



Carlson Commercial & Industrial Services Ltd.
1035 Mission Street
Winnipeg, MB, Canada R2J 0A4
204-233-0671 Phone
204-233-6938 Fax

***FRP
SHIPPING,
HANDLING &
INSTALLATION
INSTRUCTIONS***



1. GENERAL

- 1.1. The techniques and procedures used for handling and preparing FRP vessels for shipping should ensure delivery of damage-free products.
- 1.2. The flexural, impact, and shear properties of FRP laminated structures are significantly lower than those of metallic structures. Therefore, special consideration must be given to weight and weight distribution at contact points during handling, shipping, and storage of FRP vessels.
- 1.3. If any doubt exists regarding the handling procedures, the Fabricator should be consulted.

2. SHIPPING

- 2.1. Since there are variations in the design of support cradles, lifting and hold-down lugs, and methods of shipping, the manufacturer's special instructions shall be followed in all cases.
- 2.2. Cylindrical vessels that are being shipped in a horizontal position should be:
 - 2.2.1. Mounted on cradles (Padding is recommended to prevent damage to the vessel)
 - 2.2.2. The cradles should be placed as close as possible to the top and bottom heads of the vessel and/or other stiffened areas.
 - 2.2.3. Secured to the truck or railroad car with padded banding straps that are properly fastened to the bed of the vehicle.
 - 2.2.4. Blocked at the ends to prevent shifting in transit.
 - 2.2.5. The blocks should be padded and bear only on the knuckle radius of the flat or dished heads.
 - 2.2.6. A suitable stiffening member shall be provided at the open end of open-top tanks.
- 2.3. Vessels being shipped in a vertical position should be:
 - 2.3.1. secured to a pallet or skid, and then fastened to the bed of the vehicle with padded banding for safe shipment.
- 2.4. Vessels should be secured on the vehicle with 1 1/2 in. or more clearance between the vessel (including external fittings, nozzles, or other projections) and the bed of the truck or railcar. Small vessels may be shipped on pallets or skids to permit forklift truck handling.
- 2.5. When two or more separate units are shipped together, sufficient clearance should be provided between units to prevent contact in transit.
- 2.6. Flange faces 48 in. and under should be protected by fully covering the flange and opening with suitable plywood or waterproof hardboard, securely fastened. In sizes larger than 48 in., only the flange faces need to be covered.
- 2.7. Pipe ends, and nozzles should be protected by plastic caps, plywood, hardboard, or water-resistant cardboard covering, securely fastened.
- 2.8. All internals should be adequately secured and/or padded to ensure safe shipment.
- 2.9. Accessory pipe, fittings, and miscellaneous small parts should be crated or boxed. Additional protection within the crate or box may be required to ensure that pieces are not damaged. Such protection might include cross bracing, end wrapping, and/or batten padding.



- 2.10. Boxes are to be identified as to contents and purchase order number, or as otherwise required by the User.
- 2.11. Crates or boxes exceeding 50 lb gross weight should be mounted on skids or pallets to permit handling by crane or forklift truck.
- 2.12. Crates or boxes should be secured to the vehicle.
- 2.13. All crates, boxes, skids, and pallets should be made of quality lumber and selected fasteners (nails, bolts, lag screws, etc.) that will be sufficient to ensure safe handling and transit of the vessel.
- 2.14. Upon arrival at the destination, the purchaser shall be responsible for inspection for damage in transit. If damage has occurred, a claim should be filed with the carrier by the purchaser and the supplier should be notified. If the damage is not first repaired by the fabricator prior to the tank being put into service, the purchaser accepts all future responsibility for the effects of tank failure resulting from such damage.
- 2.15. The User's inspector should check that all equipment is handled, packaged, and shipped according to the purchase order.
- 2.16. The User's inspector should ensure that all information is correct on nameplates and that nameplates are permanently installed.
- 2.17. The User's inspector should ensure that all joining, or assembly kits required for field installation are complete and ready for installation.

3. HANDLING

- 3.1. Impact or excessive distortion can cause cracking or crazing of the laminate structure. Therefore, special consideration must be given to the following:
- 3.2. It is recommended that FRP vessels be lifted for moving or repositioning and not be rolled, slid, dropped, or thrown.
- 3.3. Where lifting lugs are not provided as part of the equipment, consideration should be given to the use of woven fabric rigger-slings of 3 in. minimum width for lifting cylindrical vessels in a horizontal position.
- 3.4. Open-end equipment, such as open-top tanks, may require internal cross bracing or external structure, to prevent damage from distortion during handling and transporting.
- 3.5. For lifting an uncrated and un-skidded open-end vessel in a vertical position, a spreader bar should be used to prevent damage from excessive distortion (see Fig. X1).
 - 3.5.1. Where a spreader bar is required for proper lifting, a stenciled notation to that effect should be applied to the equipment in a prominent location prior to shipping. Woven fabric rigger-slings of 3 in. minimum width and adequate strength should be used in direct contact for lifting FRP vessels.
 - 3.5.2. Where a vessel is to be lifted in a horizontal position by wrapping a cable around its circumference, wooden strongbacks of adequate strength and dimensions should be employed to distribute the load and prevent direct contact between the cable and the wall of the equipment (see Fig. X2).



- 3.6. Generally, where the L/D value is high, and/or the laminate wall is thin, lifting attachments may be required at two points, each located $L/4$ from an end (see Fig. X3)
- 3.6.1. Where an unusually long or bulky vessel is involved, special handling procedures may be required to avoid damage.
- 3.6.2. Lifting cables and/or straps must not be attached to or permitted to come in contact with nozzles, flanges, gussets, or accessories other than lifting lugs, unless specifically approved by the Fabricator.
- 3.6.3. When a vessel is being lifted using a cable, a guideline should be attached to prevent impact damage caused by swing contact with other objects.

Fig. X1 - Lifting Vessel With Spreader Bar

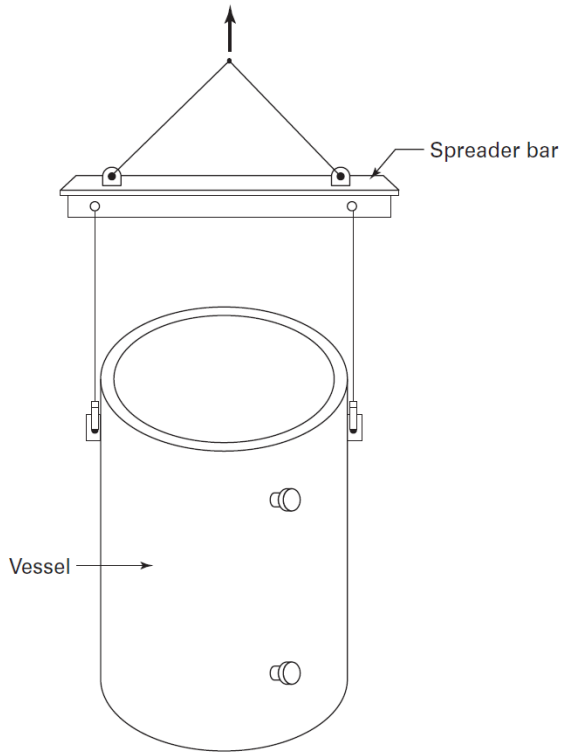


Fig. X2 - Strongback for Lifting

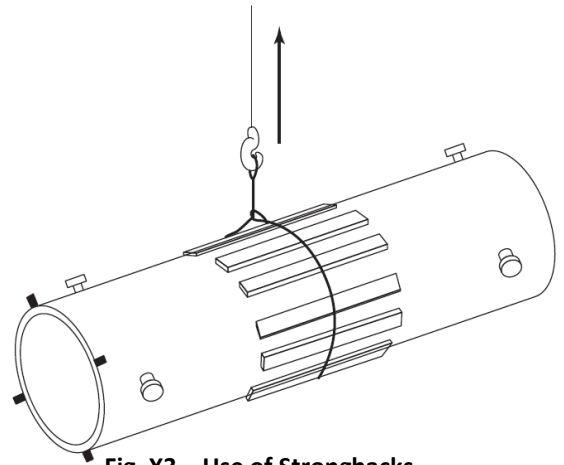
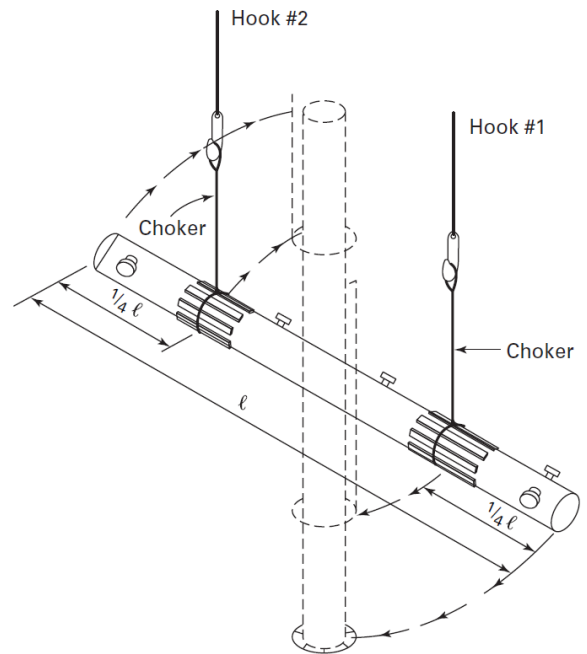


Fig. X3 - Use of Strongbacks





4. TEMPORARY STORAGE

- 4.1. During storage or repositioning, FRP vessels should be left or placed on the shipping cradle or dunnage resting only on firm, level surfaces.
- 4.2. Vessels should not be permitted to rest on stones, tools, chocks, or other small hard objects.
- 4.3. When stored outdoors, vessels should be adequately tied down to prevent movement due to wind or water flotation. Closed vessels should not be completely sealed.
- 4.4. Where a large open-end vessel is stored in a horizontal position, bracing is required at the open end to prevent excessive distortion. One cross brace, with suitable padded end plates to distribute the load, should be installed perpendicular to the surface on which the vessel is resting.

5. INSTALLATION

- 5.1. Vertical flat bottom tanks should be installed on a base providing continuous support and having sufficient strength to support the weight of the tank full of liquid with negligible deflection. Full support of the bottom should be obtained by one of the following:
 - 5.1.1. If the surface of the pad and the bottom of the tank are flat and have no projections from the plane surface, the tank may be set on such a surface.
 - 5.1.2. If the conditions of 5.1.1 cannot be met, methods of support recommended by the manufacturer should be used.
 - 5.1.3. If the tank has a bottom drain, a hole should be provided in the pad with sufficient clearance so that the drain and its flange will not contact the base at any point.
 - 5.1.4. Erection of Vertical Tank:
 - 5.1.4.1. Tanks should be handled with a crane, utilizing the lifting lugs provided. Do not attempt to lift the tank by attaching to other fittings. Prior to hoisting the top end, a suitable protection pad of material should be placed under the bottom pivot point of the tank so that as the tank rises, the strain is taken on the pad. The hoist wire should be connected to the top lifting lugs, and tank should be raised carefully using guide ropes to prevent sudden swinging.
 - 5.1.4.2. All flat-bottom vessels should be secured in place by bolting to the support base. This precaution will minimize the chance of vessel damage at nozzle locations and areas of other attachment due to movement of the unit.
 - 5.1.4.3. All hold-down lugs supplied should be utilized to secure the tank to its pad. Hold-down lugs should be grouted or shimmed to prevent excessive loads being transferred to the tank shell.
 - 5.1.4.4. Valves, controllers, or other heavy items connected to the tank nozzle should be independently supported.
 - 5.1.4.5. When agitators, mixers, or cooling/heating coils are to be installed, special design considerations are to be used.

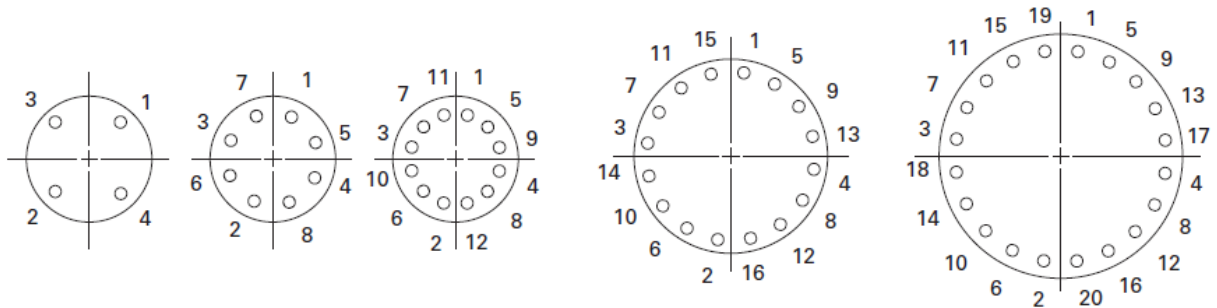


This Article covers special requirements for shipping and handling dual laminate vessels at low temperatures.

6. PRECAUTIONS TO PREVENT MECHANICAL DAMAGE

- 6.1. Since many of the thermoplastics used for liners are brittle and become more sensitive to mechanical shock as temperatures decrease, precautions must be taken in handling and storing to ensure that impact or high stresses are avoided.
- 6.2. Thermal stresses due to sudden changes in temperature will be avoided, as these can cause cracking of the thermoplastic liner. An example is moving a vessel from a heated area to the outside in cold weather.

7. BOLTING CONNECTIONS



Bolt Torquing Sequence

Recommended Bolt Torques
for Hand Lay-Up Flanges

Pipe Size	Bolt Dia.	Torque, ft-lb
2	5/8	25
3	5/8	25
4	5/8	25
6	3/4	25
8	3/4	25
10	7/8	25
12	7/8	25
14	1	30
16	1	30
18	1 1/8	35
20	1 1/8	35
24	1 1/4	40
Manways	3/4	30

GENERAL NOTES:

(a) With Felpro C5A thread lubricant or equal.



****IMPORTANT****
HANDLING AND
INSTALLATION
INSTRUCTIONS
ENCLOSED
****DO NOT DESTROY****



CARLSON COMMERCIAL & INDUSTRIAL SERVICES LTD.
1035 MISSION STREET, WINNIPEG, MANITOBA, CANADA. R2J 0A4
PH: (204) 233 0671 FAX: (204) 233 6938
www.carlsonindustrial.ca