A-18

TO: Mr. R. Marshall

DATE: April 14, 1980

FROM: B. K. Culver

SUBJECT: Wm. H. Zimmer Nuclear Power Station
Unit 1 - P/W Weldment Analysis
W.O. 57300, Job E-5590, Spec. H-2803.23

Enclosed is one copy each of the minutes of the meeting and pre meeting with P/W Inc., concerning their compliance to specification H-2803.

Also included is a copy of Gladstone Labs letter with their independent opinion on the supplied material.

B. K. Culver

JJS:dw

cc: W. W. Schwiers
J. Farra
K. Baumgarten
B. K. Culver
S. C. Swain
R. Pruski
File

[illegible] LABORATORIES, INC.
[illegible] NON DESTRUCTIVE TESTING · METALLOGRAPHY · WELDING QUALIFICATION
1034 WOODROW STREET • CINCINNATI, OHIO 45204

April 9, 1980

Cincinnati Gas & Electric Co.
W. H. Zimmer Nuclear Power Station
Moscow, Ohio 45153
Attention: Barney Culver
Joe Seibert #553-2011

OBJECTIVE: Review of documented welding requirements specifically related to P & W Fabricated Hangers with critical Visual Inspection of presented weldments and panel rebuttal commentary of evaluation opinions.

COMPOSITION: Electrical Hanger Weldments
Carbon Steel Uni-strut - GMAW, LVSC Mode - 1/8" Min. Fillet welds - post weld galvanized.

HISTORY:

9/30/79 - 1/31/80 Macro Itemized Evaluations of over 90 specimens & 250 cross-section weld profiles.

3/04/80 Initial briefing as to areas of concern; preliminary inspection & discussion of random reject hangers with C.G.&E, S & L.

3/05/80 Meeting related to stated objective with P & W, C.G.&E. & S & L.
Post meeting limited inspection of installed hangers in various locations of reactor building.

SPECIAL INSTRUCTIONS: To formulate & render an impartial third party opinion as to whether or not the fabricator has indeed supplied weldments that complied with the initial stipulated requirements and/or specifications.

RESULTS: Items of unanimous agreement between all partiest
P & W initial Quality Manual, Sampling Plan & production facilities approved and audited by S & L.

AWS Fillet Welding Procedure Specification & Welder Qualifications in compliance with AWS Structural Welding Code AWS D1.1-72.

Hangers were fabricated utilizing limited (1%) Visual Inspection by P & W, with no outside inplant inspection performed.

Hangers received @ Zimmer about 1975 with substantial installation [illegible] welding without specific additional Visual Inspection requirements.

[illegible] and of substantial disagreement: Exact interrelation of [illegible] Quality Manual & Total A.W.S. D1.1-72 content as to specific applicable [illegible] profile limits and accept/reject criteria.

Total acceptance by S & L of C. G. & E. Macro Evaluation Summary Report that concluded fillet size was currently considered a resolved issue.

Panel consensus did not substantiate the vast majority of discontinuities reported by original reject inspection.

S & L represented the super critical panel member, but in many instances did not verify substantial portions of original rejection indications.

My Visual Evaluation of 12 presented weldments indicated no rejectable defects. As most fillet welds of this nature are often less than ideal, there were two localized areas of minor concern or possible question which should require some additional verification for rejection. It is appropriate to note many of the examined welds were indeed quite good with an overall impression of satisfactory weldments.

CONCLUSION:

All the information, evaluations and observations, as I perceive them, indicate the fabricator has supplied weldments that do comply with certainly the intent and substantially to the letter of the initial stipulated requirements as established by referenced specifications, codes, approvals and audits.

At this point in time it appears that a welding problem really does not exist. The difficulty seems to stem from confused, obsessively critical, perhaps even intimidated visual weld inspection. The itemized rejection criteria provides a graphic insight relevant to this situation.

80 Reject/Pinholes (Porosity?) AWS 8.15.1.5 - Sum of diameters not to exceed 3/8"/any linear inch. Has any this size been observed?

95 Reject/Slag & Slag Inclusions GMAW is essentially a slagless process. Why listed separately? - Where produced? Perhaps spatter is inferred? If so how does spatter effect the weld now?

65 Reject/Lack of Fusion & Cold Lap Essentially synonymous How determined? Considered difficult to assess solely by Visual Inspection.

40 Reject/Stick Out (Wire Protrusion?) Has this been considered a personnel safety hazard? How does isolated small segments of wire effect quality of this type fillet weld?

These listed rejection criteria represents the alleged discontinuities contributing to the reason for rejection of over 70% of the total itemized rejection criteria as indicated by the Visual Inspection Survey. These particular items are especially considered superfluous, redundant and for all practical purposes insignificant as to weld quality. Numerous critical macro cross section evaluations has not substantiated the erroneous contentions implied by this Visual Inspection Survey.

The necessity and desire to strive for perfection in each and every component related in any manner with a nuclear facility is acknowledged. Since April of 1979 it is assumed the demands are now even more stringent with every conceivable deviation of the slightest magnitude subject to probable jurisdictional dispute, legal ramifications or public scorn.

Not withstanding this need for rigorous compliance to codes or specifications the Visual Inspection of Electrical Hanger Weldments, as currently conducted, indicates "exalted nit-picking". Now the term nit-picking is not scientific nor technical, but does convey the most appropriate connotation for this issue. If we must throw the baby out with the bath water, what indeed have we accomplished?

Life does present distressing trade-offs. Environmental issues and regulatory demands can become counterproductive. Unacceptable as opposed to acceptable weld quality has always been a dilemma for fabricators and of serious consideration from the technical community. Adequately determining the quality of this particular type of weld while protecting the environment and human life has unfortunately become an intricate problem.

The solution to this problem is provided by the existing welding codes, the resolution of this issue shall require their consistant, knowledgeable and systematic application.

GLADSTONE LABORATORIES, INC.

M. G. Bolinger, Jr., Vice-President

MGB/jh

MEETING WITH GLADSTONE LABS ON P/W WELD PROBLEM-MARCH 4, 1980

THOSE PRESENT:

J. J. Seibert	CG&E GCD	
S. C. Swain	CG&E GCD	
D. Fox	CG&E QA	
M. Bolinger, Jr.	Gladstone Labs	
M. Schuster, Jr.	S&L	
* C. Burgess	CG&E QA	* part-time

1. The purpose of the meeting was to familiarize Mr. Bolinger of Gladstone Labs with the specification requirements and history of the P/W weld problem.

   Mr. Bolinger was selected by CG&E to act as their independent third party inspector to determine if the welds meet the requirements of AWSD1.1. Mr. Bolinger is an AWS certified inspector.

   Mr. Schuster opened the meeting by noting that S&L has approved P/W's weld procedure, Specification WS-1 on 7-12-74. This document states that P/W will conform to AWSD1.1-1972. It also states that inspection of the welds will be done on a random basis.

   Mr. Schuster also had documentation indicating that P/W had qualified the procedure and a welder. Fillet welds were submitted by P/W to Coleman Labs for review and approval. P/W chose to use the MIG procedure to weld these hangers.

   Mr. Seibert then presented a history of the weld problems, starting with the initial rejection of samples in the scrap yard, the previous meeting with P/W, the analysis program for undersize welds and the inspection conducted in the Control Room.

   Control Room results were summarized by Mr. Seibert by tabulating the types of deficiencies noted on the Non-Conformance Reports. These are as follows:

Pinholes	80	Overlap	20
Slag	65	Incomplete or short	20
Slag inclusion	25	Arc strike	10
Undercut	40	Gouge	4
Lack of fusion	40	Concavity	3
Mig wire stick in the weld or mig wire not fused	40	Unequal leg	1
Blowhole	25	Crack	2
Cold lap	25	Incomplete fusion	1
Weld dribble	1	Paint on weld	6
Loose weld spatter	1	Lack of filler metal	2
		Pits	1
		Crater pit	1

[illegible] that the MIG process is inherently slag [illegible] and questioned why this was listed as a deficiency. [illegible] called weld spatter "slag").

Mr. Schuster pointed out that the pinhole criteria is very explicit in AWS and questioned whether or not the criteria had been followed.

It was also noted that MIG wire stuck in a weld was not in itself a rejectable item.

Six hanger components were examined by Mr. Bolinger to familiarize him with their construction. One component was obviously rejectable. (Note: It was discovered by Mr. Seibert after the meeting that this component was not made by P/W but by FEC. This was determined from the stampings on the hanger. The sample pile was sorted to assure that only P/W hanger pieces were examined at the meeting on March 5, 1980. The rejected piece and the others found to be made by FEC were retained so CG&E QA could verify, before the March 5, 1980 meeting, that these were in fact, not P/W components.

The meeting was adjourned until 10:00 a.m. March 5, 1980.

J. Schuster

MEETING WITH P/W ON SPECIFICATION H-2803 CABLE TRAY HANGERS
MARCH 5, 1980

PRESENT:

J. J. Seibert	CG&E GCD
S. C. Swain	CG&E GCD
D. Fox	CG&E QA&S
C. H. Miller	P/W Industries
T. P. Finnigan	P/W Industries
S. B. Storer	Sheldon Storer & Associates
M. E. Schuster, Jr.	Sargent & Lundy
M. G. Bolinger, Jr.	Gladstone Labs

The purpose of the meeting was to determine if P/W met the requirements of Specification H-2803 which requires that "all welding procedures shall be in accordance with American Welding Society Specification D-1.1."

Mr. Bolinger, AWS certified, has been retained by CG&E, as their 3rd party inspector.

P/W stated that the procedures were not AWS but what was stated in their Q.A. manual, as noted in the proposal data Section 5.1. The manual had been approved by S&L and CG&E. P/W's procedures are based on AWS, with inspection required for weld spatter, MIG wire residue, minimum fillet size, undercut, cracks and overlap. Inspection was required on the first and last piece of a type of assembly, as stated in the QA manual.

P/W qualified the procedure used to weld the hangers and the welder. Fillet welds made by the three certified welders used on the Zimmer job were submitted to J. B. Colman Labs in Philadelphia, Pennsylvania for review.

CG&E then submitted random samples for consideration and review. The samples with an "R" prefix are samples from the scrap yard which HJK QA said were rejects.. The samples with no "alpha" prefix were from the scrap yard with no previous review as to their acceptability.

* Inspection done in scrap yard 7-11-79

SAMPLE	*QC	GLADSTONE	S&L	CG&E QA
	(Clark, Cordy)	(M. Bolinger)	(M. Schuster	(D. Fox)
R14	Undercut, slag	Possible crater crack	Rejects crater crack	OK
R16	Undercut, slag	OK	Undercut	Weld spatter
R5	Irregular slag, porisity	Splatter irregular	Splatter irregular	Splatter irregular

SAMPLE	*QC	GLADSTONE	S&L	CG&E QA
R26	Porisity, insuf. slag	OK	OK	OK
R57	Insufficient undercut, irregular	OK	OK	OK
2	No inspection	OK wire stub	OK	Spatter
8	No inspection	OK	OK	OK
5	No inspection	OK	OK	OK
3	No inspection	OK	OK	OK
7	No inspection	OK	OK	OK
1	No inspection	OK	OK (SLE491)	OK
4	No inspection	OK	OK	OK

Comments by the participants are as follows:

Gladstone: Sample R14 has a possible crater crack which could only be determined by grinding. Sample R5 has weld spatter on the weld and in the area of the weld. Sample 2 has a wire stub sticking in the weld. Mr. Bolinger said that considering the weld and fabrication techniques used, and the fact that P/W was not required to inspect 100%, it was unreasonable to assume that there were to be some rejects. Although weld spatter on the weld, MIG wire in the weld are noted on Samples R5 and 2, they do not affect the integrity of the weld. R5, the irregular weld is a questionable reject as is the crater crack in R14.

Considering what was presented, and the fact that Gladstone has looked at 100 + macro sections of welds, he felt that P/W met the requirements of the specification.

Sargent & Lundy: Mr. Schuster felt R14, R16 and R5 are rejects. He agreed that further examination and testing could be done to show that they were not.

CG&E QA: Mr. Fox felt the welds were generally acceptable. He did not like the excess splatter while agreeing it had no effect except possibly masking weld deficiencies.

P/W still feels they have provided good hanger assemblies. Their axial test on a previous reject provided by CG&E shows base metal failure, not weld failure.

CG&E asked S&L if lab testing might not resolve the problem. S&L did not feel a suitable test with actual worst case samples could be executed.

CG&E QA - continued:

Mr. Bolinger was asked to submit his official report to CG&E as soon as possible.

After the meeting, Mr. Bolinger, Mr. Fox and Mr. Seibert looked at various assemblies in the Auxiliary Building, elevations 525, 521 and 546. Mr. Bolinger found these acceptable.

The rework of the Control Room hangers was discussed with Mr. Bolinger. He found the removal of weld spatter and MIG wire, as cited by the QC department to be over zealous. The removal of pits by grinding was also considered excessive.

Mr. Bolinger had the following comments based on his plant tour:

1. The QC personnel should be given additional training, with visual aids, in the requirements of AWS.

2. Since the hangers are installed, 100% visual inspection of the assemblies is almost impossible.

3. Rework may result in welds that are of a lesser quality than originally supplied.

J. Seibert

INTER-OFFICE MEMORANDUM

From M. E. Schuster, Jr. - 18 - X6570 Date September 11, 1979
Project No. 4130-00
Dept./Div. Quality Control Division Spec. No. H-2803
File No.
Page No.

Client CG&E Stn. Wm. H. Zimmer NPS Unit 1

Subject S&L Std. EB-117, Dwg. E-189 and Dwg. E-13,3

Detail 27

To: R. E. Cotta - 24 (1/1)

CC: R. J. Pruski - 20 (1/1)
J. T. Louden - 18 (1/1)

Reference: HJK QA Surveillance Report No. 2297

The reference report states that the subject EB-117 drawings indicates fillet welds where the strut is welded to the plates, angles, cable trays, etc., where the geometry of the connection indicates a flare-bevel groove weld should be used. It also asks the following questions:

1. What type of weld is this?

Answer: The two manufacturers of struts gives all the dimensions for the channels, except for corner radius. Since there is no radius specified and therefore no tolerance, there is no dimensional control. If a flare bevel groove weld of a certain size is specified and the radius of the channel is less, then the channel would have to be reworked by grinding prior to welding. The thickness of the majority of the channels are as follows:

Gauge	Nominal	Lower Limit
12	0.10938"	.0966"
14	0.07813"	.0677"
16	0.0625"	.0538"

As can be noted for the gauge thickness, it would be difficult to grind, etc., without going through the wall or thinning the wall to an extent where burn-through or excessive undercut could occur during welding.

The majority of contractors who fabricate these hangers use prequalified welding procedures to AWS D1.1. It should be noted that a flare-bevel groove is not a prequalified joint and, therefore, the welding procedure would have to be qualified.

EB-117 shows a standard fillet weld. This is prequalified by AWS D1.1. It should also be noted in paragraph 3.3.1, AWS D1.1, that the root gap can go to 3/16" maximum provided that if the separation (gap) is 1/16" or greater, the leg of the fillet weld shall be increased by the amount of the separation. The slight radius on the channel is, for your purposes, classified as the root gap. Based on all of the above, the fillet weld shown in EB-117 are suitable and the flare-bevel groove symbol should not be used.

2. How does QA verify compliance?

Answer: Welds should be visually examined to AWS D1.1 criteria, weld size checked with the appropriate weld gauge and all results documented.

MES:kao
Attachment

: C BURGESS Organization: C G&E

: Reference: QACMI-G14

Deficiency/Deviation ✓ Clarification ___ Calibration/Test Record

Audit/Follow-up ___ Subcontractor Surveillance ___ Surveillance Information only

GENERAL OBSERVATIONS/DESCRIPTION:

THE WELD SYMBOL SHOWN ON DRWG. E-13-3 DETAIL 27, L STD. EB-117, DRWG. E-189, AND VARIOUS OTHER DESIGN CUMENTS INDICATE FILLET WELDS WHERE THE SIDES OF STRUT MEMBERS AND BOX IRON ARE WELDED TO PLATES, NGLES, CABLE TRAYS, ETC. CONTRARY TO THE ABOVE, THE GEOMETRY OF THIS CONNECTION INDICATES A FLARE-BEVEL GROOVE WELD SHOULD BE USED. (SEE ATTACHMENT) WHAT TYPE OF WELD IS THIS? HOW DOES QA VERIFY COMPLIANCE?

port Prepared By: K.L. DUNN Date 8/17/79

Deficiency is Nonconforming in Nature, List:

1. Reference Drawing, Spec. or Std. _____

2. Specific Location _____

RECTIVE ACTION STATEMENT

rective Action Verified By: _____ Date _____

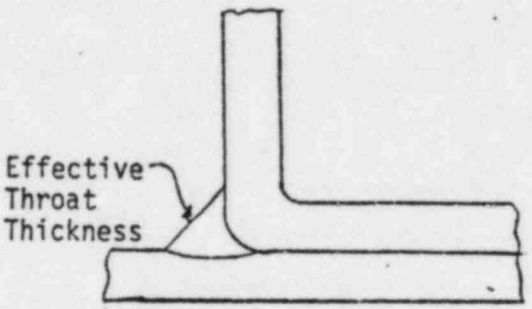
ZIMMER - 1

DEFICIENT WELDING OF CABLE TRAYS

INVESTIGATION PROGRAM

The investigation would involve the following two types of welds:

I. Type A - Shop Weld
II. Type B - Shop Weld



Type A: Weld on Curved Plate

Type B: Fillet Weld

Though only the Type A weld was indicated to be deficient earlier, Type B weld also was included since this type of weld is also deficient in the samples furnished to Sargent & Lundy. Since both types of welds are included in the same joint, these welds will have to be treated on the same basis. The investigation will consist of 3 steps:

Step 1 - Sampling of test specimen: The number of samples required for 95% confidence level are indicated below. The number of samples required will depend on the number of deficient samples found during the investigation. Each joint sample will count as one sample. Each joint consists of more than 2 lines of weld. (The sample could have consisted of only one line of weld if only Type A welds were to be investigated.)

No. Of Samples	No. Of Deficient Samples
59	0
93	1
124	2
153	3

These samples will have to be selected on a random basis from the total population and could include the structural members lying outside the plant (not used for installation) if it can be proved that they represent the total population.

Step 2 - Documentation of quality of weld: This step would include the polishing and etching of welds to verify the extent of fusion of weld material. Since weld material has to flow into a restricted area, fusion can become a problem. This step will verify the fusion so that effective throat as shown in the figure above can be utilized for the design.

This step will also involve photographing the welds to document the size of welds for permanent records.

This investigation program is based on input from M. Schuster of Q.C. and M. K. Ravindra of SAD.

Please note that the number of samples required is based on a large population and a minor revision may be possible on the basis of actual number of members required. Also please note that this program may not be possible for field welded joints and will have to be investigated separately.

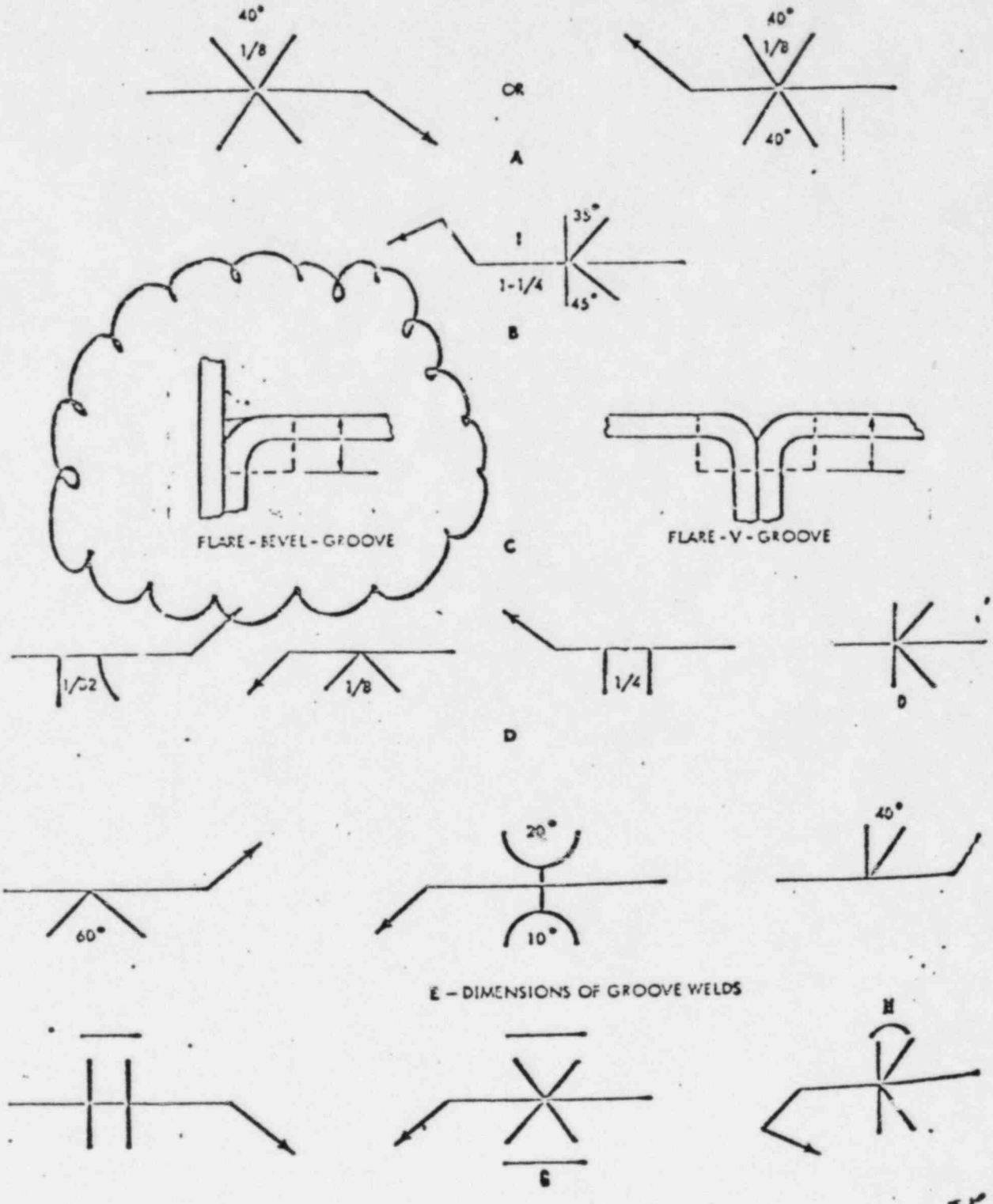


Figure 11-11. Groove weld symbols.