

71-9035



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15 August 2006

Mr. Stewart Brown, Senior Project Manager  
Licensing Section  
Spent Fuel Project Office  
Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
11555 Rockville Pike  
One White Flint  
Rockville, MD 20852

Docket No.: 71-9035  
TAC Nos. L23921 and L23897

**Subject: Additional Supportive Information for the Model 680-OP Type B Container**

Dear Mr. Brown:

In response to our conversations on 14 & 15 August 2006, we provide the following information and response:

- Section 8.2.3 is modified to incorporate the lock assembly component test as requested by your staff.
- Pages 1-1, 2-1, 2-5, 2-10 and Drawing R680-OP are revised to reflect maximum package weight as 615 lbs instead of 625 lbs.

The revised pages from Revision 10 to the Model 680-OP SAR are submitted as they are the only pages that change from Revision 9 of the SAR. Changes to the text of Revision 10 of the SAR addressing items discussed in this letter are indicated by vertical lines in the right hand margin. Should you have any additional questions or wish to discuss this submission, please contact me.

Nmss01

Sincerely,



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RA/QA Approval

16 Aug 06  
Date

  
Engineering Approval

15 Aug 06  
Date

Enclosures:

- A List of Affected Pages
- B Revised Pages 1-1, 2-1, 2-5, 2-10 and 8-3 of SAR Revision 10
- C Drawing R680-OP Rev G



## Section 1 - GENERAL INFORMATION

### 1.1 Introduction

The Model 680-OP is designed as a transport package and storage container for Type B quantities of special form radioactive material. It conforms to the Type B(U)-96 criteria for packaging in accordance 10 CFR 71, 49 CFR 173, and IAEA Regulations for the Safe Transport of Radioactive Material 1996 Edition (Revised) No. TS-R-1 (ST-1, Revised).

### 1.2 Package Description

*(Reference:*

- 10 CFR 71.33
- IAEA TS-R-1, paragraph 220 & 807)

The transport package consists of an outer carbon steel container with wood and foam inserts inside which is housed a Model 680 Series Projector (Figure 1.2.A). The Model 680-OP package may contain the following projector models; 680, 680A, 680B, 680E, 680AE, and 680BE. These models are structurally identical. All materials of construction and methods of fabrication are essentially the same. The models with the designation AE, BE and E have wires and connectors attached to the end plates for automatic source actuation when the device is in operation. All models except the 680 and 680E use a Posilok™ lock assembly. Prior to 1980, the Models 680, 680A and 680AE and 680E were manufactured with zircalloy source tubes, all other models have titanium source tubes. Throughout this evaluation, all models are considered interchangeable.

The exterior steel container is lined with polyurethane foam and wood which protects the Projector during transport. It is also fitted with wood inserts which locate and hold the projector in position within the container. The projector fits in the center of the inserts but is not mechanically fixed to the outer box. The container lid is closed by two padlock latches which are recessed into the front face of the box. The container is fitted with box section feet at each end, extending the full depth of the box enabling access underneath for mechanical lifting.

The package is constructed in accordance with descriptive drawings in Appendix A. Overall external dimensions for the 680-OP package is approximately 32" (813 mm) wide by 18 ½" (470 mm) high by 19" (483 mm) deep. The package weighs a maximum of 615 lbs (279 kgs) and is used for the transport of 4.07 TBq (110 Ci) of Co-60 as a special form source.

## Section 2 - STRUCTURAL EVALUATION

This section identifies and describes the principal structural engineering design of the packaging, components, and systems important to safety and compliance with the performance requirements of 10 CFR Part 71.

### 2.1 Description of Structural Design

*(Reference:*

- 10 CFR 71.33(a)
- IAEA TS-R-1, paragraph 220 & 807(b))

#### 2.1.1 Discussion

The Model 680-OP transport packages are described in Section 1.2, "Package Description."

#### 2.1.2 Design Criteria

The Model 680-OP transport packages are designed to comply with the requirements for Type B(U) packaging as prescribed by 10 CFR 71 and IAEA TS-R-1. All design criteria are evaluated by a straightforward application of the appropriate section of 10 CFR 71 or IAEA TS-R-1.

#### 2.1.3 Weight and Centers of Gravity

The transport package weighs up to 615 lbs (279 kg). The maximum weight of the Model 680 projector is 465 lbs (211 kg). The maximum weight of the projector shield is 302 lbs (137 kg). The shield may also include the addition of up to 28 lbs (12.7 kgs) of lead as supplemental shielding to the exterior surface of the shield. This lead if applied will not exceed ½ inch thick in any location on the depleted uranium shield. The center of gravity (C of G) is nominally assumed as the geometric center of the shield.

#### 2.1.4 Identification of Codes and Standards for Package Design

##### 2.1.4.1 Package Design

See Section 2.1.2 relating to design criteria of the package. No specific codes or standards were directly incorporated in the design effort of the finished assembly for the 680-OP transport packages. However the design was based on the Type A and Type B(U) container requirements of 49 CFR, 10 CFR 71 and IAEA regulations in effect at the time of the package design.

## Safety Analysis Report for the Model 680-OP Transport Package

QSA Global Inc.  
Burlington, Massachusetts

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Where:

t	=	steel thickness of the base = 0.06 inches
d	=	depth of the package = 15 inches
b	=	length of the package = 32 inches)

From this equation the bending moment of inertia is  $250 \text{ in}^4$ . From this the maximum stress on the package is calculated by:

$$\sigma = PLc/4I$$

Where:

P	=	The weight of the transport package 615 lbs (279 kg)
L	=	The length of the base between forks 9 inches (229 mm)
c	=	Half the thickness of the box section 7.5 inches (191 mm)
I	=	The moment of inertia $250 \text{ in}^4$ (10,406 $\text{cm}^4$ )

From this relationship, the stress generated in the base is calculated to be 42 psi. With a Safety Factor of 3 applied, the maximum stress in the base is 126 psi. This is less than 1% of the ultimate yield strength of the steel base, 42,000 psi. Further, as was demonstrated in TP 72 Report (see Section 2.12.3), TP72(A) was subjected for 24 hrs to a compressive load which was five times the maximum package weight. The test unit was measured before and after testing in two locations: (1) the overall package height at the end of the overpack, and (2) the package centerline distance measured from the package the bottom to the ground. After testing there was no buckling or deformation of the package in these areas, further supporting that the package strength is sufficient to withstand the stress requirements of this section.

### 2.4.2 Tie-Down Devices

(Reference:

- *USNRC, 10 CFR 71.45(b) (1) (2) (3)*
- *IAEA TS-R-1, paragraph 606 and 636)*

The Model 680-OP packages have no tie down attachments. The package can be blocked and braced according to standard transportation practices.

## 2.5 General Considerations

(Reference:

- *10 CFR 71.41(a)*
- *IAEA TS-R-1, paragraph 807(c)*

## Safety Analysis Report for the Model 680-OP Transport Package

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Burlington, Massachusetts

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Test unit TP72(A) weighed a total of 598 lbs. The maximum requested package weight is 615 lbs. In the normal condition drop test, the test unit sustained no damage to the inner 680 device and received less physical damage to the overpack than was produced by the hypothetical accident testing (See Section 2.7).

Therefore the test information obtained for TP72(A) under Test Plan Report 72 is considered conservative and remains valid to demonstrate that the Model 680-OP transport package maintains its structural integrity under the Normal Conditions of Transport, 1.2 m drop test.

### 2.6.8 Corner Drop

*(Reference:*

- *USNRC, 10 CFR 71.71(c)(8)*
- *IAEA TS-R-1, paragraph 722(b)*

This test is not applicable, as the transport package does not transport fissile material, nor is the exterior of the transport package made from either fiberboard or wood.

### 2.6.9 Compression

*(Reference:*

- *USNRC, 10 CFR 71.71(c)(9)*
- *IAEA TS-R-1, paragraph 723)*

Test Plan Report 72 demonstrated that the Model 680-OP transport package maintained its structural integrity and shielding effectiveness under the Normal Conditions of Transport compression test. The actual test specimen for the compression test weighed 598 lbs. The test specimen was subjected to a compressive load of 3,149 lbs (1,431 kg) for a period of 24 hours, which exceeds five times the package weight of 615 lb. This is greater than 2 lb/in<sup>2</sup> (13 kPa) multiplied by the vertically projected surface area of the package.

Following the test, no damage to the unit was observed. There was a 5/16" reduction in overall height but this was due to settling of the lid and occurred immediately after the load was applied.

### 2.6.10 Penetration

*(Reference:*

- *USNRC, 10 CFR 71.71(c)(10)*
- *IAEA TS-R-1, paragraph 724)*

## **8.2 Maintenance Program**

### **8.2.1 Structural and Pressure Tests**

Not applicable. Material certification is obtained for Safety Class A components used in the transport package prior to their initial use. Based on the construction of the design, no additional structural testing during the life of the package is necessary if the container shows no signs of defect when prepared for shipment in accordance with the requirements of Section 7 of the SAR. The 680-OP packaging system is not designed to require increased or decrease operating pressures to maintain containment during transport, therefore pressure tests of package components prior to individual shipment is not required.

### **8.2.2 Leakage Tests**

As described in Section 8.1.4, "Leakage Tests," the radioactive source assembly is leak-tested at manufacture. In addition, the sources are leak tested in accordance with that Section at least once every six months thereafter if being transported to ensure that removable contamination is less than 185 Bq (0.005  $\mu$ Ci).

### **8.2.3 Component and Material Tests**

The transport package is inspected for tightness of fasteners, proper seal wires, and general condition prior to each use as described in Section 7 of this SAR. Further the lock assembly of the device is tested to assure that the security of the radioactive source will be maintained. Failure of this test prevents use of the device until the lock assembly is corrected and re-tested.

### **8.2.4 Thermal Tests**

Not applicable. The source content of the Model 680-OP packages has minimal effect on the package surface temperature and therefore no additional testing is necessary to evaluate thermal properties of the packaging prior to shipment.

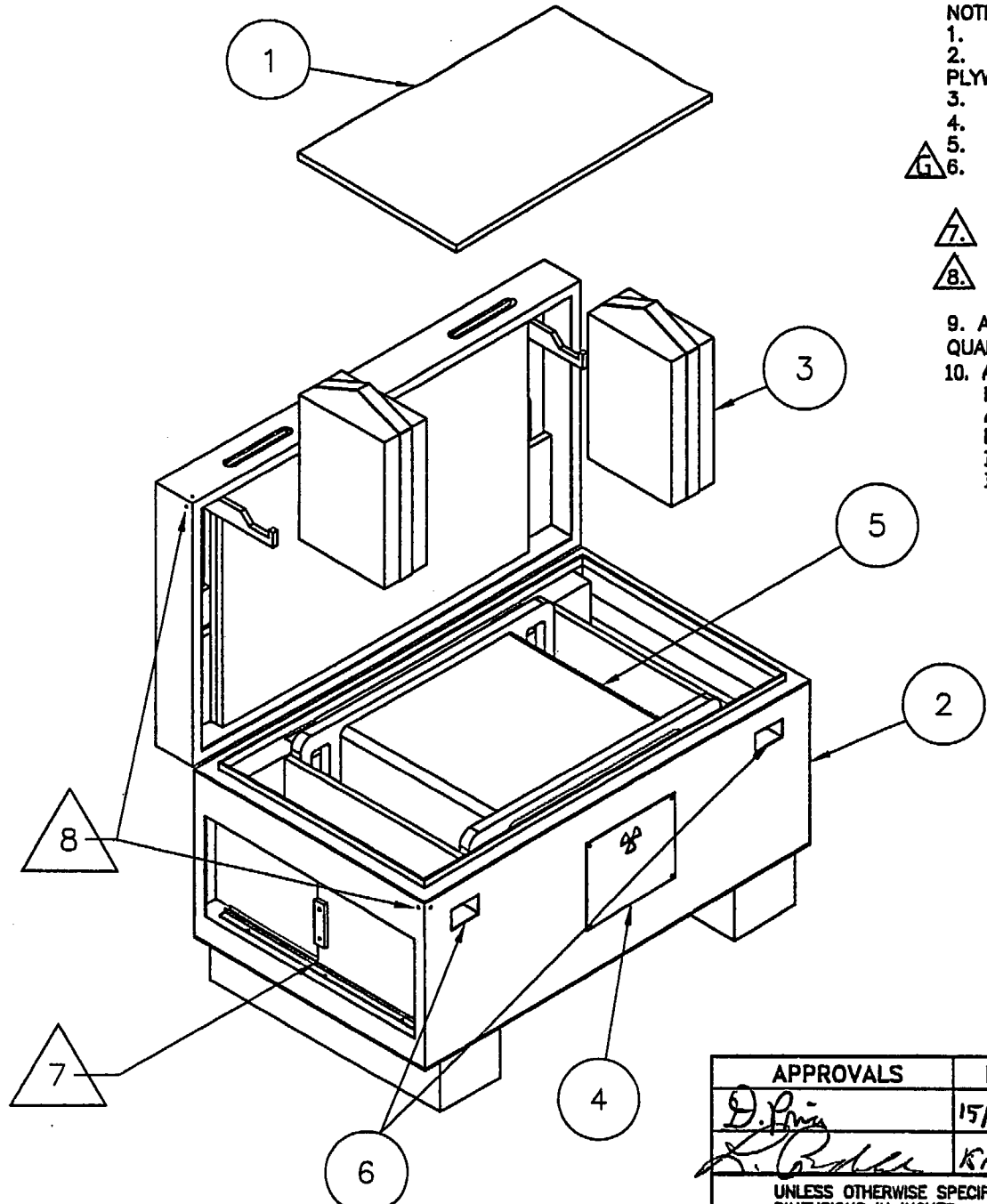
### **8.2.5 Miscellaneous Tests**

Inspections and tests designed for secondary users of this transport package under the general license provisions of 10 CFR 71.17(b) are provided in Section 7.

## **8.3 Appendix**

Not applicable.





- NOTES:
1. NOTES APPLY TO ALL PAGES.
  2. ALL WOOD EXTERIOR GRADE C-C, GROUP 1 OR BETTER PLYWOOD.
  3. WOOD TOLERANCES  $\pm 3/16"$ .
  4. "BASKET" LOAD RATING OF 2000LBS. MINIMUM.
  5. NAME PLATE ON FRONT.
  6. MAX. PACKAGE WEIGHT 615 LBS.  
WEIGHT OF STEEL BOX 68-75 LBS.
  7. WEIGHT OF STEEL BOX, WOOD, & FOAM - 130-150 LBS
  7. TAMPER INDICATOR HOLES DRILLED AS SHOWN, ON BOTH SIDES OF DEVICE.
  8. OPTIONAL TAMPER INDICATOR WIRE HOLES; DRILL 4  $\phi 1/8"$  HOLES APPROXIMATELY WHERE SHOWN.
  9. ALL STEEL TO BE COLD ROLLED STEEL, COMMERCIAL QUALITY (SAE 1008).
  10. ALL PERSONNEL QUALIFICATIONS, WELDING & EXAMINATION PROCEDURES FOR OVERPACK BOXES MANUFACTURED ON OR AFTER 21 NOV 05 ARE IN ACCORDANCE WITH THE REQUIREMENTS OF THE AWS. WELDING ON THE OVERPACK BOXES MANUFACTURED BEFORE 21 NOV 05 WERE INSPECTED BY AWS CERTIFIED WELD INSPECTORS.

6	2	PADLOCK
5	1	680 PROJECTOR PER R68090
4	1	NAME PLATE, STEEL, FIRE PROOF
3	2	WOOD BLOCK INSERTS (SHEET 3)
2	1	OVERPACK, 16ga CRS FEET 13 ga. CRS
1	1	WOOD SUPPORT TOP, 1/2 THICK

ERF # 1473

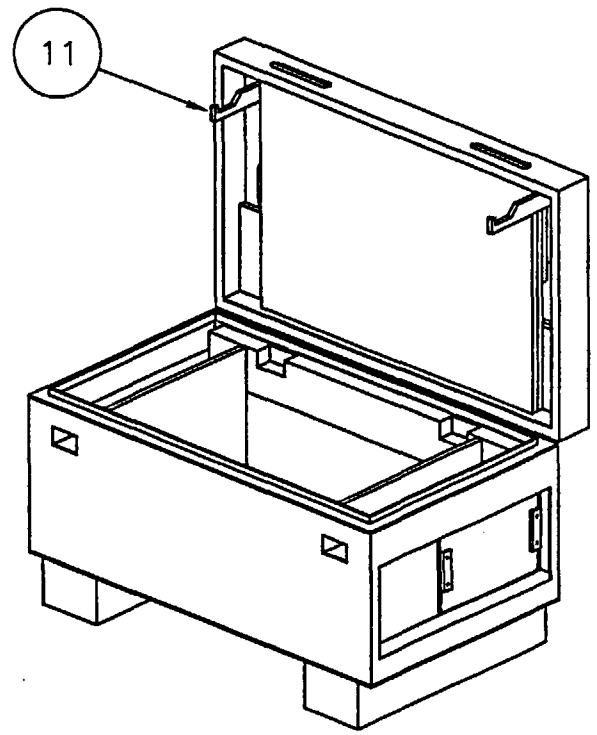
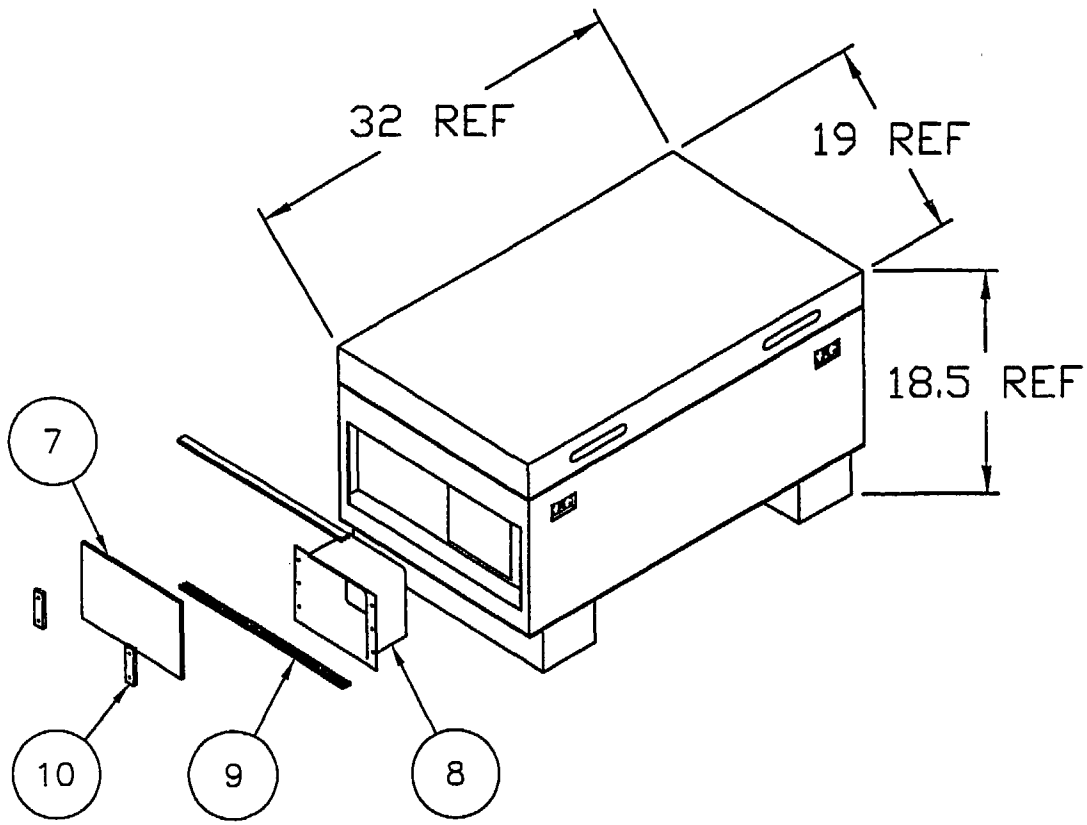
APPROVALS	DATE
<i>D. Pina</i>	15 Aug 06
<i>K. ...</i>	15 Aug 06

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DESCRIPTIVE DRAWING

UNLESS OTHERWISE SPECIFIED  
DIMENSIONS IN INCHES  
TOLERANCES:  
FRACTIONS  $\pm 1/8$   
X.X  $\pm 0.12$   
X.XX  $\pm 0.06$   
X.XXX  $\pm 0.020$

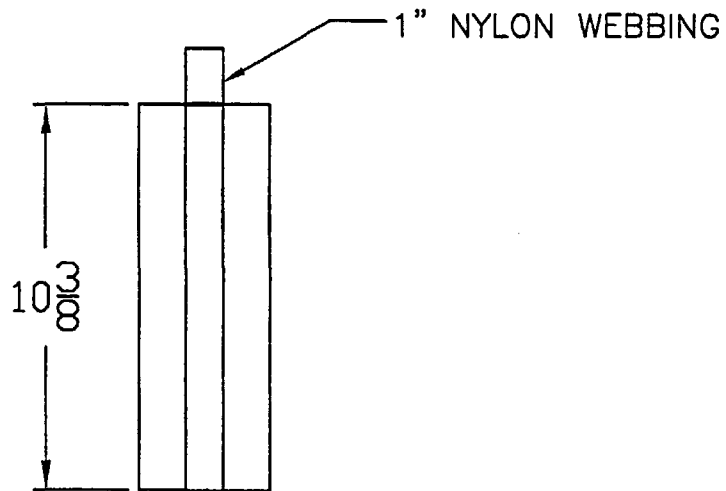
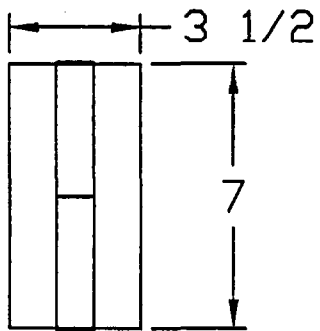
TITLE		MODEL 680-OP	
SIZE	DWG. NO.	R680-OP	
A	SCALE: NONE	SHEET 1 OF 7	
			REV G



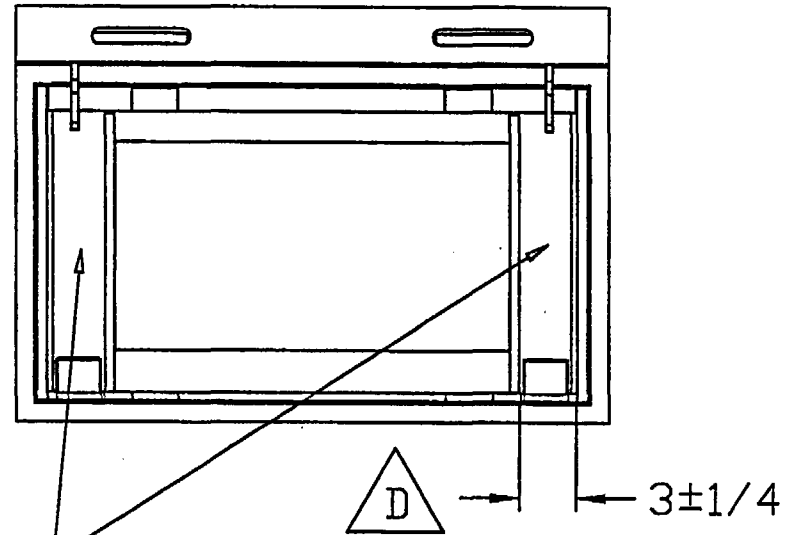
11	2	LATCH STEEL
10	4	MAGNET
9	2	DOOR TRACK, ALUMINUM
8	2	FLANGED SLEEVE, ALUMINUM
7	2	SLIDING DOOR, ALUMINUM
ITEM	QTY.	DESCRIPTION

UNLESS OTHERWISE SPECIFIED: ALL DIM.S ARE INCHES, TOL ± 1/8

SIZE	DWG. NO.	R680-OP	REV
A	SCALE:	NONE	G
		SHEET 2	OF 7



WOOD BLOCK INSERT

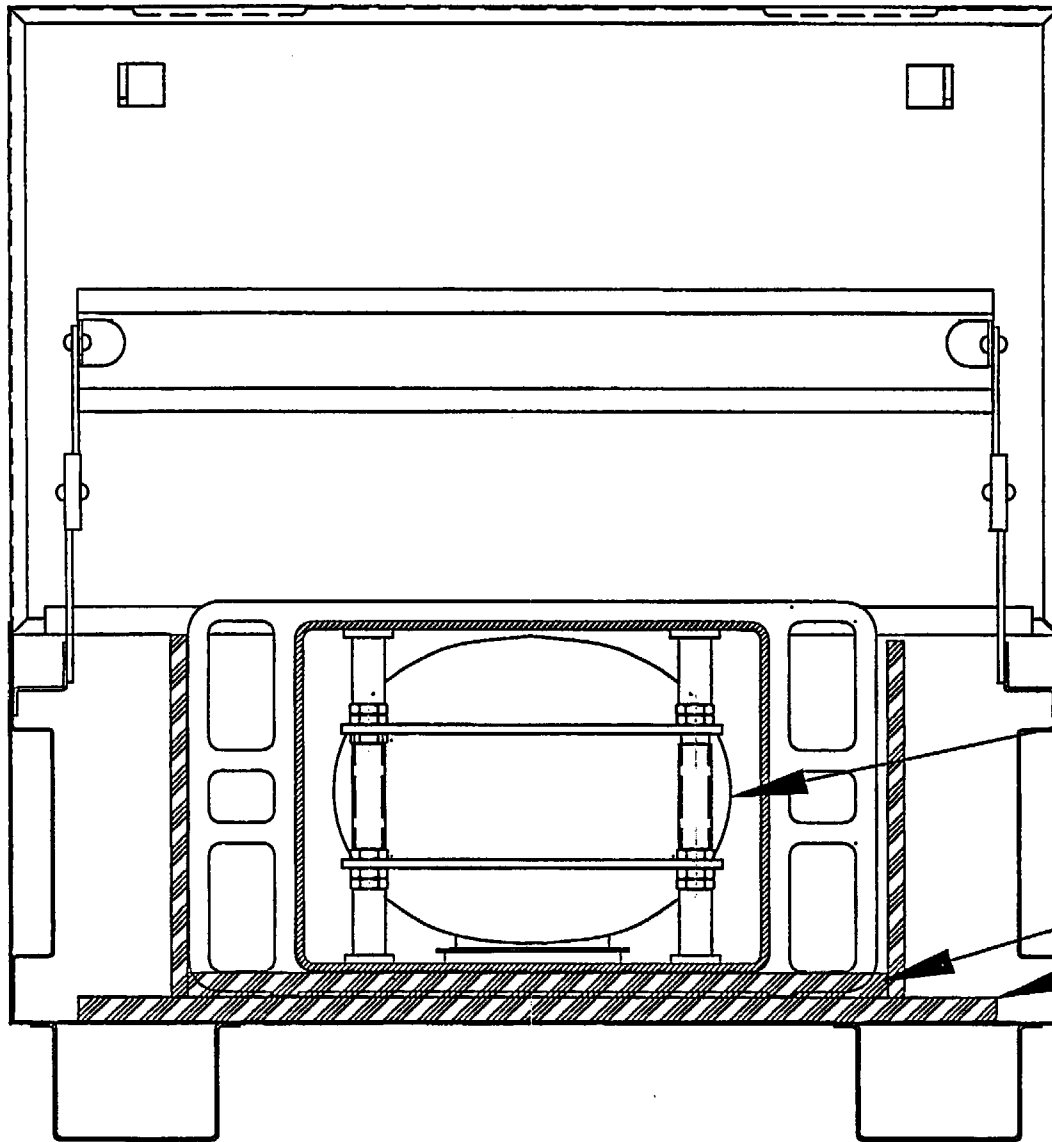


FILL CAVITY WITH RIGID POLYURETHANE FOAM,  
 MINIMUM DENSITY 8 LBS/CUBIC FOOT  
 MINIMUM HEIGHT 8 1/2"  
 SIDES MAY INCLUDE OPTIONAL COSMETIC  
 FOAM COVERS OVER POLYURETHANE FOAM  
 FILL IN THESE AREAS.

UNLESS OTHERWISE SPECIFIED: ALL DIM.S ARE INCHES. TOL ± 1/8			
SIZE	DWG. NO.	R680-OP	REV
A	SCALE: NONE	SHEET 3 OF 7	G

FIGURE WITHHELD UNDER 10 CFR 2.390

UNLESS OTHERWISE SPECIFIED: ALL DIMS ARE INCHES, TOL $\pm$ 1/8			
SIZE	DWG. NO.	R680-OP	REV
A	SCALE:	NONE	G
		SHEET 4	OF 7



680  
PROJECTOR

21 x 11 x 3/4 PLYWOOD

28 x 18 1/2 x 3/4 PLYWOOD

UNLESS OTHERWISE SPECIFIED: ALL DIM.S ARE INCHES, TOL ± 1/8

SIZE A	DWG. NO.	R680-0P	REV G
	SCALE:	NONE	



FIGURE WITHHELD UNDER 10 CFR 2.390

UNLESS OTHERWISE SPECIFIED: ALL DIMS ARE INCHES, TOL $\pm$ 1/8			
SIZE	DWG. NO.	R680-OP	REV
A	SCALE:	NONE	G
		SHEET 6	OF 7

FIGURE WITHHELD UNDER 10 CFR 2.390

UNLESS OTHERWISE SPECIFIED: ALL DIMS ARE INCHES, TOL $\pm$ 1/4			
SIZE	DWG. NO.	R680-OP	REV
A	SCALE:	NONE	G
		SHEET 7 OF 7	