

ELECTRO-MOTIVE DIVISION  
GENERAL MOTORS CORPORATION • LA GRANGE, ILLINOIS, U. S. A.

## WELDING INSTRUCTIONS FOR CARBODY REPAIR

### GENERAL DESCRIPTION

Procedure for the welding repair of the locomotive carbody will necessarily present individual problems which will require separate methods of procedure for these repairs. These individual problems may be directed for attention to the Service Department. In this instruction we endeavor to cover repair which may generally be applicable in the majority of repairs to the carbody.

When any welding repair is made to a locomotive, care must be taken as not to provide a current path through any of the working equipment of the locomotive such as, journal boxes etc. The ground connection should be made directly to the locomotive frame.

The following recommendations cover typical repair methods used in repairing damaged carbody structural members. In general, all splices should be made on a diagonal across the flange of the member. Diamond reinforcing plates should be used wherever practical. Overhead welds should be reduced to a minimum. All weld passes should be parallel with the joint or crack and no weaving will be permitted. Multiple pass welds should be peened after each pass to decrease the weld shrinkage and clean the weld. Always magnaflux the first pass. Magnaflux between subsequent layers of weld passes. Cracks in under-frame members, not otherwise damaged may be repaired by determining the extent of the crack by magnaflux inspection, then drilling a hole at the end/or

ends of the crack, scarifying out the cracked area by chipping, grinding or flame cutting and welding between holes. Holes drilled at the end of the crack, should be magnafluxed to make sure that the end of the crack has been reached.

Figure 1 shows method to be used in splicing "H" section such as center sills, bolster posts, roof members and side frame members. Diamond reinforcing plates are recommended where the size of member permits. The center sills are the "H" beams extending the length of the locomotive tying into each bolster and to which the generator mounting pads are welded. The bolster posts are the main upright carbody frame members forming an arch directly over each bolster. Figure 2 shows a repair made by removing a damaged flange section and replacing with a new section.

Figure 3 shows a typical splice in the side sill "Z" bar. Diamond patches are recommended. The side sill "Z" bar is the structural member extending the length of the locomotive on the bottom outer side and to which the side carbody frame members are welded as shown in Fig. 4.

If a side sill "Z" bar, Fig. 4, Item #4 outer flange only is damaged, repair by straightening. If "Z" bar flange and web is damaged, remove damaged section between framing members such as "A" and "B," and splice in a new section. If side sill is buckled, as between "A" and "C," remove gussets and detach items 1, 2 and 3 in the

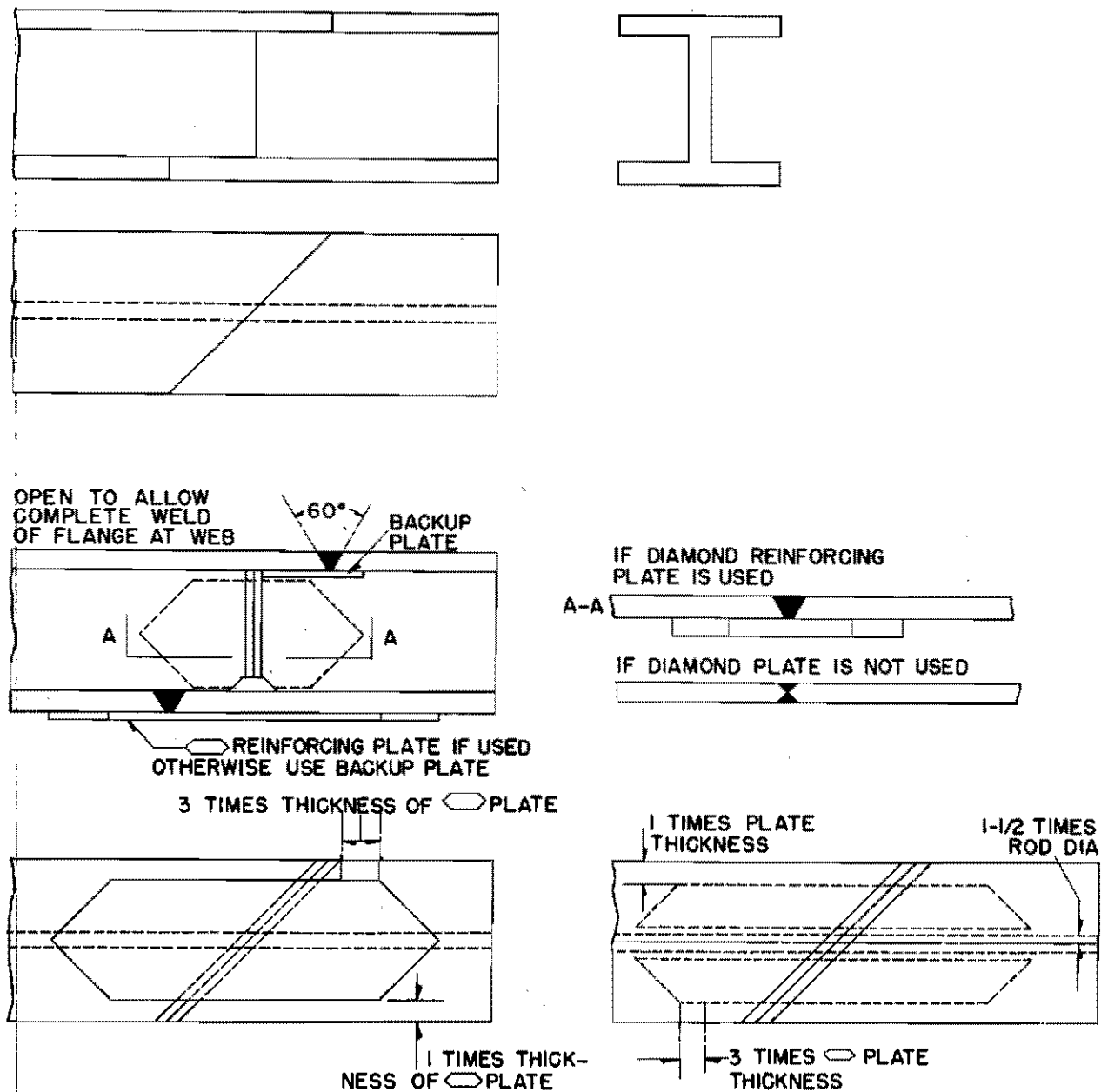


Fig. 1 - Splicing "H" Section

effected area. Straighten or replace "Z" bar and reweld framing members. Damaged side framing members such as Item 1 and 2 can be most satisfactorily repaired by replacing the damaged section.

A damaged flange may be straightened or repaired as indicated in Fig. 3. Damaged side panel support members, Item 3 of Fig. 4, should be replaced since slight bends in these members results in an exaggerated wave effect in

the finished panels. This condition is particularly noticeable in locomotives finished in dark paint colors. Repaired panel support members usually result in misalignment of batten bolts.

No attempt should be made to straighten the center sills. The damaged section should be removed and replaced following instructions shown in Fig. 1. Transverse underframe members may be repaired by straightening damaged flanges or by repair methods shown in Fig. 1 or 3.

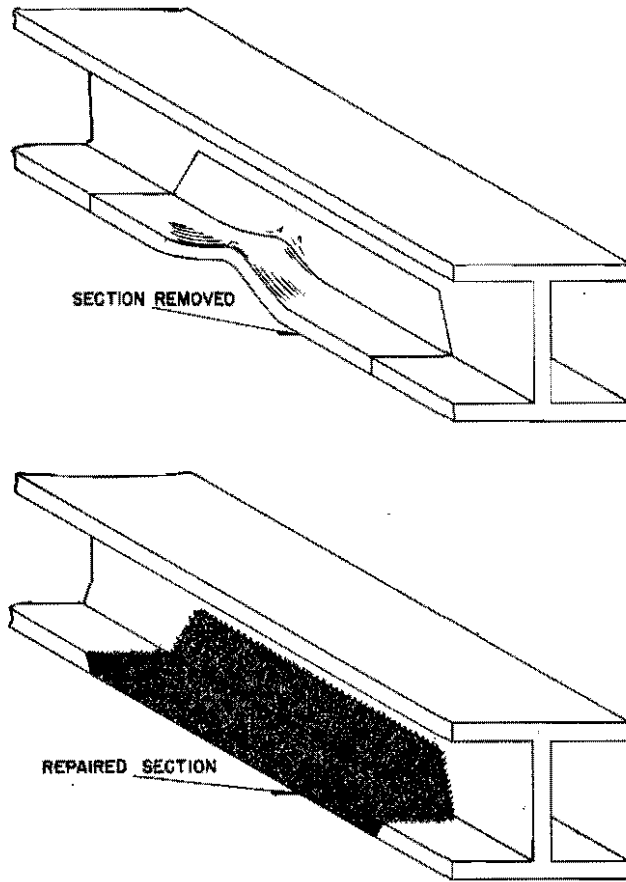
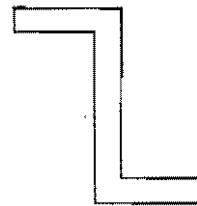
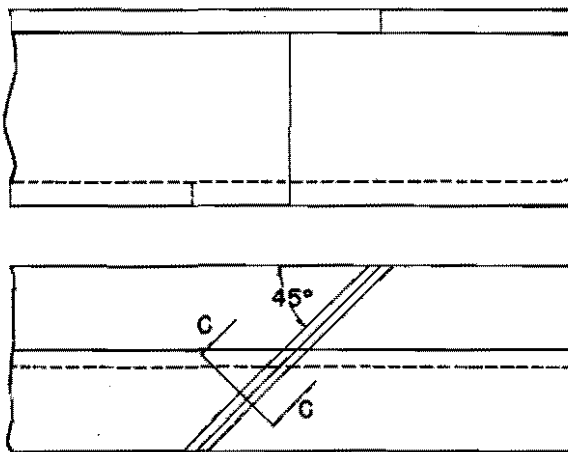


Fig. 2 - "H" Section Flange Repair



NOTE: ROOT OF SCARF SHOULD EQUAL ONE & HALF TIMES THE DIAMETER OF THE WELDING ROD TO BE USED.

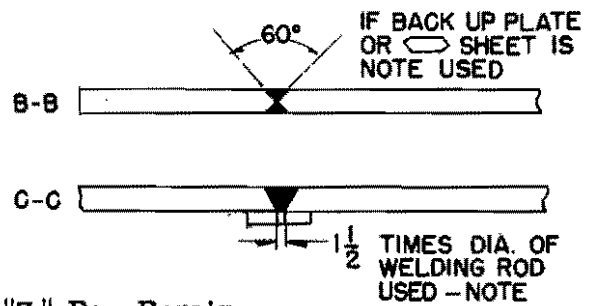
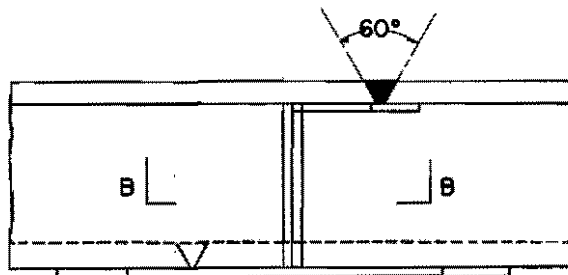


Fig. 3 - Typical "Z" Bar Repair

On page 4 is given the recommended welding electrode for various applications on the locomotives and parts. The welding rod is identified by the AWS (American Welding Society) spec-

ification code and may be purchased from many electrode manufacturer's. By the use of a electrode comparison chart, the AWS specification designation of a particular company may be obtained.

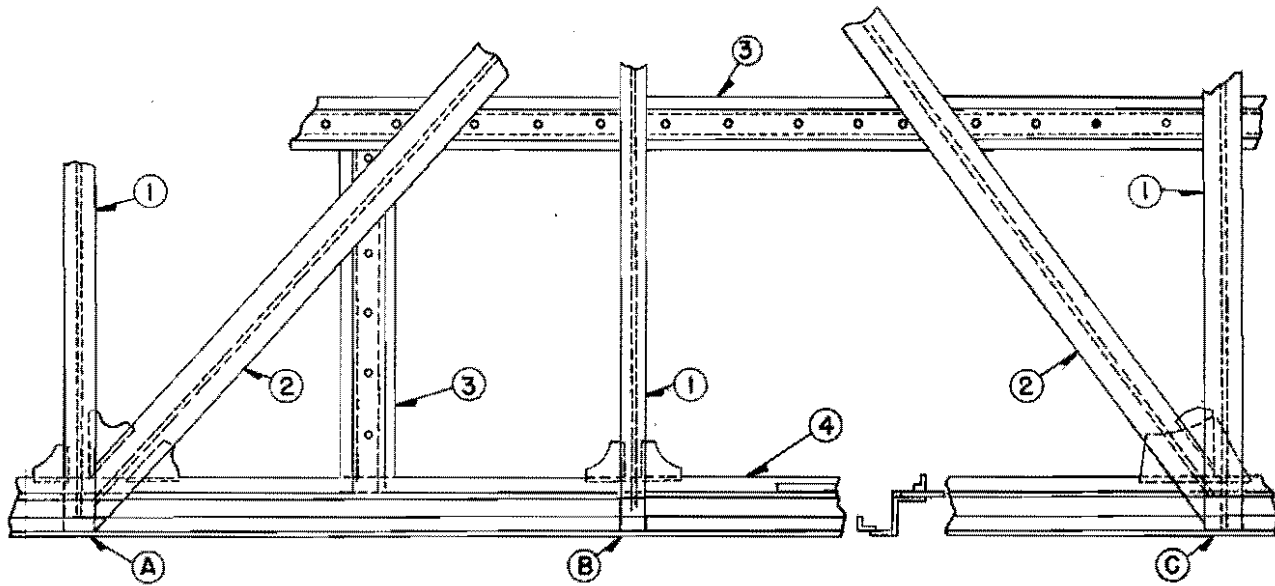


Fig. 4 - Carbody Frame Repair

Part	Locomotive Type	Electrode - Type
Journal Box Wear Plate	All	AWS E-310-15 Lime
Lube Oil Tanks	Galvanized	AWS E-6010
Lube Oil Tanks	Stainless	AWS E-347-15
Fuel Oil Tanks	All	AWS E-6012
Water Tanks	Mild Steel	AWS E-6012
Water Tanks	Galvanized	AWS E-6010
Traction Motor Gear Cases	All	AWS E-6012
Coupler Pockets	Passenger	AWS E-6012
Coupler Pockets	Switcher	AWS E-6012
Coupler Pockets	Freight	AWS E-7010 D.C. - E-7011 A.C.
Sand Boxes	All	AWS E-6010 D.C. - E-6012
Battery Boxes	All	AWS E-6012 - E-6013 A.C.
Spring Holder	All	AWS E-6012
Truck Frame	Passenger	AWS E-7010 - 7011
Truck Frame	Switcher	AWS E-6010 D.C. - E-6012
Truck Frame	Freight	AWS E-7010 - 7011
Spring Plank	All	AWS E-7010 D.C. or E-7011 A.C.
Bolsters (Carbody)	Freight & Passenger	AWS E-7010 D.C. - E-7011 A.C.
Cross Bearers	All	AWS E-7010 D.C. - E-7011 A.C.
Underframe	Passenger	AWS E-7010 D.C. - E-7011 A.C.
Underframe	Freight	AWS E-7010 D.C. - E-7011 A.C.
Underframe	Switcher	AWS E-6012 - E-6015 D.C.
Front & Rear Platform	Passenger	AWS E-7010 D.C. - E-7011 A.C.
Front & Rear Platform	Freight	AWS E-7010 D.C. - E-7011 A.C.
Side & Front Framing	All	AWS E-7010 D.C. - E-7011 A.C.
Roof & Hatches	All	AWS E-6012
Roof & Hatches	Stainless	AWS E-308-15 or 308-16
End Sheets - Air Ducts	All	AWS E-6012 - E-6013
False Ceilings	All	AWS E-6012 - E-6013
Pipe Clamps	All	AWS E-6012
Engine & Gen. Pads	All	AWS E-6012
Frog Hooks	Switcher	AWS E-6012
Fuel Tank Supports	All	AWS E-6012
Bolster	Switcher	AWS E-6012
Underframe Side Brgs.	All	AWS E-6012
Air Reservoir Brackets	Switcher	AWS E-6012
Push Pole Pocket	All	AWS E-6012
End Plates	Switcher	AWS E-6012
Cable Cleats	Switcher	AWS E-6012
Step and Skirt	Switcher	AWS E-6012
Hoods and Cabs	Switcher	AWS E-6012 - E-6013
Ballast - EMD Appl.	All	AWS E-6012
Floor Plates	All	AWS E-6012 - E-6020
Base Angles	Switcher	AWS E-6012 - E-6020

Diameter of electrodes mentioned above is governed by thickness of material to be welded. All overhead welding shall be done with 1/8" or 5/32" diameter electrode. All vertical welds shall be done with 1/8" or 5/32" diameter electrode. Electrodes not exceeding 1/4" in diameter should be used for down hand or horizontal welds.

