

DEFINING | WHAT'S NEXT

Magnetic Gaging Device

B-612 Series

Installation, Operation & Maintenance (IOM) Manual



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1 REGULATIONS AND SAFETY REQUIREMENTS

1.1 REGULATIONS

Midland fittings and accessories are used in connection with a variety of commodities. Many of those are hazardous materials and could cause serious injury or damage if mishandled.

This Midland product should only be installed, operated and maintained by qualified personnel. Read all of these instructions carefully before proceeding.

1.2 SAFETY WARNINGS AND PRECAUTIONS

Please carefully read each of the following warnings and cautions prior to performing any work.



WARNING: Toxic Hazard. Always use extreme caution and proper equipment when involved with hazardous materials. To avoid exposure to toxic or hazardous materials, make sure the tank car is empty and clean, and that the work area is free of hazardous chemicals before removing or installing any fitting or assembly.

- Wear protective clothing and equipment suitable for withstanding the materials to which you may be exposed
 - Position yourself on the upwind side of the valve when possible
 - Work in a well-ventilated area
 - Work with a partner who can help you in the event of an emergency
 - Follow approved safety precautions for hazardous or toxic materials
-

2 INTRODUCTION

Midland gaging devices are the industry standard, with more than 40,000 currently in use, providing accurate level monitoring and ensuring complete loading and unloading of liquids. The devices' small mounting-flange size reduces space requirements, making it easier to locate other equipment on the manway plate and allow for emergency capping.

Our 40-plus years of historical data ensures precise replacement of older parts, avoiding recalibration or replacement of the entire gaging device. Plus, you can retrofit existing gaging devices with a Midland Tank Car Loading System to maintain optimum load levels while reducing required fill time and allowing remote liquid-level management.

2.1 OPERATING PRINCIPLE

Midland's B-612 Magnetic Gaging Device is a level-monitoring tool that operates on the principle of a magnetic coupling between the permanent magnets in the stainless-steel float, which moves up in the tank as the product is loaded, and a graduated carbon-fiber gage rod that travels externally with the float providing an accurate level reading to the loaders.

Each gage rod is calibrated based upon the specific gravity of the commodity being loaded, and can be designed to provide information on either a tank outage or through an image of the tank.



Figure 2-1 Gage Rod Moves Upwards to Provide Level Measurement Reading

2.2 DETAILS – COMPONENT IDENTIFICATION

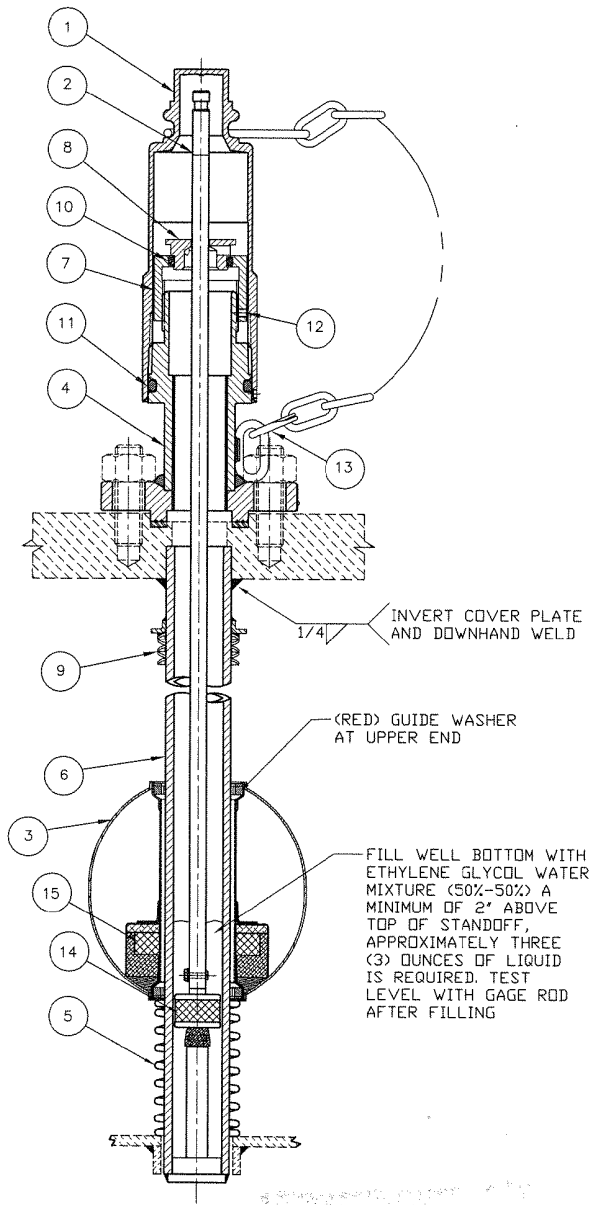


Figure 2-1 Component Identification – B-612

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ITEM	QTY	DESCRIPTION	MATERIAL	PART NO.
1	1	COVER WITH CHAIN	STAINLESS STEEL	612-103-SS
2	1	GAGE ROD ASSEMBLY	COMPOSITE	612-2-PE
3	1	FLOAT ASSEMBLY	STAINLESS STEEL	612-3008-MOL
4	1	BODY ASSEMBLY	STEEL, PLATED	612-451-CS
5	1	BOTTOM SPRING	STAINLESS STEEL	612-5-MOL
6	1	GUIDE TUBE ASSEMBLY	STAINLESS STEEL	612-6-SS
7	1	INSTALLATION CORRECTION NUT	STAINLESS STEEL	612-71-SS
8	1	SPECIFIC GRAVITY ADJ BUSHING	PLASTIC	612-84-PS
9	1	TOP WAVE SPRING ASSEMBLY	STAINLESS STEEL	612-528-SS
10	1	O-RING	SILICON	612-10-SI
11	1	O-RING	VITON A*	612-11-VA
12	1	SET SCREW	STAINLESS STEEL	612-12-SS
13	1	REPAIR LINK	STAINLESS STEEL	24-12-SS

*Alternate materials available

Table 2-1 Parts Listing – B-612

3 INSTALLATION

3.1 PRE-INSTALLATION REGULATIONS/REQUIREMENTS

3.1.1 REGULATIONS

Midland magnetic gaging devices will come in contact with a variety of products, many of which are hazardous materials. The acceptance and transportation of products are regulated by the DOT and AAR in the U.S.A., and in Canada by CTC and Transport Canada. The regulations of other governmental bodies must be complied with for stationary and mobile applications. All personnel should be familiar with and follow these regulations. Nothing in these instructions is intended to conflict with or supersede these regulations. The information in this document was gathered from knowledgeable sources. However, Midland Manufacturing Corporation makes no representations or guarantees about its accuracy or completeness, and assumes no liability for this information.

Specifications are subject to change without notice.

3.1.2 Safety Precautions

Always use extreme caution and proper equipment when handling hazardous materials.

This device should only be installed, operated and maintained by qualified personnel.

Read all of these instructions carefully before proceeding.



CAUTION: Toxic Hazard. Always use extreme caution and proper equipment when involved with hazardous materials. To avoid exposure to toxic or hazardous materials, make sure the tank car is empty and clean. The work area must also be free of hazardous chemicals before removing or installing any valve.

3.2 INSTALLATION PROCEDURE

- 3.2.1** Leave all of the parts of the gaging device in their shipping containers until the parts are to be mounted on the cover plate. The magnets in the float (item 15) and on the gage rod (item 14) are very powerful and will readily attract metal filings. The outer 1-1/2-inch stainless-steel gage tube (item 6) can get nicked or have weld berries attached if it is left uncovered.
- 3.2.2** The hole through the cover plate must be 1-3/16-inch minimum, and preferably 1-1/4-inch, in order to permit the gage rod magnet (item 14) to enter the guide tube (item 6). If the hole through the cover plate is undersized, it must be increased to the recommended size. For the typical approved mounting, refer to the AAR Tank Car Regulations, Appendix E, and Figure E9.7.
- 3.2.3** The 1-1/2-inch stainless-steel guide tube (item 6) should be positioned at 90 degrees to the cover plate. All welding must be done by a competent welder. Tack the tube in place, then check the alignment with a square. If the socket is more than 1.53-inch, be sure the gage tube is centered in the socket. When attaching the socket, it is recommended that a stainless-steel rod, AWS E-309 or equal, be used. The fillet should be a 1/4-inch all around.



NOTICE: Undercutting the welds must be avoided.

If the guide tube is threaded up into a tapped hole in the cover plate, be sure it is tightened, but ensure that any tools used do not create deep marks on the tube; then a seal weld is recommended.

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- 3.2.4** The float (item 3) must be prevented from touching the inside top of the tank, impacting the underside of the cover plate, or rubbing up against other braces or structural members. A minimum of a 1/2-inch clearance around the ball is required. This would mean a 4-1/4-inch radius from the centerline of the gauging device for a 7-1/2-inch float.



NOTICE

NOTICE: Conform to all regulations and your company's installation instructions. It is not the intention of this pamphlet to conflict with or supersede these requirements.

Placement of the spring in its working position should prevent the float from impacting against any solid metallic tank member. We recommend an additional 1/2-inch clearance as a precaution against any installation variances. Verify with the customer that when the float touches the top spring, sufficient gaging is available to permit the loader to gage to the desired outage for any possible filling density.

- 3.2.5** There must be a brace at the bottom of the guide tube. Proper bracing is critical to the operation of the unit. Braces should be carefully prepared so that the guide tube and the two (2) education lines are guided together without forcing the lines out of their normal positions.
- 3.2.6** Before the bottom brace or guide is welded in place, the float must be put on the guide tube. Up to that time, the float should be left in its cardboard shipping box or in a bag to ensure that no metal filings are attracted by the magnet. Built into the float ends are guide washers, one is red, the other white. The float must be installed on the guide tube with the red washer end facing toward the cover plate, and the white washer end facing toward the bottom of the tank. Move the float up on the guide tube at least two feet away from the welded area when the bottom brace is being installed. The float should be protected so that no weld berries can attach to it or damage it.
- 3.2.7** After all welding is completed, the welder should run his hand up and down on the guide tube the full length where the float is to travel to make sure there are no weld berries clinging to the tube. Any nicks, gouges, weld berries, etc., should be removed and the indentations blended out with a fine or smooth-cut hand file.
- 3.2.8** As a final check, the float should be moved up and down on the guide tube to be sure that it is free to travel the maximum distance without coming in contact with any structural elements.
- 3.2.9** At this time, the inner gage rod (item 2) should be removed from its cardboard shipping container. Examine the magnet (item 14) at the end of the rod to be sure there are no metal filings clinging to it. Then insert it through the cover plate into the gage tube.
- 3.2.10** Remove the protective cover (item 1) from the gaging device body assembly (item 4). Carefully fit the body assembly over the inner gage rod and bolt it in place. The gage rod should not extend more than two (2) inches above a white nylon sleeve (item 8). If it does, please contact the supervising engineer or Midland manufacturing for directions.
- 3.2.11** Measure the distance from the inside top of the tank to the top of the cover plate. If the cover plate is not in place, measure to the top of the nozzle flange and the thickness of the manway cover plate. This dimension should correspond to the tank-car installation drawing (see dimension for item 5 on Figure 6-4). If it does, then secure the installation correction nut (item 7) in place by tightening the set screw (item 12). If it does not, notify the engineer in charge of the project for instructions.



CAUTION

CAUTION: Weld only in a well-ventilated area. The nut (item 7) is zinc-plated and may give off toxic gases when heated.

- 3.2.12** After the gaging device is in place, it must be checked for leaks. The gaging device body (item 4) has 2-inch NPT thread on it. Attach a coupling to the body, and then introduce dry air into the unit. Then put soap suds (or check with a sniffer or a mass spectrometer) on all the joints. Places to check are the body mounting to the cover plate, where the tube recesses into the underside of the cover plate, and where the plug closes off the bottom of the guide tube. If there are any leaks detected, report this to the supervising engineer.

- 3.2.13** Install the protective cover (item 1) on top of the gaging device body assembly hand tighten.
- 3.2.14** Included in the shipping crate is a tan envelope containing instruction placards. A placard should be installed on each application, either on the inside top of the protective housing cover, or the inside of the dome housing where it can easily be read. Clean off the mounting surface in accordance with your company's procedure, and then peel back the protective paper that covers the adhesive backing. Apply the placard and smooth it down so that all edges are bonded to the metal. If this area is to be repainted, mask the instruction placard.
- 3.2.15** If the manway cover assembly, with all the piping, gaging device and other fittings is placed on the ground, be sure that the gaging device is not on the underside of the assembly. The float cannot support the weight of this assembly and the magnets will attract filings.
- 3.2.16** When the manway cover assembly is lowered into the tank, take great care to make sure that the float does not hit the side of the manway nozzle as it is going into the tank.

3.3 FINE TUNING OF GAGING DEVICES

- 3.3.1** During installation of a new gaging device, the correction nut (item 7) is used to fine-tune the device to accurately reflect fill level.
- 3.3.2** Engage the rod to the float.
- 3.3.3** Loosen the set screw (Item 12), adjust the correction nut (item 7) until the top of the scale reads "60" and the top hash mark on the rod is aligned with the adjustment bushing (Item 8) when the car is empty, this now establishes the "set point."



NOTICE

NOTICE: The correction nut (Item 7) will allow for ~ 1/2" of adjustment.



NOTICE

NOTICE: The adjustment bushing (item 8) is not adjustable. It simply snaps on and off.

- 3.3.4** Secure the correction nut (item 7) in place by tightening the set screw (item 12).
-



NOTICE

NOTICE: For rods with multiple scales, the scale with the "60" level hash mark is closest to the top of the rod (for the lowest specific gravity) is the device set point.

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- 3.3.5** Figure 3-1 shows an illustration of a gage rod with the top of the scale and zero marks for the first commodity (lower specific gravity) on the left, and additional top of scale and zero marks for a second commodity on the right. Note that at the set point, the left scale will read "60" while the right scale may indicate a level greater than 60. This accounts for the variation in liquid level on the float due to difference in density.

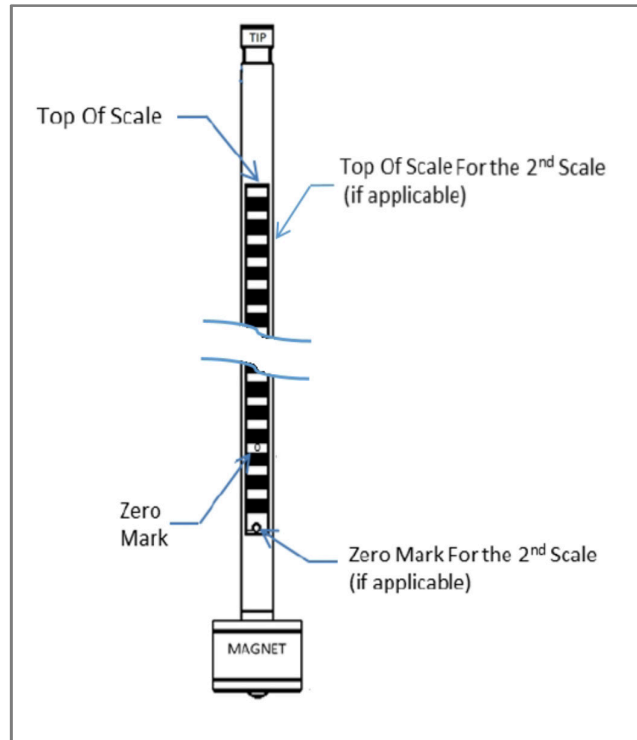


Figure 3-1 B-612 Gage Rod Scale for Two Commodities, Low SG Primary Scale (left) and Secondary Higher SG Commodity (right)

- 3.3.6** If the adjustment bushing does not align with the highest hash mark, then the correction nut may not be set correctly. This is sometimes indicated by the absence of threads under the correction nut. If this occurs, notify the engineer in charge of the project for instructions.

4 LEAK TESTING

See step 3.2.12 of the installation procedure.

5 OPERATION

The operation placard is included in the device package. Please adhere to the location most conveniently visible near the device.



NOTICE: The device cover (Item 1) does not come in contact with the commodity and needs only to be hand tighten. Do not use tools to tighten the device cover (item 1).

MIDLAND MODEL B-612 MAGNETIC GAGING DEVICE OPERATING INSTRUCTIONS **PLEASE HANDLE THIS INSTRUMENT WITH CARE!**

READ CAREFULLY:

- 1.) UNSCREW CAP FROM GAGING DEVICE. **NOTE:** IF PRESSURE IS RELEASED AS CAP IS BEING UNSCREWED, SCREW CAP DOWN AND REPORT GAGING DEVICE AS BAD ORDER. DO NOT REOPEN. OTHERWISE, PROCEED TO #2 BELOW.
- 2.) REMOVE CAP. CAREFULLY PULL GAGE ROD UPWARD AND VISUALLY INSPECT FROM TOP TO BOTTOM. **IMPORTANT:** THE LAST SCALE MARKING NEAR THE BOTTOM OF THE GAGE ROD IS THE HIGHEST LEVEL THIS DEVICE WILL INDICATE. LOADING ABOVE THIS LEVEL COULD RESULT IN AN OVERFILL.
- 3.) CAREFULLY LOWER THE GAGE ROD TO ITS ORIGINAL STORED POSITION.
- 4.) PRIOR TO LOADING, PULL GAGE ROD UP UNTIL YOU FEEL IT COUPLE MAGNETICALLY WITH THE FLOAT.
- 5.) IF ROD HAS DUAL SCALE MARKINGS, CHOOSE THE SCALE FOR THE COMMODITY BEING LOADED.
- 6.) TO TAKE CONSISTENTLY ACCURATE GAGE READINGS:
 - a.) HOLD THE GAGE ROD FIRMLY IN ONE HAND AND...
 - b.) GENTLY PUSH ROD DOWN UNTIL IT UNCOUPLES FROM THE FLOAT AND...
 - c.) LIFT THE ROD UP UNTIL IT COUPLES AGAIN WITH THE FLOAT AND...
 - d.) KEEP A SLIGHT UPWARD FORCE ON THE GAGE ROD (AS IF YOU ARE TRYING TO LIFT THE FLOAT WITHOUT UNCOUPLING IT FROM THE ROD), THEN...
 - e.) VERY SLOWLY, RELEASE THE GAGE ROD (LET IT GENTLY SLIDE OUT OF YOUR GRIP).
 - f.) READ THE SCALE ACROSS THE TOP OF THE WHITE PLASTIC BUSHING.
- 7.) AFTER FINAL READING, HOLD AND LOWER GAGE ROD TO ITS ORIGINAL STORED POSITION-DO NOT DROP.
- 8.) REPLACE AND HAND-TIGHTEN CAP IMMEDIATELY.

NOTE: TO PREVENT DAMAGE DURING TANK CAR STEAM CLEANING, THE GAGE ROD MAY BE REMOVED TEMPORARILY FROM THE GUIDE TUBE ASSEMBLY...BE SURE TO REPLACE GAGE ROD AFTERWARD.

REFER TO MIDLAND INSTALLATION, OPERATION & MAINTENANCE MANUALS FOR FURTHER DETAILS.

PT. NO. 612-1631-7-PL

Figure 5-5-1 Gaging Device Operation Placard

6 STANDARD MAINTENANCE AND REPAIR

Follow these guidelines to ensure proper operation of the device and identify potential problems.

6.1 COMPONENT INSPECTION

6.1.1 GAGE ROD INSPECTION

The gage rod alongside the float is a crucial component in the operation of the gaging device. In order to have an accurate level reading, the gage rod assembly needs to be properly handled and installed. In order to inspect the rod after its initial installation, always remove the white plastic bushing prior to removing the gage rod from the guide tube.



CAUTION: Weld only in a well-ventilated area. The nut (item 7) is zinc-plated and may give off toxic gases when heated.

Once the gage rod is removed, make sure that all of the components of the assembly are still intact. The magnet at the bottom should be firmly in place, the carbon-fiber tubing should be straight and free of any cracks/defects, the scale should be visible and provide the full level measurement desired.

6.1.2 Gage Rod Magnet Coupling Strength Inspection

- Purpose: To verify adequate magnetic coupling strength between the gaging device float and gage rod.
- Scope: For Midland gage rods with gage lengths of 60-inches or less.
- Equipment: Magnet strength test weight, Midland P/N: T612-2017 (See Figure 6-1).
- Procedure: Inspect the magnet on the lower end of the gage rod and ensure that it is not loose, broken or cracked. The gage rod must move freely inside the guide tube. Inspect for debris or magnetized particles on the magnet. Ensure that no liquid has entered the hollow tube of the gage rod (e.g., excessive glycol/water in guide tube). This will increase the rod weight and affect the magnetic coupling.

6.1.2.1 Place the gage rod in the gaging device.

6.1.2.2 Engage (magnetically couple) the gage rod with the float.

6.1.2.3 Place test weight #T612-2017 on the gage rod. Ensure the test weight is fully seated on the rod.

Refer to the hole depth in Figure 5-1.

6.1.2.4 Release the weight and rod.

6.1.2.5 The gage rod will not disengage with the float if the magnet strength is sufficient.

6.1.2.6 If the gage rod disengages with the float, i.e., it drops to the bottom of the guide tube, the float magnet or gage rod magnet is defective.

6.1.2.7 Remove the adjustment bushing (item 8) by pulling up. The bushing will simply snap out.

6.1.2.8 Place a new gage rod, with a magnet with the correct strength, in the guide tube.

6.1.2.9 Reassemble the adjustment bushing (item 8) around the rod and push down onto the gage body.

6.1.2.10 Repeat steps 6.1.2.1 through 6.1.2.6 above.

6.1.2.11 If the gage rod disengages with the float, the float magnet is defective.

6.1.2.12 If this procedure is inconclusive, contact Midland for further assistance.



NOTICE: Magnets can lose strength if broken which may be caused by high impact loads. Magnet strength is reduced at high temperatures +250°C (482°F), but recovered when brought to normal ambient temperature. However, there may be a permanent loss of magnet strength if exposed to low temperatures -20°C (-4°F).

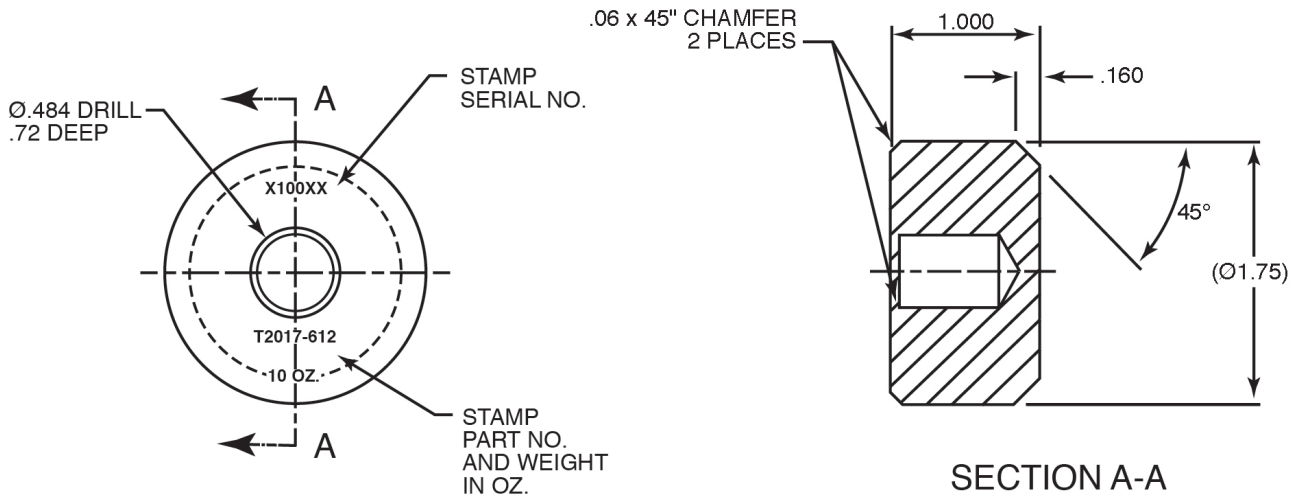


Figure 6-1 Non-Aluminum Rod Hole Depth

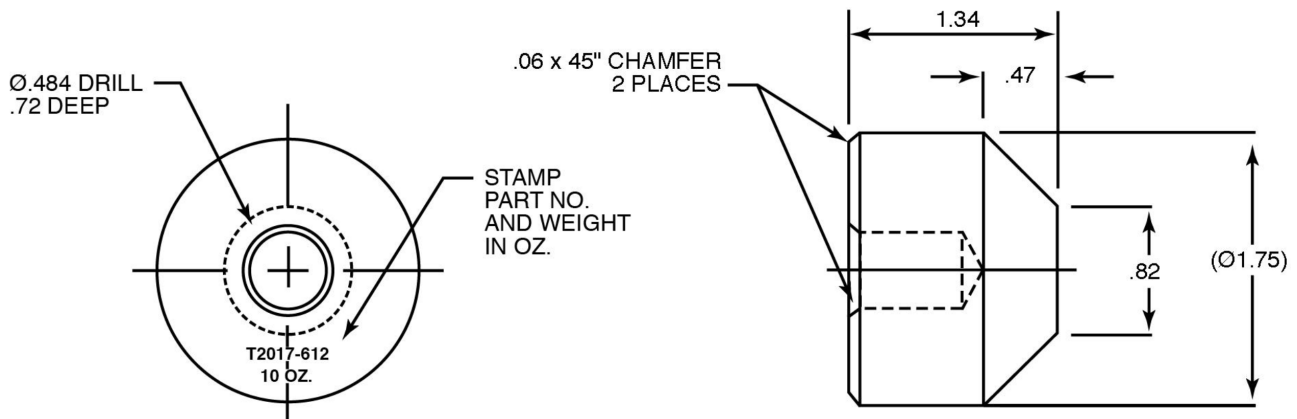


Figure 6-2 Aluminum Rod Hole Depth

6.1.3 FLOAT INSPECTION

If after the initial installation the float needs to be inspected, removal of the float should be done with great care in order not to cause physical damage to the float. Once removed, the float should be visually inspected for any signs of dents, leaks or other physical damage.

- The colored Teflon™ guide rings should freely rotate at all times.
- Check for wear of the guide rings. To check for leaks, submerge the float under hot water and look for bubbles indicating leaks.
- Shake the float. If anything is loose inside, replace the float.



NOTICE: All leaking or dented floats must be removed from service immediately.

6.1.4 O-RING INSPECTION

O-rings should be visually inspected for any signs of degradation and deformation.



NOTICE: All damaged O-rings must be replaced.

6.1.5 SPRING INSPECTION

If the top spring is not intact you need to order a replacement spring before you use the device again. Please provide the serial number of the device when placing an order.

The bottom spring also needs to be replaced if defective or missing, since it prevents physical damage to the float.

6.1.6 GUIDE TUBE INSPECTION

The condition of the guide tube will affect the movement of the float/gage rod during the loading/unloading process and its outer diameter surface needs to be free of any bends, scratches or gouges that would interfere with the travel of the engaged float/gage rod.



NOTICE: Any commodity present in the guide tube indicates a leak and requires repair or replacement. This kind of leak is normally the result of a faulty weld at the pressure plate connection or a result of physical damage to the tube.

6.2 REPAIR/REMANUFACTURING SERVICES OFFERED BY MIDLAND

Midland offers a variety of repair and remanufacture services for all of its products, including gaging devices and their components.

6.3 REPAIR PARTS

6.3.1 SERIAL NUMBERS

In order to guarantee correct part replacement, you need to provide a Midland serial number that has been assigned to every gaging device. Using the serial number information we can track down the original design and build specs for devices built over the last 40-plus years.

You can find the serial number information on metal nameplates attached to the flange and correction nut, as well as on the gage rod label.

Please refer to the pictures for the locations where you can find the serial number information.

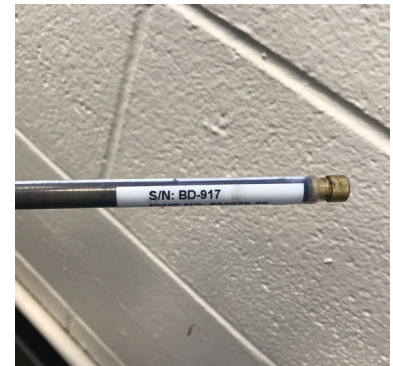


Figure 6-3 Serial Number Locations

6.3.2 GAGE ROD REPLACEMENT OPTIONS

Whenever you change the loading commodity in the tank car, and if the new commodity has a different specific gravity value from the previous one, you also need to change the gage rod. Every gage is calibrated for a particular s.g. value and will only provide accurate level-measurement readings for that value.



CAUTION: If you are not using a properly calibrated gage rod, you risk potential overload.

There are several scenarios you may run into when it comes to ordering a replacement gage rod. Please refer to the following options when placing an order:

6.3.2.1 OPTION 1: REPLACING A GAGE ROD THAT HAS A SERIAL NUMBER

If you have the following information, we can replace your gage rod:

- Serial # _____
- Commodity _____
- Specific Gravity _____

6.3.2.3 OPTION 3: ANY OTHER REPLACEMENT

If a tank car changes commodity with specific gravity (other than originally specified for the device), the gage rod needs to be replaced or a correction factor needs to be applied. The easiest method is to provide Midland customer service with the device serial number along with the new specific gravity. If the rod is missing or the serial number is unknown, complete Midland Form 6 and submit with the order. Form 6 is pictured below in Figure 6-4 and is available on the Midland website. The new rod will be calibrated for the new commodity and no adjustment will be necessary.

TO PLACE ON ORDER, OR JUST ASK A QUESTION, CALL (847) 677-0333 OR FAX (847) 677-0138

Use this form only if you are trying to replace a missing gage rod and the verification of device dimensions is required.

Rod Markings	Specific Gravity	Commodity
For one specific gravity		
For second specific gravity (optional)		

Scale Units: Inches mm both
 ("both" is not available if 2 scales are required)

Measurement: Innage Outage

Temperature Range: low (less than 250 deg. F) high (above 250 deg. F)

Dimensions

Please provide applicable dimensions on the device diagram to the right.

1. Body (Housing) height = _____
2. Guide tube length from the top of the press. plate to the internal stop = _____
3. Pressure plate thickness = _____
4. Location of the top spring (where it's welded) = _____
5. Nozzle height = _____
6. Float diameter (5, 6, 7 1/2) = _____
7. Offset from the centerline of the pressure plate = _____
8. Top spring length = _____
9. Nozzle inside diameter = _____

Car Number: _____

Customer _____ Phone No _____

Contact _____

Purchase Order No _____ Qty _____

Date _____ Signed _____

Midland Use Only: Midland S.O. No _____

Form 6

REPLACEMENT GAGE RODS FROM DEVICE DIMENSIONS
(USE WHEN ROD IS MISSING)

B-612 ROD DATA

Figure 6-4 Midland Form 6

6.3.2.4 SPECIAL CAR TYPES

For complex applications (i.e., multi-compartment cars or slope top cars), please contact Midland as other variables and considerations may be required.

6.3.3 BODY ASSEMBLY REPLACEMENT

6.3.3.1 If you need to replace a body assembly, you have to determine whether you need to replace just the body weldment (flange welded to the body or housing, as it's sometimes referred to).



Figure 6-2 Guide Body

6.3.3.2 The complete assembly contains all of the small parts (i.e., correction nut, O-rings, nameplate, specific-gravity bushing and cover with chain).



Figure 6-3 Complete Housing Assembly

6.3.3.3 When placing an order, please provide a valid serial number so the correct original assembly parts can be identified.



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