Tuffy®
Liquid Level Controls with Pneumatic Switch

Installation and Operating Manual

Side Mounted Float Level Switch



Magnetrol®

Read this Manual Before Installing

This manual provides information on the Tuffy Liquid Level Control with Pneumatic 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.

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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.

1.0 Installation

This section provides detailed procedures for properly installing the Tuffy Liquid Level Control.

Caution: If equipment is used in a manner not specified by manufacturer, protection provided by equipment may be impaired.

1.1 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 report any discrepancies to Magnetrol. Check the nameplate model number to be sure it agrees with the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.

Model Number

Serial Number

1.2 Before You Begin

1.2.1 Site Preparation

1. Ensure that the length and inside diameter of the mounting nozzle are sized correctly to allow for switch actuation at design levels. Refer to Figure 1.
2. Ensure that the mounting nozzle or coupling is within 3° of horizontal. If mounting the Tuffy in an external cage, ensure that the cage is mounted within 3° of horizontal and that the top/bottom piping is within 3° of vertical in all directions.
3. Ensure that the area is free of metallic particles which might be attracted to the magnet holder/counterbalance and interfere with the function of the Tuffy.

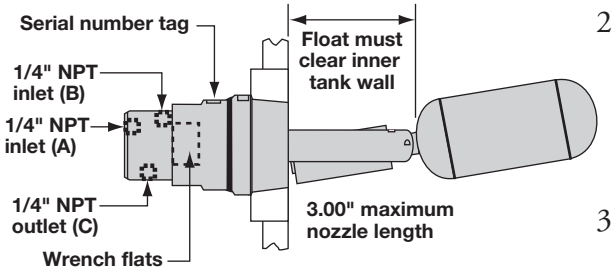


Figure 1

1.2.2 Equipment and Tools

No special equipment or tools are required to install the Tuffy Liquid Level Switch. The following items are recommended:

- Wrenches, flange gaskets and flange bolting appropriate for process connection(s).
- Pipe wrench
- Level

1.3 Mounting

The pneumatic Tuffy Liquid Level Switch is available with a 2" NPT mounting bushing, a variety of flange mountings and external cages for mounting outside of the vessel.

1.3.1 Mounting an NPT Tuffy

1. Apply either Teflon® tape or Petrolatum to the mounting threads to prevent galling.
2. Engage the 2" NPT by hand to avoid damaging threads.
3. Using a pipe wrench, rotate the unit clockwise until threads are tight in mounting. Ensure that the serial number plate is on top. See Figure 1.

Caution: The pneumatic Tuffy must be installed with the serial number plate on top to ensure correct switching action.

1.3.2 Mounting a Tuffy with Flange

1. Have proper flange bolting and gasket on hand.
2. Carefully align mounting flange with the vessel mounting flange.
3. Ensure that the flange gasket is seated properly. Install flange bolts and nuts.
4. Tighten alternating flange bolts in a star pattern.
5. Install Tuffy into 2" NPT of mounting flange as described in Section 1.3.1 above.

Caution: Operation of all buoyancy type level devices should be done in such a way as to minimize the action of dynamic forces on the float or displacer sensing element. Good practice for reducing the likelihood of damage to the control is to equalize pressure across the device very slowly.

1.3.3 Mounting External Cage Tuffy

A typical Tuffy external cage installation is shown in Figure 2.

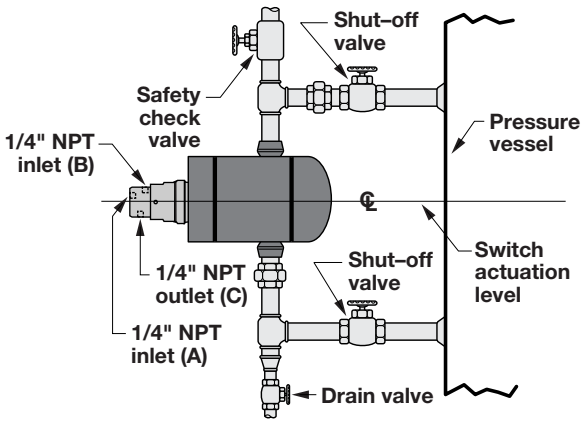


Figure 2

1. Install cage so that tappings are within 3° of vertical in all directions. Check installation with a level.
2. Mount cage as close to vessel as possible, to provide more accurate level in cage. Long pipe runs may result in cooler, denser liquid than that in the vessel and cause inaccurate level in the Tuffy cage.
3. Use pipe of sufficient size and strength to support the control. If necessary, provide a hanger or stand to help support the weight of the cage.
4. All piping should be straight and free of low spots or pockets. Lower liquid line should drain toward vessel and upper line toward Tuffy cage.
5. Shut-off valves are recommended for installation between the vessel and the cage assembly.
6. Once external cage is mounted, install pneumatic Tuffy into cage per Section 1.3.1 or 1.3.2.

1.4 Airline Connections

1. Inlet air should be filtered with a 5 micron or finer filter. This will extend the life of the valve mechanism.
2. Connect the inlet air line to the ¼" NPT connection for either air inlet A or air inlet B, depending on the valve action desired (refer to Figure 3). Inlet air pressure should be between 0–200 psig. Refer to Figure 1 for location of air inlets.
3. Connect outlet air line to the ¼" NPT connection on the bottom of the valve. This air outlet is designated with a "C". Refer to Figure 1 for location.
4. If 3-way function is used, attach the exhaust air line to the appropriate ¼" NPT connection based on valve action described in Figure 3.

Port	2-Way N.O. (direct)	2-Way N.C. (reverse)	3-Way N.O. (direct)	3-Way N.C. (reverse)	Diverter	Selector
A	Inlet	Plug	Inlet	Exhaust	Outlet	Outlet
B	Plug	Inlet	Exhaust	Inlet	Outlet	Inlet
C	Outlet	Outlet	Outlet	Outlet	Inlet	Outlet

N.O.—Direct acting: Air supply on switch condition.
N.C.—Reverse acting: Air cut-off on switch condition.

Figure 3

2.0 Reference Information

2.1 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 three-port/two-position valve actuated by a magnetically actuated pivoted cam mechanism. This instruction manual covers Tuffy level controls which have pneumatic switches. For Tuffy controls with electric switches, please consult Bulletin 44-607.

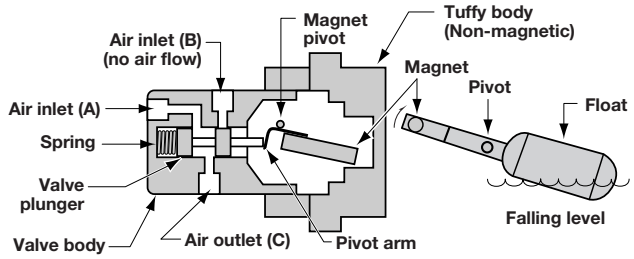


Figure 4
Low Level Operation—Direct Acting

2.2 Theory of Operation

At a "low operating level" of liquid in a tank or vessel (refer to Figure 4), the float moves the magnet upward and into the field of the switch mechanism magnet. As a result, the magnets repel causing the pivot arm and valve plunger to move so that air is allowed to pass from air inlet A to air outlet C. As liquid level rises, the float moves the magnet downward until the switch mechanism magnet reverses position, allowing the valve plunger to move so that air is allowed to pass from air inlet B to air outlet C (refer to Figure 5).

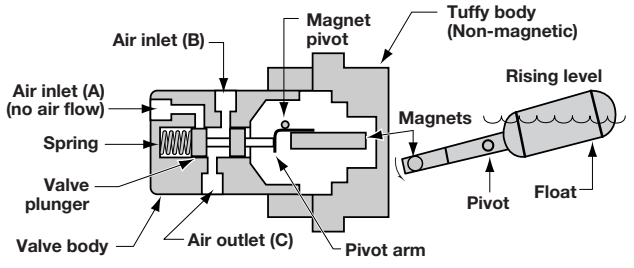


Figure 5
High Level Operation—Direct Acting

For direct acting low level operation, air inlet A is closed off when liquid level increases. Conversely, for high level operation, air inlet B is closed off when liquid level recedes.

For reverse acting operation, air inlet A is used for high level and air inlet B is used for low level. Plug the air inlet that is not in use to prevent foreign materials from entering.

2.3 Preventive Maintenance

Periodic inspections are a necessary means to keep your Magnetrol 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 the control is placed into service. Based on utilizing a preventative maintenance program and observing the following section on “what to avoid”, your Tuffy will provide reliable protection of your capital equipment for many years.

WHAT TO AVOID

1. Use only the 2" wrench flats to install or remove the unit. Refer to Figure 1. Use of any other surface could change the calibration. The valve body is calibrated at the factory and locked in place.
2. NEVER attempt to make adjustments without reading the instructions carefully. When in doubt, consult the factory or your local representative.
3. 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.

2.4 Troubleshooting

If Tuffy fails to shut off or turn on inlet air:

1. Check float for full range of travel; clicking of mechanism should be heard.
2. 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 pipe line clogged.
3. 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.
4. The factory calibration setting should not require any adjustment in the field. Check to see that the unit is installed properly with the serial number tag positioned on the top of the unit. If the unit is still not operating correctly, please contact the factory.

NOTE: When in doubt about the condition or performance of a control, please contact the factory for assistance.

2.5 Specifications

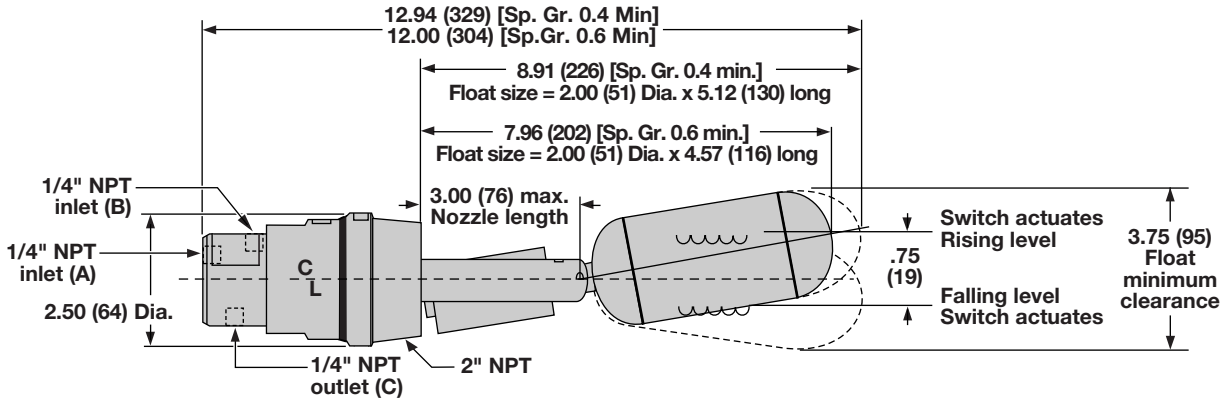
2.5.1 Mechanical Specifications

Pressure:	0.6 SG 1500 psig at +300° F (103 bar at +149° C)
	0.4 SG 500 psig at +300° F (34 bar at +149° C)
Process Temperature:	-40° F to +300° F (-40° C to +149° C)
Ambient Temperature:	Max. +100° F (+38° C) with maximum process temperature
Pneumatic Switch Supply Pressure:	Vacuum to 200 psig (13.8 bar) maximum
Maximum Leakage Rate:	0.5 SCFH (0.015 SCMH @ 100 psig (6.9 bar))
Maximum Air Flow:	12.0 SCFH (0.34 SCMH @ 100 psig (6.9 bar))
Specific Gravity:	0.6 minimum or 0.4 minimum
Materials of Construction:	316/316L SS wetted components including NACE and ASME B31.3
Housing:	316 stainless steel

2.6 Parts

2.6.1 Physical

Pneumatic switch models



2.7 Model Numbers

BASIC MODEL NUMBER

039	Tuffy Float Switch

SWITCH ACTION

6	Pneumatic

HOUSING

0	316 Stainless steel with ¼" NPT airline connections

SPECIFIC GRAVITY AND PRESSURE RATINGS

0	0.60 minimum S.G., 1500 psi maximum pressure
4	0.40 minimum S.G., 500 psi maximum pressure

0	3	9	—	6	0	0	0	—	1	0	

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.

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.

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.

Magnetrol®

5300 Belmont Road • Downers Grove, Illinois 60515-4499 • 630-969-4000 • Fax 630-969-9489 • www.magnetrol.com
145 Jardin Drive, Units 1 & 2 • Concord, Ontario Canada L4K 1X7 • 905-738-9600 • Fax 905-738-1306
Heikensstraat 6 • B 9240 Zele, Belgium • 052 45.11.11 • Fax 052 45.09.93
Regent Business Ctr., Jubilee Rd. • Burgess Hill, Sussex RH15 9TL U.K. • 01444-871313 • Fax 01444-871317

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BULLETIN: 44-606.11
EFFECTIVE: May 2010
SUPERSEDES: May 2006