

Magnetic Level Gauges

Magnetic level gauges may be used for applications where a level gauge glass may be unsafe, an environmental risk or to increase the visibility of the level indication. High pressures, high and low temperatures, toxic and corrosive services can be risky applications for level gauge glasses. Some chemical services can attack the glass material causing breakage or discoloration. Liquid-liquid Interfaces can be very difficult to read in a gauge glass. Magnetic level gauges can also be fitted with level switches and transmitters.

Selecting a magnetic level gauge needs to be done carefully, because there are a number of problems that can develop. After installing a variety of brands of magnetic level gauges a local plant developed some undesirable experiences. The basic problem was incorrect level indication during process upsets and rapid changes in liquid level.

Magnetic level gauges utilize a float that contains one or more magnets. As the float rises and falls its magnetic field passes up and down the level column. The level indicator follows the magnetic field. There are two general types of indicators used. The bullet type is a single point indicator that travels up and down a tubular guide while being attracted by the float magnet. The flag type is a strip of many small colored flags which rotate when the float magnet passes them as shown in Figure 1. If the magnetic attraction between the float magnet and indicator is broken or incorrect, the level reading will be false. This sounds like a simple principle but false readings can easily occur. The strength of the magnetic attraction must be kept high during all situations. Generally, floats have one strong magnet or a number of magnets to provide a strong magnetic field in all horizontal directions. The magnetic field must also remain strong when exposed to high temperatures and may require special high temperature magnets.

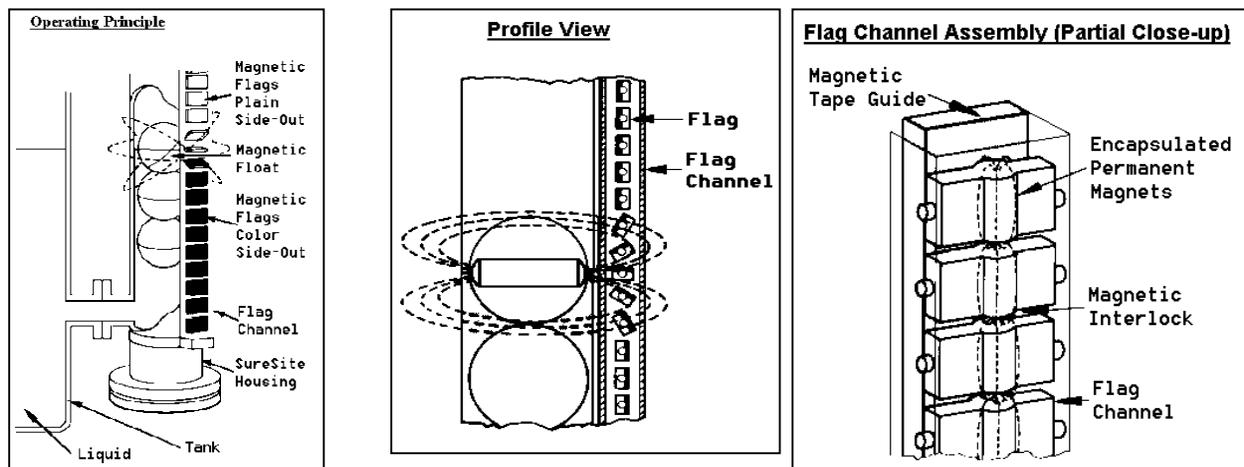


Figure 1

Figure 2

Figure 3

Flag type indicators need to be designed to only have one area where the flags are turning colors as shown in Figure 2. This should be where the float is. Flags should all be the same color below the float magnet. Red, orange and yellow are highly visible colors that are often used. Fluorescent colors are best, especially for reading in the dark with a flashlight. There are a number of methods used to keep the flags from turning back when they are not supposed to, as shown in Figure 3. Some indicators have magnets in each flag or mechanical tabs to hold the flags in position when exposed to vibration or bouncing floats. Test a sample unit by moving the float rapidly up and down the chamber. If the indicator needs to be corrected an external magnet can be used to position the indicator back to where it should be. A compass can be used to locate the float magnet when there is a question about its location.

The indicator should cover the entire measurement height. The case may be hermetically sealed to avoid contamination. It is usually a casing with a window which holds the flags or a clear plastic tube for bullet indicators. Individual flags pivot on small shafts. It is best that all parts are made of the same materials, preferably stainless steel for high temperatures and to avoid corrosion and to avoid binding due to different rates of thermal expansion. Some flag indicators are made up of multiple interconnecting sections to allow easy repair without replacing the entire indicator. Indicating scales may be used to provide accurate indication in various measurement units and percentage.

The column contains the process fluid and float. Check that the float is designed for a minimum specific gravity that suits your application. If specific gravity varies ask the supplier to provide an estimate of the float heights at the minimum, normal and maximum specific gravities. This will show how much error may be caused by the specific gravity changes.

There are many process connections and orientations available. The bottom of the chamber must be able to be opened to allow removal of the float. Top and bottom flanges may be used in dirty applications to provide access for cleaning. Each flanged connection should include a shock spring attached to the blind mating flange. This spring protects the float from damage during rapid movements. Drain and vent valves should also be installed by the supplier or user. Full bore gate valves, per piping specifications, are preferred. ANSI/ASME B31.1 or B31.3 construction may be requested to meet plant piping standards. The column must be made from non-magnetic materials such as 316 Stainless Steel, Monel, Carpenter 20 (Alloy 20), Inconel and Copper-Nickel. Schedule 40 pipe is preferred for strength. NACE construction may also be required for corrosion resistance. The level column should also have a Canadian Registration Number (CRN).

Most suppliers provide accessories such as transmitters and level switches that operate from the float magnet. Check if there are any restrictions in the mounting positions of these accessories. Transmitter sensors are usually magnetorestrictive or resistive. The resistive units operate by closing reed switches across fixed resistors. The total resistance represents the liquid level and is transmitted as a 4-20 mA signal. The resistive units signals are incremental based on the length of each resistor. The incremental steps in output may cause bumps in level control loops. Request that all electronic circuit boards are epoxy coated to military specs to prevent moisture and corrosion problems. All transmitters and switches should be certified by Canadian Standards Association (CSA) for the electrical classification they are to be installed in.

Some manufacturers provide flexible insulation for the chamber, as an option. This option allows easy removal for maintenance access.

Magnetic level gauge manufacturers Websites:

IMO Gems Sensors at:	http://imo-industries.com/html/gems-sensors.html
Jerguson at:	http://www.clark-reliance.com/jerguson.html
Krohne:	http://www.krohne.com
K-Tek Corporation at:	http://www.ktekcorp.com
Magnetrol	http://www.magnetrol.com

For a list of manufacturers of Magnetic Level Gauges, check the ISA Directory of Instrumentation book or Internet at: <http://www.isa.org/directory/>

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Brian Smith