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FINAL REPORT
DECEMBER 1990

REPORT NO. 91-06

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

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VALIDATION ENGINEERING DIVISION
SAVANNA, ILLINOIS 61074-9639

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Multiple Launch Rocket System (MLRS) Pods on a Center Beam Bulkhead Flatcar and a Bulkhead Flatcar

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Quinn D. Hartman

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19. ABSTRACT (Continue on reverse if necessary and identify by block number)

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.

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U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL
VALIDATION ENGINEERING DIVISION
SAVANNA, IL 61074-9639

REPORT NO. 91-06*

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

TABLE OF CONTENTS

PART 1

GENERAL

A. INTRODUCTION. The U.S. Army Defense Ammunition Center and School (USADACS), Validation Engineering Divison (SMCAC-DEV), was tasked by USADACS, Transportation Engineering Divison (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

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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

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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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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."

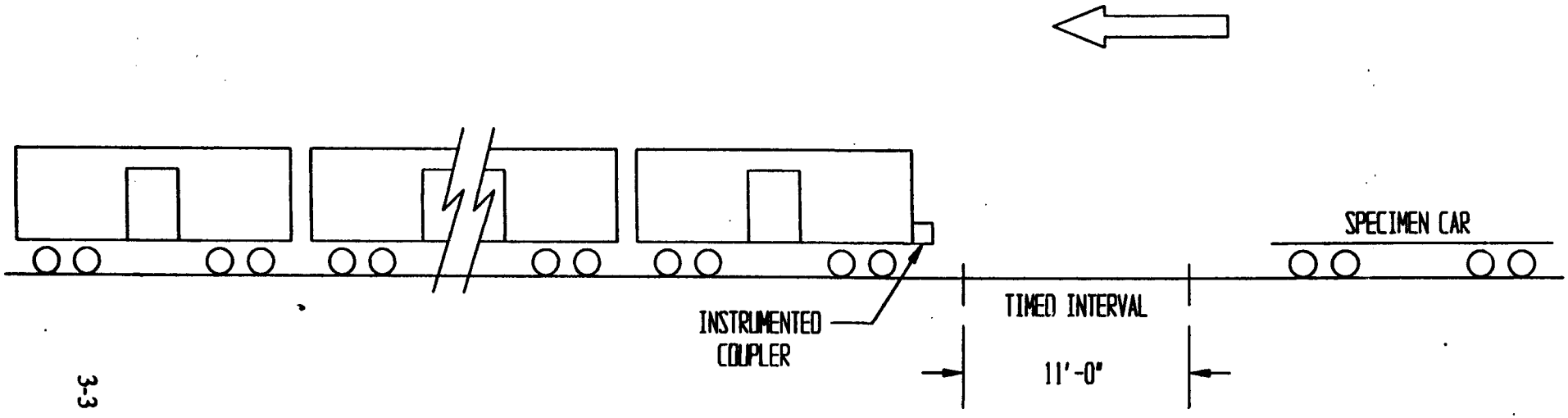
3. A locomotive (switch engine) was utilized to start the "specimen car" rolling in the direction of the buffer cars along an approximate 300-foot segment of level trackage.

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 REVERSED 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:

#:	BN625038	
LT WT:	64,000	
LD LMT:	199,000	
LD WT:	MLRS Pods:	50,780
	Dunnage:	4,520
	Simulated Wt:	47,250
	Total:	102,550

IMPACT NO.	TYPE	REMARKS
1	Forward Impact	Speed not measured; no movement.
2	Forward Impact	6.39 mph; minor shift of load.
3	Forward Impact	8.33 mph; Center dunnage between pods shifted; additional shifting in load; gap between pods and dunnage at trailing end of car 1-1/2"; bulkheads at trailing end of car are still solid.
4	Reverse Impact	8.42 mph; Load shifted back towards impact end of car; gap between pods and dunnage at trailing end of car 2-1/2"; 4" x4" at trailing end of car shifted 2-1/2" towards impact end of car, shifting of the 4"x4" allowed the rubber skid on the bottom row of pods to become partially disengaged; pods at impact end of car started to split the end wall dunnage; the large amount of shifting in the load allowed the pods in the center section to shift within 2" of being off of the metal support members.

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

IMPACT NO.	TYPE	REMARKS
1	Forward Impact	4.36 mph; no movement.
2	Forward Impact	6.30 mph; no movement.
3	Forward Impact	8.43 mph; load shifted; end gap 2-inches.
4	Reverse Impact	8.53 mph; Load shifted back; end gap 4-3/4". Marks of original position of MLRS pods prior to fourth impact indicated that the excessive compaction occured in the boxed ammunition. Minor cracking in filler assembly.

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:

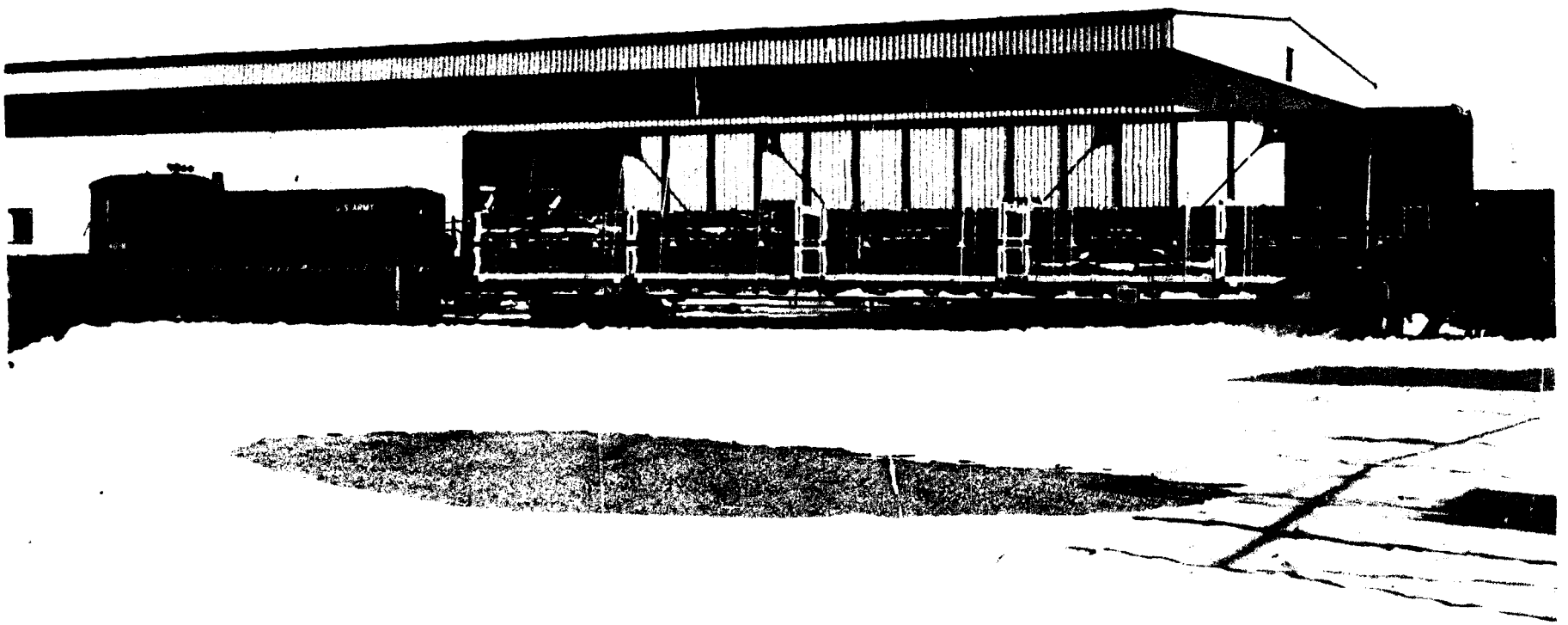
#:	BN625038	
LT WT:	64,000	
LD LMT:	199,000	
LD WT:	MLRS Pods:	50,780
	Dunnage:	4,520
	Simulated Wt:	47,250
	Total:	102,550

IMPACT NO.	TYPE	REMARKS
1	Forward Impact	4.69 mph; slight shift in load.
2	Forward Impact	7.07 mph; additional shifting of load; end gap 2-3/8".
3	Forward Impact	8.93 mph; additional shifting of load; end gap 3-3/4". End gap is now large enough to allow end blocking to be removed. Pods digging into blocking, but not splitting wood.

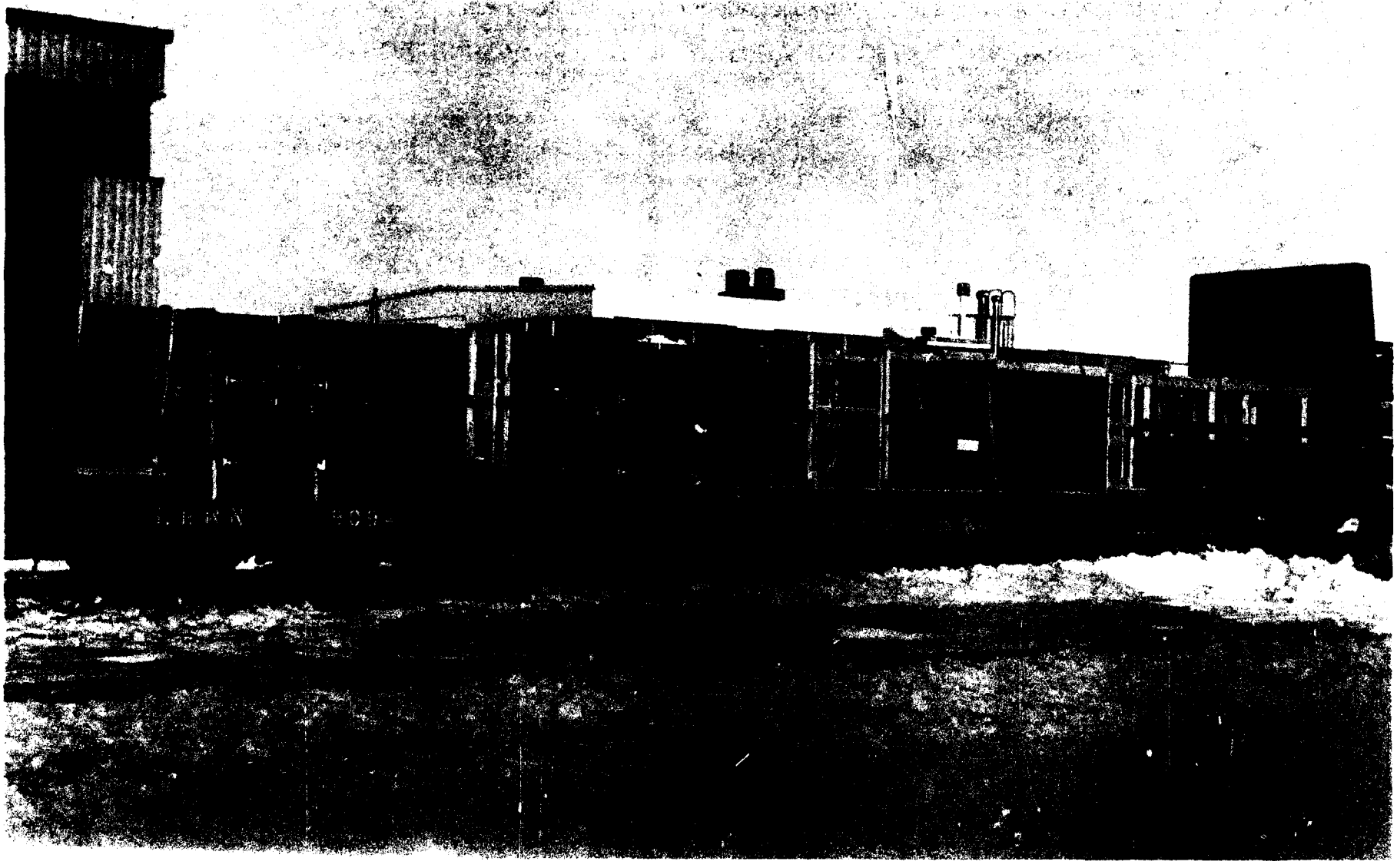
4	Reverse Impact	8.82 mph; load shifted opposite direction; end gap 3-3/8". No splitting on any dunnage, angle-iron corners of pods compressing dunnage as expected. Minor dunnage separation on 4- by 4-inch supports for first level of pods. Second column of pods in from left are within 2 inches of being 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

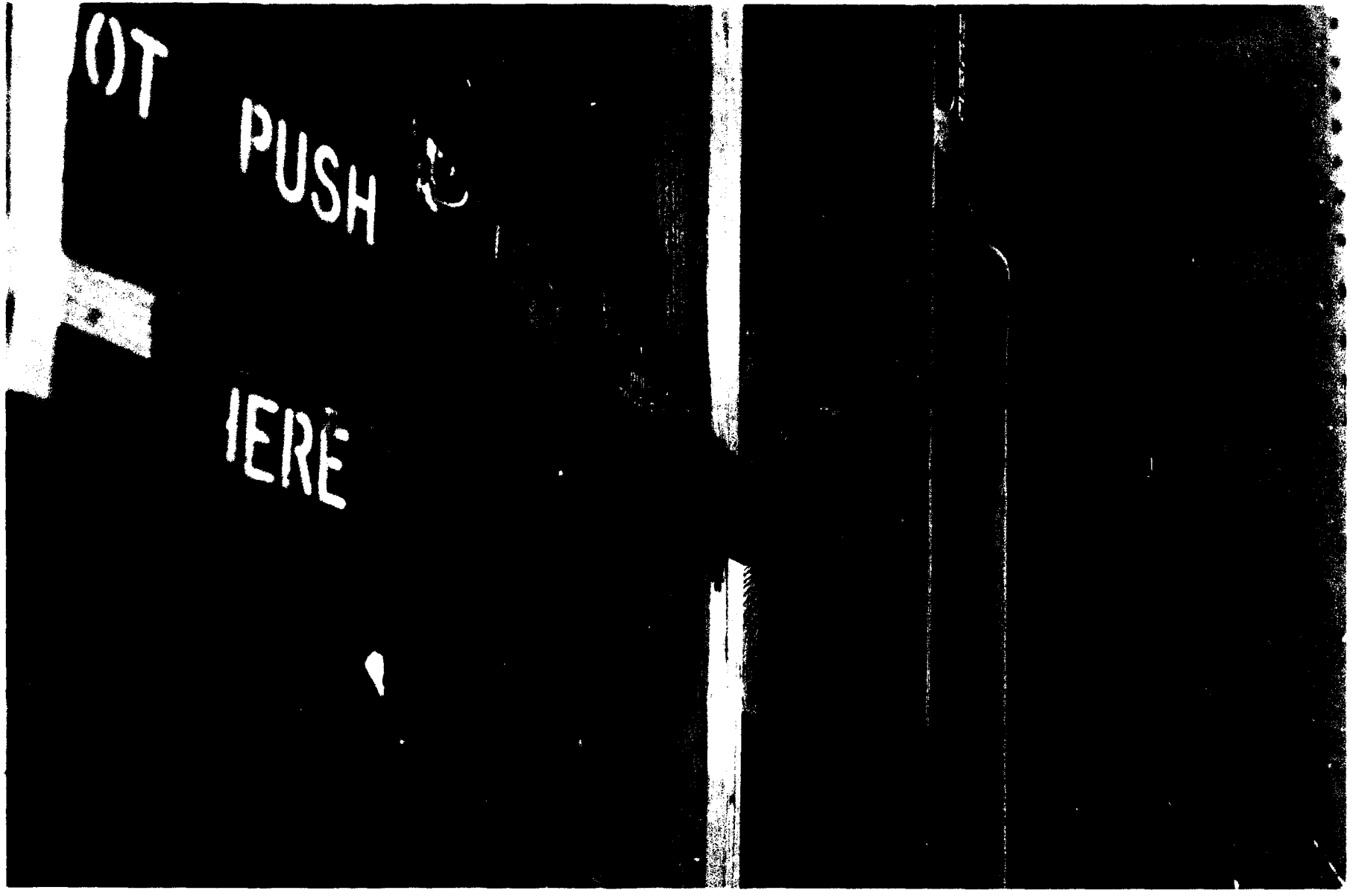
PHOTOGRAPHS



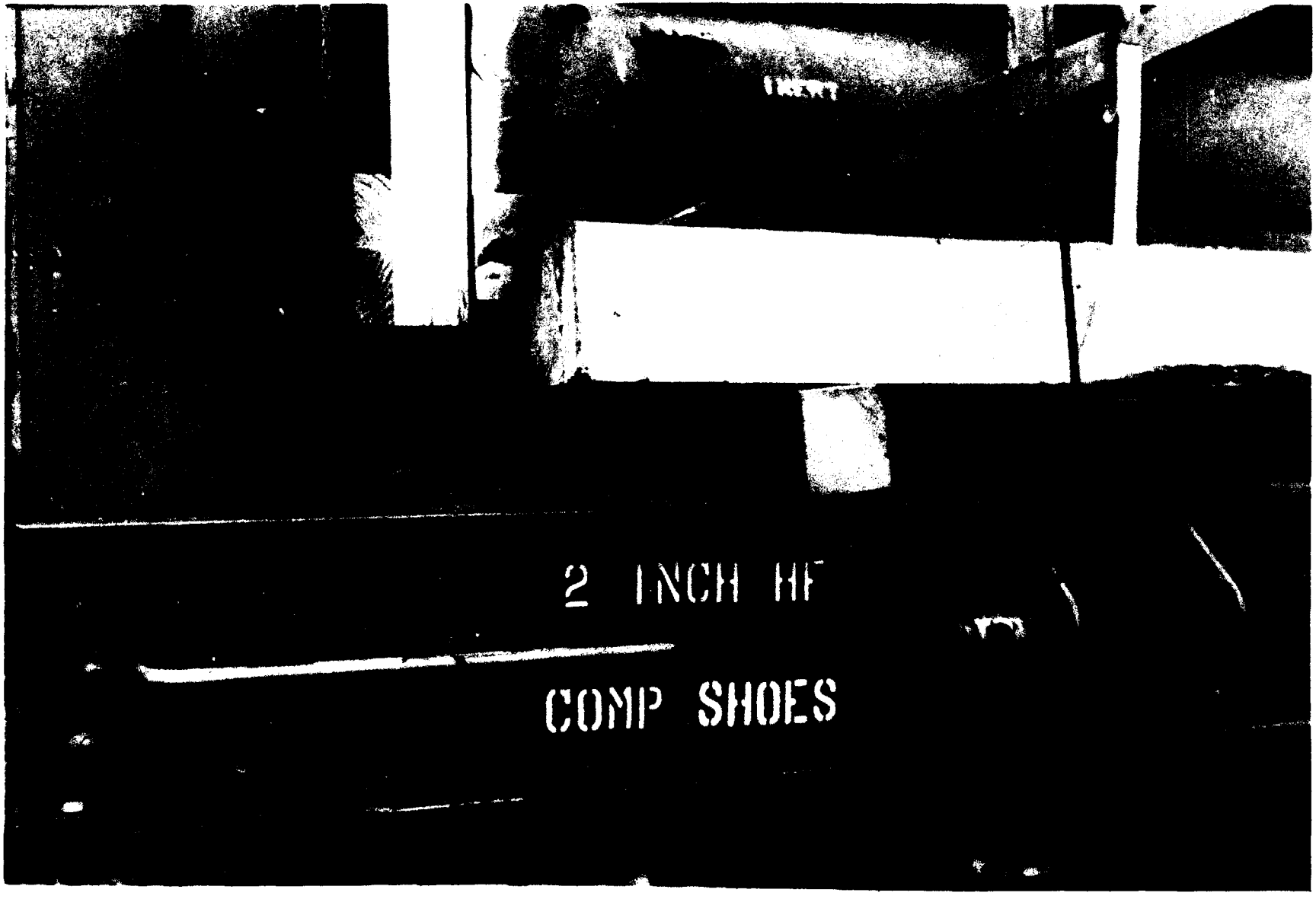
	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-91-89-648. Overall view of the MLRS pods loaded on a center beam bulkhead flatcar.		



	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-91-89-627. Overall view of the MLRS pods loaded on a bulkhead flatcar.		



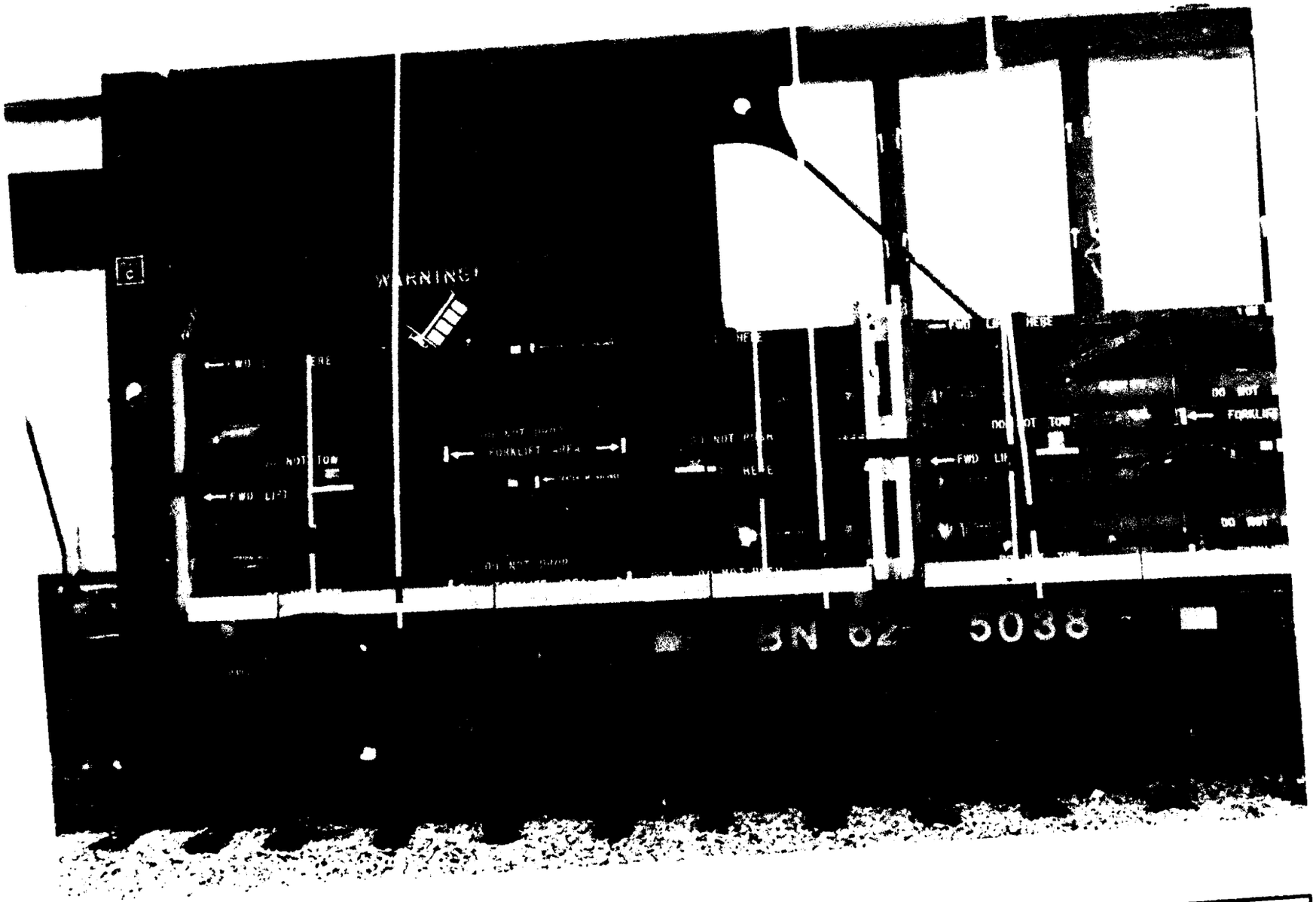
	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-91-89-602. View of damage to dunnage following the first rail impact test of MLRS pods on a center beam bulkhead flatcar. Dunnage was widened prior to the second test of the MLRS pods on a center beam bulkhead flatcar.		



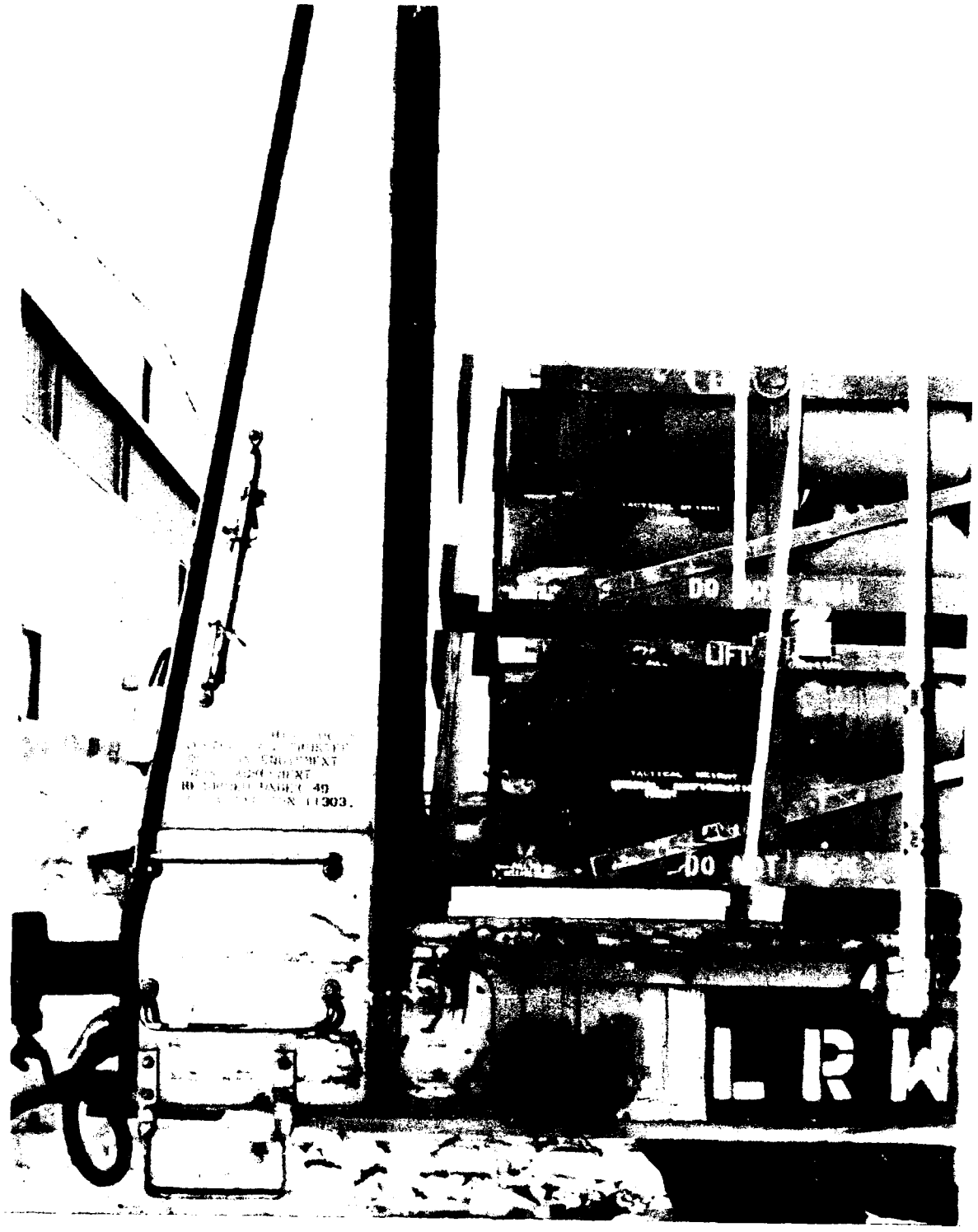
	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL	
Photo No. AO317-SPN-91-673. View of one of the 4- by 4-inch supports which slide during the first rail impact test of MLRS pods on a center beam bulkhead flatcar. Dunnage was added prior to the second test of the MLRS pods on a center beam bulkhead flatcar to prevent the 4- by 4-inch supports from shifting.		

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

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.



	U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL - SAVANNA, IL
Photo No. AO317-SPN-90-89-640 View of a retainer strap that was bent by a lifting ring on the MLRS pods.	



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

Photo No. AO317-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.

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

APPROVED BY MECH DIV AAR, THEIR LETTER	APPROVED BY BUREAU OF EXPLOSIVES
DATED _____ FILE _____ SIGNED _____ DATE _____ MTMCTEA, FT. EUSTIS, VA	_____ DATE _____

MLRS

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

INDEX

✣ 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

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

U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL

DRAFTSMAN	TECHNICIAN	ENGINEER
S. WILSON	R. ARNOLD	

VALIDATION ENGINEERING DIVISION	TRANSPORTATION ENGINEERING DIVISION	LOGISTICS ENGINEERING OFFICE

CLASS	DIVISION	DRAWING	FILE
19	48	5543	GMSRSS

DO NOT SCALE

PROJECT GM 836-90

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 "FBC" CENTER BEAM TYPE BULKHEAD (LUMBER) FLATCAR WHICH IS 73'-0" LONG BETWEEN THE BULKHEADS. THE CAR IS EQUIPPED WITH FIXED RISERS SPACED 30" O.C. FROM EACH BULKHEAD AND 48" 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'-10" 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 55-355, 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, 16" 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.

J. A HARDENED STEEL ROD 13/16" 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.

K. DUNNAGE 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 SPECIFCATIONS

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

NAILS - - - - - - - -: FED SPEC FF-N-105: COMMON.

STRAPPING, STEEL - -: FED SPEC QQ-S-781: CLASS 1, TYPE I OR IV, HEAVY DUTY, FINISH A, B (GRADE 2), OR C.

SEAL, STRAP - - - -: FED SPED QQ-S-781: TYPE D, STYLE I, II, OR IV, CLASS H, FINISH A, B (GRADE 2) OR C.

WIRE - - - - - - - - -: FED SPEC QQ-W-461: ANNEALED, BLACK.

ANTI-CHAFING MATERIAL - - - - - -: MIL-B-121 (OR EQUAL): NEUTRAL BARRIER MATERIAL.

(GENERAL NOTES CONTINUED)

L. A STAGGERED NAILING PATTERN WILL BE USED WHENEVER POSSIBLE WHEN NAILS ARE DRIVEN INTO JOINTS OF DUNNAGE ASSEMBLIES. ALSO, A STAGGERED NAILING PATTERN WILL BE USED WHEN LAMINATING DUNNAGE. 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 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 SPECIFIED HEREIN MUST BE FOLLOWED AS CLOSELY AS POSSIBLE FOR BLOCKING, BRACING, AND STAYING 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 WHICH ARE 8'-0" 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 SPACES BETWEEN THE BRACING PIECES AND THE CENTER GATE 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 45" 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.

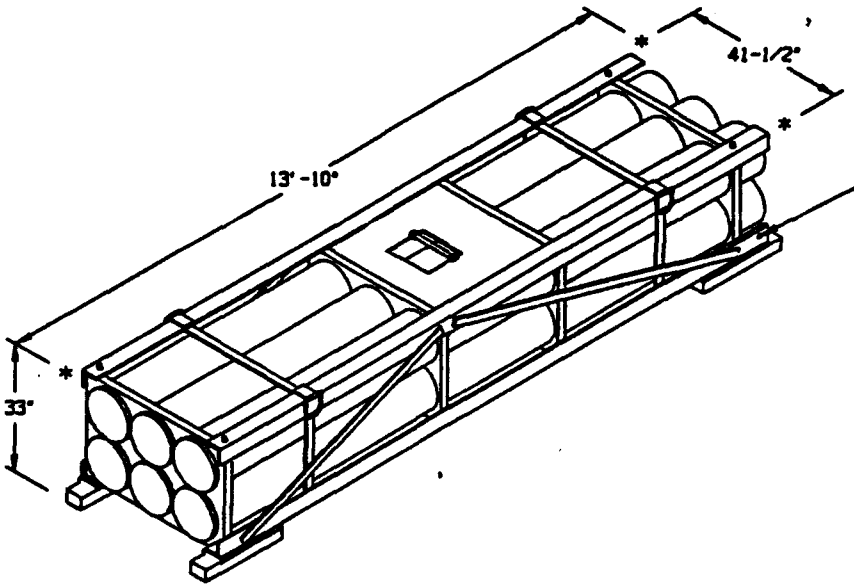
P. PORTIONS OF THE CAR DEPICTED WITHIN THIS DRAWING, SUCH AS ONE OF THE BULKHEADS, HAVE NOT BEEN SHOWN IN THE LOAD VIEW FOR CLARITY PURPOSES.

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 SLIGHTLY LONGER THAN THE MEASURED 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 ONE GATE. 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 UNITIZING 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, AND 15. NOTE THAT ALL STRAPPING USED FOR LOAD SECUREMENT, I.E., RETAINER STRAPS, MUST BE MARKED AS SPECIFIED IN LOADING RULE 15.



ROCKET POD/CONTAINER

SPECIAL HANDLING GUIDANCE

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

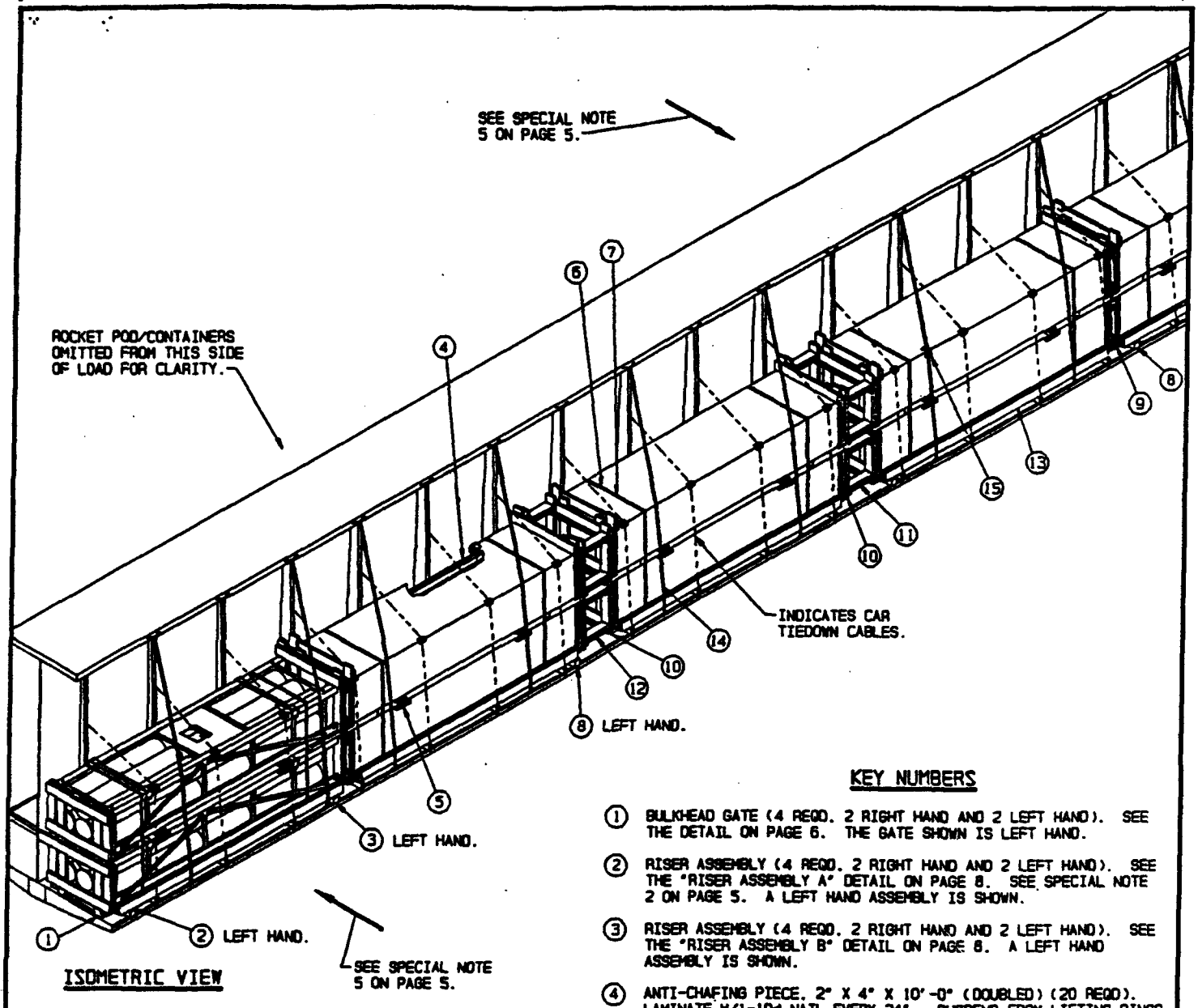
NOTES: (1) MATERIALS HANDLING EQUIPMENT (MHE) IS INTENDED TO MEAN EQUIPMENT, SUCH AS FORKLIFT TRUCKS, CRANES, HAND TRUCKS, DOLLIES, ROLLER ASSEMBLIES, SLINGS, AND SPREADER BARS, THAT CAN BE USED TO HANDLE THE DEPICTED ASSEMBLIES.

(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 BEING UNITIZED, CARE MUST BE EXERCISED WHEN TIGHTENING THE STRAPS TO INSURE 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.



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 8. SEE SPECIAL NOTE 2 ON PAGE 5. 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 8. 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 18'-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 8. SEE SPECIAL NOTE 3 ON PAGE 5.

⑨ SPACER GATE (4 REQD). SEE THE DETAIL ON PAGE 6.

⑩ CENTER GATE (8 REQD). SEE THE DETAIL ON PAGE 7.

⑪ STRUT. 2" X 6" X 15" (DOUBLED) (16 REQD). LAMINATE W/3-10d NAILS. TOENAIL 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. TOENAIL THE TOP PIECE TO THE CENTER GATES. PIECE MARKED ⑩. W/2-12d NAILS AT EACH END.

⑬ SIDE BLOCKING ASSEMBLY (10 REQD). SEE THE DETAIL ON PAGE 9.

(CONTINUED AT LEFT)

(KEY NUMBERS CONTINUED)

⑭ RETAINER STRAP. 1-1/4" X .031" OR .035" X 25'-0" LONG STEEL STRAPPING (20 REQD). INSTALL IN A COMPLETE LOOP FROM TIEDOWN DEVICE AT SIDE OF CAR THRU THE TIEDOWN DEVICE ON CENTER DIVIDER.

⑮ ANTI-CHAFING NEUTRAL BARRIER MATERIAL (AS REQD). POSITION UNDER ALL STRAPS AND UNDER THE CORNER PROTECTORS OF THE CHAIN/CABLE TIEDOWN ASSEMBLIES AT POINTS OF CONTACT WITH THE CONTAINER.

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 THOSE 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 ⑩, AND 8 STRUTS, PIECE MARKED ⑪, 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 ⑪, 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.

BILL OF MATERIAL

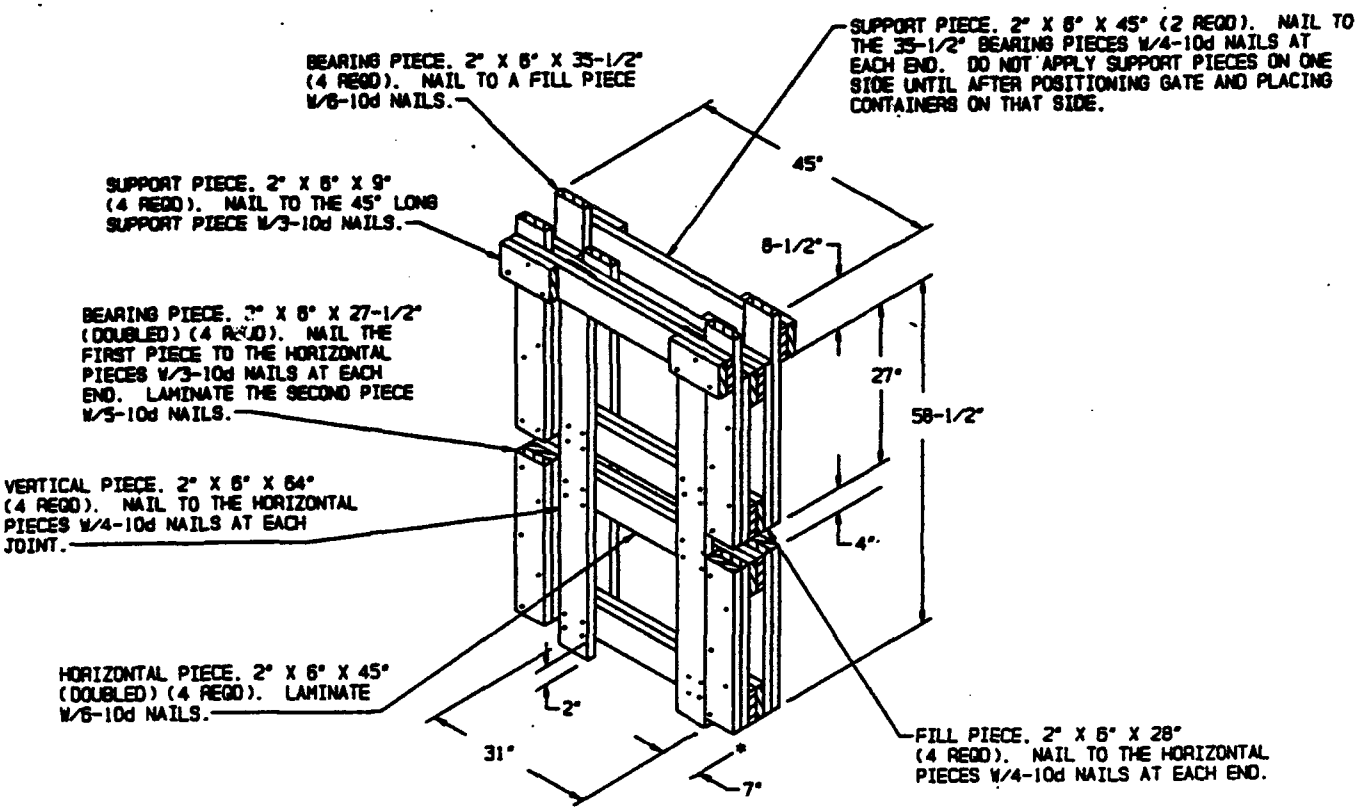
LUMBER	LINEAR FEET	BOARD FEET
1" X 4"	78	26
1" X 6"	100	50
2" X 2"	152	51
2" X 4"	594	396
2" X 6"	1,389	1,389
4" X 4"	73	98
4" X 6"	90	180

NAILS	NO. REQD	POUNDS
8d (2")	180	1-1/4
10d (3")	2,942	44-1/4
12d (3-1/4")	128	2-1/4
16d (3-1/2")	120	2-3/4

STEEL STRAPPING, 1-1/4"	860'	REQD	123 LBS
SEAL FOR 1-1/4" STRAPPING	80	REQD	4 LBS
WIRE, NO. 14 GAGE	100'	REQD	2 LBS
ANTI-CHAFING MATERIAL	AS	REQD	NIL

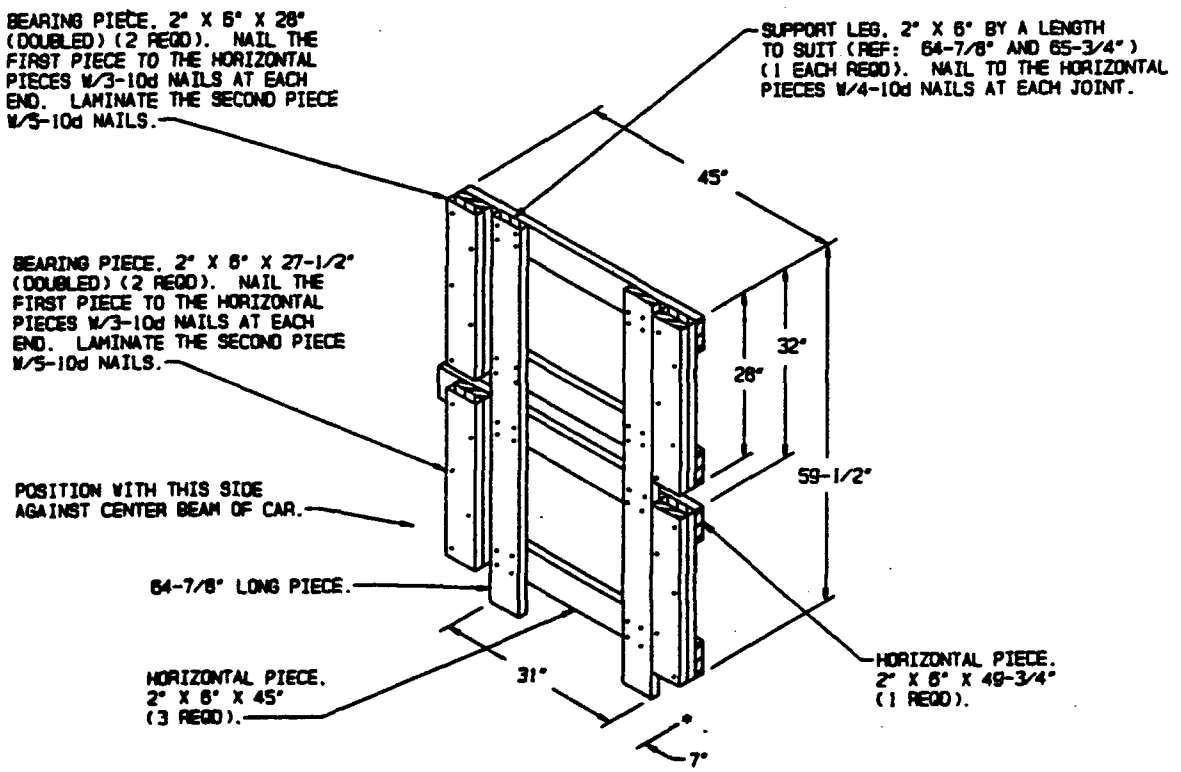
LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
MLRS RP/C	20	101,560 LBS
DUNNAGE		4,520 LBS
TOTAL WEIGHT		106,080 LBS (APPROX)



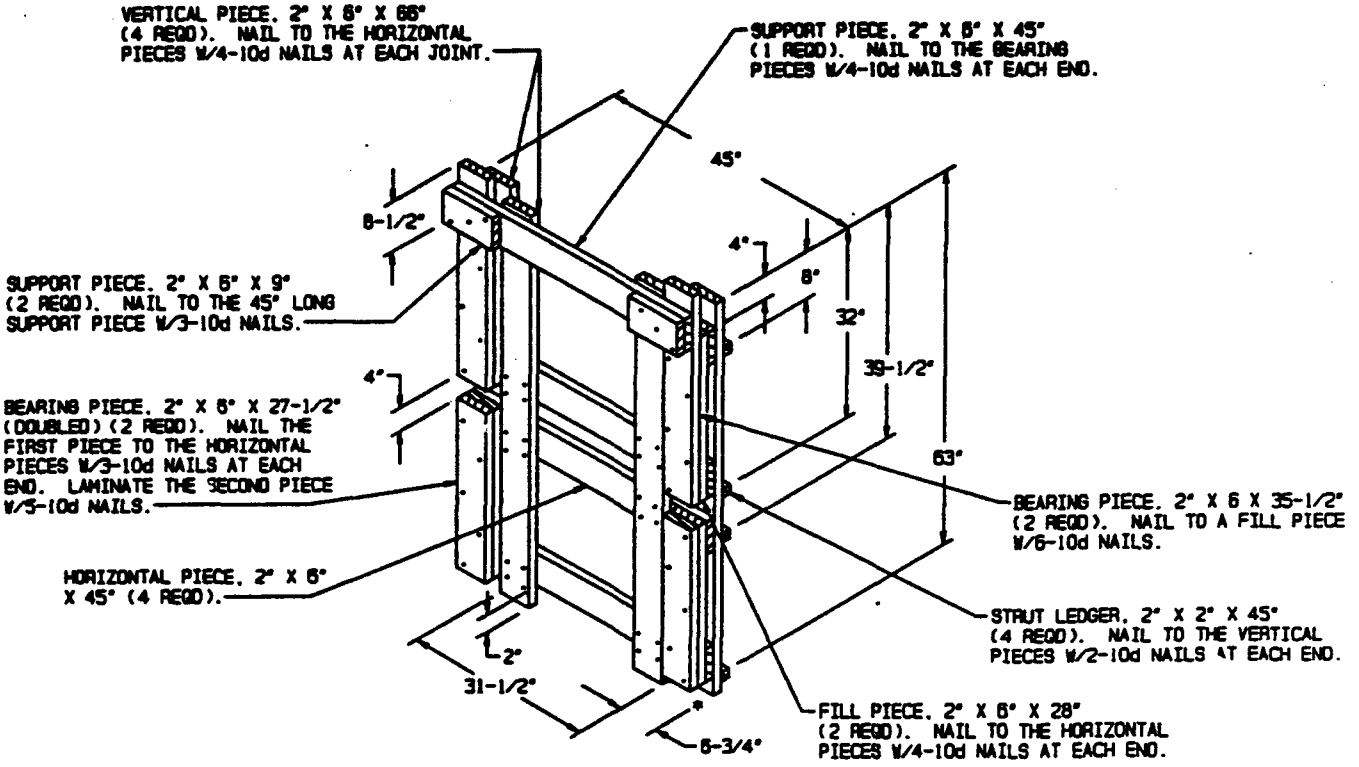
SPACER GATE

(4 REQD)

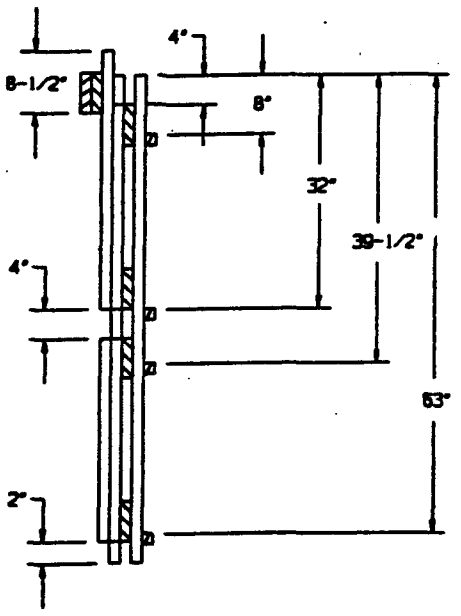


BULKHEAD GATE

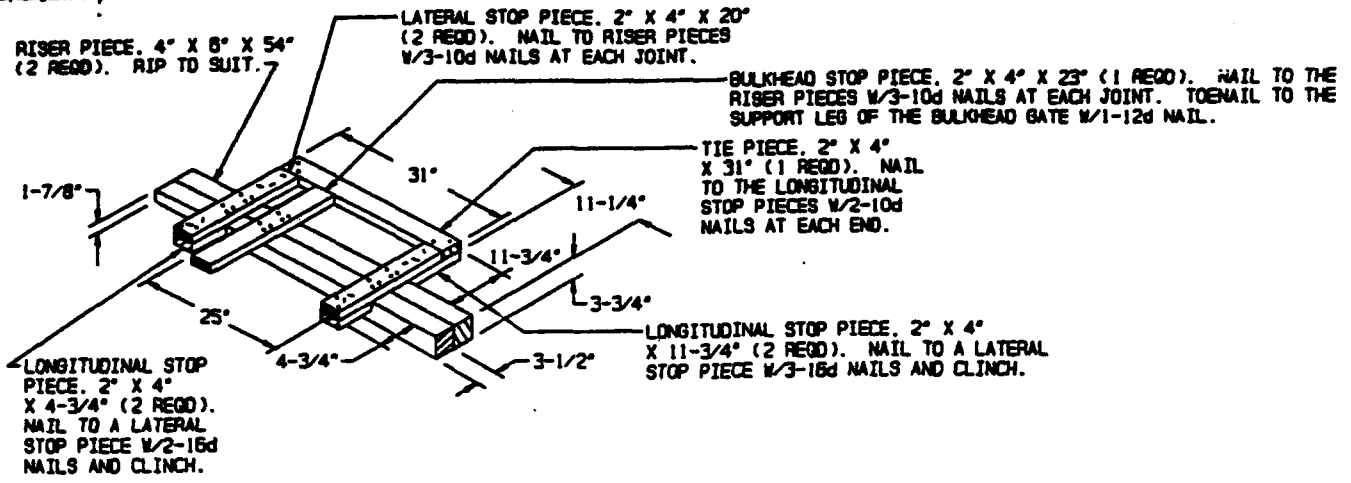
(4 REQD. 2 RIGHT HAND AND 2 LEFT HAND: A RIGHT HAND GATE IS SHOWN).



CENTER GATE
(8 REQD).

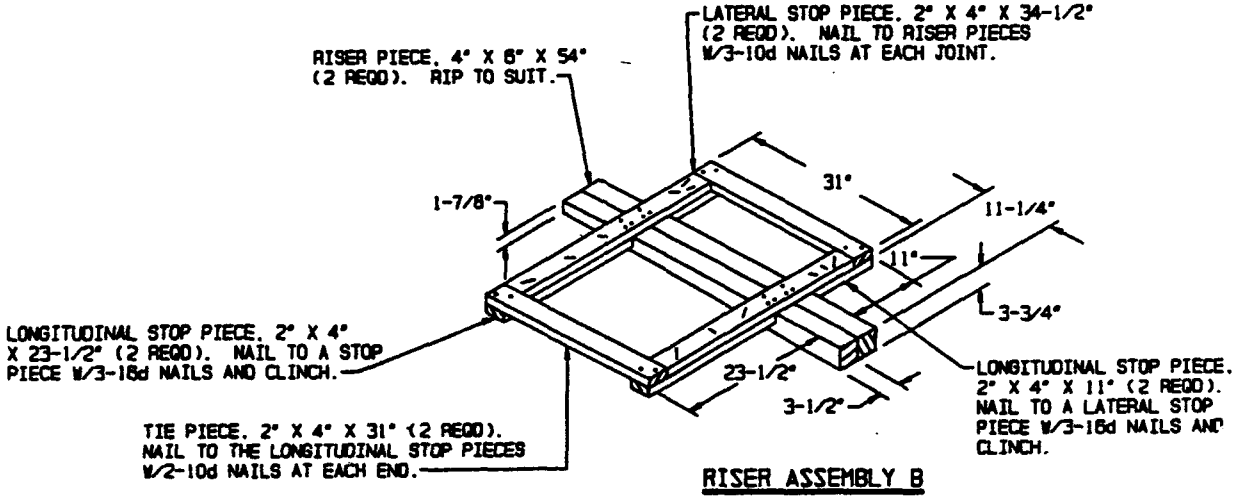


END VIEW



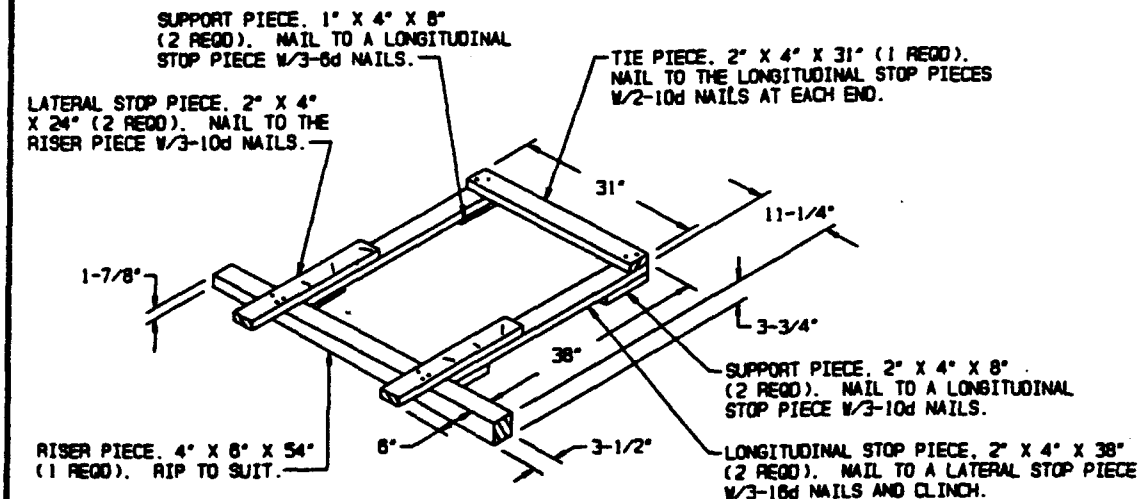
RISER ASSEMBLY A

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



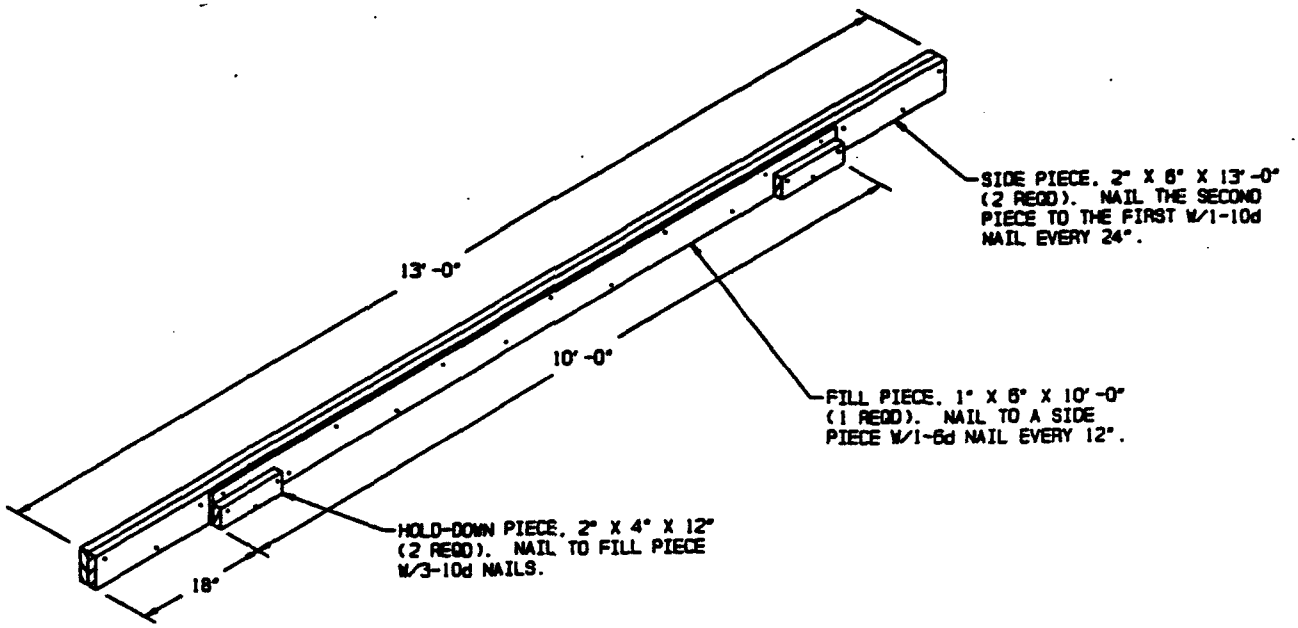
RISER ASSEMBLY B

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



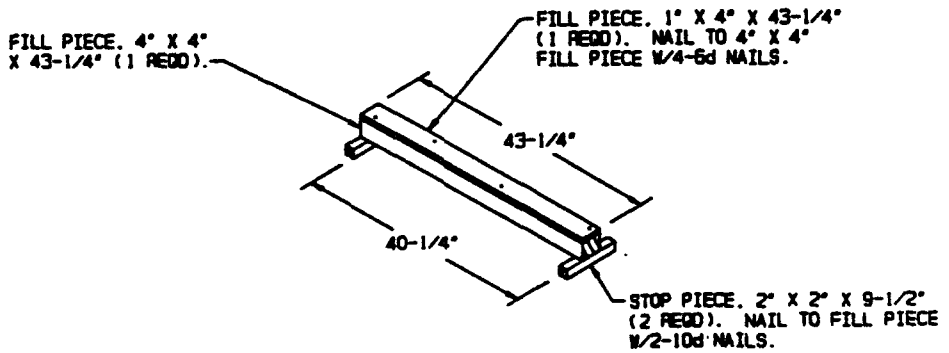
RISER ASSEMBLY C

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.

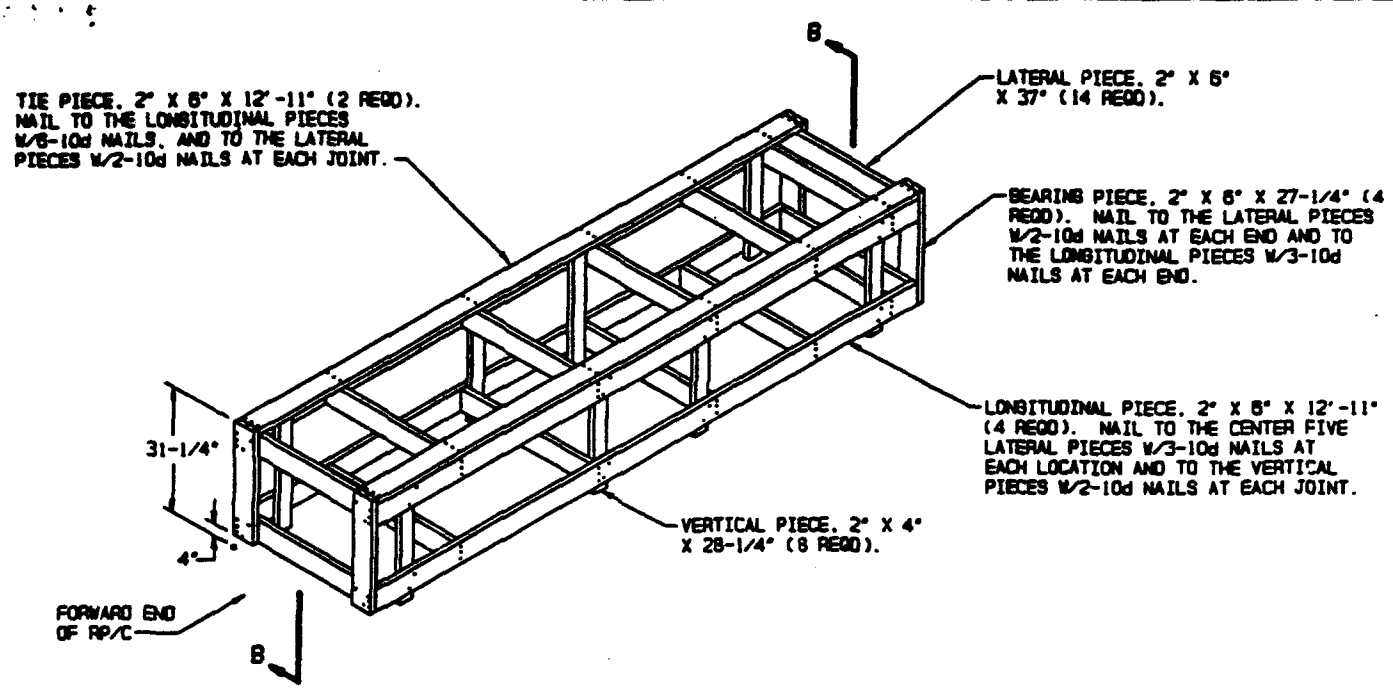


SIDE BLOCKING ASSEMBLY

(10 REQD)

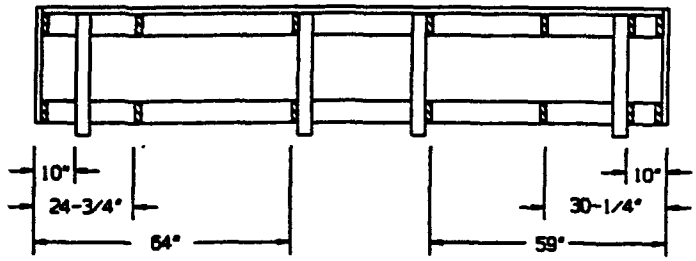


SUPPORT ASSEMBLY



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

APPROVED BY MECH DIV AAR, THEIR LETTER	APPROVED BY BUREAU OF EXPLOSIVES
DATED _____ FILE _____	
SIGNED _____	_____
DATE _____	
MTMCTEA, FT. EUSTIS, VA	DATE _____

MLRS

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

INDEX

✣ PROCEDURES CONTAINED HEREIN 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	DRAFTSMAN	TECHNICIAN	ENGINEER
			L. FIEFFER
APPROVED BY ORDER OF COMMANDING GENERAL, U.S. ARMY MATERIEL COMMAND	VALIDATION ENGINEERING DIVISION	TRANSPORTATION ENGINEERING DIVISION	LOGISTICS ENGINEERING OFFICE
		W. Trimble	W J Ernst
U.S. ARMY DEFENSE AMMUNITION CENTER AND SCHOOL	CLASS	DIVISION	DRAWING	FILE
	19	.48	5542	GM5RS4

DO NOT SCALE

PROJECT GM 835-90

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 BULKHEAD FLATCAR (WITHOUT RISERS) DESIGNATED AS CLASS "FB", WHICH IS 60'-7-1/2" 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.

D. FOR DETAILS OF THE RP/C, SEE U.S. ARMY MISSILE COMMAND DRAWING NO. 13027900, AND PAGE 3.

CONTAINER DIMENSIONS - - 13'-10" 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 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 55-355, CHAPTER 29, FOR EXPLOSIVES AND OTHER DANGEROUS ARTICLES, IN FULL.

G. TO PRECLUDE ABRASION OF RP/C FRAME MEMBERS BY STEEL UNITIZING AND BUNDLING STRAPS, ANTI-CHAFING MATERIAL WILL BE PLACED AT ALL POINTS OF CONTACT. ALSO, UNITIZATION STRAPS, BUNDLING STRAPS, AND HOLD-DOWN 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.

H. CAUTION: STAKE POCKETS ON FLATCARS WILL BE USED FOR ANCHORING HOLD-DOWN STRAPPING WHENEVER POSSIBLE. DO NOT USE SWIVEL RING TYPE ANCHOR DEVICES. IF OTHER TYPES ARE USED, THEY MUST BE OF SUFFICIENT WIDTH TO RECEIVE 2" STRAPPING, AND ALSO BE OF A DESIGN WHICH WILL PROVIDE A BEARING SURFACE, ACROSS THE FULL WIDTH OF THE STRAPPING, THAT WILL NOT DEFORM A STRAP, ESPECIALLY AT THE EDGES, WHEN IT IS TENSIONED.

J. REFER TO ASSOCIATION OF AMERICAN RAILROADS MANUAL "GENERAL RULES GOVERNING THE LOADING OF COMMODITIES ON OPEN TOP CARS" FOR APPLICABLE LOADING RULES AS FOLLOWS: PREFACE, 1A, 2, 5, AND 15. NOTE THAT ALL STRAPPING USED FOR LOAD SECUREMENT, I.E., HOLD-DOWN STRAPS, MUST BE MARKED AS SPECIFIED IN LOADING RULE 15.

K. A STAGGERED NAILING PATTERN WILL BE USED WHENEVER POSSIBLE WHEN NAILS ARE DRIVEN INTO JOINTS OF DUNNAGE ASSEMBLIES. ALSO, A STAGGERED NAILING PATTERN WILL BE USED WHEN DUNNAGE IS NAILED TO THE FLOOR OF THE TRANSPORTING VEHICLE, OR WHEN LAMINATING DUNNAGE. THE NAILING 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 ONTO OR RIGHT BESIDE A NAIL IN A LOWER PIECE.

L. 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 SPECIFIED HEREIN MUST BE FOLLOWED AS CLOSELY AS POSSIBLE FOR BLOCKING, BRACING, AND STAYING OF THE UNITS. NOTICE: A SHIPMENT WILL BE POSITIONED ON THE RAIL CAR IN COMPLIANCE WITH THE WEIGHT DISTRIBUTION REQUIREMENTS OF THE AAR.

M. IF THE CAR BEING USED FOR A SHIPMENT IS EQUIPPED WITH A NAILABLE METAL FLOOR AND A NAIL SIZE FOR FLOOR NAILING IS MARKED ON THE CAR, THAT GUIDANCE SHOULD BE APPLIED TO THE NAILING OF ALL FLOORLINE BLOCKING PIECES TO THE CAR FLOOR. IF A NAIL SIZE IS NOT SPECIFIED ON THE CAR, 30d NAILS SHOULD 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.

(CONTINUED AT RIGHT)

(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 KEPT AS SHORT 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 APPLY AN ADDITIONAL SET OF HORIZONTAL AND VERTICAL STRUT BRACING PIECES. STRUT BRACING SHOULD BE APPLIED SO AS TO PROVIDE NEARLY EQUAL SPACES BETWEEN THE BRACING PIECES AND THE CENTER GATE 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. PORTIONS 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 0.454KG.

R. TO ACHIEVE A TIGHTLY BLOCKED LOAD, A STRUT WILL BE CUT SLIGHTLY LONGER THAN THE MEASURED 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 ONE GATE. 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.

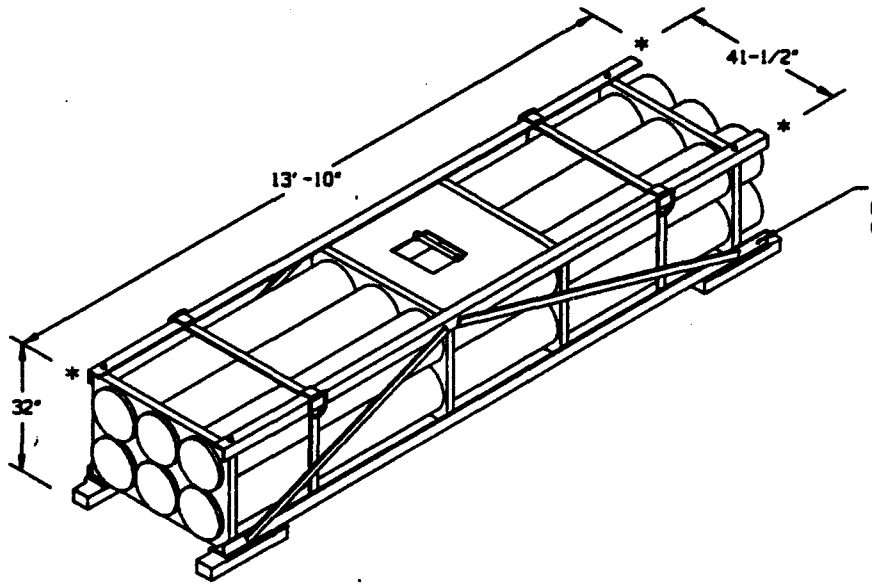
S. IF THE RAILCAR BEING USED IS NOT EQUIPPED WITH PLACARD BOARDS ON BOTH ENDS AND BOTH SIDES, 16" X 24" BOARDS MUST BE PROVIDED AS REQUIRED. CAUTION: BOARDS AND BOARD MOUNTING BRACKETS MUST NOT BE NAILED TO THE LADING.

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 SNUG FIT WITH THE RP/Cs IS OBTAINED. ALSO, ADJUSTMENTS MAY BE REQUIRED AS TO THE LOCATION OF CERTAIN PIECES OF DUNNAGE IN AN ASSEMBLY IN ORDER FOR THE DUNNAGE ASSEMBLY TO CONTACT THE RP/C AT ITS STRONGPOINT (I.E., ITS FRAME MEMBERS). THE IDEAL THICKNESS OF A SUPPORT ASSEMBLY WILL BE SUCH THAT THE ASSEMBLY WILL BE SLIGHTLY SNUG WHEN IN POSITION. THE TIGHTNESS OF THE SUPPORT PIECES ON THE FLOOR OF THE FLATCAR SHOULD BE SIMILAR. ASSEMBLIES CONSTRUCTED TO THE APPROPRIATE THICKNESS WILL ENSURE PROPER INTERLOCK ENGAGEMENT WITHOUT ALLOWING UNDO STRESS TO BE APPLIED TO THE RP/C FRAME WHEN STEEL STRAPPING IS APPLIED.

U. DUNNAGE 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" BY 3-1/2" WIDE.

MATERIAL SPECIFCATIONS

LUMBER - - - - -	SEE TM 743-200-1 (DUNNAGE LUMBER) AND FED SPEC MM-L-751.
NAILS - - - - - - - -	FED SPEC FF-N-105; COMMON.
STRAPPING, STEEL - -	FED SPEC QQ-S-781; CLASS 1, TYPE I OR IV, HEAVY DUTY, FINISH A, B (GRADE 2), OR C.
SEAL, STRAP - - - -	FED SPEC QQ-S-781; TYPE D, STYLE I, II, OR IV, CLASS H, FINISH A, B (GRADE 2) OR C.
WIRE - - - - - - - - -	FED SPEC QQ-W-461; ANNEALED, BLACK.
STAPLE, STRAP - - -	COMMERCIAL GRADE.
STAKE POCKET PROTECTOR - -	COMMERCIAL GRADE.
ANTI-CHAFING MATERIAL - - - - -	MIL-B-121 (OR EQUAL); NEUTRAL BARRIER MATERIAL.



ROCKET POD/CONTAINER

SPECIAL HANDLING GUIDANCE

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

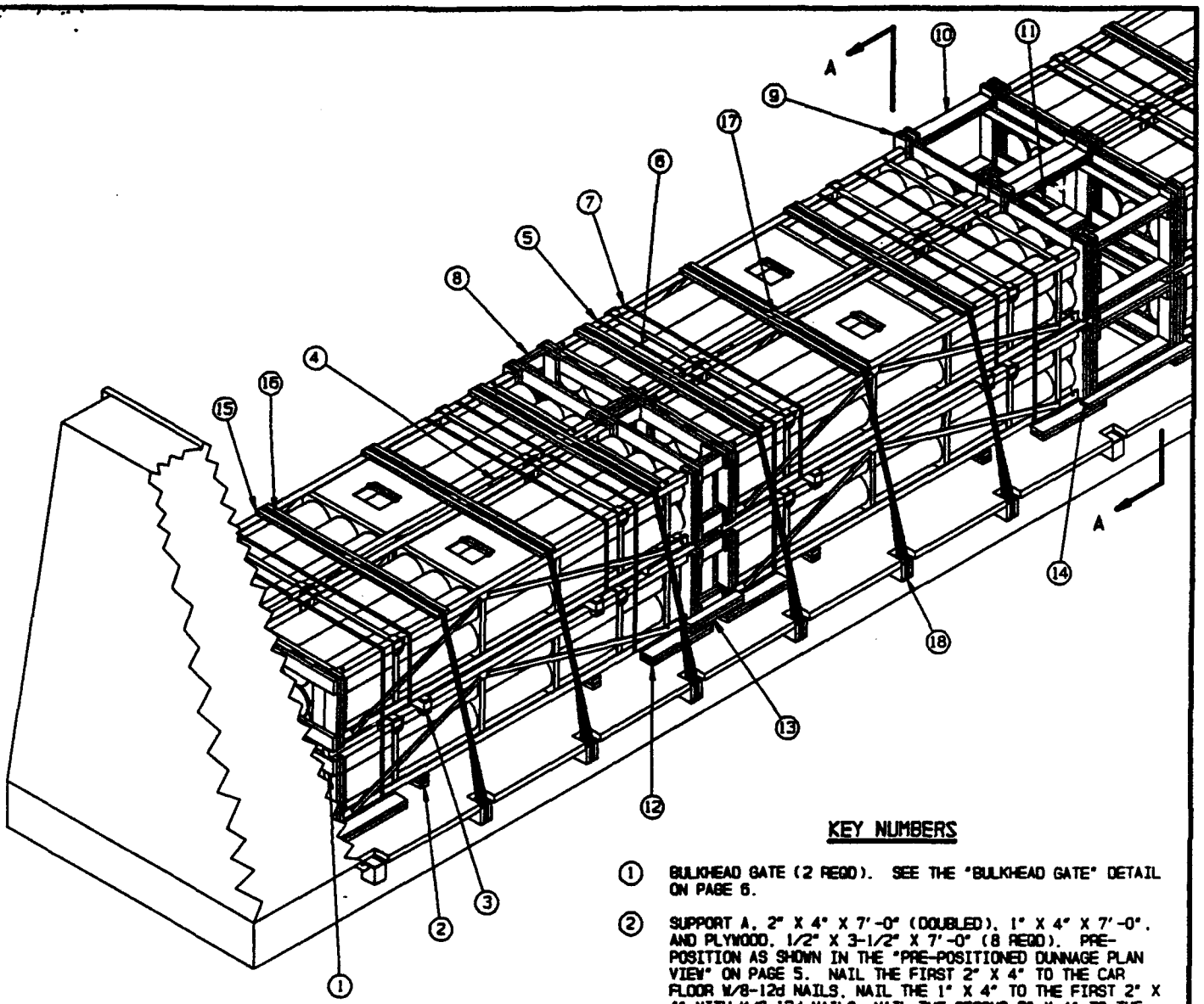
NOTES: (1) MATERIALS HANDLING EQUIPMENT (MHE) IS INTENDED TO MEAN EQUIPMENT, SUCH AS FORKLIFT TRUCKS, CRANES, HAND TRUCKS, DOLLIES, ROLLER ASSEMBLIES, SLINGS, AND SPREADER BARS, THAT CAN BE USED TO HANDLE THE DEPICTED ASSEMBLIES.

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

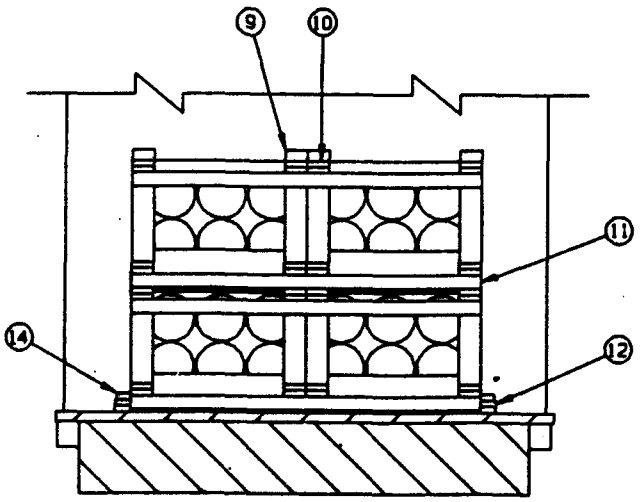
A. IF AVAILABLE MHE DOES NOT HAVE AN ALLOWABLE CAPACITY GREAT ENOUGH TO CARRY A STACK OF TWO ASSEMBLIES (APPROXIMATELY 10,200 POUNDS) IN ONE LIFT, THEN THE ASSEMBLIES MUST BE HANDLED INDIVIDUALLY. ONLY APPROVED AND APPROPRIATELY SIZED MHE WILL BE USED FOR THE HANDLING OF THE DEPICTED ASSEMBLIES.

B. WHEN AN ASSEMBLY STACK IS BEING UNITIZED, CARE MUST BE EXERCISED WHEN TIGHTENING THE STRAPS TO INSURE 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.



ISOMETRIC VIEW



SECTION A-A

STRAPPING OMITTED FOR CLARITY PURPOSES.

KEY NUMBERS

(1) BULKHEAD GATE (2 REQD). SEE THE "BULKHEAD GATE" DETAIL ON PAGE 6.

(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 DUNNAGE PLAN VIEW" ON PAGE 5. NAIL THE FIRST 2" X 4" TO THE CAR FLOOR W/8-12d NAILS. NAIL THE 1" X 4" TO THE FIRST 2" X 4" WITH W/8-12d NAILS. NAIL THE SECOND 2" X 4" TO THE 1" X 4" W/8-12d NAILS, AND NAIL THE PLYWOOD TO THE SECOND 2" X 4" W/8-6d NAILS. SEE GENERAL NOTE "T" ON PAGE 2.

(3) SUPPORT B (8 REQD). SEE THE "SUPPORT B" DETAIL AND THE SPECIAL NOTE ON PAGE 7, AND GENERAL NOTES "K" AND "T" ON PAGE 2.

(4) ANTI-CHAFING PIECE, 1" X 6" X 62" AND 2" X 6" X 62", (8 REQD). LAMINATE THE 1" X 6" PIECE TO THE 2" X 6" PIECE W/6-6d NAILS. WIRE TIE TO THE FRAME MEMBERS OF BOTH THE TOP AND BOTTOM MLRS PODS WITH 18" OF 14 GAGE WIRE AT EACH LOCATION.

(5) UNITIZING STRAP, 1-1/4" X .035" OR .031" X 19'-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.

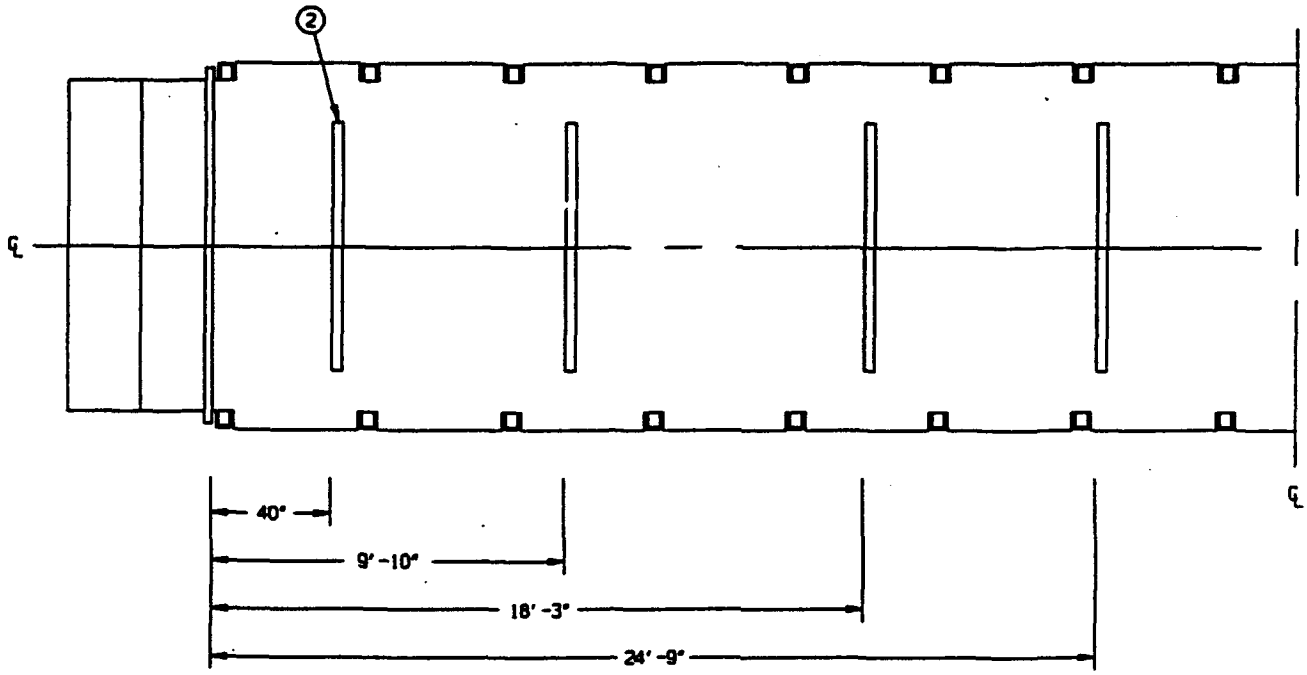
(7) BUNDLING STRAP, 1-1/4" X .035" OR .031" X 21'-0" LONG STEEL STRAPPING (8 REQD). INSTALL TO ENCIRCLE LATERALLY ADJACENT CONTAINERS IN THE TOP LAYER AS SHOWN.

(8) FILL ASSEMBLY (2 REQD). SEE THE "FILL ASSEMBLY" DETAIL ON PAGE 7.

(9) CENTER GATE (2 REQD). SEE THE "CENTER GATE" DETAIL ON PAGE 6.

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

(CONTINUED ON PAGE 5)



PRE-POSITIONED DUNNAGE PLAN VIEW

(KEY NUMBERS CONTINUED FROM PAGE 4)

⑪ STRUT LEDGER. 2" X 4" X 7'-3" (2 REQD). POSITION ON THE SECOND LEVEL OF STRUTS AND NAIL TO THE CENTER GATE VERTICAL PIECES W/3-10d NAILS AT EACH JOINT.

⑫ SIDE BLOCKING. 2" X 6" X 30" (DOUBLED) (16 REQD). LOCATE ADJACENT TO THE RP/C SKIDS. LOCATE THE SIDE BLOCKING PIECES AT EACH END OF THE LOAD SO AS TO BUTT UP AGAINST THE BULKHEAD. NAIL THE FIRST PIECE TO THE CAR FLOOR W/8-20d NAILS. NAIL THE SECOND PIECE TO THE FIRST W/8-30d NAILS.

⑬ SIDE BLOCKING FOR FILL ASSEMBLY. 2" X 4" X 24" (DOUBLED) (4 REQD). NAIL THE FIRST PIECE TO THE SIDE BLOCKING PIECES W/4-10d NAILS AT EACH END. NAIL THE SECOND PIECE TO THE FIRST W/6-10d NAILS.

⑭ SIDE BLOCKING FOR CENTER GATE. 2" X 4" X 48" (2 REQD). NAIL TO THE SIDE BLOCKING PIECES W/4-10d NAILS AT EACH END.

⑮ STRAPPING BOARD. 2" X 6" X 6'-10" (12 REQD).

⑯ HOLD-DOWN STRAP. 2" X .050" X 27'-0" LONG STEEL STRAPPING (12 REQD). INSTALL EACH STRAP FROM TWO 13'-6" LONG PIECES.

⑰ SEAL FOR 2" STRAPPING (96 REQD. 8 PER ⑯ STRAP). CRIMP EACH SEAL WITH TWO PAIR OF NOTCHES, EXCEPT THOSE USED TO SECURE THE PADS. PIECES MARKED 18.

⑱ PAD. 2" X .050" X 18" LONG STEEL STRAPPING (24 REQD). POSITION UNDER STAKE POCKET AND SEAL TO HOLD-DOWN STRAP. PIECE MARKED 16 WITH ONE SEAL CRIMPED WITH ONE PAIR OF NOTCHES. SEE "DETAIL A" ON PAGE 8.

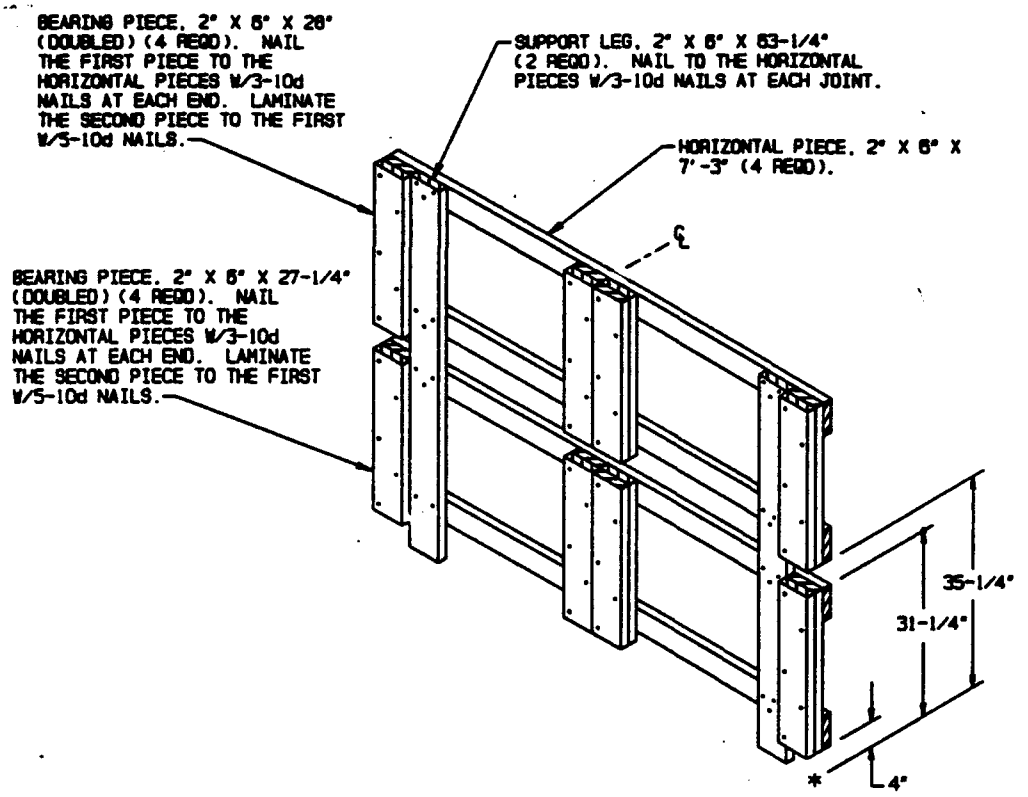
BILL OF MATERIAL

LUMBER	LINEAR FEET	BOARD FEET
1" X 4"	116	39
1" X 6"	42	21
2" X 3"	5	3
2" X 4"	187	125
2" X 6"	1.010	1.010
4" X 4"	60	80
NAILS	**NO. REQD**	**POUNDS**
6d (2")	176	1-1/4
10d (3")	1.480	22-3/4
12d (3-1/4")	256	4-1/2
20d (4")	128	4-3/4
30d (4-1/2")	128	6-1/2

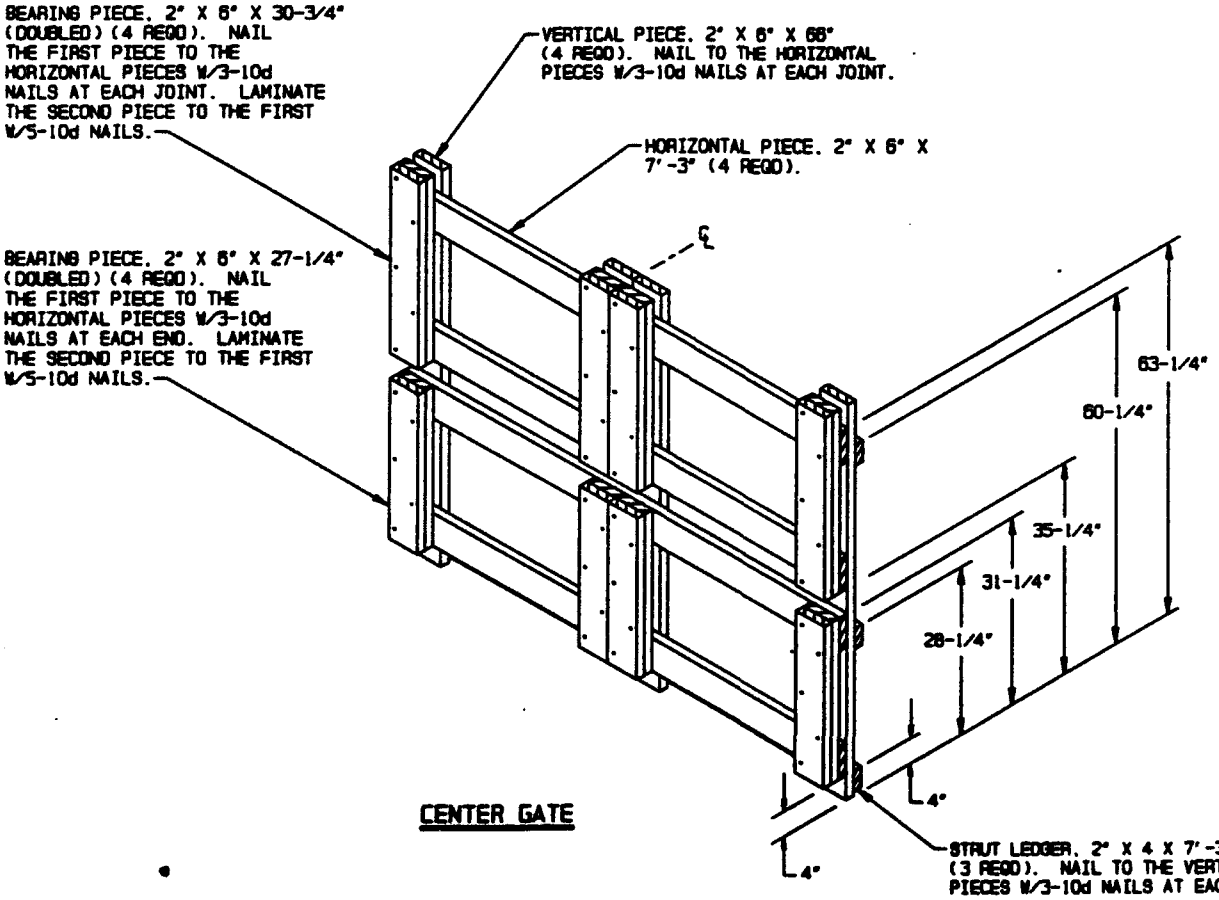
STEEL STRAPPING, 1-1/4"	472'	REQD	68 LBS
SEAL FOR 1-1/4" STRAPPING	48	REQD	2-1/4 LBS
STEEL STRAPPING, 2"	360'	REQD	120 LBS
SEAL FOR 2" STRAPPING	96	REQD	20 LBS
PLYWOOD, 1/2"	16.33 SQ FT	REQD	22-1/2 LBS
WIRE, NO. 14 GAGE	24'	REQD	1/2 LBS

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
MLRS RP/C	16	81,248 LBS
DUNNAGE		2,829 LBS
TOTAL WEIGHT		84,077 LBS (APPROX)

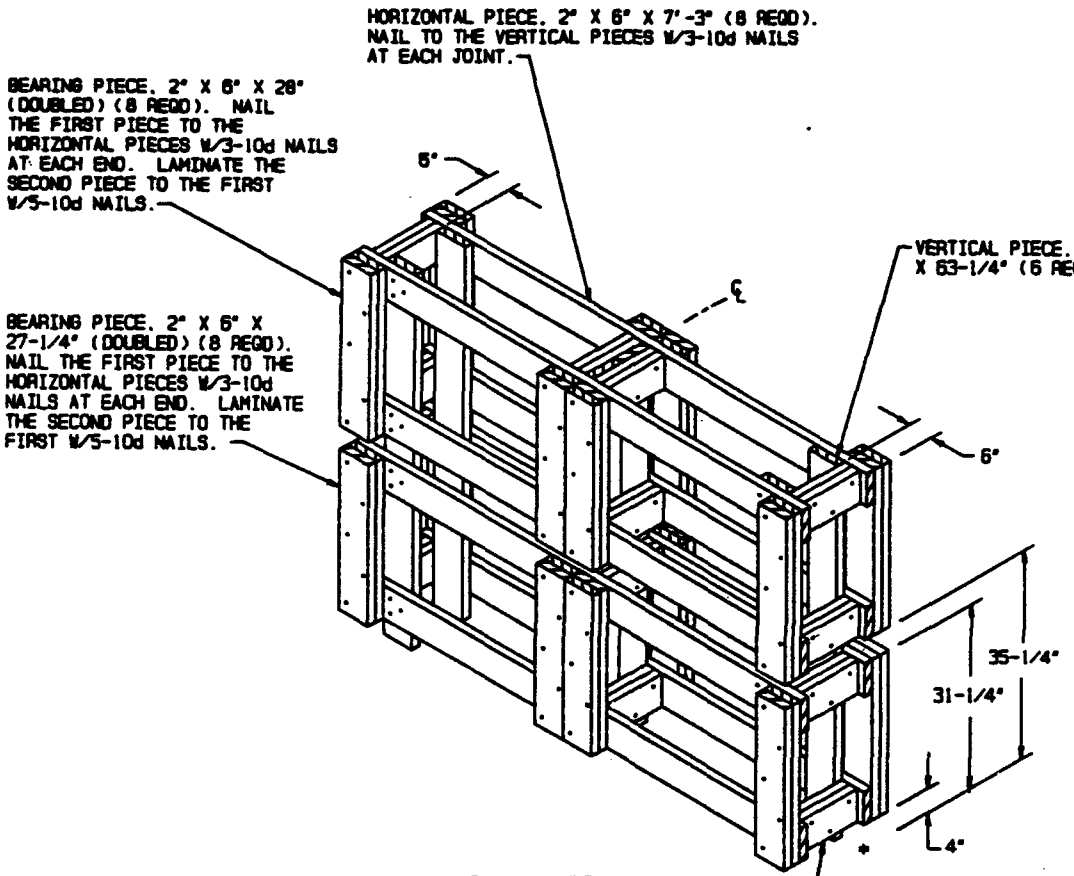


BULKHEAD GATE

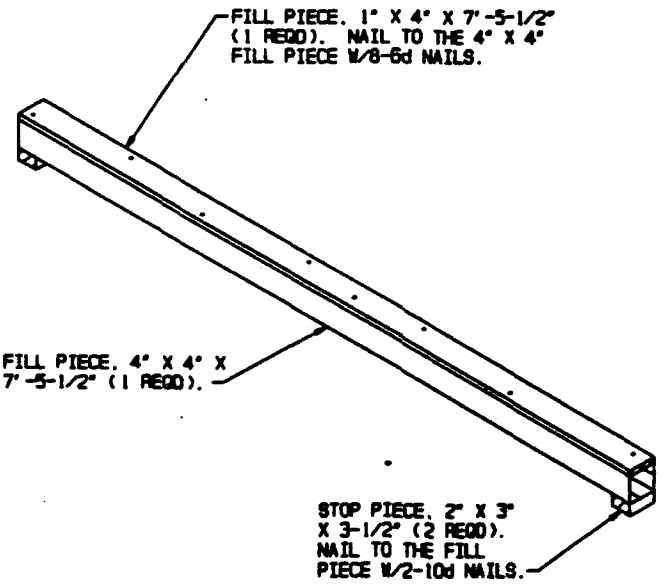


CENTER GATE

PROJECT GM 835-90



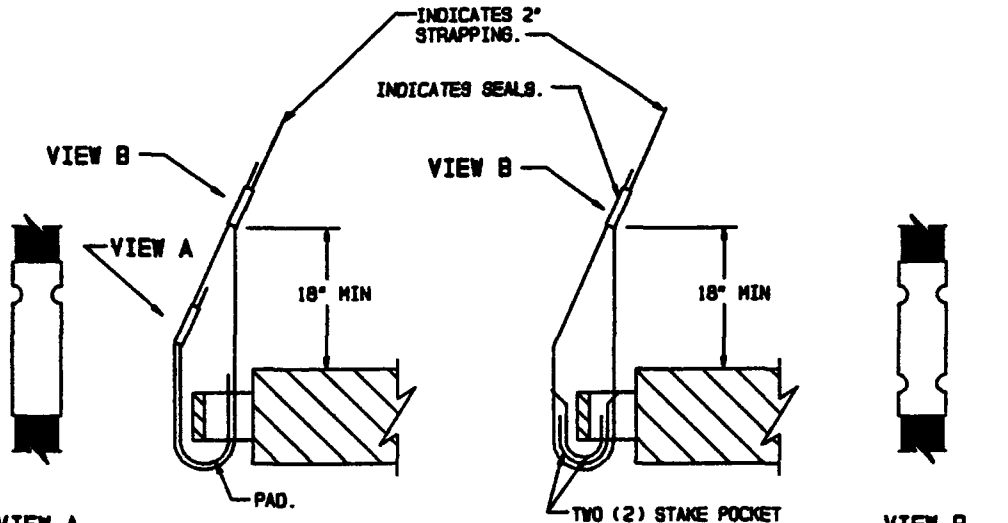
FILL ASSEMBLY



SUPPORT B

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 FOR 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.



VIEW A

ONE SEAL WITH ONE PAIR OF CRIMPS.

VIEW B

ONE SEAL WITH TWO PAIR OF CRIMPS.

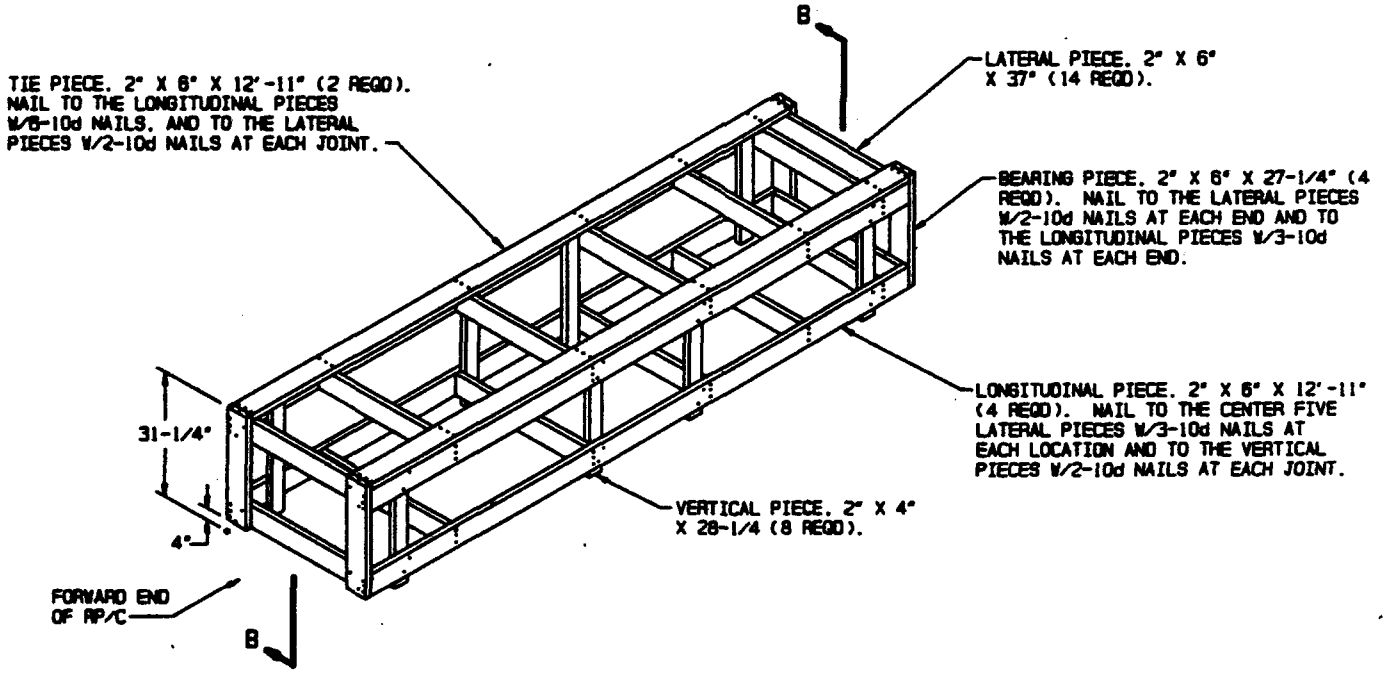
DETAIL A

METHOD OF INSTALLING 2" STRAPPING AND PAD AT ANCHORING FACILITY.

DETAIL B

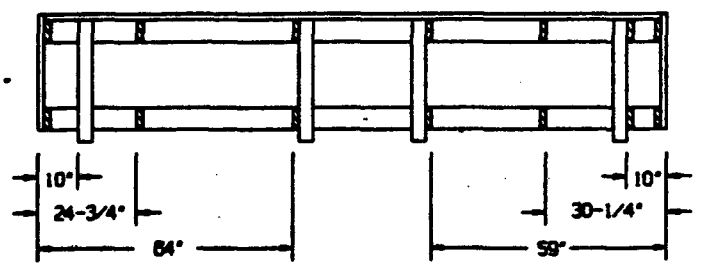
METHOD OF INSTALLING 2" STRAPPING AND STAKE POCKET PROTECTORS (ALT PAD).

HOLD-DOWN STRAP ANCHORING DETAILS



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.

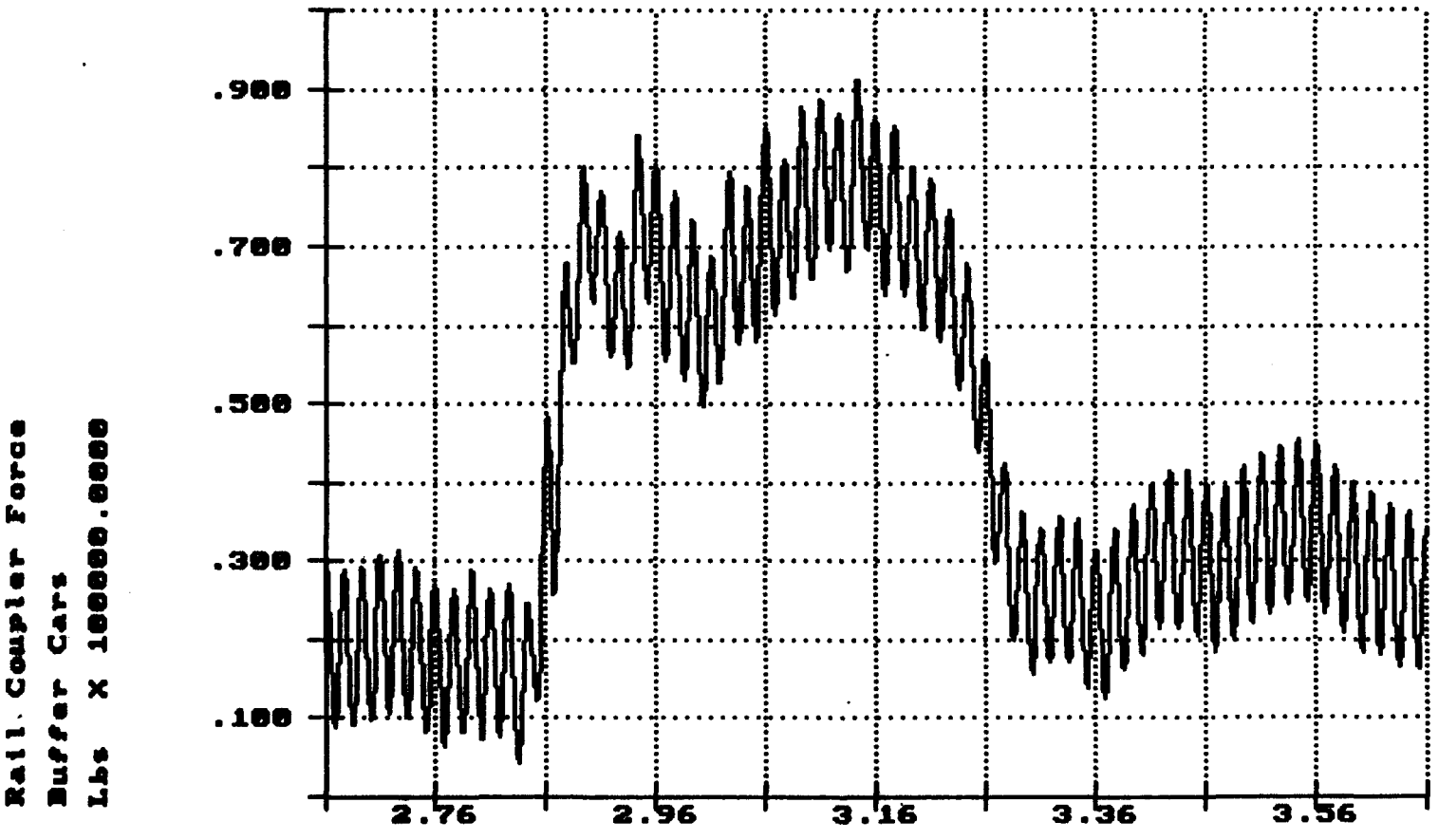


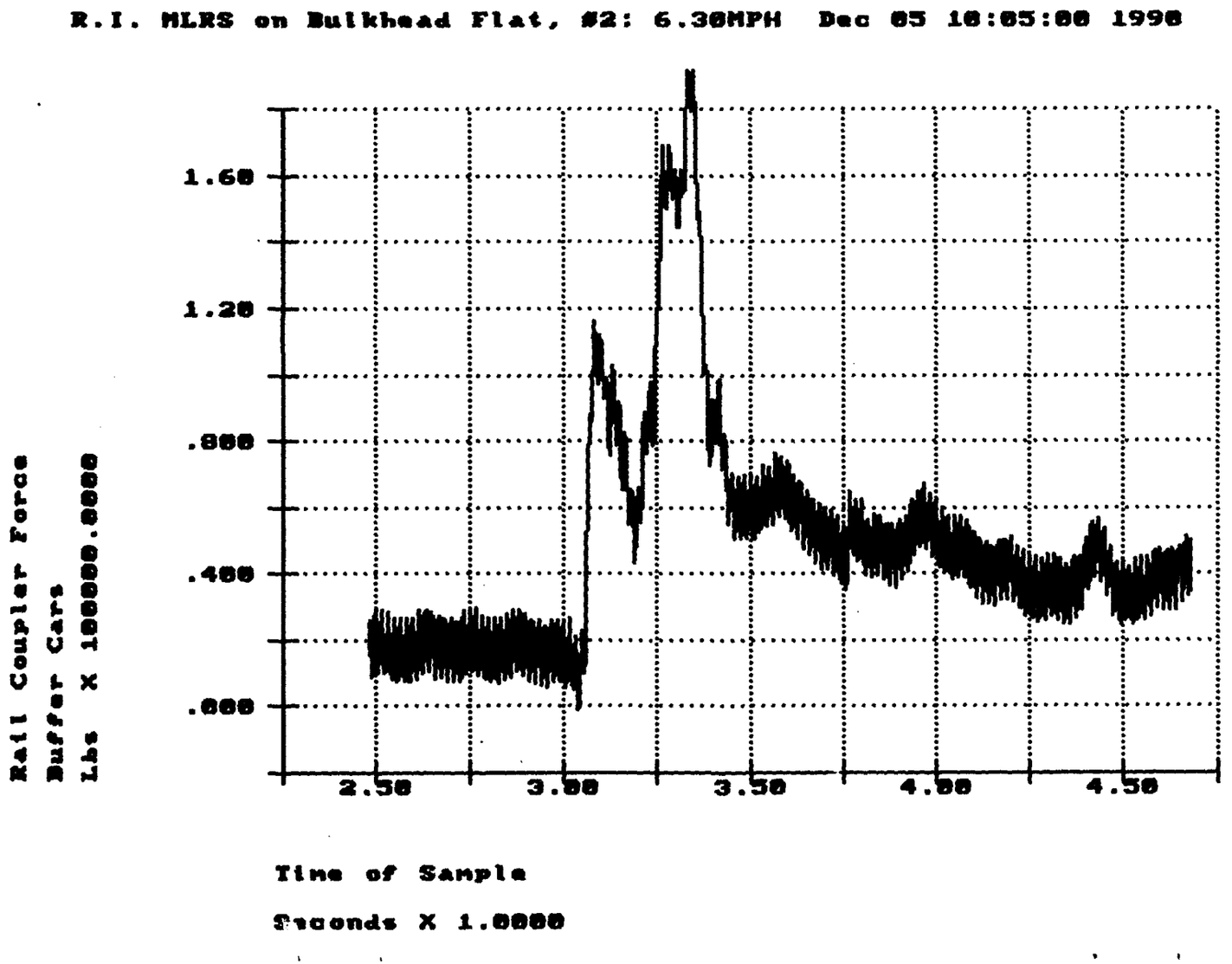
SECTION B-B

PART 7

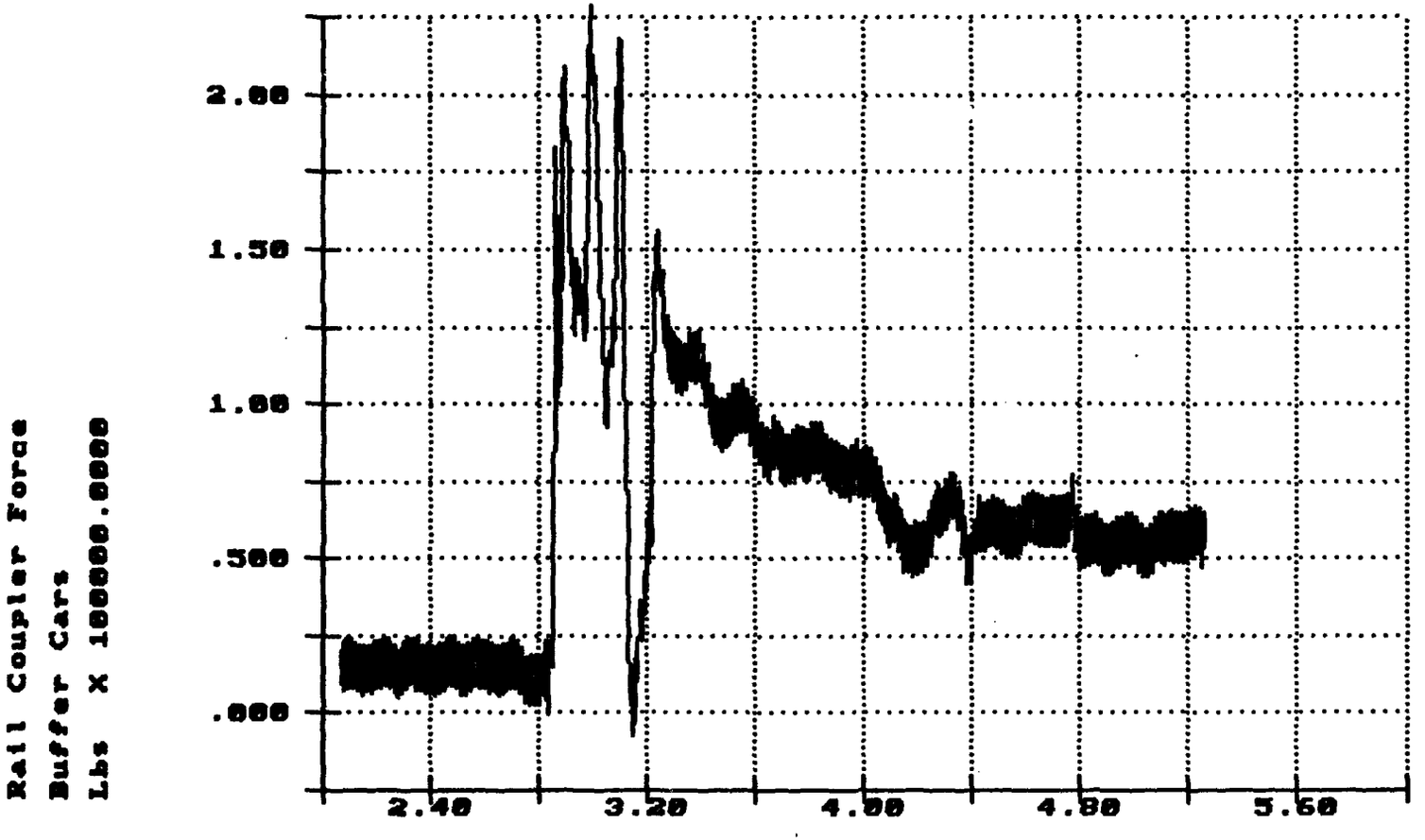
RAIL COUPLER DATA

R.I. MLRS on Bulkhead Flat, #1: 4.36MPH Dec 05 10:00:00 1990




R.I. MLRS on Bulkhead Flat, #2: 6.30MPH Dec 05 10:05:00 1998
Rail Coupler Force
Buffer Cars
Lbs X 100000.0000
1.60
1.20
.800
.400
.000
2.50
3.00
3.50
4.00
4.50
Time of Sample
Seconds X 1.0000

R.I. MLRS on Bulkhead Flat, #3: 8.43MPH Dec 05 10:10:00 1990



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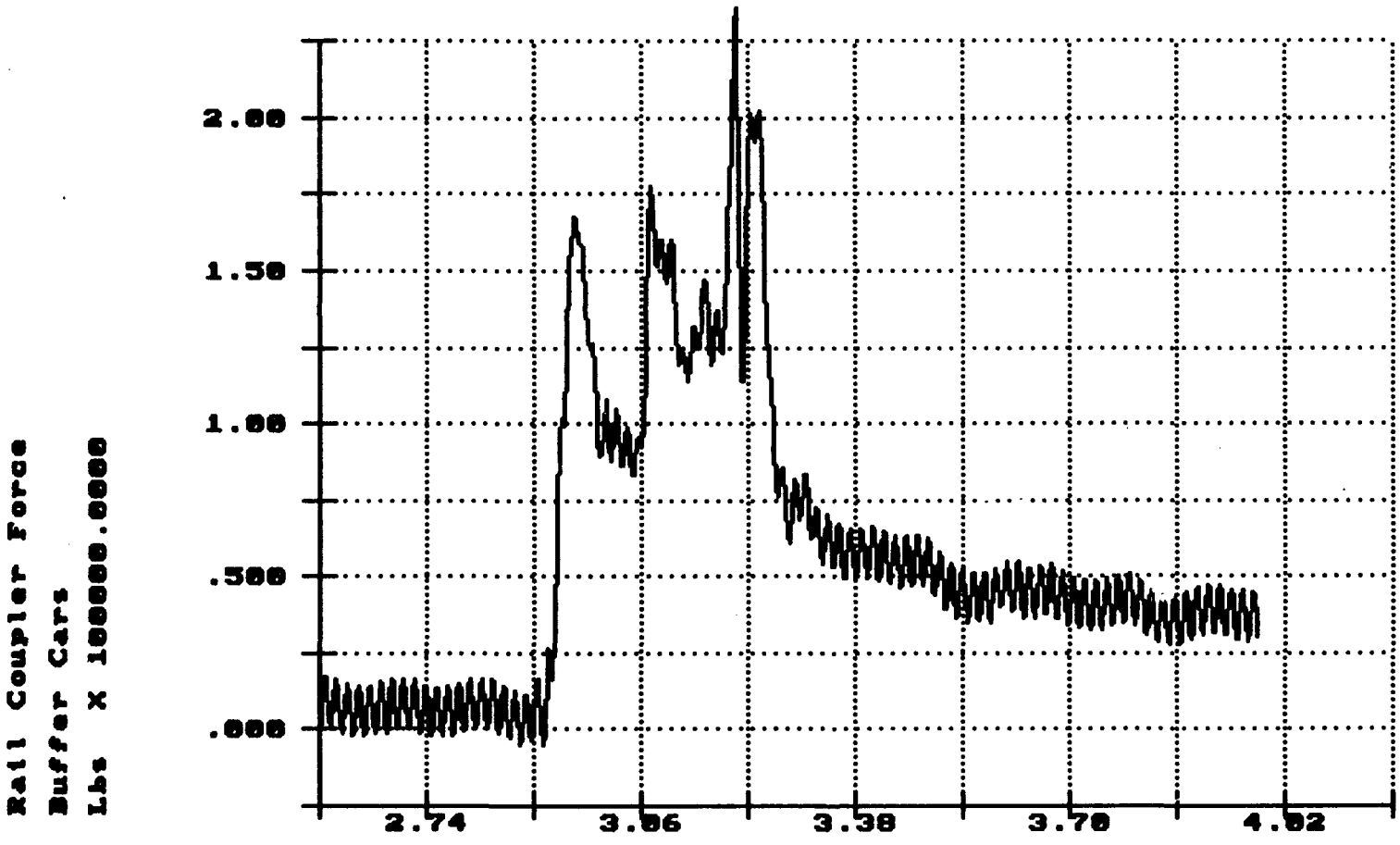

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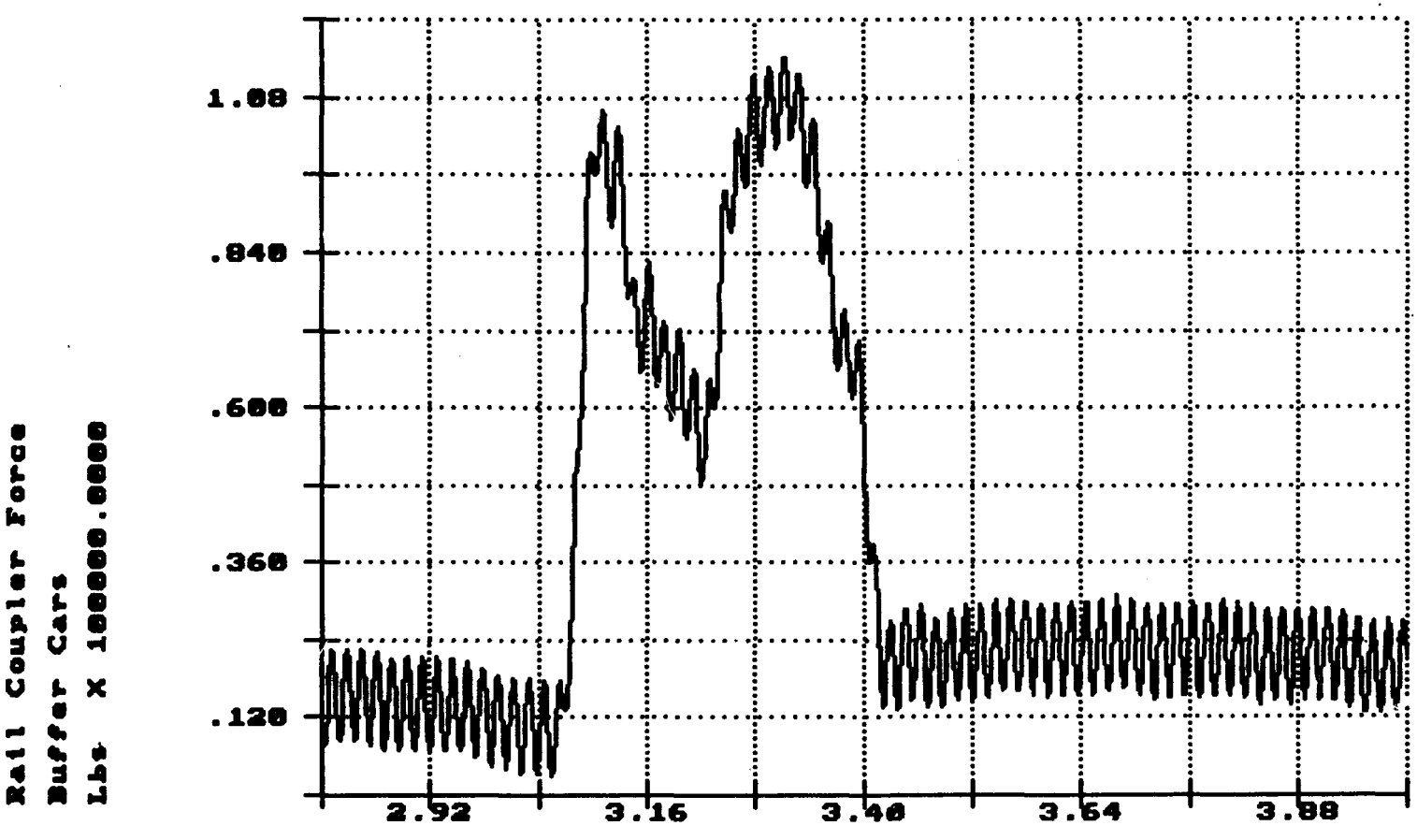

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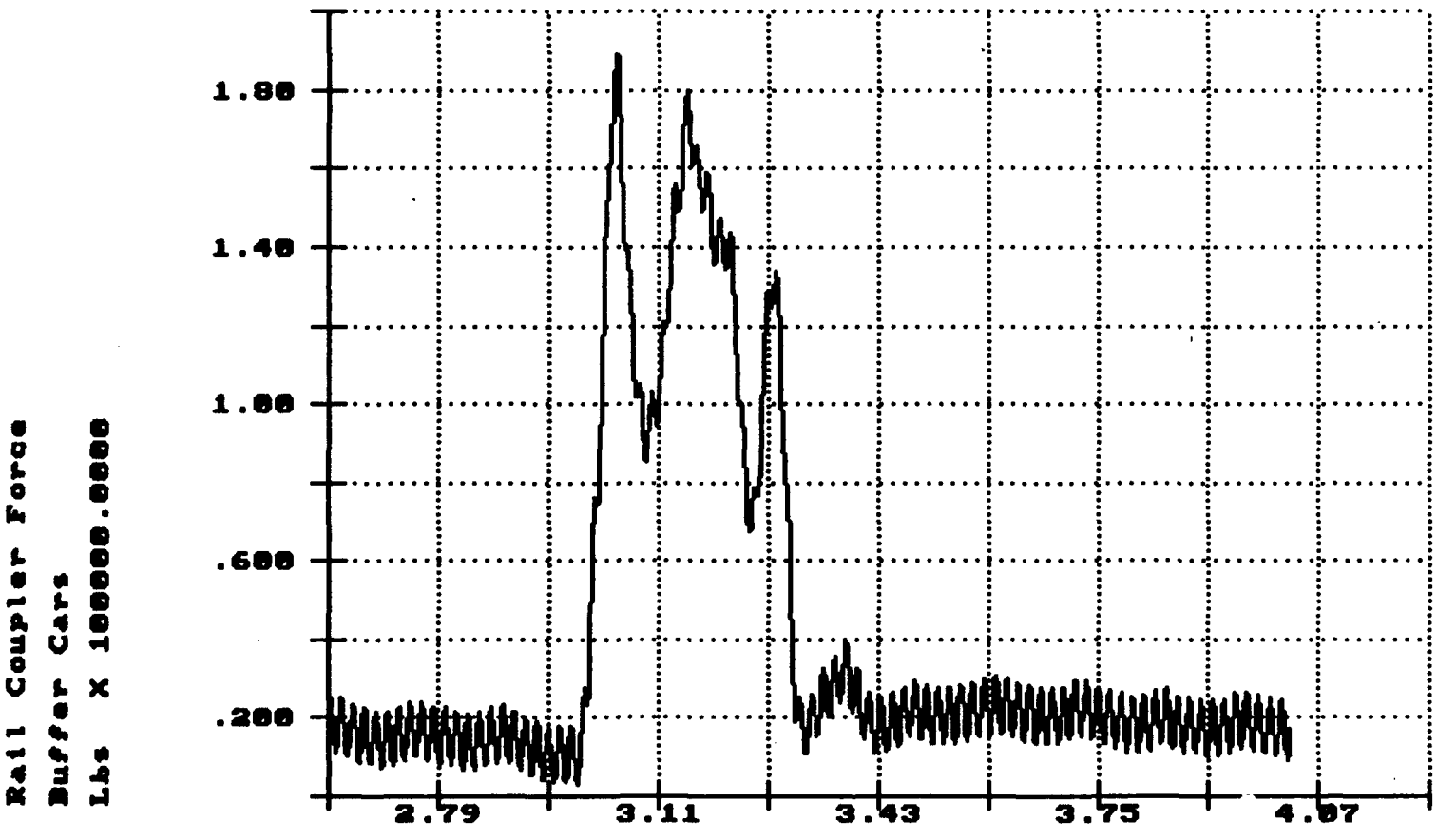

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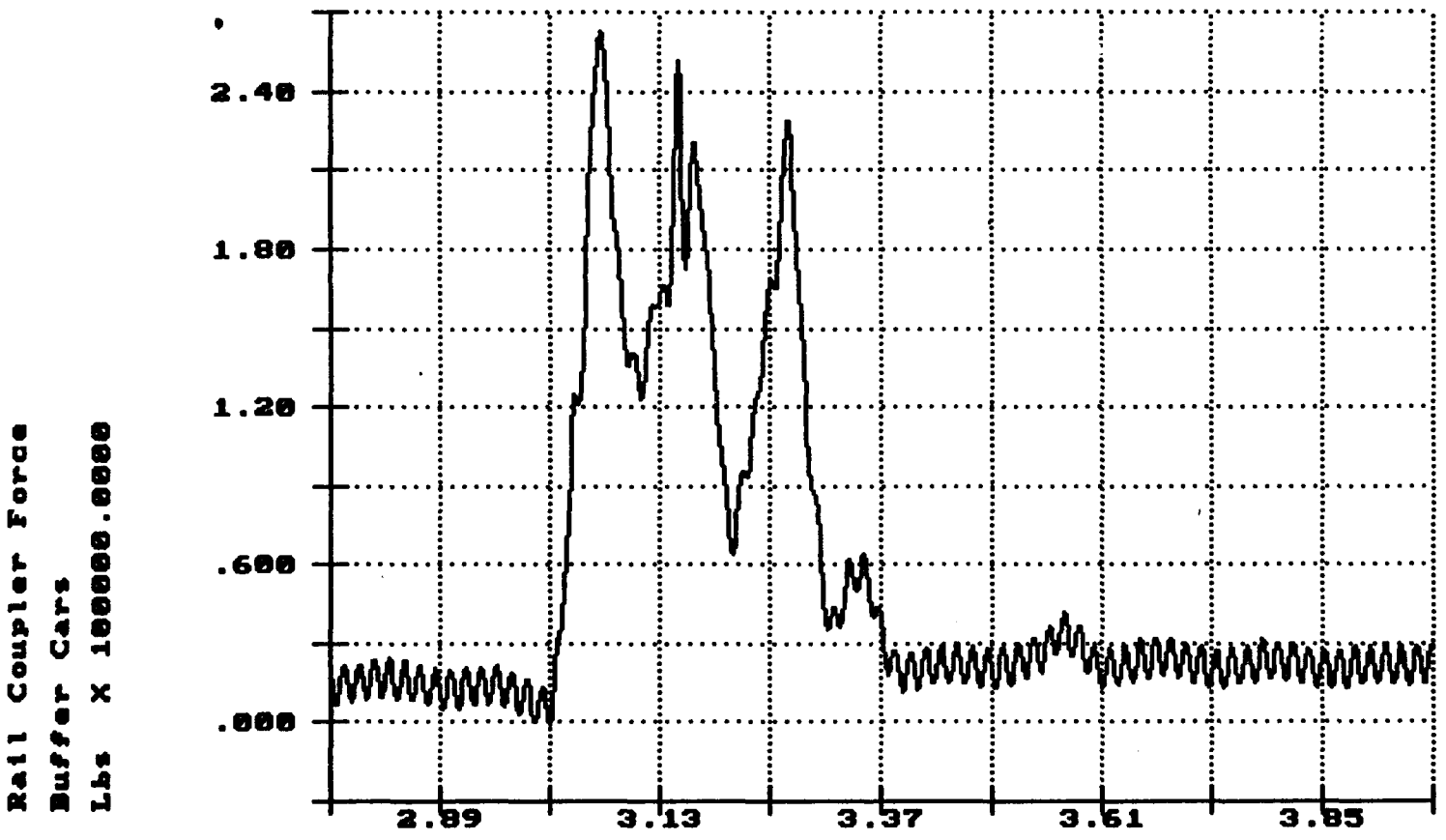

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