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6600 Liquid Level Indicator

Accurate sight tube gauge for tank liquid level measurement

Installation and Operations Manual

Automation Solutions for oil & gas, defense, and aviation applications

Varec®

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The 6600 Liquid Level Indicator (LLI) has not been tested by Varec under all possible operational conditions, and Varec may not have all the data relative to your application. The information in this instruction manual is not all inclusive and does not and cannot take into account all unique situations. Consequently, the user should review this product literature in view of his or her application. If you have any further questions, please contact Varec for assistance.

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Safety Precaution Definitions

Caution! Damage to equipment may result if this precaution is disregarded.

Warning! Direct injury to personnel or damage to equipment which can cause injury to personnel may result if this precaution is not followed.

Safety Precautions

Read this manual carefully and make sure you understand its contents before using this product. Follow all instructions and safety guidelines presented in this manual when using this product. If the user does not follow these instructions properly, Varec cannot guarantee the safety of the system.

Note Comply with all applicable regulations, codes, and standards. For safety precautions, the user should refer to the appropriate industry or military standards.

Caution! Electrical Hazard! Read and understand static and lightning electrical protection and grounding described in API 2003. Make certain that the tank installation, operation, and maintenance conforms with the practice set forth therein.

Warning! Make certain that the tank is empty and not in service. Ensure that the tank has been leak and pressure tested as appropriate for the liquid to be stored. Observe appropriate safety precautions in flammable or hazardous liquid storage areas. Do not enter a tank that has contained hydrocarbons, vapors, or toxic materials until a gas free environment is certified. Carry breathing equipment when entering a tank where oxygen may be displaced by carbon dioxide, nitrogen, or other gases. Wear safety glasses as appropriate. Use a hard hat.

Warning! Under most circumstances, the mechanical connections between the guide cables and the anchors provide a resistance to ground that is adequate for the safe electrical drain of electrostatic charges that may accumulate in the tank and the product. Additional grounding may be needed for products with low flash points. Worker activity and worker clothing may accumulate electrostatic charges on the body of a worker. Care should be used in flammable environments to avoid the hazard. Observe American Petroleum Institute (API) Recommended Practice 2003 or other appropriate industry or military standard.

ATEX Exemption

The 6600 LLI sight tube gauge is considered a simple apparatus. It moves very slowly, and has a low capacity to store energy. It is incapable of forming hot surfaces or other ignition sources, even in cases of rare malfunction. Simple apparatus are not to be classified as ATEX equipment or to be marked according to ATEX Directive 2014/34/EU.

For use in gas groups IIA, IIB, and IIC.

Installation Location	**Wetted Parts** (float, cable, bottom anchor, top anchors, sheave elbows)	**Non-Wetted Parts** (tube, level indicator)
Hazardous locations – Zone 0	Yes	No
Hazardous locations – Zone 1	Yes	Yes
Hazardous locations – Zone 2	Yes	Yes
Normal (nonhazardous) locations	Yes	Yes

Change History

Revision #	Date	Author	Approved By	Description of Change
A	6/14/2021	J. M. Rollins		Initial Change History table addition
B	1/26/2023	J. M. Rollins	T. Gibson	Removed Carp 20 as material for parts

Introduction

This manual is designed to assist the user with the installation, configuration, operation, maintenance, and troubleshooting of the Varec 6600 Liquid Level Indicator (LLI).

Getting Started

Varec 6600 LLIs are for use at atmospheric pressure. If oil-seal units are installed, pressure of 1.0 psig is the maximum used with the 27-inch W.C. seal.

A system consists of the tube, indicator, float, cables, elbows, and the user furnished gauge piping which carries the indicator cable.

Proper operation of the indicator requires the careful attention of the user to assure high quality control during installation. Long term, satisfactory performance of the sight gauge can thus be obtained. If the installation quality is compromised, sight gauge accuracy and life may be degraded.

Changes in the liquid level in the tank raise or lower the float, which moves the indicator cable. Cable movement drives the indicator up and down the tube on the side of the tank.

The liquid level in 1 - 8 feet increments is indicated by the indicator position on the tube. The user may then convert the liquid level to units of volume. This may be accomplished manually, or Varec's computer aided data acquisition system may perform the task.

When the indicator is at the top of the tube, the tank is empty with the float at the bottom of the tank.

Chapter 2, Installation, covers installations to be performed on tanks that are empty and are not in service. The section, In Service Tank Installations, covers the additional procedures that are required for making installations on tanks that are in service.

Varec service contracts provide the user substantial savings for maintaining and refurbishing the systems. Contact Field Service, a Varec representative or Product Marketing for further details.

Float Ground Kit

The Float Grounding Kit positively grounds the float to the cable. Connect the grounding cable (A) to the cable clamp (point B) and float (point C) as shown below.

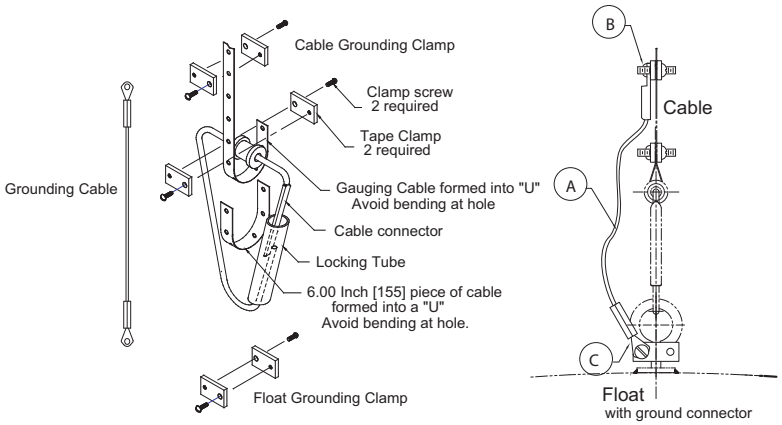


Figure 1: Float Grounding Kit Diagram

Installation

Refer to Chapter 1, Introduction to determine the feature and option codes of the unit to be installed. Use the Table of Contents to determine the appropriate installation figure in this Instruction Manual. These are typical installations. All situations may not be covered. Contact Varec if additional information is needed. It is paramount that the user monitor the quality of the installation to assure long term, accurate performance. If the quality is compromised, inferior operation may result.

Particularly important are:

- Clean interior of the gauge piping
- No kinks in the cable
- No noticeable binding friction in the mechanism
- Installation cleanliness
- True vertical gauge piping
- Location of float away from inlet pipes or mixers

Warning Make certain that the tank is empty and not in service. Ensure that the tank has been leak and pressure tested as appropriate for the liquid to be stored. Observe appropriate safety precautions in flammable or hazardous liquid storage areas. Do not enter a tank that has contained hydrocarbons, vapors, or toxic materials until a gas free environment is certified. Carry breathing equipment when entering a tank where oxygen may be displaced by carbon dioxide, nitrogen, or other gases. Wear safety glasses as appropriate. Use a hard hat.

Warning Under most circumstances, the mechanical connections between the guide cables and the anchors provide a resistance to ground that is adequate for the safe electrical drain of electrostatic charges that may accumulate in the tank and the product. Additional grounding may be needed for products with low flash points. Worker activity and worker clothing may accumulate electrostatic charges on the body of a worker. Care should be used in flammable environments to avoid the hazard. Observe American Petroleum Institute (API) Recommended Practice 2003 or other appropriate industry or military standard.

The user provides the 1.5-inch pipe that carries the cable and the necessary mounting and support welding. The user must drill holes in the tank as needed. Assemble the necessary tools and equipment at the work site. Table 1 on page 4 lists typical tools and equipment that may be needed. Use a drop cloth to maintain tool, equipment, and installation kit cleanliness.

Plan the pipe routing. Locate the roof connection into the tank interior within arms reach of a manhole or an inspection hatch.

Table 1: Typical Tools, Equipment, and Materials List

Tool/Equipment	
Breathing equipment	Pick
Cable cutter	Pipe cutter
Chalk	Pipe taps/dies
Chalk line	Pliers
Clean drop cloth	Plumb bob
Compass	Protractor
Drill bits	Screwdrivers
Electric drill	Sheet metal shears
Hole cutters	Shovel
Level	String
Light oil	Tank hand gauge
Loctite 262	Vice
Loctite 567	Welding equipment
Long measuring cable	Wrenches

Note Install a Varec manhole or inspection hatch, if there is none located within arms reach of the cable pipe location. Refer to In-service Tank Installations later in this section for hatch and manhole installations.

Locate the float at a position inside of the tank where agitation on it will be at a minimum. Install a deflector if the product stream is close to the float. Contact Varec if agitators will cause excess float disturbances. Vertical pipe runs must be plumbed and perpendicular to prevent the cable from binding inside the pipe.

The user must attach the tube to the tank by welding or bolting the supplied tube support brackets. If the environment is such that welding cannot be performed, the user can construct a support structure with 3-inch [76 mm] pipe or conduit close to the outside of the tank. The brackets can be welded to the support structure at another location, if necessary, and the pipe structure assembled at the tank site. Refer to In Service Tank Installations later in this section for additional details.

Warning The user should comply with all applicable regulations, codes, and standards. For safety precautions, the user should refer to the appropriate industry or military standards.

Oil Seal Installations

Tank configuration instructions that follow do not include the use of the oil seal accessories . If these are to be installed, refer to these illustrations as appropriate and perform the following additional installation procedures.

Note Varec recommends an oil seal if the process temperature exceeds 200° F (93° C).

Installation of Oil Seal, 8.5-Inch Water Column Operating Pressure Model

1. Apply appropriate pipe thread compound and install long pipe (1) into 135-degree elbow with bottom drain (4).
2. Apply pipe thread compound and install short pipe (2) into 135-degree elbow with bottom drain (4).
3. Apply pipe thread compound and install 135-degree elbow (3) onto long pipe (1).
4. Apply pipe thread compound and install 90-degree elbow supplied with gauge kit onto short pipe (2).
5. Adjust the assembly to provide the cable path illustrated in Figure 2-8 on page 29.
6. Provide 1.5-inch pipe installation, as required.
7. Proceed with the remainder of the tank installation to the paragraph Initial Lubrication, then fill the oil seal as follows:
   a. See Chapter 4, Maintenance, for oil selection.
   b. Remove the cover from 90-degree elbow.
   c. Fill to halfway in the short pipe.

   Note To drain the oil, open the plug in 135 degree elbow (4).

Installation of Oil Seal, 27-Inch Water Column Operating Pressure

1. Apply thread pipe compound and install short pipe (3) into 180-degree elbow (1).
2. Apply pipe thread compound and install 180-degree elbow (4) onto short pipe (3).
3. Apply pipe thread compound and install long pipe (2) into elbow (4).
4. Apply pipe thread compound and install 90-degree elbow supplied with gauge kit onto long pipe (2).
5. Complete the assembly to the user furnished 1.5-inch pipe.
6. Adjust the assembly to provide the cable path as illustrated.
7. Proceed with the remainder of the tank installation to the paragraph Initial Lubrication, then fill the oil seal as follows:
   a. See Chapter 4, Maintenance, for oil selection.
   b. Remove the cover from 90-degree elbow.

c. Fill to halfway in the short pipe.

Note To drain the oil, open the plug in 180-degree elbow (4).

Tank Roof Installation

Note Be sure to read General Preparation at the beginning of this section before proceeding with this installation.

Note If the model NA is being used, the top and bottom guidewire anchoring hardware and the alignment thereof is the responsibility of the user.

Refer to Table 1 on page 4. See Figure 2 on page 8 for full travel Tank Gauges.

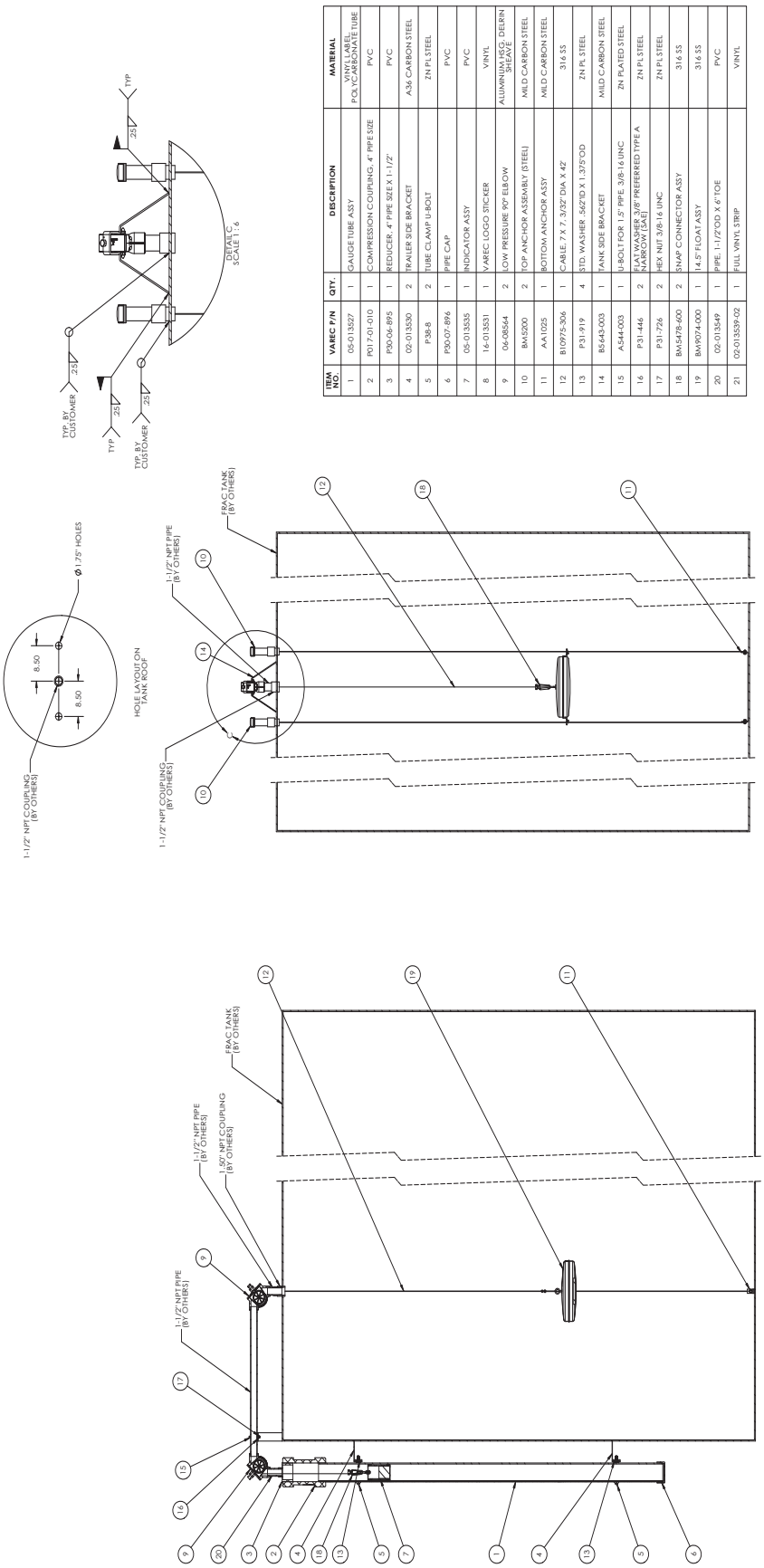
1. Determine the position on the tank roof, beneath which the center of the float will rise and fall. Notice that this position is located a minimum of 16 inches [406 mm] and a maximum of 36.00 inches [914 mm] from the wall of the tank.
2. Provide the roof holes shown in the figure, centered on this position. The float diameter is 14.50 inches [368 mm]. The guide cable holes are centered 8.50 inches [216 mm], each side of the center of the float. The indicator cable pipe is centered on a 17.00 inch [432 mm] diameter.
3. Check the angle of the roof.
4. Connect a pipe coupling to the 1.5-inch vertical pipe that is to be attached to the roof and hold it plumb while welding the coupling into the hole in the roof. Failure to place the coupling and pipe in a true vertical position may affect the accuracy of the sight tube gauge. Make sure that the interior of all pipes are clean and corrosion free.
5. After the coupling and pipe are checked to make certain that they are plumb, unscrew the pipe from the coupling.
6. Seal the threads with pipe thread compound and reconnect the pipe to the coupling.
7. Center the base of a top cable anchor in its hole. Hold it plumb while welding it to the roof. Do the same for the other top cable anchor.
8. Remove the housing nipple and cap from the top cable anchors and hang plumb lines from them at the center to mark the position where the bottom cable anchor will be welded.
9. Mark the plumb bob string at the height of the tank bench mark. This will assure that the plumb bob just touches the bottom, when the reference is made from the bench mark distance to the bottom.
10. Hang a plumb line through the center of the top cable pipe to the bottom to mark the float center. This should be 8.50 inches [216 mm] at the bottom from each of the bottom cable anchor positions.
11. When the positioning has been checked, weld the bottom cable anchor into place.
12. Thread the float guide cables into the tank through the top anchor fittings. Fasten them to the bottom cable anchor with the furnished hardware. Thread the upper end of each guide cable through the top anchor assembly. Hand tighten. Use the lock nut to lock the cable in place, then tighten the adjustment nut, until the guide cable is tensioned by the spring. Trim off excessive cable.

13. Replace the top anchor nipple and cap.
14. Apply appropriate pipe thread compound and install the sheave elbow on the vertical pipe to the tank interior. Install a pipe union in the horizontal pipe run, in order that the elbows can be easily removed, if necessary. Then install the horizontal pipe assembly into the tank drop elbow. Adjust the length as needed to properly position the outboard elbow.
15. Install the outboard elbow on the horizontal pipe.
16. Apply pipe thread compound and screw the tube connector pipe into the outboard elbow.
17. Remove the bolts, cover, and gasket from the outboard elbow and drop a plumb line through the center.
18. Drop a chalk line from the top of the tank parallel with the plumb line and mark the chalk line on the tank wall. See Figure 2 on page 8.
19. Use the width of the tube (4 inches [101.6 mm]) at the bottom of the tank wall and chalk register marks for the width as follows:

    Full Travel Tube:
    Board centered with chalked plumb line (see Figure 2 on page 8).

20. Do the same at the top of the tank.
21. Make chalk line marks between the top and bottom register mark to aid in keeping the tube sections centered and parallel during installation.
22. Weld the tube support brackets into position.
23. Use the “U” bolt and nuts (see Figure 2) to attach the tube connector to the pipe. The pipe should extend one inch [25.4 mm] below the “U” bolt.
24. Attach the tube to the connector plate. Make certain that it is centered on the chalk line.
25. Attach the remainder of the sections to the bottom of the tank. Make certain that each section is centered on the chalk line (see Figure 2).

    Note To fit the tube to the tank, cut the highest-numbered tube section at the marker that is 4.50 inches greater than the tank height to adjust the fit to the total height to the tank.



ITEM NO.	VAREC P/N	QTY.	DESCRIPTION	MATERIAL
1	05-013527	1	GAUGE TUBE ASSY	VINYL LABEL POLYCARBONATE TUBE
2	P01.7-01-010	1	COMPRESSION COUPLING, 4" PIPE SIZE	PVC
3	P30-06-895	1	REDUCER, 4" PIPE SIZE X 1-1/2"	PVC
4	02-013530	2	TRAILER SIDE BRACKET	A36 CARBON STEEL
5	P38-8	2	TUBE CLAMP U-BOLT	ZN PL STEEL
6	P30-07-896	1	PIPE CAP	PVC
7	05-013535	1	INDICATOR ASSY	PVC
8	16-013531	1	VAREC LOGO STICKER	VINYL
9	06-08564	2	LOW PRESSURE 90° ELBOW	ALUMINUM MSG, DELRIN SHEAVE
10	BM45200	2	TOP ANCHOR ASSEMBLY (STEEL)	MILD CARBON STEEL
11	AA1025	1	BOTTOM ANCHOR ASSY	MILD CARBON STEEL
12	B10975-306	1	CABLE, 7 X 7, 3/32" DIA X 42'	316 SS
13	P31-919	4	STD. WASHER, .562"ID X 1.375"OD	ZN PL STEEL
14	B5643-003	1	TANK SIDE BRACKET	MILD CARBON STEEL
15	A544-003	1	U-BOLT FOR 1.5" PIPE, 3/8-16 UNC	ZN PLATED STEEL
16	P31-446	2	FLAT WASHER, 3/8" PREFERRED TYPE A NARROW (SAE)	ZN PL STEEL
17	P31-726	2	HEX NUT 3/8-16 UNC	ZN PL STEEL
18	BM15478-600	2	SNAP CONNECTOR ASSY	316 SS
19	BM19074-000	1	14.5" FLOAT ASSY	316 SS
20	02-013549	1	PIPE, 1-1/2"OD X 6'1"OE	PVC
21	02-013539-02	1	FULL VINYL STRIP	VINYL

Figure 2: Tube Style Level Gauge for Mobile Tank Top Assembly w/ Component List

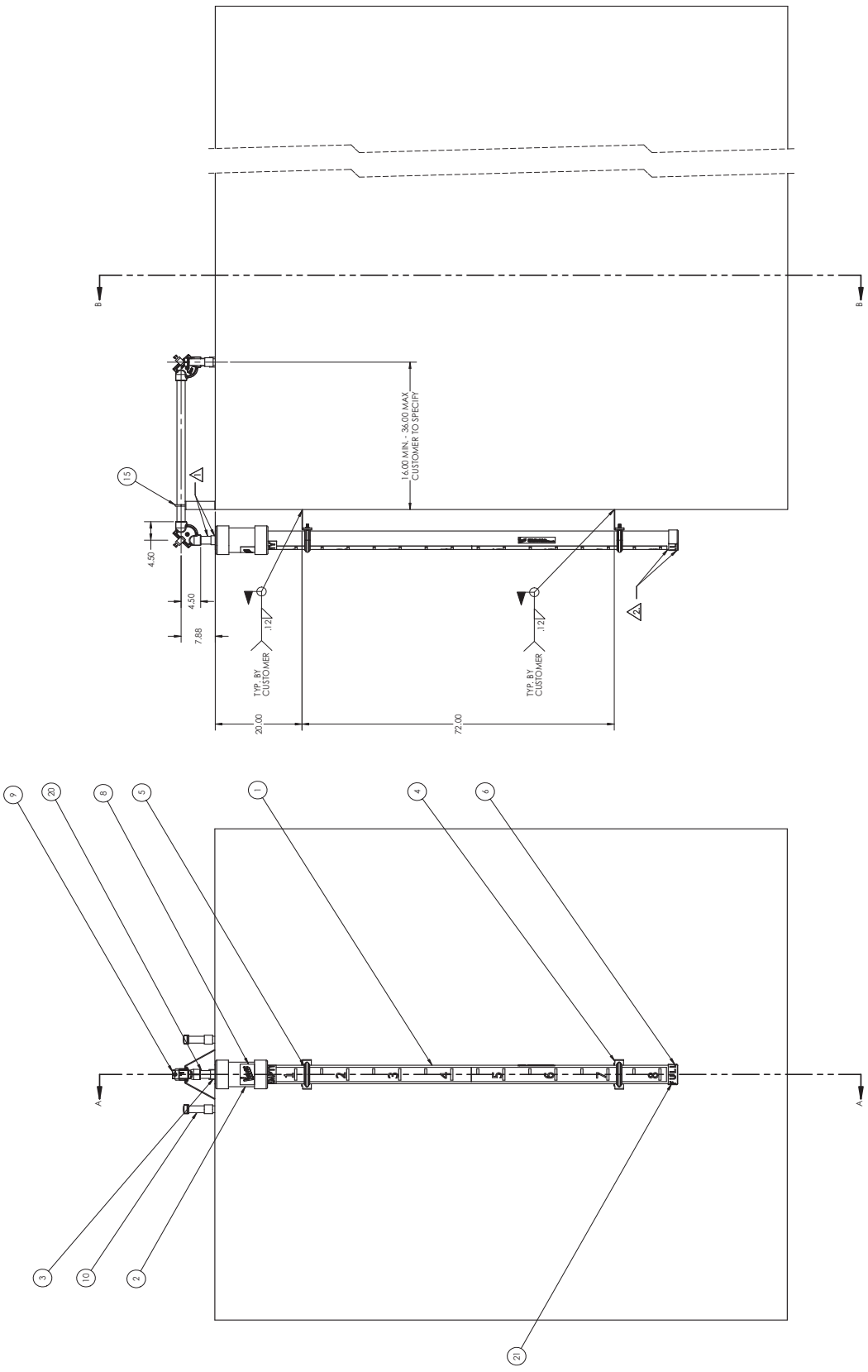


Figure 3: Tube Style Level Gauge for Mobile Tank Top Assembly Side View

ITEM	DESCRIPTION	PART NUMBER
1	CLIP	BM3612
2	JAM NUT	
3	HEX HEAD CAP SCREW	
4	CABLE	
5	PERFORATED TAPE	
6	CONNECTING CLAMP	BM5478-600
7	ROUND HEAD SCREW	
8	FLOAT CONNECTOR	
9	CABLE CLAMP (CRIMP TYPE)	B6065-006
10	BLOCK	P004-02-002
11	NUT ASSEMBLY	
12	SEAL CAP	

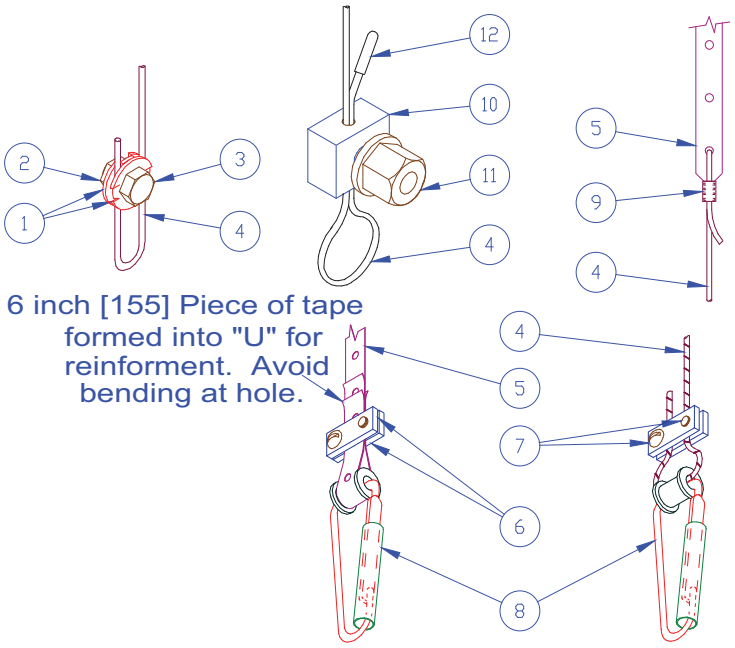


Figure 4: Cable Clamps

26. Tilt the float on edge and slip the guide cables through the loops on the inside of the tank. Set it on the tank bottom with the cable connection up.
27. At the elbow on the tank entry pipe, unroll one or two turns of the cable and start to feed it into the horizontal pipe. Continue to unroll the cable several turns at a time until it reaches the ground at the bottom of the tube installation position. Make sure that the cable on the ground does not become kinked or dirty.
28. Lower the cable to the tank bottom and let several inches fall on the tank bottom.
29. Temporarily attach the cable to the float with the furnished fastener (see Figure 3 on page 9). Feed the other end of the indicator cable over the sheave in the elbow and make sure that it is seated on the pulley. Final attachment to be made at initial calibration.
30. Check the indicator cable path between the float and the tube to be sure that the cable is not kinked or twisted. Also check the float guide cables for kinks.
31. Make certain that the float guide cables are parallel.

Note If auxiliary equipment is to be installed, do it prior to crimping the cable connector. The use of auxiliary units not manufactured or supplied by Varec will void any Varec warranty and will relieve Varec of any obligation to service the product under warranty.

32. Install indicator.

    Slip the indicator into the tube. Put the cable crimp on the end of the cable, then thread the cable through the hole in the indicator. Loop the cable on the outside back through the cable crimp and connect it to the crimp (see Figure 2 on page 8).

33. Tie a line longer than the height of the tank to the indicator.

    Caution Do not allow the float to fall back to the floor of the tank. Damage may result.

34. Slowly pull down on the indicator and lift the float to the top of the tank. Travel should not produce noticeable binding. Slowly lower the float to the floor of the tank.
35. Remove the pull line.

Connecting the Cable to the Float

Note Be sure to read this procedure before proceeding with this installation. Ensure you have completed all previous steps from your installation checklist before proceeding.

1. Unroll the cable so that it doesn't become twisted or kinked.

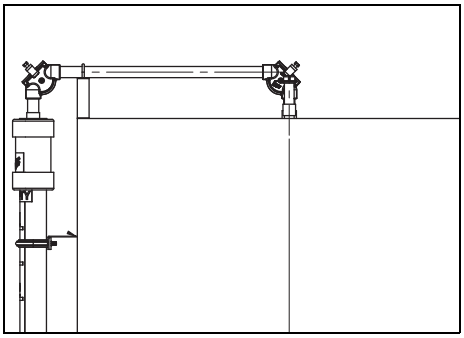


Figure 5: Feed the Cable into the Tank

2. At the elbow on the tank entry pipe, unroll one or two turns of the cable and start to feed it into the tank. If your installation is a roof-reading application with the gauge head installed on the conduit on the roof, feed the cable through the back of the gauge head first. Continue to unroll it several turns at a time until it reaches the bottom of the tank. Let several more inches fall on the tank bottom.
3. Cut a 6-inch (152 mm) piece of cable from the end inside of the tank. Do not kink.

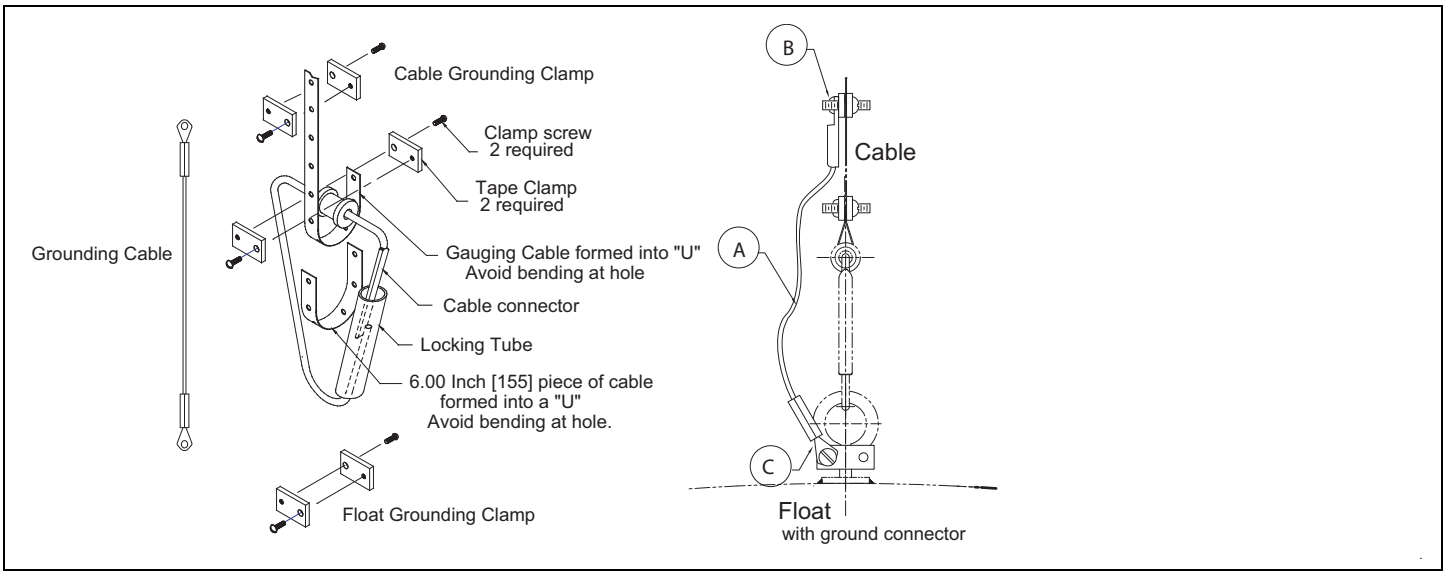


Figure 6: Cable Clamp Assembly with Grounding Cable

4. Form a 'U' at the end of the cable. Form it to match the 'U' piece previously formed. Do not kink.
5. Install the gauge cable and 'U' piece to the cable connector with the cable clamps and screws provided, making certain that the cable is not kinked or twisted.
6. Connect the grounding cable (A) to the cable connector (point B).
7. Attach the cable connector to the float.
8. Connect the grounding cable (A) to the float (point C).

Initial Calibration

These instructions apply to systems that use a hollow-shell, welded float that is 14.5 inches [368 mm] in diameter by 4.0 inches [102 mm] deep. Calibration is based upon the standard specific gravity of water (1.0).

Note For products of other specific gravities to be gauged, adjust the indicator accordingly. Refer to the industry related charts for the particular product.

With the float just touching the bottom of the tank, water will be at the float equator (water line). Use the float connecting clamps (see Figure 2 on page 8) to make the final adjustment, then trim excess cable at the float end, leaving some additional cable for future adjustment needs.

Initial Lubrication

Apply a light oil to the elbow and indicator sheaves.

Reassembly

1. Reinstall the covers, gaskets, and bolts on the elbows.
2. Close the tank manholes and inspection covers.

Float Installation

1. Refer to appropriate tank configuration and install top anchors less long nipple and cap.
2. Thread the float guide cables into the tank through the top anchor fittings and pull the ends back through the inspection hatch.
3. Fasten the bottom anchor to the guide cables (see Figure 18 on page 29) and lower the anchor slowly through the inspection hatch into the tank.
4. When anchor bar is resting on tank bottom, remove cable slack by hand. Tighten cable locking nut to secure cable in place.
5. Tighten the adjustment nut until the guide cable is tensioned by the spring. Trim excess cable.
6. Use pipe thread compound and install top anchor nipples and cap.

   Note Throughout these instructions the term “cable” is used to designate either the indicator cable drive that is used to also drive the accessory drive elbow. The cable end goes on the tube side.

   Caution If the cable binds in the pipe during threading, check the pipe for corrosion and other obstructions. Check the cable to make certain that it did not kink. Friction in the pipe will affect accuracy and may break the cable.

7. Thread the cable through the horizontal pipe and into the tube connector pipe.
8. Put a clean drop cloth on the ground and push the cable through a few turns at a time from the drop pipe elbow, until the cable is unrolled. Make sure that the cable falling to the ground does not become kinked or dirty.
9. Use the tank bench mark as a guide and pull back enough cable to drop from the bench mark to the tank bottom. Mark that position on the cable for reference.
10. Thread the cable through the drop pipe into the tank and pull the end back through the inspection hatch.
11. Install the cable to the float connector with the clamps and screws provided (see Figure 4 on page 10).
12. Attach the cable connector to the float, pass it through the hatch and attach the eyes to the guide cables.
13. Attach the grounding wire to the float as described in Connecting the Cable to the Float on page 27.

    Caution Do not allow the float to fall to the surface of the product. Damage may result.

14. Lower the float until it is hanging from the cable. Inspect the cable and cables for twists and kinks. Make sure that the cables are parallel, then lower the float to the surface of the product.

15. If an accessory is to be installed, perform the installation. Refer to the main text auxiliary equipment installation paragraphs and then continue the installation. The hole size, bolt pattern, and coupling of Varec accessories mates with the sheave drive elbow. Each mating auxiliary unit has a slotted coupling that engages the drive pin on the sprocket sheave. Mate the accessory with the sprocket sheave drive. Use the hex head cap screws and washers to attach the accessory unit to the drive elbow.

    Refer to the manual for the accessory unit, if installed, and check out the operation of the accessory as appropriate.

    Note The use of auxiliary units not manufactured or supplied by Varec will void any Varec warranty and will relieve Varec of any obligation to service the product under warranty.

16. Install the tube and indicator. Refer to the appropriate tank configuration.
17. Set indicator at measured product level.
18. Adjust the cable tension until the float barely lifts from its natural floating position, then crimp the cable connector.
19. Tie a line to the indicator.
20. Slowly pull down on the indicator and lift the float to the top of the tank. Travel should not produce noticeable binding. Slowly lower the float to the product level. Check that any installed accessory performed properly during this test.

    Caution Do not allow the float to fall to the surface of the product. Damage may result.

21. Refer to appropriate tank configuration to set the indicator at the full tank position, then use the hand gauge measurement to recheck the current product level.

Initial Lubrication

Apply a light oil to the elbow and indicator sheaves.

Reassembly

1. Reinstall the covers, gaskets, and bolts on the elbows.
2. Close the tank manholes and inspection covers.

Installation of Model 226 for 20 and 24 Inch Manhole Covers with API Drilling

See Figure 2 on page 33 to install Model 226 20 inch (Part Number BM3443) and 24 inch (Part Number BM3607) manhole covers with API drilling.

1. Remove the existing manhole cover.
2. Separate the Model 226 cover by removing the flange connecting bolts.

3. Install the cover half with the pipe coupling to the top of the tank.
4. Refer to the appropriate tank configuration figure to check the tank configuration and install the cable piping and tube.

Complete the Anchor Bar Installation, Float Installation, Initial Lubrication, and Reassembly sections of the previous procedure, Installation of Model 228 Inspection Hatch to Existing Manhole Cover. See also the following section, Typical Auxiliary Equipment Installation.

Typical Auxiliary Equipment Installation

To install auxiliary equipment, an auxiliary elbow drive adapter kit (P/N 13-08821) is required. The kit contains the English drive elbow (P/N BM4129) and the cable combination (P/N B7678-106). This has a sprocket sheave that is driven by the English cable combination. Usually this is installed on the outboard connection pipe elbow.

Note The use of auxiliary units not manufactured or supplied by Varec will void any Varec warranty and will relieve Varec of any obligation to service the product under warranty.

1. Remove the bolts, cover, and gasket from the elbow.
2. Remove the drive adapter flange bolts, washers, flange cap, and gasket.
3. Install the elbow on the indicator connector pipe.
4. Refer to the appropriate tank configuration installation procedures above and thread the cable through the elbow. The cable segment attaches to the tube indicator. The cable segment attaches to the float. Position the cable splice below the auxiliary drive elbow with the float at the bottom of the tank.
5. Seat the cable on the sheave sprocket and thread it through the indicator connector pipe.
6. Attach the auxiliary unit to the adapter flange.
7. Attach the auxiliary unit with adapter flange to the drive elbow ensuring that the sprocket drive pin engages the slotted coupling of the auxiliary unit.
8. Refer to the auxiliary unit manual for operation and checkout procedures.
9. Refer to the appropriate tank configuration to complete the installation.

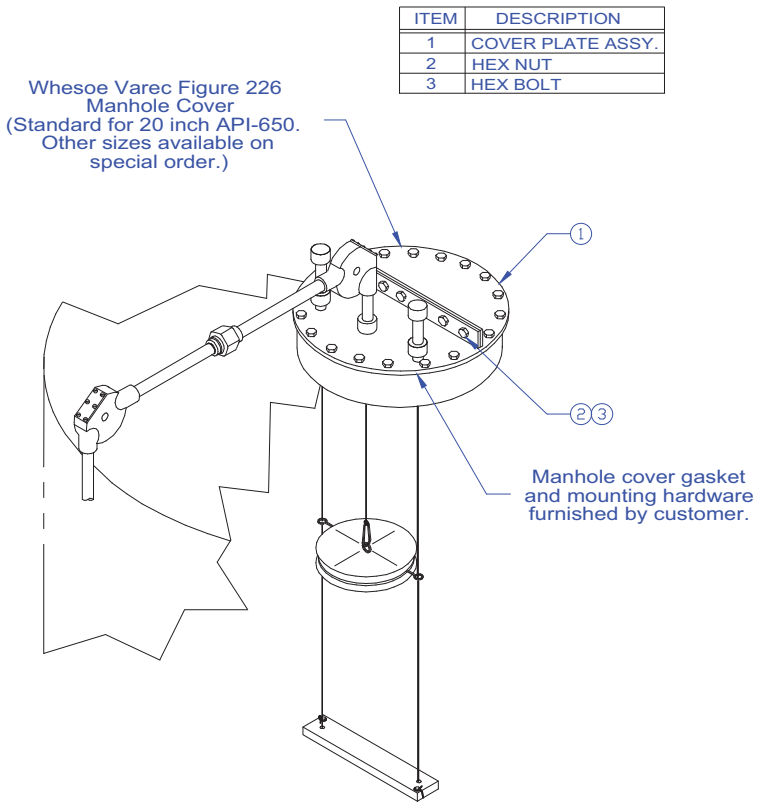


Figure 7: API 20/24-Inch Manhole cover Installation

Operation

Initial Operation

Caution Initial filling of the tank must be a reduced rate of flow, until the float travel and sight indicator operation are verified. This checks that the installation was correctly made and prevents possible damage to the gauge system. On floating roof tanks this is particularly important because the cable travel has not been checked during the installation.

1. Station an observer at the tube.
2. Begin filling the tank to raise the float several feet (about three feet or one meter) from the bottom.
3. Continue filling the tank to the desired level.
4. Hand gauge the product and compare the measurement with the tube indication. If they do not coincide, adjust the cable at the indicator or connector plate. Use the spare cable crimp, if necessary.

Normal Operation

When the tank is full, the indicator is at the bottom of the tube. As the liquid is removed from the tank, the float falls and the indicator rises.

Maintenance

Periodic Maintenance

Varec 6600 LLI sight tube gauges are designed for long service life. Like any other measuring device, LLI gauges require regular, periodic service to maintain the original performance. Table 2 on page 20 provides some suggested periodic service. Minimum maintenance lengthens the service life and assures more accurate reading of the indicator.

Varec provides maintenance service contracts that provide regular periodic inspection and maintenance at substantial savings. Some repair tasks may require special tools.

Warning Observe appropriate safety precautions in flammable or hazardous liquid storage areas. Do not enter a tank that has contained hydrocarbons, vapors, or toxic materials, until a gas-free environment is certified. Carry breathing equipment when entering a tank where oxygen may be depleted with carbon dioxide, nitrogen or other gases.

Electrostatic Discharge Hazard

Under most circumstances, the mechanical connections between the guide cables and anchors provide a resistance to ground that is adequate for the safe electrical drain of electrostatic charges that may accumulate in the tank and the product. Additional grounding may be needed for products with low flash points. Worker activity and worker clothing may accumulate electrostatic charges on the body of a worker. Care should be used in flammable environments to avoid the hazard. Observe American Petroleum Institute (API) Recommended Practice 2003 or other appropriate industry or military standard.

Lubrication

Lubricate moving parts of the elbow and indicator sheaves at regular intervals. Use a light-weight oil.

Oil Recommendations for Oil Seal Accessory Units

GENERAL SERVICE

- Low pour point, food grade, water white, mineral oil.

SERVICE BELOW 25 °F (-4 °C)

- Automotive antifreeze compatible with aluminum and water (50/50 mix)

Caution These oils may not be compatible with edible oils and potable liquids. Use product compatible substitutes for tanks holding products for human or animal consumption or products that may react chemically with the oil.

Table 2: Suggested Periodic Maintenance Schedule

Routine	90 Days	6 Months	1 Year	5 Years
Operation check	X	X	X	
Guide cables		X	X	
Float		X	X	
Lubricate			X	
Leak check	X	X	X	
Change oil			X	
Calibration		X	X	
Corrosion check			X	
Sediment check	X	X	X	
Deformation check	X	X	X	
Refurbish				X

Inspection

It is recommended that the first inspection after the unit has been placed in service be made at the end of the first thirty-day period. Oil sealed units should be inspected immediately after being placed in service and then daily for the first week. Subsequent inspections should be made every 90 days (Table 2). The user may adjust the schedule for his own convenience and safety, depending upon the product. Varec maintenance service contracts are available for 90-day, 6-month, 1-year and 5-year periods at substantial savings.

Troubleshooting Common Problems

Friction is a common problem that affects indicator accuracy. Some liquids produce corrosion in the mechanism. Periodic inspection and maintenance provided by a Varec service contract

can prevent problems from occurring. Periodic cleaning, lubrication, and replacement of worn parts stops trouble before it starts.

Table 3: Indicator at Ground Level (Tank Not Full)

	Possible Cause	**Action**
1	Cable broken?	Yes Replace cable. No Go to 2.
2	Float detached?	Yes Re-attach.

Table 4: Tube Indicator Stopped

	Possible Cause	**Action**
1	Cable stuck?	Yes: • Check cable path. • Check for frozen sheave shafts (repair/replace). • Check for frozen accessory shafts (repair/replace). No: • Go to 2.
2	Pipes dirty?	Yes: • Clean with automotive type spray degreaser. No: • Go to 3.
3	Indicator or tube slides dirty or damages?	Yes • Clean. Repair/replace.

Table 5: Calibration Repeatibility Unstable

	Possible Cause	**Action**
1	Indicator or tube slides dirty or damaged?	Yes: • Clean with automotive type spray degreaser. Repair/ replace. No: • Go to 2.
2	Cable off elbow pulley?	Remove elbow covers. Yes: • Reseat and lubricate pulley shafts. No: • Go to 3.

Table 5: Calibration Repeatibility Unstable

	Possible Cause	**Action**
3	Pulley shaft/ bushing worn/ corroded?	Yes: • Repair or replace. No: • Go to 4.
4	Cable pipe/ conduit dirty?	Yes: • Remove and clean. No: • Go to 5.
5	Guide cables loose, kinked or broken?	Yes: • Tighten, repair or replace.

Specifications

Sight Tube Gauges

Table 6: Sight Tube Gauge Specifications

Indicator Tubes:	Polycarbonate
Indicator Sight Target:	PVC
Float Cable:	Type 316 Stainless Steel
Float Cable Clamp:	Type 316 Stainless Steel
Float Cable (Elbow Drive Kit):	Type 316 Stainless Steel
Gauge Float:	Type 316 Stainless Steel

Standard Installation Kits

Table 7: Standard Installation Kit Specifications

Mounting Brackets:	Steel
Elbow Sheave Housing & Cover:	360 Aluminum
Elbow Sheave Wheel:	Delrin
Top Anchor:	Steel
Top Anchor Spring:	Zinc Plated Steel
Bottom Anchor:	Steel
Guide Cable:	3/32" Diameter Type 316 Stainless Steel

Standard Float Specifications

Table 8: Standard Float Specifications

Material:	Type 316 S. S.
Diameter:	14.5 inches (36.8 mm)
Eyelet Centers:	17 inches (43.2 mm)
Net Weight:	8.8 lbs. (3.99 kg)

Bottom Anchor Bar Weight

Table 9: Bottom Anchor Bar Weight

Weight:	52 lbs. (22.2 kg)
Material:	Steel Also, available in 304SS and 316SS

Other Specifications

Table 10: Other Specifications

Operating Range:	Full Travel: 8 ft. Maximum
Service Rating:	Atmospheric
Pipe Connections:	1 1/2 inch NPT

Reference Part Numbers

Indicator Part Numbers

Table 11: Indicator Part Numbers

Part Number	Type	Service
06-09830	Full Travel	All

Float Part Numbers

Table 12: Float Part Numbers

Part Number	Type	Service
BM9074-000	316 S.S.	Normal/Severe
BM12338-000	Monel	Extreme
P29-43	Fiberglass	Extreme

Sheave Elbow Part Numbers

Table 13: Sheave Elbow Part Numbers

Part Number	Description	Service
06-08564	Aluminum 90°	Normal
BM3480	Aluminum 135°	Normal
BM3481	Aluminum 180°	Normal
BM4675	Cast Iron 90°	Severe/Extreme
BM4129	Elbow Drive, Aluminum	Normal, English
BM8514	Elbow Drive, Aluminum	Normal, Metric

Bottom Anchor Bar Weight Part Number

Table 14: Bottom Anchor Bar Weight Part Number

Part Number	Description	Service
BA4481	Carbon Steel Bottom Guide Wire Anchor Assembly (2 Wire)	Normal
BA4482-005	304SS Bottom Guide Wire Anchor Assembly	
BA4482-006	316SS Bottom Guide Wire Anchor Assembly	

Oil Seal Accessory Part Numbers

Table 15: Oil Seal Accessory Part Numbers

Assembly Part Number	Type	Service
10-01994-AAA	Aluminum, Working Pressure 8.5 in. W.C.	Normal
10-01994-BAA	Iron Working Pressure 8.5 in. W.C.	Severe
10-02861-AAA	Aluminum Working Pressure 27 in. W.C.	Normal

All pipes are steel.

Order Codes

Order Code Table

	Application Type	
	ST	For application on standard tank type
	NA	No top or bottom float guidewires anchors included

	Tube Type and Length		
		F08	English - Tank to 8ft
N6600			**Complete Product Designation**

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