

GENERAL NOTES (Cont'd)

FED. RD. DIVISION	STATE	PROJECT	
	OHIO		

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LAK-2-0.00

RADIOGRAPHIC EXAMINATION OF

This work shall consist of the performance and interpretation of a radiographic examination of welds as required by these specifications. It shall include the preparation and positioning (where practical) of welds for examination, the radiographing of welds, the processing and examination of radiographs, the interpretation of radiographs for compliance with these specifications, and the performance and interpretation of any refakes of radiographs required for welds made to replace unsatisfactory welds.

APPROVAL OF DIRECTOR

The Contractor shall furnish evidence, acceptable to the Director, adequacy of the equipment to be used and the competence of the personnel performing the work.

The interpretation of radiographs and the correction of defective welds shall be subject to the approval of the Director.

SCOPE OF EXAMINATION

By means of radiographic examination, the Contractor shall furnish evidence of the acceptable quality of the welds used in fabricating and erecting the girders. The parts of those members to be radiographed are as follows:

1. The complete butt welds in both flanges at every flange splice.
2. One foot from each end of each of the web splice welds.

Shop butt welds of the flange plates and of the web plates shall be determined to be acceptable before these flange and web plates are assembled and welded to form the girder segments.

WELD CONDITION

All welded joints which are to be radiographed shall be free of paint, scale and grease, and shall be ground free of all weld ripples and surface irregularities on both sides. The direction of grinding shall be perpendicular to the length of the weld. The welds shall be ground to such a degree that the resulting radiographic contrast, due to remaining irregularities, cannot mask or be confused with that of any objectionable defect and that the weld surface will merge smoothly into the plate surface. The finished surface of the reinforcement may have a crown of an approximately uniform amount not to exceed the following:

Plate Thickness	Thickness of Reinforcement
Up to 1/2 inch, inclusive	1/16 inch
Over 1/2 to 1 inch, inclusive	3/32 inch
Over 1 inch	1/8 inch

RADIOGRAPHIC TECHNIQUE

The weld shall be radiographed with a technique which will determine quantitatively the size of defects with the thicknesses equal to or greater than 2 percent of the thickness of the base metal. In the case of a weld joining plates of unequal thickness, both plates must be radiographed at 2 percent sensitivity together or singly, with the weld junction evident in both views.

To determine whether the radiographic technique employed is detecting defects of a thickness equal to or greater than 2 percent of the thickness of the base material, thickness gages or penetrameters of the type hereinafter specified shall be placed on the side of the welded plate nearest the source of radiation at an extreme edge of the radiographic plate or film.

The material of the penetrameter shall be substantially the same as that of the welded plate.

The thickness of the penetrameter shall be not more than 2 percent of the thickness of the plate exclusive of any weld reinforcement. Penetrameters designed for increments of 1/8" of plate thickness are acceptable.

RADIOGRAPHIC TECHNIQUE (cont'd)

In each penetrameter there shall be three holes with diameters equal respectively to two, three and four times the penetrameter thickness, but in no case shall less than 1/16" diameter be used.

Each penetrameter shall carry an identifying number representing in two significant figures the minimum thickness in inches of the plate for which it may be used. Penetrameters may be established for differences in thickness not to exceed 1/8" so that a set of penetrameters varying for increments of plate thickness of 1/8" will be adequate to serve plates having thicknesses between these 1/8" dimensions.

The images of identifying numbers and the holes of each penetrameter must appear clearly on the radiograph to establish the 2 percent sensitivity.

For plates up to and including 2 1/2" in thickness, each penetrameter shall be 1 1/2" long and 1/2" wide. For plates thicker than 2 1/2" each penetrameter shall be 2 1/4" long and 1" wide.

The film during exposure shall be as close to the weld as practicable. If possible, this distance shall be not greater than 1 inch. In any event, the ratio

$$\frac{\text{Distance from source of radiation to weld surface toward radiation}}{\text{Distance from weld surface toward radiation to film}}$$

shall be at least 7 to 1.

All radiographs shall be free from excessive mechanical processing defects which would interfere with proper interpretation of the radiograph.

Identification markers, the images of which will appear on the film, shall be placed adjacent to the weld and their locations shall be accurately and permanently marked on the outside surface near the weld so that a defect appearing on the radiograph may be accurately located.

The size of film to be used shall be 4" wide x 15" long unless permission to use a different size is obtained in writing from the Director.

STANDARDS OF ACCEPTABILITY

The acceptability of the welds examined by radiography shall be judged by the following standards:

(1) Cracks:

Definition - A discontinuity resulting from a very narrow separation of metal.

Standard - No weld containing cracks regardless of length, size or location shall be considered acceptable.

(2) Gas Porosity:

Definition - Gas pockets or voids in metal.

Standard - The maximum dimension of any individual gas pocket shall not exceed 1/8 inch. The maximum accumulation of gas pockets shall not exceed that shown in the "Porosity Standards" of the American Society of Mechanical Engineers.

(3) Slag Inclusions:

Definition - Non-metallic, solid material entrapped in weld metal or between weld metal and base metal.

Standard - A. Elongated slag inclusions: No elongated slag inclusion shall exceed two-thirds of the thickness of the thinner plate of the joint in length and 1/16" in width, except that regardless of the plate thickness no such inclusion shall be longer than 3/4" and except that no such inclusion which is shorter than 1/4" shall be cause for rejection.

B. Isolated slag inclusions: In any 12 inch length of weld, the maximum width of any isolated slag inclusion shall not exceed 1/8 inch, the summation of lengths of isolated slag inclusions shall not exceed 1 inch, and there shall be no more than four isolated slag inclusions of the maximum width of 1/8 inch. Any two such inclusions shall be separated by at least 2 inches of sound weld metal.

STANDARDS OF ACCEPTABILITY (cont'd)

(4) Incomplete Fusions:

Definition - Failure of the weld metal to fuse completely with the base metal or preceding beads.

Standard - No individual lack of fusion shall exceed 1/2 inch in length. In any 12 inch length of weld, the summation of lengths of lack of fusion shall not exceed 3/4 inch and individual defects shall be separated by at least 6 inches of sound metal.

(5) Incomplete Penetration:

Definition - Root penetration which is less than complete or failure of a root pass and a backing pass to fuse with each other.

Standard - No individual lack of penetration shall exceed 1/2 inch in length. In any 12 inch length of weld, the summation of lengths of lack of penetration shall not exceed 3/4 inch and individual defects shall be separated by at least 6 inches of sound metal.

REPAIR OF DEFECTIVE WELDS

Defective welds shall be repaired by chipping or melting out such defects from one or both sides of the joint as required, removing only sufficient weld metal to correct the defect. The joint shall then be rewelded and again radiographed.

ADDITIONAL RADIOGRAPHS

Wherever an unacceptable weld occurs a radiograph shall be made of the adjoining 12-inch lengths of weld to determine if the flaws extend beyond the limits of the original radiograph. If unacceptable flaws occur in these adjoining lengths of weld, these defective welds shall be repaired and this entire procedure repeated for the next adjoining 12 inch length of weld.

CUSTODY OF RADIOGRAPHS

As soon as the radiographing of the weldments on the full length of each flange or web plate between field splices has been completed, the Contractor shall send to the State the processed contact film (that film closest to the source of radiation) of all original and retake radiographs. These radiographs shall be accompanied by a certification from the Contractor that the radiographic examination was performed in conformance with these specifications. The radiographs shall become the property of the State. Each radiograph shall be clearly identified to show the location on the structure at which it was taken. Unacceptable defects shall be identified in each radiograph in which they occur and the repair or replacement of each unacceptable weld defect shall be noted and identified.

REPORT OF COST

After the completion of the radiographic inspection of welds, the Contractor shall furnish the State a complete report of the cost of performing this work, separated into the items mentioned in the following paragraph.

BASIS OF PAYMENT

Payment for this work, including all labor, equipment, materials and incidentals, shall be included in the unit price bid for S-7 Structural Steel.

SHOP DRAWINGS for the girders shall include an overall layout with dimensions showing the relative unloaded vertical position of each girder or girder segment with respect to the others in the same girder line and with respect to a full length base or work line taking into account the profile of the highway.

SHOP ASSEMBLY At least three adjacent girder segments shall be assembled in the shop in their correct unloaded positions as shown on the shop drawing layout required in the above note so that the faced joints for welding the segments together may be checked for proper fit-up.

STATE OF OHIO DEPARTMENT OF HIGHWAYS DIVISION OF DESIGN AND CONSTRUCTION BUREAU OF BRIDGES							
GENERAL NOTES							
BRIDGE NO LAK-2-0401 L&R OVER VINE STREET							
						STA 310 + 54.21	
						STA. 312 + 82.19	
DESIGNED	DRAWN	TRACED	CHECKED	REVIEWED	DATE	REVISED	
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