

TECHNICAL BULLETIN

**STANDARDS OF MAINTENANCE
FOR MILVAN CONTAINERS
OVERHAUL OR REPAIRED
GENERAL CARGO
NSN 8115-00-168-2275
WITH LOAD BRACING SYSTEM
NSN 8115-00-151-9953**

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HEADQUARTERS, DEPARTMENT OF THE ARMY

15 March 1984

CHANGE

NO. 4

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WASHINGTON, D. C., 20 February 1991

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Technical Bulletin

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Technical Bulletin

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**STANDARDS OF MAINTENANCE FOR MILVAN CONTAINERS
OVERHAULED OR REPAIRED
GENERAL CARGO
NSN 8115-00-168-2275
WITH LOAD BRACING SYSTEM
NSN 8115-00-151-9953**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistake or if you know of a way to improve the procedures, please let us know. Mail your letter, DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual direct to: Commander, U.S. Army Troop Support Command, ATTN: AMSTR-MCTS, 4300 Goodfellow Boulevard, St. Louis, MO 63120- 1798. A reply will be furnished directly to you.

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SECTION I.

Introduction

1. Purpose.

a. This bulletin provides minimum standards for overhaul or repair of MILVAN container, NSNs 8115-00-168-2275 and 8115-00-151-9953.

b. These standards provide for attaining the required level of serviceability of materiel without causing unnecessary maintenance operations.

2. Scope.

a. Standards contained herein apply to all TROSCOM - MANAGED MILVAN containers overhauled or repaired at US Army Materiel Command (AMC) depot maintenance activities or contract repair facilities. Should conflicts arise between the provisions of TM 55-8115-200-23&P and the standards of this TB, the standards and specifications herein will prevail. Complete coordination/cooperation between Quality Assurance and Maintenance personnel at all levels is necessary to achieve an acceptable product.

b. Request for deviation from this bulletin, with detailed supporting justification, shall be directed to: Commander, US Army Troop Support Command, ATTN: AMSTR-MCFR, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798.

3. General.

The standards written herein are intended to provide guidance to obtain a serviceable MILVAN through overhaul without incurring unnecessary repair. For instructions regarding repair and replacement parts, refer to TM 55-8115-200-23&P.

4. Types of Damage.

The types of damage listed below are those which should be noted during inspection and which constitute damage/weathering requiring repair. (See Figures 1,2,3,4,5,6, and 7 for Parts Nomenclature.)

a. Sides.

- (1) Top and bottom rails – bent, cut or crushed.
- (2) Corrugated sheets – dented or torn.
- (3) Door hold backs – damaged or missing.
- (4) Identification – obliterated.
- (5) Welds – broken, cracked, missing, not primed or painted or not properly made.

(b). Front.

- (1) Corrugated sheets – dented or torn.
- (2) Top and bottom rails – bent, cut or crushed.
- (3) Identification – obliterated.

(c) Underside.

(1) Floor cross members—bent, cut, crushed, severely rusted, broken loose from side rail or floor, cracked or broken weld.

(2) Stiffeners—bent, cut, crushed, severely rusted, broken loose from side rail, cracked, missing or broken welds.

(9) Threshold plate – damaged or missing.

NOTE

If threshold plate is present and in good condition, check to be sure that it is securely attached to the floor with a screw in each hole, If it is damaged, remove, but do not replace.

d. Rear.

(1) Identification – obliterated.

(2) Door frame — cut, broken or distorted.

(3) Hinges – broken, torn or twisted.

(4) Locking bar tubes – bent or twisted.

(6) Locking bar guides – bent or twisted.

(6) Rubber seals – cut or torn loose.

(7) Top and bottom rails – bent, cut or crushed.

(8) Doors – out of alignment, punctured or rusted out.

(9) Door handles [operating levers) – bent or broken.

e. Roof

(1) Panel – punctured, dented or stage IV corrosion.*

(2) Identification – obliterated.

f. Interior.

(1) Roof bows – cut or broken loose from top rail.

(2) Floor boards — splintered, broken, cracked or rotted.

* Definition of stage IV corrosion: Rust, or black or white chemical corrosion with powdering, scaling, severe pitting and holes and irregular areas of surface material eroded away. Nonacceptable corrosion of nonstructural members can be determined if the corroded metal can be punctured by striking the area lightly with a welder's hammer.

(3) Restrain system—bent, torn, or detached from side panels.

(4) Walls, doors (top and bottom) – leakage from metal punctures, cracked welds, or bad door seals.

g. Corner posts — dented, fractured or torn.

h. Corner castings (fittings) – fractured or distorted.

i. Frame – out of line (see paragraph 14).

j. Corrosion – corroded to the point where fit, wear, function or life of the item has been significantly affected.

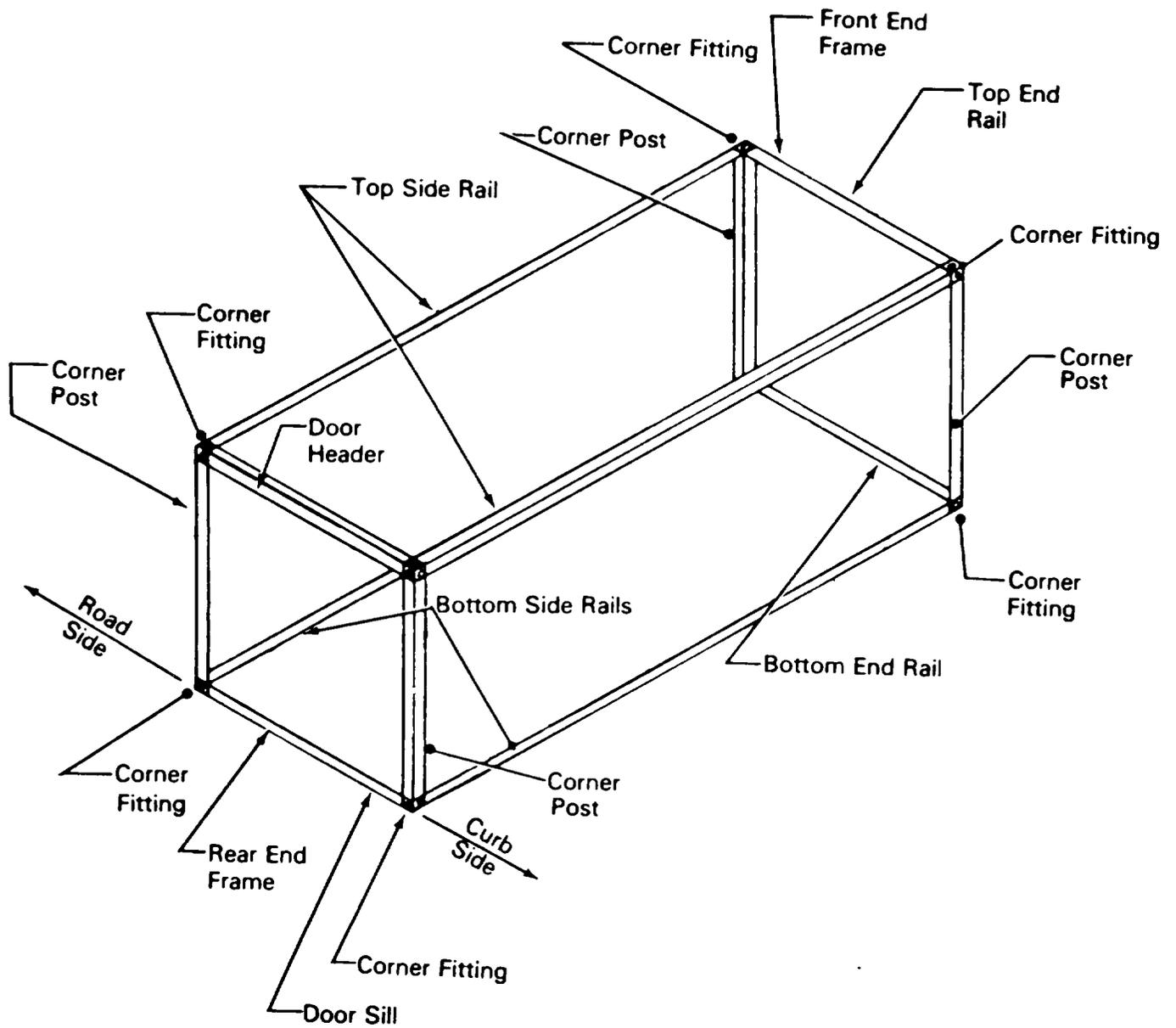


Figure No. 1. Main Structural Members.

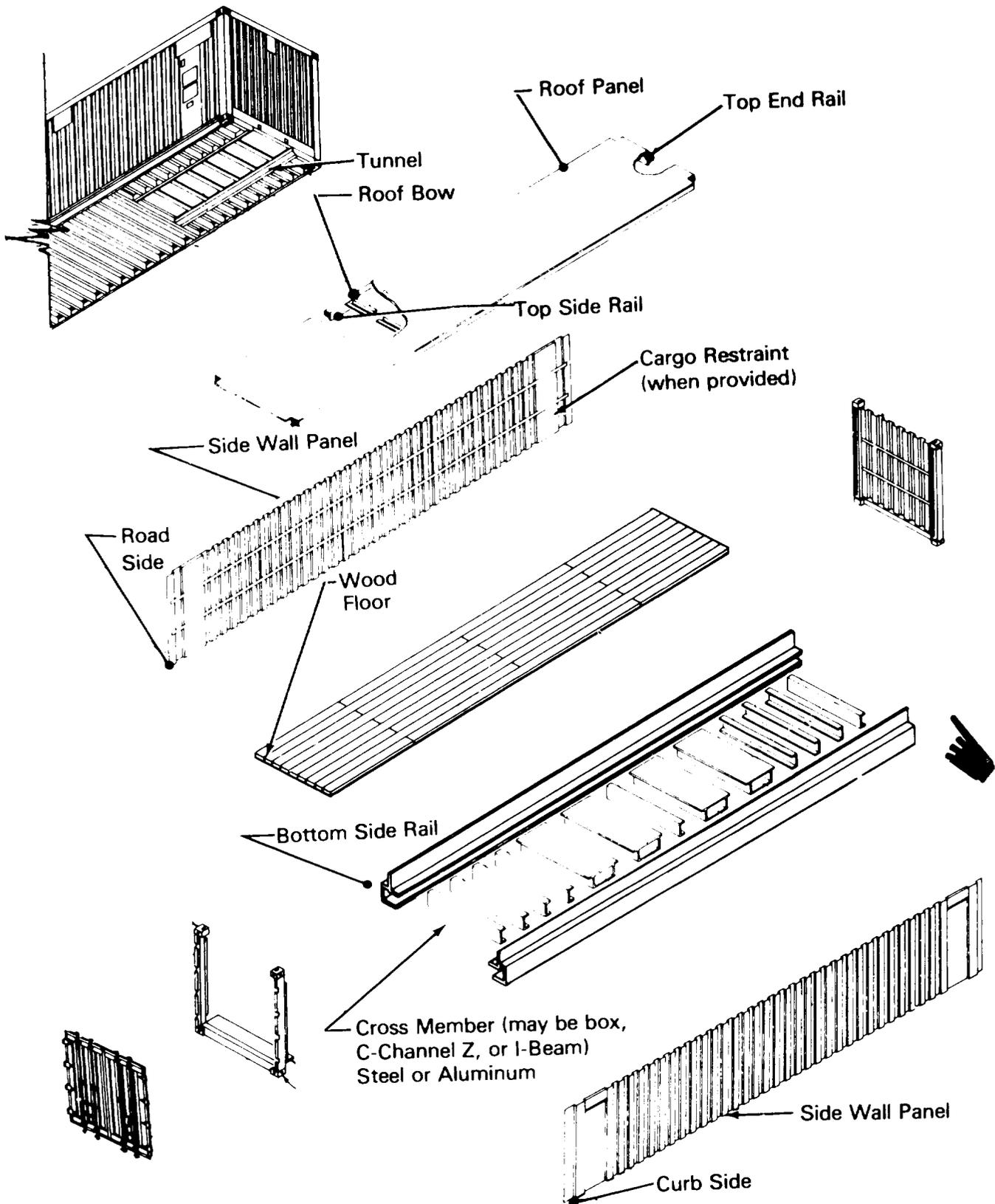


Figure No. 2. Exploded View of Typical Steel Container.

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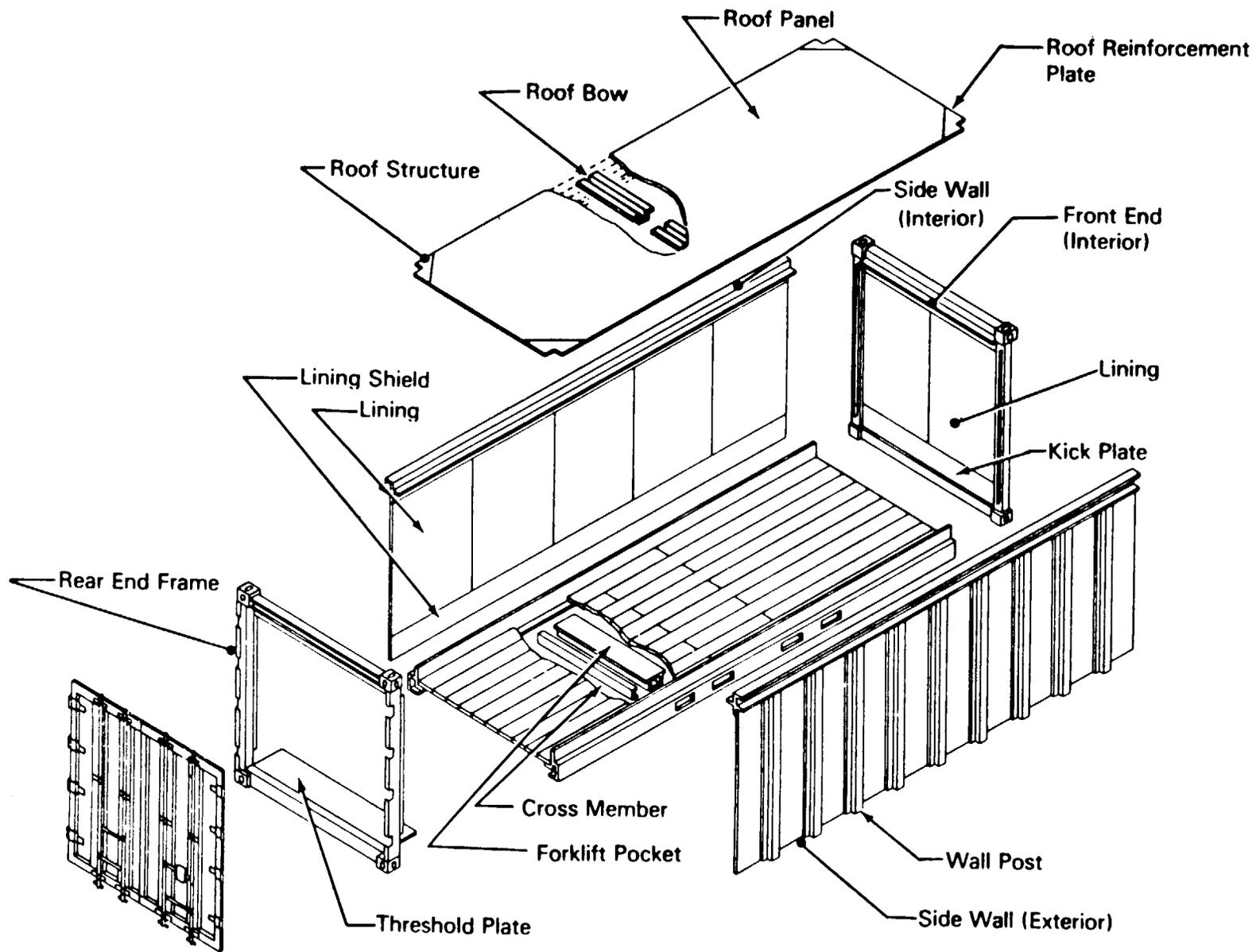


Figure No. 3. Exploded View of Typical Aluminum Container.

SECTION II.

Maintenance Standards

5. Corner Casting (Fittings).

Replace the corner casting if cracked or broken. No repair is allowed no matter how small the crack. This is critical for the safe handling of the container.

6. Corner Posts.

Replace corner post if torn, distorted or kinked. A small vertical or horizontal dent is acceptable if the post/corner casting joint is not affected. Repair if not more than .75 inches (3/4 inch/19 mm) in depth, and not more than 12 inches (.305 m) in length. If the dent exceeds these dimensions and the post/corner casting joint is not affected, it must be straightened by heating or replacement. If the corner casting joint is affected it must be repaired. After straightening, alignment of the corner casting must be within the original design dimensions tolerance.

7. Side, Top and Bottom Rails.

a. If 10 feet or more (3.05 m) of the bottom rail is cut, torn, distorted or damaged by severe (stage IV) corrosion, the entire length of the rail is to be replaced. If less than 10 feet (3.05 m), the damaged section/area is to be removed and spliced with new material. No more than two splices per bottom rail is permitted. The splice must extend for 12 inches (.305 m) minimum on each side of the damaged area. When the damaged area is near the corner fitting so that the splice would end less than 12 inches (.305 m) from the corner fitting, extend the splicing material and weld to the corner fitting. When the structural cross members (SCM) fall in the area of the side rails that have been cut out, a 1.31 inch X 1.50 inch X .1345 inch (.4 m X .458 m X .041 m) pad will be installed between the SCM and the splice plate (Drawing No. 13222E7283 applies).

b. If 10 feet (3.05 m) or more of the top rail is cut, torn, distorted or damaged by severe (stage IV) corrosion, the entire length of the rail is to be replaced. If less than 10 feet (3.05 m), the damaged section/area is to be removed and spliced with new material. No more than two splices per top side rail is permitted. The splice must extend 12 inches (.305 m) minimum on each side of the damaged area. When the damaged area is near the corner fitting, so that the splice would end less than 12 inches (.305 m) from the corner fitting, extend the splicing material and weld to the corner fitting. Drawing No. 13222E7283 applies.

8. Front and Rear, Top and Bottom Rail.

a. Front. If the top 4 feet (1.22 m) or more of the top or bottom rail is cut, torn, distorted or damaged by severe stage IV corrosion, the entire length of the rail is to be replaced. If the damaged section is less than 4 feet (1.22 m), the damaged area is to be removed and spliced with new material. No more than one splice per rail is permitted. The splice must extend for 12 inches (.305 m) minimum on each side of the damaged area. When the damaged area is near a corner fitting, extend the splicing material and weld to corner fitting. Drawing No. 13222E7283 applies.

b. Door Sill and Header. If the sill is cut, torn or distorted 4 feet (1.22 m) or more, the entire sill is to be replaced; if less than 4 continuous feet (1.22 m), one splice is permitted. A splice must not interfere with either the door seal or the operation of the locking mechanism. If the splice is within 12 inches (.305 m) of a corner fitting, it is to be extended and welded to the corner fitting. If the sill is completely severed, it is to be replaced. Drawing No. 13222E7283 applies.

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- c. Door Header Drip. This area may be repaired by butt-welding an insert in the damaged area.
- d. After repair, the outside dimension (OD) (see figure 9) will not exceed 19 feet 10.5 inches, $\pm .25$ inches (6.062 m $\pm .076$ m), and the inside dimension (ID) will not be less than 19 feet 3 inches (5.80 m).
- e. After repair, the door opening dimension will be not less than 7 feet 5 inches wide (2.262 m) in width or 7 feet (2.135 m) in height.
- f. After repair, the entire container must be square at all corners.

9. Roof Bow.

Minor bends to the roof bows will be accepted as long as there are no cracks or signs of strain on the bows. If the bows are bent, but not cracked, they maybe straightened back into position. Assure that the welds are intact. Replace when necessary in accordance with Drawing No. 13219E0074.

10. Roof Panel.

- a. Tears, punctures, cracks and holes which affect tightness of the container must be repaired.
- b. Welded or riveted (use of pop rivets not authorized) patches that do not exceed a 12 inch X 12 inch (.305 m X .305 m) surface are acceptable. Sealer No. TT-S-230 should be applied between the patch and the roof skin where the rivets are used.
- c. Roof panels with stage IV corrosion, and those that require more than one patch must be replaced. A maximum of 4 patches 12 inches X 12 inches (.305 m X .305 m) per roof will be allowed.
- d. After repair the inside height will not be less than 7 feet 3 inches (2.211 m) and the outside height will not exceed 8 feet (2.44 m).
- e. With the doors tightly closed, no light or water penetration into the container permitted after repair.
- f. Assure that there is no major dishing in the roof panel.

11. Floor Cross Members.

- a. Regardless of other repair, cross member numbers 3 through 19 will be strengthened in accordance with Drawing No. 13222E7283.
- b. Any cross member, numbers 2 through 20, must be repaired or replaced if
 - (1) Floor screws are dislodged (redrill and replace screw with next larger size screw).
 - (2) Any cross members cracked or fractured (repair or replace according to Drawing No. 13222E7283).
 - (3) Weldments at the side frame are missing, broken or distorted (straighten and reweld according to Drawing No. 13222E7283).
 - (4) Any cross member bent or distorted beyond repair (replace in accordance with Drawing No. 13222E7283).
 - (5) Any cross member severely corroded (replace according to Drawing No. 13222E7283).
 - (6) When necessary, replacement of a previously repaired/strengthened member will be accomplished according to Sheet No. 2, View D and E of Drawing No. 13222E7283).

12. Floor Boards.

a. If floor board is damaged (cracked, warped, rotted or otherwise deteriorated) for 10 feet (3.05m) or more, the floor board must be 'spliced. Stock or fabricated angle iron (1 inch to 1.25 inches X 1 inch X 1 inch X 16 inches long) (.305m to .038m X .305m X .305m X .406m) must be attached to cross members on which the ends of the splice will bear, by welding each end to prevent rotation, and along the bottom by spotting 2-inch welds 6 inches on center. The angle must extend beneath and be attached to adjacent boards. No more than three splices are allowed per container floor, and each splice must span at least four sound cross members. Joints of laterally adjacent splices must be staggered. (See figure numbers 5, 6 and 7.)

b. All caulking around the floor perimeter must be removed to a minimum depth of .25 inches below floor level and recaulked with sealing compound TT-S-230. Edges of the splices and all other small voids, .06 inches or more below the surface of the floor will be filled with sealing compound TT-S-230.

c. A forklift test as outlined below will be performed if, in the judgment of the inspector, signs of deterioration exist which indicate that the container floor may be structurally unsound.

d. Procedures for a forklift test areas follows:

(1) Support the empty MILVAN container on its four bottom corner fittings so that the floor cross members are clear of the ground approximately 6 inches.

(2) Use a forklift which has at least a 12,000 pound axle loading (6,000 pounds each wheel) with a wheel surface contact area of at least 22 square inches per wheel. The proper forklift load can be approximated by loading a lowmast forklift with a 4,000 pound load at the end of the tines.

(3) Run the loaded forklift down the center line of the container to the forward end wall and back out. Continue this procedure for both the left side and right side of the container.

(4) If there is no failure of the floor structural members, floor boards or weld joints, the container will be considered acceptable.

13. Side and End Panels.

Dents which do not protrude externally beyond the plane of the container corner fittings need not be repaired. Dents which do not reduce the internal dimensions below 19 feet 3 inches (5.87m) length, 7 feet 8 inches (2.36m) width of the general cargo container, and 7 feet 7.75 inches on the restraint container or interface with the operation of the belt rail, need not be repaired.

14. Door, Door Fittings and Door Frame.

a. Door panels must be repaired or replaced to maintain structural integrity and water tightness.

b. If wood at base of door frame is deteriorated, remove 6 inches from the bottom and across the width of the door and replace with a wood insert treated for water resistance. The metal face may then be reglued and secured around the perimeter by wood screws .5 inches long, every 3 inches. Delamination of the metal surface is acceptable if the door forms a water/airtight seal when closed and secured.

c. To repair sheet metal panels of the door when the damage is major:

(1) Remove paint from damaged area.

(2) Cut the damaged area so that a piece of metal can be placed over the damaged area (see figure 8).

(3) Apply repair sheet metal over all of the damaged area providing at least 2 inches overlap all the way around.

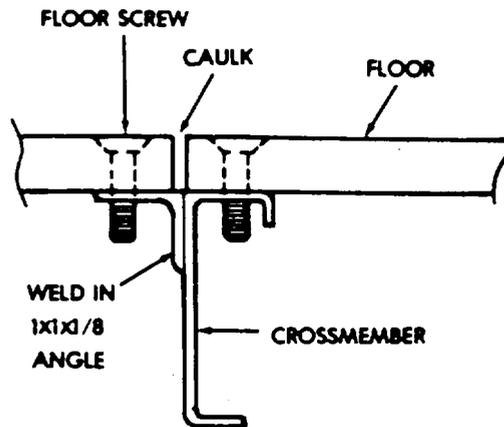


Figure No. 5. Use of Angle Iron to Repair Wood Floor.

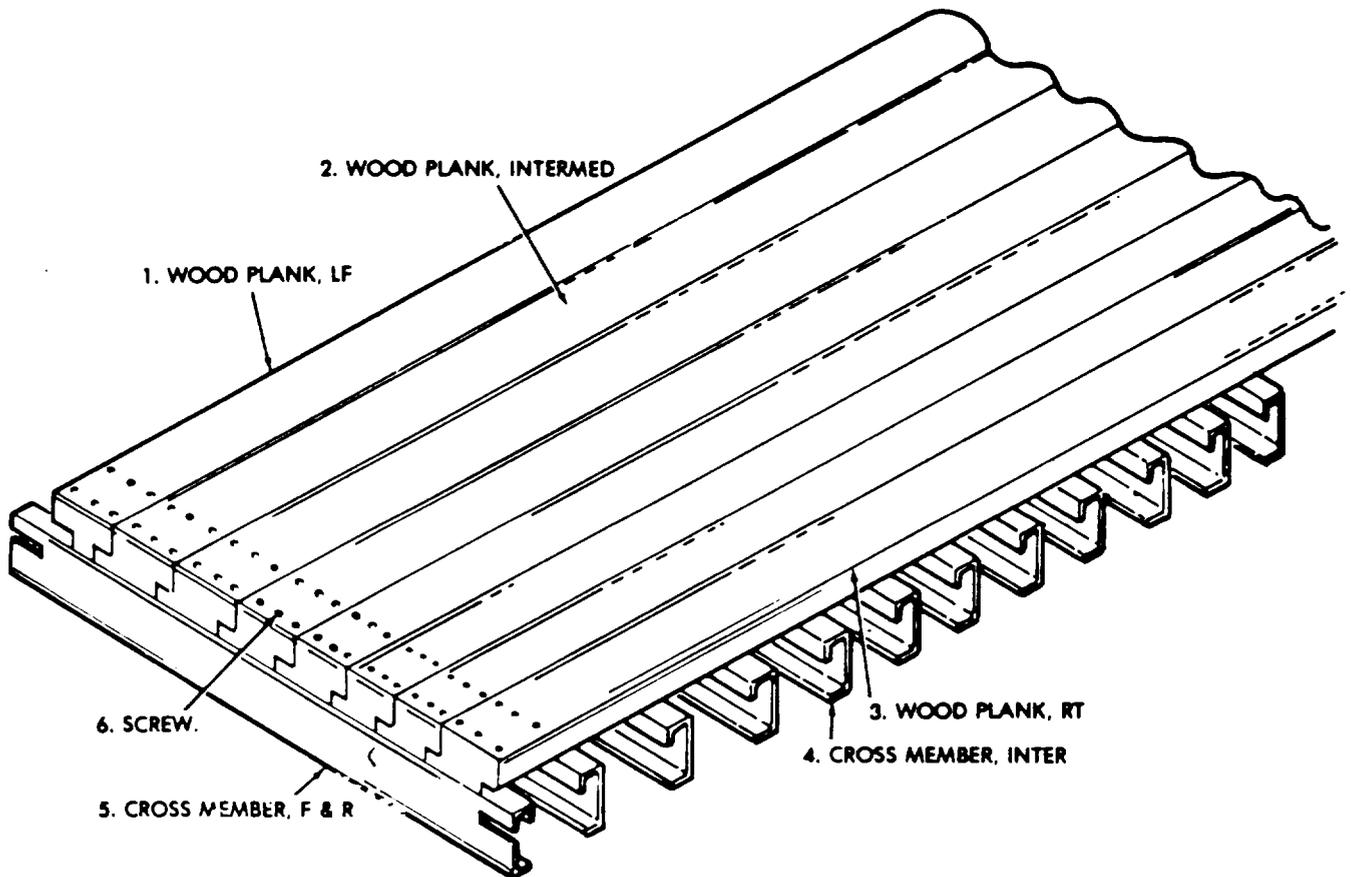
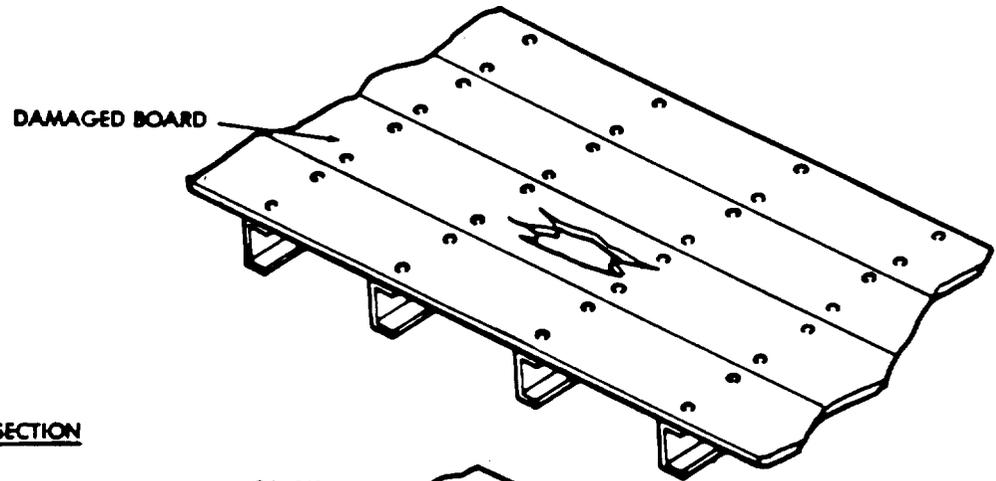
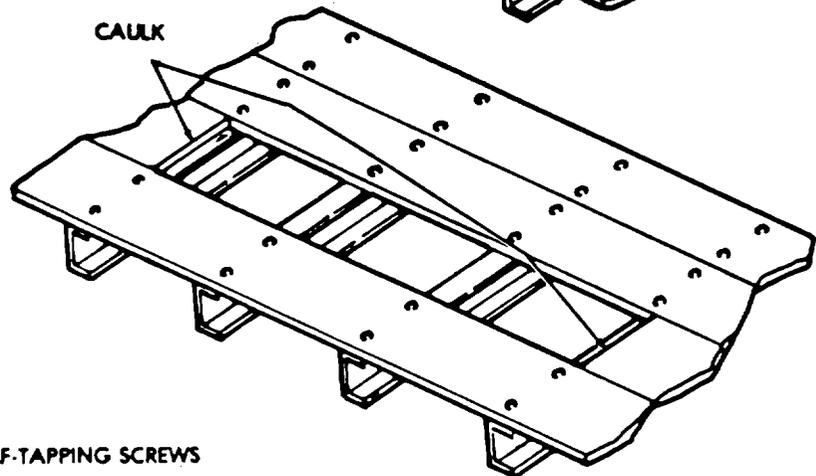


Figure No. 6. Wood Floor Structural Components.

DAMAGED FLOOR BOARDS



CUT DAMAGED SECTION



BOARD SPLICE INSTALLED

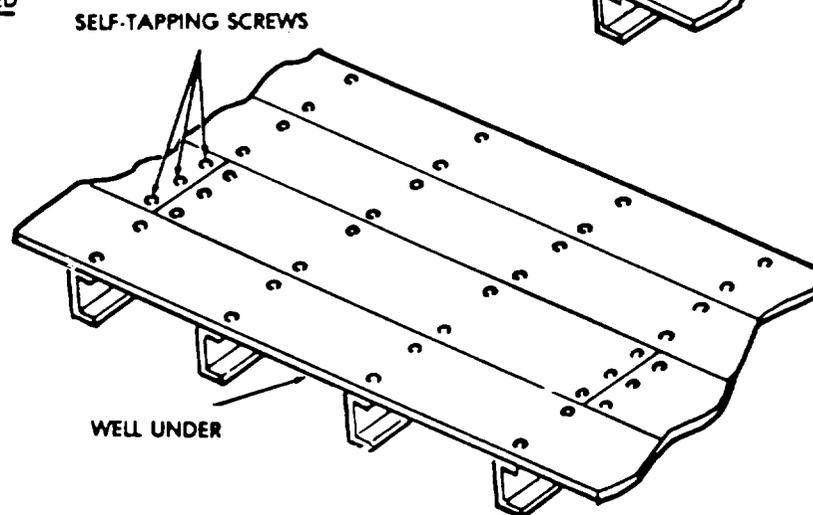


Figure No. 7. Wood Floor Repair.

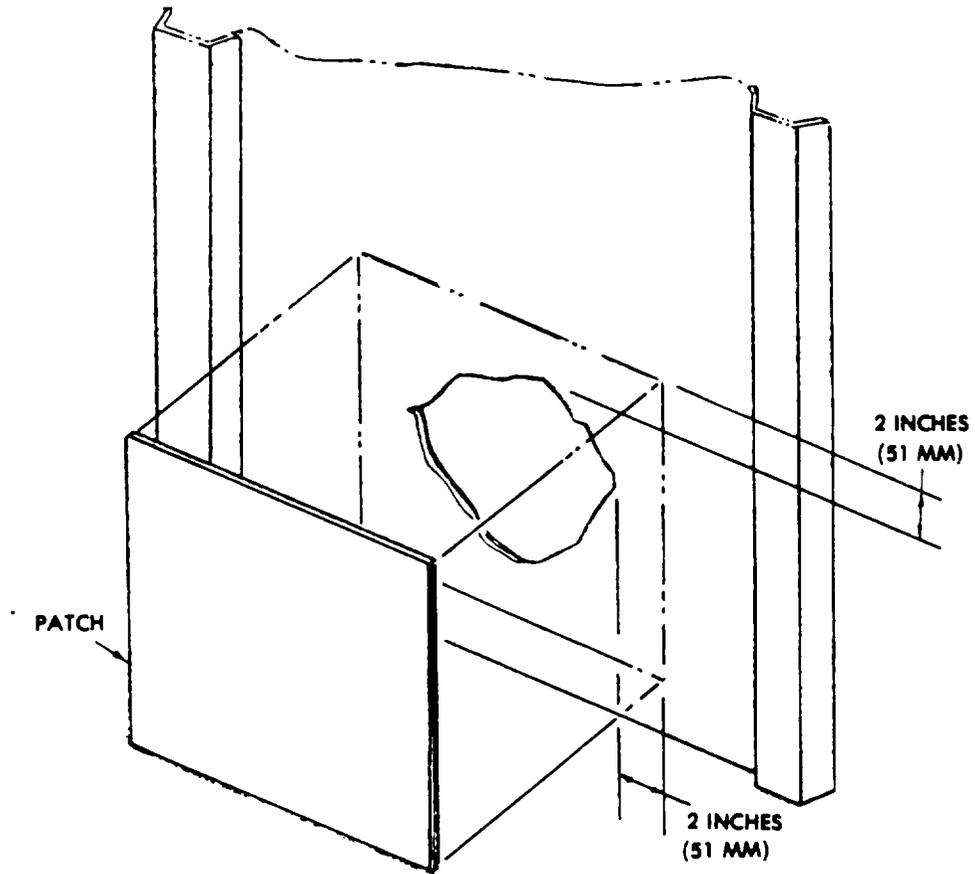


Figure No. 8 Sheet Metal Patch.

(4) Repair metal around the entire perimeter. Acceptable Techniques:

- (a) Weld.
- (b) Screw or rivet and seal with caulking compound.

(6) Paint repaired area in accordance with specification MIL-T-704. After cleaning and treating, apply two coats of rust-inhibiting semi-gloss enamel paint, allow overnight drying between coats.

- d. Hinges, when broken, torn or twisted, must be repaired or replaced.
- e. Grease fittings, when broken or missing, must be replaced. Grease all fittings.
- f. If the locking bar tube is bent, remove locking assembly from the door, straighten the tube and refit to the door. If this is not possible, install a new assembly.
- g. If the locking bar guides are broken or bent, install new parts.
- h. Replace the door seal if it leaks or is covered with paint to the extent that it is not flexible. A common nail, size 3d, (1.25 inch long), NSN 5314-00-164-5126, or equal, may be substituted for staple to install the door gasket retainer strip.

WARNING

There is no inside escape latch on MILVAN container doors. With an assistant standing by to open and close the doors, the inspector should go inside the container and with the doors closed, inspect for light leaks around door.

- i. Replace the door frame if it is distorted and cannot be straightened in order to realign door.
- j. Remove document holder and plug holes for water and light tightness.
- k. Tack-weld door hardware (nuts, hinges, locking bars, etc.) to deter removal.
- l. Door chains (for holding door to fully-opened position) must have a tensile strength equal to, or better than, that specified in Drawing No. 13219E0052 and verified by the vendor or testing agency. Size of links may vary as long as fit, form and function requirements are satisfied.

15. Interior Lining (General Cargo Containers).

If the interior lining is damaged (minor dents excepted), patch, using 20 gage galvanized or aluminum sheet metal fastened with pop rivets, The entire panel must be replaced by a similar plywood sheet if the panel damage exceeds 144 square inches. To install the plywood liners, sheet metal screws of equal grip may be substituted for drive screws. Assure that the patches have no sharp edges or corners. Punctures less than 1/2 inch in diameter do not have to be repaired.

16. Interior Kick Plate (General and Restraining Contained).

All missing or damaged fasteners must be replaced if the sidewall kick plate is damaged. Patching is allowed. If panel damage exceeds 144 square inches, the whole kick plate section must be replaced. The kick plate shall be fully adhesive-bonded to the plywood.

17. Load Bracing System.

a. Replace any vertical and/or horizontal rail that is bent, dented or distorted beyond the point that it/they cannot be adequately straightened. If any rail is fractured and/or locking slots are distorted, the rail will be removed for a distance of two side panel corrugations from each end of the damage and be replaced. Damaged vertical rails will be replaced for a distance of 6 inches (1.83 m) on each side of the damaged area of the rail. Any rail displaying stage IV corrosion is to be replaced.

b. A bent beam assembly may be straightened. If the beam has been crushed, replace complete assembly. Replace damaged or bent fittings.

18. Over-All Dimensions.

a. The over-all outside dimension must be within the tolerances indicated below:

Over-all height:	8'0" ± .19" (2.44m ± .972m)
Over-all length:	19' 10.5" + 0" -.25" (6.06m + 0 -.076m)
Over-all width:	8'0" ± .19" (2.44m ±.057m)

b. Allowable variations of + 0" - .35" (0 -.114m) are allowed between the centers of the aperture of the diagonally opposite corner fittings (see figure no. 9).

19. Painting.

a. Preparation.

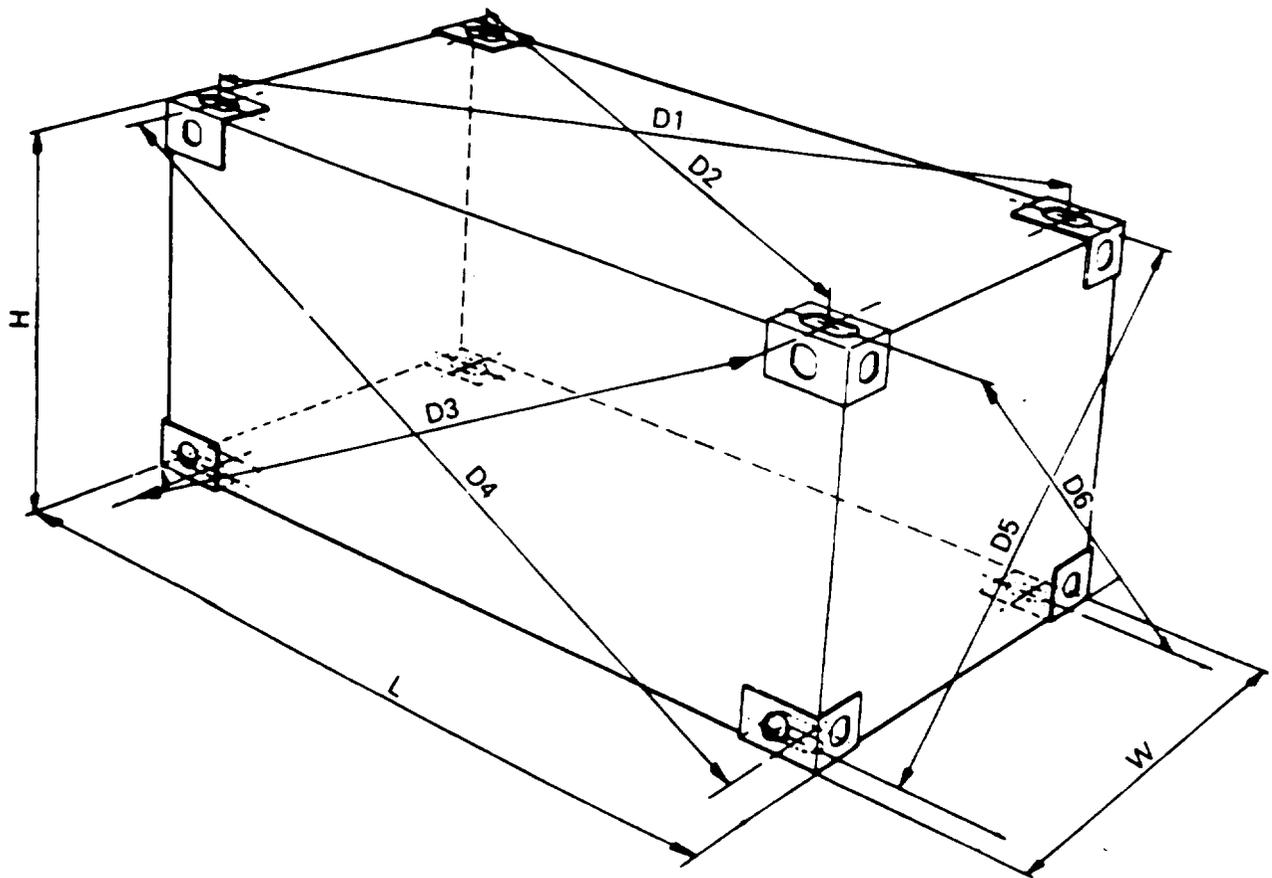
- (1) Surfaces to be painted shall be free from corrosion, dirt, grease and scaly paint.
- (2) Welds and adjacent areas shall contain no loose scale or slag.
- (3) All surfaces that are to remain free of paint shall be properly protected before painting.
- (4) Grease fittings shall be protected to remain free of paint.

b. Painting.

(1) Immediately after abrasive cleaning, light-test in accordance with paragraph 1a, Section III. Repair any visible holes and then apply one coat of either TT-P-664 primer or TT-E-485 enamel (Type IV preferred) or TT-E-529, inside and outside. If additional repairs are required, spot clean and spot paint, using like primers. Then, if TT-P-664 has been used as a primer, an additional coat of TT-E-485 or TT-E-529 enamel will be applied to the roof of the MILVAN as added protection. A final coat of either OD or Forest Green paint will be applied inside; however, the exterior surfaces must be Forest Green, MIL-E-52798. If the doors are replaced, then the following special procedures apply to the wooden, Zinc or metal-clad doors. Abrasively clean lightly (emery cloth on metal, sandpaper on wood). Do not remove zinc coating. Then apply one coat of TT-P-1757 primer to the entire door. The final coat applied to the doors shall be Forest Green. The door is to be primed prior to mounting hardware (e.g., hinges, latches, etc.).

NOTE

Apply the primer to a film thickness of 1 MIL or more.



Overall Configuration - Racked container - a suspect container that has visual distortion to the extent that it would prevent proper alignment of handling equipment, mounting on chassis or insertion into ship cells. The over-all outside dimensions must be within the following tolerances:

- Over-all height 8' 0" (2438 MM) + - .19" (5MM)
- Over-all height 8' 6" (2591MM) + .19" (5 MM)
- Over-all width 8' 0" (2438MM) + - .19" (5MM)
- Over-all length 19' 10.5" (6058MM) + 0-.25" (6 MM) (20 foot long container)
- Over-all length 40' 0' (12192 MM) + 0-.38 (10MM) (40 foot long container)

Allowable tolerances of diagonal distances between opposite corner fittings, when measured between center of the apertures of the corner fittings, are: End (D5 or 06) + 0-.38" (10MM), Top, bottom, side (D1, D2, D3, or D4) + 0"-.38" (10MM). Side or end panels that are bowed inward to severely affect the normal interior cube utilization.

Figure No. 9. Method of Checking Alignment of ISO Containers.

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(2) Painting behind the horizontal restraining rail will be by two spray passes – one from the top and one from the bottom, at angles that will assure coverage of the entire area behind the rails. Any resulting runs on the inside of the container walls are acceptable.

(3) After bottom surfaces have been painted (primer only) a coat of approved automotive undercoating conforming to MIL-C-16173, Grade 1, will be applied to the entire bottom surface, including cross members, bottom rails and floor boards.

(4) Undercoating must be applied to a film thickness as specified in MIL-C-16173.

20. Marking.

a. The phrase, “Do Not Use Forklifts”, will be stenciled in 1.75 inch (44.45 mm) white letters along the center of the bottom rail of the door end and in 4 inch (101.6 mm) white letters along the center of the bottom rail of the other three sides of the container.

b. International Organization For Standardization (ISO) marking shall be stenciled in accordance with TB-43.

c. The painting of the words “US Army MILVAN”, as outlined in MIL-C-52661 and MILVAN fabrication Drawing No. 13219E0030, Sheet 1 of 6, is no longer required. Other marking requirements remain unchanged.

d. Placard and CSC Plates. Affixing placard and CSC (Convention for Safe Container) plates will be in accordance with Drawing No. (97403) 13222E7458. Placard plates will be installed by using blind rivets. Placard plates require 8 rivets each and CSC plates require 4 rivets each: (MIL-R-24243/6).

e. Do not drill holes for CSC plates until plates are provided as GFM (Government Furnished Material).

SECTION III

Tests and Repair

21. Tests.

WARNING

The light test requires that the inspector be inside the MILVAN to check for light leaks. During the test, it is necessary that an assistant be positioned outside the MILVAN to close and open the doors, since there is no inside escape latch on the container doors.

a. Light Test. After sandblasting, and at final inspection of the MILVAN'S understructure, it is necessary that it be raised not less than 6 inches off the ground/floor and set on stands conforming to AMRC Drawing No. AC200000.210, or equivalent. With doors closed, using a minimum of a 100 watt bulb as a light source, inspect the roof, bottom, sides and ends for light penetration into the interior of the container. Repair cracks, holes, etc., as required.

b. Weatherproof Testing. Each container will be tested for weatherproofness before application of finish paint, or the installation of the plywood liner. A stream of water will be applied to all joints, seams and gasketed closures of the container from an 0.5 inch (1.27 cm) ID nozzle at a nozzle pressure of not less than 15 psig (pounds per square inch - gaged) (1.05 kg/cm²). Rate of movement over the exterior of the container shall be approximately 4 feet per second. The nozzle will be held 5 feet (1.525 m) away from the container under test. Continue the test for at least 15 minutes. After testing, examine the interior of the container. The penetration of any moisture into the container shall constitute failure of the weatherproof test.

c. Repair Procedures. To preclude additional container handling and to prevent bare metal from rusting due to water testing, the following is a step-by-step general repair procedure.

- (1) Sandblast
- (2) Light test
- (3) Repair
- (4) Apply wash primer (allow a minimum of 2 hours drying time)
- (6) Water test
- (6) Complete work as required

APPENDIX I

References

1. Regulations

- AR 56-16: Joint Procedures for Coding and Marking, DOD-Owned Containers
- AR 746-1: Color, Marking and Preparation of Equipment for Shipment
- AR 750-17: Maintenance of CONEX/MILVAN Equipment

2. Military Specifications

- MIL-T-704: Treatment and Painting of Materiel
- MIL-P-514: Plate, Identification, Instruction and Marking Blank
- TT-S-230: Sealing Compound, Synthetic Rubber Base, Single Component, Chemically Curing (For Caulking, Sealing and Glazing in Building Construction). (See also revised specification TT-S-230A, Amendment #1.)

3. Technical Publications

- TB 43-0214 Standards of Marking DOD Containers, Shelters and Vans Conforming to the American National Standards Institute (ANSI) International Organization for Standardization (ISO) Dimensional Specifications.
- TM 55-8115-200-23&P: Organizational, Direct Support and General Support Maintenance Manual (Including Repair Parts and Special Tools List) for Container, MILVAN.
- MIL-HDBK 138 (AR): Container Inspection Handbook for Commercial and Military Intermodal Containers (Dry Cargo Type)

4. Miscellaneous

- TA 13219E0030: Drawing Package
- TA 13219E0000: Drawing Package
- TA 13222E7283: Drawing Package

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Standards of Maintenance for MILVAN Containers

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PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO
6	2-1 a		
B1		4-3	
125	line 20		

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

In line 6 of paragraph 2-1a the manual states the engine has 6 Cylinders. The engine on my set only has 4 Cylinders. Change the manual to show 4 Cylinders.

Callout 16 on figure 4-3 is pointing at a bolt. In key to figure 4-3, item 16 is called a shim - Please correct one or the other.

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TEAR ALONG

RATED LINE

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 dekagram = 10 grams = .35 ounce
 1 hectogram = 10 dekagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	newton meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-foot	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	$\frac{5}{9}$ (after subtracting 32)	Celsius temperature	°C
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