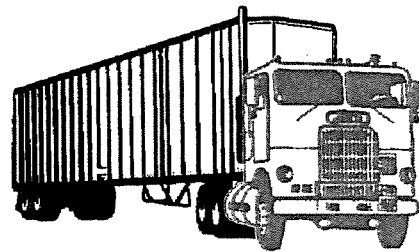


Stoughton Trailers

Dry Van Repair Manual



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Introduction

1: About This Manual ...

This manual explains the proper repair procedures to help you retain and/or restore the safety, dependability and performance qualities that were originally designed and built into your Stoughton trailer. The manual is intended to explain the repair procedures associated with the most common trailer repairs, but of course we cannot anticipate all specific repair needs and circumstances. The manual therefore stresses the concepts that define acceptable repairs, but cannot and does not address all possible variations which may arise in actual practice for different types of trailers. Procedures have been described in specific detail where appropriate, but generally we must assume that you bring some prior repair experience to these procedures.

2: General Considerations

Always consult the trailer manufacturer for recommendations, drawings and technical assistance prior to making major modifications or repairs to the original design structure.

Compatible materials, original replacement parts and recommended repairs are suggested in this manual to help you achieve optimum performance. Be sure to always select genuine original equipment as manufactured, approved and recommended by the trailer builder, to ensure compatibility with other elements and components of the unit. Compatible replacements are critical to satisfactory service work.

!! Important: Absolutely no welding is to be used in making structural repairs to aluminum extrusions or aluminum sheets.

Standard Protocols

3: Corrosion Prevention

3.1 Dissimilar Metals in Joint Assembly

Joining of dissimilar metals and other materials requires tried and proven procedures to prevent or control corrosion that may occur in certain atmospheric or moisture conditions. When carefully followed, these suggested procedures will prevent such corrosion, within practical limits.

Improper application of protective coatings between surfaces of dissimilar metals can leave the materials open to severe galvanic corrosion. (When the space between two different metals is filled by a fluid that can conduct electricity, one of the metals will gradually decompose.) Corrosion also occurs when wooden parts are not adequately protected prior to their assembly to an aluminum surface.

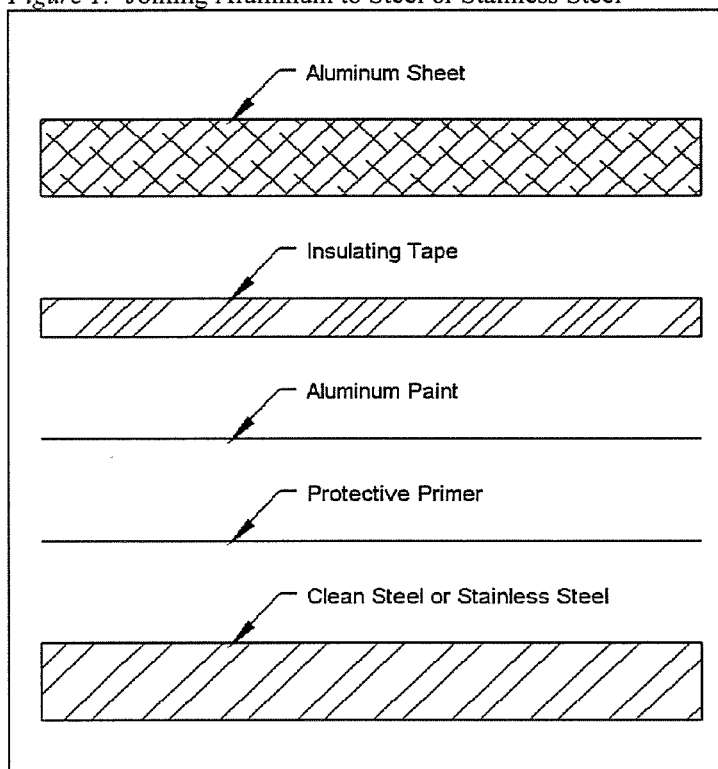
3.2 Joining Aluminum to Unfinished Steel or Stainless Steel

Figure 1 provides a cross-section illustration of how aluminum should be joined to unfinished steel or stainless steel.

1. Before assembling aluminum to steel, clean the surface of the steel of all rust, scale, weld flux, metal expulsion and other foreign materials. Steel surfaces can be cleaned by sandblasting, disc sanding and other methods.
2. Immediately after cleaning the steel surface, apply a protective primer.
3. After the primer is applied, coat the steel areas with aluminum paint.
4. An additional insulating tape should be installed between the aluminum and steel surfaces for added protection against corrosion. A flexible plastic tape will provide adequate protection.
5. All unpainted steel plates and similar exposed items should receive one heavy coat of aluminum paint before they are assembled to aluminum surfaces.

Small fasteners such as screws, bolts, nuts, and nails should be zinc or cadmium plated.

Figure 1: Joining Aluminum to Steel or Stainless Steel

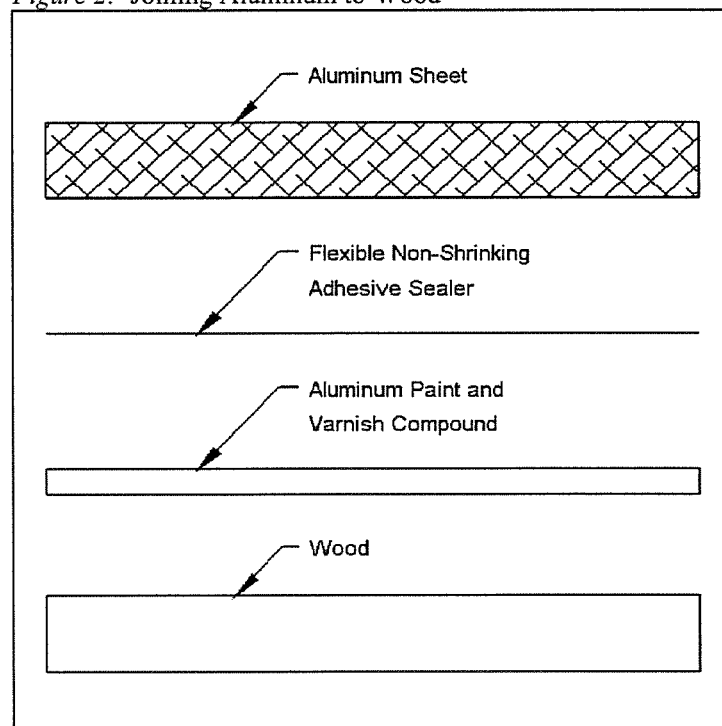


3.3 Joining Aluminum and Wood Surfaces

Figure 2 provides a cross-section illustration of how aluminum should be joined to wood surfaces.

1. On the wood surface, apply a coat of aluminum paint compound composed of aluminum paste and quick-drying spar varnish.
2. In highly corrosive areas, use sealers that are flexible and non-shrinking, and that adhere directly to aluminum, steel, wood, etc.

Figure 2: Joining Aluminum to Wood



4: Riveting Techniques

4.1 General Information

Many of the components on trailers and containers are engineered to be permanently fastened together by a reliable technique called *riveting*. For repairs that require rivets, refer to the Solid Rivets Chart (Figure 3, next page), which lists grip ranges (minimum and maximum) and hole preparation (drill size and hole limits) for the solid aluminum and steel rivet. The importance of using correct riveting techniques is not covered in the Solid Rivet Chart, which provides a guide to sizes and grip ranges of various types of solid rivets, aluminum and steel used in the production and servicing of trailers. For guidance in what is a good or poor rivet, see Figure 4.

4.2 Locating Defective or Loose Solid Rivets

These inspection methods will help you detect loose or defective rivets:

- Obviously, if a rivet can be turned or shaken with the fingers, it should be replaced.
- If looseness is suspected but cannot be verified by turning it, a sharp rap with a hammer will produce a dull sound in a loose rivet.
- Coat the rivet head with light oil, wait a few seconds for the oil to penetrate, wipe it clean, and rap it again with a hammer. If oil appears around the edges again, the rivet should be replaced.
- Visual evidence of movement or shifting between riveted parts, such as bare or shiny areas, is a good indication that the rivet needs replacement. Rust or corrosion around a rivet, while not necessarily proof of looseness, is a good reason to suspect it.

Figure 3: Solid Rivets Chart

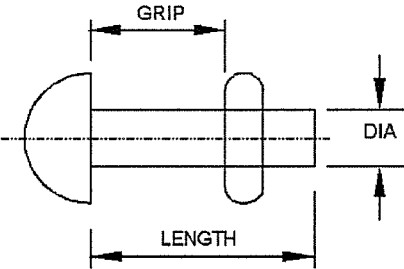
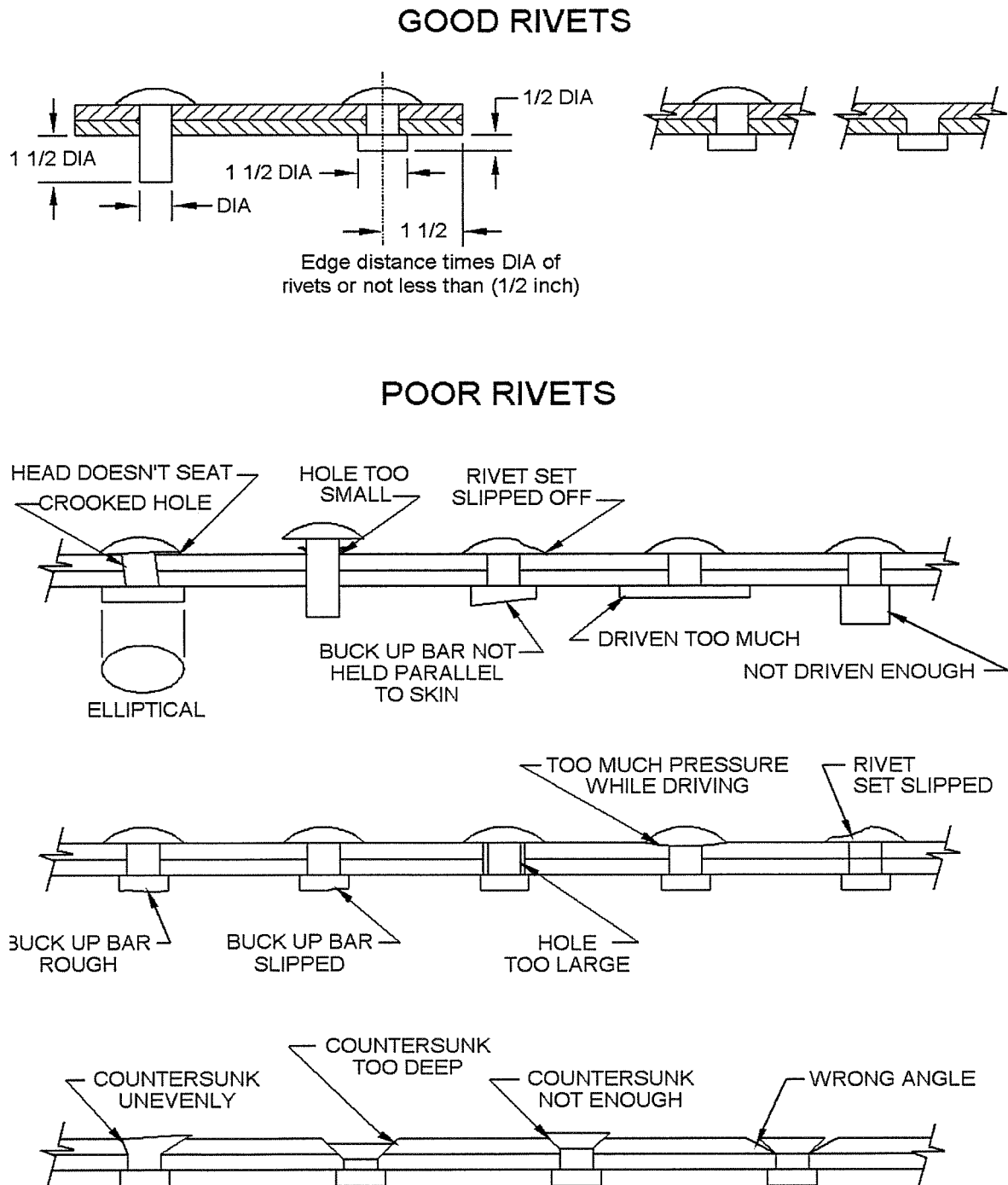
<p>LENGTHS OF RIVETS FOR FLAT DRIVEN HEADS</p> 			
RIVET DIAMETER	3/16	1/4	3/8
HOLE DIAMETER	.204	.265	.406
RIVET LENGTH	RIVET GRIP RANGE FOR GIVEN LENGTHS		
5/16	up to .069	—	—
3/8	.056-.131	—	—
7/16	.119-.194	up to .112	—
1/2	.181-.256	.075-.175	—
9/16	.244-.319	.138-.238	—
5/8	.306-.381	.200-.308	—
11/16	.369-.444	.262-.370	—
3/4	.431-.506	.322-.430	—
13/16	—	.388-.488	.301-.360
7/8	—	.450-.550	.361-.419
1	—	.575-.675	.420-.480

Figure 4: Good and Bad Riveting



4.3 Riveting Tools and Materials

The two most important tools for producing a good rivet "upset" are the Rivet Set and the Bucking Bar.

4.3.1 SOLID RIVET SETS

It is very important to select and use the correct rivet set, to match the head of the rivet being used. For example, a Universal Head Rivet Set should not be used on a round-head rivet.

Likewise, the correct size rivet set is important. An oversized set will flatten the rivet head and damage the adjacent material, while an undersized set will damage the rivet head. See Figure 5.

There are many types and sizes of rivet sets, so be careful to select the proper set for your riveting application. The most common type is the *Straight Rivet Set*. Another type is the *Offset*, used for riveting in limited-access areas.

The *Mushroom* type is used for flat head or countersunk rivets. It is important that the Mushroom rivet set be held flat against the rivet to avoid damaging the material. The rivet set is held in the gun by a retaining spring. Always make sure that the spring is securely in place prior to starting. The strike of the rivet gun is adjustable and should be tested against a block of wood to insure proper strike.

Figure 5: Oversized Rivet Set Damages Rivet Heads

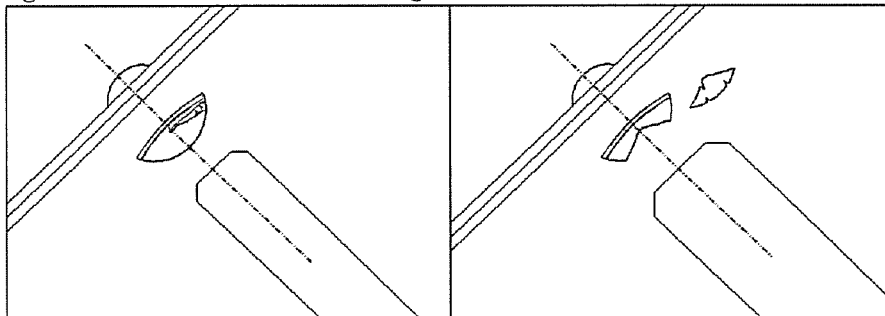
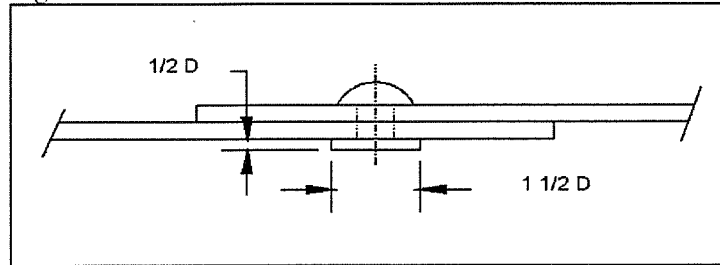


Figure 6: Correct Bucked Head Diameter and Thickness



4.3.2 BUCKING BARS

A good riveting job requires not only the selection of the right rivet set, but also the use of the proper Bucking Bar. The Bucking Bar is used to produce the flat head (bucked head) on the opposite end of the rivet from the manufactured head.

By using the correct bar properly, the bucked head diameter should measure $1\frac{1}{2}$ times the diameter of the rivet shank, and bucked head thickness should measure $\frac{1}{2}$ the diameter of the rivet shank.

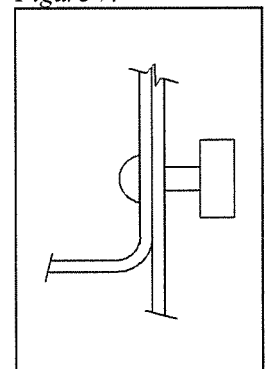
Bucking Bars are produced in many sizes, shapes and weights ranging from one to fifteen pounds. If the bar is too light, it will require more action from the riveting gun and is therefore likely to damage the material. A heavy Bucking Bar will work faster and will keep the vibration of the gun from being transmitted to the "bucker's" hand.

The surface or side of the Bucking Bar that is polished is known as the "face," and it must be positioned and held correctly to create a proper bucked head.

Improperly used tools and techniques will result in unsatisfactory riveting. These are some of the basic rules to follow when using the Bucking Bar:

- Keep the face of the bar parallel to the material. If the bar is canted, the bucked head will be improperly formed and the material will be damaged.
- Use a bar that is the right size for the riveting job.
- The face of the Bucking Bar must cover the entire rivet end.
- A firm hold on the bar will result in a smoother and faster job and will prevent "chatter."

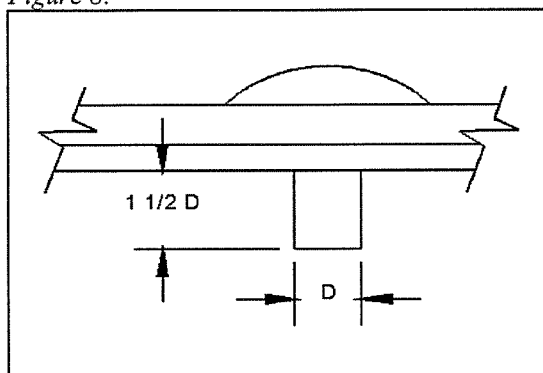
Figure 7:



4.3.3 OPTIMUM RIVET LENGTH

Select a rivet length so that the shank before riveting protrudes through the material $1\frac{1}{2}$ times the diameter of the shank.

Figure 8:



5: Welding

Welding specifications and procedural requirements:

- All welding on steel components must be done by qualified welders. Certified welders are preferred, but not required.
- The integrity of all welds must be visually verified. Welds must be free of porosity, casters and undercutting, and must appear smooth. Welds must achieve proper penetration and be watertight if required.
- For arc welding, weld slag must be removed. Weld spatter must be removed from adjacent surfaces prior to painting.
- Splicing or sectioning in structural frames or tunnel components must be accomplished by welding with a continuous single v-groove weld. For components thicker than 3/16", multiple-pass welds are required. The groove preparation must have a groove angle of 60°, and a minimum root opening of 1/32". See Figure 9.
- Voltage, current, wire speed, gas flow, and type of gases must all be appropriate for the application. The proper electrode or wire type also must be appropriate for the application. See Table 1 (next page) for electrode selection for various materials applications.

Figure 9: Welding Requirements

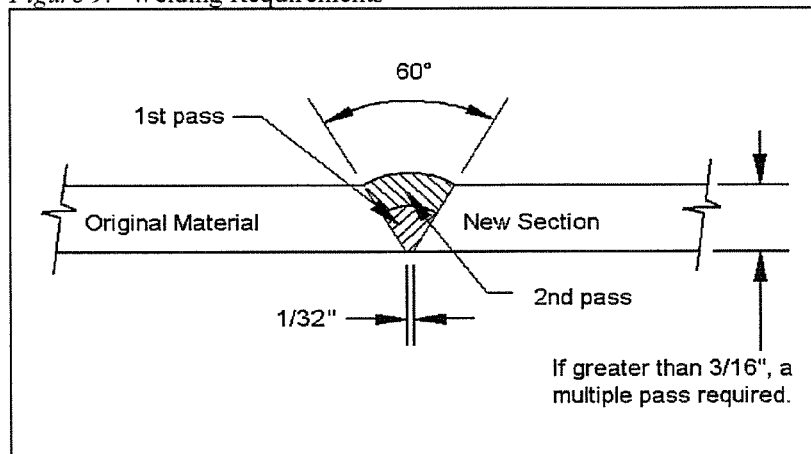


Table 1: Welding Rod Designation

TYPE OF WELD	HORIZONTAL		VERTICAL DOWN GIVES BEST ROD		FLAT OR DOWN HAND	
	MILD	Hi-Ten	MILD	Hi-Ten	MILD	Hi-Ten
Matl Thickness						
≤ .059	3/32 in E4510	— —	3/32 in E4510	— —	3/32 in E4510	— —
.060–.090	3/32 in E6012	3/32 in E7018	3/32 in E6012	3/32 in E6012	3/32 in E6012	3/32 in E7018
.091–.125	1/8 in E6012	1/8 in E7018	1/8 in E6012	1/8 in E7018	1/8 in E6024	1/8 in E7018
.126–.187	1/8 in E6012 E6024	1/8 in E7018	1/8 in E6012	1/8 in E7018	1/8 in E6024	1/8 in E7018
≥ .188	3/16 in E6012 E6024	3/16 in E7018	3/16 in E6012	3/16 in E7018	3/16 in E6024	3/16 in E7018

- (1) Rod size may vary one size with approval of welding engineer.
- (2) On combination of steels, use electrode for mild steel chart. Welding engineer should approve.
- (3) On gage combinations, use lightest gage chart.

6: Sealants and Adhesives

Sealants are used where watertightness is necessary, and where bonding strength is not required. Adhesive bonding is used where watertightness and bonding strength are both required, as in roof bows. Specifications and procedural requirements for sealing and adhesive bonding:

- Adequately prepare the bonding surface for a permanent seal.
- *All exterior sealing on Van trailers:* Use white or gray moisture-curing polyurethane sealants. We recommend Manus 75 AM (from Manus Products).
- *Bonding roof bows to roof skin:* Use a polyurethane adhesive. We recommend Sikaflex 221 (by Sika Chemical).
- *All interior and floorboard joint sealing:* Use a gray butyl rubber sealant. We recommend Manus-Bond 501-A (from Manus Products).
- *Replacing trailer panels or sections of panels:* Use sealing tapes at panel lap joints, panel-to-frame post connections, and at the top and bottom rail to panel connections. All sealing tapes must be closed-cell PVC foam material with adhesive backing. Use the 3/32" x 1/4" size at panel lap joints and panel to top rail and frame connections. Use 1/16" x 1" at bottom rail to panel connections. We recommend Duraco, Inc.'s product for this application.

7: Painting and Finishing

Painting of all surfaces, including aluminum and steel, must be preceded by a good thorough cleaning. Pre-paint cleaning must remove all corrosion and oxidation, and must wash off all traffic film, dust, grease and oil. Be sure to remove all rust, scale, weld, flux and any other loose material, which may prevent primer and paint from bonding to the base material.

Surface cleaning and removal of foreign residues in preparation for painting should be followed by an etching of all surfaces, steel and aluminum, for application of surface coatings. This etching is necessary to permit good adhesion of the coatings. Do not sand the surface after cleaning.

Nearly all paints require an underlying coat of a primer material on the surface, which is necessary for good adhesion and long life of the paint itself. Apply the primer coat immediately after etching. On aluminum, the surface should be primed and followed with a finish coat of paint, per the paint manufacturer's instructions.

Note that all parts in non-welded assemblies must be cleaned and primed before installation. Welded parts and assemblies must be cleaned and primed after welding.

Specific Repair Procedures

8: Upper and Lower Rail Repairs

!! Important: The structural integrity of a trailer may be compromised if repairs to upper and/or lower rails are not done properly!

Repair procedures and materials must conform to the vehicle manufacturer's repair procedure for that particular trailer. In particular, be sure to note the general splicing requirements listed in section 8.1 below before attempting any repairs to upper and/or lower rails.

Sections 8.2 and 8.3 provide manufacturer-approved sectioning instructions, drawings and part numbers for the splicing of rails. The risk of structural failure will be virtually eliminated if you carefully follow these recommended procedures.

8.1 General Splicing Requirements

Upper and lower rails on all van trailers are made from a heat-treated aluminum alloy, 6061-T6, with specific strength features required for trailers. For that reason:

!! Important: *Absolutely no welding may be used* in structural repairs to extruded aluminum upper and lower rails.

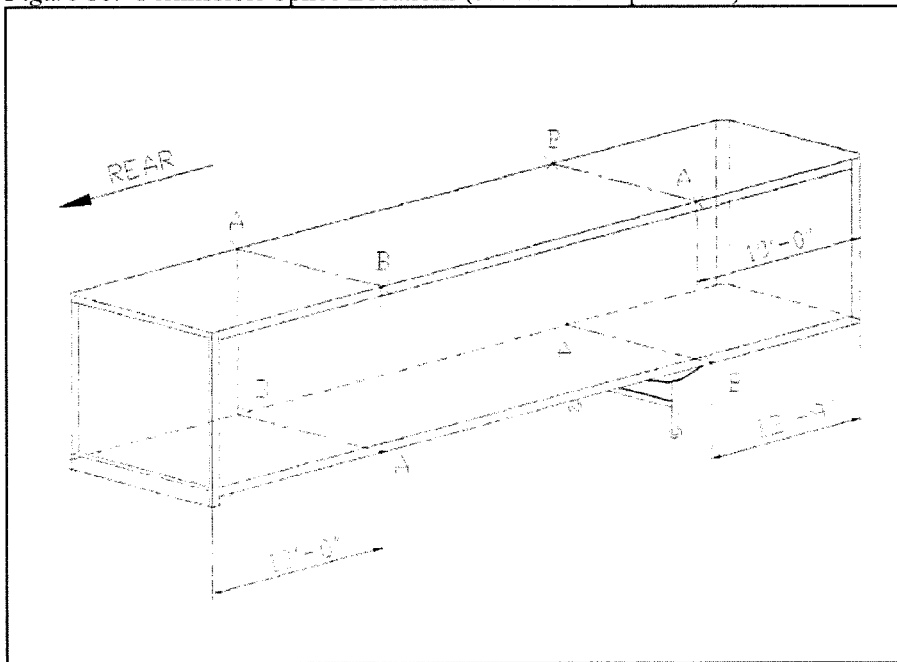
We recommend that no more than one splice be permitted in any upper or lower rail. Also, the location of any splice within the overall rail length is critical to structural integrity:

- In a lower rail, no splice may be inserted farther than 10 feet from either end or the trailer.
- In an upper rail, no splice may be inserted farther than 5 feet from either end of the trailer.

Figure 10 illustrates the requirements for splices to two or more rails in a single trailer. Note that no two rails may contain splices at the same end of the trailer, except in diagonally opposed rail pairs (upper left and lower right, or upper right and lower left). And, as noted above, no single rail may contain more than one splice.

In Figure 10, if splice(s) exist(s) at any "A" location, then splice is permitted at any other "A" location(s). If splice(s) exist(s) at any "B" location, then splice is permitted at any other "B" location(s). Neither "A" location may be spliced. If "B" location on the same side is spliced, neither "B" location may be spliced if either "A" location on the same side is spliced. No more than one splice section of rail is permitted in any top or bottom rail.

Figure 10: Permissible Splice Locations (see text for explanation)



8.2 Upper Rail Repairs

8.2.1 UPPER RAIL SPLICE, EXTERIOR POST:

TRAILERS WITH UPPER RAIL SECTION 02-06571

The splice must be inserted between two roof bows.

Do not weld on upper rail!

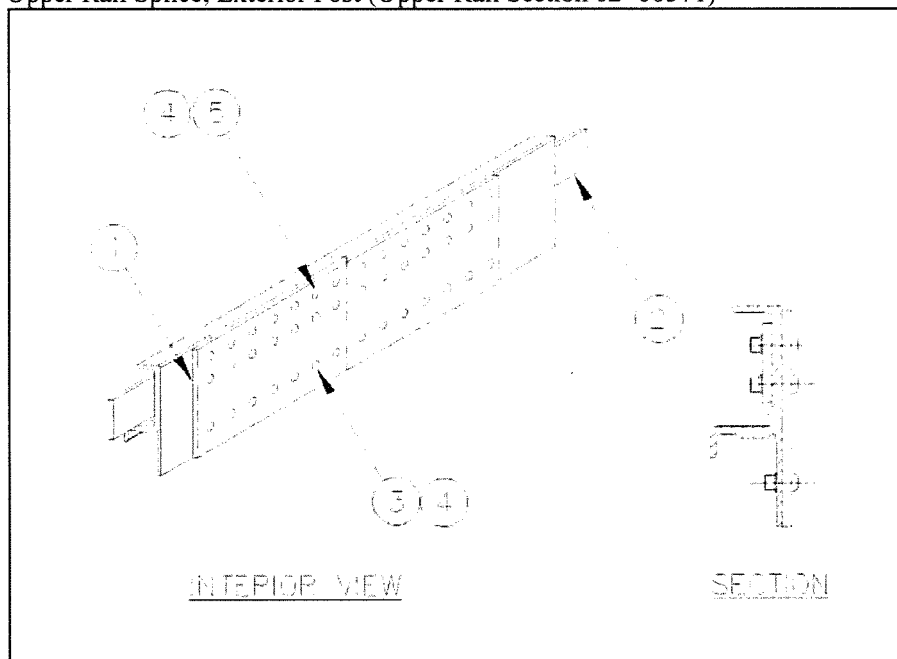
Parts list (corresponding to configuration diagram in Figure 11):

Item	Quant	Part Number	Description
1	1	PT-01*	Upper rail splice plate
2	1	01-15514*	Upper rail splice reinforcement
3	14	04-97012	†Magna grip pin: MGPB-R8-10-CA
4	42	04-97013	†Magna grip collar: MGC-R8-C
5	28	04-97061	†Magna grip pin: MGPB-E8-20

* Part diagram included in Figures 16-24 (sec. 8.4) below.

† Manufacturer: Huck Manufacturing Company

Figure 11: Upper Rail Splice, Exterior Post (Upper Rail Section 02-06571)



8.2.2 UPPER RAIL SPLICE, SMOOTH SIDE:

TRAILERS WITH UPPER RAIL SECTION 02-06388 AND 02-04795

The splice must be inserted between two roof bows.

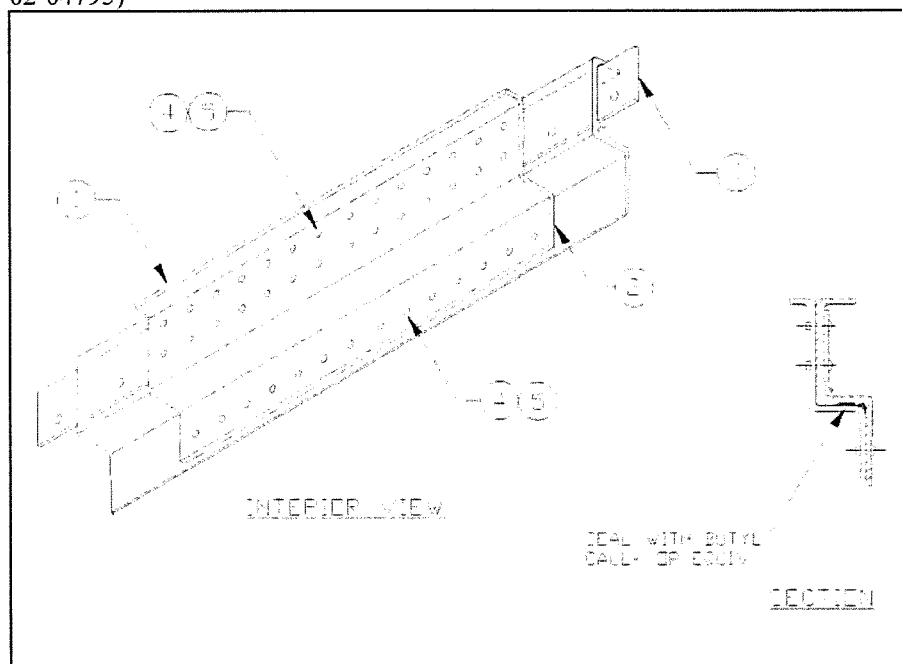
Do not weld on upper rail!

Parts list (corresponding to configuration diagram in Figure 12):

Item	Quant	Part Number	Description
1	1	01-07544*	Upper rail splice plate
2	40"	04-85011	Tape sealant, 4" wide
3	1	01-07979*	Upper rail splice reinforcement
4	58	04-97012	†Magna grip pin: MGPB-R8-10-CA
5	58	04-97013	†Magna grip collar: MGC-R8-C

* Part diagram included in Figures 16-24 (sec. 8.4) below.
† Manufacturer: Huck Manufacturing Company

Figure 12: Upper Rail Splice, Smooth Side (Upper Rail Section 02-06388 and 02-04795)



8.2.3 UPPER RAIL LIP REPAIR, SMOOTH SIDE AND EXTERIOR POST: TRAILERS WITH UPPER RAIL SECTION 02-09093, 02-06388 AND 02-06571

Notch ends of upper rail lip angle as needed to fit cutout in upper rail. Fastener and Presstite tape quantities for 12" repair kit are shown. Quantities for 6" repair kit are one half of those shown.

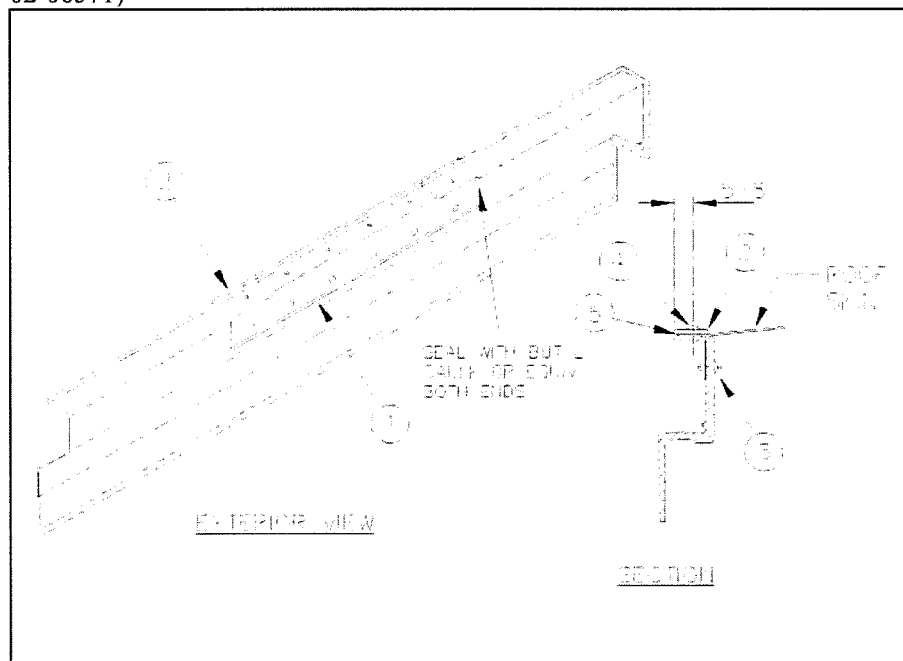
Do not weld on upper rail!

Parts list (corresponding to configuration diagram in Figure 13):

Item	Quant	Part Number	Description
1	1	01-07589*	Upper rail lip angle
2	1	01-07590-001	Roof sheet shim
3	6	04-97009	Magna-Lok Rivet: MGLP-R8-6
4	10	04-98002	Br hd alum rivet: 3/16" dia x 1/2"
5	12"	04-85017	Presstite tape

* Part diagram included in Figures 16-24 (sec. 8.4) below.

Figure 13: Upper Rail Lip Repair (Upper Rail Section 02-09093, 02-06388 and 02-06571)



8.3 Lower Rail Splices

8.3.1 LOWER RAIL SPLICE, EXTERIOR POST:

FOR TRAILERS WITH LOWER RAIL SECTION 02-14360

The splice is to be made 12" forward of the centerline of a sidewall post.

Do not weld on lower rail!

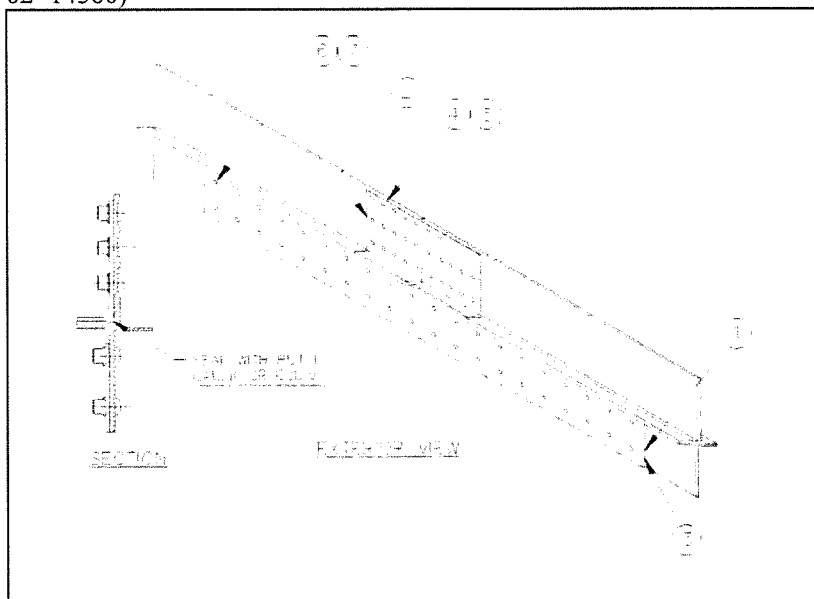
Parts list (corresponding to configuration diagram in Figure 14):

Item	Quant	Part Number	Description
1	1	01-07983*	Lower splice plate
2	1	PT-02*	Upper splice plate
3	40"	04-85011	Tape sealant, 4" wide
4	30	04-97012	†Magna grip pin: MGPB-R8-10-CA
5	30	04-97013	†Magna grip collar: MGC-R8-C
6	40	04-97001	†Magna grip pin: MGPB-R12-14-CA
7	40	04-97002	†Magna grip collar: MGC-R14-C

* Part diagram included in Figures 16-24 (sec. 8.4) below.

† Manufacturer: Huck Manufacturing Company

Figure 14: Lower Rail Splice, Exterior Post (Lower Rail Section 02-14360)



8.3.2 LOWER RAIL SPLICE, SMOOTH SIDE:

FOR TRAILERS WITH LOWER RAIL SECTION 02-09727

The splice is to be made 12" forward of the centerline of a sidewall post.

Do not weld on lower rail!

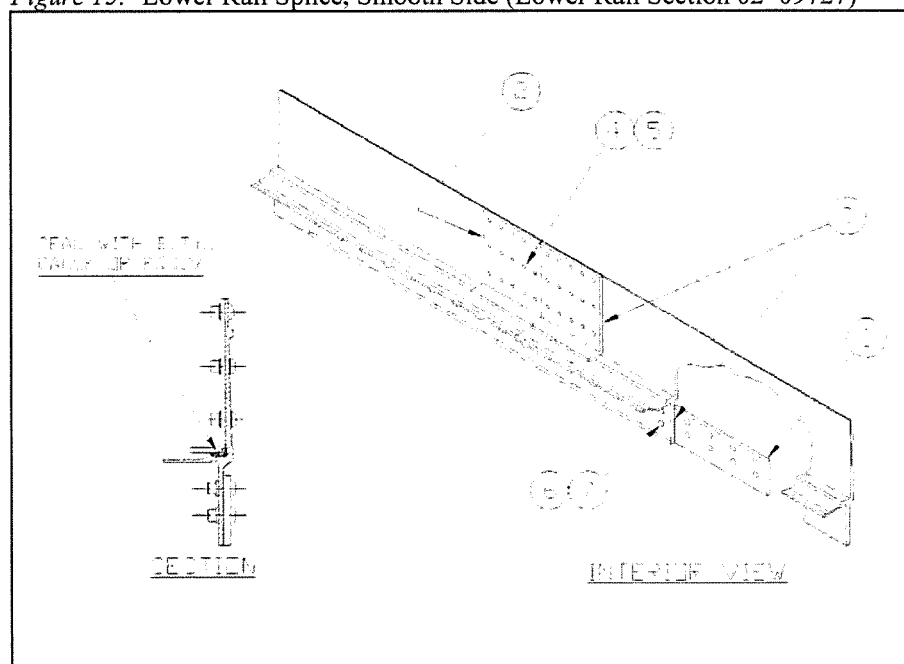
Parts list (corresponding to configuration diagram in Figure 15):

Item	Quant	Part Number	Description
1	1	01-07983*	Lower splice plate
2	1	01-10651*	Upper splice plate
3	52"	04-85011	Tape sealant, 4" wide
4	30	04-97012	†Magna grip pin: MGPB-R8-10-CA
5	30	04-97013	†Magna grip collar: MGC-R8-C
6	40	04-97001	†Magna grip pin: MGPB-R12-14-CA
7	40	04-97002	†Magna grip collar: MGC-R14-C

* Part diagram included in Figures 16-24 (sec. 8.4) below.

† Manufacturer: Huck Manufacturing Company

Figure 15: Lower Rail Splice, Smooth Side (Lower Rail Section 02-09727)



8.4 Upper/Lower Rail Repairs: Parts Diagrams

Figure 16: Part # PT-01
Matl ?????

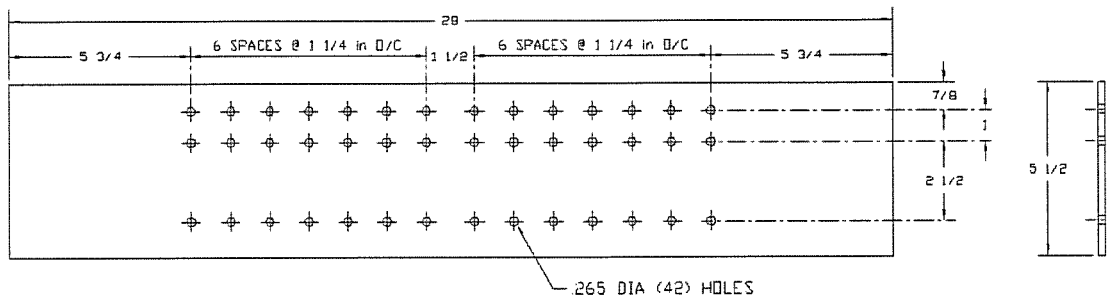


Figure 17: Part # 01-15514
Matl .25 x 2 x 28 (6061-T6 Alum)

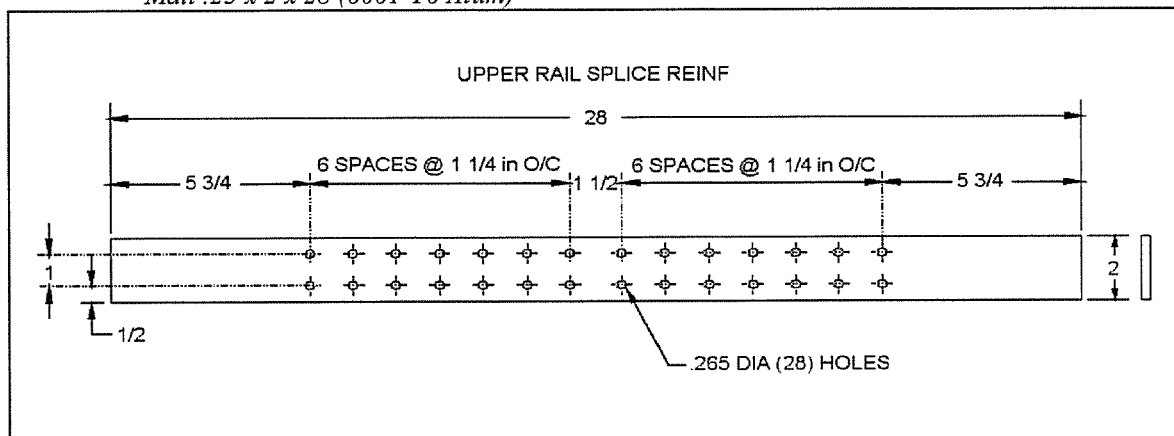


Figure 18: Part # 01-07544
Matl ????

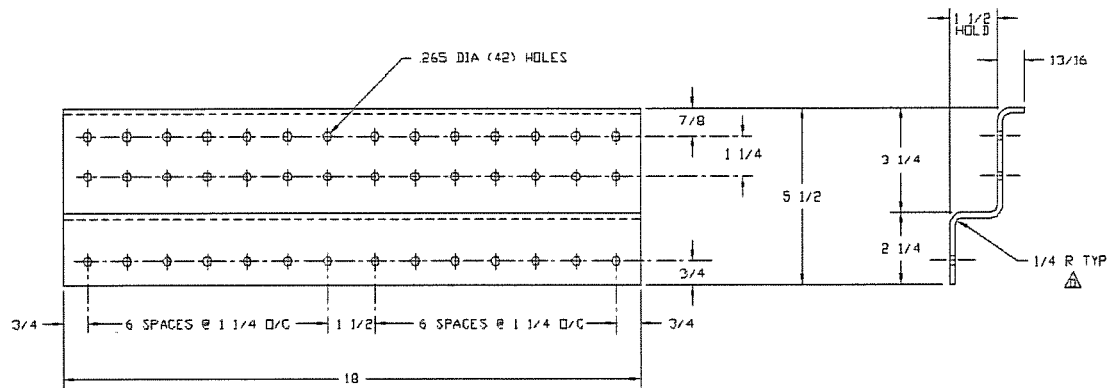


Figure 19: Part # 01-07979
Matl ?????

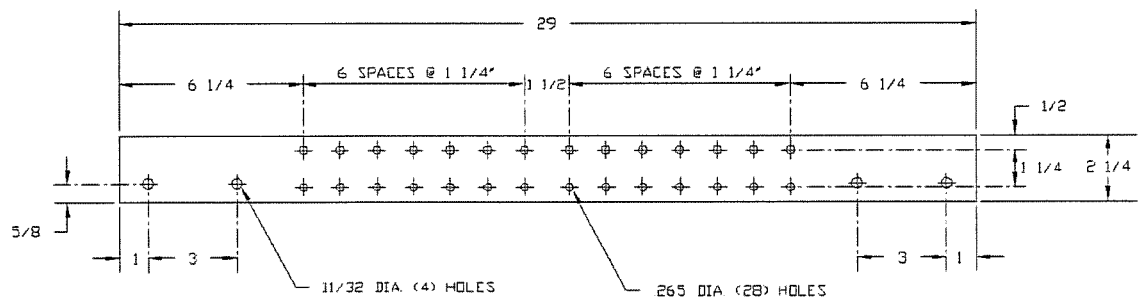


Figure 20: Part # 01-07589
Matl ?????

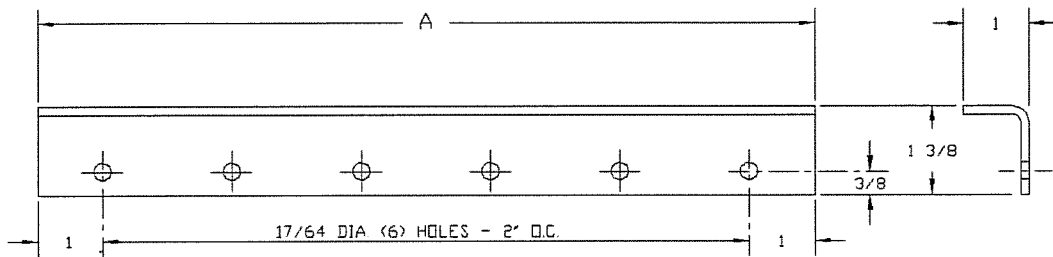


Figure 21: Part # 01-07590-001
Matl ?????

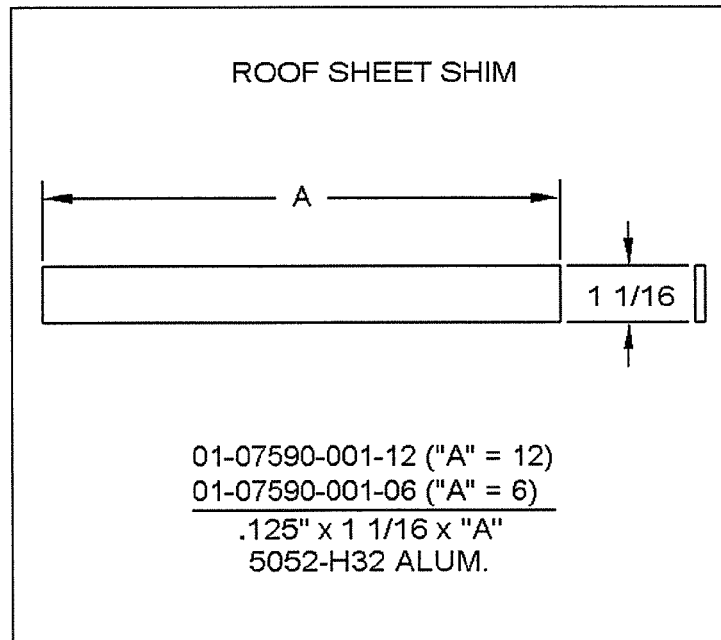


Figure 22: Part # PT-02

Figure 16: Part # PT-01

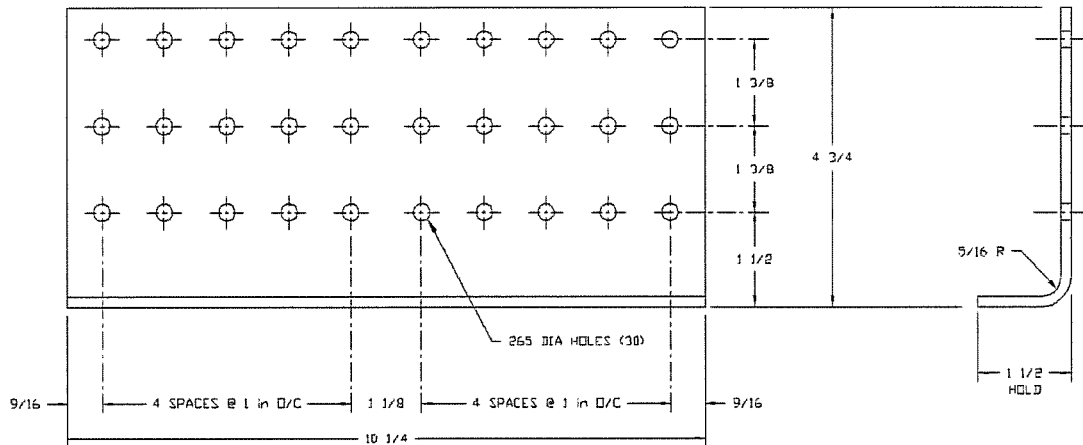


Figure 23: Part # 01-07983

Matl .179 x 3-1/2 x 40 (hi-tensile steel grade 50)

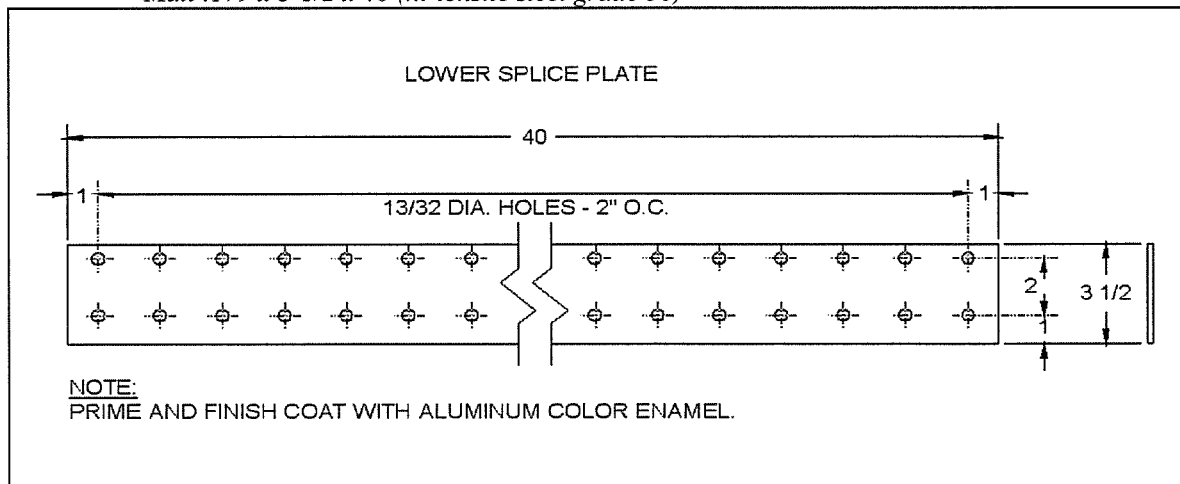
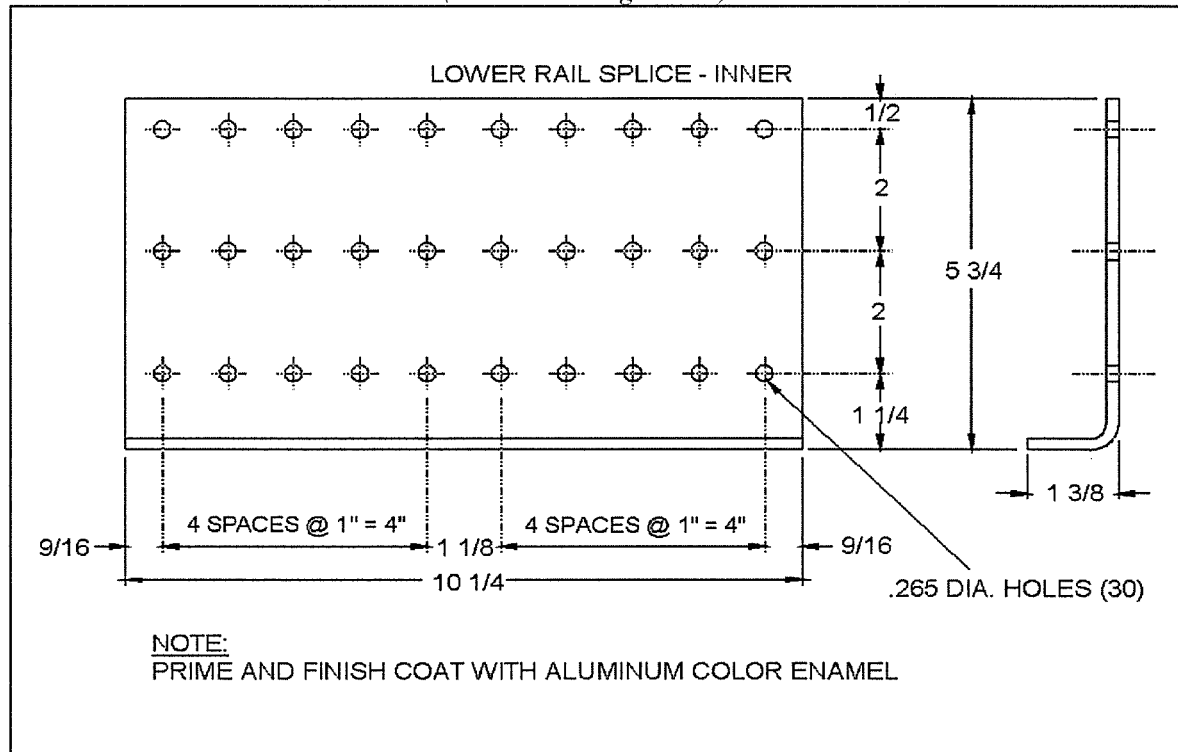


Figure 24: Part # 01-10651

Matl .179 x 6-5/8 x 10-1/4 (hi-tensile steel grade 50)



9: Body Repairs (Side Panels)

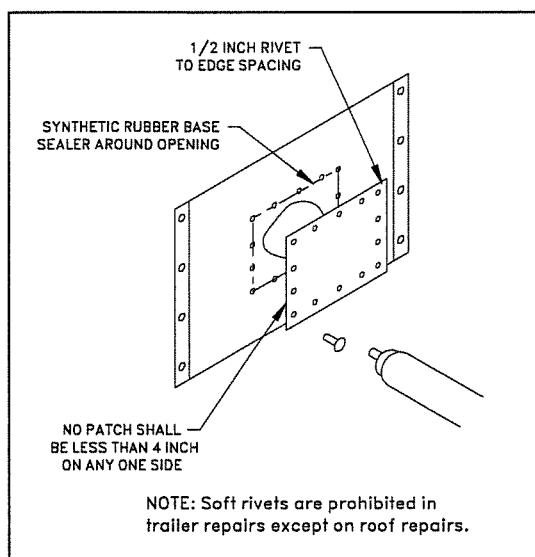
Material selected for replacing side wall panels must comply with the manufacturer's recommendation, with exterior post or smooth panel construction mated under all circumstances, including patches. Prepainted panels must likewise be mated.

9.1 Patching Body Panels

General requirements:

- *For small repairs:* A patch panel of like material must be made to overlap the existing panel break of not less than one (1) inch on all sides.
- *For larger breaks:* The damaged portion must be trimmed to produce a round or oblong opening. No patch may be less than 4" on any one side (see Figure 25, next page).
- Aluminum and steel panel patches must be the same thickness as the original panel.
- A patch may not extend from one panel to another (see Figure 26, next page).
- Use buck rivets (2117-T4 alloy) for side panel repairs (exclude drive rivets, pull rivets and screws).
- Use buck rivets to secure panels to posts to trailer structure.
- Cuts that extend the full length of a single panel, in the area of the top or bottom rail, must be sectioned. Sections must be a minimum of 9". All sections must be buck riveted.

Figure 25: Patch Configuration Requirements



Patching procedure:

1. Clean and deburr both panel and patch. Smooth any dented or creased area surrounding the damage.
2. Apply a non-shrinking sealer between the patch and the trailer body.
3. Place the panel patch over the break, to include any badly dented or creased areas. Drill holes for rivets around the patch perimeter, spaced on 1-inch centers. Rivet holes must be positioned at least $\frac{1}{2}$ inch in from the edges of the patch.

Figure 26: Correct Patch Repair

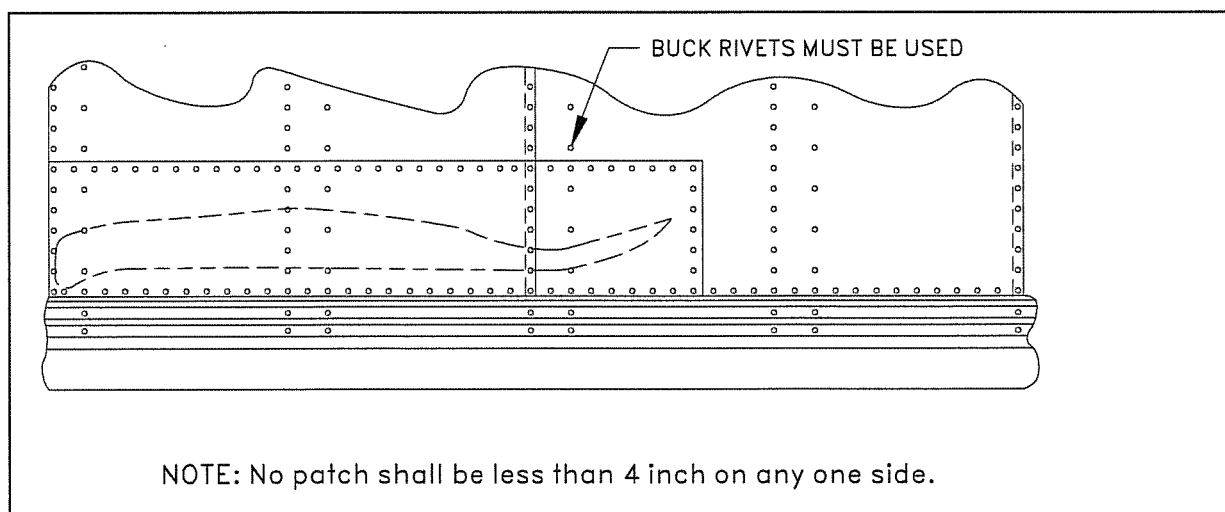
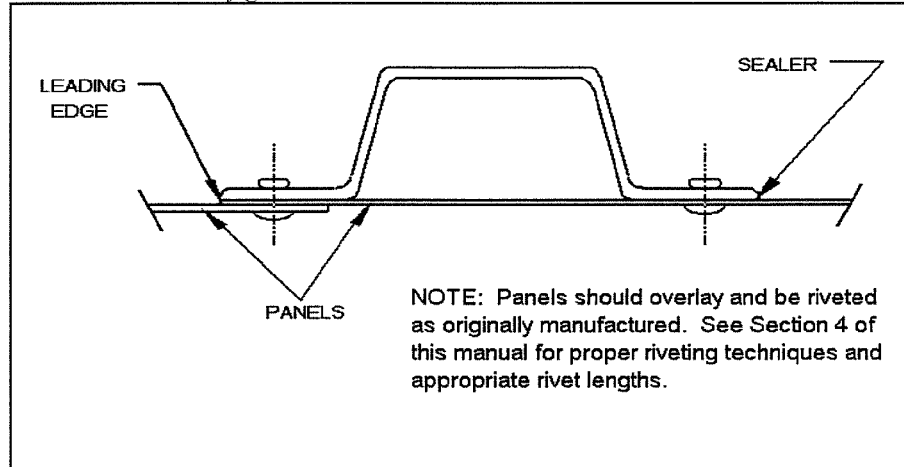


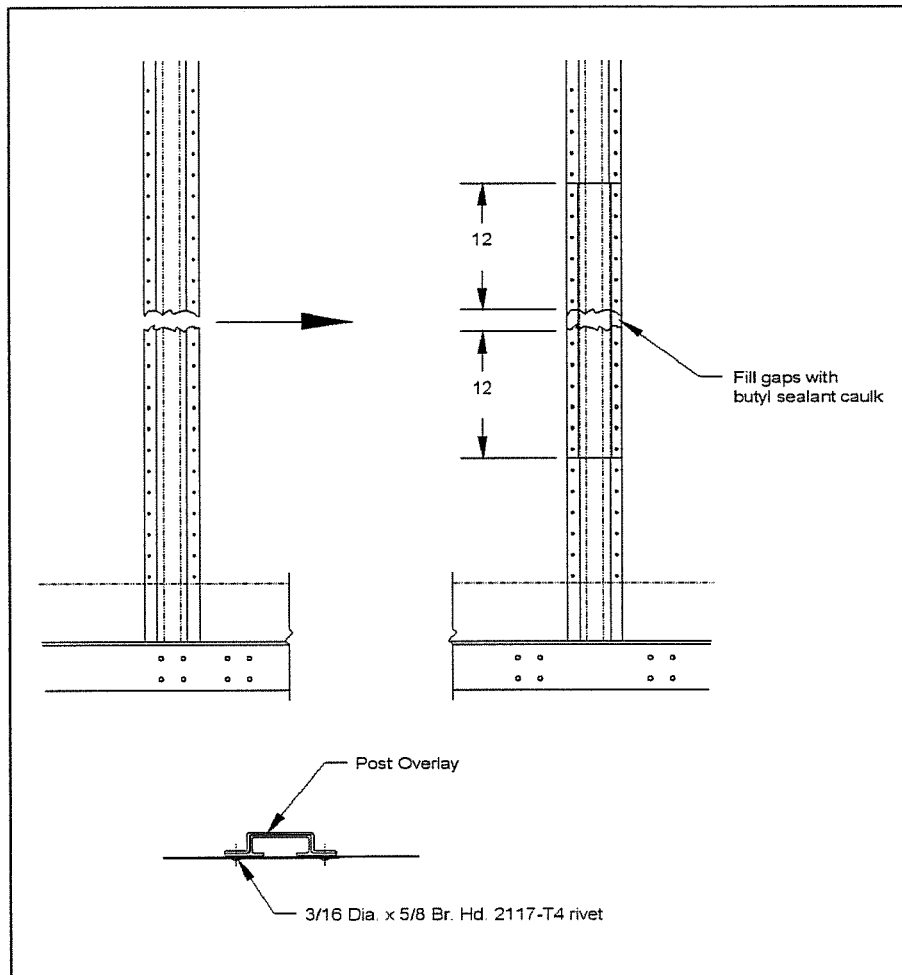
Figure 27: Patch and Rivet Configuration

9.2 Panel Replacement

General requirements:

- Sufficient panel lap is required to provide both a good seal and proper installation (see Figure 27). The exposed edge of the panel must be aligned to the trailing edge, toward the rear of the trailer.
- Clean and deburr both the placement and existing adjacent panels where they lap. Place the panel over the opening and drill around the panel perimeter, placing the holes on 2-inch centers. If an existing rivet hole is used, it must be reamed to provide a tight fit by use of a larger size rivet.
- Use aluminum alloy 2117-T4 rivets only.
- Use buck rivets to secure panels to posts to trailer structure, as shown in Figure 27.
- Never splice a side post. If a side post is badly bent or cut, the post should be replaced before the section or full panel is replaced. A damaged post on an exterior post trailer, however, may be repaired by the procedure described below.

Figure 28:



Where replacement of a damaged post is not required, the post may be repaired by the procedure described below. Note, however, that only one post overlay is permitted per post. The procedure (illustrated in Figure 28):

1. Cut a length of sidewall post overlay (Stoughton number 02-?????) long enough to extend 12 inches above and below the damaged area.
2. Transfer drill .204 dia holes from the sidewall to the post overlay. Attach the post overlay using 3/16 dia x 5/8 BR HD 2117-T4 rivets.
3. Fill the gap at the damaged section with a butyl sealant caulk.

10: Roof Repairs

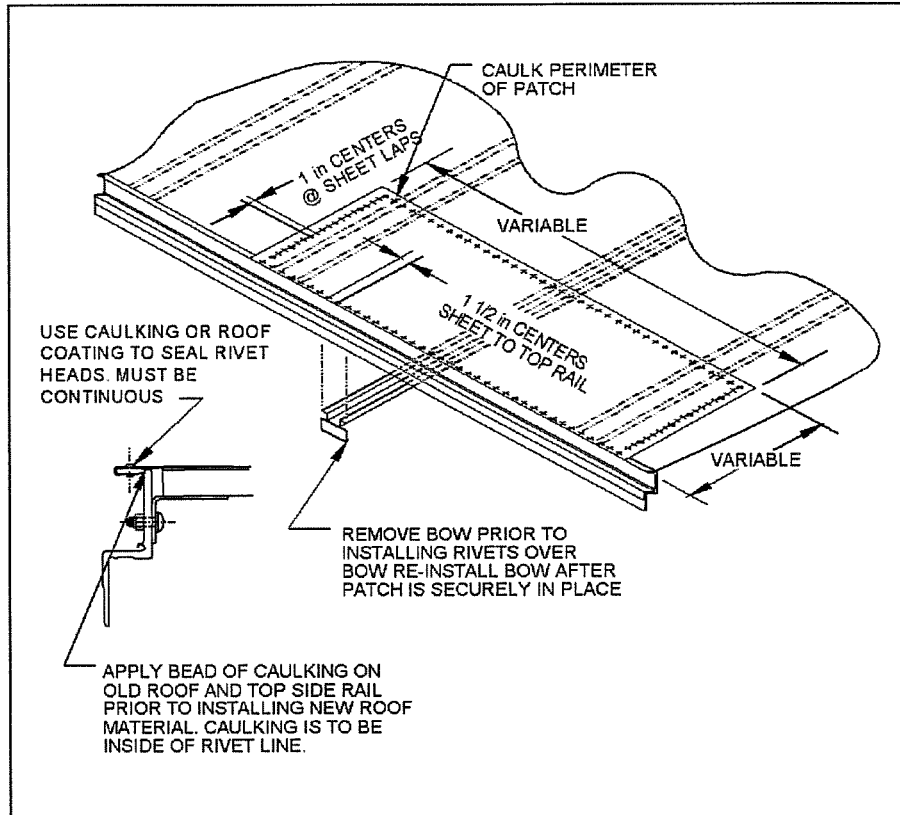
Roof repairs are no less important than repairs to a trailer's nose or side walls. Correct materials and good workmanship can determine whether there will be load damage due to weather. Roof panels that have a tear or hole should be repaired to prevent structural failure and water damage to cargo. Generally, repairs consist of a relatively simple patch or replacing a section of roof panel the full width of the trailer extending to the nearest roof bows adjacent to the damaged area. Certain procedures must therefore be followed when roof repairs are made.

10.1 Patching Roof Sheet

General requirements:

- Carefully verify that roof repairs are properly extended to the roof bows and given a good exterior seal to maximize the life of the repair and to avoid loosening of the roof sheet by flexing.
- All patches must measure no less than 4" on each side.
- *For small repairs:* A patch must be made to overlap the existing panel break by no less than one (1) inch on all sides.
- *For larger breaks:* The damaged portion must be trimmed to produce a round or oblong opening (same as side panels).
- Roof patches must be secured with soft buck rivets to prevent flexing and rivet-hole elongation. All roof bow repairs or replacements must be made with original type fasteners. (See Figure 29, next page.)
- When a patch extends to a top rail, buck rivets (2117-T4 alloy) must be used.

Figure 29: Roof Repairs



Patching procedure:

1. Repair any roof bow damage *before* applying a patch.
2. Clean and deburr both panel and patch. Smooth any dented or creased area around damage.
3. Drill holes in the leading end of any stress crack.
4. Place patch over break, and drill holes for rivet securement around the patch perimeter, spaced on 1-inch centers. Rivet holes must be positioned no closer than $\frac{1}{2}$ inch to patch edges.
5. Apply a sealer between the patch and the roof sheet, and around the edge of the patch, with additional sealer placed over the exterior rivet heads.

10.2 Roof Sections Larger than Six Inches

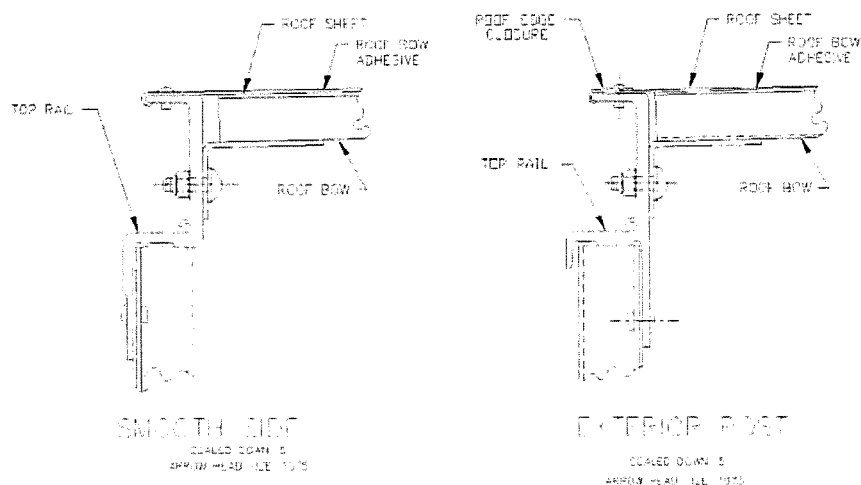
Section of roof sheet break greater than six (6) inches must extend to and be secured adjacent to roof bows. If the trailer is so constructed, the applied section must be bonded to roof bows. (See Figure 30.)

The entire roof must be replaced if:

- damage requires removal of part of the original roof from the top rail; or if
- the area to be sectioned exceeds 30% of the roof.

In any event, the entire roof may contain no more than two sections.

Figure 30: Roof Repair, Cross Section



10.3 Broken or Missing Roof Bows

Any roof bow that is broken or missing must be replaced. Due to a variety of designs, the original manufacturer should be consulted for recommendations concerning bow replacements.

10.4 Roof Replacement

General requirements:

- You must use a one-piece aluminum sheet.
- All damaged roof bows must be removed and replaced with new roof bows, bonded and secured to the top rail at each end by ribbed neck carriage bolts and hex nuts. (See Figure 30, above.)

Replacement procedure:

1. After removal of the old roof sheet and replacement of any roof bows, all roof bows and roof rails must be cleaned and deburred.
2. Before installing the new roof, apply a sealer on the roof rail, around the entire area to be reroofed. (See Figure 30.)
3. Make sure that the trailer is on level ground before proceeding with the new roof installation.
4. Stretch the new roof sheet in place by using clamps or roof stretchers at the rear and front header of the trailer. This is very important to reduce the risk of roof-sheet flapping, which could cause flex cracking.
5. Attach the sides of the new roof sheet to the top rails and headers according to the manufacturer's specifications. (See Figure 30.)

11: Rear Door Repairs

Rear doors are probably the most commonly damaged component of van trailers, and certain repair procedures are therefore often necessary to restore the overall structural integrity of the trailer.

In the event a trailer is loaded in excess of its designed capacity, the locking hardware of the trailer door will fail before the connections between the end frame and trailer body. The door end assembly is designed to withstand maximum loads and fatigue forces imposed in rail operation. (The door end assembly consists generally of door frame, doors, door hinges, door locking hardware and attachments of these items.)

11.1 General Considerations and Requirements

- Plating of rear doors is not permitted, and is not considered a proper repair.
- For minor cuts and damage (penetrating no more than 3 plies or 1/4" deep, and posing no threat to structural integrity), we recommend a patch be glued over the affected area. A glued patch is not only easier to install than blind fasteners, but also requires no holes in the door, which may cause leaks and swelling over time. A glued patch therefore increases the service life of the door blank.
- We recommend *against* sectioning of door seals or using nails to fasten seals, since the wood core is likely to absorb water and swell any time the seal is penetrated by a nail or any fastener. Water-swollen wood is then likely to cause rapid deterioration of the door, with a correspondingly dramatic reduction in service life. Good door seal maintenance with no fasteners and no splices will yield longer door life and fewer freight claims.
- All door replacements must be accomplished with *like materials* (gaskets, door hardware and door dimensions).
- Mounted doors must be mounted flush with the door frame, and must be constructed so that the curb-side door must be opened before the road-side door.
- All decals and signs must be replaced on new doors.
- All tie backs must be replaced on new doors.

11.2 Lock Rods and Hinge Plates

- All lock rods and hinge plates must be in replaceable condition or new.
- When a door is replaced, the security plate must also be replaced if one is used.
- All door-seal locking devices, door-securing hardware and door-attachment hardware must be affixed by fully welding these items, or by the use of tamper-proof fasteners to prevent entry into the trailer by removal of any of the door hardware. The top and bottom hinges, and the top and bottom lock-rod support bearings must *each* be equipped with at least one tamper-proof fastener. All door seal hasp fasteners also must be tamper-proof.

Fasteners are regarded as "tamper-proof" by virtue of their original design, or by alterations in design and/or configuration that prevent their removal without destruction by burning or cutting. We recommend against reusable fasteners, such as nuts and bolts, and these are permissible only if they are fully welded. (A "fully welded" bolt is one that is welded around its entire circumference, to weld the nut to the bolt, or the bolt to its mating hardware.)

Prevailing torque fasteners, with deformed threads or plastic inserts, are not acceptable tamper-proof fasteners unless they are inaccessible, as on refrigerated trailer doors. Tack or spot welding is not acceptable.

- All door hardware must have a hot-dip galvanized finish.

12: Rear Frame Repairs

12.1 Rear Header Repairs

12.2 Rear Corner Post Repairs

12.3 Rear Crossmember Repairs

12.4 Rear Underride Repairs

13: Floor Repairs

The floor of a trailer is a key element of the structural system, carrying longitudinal loads such as dock bumps, etc., in addition to its normal vertical loads. Trailer floor surfaces are typically glued, laminated hardwood boards, about 12" wide, that run the full length of the trailer.

The trailer floor consists of three main structural components that together support a fork lift and transfer the load to the side walls. These three components are: the floorboard, the floor supports (or crossmembers), and the crossmember supports (or crossmember-to-rail connectors). Of the three, the crossmember supports are the most critical, since a failure in these components could cause the complete collapse of the entire floor.

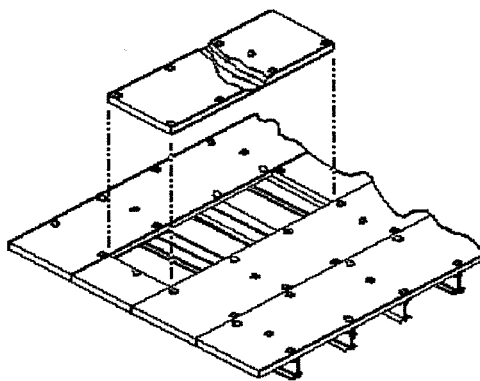
Damage to floors is invariably caused by overloading, the operation of mechanical handling trucks within the trailer, or deterioration of the floor over time. Any of these causes is likely to weaken sections so that they become more likely to fail at lower load levels. Occasionally a heavy piece of freight may puncture the floor in a single spot and thereby cause floor failure. Proper repairs to such locally broken floor sections are mandatory so that the integrity of the remaining floor is not compromised by either the damage or the repair.

13.1 General Requirements for Floor Repairs

- Flooring replacements must fasten to no fewer than three (3) crossmembers. No adjacent flooring repair may extend to the same crossmember used for any other repair; rather, end joints must be staggered and sealed. (See Figure 31, next page.)
- All repairs to flooring or decking must be of a quality and installation that are comparable to the original flooring, and free of visible defects.
- We recommend that you inspect the crossmembers in the vicinity of a board failure prior to starting repairs, to determine whether any crossmembers require repair or replacement.

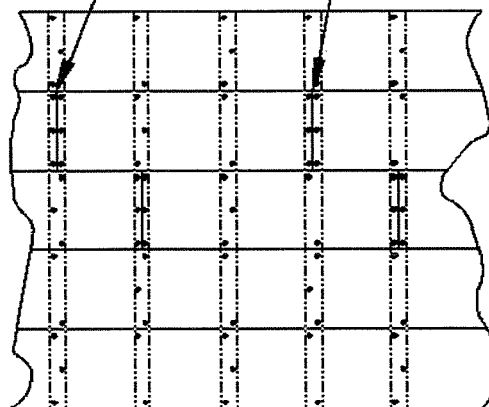
Figure 33: Floor Repairs

The new floor must be supported by a minimum of three crossmembers.

*Figure 34: Defining Segment To Be Replaced*

REMOVING DAMAGED FLOOR BOARD: New floor of the same section and material must be supported by three (3) crossmembers. Butts must fall at crossmember centerlines.

NEW BOARD INSTALLATION: Install three 2" self-tapping flat screws at each crossmember covered by new board, three at butts.



13.2 Floor Repair Procedure

1. Determine the extent of the damage and note the extremes of the damage, and mark the area of the floor to be replaced. The marked area must begin and end on crossmember centerlines, and must extend to the second crossmember beyond the limit of the damage, in each direction—fore and aft of the damage. (See Figures 31 and 32.)

Where extensive damage requires replacement of more than one floor board, be sure to install replacement boards so that no two adjacent butt joints occur at the same crossmember. If necessary, stagger the joints by installing longer replacement boards in alternate slats. *This is extremely important for overall structural integrity!* Any distortion due to a lack of contact between the floor board and crossmember can be remedied by reinstalling screws through the floor and positioning nuts on the bottom shanks of the screws, thereby clamping the floor and crossmember together.

2. Remove floor screws in adjacent boards so that the damaged floor section can be raised above floor level. Then cut the damaged boards at the marks.
3. Obtain replacement lumber that is identical to the original in variety, grade and thickness. Cut a section of the replacement lumber to match the length of the removed section.

Note that the butt gap between boards must not exceed $\frac{1}{4}$ inch.

4. Apply a bead of butyl or silicone caulking to the mating perimeter edges of the floorboard and lay the board in place, insuring that the joints between adjacent boards interlock.
5. Reinstall any missing fasteners in adjacent boards and drill at least three holes through the new board plank at each crossmember location. Install 2"-long self-tapping flathead screws at each location.
6. Install a bead of caulk across the butt joint between the new and adjacent floor planks to protect against leakage.

14: Understructure Repairs

14.1 Crossmember Replacement

Trailers are equipped with 4" depth steel crossmembers forward of the rearmost 4'. For these, the replacement crossmembers must be made of high-tensile steel using 80,000 PSI yield material, and the minimum weight per foot must be 3.19 lbs.

Steel crossmembers must be of the hot-rolled "I" beam design, with a depth matching the original crossmember. No sectioning is permitted in crossmembers; only a full replacement will restore structural integrity.

The rearmost 4' of the trailer contains a downward taper in the floor, designed to increase the vertical door opening. Crossmembers in this area will exhibit 3" depth, hot-rolled high-tensile steel "I" beams.

For floors tapered in the rearmost 4', shims have been provided at points of contact with the two chassis rails such that the bases of the shims lie in the same plane as the bases of the crossmembers in the trailer midsection. These steel "load-transfer pads" are to be installed by fillet welding to the lower crossmember flanges. Shims must be a minimum 4" x 2", and two shims per crossmember at centerline-to-centerline spacing between shims of 36". Due to the taper of the floor, shim thicknesses will vary with the location of the crossmember being replaced.

Where aluminum rails are employed, polyethylene tape must be used to prevent electrolysis between crossmember clips, which attach steel crossmembers to aluminum bottom rails.

Where crossmembers are fastened to the aluminum rails, the crossmember and clip must be fastened to the side rail with four fasteners per clip.

The fasteners shall be 3/8" diameter, aluminum 2217-74 rivets, steel two-piece lock bolt or Grade 5 zinc-plated hex HD bolts with self-locking nuts.

For crossmembers in the trailer end extensions that have steel offset rails (rearmost and forwardmost 4'), you must clean and smooth, with a grinding disk, the flame-cut area surrounding the cut-out damaged crossmembers. The replacement member must be cut and fit into position prior to welding, to verify

no more than 1/16" clearance at each end. Welds must run continuously along each side of the web.

Replacement members must be fastened to the floor, and other attaching components must meet the original design. Each floor board must have three 5/16" Torx head self-tapping phosphated screws installed per crossmember per board. All screws must be countersunk approximately 1/8" to 3/16" below the floor surface.

Use undamaged existing holes in the wood floor as guide holes to drill into the new crossmember, unless doing so would cause misalignment. Unused screw holes in the floor should be plugged with wood dowel material by driving into the hole and cutting flush with the floor.

The crossmember clip surfaces mating to rails must be cleaned and primed with zinc-rich primer, or coated with a wax-based corrosion preventive barrier coating before the crossmember is installed. After installation, the crossmember should be coated with a wax-based corrosion preventive coating, such as those sold by Tectyl, Daubert, and Ameriteck Industrial Coatings.

14.2 Upper Coupler Repairs

Please contact the trailer manufacturer for advice when repairing this area of a container.

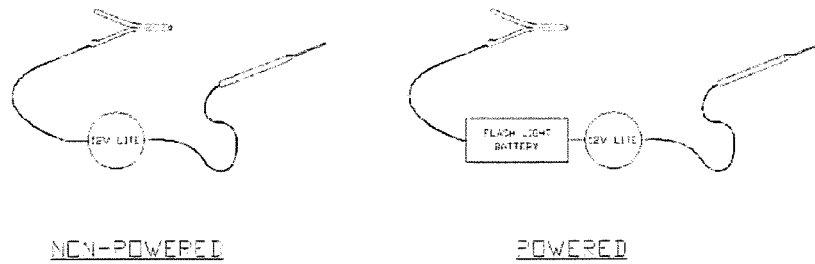
14.3 Landing Gear Repairs

Please contact the trailer manufacturer for advice when repairing this area of a container.

15: Electrical System

15.1 DEFINITIONS

- **SHORT CIRCUIT -**
a wire or portion of the energized circuit comes in contact with a “ground” circuit or grounded portion of the trailer.
- **OPEN CIRCUIT -**
a break that interrupts the electric path and does not allow electric current to return to the grounded side of the power source.
- **GROUND CIRCUIT -**
the wire circuit (or metal structure) attached to the ground side of the power source (normally the negative or “-” side of the battery).
- **CROSSOVER -**
a direct contact between two “hot” wires (“+” side of a battery) such that energizing either of the circuits will activate all the devices in both circuits.
- **ONE WIRE SYSTEM -**
system where the trailer frame (body) serves as the return (ground) wire. Lamps have a single (hot) wire lead and are grounded to the frame by a mounting screw or short pigtail. The trailer frame is grounded to the tractor.
- **TWO WIRE SYSTEM -**
two wires are provided for each lamp. Lamps are not grounded to the frame (but may be). The trailer frame may or may not be grounded to the tractor.
- **WATERPROOF SEALANT -**
any non-conductive waterproof liquid or paste that can be brushed or sprayed onto a terminal or a metal surface. (Automotive gasket sealing compound).
- **CONTINUITY TESTER -**



- **NON-CONDUCTIVE GREASE -**
any of several commercially available greases made to inhibit corrosion in electrical systems.

15.2 TROUBLE SHOOTING THE ELECTRICAL SYSTEM

15.2.1 OPEN CIRCUITS

15.2.1.1 One lamp inoperative

PROBLEM	POSSIBLE SOLUTION
➤ Bulb burned out	Replace bulb.
➤ Corrosion in lamp socket	Clean out the corrosion. Reinstall bulb with non- conductive grease.
➤ Broken or corroded hot (or ground) wire	Replace pigtail if possible. Replace lamp assembly.
➤ Corroded mounting screw or rivet (one wire system only)	Clean the metal. Replace with new self tapping screw or a bolt and nut with a star washer. Brush primer or sealant over bare metal. If serious corrosion, rotate or relocate lamp using new holes and screws

15.2.1.2 One circuit inoperative

PROBLEM	POSSIBLE SOLUTION
➤ Open circuit in system	Locate the open circuit with continuity tester. Replace the harness or the wire containing the open.
➤ Circuit breaker malfunction	Use jumper to determine if this is the problem. Clean the contacts and replace breaker with same amperage.
➤ Prong in receptacle corroded or not expanded (split pin)	Clean and/or expand the pin.
➤ Pin socket in plug corroded	Same as above. Clean out socket and reassemble with non-conductive grease.

15.2.2 SHORT CIRCUITS

PROBLEM	POSSIBLE SOLUTION
➤ Hot wire grounded to frame by: <ul style="list-style-type: none">➤ Screw into wire➤ Wire insulation chafed	Locate the short. Replace the harness or wire. (insulation may have melted or charred and will develop shorts in other locations if not replaced.)

15.2.3 CROSSOVERS

(Two circuits operating when one wire is energized)

15.2.3.1 Two hot wires in contact. (accidental or deliberate)

PROBLEM

➤ A jumper is installed between two circuit breakers or behind the receptacle.

➤ Contact between conductors in a dual filament lite or lamp base.

➤ Shorts in a molded plug or a screw piercing the insulation of two wires.

POSSIBLE SOLUTION

Check circuit breakers and front receptacle for jumper. (remove if not wanted)

Isolate problem by alternately disconnecting dual filament lites where both filaments are burning and only one wire is energized. Clean or replace the lamp with the crossover problem.

If the first two do not solve the problem, the crossover is probably in the wiring, or (more commonly) in a molded plug connector. Energize one of the circuits - starting at the rear, disconnect sub harness (es) from the main harness. Use powered continuity tester to check pairs of leads. When continuity between two circuits is found, replace that section of the harness.

15.2.3.2 Crossover - Stop/tail or Turn/tail

PROBLEM

➤ In certain instances, one tail lamp may be dimmer than the other. When the stop lamp is actuated, only one stop lamp illuminates and the tail lamp on the other side (dim lamp) becomes dimmer or goes out.

➤ Absence of ground or dim lamp.

POSSIBLE SOLUTION

Clean and/or repair the ground as described above.

15.3 REPAIRS

15.3.1 REPAIRS TO SEALED WIRE SYSTEMS

Sealed wire systems are normally installed in segments with moisture barriers in the molded plugs at the ends of each segment to localize the migration of water. If corrosion is found in one segment, it should be replaced since the corrosion will proceed thru the conductor and the failure will recur.

Temporary splices should use crimp (butt) connectors. Do not use the insulation-piercing type. The splice should be coated with a waterproofing compound and sealed with an overlaid gum-type shrink tube.

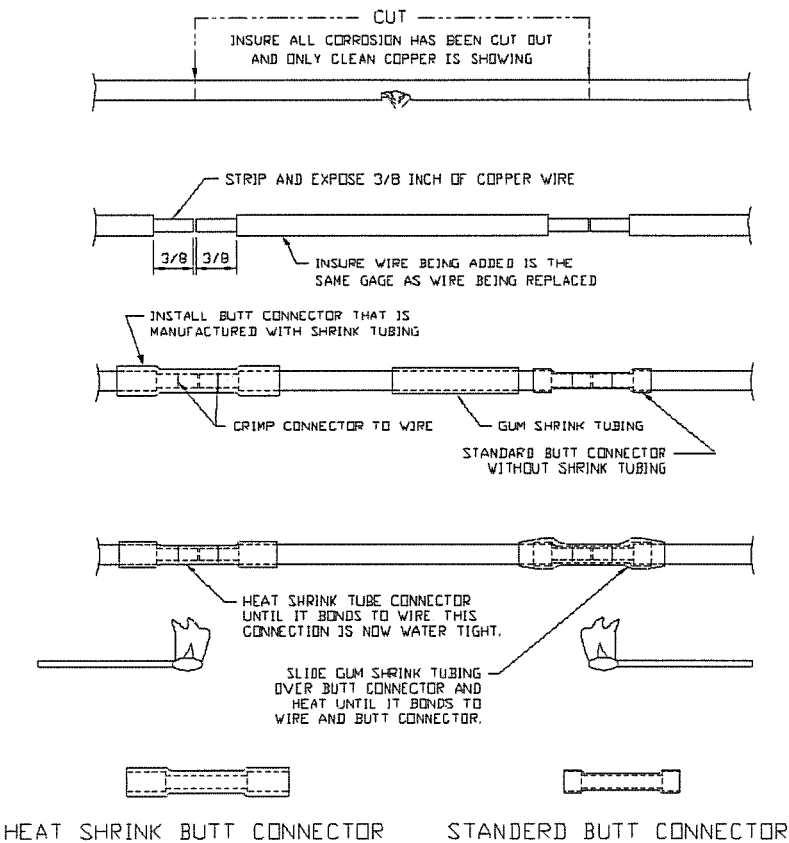
15.3.2 METAL SURFACES

Should be cleaned to remove all corrosion and, after repairs are completed, coated with a waterproofing compound.

Always apply conductive grease in receptacles and in bulb sockets prior to re-assembly.

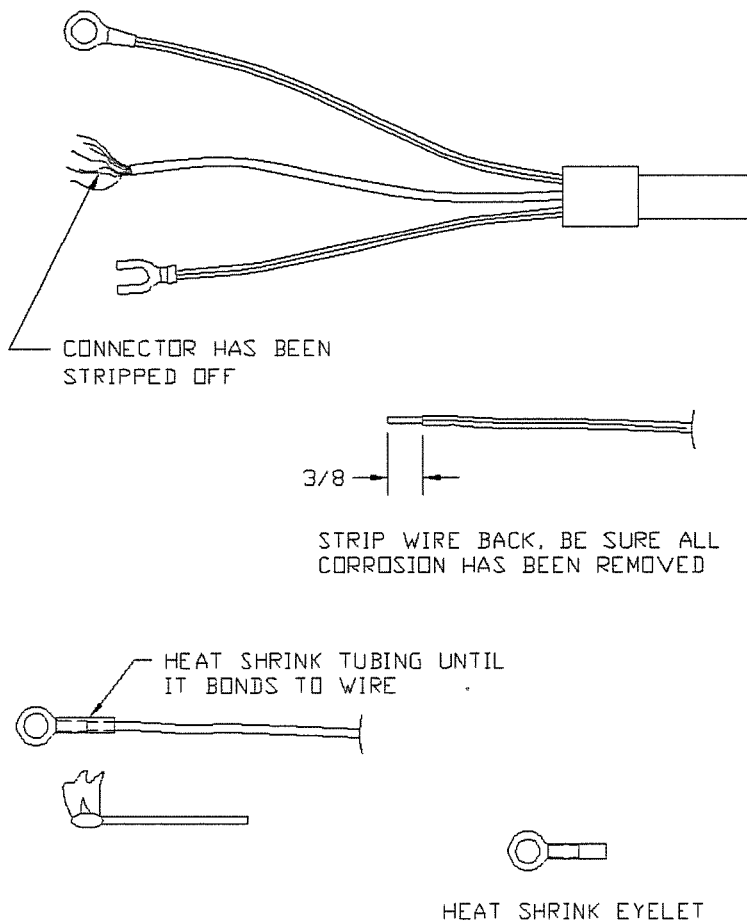
15.3.3 WIRE SPLICING

Splices should be made as shown in the following sketches.



15.3.4 REPLACING EYELETS OR FORK CONNECTORS

Replace as shown in the following sketches.

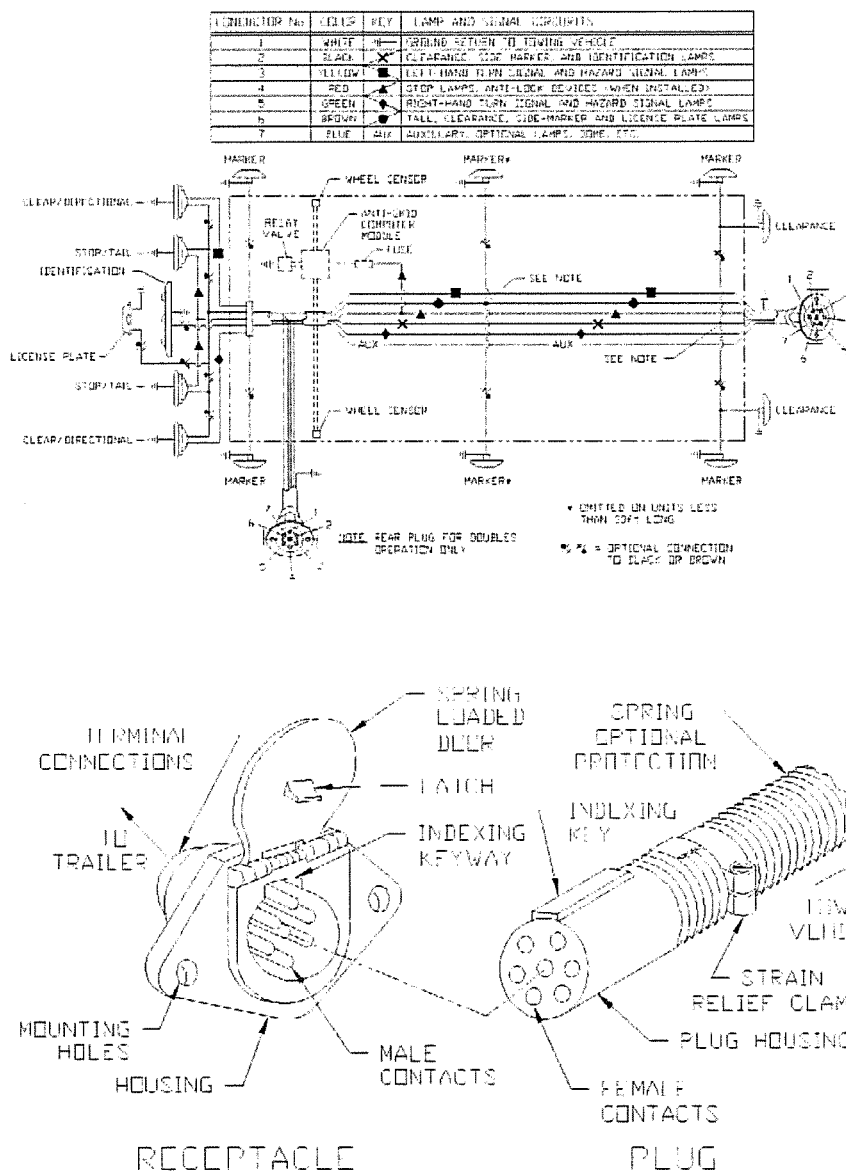


15.3.5 INSTANT AUTO ELECTRIC CONNECTORS - DO NOT USE-

These type of wire connectors are to be considered temporary connectors which are used in the rental industry. The jacket is split open when the connector is closed onto the wire. The copper is exposed and will corrode. Also a wick effect takes place and if left open long enough will pull moisture as far as 3 feet into the jacket. (which is corroded).

15.4 WIRING DIAGRAM

The trailer wiring and jumper cable connector wiring are shown in the following diagram and sketch.



16: Running Gear

16.1 AXLE ALIGNMENT

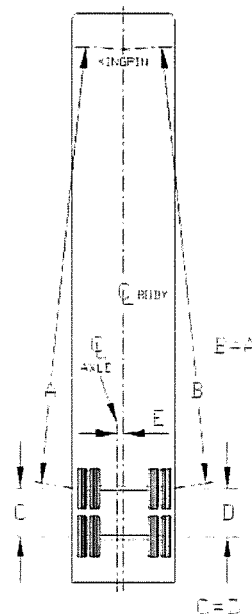
Poorly aligned axles cause vehicle dog tracking and excessive tire wear. That's why axle alignment is so important.

In aligning axles, the old adage "haste makes waste" is really true. Axle alignment **MUST** be done carefully and accurately to assure proper axle alignment.

16.1.1 ALIGNING THE AXLE

When aligning axles, suspension should be in a natural, relaxed state, free of any "binds." Before taking measurements and to achieve this relaxed condition, make sure the vehicle is unloaded. All trailers shall be pushed backwards and pulled forwards with the service brakes applied on a level floor. On trailers with an adjustable undercarriage, this will assure that the locking pins rest against the rear of their positioning holes. Trailers with air ride suspensions shall be aligned with the suspension at its nominal ride height. Vehicle **MUST** be level from side to side as well as from front to rear.

Use screw-on axle end extenders or remove outer wheels and anything else that may be in the way of the measuring tape to achieve a straight line from kingpin to the axle ends.



Proper tools for axle alignment inspection are:

- Spring loaded, kingpin extender with bubble level.
- Axle end extenders.
- 50 ft. steel tape.
- Adjustable tram.
- Gauge for measuring axle center to axle center.

Figure: XX

Refer to Figure 1. Measure distances A and B from the kingpin to the front axle. These must be equal within 1/8 inch of each other. Measure distances C and D between axles using gauge as shown in Figure 2. Note that all currently available trailer axles have dimples or recesses at the center of the axle spindle ends. These also must be equal within 1/16 inch of each other. Determine lateral

centerline of trailer body and axles. Distance E should not exceed 1/4 inch for either axle.



Figure XX

16.1.2 PRECAUTIONS

- Always measure to the front axle ends of accurate alignment.
- Avoid measuring to rims, suspension brackets, hub cap vent holes, brake drums and the like. This can result in improper alignment.
- If difficulty is encountered in obtaining true alignment, check and repair or replace problem suspension parts.
- Always align any succeeding axles with the front axle, not the kingpin.

16.2 AXLES, WHEELS AND DRUMS

In the interest of improved service life, axles, wheels, and drums should be inspected at regular intervals depending on vehicle speeds, loads and general operating conditions.

Rim clamps and wheel stud nuts should be checked and tightened, if necessary, at the beginning of each trip. With spoke type wheels be sure rims are installed so that tires do not wobble. Run nuts up, uniformly using diagonally opposite tightening pattern, snugging up nuts gradually to recommended torque.

A check for loose wheels should be made at regular intervals to determine if there is play between the bearing and the bearing race. Check wheel bearing cups and cones for wear or damage. When assembling the hub or wheel on the axle, do not force the hub or wheel over the bearings as damage may occur.

Accuracy of the wheel bearing adjustment cannot be overemphasized as it has a direct affect on the brake performance because the proper brake adjustment and bearing play are all interrelated.

You cannot properly adjust a brake if the wheel bearing has not been properly adjusted. It is therefore important that a torque wrench be used in the wheel bearing adjustment and that you adhere to the manufacturer's specification.

Oil or grease seals should be replaced each time a hub is removed to insure leak free operation. If the hub is removed it could allow contamination of the lubricant and possible bearing damage. Therefore, at any time a trailer hub is removed the seal should be replaced. Seals should be replaced each time brakes are relined rather than inspecting and reusing seals that do not show signs of leaking.

Brake drum life depends on the treatment it receives. Drum failure due to heat checking it caused by overheating. This frequently happens when the trailer brakes are used independently of the tractor brakes. Trailer brakes are designed to be used in conjunction with tractor brakes.

Brake drums must not be rebored beyond the manufacturer's recommended maximum diameter.

REMEMBER - REBORE UP TO MAXIMUM LIMITS SET BY DRUM MANUFACTURER

16.3 BRAKES

A schedule for the periodic cleaning, adjustment and lubrication of brake equipment should be established by the operator based on past experience and severity of operation.

The three things of major importance to remember are to (1) institute and maintain a comprehensive preventative maintenance program, (2) train mechanics to replace questionable components and (3) use top quality materials throughout, retaining OEM specifications for linings, drums and air brake system components.

ALWAYS: LOOK AT BRAKE SHOE SPRINGS

Weak and unmated springs bring problems of pulling and dragging brakes. When time between brake adjustments is lengthened and the travels are extreme, the brake shoe springs are abnormally stretched. A condition of this kind with any frequency would damage the spring by the excessive stretch. The stretching

and contracting of the spring is always taking place in the confined heat area of the drum.

16.3.1 LUBRICATION

Nothing can be more damaging to brake performance than a hanging brake. Lubricate all brake linkages, camshafts, camshaft splines, and slack adjusters as well as any other brake components that call for grease. **DO NOT LUBRICATE THE CAM FACE, ANCHOR PINS OR THE OUTSIDE OF THE SHOE ROLLER - THEY MUST BE DRY.**

A high-temperature resistant lubricant should be used and excessive lubrication must be avoided to prevent any getting on the lining. Grease soaked linings cannot be salvaged. Lubricate the shoe mechanism for a more responsive application and release of the brake. This will require less air in the application.

16.3.2 ADJUSTMENT

Always adjust brakes with the wheels off the floor.

This is the only true way of definitely knowing you have a free running break.

16.3.3 OVERHAUL

During a major brake overhaul, the following parts should be carefully checked and replaced as required:

- Spiders for loose or sheared fasteners and for wear or damage.
- Anchor pins for wear or misalignment.
- Cam shafts and cam shaft bearings or bushings for wear.
- Shoe return springs should be replaced at time of overhaul.
- Brake shoes for wear, oversize fastener holes and for any signs of grease on the braking surface.
- Drums for cracks, scoring, or other damage.

ALL BRAKE LINING BLOCKS ON THE AXLE SHOULD BE REPLACED IN FULL SETS. DO NOT MIX NEW AND USED BLOCKS. ALWAYS USE OEM SPECIFICATION REPLACEMENT LININGS.

16.3.4 RELINING

At the time of relining brakes, the following procedure is recommended:

- (1) Measure drums to be sure that both drums on the axle are the same diameter.
- (2) *CAUTION. Some brake linings contain asbestos. Follow manufacturer's precautions when working on or around these materials.*
- (3) Same manufacturer's drum design on each axle.
- (4) Clean brake shoe tables thoroughly after removal of old lining.
- (5) Replace all worn shoe parts. Replace the shoe if the anchor pin holes are oversize.
- (6) Treat axle as a unit - identical repairs on both brakes.
- (7) Disconnect slack adjuster lever to check cam shaft by hand.
- (8) Be sure that proper lining is used - same specification as original equipment to obtain uniform braking, and, when applicable, retain compliance with FMVSS 121 - Air Brake System.
- (9) Be certain "S" cam is clean and free of grease to allow shoe roller to run free and turn freely on the cam face. All roller surfaces should be clean and free of any flat spots. Rollers with flat spots should be replaced.
- (10) *Special precautions must be observed when servicing spring brake chambers. Use caution as these units contain large springs and improper handling can result in serious injury or death. Spring brake chambers should be replaced as a complete unit. Consult with the manufacturer for proper handling techniques when replacing chambers.*
- (11) Brake chambers, chamber springs and chamber diaphragms should be replaced in pairs.
- (12) Camshafts should be rebushed and replaced in pairs.
- (13) Replace manual slack adjusters if they will not adjust properly.
- (14) *Many trailers are equipped with automatic slack adjusters. If the trailer brakes are maintaining adjustment outside the manufacturer's specified limits, the slacks must be adjusted or replaced as specified by the manufacturer. Do not*

mix manual and automatic slack adjusters, or automatic slack adjusters of different manufacture, on the same vehicle.

- (15) All brake shoe return springs should be replaced with every reline.
- (16) Oil or grease seals should be replaced with every reline and their working surfaces checked.
- (17) Push rods should be the same length and their travels identical on both sides.
- (18) The initial adjustment should have a minimum clearance of .020 in. Subsequent adjustments should have a minimum clearance of .010 inches for a free brake and a cold drum. When adjustment is made by push rod travel, first establish the correct push rod travel for a free wheel travel.

16.3.4.1 Wedge Brakes

- (19) Should have the wedge assembly or adjusting mechanism removed for inspection and servicing.
- (20) If a wedge assembly should need replacing, be sure to install the same angle wedge to mate with the others.
- (21) Only approved lubricants should be used on the wedge brake.
- (22) Use hot soapy water on seals in the wedge brake and a solvent on all metal parts.

16.3.4.2 Disc Brakes

- (23) Follow the manufacturer's instructions in servicing and maintaining.

16.4 LUBRICATION

16.4.1 PURPOSE

Proper lubrication is essential to all types of bearings, gearing, and friction producing mechanical devices. Lack of adequate and proper lubrication results in premature wear of components due to increase abrasion or excessive heat.

Experience has shown that a large percentage of all service problems with mechanical equipment can be traced to use of the wrong lubricant or to improper application or to complete neglect.

Lubricants properly selected and applied reduce friction, protect against corrosion, carry heat away and prevent foreign matter from entering lubricated areas.

16.4.2 SELECTION AND TYPES

Careful selection of the proper lubricant is essential for best results. This is because not all lubricants are equally effective in a given application. The selection of a lubricant and its application technique are governed by the design and operating conditions of the parts requiring lubrication. The service temperature range, pressures, flash points, viscosity, sensitivity to moisture, type of materials - all go into selecting the proper lubricants. The wrong lubricant may thin out in normal temperatures created by friction, while the same lubricant may congeal in cold weather or may emulsify with only limited service in the presence of slight moisture.

Lubricant makers have been progressive, in that many synthetic, more stable products have been developed for standard and special applications. New greases with special properties have been developed and are on the market. Lithium soap and barium soap greases are becoming quite common, although because of high cost are used mainly for special uses where their unique properties justify the expense. The silicones and silicone greases have been used particularly for high temperature applications. Most applications, however, are taken care of by the standard, well refined mineral oils and standard lime soap and sodium soap greases.

16.4.3 AMOUNT

Use of the proper amount of lubricant! Excessive lubricant or too heavy a lubricant may result in an increase in operating temperatures and possible leakage. This usually is followed by the tightening of closures and a resultant further increase in friction until, in extreme cases, failure occurs.

16.4.4 CLEANLINESS

Lubricants should be clean and free of dust, dirt, and moisture and clear of other contaminants. Further, all lubricants subject to such contamination should be changed at more frequent intervals. Dirty lubricants often result in galling of metal and premature wear. Lubricants of different grades or manufacture should, in general, not be mixed together.

References

T.T.M.A. Trailer Maintenance Manual, 1990.
Truck Trailer Manufacturers Association.

Correct Trailer Repair Procedures, 1989.
Association of American Railroads.

Domestic Container Repair Manual, Proposed.
Transamerica Leasing, Inc.



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ZPLATE Body Repairs/Replacements (Side Panels)

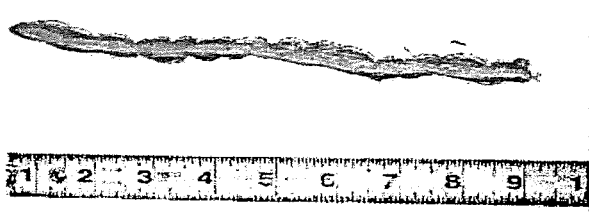
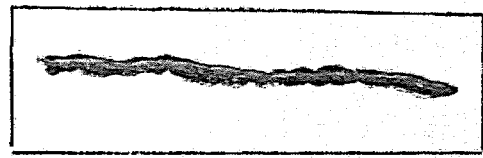
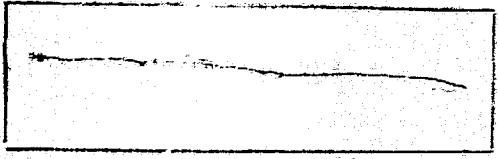
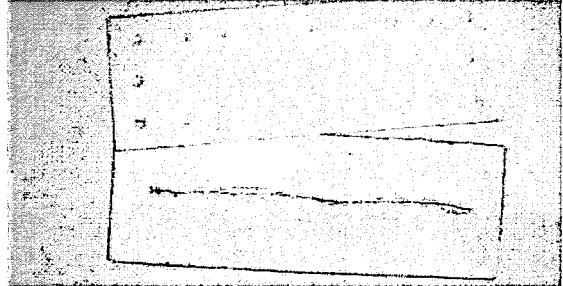
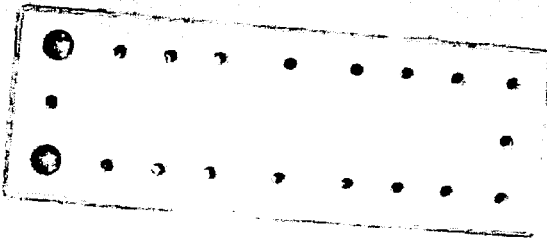
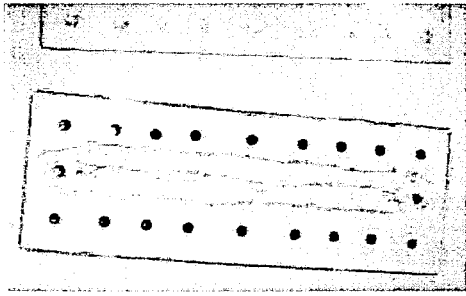
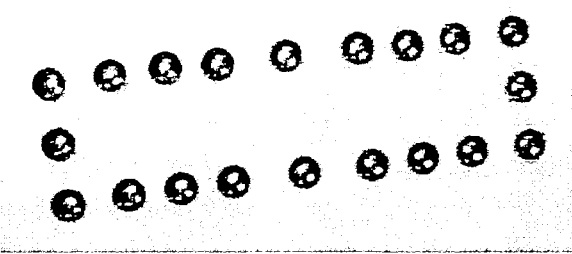
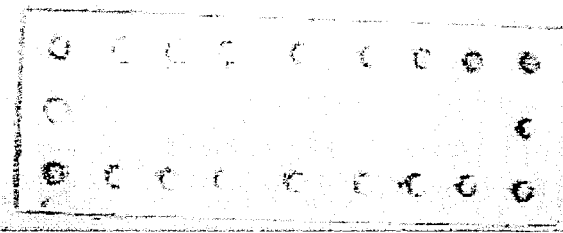
Material selected for replacing and repairing side wall panels must comply with the manufacturer's recommendation.

Patching Body Panels



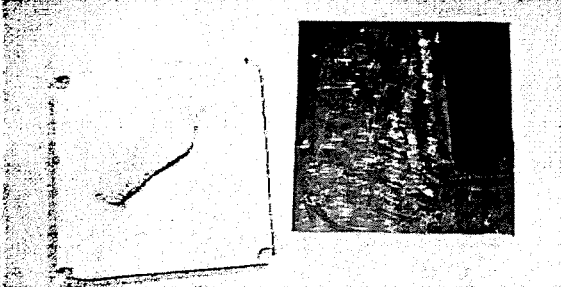
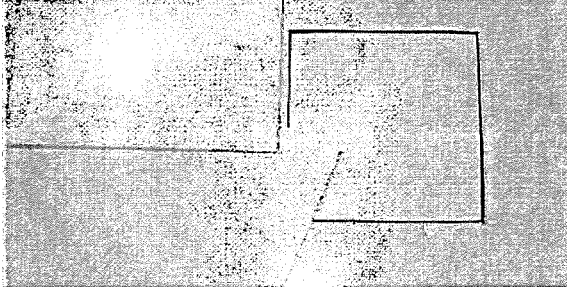
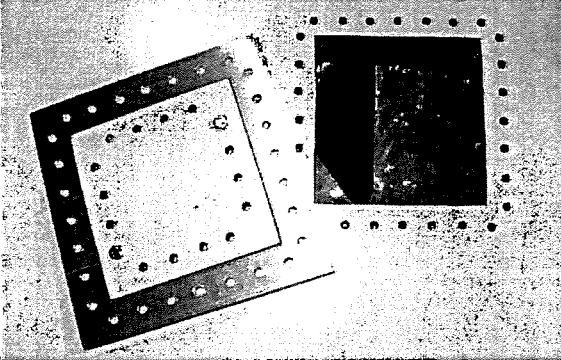
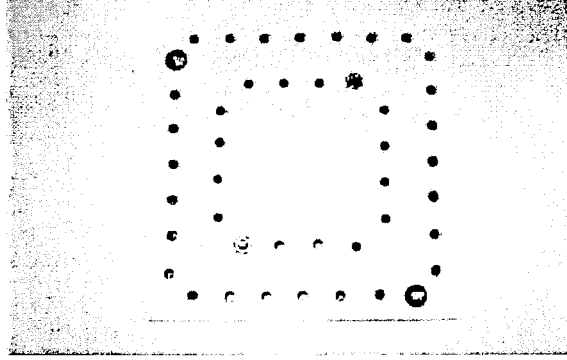
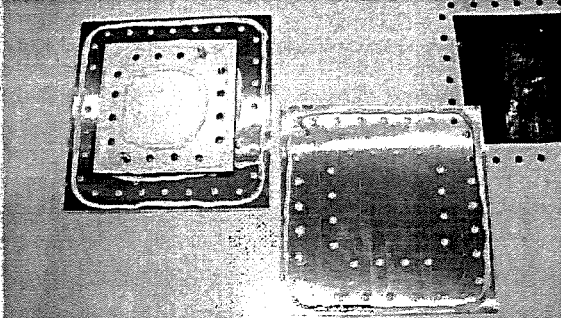
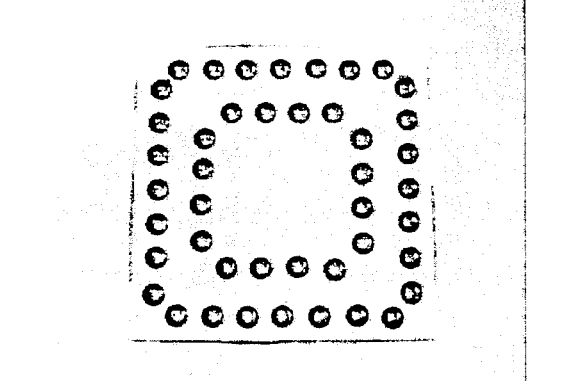
General requirements:

- *For single surface repairs:* A patch panel of like material must be made to overlap the existing panel break of not less than 1 5/8 inches on all sides.
- *For full puncture repairs:* The damaged portion must be trimmed to produce a square or rectangular opening. No repair core may be less than 4" on any one side nor larger than 12" on any one side.
- Aluminum surface patch is to be of 0.050 minimum thickness and match the original panel paint. Alternative material of prepainted galvanized steel (minimum 0.026" thickness) may be used.
- A patch may not extend from one panel to another. A patch may not be closer than 4" from any edge of the original panel; this requires panel replacement.
- Use buck rivets (6053-T61 aluminum) for side panel repairs (exclude drive rivets, pull rivets and screws).
- Use buck rivets to secure repair material to original panel.
- Cuts that extend the full length of a single panel require the replacement of that panel.
- Joining plates may be sectioned, providing a minimum of a 6" overlap.

Patching procedure: Single surface scrape

 <p>Tear in surface and damage to core: no effect to second skin</p>	 <p>Layout size of patch: allow for rivet pattern to be approximately 1" from any damaged area</p>
 <p>Peen raw edges of damage as flat as possible</p>	 <p>Cut patch and pre-drill: for 3/16" dia rivets on 1" centers around perimeter. Provide 5/8" form hole to edge of patch material</p>
 <p>Transfer drill holes into panel being repaired</p>	 <p>Remove patch and apply adhesive sealant: directly into damaged area and around perimeter of damage</p>
	 <p>Install rivets with heads on inside of unit</p>

Repair procedure: Full puncture

 <p>View from side of impact damage</p>	 <p>Resulting damage due to puncture</p>
 <p>Remove a rectangular section of panel: minimum of 1" outboard of damaged area (no greater than 12x12)</p>	 <p>Cut repair components: core panel is to be 1/8" less in width and height than material removed outer skins are to be 2 1/2" larger in height and width than material that was removed</p>
 <p>Drill core replacement and original panel for 3/16" dia rivets: Holes should be placed 5/8" from edge of panel and 1" apart around perimeter Transfer drill (1) skin using core and original panel</p>	 <p>Assemble (3) repair components and transfer drill remaining holes through second skin. Disassemble for adhesive and sealant application</p>
 <p>Apply adhesive/sealant inboard and outboard of core panel rivet holes (full perimeter) and outboard of skin holes (full perimeter)</p>	 <p>Install rivets with heads on inside of unit</p>

Panel Replacement

General Requirements (reference Figures 1 & 2):

- Remove the rivets attaching the scuff to the panel. Enough scuff rivets will have to be removed to allow for the scuff to be pulled out of the way (for access to those joining plate rivets that will be behind the scuff).
- Remove the damaged panel by chiseling off the heads of the rivets on the inside of the trailer, along the top and bottom of the damaged panel and the rivets at the joining plates. Then punch out the rivet stems with a 3/16 punch being careful not to oblong holes.
Note! Rivets may also be removed by drilling the heads off, verses chiseling.
- Remove the outer joining plates and panel.
- If outer joining plate is damaged during removal of panel it must be replaced with Stoughton number 01-21117 x 'required length', and 3/32 x 1/4 foam tape (Stoughton number 04-85299) must be applied, as shown in Figures 1 & 2.
- Clean attaching surfaces and inspect sealant tape for damage. As necessary replace upper and lower rail tape with 1/16 x 1 foam tape (Stoughton number 04-85512).
- Center replacement panel, Stoughton number 04-20547, in opening. Ensure panel offset is such that after installing the inside joining plates they will be flush with the inside of the panel (ref: Figure 1). Install inner joining plate, centering the plate across the gap. Then apply caulk filling that gap at the top of the panels. Fill dimple in outer joining plate at the top with caulk prior to installing. Install the outer joining plate, centering the plate across the gap. Tack plates and panel in place by transfer drilling .265 DIA holes from the inside. Use 1/4 DIA 6053-T61 aluminum rivets.
Note! Panel will have to be cut and therefore only be offset on one end if replacing a forward most or rear most panel.
- Finish drilling holes around perimeter of panel and secure panel to upper and lower rails and to joining plates with 1/4 DIA 6053-T61 aluminum rivets. Be careful when bucking the rivets along the top and bottom rails to prevent the hole from mushrooming around rivet.
- Reattach the scuff with 3/16DIA x 9/16 BR HD 6053-T61 aluminum rivets.

Figure 1: Splice Detail

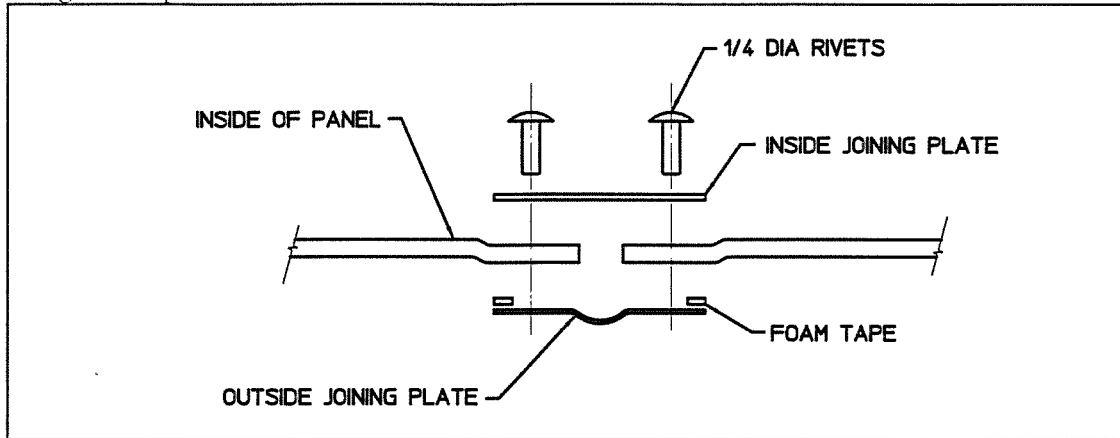
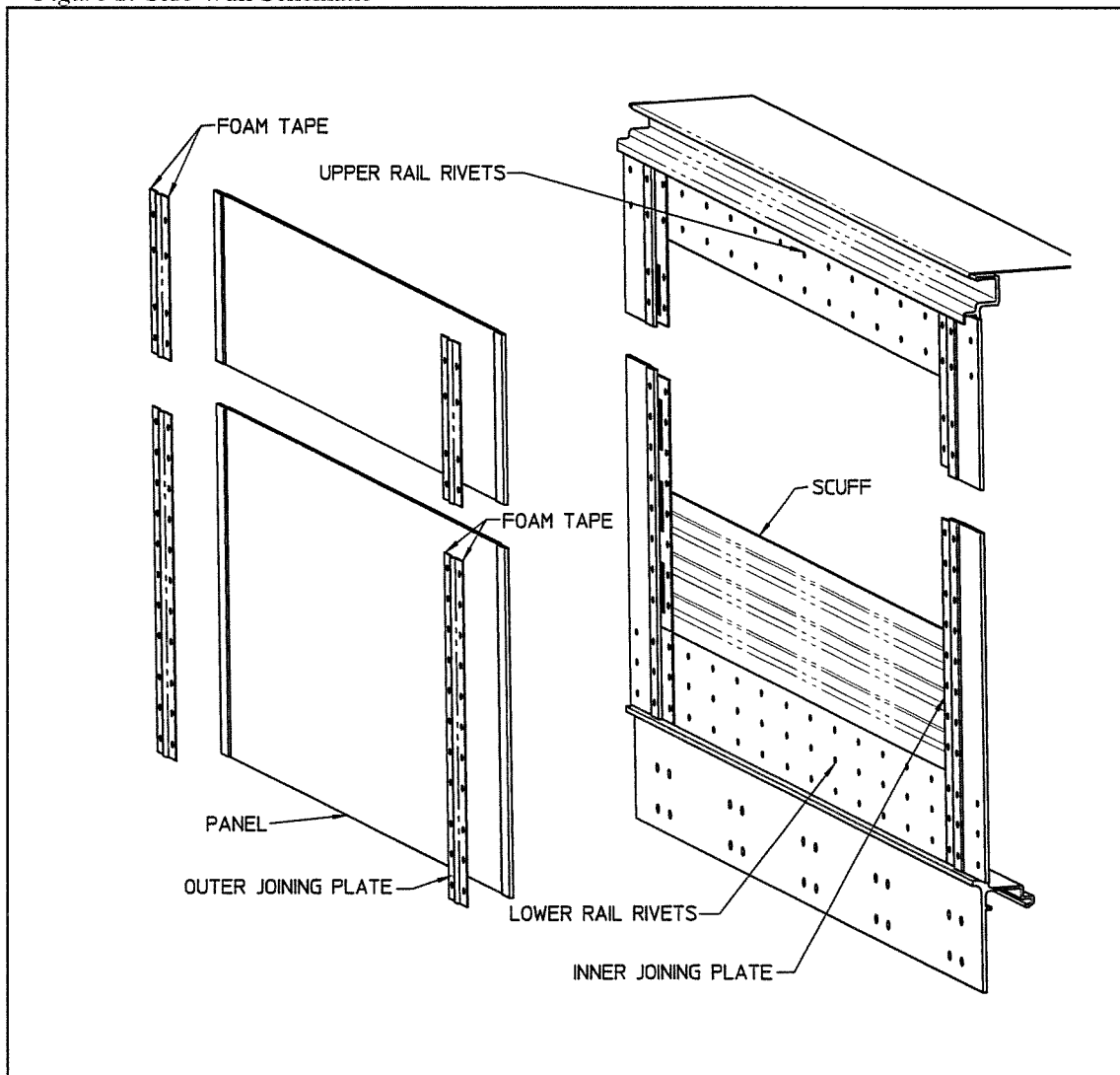
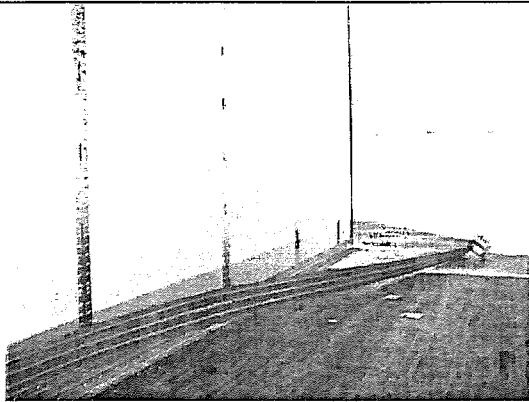


Figure 2: Side Wall Schematic



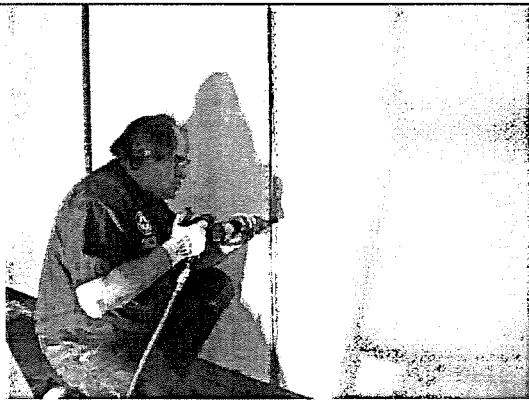
Panel Removal:



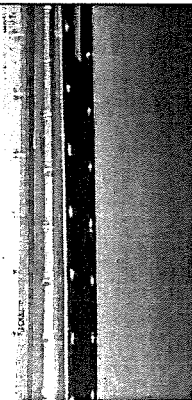
Remove enough scuff fasteners to pull scuff out of the way of the joining plate rivets at the panel to be replaced.



Remove rivet heads from joining plates and from top and bottom rails



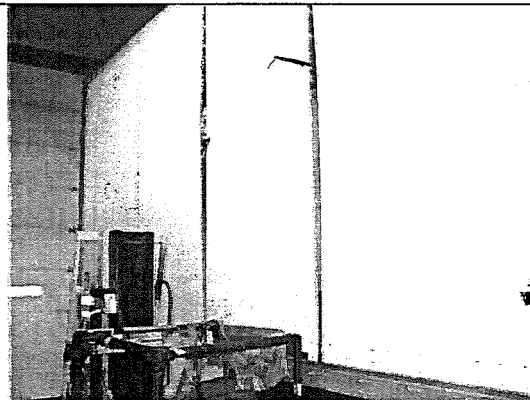
Punch out remaining rivet stems



Removing inner joining plates is not necessary for removal of panel

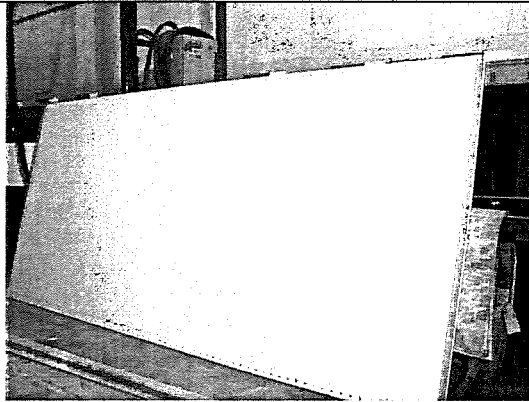


Remove outer joining plates

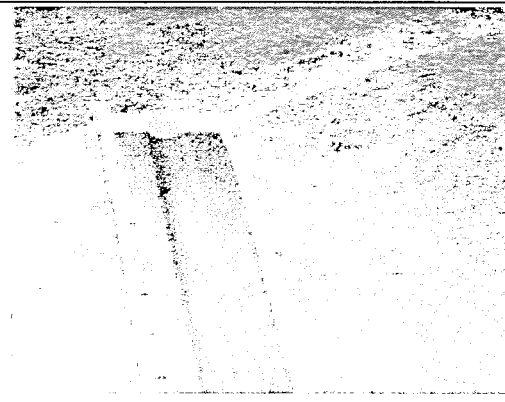


Remove damaged panel

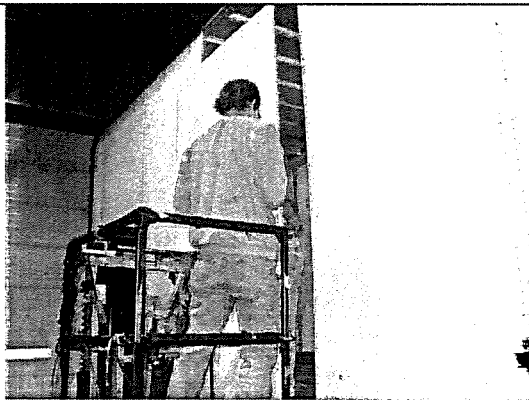
Panel Installation:



Apply foam tape along top and bottom inside edge of new panel.



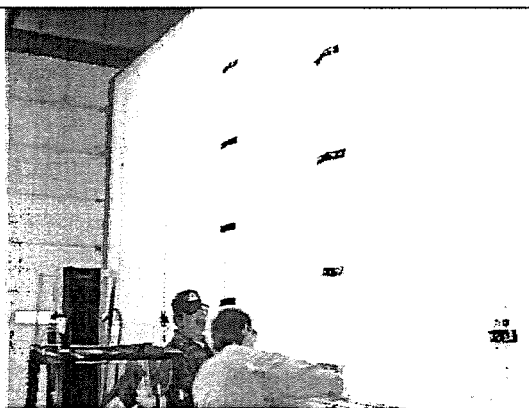
Apply foam tape to outer joining plates along sides and at top, also fill dimple at top with caulk.



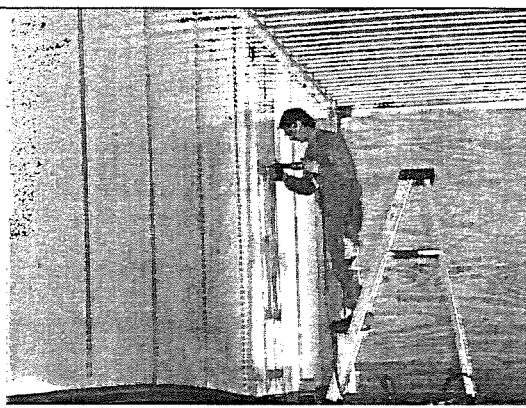
Reinstall the new panel.



Install joining plates.



Line up all holes with temporary fasteners.



Install driven rivets in all locations that rivets were removed.

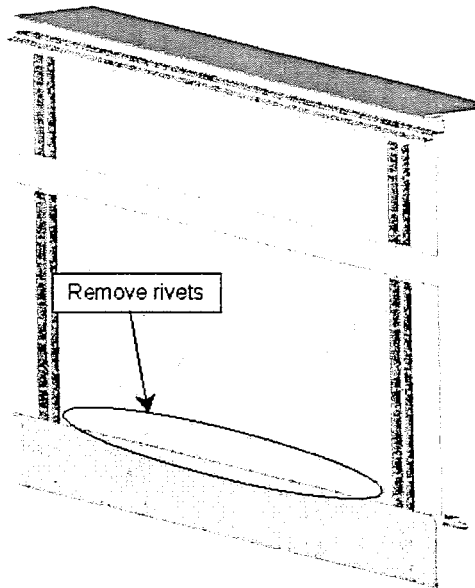
ZYPLEX Panel Rivet Replacement (Side Panels)

The following is a procedure for replacing the rivets connecting the Zyplex side wall panel to the lower rail. This procedure is intended for use in cases where panel(s) have experienced a degree of swelling.

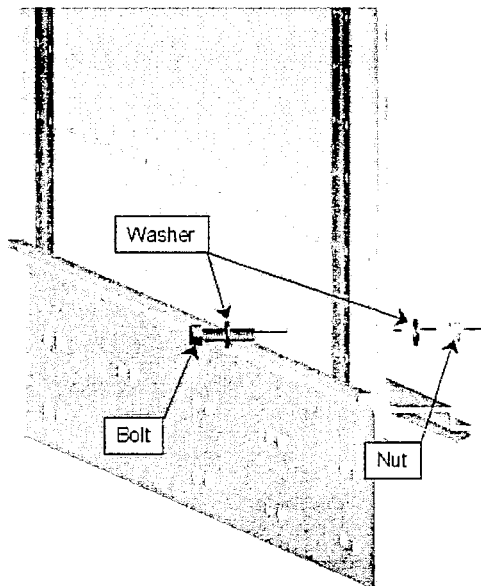
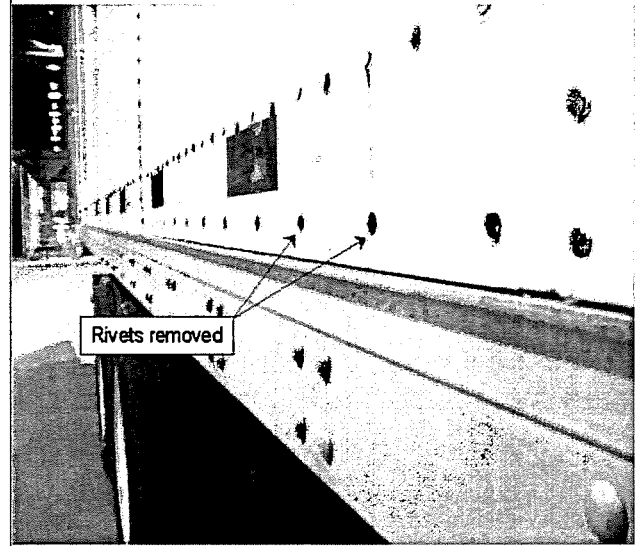
Procedure: (Refer to the Rivet Replacement Procedure figures that follow)

- Remove the lower row of rivets by drilling them out from the inside using a ¼" drill bit.
- Enlarge those holes by drilling out from the outside with a 5/16" bit. Be sure to use the hole in the panel as the pilot, then drill the rail as required.
- Install 5/16 bolts, nuts, and washers and secure panel tight to lower rail.
- Add a 5/16 hole midway between each bolt at same height from panel edge.
- Install 5/16 x 7/8" long 6053-T61 aluminum rivets. Buck rivets (heads inside of trailer).
- Remove bolts and install the 5/16" rivets into those locations also.
- Repeat this procedure until that lower row of rivets is approximately 2" on-center along the lower edge of the affected panels.
- Inspect the rivets directly above those that were just installed. Some or all of those rivets in the upper row may need to be replaced in a manner similar to that described above. More specific instructions are available after review of documentation.

Rivet Replacement Procedure:



Remove lower row of rivets



Install 5/16 bolts, nuts, and washers

