TRANSPORTABILITY TESTING OF THE INTERMODAL STORAGE AND TRANSPORT FRAMES (ISTF-2s)
TP-94-01,
"TRANSPORTABILITY TESTING PROCEDURES"

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ABSTRACT

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Transportation Engineering Division (SJMAC-DET) to conduct transportability testing on the Intermodal Storage and Transport Frame (ISTF-2) manufactured by Mobile Shelter Systems, Inc. The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures."

The objective of the testing was to evaluate the ISTF-2s, when transportability tested in accordance with TP-94-01, Revision 2, June 2004.

The ISTF-2s, without interlocks, are satisfactory for the transport of ammunition. However, due to extremely tight tolerances we do not recommend that the RIBS cradles be used to block and brace the ISTF-2s in an end-opening intermodal container. Additionally, the interlock devices are not approved for ammunition transport. Testing of the interlocks was conducted for evaluation purposes only.

Prepared by: Reviewed by:

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Lead Validation Engineer Chief, Validation Engineering Division
Transportability Testing of the Intermodal Storage and Transport Frames (ISTF-2), TP-94-01, Revision 2, June 2004 “Transportability Testing Procedures”

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PART 1 - INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Transportation Engineering Division (SJMAC-DET) to conduct transportability testing on the Intermodal Storage and Transport Frame (ISTF-2s) manufactured by Mobile Shelter Systems, Inc. The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures."

B. AUTHORITY. This test was conducted IAW mission responsibilities delegated by the U.S. Army Joint Munitions Command (JMC), Rock Island, IL. Reference is made to the following:


C. OBJECTIVE. The objective of the testing was to evaluate the ISTF-2s, when transportability tested in accordance with TP-94-01, Revision 2, June 2004.

D. CONCLUSION. The ISTF-2s, without interlocks, are satisfactory for the transport of ammunition. However, due to extremely tight tolerances we do not recommend that the RIBS cradles be used to block and brace the ISTF-2s in an end-opening intermodal container. Additionally, the interlock devices are not approved for ammunition transport. Testing of the interlocks was conducted for evaluation purposes only.
# PART 2 - ATTENDEES

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<thead>
<tr>
<th>ATTENDEE</th>
<th>MAILING ADDRESS</th>
</tr>
</thead>
</table>
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PART 3 - TEST EQUIPMENT

1. Intermodal Storage and Transport Frame (ISTF-2s)
   Manufactured by Mobile Shelter Systems, Inc.
   Weight: 455 pounds
   Length: 51-7/8 inches
   Width: 41-3/4 inches
   Height: 45 inches

2. Truck, Tractor
   5-Ton, 6 X 6
   Model #: XM818 without winch
   ID #: 05E-37770-0124-12331
   Weight: 19,260 pounds

3. Truck, Tractor
   5 Ton, 6 X 6
   Model #: XM818 with winch
   Manufactured by General Products Division, Jeep Corporation
   ID #: 05A-74971-C124-13529
   Weight: 20,955 pounds

4. Semitrailer, flatbed, breakbulk/container transporter, 22.5 ton
   Model #: M871
   Manufactured by Southwest Truck Body, St. Louis, MO
   ID #: NX03PJ – 0063
   NSN: 2330 00 122 6799
   Weight: 15,630 pounds
5. Semitrailer, flatbed, breakbulk/container transporter, 34 ton
   Model #: M872A1
   Manufactured by Heller Truck Body Corporation, Hillsdale, NJ
   ID #: 11-1505 NX05NZ
   NSN: 2330 01 109 8006
   Weight: 19,240 pounds

6. Intermodal Container
   ID # CMCU 200006-8
   Date of Manufacture: 06/99
   Manufactured by Charleston Marine Containers, Charleston, SC
   Tare Weight: 4870 pounds
   Maximum Gross Weight: 67,200 pounds

7. Container Roll-In/Out Platform (CROP)
   Model Number: M3
   Manufactured by Summa Technologies Incorporated
   NSN: 3990 01 442 2751
   Tare Weight: 3650 Pounds

8. Container Roll-In/Out Platform (CROP)
   Model Number: M3A1
   Manufactured by Hyundai Precision America
   Tare Weight: 4000 Pounds
PART 4 - TEST PROCEDURES

The test procedures outlined in this section were extracted from TP-94-01, "Transportability Testing Procedures," Revision 2, June 2004, for validating tactical vehicles and outloading procedures used for shipping munitions by tactical truck, railcar, and ocean-going vessel.

The rail impact will be conducted with the loaded intermodal container secured directly to the railcar. Inert (non-explosive) items were used to build the load. The test loads were prepared using the blocking and bracing procedures proposed for use with munitions (see Part 6 for procedures). The weight and physical characteristics (weights, physical dimensions, center of gravity, etc.) of the test loads were similar to live (explosive) ammunition.

A. RAIL TEST. RAIL IMPACT TEST METHOD. The test load or vehicle will be secured to a flatcar. The equipment needed to perform the test will include the specimen (hammer) car, four empty railroad cars connected together to serve as the anvil, and a railroad locomotive. The anvil cars will be positioned on a level section of track with air and hand brakes set and with draft gears compressed. The locomotive unit will push the specimen car toward the anvil at a predetermined speed, then disconnect from the specimen car approximately 50 yards away from the anvil cars allowing the specimen car to roll freely along the track until it strikes the anvil. This will constitute an impact. Impacting will be accomplished at speeds of 4, 6, and 8.1 mph in one direction and at a speed of 8.1 mph in the reverse direction. The tolerance for the speeds is plus 0.5 mph, minus 0.5 mph for the 4 mph and 6 mph impacts, and plus 0.5 mph, minus 0 mph for the 8.1 mph impacts. The impact speeds will be determined by using an electronic counter to measure the time for the specimen car to traverse an 11-foot distance immediately prior to contact with the anvil cars (see Figure 1).
ASSOCIATION OF AMERICAN RAILROADS (AAR)

STANDARD TEST PLAN

4 BUFFER CARS (ANVIL)
WITH DRAFT GEAR
COMPRESSED AND AIR BRAKES IN A SET
POSITION

ANVIL CAR TOTAL WT. 250,000 LBS (APPROX)

SPECIMEN CAR IS RELEASED BY SWITCH ENGINE TO
ATTAIN: IMPACT NO. 1 @ 4 MPH
IMPACT NO. 2 @ 6 MPH
IMPACT NO. 3 @ 8.1 MPH

THEN THE CAR IS REVERSED AND RELEASED BY
SWITCH ENGINE TO ATTAIN:

IMPACT NO. 4 @ 8.1 MPH

Figure 1. Rail Impact Sketch
B. **ON/OFF ROAD TEST.**

1. **HAZARD COURSE.** The test load or vehicle will be transported over the 200-foot-long segment of concrete-paved road consisting of two series of railroad ties projecting 6 inches above the level of the road surface. The hazard course will be traversed two times (see Figure 2).

![Diagram of a hazard course with railroad ties projecting above the road surface.](image)

Figure 2. Hazard Course Sketch

- a. The first series of 6 ties are spaced on 10-foot centers and alternately positioned on opposite sides of the road centerline for a distance of 50 feet.
- b. Following the first series of ties, a paved roadway of 75 feet separates the first and second series of railroad ties.
c. The second series of 7 ties are spaced on 8-foot centers and alternately positioned on opposite sides of the road centerline for a distance of 50 feet.

d. The test load is driven across the hazard course at speeds that will produce the most violent vertical and side-to-side rolling reaction obtainable in traversing the hazard course (approximately 5 mph).

2. ROAD TRIP. The test load or vehicle will be transported for a distance of 30 miles over a combination of roads surfaced with gravel, concrete, and asphalt. The test route will include curves, corners, railroad crossings and stops and starts. The test load or vehicle will travel at the maximum speed for the particular road being traversed, except as limited by legal restrictions.

3. PANIC STOPS. During the road trip, the test load or vehicle will be subjected to three (3) full airbrake stops while traveling in the forward direction and one in the reverse direction while traveling down a 7 percent grade. The first three stops are at 5, 10, and 15 mph while the stop in the reverse direction is approximately 5 mph. This testing will not be required if the Rail Impact Test is performed.

4. WASHBOARD COURSE. The test load or vehicle will be driven over the washboard course at a speed that produces the most violent response in the vertical direction.

C. OCEAN-GOING VESSEL TEST. 80-DEGREE TILT TEST. The test load (specimen) shall be positioned on level terrain with the bottom corner fittings resting on timbers so the entire container is supported solely by the bottom corner fittings. The timbers shall be oriented parallel to the end rails of the container and extend 2 feet beyond the corner fittings on each side. Using two mobile cranes and appropriate rigging, the container shall be rotated (tilted) using the bottom corner fittings on one side as a fulcrum. The rigging (slings) of one
A crane shall be attached to the bottom corner fittings of the long side and the rigging (slings) of the second crane shall be attached to the top corner fittings on the opposite side. The tilting shall be accomplished by lifting the bottom corner fittings with the first crane so the container rotates about the opposite bottom corner fittings (fulcrum). Lifting/rotating by the first crane is continued until the center of gravity passes over the fulcrum, at which point the second crane shall provide support to the container and lower the container to the 80 degrees, plus or minus 2 degrees position. Rotation shall be accomplished smoothly at a slow speed so the container sidewall is subjected only to the static force of the interior load. The crane booms shall be adjusted to maintain a rear vertical suspension of the rigging at all times. In the case of end-opening type containers, at least one door (lower side of tilted container) must be closed and fastened throughout the test. The container shall be held in the tilted position for a minimum of two minutes. At which time, observations of both the container structure and the interior load shall be made. When the test is completed, the container shall be returned to its upright position using the same manner and care in handling.

Figure 3. Washboard Course Sketch
PART 5 - TEST RESULTS

5.1

Payload: 16 ISTF-2s in an End-opening Intermodal Container.
Testing Date: 10-12 August 2004
Gross Weight: 41,000 pounds (including intermodal container)

Photo 1. ISTF-2s in an End-opening Intermodal Container
A. **RAIL TEST.**

Photo 2. Rail Impact Testing of the ISTF-2s in an End-opening Intermodal Container (Prior to Testing)

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flatcar Number: DODX 42353</td>
<td>85,000 lbs.</td>
</tr>
<tr>
<td>ISTF-2s and End-opening Intermodal Container</td>
<td>41,000 lbs.</td>
</tr>
<tr>
<td>M1 Flatrack with MLRS Pods</td>
<td>28,265 lbs.</td>
</tr>
<tr>
<td>Total Specimen Wt.</td>
<td>154,265 lbs.</td>
</tr>
<tr>
<td>Buffer Car (four cars)</td>
<td>257,900 lbs.</td>
</tr>
</tbody>
</table>

**Figure 4.**

**Remarks:** Figure 4 lists the test components and weights of the items used during the Rail Impact Tests.
Remarks:
1. Figure 5 lists the average speeds of the specimen car immediately prior to impact with the anvil. Impacts #5 and #6 are the reverse impacts.
2. Impacts #1 and #5 were each determined to be a "no test" due to the insufficient velocity at impact. The tests were repeated.
3. Following Impact #2 a cap from the Rapid ISO Bracing System (RIBS) locking pin finger holds came off.
4. Following Impact #3 the ISTF-2s moved 0.125 inches in the direction of impact.
5. Following Impact #4 the ISTF-2s moved an additional 0.125-0.375 inches in the direction of impact. The vertical stay of the RIBS cradle moved 0.5 inches and the RIBS beams bowed.
6. Following Impact #5 the ISTF-2s moved 1.75-2.5 inches in the direction of impact.
B. ON/OFF ROAD TESTS.

1. HAZARD COURSE.
Remarks:
1. Figure 6 lists the average speeds of the test load through the Hazard Course.
2. Inspection following Pass #1 revealed that the ISTF-2s had moved toward the container door 0.5 inches (toward the rear of the trailer).

2. ROAD TRIP:

Remarks:
1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the Road Trip revealed no movement of the payload or damage.

3. PANIC STOPS: Testing was not required since the load was rail impact tested.

4. HAZARD COURSE:

Remarks:
1. Figure 7 lists the average speeds of the test load through the Hazard Course.
2. Inspection following Pass #4 revealed that the ISTF-2s had moved toward the container door an additional 0.25 inches (toward the rear of the trailer).

5. **WASHBOARD COURSE:**

**Remark:** Inspection following the completion of the Washboard Course revealed no additional movement or damage.

![Photo 5. Washboard Course Testing of the ISTF-2s in an End-Opening Container](image)

C. **OCEAN-GOING VESSEL TEST. 80-DEGREE TILT TEST.**

**Remark:** Inspection following the completion of the tilt testing revealed no additional movement or damage.
D. **CONCLUSION:** As tested the ISTF-2s successfully completed transportability testing in an end-opening intermodal container. Installation of the cradles of the RIBS was difficult due to the limited space and tolerances between the rows of the ISTF-2s. The cradles could not be installed efficiently and safely. The cradles had to be shoved and banged into position using a forklift. After completion of the testing the cradles had to be pulled out of position using a chain and forklift. Damage did occur to the cradles when they were removed. Therefore, blocking and bracing of the ISTF-2s, using the RIBS cradles, is not acceptable.
5.2

Payload: 8 ISTF-2s in an End-opening Intermodal Container on a Hyundai CROP.
Testing Date: 16-18 August 2004
Gross Weight: 26,780 pounds (including ISTF-2s, intermodal container and CROP)

**Notes:** The ISTF-2s were held in place using twelve 3-inch-wide CROP straps. The ISTF-2s were not interlocked together. The tiedowns were located at the 1, 2, 3, 4, 5, 8, 11, 14, 15, 16, 17, and 18 anchor locations located on the CROP.

The test sketch shows the forward blocking assembly by the CROP A-frame. During the load build, the strap going over the assembly could not be achieved at that position. Therefore, the assembly was switched to the rear of the load as shown in Photo 7. The corner strapping board assembly, as shown in the test sketch (See Part 6), was not necessary for this load.

![Photo 7. ISTF-2s on a Hyundai CROP](image)
A. RAIL TEST.

**Photo 8.** Rail Impact Testing of the ISTF-2s on a Hyundai CROP (Prior to Testing)

<table>
<thead>
<tr>
<th>Description</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flatcar Number: DODX 42353</td>
<td>85,000 lbs.</td>
</tr>
<tr>
<td>ISTF-2s, End-opening Intermodal Container and Hyundai CROP</td>
<td>26,780 lbs.</td>
</tr>
<tr>
<td>M1 Flatrack with MLRS Pods</td>
<td>28,265 lbs.</td>
</tr>
<tr>
<td>Total Specimen Wt.</td>
<td>140,045 lbs.</td>
</tr>
<tr>
<td>Buffer Car (four cars)</td>
<td>257,900 lbs.</td>
</tr>
</tbody>
</table>

**Figure 8.**

**Remarks:** Figure 8 lists the test components and weights of the items used during the Rail Impact Tests.
<table>
<thead>
<tr>
<th>Impact Number</th>
<th>Avg. Velocity (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4.8</td>
</tr>
<tr>
<td>2</td>
<td>5.5</td>
</tr>
<tr>
<td>3</td>
<td>8.3</td>
</tr>
<tr>
<td>4</td>
<td>7.8</td>
</tr>
<tr>
<td>5</td>
<td>8.5</td>
</tr>
</tbody>
</table>

**Remarks:**

1. Figure 9 lists the average speeds of the specimen car immediately prior to impact with the anvil. Impacts #4 and #5 are the reverse impacts.

2. Impact #4 was determined to be a “no test” due to the insufficient velocity at impact. The test was repeated.

3. Following Impact #1 the ISTF-2s moved 0.625 inches in the direction of impact.

4. Following Impact #2 the ISTF-2s moved an additional 0.125 inches in the direction of impact.

5. Following Impact #4 the ISTF-2s moved 0.75 inches in the direction of impact and returned to the original starting position.
B. **ON/OFF ROAD TESTS.**

1. **HAZARD COURSE.**

![Photo 9. Hazard Course Testing of the ISTF-2s on a Hyundai CROP](image)

**Table:**

<table>
<thead>
<tr>
<th>Pass No.</th>
<th>Elapsed Time</th>
<th>Avg. Velocity (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29 Seconds</td>
<td>5.1</td>
</tr>
<tr>
<td>2</td>
<td>26 Seconds</td>
<td>5.7</td>
</tr>
</tbody>
</table>

**Figure 10.**

**Remarks:**

1. Figure 10 lists the average speeds of the test load through the Hazard Course.
2. Inspections following each pass revealed no additional movement or damage.
2. **ROAD TRIP:**

   **Remarks:**
   1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
   2. Inspection following the completion of the road trip revealed no additional movement or damage.

3. **PANIC STOPS:** Testing was not required since the load was rail impact tested.

4. **HAZARD COURSE:**

   ![Table of Average Velocities](image)

   **Remarks:**
   1. Figure 11 lists the average speeds of the test load through the Hazard Course.
   2. Inspections following each pass revealed no additional movement or damage.

5. **WASHBOARD COURSE:**

   **Remark:** Inspection following the completion of the Washboard Course testing revealed no additional movement or damage.
C. **OCEAN-GOING VESSEL TEST.** 80-DEGREE TILT TEST.

**Remark:** Inspection following the completion of the tilt testing revealed no additional movement or damage.
D. **CONCLUSION:** As tested, the ISTF-2s successfully completed the transportability testing when secured on a CROP in an end-opening intermodal container. The ISTF-2s were not interlocked during the testing. Also, twelve 3-inch CROP straps were used to secure the ISTF-2s to the Hyundai CROP.
5.3

Payload: 8 ISTF-2s on a Summa CROP.
Testing Date: 19 August 2004
Gross Weight: 21,800 pounds (including ISTF-2s and CROP)
Notes: The testing was conducted as evaluation testing of the interlocks on the ISTF-2s. The testing was not conducted to verify the interlocks for ammunition transport. The tiedowns were located at the 2, 3, 4, 7, 13, 15, and 17 anchor locations on the CROP. The corner strapping assemblies, as shown in the test sketch (See Part 6), were not necessary for this load. No aft filler was required for this load. The ISTF-2s were held in place using eight 3-inch-wide CROP straps. The ISTF-2s were interlocked.

Photo 12. ISTF-2s on a Summa CROP
A. ON/OFF ROAD TESTS.

1. HAZARD COURSE.

Photo 13. Hazard Course Testing of the ISTF-2s on a Summa CROP

<table>
<thead>
<tr>
<th>Pass No.</th>
<th>Elapsed Time</th>
<th>Avg. Velocity (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>29 Seconds</td>
<td>7.2</td>
</tr>
<tr>
<td>2</td>
<td>30 Seconds</td>
<td>7.0</td>
</tr>
</tbody>
</table>

Figure 12.

Remarks:
1. Figure 12 lists the average speeds of the test load through the Hazard Course.
2. Inspections following each pass revealed no movement or damage.
2. **ROAD TRIP:**

**Remarks:**
1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the completion of the road trip revealed no movement or damage.

3. **PANIC STOPS:**

**Remarks:**
1. The Panic Stops were conducted during the Road Trip.
2. Inspection following the completion of the panic stops revealed no movement or damage.

4. **HAZARD COURSE:**

![Table]

<table>
<thead>
<tr>
<th>Pass No.</th>
<th>Elapsed Time</th>
<th>Avg. Velocity (mph)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>30 Seconds</td>
<td>7.0</td>
</tr>
<tr>
<td>4</td>
<td>34 Seconds</td>
<td>6.1</td>
</tr>
</tbody>
</table>

**Remarks:**
1. Figure 13 lists the average speeds of the test load through the Hazard Course.
2. Inspections following Pass #3 revealed that the ISTF-2s had moved 0.5 inches toward the passenger side.
5. **WASHBOARD COURSE:**

**Remark:** Inspection following the completion of the Washboard Course testing revealed no additional movement or damage.
B. CONCLUSION: As tested, the ISTF-2s successfully completed the transportability testing when secured on a CROP. The ISTF-2s were interlocked during the testing. This testing was conducted to evaluate whether transportation forces would cause any damage to the interlocks when secured to the CROP at even a reduced restraint procedure using only eight (8) straps. This testing was not conducted to approve the interlock devices for transportability. Therefore, the interlock devices are not approved for ammunition transport.
PART 6 – DRAWINGS

The following test sketches represent the load configuration that was subjected to the test criteria.
LOAD SKETCH FOR THE TRANSPORTABILITY SERIES TESTING OF THE INTERMODAL STORAGE AND TRANSPORT FRAME - TWO PANEL VERSION (ISTF-2) IN A 20 FT END OPENING ISO CONTAINER AND ON A CONTAINER ROLL ON/OFF PLATFORM (CROP)

THS EIGHT PAGE DOCUMENT DEPICTS PROCEDURES FOR UNITIZING THE TEST LOAD FOR THE ISTF-2 TRANSPORTABILITY TESTING.

Prepared during August 2004 by:
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Fax (DSN) 956-8811
E-mail: michael.bartosiak@us.army.mil

DRAFT AS OF 8/4

Gregory L. Willis
Chief, Transportation Engineering Division
TOP SHELF, TWO FRONT PANELS AND TWO DIVIDERS NOT SHOWN. DIVIDERS WERE NOT USED IN THE LOADS FOR THIS TEST.

FRONT PANEL (4 REQD).

END WALL (2 REQD).

SHELF (2 REQD).

BOTTOM FRAME (1 REQD).

ISTF-2 INTERNAL SETUP
PLACE INTERNAL SHELF IN THE THIRD SHELF SLOT FROM THE BOTTOM OF THE ISTF-2 UNIT.

ISTF-2 DIMENSIONS

| OVERALL DIMENSIONS OF THE ISTF-2 UNIT: | 52" L X 42" W X 45" H |
PA116 FILL ASSEMBLY
30” X 15” X 1-1/2” (2 REQD). SEE PAGE 4 FOR DETAILS.

PA116 CONTAINERS
WEIGHTED TO 75 LB
FOUR STACKS - TWO HIGH EACH (8 REQD).

ISTF-2 BOTTOM FRAME LOAD STEP 1 TO 2

1. LOAD PA116 FILL ASSEMBLIES UP AGAINST EACH END WALL.
2. LOAD THE 8 PA116 CYLINDRICAL METAL CONTAINERS IN FOUR TWO HIGH STACKS AS SHOWN. INTERLOCK THE SIDE LIP GRIPS ON THE PA116 CONTAINERS PROVIDED THERE IS ENOUGH ROOM TO DO SO.

NOTE: THE TOP SHELF, CENTER SHELF AND TWO FRONT PANELS ARE NOT SHOWN FOR CLARITY.

ISTF-2 BOTTOM FRAME LOAD STEP 3 TO 4

1. PLACE THE M2A1 FILL ASSEMBLY UP AGAINST EACH END WALL.
2. LOAD THE M2A1 METAL AMMO BOXES AS SHOWN.

NOTE: TOP SHELF, CENTER SHELF, AND TWO FRONT PANELS ARE NOT SHOWN FOR CLARITY.

ISTF-2 BOTTOM FRAME COMPOSITION CHART

<table>
<thead>
<tr>
<th>PGK TYPE</th>
<th>NO. REQD</th>
<th>WEIGHT EA (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA116 CONTAINER</td>
<td>8</td>
<td>75</td>
</tr>
<tr>
<td>M2A1 / METAL CAN</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>PA116 FILL ASSEMBLY</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>M2A1 FILL ASSEMBLY</td>
<td>2</td>
<td>3.7</td>
</tr>
<tr>
<td><strong>TOTAL WEIGHT</strong></td>
<td><strong>861 LBS (APPROX)</strong></td>
<td></td>
</tr>
</tbody>
</table>
ISTF-2 SHELF LOAD STEP 1 TO 4
(SAME AS BOTTOM FRAME LOAD ON PAGE 3)

1. LOAD PA116 FILL ASSEMBLIES UP AGAINST EACH END WALL.
2. LOAD THE 8 PA116 CYLINDRICAL METAL CONTAINERS IN FOUR TWO HIGH STACKS AS SHOWN.
3. PLACE THE M2A1 FILL ASSEMBLY UP AGAINST EACH END WALL.
4. LOAD THE M2A1 METAL AMMO BOXES AS SHOWN.

ISTF-2 SHELF COMPOSITION CHART

<table>
<thead>
<tr>
<th>PKG TYPE</th>
<th>NO. REQD</th>
<th>WEIGHT EA (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA116 CONTAINER</td>
<td>8</td>
<td>75</td>
</tr>
<tr>
<td>M2A1 / METAL CAN</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>PA116 FILL ASSEMBLY</td>
<td>2</td>
<td>6.7</td>
</tr>
<tr>
<td>M2A1 FILL ASSEMBLY</td>
<td>2</td>
<td>3.7</td>
</tr>
</tbody>
</table>

TOTAL WEIGHT: 861 LBS (APPROX)

PA116 FILL ASSEMBLY DETAIL
(4 REQD PER ISTF-2 UNIT)

M2A1 FILL ASSEMBLY DETAIL
(4 REQD PER ISTF-2 UNIT)
SLIDING FILL PIECE. ENSURE THE SLIDING FILL PIECE ON EACH FRONT PANEL IS SLID OVER AND SECURED WITH THE PROVIDED CANTILEVER PIN.

BILL OF MATERIAL

<table>
<thead>
<tr>
<th>LUMBER</th>
<th>LINEAR FEET</th>
<th>BOARD FEET</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; X 4&quot;</td>
<td>20</td>
<td>6.7</td>
</tr>
<tr>
<td>1&quot; X 6&quot;</td>
<td>14.25</td>
<td>7.2</td>
</tr>
<tr>
<td>NAILS</td>
<td>NO. REQD</td>
<td>POUNDS</td>
</tr>
<tr>
<td>4d</td>
<td>112</td>
<td>.39</td>
</tr>
<tr>
<td>3/8 PLYWOOD</td>
<td>12.5 SQ FT</td>
<td>13 LBS</td>
</tr>
</tbody>
</table>

ISTF-2 UNIT LOAD

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
<th>WEIGHT (APPROX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PA116 CONTAINERS</td>
<td>16</td>
<td>1,200 LBS</td>
</tr>
<tr>
<td>M2A1 METAL BOXES</td>
<td>12</td>
<td>480 LBS</td>
</tr>
<tr>
<td>DUNNAGE</td>
<td></td>
<td>42 LBS</td>
</tr>
<tr>
<td>ISTF-2 UNIT</td>
<td></td>
<td>455 LBS</td>
</tr>
</tbody>
</table>

TOTAL WEIGHT: 2,177 LBS

16 ISTF-2 UNITS REQUIRED FOR 20FT END OPENING ISO CONTAINER LOAD. 8 ISTF-2 UNITS WILL BE USED ON THE CROP LOAD.
OPENING END OF CONTAINER.

RIBS CRADLE ASSEMBLY (3 REQD).

ISFT-2 UNIT SIMPLIFIED REPRESENTATION - RIBS FRONT ASSEMBLY (0 REQD).

ISFT-2 UNIT SIMPLIFIED REPRESENTATION. SHOWN WITH DECREASED OPAQUE TO SHOW PLACEMENT OF RIBS CRADLE ASSEMBLIES.

20 FT END OPENING ISO CONTAINER (SIDES AND TOP REMOVED FOR CLARITY).

RIBS ENDS ASSEMBLY (1 REQD).

ISOMETRIC VIEW - 20 FT ISO CONTAINER LOAD

RIBS CRADLE ASSEMBLY DETAIL (3 REQD)

RIBS END ASSEMBLY DETAIL (1 REQD)

RIBS FRONT ASSEMBLY DETAIL (1 REQD)

ISTF-2 CONTAINER LOAD

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
<th>WEIGHT (APPROX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISTF-2 UNITS</td>
<td>16</td>
<td>34,928 LBS</td>
</tr>
<tr>
<td>RIBS ASSEMBLIES</td>
<td>5</td>
<td>504 LBS</td>
</tr>
<tr>
<td>CONTAINER</td>
<td>1</td>
<td>4,700 LBS</td>
</tr>
</tbody>
</table>

TOTAL WEIGHT - 40,132 LBS

RIBS CRADLE ASSEMBLY DETAIL (3 REQD)

THESE ARE SIMPLIFIED DEPICTIONS OF THE RIBS ASSEMBLIES. THESE DETAILS WERE NOT CREATED FROM A MSS MODEL FILE.
NOTE: POSITION THE ISTF-2 UNITS WITH THE SIDE WITH THE M2A1 BOXES FACING OUTWARDS.

ISOMETRIC VIEW

KEY NUMBERS

KEY NUMBERS CONTINUED

INSTALL EACH STRAP TO EXTEND FROM THE EIGHTH TIEDOWN ANCHOR ON ONE SIDE OF THE CROP, AROUND THE END OF THE AFT ISTF-2 UNITS, OVER THE TOP OF THE AFT ISTF-2 UNITS, TO THE FIFTEENTH TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE CROP. ALIGN THE SCUFF SLEEVES OVER ALL SHARP EDGES AND FIRMLY TENSION STRAP.

INSTALL EACH STRAP TO EXTEND FROM THE FIRST TIEDOWN ANCHOR ON ONE SIDE OF THE CROP, OVER THE TOP OF THE FORWARD BLOCKING ASSEMBLY STRAPPING BOARD, TO THE FIRST TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE CROP. ALIGN THE SCUFF SLEEVES OVER ALL SHARP EDGES AND FIRMLY TENSION STRAP.

LOAD AS SHOWN

<table>
<thead>
<tr>
<th>ITEM</th>
<th>QUANTITY</th>
<th>WEIGHT (APPROX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ISTF-2 UNIT</td>
<td>8</td>
<td>17,464 LBS</td>
</tr>
<tr>
<td>DUNNAGE</td>
<td></td>
<td>209 LBS</td>
</tr>
<tr>
<td>CROP</td>
<td></td>
<td>3,800 LBS</td>
</tr>
<tr>
<td>TOTAL WEIGHT</td>
<td></td>
<td>21,473 LBS (APPROX)</td>
</tr>
</tbody>
</table>

EIGHT ISTF-2 UNITS ON A CROP

(CONTINUED AT LEFT)
STRAPPING BOARD, 2" X 4" X 7'-4" (1 REQD). NAIL TO STRUTS W/2-10d NAILS AT EACH JOINT.

HEADER, 2" X 8" X 7'-4" (2 REQD). NAIL TO STRUTS W/3-10d NAILS AT EACH JOINT.

FORWARD BLOCKING ASSEMBLY
(1 REQD)

LAMINATED BEARING PIECE 2" X 8" X 10'2" (1 REQD). NAIL THRU EACH RETAINER CLEAT W/3-16d NAILS.

RETAINER CLEAT 2" X 4" X 6" (3 REQD). INSTALL ASSEMBLY WITH RETAINER CLEATS TOWARD ISTF-2 UNITS.

BEARING PIECE 1" X 8" X 10'2" (1 REQD).

SIDE BLOCKING ASSEMBLY
(4 REQD)

BEARING PIECE 1" X 4" X 12'1/2" (1 REQD).

CONTAINER BEARING PIECE 1" X 6" X 12'1/2" (1 REQD). NAIL TO BEARING PIECE W/3-6d NAILS.

CORNER STRAPPING BOARD ASSEMBLY A
(2 REQD)

CORNER STRAPPING BOARD ASSEMBLY B
(2 REQD)

BILL OF MATERIALS

<table>
<thead>
<tr>
<th>LUMBER</th>
<th>LINEAR FEET</th>
<th>BOARD FEET</th>
<th>NAILS</th>
<th>NO. REQD</th>
<th>POUNDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&quot; X 4&quot;</td>
<td>13-1/2</td>
<td>4-1/2</td>
<td>6d</td>
<td>12</td>
<td>NIL</td>
</tr>
<tr>
<td>2&quot; X 4&quot;</td>
<td>8</td>
<td>5-3/8</td>
<td>10d</td>
<td>32</td>
<td>1/2</td>
</tr>
<tr>
<td>1&quot; X 8&quot;</td>
<td>34-3/8</td>
<td>23</td>
<td>16d</td>
<td>48</td>
<td>1</td>
</tr>
<tr>
<td>2&quot; X 8&quot;</td>
<td>50-3/4</td>
<td>67-3/4</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2&quot; WEB STRAP TIEDOWN ASSEMBLY</td>
<td>1 REQD</td>
<td>6 LBS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2&quot; STEEL EDGE PROTECTOR</td>
<td>8 REQD</td>
<td>1/2 LBS</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>