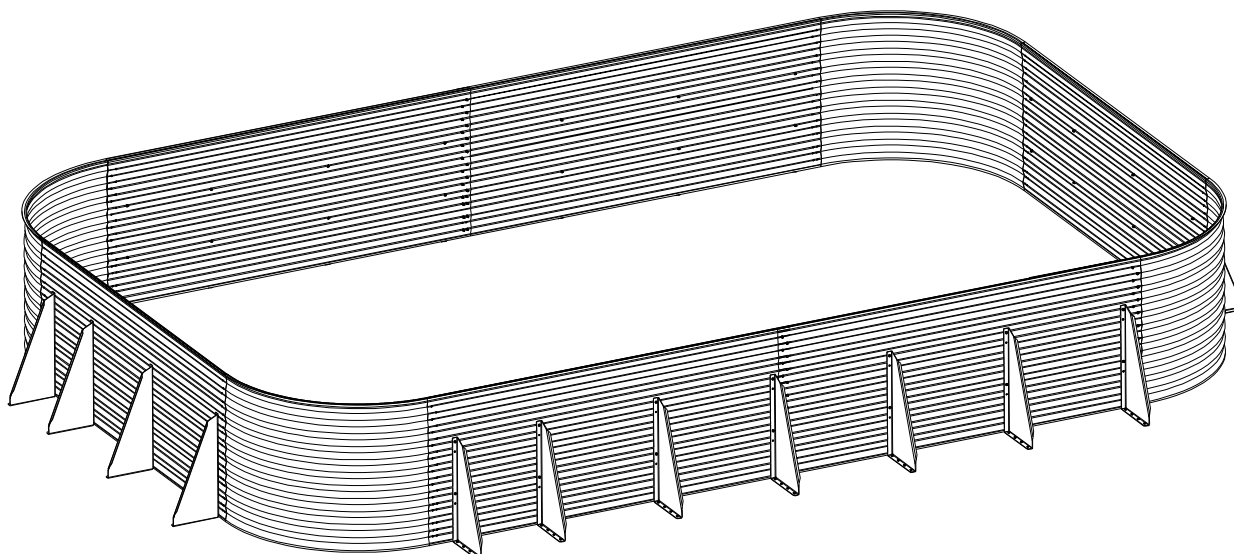




Zero Ground Disturbance C-Ring

Secondary Containment System Installation and Storage Instructions

Original Instructions



Read this manual before using product. Failure to follow instructions and safety precautions can result in serious injury, death, or property damage. Keep manual for future reference.

Part Number: 198799 R6

Revised: November 2018

New in this Manual

The following changes have been made in this revision of the manual:

Description	Section
Updated Safety Decal Locations	2.6. Safety Decal Locations and Details on page 7
Updated the hardware usage chart.	Section 6.4. – Hardware Usage on page 32

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1. Introduction

This manual describes how to assemble a Westeel Zero Ground Disturbance C-Ring.

Before assembling the C-Ring, please read this manual. Familiarize yourself with the process and the necessary precautions for efficient and safe assembly.

Everyone present at the assembly site is required to be familiar with all safety precautions.

Keep this manual available for frequent reference and review it with new personnel. Call your local distributor or dealer if you need assistance or additional information.

2. Safety

2.1. Safety Alert Symbol and Signal Words



This safety alert symbol indicates important safety messages in this manual. When you see this symbol, be alert to the possibility of injury or death, carefully read the message that follows, and inform others.

Signal Words: Note the use of the signal words **DANGER**, **WARNING**, **CAUTION**, and **NOTICE** with the safety messages. The appropriate signal word for each message has been selected using the definitions below as a guideline.



Indicates an imminently hazardous situation that, if not avoided, will result in serious injury or death.



Indicates a hazardous situation that, if not avoided, could result in serious injury or death.



Indicates a hazardous situation that, if not avoided, may result in minor or moderate injury.



Indicates a potentially hazardous situation that, if not avoided, may result in property damage.

2.2. General Product Safety

YOU are responsible for the **SAFE** use and maintenance of your C-Ring. **YOU** must ensure that you and anyone else who is going to work around the C-Ring understands all procedures and related **SAFETY** information contained in this manual.

Remember, **YOU** are the key to safety. Good safety practices not only protect you, but also the people around you. Make these practices a working part of your safety program. All accidents can be avoided.

- It is the C-Ring owner, operator, and maintenance personnel's responsibility to read and understand **ALL** safety instructions, safety decals, and manuals and follow them when operating, or maintaining the equipment.
- Owners must give instructions and review the information initially and annually with all personnel before allowing them to operate the C-Ring. Untrained users/operators expose themselves and bystanders to possible serious injury or death.
- The C-Ring is not intended to be used by children.
- Use the C-Ring for its intended purposes only.
- Do not modify the C-Ring in any way without written permission from the manufacturer. Unauthorized modification may impair the function and/or safety, and could affect the life of the C-Ring. Any unauthorized modification will void the warranty.



2.3. Personal Protective Equipment

The following Personal Protective Equipment (PPE) should be worn when installing the equipment.

Safety Glasses

- Wear safety glasses at all times to protect eyes from debris.



Coveralls

- Wear coveralls to protect skin.



Hard Hat

- Wear a hard hat to help protect your head.



Steel-Toe Boots

- Wear steel-toe boots to protect feet from falling debris.



Work Gloves

- Wear work gloves to protect your hands from sharp and rough edges.



2.4. Safety Decals

- Keep safety decals clean and legible at all times.
- Replace safety decals that are missing or have become illegible. See decal location figures that follow.
- Replaced parts must display the same decal(s) as the original part.
- Replacement safety decals are available **free of charge** from your distributor, dealer, or factory as applicable.

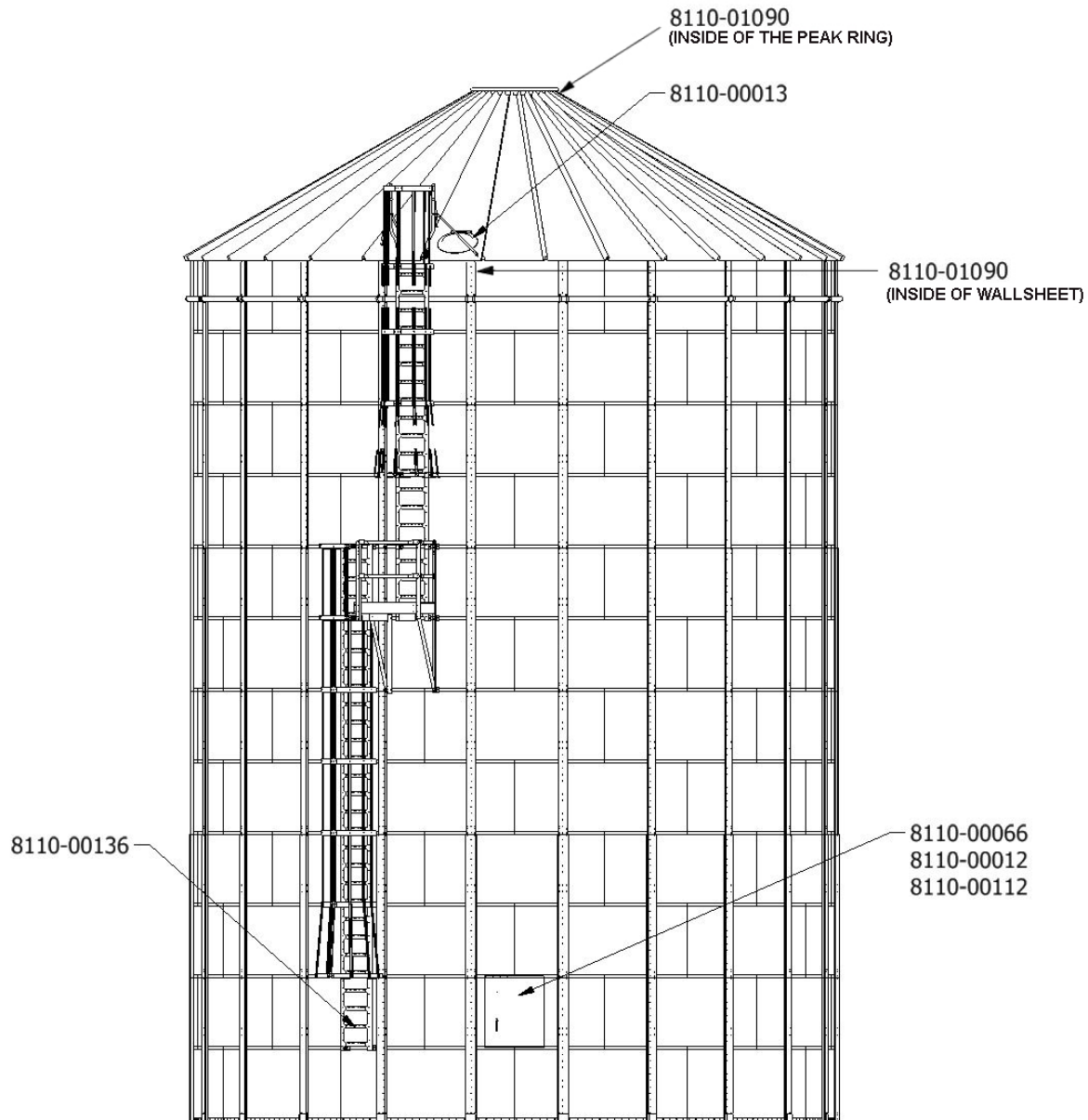
2.5. Decal Installation/Replacement

1. Decal area must be clean and dry, with a temperature above 50°F (10°C).
2. Decide on the exact position before you remove the backing paper.
3. Align the decal over the specified area and carefully press the small portion with the exposed sticky backing in place.
4. Slowly peel back the remaining paper and carefully smooth the remaining portion of the decal in place.
5. Small air pockets can be pierced with a pin and smoothed out using the sign backing paper.

2.6. Safety Decal Locations and Details

Replicas of the safety decals that are attached to the C-Ring and their messages are shown in the figure(s) that follow. Safe operation and use of the C-Ring requires that you familiarize yourself with the various safety decals and the areas or particular functions that the decals apply to, as well as the safety precautions that must be taken to avoid serious injury, death, or damage.

Figure 1. Safety Decals



 WARNING	
	
SAFETY INSTRUCTIONS • Read operator's manual and all safety decals before assembling, using, or servicing bin. • Close/latch all access doors when not in use. • Do not alter or modify bin structure. • Replace any damaged components only with factory made components. • This bin should only be used to store free flowing, granular material, unless specifically designed and marked otherwise. • When filling, use top filler cap and direct material to center of bin. • Do not over-fill bin. Material should not be in contact with or place pressure on roof sheets.	

Part Number: 8110-00012

 WARNING	
	
ENTRAPMENT HAZARD Never enter the bin when loading or unloading grain. If you must enter the bin: 1. Shut off and lock out all power. 2. Use a lifeline, safety harness, and have an observer outside before entering the bin. 3. Wear proper breathing equipment or a respirator. 4. Avoid the center of the bin. Failure to heed these warnings could result in serious injury or death.	

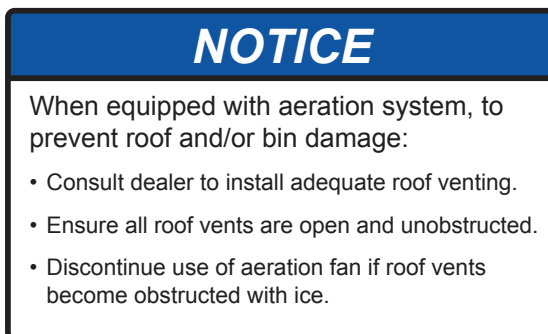
Part Number: 8110-00013

 WARNING		
		
Rotating flighting could kill or dismember.	Flowing material could trap and suffocate.	Crusted material could collapse and suffocate.
Keep clear of all augers. DO NOT ENTER this bin! If you must enter the bin: 1. Shut off and lock out all power. 2. Use a safety harness and safety line. 3. Station another person outside the bin. 4. Avoid the center of the bin. 5. Wear proper breathing equipment or respirator. Failure to heed these warnings could result in serious injury or death.		

Part Number: 8110-00112



Part Number: 8110-00136



Part Number: 8110-00066



Part Number: 8110-01090

3. Before You Begin

3.1. General Information and Requirements

1. The system is intended for secondary containment of a gradual release of fluids with a specific gravity of 1.34 or less (i.e. fluids with densities of 86.0 pounds/cubic foot, or 1340 kg/cubic meter, or less). The configuration of the system is dependent on wall height, and on the specific gravity of the intended fluid as provided in the following table.

Table 1. Number of Braces Required for Various Wall Heights and Liquid's Specific Gravity

Wall Height (in)	Specific Gravity (SG) of Contained Fluid	# of Braces
22	SG $\leq$ 1.34	3 braces for every 2 wall panels
33	SG $\leq$ 1.0	3 braces for every 2 wall panels
33	1.0 < SG $\leq$ 1.34	3 braces per full wall panel
44	SG $\leq$ 1.0	2 braces per full wall panel
44	1.0 < SG $\leq$ 1.34	3 braces per full wall panel
57	SG $\leq$ 1.0	3 braces per full wall panel

Note

This system is not intended for primary containment.

2. For liner requirements see [Section 3.1.3 – System Liner Considerations on page 12](#).
3. For site and soil requirements see [Section 3.1.1 – System Site Considerations on page 10](#).
4. For assembly requirements see [Section 3.1.2 – System Installation Considerations on page 11](#).
5. This system was not designed to resist external flooding.
6. Seismic loading was not considered in the design of this system.

3.1.1 System Site Considerations

1. Check with your local Authority Having Jurisdiction (local, state or provincial, and federal regulatory agencies such as the EPA, AEUB, etc.) regarding this product and its intended application prior to installation. If installing outside of the continental United States or Canada, contact the appropriate local Department of Environment or equivalent. Correct installation is **critical** to the performance of your system.
2. Plan your site well in advance, including access, capacity, and layout. Containment capacity is based on level walls. If your site is not level, the actual capacity of the containment will be reduced. Have installed capacity confirmed by an engineer. Standing water allowed to remain in the ring will reduce the effective capacity of your system. Regular inspection and specific disposal procedures may be required by local regulations. Local Fire Codes may require minimum clearances between the ring and primary containment tank(s).
3. The site must be sufficiently level and free of obstructions to allow wall sheet assembly without distortion or unsafe assembly conditions. There can be no high or low spots that result in suspended or bridged support pads along the length of the walls.
4. A packed base is required. The soil must be capable of supporting the brace/pad systems. This requires soil with a soil to soil static friction coefficient of 0.5 or better. Literature suggests that a packed sand base will consistently provide this requirement. Physical tests conducted with 4" or better, of a packed sand base,

consistently satisfied this requirement. If in doubt about the characteristics of soil conditions on site, consult a qualified professional engineer to certify that the site soils are suitable, or to suggest remedial action as required.

Table 2. Friction Coefficients for Sand

Type of Sand	Loose	Dense
Uniform sand, rounded particles	.51	.70
Well-graded sand, angular particles	.65	1.00
Sandy gravel	.70	1.19
Silty sand	.51 to .58	.58 to .67

(Derived from Soil Mechanics 2nd Edition, R. F. Craig)

- The soil conditions must be maintained throughout the life of the system. The soil supporting the pads cannot be allowed to erode away. Therefore site specific factors such as drainage, weather patterns, wind patterns, annual climatic factors, and other erosion factors must be considered in the installation. Depending upon the presence of these factors, there may be an ongoing maintenance requirement to insure that site conditions remain consistent with the requirements of the system, throughout the life of the system.
- Depending on system configuration, the resistance to external wind loading varies. The difference depends upon the presence, or not, of 4" of sand evenly spread on the top of the liner, inside the wall, such that the pads, and the intervening spaces, are completely covered. Another consideration depends upon the presence, or not, of 4" of sand completely covering the pad on the outside of the wall. Increasing the depth (i.e. weight) of the sand will improve the wind loading characteristics.

The values presented in the following table are the corresponding allowable reference velocity pressures (q) (kPa), as defined in the National Building Code of Canada (NBC). Values of " q " (kPa) for selected locations in Canada are provided in the NBC.

Table 3. Allowable Reference Velocity Pressures

Allowable Reference Velocity Pressures " q " (kPa) – 2 Pad Systems			
Wall Height (in)	C-Ring Structure Only	With 4" Sand Inside	With 4" Sand Inside and Outside
22	0.27	0.89	1.25
33	0.21	0.80	1.00
44	0.18	0.51	0.63
Allowable Reference Velocity Pressures " q " (kPa) – 3 Pad Systems			
57	0.22	0.49	0.61

3.1.2 System Installation Considerations

- All pads must be fully engaged in the underlying soils. All voids within the pad must be filled with soil. There can be no bridging, or suspended pads along the length of the wall.
- A packed base is required.
- The liner attachment to the wall must be as per the installation instructions. Along the straight wall sections of the oblong or rectangular systems, the liner/wall connection should be consistent, free of puckers and folds, and free of high and low spots. In the event the liner must carry load, the transfer of load should be



uniform along the entire length of the wall. The liner should not be bunched, or bagged along a straight wall, rather a smooth consistent curve between the vertical wall section and the horizontal flat section is required. Some puckering and folding is inevitable against the rounded ends of an oblong system or in the corners of a rectangular system and is acceptable in these areas only.

4. The friction characteristics between the steel pads and the protective geo-textile cloth, and between the cloth and the liner, can be improved upon by spreading a film of sand between these components. This is encouraged.

3.1.3 System Liner Considerations

1. The liner forms an integral part of the structural integrity of this system. Ultimate liner selection and installation is the responsibility of others. However the liner must be at least 30 mil and have tensile strength characteristics equal to, or greater than, 66 ppi stress at yield (not to be confused with stress at break).
2. Any welds in the liner must have a bonded seam strength equal to or greater than 66 ppi. If not, there can be no welded seam, running parallel to a straight segment of the wall, within seven feet of the wall.
3. The liner must maintain its physical properties for the life of the system. Therefore, its aging and weathering characteristics, compatibility with materials present, etc. must be considered in the selection and installation of the liner.

3.1.4 Concrete Pad Considerations

This system can be readily adapted for installation to a concrete pad. The support pads are not required and the braces can be attached directly to the concrete. The design of the pad and the attachment of the system to the pad, is the responsibility of others.

4. Preparation

4.1. Check Shipment

Unload the parts at the assembly site and compare the packing slip to the shipment. Ensure that all items have arrived and that none are damaged.

Report damaged parts or shortages immediately to the delivering carrier, followed by a confirming letter requesting inspection by the carrier, if required. Order any replacement parts immediately to ensure that assembly will not be held up by missing parts. All parts will be charged for and credit will be issued by party at fault. No credit will be issued if freight bills are signed as received in good condition.

4.2. Recommended Installation Equipment



CAUTION Some parts and equipment are heavy.

Use suitable lifting equipment to avoid injury.

- Transit
- Carpenter's Level
- Concrete Finishing Tools (if required)
- Shovel
- 9/16" wrenches and sockets
- Wrench Set
- Tape Measure - 100'
- TEKS® Screw gun w/ 3/8" bit
- Mineral spirits and rags
- Back-Hoe (for panels set into grade)
- Post Hole Digger — 12" or 16" depending on application
- Front End Loader
- Industrial Grade Drill
- Set of Drill Bits (carbide tipped)
- Impact Wrench (air or electric) w/ 9/16" socket
- Sharp Industrial Scissors
- Sufficient material to provide temporary supports

4.3. Order Optional Equipment

Optional equipment such as unloading augers, aeration equipment, anchor bolts, foundation sealant, external ladders, safety cage and platforms, etc., should all be on site and checked before assembly starts. Plan your installation in advance. For details, see assembly instruction supplied with optional equipment.



5. Assembly



Before continuing, ensure you have completely read and understood this manual's Safety section, in addition to the safety information in the section(s) below.

5.1. Assembly Safety

WARNING

- Do not take chances with safety. The components can be large, heavy, and hard to handle. Always use the proper tools, rated lifting equipment, and lifting points for the job.
- Carry out assembly in a large open area with a level surface.
- Always have two or more people assembling the C-Ring.
- Make sure you have sufficient lighting for the work area.
- Tighten all fasteners according to their specifications. Do not replace or substitute bolts, nuts, or other hardware that is of lesser quality than the hardware supplied by the manufacturer.
- Stay away from overhead power lines and other obstructions during assembly. Contact with power lines can cause electrocution.
- Do not work in high winds.

5.2. General Assembly

Before assembling the containment system:

1. Verify that all parts are present.
2. Read the following instructions carefully.
 - a. Locate the material list for your system. It can be found on the packing list included with the shipment.
 - b. Replace or order, any shortages or damaged parts immediately to ensure that your installation is not held up by missing parts.
3. Review the contents of this manual.
4. Refer to any site-specific drawings for additional information relevant to your installation.
5. Consult your dealer with any questions.

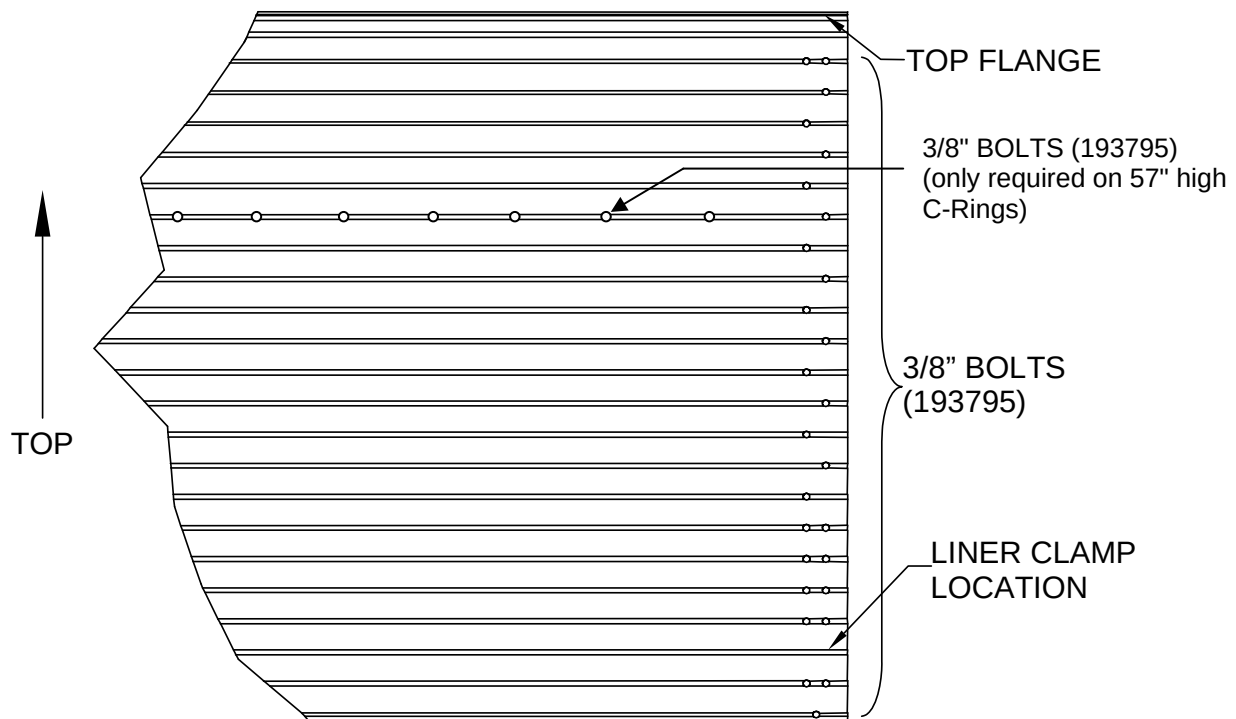
Important

Failure to follow assembly instructions may compromise the integrity of your containment ring installation and may void warranty.

5.3. Wall Panel Orientation

Figure 2. Wall Panel Orientation

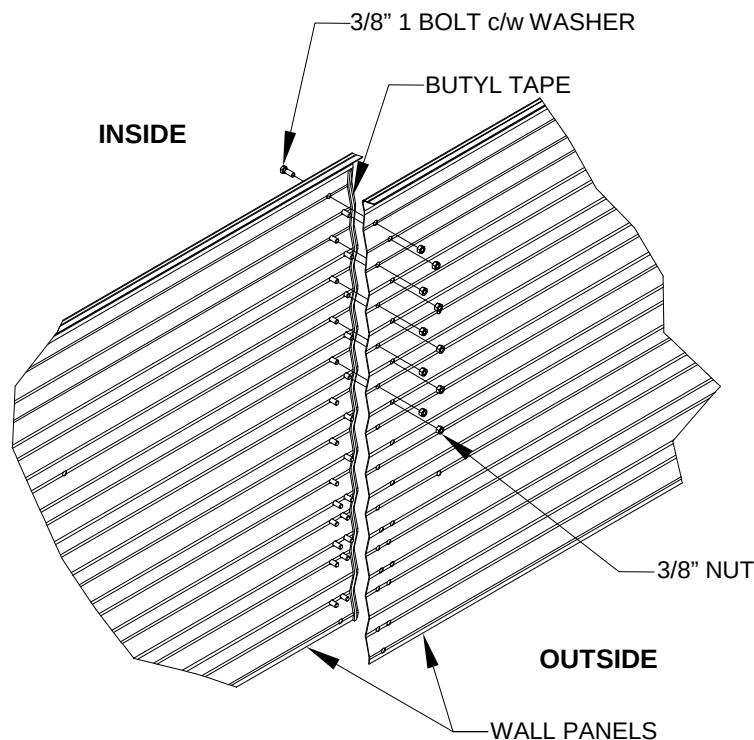
(57" panel shown)



5.4. Assembly Procedure

1. Referring to the section on Site Planning ([Section 5.5 – Site Planning on page 21](#)), lay out the site.
 - a. If required, lay down the sand base as specified in the System Site Considerations section ([Section 3.1.1 – System Site Considerations on page 10](#)).
 - b. Level and pack the site carefully to maintain capacity and avoid assembly problems.
 - c. Prepare the inner area for liner installation following the manufacturer's specifications.
2. Paint or stake out lines that lay out the length and width of the system, making sure to square them.
 - a. Make the lines long enough past the intersections of the length and the width so that the locations will be visible beyond the stretched out liner.
 - b. Unroll the liner and position it evenly over the layout.
 - c. Roll back the edges of the liner 4 to 5 feet past the layout lines, leaving enough room for the pads
3. If installing an oblong system, start by assembling the curved ends.
 - a. Loosely assemble the wall panels in place.
 - b. Wipe any oil off the sealing surface.
 - c. Install a butyl tape strip on each panel as shown in [Figure 3 on page 16](#).

Figure 3. Apply butyl tape and assemble wall sheets



- d. Place the butyl tape between the bolt holes and the edge of the wall sheet that is towards the inside of the containment cell.
- e. Install 3/8" x 1" bolts loosely with the heads on the inside.
- f. Do not tighten bolts until all panels and braces are in place and leveled.

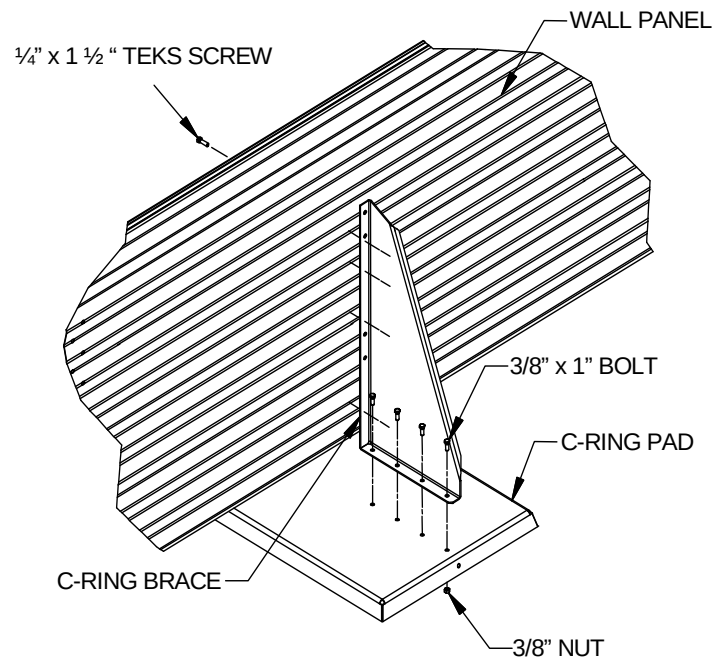
- g. Install curved panels 'inside' straight panels for best fit.

Note

The location of the butyl tape relative to the bolt holes is critical. The contained liquid should not be able to reach the bolt hole locations.

4. Once the ends of an oblong system are assembled, or if the system is rectangular, position the pads along the marked lines of the straight wall sections as shown in the Site Planning section ([Section 5.5. – Site Planning on page 21](#)).
5. Assemble the straight sheets as described in [Step 3 on page 16](#).
 - a. Assemble the braces to the wall sheets and pads as shown in [Figure 4 on page 17](#).

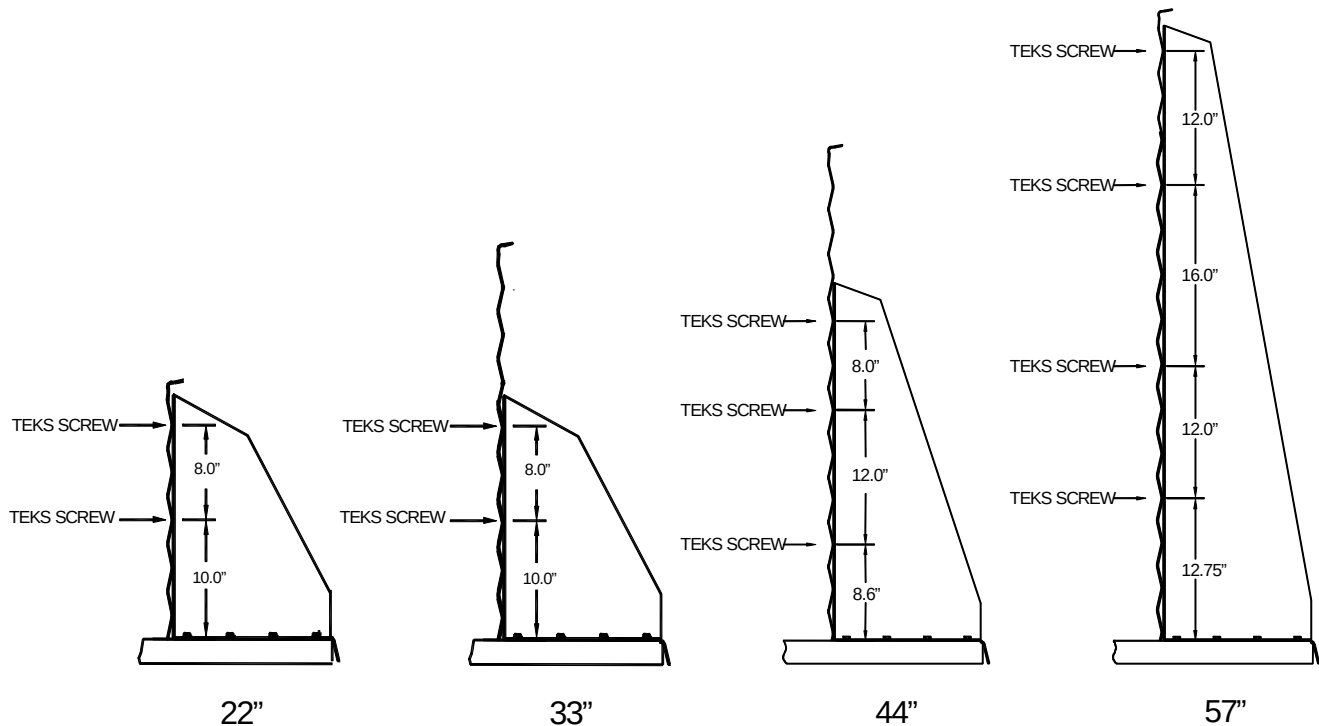
Figure 4. Assemble the braces to the wall sheet



- b. Once installed the pads must be fully engaged with the soil.
6. Before installing the liner, cover all panel seams and sharp edges below the liner clamp with a strip of geotextile material to prevent liner damage.
7. Cover the pads completely with geotextile material.
8. Sprinkle sand between the pad and geotextile material, and between the geotextile material and liner, to improve friction characteristics.

5.4.1 Wall Panel TEKS Screw Locations

Figure 5. TEKS screw locations for various size braces



1. Attach the braces to the wall panels with TEKS screws as shown in [Section 5.4.2 – Straight Wall Panel Brace Locations on page 19](#).

The 22" and 33" panels require two TEKS screws, the 44" panel requires three TEKS screws, and the 57" panel requires four TEKS screws.

2. Make sure that the wall sheets and braces are tight together before and after the TEKS screw installation.
3. Replace all TEKS screws that "climb and spin out" on the wall sheet before penetrating the brace.
4. Replace all TEKS screws that have a damaged or "spun out" sealing washer.
5. If replacing TEKS screws:
 - a. use a larger diameter TEKS screw (not supplied) to ensure connection and sealing integrity

OR

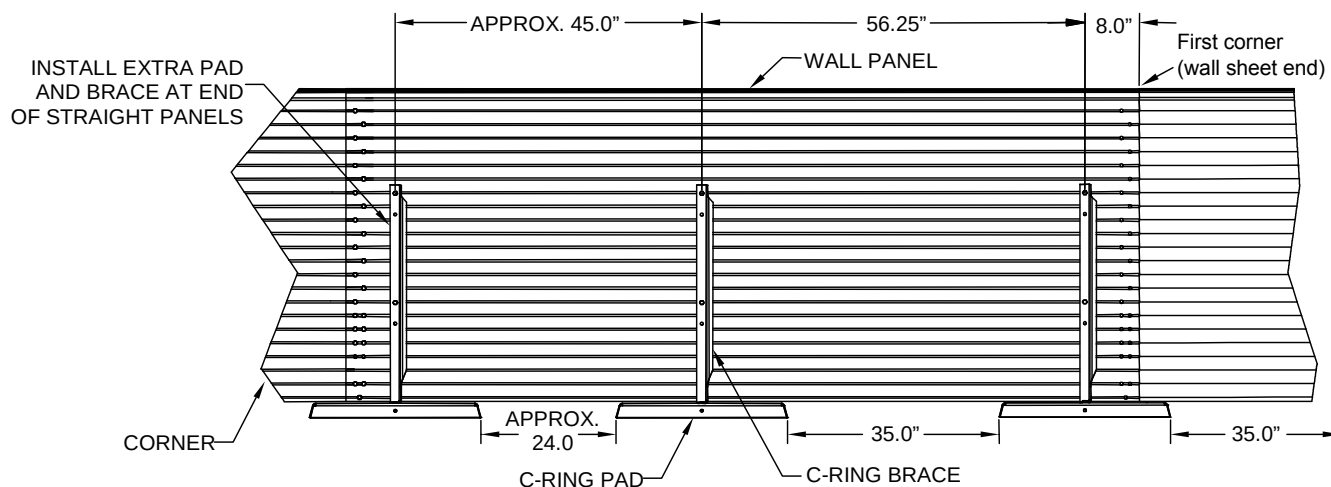
 - b. use 3/8 x 1.5" bolts in place of TEKS screws
6. When replacing TEKS screws with bolts:
 - a. Use the bolt holes located in the braces as pilots and drill through the wall sheets.
 - b. Put the bolt heads with sealing washers on the inside.
The bolt holes line up with valleys in the wall sheets.
 - c. Use a 1/2" nut as a spacer (not included but available as part of brace hardware package C10316).

5.4.2 Straight Wall Panel Brace Locations

22", 33" and 44" Petroleum and 22" Fertilizer Containment Systems

1. Support the wall panels at two points per full panel (one point per half panel) with a brace and pad.
2. Start the first brace 8" away from the first corner and space out at 56.25" from there as shown in [Figure 6 on page 19](#).

Figure 6. Brace/pad spacing for 22", 33" and 44" petroleum, and 22" fertilizer containment systems



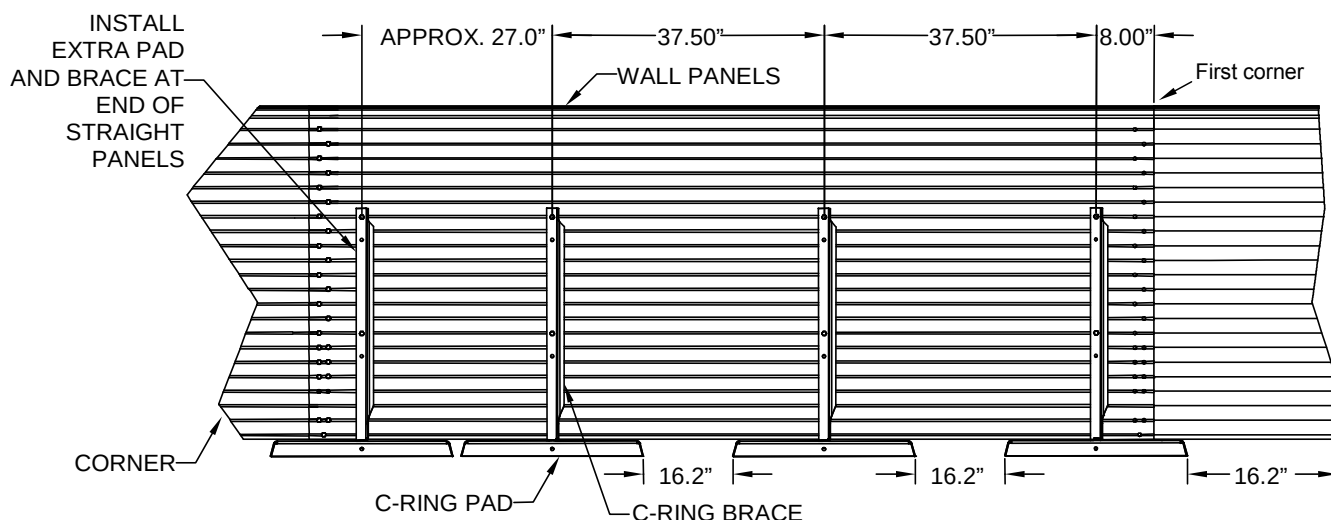
3. Attach an extra brace at the end of a row of straight panels.

For layout details see [Section 5.5.2 – Oblong System Installation Guidelines on page 24](#) and [Section 5.5.3 – Rectangular System Installation Guidelines on page 26](#).

33" and 44" Fertilizer Containment Systems

1. Support the wall panels at three points per full panel (two point per half panel) with a brace and pad.
2. Start the first brace 8" away from the first corner and space out at 37.5" from there as shown in [Figure 7 on page 19](#).

Figure 7. Brace/pad spacing for 33" and 44" fertilizer containment systems



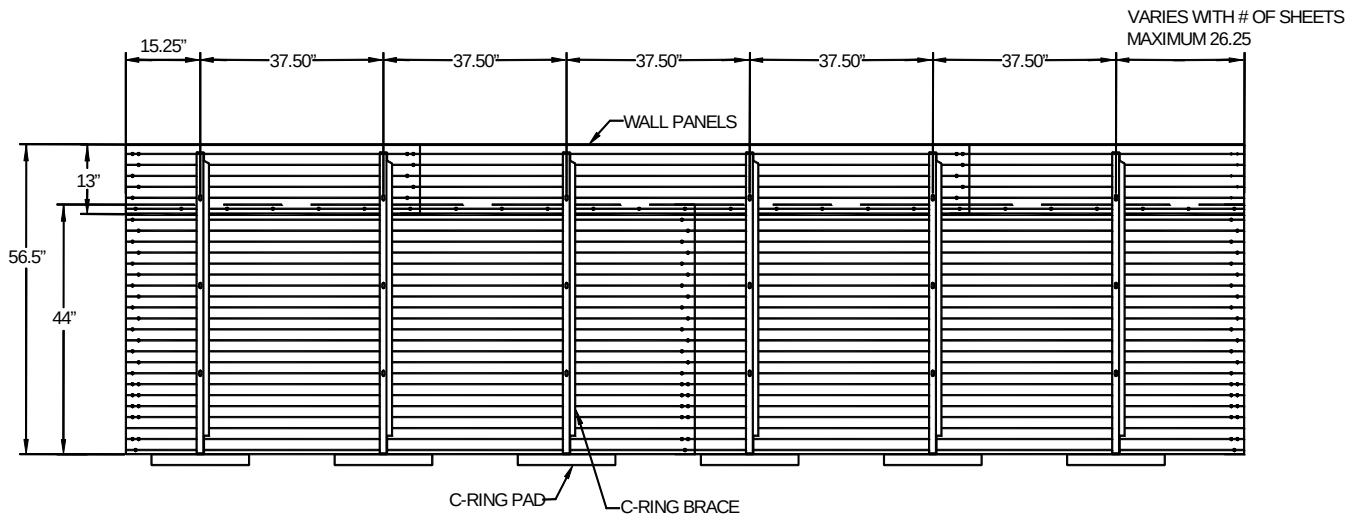
3. Attach an extra brace at the end of a row of straight panels.

For layout details see [Section 5.5.2 – Oblong System Installation Guidelines on page 24](#) and [Section 5.5.3 – Rectangular System Installation Guidelines on page 26](#).

57" Petroleum Systems

1. Support the wall panels at three points per full panel with a brace and pad.
2. Start the first brace 15.25" away from the first corner and space out at 37.5" from there as shown in [Figure 8 on page 20](#).

Figure 8. Brace/pad spacing for 57" petroleum containment systems

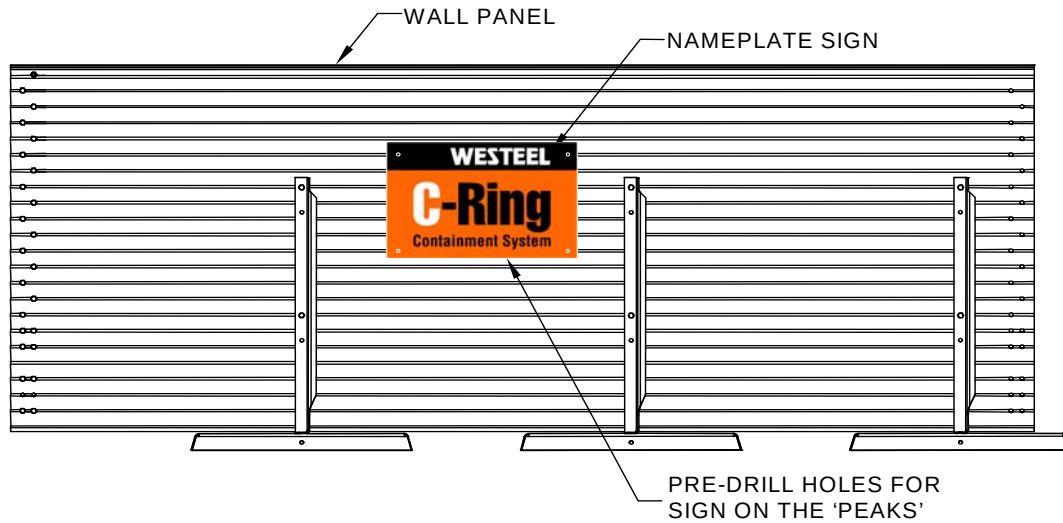


3. The distance between the last brace and the corner will vary with the number of panels.

For layout details see [Section 5.5.2 – Oblong System Installation Guidelines on page 24](#) and [Section 5.5.3 – Rectangular System Installation Guidelines on page 26](#).

5.4.3 Nameplate Sign Installation Detail

1. Locate the sign in a high visibility area.
2. Wipe wall panel to remove oil.
3. Mark holes on the panel on the 'peaks'.
4. Pre-drill holes.
5. Attach the sign on the wall panel using 3/8" x 1" bolts. Put the bolt heads with the sealing washers on the inside.

Figure 9. Nameplate Sign Installation Detail**Note**

The sign must be installed to identify the product and validate the warranty.

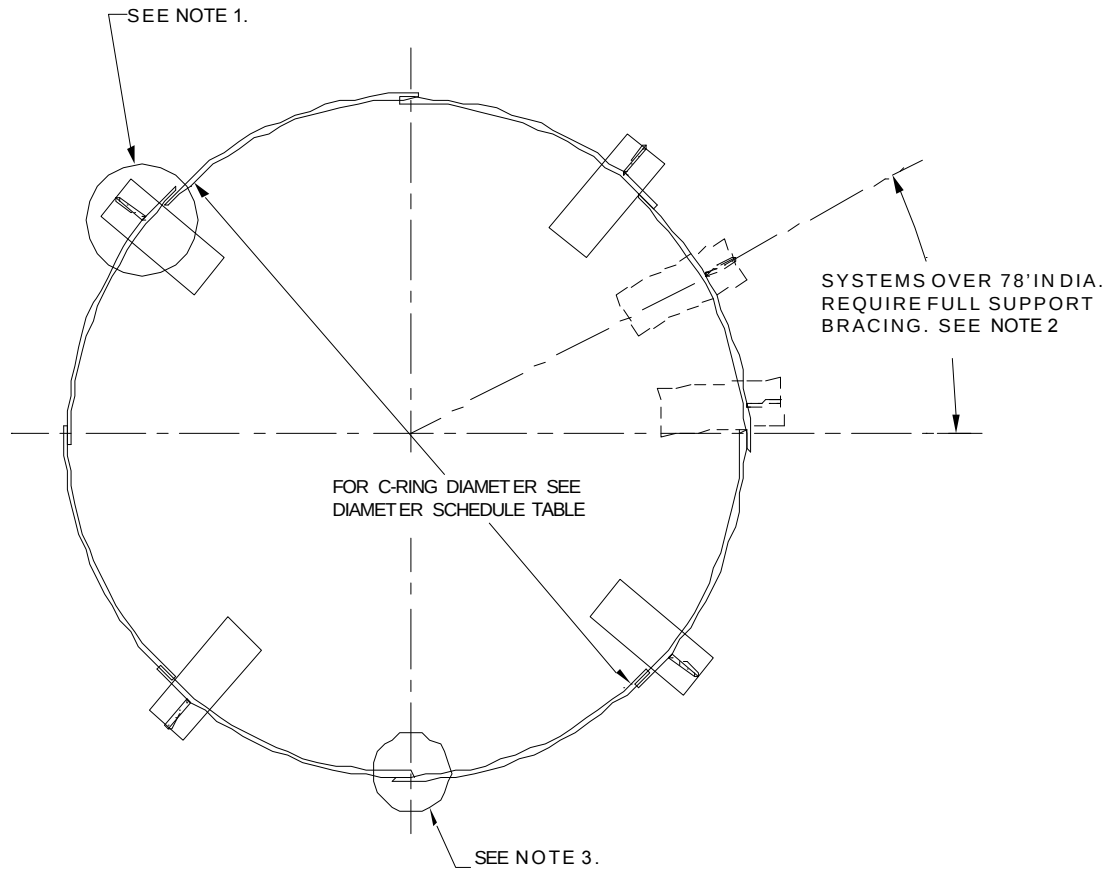
5.5. Site Planning

5.5.1 Round System Installation Guidelines

Table 4. Diameter Schedule for Round Secondary Containment System

Nominal Diameter (ft)	Actual Diameter (in)	Number of Panels
6'	71-5/8"	2
9'	107-3/8"	3
15'	179"	5
18'	214-3/4"	6
21'	250-5/8"	7
24'	286-1/2"	8
27'	322-1/4"	9
30'	358"	10
31.5'	376"	10.5
33'	393-7/8"	11
36'	429-3/4"	12
42'	501-3/8"	14
43.5'	519-1/4"	14.5
48'	573"	16
49.5'	590-7/8"	16.5
54'	644-1/2"	18
60'	716-1/4"	20
66'	787-3/4"	22
72'	859-3/8"	24
78'	931"	26



Figure 10. Round Secondary Containment System Layout

TYPICAL 4-PAD ANCHOR SYSTEM SHOWN

Note

Pad anchoring system is for wind and flood conditions. Determining the need for anchoring and the suitability of any alternate anchoring method is up to the customer.

Note

1. For brace to sheet assembly information refer to [Section 5.4.1 – Wall Panel TEKS Screw Locations on page 18.](#)
2. For full support bracing refer to [Section 5.5.3 – Rectangular System Installation Guidelines on page 26.](#)
3. For panel seam detail refer to [Section 5.4. – Assembly Procedure on page 16.](#)

Important

- A minimum of four pads are required to anchor round systems up to 78' in diameter. Equally space pads on diameter as shown. Anchor kits (containing four pads, four braces, and hardware) are available from Westeel. For brace and pad installation refer to:
 - [Section 5.4. – Assembly Procedure on page 16](#)
 - [Section 5.4.1 – Wall Panel TEKS Screw Locations on page 18](#)
 - [Section 5.4.2 – Straight Wall Panel Brace Locations on page 19](#)
- Round C-Ring systems require full support bracing if the diameter exceeds 78 ft. Use the pad spacing specified for the straight panels in [Section 5.4.2 – Straight Wall Panel Brace Locations on page 19](#) for the specific wall height.

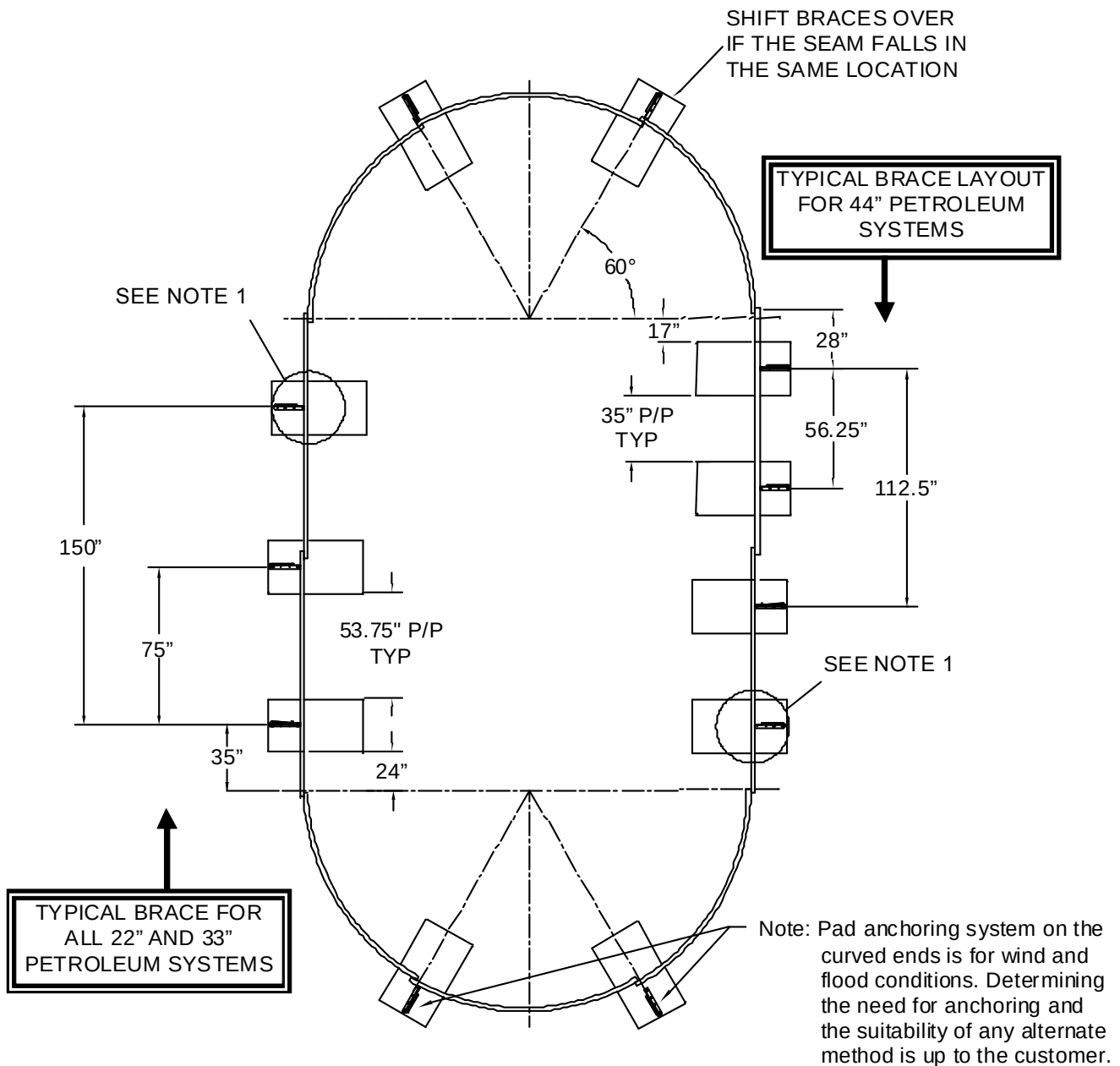
Wellhead Systems

- Six-foot and nine-foot diameter wellhead systems are made up of 21.5" high panels.
- Assemble as per procedures in [Section 5.4. – Assembly Procedure on page 16](#).
- Anchor braces and pads are not required if a minimum 4" embedment is used.



5.5.2 Oblong System Installation Guidelines

Figure 11. Oblong Secondary Containment System Layout



Note

Layout shown is general only, refer to site-specific drawing for your application.

Note

1. For brace assembly detail refer to [Section 5.4. – Assembly Procedure on page 16.](#)

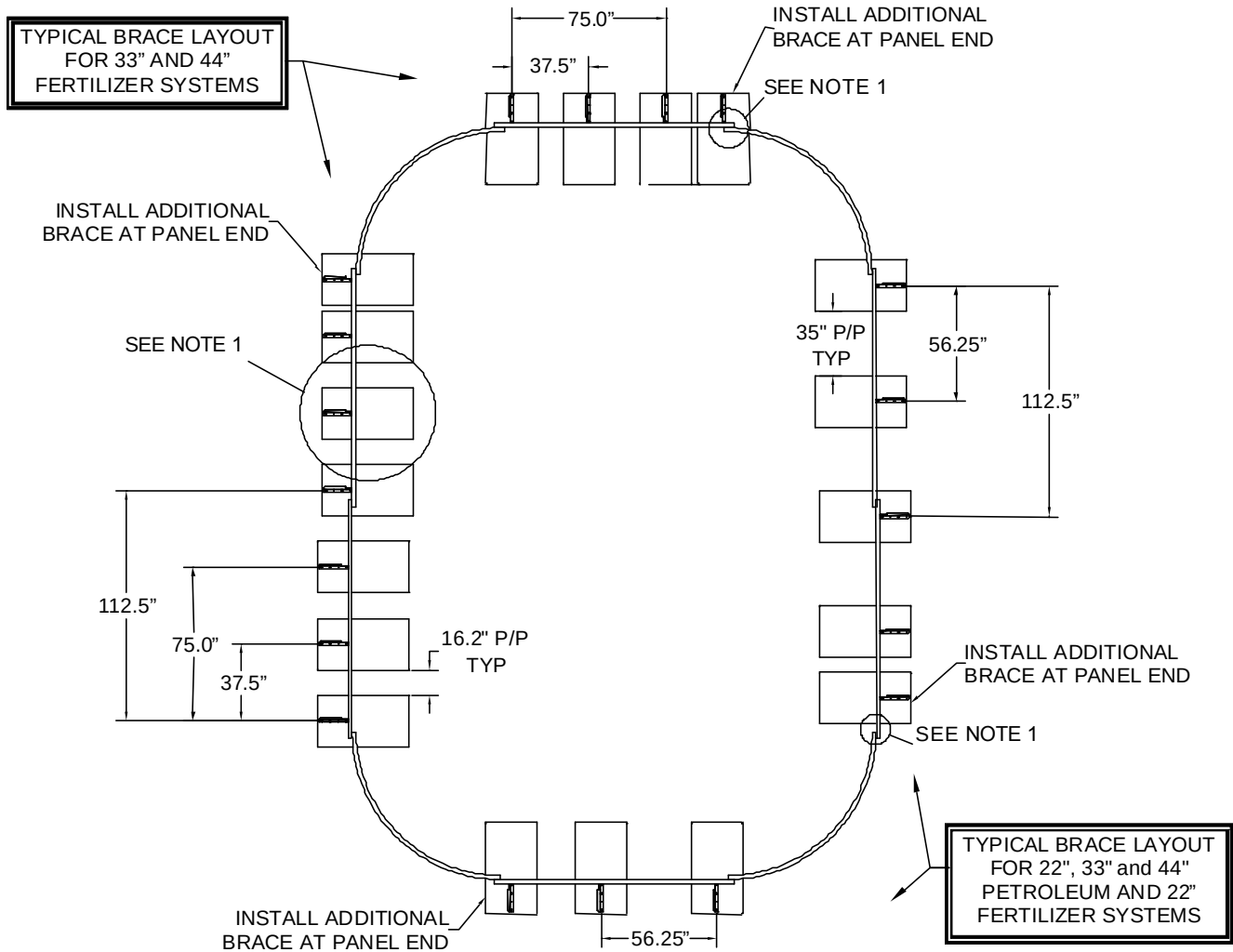
Important

- **Brace locations are referenced from the right end of the panel when viewed from outside the ring.**
- Spacing (not shown in the diagram on this page):
 - Straight panels for 22" and 33" petroleum applications (s.g. < 1.0) and 22" fertilizer applications (s.g. ≤ 1.34) use a 75" spacing (3 pads / 2 full panels).
 - Straight panels for 44" petroleum applications (s.g. < 1.0) use a 56–1/4" spacing (2 pads / full panel)
 - Straight panels for 33" and 44" fertilizer applications (s.g. ≤ 1.34) use a 37½" spacing (3 pads / full panel).
 - Straight panels for 57" petroleum applications (s.g. ≤ 1.0) use a 37 1/2" spacing (3 pads / full panel).
- For best fit and appearance, install curved panels inside straight panels as shown in [Figure 11 on page 24](#).
- Oblong system ends require full support bracing if the diameter exceeds 78 ft. Use the pad spacing specified in [Figure 11 on page 24](#)
 - For systems 78 ft and less, in diameter, 2 braces per end are required. These braces should be located at 60 degrees from the end of the curved portion.
- Some diameters (15', 21', 27', & 33') require a half-panel on each end to complete the semi-circle.



5.5.3 Rectangular System Installation Guidelines

Figure 12. Rectangular Secondary Containment System Layout



Note

Layout shown is general only, refer to site-specific drawing for your application.

Note

1. For brace assembly detail refer to [Section 5.4. – Assembly Procedure on page 16](#).

Important

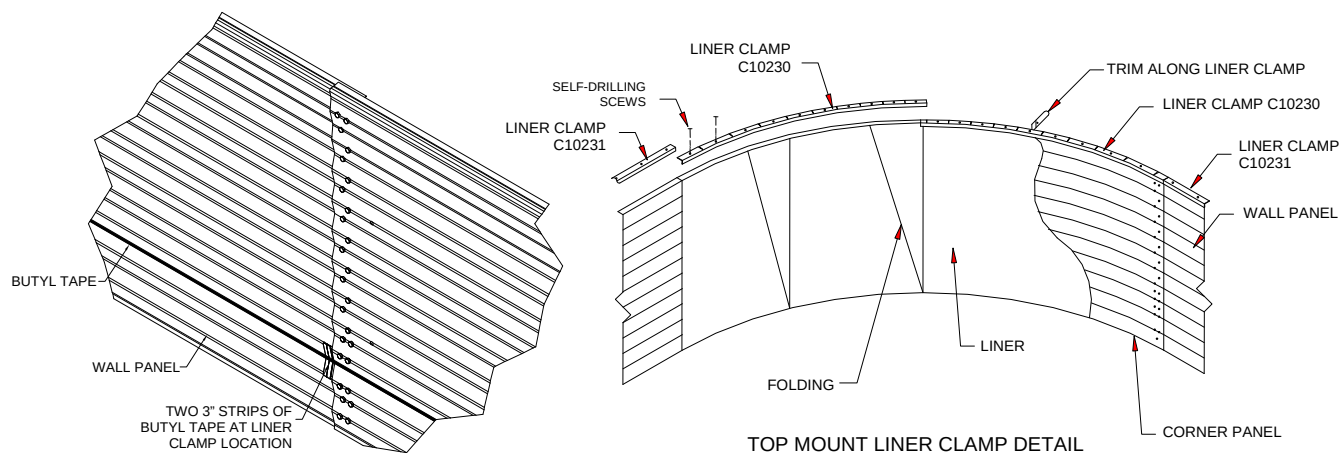
- **Brace locations are referenced from the right end of the panel when viewed from outside the ring.**
- Spacing (not shown in the diagram on this page):
 - Straight panels for 22" and 33" petroleum applications (s.g. < 1.0) and 22" fertilizer applications (s.g. ≤ 1.34) use a 75" spacing (3 pads / 2 full panels).
 - Straight panels for 44" petroleum applications (s.g. < 1.0) use a 56–1/4" spacing (2 pads / full panel)
 - Straight panels for 33" and 44" fertilizer applications (s.g. ≤ 1.34) use a 37 1/2" spacing (3 pads / full panel).
 - Straight panels for 57" petroleum applications (s.g. ≤ 1.0) use a 37 1/2" spacing (3 pads / full panel).

Overall Length Calculations

- **WIDTH** = No. of Wall Panels x Bolted Length (112.5 full, 56.25 half) + 144" (Both Curved Corner Panels) or + 16" (90° Corners)
- **LENGTH** = No. of Wall Panels x Bolted Length (112.5 full, 56.25 half) + 144" (Both Curved Corner Panels) or + 16" (90° Corners)

5.5.4 Liner Installation

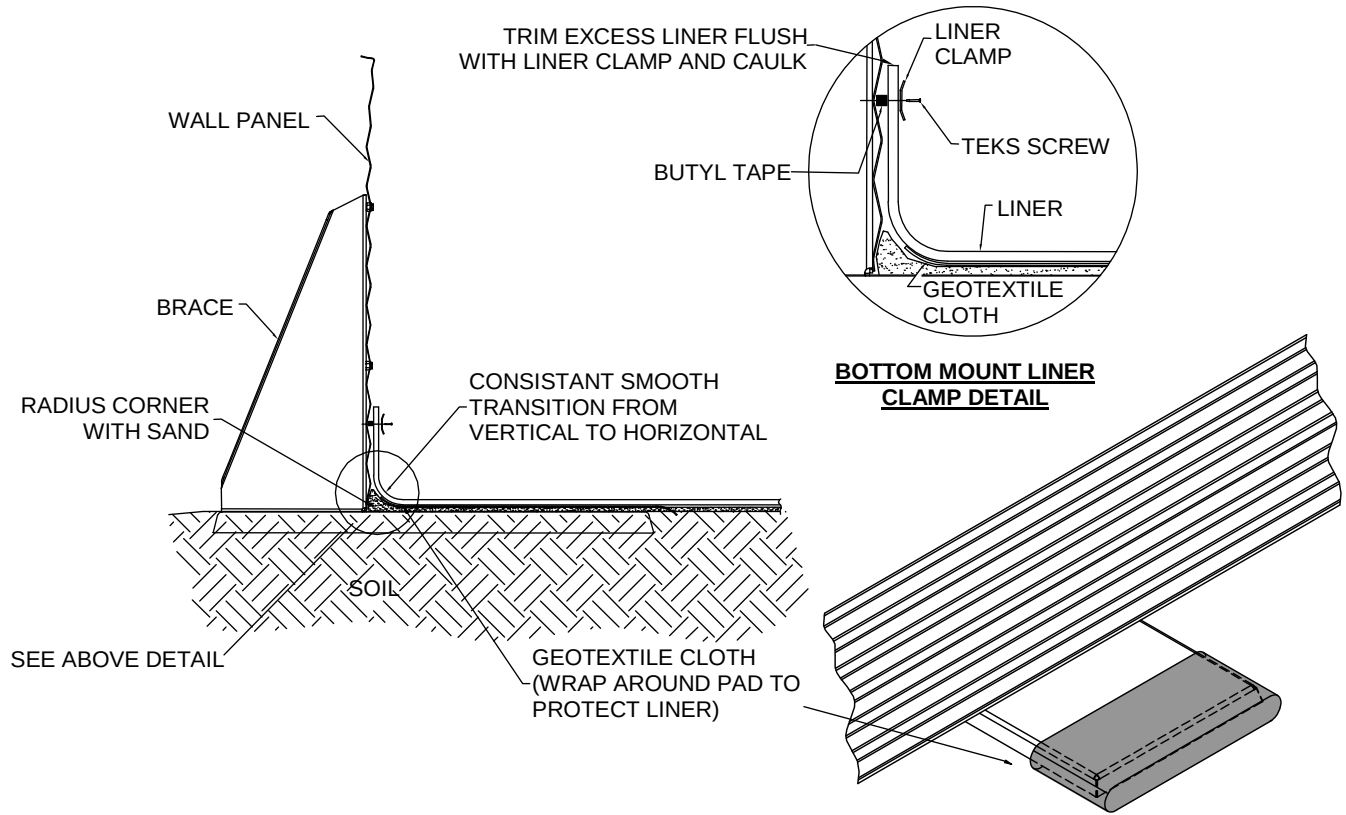
- Before installing the liner, at the wall panel seams, place two 3" long strips of butyl tape in the "valley" at the bottom liner clamp location as shown in [Figure 13 on page 27](#).
 - Make sure the strip is butted up against the edge of the lapping wall panel.
 - Apply a continuous butyl tape strip around the entire cell.

Figure 13. Applying butyl tape to wall panels and top mount liner clamp detail

- When installing the liner, ensure the liner transitions smoothly from the wall sheet (vertical) to the ground (horizontal) as shown in [Figure 14 on page 28](#).
 - Place a geotextile cloth between the liner and the steel pad to protect the liner from sharp edges.
 - Alternatively, the steel pad can be wrapped in the geotextile cloth.
 - After the liner is fully installed and all the clamps are securely in place, trim away the excess liner, using the top edge of the liner clamp as a guide.

- d. Then, apply a bead of caulking at the wall/clamp interface, all around the system.

Figure 14. Ensure the liner transitions smoothly from wall to ground



6. Appendix

6.1. Accessories and Options

Figure 15. Accessories and Options



10417 C-Ring Ladder



C-Ring Crossover Stairs

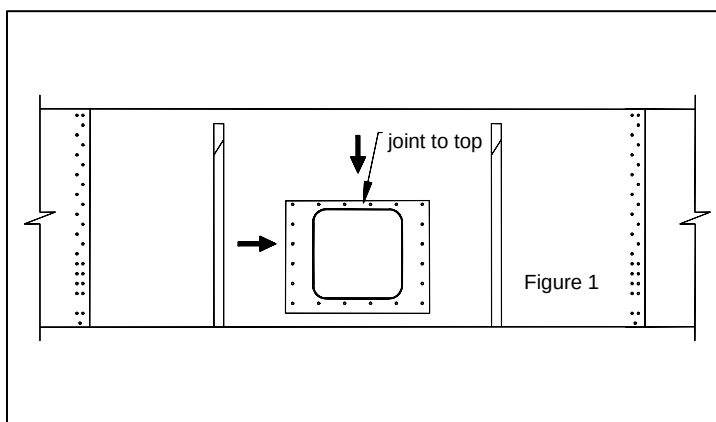
33" (C10463)

44" (C10464)

57" (C10538)

4' platform options

6' platform options



10499 C-Ring Access Door

6.2. Recommended Bolt Assembly

When tightening bolts, tighten the nut on the bolt until a “snug-tightened condition” has been achieved. A “snug-tightened condition” is defined in *Specification for Structural Joints Using ASTM A325 or A490 Bolts* (Research Council on Structural Connections: June 2004), which states:

*“The snug-tightened condition is the tightness that is attained with a few impacts of an impact wrench or the full effort of an ironworker using an ordinary spud wrench to bring the connected plies into **firm contact**.”*

A properly tightened bolt will compress the sealing washer noticeably. All assembly crew members must be made aware of this requirement, and must know how to achieve a snug-tightened condition using common bin-building tools.

It is important that the bolts in the vertical wall sheet seams are tightened enough to squeeze the caulking and bring the wall sheet surfaces into firm contact with each other. This is especially important to monitor when installing bolts in temperatures approaching -10°C (14°F).

The following table shows the minimum impact gun torque capacity necessary to achieve a snug-tightened condition for bolts used in the assembly process.

Table 5. Recommended Impact Gun Torque Values Capacity to Achieve Snug-Tightened Bolts

Bolt Diameter	Bolt Grade	Grade Mark	Recommended Torque Capacity		
			in-lb	ft-lb	N-m
1/4"	Grade 8.2		75	6	8
5/16"	Grade 8.2		215	18	24
3/8"	Grade 8.2		370	31	42
7/16"	Grade 8.2		600	50	68
1/2"	Grade 8.2		960	80	108
5/8"	Grade 8.2		1800	150	203
3/4"	Grade 5		3230	269	365

For proper sealing, do not overtighten the wall seam connections. Sealing is not critical on upright splice connections; these connections should be tightened securely to prevent loosening.

Hold the bolt head securely when tightening the nut to prevent damage to the sealing washer.

Important

ALWAYS TIGHTEN THE NUT, NOT THE BOLT!

Avoid bin assembly at temperatures below -10°C (14°F) if possible. Erection in low temperatures does not ensure strong, well sealed connections. Do not substitute bolts in place of those supplied by Westeel.

6.3. Parts Chart

Table 6. Parts

ITEM	PART NUMBER	DESCRIPTION
1	CPAD22	C-RING PAD FOR 22" PANELS
2	CPAD3344	C-RING PAD FOR 33" & 44" PANELS
3	CPAD57	C-RING PAD FOR 57" PANELS
4	CBRACE2233	C-RING BRACE FOR 22" & 33" PANELS
5	CBRACE44	C-RING BRACE FOR 44" PANELS
6	CBRACE57	C-RING BRACE FOR 57" PANELS
7	CW2215F	22" C-RING SHEET, 15 GAUGE FULL PANEL
8	CW2215H, C10510	22" C-RING SHEET, 15 GAUGE HALF PANEL
9	CW3315F	33" C-RING SHEET, 15 GAUGE FULL PANEL
10	CW3315H, C10511	33" C-RING SHEET, 15 GAUGE HALF PANEL
11	CW4415F	44" C-RING SHEET, 15 GAUGE FULL PANEL
12	CW4415H, C10512	44" C-RING SHEET, 15 GAUGE HALF PANEL
13	CW4413F	44" C-RING SHEET, 13 GAUGE FULL PANEL
14	CW4413H	44" C-RING SHEET, 13 GAUGE HALF PANEL
15	CW1357F	13.5" C-RING SHEET, 15 GAUGE FULL PANEL - 57" ONLY
16	CW1357H	13.5" C-RING SHEET, 15 GAUGE HALF PANEL - 57" ONLY
17	CW445710F	44" C-RING SHEET, 10 GAUGE FULL PANEL - 57" ONLY
18	CW445710H	44" C-RING SHEET, 10 GAUGE HALF PANEL - 57" ONLY
19	CW445715F	44" C-RING SHEET, 15 GAUGE FULL SHEET - 57" ONLY
20	CW445715H	44" C-RING SHEET, 15 GAUGE HALF SHEET - 57" ONLY
21	CC2215	22" C-RING 15 GAUGE CORNER PANEL
22	CC3315	33" C-RING 15 GAUGE CORNER PANEL
23	CCS415	44" C-RING 15 GAUGE CORNER PANEL
24	CC5710	57" C-RING 10 GAUGE CORNER PANEL
25	C10210	LINER CLAMP, 10' BASE MOUNT
26	C10230	LINER CLAMP, 5' TOP MOUNT CURVED
27	C10231	LINER CLAMP, 5' TOP MOUNT STRAIGHT
28	C10304	1/4" x 1-1/2" TEKS SCREW c/w BOOT (PKG OF 100)
29	235680	3/8" x 1.0" BOLTS PACKAGE (PKG 100)
30	235686	3/8" NUTS (PKG 100)

Most C-Rings are made according to requirements of the customer. This is a list of possible parts that will be included in the kits. Please check the packing list provided with the shipment.



6.4. Hardware Usage

Table 7. Hardware Usage/Quantity

ITEM DESCRIPTION	193795	193805	170810	157044
	3/8" x 1" Flanged Hex Bolt (Washer)	3/8" Hex Nut	Sealant Tape (ft. from 30' roll)	1/4" x 1-1/2" Self Drilling Screw
	Bag P/N 232850 (700) 235941 (325) 235943 (50)	Bag P/N 232850 (700) 235950 (300) 235951 (100)	Bag P/N 235872 (12)	Bag P/N C10304 (100) C10305 (50)
WALL PANEL - 22" x 56.25" and 22" x 112.5"	14	14	2	
WALL PANEL - 33" x 56.25" and 33" x 112.5"	20	20	3	
WALL PANEL - 44" x 56.25" and 44" x 112.5"	27	27	4	
WALL PANEL - 13" x 56.25"	12	12	1	
WALL PANEL - 13" x 112.5"	18	18	1	
C-RING BRACE - 22" PANEL	4	4		2
C-RING BRACE - 33" PANEL	4	4		3
C-RING BRACE - 44" PANEL	4	4		4
C-RING BRACE - 57" PANEL	4	4		4
LINER CLAMP - 5' TOP MOUNT CURVED				10
LINER CLAMP - 5' TOP MOUNT STRAIGHT				10
LINER CLAMP - 10' BASE MOUNT			9.5	20

7. Limited Warranty: Westeel Containment Rings

Westeel – Ag Growth International warrants the steel components of Containment Rings of its manufacture (the "goods", "system" or C-Rings) to be free from defects in materials and workmanship for a period of 24 months, for systems of 13 gauge or lighter panel material, from the date of purchase from its authorized dealer or distributor, provided that the goods have been installed in accordance with Westeel's instructions and subject to normal use and service. Westeel will replace any goods or parts thereof found to be defective to Westeel's satisfaction, under the terms of this warranty.

This warranty does not extend to defects or damage caused by:

1. improper storage of the goods prior to use
2. installation or assembly not in accordance with Westeel instructions
3. improper installation or assembly
4. misuse of the goods
5. equipment attached to or used in conjunction with the goods
6. Acts of God, accident, neglect or abuse

Westeel will not be responsible for the cost or expense of removal of any goods found to be defective, for transportation charges for defective goods to and from its authorized dealer or distributor, or for installation costs of any replacement goods furnished hereunder. Westeel shall not be liable for direct, indirect, special, consequential, or any other damages, losses, or claims; or for personal injury however caused.

There are no warranties for intended use other than those specified in Westeel's published product literature or otherwise specified by Westeel in writing. Westeel warranty does not cover products, goods, or equipment sold by it that are not of its manufacture.

The foregoing warranty is exclusive and in lieu of all other warranties or conditions, whether expressed or implied, statutory or otherwise, and if any provision of this warranty be void or unenforceable in whole or in part it shall be severable and shall be deemed not to affect or impair the validity of any other provision.

Liability under this Warranty is limited, and subject to the specific disclaimers below.

General

It is the responsibility of the owner / user to ensure the suitability and completeness of any containment system for their particular application through consultation with appropriate engineering resources and the local Authority Having Jurisdiction.

Method of Installation

Strict adherence to the site planning guidelines, support brace and pad specifications, and installation instructions is mandatory for satisfactory performance of your C-Ring system. Deviation in any manner can result in unsatisfactory results or failure. Ensuring liquid-tightness of containment sheet seams and teks screws connections is the responsibility of the end user and Westeel shall not be held liable for



any leakage through these areas. Westeel recommends that Westeel Certified Installers perform all C-Ring installations. Modifications and alterations made to the system may void the warranty

Liners

Westeel does not warrant membrane or other liners which may be used in conjunction with Containment Ring systems, or guarantee their suitability for specific applications. Liner installation suggestions and instructions are provided as guidelines only and are subject to change according to any specific installation recommendations as advised or provided by the liner and/or sealant manufacturer or by the local Authority Having Jurisdiction. Alterations or modifications from Westeel or the liner manufacturers' recommendations are done at the risk of the owner and / or contractor.

Corrosion

Westeel is not liable for corrosion or deterioration of components due to storage under wet conditions or contact with corrosive materials, chemicals, gases or liquids, etc. Store panels in a dry area to avoid "white rusting". If panels become wet: separate them, wipe to remove water, and apply a light coat of oil.

Service Limitations

In the event of a failure of the primary tank(s) within the C-Ring, some liquid may spill over the top of the containment ring. Westeel will not be liable for damage in this event. This containment system is not designed for medium or long-term storage of product. Any product spill or standing water within the ring should be pumped out as soon as possible. In some jurisdictions this is a regulatory requirement with specific time limits. Periodic inspection may also be required. Consult with your local Authority Having Jurisdiction. Westeel warranty coverage and liability does not extend to damages due to Acts of God, including but not limited to damage from lightning, extreme winds, or external flooding.

Nameplate Sign

The "C-Ring" logo sign supplied with your system must be installed per the instructions provided to identify your system and validate the warranty.





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