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# LOADING AND BRACING IN END OPENING ISO CONTAINERS OF COMPLETE ROUNDS PACKED IN CYLINDRICAL METAL CONTAINERS

## PA104 SERIES CONTAINERS

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- LOADING AND BRACING SPECIFICATIONS SET FORTH WITHIN THIS DRAWING ARE APPLICABLE TO LOADS THAT ARE TO BE SHIPPED BY TRAILER/CONTAINER-ON-FLAT CAR (T/COFC) RAIL CARRIER SERVICE. THESE SPECIFICATIONS MAY ALSO BE USED FOR LOADS THAT ARE TO BE MOVED BY MOTOR OR WATER CARRIERS.

### U.S. ARMY MATERIEL COMMAND DRAWING

APPROVED, U.S. ARMY ARMAMENT, MUNITIONS AND  
CHEMICAL COMMAND

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FILE

19

48

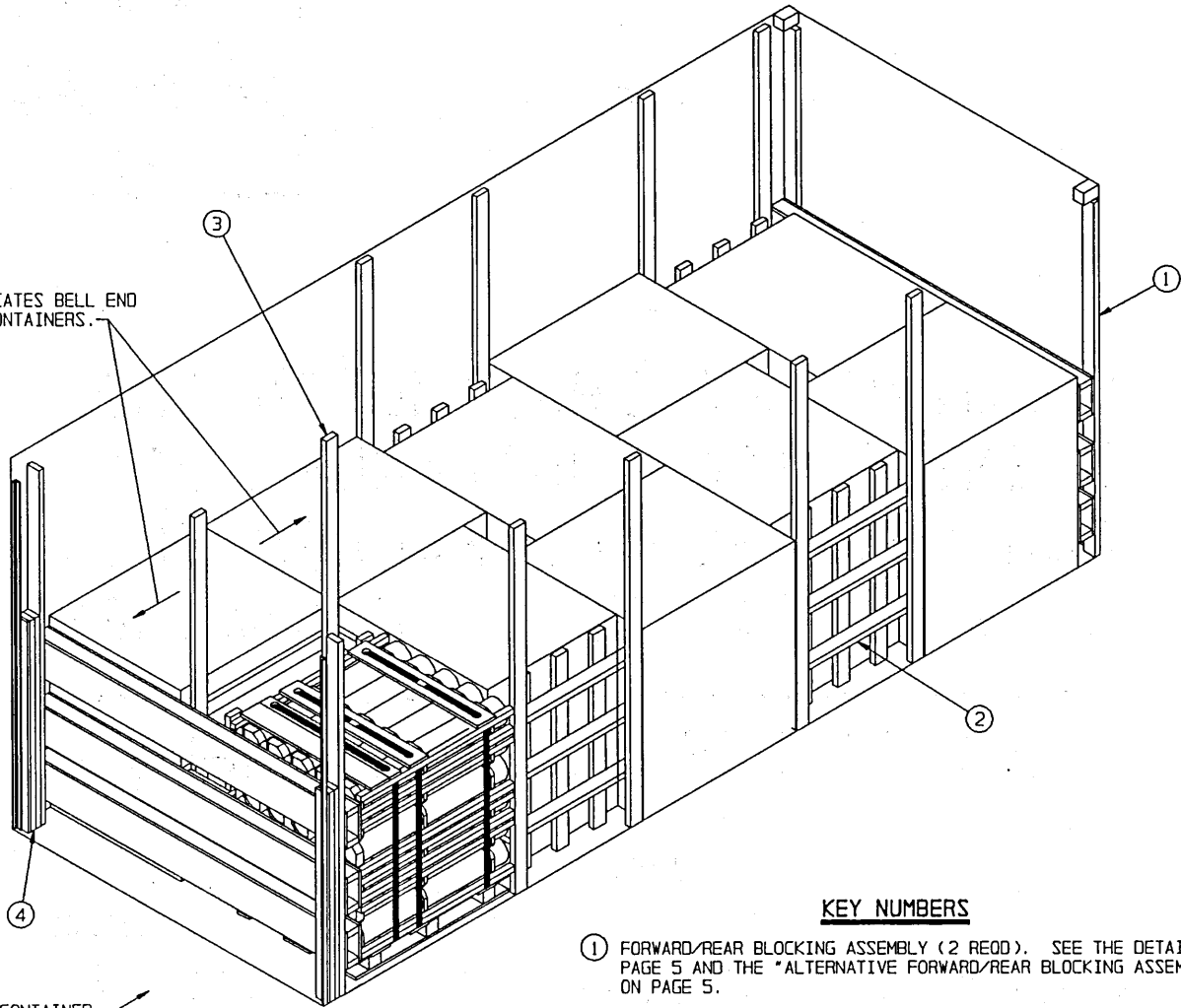
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SEE THE REVISION LISTING ON PAGE 3

DO NOT SCALE

INDICATES BELL END OF CONTAINERS.



REAR OF CONTAINER.

ISOMETRIC VIEW

KEY NUMBERS

- ① FORWARD/REAR BLOCKING ASSEMBLY (2 REOD). SEE THE DETAIL ON PAGE 5 AND THE "ALTERNATIVE FORWARD/REAR BLOCKING ASSEMBLY" ON PAGE 5.
- ② SIDE FILL ASSEMBLY (4 REOD). SEE THE DETAIL ON PAGE 6.
- ③ CENTER FILL ASSEMBLY (1 REOD). SEE THE DETAIL ON PAGE 6.
- ④ FILL MATERIAL, 4" WIDE BY 54" LONG MATERIAL (AS REOD). TOENAIL THE FIRST PIECE TO THE REAR BLOCKING ASSEMBLY W/5 NAILS OF A SUITABLE SIZE (10d NAILS FOR 2" THICK MATERIAL). TOENAIL EACH ADDITIONAL PIECE TO THE PREVIOUS PIECE IN A SIMILAR MANNER. NOTE: MULTIPLE PIECES MAY BE LAMINATED TOGETHER FIRST AND THEN TOENAILED TO THE REAR BLOCKING ASSEMBLY. SEE DETAILS A AND B ON PAGE 9.

BILL OF MATERIAL

LUMBER	LINEAR FEET	BOARD FEET
1" X 4"	9	3
2" X 4"	343	229
NAILS	NO. REOD	POUNDS
6d (2')	274	1-3/4
10d (3')	236	3-3/4
PLYWOOD, 3/4"	72.05 SQ FT REOD	148.61 LBS

LOAD AS SHOWN

ITEM	QUANTITY	WEIGHT (APPROX)
PALLET UNIT	10	24,080 LBS
DUNNAGE		619 LBS
CONTAINER		4,700 LBS
TOTAL WEIGHT		29,399 LBS (APPROX)

(GENERAL NOTES CONTINUED)

GENERAL NOTES

- N. THE QUANTITY OF PALLET UNITS SHOWN IN THE LOAD ON PAGE 2 MAY BE REDUCED FOR SHIPMENT, IF DESIRED. SEE THE FILLER ASSEMBLY ON PAGE 4. WHEN A CONTAINER IS TO BE LOADED WITH A REDUCED QUANTITY OF LADING UNITS, THE LENGTHWISE CENTER OF GRAVITY OF THE LOAD MUST BE WITHIN 12", IN EITHER DIRECTION, OF THE MID-POINT OF THE CONTAINER.
  - 1. IF A LOAD IS REDUCED BY ONLY A SMALL AMOUNT (ONE OR TWO LADING UNITS), LADING UNITS NORMALLY MAY BE ELIMINATED FROM THE CENTER OF THE LOAD.
  - 2. IF A LOAD IS REDUCED BY A LARGE AMOUNT (MORE THAN TWO LADING UNITS), LADING UNITS SHOULD BE ELIMINATED AS REQUIRED AND THE TOTAL LOAD SHIFTED FORE OR AFT, AS NECESSARY, TO ACHIEVE A SYMMETRICAL WEIGHT DISTRIBUTION. THE DEPICTED PROCEDURES WILL BE FOLLOWED AS CLOSELY AS POSSIBLE, MAKING ONLY THOSE ADJUSTMENTS TO THE DUNNAGE WHICH ARE REQUIRED TO ACCOMMODATE THE NUMBER OF UNITS TO BE SHIPPED.
- O. RECOMMENDED SEQUENTIAL LOADING PROCEDURES:
  - 1. PREFABRICATE TWO FORWARD/REAR BLOCKING ASSEMBLIES, FOUR SIDE FILL ASSEMBLIES, AND ONE CENTER FILL ASSEMBLY.
  - 2. INSTALL THE FORWARD BLOCKING ASSEMBLY.
  - 3. INSTALL ONE SIDE FILL ASSEMBLY.
  - 4. LOAD FOUR PALLET UNITS.
  - 5. INSTALL TWO SIDE FILL ASSEMBLIES.
  - 6. REPEAT STEP 4.
  - 7. LOAD TWO PALLET UNITS.
  - 8. INSTALL THE CENTER FILL ASSEMBLY.
  - 9. INSTALL THE REAR BLOCKING ASSEMBLY.
  - 10. INSTALL THE SOLID FILL MATERIAL.

- A. THIS DOCUMENT HAS BEEN PREPARED AND ISSUED IN ACCORDANCE WITH AR 740-1 AND AUGMENTS TM 743-200-1 (CHAPTER 5).
- B. THE SPECIFIED OUTLOADING PROCEDURES ARE APPLICABLE TO LOADS OF COMPLETE ROUNDS PACKED IN PA104 SERIES METAL CONTAINERS. SUBSEQUENT REFERENCE TO PALLET UNIT HEREIN MEANS THE PALLET UNIT WITH AMMUNITION ITEMS. SEE PAGE 4 AND AMC DRAWING 19-48-4079/6-20PM1002 FOR DETAILS OF THE PALLET UNIT. CAUTION: REGARDLESS OF THE QUANTITY OF CONTAINERS TO BE SHIPPED, THE "MAXIMUM GROSS WEIGHT" OF THE END OPENING ISO CONTAINER MUST NOT BE EXCEEDED.
- C. THE LOAD AS SHOWN IS BASED ON A 4,700 POUND 20' LONG BY 8' WIDE BY 8'-6" HIGH END OPENING ISO CONTAINER WITH INSIDE DIMENSIONS OF 19'-4" LONG BY 92" WIDE BY 95" (93" CLEAR HEIGHT). THE LOAD IS DESIGNED FOR TRAILER/CONTAINER-ON-FLATCAR (T/COFC) SHIPMENT, HOWEVER, THE LOAD AS DESIGNED CAN ALSO BE MOVED BY OTHER SURFACE MODES OF TRANSPORT. NOTICE: OTHER CONTAINERS OF THE SAME DESIGN CONFIGURATION CAN BE USED.
- D. WHEN LOADING PALLET UNITS, THEY ARE TO BE POSITIONED SO AS TO ACHIEVE A TIGHT LOAD (TIGHT AGAINST THE DUNNAGE ASSEMBLIES). ALTHOUGH A TOTAL OF 1-1/2" OF UNBLOCKED SPACE ACROSS THE WIDTH OF A LOAD BAY IS PERMITTED, LATERAL VOIDS WITHIN THE LOAD ARE TO BE HELD TO A MINIMUM. EXCESSIVE SLACK CAN BE ELIMINATED FROM A LOAD BY LAMINATING ADDITIONAL PIECES OF APPROPRIATE THICKNESS TO THE VERTICAL PIECES ON THE SIDE FILL 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 FILL ASSEMBLIES MAY BE ADJUSTED AS REQUIRED TO FACILITATE VARIANCE IN THE PALLET UNIT SIZE.
- E. 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" BY 5-1/2" WIDE.
- F. 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 ONTO OR RIGHT BESIDE A NAIL IN A LOWER PIECE.
- G. IN SOME CONTAINERS THERE IS A SLOT AT THE CORNERS OF THE FORWARD WALL. PIECES OF DUNNAGE MATERIAL MUST BE LAMINATED TO THE BUFFER PIECES ON THE FORWARD BLOCKING ASSEMBLY TO PROVIDE A FLAT SURFACE FOR THE BUFFER PIECES. A PIECE OF 2" X 4", 2" X 3" OR A SPECIAL WIDTH PIECE CUT-TO-FIT CAN BE USED. THIS FILL PIECE WILL BE NAILED WITH ONE APPROPRIATELY SIZED NAIL EVERY 12". THIS PIECE IS NOT REQUIRED WHEN THE CORNER PORTIONS OF THE CONTAINER FORWARD WALL ARE SMOOTH AND FLAT.
- H. CAUTION: DO NOT NAIL DUNNAGE MATERIAL TO THE CONTAINER WALLS OR FLOOR. ALL NAILING WILL BE WITHIN THE DUNNAGE.
- J. PORTIONS OF THE CONTAINER DEPICTED WITHIN THIS DRAWING, SUCH AS THE SIDEWALL, HAVE NOT BEEN SHOWN IN THE LOAD VIEWS FOR CLARITY PURPOSES.
- K. REQUIREMENTS CITED WITHIN THE BUREAU OF EXPLOSIVES PAMPHLET 6C APPLY WHEN THE SHIPMENT MOVES BY TRAILER/CONTAINER-ON-FLATCAR (T/COFC). SPECIAL T/COFC NOTES FOLLOW:
  - 1. A LOADED CONTAINER MUST BE ON A CHASSIS EQUIPPED WITH TWO BOGIE ASSEMBLIES WHEN BEING MOVED IN TOFC SERVICE.
  - 2. THE LOAD LIMIT OF A T/COFC RAILCAR MUST NOT BE EXCEEDED, NOR WILL A CAR BE LOADED SO THAT THE TRUCK UNDER ONE END OF THE CAR CARRIES MORE THAN ONE-HALF OF THE LOAD LIMIT FOR THAT CAR.
- L. DURING INTRASTATE AND/OR INTERSTATE MOVES BY MOTOR CARRIER, A PROPER CHASSIS OR MODIFIED FLATBED TRAILER MUST BE USED TO PRECLUDE VIOLATION OF ONE OR MORE "WEIGHT LAWS" APPLICABLE TO THE STATE OR STATES INVOLVED.
- M. 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 0.454 KG.

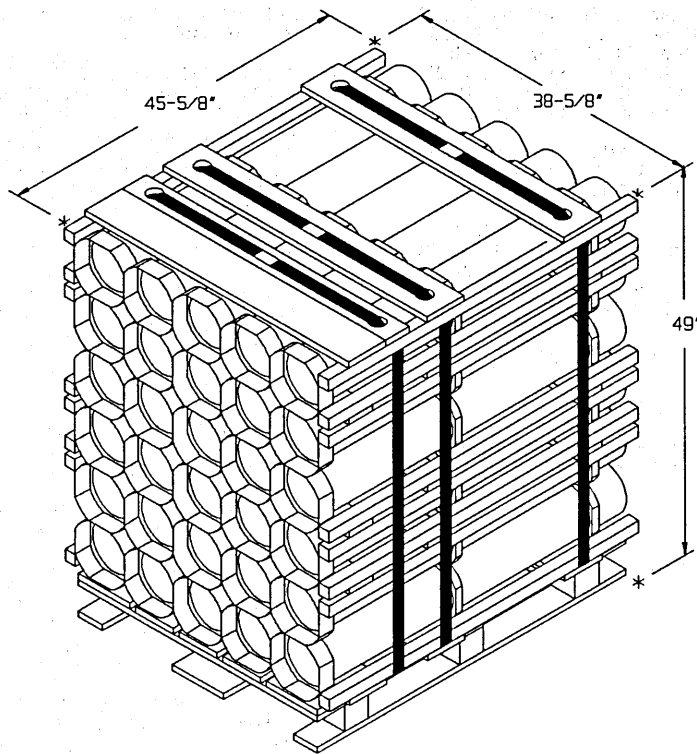
REVISION

REVISION NO. 1, DATED JANUARY 1993, CONSISTS OF: STREAMLINING DUNNAGING METHODS.

MATERIAL SPECIFICATIONS

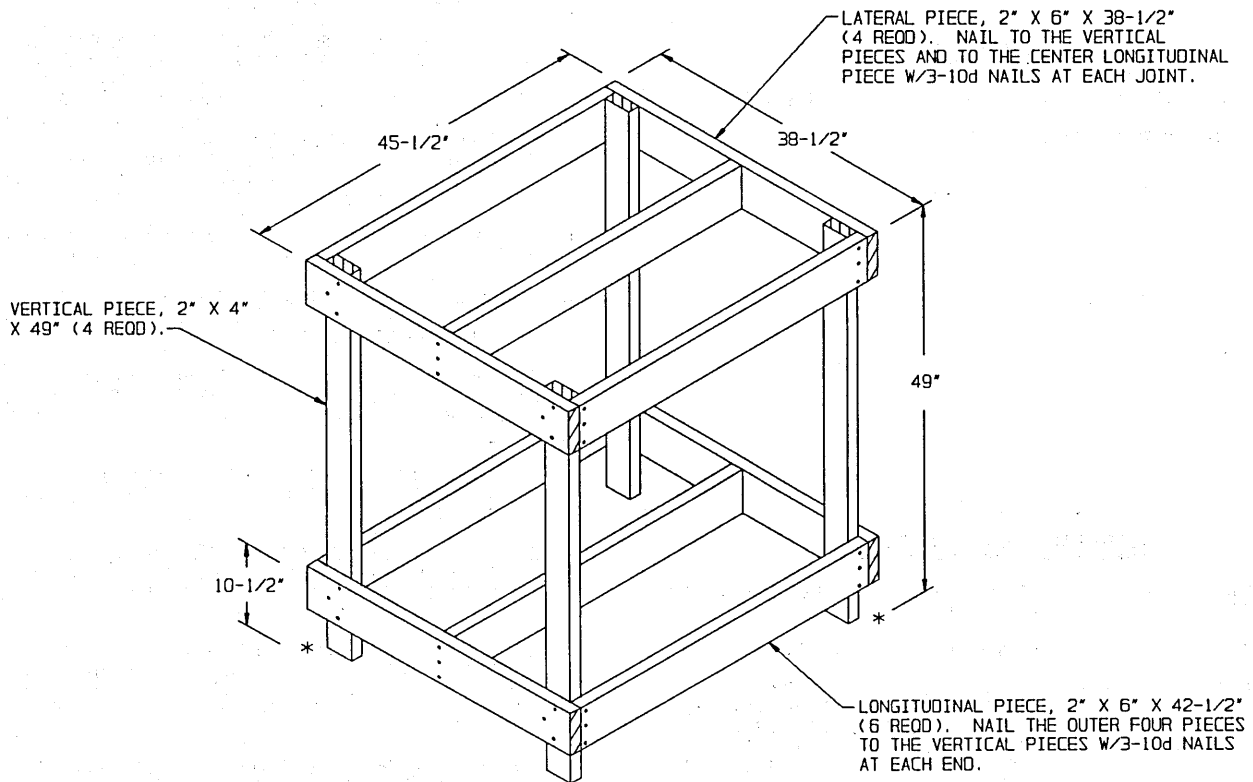
- LUMBER - - - - - : SEE TM 743-200-1 (DUNNAGE LUMBER) AND FED SPEC MM-L-751.
- NAILS - - - - - : FED SPEC FF-N-105; COMMON.
- PLYWOOD - - - - - : COMMERCIAL ITEM DESCRIPTION A-A-55057, TYPE A, CONSTRUCTION AND INDUSTRIAL PLYWOOD, INTERIOR WITH EXTERIOR GLUE, GRADE C-D. IF SPECIFIED GRADE IS NOT AVAILABLE, A BETTER INTERIOR OR AN EXTERIOR GRADE MAY BE SUBSTITUTED.
- WIRE, CARBON STEEL - : ASTM A853; ANNEALED AT FINISH, BLACK OXIDE FINISH, .0800" DIA, GRADE 1006 OR BETTER.

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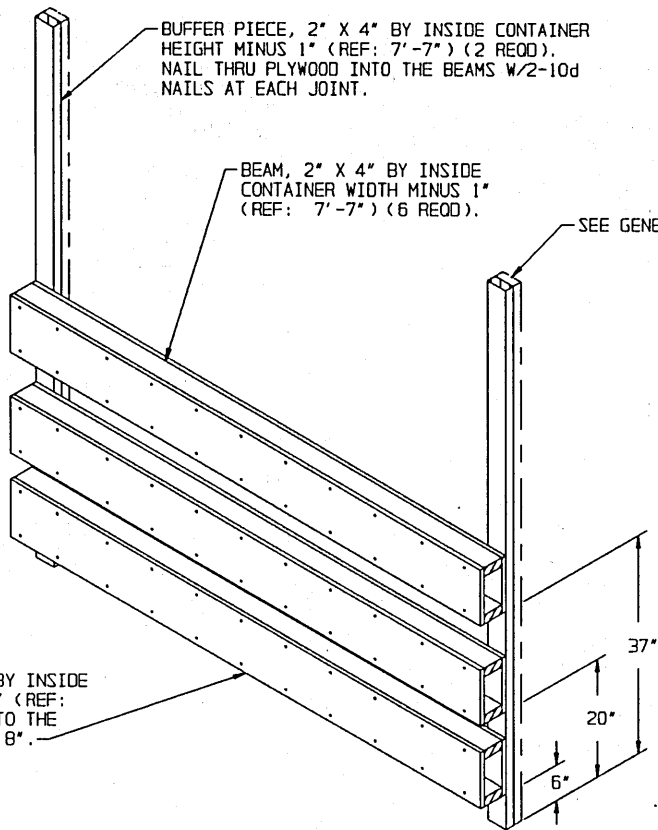
**PALLET UNIT**

UNIT WEIGHT ----- 2,408 LBS (APPROX)  
 CUBE ----- 50.0 CU FT (APPROX)



**FILLER ASSEMBLY**

THE ASSEMBLY DEPICTED ABOVE IS FOR USE IN PLACE OF AN OMITTED PALLET UNIT. FILLER ASSEMBLIES MUST BE WIRE TIED TO ADJACENT PALLET UNITS TO PREVENT UNDUCE MOVEMENT. NO MORE THAN FIVE FILLER ASSEMBLIES MAY BE USED PER LOAD. DO NOT INSTALL A FILLER ASSEMBLY IMMEDIATELY ADJACENT TO ANOTHER FILLER ASSEMBLY.



BUFFER PIECE, 2" X 4" BY INSIDE CONTAINER HEIGHT MINUS 1" (REF: 7'-7") (2 REOD). NAIL THRU PLYWOOD INTO THE BEAMS W/2-10d NAILS AT EACH JOINT.

BEAM, 2" X 4" BY INSIDE CONTAINER WIDTH MINUS 1" (REF: 7'-7") (6 REOD).

SEE GENERAL NOTE "G" ON PAGE 3.

PLYWOOD, 3/4" X 9-1/2" BY INSIDE CONTAINER WIDTH MINUS 1" (REF: 7'-7") (6 REOD). NAIL TO THE BEAMS W/1-6d NAIL EVERY 8".

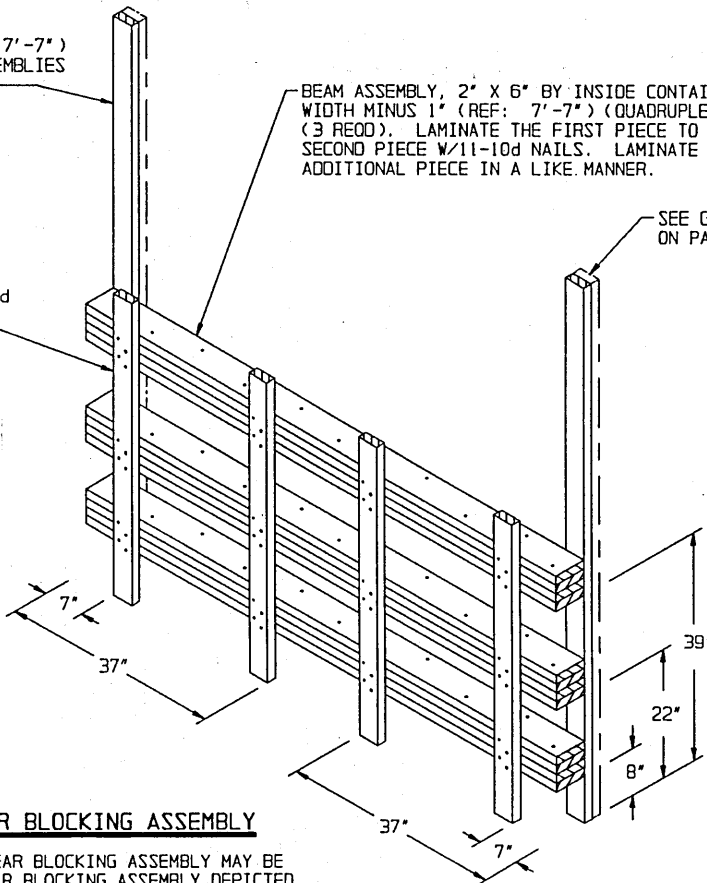
**FORWARD/REAR BLOCKING ASSEMBLY**

BUFFER PIECE, 2" X 4" BY INSIDE CONTAINER HEIGHT MINUS 1" (REF: 7'-7") (2 REOD). NAIL TO THE BEAM ASSEMBLIES W/4-10d NAILS AT EACH JOINT.

BEAM ASSEMBLY, 2" X 6" BY INSIDE CONTAINER WIDTH MINUS 1" (REF: 7'-7") (QUADRUPLED) (3 REOD). LAMINATE THE FIRST PIECE TO THE SECOND PIECE W/11-10d NAILS. LAMINATE EACH ADDITIONAL PIECE IN A LIKE MANNER.

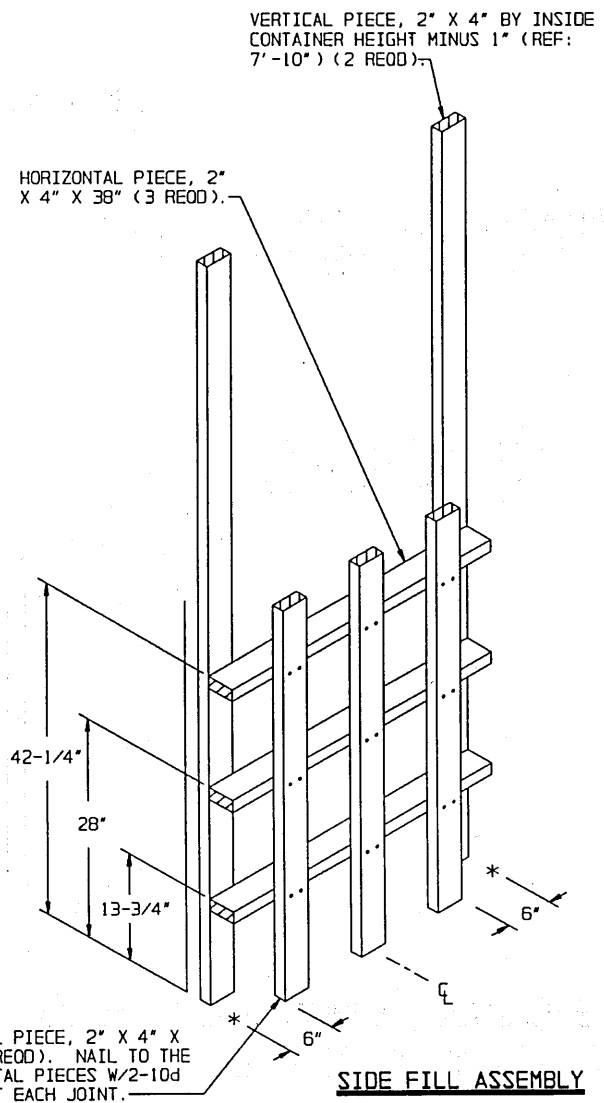
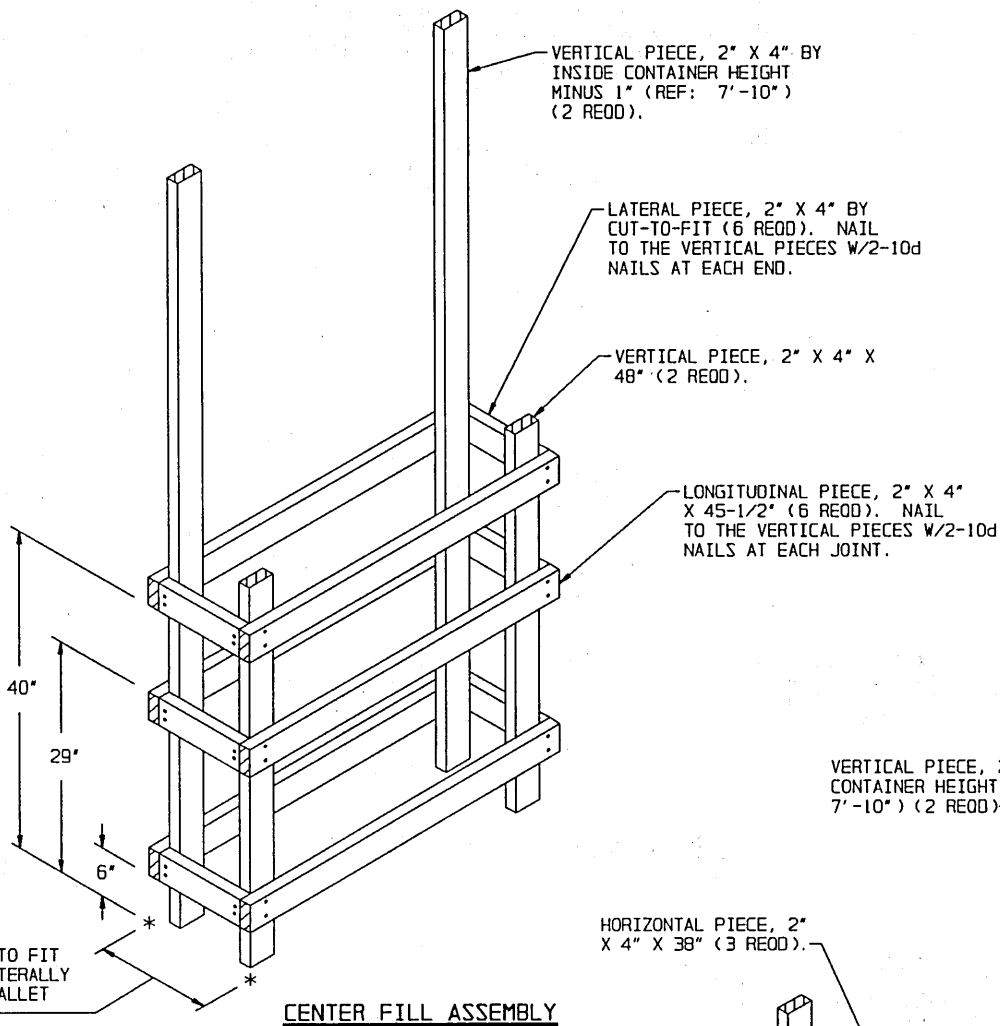
SEE GENERAL NOTE "G" ON PAGE 3.

VERTICAL PIECE, 2" X 4" X 51" (4 REOD). NAIL TO THE BEAM ASSEMBLIES W/4-10d NAILS AT EACH JOINT.



**ALTERNATIVE FORWARD/REAR BLOCKING ASSEMBLY**

NOTE: THE ALTERNATIV FORWARD/REAR BLOCKING ASSEMBLY MAY BE USED IN PLACE OF THE FORWARD/REAR BLOCKING ASSEMBLY DEPICTED IN THE LOAD ON PAGE 2; IF DESIRED.

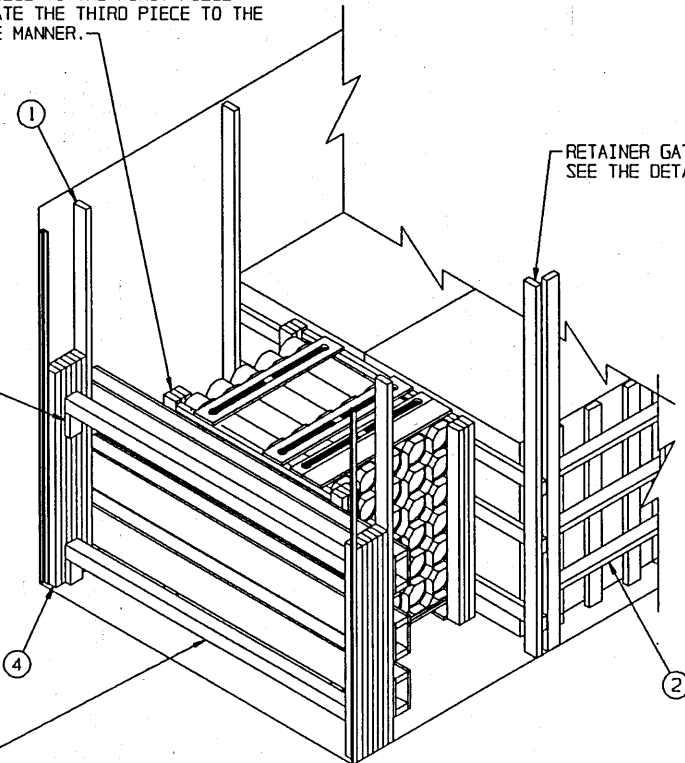


PALLET RETAINER, 2" X 4" X 49" (TRIPLED) (2 REOD).  
 NAIL THE FIRST PIECE INTO THE BEAMS OF THE REAR  
 BLOCKING ASSEMBLY W/2-10d NAILS AT EACH JOINT.  
 LAMINATE THE SECOND PIECE TO THE FIRST PIECE  
 W/6-10d NAILS. LAMINATE THE THIRD PIECE TO THE  
 SECOND PIECE IN A LIKE MANNER.

STRUT LEDGER, 2" X 4" X 6"  
 (OPTIONAL). INSTALL PRIOR  
 TO INSTALLING SPANNER  
 PIECES. NAIL TO FILL  
 MATERIAL W/2-10d NAILS.

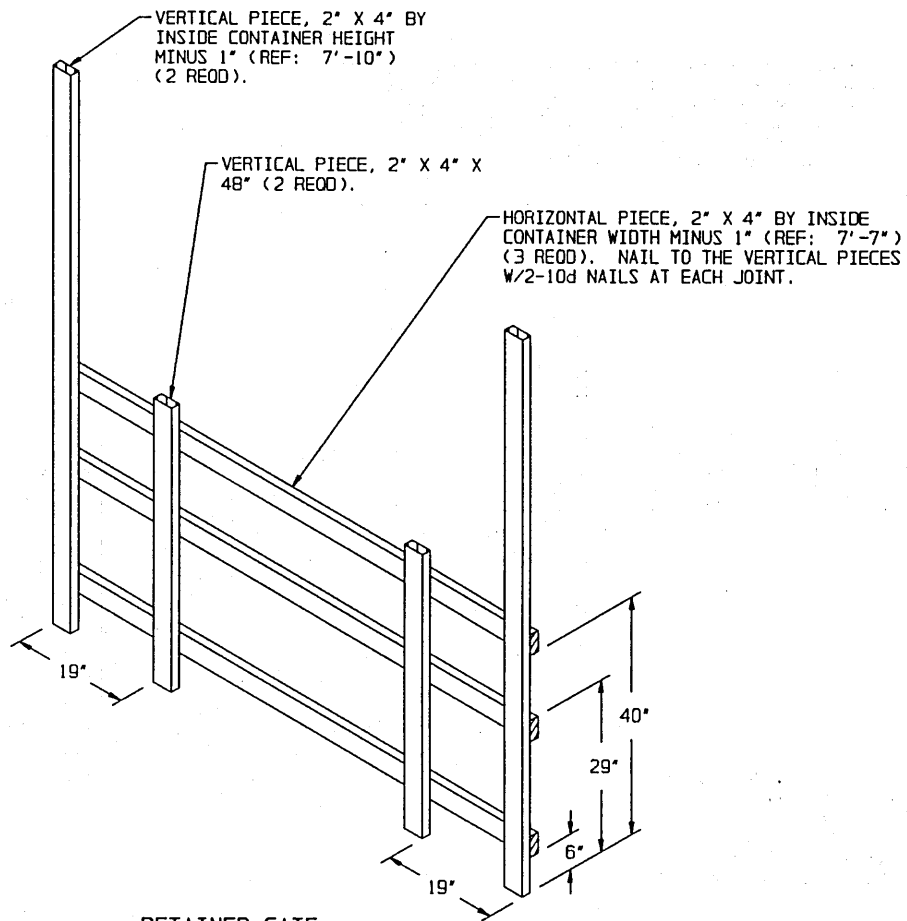
SPANNER PIECE, 2" X 4" OR 4" X 4"  
 MATERIAL, CUT TO A LENGTH THAT  
 WILL PROVIDE FOR A DRIVE FIT  
 (REF: 7'-1-3/8") (2 REOD PER 6"  
 OF FILL). TOENAIL TO THE FILL  
 MATERIAL W/2-12d NAILS AT EACH END.

RETAINER GATE (1 REOD).  
 SEE THE DETAIL ON PAGE 8.

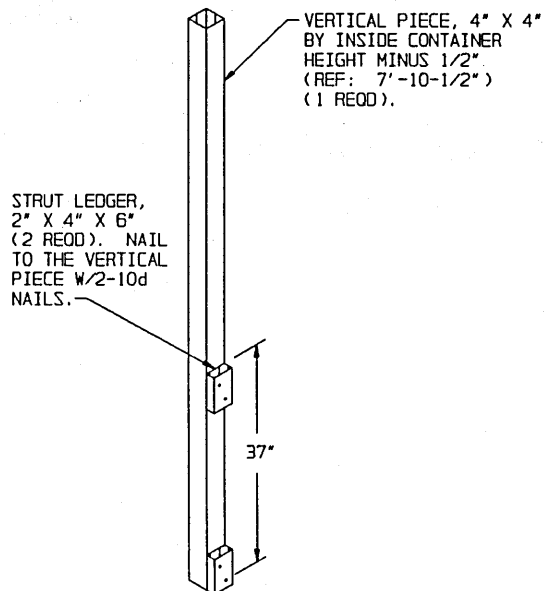


#### LESS-THAN-FULL-LOAD PROCEDURE

THE DETAIL ABOVE DEPICTS A BLOCKING METHOD TO BE USED IN A LESS-THAN-FULL CONTAINER LOAD (LESS THAN 10 UNITS). KEY NUMBERS REFER TO KEY NUMBERS ON PAGE 2. SEE GENERAL NOTE "N" ON PAGE 3. SPANNER PIECES SHOWN IN THE DETAIL ABOVE MUST BE INSTALLED AS FOLLOWS. INSTALL THE UPPER SPANNER PIECE SUCH THAT THE TOP EDGE OF THE TOP SPANNER PIECE IS AT THE SAME HEIGHT AS THE TOP EDGE OF THE TOP BOX BEAM ASSEMBLY OR BEAM ASSEMBLY IN THE REAR BLOCKING ASSEMBLY. INSTALL THE LOWER SPANNER PIECE SUCH THAT THE BOTTOM OF THE LOWER SPANNER PIECE IS AT THE SAME HEIGHT AS THE BOTTOM EDGE OF THE LOWEST BOX BEAM ASSEMBLY OR BEAM ASSEMBLY. SPANNER PIECES AND STRUT LEDGERS ARE ONLY REQUIRED WHEN USING 6" OR MORE OF SOLID FILL. THIS PROCEDURE MAY ALSO BE USED IN COMBINATION WITH THE FILLER ASSEMBLY DEPICTED ON PAGE 4.



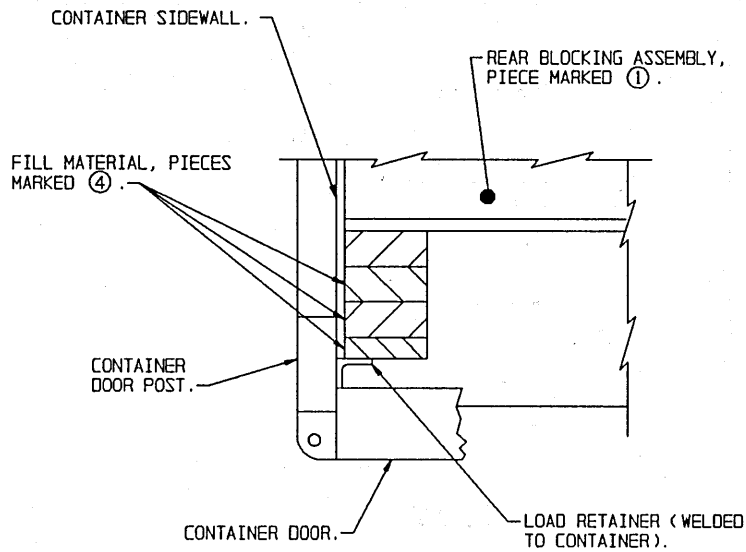
**RETAINER GATE**



**DOOR POST VERTICAL**

IF THE ISO CONTAINER TO BE LOADED IS NOT EQUIPPED WITH PRE-WELDED LOAD RETAINERS, THE DOOR POST VERTICAL MUST BE NAILED TO THE DOOR POST VERTICAL RETAINER. NAIL THROUGH THE HOLES IN THE DOOR POST VERTICAL RETAINER INTO THE DOOR POST VERTICAL W/4-10d NAILS.



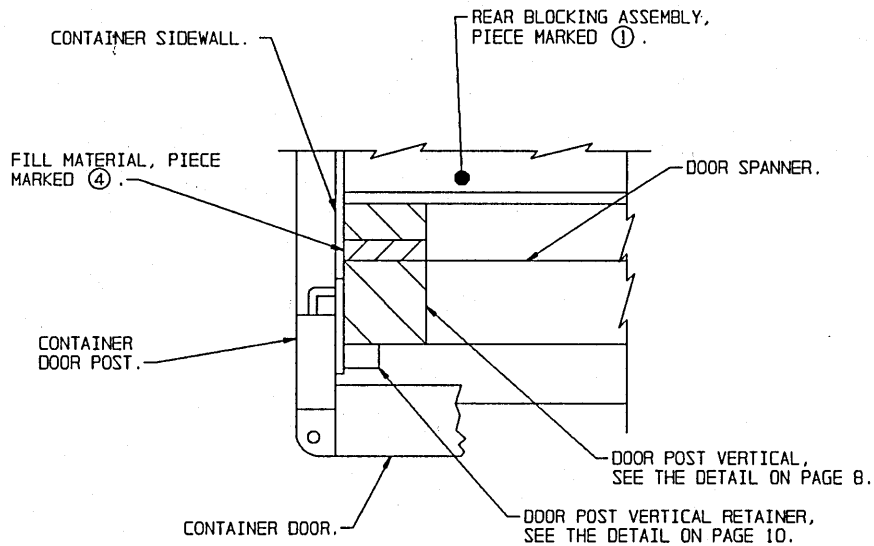


**DETAIL A**

A PARTIAL PLAN VIEW OF THE LEFT REAR PORTION OF THE CONTAINER IS SHOWN DEPICTING THE PROPER POSITION OF THE FILL MATERIAL AND ADJACENT DUNNAGE PIECES.

**SPECIAL NOTE:**

WHEN COMMERCIAL CONTAINERS ARE NOT EQUIPPED WITH PRE-WELDED LOAD RETAINERS, AS DEPICTED IN "DETAIL A" ABOVE, DOOR POST VERTICALS, DOOR POST VERTICAL RETAINERS AND DOOR SPANNERS WILL BE REQUIRED FOR THE LOAD DEPICTED ON PAGE 2. SEE VARIOUS LOADS WITHIN AMC DRAWING 19-48-4153-15PA1002 FOR EXAMPLES. SEE PAGE 10 FOR DETAILS OF THE METAL DOOR POST VERTICAL RETAINER.

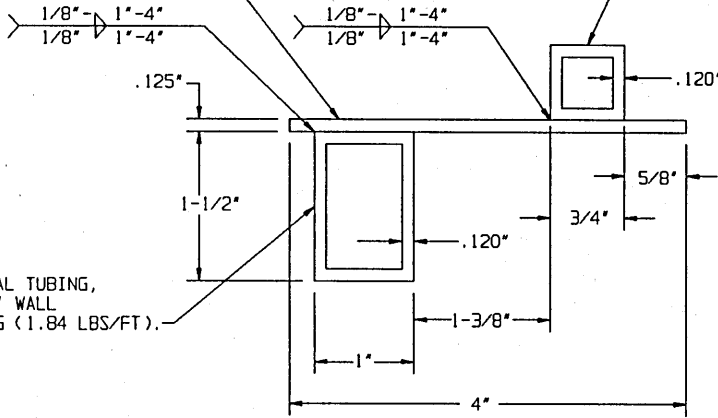


**DETAIL B**

A PARTIAL PLAN VIEW OF THE LEFT REAR PORTION OF THE CONTAINER IS SHOWN DEPICTING THE PROPER POSITION OF THE DOOR POST VERTICAL RETAINER AND ADJACENT DUNNAGE PIECES.

STEEL STRIP, 1/8" THICK BY 4" WIDE  
BY 83" LONG (1.70 LBS/FT).

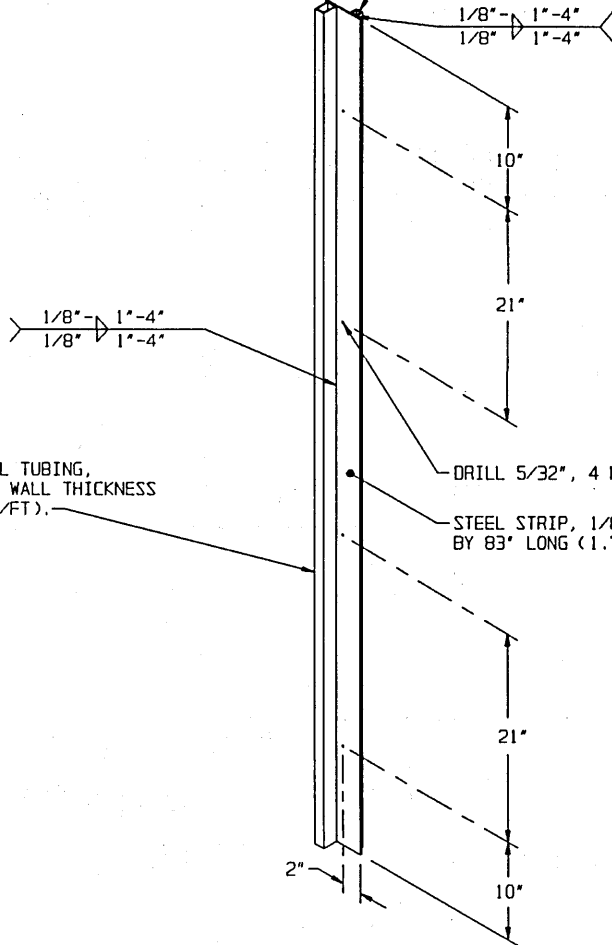
SQUARE STRUCTURAL TUBING, 3/4" SQUARE  
BY .120" WALL THICKNESS BY 83" LONG  
(1.03 LBS/FT).



RECTANGULAR STRUCTURAL TUBING,  
1-1/2" BY 1" BY .120" WALL  
THICKNESS BY 83" LONG (1.84 LBS/FT).

**VIEW A**

SQUARE STRUCTURAL TUBING,  
3/4" SQUARE BY .120" WALL  
THICKNESS BY 83" LONG  
(1.03 LBS/FT).



RECTANGULAR STRUCTURAL TUBING,  
1-1/2" BY 1" BY .120" WALL  
THICKNESS  
BY 83" LONG (1.84 LBS/FT).

DRILL 5/32", 4 HOLES.

STEEL STRIP, 1/8" THICK BY 4" WIDE  
BY 83" LONG (1.70 LBS/FT).

**DOOR POST VERTICAL RETAINER**

NOTE: THE ABOVE ASSEMBLY HAS BEEN SHOWN ROTATED 90° FROM THE ORIENTATION IN WHICH IT IS INSTALLED IN THE LEFT REAR CORNER OF THE CONTAINER. THE ASSEMBLY HAS BEEN ROTATED FOR HOLE LOCATION CLARITY.