REPORT NO. 91-06

MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) PODS ON A CENTER BEAM BULKHEAD FLATCAR AND A BULKHEAD FLATCAR

Prepared for:
U.S. Army Defense Ammunition Center and School
ATTN: SMACAC-DET
Savanna, IL 61074-9639

Distribution Unlimited

VALIDATION ENGINEERING DIVISION
SAVANNA, ILLINOIS 61074-9639
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The U.S. Army Defense Ammunition Center and School (USADACS), Transportation Engineering Division (SMCAC-DET), developed loading and bracing procedures for shipping Multiple Launch Rocket System (MLRS) pods on center beam bulkhead flatcars and bulkhead flatcars at the suggestion of CSX Transportation. U.S. Army Defense Ammunition Center and School, Validation Engineering Division (SMCAC-DEV), was tasked by USADACS, SMCAC-DET, to conduct rail impact testing of the loading and bracing procedures. Testing of the procedures was conducted in accordance with the Association of American Railroads (AAR) Bureau of Explosives (BOE) rail impact test criteria. The loading and bracing procedures met the AAR/BOE requirements and have been approved for U.S. Army (USA)-wide use for shipping MLRS pods.
MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) PODS ON A CENTER BEAM BULKHEAD FLATCAR AND A BULKHEAD FLATCAR

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PART 1

GENERAL

A. INTRODUCTION. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Division (SMCAC-DEV), was tasked by USADACS, Transportation Engineering Division (SMCAC-DET), to conduct transportability testing of the loading and bracing procedures developed by SMCAC-DET, for shipping (MLRS) pods on center beam bulkhead flatcars and bulkhead flatcars. The loading and bracing procedures were developed by SMCAC-DET per recommendation by CSX Transportation. Rail impact testing was performed in accordance with the Association of American Railroads (AAR)/Bureau of Explosives (BOE) requirements to evaluate the suitability of the loading and bracing procedures for movement of MLRS pods by rail.

B. AUTHORITY. Testing has been accomplished in accordance with mission responsibilities delegated by the U.S. Army Armament, Munitions and Chemical Command (AMCCOM), Rock Island, IL.

C. OBJECTIVE. The objective of these tests was to determine if the loading and bracing procedures, developed by SMCAC-DET, for shipping MLRS pods on center beam bulkhead flatcars and bulkhead flatcars, were capable of passing the AAR/BOE rail impact test requirements.

D. CONCLUSIONS. The loading and bracing procedures for shipping MLRS pods by rail on center beam bulkhead flatcars and bulkhead flatcars met the requirements of the AAR/BOE rail impact test.
E. RECOMMENDATIONS. It is recommended that the loading and bracing procedures for shipping MLRS pods by rail be approved for U.S. Army (USA)-wide use.
PART 2

RAIL IMPACT TEST OF MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) PODS ON A CENTER BEAM BULKHEAD FLATCAR

27 NOVEMBER 1990

TEST ATTENDEES

<table>
<thead>
<tr>
<th>NAME AND PHONE NUMBER</th>
<th>ORGANIZATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quinn D. Hartman</td>
<td>U.S. Army Defense Ammunition Center and School</td>
</tr>
<tr>
<td>DSN 585-8992 815-273-8992</td>
<td>ATTN: SMCAC-DEV</td>
</tr>
<tr>
<td></td>
<td>Savanna, IL 61074-9639</td>
</tr>
<tr>
<td>William R. Frerichs</td>
<td>U.S. Army Defense Ammunition Center and School</td>
</tr>
<tr>
<td>Chief, Transportation Engineering Div</td>
<td>ATTN: SMCAC-DET</td>
</tr>
<tr>
<td>DSN 585-8071 815-273-8071</td>
<td>Savanna, IL 61074-9639</td>
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<tr>
<td>Richard S. Haynes</td>
<td>U.S. Army Defense Ammunition Center and School</td>
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<tr>
<td>Engineering Technician</td>
<td>ATTN: SMCAC-DET</td>
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<tr>
<td>DSN 585-8225 815-273-8225</td>
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<tr>
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<td>U.S. Army Defense Ammunition Center and School</td>
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<tr>
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<tr>
<td>DSN 585-8908 815-273-8908</td>
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<tr>
<td>Ralph H. Arnold</td>
<td>U.S. Army Defense Ammunition Center and School</td>
</tr>
<tr>
<td>Engineering Technician</td>
<td>ATTN: SMCAC-DET</td>
</tr>
<tr>
<td>DSN 585-8073 815-273-8073</td>
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## PART 2

RAIL IMPACT TEST OF MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) PODS ON A CENTER BEAM BULKHEAD FLATCAR

### 5 DECEMBER 1990

### TEST ATTENDEES

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Quinn D. Hartman</td>
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<tr>
<td>Test Engineer</td>
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PART 2

RAIL IMPACT TEST OF MULTIPLE LAUNCH ROCKET SYSTEM (MLRS) PODS
ON A BULKHEAD FLATCAR

7 DECEMBER 1990

TEST ATTENDEES

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Overland Park, Kansas 66201-9136

2-5
PART 3

TRANSPORTABILITY TESTING PROCEDURES

A. RAIL IMPACT TESTING: Rail impact testing was accomplished in compliance with previously approved and standardized testing procedures (as shown on page 3-3) and described as follows:

1. The "specimen car" was scheduled to be impacted four times; three times at speeds of 4, 6, and 8 mph in one direction; and one time at 8 mph in the opposite direction. The latter two impacts cited are minimum speed requirements.

2. Impacting was accomplished by striking the test car (specimen car) into a line of five stationary cars (buffer cars). The buffer cars were coupled with all connecting draft gears compressed together to the extent possible under prevailing conditions, with all air brakes in a "set position."

3. A locomotive (switch engine) was utilized to start the "specimen car" rolling in the direction of the buffer cars along an approximate 300-foot segment of level trackage.

4. The "specimen car" was cut loose from the engine approximately 75-feet from the point of impact and allowed to run freely into the first of the buffer cars.

5. Impacting speeds were determined by the utilization of an electronic counter which measured the time required for the "specimen car" to traverse an 11-foot distance immediately prior to contact; recorded elapsed time was converted to mph speeds. Additional verification of impacting speeds was accomplished by utilization of an electronic stopclock.
B. **INSPECTIONS AND DATA COLLECTION.** At selected intervals during testing, thorough inspections of the specimen loads were made by technically proficient personnel to collect data on the specimen load and equipment resulting from above load test steps. This data is recorded in part 4, following.
ASSOCIATION OF AMERICAN RAILROADS (AAR)
STANDARD TEST PLAN

5 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 MPH

THEN THE CAR IS REVISED AND
RELEASED BY SWITCH ENGINE TO
ATTAIN: IMPACT NO. 4 @ 8 MPH

FIGURE 1
PART 4

TEST RESULTS

The loading and bracing procedures for shipping MLRS pods on center beam bulkhead flatcars and bulkhead flatcars passed the three rail impact tests. The bulkhead flatcar procedures were tested once, and the center beam bulkhead flatcar procedures were rail impact tested twice. The center beam bulkhead loading and bracing procedures were tested a second time so that a member of the AAR/BOE could be present during the test.

This test utilized a center beam bulkhead flatcar loaded with 10 MLRS pods on one side of the car and boxed ammunition for a counter weight on the other side of the car. Results from this test indicated that the end wall dunnage needed to be widened to prevent the angle-iron corners of the pods from striking the outside edge of the end wall dunnage. Also, the support 4- by 4-inch timbers needed additional dunnage to prevent longitudinal shifting.

Test No. 1: Rail Impact Test of MLRS Pods on a Center Beam Bulkhead Flatcar

Date: 27 November 1990

Center Beam Bulkhead Flatcar Specifications:

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<th>#</th>
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<tr>
<td>LT WT:</td>
<td>64,000</td>
</tr>
<tr>
<td>LD LMT:</td>
<td>199,000</td>
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<tr>
<td>LD WT:</td>
<td>MLRS Pods: 50,780</td>
</tr>
<tr>
<td></td>
<td>Dunnage: 4,520</td>
</tr>
<tr>
<td></td>
<td>Simulated Wt: 47,250</td>
</tr>
<tr>
<td></td>
<td>Total: 102,550</td>
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<tr>
<td>IMPACT NO.</td>
<td>TYPE</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------</td>
</tr>
<tr>
<td>1</td>
<td>Forward Impact</td>
</tr>
<tr>
<td>2</td>
<td>Forward Impact</td>
</tr>
<tr>
<td>3</td>
<td>Forward Impact</td>
</tr>
<tr>
<td>4</td>
<td>Reverse Impact</td>
</tr>
</tbody>
</table>
Test No. 2: Rail Impact Test of MLRS Pods on a Bulkhead Flatcar

Date: 5 December 1990

This test utilized a bulkhead flatcar loaded with 11 MLRS pods, simulated MLRS masses, and 1 filler assembly. Results from this test showed that the end wall blocking needed modification to prevent it from shifting laterally when there was longitudinal shifting of the load. The filler assembly also needed modification to prevent the center gate from separating the upper 2- by 6-inch from the filler assembly.

Bulkhead Flatcar Specifications:

| #: LRWN9094 | LT WT: 81,800 |
| LD LMT: 181,200 | LD WT: Approximatly 80,000 |

<table>
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<th>IMPACT NO.</th>
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<td>1</td>
<td>Forward Impact</td>
<td>4.36 mph; no movement.</td>
</tr>
<tr>
<td>2</td>
<td>Forward Impact</td>
<td>6.30 mph; no movement.</td>
</tr>
<tr>
<td>3</td>
<td>Forward Impact</td>
<td>8.43 mph; load shifted; end gap 2-inches.</td>
</tr>
<tr>
<td>4</td>
<td>Reverse Impact</td>
<td>8.53 mph; Load shifted back; end gap 4-3/4&quot;. Marks of original position of MLRS pods prior to fourth impact indicated that the excessive compaction occurred in the boxed ammunition. Minor cracking in filler assembly.</td>
</tr>
</tbody>
</table>
Test No. 3: Rail Impact Test of MLRS Pods on Center Beam Bulkhead Flatcar

Date: 7 December 1990

This test again utilized the center beam bulkhead flatcar loaded with 10 MLRS pods on one side of the car and boxed ammunition as a counter weight on the other side of the car. The loading procedures for this test were identical to the procedures for the first test with the exception of the modifications to the end wall dunnage and the support 4"x4" s noted following the first test. Results from this test indicated that excessive shifting in the load would allow the end blocking assemblies to be free to lateral movement as noted following test two.

Car Specifications:

<table>
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<tr>
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<th>LT WT:</th>
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<th>IMPACT NO.</th>
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<td>BN625038</td>
<td>64,000</td>
<td>199,000</td>
<td></td>
<td>1</td>
<td>Forward Impact</td>
<td>4.69 mph; slight shift in load.</td>
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<td></td>
<td>MLRS Pods:</td>
<td>2</td>
<td>Forward Impact</td>
<td>7.07 mph; additional shifting of load; end gap 2-3/8&quot;.</td>
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<tr>
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<td>Dunnage:</td>
<td>3</td>
<td>Forward Impact</td>
<td>8.93 mph; additional shifting of load; end gap 3-3/4&quot;. End gap is now large enough to allow end blocking to be removed. Pods digging into blocking, but not splitting wood.</td>
</tr>
<tr>
<td></td>
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<td>Simulated Wt:</td>
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<td>Total: 102,550</td>
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<tr>
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<td></td>
<td>Total: 50,780</td>
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</tbody>
</table>
Reverse Impact

8.82 mph; load shifted opposite direction; end gap 3-3/8". No splitting on any dunnage, angle-iron corners of pods compressing dunnage as expected. Minor dunnage separation on 4- by 4-inch supports for first level of pods. Second column of pods in from left are within 2 inches of being off of the metal crossmember supporting the second column of pods. Metal straps numbers 5 and 8 (counting from left) were bent by the lifting rings when the pods shifted back during impact no. 4.
PART 5

PHOTOGRAPHS
U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL

Photo No. AO317-SPN-91-89-648. Overall view of the MLRS pods loaded on a center beam bulkhead flatcar.
Photograph No. AO317-SPN-91-89-627. Overall view of the MLRS pods loaded on a bulkhead flatcar.
Photo No. AO317-SPN-91-000602. View of damage to ammunition following the first rail impact test of MLRS pods on a center beam bulkhead flatcar. Damage was widened prior to the second test of the MLRS pods on a center beam bulkhead flatcar.
Photo No. AO317-SPN-91-673. View of one of the 4- by 4-inch supports which slide during the first rail impact test of MLRS pods on a center beam bulkhead flatcar. Dunnage was added prior to the second test of the MLRS pods on a center beam bulkhead flatcar to prevent the 4- by 4-inch supports from shifting.
Photo No. AO317-SPN-91-89-655. View of the end gap following the second rail impact test of MLRS pods on a center beam bulkhead flatcar. The amount of end gap present will allow the end bulkhead assembly to shift laterally. The loading and bracing procedures were modified following this test to prevent the end bulkhead assembly from shifting laterally.
Photo No. A0317-SPN-90-89-621. View of the end gap that was present after the test of the MLRS pods on a bulkhead flatcar. The amount of end gap will allow the end bulkhead assembly to shift laterally. The loading and bracing procedures were modified following this test to prevent the end bulkhead assembly from shifting laterally.
Photo No. AO317-SPN-90-89-629 View of the boxed ammunition which was used to simulate four MLRS pods. The boxed ammunition was determined to be the cause for the excessive end gap following the test.
PART 6

LOADING AND BRACING PROCEDURES
MLRS

LOADING AND BRACING (CL & LCL) 
ON A CENTER BEAM TYPE BULKHEAD
FLATCAR* OF MULTIPLE LAUNCH 
ROCKET SYSTEM ROCKET POD/
CONTAINERS (RP/C)

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*PROCEDURES CONTAINED HEREIN ARE BASED ON CARS EQUIPPED
WITH FIXED STEEL RISERS AND ARE ONLY APPLICABLE TO
FLATCARS HAVING END OF CAR OR UNDER CAR CUSHIONING.

U.S. ARMY MATERIEL COMMAND DRAWING

APPROVED. U.S. ARMY MISSILE COMMAND
S. WILSON

APPROVED BY ORDER OF COMMANDING GENERAL, U.S.
ARMY MATERIEL COMMAND

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL

DO NOT SCALE

CLASS DIVISION DRAWING FILE
19 48 5543 GMSRSS
GENERAL NOTES

A. This document has been prepared and issued in accordance with AR 740-1 and augments TM 743-200-1 (Chapter 5).

B. The outloading procedures specified in this drawing are applicable to the multiple launch rocket system rocket pod/container (RP/C). Subsequent reference to container herein means the RP/C with rocket components.

C. The outloading procedures depicted within this document are applicable for shipments on a class "FB" center beam type bulkhead (center) flatcar which is 73'-0" center to center between the bulkheads. The bulkheads are equipped with fixed risers spaced 30'-0" O.C. from each bulkhead and -8'-0" O.C. thru the length of the car. Cars of other lengths may be used.

D. For details of the RP/C, see U.S. Army missile command drawing no. 13027900, and page 3.

CONTAINER DIMENSIONS -- 13'-0" long by 41-1/2" wide by 33' high
GROSS WEIGHT -- -- -- -- 5.078 pounds (approx)

E. This item is a DOT Class "A" explosive. The outloading procedures specified herein can also be utilized for the shipment of the depicted containers when they are loaded with an item which is identified differently by nomenclature than the item designated in the drawing title.

F. The selection of rail cars for the transport of the designated items will be in accordance with hazardous materials regulations of DOT and AR 35-353, chapter 29, for explosives and other dangerous articles, in full.

G. If the rail cars being used is not equipped with placard boards on both ends and both sides. 18' x 24' boards must be provided as required. Caution: boards and board mounting brackets must not be nailed to the lading.

H. The chain- cable tiedown assemblies shall be inspected for bent or worn links in the chain, for broken strands or wires in the cables, and for damaged spools or ratchets. Also, the sliding corner protectors must be examined for damage or deformation. Only tiedown assemblies of good quality will be used. Any deficiency in the chain-cable tiedown assemblies shall be cause for rejection of the car.

I. A hardened steel rod 13'-0" maximum diameter and approximately 24' long will be required for tensioning of the chain-cable tiedown assemblies. Pipe or other extension devices will not be used on the tensioning rod. Cable must be wound evenly and taut on the spool when taking up the slack in a tiedown assembly. This is a 2-man operation. Caution: extreme care must be exercised when applying final tension to the tiedown assemblies to prevent damage or permanent deformation to the lading.

J. Damage lumber specified is of nominal size. For example, 1' x 6' Material is actually 3/4" thick by 5-1/2" wide and 2' x 4' Material is actually 1-1/2" thick by 3-1/2" wide.

(Continued at right)

MATERIAL SPECIFICATIONS

LUMBER ----------------- SEE TM 743-200-1 (DAMAGE LUMBER) AND FED SPEC MW-L-751.
NAILS ----------------- FED SPEC FF-H-105: COMMON.
STRAPPING, STEEL ------ FED SPEC QQ-5-781: CLASS 1, TYPE 1 OR IV, HEAVY DUTY, FINISH A, B (GRADE 2), OR C.
SEAL, STRAP ----------- FED SPEC QQ-4-781: TYPE E, STYLE 1, 11, OR IV, CLASS H, FINISH A, B (GRADE 2), OR C.
WIRE ----------------- FED SPEC QQ-4-451: ANNEALED, BLACK.
ANTI-CHAFING MATERIAL -- MIL-Z-121 (OR EQUAL): NEUTRAL BARRIER MATERIAL.

L. A staggered nailing pattern will be used whenever possible when nails are driven into joints of damage assemblies. Also, a staggered nailing pattern will be used when laminating damage. Additionally, the nailing pattern for an upper piece of laminated damage will be staggered as required so that a nail for that piece will not be driven through onto or right beside a nail in a lower piece.

M. The number of lading units may be adjusted to fit the size of the car being loaded or the quantity to be shipped. However, the approved methods of damage as required shall be followed as closely as possible for blocking, bracing, and stacking of the units. Notice: a shipment will be positioned on the rail car in compliance with the weight distribution requirements of the AAR.

N. For additional guidance, attention is directed to the "special notes" sections which are immediately adjacent to the depicted outloading methods, and to the "special handling guidance" on page 3.

O. Load blocking struts which are 48" or longer must be stiffened by the application of horizontal and vertical strut bracing. Bracing is not required if the struts for the load being shipped are shorter than 48" . The length of the load blocking struts should be kept as short as possible (APPROX 18" MINIMUM), but in the event it is necessary to use struts 48" or more in length, it will be necessary to apply an additional set of horizontal and vertical strut bracing pieces. Strut bracing should be applied so as to provide nearly equal spacing between the bracings. If below the center of gravity or the containers, or between adjacent strut bracing pieces, vertical strut bracing pieces are to be 2" x 4" material cut to a length extending 2" above the top strut. Horizontal strut bracing pieces are to be 2" x 4" x 45" material. Horizontal pieces will be applied on each layer of struts. Both vertical and horizontal strut bracing must be nailed to the struts with 3-1/4 nails at each joint.

P. Portion of the car depicted within this drawing, such as one of the bulkheads, have not been shown in the load view for clarity purposes.

Q. Conversion to metric equivalents: Dimensions within this document are expressed in inches, and weights are expressed in pounds. When necessary, the metric equivalents may be computed on the basis of one inch equals 25.4mm and one pound equals 0.45kg.

R. To achieve a tightly blocked load, a strut will be cut so it is longer than the distance between the strut bearing areas on the two center gates. One end of the strut will be positioned at its bearing area just above the strut ledger on the car. The other end will then be driven downward until it contacts the strut ledger on the other gate. Each end of the top layer of a strut will be toenailed to the adjacent center gate. As specified within the key numbers for a load, in such a manner so that as nearly as practical equal lengths of a nail are embedded in the strut and in the vertical piece of the center gate.

S. To preclude abrasion of RP/C frame members by steel utilizing and retaining straps, anti-chafing material will be placed at all points of contact. Also unitization straps must be located as closely as possible to the strong points of the RP/C frame, I.E., near the vertical frame members and bulkheads, to preclude damage to the RP/C frame.

T. Refer to association of American railroads manual "general rules governing the loading of commodities on open top cars" for applicable loading rules: Preface 1A 2 5 15. Note that all straps used for load material I.E., retaining straps, must be marked 8040 8045 in loading rule 15.
SPECIAL HANDLING GUIDANCE

ASSEMBLY STACKING FOR OUTLOADING PURPOSES AND ASSEMBLY OR ASSEMBLY STACK HANDLING.

NOTES: (1) MATERIALS HANDLING EQUIPMENT (MHE) IS INTENDED TO MEAN EQUIPMENT, SUCH AS FORKLIFT TRUCKS, CRANES, HAND TRUCKS, DOLLIES, ROLLER ASSEMBLIES, SLINGS, AND SPREADER BARS THAT CAN BE USED TO HANDLE THE DEPICTED ASSEMBLIES.

(2) PRECAUTIONARY HANDLING TECHNIQUES NORMALLY EMPLOYED OR AS SPECIFIED FOR THE TYPE OF COMMODITY INVOLVED WILL BE OBSERVED.

A. IF AVAILABLE MHE DOES NOT HAVE AN ALLOWABLE CAPACITY GREAT ENOUGH TO CARRY A STACK OF TWO ASSEMBLIES (APPROXIMATELY 10,200 POUNDS) IN ONE LIFT, THEN THE ASSEMBLIES MUST BE HANDLED INDIVIDUALLY. ONLY APPROVED AND APPROPRIATELY SIZED MHE WILL BE USED FOR THE HANDLING OF THE DEPICTED ASSEMBLIES.

B. WHEN AN ASSEMBLY STACK IS UNITIZED, CARE MUST BE EXERCISED WHEN TIGHTENING THE STRAPS TO ENSURE THAT THE LONGITUDINAL FRAME MEMBERS OF THE ASSEMBLIES ARE NOT "PULLED IN" OR DEFORMED. POSITION THE UNITIZATION AND BUNDLING STRAPS AS CLOSE AS POSSIBLE TO THE BULKHEADS OF THE RP/C TO AVOID DAMAGING THE RP/C FRAME MEMBERS.

C. IF HANDLING IS ACCOMPLISHED WITH A FORKLIFT TRUCK, THE ASSEMBLIES SHOULD BE HANDLED FROM A SIDE POSITION AS MUCH AS POSSIBLE. CARE MUST BE EXERCISED WHEN INSERTING FORKS UNDER AN ASSEMBLY TO PREVENT DAMAGE TO THE ASSEMBLY BY THE FORK TINES OR THE FORKLIFT PACKAGE GUARD. ADDITIONALLY, THE FORK TINES SHOULD BE PLACED UNDER THE AREA MARKED "FORKLIFT AREA ONLY" LOCATED NEAR THE LONGITUDINAL CENTER OF THE ASSEMBLY.
ROCKET POD/CONTAINERS OMITTED FROM THIS SIDE OF LOAD FOR CLARITY.

ISOMETRIC VIEW

KEY NUMBERS

1. BULKHEAD GATE (4 REQD., 2 RIGHT HAND AND 2 LEFT HAND). SEE THE DETAIL ON PAGE 6. THE GATE SHOWN IS LEFT HAND.
2. RISER ASSEMBLY (4 REQD., 2 RIGHT HAND AND 2 LEFT HAND). SEE THE "RISER ASSEMBLY A" DETAIL ON PAGE 6. A LEFT HAND ASSEMBLY IS SHOWN.
3. RISER ASSEMBLY (4 REQD., 2 RIGHT HAND AND 2 LEFT HAND). SEE THE "RISER ASSEMBLY B" DETAIL ON PAGE 6. A LEFT HAND ASSEMBLY IS SHOWN.
4. ANTI-CHAFING PIECE, 2" X 4" X 10'-0" (DOUBLED) (20 REQD.). LAMINATE W/1-10d NAIL EVERY 24". SUSPEND FROM LIFTING RINGS ON CENTER-OF-CAR SIDE OF CONTAINER. WIRE TIE TO LIFTING RINGS WITH NO. 14 GAGE WIRE PRIOR TO PLACEMENT OF CONTAINER.
5. SUPPORT ASSEMBLY (20 REQD.). SEE THE DETAIL ON PAGE 9. POSITION ON LOWER CONTAINER ON THE INWARD SIDE OF THE CONTAINER LIFTING RINGS.
6. STACK UNITIZING STRAP, 1-1/4" X .031" OR .035" X 25'-0" LONG STEEL STRAPPING (20 REQD.). POSITION NEAR END OF SKIDS AS SHOWN.
7. SEAL FOR 1-1/4" STEEL STRAPPING (80 REQD.). CRIMP EACH SEAL WITH TWO PAIR OF NOTCHES.
8. RISER ASSEMBLY (4 REQD., 2 RIGHT HAND AND 2 LEFT HAND). SEE THE "RISER ASSEMBLY C" DETAIL ON PAGE 6. SEE SPECIAL NOTE 3 ON PAGE 5.
11. STRUT, 2" X 6" X 15" (DOUBLED) (16 REQD.). LAMINATE W/3-10d NAILS. TOE NAIL THE TOP PIECE TO THE CENTER GATES. PIECE MARKED 10 W/2-12d NAILS AT EACH END. SEE SPECIAL NOTE 4 ON PAGE 5.
12. STRUT, 2" X 6" BY CUT TO FIT (REF. 18") (DOUBLED) (16 REQD.). LAMINATE W/3-10d NAILS. TOE NAIL THE TOP PIECE TO THE CENTER GATES. PIECE MARKED 10 W/2-12d NAILS AT EACH END.

(CONTINUED AT LEFT)
SPECIAL NOTES:

1. ROCKET POD/CONTAINERS MUST BE LOADED ALTERNATELY ON BOTH SIDES OF THE CAR. CAUTION: DO NOT LOAD ONE SIDE OF CAR COMPLETELY BEFORE LOADING OPPOSITE SIDE; CAR MAY TIP OVER.

2. FOR CARS HAVING RISERS POSITIONED AS SPECIFIED IN GENERAL NOTE "C", THE SKIDS OF THE ROCKET POD/CONTAINERS NEXT TO A BULKHEAD WILL NOT REST ON THE FIXED RISERS. WOODEN RISER ASSEMBLIES MUST BE FABRICATED FOR USE UNDER THESE SKIDS. RISER ASSEMBLY "A" IS FOR USE UNDER THE SKIDS NEAREST THE END OF THE CAR; RISER ASSEMBLY "B" IS FOR USE UNDER THE SKIDS AT THE OTHER END OF THE CONTAINER. RISER ASSEMBLIES "A" AND "B" WILL NEED TO BE ADJUSTED TO SUIT CARS HAVING RISERS OF OTHER SPACINGS. SEE SPECIAL NOTE 5.

3. SKIDS OF THE ROCKET POD/CONTAINERS MUST REST UPON THE RISER OF THE CAR IN SUCH A WAY THAT NOT MORE THAN FIVE INCHES OF EITHER END OF THE SKID EXTENDS BEYOND A FIXED RISER. IF EITHER END OF A SKID EXTENDS MORE THAN FIVE INCHES BEYOND A FIXED RISER, A RISER ASSEMBLY "C" MUST BE INSTALLED ADJACENT TO THE FIXED RISER TO PROVIDE FOR SUPPORT UNDER THE CENTER PORTION OF THE SKID LENGTH. ADJUST QUANTITY OF RISER ASSEMBLIES FOR CARS HAVING RISERS SPACED OTHER THAN AS SHOWN.

4. TWO OF THE CENTER GATES, PIECE MARKED (A) AND 8 STRUTS, PIECE MARKED (D), MAY BE PRE-ASSEMBLED AND INSTALLED AGAINST A STACK OF CONTAINERS AS A UNIT ON EACH SIDE OF THE CAR RATHER THAN ASSEMBLING IN PLACE. IF DESIRED, NOTE THAT THE LENGTH OF THE STRUTS, PIECE MARKED (D), SHOULD BE ADJUSTED, INCREASED OR DECREASED AS NECESSARY, TO ENSURE THAT THE MIDDLE ROCKET POD STACK IS NEARLY CENTERED ON THE RISERS OF THE CAR.

5. THE RISER ASSEMBLIES FABRICATED FOR A LOAD, AS WELL AS THE BULKHEAD GATES, MUST BE CONSTRUCTED AS RIGHT HAND AND LEFT HAND TO DESIGNATE THEIR LOCATION ON A CAR. THE LEFT HAND END OF A CAR IS IDENTIFIED AS THE END OF THE CAR ON YOUR LEFT SIDE AS YOU SEE IT WHEN STANDING ON THE GROUND FACING THE CAR. SEE THE LARGE ARROWS ON THE ISOMETRIC VIEW ON PAGE 4 FOR ADDITIONAL GUIDANCE.

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**BILL OF MATERIAL**

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<tr>
<td>16d (3-1/2&quot;)</td>
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| STEEL STRAPPING, 1-1/4" | 860' REQD | 123 LBS |
| SEAL FOR 1-1/4" STRAPING | 80 REQD | 4 LBS |
| WIRE, NO. 14 GAGE | 100 REQD | 2 LBS |
| ANTI-CHAFING MATERIAL | 12 REQD | 4 LBS |

**LOAD AS SHOWN**

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<td>20</td>
<td>101.500 LBS</td>
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<tr>
<td>CRINAGE</td>
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**TOTAL WEIGHT** | **105,880 LBS (APPROX)**

---

PROJECT GM 836-90
Bearing piece, 2" x 6" x 35-1/2" (4 PCG). Nail to a fill piece 1/8-10d nails.

Support piece, 2" x 6" x 9" (4 PCG). Nail to the 45° long support piece 1/8-10d nails.

Bearing piece, 2" x 6" x 27-1/2" (doubled) (4 PCG). Nail the first piece to the horizontal pieces 1/3-10d nails at each end. Laminate the second piece 1/3-10d nails.

Vertical piece, 2" x 6" x 84" (4 PCG). Nail to the horizontal pieces 1/4-10d nails at each joint.

Horizontal piece, 2" x 6" x 45" (doubled) (4 PCG). Laminate 1/6-10d nails.

Fill piece, 2" x 6" x 28" (4 PCG). Nail to the horizontal pieces 1/4-10d nails at each end.

Support leg, 2" x 6" by a length to suit (Ref: 84-7/8" and 85-3/4") (1 each PCG). Nail to the horizontal pieces 1/4-10d nails at each joint.

Position with this side against center beam of car.

Bearing piece, 2" x 6" x 27-1/2" (doubled) (2 PCG). Nail the first piece to the horizontal pieces 1/3-10d nails at each end. Laminate the second piece 1/3-10d nails.

Horizontal piece, 2" x 6" x 49-3/4" (1 PCG). Laminate 1/6-10d nails.

Bulkhead gate

(3 PCG, 2 right hand and 2 left hand; a right hand gate is shown).
VERTICAL PIECE. 2" X 6" X 68" (4 REED). NAIL TO THE HORIZONTAL PIECES 1/4-10d NAILS AT EACH JOINT.

SUPPORT PIECE. 2" X 6" X 45" (1 REED). NAIL TO THE BEARING PIECES 1/4-10d NAILS AT EACH END.

SUPPORT PIECE. 2" X 6" X 9" (2 REED). NAIL TO THE 45" LONG SUPPORT PIECE 1/3-10d NAILS.

BEARING PIECE. 2" X 8" X 27-1/2" (Doubled) (2 REED). NAIL THE FIRST PIECE TO THE HORIZONTAL PIECES 1/3-10d NAILS AT EACH END. LAMINATE THE SECOND PIECE 1/3-10d NAILS.

HORIZONTAL PIECE. 2" X 6" X 45" (4 REED).

BEARING PIECE. 2" X 6" X 35-1/2" (2 REED). NAIL TO A FILL PIECE 1/5-10d NAILS.

STRUT LEDGER. 2" X 2" X 45" (4 REED). NAIL TO THE VERTICAL PIECES 1/2-10d NAILS AT EACH END.

FILL PIECE. 2" X 6" X 28" (2 REED). NAIL TO THE HORIZONTAL PIECES 1/4-10d NAILS AT EACH END.

CENTER GATE (8 REED).

END VIEW
RISER ASSEMBLY A

FOR USE BETWEEN THE BULKHEAD AND THE FIRST FIXED RISER. A LEFT HAND ASSEMBLY IS SHOWN.

LATERAL STOP PIECE. 2\" X 4\" X 20\" (2 REGO). NAIL TO RISER PIECES W/3-10d NAILS AT EACH JOINT.

BULKHEAD STOP PIECE. 2\" X 4\" X 23\" (1 REGO). NAIL TO THE RISER PIECES W/3-10d NAILS AT EACH JOINT. TOENAIL TO THE SUPPORT LEG OF THE BULKHEAD GATE W/1-12d NAIL.

TIE PIECE. 2\" X 4\" X 31\" (1 REGO). NAIL TO THE LONGITUDINAL STOP PIECES W/2-10d NAILS AT EACH END.

LONGITUDINAL STOP PIECE. 2\" X 4\" X 23\" (2 REGO). NAIL TO THE LATERAL STOP PIECE W/3-10d NAILS AND CLINCH.

RISER ASSEMBLY B

FOR USE BETWEEN ADJACENT FIXED RISERS. A LEFT HAND ASSEMBLY IS SHOWN.

LATERAL STOP PIECE. 2\" X 4\" X 34-1/2\" (2 REGO). NAIL TO RISER PIECES W/3-10d NAILS AT EACH JOINT.

RISER ASSEMBLY C

FOR USE WHEN CONTAINER SKID IS NOT SUPPORTED ON A CAR RISER AT LEAST FIVE INCHES FROM END OF THE SKID. A LEFT HAND ASSEMBLY IS SHOWN.
SIDE BLOCKING ASSEMBLY
(10 REQD)

FILL PIECE, 4" X 4" X 43-1/4" (1 REQD). NAIL TO FILL PIECE W/4-6d NAILS.

FILL PIECE, 1" X 4" X 10'-0" (1 REQD). NAIL TO A SIDE PIECE W/1-6d NAIL EVERY 12".

HOLD-DOWN PIECE, 2" X 4" X 12" (2 REQD). NAIL TO FILL PIECE W/3-10d NAILS.

SIDE PIECE, 2" X 6" X 13'-0" (2 REQD). NAIL THE SECOND PIECE TO THE FIRST W/1-10d NAIL EVERY 24".

STOP PIECE, 2" X 2" X 9-1/2" (2 REQD). NAIL TO FILL PIECE W/2-10d NAILS.

SUPPORT ASSEMBLY
TIE PIECE, 2" x 6" x 12'-11" (2 REQD). NAIL TO THE LONGITUDINAL PIECES W/6-10d NAILS, AND TO THE LATERAL PIECES W/2-10d NAILS AT EACH JOINT.

LATERAL PIECE, 2" x 6" x 37" (14 REQD).

BEARING PIECE, 2" x 6" x 27-1/4" (4 REQD). NAIL TO THE LATERAL PIECES W/2-10d NAILS AT EACH END AND TO THE LONGITUDINAL PIECES W/3-10d NAILS AT EACH END.

LONGITUDINAL PIECE, 2" x 6" x 12'-11" (4 REQD). NAIL TO THE CENTER FIVE LATERAL PIECES W/3-10d NAILS AT EACH LOCATION AND TO THE VERTICAL PIECES W/2-10d NAILS AT EACH JOINT.

VERTICAL PIECE, 2" x 4" x 28-1/4" (8 REQD).

FILLER ASSEMBLY

NOTE: FILLER ASSEMBLY IS TO BE INSTALLED TO REPLACE AN RP/C IN AN UPPER STACK ONLY. INSTALL NO MORE THAN EIGHT FILLER ASSEMBLIES IN ONE LOAD.

SECTION B-B
MLRS

LOADING AND BRACING (CL & LCL) ON BULKHEAD FLATCAR* OF MULTIPLE LAUNCH ROCKET SYSTEM ROCKET POD/CONTAINERS (RP/C)

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<td>3</td>
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<td>16-RP/C LOAD ON A 60'-7-1/2&quot; LONG BY 9'-4&quot; WIDE BULKHEAD FLATCAR</td>
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*PROCEDURES CONTAINED HEREIN ARE ONLY APPLICABLE TO FLATCARS HAVING END OF CAR OR UNDER CAR CUSHIONING.

U.S. ARMY MATERIEL COMMAND DRAWING

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DO NOT SCALE

PROJECT GM 835-90
GENERAL NOTES

A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1 AND AMENDMENTS TM 743-200-1 (CHAPTER 5).

B. THE OUTLOADING PROCEDURES SPECIFIED IN THIS DRAWING ARE APPLICABLE TO THE LOAD BLOCKING RP/C SYSTEM impoverishment ORDER/CONTAINER (RP/C). SUBSEQUENT REFERENCE TO CONTAINER HEREIN MEANS THE RP/C WITH HOODET COMPONENTS.

C. THE OUTLOADING PROCEDURES DEPICTED WITHIN THIS DOCUMENT ARE APPLICABLE FOR SHIPMENTS ON A BULKHEAD PLATFARM (WITHOUT RISERS) AND ARE TO BE FOLLOWED FOR RAIL LOADS 6'-7/2" BETWEEN THE 11'-0" HIGH BULKHEADS AND WHICH HAS A UsABLE FLOOR WIDTH OF 9'-4". CARS OF OTHER LENGTHS MAY BE USED. HOWEVER THE BULKHEADS MUST BE AT LEAST 62" HIGH. THE FLOOR MUST BE AT LEAST 8'-0" WIDE AND THE FLOOR MUST BE WOOD OR NAILABLE METAL.


CONTAINER DIMENSIONS -- 13'-0" LONG BY 41'-1/2" WIDE BY 32" HIGH

GROSS WEIGHT: ----------- 5,078 POUNDS (APPROX)

E. THIS ITEM IS A DOT CLASS "A" EXPLOSIVE. THE OUTLOADING PROCEDURES SPECIFIED HEREIN CAN ALSO BE UTILIZED FOR THE SHIPMENT OF THE DEPICTED CONTAINERS WHEN THEY ARE LOADED WITH AN ITEM WHICH IS IDENTIFIED AS ONLY BY ITS QUALITY THAN THE ITEM DESIGNATED IN THE DRAWING TITLE.

F. THE SELECTION OF RAIL CARS FOR THE TRANSPORT OF THE DESIGNATED ITEMS WILL BE IN ACCORDANCE WITH HAZARDOUS MATERIALS REGULATIONS OF DOT AND AR 95-355, CHAPTER 29, FOR OTHER AND OUTLOADING ARTICLES, IN FULL.


H. CAUTION: STAKE POCKETS ON FLATCARS WILL BE USED FOR ANCHORING HOLD-DOWN STRAPPING WHENEVER POSSIBLE. DO NOT USE SNAG KEY RING TYPE ANCHOR DEVICES. IF OTHER TYPES ARE USED, THEY MUST BE OF SIMILAR WIDTH TO RECEIVE 2" STRAPPING AND 1/2" OFF A DIAMETER. EACH WILL PROVIDE A BEARING SURFACE, ACROSS THE FULL WIDTH OF THE STRAPPING, THAT WILL NOT DEFORM A STRAP, EVEN AT THE EDGES. WHEN IT IS TIGHTENED.

J. REFER TO ASSOCIATION OF AMERICAN RAILROADS MANUAL "GENERAL RULES GOVERNING THE LOADING OF COMMODITIES ON OPEN TOP CARS" FOR APPLICABLE LOADING RULES AS PRECEDES. PAGE 1A, 2, 5, AND 15. NOTE THAT ALL STRAPPING USED FOR LOAD SECUREMENT MUST BE MARKED AS SPECIFIED IN LOADING RULE 15.

K. A STAGGERED NAILING PATTERN WILL BE USED WHENEVER POSSIBLE WHEN NAILS ARE DRIVEN INTO UNITS OF DUNNAGE ASSEMBLY. ALSO, A STAGGERED NAILING PATTERN WILL BE USED WHEN DUNNAGE IS NAILED TO THE FLOOR OF THE TRANSPORTING VEHICLE. ON THE LAMINATED DUNNAGE PATTERN WILL BE ADJUSTED AS REQUIRED SO THAT A NAIL DOES NOT PENETRATE INTO OR NEAR A CRACK BETWEEN FLOOR BOARDS. ADDITIONALLY, THE NAILING PATTERN FOR AN UPPER PIECE OF LAMINATED DUNNAGE WILL BE ADJUSTED AS REQUIRED SO THAT A NAIL FOR THAT PIECE WILL NOT BE DRIVEN THROUGH OR RIGHT SIDE A NAIL IN A LOWER PIECE.


M. IF THE CAR BEING USED FOR A SHIPMENT IS EQUIPPED WITH A AVAILABLE METAL FLOOR AND A NAIL SIZE FOR FLOOR NAILING IS MARKED ON THE CAR, THAT GUIDANCE SHOULD BE APPLIED TO THE NAILING OF ALL FLOOR BLOCKING PIECES TO THE CAR FLOOR. IF A NAIL SPECIFIED IS NOT SPECIFIED ON THE CAR, OR NAILS SHOULDN'T BE USED IN LIEU OF THOSE SPECIFIED IN THE APPLICABLE KEY NUMBERS. SEE GENERAL NOTE "K" ABOVE.

N. FOR ADDITIONAL GUIDANCE, ATTENTION IS DIRECTED TO THE "SPECIAL NOTES" SECTIONS WHICH ARE IMMEDIATELY adjacent TO THE DEPICTED OUTLOADING METHODS, AND TO THE "SPECIAL HANDLING GUIDANCE" ON PAGE 3.

(GENERAL NOTES CONTINUED)

O. LOAD BLOCKING STRUTS WHICH ARE 48" OR LONGER MUST BE STIFFENED BY THE APPLICATION OF HORIZONTAL AND VERTICAL STRUT BRACING. BRACING IS NOT REQUIRED IF THE STRUTS FOR THE LOAD BEING SHIPPED ARE SHORTER THAN 48". THE LENGTH OF THE LOAD BLOCKING STRUTS SHOULD BE AS LONG AS POSSIBLE (APPROX 18" MINIMUM). BUT IN THE EVENT IT IS NECESSARY TO USE STRUTS WHICH ARE 8'-0" OR MORE IN LENGTH, IT WILL BE NECESSARY TO SET THE CENTERS OF HORIZONTAL AND VERTICAL STRUT BRACING PIECES. STRUT BRACING SHOULD BE APPLIED SO AS TO PROVIDE NEARLY EQUAL SPACING BETWEEN THE BRACING PIECES. STRUTS AND/OR BETWEEN ADJACENT STRUT BRACING PIECES. VERTICAL STRUT BRACING PIECES ARE TO BE 2" X 4" MATERIAL CUT TO A LENGTH TO EXTEND 2" ABOVE THE TOP STRUT. HORIZONTAL STRUT BRACING PIECES ARE TO BE 2" X 4" X 7'-0" MATERIAL. HORIZONTAL PIECES WILL BE APPLIED ON EACH LAYER OF STRUTS. BOTH VERTICAL AND HORIZONTAL STRUT BRACING PIECES WILL BE NAILED TO THE STRUTS WITH 3-10d NAILS AT EACH JOINT.

P. PARTITIONS OF THE CAR DEPICTED WITHIN THIS DRAWING, SUCH AS ONE OF THE BULKHEADS, HAVE NOT BEEN SHOWN IN THE LOAD VIEW FOR CLARITY PURPOSES.

Q. CONVERSION TO METRIC EQUIVALENTS: DIMENSIONS WITHIN THIS DOCUMENT ARE EXPRESSED IN INCHES, AND WEIGHTS ARE EXPRESSED IN POUNDS. WHEN NECESSARY, THE METRIC EQUIVALENTS MAY BE COMPUTED ON THE BASIS OF ONE INCH EQUIVALENTS 25.4MM AND 1 POUND EQUALS 0.454KG.


S. IF THE RAILCARS BEING SHIPPED ARE EQUIPPED WITH PLACARD BOARDS, THE CAR MUST BE bolster UP TO SUPPORT THE CAR, OR NEAR A PROPER INTERLOCK ENGAGEMENT WITHOUT ADDED UNDERS. STRAP TO BE APPLIED TO THE RP/C FRAME WHEN STRUT STRAPPING IS APPLIED.

T. DIMENSIONS GIVEN FOR DUNNAGE PIECES OR DUNNAGE ASSEMBLIES WILL BE FIELD CHECKED PRIOR TO THEIR ASSEMBLY AND INSTALLATION ON THE FLATCAR. DUNNAGE ASSEMBLIES MUST BE CONSTRUCTED SO THAT A STRUT FITS WITHIN THE RP/C. AS SPECIFIED, UNITIZATION SPECIFICATIONS WITHIN THE UNITIZATION SPECIFICATIONS FOR THE LOAD BEING SHIPPED IS SPECIFIED TO THE STRUCTURAL DESIGN OF THE CAR, THE STRUTS MUST BE NAILED TO THE SUPPORT ASSEMBLY.

U. DUNNAGE LUMBER SPECIFIED IS OF NOMINAL SIZE. EXAMPLE. 1" X 6" MATERIAL IS ACTUALLY 3/4" THICK BY 5-1/2" WIDE AND 2" X 4" MATERIAL IS ACTUALLY 1-1/2" BY 3-1/2" WIDE.

MATERIAL SPECIFICATIONS

LUMBER ---------: SEE TM 743-200-1 (DUNNAGE LUMBER) AND FED SPEC MH-L-751.

NAILS --------: FED SPEC FS-N-110: COMMON.

STRAPPING, STEEL: : FED SPEC QQ-S-781: CLASS I, TYPE I OR HEAVY DUTY, FINISH A, B (GRADE 2), OR C.


STAPLE, STRAP: : FED SPEC QQ-V-461: ANNCHLED, BLACK.

STAKE POCKET PROTECTOR: : COMMERCIAL GRADE.

ANTI-CHAFING MATERIAL: : MIL-B-121-1 (OR EQUAL); NEUTRAL BATTER MATERIAL.
SPECIAL HANDLING GUIDANCE

ASSEMBLY STACKING FOR OUTLOADING PURPOSES AND ASSEMBLY OR ASSEMBLY STACK HANDLING.

NOTES: (1) MATERIALS HANDLING EQUIPMENT (MHE) IS INTENDED TO MEAN EQUIPMENT, SUCH AS FORKLIFT TRUCKS, CRANES, HAND TRUCKS, DOLIES, ROLLER ASSEMBLIES, SLINGS, AND SPREADER BARS, THAT CAN BE USED TO HANDLE THE DEPICTED ASSEMBLIES.

(2) PRECAUTIONARY HANDLING TECHNIQUES NORMALLY EMPLOYED OR AS SPECIFIED FOR THE TYPE OF COMMODITY INVOLVED WILL BE OBSERVED.

A. IF AVAILABLE MHE DOES NOT HAVE AN ALLOWABLE CAPACITY GREAT ENOUGH TO CARRY A STACK OF TWO ASSEMBLIES (APPROXIMATELY 10,200 POUNDS) IN ONE LIFT, THEN THE ASSEMBLIES MUST BE HANDLED INDIVIDUALLY. ONLY APPROVED AND APPROPRIATELY SIZED MHE WILL BE USED FOR THE HANDLING OF THE DEPICTED ASSEMBLIES.

B. WHEN AN ASSEMBLY STACK IS BEING UNITIZED, CARE MUST BE EXERCISED WHEN TIGHTENING THE STRAPS TO ENSURE THAT THE LONGITUDINAL FRAME MEMBERS OF THE ASSEMBLIES ARE NOT "PULLED IN" OR DEFORMED. POSITION THE UNITIZATION AND BUNDLING STRAPS AS CLOSE AS POSSIBLE TO THE BULKHEADS OF THE RP/C TO AVOID DAMAGING THE RP/C FRAME MEMBERS.

C. IF HANDLING IS ACCOMPLISHED WITH A FORKLIFT TRUCK, THE ASSEMBLIES SHOULD BE HANDLED FROM A SIDE POSITION AS MUCH AS POSSIBLE. CARE MUST BE EXERCISED WHEN INSERTING FORKS UNDER AN ASSEMBLY TO PREVENT DAMAGE TO THE ASSEMBLY BY THE FORK TINES OR THE FORKLIFT PACKAGE GUARD. ADDITIONALLY, THE FORK TINES SHOULD BE PLACED UNDER THE AREA MARKED "FORKLIFT AREA ONLY" LOCATED NEAR THE LONGITUDINAL CENTER OF THE ASSEMBLY.
KEY NUMBERS


2. SUPPORT A, 2" X 4" X 7"-0" (DOUBLED), 1" X 4" X 7"-0", AND PLYWOOD, 1/2" X 3-1/2" X 7"-0" (8 REQD.). PRE-POSITION AS SHOWN IN THE "PRE-POSITIONED DAMAGE PLAN VIEW" ON PAGE 5. NAIL THE FIRST 2" X 4" TO THE CAR FLOOR 1/8-12d NAILS, NAIL THE 1" X 4" TO THE FIRST 2" X 4" WITH 1/8-12d NAILS, NAIL THE SECOND 2" X 4" TO THE 1" X 4" 1/8-12d NAILS, AND NAIL THE PLYWOOD TO THE SECOND 2" X 4" 1/8-12d NAILS. SEE GENERAL NOTE "T" ON PAGE 2.


4. ANTI-CHAFING PIECE, 1" X 6" X 62" AND 2" X 5" X 62". (8 REQD.). LAMINATE THE 1" X 6" PIECE TO THE 2" X 5" PIECE 1/8-6d NAILS. TIE TO THE FRAME MEMBERS OF BOTH THE TOP AND BOTTOM HUBS WITH 16" OF 14 GAUGE WIRE AT EACH LOCATION.

5. UNITIZING STRAP, 1-1/4" X .035" OR .031" X 16'-0" LONG STEEL STRAPPING (16 REQD.). SEE THE "SPECIAL HANDLING GUIDANCE" ON PAGE 3.

6. SEAL FOR 1-1/4" STRAPPING (48 REQD., 2 PER STRAP). CRIMP EACH SEAL WITH TWO PAIR OF NOTCHES.

7. BUNDLING STRAP, 1-1/4" X .035" OR .031" X 21'-0" LONG STEEL STRAPPING (8 REQD.). INSTALL TO ENCLOSE LATERALLY ADJACENT CONTAINERS IN THE TOP LAYER AS SHOWN.


10. STRUT, 2" X 6" X CUT-TO-FIT (DOUBLED) (16 REQD.). LAMINATE THE SECOND PIECE TO THE FIRST 1/4-10d NAILS, TOE-NAIL TO CENTER GATE 1/2-12d NAILS AT EACH END. SEE GENERAL NOTES "D" AND "R" ON PAGE 2.

(CONTINUED ON PAGE 5)
**PRE-POSITIONED DUNNAGE PLAN VIEW**

(KKEY NUMBERS CONTINUED FROM PAGE 4)

1. STRUT LUGGER, 2" x 4" x 7'-3" (2 REQ). POSITION ON THE SECOND LEVEL OF STRUTS AND NAIL TO THE CENTER GATE VERTICAL PIECES 1/3-10d NAILS AT EACH JOINT.

2. SIDE BLOCKING, 2" x 6" x 30' (DOUBLED) (16 REQ). LOCATE ADJACENT TO THE RP/C SKIDS. LOCATE THE SIDE BLOCKING PIECES AT EACH END OF THE LOAD 20 AS TO BUFT UP AGAINST THE BULKHEAD. NAIL THE FIRST PIECE TO THE CAR FLOOR V/6-20d NAILS. NAIL THE SECOND PIECE TO THE FIRST V/6-30d NAILS.

3. SIDE BLOCKING FOR FILL ASSEMBLY, 2" x 4" x 24" (DOUBLED) (4 REQ). NAIL THE FIRST PIECE TO THE SIDE BLOCKING PIECES V/4-10d NAILS AT EACH END. NAIL THE SECOND PIECE TO THE FIRST V/4-10d NAILS.

4. SIDE BLOCKING FOR CENTER GATE, 2" x 4" x 48" (2 REQ). NAIL TO THE SIDE BLOCKING PIECES V/4-10d NAILS AT EACH END.

5. STRAPPING, 2" x 5" x 6" (12 REQ).

6. HOLD-DOWN STRAP, 2" x .050" x 27'-0" LONG STEEL STRAPPING (12 REQ). INSTALL EACH STRAP FROM TWO 13'-6" LONG PIECES.

7. SEAL FOR 2" STRAPPING (95 REQ. 8 PER STRAP). CRIMP EACH SEAL WITH TWO PAIR OF NOTCHES, EXCEPT THOSE USED TO SECURE THE PADS. PIECES MARKED 18.

8. PAO, 2" x .050" x 18" LONG STEEL STRAPPING (24 REQ). POSITION UNDER STAKE POCKET AND SEAL TO HOLD-DOWN STRAP. PIECE MARKED 15 WITH ONE SEAL CRIMPED WITH ONE PAIR OF NOTCHES. SEE DETAIL A ON PAGE 8.

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**BILL OF MATERIAL**

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<td>20d (4&quot;)</td>
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<tr>
<td>30d (4-1/2&quot;)</td>
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STEEL STRAPPING, 1-1/4" - 472 REQ - - - - - - - - - 68 LBS
SEAL FOR 1-1/4" STRAPPING - 48 REQ - - - - - - - - - 2-1/4 LBS
STEEL STRAPPING, 2" - - - - - 300 REQ - - - - - 120 LBS
SEAL FOR 2" STRAPPING - - - - - 95 REQ - - - - - 20 LBS
PLYWOOD, 1/2" - - - - - - - 16.33 90 FT REQ - - - 22-1/2 LBS
WIRE, NO. 14 GAGE - - - - - - - - 24' REQ - - - - - 1/2 LBS

---

**LOAD AS SHOWN**

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<th>WEIGHT (APPROX)</th>
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<tbody>
<tr>
<td>MPLS RP/C</td>
<td>16</td>
<td>81,248 LBS</td>
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<tr>
<td>DUNNAGE</td>
<td>2,829 LBS</td>
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TOTAL WEIGHT - - - - - - - - - 84,077 LBS (APPROX)
BEARING PIECE, 2" X 6" X 26" (DOUBLED) (4 REQD). NAIL THE FIRST PIECE TO THE HORIZONTAL PIECES W/3-10d NAILS AT EACH END. LAMINATE THE SECOND PIECE TO THE FIRST W/5-10d NAILS.

SUPPORT LEG, 2" X 8" X 83-1/4" (2 REQD). NAIL TO THE HORIZONTAL PIECES W/3-10d NAILS AT EACH JOINT.

BEARING PIECE, 2" X 6" X 27-1/4" (DOUBLED) (4 REQD). NAIL THE FIRST PIECE TO THE HORIZONTAL PIECES W/3-10d NAILS AT EACH END. LAMINATE THE SECOND PIECE TO THE FIRST W/5-10d NAILS.

HORIZONTAL PIECE, 2" X 6" X 7'-3" (4 REQD).

BEARING PIECE, 2" X 6" X 30-3/4" (DOUBLED) (4 REQD). NAIL THE FIRST PIECE TO THE HORIZONTAL PIECES W/3-10d NAILS AT EACH JOINT. LAMINATE THE SECOND PIECE TO THE FIRST W/5-10d NAILS.

VERTICAL PIECE, 2" X 6" X 68" (4 REQD). NAIL TO THE HORIZONTAL PIECES W/3-10d NAILS AT EACH JOINT.

BEARING PIECE, 2" X 6" X 27-1/4" (DOUBLED) (4 REQD). NAIL THE FIRST PIECE TO THE HORIZONTAL PIECES W/3-10d NAILS AT EACH END. LAMINATE THE SECOND PIECE TO THE FIRST W/5-10d NAILS.

HORIZONTAL PIECE, 2" X 6" X 7'-3" (4 REQD).

BULKHEAD GATE

CENTRAL GATE

Strut Ledger, 2" X 4 X 7'-3" (3 REQD). NAIL TO THE VERTICAL PIECES W/3-10d NAILS AT EACH JOINT.
HORIZONTAL PIECE, 2" x 6" x 7'-3" (8 REGD). NAIL TO THE VERTICAL PIECES W/3-10d NAILS AT EACH JOINT.

BEARING PIECE, 2" x 6" x 28" (Doubled) (8 REGD). NAIL THE FIRST PIECE TO THE HORIZONTAL PIECES W/3-10d NAILS AT EACH END. LAMINATE THE SECOND PIECE TO THE FIRST W/5-10d NAILS.

BEARING PIECE, 2" x 6" x 27-1/4" (Doubled) (8 REGD). NAIL THE FIRST PIECE TO THE HORIZONTAL PIECES W/3-10d NAILS AT EACH END. LAMINATE THE SECOND PIECE TO THE FIRST W/5-10d NAILS.

FILL ASSEMBLY

VERTICAL PIECE, 2" x 6" x 63-1/4" (8 REGD).

FILL PIECE, 1" x 4" x 7'-5-1/2" (1 REGD). NAIL TO THE 4" X 4" FILL PIECE W/6-6d NAILS.

SPECIAL NOTE:
The support assembly as depicted at left can only be used when a flatcar is being loaded from both sides. If the loading area at an installation only allows one side access to the flatcar, the support assemblies must be modified to allow proper car loading. Modifications required are reducing overall length to 44", using two of the shortened assemblies in place of the depicted assembly and fastening a 2" x 2" x 3-1/2" stop piece to the end of the assembly that will be between RP/C stacks. Also, the shortened support assemblies in laterally adjacent stacks will need to be offset to preclude interference.
HOLD-DOWN STRAP ANCHORING DETAILS

TIE PIECE. 2" X 6" X 12'-11" (2 REGO). NAIL TO THE LONGITUDINAL PIECES W/5-10d NAILS AND TO THE LATERAL PIECES W/2-10d NAILS AT EACH JOINT.

LATERAL PIECE. 2" X 6" X 37" (14 REGO).

BEARING PIECE. 2" X 6" X 27-1/4" (4 REGO). NAIL TO THE LATERAL PIECES W/2-10d NAILS AT EACH END AND TO THE LONGITUDINAL PIECES W/3-10d NAILS AT EACH END.

LONGITUDINAL PIECE. 2" X 6" X 12'-11" (4 REGO). NAIL TO THE CENTER FIVE LATERAL PIECES W/3-10d NAILS AT EACH LOCATION AND TO THE VERTICAL PIECES W/2-10d NAILS AT EACH JOINT.

VERTICAL PIECE. 2" X 4" X 28-1/4 (8 REGO).

FORWARD END OF RP/C

FILLER ASSEMBLY

NOTE: FILLER ASSEMBLY IS TO BE INSTALLED TO REPLACE AN RP/C IN AN UPPER STACK ONLY. INSTALL NO MORE THAN SEVEN FILLER ASSEMBLIES IN ONE LOAD.

SECTION B-B
PART 7

RAIL COUPLER DATA
R.I. MLRS on Bulkhead Flat, #1: 4.36 MPH  Dec 85 18:00:00 1990

Rail Coupler Force
Lbs X 100000.0000

Time of Sample
Seconds X 1.0000
R.I. MLRS on Bulkhead Flat, #2: 6.30MPH Dec 05 10:05:00 1996

Time of Sample
Seconds x 1.0000
R.I. MLRS on Bulkhead Flat, #4: 9.53MPH  Dec 05 16:15:00 1990

Graph showing the time of sample in seconds multiplied by 1.0000.
R.I. MLRS on Cntr Beam Flat, 01: 4.69MPH Dec 07 10:00:00 1998

Time of Sample
Seconds X 1.0000
R.I. MLRS on Cntr Beam Flat, #2: 7.07MPH Dec 07 10:05:00 1990

Time of Sample
Seconds X 1.0000

[Graph showing Rail Coupler Force and Buffer Cars in Lbs X 100000 0000]
R.I. MLRS on Cntr Beam Flat, #3: 8.93MPH Dec 07 10:10:00 1990

Time of Sample
Seconds X 1.0000
R.I. MLRS on Cntr Beam Flat, #4: 8.82MPH Dec 07 10:15:00 1990

Time of Sample
Seconds x 1.0000