

April 5, 1978

Mr. Boyce Grier, Director  
Office of Inspection and Enforcement, Region I  
United States Nuclear Regulatory Commission  
631 Park Avenue  
King of Prussia, Pa. 19406

Subject: Significant Deficiency Report #5  
Cold Formed Back-to-Back Channel  
Shop Welding Deficiency - Final Report  
Limerick Generating Station - Units 1 and 2  
NRC Construction Permits Nos. CPPR-106, -107

Reference: Telecon of March 7, 1978 (H. R. Walters,  
PECo. to R. McGaughy, NRC)

File: QUAL 2-10-2 (SDR #5)

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Dear Mr. Grier:

Attached is our final report on the above subject deficiency which was reported to USNRC per the referenced telecon in accordance with 10CFR50.55(e).

If there are any questions on this matter, we would be pleased to discuss them with you.

Sincerely,

*V S Boyce*

Copy to: Dr. Ernest Volgenau, USNRC

Attachment

FINAL REPORT  
COLD FORMED BACK-TO-BACK CHANNEL  
SHOP WELDING DEFICIENCY  
AT  
LIMERICK GENERATING STATION  
UNITS 1 & 2

Philadelphia Electric Company

March 1978

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## 1.0 Introduction

- 1.1 In compliance with 10CFR50.55(e) this Final Report is issued on the problem of cold formed back-to-back channel shop welding deficiencies. This significant deficiency was reported via Telecon to NRC Region I on March 7, 1978.
- 1.2 This report describes the deficiencies, analyzes safety implications, summarizes results of test programs, and discusses corrective measures taken to prevent re-occurrence of the problem; and describes measures taken in the field to remedy problems on supports already in place.
- 1.3 The material on which these weld deficiencies has occurred consists of cold formed, channel shaped members of material conforming to ASTM A-570-72, Grade C, hot dip galvanized per ASTM A-386-73 or ASTM A-153-73, after spot welding in a back-to-back configuration to form composite members. Class I electrical raceway supports are field fabricated from stock member lengths. Typical raceway support configurations are shown in Figure 1a, and Figure 1b shows a typical cross section of the members.

## 2.0 Description of the Deficiencies

- 2.1 The back-to-back channel members are procured from catalog designations, and are available from several manufacturers. Catalogs contain section properties of the composite, spot-welded members, and specify spot weld spacing.
- 2.2 The deficiencies described herein occurred on material purchased from Super-Strut, Inc., of Oakland, California, and fabricated at their Goshen, Indiana, plant.
- 2.3 Inspection and limited testing of back-to-back channels being used on site, and procured from another supplier has indicated thus far that the deficiencies noted herein are related only to material procured from Super-Strut, Inc.
- 2.4 On about January 10, 1978, a support was observed to contain back-to-back channels which had failed spot welds. Another support was noted to include a member which did not contain any spot welds in a 12" length. The catalog description specifies spot welds spaced at 2" to 3". An unused 24" long section was observed to have separated as a result of weld failure. A qualitative review of the material at the site indicated sufficient evidence of weld deficiencies and weld spacing irregularities to warrant a more quantitative review. Accordingly, fifty-five samples, representing three sizes of back-to-back channels, were randomly taken from field stock of material furnished by Super-Strut, Inc. Specimens containing three spot welds were cut from these samples, and the welds were tested in tension to failure by an independent laboratory. Failures occurred at loads ranging from 550 pounds per 3 welds, to 11,450 pounds per 3 welds. Super-Strut's acceptance criteria had been set at 8000 pounds per 3 welds.

- 2.5 At the time the deficiencies were discovered, approximately 1100 supports for Q-listed raceway had been erected.

### 3.0 Analysis of Safety Implications

- 3.1 To assure composite action of the back-to-back channel members, spot welding is provided at the interface of the two channels. The load capacity of the members is based on structurally adequate welds spaced in accordance with the specifications contained in the manufacturer's catalog.
- 3.2 Welding deficiencies, in spacing of welds in excess of the manufacturer's catalog specification, or in the quality of weld, would result in a reduction in the load capacities of the members involved.

### 4.0 Corrective Measures.

- 4.1 A site fabrication and erection hold was placed on all raceway supports on January 18, 1978. This hold was released on February 3, 1978, on the condition that any strut material used for fabrication of new supports, and strut in supports already installed, be stitch welded to develop adequate composite member strength, without dependence on existing spot welds. Maximum load capacity of the strut was used as the basis for determining weld spacing, pending completion of a more detailed analysis based on actual loading. (see Figure 1b, notes 1 and 2). Instructions were issued to the field describing the procedures to be used for this repair welding.
- 4.2 A shipping hold was placed on all field procured back-to-back channel material, pending development of formal test/inspection acceptance criteria and production monitoring.
- 4.3 On February 23, 1978, a survey was made of the Goshen, Indiana, facilities of Super-Strut, Inc. It was observed that a new automatic welding machine has been installed at that facility, which should eliminate the deficiency in weld spacing. However, prior to release of the shipping hold and acceptance of any new material from Super-Strut, Inc., that supplier will be required to demonstrate a level of quality control adequate to assure that the deficiencies addressed to in this report will not recur.
- 4.4 To assure structural adequacy, all material procured from Super-Strut, Inc., that has been delivered and/or installed prior to the discovery of the deficiencies noted herein will be repaired, determined by analysis to be acceptable, or replaced by new, qualified material.
- 4.5 Additional material will be procured only from suppliers that have been found acceptable by survey, and are implementing an approved weld testing and inspection program.
- 4.6 The appropriate material specification is being revised to include test/inspection acceptance criteria and production monitoring requirements.

5.0 Conclusions

- 5.1 The revision of material specifications, and actual load analysis was completed March 24, 1978. The repair of supports previously installed will be completed by August 1, 1978.
- 5.2 Implementation of the corrective measures stated herein will minimize the recurrence of weld deficiencies during fabrication of strut material.

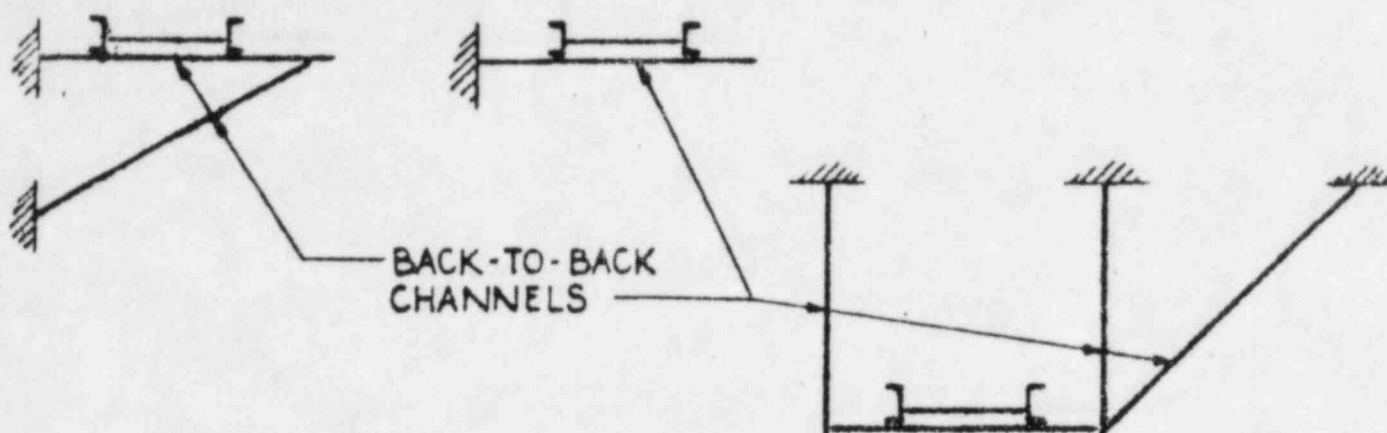
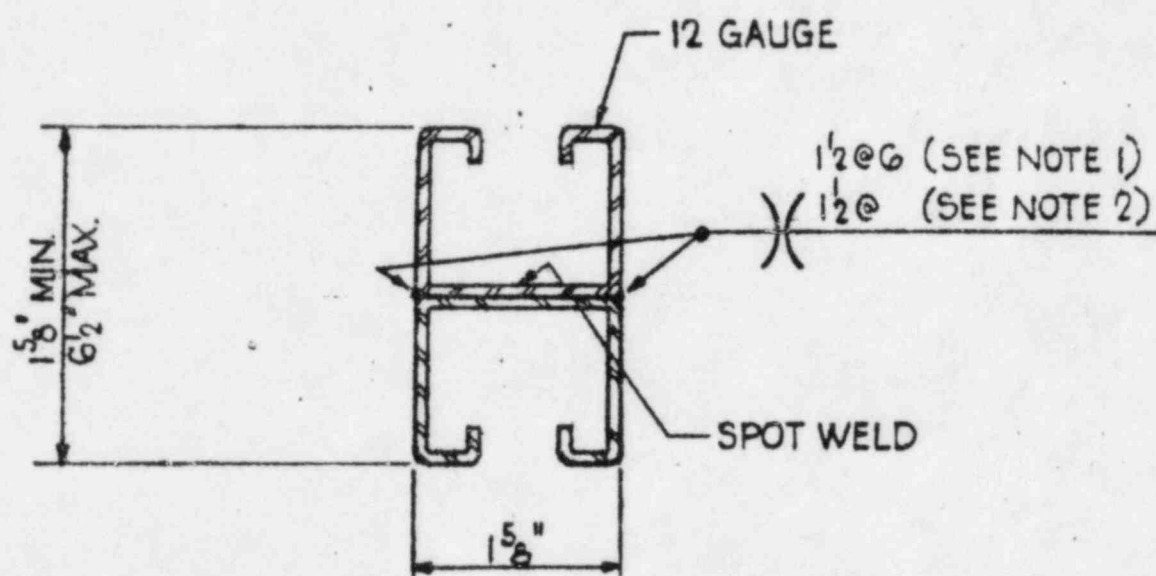


FIG. 1a TYPICAL CLASS I RACEWAY SUPPORTS



NOTES:

1. SPACING OF WELD BASED ON MAXIMUM LOAD CAPACITY OF STRUT.
2. SPACING OF WELD AS REQ'D. BY ANALYSIS BASED ON ACTUAL LOADINGS.

FIG. 1b BACK-TO-BACK CHANNEL CROSS SECTION