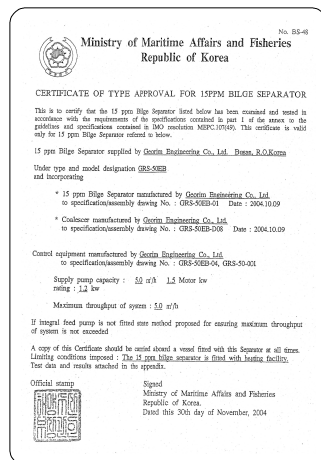


• AX7



• AX9





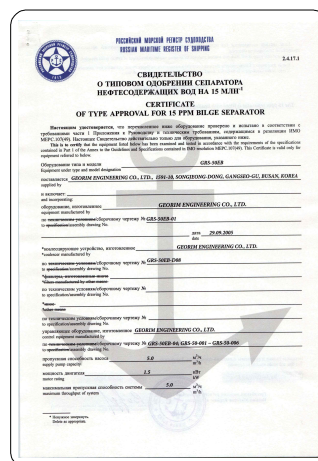
* IMO TYPE APPROVAL



* DNV-GL MED-B



* DNV-GL MED-D



* RMRS TYPE APPROVAL



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