

**FINAL REPORT
JUNE 2008**

REPORT NO. 08-07



**EXCALIBUR STRATEGIC CONFIGURED LOAD (SCL) FOR THE
HEAVY EXPANDED MOBILITY TACTICAL TRUCK (HEMTT)
TESTING IAW**

**TP-94-01, REVISION 2, JUNE 2004,
"TRANSPORTABILITY TESTING PROCEDURES"**

Prepared for:

Distribution Unlimited:

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ATTN: SFAE-AMO-CAS-EX
Picatinny Arsenal, NJ 07806



**DEFENSE AMMUNITION CENTER
VALIDATION ENGINEERING DIVISION
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**EXCALIBUR STRATEGIC CONFIGURED LOAD (SCL) FOR THE
HEAVY EXPANDED MOBILITY TACTICAL TRUCK (HEMTT)
TESTS IAW -TP-94-01, REVISION 2, JUNE 2004,
"TRANSPORTABILITY TESTING PROCEDURES"**

ABSTRACT

The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Product Manager - Excalibur (SFAE-AMO-CAS-EX), Picatinny Arsenal, NJ to conduct Transportability Testing on the Excalibur Strategic Configured Load (SCL) for the Heavy Expanded Mobility Tactical Truck (HEMTT). The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures."

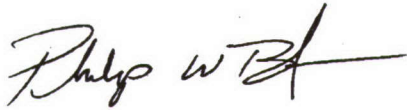
The objective of the testing was to evaluate the Excalibur SCL when transportability tested in accordance with TP-94-01, Revision 2, June 2004.

The following observations resulted from the testing of the Excalibur SCL for the HEMTT:

1. Minor wear occurred to one strap at the hook. Care must be taken to ensure that the strap protectors are in place where the dunnage may contact the strap at the hook location.
2. The payload and dunnage with the straps in place shall not extend beyond the width of the Container Roll-In/Out Platform (CROP).
3. During rail impact testing the DA13 (Modular Artillery Charge System [MACS]) pallet unit containers racked excessively. The containers are only secured by a stacking plug/slot interface. The containers do not have the side "lip grip" feature similar to the 120MM cartridge PA116 containers that prevent racking. Additional securement provisions, such as plywood, should be used as part of the blocking and bracing to prevent movement of the containers.

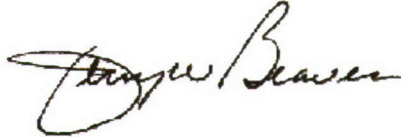
The Excalibur SCL for the HEMTT successfully completed transportability testing when secured on the CROP.

Prepared by:

A handwritten signature in black ink, appearing to read "Philip W. Barickman". The signature is fluid and cursive, with a long horizontal stroke at the end.

PHILIP W. BARICKMAN
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JERRY W. BEAVER
Chief, Validation Engineering Division

U.S. ARMY DEFENSE AMMUNITION CENTER

VALIDATION ENGINEERING DIVISION
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REPORT NO. 08-07

**Excalibur Strategic Configured Load (SCL) for the Heavy Expanded
Mobility Tactical Truck (HEMTT) Testing IAW
TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures"**

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PART 1 – INTRODUCTION

A. BACKGROUND. The U.S. Army Defense Ammunition Center (DAC), Validation Engineering Division (SJMAC-DEV), was tasked by the Product Manager - Excalibur (SFAE-AMO-CAS-EX), Picatinny Arsenal, NJ to conduct Transportability Testing on the Excalibur Strategic Configured Load (SCL) for the Heavy Expanded Mobility Tactical Truck (HEMTT). The testing was conducted in accordance with TP-94-01, Revision 2, June 2004 "Transportability Testing Procedures."

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

1. AR 740-1, 9 Sep 2002, Storage and Supply Activity Operation.
2. JMC-R, 10-23, Mission and Major Functions of U.S. Army Defense Ammunition Center (DAC) 12 April 07.

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

D. OBSERVATIONS. The following observations resulted from the testing of the Excalibur SCL for the HEMTT:

1. Minor wear occurred to one strap at the hook. Care must be taken to ensure that the strap protectors are in place where the dunnage may contact the strap at the hook location.
2. The payload and dunnage with the straps in place shall not extend beyond the width of the Container Roll-In/Out Platform (CROP).
3. During rail impact testing the DA13 (Modular Artillery Charge System [MACS]) pallet unit containers racked excessively. The containers are only secured by a stacking plug/slot interface. The containers do not have the side "lip grip"

feature similar to the 120MM cartridge PA116 containers that prevent racking. Additional securement provisions, such as plywood, should be used as part of the blocking and bracing to prevent movement of the containers.

The Excalibur SCL for the HEMTT successfully completed transportability testing when secured on the CROP.

PART 2 - ATTENDEES

ATTENDEE

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PART 3 - TEST EQUIPMENT

1. Semitrailer, flatbed, breakbulk/container transporter, 34 ton
Model #: M872A1
Manufactured by Heller Truck Body Corporation, Hillsdale, NJ
ID #: 11-1505 NX05NZ
NSN: 2330 01 109 8006
Weight: 19,240 pounds
2. Truck, Tractor, MTV, M1088 A1
ID #: J0229
NSN: 2320 01 447 3893
VSN: NL1FSC
MFG Serial #: T-018488EFJM
Weight: 19,340 pounds
5. Intermodal Container
ID # USAU 076639 1
Date of Manufacture: 1/2007
Tare Weight: 4,695
Maximum Gross Weight: 67,200 pounds
6. Palletized Load System Truck
Model #: M1074
Manufactured by Oshkosh Truck Corporation, Oshkosh, WI
ID #: 10T2P1NH6N1044011
NSN: 2320-01-304-2277
Serial #: 44011
Curb Weight: 55,000 pounds

7. Railcar DODX 42353

Manufactured by Thrall Car

Length: 89 feet – 4 inches

Empty Weight: 85,000 lbs.

8. Container Roll-In/Out Platform (CROP)

Model Number: M3

NSN: 3990 01 442 2751

Manufactured by SUMMA Technology

Tare Weight: 3,600 Pounds

PART 4 - TEST PROCEDURES

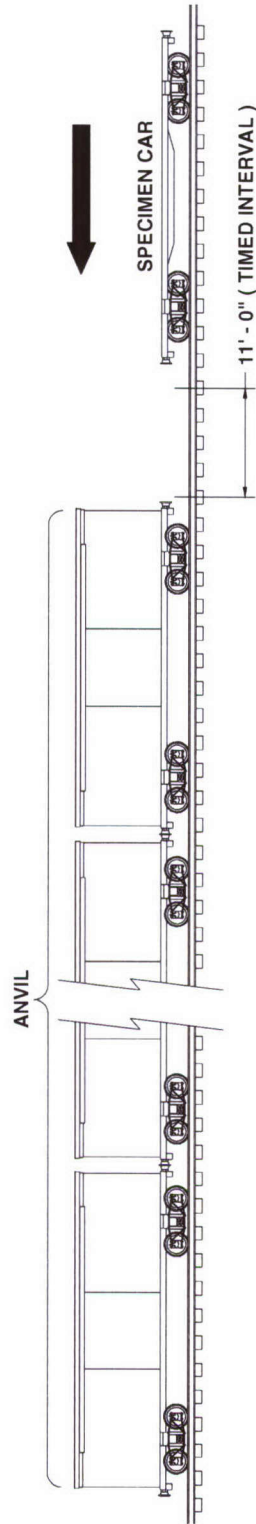
The test procedures outlined in this section were extracted from TP-94-01, "Transportability Testing Procedures," Revision 2, June 2004, for validating tactical vehicles and outloading procedures used for shipping munitions by tactical truck, railcar, and ocean-going vessel.

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

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

ASSOCIATION OF AMERICAN RAILROADS (AAR)

STANDARD TEST PLAN



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

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

SPECIMEN CAR IS RELEASED BY SWITCH ENGINE
TO

ATTAIN: IMPACT NO. 1 @ 4 MPH

IMPACT NO. 2 @ 6 MPH

IMPACT NO. 3 @ 8.1 MPH

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

IMPACT NO. 4 @ 8.1 MPH

Figure 1. Rail Impact Sketch

B. ON/OFF ROAD TEST.

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

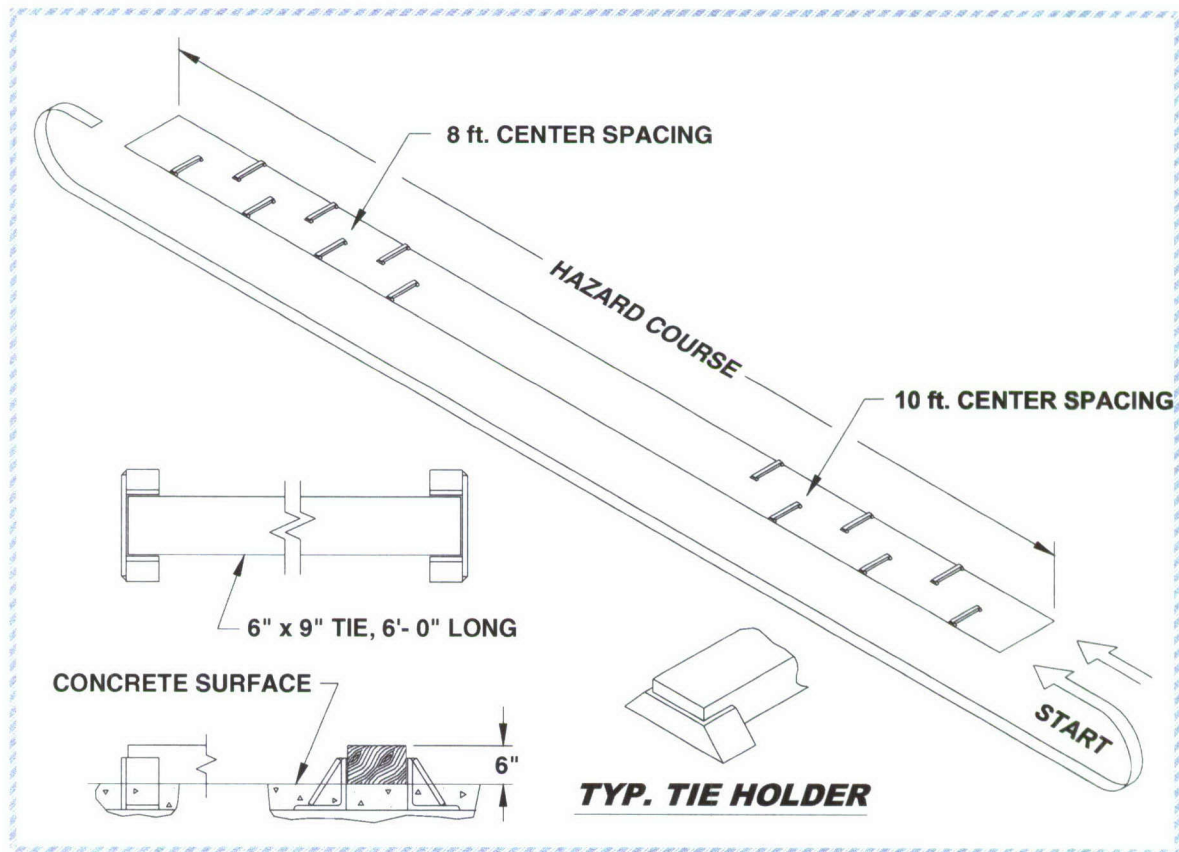


Figure 2. Hazard Course Sketch

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

c. The second series of 7 ties are spaced on 8-foot centers and alternately positioned on opposite sides of the road centerline for a distance of 48 feet.

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

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

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

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

C. OCEAN-GOING VESSEL TEST. Shipboard Motion Simulator (Test Method 5). The Shipboard Motion Simulator (SMS) is used for testing loads in 8-foot-wide by 20-foot-long intermodal freight containers. The specimen shall be positioned onto the SMS and securely locked in place using the cam lock at each corner. Using the procedure detailed in the operating instructions, the SMS shall begin oscillating at an angle of 30 degrees, plus or minus 2 degrees, either side of vertical center and a frequency of 2 cycles-per-minute (30 seconds, plus or

minus 2 seconds) for a duration of two (2) hours. This frequency shall be observed for apparent defects that could cause a safety hazard. The frequency of oscillation shall then be increased to 4 cycles-per-minute (15 seconds, plus or minus one second per cycle) and the apparatus operated for two (2) hours. If an inspection of the load does not indicate an impending failure, the frequency of oscillation shall be further increased to 5 cycles-per-minute (12 seconds, plus or minus one second per cycle), and the apparatus operated for four (4) hours. The operation does not necessarily have to be continuous; however, no changes or adjustments to the load or load restraints shall be permitted at any time during the test. After once being set in place, the test load (specimen) shall not be removed from the apparatus until the test has been completed or is terminated.

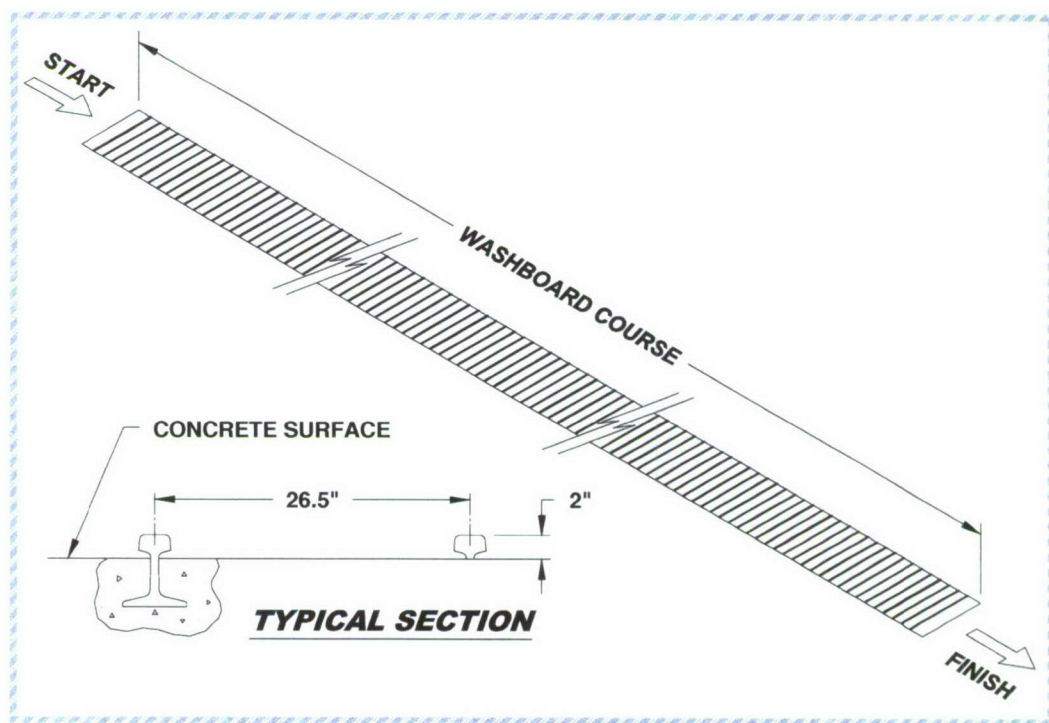


Figure 3. Washboard Course Sketch

PART 5 - TEST RESULTS

5.1

Payload: Excalibur Strategic Configured Load (SCL) for the
Heavy Expanded Mobility Tactical Truck (HEMTT)

Testing Date: 19 March 2008

Gross Weight: 24,820 pounds (SCL and CROP).

A. RAIL TEST.



**Photo 1. Rail Impact Testing of the Excalibur SCL
(Prior to Testing)**

Description	Weight
Flatcar Number: DODX 42353	85,000 lbs.
Excalibur SCL on the CROP in the Intermodal Container	29,515 lbs.
M1 Flatrack with MLRS Pods	28,265 lbs.
Total Specimen Wt.	142,780 lbs.
Buffer Car (four cars)	257,900 lbs.

Figure 4.

Remarks: Figure 4 lists the test components and weights of the items used during the Rail Impact Tests.

Impact Number	Avg. Velocity (mph)
1	3.3
2	5.0
3	7.0
4	8.7

Figure 5.

Remarks:

1. Figure 5 lists the average speeds of the specimen car immediately prior to impact with the anvil. Testing was discontinued prior to the reverse impact.
2. Impact #1 was determined to be a “no test” due to the insufficient velocity at impact. The test was repeated.
3. Following Impact #3 the containers of the DA13 (MACS) pallet racked in the direction of impact 1-inch.
4. Following impact #4 the top Excalibur pallet moved in the direction of impact 2.25 inches. This movement also caused extensive movement of the cans in the DA13 (MACS) pallet. Testing was discontinued.

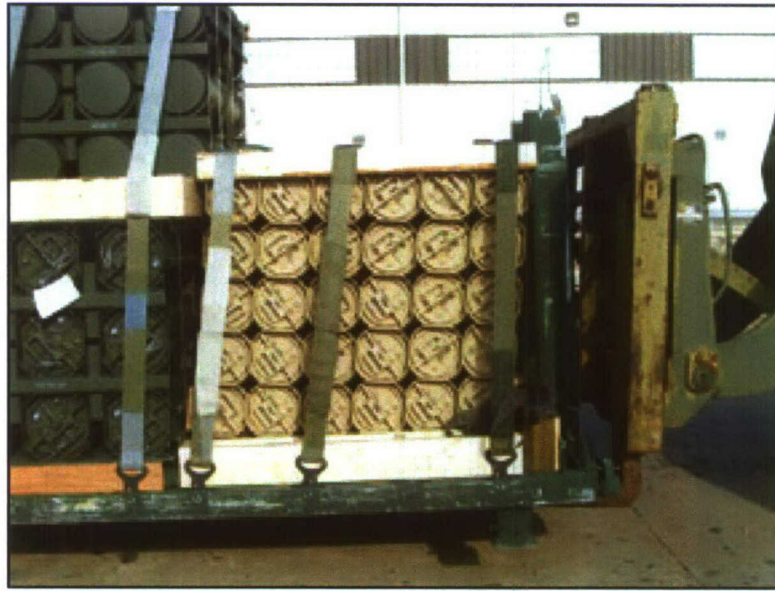


Photo 2. Forward Movement of Containers

B. OBSERVATIONS:

1. During the Rail Impact testing the DA13 (MACS) pallet unit containers racked excessively. The containers are only secured by a stacking plug/slot interface. The containers do not have the side “lip grip” feature similar to the 120MM cartridge PA116 containers that prevent racking. Additional securement provisions, such as plywood, should be used as part of the blocking and bracing to prevent movement of the containers.

2. The Excalibur SCL is a high load with minimal clearance of the intermodal container door header. (See Photo 3) Therefore caution must be used when inserting/extracting the CROP into/from the intermodal container to prevent damaging the straps or payload.



Photo 3. Minimal Clearance of SCL with Door Header

5.2

Payload: Excalibur Strategic Configured Load (SCL) for the
Heavy Expanded Mobility Tactical Truck (HEMTT)

Testing Date: 20 March 2008

Gross Weight: 24,820 pounds (SCL and CROP).

Note: Cross strapping was added across the DA13 pallets and Excalibur pallets at the A-frame end of the CROP. Separator gates were added at A-frame end of the CROP, between the DA13 (MACS) pallets and the Excalibur pallets.

A. RAIL TEST.



Photo 4. Damage to Wood Pallet

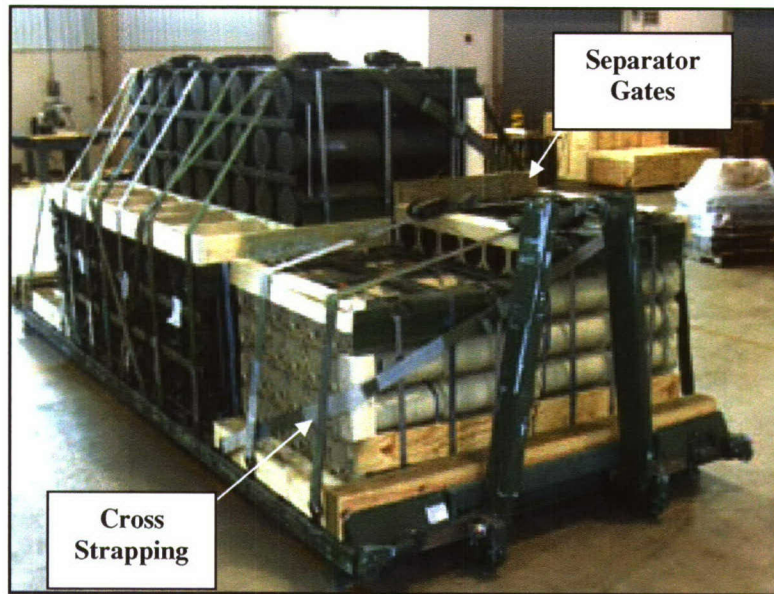


Photo 5. Excalibur SCL for Retest



**Photo 6. Rail Impact Testing of the Excalibur SCL
(Prior to Testing)**

Description	Weight
Flatcar Number: DODX 42353	85,000 lbs.
Excalibur SCL on the CROP in the Intermodal Container	29,515 lbs.
M1 Flatrack with MLRS Pods	28,265 lbs.
Total Specimen Wt.	142,780 lbs.
Buffer Car (four cars)	257,900 lbs.

Figure 6.

Remarks: Figure 6 lists the test components and weights of the items used during the Rail Impact Tests.

Impact Number	Avg. Velocity (mph)
1	3.3
2	5.0
3	6.5
4	8.3
5	8.3

Figure 7.

Remarks:

1. Figure 7 lists the average speeds of the specimen car immediately prior to impact with the anvil. Impact #5 was the reverse impact.
2. Impact #1 was determined to be a “no test” due to the insufficient velocity at impact. The test was repeated.
3. Following Impact #3 the top row of Excalibur pallets moved in the direction of impact 0.5 inches.
4. Following Impact #4 the top row of Excalibur pallets moved in the direction of impact an additional 0.25 inches.
5. Following Impact #5 the cross straps loosened on the A-frame end.

B. ON/OFF ROAD TESTS.

1. HAZARD COURSE.



Photo 7. Hazard Course Testing of the Excalibur SCL

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	24 Seconds	6.3
2	23 Seconds	6.6

Figure 8.

Remarks:

1. Figure 8 lists the average speeds of the test load through the Hazard Course.
2. Inspection did not reveal any damage or excessive movement of the Excalibur SCL following each pass.

2. ROAD TRIP:

Remarks:

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

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

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	24 Seconds	6.3
4	24 Seconds	6.3

Figure 9.

Remarks:

1. Figure 9 lists the average speeds of the test load through the Hazard Course.
2. Inspection did not reveal any damage or excessive movement of the Excalibur SCL.

5. WASHBOARD COURSE:



Photo 8. Washboard Course Testing of the Excalibur SCL

Remarks:

1. Final inspection following completion of the Washboard Course revealed that the center dunnage piece was no longer in position and the side strapping assembly had failed. (See Photos 9 and 10).
2. One of the straps holding the double stack of Excalibur pallets loosened and repositioned itself. (See Photos 9 and 11).
3. Following the inspection the testing was discontinued.

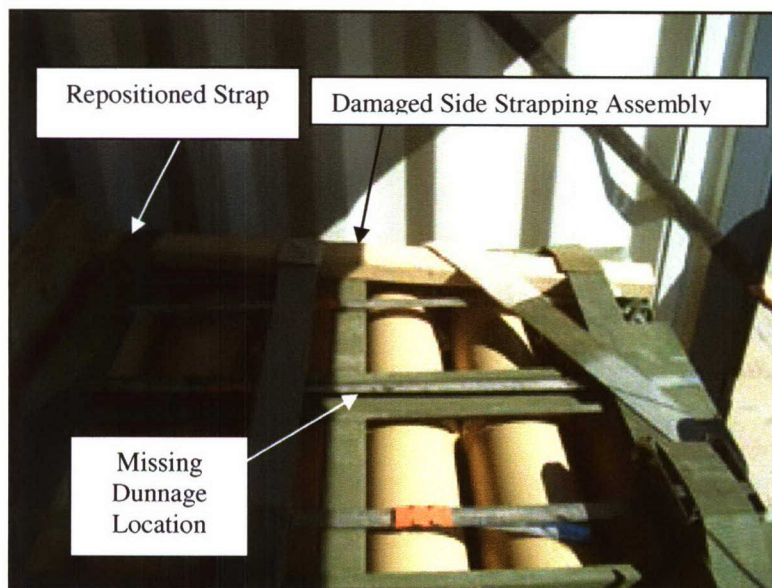


Photo 9. Missing Center Dunnage, Damaged Side Strapping Assembly and Loose (repositioned) Strap.

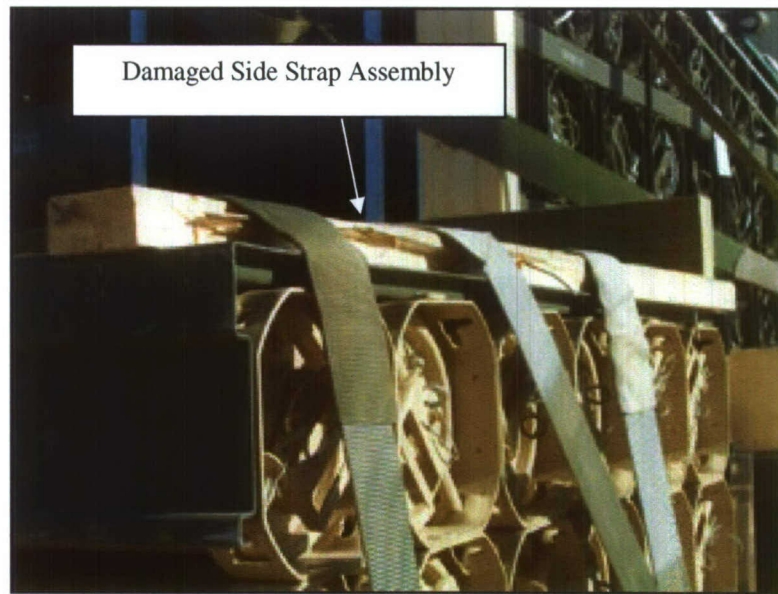


Photo 10. Damaged Side Strapping Assembly

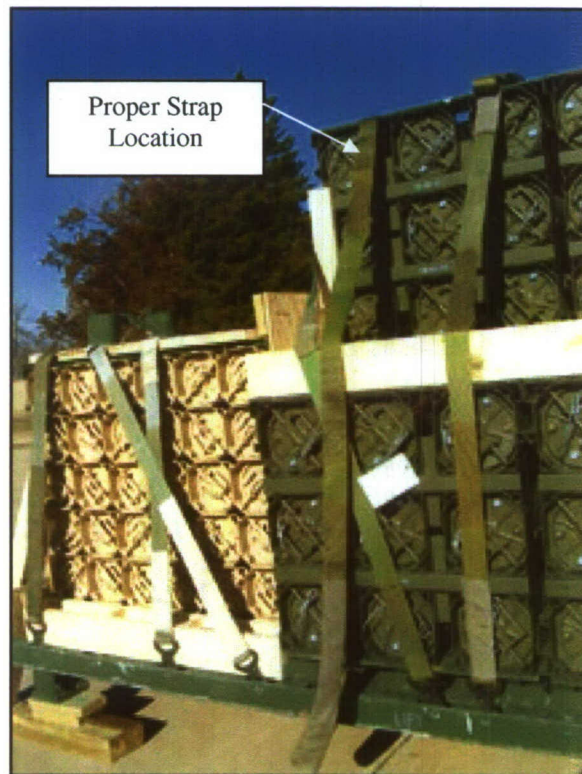


Photo 11. Proper Strap Location

5.3

Payload: Excalibur Strategic Configured Load (SCL) for the Heavy Expanded Mobility Tactical Truck (HEMTT)

Testing Date: 17-18 April 2008

Gross Weight: 24,820 pounds (SCL and CROP).

Note: Plywood was added at the A-frame end of the CROP and the material for the side strapping assemblies was changed.

A. RAIL TEST.



Photo 12. Excalibur SCL for Retest



**Photo 13. Rail Impact Testing of the Excalibur SCL
(Prior to Testing)**

Description	Weight
Flatcar Number: DODX 42353	85,000 lbs.
Excalibur SCL on the CROP in the Intermodal Container	29,515 lbs.
M1 Flatrack with MLRS Pods	28,265 lbs.
Total Specimen Wt.	142,780 lbs.
Buffer Car (four cars)	257,900 lbs.

Figure 10.

Remarks: Figure 10 lists the test components and weights of the items used during the Rail Impact Tests.

Impact Number	Avg. Velocity (mph)
1	4.3
2	6.8
3	8.7
4	8.8

Figure 11.

Remarks:

1. Figure 11 lists the average speeds of the specimen car immediately prior to impact with the anvil. Impact #4 was the reverse impact.
2. Following Impact #2 the top row of Excalibur DA13 (MACS) containers moved 0.25 inches.
3. Following Impact #4 the top row of the DA13 (MACS) containers moved 0.25 inches (back to original starting position).

B. ON/OFF ROAD TESTS.

1. HAZARD COURSE.



Photo 14. Hazard Course Testing of the Excalibur SCL

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	24 Seconds	6.3
2	24 Seconds	6.3

Figure 12.

Remarks:

1. Figure 12 lists the average speeds of the test load through the Hazard Course.
2. Inspection did not reveal any damage or excessive movement of the Excalibur SCL following each pass.

2. ROAD TRIP:

Remarks:

1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the Road Trip revealed no damage to the Excalibur SCL. The plywood, at the A-frame end of the CROP, shifted in the direction of the driver's side.

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

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	24 Seconds	6.3
4	24 Seconds	6.3

Figure 13.

Remarks:

1. Figure 13 lists the average speeds of the test load through the Hazard Course.
2. The plywood, at the A-frame end of the CROP, continued to shift in the direction of the driver's side.
3. Inspection did not reveal any damage of the Excalibur SCL.

5. WASHBOARD COURSE:



Photo 15. Washboard Course Testing of the Excalibur SCL

Remarks:

1. Final inspection following completion of the Washboard Course revealed that the corner strapping board assembly and the strap on the plywood repositioned during testing and caused the strap to loosen. (See Photo 16).
2. The top corner strapping board assembly on the Excalibur pallet was no longer in contact with the Excalibur pallet upon completion of testing. (See Photo 17).
3. Following the inspection the testing was discontinued.

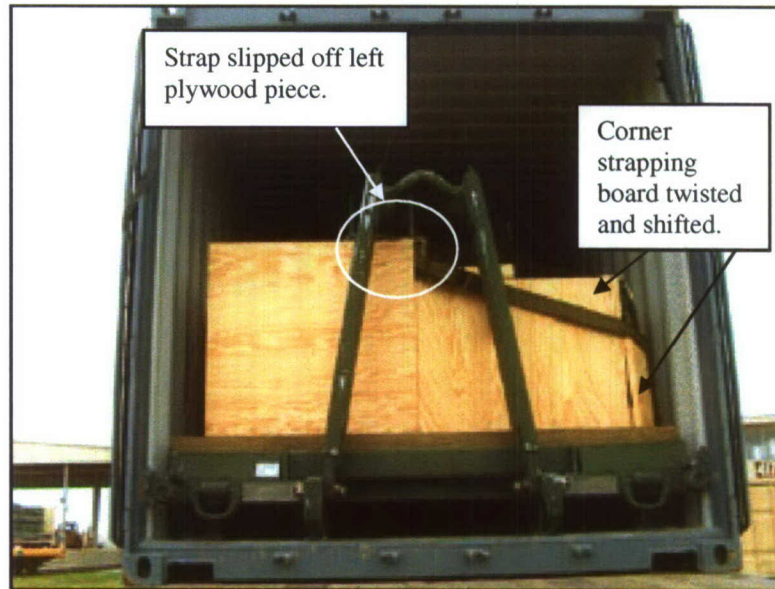


Photo 16. Repositioned Corner Strapping Board Assembly and Strap



Photo 17. Missing Top Corner Strapping Board Assembly

5.4

Payload: Excalibur Strategic Configured Load (SCL) for the Heavy Expanded Mobility Tactical Truck (HEMTT)

Testing Date: 7 May 2008

Gross Weight: 24,800 pounds (SCL and CROP).

Note: The material used in the corner strapping board assemblies was changed and the dunnage was added to the plywood to prevent movement.

A. RAIL TEST.



Photo 18. Excalibur SCL for Retest



**Photo 19. Rail Impact Testing of the Excalibur SCL
(Prior to Testing)**

Description	Weight
Flatcar Number: DODX 42353	85,000 lbs.
Excalibur SCL on the CROP in the Intermodal Container	29,515 lbs.
M1 Flatrack with MLRS Pods	28,265 lbs.
Total Specimen Wt.	142,780 lbs.
Buffer Car (four cars)	257,900 lbs.

Figure 14.

Remarks: Figure 14 lists the test components and weights of the items used during the Rail Impact Tests.

Impact Number	Avg. Velocity (mph)
1	4.5
2	6.2
3	8.3
4	8.2

Figure 15.

Remarks:

1. Figure 15 lists the average speeds of the specimen car immediately prior to impact with the anvil. Impact #4 was the reverse impact.
2. Inspection did not reveal any damage or excessive movement of the Excalibur SCL following each impact.

B. ON/OFF ROAD TESTS.

1. HAZARD COURSE.



Photo 20. Hazard Course Testing of the Excalibur SCL

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	26 Seconds	5.9
2	27 Seconds	5.6

Figure 16.

Remarks:

1. Figure 16 lists the average speeds of the test load through the Hazard Course.
2. Inspection did not reveal any damage or excessive movement of the Excalibur SCL following each pass.

2. ROAD TRIP:

Remarks:

1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the Road Trip did not reveal any damage or excessive movement of the Excalibur SCL.

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

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	27 Seconds	5.7
4	29 Seconds	5.3

Figure 17.

Remarks:

1. Figure 17 lists the average speeds of the test load through the Hazard Course.
2. Inspection did not reveal any damage or excessive movement of the Excalibur SCL following each pass.

5. WASHBOARD COURSE:



Photo 21. Washboard Course Testing of the Excalibur SCL

Remarks: Final inspection following the Washboard Course revealed that the crossing strap had moved on the plywood at the A-frame end of the CROP but still remained tight and secure. The top corner strapping board assembly on the Excalibur pallet was no longer in contact with the Excalibur pallet upon completion of testing.

C. SHIPBOARD MOTION SIMULATION (SMS).

Remarks: Inspection did not reveal any damage or excessive movement of the Excalibur SCL following the completion of the SMS.

D. CONCLUSION. The Excalibur SCL for the HEMTT successfully completed transportability testing when secured on the CROP.

5.5

Payload: Excalibur Strategic Configured Load (SCL) for the
Heavy Expanded Mobility Tactical Truck (HEMTT)

Testing Date: 21 May 2008

Gross Weight: 24,800 pounds (SCL and CROP).

Note: The CROP with Excalibur SCL was removed from the intermodal container and then tested on the Palletized Load System (PLS) Vehicle.

A. ON/OFF ROAD TESTS.

1. HAZARD COURSE.



Photo 22. Hazard Course Testing of the Excalibur
SCL on the PLS Vehicle

Pass No.	Elapsed Time	Avg. Velocity (mph)
1	30 Seconds	4.6
2	25 Seconds	5.4

Figure 18.

Remarks:

1. Figure 18 lists the average speeds of the test load through the Hazard Course.
2. Inspection did not reveal any damage or excessive movement of the Excalibur SCL following each pass.

2. ROAD TRIP:

Remarks:

1. The Road Trip was conducted between the Road Hazard Course Passes #2 and #3.
2. Inspection following the Road Trip did not reveal any damage or excessive movement of the Excalibur SCL.

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

4. HAZARD COURSE:

Pass No.	Elapsed Time	Avg. Velocity (mph)
3	30 Seconds	4.7
4	30 Seconds	4.7

Figure 19.

Remarks:

1. Figure 19 lists the average speeds of the test load through the Hazard Course.
2. Inspection did not reveal any damage or excessive movement of the Excalibur SCL following each pass.

5. WASHBOARD COURSE:



Photo 23. Washboard Course Testing of the Excalibur SCL on the PLS Vehicle

Remarks: Inspection did not reveal any damage or excessive movement of the Excalibur SCL following completion of the Washboard Course.

B. OBSERVATIONS.

1. Minor wear occurred to one strap at the hook. Care must be taken to ensure that the strap protectors are in place where the dunnage may contact the strap at the hook location.
2. The payload with the straps in place shall not extend beyond the deck of the CROP.

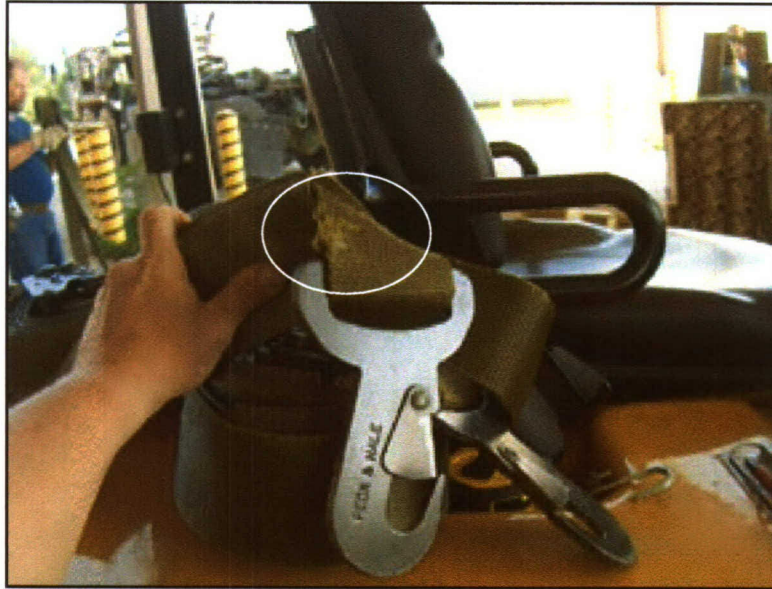


Photo 24. Minor Strap Wear



Photo 25. Minor Strap Wear from Container Wall Contact

C. CONCLUSION. The Excalibur SCL for the HEMTT successfully completed transportability testing when secured on the CROP.

PART 6 – DRAWINGS

The following drawing represents the load configuration that was subjected to the test criteria.

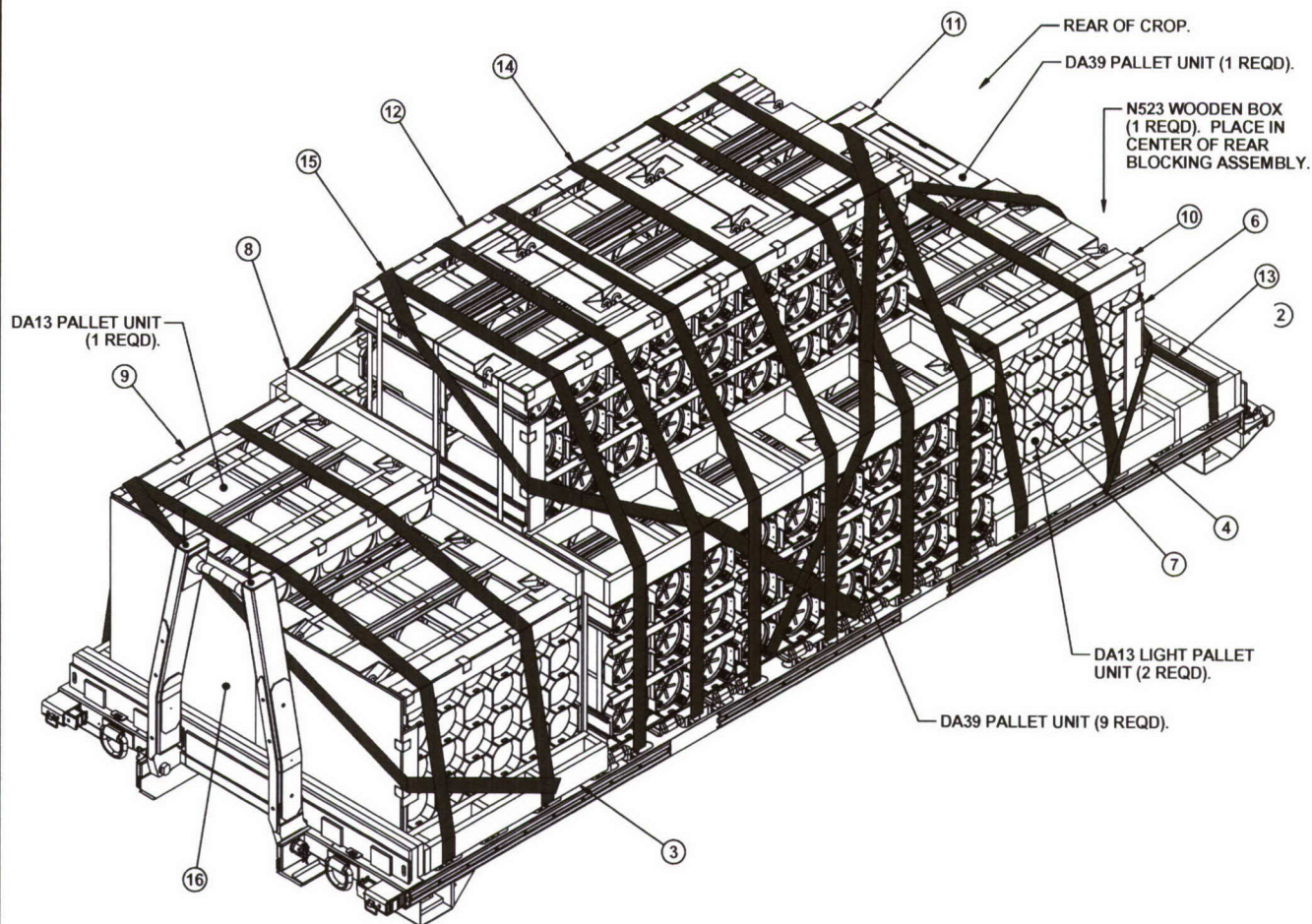
TEST SKETCH

LOADING AND BRACING OF PROJECTILES, PROP CHARGES, AND PRIMERS ON A CONTAINER ROLL IN/OUT PLATFORM (CROP)

THIS NINE PAGE DOCUMENT DEPICTS AN EXCALIBUR SCL FOR HEMTT FOR INTEGRATION TRANSPORTABILITY TESTING AT AN APPROXIMATE 22,000 LBS GROSS LOAD

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ISOMETRIC VIEW

KEY NUMBERS

- 15 HOLD-DOWN STRAP, 3" WIDE WEB STRAP TIEDOWN ASSEMBLY (4 REQD). INSTALL EACH HOLD-DOWN STRAP TO EXTEND FROM THE DESIGNATED TIEDOWN ANCHOR ON ONE SIDE OF CROP, AROUND THE END AND OVER THE TOP OF THE DESIGNATED PALLET UNITS, TO THE DESIGNATED TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE CROP. ALIGN SCUFF SLEEVES OVER ALL SHARP EDGES AND FIRMLY TENSION STRAP.
- 16 FORWARD END PLYWOOD SUPPORT PIECES (2 REQD). SEE DETAIL ON PAGE 9.

- 1 FORWARD BLOCKING ASSEMBLY (1 REQD). SEE DETAIL ON PAGE 5.
- 2 REAR BLOCKING ASSEMBLY (1 REQD). SEE DETAIL ON PAGE 5.
- 3 SIDE BLOCKING ASSEMBLY A (2 REQD). SEE DETAIL ON PAGE 6.
- 4 SIDE BLOCKING ASSEMBLY B (2 REQD). SEE DETAIL ON PAGE 6.
- 5 SIDE BLOCKING ASSEMBLY C (4 REQD). SEE DETAIL ON PAGE 6.
- 6 CORNER STRAPPING ASSEMBLY (3 REQD). SEE DETAIL ON PAGE 8.
- 7 SEPARATOR ASSEMBLIES A AND B (1 EACH REQD). PLACE SEPARATOR ASSEMBLY A BETWEEN THE DA13 LIGHT PALLET UNIT AND THE MIDDLE DA39 PALLET UNITS, WITH CLEATS FACING THE REAR OF THE CROP. PLACE SEPARATOR ASSEMBLY B BETWEEN THE REAR DA39 PALLET UNIT AND THE MIDDLE DA39 PALLET UNITS, WITH CLEATS FACING THE REAR OF THE CROP. SEE DETAIL ON PAGE 7.
- 8 SEPARATOR ASSEMBLIES A AND C (1 EACH REQD). PLACE SEPARATOR ASSEMBLY A BETWEEN THE DA13 LIGHT PALLET UNIT AND THE MIDDLE DA39 PALLET UNITS, WITH CLEATS FACING THE FORWARD END OF THE CROP. PLACE SEPARATOR ASSEMBLY C BETWEEN THE DA13 PALLET UNIT AND THE MIDDLE DA39 PALLET UNITS, WITH CLEATS FACING THE FORWARD END OF THE CROP. SEE DETAIL ON PAGE 7.
- 9 FORWARD END STRAPPING ASSEMBLY (3 REQD). SEE DETAIL ON PAGE 8.
- 10 AFT END STRAPPING ASSEMBLY A (1 REQD). SEE DETAIL ON PAGE 8.
- 11 AFT END STRAPPING ASSEMBLY B (1 REQD). SEE DETAIL ON PAGE 8.
- 12 CENTER STRAPPING ASSEMBLY (4 REQD). SEE DETAIL ON PAGE 8.
- 13 RETAINER STRAP, 2" WIDE WEB STRAP TIEDOWN ASSEMBLY (1 REQD). INSTALL TO EXTEND FROM THE FIRST TIEDOWN ANCHOR ON ONE SIDE OF THE FORWARD BLOCKING ASSEMBLY, TO THE FIRST TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE CROP. ALIGN SCUFF SLEEVES OVER ALL SHARP EDGES AND FIRMLY TENSION STRAP.
- 14 HOLD-DOWN STRAP, 3" WIDE WEB STRAP TIEDOWN ASSEMBLY (10 REQD). INSTALL EACH HOLD-DOWN STRAP TO EXTEND FROM THE DESIGNATED TIEDOWN ANCHOR ON ONE SIDE OF CROP, OVER THE TOP OF THE PALLET UNITS, TO THE CORRESPONDING TIEDOWN ANCHOR ON THE OPPOSITE SIDE OF THE CROP. ALIGN SCUFF SLEEVES OVER ALL SHARP EDGES AND FIRMLY TENSION STRAP.

GENERAL NOTES

- A. WHEN STEEL STRAPPING IS SEALED AT AN END-OVER-END LAP JOINT, A MINIMUM OF ONE SEAL WITH TWO PAIR OF NOTCHES WILL BE USED TO SEAL THE JOINT WHEN A NOTCH-TYPE SEALER IS BEING USED. A MINIMUM OF TWO SEALS, BUTTED TOGETHER WITH TWO PAIR OF CRIMPS PER SEAL WILL BE USED TO SEAL THE JOINT WHEN A CRIMP-TYPE SEALER IS BEING USED.
- B. WHEN LOADING CONTAINERS, THEY ARE TO BE POSITIONED SO AS TO ACHIEVE A TIGHT LOAD (TIGHT AGAINST THE DUNNAGE ASSEMBLIES). THE UNBLOCKED SPACE ACROSS THE WIDTH OF A LOAD BAY IS NOT TO EXCEED 1-1/2". EXCESSIVE SLACK CAN BE ELIMINATED FROM A LOAD BY LAMINATING ADDITIONAL PIECES OF APPROPRIATE THICKNESS TO THE HORIZONTAL PIECES ON THE SIDE BLOCKING ASSEMBLIES. NAIL EACH ADDITIONAL PIECE W/1 APPROPRIATELY SIZED NAIL EVERY 12". ADDITIONALLY, THE THICKNESS AND/OR QUANTITY OF THE VERTICAL OR HORIZONTAL PIECES IN THE SIDE BLOCKING ASSEMBLIES MAY BE ADJUSTED AS REQUIRED TO FACILITATE VARIANCE IN THE SIZE OF THE CONTAINERS.
- C. DUNNAGE LUMBER SPECIFIED IS OF NOMINAL SIZE. FOR EXAMPLE, 1" X 4" MATERIAL IS ACTUALLY 3/4" THICK BY 3-1/2" WIDE AND 2" X 6" MATERIAL IS ACTUALLY 1-1/2" THICK BY 5-1/2" WIDE.
- D. A STAGGERED NAILING PATTERN WILL BE USED WHENEVER POSSIBLE WHEN NAILS ARE DRIVEN INTO JOINTS OF DUNNAGE ASSEMBLIES OR 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, ON TO, OR RIGHT BESIDE A NAIL IN A LOWER PIECE.

E. RECOMMENDED SEQUENTIAL LOADING PROCEDURES:

1. PREFABRICATE FORWARD BLOCKING ASSEMBLY, REAR BLOCKING ASSEMBLY, TWO OF SIDE BLOCKING ASSEMBLY A, TWO OF SIDE BLOCKING ASSEMBLY B, FOUR OF SIDE BLOCKING ASSEMBLY C, TWO OF SEPARATOR ASSEMBLY A, ONE OF SEPARATOR ASSEMBLY B, ONE OF SEPARATOR ASSEMBLY C, FOUR OF CORNER STRAPPING ASSEMBLY, THREE OF FORWARD END STRAPPING ASSEMBLY, ONE OF AFT END STRAPPING ASSEMBLY A, ONE OF AFT END STRAPPING ASSEMBLY B, AND FOUR OF CENTER STRAPPING ASSEMBLY.
2. INSTALL THE REAR BLOCKING ASSEMBLY AGAINST THE REAR GATE OF THE CROP, WITH THE N523 WOODEN BOX PLACED INSIDE.
3. LOAD ONE DA13 LIGHT PALLET UNIT AND THE FORWARD DA39 PALLET UNIT TIGHT AGAINST REAR BLOCKING ASSEMBLY. PLACE ONE SIDE BLOCKING ASSEMBLY B ON EACH SIDE OF THE ROW OF PALLET UNITS AND CENTER ROW ON CROP.
4. INSTALL SEPARATOR ASSEMBLIES (SEE KEY NUMBER 7 ON PAGE 2).
5. LOAD THREE ROWS OF TWO DA39 PALLET UNITS TIGHT AND CENTERED AGAINST PRIOR ROW OF PALLET UNITS. LOAD LAST THREE DA39 PALLET UNITS CENTERED ON TOP OF PRIOR DA39 PALLET UNITS, AND PLACE TWO OF SIDE BLOCKING ASSEMBLY C ON EACH SIDE OF THE TOP PALLET UNITS.
6. INSTALL SEPARATOR ASSEMBLIES (SEE KEY NUMBER 7 ON PAGE 2).
7. LOAD THE DA13 PALLET UNIT AND ONE DA13 LIGHT PALLET UNIT TIGHT AND CENTERED AGAINST THE DA39 PALLET UNITS, AND PLACE ONE SIDE BLOCKING ASSEMBLY A ON EACH SIDE OF THE ROW.
8. INSTALL THE FORWARD BLOCKING ASSEMBLY, PLYWOOD SUPPORT PIECES AND FILLER PIECES AND NAIL W/2-12d NAILS THRU THE CROP END GATE, LEAVING THE NAIL HEADS PROTRUDING TO PROVIDE LATERAL AND VERTICAL RESTRAINT.
9. INSTALL THE STRAPPING ASSEMBLIES AND THE 2" AND 3" STRAPS AS SHOWN ON PAGE 2.

MATERIAL SPECIFICATIONS

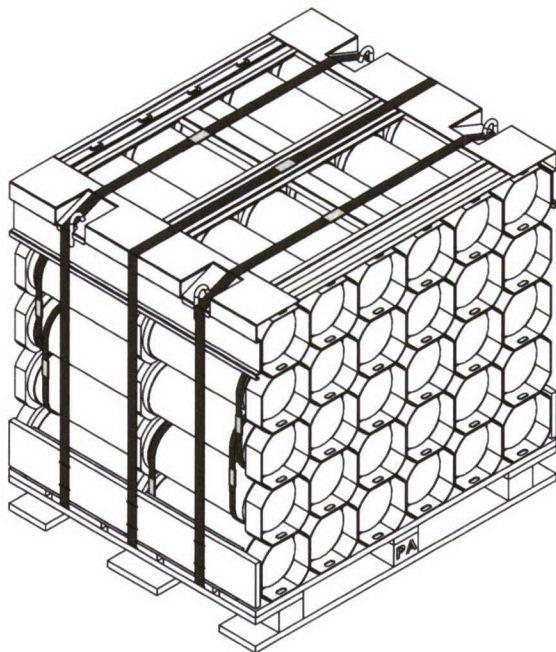
- LUMBER - - - - - : SEE TM 743-200-1 (DUNNAGE LUMBER) AND VOLUNTARY PRODUCT STANDARD PS 20.
- NAILS - - - - - : ASTM F1667; COMMON STEEL NAIL NLCMS OR NLCMMS).
- STRAPPING, STEEL - - : ASTM D3953; FLAT STRAPPING, TYPE 1, HEAVY DUTY, FINISH A, B (GRADE 2), OR C.
- SEAL, STRAP - - - - : ASTM D3953; CLASS H, FINISH A, B (GRADE 2), OR C, DOUBLE NOTCH TYPE, STYLE I, II, OR IV.
- WIRE, CARBON STEEL - : ASTM A853; ANNEALED AT FINISH, BLACK OXIDE FINISH, 0.0800" DIA, GRADE 1006 OR BETTER.

BILL OF MATERIAL

LUMBER	LINEAR FEET	BOARD FEET
1" X 8"	7	5
2" X 4"	19	13
2" X 6"	110	110
2" X 8"	47	62
NAILS	NO. REQD	POUNDS
6d (2")	176	1.0
10d (3")	350	5.4
METAL BRACKET - - - - -	44 REQD - -	4.40 LBS
PLYWOOD, 1/2" - - - - -	93.71 SQ FT REQD -	128.85 LBS
2" WIDE WEB STRAP - - - -	1 REQD - -	5.50 LBS
3" WIDE WEB STRAP - - - -	14 REQD -	145.30 LBS

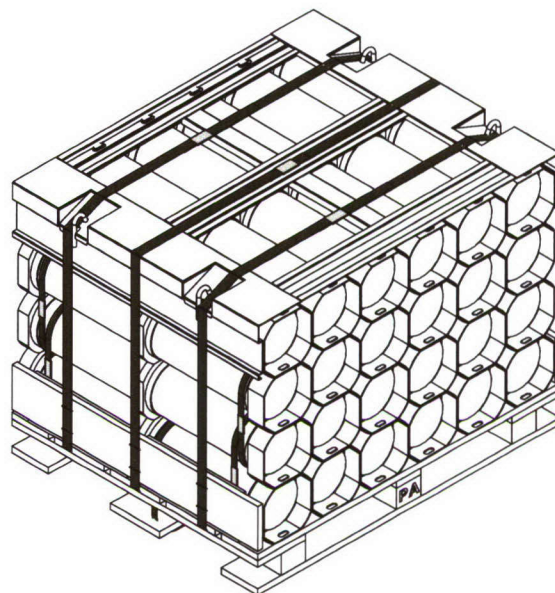
LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
DA13 PALLET UNIT - - - - -	1 - - - - -	1,835 LBS
DA13 LIGHT PALLET UNIT - -	2 - - - - -	3,010 LBS
DA39 PALLET UNIT - - - - -	10 - - - - -	16,490 LBS
N523 PRIMER BOX - - - - -	1 - - - - -	34 LBS
DUNNAGE - - - - -	- - - - -	669 LBS
TOTAL WEIGHT - - - - -		22,038 LBS



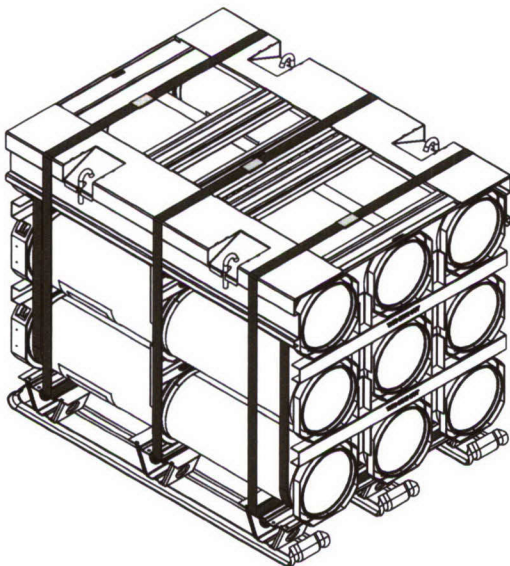
DA13 PALLET UNIT

GROSS WEIGHT - - - - - 1,835 LBS (APPROX)
 CUBE - - - - - 44.6 CU FT (APPROX)



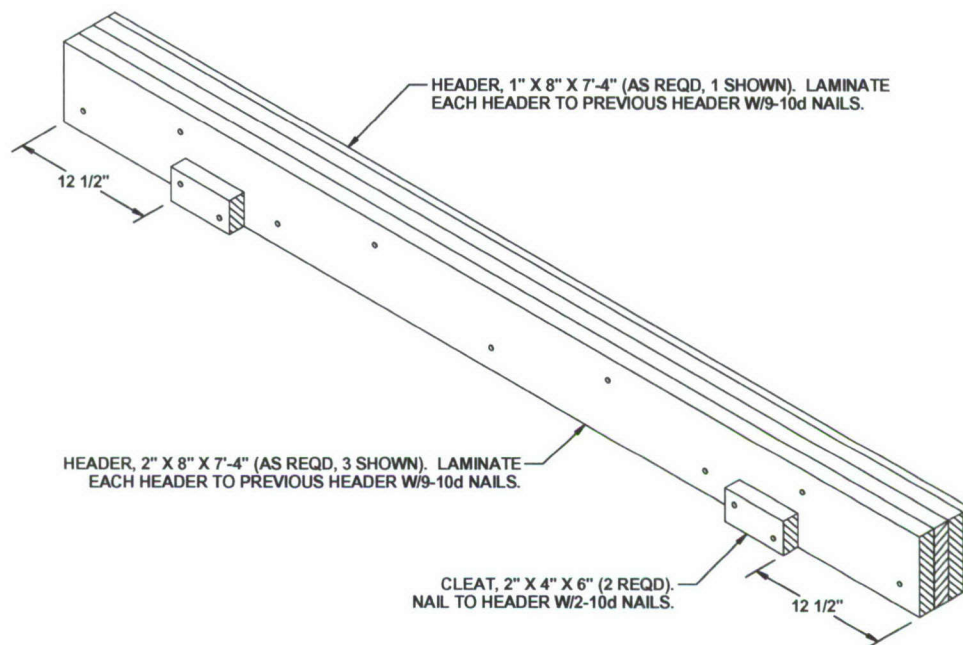
DA13 LIGHT PALLET UNIT

GROSS WEIGHT - - - - - 1,505 LBS (APPROX)
 CUBE - - - - - 37.0 CU FT (APPROX)

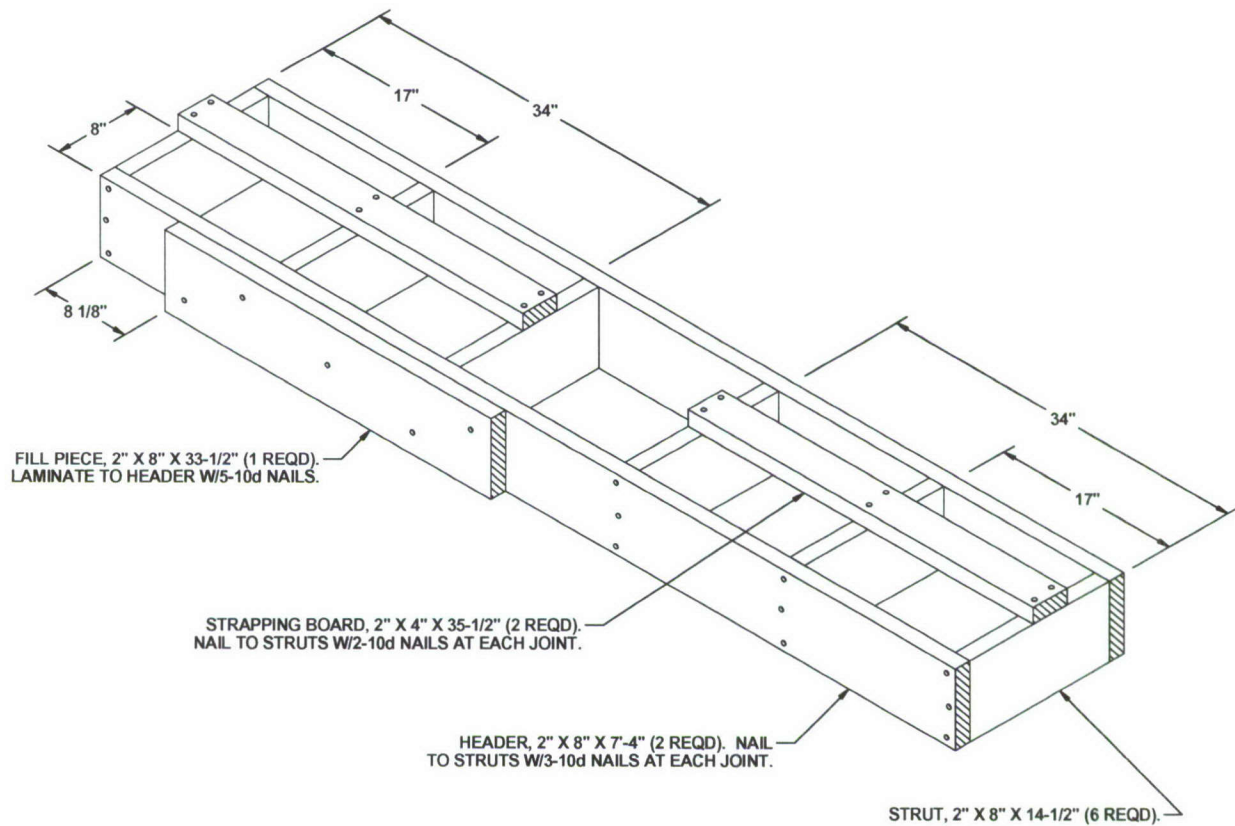


DA39 PALLET UNIT

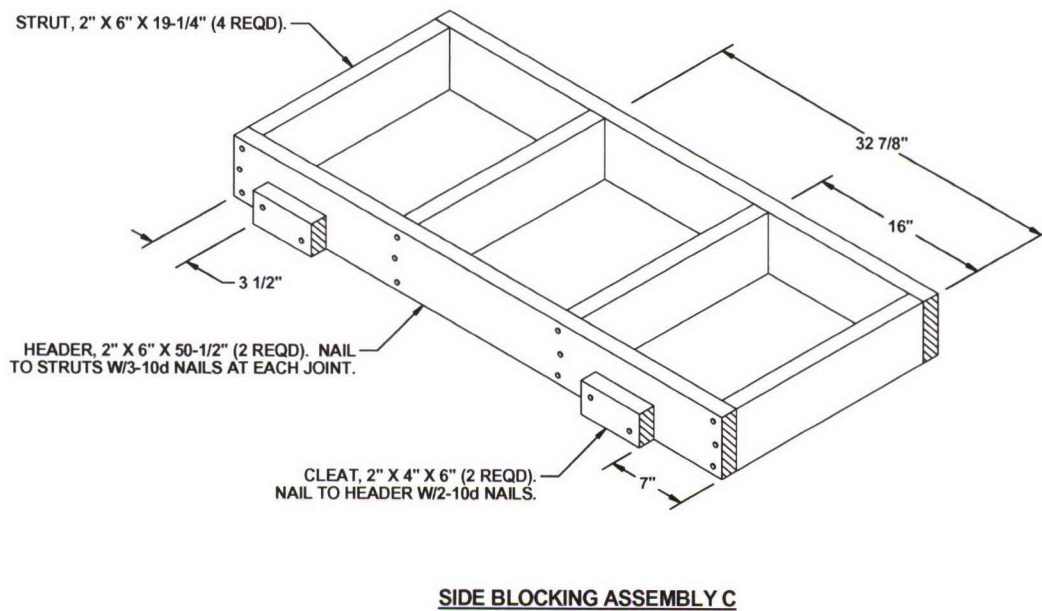
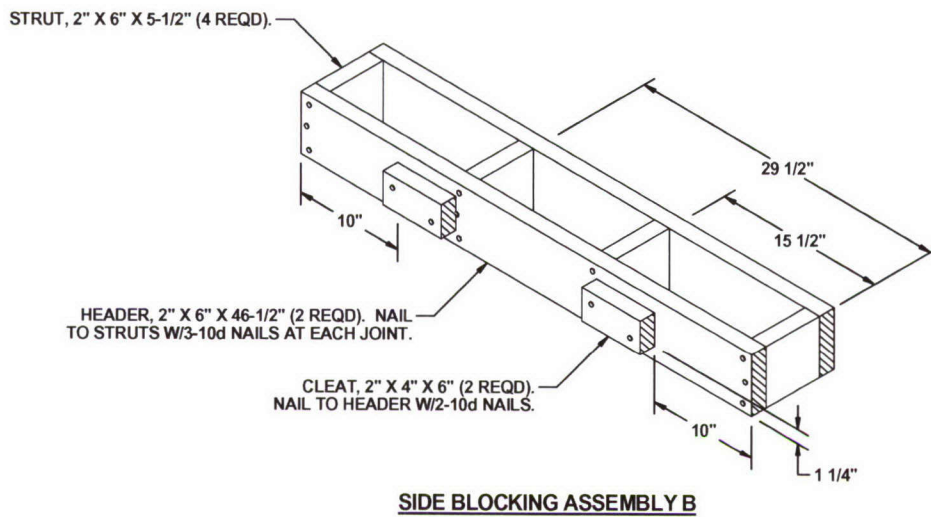
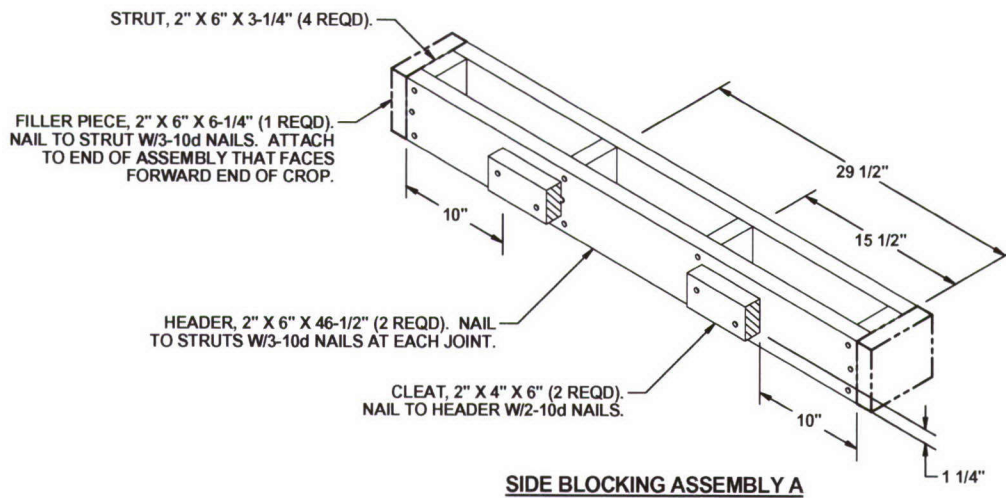
GROSS WEIGHT - - - - - 1,649 LBS (APPROX)
 CUBE - - - - - 31.7 CU FT (APPROX)



FORWARD BLOCKING ASSEMBLY



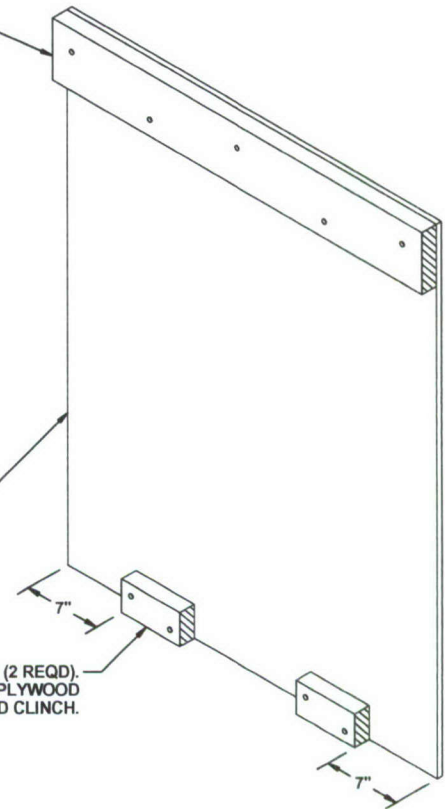
REAR BLOCKING ASSEMBLY



BEARING PIECE, 2" X 6" X 38" (1 REQD). NAIL THROUGH PLYWOOD W/5-10d NAILS AND CLINCH.

PLYWOOD, 1/2" X 38" X 49-3/8" (1 REQD).

CLEAT, 2" X 4" X 6" (2 REQD). NAIL THROUGH PLYWOOD W/2-10d NAILS AND CLINCH.



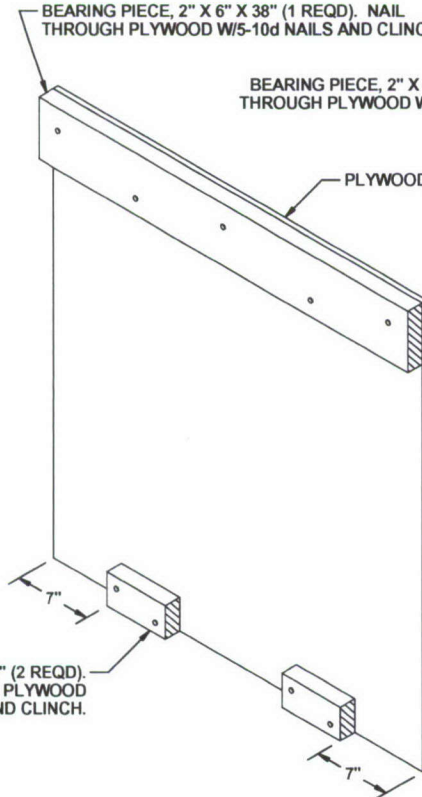
SEPARATOR ASSEMBLY C

BEARING PIECE, 2" X 6" X 38" (1 REQD). NAIL THROUGH PLYWOOD W/5-10d NAILS AND CLINCH.

BEARING PIECE, 2" X 6" X 33-3/4" (1 REQD). NAIL THROUGH PLYWOOD W/5-10d NAILS AND CLINCH.

PLYWOOD, 1/2" X 38" X 42" (1 REQD).

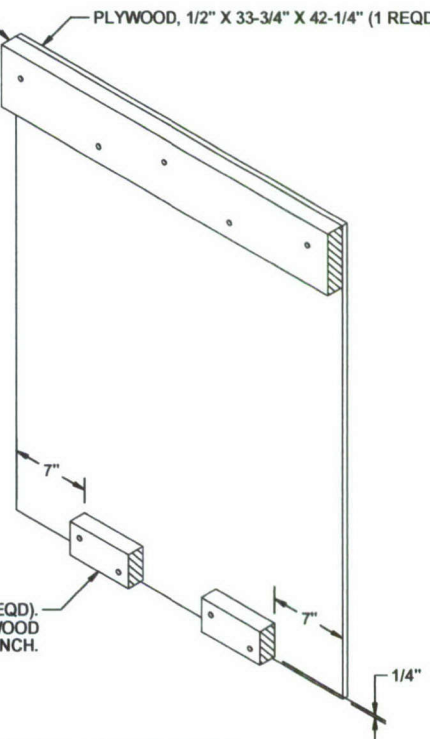
CLEAT, 2" X 4" X 6" (2 REQD). NAIL THROUGH PLYWOOD W/2-10d NAILS AND CLINCH.



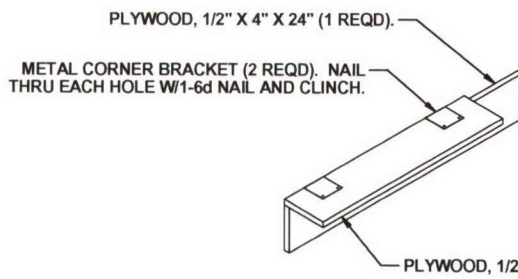
SEPARATOR ASSEMBLY A

PLYWOOD, 1/2" X 33-3/4" X 42-1/4" (1 REQD).

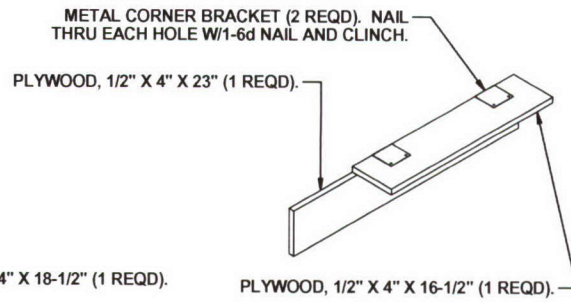
CLEAT, 2" X 4" X 6" (2 REQD). NAIL THROUGH PLYWOOD W/2-10d NAILS AND CLINCH.



SEPARATOR ASSEMBLY B

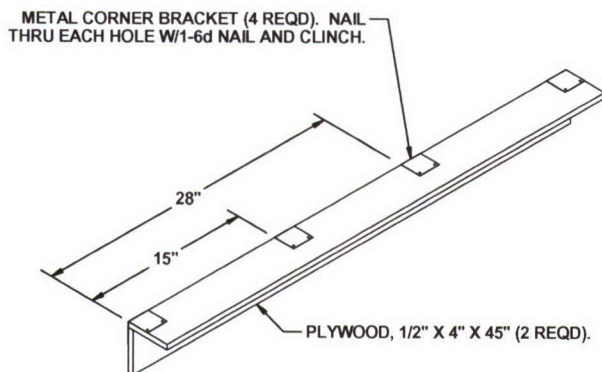


EXCALIBUR

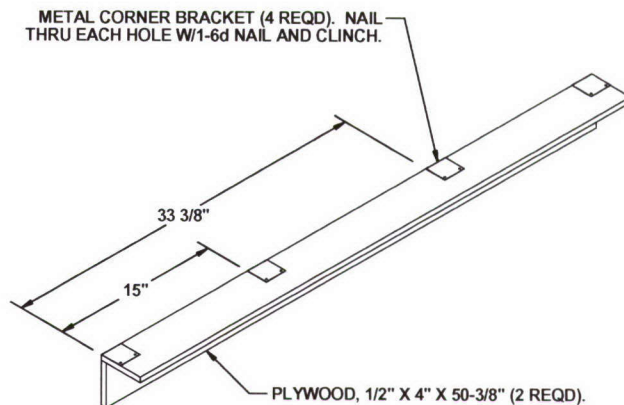


MACS

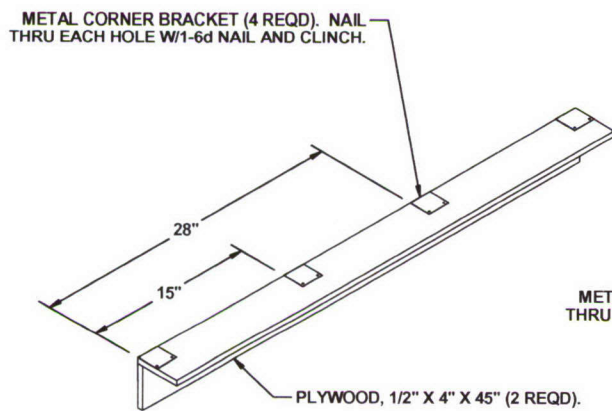
CORNER STRAPPING ASSEMBLY



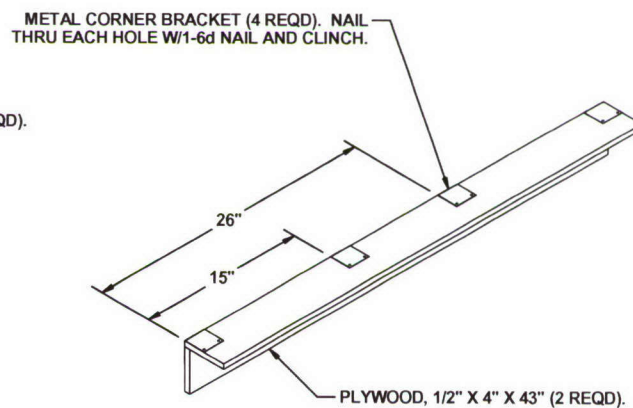
FORWARD END STRAPPING ASSEMBLY



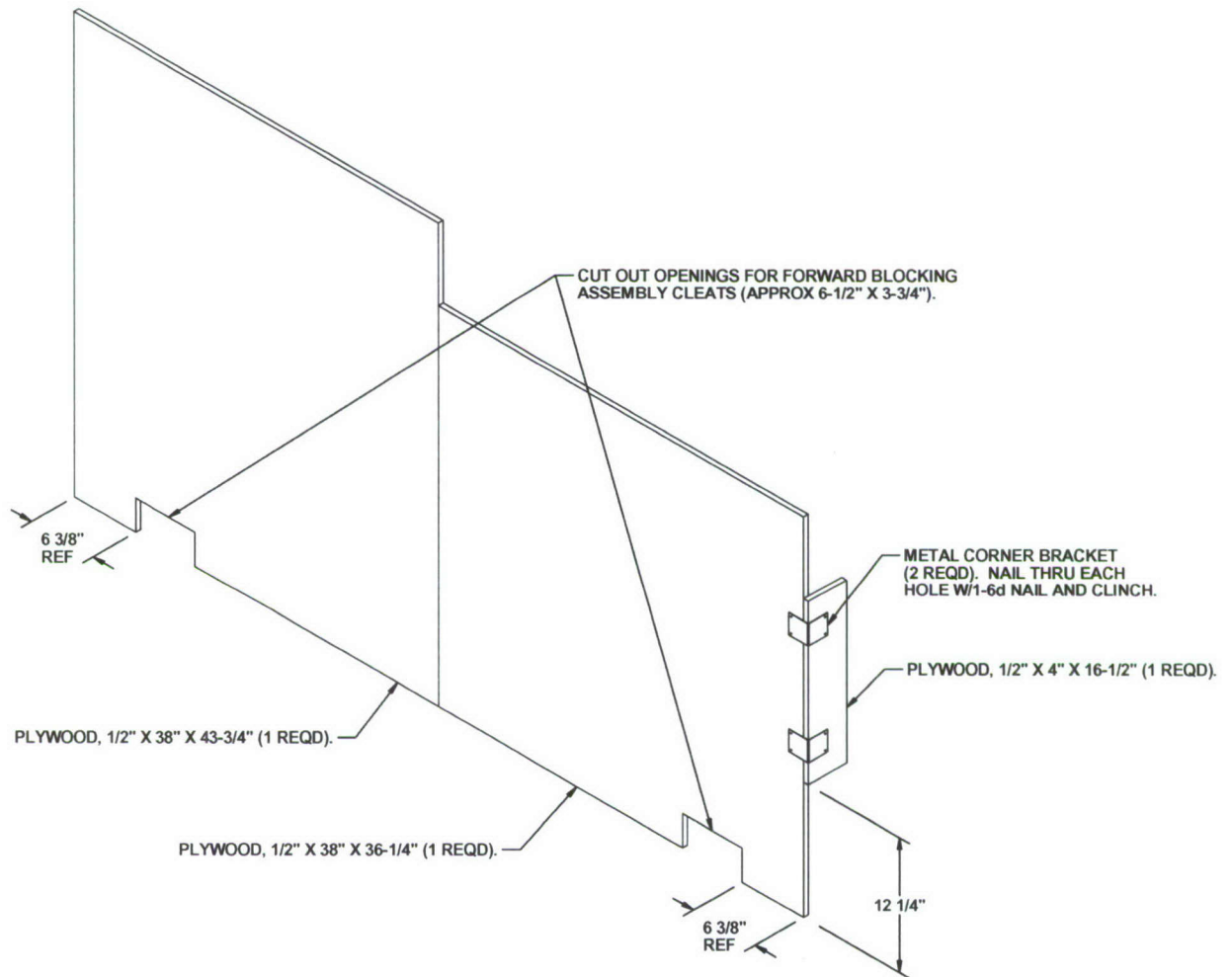
CENTER STRAPPING ASSEMBLY



AFT END STRAPPING ASSEMBLY A



AFT END STRAPPING ASSEMBLY B



FORWARD END PLYWOOD SUPPORT PIECES