

INSTRUCTION MANUAL

VIBRASWITCH MALFUNCTION DETECTOR

MODEL 368



Robertshaw Industrial Products Division
1602 Mustang Drive
Maryville, TN 37801
Telephone: (865) 981-3100 Fax: (865) 981-3168

NUMBER

909GF085B

P-2402 (Rev. B)

Section I – SPECIFICATIONS

GENERAL

The Vibraswitch Malfunction Detector, Model 368, is a non-electric acceleration sensitive instrument that measure the total destructive acceleratory forces acting on rotating and reciprocating machinery.

Housing

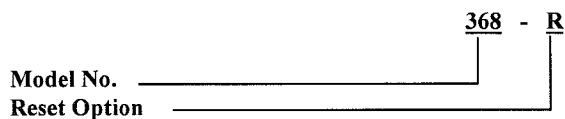
- Cover** High Impact, ABS Thermoplastic
- Gasket** Thermoplastic styrene copolymer
- Base** Type 360 Aluminum (Copper Free)

- Inlet Pressure** 15 to 50 psig
- Control Pressure**..... (Tripped) — 3 psig maximum
- Reset Pressure** 15 to 50 psig
- Vibration Measurement Range** 0 to 4.5 g from 0 to 300 Hz (18,000 RPM)

- System Operating Conditions** ... Reset: Less than 10 SCFH
Tripped: 16 SCFH @ 20 psig
- Ambient Temperature Limits** -40°F. to +200°F.
- Humidity** To 95% RH @ 100°F.
- Shock** 40 g @ 11 Milliseconds maximum
- Mounting Locations** Hazardous, outdoors, unprotected, Meets NEMA 1 through 5 and 12 classifications.
- Accuracy**.....±5% of full range from 0 to 300 Hz (18,000 RPM)
- Setpoint Adjustment** 1 turn per g

MODEL IDENTIFICATION

Specify and order instrument models in accordance with the description and variations listed in the table.



KEY MODEL NO.

Model No.	Description
368-R	Pneumatic Vibration Detector, Weather Resistant Housing. Range: 0-4.5 G. Pneumatic signal loss when setpoint is exceeded, with manual and remote pneumatic reset provisions. Reset supply pressure 15-50 psig.

ACCESSORIES*

Part No.	Description
904GB014	.028 Orifice. Double ended male fitting. Mates with SAE 45° flared female fitting for 1/4" hose.
99448-A1	.028 Orifice. (1) 1/8 NPT male end and (1) 1/8 NPT female end.
83939-B21	Pneumatic relay. 1/8 NPT female connections
83939-F211	Remote reset valve, push-button. 1/8 NPT female connections.

* An Orifice must be connected to inlet of VIBRASWITCH for proper operation.

Section II– OPERATION

DESCRIPTION

The Vibraswitch, Model 368, is designed to protect rotating, reciprocating, or similar equipment against serious damage from malfunctions that can be detected as an increase in vibration. This unit is designed for use in installation sites where pneumatic power is plentiful and electric current is not readily available. Being non-electric, the unit may be employed in hazardous locations and is well suited for applications on pipeline compressor stations and on skid-mounted compressors.

OPERATION

The Vibraswitch, Model 368, (Ref. Figure 2-1) is sensitive to vibration in a direction perpendicular to its mounting base. It contains a vibration detecting mechanism, which also functions as a “mechanical amplifier” to open a pneumatic valve when the selected level of vibration is exceeded. The detector mechanism consists of an armature suspended on a flexure pivot and restrained from motion by a permanent magnet acting through a small air gap. A compression spring provides an adjustable force opposing the magnetic force. Whenever the peak vibration, inertial force (mass x acceleration) plus the adjustable spring force exceeds the holding force of the magnet, the armature breaks away from the stop pin, moving upward to open the pneumatic valve which is normally closed at 20 psig pressure (high system pressures available). On actuation, the “inlet” (control) pressure drops to 3 psig or lower, and the air (may be natural gas if desired) flows through the pneumatic valve into the sealed cover chamber and out the Vent port. This decrease in line pressure may be used to actuate a pneumatic relay in the pneumatic control system to sound an alarm or shut down the malfunctioning equipment.

NOTES:

1. If the “Remote Reset” feature is not used, leave the plastic shipping plug in the “Reset” port to prevent contamination of the port.
2. Make certain that the plastic shipping plug is removed from the “Vent” port since the only function of this opening is to act as a vent for pressure released inside the Vibraswitch housing when the unit is tripped.
3. When natural gas is used for the supply pressure, the Vent port should be piped to an area where it is safe to vent the gas.

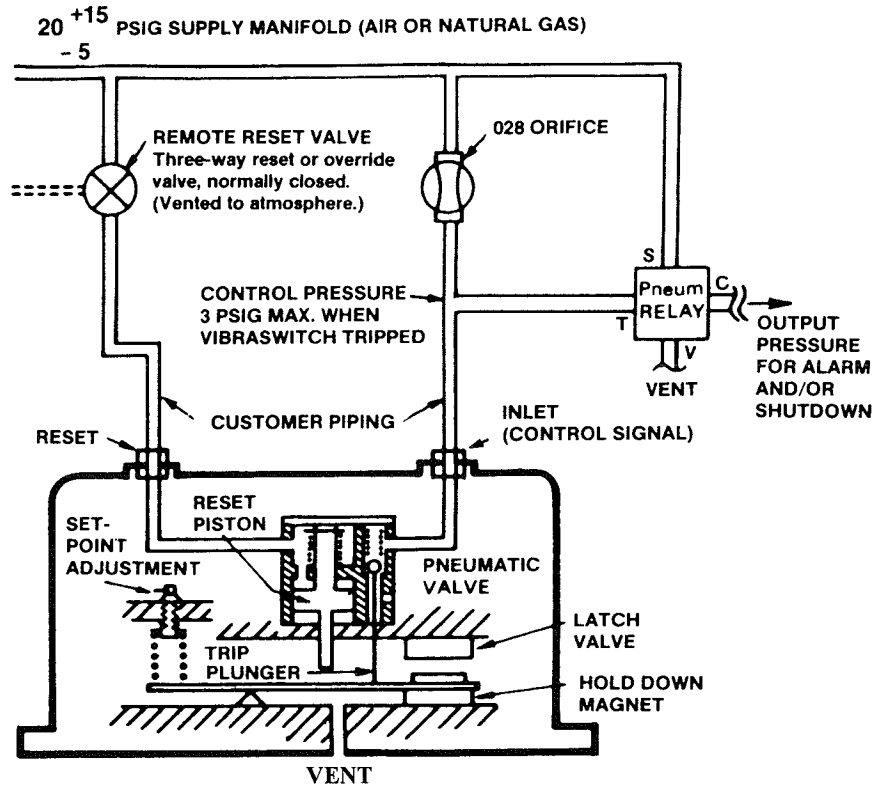


Figure 2-1.

Operating Principle and Piping Diagram for the Vibraswitch, Model 368.

INSTALLATION

Location

The Vibraswitch, Model 368, detector may be located in an unprotected outdoor or indoor area. The housing is designed to meet the installation requirements of NEMA Type 3 (weather-proof), Type 4 (water-tight), and Type 5 (dust-tight) construction. Because the unit is pneumatically operated, having no electrical contacts or components, the unit can be installed in hazardous locations without introducing explosion hazards.

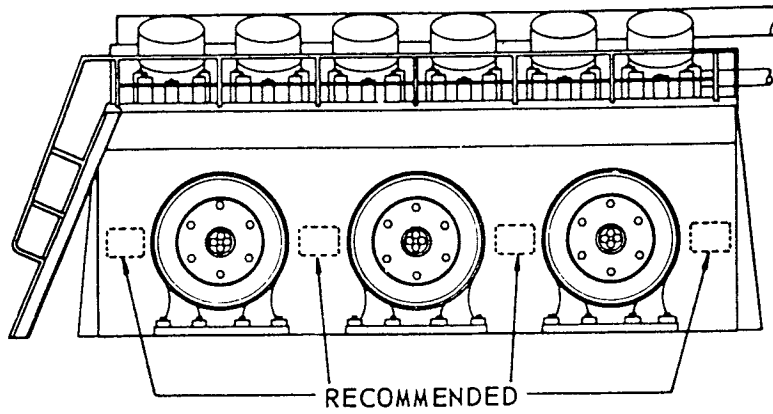
Mounting

The vibration sensitive axis of the Vibraswitch is perpendicular to its mounting base. Therefore, the Vibraswitch must be mounted in a plane that will detect the vibratory motion for which protection is desired. The Vibraswitch may be mounted at any location along the length of machines containing rotating shafts that are horizontal and parallel to the base of the machine: the preferable location being in line with the rotating shaft. Do not mount the Vibraswitch perpendicular to the ends of rotating shafts unless the end-play or end-thrust measurement is desired. Normally, bent shafts, unbalances on the rotating mass of the shaft, worn bearings, and other anomalies are detected near the bearing housings and at right angles to the shaft.

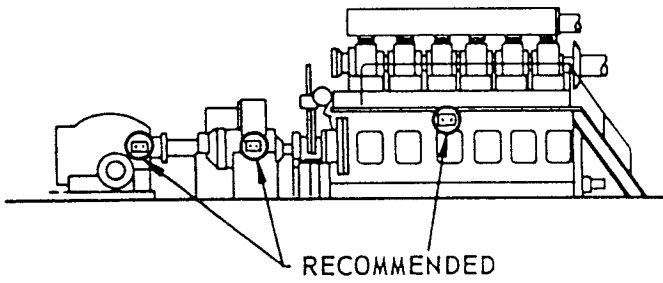
The Vibraswitch may be mounted in any position between the side (vertical) or the top (horizontal) of bearings or machine housings. It should be noted that when mounting Vibraswitches on top (horizontal positions) of equipment the vibration measurement range is as stated in the Specification section. However, when the Vibraswitch is mounted on a side position (90° from the horizontal), 1 g is subtracted from the maximum range of the instrument.

If a mounting bracket assembly is used to mount the Vibraswitch due to an irregular mounting surface, it must be constructed of steel having sufficient thickness and properly reinforced so that mechanical resonances are not introduced; usually 1/2" steel plate is satisfactory if the dimensions of the bracket are not large. It is extremely important that all four corners of the Vibraswitch, as well as the mounting assembly, be rigidly secured to the machine. Exact location is not critical as the adjustment procedure of the Vibraswitch automatically accounts for the normal vibration at that location. The Vibraswitch, properly adjusted, trips on a relative increase in vibration.

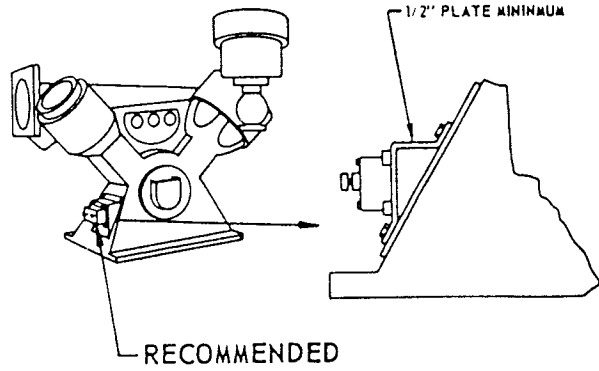
When installing the Vibraswitch on existing equipment and several convenient mounting positions are available, it is advisable to check the existing vibration level at each



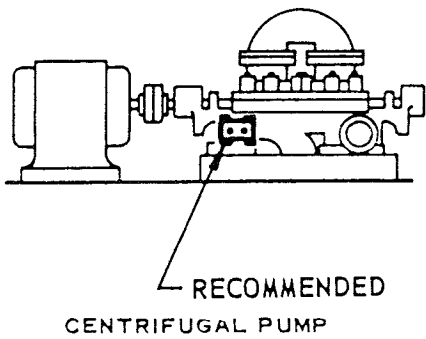
DIESEL ENGINE - COMPRESSOR UNIT



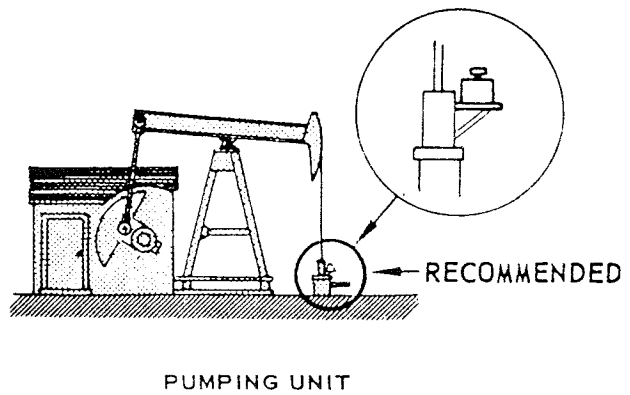
ENGINE-GEAR-CENTRIFUGAL COMPRESSOR



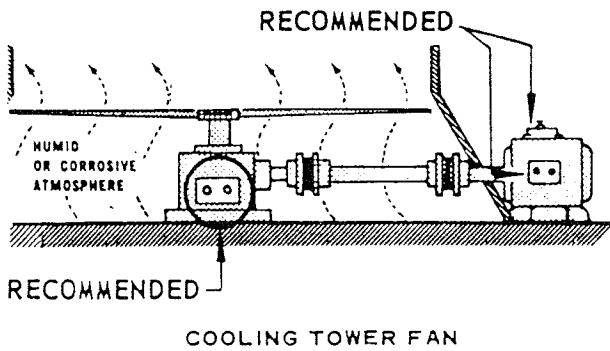
RECIPROCATING COMPRESSOR "Y" TYPE



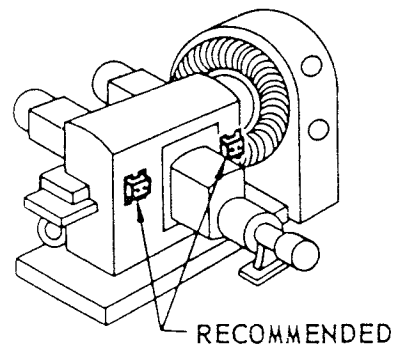
CENTRIFUGAL PUMP



PUMPING UNIT



COOLING TOWER FAN



HORIZONTAL OPPOSED RECIPROCATING COMPRESSOR

Figure 2-2. Methods of Mounting the Vibraswitch, Model 368.

possible position before permanently mounting. The Vibraswitch can be used to measure existing vibration by holding or clamping it against the running machine and determining the trip point as described under "Adjustment" in this manual. Should normal vibration exceed the range of the Vibraswitch, it is recommended that consideration be given to a Robertshaw Model 566, Continuous Monitor Unit which is capable of monitoring higher g levels.

Piping

The piping connections to the Vibraswitch, Model 368, should be made with 1/4" metallic or plastic tubing. Plastic tubing is preferable because the flexibility of the tubing will have a tendency to isolate tubing vibrations from affecting the Vibraswitch (Ref. Figure 2-1).

The .028 Orifice, Reset Valve and the Shutdown or Alarm Relay are supplied by the customer. They may also be purchased from Robertshaw. An .028" orifice must be located downstream from the air supply line and ahead of the alarm relay. The Pneumatic Relay will cause a loss of pressure from typically 3 psig maximum when the Vibraswitch setpoint is exceeded.

The Outlet fitting *must* be left open to vent air from the unit to insure proper operation or should be piped to a suitable location outside the operating area to prevent gas from contaminating the area when natural gas is used to energize the Vibraswitch.

To prevent any leakage of gas from the Vibraswitch Unit, verify that the cover is properly tightened to the gasket on the case.

ADJUSTMENTS

Operating Setpoint

The operating setpoint for the Vibraswitch varies with the type of machine and its location (measurement point) on the machine. The setpoint adjustments suggested in this instruction manual are for machines which are functioning in a "good" or "normal" condition. This method follows the concept of vibration tolerance for the machine and in this case is dependent upon an individual who is experienced in the operation of the machine to define the vibration as "normal," "fair," "slightly rough," etc. These various degrees of machine vibration are, therefore, based on the individual's physical perception between normal and abnormal roughness while the machine is operating.

It is agreed that this method can lead to differences in the classification of degree of vibration between individual observers. It is Robertshaw's contention, and experience bears out this conclusion, that if the machine is operating satisfactorily as previously defined and the acceleration as measured by the Vibraswitch is within certain limits, the settings as outlined in the instructions will offer protection to the machine and prevent catastrophic failure.

For example, assume that a relatively new machine which, in the experience of the operator, is operating as "smooth" or "good regarding vibration and the Vibraswitch measures

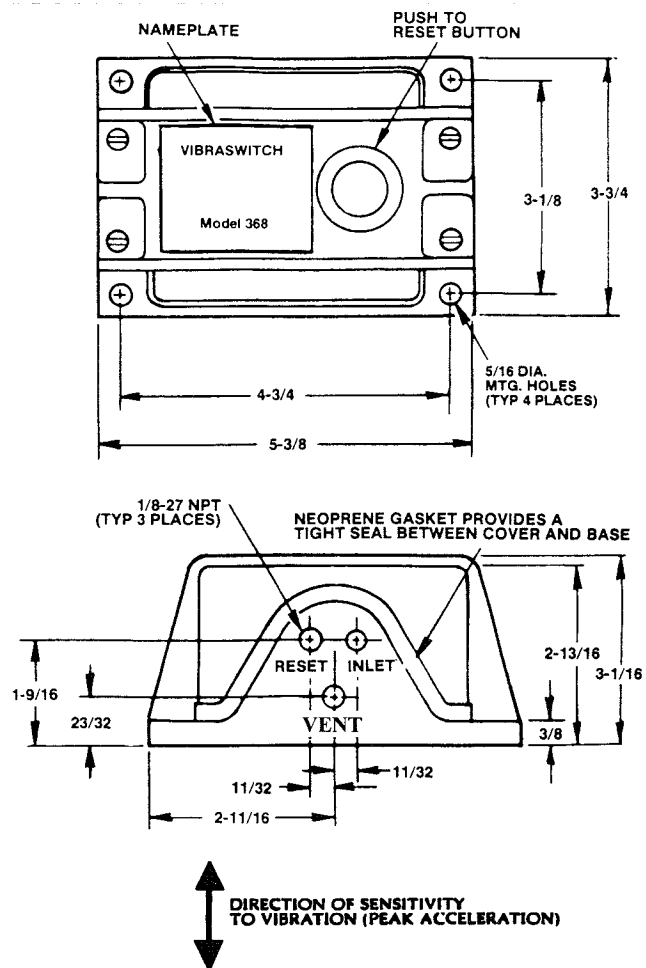


Figure 2-3. Mounting Dimensions for the Vibraswitch, Model 368.

this acceleration level to be 0.25 g above its static condition (zero). Experience suggests that a reasonable level for alarm conditions would be a minimum of twice this value or 0.5 g. It must be acknowledged that such a definition of upper vibration limits (alarm conditions) on the machine may not have adequately defined the upper tolerance limit of the machine before major repairs or excessive machine damage occurs. It does, however, define a limit which, in our experience, has proven to be safe. As the user becomes more adept in using the Vibraswitch as a monitoring device, his experience will dictate a higher setpoint more in keeping with the experience he has gained on the particular machine.

The Model 368 Vibraswitch is adjusted by a simple, three-step procedure. In making these measurements the cover must be removed to gain access to the setpoint adjusting screw (see Figure 2-4).

1. Zero Vibration Level Measurement

With the equipment on which the Vibraswitch is mounted *not* operating, back off the setpoint adjusting screw counterclockwise (CCW) two turns and press the reset button. Then turn the setpoint adjustment screw slowly clockwise until actuation occurs (the armature assembly is against the latch magnet, Figure 2-1). *This is*

the zero vibration point, or actuating point, with the machine not operating. A mark should be made with a lead pencil or other convenient means to permanently record this "zero vibration point." Subsequent measurements are made relative to this point.

2. Normal G-Level Measurement

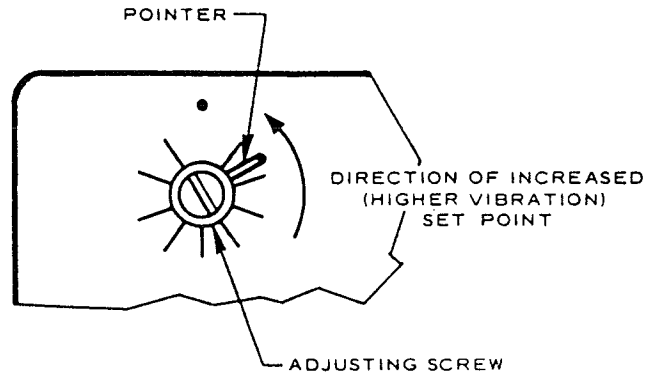
With the machine (equipment) operating, back off the setpoint adjusting screw one turn CCW and reset. If it will not reset, back off the setpoint adjusting screw two turns CCW, etc.

Again turn the setpoint adjusting screw slowly clockwise until actuation occurs. Mark this position with a lead pencil or other convenient means. The difference between the two actuating points in steps 1 and 2 is the normal g-level of the operating machine in scale divisions. One scale division is 0.1 g; one full revolution is 1.0 g.

3. Final Setpoint Adjustment

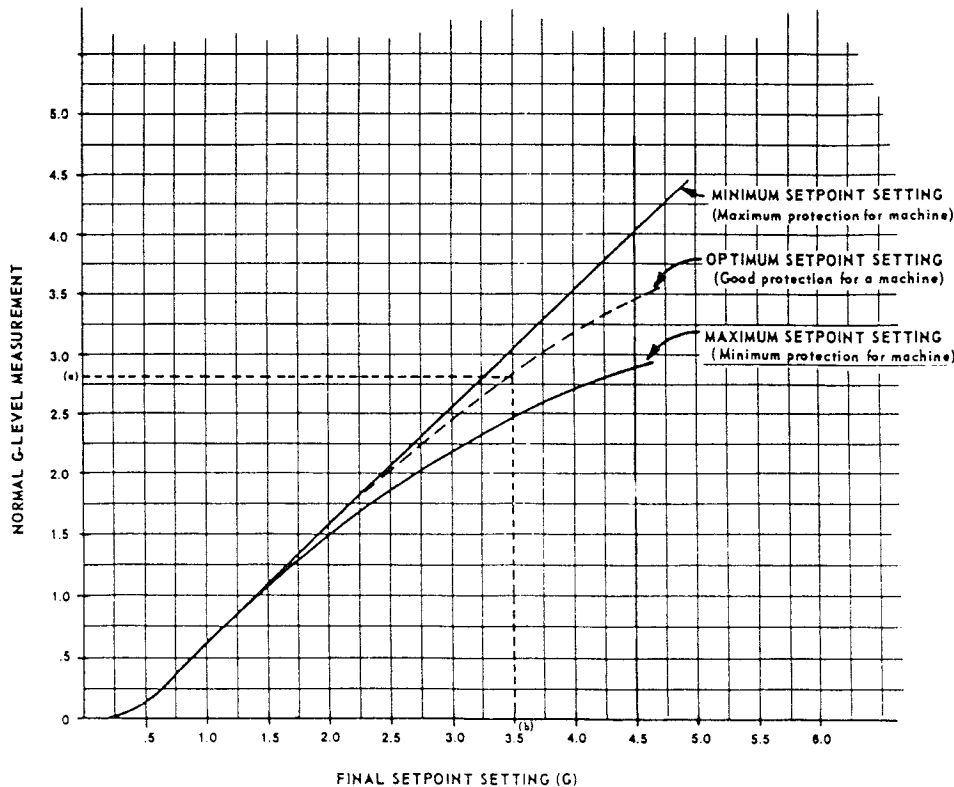
If the "normal" g-level is less than 1.0g, rotate the setpoint adjusting screw CCW 0.5 g (five graduations) from the point where actuation occurs in Step 2 above. If the "normal" g-level is greater than 1.0 g refer to Table 2-1 for the proper final setpoint setting with respect to the "normal g-level vibration point" obtained in Step 2. See example on Table 2-1.

NOTE: In the preceding adjustments, actuation can be heard as an audible "click." In very noisy surroundings, it will be necessary to observe visually that the armature is in the up (latched) position.



NOTE: EACH SCALE DIVISION IS 0.1g
ONE FULL REVOLUTION IS 1.0 g

Figure 2-4. Setpoint Adjustment.



Example: If the Normal G-Level (a) is 2.8 g above the Zero Vibration Level, the Final Setpoint Setting (b) should be set at 3.5 g above the Zero Vibration Level. Therefore, advance the Setpoint Pointer CCW .7 g (3.5 g - 2.8 g = .7 g) or 7 divisions (one scale division is .1 g) from the normal g-level.

Table 2-1. Setpoint Alarm Settings

Section III — MAINTENANCE

TROUBLESHOOTING

Vibraswitches do not normally require maintenance or repair; however, listed below are some of the possible malfunctions that may occur and their recommended solutions.

1. Insufficient Inlet Pressure

- Check pneumatic supply.
- Check pneumatic connections for leaks.
- Perform calibration.

2. Unable to Adjust Setpoint Setting to Obtain Tripping.

Improper air gap between Holddown (lower) Magnet and Armature — return the Vibraswitch to the factory for repair.

3. Vibraswitch Will Not Reset.

- Broken leaf spring — Return Vibraswitch to factory for repair.
- Dirt or metal chips on magnets — clean magnets.

4. Functional Test — (Ref. Figure 2-1)

- With the Vibraswitch cover removed, place Vibraswitch on a table with its mounting surface down.
- Press reset button. If switch does not reset (armature latched on hold down magnet), turn set point adjustment screw CCW until switch can be manually reset.

c. Slowly turn set point adjustment screw CW until switch trips. This is the zero trip point which is the amount of spring tension required to overcome the 1 g force exerted by the earth's gravitational pull.

d. Note set point setting. One complete turn equals approximately 1 g. Set point scale is marked in 0.1 g increments. Turn set point adjustment screw 1 complete turn CCW. This is a 1 g setting above the earth's gravitational pull.

e. Manually reset the switch (press reset button).

f. With the reset button to your right and the set point adjustment screw to your left, slowly rotate the Vibraswitch toward you 90°. The switch will trip when the mounting surface is in a vertical plane and the earth's gravitational pull is not aiding the lower magnet to hold the armature against the stop pin.

Section IV — PARTS

GENERAL

Listed below are the major components comprising the Vibraswitch, Model 368.

Item No.	Description	Part No.	Used On
1.	Cover (Includes Grommet and Gasket)	040KB132-10	All Models
2.	Grommet	150KB091-10	All Models
3.	Gasket	560KB052	All Models
4.	Setpoint Pointer Assembly	904GA931	All Models
5.	Latching Magnet Assembly*	205KB020	All Models
6.	Holddown Magnet Assembly*	205KB014	Models Produced Before Mid 1987
		205KB007	Models Produced After Mid 1987
7.	Armature Assembly with Upper Flexure Block*	904GA929	All Models
8.	Reset Button Spring	037658A0001	All Models
9.	Setpoint Pointer Spring	295KB058	All Models
10.	Pneumatic Valve Assembly*	040KB128	368-R
		040KB128-01	368-O
11.	Lower Flexure Block*	904GB792	All Models
12.	Reset Button	420KB036	All Models
13.	Stop Pin*	435KB021-28	All Models
14.	Retainer	904GA926	All Models
15.	.028 Orifice, Double Ended Male Fitting	904GB014	All Models
16.	.028 Orifice, 1/8 NPT Connections	99448-A1	All Models
17.	Pneumatic Relay	83939-B21	All Models
18.	Remote Reset Valve	83939-F211	All Models

*Requires factory representative repair service.



U.S.A. and Canada
Robertshaw Industrial Products Division
1602 Mustang Drive
Maryville, TN 37801
Telephone: (865) 981-3100 Fax: (865) 981-3168
<http://www.robertshawindustrial.com>

Exports
Invensys Appliance Controls
1701 Byrd Avenue
P.O. Box 26544
Richmond, Virginia 23261-6544
Telephone: (804) 756-6500 Fax: (804) 756-6561

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