D0 ENGINEERING NOTE

No. 3740.220-EN-453

**CALORIMETER INSTALLATION BRIDGE
NON-DESTRUCTIVE TEST RESULT**

**Oct. 29, 1990
H.J. Stredde**

CC BRIDGE WELD EXAMINATION (NDT)

After the central calorimeter was installed on the center beam a cracked weld was found on the bridge. The weld was a partial penetration between the top rail plate and the T-1 steel nose section. The crack is fully across the width of the rail plate and the rail is depressed in a concave shape. That is, the depression is deeper in the center and feathers out to zero at the end of the rail. Upon close inspection it was obvious that there was no penetration of weld metal into the T-1 material. The assumption is that the T-1 was not properly pre-heated before welding. The reason for the concave depression comes from the fact that the rail plate rests on the flanges of the 'S' beams and that during welding the plate pulled off the beams. This weld failure can not propagate to any other welds and therefore, will not start a chain of failures. Clearly the failure of this weld did not hinder the installation of the central calorimeters. This weld failure occurred on both sides of the bridge.

This failure did, however, alert us to check the critical weld on the bridge, S-beam webs to T-1 nose section, to assure us we had a sound weldment. (Note: it must be used again for both EC's).

We contacted M.Q.S. Inspection Inc. (Lab contractor for N.D.T.). A technician from M.Q.S. came to DAB and performed an ultrasonic examination of the welds in question. The exam showed that we don't have a full penetration weld of the S Beam web, but that it is between 67-83%. (See report attached). A calculation was performed based on 67% penetration and the CC & EC loads. In both cases the weld stresses were well within acceptable limits (see calculations attached). Based on this result, it is not deemed necessary to modify the current weldment.

L.J. Strubbe
10/29/90

Control Number: SHF-1721

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Customer

Address

Fermi Nat'l Accelerator Lab, P. O. Box 500, Batavia, IL

P.O. Number

894730

Plan or Drawing Number

N/S

Part Number

N/S

Type of Material

A-36 to T-1

Heat Number

N/S

Temp. of Mat'l

Ambient

Surface Condition

As Welded

Heat Treat: N/S

Before ☐ After ☐

Examination Code / Spec.

AWS D1.1/90

Acceptance Standard

Client Info

MQS Procedure Number

22.B.100

TECHNIQUE

Equipment Make

Magnaflux

Model

FX-7

S/N

86095

Presentation:

☒ A-Scan

☐ B-Scan

☐ C-Scan

☐ Other:

Transducer Make

Panametrics

Model

A421S

S/N

136147

Sound Beam Angle (Material)

70°

Size

.625"
.750"

Frequency

2.25 MHZ

Transducer Make

N/A

Model

N/A

S/N

N/A

Sound Beam Angle (Material)

N/A

Size

N/A

Frequency

N/A

Couplant Material

Cellulose

Manufacturer

Aqualon

Batch Number

N/A

Calibration Block Type

DSC Block

Material

A-36

S/N

MXS-1

Method: ☒ Contact

☐ Immersion

☐ Through Transmission

Scanning: ☒ Manual

☒ Pulse Echo

☐ Resonance

☐ Water Column

☐ Automatic

Scanning Pattern

- A -

Speed

≤ 6 Inches Per Second

% Overlap

50%

DISPOSITION

Piece / Serial Number	Accept	Reject	Piece / Serial Number	Accept	Reject
1 / 4 Welds	Client	Info			
A-36 Steel to T-1					
Components					

Number of Items Accepted: N/A

Number of Items Rejected N/A

Remarks: Ultrasonic Inspection was performed on the welds listed above utilizing the shear wave technique with a 70° transducer. Calibration and linearity were set up utilizing a DSC block recommended by AWS D1.1.

Conclusion: All four welds showed a lack of penetration in the single bevel joint. The penetration of the deposited weld metal varied from 1/2" to 5/8". The quality of weld metal deposited was excellent. No signs of lack of fusion with the base metal or large inclusions were noted. Mr. Stredde was notified of the test results.

TECHNICIAN (PRINT)

Richard Gerhard

TECHNICIAN SIGNATURE

SNT-TC-1A

LEVEL II

DATE

10/2/90

CC BRIDGE WELD ANALYSIS

H. STEEDOE

10/2/90

$$\sum M_{R_L} = (47 \times 182) + (117 \times 83) + 117 R_L$$

$$R_L = \frac{(47 \times 182) + (117 \times 83)}{117} = 156.1 \text{ kips}$$

MAX. REACTION AT R_L IS WITH 182 k LOAD OVER THAT PT. AND IS EQUAL TO 182 k. THIS LOAD IS $(262,800 - 182,000) = 80.8 \text{ k}$ LESS THAN CC MAX. LOAD.

SHEAR STRESS WEB:

$$S = \frac{182 \text{ kips}}{20.5 \times .75 \times 2} = 5.919 \text{ ksi} < 14.4 \text{ ksi}$$

↑
4 x 36 ksi

WELD STRESS: 7018

$$S = \frac{182 \text{ kips}}{20.5 \times .5 \times 2} = 8.88 \text{ ksi} < 21 \text{ ksi}$$

↑
3 x 70 ksi

'CC' CONDITION: WELD STRESS

$$S = \frac{262.8 \text{ kips}}{20.5 \times .5 \times 2} = 12.8 \text{ ksi} < 21 \text{ ksi}$$