

I N S T R U C T I O N M A N U A L

F O R




V I B R A T I N G L E V E L S E N S O R

M O D E L : V C 1 2

Issued

2008-03-27

IMPORTANT INFORMATION

- A. This manual describes the installation, operation, adjustment and maintenance of model VC12 VIBRATING LEVEL SENSOR. Read and understand this manual before installation. After reading, save to refer when you need.
- B. Specifications are subject to change without any obligation on the part of the manufacturer.
- C. This manual specifies standard specifications of this product.
Some specifications may be different from your product if you order the custom-made product.
- D. A variety of specifications are available to meet your process conditions, such as installation conditions, chemical compatibility, and so on. We are glad to offer suggestions to assist your decision.
- E. If you have any questions or comments for the contents of this manual, ask Nohken's sales office.
- F. Nohken Inc. pursues a policy of continuing improvement in design and performance of this product. We will supply the alternative parts or complete new products required to repair or replacement.
- G. Signal words in this manual means as follows:
 - G-a  **WARNING**
Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
 - G-b  **CAUTION**
Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
 - G-c **NOTE**
Indicates exceptional cases and attention for handling of products.
 - G-d **REFERENCE**
Indicates technical valuable suggestions, which is unrelated to the hazard.
 - G-e  Indicates prohibition.

* : See section page 25 for the word explanation.

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1. WARRANTY & DISCLAIMER

- A. Nohken Inc. warrants this product against defects in design, material and workmanship for a period of one (1) year from the date of original factory shipment.
- B. If defects occurs during the above-mentioned warranty period, Nohken will, at its option, replace or recondition the product without charge. This shall constitute the exclusive remedy for breach of warranty.
- C. Nohken Inc. makes no warranty with respect to:
 - C-a Failure to comply with instructions of this manual.
 - C-b Failure or damage due to improper installation, wiring, operation, maintenance, inspection and storing.
 - C-c Product which has been in any way repaired, altered or tampered with by others.
 - C-d Product repaired or modified by using undesignated parts, subassemblies and materials.
 - C-e Direct incidental or consequential damages or losses or expenses resulting from any defective product or the use of any product.
 - C-f Inevitable accident such as acts of God, force majeure, radioactive contamination and so on.

THIS WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

2. PURPOSE OF USE

The vibrating level sensor, model VC12 is used for level detection of solids, fine powders, granular, pellets and sediments under liquids such as sludge and sand.

The output signal from the sensor is used for the alarm and/or control of valves, pumps, pneumatic systems, and so on.

Do not use in any other applications.

3. DESCRIPTION

3. 1 DESCRIPTION

The sensor is installed on the hopper by the mounting flange or the mounting plug.

When the detecting pipe(*) is covered with solids, vibration is damped.

The electronic circuit detects the damp of vibration and converts into a relay output.

* : See section 13 on page 25 for the word explanation.

3. 2 PRINCIPLE OF OPERATIONS

The detecting pipe vibrates by installing magnet and electromagnet in the detecting pipe. Covered with solids damps vibration of the detecting pipe. The current which flows on an electromagnet changes with the states of vibration. The electronic circuit detects the change of the current which flows on an electromagnet and converts into an relay output.

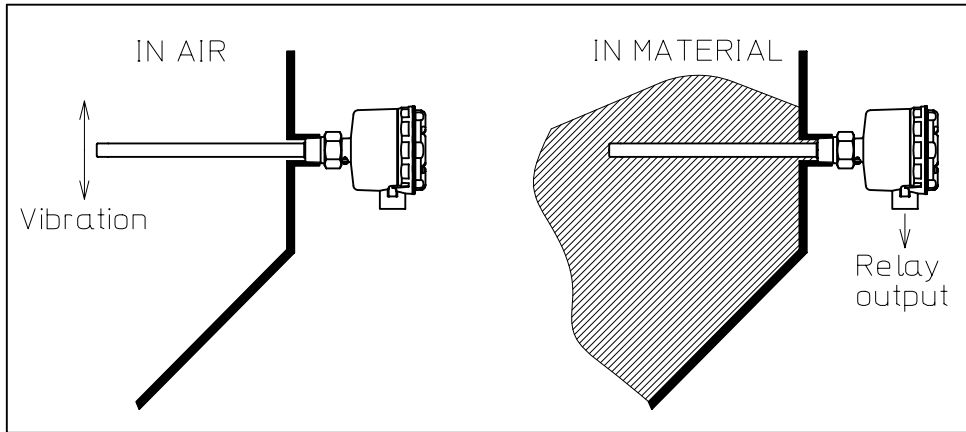
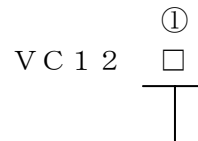


Fig. 3-1

4. SPECIFICATIONS

4.1 MODEL NUMBERING

Model numbering is shown on the nameplate as below:



①	Mounting type
N	Threaded type
F	Flange type
G	Flange with protective shield (guard) type

4.2 STANDARD SPECIFICATIONS

(1) MODEL	VC12N, F, G
(2) MEASURING OBJECT	Powder, Granular materials, Pellets
(3) OPERATION CHARACTERISTICS	
a) Sensitivity	Bulk density : approx. 0.2 g/cm ³ min.
b) Indication	By Red LED for Relay status By Green LED for Power status
c) Initial reset time	Approx. 15 sec.
d) Vibration frequency	Approx. 900 to 1100 Hz
(4) ELECTRIC CHARACTERISTICS	
a) Power	100 to 240 V ±10% AC 50/60Hz
b) Power consumption	5 VA Max.
c) Output	Relay contact 1 transfer. Fail-safe switch. Switching delay time : Turn-on, approx. 3 to 5 sec. Turn-off, approx. 3 to 5 sec.
d) Contact rating	250V 3A AC , 30V 3A DC (Resistive load)
e) Withstand voltage	1500V AC , 1 minute. (Between housing and each terminal except "E" terminal.)
f) Insulation resistance	More than 100 MΩ 500V DC Megger (Between housing and each terminal except "E" terminal.)
(5) MECHANICAL CHARACTERISTICS	
a) Withstand pressure	2MPa Max. (Except a mounting part)
b) Concentrated load	0.55kN Max.
(6) ENVIRONMENT	
a) Operating temperature (Get rid of dew.)	Detecting part ; -20 to +150°C Housing ; -20 to + 60°C
b) Operating humidity	5 to 95 % RH
(7) CONSTRUCTION	
	Detecting part ; IP68 or equivalent Housing ; IP65 or equivalent
(8) PHYSICAL	
a) Materials	Detecting part ; 304 stainless steel Housing ; Aluminium die casting(ADC12) (Acrylic coating)
b) Cable inlet	G 3/4 or equivalent

4. 3 COMPONENT NAMES

① Detecting Pipe($\phi 16$, L=175mm)

Detecting part which touches directly to the powders. It vibrates when there's no powders, but vibration will be damped or stop when it becomes buried in the measured materials.

② Plug for VC12N

Screw to install the sensor to the tank.

③ Flange for VC12F

Flange to install the sensor to the tank.

④ Housing

Electronic circuit is placed.

⑤ Cable inlet

Sizes are G 3/4 or equivalent.

⑥ Cover

Cover for the sensor.

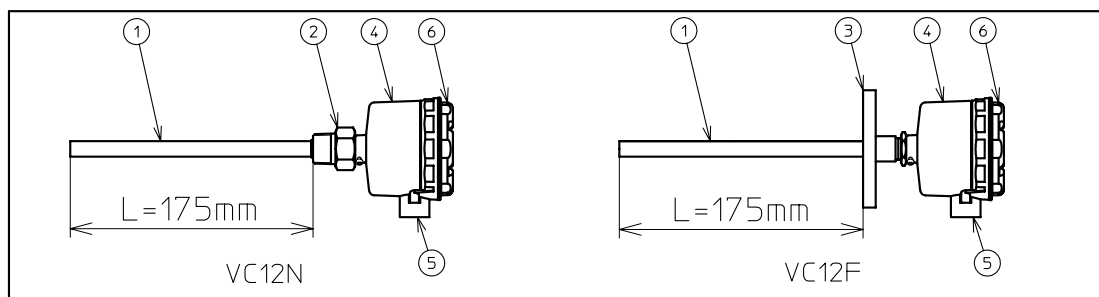
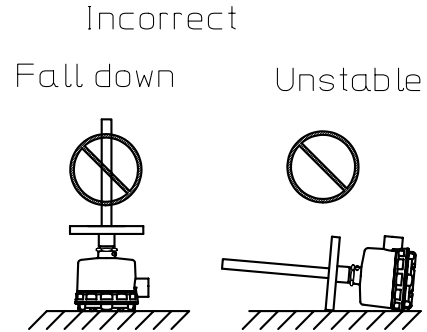
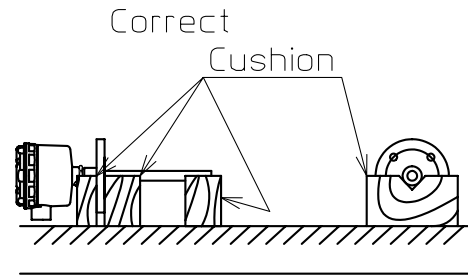


Fig. 4-1

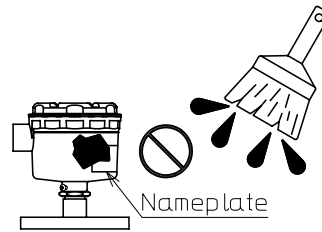
5. HANDLING NOTES

Cautions for handling shall be taken as follows. Otherwise the sensor may be damaged.

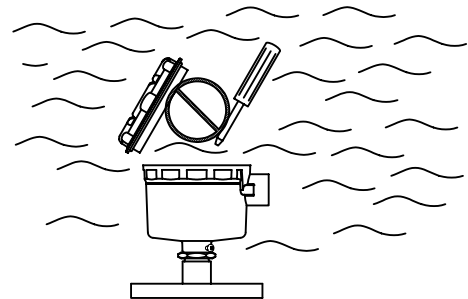
5. 1 When storing, put the sensor on the flat and ample space with the cushion or the tie. Avoid physical shock, bending, dropping and rolling the sensor.
If you upright the sensor, provide appropriate means to avoid falling. You especially avoid physical shock to detecting pipe.



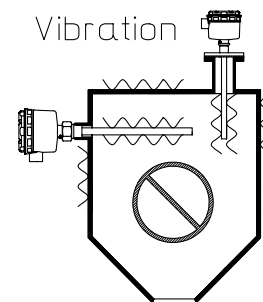
5. 2 When painting the sensor, do not paint on the nameplate to keep indication for future reference of maintenance.



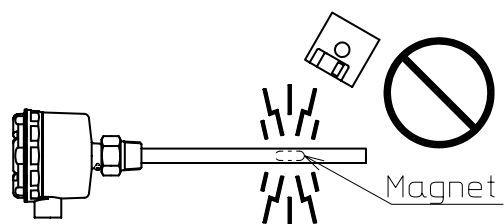
5. 3 Do not use the sensor where corrosive gases generate. The electronics in the housing may be corroded and damaged by the corrosive gases (NH_3 , SO_2 , Cl_2 , and so on).



5. 4 Do not use the sensor in the areas of the strong vibration which is invisible of the sensor outline. If inevitable, provide appropriate means to prevent fracture of the sensor.



5. 5 Do not place the thing influenced of the magnetic field like a floppy disk near the detecting pipe, since the magnet is in the detecting pipe.

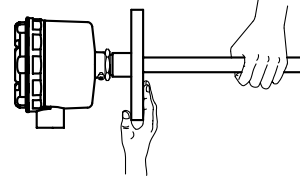


6. INSTALLATION

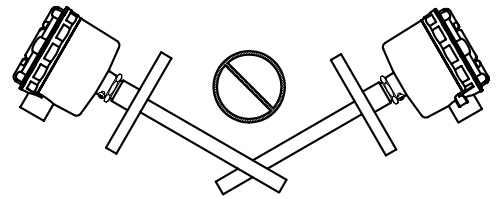
6. 1 UNPACKING

6.1.1 When unpacking, take out the sensor carefully. To avoid bending or dropping the sensor, hold the following place:

- Flange mounting: cumbersome part around the flange and flange itself.
- Plug mounting : cumbersome part around the plug and plug itself.

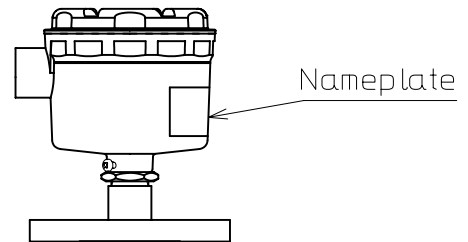


6.1.2 Avoid physical shock more than 10G. Dropping, throwing or bumping shall damage the sensor.



6.1.3 Remove all packing materials such as tape, plastic bags and carton box before using.

6.1.4 Do not put things on the sensor. It shall damage and deform the sensor.



6.1.5 Make sure that it is the right product you required. Model numbering of the sensor is indicated on the nameplate. If incorrect, ask Nohken or our distributor.

6.1.6 Check the sensor exterior for damage. If any, ask Nohken or our distributor.

6. 2 INSTALLATION LOCATION

6.2.1 Before installing the sensor, provide ample space for installation, maintenance and inspection. Especially keep the enough overhead space for top mounting. This sensor shall be installed in an area which meets the following conditions. Refer to Figure 6-1.

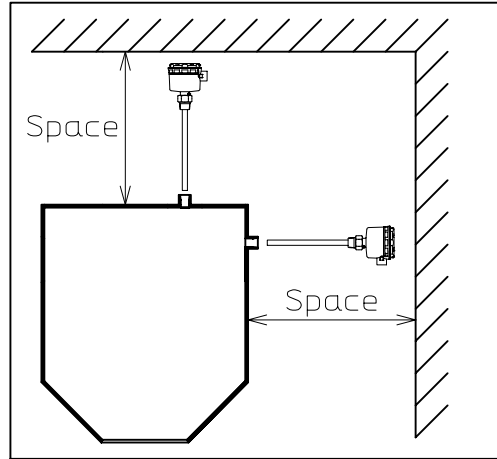


Fig.6-1

(1) Pay attention to the angle of repose. (*) Otherwise, the sensor may cause malfunction. Refer to Figure 6-2.

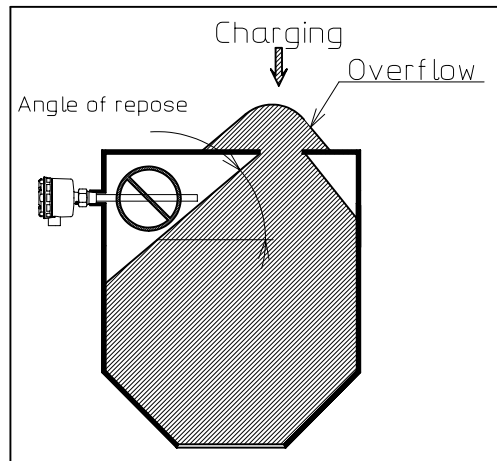


Fig.6-2

(2) Do not install where vibration occurs. Installing near the vibrator(*) or the knocker(*) will cause malfunction and damage the sensor. Refer to Figure 6-3.

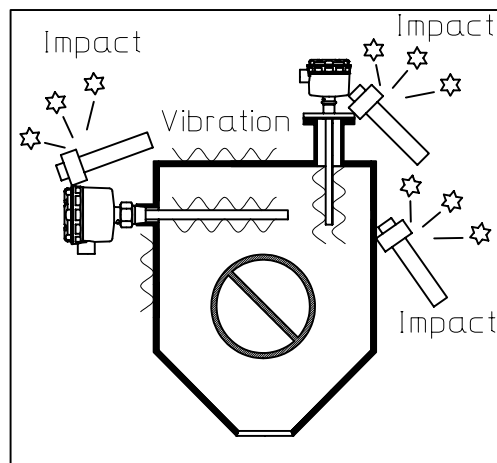


Fig.6-3

* : See section 13 on page 25 for the word explanation.

- (3) Pay attention to the dead stock. (*)
 Otherwise, the sensor may cause malfunction.
 Refer to Figure 6-4.

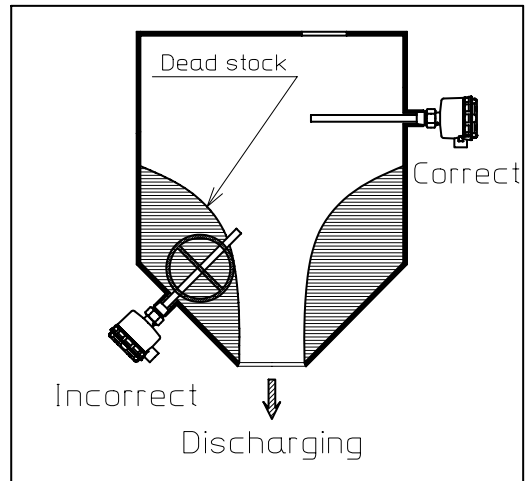


Fig.6-4

- (4) Pay attention to the bridge. (*)
 Otherwise, the sensor may cause malfunction and it is damaged by crumble solids.
 Refer to Figure 6-5.

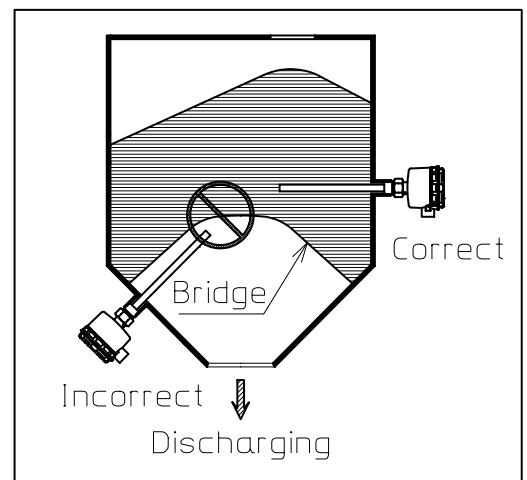


Fig6-5

- (5) Keep the detecting pipe out of the direct flow. Install the protective shield(*) above it or replace to the "G" type sensor if necessary.
 Refer to Figure 6-6.

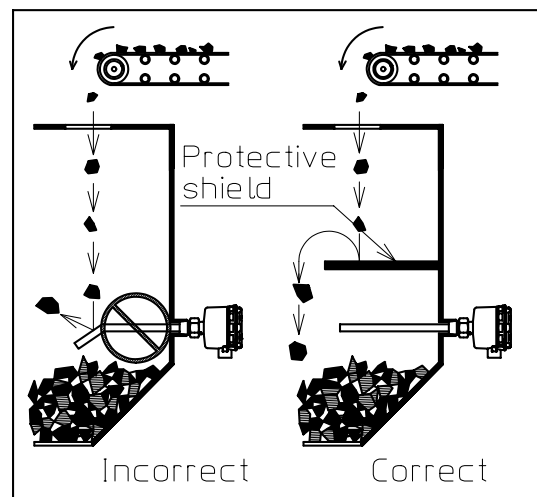


Fig6-6

* : See section 13 on page 25 for the word explanation.

(6) Do not install the sensor where the temperature is high. Maximum operating temperature is as section 4.2 (6) on page 5.

(7) Do not locate the sensor where exposed to direct sunlight. Install the sun shield(*) over the housing if necessary.

Refer to Figure 6-7.

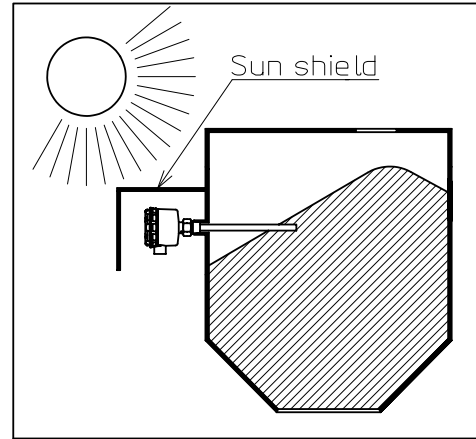


Fig.6-7

(8) The housing protection of the sensor is IP65. The cable gland and the cover must be properly fitted to protect the sensor from rain, splashing water, and so on.

When side-mounting, make sure the cable gland is pointing down to the ground to prevent from water penetration.

Recommended cable diameter is shown on Table 6-1.

Refer to Figure 6-8.

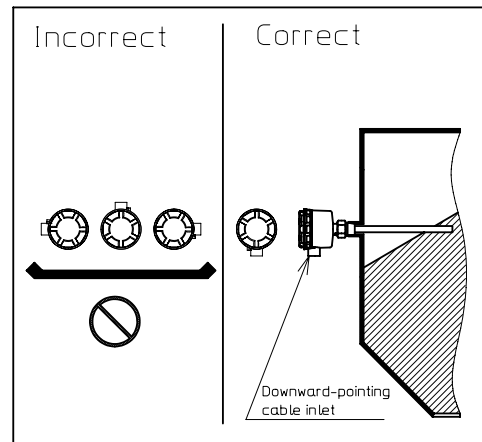


Fig.6-8

Table 6-1

Cable inlet	Cable dimension
G 3/4 or equivalent	ϕ 11.0~11.9mm

* : See section 13 on page 25 for the word explanation.

- (9) Maximum static lateral load at the tip of the detecting pipe is 0.55 kN. Please secure an appropriate safety rate. Otherwise, the detecting pipe, $\phi 16.0 \times L175$, will bend. Refer to Figure 6-9. Install the protective shield above it if necessary. Refer to Figure 6-6.

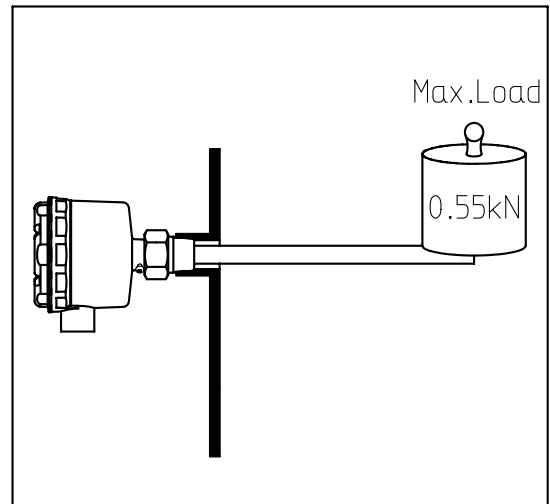


Fig.6-9

- (10) The detecting pipe $\phi 16.0 \times L175\text{mm}$, shall not contact with hopper wall or bottom.
- (11) For the VC12, maximum length for the mounting nozzle or threaded boss is 55mm. If exceeds 55mm, the sensor will detect dead stock or solid residues. Refer to Figure 6-10.
- (12) Do not use the sensor where corrosive gases generate. The electronics in the housing may be corroded and damaged by the corrosive gases (NH_3 , SO_2 , CO_2 , and so on).

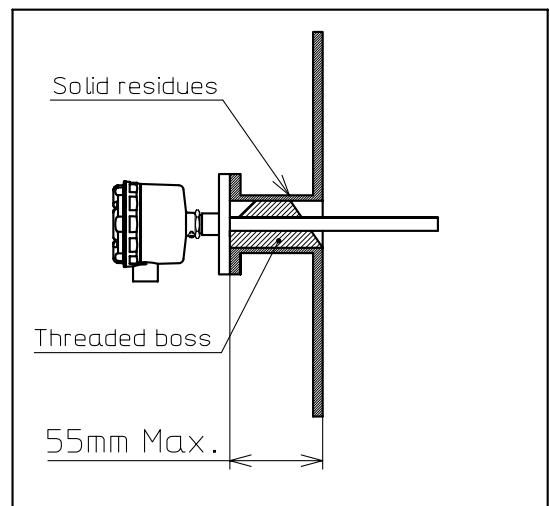


Fig.6-10

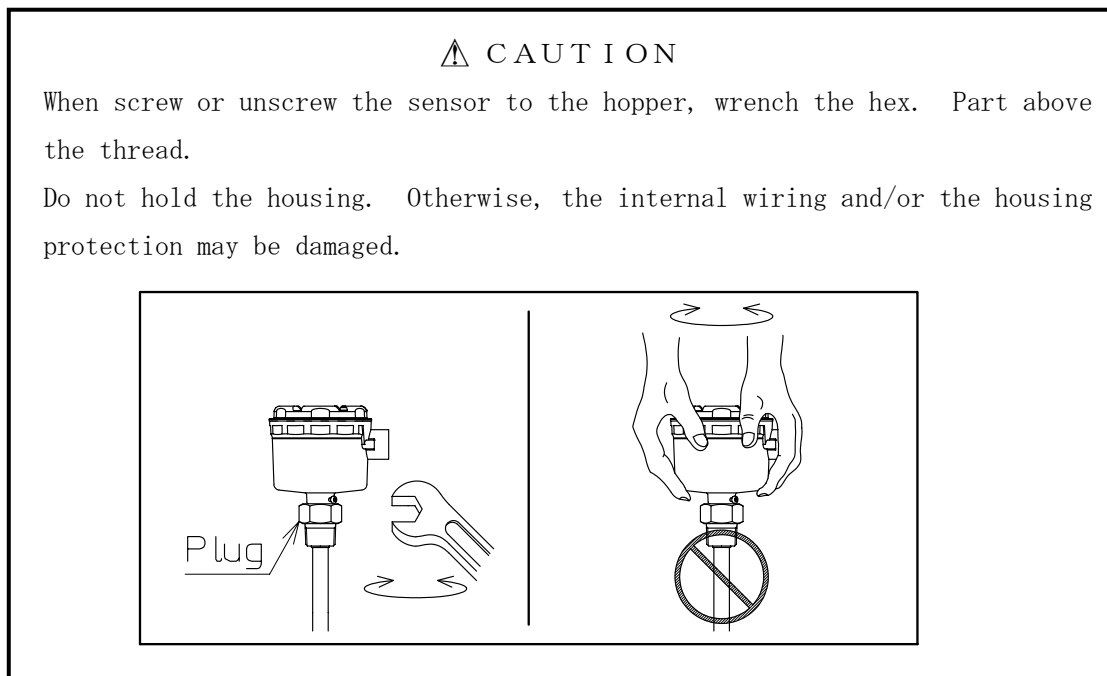
6.2.2 Installation

(1) Flange mounting

Make sure that the size of standoff pipe or mating flange is fitted to achieve seal. In case of negative or positive pressure within the hopper, use suitable gasket and bolt and nut with appropriate tool. Locate the sensor at the position where the desired control level will actually make contact with it.

(2) Plug mounting

Make sure that the size of mounting hole or threaded boss is fitted to achieve seal. In case of negative or positive pressure within the hopper, use suitable pipe compound or seal tape. Locate the sensor at the position where the desired control level will actually make contact with it.



7. WIRING

7. 1 PREPARATION

7.1.1 Turn off the power.

⚠ WARNING

To avoid personal injury, the power source shall be always turned off while wiring.

7.1.2 This sensor has no power switch and the fuse. Provide it separately if necessary.

7.1.3 If 100 to 240V AC is used,
connect the power line to the L and the U terminal.

⚠ WARNING

Check for miswiring for the power line. Otherwise, the sensor will be damaged.

7.1.4 Output signal is changeable by the fail-safe switch selection.

See Figure 7-1.

	Fail-safe mode	LAMP		Relay contact
		DETECTION	POWER	
	H.ON			C — ○ NO ● NC
	L.ON	●		C — ○ NO ● NC
	H.ON	●		C — ○ NO ● NC
	L.ON			C — ○ NO ● NC
POWER OFF		●	●	C — ○ NO ● NC

Fig.7-1

⚠ CAUTION

Maximum relay contact is 250V 3A AC or 30V 3A DC (resistive load).
Do not connect overload. When load capacity exceeds the contact rating,
connect external relays between the load and the sensor.

7.1.5 Ground terminal "E" shall be grounded as JIS Class D, Max. 100Ω.

⚠ CAUTION

To avoid electrical shock and sensor's damage, ground terminal shall be always grounded.

7. 2 CONDUIT CONNECTION

In case of the conduit method, sealing compound shall be applied onto the screw of the cable inlet to protect water penetration.

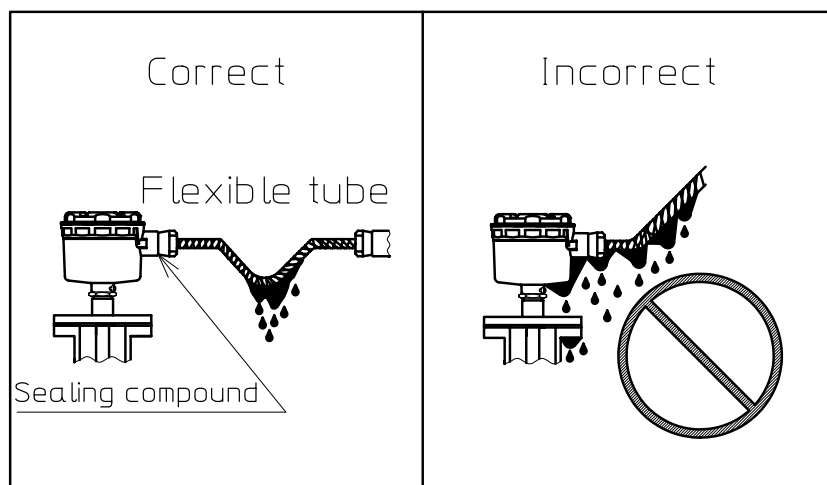


Fig. 7-2

7. 3 WIRING

Wiring shall be in accordance with all local codes. Since terminal screws are M3.5, our recommended solderless lugs are R1.25-3.5. See Figure 7-3.

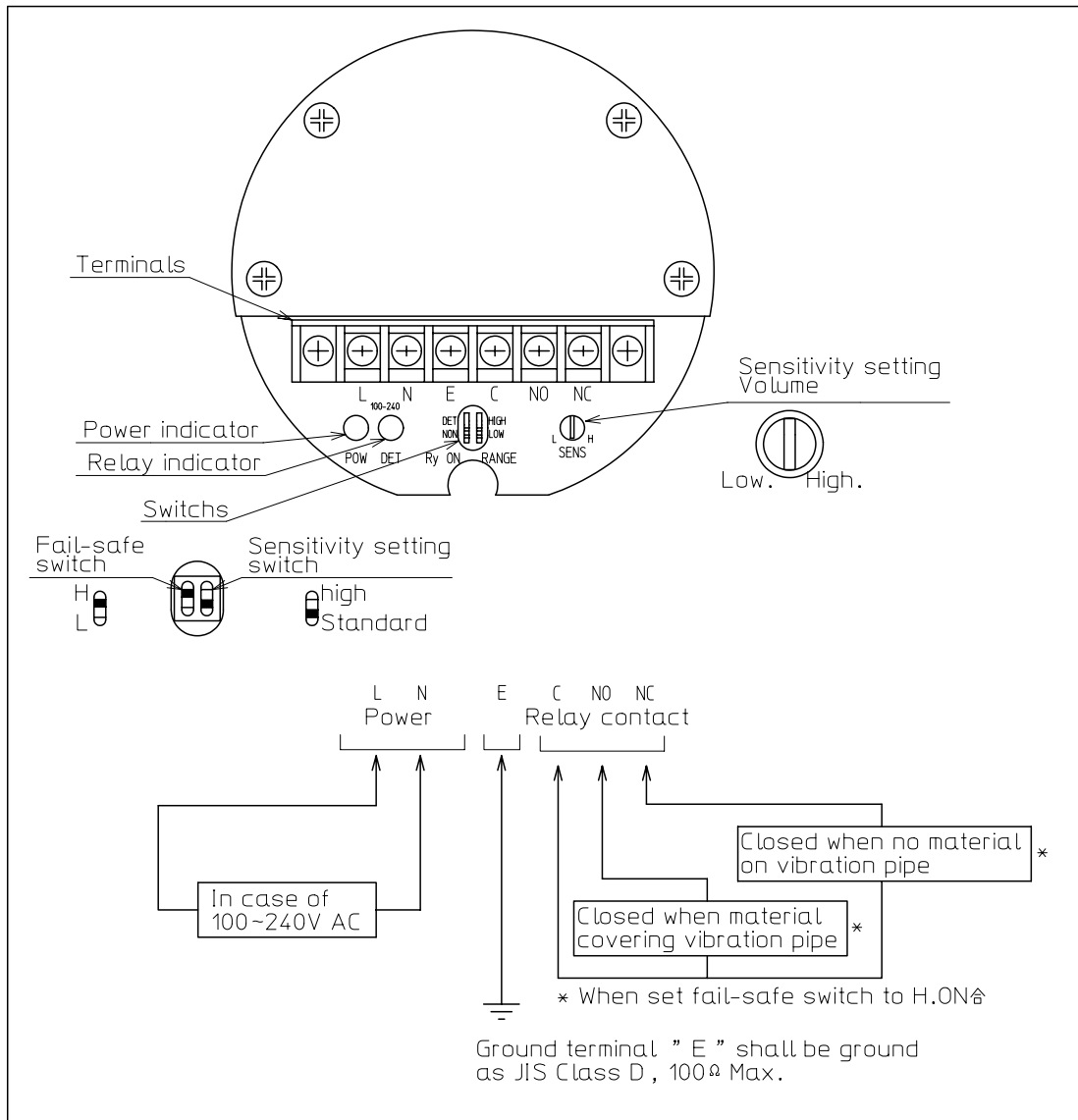


Fig. 7-3

7. 4 OPERATION CHECK

- 7.4.1 Make sure that there are no dust or metallic substances in the housing.
- 7.4.2 Make sure the sensor operation in the test stage. If the operation is unsuccessful, check wiring and read this manual again.

7. 5 COVER INSTALLATION

Tighten the cover onto the housing to prevent from dust or water penetration. Otherwise, malfunction may occur thanks to corrosion or short-circuit.

8. NOMENCLATURE

Refer to Figure 8-2 for nomenclature of the amplifier.

① Terminals

Output terminal for power connection and sensor relay contact signal.

② Power Indicator

Green lamp lights when the sensor power is on.

③ Alarm Indicator

Red lamp lights when the sensor detects the measuring materials.

④ Fail-Safe Switch

To set the high or low fail-safe mode.

⑤ Sensitivity Setting Switch

To set the sensor detecting sensitivities. Refer to Figure 8-1.

⑥ Sensitivity Setting Volume

To set the sensor detecting sensitivities. Refer to Figure 8-2.

⑦ Earth Terminal

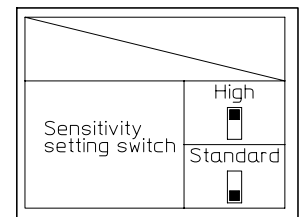


Fig. 8-1

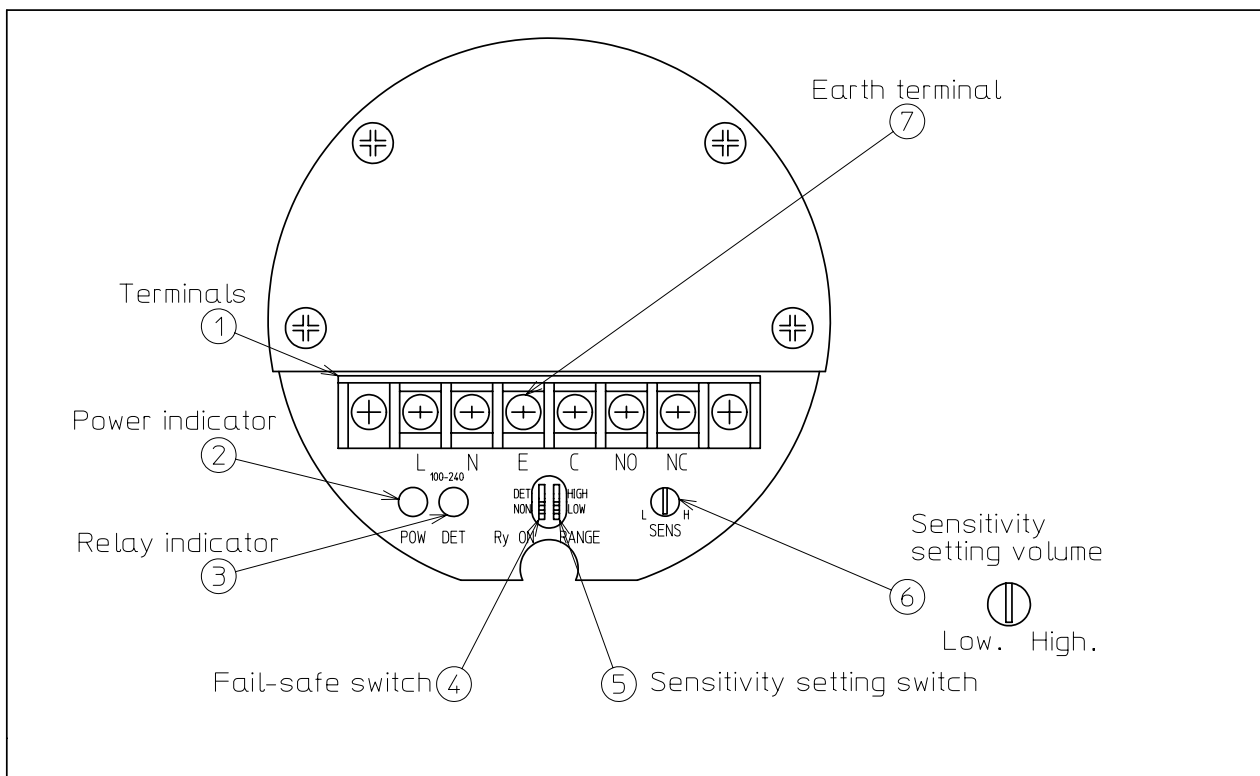


Fig. 8-2

9. ADJUSTMENT

The VC series is generally not necessary for the adjustment. Sensitivity of the VC series is factory set for use in a wide range of solids. However, in extreme applications, the adjustment may require ensuring correct operations.

9. 1 PREPARATION OF THE EQUIPMENT

Prepare small slotted driver which meets 0.7mm×5mm slot.

9. 2 TECHNICAL NOTE

⚠ CAUTION

Output may chatter during adjustment or inspection. Any devices connected to the VC will actuate until the adjustment or inspection is finished.

9. 3 SENSITIVITY SETTING PROCEDURE

(1) Clean up the vibration pipe. While adjusting, make sure the measuring materials are not contacting the vibration rod. IF it contacts, exact adjustment will be impossible.

⚠ CAUTION

Adjust the sensitivity after installing the sensor on the hopper which you actually use. Also, use the solids that you actually use.

Otherwise, the sensitivity may be changed in accordance with the different of apparent bulk density around the detecting pipe.

(2) Make sure the power supply is turned on. (Initial reset time: approx. 15 sec.)

(3) Sensitivity setups

(a) High sensitivity setting.

Set the sensitivity setting switch to H side.

Turn sensitivity volume slowly H side. (clockwise)

⚠ CAUTION

If it turns to a high sensitivity too much, Since it will be detected by a little adhesions, turn to a low sensitivity as much as possible.

(b) Low sensitivity setting

Set the sensitivity setting switch to L. (ordinary sensitivity range.)

Turn sensitivity volume slowly L side.

⚠ CAUTION

If it turns to a low sensitivity too much, Keep in mind that it does not detect powder.

(4) Check the operation status by using actual medium.

10. MAINTENANCE & INSPECTION

Inspection shall be done after removing the sensor from the hopper. First, refer to the section "5. HANDLING NOTES". Prepare the ample space for inspection.

10. 1 REMOVING

10.1.1 Turn off the power.

⚠ WARNING

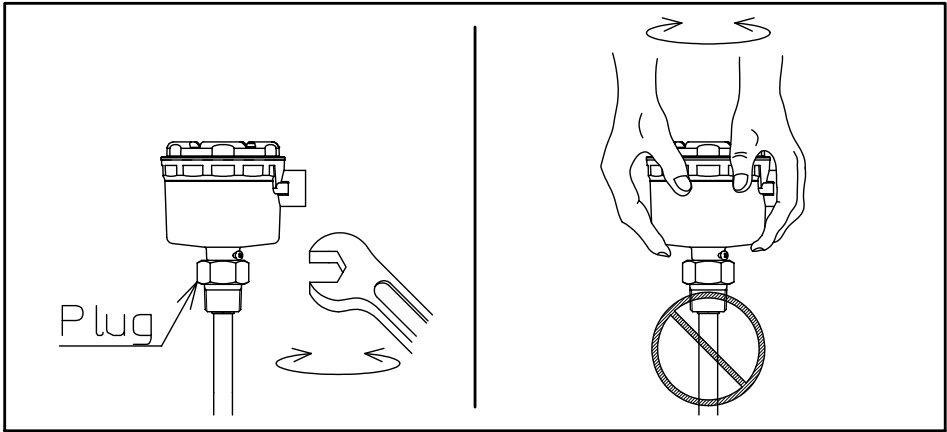
To avoid personal injury, the power source shall be always turned off while removing.

10.1.2 Remove the housing cover and disconnect cables.

⚠ CAUTION

When screw or unscrew the sensor to the hopper, wrench the hex. part above the thread.

Do not hold the housing. Otherwise, the internal wiring and/or the housing protection may be damaged.

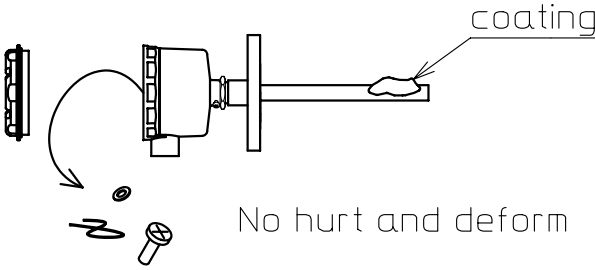
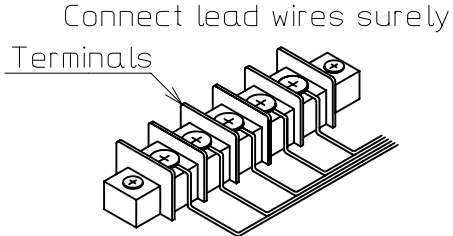
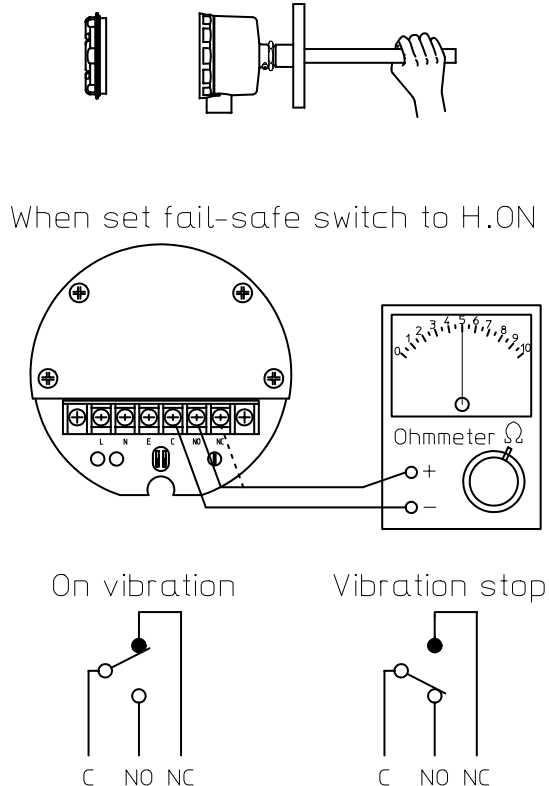


10.1.3 Loosen or unscrew the flange or the plug part, and remove the sensor from the hopper.

10.1.4 Put the sensor on the flat place.

10. 2 MAINTENANCE & INSPECTION

Inspect the sensor semi-annually or annually. Since inspection intervals varies with applications and process conditions such as pressure, temperature and so on. We recommend you to inspect periodically.

<p>10.2.1 Make sure that there is no damage. If necessary, repair or replace parts.</p> <p>10.2.2 Clean build-up or coating on the detecting pipe.</p> <p>10.2.3 Check for and clean dirt, dust, moisture and metallic substances in the housing.</p>	
<p>10.2.4 Make sure that lead wires are surely connect to terminals. Tighten screws if necessary.</p> <p>10.2.5 Make sure terminals and lead wires are not corroded. Replace it if necessary.</p>	
<p>10.2.6 Connect an ohmmeter to terminals. Check the relay operation by holding the detecting pipe. If correct value is not read, repair or replace it.</p>	

10. 3 RE-INSTALLATION

Refer to section "6.2 INSTALLATION LOCATION" (page 9 to 13).

10. 4 WIRING

Refer to section "7 WIRING" (page 14 to 16).

10. 5 REPLACEMENT PARTS & CYCLE

Replace to our special-purpose parts if the following symptoms occur.
When replacing the parts, make sure that the specification is correct.
Some parts are same outlook with different specifications.

10. 6 REPLACEMENT CYCLE OF THE SENSOR

The life expectancy of the sensor may be 5 years due to the deterioration of electric parts or corrosion and abrasion of the detecting pipe.

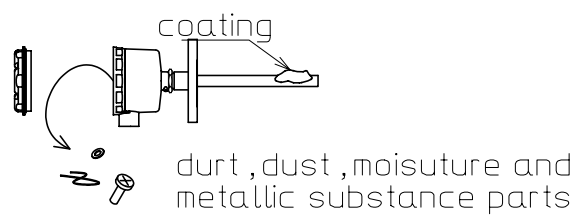
11. STORING

The sensor shall be stored under the following conditions when it is not used for a long time.

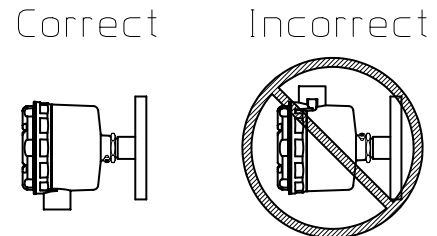
11.1 Environmental conditions are as follows:

- The storing temperature range is -10°C to $+60^{\circ}\text{C}$.
- Relative humidity is Max. 85% RH.
- No corrosive gases (such as NH_3 , SO_2 , CO_2 , etc.)
- Vibration is low.

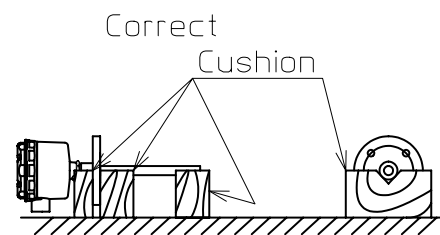
11.2 Clean or remove buildup. Otherwise, it may cause malfunction when you use the next time.



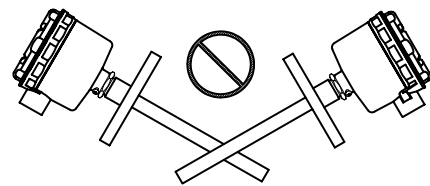
11.3 Locate the sensor away from rain and splashing water. Especially the cable gland shall be pointing down.



11.4 Put the sensor on the flat space with the cushion or the tie as shown on the right. Avoid physical shock, bending, dropping and rolling the sensor.



11.5 Do not put things on the sensor. It shall deform or damage the sensor.



REFERENCE

Keep the sensor in sealed plastic bags with desiccant or other moisture-proof packing when it is not used for a long time.

12. TROUBLESHOOTING

⚠ CAUTION

Use the following chart to troubleshoot the malfunctioning sensor.

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

Problems	Possible causes	Remedies	Reference
No signal outputs. It overflow.	Bulk density is too small. The VC series can not detect less than 0.2 g/cm ³ .	Set high sensitivity or replace to other sensors.	Section 9.3(3)(a), Page 19
	Solids has angle of repose.	Install the sensor in a good location.	Section 6.2.1(1), Page 9
	Solids has bridge.	Install the sensor in a good location.	Section 6.2.1(4), Page 10
	Solids too fluid.	Set high sensitivity.	Section 9.3(3)(a), Page 19
	Effected by severe hopper vibration.	Install the sensor in a good location.	Section 6.2.1(2), Page 9
	Supply power is not connected.	Connect the power.	Section 7.1.3 Page 14
Signal always outputs. Abnormal discharge from the hopper.	Miswiring.	Wire correctly.	Section 7.3, Fig. 7-3, Page 16
	Heavy deposit on the detecting pipe.	Clean it regularly, or set low sensitivity.	Section 9.3(3)(b), Page 19
	Solids has dead stock.	Install the sensor in a good location.	Section 6.2.1(3), Page 10

13. GLOSSARY

The list of explanation of words on this manual is shown below.

Detecting pipe	The detection part which generates vibration.
Angle of repose	Angle of maximum slope at which a heap of any loose solids will stand in direct flow. Refer to Figure 6-2.
Vibrator	A mechanical vibrating device to shake and remove the buildup on the inner surface of the hopper.
Knocker	A pneumatic device to knock and remove the buildup on the inner stand without sliding.
Dead stock	A space left in the cone of the hopper which varies with the angle of repose. Refer to Figure 6-4.
Bridge	An obstruction in the hopper to make a bridge by stacking solids. Refer to Figure 6-5.
Protective shield	The guard to protect the vibration rod from heavy static load surface of the hopper. Refer to Figure 6-6.
Sun shield	A shield or baffle to deflect the direct sunlight from the housing. Refer to Figure 6-7.

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