

Tuffy® Liquid Level Controls with Electric Switches

Installation and Operating Manual



*Side
Mounted
Float Level
Switch*

Read this Manual Before Installing

This manual provides information on the Tuffy Float Level Switch. It is important that all instructions are read carefully and followed in sequence. Detailed installation and wiring instructions are included in this manual.

Conventions Used in this Manual

Certain conventions are used in this manual to convey specific types of information. General technical material, support data, and safety information are presented in narrative form. The following styles are used for notes, cautions, and warnings.

Notes

Notes contain information that augments or clarifies an operating step. Notes do not normally contain actions. They follow the procedural steps to which they refer.

Cautions

Cautions alert the technician to special conditions that could injure personnel, damage equipment, or reduce a component's mechanical integrity. Cautions are also used to alert the technician to unsafe practices or the need for special protective equipment or specific materials. In this manual, a caution box indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

Warnings

Warnings identify potentially dangerous situations or serious hazards. In this manual, a warning indicates an imminently hazardous situation which, if not avoided, could result in serious injury or death.

Safety Messages

Follow all standard industry procedures for servicing electrical equipment when working with or around high voltage. Always shut off the power supply before touching any components.

WARNING! Explosion hazard. Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Low Voltage Directive

For use in Installations Category II, Pollution Degree 2. If equipment is used in a manner not specified by the manufacturer, protection provided by equipment may be impaired.

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Performance specifications are effective with date of issue and are subject to change without notice. Magnetrol reserves the right to make changes to the product described in this manual at any time without notice. Magnetrol makes no warranty with respect to the accuracy of the information in this manual.

Warranty

All Magnetrol mechanical level and flow controls are warranted free of defects in materials or workmanship for five full years from the date of original factory shipment.

If returned within the warranty period; and, upon factory inspection of the control, the cause of the claim is determined to be covered under the warranty; then, Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation.

Magnetrol shall not be liable for misapplication, labor claims, direct or consequential damage or expense arising from the installation or use of equipment. There are no other warranties expressed or implied, except special written warranties covering some Magnetrol products.

Quality Assurance

The quality assurance system in place at Magnetrol guarantees the highest level of quality throughout the company. Magnetrol is committed to providing full customer satisfaction both in quality products and quality service.

Magnetrol's quality assurance system is registered to ISO 9001 affirming its commitment to known international quality standards providing the strongest assurance of product/service quality available.



DESCRIPTION

Tuffy liquid level switches are designed for horizontal mounting in a tank or vessel through threaded or flanged pipe connections. Standard models are equipped with a single switch mechanism for high or low level alarm or control applications. This instruction manual covers Tuffy level controls which have electric switches. For Tuffy controls with pneumatic switches, please consult Bulletin 44-606.

APPLICATIONS

Tuffy is recommended as a Hi/Lo Alarm switch for clean liquid applications only.

OPERATING PRINCIPLE

Figures 1 and 2 illustrate the simple Magnetrol operating principle. Switching action is obtained through the use of a magnet attached to a float and a switching mechanism. These two basic component assemblies are separated by a non-magnetic, pressure tight barrier.

Figure 1
Low level

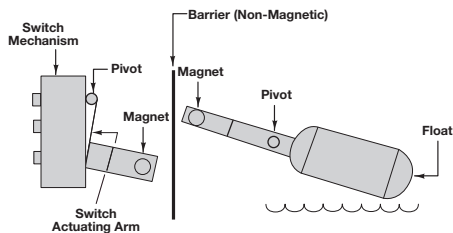
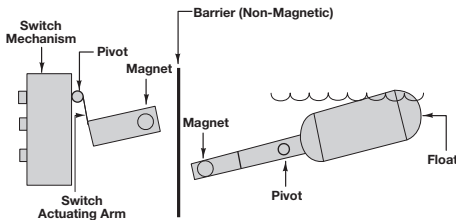


Figure 2
High level



UNPACKING

Unpack the instrument carefully. Inspect all units for damage. Report any concealed damage to the carrier within 24 hours. Check the contents of the packing slip and purchase order and report any discrepancies to the factory. Check and record the serial number for future reference when ordering parts.

MODEL IDENTIFICATION

39-500 0 -

Approval
0 = FM, CSA

Switch
1 = 5 Amp Resistive SPDT, 120 vAC
2 = 15 Amp Resistive SPDT, 120 vAC
3 = 15 Amp Resistive Form Z, 120 vAC
5 = 1 Amp Resistive SPDT Hermetic, 120 vAC
6 = 10 Amp Resistive DPDT, 120 vAC

Housing
0 = Carbon steel, 3/4" NPT
1 = Stainless steel, 3/4" NPT

Specific Gravity
0 = 0.6 Minimum
4 = 0.4 Minimum

OPERATING CYCLE

At a low operating level of liquid in a tank or vessel (refer to Figure 1), the float moves the magnet upward and into the field of the switch mechanism magnet. As a result, the magnets repel causing the switch to trip, making or breaking an electrical circuit. As liquid level rises, the float pulls the magnet downward until the switch magnet tilts the switch in an opposite direction, thus reversing the switch action. Refer to Figure 2.

When liquid level recedes, the float once again moves the magnet upward causing the switch to assume its original position.

INSTALLATION

CAUTION: During installation of Tuffy, the counter balance area must be free of metallic particles that might attract to the magnets in this section.

MOUNTING

1. Before assembling Tuffy in a tank or vessel, check threaded or flanged mounting nozzle for the following:
 - a. Nozzle length and inside diameter must be sized correctly to allow for switch actuation at design levels. Refer to Figure 3 on page 4.
 - b. Nozzle must be checked for horizontal alignment.
2. Thread a one foot pipe into the 3/4" NPT conduit as a handle or use a pipe wrench. Engage 2" NPT threads by hand. Then pull the threads tight in the tank by rotating the unit clockwise.

NOTE: To prevent galling of Tuffy mounting (2" NPT) and cover

CAUTION: The Tuffy **must** be installed with the 3/4" NPT connection pointing down to allow for correct switching action.

threads (2 1/2" x 16"), apply either Teflon tape or Petrolatum (petrocene jelly) to the threads.

NOTE: The correct positioning of the 3/4" NPT connection will also prevent the entrance of moisture into the switch enclosure via the conduit. Refer to Figure 3 on page 4.

INSTALLATION cont.

MOUNTING cont.

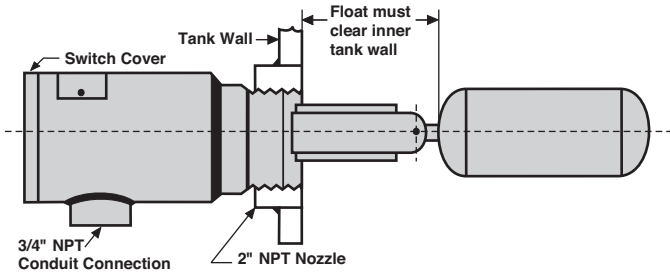


Figure 3

WIRING

On high temperature applications (above 250° F or 120° C), a suitable covered wire should be used between Tuffy and the first junction box located in a cooler area. On non-hazardous applications, flexible conduit may be used between Tuffy and the first junction box. Conduit should have sufficient slack to permit removal of the switch assembly.

1. To gain access to the switch mechanism, unscrew the switch cover (2¼" spanner wrench required).
2. Pull in supply wires (conductors) and connect to the proper terminals. Be certain that excess wire does not interfere with replacement of the switch cover, or the moveable switch mechanism. Refer to Figure 4 for Wiring Diagrams.

NOTE: The green headed ground screw is to the right of the switch. In hazardous locations a conduit seal is required within 18" (457 mm) of the conduit connection and conduit must be screwed into the housing a minimum of 5 turns.

3. Replace the switch cover.

NOTE: Cover requires approximately 6½ turns to tighten.

4. Seal housing at the conduit outlet with a suitable pipe compound to prevent entrance of air.
5. Connect power supply to Tuffy and test switch action by varying liquid level in tank or vessel.

NOTE: If the switch mechanism fails to function properly, make sure the conduit connection is vertically aligned and pointing down. Also, check cover to housing fit to be certain gasketed joint is tight. A positive seal is necessary to prevent infiltration of moisture laden air or corrosive gases into switch housing.

FORM "Z" SWITCH WIRING

The primary advantage of the Form "Z" is that it has two independent switches in the same housing. Also, the special contact configuration allows for a high electrical rating.

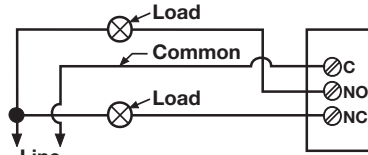
The switch has four terminals. Two marked NC (normally closed) and two marked NO (normally open). These terminals can be wired to allow the switch to function as an SPDT or DPDT unit. Refer to Figure 4 for exact wiring details.

Both sets of contacts carry the identical ratings and the resistive rating is independent of voltage. Also, the switch action is break before make. This means both circuits will not be energized simultaneously.

FORM "Z" SWITCH WIRING cont.

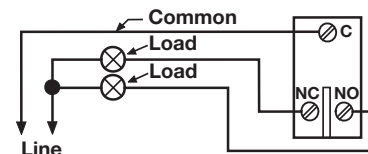
For example: A user is filling a tank and wants to turn off the pump and get a "full" signal when the tank is full. When the level is below the trip point, the pump runs. As soon as the level is above the trip point, the pump turns off and the "full" signal is given.

5 Amp SPDT, 15 Amp SPDT, 1 Amp SPDT Hermetic Switches



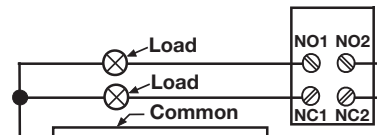
Close On Rise, Wire C & NC
Close on Fall, Wire C & NO

10 Amp SPDT Micro Switch



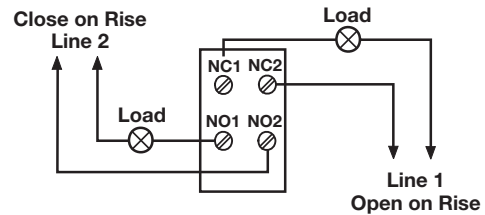
Close on Rise, Wire C & NC
Close on Fall, Wire C & NO

Form "Z" Micro Switch Wired for SPDT Function



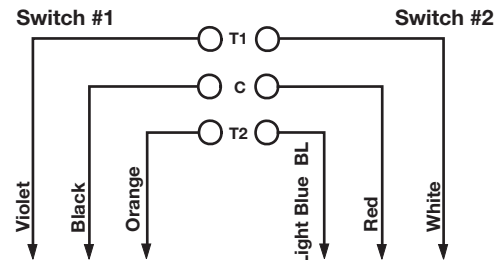
Close on Rise, Wire NC1 & NC2
Close on Fall, Wire NO1 & NO2

Form "Z" Switch Wired for DPDT Function



Line 1
Open on Rise

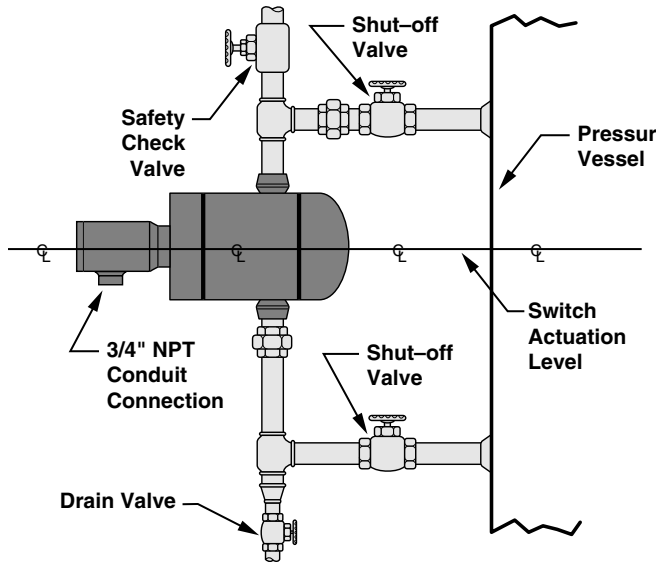
10 Amp DPDT Snap Action Switch



Float Position	Relay Terminal	
	T1 to C	T2 to C
Down	Closed	Open
Up	Open	Closed

Figure 4

EXTERNAL CAGE INSTALLATION



Typical Piping Arrangement
Figure 5

Figure 5 shows a typical piping installation of a Tuffy External Cage Assembly. Switch actuates within 0.75 inch (19mm) above the Tuffy cage centerline for rising level and within 0.75 inch (19 mm) below the centerline on falling level.

The external cage must be installed so that the trappings are vertical. Installation should be checked with a spirit level on top and/or sides of cage.

Controls should be mounted as close to the vessel as possible. This will result in a more responsive and accurate level change in the cage. Liquid in a long pipeline may be cooler and more dense than liquid in a vessel causing lower level indication in the control than actual level in the vessel.

Use pipe of sufficient strength to support the control. If necessary, provide a stand or hanger to help support its weight. All piping should be straight and free of low spots or pockets so that lower liquid line will drain toward the vessel and upper vapor line will drain toward the control. Shut-off valves are recommended for installation between vessel and the cage assembly. If the control is to be used with a low temperature liquid (one which will boil in the float chamber if outside heat is absorbed), the chamber and piping should be insulated. Such boiling in the chamber will cause false level indications. In this case, **DO NOT** insulate the switch mechanism housing.

PREVENTIVE MAINTENANCE

Periodic inspections are a necessary means to keep your level control in good working order. This control is a safety device to protect the valuable equipment it serves. A systematic program of preventive maintenance should be implemented, when control is placed into service. If the following instructions are observed, your control will provide reliable protection of your capital equipment for many years.

WHAT TO DO

1. KEEP CONTROL CLEAN.

- Be sure the switch housing cover is always in place on the control. This cover is designed to keep dust and dirt from interfering with switch mechanism operation. In addition, it protects against damaging moisture and acts as a safety feature by keeping bare wires and terminals from being exposed. Should the housing cover become damaged or misplaced, obtain a replacement immediately.

2. INSPECT SWITCH MECHANISMS, TERMINALS AND CONNECTIONS MONTHLY.

- Tuffy controls may sometimes be exposed to excessive heat or moisture. Under such conditions, insulation on electrical wires may become brittle, eventually breaking or peeling away. The resulting "bare" wires can cause short circuits.

Check wiring carefully and replace at the first sign of brittle insulation.

- Vibration may sometimes cause terminal screws to work loose. Check all terminal connections to be certain that screws are tight. Check wiring carefully and repair or replace if necessary.

NOTE: As a matter of good practice, spare switches and covers should be kept on hand at all times.

WHAT TO DO cont.

3. INSPECT ENTIRE TUFFY UNIT PERIODICALLY.

- A periodic cleaning of the float and counterweight assembly will assure continued free movement of the mechanism.

WHAT TO AVOID

1. **NEVER** leave switch housing cover off the control longer than necessary to make routine inspections.
2. **NEVER** place a jumper wire across terminals to "cut-out" the control. If a "jumper" is necessary for test purposes, be certain it is removed before placing control into service.
3. **NEVER** attempt to make adjustments or replace switches without reading instructions carefully. When in doubt, consult the factory or your local representative.
4. **NEVER** use in systems which have excess iron particles in the solution. The magnet at the counterweight end of the float can attract the particles which could cause the float rod to jam.

TROUBLESHOOTING

Usually the first indication of improper operation is failure of the controlled equipment to function, i.e.: pump will not start (or stop); signal lamps fail to light, etc. When these symptoms occur, whether at time of installation or during routine service thereafter, check the following potential external causes first.

- Fuses may be blown.
- Reset button(s) may need resetting.
- Power switch may be open.
- Controlled equipment may be faulty.
- Wiring leading to control may be defective.

If a thorough inspection of these possible conditions fails to locate the trouble, proceed next to a check of the control's switch mechanism.

1. Pull disconnect switch or otherwise disconnect power to the control.
2. Remove switch cover.
3. Disconnect power wiring from switch assembly.
4. Failure of the switch to operate is most likely caused by:
 - a. Mechanical binding of the switch mechanism. Carefully inspect the switch actuating arm and magnet assembly for evidence of binding or wiring interference (refer to Figure 1). The switch and magnet assembly must move throughout its entire range without interference. If there is any binding, the ENTIRE switch and magnet assembly must be replaced.
 - b. Failure of the switch's electrical circuits. If the assembly can move freely, use an electrical continuity checker to determine if the switch is operating electrically. Refer to Figure 4 for the appropriate wiring diagram. If the switch operates properly when moved mechanically, but not when electrically activated, the entire switch and magnet assembly must be replaced.

5. If the switch responds to both mechanical and electrical operation, but does not activate when the float changes position, remove Tuffy from service. Check the float assembly for obstructions or an accumulation of particles, which may cause binding. If binding is present in the float assembly, and cannot be cleared by normal cleaning procedures, the entire control must be replaced.
6. If the complete Tuffy mechanism operates properly when removed from service, check to be certain that liquid is entering the storage tank or vessel. A valve may be closed or a pipeline clogged.
7. Check the float to be certain that it is buoyant in the liquid (tank or vessel must have adequate level).
8. If the float is determined to be filled with liquid or is collapsed, the entire level switch must be replaced. Do not attempt to repair the float.

If all the components are in operating condition, the trouble must be (and should be) located external to the level switch. Repeat inspection of external conditions previously described.

NOTE: When in doubt about the condition or performance of a Tuffy control, consult the factory for further instructions.

REPLACEMENT PARTS

Switch and Magnet Assemblies are factory calibrated after being installed in the control to ensure proper operation. This cannot be done in the field. Your replacement assembly has been calibrated to a typical standard. If, because of the field application or the specific gravity of the media, the new assembly does not function properly, the entire unit must be returned for factory calibration.

To replace the switch mechanism, remove 2 slot head screws holding the switch mounting bracket. Remove the switch and bracket from the housing. Replace the switch bracket and magnet assembly.

The switch mechanism and cover are the only replaceable parts on a Tuffy level switch. If any other part on a unit fails, the entire unit must be replaced.

Model No.	Switch Assembly No.	Cover No.
39-5000-100	89-7301-001	89-7303-001
39-5000-200	89-7301-002	89-7303-001
39-5000-300	89-7301-003	89-7303-001
39-5000-400	Consult Factory	
39-5000-500	89-7301-005	89-7303-001
39-5000-600	89-7301-006	89-7303-001
39-5001-100	89-7301-001	Consult Factory
39-5001-200	89-7301-002	
39-5001-300	89-7301-003	
39-5001-400	Consult Factory	
39-5001-500	89-7301-005	
39-5001-600	89-7306-001	

SPECIFICATIONS

MECHANICAL SPECIFICATIONS

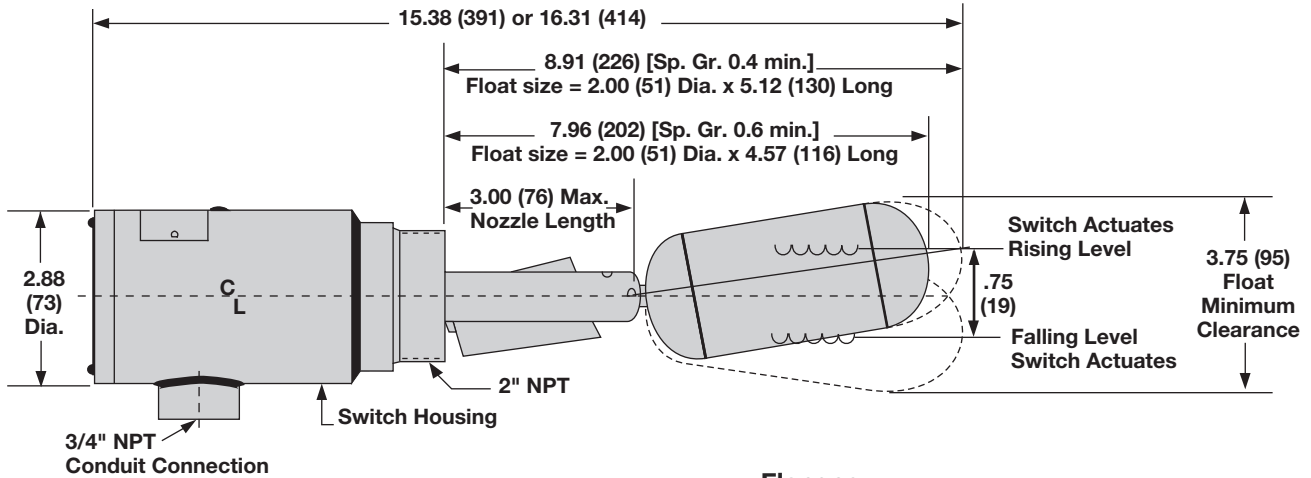
Pressure	0.6 SG 1500 psig (103 bar) 0.4 SG 500 psig (34 bar)
Process Temperature	-40° F to +400° F (-40° C to +204° C)
Ambient Temperature	Maximum 100° F (38° C) with maximum process temperature
Switch Process Temperature Rating	5 Amp 400° F (204° C) 15 Amp 220° F (104° C) 15 Amp Form Z 400° F (204° C) 1 Amp Hermetic 220° F (104° C) 10 Amp DPDT 400° F (204° C)
Specific Gravity	0.6 minimum, or 0.4 optional
Materials of Construction	316 SST wetted components, (316L SST optional) (NACE and ASME B31.3)
Housing	NEMA 7/9 carbon steel (316 SST optional)
Cage (optional)	Carbon steel (316 SST optional)
Cage Rating	Schedule 80 1500 psig @ 400° F (103 bar @ 204° C) Schedule 40 1000 psig @ 400° F (69 bar @ 204° C)
Flange Rating (optional)	250 psig @ 400° F (17 bar @ 204° C)

AGENCY APPROVALS

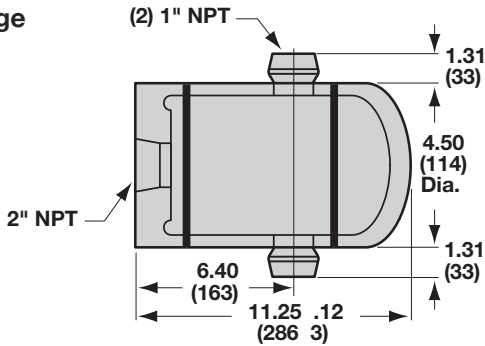
Agency	Approval	Models
CSA	Class I, Groups C & D Class II, Groups E, F & G	39-5000-1XX
		39-5000-2XX
		39-5000-3XX
FM	Class I, Div. 1, Groups C & D Class II, Div. 1, Groups E, F & G	39-5000-5XX
		39-5000-6XX
		39-5001-1XX
GENELEC	EEx d IIC T6	39-5001-2XX
		39-5001-3XX
		39-5001-5XX
		39-5001-6XX

DIMENSIONAL SPECIFICATIONS INCHES (mm)

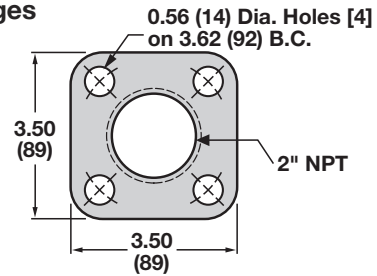
Level switch



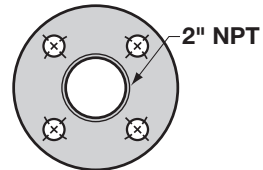
Cage



Flanges



Flange Part Number: 04-6804-001
Flange Rating: 250 psig @ 400° F (17 bar @ 204° C)



ASME Flange
(Consult factory when ordering)

Cage Part Number	Chamber Construction	Pressure	Temperature
33-4740-001	4" Sch. 80 carbon steel	1500 psig (103 bar)	400° F (204° C)
33-4740-002	4" Sch. 80 316 SST		
33-4741-001	4" Sch. 40 carbon steel	1000 psig (69 bar)	
33-4741-002	4" Sch. 40 316 SST		

Service Policy

Owners of Magnetrol may request the return of a control or any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Controls returned under our service policy must be returned by Prepaid transportation. Magnetrol will repair or replace the control at no cost to the purchaser (or owner) other than transportation if:

1. Returned within the warranty period; and
2. The factory inspection finds the cause of the claim to be covered under the warranty.

If the trouble is the result of conditions beyond our control; or, is NOT covered by the warranty, there will be charges for labor and the parts required to rebuild or replace the equipment.

In some cases it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned will be determined on the basis of the applicability of our warranty.

No claims for misapplication, labor, direct or consequential damage will be allowed.

Return Material Procedure

So that we may efficiently process any materials that are returned, it is essential that a "Return Material Authorization" (RMA) number be obtained from the factory, prior to the material's return. This is available through Magnetrol's local representative or by contacting the factory. Please supply the following information:

1. Company Name
2. Description of Material
3. Serial Number
4. Reason for Return
5. Application

Any unit that was used in a process must be properly cleaned in accordance with OSHA standards, before it is returned to the factory.

A Material Safety Data Sheet (MSDS) must accompany material that was used in any media.

All shipments returned to the factory must be by prepaid transportation.

All replacements will be shipped F.O.B. factory.

