

INSTRUCTION MANUAL

FOR

MAGNETIC FLOAT SENSOR

MODEL: F R

Revision 2015-04-17

Read and understand this manual for safely usage.

- This manual describes the product of standard specification. Read the other manual for the product of explosion-proof specification.
- This manual describes the handling, inspection and adjustment of the product which model is mentioned on cover page. Read and understand this manual before handling.
- Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent, even if the terms are mentioned in this manual.
- · Save this manual in proper place being available to refer immediately.
- The specification of product mentioned in this manual may not be satisfied by the condition of environment and usage. Check and consider carefully before using.
- Contact to sales office at NOHKEN INC. for any question or comment about this manual and product.

The followings are the description of the terms in this manual.

	Indicates a potentially hazardous situation which, if not pay
⚠ WARNING	attention, could result in death, serious injury or serious
	disaster.
	Indicates a hazardous situation which, if not pay attention,
⚠ CAUTION	may result in minor or moderate injury or damage to
	device.

	Indicates prohibited matter. The explanation with this mark shall be followed.
0	Indicates instructed matter. The explanation with this mark shall be followed.

♠ WARNING-

• This product is not explosion-proof construction. Do not install this product to the place where the flammable gas or vapor is occurred. If installed, the flammable gas or vapor may be ignited, and serious disaster may be occurred. Use the product of explosion-proof construction in this case.



• Do not modify or disassemble the product. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or miner injury and electric shock may be occurred. (Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent.)



• Turn off the power, before wiring and inspection. Otherwise, electric leakage, fire caused by short circuit, and electric shock may be occurred.



• Ensure the wire is properly connected. The product and connected device may be malfunctioned, damaged, fired, or miner injury and electric shock may be occurred by improper wiring.



• Turn off the power immediately, if the smoke, strange smell and sound are occurred.



Do not use it until the problem is solved.

⚠ CAUTION

 Avoid strong shock and rough handling to this product. The product may be damaged by strong shock as dropping, falling, throwing, knocking, lugging, and etc.



• Follow the specification of operating temperature, operating pressure, switch rating, and etc. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or miner injury and electric shock may be occurred. Check the manual or specification sheet.



• Operation test shall be done before practical usage. If the serious accident is expected to occur by malfunction of product, the other operating principle of product shall be installed in parallel.



A CAUTION .

• Check and deeply consider the chemical compatibility for material of product in advance. The part especially float, which is very thin, may be malfunctioned by miner corrosion.



• Hold the stem very close to mounting point, when carrying, installing, and removing. If hold the terminal box, it may be taken off from the flange or plug, and the product may be damaged by dropping.



• The product is 50cm or longer

The product shall be kept in horizontally. The product and other goods be damaged, and miner injury may be occurred by falling.



In case of connecting inductive or lamp load to the product.
 Provide protective circuit to the load to avoid over voltage and over current. If not provide, the contact may be damaged.



INTRODUCTION

- A) This manual specifies the specification of general product. If you order special product, some details of specification may be different with the manual.
- B) We are glad to suggest and advice for Model selection and chemical resistant of material, but final decision has to be made by the customer.
- C) This manual has prepared with close attention. Ask sales office at NOHKEN INC. for any question or comment about the contents of this manual.
- D) For replacement parts
 - The quality of product has frequently improved, so same spare part may not be supplied. In this case, replacement part or product may be supplied. Ask sales office at NOHKEN INC. for details.
- E) The contents of this manual are subject to change any time without notice due to the improvement of product.

WARRANTY & DISCLAIMER

- A) NOHKEN INC. warrants this product against defect in design, material and workmanship for a period of 1(one) year from the date of original factory shipment.
- B) The warranty only covers the damage of products. The secondary and third kind disasters are not covered by NOHKEN INC.
- C) NOHKEN INC. shall not be liable for the following.
 - C-a) Do not follow the description and direction in this manual.
 - C-b) Damage due to improper installation, wiring, usage, maintenance, inspection, storing, and etc.
 - C-c) Repair and modification are done by the person who is not employee of NOHKEN INC. and our distributor or agent.
 - C-d) Improper parts are used and replaced.
 - C-e) The damage is occurred by the device or machine except our products.
 - C-f) Improper usage. (See "Proper of usage" in chapter 1 in this manual)
 - C-g) Force Majeure including, but not limited to, fire, earthquake, tsunami, lightning, riots, revolution, war, radioactive pollution, acts of God, acts of government or governmental authorities, compliance with law, regulation, and order.

THE TERMS OF WARRANTY AND DISCLAIMER SHALL IN NO WAY LIMIT YOUR REGAL LIGHT.

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1. PURPOSE OF USE

The FR series Magnetic float sensors are manufactured specifically for liquid level detection. The 15VA and 220VA switch ratings are available. The 15VA version is possible up to seven actuation levels and up to five levels with the 220VA version. Both version has the capability to adjust the position of actuation levels in the field.

2. SPECIFICATIONS

2.1 Mode1

(1) Standard version



-10 : For high viscosity liquids with large stainless steel float and 15VA switch.

30B : Low-cost for water and oil usage with BUNA float and 15VA switch.

30S : General usage with stainless steel float and 15VA switch.

30VS : General usage with PVC float and 15VA switch.

30PS : General usage with Polypropylene float and 15VA switch.

30HVS: General usage with CPVC float and 15VA switch.

60S : 220VA high switch rating with stainless steel

float.

60VS : 220VA high switch rating with PVC float.

60 PS: 220 VA high switch rating with Polypropylene

float.

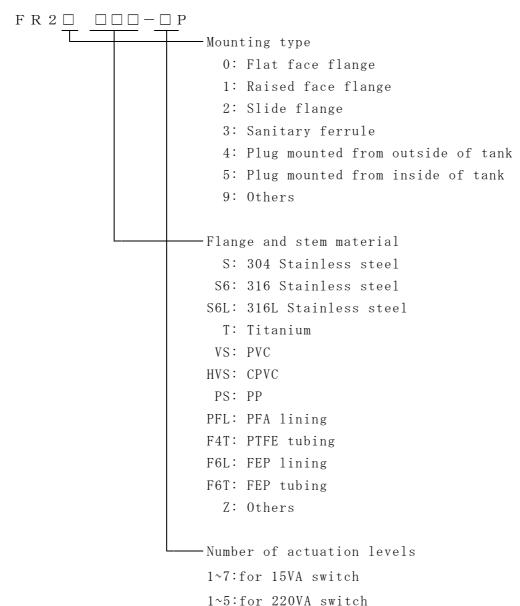
60HVS: 220VA high switch rating with CPVC float.

-Number of actuation levels

1~7: for 15VA switch (FR10 and FR30 series)

1~5: for 220VA switch (FR60 series)

(2) Custom switch version



2.2 Specifications

(1) Contact Rating

Table 1

Contact Rating(re	15	VA	220VA		
Contact capacity	Max.	15 VA	15 W	220 VA	55 W
	Min.	10 μ VA	$10~\mu$ W	I	_
Working current	Max.	1 A AC	1 A DC	1 A AC	0.5 A DC
	Min.	100 μΑ ΑС	100 μ A DC	1 mA AC	1 mA DC
Working voltage	Max.	264 V AC	200 V DC	220 V AC	110 V DC
	Min.	50 mV AC	50 mV DC	24 V AC	24 V DC

Rating is specified on the name plate at the housing or the housing cover, such as "15VA 1A AC Max.".

(2) Life expectancy : Min. 1×10^6 (3) Allowable impact : Max. 100 m/s^2 (4) Insulation resistance : More than $100 \text{M}\,\Omega$ at 500 V DC (for metallic sensor only)

(5) Withstand voltage : 1500V AC for 1 minute (for metallic sensor only)

(6) Standard specifications

Table 2

				Table 2			
	Flange size	Working tem	perature				Contact
Model	(JIS B 2210)	Wetted part	Terminal	Construction	Cable inlet	Float size	rating
			box part				
10	5K 100A (t6)	-10 ~ +100℃	-10 ~ +80°C	IP65	G 3/4	ϕ 98×H63	
					or equivalent		
30B	5K 50A (t6)	-10 ~ +90°C	−10 ~ +80°C	IP65	G 3/4	ϕ 50 \times H45	
					or equivalent		
30S	5K 50A	-10 ~ +100°C	-10 ~ +80°C	IP65	G 3/4	ϕ 49×H50	
					or equivalent		15 VA
30VS	5K 80A	-10 ~ +50°C	-10 ~ +50°C	IP43	G 3/4	φ 65×H80	
	or equivalent				or equivalent		
30PS	5K 80A	−10 ~ +80°C	-10 ~ +50°C	IP43	G 3/4	φ 65×H80	
	or equivalent				or equivalent		
30HVS	5K 80A	−10 ~ +80°C	-10 ~ +50°C	IP43	G 3/4	φ 74×H80	
	or equivalent				or equivalent		
60S	5K 50A	-10 ~ +100°C	-10 ~ +80°C	IP65	G 3/4	ϕ 49×H50	
					or equivalent		
60VS	5K 80A	−10 ~ +50°C	-10 ~ +50°C	IP43	G 3/4	φ 65×H80	
	or equivalent				or equivalent		220 VA
60PS	5K 80A	-10 ~ +80°C	-10 ~ +50°C	IP43	G 3/4	φ 65×H80	1
	or equivalent				or equivalent		
60HVS	5K 80A	-10 ~ +80°C	-10 ~ +50°C	IP43	G 3/4	φ 74×H80	
	or equivalent				or equivalent		

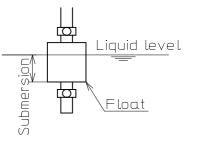
(7) Float specifications

Table 3

		Float pressure	Specific	Submersion	Reversed	Identifying Mark	Contact
Float size	Float material	Max. (static)	gravity	(*1)	characteristic	of Actuation (*3)	rating
			Min.		of float (*2)		
φ98×H63	304 Stainless steel	200 kPa	0.5	26mm	×	No mark	
φ 50×H45	Foamed NBR+PF	2 MPa	0.5	19mm	×	S	
φ49×H50	316 Stainless steel	2 MPa	0.55	25mm	0	0	
φ65×H80	PVC	200 kPa	0.65	43mm	0	SWITCH ON	15VA
φ65×H80	PP	200 kPa	0.5	30mm	0	SWITCH ON	
φ74×H80	CPVC	200 kPa	0.7	47mm	×	1	
φ38×H50	316 Stainless steel	600 kPa	0.65	26mm	×	0	
φ48×H58	PP	200 kPa	0.75	37mm	×	SWITCH ON	
φ98×H63	304 Stainless steel	200 kPa	0.5	28mm	×	No mark	
φ49×H50	316 Stainless steel	2 MPa	0.75	32mm	×	No mark	
φ65×H80	PVC	200 kPa	0.75	51mm	×	SWITCH ON	220VA
φ65×H80	PP	200 kPa	0.6	40mm	×	SWITCH ON	
φ74×H80	CPVC	200 kPa	0.75	57mm	×	3	

- (*1)1.0 specific gravity of the liquid
- (*2) The reversed characteristic of float means that the actuation of float can be changed by revised direction of insertion.
- (*3) The float must be inserted to same direction with ON actuation of switch and identifying mark of actuation. If the float does not have identifying mark, do not care about direction of insertion.

Custom switch versions can select required mountings.



3. PRINCIPLE OF OPERATION

FR series units contain hermetically-sealed reed switches in the stem and a permanent magnet in the floats. As the float rises or falls with the level of the liquid, the reed switch is activated by the magnet in the float.

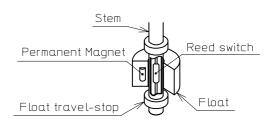


Fig. 1 Construction

4. INSTALLATION

4.1 Unpacking

- (1) This unit has been thoroughly inspected and carefully packed at the factory to prevent damage shipment.
- (2) When unpacking, exercise due care not to subject the instrument to mechanical shock.
- (3) After unpacking, visually check the instrument exterior for damage.
- (4) When the length exceeds 1500mm, carry by two or more persons.
 - Otherwise the switch may be damaged
- (5) Keep sensor clean. Otherwise detecting errors may be caused.
- (6) It doesn't place in piles.

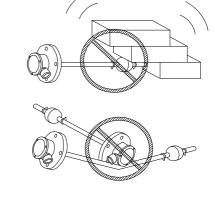


Fig. 2

4.2 Installation site

This unit should be installed in an area which meets the following conditions

- (1) Normal temperatures, with nominal temperature fluctuations.
- (2) Low relative humidity and no exposure to moisture.
- (3) No corrosive gases (Such as NH₃, SO₂, Cl₂, etc.)
- (4) No excessive vibration.
- (5) Ample space for maintenance/inspection.
- (6) If there is surface wave motion, use a time-delay relay for chattering the switch action. Otherwise we recommend the installation of a stilling tube. Drill vent holes in the tube and use spacer to keep the float traveling.

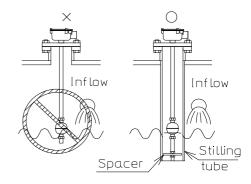
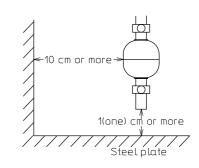


Fig. 3

- (7) This float switch should be located away from strong magnetic fields such as those produced by motors or solenoid valves.
- (8) Make sure that the FR should be located away from metallic substances such as steel plate 10cm or more.
- (9) Please use caution during installation. Bending or hitting the stem may break the reed switches.



4.3 Installation method

Fig. 4

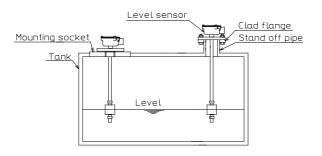


Fig. 5 Example of mounting

(1) In case of flange

Fix with the bolt which was in clad flange and the standard on the side of the tank. When pressure is taken, it makes not leak out with the gasket.

(2) In case of plug

Install to become perpendicular.



Don't turn a terminal box.

5. WIRING

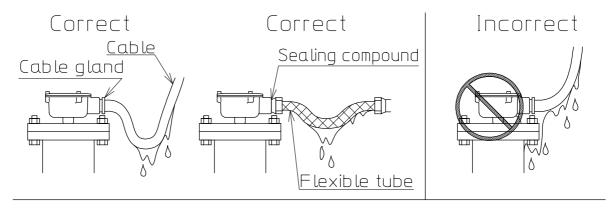
5.1 Cable inlet

The size of the cable inlet is G 3/4".

There are two ways for connecting the sensor cable. One is fixing the cable with a cable gland. The other is connecting a conduit to the housing.

In either case, an adequate sealing should be provided to prevent water or dust ingress into the housing through the sensor cable.

Secure the cable using sealing material for the conduit connection, or a proper tool when the gland is used, to protect the housing inside from dust or water. When water or moisture comes into the housing from the conduit, use putty to fill the inside of the conduit.



5.2 Terminal blocks and wiring

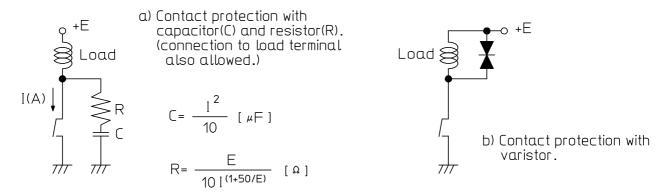
Table 4

Actuation			Те	rmina	1 bl	ocks					W	iring(color	·)			
levels	<i>Q</i> 1	<i>Q</i> 2	<i>Q</i> 3	Q 4	<i>Q</i> 5	Q 6	Q 7	Com.	<i>Q</i> 1	Q 2	<i>Q</i> 3	Q 4	<i>Q</i> 5	<i>Q</i> 6	Q 7	Com.
1	А-В								black×2							
2	A-B	C-D							black×2	White × 2						
3	А-В	C-D	E-F						black×2	White × 2	red×					
4	А-В	C-D	E-F	G-H					black×2	White \times 2	red×	green×2				
5	A	В	С	D	Е			Н	black	White	red	green	yellow			gray
6	A	В	С	D	Е	F		Н	black	White	red	green	yellow	brown		gray
7	A	В	С	D	Е	F	G	Н	black	White	red	green	yellow	brown	blue	gray

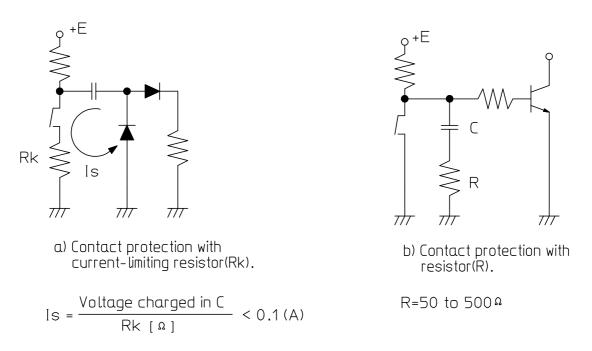
[·]If you specified optional terminal blocks and/or wiring colors, please check your order sheet or the drawings you approved.

^{&#}x27;Normally, wiring data are indicated at the back of the housing cover.

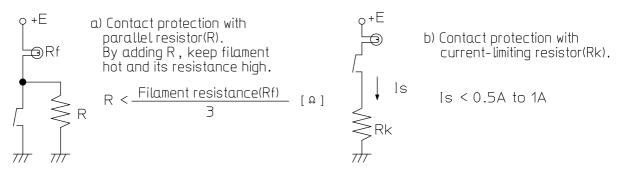
- 5.3 Protect circuit of switch contact
 - (1) Recommend to set protective circuit against damage of switch contact and a short life by back electromotive voltage in case of using inductive load such as relay, solenoid, and transformer. Refer to the diagram as below.



(2) Recommend to set protective circuit against damage of switch contact and a short life, if the no-load current is flowing by charge and discharge from circuit including condenser to switch. Refer to the diagram as below.



(3) Necessary to set protective circuit to connect with load like a lamp (electric filament lamp and etc.) due to the flowing inrush current right after turned ON. Refer to the diagram as below.

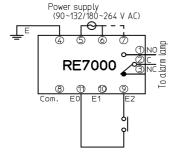


5.4 Model RE relay unit

We recommend the use of our relay unit model RE. It is single level (alarm) and/or dual level (empty/fill control) relay.

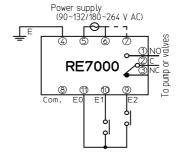
The latching (holding relay) feature allows pumps, valves and other devices to be turned on at one level and off at another. It also contribute to safety since it allows lower voltage and smaller currents to be used with FR.

·SINGLE LEVEL ALARM



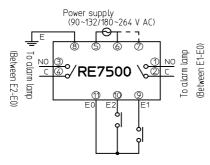
SELECT.SW. H.ON side : High alarm SELECT.SW. L.ON side : Low alarm

·DUAL LEVEL EMPTY/FILL CONTROL



SELECT.SW. H.ON side : Filling control SELECT.SW. L.ON side : Emptying control

\cdot SINGLE LEVEL ALARM



SELECT.SW. H.ON side : High alarm SELECT.SW. L.ON side : Low alarm

Fig. 6

For the relay unit Model RE, refer to Instruction Manual.

5.5 Wiring procedure

Proceed as follows:

- (1) Remove the housing cover Standarad Box:loosen M3 screws. See Fig. 7.
- (2) Bring cables into housing.
- (3) Connect cables to the terminals.
- (4) Make sure that there are no miswirings.
- (5) Re-install and tighten the housing cover to preserve the protection category IP65.

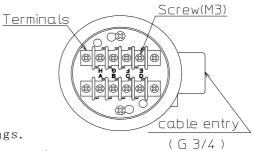


Fig. 7

NOTE the following points:

- Standard Box Fig .7:Install solderless lugs fitted to M3 screw to the end of lead wires and the inner conductor.
- The size of the cable inlet is ${\rm G3/4}"$.

There are two ways for connecting the sensor cable. One is fixing the cable with a cable gland. The other is connecting a conduit to the housing.

In either case, an adequate sealing should be provided to prevent water or dust ingress into the housing through the sensor cable.

Secure the cable using sealing material for the conduit connection, or a proper tool when the gland is used, to protect the housing inside from dust or water.

When water or moisture comes into the housing from the conduit, use putty to fill the inside of the conduit.

6. TECHNICAL NOTES

- (1) Actuation levels are assumed with water (SG=1.0). If your liquid has a different specific gravity, please specify this when you order.
- (2) Maximum allowable impact is 100m/s². Shocks greater than 100m/s² may damage the switch. The reed switch's enclosure is made from glass. If the FR is dropped to the hard floor from more than 30cm, the reed switch may be damaged.
- (3) Please use caution during installation. Bending or hitting the stem or pulling the lead wires may break the reed switches.
- (4) The float travel stop settings are based on how the magnetic field influences the reed switches. When you move the float travel stop, check switch action for float overrun.
- (5) This float switch should be located away from strong magnetic fields such as those produced by motors or solenoid valves.

7. INSPECTION AND MAINTENANCE

Periodic inspection are necessary means to keep your FR switches in good working order.

Please pay attention to the following.

7.1 Remove sensor from the tank

- (1) The power supply is turned off.
- (2) Open a cover and remove wiring.
- (3) Remove flange bolts or turn a plug. It pulls a sensor out of the tank.
- (4) Put a sensor on the flat place.

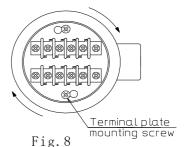
- 7.2 How to inspection and maintenance
 - Adjustment, inspection and maintenance shall be done by the skilled engineer. Check once or more in the half year or in the year. But, it depends on the use condition.
 - (1) Never leave the housing cover off. It become damaged or misplaced, order a replacement immediately.
 - (2) If it has buildup on float and stem, detecting errors may be caused. Keep clean float and stem.
 - (3) Inspect switches and terminals.
 - (4) After removing the housing cover, check switches actuation.
 - (5) The float travel stop settings are based on how the magnetic field influences the reed switch. If float overrun, adjust and check the float travel stop.
 - (6) The life expectancy of reed switches are over 10⁶ operations. They are susceptible to damage from electric surges and mechanical shocks. If these conditions exist, order replacements immediately.
 - (7) If the float is filled with water or damaged, it must be replaced immediately.
 - (8) Vibration may sometimes cause terminal screws to work loose. Check all terminals to be certain that screws are tight.

8. LEVEL ADJUSTMENT

Generally FR model allows adjustment of actuation levels to meet changing operating conditions. Use the following procedure to make adjustments:

(1) Loosen the mounting screws.

Standard Box:Loosen the terminal plate as Fig. 8 and pull. It becomes off.



(2) Remove the internal circuit and its associated support rod from inside the

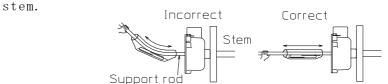


Fig. 9

(3) Move position of reed switches to new levels.

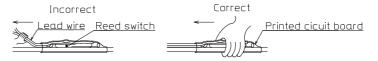


Fig. 10

(4) Secure reed switches with vinyl tape.

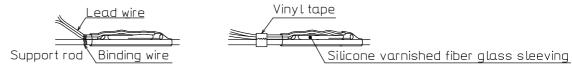


Fig. 11

- (5) Insert internal circuit back into stem.
- (6) Adjust position of floats and float travel stop to match position of switch. Consult Table 5.

Table 5

	Length between					
	float and float					
Model	travel stop.					
	ON range	OFF range				
FR10, FR30S	$4\pm2\mathrm{mm}$	8 ± 2 mm				
FR30B, FR30VS	$8\pm2\text{mm}$	8 ± 2 mm				
FR30PS, FR30HVS						
FR60S, FR60VS	5 ± 2 mm	$8\pm2\text{mm}$				
FR60PS, FR60HVS						

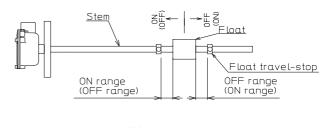


Fig. 12

9. TROUBLESHOOTING

CAUTION

Use the following chart to troubleshoot the malfunctioning sensor.

If your remedies are unsuccessful, ask Nohken for repair and replacement.

Table 6

Problems	Possible causes	Remedies
	Miswiring	Wire correctly
Floats rises or falls	Cables broken	Replace cables
with the liquid level	Float travel stop is in	Adjust position of float
Switch de-activated	improper position	travel-stop
	Reed switch is in improper	Adjust position of reed
	position	switch or float
	Reed switch is damaged	Replace reed switch
	Affected by strong magnetic	Use shield or install in
	field	good location
	Liquid immerse in sensor	Replace sensor
	Buildup on float or stem	Clean float and stem
Floats doesn't		
rises or falls with	Specific gravity of liquid	Change the proper float
the liquid level	too light	
	Float is filled with water	Replace float
	Install into the stilling	Drill vent holes where
	tube, no vent holes	it is upper side
	Float is in contact with	Use spacer
	stilling tube	
	Float damaged by over-	Replace float
	pressure	
	Float is swelled or	Replace compatible float
	corroded	
	Loose cables	Tighten connections
Switch chattered	Waves or disturbances in	Use stilling tube or
	tank	time-delay relay
	Install in wrong	Install in good location
	location	

10. REPLACEMENT PARTS

Table 7

Code	Description	Remarks
Reed switch A	15VA, 15W	Specify the length if
Reed switch B	110VA, 33W	you need lead wires.
Reed switch C	220VA, 55W	
Float A	≬49×H50, 316 Stainless	Specify the reed switch
	steel	rating when you order.
Float B	≬38×H50, 316 Stainless	The magnet in the float
	steel	must be changed in
Float C	∮98×H63, 304 Stainless	accordance with switch
	steel	rating.
Float D	≬48×H50, Titanium	For example,
Float E	≬38×H50, 316L Stainless	Float A for 15VA.
	steel	
Float K	∮50×H45, NBR	
Float M	∮65×H80, PVC	
Float N	∮65×H80, PP	
Float P	∮74×H80, CPVC	
Float R	∮70×H70, PVDF	
Float S	∮75×H100, PTFE	

NOTE: Reed switch C (220VA,55W) is not available for Float B, K, R and S. When ordering other parts or the whole FR for repeat, specify the model number and serial (manufacturing) number on the name plate or attach the drawing you approved.

NOHKEN INC.

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