
Handling, Shipping and Storage for EnergySolutions' TCT

Revision 2

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1. PURPOSE

This procedure delineates the requirements for handling, shipping and storage of EnergySolutions' Tandem Container Transport (TCT).

2. REFERENCES

2.1 US Department of Transportation Requirements (49 CFR documents)

2.2 ES-QA-PR-005, Records

3. PRECAUTIONS

Radiation Protection (RP) to provide proper radiological controls when lifting the lid and loading contents to preclude the possibility of contamination.

4. PREREQUISITES

None

5. EQUIPMENT REQUIREMENTS

Torque wrench (calibrated)

6. PERSONNEL

6.1 Facilities Manager is responsible for compliance with EnergySolutions's QA Program and all approved procedures. The Facility Manager is responsible for overall project coordination, budget, and schedule for the project. He is also responsible for the reporting requirements to the customer unless the EnergySolutions Site Supervisor is designated for this function.

6.2 Facilities Manager is responsible for ensuring that only equipment (Radwaste shipping casks and transport trailers) which has been properly inspected, maintained, stored, and repaired will be used, or scheduled for use, for the transportation of radioactive materials. Ensuring that only trained personnel perform activities associated with the implementation of this procedure.

6.3 EnergySolutions Technicians are responsible for performing inspection, maintenance, and repair activities in accordance with the requirements of this procedure. Notifying the Site Supervisor of the condition of equipment. Notifying engineering to provide direction when conditions require engineering input in accordance with this procedure. Notifying QA personnel when repairs warrant QA involvement in accordance with this procedure. The maintenance of records

documenting equipment inspection, maintenance and repair activities associated with the implementation of this procedure.

- 6.4 EnergySolutions Engineering and Licensing Department is responsible for providing direction, instructions, and recommendation for maintenance and repair of equipment in accordance with this procedure. Interface with regulatory agencies governing the approval and certification of Radwaste shipping casks and transport trailers.
- 6.5 EnergySolutions Site Supervisor is responsible for the daily operation of the equipment at the plant and is the direct interface between the EnergySolutions Facility Manager and customer for all operations. He is also responsible for the repair and maintenance of the EnergySolutions equipment and for the technicians assigned to the project.
- 6.6 Radiation Protection (RP) Section provides qualified Radiation Protection Personnel for necessary job coverage and surveys.
- 6.7 EnergySolutions Quality Assurance (QA) Department is responsible for providing inspection and inspection documentation of activities and components associated with the repair of equipment as required in accordance with this procedure. The qualification of vendors providing components and/or services necessary for equipment repair and maintenance based on the quality necessary to meet regulatory requirements.
- 6.8 Transport Operator is responsible for following direction provided by EnergySolutions in the delivery of radioactive materials utilizing Radwaste shipping casks and associated transport trailers. Following the DOT requirements regarding the conveyance of radioactive materials utilizing Radwaste shipping casks and associated transport trailers. Notifying the Operations Supervisor of unacceptable conditions discovered as a result of implementing instructions as provided by EnergySolutions. Providing diligent effort in the care of EnergySolutions owned equipment.

7. PROCEDURE

7.1 Initial Shipment Prior to First Use (see Reference 2.1.)

The TCT shall be mounted by bolting or welding to the transportation trailer.

7.2 Lifting TCT from Transport Trailer

- 7.2.1 If the TCT needs to be removed from the transport trailer, the TCT shall always be lifted by the four (4) provided lifting lugs only. The lifting lugs are oriented on the ends of the TCT. The TCT must be

empty when removing it from the trailer and lid must be in place. If the TCT is attached in accordance with Section 7.1 the welds or bolts must be removed first.

7.2.2 All other lifting lugs on the primary lid shall only be used to lift the lid.

7.3 TCT Handling and Loading

Note: Verify TCT is marked by either TCT-1 or TCT-2 and follow the respective procedure sections. Any fasteners or binders threads can be cleaned and relubricated as needed due to road dirt and debris.

7.3.1 Removal of the TCT-1 Lid

7.3.1.1 Loosen the lid nuts on the thirty-two (32) ½” diameter eye bolts.

7.3.1.2 Swing the eye bolts clear.

Note: TCT-1 lid weight is approximately 3,500 lbs.

7.3.1.3 Remove the TCT-1 lid. Use the four (4) lifting lugs on the lid to accommodate suitable rigging. Exercise caution in the handling of the lid due to possible contamination of the underside of the lid.

7.3.2 Removal of the TCT-2 Lid

7.3.2.1 Release the twelve (12) ratchet binder handles.

7.3.2.2 Engage the flip blocks to the sprocket wheels in the direction necessary to loosen the ratchet binders.

7.3.2.3 Loosen the ratchet binders by pulling the handles in the appropriate direction.

7.3.2.4 Remove the lock pins from the top Duo Pins and pull the Duo Pins out through the ratchet binder/lug holes.

7.3.2.5 Remove the three (3) lid lifting lug covers.

Note: TCT-2 lid weight is approximately 5,000 lb.

7.3.2.6 Remove the TCT-2 lid. Use the three (3) lifting lugs on the lid to accommodate suitable rigging. Exercise caution in

the handling of the lid due to possible contamination of the underside of the lid.

7.3.3 Gasket Inspection

7.3.3.1 Prior to installation of TCT lid inspect the gasket for the following:

7.3.3.1.1 O-ring gasket fully secured to TCT surface.

7.3.3.1.2 Gasket not cut, ripped or gouged.

7.3.3.1.3 Gasket is resilient, without permanent deformation.

7.3.3.1.4 Gasket is free of debris and dirt.

7.3.3.1.5 If the gasket is damaged or missing, repair/replace per Section 7.8.2.

Note: Steps in this procedure may be performed out of sequence as required.

7.4 Installation of TCT Lid

7.4.1 Installation of the TCT-1 Lid

7.4.1.1 Using the four (4) lifting lugs on the lid to accommodate suitable rigging, lift and place lid on TCT-1. Exercise caution to avoid damaging the gasket.

7.4.1.2 Swing the ½” diameter eye bolts up and hand tighten nuts.

7.4.1.3 Torque the lid bolts to 40 ± 5 ft-lbs by applying torque to opposite pairs until each nut has been torqued (see Attachment 9.1 for TCT-1 swing bolt torque sequence).

7.4.2 Installation of the TCT-2 Lid

7.4.2.1 Using the three (3) lifting lugs on the lid to accommodate suitable rigging, lift and place lid on TCT-2 using alignment stripes to assure proper positioning. Take care not to damage gasket.

7.4.2.2 Install the Duo Pins through the upper ratchet binder connectors and the lid closure lugs.

7.4.2.3 Install the lock pins in the Duo Pins.

Note: See Attachment 9.4 for a method to determine torque wrench values based on ratchet and wrench lengths.

7.4.2.4 Tighten the ratchet binders by engaging the flip blocks to the sprocket wheels and rotate the ratchet binder handle in the direction necessary to tighten the ratchet binders. Tighten to 40 ± 10 ft-lbs torque (see Attachment 9.2 for TCT-2 Ratchet Binder Torque Sequence).

7.4.2.5 After all binders are at 40 ft-lb., torque binders 1, 2, 3, 4, 5, and 6 to $65 \text{ ft-lbs} \pm 5$. Recheck 1, 2, 3, 4, 5 and 6 before torquing the rest to $65 \text{ ft-lbs} \pm 5$.

7.4.2.6 Disengage the flip blocks and rotate and secure the handles.

7.4.2.7 Install the three (3) TCT-2 lid lifting covers.

7.5 TCT Loading Procedure

Note: Maximum TCT-1 payload=24,000. Maximum TCT-2 payload = 22,000 lb.

7.5.1 Survey empty TCT to determine the loose and/or fixed contamination levels.

7.5.2 Inspect lid fasteners to assure all are present and undamaged.

7.5.3 Check to assure that lid lifting lug covers are in place (TCT-2 only).

7.5.4 Remove lid in accordance with Section 7.5 or 7.6.

7.5.5 Inspect interior of TCT for standing water.

Note: Water must be removed prior to shipment.

7.5.6 Inspect interior for obstructions prior to loading.

7.5.7 If loading drums pallets, proceed as follows:

Note: Empty pallet weight is 750lb each. Maximum pallet payload is 5,000lb. each.

7.5.7.1 Load seven (7) drums on each pallet.

7.5.7.2 Place drums within guides provided on the pallet deck to facilitate proper orientation.

7.5.7.3 For maximum shielding, load higher dose rate drums in the CENTER position and the positions toward the front and rear of the trailer.

7.5.7.4 The lifting slings should remain attached to the pallet at all times. This will facilitate off-loading drums at the designated unloading facility.

7.5.7.5 By loading the center drum first and then three (3) drums on one side, the sling can be placed over the loaded drums while the remaining three are loaded. This technique prevents damage to the sling.

7.5.7.6 The sling assembly should be placed around the drums in such a way to prevent damage to the sling.

7.5.7.7 The sling assembly should be inspected at each loading for damage and general condition.

7.5.7.8 Place loaded pallet into TCT, assuring that pallet slings are not caught along side or under the pallet.

7.5.7.9 Place sling around or along side drums to prevent pinching or damage to the sling by the lids or second/top pallet.

7.5.7.10 Load a second pallet on top of the first in the same manner described in Steps 7.5.7.1 through 7.5.7.9 above.

7.5.7.11 Inspect lid and gaskets. Install TCT lid and secure as described in Section 7.4.

7.5.7.12 Install tamper-proof seals (where applicable).

- 7.5.8 If loading pre-loaded liners, proceed as follows:
 - 7.5.8.1 Assure all lids, plugs or caps are installed on liner.
 - 7.5.8.2 Install shims/shoring between liner and inside wall of TCT, if necessary, to secure in position.
 - 7.5.8.3 Using lifting slings or grappable unit, place liner into the TCT front or rear sections.
 - 7.5.8.4 Inspect gaskets, install lid and secure as described in Section 7.4.
 - 7.5.8.5 Install tamper-proof seals (where applicable).
- 7.5.9 If filling liner inside the TCT, proceed as follows:
 - 7.5.9.1 Using lifting slings or grappable unit, place liner in the TCT.
 - 7.5.9.2 Install shims/shoring between liner and inside wall of TCT if necessary to secure in position.
 - 7.5.9.3 Load the waste into the liner.
 - 7.5.9.4 Process liner in accordance with appropriate procedure.
 - 7.5.9.5 Install the liner lid, plugs, or caps onto the liner.
 - 7.5.9.6 Ensure that no water or other fluids have spilled into the TCT during liner filling. Remove any fluid present, and perform appropriate radiological surveys.
 - 7.5.9.7 Inspect gaskets, install and secure lid as described in Section .4.
 - 7.5.9.8 Install tamper-proof seals (where applicable).

7.6 Preparation of TCT for shipment

- 7.6.1 Perform radiation surveys of TCT and vehicle and complete the necessary shipping papers, certifications, and prerelease checklist (Attachment 9.3) or site equivalent.
- 7.6.2 Placard vehicle, as necessary.

7.7 Containment Penetration Seals

- 7.7.1 Installation of pipe plug(s) used to seal the pressure tap line and the drain line is to be done using a pipe joint sealing compound.
- 7.7.2 Plugs are to be tightened to a minimum of 20 ft-lbs torque.
- 7.7.3 Install tamper proof seal(s) (where applicable).

7.8 Maintenance

- 7.8.1 Maintenance Program - General maintenance program requirements are listed in this section. Detailed maintenance programs must be developed by the end user of the TCT. These programs will reflect the specific operating conditions, limitations and regulatory requirements pertaining to the user.

7.8.1.1 Painted Surfaces

- 7.8.1.1.1 Painted surfaces may be steam or pressurized hot water cleaned using standard commercial equipment, chemical solutions and procedures. No special precautions are required.

- 7.8.1.1.2 Chipped or scratched surfaces shall be repainted as follows:

- 7.8.1.1.2.1 Remove any rust or loose coatings and sand edges so they flare into sound coating.

Note: If using a self priming epoxy, a primer coat is not necessary.

- 7.8.1.1.3 Prime bare surfaces with a good commercial quality red oxide primer.

Note: These coating numbers designate a light gray color and paint brands which match EnergySolutions color and paint scheme. If the user has ordered another color or paint system, that system may be used for the recoat as appropriate. Approval from EnergySolutions is required.

- 7.8.1.2 Recoat with Mobil Chem 89W9 or Tenemec 66-2000 epoxy. Top coat with light gray polyethylene.
- 7.8.1.3 Dulled or oxidized finishes may be restored via the use of normal automotive finish polishes and waxes, if desired.
- 7.8.1.4 Alignment stripes shall be repainted when they are chipped, peeled off or faded such that they are not legible. Standard commercial bright orange machinery enamel is used to paint these stripes. Only local sanding and cleaning is required prior to repainting of the alignment stripe.

7.8.2 O-ring Gasket

- 7.8.2.1 The gasket shall be inspected for resiliency and complete adhesion in the O-ring groove prior to each TCT loading.
- 7.8.2.2 Gaskets that are intact but not adhered shall be reattached as follows:
 - 7.8.2.2.1 Gently pull gasket away from its normally secured location until it cannot be removed further be removed without damaging the gasket.
 - 7.8.2.2.2 Remove residual RTV adhesive from the surface. Clean with solvents which are recommended by the adhesive manufacturer's instructions.
 - 7.8.2.2.3 Reapply RTV adhesive compatible with neoprene rubber to the gasket and/or surface and rejoin in accordance with the manufacturer recommendation. The gasket may be adhered directly to the surface. However, all exposed surfaces which are not painted shall be painted per the appropriate sections of Section 7.8.
- 7.8.2.3 Gaskets which cannot be sealed or are obviously damaged must be replaced. Damage may include cuts, nicks, chips, indentions, permanent deformations or any other defect apparent to the naked eye which would affect sealing integrity.
- 7.8.2.4 All gaskets shall be replaced a minimum of once per year regardless of apparent condition or TCT usage.

- 7.8.2.5 Any painted surface in contact with the gasket must be maintained in good condition. Any loose, chipped, or scratched painted surface must be repaired in accordance with Sections 7.8.1.1.2 through 7.8.1.1.3 prior to use.

7.9 Welds

- 7.9.1 All welds have been completely checked in accordance with ASME Code requirements. In use inspections should not be required unless the TCT has been involved in an accident or has been lifted improperly or in an overloaded condition. In these cases, inspection shall include the following:

- 7.9.1.1 Drop or accident: All accessible body, lug and ratchet binder lug welds shall be magnetic particle inspected in accordance with ASME Code Section III, Division I, Subsection NB, Article NB-5000 and Section V, Article 7. These inspections must be performed with the paint finish removed.

- 7.9.1.2 Improper or overloaded lift: All welds on the body or lid which were in use at the time of the improper or overload lift shall be magnetic particle inspected per the requirements delineated in 7.9.1, above.

- 7.9.1.3 Whenever the TCT requires total repaint and is sandblasted, all welds shall be visually inspected per AWS DI.1 Para. 8.15 or ASME Code Section III, Division I, Subsection NBI Article NB-5000 and Section V, Article 9. Suspect welds may then be magnetic particle inspected per 7.9.1, above.

- 7.9.1.4 Any weld repairs shall be performed utilizing weld procedures and welders qualified for weldments in accordance with ASME Code Section requirements. Repairs shall be accomplished per ECN's generated by EnergySolutions Engineering.

- 7.9.2 Fasteners

- 7.9.2.1 All fasteners shall be inspected after each use and replaced if the following conditions are present:

- 7.9.2.2 Deformed or stripped threads.

- 7.9.2.3 Cracked or deformed hex on bolt heads or nuts.

- 7.9.2.4 Elongated or scored grip length area on bolts or studs.
- 7.9.2.5 Severe rusting or severe corrosion pitting.
- 7.9.2.6 In general, all fasteners shall be inspected for damage at least once a year under normal usage conditions and affected components replaced when the conditions delineated in 7.9.2.1 through 7.9.2.5 are present.

Note: Actual replacement frequency should be established by the user utilizing maintenance history and inspection results based on the replacement criteria listed in 7.9.2.5.

- 7.9.2.7 Lanyards are provided to secure loose fasteners. This assures usage of correct fasteners in the various locations. Any frayed or broken lanyard must be replaced prior to the next use.
- 7.9.2.8 All fasteners must be inspected for the presence of lubricant and thread cleanliness prior to each use. Any fastener without lubricant, or that is dirty, shall be cleaned and relubricated. The specific lubricant and quantity utilized shall be determined by the user.

7.9.3 Ratchet Binders

- 7.9.3.1 The ratchet binders are designed for long use with minimal maintenance. Inspect for operation and general condition before each use.
- 7.9.3.2 If lubrication is required this can be achieved by greasing the threaded area. A good indication of the need to lubricate the ratchet binder will be dry threads on the threaded end or hard operation.
- 7.9.3.3 The only other area requiring lubrication is the ratchet handle mechanism. A small amount of standard automotive chassis lubricant should be placed on the teeth every three (3) to four (4) shipments.

Note: Actual frequency of lubrication should be established by the user based on maintenance history and inspection results.

7.9.3.4 Any ratchet binder which received impact or suspected overloading in an accident must be completely disassembled and inspected or replaced. Cause for rejection during a damage inspection should include:

7.9.3.4.1 Cracks in the jaws or joining bolt.

7.9.3.4.2 Deformation of the jaws or joining bolt.

7.9.3.4.3 Excessive rust or corrosion pitting in the threads of the jaw or joining bolt.

7.10 Long Term Storage

7.10.1 The TCT can be stored for extended periods one (1) to three (3) years with minimal special preservation. The following precautions should be taken.

7.10.1.1 Ratchet binders and all fasteners should be fully coated with good quality automotive chassis grease.

7.10.1.2 To maintain original finish gloss, the entire TCT painted surface may be coated with two (2) to three (3) layers of any good quality automotive finish wax. The last coat should be allowed to dry without being polished.

7.10.1.3 If required, the TCT finish can be further protected from harsh salt spray or chemicals by covering with tarps or storing under other suitable cover.

7.10.1.4 Lids and covers should remain installed and secured.

7.10.1.5 To maintain the original surface gloss or finish, the interior cavity, painted or stainless steel, may be wax coated as described in Step 7.10.1.2.

7.10.1.6 The TCT can be prepared for use by standard steam cleaning methods after storage. Ratchet binder threads should be re-greased with good grade automotive chassis lubricant after steam cleaning.

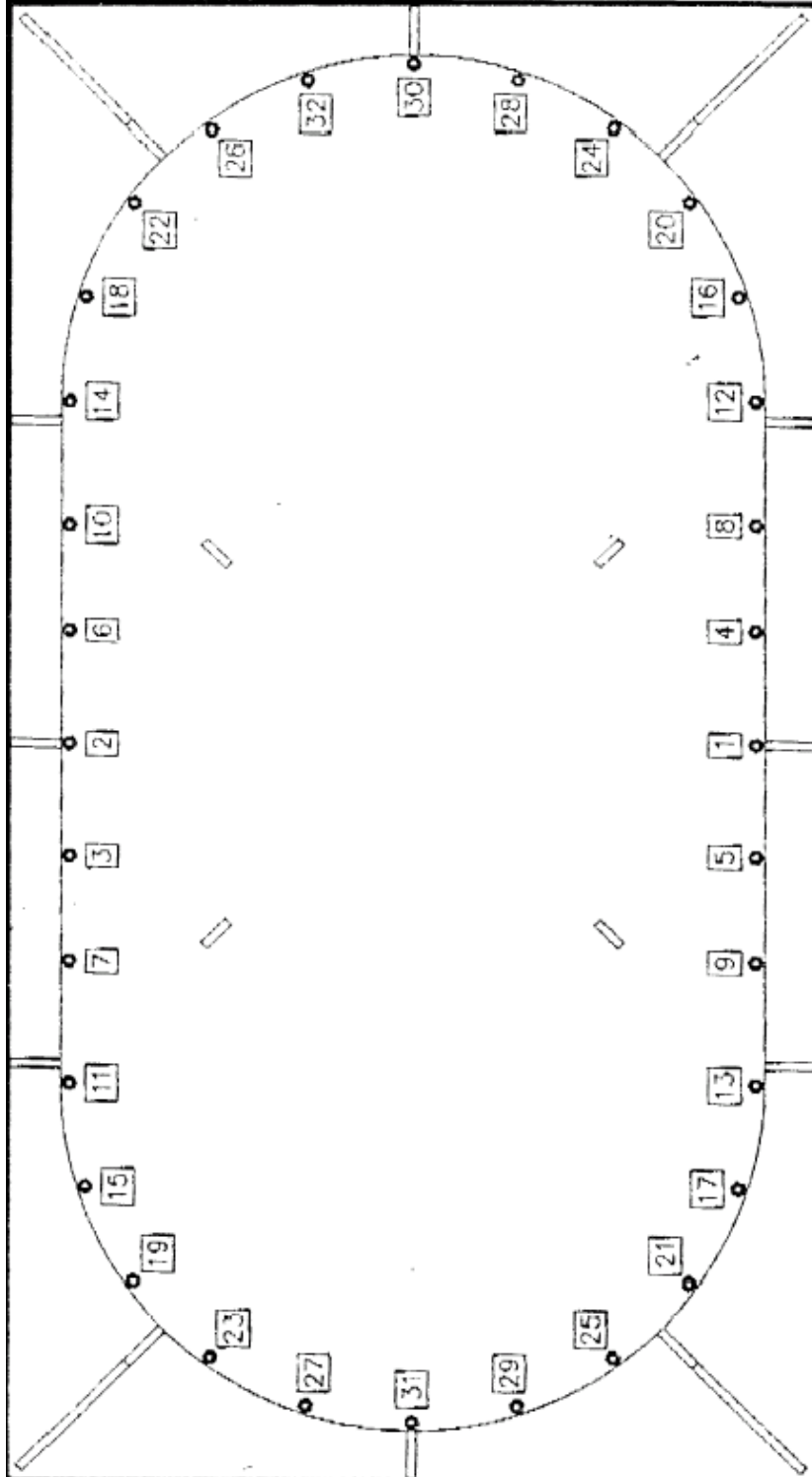
8. RECORDS

Attachment 9.3 shall be maintained in accordance with Reference 2.2.

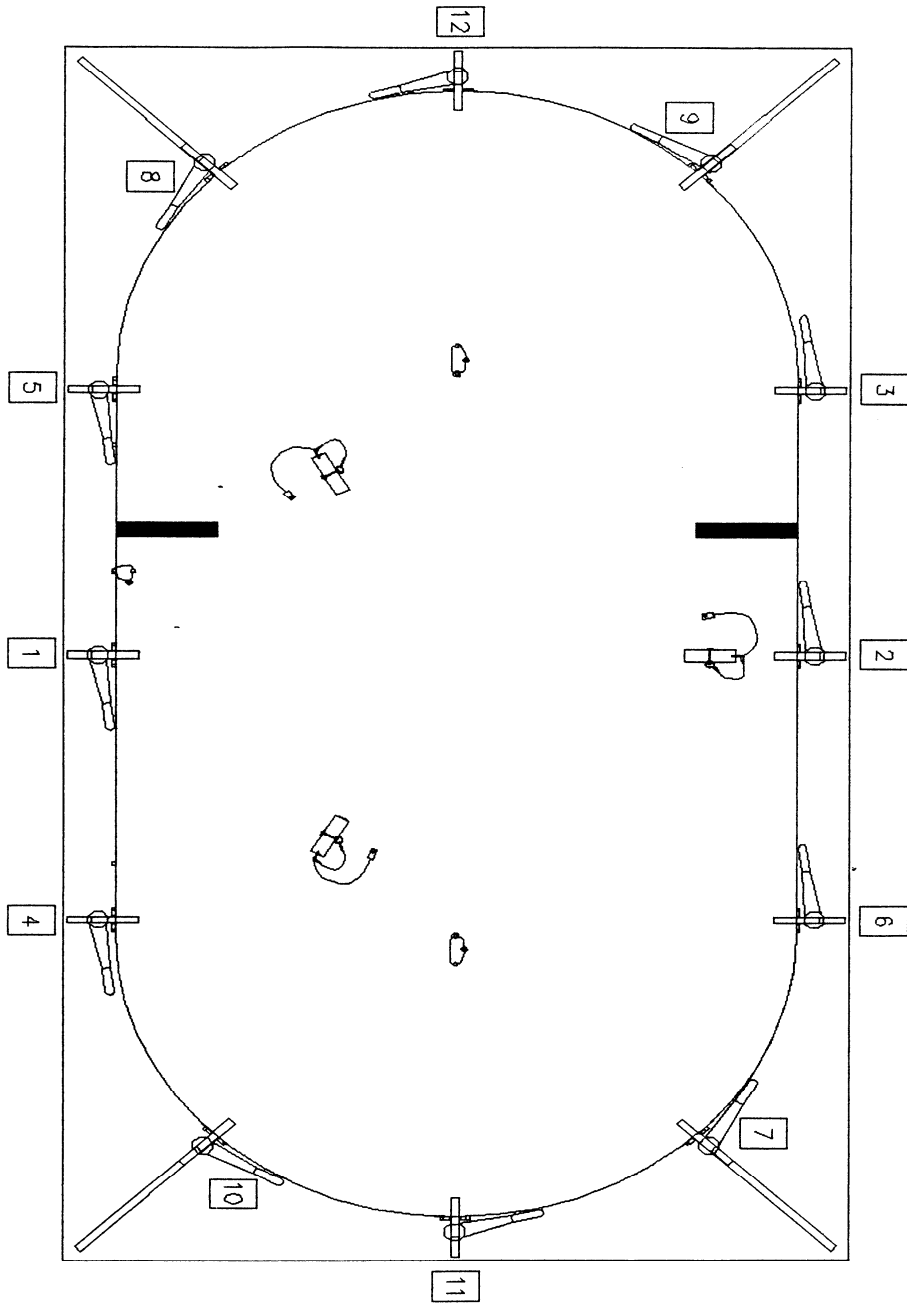
9. **ATTACHMENTS**

- 9.1 TCT-1 Swing Bolt Torque Sequence
- 9.2 TCT-2 Ratchet Binder Torque Sequence
- 9.3 Suggested Pre-Release Checklist
- 9.4 General Method for Determining Torque Wrench Valves for TCT-2 Cask
- 9.5 Illustration of Torque Configuration for Type A Casks

Attachment 9.1
TCT-1 Swing Bolt Torque Sequence



Attachment 9.2
TCT-2 Ratchet Binder Torque Sequence



**Attachment 9.3
Suggested Pre-Release Checklist**

Date: _____

Shipment No. _____

Container No. _____

Item	Description	Initials	Verified By
1	Inner Container(s) Sealed.	_____	
2	Inner Container(s) Secured in Place.	_____	
3	No Free Standing Water in TCT Cavity.	_____	
4	All Gaskets and Gasket Sealing Surfaces Inspected and Free of Defects	_____	
5	M&TE - Description _____ Serial No. _____ Calibration Due Date _____	_____ _____ _____	
6	Ratchet Binders/Bolt Closures Tightened/Torqued.	_____	_____
7	Containment Penetration Seals Intact or Plug Torqued.	_____	_____
8	Tamper-Proof Seal(s) Inspected/Installed.	_____	_____
9	Lift Lugs Covers Installed (where applicable).	_____	
10	TCT properly secured to transport trailer.	_____	
11	TCT Properly Labeled.	_____	
12	Vehicle Properly Placarded.	_____	
13	Surveys Completed and Recorded.	_____	
14	Shipping Papers Properly Filled Out and Signed.	_____	

Performed By

Signature

Date

Title

Verified By

Signature

Date

Title

Attachment 9.4
General Method for Determining Torque Wrench Values for TCT-2 Cask

Determine the required torque wrench reading D to attain the required ratchet binder torque value "C" using the following formula:

$$D = \frac{B}{(A+B)} \times C$$

- A = Length from center line of the torque wrench adapter ½" drive socket to the center line of the ratchet binder retaining screw (see Attachment 9.5).
- B = Length of torque wrench from center line of ½ drive to the center of the grip area (see Attachment 9.5).
- C = Required torque for the applicable ratchet binder.
- D = Calculated final setting or reading of the torque wrench required to attain "C".

The measurement points for determining the A and B parameters in the above equation are shown in Attachment 9.5.

As an example (refer to Attachment 9.5), using a torque wrench with measured length (B) of 18" from ½" drive socket to center of gripper, a measured length (A) of 12" from the centerline of the torque wrench adapter ½" drive socket installed on the handle to the centerline of the ratchet binder retaining screw, and a required torque reading of 100 ft-lbs. Prior to do the calculation, convert the inches into feet:

$$A = 12" = 1'$$

$$B = 18" = 1.5'$$

$$D = \frac{1.5'}{1.5' + 1.0'} \times 100 \text{ ft-lbs} = 60 \text{ ft-lbs} = \text{calculated final torque reading to attain "C"}.$$

$$\text{Range} = 60 \pm 10\% = 54 \text{ to } 66 \text{ ft-lbs}$$

Attachment 9.5
Illustration of Torque Configuration

