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Installation and operating instructions

Bolt-on Weighing Cells L-Cell® and Microcell®



Note



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Please read these installation and operating instructions carefully. All instructions in this manual must be followed exactly to ensure proper operation of the unit.

If you have any questions regarding the product, installation or commissioning, please contact Anderson-Negele Support at:

America:
Phone 800-833-0081
techservice@anderson-negele.com

Other countries:
Phone +49-8333-9204720 or by
support@anderson-negele.com

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Welcome

In many applications, weighing systems for content measurement offer a more practical and precise solution than other techniques. With a field-proven sensor program of the brand Kistler-Morse, Anderson-Negele now also offers precise, robust and efficient solutions in this measuring category.

This manual describes the installation of the sensors and its various hardware options. It includes procedures for adjusting the vessel, and instructions for wiring the sensors to one or several junction boxes and to the signal processor.

Refer to the signal processor manual for specific information on wiring the junction boxes to the signal processor.

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Authorized Personnel

All instructions described in this document must be performed by authorised and qualified service personnel only. Before installation, please read these instructions and familiarise yourself with the requirements and functions. The required personal protective equipment must always be worn when servicing the device.

Use

The device is solely intended for use as described in this manual. Reliable operation is ensured only if the instrument is used according to the specifications described in this document. For safety and warranty reasons, use of accessory equipment not recommended by the manufacturer or modification of this device is explicitly forbidden. All servicing of this equipment must be performed by qualified service personnel only. This device should be mounted in locations where it will not be subject to tampering by unauthorized personnel.

Caution



If welding on the vessel, electric current may pass through the sensor, causing damage to the transducer and possibly the signal processor. To avoid damage, follow these precautions.

1. Disconnect the sensor cables from the Signal Processor.
2. Ground the welding unit as close as possible to the welding joint.

The welding ground must be between the sensor and the welding joint so that the welding current does not flow through the sensor to earth ground.

Manual Conventions

Two kinds of special explanations appear throughout the manual: Caution and Note.

Caution



Possible risk to the product. The sensor or other equipment may be damaged if this information is ignored.

Note



Contains additional information about a step or feature critical to the installation or operation of the sensors.

Misuse

Improper use or installation of this device may cause the following:

- Personal injury or harm
- Application specific hazards such as vessel overflow
- Damage to the device or system

Inspection and storage

Inspect each package upon receipt for damage that may have occurred due to mishandling during shipping. If the unit is received damaged, notify the carrier or the factory for instructions. Failure to do so may void your warranty.

If the device is not scheduled for immediate installation:

1. Following inspection, repackage the unit into its original packaging.
2. Select a clean dry site, free of vibration, shock and impact hazards.
3. If storage will be extended longer than 30 days, the unit must be stored at temperatures between 0 to 40 °C (32 to 104 °F) in non-condensing atmosphere with humidity less than 85 %.

Note



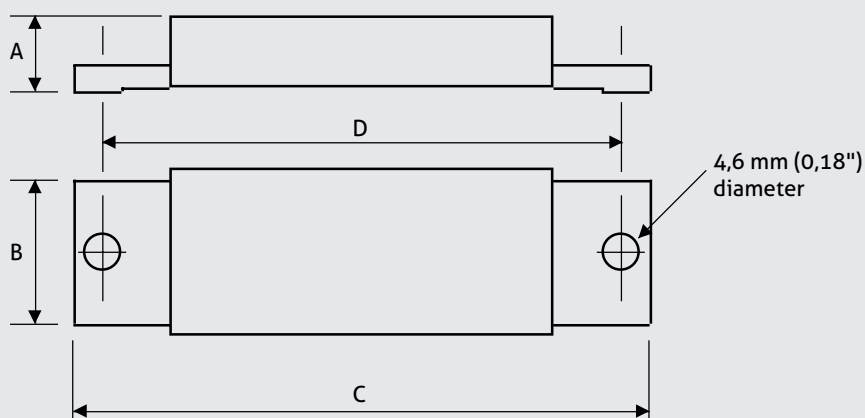
High temperatures can damage the sensor.

When welding near a sensor, observe the temperature of the metal nearby. If it becomes too hot to touch, stop welding and remove the sensor before continuing.

Before reinstalling the sensor, verify that no damage has occurred by using the measurement procedures in the Troubleshooting section, see Appendix.

Specification L-Cell® Weighing Cells	
Excitation Voltage Excitation Current Strain Gauge to Sensor Frame Breakdown Voltage Stress Level	12 (± 5 %)...30 VDC 12 V: 4.0 mA at -18 °C (0 °F) to 2.7 mA at 30 °C (100 °F) > 250 VDC Carbon structures: Maximum: ± 15,000 psi (10.5 kg/mm ²) Recommended: 5,000 ± 3,500 psi (3.5 ± 2.5 kg/mm ²) Aluminium structures: Maximum: ± 6,500 psi (4.6 kg/mm ²) Recommended: 3,000 ± 1,500 psi (2.1 ± 1.1 kg/mm ²)
Fatigue Life	> 20 million cycles; load & unload at 0 to 7,500 psi (0 to 5.3 kg/mm ²)
Output Sensitivity Zero Strain Output Output Impedance Sensitivity Change Zero Shift	Carbon Steel: 35 mV ± 1 %/1,000 psi (35 mV ± 1 %/0.7 kg/mm ²) Aluminum: 80 mV ± 1 %/1,000 psi (80 mV ± 1 %/0.7 kg/mm ²) 0 mV ± 100 mV 3.75K Ω (± 1 %) 0.02 % per degree F (0.036 % per degree C) over the compensated range 2 mV between -18 and 38 °C (0 and 100 °F)
Operational Temperature range Storage Temperature range Compensated Temperature range	-34...66 °C (-30...150 °F) -34...66 °C (-30...150 °F) -18...38 °C (0...100 °F)
Cable	3-conductor, 22 gauge, unshielded (15" (4.6 m))

Specification Microcell® Weighing Cells	
Excitation Voltage	12 (± 5 %)...30 VDC
Excitation Current	12 V: 4.0 mA at -18 °C (0 °F) to 2.7 mA at 30 °C (100 °F)
Strain Gauge to Sensor	> 250 VDC
Frame Breakdown Voltage	3" Microcell Standardized: 8.50 K ± 850 Ω at 21 °C (70 °F)
Red to White & Black to White	3" Microcell Non-Standardized: 2.0 K ± 200 Ω at 21 °C (70 °F)
Resistance	2" Microcell 2.0 K ± 200 Ω at 21 °C (70 °F)
Stress Level	3" Microcell: Maximum: ± 10,000 psi (7.0 kg/mm²), Recommended: 5,000 ± 2,500 psi (3.5 ± 1.5 kg/mm²) 2" Microcell: Maximum: ± 15,000 psi (10.5 kg/mm²), Recommended: 7,500 ± 3,750 psi (5.3 ± 2.6 kg/mm²)
Fatigue Life	> 20 million cycles; load & unload at 0 to 5,000 psi (0 to 3.5 kg/mm²)
Zero Strain Output	0 mV ± 100 mV
Output Impedance and Temperature Effects	3" Microcell Standardized: 7.50K ± 75 Ω at 21 °C (70 °F) 3" Microcell Non-Standardized: 1000 Ω ± 100 Ω at 21 °C (70 °F) 2" Microcell: 1000 Ω ± 100 Ω at 21 °C (70 °F)
Sensitivity Change	0.036 % per degree C (0.02 % per degree F) over the compensated range
Zero Shift	± 5 mV/56 °C (± 5 mV/100 °F) in compensated temperature range
Operational Temperature range	-34...66 °C (-30...150 °F)
Storage Temperature range	-34...66 °C (-30...150 °F)
Compensated Temperature range	Standard -18...38 °C (0...100 °F) (other ranges: contact Anderson-Negele)
Cable	3-conductor, 22 gauge, unshielded (15" (4.6 m))



Reference dimensions		
	3" Microcell®	2" Microcell®
A	9,52 mm (0,375")	9,52 mm (0,375")
B	19 mm (0,75")	19 mm (0,75")
C	76,2 mm (3,00")	50,8 mm (2,00")
D	69,8 mm (2,75")	44,4 mm (1,75")

Note

These dimensions are for reference only.

Use the Microcell® drill template to locate, drill, and tap the mounting holes.



Field of application / intended use

General Description of the Weighing Cells

Microcell® and L-Cell® load cells are extremely durable, reliable and compact bolt-on strain sensors for new installations or retrofitting. They enable cost-effective and safe quantity measurement in all types of vessels with metal substructures and in skirted silos. Depending on the type of container, the sensors simply bolt onto the existing legs, cross beams or panels, depending on the type of container. With bolt-on sensor technology, the supporting container structure is used as the measuring system.

Microcell® and L-Cell® can also be used for any type of application where strain can be measured on a metal substructure. Contact Anderson-Negele if you want to check the suitability for a specific application.

When weight is added to or removed from the vessel, the structural support of the vessel experiences strain changes proportional to the weight changes. The load cell detects

these and generates an proportional output voltage, which is converted in a signal processor into engineering units for display and control.

The load cells are easy to install. They are mounted on the surface of the structural support and do not come into contact with the contents of the vessel. No special tools are required for installation and there is no need to empty the vessel or remove it from production line.

For best results, a thorough understanding of the vessel, its support structure and the operating environment is necessary. For this, plans, drawings or photos in the as-is state are advantageous.

Description L-Cell®

The L-Cell® is suitable for all types of vessels fixed on vertical feet or on cross braces, and for skirted silos. It measures the strain simultaneously in two perpendicular directions.

The L-Cell® goes beyond conventional passive temperature compensation. The Standardised Axial Strain Sensitivity (SASS®) of the L-Cells provides active temperature compensation.

L-Cell® application areas and load limits:

- Leg- or beam supported vessels (non-pipe) with maximum live load stresses between 1.0 and 6.0 kg/mm² (1,500 and 8,500 psi).
- Carbon steel, skirt-supported vessels with maximum live load stresses between 1.0 and 6.0 kg/mm² (1,500 and 8,500 psi)
- Aluminum, skirt-supported vessels with maximum live load stresses between 1.0 and 3.2 kg/mm² (1,500 and 4,500 psi)

Description Microcell®

The Microcell® measures strain in one direction (recommended: vertical).

The 3-inch Microcell® can be installed on carbon steel, stainless steel or aluminium vessel supports.

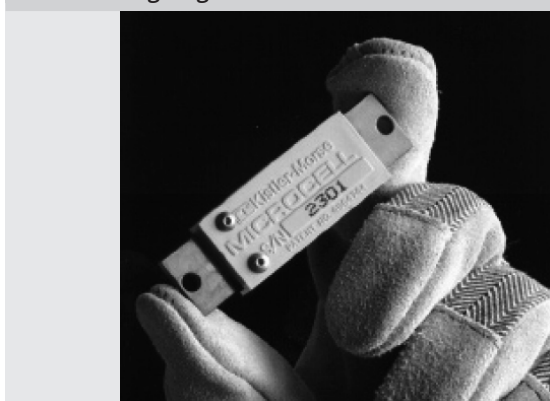
Load limits:

- 3 inch Microcell® - 1.8 kg/mm² to 5.3 kg/mm² (2,500 psi to 7,500 psi).
- The 2-inch Microcell® can only be installed on carbon steel vessel supports and in case of a load limit above 5.3 kg/mm² (7,500 psi). Contact Anderson-Negele if you have such an application.

Figure 1-1
Bolt-on weighing cell L-Cell®



Figure 1-2
Bolt-on weighing cell Microcell®



Preparing for installation of the weighing cells

Check application

Before ordering the bolt-on sensors, you should have completed application data sheet #97-5092, which is available on the Anderson-Negele website. If you cannot find the form contact Anderson-Negele to obtain another copy before proceeding. Check the information on the form to verify the details of the application.

Note



If additional items are required, please contact Anderson-Negele before proceeding. Substituting parts without Anderson-Negele approval may result in system problems and will void the warranty.

Visual inspection

Carry out a visual inspection of all equipment in the order - including sensors, junction boxes and signal processors - to ensure that they have not been damaged during transport. If an item is damaged, contact Anderson-Negele.

Note



An Anderson-Negele signal processor or Anderson-Negele test meter is required to set up and install the system.

Check L-Cell® order items

The following items are included in a typical order for each vessel (quantities depend on the application):

L-Cell® unit, consisting of:

- Sensor
- Environmental cover
- #6-32 x 1/4" Socket head cap screws (3)

Junction boxes, each complete with:

- Terminal board 63-1170-01 or 63-1135-03 (Shear reverse wiring sensors)
- Watertight fittings (4)
- Watertight plugs (for any cable openings that will not be used)

Check Microcell® order items

The following items are included in a typical order for each vessel (quantities depend on the application):

Microcell® unit, each complete with:

- Sensor
- Environmental cover
- #8-32 socket head cap screws (2)
- #8 hardened flat washers (2)

Junction boxes, each complete with:

- Terminal board 63-1170-01 or 63-1135-03 (Shear reverse wiring sensors)
- Watertight fittings (4)
- Watertight plugs (for any cable openings that will not be used)

Prepare Required Installation Equipment

L-Cell® installation

The following equipment is needed:

Optional Installation Kit #39-2052-03 or -04, each complete with:

- L-Cell® drill template with #6-32 x 15/8 socket head cap screw
- L-Cell® surfacing disk
- 7/64" Hex T-handle driver
- Sander disks, coarse and fine (36, 60 and 80 grit for carbon steel, 80 and 100 grit for aluminum)
- #36 cobalt HSS drill bits
- #6-32, 2-flute, spiral-point taps
- 3/16" drill bits
- Sikaflex™ sealant and Material Safety Data Sheet (MSDS)
- Rust-inhibiting silicone grease (for carbon steel surface only) and Material Safety Data Sheet (MSDS)

Level (Not included in kit)

Anderson-Negele Test Meter (Not included in kit)

Drill motor (Not included in kit)

Torque spanner (optional)

Microcell® installation

The following equipment is needed:

Optional Installation Kit MC-I3 for 3" sensors and MC-I2 for 2" sensors, each complete with:

- Microcell® drill template with #8-32 socket head cap screw
- 9/64" Hex T-handle driver
- #29 drill bits
- #8-32, 2-flute, spiral-point taps
- Sikaflex™ sealant and Material Safety Data Sheet (MSDS)
- Rust-inhibiting silicone grease (for carbon steel surface only)

Anderson-Negele Test Meter (Not included in kit)

Drill motor (Not included in kit)

Torque spanner (optional)

Caution



Use only Sikaflex™ 1A polyurethane sealant, Sikaflex™ ProSelect Construction sealant or Dow Corning™ RTV 739 or RTV 738. Other sealants may contain acetic acid, which is harmful to sensors and electronics.

Junction Box and Field wiring installation

The following equipment, provided by the customer, is used to install the junction boxes, and to field wire the junction boxes to each other and to the signal processor:

- Drill motor
- #29 drill bit
- #8-32, 2-flute, spiral-point tap
- Tap handle
- Tapping fluid
- 9/64" Allen wrench
- #8-32 socket head cap screws
- #8 flat washers (3/16" inner diameter, 7/16" outer diameter)
- Belden 8791 18-gage 3-conductor shielded interconnect cable or equivalent (for up to 1,000. [305 m] length)
- Belden 8618 16-gage 3-conductor shielded interconnect cable or equivalent (for 1,000. to 2,000. [305 m to 610 m] length)
- Conduit and fittings
- Caulking gun
- Sikaflex™ or equivalent RTV

Visual inspection

Carry out a visual inspection of all equipment in the order - including sensors, junction boxes and signal processors - to ensure that they have not been damaged during transport. If an item is damaged, contact Anderson-Negele.

Function test

Before installation, carry out a functional check of all sensors to ensure that they have not been damaged during transport. The next section describes two methods for performing the functional check.

Option 1: Testing with Anderson-Negele Test Meter

1. Connect the red, white, and black wires of a sensor to the corresponding Test Meter terminals, as shown in **Figure 2-1**. Place the sensor on a stable surface.
2. Turn on the power to the Test Meter and set the Simulate/Test switch to the Test position. Verify the sensor's no-load output is 0 ± 100 mV.
3. Repeat Steps 1 and 2 for each sensor. If the reading for any sensor is outside the specifications described above:
 - A. Proceed to Testing Sensors with Digital Multimeter below to determine the resistance values for the sensor, and
 - B. Contact Anderson-Negele for assistance after determining the resistance values and before proceeding with the installation.

Option 2: Testing with Digital Multimeter (DMM)

Follow this procedure to test the sensors if you do not have an Anderson-Negele Test Meter or if the no-load output using the Test Meter was out of range for a sensor:

1. Set the ohmmeter resistance scale to accommodate a measured range up to 20,000 Ω .
2. Put one DMM lead on the sensor's white wire and the other lead on the red wire. Place the sensor on a stable surface. Verify the red-to-white resistance is:
 - 3800 - 4200 Ω for an L-Cell[®],
 - 8300-8700 Ω for a 3" Microcell[®],
 - 1800-2200 Ω for a 2" Microcell[®] or a 3" Microcell Non-standard
3. Put one DMM lead on the sensor's white wire and the other lead on the black wire. Place the sensor on a stable surface. Verify the black-to-white resistance is:
 - 3800 - 4200 Ω for an L-Cell[®],
 - 8300-8700 Ω for a 3" Microcell[®],
 - 1800-2200 Ω for a 2" Microcell[®] or a 3" Microcell Non-standard
4. Put one DMM lead to the white wire and the other lead to the sensor's metal body. The measurement should be infinite ohms.

Repeat this procedure for each sensor. If the reading for any sensor is outside the above ranges, contact Anderson-Negele for assistance before proceeding with installation.

Figure 2-1
Anderson-Negele Test Meter

**Note**

Replace L-Cell[®] or Microcell[®] in its packing material until ready to install.

Installation of the L-Cell® on Vertical Legs

L-Cell® Mounting Locations

For best performance, L-Cells are mounted on the flanges of the vertical leg (See Figure 3-1). An L-Cell® Set consists of two L-Cells mounted on opposite sides of a support leg, at the same elevation.

Note



Do not install L-Cell® on pipe leg. (See Chapter "Microcell® Installation") Always place L-Cells at center of flange, regardless of orientation of leg to vessel.

Note



For Installation on vertical legs the Junction Box type JB-S (Terminal board 63-1170-01) has to be used.

Horizontal Locations of L-Cell® Sets

L-Cell® sets are placed on each support leg. Refer to Figure 3-2 for the mounting locations.

Vertical Location of L-Cell® Sets

L-Cell® locations may be adjusted up to 300 mm (12") vertically to avoid obstacles. If adjusting locations, maintain the configuration of the L-Cell® set (i.e., if you move one L-Cell® in the set from its ideal location, move the other(s) as well).

Note



minH = minimum free height to install sensors. The height should be three times the beam width or 305 mm (12"), whichever is highest of the two.

Support Legs without X-Braces

See Figure 3-3. If the free leg distance (length between foundation and the vessel) is between minH (see Note) and 3.4 m (11'), mount the L-Cell® sets at midheight of the free leg.

If the free leg distance is more than 3.4 m (11'), mount the L-Cell® sets at 1.7 m (5'6") above the foundation.

-If the free leg distance is less than minH, this is a special application situation. Consult Anderson-Negele before proceeding further.

Figure 3-1
L-Cell® Mounting Locations

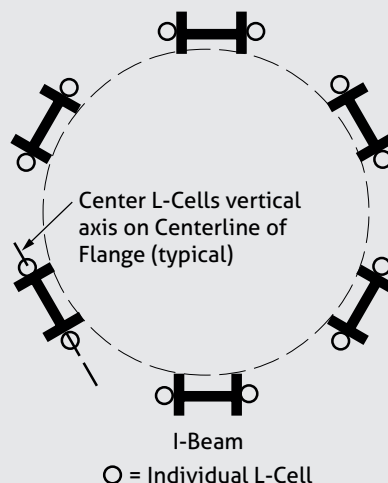


Figure 3-2
L-Cell® Mounting for Best Performance

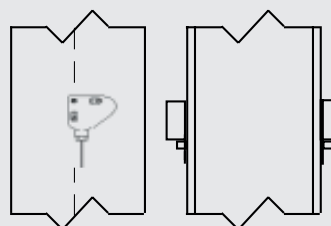
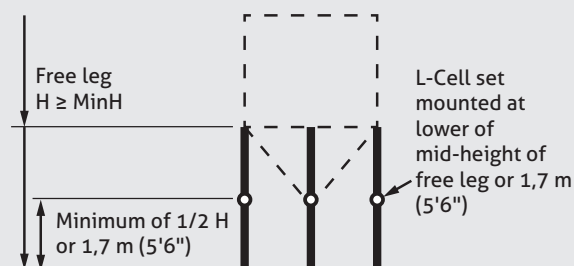


Figure 3-3
Vertical Location of L-Cell® Sets for Legs without Braces



Support Legs with X-Braces

See Figure 3-4. If the free leg distance is minH or more, mount the L-Cell® sets at mid-height of the free leg.

Measure the free leg between the bottom of the lower x-brace or horizontal brace and the top of the foundation.

For an alternate location, measure the free leg between the top of the upper x-brace or horizontal brace and the beam supporting the vessel.

See Figure 3-5. If the free leg distance is less than minH , mount the L-Cell® sets at the mid-height between the lowest braces.

Figure 3-4

Vertical Location of L-Cell® Sets for Legs with Braces and with Free Leg greater than minH

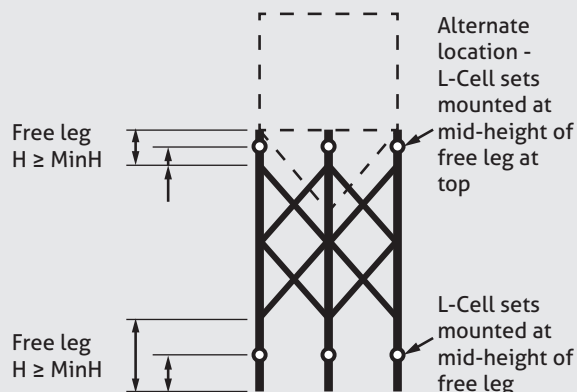
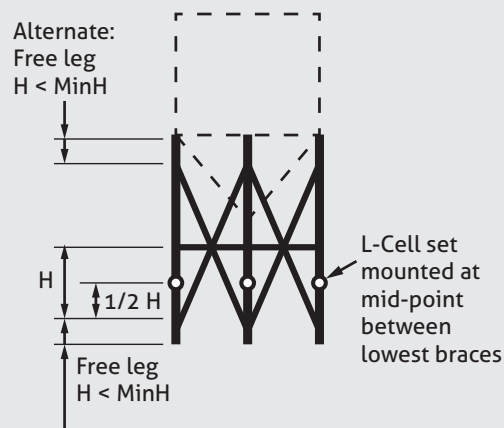
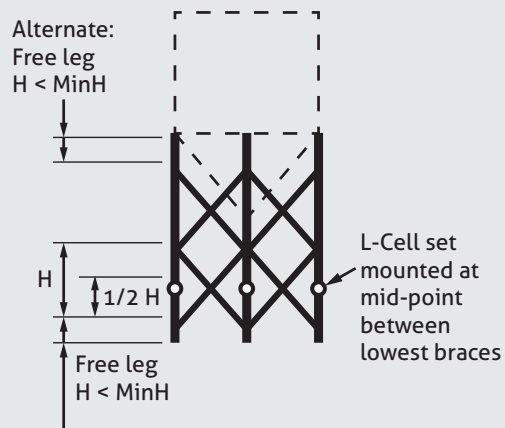


Figure 3-5

Vertical Location of L-Cell® Sets for Legs with Braces and with Free Leg less than minH



Installing L-Cells

Note



1. Use lubricating fluid (Relton RapidTap® Heavy Duty Cutting Fluid or equivalent) when drilling and tapping.
2. Drilling and tapping instructions assume metal thickness greater than 19 mm (3/4"). If the thickness is less, drill all the way through the metal and tap until cutting complete threads through the other side. Minimum metal thickness is 5 mm (0.1875").

Surface Preparation

1. **Fig. 3-6.** Mark the center line (axis) of the beam. Mark the position for the template mounting hole 11.7 mm (0.462") from this center line.
2. **Fig. 3-7a.** At the marked location drill a 19 mm (3/4") deep hole with a #36 drill bit. This produces the template mounting hole.

Peel the backing off the coarse (36) grit sander disk and press it onto the surfacing disk. Using the template mounting hole as a tool center, remove heavy paint and rust with the drill-mounted surfacing disk until a 63 mm (2.5") diameter bare metal surface is achieved.

Use straight, constant pressure and don't roll to grind a flat surface for mounting the L-Cell®, removing paint and rust.
3. Repeat with the fine (60) grit sander disk until the surface is flat and smooth to the touch. **See Figure 3-7b.**
4. Repeat Steps 1 through 4 to prepare the surface on the opposite side of the vertical leg before proceeding with L-Cell® installation.

Note



The L-Cell® must be mounted against smooth, bare metal. All paint and rust must be removed.

Drill and Tap

1. Using the #6-32 tap, thread the template mounting hole for the L-Cell® to a minimum of 16 mm (5/8") depth, full threads. (**See Figure 3-8**) Remove any burrs from the hole.
2. Position the drill template so the center hole lines up with the template mounting hole.
3. Fasten the drill template to the template mounting hole through the #5A hole, using the #6-32 x 1 5/8" socket head cap screw. Use a level placed on the horizontal top guide of the drill template to ensure correct orientation.
4. Drill the L-Cell® mounting holes with the #36 drill bit, using the template guides (**Fig. 3-9**) as follows:

Figure 3-6

Drill Mounting Hole with offset to the beam center line (axis)

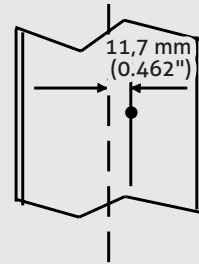


Figure 3-7a

63 mm (2.4") Diameter surface for mounting L-Cell®



Figure 3-7b

Prepared surface showing mounting hole



Figure 3-8

Thread the mounting hole using Tap and lubricating fluid



- A. Drill hole #2.
- B. Insert a spare drill bit through hole #2 in the template to hold the template securely in place.
- C. Drill hole #1 and #3. Remove the spare drill bit from hole #2.

5. Tap the mounting holes:
 - A. Loosen the screw securing the template and rotate the template until the tap guide is aligned with hole #1. Retighten the screw.
 - B. Using the tap guide, thread hole #1 with the #6-32 tap.
 - C. Repeat steps A and B for hole #2 and #3.
6. Remove burrs from all the holes created.
7. Repeat Surface Preparation and Drill/Tap for the second L-Cell.

Mounting the L-Cell®

1. Wipe down a 115 mm (4.5") diameter surface, centered on the template mounting hole, with degreaser. This cleans the bare metal and adjacent mounting surface for the environmental cover. **(Fig 3-12)**
2. Apply on a 65 mm (2.5") diameter surface a thin coat of Anderson-Negele rust inhibitor to the bare metal surface for the L-Cell. **(Fig 3-10)**
3. Connect the L-Cell's red, black, and white wires to the corresponding terminals on the Anderson-Negele Test Meter. Turn on the power to the Test Meter and set the Simulate/Test switch to the Test position. **(Fig 3-11)**
4. With the cable end down, align an L-Cell® with its mounting holes. Fasten the L-Cell® **loosely** to the leg using the three #6-32 x 5/8. socket head cap screws. **Do not tighten the screws.** If the voltage goes outside the range -200 to +200 mV, immediately loosen the screw(s).

Note



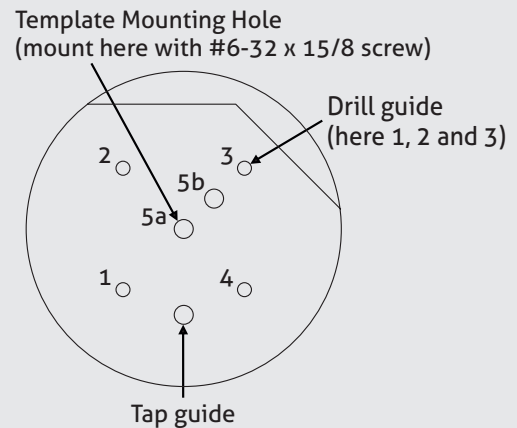
If an Anderson-Negele Test Meter is not available, refer to chapter "Alternate Method for Checking Output" before proceeding.

Caution



Do not install L-Cells in the rain. Do not trap moisture under the environmental cover.

Figure 3-9
Drill and Tap Template



Note



1. After L-Cell® mounting holes drilled, rotate template to use tap guide to tap holes.
2. Holes #4 and 5B are not used for this application.

Fig. 3-10
Apply rust inhibitor



Caution



Do not apply rust inhibitor beyond this area, or the environmental cover will not adhere properly.

Fig. 3-11
Test L-Cell®



5. **Fig. 3-12.** Using the T-handle driver, **slowly** tighten the S1 screw a little, then S2 and S3. Then continue in this way, always applying a bit more torque, until all 3 screws are tight. While turning the T-handle driver, monitor the Test Meter carefully.

If the voltage goes outside the range -200 mV to +200 mV while tightening, stop immediately and evaluate the following:

- If the voltage **jumped** outside the range -200 to +200 mV, it may indicate a burr or rough surface. Remove the screws holding the L-Cell® to the leg. Remove burrs and surface roughness (refer to Surface Preparation for removing surface roughness). Repeat Steps 1 through 5.
- If the voltage **gradually moved** outside the range -200 to +200 mV, slowly loosen the screw until the voltage is within range again and proceed to Step 6.

6. To complete installation, ensure that:
 - All three screws are tightened with a torque of 2.94 Nm (26 inch/lb) or until the T-handle driver flexes in torsion, 1/4 turn past the point where the screw stops turning, with this flexing procedure repeated several times to ensure the screw is tight, and
 - Voltage is in the range -200 to +200 mV.
7. Prior to installing the environmental cover(s), ensure the mating surface(s) on the leg is free of dirt and grease. Reclean if necessary, being careful not to remove the rust inhibitor on the bare metal.
8. **Fig 3-13.** Peel the protective backing from the double-sided tape on the environmental cover's inside flange.
 - A. Align the environmental cover over the installed L-Cell®, with the cable through the cover's exit channel. Press the cover onto mounting surface.
 - B. Spread a 3 mm (1/8") bead of sealant around the joint between the cover and mounting surface. Add extra sealant to the cable exit channel.
 - C. Use your finger to smooth the sealant around all edges and joints, eliminating areas where moisture may pool, especially along the top edge. Verify that the sealant forms a continuous, watertight seal. Ensure the cable exit channel is completely sealed. Avoid any contact with clothes.
9. If you created any holes that go completely through the support metal, fill and cover these completely with sealant.

Caution



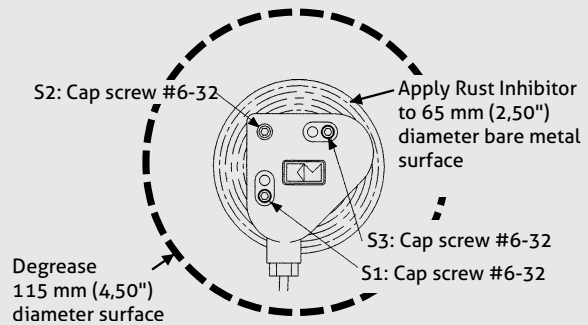
For proper installation, tighten each screw until the T-handle driver flexes in torsion 1/4 turn past the point where the screw stops turning. Repeat this flexing procedure several times to ensure the screw is tight. When all three screws are tight, the voltage must be in the range -200 to +200 mV. Follow the procedure in Steps 5 through 7 to achieve this goal.

Caution



Use only Sikaflex™ 1A polyurethane sealant, Sikaflex™ ProSelect Construction sealant or Dow Corning™ RTV 739 or RTV 738. Other sealants may contain acetic acid, which is harmful to sensors and electronics.

Figure 3-12
L-Cell® Mounting

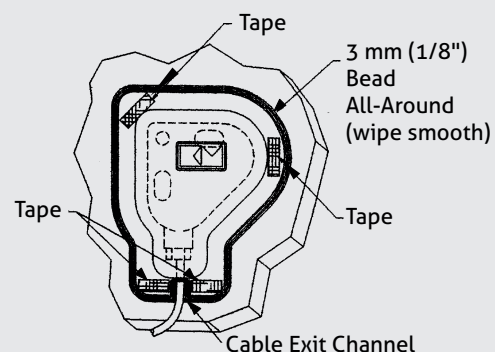


Note



1. Do not apply rust inhibitor outside the 65 mm (2,50") diameter bare metal, or environmental cover will not adhere properly.
2. Place small amount of sealant on each screw before mounting L-Cell®.

Figure 3-13
Environmental Cover



Installation of the L-Cell® on Horizontal Beams

L-Cell® Mounting Locations

L-Cell® Sets

L-Cells are best mounted on beams in a shear mounting set (**Fig 4-1**). The number of cells and their placement is a function of desired accuracy, installation requirements, and maintenance considerations. In the chapter Mounting Methods you find a description of the five mounting methods.

Distribution of L-Cell® Sets

The distribution of L-Cell® sets on beams is dependent on vessel support configuration. **Figure 4-2** shows the distribution of sets for eight support configurations, varying from independent vessels to multiple vessels with common columns and beams. Note in all cases with common beams between multiple vessels, **the common lateral beams are not instrumented with L-Cells**.

Figures 4-3 through 4-7 show the location of L-Cell® sets on a beam. The ideal location is midway between the vessel support bracket and the support column or beam. This places the shear mounting set away from joints and load points. The minimum distance between the load point and the support column or beam should be equal to the beam height or 460 mm (18"), whichever is highest. If less space is available, consult Anderson-Negele before proceeding further.

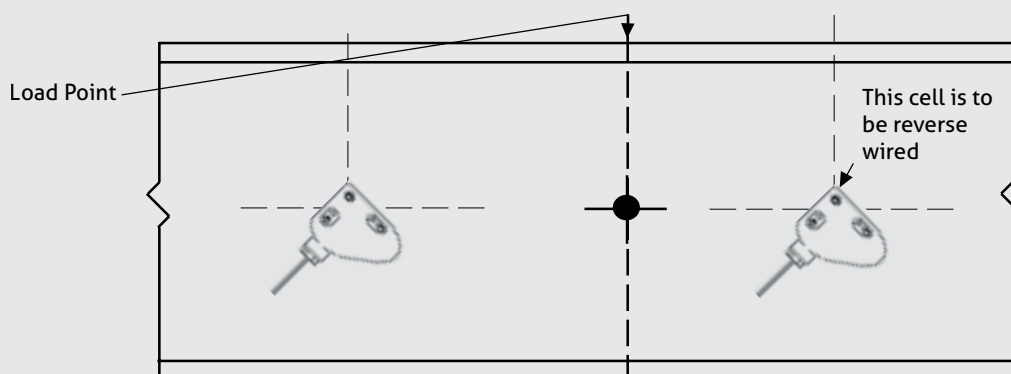
Note



L-Cell® locations may be adjusted up to 300 mm (12") horizontally to avoid obstacles. If adjusting locations, maintain the configuration of the set (i.e., if you move one L-Cell® in the set from its ideal location, move the other L-Cell® as well).

Figure 4-1

L-Cell® Shear Mounting Set – One on either side of load point, same side of web

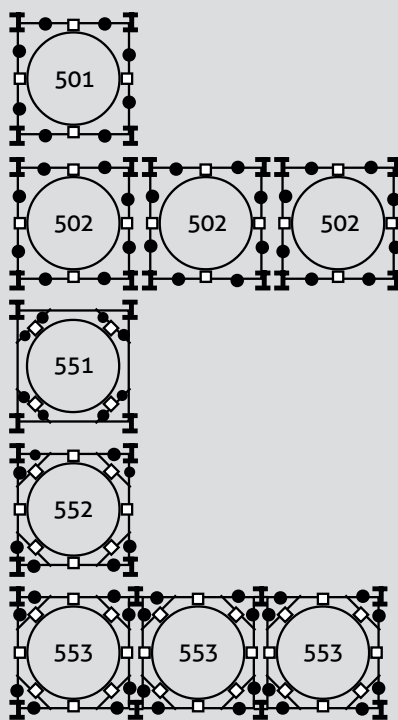
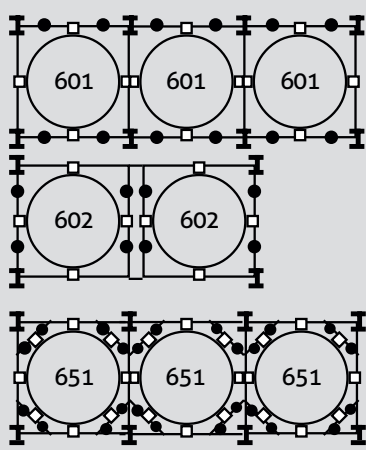


Note



For Installation on horizontal beams the Junction Box type JB-R (Terminal board 63-1135-03) has to be used.

Figure 4-2
L-Cell® Mounting Locations

Series 500 . Independent Beams	Description	Number of Support Points per Vessel
	Single vessel . no diagonal beam supports	4
	Multiple vessels . no diagonal beam supports, no common beams or common vertical legs	4
	Single vessel . diagonal beam supports, weight supported by diagonal beams only	4
	Single vessel . diagonal beam supports, weight supported by horizontal and diagonal beams	8
	Multiple vessels . diagonal beam supports, weight supported by horizontal and diagonal beams, no common beams, common vertical legs	8
Series 600 . Common Horizontal Lateral and/or Longitudinal Beams		
	Multiple vessels . no diagonal beam supports, common internal lateral beams, common internal vertical legs (Note: This application will produce some degree of interference between vessels.)	4
	Multiple vessels . no diagonal beam supports, independent internal lateral beams, common longitudinal beams (Note: This application will produce some degree of interference between vessels.)	4
	Multiple vessels . diagonal beam supports, weight supported by horizontal and diagonal beams, common internal lateral beams, common internal vertical legs (Note: This application will produce some degree of interference between vessels.)	8

Note

1. Illustrations for Series 501, 502, 551, 552, 553, and 651 show L-Cells in relationship to the load points.
2. If your application differs from the above, contact Anderson-Negele for application assistance.



Legend

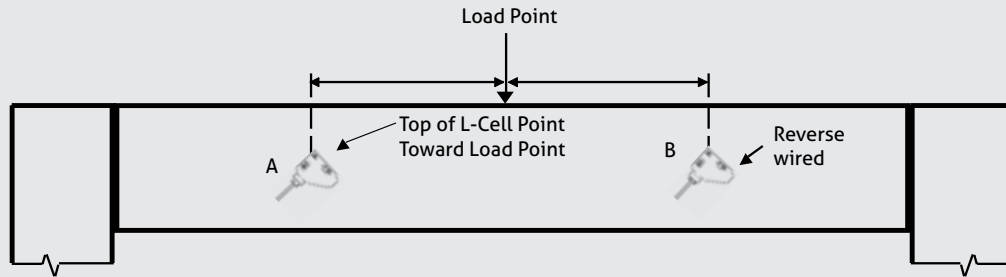
- ┳ = vertical leg
- = vessel support point
- = mounting location for L-Cell® set

L-Cell® Mounting Methods

The sensors are mounted at the neutral axis on the web of the beam, at a 45-degree angle, halfway between the loading point and the support point. The following methods provide varied degrees of accuracy.

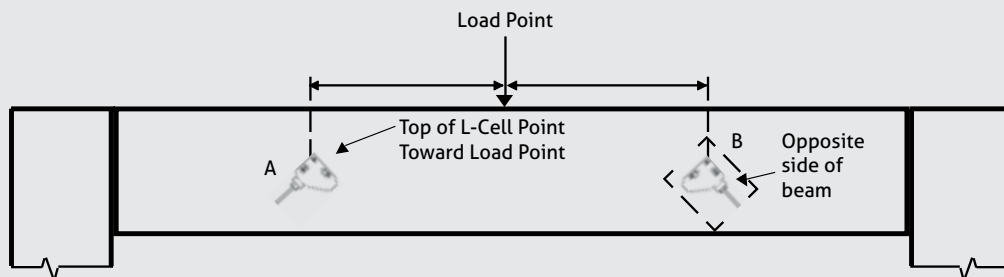
1. **Same Side (Figure 4-3):** One L-Cell® to the left and one L-Cell® to the right of the load point equidistant between the load and the support. The L-Cells are mounted on the same side of the web. The excitation of the L-Cell® "B" pointing away from the load point must be reverse wired (figure 4-1).

Figure 4-3
Placement of Two L-Cells on same side of web



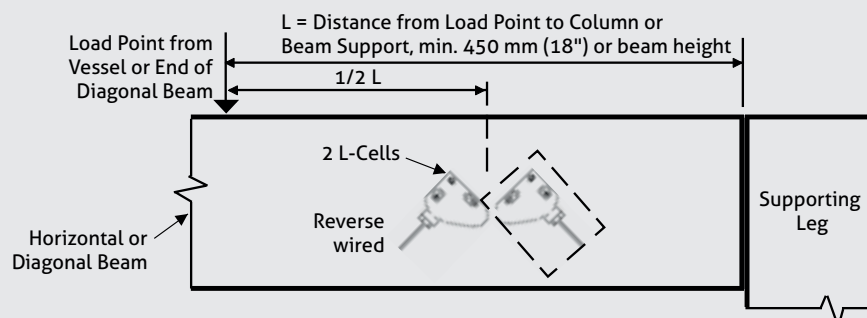
2. **Opposite Side (Figure 4-4):** One L-Cell® to the left and one L-Cell® to the right of the load point equidistant between the load and the support. The L-Cells are mounted on opposite sides of the web, they are both pointing to the load point and have to be wired normally.

Figure 4-4
Placement of Two L-Cells on opposite sides of web



3. **Same End of Beam (Figure 4-5):** Two L-Cells mounted back-to-back on the web on opposite sides of the beam. They can be mounted back-to-back on either side of the load point, equidistant between the load and the support. The sensor pointing away from the load point has to be reverse wired.

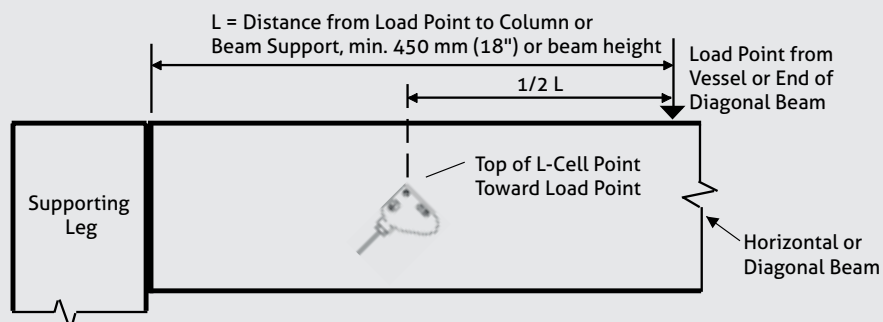
Figure 4-5
Placement of 2 L-Cells on opposite sides of the beam, on the same end of the beam



4. **Single L-Cell® (Fig. 4-6):** One L-Cell® mounted on the web. It can be mounted on either side of the web and on either side of the load point.

It should be mounted at the same distance between the load and support points. This arrangement provides the lowest accuracy.

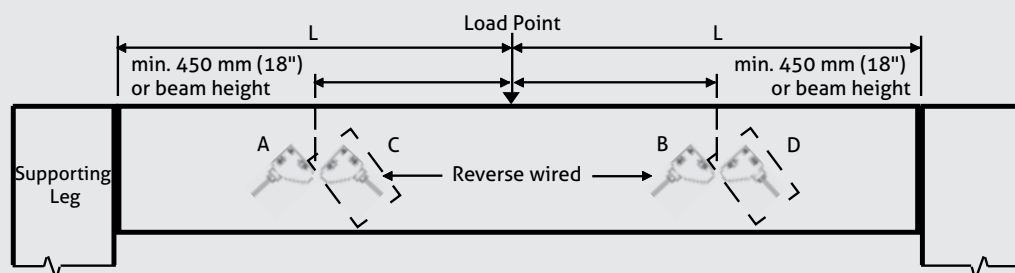
Figure 4-6
Placement of single L-Cell® Set to Left of Load Point



5. **Four L-Cells (Figure 4-7):** Four L-Cells mounted back-to-back on the web. One pair mounted back-to-back to the right of the load point and one pair mounted back-to-back to the left of the load point. The pairs are mounted

equidistant between the load and the support. The sensors B and C pointing away from the load point have to be reverse wired. This arrangement provides a degree of accuracy improvement over a two L-Cell® arrangement.

Figure 4-7
Placement of Four L-Cells on a Beam



Installing L-Cells

Surface Preparation

1. **Fig. 4-8.** Mark position of beam axis and of drill template mounting hole in the center line of the beam.
2. **Fig. 3-7a.** At the center of the L-Cell® mounting location drill a 19 mm (3/4") deep hole with a #36 drill bit. This produces the template mounting hole.

Peel the backing off the coarse (36) grit sander disk and press it onto the surfacing disk. Using the template mounting hole as a tool center, remove heavy paint and rust with the drill-mounted surfacing disk until a 63 mm (2.5") diameter bare metal surface is achieved.

Use straight, constant pressure and don't roll to grind a flat surface for mounting the L-Cell®, removing paint and rust.
3. Repeat with the fine (60) grit sander disk until the surface is flat and smooth to the touch. **See Figure 3-7b.**

Drill and Tap

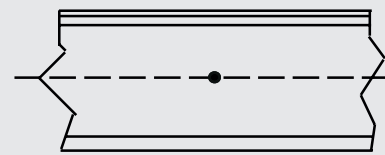
1. Using the #6-32 tap, thread the template mounting hole for the L-Cell® to a minimum of 16 mm (5/8") depth, full threads. (**See Figure 3-8**) Remove any burrs from the hole.
2. Position the drill template so the center hole lines up with the template mounting hole.
3. Fasten the drill template to the template mounting hole through the #5A hole, using the #6-32 x 1 5/8. socket head cap screw. Rotate until the hole '3 is on top and the 45° guide for the level is horizontal. Use a level placed on the top guide of the drill template to adjust horizontal position.
4. Drill the L-Cell® mounting holes with the #36 drill bit, using the template guides (**Fig. 4-9**) as follows:
 - A. Drill hole #2.
 - B. Insert a spare drill bit through hole #2 in the template to hold the template securely in place.
 - C. Drill hole #3 and #4. Remove the spare drill bit from hole #2.
5. Loosen the screw securing the template and rotate the template until the tap guide is aligned with hole #2. Retighten the screw. Using the tap guide, thread hole #2 with the #6-32 tap.

Repeat steps for hole #3 and #4.
6. Remove burrs from all the holes created.
7. Repeat Surface Preparation and Drill/Tap for the second L-Cell®.

Note

1. Use lubricating fluid (Relton RapidTap® Heavy Duty Cutting Fluid or equivalent) when drilling and tapping.
2. Drilling and tapping instructions assume metal thickness greater than 19 mm (3/4"). If the thickness is less, drill all the way through the metal and tap until cutting complete threads through the other side. Minimum metal thickness is 5 mm (0.1875").

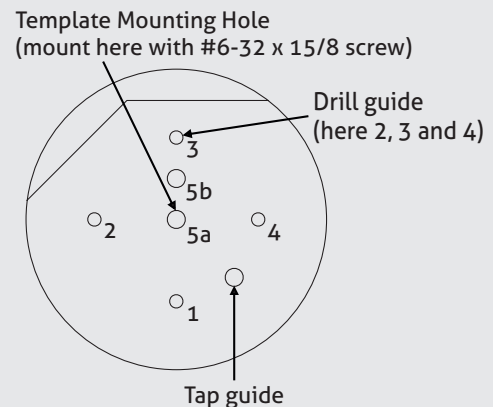
Figure 4-8
Mark Position



Note

The L-Cell® must be mounted against smooth, bare metal. All paint and rust must be removed.

Figure 4-9
Drill and Tap Template rotate until hole #3 is on top, adjust for level



Note

1. After L-Cell® mounting holes drilled, rotate template to use tap guide to tap holes.
2. Holes #1 and 5B are not used for this application.

Mounting the L-Cell®

1. Mark one L-Cell® with a sticker as "A", the other L-Cell® as "B".
2. Wipe down a 115 mm (4.5") diameter surface, centered on the template mounting hole, with degreaser. This cleans the bare metal and adjacent mounting surface for the environmental cover.
3. Apply on a 65 mm (2.5") diameter surface a thin coat of Anderson-Negele rust inhibitor to the bare metal surface for the L-Cell. (**Fig 4-10**)
4. Connect the L-Cell's red, black, and white wires to the corresponding terminals on the Anderson-Negele Test Meter. Turn on the power to the Test Meter and set the Simulate/Test switch to the Test position.

Note



Do not apply rust inhibitor beyond this area, or the environmental cover will not adhere properly.

Note



If an Anderson-Negele Test Meter is not available, refer to chapter "Alternate Method for Checking Output" before proceeding.

5. With the cable end down, align L-Cell® "A" with its mounting holes. Fasten the L-Cell® **loosely** to the leg using the three #6-32 x 5/8. socket head cap screws. **Do not tighten the screws.** If the voltage goes outside the range -200 to +200 mV, immediately loosen the screw(s).
6. **Fig. 4-10.** Using the T-handle driver, **slowly** tighten the S2 screw a little, then S3 and S4. Then continue in this way, always applying a bit more torque, until all 3 screws are tight. While turning the T-handle driver, monitor the Test Meter carefully.

If the voltage goes outside the range -200 mV to +200 mV while tightening, stop immediately and evaluate the following:

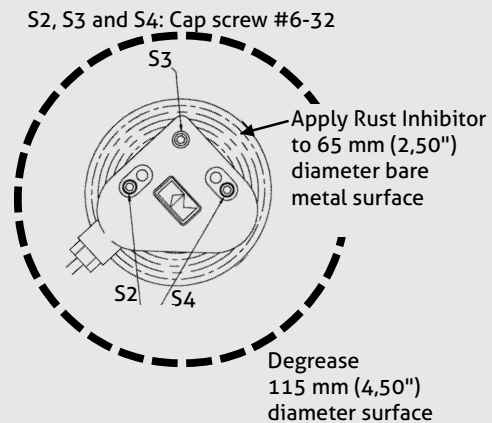
- If the voltage **jumped** outside the range -200 to +200 mV, it may indicate a burr or rough surface. Remove the screws holding the L-Cell® to the leg. Remove burrs and surface roughness (refer to Surface Preparation for removing surface roughness). Repeat Steps 2 through 6.
- If the voltage **gradually moved** outside the range -200 to +200 mV, slowly loosen the screw until the voltage is within range again and proceed to Step 7.

Caution



Do not install L-Cells in the rain. Do not trap moisture under the environmental cover.

Figure 4-10
Mounting the L-Cell®



Note



1. Do not apply rust inhibitor outside the 65 mm (2,50") diameter bare metal, or environmental cover will not adhere properly.
2. Place small amount of sealant on each screw before mounting L-Cell®.

Achtung



For proper installation, tighten each screw until the T-handle driver flexes in torsion 1/4 turn past the point where the screw stops turning. Repeat this flexing procedure several times to ensure the screw is tight. When all three screws are tight, the voltage must be in the range -200 to +200 mV. Follow the procedure in Steps 6 through 8 to achieve this goal.

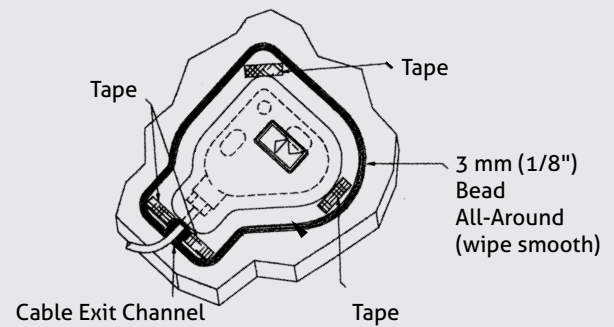
7. To complete installation, ensure that:
 - All three screws are tightened with a torque of 2.94 Nm (26 inch/lb) or until the T-handle driver flexes in torsion, 1/4 turn past the point where the screw stops turning, with this flexing procedure repeated several times to ensure the screw is tight, **and**
 - Voltage is in the range -200 to +200 mV.
8. Repeat all steps from 2 to 8 for the second L-Cell® "B".
9. Prior to installing the environmental cover(s), ensure the mating surface(s) on the leg is free of dirt and grease. Reclean if necessary, being careful not to remove the rust inhibitor on the bare metal.

10. **Fig 4-11.** Peel the protective backing from the double-sided tape on the environmental cover's inside flange.
- A. Align the environmental cover over the installed L-Cell®, with the cable through the cover's exit channel. Press the cover onto mounting surface.
 - B. Spread a 3 mm (1/8") bead of sealant around the joint between the cover and mounting surface. Add extra sealant to the cable exit channel.
 - C. Use your finger to smooth the sealant around all edges and joints, eliminating areas where moisture may pool, especially along the top edge. Verify that the sealant forms a continuous, watertight seal. Ensure the cable exit channel is completely sealed. Avoid contact with clothes.
 - D. Repeat step 11 for L-Cell® "B".
11. If you created any holes that go completely through the support metal, fill these completely with sealant.

Caution

Use only Sikaflex™ 1A polyurethane sealant, Sikaflex™ ProSelect Construction sealant or Dow Corning™ RTV 739 or RTV 738. Other sealants may contain acetic acid, which is harmful to sensors and electronics.

Figure 4-11
Environmental Cover



Installation of the L-Cell® on Skirted Silos

Based on information you provided on the Application Data Form, Anderson-Negele marked the form to show approximate L-Cell® and junction box locations. Consult Anderson-Negele if the information you provided on the form does not reflect the current vessel configuration.

Note



If you have a skirted silo with spars, legs, or any load-bearing structures that are in addition to the skirt, consult Anderson-Negele for application and mounting location assistance. Stress distribution for these vessels is complex and can adversely affect system performance.

Note



For Installation on skirted Silos the Junction Box type JB-S (Terminal board 63-1170-01) has to be used.

L-Cell® Mounting Locations

For best performance, L-Cells are mounted in pairs (See Figure 5-2). An L-Cell® Set consists of two L-Cells, one is mounted on the outside and one on the inside of the skirt, with 63 mm (2.5") horizontal offset.

Distribution of L-Cells and Junction Boxes Around Vessel-Carbon Steel

Bolted, Skirt-Supported Vessels

Typically, the panels are approximately 1.5 m (5') wide x 2.4 m (8') high, with some overlap between panels. The mounting locations shown in Figures 5-3 and 5-4 are based on this industry standard.

Example: The Application Data Form indicates a 3.7 m (12') diameter bolted vessel.

From Figure 5-3, such a bolted vessel has 8 panels around its circumference.

1. Locate an L-Cell® set on panels 2, 4, 6, and 8 (skipping panel 1, which has a door), for a total of 8 L-Cells (4 panels x 1 L-Cell® set/panel x 2 L-Cells/set).
2. Locate junction boxes on panels 3 and 7. The junction boxes will be wired as follows: panel 3 box to L-Cells (4) on panels 2 and 4, and panel 7 box to L-Cells (4) on panels 6 and 8.

Welded, Skirt-Supported Vessels

See Figures 5-3 and 5-4. The placement of L-Cells and junction boxes for welded vessels is similar to that for bolted. However, since there are no standardized panels, the L-Cell® placement is based on the nominal distance between L-Cells shown in Figure 5-3

Note



If the panels vary significantly from these dimensions or the height is less than 1.8 m (6'), contact Anderson-Negele for assistance in determining optimum mounting locations.

Figure 5-1
Skirted Silo

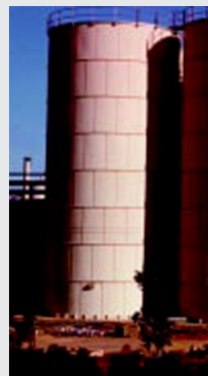
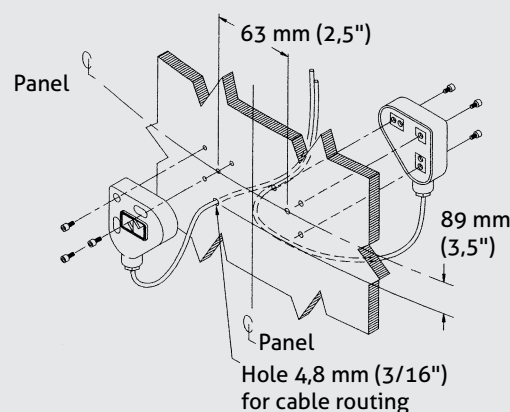


Figure 5-2
L-Cell® Set Mounting



Example 1: The Application Data Form indicates a 3.7 m (12') diameter welded vessel.

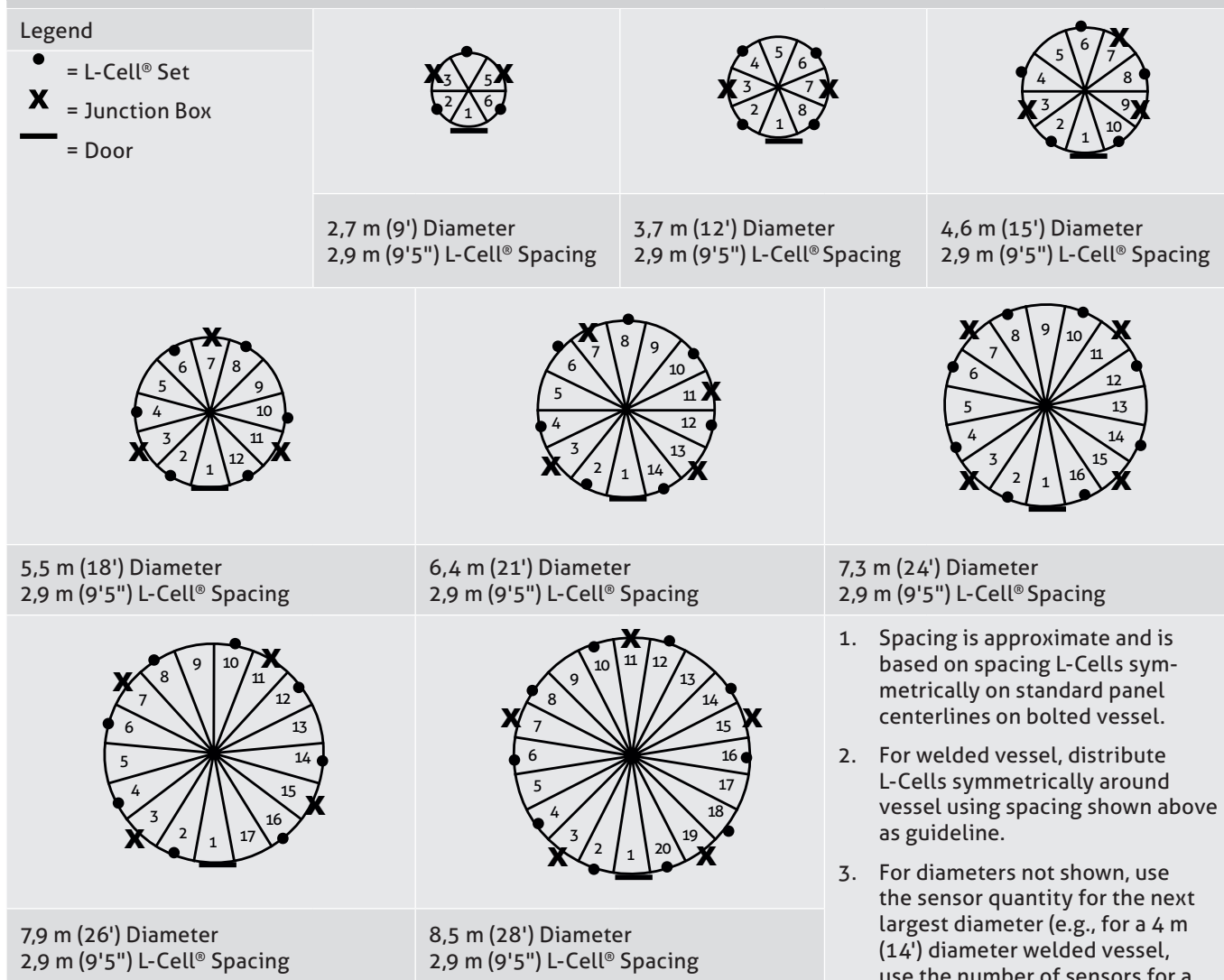
1. From Figure 5-3, for such a diameter vessel, the spacing between sensors is approximately 2.9 m (9'-5"). Locate L-Cell® sets around the vessel, with the door centered between 2 L-Cell® locations, for a total of 8 L-Cells (4 locations x 1 L-Cell® set/location x 2 L-Cells/set).
2. Locate junction boxes at 2 places, centered between the L-Cell® locations. Two junction boxes will each be wired to 4 adjacent L-Cells.

Example 2: The Application Data Form indicates a 4.2 m (14') diameter welded vessel.

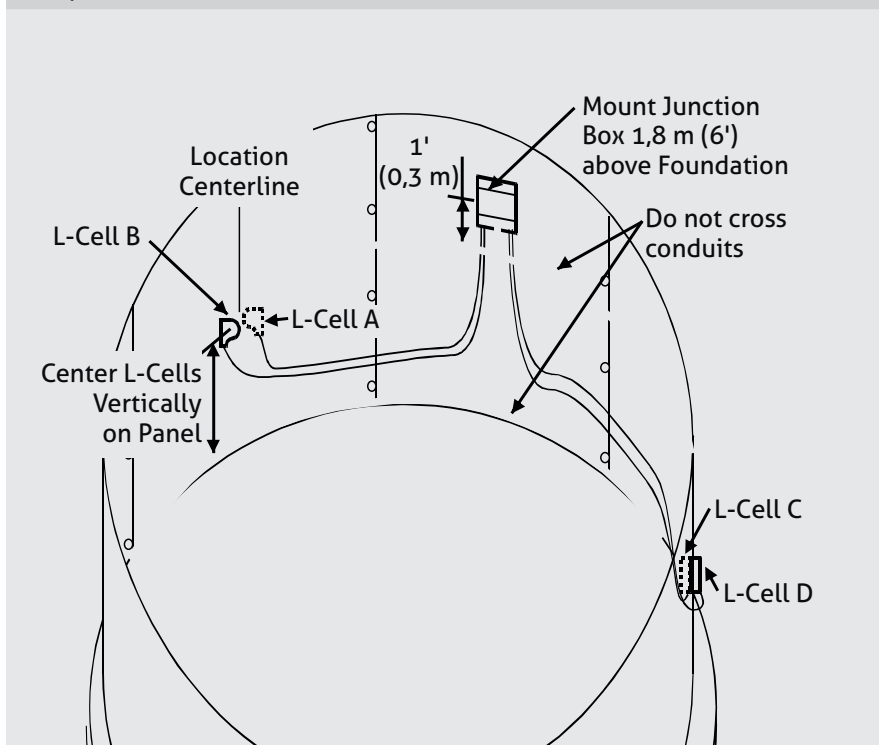
1. From Figure 5-3, for the next largest size (a 4.6 m (15') diameter) vessel, there are 5 L-Cell® locations. Calculate the L-Cell® spacing for a 14.2 m (14') diameter vessel: $(p \times \text{diameter}) / \text{number of locations} = \text{spacing}$ ($p \times 4.2 \text{ m} / 5 \text{ locations} = 2.6 \text{ m (8'-9")}$ spacing). Locate L-Cell® sets at 2.6 m (8'-9") spacings around the vessel, with the door centered between 2 L-Cell® locations, for a total of 10 L-Cells (5 locations x 1 L-Cell® set/location x 2 L-Cells/set).
2. Locate junction boxes at 3 places, centered between the L-Cell® locations. Two junction boxes will each be wired to 4 adjacent L-Cells and one junction box will be wired to 2 adjacent L-Cells.

Figure 5-3

Plan View . L-Cell® and Junction Box Locations (Carbon Steel)

**Figure 5-4**

Perspective View . L-Cell® and Junction Box Locations (Carbon Steel)

**Notes**

- L-Cells A and C are on inside of skirt.
- L-Cells B and D are on outside of skirt.
- Minimum panel height for L-Cell® installation is 1.8 m (6').
- Junction box is on inside of skirt, 1.8 m (6') above foundation.
- Run conduit 0.3 m (1') below junction box or near foundation, so it does not interfere with L-Cell® placement.

See Figure 5-7. Place the first L-Cell® set at the centerline of the door, or place one L-Cell® at each side of the door.

Note



If the vessel diameter is outside the range shown in **Figure 5-5** (3.0 to 6.0 m / 9.8' to 19.7') or the tier height is less than 1.8 m (6'), consult Anderson-Negele for assistance in determining optimal mounting locations.

Example 1: The Application Data Form indicates a 3 m diameter aluminum vessel. The distance from top of door to top of tier is 1.0 m.

1. From **Figure 5-5**, for a 3m diameter vessel, the spacing between sensors is approximately 1.18 m. Locate L-Cell® sets at 1.18 m spacings around the vessel, for a total of 16 L-Cells (8 locations x 1 L-Cell® set/location x 2 L-Cells/set). From Figure 5-7, center the first set above the door.
2. Locate junction boxes at 4 places, centered between the L-Cell® locations. Each junction box will be wired to 4 adjacent L-Cells.

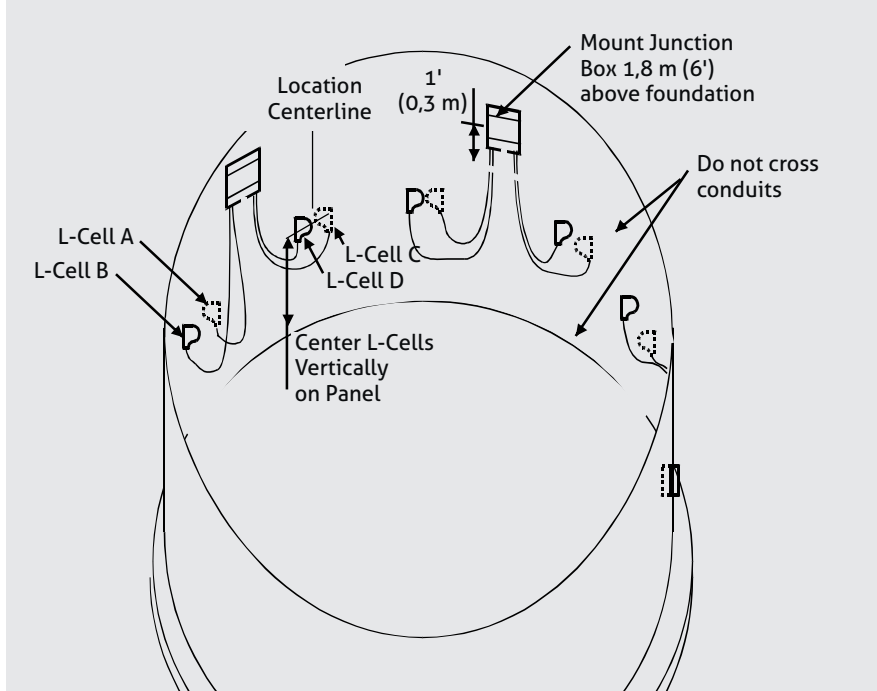
Figure 5-5
Plan View . L-Cell® and Junction Box Locations (Aluminum)

Legende					
● = L-Cell® Set					
✕ = Junction Box					
— = Door					
	3,0 m (9'-10") Diameter 1,18 m (3'10") L-Cell® Spacing	3,5 m (11'-6") Diameter 1,10 m (3'7") L-Cell® Spacing	4,5 m (14'-9") Diameter 1,18 m (3'10") L-Cell® Spacing		
	5,0 m (16'-5") Diameter 1,12 m (3'8") L-Cell® Spacing	6,0 m (19'-8") Diameter 1,18 m (3'10") L-Cell® Spacing			

Note

- Distribute L-Cells symmetrically around vessel using spacing shown as guideline.
- For diameters not shown, use the sensor quantity for the next largest diameter (e.g. for a 5.5 m diameter vessel, use the number of sensors for a 6.0 m diameter vessel, and distribute symmetrically around vessel).

Figure 5-6
Perspective View . L-Cell® and Junction Box Locations (Aluminum)

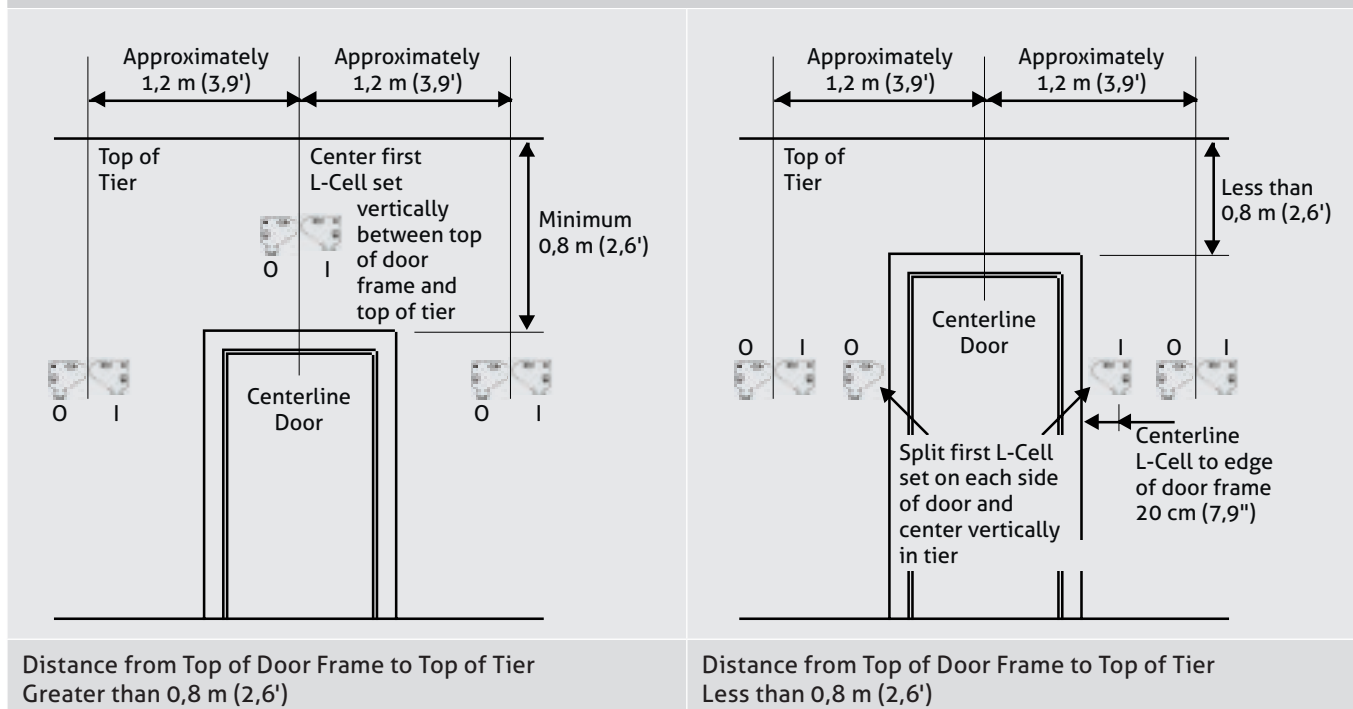


Note



- L-Cells A and C are on inside of skirt.
- L-Cells B and D are on outside of skirt.
- Minimum panel height for L-Cell® installation is 1.8 m (6').
- Junction box is on inside of skirt, 1.8 m (6') above foundation.
- Run conduit 0.3 m (1') below junction box or near foundation, so it does not interfere with L-Cell® placement.

Figure 5-7
L-Cell® Detail at Door



Obstructions

Typical obstructions on a skirt-supported vessel include:

- pipe, conduit, auger, or other installations passing through a panel
- open hole in a panel
- welded or bolted seams between panels
- bracket or electrical box welded or bolted to a panel
- welds around a patch, plugged opening

Carbon Steel

Obstructions can be classified as major or minor:

- **Figure 5-8** shows an example of a **major obstruction**. For bolted vessels, do not place an L-Cell® set on a panel with a major obstruction - use next panel. For welded vessels, do not place an L-Cell® set within 1.2 m (4') of a major obstruction.

- **Figure 5-9** shows an example of a **minor obstruction**. Do not place an L-Cell® set within 0.6 m (2') of a minor obstruction less than 100 mm (4") in size

See Figure 5-10. Minor obstructions may occur near the top or bottom of a panel. The effective panel height is the distance between the edge of the panel and the minor obstruction. If the effective panel height is 1.8 m (6') or greater, modify the vertical location of the L-Cell® set so the set is at the center of the effective panel height. If the effective panel height is less than 1.8 m (6'), relocate the L-Cell® set as shown in **Figure 5-9**.

If adjusting L-Cell® locations because of obstructions, maintain the offset configuration of the set (i.e., if you move one L-Cell® in the set from its ideal location, move the other one as well).

See Figure 5-11. On some vessels, most obstructions occur on the first tier of panels, while the second tier is largely free of obstructions. If your vessel has many obstructions on the first tier and meets the requirements shown in **Figure 5-11**, consider installing the L-Cells on the second tier.

Figure 5-8
Mounting L-Cells in Alternate Locations because of Major Obstructions

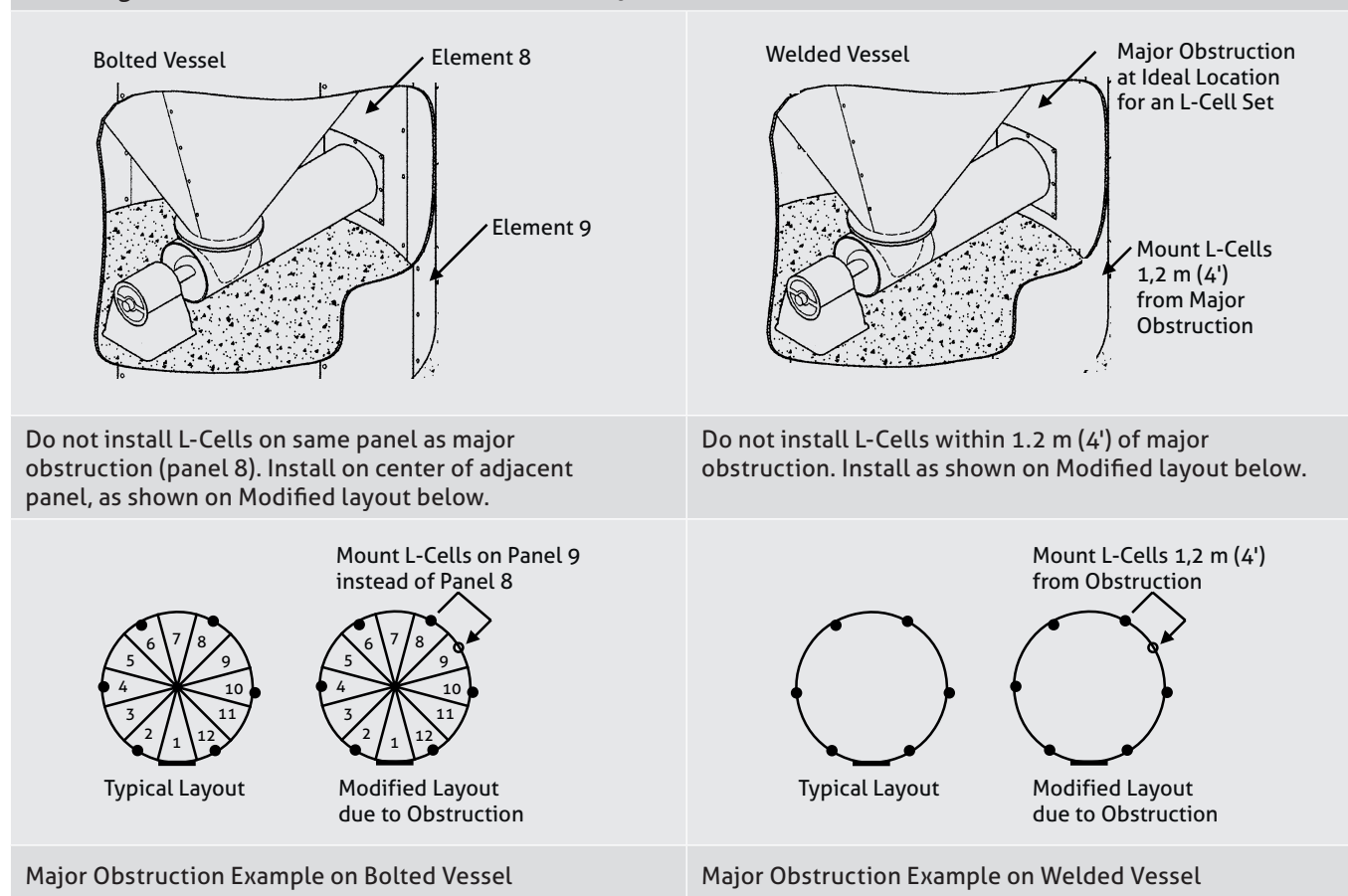
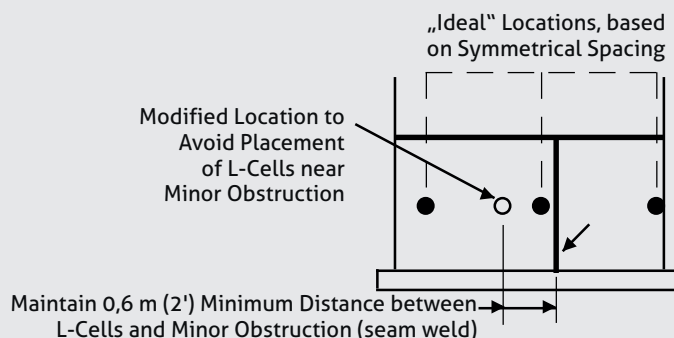


Figure 5-9
Mounting L-Cells in Alternate Locations because of Minor Obstructions



Mark Locations (Bolted, Skirt-Supported Vessels)

- Beginning on the outside of the skirt at the door panel (panel 1), walk clockwise to panel 2. Mark the preliminary L-Cell® location:
 - Locate the L-Cell® on the panel horizontal centerline.
 - Vertically, locate the L-Cell® at the panel mid-height (typically 0.9 to 1.2 m / 3 to 4') above the foundation).
 - Minor obstructions: Move the L-Cell® so it is not within 0.6 m (2') of a minor obstruction. Vertically, center the L-Cell® within the effective panel height.
 - Major obstructions: Move the L-Cell® to the centerline of the next panel to avoid major obstructions.
- Continuing to move clockwise around the outside of the skirt, repeat Step 1, marking preliminary mounting locations on panels 4, 6, etc.

- Continuing to move clockwise around the inside of the skirt, repeat Step 3, marking mounting locations on panels 4, 6, etc.
- Mark junction box locations on the inside of the skirt, centered between the L-Cell® sets. Each junction box can be wired to a maximum of two L-Cell® sets (four L-Cells total). Vertically, locate junction boxes approximately 1.8 m (6') above the foundation. This minimizes the possibility of interference with L-Cells in the event the L-Cells cannot be placed in the ideal locations. Ensure you have sufficient cable length and that a drip loop will be formed by the L-Cell® cables when wired to the junction box.



Note

The procedure for marking mounting locations is based on the nominal locations shown. Refer to the Application Data. Form for the approximate mounting locations selected by Anderson-Negele.

- Proceed to the inside of the skirt and walk clockwise to panel 2. Mark the preliminary L-Cell® location to match the marked location on the outside of the skirt:
 - If you adjusted the outside location because of an obstruction, maintain offset configuration of the set (i.e., if you move the outside L-Cell® in the set from its ideal location, move the inside LCell® as well).
 - If there is an obstruction on the inside, follow the guidelines in Step 1 for relocating the L-Cell®. Verify the L-Cell® on the outside can be relocated to match the inside location and remark the outside location.

Mark Locations (Welded, Skirt-Supported Vessels)

- L-Cells are located symmetrically around the vessel. Beginning on the outside of the skirt at the door centerline, measure clockwise **1/2 the spacing distance**. Mark the preliminary location of the first L-Cell®:
 - Vertically, locate the L-Cell® at the panel mid-height (typically 0.9 to 1.2 m / 3 to 4' above the foundation).
 - Minor obstructions. Move the L-Cell® so it is not within 0.6 m (2') of a minor obstruction. Vertically, center the L-Cell® within the effective panel height.
 - Major obstructions. Move the L-Cell® so it is not within 1.2 m (2') of a major obstruction.

Figure 5-10
Modifying L-Cell® Vertical Locations because of Minor Obstructions Near Panel Edge

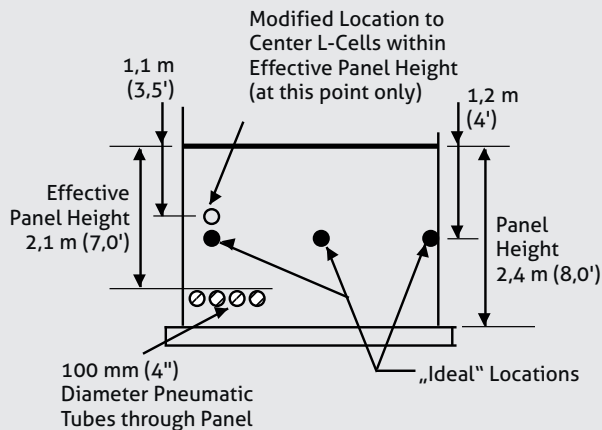
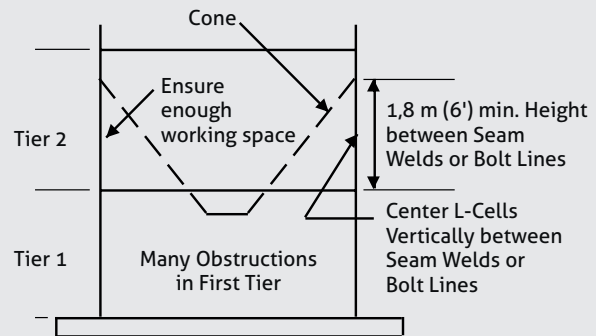


Figure 5-11
Mounting L-Cells on Second Tier



2. Continuing to move clockwise around the outside of the skirt and now **measuring the full spacing distance**, repeat Step 1, marking preliminary mounting locations all the way around the outside of the skirt.

Measure the spacing distance from the **ideal** location for the previous L-Cell®. Do not measure from the modified location if you relocated the previous L-Cell® because of an obstruction.

3. Proceed to the inside of the skirt and walk clockwise to the first L-Cell® location. Mark the preliminary L-Cell® location to match the **marked** location on the outside of the skirt:
 - If you adjusted the outside location because of an obstruction, maintain the offset configuration of the set (i.e., if you move the outside L-Cell® in the set from its ideal location, move the inside L-Cell® as well).
 - If there is an obstruction on the inside, follow the guidelines in Step 1 for relocating the L-Cell®. Verify the L-Cell® on the outside can be relocated to match the inside location and remark the outside location.

Note



Minimum effective panel height is 1.8 m (6'), otherwise relocate L-Cell® set to another location.

4. Continuing to move clockwise around the inside of the skirt, repeat Step 3, marking locations all the way around the skirt.
5. Mark junction box locations on the inside of the skirt, centered between the L-Cell® sets. Each junction box can be wired to a maximum of two L-Cell® sets (four L-Cells total). Vertically, locate junction boxes approximately 1.8 m (6') above the foundation. This minimizes the possibility of interference with L-Cells in the event the L-Cells cannot be placed in their ideal locations. Ensure you have sufficient cable length and that a drip loop will be formed by the L-Cell® cables when wired to the junction box.

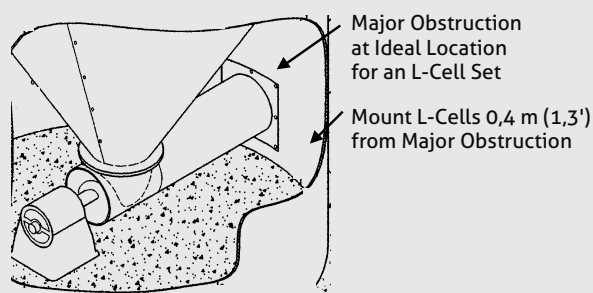
Obstructions (Aluminum)

Obstructions can be classified as major or minor:

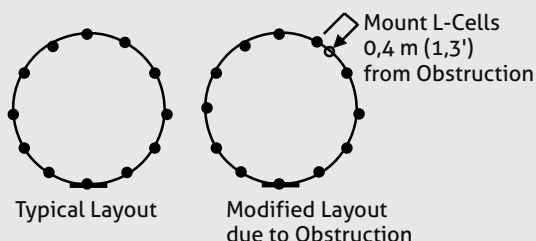
- **Figure 5-12** shows an example of a major obstruction. Do not place an L-Cell® set within 0.4 m (1.3') of a major obstruction.
- **Figure 5-13** shows an example of a minor obstruction. Do not place an L-Cell® set within 0.2 m (7") of a minor obstruction less than 100 mm (4") in size.

Figure 5-12

Mounting L-Cells in Alternate Locations because of Major Obstructions



Do not install L-Cells within 0.4 m (1.34') of major obstruction. Install as shown on Modified layout below.



See **Figure 5-10**. Minor obstructions may occur near the top or bottom of a panel. The effective panel height is the distance between the edge of the panel and the minor obstruction. If the effective panel height is 0.8 m (2.6') or greater, modify the vertical location of the L-Cell® set so the set is at the center of the effective panel height. If the effective panel height is less than 0.8 m (2.6'), relocate the L-Cell® set as shown in **Figure 5-15**.

Figure 5-13

Mounting L-Cells in Alternate Locations because of Minor Obstructions

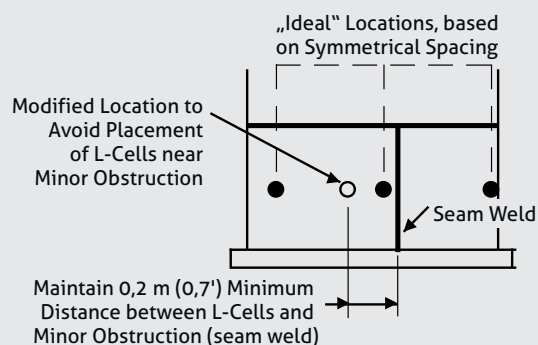


Figure 5-14

Modifying L-Cell® Vertical Locations because of Minor Obstructions Near Panel Edge

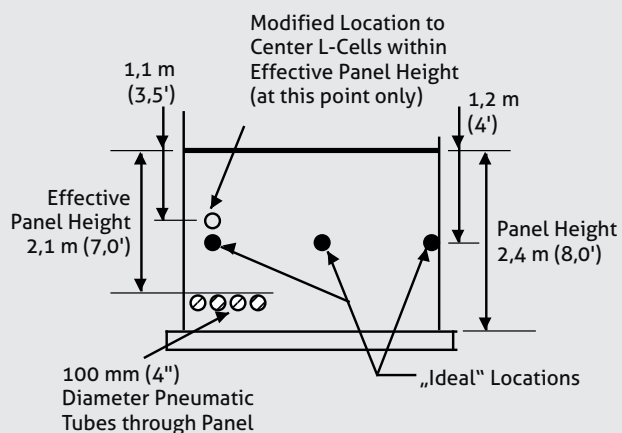
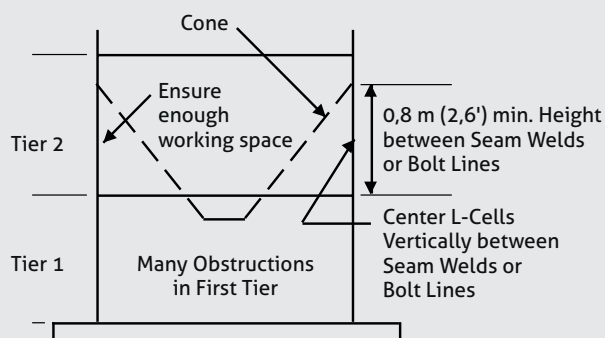


Figure 5-15

Mounting L-Cells on Second Tier



Note

Minimum effective panel height is 0.8 m (2.6'), otherwise relocate L-Cell® set to another location.



Installing L-Cells

Surface Preparation

1. **Fig. 5-16.** Mark position of drill template mounting hole. At the center of the L-Cell® mounting location drill a hole with a #36 drill bit. This produces the template mounting hole.

Peel the backing off the coarse (36) grit sander disk and press it onto the surfacing disk. Using the template mounting hole as a tool center, remove heavy paint and rust with the drill-mounted surfacing disk until a 63 mm (2.5") diameter bare metal surface is achieved.

Use straight, constant pressure and don't roll to grind a flat surface for mounting the L-Cell®, removing paint and rust.

Note

The L-Cell® must be mounted against smooth, bare metal. All paint and rust must be removed.

2. Repeat with the fine (60) grit sander disk until the surface is flat and smooth to the touch. **See Figure 5-18.**
3. Repeat Steps to prepare the surface on the opposite side of the vertical leg before proceeding with L-Cell® installation.

Drill and Tap

1. Using the #6-32 tap, thread the template mounting hole for the L-Cell®, full thread. (**See Figure 5-19**) Remove any burrs from the hole.
2. Position the drill template so the center hole (hole #5a) lines up with the template mounting hole.

Note

Steps 3 to 5 show a through hole. If the wall thickness exceeds 10 mm (0.4"), a hole with a minimum depth of 10 mm should be drilled.

3. Drill the L-Cell® mounting holes with the #36 drill bit, using the template guides (**Fig. 5-21**) as follows:
 - A. Fasten the drill template to the template mounting hole through the #5a hole, using the #6-32 x 1 5/8" socket head cap screw. Refer to Figure 3-9 and use a level placed on the horizontal top guide of the drill template to ensure correct orientation.
 - B. Drill hole #2.
 - C. Insert a spare drill bit through hole #2 in the template to hold the template securely in place.
 - D. Drill hole #1 and #3. Remove the spare drill bit from hole #2.

Note

Use industrial-grade, heavy-duty tapping fluid when drilling and tapping.

Figure 5-16
Drill Mounting Hole



Figure 5-17
Prepare surface with grinder



Figure 5-18
Fine grinding the surface



Figure 5-19
Tap thread in the mounting hole

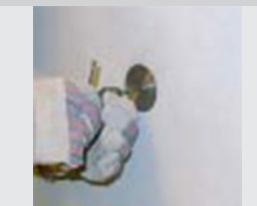
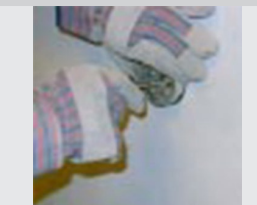


Figure 5-20
Fasten drilling template

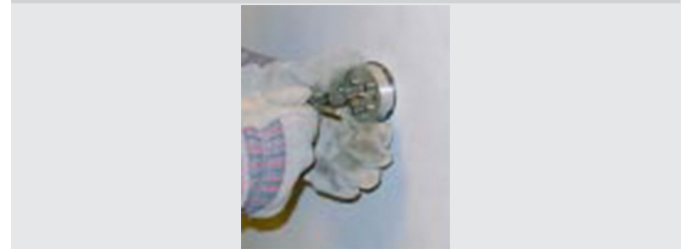


4. Tap the mounting holes:
 - A. Loosen the screw securing the template and rotate the template until the tap guide is aligned with hole #1. Retighten the screw.
 - B. Using the tap guide, thread hole #1 with the #6-32 tap.
 - C. Repeat steps A and B for hole #2 and #3.
5. Repeat steps 1 to 4 for the second L-Cell® on the inside.
6. Using the 3/16 drill bit, drill a through hole 90 mm (3.5") below the mounting hole on the outside for the cable feed-through.
7. Remove burrs from all the holes created.

Figure 5-21
Drill more mounting holes



Figure 5-22
Tap further threads in the mounting hole



Mounting the L-Cell®

Caution



Do not install L-Cells in the rain. Do not trap moisture under the environmental cover.

1. Wipe down a 115 mm (4.5") surface, centered on the template mounting hole, with degreaser. This cleans the bare metal and adjacent mounting surface for the environmental cover.
2. Apply on a 65 mm (2.5") surface a thin coat of Anderson-Negele rust inhibitor to the bare metal surface for the L-Cell®. (Fig 5-25)

Caution



Do not apply rust inhibitor beyond this area, or the environmental cover will not adhere properly.

3. Connect the L-Cell's red, black, and white wires to the corresponding terminals on the Anderson-Negele Test Meter. Turn on the power to the Test Meter and set the Simulate/Test switch to the Test position. (Fig 5-26)

Note



If an Anderson-Negele Test Meter is not available, refer to chapter "Alternate Method for Checking Output" before proceeding.

Caution



Use only Sikaflex™ 1A polyurethane sealant, Sikaflex™ ProSelect Construction sealant or Dow Corning™ RTV 739 or RTV 738. Other sealants may contain acetic acid, which is harmful to sensors and electronics.

Figure 5-27
Drilled and Tapped Holes (outside view of skirt)

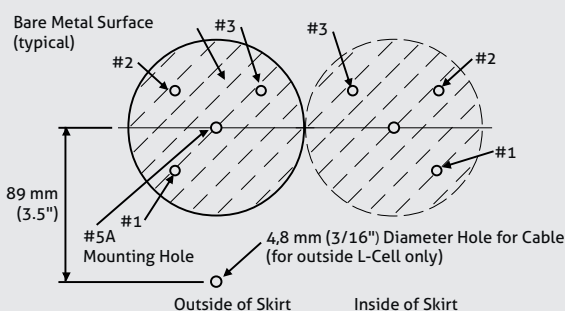


Figure 5-24
Clean surface



Figure 5-25
Apply rust inhibitor



Figure 5-26
Test the L-Cell®



4. With the cable end down, align an L-Cell® with its mounting holes. Fasten the L-Cell® **loosely** using the three #6-32 x 5/8. socket head cap screws. **Do not tighten the screws.** If the voltage goes outside the range -200 to +200 mV, immediately loosen the screw(s).
5. Using the T-handle driver, **slowly** tighten the S1 screw a little, then S2 and S3. Then continue in this way, always applying a bit more torque, until all 3 screws are tight. While turning the T-handle driver, monitor the Test Meter carefully. If the voltage goes outside the range -200 mV to +200 mV while tightening, stop immediately and evaluate the following. (Figure 5-28)
 - If the voltage **jumped** outside the range -200 to +200 mV, it may indicate a burr or rough surface. Remove the screws holding the L-Cell® to the leg. Remove burrs and surface roughness (refer to Surface Preparation for removing surface roughness). Repeat Steps 1 through 5.
 - If the voltage **gradually moved** outside the range -200 to +200 mV, slowly loosen the screw until the voltage is within range again and proceed to Step 7

Caution

For proper installation, tighten each screw until the T-handle driver flexes in torsion 1/4 turn past the point where the screw stops turning. Repeat this flexing procedure several times to ensure the screw is tight. When all three screws are tight, the voltage must be in the range -200 to +200 mV. Follow the procedure in Steps 6 through 8 to achieve this goal.

Note

If the following two situations occur while tightening screws, check L-Cell® resistance using a DMM (described in chapter Troubleshooting):

- Voltage does not change or changes less than 25 mV as you turn a screw, **or**
- Voltage changes randomly as you turn a screw (i.e., not in a consistent direction)

6. To complete installation, ensure that:

- All three screws are tightened with a torque of 2.94 Nm (26 inch/lb) or until the T-handle driver flexes in torsion, 1/4 turn past the point where the screw stops turning, with this flexing procedure repeated several times to ensure the screw is tight, **and**
- Voltage is in the range -200 to +200 mV.

7. Prior to installing the environmental cover(s), ensure the mating surface(s) on the leg is free of dirt and grease. Reclean if necessary, being careful not to remove the rust inhibitor on the bare metal.

8. **Fig 5-31 to 5-33.** Peel the protective backing from the double-sided tape on the environmental cover's inside flange.

- A. Align the environmental cover over the installed L-Cell®, with the cable through the cover's exit channel. Press the cover onto mounting surface.
- B. Spread a 3 mm (1/8") bead of sealant around the joint between the cover and mounting surface. Add extra sealant to the cable exit channel.
- C. Use your finger to smooth the sealant around all edges and joints, eliminating areas where moisture may pool, especially along the top edge. Verify that the sealant forms a continuous, watertight seal. Ensure the cable exit channel is completely sealed. Avoid contact with clothes.

9. Repeat Steps 1 through 10 to install the L-Cell® on the inside of the skirt wall.

10. Thread the outside L-Cell® cable through the hole to the inside.

11. Clean with degreaser and then spread Sikaflex™ 1A sealant:

- A. Over the open hole on the backside of each screw,
- B. Over the template mounting hole, and
- C. Around the cable routing hole in the skirt wall. Use your finger to press sealant into each hole.

Figure 5-30
Environmental Cover

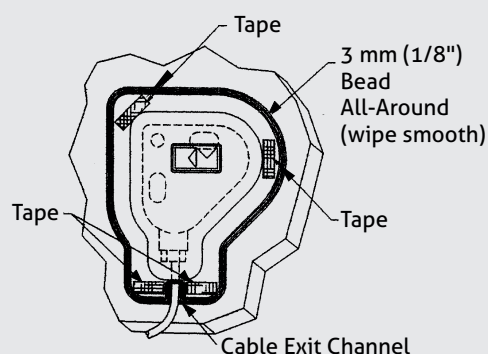


Figure 5-31, 5-32, 5-33
Environmental Cover

**Caution**

Use only Sikaflex™ 1A polyurethane sealant, Sikaflex™ ProSelect Construction sealant or Dow Corning™ RTV 739 or RTV 738. Other sealants may contain acetic acid, which is harmful to sensors and electronics.

Installation of the Microcell® on Vertical Legs

Microcell® Mounting Locations

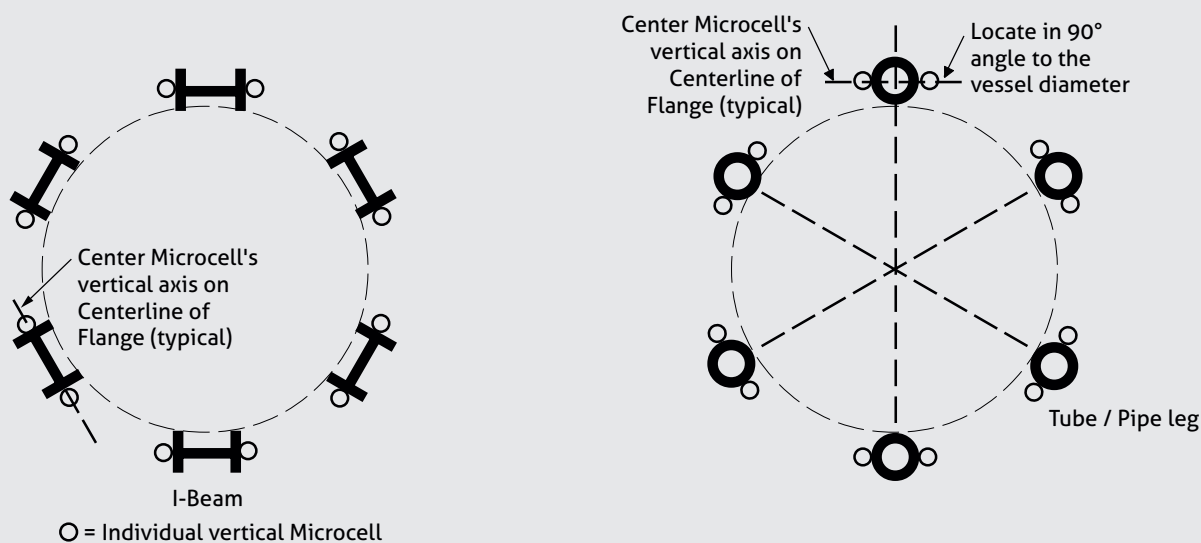
For best performance, Microcells are mounted on the flanges of the vertical leg. (See Figure 6-1 and 6-2). A Microcell® Set consists of two Microcells mounted on opposite sides of a support leg, at the same elevation.

Note



Always use only the same Microcell® type on a vessel.

Figure 6-1
Microcell® Mounting Locations



Horizontal Locations of Microcells

Microcell® sets are placed on each support leg. Refer to Figure 6-2 for the mounting locations.

Vertical Locations of Microcells

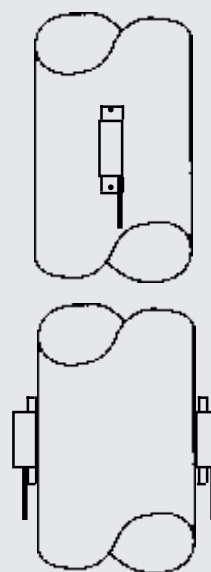
Microcell® locations may be adjusted up to 300 mm (12") vertically to avoid obstacles. If adjusting locations, maintain the configuration of the Microcell® set (i.e., if you move one Microcell® in the set from its ideal location, move the other(s) as well).

Note



For Installation on vertical legs the Junction Box type JB-S (Terminal board 63-1170-01) has to be used.

Figure 6-2
Vertical Microcell® Mounting for Best Performance



Support Legs without X-Braces

See Figure 6-3.

- If the free leg distance (length between foundation and the vessel) is between minH (**see Note**) and 3.4 m (11'), mount the Microcell® sets at midheight of the free leg.
- If the free leg distance is more than 3.4 m (11'), mount the Microcell® sets at 1.7 m (5'6") above the foundation.
- If the free leg distance is less than minH, consult Anderson-Negele before proceeding further.

Support Legs with X-Braces

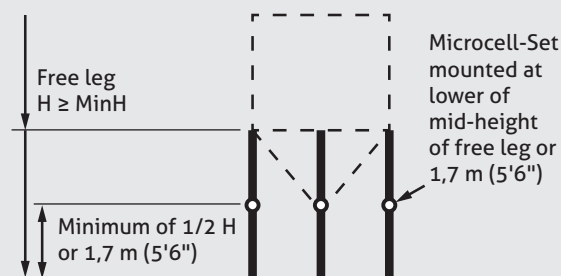
See Figure 6-4.

- If the free leg distance is minH or more, mount the Microcell® sets at mid-height of the free leg
- Measure the free leg between the bottom of the lower x-brace or horizontal brace and the top of the foundation.
- For an alternate location, measure the free leg between the top of the upper x-brace or horizontal brace and the beam supporting the vessel.

See Figure 3-5. If the free leg distance is less than minH, mount the Microcell® sets at the mid-height between the lowest braces.

Figure 6-3

Vertical Location of Microcell® Sets for Legs without Braces



Note

minH = minimum free height to install sensors. The height should be three times the beam width or 305 mm (12"), whichever is highest of the two.

Figure 6-4

Vertical Location of Microcell® Sets for Legs with Braces and with Free Leg greater than MinH

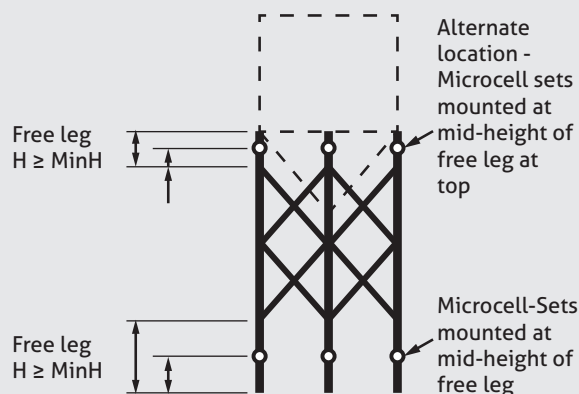
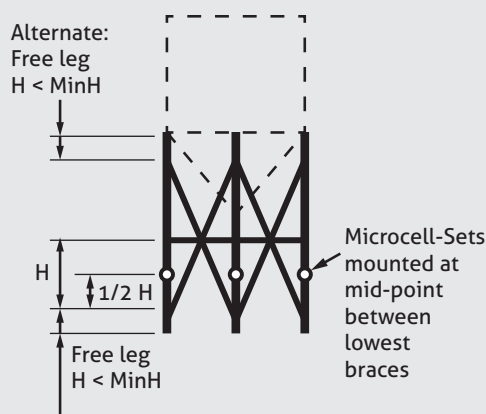
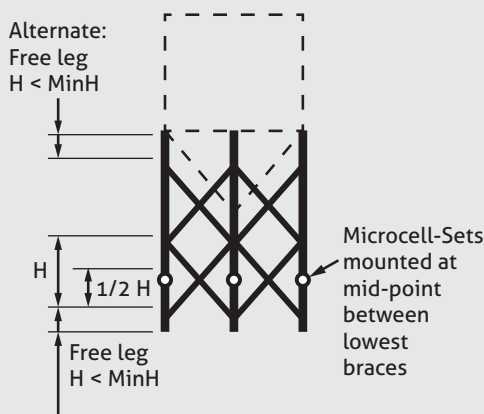


Figure 6-5

Vertical Location of Microcell® Sets for Legs with Braces and with Free Leg less than minH



Installing Microcells

Surface Preparation

1. Mark position of beam axis and of drill template mounting hole.
2. **Fig. 6-6.** At the center of the Microcell® mounting location drill a 19 mm (3/4") deep hole with a #36 drill bit. This produces the template mounting hole.

Note



1. Use lubricating fluid (Relton RapidTap® Heavy Duty Cutting Fluid or equivalent) when drilling and tapping.
2. Drilling and tapping instructions assume metal thickness greater than 19 mm (3/4"). If the thickness is less, drill all the way through the metal and tap until cutting complete threads through the other side. Minimum metal thickness is 5 mm (0.1875").
3. With a coarse grit sander remove heavy paint and rust until bare metal surface is achieved.
4. Repeat with the fine (60) grit sander until the surface is flat and smooth to the touch. **See Figure 6-7.**

Note

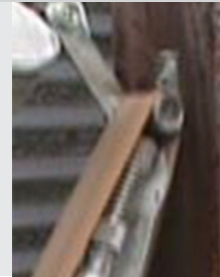


The Microcell® must be mounted against smooth, bare metal. All paint and rust must be removed.

Figure 6-6
Drill Mounting Hole



Figure 6-7
Grind surface



Drill and Tap

1. Using the #8-32 tap, thread the template mounting hole for the Microcell® to a minimum of 16 mm (5/8") depth, full threads. (**See Figure 6-8**) Remove any burrs from the hole.
2. Position the drill template.
3. Fasten the drill template to the template mounting hole using the #8-32 socket head cap screw. Refer to the level bubble to ensure correct vertical orientation.
4. Using the Microcell® template guide, drill one mounting hole, leave a drill bit in the hole, then drill the second hole.
5. Loosen the screw securing the template and rotate the template until the tap guide is aligned with the holes. Retighten the screw.
6. Using the tap guide, thread the two hole #8-32 tap min. 16 mm (5/8" deep)
7. Remove burrs from all the holes created.

Figure 6-8
Prepared surface

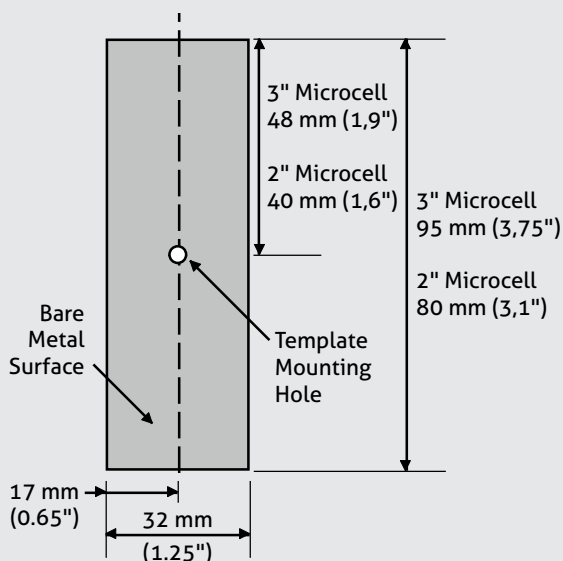
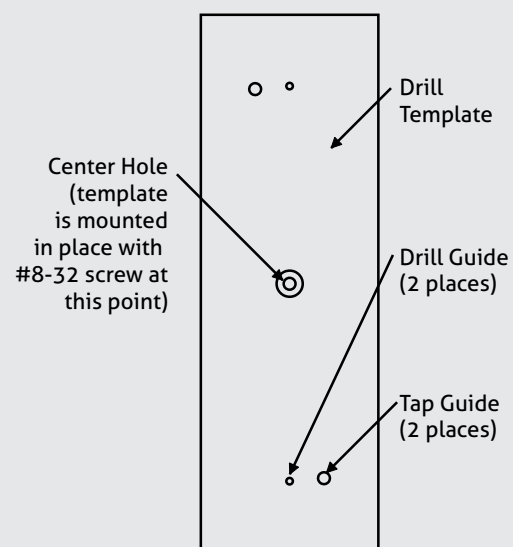


Figure 6-9
Drill and tap template



Mounting the Microcell®

1. Wipe down a 127 x 57 mm (5" x 2 1/4") surface with degreaser. This cleans the bare metal and adjacent mounting surface for the environmental cover.
2. Apply a thin coat of Anderson-Negele rust inhibitor to the bare metal surface for the Microcell®. (Fig 6-10)

Caution



Do not apply rust inhibitor beyond this area, or the environmental cover will not adhere properly.

3. Connect the Microcell's red, black, and white wires to the corresponding terminals on the Anderson-Negele Test Meter. Turn on the power to the Test Meter and set the Simulate/Test switch to the Test position. (Fig 6-11)

Note



If an Anderson-Negele Test Meter is not available, refer to chapter "Alternate Method for Checking Output" before proceeding.

4. With the cable end down, align a Microcell® with its mounting holes. Fasten it **loosely** to the leg using the two #6-32 x 5/8. socket head cap screws and washers. **Do not tighten the screws.** If the voltage goes outside the range -200 to +200 mV, immediately loosen the screw(s) (Figure 6-12).

Caution



For proper installation, tighten each screw until the T-handle driver flexes in torsion 1/4 turn past the point where the screw stops turning. Repeat this flexing procedure several times to ensure the screw is tight. When both screws are tight, the voltage must be in the range -200 to +200 mV. Follow the procedure in Steps 5 through 7 to achieve this goal.

5. Using the T-handle driver, **slowly** tighten the upper screw a little, then the lower one. Then continue in this way, always applying a bit more torque, until both screws are tight. While turning the T-handle driver, monitor the Test Meter carefully. If the voltage goes outside the range -200 mV to +200 mV while tightening, stop immediately and evaluate the following:
 - If the voltage **jumped** outside the range -200 to +200 mV, it may indicate a burr or rough surface. Remove the screws holding the Microcell® to the leg. Remove burrs and surface roughness (refer to Surface Preparation for removing surface roughness). Repeat Steps 1 through 5.
 - If the voltage **gradually moved** outside the range -200 to +200 mV, slowly loosen the screw until the voltage is within range again and proceed to Step 6.

Caution



Do not install Microcells in the rain. Do not trap moisture under the environmental cover.

Figure 6-10

Apply rust inhibitor



Figure 6-11

Test Microcell®



Figure 6-12

Install Microcell®



6. To complete installation, ensure that:
 - both are tightened with a torque of 3.95 Nm (35 inch/lb) or until the T-handle driver flexes in torsion, 1/4 turn past the point where the screw stops turning, with this flexing procedure repeated several times to ensure the screw is tight, **and**
 - Voltage is in the range -200 to +200 mV.
7. Prior to installing the environmental cover(s), ensure the mating surface(s) on the leg is free of dirt and grease. Reclean if necessary, being careful not to remove the rust inhibitor on the bare metal.
8. **Fig 6-14.** Spread a 3 mm (1/8") bead of sealant around the joint between the cover and mounting surface. Add extra sealant to the cable exit channel.
 - A. Align the environmental cover over the installed Microcell, with the cable through the cover's exit channel.
 - B. Press the cover onto mounting surface.
 - C. Use your finger to smooth the sealant around all edges and joints, eliminating areas where moisture may pool, especially along the top edge. Verify that the sealant forms a continuous, watertight seal. Ensure the cable exit channel is completely sealed. Avoid contact with clothes.

Abbildung 6-13

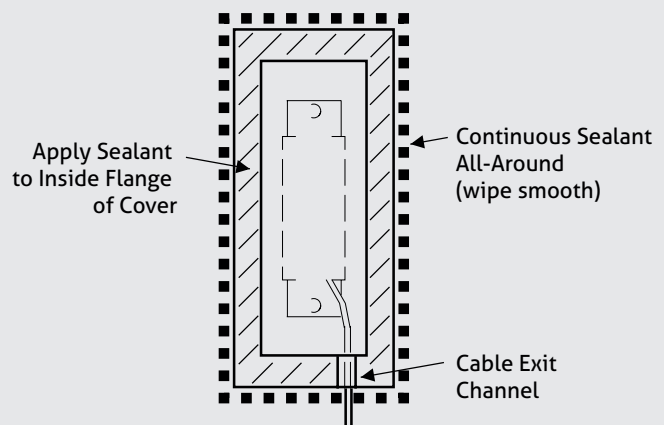


Caution



Use only Sikaflex™ 1A polyurethane sealant, Sikaflex™ ProSelect Construction sealant or Dow Corning™ RTV 739 or RTV 738. Other sealants may contain acetic acid, which is harmful to sensors and electronics.

Figure 6-14
Environmental Cover



Mounting and Wiring of the Junction Box

Mounting Location

Each junction box can be wired to a maximum of four sensors (L-Cells / Microcells) (mind maximum cable length):

See Figure 6-15. Locate the junction box on the support leg, brace or silo panel. Vertically, locate junction boxes at a convenient height, approximately 1.2 m (4') from the ground. The exact location of the junction box is not critical, but ensure you have sufficient cable length and that a drip loop will be formed by the sensor cables when wired to the junction box

Note



For Installation on vertical legs the Junction Box type JB-S (Terminal board 63-1170-01) has to be used.

For Installation on horizontal beams the Junction Box type JB-R (Terminal board 63-1135-03) has to be used.

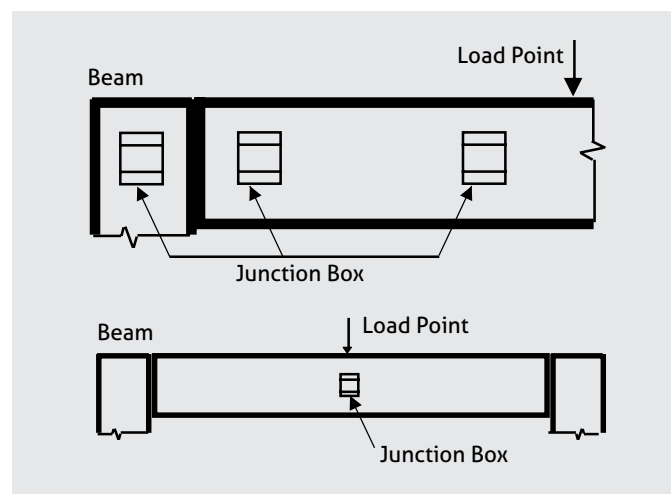
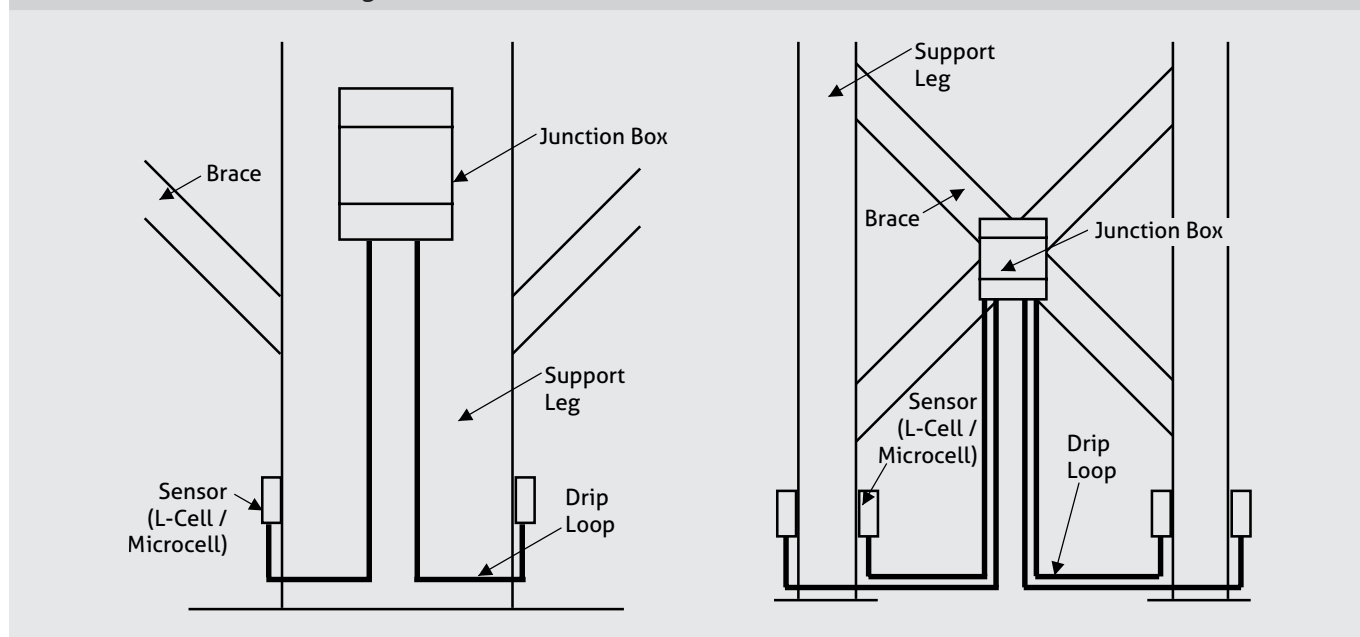


Figure 6-15

Possible Junction Box Mounting Locations



Junction Box Installation

Caution



Do not install junction boxes in the rain. Moisture in the junction box will cause corrosion and system errors.

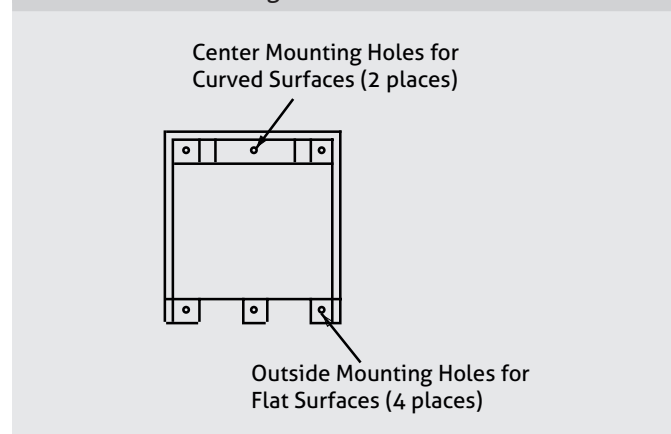
Note



Junction box mounting hardware is not supplied by Anderson-Negele. We recommend #8-32 socket head head cap screws and flat washers.

Figure 6-16

Junction Box Mounting



1. Remove the junction box cover.
2. **Figure 6-16:** Hold the junction box at the previously marked mounting location. Mark the four outer mounting holes (mounting on a flat surface), e.g. on an I-beam or the two central mounting holes (mounting on a curved surface), e.g. on a profile tube.
3. Drill and tap the mounting holes with a #29 drill bit and #8-32 tap.
4. Mount the junction box with #8-32 socket head cap screws and flat washers. Tighten the screws until snug. Replace the junction box cover and screws if not ready to begin wiring, to ensure no moisture enters the junction box.

Wiring Sensor (L-Cell / Microcell) to Junction Box

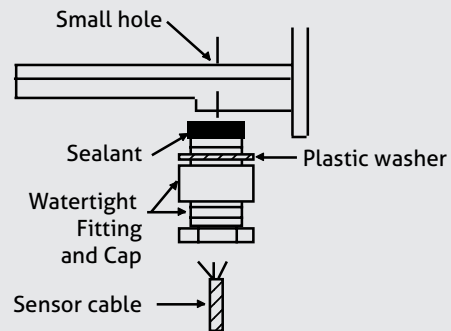
1. Remove the junction box cover.
2. **See Figure 6-17.** Place a plastic washer on a watertight fitting. Thread the sensor cable through a cap and watertight fitting. Leave an adequate length of cable between the sensor and fitting to provide a drip loop (**see Figure 6-18**).
3. Spread a generous bead of sealant around the sides of the watertight fitting.
4. In the bottom of the junction box, screw the watertight fitting into the closest hole.
5. Estimate the required length of cable to the terminal strip, allowing a little extra for strain relief. Cut the excess cable.
6. Strip back 76 mm (3") of the cable sheathing to expose the three wires inside. Strip back 6 mm (1/4") of insulation from the end of each of the wires.
7. **Figure 6-18:** Connect the wires from the sensor to the selected TB3 terminals: black wire to B terminal, white wire to W terminal, and red wire to R terminal.
8. Perform Steps 2 through 7 for each sensor you wire to this junction box (up to four).
9. Spread a generous bead of sealant around the sides of the plug for each hole not being used. Screw a plug into each hole.
10. Replace the junction box cover if not ready to begin wiring the junction boxes.

Note

The four small holes in the bottom of the junction box are for wiring the Microcells to the junction box.

Figure 6-17

Inserting Microcell® Cable through Watertight Fitting and Cap



Caution

Use only Sikaflex™ 1A polyurethane sealant, Sikaflex™ ProSelect Construction sealant or Dow Corning™ RTV 739 or RTV 738. Other sealants may contain acetic acid, which is harmful to sensors and electronics.

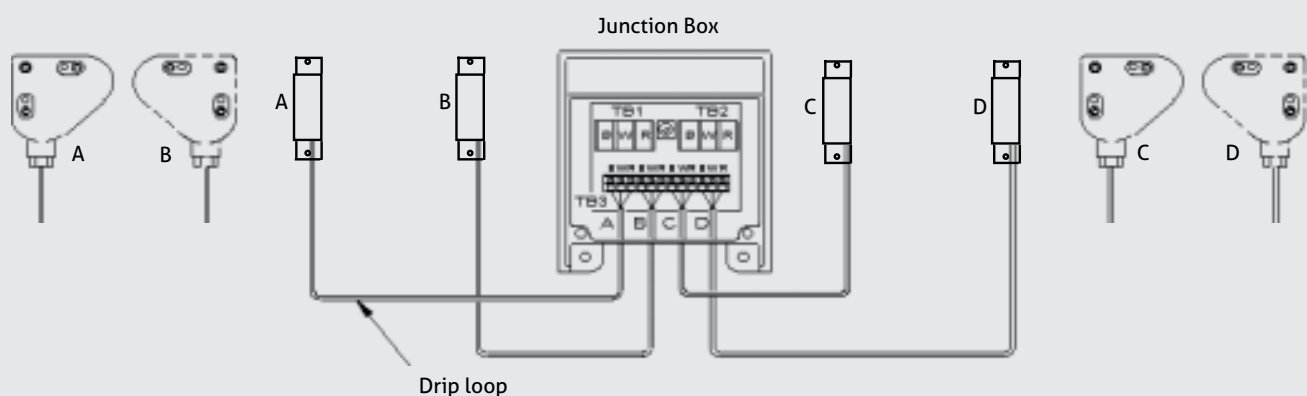
Note

TB3 terminal block has 12 terminals to accommodate up to four sensors (A, B, C, and D). Locate the terminal labeled for the sensor you are wiring.

Note

For Installation on horizontal beams the Junction Box type JB-R (Terminal board 63-1135-03) has to be used. In this case the terminals A and D are for normal wiring, the terminals B and C are for reverse wiring. Make sure that sensors pointing to the load point are normally wired, and sensors pointing away from the load point are reverse wired (see figure 4.3 to 4.7).

Figure 6-18
Sensor connection



Wiring Junction Boxes Together and to Signal Processors

There are two junction box versions. Both have four small holes for the wiring of sensors as described above. In addition, the junction box has one or two large holes:

- One large hole for conduited installation. The large hole for a 3/4" conduit fitting, is for wiring the junction box to the other junction boxes and to the signal processor.
- Two large holes for non-conduited installation, with PG13.5 cable fittings for wiring the junction box to the other junction boxes and to the signal processor. **Please use cable trays for non-conduited installations.**

Note

1. The procedure below assumes the conduit/cable tray has been installed.
2. Seal all conduit fittings against water entry. Install drain holes at conduits lowest elevation(s) to allow condensation to drain.
3. Use Belden 3-conductor shielded interconnect cable or equivalent to wire junction boxes together and to the signal processor. For lengths up to 305 m (1000') use 18-gage Belden 8791 cable. For lengths from 305 m to 610 m (1000 to 2000') use 16-gage Belden 8618 cable.
4. When wiring cable to junction box terminals, strip back 76 mm (3') of cable sheathing to expose the three conductor wires and shield wire inside. Strip 6 mm (1/4") of insulation from the end of each of the conductor wires.
5. All wiring routed between junction boxes and signal processor must be continuous (no splices).

1. Remove the junction box cover.
 - Conduited installation: Install a conduit fitting in the large hole in the bottom of the junction box.
 - Non-conduited installation: **See Figure 6-19.** Spread generous bead of sealant around the sides of the PG13.5 cable fittings. Install the fittings in the two large holes in the bottom of the junction box.
2. **See Figure 6-20** (conduited installation) or **Figure 6-21** (nonconduited installation). Route the 3-conductor cable through the fitting into the junction box farthest from the signal processor. Connect wires from the cable to the TB2 terminal in the junction box: black wire to B terminal, white wire to W terminal, and red wire to R terminal. Connect the cable shield wire to the Shield terminal between TB1 and TB2.
3. Route the cable through conduit/cable tray to the next junction box.

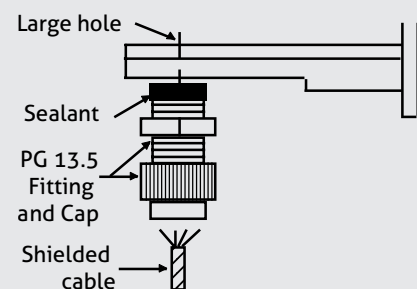
Estimate the required length of cable to the terminal strip, allowing a little extra for strain relief. Cut the excess cable. Connect wires from the cable to the TB1 terminal in the junction box: black wire to B terminal, white wire to W terminal, and red wire to R terminal. Connect the cable shield wire to the Shield terminal between TB1 and TB2.

Note

- Make sure that the printed circuit board of the connection box is No. 63-1170-01 or 63-1135-03.
- Sensors A and B are located on one support leg.
- Sensors C and D are located on another support leg. Sensors C and D can be wired as shown or, if desired, wired to a separate junction box (terminals A and B).
- For L-Cell mounting on a skirted silo: L-Cell® A and C are mounted on the inside, L-Cell® B and D on the outside.

Figure 6-19

Inserting Shielded Interconnect Cable through PG13.5 Fitting and Cap



Note

After cable is connected to terminals, tighten cap until cable glands in fitting seal around cable.

4. Route another 3-conductor cable through the fitting into this junction box, and attach wires to the TB2 terminal: black wire to B terminal, white wire to W terminal, and red wire to R terminal. Connect the cable shield wire to the Shield terminal between TB1 and TB2.
5. Repeat Steps 3 and 4 until all junction boxes for the vessel are wired together.
6. Route the cable from the last junction box through conduit/cable tray to the signal processor. Refer to the signal processor manual for wiring the junction box to the signal processor. One vessel takes up one channel in the signal processor - the channel shows the average value from all the sensors on the vessel supports.

Figure 6-20
Wiring Junction Boxes Together . Conduited Installation

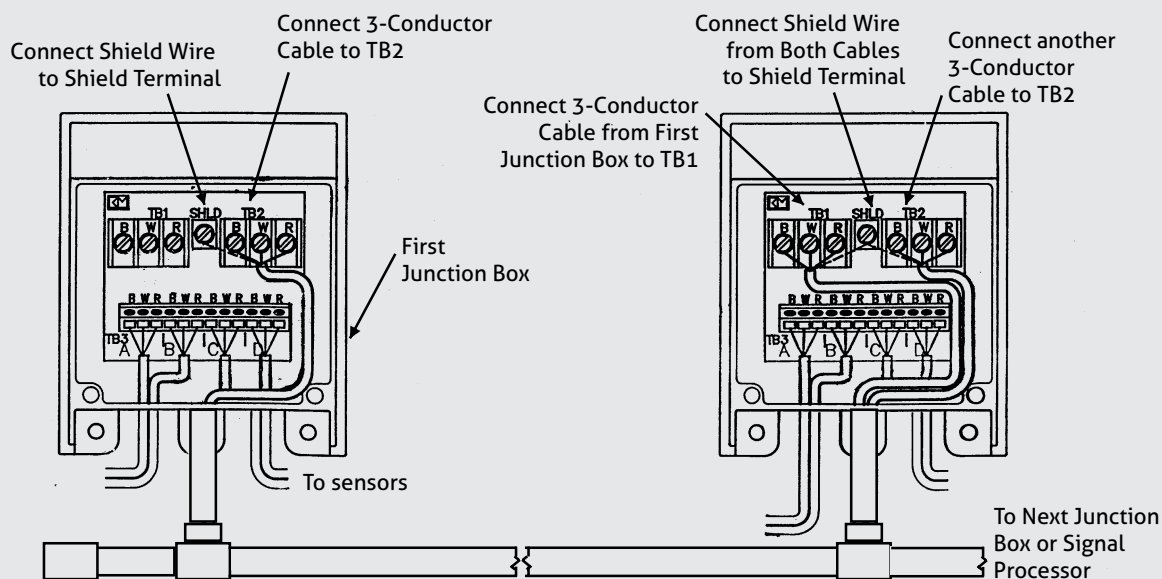
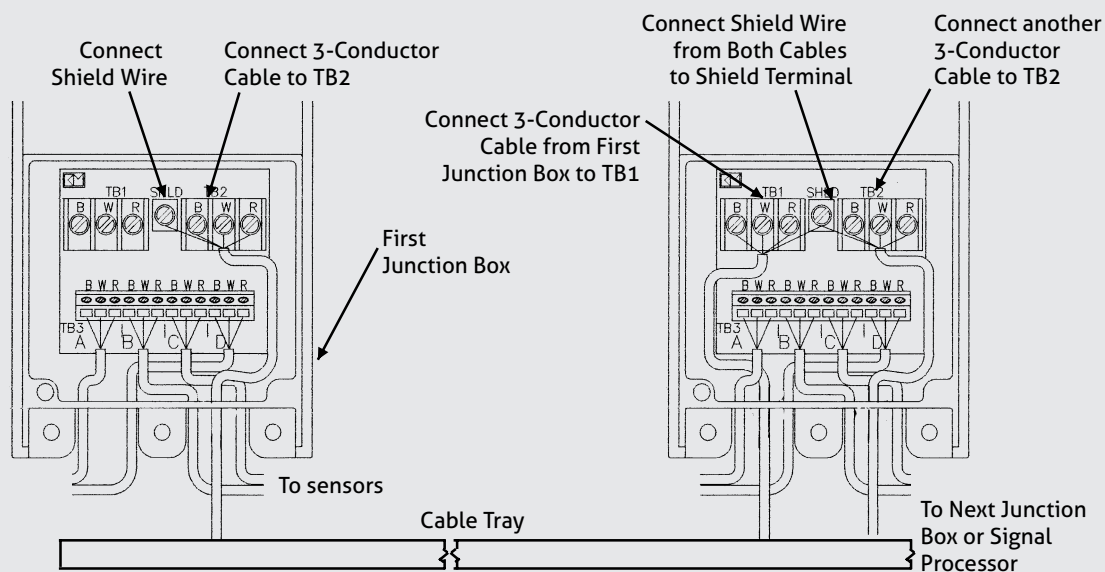


Figure 6-21
Wiring Junction Boxes Together . Non-Conduited Installation



Note



Connect the other end of the shield wire at the electronics. This shield connection is not actually grounded, it is just to fix it so it isn't loose.

System Calibration

Calibration methods

Before calibrating, you must install a signal processor.

There are two calibration methods:

- Live Load calibration: set lo span and hi span while moving material into or out of the vessel. This is the preferred method.
- Manual calibration: set scale factor counts, scale factor weight, and zero calibration value without moving material. This method is less accurate than Live Load calibration.

A Live Load calibration requires you to move a known quantity of material into or out of the vessel while performing the procedure. The quantity of material moved must be at least 25% of the vessel's total capacity to provide best accuracy. Live Load calibration is also based on the material weight currently in the vessel.

Manual calibration allows you to start using the system as soon as sensors, junction boxes, and signal processor are installed and wired, even if you cannot

move any (or enough) material now. Manual calibration values are based on system parameters, including sensor sensitivity, vessel stress, and signal processor A/D converter sensitivity. These values are known, can be calculated, or can be obtained from the signal processor. Manual calibration is also based on the material weight currently in the vessel.

Note that manual calibration does not take into account the actual response to changes in weight. Theoretically, a change in weight results in a proportional change in digital counts. However, the structure's actual response to load and interaction with piping, catwalks, a roof, discharge chutes, etc. prevents the system from achieving theoretical values. Manual calibration is a good start, but to obtain the highest accuracy, perform a Live Load calibration when scheduling permits you to move material into or out of the vessel.

Refer to the signal processor manual for the procedure to input calibration parameters.

Troubleshooting the L-Cell® / Microcell®

Problem	Description	Solution
Small Amplitude Changes or Erratic Fluctuations in display readings	Small amplitude drift or oscillation, with peak-to peak disturbance of 0.1 % to 0.3 % of full scale, is normal.	Reduce drift or oscillation by setting "count by" and "averaging" appropriately on signal processor (refer to signal processor manual).
	Erratic fluctuations can be caused by moisture in cable conduit, junction boxes, or junction box PCBs.	<p>Check conduit, junction boxes, and PCBs for water contamination. Find water entry source and correct problem. Dry with a hair drier. Remove/replace corroded parts and materials.</p> <p>Caution If using sealant to eliminate water entry, use Sikaflex™ 1A polyurethane sealant, Sikaflex™ ProSelect Construction sealant or Dow Corning™ RTV 739 or RTV 738. Other sealants may contain acetic acid, which is harmful to sensors and electronics.</p>
	Fluctuations can be caused by damaged sensors.	<p>Using Digital Multimeter (DMM), check resistance for individual Sensors:</p> <ol style="list-style-type: none"> Set meter resistance scale to accommodate measured range up to 20,000 Ω. Remove one sensor's wires from junction box terminal TB3. Put one DMM lead on sensor's white wire and other lead on red wire. Record resistance reading, and verify it is: <p>L-Cell: 4000 \pm 10% 3" Microcell: 8500 \pm 10% 2" Microcell: 2000 \pm 10%.</p> <p>If reading is outside this range, the sensor is damaged and must be replaced.</p> Put one DMM lead on the sensor's white wire and other lead on black wire. Record resistance reading, and verify it is within the values indicated in 3. If reading is outside this range, the sensor is damaged and must be replaced. Verify readings from Steps 3 and 4 are within 200 Ω of each other. If not, the sensor is damaged and must be replaced. Repeat Steps 2 through 5 for each suspect sensor, until damaged one is located.

Problem	Description	Solution
Small Amplitude Changes or Erratic Fluctuations in display readings	Fluctuations can be caused by short to ground	<p>Using a Digital Multimeter (DMM) or ohmmeter, check for shorts to ground as follows:</p> <ol style="list-style-type: none"> 1. Set meter resistance scale to accommodate maximum measured range. 2. Disconnect junction box wires from signal processor. 3. With one lead to earth ground and other lead to white wire, check resistance on disconnected junction box wires: <ul style="list-style-type: none"> · If reading is less than infinite (i.e., there is resistance), short is indicated; proceed to Step 4 to identify location. · If no short is indicated, investigate other explanations for problem. 4. Starting with junction box closest to signal processor in daisy chain, disconnect wires connecting junction box to other junction boxes. With one lead to earth ground and other lead to white wire, check resistance on wires leading from junction box: <ul style="list-style-type: none"> · If reading is less than infinite (i.e., there is resistance), short is indicated; proceed to Step 5 to identify location. · If no short is indicated, proceed to next junction box in daisy chain, disconnecting wires connecting it to other junction boxes and checking resistances. Perform for each junction box down chain until short is located; proceed to Step 5 to identify location. 5. Disconnect the wires for one sensor from above identified junction box. With one lead to earth ground and other lead to white wire, check resistance on disconnected sensor wires: <ul style="list-style-type: none"> · If reading is less than infinite (i.e., there is resistance), short is indicated. Replace shorted sensor. · If no short is indicated, disconnect next sensor wires from junction box and check resistances. Repeat for each sensor wired to junction box until short is located. Replace shorted sensor.

Problem	Description	Solution
Small Amplitude Changes or Erratic Fluctuations in display readings	Fluctuations can be caused by problems with signal processor.	Check signal processor excitation voltage and incoming AC voltage for accuracy and stability (refer to signal processor manual).
Repeatable Drift over 24-hour Period	Periodic drift is most likely caused by vessel thermal expansion due to sun's radiation or vessel's response to its own heating cycles.	<ol style="list-style-type: none"> 1. If periodic drift is outside specifications (Appendix A & B), contact Anderson-Negele. 2. If keeping long-term records of material levels, take readings at same time each day to minimize error.
Sudden Change in Display Reading or System Requires Frequent Recalibration	A single broken sensor can cause indicated weight to shift up or down by large amount, up to 100 % of full-scale live load.	Check voltage outputs of individual sensors (refer to Chapter 2, Pre-Installation procedures). Voltage should be between -200 mV and +200 mV on installed sensors. If not, check sensor resistance as described in the previous pages.
	Slipping of a sensor can cause indicated weight to shift suddenly.	<p>If a broken sensor is not indicated, perform following procedure:</p> <ol style="list-style-type: none"> 1. Carefully remove environmental cover from the sensor. 2. Retighten the sensor's socket head cap screws, following procedure in L-Cell® / Microcell® Installation Chapter applicable to installation. 3. Replace environmental cover on the sensor. Follow procedure provided in sensor Installation Chapter applicable to installation.
	Sudden change in weight reading can be caused by problems with signal processor.	Check signal processor excitation voltage and incoming AC voltage for accuracy and stability (refer to signal processor manual).

Spare Parts Recommendations

L-Cell®

We recommend you purchase and maintain the following minimum number of spare parts/tools:

1 Extra per Vessel

- L-Cell® Sensor, each complete with:
Sensor
Environmental Cover
#6-32 socket head cap screws (3)

1 Extra per Plant

- T-handle driver
- Sikaflex™ 1A polyurethane sealant or ProSelect Construction Sealant, or Dow Corning™ RTV 739 or RTV 738
- Anderson-Negele Test Meter

Microcell®

We recommend you purchase and maintain the following minimum number of spare parts/tools:

1 Extra per Vessel

- Microcell® Sensor, each complete with:
Sensor
Environmental Cover
#8-32 socket head cap screws (2)
#8 hardened flat washers (2)

1 Extra per Plant

- T-handle driver
- Sikaflex™ 1A polyurethane sealant or ProSelect Construction Sealant, or Dow Corning™ RTV 739 or RTV 738
- Anderson-Negele Test Meter

Alternate Method of Checking Output

Microcell®

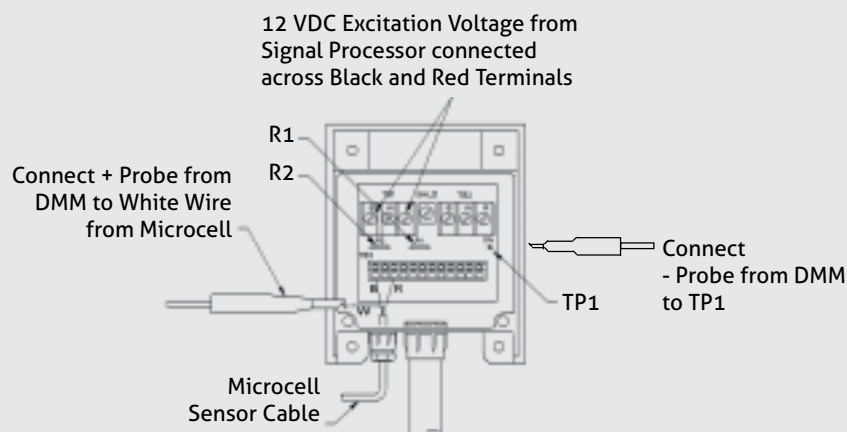
If you do not have an Anderson-Negele Test Meter, use a Digital Multimeter (DMM) to monitor the voltage output of each Microcell® during installation. Set up the DMM as described below and then follow the installation procedure for Mounting Microcell®.

The junction box must be mounted and wired to the signal processor and powered up before following this procedure. See Mounting Junction Box, Wiring Microcells to Junction Box, and Wiring Junction Boxes Together and to Signal Processor before proceeding.

1. **See Figure G-1.** Connect the red wire from the Microcell® cable to the R terminal on terminal block TB3 in the junction box. Connect the black wire to the B terminal on TB3.
2. Connect the signal (+) probe of the DMM to the white wire from the Microcell® cable. DO NOT connect the white wire to the terminal block.
3. Connect the common (-) probe of the DMM to TP1 on the junction box circuit board. If a test point is not present, connect the common probe to the lead of either R1 or R2 nearest the TB2 terminal strip.
4. Set a voltage range on the DMM that will accommodate a measured range of ± 1 volt.
5. Complete installation of the Microcell®, using the DMM to monitor the voltage output as you tighten the screws. See Mounting Microcell® for your installation.

Figure G-1

Using DMM to Monitor Voltage Output



L-Cell®

If you do not have an Anderson-Negele Test Meter, use a Digital Multimeter (DMM) to monitor the voltage output of each L-Cell® during installation. Set up the DMM as described below and then follow the installation procedure for Mounting L-Cell®.

The junction box must be mounted and wired to the signal processor and powered up before following this procedure. See Mounting Junction Box, Wiring L-Cells to Junction Box, and Wiring Junction Boxes Together and to Signal Processor before proceeding.

1. **See Figure G-2.** Connect the red wire from the L-Cell® cable to the R terminal on terminal block TB3 in the junction box. Connect the black wire to the B terminal on TB3.

2. Connect the signal (+) probe of the DMM to the white wire from the L-Cell® cable. DO NOT connect the white wire to the terminal block.
3. Connect the common (-) probe of the DMM to TP1 on the junction box circuit board. If a test point is not present, connect the common probe to the lead of either R1 or R2 nearest the TB2 terminal strip.
4. Set a voltage range on the DMM that will accommodate a measured range of ± 1 volt.
5. Complete installation of the L-Cell, using the DMM to monitor the voltage output as you use the T-handle driver to tighten the screws. See Mounting L-Cell® for details.

Figure G-2
Using DMM to Monitor Voltage Output

