

I N S T R U C T I O N M A N U A L
F O R
R E C I P R O C A T I N G - P A D D L E L E V E L S E N S O R

M O D E L : B 3

M O D E L : C 5



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NOHKEN INC.

MUST BE READ BEFORE USING





- This manual is for standard specifications. Read the other manuals for explosion-proof specifications.
- This manual describes the handling, inspection and adjustment of the sensor. Read and understand this manual before installation.
- Any documents and/or directions from Nohken and the agents aside from this manual shall be preceded.
- Save this manual to refer when you need.
- If you have any questions or comments about this manual and/or the sensor, ask Nohken's sales office written on the front cover.

Signal words in this manual means as follows:




 CAUTION	Indicates an potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
 NOTE	Indicates exceptional cases and attention for handling of sensors.

	Indicates prohibition. The explanation with this manual should always be followed.
	Indicates directions. The explanation with this manual should always be followed.






⚠ CAUTIONS

<p>• Since this sensor is not an explosion-proof construction, do not use where flammable gas, explosive gas or the vapor exists. Otherwise, explosion the gases and/or the vapor may cause serious disasters. Use explosion-proof sensors at hazard areas.</p>	
<p>• Do not modify or disassemble the sensor. Otherwise, the sensor may be damaged,</p>	
<p>• Operating test shall be conducted before practical use. If malfunction occurs and the accident is predicted, the remedy shall be administrated by using another sensor with different operating principle in parallel.</p>	
<p>• To prevent from electric shocks such as lightning and the static electricity, provide conductor or the surge absorber. Otherwise, the sensor may cause malfunction, damage, ignition, electric shock and injury.</p>	

⚠ NOTES

<p>• Do not give strong shocks to the sensor. Dropping, throwing, striking and dragging the sensor, for example, are to cause strong shocks and damage the sensor.</p>	
<p>• The specifications such as ambient temperature, maximum voltage and the power rating shall meet the conditions. Otherwise, the sensor may cause malfunction, damage, ignition, electric shock and injury. Read and check the clause of specification in the manual or specification sheets.</p>	
<p>• Operating test shall be conducted before practical use. If malfunction occurs and the accident is predicted, the remedy shall be administrated by using another sensor with different operating principle in parallel.</p>	

▲ NOTES

<ul style="list-style-type: none">• Check the chemical compatibility with the material you want to use.	
<ul style="list-style-type: none">• When carrying, installing and removing the sensor, hold the flange or the plug part. Otherwise, the flange or the plug may drop off from the housing and be damaged.	
<ul style="list-style-type: none">• <u>The sensor which is 50cm or longer</u> Do not leave the sensor upright, but lay it down on the floor. Otherwise, the sensor and/or the surrounding things may be damaged or get injured if the sensor falls.	
<ul style="list-style-type: none">• To prevent from electric shocks such as lightning and the static electricity, provide conductor or the surge absorber. Otherwise, the sensor may cause malfunction, damage, ignition, electric shock and injury.	
<ul style="list-style-type: none">• <u>When connecting inductive load or the lamp load to the output contact.</u> To prevent overvoltage and overcurrent, provide a protective circuit to the load. Otherwise, the contact may be damaged.	

INTRODUCTION

- A. This manual specifies standard specifications of this product. Some specifications may be different from your product if you order the custom-made product.
- B. 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.
- C. If you have any questions or comments for the contents of this manual, ask Nohken's sales office written on the front cover.
- D. 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.
- E. Specifications are subject to change without any obligation on the part of the manufacturer.

WARRANTY & DISCLAIMER

- A. Nohken Inc. warrants this product against defects in design, material and workmanship for a period of 1 (one) 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 not 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 Objective of the sensor is clearly specified in chapter 1, PURPOSE OF USE.
 - C-g 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.

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1. PURPOSE OF USE

The Bin Leveller is a powder level gauge of the type in which the sensing impeller put in hopper detects the presence or absence of powder by slowly repeating piston motion. While there is no powder around the sensing element, the impeller repeats the piston motion, but stops the motion when there is powder.

2. OPERATION PRINCIPLE

Main structural parts are illustrated in Fig. 1.

a. When there is no powder around the sensing impeller:

The revolutions of the motor are converted by crank into piston motion to cause the shaft and the sensing impeller to repeat the piston motion at low speeds. Since no external force acts upon the sensing impeller, the spring does not elongate nor contract.

b. When there is powder around the sensing impeller:

While the sensing impeller is advancing, its advance motion is hampered by the powder around the impeller. This causes the spring to contract. When the spring contracts, it causes the link to be deformed which in turn actuates the micro switch to transmit a signal to the outside. At the same time, the motor circuits are opened to stop the piston motion.

c. Resetting

By the absence of the powder from the state where the impeller has stopped by detecting the powder, the

spring force causes the impeller to advance. Then both link and micro switch are reset to the original condition and the impeller again repeats the piston motion.

d. Actual Construction

Although the basic principle is as explained above, the link mechanism that permits detection of powder even during retreating of the sensing impeller is actually employed.

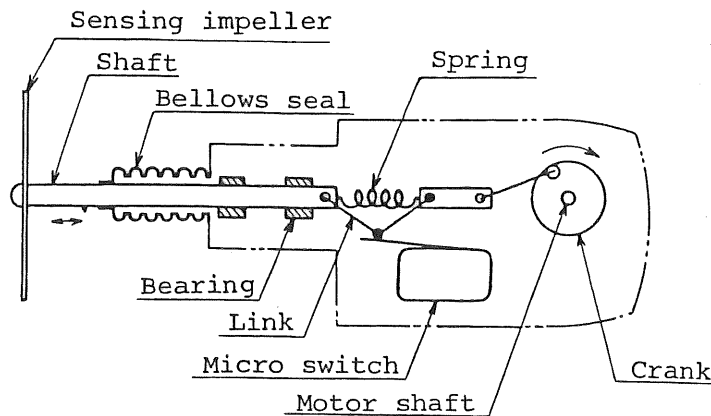


Fig. 1 Principle Diagram

3. POWDER RESISTANCE ON SENSING IMPELLER

The resistance that the sensing impeller receives from powder when it makes the piston motion in the stationary powder layer can be largely classified as follows:

a. Latetral Pressure (Horizontal Powder Pressure)

Since the pressure in the powder layer has no isotropy unlike in fluid, the lateral pressure by the own weight of the powder is lower than the vertical pressure.

b. Vertical Pressure (Vertical Powder Pressure)

The vertical pressure of powder is not in linear proportion to depth. In other words, when the depth increases and approaches a given value, the vertical pressure of the powder dos not increase even if the the depth increases further. Such a phenomenon occurs in the arch formed by the internal friction and adhesive power of the powder. Phenomenon like "bridging" occurs by the same cause.

c. Internal Friction Resistance

When the sensing impeller makes the piston motion in the powder layer, internal friction resistance, besides the abovementioned powder pressures, acts upon the sensing impeller. In other words, when the sensing impeller makes the piston motion in the powder layer, friction is developed between powder and powder owing to the powder movement, between powder and sensing impeller and between powder and bellows. This friction becomes resistance to hamper the piston motion of the sensing impeller.

4. SENSITIVITY

Table 1 shows the standard sensitivity of each type.

Table 1 Standard Sensitivity

Unit: N

Type Direction	X	F	G	L	T
Vertical	1-1.5	1-1.5	1-1.5	2.5-3	2.5- 3
Horizontal	2.5-3	2.5-3	2.5-3	4-4.4	4-4.4

The values shown are the resistance at which the Bin Leveller, with its shaft being set vertically and horizontally, actuates and stops when an axial resistance is applied from the outside on its sensing impeller while making the piston motion.

5. SPRING SPECIFICATIONS

Table 2 shows the standard spring size of each type.

Table 2 Spring Size of Each Type

Spring diameter		ϕ 0.55	ϕ 0.60	ϕ 0.65	ϕ 0.7	ϕ 0.8
Type	B3	X, F, G	HA			
	C5	X, F, G, XA, FA, GA		L, T	D	TA

6. INTERNAL CIRCUITS

Internal circuits of standard type and relay built-in type are shown in Figs. 2 to 3.

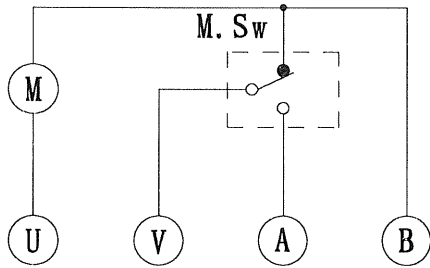


Fig.2 Standard Type

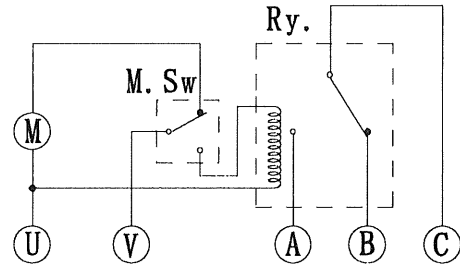


Fig.3 Relay Built-in Type

7. CONTACT CAPACITY

The standard contact capacity of all models is AC 250V 5A.

8. TYPE SELECTION

Type selection should depend upon the position and method of installation, the nature of powder, powder loads and environmental conditions. Of these factors to be considered, particular care is required for the powder loads.

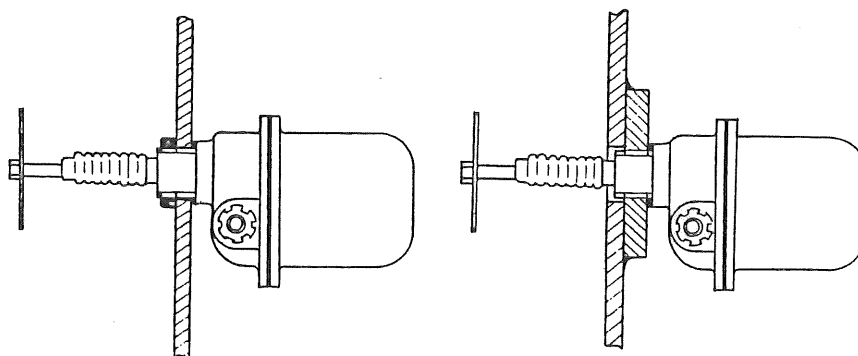
If the height of the powder layer exceeds 1 to 1.5 m, it is desirable to use a guard type or provide a suitable guard by user, for the lower limit.

9. INSTRUCTIONS FOR HANDLING

9-1 Installation Methods

- a. Installations by nut and screwing are illustrated in Fig. 4.

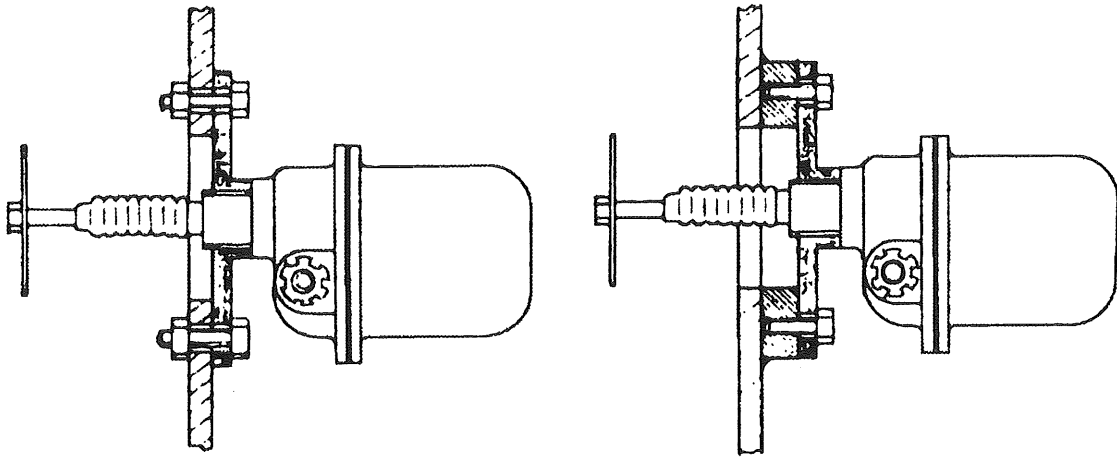
Fig. 4 Installation of X Type



If no flange is used, the X Type should be installed as shown in Fig. 4. This requires mounting of the sensing impeller within hopper. Then care must be taken so as to mount the sensing impeller perfectly.

b. Fig. 5 shows the installation by means of a flange.

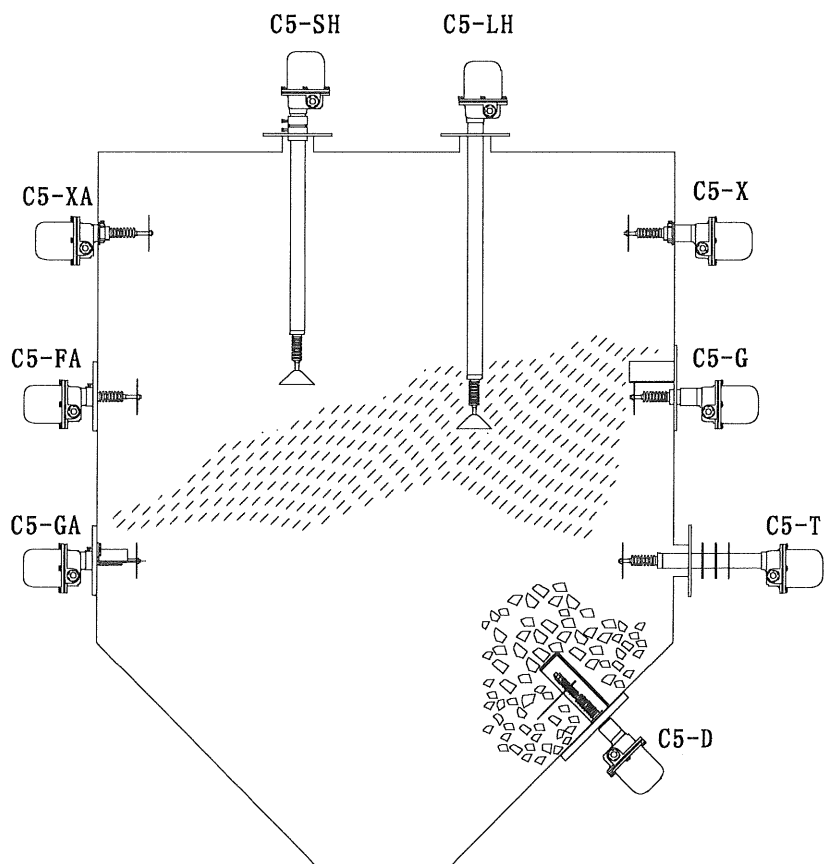
Fig. 5 Installation of Type F



9-2 Installation Position

Fig. 6 shows installation examples.

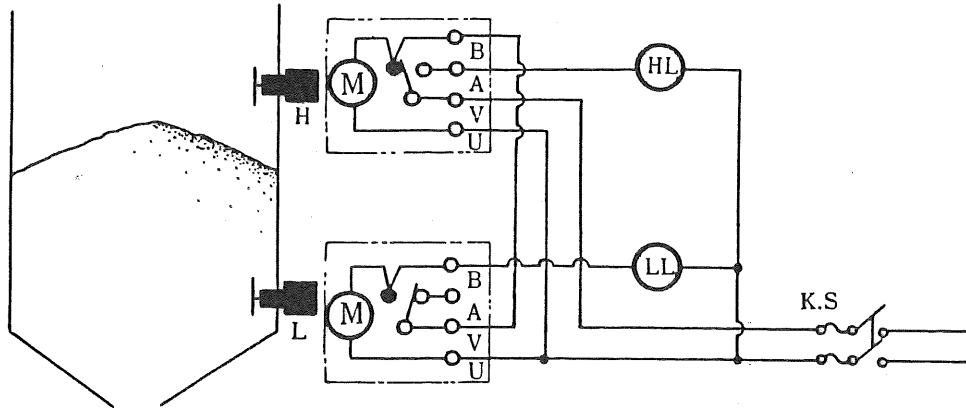
Fig. 6 Installation Examples



9-3 Connection Examples

- a. An example of connection of alarm circuits is shown in Fig. 7.

Fig. 7 Alarm Circuits



- b. Examples of connections of control circuits are shown in Figs. 8 to 9.

Fig. 8 Control Circuit (Standard Type)

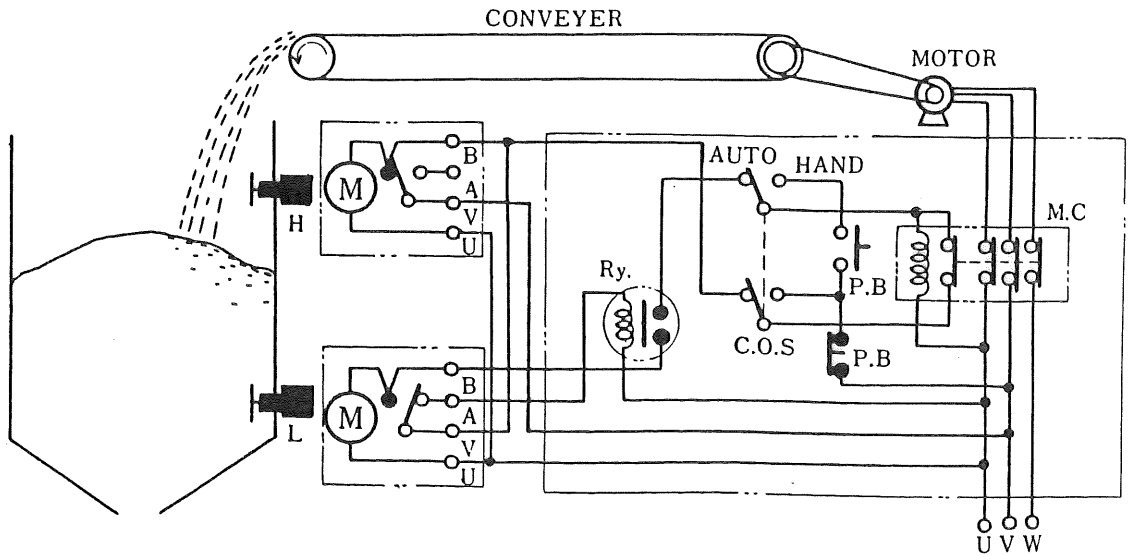
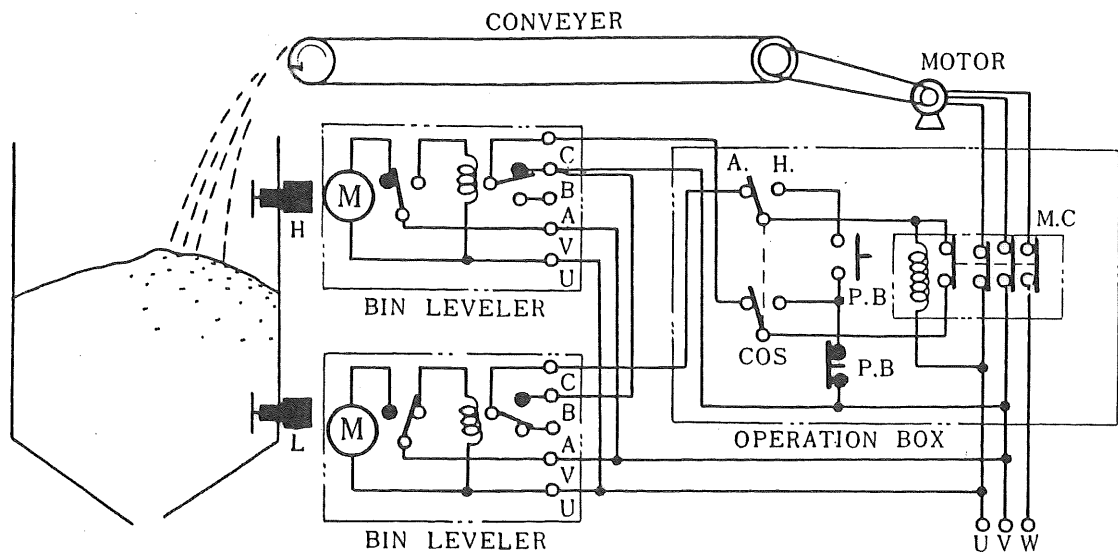


Fig. 9 Control Circuit (Relay Built-in Type)



9-4 Cares for Installation

- a. Considering dead stock, install the Bin Leveller so that its sensing impeller is set in the position where the powder level actually changes.
- b. If the Bin Leveller is positioned directly beneath falling powder, the Bin Leveller may be damaged by the impact of the falling powder. Avoid such position or install a protective plate.
- c. In the vicinity of discharge outlet, powder flow is intensive and mechanical damages and "chattering" tend to occur. Avoid installation around here unless unavoidable.

- d. If pressures exceeding ± 10 kPa are to be applied in the hopper, inform it to us beforehand. We will solve it by adjusting spring or others.
- e. Perfectly seal the electric wire gland. Entry of powder in the mechanism part can be a cause for operation errors.
- f. Although the Bin Leveller has superior vibration resistance, inform us beforehand if forced vibrations are given to the hopper by vibrators, etc. We will ship after giving particularly stringent stopping to screws or other parts.
- g. Connect power supply to UV terminals. If the voltage of V phase is applied to the B terminal owing to wrong connections, the motor circuits will fail to be opened to transmit frickering signals and lead to mis-operation, when the Bin Leveller actuates to operate the micro switch.
- h. "Bridging" can be a cause for signal errors. Also mis-operation may occur if a guard type is used for the Bin Leveller for lower limit with moist fine powder, because cavities may be made beneath the guard. Since the pressure that such powder gives to the lower limit is small, there is no need for use of the guard.

i. Standard sensitivity of the Bin Leveller is applicable to most powders. However, for light powder of less than 0.3 in apparent specific gravity, better results will be given if the sensitivity is increased, for which there are the following methods:

- 1) Change the sensing impeller size from standard 80 ϕ to 120 ϕ .
- 2) Weaken the spring than standard.

If the powder is sticky and the Bin Leveller fails to reset and restart reciprocating motion even when the hopper is emptied, strengthen the spring.

j. If powder load is heavy, use the type with a guard, or protect the shaft by installing a guard in tank.

k. After the sensing impeller is buried in powder and stops reciprocating motion, the sensing impeller is sometimes moved by flow of the powder being discharged and may emit frickering signals to the outside. Compared to level switches of other operating systems, the Bin Leveller shows the stablest action against such phenomenon. If, however, it makes mis-operation, bend the impeller so that it becomes parallel to the powder flow.

1. Our experience tells that the majority of mis-operations occur in wrong selection of type or imperfect handling. If selection is difficult or the cause for troubles cannot be traced, be sure to let us know.

10. CHECK PROCEDURE AND REMEDY IN CASE OF FAILURE IN NORMAL OPERATION



C A U T I O N

Use the following chart to troubleshoot the malfunctioning sensor. If your remedies are unsuccessful, ask Nohken for repair and replacement.

10-1 Causes lie not in Bin Leveller but in others.

a. Upper limit (full) signal is not given:

Check if powder level has reached above the sensing impeller position. In some instances, the surfaces of powder layer heap up, due to which the sensing impeller is not buried in the powder.

b. Lower limit (empty) signal is not given:

Check if powder is emptied before and behind the sensing impeller. The sensing element may be buried in the powder owing to dead stock.

When the Bin Leveller is used by being suspended from the tank top, the powder may build up on the impeller failing to give empty signal unless a conical impeller is used.

- c. An empty signal is given when the tank is not empty:

If hopper is small and the Bin Leveller is installed where the vertical flow of the powder is vigorous, the powder flow may cause the sensing element to actuate and give wrong empty signals. This may be solved by installing the Bin Leveller facing slightly upward, or giving an angle to the sensing impeller by slightly bending the lower half of the impeller upward.

- d. Check if there are any errors in the connections of external circuits.

10-2 Causes line in Bin Leveller.

- a. Bin Leveller fails to make piston motion:
 - o Check if motor is running.
 - o If motor does not run even if there is no resistance on the impeller, make the following checking.
 - o Check connections to external circuits and internal connections.
 - o If motor does not run despite application of voltage, remove the crank and unload the motor shaft. If the motor still fails to run, the motor is defective.
 - o If the motor runs when unloaded but fails to run when assembled with the crank and shaft, possible cause lies in mechanical troubles.

Then, check driven parts.

- o If no voltage is applied to the motor despite application of voltage on the external circuits and connections (terminal board), probable cause lies in the defect of micro switch or contacts.
 - o Link mechanism or micro switch fails to be reset owing to entry of powder in the driven parts of the shaft or link mechanism.
- b. Although the impeller makes piston motion but fails to give level detecting signals, i.e., although the impeller is buried in powder, the impeller fails to stop the piston motion:
- o Specific gravity of powder is too small, or powder resistance upon the sensing impeller is too small owing to low coefficient of friction. In such a case, this condition occurs. Then, increase the size of the sensing impeller or replace the spring with weaker one.
Notice that excessively large sensing impeller makes resetting difficult at the time of empty owing to the weight of the sensing impeller and that resetting is again difficult if the spring is too weak.
 - o Replacement of the spring requires removal of the link mechanism from the shaft.

To do this, first remove the crank pin (the screw connecting the link to the crank), and remove the crank from the motor shaft. Then, remove the snap ring at the rear end of the shaft, and remove the link mechanism from the shaft.

- o If the Bin Leveller fails to give a full signal even after the tank is filled and the Bin Leveller stops the piston motion, check the micro switch and electric circuits.

11. MAINTENANCE

Feed additional lubricant to the driven parts of the link mechanism of all models, once a year.

NOHKEN INC.

HEAD OFFICE : 15-29,Hiroshiba-cho,Suita-city,Osaka 564-0052,Japan.

TEL:06-6386-8141 FAX:06-6386-8140

TOKYO BRANCH OFFICE : 67,Kandasakumagashi,Chiyoda-ku,Tokyo 101-0026,Japan.

TEL:03-5835-3311 FAX:03-5835-3316

NAGOYA OFFICE : 3-10-17,Uchiyama,Chikusa-ku,Nagoya-city,Aichi 464-0075,Japan.

TEL:052-731-5751 FAX:052-731-5780

KYUSHU OFFICE : 14-1,2-chome,Asano,Kokurakita-ku,Kitakyushu-city,Fukuoka 802-0001,Japan.

TEL:093-521-9830 FAX:093-521-9834