Committee: 4 (Rail), Subcommittee: 1 (Welding of Rail)

Letter Ballot Number: TBD

Assignment: None

Explanation of Ballot:

This ballot proposes to more clearly define the hardness testing method for electric flash butt (EFB) welds (Section 3.10.3.3). It also proposes a revision of the EFB weld hardness acceptance criteria (Section 3.10.2.3) to better reflect current rail and EFB weld practices.
Delete existing guidelines “a” and “b” in 3.10.2.3 (shown in red strikethrough below) and replace with the proposed guideline “a”.

3.10.2.3 Hardness Criteria

   a. No welds shall have hardness values greater than 400 BHN or 43 Rc.

   b. Hardness within the weld shall be within ±30 BHN points or ±5 Rc of parent rails head hardness except at decarburized centerline and at the spheroidized edge of the heat affected zone.

       a. The average HAZ hardness, excluding the bond line (decarburized centerline) and the spheroidized portion at the edge of the HAZ, shall be within ±8 HRC of the parent rail hardness.

Delete existing guidelines “a-c” in 3.10.3.3 (shown in red strikethrough below) and replace with the proposed guidelines “a-g”. Also add the figure shown as “Figure XX.”

3.10.3.3 Hardness Criteria

   a. Rc hardness values or equivalent shall be measured 5 mm below the running surface, on the vertical longitudinal section at 1/8 inch intervals.

   b. The complete welded zone into the parent rail shall be tested.

   c. The center measurement shall be on the weld bond line.

       a. The hardness test shall be performed as described in 3.10.3.3.b-g and shown in Figure XX.

       b. Rockwell C (HRC) hardness shall be measured at a depth of 0.2 in [5 mm] below the running surface on the vertical longitudinal section, as close to the rail centerline as possible.

       c. The complete flash welded zone into the parent rail shall be tested, and the center measurement shall lie approximately on the weld bond line.

       d. The spacing between adjacent indents shall not exceed 0.125 in [3 mm]. A smaller spacing between indents is permitted to increase spatial resolution, as long as the indent spacing is sufficient to avoid overlapping of the work hardened material between adjacent indents as specified in ASTM E18.

       e. When a weld HAZ hardness is compared to the parent rail hardness, the hardness shall be compared between the HAZ and the rail on the same side of the bond line.

       f. When a weld HAZ hardness is compared to the parent rail hardness, the parent rail hardness shall be determined by averaging at least three hardness measurements outside of the HAZ.

       g. When a weld HAZ hardness is compared to the parent rail hardness, the average hardness of the HAZ, excluding the bond line (decarburized centerline) and the spheroidized portion at the edge of the HAZ, shall be used.
Figure XX. (top) Example of a Rockwell C hardness test performed on the vertical longitudinal section of an electric flash butt weld, near the rail centerline. The indent spacing was 0.08 in [2 mm], which is less than the maximum spacing of 0.125 in [3 mm]. (bottom) Example results from the Rockwell C hardness test above showing how HAZ and parent rail hardness should be compared. The bond line and spheroidized regions, which are not used in the hardness comparison, are also shown.