
**Oak Ridge National Laboratory (ORNL)
Transportation and Packaging Management (TPM)
Container Preparation and Filling Instructions/Checklist**

DOT Specification 6M Drum

ORNL-PKG-26, Rev. 3

Issued: 2/27/1997

Revised: 11/1/2005

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NOTE 1: The Department of Transportation (DOT) Specification 6M Drum (screw cap 2R container and leak-testable, flange type 2R container) is authorized for solid Type B materials with a heat load not exceeding 10 watts in Title 49 CFR §173.416 and for solid fissile materials in Title 49 CFR §173.417. The DOT Specification 6M Drum consists of an outer metal drum and an inner DOT Specification 2R container held in position by insulating material. Refer to Title 49 CFR §178.354 for the specification.

NOTE 2: Plutonium in excess of 20 Ci per package must be in solid form and be in compliance with Title 10 CFR §71.63 for special requirements for shipping Plutonium.

NOTE 3: The DOT Specification 6M drum will be referred to as a "6M drum" and the DOT Specification 2R Container will be referred to as a "2R" throughout this instruction.

I. Pre-loading Instructions for the DOT Specification 6M Drum

- A. Ensure that external and internal contamination limits are within Oak Ridge National Laboratory (ORNL) site limits by:
- Reviewing existing ORNL-236 ["Radioactive" Material (yellow tag)] or radiological survey documentation, *or*
 - Requesting new radiological survey.
- B. Inspect the following visually for damage, dents, defects, etc. prior to each use:
- 2R including the lid;
 - External and internal threads of the screw-cap 2R;
 - Internal threads and flange bolt threads of the flange type 2R;
 - O-rings in the flange of the flange type 2R;
 - Seals at the leak check port of the flange type 2R;
 - Insulating material (celotex, fiberboard, etc.);
 - Outer drum for defects such as rust and dents;
 - Gasket in the lid of the outer drum for wearing or tears;
 - Nameplate on the outer drum to ensure a continuous weld or other suitable material seals the edges of the nameplate; ***and***

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I. Pre-loading Instructions for the DOT Specification 6M Drum (*cont.*)

B. Inspect the following visually: (*cont.*)

- Nameplate on the outer drum for the following information:
 - "DOT-6M Type B";
 - "Fissile Radioactive Materials", or "Radioactive Materials" as appropriate;
 - The gauge of metal, rated capacity of the drum, and the year of manufacture, i.e., 12-30-94;
 - "max gross weight = XXX," owner's name and address, and trefoil symbol.

C. Report any deficiencies to the Packaging Supervisor.

D. Ensure that all vent holes (four minimum) are 0.5 inches in diameter and are covered with weatherproof tape or a fusible plug.

II. Packaging the DOT Specification 6M Drum

A. FBF Nuclear Containers, LLC Instructions

1. See [Appendix A \(page 1 of 3\)](#) for package loading instructions.
2. See [Appendix A \(page 2 of 3\)](#) for 10 gallon steel drum closure instructions.
3. See [Appendix A \(page 3 of 3\)](#) for 30 gallon — 110 gallon steel drum closure instructions.

B. Generic (non-FBF containers) Instructions

1. Load the solid fiberboard rings into the drum until the minimum thickness required per 49 CFR §178.354-3(a) (1) is achieved. *If the container volume is such that a bearing plate is required per 49 CFR §178.354-3(e), the ring containing the plywood insert must be installed so that the plywood is in contact with the inner 2R vessel.*
2. Load the middle fiberboard rings. These rings have a center cavity cut out hole in the center of the rings. If the 2R vessel has an external closure cap, load the fiberboard rings with the smaller inside diameter center cavity hole cut out into the drum first. For a 2R vessel with a plug closure, load all of the fiberboard rings with the center cavity hole cut out.
3. Securely position the material within the 2R.
4. Fissile material in normal form must be in a tightly sealed metal can or polyethylene bottle.
5. Place impact absorbers in the bottom and top of the 2R and between inner containers, if applicable, to position the inner containers in the center of the 2R.

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II. Packaging the DOT Specification 6M Drum (cont'd)

B. Generic (non-FBF containers) Instructions (cont'd)

6. **IF** the 6M drum is a Screw Cap 2R Container, **THEN**
GO TO [Section B¹](#) of this instruction.
7. **IF** the 6M Drum is a Leak-Testable, Flange Type 2R Container,
THEN
GO TO [Section B²](#) of this instruction.

B¹ Packaging the DOT Specification 6M Drum--Screw Cap 2R Container

1. Apply non-hardening compound capable of withstanding 149° C (300° F) without loss of efficiency as a luting compound to the pipe threads of the screw cap 2R.
2. Place the pipe cap on the 2R and tighten until at least five (5) threads are engaged.
3. Torque the lid of the screw cap 2R to 15 (+5, -0) foot-pounds.
4. **GO TO** [Section B³](#) of this instruction.

B² Packaging the DOT Specification 6M Drum--Leak-Testable, Flange Type 2R Container

1. Apply vacuum grease to both o'rings.
2. Place the lid on the 2R.
3. Torque each of the eight 1-1/8" bolts on the flanged 2R to 30 (+/-5) foot-pounds.
4. Perform a leak check on the flanged 2R (according to the Croft, Inc. CALT 5 operating procedure for the leak test equipment) for Type B quantities of Plutonium or at the direction of the Packaging Supervisor.
5. **IF** the leak test is unsuccessful, **THEN**
Open the 2R, re-inspect the o'rings and/or replace the o'rings and repeat steps C.1 through C.4 until the leak test is successful.
6. **GO TO** [Section B³](#) of this instruction.

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II. Packaging the DOT Specification 6M Drum (cont'd)

B³. Completion of Packaging the DOT Specification 6M Drum

1. Place the top spacer in the drum on top of the 2R.
2. Load the remaining solid fiberboard rings. These fiberboard rings will have 1" finger holes installed. *If a plywood bearing plate is inset in one of the top rings, this must be placed so that the plywood is in contact with the top of the 2R vessel. All rings with finger holes are intended to be placed above the 2R vessel to allow for access to the 2R vessel.*
3. Place the lid on the 6M drum positioning the cover and the gasket so an uninterrupted seal is assured.
4. Tap around the closing ring with a hammer while tightening the bolt to the following torque:
 - 5/8" - 40 (+/-5) ft-lb
 - 5/16" - 15 (+5, -0) ft-lb

NOTE: To prevent the bolt from unintentional loosening during transport, the jam, or lock nut must be positioned against the non-threaded lug (between the two lugs.) tighten against the non-threaded lug to form a secured lock. Check for secure fit and proper tightness of the ring.

5. Secure the drum and attempt to slide, or rotate, the ring. Any sliding of the ring may indicate an oversize ring, or improper torque.

III. Post-loading Instructions

- A. Verify that the gross weight of the drum does not exceed the allowable limit.

Each drum is marked with the maximum allowable gross weight on the permanent data plate attached to the drum.

- B. Attach a plain wire seal for nonaccountable materials or a controlled, numbered seal for accountable materials, if required.

The seal wire should be threaded through the hole in the center buckle so that the buckle cannot be opened without breaking the wire.

- C. Record the controlled, numbered seal for accountable materials, if required.

Prepared by: ORNL TPM Organization

Approved by: Jeff Shelton
Jeff Shelton, Manager (576-6401)
ORNL TPM - Packaging Operations

November 1, 2005

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FBF NUCLEAR CONTAINERS, LLC

PLANT LOCATION
1201 HILTON ROAD
KNOXVILLE, TN 37921

TELEPHONE: (865) 584-1868
FAX: (865) 584-4935

DIRECT MAILING
P. O. BOX 51026
KNOXVILLE, TN 37950-1026

DOT-6M TYPE B PACKAGE LOADING INSTRUCTIONS

THE PROCEDURE FOR LOADING THE CONTENTS OF A TYPICAL DOT-6M MAY VARY SLIGHTLY DEPENDING ON THE TYPE OF 2R VESSEL AND THE SIZE OF THE DRUM.

LOWER SIDE OF DRUM

1. LOAD THE SOLID FIBERBOARD RINGS INTO THE DRUM UNTIL THE MINIMUM THICKNESS REQUIRED PER 49 CFR 178.354-3 (a), (1) IS ACHIEVED. IF THE CONTAINER GROSS WEIGHT IS SUCH THAT A BEARING PLATE IS REQUIRED PER 49 CFR 178.354-3 (e), THE RING CONTAINING THE STEEL BEARING PLATE OR PLYWOOD DISC MUST BE INSTALLED SO THAT THE STEEL OR PLYWOOD IS IN CONTACT WITH THE 2R VESSEL. THE LOWER INSULATION THICKNESS CORRESPONDS TO THE LOWER INSULATION THICKNESS SHOWN ON THE FBF ATTACHMENT 6 – “INSULATION SHIELDING INSPECTION REPORT”.

MIDDLE OF DRUM

2. LOAD THE MIDDLE FIBERBOARD RINGS. THESE RINGS HAVE A CENTER CAVITY CUT OUT HOLE IN THE CENTER OF THE RINGS. IF THE 2R VESSEL HAS AN EXTERNAL CLOSURE CAP, LOAD THE FIBERBOARD RINGS WITH THE SMALLER INSIDE DIAMETER CENTER CAVITY HOLE CUT OUT INTO THE DRUM FIRST. FOR A 2R VESSEL WITH A PLUG CLOSURE, LOAD ALL OF THE FIBERBOARD RINGS WITH THE CENTER CAVITY HOLE CUT OUT. THE MIDDLE INSULATION THICKNESS CORRESPONDS TO THE MIDDLE INSULATION THICKNESS SHOWN ON THE FBF ATTACHMENT 6 – “INSULATION SHIELDING INSPECTION REPORT”. NOTE: THE UPPERMOST 2 SECTIONS OF THE MIDDLE INSULATION DISCS HAVE 15/16” FINGER HOLES. INSURE THAT THESE DISCS ARE INSTALLED LAST.
3. LOAD THE 2R VESSEL.
4. IF THE 2R VESSEL HAS A CLOSURE CAP, LOAD THE REMAINING RINGS WITH THE LARGER INSIDE DIAMETER CENTER CAVITY HOLE CAP CUT OUT.
5. IF THE 2R VESSEL HAS A PLUG CLOSURE, STEP 4 IS IGNORED.

TOP OF DRUM

6. LOAD THE REMAINING SOLID FIBERBOARD RINGS. THESE FIBERBOARD RINGS WILL HAVE 15/16” FINGER HOLES INSTALLED. IF A STEEL OR PLYWOOD BEARING PLATE IS INSET IN ONE OF THE TOP RINGS, THIS MUST BE PLACED SO THAT THE PLYWOOD OR STEEL IS IN CONTACT WITH THE TOP OF THE 2R VESSEL. ALL RINGS WITH THE FINGERHOLES ARE INTENDED TO BE PLACED ABOVE THE 2R VESSEL TO ALLOW FOR ACCESS TO THE 2R VESSEL. THE TOP INSULATION THICKNESS CORRESPONDS TO THE TOP INSULATION THICKNESS SHOWN ON THE FBF ATTACHMENT 6 – “INSULATION SHIELDING INSPECTION REPORT”.
7. UPON COMPLETION OF 2R LOADING, INSTALL DRUM LID WITH GASKET AND BOLT RING PER DRUM CLOSURE INSTRUCTIONS PROVIDED ELSEWHERE IN THE QA PACKAGE.

TO UNLOAD GO IN THE REVERSE ORDER OF THE ABOVE.

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10-GALLON STEEL DRUM CLOSURE INSTRUCTIONS

OPEN HEAD / CLOSED HEAD BUNG FITTING INSTALLATION:

FITTINGS ARE REQUIRED TO HAVE THE GASKETS PROPERLY SEATED ON THE BUNG AND THE BUNG FLANGE. TORQUE BUNG TO 15-20 FT. LBS. TO PROVIDE ADEQUATE SEAL OF THE GASKET. OPEN HEAD DRUM COVER (LID) CLOSURE INSTRUCTIONS ARE SHOWN BELOW.

OPEN HEAD DRUM COVER (LID) INSTALLATION:

POSITION COVER AND GASKET ON THE BODY CURL SO THAT AN UNINTERRUPTED SEAL IS ASSURED COMPLETELY AROUND THE FULL AREA OF THE COVER BY THE COVER GASKET. THE RING CLOSURE MUST BE PROPERLY SEATED ON THE COVER AND THE OUTER EDGE OF THE BODY CURL SO THAT THE BOLT CAN BE TORQUED TO THE FULL INTEGRITY OF THE RING CLOSURE.

HOLD THE RING IN BOTH HANDS WITH THE BOLT EYELETS FACING THE INSTALLER. APPLY PRESSURE WITH THE HANDS TO SEAT THE RING COMPLETELY AROUND THE PERIMETER OF THE COVER. PLACE THE BOLT THROUGH THE RING OPENING AND APPLY THE NUT TO THE BOLT END. TIGHTEN THE BOLT CLOSURE WHILE TAPPING AROUND THE RING WITH A Mallet TO ASSURE THAT THE RING IS PROPERLY SEATED, UNTIL THE LUGS BEGIN TO BEND INWARD OR COME TOGETHER--TYPICALLY LESS THAN 40 FT-LBS.

TO PREVENT THE BOLT FROM UNINTENTIONAL LOOSENING DURING TRANSPORT, A JAM OR LOCK NUT MUST BE POSITIONED AGAINST THE NON-THREADED LUG (BETWEEN THE TWO LUGS). TIGHTEN AGAINST THE NON THREADED LUG TO FORM A SECURED LOCK. CHECK FOR SECURE FIT AND PROPER TIGHTNESS OF THE RING.

SECURE THE DRUM AND ATTEMPT TO SLIDE OR ROTATE THE RING. ANY SLIDING OF THE RING MAY INDICATE AN OVERSIZE RING OR IMPROPER TORQUE.

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30 GALLON – 110 GALLON DRUM CLOSURE INSTRUCTIONS

OPEN HEAD / CLOSED HEAD BUNG FITTING INSTALLATION:

FITTINGS ARE REQUIRED TO HAVE THE GASKETS PROPERLY SEATED ON THE BUNG AND THE BUNG FLANGE. TORQUE BUNG TO 15-20 FT. LBS. TO PROVIDE ADEQUATE SEAL OF THE GASKET. OPEN HEAD DRUM COVER (LID) CLOSURE INSTRUCTIONS ARE SHOWN BELOW.

OPEN HEAD DRUM COVER (LID) INSTALLATION:

POSITION COVER AND GASKET ON THE BODY CURL SO THAT AN UNINTERRUPTED SEAL IS ASSURED COMPLETELY AROUND THE FULL AREA OF THE COVER BY THE COVER GASKET. THE RING CLOSURE MUST BE PROPERLY SEATED ON THE COVER AND THE OUTER EDGE OF THE BODY CURL SO THAT THE BOLT CAN BE TORQUED TO THE FULL INTEGRITY OF THE RING CLOSURE.

HOLD THE RING IN BOTH HANDS WITH THE BOLT EYELETS FACING THE INSTALLER. APPLY PRESSURE WITH THE HANDS TO SEAT THE RING COMPLETELY AROUND THE PERIMETER OF THE COVER. PLACE THE BOLT THROUGH THE RING OPENING AND APPLY THE NUT TO THE BOLT END. TIGHTEN THE BOLT CLOSURE WHILE TAPPING AROUND THE RING WITH A MALLETT TO ASSURE THAT THE RING IS PROPERLY SEATED. TORQUE BOLT TO A MINIMUM OF 40 FT. LBS. (+ / - 5 FT. LBS.).

TO PREVENT THE BOLT FROM UNINTENTIONAL LOOSENING DURING TRANSPORT, THE JAM OR LOCK NUT MUST BE POSITIONED AGAINST THE NON-THREADED LUG (BETWEEN THE TWO LUGS). TIGHTEN AGAINST THE NON-THREADED LUG TO FORM A SECURED LOCK CHECK FOR SECURE FIT AND PROPER TIGHTNESS OF THE RING.

SECURE THE DRUM AND ATTEMPT TO SLIDE OR ROTATE THE RING. ANY SLIDING OF THE RING MAY INDICATE AN OVERSIZE RING OR IMPROPER TORQUE.

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