

d. Members Dented in a Bay. Repair dented, bent, cracked, or otherwise damaged tubular members by using a split-sleeve reinforcement. Carefully straighten the damaged member, and in the case of cracks, drill No. 40 (0.098) inch stop holes at the ends of the crack.

4-92. REPAIR BY WELDED SLEEVE.

This repair is outlined in figure 4-35. Select a length of steel tube sleeve having an inside diameter approximately equal to the outside diameter of the damaged tube and of the same material, and at least the same wall thickness. Diagonally cut the sleeve reinforcement at a 30-degree angle on both ends so that the minimum distance of the sleeve from the edge of the crack or dent is not less than 1-1/2 times the diameter of the damaged tube. Cut through the entire length of the reinforcement sleeve, and separate the half-sections of the sleeve. Clamp the two sleeve sections to the proper positions on the affected areas of the original tube. Weld the reinforcement sleeve along the length of the two sides, and weld both ends of the sleeve to the damaged tube. (See figure 4-35.) The filling of dents or cracks with welding rod in lieu of reinforcing the member is not acceptable.

4-93. REPAIR BY BOLTED SLEEVE.

Do not use bolted-sleeve repairs on welded steel-tube structure unless specifically authorized by the manufacturer or the FAA. The tube area removed by the bolt holes, in this type of repair, may prove critical.

4-94. WELDED-PATCH REPAIR. Dents or holes in tubing may be repaired by using a patch of the same material, one gauge thicker. (See figure 4-36.)

a. Dented Tubing.

(1) Dents are not deeper than 1/10 of

tube diameter, do not involve more than 1/4 of the tube circumference, and are not longer than tube diameter.

(2) Dents are free from cracks, abrasions, and sharp corners.

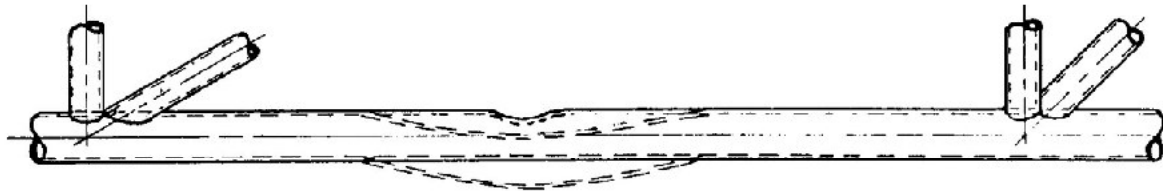
(3) The dented tubing can be substantially reformed, without cracking, before application of the patch.

b. Punctured Tubing. Holes are not longer than tube diameter and involve not more than 1/4 of tube circumference.

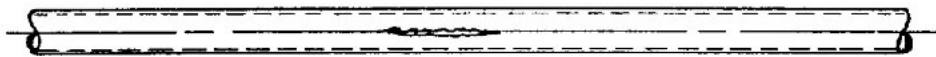
4-95. SPLICING TUBING BY INNER-SLEEVE METHOD.

If the damage to a structural tube is such that a partial replacement of the tube is necessary, the inner-sleeve splice is recommended; especially where a smooth tube surface is desired. (See figure 4-37.)

a. Make a diagonal cut when removing the damaged portion of the tube, and remove the burr from the edges of the cut by filing or similar means. Diagonally cut a replacement steel tube of the same material and diameter, and at least the same wall thickness, to match the length of the removed portion of the damaged tube. At each end of the replacement tube allow a 1/8-inch gap from the diagonal cuts to the stubs of the original tube. Select a length of steel tubing of the same material, and at least the same wall thickness, and of an outside diameter equal to the inside diameter of the damaged tube. Fit this inner-sleeve tube material snugly within the original tube, with a maximum diameter difference of 1/16 inch. From this inner-sleeve tube material cut two sections of tubing, each of such a length that the ends of the inner sleeve will be a minimum distance of 1-1/2-tube diameters from the nearest end of the diagonal cut.



DENTED OR BENT TUBE

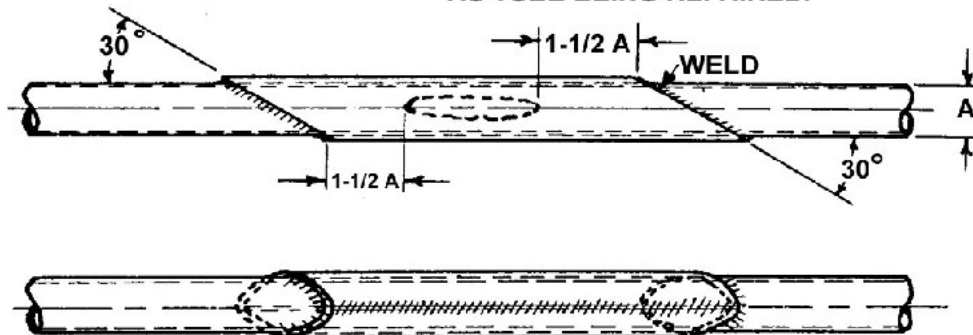


CRACKED TUBE

NOTE:
LOCALLY DENTED OR BENT MEMBERS SHOULD FIRST BE REFORMED IN CLAMP.



REINFORCEMENT SLEEVE TO BE OF SAME MATERIAL AND AT LEAST THE SAME GAUGE AS TUBE BEING REPAIRED.



AS ALTERNATIVE TO SPLIT TUBE, A TWO-PIECE REINFORCEMENT SLEEVE MAY BE FORMED FROM STEEL SHEET OF THE SAME MATERIAL AND AT LEAST THE SAME GAUGE AS THE DAMAGED TUBE. USE FISHMOUTH ENDS AND FOUR ROSETTE WELDS AS SHOWN.

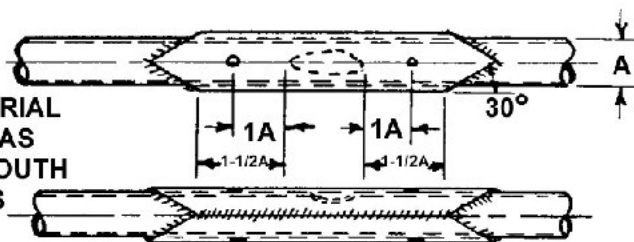


FIGURE 4-35. Members dented in a bay (repairs by welded sleeve).

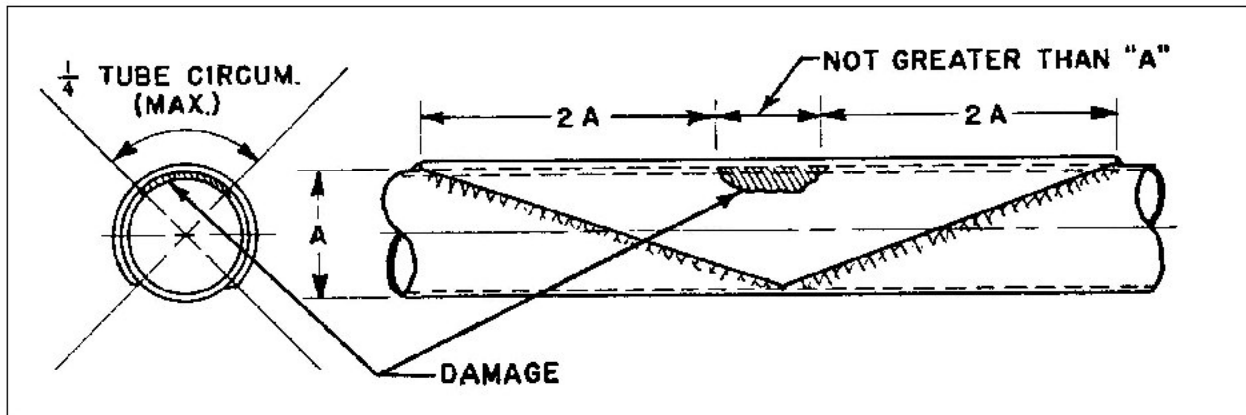


FIGURE 4-36. Welded patch repair.

b. If the inner sleeve fits very tightly in the replacement tube, chill the sleeve with dry ice or cold water. If this is insufficient, polish down the diameter of the sleeve with emery cloth. Tack the outer and inner replacement tubes using rosette welds. Weld the inner sleeve to the tube stubs through the 1/8-inch gap, forming a weld bead over the gap.

4-96. SPLICING TUBING BY OUTER-SLEEVE METHOD. If partial replacement of a tube is necessary, make the outer-sleeve splice using a replacement tube of the same diameter. Since the outer-sleeve splice requires the greatest amount of welding, it should be used only when the other splicing methods are not suitable. Information on the replacement by use of the outer-sleeve method is given in figure 4-38 and figure 4-39.

a. Remove the damaged section of a tube utilizing a 90-degree cut. Cut a replacement steel tube of the same material, diameter, and at least the same wall thickness to match the length of the removed portion of the damaged tube. This replacement tube must bear against the stubs of the original tube with a total tolerance not to exceed 1/32 inch. The outer-sleeve tube material selected must be of the same material and at least the same wall thickness as

the original tube. The clearance between inside diameter of the sleeve and the outside diameter of the original tube may not exceed 1/16 inch.

b. From this outer-sleeve tube material, cut diagonally (or fishmouth) two sections of tubing, each of such length that the nearest end of the outer sleeve is a minimum distance of 1-1/2-tube diameters from the end of the cut on the original tube. Use a fishmouth sleeve wherever possible. Deburr the edges of the sleeves, replacement tube, and the original tube stubs.

c. Slip the two sleeves over the replacement tube, align the replacement tube with the original tube stubs, and slip the sleeves over the center of each joint. Adjust the sleeves to suit the area and provide maximum reinforcement.

d. Tack weld the two sleeves to the replacement tube in two places before welding. Apply a uniform weld around both ends of one of the reinforcement sleeves and allow the weld to cool; then, weld around both ends of the remaining reinforcement tube. Allow one sleeve weld to cool before welding the remaining tube to prevent undue warping.

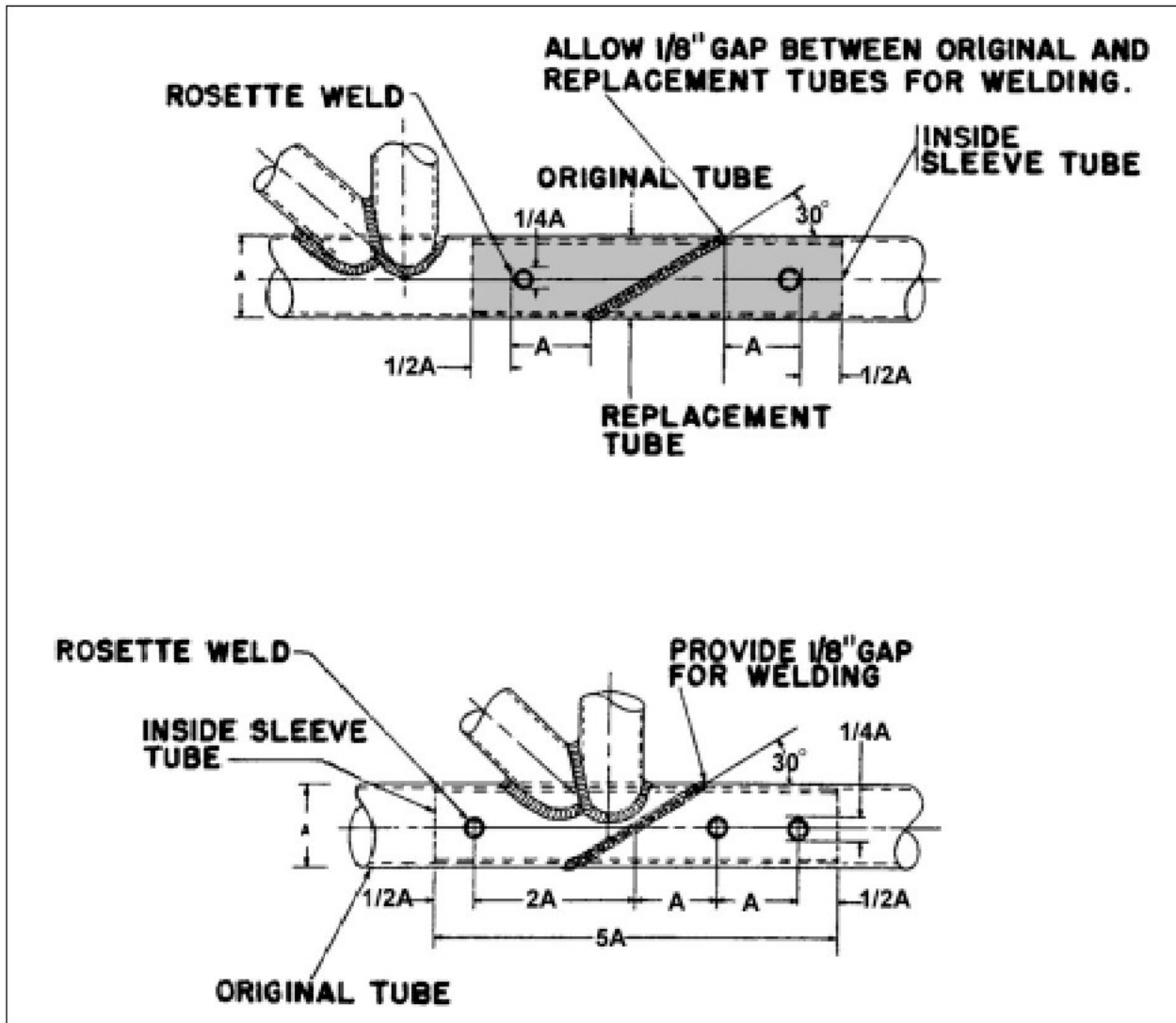


FIGURE 4-37. Splicing by inner-sleeve method.

4-97. SPLICING USING LARGER DIAMETER REPLACEMENT TUBES. The method of splicing structural tubes, as shown in figure 4-40, requires the least amount of cutting and welding. However, this splicing method cannot be used where the damaged tube is cut too near the adjacent cluster joints, or where bracket-mounting provisions make it necessary to maintain the same replacement tube diameter as the original. As an aid to installing the replacement tube, squarely cut the original damaged tube leaving a minimum short stub equal to 2-1/2-tube diameters on one end and a minimum long stub equal to 4-1/2-tube diameters on the other end. Select a length of steel tube of the same material and at

least the same wall thickness, having an inside diameter approximately equal to the outside diameter of the damaged tube. Fit this replacement tube material snugly around the original tube with a maximum diameter difference of 1/16 inch. From this replacement tube material, cut a section of tubing diagonally (or fishmouth) of such a length that each end of the tube is a minimum distance of 1-1/2-tube diameters from the end of the cut on the original tube. Use a fishmouth cut replacement tube wherever possible. Deburr the edges of the replacement tube and original tube stubs. If a fishmouth cut is used, file out the sharp radius of the cut with a small round file.

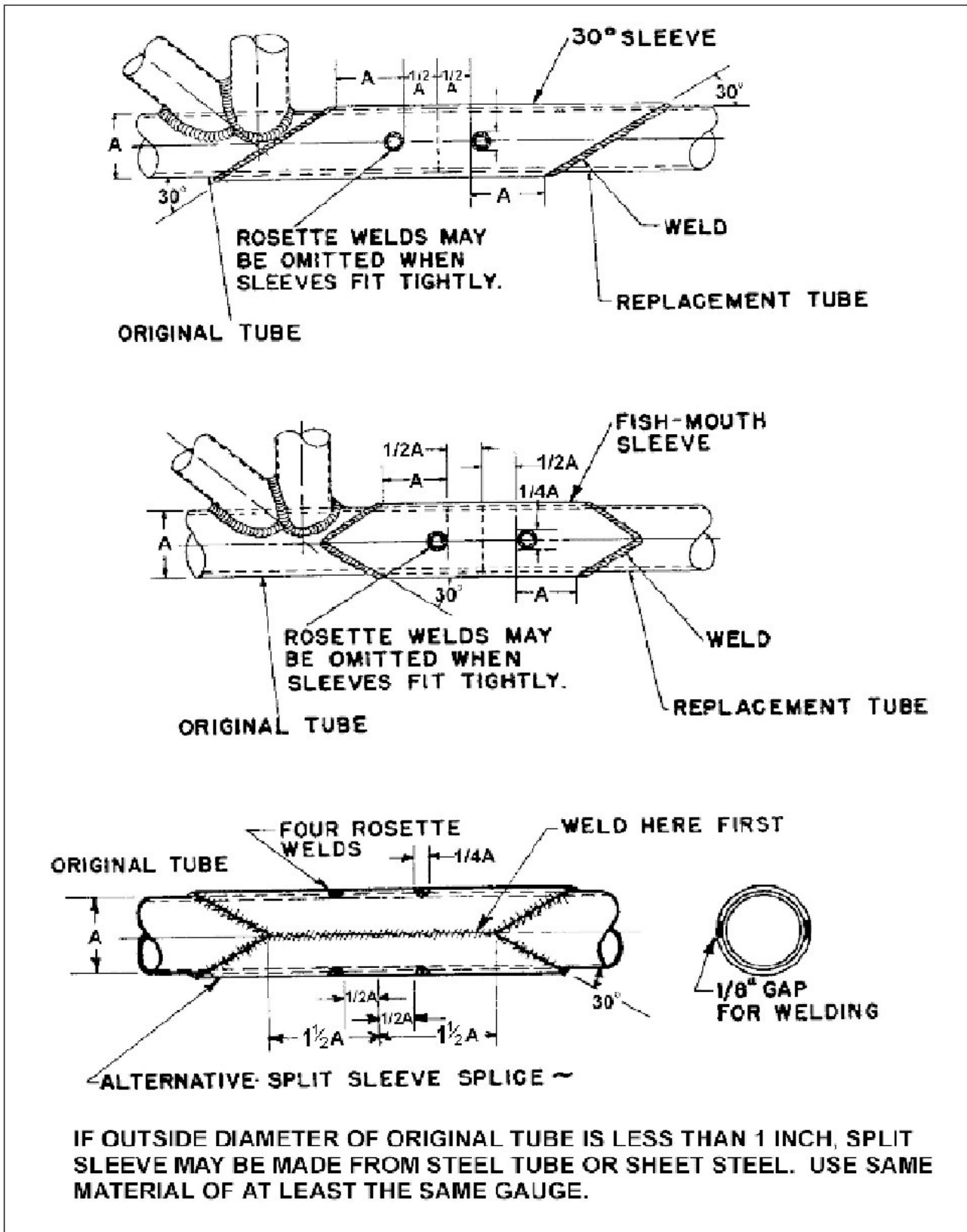


FIGURE 4-38. Splicing by outer-sleeve method (replacement by welded outside sleeve).