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5.C SPECIFICATION FOR SPlicing REINFORCING BAR USING THE CADWELD PROCESS

5.C.1 SCOPE

This Specification covers the mechanical splicing of deformed concrete reinforcing bar for full tensile loading. The average tensile strength of the Cadweld joints shall be equal to or greater than the minimum tensile strength for the particular grade of reinforcing steel as specified in the appropriate ASTM standard. The minimum tensile strength of the splices shall equal or exceed 125 percent of the minimum yield strength for each grade of reinforcing steel as specified in the appropriate ASTM Standard.

5.C.2 PROCESS

All splices shall be made by the Cadweld Process using clamping devices, sleeves, charges, and so on, as specified by the Cadweld Instruction Sheets for "B" and "T" Series connections. "C" series materials shall not be permitted.

5.C.3 QUALIFICATION OF OPERATORS

Prior to the production splicing of reinforcing bars, each operator or crew, including the foreman or supervisor for that crew, shall prepare and test a joint for each of the positions to be used in production work. These splices shall be made and tested in strict accordance with this Specification using the same ASTM grade and size of bar to be spliced in the production work. To qualify, the completed splices shall meet the acceptance standards of Section 5.C.6 for workmanship, visual quality and minimum tensile strength. A list containing the names of qualified operators and their qualification test results shall be maintained at the jobsite.

5.C.4 PROCEDURE SPECIFICATION

All joints shall be made in accordance with the manufacturer's instruction sheets "Rebar Instructions for Vertical Column Joints", plus the following additional requirements:

- a. A manufacturer's representative, experienced in Cadweld splicing of reinforcing bar, shall be present at jobsite at the outset of the work to demonstrate the equipment and techniques used for making quality splices. He shall also be present for at least the first fifty (50) production splices to observe and verify that the equipment is being used correctly and that quality splices are being obtained.
- b. The splice sleeves, exothermic powder, and graphite molds shall be stored in a clear dry area with adequate protection from the elements to prevent absorption of moisture.
- c. Each splice sleeve shall be visually examined immediately prior to use to ensure the absence of rust and other foreign material on the inside surface.

- d. The graphite molds shall be preheated with an oxyacetylene or propane torch to drive off moisture at the beginning of each shift when the molds are cold or when a new mold is used.
- e. Bar ends to be spliced shall be in good condition with full size undamaged deformations. The bar ends shall be power brushed or sand blasted to remove all loose mill scale, rust, concrete and other foreign material. Prior to power brushing all water, grease and paint shall be removed by heating the bar ends with an oxyacetylene or propane torch.
- f. A permanent line shall be marked 12" back from the end of each bar for a reference point to confirm that the bar ends are properly centered in the splice sleeve.
- g. Immediately before the splice sleeve is placed into final position, the previously cleaned bar ends shall be preheated with an oxyacetylene or propane torch to insure complete absence of moisture.
- h. Special attention shall be given to maintaining the alignment of sleeve and guide tube to insure a proper fill.
- i. When the temperature is below freezing or the relative humidity is above 65 percent the splice sleeve shall be externally preheated with an oxyacetylene or propane torch after all materials and equipment are in position.
- j. The reinforcing bar deformations which become engaged in the Cadweld splice shall not be ground, flame-cut or altered in any way except the longitudinal ribs which may be ground to a diameter not less than the other bar deformations.
- k. A hairpin piece of soft twisted wire may be inserted at the top of the horizontal splices between the rebar and the sleeve to provide an escape route for the gases generated during the casting of the filler material.
- l. The packing material at the ends of the horizontal splices and at the top of the vertical splices should not be hard packed. The material should be firmly in place but loose enough to allow the escape of gases.

5.C.5 JOINT TESTING

- a. All completed splices shall be visually inspected at both ends of the splice sleeve and at the tap hole in the center of the splice sleeve.
- b. Selected splices shall be tensile tested in accordance with the following schedule for each position, bar size and grade of bar:

- 1 out of first 10 splices
- 3 out of the next 100 splices
- 2 out of the next and subsequent units of 100 splices.

- c. Splices for testing shall be selected by the Quality Assurance Engineer on a random selection basis directly from the production work. If splices are made before the bars are placed, splices can be selected on the site of splice production.
- d. Under the extreme condition, when the proper replacement of a production splice specimen splices is extremely difficult, sister splices may be used with the approval of the Project Engineer.

5.C.6 JOINT ACCEPTANCE STANDARDS

- a. Sound, nonporous filler metal shall be visible at both ends of the splice sleeve and at the tap hole in the center of the splice sleeve. Filler metal is usually recessed 1/4" from the end of the sleeve due to the packing material and is not considered a poor fill.
- b. Splices which contain slag or porous metal in the riser, tap hole or at the ends of the sleeves (general porosity) shall be rejected except as covered in (e) below. A single shrinkage bubble present below the riser is not detrimental and should be distinguished from porosity as described above.
- c. There shall be evidence of filler material between the sleeve and bar for the full 360 degrees.
- d. The splice sleeves need not be exactly concentric or axially aligned with the bars. However, there shall be a minimum of 1/16 of an inch between the splice sleeve and deformations of the reinforcing bar. This condition of maximum acceptable eccentricity or concentricity may be measured using a stiff 1/16" diameter wire.
- e. The Cadweld splices, both horizontal and vertical, may contain voids at either or both ends of the Cadweld splice sleeve. At the end of the Cadweld splice sleeves the acceptable size void for an 188 splice shall not exceed three (3) square inches per end of splice sleeve. The area of the void shall be assumed to be the circumferential length as measured at the inside face of the sleeve times the maximum depth of wire probe minus 3/16".
- f. The average tensile strength of the Cadweld joints shall be equal to or greater than the minimum tensile strength for the particular grade of reinforcing steel as specified in the appropriate ASTM standard. The minimum strength of the Cadwell joints shall be equal to or greater than 125 percent of the specified minimum yield strength for the particular bar.

5.C.7

REPAIRS

- a. Joints which do not meet the visual quality acceptance standards of Section 5.C.6 shall be rejected and completely removed. The bars shall then be rejoined with new splice(s) made in accordance with this specification.
- b. No failure of Castweld splices below the required minimum tensile strength is expected, however, in the unlikely event that one does occur, the sample shall be sent to an independent testing laboratory for analysis of failure. Based on the Test Lab's report, additional samples shall be taken to ensure that there are no other defective welds.