

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION
UNIT 1 AND 2

RECEIPT AND STORAGE OF SPENT FUEL
TN-8L SHIPPING CASK
UNLOADING AND HANDLING PROCEDURES

1.0 PURPOSE:

- 1.1 This procedure outlines the methods of receipt, placement in the Spent Fuel Cask Area, unloading Spent Fuel, Removal from Spent Fuel Cask Area, decontamination, dryness verification, and shipment of the TN-8L Spent Fuel Shipping Cask.
 - 1.1.1 Unloading Cask from truck
 - 1.1.2 Preparation of Cask for unloading spent fuel
 - 1.1.3 Cask Unloading
 - 1.1.4 Preparation of Cask for departure

2.0 INITIAL CONDITIONS

- 2.1 The cask has arrived at Security Gate.
- 2.2 Security has notified Health Physics and Operations of Cask arrival.
- 2.3 Security has verified seals have not been tampered with and recorded Seal Numbers
- 2.4 QC has been notified.
- 2.5 Fuel Building Roll-up Doors and Decon Bldg. access hatch at operating deck of Fuel Building are open.
- 2.6 The water level in the Spent Fuel Cask area is at the 284' 9" level.
- 2.7 A current Fuel Storage Area map is posted in the Fuel Building.

2.0 INITIAL CONDITIONS (continued)

- 2.8 Health Physics has performed its initial Radiation Survey at the gate and has granted permission for the Cask to be brought on Station.
- 2.9 The Surry Spent Fuel Handling Tool is available. The Spent Fuel Cask Handling Crane, (1-MH-CR-15), and the Fuel Pit Bridge Crane, (1-MH-FH-13) are operable. Also, hand tools are provided in storage boxes outside, in Decon. Bldg. and in Fuel Building.
- 2.10 Portable underwater lighting in Spent Fuel Cask Area is available.
- 2.11 A VNF-7 Form has been initiated and approved for receipt of Fuel from Surry Power Station and Fuel Assembly and device History Sheets are available.
- 2.12 The Cask Service Equipment, Utilities, and special tools are on hand and operable.
- 2.13 Health Physics Coverage available for Cask Handling Operation per the applicable H.P. Procedures and Radiation Work Permit.
- 2.14 Area prepared and accessible to Crane for lifting beams.
- 2.15 Access to Fuel Building via the stairwell between the Fuel Bldg. and Decon. Bldg. is made available during operation.
- 2.16 The Crane hook adapter is stored in the Cask Area on its special hanger.
- 2.17 Personnel involved have been instructed in the proper use of tools and equipment utilized.
- 2.18 The continuous Radiation Monitoring System of the Fuel Bldg. is in service air activity is being continuously monitored.

2.0 INITIAL CONDITIONS (continued)

- 2.19 Decon Bldg. ventilation in operation via exhaust fan 1-HV-F56A or 1-HV-56B and booster fan 1-HV-F-63 (located in the Decon Bldg.) .
- 2.20 P.G. Water Supply and hoses are available at Spent Fuel Pit Cask Area to wash down Cask upon leaving water.
- 2.21 Spent Fuel Data has been obtained and is on copy of Cask Loading Report. Cask Loading Report to be provided be Surry Power Station and transmitted with the shipment.
 - 2.21.1 Spent Fuel Shipment Number
 - 2.21.2 Spent Fuel Assembly Serial Number and Insert Number.
 - 2.21.3 Spent Fuel Location within the Cask
 - 2.21.4 Decay Heat content (KW)
 - 2.21.5 Total Activity of Element (WRIES)
 - 2.21.6 Weight of Fissile Uranium (GRAMS)
 - 2.21.7 Weight of Fissile Plutonium (GRAMS)
- 2.22 A Supervisor from Operations will be in charge of fuel movements in order to certify the proper records are completed and to ensure a smooth evolution.
- 2.23 Fuel Resources Personnel will be present any time fuel is moved.
- 2.24 The Transportation Documents have been received from the carrier and are in good order.

3.0 PRECAUTIONS AND LIMITATIONS

- 3.1 All Fuel Handling Equipment will have been tested prior to handling the shipping Cask and Fuel Assemblies.
- 3.2 Positive and accurate records will be maintained at all times.

3.0 PRECAUTIONS AND LIMITATIONS (continued)

- 3.3 Cask shall not be moved outdoors when threat of severe weather disturbance exists.
- 3.4 Slings, shackles, and cables shall be checked to verify that they appear to be in good working order and then are within their test date requirements as indicated on the tag attached to the device.
- 3.5 The cask and all handling tools and equipment are massive and heavy. Many pinch point hazards exist. A very slow swing of the suspended cask will contain a large amount of energy. Be careful in the cask equipment moves.
- 3.6 The Cask in the upright position is sixteen (16) feet high, which constitutes a fall hazard. Improper rigging can cause a cask or equipment drop.
- 3.7 The surface of a loaded cask at equilibrium may be uncomfortably hot.
- 3.8 It is imperative that the cask handling crew be thoroughly familiar with cask equipment, potential hazards and proper handling procedure. Also, all safety rules and equipment are available to perform all areas of cask handling safely.
- 3.9 All personnel in Fuel Building, taking part or observing work, shall be familiar with Station Emergency Plan and AP for Fuel Failure.
- 3.10 Care should be taken to keep the skirt inlet and vent hoses as short as possible. Excessive lengths may results in interference problems. The hoses should be allowed to hang freely but not allowed to become entangled.

3.0 PRECAUTIONS AND LIMITATIONS (continued)

- 3.11 Thorough planning should be done prior to cask pool immersion to ensure that immersion times are minimized. Normally, the shorter the immersion time, the less severe the contamination problems incurred and associated decontamination efforts.
- 3.12 Do not allow Cask to dry prior to decontamination.
- 3.13 Operation of the Fuel Building Bridge and Trolley Crane will be governed by 1-OP-4.10 "Fuel Building Bridge and Trolley Crane".
- 3.14 Safety belts will be worn by personnel as necessary to prevent falling into Spent Fuel Pool.
- 3.15 All hand tools used over Spent Fuel Pool or Cask Area will have lines attached to prevent their dropping into the pool.
- 3.16 When fuel handling is in progress, all doors will be shut in the Spent Fuel Building, except for the movement of people or equipment.
- 3.17 Prior to moving Fuel Building Bridge Crane into the vicinity of the Cask Area, ensure cask crane has been moved clear so as not to obstruct the path of the bridge crane.
- 3.18 Whenever the lifting beam or special service tools are being moved underwater, at least one person other than the man controlling or directing the crane movement, must be observing the lifting beam or service equipment. The lifting beam or service equipment shall not be moved when visibility problems obscure their underwater movement.
- 3.19 Avoid movement of fuel over fuel assemblies in storage if possible.

3.0 PRECAUTIONS AND LIMITATIONS (continued)

- 3.20 Avoid excessive "jerky" motion of crane when carrying fuel.
- 3.21 When handling fuel, the fuel handling tool should be supported by hand, to prevent unnecessary swinging action.
- 3.22 Move trolley and bridge smoothly when moving fuel.
- 3.23 Insure the locking device is in place prior to lifting fuel assembly.
- 3.24 Always ensure adequate clearance exists between the top of the Fuel Assembly Storage Racks and the bottom of the Fuel Assembly prior to moving fuel horizontally in pool. Observe same caution when moving through the gateway between the Cask Area and the Spent Fuel Pit, and when removing Fuel Assembly from the shipping cask.
- 3.25 Minimum allowable depth of water between top of Spent Fuel and surface of water is 8 feet while moving fuel.
- 3.26 T.S. 3.9.11: At least 23 feet of water shall be maintained over the top of irradiated fuel assemblies seated in the Storage Racks.
- 3.27 T.S. 3.9.12: Fuel Building ventilation system shall be operable and discharging through at least one Auxiliary Building HEPA and charcoal absorber filter during irradiated fuel movement within the Spent Fuel Pit, or during crane operation with loads over irradiated fuel in the Spent Fuel Pit.
- 3.28 Loads in excess of 2000 lbs. shall be prohibited from travel over irradiated fuel assemblies in the Spent Fuel Pit, and over the Spent Fuel Pit Heat Exchangers. 1-OP-4.10 Fuel Building Bridge and Trolley Crane describe the Safe Load paths that are required for the Fuel Building.

3.0 PRECAUTIONS AND LIMITATIONS (continued)

- 3.29 To minimize axial loading during the last few inches of travel when setting an assembly down or attaching a handling tool MUST proceed by jogging the crane at minimum possible speed.
- 3.30 The Fuel Building Bridge Crane should be parked over the new Fuel Storage Area and the power supply disconnect switch shall be open and padlocked with an Administrative Control Lock whenever it is not in use.
- 3.31 Any fuel assembly movement will be proceeded by Form VNF-7 issued from the Refueling Office with the Superintendent of Operations, approval signature affixed for fuel assembly position changes.
- 3.32 In the event of anything abnormal occurring during operations, stop and have situation evaluated by the Supervisor.

INITIAL

4.0 PROCEDURE

4.1 Unloading Cask From Truck

4.1.1 Initial conditions are noted and satisfied.

4.1.2 Precautions and Limitations are noted.

4.1.3 Slide back the trailer enclosure as follows

4.1.3.1 Release the tarpaulin in tie-down along the sides of the trailer by pulling the elastic tie-down ropes from the trailers tie-down hooks.

4.1.3.2 Release the trailer rear tarpaulin section by unbuckling the leather straps along each side of the tarpaulin releasing the bottom of the tarpaulin.

4.1.3.3 Roll-up the rear tarpaulin section and secure it in this position by placing the straps around the tarpaulin and buckling the straps to the tarpaulin roof section.

4.1.3.4 Slide the enclosure forward by having one man at ground level on each side of the trailer grasp the side section of the tarpaulin and pull it towards the front of the trailer (this will result in sliding the roller mechanism forward). Slide the enclosure until the tarpaulin is drawn as far as possible against the front of the enclosure.

(Step 4.1.3 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

A rope and pulley are also located on the inside of the trailer front wall to assist in pulling the tarpaulin forward. The mechanism can then be locked in place by the pin locks on the rails.

NOTE: If it is desirable to limit the cask or cover lift height during removal from the trailer, the lengths of the slide mechanism roller tracks may be removed between the track support posts. This removal is done by retracting the spring loaded pins from the ends of the track and removing the track section.

*4.1.4 Perform Cask and Trailer Radiation Surveys and Record Data on "Cask Receipt Radiation Survey" and on the "Cask Unloading Report". Complete the Survey Forms and retain for documentation requirements. This is performed and document by Station Health Physics Department.

NOTE: Steps in the "Unloading Procedure", marked by an asterisk (*), indicate information is required to be entered on the referenced form or report.

*4.1.5 Using a hand-held pyrometer measure the fin surface temperatures on right and left sides of Cask and record on "Cask Unloading Report". Health Physics requirements should be checked to determine if protective clothing (e.g. gloves) are required.

*4.1.6 Record Security Seal Numbers on the "Cask Unloading Report." (Seals on front and back shock absorbing covers). Remove seals.

INITIAL

4.0 PROCEDURE (continued)

*4.1.7 Remove (6) trunnion impact limiters per the following instructions: (two on lower end of cask, four on upper end of cask). See figure 2, Attachment 2.

Required Equipment

Waterproof Tape

Ratchet

~~13/16~~
13/16 inch socket

Ratchet drive extension

Trunnion

#1 #2 #3 #4 #5 #6 Tape

4.1.7.1 Remove the limiter 9/16" bolt.

NOTE: As the bolt is removed, manually restrain the trunnion impact limiter (approximate weight of a trunnion impact limiter is 45 lbs).

4.1.7.2 When the bolt is removed, remove the trunnion impact limiter from the trunnion.

4.1.7.3 Inspect the threads of the 9/16" bolts and the trunnion hole. Tape over the bolt holes.

QC QC QC QC QC QC

4.1.7.4 Store the bolts and trunnion impact limiter in their prescribed storage area.

NOTE: If storage is made in a contaminated area the trunnion impact limiters should be covered with a sheet of plastic, etc. to avoid their contamination.

(Step 4.1.7 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

Repeat steps 4.1.7.1 thru 4.1.7.4 for the remaining trunnion impact limiters. The front cradle dust cover plate must be swung back to gain access to front trunnion on underside of cask.

- 4.1.8 Position trailer under unloading crane and release front trunnion, trunnion guide assembly and rear trunnion tie-down per the following instructions: Make reference mark of position of trailer for loading/unloading operations, by taping a line on the side of the trailer midway $\pm 1/2$ inch between cask front and rear trunnion center lines. Locate the trailer centered laterally on the road way $\pm 1/2$ inch so that the cask trunnion mid point is over the crane centerline mark on the road ± 1 inch.

Required Equipment

Ratchet

3/4 inch socket (for trunnion guide assembly bolts)

1 1/8 inch socket (for rear trunnion bolts)

1 1/4 inch open end wrench

Front Trunnion

- 4.1.8.1 Remove the load binder handle restraint chain from the trailer chain securement hook.

RIGHT

LEFT

(Step 4.1.8 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

RIGHT

LEFT

4.1.8.2 Release tension from the front trunnion restraint by lifting up on the binder handle.

4.1.8.3 Remove the binder attachment hook from beneath the trunnion tie-down support lip.

4.1.8.4 Swing the binder assembly free of the cask trunnion by pivoting around the tie-down rod pivot pin. Lay the binder assembly on trailer deck.

4.1.8.5 Repeat steps 4.1.8.1 through 4.1.8.5 for the second front trunnion tie-down.

Trunnion Guide Assembly Removal

4.1.8.6 Swing back the front cradle dust cover plate from the underside of the trailer.

4.1.8.7 Remove the two 1/2 inch hex head bolts and their lock washers.

4.1.8.8 Remove the trunnion guide assembly from the trailer (this frees the lower redundant trunnion and allows cask removal from the trailer).

(Step 4.1.8 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

RIGHT

LEFT

Rear Trunnion

4.1.8.9 Remove the two 3/4 inch bolts and their lock washer from the rear trunnion tie-down.

4.1.8.10 Lift the rear trunnion collar free of the cask rear trunnion.

4.1.8.11 Repeat steps 4.1.8.9 and 4.1.8.10 for the second rear trunnion tie-down.

4.1.9 Remove the shock absorbing covers per the instructions below and apply two layers of tape over each shock absorbing cover bolt and alignment pin hole on the front and rear front. See figure 1 and 2 in Attachment 2.

Required Equipment

2 legged sling equipped with connections to allow attachment to the lifting crane auxiliary hook (bale) and to the cover connecting shackles (loops, et:.)

2 connecting shackles

Ratchet

Ratchet drive extension

1 7/8 inch socket

Storage area (for covers)

Plastic or tarpaulin cover (if necessary, see step 4.1.9.7 Note).

1/2 ton chain fall with dynamometer

INITIAL

4.0 PROCEDURE (continued)

FRONT

REAR

4.1.9.1 Center the crane auxiliary hook directly over the shock absorbing cover to be handled. There is no preference in the shock absorbing cover removal sequence; either may be removed first. Lower the crane auxiliary hook and attach to chain fall dynamometer assembly.

4.1.9.2 Attach the 2 legged sling lifting bale to the dynamometer.

4.1.9.3 Attach the 2 legged sling to the 2 lifting lugs of the shock absorbing cover by means of the 2 connecting shackles.

4.1.9.4 Carefully raise the auxiliary hook to take slack out of the cable; then, by use of the chain hoist pick-up approximately 850 to 900 lbs as indicated on the dynamometer.

4.1.9.5 Remove the four shock absorbing cover bolts. The 2 top bolts should be removed before the 2 bottom bolts. Inspect bolts for wear and grease with Never-Seeze prior to re-installation.

QC

NOTE: Due to the angle of the covers from the vertical, care should be taken when removing these bolts as the bottom of the rear cover could swing out from the cask when its bolts are removed.

(Step 4.1.9 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

FRONT

REAR

4.1.9.6 Gently move the shock absorbing cover away from the cask until the cover centering pins are clear of the cask. Lift the shock absorbing cover using crane auxiliary hook.

4.1.9.7 Move the shock absorbing cover to its designated storage area and disconnect the 2 shackles from the shock absorbing cover lifting lugs.

NOTE: If the storage area is dirty or contaminated, the covers should be stored on a sheet of plastic or a tarpaulin and covered. Care should be exercised in handling and storing cover bolts to prevent thread damage.

4.1.9.8 Transfer the crane hook and 2 legged sling to the other shock absorbing cover.

4.1.9.9 Repeat steps 4.1.9.1 thru 4.1.9.7 for the other shock absorbing cover.

QC

4.1.9.10 Remove the 2 legged sling assembly from the crane auxiliary hook.

4.1.10 Attach main hoist of cask crane to horizontal lifting beam using the following steps:

(Step 4.1.10 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

- 4.1.10.1 Traverse the crane over the stored horizontal lift beam. Lower the hook between the yoke plates, insert the pin, and lock the pin in place with the keeper plate. Apply Never-seeze grease to all four lifting pendant bearing surfaces.
- 4.1.10.2 Raise the horizontal lift beam clear of its supports and rotate it on the hook swivels so that the front end (short pendants) is oriented toward the front of the cask. Raise high enough for the trunnion plates to clear the cask. Traverse the beam directly over the cask. Apply Never-seeze to cask trunnions.
- 4.1.11 Lower the beam slowly and guide the trunnion plates past the trunnions until they can be slipped on. Raise the locking bars, slip the plates over the trunnions and release the locking bars so that they rest on the trunnions inside the trunnion lip thus preventing the plates from coming off.

NOTE: If difficulty is experienced in attaching a rear trunnion plate because the cask is not centered on the trailer, it will be necessary to shift the cask to a central position first.

INITIAL

4.0 PROCEDURE (continued)

_____ 4.1.12 The cask should be raised carefully until it is clear above the supports. The front will rise about 8 inches before the rear trunnions lift off their supports. If, at this time, it appears necessary to control lateral movement of the cask, ropes should be attached at the trunnions and held on the ground.

_____ 4.1.13 When the cask is clear of the trailer, the trailer should be driven out. The cask can then be lowered until it is near the elevation of the tilting frame trunnion supports. Rotate cask 90° to align cask with tilting frame.

_____ 4.1.14 The rotated cask is then traversed over the tilting frame and lowered until the rear trunnions are in their supports. Care must be taken to center the rear trunnions within 1/4 inch as they contact the supports. Once they are positioned the cask can be fully lowered.

_____ 4.1.15 With the pendants slack, the locking bars can be raised and the trunnion plates removed from the trunnions. Raise the horizontal lift beam and traverse to the storage supports. Lower the horizontal lift beam onto the supports. Disengage the hook pin, raise the hook, store the pin in the yoke plates.

INITIAL

4.0 PROCEDURE (continued)

INITIAL

4.0 PROCEDURE (continued)

4.1.16 Attach primary lifting beam to crane hook using following steps:

4.1.16.1 Lower the crane hook between the strong back plates of the lift beam. Align the four-inch hole in the crane hook with the four-inch hole in the lift beam. (A sleeve adapter is to be required as the center hole of crane is larger than the 4 in. diameter pin). See figure 3, Attachment 2.

4.1.16.2 Insert the four-inch diameter pin and install the keeper plate.

4.1.17 Connect air system to lifting beam and insure operability as follows:

(Refer to figure 4).

4.1.17.1 Connect the air controller to an air supply of 75-100 PSIG.

4.1.17.2 Attach as many 50 ft. long sections of flexible hose to the three quick-connectors on the air controller as needed. The hoses and quick connectors are color coded to assure proper connection.

(Step 4.1.17 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

- _____ 4.1.17.3 Connect the three hoses to the fittings on the right hand side of the beam as one faces the side with the piping. (hoses, piping and air controller are color coded).
- _____ 4.1.17.4 Verify that the bypass toggle valves on the beams are in the closed position.
- _____ 4.1.17.5 Observe whether the lifting arms are in the released or engaged position. Set the arm control lever on the air controller to the same position.
- _____ 4.1.17.6 Set the green handle of the locking cylinder valve to the "locked" position.
- _____ 4.1.17.7 Depress the black handled toggle valve on the air controller until line pressure is indicated on the pressure gauge. Releasing the toggle will close this valve.

NOTE: The system is now operational. It is always operated in the following sequence:

Set the green handled locking cylinder valve to "unlocked".

Move the arm positioning lever to the desired position. Lifting beam latching mechanism fails to "engaged" position. Air may be disconnected once engaged for ease of movement of cask. Visually verify that the arms have moved fully to the desired position.

Set the green handled locking cylinder valve to "locked".

INITIAL

4.0 PROCEDURE (continued)

CAUTION: Do not attempt to move the arms when the green handle is on "locked". However, if this should happen, return the arm positioning lever to the position corresponding with the current position of the arm of the beam before opening (unlocking) the locking cylinder.

When the system is in the "locked" position, visual confirmation is provided by small metal flags which are moved by the end of the locking pin. These flags extend horizontally when the system is fully locked and can be seen from the surface of the pool when the cask is under water. The location of these flags may influence the position of the beam with respect to the cask (i.e., whether 180° rotation is desired) before the cask goes into the pool.

Note that the arm repositioning will take a few seconds more if:

- . The air lines are especially long
- . Air pressure is on the low side
- . The system is in redundant configuration.

Allow sufficient time before returning the green handled valves to the "locked" position.

4.1.18 Apply Never-seeze grease to the lifting shoulder of front horizontal trunnions and to the engagement surface of the lifting arms. Position the lift beam over the front trunnions and engage the lift beam to the trunnions.

4.1.19 Tilt the cask to the vertical position using the crane. Maintain crane and cables in a vertical position over lifting trunnions as the cask is tilted to the vertical position. Lift the cask off the tilting frame.

INITIAL

4.0 PROCEDURE (continued)

4.1.20 Transfer the cask to the decon. area (Decon Bldg.), installing the bottom protective cover as the cask is lowered onto the pad per the following instructions: See figure 18.

4.1.20.1 Prior to lowering the cask onto the decontamination pad, place the Bottom Protective Cover onto the decontamination pad.

4.1.20.2 Lower the cask until its bottom region is approximately 6 inches above the bottom cover.

4.1.20.3 Manually lift the bottom cover and fit it onto the cask rear face (approximate weight 30 lb.).

4.1.20.4 Attach the cover to the cask by looping the cover attachment cables over the lower cask trunnions and securing them to their attachment point on the bottom cover.

4.1.20.5 Slowly lower the cask onto the decontamination pad.

4.1.21 Disengage the lift beam and move it from the operations area (see step 4.1.17).

4.1.22 Proceed to section 4.2 for Preparation of Cask prior to unloading.

Completed By: _____

Date: _____

INITIAL

4.0 PROCEDURE (continued)

4.2 Preparation of Cask for Unloading Spent Fuel.

4.2.1 Initial condition are noted and satisfied.

4.2.2 Precautions and Limitations are noted.

Skirt Operation Precautions

The skirt's condition should be checked on a routine basis. Special attention to leakage inspections is advised. If leaks are identified, the area shall be patched using a reinforced plastic patch kit.

4.2.3 Install the plastic protective skirt around the finned length of the cask per the instructions provided below:

Skirt Installation

Allen wrench - 3/8 inch

Crescent wrench (adjustable)

Never-Seeze grease, or site approved equivalent

Waterproof tape

Ratchet wrench

Torque wrench 0-100#

3/8" hex set screw socket

4.2.3.1 Place plastic protective cover on top surface of cask.

(Step 4.2.3 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

4.2.3.2 Remove the skirt from storage. Unroll it and inspect it to ensure that it is in an acceptable condition (i.e. no holes, acceptable contamination levels, etc.,) Check condition of skirt accessories, water hoses, connectors "J1" and "J2" cables, cable tensioners, and screws. Grease screw threads if necessary.

4.2.3.3 Insert the 2 pins (4) of the lower bar into the cask skirt lugs (11) and manually wrap the skirt around the cask utilizing the handles (5).

NOTE: Item numbers used in this section are shown in figures 20, 21, 22, 23, 24.

4.2.3.4 Insert the 2 pins (3) of the upper bar into the corresponding holes of the skirt lower bar (2). Install the 13 screws (22) to close the skirt.

4.2.3.5 Locate the upper skirt lateral guide (8a) in the cask front drum groove.

4.2.3.6 Position the cable as shown in Fig. 20 detail 1. The cable is wrapped "below" the lateral guide (i.e. between the lateral guide and the cask center). Wrap the cable once around the cask as shown in Fig. 20.

INITIAL

4.0 PROCEDURE (continued)

- _____ 4.2.3.7 Insert the cable under the upper bar (1) and into the drum groove (insert cable in groove shown in Fig. 20, detail 1 and wrap the cable around the cask a second time, while carefully positioning the cable in the cask drum groove, "below" the lateral guide (as shown in Fig. 20, detail 1)).
- _____ 4.2.3.8 Pull the cable taut and check that the cable is correctly positioned in the drum groove.
- _____ 4.2.3.9 Insert the free end of the valve through the rotation drum hole (15) of the rotation drum (14) of the upper skirt cable tensioner (7). (Refer to Fig. 20 and Fig. 23).
- _____ 4.2.3.10 Lock the cable by tightening the cable locking screw (16).
- _____ 4.2.3.11 Attach the locking O-rings (18) to the locking handles (17) as shown in Figure 23 (the O-ring forces the locking handles down onto the rotational drums (14) and prevents rotation. This keeps the cables under tension).

INITIAL

4.0 PROCEDURE (continued)

- 4.2.3.12 Attach a wrench to the cable tensioning nut (19) and turn the rotation drum as indicated by arrows in section AA of Fig. 24. The locking handle should be pulled up to allow the rotation drum to turn. When the cable is sufficiently tensioned, push the locking handle (17) firmly down to ensure that it is seated against the rotation drum (14).
- 4.2.3.13 Repeat step 4.2.3.11 for the second rotation drum (14) of the skirt cable tensioner.
- 4.2.3.14 Locate the lower lateral guide (8b) in the cask rear drum groove.
- 4.2.3.15 Repeat steps 4.2.3.5 through 4.2.3.12 for the lower skirt cable tensioner (6) (the cables placed between the lateral guide and the center of the cask).
- 4.2.3.16 Install a layer of water proof tape along the upper and lower edges of the skirt as shown on Fig. 20, detail 1. Tape also to be installed over the upper bar after the screws have been installed. This reduces skirt water supply requirements by improving the skirt sealing.

QC

QC

QC

INITIAL

4.0 PROCEDURE (continued)

4.2.4 Remove the blind flanges from openings "J1" and "J2" and install the connectors "J1" and "J2" and torque the bolts to 35 ft-lb per the following instructions:

Refer to Figure 2 and 17.

4.2.4.1 One torque wrench equipped with a 3/8 hex set screw socket suitable for setting torques of 35 ft-lbs is required.

4.2.4.2 Install the three bolts for each flange and the shield plug and torque the bolts to 35 ft-lbs in a counter clockwise direction.

4.2.4.3 Repeat the torquing of the bolts to 35 ft-lb in a counter clockwise direction.

4.2.5 Remove the blind flange from opening "B" using the 3/8 inch hex set screw socket.

*4.2.6 Perform radiation survey of the exposed recess of opening "B" (γ at contact) and record on the "Cask unloading Report" (5.0).

4.2.7 Seal the cask front face shock absorbing cover bolt and alignment pin holes by applying two layers over each hole.

4.2.8 Remove grease from all trunnions except for areas that come in contact with the lifting arms during handling between the decontamination pad and the pool.

QC

INITIAL

4.0 PROCEDURE (continued)

4.2.9 Sample the cask cavity atmosphere as follows:

4.2.9.1 Install the VDS in the Sampling Mode as shown on Figure 7. Ensure valves V-1, V-2 and V-3 are closed and Connection "B" is blanked off at the 2 inch vacuum hose connection prior to connecting to the cask, and sample cylinder is attached.

*4.2.9.2 Measure the cask internal cavity pressure by opening valve V-2 and reading the pressure off gauge G-1. Record pressure reading on the "Cask Unloading Report". Close valve V-2.

4.2.9.3 Dependent upon the measured cask internal cavity pressure, perform the following:

If the measured pressure is less than atmospheric, vent the cask cavity to atmosphere by disconnecting 2" blank from the "B" connector. See Figure 7 and 14.

(Step 4.2.9 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

If the measured pressure is greater than atmospheric, indicating fission gas build-up in the cask cavity, release cask pressure by opening valve V-3 thereby venting the cask cavity to gaseous radwaste. Ensure the gaseous radwaste discharge line is connected to valve V-3 prior to opening valve V-3. When cask is at atmospheric pressure, close valve V-3.

NOTE: VDS pump must be started for this evolution.

- 4.2.9.4 Purge the gaseous sample cylinder, "B" connector and associated piping as follows:
- 4.2.9.5 Remove the "B" Connector with sample cylinder from cask.
- 4.2.9.6 Open valves V-1, V-2 and V-3.
- 4.2.9.7 Start vacuum pump and run for three minutes to evacuate sample cylinder, "B" Connector and associated piping.
- 4.2.9.8 Close valves V-1, V-2, V-3 and stop vacuum pump.
- 4.2.9.9 Reconnect "B" Connector with sample cylinder to cask Hansen Coupling at "B" flange opening.

(Step 4.2.9 continued on next page)

TIAL

4.0 PROCEDURE (continued)

- 4.2.9.10 Open valves V-1 and V-2 to draw sample from cask cavity into sample cylinder.
- 4.2.9.11 After collecting the sample, isolate the sample cylinder by closing valves V-1 and V-2; then remove "B" Connector from cask.

*4.2.9.12 Remove the sample flask and analyze cask gaseous activity for fission gas content. Record measured activity on the "Cask Unloading Report."

4.2.10 Install Thermocouple as follows:

NOTE: Thermocouples are rods of three different lengths and have specific associated ports. Refer to Figure 2.

Remove plugs from ports "F1", "F2" and "F3" and install test thermocouples into thermocouple wells "F1", "F2", and "F3". Inspect gaskets and apply Never-Seeze grease to threads as necessary, prior to re-installation.

*4.2.11 Measure cask cavity wall temperature using the thermocouples, and ambient temperature using a thermometer and record all measurements on the "Cask Unloading Report".

NOTE: Thermocouples will remain installed to verify completion of cask cooldown.

4.2.12 Initiate Cask Filling/Cooling as follows:

Refer to Figures 2, 8, 12 and 15.

(Step 4.2.12 continued on next page)

INITIAL

4.0 PROCEDURE (continued)

_____*4.2.12.1 Remove the blind flange from opening "C"
and survey the recess. Record radiation
measurement on the "Cask Unloading
Report."

_____*4.2.12.2 Remove the shield plug from opening "A".

NOTE: When removing or working in the area of shield
plug "A", care should be exercised as radiation
streaming may be present.

_____*4.2.12.3 Install the CDS in the Cask

_____* Filling/Cooling Mode as shown in Figure 8.

_____* QC

Install Connectors "A2", install the three bolts and
torque to 35 ft-lb power steps 4.2.4.1 thru

_____*4.2.4.3. Ensure valve line-up is as shown with
valves V-9 and V-10, V-11, V-12 closed.
The safety valve connected to the cask
through connector "A2" shall be set at
75 PSIG.

_____*4.2.12.4 Open valve V-9 and crack open valve
V-11.

_____*4.2.12.5 Set pressure regulator PR-1 to 75 PSIG.

_____*4.2.12.6 Initiate cooling water flow through the
CDS by opening valve V-10. Monitor
pressure gauge G-4. Pressure should
increase to saturation pressure for the
cold wall temperature.

(Step 4.2.12 continued on next pages)

INITIAL

4.0 PROCEDURE (continued)

Establish a cask cavity cooling water inlet flow rate by throttling valve V-10 to maintain saturation pressure on G-4. Continue to fill the cask cavity through connector "C".

NOTE: Monitor cask cavity temperature using thermocouples installed in "F1", "F2", and "F3" during filling and circulation of the cask cavity water.

4.2.12.7 When the cask is filled, the pressure on gauge G-4 should show 75 PSIG (equal to G-5). Open both valves V-10 and V- to obtain full flow of cooling water through cask.

NOTE: Observe vent hose while filling. When water is seen in vent hose, open valve V-12 and close valve V-9 to drain cooling water to liquid waste.

4.2.12.8 When temperature measurements are acceptable ($\leq 125^{\circ}\text{F}$), stop the flow of coolant water. Close valve V-10.

4.2.12.9 Record the "F1" temperature reading at the completion of cooldown on the "Cask Unloading Report".

4.2.12.10 Remove Connector "A2" and Connectors "C" and drain the CDS lines.

4.2.12.11 Install shield plug "A" without bolts.

NOTE: Since the shield plug "A" is not torqued, the cask cavity is vented providing thermal expansion protection.

(Step 4.2.12 continued on next pages)

INITIALS

4.0 PROCEDURE (Cont.)

4.2 Continued

_____ 4.2.12.12 Attach a drain line to Connector "C" and
reinstall Connector "C" to the cask to
adjust the cask water level until it is
approximately twelve (12) inches below
the top of the cask lid. (i.e. drain 10
gallons).

_____ 4.2.12.13 Disconnect Connector "C" from the cask
(Hansen coupling at "C" is
self-sealing).

_____ 4.2.12.14 Remove thermocouples and reinstall and
torque well port plugs "F1", "F2" and
"F3" as follows.

_____ QC One torque wrench equipped with a
1-3/8 inch socket, suitable for setting
torques of 35 ft-lb is required.
Install plugs to hand tight, then torque
to 35 ft-lb.

_____ QC *4.3.12.15 Visually inspect the gaskets of the
blind flanges for "B" and "C" to ensure
they are free of cuts, grooves, gouges
or cracks. Particular attention should
be given to observe "feathering" at the
edges. An indication of normal
conditions will be that the seating

(Step 4.3.12.15 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

4.2 Continued

surface appears as a somewhat flattened area. If the inspection indicates a gasket defect, the gasket should be replaced.

Records of gasket inspection shall be recorded in the Cask Unloading Report. Gasket installation and replacement shall be detailed and recorded in the Report under "Remarks".

4.2.12.16 Reinstall the flanges of openings "B" and "C" per the procedure in Steps 4.2.4.1 - 4.2.4.3 and tape flanges.

4.2.13 Remove the port plug from opening "D". See Figure 2.

4.2.14 Loosen and remove lid bolts per the following procedure: See Figure 25.

4.2.14.1 Select one bolt and loosen 1/4 turn.

4.2.14.2 Continue loosening all remaining bolts by 1/4 turn following the sequence as numbered on Figure 25.

4.2.14.3 Repeat the loosening of the lid bolts by another 1/4 turn by repeating the procedure in Steps 4.2.14.1 and 4.2.14.2.

(Step 4.2.14 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

4.2 Continued

_____ 4.2.14.4 Upon completion of both 1/4 turn cycles,
all the bolts may then be removed.

Leave 4 bolts in hand tight until cask
is in pool, submerged except for top.

_____ 4.2.14.5 Inspect removed bolts for damage, store
and protect bolts from contamination in
_____ bolt storage box.

QC

_____ 4.2.15 Remove plastic protective cover from top surface
of cask.

_____ 4.2.16 Proceed to Section 4.3 for unloading of cask.

Completed By: _____

Date: _____

INITIALS

4.0 PROCEDURE (Cont.)

4.3 Cask Unloading

- _____ 4.3.1 Apply never-seeze grease to lifting trunnions on areas that come in contact with lifting arms during cask handling between the decontamination pad and the spent fuel cask area of the pool.
- _____ 4.3.2 Position primary lifting beam (still attached to cask crane main hook) over the cask.
- _____ 4.3.3 Install the air locking system as per Step 4.1.17 (Air Locking System Operation).
- _____ 4.3.4 Lower the primary lifting beam into position with the guide arms resting on the top surface of cask trunnions.
- _____ 4.3.5 Engage the primary lifting beam to cask trunnions as described in note in Step 4.1.17.
- _____ 4.3.6 Lift the cask off the decontamination pad and transfer to the Fuel Building.
- _____ 4.3.7 Rotate the cask to orient the skirt fill and vent connections ("J1" and "J2") facing north in order to facilitate connection and disconnection when cask is in the water. (See Figure 26).
- _____ 4.3.8 Attach the fill hose to "J1" when cask is in position over shelf section of the spent fuel pit cask area.

INITIALS

4.0 PROCEDURE (Cont.)

_____ 4.3.9 Lower the cask into the cask area while filling the skirt volume with P.G. water such that the skirt internal volume water level is maintained approximately 6" to 12" above the cask area water surface.

NOTE: When cask is in position establish reference mark on floor (use plumb bob suspended from cab of crane) for future alignment of crane.

_____ 4.3.10 Reduce crane speed and water flow rate into the skirt as the skirt water level approaches the top of the skirt. When the entire skirt volume is full (indicated by water issuing from the "J2" port), connect floating vent to connector "J2", and tie off float at floor level allowing overflow to return to cask area.

_____ 4.3.11 Disconnect water fill line from P.G. hose and connect to water level box.

CAUTION: Ensure water fill line is held approximately one half (1/2) foot above vent at all times during this step. Make up to water level box with P.G. hose.

_____ 4.3.12 Maintain an approximate one-half (1/2) foot water head over-pressure inside the skirt by maintaining the water level in the water level box approximately one half (1/2) foot above the vent.

NOTE: This prevents inleakage of contaminated water, and must be maintained at all times while cask is submerged.

INITIALS

4.0 PROCEDURE (Cont.)

4.3.13 Continue lowering the cask to the cask area shelf at normal crane speed while continuing to maintain the one-half (1/2) foot of water over-pressure in the skirt.

4.3.14 Gently place the cask on the shelf of cask area. (Figure 26).

NOTE: Utilize underwater camera as an aid to determine distance when cask is approaching bottom.

4.3.15 Release the primary lifting beam from the cask. (Refer to Section 4.1.17 - Air Locking System Instructions).

4.3.16 Raise the primary lifting beam from the cask area and place it on its storage stand.

4.3.17 Disconnect primary lifting beam from main hook of cask crane.

4.3.18 Position main hook over the cask crane hook adaptor and lower hook into place for attachment.

4.3.19 Insert the pin through the holes in the crane hook adaptor and main hook. Install keeper plate.

4.3.20 Raise the crane hook adaptor to a height sufficient to allow the engagement of the primary lifting beam to the crane hook adaptor. (Primary lifting beam is on its storage stand).

INITIALS

4.0 PROCEDURE (Cont.)

- _____ 4.3.21 Position the crane hook adaptor between the strongback plates of the primary lifting beam and align holes. Insert pin and install keeper plate.
- _____ 4.3.22 Attach four-legged lid lifting sling to crane hook adaptor with four eye bolts.
- _____ 4.3.23 Raise primary lifting beam assembly from storage stand and move to pre-determined reference mark thus positioning the lifting beam directly above cask.
- _____ 4.3.24 Lower lifting beam to cask and engage with cask trunnions. See Steps 4.3.4 thru 4.3.5.
- _____ 4.3.25 Start filling the cask area utilizing the cask-area pump down system from the spent fuel pit. Bring level to normal (289' 10"). This takes approximately 30 minutes.
- _____ 4.3.26 While cask area is filling, slowly raise the cask toward the surface. Do not bring lid above surface at this time.
- _____ 4.3.27 When cask area level is back up to normal (289' 10"), bring the cask up slowly the rest of the way until the top surface of the cask is even with the floor (Elev. 291' 10").
- _____ 4.3.28 Remove the four remaining (lid bolts and place them in the bolt box.

INITIALS

4.0 PROCEDURE (Cont.)

- _____ 4.3.29 Attach the four-legged lid lifting sling to the
_____ lid lifting lugs with provided shackles.
- _____ 4.3.30 Adjust the four-legs of the sling until slack is
_____ taken out and legs are equal in tension.
- _____ 4.3.31 Commence pump down of cask area to original level.
_____ Return water to spent fuel pit.
- _____ 4.3.32 While cask area is pumping down, move cask over
_____ into the cask unloading section (deep portion) and
_____ begin (See Figure 27) lowering. Do not lower so
_____ far as to submerge the crane hook. Mark floor
_____ with plumb bob for reference. (See Note at Step
_____ 4.3.9).
- _____ 4.3.33 When original cask area level is reached, secure
_____ pump down system.
- _____ 4.3.34 Continue lowering the cask all the way to the
_____ bottom. Utilize underwater camera to observe
_____ approach, and gently set cask on bottom of cask
_____ area.
- _____ 4.3.35 Release the primary lifting beam from the cask
_____ (4.1.17).
- _____ 4.3.36 Remove the cask lid as follows:
_____ 4.3.36.1 Slowly raise the crane hook in "jog"
_____ speed until the cable is slightly taut.
_____ Note the height of the crane hook
_____ cables. (This is done by noting a

(Step 4.3.36 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

reference point on the crane cables,
etc.).

4.3.36.2 Slowly raise the cask lid in the jog
speed until the lid lifts freely out of
the lid recess area.

NOTE: If the lid shows signs of binding, lower the crane
hook until the cable is slack and carefully check
the crane hook vertical alignment over the lid
center and adjust as necessary. Repeat Steps
4.3.36.1 and 4.3.36.2 as needed.

4.3.36.3 Once lid is free, continue lifting the
lid in normal speed. As crane hook
adaptor emerges from water, spray it
down with P.G. water continue lifting.
Repeat spray down for primary lifting
beam and cask lid as they emerge from
water. See Figure 28.

4.3.36.4 Remove the lid from the operations area.

4.3.37 Position the cask crane with cask lid still
suspended from main hook in the area between the
two roll-up doors and close the inner roll-up
door.

4.3.38 Install the Front Face Protective Cover per the
instructions below and as shown on Fig. 19. Fuel
pit bridge may be used as a working platform.

(Step 4.3.38 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

4.3.38.1 Attach a tag line to each cover handling cable.

CAUTION: Prior to bridge travel, ensure there are no obstructions.

4.3.38.2 Orient the cover over the lid recess area such that the 2 lid centering pins are in alignment with the bosses of the cover.

4.3.38.3 Lower the cover onto the cask until it is fully down (i.e. slack cable). The cover is designed such that the edges of the cover will center it correctly.

NOTE: If the cover position is not correct, slowly lift the cover clear, adjust its position as needed by rotating the crane hook and repeat Steps 4.3.38.2 and 4.3.38.3. Utilize underwater camera as necessary.

4.3.38.4 Using the tag lines, position the cables such that they hang along the side of the cask and are out of the way of fuel unloading operations. Tie off ends of tag lines at operating level.

4.3.39 Utilizing the cask area pump down system, restore cask area to normal level (289' 10") to equalize with spent fuel pit. Return water to spent fuel pit.

INITIALS

4.0 PROCEDURE (Cont.)

- _____ 4.3.40 When the cask area water level has been restored to normal (i.e. approximately equal to spent fuel pit level) secure pump-down system.
- _____ 4.3.41 Depressurize cask area gate seals and remove gate and place on hanger using fuel pit bridge crane in preparation for fuel movement.
- _____ *4.3.42 Per the instructions provided below unload the fuel assemblies from the cask cavity. Record the position of each fuel assembly in the "Cask Unloading Report" while verifying the position and identification of the assemblies by identification number from the "Cask Loading Report" which accompanied the cask shipment. Refer to VNF-7 for Fuel Movement Details. (See Figure 29)

NOTES:

1. If operating problems occur such that the "Binding Procedure" in Section 4.3.42.15 thru 4.3.42.19 is utilized, information on the problem should be provided in the "Cask Unloading Report" under "Remarks".
2. Any lateral position adjustments of the fuel handling tool must be done with the fuel assembly outside the cask fuel compartments during loading operations or with the fuel assembly disengaged from the fuel handling tool during unloading operations (unless otherwise specified in these instructions).
3. It is recommended that reference height indications be marked on the fuel handling equipment such that they can be referred to, to assist in determining fuel assembly heights.
4. During all fuel transfer operations performed in the pool, ensure that the fuel assemblies are free of all obstacles throughout transfer.

(Step 4.2.42 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

5. Fuel Resources Personnel are present at all times during handling of fuel.

Fuel Assembly Unloading

- _____ 4.3.42.1 Attach the Surry fuel handling tool to the bridge crane hook.
- _____ 4.3.42.2 Transfer the fuel handling tool to a point directly over the fuel assembly to be unloaded from the cask. Refer to VNF-7.
- _____ 4.3.42.3 Lower the fuel handling tool until it is about 3 feet above the cask front face.
- _____ 4.3.42.4 Verify that the fuel handling tool is centered over the desired fuel assembly. If it is not, adjust its position as needed. Ensure that the fuel handling tool is free of any obstacles during these adjustments.
- _____ 4.3.42.5 When alignment is satisfactory, slowly begin lowering the fuel handling tool onto the fuel assembly. If further adjustment is needed, this should be done with the fuel handling tool above

(Step 4.3.42 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

the cask fuel compartment. No lateral adjustment should be made with the tool in a fuel compartment.

_____ 4.3.42.6 Continue lowering the fuel handling tool until it is completely down on the fuel assembly (i.e. no weight on load cell).

_____ 4.3.42.7 Engage the fuel assembly with the fuel handling tool and lock handle.

_____ 4.3.42.8 Slowly raise the fuel assembly while closely monitoring for binding.

_____ 4.3.42.9 If binding is indicated, stop movement and proceed to Section 4.3.42.15 thru 4.3.42.19.

_____ 4.3.42.10 Continue slowly lifting the fuel assembly until its bottom nozzle is about 3 feet above the cask front face.

_____ 4.3.42.11 Transfer the fuel assembly to its spent fuel storage location. Refer to VNF-7.

_____ 4.3.42.12 Slowly lower the fuel assembly into the desired storage area and disengage the fuel handling tool from the fuel assembly.

_____ 4.3.42.13 Repeat Steps 4.3.42.2 thru 4.3.42.12 until the cask is unloaded.

(Step 4.3.42 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

4.3.42.14 Store the fuel handling tool in its storage area and disconnect it from the crane hook.

Binding Indication Instructions

4.3.42.15 Stop removal of the fuel assembly.

Release excessive tension in the fuel handling crane cable by lowering the crane hook in the jog mode.

4.3.42.16 If assembly is not binding and free to be lowered, lower the fuel assembly in the jog mode until the assembly is in the full down position.

4.3.42.17 If assembly is binding and cannot be lowered carefully move the fuel handling tool slightly back and forth (laterally) in a "Rocking" motion. Perform this step in combination with lowering the assembly in a jog mode until the fuel assembly is in the full down position.

4.3.42.18 Disengage the fuel handling tool from the assembly and raise the fuel handling tool such that it is clear of the cask front face.

(Step 4.3.42 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

4.3.42.19 Attempt to repeat fuel unloading

operations starting at Step 4.3.42.5.

If the assembly still indicates binding, a thorough review of the problem should be made. If it is decided that the fuel assembly must be removed, this should be done by carefully performing Step

4.3.42.17.

4.3.43 Replace cask area gate with fuel pit bridge crane.

4.3.44 Repressurize cask area gate seals. (32 to 35 psig)

4.3.45 Commence pumping down water level in cask area to original level, using cask area pump down system from Spent Fuel Pit.

4.3.46 While pumping down cask area, remove the front face protective cover from the cask:

4.3.46.1 Slowly remove the cover from the front face by lifting the tag lines. Verify that cover is removed without binding, etc.

4.3.46.2 Transfer the cover to its storage area and store properly.

4.3.47 When cask area water level has been returned to its original level, secure pumping from Spent Fuel Pit.

INITIALS

4.0 PROCEDURE (Cont.)

4.3.48 Replace the cask lid on the cask per the following instructions:

4.3.48.1 Open the inner roll-up door that was closed in Step 4.3.37.

4.3.48.2 Transfer the lid to the position directly over the cask cavity lid seating surface using cask area crane by positioning crane at reference mark established in Step 4.3.32.

4.3.48.3 Establish correct cask cavity lid orientation (orientation markers) and lower it to a height of about 4 feet above the cask. Check lid alignment and orientation as needed.

NOTE: This alignment is important and should be done carefully. Angular orientation is to be established by lining up the cask and lid orientation marks prior to installing the lid. The lid should be rotated as needed.

4.3.48.4 Slowly lower the lid into the lid recess.

NOTE: Lateral and rotational adjustments of the lid may be made as the lid nears the cask front face but no lateral movement of the crane should be made once the lid has entered the lid recess. If further lid position adjustments are needed, the lid should be lifted until it is free of the lid recess and above the cask.

(Step 4.3.48 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

_____ 4.3.48.5 If the lid indicates significant binding during crane descent, slowly raise the lid in the jog mode until it is again free of binding and raise the lid out of the lid recess. Check the lid alignment and repeat Steps 4.3.48.3 and 4.3.48.4.

_____ 4.3.48.6 As the lid nears its full down position, ensure that the 2 centering pins are protruding through their respective lid flange holes.

NOTE: Use binoculars and/or underwater camera as needed to perform this evolution.

_____ 4.3.48.7 If they do not protrude stop crane descent. Slowly raise the lid a few inches.

_____ 4.3.48.8 Twist the crane hook in whichever direction is needed by referencing the lid orientation marks. Return to Step 4.3.48.4 and continue lid installation.

_____ 4.3.48.9 Continue lowering until the lid is fully down as indicated by slack cable in the sling cables. Visually verify the lid for proper installation. (i.e. visually looks to be seated and the alignment pins protrude from the lid plate).

QC

INITIALS

4.0 PROCEDURE (Cont.)

- _____ 4.3.49 Lower the primary lifting beam slowly
until its guide arms are resting on
shoulders of lifting trunnions.
- _____ 4.3.50 Engage the primary lift beam to the cask
lifting trunnions as outlined in Step
4.1.17.
- _____ 4.3.51 Raise the cask from the bottom of the
cask area and place over cask area
shelf. Reference mark for crane
established in Step 4.3.9 should be
used.
- _____ 4.3.52 Gently set cask down on cask area shelf.
Do not release primary lift beam from
cask.
- _____ 4.3.53 Raise the water level in the cask area
to the normal level (289' 10") using the
cask area pump down system.
- _____ 4.3.54 Begin raising cask to surface while
pumping up water level in cask area. Do
not bring skirt out of water.
- _____ 4.3.55 When normal water level in cask area is
reached, secure cask area pump down
system.

TIALS

4.0 PROCEDURE (Cont.)

4.3.56 Continue raising cask until top face is approximately even with operating deck (291' 10").

4.3.57 Check and grease (using Never-Seeze) the threads of all removed cask bolts and screws as needed.

4.3.58 Remove water from four bolt holes (with an aspirator) prior to returning four lid bolts which were removed in Step 4.3.28.

NOTE: Each bolt is associated with a specific bolt hole. Check bolt number with hole number.

4.3.59 Replace the above mentioned lid bolt in their respective hole and hand tighten.

4.3.60 Remove four legged sling from lid lifting lugs by removing four shackles.

4.3.61 Lower cask down to cask area shelf.

4.3.62 Release primary lift beam from cask trunnions (4.1.17).

4.3.63 Raise primary lift beam toward surface.

4.3.64 As crane hook adaptor emerges from water spray down with P.G. water continue spraying the crane hook adaptor while lifting to full up position. Also spray down primary lifting beam when it emerges.

TIALS

4.0 PROCEDURE (Cont.)

- 4.3.65 Transfer the crane to a position directly above the primary lift beam storage stand.
- 4.3.66 Lower the primary lift beam onto its stand and disengage it from crane hook adaptor by removing keeper plate and pulling pin. Remove four eye bolts from crane hook adaptor and store four legged sling.
- 4.3.67 Raise crane hook adaptor clear of primary lift beam and reinsert pin thru holes in lifting beam for storage.
- 4.3.68 Move crane with crane hook adaptor to position above crane hook adaptor storage back.
- 4.3.69 Lower crane hook adaptor onto its storage rack and disengage from crane hook by removing keeper plate and pulling pin.
- 4.3.70 Raise crane hook clear of crane hook adaptor and re-insert pin in holes in crane hook adaptor for storage.
- 4.3.71 Position the cask crane hook directly above the primary lifting beam.

INITIALS

4.0 PROCEDURE (Cont.)

- _____ 4.3.72 Remove the pin from primary lifting and lower between strongback plates on primary lifting beam.
- _____ 4.3.73 Align holes in primary lifting beam with hole in crane hook and insert pin.
- _____ 4.3.74 Install keeper plate.
- _____ 4.3.75 Raise the primary lift beam from its storage stand and transfer into position above cask.
- _____ 4.3.76 Lower primary lift beam guide arms onto cask lifting trunnions.
- _____ 4.3.77 Engage primary lifting beam with cask trunnions (4.1.17).
- _____ 4.3.78 Commence raising cask toward surface.
- _____ 4.3.79 As the cask is removed from the water, the water inlet flow should be reduced and finally stopped as the top of the skirt surfaces from the pool. At all times the flow rate should be such that approximately a 1 foot skirt overpressure is maintained. Control the crane speed to maintain but not exceed the one foot skirt overpressure.

INITIALS

4.0 PROCEDURE (Cont.)

- 4.3.80 When vent hose connection "J2" reaches surface, remove the hose connection to shorten the drainage flow path. Disconnect from float line. Mate ends of hose together to form a circular hose. This prevents internal contamination of hose. Store hose.
- 4.3.81 Slowly remove the cask from the pool while thoroughly washing down the lift beam top, skirt and base of the cask with a water spray to remove particulate and soluble contaminants.
- 4.3.82 Disconnect "J1" hose from water level control box.
- 4.3.83 Insert hose into drain funnel to drain skirt. Observe level inside skirt while draining; maintain this level approximately one foot above cask area water level by raising cask as required.
- 4.3.84 When skirt has completely drained and cask has been pulled completely out of the water, disconnect "J1" hose from "J1" connection.

INITIALS

4.0 PROCEDURE (Cont.)

- _____ 4.3.85 Position the crane above the open Decon
Building access doors and lower cask
into the Decon building.
- _____ 4.3.86 Set cask down gently and disengage
primary lifting beam from cask.
- _____ 4.3.87 Raise primary lifting beam back up into
the Fuel building, and transfer to a
position above the storage stand.
- _____ 4.3.88 Dry all cask surfaces with clean rags as
soon as practicable.
- _____ 4.3.89 Decontaminate exposed cask surfaces as
necessary including outside of skirt.
- _____ 4.3.90 Proceed to Section 4.4 for Preparation
Of Cask For Departure.

Complete By: _____

Date: _____

INITIALS

4.0 PROCEDURE (Cont.)

4.4 Preparation of Cask for Departure

4.4.1 Initial conditions are noted and satisfied.

4.4.2 Precautions and Limitations are noted.

4.4.3 Verify that the port plug from opening "D" is removed.

4.4.4 Remove water from bolt holes using an aspirator and install remaining lid bolts and tighten all lid bolts to the specified torque as follow:

Required Equipment

- torque wrench suitable for setting
- torques of 40 to 290 ft-lb
- 1-7/8" socket
- drive extension.

4.4.4.1 Install all bolts and tighten to hand tight.

4.4.4.2 Tighten all bolts to 40 ft-lb in the following fashion:

4.4.4.3 Tighten the bolts to 40 ft-lb following the numerical sequence as shown in Figure 25.

4.4.4.4 Repeat the cycle of Step 4.4.4.3 starting with bolt number 1 until all bolts are torqued to 40 ft-lb.

4.4.4.5 Tighten all lid bolts to the final required torque of 290 ft-lb by following the procedure in steps 4.4.4.3 and 4.4.4.4

QC

QC

INITIALS

4.0 PROCEDURE (Cont.)

- 4.4.5 Remove the blind flanges from openings "B" and "C", and thermocouple well port plugs "F1", "F2" and "F3". Install thermocouples.
- 4.4.6 Install the CDS in the Cask Draining Mode as shown on Figure 9. Drain the cask cavity water to the Decon Building sump until no more water comes out.

NOTE: Skirt removal may commence at this time if desired.

- 4.4.7 Remove shield plug from "A".
- 4.4.8 Connect the VDS to the cask cavity through shield plug opening "A" as shown on Figure 10, 12. Ensure valves V-2, V-3, V-4, V-5 and V-7 are closed and valve V-6 is open. Install drain bottle in Connector "C".

NOTE: To facilitate operations, it is recommended that a curve be plotted of cask internal pressure (mbar) versus pumping time during cask drying.

- 4.4.9 Open valve V-2 and start the vacuum pump with the gas ballast valve open. Observe the cask cavity pressure using the gauges G-1 and G-3 using valve V-6 to throttle the vacuum pump suction.

NOTE: The cask cavity pressure will normally show an initial steep pressure decrease until a pressure corresponding to the vapor pressure of the residual liquid in the cavity is reached. At this point, the cask cavity pressure will remain nearly constant showing a plateau region. This plateau will be observed to be at a pressure equal to the vapor pressure corresponding to the temperature of the cold wall of the cask cavity (anticipated pressure: 14 mbar - 35 mbar).

INITIALS

4.0 PROCEDURE (Cont.)

4.4.10 When the vacuum reaches approximately 40 mbar, close valve V-6 and remove blind flange on "B" Connector (Fig. 14) to break vacuum, forcing any water out drain into the drain bottle.

CAUTION: Be careful to retain "O" Ring when removing flange; vacuum could suck in if not careful.

4.4.11 Replace blind flange on "B" Connector, and open valve V-6 and continue pumping until the pressure is back down to approximately 40 mbar. Continue to repeat this step as long as a level increase is observed in the drain bottle.

4.4.12 When no significant level increase in the drain bottle is noted, disconnect connector "C" from the cask and continue vacuum pumping using valve V-6 to obtain a cavity pressure of approximately 20 mbar.

NOTE: Monitor the cask cavity internal pressure. As the last of the residual moisture is removed by the vacuum pump, the internal pressure as monitored on gauge G-1 will show a second steep pressure decrease. Ensure the cask cavity pressure is not pumped below 7 mbar, which could cause freezing of the remaining water.

4.4.13 Measure the temperature (T) of the cask cavity walls using the thermocouples installed in wells "F1", "F2" and "F3". Determine the water vapor pressure (P) in equilibrium with the coolest cavity wall temperature reading.

INITIALS

4.0 PROCEDURE (Cont.)

_____ 4.4.14 Continue vacuum drying until a pressure of less than 1/2P (but not less than 7 mbar) is achieved.

_____ 4.4.15 Isolate the vacuum pump from the cavity by closing valve V-6. Record initial pressure and time on test data sheet.

_____ *4.4.16 The cask cavity is considered dry if a rise in pressure does not exceed P/4 or 3.3 mbar, whichever is less, during a period of 10 minutes (record final pressure and time on test data sheet).

_____ 4.4.17 If the pressure increase exceeds the above limits, open valve V-6 and start vacuum pump for further vacuum drying. Continue to repeat dryness verification until criteria of Step 4.4.16 are met.

_____ 4.4.18 Upon successful completion of the cask cavity dryness verification, disconnect the VDS by disconnecting connector "A1" from the Shield Plug opening "A".

_____ 4.4.19 Reinstall shield plug "A" and torque bolts to 35 ft. - lbs. in a clockwise direction from the first bolt.

_____ 4.4.20 Repeat the torquing of the bolts to 35 ft. - lbs. in a counter-clockwise direction.

INITIALS

4.0 PROCEDURE (Cont.)

4.4.21 Readjust the VDS to place it in the Evacuation Mode as shown in Figure 11.

*4.4.22 Adjust the cask cavity internal pressure to 0.3 bars, absolute (-10 psig) using valve V-3 (not connected to the gaseous radwaste discharge line) as a vent to atmospheric pressure and by the operation of the vacuum pump (valve V-6 must be open during vacuum pump operation). Record the final pressure on the "Cask Unloading Report".

4.4.23 Remove the VDS including Connector "B".

4.4.24 Remove the tape and plugs from the cask front face bolt holes.

4.4.25 Check external contamination of all exposed surfaces of the cask and decontaminate as required.

4.4.26 Survey the recesses for openings "B" and "C".

4.4.27 Remove thermocouples and replace well port plugs "F1", "F2" and "F3", port plug "D" and the blind flanges for openings "B" and "C", and tighten all bolts and plugs to the specified torque per the following instructions:

4.4.27.1 Thermocouple well port plugs "F1", "F2" and "F3" and port plug "D".

One torque wrench equipped with a 1-3/8" socket, suitable for setting torques of 35 ft-lb is required.

(Step 4.4.27 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

4.4.27.2 Install plug to hand tight, then torque to 35 ft-lb.

QC

4.4.27.3 Bolts for the blind flanges of openings "B", and "C".

One torque wrench equipped with a 3/8" hex set screw socket, suitable for setting torques of 35 ft-lb is required.

4.4.27.4 Install the three bolts for each flange and torque the bolts to 35 ft-lb in a clockwise direction from the first bolt.

4.4.27.5 Repeat the torquing of the bolts to 35 ft-lb in a counter clockwise direction.

QC

4.4.28 Remove the protective skirt as follows:

NOTE: Do not remove the skirt until all required external cask decontamination operations are complete. Removal of the skirt prior to the completion of these steps risks contamination of the cask fins.

4.4.28.1 Remove connectors "J1" and "J2".

4.4.28.2 Remove any remaining tape from the upper and lower skirt edges and unwrap the tensioning cables, freeing the skirt from the drum grooves.

(Step 4.4.28 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

_____ 4.4.28.3 Remove the 13 screws from the upper and lower skirtbars. (Note: Remove the bolts from bottom to top).

_____ 4.4.28.4 Check that both the upper and lower lateral guides are free of the drum grooves.

_____ 4.4.28.5 Remove the skirt from the cask using the skirt handles (5). Hang skirt on storage ring.

_____ 4.4.28.6 Check the skirt contamination level. Decontaminate if necessary until acceptable levels are attained. Normally, washing the skirt with clean water and a soft cloth is sufficient to decontaminate the skirt.

_____ 4.4.29 Survey the cask/skirt joints now exposed and the finned surfaces of the cask for contamination and decontaminate as required. Reinstall flanges "J1" and "J2" and torque 3/8" hex head bolts to 35 ft-lb.

QC

_____ 4.4.30 Transfer cask crane to a position above the cask and lower lift beam.

_____ 4.4.31 Grease the surfaces of the lift beam arms, outer front trunnion shoulders and rear trunnion inner shoulders with Never-Seize.

INITIALS

4.0 PROCEDURE (Cont.)

_____ 4.4.32 Re-engage lift beam arms (see 4.1.17) and lift the
cask off the decontamination pad and remove the
Bottom Protective Cover per the following
instructions:

_____ 4.4.32.1 Disconnect the bottom cover attachment
cables from the cask trunnions and fold
them to the side of the cover so they
are not in the way.

_____ 4.4.32.2 Slowly lift the cask off the
decontamination pad. As the cask is
lifted, remove the bottom cover from the
cask.

_____ 4.4.32.3 Check the bottom cover for
contamination. Decontaminate as needed.

_____ 4.4.32.4 Transfer the cover to its storage area.

_____ 4.4.33 Remove tape from alignment pin and bolt holes and
survey for removable contamination and
decontaminate the rear cask face as required.

_____ 4.4.34 Transfer the cask to a position over the rear
trunnion supports of the tilting frame.

_____ 4.4.35 Grease rear trunnion supports with Never-Seeze
grease.

INITIALS

4.0 PROCEDURE (Cont.)

_____ 4.4.36 Lower the cask bottom trunnions onto the tilting frame rear trunnion supports.

NOTE: Cask should be oriented such that drain "C" will face upward, after cask is tilted into a horizontal position.

_____ 4.4.37 Carefully rotate cask to horizontal position with front trunnions resting on front trunnion support of tilting frame.

CAUTION: Maintain crane and crane cables in a vertical position over lifting trunnions while performing tilting of cask.

_____ 4.4.38 Disengage the primary lifting beam from the cask and return it to its storage stand in the Fuel Building.

_____ 4.4.39 Perform contamination survey required by H.P. on cask surfaces inaccessible after shock absorbing cover and impact limiter installation.

_____ 4.4.40 After releasing primary lift beam from cask crane main hook, position main hook over horizontal lifting beam.

NOTE: Primary lifting beam air locking system may be disconnected and returned to storage at this time, if so desired.

_____ 4.4.41 Lower main hook between the yoke plates, insert the pin, and lock the pin in place with the keeper plate.

_____ 4.4.42 Return truck and trailer to the loading/unloading position as indicated by reference mark established in Step 4.1.8 - "Unloading Cask From Truck".

INITIALS

4.0 PROCEDURE (Cont.)

- _____ 4.4.43 Raise the horizontal lift beam clear of its supports and rotate it on the hook swivel so that the front end (short pendants) is oriented toward the front of the cask. Raise high enough for the trunnion plates to clear the cask. Traverse the beam directly over the cask. Grease the bearing surfaces of the lifting pendants and the lifting trunnions of the cask with Never-Seeze.
- _____ 4.4.44 Lower the beam slowly and guide the trunnion plates past the trunnions until they can be slipped on. Raise the locking bars, slip the plates over the trunnions and release the locking bars so that they rest on the trunnions inside the trunnion lip thus preventing the plates from coming off.
- _____ 4.4.45 The cask should be raised carefully until it is clear above the supports. The front will rise about 8 inches before the rear trunnions lift off their supports. If, at this time, it appears necessary to control lateral movement of the cask, ropes should be attached at the trunnions and held on the ground.
- _____ 4.4.46 The cask shall be raised high enough to clear its supports on the trailer and rotated 90° to align with trailer.

INITIALS

4.0 PROCEDURE (Cont.)

- _____ 4.4.47 Raise cask to an elevation sufficient to clear the tarpaulin rails and position over trailer.
- _____ 4.4.48 The cask is lowered onto the trailer. Slight traversing of the crane may be required to center the rear trunnions within 1/4 inch in their supports. Once the rear trunnions are in contact the cask can be fully lowered.
- _____ 4.4.49 With the pendants slack, the locking bars can be raised and the trunnion plates removed from the trunnions. Raise the horizontal lift beam and traverse to the storage supports.
- _____ 4.4.50 Lower the horizontal lift beam onto the supports. Disengage the hook pin, raise the hook, store the pin in the yoke plates.
- _____ 4.4.51 Position the cask crane to facilitate the installation of the shock absorbing covers.
- _____ 4.4.52 Perform rear trunnion, front trunnion and trunnion guide assembly tie-down operations per the following instructions:

Required Equipment

- Ratchet
- 3/4 inch socket (front trunnion guide assembly bolts)
- 13/16 inch socket
- Torque wrench (suitable for setting torques of 30 and 125 ft-lbs)
- 1-1/4 open end wrench
- Ratchet drive extension

INITIALS

4.0 PROCEDURE (Cont.)

4.4.53 Install the rear trunnion tie-down as follows:

Rear Trunnions

4.4.53.1 Place the trunnion tie-down collars over the rear trunnions.

4.4.53.2 Install the two 3/4 inch bolts (with their lock washers) to hand tight.

NOTE: Ensure that the bolt threads contain an acceptable grease coating. Ensure that the bolt lock washers are installed.

4.4.53.3 Install the rear trunnion support bolts and tighten each to a torque of 125 ft-lb. Repeat for second rear trunnion.

4.4.54 Front Trunnions

4.4.54.1 Swing the binder assembly over the cask trunnion.

4.4.54.2 Verify that the collar is correctly positioned on the trunnion inside shoulder. The position of the collar should be such that it restrains the top half of the trunnion shoulder. If necessary, adjust the collar position, by performing Step 4.4.56.

4.4.54.3 With the binder handle in the up position, engage the binder attachment hook under the trunnion tie-down support lip.

(Step 4.4.54 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

_____ 4.4.54.4 Push the binder handle down to the full
_____ down position. Verify that the collar
QC is tight against the cask trunnion. If
it is not, adjust the tie-down assembly
by performing Step 4.4.56.

_____ 4.4.54.5 Lock the binder in its down position by
_____ securing the binder handle restraint
chain in the trailer chain securing
hook.

_____ 4.4.54.6 Repeat Steps 4.4.54.1 through 4.4.54.5
QC for the second front trunnion.

_____ 4.4.55 Trunnion Guide Assembly Installation

_____ 4.4.55.1 Swing back the trailer front cradle dust
_____ cover plate.

_____ 4.4.55.2 Install the trunnion guide assembly
_____ around the cask bottom trunnion.

_____ 4.4.55.3 Install the two 1/2" bolts with their
_____ lock washers.

NOTE: Grease the bolt threads as needed prior to
installation.

_____ 4.4.55.4 Torque the two 1/2" bolts to a torque of
QC 30 ft-lbs.

INITIALS

4.0 PROCEDURE (Cont.)

4.4.56 Front Trunnion Tie-Down Adjustment

If it is deemed necessary to adjust the tie-down collar height, the steps of this section should be performed.

4.4.56.1 Using two 1-1/4" open end wrenches, adjust the lock nuts which secure the collar to the 3/4" tie-down rod. These nuts should be turned to raise or lower the collar as needed.

4.4.56.2 Position the tie-down assembly over the trunnion and verify that the adjustment is correct.

4.4.56.3 Tighten lock nuts (upper and lower) tight against the collar and each other to ensure that they do not loosen.

4.4.57 Replace the shock absorbing covers per the following instructions. The weight of each cover is approximately 870 lb.

Required Equipment

- 2 legged sling equipped with connections to allow attachment to the lifting crane hook (bale) and to the cover connecting shackles (loops, etc.).
- 2 connecting shackles
- Ratchet
- Ratchet drive extension

(Step 4.4.57 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

- 1-7/8 inch socket
- Torque wrench suitable for setting torques of 40 and 290 ft-lbs.
- 1/2 ton chain fall with dynamometer

4.4.57.1 Attach the 2 legged sling to the 2 lifting lugs of the shock absorbing cover by means of the 2 connecting shackles.

4.4.57.2 Center the crane auxiliary hook directly over the shock absorbing cover to be handled. There is no preference in the shock absorbing cover installation sequence; either may be installed first. Lower the crane auxiliary hook. Attach chain fall and dynamometer assembly to auxiliary hook.

4.4.57.3 Attach the 2 legged sling lifting bale to the dynamometer.

4.4.57.4 Slowly raise the crane auxiliary hook until the sling legs are taut.

4.4.57.5 Transfer the shock absorbing cover to its respective end of the cask.

NOTE: The shock absorbing covers are not interchangeable.

(Step 4.4.57 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

_____ 4.4.57.6 Lower the shock absorbing cover such
that its centering pins are in alignment
with the cask alignment pin holes. Use
chain fall for fine adjustments during
alignment.

_____ 4.4.57.7 Install the cover by slowly moving the
cover toward the cask face. Care should
be taken to ensure that the alignment
pin holes are aligned correctly and the
covers remain vertical during
installation. It is recommended that a
dynamometer be used to ensure that
excessive force is not applied to the
bolts.

_____ 4.4.58 Install the four shock absorbing cover bolts and
torque them as follows:

_____ 4.4.58.1 Install all cover bolts and tighten to
hand tight.

_____ 4.4.58.2 Tighten all bolts to 40 ft-lb. in the
following fashion.

_____ (a) Following the numerical sequence
shown in Figure (25), tighten the
bolts to 40 ft-lb.

_____ (b) Repeat the cycle until all bolts
are torqued to 40 ft-lb.

_____ QC

(Step 4.4.58 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

_____ 4.4.58.3 Tighten all cover bolts to the final
_____ required torque to 290 ft-lb by
QC following the procedure in 4.4.58.2 (a)
and (b).

_____ 4.4.59 Lower the crane auxiliary hook until the 2 legged
_____ sling cables are slack.

_____ 4.4.60 Remove the shackles from the shock absorbing cover
_____ and transfer the crane auxiliary hook and 2 legged
sling to the other cover, and attach.

_____ 4.4.61 Repeat Steps 4.4.57.4 to 4.4.60 for the other
QC shock absorbing cover.

_____ 4.4.62 Store the 2 legged sling, connecting shackles and
_____ hand tools and return the crane to the Fuel
building. Close roll-up doors and Decon building
access hatch.

_____ 4.4.63 Replace the (6) trunnion impact limiters as
follows:

Required Equipment

- Ratchet
- 13/16 inch socket
- Torque wrench suitable for setting torques of 30
ft-lb
- Ratchet drive extension

(Step 4.4.63 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

#1 #2 #3 #4 #5 #6

4.4.63.1 Manually position the trunnion impact limiter on its respective trunnion. Note that trunnion impact limiter without gussets is to be installed on the downward facing (in relation to trailer) redundant trunnion (Figure 6).

4.4.63.2 Install the 9/16" bolt which attaches the limiter to hand tight.

4.4.63.3 Tighten the 9/16" bolt to a torque of 30 ft-lb.

QC

4.4.64 Repeat Steps 4.4.63.1 thru 4.4.63.3 for the remaining impact limiters to be installed.

QC

*4.4.65 Perform a cask and trailer contamination survey, recording the results on "Cask Transport Radiation Survey" and "Trailer Departure Radiation Survey" as applicable. Decontaminate as required to meet allowable levels for transport. Complete and retain the forms for documentation requirements.

NOTE: DOT considers a contamination level significant, if when averaged over 300 square centimeters of any part of the package surface, it exceeds 10^{-4} μ Ci/cm² (220 disintegrations per second per square centimeter) for beta-gamma and 10^{-5} μ Ci/cm² (22 disintegrations per second per square centimeter for alpha). (49CFR 173.397).

4.4.66 Attach the required regulatory labels to the cask.

INITIALS

4.0 PROCEDURE (Cont.)

4.4.67 Install the trailer protective enclosure as follows:

- 4.4.67.1 Install any roller track sections, if they were removed to position the cask or cover onto the trailer.
- 4.4.67.2 Install the trailer protective enclosure by sliding the enclosure rearward by having one man on each side of the trailer grasp the side section of the tarpaulin and pull it towards the rear of the trailer. Slide the enclosure until the tarpaulin is fully extended.
- 4.4.67.3 Release the back section of the tarpaulin by unbuckling the straps which fasten it to the tarpaulin roof section. Allow it to unroll.
- 4.4.67.4 Fasten the rear tarpaulin section to the enclosure sides by buckling the straps along both sides of the rear tarpaulin section.
- 4.4.67.5 Tie-down the side tarpaulin walls of the protection enclosure by pulling the elastic tie-down rope over the trailer tie-down hooks. Ensure that the rope is taut and firmly restraining the

QC

(Step 4.4.67 continued on next page)

INITIALS

4.0 PROCEDURE (Cont.)

tarpaulin at all tie-down points.
Carefully check the ends of the tie-down
rope to assure that they are properly
tied and that the rope will not come
loose.

4.4.67.6 Verify that all air vents of the
protective enclosure are not obstructed
(e.g. snow, etc.).

4.4.68 Verify that trailer placards read "Radioactive".

4.4.69 Complete and sign the "Cask Unloading Report".

4.4.70 Provide all required shipping documents and a copy
of the "Cask Unloading Report" to the carrier.
The description on the shipping paper for an empty
packaging containing residue of radioactive
material may be listed as "Empty-Last Contained
Radioactive Material, Fissile".

4.4.71 Release the package for transport.

4.4.72 Return all tools and equipment to normal storage.

Completed By: _____

Date: _____

TEST DATA SHEET

Cavity Drying and Dryness Verification

Vacuum Drying Operations

Time: _____ at start of vacuum drying operations.

Minimum cold wall temperature (t) as measured by thermocouple
"F1", "F2" or "F3":

Location: _____

Temperature: _____ °F

Water vapor pressure (P) in equilibrium with cold wall
temperature, (t):

Vapor pressure: _____ mbar

Cavity Dryness Verification

Cavity pressure at beginning of dryness verification:

Pressure: _____ mbar

Time: _____

Cavity pressure at end of dryness verification:

Pressure: _____ mbar

Time: _____

Verify cavity gas pressure rise is no greater than $P/4$
or 3.3 mbar, whichever is less:

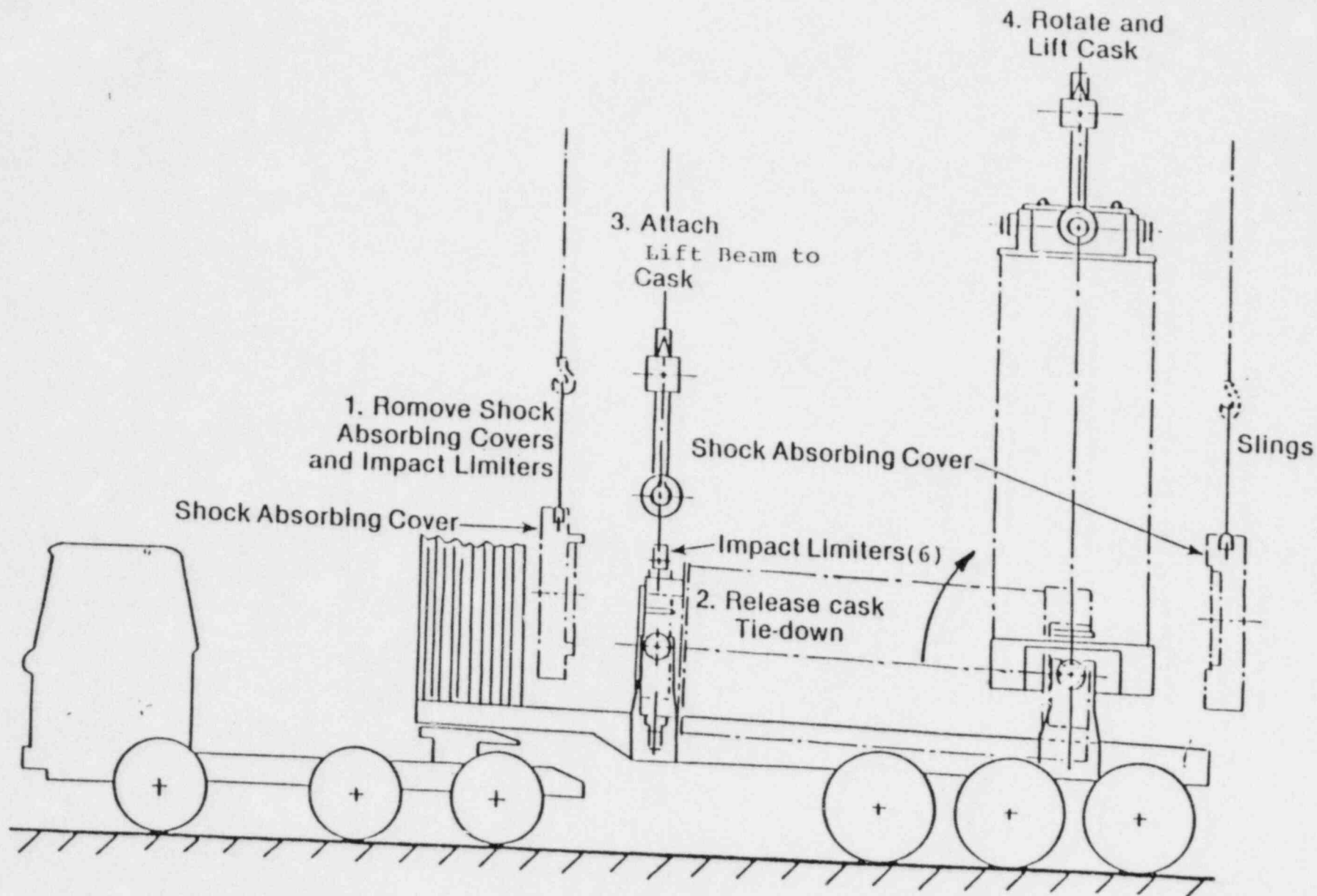
Δp : _____ mbar

Δt : _____

Test is acceptable: _____

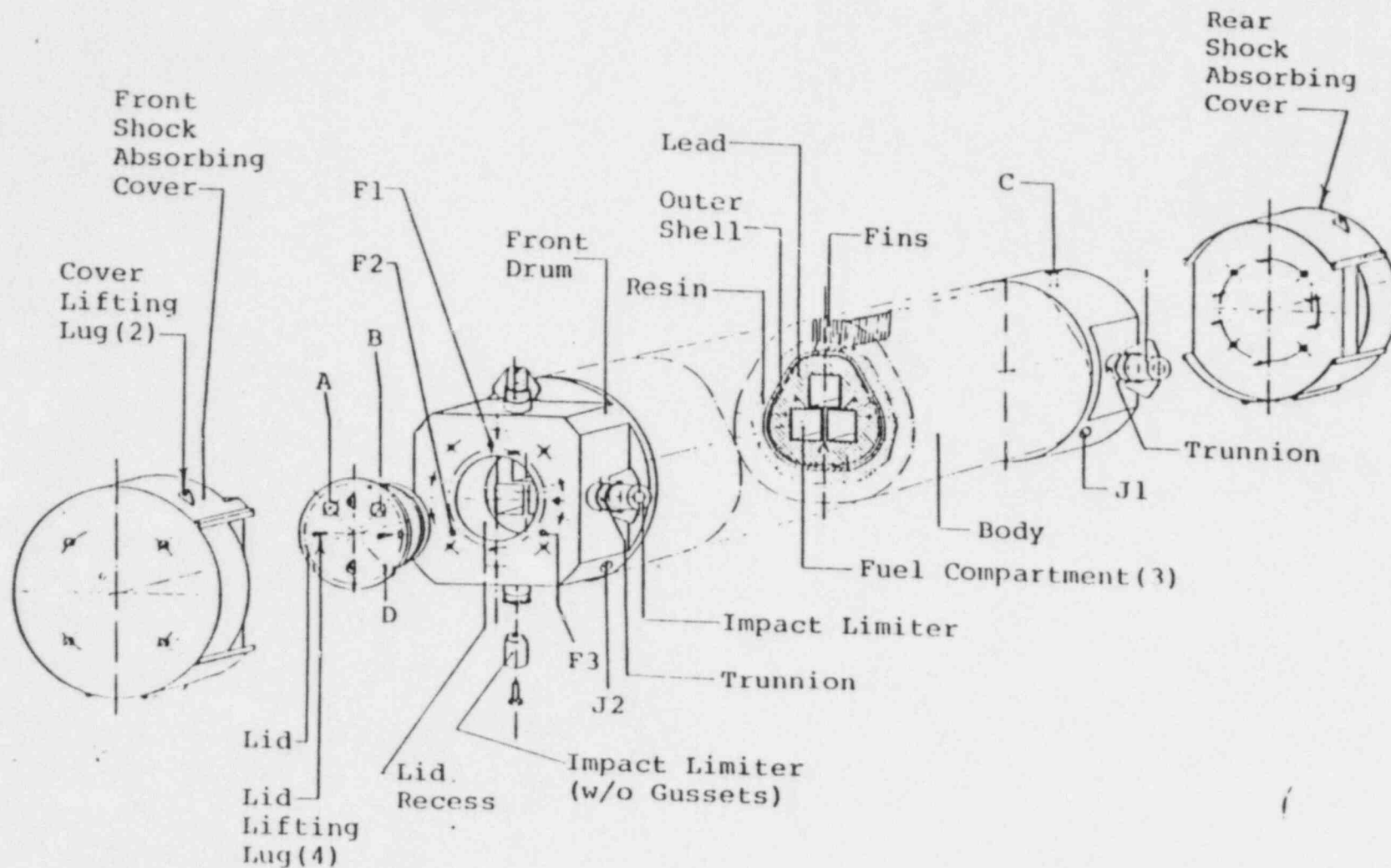
QC: _____

DATE: _____

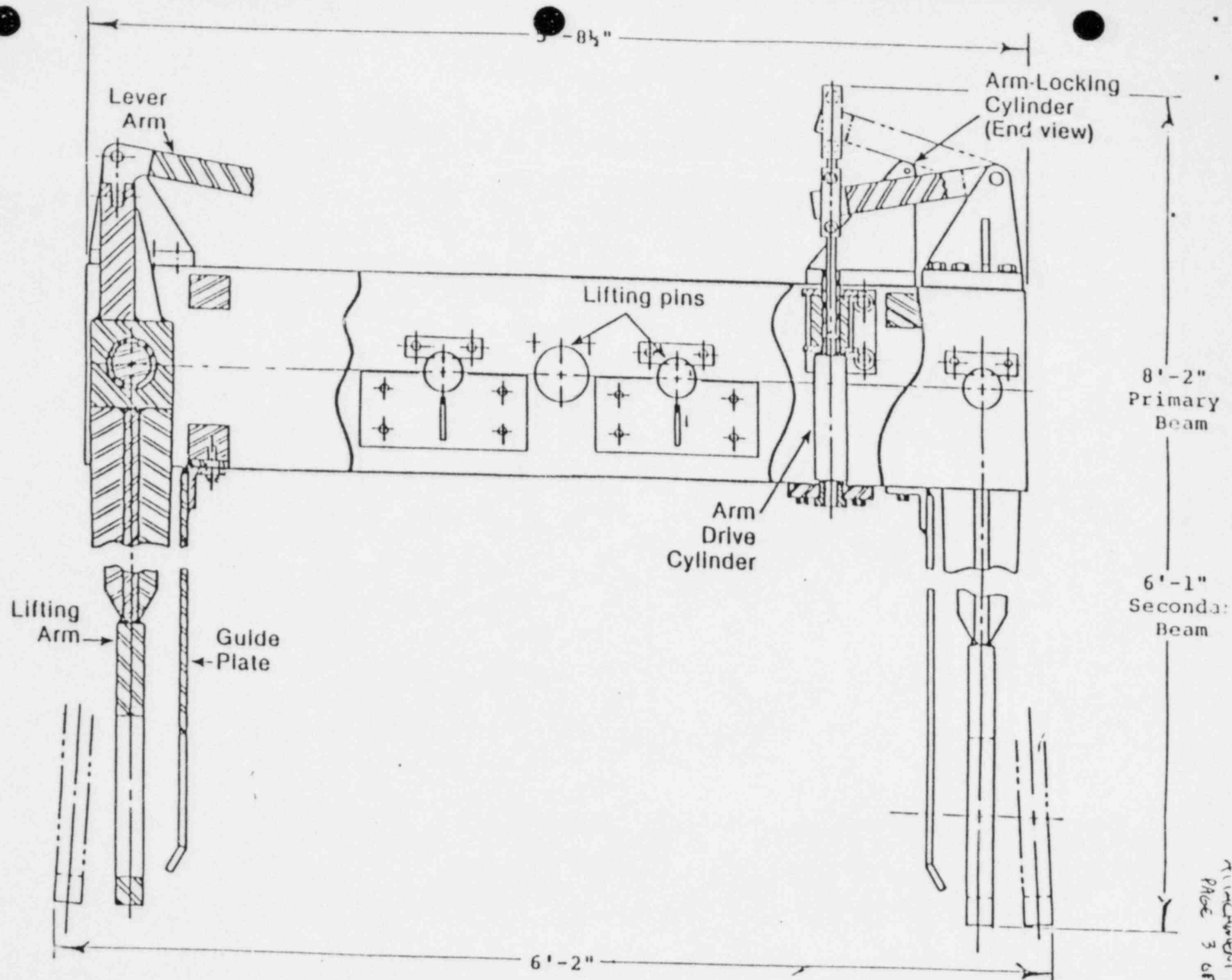


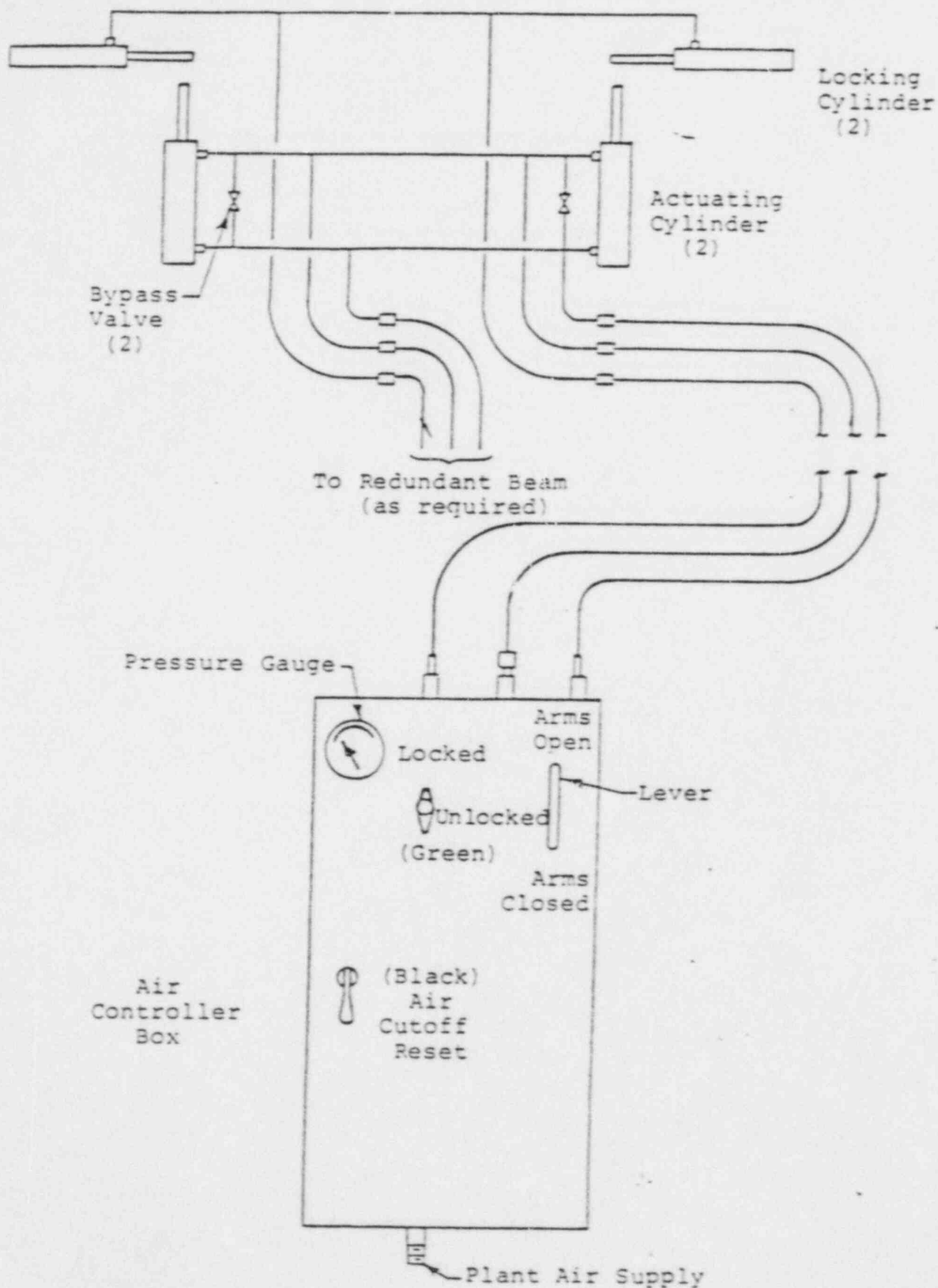
Trailer Loading/Unloading Operations

Figure 1

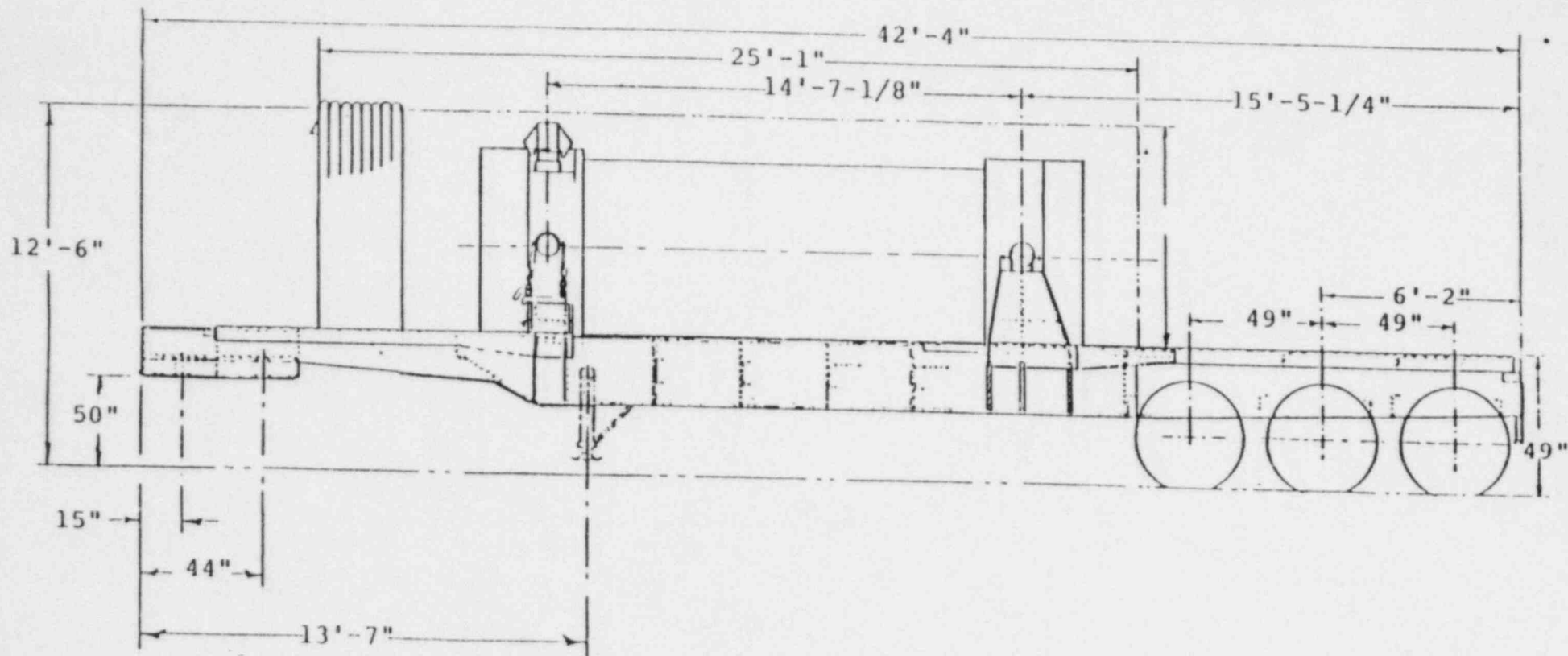


CASK OVERVIEW
Figure 2



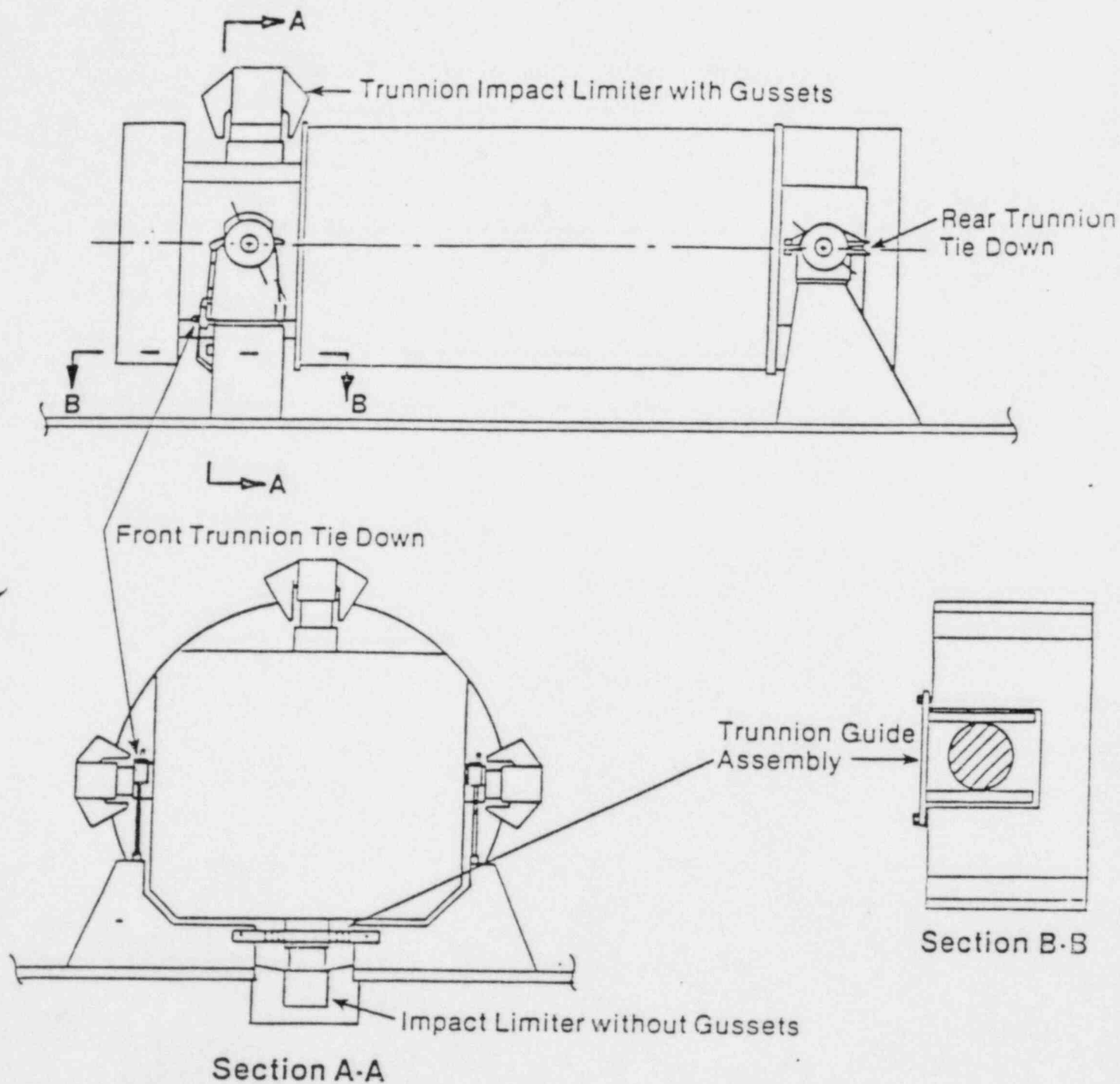


Schematic of Lift Beam Pneumatic Actuating System



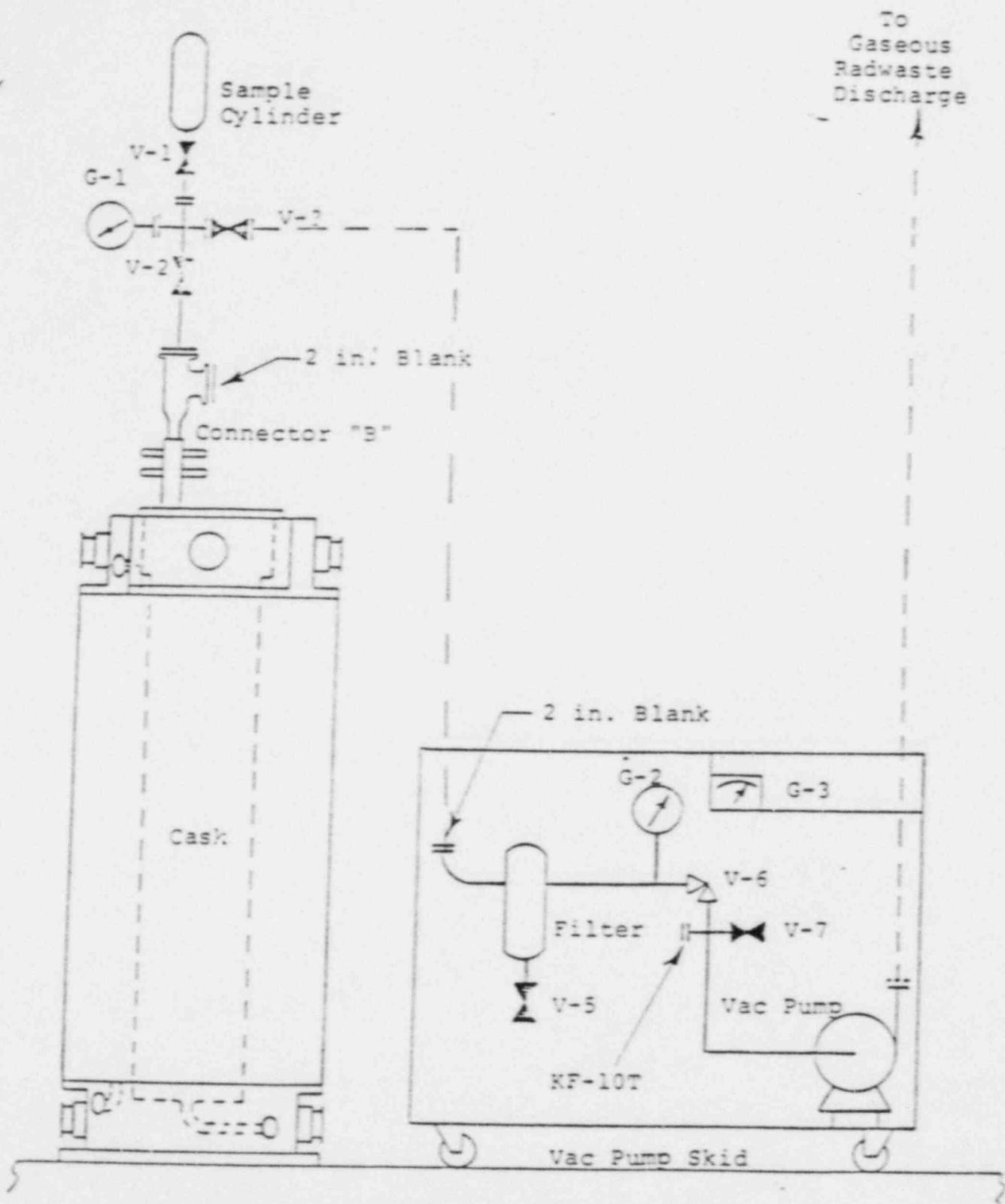
Trailer Arrangement

Figure 5



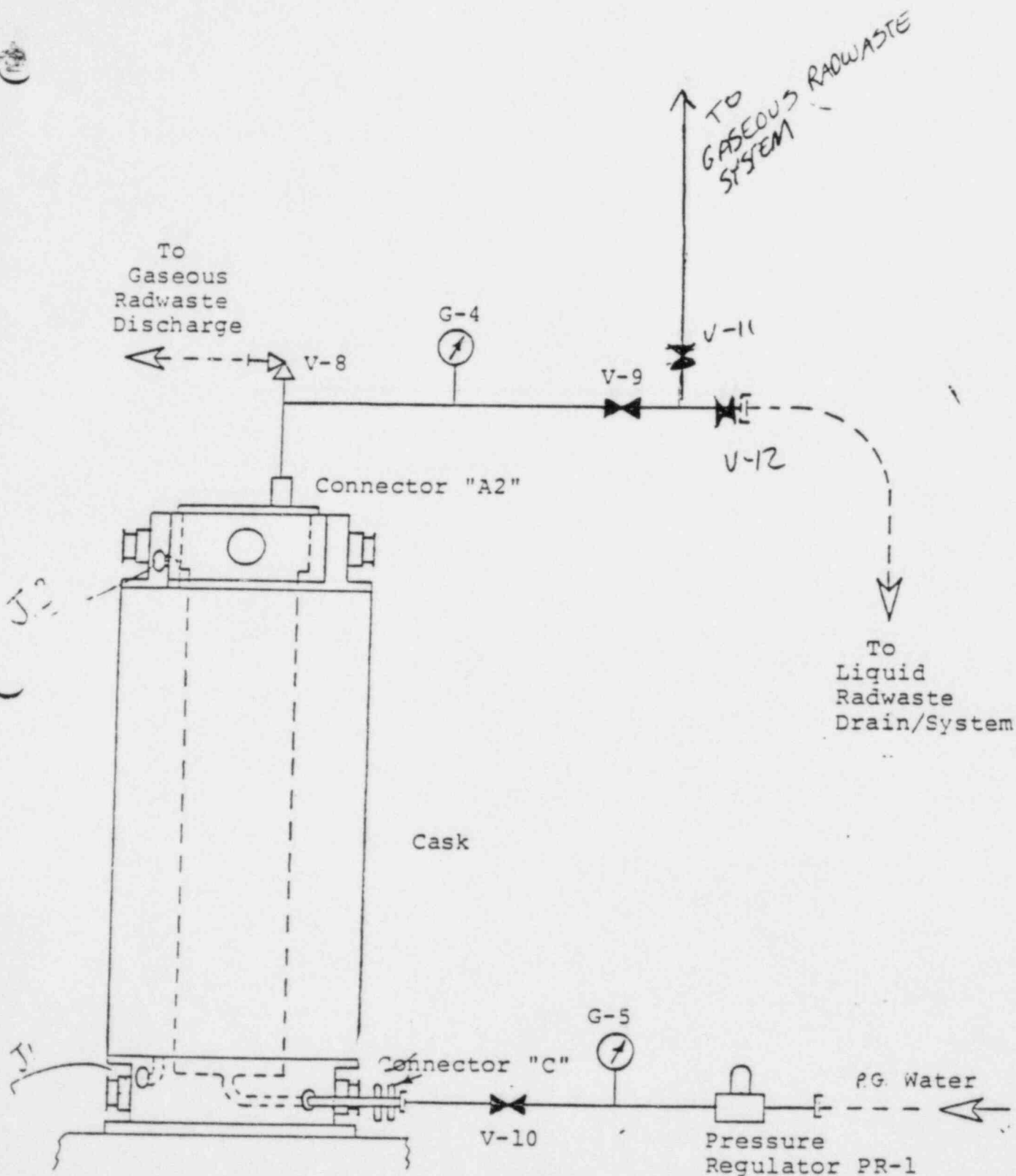
Cask Transport Arrangement

Figure 6



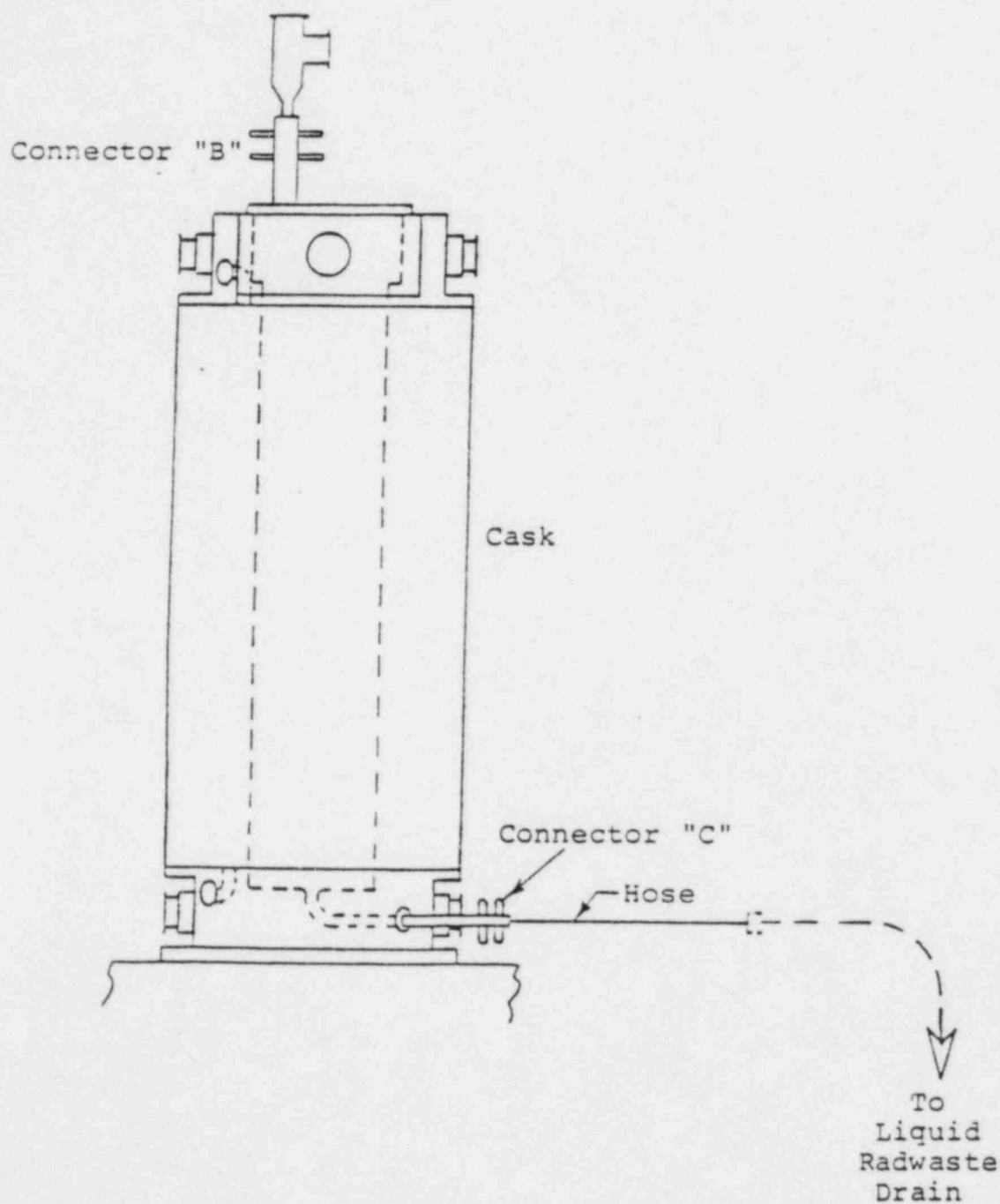
VDS in Sampling Mode

Figure 7



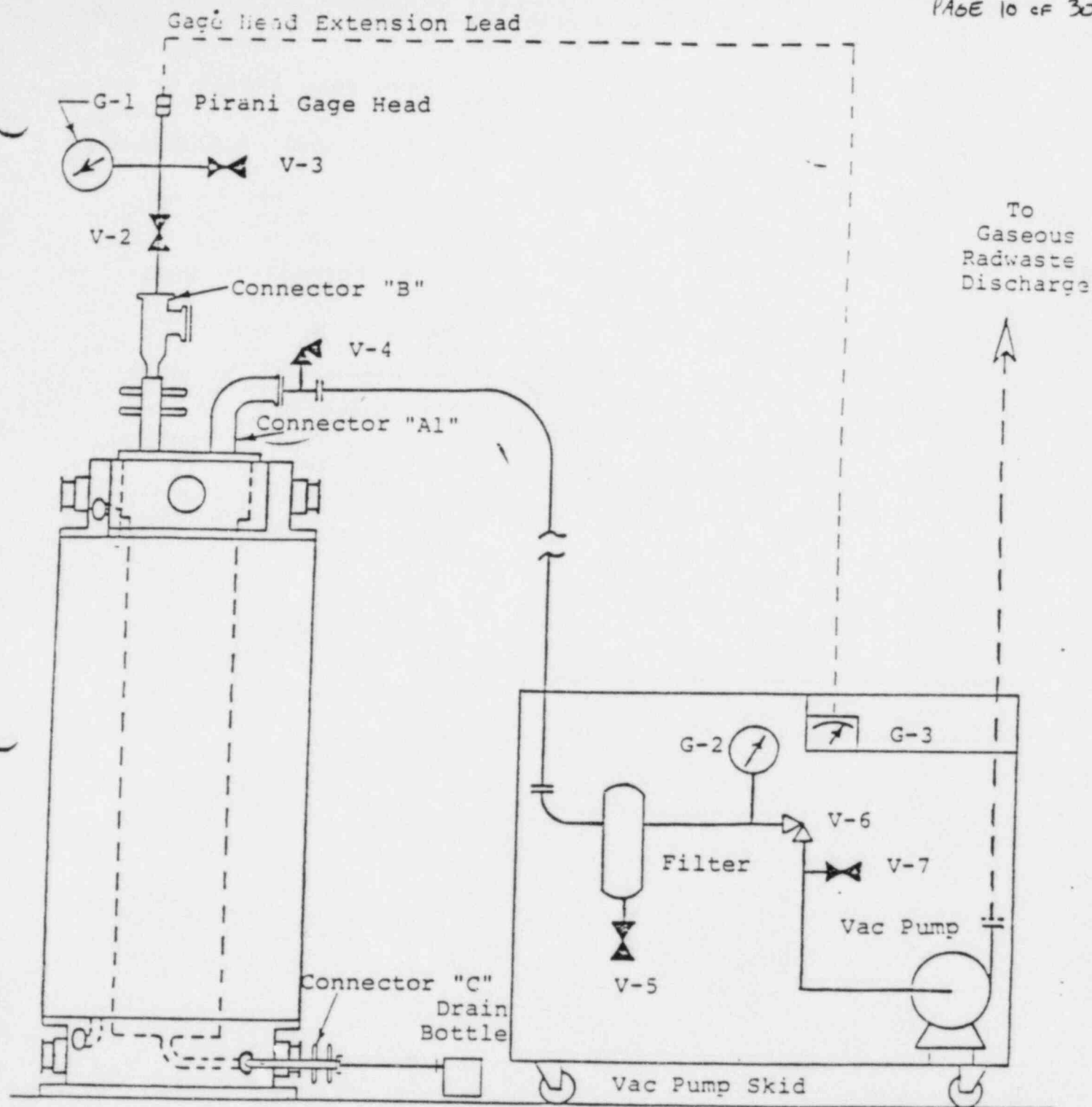
CDS in Cask Filling/Cooldown Mode

Figure 6



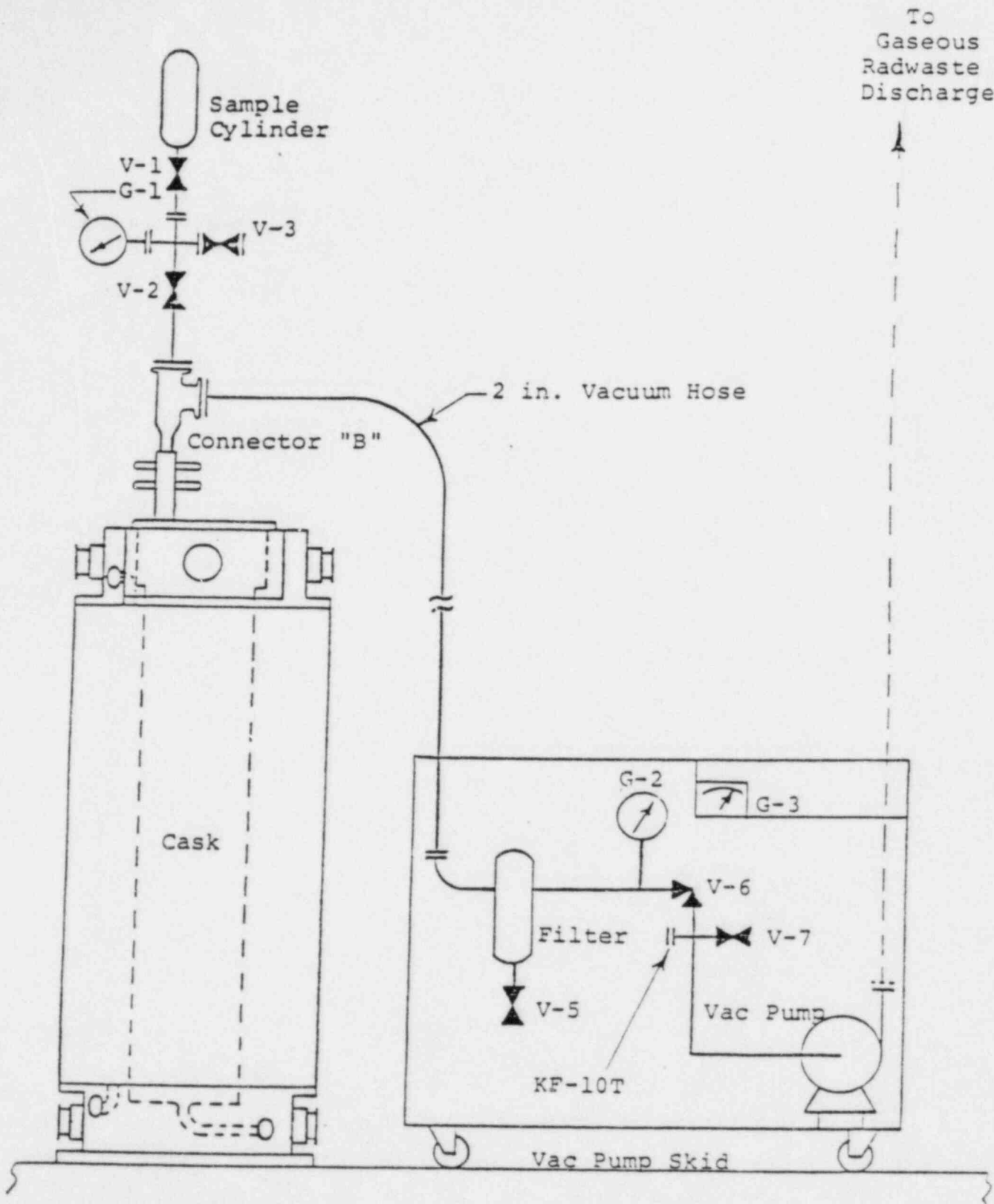
CDS in Cask Draining Mode

Figure 9



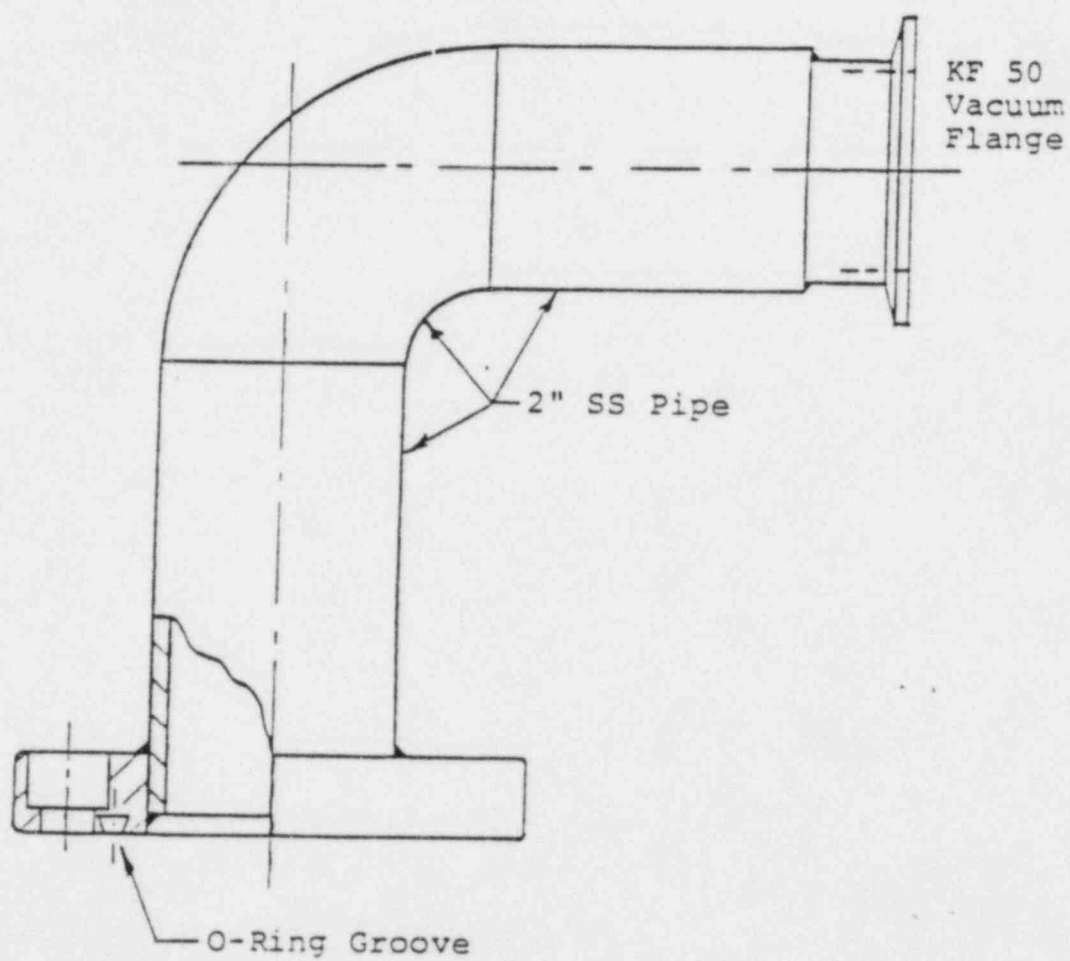
VDS in Vacuum Drying Mode

Figure 10



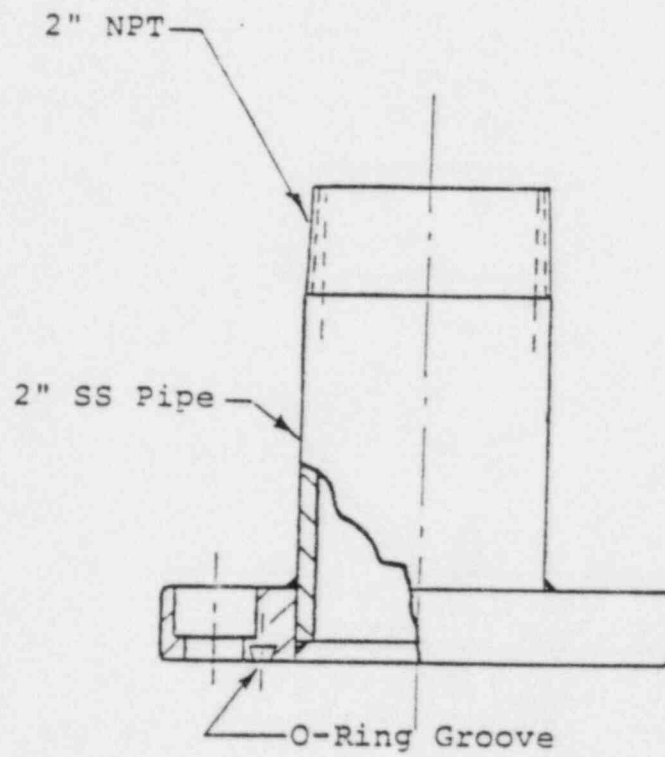
VDS In Evacuation Mode

Figure 11



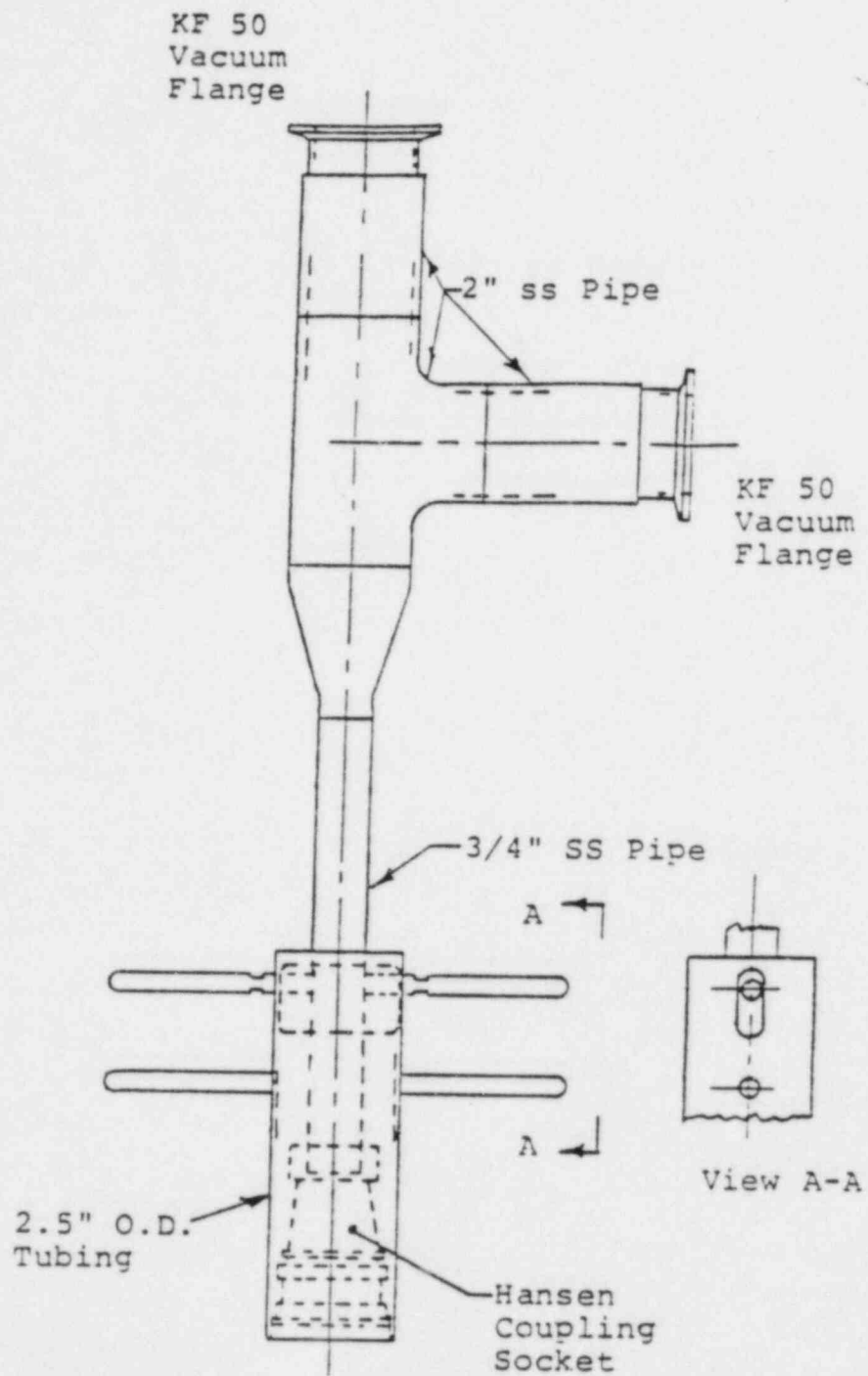
Connector "A-1"

Figure 12



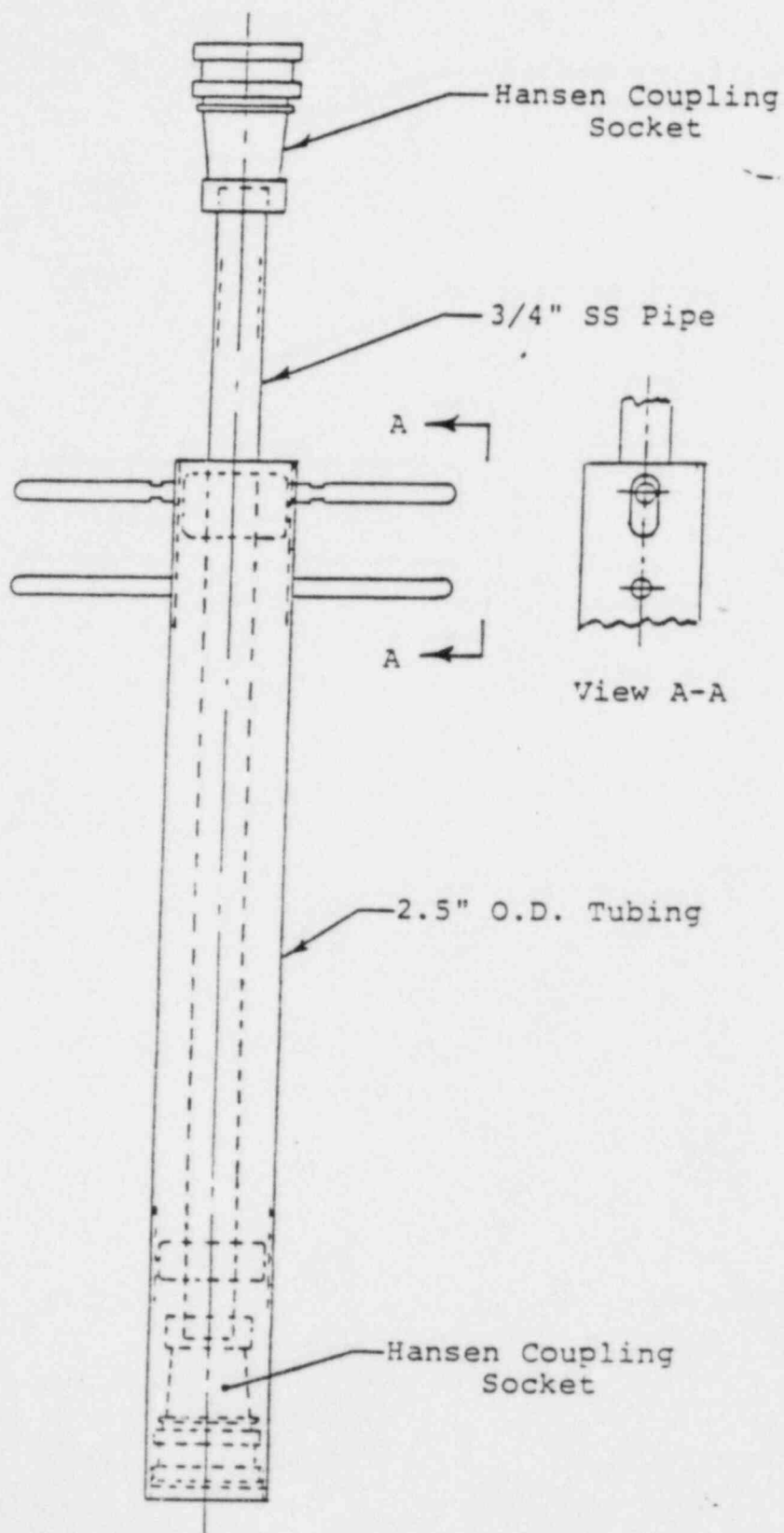
Connector "A-2"

Figure 13



Connector "B"

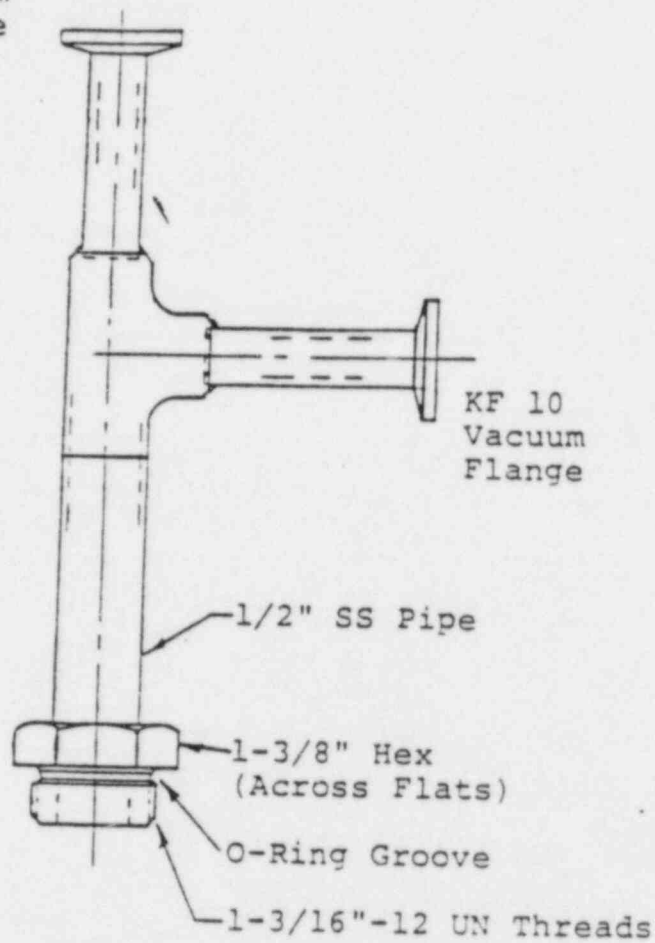
Figure 14



Connector "C"

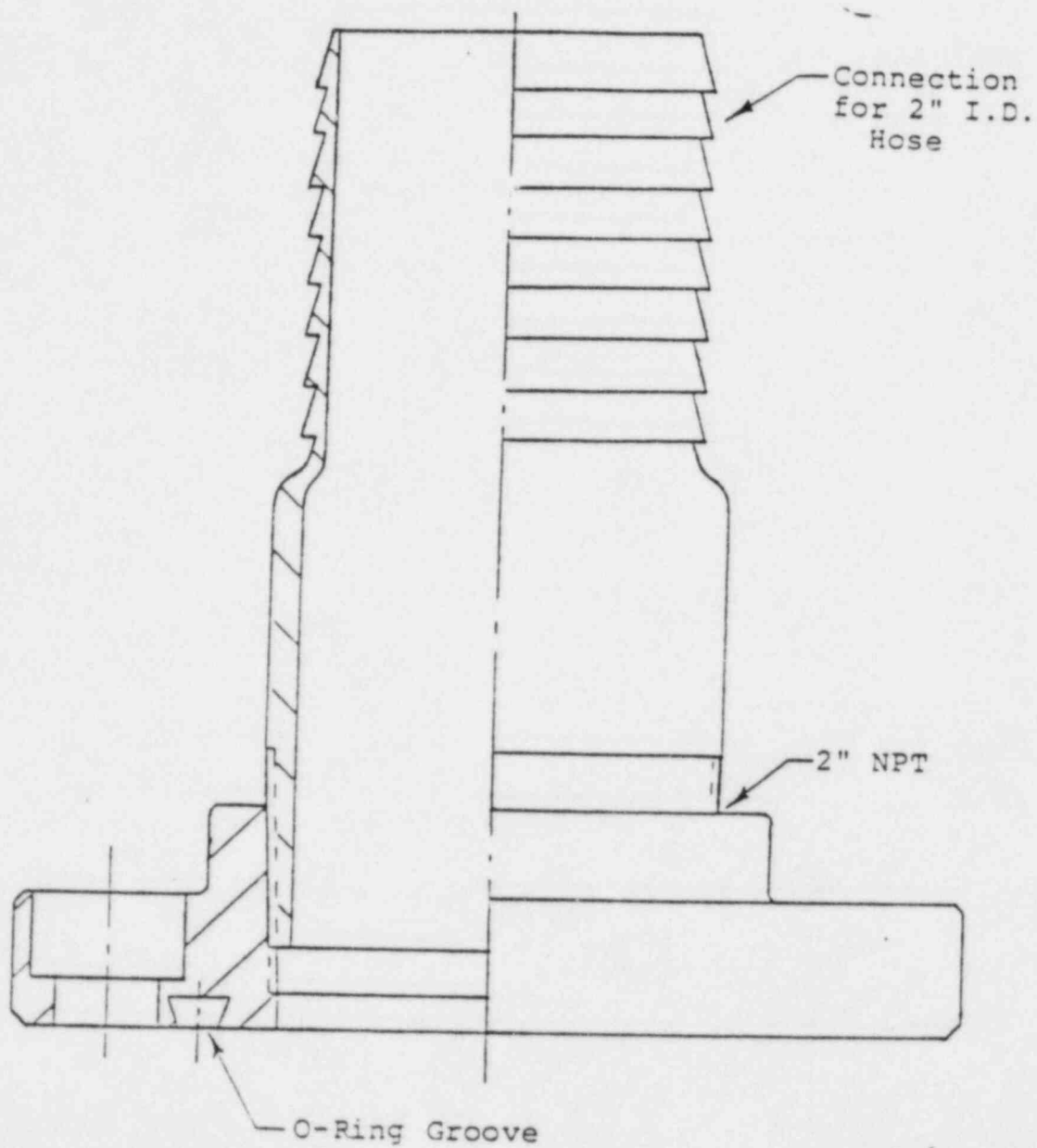
Figure 15

KF 10
Vacuum
Flange



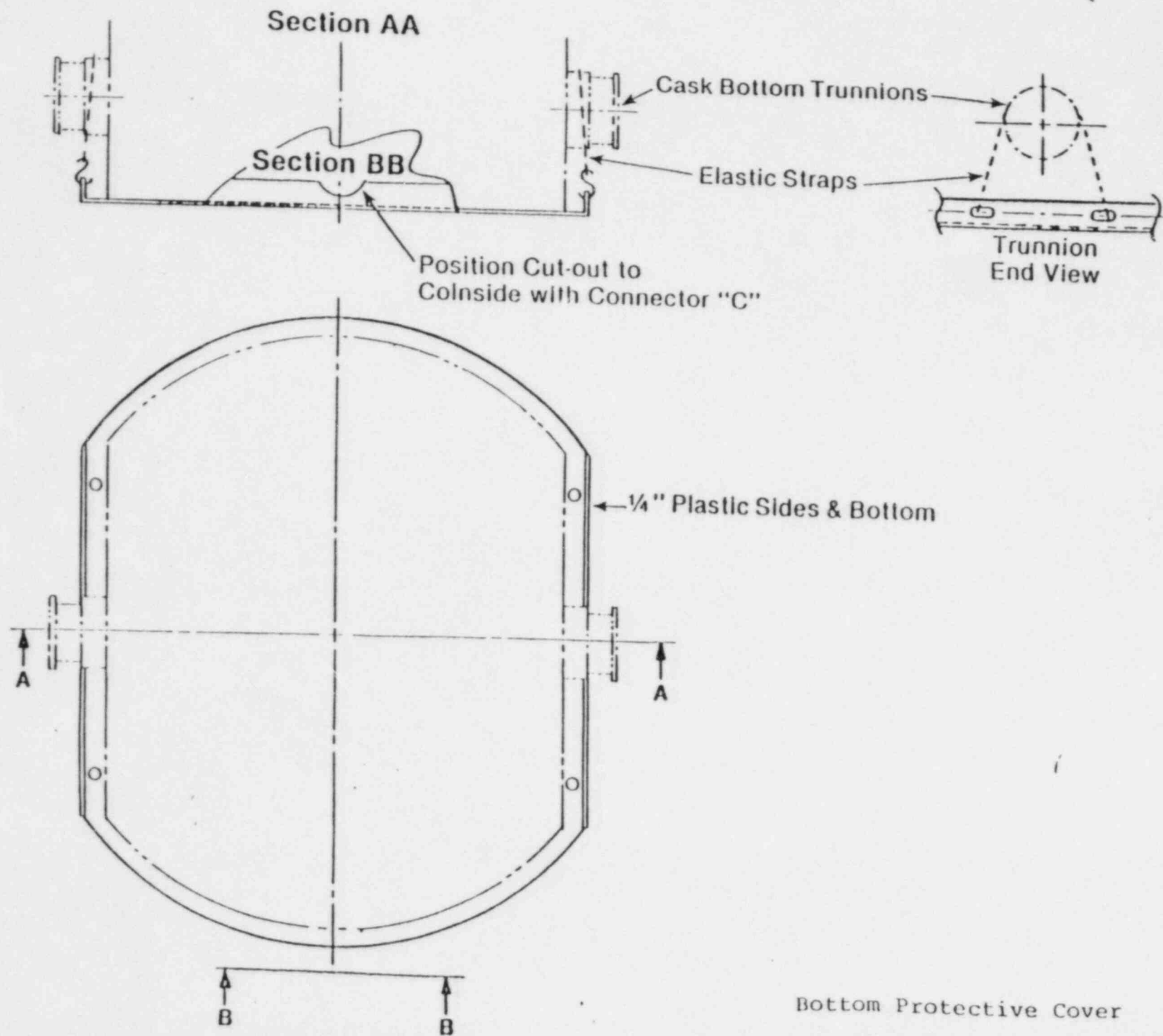
Connector "D"

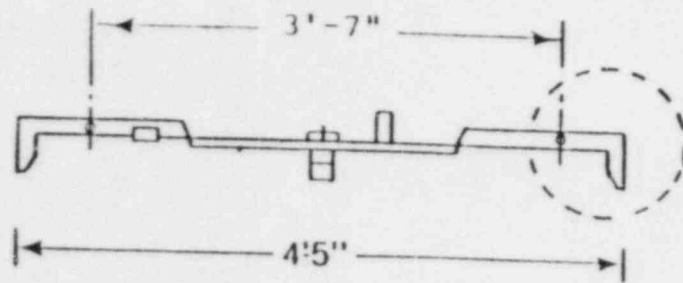
Figure 16



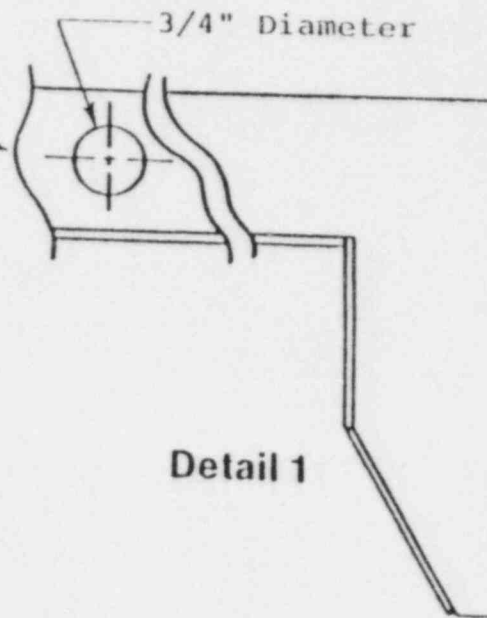
Connector "J"

Figure 17

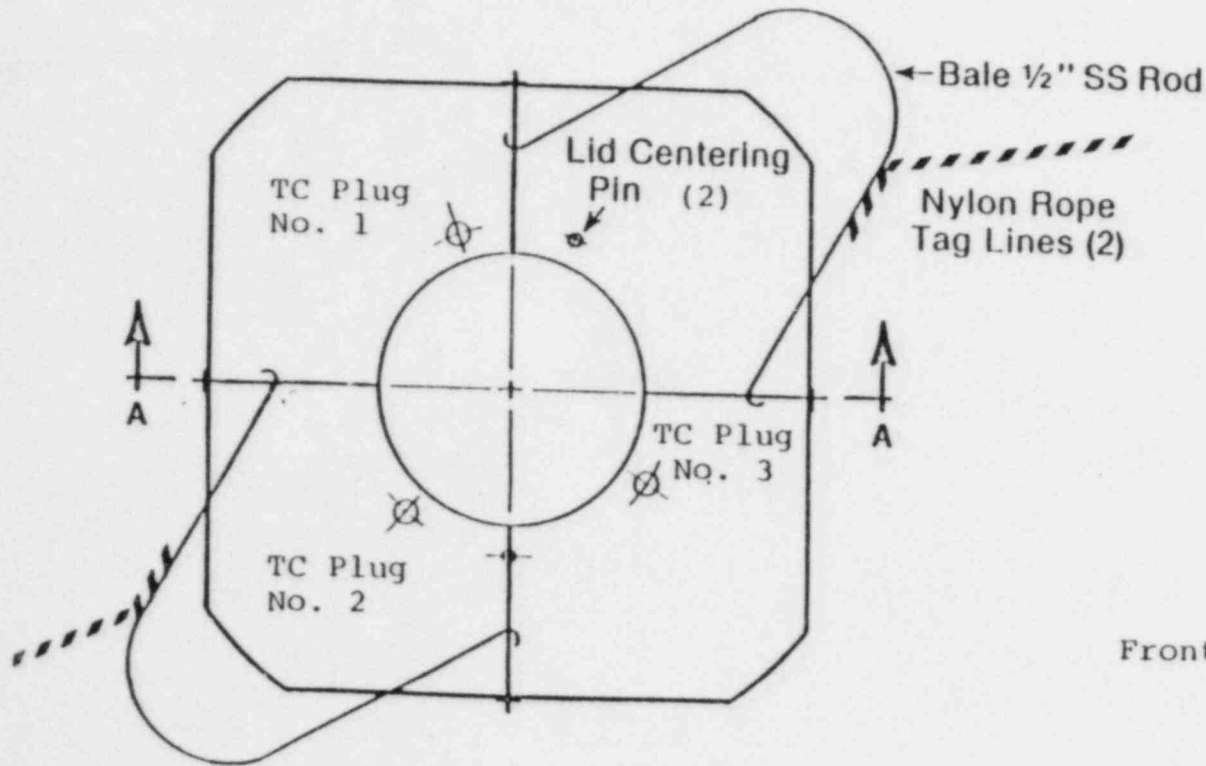
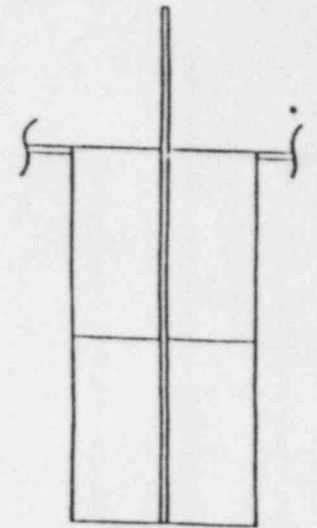




Section AA

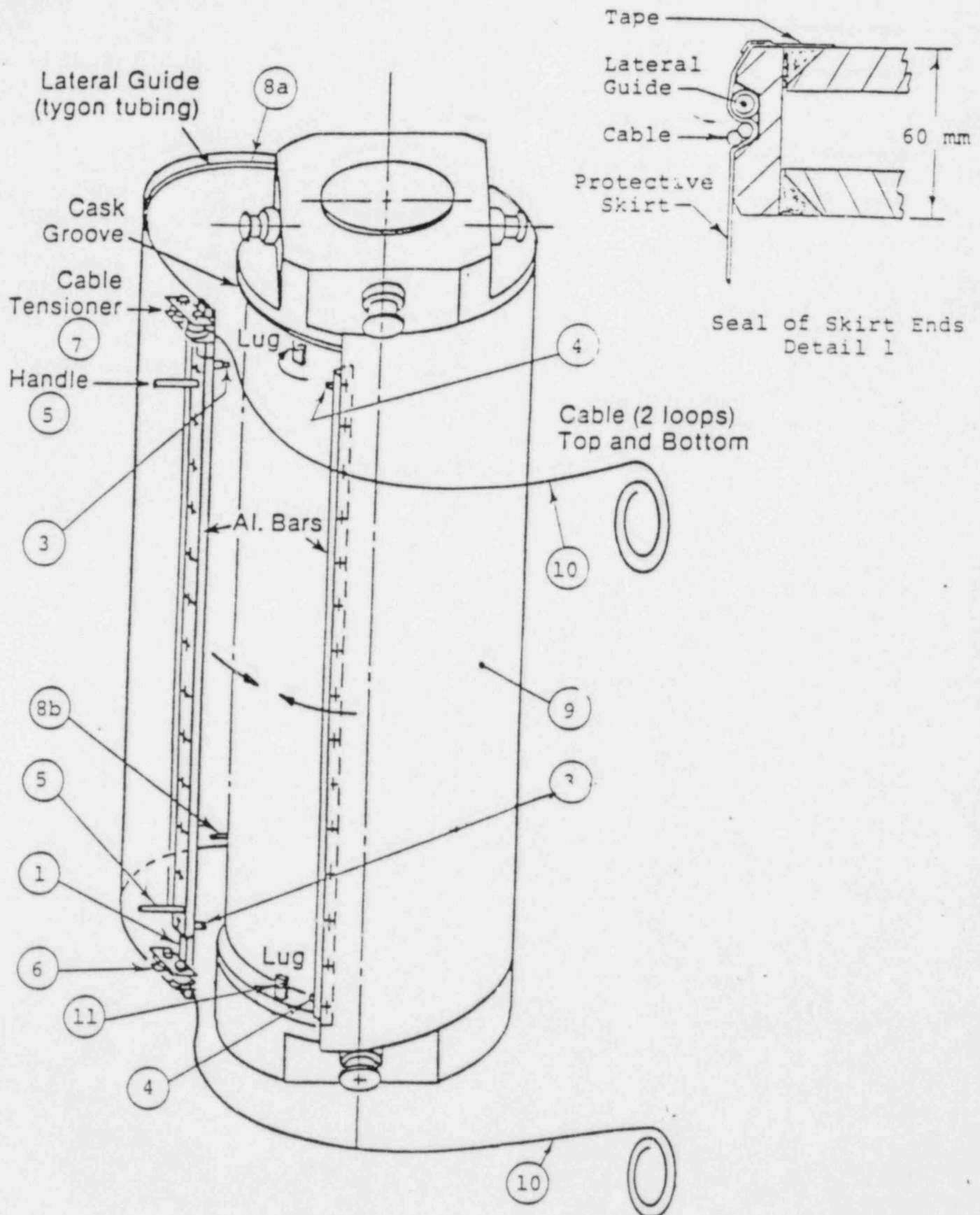


Detail 1



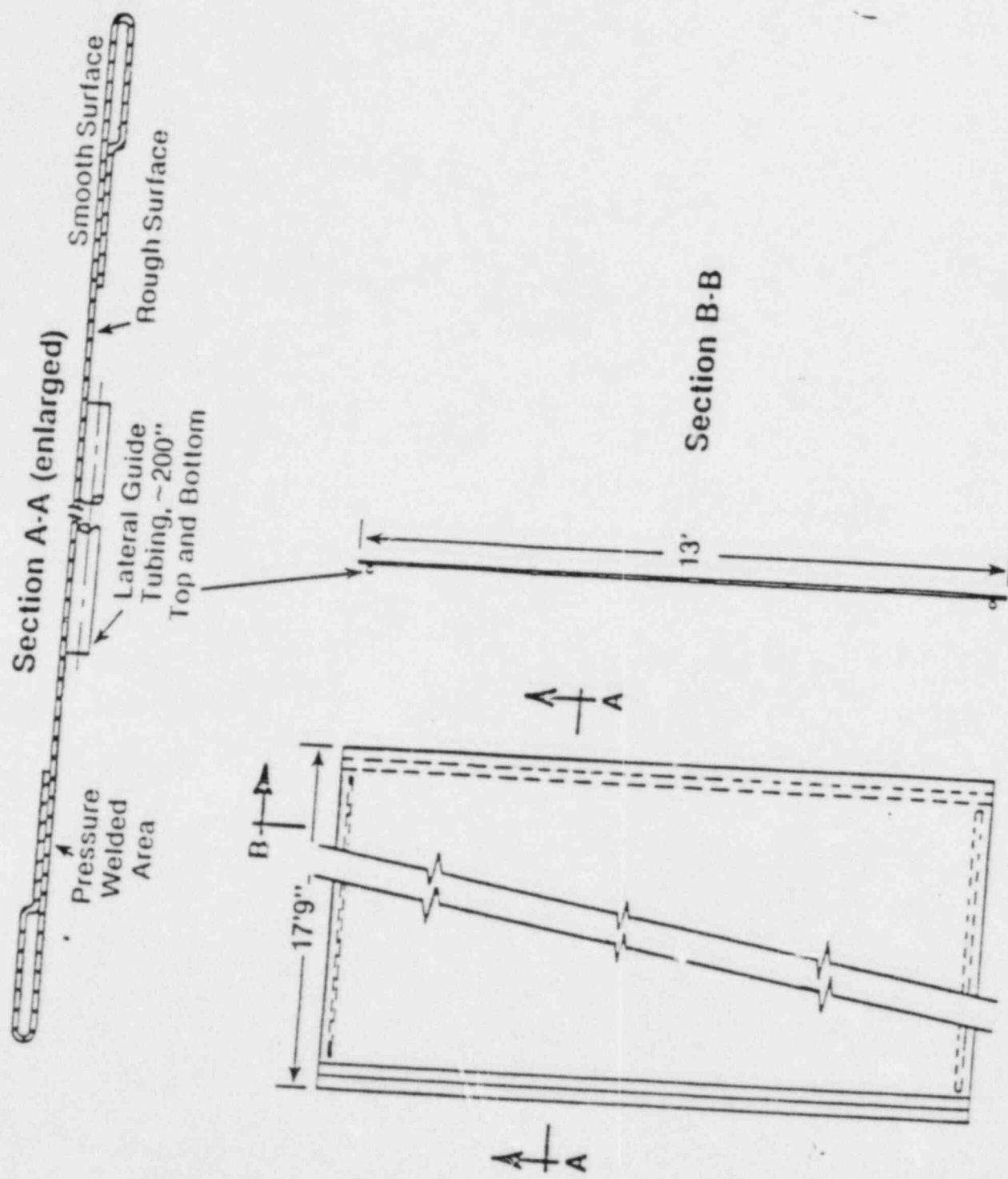
Front Face Protective Cover

Figure 19



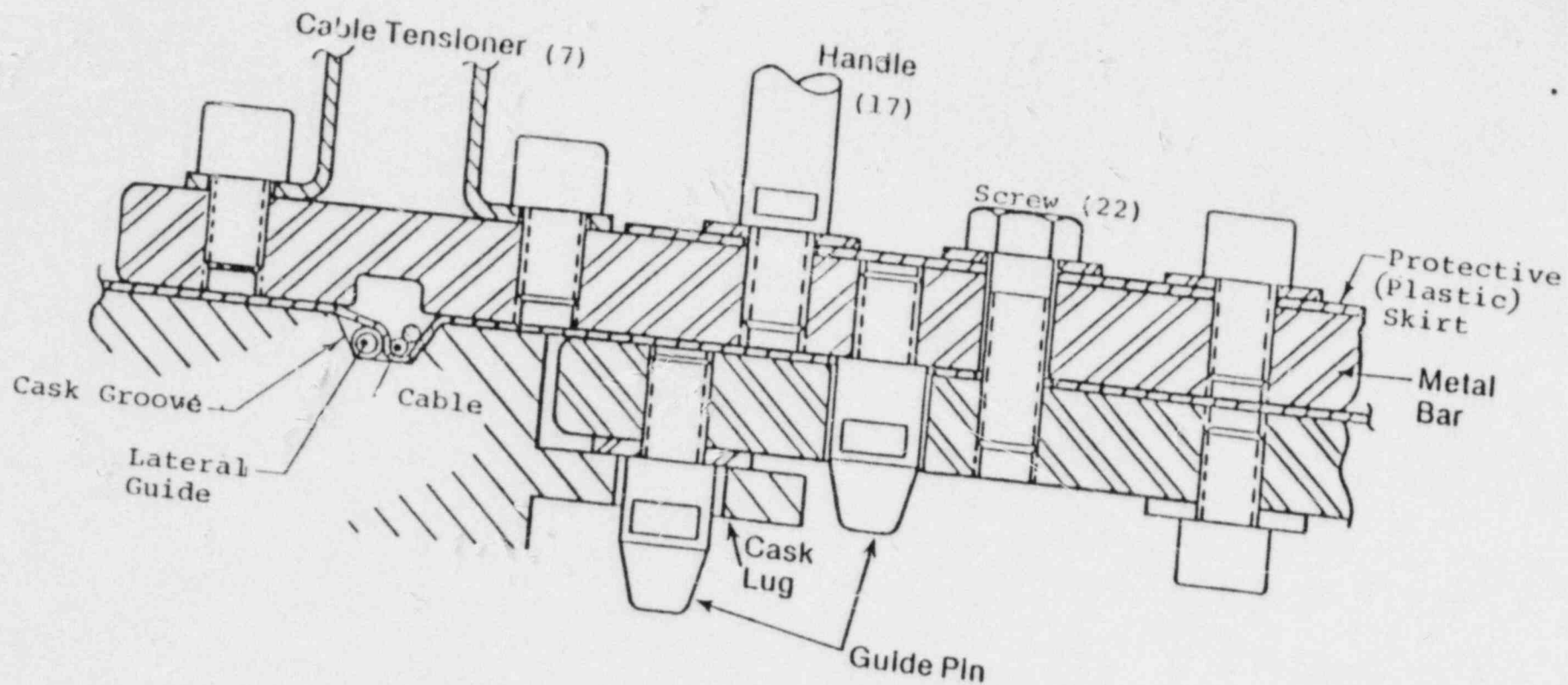
Protective Skirt Installation

Figure 20

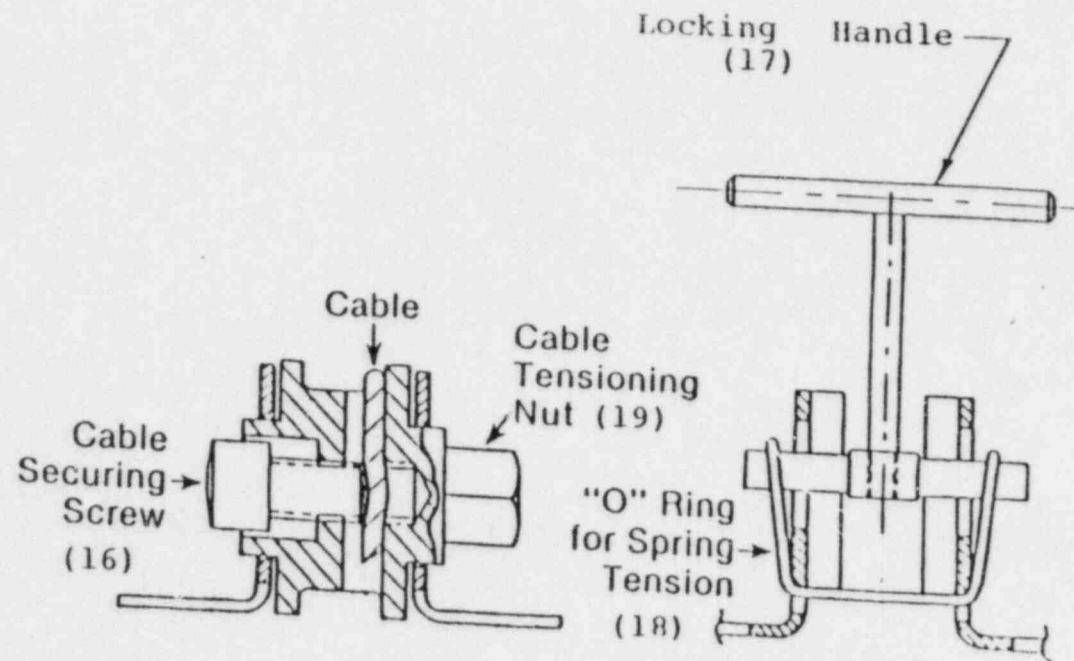
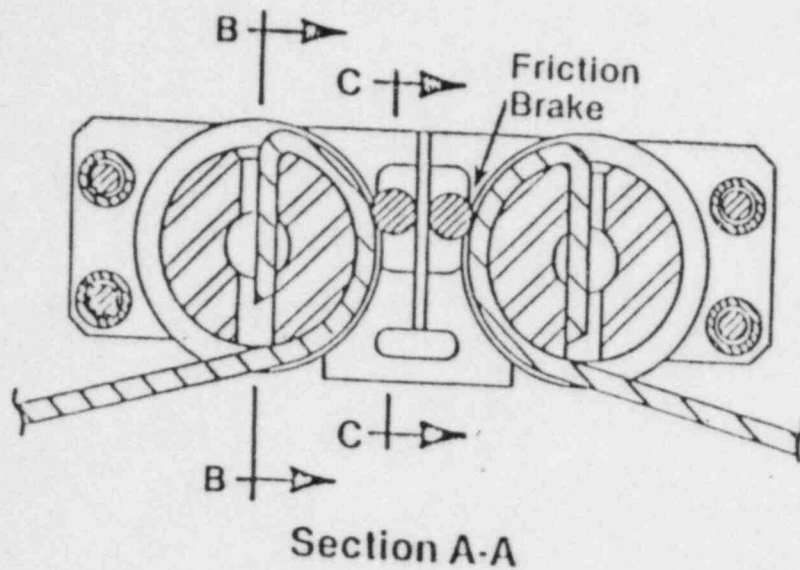
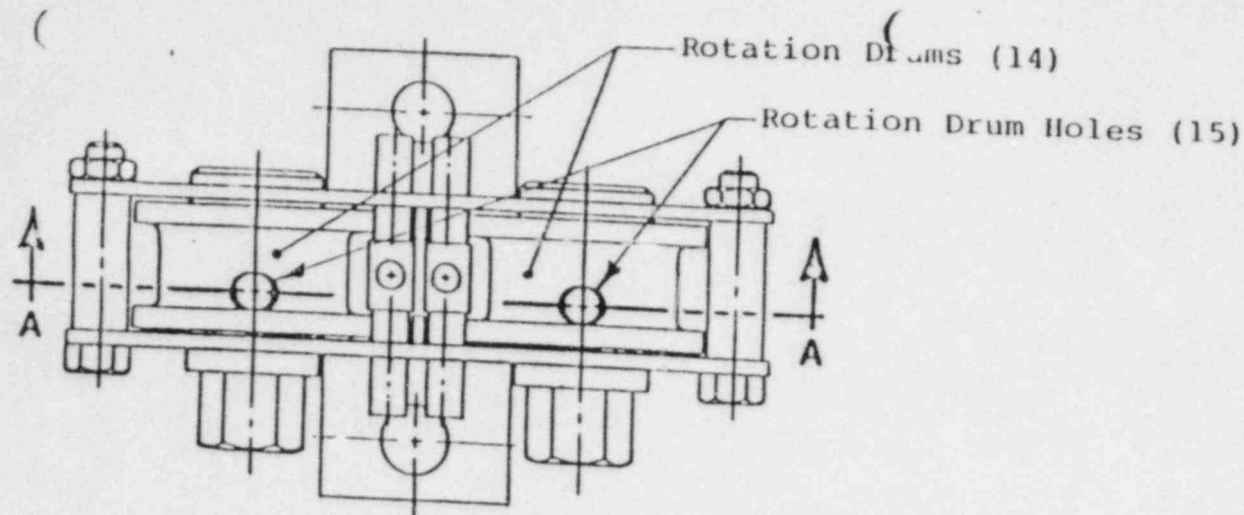


Protective Plastic Skirt

Figure 21



Closure Bars for Protective Skirt
Figure 22

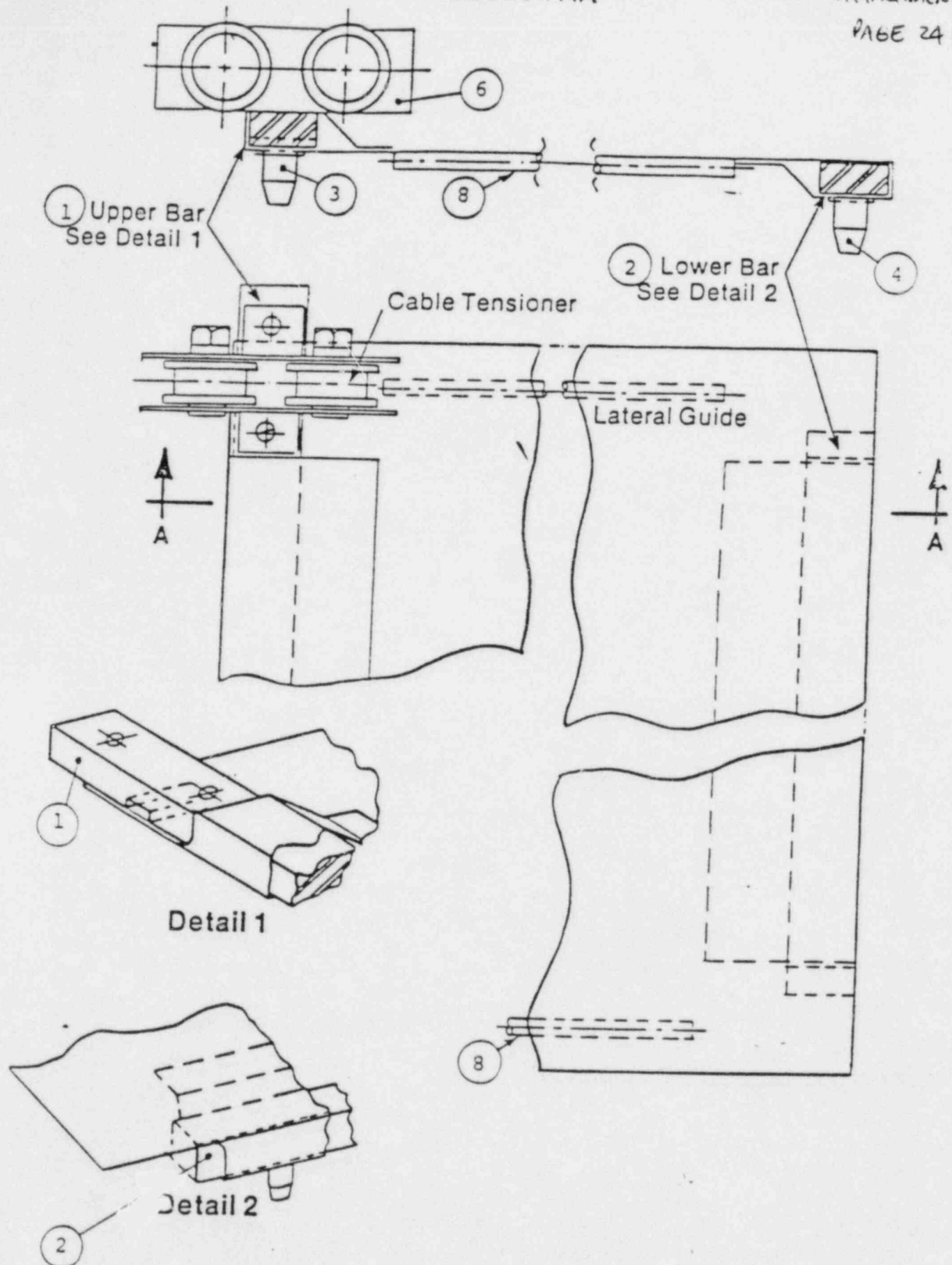


Skirt Cable Tensioner

Figure 23

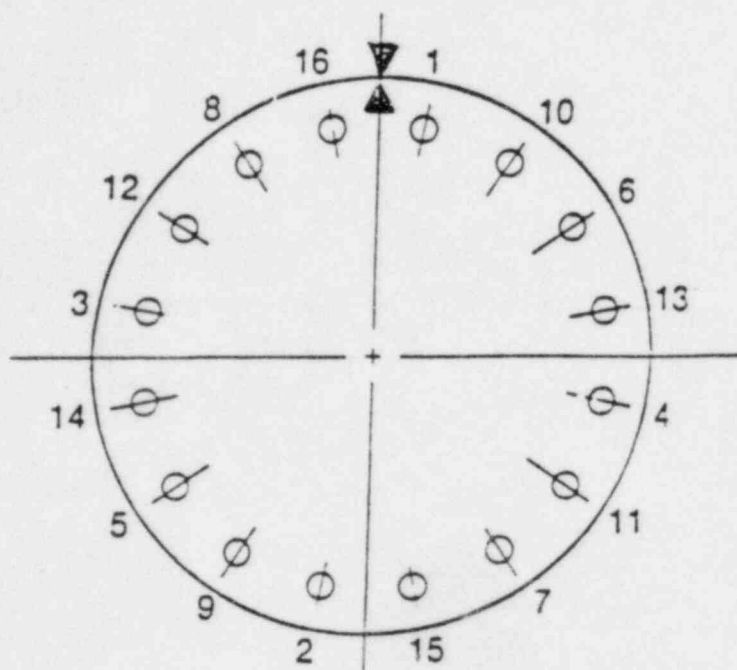
Section AA

ATTACHMENT C
PAGE 24 OF 30

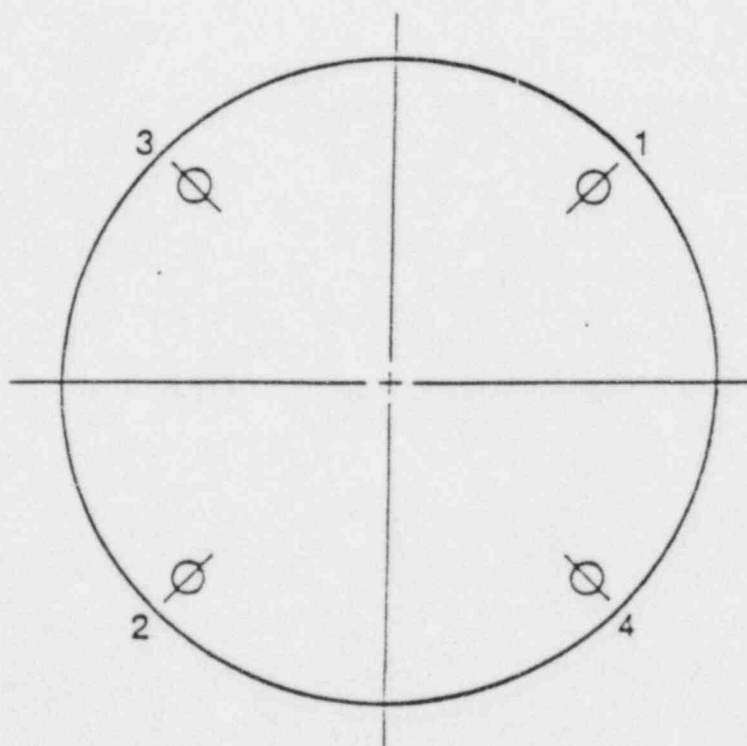


Protective Skirt Assembly

Figure 24



(a) Lid



(b) Shock Absorbing Covers

Lid and Cover Bolt Tightening Sequence

Figure 25

VIEW OF CASK AREA WITH CASK ON SHELF

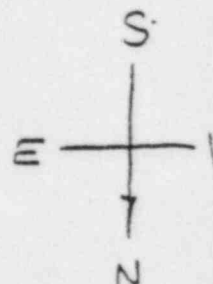
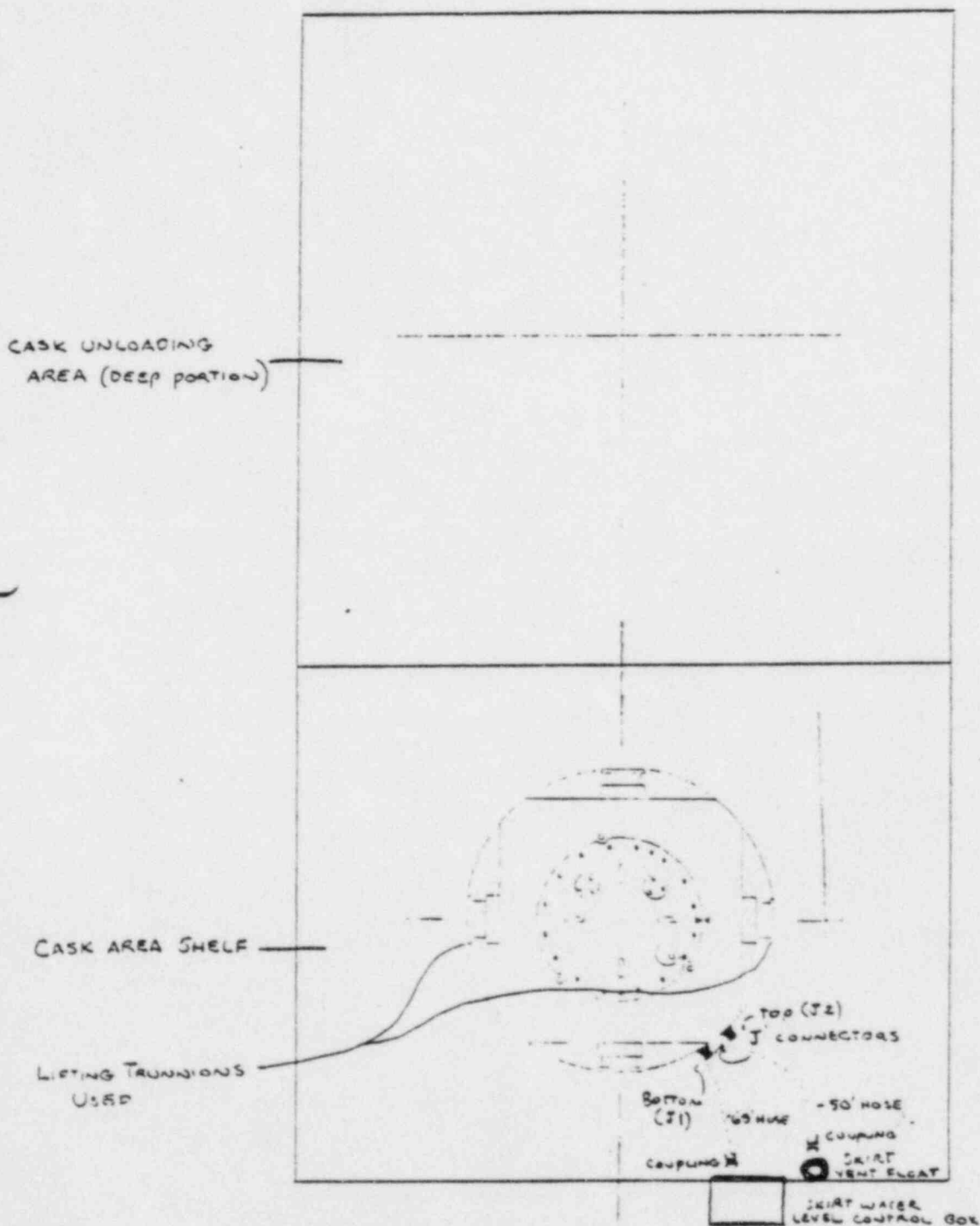


FIGURE 26

VIEW OF CASK AREA WITH CASK READY TO UNLOAD

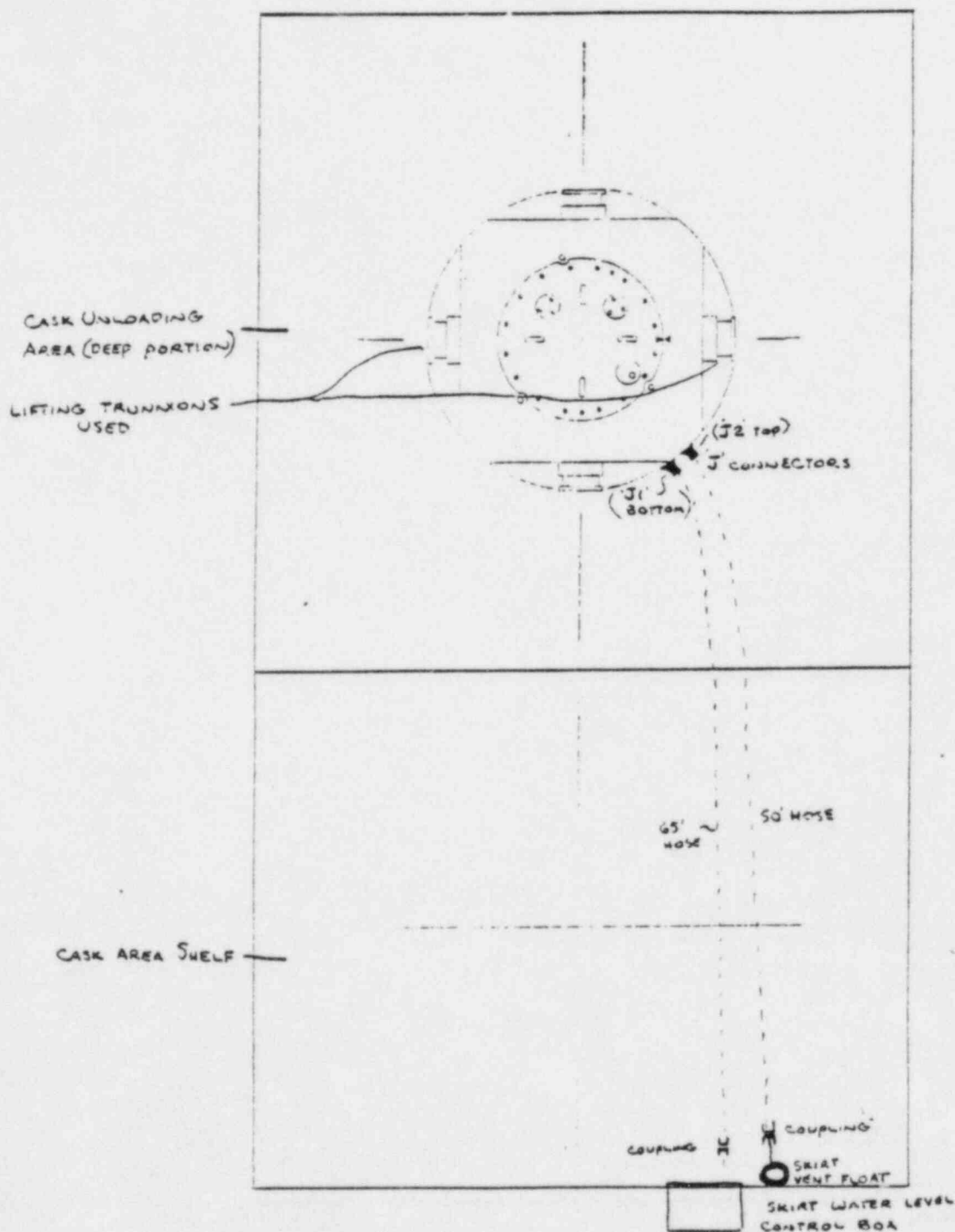


FIGURE 27

CASK WITH LID REMOVED, FUEL EXPOSED

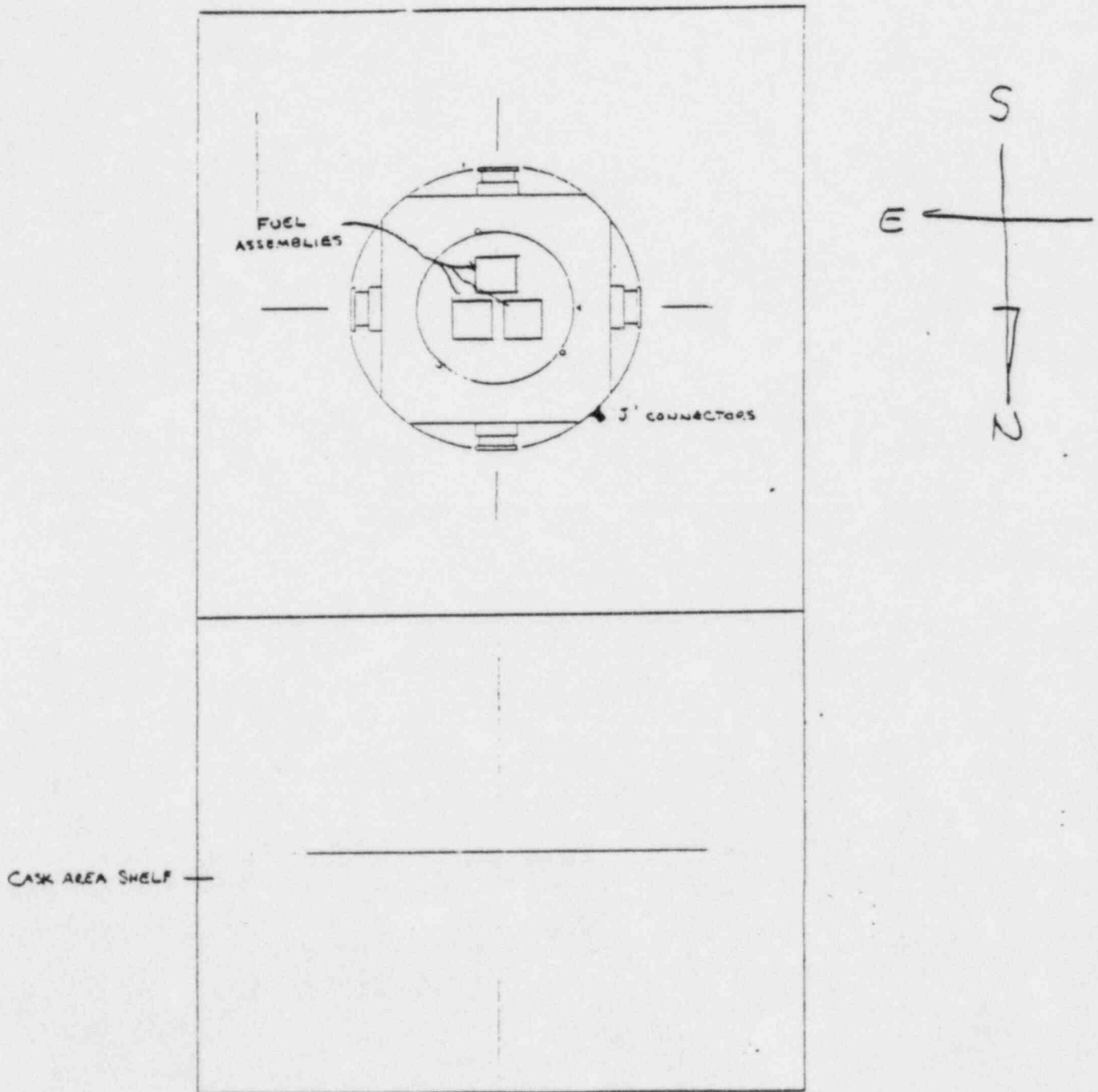
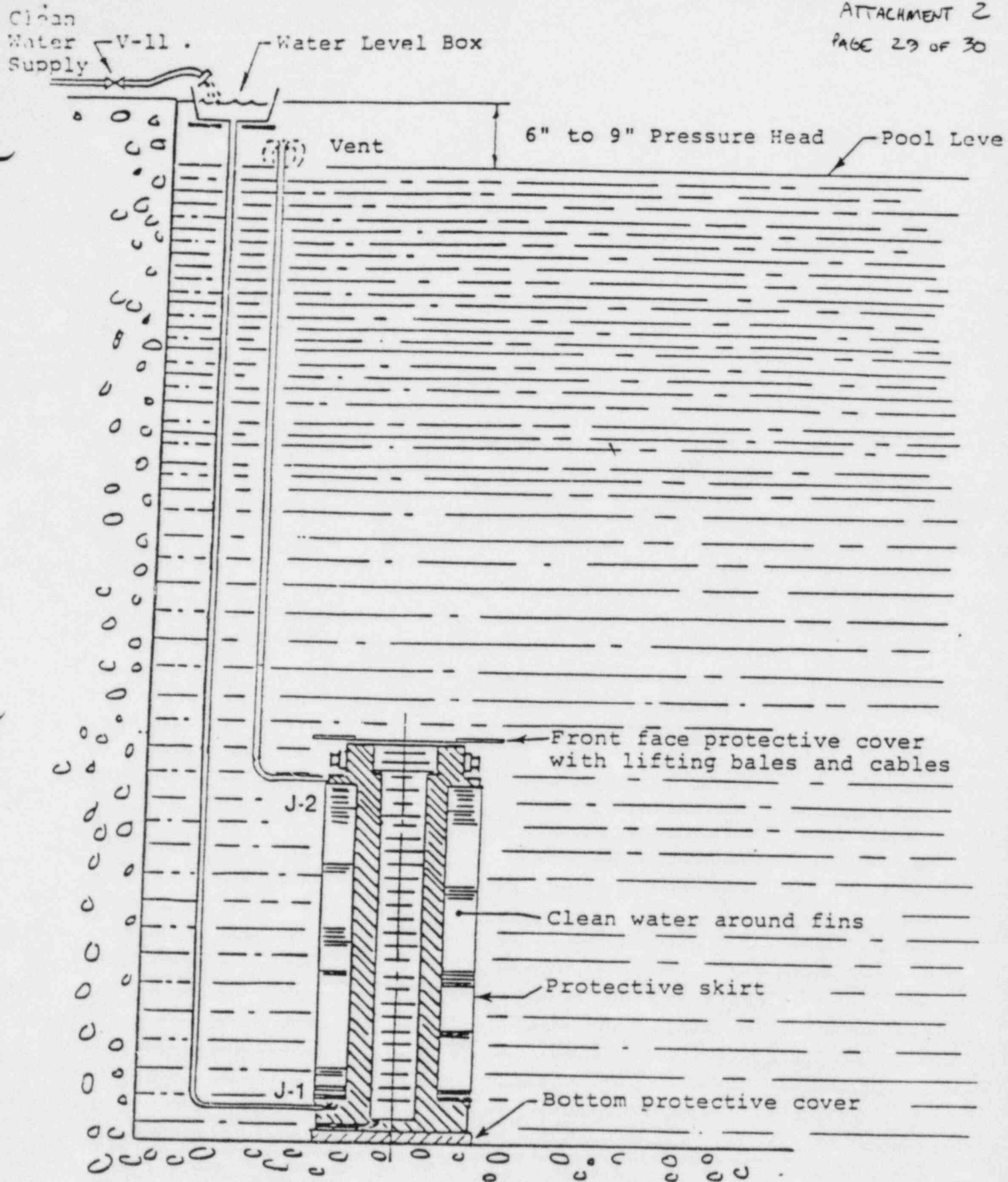
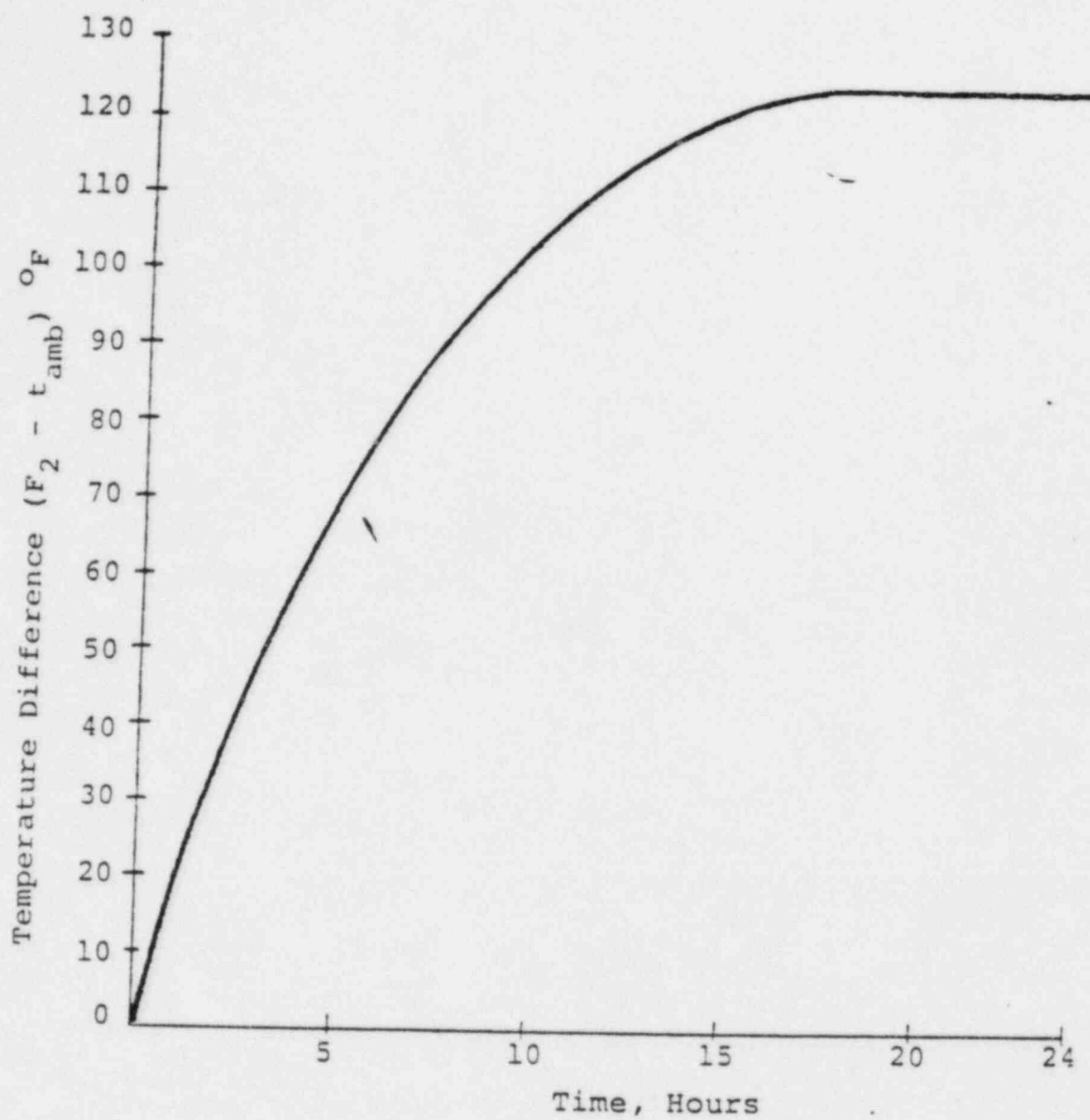


FIGURE 28



Cask Arrangement in Pool
for Fuel Loading/Unloading

Figure 29



Temperature Difference (Thermocouple $F_2 - t_{amb}$)
as a Function of Time (Heat Load 23.7 kw)

Figure 30

CASK DEPARTURE FORMS

"SHIPPER'S CERTIFICATION FOR RADIOACTIVE MATERIALS"

Transport No. _____

Consigned to: _____

Place of Departure: _____

Destination: _____

Shipper: _____

Proper Shipping Name: Radioactive Material, Fissile, N.O.S.

Number of Packages: One (1)

Material Quantity: _____

Activity of Package: _____ curies

Packaging Identification: USA/9015/B()F

Material Class: Radioactive Material

Name of Radionuclides: Mixed Fission Products

Transport Group to which material belongs: II

Category Label Applied: Radioactive Yellow III

Transport Index: _____

Fissile Class of Package: Fissile Class III

"NOTE: Warning - Fissile Class III Shipment. Do not load more than one package per vehicle. In loading the storage areas, keep at least 20 feet (6 meters) from other packages, bearing radioactive labels."

Description of the physical and chemical form of the material: _____

Irradiated Fuel Assemblies

Highest dose rate at the external surface of the package: _____

_____ mrem/h

Highest dose rate at one (1) meter from the surface: _____ mrem/h

Highest dose rate at two (2) meters from surface of trailer:

_____ mrem/h

Maximum level of non-fixed contamination of package and trailer:

Beta, gamma: _____ ($< 10^4$ Ci/cm²)

Alpha : _____ ($< 10^5$ Ci/cm²)

This is to certify that the above named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation.

Shipper's Representative: _____
(Signature)

Date and hour of departure: _____

Name(s) of driver(s): _____

Vehicle Identification Number: _____

Date and hour of arrival: _____

Receiver's Signature: _____

SURVEY DATA

[illegible]

SITE:

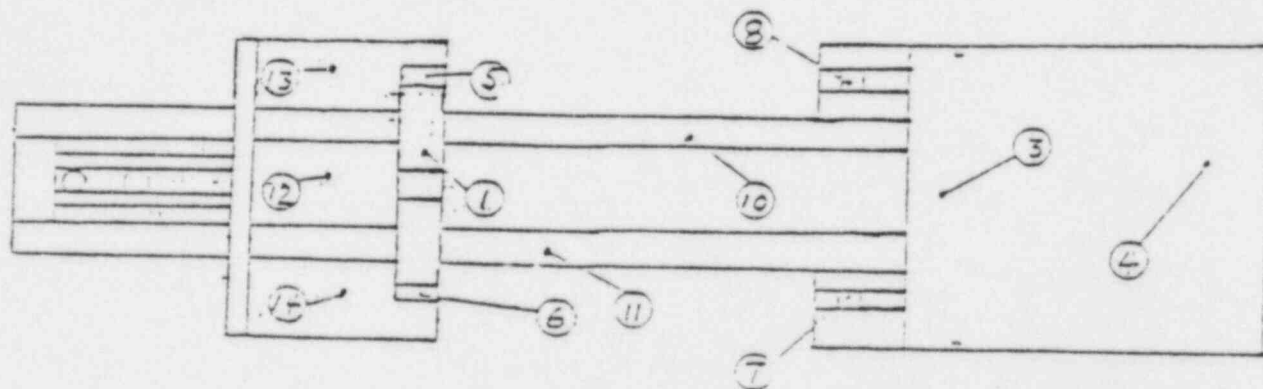
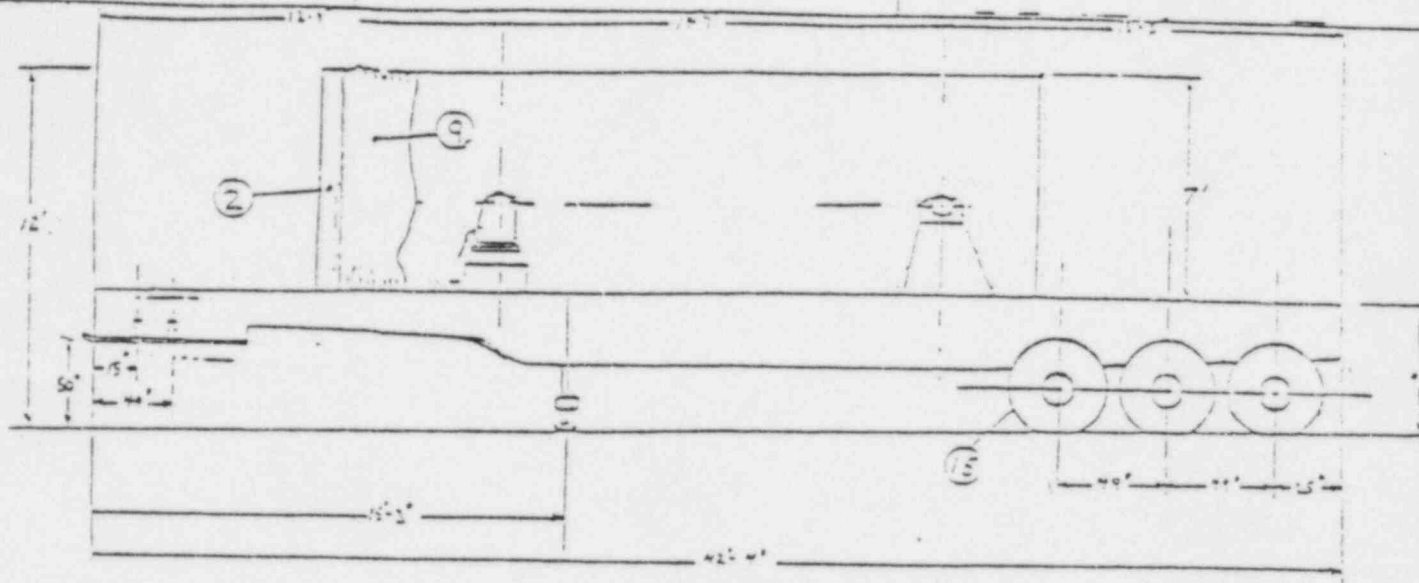
SURVEYED BY:

SIGNATURE: DATE:

TRUCK NO.

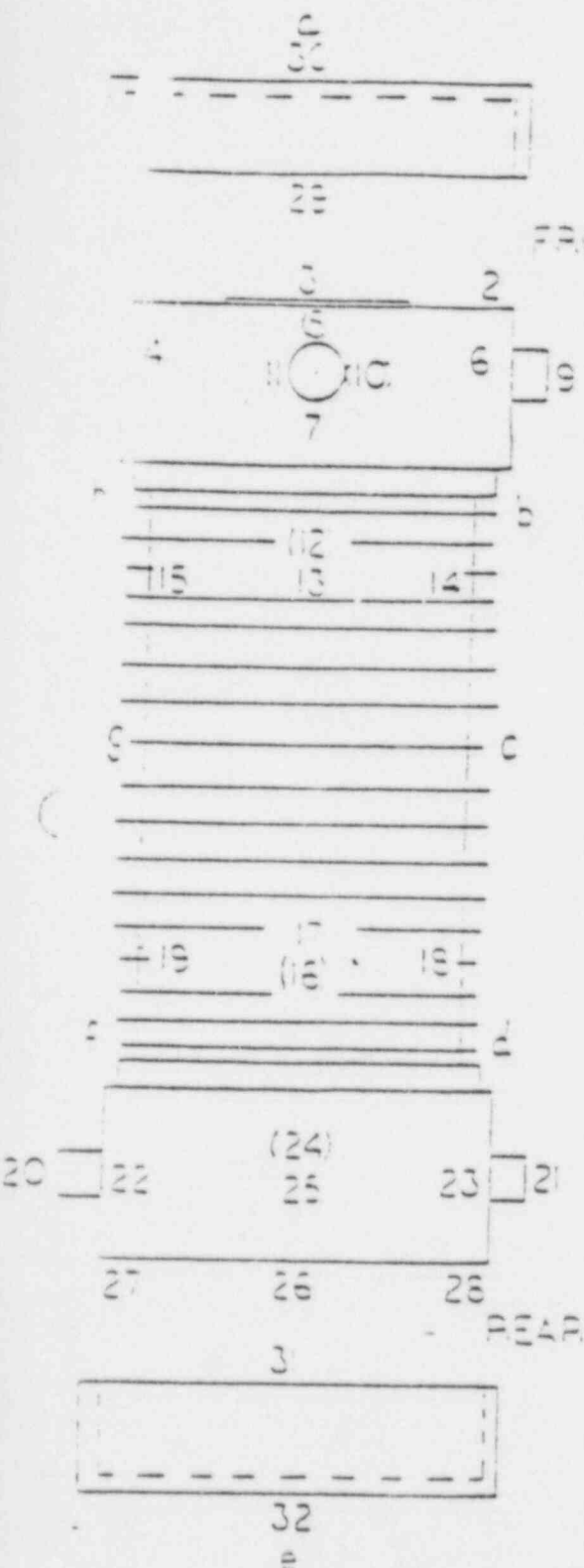
INSTRUMENT:

SURVEY DATE/TIME:



LOCATION	Fixed	Removable
	front/rear	front/rear
1 Crank Drum Support		
2 Tarpaulin support		
3 Rear Deck plate		
4 Rear Deck plate		
5 Frontion Support - front		
6 Frontion Support - front		
7 Frontion Support - back		
8 Frontion Support - back		
9 Tarpaulin		
10 Frontion beam		
11 Frontion beam		
12 Front Deck plate		
13 Front Deck plate		
14 Front Deck plate		
15 Front Deck plate		

H.P. RECEIPT SURVEY FORMS



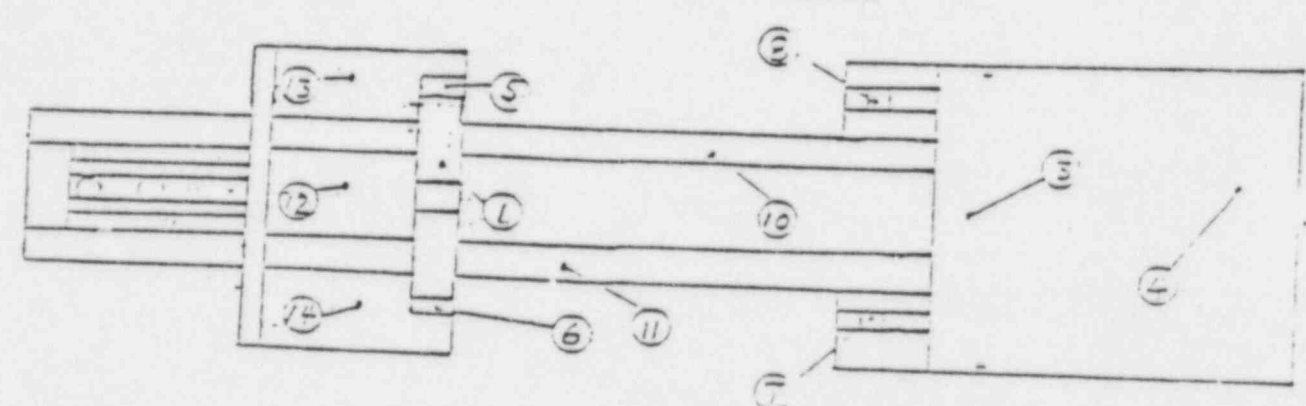
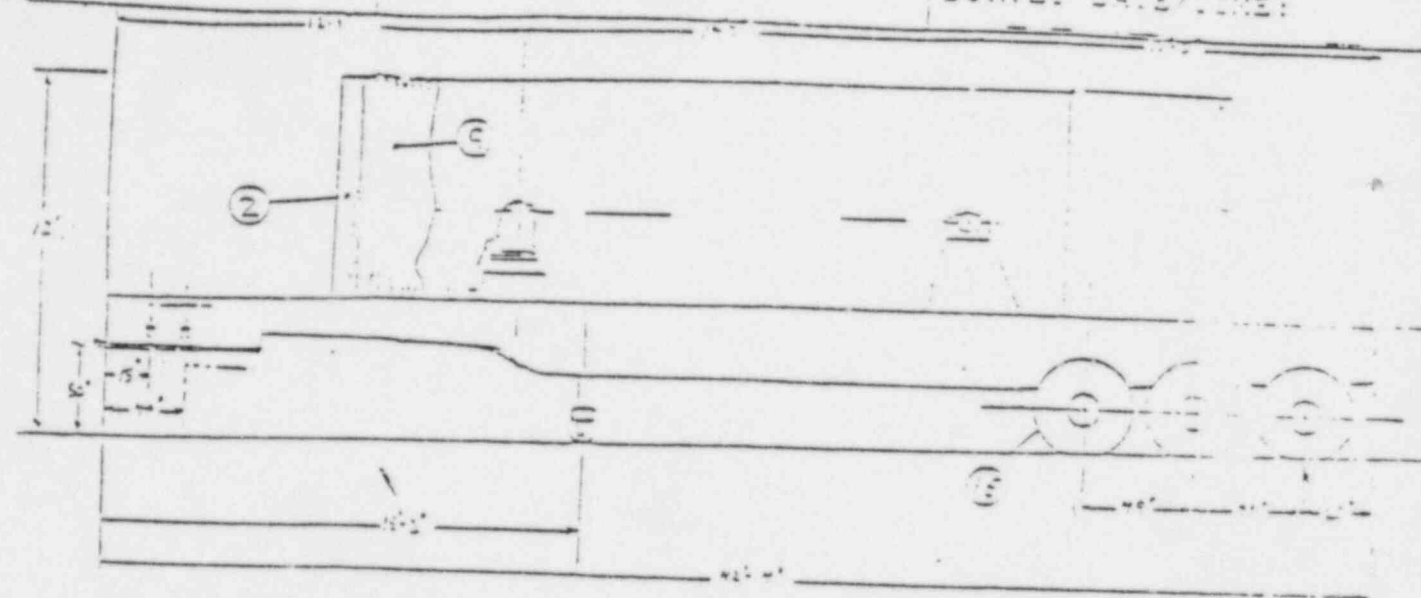
PT	Contamination Survey Points	dep/
1	Front Face - left	
2	Front Face - right	
3	Top Surface	
4	Front Drum Surface - left side	
5	Front Drum Surface - bottom	
6	Front Drum Surface - right side	
7	Front Drum Surface - top	
8	Left Trunnion/Inboard Liner	
9	Right Trunnion/Inboard Liner	
10	Bottom Redundant Trunnion/Inboard Liner	
11	Top Redundant Trunnion/Inboard Liner	
12	Fins - bottom front	
13	Fins - top front	
14	Fins - right side front	
15	Fins - left side front	
16	Fins - bottom rear	
17	Fins - top rear	
18	Fins - right side rear	
19	Fins - left side rear	
20	Left Rear Trunnion/Inboard Liner	
21	Right Rear Trunnion/Inboard Liner	
22	Rear Drum Surface - left side	
23	Rear Drum Surface - right side	
24	Rear Drum Surface - bottom	
25	Rear Drum Surface - top	
26	Rear Drum Base Surface - center	
27	Rear Drum Base Surface - left	
28	Rear Drum Base Surface - right	
29	Front Shock Absorbing Cover (inside)	
30	Front Shock Absorbing Cover (outside)	
31	Rear Shock Absorbing Cover (inside)	
32	Front Shock Absorbing Cover (outside)	

PT	Radiation Levels (mrem/h)								
	at contact			3' from surface			6' from sur		
	Y	n_1	$Y+n_1$	Y	n_1	$Y+n_1$	Y	n_1	Y
a									
b									
c									
d									
e									
f									
g									
h									
i									
j									
k									
l									
m									
n									
o									
p									
q									
r									
s									
t									
u									
v									
w									
x									
y									
z									

TABLE NO.

INSTRUMENT:

SURVEY DATE/TIME:



LOCATION		Fixed	Removable
1	Cash Drum Support		
2	Tarpaulin Support		
3	Front Deck Plate		
4	Front Deck Plate		
5	Front Support - Front		
6	Front Support - Front		
7	Front Support - Back		
8	Front Support - Back		
9	Tarpaulin		
10	Front Seat		
11	Front Seat		
12	Front Deck Plate		
13	Front Deck Plate		
14	Front Deck Plate		

1-OP-4.19
Attachment 5
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CASK UNLOADING REPORT

"FORM - TN-8L CASK UNLOADING REPORT"

Unloading Identification Number: _____

Package Identification Number: _____

Date: _____ Facility: _____

Time of Arrival: _____

1.0 Cask Receipt

1.1 Maximum dose rate at cask surface:

(4.1.4) a) beta, gamma ($\beta\gamma$): _____ mrem/h

location: _____

b) neutron (n'_{o}) : _____ mrem/h

location: _____

1.2 Maximum dose rate at trailer surface:

(4.1.4) a) beta, gamma ($\beta\gamma$): _____ mrem/h

location: _____

b) neutron (n'_{o}) : _____ mrem/h

location: _____

1.3 Maximum removable surface contamination of the cask:

(4.1.4) a) alpha, beta, gamma ($\alpha\beta\gamma$): _____ dmp/100cm²

b) location: _____

1.4 Maximum removable surface contamination of the trailer:

(4.1.4) a) alpha, beta, gamma ($\alpha\beta\gamma$): _____ dmp/100cm²

b) location: _____

1.5 Maximum cask surface temperature:

(4.1.5) a) _____ °F

b) location: _____

NOTE: Attach completed forms 1 and 2 to the report.

1.6 Verify Security Seal Numbers from the Cask Loading Report,
accompanying the shipment.

(4.1.1) Front: _____ Rear: _____

2.0 Cask Preparation for Unloading

2.1 Surface contamination level of the recessed surface of

(4.2.6) vent opening "B": gamma (γ) _____ mrem/h

2.2 Record Cask Internal Cavity pressure upon

(4.2.9.2) receipt: _____ psia.

2.3 Cask cavity gaseous activity level: _____ μ Ci/ml

(4.2.9.12)

2.4 Record temperature measurements observed prior to

(4.2.11) initiation of cask cooldown:

a) "F1": _____ °F

b) "F2": _____ °F

c) "F3": _____ °F

d) Ambient: _____ °F

e) Time: _____ Date: _____

2.5 Surface contamination level of the recessed surface

(4.2.12.1) of drain opening "C": gamma (γ) _____ mrem/h

2.6 Record the temperature measurement observed at

(4.2.12.9) completion of cask cooldown on "F2": _____ °F

Time: _____

2.7 Verify that gaskets for blind flanges "B" _____

(4.2.12.15) and "C" _____ have been inspected. Any replacement of these gaskets shall be noted under "Remarks".

3.0 Inspections Required Prior to the Start of Each Shipment

- 3.1 Surfaces should be inspected for corrosion, large dents, cracks, or other deformations.
- 3.2 Resin and painted surfaces should be inspected for large areas of cracks, chips, blisters, or bare areas.
- 3.3 The ease of operations of removable components (lid, blind flanges, bolts, quick connections, plugs, shock absorbing covers, and trunnion impact limiters) shall be observed.
- 3.4 The following cask components shall be inspected to ensure that their general condition is acceptable:
 - a) Shield plug for "A" (bolts, gasket, general condition)
 - b) Blind flanges for "B", "C", "J1" and "J2" (bolts, gaskets, general condition).
 - c) Lid gasket annulus port plug "D" (gasket, threads, general condition)
 - d) Quick connections at "B" and "C" (ease of operation)
 - e) Shock absorbing covers (alignment pins, general condition, bolts, lifting lugs)
 - f) Lid lifting lugs and skirt lugs (general condition)
 - g) Front and rear trunnion lifting and tie-down shoulders (visual inspection for general condition)
 - h) Trunnion impact limiters (bolts, gasket, general condition)
 - i) Lid orientation marks (screws, general condition)
 - j) Trunnion impact limiters and shock absorbing covers properly installed prior to cask departure

- k) All cask labeling and markings (general condition)
- l) Heat dissipating fins (cleanliness, general condition)
- m) Skirt (general condition)

Any component which is found not acceptable shall be replaced, or reworked as deemed necessary. Such replacements or rework shall be documented. Repairs of packaging components are not within the scope of this manual.

4.0 Cask Unloading

4.1 Verify fuel assembly positions in the cask by identi-

(4.3.42) fication number as individual assemblies are removed and
record below (from the Cask Loading Report)

COMPARTMENT NUMBER	FUEL ASSEMBLY IDENTIFICATION NO.
1	
2	
3	

Lid
Orientation
Mark

5.0 Cask Preparation for Shipment

- 5.1 Cavity dryness verification test satisfactory_____
- (4.2.16)
- 5.2 Record final cask cavity internal pressure:
- (4.4.22) _____psia
- 5.3 Maximum dose rate at cask surface:
- (4.4.65) a) beta, gamma ($\beta\gamma$): _____mrem/h
- b) location: _____
- 5.4 Maximum dose rate at three (3) feet from cask surface:
- (4.4.65) a) beta, gamma ($\beta\gamma$): _____mrem/h
- b) location: _____
- 5.5 Maximum removable surface contamination of the cask surface:
- (4.4.65) a) alpha, beta, gamma ($\alpha\beta\gamma$): _____dpm/100cm²
- b) location: _____
- 5.6 Maximum removable surface contamination of the trailer:
- (4.4.65) a) alpha, beta, gamma ($\alpha\beta\gamma$): _____dpm/100cm²
- b) location: _____
- 5.7 Maximum dose rate at the outer surface of the vehicle, (as measured along the trailer protective enclosure perimeter) with the cask installed:
- (4.4.65) a) beta, gamma ($\beta\gamma$): _____mrem/h
- b) location: _____

5.8 Maximum dose rate at six (6) feet from the outer surface
of the vehicle:

(4.4.65) a) beta, gamma ($\beta\gamma$): _____ mrem/h

b) location: _____

5.9 Maximum dose rate inside the truck cab

(4.4.65) a) beta, gamma ($\beta\gamma$): _____ mrem/h

b) location: _____

NOTE: Attach completed radiation and contamination forms to this
report.

5.10 Cask Departure: TIME: _____

DATE: _____

6.0 Remarks:

Inspector: _____
Data Recorder: _____
Date of Receipt _____
Time of Receipt _____
Responsible Supervisor: _____